

Integrated Land Ownership Management Using Geospatial Technologies and
Visual Basics: a Case of Debark Town, Ethiopia



Andinet Aydia Kanssa

A Thesis Submitted to

The Department of Geomatics Engineering,
School of Civil Engineering and Architecture

Presented in Partial Fulfillment of the Requirement of Master of Science
Degree in Geoinformatics Engineering

Office of Graduate Studies
Adama Science and Technology University

Sep 2021

Adama, Ethiopia

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Maior Advisor: - Dr Tilahun Erdon (PhD)

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APPROVAL OF BOARD OF EXAMINERS

I, the advisors of the thesis entitled “Integrated Land Ownership Management Using Geospatial Technologies and Visual Basics; a Case of Debark Town, Ethiopia; A Case of Debark Town, Ethiopia” and developed by Andinet Aydia Kansa, hereby certify that the recommendation and suggestions made by the board of examiners are appropriately incorporated into the final version of the thesis.

Tilahun Erduno (PhD)

Major Advisor

Signature

Date

We, the undersigned, members of the board of Examiners of the thesis by Andinet Aydia Kansa have read and evaluated the thesis entitled “Integrated Land Ownership Management Using Geospatial Technologies and Visual Basics; a Case of Debark Town, Ethiopia” and examined the candidate during open defense. This is, therefore, to certify that the thesis is accepted for partial fulfillment of the requirement of the degree of Master of Science in Geoinformatics Engineering.

Mesfin Benti (PhD)

Chairperson

Signature

Date

Tulu Basha (PhD)

External Examiner

Signature

Date

Roba Gemechu (PhD)

Internal Examiner

Signature

Date

Finally, approval and acceptance of the thesis is contingent upon submission of its final copy to the office of Postgraduate Studies (OPGS) through the Department Graduate Council (DGC) and School Graduate Committee (SGC)

Department Head

Signature

Date

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Signature

Date

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LIST OF ACRONYMS

3D	3 Dimension
CRPRS	Cadastre and Real Property Registration System
GIS	Geographic Information System
GPS	Global Positioning System
IDE	Integrated Development Environment
KML	Keyhole Mark-up Language
LIS	Land Information Management
LMS	Land Management Systems
MUDHo	Ministry of Urban Development and Housing
MUDHo	Urban Development and Housing
NHD	nebourhood
RAD	Rapid Application Development
UPIN	unique parcel identification number
VB.Net	Visual Basics.Net

ABSTRACT

Land is the most valuable resource; without it, life on the planet would not exist. Growing population, expanding needs and demands for economic development, as well as land degradation and negative environmental impacts, all place increasing strains on land resources, making an efficient and effective land management and administration system critical. Ethiopian land records, like those of many other African countries, are largely in paper format, with data that is sometimes disorganized, duplicated, or obsolete. The majority of Ethiopian urban lands including Debark today lack a comprehensive and well-organized land management system. This implies that each piece of land should be properly counted and documented and managed through inventory. Therefore this study aim to establish Integrated Land Ownership Management Using Geospatial Technologies and Visual Basic. A high-resolution Ortho Photo with a 15 cm spatial resolution master plan of the city, as well as other materials, were used in this study. ArcGIS was used to build the geodatabase and tabular data format. For the purpose of data gathering, table and base maps with sample blocks were created. The study region's necessary ancillary data was gathered from the Debark town government office. Also, there are additional organizations. The primary data is acquired on the field survey by delineating the landholders' boundaries on a printed aerial photo, gathering point data using a portable GPS, and filling out a tabular form that the data collector fills out by asking landholders. The information collected on the field for each and every parcel was digitized and encoded, and parcel, block, and NHD cods were assigned. By combining Region code, City code, Kebele code, Neighborhood code, Block code, and Parcel code, a 14-digit UPIN is formed, which is then used to reorganize and link some files in the municipal office. In the three Kebeles of Debark City, a total of 7973 properties, 598 blocks, and 56 NHD were mapped. Land use was counted and calculated by area, and 167 kebele houses, 98649.619 hec temporary land holdings, 22.8826 hec vacant lands were discovered, and 31.64 hec extra lands occupied by individuals were discovered. Finally, visual basics was used to construct a secure app that displayed all land ownership data.

Keywords: Land inventory, Geospatial Technologies, Neighborhood, Unique Parcel Identification Number, Visual Basics

CHAPTER I: INTRODUCTION

1.1. Background of the Study

Land is the ultimate resource, without it, life on the earth cannot be sustained. Land fulfils many functions in society (Andrew whitaker, 2018). From a physical perspective, it is the space in which we move and create shelter and from which we obtain our food and water. From an ecological perspective, it plays a vital role in the breeding and survival strategies of many living species and all too often is the reason why country and neighbor. From an economic point of view, it is a foundation on which wealth is built. From a legal stand point, it is an abstract set of property rights, while from a social and cultural perspective; it is taproot through which people draw spiritual sustenance (Asima Mishara, 2000). Overall, it is essential to carry out all developmental activities, and safeguard natural resources, ecosystem and agriculture (T., 2015). Land availability is only about 21% of the earth surface. Growing population, rising needs and demands for economic development, as well as degradation of land and negative environmental impacts are posing increasing pressures to the land resources. Efficient and effective land management and administration system is very essential for overcoming the challenge and promoting sustainable development (Minstry of Urban Development, 2014).

In view of the fact that land is a limited resources. It is important to properly count through inventory, manage and document each piece of land (Andrew whitaker, 2018). Additional, it is essential to know how it is planned, and the location and size of each piece of land in order to understand its contribution to sustainable development. Moreover, policy and legal frameworks should be developed to guide the documentation of each parcel of land, to solve land disputes issues, to control the invasion of open public places, and the like which is essential to address the present problem of urban land management (Minstry of Urban Development, 2014). Furthermore, as land holds importance in many spheres, it is required to have a system gather, distribute and update information of land records. At the moment, everybody needs more detailed land information than it has been traditionally available. Land Management Systems (LMS) are administrative structures that are complicated by the roles to be undertaken by national cultural, political, and judicial environments and technology. (Lim, 2005). The countries should set up their LMS depending on their understanding of property rights, restrictions, and responsibilities to manage the relationship between land and people; since effective land governance and property rights system are

fundamental to the broad process of economic and political development (Bennett et al. & USAID, 2013GC).

Land inventory is the process of counting any property, with a particular focus on public and state ownership, which is a map and human resource, and is essentially a collection of data showing ownership, size and service. It is also a data base of the lands and their uses within the community including both developed and undeveloped land (Government, 2010). Land inventory is conducted to specify and define land management unit locations, their boundaries without onsite fixations, identification of unused, irrationally used or misused lands and other land characteristics. Land inventory is a way of promoting land management systems (LMS), land management, land development, planning for land use, land transactions, and management of natural resources (Augustinus). The continued rapid rate of urbanization is expressed in the dynamics of physical expansion, population growth, and socio-economic development that together lead to the growing demand for urban land (Chandra.P.Gri, 2012). This loophole has created an opportunity for speculators, informal settlers, and other illegal actors to occupy and encroach vacant and state lands

In almost all Ethiopian cities/towns, urban land creation and management activities are exacerbated by a multitude of issues that together have led to inefficiency, non-responsiveness to land-related problems, public complaints/dissatisfaction, and artificial land shortages for development against the illegal occupation of large parts of public land by speculators and informal developer (Abebe, 2010). The efficient and effective management of land and its related resources depends on the availability of good knowledge about the land (Ghose., 2016).

A land inventory is a record, consisting of a map showing all land area, units or parcels and a description or attributes of these land areas, units or parcels (Augustinus). Parcel is the smallest unit of the inventory where unique ownership and homogenous right is recognized. Land inventory conducted in urban centers consists of the database of land and their uses including both developed and undeveloped. In this practice, an evaluation of the current land use character is necessary in preparing the land use element which provides impetus and pertinent information for comparing the current use with what is permitted in the title deed, the status of state land as well as protecting and banking state land for meeting future land use demand through preparation of serviced land (Abebe, 2010).

An up to date land inventory provides benefit for both government and citizens. In case of government, management of land resource is important for the state to exercise its custodianship role for protecting every bit of its land from illegal squatters and invaders as well as banking the land for preparation of serviced land, environmental activities and management of land resources through obtaining up to date information. Besides, by building an up-to-date land inventory, it is possible to track the status of land tenure that would help address multitude of problems facing our urban centers due to poor land inventory such as poor banking of temporarily holding land, after the use right expires, changing use right responsibility of title deed to other uses by skipping the required lease payment as in the case of changing use right of quarry sites to hotel, changing Kebele and state houses use right to private ownership right.

In order to prepare a comprehensive plan that serves land development and management objectives, it requires comprehending the current land use using enabling GIS technology and people operating it. The information gathered in this step is used to produce a map of current uses by amount/size and type. The typical method for determining current land use includes through walking survey and using tape measurement or GPS backed with recent high resolution satellite imagery, printed in large scale map of 1:1000.

Based on these approaches, computation of spatial information is performed to approximate block frame, parcel boundary, and road casing; which is used in locating landscape features for field verification. For land inventory purpose and updating base map at parcel level, large scale map that ranges from 1:700 to 1:1000 is required for both the Urban and Rural Land Inventory.

A further refinement of the land inventory result will provide buildable land supply differentiated from non-buildable land supply as well as the ownership status- be it natural or non-natural person are identified. For instance, land inventory identifies vacant land and land with no other physical restrictions, such as open spaces/bare land, agricultural land, grazing land, Communal land, playground, greenery and other lands with no ownership attached to such lands, which provides ample information for designing regulation and strategy for protecting land with no party ownership right from illegal encroachers.

The whole purpose of land inventory is to know and identify land available for development and increase the custodianship role of the state, implies increase the land resource management capacity of the state which ultimately provides no loophole for squatters, encroachers and speculators. When calculating the amount of land in an inventory, it can be

stated as gross hectare, which includes the sum of the parcels in the inventory, or as net hectare, which subtracts land that is available for right of way.

It is important that the most consistent approach in land inventory is to include right of way plus other land uses in computing the statistics so that the urban administrative area is equivalent with the calculated statistics of land inventory, which also provides impetus for convincing land inventory figure cognizant of the fact that when deducting land inventory area from urban administrative boundary, the calculation should be '0' or at least close to zero to cross-check the quality of completeness of land inventory.

The land inventory is compounded with many problems, in Ethiopian context, among others include:

1. The absence of clear administrative boundary and lack of parcel based land information makes file reorganization and retrieval cumbersome job, triggers rural urban conflict, and affecting proper management of land and land units.
2. The state cannot play its role of custodianship as the land is invaded by illegal settlers, speculators, and other illegal/informal actors.
3. The land use function such as green area, recreation area, farm land and grazing land within urban jurisdiction have no entity responsible for administration which makes them to be reliable for abuse and illegal encroachment.
4. The current file arrangement system is obsolete since it arranged in Amharic Alphabet as in the case in Amhara Region which makes it difficult to answer the question of where the land is located.
5. Land holding files have never been linked with their respective parcel with unique identification number and hence spatial information system/geo-data base has never been established

To sum up, land inventory is a multi-stage process that, in its generic form, includes conducting public outreach program, delineating administrative and Kebele boundary, preparing base map, deciding on land use categories, collecting current land use data, preparing the current land use map, preparing parcel and ownership map based on the framework of current land use map.

Land registration file, on the other hand, is expected to provide information on who owns what unit of land; however, in most developing countries registration practice, the focus is on deed registration or registering of legal facts associated with the land in haphazard and

inconsistent manner (Melkamu Belachew and Shewakena Aytenfisu, 2010). As the denominator of registration is not parcel based, the linking and synchronization of the whereabouts of the land to who owns the land is critical problem, which, in turn, makes file reorganization work cumbersome. In general, the file organization in Debark city is compounded with multitude of problems as stipulated below:

1. The registration of the file implicitly tells that a particular transaction took place without actually telling who the rightful owner is, as the title plan and current owner information is not actually updated.
2. It is not compulsory to register change of ownership, which implies that the owner existed on the old file might be different from the current owner especially on poorly organized files of document of the deed system.
3. The parcel or the object the deed refers to is not well-described while the primary focus is the owner, not the object itself, i.e. parcel , as a result ,the question of who owns where and what is the extent of the parcel is difficult to answer..
4. It is difficult to access deed file organized in poor alphabetical order put haphazardly and carelessly, sometimes in sack or dispersed on floors.
5. The poor file organization system without logical arrangement of file, folder and file cabinet and in some cases without due respect to the legal proprietor file, file is congested in sack or littered around the ground or locked in the tables of officials for unnecessary long time.
6. The mixed up of files- one kebele file origin is traced back on another Kebele which needs detail scrutiny to re-assign the file based on Kebele and non-land related files are mixed with land related files.
7. If one proprietor owned a parcel in different Kebeles', the file for different parcel in different Kebeles' for the same proprietor is organized under one file.
8. New file is opened for the same parcel as per request of the customers without freezing the previous file as dead file which implies the same proprietor may have one or more file which needs verification based on current facts of ownership to make one file as active or dead.
9. The work quality of linking owner file with parcel is degraded by the use of nick name by the proprietors during filed interview.

10. Property (Building) site, floor, section and elevation plan are mixed with parcel title deed related files which makes it bulky of individual file in some cases an individual file embrace with a single Folder.
11. Non Land related file like free medical certificate letter, vital registration files and others are mixed up with land files which makes it difficult to reorganize the files in Kebele- Neighborhood-Block and Parcel level spatial hierarchy.
12. Title deed is provided for vacant land on the fly without any cross-reference with the statutory urban plan (Structure or Local development plan) until 2014 with the pretext of regularizing all illegal occupants.
13. During field inventory, in areas where husband has one or more wives, wife wants only to register herself avoiding the husband, and in the same way, the husband wants to declare the property in his own name or his elder son which outstrips the ownership legal status of women.
14. Land is provided through informal transaction due to the fear of paying the cost associated with the formal land delivery system.
15. Most proprietors who have file and legal title deed but in real practice, the place is devoid of any development activities for long period of time.
16. Regarding the link of parcel and file reorganization, from the land inventory result, those ownership status is verified and unambiguously defined through title deed, file is organized based on Kebele- Neighborhood-Block and Parcel level spatial hierarchy.

On the other hand, for those proprietors who have file in the municipality while the parcel is not unambiguously defined through title deed, the region and municipality shall redefine the legal status through implementing regularization scheme as per the lease proclamation no. 721/2004 through rigorous land readjustment strategy and then the parcel can be linked with the corresponding owner in the database (USAID, 2004). In addition, party is also clearly defined for parcels administered by Kebele, Municipality and other non-natural entity for reinforcing the protection role of the state on the land.

A geographic information system (GIS) is a framework for gathering, managing, and analyzing data. Rooted in the science of geography, GIS integrates many types of data (Andrew whitaker, 2018). It analyzes spatial location and organizes layers of information into visualizations using maps and 3D scenes. With this unique capability, GIS reveals deeper insights into data, such as patterns, relationships, and situations helping users make

smarter decisions. GIS integrates many different kinds of data layers using spatial location. Most data has a geographic component. GIS data includes imagery, features, and base maps linked to spreadsheets and tables.

Google Earth is a computer program, formerly known as Keyhole Earth viewer, that renders a 3D representation of Earth-based primarily on satellite imagery. The program maps the Earth by superimposing satellite images, aerial photography, and GIS data onto a 3D globe, allowing users to see cities and landscapes from various angles. Users can explore the globe by entering addresses and coordinates, or by using a keyboard or mouse. The program can also be downloaded on a smartphone or tablet, using a touch screen or stylus to navigate. Users may use the program to add their data using Keyhole Markup Language and upload them through various sources, such as forums or blogs. Google Earth can show various kinds of images overlaid on the surface of the earth and is also a Web Map Service client. Recently Google has revealed that Google Earth now covers more than 98 percent of the world, and has captured 10 million miles of Street View imagery, a distance that could circle the globe more than 400 times. In addition to Earth navigation, Google Earth provides a series of other tools through the desktop application (Akanbi & Agunbiade, 2013). Additional globes for the Moon and Mars are available, as well as a tool for viewing the night sky. A flight simulator game is also included. Other features allow users to view photos from various places uploaded to Panoramio, information provided by Wikipedia on some locations, and Street View imagery. The web-based version of Google Earth also includes Voyager, a feature that periodically adds in-program tours, often presented by scientists and documentarians. Google Earth has been viewed by some as a threat to privacy and national security, leading to the program being banned in multiple countries. Some countries have requested that certain areas be obscured in Google's satellite images, usually areas containing military facilities (Retrieved, March 11, 2018).

Visual basic is derived from the BASIC programming languages, it is a Microsoft window programming language, visual basic program is created in an integrated development environment (IDE), which allows the programmer to create run and design visual basic programs conveniently it also allows a programmer to create working programs in a fraction of time that normally takes to code programs without using IDEs. The widespread use of BASIC Language with various types of computer (sometimes called hardware platform) led to many enhancement to the languages with the development of Microsoft Windows graphical user interface (GVI) in the late 1980s and the early 1990's, the natural evolution

of basic was visual basic which was created by Microsoft corporation in 1991. Visual basic is the words most widely used in RAD language, (Rapid Application Development (RAD) is the process of rapidly creating an application. Visual Basic provides powerful features such as graphical user interface, events handling access to Win 32 API, object-oriented features, error handling, structured programming, and much more. Not until Visual Basic appeared, developing Microsoft windows based application as a difficult and cumbersome process. Visual basic greatly simplifies window application development.

Google Earth has been termed ‘the democratization of GIS’, as it has exposed geographic information technology to virtually everyone, and browsers are now used by a growing number of scientists as they enable data with a spatial component to be overlaid on top of remotely sensed imagery (Butler & Goodchild, 2008). The release of the KML (Keyhole Mark-up Language) grammar specifications has allowed more sophisticated use of the service. KML is an XML language focused on geographic visualization, including annotation of maps and images. The adoption of KML provided the means of integration between Google earth and GIS(Akanbi & Agunbiade, 2013).

1.2. Statement of the problem

The land records in Ethiopia are mostly held in paper format, as is the case in many other African nations, and the data is typically unorganized, duplicated, or obsolete (Abebe, 2010). For some time, the Ministry of Urban Development and Housing (MUDHo) has been preparing to create a national registry and information system for urban real estate (URPRIS), acknowledging the need to organize and digitize existing land records. (Belachew & Aytenfisu, 2010)

Nowadays most urban centers found in Ethiopia lack comprehensive and well organized system for the land management (Africa, 2004-05). The file containing the documents of land parcels are poorly organized in the cities/town archives. In some cases, even the basic document that shows the rights on the land did not give correct information and it is outdated. Absence of proper land holding file management system in the cities/towns lead to loss of the land holding files, legalizing forged files and giving poor service delivery to the owner of the file.

In Debark town case the land records are organized in files and ordered by file number. When there is a change or a transfer, an entry is usually, but not consistently, recorded in a registry book. The registry Book entries also contain a file number, but this number does not always

match with the number of the related file, as the numbering system may have been revised multiple times. Some of These registry books in the city archives were so old that they had become unreadable and were falling apart.

The land offices relied on landholders to remember their file number. They would need this number when registering a sale or inheritance, or another change in tenure. Without the file number, it could take days, or weeks, to find the file. The offices did keep lists of names, addresses, and file numbers, but these lists appeared to be outdated and unreliable. Sometimes, the files could not be found at all, in which case registration could not take place and landholders had to be sent away. The situation made it difficult for land offices to answer basic questions such as: How many Landholdings are residential and how many are commercial? How many title deeds have been? Issued this year? Which landholders have paid their annual land tax and which ones have not? Or even: how many landholder files are there in the city? The files did not contain addresses or Contact information, and it became clear that extensive to match landholders and parcels with their landholding files. Due to the absence of proper land inventory system, and traditional and outdated landholding file management system, currently, different problems has occurred; this problems includes:

1. Poor service delivery to the customers in the land management offices
2. Registration of transactions are not properly treated; thus encouraging illegal transaction (registration and transaction follow long and tidies procedures)
3. Absence of giving building permits (maintenance and construction), this encouraging illegal transaction
4. Land disputes do not get quick and legal solution.
5. Property taxation is not efficiently collected due to lack proper registration of owner value and use of property.
6. Land supply is not efficiently practiced due to inefficient identification of speculators and squatter settlers through land inventory.
7. Alarming increase of squatter settlement or illegal constriction.
8. Difficulty on planning and implementing development projects due to the lack of sufficient information and resources especially financial.
9. In adequate revenue collection, due to lack of up to date information on land evaluation and registration

Therefore, land related information, which has obtained through land inventory is an essential resource that must be managed efficiently in order to maximize potential benefits

that can be obtained from land. Land holding file management systems are concerned with the effective management of land information resources to achieve specific objectives and improve decision making in urban centers.

1.3. The objective of the study

1.3.1. General objective

The main objective of this study is to establish Integrated Land Ownership Management System Using Geospatial Technologies and Visual Basics; a Case of Debark Town, Ethiopia

1.3.2. Specific objectives

1. To conduct a parcel-level land inventory and linking spatial and non-spatial data.
2. To create a system that allows the user to access Google Earth Pro and Arc GIS land management data information's by using VB.Net.
3. To develop Data base contain Information of all landholdings.

1.4. Research Questions

Since this research focuses primarily on the Land Inventory and Filing System, the research questions were laid out:

1. How to conduct land inventory at parcel level and link spatial and non-spatial attributes?
2. How to create a system that allows the user to access Google Earth Pro and Arc GIS land management inventory data information's by using VB.Net.
3. How to develop Data base contain Information of all landholdings?

1.5. Significance of the Study

It is expected that the finding of the urban land inventory and filing system will help classify the exact active and deed land holding files, all vacant, formally occupied, informally occupied, and temporarily permitted land within the city administration's defined urban boundary. It will also allow the city, through proper land and property taxation, to protect its land resources from wastage, improve governance and increase revenue. Debark city will have an established urban neighborhood, blocks, parcels, and also a well-organized geo-database along with a modern land information management system after the completion of this report.

1.6. Scope of the study

This study is delimited geographically Debark is a town in northern Ethiopia, 90 kilometers north of Gondar on the highway between Gondar and Axum and in the Semien Gondar Zone of the Amhara Region.. Debark is the closest town to the Semien Mountains National Park, and is the location of the park headquarters. The content scope of the study is delimited geographically to the built-up urban area of Debark Town, Ethiopia, to prepare a file organization framework for land inventory by incorporating GIS, Google Earth Pro, and visual basics programming.

1.7. Limitation and delimitation of the research

Bureaucracy and limited access to data from multiple governmental entities and landowners were the major roadblocks from the time the problem was identified until the time the research was completed. Another issue is that files are not being separated into active and inactive files, and land ownership documents are being lost. Furthermore, the lack of an LDP (land development plan) posed a challenge for the built-up areas that formed after the photo was taken.

1.8. Organization of the Thesis

There are five chapters in this thesis. The first chapter introduces the proposed issues as well as the study's backdrop. Problem statements, research questions, study importance, aims, delimitations, and constraints are also included. The second chapter is a literature review. This includes the theoretical framework for review of land inventory and file organization which was studied by different scholars in different time and an empirical framework that includes previous studies related to this study and Policy's and Regulations prepared by Ministry of Urban Development and Housing. Following that, Chapter three delves deeper into the materials and methods. This chapter provides an overview of the study, materials used, data analysis methods, and the conceptual framework of the study. The findings of the data analysis used to achieve the study's objectives are presented in Chapter four, along with their interpretation and discussion. The study's conclusion and recommendations for future research are found in Chapter five.

CHAPTER II: LITERATURE REVIEW

This section explores theoretical, empirical, and conceptual frameworks. A Comprehensive review and Policy's and Regulations prepared by Ministry of Urban Development and Housing about land inventory and file organization are explored under a theoretical framework. An empirical framework explores key concept, other researches which was studied by different scholars in different time. This section concluded with the conceptual framework of the current study that was developed from both theoretical and empirical frameworks.

2.1 Theoretical framework

2.1.1. Land inventory and file organization

Land inventory is the process of counting any property, with a particular focus on public and state ownership, which is a map and human resource, and is essentially a collection of data showing ownership, size and service (Abebe, 2010). It is also a data base of the lands and their uses within the community including both developed and undeveloped land. Land inventory is conducted to specify and define land management unit locations, their boundaries without onsite fixations, identification of unused, irrationally used or misused lands and other land characteristics (Housing, 2004). Land inventory is a way of promoting land management systems (LMS), land management, land development, planning for land use, land transactions, and management of natural resources. The continued rapid rate of urbanization is expressed in the dynamics of physical expansion, population growth, and socio-economic development that together lead to the growing demand for urban land. This loophole has created an opportunity for speculators, informal settlers, and other illegal actors to occupy and encroach vacant and state lands (Africa, 2004-05).

2.1.2. Land inventory and file organization in Ethiopia

In almost all Ethiopian cities/towns, urban land creation and management activities are exacerbated by a multitude of issues that together have led to inefficiency, non-responsiveness to land-related problems, public complaints/dissatisfaction, and artificial land shortages for development against the illegal occupation of large parts of public land by speculators and informal developers (Zeluel et al., 2017b). The efficient and effective management of land and its related resources depends on the availability of good knowledge about the land.

2.1.3. Policy and Regulations considered in the study

Pursuant to the 2011 Urban Land Development and Management Policy, Amharic version, prepared by Ministry of Urban Development and Housing, due to the challenges faced by cities to register and monitor land resources in their administrative jurisdiction, public and state land especially on the expansion area is liable to illegal invaders and encroachers (Government, 2010). The poor inventory also makes administering the land resources as a critical problem to deal with. Besides, in urban areas, plots not conforming to parcel subdivision standard are increasing due to illegal invasion, subdivision and encroachment (T., 2015). Due to poor land inventory practice, houses administered by the State like Rental Housing Administration and Municipality-or kebele houses, are liable to illegal building as well as transferred to private ownership right through falsifying documents illegally for there is no title deed issued for such group of properties/parcels in the name of the right owner the state and the municipality (Government, 2010). The aforementioned policy statements reflect the consequent impact of poor land inventory and administration of state land on abuse of land resources by squatters, speculators and other illegal occupiers.

The urban land and management policy specifically articulates, regarding land inventory and registration, that “Cities shall protect public land from unnecessary wastages and unauthorized invasion. The policy also underscores that “Cities will take full inventory and register land under their administrative jurisdictions (Abuelgasim, A. A., Ross, W. D., Gopal, S and Woodcock, C. E., 1999). They will organize data on land that is sufficient to enable its efficient utilization and to prevent irregularities”. The 2011 urban land development and management policy (Ministry of Urban Development and Housing) (Ministry of Urban Development, 2014) stipulates the following tasks to be done:

1. Demarcating the administrative boundaries of cities;
2. Preparing urban land base map at block level;
3. Registering all parcels of land at block level using geographic coordinates;
4. Registering and protecting sites of Ground Control Points;
5. Issuing temporary use rights for temporarily occupied land; and repossessing the land immediately after the term for temporary use right expires.”

As per the 2011 Urban Land Development and Management Policy (Ministry of Urban Development and Housing), the following tasks are given due emphasis with regard to urban land inventory and file organization for the ultimate purpose of achieving efficient and sustainable land management in all urban centers of the country (Abebe, 2010):

I. Demarcating Administrative Boundary

In the absence of a proper delineation of administrative boundaries of cities, it is difficult to ensure accountability in its management (Abebe, 2010). Therefore, before carrying out land inventory and registration, cities shall demarcate their administrative boundary. The rationale behind this is to enable cities to undertake land inventory and registration for the efficient management of land. This, however, should not be interpreted as an attempt to control the natural growth of cities (Melkamu Belachew and Shewakena Aytenfisu, 2010).

II. Base map Preparation

Following this-(boundary demarcation), preparation of base maps that comprehensively indicate urban land resources shall be carried out. The Ethiopian National Mapping Agency has the full authority and responsibility of developing standards and monitoring base map preparations by cities. To prepare base maps and to carry out land inventory and registration, Ground Control Points of appropriate quality and quantity shall be established. Prior to this, proper site identification and preliminary work for establishing Ground Control Points shall be undertaken. If the ground for putting up the control points falls within land held by any entity, in addition to having the duty of clearing and handing over the site to the government for this purpose, these entities shall have the responsibility of protecting Ground Control Points.

III. Full Inventory of Land Resources within the Administrative Jurisdiction

Cities will take full inventory and register land under their administrative jurisdictions. They will organize data on land that is sufficient to enable its efficient utilization and prevent irregularities.

To sum up, as per the aforementioned urban land management and development policy, the tasks to be carried out for land inventory include demarcating administrative boundary of cities, preparing urban land resource map at block level, registering parcels of land at block level using geographic coordinates, registering and protecting sites of ground control points, issuing temporarily use rights for temporarily occupied land and repossessing the land immediately after the use right expires.

As per the Amharic version model regulation of the Ministry on Urban Jurisdiction Delineation (December, 2012), the following provisions and requirements are clearly stipulated, regarding land inventory and file reorganization:

Places where Urban Land Inventory and Registration Can Be Conducted:

1. Any vacant land within an urban administration.
2. Any land within urban jurisdiction with land cover of agriculture or grazing land.
3. Any greenery, recreation and resort land not occupied legally through title deed.
4. Temporarily use right land released by appropriate body through lease or rent.
5. Inventorying spots where ground control points are established.
6. Confiscated properties as per proclamation 47/67.
7. Places where urban land inventory and registration conducted:

1) Basic Information Template for Land Inventory

1. Address of the site: Region, City, Sub-city, Kebele, Block and Parcel
2. Parcel Identification Number
3. Size of the parcel(Area in square meter)
4. Land use function.
5. History of land acquisition.
6. Basic information template for land inventory

2) Land Inventory and Community Participation

1. Land inventory shall be conducted with full participation of the community.
2. The land inventory conducted at parcel level shall be done with participation of dwellers of the land or informants who have had knowledge of the area under consideration.

3) Title deed certificate provision and certification

1. Those unauthorized settlements, identified from the land inventory database, if they are eligible for title deed based on regulation devised as per proclamation no.721/2004 (Housing, 2004), the legal status shall be registered on archive file and the title deed shall also be registered on information bank. On the contrary, if the unauthorized settlements are not eligible to be registered as per proclamation no.721/2004, the land shall be registered as “short title”.
2. Regarding parcels located on property confiscated as per proclamation no. 47/67, title deed shall be issued for the responsible party by pertinent body and the certificate shall be registered on the information bank.

3. Certificate of title is issued for administration entity by pertinent body for public recreation and land allotted for recreation
4. Block certificate is given for vacant land by pertinent body, declaring in the name of the town or city and the certificate is granted for an entity responsible for administration.
5. Temporary use right is given for rightful owner in the case of land owned by farmers in urban jurisdiction for crop cultivation or grazing purpose. The certificate is registered in the information bank in the name of the rightful owner.
6. Temporarily holding land right transferred through lease or other modalities shall be given temporarily land holding certificate. The certificate shall be registered in the information bank.

4) Issues that need Monitoring for Protection of Land Resources

1. No one shall settle on registered vacant land.
2. No one can perform other activities on registered vacant land unless authorized by the pertinent body for administration.
3. Those proprietors lying adjoining to vacant land are not allowed to encroach on registered vacant land.
4. The Ground control points located within the registered vacant land shall be protected in order to inhibit the dislocation of the monument/bolt or other harmful activities.
5. Rightful owner/s shall be accorded use right certificate in the case of land owned by farmers in urban jurisdiction for crop cultivation or grazing purpose. The certificate is registered in the information bank in the name of the rightful owner.
6. Temporarily holding land transferred through lease or other modalities shall be given temporarily land holding certificate. The certificate shall be registered in the information bank.

5) Urban Administrative Boundary Delineation

Urban administrative boundary shall be delineated primarily by identifying natural and man-made features such as river, mountain, other natural landscape or road (Housing, 2004).

2.2. Empirical Framework

2.2.1. Key Concept of the study

The key concept which initiates research on this topic is as is the case in many other African countries, the land records in Ethiopia are mostly kept in Paper format, and the information is generally unorganized, duplicated, or outdated(Belachew & Aytenfisu, 2010). In Debark town case the land records are organized in files and ordered by file number. When there is a change or a transfer, an entry is usually, but not consistently, recorded in a registry book. The registry Book entries also contain a file number, but this number does not always match with the number of the related file, as the numbering system may have been revised multiple times. Some of These registry books in the city archives were so old that they had become unreadable and were falling apart. Land offices in Debark town relied on landholders to remember their file number. They would need this number when registering a sale or inheritance, or another change in tenure. Without the file number, it could take days, or weeks, to find the file. The offices did keep lists of names, addresses, and file numbers, but these lists appeared to be outdated and unreliable. Sometimes, the files could not be found at all, in which case registration could not take place and landholders had to be sent away.

As this study mainly focuses on Land Inventory and File Organization System the research is started by setting questions this area How to conduct land inventory at parcel level and link spatial and non-spatial attributes? How to develop an application which authorized the user to access land information by using VB.Net? And How to display land holding information by using GIS and Google Earth Pro? At the end of this study, these questions will be answered.

2.2.2. Explanation and evaluation of others theories

(Zeluel et al., 2017a) stated that Ethiopian urban centers lack a comprehensive and well organized archiving system for the land records. The files containing the documents of land parcels are poorly organized in the city archives. In some cases, even the basic documents as those showing the rights on the land are missing from the files. At the same time, this study tells as the Government of Ethiopia is preparing a Cadastre and Real Property Registration System (CRPRS) for its urban areas. Moving to this system requires not only systematic adjudication but also reorganizing and structuring the existing cadastral data. For (Abraham Kelilo Tula & Firaol Befikadu Geleta, 2019)the study said that the existing land information management system in Ethiopia can be generally identified as The existing manual paper land registration system does not have secured access for different types of

users and the data cannot be easily processed as per the required objectives, Information flow among different departments is restricted to manual information. This hinders the time and manipulation of data and the organized data recorded on paper does not have a basic relation between different data types (spatial and non-spatial data type). This research project developed a central database system using a PostgreSQL software to retrieve, update and store the required data using a user-friendly graphical interface.

(Un-Habitat, 2003)from some experience from Africa Uganda is implementing a strategic action plan that requires a LIS/GIS system and a land information management system that can deal with both cadastral and non-cadastral parcels as foundation data in the same land record system. In South Africa, the cadastral system covers 80-90 percent of the country but 25-30 percent of South Africans live outside the system. (Belachew & Aytenfisu, 2010)As is the case in many other African countries, the land records in Ethiopia are mostly kept in Paper format, and the information is generally unorganized, duplicated, or outdated. The Ministry of Urban Development and Housing (MUDHo) has been planning for the development of a national urban real property registration and information system (URPRIS) for some time And recognizes the need to organize and digitalize existing land records(Abraham Kelilo Tula & Firaol Befikadu Geleta, 2019).

(Zeluel et al., 2017a) (Belachew & Aytenfisu, 2010) and (Abraham Kelilo Tula & Firaol Befikadu Geleta, 2019) researches problem statement is the most relevant aim to this study. This research emphasizes that urban centers in Ethiopia lack a robust and well-organized land record archiving system. The files containing the documents of land parcels are poorly organized in the city archives. In some cases, even the basic documents as those showing the rights on the land are missing from the files. But the methods they used to solve this critical issue is differ from this study.(Zeluel et al., 2017a) and (Abraham Kelilo Tula & Firaol Befikadu Geleta, 2019) used the cadastral method to create a system that solves the existing file management system, and (Belachew & Aytenfisu, 2010) developed a central database system using PostgreSQL software to retrieve, update and store the required data using a user-friendly graphical interface.

Table 2.1: Summery of Empirical review

Literatures	The method they used
(Zeluel et al., 2017a)	Cadastre and Real Property Registration System (CRPRS)
(Abraham Kelilo Tula & Firaol Befikadu Geleta, 2019).	developed a central database system
(Belachew & Aytenfisu, 2010)	developed a central database system using a PostgreSQL software

2.2.3. How this study Fit in?

This study differs from the analysis because the method of file organization is focused on land inventory, not in the cadaster, which strengthens this study because it is quick, cost-effective, and time-efficient. And this analysis will also include some additional features from other studies, such as showing land information with the image of the landowner and designing the application used by only approved individuals to access land information. This study uses Geospatial technologies and visual basics.

Geospatial technology is a term used to describe the range of modern tools contributing to the geographic mapping and analysis of the Earth and human societies. These technologies have been evolving in some form since the first maps were drawn in prehistoric times. In the 19th century, the long important schools of cartography and mapmaking were joined by aerial photography as early cameras were sent aloft on balloons and pigeons, and then on airplanes during the 20th century. The science and art of photographic interpretation and map-making was accelerated during the Second World War and during the Cold War it took on new dimensions with the advent of satellites and computers. Satellites allowed images of the Earth's surface and human activities therein with certain limitations. Computers allowed the storage and transfer of imagery together with the development of associated digital software, maps, and data sets on socioeconomic and environmental phenomena, collectively called geographic information systems (GIS). An important aspect of a GIS is its ability to assemble the range of geospatial data into a layered set of maps that allow complex themes to be analyzed and then communicated to wider audiences. This 'layering' is enabled by the fact that all such data includes information on its precise location on the surface of the Earth, hence the term 'geospatial'.

Especially in the last decade, these technologies have evolved into a network of national security, scientific, and commercially operated satellites complemented by powerful desktop GIS. Besides, aerial remote sensing platforms, including unmanned aerial vehicles (e.g. the Global Hawk reconnaissance drone), are seeing increased non-military use as well. High-quality hardware and data are now available to new audiences such as universities, corporations, and non-governmental organizations. The fields and sectors deploying these technologies are currently growing at a rapid pace, informing decision-makers on topics such as industrial engineering, biodiversity conservation, forest fire suppression, agricultural monitoring, humanitarian relief, and much more.

visual Basic (VB) is an event-driven programming language and the environment from Microsoft that provides a graphical user interface (GUI) that allows programmers to modify code by simply dragging and dropping objects and defining their behavior and appearance. VB is derived from the BASIC programming language and is considered to be event-driven and object-oriented. VB is intended to be easy to learn and fast to write code with; as a result, it is sometimes called a rapid application development (RAD) system and is used to prototype an application that will later be written in a more difficult but efficient language. The last version of VB, Visual Basic 6, was released in 1998 but has since been replaced by VB .NET, Visual Basic for Applications (VBA), and Visual Studio. NET. VBA and Visual Studio are the two frameworks most commonly used today.

2.2 Conceptual framework

As stated in the approach of the assignment, the urban land inventory has two sub-processes: land inventory and file reorganization. Thus, it is planned to undertake the two work sub-processes in parallel and make information exchange when needed.

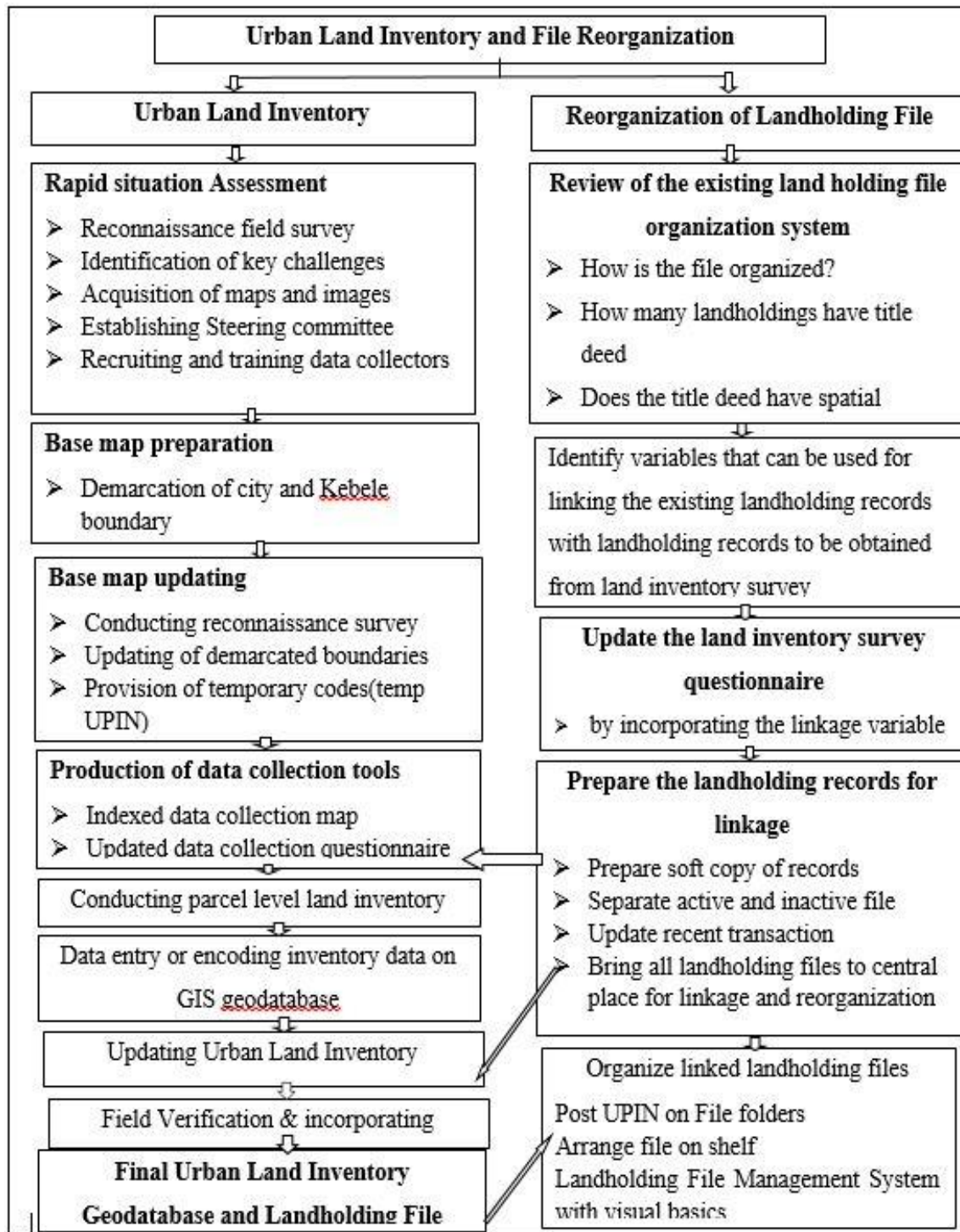


Figure 2.1: Technical scheme

CHAPTER III: MATERIALS AND METHODOLOGY

3.1. Description of the Study Area

The study area Debark is a town in northern Ethiopia, 90 kilometers north of Gondar on the highway between Gondar and Axum and in the Semien Gondar Zone of the Amhara Region. It has a latitude and longitude of 13°08'N 37°54'E and an elevation of 2850 meters above sea level. Debark is the closest town to the Semien Mountains National Park, and is the location of the park headquarters. The distance between Addis Ababa and Debark is 834.3 Km (kilometers).

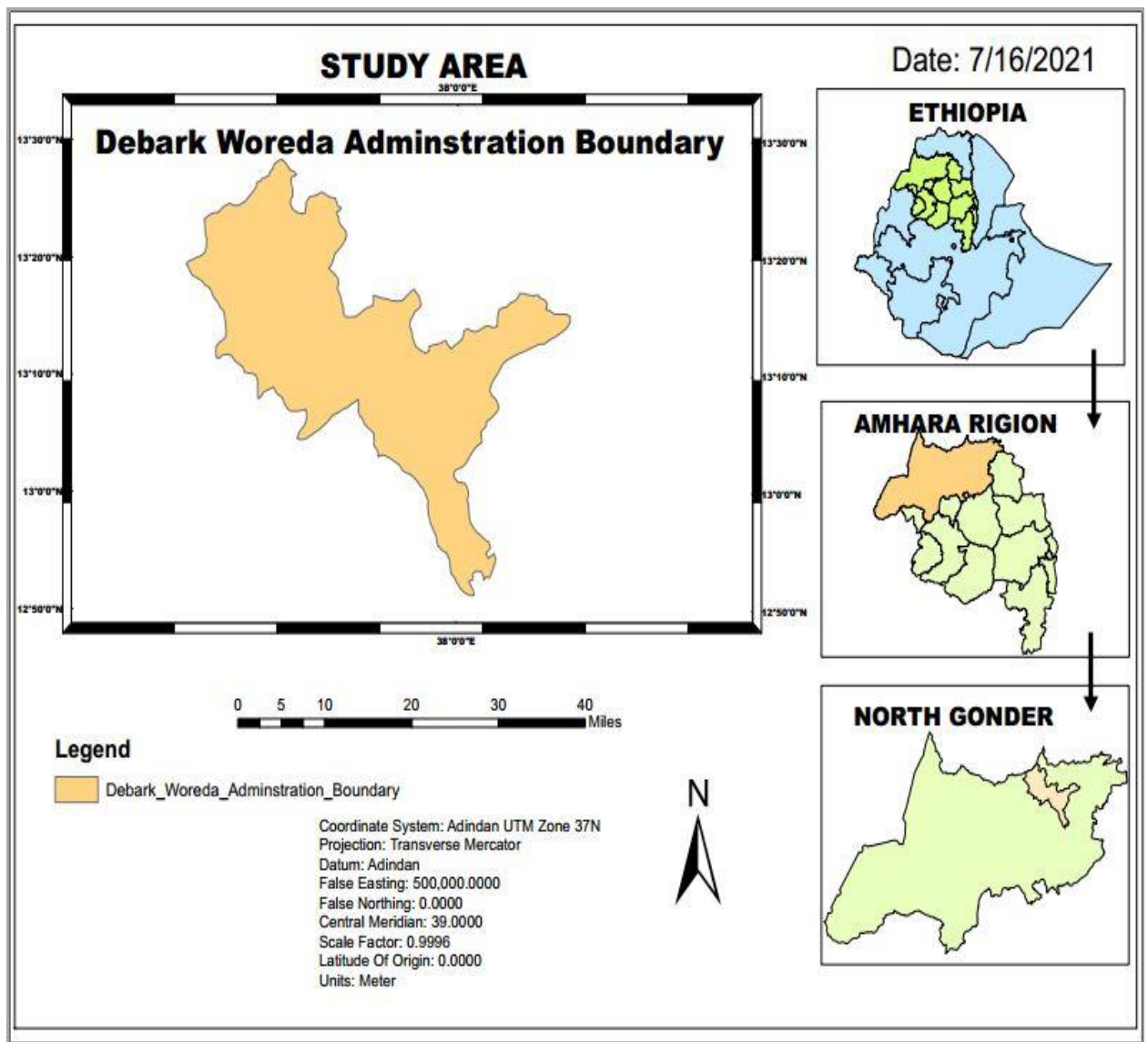


Figure 3.1 Location Map of Debark Town

3.1.1. Population

According to CSA data of 2007, the population projections of Ethiopia for all regions at the district level for 2015, the total population of the town was estimated to be 32,600. Out of these, 15,350 are male and 17,250 are female. The town has three kebeles, the smallest administrative units.

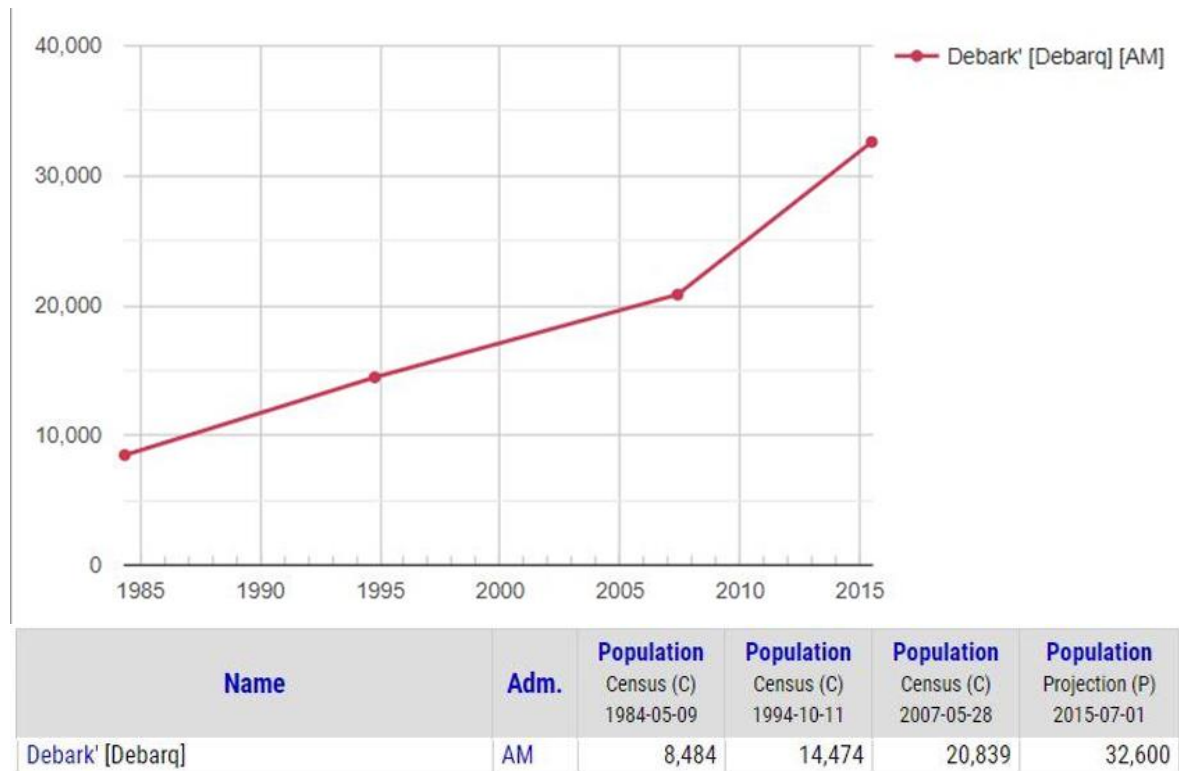


Figure 3.2: Population graph of debark town

3.1.2. Temperature

In Debarq', the wet season is cool and overcast and the dry season is comfortable and partly cloudy. Over the course of the year, the temperature typically varies from 6.67°C to 24°C and is rarely below 4.44°C or above 27.2°C. The warm season lasts for 4.0 months, from January 29 to May 27, with an average daily high temperature above 22.2°C. The hottest day of the year is April 4, with an average high of 24.4°C and low of 10.5°C. The cool season lasts for 2.2 months, from July 9 to September 15, with an average daily high temperature below 17.7°C. The coldest day of the year is December 21, with an average low of 6.67°C and high of 21.67°C.

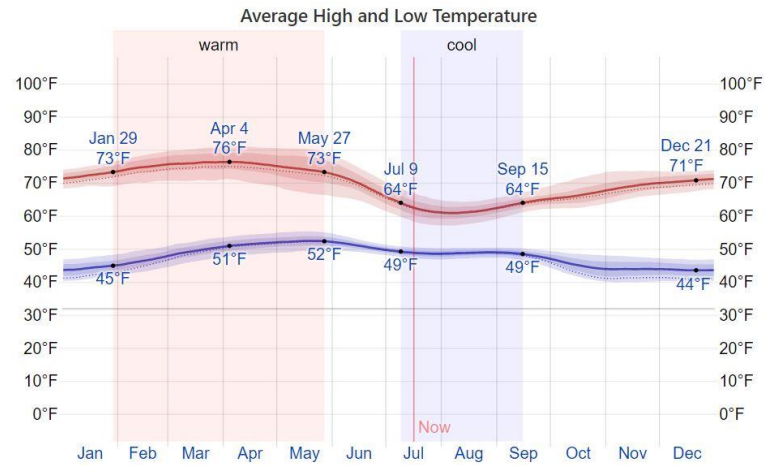


Figure 3.3: Average temperatures in Debark (*Average Weather in Debark, Ethiopia, Year Round - Weather Spark, n.d.*)

3.1.3. Rainfall

Debark' experiences extreme seasonal variation in monthly rainfall. The rainy period of the year lasts for 7.6 months, from March 16 to November 3, with a sliding 31-day rainfall of at least 12.7 mm. The most rain falls during the 31 days centered on August 3, with an average total accumulation of 294.64 mm. The rainless period of the year lasts for 4.4 months, from November 3 to March 16. The least rain falls around January 31, with an average total accumulation of 2.54 mm.

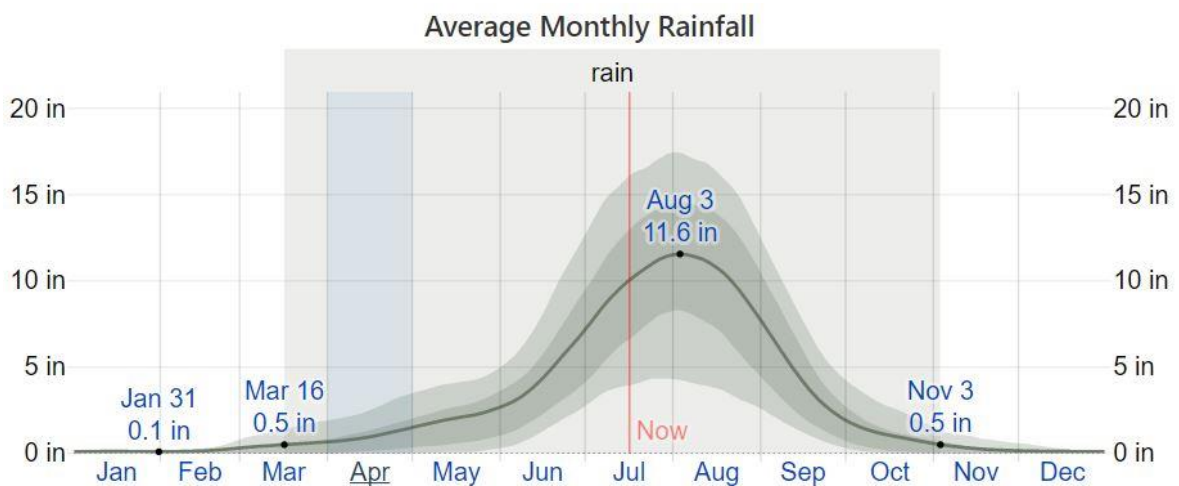


Figure 3.4 Average Monthly Rainfall in Debark (*Average Weather in Debark, Ethiopia, Year Round - Weather Spark, n.d.*)

3.2. Research Design

The conceptual structure or the design of the research project that the researcher followed in conducting the research is essential to clearly define and visualize the whole image of the work. Defining the research design highly contributes towards result findings by showing overall highlights of methods. Therefore, before the commencement of the research techniques, it is imperative to prepare tracks of the research by assembling all the requirements for the problem-solving objective.

3.2.1. Approaches to the Research

In this study, both Quantitative and Qualitative research approaches are implemented to get the final result and it can be known as Mixed Approach. Even though the qualitative side has more weightage than the quantitative, it is difficult to attain the objective of the study without the involvement of both.

3.2.2. Research Type

It is known that there are different types of researches to be employed based on the goal (purpose), Type of data, Field of study, or the aim (objective) of the research. Therefore, this study is categorized under the applied research type. Because the result can be applied to solve real-world problems.

3.3. Data Sources and type

The data sources that are collected for research fall into two categories. These are the primary and secondary data sources.

3.3.1. Primary Data Collection

The primary data is collected on the field survey using by tracing the boundary of the landholders on the printed Arial photo, and by collecting point data by handheld GPS. There was a tabular form which filled by the data collector about the parcel from each landholding parcel. The information included the parcel owners Kebele, Name of Title deed owner (if the title deed is registered on person different from the current owner), Title deed No, Acquisition year, Method of acquisition, Tenure status, land use type (existing and on the title deed), Area (title deed), last tax paid year, archive number and parcel number. Almost all variables are made to own the associated explanatory tables which describe the land use coding is also attached with the tabular form used as a guide for a data collector. The first thing made in conducting parcel based land inventory data collection is identification of the

parcel on the ground. The parcel which is initially identified on the image map has located or identified on the ground and enough verification was made if changes are made after acquisition of the Ortho Photo. This was done by one or more of the following methods:

1. Relating features on the image to features on the ground (matching the same features (on the image and on the ground)
2. By comparing the number of parcel frontages in a block on the image and on the ground
3. Estimating (or scaling) the distance of a parcel boundary on the image map and comparing the same distance estimated on the ground.
4. By comparing scaled image map distances with measurement.
5. Where a parcel is shown correctly on the draft image map, indicate this on the field map by a tick [✓] inside the parcel. If a parcel is not correctly shown, mark this directly onto the field map and on a separate sketch where some measurements are needed.
6. If measurements are needed, these can be made in most cases using a tape measure.
7. Asking the owners or neighbors if basic changes are made after taking of aerial photograph, by referring the date when the image was captured.

3.3.2. Secondary Data Collections

The required Ancillary data for the study area were collected from the municipality office of Debark town. The city acquired a high-resolution Ortho Photo with 15 cm spatial resolution flown by Information Network Security Agency of Ethiopia and georeferenced by Ethiopian Mapping Agency Ground Control Points and also.

Table 3.1 secondary data required for the study.

No	Data used	Data type	Source	purpose
1	Ortho photo of Debark town	tiff file	Debark Municipality office	For data collection
2	The administrative boundaries of Debark town	Shape file	Debark Municipality office	To identify the boundary

3	Existing neighborhood boundary of Debark town	Shape file	Debark Municipality office	Reference to delineate the new neighborhood
4	Master plan of Debark town	Shape file	Debark Municipality office	to understand the future plan

3.3.3. Software and Materials

Software and materials listed in Table 3.5 below are used in the study for conducting tasks successfully.

Table 3.2: Software and materials used

No	Software and materials used	Purpose
1	Arc GIS 10.8	To link spatial to a spatial information
2	Google earth pro	For display the image and information of land holdings
3	Visual studio 2019	To provide accessing application
4	Handy Held GPS	To measure coordinate point
5	Tape or meter	To measure distance
6	Computer	To perform over all analysis
7	Color Printer	For printing
8	Binder	For binding

3.4. Data Analysis

3.4.1. Creating Geodatabase, Feature data set, and Feature class

The Geodatabase is the core of the ArcGIS data model that has the information about the earth or land. The first step of GIS-based land inventory is creating Geodatabase in arc catalog, which can contain multiple points, polygon, and/or polyline layers. A Geodatabase

is a relational database that is the collection of tables logically associated with each other by common key attributes stores geographic information. Tables in a Geodatabase can store a geometric object (i.e., polygon, line, or point) with defined shape and location.

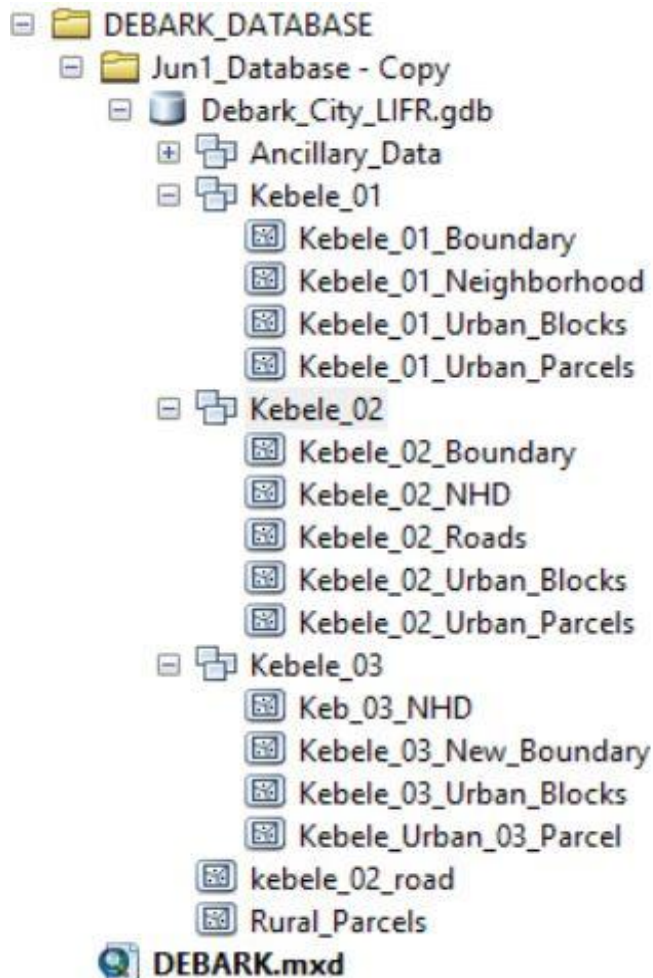


Figure 3.5: Image of data base

3.4.2. Creating Tabular data formats

GIS data sets include not lonely spatial data (such as point, line, polygons) but also attribute data in tabular form. A list of attributes that could be included in the table for a polygon data set of attribute data is defined as data that relates to a specific, precisely defined location. The data are often statistical but maybe text, images, or multi-media. These characteristics can be quantitative and qualitative. Attribute data is often referred to as tabular data. Some The attribute table will contain the domain for the Geodatabase

UPIN	Reg	City	Kebe	NHD	Block	Parcel	First Nam	Fathers	GrandFat	TitleDeed	Land_Acquis	Acquisition	Land T	Landus	Landuse	Area	Area M	Last Ta	File N	Join	Area	Block	h+h+P	Parcel
AM0110	AM	011	01	14	04	003	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	1. Residen	<Null>	<Null>	<Null>	<Null>	<Null>	10	304	<Null>	008
AM0110	AM	011	01	15	06	006	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	1. Residen	<Null>	<Null>	<Null>	<Null>	<Null>	10	281	<Null>	006
AM0110	AM	011	01	15	07	003	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	1. Residen	<Null>	<Null>	<Null>	<Null>	<Null>	10	500	<Null>	002
AM0110	AM	011	01	08	08	006	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	1. Residen	<Null>	<Null>	<Null>	<Null>	<Null>	10	900	<Null>	026
AM0110	AM	011	01	03	01	014	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	1. Residen	<Null>	<Null>	<Null>	<Null>	<Null>	10	902	<Null>	014
AM0110	AM	011	01	03	01	013	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	1. Residen	<Null>	<Null>	<Null>	<Null>	<Null>	10	902	<Null>	015
AM0110	AM	011	01	03	01	015	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	1. Residen	<Null>	<Null>	<Null>	<Null>	<Null>	10	902	<Null>	016
AM0110	AM	011	01	08	07	012	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	1. Residen	<Null>	<Null>	<Null>	<Null>	<Null>	10	900	<Null>	016
AM0110	AM	011	01	03	03	009	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	1. Residen	<Null>	<Null>	<Null>	<Null>	<Null>	10	70	<Null>	006
AM0110	AM	011	01	04	12	003	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	9. Administ	<Null>	<Null>	<Null>	<Null>	<Null>	10	167	<Null>	019
AM0110	AM	011	01	08	02	002	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	3. Mixed(R	<Null>	<Null>	<Null>	<Null>	<Null>	10	94	<Null>	004
AM0110	AM	011	01	03	08	020	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	3. Mixed(R	<Null>	<Null>	<Null>	<Null>	<Null>	10	232	<Null>	008
AM0110	AM	011	01	09	07	034	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	1. Residen	<Null>	<Null>	<Null>	<Null>	<Null>	10	195	<Null>	025
AM0110	AM	011	01	09	07	002	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	1. Residen	<Null>	<Null>	<Null>	<Null>	<Null>	10	195	<Null>	020
AM0110	AM	011	01	15	07	005	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	1. Residen	<Null>	<Null>	<Null>	<Null>	<Null>	10	500	<Null>	003
AM0110	AM	011	01	06	07	045	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	1. Residen	<Null>	<Null>	<Null>	<Null>	<Null>	10	930	<Null>	127
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AM0110	AM	011	01	01	09	006	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	1. Residen	<Null>	<Null>	<Null>	<Null>	<Null>	10	414	<Null>	006
AM0110	AM	011	01	10	02	023	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	1. Residen	<Null>	<Null>	<Null>	<Null>	<Null>	10	285	<Null>	005
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AM0110	AM	011	01	08	010	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	1. Residen	<Null>	<Null>	<Null>	<Null>	<Null>	10	423	<Null>	013

Figure 3.6: Tabular data formats

3.4.3. Base Map Preparation

The purpose of the base map is to collect existing man-made and natural features which provide basic line information for land inventory to be conducted through ground verification and collecting information about land holding. A land inventory requires a suitable base map onto which the spatial categorization of urban attributes is represented. The base map most suitable for land inventory purpose is an up-to-date ortho-photo or Satellite image.

3.4.4. Digitizing sample block and assigning the temporary block number

Digitizing is the process of converting the geographic features on an analog map into a digital format using a digitizing tablet, or digitizer, which is connected to a computer. In this Step, we will digitize the sample block and assigned the block number randomly which makes our data collection simple. The thematic map of the sample block is used also as a reference during the time of data collection.

3.4.5. Preparation and Production of Data Collection Maps

Preparation of index map for land inventory includes setting of indexes at an interval that suits the scale preferred for capturing inventory data on the ground. In this regard, the consulting firm proposed a large scale 1:700 or 1:1000 indexed maps in A3 size papers by labeling major land marks in the map, scale and North arrow to facilitate field data inventors.



Figure 3.7: Base map used for data collection

Data entry

The process of encoding the information about each and individual parcels which are collected on the field concerning their temporary block number which is given in the sample block in which was digitized before the site work to simplify the data collection process and also they Temporary parcel number which is given on the site to create a link between the parcel and its attribute information.

Data entry is the act of entering information into electronic formats by using word processing or data processing software hosted on a computer and its data entry operators who perform these tasks .Digitizing is also the process of converting the geographic features on an analog map into a digital format using a digitizing tablet, or digitizer, which is connected to a computer. Features on a paper map are traced with a digitizer puck, a device similar to a mouse, and the x, y coordinates of these features will be automatically recorded and stored as spatial data. The data that recorded on GPS was downloaded. And it was converted into a usable data type. The type of data that is usable in ARC-GIS is that of CSV comma-delimited. So, after the data is downloaded into the computer it is converted into a CSV file by using MS excel.

3.4.6. Defining and Delineating Parcels

A land parcel is an area or unit of land that is used exclusively or is separately held by an agency, group or individual. Land parcels are defined by a series of boundary lines that form an enclosed area or polygon. These boundary lines are typically demarcated (marked on the ground) by walls, fences, hedges or other linear features. In some cases, boundaries, may only be marked by beacons (pegs or marks) at the intersection corner or turning points of straight boundary lines.

Boundary lines dividing adjacent lands have zero width, which means that accurately recording the position of these lines and corners usually means precise surveying methods. However, for land inventory purposes, it is not necessary to precisely survey the boundaries to centimeter accuracies in absolute and relative position. It is more important to identify the land parcel in relation to its location and relative position to other parcels.

Accordingly, land parcels of Debark City will be demarcated using the aforementioned definitions and following the rules specified above. Typical example of parcel demarcation is presented in figure below.



Figure 3.8: Digitized parcels

3.4.7. Delineation of Neighborhood and provision of Neighborhood code

As it is a new trend to use neighborhood in land inventory as well as national addressing system, it required to create a common understanding on the definition of the neighborhood and decision on its incorporation in the parcel coding system. Standard rules which are formulated for defining and demarcating neighborhoods are:-

1. A Neighborhood within a Kebele shall have defined and clear boundary;
2. A Neighborhood contains a maximum of 200 Parcels;
3. A Neighborhood must not contain more than 200 parcel
4. The number of blocks within a given Neighborhood is determined on the number of parcels mentioned under principle number 1;
5. The boundary of a neighborhood shall not cross a major road, High tension line, Kebele boundary, River, and wide natural dividing features;
6. A neighborhood should be defined in such a way that it will be understandable to the local community and visitors;
7. A neighborhood may have a size equal to a block in some case;

By using these rules the neighborhood is digitized. The code is also assigned for neighborhoods within a given Kebele is numeric and it contain 2 in a continuous manner. The code assignment for neighborhoods in a given Kebele starts from the North West and it goes into the left (Clockwise) for all built up and planned areas. However, when NHD in a block are arranged irregularly, NHD code is given starting from the northwest tip and moves in a clockwise direction at the beginning and continue in a zig-zag manner by following the paths that serve for accessing the next adjacent NHD.

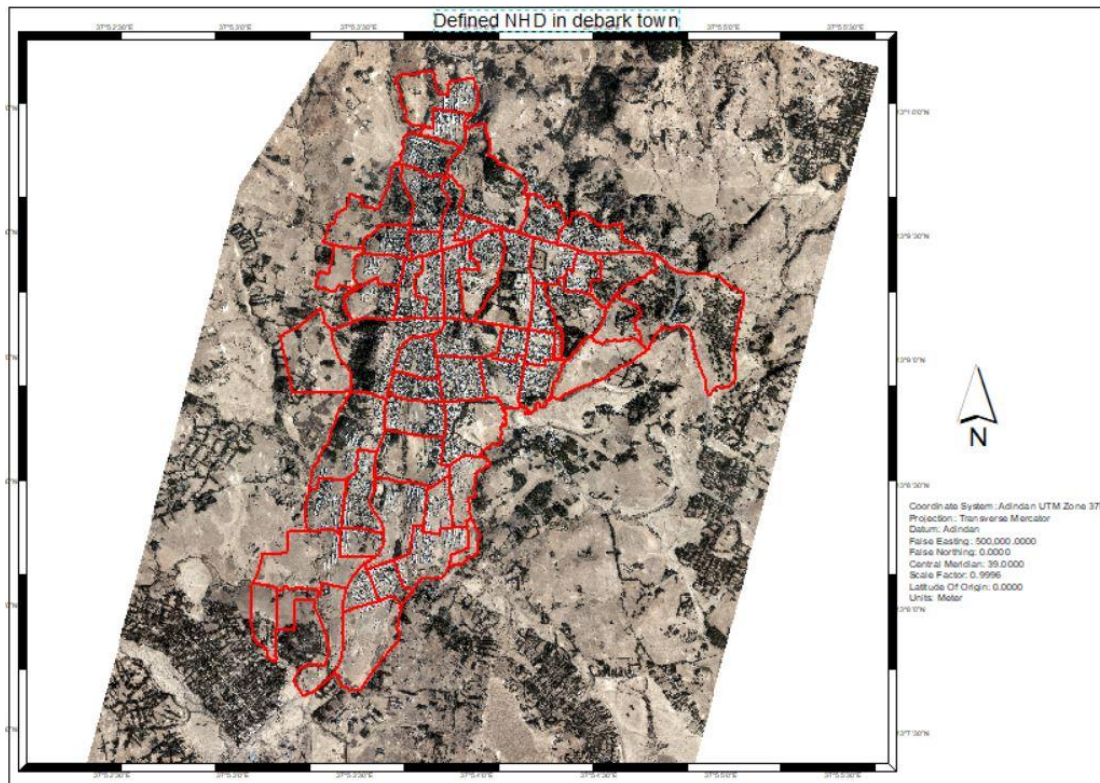


Figure 3.9: Defined NHD in debark town

3.4.8. Delineating block and Provision Block code

Urban blocks are the third hierarchy next to kebeles and neighborhoods in the city's land inventory boundary. Urban blocks within a given neighborhood are defined by existing roads and other natural features. A block may contain as many parcels and in some cases, a block is equal to a parcel. This is done by the tool which is called Aggregate Polygons (Cartography) this tool combines polygons within a specified distance of each other into new polygons.

Blocks of Debarq will be delineated using rectified ortho-photo as a base map and taking the standard definition of block which is stated in Urban Landholding Registration Proclamation (No. 818 /2014) "'block partition" means a plan block drawn up in line with roads and line features according to the standard prepared for block partition and containing one or more holdings within the lower administrative unit of an urban center".

Provision of Block code within a neighborhood is assigned starting from the North-West tip and moving clockwise for regularly arranged blocks. However, if blocks in a neighborhood are arranged irregularly, block code is given starting from the northwest tip and moving in a clockwise direction at the beginning and continuing in an ordered manner by following the paths that serve for accessing the next adjacent parcel.

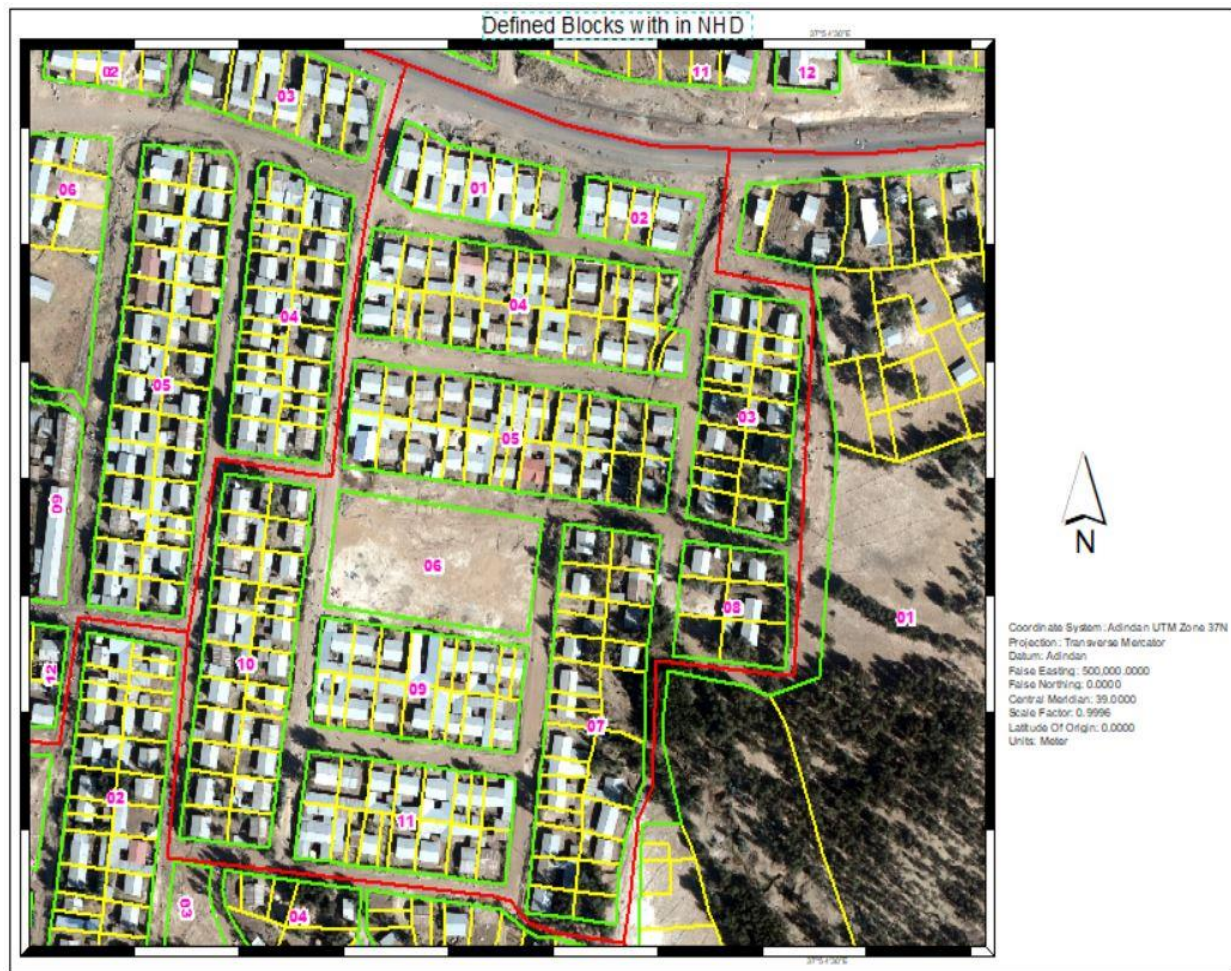


Figure 3.10: Defined Blocks with in NHD

3.4.9. Assignment of Unique Parcel Identification Number (UPIN)

This includes assigning of unique code for the Amhara region which identifies it from other regions in the country, Unique city code for Debarq City under the Administrative boundary of Amhara region, for each kebeles found within the City Administration boundary; unique neighborhood codes under the boundary of each kebele; unique block codes under the boundary of each neighborhood, unique parcel codes under the boundary of each block.

The provision of parcel code is made in light of the Urban Land Holding Registration Proclamation (No. 818/2014) and standards issued for guiding implementation of Urban Legal Cadaster survey (No. 03/2015). On top of these, regional proclamations, regulations, standards and manuals which have been enacted pertinent to land inventory will be referred prior to provision of the final unique codes.

The UPIN is 14 digit that signifies the region, city, kebele, Neighborhood, block and parcels as reference for commencing the project and to develop working guideline in consultation with the client and key stake holders for provision of the final unique codes for all elements. The arrangement and characteristics of the 14 digit codes are:

Arrangement= Region code + City/town code +Wereda/Kebele Code+ Neighborhood Code + Block code+ Parcel code

- Region code (type =alphabetical; 2 digit)
- City Code (type =number; 3 digit)
- Wereda/Kebele code: (type =number; 2 digit)
- Neighborhood codes (type =number; 2 digit)
- Block Codes (type =number; 2 digit)
- Parcel codes (type =number; 3 digit)

Accordingly, the regional code for Amhara Regional Government is AM. Therefore, it is planned to apply the following optional strategy for carrying out the assignment:



Figure 3.11: Parcels with UPIN

3.4.10. File reorganizing

File organization is the process of Linking every landholding file in the municipal office with their corresponding attribute which is recorded in ArcGIS Geodatabase obtained from land inventory survey. These Identification variables that used for linking purposes were title deed number, owner name, and archive file number. These variables were obtained from landholding files. Provide temporary unique ID for the matched files. This temporary unique ID includes parcel id, block id, and neighborhood id. Provide permanent unique ID (UPIN) for the linked landholding files in the city administration archive as City – Kebele – Neighborhood - Block- Parcel by providing unique ID. Post UPIN on the file folders Arrange file on the shelf.

3.4.11. Import the shape file of the parcel data in to Google earth pro

The main use of the Google earth software is to show or to display the final output of the study since the final output is shown in Google earth pro by importing the shape file of the parcels in to Google earth pro.

3.4.12. Insert image parcel owner

The other and the main use of the Google earth pro software is to show and to make a clear identification of each parcel owned by inserting the image of the parcel owner.

3.4.13. Create Login form visual studio programming

This programming is performed to create an application in which integrated to Google Earth Pro and GIS software and ask password to open the files exported to the software. The visual basics windows application contains two forms the first one is login form this log in form contain textbox to insert username and password if it is correct the next form will load and the user can access landholding information's by using ArcGIS and Google earth pro.

CHAPTER IV: RESULT AND DISCUSSION

4.1. Results

In this section, the study findings are interpreted and discussed concerning a research objective, empirical framework, and methodology. And also presents the land use pattern, total number and spatial distribution of parcels by ownership status, number of blocks by major land uses, and, more importantly, the size and spatial distribution as well as current status of state lands and vacant lands under different ownership status. It also indicates the number, size and distribution of temporarily allowed lands which are eventually state lands. The results are presented for each Kebele separately in the following sub-sections. The results on urban land inventory includes Neighborhood, Block and parcel based land information.

4.1.1 Results of Land Inventory for Urban Built up

A total about 7973 parcels were mapped and attribute data collected in all the three Kebele's of Debark City. The attribute data collected for the urban land parcel include the following:

- Full Name
- Land Acquisition
- Acquisition Year
- Tenure ship
- Land use(Title and Existing)
- Area(Title and Tax Receipt)
- Title Deed Number
- Last Tax Paid Year

From the total 7973 mapped parcels, Kebele 02 has the maximum number of parcels which accounted 3073 followed by Kebele 03 and Kebele 01 has the second and third which accounted 2548 and 2352 respectively. The rest of the details can be referred from table 4.1 below

Table 4.1: Parcel based Land Inventory Result of Debark town at Kebele Level

Kebele Name	Number of Parcels	Percent
Kebele 01	2352	29.499 %
Kebele 02	3073	38.543 %
Kebele 03	2548	31.958 0%
Total	7973	100.00%

4.1.2. Total Number of Neighborhood Block and Parcels for Urban Built up

Block and Neighborhood are inventoried in each Kebele particularly for the urban part of the city in which the current Structure Plan and previous plans implemented. Accordingly, the result shows that a total of 56 and 598 Neighborhood and Block were mapped in Debark City respectively. Kebele 02 has the largest number of Neighborhood and Block which is a total count of 21, and 241 respectively followed by Kebele 03 has 20 and 191 Neighborhood and Block respectively. The rest of the details can be referred from table 3 below.

Table 4.2: Total Number of Mapped Neighborhoods and Blocks

Kebele Name	Number of Neighborhood	Number of Block
Kebele 01	15	166
Kebele 02	21	241
Kebele 03	20	191
Total	56	598

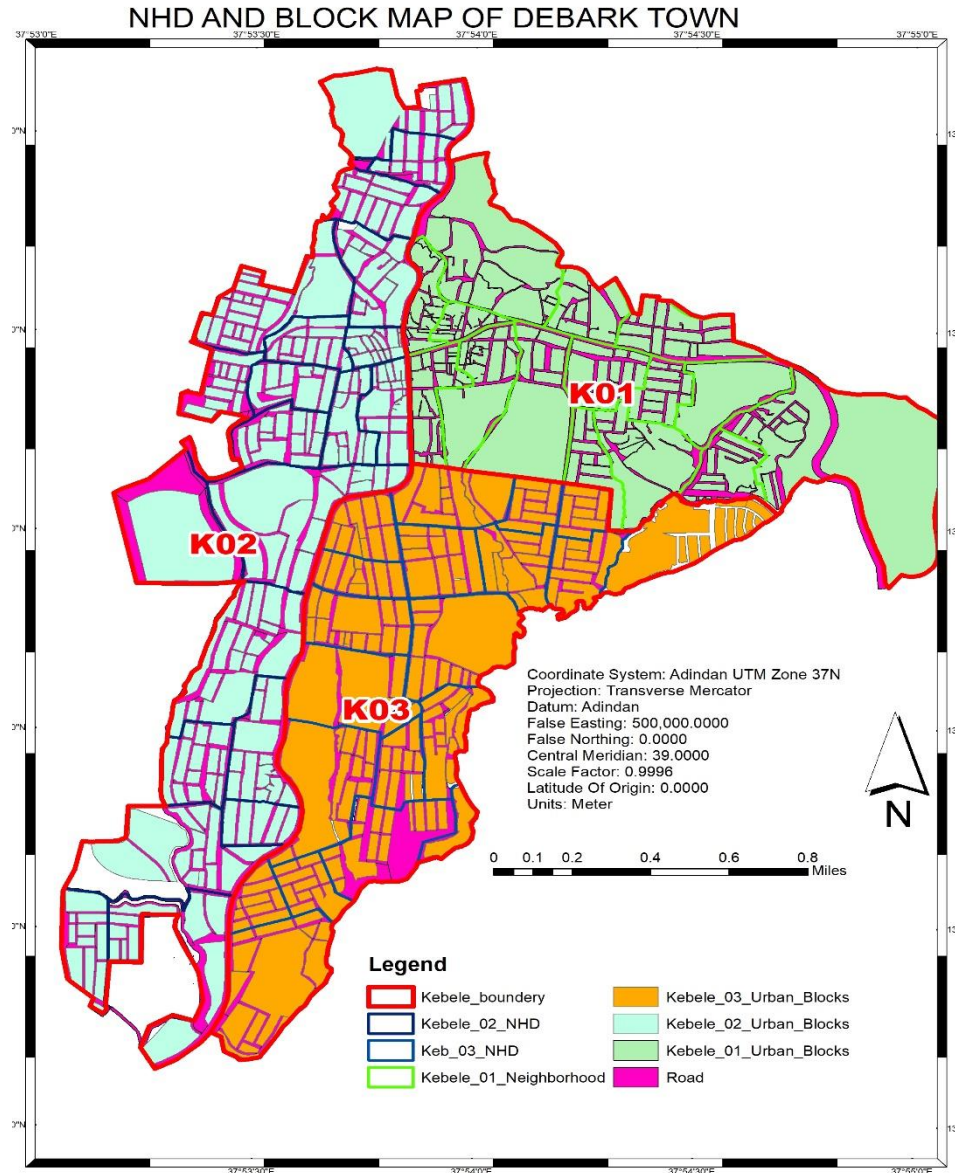


Figure 4.1: NHD and Block Map of debark town

4.1.2 Land use/Land Cover of Urban Land Parcel

The current land use/land cover of all mapped parcels was inventoried during the field survey period. Accordingly; the inventory result revealed that about 39.46 %(211.17 hectares) of the total parcels have Residential land use followed by Social Service which accounted 25.01 %(133.83hectares) and Commercial with a percentage share of 8.29 %(44.37hectares). The rest of the land uses are showed in table 4 below

Table 4.3: Distribution of Existing Land use/Land Cover for Urban Parcel

S.No	Land use Category	K01 Area(m2)	K02 Area(m2)	K03 Area(m2)	Total Area(m2)	Area(Ha)	Percent
1	Residential	507490.999	985872.760	1052177.608	2545541.56	254.554	50.68%
2	Social Service	651221.006	332713.661	274077.949	1258012.62	125.801	25.04%
3	Gorge	553.760	4655.590		5209.35	0.521	0.001%
5	Forest Land	125717.331			125717.331	12.572	0.025%
10	Recreation and Sport		13363.695	29200.102	42563.695	4.256	0.008%
12	Commercial	38320.010	81411.312	37872.696	157604.018	15.760	0.031%
14	MSEs(Permanent)		75506.944	10732.847	86239.791	8.624	0.017%
15	MSEs(Temporary)	133028.054	37777.350	12485.543	183290.947	18.329	0.036%
16	Mixed land use	75604.401	29115.554	13985.496	118705.451	11.870	0.023%
17	Vacant or State Land	50221.616	181953.113	20823.662	252997.729	25.3	0.05%
18	Agricultural Land	3538.964	5907.518	117038.021	128284.503	12.828	0.025%
20	Greenery	10372.931	12759.436	14347.889	37480.256	3.748	0.007%
21	Open Space	1056.334	11245.744	12679.887	24981.965	2.478	0.004%
22	Administration	19334.704	27725.409	9337.802	56397.915	5.64	0.011%
23	Road Network						
	Total	1616460.114	1800008.087	1604759.504	5021227.69	502.281	100%

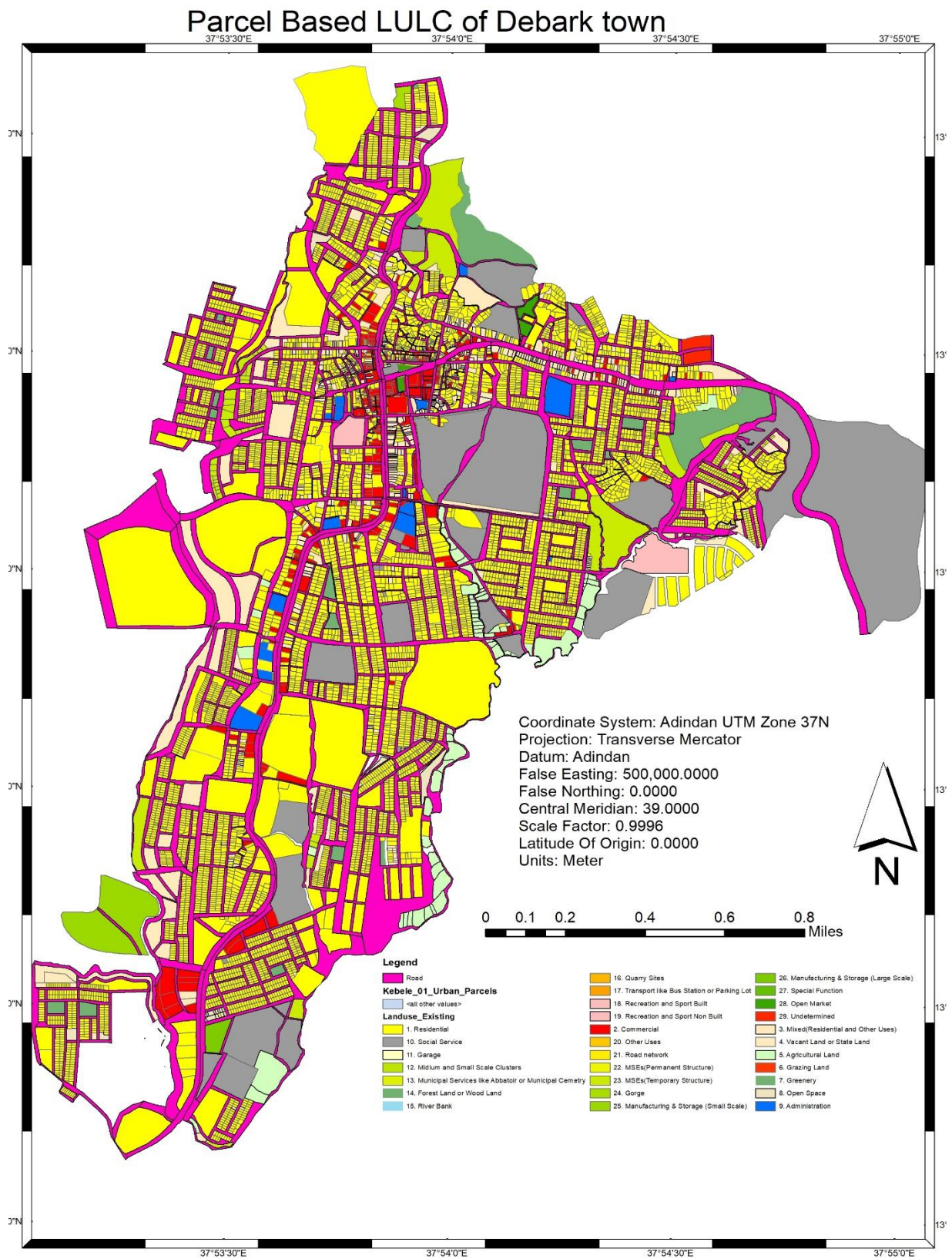


Figure 4.2: Parcel level Land use/Land cover Map of debark

4.1.3 Inventory of Vacant Lands

Important result from Land Inventory of Debarq City is knowing all vacant lands. Accordingly, the inventory result shows that Kebele 02, Kebele 01 and kebele 03 ranked 1st to 3rd for having that largest vacant lands of 18.195, 5.022 and 2.082 hactars respectively. There are about 21.535 hectare Area Covered.

Table 4.4: Inventory of Vacant Lands in Debarq City

Kebele Name	Kebele 01	Kebele 02	Kebele 03	Total
Parcels (number)	35	44	25	104
Area(Hac)	5.022	18.195	2.082	21.535

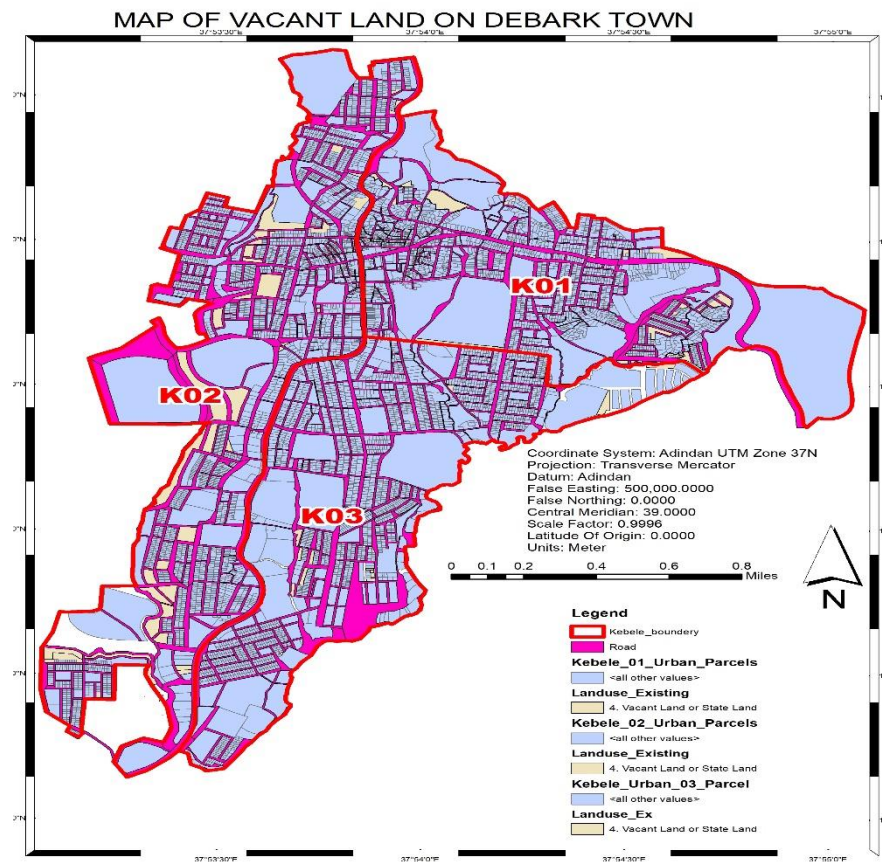


Figure 4.3: Map of vacant land in Debarq town

4.1.3. Inventory of Extra Lands occupied by Individuals and Institutes

Other Important result from Land Inventory study of Debark City is knowing all extra land occupied by private owners and institutions without paying any tax for the city administration. Accordingly, the inventory result shows that a total of 159.555 Hectare of extra land occupied

Table 4.5: Vacant Lands in Debark City

Kebele Name	Kebele 01	Kebele 02	Kebele 03	Total
Number of extra holder parcels	266	236	177	649
Vacant Land Area (hac)	67.562	21.797	70.196	159.555

4.1.4. Inventory of kebele owned parcel

The other important result from Land Inventory of Debark City is knowing all Kebele Houses. Accordingly, the inventory result shows that there are about 167 Kebele parcels in the city while Kebele 01, Kebele 03 and Kebele 02 ranked 1st to 3rd for having that largest Kebele parcels area in hectare 9.409, 2.428 and 15.07 parcels respectively. The rest of the details can be referred from the table below.

Table 4.6: Inventory result of Kebele Parcels (Houses)

Kebele Name	Kebele 01	Kebele 02	Kebele 03	Total
Total Kebele Houses	83	68	16	167
Area(M2)	9.409	2.428	15.07	26.907

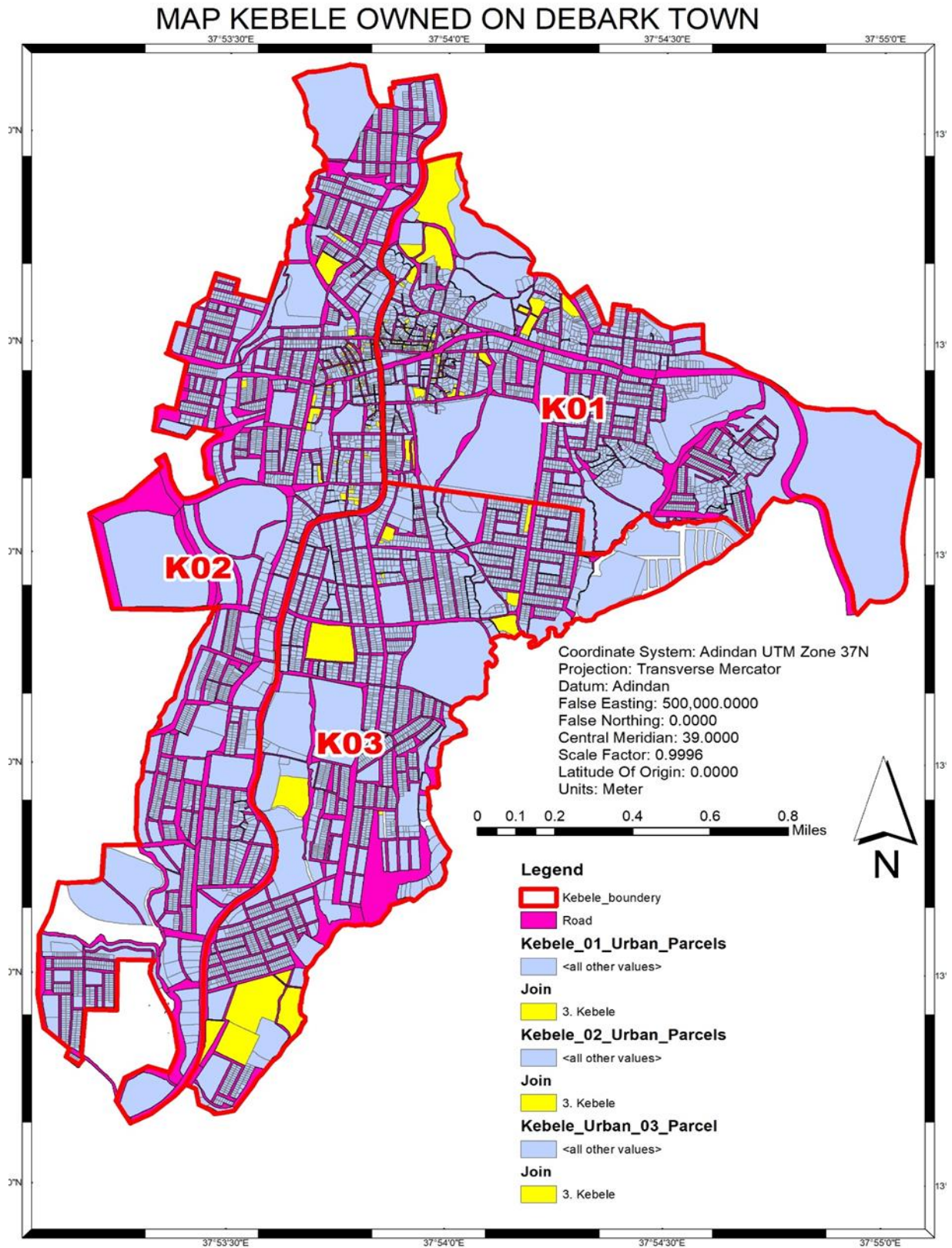


Figure 4.4: Map of Kebele owned parcels

4.1.5. Inventory of Temporary Landholding

The other important result from Land Inventory of Debarq City is knowing Temporary Landholdings. Accordingly, the inventory result shows that there are about **40** Temporary Landholdings in the city while Kebele 02 having that largest temporary landholdings. The rest of the details can be referred from the table below.

Table 4.7: Distribution of Temporary Landholdings

Kebele Name	Kebele 01	Kebele 02	Kebele 03	Total
Total TLH	10	19	1	40
Area(m2)	133028.054	37777.35	12485.543	183290.893

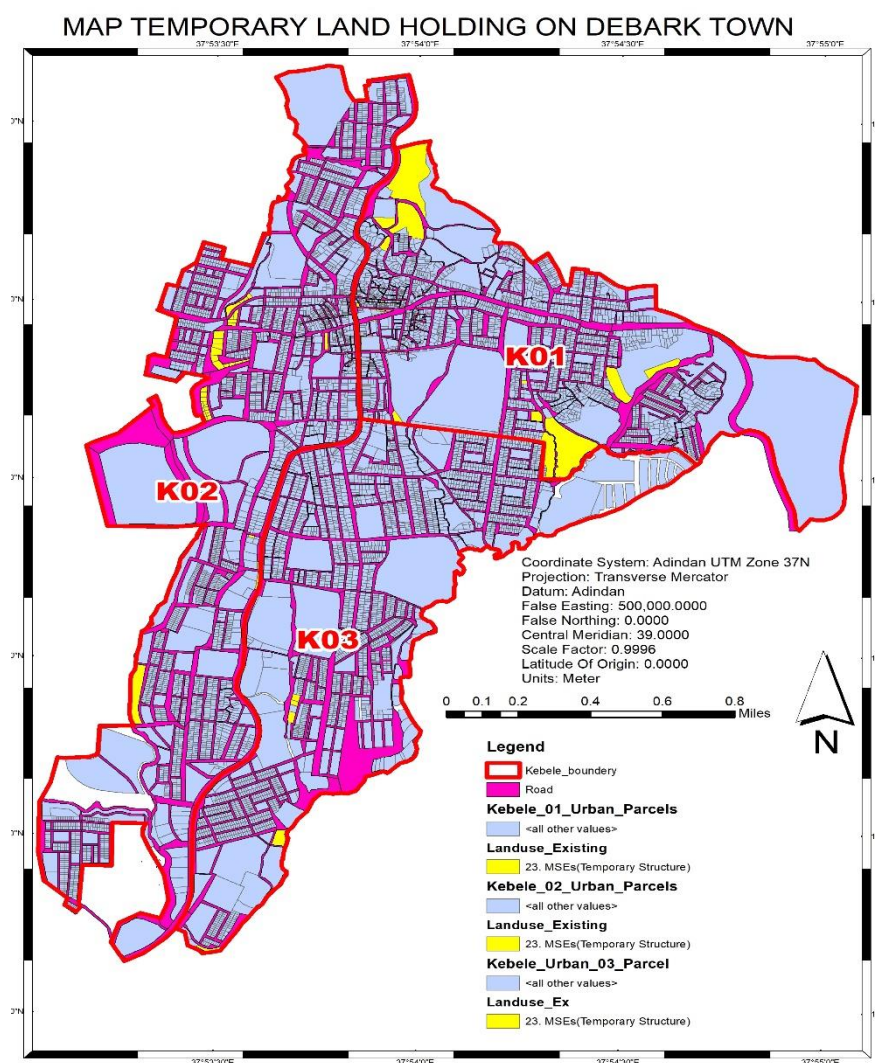


Figure 4.5: Map of temporary land holdings in Debarq town

Form 1 result

Contain user name is an identification of a person used by a person with have the right to access to this software password secret series of characters that enables a user to access a computer, data file, or program. The user must enter his or her password before the computer will respond to commands but in ours case unlike computer password it was used to inter into Google earth pro and to access owner parcel information. The password helps ensure that unauthorized users do not access the computer, file, or program and enter button and clear button is a button which used to load the form 2

CLEAR button: - used to clear the textbox's in which the username and password is written

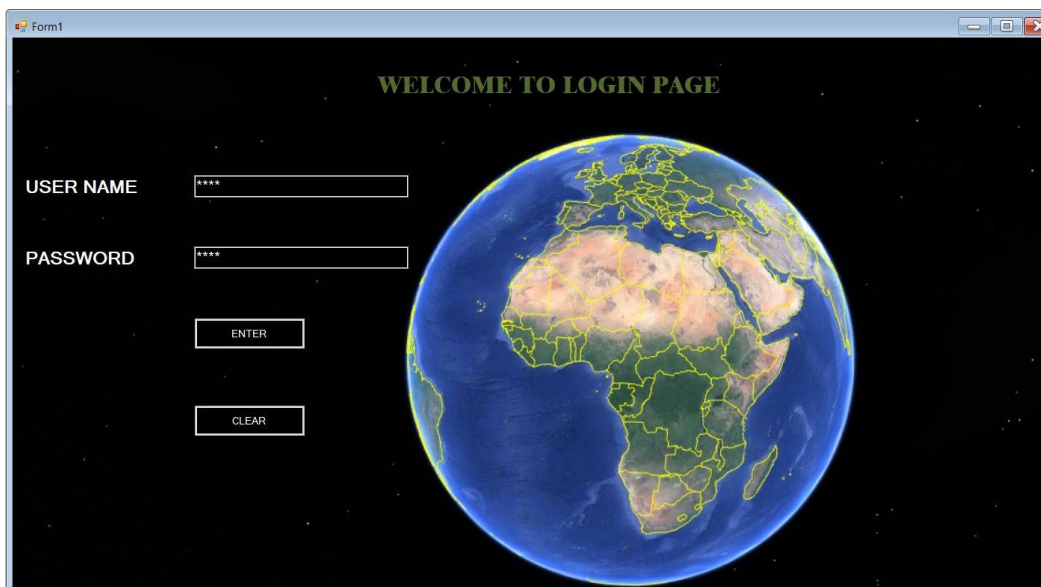


Figure 4.6: Login page

Form 2 result

This is a form which will open when an authorized person fills user name and password correctly and then the land holding file will be load by using AcGIS and Google earth pro ENTER button.

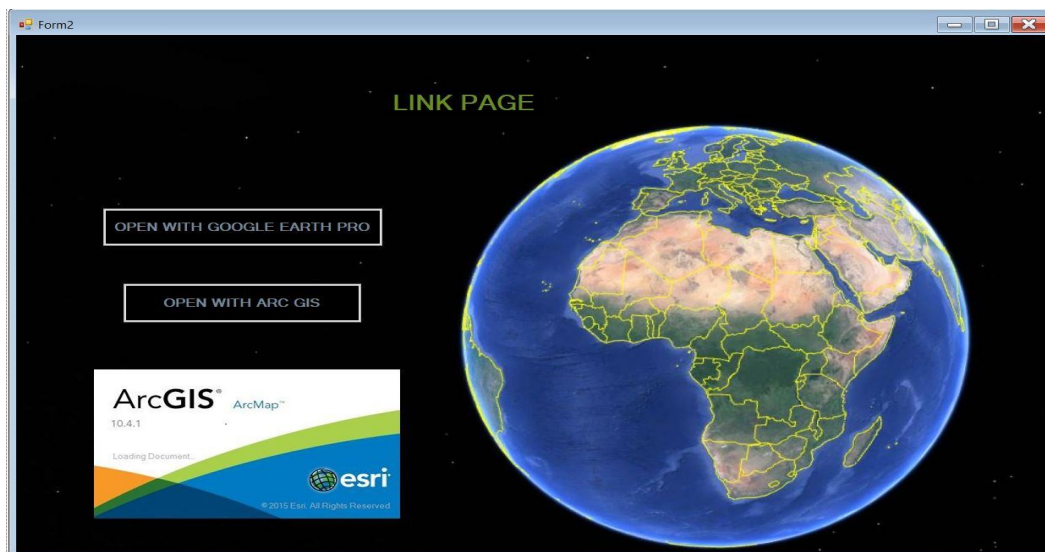


Figure 1: Link Page

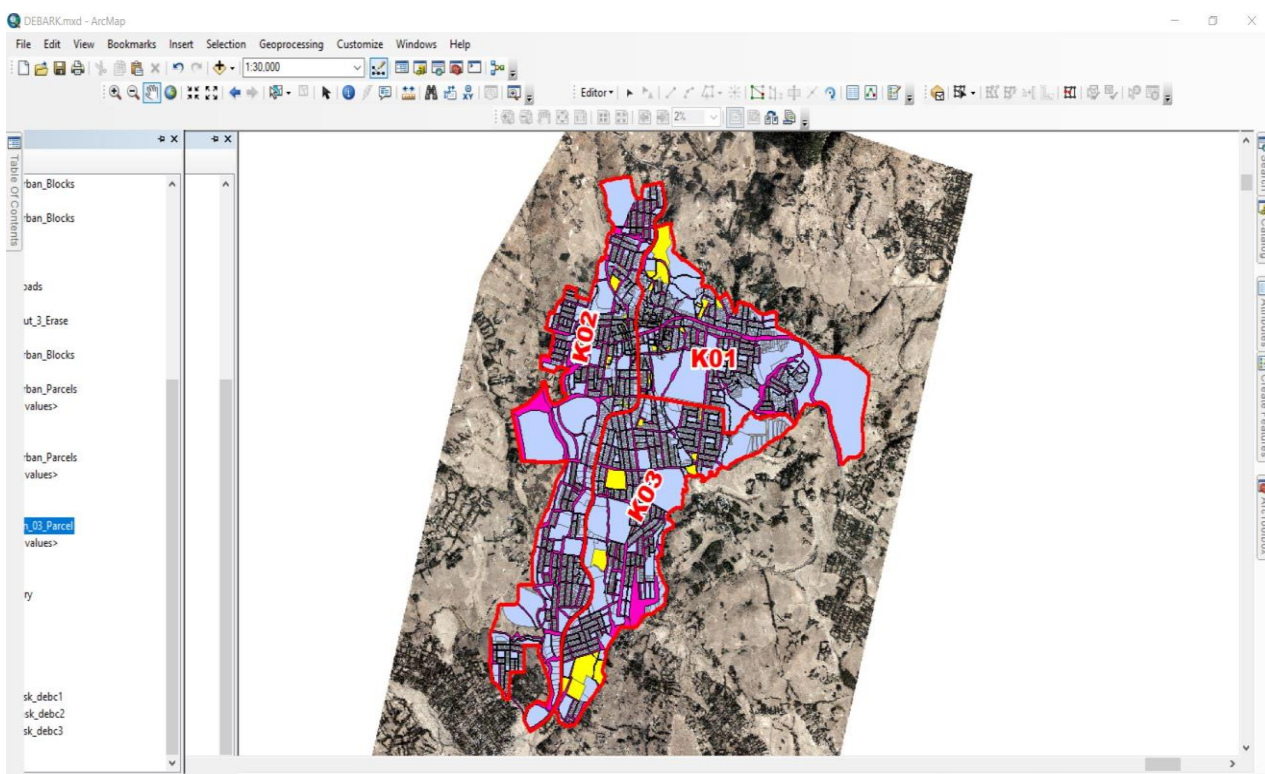


Figure 4.7: Data access in Arcgis from link page

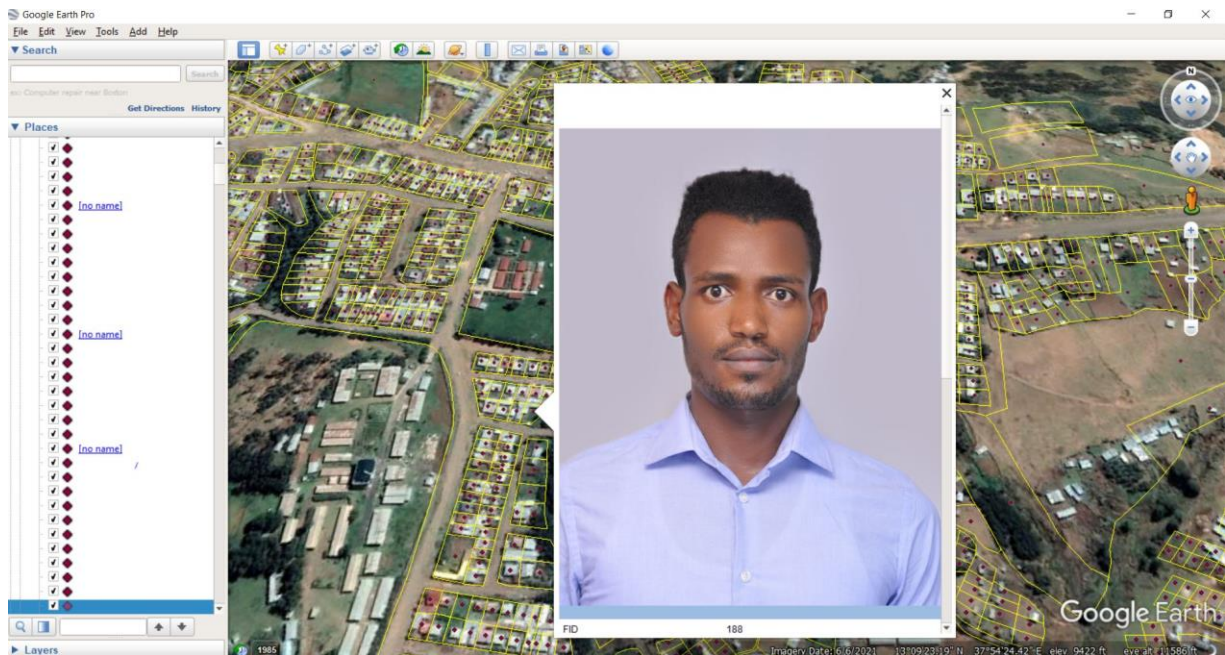


Figure 4.8: Data access in Google earth pro from link page

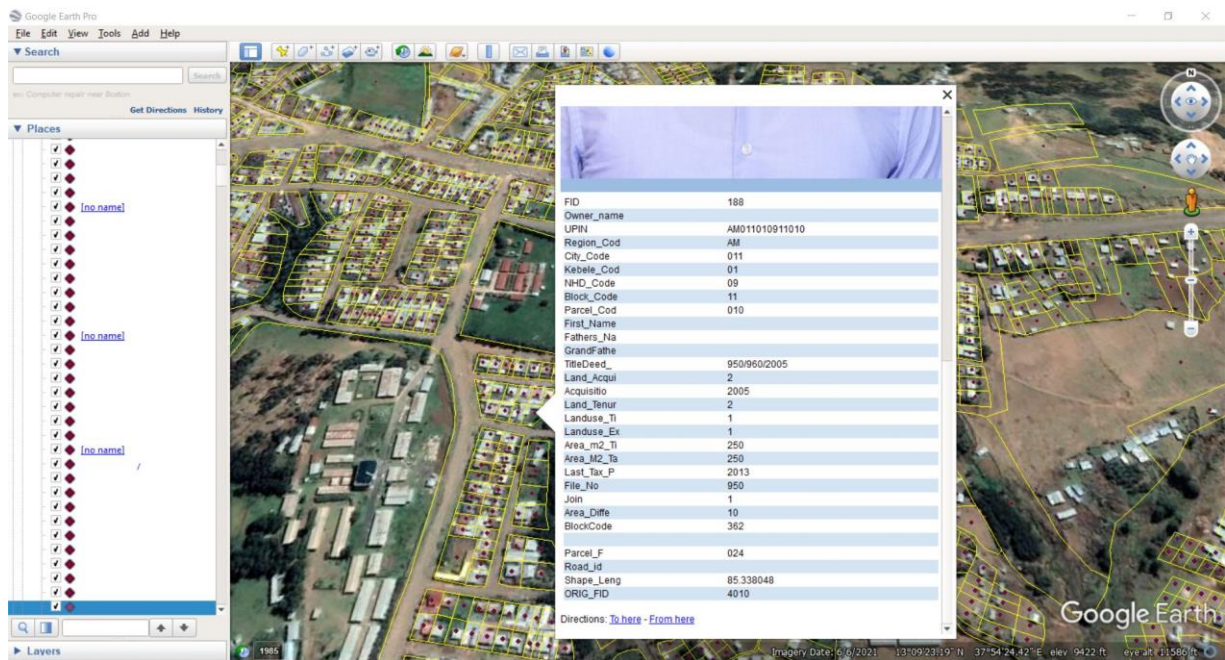


Figure 4.9: Data access in Google earth pro from link page

1.1.1. Assigning parcel codes

Parcels within a block contain 3 digits. The coding system started is from the road on the north of the block and then continued to the road that surrounded the block then to the parcel in North-West tip of the block and moves clockwise for regularly arranged parcels. However, when parcels in a block are arranged irregularly, parcel code is given starting from the northwest tip and moves in a clockwise direction at the beginning and continue in a zig-zag manner by following the paths that serve for accessing the next adjacent parcel.

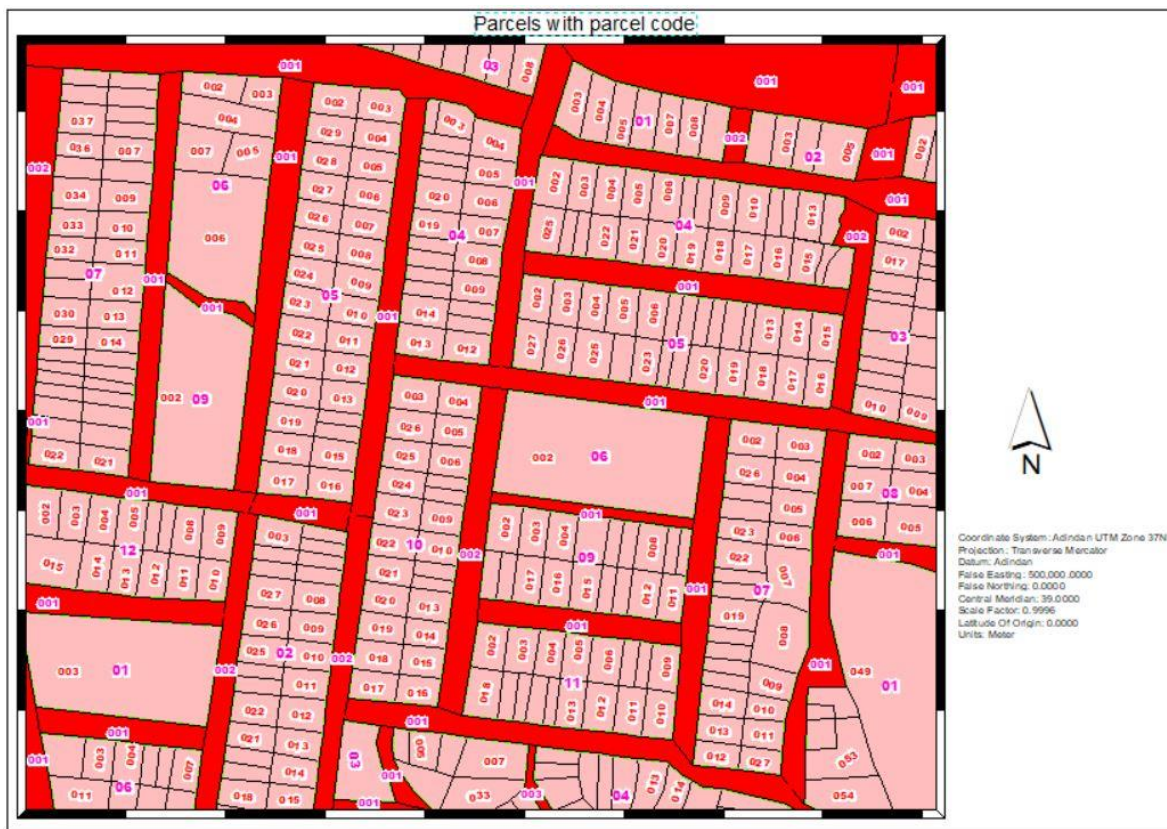


Figure 4.10: Parcels with parcel code

4.2. Discussion

The current study developed Integrated Land Ownership Inventory Using Geospatial Technologies and Visual Basics: a Case of Debarq Town, Ethiopia .it provides the answer to the research question to How to conduct land inventory at parcel level and link spatial and non-spatial attributes? , How to view details on landholdings using GIS and Google Earth Pro? And

How to create a system that allows the user to access Google Earth Pro and Arc GIS land inventory data information's by using VB.Net. The result of the current study shows urban land inventory includes Neighborhood, Block and parcel based land information.

From the study the total 7973 mapped parcels, Kebele 02 has the maximum number of parcels which accounted 3073 followed by Kebele 03 and Kebele 02 has the second and third which accounted 2548 and 2352 respectively and it shows that a total of 56 and 598 Neighborhood and Block were mapped in Debark City respectively.it shows extra landholdings owned by private or institutions and kebele houses temporary land holdings and necessary information about the land in Debark city.

The findings of the current study have to be turning point to focus on strategic land management. Because in almost all Ethiopian cities/towns are compounded by multitude of problems which together brought about inefficiency, non-responsiveness to land related problems, public complaints/dissatisfaction and artificial shortage of land for development against unlawful occupation of large tracts of public land by speculators and informal developers.

This study differs from other researches because the method of file organization is focused on land inventory, not in the cadaster, which strengthens this study because it is quick, cost-effective, and time-efficient. And this analysis will also include some additional features from other studies, such as showing land information with the image of the landowner and designing the application used by only approved individuals to access land information. This study uses Geospatial technologies and visual basics.

CHAPTER V: CONCLUSION AND RECOMMENDATION

The current study is aimed to establish Integrated Land Ownership Inventory Using Geospatial Technologies and Visual Basics: a Case of Debark Town, Ethiopia. The study covered all the built up area boundary of debark town. All lands in the built up boundary are counted and registered. The study concludes with the following stopping points and recommendations

5.1. Conclusion

This study interpreted and discussed concerning a research objective, empirical framework, and methodology. And also presents the land use pattern, total number and spatial distribution of parcels by ownership status, number of blocks by major land uses, and, more importantly, the size and spatial distribution as well as current status of state lands and vacant lands under different ownership status. It also indicates the number, size and distribution of temporarily allowed lands which are eventually state lands. The results are presented for each Kebele separately in the following sub-sections. The results on urban land inventory includes Neighborhood, Block and parcel based land information.

Starting from the result Debark town face immense challenges in land management and administration, and inefficient delivery of land information services because at least 159.555 hectare of the city invaded by extra land holders informally. They have difficulty focusing on strategic land management issues when they must mainly deal with daily problems experienced in service delivery.

5.2. Recommendation

The finding of this study shows that geospatial technology (GIS, RS, Google earth) are use full to not only useful they are basic technologies for Integrated Land Ownership Inventory and related studies. The following are also recommended as potential research recommendations, based on the results of the study:

- My recommendation for a researcher undertaking any type of research or studies related to land or earth should be considered geospatial technologies.
- For a researcher that use a satellite image, it is better to use the most recent satellite image especially on land inventory related research.

- Similar researches needs to be conducted in other towns in Ethiopia because land is become serious issue.
- The government should focus on land administrations because there are many corrupted files.

SPECIAL ACKNOWLEDGMENT

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ASTU/SM-R/182/21

Adama, Ethiopia

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APPENDICES

Appendix 1: Codes used in visual basics

Cods for form 1

Form 1 contain the form of inputting User name and password and also the description about the application

Programms for form 1

Public Class Form1

```
Private Sub Button1_Click(sender As Object, e As EventArgs) Handles Button1.Click
```

```
    If TextBox1.Text = "*****" And TextBox2.Text = "*****" Then
```

```
        Form2.Show()
```

```
        Me.Hide()
```

```
    Else
```

```
        MsgBox("ENTER RIGHT PASSWORD")
```

```
    End If
```

```
End Sub
```

```
Private Sub TextBox1_TextChanged(sender As Object, e As EventArgs) Handles  
TextBox1.TextChanged
```

```
End Sub
```

```
Private Sub TextBox2_TextChanged(sender As Object, e As EventArgs) Handles  
TextBox2.TextChanged
```

```
End Sub
```

```

Private Sub Label1_Click(sender As Object, e As EventArgs)

End Sub

Private Sub Form1_Load(sender As Object, e As EventArgs) Handles MyBase.Load

End Sub

Private Sub Label3_Click(sender As Object, e As EventArgs) Handles Label3.Click

End Sub

End Class

```

Cods for form 1

Form 2 contain the link to open ArcGIS and Google earth pro

Programs for form 2

```

Public Class Form2

Private Sub Button1_Click (sender As Object, e As EventArgs) Handles Button1.Click

    Process.Start("E:new_B.kml")

End Sub

Private Sub Button2_Click (sender As Object, e As EventArgs) Handles Button1.Click

    Process.Start("E:new_B.kml")

End Sub

Private Sub Label1_Click (sender As Object, e As EventArgs) Handles Label1.Click

End Sub

End Class

```

Ethiopia

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[illegible]

Appendix 1: Base map used for data collection



Appendix 2: Justification letter

