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# An Assessment of Vegetal Cover Transition in the Zugurma Sector of Kainji Lake National Park, Nigeria

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**Abstract**
In Nigeria, National Parks and other categories of protected areas have played a major role in modern systems of biodiversity conservation and it is likely to be an important component of national biodiversity conservation strategies in the future. This research work aimed at assessing the vegetal cover transition in Zugurma Sector of Kainji Lake National Park using satellite-derived data. Satellite imageries of 1986, 2000 and 2010 were downloaded from GLCF and classified using ArcGIS, while evaluation of the agricultural resource in the study area was done using Normalized Difference Vegetation Index (NDVI); to comprehend the socioeconomic and human impact on the flora dynamics, questionnaires and interviews were used; and mathematical modeling was used to project the study area to the year 2020. Various softwares (ArcGIS 10.1, SPSS 10.0, Microsoft Office Excel, 2007 and Microsoft Office Word, 2007) were used. The results show that there is significant decrease in the forest cover between 1986 – 2010, while farmlands around the forest experienced an increase in year 2000 but reduced again in 2010. As for settlements, we have more cases of immigration, while the bare lands in and around the forests reduce or increase based on climatic aberrations, soil erosion and human activities. NDVI maps were used to show the changes in the vegetation indices for Zugurma in 1986, 2000 and 2010 derived from the classified satellite imageries. These changes ranged from 0.473684 to 0.503106 then to 0.491525 respectively (for high NDVI values); this suggests that the forest had degraded probably caused by deforestation or climatic factors. The low NDVI values as shown by the maps are -0.0616327, -0.386773 and -0.118644 for 1986, 2000 and 2010 respectively. It is projected that by the year 2020, Forests will have a percentage of 32.878% (from70.52%), while farmlands are expected to increase to 25.815% (from11.34%), Settlements to 29.259% (from 12.85%), and Bare lands will be the least with about 12.048% (from 5.29%).In order to reduce the human pressure on the KLNP, there is a need for constant dialogue and collaboration between the Park authority and the communities around the study area. This constant interaction will facilitate mutual understanding and guarantee sustainable park management. The Nigerian government should enhance biodiversity protection by incorporating biodiversity concerns into development planning, expand and consolidate protected area networks.
**Keywords:** Biodiversity, National Park, Geographic Information System, Vegetation Index

## BACKGROUND TO THE STUDY

Nigeria is very much dependent on biological resources compared to other countries. For example, agricultural production, livestock, logging and fishing account for the bulk of employment, economic output and export earnings. The dependence of the nation on biodiversity is hardly captured in economic statistics. This action of no valuation or under-valuation invariably leads to misuse of biological resources. As these natural resources continue to be essential for future development of the nation, of concern is the serious lack of inventories of these resources and other baseline data that are of fundamental importance for monitoring biodiversity trends. In essence, it is important to know the current status, distribution, rate of exploitation and restoration, and the stakeholders involved in the use of these biodiversity. Equally important is the knowledge of how they are managed from village level decision-making to state policies and to international concern. These issues and conservation practices adopted will no doubt determine how much and in what conditions these natural resources will be available to future generation. The place of gender in biological resources consumption, conservation and management practices is also of importance. Lack of natural resource inventories and other baseline data are inimical for monitoring biodiversity trends. Without this information, many wrong decisions are likely to be adopted and it will be impossible to accurately address the impact of most projects and provide feedback for making corrections and requirements (Ecological Survey of KLNP, 2004).

The land use/land cover pattern of a region is an outcome of natural and socio – economic factors and their utilization by man in time and space. Land is becoming a scarce resource due to immense agricultural and demographic pressure. Hence, information on land use / land cover and possibilities for their optimal use is essential for the selection, planning and implementation of land use schemes to meet the increasing demands for basic human needs and welfare. This information also assists in monitoring the dynamics of land use resulting out of changing demands of increasing population (Zubair, 2006).

Land use and land cover change has become a central component in current strategies for managing natural resources and monitoring environmental changes. The advancement in the concept of vegetation mapping has greatly increased research on land use land cover change thus providing an accurate evaluation of the spread and health of the world's forest, grassland, and agricultural resources has become an important priority (Zubair, 2006).

The term 'transition' defines the passage (sudden or gradual) from a state/situation/idea to another, referring to something intermediary, transitory. Physico-geographical transitions may be approached from several viewpoints, yet the study is limited to passages only, in the attempt to see how these are manifested in the case of soils. Geographic regions present themselves as a system resulted from the interactions between natural and anthropogenic components on a certain area. Yet these components maintain close connections to the geospheres they are part of, thus frequently their limits are not clear. In this way are evidenced a series of transition areas between different territorial units, in which a clearer or more graded passage is made towards the neighboring units (Ionut *et al.*, 2010).

Kainji Lake National Park is surrounded by settlements that are either villages, or towns. The area is also bisected by roads, and is under pressure by land hungry farmers. Avoiding human areas of activity when designing the protected areas boundaries has minimized conflicts with the people and other land users in the Park areas. The immediate task, therefore, is the stabilization of land use by these communities.

The survival of indigenous diverse plant and wildlife resources is a paramount issue. Africa in general, has paid a heavy price for overlooking the social realities determining the interaction between its people and National Parks. In the process, indigent people have turned into dispossessed onlookers to wild resources and eventually become trespassers and poachers. Crisis initiative and reactionaries from different quarters are regrettably becoming a fact of everyday life for the management authorities of the Park. There is need to adopt 'conservation measures', either the management measures and means of collection for the purpose of increasing and maintaining the number of plants and animals within species and populations at some optimum level with respect to their habitat.

**Aim and Objectives**

The aim of this paper is to assess the vegetal cover transition in the Zugurma Sector of Kainji Lake National Park using satellite-derived data. The objectives are to:

i. Map and analyze the vegetal cover changes at a scale of 1:100,000 from the satellite images of 1986, 2000 and 2010;
ii. Evaluate the vegetation in the study area using Normalized Difference Vegetation Index (NDVI);
iii. Project the possible future impact of this vegetal cover transition on the study area;

**The Study Area**

The Kainji Lake National Park, formerly known as Borgu Game Reserve, was upgraded to its present status in 1991. It is situated between latitudes 9°40'N and 10°30'N and longitudes 3°30'E to 5°50'E. Made up of Borgu and Zugurma sectors, the Park covers a total area of 5,370km, out of which Zugurma occupies 1,370.80 km$^2$). The Zugurma sector in Borgu and Mashegu Local Government Areas of Niger State to the east of the Lake was joined to the Borgu sector in 1975 to form the Kainji Lake National Park.

The amalgamation of the two reserves and signing into law an enabling decree that backed up the creation, (Decree 46 of 1979) gave birth to the pioneer conservation enclave the "Kainji Lake National Park". It enjoys the privileged of being the first National reserve in the country today; it is smaller than Gashaka-Gunti (the largest National reserve in Nigeria with an area of 6,402.48sq.km) in size and bigger than all other reserves in the country.

 

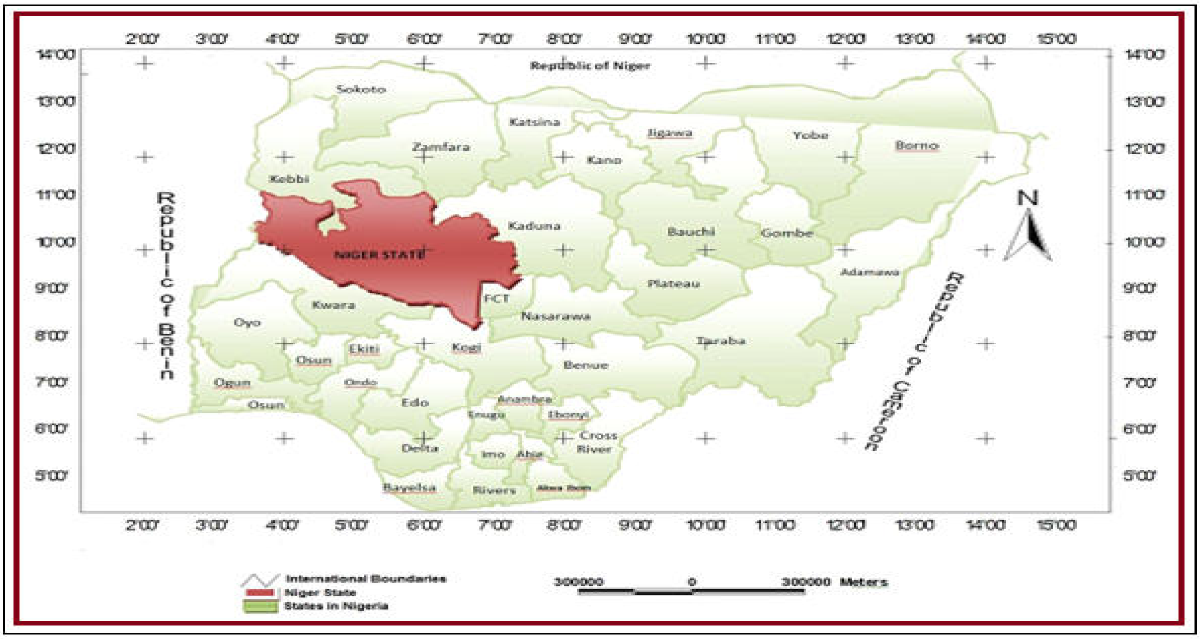


**Figure 1:** **Niger State in Nigeria**
**Source:** Department of Geography, FUT Minna

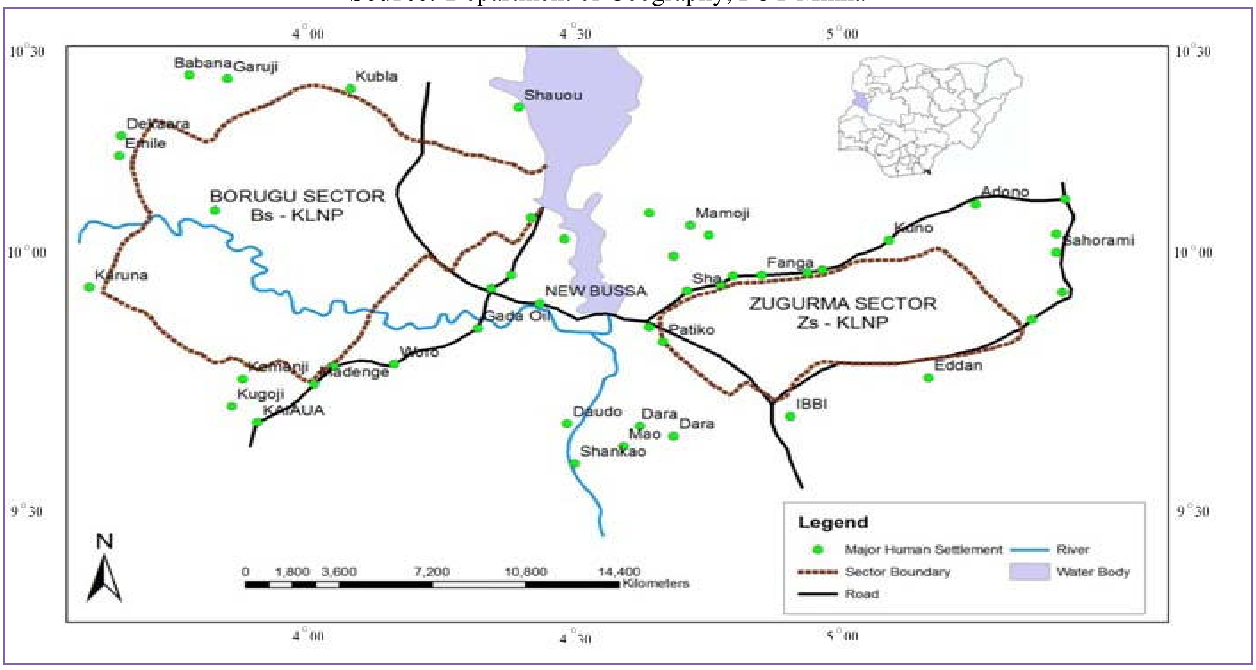


**Figure 2:** **Kainji Lake National Park - Two Non Contiguous Sectors with Surrounding Communities**
**Source:** Department of Geography, FUT Minna

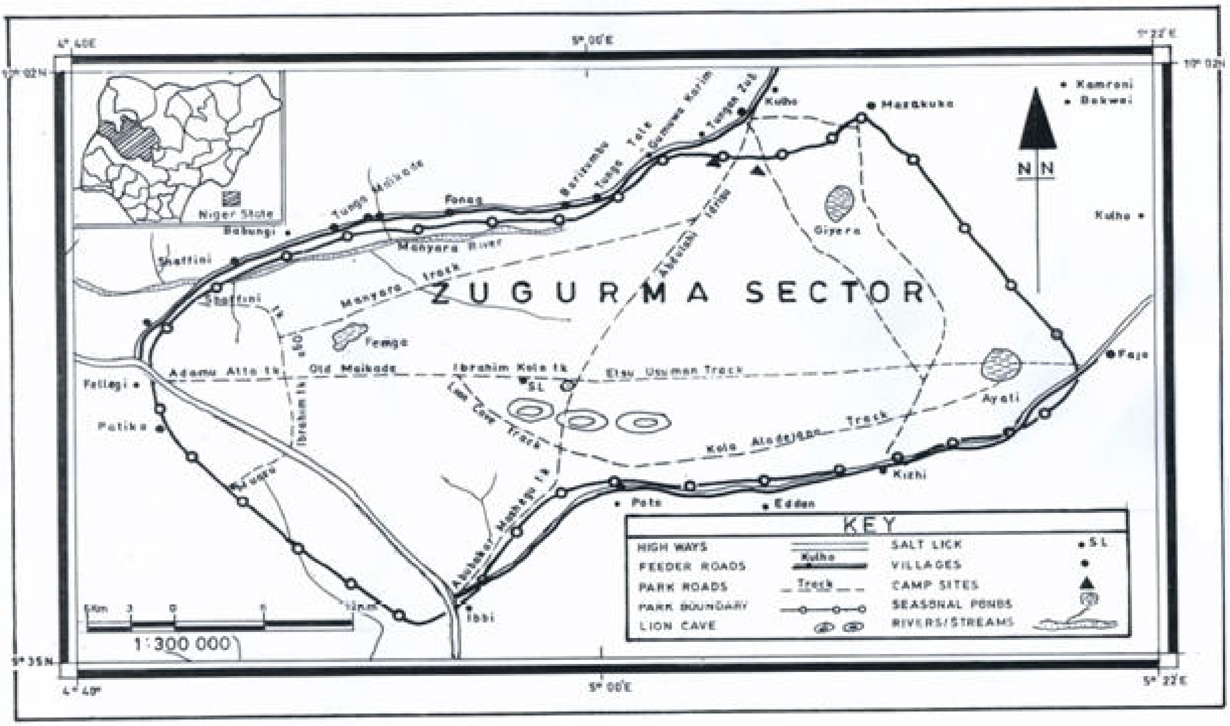


**Figure 3: Zugurma Sector of Kainji Lake National Park**
**Source:** Geography Department, 2012

**Climate**

Kainji Lake National Park area enjoys the savanna climate of Nigeria. In this area there are two distinct seasons of wet and dry seasons. The wet season begins around mid –April of every year and ends in October giving about seven months wet season while November to March represents the dry season. Like most part of Nigeria Kainji Lake National Park enjoys the characteristic West Africans climate, marked by distinct seasonal shift in the wind pattern. There is the prevalence of moisture-laden south westerly wind during the wet months while the dust-laden northeasterly wind is associated with the dry months. The mean temperature during the wet season is about 30ºC and drops to about 28º C during the dry season being affected by the north east harmatan winds. Rainfall is a major climatic element in the reserve being responsible for vegetal growth and the hydrology of the rivers. The mean annuals rainfall is about 1200mm. The rainfall amount increases to the southeast from Borgu towards the Niger valley. This is due to leeward nature of the reserve site being east of the Yoruba hills. Individual rainstorms are often short and stormy, with high rainfall intensities. The number of rainy days averages about 200 days increasing eastwards to the Niger valley (Ecological Survey of KLNP, 2004).

**Drainage and hydrology**

The main drainage networks in the Zugurma Sector of the Park are the minor tributaries of larger rivers outside the reserve. The sector is a plateau with few small rivers flowing to the south and the north of the sector (Ecological survey of KLNP, 2004).

**Topography**

The topography of the Kainji Lake National Park consists of hills, extensive plains and river valleys. On the whole, the entire area is gently undulating with quartzite ridge in few places. Elevation in most parts of the reserve ranges between 250m and 300m. The highest point in the reserve is at the northwestern corner with an elevation of 350m, while the lowest elevation is along the River Niger where the maximum water mark is about 140m. For the Zugurma sector, the highest parts lie east-west across the park forming a drainage divide to streams flowing away in all directions. The rivers develop extensive floodplains because of the relative nearness of the park to River Niger (Ecological Survey of KLNP, 2004).

**Geology and soil**

Kainji Lake National Park is underlain by the old crystalline basement rocks of the undifferentiated igneous and metamorphic rocks. These rocks have been deeply weathered in the most of the area occupied by the Park but remnants of hard granitic rocks have been exposed on the high grounds forming granitic hills and pediments especially close to the river valleys.

The nature of the underlying rocks, parent material, the topography and the extent of weathering determines the nature of soils in the sectors occupied by Kainji Lake National Park. For the Zugurma sector, the soils are deeply weathered into latosol. The interfluves areas at the centre of the sector are covered with deep gravelly loam with reddish unmolted upper horizons. The soils on the lower slopes are mottled red and well drained. It is common to come across lateritic ironstone in the soil profiles except in the alluvium in the valley bottoms (Ecological survey of KLNP, 2004).

**Vegetation**

The vegetation of both sectors of Kainji Lake National Park lie within the Northern Guinea Savanna, which is Savanna woodlands dominated by tree species such as *Aflezia Africana*, *Isorberlinia tomentosa, Monotewse kerstingii, Burkea Africana, Isoberlinia doka, Crossopbteryx ferbrifuga, Anogeissus leicarpus, Khaya senegalendis, Terminalva avicinoides, Butryos permum paradoxum, Terminalva macroptera, Retarium microcarbum, Diospyros mespiliformis* and *Maytemus senegalsio*. Prominent shrubs include *Piliostigma thonningii, Anona senegalensi, Strychnos inocua* and *Gardenia sp.* The herb layer is dominated by the following grasses: *Andropogon gayus, Andropogon tectorum, Hyparrhenia sp.* and woody forbs such as *Cochlospermum tinctorum* and *C. Planchoniwith planchoni.* Being largely rural, households in the SZC depend extensively on biological resources for their livelihoods. Very salient among these resources are trees, animals, and timber forest products (NTFPs). Sometimes, herdsmen allow their stock to move into the protected areas for grazing. Poaching also takes place, while wild fires invade it from the surrounding farmlands (Ecological Survey of KLNP, 2004).

The Zugurma sector is devoid of species richness when compared to Borgu sector because of the lack of surface water such as rivers and streams, which are almost absent in the Park. The water is one of the major livelihood of animal species in the Park. However, species like Roan antelope, Hartebeest, Red flanked duiker, Bush buck and Warthog are present at the Park. The three major primate species recorded in the Sector are Mona monkey, Green monkey and Red patas monkey. Further reason that was deduced for scanty species presence in the sector is the numerous villages and enclaves that surrounded the area. The socio-economic activities of the indigenous communities invariably affected the species richness due to various inimical activities such as poaching, farming pervaded the sector. There is a general perception that human activities have been impacting negatively on the biodiversity status of the PA. However, opinion is divided as to whether recent activities create more externalities than those of the past (Ecological Survey of KLNP, 2004).

## MATERIALS AND METHODS

**Satellite Data Acquisition**

Landsat Thematic Mapper (TM) of the 1980s and Landsat Enhanced Thematic Mapper (ETM+) of 2000s (that is 1986, 2000 and 2010) that cover a major part of the study area (Zugurma) was acquired for use in the study in line with Objective 1. Both Landsat TM and ETM+ having 30m spectral resolution at the visible and near infrared spectral region (10.4-12.5µm) but they differ in the spatial resolution while the Landsat ETM+ has enhancements with two bands at the thermal infrared region (Band 61&62). The imageries were acquired through the United States Geological Survey (USGS) Earth Resource Observation Systems Data Centre (Global Land Cover Facility (GLCF)), which will correct the radiometric and geometrical distortions of the images to a quality level of 1G before delivery. The Geo–referencing properties of the imageries are as follows: Data type: rgb8, with Columns 535 and Rows 552, Projection is UTM, Zone 31N and Reference units in meters, Datum: WGS – 84

**Software**

The software utilized in the research included:

- *ArcGIS 10.1:* This software was used map digitizing and GIS analysis. It was also used to mosaic the various scenes, convert the vector shapefiles to raster data format and also used to mask the study area from the mosaic satellite imagery covering the study area.
- *Microsoft Word 2007:* This was used for the typing and setting of gathered information and presentation of the research.
- *Microsoft Excel 2007:* This was used in production of the charts or graph and carrying out other statistical operation performed in ArcGIS.
- *Statistical Package for Social Sciences (SPSS) 10.0*

**Development of Classification Domain**

Mather (1999) considered classification to be the process of pattern recognition of the pattern associated with each pixel position in an image in terms of the characteristics of the objects or materials present at the corresponding point of the Earth's surface. Its major functions are spatial, spectral and temporal pattern recognition (Syed and Abdulla, 2002).

The classification approach used here is the Supervised Techniques of Classification which is based on the knowledge of the user about the area under study or research. The delineation of the land cover types is based on statistical characterization data drawn from known examples in the image and this is called training sites or Classification Domains.

Maximum likelihood classification algorithm was used. A classification domain or scheme was developed for the study area based on the prior knowledge of the study area. Maximum likelihood procedure is the most sophisticated and is unquestionably the most widely used classifier in classification of remotely sensed imagery. The classification schemes are shown in Table 3.1 below:

**Table 1: Landcover Classification Scheme**

| Code | Investigated domains |
|---|---|
| 1 | Forest |
| 2 | Farmland |
| 3 | Settlement |
| 4 | Bareland |

The afore – mentioned domains were examined on the acquired satellite imageries of the study area to obtain information about the change that has taken place over the past 24 years (between 1986 – 2010).

**Normalized Difference Vegetation Index**

Remote sensing for agricultural resource evaluation use vegetation indices calculated from digital multispectral image data. There are various types of vegetation indices but the one employed in this research is the Normalized Difference Vegetation Index (NDVI). Data from high, medium and low resolution sensors are used and sometimes in combination to monitor crop condition. This is calculated from 2 bands of multi-spectral image data: the visible (red) band and the near infrared (NIR) band as follows:

$$\mathrm{NDVI} = \frac{\mathrm{NIR} - \mathrm{Red}}{\mathrm{NIR} + \mathrm{Red}}$$

**Modeling**

This was used in the research to project the study area to 2020 using the data derived from the satellite imagery.

**RESULTS AND DISCUSSION**

**Landuse/Landcover changes in 1986**

Figure 4 shows the landuse/landcover map of Zugurma Sector in 1986 and is classified into four (4) landuse/landcover types. These are forests, farmland, settlement, and bareland.

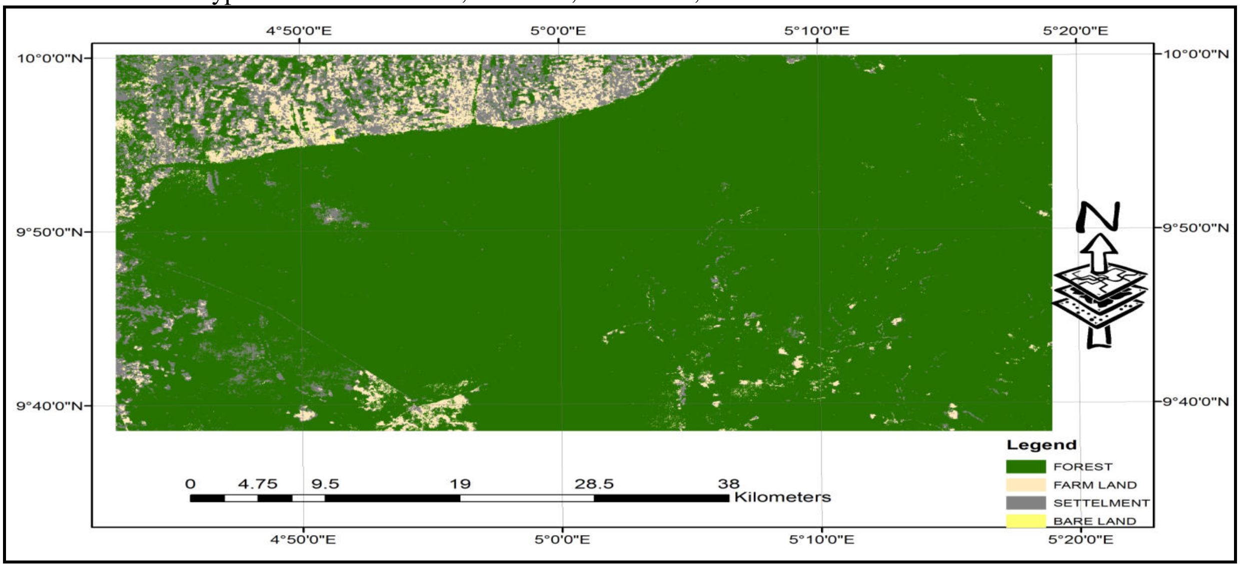


**Figure 4: Classified LandSat TM Satellite Imagery of Zugurma in 1986**
**Source: GLCF, 2014**

 

**Table 2: Zugurma Landuse/Landcover Statistics in 1986**

| Landuse/Landcover Type | Count | Area (Hectares) ($cm^2$) | Percentage (%) |
|---|---|---|---|
| Forest | 202,971 | 231,802.61 | 87.562 |
| Farmland | 614 | 12,835.25 | 4.7837 |
| Settlement | 1,076 | 19,846.17 | 5.4217 |
| Bareland | 6 | 268.75 | 2.2326 |
| **Total** | **204,667** | **264,752.78cm$^2$** | **100%** |

**Source:** Field Work, 2014

Table 2 shows that the bare lands have a statistic land cover area of 268.75cm$^2$ giving it 2.2326%, farmlands have an area of 12,835.25cm$^2$ giving it 4.7837%, settlements have 19,846.17cm$^2$ giving it 5.4217%, while forests have 231,802.61cm$^2$ giving it 87.562%. By this statistics, it can be said that by 1986, Zugurma had few residents and more forestlands.

**Landuse/Landcover changes in 2000**

Figure 5 shows the landuse/landcover map of Zugurma Sector in 2000 and is classified into four (4) landuse/landcover types. These are forests, farmland, settlement, and bareland.

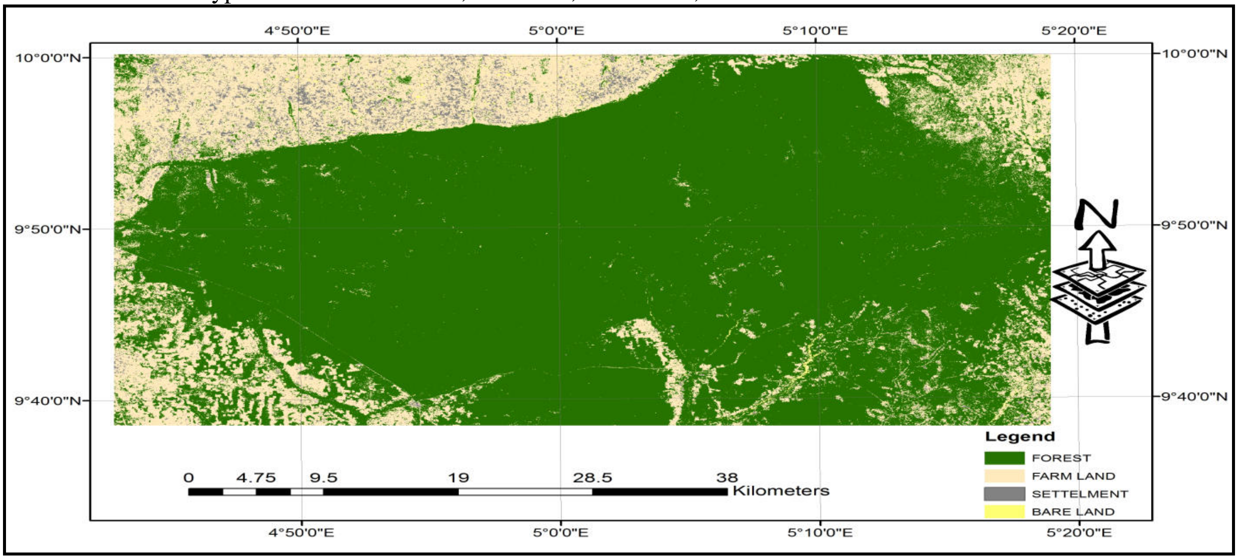


**Figure 5: Classified LandSat ETM Satellite Imagery of Zugurma in 2000**
**Source: GLCF, 2014**

**Table 3: Zugurma Landuse/Landcover Statistics in 2000**

| Landuse/Landcover Type | Count | Area (Hectares) ($cm^2$) | Percentage (%) |
|---|---|---|---|
| Forest | 139,350 | 202,749.89 | 68.73 |
| Farmland | 6,657 | 55,336.66 | 12.03 |
| Settlement | 772 | 5,663.98 | 13.63 |
| Bareland | 55 | 980.39 | 5.61 |
| **Total** | **146,834** | **264,730.92cm$^2$** | **100%** |

**Source:** Field Work, 2014

Table 3 shows that bare lands have a statistic land cover area of 980.39cm$^2$ giving it 5.61%, settlements have 5,663.98cm$^2$ giving it 13.63%, farmlands have an area of 55,336.66cm$^2$ giving it 12.03%, while forests cover the most area of 202,749.89cm$^2$ giving it 68.73%. By this statistics, it can be said that the forest reduced as population increased.

**Landuse/Landcover changes in 2010**

Figure 6 shows the landuse/landcover map of Zugurma Sector in 2010 and is classified into four (4) landcover types. These are forests, farmland, settlement, and bareland.

 

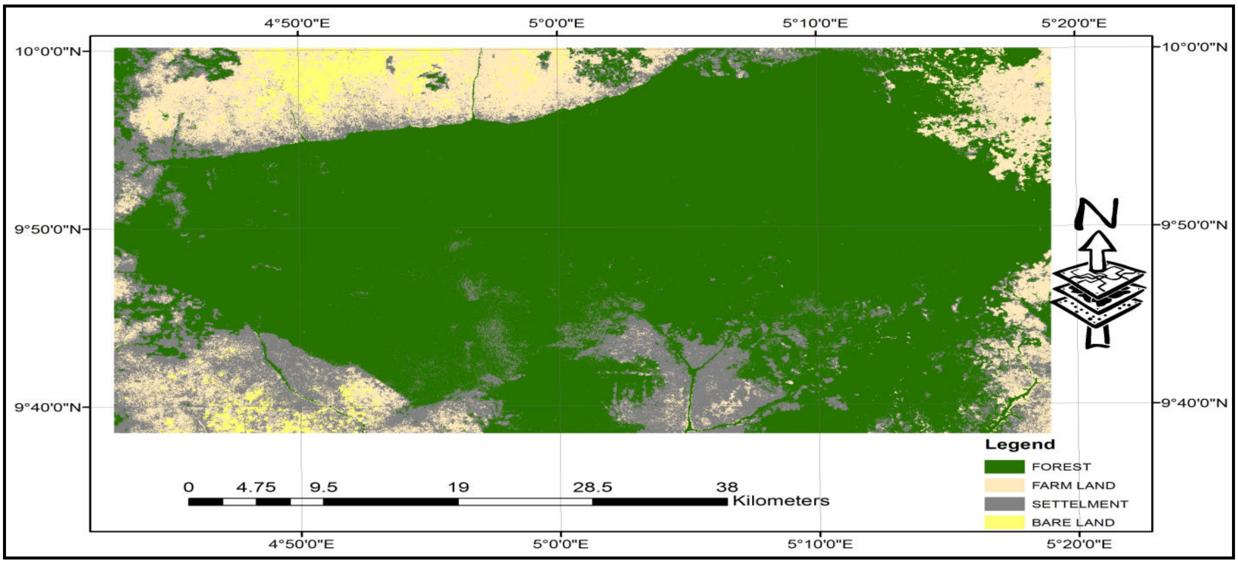


**Figure 6: Classified LandSat ETM Satellite Imagery of Zugurma in 2010**
**Source: GLCF, 2014**

**Table 4: Zugurma Landuse/Landcover Statistics in 2010**

| Landuse/Landcover Type | Count | Area (Hectares) ($cm^2$) | Percentage (%) |
|---|---|---|---|
| Forest | 87,196 | 157,769.42 | 55.268 |
| Farmland | 7,202 | 41,864.79 | 17.203 |
| Settlement | 8,888 | 45,584.63 | 19.4978 |
| Bareland | 1,567 | 19,516.75 | 8.029 |
| **Total** | **104,853** | **264,735.59$cm^2$** | **100%** |

**Source:** Field Work, 2014

Table 4 indicates that bare lands have 19,516.75$cm^2$ giving it 8.029%, farmlands have a statistic land cover area of 41,864.79$cm^2$ giving it 17.203%, settlements have an area of 45,584.63$cm^2$ giving it 19.4978%, while forests have 157,769.42$cm^2$ giving it 55.268%. By this statistics, it can be said that there was fast population growth resulting in more farmlands and fewer bare lands. The forest area, however, has reduced some more by nearly half.

**Summary of landuse/landcover changes in 1986, 2000 and 2010**

The summary of the landuse/landcover changes in 1986, 2000 and 2010 are shown in the table 5 and figure 7 below:

**Table 5: Summary of Landuse/Landcover Changes in 1986, 2000 and 2010**

| Landuse/Landcover | | Years | | Average | Differences | |
|---|---|---|---|---|---|---|
| Type | 1986 | 2000 | 2010 | Percentage | 1986/2000 | 2000/2010 |
| Forest | 87.562% | 68.73% | 55.268% | 70.52% | -18.832 | -13.462 |
| Farmland | 4.7837% | 12.03% | 17.203% | 11.34% | 7.2463 | 5.173 |
| Settlement | 5.4217% | 13.63% | 19.498% | 12.85% | 8.2083 | 5.8678 |
| Bareland | 2.2326% | 5.61% | 8.029% | 5.29% | 3.3774 | 2.419 |

**Source: Field Work, 2014**

From Table 5, the summary of the satellite imageries show that bare lands reduced the most over the years due to fast population growth. Farmlands come next as a result of bad farming methods and climate variations. Settlements come not far afterwards as most of the households share compounds. Averagely, the percentage of Forest land is found to be 70.52, that of Farmland is 11.34, Settlement is 12.85, while Bareland is the least with an average of 5.29%. There was sharp decline in the forest area (from -18.832 to -13.462).

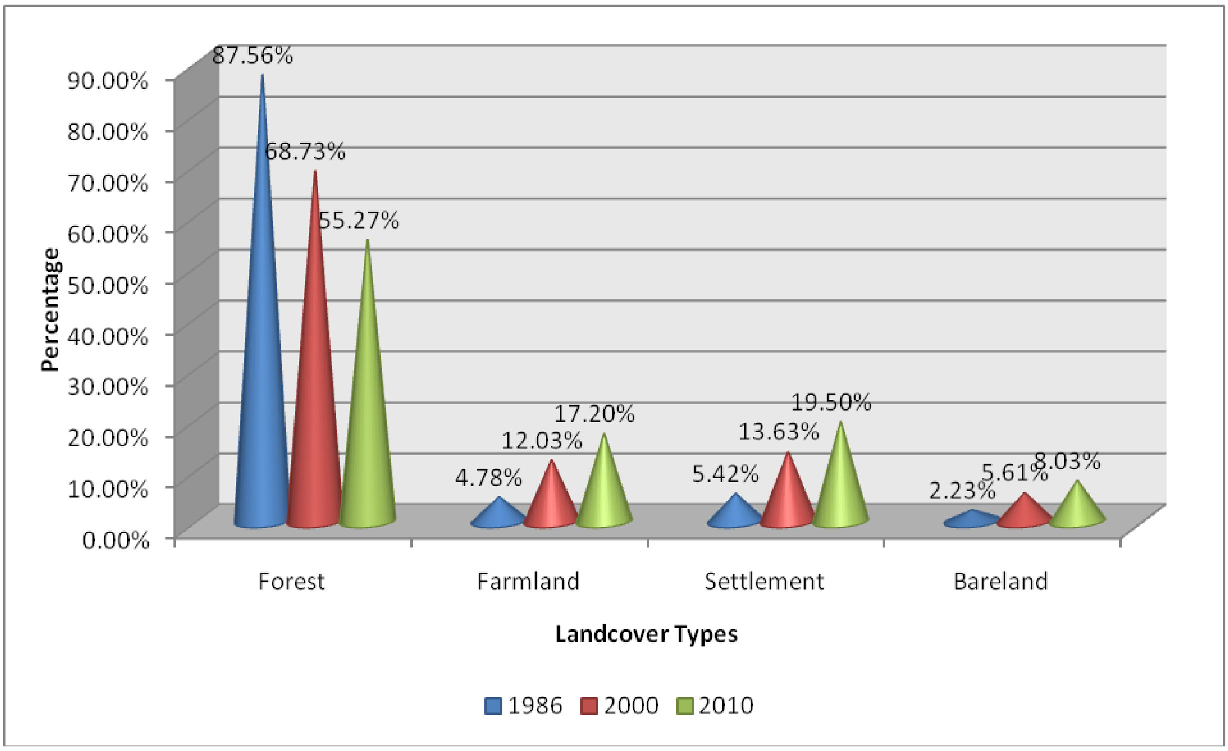


**Figure 7: Summary of Landcover Changes in 1986, 2000 and 2010**
**Source: Field Work, 2014**

Figure 7 shows a graphical representation of Table 5. It is clear from the graph that Zugurma Forest has been recording the highest percentage from 1986 to 2010, although there is obvious decrease in the landcover. As for settlements, we have more cases of migration as the years go by. Farmlands, however, increased over the years, while the barelands increased too.

**The Normalized Difference Vegetation Index**

NDVI generally correlates very well with biomass because healthy plants of a given species tend to have greater biomass, thus, it is a good measure of plant vigour. The NDVI values increase from the period when the first plant emerges to when they reach their maximum development called the Peak-of-Green (the time when the leafy parts of the plants are fully developed and the green reflectance is maximum). The NDVI values then decline as the plant matures and goes to seed. Particular years when NDVI values are low produce lower hear and lower produce/yield. Airborne and multi-spectral images are used for crop identification and condition assessment. Figures 8 – 10 show the increase and decrease in NDVI values from 1986 to 2010.

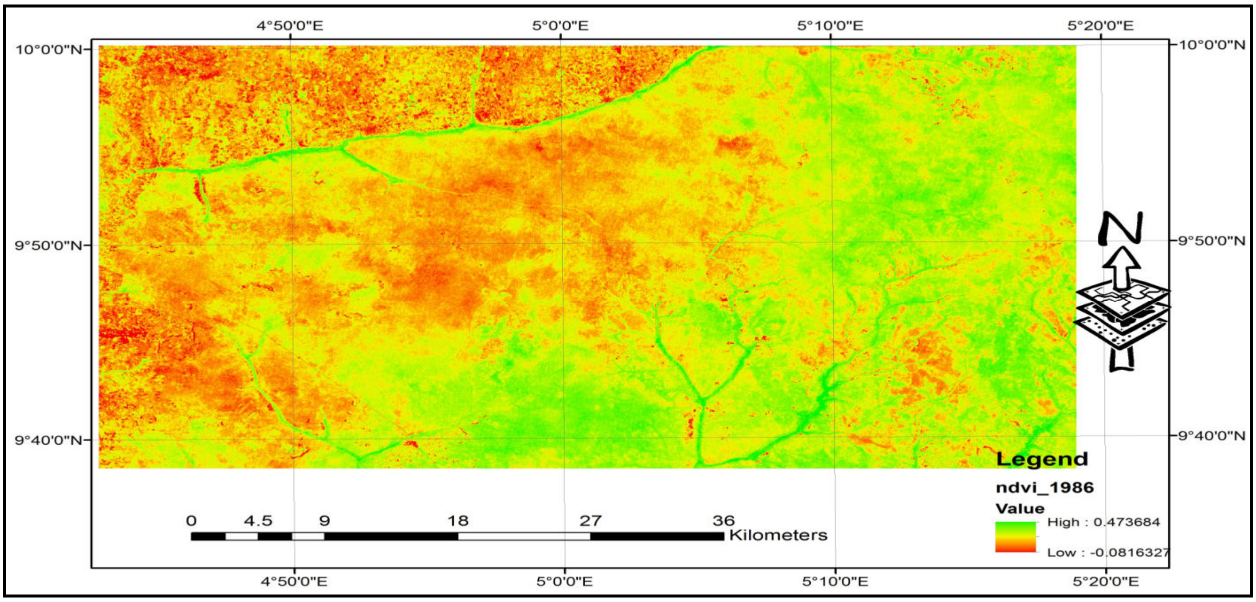


**Figure 8: NDVI Image of Zugurma in 1986**
**Source: Field Work, 2014**

Figure 8 shows high NDVI values for Zugurma in 1986 (0.473684); this suggests that the vegetation was quite stressed in this period in the area (having red reflectance).

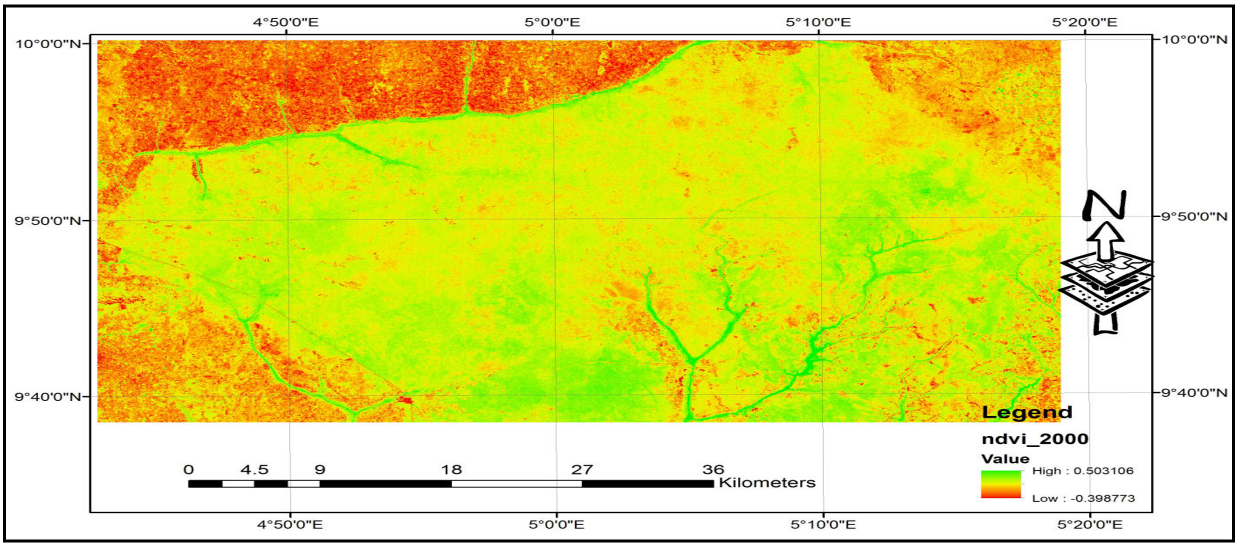


**Figure 9: NDVI Image of Zugurma in 2000**
**Source: Field Work, 2014**

Figure 9 shows an increase in the NDVI values for Zugurma in 2000 (from 0.473684 to 0.503106); this suggests that the vegetation in the area were healthier probably due to increase in rainfall and decrease in temperature at the time.

 

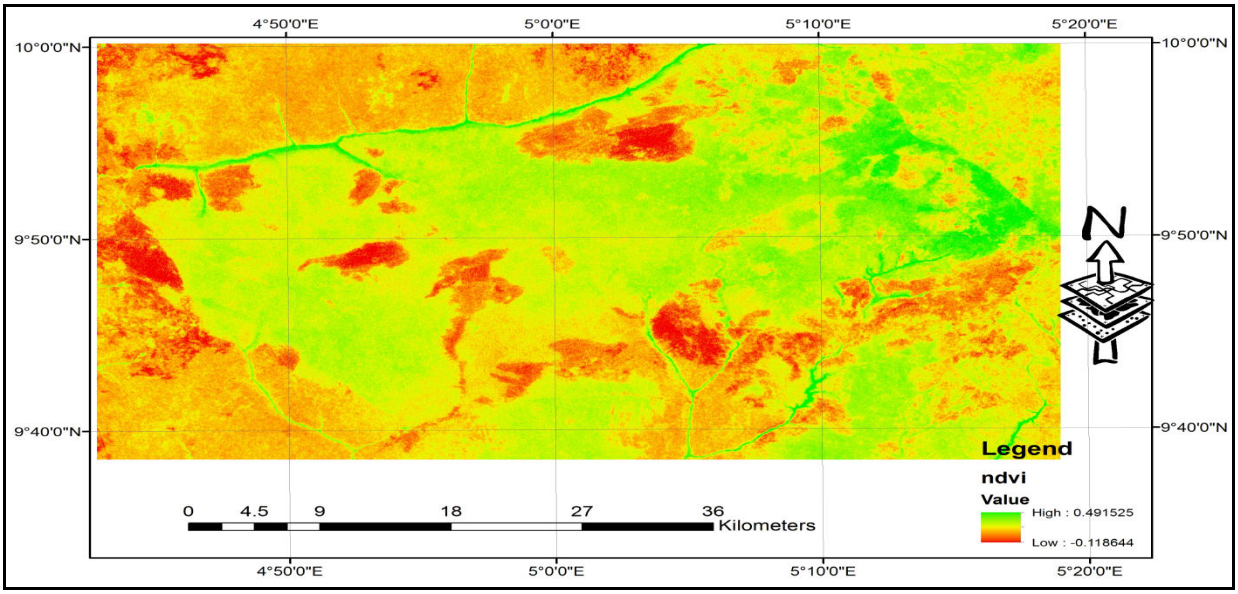


**Figure 10: NDVI Image of Zugurma in 2010**
**Source: Field Work, 2014**

Figure 10 shows a decline in the NDVI values for Zugurma in 2010 (from 0.503106 to 0.491525); this suggests that the forest had degraded probably caused by deforestation or climatic factors.

**Projection**

The landuse/landcover was projected to predict the extent of change over a period of 10 years (from 2010 to 2020). The projection was meant to give an insight into the rate of vegetal cover decline using results from the satellite imageries of 1986, 2000 and 2010.

$$P = \frac{P_0 Y_0}{Y} - k\,(Y - Y_0)$$

Where:

| | | |
|---|---|---|
| $P$ | = | Percentage |
| $P_0$ | = | Initial Percentage |
| $Y$ | = | Year |
| $Y_0$ | = | Initial Year |
| $k$ | = | Constant |

To get the constant of proportionality, *k*:

$$P_1 Y_1 \neq P_2 Y_2$$

$$P_1 Y_1 = k P_2 Y_2$$

$$87.562 \times 1986 = k \times 59.596 \times 2010$$

$$k = \frac{87.562 \times 1986}{55.268 \times 2010}$$

$$\boldsymbol{k = 1.565}$$

To project for Forests:

$$P = \frac{87.562 \times 1986}{2020} - 1.565\,(2020 - 1986)$$

$$\mathbf{P} = 86.088 - 53.21 = \mathbf{32.878}$$

To project for Farmlands: 0.3846 (100 – P) = **25.815**
To project for Settlements: 0.4359 (100 – P) = **29.259**
To project for Barelands: 0.1795 (100 – P) = **12.048**

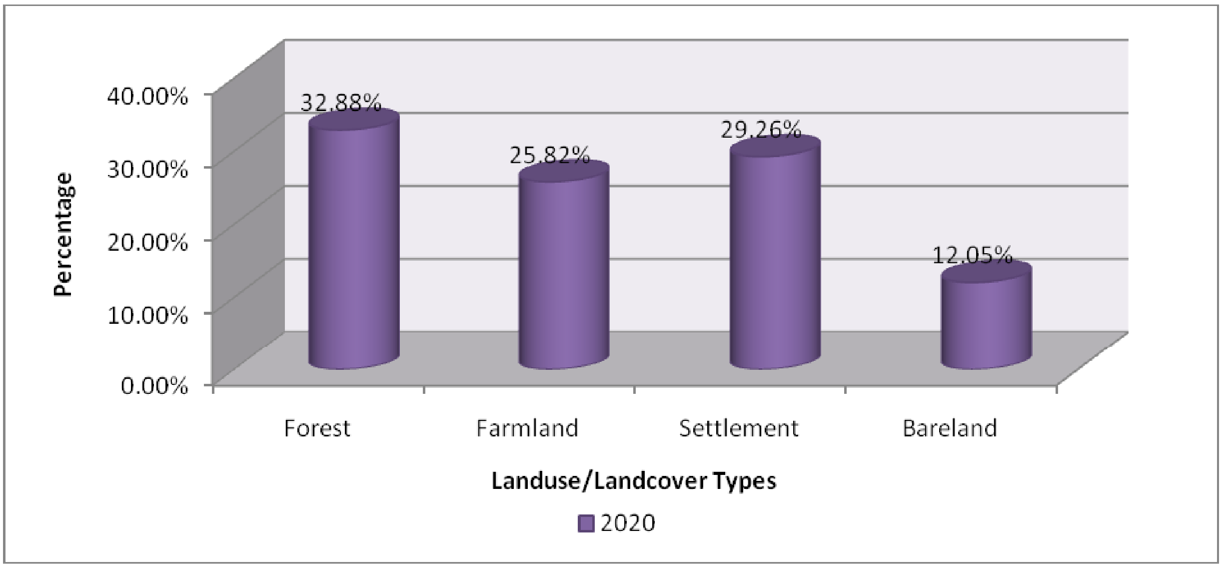


**Figure 11: Projection of Landuse/Landcover to Year 2020**
**Source: Field Work, 2014**

**Discussion of Results**

It is clear from the results and analysis above that Zugurma Forest has been receding and will continue to do so if actions are not taken to reduce bush burning and poaching activities. Although there are laws guiding the Park, residents still encroach on the Park land. From the prediction, year 2020 will have 32.878% Forests (from 70.52%), 25.815% Farmlands (from 11.34%), 29.259% Settlements (from 12.85%), and 12.048% Bare lands (from 5.29%). From the responses of the respondents through the questionnaires, farming is the major source of livelihood and the immigrants keep increasing, thereby stressing the limited resources especially the land. The increase in bareland results from human activities (use of land for brick moulding, construction works, dumpsites, etc), and climatic factors (soil erosion, runoff and high temperatures). The positive socio-economic impact of the Park on the residents of Zugurma Sector include: influx of government officials due to the Park's facilities, diversification of the economy (increase in civil servants), social amenities, and other dividends of civilization.

**Conclusion**

This research has revealed that the establishment and existence of the Park has taken a large portion of one of the major common properties of the people – the land. The protected area cut into land as a major common resource of the people and thus was seen to have generally affected the size of farmlands that are available to the people and that is put under cultivation. In addition, it has placed some restriction on shifting cultivation practice. The modern concept of conservation (the wise maintenance and utilization of the natural resources most especially in the tropical region), is based on combination of two ancient principles: these are the need to plan resource management on the basis of accurate inventory and the need to take protective measures to ensure that resources do not become exhausted.

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