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IMPACT OF URBANIZATION ON VEGETATION COVER IN GOMBE METROPOLIS AND ENVIRONS

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ABSTRACT: *Demographic characteristics and economic development are the major determinants of urban shape and pattern of urbanization in Gombe which gave rise to rapid population growth. These determinants resulted to unplanned urban growth, unprecedented urbanization and land use change as a result contributing in the rapid reduction of vegetation cover and loss of arable land in the surrounding urban environment. The aim of this paper is on the impact of urbanization on vegetation cover. Both primary and secondary data was employed in this work. Socio-economic data and information on the status of tree species were gathered through questionnaire survey that involved 195 respondents using purposive sampling techniques in the study area. While the land use land cover analysis was carried out using ArcGis 10.5 and Edras Imagine 9.0. The finding was made to capture as accurate as possible six land use land cover classes as they changed through time. The result of the work shows a rapid decrease on the vegetation and a gradual increase in settlements between 1976 and 2016 due to the fact that Gombe metropolis became the capital of Gombe state in 1996. Also only few tree species were found within the study area, as most trees are cut down for various developmental purposes. The study recommends that urgent attention on conservation of vegetal resources within the metropolis should be encouraged.*

KEYWORDS: Environment, Urbanization, Vegetation, Population, Expansion

INTRODUCTION

Changes in the ecology of urban environment occasioned by increasing population, overcrowded habitations and uncontrolled exploitation of natural resources may have accounted for this wide ecological footprint of urban areas which is not peculiar to developing countries (Stoel, 1999 and Hales, 2000). Hales,(2000), observed that the pace and scale of growth have outstripped the capacity to maintain acceptable standards of public health, environmental safety and sustainable economic growth in urban areas in less developed nations in Africa, Asia and Latin America. Undoubtedly, urbanization is a process that continuously initiates changes in land use.

For any meaningful development to take place in an area there is the need for adequate information on the past and present land use patterns. Sufficient records on land and its uses are generally scanty in Nigeria (Abbas and Arigbede, 2011). This may be due to the tedious nature and cost of conducting ground surveys, and the bulky nature of data generated. The use of remote sensing and GIS techniques to capture data and process for safe keeping, management and regular updating, therefore, serves as a reliable alternative to the analogue methodology.

Thus, the monitoring of land cover/land use (LCLU) using satellite imagery has been adequate for general extensive synoptic coverage of large areas (Lillesand, *et al.,* 2004). As a result, this has reduced the need for expensive and time consuming ground surveys conducted for validation of data.

One of the major problems arising from urbanization is thus vegetation degradation. It is a decline in the quantity and quality of the grasses, herbs and woody species found in an ecosystem (Douglas, 1994). Vegetation degradation as defined by Conacher and Sala, (1998), "is the temporary or permanent reduction in the density, structure, species composition or productivity of vegetation cover". Vegetation condition is the key aspect of degradation in grasslands, wood/forest lands and croplands. Thus, over exploitation and management practices may result in vegetation degradation and tend to enhance land degradation risk. Pressure on the natural vegetation has arisen from changing agricultural practice, fire and livestock grazing, and the feed-back with the loss of bio-diversity.

Natural land degradation develops because the sparse native vegetation and its inherently low productivity are not able to contribute the necessary organic matter that gives life to soil and binds soil particles. With this degeneration in soil quality, productivity falls, leading to reduction of vegetation. However, natural degradation of vegetation is typically gradual and often reversible (Michael, 2013). In contrast, man-induced destruction is mostly rapid with diminished time or chance to compensate for the loss.

MATERIALS AND METHODS

Study Area

The study area is Gombe town and, it is located on latitude 10^0 13'and $10^020^{'}$N and longitude 11^002'and 11^016'E. The study area is limited to the urban area and environs. Some 9km radius around the town has been arbitrarily demarcated for the study with Union Bank round about, along Biu Road being the centre point (Fig.1).Gombe is located within the sub-Sahara climatic zone. It is characterized by two distinctive seasons, that is, dry season (November-April) and wet season (May-October). The rainfall here averages 907 mm. The vegetation of Gombe is within Sudan/Guinea savannah. This is characterized by shrubs and scattered trees with a different species of grasses. The predominant tree species include Locust bean tree, Baobab tree, Tamarin, Moringa, Date-palm, Neem trees and *Azadirachtaindica*.The soils are highly ferruginous, formed as a result of intensive weathering of the basement rocks.

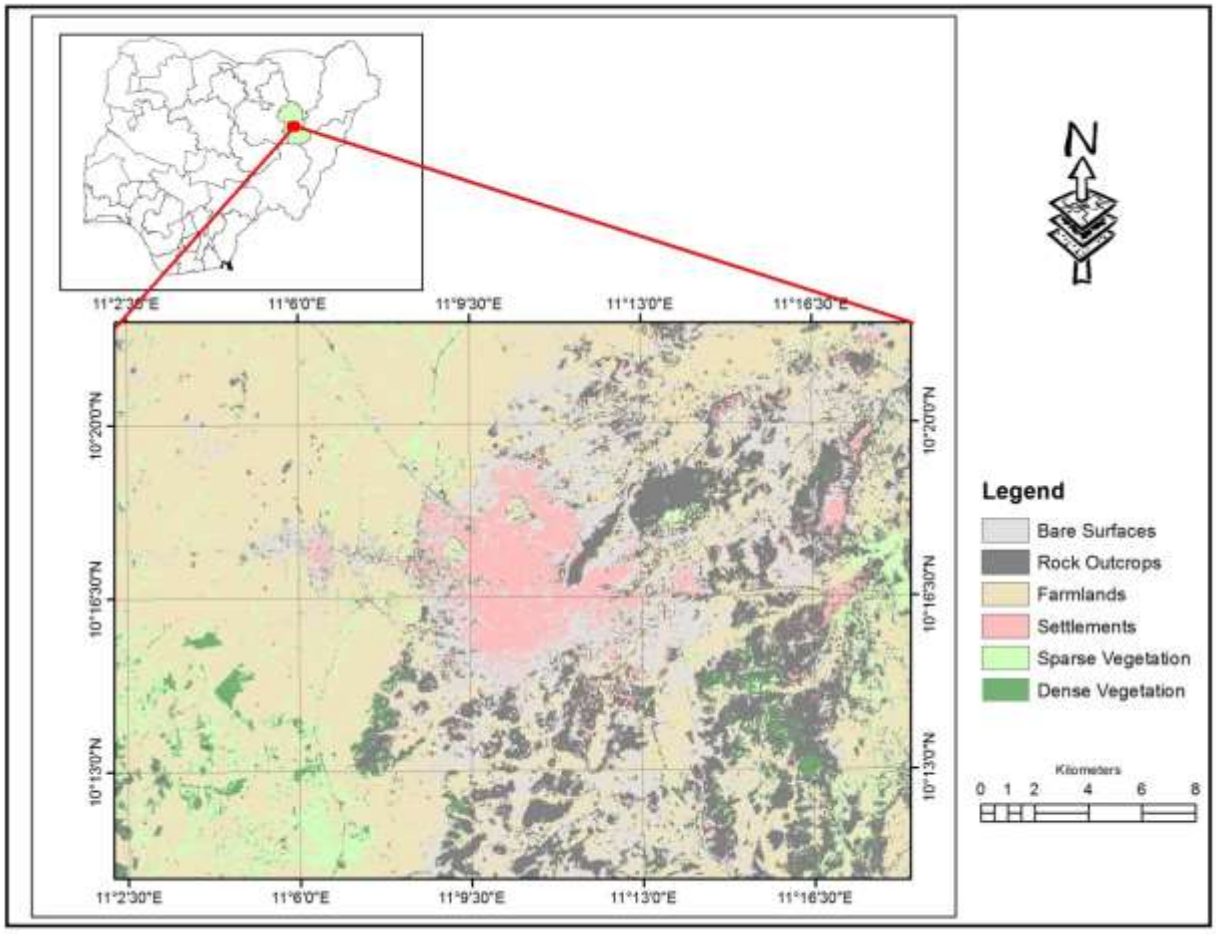

Figure 1: The Study Area

Procedure for Data Collection

Both primary and secondary data was employed in this work. Socio-economic data and information on the status of tree species were gathered through questionnaire survey that involved 195 respondents using purposive sampling techniques in the study area.

The remote sensing and the geographic information system (GIS) technology and applications were applied in the determination of the land cover changes. The interpretation and classification of satellite images involved subsetting and other pre-processing steps including georeferencing,colour composite and unsupervised classification; ground truthing, screen digitization of some features, supervised classification and change detection. Subsetting consisted mainly in selecting and extracting the study area from the full scene images. Colour composite and unsupervised classification enabled us to establish major land cover classes before ground truthing to match the reality in the field with the classified image. After ground truthing, the supervised classification enabled to proceed on land cover map composition for each image.

Data Analysis

The obtained result was analyzed using tables, charts and maps. The size and area of the land cover changes were calculated and represented in hectares. The rationale for these was based on the total size of the study area.

RESULTS AND DISCUSSION

Socio-Economic Characteristics of Respondents

Table 1 shows the distribution of respondents by age, sex, educational level and level of income. As presented in Table 1, majority of the respondents that responded to the questionnaires constitute 67% males and 33% females. The data on Table 1 also indicates that majority of the respondents are between the ages of 21-30 years which is 44%, those in ages between 31 -40 years, 37%, 41-50 years constituted only 8% while those above 51 years accounted for 11% respectively.
The distribution of respondents by educational level reveals that, 12% have attained primary school education, 28% secondary school education, and 49% tertiary education while 11% have no formal education. The result reveals that most of the respondents are literate which cut across different educational backgrounds.

Table 1: Distribution by Sex, Age group, Educational level and Occupation of Respondents

Socio-economic attributes		
Sex	**Frequency**	**%**
Male	131	67.2
Female	64	32.8
Total	**195**	**100**
Age (years)		
21-30	86	44.1
31-40	73	37.4
41-50	15	7.7
>51	21	10.8
Total	**195**	**100**
Educational level		
No formal education	21	10.8
Primary education	24	12.3
Secondary education	54	27.7
Tertiary education	96	49.2
Total	**195**	**100**
Occupation of the respondents		
Civil servant	72	36.9
Trader/business person	64	32.8
Farmer	28	14.4
Others	31	15.9
Total	**195**	**100**

Source: Fieldwork, 2017

The occupation of the respondents indicates that 37% of them are civil servants and 33% constituted the traders/ business person. This two categories were the highest and simply be due

to the fact that the study was carried out within the metropolis where majority of the people are either government works or businessmen. The farmers constituted only 14% which can only explain the fact that due to urbanization, fertile land for agriculture is hardly found.

Vegetation Cover Characteristics

Distribution of Tree Species.

The study sought to identify dominant species found in the study area, in all 12 tree species were identified belonging to 9 families as shown in the Table 2. The Fabeceae family has the largest number of species. The woody vegetation was hardly found in the study area as a result of urbanization and infrastructural development. The few species found were mostly planted by house owners as shades and wind breakers. Also, around the Gombe State University and Old GRA, trees such as date palm, neem tree, mahogany were dominant.

Table 2: Distribution of Tree Species

S/N	Scientific Names	Family Names	Local Names	Common Names
1	Adansoniadigitata	Bombacaceae	Kuka	Baobab
2	Azardirachtaindica	Fabeceae	Dogonyaro	Neem
3	Balanitesaegyptiaca	Balanitiaceae	Aduwa	Desert date
4	Ficusplatyphylla	Moraceae	Gamji	Fig tree
5	Grewiamollis	Tiliaceae (Malvaceae)	Dargaza	Apple ring acacia
6	Hyphaenethebaica	Arecaceae (Palmae)	Goriba	Doum palm
7	Khayasenegalensis	Meliaceae	Madaci	Mahogany
8	Pakiabiglobosa	Fabeceae	Doruwa	Locust beans
9	Prosopis Africana	Fabeceae	Kirya	Iron tree
10	Tamarindusindica	Fabeceae	Tsamiya	Tamarind
11	Vitellariaparadoxa	Sapotaceae	Kadanya	Shea butter tree
12	Vitexdonaina	Verbenaceae	Dinya	Black plum

Source: field survey

The trees in the area present significant importance almost in all human endeavors. A large percentage of the trees in the area have their advantage which made them of great use and advantage to the people of the area. Almost every tree or shrub has one or more uses that attract people's attention to put proper care on such plants.

Table 3 below shows the status of the woody species, reasons for the vegetal loss and the challenges experienced when urbanization takes place at the detriment of vegetation cover.

Table 3: Vegetation Cover Exploitation

Status of the woody species		
Abundant	10	5.1
Moderate	58	29.7
Sparse	110	56.4
None	17	8.7
Total	**195**	**100**
Reasons for vegetation cover loss		
Cutting of tree branches for grazing/fencing	30	15.4
Agricultural expansion	32	16.4
Fuelwood	36	18.5
Urban development	95	48.7
Others	2	1.0
Total	**195**	**100**
Challenges experienced due to urbanization		
Flooding	22	11.3
Erosion	62	31.8
Flooding and Erosion	104	53.3
None	4	2.1
Others	3	1.5
Total	**195**	**100**

Source: Fieldwork

The status of the woody species indicates that the area is majorly composed of sparse vegetation constituting about 56% while moderate and abundant vegetation constitutes only 30% and 5% respectively. The major reasons for these were attributed to urban development (64%) as seen in Figure 2 and closely followed by cutting the trees for fuelwood (19%) and agricultural expansion (16%). Despite the fact that the study area is in the centre of the town, people who purchase parcels of land for development and find trees within it cut them and either sell or use for their consumption. Likewise, as the economic situation is telling on the people, they tend to clear any available land or space within their environs for cultivation and livestock rearing. The challenges experienced due to urbanization were majorly flooding and erosion which constituted 53% and this is due to cutting down of trees which has made the environment prone to this hazards.

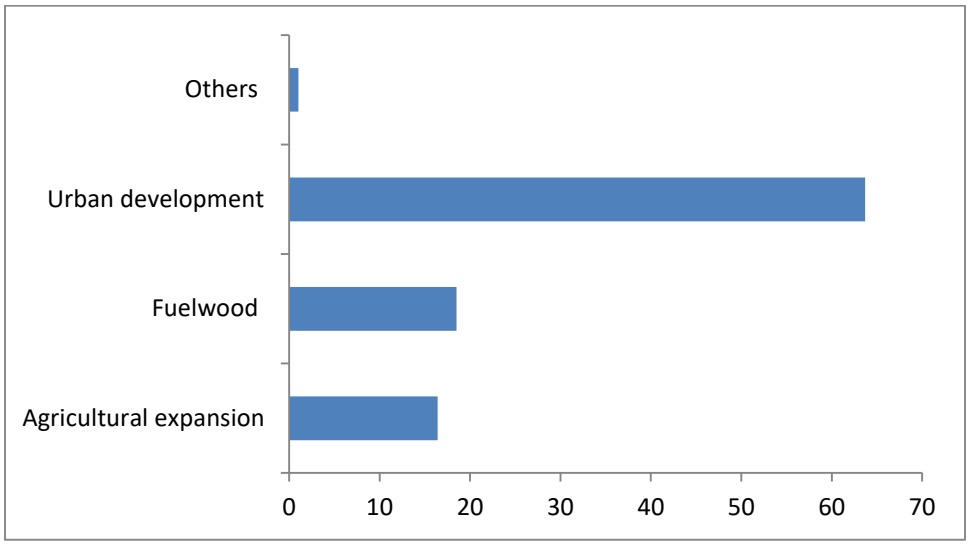

Figure 2: Reasons for Tree Loss in the Area

Land Use Land Cover Variation

As shown in Figure 3, the land-use/land-cover distribution clearly indicate,that there is considerable variation in the land use/land cover of the studied area over the examined period. There is however no consistent variation in the area coverage of the different land uses over time. The only exception is the built-up area that showed a consistent increase over time.The bare surfaces covered about 11% in 1976 then increased to about 13% in 1996 and increased again to 17% in 2016. This may be attributed to the fact that open spaces can easily be used for urban development. In a similar fashion, the area covered by vegetation decreased from 62% in 1976 to 27% in 1996 then decreased again to 11% in 2016. The farmland increased from 25% in 1976 to 43% in 1996 and decreased to17% in 2016.This was as a result of the conversion of farmlands to infrastructures. By contrast, the settlements increased from 2% in 1976 to 15% in 1996 and subsequently to 51% in 2016. So also, the rock outcrop increased from 0.36% in 1976 to 10% in 2016.

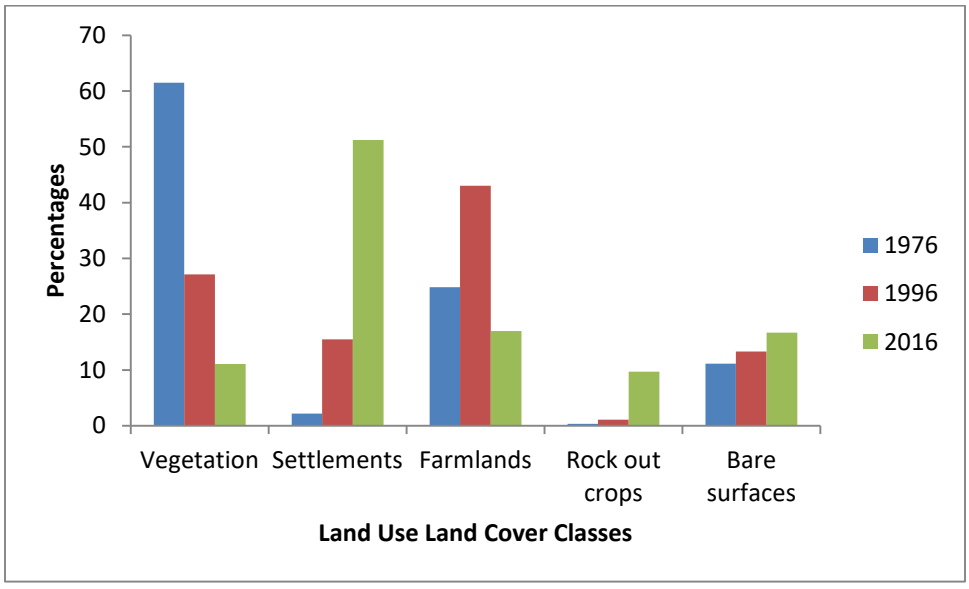

Figure 3: land use land cover classes variation

The studies of Chigbu, *et al.*, (2011) and Oluseyi (2006) conforms with the results of this work as they noted a significant disparity and trend in vegetation landcover due to rapid urbanization and socio economic activities. Likewise, Bisong (2007) and Ujoh et al (2011) opined that deforestation was higher due to rapid urban expansion.

CONCLUSION

Attempt was made to capture as accurate as possible six land use land cover classes as they changed through time. The six classes were distinctly produced for each study year but with more emphasis on vegetation as it is affected by a combination of natural and anthropogenic activities and indeed, it is one that affects the other classes. The result of the work shows a rapid decrease on the vegetation and a gradual increase in settlements between 1976 and 2016 due to the fact that Gombe metropolis became the capital of Gombe state in 1996. As a result there was an influx of people from other part of the state and the country mounting pressure on the land for development purposes. Since then the area had been growing spatially to the detriment of other land cover types especially vegetation and agricultural land. Thus, the study aimed at assessing the impact of urbanization on vegetation cover in the Gombe town and its environs.

Using maximum likelihood classifier, it was found out that the settlement increased steadily over the years at the detriment of vegetation and agricultural land that decrease rapidly from 1976 to 2016.

The status of the woody species indicates that the area is majorly composed of sparse vegetation constituting about 56% while moderate and abundant vegetation constitutes only 30% and 5% respectively.The study also sought to identify dominant species found in the study area, in all 12 tree species were identified belonging to 9 families. The Fabeceae family had the largest number of species.

The study has shown that the vegetation of Gombe state is undergoing degradation at an unsustainable rate which may likely disrupt the ecological functioning of the ecosystem in the state. Therefore, the study recommends that urgent attention on conservation of remaining vegetal resources in order to preserve the valuable assets of flora and fauna which are indigenous to the area. This can be done by insuring strict compliance with rules and regulations guiding conservation in the region and Nigeria as a whole also efforts should also be geared towards enlighten of the communities on the benefits of vegetation and the need for conservation in the ecosystem.

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