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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 (Zahair, 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-Gumti (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.

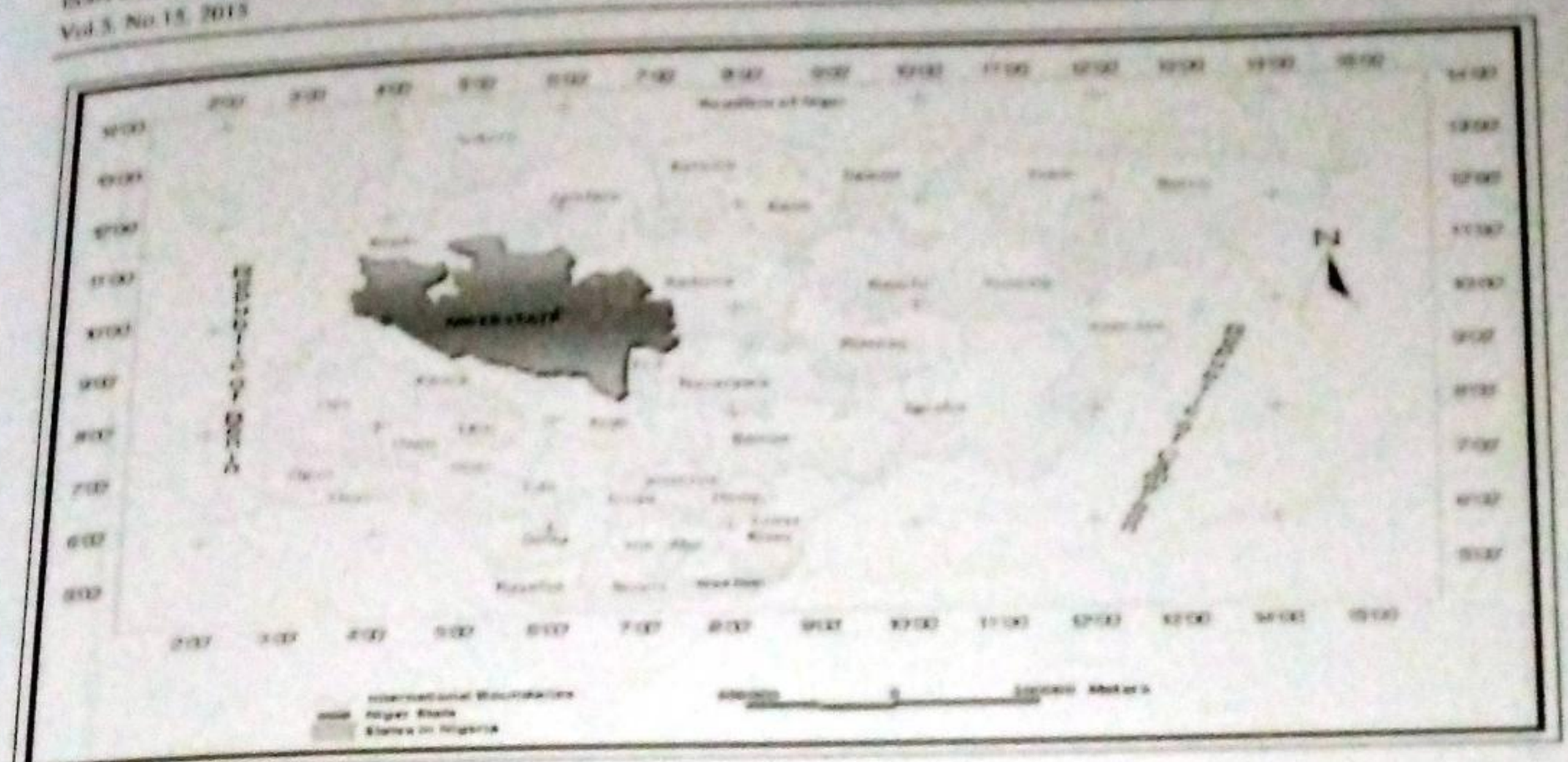

Figure 1: Niger State in Nigeria
Source: Department of Geography, FUT Minna

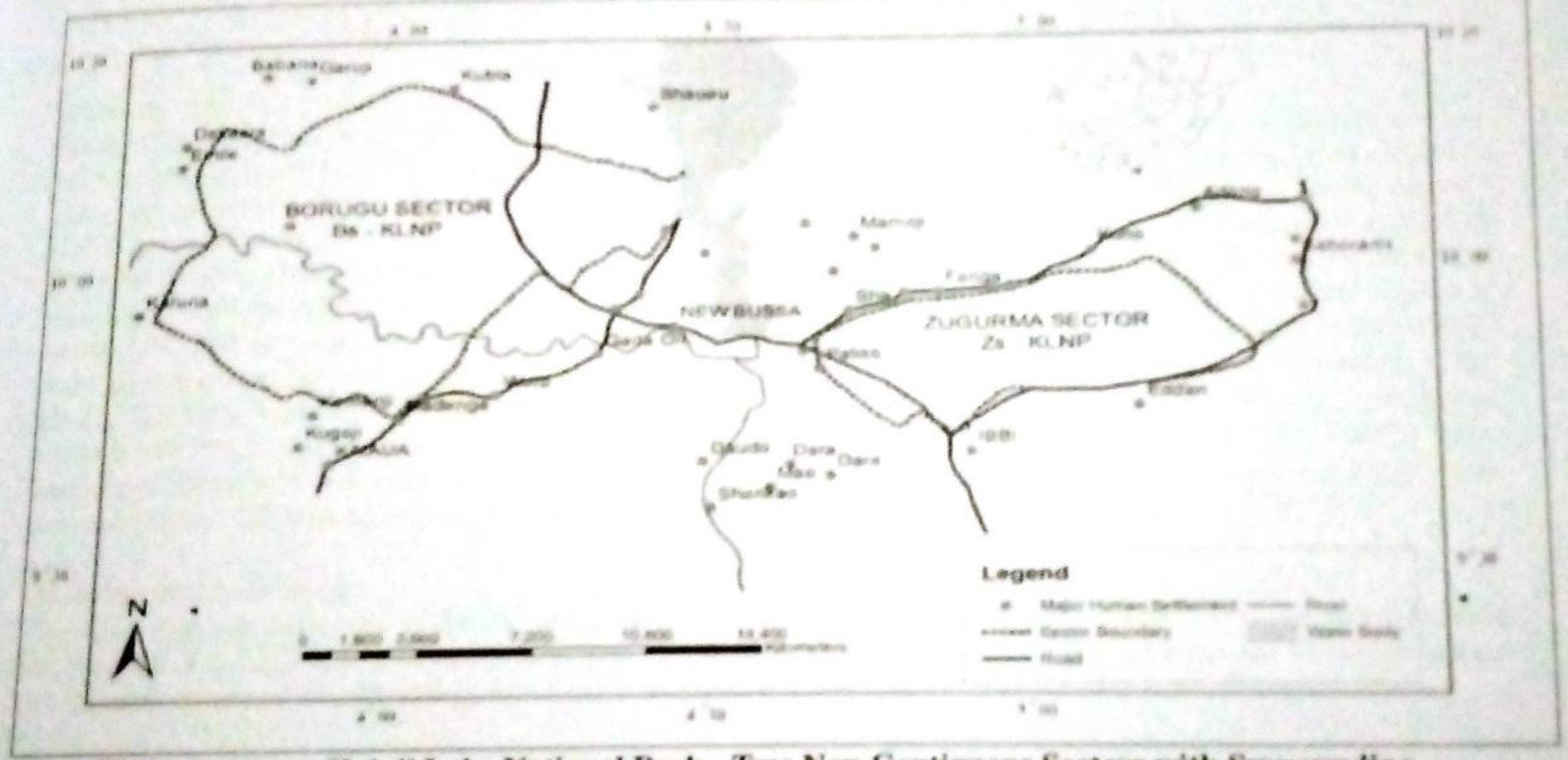

Figure 2: Kainji Lake National Park - Two Non Contiguous Sectors with Surrounding Communities
Source: Department of Geography, FUT Minna

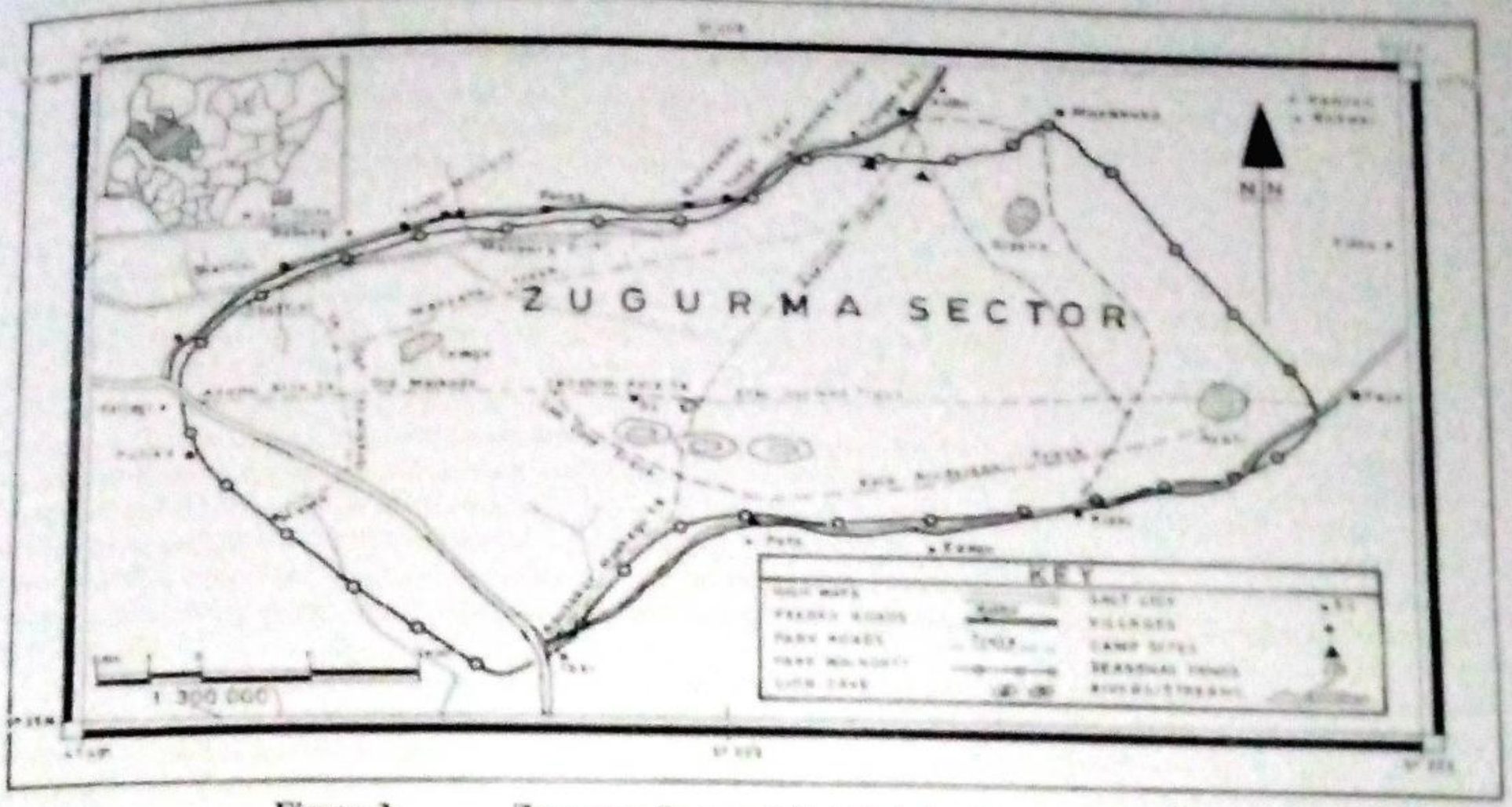

Figure 3: Zugurma Sector of Kainji Lake National Park
Source: Geography Department, 2012

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 30°C and drops to about 28° 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 nuicrocarbum, 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. Planchontwith 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*

velopment of Classification Domain

her (1999) considered classification to be the process of pattern recognition of the pattern associated with pixel position in an image in terms of the characteristics of the objects or materials present at the sponding 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 above – 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:

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

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.

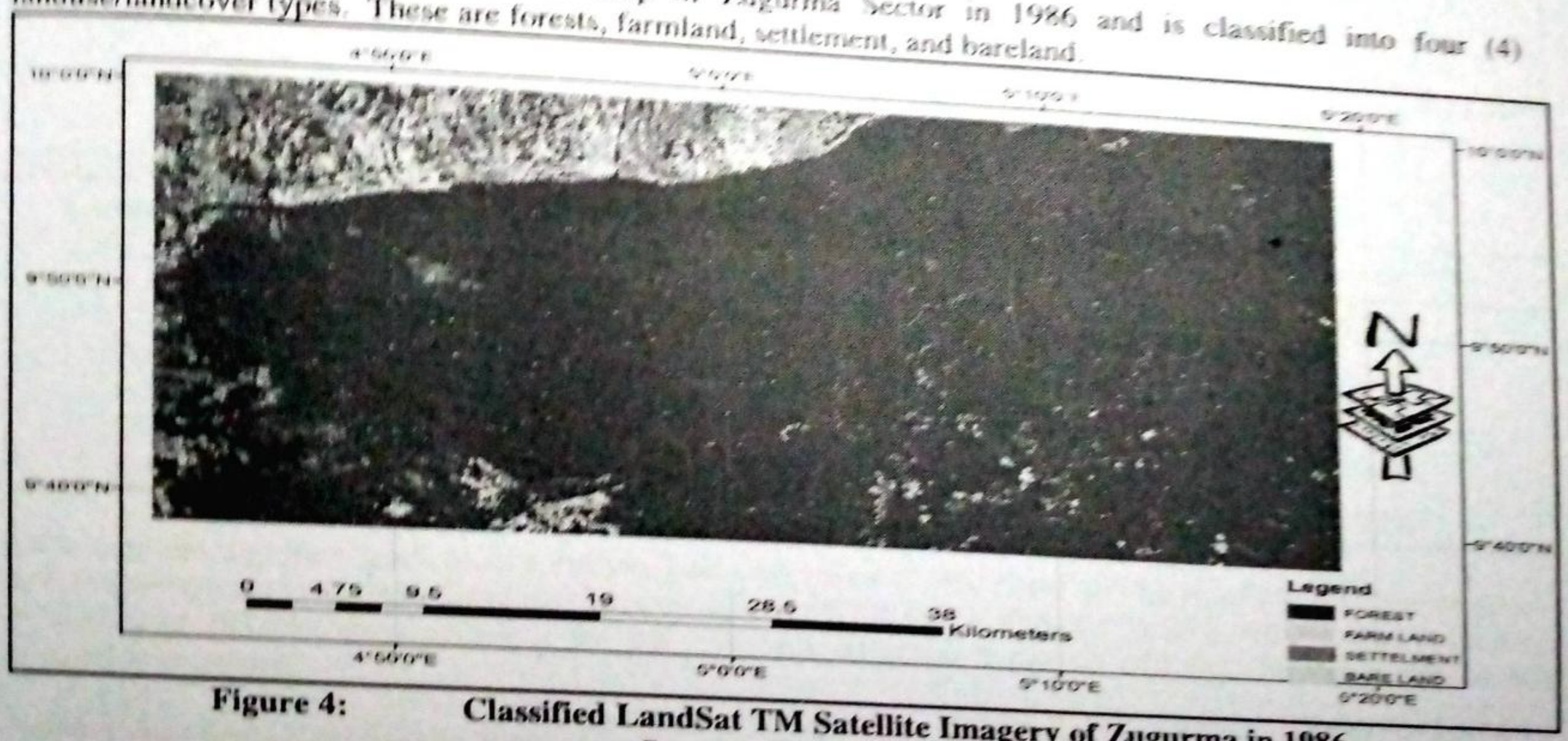

Figure 4: Classified LandSat TM Satellite Imagery of Zugurma in 1986
Source: GLCF, 2014

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.

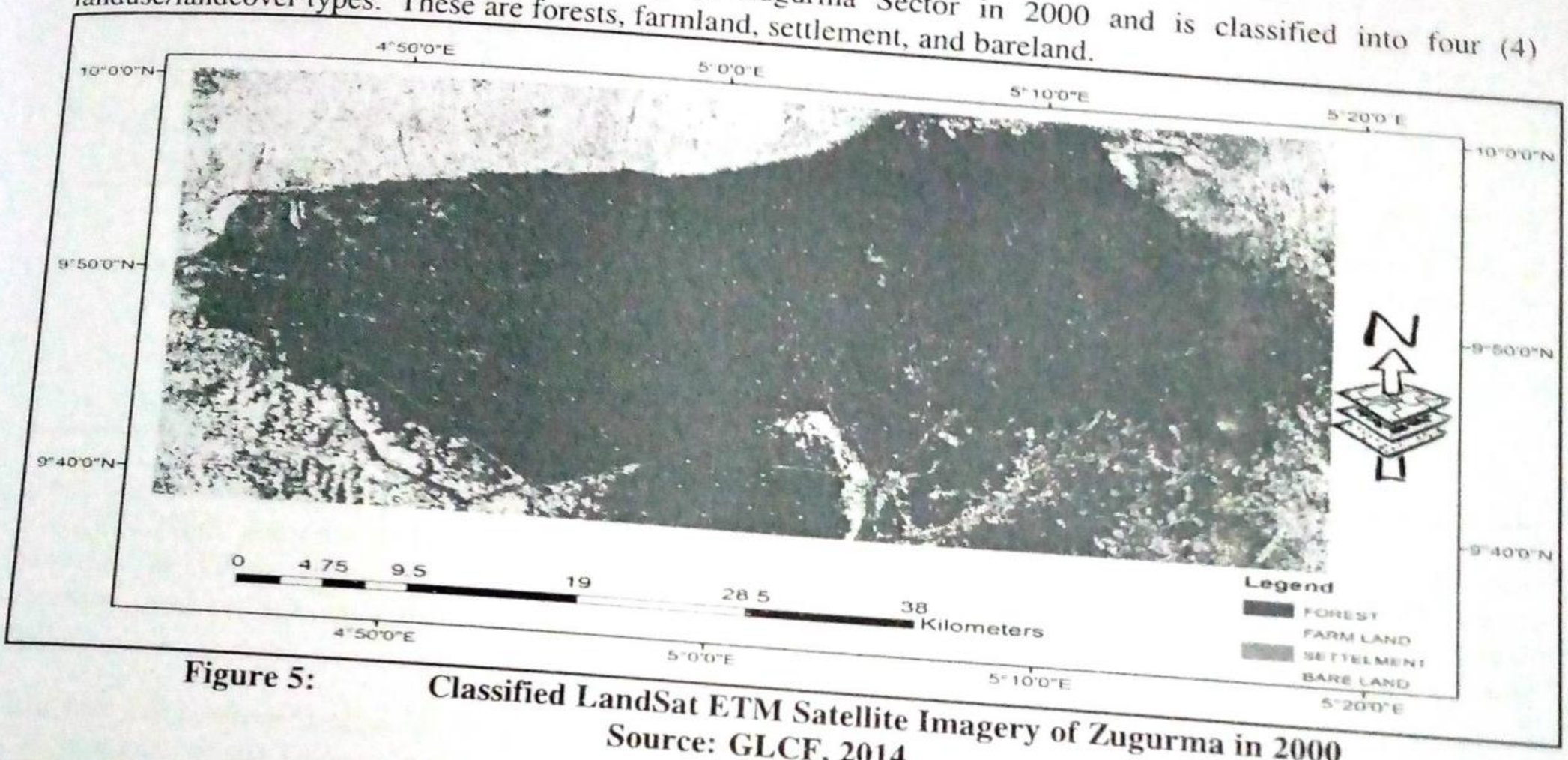

Figure 5: Classified LandSat ETM Satellite Imagery of Zugurma in 2000
Source: GLCF, 2014

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.

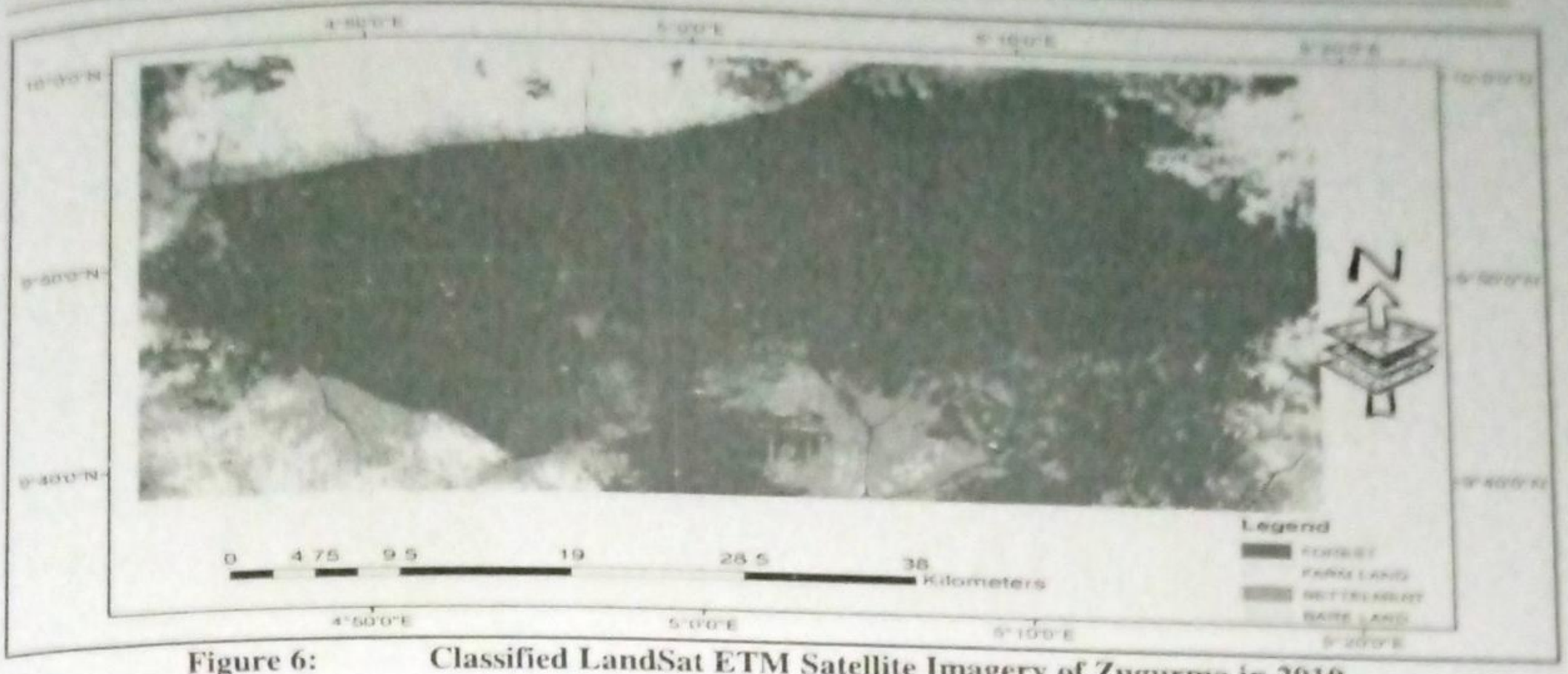

Figure 6: Classified LandSat ETM Satellite Imagery of Zugurma in 2010
Source: GLCF, 2014

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**	**264,735.59cm^2**	**100%**

Source: Field Work, 2014

Table 4 indicates that bare lands have 19,516.75cm^2 giving it 8.029%, farmlands have a statistic land cover area of 41,864.79cm^2 giving it 17.203%, settlements have an area of 45,584.63cm^2 giving it 19.4978%, while forests have 157,769.42cm^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 Type	Years			Average Percentage	Differences	
	1986	2000	2010		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.

he Normalized Difference Vegetation Index

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

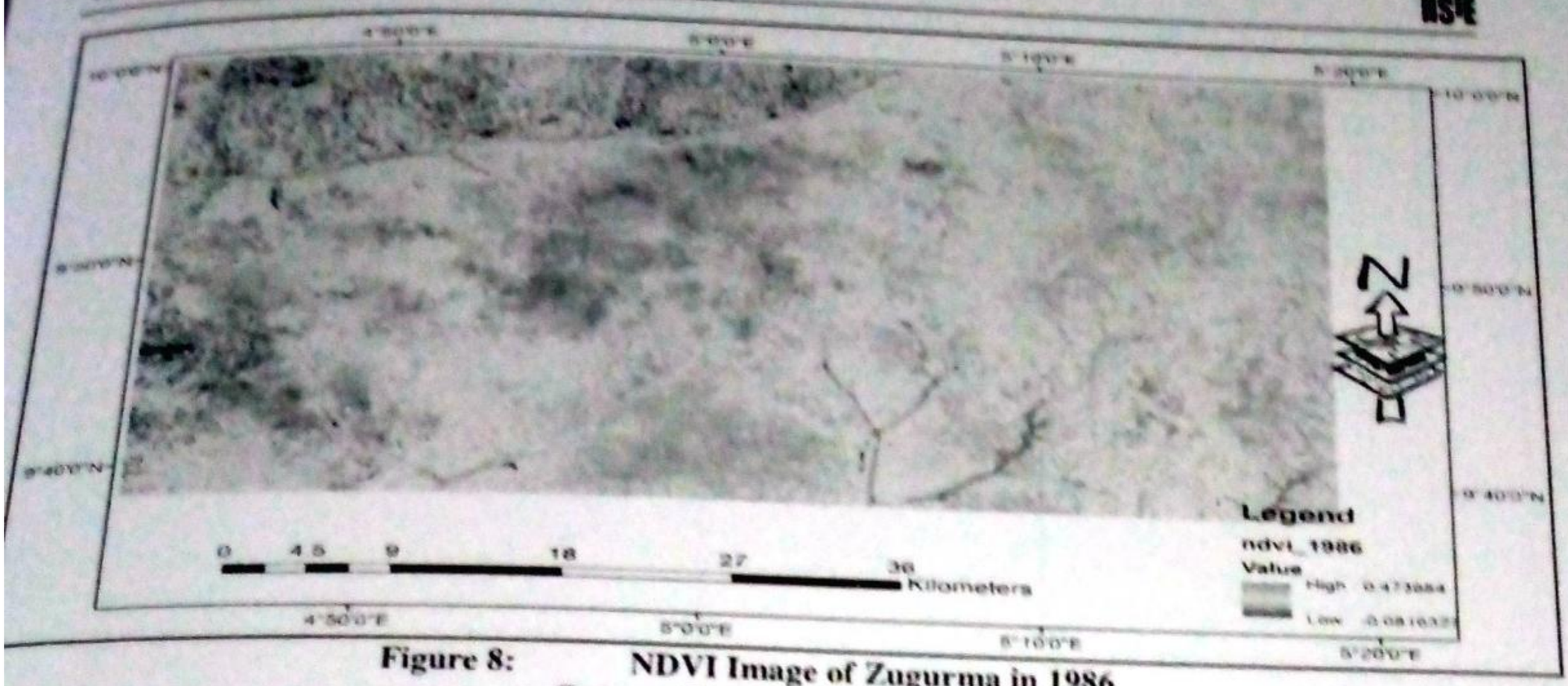

Figure 8: NDVI Image of Zugurma in 1986
Source: Field Work, 2014

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

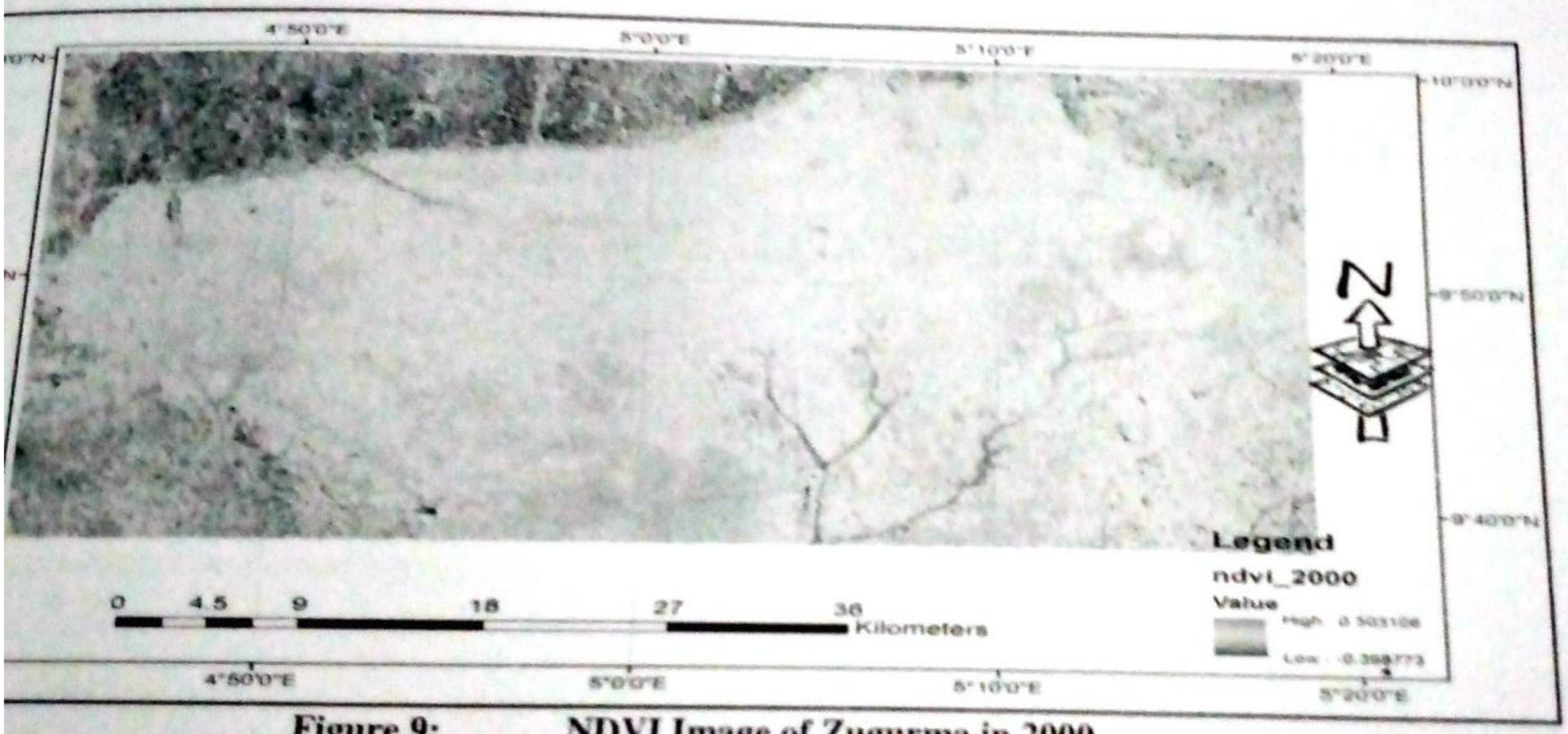

Figure 9: NDVI Image of Zugurma in 2000
Source: Field Work, 2014

ows an increase in the NDVI values for Zugurma in 2000 (from 0.473684 to 0.503106); this suggests getation in the area were healthier probably due to increase in rainfall and decrease in temperature at

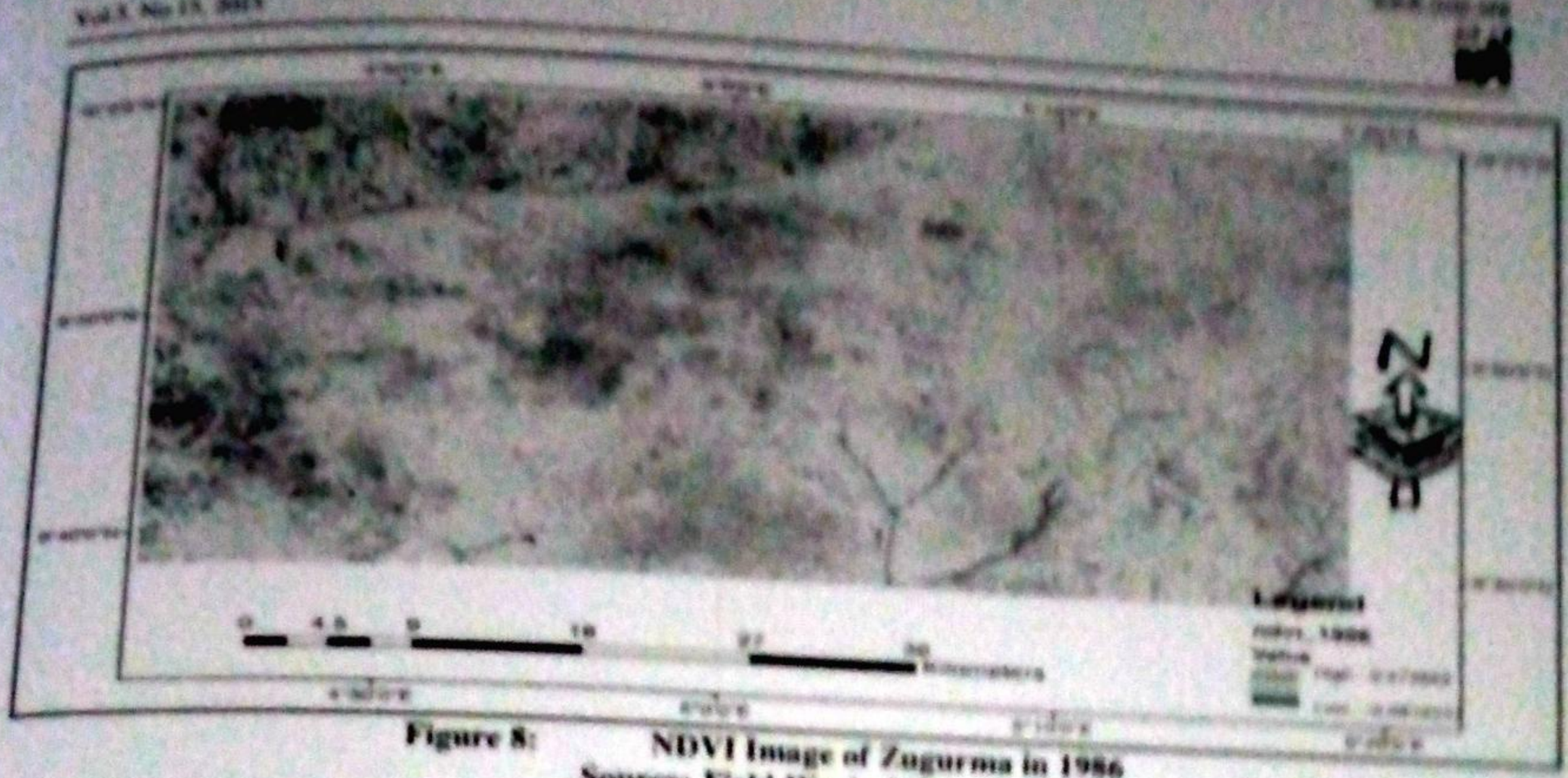

Figure 8: NDVI Image of Zugurma in 1986
Source: Field Work, 2014

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)

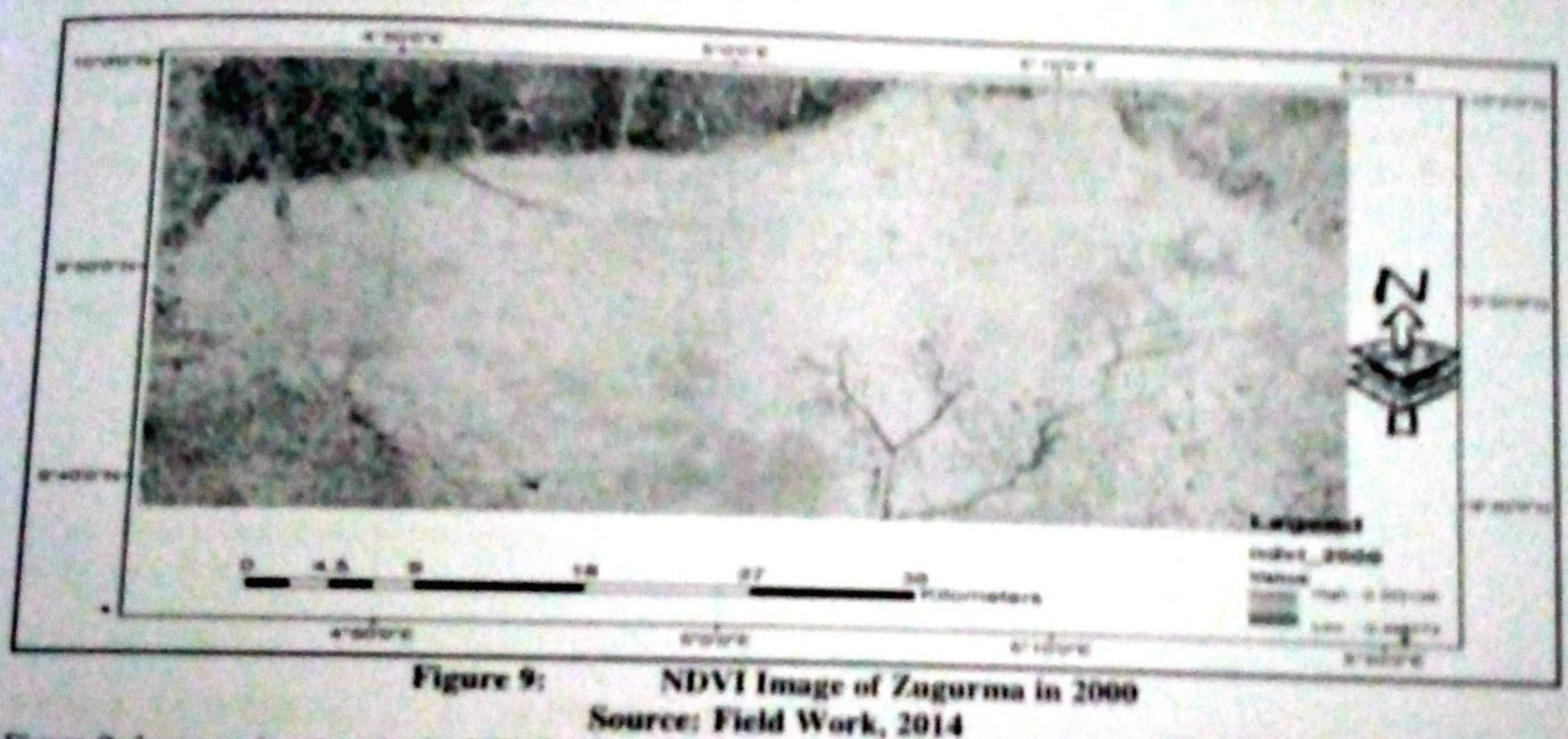

Figure 9: NDVI Image of Zugurma in 2000
Source: Field Work, 2014

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*:

$P_1Y_1 = P_2Y_2$

$P_1Y_1 = kP_2Y_2$

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

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

$k = 1.565$

To project for Forests:

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

$P = 86.088 - 53.21 = 32.878$

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**

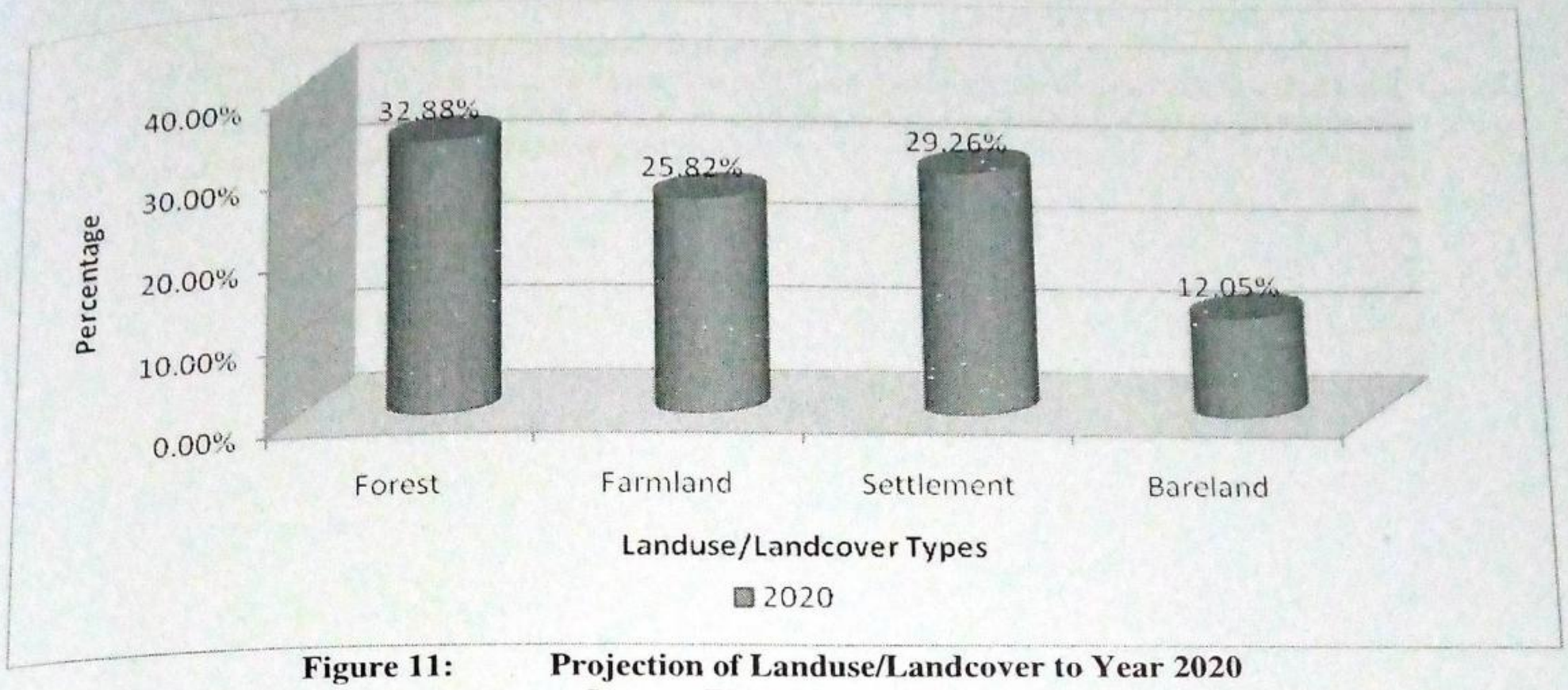

Figure 11: Projection of Landuse/Landcover to Year 2020
Source: Field Work, 2014

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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A REVIEW ON DISASTER RISK REDUCTION AND SUSTAINABLE DEVELOPMENT IN NIGERIA

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ABSTRACT

The occurrences of disaster often call for the support of both government and non government organization. Consequently, disaster relief remains extremely important in disaster management. However, this approach alone does not proactively address the need to adduce the human and environment impacts of future disasters. Recent thinking in the area of disaster management is indicative of the need for a new paradigm that focuses on reducing the risk of disasters with the involvement and participation of communities. This paper reviews the need for communities to place more emphasis on a holistic approach to disaster risk reduction. This approach involves risk assessment, risk reduction, early warning and disaster preparedness in order to effectively address the reduction of social, economic, and environmental costs of disasters nationally and at the global level.

Keywords: Disaster, Vulnerability, Risk Management, Early Warning, Relief

INTRODUCTION

A disaster describes a situation where the occurrence of abnormal or infrequent hazard events has impact on vulnerable communities, causing substantial damage, disruption and possible casualties and unable to function normally without external assistance. A disaster is therefore conceived as a severe disruption to the survival and livelihood systems of a society or

community, resulting from their vulnerability to the impact of one or a combination of hazards involving loss of lives and property on a scale which overwhelms the capacity of those affected to cope unaided (NEMA, 2014)

In contemporary academic, disasters are seen as the effect of hazards on vulnerable area. This is because hazards that occur in areas with low vulnerability do not result in a disaster, as in the case of uninhabited regions. Hazards are routinely divided into Natural or man made, although complex disasters where there is no single root cause are more common in developing countries. A special disaster may spawn a secondary disaster that increases the impact. A classic example is an earthquake that causes a tsunami, resulting in coastal flooding. A disaster is therefore, disruption of the functioning of a community causing widespread human, mental, economic or environmental losses which exceed the ability of the affected community to cope with using its own resources (Carby, 1993).

Disasters having an element of human intent, negligence, error or the ones involving the failure of a system are called man made disasters which could be technological (results of failure of technology, such as engineering failure, transport accidents, or environmental disasters) or sociological hazards (such as crime, stampede, riots and war) while natural disasters could occur as hydrological, climatic or geologic events (such as volcanic eruption' earthquake, flood, drought, hurricane, tornado, landslide epidemic, and famine (Adefolalu, 2001).

The paper is aimed to review Disaster Risk Reduction strategies with the view of providing holistic approach to achieving sustainable development in Nigeria.

Disaster Management

Disaster risk management is a system i.e. process of using administrative decisions, organization, operational skills and capacities to implement policies, strategies and coping capacities of the society and communities to lessen the impacts of natural hazards and related environmental and technological disasters. This comprises of all forms of activities, including

structural and non-structural measures to avoid (prevention) or to limit invitation and preparedness) adverse effects of hazards.

Disaster Risk Reduction (DRR)

According to UNDP (2004) DRR is a conceptual framework of elements considered with the possibilities to minimize vulnerabilities and disaster risks, to avoid or limit the adverse impacts of hazards, within the broad concept of sustainable development. The DRR framework consists of the following fields of action:

a) Risk awareness and assessment including: hazard analysis and vulnerabilities/ capacity analysis.

b) Knowledge development including education, training, research and information.

c) Public commitment and institutional framework, including organizational, policy, legislation and community action.

d) Application of measures including environmental management, landuse and urban planning, protection of critical facilities, application of science and technology, partnership, networking and financial instructments.

e) Early warning systems including forecasting, dissemination of warnings, preparedness measures and reaction capacities.

The Concept of Disaster Management

The concept of disaster management is the discipline of dealing with and avoiding risks. It is a discipline that involves preparing, supporting and rebuilding society when natural or man-made disaster management is the continuous process by which individual, groups and communities manage hazards in an effort to avoid or ameliorate the impact of disasters resulting from the hazards.

Phases of Emergency Management

According to Haddow and Jane (2004) Disaster Emergency Management has overlapping phases as follows.

Mitigation:

Mitigation efforts attempts to prevent hazards from developing into disasters or to reduce the effects of disasters when they occur. Mitigative measures can be structural or non-structural.

a) Structural measures use technological solutions like flood levees.
b) Non structural measures include legislation, landuse planning

Preparedness:

Here, managers develop plans of action for when the disaster strikes common preparedness measurers including the;-

- Communication plans with easily understandable terminology and chain of command.
- Development and practice of multi-agency coordination.
- Proper maintenance and training of emergency services.
- Development and exercise of warning methods combined with emergency shelters and evacuation plans.
- Stock- piling, inventory, and maintenance of supplies and equipment.

Response

The response phase includes the mobilization of the necessary emergency services and first responders in the disaster area. This is likely to include the first wave of core emergency services. Such as fire fighters, police, ambulance crews and non- governmental organizations.

Recovery

The aim of this phase is to restore the affected area to its previous state. Recovery efforts are concerned with issues and decisions that must be made after immediate needs are addressed. These efforts are primarily concerned with actions that involve rebuilding destroyed property, re-employment and the repair of other essential infrastructure.

Disaster Risk Reduction and Development Nexus

Without going into controversies in the meaning of development, it is referring to situation where economic growth is accompanied by improved living standards. Consequently, development may be seen as improving the society in terms of the provision of social services, acquisition of economic assets improved productivity and reducing vulnerability. However, sustainable development defined, may focus on conditions for economic growth while maintaining the stock of natural resources at or above their current level.

Table 1: Disaster-Development Relationship

Disasters limits or destroy relationship	- Destruction of physical assets and loss of production capacity - Damage to infrastructure - Death, disablement or migration of productive labour force
Development causes disaster risk	- Unsustainable development practices that create unsafe working conditions and degrade the environment
Development reduces disaster risk	- Access to safe drinking water and food and secure dwelling which increases people resilience - Fair trade & technology can reduce poverty and social security can reduce vulnerability. - Development can build communities and broaden the provision of opportunities for participation and involvement in decision making recognizing excluded group such as women enhancing education and health capacity.
Disasters create development opportunities	- Favorable environment for advocacy for DRR measures - Decision makers more willing to allocate resources in the wake of a disaster - -Rehabilitation and reconstruction activities create opportunities for integrating disaster risk measures

Source: A challenge for development UNDP, 2004.

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Developing the Capacities of Communities for Disaster Risk Reduction

In fact, it is when disaster strikes that the ingenuity and creativity in all of us come to the fore. This is a very true statement. Examples abound of local people acting as first responders when there is a major disaster, such as multi- vehicle, road accident, a plane crash, a boat mishap or fire disaster. In the case of a slow onset disaster, such as drought, we find people in rural areas putting into practice a whole array of coping mechanisms that they had built up over time.

But people and communities should not be made to wait for disasters to strike before they put their ingenuity and creativity to work. Rather, they should be empowered to use these attributes to reduce the occurrence or the impact of disasters. Every community has some form of capacity, no matter how small, to reduce the disaster risk to which they are exposed. For most communities in Nigeria, this capacity needs to be identified, developed and used for disaster reduction. But, what does this capacity consist of? It may be grouped into four categories (NEMA, 2014):-

1. Physical or material resources
2. Social organization resources
3. Knowledge and skills, and
4. Attitudes and motivation

1) Physical / material resources:- these include:-

- Able bodies' people who can do physical work
- Work tools (for building, earth works etc)
- Land
- Food storage facilities
- Stored food
- Domestic animals
- Public buildings that could serve as temporary shelters, etc.

2) Social organizational resources:-these include:-

- Traditional institutions (chieftaincy)
- Religious organizations
- Community development associations
- Cooperative group
- Social clubs

3) Knowledge and skills:-

Knowledge may be in such areas of the local environment (e.g. knowledge of local terrain, disaster threats, footpaths, etc), while skills may be in farming, wood work, black smithing, commerce, healthcare, transportation, swimming etc.

4) Attitudes and motivation:-

These determine people's outlook on life in general and on disasters in particular positive attitudes and appropriate motivation are required for disaster reduction and sustainable development.

These recourses need to be identified, mobilized, developed and applied to reduce the occurrence of disasters or minimize their impact. An excellent example of the role that communities could play in disaster mitigation is provided by flood control activities within the hadejia valley in jigawa and yobe states. In this flat- lying area, the blockage of river channels by sediment deposition and the growth of typha grass over the years, coupled with unusually heavy rainfall upstream result in widespread, damaging floods. The British department for international development (DFID) has been working with relevant stake holders to develop and implement sustainable solution to this problem including:

a) Structural measures, such as construction of embankments and flood diversion channels and the clearance of blocked river channels.

b) Non structural measures, such as raising people's awareness of the problem, what needs to be done, promoting flood preparedness and flood forecasting.

In fact, developing the capacity of Communities' for Disaster Reduction involves:-

- Public education
- Training
- Social mobilization
- Technical assistance, and
- Provision of materials

Climate Change as a Major Threat in the 21st Century

Over the last 200 years ,man in his quest for better living standard have resulted in increasing emission of green house gases (primarily $C0^2$) above natural levels from the burning of fossils fuels, forest fires and other forum of deforestation which have altered the composition of the atmosphere and caused an enhanced green house effect.

Projections made by IPCC (2007) are summarized as follows:-

a) Deserts are likely to become extremely hotter but not significantly wetter
b) Global hydrological cycle will be intensified with changes in precipitation. Its total amount, frequency and intensity.
c) Agricultural production (including forestry), will increase in dome areas and decrease in others taking into account the beneficial effect of C02 concentration

Implications for Nigeria

According to a climatological report by UNDP, 2004, natural disasters are estimated to claim nearly 250,000 lives and in the average cost between US$ 50 billion and US$100 billion (1 billion = 1000 million) in property damage. In 1991 alone, more than 90% of those killed were by meteorological hazards.

In Nigeria, studies since the year 2000 shows that while mean surface temperature has risen by about 0.5-0.8°C within the past 100 years (1901-2005), in general, the change in the Gulf of Guinea, from about 24-25°C in 1960 to 26°C in 2000 has been phenomenally high. Investigations in the mentioned studies has, the country is one of the most vulnerable nations with respect to climate variability.

a) Floods in both north and south are known to be worst occurring in 1999 with losses of life, property and agricultural produce in excess of ₦50 billion.

b) A 2.5% increase in sea surface temperature (SST) is the pull of storms from 20% in 1999 to about 26.5°C in 1998. This severe storms could generate into tornado type storms that will combine with an over run (SLR) to ravage the coastal areas of Nigeria.

c) Hot dry season with record breaking temperature that exceed 50% in the extreme north east in 2005 resulting to deaths.

d) Drought and desertification has been taken over states north of 12° parallel. Sand dunes advancing 5 km and farm states in the north east geopolitical zone is wiping out vegetation and settlements. A situation that could lead to severe migration for new lands to create congestion in southern states similar to what occurred at the wake of the drought of the 1972-73. In fact, Lake Chad has shrunken to "little Chad" having about 10% of its original size in 1960s.

It is now obvious that Nigeria will suffer from future unprecedented climate episodic events of which the following will take 'centre stages':

i) Devastating wind storms and flooding especially along poor drainage basins in many parts of the country at the peak of the monsoon rains

ii) Severe drought in all the 19 northern states.

iii) Pollution and related health effects in both humans and livestock.

iv) Loss of biodiversity, especially aquatic life, exotic plant species and medicinal plants and some soil enriching organic natural plants.

Strategies for Coping with Climate Change

While climate change is a global phenomenon, it has regionally variable characteristics and impacts, and therefore, regional strategies for overcoming or adapting to the future situation are required. Besides data collection, there are several other areas that need to be improved in Africa in order to better the continent's chances of adapting to climate change such include

- Forecasting techniques and early warning systems.
- Capacity building
- Data and information dissemination
- Natural Resources management

The above mentioned strategies as already highlighted by Benoit (1977) will help build the capacity of communities to generate, effectively communication decision without this information on the climatic risks and the adaptation measures appropriate for such risks, no sound decisions can be made to sustainable harness available resources for development.

CONCLUSION

It is clear from the paper that financial resources available for disaster management are increasingly becoming limited in the face of competing demands from the other sections of the economy. We therefore have no choice but join the international community in promoting disaster reduction and mitigation activities; moreover, disaster management is a shared responsibility.

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