FUDMA Journal of Sciences (FJS)
ISSN online: 2616-1370
ISSN print: 2645 - 2944
Vol. 9 No. 4, April, 2025, pp 116 - 122
DOI: https://doi.org/10.33003/fjs-2025-0904-3280

TREE SPECIES COMPOSITION AND DIVERSITY IN DANSOSHIYA FOREST RESERVE, KANO STATE, NIGERIA

Mohammed Sunusi Yusuf

Department of Environmental Management, Faculty of Earth and Environmental Sciences, Bayero University Kano.

*Corresponding authors' email: msyusuf.em@buk.edu.ng Phone: +2347033150049

ABSTRACT

It is essential to document the composition and diversity of tree species, particularly in light of an urgent need for biodiversity conservation, ecosystem management, and the requirements by key tree species conservation players. This study was carried out to assess the composition and diversity of tree species in the Dansoshiya Forest Reserve (DFR). The study conducted a detailed fieldwork, 30 stratified random sample plots with a quadrat size of 12.5m x 8m were collected and measured across the five strata of the study area. Botanical exploration and analytical results successfully identified a total of 67 tree species, distributed among 24 families and 55 genera, with a total count of 1,554 individual tree stands. The Fabaceae family, comprising 32.8% of the total, while families such as Anacardiaceae, Annonaceae, Bignoniaceae, Burseraceae, Dioscoreaceae, Ebenaceae, Lamiaceae, Loganiaceae, Olacaceae, Polygalaceae, Sapotaceae, and Zygophyllaceae were the least represented, each accounting for only 1.5% of species. Species diversity analysis showed that *Combretum molle* was the most abundant, ranked first, while *Cassia singueana*, *Ceiba pentandra*, *Ficus platyphylla*, *Piliostigma thonningii*, and *Securinega virosa* had the fewest individuals, all ranked 30. The results indicated that, although the area is rich in species diversity, certain families are poorly represented, hence the need for regular assessment to prevent the potential loss of tree species in DFR.

Keywords: Biodiversity, Conservation, Species composition, Species diversity, Dansoshiya

INTRODUCTION

In recent years, global efforts to identify tree species composition and diversity have intensified, driven by the urgent need for biodiversity conservation and ecosystem management. This complex task involves a collaborative effort between a wide range of stakeholders, including international organizations, researchers, governments, conservation NGOs, and local communities. Organizations such as Botanic Gardens Conservation International (BGCI), the International Union for Conservation of Nature (IUCN), the Food and Agriculture Organization (FAO), and the Global Trees Campaign (GTC) have played pivotal roles in this mission. These institutions coordinate large-scale assessments to ensure that tree species worldwide are properly documented, monitored, and conserved. For example, BGCI's Global Tree Assessment aims to evaluate the conservation status of all tree species, offering a comprehensive database to guide global conservation priorities (Beech et al., 2017; BGCI, 2021).

Researchers (Rivers et al., 2019; Amir et al., 2018; Boonman et al., 2024; Collins, 2020; Duan et al., 2021; Taiwo et al., 2020 & Ajagbe et al., 2021) also contribute significantly to this endeavor. For instance, Taiwo et al. (2020) and Ajagbe et al. (2021) studied tree species composition and diversity in Nigerian forest reserves. Despite the immense ecological, socioeconomic, and cultural significance of tree species diversity (Newton et al., 2015) for the inhabitants of the Dansoshiya Forest Reserve (DFR), no assessment of tree species composition and diversity has been conducted in this area. This research seeks to address that gap by conducting a thorough assessment of tree species composition and diversity in the DFR. Such an assessment is crucial not only for providing a baseline for future conservation efforts but also for gaining insights into the current state of biodiversity in the region. The findings will contribute to both local and global conservation initiatives, supporting efforts to mitigate the risks of biodiversity loss.

MATERIALS AND METHODS

Study Area

The study was conducted at the Dansoshiya forest reserve that roughly lies between latitude11°30'30"N to 11°37'00" N and longitude 8°3'37" E to 8°8'70" E of the Greenwich meridian (see Figure 1), in the Sudan Savanna region of Northern Nigeria. The area has a tropical wet and dry climate, with a broad canopy and needle leaf deciduous trees and shrubs. The vegetation includes various tree species and shrubs, adapted to drought conditions. The predominant socio-economic activities include farming, livestock rearing, hunting, and marketing agricultural products (Mustapha, 2014).

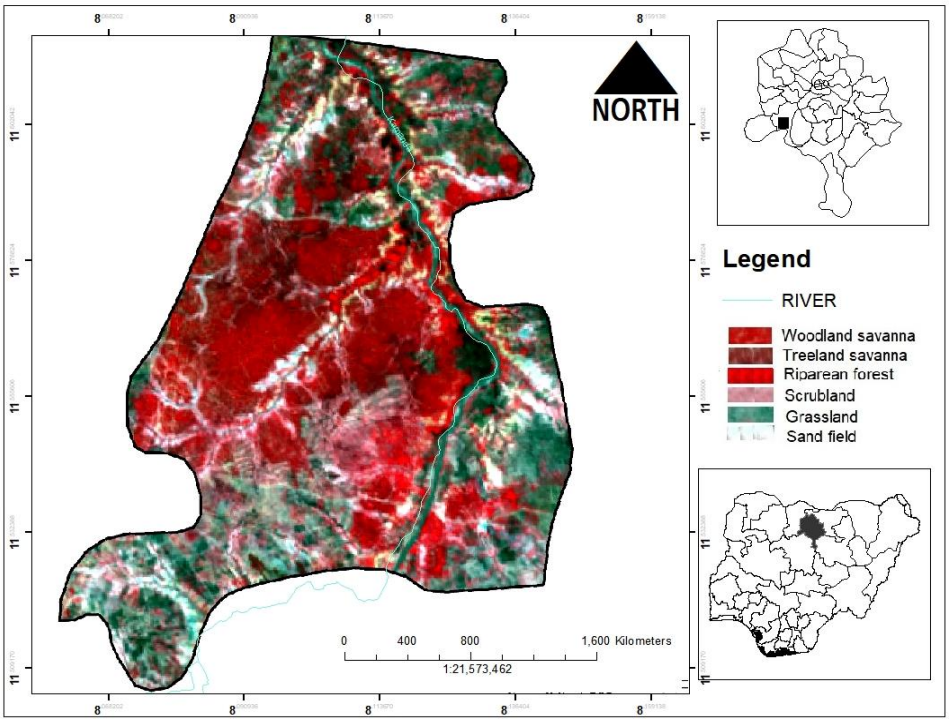

Figure 1: False colour image
Source: Resource Room, Department of Environmental Management, Bayero University Kano

Data Collection
The detailed fieldwork was conducted from September to October 2023, collecting information for tree species diversity. 30 sample plots with a quadrat size of 12.5m x 8m (equivalent to 10m x 10m) (Kindt & Coe 2005) were randomly (Brunbjerg et al., 2019; Dengler et al., 2016) selected and measured across the stratified study area.

Locating of Sample Plots
Landsat 8 OLI bands 5, 4, 3 (Near-infrared, red, and green) of the May 2023 were downloaded from earthexplorer.usgs.gov. A false colour infrared image that depicted the vegetation and its conditions was created with the downloaded Landsat satellite images using ArcMap 10.8 software, as presented in Figure 1. This false colour image, which covered the whole study area, was used to define the area into stratified homogenous units, or strata (Barnett et al., 2019). The strata were covered with quadrat-sized rectangular grids measuring 12.5 m x 8 m, which were plotted inside the stratified homogenous units. Excel was used to create random numbers, which were then dispersed throughout the complete quadrat-sized rectangular grids. Random samples were selected from quadrat-sized rectangles for each stratum. Number of samples was determined according to the size of each stratum (Kindt & Coe, 2005; Singh, 2014). Sample plots were located using the coordinates of each of the proposed quadrat-sized rectangular grids of stratified homogeneous units, entered into the Google Maps on a Galileo-enabled Smartphone with Built-in GPS.

Major vegetation communities used for sampling frame
On the basis of floristic observations made during field survey, different plant communities were identified within the study area and used for deciding a sampling scheme that would represents the actual plant communities in the study site. The brief description was given below based on observation during the survey and literature review.
Woodland savannas are areas with a mix of wood and grasses, with a higher density of trees and seasonal non-woody vegetation, with minimal anthropogenic modification (see Plate I a).
Tree savannas are areas with scattered trees and shrubs, with tree cover exceeds any other growth forms. This type of community emerged from anthropogenic interference (see Plate I b).
Scrubland: these are areas dominated by shrubs, grasses, herbs, and low growing woody trees species, and in which shrub cover exceeds trees. The Scrubland in the area can be divided into two types: lowland and upland scrubland (see Plate I c).
Grassland are areas dominated by grasses or grass-like plants and was created naturally by climate, soil, wildfire and grazing by animals or by human manipulation of forests for farming (see Plate I d).
The Riparian Forest, a grows alongside of river Kamanda and its attributes dominated with dense tree species and a ground layer rich in herbs and grasses (see Plate I e).

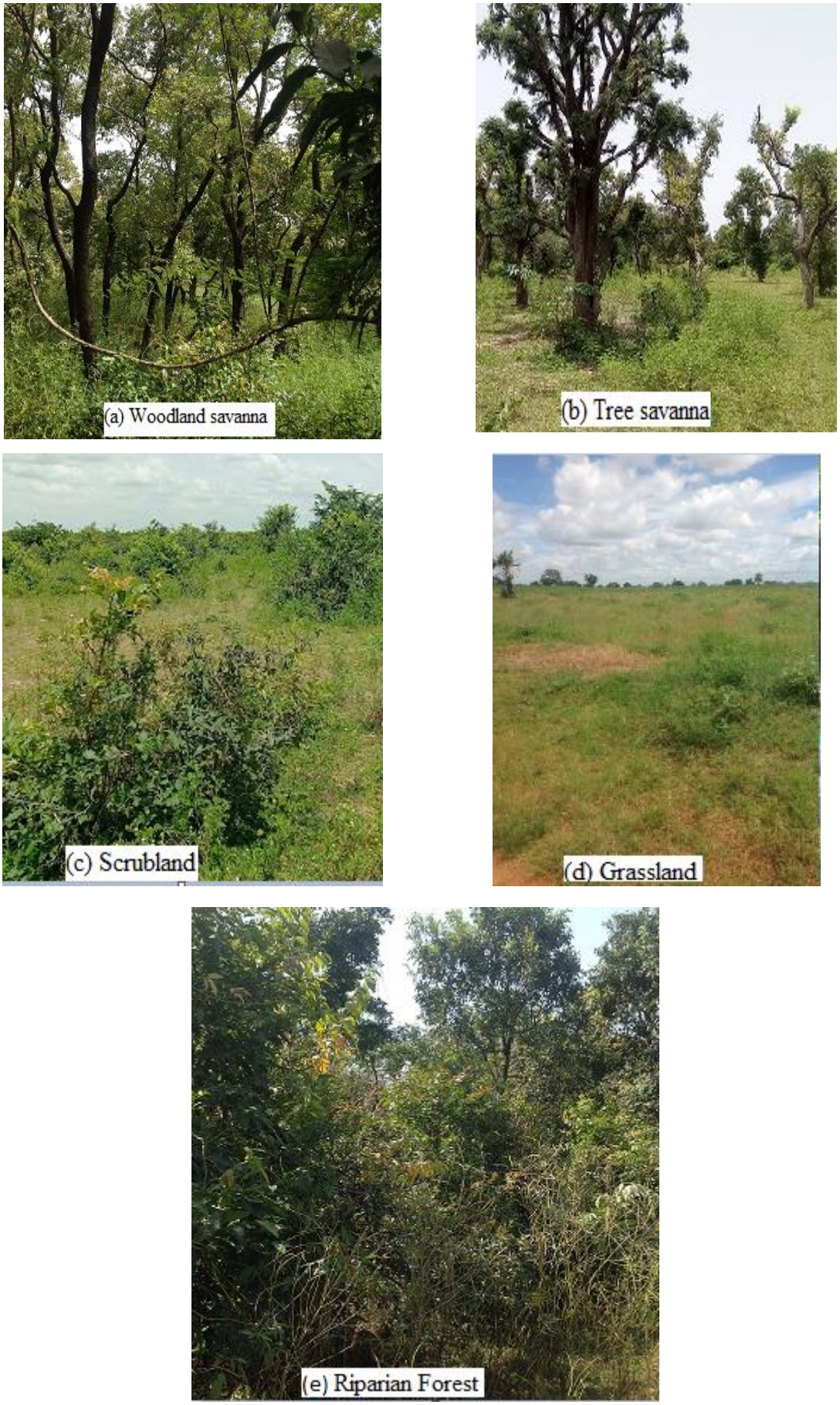

Plate 1: Vegetation community types in DFR used as a sampling frame

Identification and classification of the existing tree species diversity

Identification of tree species:

PictureThis android-based application were used for identification, classification and placement of the tree species into an appropriate taxonomic hierarchy (Balakrishnan, 2005 & Boho et al., 2020).

The proportions of each family were calculated using the following formula:

$$P = \frac{X}{Y} * 100 \quad (1)$$

Where:

P = Proportion of each family in percentage, X = Number of individuals of Family, Y = Total number of individuals of all families

Tree species diversity analysis:

Tree species diversity was carried out by construction of the rank-abundance curve, also known as a Whittaker plot for diversity analysis. The reason behind the researcher's choice to use the rank-abundance curve was that it provided information on the species richness (abundance) and evenness (proportion) of each species in the entire study area without favoring any (Gattone & Battista, 2008; Kindt & Coe, 2005).

RESULTS AND DISCUSSION

Identification and Classification of the Existing Tree Species

Based on the survey intensity and level of botanical exploration, the survey successfully identified a total of 67 tree species, distributed among 24 families and 55 genera, with a total count of 1,554 individual tree stands. Additionally, taxonomic arrangement (i.e. Family, Genus, Species and local name) of every tree species that currently exists in the study area have been determined. Table 1 provides a detailed breakdown of the tree species identification and classification results.

Table 1: Existing Tree Species in the DFR

S/N	Family	Genus	Name of Species	Local name	Abundance
1	Anacardiaceae	*Sclerocarya*	*Sclerocarya birrea*	Danya	9
2	Annonaceae	*Annona*	*Annona senegalensis*	Gwandar daji	3
3	Apocynaceae	*Landolphia*	*Landolphia owariensis*	Cewu	83
		Carissa	*Carissa edulis*	Gizaki	7
4	Arecaceae	*Borassus*	*Borassus aethiopum*	Giginya	6
		Hyphaene	*Hyphaene thebaica*	Goriba	11
5	Bignoniaceae	*Stereospermum*	*Stereospermum kunthianum*	Sansami	5
6	Burseraceae	*Commiphora*	*Commiphora africana*	Dashi	17
7	Combretaceae	*Terminalia*	*Terminalia macroptera*	Kwandari	17
		Terminalia	*Terminalia ivorensis*	Baushe	9
		Combretum	*Combretum molle*	Wuyan damo	212
		Combretum	*Combretum glutinosum*	Calauniya	89
		Anogeissus	*Anogeissus leiocarpa*	Marke	188
8	Dioscoreaceae	*Dioscorea*	*Dioscorea bulbifere*	Tuwon buri	13
9	Ebenaceae	*Diospyros*	*Diospyros mespiliformis*	Kanya	176
10	Euphorbiaceae	*Jatropha*	*Jatropha curcas*	Bini da zugu	106
		Euphorbia	*Euphorbia poissonii*	Tinya	6
11	Fabaceae	*Erythrina*	*Erythrina senegalensis*	Minjirya	9
		Parkia	*Parkia biglobosa*	Dorawa	3
		Anonychium	*Anonychium africana*	Kirya	11
		Entada	*Entada africana*	Tawatsa	16
		Acacia	*Acacia sieberiana*	Farar kaya	16
		Acacia	*Acacia polycantha*	Ƙaro	4
		Acacia	*Acacia nilotica*	Bagaruwa	9
		Acacia	*Acacia macrothyrsa*	Gwano	19
		Acacia	*Acacia seyal*	Dushi	2
		Daniellia	*Daniellia oliveri*	Maje	5
		Bauhinia	*Bauhinia rufescens*	Tsattsagi	2
		Isoberlinia	*Isoberlinia doka*	Doka	27
		Faidherbia	*Faidherbia albida*	Gawo	18
		Pterocarpus	*Pterocarpus erinaceus*	Madobiya	6
		Cassia	*Cassia sieberiana*	Marga	4
		Cassia	*Cassia singueana*	Runhu	1
		Detarium	*Detarium microcarpum*	Taura	118
		Tamarindus	*Tamarindus indica*	Tsamiya	9
		Dichrostachys	*Dichrostachys cinerea*	Dundu	12
		Albizia	*Albizia chevalieri*	Katsari	4
		Piliostigma	*Piliostigma thonningii*	Kalgo	1
		Pericopsis	*Pericopsis laxiflora*	Rafkau/makarho	12
12	Lamiaceae	*Vitex*	*Vitex doniana*	Dinya	15
13	Loganiaceae	*Strychnos*	*Strychnos usambarensis*	Kokiya	7
14	Malvaceae	*Adansonia*	*Adansonia digitate*	Kuka	7
		Grewia	*Grewia mollis*	Kyalli	7
		Sterculia	*Sterculia setigera*	Kukkuki	13
		Bombax	*Bombax costatum*	Gujjiya	7

		Ceiba	*Ceiba pentandra*	Rimi	1
15	Meliaceae	*Khaya*	*Khaya senegalensis*	Madaci	7
		Pseudocedrela	*Pseudocedrela kotschyi*	Tonna	21
		Azadirachta	*Azadirachta indica*	Darbejiya	12
16	Moraceae	*Ficus*	*Ficus iteophylla*	Shirinya	12
		Ficus	*Ficus ingens*	Ƙawuri	14
		Ficus	*Ficus thonningii*	Cediya	7
		Ficus	*Ficus platyphylla*	Gamji	1
		Ficus	*Ficus polita*	Durumi	1
17	Myrtaceae	*Eucalyptus*	*Eucalyptus globulus*	Dogon yaro	7
18	Olacaceae	*Ximenia*	*Ximenia Americana*	Tsada	4
19	Polygalaceae	*Securidaca*	*Securidaca longipedunculata*	Sanya	2
20	Phyllanthaceae	*Securinega*	*Securinega virosa*	Tsa	1
		Hymenocardia	*Hymenocardia acida*	Janyaro	7
21	Rubiaceae	*Gardenia*	*Gardenia aqualla*	Gaude	13
		Catunaregam	*Catunaregam nilotica*	Ƙwanarya	3
		Breonadia	*Breonadia salicina*	Kadanyar rafi	18
22	Rhamnaceae	*Ziziphus*	*Ziziphus mucronata*	Magaryar kura	5
		Ziziphus	*Ziziphus mauritiana*	Magarya	18
		Ziziphus	*Ziziphus spina-christi*	Kurna	20
23	Sapotaceae	*Vitellaria*	*Vitellaria paradoxa*	Kadanya	44
24	Zygophyllaceae	*Balanites*	*Balanites aegyptiaca*	Aduwa	15
			Total		**1554**

Source: Author's Fieldwork 2023

Table 1. encompassed all the potential combinations of tree species families within the study area. In addition, an analysis of the distribution of tree species among families was carried out, and as recommended by McGill et al. (2007), bar graphs were used to visually present the findings. Consequently, a graphical representation of the proportion of species per family found in the DFR was provided in Figure 2.

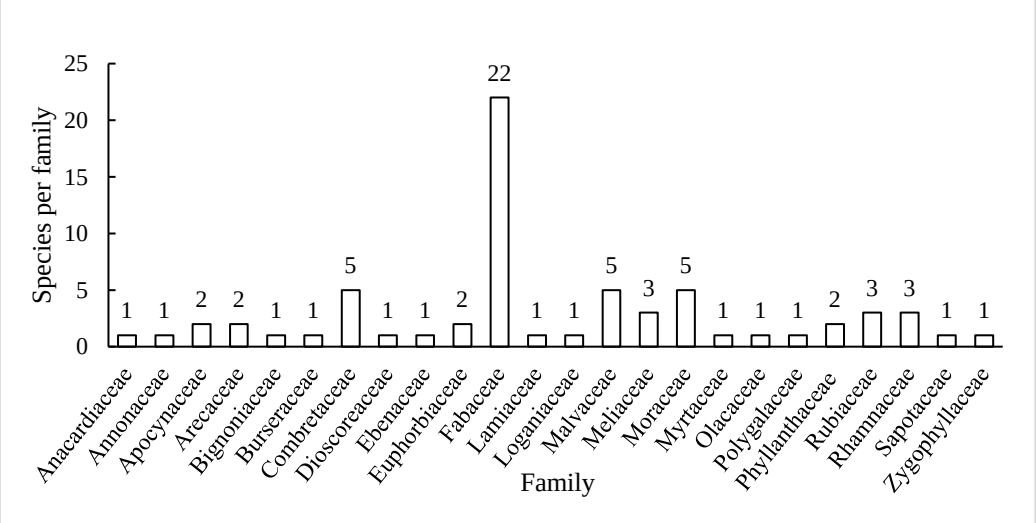

Figure 2: Proportion of species per family

As per the findings of this study, the highest number of species belongs to the Fabaceae family, constituted (32.8%) of the total, encompassing 22 species across 17 genera (Figure 2). The family of Combretaceae (7.5%), with 5 species in 3 genera, Malvaceae (7.5%), with 5 species in 5 genera and Moraceae (7.5%), with 5 species in 1 genus are second largest family in the study area. Meliaceae (4.5%) and Rubiaceae (4.5%), containing about 3 genera and about 3 species of plants each. Whereas Rhamnaceae (4.5%), with 3 species in 1 genus. In addition, other families such as Apocynaceae, Arecaceae, Euphorbiaceae, and Phyllanthaceae are also present, each contributed (3.0%) of the total with 2 species across 2 genera. Anacardiaceae, Annonaceae, Bignoniaceae, Burseraceae, Dioscoreaceae, Ebenaceae, Lamiaceae, Loganiaceae, Olacaceae, Polygalaceae, Sapotaceae, and Zygophyllaceae are among the families with the lowest representation, each account for (1.5%) with 1 species in 1 genus.

Tree Species diversity in the area

The survey and analysis of tree species conducted in the DFR unveiled the presence of five distinct strata within the study area: Grassland, Scrubland, Tree Savanna, Woodland Savanna, and Riparian Forest (refer to Figure 1 and Plate I a-e). The findings indicated that the highest diversity was observed in the Woodland Savanna and Tree Savanna strata, each accounting for 28.22%, while the Scrubland exhibited the lowest diversity of tree species (5.94%). Furthermore, Figure 3 below featured a diversity of tree species found during the DFR survey.

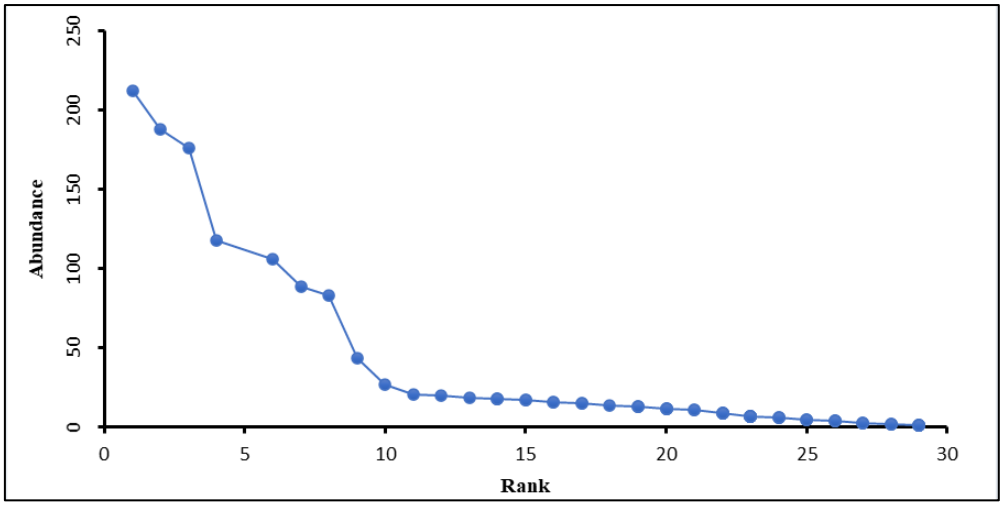

Figure 3: Rank-abundance Curve of Tree species diversity in DFR

The interpretation of the tree species diversity in the study area is that, a total number of individuals calculated for each species, and then the species are ranked from the most abundance to the least abundance. Kindt & Coe (2005) and Gattone & Battista (2008) considered this as the easiest way to provide information on species diversity (richness and evenness) without favouring any as proposed by Whittaker (1972). Finally, a plot is constructed with the rank number (species evenness) on the horizontal axis, and the abundance (species richness) on the vertical axis.

A total of 67 species diversity of trees has been identified belonging to 24 families and 55 genera of total 1,554 individual tree stands from four strata in 30 sample plots (see table 1). *Combretum molle* was ranked 1 as this species had the largest total abundance of 212 individual tree stands of the family Combretaceae. Another most prominent species is *Anogeissus leiocarpa*, also from the family of Combretaceae, ranked 2 with total abundance of 188 of individual stands. Diospyros mespiliformis, from Ebenaceae family with total individual of 176 ranked as 3. Ziziphus spina-christi having about 20 of total individual stands ranked as 12, Faidherbia albida ranked as 14. The lowest number of individuals, i.e., one species only was found in species such as Cassia singueana from Fabaceae family, Ceiba pentandra of the Malvaceae family, Ficus platyphylla of the Moraceae family, Piliostigma thonningii from the Fabaceae family and Securinega virosa of Polygalaceae family, ranked as 30, each with 1 individual stand which makes it to be the lowest in the rank-abundance curve.

CONCLUSION

The results of this study revealed that the DFR is home to five major vegetation communities, each contributing to the overall tree species composition and diversity of the area. A total of sixty-seven tree species were identified, belonging to 24 families and 55 genera, with a cumulative count of 1,554 individual tree stands recorded across the study area. This diversity highlights the rich floristic composition of the reserve, indicating that it supports a broad spectrum of tree species. Among the vegetation communities, the highest tree species diversity was observed in the Woodland Savanna and Tree Savanna strata. These areas exhibited a greater variety of species, likely due to their relatively less disturbed environments and favorable ecological conditions for tree growth. Conversely, the Scrubland community exhibited the lowest diversity of tree species. This could be attributed to higher levels of disturbance, which may limit tree establishment and growth. These findings are significant for developing effective management strategies for the conservation of tree species within the Dansoshiya Forest Reserve.

REFERENCES

Ajagbe, S. O., Odulate, D. O., Akegbejo-Samsons, Y., Kehinde, A. S., Ajagbe, R. O., & Ojubolamo, M. T. (2021). Species composition, abundance and diversity of Ichthyofauna of Ikere-Gorge, Oyo State, Nigeria. *Acta Ecologica Sinica*, *41*(6), 575–583. https://doi.org/10.1016/j.chnaes.2021.07.002

Amir, A., Abdulrashid, I., & Aliyu, M. S. (2018). An Examination of the Socio-Environmental Effects of Deforestation in Zamfara State Forest Reserves, Nigeria. *Fudma Journal Of Sciences*, *2*(1), Article 1. https://fjs.fudutsinma.edu.ng/index.php/fjs/article/view/1276

Balakrishnan, R. (2005). Species Concepts, Species Boundaries and Species Identification: A View from the Tropics. *Systematic Biology*, *54*(4), 689–693. https://doi.org/10.1080/10635150590950308

Barnett, D. T., Adler, P. B., Chemel, B. R., Duffy, P. A., Enquist, B. J., Grace, J. B., Harrison, S., Peet, R. K., Schimel, D. S., Stohlgren, T. J., & Vellend, M. (2019). The plant diversity sampling design for The National Ecological Observatory Network. *Ecosphere*, *10*(2), e02603. https://doi.org/10.1002/ecs2.2603

Beech, E., Rivers, M., Oldfield, S., & Smith, P. P. (2017). GlobalTreeSearch: The first complete global database of tree species and country distributions. *Journal of Sustainable Forestry*, *36*(5), 454–489. https://doi.org/10.1080/10549811.2017.1310049

BGCI. (2021). State of the World's Trees. BGCI, Richmond, UK. Retrieved on 7 December 2022, https://www.bgci.org/wp/wp-content/uploads/2021/08/FINAL-GTAReportMedRes-1.pdf

Boho, D., Rzanny, M., Wäldchen, J., Nitsche, F., Deggelmann, A., Wittich, H. C., Seeland, M., & Mäder, P. (2020). Flora Capture: A citizen science application for collecting structured plant observations. *BMC Bioinformatics*, *21*(1), 576. https://doi.org/10.1186/s12859-020-03920-9

Boonman, C. C. F., Serra-Diaz, J. M., Hoeks, S., Guo, W.-Y., Enquist, B. J., Maitner, B., Malhi, Y., Merow, C., Buitenwerf, R., & Svenning, J.-C. (2024). More than 17,000 tree species are at risk from rapid global change. *Nature Communications*, *15*(1), 166. https://doi.org/10.1038/s41467-023-44321-9

Brunbjerg, A. K., Bruun, H. H., Brøndum, L., Classen, A. T., Dalby, L., Fog, K., Frøslev, T. G., Goldberg, I., Hansen, A. J., Hansen, M. D. D., Høye, T. T., Illum, A. A., Læssøe, T., Newman, G. S., Skipper, L., Søchting, U., & Ejrnæs, R. (2019). A systematic survey of regional multi-taxon biodiversity: Evaluating strategies and coverage. *BMC Ecology*, *19*(1), 43. https://doi.org/10.1186/s12898-019-0260-x

Collins, L. (2020). Eucalypt forests dominated by epicormic resprouters are resilient to repeated canopy fires. *Journal of Ecology*, *108*(1), 310–324. https://doi.org/10.1111/1365-2745.13227

Dengler, J., Boch, S., Filibeck, G., Chiarucci, A., Dembicz, I., Guarino, R., & Biurrun, I. (2016). Assessing plant diversity and composition in grass-lands across spatial scales: The standardised EDGG sampling methodology. *Bulletin of the Eurasian Grassland Group*, *32*, 13–30. https://www.researchgate.net/profile/Juergen_Dengler.

Duan, H., Luo, C., Zhu, S., Wang, W., Naseer, M., & Xiong, Y. (2021). Density- and moisture-dependent effects of arbuscular mycorrhizal fungus on drought acclimation in wheat. *Ecological Applications*, *31*(8), e02444. https://doi.org/10.1002/eap.2444

Gattone, S. A., & Battista, T. D. (2008). A functional approach to diversity profiles. *Journal of the Royal Statistical Society: Series C (Applied Statistics)*, *58*(2), 267–284. https://www.academia.edu/7941773/A_functional_approach_to_diversity_profiles

Kindt, R., & Coe, R. (2005). *Tree diversity analysis: A manual and software for common statistical methods for ecological and biodiversity studies*. World Agrofirestry Centre. https://www.researchgate.net/publication/258926046

McGill, B. J., Etienne, R. S., Gray, J. S., Alonso, D., Anderson, M. J., Benecha, H. K., Dornelas, M., Enquist, B. J., Green, J. L., He, F., Hurlbert, A. H., Magurran, A. E., Marquet, P. A., Maurer, B. A., Ostling, A., Soykan, C. U., Ugland, K. I., & White, E. P. (2007). Species abundance distributions: Moving beyond single prediction theories to integration within an ecological framework. *Ecology Letters*, *10*(10), 995–1015. https://doi.org/10.1111/j.1461-0248.2007.01094.x

Mustapha, A. (2014). *Overview of Physical and Human Setting of Kano Region, Nigeria*. https://www.academia.edu/8127400/Overview_of_Physical_and_Human_Setting_of_Kano_Region_Nigeria

Newton, A., Oldfield, S., Rivers, M., Mark, J., Schatz, G., Tejedor-Garavito, N., Cantarello, E., Golicher, D., Cayuela, L., & Miles, L. (2015). Towards a Global Tree Assessment. *Oryx*, *49*, 1–6. https://doi.org/10.1017/S0030605315000137

Rivers, M., Beech, E., Bazos, I., Bogunić, F., Buira, A., Caković, D., Carapeto, A., Carta, A., Cornier, B., Fenu, G., Fernandes, F., Fraga i Arguimbau, P., Garcia Murillo, P., Lepší, M., Matevski, V., Medina, F., Menezes de Sequeira, M., Meyer, N., Mikoláš, V., … Allen, D. (2019). *European Red List of Trees: European Red list assessment review workshop: trees and shrubs*. International Union for Conservation of Nature and Natural Resources (IUCN). https://doi.org/10.2305/IUCN.CH.2019.ERL.1.en

Singh, S.N., & Masuku, M.B. (2014). Sampling Techniques & Determination of Sample Size in Applied Statistics Research: An Overview. https://www.semanticscholar.org/paper/Sampling-Techniques-%26-Determination-of-Sample-Size Singh/1325baea7d2b63e7e67ef6d58e035d64a69b9de5

Taiwo, D. M., Udoh, S. I., Olaoti-Laaro, S. O., Jeminiwa, O. R., & Jeminiwa, M. S. (2020). Assessment of species diversity and distribution of woody species on selected plots in Olokemeji Forest Reserve, Ogun State, Nigeria. *Ife Journal of Science*, *22*(3), Article 3. https://doi.org/10.4314/ijs.v22i3.3

Whittaker, R. H. (1972). Evolution and Measurement of Species Diversity. *Taxon*, *21*(2/3), 213–251. https://doi.org/10.2307/1218190