



## FLORISTIC COMPOSITION AND DIVERSITY OF TREE SPECIES IN KUMO TOWN AND ITS ENVIRONS

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### ABSTRACT

Study was conducted on Floristic Composition and Diversity of Tree Species in Kumo Town and its Environs. The aim was to investigate the Tree Species Structure, composition and diversity. Systematic random sampling method was used to sample the Tree species. The result showed that a total number of Twenty –Seven (27) species belonging to 8 genera and 12 families were identified. The family Leguminosae: Mimosoideae had the highest number of 4 species. The family Combretaceae, Moraceae, Caesalpinoideae, and Palmae had 3 species each. The family Anacardiaceae, Myrtaceae, were represented by 2 species each. The remaining 5 families; Balanitaceae, Bombacaceae, Meliaceae, Rhamnaceae and Sterculiaceae were represented by 1 species each. The plant with the highest dominance was *Adansonia digitata*. The Shannon Weiner index was 2.45 and Simpson index was 0.48. This study therefore concluded that the species *Azadirachta indica* was the most abundant, with highest Relative Density, Relative Frequency, and Importance Value Index in the study area. This study recommended that the plants that had the lowest IVI such as *Prosopis africana*, *Cassia sieberiana*, need urgent conservation measures.

**Keywords:** Floristic composition, Diversity, Tree species, Kumo town, Conservation

### INTRODUCTION

Tropical forests have the highest species-richness among the different ecosystems on the planet, and they are the most diverse land ecosystem facing pressures resulting from deforestation due to Agricultural expansion. This is consistent with the works of (Taubert *et al.*, 2018; FOA and UNEP. 2020). Loss of forest cover and biodiversity due to anthropogenic activities is a growing concern in many parts of the world (Derouin, 2019). However extensive tropical deforestation is a relatively modern event that gained momentum in the 20th century and particularly in the last half of the 20th century. Man from time immemorial has interacted negatively with his environment through his insatiable quest for food, shelter, energy and clothing among others. This has resulted to environmental problems such as deforestation, desertification and pollution of various types and magnitude on global, national and regional scales. The biodiversity is being tragically impoverished due to human actions in the last few years. This is consistent with the works of (Oribhabor, 2016 and Ikyagba *et al.*, 2019). The vegetation of Kumo Town, is under high biotic pressure

due to collection of native plants hence the need to investigate the Floristic composition and diversity of woody species in Kumo town and its environs in order to understand the status of forest stands and diversity for conservation purposes.

### Study Area

Kumo Town is located in Akko Local Government Area of Gombe State Nigeria. It lies in the part of Sudan Savanna between Longitude 11<sup>o</sup> 21'E and Latitude: 10<sup>o</sup> 14'N and with an Altitude of 521m above sea level. Four study sites Kumo (Long. 11°, 21 31'E & Lat.10°, 14 53"N) Gadawo (Long. 11°, 8 37'E & Lat.10°, 5 28"N &), Maiganga (Long. 11°, 9 32 E' & Lat.10°, 59 48N"), and Chilo (Long. 11°, 17 43"E & Lat.10°, 6 28" N). The Study Area experiences two seasonal climates, rainy and dry seasons. The hottest are in March and April with temperature ranging from 37°C – 45°C while from December to February the temperature lowers to 21°C. Relative humidity has the same pattern being 94% in August and dropping to less than 10% during harmatan December/January. The area consists of Sudan Savannah vegetation types.

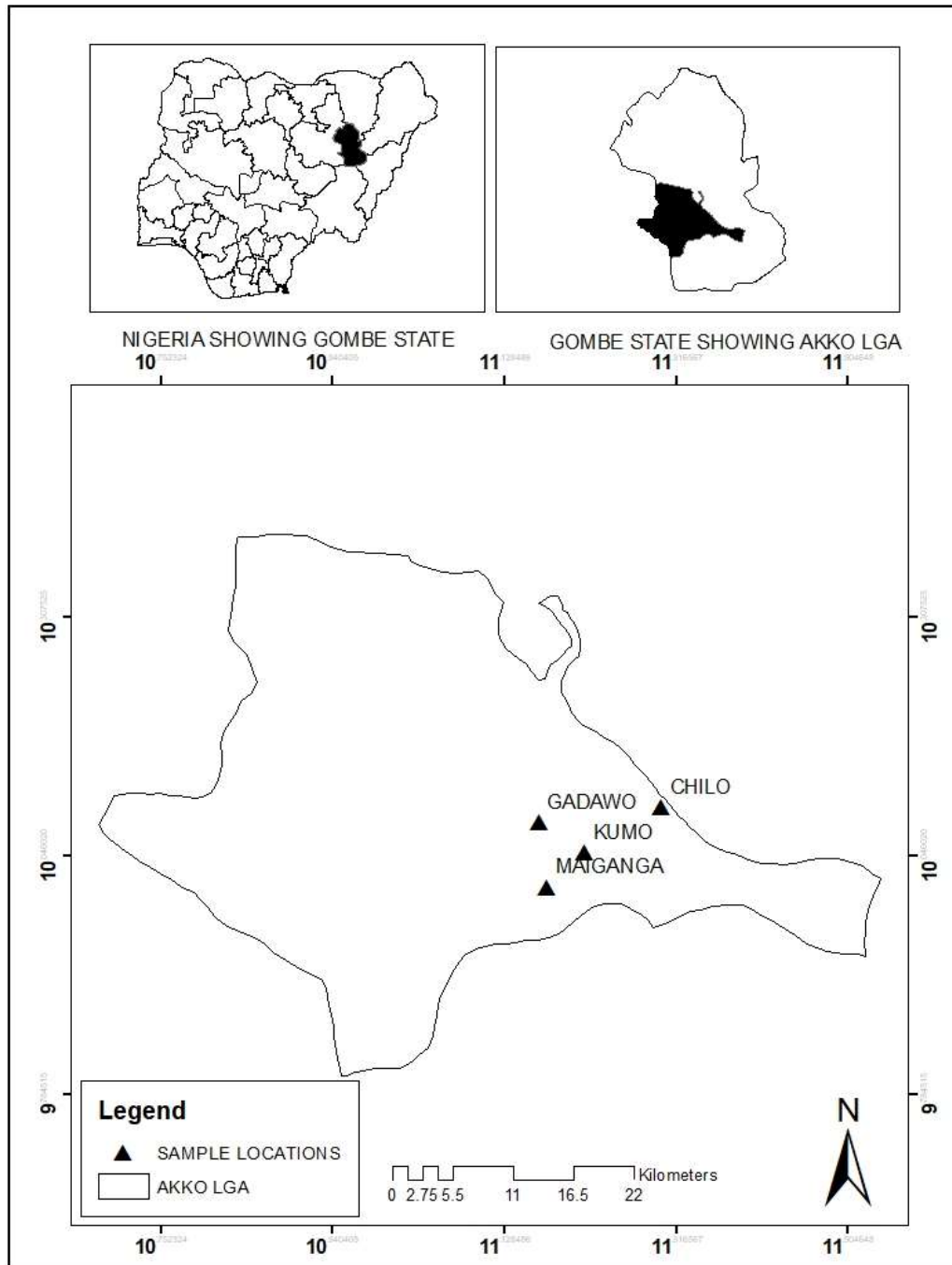


Fig 1. Map of the Study Area Showing Study Sites. (Field work, 2019).

**MATERIALS AND METHODS**

**Sampling Design and Data Collection**

The size of the study sites was measured. Systematic sampling method (Systematic line transect) was used to generate data on the floral composition in the four study sites Kumo, Gadawo, Maiganga, and Chilo. Using Bullock, (1996) method, two parallel line transects of 1000m in length were established in each of the study site and the distance between the transect line was 500m. Sampling

plots of 50 x 50m was laid in alternate direction along each transect at an interval of 100m, thus summing up to 4 sample plots per 500 m transect and a total of 8 sample plots per study site. Complete enumeration of plant species per plot (trees) were carried out and the plants identified by their local and scientific names by the help of an experienced taxonomist. In few cases where a plant species cannot be identified, specimen of such plants were collected, preserved and taken to the herbarium of Botany

Department Gombe State University, where voucher number is given, GSUH 001 to 027 and compared with the plants there.

**Statistical Analysis**

Plant species diversity in the various vegetation types were estimated using the following diversity indices such as

Density, relative Density, Frequency, Relative Frequency, Dominance and Relative Dominance Importance, Value Index and Species richness, species evenness.

Density, Relative Density, Frequency, Relative Frequency, Dominance, Relative Dominance Importance, Value Index were calculated using the following formula

$$Density (D) = \frac{\text{Number of individuals of a species in all the sample plots}}{\text{Total number of sample plots studied}}$$

$$Relative Density (R.D) = \frac{\text{Number of individuals of a species}}{\text{Number of individuals of all species}}$$

$$Frequency (F) = \frac{\text{Number of sample plots in which the species occurs}}{\text{Total number of plots sampled}}$$

$$Relative Frequency (R.F) = \frac{\text{Number of occurrences of the species}}{\text{Number of occurrences of all species}} \times 100$$

$$Dominance (DO) = \frac{\text{Basal area of a family}}{\text{Total Basal area}}$$

$$Relative Dominance (R.DO) = \frac{\text{Basal area of a family}}{\text{Total Basal area}} \times 100$$

$$Importance Value Index (IVI) = \frac{RD + RF + RDO}{3}$$

- Species diversity (is a measure of the species richness and species evenness). This was calculated using Simpson and Shannon-Wiener index (H') as described by Sugar *et al.* (2003).

$$D = \frac{\sum n(n-1)}{N(N-1)}$$

D = Simpson Index Diversity

n = the total number of organisms of a particular species

N = the total number of organisms of all species

$$H' = \sum_{i=1}^S pi Lnpi = \dots\dots\dots (2)$$

Where: S= is the number of species. Pi= is the relative abundance of each species, Calculated as the proportion of individuals of a given species to the total number of Individuals in the community (ni/N), ni= is the number of individuals in each species, N= is the total number of all individuals. Where H =Shannon index, S=number of species

**RESULTS**

**4.1.1 Composition of tree species identified at Kumo town and it's Environ, Gombe State, Nigeria.**

Table 4.1 shows identified tree species from Kumo Town and its environs and their families. The family Leguminosae: Mimosoideae had the highest number of 4 species each. The family Combretaceae, Moraceae, Caesalpinioadeae, and Palmae had 3 species. The families Anacardiaceae, Myrtaceae were represented by two species each. The remaining five families are Balanitaceae, Bombacaceae, Meliaceae, Rhamnaceae and Sterculiaceae were represented by one species each.

**Species Composition of Tree species identified at Kumo town and it's Environ, Gombe State, Nigeria.**

**Table 1: Families and species of trees, identified in Kumo town and its Environs, Gombe State, Nigeria**

| S/N | Family Name           | Species Name                                     | Hausa Names    |
|-----|-----------------------|--|----------------|
| 1   | Anacardiaceae         | <i>Mangifera indica</i> L.                       | Mangoro        |
|     |                       | <i>Sclerocarya birrea</i> A. Rich.               | Danya          |
| 2   | Balanitaceae          | <i>Balanites aegyptiaca</i> (L) Dell             | Aduwa          |
| 3   | Bombacaceae           | <i>Adansonia digitata</i> L.                     | Kuka           |
| 4   | Leguminosae: Fabaceae | <i>Senna siamea</i> (Lam.) Irwin & Barneby       | Gadila         |
|     |                       | <i>Cassia sieberiana</i> DC.                     | Malga          |
|     |                       | <i>Isobertina doka</i> Craib & Stapf             | Doka           |
| 5   | Combretaceae          | <i>Anogeissus leiocarpus</i> (DC) Guill&Perr     | Marke          |
|     |                       | <i>Combretum glutinosum</i> Perr. Ex DC          |                |
|     |                       | <i>Combretum collinum</i> Fresen.                |                |
| 6   | Meliaceae             | <i>Azadirachta indica</i> A. Juss                | DogonYaro      |
| 7   | Mimosoideae           | <i>Acacia albida</i> (Del.) A. Chev.             | Gawo           |
|     |                       | <i>Parkia biglobosa</i> (Jacq.) R.Br.ex G Don f. | Dorowa         |
|     |                       | <i>Prosopis Africana</i> (Guill. & Perr.) Taud   | Kiryra         |
| 8   | Moraceae              | <i>Acacia tortilis</i> (Forsk.) Hayne.           |                |
|     |                       | <i>Ficus platyphylla</i> Del.                    | Gamji          |
|     |                       | <i>Ficus polita</i> Vahl.                        | Durmi          |
| 9   | Myrtaceae             | <i>Ficus thonnigii</i> Blume.                    | Chediya        |
|     |                       | <i>Eucalyptus camaldulensis</i> Dehnhardt        | BishiyarTurare |
|     |                       | <i>Psidium guajava</i> L.                        | Gwaiba         |
| 10  | Palmae                | <i>Phoenix dactylifera</i> L.                    | Dabino         |
|     |                       | <i>Borassus aethiopicum</i> Var.                 | Giginya        |
|     |                       | <i>Hyphaenia thobaica</i> (L.) Mart.             | Goruba         |
| 11  | Papilionoideae        | <i>Tamarindus indica</i> L.                      | Tsamiya        |
| 12  | Sapotaceae            | <i>Vitellaria paradoxa</i> (C.F. Gaertn.)        | Kadanya        |
| 13  | Rhamnaceae            | <i>Zizipus spina-christi</i> (L.) Willd.         | Kurna          |
| 14  | Sterculiaceae         | <i>Sterculia setigera</i> Del.                   | Kukkuki        |

**Importance Value Index of Trees identified in Kumo Town and its Environs, Gombe State, Nigeria.**

The tree species with the highest importance value index in Kumo Town and its environs was *Azadirachta indica* (37.11%) while the lowest value was recorded on *Cassia sieberiana* (3.45%).

**Table2: Importance Value Index of Trees identified at Kumo Town and its Environs, Gombe State, Nigeria.**

| S/N | SPECIES                         | RD   | RF    | RDO   | IVI  |
|-----|---------------------------------|------|-------|-------|------|
| 1   | <i>Acacia albida</i>            | 1.5  | 5.88  | 5.6   | 4.3  |
| 2   | <i>Acacia tortilis</i>          | 3.5  | 12.03 | 3.01  | 6.1  |
| 3   | <i>Adansonia digitata</i>       | 8    | 14.68 | 37.88 | 20.2 |
| 4   | <i>Anogeissus leiocarpus</i>    | 9    | 25.21 | 16.86 | 17.0 |
| 5   | <i>Azadirachta indica</i>       | 22.5 | 58.94 | 29.87 | 37.1 |
| 6   | <i>Balanites aegyptiaca</i>     | 9    | 24.41 | 7.86  | 13.7 |
| 7   | <i>Borassus aethiopicum</i>     | 4    | 10.24 | 12.51 | 8.9  |
| 8   | <i>Cassia sieberiana</i>        | 2.5  | 7.69  | 0.16  | 3.5  |
| 9   | <i>Combretum collinum</i>       | 3.5  | 10.77 | 0.15  | 4.8  |
| 10  | <i>Combretum glutinosum</i>     | 6.5  | 37.24 | 0.29  | 14.6 |
| 11  | <i>Eucalyptus camaldulensis</i> | 6    | 18.23 | 18.81 | 14.3 |
| 12  | <i>Ficus platyphylla</i>        | 2    | 5.68  | 35.45 | 14.4 |
| 13  | <i>Ficus polita</i>             | 5    | 12.99 | 10.08 | 9.3  |

|    |                               |     |       |       |      |
|----|-------------------------------|-----|-------|-------|------|
| 14 | <i>Ficus thonningii</i>       | 7.5 | 20.6  | 12.07 | 13.4 |
| 15 | <i>Hyphaenia thabaica</i>     | 4   | 9.42  | 7.61  | 7    |
| 16 | <i>Isobertina doka</i>        | 3.5 | 10.77 | 0.16  | 4.8  |
| 17 | <i>Magifera indica L.</i>     | 4   | 9.24  | 17.36 | 10.2 |
| 18 | <i>Parkia biglobosa</i>       | 9.5 | 19.52 | 30.04 | 19.6 |
| 19 | <i>Phoenix dactylifera</i>    | 4   | 11.71 | 19.87 | 11.8 |
| 20 | <i>Prosopis africana</i>      | 1   | 3.92  | 15.98 | 6.9  |
| 21 | <i>Psidium guajava</i>        | 4   | 10.39 | 0.95  | 5.1  |
| 22 | <i>Sclerocarya birrea</i>     | 1   | 1.83  | 9.01  | 3.9  |
| 23 | <i>Senna siamea</i>           | 7.5 | 23.45 | 18.55 | 16.6 |
| 24 | <i>Sterculia setigera</i>     | 3.5 | 9.55  | 23.28 | 12.1 |
| 25 | <i>Tamarindus indica</i>      | 7   | 17.49 | 30.01 | 18.1 |
| 26 | <i>Vitellaria paradoxa</i>    | 2.5 | 4.59  | 11.56 | 6.2  |
| 27 | <i>Ziziphus spina-christi</i> | 6.5 | 11.93 | 3.5   | 7.3  |

### Vegetation Analysis

#### Tree species diversity

Simpson's index of diversity (1-D) was 0.48, while Shannon Weiner index of diversity was 2.45 for trees in the study area. Simpson's Diversity Index (D) ranges from 0-1 while Shannon-Weiner index ranges from 1-4

#### DISCUSSION

The low number of tree species recorded in Kumo Town and its environs, shows low species composition. It also confirms the level of deforestation going on in the study area. 27 species of trees under 23 genera and 13 families were identified within a 20 hectares in Kumo Town and its environs, Gombe State, Nigeria in the Northern Savanna Woodlands. The findings were also in line with the works of Abdullahi (2010); who obtained 47 species belonging to 19 families were encountered during the survey period in Yankari Game Reserve (YGR), Abba (2014); who obtained 25 tree species belonging to 22 genera and 14 families were identified in Kanawa Forest Reserve (KFR) and Ikyaba *et al.*, (2015) who obtained 52 tree species in 48 genera and 22 families in Federal University of Agriculture Makurdi, Benue State, Nigeria. It was also similar to Wakawa *et al.*, (2017) who obtained 174 tree species in 8 families. When compared with other studies, it implies that species composition in Kumo Town is less diverse. This could be because of deforestation for fuel wood. The higher number of species reported by Abdullahi (2010), Abba (2014) while working in Yankari Game Reserve (YGR) and Kanawa Forest Reserve and Ikyaba *et al.*, (2015) in Federal University of Agriculture Makurdi, Benue State, Nigeria compared to that of Kumo town and its environs was due to the size, geology, location and conservation efforts associated with both Yankari Game Reserve and Kanawa Forest Reserve as a protected area and its location in the Savanna woodland area.

The family Fabaceae: Mimosoideae had the highest number of 4 species in the study area. These families were known to be native species in most Savannah-Woodlands in Africa and more typical of the Sudano-Sahelian Zones. The members of the families Fabaceae: Mimosoideae are wide spread in the tropics due to their ecological and reproductive adaptations. A similar report was presented

by (Wakawa *et al.*, 2017) In Gashuwa, Bade Local Government, Yobe State, Nigeria, Sawadogo *et al.*, (2007) Kalfou Forest Reserve, Cameroon, Abdullahi, (2010) in Yankari game reserve (YGR) in Bauchi State, of Northern Nigerian Savanna Woodlands, Moksia *et al.*, (2012) Tiogo forest, Burkina-Faso, Abba *et al.*, (2015) and in Kanawa Forest Reserve, Gombe State, Nigeria..

The tree species *Azadirachta indica* had the highest Relative Density (22.5%) and Relative Frequency is (58.94 %) hence the most densely and frequent populated. This shows that *Azadirachta indica* was the species that had the highest number per unit area in Kumo Town and its environs. The location of the Kumo town and its environs, the plants invasive nature and its historical uses, could have influenced its floristic richness. This is consistent with the works of Abba *et al.*, (2015) who reported on some sites (Site 1 and 2) in Kanawa Forest Reserve (KFR), where *Azadirachta indica* had the highest Relative Density. It was also consistent with the works of Idris *et al.*, (2017) where he worked on the Distribution and Diversity of trees and shrubs in Tumfure and Shongom Villages of Gombe State, Nigeria, and obtained *Azadirachta indica* as the plant with the highest Relative Density (3.16 m<sup>2</sup>).

The tree species *Azadirachta indica* had the highest Relative Frequency (58.94 %) in Kumo town and its environs, hence the most frequent and important plant species. The plants are invasive in nature and its historical uses, could have influenced its floristic richness. This is probably because it produces plenty fruits which could be easily dispersed by birds. It could also be because it is a plant that is well adapted to the Sudan Savanna vegetation types. This works is consistent with that of Idris *et al.*, (2017). The tree with the highest relative dominance in the study area was *Adansonia digitata* (37.88%). This shows that *Adansonia digitata* (37.88%) is the most important species in the study area, and that it possesses large sized trees that were sparsely distributed. The relative and absolute dominance of trees in Savanna systems varies widely according to soil types (Abba, 2014) and fire history, as well as grazing intensity and the overall extent of past disturbances (Sawadogo, 2017).

The tree with the highest importance value in the study area was *Azadirachta indica* (37.11%) while the tree with the lowest Importance value in the study area was *Cassia seiberiana* (3.45%). The importance value, or the importance percentage, gives an overall estimate of the influence of importance of a tree species in the community. This value also gives an overall estimate of the importance of the species in the community and also describes the importance of the analyzed species. It weighs Relative Dominance, Relative Density and Relative Frequency equally. This may lead to the result, that species occurring singular but with a big basal area are given the same dominance as mostly small but wide spread species.

According to Curtis and McIntosh (1951), high Importance Value Index (IVI) of a species indicated its dominance and ecological success, its good power of regeneration and greater ecological amplitude and also those plants need-monitoring management, while, species which were grouped as having low importance value therefore need high conservation effort (Abba, *et al.*, 2015).

The species diversity of the study area was (0.48), while the value of Shannon –Wiener index of tree species was (2.45). The trees are few and Species diversity is poor when compared with Guinea Savannah or Tropical Forest ecosystem. This value is typical of Sudan Savannah ecosystem and is consistent with the works of Ikyaagba *et al.*, (2019), Ogunjemite, (2015) and Abdullahi (2010) who reported Simpson's index of diversity for trees in Yankari National Park as (0.984). Abba, (2014) similarly reported Simpson's index of diversity as (0.946) for the Kanawa Forest Reserve (KFR) in Gombe. These values were much higher than those of the present study due to size and higher enforcement of protection laws. The Shannon-Wiener Index of diversity ( $H'$ ) was reported by Abba, (2014) to be (4.43) for the Kanawa Forest Reserve (KFR). This lower value observed in this study may be due to the anthropogenic activities found in the study area. Also may be due to lack of protection in Kumo Town and its environs. Also the species richness, diversity and evenness of 2.52, 0.38 and 1.97 respectively of Tree Species Biodiversity of a Sahelian Ecosystem in North-East Nigeria is poor when compared with 6.01, 0.82 and 2.24 value of Federal University of Agriculture Makurdi, Benue State, Nigeria (Ikyaagba *et al.* 2015), 0.78 Species evenness and 2.60 diversity index of Kogo forest reserve in Katsina State, Nigeria (Bello *et al.* 2013) and 2.61 diversity index of Girei forest reserve in Adamawa State, Nigeria (Saka *et al.* 2013) but higher species richness in comparison with Kogo forest reserve in Katsina which has 1.84 (Bello *et al.* 2013). Even though all the study area are in the savannah, a closer look at the climate of each study area will revealed a difference in amount of precipitation received annually. This could be responsible for the difference in biodiversity indices recorded by each study area since precipitation has been regarded as one of the most important environmental factor affecting the growth and distribution of vegetation (Zakaluk and Ranjan, 2008; Aregheore, 2009). The variation in climates, topography, soil properties and their interaction as

well as sampling intensity employed could also be another possible explanation for the observed difference across the study areas.

## CONCLUSION

This study concluded that Kumo Town and its environs was dominated by species of the family Fabaceae; Mimosoideae. The species *Azadirachta indica* was the most abundant and with the highest Relative Density, Relative frequency, Importance value index than any other common tree species in the study area. These species (*Azadirachta indica*) are not native species. It is an introduced species that is taking over the native species because of their invasive nature. Other common tree species recorded includes: *Adansonia digitata*, *Parkia biglobosa*, *Tamarindus indica*, and *Combretum glutinosum*. The tree species richness of the study area is moderate and the composition is less diverse.

This study recommends that management, and conservation approaches such as afforestation of species with lowest importance such as (*Cassia seiberiana*, *Prosopis africana*) will therefore be highly advantageous to save the study area Kumo and its environs from deforestation, and also save the floral species from local extinction and to maintain a viable population size. It was noted that the species richness was taken over by invasive species (*Azadirachta indica*).

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## CONFLICT OF INTEREST:

The authors declare that there is no conflict of interest.

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