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THE ANALYSES OF LANDUSE CHANGE IN ETIOSA L.G.A OF LAGOS STATE NIGERIA FROM 2004-2010

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ABSTRACT

The results and information obtained from analysis in this study using Satellite Imagery and Geospatial techniques has shown that it is possible to effectively monitor the changing landuse trends and patterns and other developments within the study area over the years. Desired analyses and inferences were also carried to achieve specific goals. It also demonstrated the type and extent of land use or land cover at various times within the study area.

The application of satellite imagery is a useful method for the fast collection of information to assess the dynamic changes of natural objects, natural resources and of the earth surface in general. GIS will continue to be a valuable tool when decisions must be made quickly and lives are to be affected. Therefore, well informed investments in the establishment and running of satellite ground stations and the GIS technology can only be a rewarding enterprise, now and in the future. It is obvious at a glance to see that Eti-osa Local Government has undergone a series of change in Land use and land cover area within the past few years. Though economically viable, it however raises environmental concerns on its effect on the ecosystem, drainage and vegetation of that area.

The result as shown on the satellite images for those two periods has demonstrated a drastic change in the distribution of the three main features which we studied i.e Built-up area, Undeveloped area and water bodies with the quota of built up area going higher. This can be seen as a high rise in the state of urbanization as witnessed in other cities around the world.

From the charts plotted for the varying landuse types and its percentage coverage, it is noticed that the undeveloped land mass has decreased with an increase in built up area. This

is attributed to the increase in development (the built up areas) and an increase in commercial activities over the years leading to a continuous decrease in the undeveloped area. The water bodies too are affected as there is massive land reclamation and sand filling projects going on around the local government.

INTRODUCTION

Earth surface is being significantly altered by man and this has had a profound effect upon the natural environment thus resulting into an observable pattern in the land use over time. Man continues to explore and exploit the natural resources in his environment and this has brought immense contribution to observable changes in land. "Land use involves both the manner in which the biophysical attributes of the land are manipulated and the intent underlying that manipulation – the purpose for which the land is used" (Turner et al. 1995).

Land is the fundamental basis of all human activities, from it we obtain our food we eat, our shelter, our water, the space to work, the room to relax and lots more. The magnitude of land use change varies with the time being examined as well as with the geographical area. The assessment of these changes depends on the area, the land use types being considered, the spatial groupings, and the data sets used.

The land use- land cover pattern of a region is the result of interplay of both natural and socioeconomic factors. Issues of Land use-land cover and its effect on environmental sustainability and human welfare has become of great concern all over the world. Changes in land use patterns impact significantly local and global environmental conditions as well as economic and social welfare. An

understanding of how these factors influence land use patterns would provide new dimensions to policy making and public policy evaluation (Chakir and Parent, 2008). Change detection is the process of identifying differences in the state of an object or phenomenon by observing it at different times (Singh, 1989). Change detection is an important process in monitoring and managing natural resources and urban development because it provides quantitative analysis of the spatial distribution of the population of interest. Macleod and Congation (1998) identified four aspects of land use change detection that are important:

(i) Detecting the changes that have occurred,

(ii) Identifying the nature of the change,

(iii) Measuring the area extent of the change

This growth has been identified in recent time to have taken on more dramatic momentum in those areas that have come to be regarded as the “third world”.

“In these regions contemporary urbanization has not only been extremely rapid in nature but also devastating in impact” (Aina, 1992). Nigeria since independence has become an increasingly urbanized and urban-oriented society. Because of the great influx of people into urban areas, the population of Nigerians living in urban cities has tremendously increased.

STUDY AREA

Eti-Osa is one of the 20 Local Government Area in the Lagos Division, of Lagos State, Nigeria. Eti-Osa is now Eti-Osa East and Eti-Osa West. Within Eti-

Osa are several important areas of Lagos, including Victoria Island, Lekki, and Ikoyi. Before the Nigerian capital moved to Abuja, Eti-Osa was the seat of the national capital. It is also the location of the commercial nerve of the country playing host to various headquarters of banks and businesses.

Topographically it lies around the rainforest belt region and it is bordered by the Lagos Lagoon and the Atlantic ocean at the north and south respectively.

METHODOLOGY

Data Acquisition

For this project, we made use of LandSat imagery (2004), Lagos State administrative Map covering Etiosa Local Government, and an Ikonos imagery (2010) to determine the change in land use in the Etiosa Local Government area at different times. From this we obtained adequate information for the analysis of the changes in these areas over the years by overlapping both satellite imageries. The changes observed between the years were analysed in a GIS environment. The result shows a change of other land use types to developed (built) and reclaimed land between 2004 and 2010. The result was discussed and a viable conclusion was made on the impact of these observed changes in the local and global environment.

The satellite imageries in (digital format already) were directly imported into the ArcMap environment using the Add Tool. The images in the ArcMap environment were georefenced. The geo-referenced images were vectorized

(digitized) on the computer system. Based on prior knowledge of the study area for over 6 years and a reconnaissance survey using previous maps of the study area and additional information from previous research in the study area, a classification scheme was developed for the study area. The classification scheme developed gives a rather broad/general classification and four different classes where identified. They include are defined in the below:

Table 1.0: Land Use Classifications

S/N	Land Use Types	Types
1	Built-up area	Commercial, residential, industrial, government facilities, and settlements.
2	Water bodies	Lagoons, Creeks, rivers and waterlogged areas
3	Undeveloped areas	Open spaces, cleared and non vegetated land

The geo-referenced images were vectorized (digitized) on the computer system. Different layers were created for the various land use classes. Layers were created for the land use classes and these layers were grouped under the built up areas, undeveloped areas or the open areas, water bodies, Lagos boundary and vegetation area. In ArcMap this is done by creating Shape Files. The sketch tool on the editor toolbar in ArcMap was selected to trace the outline of these

features. Upon closure of the sketch tool, the polygon was formed. The shapefiles were assigned to a projected coordinate system. UTM was used and WGS 1984(Zone 31N) was chosen. The shapefiles were then imported to ArcMap.

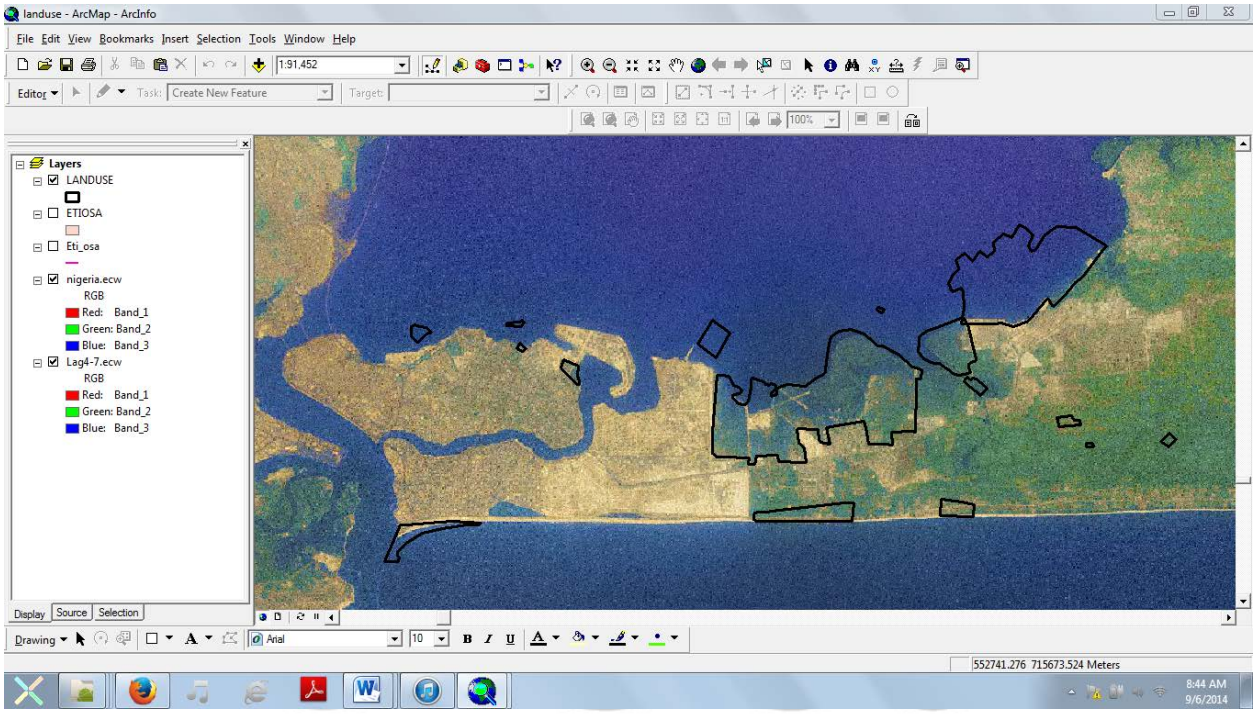

Fig1: Change in Land Use not detected from Landsat 2004 Imagery

From the figure above, it can be deduced that as at 2004, the highlighted areas were still undeveloped swampy waterlogged areas, some even extending hundreds of metres into the ocean and lagoon but when viewed on an Ikonos 2010 image these areas are already builtup urban areas. This attests to the fact that land particularly the earth surface is dynamic and can be acted upon by external forces. The extent of reclaimed land is shown in fig 2 below.

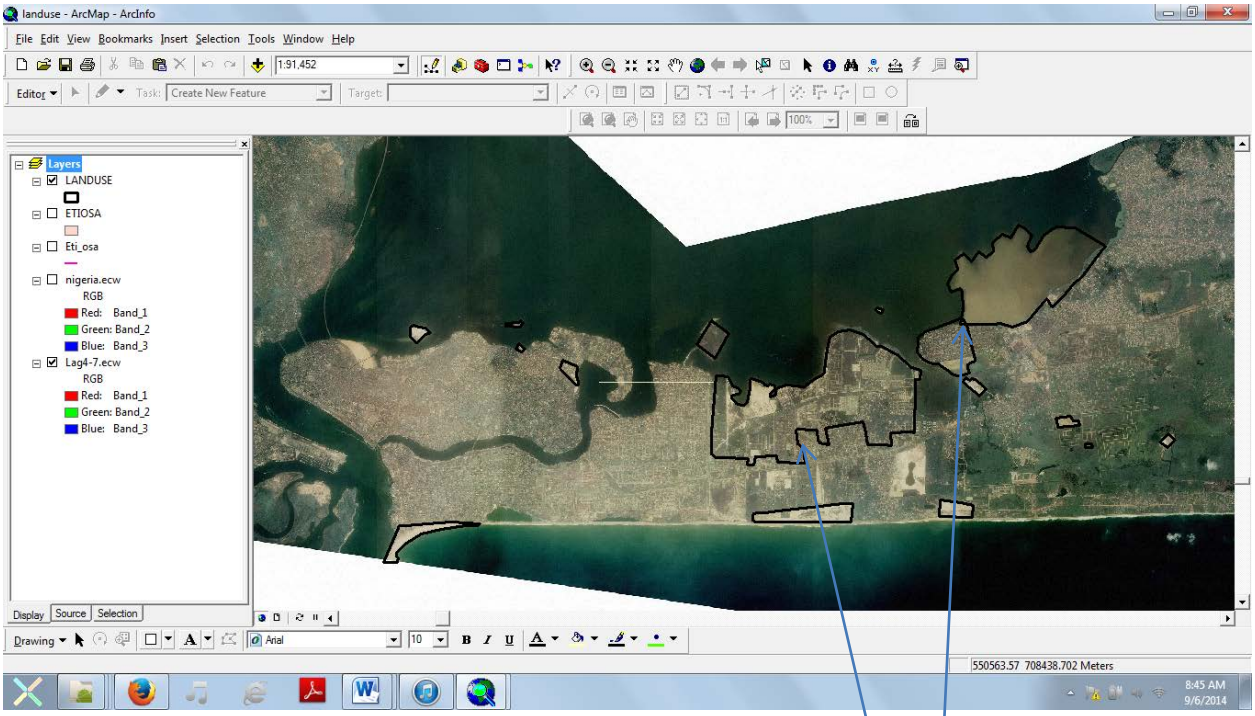

Fig 2: Showing Land Use change as at 2011.

Reclaimed Land

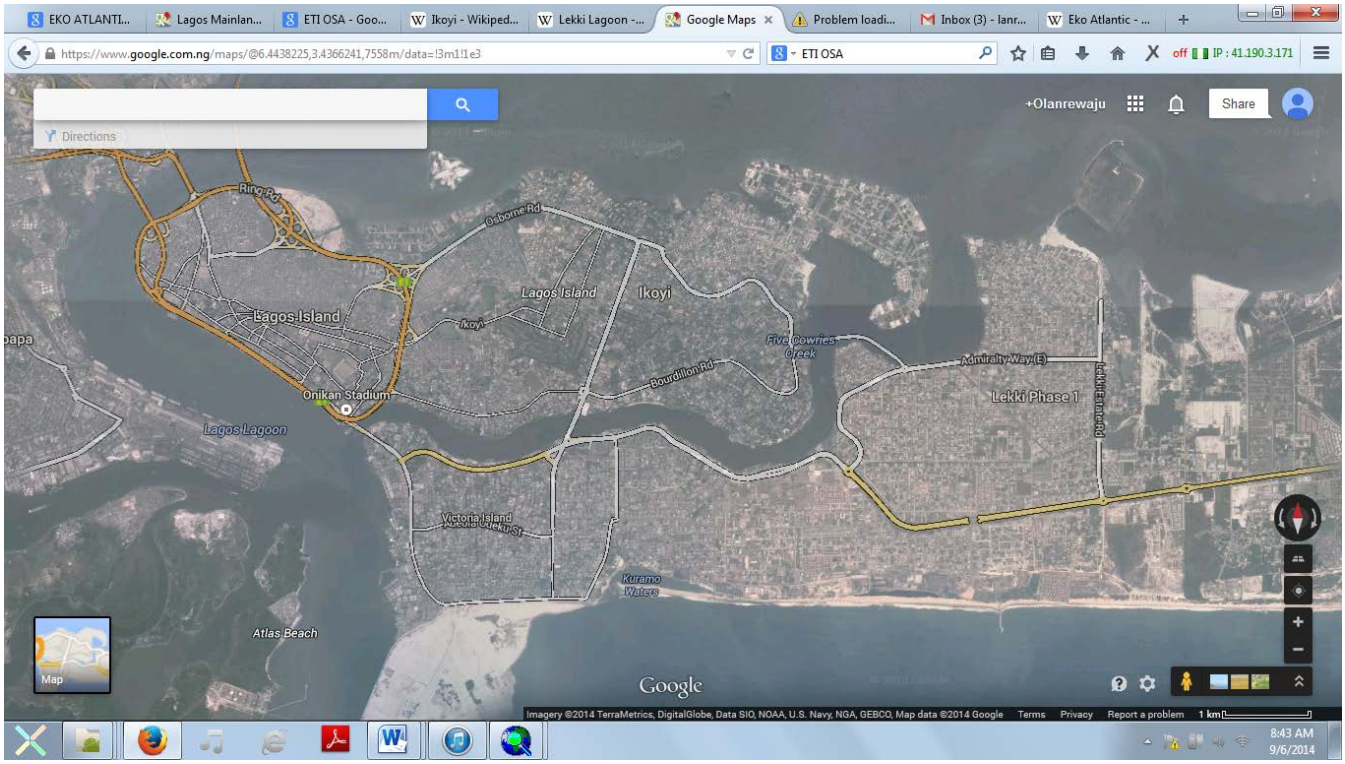

FIG 3: Current layout of the study area as viewed on google earth.

From the figure above it can also be seen that the Eko Atlantic City viewed is almost four times the size of the one seen on the Ikonos imagery for 2010 and very few undeveloped areas are seen on the whole horizon.

LAND USE RESULT PRESENTATION

The area of coverage for the various landuse types in this project was calculated using the ArcGIS 9.3 software and the results are provided in this section.

The land use types have been grouped as builtup area, undeveloped area and the water body within the study area. The undeveloped area in this project comprises of all the various lands such as swampy area vegetation and areas of encroachment.

USE	2004 (Sq Metres)	2010 (Sq Metres)	2004 (Hectares)	2010 (Hectares)
Built Up	54283000	104374000	5428	10437.4
Undeveloped	56944000	37774000	5694.4	37.4
Water Body	35631000	4448000	3563	444.8

Table 2.0: Area coverage of each land use type between 2004 and 2010

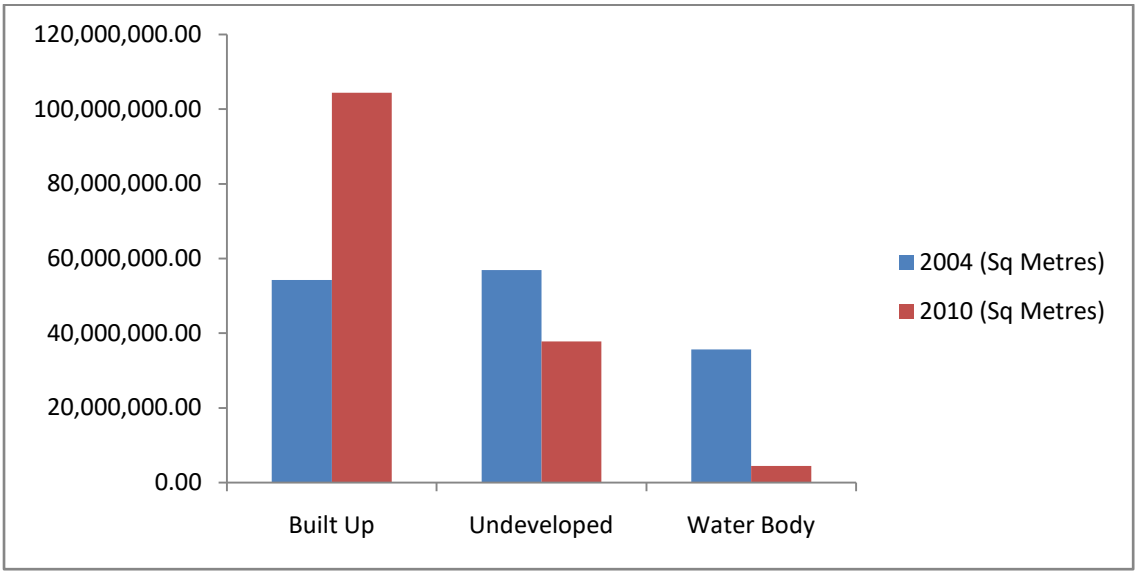

Fig4: Land use Change between 2004 and 2010

Table 3.0: Percentage Coverage of Land Use from 2004 to 2010

USE	2004	2010
Built Up	37%	71.20%
Undeveloped	39%	25.8%
Water Body	24.30%	3%

From the table above, it can be discerned that the rate of urbanization in greatly increasing with built up areas increasing from 37% to 71% in 2010. This represents about forty percent increase in total area covered. The size of the undeveloped areas has decreased from 39% in 2004 to about 26% in 2010. This shows that a high rate of development is going on and more and more land is

being encroached as the years go by. The inland water bodies were the most affected with a high decline from 24% in 2004 to just over 3% in 2010. This is due to the massive sandfilling and land reclamation projects going on around the study area, This figure itself does not account for the Eko Atlantic Project where the Lagos State government is headling a massive land reclamation project which sets the Atlantic ocean back for at least 4 sq. Kilometers.

DISCUSSION OF LAND USE ANALYSIS RESULT

It is obvious at a glance to see that Eti-osa Local Government has undergone a series of change in Land use and land cover area within the past few years. Though economically viable, it however raises environmental concerns on its effect on the ecosystem, drainage and vegetation of that area.

Going by the figures above and viewing the satellite image for those two periods, it can be seen that there is a drastic change in the distribution of the

three main features we are studying i.e Built-up area, Undeveloped area and water bodies with the quota of built up area going higher. This can be seen as a high rise in the state of urbanization as witnessed in other cities around the world.

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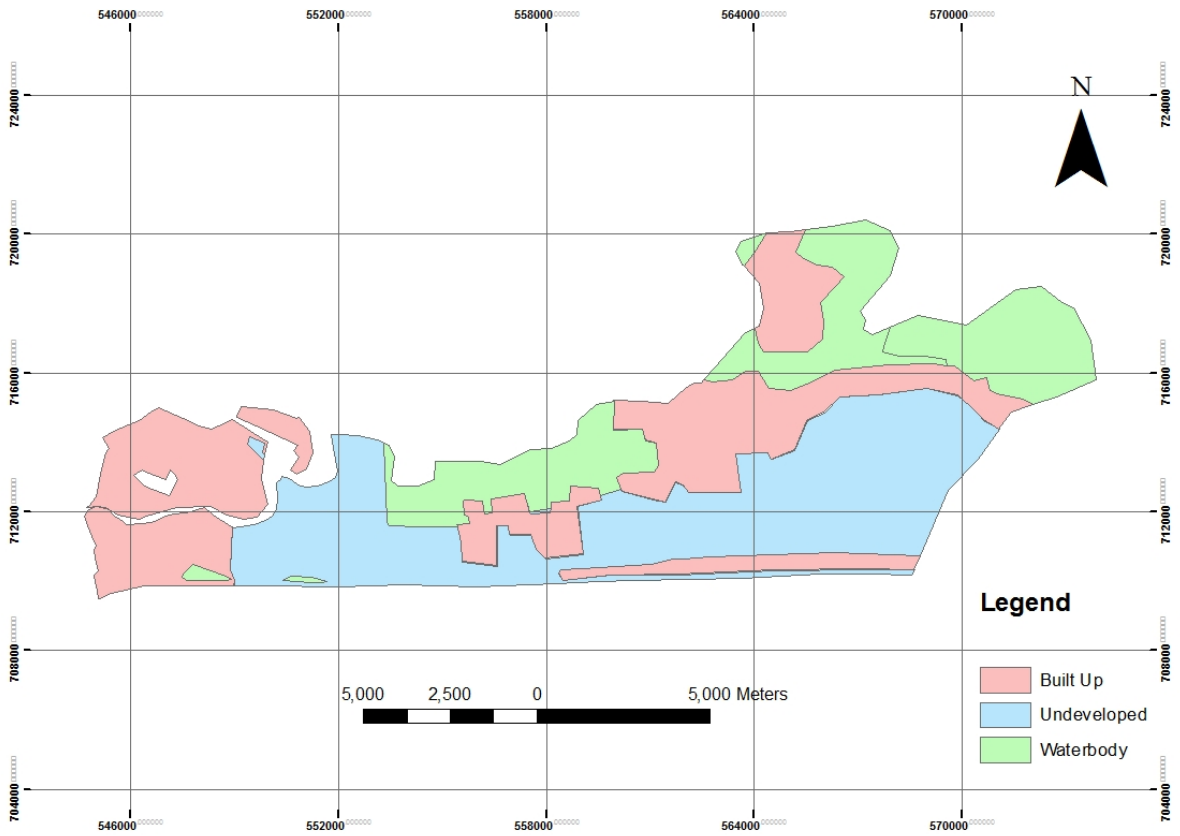

Fig 5 : Land Cover of Etiosa Local Government as at 2004

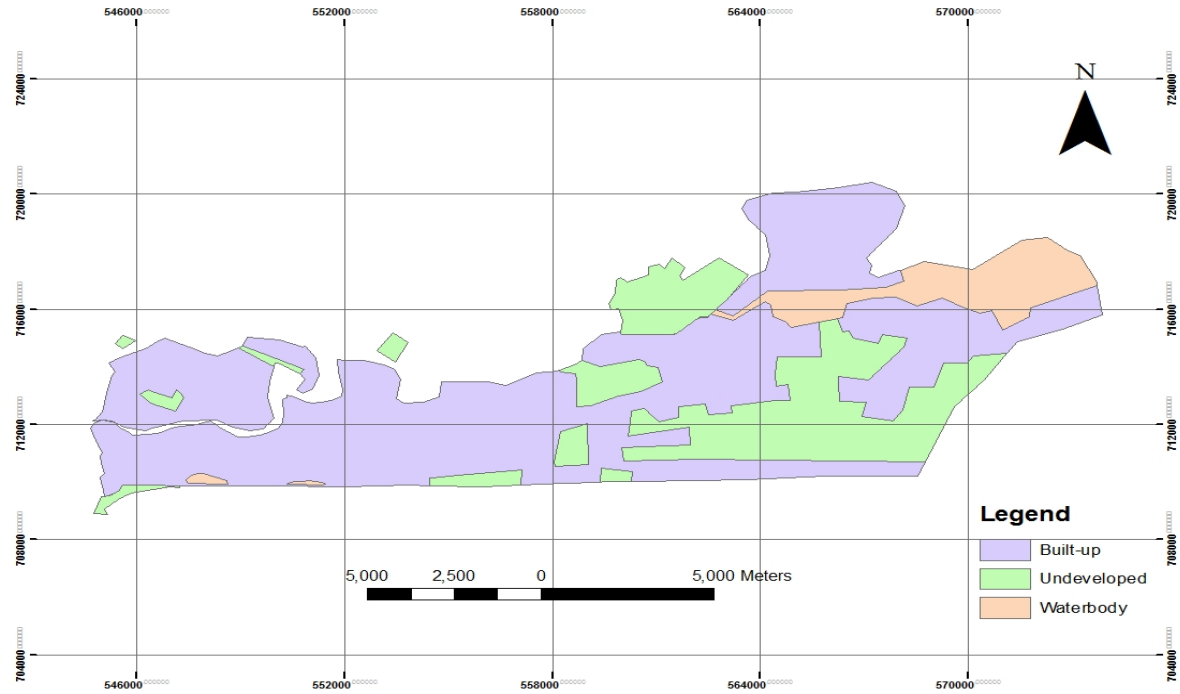

Fig 6 : Land Cover of Etiosa Local Government as at 2010

ENVIRONMENTAL CONSEQUENCES

Changes in land use and land cover date to prehistory and are the direct and indirect consequence of human actions to secure essential resources. This may first have occurred with the burning of areas to enhance the availability of wild game and accelerated dramatically with the birth of agriculture, resulting in the extensive clearing (deforestation) and management of Earth's terrestrial surface

that continues today. More recently, industrialization has encouraged the concentration of human populations within urban areas (urbanization) and the depopulation of rural areas, accompanied by the intensification of agriculture in the most productive lands and the abandonment of marginal lands. All of these causes and their consequences are observable simultaneously around the world today.

Biodiversity loss: The biodiversity of these area will also be affected. When land is transformed from a primary forest to a farm, the loss of forest species within deforested areas is immediate and complete. Even when unaccompanied by apparent changes in land cover, similar effects are observed whenever relatively undisturbed lands are transformed to more intensive uses, including livestock grazing, selective tree harvest and even fire prevention.

Climate Change

LULCC plays a major role in climate change at global, regional and local scales. At global scale, LULCC is responsible for releasing greenhouse gases to the atmosphere, thereby driving global warming. LULCC can increase the

release of carbon dioxide to the atmosphere by disturbance of terrestrial soils and vegetation, and the major driver of this change is deforestation, especially when followed by agriculture, which causes the further release of soil carbon in response to disturbance by tillage. Changes in land use and land cover are also behind major changes in terrestrial emissions of other greenhouse gases, especially methane (altered surface hydrology: wetland drainage and rice paddies; cattle grazing), and nitrous oxide (agriculture: input of inorganic nitrogen fertilizers; irrigation; cultivation of nitrogen fixing plants; biomass combustion).

Land cover changes that alter the reflection of sunlight from land surfaces (albedo) are another major driver of global climate change. The precise contribution of this effect to global climate change remains a controversial but growing concern. The impact of albedo changes on regional and local climates is also an active area of research, especially changes in climate in response to changes in cover by dense vegetation and built structures. These changes alter surface heat balance not only by changing surface albedo, but also by altering evaporative heat transfer caused by evapotranspiration from vegetation (highest

in closed canopy forest), and by changes in surface roughness, which alter heat transfer between the relatively stagnant layer of air at Earth's surface (the boundary layer) and the troposphere. An example of this is the warmer temperatures observed within urban areas versus rural areas, known as the urban heat island effect.

Pollution: Changes in land use and land cover are important drivers of water, soil and air pollution.

Other impacts: Other environmental impacts of LULCC include the destruction of stratospheric ozone by nitrous oxide release from agricultural land and altered regional and local hydrology (dam construction, wetland drainage, irrigation projects, increased impervious surfaces in urban areas). Perhaps the most important issue for most of Earth's human population is the long-term threat to future production of food and other essentials by the transformation of productive land to nonproductive uses, such as the conversion of agricultural land to residential use and the degradation of rangeland by overgrazing.

RECOMMENDATION AND CONCLUSION

The result and information generated from this study using Satellite Imagery and GIS has demonstrated that it is possible to effectively monitor the changing landuse trends and other developments within the study area over the years.

Desired analyses and inferences may also be carried out at whatever time they are required. It also serves to show the type and extent of land use or land cover at various times

The application of satellite imagery is a useful method for the fast collection of information to assess the dynamic changes of natural objects, natural resources and of the earth surface in general GIS will continue to be a valuable tool when decisions must be made quickly and lives are to be affected. Therefore, well informed investments in the establishment and running of satellite ground stations and the GIS technology can only be a rewarding enterprise, now and in the future.

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