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Saving the natural habitats of the Jos-Plateau: which indigenous fuel-wood plant species should be planted?

A report submitted to the
Rufford Small Grants Foundation
BY

ADAMS .A. CHASKDA (Bsc. Msc.)

2007

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Summary

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Previous studies have revealed that the highest form of wood consumption in Nigeria is fuel-wood and that utilised plant species vary in their combustion efficiency. This has raised the fear that certain plant species could be threatened by frequent usage or most have even gone locally extinct with serious implications for local fauna. This study investigated pattern of fuel-wood consumption and its attendant consequences on local fauna (insects, birds and mammals) in northern parts of Plateau State, Nigeria. Results showed that 58 plant species are consumed and that top fuel-wood plant species greatly support local fauna as compared to *Eucalyptus camaldulensis* often employed in local reforestation projects. Results are discussed based on its implications to the ecology of the Jos environment.

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1.0 INTRODUCTION

Africa's natural habitats harbour a great part of the earth's biodiversity and earns a lot of foreign exchange to the continent through tourism. (FAO 2000, Amusa 2003). However, deforestation poses a serious threats to African natural habitats, their existing wildlife and other indirect benefits. Africa's annual deforestation rate between 1980 – 1995 (estimated at 0.7%) is twice the world average of 0.3%. This has resulted in the lost of almost 10.5% of forests within this period. The main causes of deforestation and of degradation of land and forest resources is primarily anthropogenic. This include Agricultural activities, overgrazing, wildfire, unsustainable fuel-wood collection, charcoal making, unmanaged timber harvest etc. (FAO 2000).

In Nigeria, fuel-wood is the highest form of wood consumption with annual consumption rate put at about 120 million metric tons (estimated to reach 156 million tons by 2010). Annual per capita wood consumption for urban dwellers is estimated at about 360kg/person and 511.2kg/person for rural dwellers. This high consumption figures are encouraged by weak legislation and poor economic conditions (especially in rural areas). Communal bushes and forests constitute the major source of fuel-wood for both urban and rural dwellers with attendant consequences on local flora and fauna (Fuwape 2003, www.onlinenigeria.com, 2005). Previous research suggested that utilised plant species vary in their combustion efficiency (Lucas and Fuwape 1984) thus, raising the fear that certain plant species could be threatened or most have even gone locally extinct. To compound this problem, most aforestation programmes have utilised exotic and fast growing plant species such as *Eucalyptus sp.,* and *Azadirachta indica* Which are feared to be of little benefit to local fauna (Ameibenomo 2002). Sadly, little information is available at local levels to ascertain this especially as it concerns which plant species are the most utilised as fuel-wood and what ecological roles are played by such utilised plant species in relation to local fauna.

1.1 Study Aim

This study aimed at showcasing local plant species most threatened by fuel wood consumption on the Jos-Plateau, Nigeria and to highlight their ecological importance in the remnant natural habitats of these areas. As well as to use these findings to enlighten government agencies and NGO's involved in tree planting campaigns aimed at saving the degraded habitats of this region.

1.2 Objectives

1. To determine the indigenous tree and shrub species most utilized for fuel wood in Jos and its surroundings.
2. To determine the range of biological diversity (birds, insects and mammals) supported by the most utilised fuel wood species in comparison with a common exotic plant species (*Eucalyptus camaldulensis*) used often in reforestation projects.
3. To enlighten utilising communities as well as government agencies and organisations involved in tree planting campaigns at the local level using findings from the research.

2.0 MATERIALS AND METHOD

2.1 Study area

This study was conducted on the Jos plateau in the following Local Government Areas (LGA): Jos-north, Jos-south, Jos-east Barkin Ladi and Bassa (Figure 1). These LGA's were chosen to obtain a representative samp of both rural and urban areas. The Jos environment has suffered environmer degradation as a result of tin mining activities in the past. This has left the landscape dotted with mining ponds. Available natural habitats in this area ar under pressure as a result of Agricultural activities and fuel-wood collection. Fuel-wood collection in this area is greatly attributable to poor economic conditions (possibly compounded by incessant increments in kerosene prices of recent) and the largely rural population which lacks sophisticated, fuel-efficient, modern cooking devices. Thus, most of domestic cooking and bakir industries use fuel-wood often collected from surrounding bushes and forests

Figure 1: Study areas (encircled in red are the Local Government Areas were surveys were conducted)

This study was conducted in three phases viz;

1. Market survey: used to determine common fuel-wood plant species
2. Ecological survey: to determine birds, insects and mammals supported by the most utilised fuel-wood plant species.
3. Workshop (Seminar): Mainly to enlighten government agencies, NGO's, fuel - wood marketers and the local with the findings of the research and to deliberate on recommendations.

2.2 MARKET SURVEY

This phase of the study was carried out between August – December 2006. It involved visit to twenty five (25) fuel-wood markets, five each in the five study Local Government Areas. At each market, ten bundles of fuel wood – consisting between 10-20 wood pieces (the form in which fuel wood was sold) were randon selected. From each bundle, five wood pieces were further selected randomly ar identified to species level using plant identification guide (Arbonnier 2002).

2.3 BIODIVERSITY SURVEY

The top three plant species utilised as fuel-wood and *Eucalyptus camaldulensis* were sampled for insect, bird and mammalian visits/utilisation between January - June 2007. 20 individual plants were sampled for each plant species (10 individulas each for Amurum Forest Reserve and Kurra-Falls Forest).

2.3.1 Insect sampling

Insect samples were obtained by enclosing plant branch into a 25 x 65 cm net (diameter x length) this was shaken 10-times and net content emptied into plasti bags, trapped insects were preserved in an ethanol solution (70% ethanol, 10% glycerine and 20% distilled water) these were later identified and enumerated in the laboratory using insect identification keys (Borrer et. al. 1989, Shattuck 2000 Castner 2002).

2.3.2 Bird and Mammalian sampling

Bird survey was carried out by positioning telescope within a range of 10 – 30 m focal plant (depending on density of vegetation at the habitat). A period of 30 mir was spent recording avian visits and behaviour (foraging and perched,). Avian identification guide (Borrow and Demey 2001) was used to confirm some sighted individuals. This period was also used to record any mammalian species that visited the focal plant. At the end of each sample period, focal plants were sampled for avian nests.

2.4 WORKSHOP

A workshop was carried out on the 6th July 2007 for representatives of the Plateau State Environmental Agency, some fuel-wood marketers, NGO's, members and Chiefs of the communities were biological survey was done. During this workshop, a power point presentation of the research findings was done at the end of the presentation questions, discussions and recommendations were made by participants.

3.0 RESULTS

3.1 Market survey

A total of 1250 cut wood pieces were sampled during the market survey. These were observed to spread across 58 plant species and 23 plant families. The three most common fuel-wood plant species were *Parkia biglobosa* (Mimosoideae)*, Terminalia macroptera* (Combretaceae) and *Syzygium guineense* (Myrtaceae) respectively (Table 1)

.

Table 1: Fuel-wood plant species recorded at fuel-wood markets in Jos and its environment (August – December 2006).

S/n.	Fuel-wood plant species	Mean number / bunch/market (± S.D.) n=1250	n	%
1.	*Acacia ataxacantha*	0.28 ± 0.50	7	0.6
2.	*Acacia gourmaensis*	0.04 ± 0.00	1	0.1
3.	*Acacia macrostachya*	0.80 ± 0.00	20	1.6
4.	*Acacia mellifera*	0.08 ± 0.00	2	0.2
5.	*Acacia sieberiana*	0.48 ± 1.14	12	1.0
6.	*Albizia zygia*	1.8 ± 1.21	45	3.6
7.	*Alchornea cordifolia*	0.08 ± 0.00	2	0.2
8.	*Annona senegalensis*	1.88 ± 1.51	47	3.8
9.	*Annona squamosa*	0.16 ± 0.58	4	0.3
10.	*Anogeissus leiocarpus*	2.76 ± 1.32	69	5.5
11.	*Bombax costatum*	0.44 ± 0.96	11	0.9
12.	*Canarium spp*	0.08 ± 0.00	2	0.2
13.	*Canthium cornelia*	0.04 ± 0.00	1	0.1
14.	*Carissa edulis*	0.44 ± 0.44	11	0.9
15.	*Cola laurifolia*	0.08 ± 0.00	2	0.2
16.	*Combretum fragrans*	2.32 ± 1.46	58	4.6
17.	*Combretum molle*	0.64 ± 0.52	16	1.3
18.	*Combretum tomentosum*	0.44 ± 0.75	11	0.9

19.	*Dichrostachys cinerea*	0.76 ± 0.79	19	1.5
20.	*Ekebergia senegalensis*	0.08 ± 0.00	2	0.2
21.	*Erythrophleum suaveolens*	0.92 ± 1.83	23	1.8
22.	*Euphorbia kamerunica*	0.08 ± 0.00	2	0.2
23.	*Ficus asperifolia*	0.68 ± 0.55	17	1.4
24.	*Ficus cordata*	0.20 ± 0.50	5	0.4
25.	*Ficus ovata*	1.20 ± 1.33	30	2.4
26.	*Ficus polita*	0.04 ± 0.00	1	0.1
27.	*Flueggea virosa*	0.04 ± 0.00	1	0.1
28.	*Guibourtia copallifera*	0.20 ± 0.58	5	0.4
29.	*Harungana madagascariensis*	0.08 ± 0.00	2	0.2
30.	*Holarrhena floribunda*	1.72 ± 1.21	43	3.4
31.	*Hymenocardia acida*	0.44 ± 0.41	11	0.9
32.	*Isoberlinia doka*	0.52 ± 1.47	13	1.0
33.	*Jasminum dichotomum*	0.44 ± 0.96	11	0.9
34.	*Khaya senegalensis*	0.08 ± 0.00	2	0.2
35.	*Lantana camara*	0.32 ± 0.52	8	0.6
36.	*Mangifera indica*	0.56 ± 1.91	14	1.1
37.	*Manilkara multinervis*	0.32 ± 1.15	8	0.6
38.	*Ochnella alba*	0.52 ± 0.67	13	1.0
39.	*Pachystela pobeguiniana*	0.56 ± 1.00	14	1.1
40.	***Parkia biglobosa***	**5.92 ± 1.76**	**148**	**11.8**
41.	*Phyllanthus muellerianus*	0.12 ± 0.71	3	0.2
42.	*Piliostigma thonningii*	0.60 ± 0.87	15	1.2
43.	*Psidium guajava*	0.16 ± 1.41	4	0.3
44.	*Rhus natalensis*	0.60 ± 0.71	15	1.2
45.	*Santaloides afzelii*	0.08 ± 0.00	2	0.2
46.	*Sarcocephalus latifolius*	0.92 ± 1.01	23	1.8
47.	*Senna siamea*	0.16 ± 0.58	4	0.3
48.	*Steganotaenia araliacea*	0.04 ± 0.00	1	0.1
49.	*Swartzia madagascariensis*	0.08 ± 0.00	2	0.2
50.	***Syzygium guineense***	**3.08 ± 0.89**	**77**	**6.2**
51.	*Tamarindus indica*	1.44 ± 1.48	36	2.9
52.	*Tapinanthus dodoneifolius*	0.08 ± 0.00	2	0.2
53.	*Terminalia brownii*	0.76 ± 1.80	19	1.5
54.	***Terminalia macroptera***	**3.80 ± 1.22**	**95**	**7.6**
55.	*Terminalia mollis*	1.40 ± 1.16	35	2.8
56.	*Uvaria chamae*	0.44 ± 1.33	11	0.9
57.	*Vitellaria paradoxa*	0.32 ± 0.82	6	0.5
58.	*Vitex madiensis*	0.16 ± 0.58	4	0.3
*	*Eucalytus camaldulensis*	5.92 ± 1.76	148	11.8
*	Unknown	1.32 ± 1.36	35	2.8
	Total		**1250**	**100.3****

The three most common fuel-wood plant species are highlighted in blue

* *Eucalyptus* was treated separate from the other species being an exotic and the subject of ecological comparison with the top three local plant species.

**Sum of percentages exceeds 100 due to rounding up of figures to one decimal point

3.2 BIRD SPECIES ON FUEL-WOOD PLANT SPECIES AND *Eucalyptus camaldulensis*

A total of 142 individual birds spread across 37 bird species and 11 families were recorded during this aspect of the study

Table 2: Estimates of abundance and diversity of bird species across top fuel-wood plant species and *Eucalyptus camaldulensis*

Plant species	Mean avian visitation/plant/half hour (± S.D.)	Avian species richness	Simpson's diversity index
Parkia biglobosa (n=20)	2.00 ± 0.391	14	10.00
Syzygium guineense (n=20)	1.00 ± 0.486	8	6.25
Terminalia macroptera (n=20)	0.75 ± 0.509	9	11.11
Eucalyptus camaldulensis (n=20)	0.80 ± 0.507	6	4.76

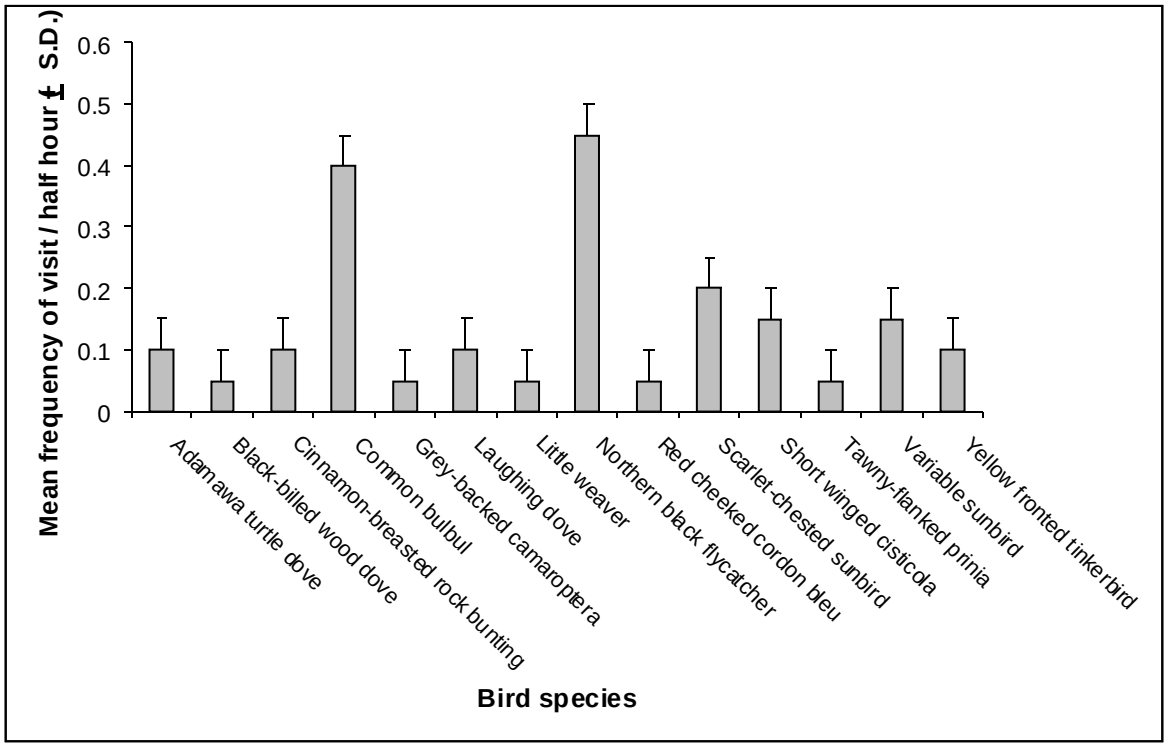

Figure 1: Mean frequency of visit by bird species on *Parkia biglobosa* (n=20)

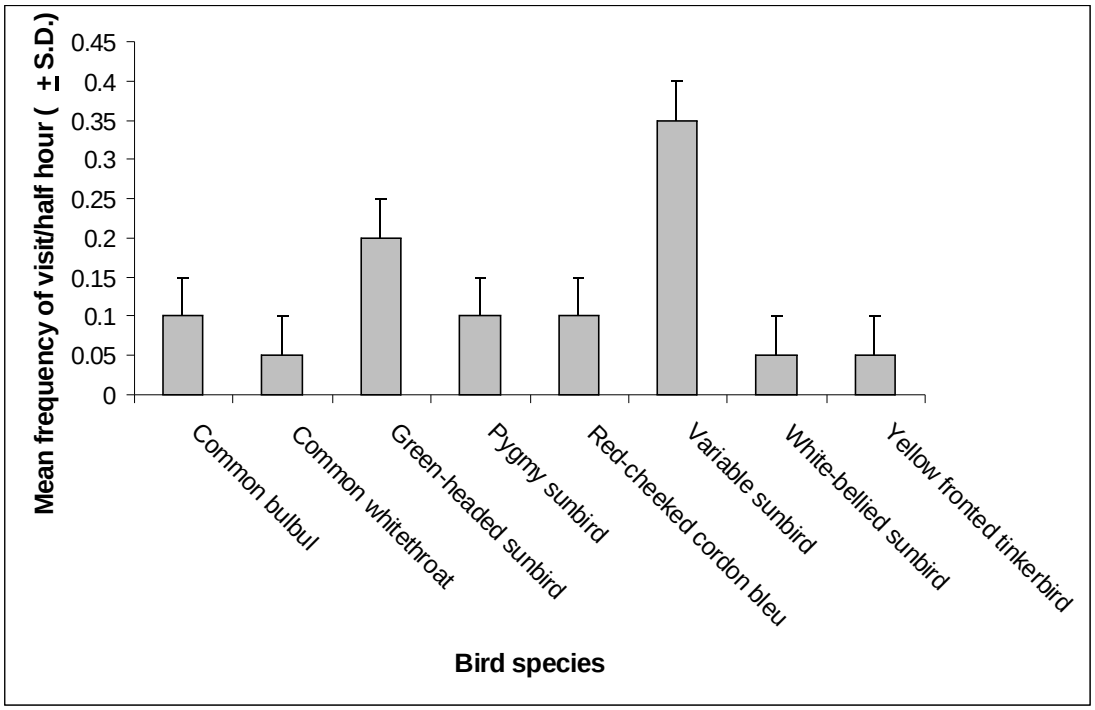

Figure 2: Mean frequency of visit by bird species on *Syzygium guineense* (n=20)

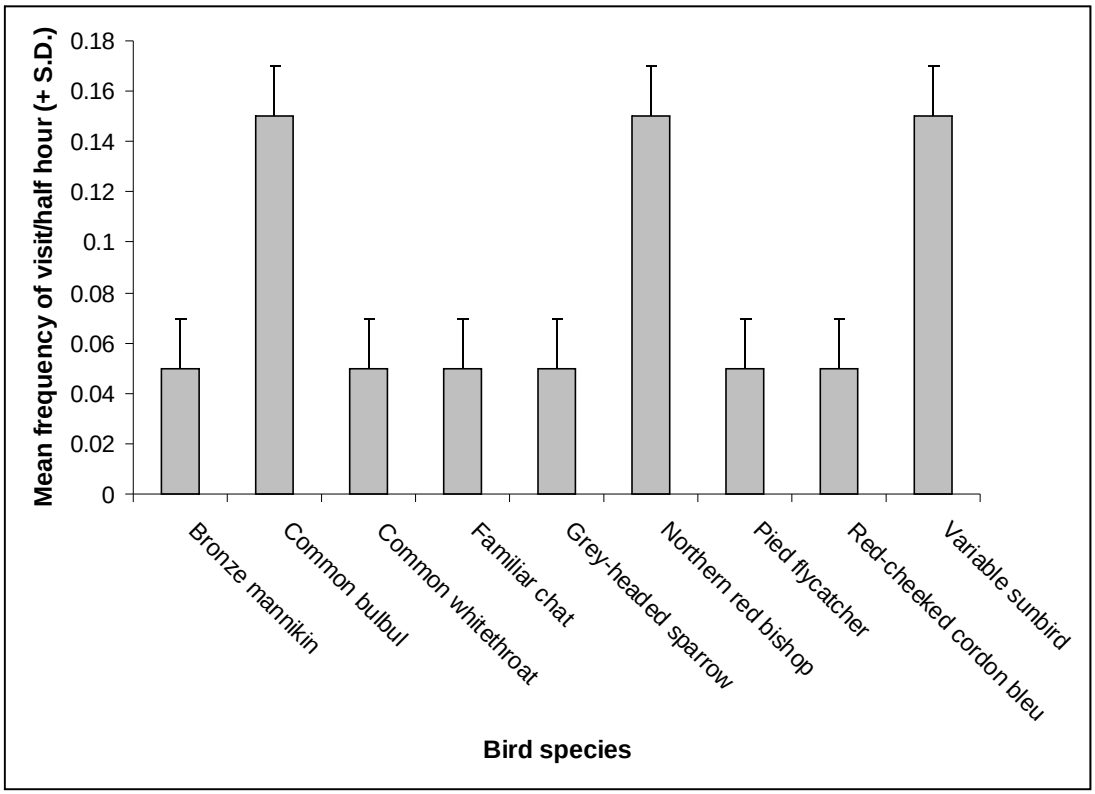

Figure 3: Mean frequency of visit by bird species on *Terminalia macroptera* (n=20)

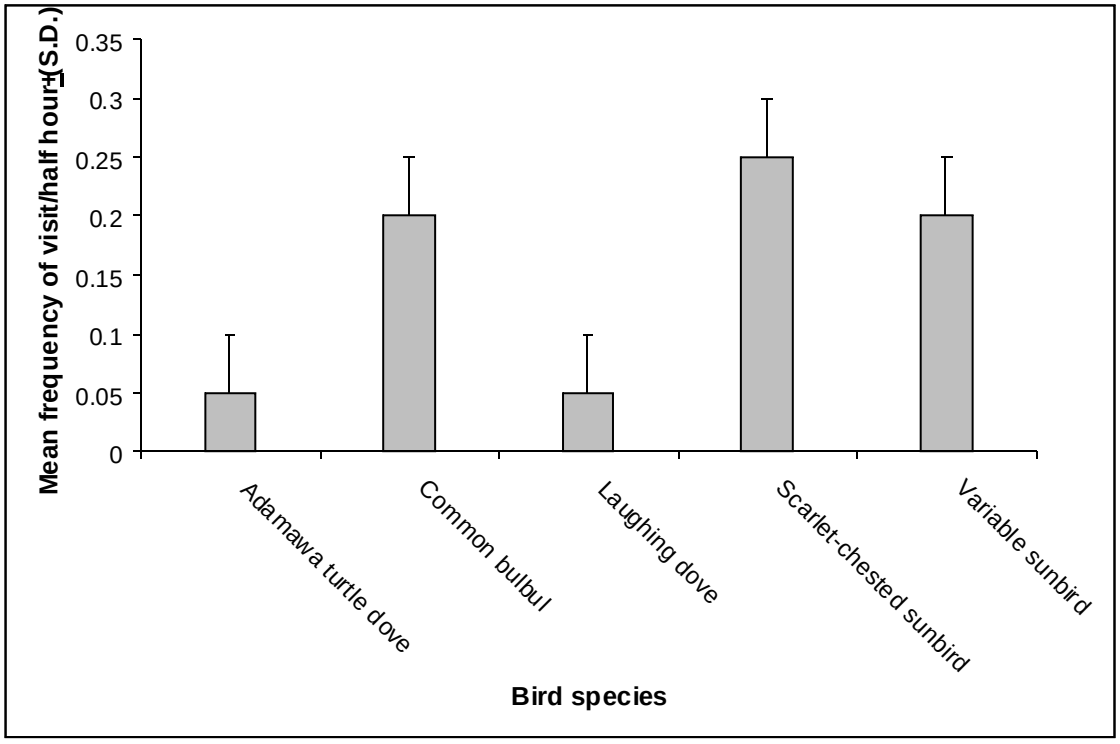

Figure 4: Mean frequency of visit by bird species on *Eucalyptus camaldulensis* (n=20)

3.3 INSECT SPECIES ON FUEL-WOOD PLANT SPECIES AND *Eucalyptus camaldulensis*

739 individual insects were sampled on the top three fuel wood plant species and *E. camaldulensis.* These were divided across 12 insect orders and 39 families. Majority of families and species occurred on the plant, *S. guineense* while *E. camaldulensis* supported the least number of insects during the period of this study (Tables 3 & 4).

Table 3: Estimates of abundance, richness and diversity of insect species across fuel-wood plant species and *Eucalyptus camaldulensis*

Plant species	Mean insect abundance/branch (± S.D.)	Number of insect families	Simpson's diversity index
Parkia biglobosa (n=20)	10.78 ± 4.85	18	1.92
Syzygium guineense (n=20)	4.18 ± 1.78	26	12.50
Terminalia macroptera (n=20)	3.00 ± 0.74	23	4.17
Eucalyptus camaldulensis (n=20)	0.53 ± 1.08	7	0.40

Table 4: Distribution of insect families found on fuel wood plant species and *Eucalyptus camaldulensis*

S/n.	Insect families	*Parkia biglobosa* n=20	*Syzygium guineense* n=20	*Terminalia macroptera* n=20	*Eucalyptus camaldulensis* n=20
1.	Acanaloniidae				v
2.	Acrididae	v	v	v	
3.	Alydidae	v	v	v	
4.	Apidae		v		
5.	Aradidae				v
6.	Blattidae		v	v	
7.	Brachonidae		v	v	
8.	Bruchidae	v		v	v
9.	Buprestidae	v			
10.	Calliphoridae	v	v	v	
11.	Cercopidae	v	v	v	
12.	Chalcididae		v	v	
13.	Chrysididae		v	v	
14.	Chrysopidae			v	
15.	Cicadellidae	v	v	v	
16.	Cicadidae	v	v	v	v
17.	Coccinellidae		v		
18.	Conopidae	v			
19.	Curculionidae	v	v	v	v
20.	Cynipidae	v	v	v	
21.	Dermestidae			v	
22.	Drosophilidae			v	
23.	Formicidae	v	v	v	
24.	Mantidae		v		
25.	Meloidae		v		
26.	Membracidae	v	v	v	
27.	myrmeleontidae		v		
28.	Nabidae	v		v	
29.	Pentatomidae		v	v	
30.	Perlodidae	v			
31.	Polistinae				v
32.	Pyrrhocoridae	v		v	
33.	Reduviidae		v		
34.	Scarabaeidae		v		
35.	Scutelliridae	v	v	v	
36.	Staphylinidae				v
37.	Tenebrionidae	v	v	v	
38.	Tephritidae		v		
39.	Tingidae		v		
Total (Families)		**18**	**26**	**23**	**7**

v = implies insect family recorded on plant species

3.4 Nest and mammalian surveys

Only one bird nest was recorded during the period of this study and this belonged to the little weaver and was found on *P. biglobosa*. Similarly, we only had one record of the Tantalus monkey (*Chlorecebus* species) feeding on the fruits of *P. biglobosa* during focal observations

4.0 DISCUSSION

Previous studies have recognised the magnitude of anthropogenic tendencies on natural habitats (Ameibenomo 2002, Amusa 2003, Fuwape 2003). For example, rate of fuel-wood utilisation across different geographic regions have been well documented (FAO 2000, Ameibenomo 2002, Fuwape 2003) and in some instances, details have included per capita consumption figures for urban and rural dwellers (Fuwape 2003, www.onlinenigeria.com, 2005). However, to gain a better understanding of the effects of man made tendencies on natural habitats, the importance of integrated studies that explore community specific resource usage patterns and its implications on local fauna can not be overemphasized. This is important as the nature and scale of habitat disturbance should vary from one community to another therefore suggesting community specific approach. Such a measure will provide conservation stakeholders with the knowledge of specific problem areas and therefore ways of tackling them.

This study, investigated pattern of fuel-wood usage across northern communities of Plateau State, Nigeria and its implications on local fauna. Results from market surveys showed utilisation to include 58 plant species. However, the top three plant species in order of utilisation include *Parkia biglobosa, Terminalia macroptera* and *Syzygium guineense*. These plant species when compared with *Eucalyptus camaldulensis* often employed in government reforestation programmes differed significantly in both diversity and abundance of faunal presence. Avian abundance and richness favoured *P. biglobosa* while insect families and abundance was harboured more on *S. guineense.* Sadly, *E. camaldulensis* (an exotic) which is often employed in reforestation programmes had the least faunal presence. These findings have a wide range of implications, for example, Even though the aim of ‘greening the environment’ is achieved, local reforestation projects might not be sustainable for local flora and fauna in the long term as the major plant species employed for such projects is less supportive of local fauna and this is further compounded by the fact that local flora which support a significant number of fauna

are gradually being decimated. All of these have tendencies of distorting ecological stability at local scale especially as it relates to foraging and pollination ecosystems. For example, a number of the bird species recorded such as members of the family Nectarinidae (variable sunbird, scarlet-chested sunbird, pygmy sunbird and green headed sunbird) are pollinator species of *Parkia biglobosa* and *Syzygium guineense* while birds like the northern black flycatcher (*Melaenomis edolioides*) and Common bulbul (*Pycnonotus babatus*) forage often for insects on these plants. Similarly, migratory passerines such as the common whitethroat (*Sylvia communis*) and pied flycatcher (*Ficedula hypoleuca*) have also been recorded during this study as insect foragers on *Terminalia macroptera.*

4.1.1 Why *Eucalyptus*?

Some of the reasons for the utilisation of *Eucalyptus* species for reforestation projects, as stated during the workshop by participants from the Plateau State Environmental agency, have been due to its fast growth rates and drought resistance therefore reducing the long term cost of sustaining such projects and very valuable for prompt solutions necessary for combating erosion and desertification.

4.1.2 Recommendations from workshop

Considering the above implications, participants at the workshop have made the following recommendations:

1. Educate communities on the detrimental effects of fuel-wood usage especially as it relates to the top three plant species (*P. biglobosa, S. guineense* and *T. macroptera*).
2. Integrate some of the local species into reforestation projects as this will help preserve indigenous species and support local fauna.
3. Encourage research at relevant Institutions aimed at producing fast growth indigenous plant species which could be employed for reforestation projects requiring prompt solutions (e.g. erosion control).
4. Support research at relevant institutions (such as the A.P. Leventis Ornithological Research Insitute, Jos, Nigeria) for the development of fuel-efficient stoves that could reduce pressure on local plant species.

4.2 CONCLUSION

Previous researchers have feared that available data on fuel-wood consumption have been largely based on estimates; this is because a major part of fuel-wood production and utilisation goes unrecorded. This research is considered a major contribution in this direction as it has succeeded in providing relevant local data that could be explored by stakeholders interested in the long term survival of flora and fauna on the Jos-Plateau.

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Project Photos

Identification of Fuel-wood with Mr Afan Ajang (research Assistant)

An example of the magnitude of fuel-wood consumption on the Jos-Plateau

Insect identification by Akwashiki Ombugadu (research assistant) at the A.P. Leventis Ornithological Research Institute's Laboratory

Insect collection from *Parkia biglobosa*

Focal observation session

Data analysis

Terminalia macroptera

Parkia biglobosa

Syzygium guineense (During fruiting)

Appendix 1: Location of surveyed fuel-wood markets

S/n	Local Government Area (LGA)	Site Name	Coordinates
	Jos-East		
1		Laminga	09^0 52.129'N, 08^0 58.735'E
2		Rizek	09^0 53.349'N, 09^0 00.242'E
3		Fobur	09^0 51.378'N, 09^0 01.272'E
4		Kyerkyer	09^0 52.646'N, 09^0 00.623'E
5		Sabon Gari	09^0 50.371'N, 08^0 58.677'E
	Jos-North		
6		Rock Haven	09^0 56.724'N, 08^0 51.604'E
7		Congo-Russia	09^0 55.831'N, 08^0 53.927'E
8		Anguwan-Rimi	09^0 57.004'N, 08^0 53.181'E
9		Jos-Jarawa	09^0 55.229'N, 08^0 54.407'E
10		Babale	10^0 00.090'N, 08^0 54.510'E
	Jos-South		
11		Vwel Kuru	09^0 43.214'N, 08^0 52.064'E
12		Rahwol Kanang	09^0 47.594'N, 08^0 52.652'E
13		Bukuru Kugiya	09^0 47.353'N, 08^0 51.910'E
14		Gyel Road	09^0 47.391'N, 08^0 51.602'E
15		Kufang	09^0 51.782'N, 08^0 51.815'E
	Barkin Ladi		
16		Hypang	09^0 38.893'N, 08^0 53.358'E
17		Mararaban Furong	09^0 41.237'N, 08^0 53.502'E
18		Chit	09^0 37.359'N, 08^0 53.644'E
19		Kurra Falls	09^0 23.541'N, 08^0 43.052'E
20		Kai	09^0 21.917'N, 08^0 44.180'E
	Bassa		
21		Zaria Road	10^0 01.998'N, 08^0 52.188'E
22		Buji	10^0 04.403'N, 08^0 52.902'E
23		Zaria Road 2	10^0 02.268'N, 08^0 52.599'E
24		Shakan	09^0 45.711'N, 08^0 42.607'E
25		Rukuba Road	09^0 55.648'N, 08^0 50.807'E