



## Structure of Plants across Habitat Types in Amurum Forest Reserve, Plateau State Nigeria

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**ABSTRACT:** The Amurum Forest Reserve is one of the nature reserves in Plateau State North central Nigeria. Strict Nature reserve is prominent among the methods for in situ conservation of biodiversity in Nigeria and also the world at large. A study was conducted in the Forest across three habitat types in order to measure tree height and diameter at breast height (dbh) of trees. 50m x 50m plots were marked across the habitat types by simple random sampling technique. Trees and shrubs were identified to species level. Measurement were limited to all woody plants with diameter at breast height (dbh) of  $\geq 10$ cm. Data collected was analyzed in excel. A total of 397 woody species were identified during the study period. 87.7 of the plants were shrubs while 12.3% were trees. The gallery forest had the highest diameter class(30-35cm) followed by the savanna(25-30cm) and lastly the rocky outcrop with the diameter class of 20-25cm. The rocky outcrop had the highest number of trees with the lowest dbh (10-15cm) while the gallery forest had more trees in the highest diameter class (30-35) (Figure 2). The highest mean height distribution in the Gallery forest shows that the plant communities in this habitat type has grown over the years without disturbance since the place is a protected site. Therefore, other surrounding bushes should be protected in order to preserve species from local extinction.

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The accurate measurement of tree height and diameter at breast height (dbh) remains a very important input variable for growth and yield models and are important predictive models for determining canopy and thickness of forests (Liu *et al.*, 2017). These two parameters are the most important factors in surveys, production and management of forest resources and detailed research on forest communities because they can be used to calculate the volume, site index, growth, biomass and carbon stock (Lei *et al.*, 2009; Vargaslarreta *et al.*, 2009; Daniel and Jeffery, 2009). Approximately, one third of the world's land Ecosystem is covered with forest and 50% of such ecosystem is found in the tropics but are threatened by anthropogenic activities to the extent that the forests are almost reduced to mere grass lands (FAO, 2015; Olajuyigbe and Adaja, 2014; Oke and Odebisi, 2007; Parthasarathy, 2001; Awotoye and Adebola, 2013). The Amurum Forest Reserve is one of the nature reserves in Plateau State North central Nigeria. Strict Nature reserve is prominent among the methods for in situ conservation of biodiversity in Nigeria and also the world at large (Adenkunle *et al.*, 2013). A woody

plant is any plant that has wood as its structural tissue and is either a tree, shrub or a liana which is usually described as a perennial plant whose stems and larger roots are reinforced with wood produced from secondary xylem and contains roots that are usually covered by a layer of bark (Chase and Mark, 2004). The importance of woody species to man cannot be overemphasized. Beyond their economic value, shrubs and trees act as biological filters by helping to cleanse the environment of pollutants such as oxides of carbon, toxic gases and heavy metals (Chakraverty and Jain, 1984).

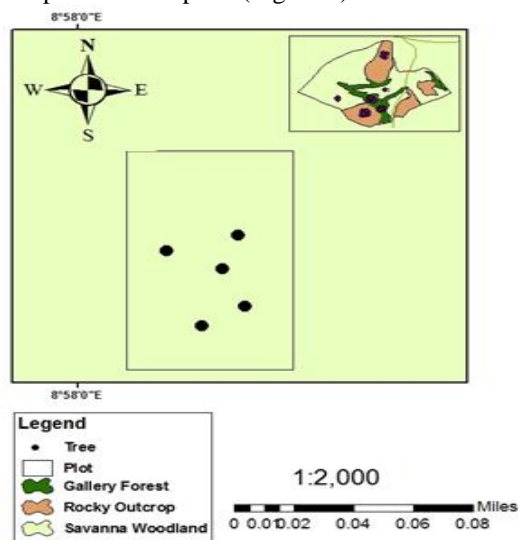
Seventy percent of the world's plants and animals live in forests and are losing their habitats to deforestation, according to national geographic. Loss of habitat leads to species extinction and also has negative consequences for medicinal research and local populations who rely on the plants in the forest for medicine (Alina, 2005). Hence, the significance of this study, aimed at identifying and documenting species, so as to help conserve such places because of their benefits to the environment.

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### MATERIALS AND METHODS

**Study Area:** The study was carried out in Amurum Forest Reserve. The forest is about 300ha and is located 15km North east of Jos in North-Central Nigeria (09°53'N, 08°59'E) and it is 128m above sea level (Vickery and Jones, 2003). Amurum Forest is one of the important bird areas (IBA) in Nigeria with at least 278 bird species. The reserve houses some endermic bird species, Rock firefinch (*Lagonosticta sanguinodorsals*) and Jos Plateau Indigobird (*Vidua Maryae*) (Ezealor, 2001). Other faunal species include rock hyraxes, Bats, Rabbits and several species of Reptiles (Ibrahim, 2002). It comprises of three major habitats-the gallery forest, Savannana wood land and Rocky outcrop, all of which differs remarkably in floristic composition (Yessoufon *et al.*, 2012). Temperature ranges from 8°C to 38°C, and mean annual rainfall is 1411mm. Some common tree species include *Khaya senegalensis*, *Daniella oliveri*, *Parkia biglobasa*, *Lophura lauceolata*, *Ficius species* (Ezealor, 2001).

**Data Collection:** 50m x 50m plots were marked across the habitat types by simple random sampling technique (Daru *et al.*, 2015). A total of 9 plots, 3 each across the three habitat types were measured. Trees and shrubs were identified to species level. Measurement were limited to all woody plants with diameter at breast height (dbh) of ≥ 10cm. With this minimum diameter at breast height, most of the species of the woody plants were measured. The two parameters assessed in each sample plot were diameter at breast height (dbh) using the veneer caliper and height of all trees in each plot using the Haga altimeter. The GPS was also used to take coordinates of all the trees species in the plots (Figure 1).



**Fig 1:** Map Showing the Habitat types and Location of sampling plots

### RESULTS AND DISCUSSION

A total of 397 woody plants belonging to 49 species were identified during the study period (Table 1).

**Table 1:** List of Woody Species across Family and life Form in Amurum Forest Reserve, Plateau State Nigeria

Species	Family	Life Form
<i>Ficus cordata</i>	Moraceae	Shrub
<i>Ficus abutilifolia</i>	Moraceae	Shrub
<i>Ficus platyphylla</i>	Moraceae	Shrub
<i>Rhus natalensis</i>	Anacardiaceae	Shrub
<i>Euphorbia desmondii</i>	Euphorbiaceae	Shrub
<i>Albizia zygia</i>	Mimosoideae	Tree
<i>Holarrhena floribunda</i>	Apocynaceae	Shrub
<i>Allophylus nigericus</i>	Sapindaceae	Shrub
<i>Jasminum dichotomum</i>	Oleaceae	Shrub
<i>Sterculia setigera</i>	Sterculiaceae	Tree
<i>Ficus glumosa</i>	Moraceae	Shrub
<i>Parkia biglobosa</i>	Fabaceae	Tree
<i>Erythrina Abyssinica</i>	Leguminosae	Shrub
<i>Lantana camara</i>	Verbanaceae	Shrub
<i>Kleinia cliffordiana</i>	Asteraceae	Shrub
<i>Stegandaenia araliacea</i>	Apiaceae	Tree
<i>Euphorbia kamerunica</i>	Euphorbiaceae	Shrub
<i>Dichrostachys cinerea</i>	Mimosaceae	Shrub
<i>Pachystela pobeguineana</i>	Sapotaceae	Tree
<i>Heeria insignis</i>	Anacardiaceae	Shrub
<i>Croton zambeisicus</i>	Euphorbiaceae	Shrub
<i>Acacia ataxacantha</i>	Leguminosae	Shrub
<i>Heeria pulcherrima</i>	Anacardiaceae	Shrub
<i>Bridelia ferruginea</i>	Euphorbiaceae	Shrub
<i>Ochna schweinfurthiana</i>	Ochnaceae	Tree
<i>Ziziphus mucronata</i>	Rhamnaceae	Shrub
<i>Pterocarpus erinaceus</i>	Leguminosae	Shrub
<i>Anogeissus leiocarpus</i>	Combretaceae	Tree
<i>Daniellia oliveri</i>	Fabaceae	Tree
<i>Uvaria chamae</i>	Annonaceae	Shrub
<i>Ekebergia senegalensis</i>	Meliaceae	Shrub
<i>Rhus natalensis</i>	Anacardiaceae	Shrub
<i>Annona senegalensis</i>	Annonaceae	Shrub
<i>Guira senegalensis</i>	Combretaceae	Shrub
<i>Perinari curatellifolia</i>	Chrysobalanaceae	Shrub
<i>Olex subscorpioides</i>	Olacaceae	Shrub
<i>Syzygium guineense</i>	Myrtaceae	Tree
<i>Terminalia avicennioides</i>	Combretaceae	Shrub
<i>Strophanthus sarmentosus</i>	Apocynaceae	Shrub
<i>Carissa edulis</i>	Apocynaceae	Shrub
<i>Diospyros spp</i>	Ebanaceae	Shrub
<i>Combretum spp</i>	Combretaceae	Shrub
<i>Dichrostachys cinerea</i>	Mimosaceae	Shrub
<i>Psorospermum febrifugum</i>	Hypericaceae	Shrub
<i>Hymonocardia acida</i>	Phyllanthaceae	Shrub
<i>Keeta venosa</i>	Rubiaceae	Shrub
<i>Vitex doniana</i>	Verbanaceae	Tree
<i>Bridelia ferruginea</i>	Euphorbiaceae	Shrub
<i>Ekebergia senegalensis</i>	Meliaceae	Shrub
<i>Pericopsis laxiflora</i>	Leguminosae	Shrub
<i>Bersema abyssinica</i>	Meliantaceae	Shrub
<i>Psychotria psychotrioides</i>	Rubiaceae	Shrub
<i>Manilkara multinervis</i>	Sapotaceae	Tree
<i>Cleridendrum volubile</i>	Lamiaceae	Shrub
<i>Dialium guineense</i>	Leguminosae	Tree
<i>Santaloides afzelii</i>	Connaraceae	Shrub
<i>Olea capensis</i>	Oleaceae	Shrub
<i>Keetia cornelia</i>	Rubiaceae	Shrub
<i>Saba senegalensis</i>	Apocynaceae	Shrub
<i>Diospyros ferrea</i>	Ebanaceae	Tree
<i>Fadogia spp</i>	Rubiaceae	Shrub
<i>Opilia celtidifolia</i>	Opiliaceae	Shrub
<i>Sericanthe chevalieri</i>	Rubiaceae	Shrub
<i>Pavetta spp</i>	Rubiaceae	Tree
<i>Cleistopholis glauca</i>	Annonaceae	Tree
<i>Ficus citricifolia</i>	Moraceae	Tree
<i>Paullinia pirinita</i>	Sapindaceae	Shrub
<i>Bersema abyssinica</i>	Meliantaceae	Tree
<i>Mitragyna spp</i>	Rubiaceae	Tree
<i>Erythrina sigmodia</i>	Leguminosae	Tree
<i>Tinnae spp.</i>	Lamiaceae	Tree

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These plants belong to different families. Shrubs were the most dominant species identified in the forest. 348 shrubs were identified which represents 87.7% and the trees were 12.3%. Family composition of trees and shrubs species in the area is presented in appendix 1. 7 of the species belong to the family *Rubiaceae* followed by *moraceae* and *Euphorbiaceae* (with 5 species each). The families with the least species representations were *Sapindaceae*, *Fabaceae*,

*Verbanaceae*, *Vimosaceae*, *Sapotaceae*, *Leguminosae*, *Melaceae*, *Melianthaceae* and *Ebanaceae* with two species each. The gallery forest had the highest diameter class(30-35cm) followed by the savanna(25-30cm) and lastly the rocky outcrop with the diameter class of 20-25cm. The rocky outcrop had the highest number of trees with the lowest dbh (10-15cm) while the gallery forest had more trees in the highest diameter class (30-35) (Figure 2).

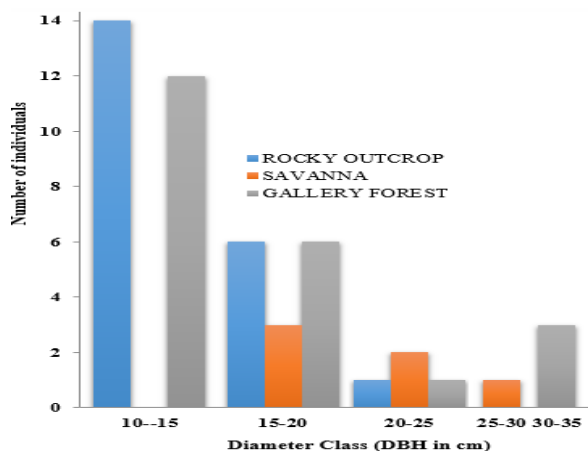


Fig 2: Diameter distribution of trees (≥ 10cm) in the three habitat types at Amurum Forest Reserve

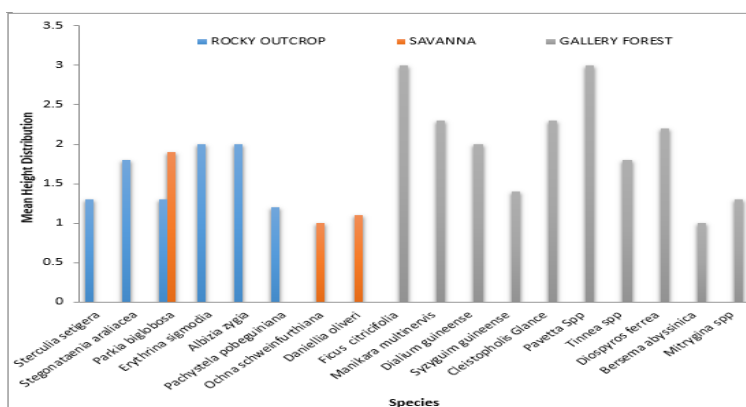


Fig 3: Mean Height (m) Distribution of Trees at Amurum Forest Reserve

The gallery forest had the highest mean height distribution followed by the rocky outcrop and then the savanna with the least mean height distribution (figure 3). The highest mean height distribution in the Gallery forest shows that the plant communities in this habitat type has grown over the years without disturbance since the place is a protected site. Plants are expected to grow with age and increase in height and diameter when there is minimal or no disturbance at all (Adenkunle *et al.*, 2013). The description of forest structure is commonly based on the aggregation of individual plant measures (e.g. density, tree diameter at breast height distribution). Pereira *et al.*, (2001) recorded highest canopy cover in an

undisturbed area while light intensity on the forest floor was high in the disturbed forest. Sang (2009) followed the same trend. The decrease in canopy cover and increased light intensity in the Rocky outcrop and savanna woodland was probably responsible for the low mean height distribution in these two habitats. Todaria *et al.*, (2010) also recorded higher density of shrubs and herbs in undisturbed stand while maximum herb and shrubs species richness was recorded in the moderately disturbed forest. In-situ preservation through the establishment of a natural reserve as a biodiversity conservation apparatus has shown to be one of the most effective and least expensive means to protect biodiversity. Protected areas, such as Amurum

Forest Reserve, often provide habitat and protection for threatened and endangered species in addition to maintaining ecological processes (Dudley, 2008). Amurum forest reserve is a vulnerable site of conservation concern because of its small size and proximity to the urban community of Jos. Though the reserve is a protected area, there are still a few sporadic cases of wood cutting and setting of fire (Abiem, 2013). This has been recorded in the woodland savanna and some parts of the rocky outcrop. The presence of water in the Riparian forest is probably one of the reasons for the robust nature of the plants in the habitat. This is similar with the findings of Molles, (2008) who stated that Riparian zones are transition zones between an upland terrestrial environment and an aquatic environment and therefore support biodiversity. In summary, the gallery forest had *Cleistopholis glauca* with the highest diameter distribution between 30 – 35 cm while *Manilkara multnervis*, *Syzygium guineense*, *Dialium guineense*, *Tinnea spp*, *Pavetta spp*, *Diospyros ferrrea* and *Bersema abyssinica* with the lowest diameter distribution between 10 – 15 cm. The highest diameter range of species in savannah was 25-30 cm with only *Parkia biglobosa* and no species in the diameter class of 10-15cm. The rocky outcrop had the highest diameter range of species in 20-25cm with only *Sterculia setigera* while *Stegonataenia araliaceae*, *Parkia biglobosa*, *Erythrina sigmodia*, *Abizia zygia*, *Pachystela pobeguiniiana* and *Sterculia setigera* with the lowest diameter distribution between 10 – 15 cm (Figure 2)

**Conclusion:** This research shows the importance of nature Reserves in encouraging the growth of trees and supporting other biodiversity. Therefore, other surrounding bushes should be protected in order to preserve species from local extinction and for the benefit of ecosystem services to the environment.

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## REFERENCES

- Abiem, I (2013): Earthworms, Soil Nutrient and plant Diversity of Amurm Forest Reserve and Its Surrounding Area. M Sc. Thesis, 'University of Jos, Nigeria Pp 71.
- Adenkunle, VAJ; Olagoke, AO; Akindele, SO (2013). Tree species diversity and structure of a Nigerian strict nature Reserve. *Trop. Ecol.* 54 (3): 275-289.
- Chase, Mark, W (2004). "Monocot relationships: an overview". *Amer. J. of Bot.* 91 (10): 1645–1655.
- Daniel, L; Jeffery, G (2009). A height-diameter curve for longleaf pine plantations in the gulf coastal plain. *Southern J. of Appl. Fores.* 33 (4), 164-170.
- Daru, BH; Yessoufou, K; Nuttman, C; Abalaka, J (2015). A preliminary study of birds use of fig *Ficus* species in Amurum forest reserve, Nigeria. *Malimbus* 37: 1-15.
- Dudley, N (2008). Guidelines for Applying Protected Areas Management Categories. (IUCN: Switzerland).Pp 86.
- Ezealor, AU (2001). In: Fishpool, L.D.C., Evans, M. I., Eds. Important Bird Areas in Africa and Associated Island: Priority site for conservation. Pisces publication And Bird Life International (Bird Life conservation series NO.11), Newbury And Cambridge, UK.Pp 2-3.
- Ibrahim, MI (2002). Renewable Natural Resources. Draft Action Plans for Laminga Community Forest (Amurum). Nigerian Conservation foundation (NCF) Pp. 2-5.
- Lei, XD; Peng, CH; Wang, HY; Zhou, XL (2009). Individual height-diameter models for young black spruce (*Picea mariana*) and jack pine (*Pinus banksiana*) plantations in New Brunswick, Canada. *Fores. Chron.* 85(1): 43-56.
- Liu, M; Feng, Z; Zhang, Z; Ma, C; Wang, M; Lian, B; Sun, R; Zhang, L (2017). Development and evaluation of height diameter at breast models for native Chinese Metasequoia. *PLOS ONE* 12 (8).
- Molles, MC Jr (2008). Ecology: Concepts and Applications (4th ed.). New York: McGraw-Hill. Pp 291.
- Sang, W (2009). Plant diversity patterns and their relationships with soil and climatic factors along an altitudinal gradient in the middle Tianshan Mountain area, Xinjiang, China. *Ecol. Res.* 24: 303–314
- Vargaslarreta, B; Castedodorado, F; AlvarezGonzalez, Gabriel, J; Barrionta, M; Cruzcobos, F (2009). A generalized height-diameter model with random coefficients for uneven-aged stands in Elsalto, Durango, Mexico. *Forestry* 84(4): 445-462.
- Yessoufou, K; Michelle VanDer, B; Abalaka, J; Daru, BH (2012). Evolution of fig- Frugivore Interactions in West Africa. *Isr. J. of Ecol. and Evol.* 58:39-51.