Sustainability and Biodiversity Conservation

Diversity, distribution, and conservation status of forest tree species in cross river state, Nigeria

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Abstract

Tree species diversity plays a central or decisive function in ecosystem operations, delivering palpable and impalpable advantages. The periodical evaluation of forest trees is absolutely necessary for the management and conservation goals. Our study employed the modified Whittaker sampling method to survey the diversity and distribution of tree species in 22 forested sites across the northern, central, and southern geographical zones of Cross River State, Nigeria. Only tree species (dbh $\geq$ 10 cm) present in our sampled plots were identified and recorded. The conservation status of identified forest tree species was checked using the IUCN red list categories and Criteria 2021: ver. 3.3.1-second edition. Field studies were undertaken from April 2019 – October 2020. A total of 197, 249, and 229 tree species belonging to 49, 50 and 49 families were recorded in the northern, central and southern geographical zones, respectively. A total of 403 tree species belonging to 65 families was recorded across the study area, of which 55, 79 and 78 tree species were localized to the northern, central and southern geographical zones, respectively. The Fabaceae was the most dominant family (64 species) while twenty families had one species each. The Cross River National Park (CRNP), Okwangwo Division had the highest number of tree species (171) while Adiabo community forest had the lowest (26). The CRNP, Okwangwo Division exhibited the highest species richness (11.39) and diversity index (4.75) while Adiabo community had the lowest species richness (4.47) and diversity index (1.14). The Least Concern conservation status had the highest number of species (226) while the Critically Endangered and Data Deficient had the lowest (1 each). Our findings will assist accord policymakers or stakeholders the information obligatory for implementing a forestry blueprint and plan of action or scheme in Cross River State, Nigeria.

Keywords: Biodiversity, Forest survey, IUCN

Introduction

Cross River State is a coastline state situated in Southern Nigeria and termed after the Cross River, which moves through the state. The land mass of the State is about 20,156 square kilometers. The State lies between, latitude 5° 45′N and 6˚ 10ˈN and longitude 8° 30′E and 8˚ 39ˈE (Aju & Ezeibekwe, 2010). Cross River State belongs to a tropical rainfall belt where rainfall is customarily seasonal and at times very heavy. The humid tropical climate of about 1300 – 3000 mm rainfall and 30˚C mean annual temperatures prevail over Cross River State, except on the Obudu Plateau, where the climate is sub-temperate, with temperatures of 15 – 23˚C (NIMET, 2015). The vegetation spans from mangrove swamps, through rainforest, to derived savannah, and montane parkland. The state is further divided into three regions namely; north, central and south. Each region is further distinguished by its own distinctive environmental and soil features (NIMET, 2015). Currently, the state has more or less 31% of the total existing tropical high forests in Nigeria (Philip et al., 2014).

The tropical rainforests are the greatest bio-diverse of all earthly ecosystems (Turner 2001; Onyekwelu et al., 2008; Schmitt et al., 2009; FAO, 2010; IUCN, 2010). Despite the fact that attributed to at most 7% of the terrestrial parched exterior area, rainforests sustain about 70% of all animal and plant species in worldwide ecosystems (Lovejoy, 1997). Around 100 and 300 tree species, ha^{-1} are located in rainforests (Onyekwelu et al., 2008). Forests play a critical function in supporting foundational ecological processes, in addition to equipping livelihoods and upholding economic growth (UNEP, 2007; FAO 2009). Trees species are vital constituents of forest ecosystems. According to Singh (2002), trees in addition to solidifying the crucial structural and practical foundation of tropical rainforests, are essential as carbon sinks,watersheds, make available shades and homes for several life forms and most importantly serve as a main harvester of energy into the ecosystem. Trees diversity is vital to tropical forest biodiversity, since trees make available homes and resources to a wide array of plant and animal species. For that reason, they control the design and affect the make-up of forest communities. The size, amount or degree of the biodiversity of an ecosystem impacts the total health standing of the ecosystem (Naidu and Kumar, 2016). The firmness or permanence and task of the ecosystem are controlled by the variability of vegetation (Buba, 2015). There is also burgeoning proof on the good effect of elevated species variability in a physical surrounding task such as controlling the gradual wearing away of land surface materials by the action of water, winds, waves, etc. (Ogunjemite, 2015).

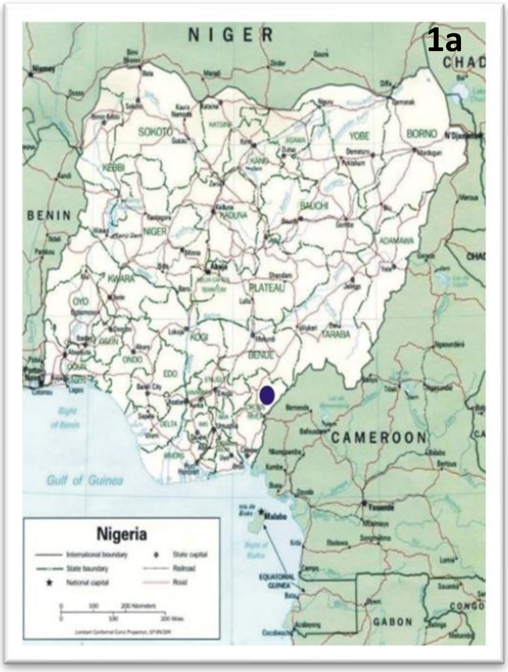
The IUCN Red List Categories and Criteria are comprehensively endorsed as the greatest goal and dependable set of principles and procedures usable for appraising the worldwide or universal possibility of extirpation for species (Mace et al., 2008; De Grammont and Cuarón 2006; Rodrigues et al., 2006). It set about in the sixties with the provision or presentation of the foremost Red Data Books (Fitter and Fitter 1987) and has hence developed gradually or progressed from consisting of catalogs or records and books devoted to animal classes or plants into a distinctive all-embracing conspectus of conservancy-connected statistics (Vie et al., 2008). The widespread or broad desired outcome of the IUCN Red List Categories and Criteria is to make available a clear and exact, objective essential supporting structure for the classification of the comprehensive assortment of species conforming to their extirpation risk (IUCN, 2004). It is built or found on an intention system permitting allocation of whichever species (excluding micro-organisms) to sole Nine Red List Categories (Not Evaluated (NE), Data Deficient (DD), Least Concern (LC), Near Threatened (NT), Vulnerable (VU), Endangered (EN), Critically Endangered (CR), Extinct In The Wild (EW) and Extinct (EX) (IUCN, 2021) predicated on in-case they connect principle or standard connected to population drift, proportion and structure and geographic span or scope (Mace *et al.*, 2008). For instance, a scientifically classified group or entity is contemplated seriously at risk of extinction if there is a depletion in population proportion (>80% in the last 10 years or predicted depletion in the future) in numbers (approximated to be less than 2,500 mature individuals) and if projected extirpation of at least 20% not beyond 20 years (IUCN, 2004).

Increasing population and high level of poverty have led to more dependence on forest resources (timber, non-timber forest products) and the increased global discourse on issues of agricultural expansion, deforestation, forest degradation, biodiversity loss, and climate change. Nigeria has an estimated 14, 000 sq. km of forest reserves, of which about 36.5 % (i.e. about 6000 sq km) are located within the tropical rainforest biome in Cross River State (NEST, 1991). However, Cross River State forests (open or restricted) which hold diverse flora and fauna species are without appropriate monitoring schemes to checkmate threats to forest degradation, indelibly posing a threat to native and endemic species found therein (FAO, 2010; WCS, 2012). Impregnable or plausible coordination and administration of these forests demand a satisfactory awareness or information of the greatest amount if not all of the natural forests resource; this awareness or information could be dependable only through scrutinizing of the forest environment. Comprehension of the diversity, distribution and conservation status of species of the forest is an all-important instrument in appraising the stabilisation of the forest, conservation of species in their natural habitat and regulation of forest ecosystems. Relatively long period of biodiversity preservation relies by and large on the awareness of the diversity, distribution and conservation status of the species in the forest. Some studies on tree species diversity have been documented for some forests in Cross River State (Bisong & Mfon, 2006; Edet *et al.,* 2012; Jimoh *et al.,* 2012; Adeyemi *et al.,* 2013; Aigbe *et al.,* 2014; Aigbe & Omokhua, 2015; Ajayi & Obi, 2016), to whatever degree or extent, these studies were altogether limited or restricted to the Afi forest, Cross River National Park, Okwangwo and Oban Divisions and Oban forest reserve in Central and Southern Cross River State, respectively. Our study provides more detailed and crucial information or knowledge on forest tree species diversity, distribution and, conservation status as it covered National Parks, Reserves and, Community forests across twenty-two communities (North, Central and Southern) zones in Cross River State, Nigeria. The aim of our study, therefore, is to inventories forest tree species diversity in Cross River State forests, Nigeria. Our study objectives are to provide basic ecological data on the diversity, distribution, and conservation status of forest tree species sampled across these forests which are foundational requirements for sustainable tree species management and conservation in the forests ecosystem. Our study is strategic as it will provide stakeholders the information necessary for implementing a forestry blueprint and a plan of action in Cross River State, Nigeria.

Materials and methods

Study area

Cross River State is located in the southern zone of Nigeria (Fig. 1a). The study was carried out in twenty-two forests located in the northern, central and southern zones of Rivers State, Nigeria (Figure 1b). The survey to provide field data was conducted between April 2019 and October 2020. The northern zone is part of the Tropical Dry Forest/Guinean Savanna agro-ecological zone of Nigeria and lies between latitude 6.6659716/6.654837˚N and longitude 8.7945557/8.797694˚E. The topography ranges from less than 80 to 140 m above sea level (excluding the Obudu plateau (1,700 m) altitude with threesome soil types, i.e.; clay, silt and sand (NIMET, 2015). The area has a yearly rainfall of 1,250-1,300 mm, an average yearly temperature of 30˚C, as well as a dry period of 3 to 5 months (NIMET, 2015). The central zone falls within the tropical high forest agroecological zone of Nigeria and lies between Latitude 6.268036/6.2467˚N and Longitude 9.029084/9.9245˚E. The terrain or forest landform in this zone is exceptionally compounded with several linked mountain arrangements, outlying summits, and crops, with elevation stretching at intervals 200 m - 1300 m altitude and fast-moving streams (Nsor, 2004). Soils range from clay loam to loam and are generally red with high iron oxide content (Agbor, 2003). Yearly rainfall spans between 3, 000 mm - 3, 800 mm (Agbor, 2003), mean yearly temperature of 22.2˚C - 27.4˚C with a mean annual relative humidity of 78% (Agbor, 2003). The southern zone belongs to the tropical high forest belt agro-ecological zone of Nigeria and lies at Latitude 5.389646/5.3190˚N and Longitude 8.544654/8.3499˚E. The vegetation is mostly lowland rainforest with a rough terrain and altitude surges through the river basins to above 1, 000 mm in steep areas (Jimoh et al., 2012). Lesser sandy soils are located in igneous areas, while the plains are dominated by deeper soils, while on hilly or elevated slopes they become progressively pebble, and corroded (Ogunjobi *et al.*, 2010). The zone has rains of not less than nine months (March – November) and receives more than 3,800 mm of rain per year (Ogunjobi et al., 2010). The temperature range is 25°C - 27°C, sometimes a bit more than 30°C. Relative humidity ranges from 75 - 95%, but gradually decreases due to the dry season (Bisong & Mfon, 2006). The flora of the zone is a combination of mangroves, tropical forests and savannahs. Tropical forests are also divided into lowland tropical forests and freshwater marsh.



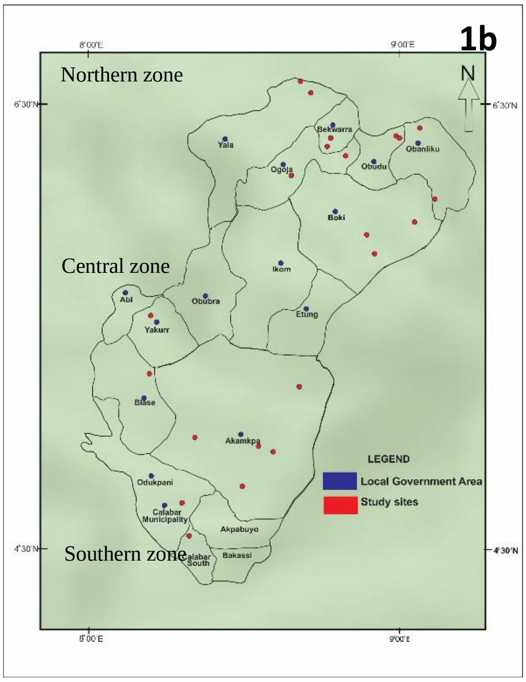


Figure 1a. Geographical map of Nigeria indicating the location of Cross River State Figure 1b: Cross River State map indicating study sites in the various zones (based on data generated during field work)

Forest survey

Our study employed the Modified Whittaker sampling method (Herrick *et al.,* 2005) to survey the diversity and distribution of forest tree species. In each forest, we set up three 200m × 200m plots outlined in a spoke pattern. Inside all of these plots, a single 50m × 40m subplot followed by four 20 × 10m least subplots were set. Beginning with the least plots, all plots were surveyed and the tree species present were identified and recorded. This was augmented by the use of line transects in areas of challenging or intractable topography. Our assessment comprised of listing and taking account of all free stationed trees of 10 cm and above diameter at breast height (dbh) in each plot. Forest tree species were identified using the works of Hutchinson & Dalziel (1972) and authenticated by a plant taxonomist. Data collated from the field was analysed to obtain tree species diversity indices (species richness, diversity and dominance).

Tree species richness

Tree species richness was calculated using the Menhinick Index based on the proportion of the number of taxa to the 'square root of sample size' using the equation; $D_{mn} = S/\sqrt{N}$, Where, D_{mn} is the Menhinick Index, S = number of species and $\sqrt{N}$ = 'square root of the number of individuals in the sample plot' (Tuomisto, 2010).

Tree species diversity

Tree species diversity was calculated using the Shannon – Weiner's Diversity index (*H*) using the equation; H = ∑piInpi Where H = Diversity index, In = lnPi = Natural logarithm of the corresponding relative abundance (Pi) of the species, Pi = the proportion of individuals found in the ith species (Petchay & Gaston, 2002).

Tree species dominance

Tree species dominance was calculated using Simpson's dominance index (D) using the equation; Dominance = 1 – D. It is also represented as D = ∑ (ni * (ni – 1)/(N *(N – 1), Where ni – Number of individuals in the ith species and N – the total number of individuals (Gower *et al.*, 2003). The reciprocal (*D*) of Simpson's index (number of very abundant species) will ensure that the index *D* increases with increasing diversity.

Conservation status of forest tree species

Conservation status of forest tree species in our study was carried out based on the different IUCN Red List Categories and Criteria 2021: Version 3.1 Second edition; Not Evaluated (NE), Data Deficient (DD), Least Concern (LC), Near Threatened (NT), Vulnerable (VU), Endangered (EN), Critically Endangered (CR), Extinct in the Wild (EW), and Extinct (EX) (IUCN, 2021). The conservation status of each tree species sampled in our study was confirmed using the site www.iucnredlist.org

RESULTS

Forest tree species composition, diversity and distribution across forests in Cross River State

In the Northern zone (Gabu, Aliforkpa, Winniba-Ekajuk, Aragban, Ukpah, Okpeche-Afrike 1, Alege/Utugwang, Bebuabong/Ohong, Becheve and Sankwala), an aggregate of 197 tree species belonging to 49 families were recorded (Appendix 1). The most frequently encountered species were members of the Fabaceae family (33 species), followed by Moraceae (13), Malvaceae (12), Annonaceae (10), Meliaceae (9), Rubiaceae (8 species), Apocynaceae, Combretaceae, Euphorbiaceae and Phyllanthaceae (7 species each), Anacardiaceae and Bignoniaceae (5 species each), Olacaceae and Sapotaceae (4 species each), Fabaceae, Clusiaceae, Gentianaceae, Irvingiaceae, Lecythidaceae, Myristicaceae, Ochnaceae and Sapindaceae (3 species each), Agavaceae, Araliaceae, Bombacaceae, Burseraceae, Chrysobalanaceae, Connaraceae, Ebenaceae, Gentianaceae, Lamiaceae, Melastomataceae, Myristicaceae, Ochinaceae, Salicaceae and Urticaceae (2 species each), Arecaceae, Boraginaceae, Cannabaceae, Ericaceae, Flacourtiaceae, Guttiferae, Hypericaceae, Juglandaceae, Moringaceae, Myrtaceae, Pandanaceae, Passifloraceae, Rhamnaceae, Sterculiaceae and Tiliaceae (1 species each).

In the Central zone (Cross River National Park, Okwangwo Division, Mbe, Afi, and Agoi), an aggregate of 249 tree species belonging to 50 families were recorded (Appendix 1). The most frequently encountered species were members of the Fabaceae family (27), followed by Malvaceae (21), Rubiaceae (19), and Sapotaceae (17 species each), Apocynaceae (15), Meliaceae and Moraceae (13 species each), Annonaceae (10), Anacardiaceae (8), Clusiaceae (7), Euphorbiaceae and Phyllanthaceae (6 species each), Bignoniaceae, Ebenaceae and Lamiaceae (5 species each), Irvingiaceae, Olacaceae and Rutaceae (4 species each), Combretaceae, Cannabaceae, Myristicaceae, Ochnaceae and Sapindaceae (3 species each), Burseraceae, Calophyllaceae, Fabaceae, Chrysobalanaceae, Lecythidaceae, Loganiaceae, Myrtaceae, Pandaceae, Polygalaceae, Salicaceae, Tiliaceae and Urticaceae (2 species each), Achariaceae, Agavaceae, Asteraceae, Bombacaceae, Connaraceae, Dichapetalaceae, Elaeocarpaceae, Clusiaceae, Huaceae, Hypericaceae, Pandanaceae, Passifloraceae, Sterculiaceae and Violaceae (1 species each).

In the Southern zone (Cross River National Park, Oban Division, Oban Forest Reserve, Kwa Falls, Ekuri, Ekong-Anaku, Adiabo and Idim Ita), an aggregate of 229 tree species belonging to 49 families were recorded (Appendix 1). The most frequently encountered species were members of the Fabaceae family (32), followed by Rubiaceae (21), Malvaceae (17), Apocynaceae and Moraceae (13 species each), Meliaceae (11), Euphorbiaceae (10), Annonaceae and Sapotaceae (8 species each), Ebenaceae, Phyllanthaceae and Sapotaceae (7 species each), Gentianaceae (6), Cannabaceae and Salicaceae (5 species each), Anacardiaceae and Burseraceae (4 species each), Bignoniaceae, Fabaceae, Chrysobalanaceae, Clusiaceae, Lamiaceae and Salicaceae (3 species each), Cercidiodeae, Combretaceae, Irvingiaceae, Lauraceae, Myristicaceae, Ochinaceae, Olacaceae, Pandaceae, Passifloraceae, Polygalaceae, Putranjivaceae, Rutaceae, Sapindaceae and Urticaceae (2 species each), Agavaceae, Anisophyllaceae, Arecaceae, Calophyllaceae, Connaraceae, Ericaceae, Guttiferae, Hypericaceae, Lecythidaceae, Lepidobotryaceae, Octoknemaceae, Rhizophoraceae, Simaroubaceae, Ulmaceae and Violaceae (1 species each).

An aggregate of 1560 individuals belonging to 403 in 65 families were recorded across forests comprising Northern, Central and Southern zones of Cross River State, Nigeria (Appendix 1). Of the 403 recorded forest tree species; 55, 78 and 79 forest tree species were observed to be confined to the Northern, Central and Southern geographical zones of Cross River State forests, respectively (Table 1). The most frequently encountered species were members of the family Fabaceae (64), followed by Rubiaceae (30), Malvaceae (29), Sapotaceae (23), Moraceae (21), Meliaceae (18), Annonaceae and Apocynaceae (17 species each), Euphorbiaceae (15), Phyllanthaceae (14), Anacardiaceae, Clusiaceae, Ebenaceae and Gentianaceae (8 species each), Combretaceae (7), Cannabaceae and Salicaceae (6 species each), Bignoniaceae, Chrysobalanceae, Lamiaceae, Olacaceae and Rutaceae (5 species each), Burseraceae, Irvingiaceae, Lecythidaceae and Ochinaceae (4 species each), Myristicaceae, Passifloraceae and Sapindaceae (3 species each), Agavaceae, Araliaceae, Arecaceae, Bombacaceae, Calophyllaceae, Connaraceae, Ericaceae, Lauraceae, Loganiaceae, Melastomataceae, Myrtaceae, Pandaceae, Polygalaceae, Putranjivaceae, Tiliaceae and Urticaceae (2 species each), Achariaceae, Anisophyllaceae, Asteraceae, Boraginaceae, Dichapetalaceae, Elaeocarpaceae, Flacourtiaceae, Clusiaceae, Huaceae, Hypericaceae, Juglandaceae, Lepidobotryaceae, Moringaceae, Octoknemaceae, Pandanaceae, Rhamnaceae, Rhizophoraceae, Simaroubaceae, Sterculiaceae and Violaceae (1 species each).

Species richness (Menhinick Index)

Table 1 shows the results of forest tree species richness (Menhinick Index) of the Northern, Central and Southern geographical zones of Cross River State. In the Northern zone (Gabu, Aliforkpa, Winniba-Ekajuk, Aragban, Ukpah, Okpeche-Afrike 1, Alege/Utugwang, Bebuabong/Ohong, Becheve and Sankwala); the highest tree species richness was in the Becheve Forest Reserve (8.83). This was followed by Sankwala community forest with a species richness of 8.22 while the lowest tree species richness in the zone was in Gabu and Aliforkpa community forests (5.44) and (5.09). Winniba-Ekajuk, Aragban, Ukpah, Okpeche-Afrike 1, Alege/Utugwang and Bebuabong/Ohong communities had a tree species richness of 6.49, 6.68, 6.96, 6.96, 7.30 and 6.96, respectively.

In the Central zone (CRNP-Okwangwo, Mbe, Afi and Agoi (Agoi/Abini): the highest forest tree species was in the Cross River National Park, Okwangwo Division (11.39). This was followed by Mbe Mountain community forest with a species richness of 8.40 while the lowest tree species richness in the zone were in the Afi Mountain and Wildlife Sanctuary and Agoi Forest Reserve (7.71) and (7.26).

In the Southern zone (CRNP-Oban, Oban Forest Reserve, Kwa Falls, Ekuri, Ekong-Anaku, Adiabo, and Idim Ita), the highest forest tree species richness was in the Cross River National Park, Oban Division (10.66). This was followed by Oban Forest Reserve with a species ichness of 7.92 while Kwa Falls, Ekuri and Ekong-Anaku community forests had a tree species richness of 7.60, 6.12, and 7.37 respectively. The lowest tree species richness in the zone was recorded in Idim Ita (4.47) and Adiabo (4.39) community forests. The species richness of the study area shows that Gabu, Aliforkpa, Winniba-Ekajuk, Aragban, Ukpah, Okpeche-Afrike 1, Alege/Utugwang, Bebuabong/Ohong, Becheve and, Sankwala (Northern zone), CRNP-Okwangwo, Mbe, Afi and Agoi (Agoi Ibami/Abini Sectors) (Central zone), CRNP-Oban, Oban Forest Reserve, Kwa Falls, Ekuri, Ekong-Anaku, Adiabo and Idim Ita (Southern zone) had a tree species richness of 5.44, 5.09, 6.49, 6.68, 6.96, 6.96, 7.30, 6.96, 8.83, 8.22, 11.39, 8.40, 7.71, 7.26, 10.66, 7.92, 7.60, 6.12, 7.37, 4.39 and 4.47 respectively. Therefore, Cross River National Park, Okwangwo Division (Central zone) had the highest tree species richness (11.39) in Cross River State followed by Cross River National Park, Oban Division (10.66) (Southern zone) while Idim Ita (4.47) and Adiabo (4.39) communities, respectively had the lowest.

Species diversity (Shannon – Weiner's Index)

Table 1 also shows the results of tree species diversity index (Shannon – Weiner's diversity index) of the Northern, Central and Southern geographical zones of Cross River State. In the Northern zone (Gabu, Aliforkpa, Winniba-Ekajuk, Aragban, Ukpah, Okpeche-Afrike 1, Alege/Utugwang, Bebuabong/Ohong, Becheve and Sankwala), the Becheve Forest Reserve had the highest tree species diversity index of 3.38. This was followed by the Sankwala community forest with a diversity index of 3.20 while Gabu and Aliforkpa community forests had the lowest tree species diversity index of 1.60 and 1.49, respectively). Winniba-Ekajuk, Aragban, Ukpah, Okpeche-Afrike 1, Alege/Utugwang and Bebuabong/Ohong community had tree species diversity indices of 1.96, 2.04, 2.06, 2.08, 2.11 and 2.13, respectively.

In the Central zone (CRNP-Okwangwo, Mbe, Afi and Agoi (Agoi Ibami/Abini Sections); the Cross River National Park, Okwangwo Division had the highest tree species diversity index of 4.75. This was followed by Mbe Mountain community forest with a species diversity index of 3.83 while Afi Mountain and Wildlife Sanctuary and Agoi Forest Reserve had the lowest tree species diversity index in the zone (3.25 and 3.02, respectively).

In the Southern zone (CRNP-Oban, Oban Forest Reserve, Kwa Falls, Ekuri, Ekong-Anaku, Adiabo and Idim Ita), the Cross River National Park, Oban Division had the highest tree species diversity index (4.68). This was followed by Oban Forest Reserve with a species diversity index of 3.44 while Kwa Falls, Ekuri and Ekong-Anaku community forests had a tree species diversity index of 3.35, 2.88 and 2.90 respectively. Idim Ita and Adiabo community forests had the lowest tree species diversity indices of 1.27 and 1.14 in the zone, respectively). Thus, the Shannon – Weiner's diversity index of tree species in the study area shows that the highest diversity indices were recorded in the Cross River National Park, Okwangwo Division (Central zone) (4.75) followed by the Oban Division (Southern zone) with a diversity index of 4.68. The least diversity indices were recorded in Idim Ita and Adiabo communities (Southern zone) (1.27 and 1.14 respectively). Shannon – Weiner's diversity indices of 1.60, 1.49, 1.96, 2.04, 2.06, 2.08, 2.11, 2.13, 3.28, 3.20, 3.25, 3.83, 3.44, 3.35, 3.68, 2.88 and 2.90 were recorded for tree species in Gabu, Aliforkpa, Winniba-Ekajuk, Aragban, Ukpah, Okpeche-Afrike 1, Alege/Utugwang, Bebuabong/Ohong, Becheve, Sankwala, Mbe, Afi, Agoi (Agoi Ibami/Abini Sectors), Oban, Kwa Falls, Ekuri and Ekong-Anaku forests, respectively.

Simpson's dominance index

Table 1 also shows the results of forest tree species diversity index (Simpson's dominance index) of the Northern, Central and Southern geographical zones of Cross River State. In the Northern zone (Gabu, Aliforkpa, Winniba-Ekajuk, Aragban, Ukpah, Okpeche-Afrike 1, Alege/Utugwang, Bebuabong/Ohong, Becheve and Sankwala), the Becheve Forest Reserve had the highest tree species dominance index of 0.9889. This was followed by Sankwala community forest with a dominance index of 0.988 while Gabu and Aliforkpa community forests had the lowest tree species dominance index of 0.9713 and 0.9676 in the zone, respectively. Winniba-Ekajuk, Aragban, Ukpah, Okpeche-Afrike 1, Alege/Utugwang and Bebuabong/Ohong community had tree species dominance indices of 0.9798, 0.9818, 0.9813, 0.9825, 0.9835 and 0.9817, respectively.

In the Central zone (CRNP-Okwangwo, Mbe, Afi and Agoi (Agoi Ibami/Abini

Sections); the Cross River National Park, Okwangwo Division had the highest tree species dominance index of 0.9928. This was followed by Mbe Mountain community forest with a species diversity index of 0.9876 while Afi Mountain and Wildlife Sanctuary and Agoi Forest Reserve had the lowest tree species dominance index of 0.9846 and 0.9821 in the zone, respectively.

In the Southern zone (CRNP-Oban, Oban Forest Reserve, Kwa Falls, Ekuri, Ekong-Anaku, Adiabo and Idim Ita), the Cross River National Park, Oban Division had the highest tree species dominance index of 0.992. This was followed by Kwa Falls with a species dominance index of 0.9854 while Oban Forest Reserve, Ekuri and Ekong-Anaku community forests had tree species dominance indices of 0.9849, 0.9756 and 0.983 in the zone, respectively. Idim Ita and Adiabo community forests had the lowest tree species dominance indices of 0.9563 and 0.9502 in the zone, respectively.

Table 1. Indices of forest tree species in Cross River State

S/N	Study sites	Taxa_S	Simpsons _1-D	Menhinick Index	Shannon_H Index
1.	Gabu Community Forest (North)	39	0.9713	5.44	1.60
2.	Aliforkpa CommunityForest (North)	35	0.9676	5.09	1.49
3.	Winniba-Ekajuk Community Forest (North)	56	0.9798	6.49	1.96
4.	Aragban Community Forest (North)	63	0.9818	6.68	2.04
5.	Ukpah Community Forest (North)	60	0.9813	6.96	2.06
6.	Okpeche-Afrike Community Forest (North)	65	0.9825	6.96	2.08
7.	Alege-Utugwang Community Forest (North)	68	0.9835	7.30	2.11
8.	Bebuabong-Ohong Community Forest (North)	61	0.9817	6.96	2.13
9.	Becheve Forest Reserve (North)	104	0.9889	8.83	3.38
10.	Sankwala Community Forest (North)	94	0.988	8.22	3.20
11.	Cross River National Park, Okwangwo (Central)	171	0.9928	11.39	4.75
12.	Mbe Mountain Community Forest (Central)	91	0.9876	8.40	3.83
13.	Afi Mountain and Wildlife Sanctuary (Central)	85	0.9846	7.71	3.25
14.	Agoi Forest Reserve Agoi Ibami (Central)	60	0.9821	7.26	3.02
15	Agoi Forest Reserve Abini (Central)	60	0.9821	7.26	3.02
16.	Cross River National Park, Oban (South)	143	0.992	10.66	4.68
17.	Oban Forest Reserve (South)	76	0.9849	7.92	3.44
18.	Kwa Falls (South)	81	0.9854	7.60	3.35
19.	Ekuri Community Forest (South)	56	0.9756	6.12	2.88
20.	Ekong-Anaku Community Forest (South)	62	0.983	7.37	2.90
21.	Adiabo Community Forrest (South)	26	0.9502	4.39	1.14
22.	Idim Ita Community Forest (South)	30	0.9563	4.47	1.27

Conservation status of forest tree species

The results of the conservation status of forest tree species recorded in this study based on the different IUCN red list categories are presented in Appendix 1. Results revealed that the conservation categories; Not Evaluated (NE), Data Deficient (DD), Least Concern (LC), Near Threatened (NT), Vulnerable (VU), Endangered (EN) and Critically Endangered (CR) were represented except Extinct in the Wild (EW) and Extinct (EX). Of the 403 forest tree species recorded in the study area; 226 species are in the Least Concern (LC) category, 121 species in Not Evaluated (NE), 42 species in Vulnerable (VU), 7 species in Near Threatened (NT), 5 species in Endangered (EN) and 1 species each in Critically Endangered (CR) and Data Deficient (DD), respectively. The LC category (226) had the greatest aggregate of species while CR and DD with one (1) species each had the lowest. It is noteworthy to state that all forest tree species not yet listed in the IUCN red list categories but listed in cataloque of life were categorized under the Not Evaluated (NE) category.

DISCUSSION

Forest tree species composition and distribution across Cross River State

Our survey carried out in twenty two selected forests across the northern, central and southern geographical zones of Cross River State documented an aggregate of 191 trees belonging to 49 families, 248 trees belonging to 50 families and 224 trees belonging to 49 families, respectively. The differences in the number of tree species recorded in the sampled plots in each zone may be due to variations in ecological factors and other habitat conditions which favoured more tree growth, diversity and distribution (Aigbe & Omokhua, 2015). In the Northern zone, of the 191 trees belonging to 49 families; the most frequently encountered family was the Fabaceae. This is not extraordinary since trees associated to the family Fabaceae are commonly in abundance in the savannah and contribute significantly in the social and economic existence of the populace. Akwaji & Edu (2017) and Wakawa *et al.*, (2017) made similar observations when they assessed tree species in a savannah ecosystem. Trees associated to the Fabaceae family like *Parkia biglobosa*, *Prosopis africana*, *Afzelia africana*, *Pentaclethra macrophylla*, *Tetrapleura tetraptera*, *Acacia gourmaensis* and *Dialium guineense* are valuable to the inhabitants on account of their function in soil enhancement and conservancy, animals feed, therapeutic and economic usefulness. As a result of their significance to the rural dwellers, they are mostly conserved. Also, the dominance of tree species in the Fabaceae family may partly be due to the availability of viable seeds in soil seed banks to sustain regeneration. Most members of the Fabaceae are hardseeded, with glabarous seed coats. The Fabaceae family was followed by Moraceae, Malvaceae, Annonaceae, Meliaceae and Rubiaceae, Apocynaceae, Euphorbiaceae and Phyllanthaceae, respectively. The dominance of these families in the northern zone could be as a result of their rapid reestablishing capacity, connected with symbiotic attributes, which might have facilitated the species to effortlessly start to exist in available ecosystem categories. This observation corroborates that of Deka *et al.,* (2012), that Moraceae, Malvaceae, Annonaceae, Meliaceae and Rubiaceae were amongst the most prominent families recorded in the contiguous Takamanda forest in Cameroon. The study zone shares certain habitat attributes and geographic borderlines with Cameroon. The supremacy of these families may in addition be an outcome of habitat adaption and commensurate beneficial eco-conditions, that boost pollinate, distribution and consequent initiation of species belonging to these families (Pausas & Austin 2001; Adekunle *et al.,* 2004; Ojo, 2004; Adekunle & Olagoke, 2008). Also, Austin *et al.,* (1996) reported that soil features play a significant function in species abundance and establishment at all habitat. Out of the 248 trees belonging to 50 families in the central zone, the family Fabaceae also had the greatest aggregate of species. Aigbe *et al.,* (2014) and Edet *et al.,* (2012) made similar observations in the contiguous Afi River Forest and Wildlife Mountain Sanctuary. Other families dominanting this zone include the Malvaceae, Rubiaceae and Sapotaceae, Apocynaceae, Meliaceae and Moraceae, respectively. Similar observations about the dominance of these species in the central zone have also been made by Adekunle (2006) and Adekunle *et al.,* (2010). For the southern zone, out of the 224 trees belonging to 49 families the family Fabaceae also had the most dominant tree species. The dominance of the Fabaceae family corroborates with previous research works by Adeyemi *et al.,* (2013) and Aigbe & Omokhua (2015) in Cross River National Park, Oban Division and the Oban Forest Reserve which are also located in the southern zone of our study area. The additional predominant families in the zone are Rubiaceae, Malvaceae, Apocynaceae, Moraceae, Meliaceae and Euphorbiaceae, respectively. Adeyemi *et al.,* (2015) have reported that dominance of these families may partly be due to their capacity to give rise to multitudinous seeds which could promote their establishment at adapted habitats. Ige (2011) and Sanwo *et al.,* (2015) reported the families Malvaceae, Apocynaceae, Rubiaceae, Euphorbiaceae and Meliaceae as the dominant families in Shasha and Onigambari forests in southwestern Nigeria, respectively. Across the three zones (North, Central and South) of our study area some families exhibited much lower representation with only five, four, three, two or one species each. The basis for the below par enactment of a number of families could be ascribed to competition especially for light due to canopy cover and loss of ground flora in the course of logging operations and snapping of trees. Egbe *et al.,* (2012) recanted a related occurrence in a disrupted and natural restoration forest in Korup National Park of Cameroon. Also, the low number of species in these families might be as a result of human-use stress influencing species growth and yields as reported in Korup National Park, Cameroon. An aggregate of 403 tree species belonging to 65 families was recorded in our study area. The tree species diversity of the study area is similar to reports in other biodiversity hotspots of the tropical rainforests biome. For instance, Lu *et al.,* (2010) reported a total of 428 trees belonging to 38 families in tropical rainforests of Xishuangbana, China whereas Rajkumar & Parthasarathy (2008) reported 415 species belonging to 32 families in Andaman Giant, India. Small *et al.,* (2004) reported 422 tree species for Borneo and as large as 544 reported for natural forests in Indonesia by Kessler *et al.,* (2005). However, the total tree species recorded in this study (398 in 65 families) is higher than the 347 belonging to 42 families in a Mexican tropical forests reported (Duran *et al.,* 2006), 245 trees reported for tropical forests by Campbell *et al.,* (1992), 247 tree species recorded for a matured tropical forest in southeast Asia (Losose & Leigh, 2004), 92 species in a semi mountainous tropical rainforests in Phillipines (Hamann *et al.,* 1999) and 81 species in a matured lowland closed canopy forests in Vietnam (Blanc *et al.,* 2000). Of the 403 tree species recorded in our study area, the family Fabaceae was the most frequently encountered. The greater number of species in the family Fabaceae may be as a result of their fast germination ability and persistence of their seeds in soils banks. Ihenyen *et al.,* (2009) reported that family Fabaceae was the most frequently encountered with eighteen species in Ehor Forest Reserve, Nigeria. Omorogbe (2004) recorded that the Fabaceae family had the greatest diversity with fourteen tree species in Sakponba forest Reserve, Nigeria. Other researchers like Aigbe *et al.,* (2014), Aigbe and Omokhua (2015), Wakawa *et al.,* (2017) and Amonum *et al.,* (2016) have made similar observations with the Fabaceae family reported as the dominant family in Afi River Forest, Oban Forest Reserve in Cross River State, Nigeria, Sahelien Ecosystem in North-East and Nengi Forest Reserve, Benue State, Nigeria, respectively. The Fabaceae family was followed by Rubiaceae, Malvaceae, Sapotaceae, Moraceae, Meliaceae, Anonaceae, Apocynaceae, Euphorbiaceae and Phyllanthaceae, respectively. The dominance of these families in the study area may be due to their adaptability to the edaphic conditions of the area. The families Euphorbiaceae, Annonaceae, Apocynaceae and Meliaceae were delineated by Ojo (2004) as constituting 86% of the trees in Abeku axis of Omo forest Reserve in Ondo State, Nigeria. The high frequency of species in these families could be partly as a result of their wide seed dispersal by explosive mechanism and wind dispersal. Ogunleye *et al.,* (2004) gave an account of the dominance of Fabaceae, Annonaceae, Apocynaceae and Meliaceae families in Olokemeji Forest Reserve, Nigeria due to superficial wind dispersal that eased their distribution. Soladoye *et al.*, (2005) also reported that dispersal medium played a major role in the establishment of species of Fabaceae, Sapotaceae, Phyllanthaceae and Euphorbiaceae on the Olabisi Onobanjo University permanent plot. Adekunle *et al.,* (2013) also observed that the families Sterculiaceae, Meliacese and Moraceae were the dominant families in a Strict Nature Reserve in Southwest Nigeria. The findings of our study corroborates previous works by Adekunle (2006) and Adekunle *et al.,* (2010) that the tropical rainforest ecosystem of Southwest and Southeastern Nigeria was dominated by tree species of these families. In similar studies, the families Meliaceae, Euphorbiaceae and Moraceae were recorded as the mostly prominent in some tropical rainforests of Southeast Asia (Kanzaki *et al.,* 2004), (Kessler *et al.,* 2005), (Rajkumar & Parthasarathy, 2008) and (Lu *et al.,* 2010). Also, in our present study, the families Anacardiaceae, Clusiaceae, Ebenaceae, Gentianaceae, Combretaceae and Salicaceae had reasonable representation, respectively. The representation of these families in the study area suggested good adaptability to the prevailing ecological conditions in the ecosystem. The families Bignoniaceae, Chrysobalanaceae, Lamiaceae, Olacaceae and thirty nine others had the lowest representation in our study area. The low aggregate of tree species observed in these families might be due to deficient germination or sprouting as seeds could exhibit some dormancy which might be in need of scarification or alterations in thermal or light conditions to overcome. Pausas & Austin (2001) reported that these environmental conditions could have impacts on species richness. Additional restricting features encompass shadow light by canopy trees; desication of ground flora on the forest floor in the course of lumbering, distribution of nutrients and additional anthropogenic factors (Egbe *et al.*, 2012).

It is noteworthy to state that in our study, out of the 197, 249 and 229 forest tree species we recorded for the northern, central and southern geographical zones of Cross River State; 55, 79 and 78 tree species were observed confined to the northern, central and southern zones, respectively. The confinement of these tree species to particular zones in our study area may be due to the variations in climatic factors such as precipitation (rainfall), temperature, topography and soil (edaphic factors). Differences in precipitation have been reported as a key factor which controls the variety of plant that sprouts and individuals that would grow once reintroduced to any ecological zone (Aregheore, 2009). Also, climatic variables like precipitation and temperature are major drivers influencing distribution of species whenever they surpass the ecophysiological resiliences of species as plant synthetic processes and biological activities are promptly affected (Rowe, 2009). Landscape characteristics like hills, altitude, and height can affect community climate and edaphic conditions which consecutively have differing impacts on flora arrangement (Zhang *et al.,* 2006; Zhang *et al.,* 2016). The proportionate interval from a water source can as well influence the structure and distribution of wooded flora due to the ensueing differing quantity of water accessible for growth (Sarvade *et al.,* 2016; Asanok *et al.,* 2017). Soil physico-chemical characteristics can affect flora arrangements on a geographical range (Han *et al.,* 2011; Zhao *et al.,* 2015). For instance, excessive soil-sand proportion minimizes water holding ability that could induce water stress on trees (Toledo *et al.,* 2012), and acidity volume influence the dispersion of species and is connected to hills and altitude in lowland tropical forests (Nguyen *et al.,* 2015; Vahdati *et al.,* 2017). Soil moisture in addition remarkably alters the growth habit of trees in drought regions (Asanok and Marod, 2016; Tilk *et al.,* 2017). Furthermore, the organic matter in the soil is applicable to an investigation of ecological components and association of plant species in the forest (Sarker *et al.,* 2014; An *et al.,* 2015). Soil minerals like nitrogen, potassium, phosphorus, calcium and magnesium are linked with plant species abundance and distributions in tropical forests (Zhang *et al.*, 2013; Tilk *et al.*, 2017). At broad range, precipitation has been demonstrated to affect species abundance, composition and distribution (ter Steege *et al.,* 2006; Engelbrecht *et al.,* 2007; Toledo *et al.*, 2012), while on the contrary at a local range soil fertility and terrain can influence species distribution (John *et al.,* 2007). Several tropical forest exhibit periodic differences in rainfall, and species drought action and physiological drought toleration have consequently been established to control the distribution of tropical species (Engelbrecht *et al.,* 2007; Baltzer *et al.,* 2008). Amissah *et al.,* (2014) reported that precipitation and temperature affected tree species distribution in Ghana. Additional studies have as well determined that precipitation was the major influencer of broad-scale distribution frameworks of tropical plant as well as tree species (Holmgren and Pouter, 2007; Maherjan *et al.,* 2011; Toledo *et al.,* 2011, 2012). Morisol *et al.,* (2011) in their survey of tree species distribution in Bolivian forests confirmed that climatic factors such as precipitation, temperature, soil fertility and topography were the strongest driver of tree species composition. The tree species composition in the central and southern zones of Cross River State would be contemplated to be abundant compared to the northern zone (drier zone) which falls under the Forest/Guinea savannah agro ecological zone of Nigeria. This is because precipitation is a key influencing force that regulates the flora of an area (Aregheore, 2009). The central and southern zones of our study area fall under the humid tropical forest zone of Southeastern Nigeria which usually experiences more rainfall than the Northern zone. In our study, tree species endemic to the northern zone include; *Parkia biglobosa* Jacq., *Prosopis africana* (Guill. & Perr.) Taub, *Vitellaria paradoxa* C. F. Gaertn., *Isoberlina doka* Craib & Staph., *Guibourtia ehie* (A. Chev.)

J. Leonard, *Acacia gourmaensis* A. Chev., *Gambeya albida* (G. Don.) Aubrev. & Pellegr. etc. The presence of these tree species in the Northern zone of our study area is not surprising as they are mostly species of the savannah ecosystem. Aju and Ezeibekwe (2010) and Edet *et al.,* (2012) described the Northern zone of Cross River State as an ecotone; a transition belt between the guinea savannah zone and forest ecosystem of the study area. Also, Bisong & Mfon (2006) described the northern zone as guinea savannah and therefore will more likely support the growth of trees that can withstand drought conditions as the area experiences less rainfall than the central and southern zones. Magnussen *et al*., (2010) reported that species composition varies markedly along a rainfall gradient and that the gradients are distinguished by inherent slower-growing, drought habituated species. These tree species can exist in natural and semi-natural environments like woodlands and savannahs, occasionally on stony ridges, rocky terrains and sandstone slopes. The trees are suitable to overcome drought due to their deep tap root (Shao, 2002). Sabiiti and Cobbina (1992) observed that a tree like *P. biglobosa* is well-dispensed to dry zones with mean annual rainfall lower than 400 mm. The tree has a capacity to overcome a period of below average precipitation conditions due to its straight tapering root growing system and the aptness to control transpiration.

Tree species confined to the Central zone in our study include *Camptostylus mannii* (Oliv.) Gilg., *Sorindeia grandifolia* Engl., *Pleiocarpa talbotii* Wernh., *Tapura fischeri* Engl., *Chrysophyllum spp*, .Cola species such as *Cola argentea* Mast., *Cola laeteritia* K. Schum., *Cola laurifolia* Mast., *Cola lepidota* K. Schum and *Cola pachycarpa* K. Schum. Others include; *Psidium eugeniaefolia* L., *Milicia regia* (A. Chev.) C. C. Berg, *Brachystegia nigerica* Hoyle and APD Jones, *Angylocalyx oligophyllus* (Baker) Baker f. and *Garcinia* species such as *Garcinia gnetoides* Hutch, *Garcinia livingstonei* T. Anders and *Garcinia ovalifolia* Oliv etc. Some of these species have been reported to thrive in a complex topography where rainfall is between 3, 000 – 4, 320 mm and a temperature of 22 - 27˚C in the lowland/montane humid rainforest up to 1300 m altitude (Burkill, 1985; Breteler, 1991; Lovette *et al.,* 2007). The dominance of the *Chrysophyllum* and *Cola* species in the Central zone may be due to soil properties of the zone, or due to adaptation of the species to the area. The greater account of the species could also have stem from ecological adaptation of members of the two species to the environment. A related scenario was recorded by Vasanthraj and Chandrasheker (2006) in a tropical forest, in which Dipterocapaceae was dominant as a result of adaptations to the forest ecology. Trees like *Brachystegia nigerica* have been reported in high wet forest areas, gregarious near water (stream valley), deciduous woodland, hill slopes in West tropical Africa – Southern Nigeria (WCMC, 1998). *Psidium eugeniaefolia* recorded in this zone was reported to be endemic to the Amazonian rainforest in Brazil (Dexter & Chave, 2016). The Amazonian rainforest is the greatest outstanding tropical rainforest worlwide overlaying the earth's surface with about three billion trees (Amazon Watch, 2021). The presence of *P. eugeniaefolia* may be due to similarities in the topography, altitude, soils, rainfall and temperature of the two forests areas. For instance, the forests in the central zone are exceptionally composite with numerous linked ridges structures, cloistered summits and altitude of 200m – 1300m and fast moving streams. Crustaceous sedimentary sandstones occupying a significant area of the zone (Nsor, 2004), the soils vary from loam to clay usually red laterite with elevated accumulation of iron oxide and poor in nutrient (Agbor, 2003). Yearly rainfall ranges between 3, 000mm to 3, 800mm (Agbor, 2003) while yearly average temperature is between 22.2˚C and 27.4˚C with a mean annual relative humidity of 78%. At about 700 m altitude, the forest formation modifies continuously into sub-montane vegetation (Agbor, 2003). Certain features in the Amazonian rainforest are similar with the terrain of the central zone of our study area being mostly flat to rolling-low lands in the north, some plains, hills, mountains and a narrow coastal belt in the Northwest of Brazil with an altitude of 1, 000 m in the Neblina (WWF, 2010), temperature ranges from 23˚C - 27˚C with an annual rainfall of 3, 000 mm and above with a relative humidity of close to 100% (Colinvaux *et al.*, 2000), the soil is clay-like laterite soil that is reddish or yellowish which is acidic and poor in nutrients (Colinvaux *et al.*, 2000).

Tree species confined to the Southern zone include; *Hypodaphnis zenkeri* (Engl.) Staph, *Petersianthus macrocarpus* (P. Beauv.) Liben, *Cola hispida* Brenan & Keay, *Cola millenni* K. Schum, *Drypetes gossweileri* S. Moore, *Diospyros ferrea* F. R. Fosberg, *Millettia griffoniana* Baill., *Anthocleista nobilis* G. Don, *Anthocleista madagascariensis* Baker, *Cinnamomum zeylanicum* Blume, *Bridelia micrantha* (Hochst) Baill. The presence of these forest tree species in the zone may be due to the high precipitation and soil factors which may be favourable to their distribution. Some of these tree species have been reported to thrive where annual rainfall is 3, 500 to 4, 000 mm (Aigbe & Omokhua, 2015) in a lowland rainforest, moist semi – deciduous and in evergreen forest and transitional zones between evergreen and moist semi-deciduous forest in Liberia, Cote d'Ivoire and Ghana (Pausas & Austin, 2001; Hawthorne & Gyakari, 2007; Holmgren & Poorter, 2007). The zone has a rainy season of at least nine months (March – November) and receives over 3, 500 mm of rain annually (Ogunjobi *et al.*, 2010). The distribution of these tree species in this zone may also be as a result of the topography of the zone. This corroborates the findings of Jimoh *et al.*, (2012) that hilly terrains, river valleys and elevation in mountainous areas influenced tree species diversity and distribution. In addition, Schmitt (1990) reported that the dominant rock types in the zone which are ancient metamorphic rock of the basement complex influenced vegetation patterns. The vegetation of the zone is mostly lowland rainforest except in the Oban axis which is mountaneous, with limited access and minor intrusion, however in other areas the vegetation has undergone a greater impact by anthropogenic disturbances.

Species richness

In the Northern zone, the greatest tree species richness was recorded in the Becheve Forest Reserve (8.83) while Aliforkpa community forests (5.09) had the lowest. The variations in the species richness of the zone may be due to the impacts of human disturbance in the zone. Sanwo *et al.*, (2015) reported that human disturbance in a forest ecosystem can significantly influence or alter the species richness of the area. Also, it may be due to differences in precipitation, temperature, topography and soil properties of the zone. For instance, Becheve Forest Reserve is a montane forest with rough terrains and semi-temperate climate. The temperature can be as low as 21˚C, a relative humidity of 95 – 99% and the soils vary from clay to loam and are exceptionally red with elevated accumulation of iron oxide (Agbor, 2003) as compared to Aliforkpa forests with a temperature range of 30 - 35˚C, a relative humidity of 50 – 60% and soils that tend to be sandy with incipient laterite (Nsor, 2004). Zakaluk & Rajan (2008) and Aregheore (2009) have also reported that the difference in climates, topography, soil properties, and their interactivity can influence species richness in an area. However, not much variation was observed in the species richness of the other forests in the study zone. This may be due to the fact that most part of the zone falls under the guinea savannah agroecological zone and as such shares a lot of some common climatic features. Similar reports were made by Amonum *et al.*, (2016) and Wakawa *et al.*, (2017) in a savannah ecosystem in the middle belt region and northeast region of Nigeria, respectively.

In the Central zone, the greatest tree species richness was recorded in the Cross River National Park, Okwangwo Division (11.39) while Agoi Forest Reserve (7.26) had the lowest. The species richness values recorded in the zone were quite high when compared with values of 5.01, 4.82 and 4.59 for Onigambari forest reserve, southern Nigeria (Sanwo *et al.*, 2015), Nagi Forest Reserve, Benue State, Nigeria (Amonum *et al.*, 2016) and inland tropical dry evergreen forest, Peninsular India (Mani & Parthasarathy, 2005). The very high species richness of 11.39 recorded for CRNP, Okwangwo is expected as it is a strictly conserved area. Adekunle (2006) and Adeyemi *et al.*, (2013) reported similar findings in a Nigerian Strict Nature Reserve and CRNP, Oban Division, Nigeria respectively. The high species richness recorded in the zone may also be as a result of the embargo on lumbering and unlawful removal of forest resources in the zone by the Cross River State government.

In the Southern zone, the greatest tree species richness was recorded in the Oban Division of Cross River National Park (CRNP), (10.66) while Idim Ita community forest (4.39) had the lowest. The high species richness recorded in Oban Division of the CRNP is an indicator that the park is not so much as disturbed in contrast to the other forests. The values recorded for CRNP, Oban Division was greater in comparison to those recorded by Adekunle *et al.,* (2004), Ojo (2004), Adekunle & Olagoke (2008) for diverse tropical rainforests in Nigeria. The low species richness recorded in Idim Ita community forest may be due to illegal logging and other forest degradation activities going on in the area. The proximity of the area to urban settlement (urbanization) may also be responsible for the low species richness of the area. According to Johnson & Mercellinus (2013) vegetations that are obstructed by anthropogenic exploitation normally undergo forest dendrometric constituents interfered with and the equilibrium or stability is disorganized. The impacts of the interference differ in gravity hinged on how broad of the ecosystem or vegetation is thus far retained in the course of resource utilization and development. Varshney & Anis (2014) reported that the existence of tree species of timber value globally is endangered by anthropogenic activities and additional determinants like demographical alterations overflow in human population and urbanization. Urbanization and agricultural ventures are in general linked with several development ventures, lands are ridden of vegetation, and trees are cut down disregarding taking into thought their significance. It may not be startling if vulnerable trees have been felled in the pathway of such developmental activities. The species richness index evaluates the heterogeneity of species. It takes into consideration the overall aggregate of a certain species in connection to the overall aggregate of individuals inside the forest plot (Gebreselassen, 2011). The species richness (Menhinick index) obtained for Cross River State was 152.28 which indicates high species richness. Results of species richness showed that, the Okwangwo Division of Cross River National Park (CRNP) had the highest tree species richness of 11.39; this was followed by Cross River National Park, Oban Division with 10.66 while the lowest was recorded in Adiabo and Idim Ita communities with 4.39 and 4.47, respectively. The species richness results (CRNP Okwango and Oban Divisions) achieved in our study is high compared to the values reported by Adekunle *et al.,* (2004) for a tropical lowland rainforest in Southwest Nigeria, Ojo (2004) in Abeku Sector of Omo Forest Reserve, Adekunle (2006) and Adekunle & Olagoke (2008) in other tropical rainforests in Southwest Nigeria, Aigbe and Omokhua (2015) in Oban Forest Reserve, Cross River State, Nigeria and the values for a number of other tropical forests in the world like 7.19 for Bwindi forest, 7.54 for Kasyohakitomi forest and 6.38 for Kibale, altogether of which are situated in the Albertine rift, Uganda as reported by Eilu *et al.*,(2004). Higher species richness values in the CRNP could be ascribed to the accomplishment of conservation endeavors as well as the current prohibition in lumbering and unlawful removal of forest resources in the zone by the government of Cross River State. The low species richness of some of the study sites (Adiabo and Idim Ita communities) may be due to logging and other anthropogenic activities. Odebiyi *et al.,* (2004) reported low population framework of mercantile profitable tree species in Kwara State, Nigeria as a result of human activities.

Species diversity

In the Northern zone, the greatest tree species diversity index was recorded in the Becheve Forest Reserve (3.38) while the lowest in the zone was in Aliforkpa community forests (1.49). The species diversity recorded for tree species in Becheve Forest Reserve was superior in comparison to the values recorded for some tropical rainforests in Asia and Africa (Shivaprasad *et al.,* 2002; Vasanthraj *et al.,* 2004; Vasanthraj & Chandrashekar, 2006; Adekunle, 2007). However, the differences in species diversities in this study zone with other studies somewhere else may be partly due to the plot size sampled. The tree species diversity recorded in Beceheve suggests that the diversity of the reserve is heightened and is an indicator of a healthy reserve. The low value of the diversity index recorded for the Aliforkpa community forest might be due to random intrusion or inversion and misuse of the forest. Adeduntan (2009) has reported that primary forests are progressively being diminished in Nigeria via the non-selective removal of economic trees and intrusion.

In the Central zone, the greatest tree species diversity index was in the Okwangwo Division of Cross River National Park (4.75) while the lowest in the zone was recorded in Agoi Forest Reserve (3.02). The extremely heightened values of the diversity index revealed forests with exceptionally high tree species diversity and abundance. The diversity index of the CRNP, Okwangwo Division is higher than the average values (2.40) reported for the conserved area (Lu *et al.,* 2010); Rajkumar and Parthasarathy (2008) and Yang *et al.,* (2008). The diversity index of 3.25 recorded in Afi Mountain Wildlife Sanctuary is lower than that reported by Aigbe *et al.,* (2014) as 3.90 for the same area. This may be due to differences in plot size and sampling intensity. The high diversity indices recorded for tree species in the central zone is expected as most of the forest sampled in the zone are under protection by law. However, the low diversity index recorded for tree species in Agoi Forest Reserve in the study zone may possibly be due to human activities catalyzed by bush burning and agriculture. Excessive use and absolute alteration of forest ecosystems culminate in the destruction of tree species (Iroko *et al.,* 2008). The diversity index of the reserve revealed that there was a probability of further removal for timber and additional usage in the reserve tin han the other conserved areas in the zone. On account of this extraction, a number of these species become rare and threatened. A related report was given by Agbogidi *et al.*, (2011) in a survey of economically valued tree species for a protected area in Asaba, Delta State, Nigeria.

In the Southern zone, the greatest tree species diversity index was in the Oban Division of Cross River National Park (4.68) while the Adiabo community (1.14) had the lowest in the zone (1.27). The diversity indices for CRNP, Oban Division were higher than other reported values (3.1 – 3.3) for various protected rainforests in Nigeria (Adekunle, 2006; Onyekwelu *et al*., 2008; Bello *et al.,* 2013; Saka *et al.*, 2013; Ikyaagba *et al.,* 2015). Also, the diversity index recorded for tree species in the CRNP, Oban Division is higher than the value of 4.36 reported by Adeyemi *et al.,* (2013) for the same location. The observed differences in the diversity indices of the area may be due to the plot size as well as the sampling intensity employed. The low diversity indices recorded for Adiabo and Idim Ita community is expected as the areas are witnessing severe forest degradation activities as a result of urbanization and conversion of forested areas for agricultural ventures and logging of trees for timber and other construction activities. Buba *et al.*, (2015) have observed that areas that were hitherto categorized as forest agro-ecological zone in actual fact have commutated to various agro-ecological zones in all likelihood as a result of human disturbances as well as modification in climate conditions. In general, species diversity is regular of the uttermost requisite or essential keys employed to evaluate an ecosystem. An abundant ecological community with substantial species diversity holds a high-rise Shannon-Weiner (H) value while on the contrary, an ecological community with low (H) confers a lower species diversity (Deka *et al.*, 2012; Sobuj & Rahman, 2011). Findings of Shannon-Weiner's index (H) of tree species diversity in our study area (Table 1) revealed that Cross River National Park (CRNP), Okwangwo Division had the highest species diversity of 4.91and this was followed by Cross River National Park, Oban Division with a value of 4.78. The (H) index value of the CRNP, Okwangwo, and Oban Division is higher than that of 3.75 for a Strict Nature Reserve in Southwest Nigeria (Adekunle *et al.*, 2013), 4.46 obtained for a tropical rainforest of the Congo Basin, 3.79 for Oban Forest Reserve, Cross River State, Nigeria (Aigbe and Omokhua, 2015) and 4.34 in Afi Mountain Wildlife Sanctuary (Edet *et al.,* 2012). The lowest (H) index values of 1.14 and 1.58 were obtained for Adiabo and Idim Ita communities respectively. The (H) index values of 1.14, 1.27, 1.60, and 1.49 obtained for Adiabo, Idim Ita, Gabu and Aliforkpa community forest, respectively lower than that of 3.1 and 3.3 for different rainforest sites in South-western Nigeria (Adekunle, 2006; Onyekwelu *et al.,* 2008) and that of 2.65 obtained for tropical forests of Kudarya in the Western Ghats, India (Sundaranpandian and Swamy, 2000). Nevertheless, it ought to be well known that essential quantitative considerations of species varieties connecting forest environments are dependent on plot size, sample size, climatic factors, as well as other site components. The low (H) index of the tree species in our study area may be due to the vast monetary worth of the species to the rural populace of the neighborhood as greater species give rise to eatable fruits and seeds on whereupon the populace relies for medicine, food, oil and timber. The commodities are usually traded in the rural and urban areas by persons who hawk them to acquire a livelihood (Nath et al., 2005; Udo et al., 2009). The low (H) index value of the tree species also indicates that these tree species are low in their distribution; similar findings were reported by Olajide et al., (2008) and Udo et al., (2009). Also, the overexploitation and total alteration of forest ecosystems lead to the destruction of tree species (Iroko et al., 2008). The very low (H) index in some study sites may be a result of tree logging for timber and additional uses in the communal forests than the conserved areas. In view of such needs, a number of these species evolve into rare and threatened. The disappearance of several merchantable profitable tree species in Nigeria is a popular occurrence (Sale et al., 2008; Adekunle & Akinlembola, 2008; Oni et al., 2010; Abgogidi, 2011). If forests are aimlessly diminished, the different usage and functions connected with them can be lost.

Simpson’s dominance index

Results of Simpson’s diversity index in the northern zone showed that the Becheve forest reserve had the highest number of dominant trees with an index of 0.989 while the Gabu community forest had the lowest index of 0.976. In the central zone, Cross River National Park, Okwangwo Division had the most dominant tree species in the zone with a Simpson’s index of 0.992 while Agoi forest reserve had the lowest index of 0.982. In the southern zone, Cross River National Park, Oban Division had the highest Simpson’s index of 0.992 while the Adiabo community had the lowest index of 0.950. Species richness as a sole measurement takes into consideration the sum total or aggregate of individuals of all species present. It accords proportionate weight to those species with exceptionally fewer individuals and those with numerous individuals. A superior measurement of diversity must take into consideration the abundance of individual species. Simpson’s index (D) is a measurement of diversity, thus taking into consideration either species richness, as well as evenness of abundance amongst the species present. Basically, it calculates the likelihood that twain individuals arbitrarily chosen from an area have a tendency to be part of the same species. The Simpson’s index obtained in our study showed that Becheve forest reserve and Sankwala community forest (North), Cross River National Park, Okwangwo and Mbe mountain community forest (central) and Cross River National Park, Oban and Kwa Falls (South) had the most dominant tree species and as such a high diversity index. This is in agreement with Young & Swiacki (2006) who affirmed that diversity consisted of a variation of species present and the relative abundance of those species. The greater the Simpson's index values, the greater the diversity (Ojo, 2004). The Simpson's index obtained for these forests indicates that the diversity indexes of the forests are high and it is an indication of healthy ecosystems. The low Simpson's index recorded for tree species in Gabu and Aliforkpa community forest (North), Agoi forest reserve (central) and Idim Ita and Adiabo community (south) may be due to disturbances in the forests. Several commensurate distinct occurrences ultimately disturb an ecosystem, community, or population structure and alter resources, substrate availability, or the physical environment is called disturbance. Some of the forest vegetation with low index could be vulnerable to many kinds of disturbances and all of them are alternatively natural or anthropogenic or both. Natural disturbances such as landslides and anthropogenic disruptions such as grazing, biomass removal in the pattern of fuelwood, fodder and litter collection, and roads construction influence or act on the ecosystem stability giving rise to recurrent modifications in land and resource use, the heightened incidence of biotic invasions, depletion in species sum total, the origination of stresses as well as the possibility for alterations in the climate system and additionally slow down the successional mechanisms (Kumar & Ram, 2005). Anthropogenic disruptions, especially from the excessive use of biological resources, in general, embody negative effects on species diversity globally (Goudie, 2005).

Conservation status of forest tree species based on IUCN status

The conservation status of a species is an index or measure of the possibility of plant species persisting to live both in the current moment or the future. Conservation status designates if the group so far subsists and in all probability it is to metamorphose into extinction in the imminent future. Numerous components are taken into consideration whenever evaluating conservation status: not just the sum total of individuals in existence but the general increase or decrease in the population progressively, breeding success rates and familiar threats. Extinction takes place whenever the death and emigration rate is higher than the birth and immigration rate for a suitable duration that the population size gets as far as zero. Whenever applied with respect to the IUCN Red List, a species is ranked or categorized as vulnerable whenever exposed to dangers of extinction in the wild in the not-too-distant future (IUCN, 2012). Endangerment is vulnerability to danger or exposure. In connection with living organisms, and applied in the background of "endangered species", in a general sense denotes the danger of the species metamorphosing extinct (Miller, 2013). A species is threatened whenever it is certain or affirmed to be in risk of extinction. The results of the conservation status of the 403forest tree species belonging to 65 families encountered in our study area showed the tree species were represented in the different conservation categories except Extinct in the Wild (EW) and Extinct (EX) categories. The highest numbers of forest tree species are in the Least Concern (233) conservation status category. Similar reports of the greatest sum total of tree species belonging to the Least Concern (LC) category of 69 and 85 species have been made by Hossen & Hossain, (2018) and Hossain *et al.*, (2019) in a survey at Himchari National Park, Bangladesh, and Hazarikhil Wildlife Sanctuary, Bangladesh, respectively. Borokin (2014) has reported the highest number of plant species (132) in the Vulnerable (VU) category out of the 164 threatened plant species endemic to Nigeria. FME (2006b) reported that approximately 0.4 and 8.5% of 7895 plant species from 338 families and 2215 genera identified in Nigeria fall under threatened and endangered statuses, respectively. Other studies; in the dry lands of Northwestern Nigeria (Mohammad & Sa'adu, 2017) and Tehsil Takht - e - Nasratti, Karak-Pakistan (Musharaf *et al.*, 2013) revealed 50 and 21 tree species with the greatest aggregate of species in the Endangered (22) and 9 in Vulnerable categories, respectively. The high numbers of tree species in the Least Concern (LC) category may be as a result of the protected areas in Cross River State. However, there is the need for Nigeria to develop its own red list of threatened tree species as those evaluated globally as Least Concern (LC) in the IUCN red list may be Endangered (EN), Near Threatened (NT) or Critically Endangered (CR) when evaluated in Nigeria.

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Appendix 1. Forest tree species composition, diversity and distribution in northern, central and southern Cross River State

S/N	Species	Family	Occurrence			IUCN Status
1.	*Acacia gourmaensis* A. Chev*	Fabaceae	North			LC
2.	*Afrostyrax lepidophyllus* Mildbr**	Huaceae		Central		VU
3.	*Afzelia africana* Sm.	Fabaceae	North	Central	South	VU
4.	*Afzelia bipindensis* Harms	Fabaceae	North		South	VU
5.	*Agauria salicifolia* (Comm. ex Lam.) Hook. f. ex Oliv.***	Ericaceae			South	LC
6.	*Albizia adianthifolia* (Schumach.) W. F. Wight**	Fabaceae		Central		LC
7.	*Albizia ferruginea* (Guill. & Perr.) Benth	Fabaceae	North	Central	South	VU
8.	*Albizia gummifera* (J. F. Gmel) C. A. Sm.**	Fabaceae		Central		LC
9.	*Albizia lebbeck* (L.) Benth	Fabaceae	North	Central	South	LC
10.	*Albizia zygia* (DC.) JF Macbride.	Fabaceae	North	Central	South	LC
11.	*Alchornea cordifolia* (Scumach & Thonn.) Mull. Arg.	Euphorbiaceae	North	Central	South	LC
12.	*Alchornea laxiflora* (Benth.) Pax & Hoffman	Euphorbiaceae	North	Central	South	LC
13.	*Allanblackia floribunda* Oliv.	Clusiaceae	North	Central	South	VU
14.	*Allophyllus africanus* P. Beauv.	Sapindaceae	North	Central	South	LC
15.	*Alstonia boonei* De Wild.	Apocynaceae	North	Central	South	LC
16.	*Alstonia congensis* Engl.	Apocynaceae		Central	South	LC
17.	*Alstonia macrophylla* Wall. ex G. Don	Apocynaceae		Central	South	LC
18.	*Amphimas pterocarpoides* Harms*	Fabaceae	North			LC
19.	*Anacardium occidentale* L.	Anacardiaceae	North	Central		NE
20.	*Andira inermis* (W. Wright.) Kunth ex DC**	Fabaceae		Central		LC
21.	*Angylocalyx oligophyllus* (Baker) Baker f.	Fabaceae	North	Central	South	LC
22.	*Angylocalyx zenkeri* Harms*	Fabaceae	North			LC

23.	*Annogeisus leiocarpa* (DC.) Guill. & Perr.*	Combretaceae	North			LC
24.	*Annona senegalensis* Pers.	Annonaceae	North	Central	South	LC
25.	*Anonidium manni* (Oliv.) Engl. & Diels ***	Annonaceae			South	LC
26.	*Anopyxis klaineana* (Pierre) Engl.***	Rhizophoraceae			South	VU
27.	*Anthocleista djalonensis* A. Chev.	Gentianaceae	North	Central	South	LC
28.	*Anthocleista liebrechtsiana* De Wild. & T. Durand***	Gentianaceae			South	NE
29.	*Anthocleista longifolia* (Lam.) Boiteau ***	Gentianaceae			South	VU
30.	*Anthocleista madagascariensis* Baker***	Gentianaceae			South	LC
31.	*Anthocleista microphylla* Wernham**	Gentianaceae		Central		VU
32.	*Anthocleista nobilis* G. Don***	Gentianaceae			South	LC
33.	*Anthocleista procera* Lepr. ex Bureau	Gentianaceae	North	Central		NE
34.	*Anthocleista vogelii* Planch	Gentianaceae	North	Central	South	LC
35.	*Anthonotha macrophylla* P. Beauv.	Fabaceae	North	Central		LC
36.	*Antiaris africana* Engl.**	Moraceae		Central		LC
37.	*Antiaris toxicaria* Lesch.	Moraceae			South	LC
38.	*Antiaris welwitschii* Engl.	Moraceae	North		South	LC
39.	*Antidesma vogelianum* Mull. -Arg.***	Phyllanthaceae			South	NE
40.	*Antrocaryon klaineanum* Pierre	Anacardiaceae		Central	South	NE
41.	*Antrocaryon micraster* A. Chev. & Guill.	Anacardiaceae	North	Central	South	VU
42.	*Baillonella toxisperma* Pierre.	Sapotaceae	North	Central	South	VU
43.	*Baphia nitida* Lodd	Fabaceae	North	Central	South	LC
44.	*Baphia pubescens* Hook. f.**	Fabaceae		Central		LC
45.	*Barteria fistulosa* Mast***	Passifloraceae			South	LC
46.	*Barteria nigritana* Hook f.	Passifloraceae	North	Central	South	LC
47.	*Berlinia bracteosa* Benth***	Fabaceae			South	LC
48.	*Berlinia confusa* Hoyle***	Fabaceae			South	LC
49.	*Berlinia grandiflora* (Vahl.) Hutchinson & Dalziel	Fabaceae	North	Central	South	LC
50	*Berlinia spp.* Hutchinson & Dalziel**	Fabaceae		Central		CR
51.	*Blighia sapida* K. D. Koenig	Sapindaceae	North	Central	South	LC
52.	*Bombax brevicupse* (Spraque) Roberty *	Bombacaceae	North			VU
53.	*Bombax buonopezense* P. Beauv.	Bombacaceae	North	Central	South	LC
54.	*Bombax ceiba* Linn.*	Malvaceae	North			LC
55.	*Bombax costatum* Pellegr. & Vuillet	Malvaceae	North		South	LC
56.	*Bosqueia angolensis* (Welw.) Ficalho	Moraceae	North		South	NE
57.	*Brachystegia eurycoma* Harms	Fabaceae		Central	South	LC
58.	*Brachystegia nigerica* Hoyle & APD Jones**	Fabaceae		Central		VU
59.	*Brenania brieyi* (De Wild.) E. M. A. Petit***	Rubiaceae			South	NE
60.	*Bridelia ferruginea* Benth	Phyllanthaceae	North	Central	South	NE
61.	*Bridelia micrantha* (Hochst.) Baill.*	Phyllanthaceae	North			LC
62.	*Burkea africana* Benth*	Fabaceae	North			LC
63.	*Calamus deeratus* Mann & Wendl. ***	Arecaceae			South	LC
64.	*Calophyllium inophyllum* Linn**	Calophyllaceae		Central		LC
65.	*Calpocalyx brevibracteatus* Harms***	Fabaceae			South	LC
66.	*Calpocalyx cauliflorus* Hoyle**	Fabaceae		Central		VU
67.	*Calpocalyx winkleri* (Harms) Harms	Fabaceae	North	Central	South	NE
68.	*Camptostylus mannii* (Oliv.) Gilg **	Achariaceae		Central		LC
69.	*Canarium schweinfurthii* Engl.	Burseraceae	North	Central	South	NE

70.	*Carapa procera* DC.	Meliaceae	North	Central	South	LC
71.	*Carpolobia alba* G. Don	Polygalaceae	North	Central	South	LC
72.	*Carpolobia lutea* G. Don	Polygalaceae		Central	South	LC
73.	*Casearia barteri* Mast.	Salicaceae	North	Central	South	LC
74.	*Casearia stipitata* Mast.	Salicaceae		Central	South	NE
75.	*Cedrela odorata* L.	Meliaceae	North	Central	South	VU
76.	*Ceiba pentandra* (Linn.) Gaertn.	Malvaceae	North	Central	South	LC
77.	*Ceiba thonningii* A. Chev.*	Malvaceae	North			NE
78.	*Celtis africana* Burm. f.	Cannabaceae		Central	South	NE
79.	*Celtis mildbraedii* Engl. ***	Cannabaceae			South	LC
80.	*Celtis philippensis* Blanco	Cannabaceae		Central	South	LC
81.	*Celtis zenkeri* Engl.	Cannabaceae		Central	South	LC
82.	*Chrysophyllum albidum* G. Don	Sapotaceae	North	Central	South	LC
83.	*Chrysophyllum spp.* A**	Sapotaceae		Central		NE
84.	*Chrysophyllum spp.* B**	Sapotaceae		Central		NE
85.	*Chrysophyllum spp.* C**	Sapotaceae		Central		NE
86.	*Chrysophyllum spp.* D**	Sapotaceae		Central		NE
87.	*Chrysophyllum spp.* E**	Sapotaceae		Central		NE
88.	*Chrysophyllum spp.* F**	Sapotaceae		Central		NE
89.	*Chrysophyllum spp.* G**	Sapotaceae		Central		NE
90.	*Chrysophyllum spp.* H**	Sapotaceae		Central		NE
91.	*Chrysophyllum spp.* I**	Sapotaceae		Central		NE
92.	*Chrysophyllum spp.* J**	Sapotaceae		Central		NE
93.	*Chrysophyllum spp.* K**	Sapotaceae		Central		NE
94.	*Chrysophyllum spp.* L**	Sapotaceae		Central		NE
95.	*Chrysophyllum spp.* M**	Sapotaceae		Central		NE
96.	*Cinnamomum zeylanicum* Blume***	Lauraceae			South	EN
97.	*Claoxylon hexandrum* Mull. Arg.***	Euphorbiaceae			South	LC
98.	*Cleistopholis patens* (Benth) Engl. & Diels	Annonaceae	North	Central	South	LC
99.	*Cnestis ferruginea* DC.	Connaraceae	North	Central		NE
100.	*Cola acuminata* (P. Beauv.) Schott. & Endl.	Malvaceae	North	Central	South	LC
101.	*Cola altissima* Engl.***	Malvaceae			South	LC
102.	*Cola argentea* Mast**	Malvaceae		Central		NT
103.	*Cola digitata* Mast**	Malvaceae		Central		LC
104.	*Cola gigantea* A. Chev.	Malvaceae	North	Central	South	LC
105.	*Cola hispida* Brenan & Keay ***	Malvaceae			South	NE
106.	*Cola lateritia* K. Schum**	Malvaceae		Central		LC
107.	*Cola laurifolia* Mast**	Malvaceae		Central		LC
108.	*Cola lepidota* K. Schum**	Malvaceae		Central		LC
109.	*Cola millenni* K. Schum	Malvaceae	North	Central	South	NE
110.	*Cola nitida* (Vent.) Schott & Endl.	Malvaceae	North	Central	South	LC
111.	*Cola pachycarpa* K. Schum**	Malvaceae		Central		LC
112.	*Cola rostrata* K. Schum	Malvaceae		Central	South	LC
113.	*Combretodendron africanum* (Welw.) ex. Benth*	Lecythidaceae	North			NE
114.	*Combretodendron macrocarpum* (P. Beauv.) Keay	Lecythidaceae	North		South	NE
115.	*Combretum nigricans* Lepr. ex Guill. & Perr.*	Combretaceae	North			LC
116.	*Conopharyngia crassa* Benth ***	Apocynaceae			South	VU
117.	*Cordia millenii* Bak. *	Boraginaceae	North			LC

118.	*Corynanthe pachyceras* K. Schum***	Rubiaceae			South	LC
119.	*Coula edulis* Baill.	Olacaceae		Central	South	LC
120.	*Crescentia cujete* Linn.	Bignoniaceae	North	Central		LC
121.	*Crossopteryx febrifuga* (Afzel ex. G. Don) Benth*	Rubiaceae	North			LC
122.	*Croton penduliflorus* Hutch**	Euphorbiaceae		Central		LC
123.	*Cussonia arborea* Hochst ex. A. Rich*	Araliaceae	North			LC
124.	*Cussonia barteri* Seem. *	Araliaceae	North			LC
125.	*Cuviera acutifolia* DC***	Rubiaceae			South	LC
126.	*Cylicodiscus gabunensis* Harms	Fabaceae	North	Central		LC
127.	*Dacryodes edulis* (G. Don.) H. J. Lam	Burseraceae	North	Central	South	LC
128.	*Dacryodes rostrata* (Blume) H. J. Lam***	Burseraceae			South	LC
129.	*Dalbergia latifolia* Roxb***	Fabaceae			South	VU
130.	*Daniellia ogea* Rolfe	Fabaceae	North		South	NT
131.	*Daniellia oliveri* (Rolfe) Hutch & Dalz.	Fabaceae		Central	South	LC
132.	*Datarium microcarpum* Guill. & Perr.	Fabaceae	North		South	NE
133.	*Dennettia tripetala* G. Baker. f *	Annonaceae	North			LC
134.	*Deplatsia dewevrei* De Wild & Th Dur**	Tiliaceae		Central		NE
135.	*Detarium senegalense* JF Gmelin*	Fabaceae	North			LC
136.	*Dialium guineense* Willd.	Fabaceae	North	Central	South	LC
137.	*Didymosalpinx parviflora* Keay***	Rubiaceae			South	NE
138.	*Diospyros crassiflora* Hiern	Ebenaceae		Central	South	VU
139.	*Diospyros dendo* Welw.	Ebenaceae	North		South	LC
140.	*Diospyros ferrea* F.R. Fosberg***	Ebenaceae			South	VU
141.	*Diospyros heudelotii* Hiern	Ebenaceae		Central	South	NE
142.	*Diospyros melocarpa* F. White**	Ebenaceae		Central		NE
143.	*Diospyros mesipiliformes* Hochst. ex A. DC.	Ebenaceae	North	Central	South	NE
144.	*Diospyros suaveolens* Gurke***	Ebenaceae			South	NE
145.	*Diospyros zenkeri* (Gurke) F. White	Ebenaceae		Central	South	LC
146.	*Distemonathus benthamianus* Baill***	Fabaceae			South	LC
147.	*Dombeya burgessiae* Gerr. Ex Harv.	Malvaceae	North	Central		LC
148.	*Dombeya sp.* Cav. **	Malvaceae		Central		LC
149.	*Dracaena arborea* (Willd.) Link	Agavaceae	North		South	LC
150.	*Dracaena mannii* Bak	Agavaceae	North	Central		LC
151.	*Drypetes gossweileri* S. Moore***	Putranjivaceae			South	NE
152.	*Drypetes preussii* (Pax) Hutch***	Putranjivaceae			South	VU
153.	*Duboscia macrocarpa* Bocq.	Malvaceae		Central	South	LC
154.	*Ekerbergia senegalensis* A. Juss	Meliaceae	North	Central		NE
155.	*Elaeocarpus dentatus* (J. R. Forst. & G. Forst) Vahl. **	Elaeocarpaceae		Central		NE
156.	*Enantia chlorantha* Oliv.	Annonaceae		Central	South	LC
157.	*Entandrophragma africana* C.DC***	Meliaceae			South	NE
158.	*Entandrophragma angolensis* (Welw.) C. DC**	Meliaceae		Central		VU
159.	*Entandrophragma cylindricum* Harms	Meliaceae	North	Central	South	VU
160.	*Eriboma oblonga* (Mast.) Bod.*	Ericaceae	North			NE
161.	*Erythrina senegalensis* DC.*	Fabaceae	North			LC
162.	*Erythrophleum ivorense* A. Chev***	Fabaceae			South	LC
163.	*Erythrophleum suaveolens* (Guill. & Perr.) Brenan***	Fabaceae			South	LC
164.	*Fagara macrophylla* (Oliv.) Engl.*	Rutaceae	North			LC

165.	*Feretia apodanthera* Del.	Rubiaceae	North		South	NE
166.	*Ficus capensis* Thunb.	Moraceae			South	NE
167.	*Ficus congesta* Roxb.	Moraceae		Central	South	LC
168.	*Ficus exasperata* Vahl	Moraceae	North	Central	South	LC
169.	*Ficus glumosa* Del.	Moraceae	North	Central		LC
170.	*Ficus mucuso* Ficalho***	Moraceae			South	LC
171.	*Ficus polita* Vahl	Moraceae	North	Central		LC
172.	*Ficus sur* Forssk	Moraceae	North	Central		LC
173.	*Ficus thonningii* Blume	Moraceae	North		South	LC
174.	*Ficus trichopoda* Baker.	Moraceae	North	Central		LC
175.	*Ficus umbelatta* Vahl	Moraceae		Central	South	LC
176.	*Ficus vallis-choudae* Del.	Moraceae	North		South	NE
177.	*Flacourtia flavescens* Willd.*	Flacourtiaceae	North			NE
178.	*Funtumia africana* (Benth.) Stapf **	Apocynaceae		Central		LC
179.	*Funtumia elastica* (Preuss.) Stapf	Apocynaceae	North	Central	South	LC
180.	*Gambeya albida* (G. Don) Aubrev. & Pellegr*.	Sapotaceae	North			NT
181.	*Garcinia gnetoides* Hutch **	Clusiaceae		Central		NE
182.	*Garcinia kola* Heckel	Clusiaceae	North	Central	South	VU
185.	*Garcinia livingstonei* T. Anders **	Clusiaceae		Central		NE
184.	*Garcinia manni* Oliv.	Clusiaceae		Central	South	VU
185.	*Garcinia ovalifolia* Oliv **	Clusiaceae		Central		LC
186.	*Garcinia spp.* Heckel **	Clusiaceae		Central		LC
187.	*Gardenia ternifolia* Schumach & Thonn.*	Rubiaceae	North			LC
188.	*Gliricidia sepium* (Jacq.) Kunth ex Walp.*	Fabaceae	North			LC
189.	*Glyphaea brevis* (Spreng) Monachino	Tiliaceae	North	Central		NE
190.	*Gossweilerodendron balsamiferum* (Verm.) Harms***	Fabaceae			South	EN
191.	*Grewia brevis* Spreng**	Malvaceae		Central		LC
192.	*Grewia venusta* Fresen	Malvaceae	North	Central	South	NE
193.	*Guarea cedrata* (A.Chev.) Pellegr.	Meliaceae	North	Central	South	VU
194.	*Guarea glomerulata* Harms**	Meliaceae		Central		NE
195.	*Guarea thompsonii* Sprague & Hutch***	Meliaceae			South	VU
196.	*Guibourtia arnoldiana* J. Leon.*	Fabaceae	North			NE
197.	*Guibourtia ehie* (A. Chev.) J. Leonard *	Fabaceae	North			LC
198.	*Hannoa klaineana* Pierre ex. Engl***	Simaroubaceae			South	NE
199.	*Harungana madagascariense* Lam ex. Poir.	Hypericaceae	North	Central	South	LC
200.	*Hevea brasiliensis* Mull. Arg.***	Euphorbiaceae			South	LC
201.	*Holarrhena floribunda* (G. Don) T. Durand & Schinz	Apocynaceae	North	Central	South	LC
202.	*Holarrhena pubescence* (G. Don) T. Durand & Schinz	Apocynaceae	North	Central	South	LC
203.	*Holoptelea grandis* (Hutch.) Mildbr***	Ulmaceae			South	LC
204.	*Homalium betulifolium* Daniker***	Salicaceae			South	NT
205.	*Homalium cochinchinense* (Lour.) Druce***	Salicaceae			South	NE
206.	*Homalium letestui* Pelleg***	Salicaceae			South	LC
207.	*Hunteria eburnea* Pichon	Apocynaceae		Central	South	NE
208.	*Hunteria umbellata* (K. Schum.) Hallier f.	Apocynaceae	North	Central	South	LC
209.	*Hylodendron gabunense* Taub***	Fabaceae			South	LC
210.	*Hymenocardia acida* (A. DC.) Pichon*	Phyllanthaceae	North			LC
211.	*Hymenodictyon biafranum* Hiern	Rubiaceae	North	Central		NE

212.	*Hymenostegia afzelii* (Oliv.) Harms*	Fabaceae	North			NE
213.	*Hyphaene thebaica* L. *	Arecaceae	North			LC
214.	*Hypodaphnis zenkeri* (Engl) Stapf***	Lauraceae			South	LC
215.	*Irvingia gabonensis* (O'Rorke) Baill.	Irvingiaceae	North	Central	South	NT
216.	*Irvingia grandifolia* (Engl.) Engl.**	Irvingiaceae		Central		LC
217.	*Irvingia tenuinucleata* Tiegh	Irvingiaceae	North	Central	South	NE
218.	*Isoberlina tomentosa* (Harms) Craib & Stapf*	Fabaceae	North			LC
219.	*Isoberlinia doka* Craib & Stapf*	Fabaceae	North			LC
220.	*Ixora brachypoda* D.**	Rubiaceae		Central		NE
221.	*Juglans nigra* L.*	Juglandaceae	North			LC
222.	*Khaya grandifoliola* (Welw.) C. DC.	Meliaceae	North	Central	South	VU
223.	*Khaya ivorensis* A. Chev.	Meliaceae	North	Central	South	VU
224.	*Khaya senegalensis* (Desr.) A. Juss.*	Meliaceae	North			VU
225.	*Kigelia africana* (Lam.) Benth.	Bignoniaceae	North	Central		LC
226.	*Klainedoxa gabonensis* Pierre ex Engl.	Irvingiaceae	North	Central	South	LC
227.	*Lannea nigritiana* (Sc. Elliot) Keay **	Anacardiaceae		Central		LC
228.	*Lannea welwitschii* (Hiern) Engl.	Anacardiaceae	North	Central	South	LC
229.	*Lecaniodiscus cupanioides* Planch. ex. Benth	Sapindaceae	North	Central		NE
230.	*Lepidobotrys staudtii* Engl.	Lepidobotryaceae			South	LC
231.	*Lophira alata* Banks ex. C. F. Gaerttn.	Ochinaceae	North	Central	South	VU
232.	*Lophira lanceolata* Van. Tiegh. ex. Keay**	Ochinacaea		Central		NE
233.	*Lovoa trichiloides* Harms	Meliaceae		Central	South	LC
234.	*Macaranga barteri* Mull. Arg.	Euphorbiaceae		Central	South	LC
235.	*Macaranga grandifolia* Linn**	Euphorbiaceae		Central		VU
236.	*Maesobotrya barteri* (Baill.) Hutch.*	Phyllanthaceae	North			LC
237.	*Maesobotrya dusenii* (Pax) Hutch**	Phyllanthaceae		Central		NE
238.	*Maesobotrya staudtii* (Pax) Hutch**	Phyllanthaceae		Central		NE
239.	*Maesopsis eminii* Engl.*	Rhamnaceae	North			LC
240	*Magaritaria discoidea* (Baill.) Webster*		North			NE
241.	*Malacantha alnifolia* (Baker) Pierre	Sapotaceae		Central	South	VU
242.	*Mammea africana* Sab.	Calophyllaceae		Central	South	LC
243.	*Manilkara obovata* (Sabine & G. Don) Hemsley***	Sapotaceae			South	NE
244.	*Mansonia altissima* (A. Chev.) A. Chev	Sterculiaceae	North	Central		EN
245.	*Marssularia acuminata* (G. Don) Bullock ex Hoyle	Rubiaceae		Central	South	NE
246.	*Memocylon blakeoides* G. Don*	Melastomataceae	North			NE
247.	*Memocylon malabricum* (C. B. Clarke) Cogn.*	Melastomataceae	North			NE
248.	*Microdesmis puberula* Hook. f. ex Planch	Pandaceae		Central	South	NE
249.	*Milicia excelsa* (Welw) C. C. Berg	Moraceae	North	Central	South	NT
250.	*Milicia regia* (A. Chev.) C. C. Berg**	Moraceae		Central		VU
251.	*Millettia griffoniana* Baill***	Fabaceae			South	LC
252.	*Millettia ovalifolia* Kurz***	Fabaceae			South	LC
253.	*Millettia thonningii* (Schum. & Thonn.) Bak**.	Fabaceae		Central		LC
254.	*Mimusops andongensis* Hiern**	Sapotaceae		Central		LC
255.	*Mimusops djave* Engl.***	Sapotaceae			South	NE
256.	*Mitragyna inermis* (Willd.) O. Kuntze***	Rubiaceae			South	NE

257.	*Mitragyna ledermannii* (K. Krause) Ridsdale	Rubiaceae	North	Central	South	VU
258.	*Mitragyna stipulosa* (DC.) Kuntze	Rubiaceae		Central	South	VU
259.	*Mitragynia speciosa* Kratom***	Rubiaceae			South	NE
260.	*Monodora myristica* (Gaertn.) Dunal	Annonaceae	North	Central	South	LC
261.	*Morinda lucida* Benth	Rubiaceae	North	Central	South	NE
262.	*Morinda officinalis* F. C. How***	Rubiaceae			South	NE
263.	*Morinda muscosa.* L.***	Rubiaceae			South	LC
264.	*Moringa oleifera* Lam.	Moringaceae	North	Central	South	NE
265.	*Musanga cecropioides* R. Br. Apud Tedlie	Urticaceae	North	Central	South	LC
266.	*Myrianthus arboreus* P. Beauv.	Urticaceae	North	Central	South	LC
267.	*Napoleonaea imperialis* P. Beauv.	Lecythidaceae	North	Central		NE
268.	*Nauclea diderrichii* (De wild. & T. Durand) Merrill	Rubiaceae		Central	South	VU
269.	*Nauclea latifolia* Sm.	Rubiaceae	North	Central		LC
270.	*Neoboutonia glabrescens* Prain***	Euphorbiaceae			South	NE
271.	*Neocarya macrophylla* (Sabine) Prance***	Chrysobalanaceae			South	NE
272.	*Nesogordonia papaverifera* (A. Chev.) Capuron***	Malvaceae			South	VU
273.	*Newbouldia laevis* (P. Beauv.) Seeman ex. Burea	Bignoniaceae	North	Central	South	NE
274.	*Newtonia duparquetiana* (Baill.) Keay***	Fabaceae			South	LC
275.	*Ochna afzelia* R. Br. ex Olive	Ochinaceae	North	Central		LC
276.	*Octoknema affinis* Pierre ex Tieghem***	Octoknemaceae			South	NE
277.	*Olax subscorpioidea* Oliv.	Olacaceae	North	Central		NE
278.	*Omphalocarpum elatum* Miers***	Sapotaceae			South	LC
279.	*Oncoba spinosa* Forssk.*	Salicaceae	North			LC
280.	*Ouratea calophylla* (Hook. f.) Engl.***	Ochnaceae			South	NE
281.	*Oxyanthus latifolius* DC. (K. Schum)**	Rubiaceae		Central		NE
282.	*Oxyanthus macrophylla* DC**	Rubiaceae		Central		NE
283.	*Oxyanthus speciosus* DC.	Rubiaceae		Central	South	LC
284.	*Oxystigma mannii* (Baill.) Harms***	Fabaceae			South	NT
285.	*Pachypodanthium staudtii* Engl. & Diels ***	Annonaceae			South	LC
286.	*Panda oleosa* Pierre**	Pandaceae		Central		LC
287.	*Pandanus candelabrum* P. Beauv.	Pandanaceae	North	Central		LC
288.	*Parinari chrysophylla* (Oliv.) Prance	Chrysobalanaceae	North	Central		NE
289.	*Parinari curatellifolia* Planch ex. Benth *	Chrysobalanaceae	North			LC
290.	*Parinari excelsa* Sab. **	Chrysobalanaceae		Central		LC
291.	*Parinari kerstingii* Engl. *	Chrysobalanaceae	North			NE
292.	*Parkia bicolor* A. Chev	Fabaceae	North	Central	South	LC
293.	*Parkia biglobosa* (Jacq.) R. Br.*	Fabaceae	North			LC
294.	*Pauridiantha floribunda* K. Schum. ex K. Krause**	Rubiaceae		Central		NE
295.	*Pausinystalia macroceras* (K. Schum) Pierre ex Beille	Rubiaceae		Central	South	NE

296.	*Pausinystalia yohimbe* (K. Schum.) Pierre ex Beille	Rubiaceae		Central	South	NE
297.	*Pentaclethra macrophylla* Benth	Fabaceae	North	Central	South	LC
298.	*Pentadesma butyracea* Sabine *	Clusiaceae	North			LC
299.	*Petersianthus macrocarpus* (P. Beauv.) Liben*	Lecythidaceae		Central		LC
300.	*Phyllanthus discoideus* (Baill.) Mull.Arg.***	Euphorbiaceae			South	NE
301.	*Phyllanthus muellerianus* (O. Kuntze) Excel.*	Euphorbiaceae	North			NE
302.	*Piliostigma reticulatum* (DC.) Hochst***	Fabaceae			South	NE
303.	*Piliostigma thonningii* (Schum.) Meline Readhead***	Fabaceae			South	NE
304.	*Piptadeniastrum africanum* (Hook f.) Brenan	Fabaceae	North	Central	South	LC
305.	*Pleiocarpa talbotii* Wernh. **	Apocynaceae		Central		NE
306.	*Poga oleosa* Pierre ***	Anisophyllaceae			South	LC
307.	*Polyalthia suaveolens* Engl. & Diels *	Annonaceae	North			LC
308.	*Polyceratocarpus parviflorus* Ghesq. *	Annonaceae	North			LC
309.	*Prosopis africana* (Guill. & Perr.) Taub.*	Fabaceae	North			LC
310.	*Pseudospondias microcarpa* (A. Rich.) Engl.	Anacardiaceae	North	Central		NE
311.	*Psidium eugeniaefolia* L.**	Myrtaceae		Central		NE
312.	*Psydrax palma* (K. Schum.) Bridson***	Rubiaceae			South	NE
313.	*Pterocarpus erinaceus* Poir.	Fabaceae	North	Central	South	EN
314.	*Pterocarpus lucens* Guill. & Perr.	Fabaceae	North		South	LC
315.	*Pterocarpus milbraedii* Harms	Fabaceae	North	Central	South	VU
316.	*Pterocarpus osun* Craib.	Fabaceae	North	Central	South	NE
317.	*Pterocarpus soyauxii* Taub**	Fabaceae		Central		NE
318.	*Pterygota bequaertii* De Wild***	Malvaceae			South	VU
319.	*Pterygota macrocarpa* K. Schum.	Malvaceae		Central	South	VU
320.	*Pycnanthus angolensis* (Welw.) Warb.	Myristicaceae	North	Central	South	NE
321.	*Pycnanthus microcephalus* (Benth. & Hook. f.) Warb**	Myristicaceae		Central		NE
322.	*Randia nilotica* (Stapf) Tirveng***	Rubiaceae			South	NE
323.	*Rauvolfia vomitoria* Afzel	Apocynaceae	North	Central	South	LC
324.	*Ricinodendron africanum* Mull. Arg.***	Euphorbiaceae			South	NE
325.	*Ricinodendron heudelotii* (Bail.) Heckel	Euphorbiaceae	North	Central	South	VU
326.	*Rinorea oblongifolia* (C.H. Wright) Marquand	Violaceae		Central	South	NE
327.	*Rothmannia hispida* (K. Schum.) Fagerlind	Rubiaceae		Central	South	LC
328.	*Saba senegalensis* (A. DC.) Pichon **	Apocynaceae		Central		NE
329.	*Santaloides afzelii* (R. Br.) Schellenb.	Connaraceae	North		South	NE
330.	*Santiria trimera* (Oliv.) Aubrev	Burseraceae		Central	South	LC
331.	*Sapium ellipticum* (Hochst.) Pax.	Euphorbiaceae	North		South	LC
332.	*Sarcocephalus latifolius* (JE SM.) EA Bruce	Rubiaceae	North	Central	South	NE
333.	*Smeathmannia pubescens* Soland ex R. Br*	Passifloraceae	North			LC
334.	*Sorindeia grandifolia* Engl. **	Anacardiaceae		Central		LC
335.	*Spathodea campanulata* P. Beauv.	Bignoniaceae	North	Central	South	LC
336.	*Spondianthus preussii* Engl.*	Phyllanthaceae	North			NE
337.	*Spondias mombin* L.	Anacardiaceae	North	Central	South	LC
338.	*Staudtia stipitata* Warb.	Myristicaceae	North	Central	South	NE
339.	*Sterculia oblonga* Mast	Malvaceae	North	Central	South	VU
340.	*Sterculia rhinopetala* K. Schum***	Malvaceae			South	LC
341.	*Sterculia tragacantha* Lind	Malvaceae	North	Central	South	LC

342.	*Stereospermum kunthianum* Cham.	Bignoniaceae	North	Central	South	LC
343.	*Strombosia grandifolia* Hook. f. ex Benth	Olacaceae	North	Central	South	NE
344.	*Strombosia postulata* Oliv.	Olacaceae	North	Central	South	LC
345.	*Strychnos spinosa* Lam**	Loganiaceae		Central		NE
346.	*Strychnox innocua* Del**	Loganiaceae		Central		LC
347.	*Swartzia fistuloides* Harms**	Fabaceae		Central		LC
348.	*Swartzia madagascariensis* Desv.*	Fabaceae	North			LC
349.	*Symphonia globulifera* Linn f.	Clusiaceae	North	Central	South	DD
350.	*Syzygium guineense* (Wild.) DC.	Myrtaceae	North	Central		LC
351	*Tabernaemontana* (*Conopharyngia*) *crassa* Benth**	Apocynaceae		Central		LC
352.	*Tabernaemontana pachysiphon* Stapf	Apocynaceae		Central	South	LC
353.	*Tabernaemontana ventricosa* Hochst. ex DC.	Apocynaceae	North	Central	South	LC
354.	*Tapura fischeri* Engl.**	Dichapetalaceae		Central		LC
355.	*Teclea afzeli* Engl.**	Rutaceae		Central		NE
356.	*Terminalia avicennioides* Guill. & Perr.*	Combretaceae	North			LC
357.	*Terminalia brownie* Fresen*	Combretaceae	North			LC
358.	*Terminalia ivorensis* A. Chev.	Combretaceae	North	Central	South	VU
359.	*Terminalia macroptera* Guill. & Perr.	Combretaceae	North	Central		LC
360.	*Terminalia superba* Engl. & Diels.	Combretaceae	North	Central	South	NE
361.	*Tetrapleura tetraptera* (Schum. & Thonn.) Taub	Fabaceae	North	Central	South	LC
362.	*Tetrorchidium didymostemon* (Baill.) Pax*	Euphorbiaceae	North			LC
363.	*Tetrorchidium macrophyllum* Mull. Arg*	Euphorbiaceae	North			LC
364.	*Tieghemella heckelii* (A. Chev.) Pierre ex Dubard***	Sapotaceae			South	EN
365.	*Trachilia heudelotti* Planch ex Oliv**	Meliaceae		Central		NE
366.	*Treculia africana* Decne ex. Trec.	Moraceae	North	Central	South	NE
367.	*Treculia obovoidea*, NE Br.	Moraceae	North	Central	South	LC
368.	*Trema guineensis* (Schumach. & Thonn.) Ficalho ***	Cannabaceae			South	NE
369.	*Trema orientalis* (L.) Blume *	Cannabaceae	North			LC
370.	*Trichilia africana* Vahl***	Meliaceae			South	LC
371.	*Trichilia gilgiana* Harms**	Meliaceae		Central		LC
372.	*Trichilia lanata* A. Chev.*	Meliaceae	North			NE
373.	*Trichilia tessmanii* Harms	Meliaceae		Central	South	LC
374.	*Trilepisium madagascariense* (Miq.) Miq	Moraceae	North	Central		NE
375.	*Triplochiton scelroxylon* K. Schum**	Malvaceae		Central		LC
376.	*Uapaca acuminata* (Hutch.) Pax & K. Hoffm.	Phyllanthaceae	North	Central	South	LC
377.	*Uapaca guineensis* Mull. Arg.***	Phyllanthaceae			South	LC
378.	*Uapaca heudelotii* Baill	Phyllanthaceae		Central	South	LC
379.	*Uapaca staudtii* Pax***	Phyllanthaceae			South	LC
380.	*Uapaca togoensis* Pax	Phyllanthaceae	North	Central		LC
381.	*Uvaria chamae* P. Beauv.	Annonaceae	North	Central		LC
382.	*Uvariodendron calophyllum* R. E. Fr. ***	Annonaceae			South	LC
383.	*Uvariopsis dioica* (Diels) Robyns & Ghesq.*	Annonaceae	North			NE
384.	*Vernonia conferta* Benth **.	Asteraceae		Central		NE
385.	*Villaria odorata* (Blanco) Merr***	Rubiaceae		Central		NE
386.	*Vitellaria paradoxa* C. F. Gaertn.*	Sapotaceae	North			VU

387.	*Vitex doniana* Sweet	Lamiaceae	North	Central	South	LC
388.	*Vitex ferruginea* Schumach. & Thonn.	Lamiaceae		Central	South	LC
389.	*Vitex grandifolia* Gurke	Lamiaceae	North	Central	South	LC
390.	*Vitex rivularis* Gurke**	Lamiaceae		Central		LC
391.	*Vitex simplicifolia* Oliv**.	Lamiaceae		Central		LC
392.	*Voacanga africana* Stapf	Apocynaceae	North	Central	South	NE
393.	*Voacanga caudiflora* Stapf **	Apocynaceae		Central		NE
394.	*Voacanga bracteata* Stapf ***	Apocynaceae			South	LC
395.	*Ximenia americana* Linn.*	Olacaceae	North			LC
396.	*Xylopia acutiflora* (Dunal) A. Rich. **	Annonaceae		Central		LC
397.	*Xylopia aethiopica* (Dunal) A. Rich	Annonaceae	North	Central	South	LC
398.	*Xylopia africana* Oliv.	Annonaceae	North	Central		VU
399.	*Xylopia parviflora* (A. Rich.) Benth **	Annonaceae		Central		LC
400.	*Xylopia staudtii* Engl. & Diels **	Annonaceae		Central		LC
401.	*Zanthoxylum gilletii* (DeWild.) P.G. Waterman	Rutaceae		Central	South	LC
402.	*Zanthoxylum rubescens* Planch. ex Hook. f.**	Rutaceae		Central		NE
403.	*Zanthoxylum zanthoxyloides* (Linn.) P.G. Waterman	Rutaceae		Central	South	LC

Tree species confined to * - Northern zone, ** - Central zone, *** - Southern zone, NE - Not Evaluated, DD - Data Deficient, LC - Least Concern, N- TNear Threatened, VU - Vulnerable, EN - Endangered, CR - Critically Endangered