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Vegetation Analysis of Ngel Nyaki Forest Reserve, Mambilla Plateau, Nigeria

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Abstract
The vegetation of Ngel Nyaki Forest Reserve, Nigeria was analysed using data gathered with point-centred quarter method. 80 trees belonging to 29 species distributed in 21 families were encountered. The density of trees was 785 trees per hectare. The girth-size distribution curve indicated that the vegetation of Ngel Nyaki is stable and self-sustaining. The more dominant species based on Importance Values are *Poulteria altissima, Polyscias fulva, Carapa grandiflora and Entandrophragma angolense.* The least dominant species are *Dombeya ledermanii, Celtis occidentalis and Croton macrostachyus.*
Keywords: Ngel Nyaki Forest Reserve, Mambilla Plateau, vegetation analysis

1. Introduction

The forests of Nigeria form part of the Guinean forest biodiversity hotspot which extends from Sierra Leone to Cameroon mountains. The Cameroon highlands are fragmented and extends to eastern parts of Nigeria where they form montane and sub-montane forests. One of such fragmented forests is Nge lNyaki Forest Reserve (NNFR) which was gazetted as a forest reserve in 1969. NNFR which is located on the western escarpment of Mambilla Plateau in the south eastern corner of Taraba State, Nigeria at an altitude of 1450-1600m asl is a mosaic of mountain top grassland and sub-montane closed canopy forest limited to the streams' valleys (Fig. 1). NNFR (07^{o} 14^{1} N 11^{o} 04^{1} E) covers an area of about $46km^{2}$ with a woody plant density of 669/ha (Ihuma *et al*, 2011). NNFR is one of the most floristically diverse montane –submontane forest stands in Nigeria (Dowsett-Lemaire, 1989) and the most diverse on Mambilla plateau (Chapman and Chapman, 2001). It contains many plants which are endemic to the afromontane region of White (1983). This high level of endemism makes the forest a priority for conservation (Fishpool, 1997). NNFR has more than 146 vascular plants out of which 25 are in the IUCN Red Data List (Borokini *et al*., 2012) four of which are endangered and several are new to Nigeria (eg. *Anthonotha noldeana*) (Chapman and Chapman, 2001). The forest is also rich in birdlife (Ihuma *et a*l, 2011) and has been classified as an Important Bird Area by Birdlife International and a critical site for biodiversity conservation (Ezealor, 2002). The climate is seasonal with dry season lasting from November to March and rainy season from April to October with a mean annual rainfall of 1780mm (Chapman and Chapman, 2001). The need to compare vegetation from different locations requires objective analysis of quantitative data. Akinsoji et al, (2003) stated that quantitative data obtained from objective sampling procedures is required for comparative purposes.Two methods used in gathering vegetation data are Count Plot methods (quadrats) and Plotless methods, also called Wisconsin Distance Methods (Mueller-Dombois and Ellenberg, 1974). Plotless methods are preferred because they are less laborious and time conserving. Of the four plotless techniques the one found to be most efficient is the point-centred quarter method (Cottam and Curtis, 1956). It has been widely used with satisfactory report in North America (Caplenor, 1968, Boorman and Buell, 1964; Bray and Curtis, 1957) and in Nigeria (Akinsoji et al, 2003).
Ngel Nyaki Forest Reserve is a fertile ground for research in tropical biology and conservation because of its diversity and level of endemism. The Nigerian Montane Forest Project has pioneered the research in NNFR and contributed immensely to literature. This study which is a phytosociological analysis of the sub-montane forest using point-centred quarter method is to complement the work done so far in NNFR.

2. Materials And Methods.

At each sampling station, a baseline was established parallel to the forest edge. A transect perpendicular to the baseline was also established and a sampling point was located at a distance determined by a figure from random table. At each sampling point, four quarters were marked with the sampling point as the origin. The nearest tree to the origin in each quarter was identified. Its distance from the origin was recorded and its girth at breast height was also recorded. This procedure was carried out at 20 randomly selected points in the forest reserve. The few species that could not be identified in the field were taken to Forestry Research Institute Herbarium at Ibadan. All the distances were added together and a mean distance (d) was calculated. The mean area was computed as d2.. Using this value, the absolute density of trees per hectare was calculated as 10,000/d2. From this the absolute densities of each species was calculated and then relative densities. Frequency was calculated as the number of sampling points a species occurred divided by the total number of sampling points. Species dominance was calculated as basal area of a species divided by the total number of all species. Basal area (A)

was calculated as A= c2 / 4.pi where c circumference and pi = 3.14. Relative frequency and relative dominance of each species was calculated. The three relative values were added together to obtain Importance Values (IV) for the species and they were ranked according to the magnitude of their IV.

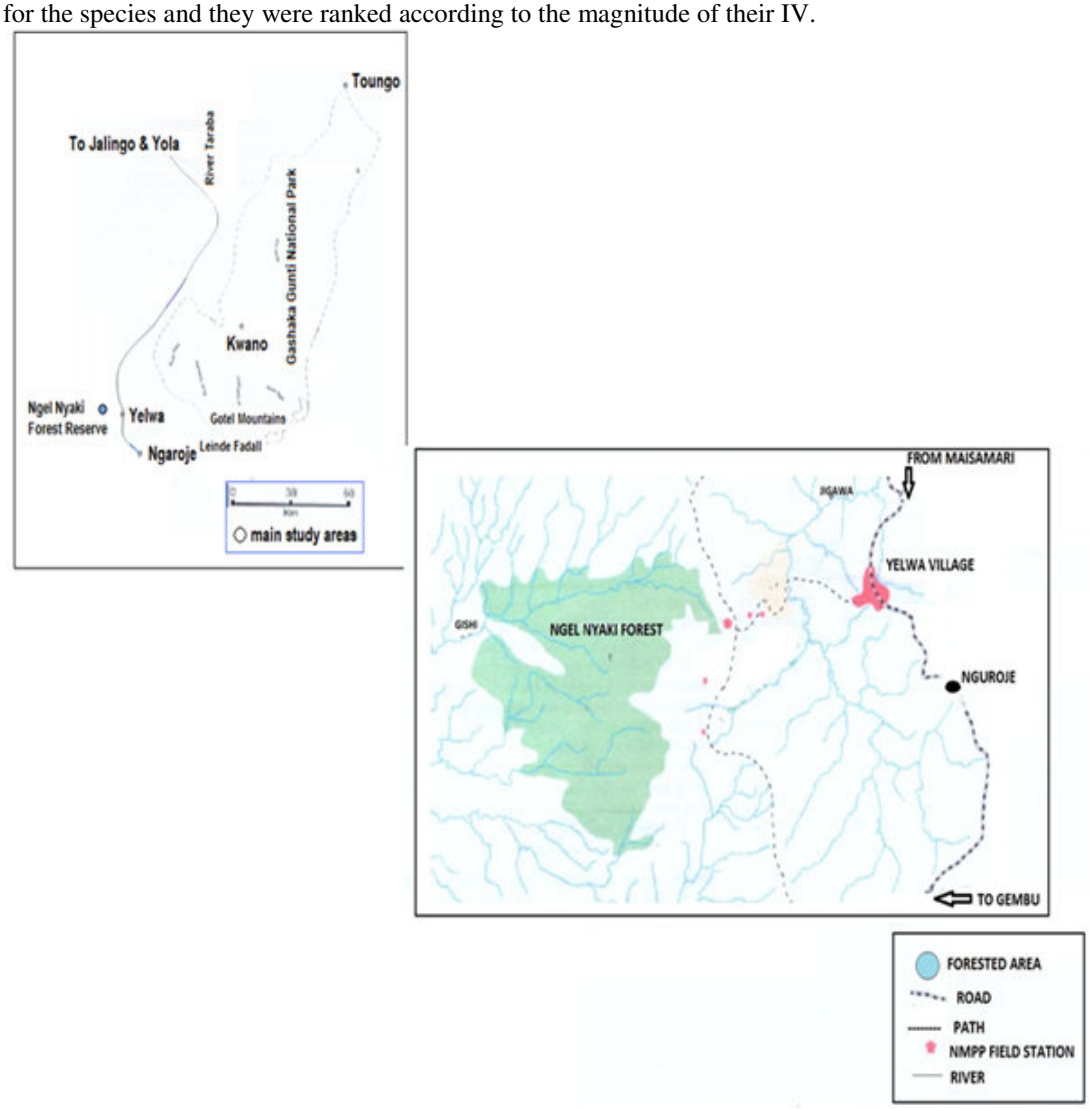

Fig. 1: Map of Southeastern Taraba State Showing Ngel Nyaki Forest Reserve.

3. Results and Discussion

The forest is a closed canopy forest with gaps in places where there had been tree falls. A total of eighty trees belonging to twenty nine species distributed in twenty one families were recorded (Table 1). Most of the forest is relatively undisturbed but the edges are subjected to burning by incursions of grass land fires. Although the density of the forest trees was estimated to be 785 trees per hectare which is higher than the estimate of Ihuma *et al*, (2011), the actual density may be higher because the point-centred quarter method is known to underestimate absolute density of trees (Akinsoji *et al*., 2003, Skarpe, 1990) and species richness thus rarer species tend to be missed out. The girth size distribution

Table 1. Tree Species Composition Of Ngel Nyaki Forest Reserve Sampled With Point-Centred Quarter Method.

SPECIES	FAMILY
Anthonotha noldeae	Leguminosae-Caesalpinoideae
Beilshmeidea mannii	Lauraceae
Carapa grandiflora	Meliaceae
Celtis occidentalis	Ulmaceae
Chrysophyllum albidum	Sapotaceae
Croton macrostachyus	Euphorbiaceae
Deinbolia pinnata	Sapindaceae
Diospyros montbutensis	Ebenaceae
Dombeya ledermanni	Sterculiaceae
Entandrophragma angolense	Meliaceae
Ficus sp.	Moraceae
Garcinia smeathmeanii	Clusiaceae
Isolona deightonii	Annonaceae
Khaya grandifoliola	Meliaceae
Leptaulus zenkeri	Icacinaceae
Macaranga occidentalis	Euphorbiaceae
Oxyanthus speciosus	Rubiaceae
Pleiocarpa pycnantha	Apocynaceae
Polyscias fulva	Araliaceae
Poulteria altissima	Sapotaceae
Pterygota mildbraedii	Sterculiaceae
Santiria trimera	Burseraceae
Strombosia schefflerii	Olacaceae
Symphonia globulifera	Clusiaceae
Syzygium *guineense*	Myrtaceae
Tabernaemontana contorta	Apocynaceae
Treculia obovoidea	Moraceae
Trichilia prieuriana	Meliaceae
Zanthxylum zanthxyloides	Rutaceae

of trees (Fig. 2) shows that more of the trees fall within the smaller girth size classes and typifies the Type 1 curve of Obot (1991) which represents a stable self –sustaining plant population. There is more of smaller trees to replace the more mature trees when they reach senescence. The phytosociological analyses of NNFR are summarized in Table 2. Because of the underestimation of tree density and species richness due to the methods, relative values are employed to determine Importance values of species as an indicator of their dominance status in the community. The more dominant species in order of IV rankings are *Poulteria altissima, Polyscias fulva, Carapa grandiflora and Entandrophragma angolense.* Although *P. altissima* has low density and frequency values, but its large dominance value accounts for its overall dominance. The least dominant species are *Dombeya ledermanni*, *Celtis occidentalis*. and *Croton macrostachyus*. Their density, frequency and dominance values were comparatively small.

Fig. 2: Girth Size Distribution of Trees In Ngel Nyaki Forest Reserve.

Table 2. Phytosociological Analyses Of Data Collected From Ngel Nyaki Forest Reserve

SPECIES	*RDe	*RF	*RDo	*IV
Poulteria altissima	2.5	2.9	17.3	22.7
Polyscias fulva	6.2	7.1	6.8	20.1
Carapa grandiflora	6.2	5.7	7.1	19
Entandrophragma angolense	3.8	2.9	11.6	18.3
Garcinia smeathmeanii	7.5	7.1	3.6	18.2
Trichilia prieuriana	7.5	7.1	3.6	18.2
Ficus sp.	5	4.3	4.9	14.2
Anthonotha noldea	3.8	4.3	5.9	14
Syzygium guineense	3.8	4.3	4.9	13
Pleiocarpa pycnantha	5	5.7	2	12.7
Macaranga occidentalis	5	4.3	2.1	11.4
Strombisia scheffleri	5	2.9	3.1	11
Oxyanthus speciosus	3.8	4.3	2.7	10.8
Deinbollia pinnata	3.8	4.3	1.5	9.6
Tabernaemontana contorta	3.8	2.9	2.1	8.8
Leptaulus zenkeri	3.8	2.9	1.9	8.6
Chrysophyllum albidum	2.5	2.9	2.2	7.6
Khaya grandifoliola	2.5	2.9	2.2	7.6
Diospyros montbutensis	2.5	2.9	1.3	6.7
Beilshmiedia manni	2.5	2.9	1.3	6.7
Isolona deightonii	2.5	1.4	1.2	5.1
Zanthoxylum zanthoxyloides	2.5	1.4	0.9	4.8
Treculia obovoides	1.2	2.4	1.9	4.5
Pterygota mildbraedii	1.2	1.4	1.8	4.4
Santiria trimera	1.2	1.4	1.7	4.3
Symphonia globulifera	1.2	1.4	1	3.6
Dombeya ledermanii	1.2	1.4	0.89	3.5
Celtis occidentalis	1.2	1.4	0.89	3.5
Croton macrostachyus	1.2	1.4	0.5	3.1

- RDe- Relative Density
- RF - Relative Frequency
- RDo-Relative Dominance
- IV - Importance Value

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