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ASSESSMENT OF FUELWOOD EXPLOITATION AND MARKETING WITHIN RURAL-URBAN FRINGES OF MAKURDI TOWN IN CENTRAL NIGERIA

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ABSTRACT: *This study set out to examine the sustainability of fuelwood exploitation and marketing in the rural-urban fringes of Makurdi town in Benue State, Nigeria. A sample of 230 fuelwood dealers was used to obtain data for the study. Findings from the study showed high informality which robbed the activity of definite and regular organisation of activities, and management of the supply base. It was also found that, fuelwood harvesting has led to the decline of species diversity in the area, involving especially Crossopteryx febrifuga and Sysygium guineense. Similarly, income realised from the fuelwood trade was not remunerative to encourage its sustainability. In addition, the study indicated that more villagers were entering fuelwood harvesting and trading activity; 66.0% of respondents joined it only between 2014 and 2016. The study noted that as more people join the trade, greater loss of species will be experienced to ruin the industry. The study recommends restoration of subsidy on kerosene and operation of woodlots by harvesters to sustain the activity.*

KEYWORDS: Fuelwood, harvesting, marketing, livelihood, sustainability

INTRODUCTION

Energy supply is one of the basic needs of all human beings throughout ages. What varies over time is the source from which energy is supplied and the system of supply. It is required for diverse purposes such as cooking, heating, transport and industrial production. Fuelwood was probably the earliest source of energy ever used by human beings; and it has remained a dominant source of domestic energy especially in developing countries due to its affordability and social appropriateness of its use. In Nigeria, for instance, Business Trumpet (2018) has reported that over 70% of the country's estimated population of 180 million depend on fuelwood for their energy needs. The widespread demand for it therefore, offers market to provide primary jobs for those involved in it (Guild & Shackleton, 2018).

The appeal of fuelwood trade to low income households around major urban centres in developing countries lies in the low capital investment required, low technology involved in harvesting wood and transporting it to consumers and the ready market for it that is sustained by urban poverty. Owing to the fact that most urban households in developing countries use fuelwood for activities requiring energy, marketing it provides a means of livelihood to a large section of the poor within rural-urban fringe zones in developing countries. In all major towns, wheelbarrow loads or head loads of fuelwood from small scale dealers move into urban centres on a daily basis from 'rural belts' which have only limited capacity for supply of the commodity. The concern about the

supply capacity of the environment to keep pace with demand for fuelwood started in the 1970s, following the sudden rise in prices of fossil fuels in 1973 (Nash & Luttrell, 2006). At present, the concern for capacity to supply in the long term is raised even higher, in the case of developing nations generally and Nigeria in particular, by the rapid population growth generally and rapid urbanisation that have pitched, according to Worldometer (2019), at averages of 2.6% and 5.2% per annum respectively. Urban growth and urban services continually encroach on adjacent rural lands from where wood is harvested for trade. In addition, as Ebe (2014) has noted, the emerging crisis in modern energy sector coupled with increasing poverty level in developing countries is pushing more households to the traditional energy source which is fuelwood and charcoal. This raises the issue of sustainability of livelihoods that are dependent on fuelwood trade for the growing number of the poor, within the rural-urban fringe zones of urban centres.

There are many perspectives on the concept of sustainability of a resource. The perspective adapted to this study is the one by Izac and Swift (cited in Morse, McNamara & Acholo, 2002) which sees it as a system that has "acceptable level of supply of harvestable yield... over the long term". Wood resources are perfectly renewable, but as Fellmann, Getis and Getis (1998) noted, they have 'maximum sustainable yield' which is the highest rate of exploitation that will not destroy the capacity for renewal and future productivity. This capacity can easily be destroyed in a savannah biome through reckless exploitation in response to urban demand.

The sustainability of livelihoods based on fuelwood trade in the rural fringes of urban centres in developing countries is further made doubtful by the fact that fuelwood harvesting is not guided by the principles of 'resource capitalism' which according to David and Wright (cited in Woods, 2011) involves intensity of research, new technologies of exploitation, value addition and use, market development and investment in transport infrastructure. Those involved in small scale, informal fuelwood business do none of these, but continually remove wood from the natural environment as if it is an inexhaustible resource reservoir.

Traditional energy sector generally and use of fuelwood for energy in particular is a characteristic of rural economy. Conversely, because of the technological complexities involved, modern energy sector comprising use of fossil fuel, solar energy, thermal energy, hydroelectricity and uranium derived power is associated with urban economy. In developing countries however, owing to the primary nature of urbanisation which is fuelled mainly by rural migrants who still retain folk preferences, towns share many essential attributes with villages, including use of fuelwood for domestic purposes. The irony created by this situation is that, while towns are physically distinct from rural surroundings, they are socially enmeshed in many ways that are rural. But even more germane to the explanation of the popularity of fuelwood use in Nigeria generally is the rising poverty among both rural and urban residents which according to Naibbi and Healey (2013), has closed the door to energy alternatives such as cooking gas and electricity.

Makurdi town clearly illustrates the scenario sketched here. With a short history of urban existence of about 100 years, it holds a population whose majority are living rural migrants still in the process of social and economic transformation to urbanism. Apart from the inability to afford high cost of modern sources of energy, many households in the town prefer use of fuelwood to cook food, believing in some cases that food cooked with this energy tastes better. In this way, the high demand that is created for fuelwood has in turn provided market for the commodity. It has also opened up primary coping occupations for the surrounding rural residents wishing to break away from the crushing monotony and drudgery of smallholder agriculture as a sole source of income. Around the town just like any other major town in Nigeria, selling of fuelwood by low income dealers is a system of economic activity that involves wood harvesting, transportation and marketing from all approaches to the town. The business involves unskilled poor villagers, mainly women and children who find it as another 'gainful activity' which supplements the smallholder farming they do.

The development of fuelwood dependent livelihood in the rural-urban fringe zones of Makurdi town can be understood in the light of the theory of portfolio entrepreneurship discussed by Kodithuwakku and Rosa (2002). The model postulates that in a constrained environment, people are willing to try a range of business options for survival. If an environment that has supported a set of livelihoods becomes constrained, overworked, degraded and shows evidence of declining availabilities, inhabitants diversify or shift away altogether from traditional activities to new ones. The postulation concerts with Landes' (cited in Gallup, Gaviria & Lora, 2003, p. 1) more balanced view of environmental influence on human activities which sees it as not being absolute in its prescriptions, but offering a set of choices to human beings.

The agro-environment all over the world has come under climate variabilities, making uncertain onset of rains, cessation of rains, increasing warmth and associated pest invasion which have rendered agriculture less rewarding for many smallholder farmers. While these changes are happening, rapid urbanisation in developing countries has created new markets for fuelwood that is derivable from the local environment. The opportunity for portfolio expansion is therefore exploited by villagers surrounding large urban settlements. But in the case of the study area, the question is: how far can the informal fuelwood trade be sustained?

This study therefore set out to consider the sustainability of fuelwood market as a livelihood generating sector for low income rural residents within the rural-urban fringe zones of Makurdi town. The objectives were to examine methods of fuelwood harvesting; explain the exacting transportation process involved; examine the gender and age specificities of the people involved in the trade; evaluate the income accruable to fuelwood hawkers; and the management of fuelwood supply base.

METHODOLOGY

The study area

Makurdi, the capital of Benue State, is located in the guinea savannah vegetation zone where deciduous trees intersperse with tall grasses. Most of the tree species found in

the area yield abundant biomass for fuel and are constantly exploited for that purpose. The common native tree species in the area are shown in Table 1.

Table 1: Common natural tree species in the rural belt around Makurdi town

Local name	English name	Botanical name
Kuegh	Narrow long-leafed Terminalia	*Terminalia avicennioides*
Chaha	African copaiba balsam	*Daniellia oliveri*
Irkwar	African bark Crossopteryx	*Crossopteryx febrifuga*
Shase	Acajou	*Anacardium occidentale*
Gbagbongom	Makarati timber tree	*Burkea Africana*
Jiagba	Savanna Afrormosia	*Pericopsis laxiflora*
Chamegh	Shea butter tree	*Vitellaria paradoxa*
Gbaaye	Nigerian ironwood	*Prosopsis Africana*
Nune	Locust bean tree	*Parkia biglobosa*
Mho	Watercherry	*Syzygium guineense*
Haa	African mahogany	*Khaya grandifoliola*
Kpine	Ferruginous Bridelia	*Bridelia ferruginea*
Hulugh	Savanna black plum	*Vitex doniana*
Kovor	Doka	*Isoberlinia doka*
Ngaji	Savanna Cochlospermum	*Cochlospermum planchoni*
Ibua	Savanna maranthes	*Maranthes polyandra*

Source: Fieldwork, 2018

Due to predominance of arable agricultural activity in the area, much of the floral diversity of the original vegetation has been lost. The rural belt around the town has lost this diversity to the combined effect of farming and fuelwood exploitation for supply to the urban centre. Situated in the lower guinea savannah zone and in the flood plain of River Benue, the environment is sufficiently wet for rapid regrowth of vegetation to support wood harvesting activity, but it is being stressed by indiscriminate felling of trees.

Data Collection

The design for the study consisted of field survey and measurement. For field survey, a sample of 230 randomly selected fuelwood sellers was used. This sample was shared among the main approaches to Makurdi urban centre and the rate of valid returns was as shown in Table 2.

Table 2: Distribution of questionnaire and rate of valid return from the approaches

Approaches to town	Sample allotment	Valid copies returned
Tse Poor	60	42
Agan	55	36
Kanshio	60	31
Naka Road	55	35
Total	230	144

Source: Field work, 2018

In each approach, a research assistant was stationed at a point marking the end of built up area of the town to intercept fuelwood sellers with their wheelbarrow loads of wood for face-to-face questionnaire administration. The structure of the questionnaire was designed to elicit socio-demographic and economic information about respondents, their perception of the natural environment and the quantity of fuelwood carried in this manner by a dealer. In order to get an idea of the quantity of fuelwood hawked daily, wheelbarrow loads of wood passing through interaction points were weighed using Camry's Table Scale; and at the same time species of trees carried were ascertained to know the species most preferred by harvesters. Such close examination also enabled the researchers to have an idea about the maturity of the trees harvested as indicated by the size of pieces of wood pushed into town.

With regard to the dimension of the wood field from which fuelwood was collected and the distance sellers moved the wood manually to the urban centre, respondents were asked to reveal names of their villages after which the researchers visited the settlements to establish the distance. Such visits afforded the researchers the opportunity to personally observe methods of wood exploitation and the effects the activity is creating on the flora environment in the area with respect to its continued resilience.

Data so obtained were presented in tables and graphs as well as in photographs. Analysis involved comparison between species sold and income accruing from sales. It also involved comparison of quantities sold, species most often sold and income made among the four approaches to the town.

RESULTS AND DISCUSSION

Characteristics of Respondents

The dominant characteristics of respondents involved in fuelwood trade in the rural-urban fringe zones of Makurdi town revealed the gender and age bias of the business, involving mainly females and children in the area. The connection between the trade and female gender and children is easy to imagine. It is a low income generating activity that requires no special skills; and it is an energy exacting engagement which suits mainly the able-bodied young people. The characteristics of fuelwood sellers in the area are shown in Table 3.

Table 3: Characteristics of fuelwood sellers in rural-urban fringe zones of Makurdi town

Sex of sellers	Frequency	Percent	Cumulative %
Male	59	41.0	41.0
Female	85	59.0	100.0
Total	144	100.0	
Age of sellers (in years)	Frequency	Percent	Cumulative %
< 15	26	18.1	18.1
15-20	45	31.2	49.3
21-25	28	19.4	68.8
26-30	26	18.1	86.8
> 30	19	13.2	100.0
Total	144	100.0	
Level of education	Frequency	Percent	Cumulative %
Non-formal education	28	19.5	19.5
Primary school	34	23.6	43.1
Secondary school	29	20.1	63.2
Tertiary school	15	10.4	73.6
Still attending school	23	16.0	89.6
School dropout	11	7.6	97.2
No response	4	2.8	100.0
Total	144	100.0	

Source: Fieldwork, 2018

It is evident from Table 3 that the people involved in fuelwood sale are the lowest income earning people in society occupying the bottom rung of the social ladder. In terms of gender, they are predominantly females (59.0%); in terms of age, they are mainly children and the youths between eight and thirty years constituting more than 86% of the sample studied. This group is educationally disadvantaged as they either do not possess formal education or have too little education to be relevant in other income generating portfolios. They are therefore left with no other choice outside subsistence agriculture than harvesting and selling fuelwood for an income. Plates 1 and 2 depict gender and age specificities of fuelwood trade in rural-urban fringes of Makurdi town.

Plates 1 & 2: Women and children transporting fuelwood from rural-urban fringes of Makurdi town

Informal fuelwood selling in the area is not an activity likely to liberate participants from poverty. In the first place, the quantity of wood per person is too small to yield meaningful income to the seller for expansion of the business or investment in higher gainful activity. Secondly, supplies are dwindling due to lack of management of the natural ecosystem; trees are only felled without replanting to replenish the supply system. Moreover, as an informal activity, sellers are not properly organised which leaves individual sellers at the pricing mercies of urban buyers.

METHODS OF HARVESTING FUELWOOD

Fuelwood is a perfectly renewable resource if correct methods and measures are used in exploiting it. But if inappropriate methods are applied, they lower its 'maximum sustainable yield' irretrievably, thereby risking the sustainability of livelihood that depends on it. Field investigation revealed that different methods of fuelwood exploitation in the rural-urban fringe zones of Makurdi town were used which were not environment friendly. The methods are presented in Figure 1.

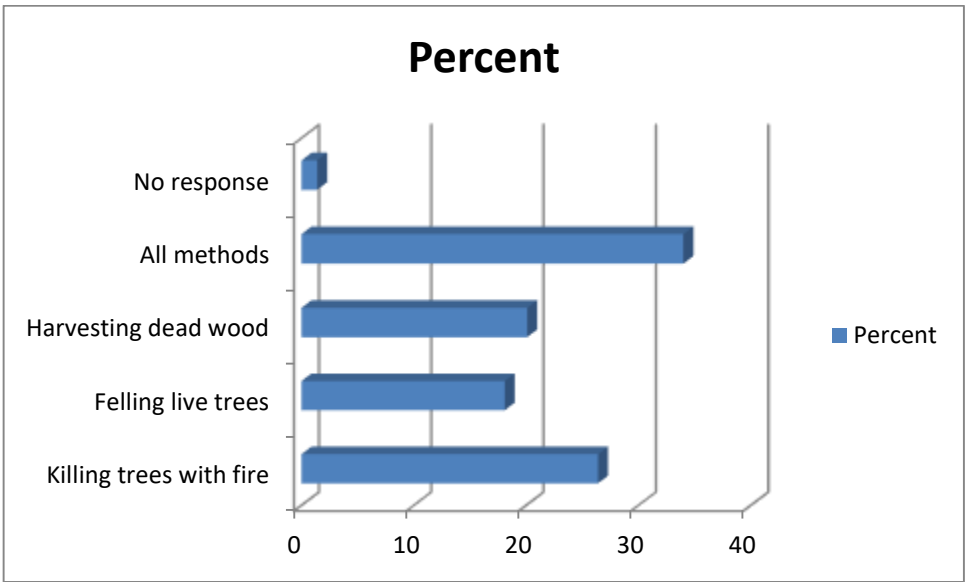

Figure 1: Methods of fuelwood harvesting in rural-urban fringe zones of Makurdi
Source: Fieldwork, 2018

As Figure 1 shows, fuelwood harvesters use the most destructive techniques of collecting fuelwood for sale in the area. Killing trees by putting fire around their bases does not only kill a tree, but destroys its capacity for quick rejuvenation. The heat from the fire affects even nearby woody trees and shrubs that are not ripe for exploitation. Nevertheless, killing trees with fire was reported to be the second most prevalent technique of preparing trees for fuelwood harvesting. Felling of live trees with hand axes or saws is equally unhealthy to the environment especially when done without replanting new ones in replacement. The techniques are all capable of destroying the sustainability of livelihood that is dependent on fuelwood trade.

Organisation of Fuelwood Harvesting

Fuelwood supply industry in the rural-urban fringes of Makurdi town is a small scale enterprise which revealed chaotic arrangement and extreme informality that are characteristic of rural livelihood activities in developing countries. Basically the activity is mainly family based. The components of the industry such as harvesting and transportation are carried out by family members; and the commodity is collected from family fallow lands and backyards of homesteads. Beyond these, no definite organisation was reported in terms of regulating supply to avoid 'glut' and maintain prices; and even regulate activities of harvesters to check against inappropriate techniques of exploitation. Respondents in the study reported the arrangement as shown in Figure 2.

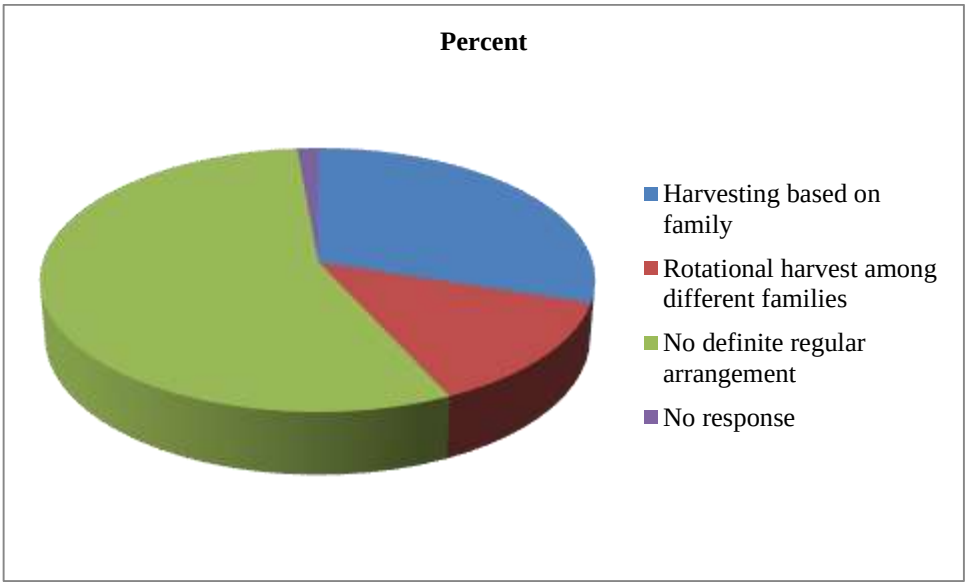

Figure 2: Organisation of fuelwood harvesting in rural fringe zones of Makurdi town
Source: Field work, 2018

The implication of lack of definite organisation in the industry on sustainability of livelihoods deriving from it is that individual family traders are left at the mercy of buyers to accept whatever price they offer. Net returns on investment of effort and time are small enough to sustain poverty among fuelwood hawkers. Another implication is that, operating in disparate fashion does not allow for checking against unwholesome harvesting practices which are reminiscent of ecological commons, setting it for ruin.

No variable of fuelwood trade in the area indicates as clearly the family centeredness of the livelihood as the labour that is used. Family labour is usually preferred in all traditional economic activities because it is cheap, accessible and unskilled, and can be manipulated unchallenged. However, it suggests the small scale of operation and the degree of informality of an enterprise. The study revealed that fuelwood harvesting and transportation to town rely on family labour that is only augmented by hired labour. The relative importance of the two sources is shown in Table 4.

Table 4: Labour used for fuelwood harvesting and transportation in rural fringes of Makurdi town

Labour source	Frequency	Percent	Cumulative %
Personal labour	27	18.7	18.7
Family labour	17	11.8	30.5
Hired labour	31	21.5	52.0
Personal & family labour	59	41.0	93.0
personal & hired labour	5	3.5	96.5
No response	5	3.5	100.0
Total	144	100.0	

Source: Field work, 2018

The inefficiency of family labour in any economic activity needs not be overemphasised as social relations of production in family settings are too familiar and too indulgent to be adequately profit oriented. In this way, the predominance of family labour in fuelwood trade in the area makes the industry less rewarding, less progressive and less sustainable in the long term. This is more so as the bulk of family members and even hired people involved in it are usually children as shown in Table 2, Section 2.1.

The asymmetrical gender and age distribution of dealers in fuelwood trade serves to emphasise social and economic worth of the business. It is seen as a menial occupation, requiring no skill and yielding little income. Naturally it is left for those on the lowest rung of socio-economic ladder. Thus in the current study, 59% of respondents involved in the activity were females and 41% were males. Similarly, 68.8% of the respondents were below 25 years of age. These sex and age characteristics are typical of people involved in low paying jobs.

Types of Trees Harvested and Marketed

It is not every type of tree that is good for fuelwood. An ideal fuelwood is the one that burns with little smoke, but yields great heat and little ash. This is all a function of the degree of hardness and maturity of a wood. Where there is abundant wood for harvesting, fuelwood hawkers discriminate to collect for sale only wood which can burn to produce the best results. In the rural-urban fringes of Makurdi town, respondents reported collection of a range of tree species for sale that indicated degradation of the biodiversity of the ecosystem in the area. The range of common types of trees harvested and marketed is shown in Table 5.

Table 5: Species of trees commonly harvested for sale in rural fringe zones of Makurdi town

Local name of specie	Botanical name of specie	Frequency of respondents selling	Percent	Cumulative %
Kuegh	*Terminalia avicennioides*	29	20.1	20.1
Chaha	*Daniellia oliveri*	23	16.0	36.1
Irkwar	*Crossopteryx febrifuga*	6	4.2	40.3
Shase	*Anacardium occidentale*	18	12.5	52.8
Gbagbongom	*Burkea Africana*	15	10.4	63.2
Jiagba	*Pericopsis laxiflora*	11	7.6	70.8
Chamegh	*Vitellaria paradoxa*	6	4.2	75.0
Malina	*Gmelina arborea*	13	9.0	84.0
Mho	*Syzygium guineense*	6	4.2	88.2
Gbaaye	*Prosopsis Africana*	15	10.4	98.6
Others		2	1.4	100.0
Total		144	100.0	

Source: Field work, 2018

In the past tradition in the area forbade use of certain tree species for fuelwood. Such forbidden trees included *Prosopsis africana*, *Parkia biglobosa*, *Vitex doniana*, *Vitellaria paradoxa* and *Sterculia setigera*. Some of the tree species were forbidden for their economic value while *Sterculia setigera* would not be used as fuelwood because of its sacred value. The import of what was revealed in the study was that the discriminatory tradition no longer holds as wood availabilities have dwindled to the extent that any woody tree in the area is harvested and sold for biomass fuel. This means that, the damage to the ecosystem has grown from loss of flora diversity caused by selective exploitation of certain species to comprehensive degradation occasioned by indiscriminate harvesting of biomass materials for fuelwood. This overstretches the maximum sustainable yield of the supply base and therefore reduces sustainability of livelihood based on fuelwood trade in the area.

The Worth of Fuelwood Trade

Sustainability of a trade does not only lie in the resilient capacity of the supply base, but it also has to do with the profit that is accruable from it. Trading in crude primary commodities like fuelwood is subject to constant fortune reversals. These reversals manifest in form of unguaranteed continued supply, erratic labour availability and fluctuating prices in the unregulated market that involves sellers who operate individually under severe conditions of poverty and long distance trekking to reach the point of sale. In rural-urban fringes of Makurdi town, fuelwood hawkers get little for a wheelbarrow load of wood which is moved over a long distance. The same distance places a limit to the number of trips a hawker can make in a day, usually a single trip. Table 6 shows the rate at which a wheelbarrow load of fuelwood is sold in the area.

Table 6: Money realised from sale of wheelbarrow load of wood in rural-urban fringe zone of Makurdi town

Rate (N)	Frequency of respondents	Percent	Cumulative %
< 500	14	9.7	9.7
500-1000	61	42.3	52.0
1001-2000	42	29.2	81.2
2001-3000	7	4.9	86.1
3001-4000	7	4.9	91.0
4001-5000	3	2.1	93.1
>5000	8	5.5	98.6
No response	2	1.4	100.0
Total	144	100.0	

Source: Field work, 2018

It is apparent from Table 6 that majority of respondents (52%) reported N1000 or less as price for a wheelbarrow load of wood. Prices for wheelbarrow loads vary depending on the specie of tree and its maturity which indicates efficiency in heat generation. Normally species that burn to produce great heat and little ash are priced higher than others. *Terminalia avicennioides*, *Prosopsis Africana* and *Pericopsis laxiflora* typify such species that attract higher prices. Placed against the investment in terms cutting the wood and pushing the load to the point of sale, it is seen that income per wheelbarrow load of fuelwood is too little to reduce poverty among the people involved in the trade.

To appreciate what this activity really means to those engaged in it in terms of accruable income, a reader needs to understand that fuelwood hawkers in the area do not always make a trip to town to sell every day. The frequency with which individual hawkers go out to sell fuelwood is presented in Table 7.

Table 7: Frequency of fuelwood sales per person in the area

Frequency of supply	Frequency of respondents	Percent	Cumulative %
Once a week	22	15.3	15.3
Twice a week	28	19.4	34.7
Thrice per week	25	17.4	52.1
Four times per week	15	10.4	62.5
Five times a week	4	2.8	65.3
Seven times a week	47	32.6	97.9
No response	3	2.1	100.0
Total	144	100.0	

Source: Field work, 2018

Due to the fact that informal hawkers do not consciously keep record of sales, it was safer to require them to say what they could easily remember and give authentic information about. In this way, an idea of net income made from sale of fuelwood per week could be gained from Tables 6 and 7. A hawker who went out seven times a week

and sold at N500-1000 realised on average N5,250; the one hawking once a week and selling at the same price got only N750. Those hawking twice a week and selling at that price got N1,500. In sum, whatever income that could be computed from the tables is not viable to reasonably sustain a family, let alone bring it out of poverty.

Fuelwood Hawking as a Growing Trade in Rural-urban Fringes of Makurdi Town

The increasing economic difficulties have literally imposed certain coping strategies on families especially in areas near major urban centres in Nigeria. Rural areas fringing Makurdi town are no exception to this development. Fuelwood hawking as our study revealed, is a coping strategy undertaken alongside farming, selling of processed farm produce like baked cassava flour (*gari)* and fermented cassava (*akpu*); and selling of cooked food in the area. The activity has always been there; but in the past, firewood was head loaded and hawked about town. At the time of this study, the activity has technically improved from head loading few pieces of wood to pushing wheelbarrow loads of fuelwood from house to house to sell. It is still a small scale economic activity for the very poor families within the rural-urban fringe zones of Makurdi town. That the activity is gaining popularity in recent time among households in the zone can be discerned from the year participants joined the trade as indicated in Figure 3.

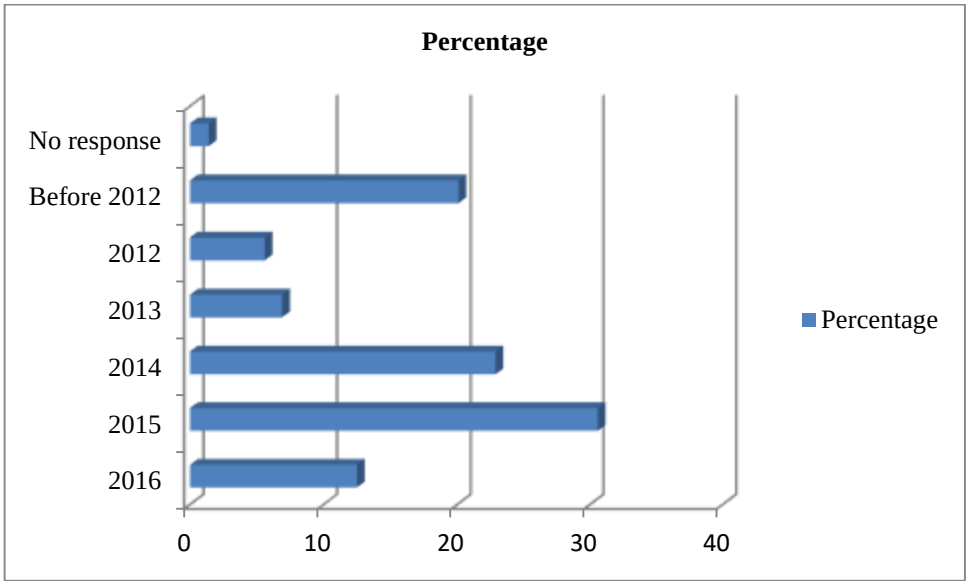

Figure 3: Years respondents started fuelwood trade in the study area
Source: Field work, 2018.

It can be observed that most respondents in the study were new participants in fuelwood business in the area, coming into it mainly between 2014 and 2016. This period coincided with reversal of economic fortunes in the country generally and in Benue State in particular. Prices of kerosene that used to be a staple energy source for low income urban households went out of reach, pushing them to fuelwood as alternative. Rural residents who were even worse hit by the reversal and finding available demand for fuelwood responded by taking to fuelwood harvesting and marketing. Respondents reported other gainful activities they undertake as shown in Figure 4.

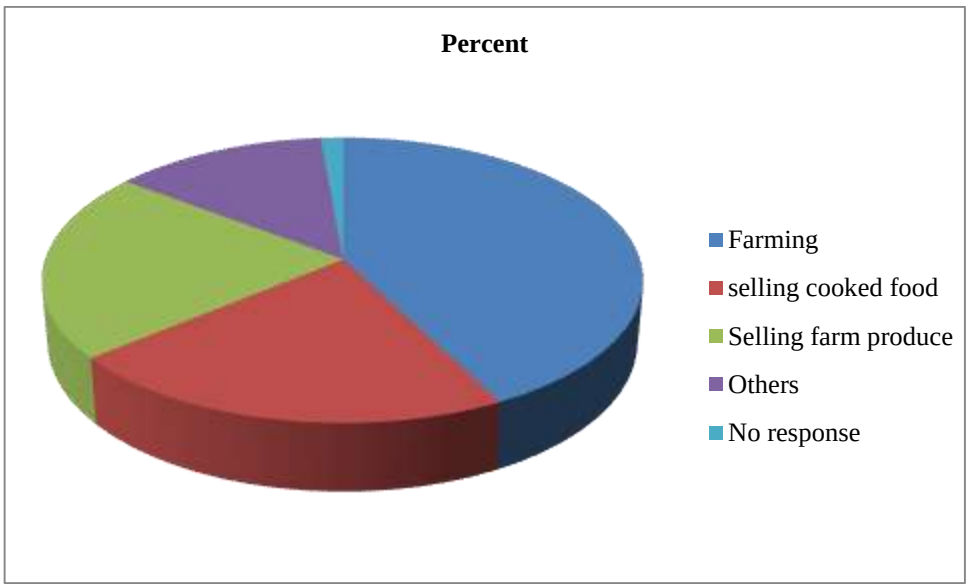

Figure 4: Relative shares of other gainful activities undertaken by respondentsin the study area
Source: Field work, 2018

Though a popular and important cultural economic activity in the area, farming yields an income only in specific seasons of the year. More often than not, crop failures are experienced in which case a farming family depending solely on it may have nothing to fall back to. This holds true for selling of farm produce too. Fuelwood selling on the other hand is an all season activity and goes a long way to augment income of poor households in the area.

The Influence of Education on Nature of Participation in Fuelwood Activity
In terms of low level liberal education, the area is well acquitted as over 75% (shown in Table 1) of respondents spread between primary and tertiary levels of formal education. However, the kind of education acquired does not equip them with skills for even simple value adding economic activities, thus they see fuelwood business which is based on primary commodity as a ready option to take. In the context of seeming homogeneity, level of education seems to be a variable that makes the difference in nature of participation in fuelwood harvesting, selling and access to income from fuelwood trade. This fact is apparent from Table 8.

For example, those with no formal education are involved in harvesting from own land and exploiting wood from family land for parents. Respondents who reported harvesting mainly from own land and selling for themselves possess primary and secondary education, or they were still attending school at the time of the study. Respondents who reported participating in fuelwood activity as hired labourers to cut wood and hired to push fuelwood around to buyers were mainly those without formal education or they had only primary education.

Table 8: Relationship between level of education and nature of participation in fuelwood business in the rural-urban fringes of Makurdi town

Level of education	No response	Harvest from own land	Buy from others to sell	Direct harvester for parents	Selling for parents	Hired to harvest wood	Hired to sell wood	Total
Non formal education	1	9	7	10	0	3	1	31
Primary sch. Education	1	13	8	4	2	5	1	34
Secondary sch. Education	0	10	6	7	4	1	1	29
School dropout	1	3	5	3	0	0	0	12
Tertiary education	0	5	3	2	5	0	0	15
Still attending school	1	18	1	2	1	0	0	23
Total	4	58	30	28	12	9	3	144

Source: Field work, 2018

Generally, respondents with formal education exhibited higher tendency towards greater pecuniary benefits from participation in fuelwood activity than those without formal education. Conversely, respondents with no formal education reported working for others as hired wood cutters and wheelbarrow pushers. They get only a pittance in return for their services.

Duration of Participation and Species of Trees Traded

Preference for different species of trees for fuelwood varies, based on carbon concentration and the amount of heat and ashes each species generates. There are specific types of trees which consumers go for, and sellers know preference pattern in the area. Although no clear pattern of specie supply is revealed, but it appeared tree species mostly preferred on account of efficient heat generation are declining in supply in the area. Table 9 shows this trend. Species such as *Terminalia avicennioides*, *Crossopteryx febrifuga*, *Pericopsis laxiflora*, *Prosopsis africana* and *Vitellaria paradoxa* have declined in supply as can be seen from the reduced number of respondents reporting its sale, especially those who joined the fuelwood activity in 2016. The field investigation revealed that the most preferred tree species have been exploited beyond their maximum sustainable yield in the area. According to respondents, in the absence of the best fuelwood, any woodfuel material is harvested and sold.

Table 9: Declining supply of some tree species as fuelwood in the rural-urban fringe zones of Makurdi town

Year of starting participation	Species of trees mostly harvested											Total
	A	B	C	D	E	F	G	H	I	J	K	
2016	3	2	1	4	3	1	2	0	1	2	1	20
2015	10	6	3	5	5	2	2	5	1	5	0	44
2014	5	8	0	4	1	6	1	3	1	3	1	33
2013	3	1	0	1	1	1	0	2	1	0	0	10
2012	2	2	0	0	1	0	1	1	0	1	0	8
Before 2012	6	4	2	2	4	1	2	2	2	4	0	29
Total	29	23	6	16	15	11	8	13	6	15	2	144

Source: Field work, 2018

A-*Terminalia avicennioides*; B-*Daniellia oliveri*; C-*Crossopteryx febrifuga*; D-*Anarcadium occidentale*; E-*Burkea Africana*; F-*Pericopsis laxiflora*; G-*Vitellaria paradoxa*; H-*Gmelina arborea*; I-*Syzygium guineense*; J-*Prosopsis Africana*; K-others.

If the current rate of exploitation continues, small scale trade, better referred to as fuelwood hawking, will become extinct in the future. The reduced sustainability of fuelwood based livelihood is further indicated by the decline of occurrence of fuelwood sites among respondents in the area. About five years ago, many wood harvesters were collecting fuelwood from village community land, which was a local ecological common accessible to all. The other popular site for fuelwood collection was family farm plot. At the time of field investigation for this study, a declining trend of wood harvesters from high number to fewer people for village community land and a rise in the number of harvesters in the case of family farm plots became apparent. This trend is shown in Table 10.

Table10: Shift in popularity of fuelwood collection sites in rural-urban fringe zones of Makurdi town

Year considered	Fuelwood collection sites				Total
	Family farm plot	Family fallow land	Community woodland	Rented land	
	Respondents percentage occurrence				
Before 2012	31.0	13.8	44.8	10.4	100.0
2012	37.5	0.0	37.5	25.0	100.0
2013	50.0	10.0	40.0	0.0	100.0
2014	33.3	15.1	45.6	6.1	100.0
2015	31.8	9.1	38.6	20.5	100.0
2016	55.6	5.5	27.8	11.1	100.0

Source: Field work, 2018

It is clear that the patronage of village lands that were once a general site for fuelwood harvesting is falling due to exhaustion of wood in general and favourite tree species in particular. Conversely, private sites such as family farm plots and fallow lands have become dominant sites for fuelwood harvesting. Once supplies from these private sites

deplete the activity will cease to be. This may happen soon as no effort is made by exploiters to restore the environment by way of replanting.

Quantity of Wood Marketed in the Zone

The impact of fuelwood harvesting and marketing on the supply base can be gauged from the quantity that is removed daily from the base. Vegetal resources are perfectly renewable, but only to the extent that their exploitation is carried out under organised cutting that controls the type and size of trees to be cut; and the methods to be applied. If no control is exercised, supply will be upset in the long term, especially where collection is persistent as in the case of the study area. Bhattarai (1998, cited in Remedio and retrieved on 12th February, 2019) had argued that "deforestation is not caused by heavy reliance of people on woodfuels for energy". This is because the quantity of wood removed is compensated for by rapid regrowth. According to Bhattarai, it is when wood collection is for the purpose of industrial energy supply that deforestation results. In the rural-urban fringe zones of Makurdi town, fuelwood trade is a small scale activity by which harvesting is done manually and transported manually in wheelbarrows to deliver door-to-door to buyers as shown in Plate 3.

Plate 3: Urban fuelwood consumers buying from hawkers in Makurdi town

However, rural-urban fringe zones of Makurdi town are a savannah woodland which has been interfered with and weakened ecologically by arable agriculture, and has therefore become susceptible to vegetal exhaustion. In this way, even though fuelwood is harvested in small quantities and moved manually in wheelbarrows, the consistency of the business and number of people involved are enough to upset supply from the limited zone. The average quantity of fuelwood traded per day in the area is given in Table 11.

Table 11: Daily quantity of fuelwood marketed per seller in rural-urban fringe zones of Makurdi town

Respondent	Quantity moved (kg)	Cost of load (N)
1	75.70	1,300.0
2	96.27	1,500.0
3	55.92	1,100.0
4	60.70	1,000.0
Total	288.59	4,900.0
Average	72.15	1,225.0

Weighed on 'Camry Table Scale'
Source: Field work, 2018

It is clear from Table 11 that, overall, the quantity of trees destroyed in the process of fuelwood harvesting in the area is huge enough to undermine the natural renewability of trees in the area. This is more so as no effort is made by harvesters to replant trees to replace those felled. In this way, livelihood based on fuelwood trade in the area will eventually die out due to depletion of trees; or zone of wood availability will become too distant for wheelbarrow transport.

Lack of Management of the Supply Base

A universal feature of informal economic activities is that issues of sustainability are never considered by those who participate in them. In many cases, the sense of resource common beclouds judgement and responsible use of resource base. Resource removal proceeds without protection of the resource base to sustain its resilience. This feature plays out clearly in the case of informal fuelwood trade in the rural-urban fringe zone of Makurdi town. Fuelwood harvesters remove wood using all kinds of techniques without prescribing size of trees to cut down and replanting of trees to restock the biome.

Field interaction with respondents revealed wild perception of the natural ecosystem that prevents respondents from taking any conscious measure to protect the supply base. Asked why they did not plant trees in place of those felled, responses that betrayed ignorance were given as presented in Table 12.

Table 12: Prevailing notions about natural trees in rural-urban fringe zone of Makurdi town

Notions	Frequency of respondents	Percent	Cumulative %
Trees are planted by nature	38	26.4	26.4
Trees take too long to grow	40	27.8	54.2
Vegetation field is a common	38	26.4	80.6
Fuelwood are not crops that can be grown	11	7.6	88.2
Trees are abundant & need not be planted	9	6.2	94.4
No response	8	5.6	100.0
Total	144	100.0	

Source: Field work, 2018

The responses show a deep-seated misconception about the nature of vegetation system and the inherent neglect that comes with the wrong notions held by harvesters in the area. If over 80% of respondents in the area believe that trees are put there by nature, they take too long a time to grow such that one could not plant them and hope to harvest in one's lifetime; and that harvesting wood from a vegetation common places no responsibility on the harvester, it then meant that the future of livelihood based on fuelwood trade in the area is not assured. What the responses suggest is that those exploiting the ecosystem resources in the area are not ready for deferred gratification and generally bear an attitude that gives up the ecosystem to the 'tragedy of the commons'. Both realities do not guarantee a future for a livelihood that is dependent on availability of wood in the area.

DISCUSSION

This study was undertaken to examine the sustainability of fuelwood harvesting and trading as a coping activity for the very poor households living within the rural-urban fringe zones of Makurdi town in Benue State. The informal business dominated by the female gender and children, the economically vulnerable groups in society with no trained skills to take up other enterprises. The study revealed that fuelwood harvesting and marketing are activities undertaken on small scale by the same rural households, using mainly family labour and family resource fields (farm plots and fallow lands). As an informal activity, it showed no form of formal organisation in terms of administration, techniques of wood collection and marketing arrangement.

Methods of fuelwood harvesting were considered to be destructive enough to destroy the maximum sustainable yield of the ecosystem and render the business ruin-bound. The wrong perception of the supply base giving rise to reckless exploitation of wood, lack of remedial measures to replenish the stock of wood, leaves no guarantee for a viable survival of livelihoods that depend on wood harvesting and marketing.

Moreover, as more families have joined the business in recent years, having been pushed into it by severe reversal of economic fortunes in the country, fuelwood supply in the area is fast dwindling.

The study found that fuelwood trade is a coping strategy to augment income from farming, farm produce processing and selling of cooked food as main activities in the area. The combined effect of agriculture and wood harvesting has already distorted flora diversity in the area, such that tree species like *Terminalia avicennioides*, *Crossopteryx febrifuga, Pericopsis laxiflora, Vitellaria paradoxa* and *Syzygium guineense* which were traditionally preferred for fuel because of their efficient heat generation have virtually exhausted. Fuelwood harvesters who must continue in the trade resort to heat-inefficient species with the implication that more quantities of wood have to be supplied to satisfy the energy requirement of poor urban households who depend on fuelwood for domestic energy. Similar findings on loss of species diversity were made by Orimoogunje and Asifat (2015) in a study on fuelwood consumption in South-western Nigeria. Another study by Zubairu and Zubairu (2016) reported dwindling fuelwood supplies in the Guinea savannah zone of Nigeria, explaining the depletion by population pressure and poverty. For the rural-urban fringe zones of Makurdi town, the increased fuelwood harvesting is likely to rise even further as no sign of developing alternative energy strategy for the rural and urban poor households is in sight.

The implication of continued dependence on fuelwood for domestic energy supply on the environment and local economy is obvious. Depletion of trees will open up land surfaces to agents of erosion which will destroy farmlands to remove a critical factor of agricultural production. So far, fuelwood trade has provided a useful coping activity for low income families in the area. Once the basis of commodity supply for this trade is destroyed, the income of most households in the area will be undermined; and that may also result to what Felmann, Getis and Getis (1998) referred to as ‘poor man’s energy crisis’ in the villages and in the urban centre.

Concluding, it can be said that fuelwood has been an age-long energy source. The resilience of its use certainly stems from the ubiquitous incidence of trees, the ease and cheapness of its exploitation (not requiring any special skill) and the social appropriateness of its use that permits versatile applications such as cooking, heating, warming and industrial application. It has been shown that hawking fuelwood around Makurdi town is not a new activity, but owing to economic hardship that has hit poor rural residents around Makurdi town and low income urban dwellers in the town the activity has increased in recent years. Together with agriculture, wood harvesting has taken a toll on flora diversity and wood availability in a way that threatens the survival of fuelwood trade in the area.

There is therefore an urgent need to introduce strategies that will either divert attention from wood harvesting, or introduce deliberate management of wood supply base. One such strategy can be to subsidise cost of kerosene and make it available to low income households and encourage its use for domestic energy. Up to the 1980s, kerosene was a popular source of energy for the urban poor families. However, government removed subsidy on it while retaining subsidy on petrol. There is no economic sense in making

kerosene more expensive than diesel and petrol in a country that mines petroleum and whose huge growing population is dangerously impacting on its vegetal resources through fuelwood harvesting. Reintroducing subsidy on kerosene will curb demand on fuelwood and restore floral diversity in the area. Those currently selling fuelwood as a coping strategy can be redirected to other gainful activities that do not require special skills. One possible activity that can replace fuelwood harvesting in the area is agro-tourism by which local farmers preserve quasi- original ecosystem niches where people can relax watching elements of nature in their originality. Another socially harmless alternative is to render domestic services to affluent urban families during part of the day and work on their farms in another part of the day. Since they live within the rural-urban fringe zones they can profitably combine the two roles.

Those who must remain in fuelwood harvesting business should be encouraged to deliberately manage the supply base by establishing family woodlots where trees are planted and carefully husbanded under the principles of resource capitalism to supply firewood for sale. They should also be encouraged to plant a tree wherever they fell a tree for fuelwood. The notion that it is only domesticated trees that can be planted should be made to dissolve away from their minds. Equally important is to enlighten them to accept deferred gratification and invest in tree planting even if they themselves may not get immediate direct benefit from such efforts, their heirs will be the beneficiaries.

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