



An Assessment of the Socio-Economic Impacts of Fuel Wood Exploitation on the Supply Areas and Local Vicinity in Gombe State, Nigeria

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ABSTRACT: Fuel wood extraction and its implication for the environment and development have been on increase worldwide. It is a known fact that the utilization of fuel wood in Nigeria contributes greatly to desertification, deforestation and consequently has implications with regard to climate change. Very little is however known on the situation in Gombe State, more especially the extent of the socio-economic impacts. This study focuses on the assessment of socio-economic impacts of fuel wood exploitation on the source areas of the study area. This was achieved through examining 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. Four 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. The environmental impact was assessed by conducting time-series analyses of satellite imageries such as LANDSATs over a period of ten years (2006-2016). The results show that there are more negative impacts and the destruction was caused more by land clearing for agricultural production. That affects the socio-economic life of the people both positively and negatively. Recommendations were made at the end of the study, based on the findings.

Keywords: Environment, Forest reserve, Fuel wood, Satellite Imageries.

I. INTRODUCTION

Forestry is a source of livelihood for many farmers and rural households in developing countries, especially in sub-Saharan Africa (SSA) (Ayotebi, 2000; Adebawale, 2007). However, the exploitation of fuelwood in Nigeria contributes greatly to environmental degradation, deforestation, desert encroachment, and consequently has implications with regard to climate change as well as on the economic and social environment yet, little is understood about the drivers, impacts and dynamics of fuelwood consumption in Nigeria and other African countries (Adebawale, 2007; An et al., 2002). Evidence from China, another developing country, indicates that a considerable majority of households in the Wolong region still remain dependent on fuelwood despite their access to electricity. Scholars have proposed reasons for this trend in different parts of the developing world. One of the main reasons for this lack of inter-fuel substitution is that household choice, and use of a given source of fuel, hinges on a host of socio-economic (e.g. income and wealth), demographic (e.g. family size, household composition, lifestyle, and culture) and location attributes (e.g. proximity to sources of modern and traditional fuels) in addition to fuelwood availability (Dovie et al., 2004; An et al., 2002; Karekezi et al., 2002; and Israel, 2002). This may also hold true in the context of Nigeria, as the country has different climates and a diverse mix of ethnic, religious and linguistic backgrounds. Ayotebi (2000) noted that urban and rural areas of Nigeria largely depend on fuelwood, however, the factors influencing the pattern and magnitude of fuel consumption by urban and peri-urban households are still inadequately understood. For instance, there is a gap in knowledge regarding how household characteristics and wealth endowment influence use of firewood and charcoal (Adebawale, 2007).

The Food and Agricultural Organization (FAO) (1997b & c) observed that the challenge of bridging the gap between demand and supply of about 6 million tons per year led to the depletion of forests and consequent loss of soil fertility. In the absence of forests, flooding from rainstorms led to serious damage to material objects, as well as human

casualties. FAO(2005), "Scenario Analysis" on Nigeria observed that, "The land and environment are highly devastated by climate, farming, fires, erosion and population pressures." The report further projected that by 2020, "oil is deemphasized and the demand for renewable natural resources including wood and non-wood forest products is on the increase."

Millions of people also depend on the fuelwood exploitation as a means of livelihood and source of income. Consequently, as firewood becomes increasingly scarce, women and children especially those hitherto close to the source areas spend, more and more hours searching for fuel wood. In some places it takes eight or more hours just to walk to the nearest fuel wood supply and even longer to walk back with a load of sticks and branches that will last for a few days.

Over the years, there is compelling evidence which suggests that firewood demand is increasing in Gombe State. To cope with this growing demand, numerous firewood selling points have emerged, leading to systematic destruction of the State's forest reserves. Presently, all the State's forest reserves are heavily encroached. Illegal cutting of trees for firewood were the major disturbance/challenges observed in all the forest reserves in Gombe state. Undoubtedly, such an overwhelming and persistent dependence on biomass fuels for household energy has given rise to development concerns on several fronts and has become a serious issue to many developing countries.

Even though a holistic understanding of the economic systems that perpetuate consumption of fuelwood and lead to deforestation will provide better evidence for policy makers interested in addressing efficient energy use and abatement of deforestation in Sub-Saharan Africa, unfortunately, the available works on fuelwood exploitation in Nigeria (e.g. Cline-Cole et-al, 1987; Nura et-al, 2001; Haruna, 2006; Ebe, 2006; Yusuf, 2006; Ikerekong et-al 2009; Ndaghu, Taru, Tizhe and Tizhe, 2011; Naibbi, 2015; Abui, Shat, Augustine; Botkin & Keller, 1998) did not study Gombe state. Unfortunately, even the few studies that covered Gombe State such as Bashir, 2015; Maryam, 2012; Mbaya and Hashidu, 2017; Yahaya, 2017; 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, researching into fuel wood exploitation, its socio-economic intricacies among others is a vital and timely especially in this period of climate change, environmental challenges and the global focus on sustainable development. Against this background, this study was designed to find out the socio-economic impacts of the fuel wood exploitation in Gombe State, Nigeria.

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 socio- economic and physical environment.

II. 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 $9^{\circ} 30'$ and $12^{\circ} 30'$ North and longitudes $8^{\circ} 45'$ and $11^{\circ} 45'$ 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).

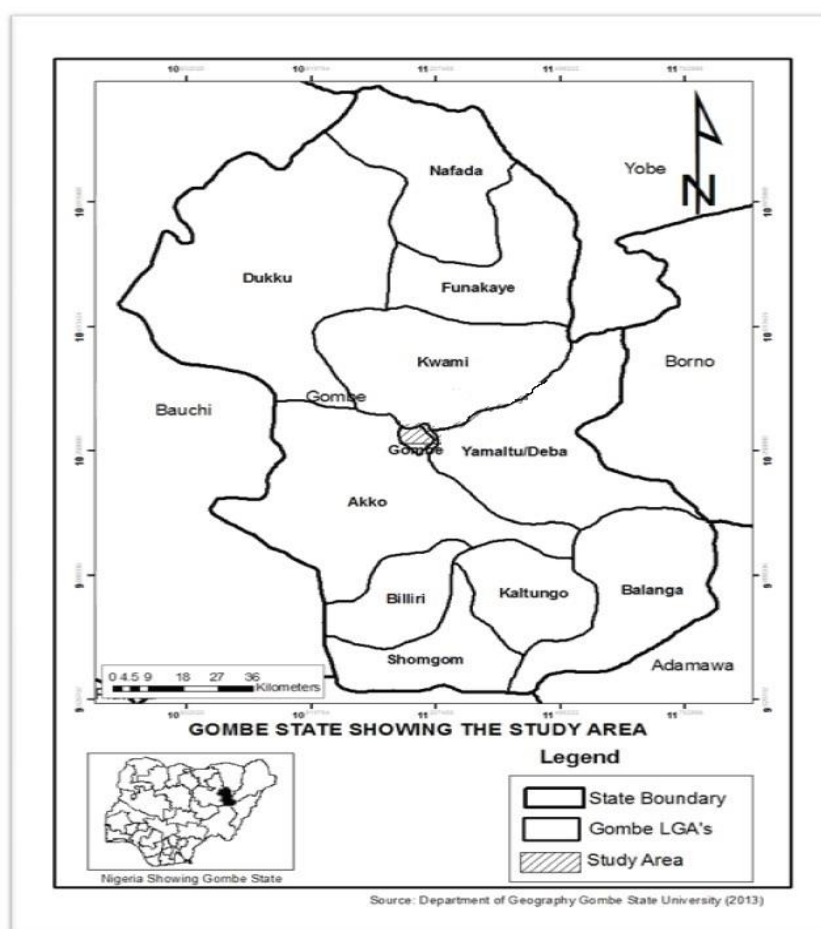


Figure 1: The Study Area (Gombe State)

Source: GIS Lab. FUK.

2.2 Forest Reserves

There were 30 gazetted forest reserves located in different parts of the state, which were either tempered with or completely taken over by urbanization process. These forest reserves constitute 1597.38 square kilometers or representing only about 9.1% of the total land area of the country (Mayomi et al, 2015).

III. MATERIALS AND METHODS

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 fell for fuel wood.

Four 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. In depth 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. The environmental impact was assessed by conducting time-series analyses of satellite imageries such as LANDSATs over a period of ten years (2006-2016).

IV. RESULTS AND DISCUSSION

4.1 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. 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.

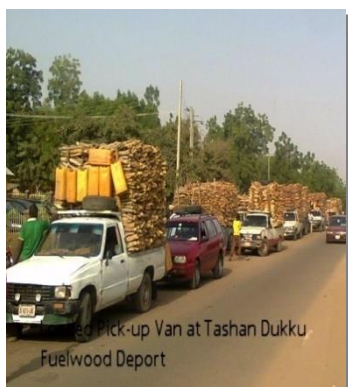


Plate 1 Plate 2 Plate 3

Plates 1, 2 & 3: Pick-up Vans loaded with fuel wood at selling point and a bundle of being measured.

4.2 The Pattern of Fuel Wood Supply to Gombe Urban Area and Its Environmental Implications on the Source Area

The exploitation of forest product in the name of fuel wood is in on the increase in the study area. This is mainly as a result of increase in family size, and the ever increasing prices of other alternative sources of energy. Consequently, this has no doubt a devastating impact on the environment.

This study focuses on the pattern of fuel wood supply to Gombe urban area and its environmental implication to the source areas. This was achieved through examining the temporal variation of fuel wood supply between seasons; the empirical estimate of daily supply of fuel wood into Gombe urban area, the reasons for use of fuel wood supply as well as find out the major participants of fuel wood business.

Four forest reserves were selected based on checklists of variables such as accessibility, safety, population pressure, fuel wood activities on gazette or non gazetted forests. Determinants of fuel wood such as quantity of fuel wood per kilogram per week, cost of the product, revenue generated, years of experience in the business and distance travelled to obtain the product were also be examined. Field observations, interview and questionnaire surveys were also used to generate data from the respondents. The respondents who were the major participants in the fuel wood business include fuel wood cutters, transporters also known as vendors, marketers (dealers and retailers) and other stake holders as well as farmers in close vicinity of the source areas.

The study reveals that the quantity fuel wood removed from the forest is over whelming even though it varies between the two seasons (dry and wet) as indicated in table 3 and 4 below.

Table 3: Daily-Trips of Pick up Van and Tonnage of Fuelwood during Dry Season

		DUKKU		BAUCHI		KUMO	
		Trips	Tonnes	Trips	Tonnes	Trips	Tonnes
Monday	6/3/2017	71	142	28	56	13	26
Tuesday	7/3/2017	81	162	30	60	14	28
Wednesday	8/3/2017	63	126	24	48	13	26
Thursday	9/3/2017	70	140	27	54	16	32
Friday	10/3/2017	51	102	31	62	15	30
Saturday	11/3/2017	70	140	28	56	17	34
Sunday	12/3/2017	82	144	27	54	17	34
		488	956	195	390	105	210
	Mean	69.71	136.57	27.86	55.71	15	30
	S.D	10.61	18.54	2.27	4.54	1.73	3.46
	C.V	15.22	13.57	8.14	8.14	11.55	11.55

Source: Field work, 2017

Table 3 gives a summary of daily import of fuelwood for seven consecutive days from various sources during dry season and different routes. The drop in supply during rainy season led to scarcity of the product. This is manifested in the way retailers are going to fuelwood depots and entry routes to wait for suppliers which is contrary to what is happening during the dry season.

Table 4: DailyTrips of Pick up Van and Tonnage of Fuelwood during Wet Season

		DUKKU		BAUCHI		KUMO	
		Trips	Tonnes	Trips	Tonnes	Trips	Tonnes
Monday	5/8/2017	38	76	11	22	9	18
Tuesday	6/8/2017	40	80	10	20	10	20
Wednesday	7/8/2017	41	82	12	24	9	18
Thursday	8/8/2017	47	94	15	30	8	16
Friday	9/8/2017	28	56	9	18	7	14
Saturday	10/8/2017	41	82	11	22	8	16
Sunday	11/8/2017	40	80	13	26	10	20
		275	550	81	162	61	122
	Mean	39.29	78.57	11.57	23.14	8.71	17.43
	S.D	5.71	11.41	1.99	3.98	1.11	2.23
	C.V	14.53	14.53	17.18	17.18	12.77	12.77

Source: Field work, 2017

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 on tables 3 and 4. Dukku road carries the largest percentage of supply (62%) of fuelwood followed by Bauchi road (19%), Kumo road (15%) and lastly Mallam sisi 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 sisi 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.

Volume of Fuelwood from the Sources

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 (Table 3). Most of the fuelwood were from the lands cleared for agriculture during the dry season. But during the rainy season the number of trips is expected to drop 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 carry large lots from virgin lands and forests of Gombe to Kano region. Other fuel wood exploitation taking places in the sources and impacting on the environment include, production of charcoal which involves burning full trees in ditches by fast fire on them.

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 players of fuel wood in Gombe state cut trees indiscriminately. Observation made and data collected revealed that some of the wood cutters used to select particular species of trees at the beginning of the business but could still either come back the remaining ones or due to scarcity of their choice of trees for fuel wood they travelled long distances to obtain these wood. Sometimes those trees left behind and those cut half way are cleared for farming activities.

4.3 The Socio-Economic Implications of Fuelwood Exploitation

Arguments show that it is particularly important to have detailed understanding of: the contribution of fuelwood to household economies and factors influencing household dependence on forests (including household wealth).

In doing so, we can begin to evaluate relationships between poverty and forest use and explore how social and economic issues impact fuelwood use and management. Shifting cultivation coupled with excessive deforestation for fuelwood has caused severe environmental degradation in some countries (FAO, 2009). This suggests that wood fuel extraction is contributing to forest degradation in areas very near to their locations. Fuelwood can also be important for socio-cultural reasons. For example, Muslims require wood for covering graves. Studies suggest that demand for wood fuels may increase as countries seek to find clean, green, efficient and cheaper alternatives to fossil fuels (FAO, 2010). "Perhaps the greatest environmental benefit of woodfuels is that, when produced and harvested sustainably, they provide a renewable source of energy with low net carbon emissions. Woodfuels are derived from vegetation that sequesters atmospheric carbon during growth, releases it to the atmosphere when converted to energy, and takes it back as it re-grows" (FAO, 2009).

The environmental effects associated with harvesting fuelwood are highly contentious and inadequately known in many sites. The findings of this study conforms with the notion, 'adverse environmental and socio-economic impacts can arise from unsustainable fuelwood harvesting and lead to fuelwood shortages and the degradation of natural forests (Adebaw, 2009)'. Regarding socio-economic impacts, fuelwood harvesting that depletes resource supplies can disproportionately impact poor households who are forced to either spend more time collecting fuelwood or pay high prices to buy wood or alternative energy sources. For such households, when fuelwood availability is extremely limited or costly, food production and consumption can be adversely affected. Furthermore there are gender-specific impacts. Fuelwood collection is generally considered to be women's work in some localities (FAO, 2009). Thus, FAO (2009) estimated that on average women spend 55% of their total labor gathering firewood, energy that would otherwise be spent gathering or producing food.

4.5 Woodfuel as Source of Household Income

The sale of fuelwood provides income for huge numbers of people. In the study area, the fuelwood sector employs about 10% of the population. With easy access to both resources and markets, very large numbers of landless and very poor gather and sell wood for fuel, and large numbers of farmers harvest and sell it as well.

V. CONCLUSION

This study provides an assessment of the impacts of fuel wood exploitation on the socio-economic environment in Gombe State. It involved 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 Nigeria which causes irreversible damage to the environment thereby leading to desert encroachment, economic problems 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 past. 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, climate change and poverty is too numerous and hard to bear.

VI. 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.

VII. 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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