

PATTERNS OF FIREWOOD EXPLOITATION AND UTILIZATION IN PERI-URBAN AND RURAL AREAS OF OWERRI ZONE IN SOUTHERN NIGERIA

Adeyemi, A. A. and Ibe, A. E.

ABSTRACT

Department of Forestry and Wildlife Technology, Federal University of Technology, Owerri, Nigeria
E-mail: adeyemiadesoji@yahoo.com; Phone: +234(0)8032082627

A study was conducted to assess the firewood extraction and utilization patterns in two local government areas of Owerri zone, Imo State, Nigeria. Purposive sampling technique was adopted for sites selection based on the prominence and prevalence of firewood extraction and utilization in the areas. Five communities each were chosen from the two local government areas. Both primary and secondary data collections were made. The primary data collection involved the use of a well-structured questionnaire, and the secondary data were obtained from National Bureau of Statistics' Annual Abstract of Statistics. The third part of data collection involved the measurement of the amount of firewood collected by individual using a weighing balance. Data were analyzed using descriptive statistics and t-test of significance. The result indicated that majority of the firewood exploiters were women, who are above forty years of age. The major sources of firewood in the area remain natural forests with only a fraction exploited from the farm/fallow lands. There was no established fuel-wood plantation in the area, and plan to establish such appears non-existent. The species mostly extracted are *Acioa barteri*, *Alconia cordifolia*, *Anthonatha macrophyllum*, *Dialium guinense*, *Harungana madagascariensis*, *Macaranga barterii*, *Milicia excelsa* and *Pentaclethra macrophylla*, with preference for *Acioa barteri*, *Dialium guinense* and *Pentaclethra macrophylla* due to their low moisture contents and ability to burn faster and efficiently. Firewood was exploited in both farming and off-farming seasons at varied degrees with most exploitation done in the off-farming season. Firewood was found to be more expensive during farming season. The most expensive species are *Dialium guinense*, *Macaranga barterii* and *Pentaclethra macrophylla*, which are sold for ₦18.18 each during the farming season, and ₦13.64 kg⁻¹, ₦15.21 kg⁻¹ and ₦15.21 kg⁻¹ respectively in the off-farming season. The result revealed that the average per capita firewood consumptions were 1.83±1.62 kg day⁻¹ and 2.15±0.94 kg day⁻¹ in Owerri North and West Local Government Areas respectively. The study shows that the patterns of exploitation and utilization in the area are not sustainable. It is therefore recommended that a strategy be put in place to ensure adequate replenishment to avoid over-exploitation, deforestation and environmental degradation.

Keywords: Firewood, species, extraction, consumption, season

INTRODUCTION

The strives for survival coupled with geometric population growth worsened by extreme poverty in most of the developing countries as well as the quest for more comfort are the major causes of natural resources depletion the world over. One of the environmental resources over-exploited in Nigeria without adequate replacement is forest resources, especially wood products (Audu, 2013a). According to Olanrewaju and Ogunleye-Adetona (2000), fuel-wood extraction is one of the causes of climate change. The search for fuel-wood is said to be one of the primary causes of deforestation in developing countries (Mallo and Ochai, 2009). Furthermore, it has been noted that fuel-wood harvesting is a major cause of the massive destruction of the indigenous trees in many parts of Nigeria. Ayuba and Dami (2011) also pointed out that the demand for fuel-wood is a major cause of deforestation in northern Nigeria. Moreover, deforestation, as one of the anthropogenic activities, is contributing to erosion, flooding, loss of soil nutrients, poor agricultural produce, global warming, climate variability, climate change and desertification (Audu, 2013a).

Fuelwood provides energy for rural household, employment and income for rural farmers, and is a part of the energy requirement for cooking in urban areas throughout Nigeria (Moss and Morgan, 1981). Although it was generally assumed that rural households in the humid forest zone of Nigeria did not suffer from fuel-wood scarcities (Oguntala, 1986), the recent trend of exploitation shows that this assumption has been overtaken. On the average, an individual consumed an estimated value of between 1.9 and 4.0 kg of fuel-wood per day in Nigeria (Ikurekong *et al.*, 2009), with no reasonable annual replenishment of our forests.

Majority of people in peri-urban areas of Owerri zone, particularly the Owerri North and West Local Government Areas of Imo State depend mainly on fuel-wood for domestic cooking as well as small-scale processing such as *garri* and palm oil processing. Generally, the use of electricity for cooking in Imo State is very poor, as it is the case in every other part of the country, due, probably, to the epileptic power supply in the country. The use of gas is also low, not because of non-availability, but due to unpopularity, poor technology and ignorance, as cooking gas is usually flared to give way to the exploitation of crude oil (Audu, 2013b). Kerosene is the second major source of domestic energy in Nigeria, but its use is often not smooth due to scarcity and high purchasing cost

(Audu, 2013a). It has been established that kerosene is mostly used in urban areas of Nigeria (Akwa *et al.*, 2008; NBS, 2009).

Audu (2013a) has described Nigeria as a rich country in disguise leading to high poverty rate especially in rural areas as well as unemployment. Many Nigerians live below poverty level and as such cannot afford the cost of kerosene, which is now an essential commodity and more expensive than premium motor spirit (petrol). For instance, as petrol is sold for ninety seven naira (₦97.00) per litre, equivalent quantity of kerosene sell at hundred and thirty naira (₦130.00) in most filling stations across the country with long queues. This makes most Nigerians to depend on “nature” for fuels, hence high rate of fuel-wood consumption, leading to unsustainable extraction and depletion in most cases.

Despite the fact that most energy demands in Owerri North and Owerri West Local Government Areas of Imo State are met with fuel-wood, there is dearth of information on the common fuel-wood species, their sources, pattern of extractions as well as marketing and consumption of the products. The knowledge of the quantities of each species extracted is crucial for sustainable management strategies for the species mostly exploited. Furthermore, the key players as well as the measures put in place by the stakeholders to ensure that this all-important product is available on sustainable basis are unclear. The objective of this study is to document fuel-wood extraction, marketing and consumption patterns of this resource in the two local government areas of the state.

MATERIALS AND METHODS

The study was conducted in Owerri North and West Local Government Areas of Imo State, Nigeria. Owerri North is a peri-urban area. It encircles Owerri Municipal like a peninsular. The Owerri West Local Government Area on the other hand, is located at the rainforest zone about 120km North of the Atlantic Coast and shares boundaries with Ngor Okpala Local Government Area in the South, Owerri Municipal Council by the East, Mbaitoli Local Government by the North, and Ohaji Egbema Local Government (which houses Ohaji forest reserve) by the West. Owerri North and West Local Government Areas have land areas of 198km² and 295km² and populations of about 175,395 and 117,492 people respectively (NPC, 2006). The two local government areas have population densities of 886 and 398 individuals per square kilometres respectively. The chief occupation of the people in the area is farming. There are also *garri* and palm oil processing activities as well as non-timber forest product exploitation and marketing in the two local government areas among others.

Purposive sampling technique was adopted for study sites selection based on the prevalence of fuel-wood extraction, marketing and utilization in the selected local government areas. Five communities, each, where stakeholders were very active in fuel-wood marketing and utilization, were chosen from the two local government areas for the study. In the Owerri North, the communities chosen include: *Agbala* (5.428°N; 7.082°E), *Obeke* (5.377°N; 7.049°E), *Oratta* (5.500°N; 7.052°E), *Orji* (5.526°N; 7.061°E) and *Ulakwo* (5.409°N; 7.121°E); while *Ezeobodo* (5.367°N; 7.004°E), *Ihiagwa* (5.398°N; 7.006°E), *Irete* (5.516°N; 6.976°E), *Oroewe* (5.542°N; 6.982°E) and *Ubomiri* (5.539°N; 7.014°E) were chosen in the Owerri West (Fig. 1).

Three methods of data collection were employed. First, well-structured questionnaire was developed and used for primary data collection from the targeted respondents (fuel-wood collectors, marketers and consumers). Thirty (30) copies of the questionnaire were administered in each of the study sites (communities) in the two local government areas. A total of one hundred and fifty (150) copies of questionnaire were used in each of the local government areas, making a total of three hundred (300) copies of the questionnaire for the study. Three key aspects of the firewood business (harvesting, marketing and consumption) were adequately captured in the research instruments. Both closed- and open-ended questions were asked. Also, focused group discussions were conducted in three, each, of the five communities in the two local government areas to ensure that the information on the entire feelings of the stakeholders in the fuel-wood business were well-captured. Secondary data on firewood consumption in Imo State were sourced from National Bureau of Statistics' Annual Abstract of Statistics (2009). The third part of data collection involved the measurement of the amount of fuel-wood collected by individual using a weighing balance.

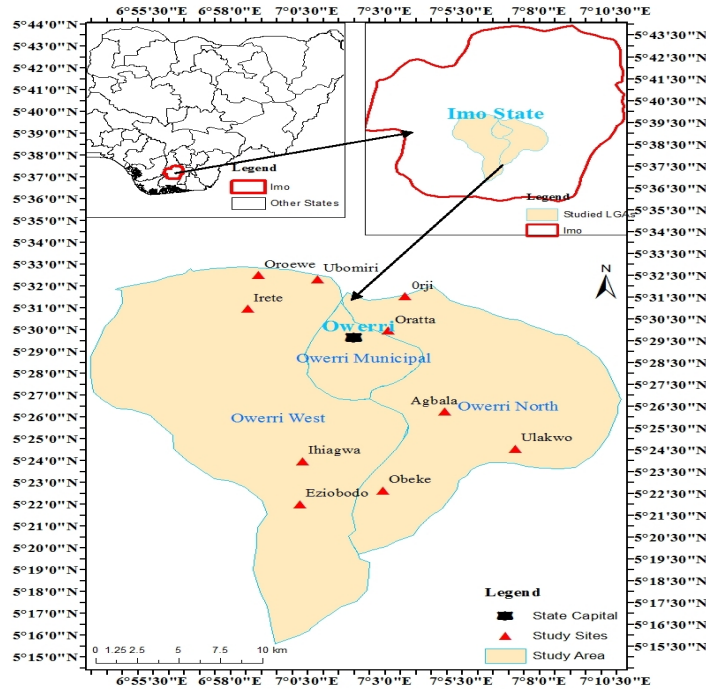


Fig.1: Map of the study area showing the study sites (communities)

Data were analyzed using descriptive statistics such as frequency and percentages for gender and age of the fuel-wood collectors and marketers in the area; means for the average per capita fuel-wood consumption in the two local government areas; and graphs for the households cooking means in the state. Student 't' statistics was used for comparing the impacts of seasonal variation on the quantities of fuel-wood exploited and prices of the products in the two local government areas.

RESULTS AND DISCUSSION

The result shows that about 90% and 92% of the people engaged in firewood collection in Owerri North and West local government areas were females, while only 10.30% and 7.60% of the respondents were males respectively (Table 1). More than half of these women (63% and 67%) in the two local government areas respectively were above 50 years of age. About 19% of the respondents were between 40-50 years of age while only 4.30% and 4.10% were between 20-30 years of age (Fig. 2). This implies that fuel-wood exploitation in the area is dominated by women, who are aged. Only few youth are engaged in the business. Male counterparts were more involved in transportation of fuel-wood to locations, where the firewood are marketed as well as to the points of consumption (for medium and large-scale consumptions). This may be due to the fact that women in the southern part of Nigeria are more involved in household duties of which cooking is a key aspect, and they must source for fuels to do so. Men are involved in other activities such as transportation and petty trading. A similar case has been reported by Muregerera (2008), who noted that firewood collection is done mostly by women compared to their male counterparts. This is also in consonance with the findings of Ikurekong *et al.* (2009) that most of the firewood are exploited by women, who concentrate more on cutting and picking of the fallen dead woods.

This finding however, disagrees with the report by Sultana (2012) that the far distance travelled by men to collect firewood may not favour women, who would not be able to leave their household responsibilities to travel greater distances for firewood collection. The result also shows that most of the respondents are above 40 years of age with the majority of them greater than 50 years. This may be due to the fact that majority of women in this category usually lack enough money for a better business, and since fuel-wood exploitation in this area requires no capital. They all fall back to forest resources because of their open-access nature. This is supported by the submission of Webb and Arun (2010) that most of fuel-wood collectors were within the age range of 40 and 86 years. In another study, Mohammed and Oyeniyi (2012) reported that younger women are married in *purdah*, and they are in seclusion, they are not expected to go out to the field to source firewood, only the older women are expected to engage in such activity.

Table 1: Gender distribution of respondents in the study sites

Gender	Owerri North LGA		Owerri West LGA	
	Frequency	%	Frequency	%
Male	15	10.3	11	7.6
Female	135	89.7	139	92.4

Table 2 presents the sources of the firewood marketed and consumed in the study area. Eight wood species are commonly exploited and used as firewood in the study area. The result shows that most of the species are collected from the natural forests. For instance, about 96% and 90% of *Anthonatha macrophylla* and *Milicia excelsa* respectively were extracted from the natural forest with only 3.80% and 9.70% of the two species collected from the farm/fallow lands respectively, and nothing was collected from planted stand. The percentage of *Dialium guineense* and *Macaranga barteri* extracted from natural forests were 76.80% and 68% respectively. For these two species, only 23.20% and 32% were collected from the farm/fallow land with nothing from the planted stand. For *Pentaclethra macrophylla* and *Alchornea cordifolia*, about 67% and 62% were being collected from natural forests with only 33% and 38.20% of the total collection coming from the farm/fallow lands. However, 88.10% and 51% of *Harungana madagascariensis* and *Acioa barteri* were collected from farm/fallow lands in the area. Only 11.90% and 49% of the two species respectively were being collected from natural forests. This has been the trend in firewood extractions especially in developing world. For example, Hassan *et al.* (2002) reported that South Africa's rural households are highly dependent on natural woodland and forest resources for fuel and as a source of income. This may also be due to the 'open-access' nature of forest resources and high levels of poverty in the study area. This findings is supported by the work of Maphiri (2009), Prasad and Visagie (2005), who independently reported that open access, high levels of poverty, weak management regimes and lack of coordination between local and traditional governance on local woodlands and forests have led to over-exploitation of woodland and forestry resources. The firewood extraction in the study area attracts no cost, and it is virtually done without replenishment. Fortmann *et al.* (1997) reported a similar case in Zimbabwe and noted that women were also significantly less likely to plant trees for fuel-wood in areas where future access is uncertain. In other words, extractions are concentrated mostly in the natural forests resulting in over-exploitation. In all the sites visited, no fuel-wood plantation existed, and there is plan to put any in place in the shortest possible time. Considering the energy demands of some the activities engaged in by the various households as well as the domestic energy requirement in the area, one would expect that firewood plantations would be a common place. For example, there are various mini *garri* and palm oil processing factories, which are highly energy-demanding, it is expected that a provision would have been made to ensure a continuous supply of fuel-woods. However, such is not the case in the area. For *Harungana madagascariensis* and *Acioa barterii*, which have larger percentage of fuel-wood materials being collected from the farm and fallow lands, it may be due to the fact that these two species are mostly found in the free areas due to their shrubby nature and reduced canopies, which cast less shade on the arable crops. Therefore, some of their stems are usually spared during land clearing for agricultural purposes, hence, their presence on farm and fallow lands in the area.

Table 2: Sources of firewood marketed and consumed in the study area

S/N	Species	Local name	Sources		
			Natural forest	Planted stand	Farm/fallow land
1	<i>Acioa barterii</i>	<i>Ahaba</i>	49%	-	51%
2	<i>Alchornea cordifolia</i>	<i>Ububo</i>	61.8%	-	38.2%
3	<i>Anthonatha macrophylla</i>	<i>Ububa</i>	96.2%	-	3.8%
4	<i>Dialium guineense</i>	<i>Icheku</i>	76.8%	-	23.2%
5	<i>Harungana madagascariensis</i>	<i>Ututru</i>	11.9%	-	88.1%
6	<i>Macaranga barteri</i>	<i>Owariwa</i>	68%	-	32%
7	<i>Milicia excelsa</i>	<i>Oji</i>	90.3	-	9.7%
8	<i>Pentaclethra macrophylla</i>	<i>Ugba</i>	67%	-	33%

Table 3 shows the result of the quantities of firewood collected per week during farming and off-farming seasons for the eight species and their respective prices/kg. The result revealed that between 22 and 300 kg of *Dialium guineense* are collected per person in a week during the farming season while between 22 and 450 kg are collected per person in a week during the off-farming season. For the *Anthonatha macrophyllum*, between 18 and 250 kg are collected per person in a week during the farming season while between 20 and 340 kg are collected in the off-farming season. Between 22.4 and 350 kg of *Acioa batterri* are collected by an individual during the farming season while between 25 and 500 kg are collected in the off-farming season by one person in a week. For *Milicia*

excelsa, between 20 and 200 kg are collected per week during the farming season while between 25 and 350 kg are collected in the off-farming season by an individual. With respect to *Alconia cordifolia*, between 20 and 350 kg are collected per week during the farming season while between 40 and 500 kg are collected in the off-farming season by an individual. The amount of *Macaranga barteri* collected per week during the farming season ranges between 15 and 180 kg while between 22 and 300 kg are collected per week in the off-farming season by a single individual. For the *Harungana madagascariensis*, between 23 and 180 kg are collected per week in the farming season while between 50 and 500 kg of the species are collected during the off-farming season by an individual. The most expensive species were *Dialium guinense* (Icheke), *Macaranga barteri* (Uturu) and *Pentaclethra macrophylla* (Ugba), which are sold for ₦18.18 each during the farming season, while the prices of the three species in the off-farming season reduce to ₦13.64 kg⁻¹, ₦15.21 kg⁻¹ and ₦15.21 kg⁻¹ respectively. *Acioa batterii* and *Harungana madagascariensis* are sold for ₦17.85 kg⁻¹ and ₦17.39 kg⁻¹ respectively during the farming season. In the off-farming season, these two species are sold for ₦13.39 kg⁻¹ and ₦15.21 kg⁻¹ respectively. For *Milicia excelsa* and *Alconia cordifolia*, the fuel-woods go for ₦13.51/kg each during the farming season and ₦11.26 kg⁻¹ each in the off-farming season for the two species. *Anthonatha macrophyllum* is the lowest priced in the area, being sold for ₦13.27 kg⁻¹ during the farming season, and ₦11.06 kg⁻¹ in the off-farming season.

Table 3: Quantity of species collected per person and their corresponding prices kg⁻¹

S/N	Species	Local name	Quantity per person per week (kg)		Amount kg ⁻¹ (Naira)	
			FS	OFS	FS	OFS
1	<i>Acioa batterii</i>	<i>Ahaba</i>	22.4-350	25-500	17.85	13.39
2	<i>Alconia cordifolia</i>	<i>Ububo</i>	20-350	40-500	13.51	11.26
3	<i>Anthonatha macrophyllum</i>	<i>Obuba</i>	18-250	20-340	13.27	11.06
4	<i>Dialium guinense</i>	<i>Icheke</i>	22-300	22-450	18.18	13.64
5	<i>Harungana madagascariensis</i>	<i>Uturu</i>	23-180	50-500	17.39	15.21
6	<i>Macaranga barteri</i>	<i>Owuriwa</i>	15-180	22-300	18.18	13.64
7	<i>Milicia excelsa</i>	<i>Oji</i>	20-200	25-350	13.51	11.26
8	<i>Pentaclethra macrophylla</i>	<i>Ugba</i>	23-180	50-500	17.39	15.21

FS: farming season; OFS: off-farming season

Table 4 shows average per capita firewood consumption in the two local government areas of Imo State. The result revealed that an average of 1.83±1.62 kg of firewood is consumed per person in Owerri North on daily basis. An average of 2.15±0.94 kg of firewood is consumed per person in Owerri West of Imo State. The quantities of firewood consumed per head in the two local government areas fell within the 1.9 and 4.0 kg range reported by Ikurekong *et al.* (2009) in a Nigeria coastal settlement. However, these values are more than country average per capita consumptions of between 0.5 and 1.0 kg reported by Ohunakin (2010). This may probably be due to the fact that his work included data from urban areas of the country, which may have significantly influenced the range of values reported. It may also be as a result of the fact that majority of the people in the area depend largely, if not solely on firewood as a means of cooking both for domestic and commercial purposes.

Table 4: Per capita firewood consumption in Owerri North and West LGAs

LGA	Population size	Average household size	Per capita fuel-wood consumption
Owerri North	175,395	6±2	1.83±1.62 kg
Owerri West	117,492	6±3	2.15±0.94 kg

LGAs: local government areas

The result of the general means of cooking in Imo State is presented in Fig.3. The result revealed that majority (85.10%) of the households in the state cook with firewood. Only 13.60% of the households in the state are dependent on kerosene for their cooking. Electricity, gas and charcoal as means of cooking are seemingly unpopular with only 0.20%, 0.70% and 0.40% respectively of the households in the state depending on them. This may be due to the fact that these other means of cooking in the area are considered expensive and unaffordable. A similar case has been reported by Polestico (2002), that rural women energy consumption pattern in most developing countries are characterized by a high dependence on biomass resources, with cooking as the primary end-use.

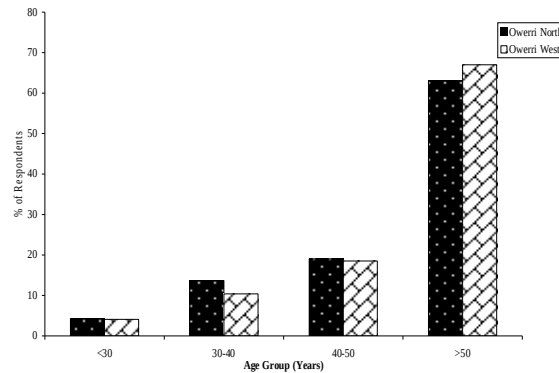


Fig. 2: Age distribution of respondents in the study sites

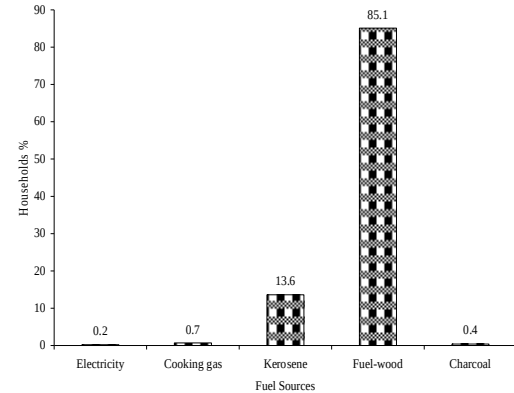


Fig. 3: Means of cooking in the study area

The results of the t-tests for the comparisons of firewood quantities and prices during farming and off-farming seasons are shown in Table 5. The result revealed that there is a significant variation in the average quantity (139.3 kg and 216 kg) of fuel-woods extracted/week per person in the two seasons ($p=0.0042$). However, there is no significant variation in the average prices/kg of firewood during farming and off-farming seasons ($p=0.015$). For all the eight species of firewood commonly exploited and utilized in the study area, collections are made during farming and off-farming seasons with lesser quantities being extracted during the farming season. The prices of all the eight firewood species were also higher in the farming season than off-farming season. The higher prices may have stemmed from inadequacies and scarcity of the products during the farming season, since fewer individuals engaged in firewood collection compared to the off-farming season. On the other hand, the higher value range in the off-farming season may be due to the fact that more hands are engaged in the collection because farming activities are usually reduced considerably during this period. This is in agreement with the finding of Jaiswal and Bhattacharya (2013) that because of people involvement in the farming activity, they prefer major fuel-wood collection before their active farming activity in order to save quality time required for agricultural production.

Table 5: T-test results for firewood amount and price variations in the two seasons

Variable	Season	N	Mean	Std. Dev.	t-cal	P-value
Quantity	Farming	7	139.3kg/week	±38.3	3.60	0.0042
	Off-farming	7	216.7kg/week	±42.1		
Prices	Farming	7	15.98 (NGN)	±2.41	2.94	0.0150
	Off-farming	7	12.78 (NGN)	±1.60		

$\alpha = 0.05$

CONCLUSION

This study has given an insight into the pattern of firewood exploitation and consumption in the Owerri North and West Local Government Areas of Imo State in Southern Nigeria. It was discovered that most of the firewood exploitation in the area are women-dominated, with majority of the women more than forty years of age. Eight important wood species mostly sought-after in the study area are *Acioa batterii*, *Alconia cordifolia*, *Anthonatha macrophyllum*, *Dialium guinense*, *Harungana madagascariensis*, *Macaranga barteri*, *Milicia excelsa* and *Pentaclethra macrophylla*. Sadly, in spite of the fact that these species are very essential, no plantation of any existed in the area. Therefore, their exploitations for firewood are wholly done in the natural forests. Considering the several tonnes of firewood extracted in the area on annual basis, deforestation, degradation, and the associated adverse environmental conditions may be unavoidable in the nearest future since most of these species takes several years to grow to fuel-wood sizes. Moreover, some of the species (e.g. *Milicia excelsa*) require rigorous manipulations for them to thrive, and this can be costly. It is therefore recommended that the stakeholders are sensitized and encouraged to plant trees, especially the preferred species in the area. Governments at state and local levels can also incentivize tree planting campaign and actual planting in the concerned communities.

The consumption of firewood in the area seems to be above the national average. This is expected because of its peri-urban and rural nature on one hand, and the nature of activities engaged in the area coupled with the poverty situation in the two local government areas, which may have led to the over-dependent on fuel-wood resources. It is recommended that Government provides alternative cooking means in the area, while given due consideration

to joint forest management, in which the affected communities are seen as part of forest managers with a significant contribution to the decision-making and benefit sharing.

It also recommended that a law be promulgated and enforced to ensure that anybody engaged in firewood collection should be made to replenish, at least 200% of what is extracted on annual basis. And each household should be encouraged to establish fuel-wood plantations of choice-species, where personal and family exploitations can be carried out to meet household energy needs. This would ensure sustainability of the forest resources and environmental safety in the study area. Failure to consider these and act fast may pose further threat to the remaining forest tracts in the area.

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