ISSN: 2994-5569

Research Article

World Journal of Forest Research

Ecological Status of Medicinal Plants in Some Selected Land Use Types (LUT) of Sokoto Metropolis, Sokoto State, Nigeria

Senchi A A[1*], O Y Ogunsanwo[2] and I O Lawal[3]

[1]*Department of Forestry and Environment, Usmanu Danfodiyo University, Sokoto, Nigeria*

[2]*Department of Forest Production and Products, University of Ibadan, Nigeria*

[3]*Forestry Research Institute of Nigeria (FRIN)*

[*]Corresponding Author
Senchi A A, Department of Forestry and Environment, Usmanu Danfodiyo University, Sokoto, Nigeria.

Submitted: 2024, Oct 21; **Accepted:** 2024, Nov 26; **Published:** 2024, Dec 12

Citation: Senchi, A. A., Ogunsanwo, O. Y., Lawal, I. O. (2024). Ecological Status of Medicinal Plants in Some Selected Land Use Types (LUT) of Sokoto Metropolis, Sokoto State, Nigeria. *World J Forest Res, 3*(1), 01-06.

Abstract

This study aimed to assess the ecological status of medicinal plant in Sokoto Metropolis, Sokoto state, Nigeria. Data for this research was collected using three out five land use types. The three Land Use Types (woodlot, farmland and Fadama land) were purposively selected in each LGA based on accessibility. Using a sampling intensity of 2% proportionate to size, sampling plots (50 m x 50 m) were demarcated in each LUT for tree species enumeration. Five sub-plots (5 m x 5 m) were established in each plot for wildlings and saplings assessments. All plants were identified to species level. Relative density and Shannon-Wiener diversity index (H′) were computed. Eucalyptus camaldulensis (29.4%), Adansonia digitata (28.8%) and Azadirachta indica (94.6%) were the relative density in Fadama land, Farmland and woodlot respectively. There were 34 plant species representing 23 families across LUT. Highest (2.42) and least (0.30) diversity of trees occurred in farmland and woodlot, respectively. Wildlings and saplings had the highest (1.66 and 0.90) diversity in Fadama land, while woodlot had the least (0.18) wildlings and no saplings. From the results, Sokoto Metropolis was endowed with medicinal plants, although mostly are sourced from the wild. Cultivation of medicinal plants in the area was recommended.

Keywords: Ecological Status, Land Use Types, Medicinal Plants, Metropolis

1. Introduction

Forest resources have the natural ability to be renewed, which offers people great opportunity to tap these resources for their benefit. The availability of a reliable database on the potential, extent and state of the resources, is a basic requirement for a sound forest management strategy [1]. Diversity and abundance of tree species are fundamental to total forest biodiversity because trees provide resources and habitat for almost all wildlife species. Life and survival of man would be impossible without the use of plants and plant products [2]. Non-timber forest products (NTFPs) such as plant roots, leaves and bark and other items from the forest provide food, shelter, medicine, and materials for ceremonies and worship [3]. When people began to domesticate plants and animals, they became less dependent on wild foods and other forest materials. Non-timber forest products are components of the forest ecosystem that exist in nature and are generally not cultivated. They are non-timber, but can be made of wood.

Medicinal plants have been playing very important role in human health care since time immemorial. This practice of health care is based on tradition and culture of the people. Plants are reliable sources for the treatment of diseases in different parts of the world [4]. There is an increasing demand for herbal drugs in international trade because herbal medicines are cheap, more effective and easily available and supposed to have no side effects. This is why patients in developing countries such as Bangladesh (90%), Myanmar (85%), India (80%), Nepal (75%), SriLanka (65%) and Indonesia (60%) have strong conviction in this system [5].

In Nigeria, traditional medicine is filling the gap of inequalities in access to health care system [6]. Medicinal plants have maintained its popularity in all regions of the developing world and its use is rapidly expanding in the industrialized countries like China [7]. Nonetheless, the botanical studies which examine the medicinal use of plant resources indicate that there is great diversity in the number of plant resources that are available in many regions of the world, and that these plants are widely exploited for their medicinal qualities [8].

Globally, over-exploitation and destructive harvesting techniques have been identified as two critical threats directly or indirectly affecting medicinal plant species [9]. The main direct environmental

consequence of unsustainable harvesting practices is the reduced reproduction, growth, and survival rates of the targeted species [10]. Such changes can consecutively destroy the ecosystem balances and influence the dynamics and structure of populations or even drive species to the brink of extinction [11].

However, medicinal plants of Nigeria more especially Northern Nigeria are subjected to continuous depletion and are threatened with extinction due to habitat loss and over exploitation. The danger poses a threat to the well-being of the rural population which has, for generations, relied on the plants to ward off some of the common ailments in both human beings and domestic animals [12]. On one hand, the use of these plants has contributed enormously to the health sector, on the other hand, the demand for herbs, particularly in parts of Africa, has brought some plants near extinction (even the simplest plant may have a future importance that we cannot predict [13]. In most developing countries like Nigeria, it is well known that traditional medicines are widely used especially in the low-income rural parts of the country [14]. According to the World Health Organization (WHO), approximately 80% of the world's population relies on traditional medicine to fulfill their daily health care needs [15].

The reasons for this dependence on plant medicine among rural/peri urban communities in developing countries are: That plant medicine is more easily available and they are comparatively cheaper in some areas. In some instances, plant medicine is entirely free of charge. The wide utilisation of plant-based traditional healthcare is mainly attributed to the fact that it makes use of locally available plant resources. For sustainable development to be achieved in the preservation of medicinal plants there is need to document existing medicinal plants species so as to serve as guide for researchers, foresters, environmentalists, botanists and wildlifers among others to preserve the environment from unnecessary exploitation. For this reason, the research examined the ecological status of medicinal plants in Sokoto Metropolis, Sokoto State, Nigeria.

2. Methodology

2.1. The Study Area

The study was carried out in Sokoto Metropolis, Sokoto State. Sokoto is located in the extreme North-west part of Nigeria at the confluence of rivers Sokoto and Rima. It lies between latitude 12◦57′ 30″N to 13◦8′ 0″N and longitude 05◦9′ 0″Eto 05◦19′ 30″E [16]. The state covers an area of 25,973kmsq or 10,028sqm. Sokoto state is made up of 23 local government areas and an estimated projected population of over 5.4 million as at 2017 [17]. The GDP of the state is $4,818m with per Capita income of about $1,274 [18]. The weather is marked by a single rainy season and long dry season, which is a typical characteristic of the tropic region. It records annual rainfall between 300mm-800mm and mean temperature of 34.5oC. The dry season temperatures exceed 45oC during the day time which is the highest recorded in Nigeria. It is dominated by the North-East Trade wind harmattan from the month of November to February [19]. The relative humidity is recorded to be constantly below 40% (20 – 35%) in the dry season and 43 – 70% in the rainy season [20,21]. The vegetation is Sudan savanna with predominance of trees such as *Adansonia digitata, Balanites aegyptiaca, Ziziphus spina-christi, Z. mauritiana,* and *Vitex doniana* and shrubs like **Senna obtusifolia, S. occidentalis**, and grasses like (*Sida acuta, Sida cordifolia, Striga hermonthica, Eragrostis tremula, Combretum glutinosum*, etc). The soil type is sand and sandy loam with low organic matter content.

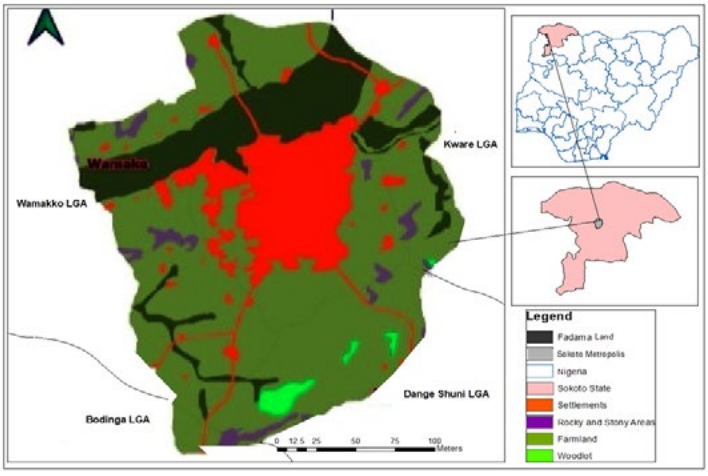

Figure 1: Map of Sokoto Metropolis Showing the Land Use Types

2.2. Sampling Procedure

Plot samples were established to estimate tree species abundance and distribution in the different landuse types. Plots of 50m x 50m were demarcated from Fadama lands, Farmlands and Woodlot proportionate to size in Sokoto Metropolis (Table 1). For Fadama land, five out of ten hectares were randomly selected for the study. Two sub plots of 50m x 50m were also selected randomly which gave a total number of 10 subplots. For farmland, eleven (11ha) out of twenty three hectares (23ha) were randomly selected for the study. Two sub plots of 50m x 50m sizes were also selected randomly which gave a total number of 22 subplots, while one hectare of natural woodlot was used and four (4) sub-plots of 50m x 50m each was used. Quadrats of 5m x 5m were established at the four corners and the center of each 50m x 50m plots and, saplings and wildlings of tree species were identified and enumerated. The inventory was carried out on all the sub plots.

Landuse Types	Land area covered (sqkm)	Land area covered (m2)	Land area covered (ha)	2% of Land area covered (ha)	Sampled Plots (ha)	Sampled Plots (50x50m)
Fadamaland	52.28	5228000	522.8	10.46	5.0	10
Farmland	115.23	11523000	1152.3	23.05	11.0	22
Woodlot	3.69	369000	36.9	0.72	1.0	4
Total	171.20				17.0	36
Source: Field Survey, 2022						

Table 1: Spatial Land Area Covered by Land Use Types in Sokoto Metropolis

2.3. Data Collection and Analysis

Descriptive statistics was used for this research. All the tree species in each plot were identified to species level and enumerated. From the inventory data obtained, relative density of the species, relative abundance of species and species diversity indices were calculated from each land use type using the following formulae:

1. Relative Density of species (RD)=Number of individual specie/ Total number of speciesx 100 ……...…1

2. Relative Abundance of species (Pi)=Relative density of species/100…….....2

3. Shannon-Wiener Diversity Index (H): H=-Σ Pi In Pi……...…….……...…….3

Where:

Pi = S/N S = Number of individuals of one specie

N = Total number of all individuals in the sample plot and

In = Logarithm to base e.

H = Shannon-Wiener Diversity Index

3. Results and Discussions

The ecological status of medicinal plants in Sokoto metropolis using Shannon-Wiener Diversity Index showed high diversity of trees in farmland with a value of 2.415686 and the least was observed in woodlot with 0.301246. Similarly, diversity index of wildlings recorded 1.656372 as the highest in Fadama land and 0.178112 in woodlot as the lowest. Lastly, Fadama land had 0.900256 as the highest and woodlot had 0.000000 as the least diversity index of saplings (Figure 2).

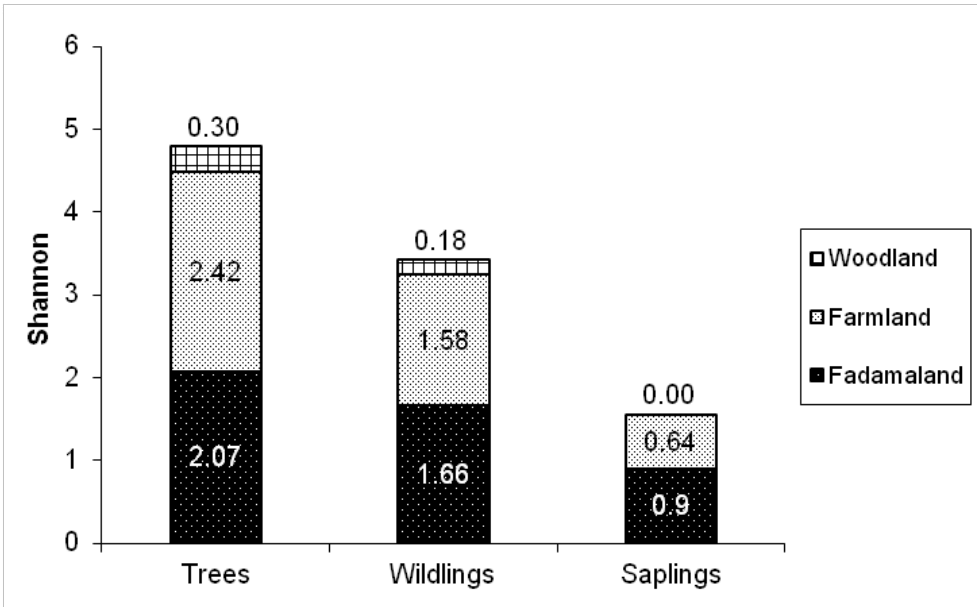

Figure 2: Diversity Index of Medicinal Plants in Sokoto Metropolis

The indices of diversity explained the richness and diversity of species in the different landuse areas. Diversity index of trees which was higher in farmland than other landuse types, may be due to security challenges in the region. Farmland and Fadama land although lower in density, depicted higher species diversity than woodlot. The most abundant species in all the land-uses were Eucalyptus camaldulensis (Fadama land), Adansonia digitata (farmland) and woodlot was dominated by Azadirachta indica (94.6%) with sparse trees in the area. This was in line with Ifo et al., who reported that, there is Low diversity due to the fact that it is dominated by a single species Musanga cecropioides [22]. This species contributes nearly 90% of the total number of trees in the plot. It was also agreed by Nolan and Callahan, who indicated that Brooklyn collection was dominated by Mytilus edulis, and was much less diverse (even though the shells were found at a greater density. Similarly, diversity index of wildlings was highest in Fadama land and lowest in woodlot [23]. Lastly, Fadama land had the highest and woodlot had the least diversity index in saplings.

Scientific Name	Local Name (Hausa)	Family	Frequency	RD(%)	RA
Relative Density and Abundance of Fadama Land Trees					
Acacia nilotica	Bagaruwa	Mimosaceae	6	11.76	0.12
Fadherbia albida	Gawo	Mimosaceae	4	7.84	0.08
Azadirachta indica	Dogonyaro	Meliaceae	7	13.73	0.14
Ceiba pentandra	Rimi	Malvaceae	1	1.96	0.02
Eucalyptus camaldulensis	Turare	Mimosaceae	15	29.41	0.29
Lawsoniainermis	Lalle	Lyhtraceae	2	3.92	0.04
Mangifera indica	Mangwaro	Anacardiaceae	5	9.80	0.10
Piliostigmareticulatum	Kalgo	Fabaceae	1	1.96	0.02
Psidium gwajava	Gwaiba	Myrataceae	7	13.73	0.14
Tamarindus Indica	Tsamiya	Caesalpiniaceae	2	3.96	0.04
Acacia Senegal	Jirai	Mimosaceae	1	1.96	0.02
		Total	51	100.00	1.00
Relative Density and Abundance of Farmland Trees					
Acacia nilotica	Bagaruwa	Mimosaceae	17	9.60	0.10
Acacia Senegal	Jirai	Mimosaceae	3	1.69	0.02
Fadherbia albida	Gawo	Mimosaceae	14	7.91	0.08
Adansonia digitate	Kuka	Malvaceae	51	28.81	0.29
Anona senegalensis	Gwandandaji	Anonaceae	1	0.56	0.01
Azadirachta indica	Dogoyaro	Meliaceae	19	10.73	0.11
Balanites aegyptiaca	Aduwa	Balanitaceae	25	14.12	0.14
Bauhinia racemose	Jirga	Fabaceae	3	1.69	0.02
Piliostigmareticulatum	Kalgo	Fabaceae	2	1.13	0.01
Borasuseathiopum	Giginya	Arecaceae	4	2.26	0.02
Hyphanethebaica	Goriba	Arecaceae	5	2.82	0.03
Bosciaalbitrunca	Shepherds tree	Capparaceae	1	0.56	0.01
Combrethum indicum	Dundu	Combretaceae	1	0.56	0.01
Combrethummicranthum	Geza	Combretaceae	4	2.26	0.02
Ficus thonningii	Chediya	Moraceae	1	0.56	0.01
Gardenia ternifolia	Gaudenkura	Rubiaceae	1	0.56	0.01
Lawsoniainermis	Lalle	Arecaceae	4	2.26	0.02
Parkia biglobosa	Kuka	Caesalpiniaceae	2	1.13	0.01
Sclerokaryabirrea	Nunu	Anacardiaceae	9	5.08	0.05
Vitex doniana	Dunya	Verbenaceae	3	1.69	0.02
Ziziphus mauritiana	Kurna	Rhamaceae	5	2.82	0.03
Zizipus spina-christis	Magarya	Rhamaceae	2	1.13	0.01
		Total	177	100.00	1.00
Relative Density and Abundance of Woodlot Trees					
Adansonia digitata	Kuka	Malvaceae	1	0.34	0.00
Azadirachta indica	Dogon yaro	Meliaceae	279	94.58	0.95
Chukrasiatabularis	Indian mahogany	Meliaceae	1	0.34	0.00
Cordylaafricana	Wild mango	Fabaceae	1	0.34	0.00
Dichrostachys cinerea	El-Marabu	Fabaceae	1	0.34	0.00
Eucalyptus globulus	Turarenzaiti	Myrtaceae	2	0.68	0.01
Fadherbia albida	Gawo	Mimosaceae	6	2.03	0.02
Sclerokaryabirrea	Nunu	Anacardiaceae	4	1.36	0.01

		Total	295	100.00	1.00
Note: rd = relative density, ra = relative abundance					

Table 2: Relative Density and Abundance of Medicinal Plants in Sokoto Metropolis

The results revealed that Fadamaland, Farmland and Woodlot trees were observed to have frequencies of 51, 177 and 295 respectively (Table 2). The Fadamaland, farmland and woodlot trees which were observed to have relative density of 100% and relative abundance of 1.00 each. In Fadama land, there are frequency of 51 stands, 9 families' with 6 species in Mimosaceae, Myrataceae and Myrtaceae, while Caesalpiniaceae and Fabaceae have 1 species each. Relative density and abundance of Fadama The results revealed that Fadamaland, Farmland and Woodlot trees were observed to have frequencies of 51, 177 and 295 respectively (Table 2). The Fadamaland, farmland and woodlot trees which were observed to have relative density of 100% and relative abundance of 1.00 each. In Fadama land, there are frequency of 51 stands, 9 families' with 6 species in Mimosaceae, Myrataceae and Myrtaceae, while Caesalpiniaceae and Fabaceae have 1 species each. Relative density and abundance of Fadama land trees both showed that *Eucalyptus camaldulensis* has the highest density while the lowest was observed in *Ceiba pentandra, Piliostigma reticulatum and Acacia Senegal*.The study showed that farmland has 177 stands, 15 families 51 species in Malvaceae (*Adansonia digitata*) and 1 species in Annonaceae, Capparaceae, Moraceae and Rubiaceae. The results also revealed that woodlot trees were observed to have frequencies of 295 stands, 6 families with Meliaceae that has 280 stands (279 stands nearly 95% of *Azadirachta indica and 1 Chukrasia tabularis*). This was in line with Ifo *et al*. who reported that, Musanga cecropioides species contributes nearly 90% of the total number of trees in their plots studied in the Tropical Rainforest of the Congo Basin [23].

4. Conclusion and Recommendation

Conclusively, the ecological status of medicinal plants in Sokoto metropolis showed that diversity index of trees was highest in farmland and the least was observed in woodland. The most abundant species in all the land-uses were *Eucalyptus camaldulensis* (Fadama land). *Adansonia digitata* (farmland) and woodland was dominated by *Azadirachta indica* with sparse trees in the area. There was therefore low diversity due to the fact that it is dominated by a single species. The increasing exploitation of medicinal plants for different uses might endanger some species. Hence, the cultivation and conservation of medicinal plant species should be prioritised for continual and sustainable use.

Acknowledgement

Our appreciation goes to the Tertiary Education Trust Fund (TETFund) Nigeria, for supporting the Institution Based Research (IBR) Funds for Nigerian tertiary institutions who provided the fund for the research to be published.

References

1. Ajayi, I. K., Kayode, J., & i Ademiluy, B. O. (2020). Study on urban trees in Ekiti State University, Ado Ekiti, Nigeria: 1. structure and composition. *Budapest International Research in Exact Sciences (BirEx) Journal, 2*(2), 147-156.
2. Chukwuma, E. C., Soladoye, M. O., & Feyisola, R. T. (2015). Traditional medicine and the future of medicinal Plants in Nigeria. *Journal of Medicinal Plants Studies, 3*(4), 23-29.
3. Robbins, P., Emery, M., & Rice, J. L. (2008). Gathering in Thoreau's backyard: nontimber forest product harvesting as practice. *Area, 40*(2), 265-277.
4. Sofowora, A., Ogunbodede, E., & Onayade, A. (2013). The role and place of medicinal plants in the strategies for disease prevention. *African journal of traditional, complementary and alternative medicines, 10*(5), 210-229.
5. World Health Organization (WHO). (2011). Programmes and projects. Traditional medicine.
6. Erinoso, S. M., & Aworinde, D. O. (2018). Current outlook and future promise of ethnobotany in Nigeria: A review and personal observation. *African Journal of Plant Science, 12*(4), 73-80.
7. Musa, D. D., Anakaa, T. M., & Bashir, K. A. (2017). Phytochemical analysis of crude extracts from Annona senegalensis (L) and its anti-snake venom potential on albino rats. *Fudma journal of Sciences, 1*(1), 139-142.
8. Abd El-Ghani12, M. M. (2016). Traditional medicinal plants of Nigeria: an overview. *Agriculture and Biology Journal of North America.* 7.5: 220-247.
9. Allen, David, Melanie Bilz, Danna J. Leaman, Rebecca M. Miller, Anastasiya Timoshyna, and Jemma Window. "European red list of medicinal plants." (2014).
10. Papageorgiou, D., Bebeli, P. J., Panitsa, M., & Schunko, C. (2020). Local knowledge about sustainable harvesting and availability of wild medicinal plant species in Lemnos island, Greece. *Journal of ethnobiology and ethnomedicine, 16*, 1-23.
11. Ouarghidi, A., Powell, B., Martin, G. J., & Abbad, A. (2017). Traditional sustainable harvesting knowledge and distribution of a vulnerable wild medicinal root (A. pyrethrum var. pyrethrum) in Ait M'hamed Valley, Morocco. Economic Botany, 71, 83-95.
12. Olagunju, T. E. (2015). Drought, desertification and the Nigerian environment: A review. *Journal of Ecology and the Natural Environment, 7*(7), 196-209.
13. Mothibe, M. E., & Sibanda, M. (2019). African traditional medicine: South African perspective. *Traditional and Complementary Medicine*, 2019, 1-27.
14. Abdullahi, A. A. (2011). Trends and challenges of traditional medicine in Africa. *African journal of traditional, complementary and alternative medicines, 8*(5S).
15. World Health Organization. (2019). WHO global report on traditional and complementary medicine 2019. World Health Organization.
16. Benin, C. (2016). Responses of Hydroclimatological Indices to Climatic Variability and Change in the Sokoto-Rima River Basin, North-Western Nigeria.
17. Tijjani, U. (2020). Determinants of Childhood Routine

Immunization Coverage in Sokoto State, North West Nigeria. *Scientific Research Journal, 8*(8), 76-96.
18. Senchi, A., Ahmad, M., & Gupa, M. (2023). Marketing of Hypheane Thebaica (Doum Palm) Fruits in Sokoto, Sokoto State. Fudma *FUDMA Journal of Agriculture and Agricultural Technology, 9*(4), 114-123.
19. Adegboyega, S. A., Olajuyigbe, A. E., Balogun, I., & Olatoye, O. (2016). Monitoring drought and effects on vegetation in Sokoto State, Nigeria using statistical and geospatial techniques. *Ethiopian Journal of Environmental Studies and Management, 9*(1), 56-69.
20. Sokoto Energy Research Center. (2012). Usmanu Danfodiyo University, Sokoto. Nigeria.
21. Anonymous, (2015). http://itouchmap.com/latlong.html. Retrieved 06/09/2019.
22. Ifo, S. A., Moutsambote, J. M., Koubouana, F., Yoka, J., Ndzai, S. F., Bouetou-Kadilamio, L. N. O., ... & Joel, L. J. (2016). Tree species diversity, richness, and similarity in intact and degraded forest in the tropical rainforest of the Congo Basin: case of the forest of Likouala in the Republic of Congo. *International Journal of Forestry Research, 2016*(1), 7593681.
23. Nolan, K. A., & Callahan, J. E. (2006, July). Beachcomber biology: The Shannon-Weiner species diversity index. In Proc. workshop able (Vol. 27, pp. 334-338).