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MAPPING OF FUELWOOD MARKETING POINTS AT KIYAWA TOWN, JIGAWA STATE, NIGERIA

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ABSTRACT

Fuelwood is essential resource for the survival of most households in Nigeria because it provides energy to light, heat, and cook. This study was conducted to map out fuelwood marketing points in Kiyawa with a view to providing baseline information for future studies on woody species decline in the area. Garmin GPS (76cxs) was used to collect the coordinates of all fuelwood marketing points in the area while structured interview was used to identify the prevalent fuelwood species. ArcGis 10.2 was used to map out the marketing points while simple percentage was used to analyze the perceptions of the participants on the reason for choice of fuelwood species. This study found a total of 25 major fuelwood marketing points in the area. These serve as pools for stockfiling fuelwood sourced from the surrounding bushes and woodlands in northeastern Nigeria. A total of 16 species were identified at the marketing points out of which 14 are woody. The most prevalent wood fuel species located at the marketing points include *Parkia biglobosa* (10 locations), *Azadirachta indica* (7 locations) and *Anogeissus leiocarpus* (4 locations). The most preferred wood fuel species are *Balanites aegyptiaca*, *Parkia biglobosa*, *Azadirachta indica* and *Piliostigma reticulatum*. Reasons advance for choice of those species include its availability at the marketing points (50%), cost (28.57%) and wood quality (21.43). This study therefore recommended that policies and programmes should be mounted to combat over-exploitation of the prevalent plants in order to avoid the danger of extinction.

Keywords: fuelwood, energy, bio-resources, woody species,

INTRODUCTION

Fuelwood is a source of energy derived by burning wood materials like logs and twigs and is common among the rural dwellers (FAO, 2001). It is a vegetal resource which provides the main source of domestic fuel for both the rural and urban household (Ikurekong *et al*., 2009). Fuelwood serves foremost as a cooking energy for households in the absence of accessible and affordable alternative energies (Zaku Kabir, Tukur & Jimento, 2013).

Fuelwood still remain the most important energy source for humankind, excluding the short industrial era that began in the 18th century (de Vries, van Vuuren, & Hoogwijk, 2007). Today, wood used as fuel (wood-fuels — i.e. firewood and charcoal) still accounts for around 10% of the global energy supply. It dominates energy provision in many parts of the developing world, particularly remote communities. Over 90% of the population in sub Saharan Africa relies on wood-fuels (United Nations Convention to Combat Desertification, 2015). Approximately 2.5-3.0 billion people (40-50%) of the world population rely on wood for fuel, both for warmth and food preparation (FAO, 2001; Adeniyi & Felix, 2011). In developing countries, fuelwood often contributes to over 50% of final energy consumption, and is usually directly combusted as either firewood or charcoal (UNECE/FAO, 2009). In Nigeria, daily consumption of firewood by the rural communities in Nigeria is estimated at 27.5 million kg/day (Ogunsanwo & Ajala, 2002). In 2005, the amount of fuelwood removed from forests in Nigeria was 72,710,935 m^3 (FAO, 2005). These justify the dominant contribution of fuelwood in the energy sector especially in developing countries.

The technology for harvesting, preparing, and burning firewood is simple and cheap, enabling practically all people, especially those in rural areas of the world, to use this form of energy. Thus, fuelwood dependence and exploitation is likely to persist for decades to come in Africa and this has significant consequences for forest resources (United Nations Development Programme, 2004). Records available projected that the global production of wood fuel is expected to increase moderately from 1885 million m^3 in 2000 to 1921 million m^3 in 2020. This shows the demand scenario of wood fuel, which is increasing rather than decreasing worldwide (FAO, 2005). This high consumption of fuelwood will led to new challenges of land degradation and forest over-exploitation in most African countries including Nigeria. Informal and uncontrolled fuelwood harvesting often associated with over exploitation will led to land conversion which turns biodiversity rich landscapes less productive (Spangenberg & Settele, 2009). Increasing demand for fuelwood leads to both direct and indirect

destruction of pristine areas, resulting in further habitat loss and negative impacts on biodiversity (Preston, 2012).

The replete of literature on fuelwood in Nigeria and the Kano Region in particular includes: Cline-cole *et al.* (1987), Nichol (1989), Machonacie, Tanko & Zakariya, (2009) and Kiyawa (2014) which provided in depth knowledge on fuelwood, its harvesting and effects on species in the Region. Available information from those works showed that although alternative energy sources are versatile in the area, several households do not utilize them because fuelwood is more available at marketing points. However, this commercialization is indeed the biggest threat to plants in the area because domestic use has not threatened sustainable exploitation. Because the demand for wood biomass will increase in developing countries (UNECE/FAO, 2009), important concerns including plant diversity loss need to be addressed. The aim of this study is to map fuelwood marketing points in Kiyawa town with a view to providing information for future studies on woody species decline in the area as well as developing regulatory framework for controlling unsustainable practices since lack of it poses serious threats to the sustainability of the resource base which provide wood.

Study Area

Kiyawa town is located in Jigawa State, Northwestern Nigeria. It is located between latitude 11º47'05'' and 11º48'02'' and longitude 9º35'00'' and 9º38'04'' (Figure 1). The estimated population of Kiyawa is put at 200,845 inhabitants with the area majorly populated by Hausa and Fulani ethnic groups (National Population Census, 2006). Kiyawa has an average temperature of 34^0C and witnesses two major seasons namely dry and wet coded as Aw in the Koppen's classification (Olofin, 1987). The natural vegetation types of the area are characterized by moderately tall grasses and scattered trees. Vegetation in Kiyawa is composed of indigenous species which grow spontaneously. The trees found include *Parkia biglobosa, Phoenix dacylifera, Adansonia digitata, Fadherbia albida, Tamarindus indica*, and *Borassus aethiopum*, and exotic species *Azadirachta indica.* However, due to high level of human activities, it is difficult to claim the existence of natural vegetation.

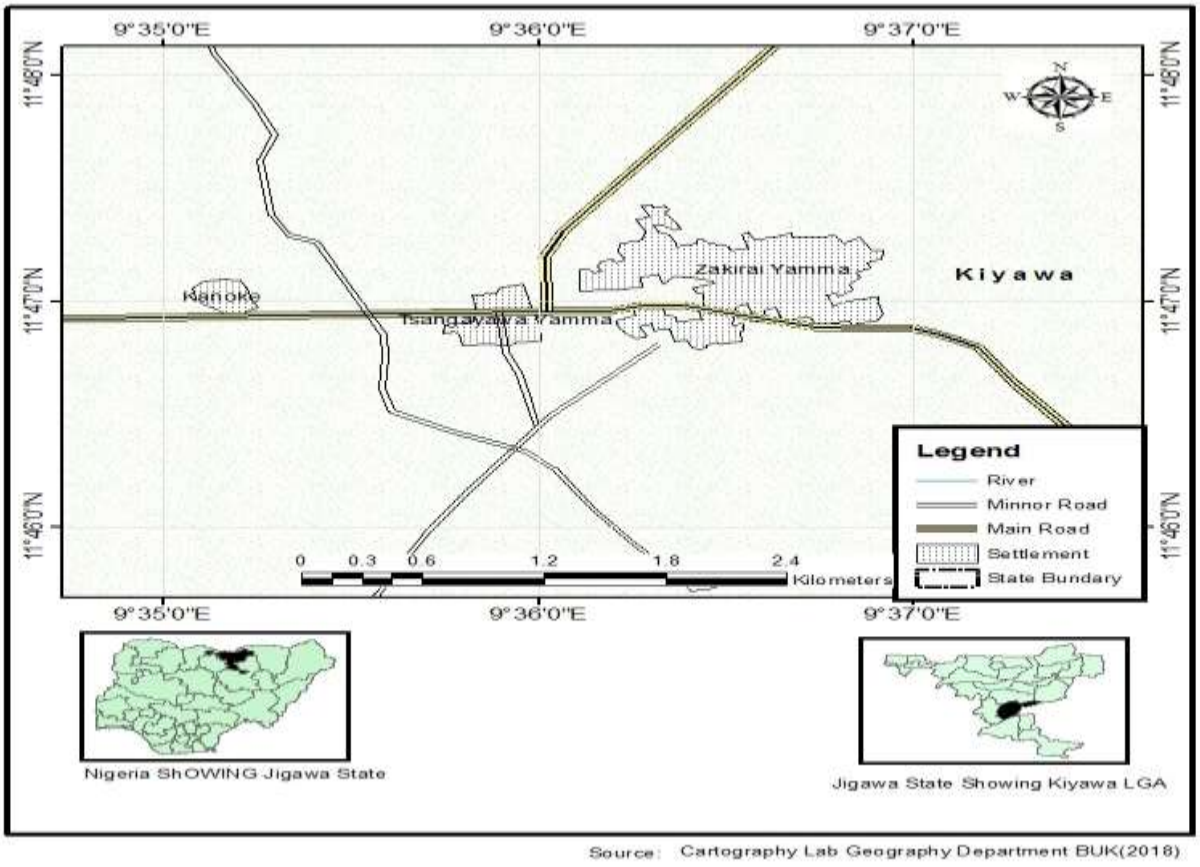

Fig. 1: Map of Kiyawa Town, Jigawa State, Nigeria

MATERIALS AND METHODS

Reconnaissance survey was conducted to identify wood marketing points in the area and to elicit information about fuelwood marketing in the study area. A total of 25 participants (fuelwood marketers) between the ages of 42 and 60 were sampled using snowball sampling procedure. The participants

are all male household heads with 5-14 members. These families have implication on rural energy consumption pattern.

A GPS (Garmin 76csx) was used for taking the co-ordinates of each fuelwood marketing point in the area. The GPS was placed at the top of each heap in a fuelwood marketing point and then allowed to settle for two minute. Co-ordinates were then taken by a field assistant. Observation was also made to identify the fuelwood species in marketed at the point. This was complemented with an interview with the participants using checklist. The interview was done to elicit information on the most preferred and prevalent fuelwood species and source of Fuelwood of the marketing point. Local names of the encountered fuelwood species was collected as well as pictures of the area.

ArcGIS 10.2 software was used for mapping of the marketing points. Data of preferred and prevalent species was presented in tables. Data on the reasons for choice of preferred species were analysed using percentages while the sources of fuelwood of the marketing points were highlighted in various sections of the discussion.

RESULT AND DISCUSSION

Map of Fuelwood Marketing Points

A total of 25 wood marketing points were mapped (Figure 2). The map showed that the marketing points are distributed unevenly in the area although there is clustering towards the main road leading to Bauchi. This distribution showed that the marketers prefer such location because it is near the weekly market and beside the road to Bauchi where more buyers can be attracted.

All of the fuelwood selling points are located within the settlement except two in order to secure their product from pilferers. This corroborates Gbadegesin and Olorunfemi (2011) who reported that most fuelwood sellers use depots located within their settlements where they can use stores or simply stack the bundles of fuelwood in front of their residence in Ijebu-Jesa/Efon Alaiye and Minna thereby safeguarding their wood against would be pilferers. Locating the fuelwood marketing point close to residence is a way of maximization by ensuring that at least someone is around to attend to buyers who may come at awkward times (e.g. at night) to buy fuelwood when they run out of supply while cooking. This is also to ensure easy access to buyers.

This soaring number of fuelwood marketing points in Kiyawa town and their proliferation depicted a serious concern for diversity conservation. Currently about 119 plants are threatened owing to wood related activities in Nigeria (FAO, 2014). The alarming rate at which plants are exploited in the hinter land and forest in northern Nigeria underscores the need for a large amount of data for securing appropriate conservation measures in the area. With fairly well known major marketing points in the area, it is easy to show commitments to habitat protection.

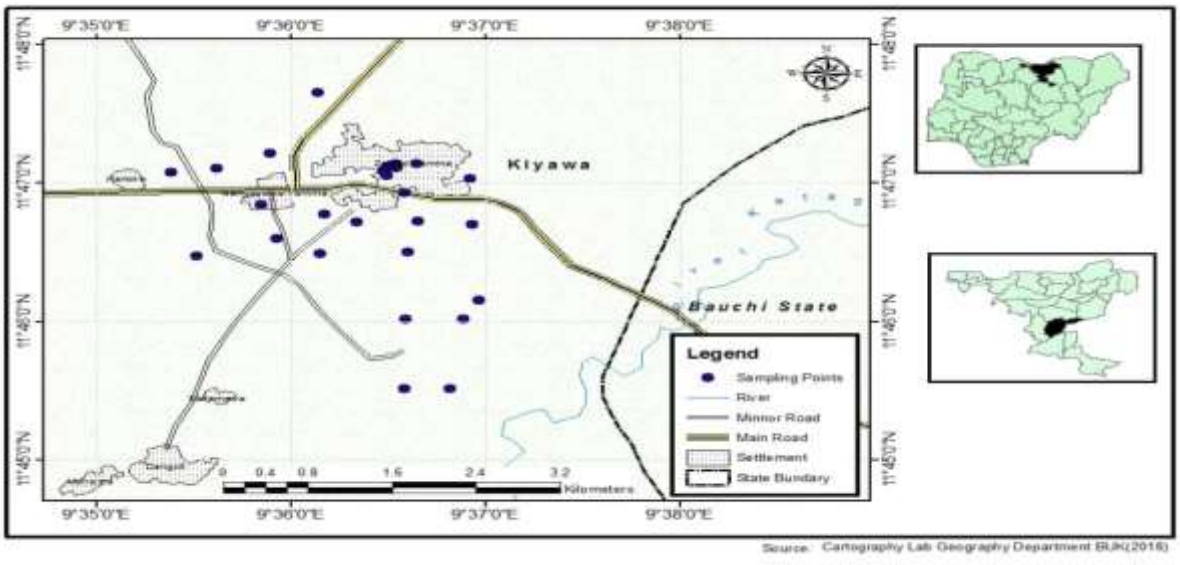

Fig. 2: Fuelwood Marketing Points in Kiyawa Town, Jigawa State, Nigeria

Wood fuel Plants Encountered in the Study Area

The use of plants for fuelwood is as old as human civilization. In Nigeria, wood is the major source of energy. Plants are used foremost as energy source for cooking in households in the absence of accessible and affordable alternative energy sources. A total of 16 plants used for fuelwood were identified in Kiyawa Town. With the exception of *Gueira senegalensis* and *Combretum micranthum* all the others are woody (Table 1).

Additionally, *Azadirachta indica* (14.11%), *Diosphros mespiliformis* (12.94%), and *Proposis africana* (11.76%) were the most commonly identified fuelwoods at the marketing points (Table 1). This indicated that the dependency of the rural people on woody species is high in the study area. This finding is in line with Sharma & Samant (2014) who reported total 45 species (33 trees and 12 shrubs) belonging to 23 families were used as fuel by the inhabitants in Pradesh North Western Himalaya. Rosaceae and Pinaceae were the dominant families (5 species each); followed by Moraceae (4 spp.); Fagaceae, Lauraceae and Meliaceae (3 spp. each). *Quercus leucotrichophora*, *Rhododendron arboreum*, *Neolitsea pallens*, *Pinus wallichiana*, *Berberis lycium*, *Sorbaria tomentosa*, *Alnus nitida* and *Desmodium elegans* were contributed most to collections as fuel. This study also corroborates Abui et al. (2014) who reported that most of the fuelwood in Gora Area in Zangon Kataf Local Government Area, Kaduna State originates from *Gmelina Aborea, Mitryana Inermis, Prosopis africana* and *Comberetum micranthum. Butyrospermum parkii* and *Balanite aegyptiaca* are least encountered species in the area probably because they are infrequent in bush and forest reserves in the area. This was reported by Danjuma (2017) that the species are disappearing in common landscapes in northwestern Nigeria.

Table 1: Fuelwood Species in the Study Area

SN	Type of Plants	Local Name (Hausa)	Lifeform	Frequency (number of times the species was located in fuelwood marketing points)	Percentage
1	*Gueira senegalensis*	Sabara	Shrub	09	05.29
2	*Combretum micranthum*	Geza	Shrub	17	10.00
3	*Diosphros mespiliformis*	Kanya	Tree	22	12.94
4	*Piliostigma reticulatum*	Kalgo	Tree	11	06.47
5	*Parkia biglobosa*	Dorowa	Tree	07	04.11
6	*Ficus iteophylla*	Shiriya	Tree	05	02.94
7	*Azadirachta indica*	Maina	Tree	24	14.11
8	*Ficus thonninngii*	Chediya	Tree	12	07.05
9	*Acacia sieberina*	Farar kaya	Tree	03	01.76
10	*Anogeisus leiocarpus*	Marke	Tree	13	07.64
11	*Proposis africana*	Kirya	Tree	20	11.76
12	*Ficus sycomorus*	Baure	Tree	10	05.88
13	*Vitex doniana*	Dunya	Tree	05	02.93
14	*Acacia nilotica*	Bagaruwa	Tree	06	03.52
15	*Balanite aegyptiaca*	Kanya	Tree	04	02.35
16	*Butyrospermum parkii*	Kadanya	Tree	02	01.17
				170	100.00

Source: Field work (2018)

Butyrospermum parkii (01.17), *Acacia sieberina* (01.76%), and *Balanite aegyptica* (02.35%) are not frequently identified in the marketing points. This is because their density is reducing on farmland and near sources making it difficult for the suppliers to have enough for supply. Danjuma (2017) has found that the density of these species in northwestern Nigeria has drastically declined owing to over exploitation of their resources. Particularly, *Butyrospermum parkii* has significantly decline owing to exploitation of its butter leading to the death of the mother trees.

Preferred Fuelwood Species in the Study Area

A total of five species were preferred by local people in the area (Table 2). Local perception shows that 40% preferred *Azadirachta indica* because of its availability. Another 24% preferred *Proposis africana* because of their high quality in terms of heat output, good combustion and their potential to produce less smoke even when they are wet (during rainy season). This finding corroborates Wakili, Abdullahi, Gani & Bello (2012) who reported that *Anogeisus leiocarpus*, *Prosopis africana*, *Guiera senegalensis*, *Piliostigma reticulatum*, *Combretum* and *Bauhinia rufescens* are the most preferred fuelwood species in Bauchi State due to their high combustion

rate. It also supports Abdul-Hadi (2016) who found that *Azadirachta indica* and *Proposis africana* are most preferred in Zaria and its environs. *Combretum* species were the preferred species in Sokoto State (Isah, Shamaki, Yakubu, Babangida & Musa, 2016). The most preferred tree in Jos Plateau is *Anogeissus Leiocarpus* (Makinde, 2017).

Table 2: Preferred Fuelwood Species in the Study Area

SN	Types of Plants	Local Name (Hausa)	Frequency (number of respondents that cite the species at the marketing points)	%
1	*Azadirachta indica*	Maina	10	40
2	*Parkia biglobosa*	Dorowa	04	16
3	*Diosphyros mespliformis*	Kanya	03	12
4	*Proposis africana*	Kirya	06	24
5	*Gueira senegalensis*	Sabara	02	08
	Total		25	100

Source: Field work (2018)

Causes of Fuelwood Species Preference

Several works have shown various reasons for fuelwood species preference. Here, availability, affordability, combustion rate of wood and low smoke determines species preference (Table 3). Of 25 respondents, majority cited affordability is the main reason for fuelwood preference in area while few mentioned that low smoke was the motive. This result is not surprising because majority of the buyers are rural people often with low income and weak purchasing power. Findings of this study suggest that people in the study area are characterized by high poverty hence will look for most affordable (56%) wood first before any other. This finding corroborates Machonacie, Tanko & Zakariya (2009) and Kiyawa (2016) that because of any or combination of high poverty, high cost of other fuels, and family sizes people tend to descend the energy ladder in the Kano Region.

Table 3: Reasons for Fuelwood Species Preference

SN	Reasons	Frequency (number of respondents that cited an option at the marketing points)	%
1	Affordability	14	56
2	Availability	06	24
3	Combustion rate of wood	03	12
4	Low smoke	02	08
	Total	25	100

Source: Field work (2018)

Those assertions were also buttressed by Ikurekong *et al*. (2009) who reported that local fuel exploitation was mostly prevalent in communities with low income in Nigeria. Obua *et al*. (2010) found that over-exploitation and unsustainable woodland exploitation is mainly prevalent in poorer communities thus affordability will dictate preference. According to Clarke and Grundy (2004), poor people, often desperate for survival use the most readily available resource for survival and are more likely to engage in unsustainable fuel wood exploitation practices. Wakili, Abdullahi, Gani & Bello (2012) reported high combustion rate was the reason for preference of some species in Bauchi State. Smoke is the least mentioned probably because fuelwood users weigh options for survival rather than comfort or health risk. This is in line with Ogunsawa & Ajala (2002) that due to fuelwood crises, users have no choice that to continue with affordable wood despite its health consequences.

Sources of Fuelwood in the Study Area

A total of four fuelwood sources were identified in the study area (Table 4). These were based on the interpretations of the respondents. First, community forest is the main source as indicated by 48% of the respondents (Table 4). Fuelwood is mostly sourced from fields because it is open access land where people maximize exploitation without concern for the resource base or any punishment (Table 4). In fields which enjoy private protection such as farmlands, permission of owners must be requested before felling a tree or even encroachment hence only about 16% of the respondents source their wood from such area.

However, fuelwood is not commonly sourced from bush as indicated by 8% of the respondents. This is due to distance and security as mentioned by the respondents. The respondents stated that the bush fields are far from the compound area hence people especially women and children who mainly collect wood in the area recently are scared of going into distant areas.

Table 4: Sources of Fuelwood in the Study Area

SN	Source	Frequency	%
1	Community Forest	12	48
2	Farmed parkland	7	28
3	Farmland	4	16
4	Bush	2	08
	Total	25	100

Source: Field work (2018)

Findings of this study on common pool fields as the main sources of fuelwood in study area corroborates Adedayo *et al.* (2008) who noted that in most rural parts of Nigeria, uncontrolled access of local communal forestry resources and absence of defined property rights have led to significant destruction of the "open" resources.

CONCLUSION AND RECOMMENDATIONS

This study showed that fuelwood is a vital energy source for the poor in the study area. Evidently, the study revealed proliferation of marketing points and high commercialization of fuelwood in the area. Fuelwood is mainly derived from common pool fields which stores many species most of which are indigenous and in dire need of conservation. The three most preferred species namely *Parkia biglobosa*, *Disophyros mespiliformis* and *Prosopis africana* are vulnerable because of the high demand and marketing of wood derived from the species hence this study concluded species that are preferred for fuelwood are over exploited, leaving woodlands of lower diversity in the area.

This study therefore recommended that programmes should be mounted to combat over harvesting of prevalent fuelwood plants and avoid the danger of extinction. This can be achieved through campaigns, schools, and the use of ICT. It also recommended that alternative energy (such as wind, solar, energy efficient stove) projects should also be mounted through increase collaboration with local and international organizations such World Wildlife Fund for energy provision in the context of sustainable forest management in Nigeria. The dissemination of biomass briquetting technology (for converting waste to energy) as an option for reducing pressure on forests and woodlands for bioenergy is also another strategy.

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