TAXONOMY, ETHNOBOTANY AND VEGETATION ANALYSIS OF BIODIVERSITY IN DUTSE LOCAL GOVERNMENT, JIGAWA STATE, NIGERIA

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Abstract: The survey investigated the biodiversity distribution and the respective economic uses of these plants in Dutse Local Government, Jigawa State. Twelve (12) sampling points were randomly located across the study while a quadrant size of 10m x 10m was used to gather taxonomic, quantitative and qualitative species diversity and richness. A total of 32 taxa belonging to 18 families were encountered during the study. Sampling point 4 (S4) had highest diversity of species (29) while S2 topped the number of species composition (13). The most abundant family was fabaceae with 8 taxa; dominant species was *Piliostigma thonningii* with the frequency (83.33%), density (0.31 m^2), relative density (11%) and abundance value 65 while the dominant life form was tree as it covers 69% (22 species) of the encountered species. Moreso, 41% (13 species) are used mainly for medicinal purposes. Plant diversity indices revealed that S4 had the highest diversity value (Simpson's index- 0.8371 and Equitability- 0.8695); S2 (Shannon-Wienners- 2.148 and Margalef- 3.641) while S5 had the highest evenness value of 0.8094. It was observed that the species encountered during the study provides one benefit or the other to the indigenous people, therefore they were conserved. The implication is that high level of awareness about the sustainable use of plants will probably have a significant effect on the gene pool conservation. International Union for Conservation of Nature (IUCN) redlistv2015.2 revealed that 29 of the species encountered are yet to be assessed.

Keywords: Biodiversity, diversity, ethnobotany, Fulfude, indices, taxonomy

Introduction

Biodiversity dominates the earth, scientist (especially taxonomists) have recently offered name to an expansive number of ca. 1.5 million, and these species are reported to be less studied (Urguhart *et al*., 2005). Biodiversity depicts inter and intra specific variations in species and their ecosystems (Gaston and Spicer, 2004). Kunwar*et al*. (2009) reported that these variations are assessed using species richness, genetic divergence and niches. Furthermore, Schere*et al*. (2005) highlighted that species diversity is crucial component of an ecosystem hence; it becomes a vital tool in characterizing the ecosystems. Consequently, ethnobotanical research performs an incompressible and significant role in the sustainable utilization of these plant resources.

According to Oladele (1988), many scientists have developed the keen interest in ethnobotanical studies in recent years. Thus, timber and non-timber products can be extracted from plant communities with reduced environmental degradation and therefore provide encourages conservation. Ethnobotany enhances conservation of diversity for sustainable use such as aesthetic, ethical, medicinal, scientific values and other economic uses, which is the most expensive method to be practiced. Ugbogu and Odewo (2004) stated that poor conservation methods of plant diversity may be as a result of lofty unawareness about the efficacy and curative ability of the alternative medicines and particularly as of the various side-effects associated with attributed to several synthetic drugs. In addition, ethnobotany proffers an operative approach to plant biodiversity conservation, since it contains abundance of data on the economic uses which can be exploited rationally. Emiru (2011) stated that the actual emergence of indigenous knowledge on medicinal plants became visible when humans started and learned the application of traditional knowledge on the use of medicinal plants. Ampitan (2013) reported that the demand for affordable treatments to meet primary health care needs and the vanishing plant species in Biu Local Government Area (LGA) in Borno State which has increased interest in traditional medicine among the rural and urban dwellers. According to World Health Organization (WHO) due to poverty and lack of access to modern medicine in the developing countries substantive population of about 65 – 80% rely on the use of plants as their major source(s) of healthcare (Awoyemi*et al*., 2012).

Ethnobotany, as earlier described, harmonizes relationship between people, plants and the environment. The plants provide three basic needs of man namely; cloth, food, and shelter while in return man protect the plants against destructions therefore, resulting into ecosystem balance. However, man activities such as agriculture, and various developmental projects with low interest of the younger generation has led to an increase in biodiversity loss and poor sustenance of indigenous knowledge in herbal medicine (Atawodi*et al*., 2014). Also, Muthu*et al*. (2006) iterated on the extinction of the knowledge of herbal medicine due to the aging generation of herbal medical practitioners. Therefore, there is need to document and preserve the knowledge through ethnobotanical survey about the exploitation and utilization of the biodiversity in Dutse local government area of Jigawa state.

Materials and Methods

Study area

An ethnobotanical survey was conducted among indigenes of Dutse local government area of Jigawa state geographically located on Latitude 114017.80 N and Longitude 92156.82 E at an elevation of 435 m above sea level. Some of the settlements in the studied location include; Katangalafia, Hammayayi, BakinJeji, Rahama, Danmasara, Madobi, Ruru, Kude, Sharipaya which are made up of Hausa, Fulani and Manga (a Kanuri dialect). The larger percentage of the local people engaged mostly in farming and rearing of livestock (herdsmen) such as cattle, guinea fowl, sheep, short and long legged goat. The rainy season lasts from May to September with average rainfall of between 600 to 1000 mm while high temperatures are normally recorded between the months of April and September. The southern part of the state has a higher rainfall percentage than the northern part.

Methodology

The vegetation assessment was carried out by establishing twelve (12) points which were randomly established within the site and were adequately geo-referenced. Afterwards vegetation survey was carried out using transect of 10 x 10 m followed by identification, classification and quantification of

species diversity. Group of elders, youths, farmers and haunters within the community were interviewed on the local names (Hausa and Fulani) and uses of the encountered taxa. The details of the economic uses of the species were obtained by consulting the elders and youths across the studied location. In a few cases, farmers and hunters were also interviewed. Information sought during the interview was the local names and economic uses of the encountered plants. Subsequently, the interviewers were accompanied to the field to ensure identification and collection of these plants. Confirmation of the conservation statuses was done using International Union for Conservation of Nature red list (IUCN) red list version 2015.2.

Plant identification

The literature used in the process identification include; Akobundu and Agyakwa (1998); Abiodun and Yong (2012); Burkill (1985, 1994, 1995, 1997, 2000); Hutchinson and Dalziel (1954, 1963); Keay (1989). In instances where on-site assessment was not possible, specimens were collected and taken to the Herbarium, Department of Botany, University of Lagos for adequate identification.

Results and Discussion

Nigeria is characterized with different vegetation types with arrays of diverse species in various forms. However, these vegetation types are been degraded at alarming rate as a result of the anthropogenic and environmental factors. Despite the combine effects of the harsh climate and anthropogenic factors such as farming, grazing and consistent exploitation of the biodiversity for various economic uses that threatens plants distribution, a total of 32 taxa belonging to 18 families were encountered during the study (Table 1) while the fulfude and economic uses of the encountered species are presented in Table 2. The physiognomy was characterized by open vegetation with scanty trees as expected in the savanna vegetation. It was revealed that sampling point 4(S4) have the highest sum of individual species of 29 followed by S11 and S2 with 28 and 27 species, respectively. Consequently, S2have the highest number of taxa (13), followed by S9 and S4 with 12 and 11 species respectively (Table 1).

The richest plant family was Fabaceae with 8 taxa while others ranged between 1 – 3 species (Fig. 1). Also, Fig. 2 showed that the most dominant life form was trees as it covers 69% (22 species) followed by shrubs 22% (7 species) while herbs, grasses and creepers covers 3% (1 species). Trees are able to dominate because of the presence of long tap root that penetrates through the soil to the water table in order to buffer their survivability.

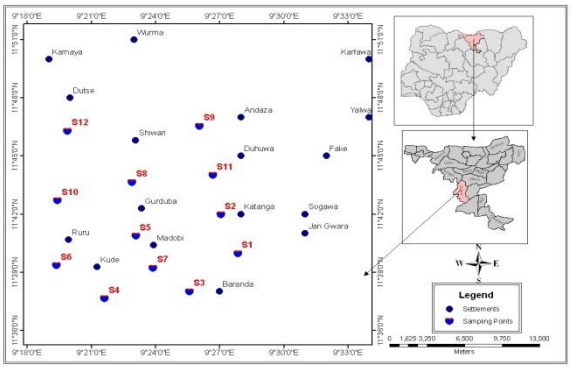


Fig. 1: Map of the study area

The most dominant species was *Piliostigma thonningii*with the highest occurrence value of 10, frequency of 83.33%, density (0.31 m^2), relative density (11%), and abundance value of 65 followed by *Guiera senegalensis*, *Azadirachta indica*, and *Balanites aegyptiaca* with occurrence value of 8, frequency (66.67%), density (0.25 m^2), relative density (8.80%) and abundance value of 37, 27 and 18, respectively (Table 1). It was observed that the indigenous inhabitant of this locality mostly spare these plants because of the benefits derived from them. In other words, the purpose of sustainable use has resulted into conservation.

Table 1: Statistical distribution of species across the studied area

S/N	Botanical Names	FAMILY	Habit	NOS	F (%)	D (M^2)	R. D. (%)	A
1	*Acacia sp.* L.	Fabaceae	Tree	2	16.67	0.06	2.20	5
2	*Adansonia digitata* L.	Bombacaceae	Tree	5	41.67	0.16	5.50	7
3	*Anacardium occidentale* L.	Anacardiaceae	Tree	1	8.33	0.03	1.10	1
4	*Anogeissus leiocarpus* (DC.) Guill. & Perr.	Combretaceae	Tree	3	25.00	0.09	3.30	10
5	*Asparagus africanus* L.	Liliaceae	Shrub	1	8.33	0.03	1.10	1
6	*Azadirachta indica* A.Juss.	Meliaceae	Tree	8	66.67	0.25	8.80	27
7	*Balanites aegyptiaca* (L.) Delile,	Zygophyllaceae	Shrub	8	66.67	0.25	8.80	18
8	*Borassusaethiopum* Mart.	Arecaceae	Tree	3	25.00	0.09	3.30	3
9	*Calotropis procera* (Aiton) W.T.Aiton	Asclepiadaceae	Shrub	1	8.33	0.03	1.10	2
10	*Cissus quadrangularis* L.	Vitaceae	Shrub	2	16.67	0.06	2.20	7
11	*Daniellia oliveri*Benn.	Fabaceae	Tree	1	8.33	0.03	1.10	1
12	*Dicoma tomentosa* Cass.	Asteraceae	Herb	1	8.33	0.03	1.10	8
13	*Dicrostachys cinerea* Wight et Arn.	Fabaceae	Tree	1	8.33	0.03	1.10	3
14	*Diospyros mespiliformis* Hochst. ex A. DC.	Ebenaceae	Tree	6	50.00	0.19	6.60	7
15	*Eucalyptus globulus* Labill.	Myrtaceae	Tree	2	16.67	0.06	2.20	12
16	*Euphorbia sp.* L.	Euphorbiaceae	Shrub	1	8.33	0.03	1.10	1
17	*Ficus sp.* L.	Moraceae	Tree	1	8.33	0.03	1.10	1
18	*Guiera senegalensis*J.F. Gmel	Combretceae	Shrub	8	66.67	0.25	8.80	37
19	*Hyphaene thebaica*(L.) Mart.	Arecaceae	Tree	4	33.33	0.13	4.40	5
20	*Lannea kerstingii*Engl. &K.Krause	Anacardiaceae	Tree	1	8.33	0.03	1.10	1
21	*Leptadenia hastate* (Pers.) Decne	Asclepiadaceae	Creeper	3	25.00	0.09	3.30	7
22	*Mangifera indica* L.	Anacardiaceae	Tree	1	8.33	0.03	1.10	1
23	*Parkia biglobosa* (Jacq.) R.Br. ex G.Don	Fabaceae	Tree	3	25.00	0.09	3.30	3
24	*Phoenix dactylifera* L.	Arecaceae	Tree	1	8.33	0.03	1.10	2
25	*Piliostigma thonningii*(Schum.) Milne-Redh.	Fabaceae	Tree	10	83.33	0.31	11.00	65
26	*Prosopis Africana* (Guill. & Perr.) Taub.	Fabaceae	Tree	3	25.00	0.09	3.30	4
27	*Senna occidentalis* L.	Fabaceae	Shrub	3	25.00	0.09	3.30	4
28	*Tamarindus indica* L.	Fabaceae	Tree	2	16.67	0.06	2.20	3
29	*Terminalia laxiflora* Engl. & Diels	Combrtaceae	Tree	1	8.33	0.03	1.10	2
30	*Vetiveria sp.* L.	Paoceae	Grass	1	8.33	0.03	1.10	4
31	*Vitellaria paradoxa*C.F.Gaertn.	Sapotaceae	Tree	1	8.33	0.03	1.10	1
32	*Vitex doniana* Sweet	Verbenaceae	Tree	2	16.67	0.06	2.20	2

***NOS- Number of Species, * F- Frequency, *A- Abundance, *D- Density, *R.D- Relative Density**

Table 2: Economic importance of the encountered species

S/N	Botanical Names	Family	Habit	Common Name	Local Name	Economic Importance	IUCN Status
1.	**Abelmoschusesculentus*	Malvaceae	Herb	Okra	Kubewa (H)	Food and Medicine	
2.	*Acacia nilotica*	Fabaceae	Tree		Gawdi(H)	Fencing	
3.	*Adansonia digitata* L.	Bombacaceae	Tree	Baobab	Kuka (H), Bokki(F)	Edible leaf, Fodder	NA
4.	*Anacardium occidentale* L.	Anacardiaceae	Tree	Cashew	Dankanju(H)	Edible Fruit	NA
5.	*Anogeissus leiocarpus* (DC.) Guill. &Perr.	Combretaceae	Tree	African birch	Mareke(H)	Medicine, Fodder	
6.	*Asparagus africanus*L.	Liliaceae	Shrub	Lace fern	Adamuadawa (H)	Medicine	NA
7.	*Azadirachta indica* A.Juss.	Meliaceae	Tree	Neem	Dogonyaro (H), Sharubiyi (F)	Medicine, Fodder	NA
8.	*Balanites aegyptiaca* (L.) Delile,	Zygophyllaceae	Shrub	Desert date	Aduwaa (H), Tanni (F)	Edible Fruit	NA
9.	*Borassus aethiopum*Mart.	Arecaceae	Tree	Fan Palm	Giginya (H), Dubbi(F)	Edible Fruit	NA
10.	*Calotropis procera* (Aiton) W.T.Aiton	Asclepiadaceae	Shrub	Apple of Sodom	Tumpaapahi (H, F)	Domestic use	NA
11.	*Cissus quadrangularis* L.	Vitaceae	Shrub	Devil's Backbone	Sasarikura (H)	Medicine	NA
12.	**Citrullus lanatus*	Cucurbitaceae	Climber	Water melon	Kankana (H)	Fruit	NA
13.	**Cucumis sativus*	Cucurbitaceae	Creeper	cucumber	Gurji (H)		NA
14.	*Daniellia oliveri* Benn.	Fabaceae	Tree	African Copaiba Balsam	Maje (H)	Medicine	NA
15.	**Daucus carota*	Umbeliferae	Herb	Carrot	Karas (H)		
16.	*Dicoma tomentosa*Cass.	Asteraceae	Herb	fever bush	Farindaya	Medicine	NA
17.	*Dicrostachys cinerea* Wight et Arn.	Fabaceae	Tree	Bell mimosa	Dundu (H)	Medicine	LC
18.	*Diospyros mespiliformis* Hochst. ex A. DC.	Ebenaceae	Tree	Ebony tree	Kanya (H), Nelbi (F)	Edible Fruit	NA
19.	**Eragrostis ciliaris*	Poaceae	Grass	Cane Grass		Fodder	
20.	*Eucalyptus globulus*Labill.	Myrtaceae	Tree	River red gum		Medicine	NA
21.	**Euphorbia balsamifera*	Euphorbiaceae	Herb	Balsam Spurge	Agwaje(H)		
22.	*Euphorbia sp.* L.	Euphorbiaceae	Shrub		Arira (F)	Medicine	
23.	*Ficus sp.* L.	Moraceae	Tree			Medicine	
24.	*Ficus thonningii*	Moraceae	Tree		Iyahi (H)		
25.	*Guiera senegalensis*J.F. Gmel	Combretceae	Shrub	Mosci medicine	Sabara (H), geelooki (F)	Medicine, Fodder	NA
26.	*Hyphaene thebaica* (L.) Mart.	Arecaceae	Tree	Dum Palm	Goruba (H), Gellee (F)	Edible Fruit	NA
27.	*Lannea kerstingii* Engl. &K.Krause	Anacardiaceae	Tree	Plum mango	Faruhi (F)	Medicine	NA
28.	*Leptadenia hastate* (Pers.) Decne	Asclepiadaceae	Creeper		Yadiha (H, F)	Edible leaf, Fodder	NA
29.	*Mangifera indica*L.	Anacardiaceae	Tree	Mango	Mongoro (H)	Edible Fruit, Fodder	NA
30.	**Oryza glaberrima*	Poaceae	Grass	African rice	Shinkafa (H)		
31.	**Oryza sativa*	Poaceae	Grass	Asian rice	Shinkafa (H)		
32.	*Parkiabi globosa*(Jacq.) R. Br. Ex G. Don	Fabaceae	Tree	Locust bean	Dorowa (H), Naree (F)	Edible Fruit, Fodder, Domestic use	NA
33.	**Pennisetum glaucum*	Poaceae	Grass	Bulrush millet	Gero (H)		
34.	*Phoenix dactylifera*L.	Arecaceae	Tree	Date palm	Dabino (H), (F)	Edible Fruit	NA
35.	*Piliostigma thonningii* (Schum.) Milne-Redh.	Fabaceae	Tree	Monkey bread	Karogo (H), Barkee (F)	Medicine	NA
36.	*Prosopis Africana* (Guill. & Perr.) Taub.	Fabaceae	Tree	African mesquite	Kirya (H), Kahi (F)	Medicine, Fodder	NA
37.	**Sclerocrya birrea*		Tree		EEri (H)		
38.	*Senna occidentalis* L.	Fabaceae	Shrub	Coffee senna	Tabsahi (F)	Medicine	NA
39.	**Sorghum arundinaceaum*	Poaceae	Grass		dakwumbehi		
40.	**Sorghum bicolor*	Poaceae	Grass	Guinea corn	Dawa (H)		
41.	*Tamarindus indica* L.	Fabaceae	Tree	Tamarind blossom	Tsamiya (H), Jabbi (F)	Edible Fruit, Fodder	NA
42.	*Terminalia laxiflora*Engl. & Diels	Combretaceae	Tree		Farinchinharamata (H)	Medicine	NA
43.	**Triticum aestivum*	Poaceae	Grass	Wheat	Alkama (H)		
44.	*Vetiveria sp.* L.	Paoceae	Grass			Fodder	
45.	*Vitellaria paradoxa* C. F. Gaertn.	Sapotaceae	Tree	Shea butter tree	Kadanya (H)	Medicine	NA
46.	*Vitex doniana* Sweet	Verbenaceae	Tree	Black plum	Dinya (H), Galbihi(F)	Medicine, Fodder	NA
47.	**Zea mays*	Poaceae	Grass		Masara (H)		
48.	**Ziziphus mucronata*	Rhamnaceae	Tree	Buffalo's thorn	gulumjaabe		

***- Present but not within the sampled plots, NA- Not assessed, LC- Least concern, H- Hausa, F- Fulfude**

Several diversity indices were used to describe the species distribution diversity, evenness and abundance across the area (Fig. 4).Simpson's and Equitability index indicated high diversity in S4 with the value 0.8371 and 0.8695 which correlates with the highest sum of individuals recorded for this point. Consequently, Shannon-Wienners (H) and Margalef index justifies the species abundance (13) documented in S2 with the value 2.148 and 3.641, respectively. The range of evenness value is between 0 – 1 hence, evenness tends to increase as it moves toward 1. The species evenness values across the studied area were above average as it ranged between 0.6 and 0.8; however, the highest evenness value (0.8094) was recorded for S5. *Adansonia digitata* and *Leptadenia hastata* were observed to be common even around settlements because of its numerous uses to man and livestock. Apparently, all the encountered taxa were consumed by either man or livestock. From the study, the following species with edible fruits were encountered: *Anacardium occidentale*, *Borassusae thiopicum*, *Balanites aegyptiaca*, *Detarium microcapum*, *Diospyros mespiliformis*, *Hyphaenethebaica*, *Mangifera indica*, *Phoenix dactylifera*, and *Tamarindus indica* among others. There is ample evidence that increasing numbers of people across various parts of the world depend on traditional herbal remedies for their health care.

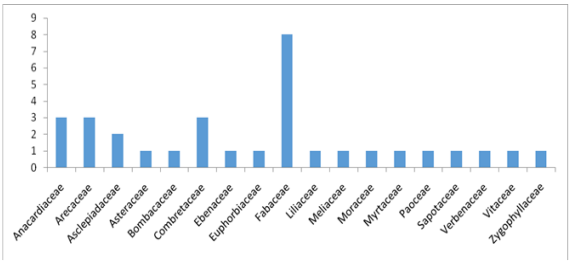


Fig. 2: Family distribution across the study area

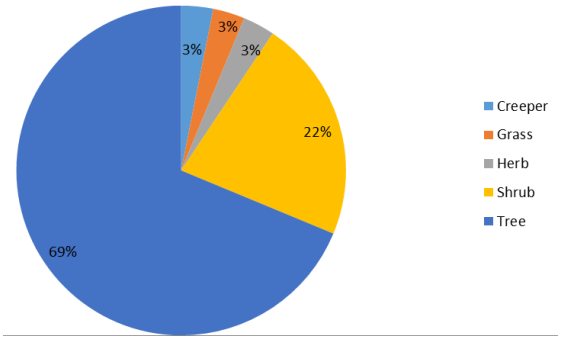


Fig. 3: Percentage distribution of the encountered species into different plant forms

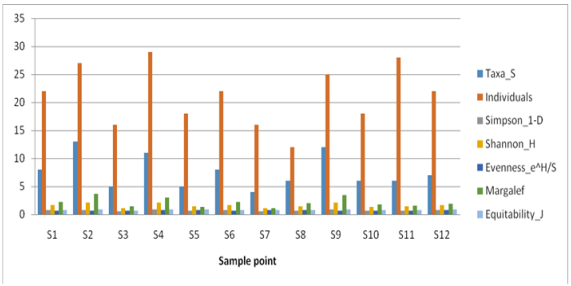
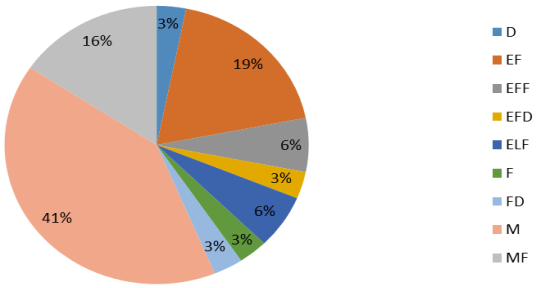


Fig. 4: Diversity indices



D- Domestic use,EF- Edible Fruits, EFF- Edible Fruit, Fodder, EFD- Edible Fruit, Fodder, Domestic use, ELF- Edible Leaf, Fodder, F- Fencing, FD- Foddder, M- Medicine, MF- Medicine, Fodder

Fig. 5: Percentage distribution of the encountered species into various economic uses

Plate I: Open woody vegetation

Plate II: Cultivated land

Plate III: Plot dominated by *Piliostigmathonningii*

The local uses of plants and products in health care are even much higher in particularly those areas with little or no access to modern health services (Saeed*et al*., 2004). Medicinal plants have been used as traditional medicine to treat different human ailments (Kalayu*et al*., 2013). Of these species, 41% (13 species) are used for medicine, 19% (7 species) are edible fruits and 16% (5 species) are used for medicine and fodder simultaneously (Fig. 5). The percentage of grass and other herbaceous species was low because of the season of study.

Conclusion

The study revealed that Dutse, LGA of Jigawa State is an open wood savannah vegetation dominated by trees however, *Azadirachta indica*, *Guirea senegalense* and *Piliostigma thonningii* amongst other species are found to be more common. Various economic uses derived from this vegetation include, medicinal plants, fodder, edible fruits, vegetables and for domestic uses such as fire wood, fencing. Consequently, no endangered species was identified during the study. Moreso, it was revealed that there is a significant relationship between ethnobotany and conservation of biodiversity; hence, it plays a key role in biodiversity conservation. Therefore, the results from this study can serve as baseline information to Jigawa State Government in conserving, monitoring and sustainable utilization of the indigenous economic plants in DutseLGA, Jigawa State.

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Conflict of Interest

No conflict of interest among the authors.

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