Land Vegetation Cover Changes in and Around Some Gazeeted Forest Reserves of Gombe State, Nigeria and Implications: 1996 - 2016

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ABSTRACT:

This study focuses on the assessment of vegetation cover changes in and around some gazeeted forest reserves in Gombe state and implications on the physical environment. To achieve the aim, satellite images for over a period of 10 years (2006-2017) were examined. Thus, four forest reserves were selected and five sites and communities in each of them were picked based on a checklist and subjected to time-series analyses. Landsat data and SPOT XS data were used. Determinants of fuel wood such as quantity of fuel wood per kilogram per week were also observed. Interviews, focus group discussions (FGD) and questionnaire surveys were used to generate data from the respondents on the impacts of fuelwood exploitation on physical environment of the source areas. The patterns, levels and temporal variation of fuel wood supply between seasons; the empirical estimate of daily harvest and supply of fuel wood to various parts of the country from the sources in Gombe state, Nigeria were also assessed. The results show that the there are more negative impacts and the destruction was caused more by human activities such as land clearing for agriculture, logging for timber and fire wood production. The study also reveals that rapidly urbanizing areas and those close to the highways like Lawanti are almost 4km or specifically 3.61km away from its nearest Lambo forest. Thus, the change has taken place in the last ten years. Recommendations were made at the end of the study, based on the findings.

Keywords: Vegetation cover, Forest reserve, Fuel wood, Satellite Imageries

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1. INTRODUCTION

Changing and declining land vegetation cover is largely attributable to fuelwood exploitation. Thus, in order to satisfy man's fuelwood requirements, most lands have been stripped bare of vegetation cover. This has resulted in soil exposure, deforestation, increasing desertification and erosion in parts of Nigeria and other parts of sub-Saharan Africa, thereby placing a heavy burden on the environment and on the resources base (Adedayo, 2005). The rate of deforestation in Nigeria is estimated at 400,000 hectares per annum. Popoola (2000) observed that the country's forest reserve which was estimated to be at 10% of the total land area in 1970 has been reduced to just 5% as of 1999, which is alarming. In Katsina state, which is located in Northern Nigeria, it was reported that the major source of fuelwood is farm trees, whose density is diminishing (Aide Memoire, 2002).

It has been estimated that about 1,700 million tonnes of fuel wood is being harvested each year globally. There is at least 500 million tonnes less than what is needed. By 2025 the world wide demand for fuel wood is expected to be about twice the current harvest rates, while supply will not have expanded much beyond current levels, some places will be much worse than the average (Maryam, 2012). In Africa, fuel wood accounts for about 90% of the total energy use and two-third of this

consumption is household energy for the most part procured by women (FAO, 2010). The major reason for deforestation in Africa is the fuel wood collection by the poorer section of the population. Fuel wood use exceeds 1.6 metric cubes per capita per year in Nigeria, Kenya, Sudan, Tanzania, Serra Leone, Liberia and Cameroon (Ayuba, 2004).

Over the years, there is compelling evidence which suggests that fuelwood demand is increasing in Gombe State and the removal of natural vegetation followed by prolonged over-farming has impoverished many areas in Gombe and Akko axis (Mayomi et al, 2015). There were 30 gazetted forest reserves that are located in different parts of Gombe state, constituting 1597.38 square kilometers or representing only about 9.1% of the total land area of the country (Mayomi et al, 2015).This percentage is quite low and falls short of the internationally recommended standard of 25 percent (Abdulrasheed, 2009)). Moreso, these forest reserves only exist on map of the state but in reality most have been de reserved.

Various studies looked at the economic systems that perpetuate consumption and exploitation of fuelwood that lead to deforestation in many parts of Nigeria, including the northern region, The available works so far, include: Cline-Cole et-al, 1987; Nura et-al 2011; Haruna, 2006; Ebe, 2006; Nwafor, 2006; Langa, Polycarp, Simon and Ogunmola (*2018).*, 2009; Mbaya, 2004; Ndaghu, Taru, Tizhe and Tizhe, 2011; Naibbi**,** 2015**;** Abui, Shat, Augustine, Na'o'mi & Obassi, 2014. Unfortunately even the few studies that covered Gombe State such as Bashir, 2015; Maryam, 2012; Mbaya 2004, Mbaya and Hashidu, 2017; Ayotebi, 2000; Ahmad, Yahaya & Ahmed, 2018 researched mainly into demand and supply of fuel wood, its socio-economic intricacies and environmental implications among others. In view of the foregoing, this study is vital and timely especially in this period of environmental challenges and the global focus on sustainable development.

Against this background, the study assesses the changes in vegetation cover in and around the gazeeted forest reserves of Gombe state. This aim was achieved through: identifying and mapping the fuelwood exploitation patterns and levels in the supply areas (into urban Gombe) of the study area; estimating the daily forest degradation and fuel wood exploited at the source areas over the last 10 years (i.e. 2006-2016), finding out the dominant tree species felled in the study area and examining the implications of the exploitation on the physical environment.

2.   THE STUDY AREA

2.1 Location, Position and Size

Gombe State occupies a total land area of about 20,265 sq. km. It is made up of eleven (11) local government areas, located between latitudes 90 30' and 120 30' North and longitudes 80 45' and 110 45' East. It shares boundaries with Yobe in the north, Borno State in the east, Adamawa and Taraba States in the south and Bauchi State in the west (fig. 1).
Based on the 2006 national population census, the study area has a total projected population for 2011 of 2,753,806 which comprises of 1,448,146 males and 1,305,661 females (National Population Commission, 2006).

2.2 Relief and Drainage

The topography of the State is mountainously undulating and hilly to the south but flat open plain to the north. The Gongola River traverses the State with numerous streams that are mostly seasonal and also serve as tributaries to it. For instance, Rivers Nafada and Dadin-kowa serve as the tributaries and also cross a large territory. The Gongola River plays an important role in the socio-economic and political life of the area.

Figure 1: The Study Area (Gombe State)
Source: GIS Lab. FUK.

Table 1: Major forest Reserves that supply fuel wood to Urban Gombe and other Areas

Local Govt. Location	Name of Forest	Distance from Gombe (km)	Latitude	Longitude	Altitude (meters)	Selected
Akko	Tukulma forest	35	10°08'05.2"	10°58'53.7"	393	❖
	Lambo Daji	32	10°14'43.0"	10°52'38.5"	469	❖
	Kulum forest	39	10°08'72.4	10°53'53.7"	370	
Dukku	Bojude forest	46	10°34'38.4"	11°00'05.5"	481	
	Lungun Maizare	48	10°37'03.0"	10°57'45.9"	537	
	Bozon Shilwa	58	10°39'53.0"	10°53'48.9"	532	
	Bano forest	76	10°47'13.6"	10°48'08.9"	496	
	Dirri forest	118	10°49'27.5"	10°39'05.0"	382	
	Galuchi forest	109	10°49'06.5"	10°47'34.3"	457	
Kwami	Gadam	26	10⁰.13'05.7"	10⁰9' 28.7"	431	❖
Nafada	Wawa	102	10°24'33.6"	10°83'42.8"	411	❖

❖ = Selected. Source: Field work, 2016

2.3 Climate, Soils and Vegetation

The weather of Gombe state is characterized by two seasons, the dry and wet seasons. The life span of these climatic conditions can be seen in the following four stages. The seasons are characterized by cold dry season starting from December to February. This is followed by hot, dry season from March to May, then the wet season lasting from June to September. There is rising temperature (decrease in rainfall) from October to November.

The soil in Gombe State is classified into four broad zones. These are wawa soil type, the mixed farming soil, black cotton soil and rocky hills. The wawa soil is a loamy red soil, covers the western half of the Nafada LGA, the whole of Dukku LGA, part of Kwami LGA and a small section of north-east Akko LGA. As the soil type covers large part of the state, one would appreciate the predominance of livestock rearing and the cultivation of cotton, peanuts and cereals (Abba, Shehu & Abba, 1999). There are gazeeted forest reserves in the state, which were either tempered with or completely taken over by urbanization process (see Table 2). There are 30 gazetted forest reserves that are located in different parts of Gombe state, constituting 1597.38 square kilometers or representing only about 9.1% of the total land area of the country (Mayomi et al, 2015). Figure 2 depicts the forests in the state.

3. MATERIALS AND METHOD

3.1 The materials used for the study include, the hand held Global Positioning System (GPS) receiver to take the coordinates in terms of latitudes and longitudes of the source areas. A digital camera was used to take the photographs of the vegetation cover, the felled trees, loaded trucks, piled up lots and the cleared farmlands. The ranging poles and measuring wheels were used to establish the quadrants of the areas in order to identify the predominant trees felled for fuel wood. A quadrant measuring 50 square meters was taken at 10 sample plots in each of the identified fuel wood sources to determine the number of individual species. Hassan, Scholes, and Ash (2005). opined that 100, 50 and 25 square metres quadrants can be used in vegetation studies of woodland trees and shrubs. Other equipment used include Prismatic compasses for measuring
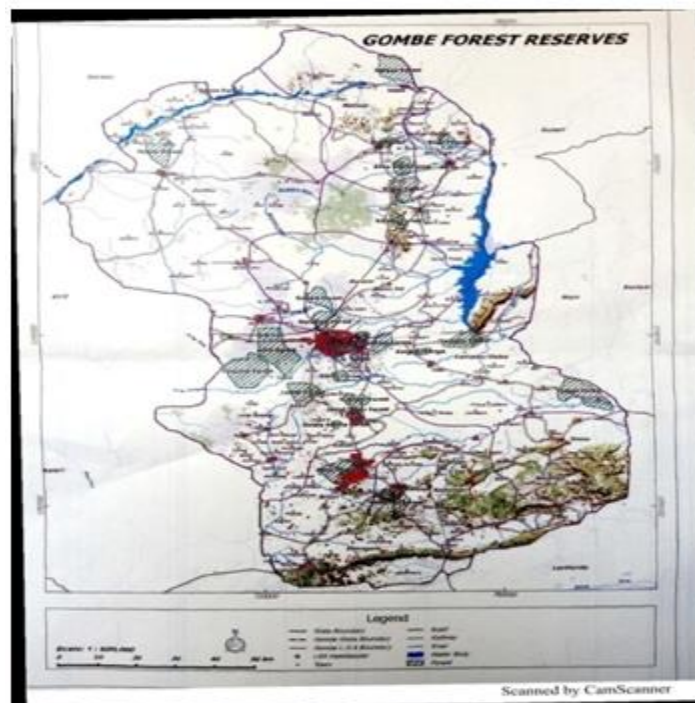

Fig. 2: Gombe Forest Reserves and Areas of Coverage.
Source: Sourced by the Researcher

angular distances, Audio recorder for the Focus Group Discussion, External Hard Disks and Flash drives for back up.

Three forest reserves were selected and five sites and communities in each of them were picked based on a checklist. Determinants of fuel wood such as quantity of fuel wood per kilogram per week were observed. Interview, focus group discussions (FGD) and questionnaire surveys were used to generate data from the respondents on the impacts of the exploitation on the socio-economy settings of the source areas. This poses serious implications for agriculture in terms of food security for those using it for irrigation, water availability for different uses and infrastructural development in term of electricity where it is used for power generation. It also has a serious implication for survival and livelihoods on the communities that depend on aquaculture and irrigational farming. The future prediction could spell a serious calamity due to inundation and loss of small lakes and ponds considering the fact that the loss of the ecosystem constitutes severe degradation and increases the vulnerability of people to disaster especially those whose livelihoods are

3.2 Reconnaissance Survey: A reconnaissance survey was conducted from 26th March to 2nd April, 2017; the survey was done in two phases. The first phase was to identify the major sources of fuel wood along the five routes into Gombe metropolis while the second phase involved the recording of geo-coordinates and measurement making such as taking of quadrants, identification of tree species cut/fell for fuel wood and piloting/pre/trial test administration of the questionnaires on fuel wood cutters, vendors and suppliers as well as Focus Group Discussion (FGD) with the communities close the sources for the fuel wood. The third phase is to use satellite images to assess the amount of fuelwood fell over the period of ten (10) years, by measuring their sizes every five years.

3.3 Focus Group Discussion (FGD): For a viable Focus Group Discussion (FGD) to be conducted in the study area, discussion guidelines were first designed and pretested. Three (3) groups were formed in each location for the study and 10-12 persons constituted each group. The discussion which lasted for about 30-40 minutes for each group was led by an experienced moderator and other team members held a note taker and a video recorder. At the end of the exercise, comparisons was made between the notes and taped discussion for thoroughness. The data which recorded in local languages was translated into English language and analysed using a content analysis.

3.4 Sampling Methods and Questionnaires Administration: The structured questionnaires were randomly administered among 160 fuel wood operators of the cutters, vendors and other stakeholders. A total of 40 questionnaires were administered among the cutters, 50 for the vendors (some of them are the cutters as well), 50 fuelwood end users and 20 for other stakeholders, all using accidental sampling method. Focus Group Discussion (FGD) was also organized among the rural dwellers at the source regions to examine the effect of indiscriminate felling of trees on biosphere (environment). In each of the sampled areas three groups of nine to fifteen community members were involved in the FGD.

Table 2: Sample Size

Categories of respondent	Sampled size
Fuelwood cutters	40
Fuelwood vendors	50
Fuelwood End Users	50
Stakeholders	20
Total	**160**

The inflow of fuel wood into Gombe was taken along the five routes of Kano – Gombe Road, Bauchi – Gombe Road, Yola – Gombe Road, Maiduguri –Gombe Road and Biu – Gombe Road. Along each route research assistance stationed at the entry of Gombe to take the record of inflow of fuel wood into the town between time periods of 6am – 12noon and 2pm – 7pm from Monday – Sunday 21st -26th May, 2017. Descriptive statistics such as frequency counts, percentages and graphs were used in the study.

4.   RESULTS AND DISCUSSION

4.1   Characteristics of the Selected Areas

The results of the reconnaissance shows that from all the routes that enter Gombe metropolis fuel wood sources were identified. The identified settlements along Kano – Gombe routes are Dukku, Kwami, Gadam, Dawo and Bojude. The real cuttings are done outside the identified settlements along the main road of Kano – Gombe. The settlement of Dawo on coordinates of $10^0.13'$N and 10^0 $9'$E about 7.91km from Bojude settlement is identified as the main source of fuel wood cutting in the Gadam area. The identified settlements around the source areas along Kumo route are Tukulma, Futuk and Yelwa.

The results indicate that almost 100% of the respondents were males probably because firewood business is mainly a menial job and males are also easily available for any open interview.

The result also indicates that majority (60%) of the respondents were farmers by primary occupation. Since this industry is dominated by farmers, it means that firewood business was markedly affected by season due to the attention and time it would receive. Farmers spend substantial part of their time on their farms during raining season, and are more likely concern with farming activity. That perhaps means the activity is used in supplementing farm income in off season periods.

There is an indication in the result that young adult constituted more than half (64%) of the respondents who were largely (97.8%) married. the proportion of people engaged in these fuel wood exploitation and even marketing with respect to age and marital status should favour income generation. Ethnicity wise, the population engaged in the fuel wood business is largely (36%) Bolawa. This is probably because of the fact that most of the dense forests are found the areas dominated by them.

4.2   Identification and Mapping of the Fuelwood Exploitation Patterns and Levels in the Supply Areas

The processes of fuel wood cutting are classified into two types of nearby and distance felling. Those felled within the settlement vicinity are classified as nearby which is usually done by farmers during farm clearance not purposely for fuel wood fetching, although some of the trees felled are assembled and sold to the wholesale fuel wood traders at relatively cheaper price than the full time fuel wood cutters. Cutting from the root is done under this. Distance felling is mainly engineered by wood cutters who some of them come all the way from Gombe town for this purpose. In their own case the trees are mostly selected and cut half way. Plates 1-3 indicate the cutting, transportation and selling of the fuel wood

4.2 Dominant Tree Species Felled in the Study Area

The fuel wood cutters that operate at distance from the settlements are also divided into three categories of the commissioned wood cutters, the voluntary fuel wood cutters(main fuel wood private biz) and the timbers wood cutters. The commissioned wood cutters are from all parts of Gombe state and some are from neighbouring countries of Chad and Niger. These groups of wood cutters are selective and have a preservative mechanism of cutting trees for fuel wood; their selection is based on strengh and softness of the trees. The major trees cut by this group are *Taura, Daniyah, Kukoki, Katakara, marke and Butum Tubule*.

Other predominant tree species consist of fine leaf, thorny trees such as *Balanite aegyptica (Aduwa) Sclerocarya birrea (Danya) Sieberiana (Farar Kaya)* and *Bombar castatum (Gurjiya).* The Acacia spp include *Albedo (Gawo) Nilotica (Gabaruwa), Polyacantha (Karo),* the fruit trees include *Parkia buglungosa, parkia clappertonia (Daurowa), Adansonia degitata (Kuka) and Tamarindus Indica (Tsamiya).* Also in the study area there are some perennial and annual shrubs, herbs and grasses.

The voluntary fuel wood cutters are those that are fully into fuel wood business and they are mainly from the identified settlements of Dukku, Bojude, Kwami, Gadam and other nearby settlements. These groups of cutters fell the trees

indiscriminately, they are not selective in terms of types and sizes of the tree cut for fuel wood and the only trees exempted from their activities are the Baobab tree, Neem tree and the locust beans tree which are regarded as economic trees. Their activities are not restricted to any particular location it can either be nearby or distance points from the main settlement, the availability of trees in an area determined their activities. After cutting the reasonable amount of trees that can make a full load of the truck they invite the fuel wood vendors to come and buy the cut and tied in bundled fuel woods. The third categories of tree cutters identified are those that cut the timber mainly for construction purposes. Their activities are restricted to areas of economic trees and matured trees characterized by wide girths.

The quadrant analysis conducted revealed that Eighty five (85) trees were cut within a quadrant of 50 square metres and 35 trees were left standing. The frequency shows that *marke and Butum Tubule* range the highest of the trees cut for fuel wood. The standing trees within the quadrants have *Taura* and *Kukoki a*s the highest in frequency of the trees cut for fuel wood due to their softness. Other trees found within the quadrant not cut but also dominant are Neem and Locust bean trees.

The result from the Focus Group Discussion (FGD) with people within the fuel wood sources shows that there are various problems created in the environment where trees are felt for fuel wood or other activities. Some of the enumerated problems facing the settlement around the vicinity of fuel wood fetching includes; soil degradation of high gully erosion, evidence of loose soil fertility. Vanishing of some wild fruits or wild yam, rice, hungry rice and okra, disappearance of bush animals for example grass cutters, antelopes and birds, drying of rural water sources and depopulation of the settlements due to stream and rivers drying up.

4.3 Sources and Volume of Fuelwood

 The study indicates that the vegetation of the study area has been altered by several human activities such as urban expansion, cultivation, livestock grazing etc. In 1960, there were 39 forest reserves in Gombe state but due to human impact they have been turned to what is called parkland vegetation (Abba et-al. 1999).

The largest sources of fuelwood are annual bushes and private farms lands (Cline-Cole, 1990; Obueh, 2000).This study however, reveals that the sole source of fuel wood in the study area is the forest reserve. The study discovered that an average of 136 trips of vehicles of different sizes carrying different quantities of fuelwood entered into Gombe Urban centre on daily basis during the dry season period. Most of the fuelwoods were from the lands cleared for agriculture during the dry season. But during the rainy season the number of trips dropped sharply due to some factors such as abandonment of fuelwood business by many for farming activities, inaccessibility of some routes leading to the woodland areas, lack of farm clearance as well as rainfall disturbance among others.

The study further revealed that, apart from the ones conveyed to urban Gombe and other towns and big villages in the state mainly in Pick-up Vans, big and long trucks carrying large lots from virgin lands and forests of Gombe to Kano region. Other fuel wood exploitation taking place in the source areas and impacting on the environment include, production of charcoal which involves burning full trees in ditches. Sometimes those trees left behind and those cut half way are cleared for farming activities.

4.4: Estimating the Daily Forest Degradation and Fuel Wood Exploited at the Source Areas over the Last 10 Years (2006-2016).

Figures 4, 5 and 6 reveal changes in the forests sizes over the three periods (2006 – 2016). Figure 5 shows that there was annual loss of 2.5% in the forest of Wawa, 8.49%, 6.1% and 3.48% for Gadam, Lambo and Tukulma forests respectively for the past 10 years (2006- 2016).
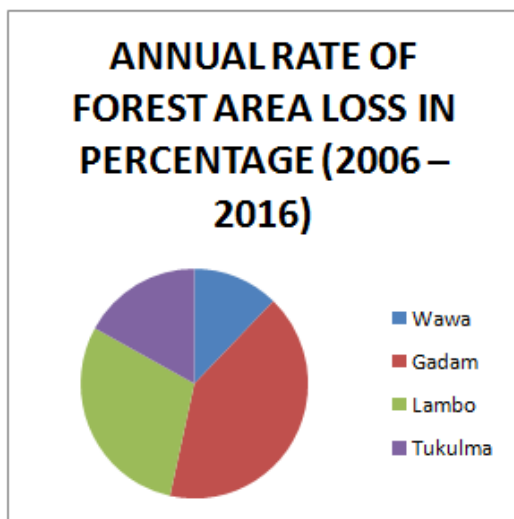
Source: Field work, 2017
Fig. 4: Annual Rate of Forest Area
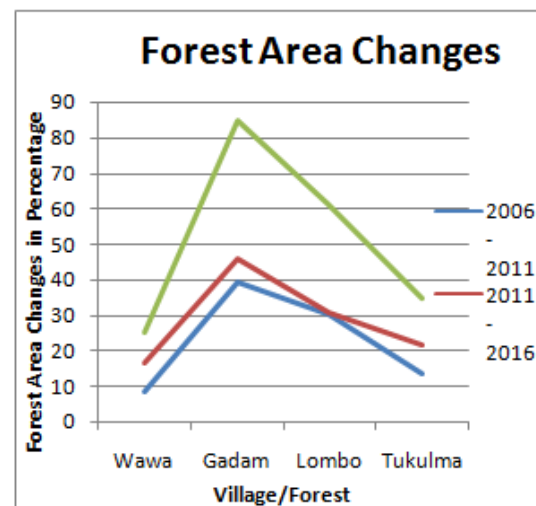
Source: Measurement on Satellite Im.
Fig. 5: Forest area Changes in %

Figure 5 also depicts that there were various proportions of changes in all the forest reserves over the ten years period. The changes are expressed in percentages as follow: Wawa forest reserve with the highest alteration in 2006 – 2011, 2011 -2016 and 2006 – 2016 changed by 25.41%, 37.92% and 63.33 respectively. This was probably because of the massive exploitation taking place there as a result of some of the fuel wood being transported to other states such as Kano and Yobe. The other forest reserves followed suit but in lesser magnitude as depicted in figure 5.

In terms of areal coverage changes expressed in square kilometers, Figure 6 depicts the changes over the ten year period (2006 -2016). Wawa Forest reserve takes the lead in the depletion in terms of size and faster movement away from the localities in its close vicinity before. They needed to trek a long distance to fetch the firewood, take their animals to far distance for fodder, the animals which they used to tame from closer points, now no more. In addition to that, as expressed by them in the interviews and focus group discussions conducted with them, they notice a lot of changes in terms of well water, soil erosion, flooding etc.

Plate 4: Half Cut tree


Plate 5: Fuel woods cut and Displayed

Plate 6: Firewood Logs

For Sale
Plate 4 shows a half cut by cutters with the view to

having the tree regenerate Plate 5 shows bundles of firewood displayed for sale in the forest by the cutters. Fuel wood logs which are big to be broken into pieces are displayed in logs in the forest for sale to interested customers (plate 6)**.** These types of logs are used as source of energy/fire in bakeries and meat/suya houses.
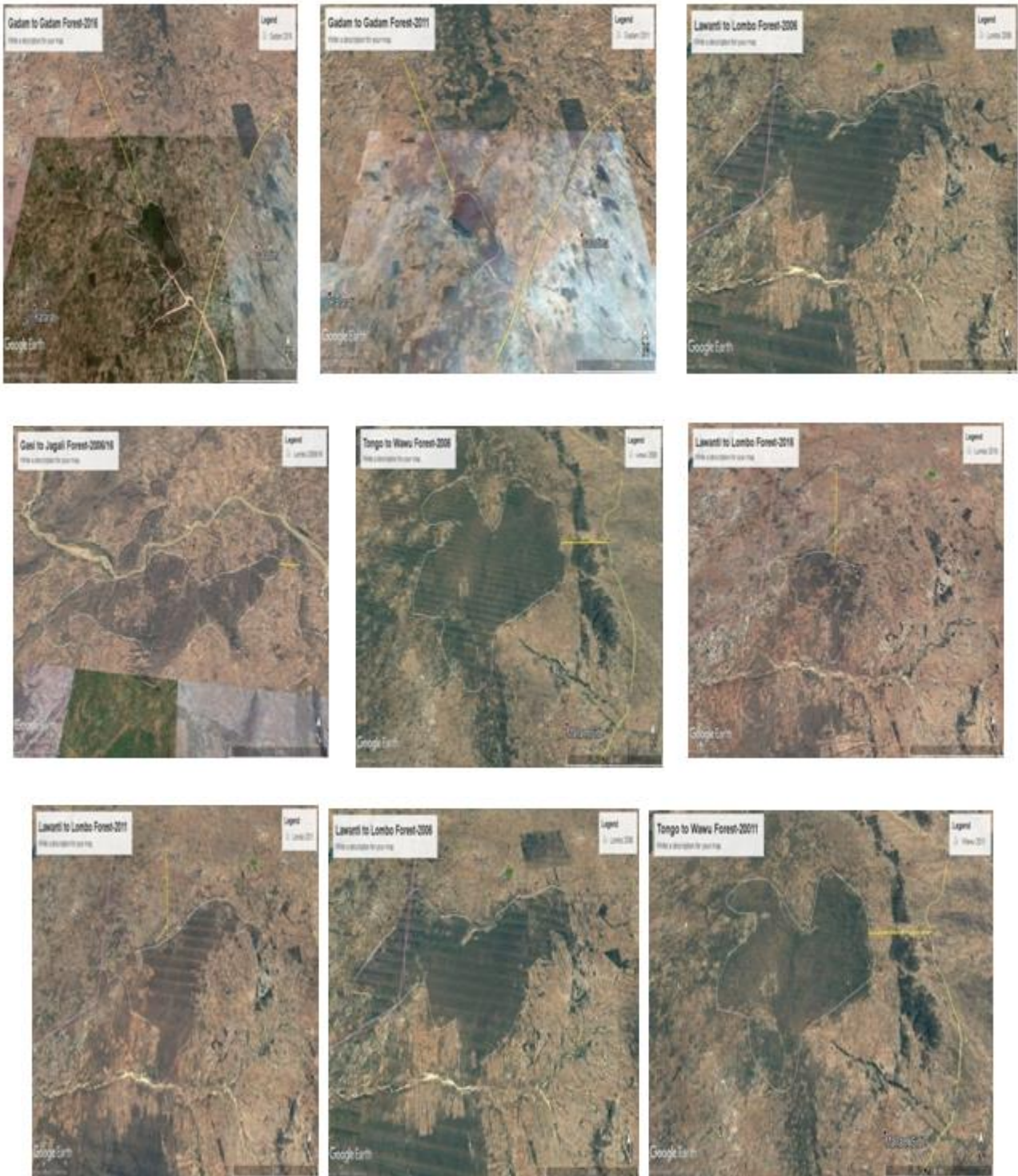
Plates: 1- 9 Changes in the sizes and distances of the selected forest reserves

Plates 1 - 9 as well figures 4 and 5 all indicate the distance from the settlements. Examples such as from Gadam to Gadam forest, Lawanti to Lambo forest, Tukulma to Tukulma forest and Tongo and Wawa to Wawa forest..

4.5: Estimates of Daily Forest Degradation and Fuel Wood Exploited at the Source Areas

The study reveals that the quantity of fuel wood removed from the forest is over whelming even though it varies between the two seasons (dry and wet). Daily import of fuelwood for seven consecutive days from various sources during dry season is higher than that of the rainy season. The drop in supply during rainy season led to scarcity of the product. This is manifested in the way retailers are going to fuelwood deports and entry routes to wait for suppliers which is contrary to what is happening during the dry season.

Some of the volumes of fuelwood in tonnes imported on daily basis into Gombe urban area in two different seasons (wet and dry in 2017) have been recorded and presented. Dukku road carries the largest percentage of supply (62%) of fuelwood followed by Bauchi road (19%), Kumo road (15%) and lastly Mallam sidi road with 4%. Dukku road carries the largest percentage of fuelwood supply to Gombe urban area because of huge existing woodland areas, accessibility and proximity to Gombe by motorists. Conversely the problem of accessibility and low forest reserves made Kumo, Mallam sidi and Bauchi road sources supply less than Dukku area source. Fuelwood from Kumo road source are sometimes conveyed to Gombe through Bauchi road. Pick up vans are main transporters. From the Dukku road source especially within the wawa-zange forest long trucks and lorries are often seen carrying full loads of fuelwood to Kano. Thus, the people whose localities were socially and economically affected as the forest moved away from them.

4.6: The Implications of the Exploitation on the Physical Environment

The wells are so deep that a long rope is often tied to a donkey and the container and to draw water from the well, the donkey is pushed to a far away distance before the container is pulled out from the well. The result on table 3 therefore largely indicates that there had been a massive disappearance of animals, degradation of the land through erosion, floods and high temperatures as well as lowering of water table, making it necessary to use donkeys for the drawing of water from the deep very few wells.

Physically, the environment is so much affected just like in the words of Adegoke (2002 as quoted in Abebaw, 2009) who pointed out that, Nigeria consumes about 80 million m3 of fuelwood annually. He stressed that the forest of developing countries are been consumed at over 10-15 million hectares a year

4.8: The Implications on the Physical Environment

The rate of fuelwood supply is increasing with an estimated average of 39,156 tonnes imported annually into Gombe urban, excluding the unrecorded ones from the surrounding communities. As it continues over time, the forest reserves in Gombe State might all get exhausted (Bashir, 2015).

The exploitations of fuel wood has created great havoc to the environment in the following ways:

  i.   The rate of erosion has increased over the years with large gullies and erosion channels.

  ii.   Less vegetation cover/grasses.

  iii. Drying up of water bodies and rivers is noticed.

  iv.   Destruction of farmland by water erosion

  v.   Disappearance of wild animals.

vi.   Vanishing of Honey, fruits, wild yams etc

vii.   Probable lowering of water table – In one of the areas visited, it was discovered that donkeys were being used to draw water from a well because of its depth

The forest continues to decline and thus its distance away from the nearest locality increases on daily basis. For instance in the ten years period (2006 – 2017), there was an increase of almost one kilometer or specifically 0.95 km, for both Tongo to Wawa and Pindiga to Tukulma forests respectively. As for Lawanti to Lambo forest, the increase in the four years is almost 4km i.e. 3.61km. That is probably so because Lawanti town is urbanizing more rapidly because of the presence of the international airport and its proximity to the main Bauchi-Gombe highway. As for Gasi to Jagali forest the increase in distance is not significant, perhaps because of its remoteness.

5.   CONCLUSION

This study provides an assessment of the impacts of fuel wood exploitation on the decline in the vegetation in Gombe State. It involves spatial and temporal trends of forest reserved changes over three time periods (2006, 2011 and 2016), assessing the impacts of the identified and mapped changes which led to deforestation.

According to some studies, deforestation expands at the rate of about 1 km per year in the northern part of the Nigeria which causes irreversible damage to the environment thereby leading to desert encroachment and poverty. Hence, the need for extra attention to avert it even though, it is not simply a recent phenomenon, and the history of deforestation represents an important avenue of study if we are to understand its causes and consequences. Notwithstanding this, deforestation rates are currently higher in Gombe and environs than what was obtained in the pas t. However, one can conclude that deforestation is a product of economic and social crises and population pressure on the vegetation resources of the area. In addition to that, the risk of deforestation is too numerous and hard to bear.

6.   RECOMMENDATIONS

i.   Economic empowerment and provision of other alternative sources of energy such as nuclear, solar, kerosene, wind and cooking gas etc at cheaper and affordable rates to divert people's attention from over dependence on fuel wood consumption which is environmental –friendly by the government is absolutely necessary.

ii.   Education on environmental issues for younger generations, adults as well as the underprivileged and the vulnerable should be given utmost priority. That would broaden the bases for an enlightened opinion and responsible conduct by individuals, enterprises and communities in projecting and improving the environment in its full human dimension.

iii.   It is also essential that mass-media be fully involved in public re-orientation towards conserving natural vegetation in all respects.

iv.   Legislation also should be re-enforced to curtail unnecessary bush burning and tree cutting. This can be done successfully through the use of forest guards.

7.   SUGGESTIONS FOR FUTURE STUDIES

- Research Studies into fuel wood for covering graves at cemeteries , bakeries, and suya spots
- Research into selling of fuel wood and charcoal as a determinant of household income.

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