Comparative Study on the Trees and Shrubs composition in Jos Wildlife Park, Plateau State, Nigeria

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ABSTRACT

Trees, shrubs and other plants play significant roles to support existence of wildlife in terms of shelter and source of food. However, factors such as over browsing, climate change and anthropogenic activities affect the floristic composition. This study therefore investigated trees/shrubs diversity and abundance in Jos Wildlife Park with a view to establishing the current status towards sustainable management. Systematic line transects was used in the laying of the sample plots at the centre of the Park. Two transects of 1000 m in length parallel to each other were laid at 100 m apart. Then, sample plots of 25m x 25 m were established in alternate positions along the two transects at 100 m interval. In the main plot, five randomly selected plots were further laid into 4 quadrats of 10 x 10 m and total of 2 quadrats per plot were sampled where all trees and shrubs were identified to species level. Data were subjected to descriptive statistical analysis of frequency distribution and percentage, while chi-square was used for assessing variation in trees/shrubs abundance. A total of forty plant species belonging to twenty-eight families were identified and recorded. *Piliostigma thonningii, and Pinus caribea* had the Relative Dominance (RD) of 7.37% followed by *Terminalia avicenmoides* (6.63%) while *Parkia biglobosa* had 6.14%. *Combretum molle, Pseudocedrela koyschyi, Senna singuena, Stereopermum kuthianum* and *Strychros spinosa* had the least RD of 0.74% .The chi-square result showed a variation between trees and shrubs species abundance significantly at 5% level of probability. The relative densities of trees and shrubs were found to be lower as evidence of the forest community degradation through anthropogenic activities.

Keywords: Diversity, protected area, encroachment, deforestation, sustainable conservation

Introduction

Forests are disappearing at alarming rates mostly due to human activities including over exploitation of forest resources, expansion of cropping land, uncontrolled bush burning and urbanization (Asinwa and Olajuyigbe, 2022). These have resulted in the disappearance of the forest resources from traditional places where they are sourced. Consequently, the environment the socio-economic life of the people and wildlife habitat has been adversely affected, thus increasing their poverty level (Owonubi and Otegbeye, 2004).

Forest plays important role in the economic development of developing countries such as Nigeria, since they have developmental linkages with agricultural sector as well as supply of raw materials for industries

(Ampitan and Omoayena, 2008). A survey of the forest resources (1996-1998) revealed that the forest cover in Nigeria decreased by 20% over the preceding 18 years, while the forest estate which covered about 10% of the country's land in 1976 has decreased to less than 6%. While In the period between 1990 and 2010, about 3.3% annual rate of deforestation was reported as the forest cover reduced to about 10% of its total land area (FAO 2012).

The world population is fast increasing especially in the developing world as over 80% of these people live in the rural areas and engage mostly in agricultural activities which predominantly take the form of the slash and burn farming (Kola-Oladiji and Tolawo, 2008; Ampitan and Omoayena, 2008). The people have been exploiting the forests for timber, food, medicine, fuelwood, poles, leaves, wildlife and so on, without a management practices to ensure sustainable provision of these goods for the future (Adekunle and Akinlemibola, 2008)

Since the establishment of Jos Wildlife Park in 1972, there has been little or no documented record of the forest cover of the Park in terms of species number. The situation of the forest cover of the Park calls for concern as part of the forest cover of the Park has been depleted without any record as a reference point (Ijeomah *et al.*, 2007). Man's activities directly or indirectly have adversely affected the Park; the worse is that degradation processes are growing bigger at a rate faster than ever. The effect is a poorer biodiversity and landscape impoverishment. The rich biological resources, especially plant species are disappearing before they can be inventoried and assessed (Gomez, 1991).

It is unfortunate that environmental degradation including deforestation is often caused by government through de-reservation of gazetted reserves. Skoup and Company, (1986) reported that in almost all the states of the federation, gazetted forest and game reserves have been reportedly de-reserved without proper inventory of the tree composition on ground. For example, research plots of established plantation of diverse tree species have been de- reserved at a rate of 230km/annum or 23,000 ha/annum since independence in 1960 (Adewusi *et al.*, 2002).

With a view at informing, as well as repositioning policy initiatives and thereby stemming the tide of de-vegetation and continual loss of biodiversity, the study investigated trees and shrubs composition in Jos Wildlife Park.

Materials and methods

The Park is located in Jos North Local Government of Plateau State and has a total area of about eight square kilometres out of which about two square kilometres had been encroached. The geographical location of the Park lies to the South West of the Jos township which is situated within latitude 9° 52' and 9° 32' N and longitude 8° 53' and 8° 44' E with an average elevation of about 1250 metres above sea level. It is located within the Guinea savanna vegetation zone of Nigeria.

The Park is characterized by hilly topography comprising of rocks, hills, and streams which flow with water throughout the year. The soil type is sandy loam (very loose soil) which can hardly retain rain water for a long period. The hilly and rocky nature of the topography of the Park serve as a good habitat for the indigenous rock python, rock hyrax, monkeys, medium and small size antelopes, reptiles and so on.

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The total annual rainfall in the Park ranges from 1300 – 1800mm, with two seasons (dry season between October and March, and rainy season between April and September). The mean annual temperature range from 13 - 28°C and mean maximum temperature falls from 10 – 32°C, but get high these days due to effects of green-house emission and destructive activities of man on the environment. The vegetation of the Park is characterized as a Guinea savannah with low moisture of upland forest with mostly shrubs and grasses. The trees shed their leaves as from the month of November to March but immediately after the effects of both early and late burning are over, new grasses/leaves soon regenerate (Ijeomah, *et al.*, 2007)

Sampling procedure and Data analysis
Systematic line transects as described by Osemeobo, (1992) was used in the laying of the sample plots at the centre of the Park. Two transects of 1000 m in length parallel to each other were laid at 100 m apart. Then, sample plots of 25m x 25 m were established in alternate positions along the two transects at 100 m interval. In the main plot, five randomly selected plots were further laid into 4 quadrats of 10 x 10 m and total of 2 quadrats per plot were sampled where all trees and shrubs were identified to species level.

Frequency of occurrence was obtained for tree species abundance.

The species relative density (RD): This was obtained using the Equation 1

RD = $\frac{\text{Number of individual species per unit area}}{\text{Total number of individual of all species}}$ X 100 ------ (1)

Data were subjected to descriptive statistical analysis of frequency distribution and percentage, while chi-square was used for assessing variation in trees/shrubs abundance. Formular for calculating the chi-square used is presented below:

$$X^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i},$$ ------------- (2)

Where:
O = Observed frequency
E= Expected frequency
Level of test at 5%

Results
A total of forty one (40) tree/shrubs species belonging to 28 different families were identified in the study area (Table 1). *Piliostigma thonningii, and Pinus caribea* had the Relative Dominance (RD) of 7.37% followed by *Terminalia avicenmoides* (6.63%) while Parkia biglobosa had 6.14%. *Combretum molle, Pseudocedrela koyschyi, Senna singuena, Stereopermum kuthianum* and *Strychros spinosa* had the least RD of 0.74% (Table 2)

Table 1: Checklist of plants found in Jos Wildlife Park,Jos

S/N	Botanical name	Family	Life forms
1.	*Adina microcephala*	Rubiaceae	Tree
2.	*Annona senegalensis*	Annonaceae	Shrubs
3.	*Balanites aegyptiaca*	Balanitaceae	Tree
4.	*Bergia suffruticosa*	Elantinaceae	Shrubs
5.	*Boswellia dalzielii*	Burseraceae	Tree
6.	*Carissa edulis*	Apocynaceae	Shrub
7.	*Combretum molle*	Combietaceae	Tree
8.	*Cordia Africana*	Boraginaceae	Tree

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9.	*Cussonia arborea*	Araliaceae	Tree
10.	*Daniellia oliveri*	Caesalpinioideae	Tree
11.	*Dichrostachys cinerea*	Mimosoideae	Tree
12.	*Erythrina senegalensis*	Fabaceae	Tree
13.	*Eucalyptus camaldulensis*	Myrtaceae	Tree
14	*Gardenia aqualla*	Rubiaceae	Tree
15.	*Gossypium spp*	Malvaceae	Shrub
16.	*Hymenocardia acida*	Hymenocardiaeae	Tree
17.	*Jacaranda mimosifolia*	Fabaceae	Tree
18.	*Lantana camara*	Verbennaceae	Shrub
19.	*Lophira lanceolata*	Ochnaceae	Tree
20.	*Mangifera indica*	Anarcardiacea	Tree
21.	*Maytenus senegalensis*	Celastraceae	Shrub
22.	*Nauclea latifolia*	Rubiaceae	Tree
23.	*Pavetta crassipes*	Rubiaceae	Tree
24.	*Parkia biglobosa*	Mimosoideae	Tree
25.	*Parinari polyandra*	Chrysobalanceae	Tree
26.	*Parkia clappertoniana*	Mimosoideae	Tree
27.	*Piliostigma thonningii*	Fabaceae	Tree
28.	*Pinus caribaea*	Pinaceae	Tree
29..	*Myrianthus holstii*	Urticaceae	Shrub
30.	*Pseudocedrela kotschyi*	Meliaceae	Shrub
31.	*Pterocarpus erinaceus*	Fabaceae	Tree
32.	*Senna singueana*	Fabaceae	Shrub
33.	*Stereospermum kunthianum*	Bignoniaceae	Shrub
34	*Strychnos spinosa*	Loganiaceae	Shrub
35.	*Syzygium guineense*	Myrtaceae	Tree
36.	*Terminalia avicennoides*	Combretaceae	Shrub
37.	*Uvaria chamae*	Annonaceae	Shrub
38.	*Vitellaria paradoxa*	Sapotaceae	Tree
39.	*Vitex doniana*	Verbenaceae	Tree
40.	*Vitex simplicifolia*	Verbenaceae	Shrub

Table 4: List of Trees/Shrubs in the study area and their frequency of occurrence.

Species Name	Frequency	RD (%)
Adina microcephala	7	1.72
Annona senegalensis	12	2.95
Balanites aegyptiaca	13	3.19
Bergia suffruticosa	5	1.23
Boswellia dalzodlii	6	1.47
Carissa edulis	10	2.46
Cassia singuena	5	1.23
Combretum molle	3	0.74

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Cordia africana	7	1.72
Cussiona arborea	10	2.46
Daniella oliveri	5	1.23
Dichrostachys cinerea	13	3.19
Erthrina senegalensis	6	1.47
Eucalyptus camadulensis	4	0.98
Gardenia aqualla	7	1.72
Gossypium spp	5	1.23
Hymenocardia acida	8	1.97
Jacaranda minosifolia	6	1.47
Lantana camara	14	3.44
Lophira lanceolata	8	1.97
Mangifera indica	16	3.93
Maytenus senegalensis	10	2.46
Nauclea latifolia	4	0.99
Pavetta crassipes	10	2.45
Parkia biglobosa	25	6.14
Parinari polyandra	10	2.46
Parkia clappertoniana	5	1.22
Piliostigma thonningii	30	7.37
Pinus caribea	30	7.37
Pistia stratioletes	5	1.22
Pseudocedrela koyschyi	3	0.74
Pterocarpus erinaceus	4	0.98
Senna singuena	3	0.74
Stereopermum kuthianum	6	1.47
Strychros spinosa	3	0.74
Synzygium guineense	12	2.95
Terminalia avicenmoides	27	6.63
Uvaria chamae	20	4.91
Vitex doniana	18	4.42
Vitellaria paradoxa	8	1.97
Vitex simplicifolia	4	0.98
TOTAL	**407**	

Figure I show the quadrat with the highest number of trees/shrubs. From the bar chart, plot 2 – quadrat 2 had the highest number of trees/shrubs (65), followed by plot 4 – quadrat 3 (60) and plot 5 – quadrat 4 (53).Others were plot 5 – quadrat 3 (44), plot 4-qudrat1 (42), plot 2 – quadrat 3 (39), plot 3 – quadrat 2 (36) and plot 3 – quadrat 4 (45) respectively. While, plot 1 – quadrat 1 and plot 1- quadrat 4 had the lowest number of trees/shrubs.
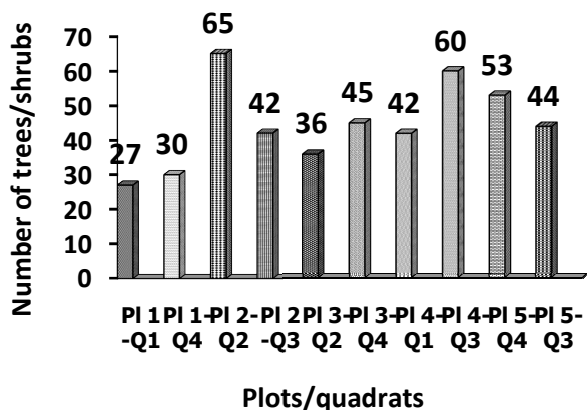
Figure 1: Number of trees/shrubs represented in each quadrat

The result in Figure 2 shows the summary of the number of trees/shrubs per plot. From the bar chart, plot 2 had 101 as the highest number of trees/shrubs, plot 5 had 97 trees/shrubs, plot 3 had 72 trees/shrubs and plot 4 had 67 while plot 1 had the lowest number of trees/shrubs (54), thus bringing the total trees/shrubs sighted to 407 in the five plots enumerated.
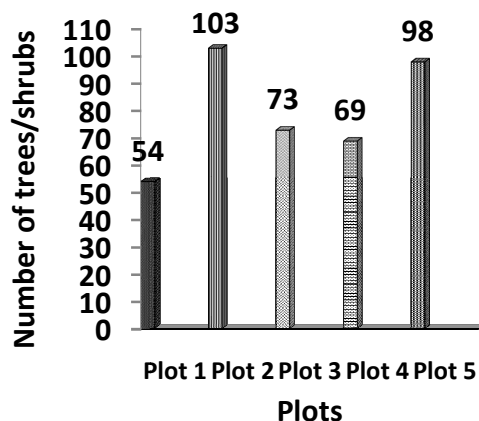
Figure 2: Number of Trees/Shrubs present in each plot

Table 5: Showing the tested hypothesis for the number of tree in the quadrats

Calculated Value	Tabulated Value	df	Level of significant
37.51*	9.488	9	0.05

The chi-square result (Table 5) showed a variation in tree and shrub species abundance with the calculated value of 37.51 greater than the tabulated value of 9.488 significantly at 5% level of probability

Discussion

Over the past five decades, man has been faced with a rapidly deteriorating environment that daily draws disturbing attention (Ijeomah, *et al*., 2007). This menace; deforestation, forest degradation, land-use misuse had led to major environmental problems in the country (Jaiyeoba, 2002).

In Jos Wildlife Park, a wide range of different tree species were encountered, however, species composition and dominance differ greatly among the trees. While trees like *Piliostigma thonningii, Pinus caribea, Parkia biglobosa, Terminalia avicennoides, Uvaria chamae* and *Vitex doniana* were found to be dominant, some species such as *Senna singuena,Pseudocedrela koyschyi and Combretum molle* were found to be poorly represented. The dominance of trees like *Parkia biglobosa* and *Vitex doniana* may not be unconnected with the soil types that favour their growth and also their conservation may be linked to their usefulness as food for wildlife and medicine for inhabitants of the area (Akanni, 2013; Amusa *et al*., 2010).

The density of 40 tree/shrub observed in the study area was lower compared to 48 tree species identified by Ugbogu and Akinyemi (2004) in the study of Ribako Strict Nature Reserve in Kaduna State, 44 tree species were identified by Akinyemi *et al*., (2004) in Omo forest reserve in Ogun state and 126 plant species distributed in 49 families identified in Ile-Ife, Osun State (Ogunniran and Muoghalu, 2007). This low density obtained in the study area could therefore be ascribed to encroachment and other anthropogenic activities in the Park.

According to Kimaro and Lulandala, (2013) and Akinyemi *et al., (*2002), felling of mature trees for timber, clearing of land for farming, collection of fuelwood and other non-timber forest products, as well as farmers encroachment most likely have affected species quantity and quality in many forested area. This finding is in agreement with findings of Abagai, (2011) who found that human interference in Kagoro/Tsonje watershed in Kaduna State declined population structure of tree species and richness. The relative low frequency of trees and shrubs in the study area depicts the high level of disturbance and degradation. This is in agreement with (Nath *et al.,*2005 and Addo-Fordjour *e tal.,*2009) who observed that anthropogenic activities impede healthy tree structure of moist forest and wet evergreen forests respectively. The findings from this study revealed deforestation leading to the decline in the forest area of the Jos Wildlife Park. Though the chi-square result showed variation in species abundance between trees and shrubs, it is evident that forest and wildlife resources of the Park are being depleted by encroachers. This is aggravated through farming activities, developmental projects such as construction of residential houses due to increase in human population, petrol stations and roads at a fast rate judging from the relative densities of trees and shrubs. During the course of study, Wildlife species were only found where there was favourable environment that could support and sustain their existence, whenever the habitat condition of these species becomes unfavourable, the existence of these animals become threatened (Ijeomah, *et al*., 2007). Changes in vegetation composition will also affect the physical, biological and biogeochemical characteristics of the Park modifying the ecosystem and structure leading to a change in biodiversity (Amusa *et al*., 2010). Similar observation was made by

Ijeomah, (2008) on people encroaching into Pai Game Reserve that has led to the reduction in the animal population in the Park.

Conclusion

Trees/shrubs diversity and abundance in Jos Wildlife Park was investigated with a view to establishing the current status towards sustainable management. The relative densities of trees and shrubs were found to be lower as evidence of the forest community degradation through anthropogenic activities.

It is therefore recommended that there should be adequate public awareness on the importance of Wildlife Park which will lead to proper preservation and conservation of the flora and fauna resources in the Park. There should be appropriate policy that will restrict encroachers from tampering with the vegetation and/or animals within the Park and government should finance the survey and mapping of the Park and also reclaim all the lands that are under construction for residential buildings and roads belonging to the Park.

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