Trends in Population Growth and Its Effects on Sustainable Land Uses in Obudu, Nigeria

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Abstract: **Population growth is an inevitable process that always initiates the continual transformation and or conversion of land from one use to the other. Land use change is presently being experienced in and around fast growing towns like Obudu in Cross River State. This study used remote sensing and Geographic Information Systems techniques to identify and analyze the extent of the changes in various land uses from the land use map of Obudu and satellite imageries of 1986, 2000 and 2013. The study revealed that there have been rapid increase in the population of Obudu and this development has consistently placed constant pressure on the different land uses, thus causing tremendous transformation in the various land uses in the area. The built up areas expanded more than other land uses covering 5.0, 7.6 and 13.4 percent for1986, 2000 and 2013 respectively. This spatial change in the land uses is affecting the changing functionality of Obudu as a tourist destination in Cross River State and the country at large. There is therefore a need for an update and urgent review of the Obudu Master plan and the enforcement of development control laws in order to avert the negative environmental implications of rapid population growth and changes in the land use patterns.**

Keywords: **Population growth, land use, satellite imagery, development control, Obudu, Remote Sensing.**

I. INTRODUCTION

Human population growth and its impact on the carrying capacity of the environment have long been acknowledged as one of the most pressing and fundamental issue in recent time. Rapid population growth is also a major driving force altering local and regional environment (Ifatimehim, Musa and Adeyemi, 2009). In view of this, most of the environmentalists are of the position that human pressure on the environment (housing, agriculture, road construction activities) is a product of three factors: population, consumption and technology (Akpofure, 2009, Harrison and Pearce 2001). This is because; the state of the environment at any point in time is largely affected by human activities which revolve around production and consumption of goods and services.

Cunningham and Saigo (2005) have noted that rapidly increasing human populations and expanding agricultural activities have brought about extensive land use changes throughout the world. Therefore information on land uses and possibilities for their optimal use is essential for selection, planning and implementation of land use schemes to meet the ever rising demand for basic human needs and welfare. This information will also assist in monitoring the population and land use dynamics within the study area.

The scale of human activities on the environment which is geared towards obtaining food, shelter and other essentials of life over time and in the present century is unprecedented (Oko, 2015). This has produced phenomenal changes in ecosystem and environmental processes at local, regional and global scales. Analyzing, monitoring and mediating the negative consequences of population growth and land use changes while sustaining the production of essential resources has therefore become a major priority of environmentalists, researchers in general and policy makers around the world.

According to Ayoade in Efiong (2011), substantial changes in vegetation and rural land use changes by deforestation which is a product of rapid population growth have not been given attention as an important environmental change in the same way as urbanization. This is a dangerous oversight particularly in Obudu which is the hub of tourism destination of Cross River State. Most of the original vegetation in the area has been replaced as a result of agriculture, road construction, tree logging and exploitation, residential and institutional development etc. These have resulted in changes in land uses in the area.

This study therefore seeks to:

i. Examine the population growth trend of Obudu from 1986 to 2013
ii. Identify the various land uses and
iii. Examine the effects of population growth on land uses

Study Area

Obudu, the study area is found in the Northern Senatorial District of Cross River State, Nigeria. It is located on latitude 6^0 22 – 6^0 43 North of the equator and longitude 8^0 53 – 9^0 14 East of the Greenwich Meridian and covers a total land area of about 1200km^2 (figure 1). The population is currently estimated to be about 200,000 based on 2016 census at a growth rate of 3.0%. The economy of the area is mainly agrarian. Farming is the predominant economic activity of the residents with over 75% of the people involved in various facets of agriculture at subsistence level. The people practice shifting cultivation with reduced fallow period over time due to rapid population increase.

Obudu falls within the tropical humid climate with wet and dry season, and with mean annual temperature of between 15^0c and 16^0c and rainfall of 1300mm – 2000mm. It is surrounded and cross-crossed by rolling hills and mountains which help to make the climate mild throughout the year. Obudu is underlain mainly by basement complex rocks which mark the western and of the foothills of Cameroon Mountains.

The presence of the Federal College of Education and other tertiary institutions in the area coupled with its host to the popular Obudu Cattle Ranch and Resort and other establishments such as the dam, banks, agro-allied industries etc are rapidly initiating and transforming the land use types in the area.

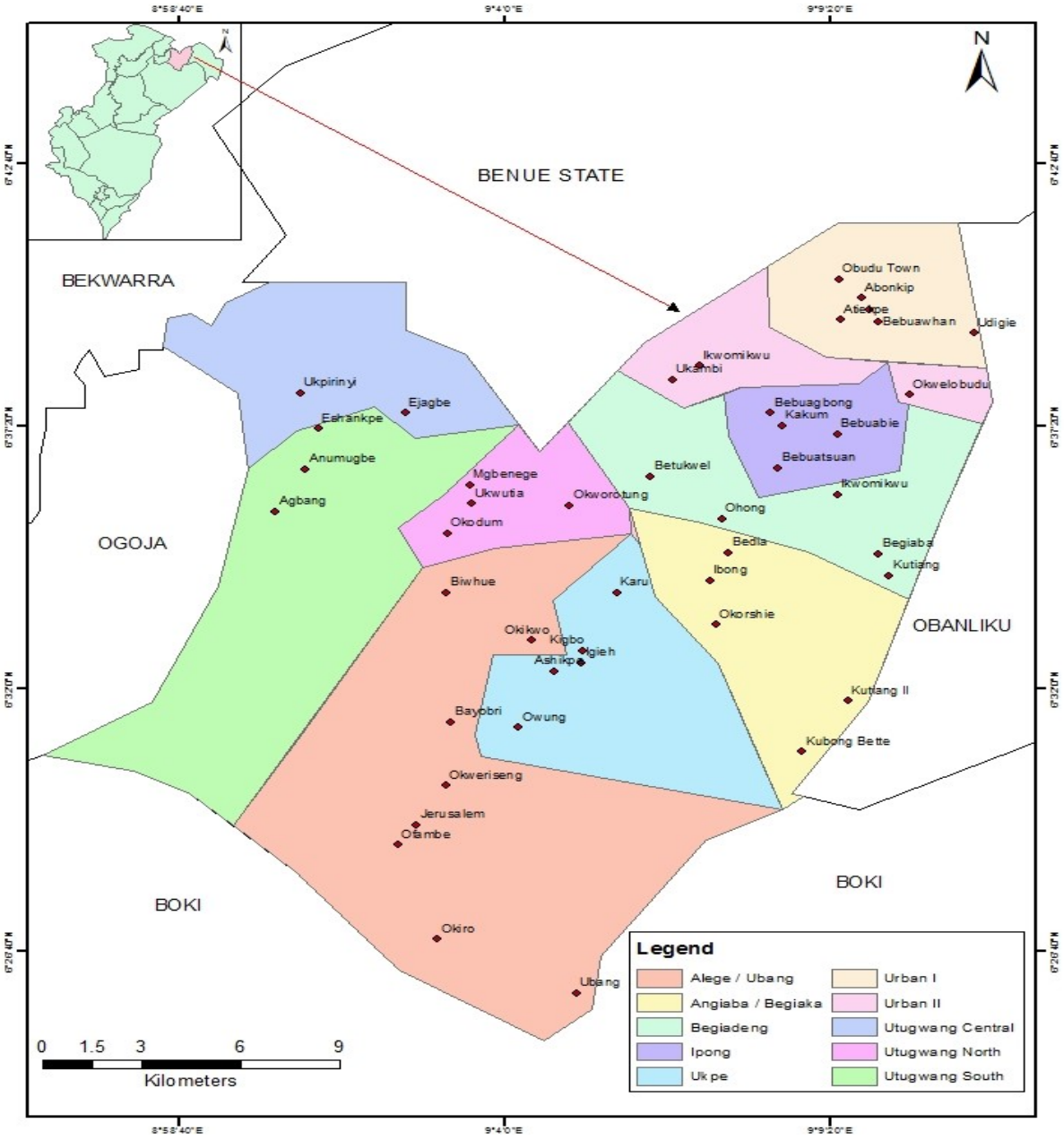

Figure 1: Map of Obudu Local Government Area

II. MATERIALS AND METHODS

The study utilizes diverse forms of remotely sensed data ranging from Landsat TM of 1986 and ETM+ of 2000 and 2013 which were acquired and analysed. The three images were of the months of December and January during which cloud free images were captured and were obtained from the United States Geological Survey (USGS). Each of the images had a spatial resolution of approximately 28.5km^2. These three images covering (a 28 year time span) were chosen based on data availability and the need to capture meaningful changes within the period of consideration. An existing land use map of Obudu prepared in 1982 was acquired from the Cross River Basin Development Authority (CRBDA) and was used as ancillary data for training sets and accuracy assessment of the 1986 classified image. More so, large scale aerial photographs of 2000 were acquired from Cross River State Ministry of Land and Survey and used in the accuracy assessment of the classified 2000 image while randomly selected GPS points were collected and utilized for the accuracy assessment of 2013 land use data.

The population census data of Obudu was also obtained from National Population Commission (NPC, 2007). The trend of the population growth is presented in figure 2. Statistical analysis was employed to define the spatial and temporal variation and changes in the various land uses over the period of the study.

The population of Obudu within the base year of the study was 72,820, however, ten years down the line, it jumped to 100,738. It can also be observed that in 2000, the total number of people in Obudu was 124,938 while in 2005, it rose to 154, 951. It is further revealed that by 2010, Obudu had a population of 180,314 which increased to 195,888 in 2013. Generally the trend of the population of Obudu has been on steady increase, though not following a regular pattern.

Table I Trends in Population Growth of Obudu Local Government Area from 1986 to 2013

S/N	Year	Population figures
1	1986	**72,820**
2	1987	**75,077**
3	1988	**77,404**
4	1989	**79,804**
5	1990	**82,278**
6	1991	**84,799**
7	1992	**88,530**
8	1993	**92,425**
9	1994	**96,492**
10	1995	**100,738**
11	1996	**105,170**
12	1997	**109,797**
13	1998	**114,628**
14	1999	**119,672**
15	2000	**124,938**
16	2001	**130,435**
17	2002	**136,174**
18	2003	**142,166**
19	2004	**148,421**
20	2005	**154,951**
21	2006	**161,457**
22	2007	**165,978**
23	2008	**170,625**
24	2009	**175,403**
25	2010	**180,314**
26	2011	**185,363**
27	2012	**190,553**
28	**2013**	**195,888**

Source: *National Population Commission, 2006*

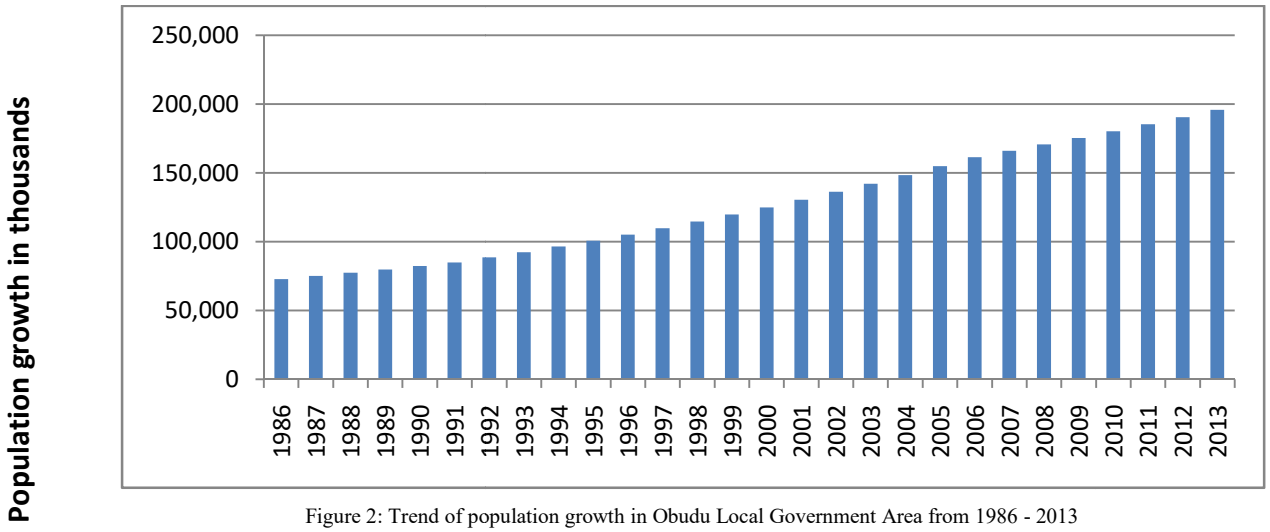

Figure 2: Trend of population growth in Obudu Local Government Area from 1986 - 2013

Land use types in Obudu

The total areal coverage of Obudu measured 47993.38km^2. In this study, eight categories of land use types were identified (table 2)

Table 2 Land use types in Obudu

SN	Class_Name	Area 1986	Area 2000	Area 2013
1	Mature Forest	7834.27	6270.95	3602.28
2	Bush Fallow with Trees	7519.95	7884.59	8223.77
3	Bush Fallow	4805.73	5150.09	4776.32
4	Secondary Forest	6124.77	6077.39	5210.82
5	Fresh Water Swamp Grassland	5185.17	6083.51	7023.51
6	Mountain Grassland	6610.14	6085.73	5597.02
7	Farmland	7466.31	6747.86	6636.19
8	Built-up/Bareland	2447.04	3693.26	6423.46
	Total	**47993.38km^2**	**47993.38km^2**	**47493.38km2**

Source: Author's field work, 2014

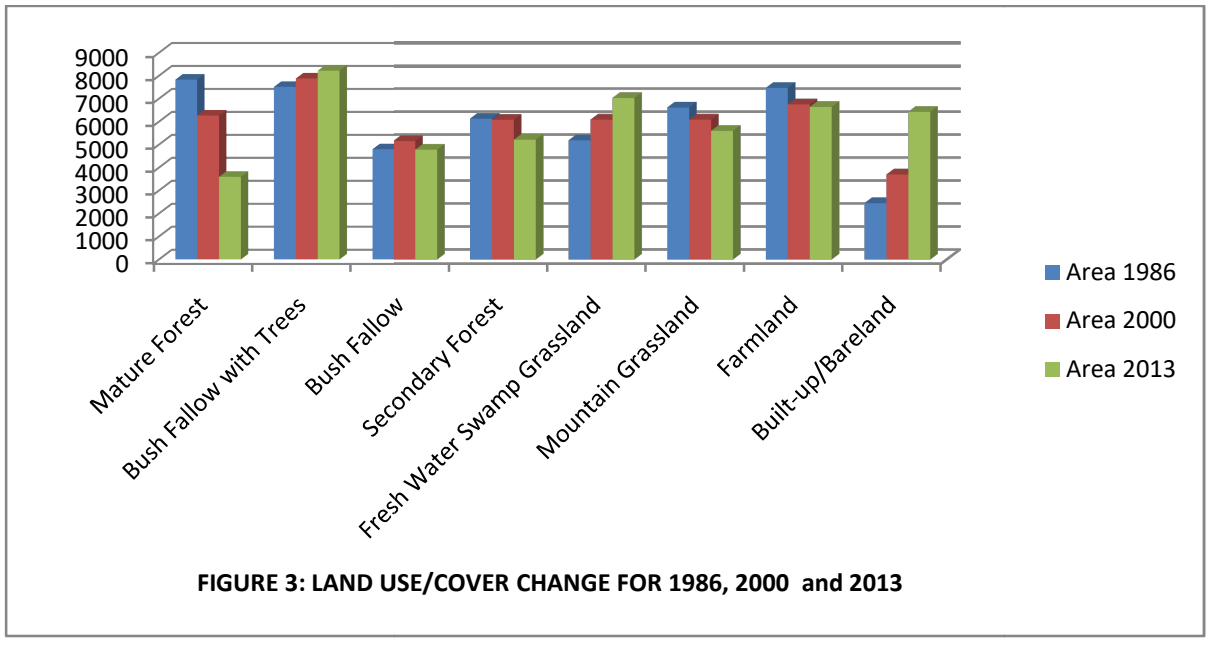

FIGURE 3: LAND USE/COVER CHANGE FOR 1986, 2000 and 2013

III. RESULTS ANALYSIS AND DISCUSSION

The rapid land use changes in Obudu is largely due to the current status of the area as a town housing several tertiary institutions, (private and public), its proximity and services as a buffer zone to the international Obudu Cattle Ranch and resort, establishment such as banks and agro-allied that are increasing by the days.

In the last few years, the town and its surroundings has undergone radical changes in its land use types and in consumption and utilization of resources. Both the private individuals and government had gone into development of properties particularly residential, commercial and academic structure.

Effects of population growth on land uses

The impact of population growth on land use pattern in Obudu is presented in Table 3 and figures 4a, b and c. From table 1, it can be observed that the population of the area showed a steady increase between 1986 and 2013 which had varying effects on the total land area and the various land uses. For instance in 1986, matured forest covered 16.3% of the total land area while in 2000 it decreased to 13.0% and by 2013, mature forest was only 7.5%. This revealed that the increase in population led to a reduction in the total land cover of the area. The vegetation reduction during the period under review is a sign of environmental degradation which may result in soil fertility reduction, increased surface run off and exposure of impervious rock layers to the climatic and atmospheric forces within the study area. More so, Table 3 further indicates that bush fallow also experienced a similar trend on the total area lost due to anthropogenic factors. From the Table, the total percent cover for bush fallow land was 15.6 per cent, 16.4 per cent and 17.1 per cent for 1986, 2000 and 2013 respectively. This confirms the facts that most of the forest areas were converted to bush fallows after cultivation which is a common practice in Sub-Saharan Africa.

Bisong, (2001), and FAO, (2004) noted that with increase in population most of the forest areas in the sub Saharan regions of Africa have been converted to bush fallows after cultivation to meet the food needs of the populace. It can also be seen in Table 3 that built up areas increased steadily corresponding to increased population of the area. In 1986, total built up areas was 5.0 per cent, this figure increased to 7.6 per cent by 2000 while by 2013 it almost doubled to 13.8 per cent. The increase in the spatial coverage of settlements may be due to population influx in search for better livelihood. More so, the status of Obudu as a tertiary institution town, the establishment of the Obudu dam, the introduction of five commercial banks and the presence of Goddy Logo farms - an agro-allied industry in Obanliku Local Government Area among others are due largely to the increase in demand for housing development and other infrastructures to accommodate the population surge in the study area.

Within the 28 years period (1986 - 2013) in the study area the built up areas increased progressively consequent upon the various projects located in Obudu. This led to the physical expansion as evident in the increased land consumption rate of built up areas from 5.0 per cent in 1986 to 13.8 per cent in 2013, as many immigrants had moved into Obudu. The forests also reduced in spatial extent as a result of increased deforestation due to land degradation and encroachment of people for building purposes.

Table 3: Effects of population growth on land use.

SN	Land use category	Population for 1986	Area 1986 (Sqkm)	% of area 1986	Population for 2000	Area 2000 (Sqkm)	% of area 2000	Population for 2013	Area 2013 (Sqkm)	% of area 2013
1	Mature Forest		7834.27	16.3		6270.95	13.0		3602.28	7.5
2	Bush Fallow with Trees		7519.95	15.6		7884.59	16.4		8223.77	17.1
3	Bush Fallow		4805.73	10.0		5150.09	10.7		4776.32	9.9
4	Secondary Forest		6124.77	12.7		6077.39	12.6		5210.82	10.8
5	Fresh Water Swamp Grassland	72,820/18.4	5185.17	10.8	124,938/31.7	6083.51	12.6	195,888/49.8	7023.51	14.6
6	Mountain Grassland		6610.14	13.7		6085.73	12.6		5597.02	11.6
7	Farmland		7466.31	15.5		6747.86	14.0		6636.19	13.8
8	Built-up/Bareland		2447.04	5.0		3693.26	7.6		6423.46	13.4
			47993.38	**100**		**47993.38**	**100**		**47493.38**	**100**

Source: Analysis by Author, 2014.

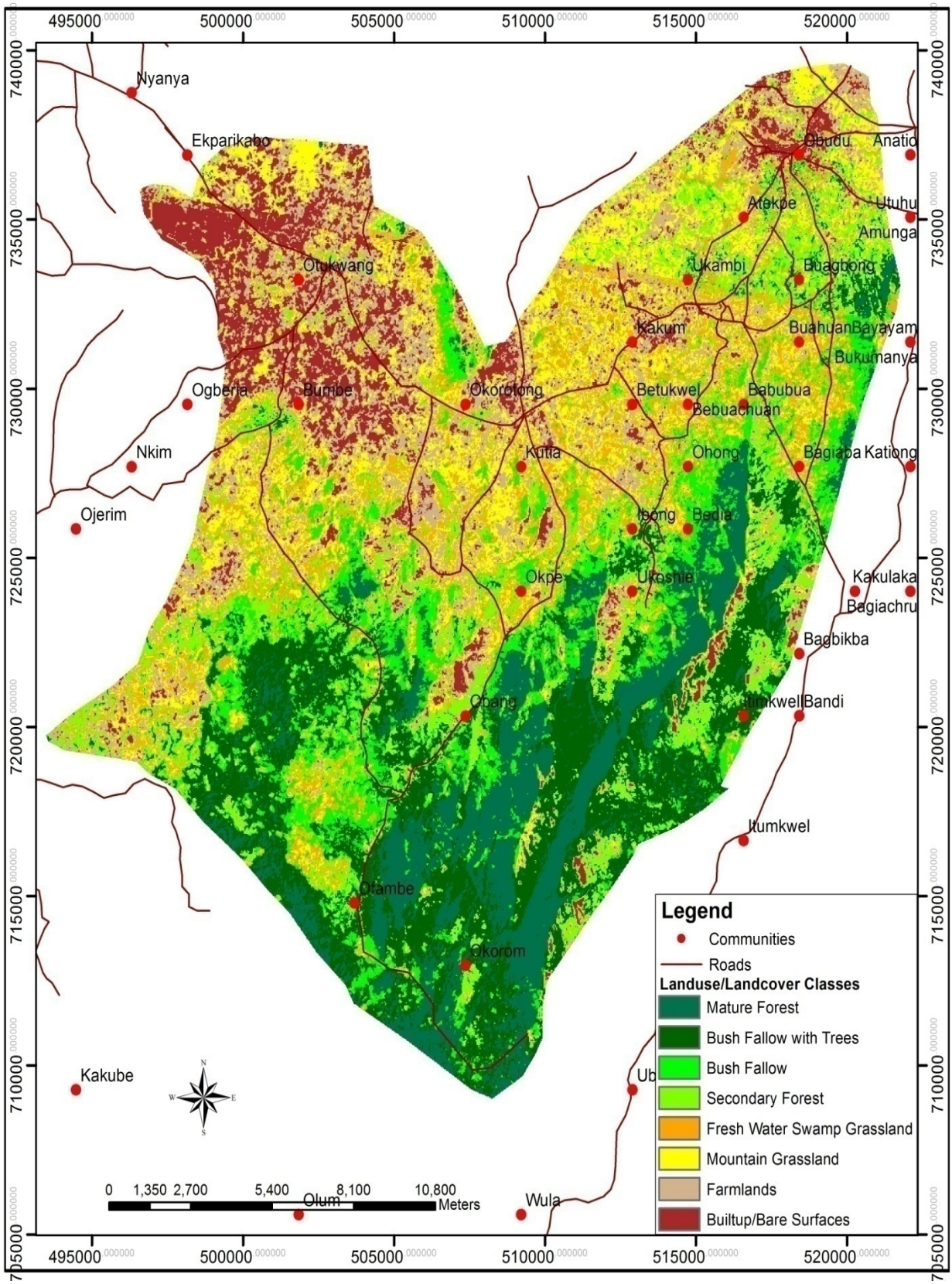

Figure 4a: Obudu Local Government Area Showing Land Use change in 1986

Source: Author's fieldwork, 2014

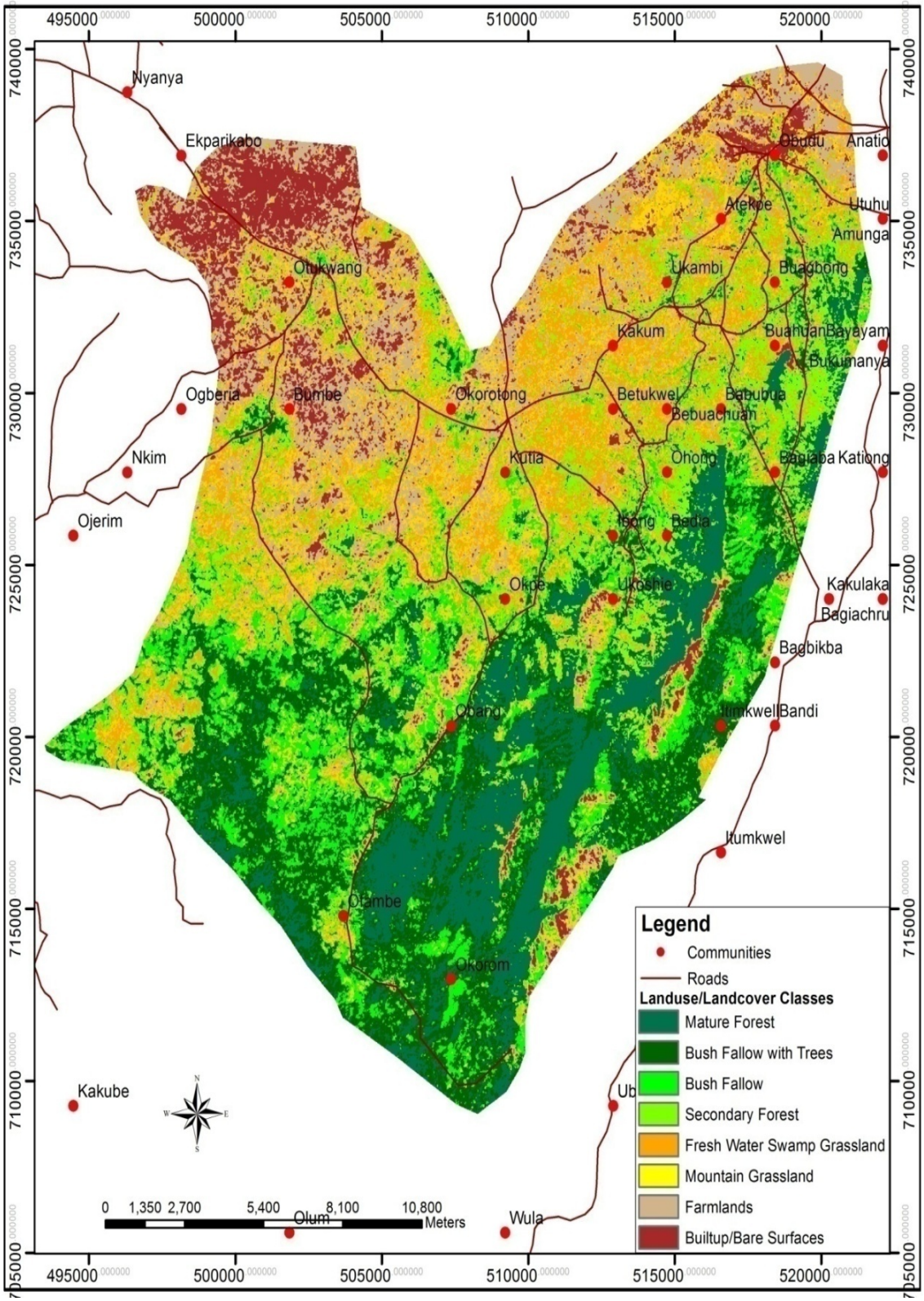

Figure 4b: Obudu Local Government showing Land use change in 2000

Source: Author's fieldwork, 2014

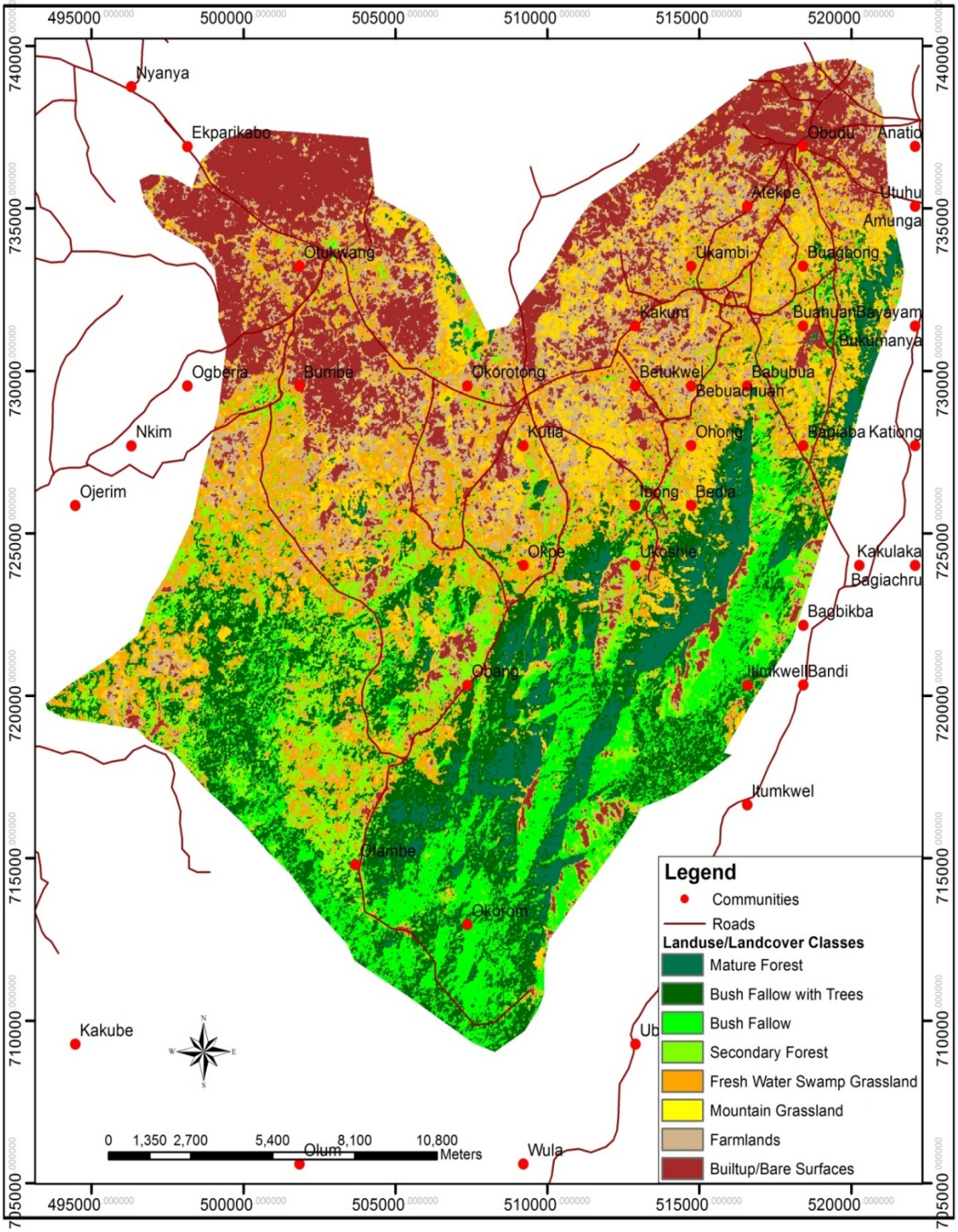

Figure 4c: Obudu Local Government showing Land use change in 2013

Source: Author's fieldwork, 2014

IV. CONCLUSION

The study has revealed that the population of Obudu is growing at a fast rate and this has placed constant pressure on the different land uses which has detrimental effect on the area. Furthermore the study has revealed that there is a tremendous transformation in the various land uses in the area. The built up areas has shown the highest rate of expansion while the mature forests suffered the greatest loss. This trend is affecting the changing functionality of Obudu and her importance in the state's economic status and the country at large.

Finally, a review of the Obudu Master Plan and enforcement of Development Control laws is hereby recommended to avert the negative environmental implications of rapid population growth and changes in land use pattern.

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