

# ANALYSIS OF LAND USE/LAND COVER CHANGES IN JIBIA LOCAL GOVERNMENT AREA KATSINA STATE NIGERIA.

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## **ABSTRACT**

*Conversion of agricultural and settlement land to an impounded reservoir by constructing a 3.6km dam on Gada river in 1980s and the laying of a 192km irrigation canal network in a 3.5km<sup>2</sup> restricted land for irrigation and farming and population influx has resulted to an unprecedented accelerated land use/land cover changes in Jibia Local Government. This paper analyze these changes and their impacts at a four year epochs in using TM and ETM+ Landsat satellite imageries of the years 1986, 1990, 2000 and 2010 respectively. Erdas imagine version 9.1 software was used for image processing and classification and ArcGIS version 9.3 software was used for map making and analysis. The result shows an increase in the surface water bodies from 2.635 km<sup>2</sup> in 1986 to 33km<sup>2</sup> in 2010. The settlement areas increase from 6.00 km<sup>2</sup> in 1986 to 10.123km<sup>2</sup> in 2010 and the agricultural land decrease from 728 km<sup>2</sup> 1986 to 622km<sup>2</sup> respectively. The constructed irrigation structures covering 3.5 km<sup>2</sup> imposed restriction on residential land expansion and development of especially in the most populated areas of Jibiya Magama and Faru and other villages around the dam.*

***Keywords:*** *Jibiya, Dam, Land use, land cover , Remote sensing and GIS*

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## **Introduction**

Changes resulting from anthropogenic forces as a result of human modification of the environment as well as natural forces are usually viewed as land use and Land cover changes. According to Pilon et al (1988), change detection is the process of identifying the difference in the state of an object or phenomenon by remotely observing it at different times. Land use/land cover changes are often use simultaneously to provide information often graphically, about the types and impacts of facilities found on the earth surface and human activities that are associated with them. The construction of Jibia dam in 1980s on a Gada river to impound water for irrigation, domestic use and recreational purpose is one of such anthropogenic alteration of an environment. It has influences the land use/land cover changes especially in the areas around the dam. The impounded reservoir replaces the location of some settlements particularly the old Makiyawa, Zandam and Kada Villages, and also part of productive agricultural land and forestland. This brought birth to migration of people from villages occupied by the impound reservoir to nearby Jibia, Magama and Faru towns and consequently causes the rapid expansion of those towns toward productive agriculture. However, the imposed restriction of about 3.5km<sup>2</sup> of agricultural land that surrounded the affected communities also limits the spatial expansion of these settlements. Thus the displaced persons constituted a very high population density and congestion in their new settlement areas.

The classification of land cover from satellite data has provided means of accessing a large geographic area with limited time and resources. This study aimed at Mapping and analyses of land use/land cover changes within the period of 24 years (i.e1998-2010), using high resolution

Satellite remote sensing approach. This is to help provide a platform for decision makers and town planners for effective monitoring and planning of the environment. The approach entails the analysis of two registered satellite multispectral bands from the same geographical area obtained at two or more different times such an analysis aim at identifying changes that have occurred at the same geographical area between the two or more terms considered (Bruzzone 1997). The satellite imagery of the study area would be processed manipulate and analyze using digital technologies in a popular digital image processing software Erdas imagine version 9.1 and Geographic information system (GIS) software, ArcGIS version 9.3.

### **Aims and Objectives of the Study.**

The aim of the study is to produce maps of and analyzed the land use and land cover (LULC) changes and its socio-economic effects in some settlement and to provide effective platform for decision makers and town planners for monitoring and planning of land use in the study area.

The specific objectives are as follows

1. To map and classified the different Land use/Land Cover at the Period of 1986, 1990, 2000 and 2010
2. To compute the extents of different Land Covers
3. To create chart that will displace the result graphically.

### **Limitation of the study**

This study is limited to the land use/land cover changes and its Socio-economic impacts on the Jibia, Magama and Faru towns of Jibia Local Government area of Katsina State.

### **Statement of the Problem**

Construction of Jibia dam forces the people of Makiyawa, Zandam and Kaga to relocate and settle in the nearby Jibia, Magama and Faru towns. The spatial extent of these towns were themselves also bounded by Gada River and the restricted irrigation farm land (3.5km<sup>2</sup>) and the constructed irrigation canals.

The booming commercial activities in Jibia and Magama towns is also another factor responsible for influx of people to these areas. Lamentably the irrigation canals were left idle for years, the high demand for residential development and limited supply due imposed restrictions has significantly results in a high the Price of Land especially in Jibia town.

As there was little or no study carried in respect of this paper is an attempt to highlights the associated problems as an avenue for decision makers and town planners for effective monitoring and future planning

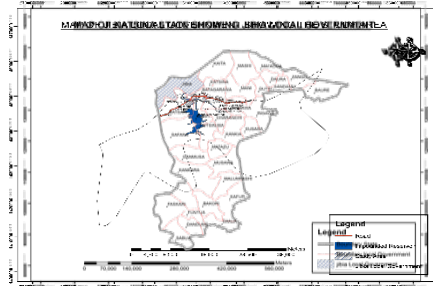
### **The Study Area**

Jibia local government was created 1985 the federal Government of Nigeria. Jibia town is it's headquarter. The local Government Area lies between the latitude of 13<sup>0</sup>57'08", 13<sup>0</sup>71'27" and longitude of 7<sup>0</sup>15'48" and 7<sup>0</sup>18'15" respectively. It share land borders with Niger Republic from the north, Katsina and Kaita local government from the east, Batagarawa and Batsari from the south and Zamfara State from the west. The local government area is largely crossed by rivers  
The topography of the area can be characterized as relatively undulated with high elevation in Southern and Eastern Parts. The Climate of Jibia is of tropical continental type with wet and dry seasons naught for seasons, roughly following the movement of tropical discontinuity. The rainfly seasons last for about four month starting from May to late September. The projected

population of people in the study areas is about 245,000. The dominant s are Hausa and Fulani Other tribes includes Zabarmawa, Berbers and Kanuri.

The mean annual rainfall 690mm and maximum rainfall has in many instances been experienced in August. The dry season on the other hand last from April to many and the maximum temperature ranges between 75<sup>o</sup>C to 85<sup>o</sup>C. While dried wind harmattan season start from September to April and the effect of its felt most when a dust laden dry air across the Sahara blows over the area. The construction of Jibia dam and Makiyawa water treatment plant and lying of irrigation canal across 3.5 km<sup>2</sup> farm land also contribute to the constant water supply in Jibiya town and nearby Villages.

**1.00 Map of the Study Area**



a) Map of Nigeria showing Katsina State

b) Map of Katsina State Showing Jibiya LGA c) Map Jibiya LGA Showing the study area

**Fig.1 Maps of the Study Area.**

**Materials and Method**

The Lands at imageries of the study area used in this study are those of years 1986, 1990, 2000 and 2010 respectively downloaded from the United States Geological Survey (USGS) portal. A Combination of the TM and ETM+ images were made to cover the period under study

The software use includes the following Erdas imagine version 9.1 for image processing (band combination, subsetting radiometric and geometric correction and classification of the image) ArcGIS version 9.3 (for the creation of the land use/land cover Maps and GIS analysis) and WinRAR version 4.5 was used for unzipping the images. The images were the transformed to a uniform UTM coordinate system.

Ground control points were established and were used to georeferenced the image for the purpose of reducing geometric distortion during overlaying of the different images layers.

The images of the selected different period were classified using Erdas imagine software. A supervise classification method was adopted. The identified major image classes were settlement, farmland, water body, forest and barren land/shrubs. The location of these classes were delineated and they there were represented using appropriate cartographic symbols and colors. The respective extend area of each land use or land cover were determined and recorded. Other

attributes of the land features were recorded and an attribute table was prepared to enable query to be made in decision support system

### Result and Analysis

The Figures below (Fig 2, Fig.3, Fig 4 and Fig.5) depicted the land use/ land cover changes of the Study Area as at the year 1986, 1990, 2000 and 2010 respectively.

Table 1.1 shows the Results of the land cover Calculation and Fig1.1, Fig 1.2, Fig 1.3, Fig 1.4 and Fig 1.5 shows the changes (increase and decrease) of the various land use/ land cover of the Study Area.

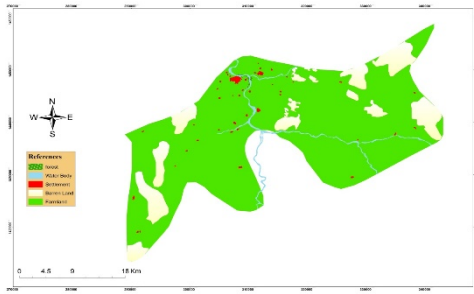


Fig.2 1986 Land use Map of Jibia LG

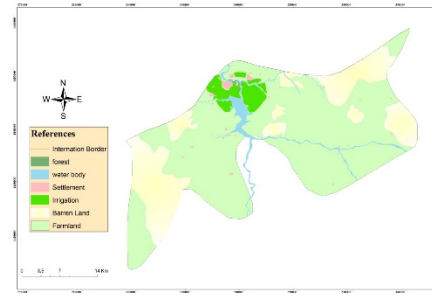


Fig.3 1990 Land use Map of Jibia LG

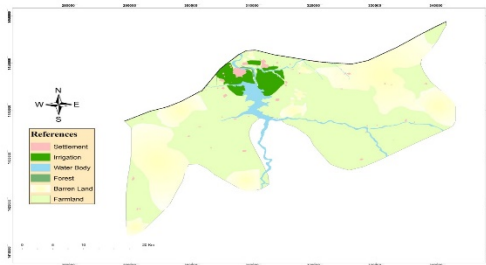


Fig.4 2000 Land use Map of Jibia LG

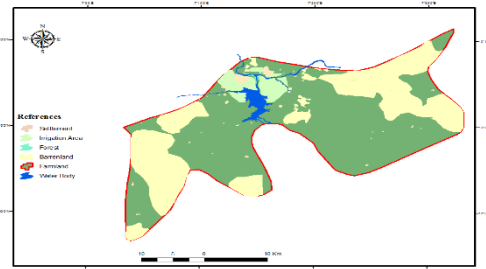


Fig.5 2010 Land use Map of Jibia LG

TABLE 1.1 Summary of Land use/land cover Area Computation

Land uses	LU/LC 1986(Km <sup>2</sup> )	LU/LC 1990(Km <sup>2</sup> )	LU/LC 2000 (Km <sup>2</sup> )	LU/LC 2010 (Km <sup>2</sup> )
Barren land	154.732	266.403	351.93	340
Forest	1.05	1.125	2.206	2.105
Farmland	897.771	756.391	661.779	675.489
Irrigation Farm	0	3.5	3.5	3.5
Settlement	6.213	7.112	9.023	10.126
Water Body	8.849	33.145	39.679	35.678

Fig. 1.1 Area covered by Barren Land/Shrubs (1986-2010) Fig. 1.2 Area covered by Forest (1986-2010)

Fig. 1.3 Area covered by Farmland (1986-2010)

Fig. 1.4 Area covered by Irrigation Farmland (1986-2010)

Fig 1.5 Area covered by Settlements (1986-2010)

Fig 1.6 Area covered by Water body (1986-2010)

### **Analysis of the Result**

The general outcome indicated that, the construction of Jibia Dam within the 1987-1990 period has influence the land use/ Land cover changes in the area significantly. There is a noticeable loss of the productive agricultural farmland especially the Fadama land that was earlier on were being used for rain fed farming and irrigation farming during wet and dry seasons respectively. The Dam, its Inlets, out lets and Facilities of water distribution System set a constant limit to the expansion of the Main towns of the study Areas around the Dam. Similarly it was found that, the impounded reservoir expand from 1990-2000 and shrink from 2000 to 2010 due to the lack of evacuation of sediments

Forest was found to have increased from 1986 to 2000 due to afforestation exercise that took place at Magama, Kagadama, Kayauki, Kukar Babangida and Nasarawa Villages. This however plumb down from 2000 to 2010. The settlements also increase by about 4km<sup>2</sup> only against Agricultural land. Finally barren land /shrubs has reduces from 2000 to 2010 due to the conversion of areas occupied by shrubs to farmland.

The details of the results are summarized below;

- i. The result, shows that, the Agricultural Land has decrease from 877.771 km<sup>2</sup> to 661.779 km<sup>2</sup> from 1986 to 2000. Agricultural land value thence increases from 661.779 km<sup>2</sup> to 675.489 km<sup>2</sup> in 2010. Thus this shows that there was a conversion of some barren land/Shrubs and forest to for agricultural usage
- ii. The Value of computing forest area shows that forest have increase from 1986 – 2010. This was likely due to the State Government's afforestation drive during the period. However from year 2000 -2010 forestland reduces significantly to 2.105 km<sup>2</sup> from 2.206 km<sup>2</sup>
- iii. The water body also result has shown that it has increased significantly with the period. The increase was from the year 1986 This is attributable to the construction of Jibia Dam which Impound water.
- iv. Due to the erosion of the sides of the reservoir especially after 2000 and the lack of evacuation of the sediment paves, the way for the sediment transport which consequently lead to continuing of the Jibiya dam reservoir shrinkage hence decrease in water surface area.. This results in the decline value of the water surfaces from 39.679 km<sup>2</sup> to 35.678km<sup>2</sup> in 2010. The decline in the rainfall and climate change phenomena which aggravates desertification impacts are also viewed as factor for this decline.
- v. Settlements in Jibia town expand from 6.213 km<sup>2</sup> to 10.126 km<sup>2</sup> in the period of ten years. This expansion is not significant because the increase of the Settlement was limited by both natural bounds of the rivers and the artificial bounds of the constructed irrigation canals.
- vi. Irrigation area was absent in 1986, but in 1990 it appear to have occupy 3.5km<sup>2</sup> and remain constant up to now due to the Rules and Regulations that Prevent other development within the restricted irrigation bounds.
- vii. The Rain fed agricultural farmlands have suffer a great loss to surface water body area

significantly and few to the residential settlement areas.

These changes has impacted on both the economic and social life of the affected communities. The loss of arable land for an agrarian communities whose livelihood depends on subsistence farming has a negative impact on their income and wellbeing. Similarly derivation of ancestral home for cultural sensitive communities could best be imagined. The limited supply of land for residential development and it cost implications has a profound negative impact on the displaced persons in the new settlements.

## **Conclusion**

This paper has analyzed the land use and land cover changes of Jibiya Local Government Area within a period of thirty year using 1986 as baseline year. The study compares the pre and post Jibiya dam construction epochs and attempts analysis of the different land changes induced by the dam within the period of the study and its socio-economic implications.

The remote sensing data and software utilized in this Study affirmed their respective complementary roles that if coupled together they could provide an effective podium for Land use changes planning and Monitoring.

## **3.00 Recommendations**

It is recommendation of this that the following be considered by Government in its planning and monitoring of the study area due to its untapped economic potentials and socio-economic impacts on the people of the area.

1. The erosion of the sides of the Jibiya Dam's reservoir is a major concern on its safety and the downstream lives and properties. It is therefore recommended that control and prevention measures be emplaced by the Government.
2. The sedimentation and lack of evacuation of the sediment within the dam are playing negative roles to the reservoir capacity and also posed a dangerous tendency of flooding at times of excess rainfalls. Therefore there is a need for regular evacuation of the dam's reservoir to prevent the possible occurrences of Flooding The State and Local Government should provide social Amenities to the Villages around Jibiya town in order to reduces rural-urban Migration
3. New land areas need to be open up for residential development. This is to minimize congestion due the influx of the Jibiya dam's displaced persons and to help deflate the land price in the area. This may entails decommissioning of some areas restricted for irrigation only.
4. Efforts towards afforestation need to be encouraged and enhanced by providing incentives and creating further public awareness of it significance.

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