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ILLEGAL LOGGING AND ITS EFFECTS ON THE ABUNDANCE AND DISTRIBUTION OF BIG TREE SPECIES IN AFI MOUNTAIN WILDLIFE SANCTUARY, CROSS RIVER STATE NIGERIA

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ABSTRACT

This study focused on big trees species abundance and distribution in Afi Mountain Wildlife Sanctuary Cross River State State, Nigeria. The study assessed the big tree species abundance and distribution in the highland and lowland areas of the Sanctuary and the effects of illegal logging. The research was conducted from June, 2020 to June, 2021. The methods used were the total enumeration count for big tree species abundance and distribution. Results revealed that the big tree species of the study area were mainly of primary forest which has been modified through human activities of logging. Sixty three (63) species of big trees were enumerated, out of which 66.7% where located in the highland area and only 33.3% were located in the lowland area. On site assessment, revealed evidence of logging activity in the study area. It was recommended that enrichment planting and enforcement of laws should be carried out in the study area for posterity.

Keywords: Illegal logging Big trees, abundance, distribution, Afi Mountain Wildlife Sanctuary

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INTRODUCTION

Tropical forests are the richest biological communities on earth and these forests have been recognized to harbour a significant proportion of global biodiversity (Daniel. *et.al*, 2013; Bukie, 2021). These forests provide many ecosystem services such as species conservation, prevention of soil erosion, and preservation of habitat for plants and animals (Onouh *and ogogo*, 2019). Biotic factors such as seed quality, seedling survivorship, and recruitment are important in maintaining the tree composition of tropical forests. However, over exploitation has resulted in the rapid loss of forests and is recognized to be one of the biggest environmental and economic problems around the world (Mani and Parthasarathy, 2006). Tropical forests are disappearing at alarming rates worldwide, reducing annually by1-4% of their current area (Laurence, 1999). Trees, are as an important component of vegetation, must therefore be constantly monitored and managed in order to direct successional processes towards maintaining species and habitat diversity (Attua and Pabi 2013). Tree species diversity is an important aspect of forest ecosystem diversity (Rennolls and Laumonier 2000; Tchoutoetal 2006) and is also fundamental to tropical forest biodiversity (Evariste et al 2010).

Although, biodiversity is conventionally measured in terms of genetics, species and ecosystem diversity (Kayode and Ogunleye, 2008; Edet, 2011; Adeyemi *et.al*, 2015; Bello *et.al*, 2013), Nigeria's rich biodiversity is highly influenced by its enormous Anthropogenic activities such as illegal logging operations. Information on Afi Mountain Wildlife Sanctuary (AMWS) floral diversity

status is poorly documented, hence there is need to ascertain the effects of illegal logging on the abundance and distribution of tree species in AMWS to ensure sustainable forest management planning.

MATERIALS AND METHODS

Study area

This study was conducted in Afi mountain wildlife sanctuary (AMWS), Boki local Government Area of Cross River State Nigeria. It covers approximately 100KM^2. It is contiguous in land mass with the forest of southern Cameroon and Cameroon's Korup National Park, Lying between latitude 6˚10 'and 6˚30' North of the Equator, and longitude 8˚50' and 9˚30' East of the Greenwich meridian (Figure 1).

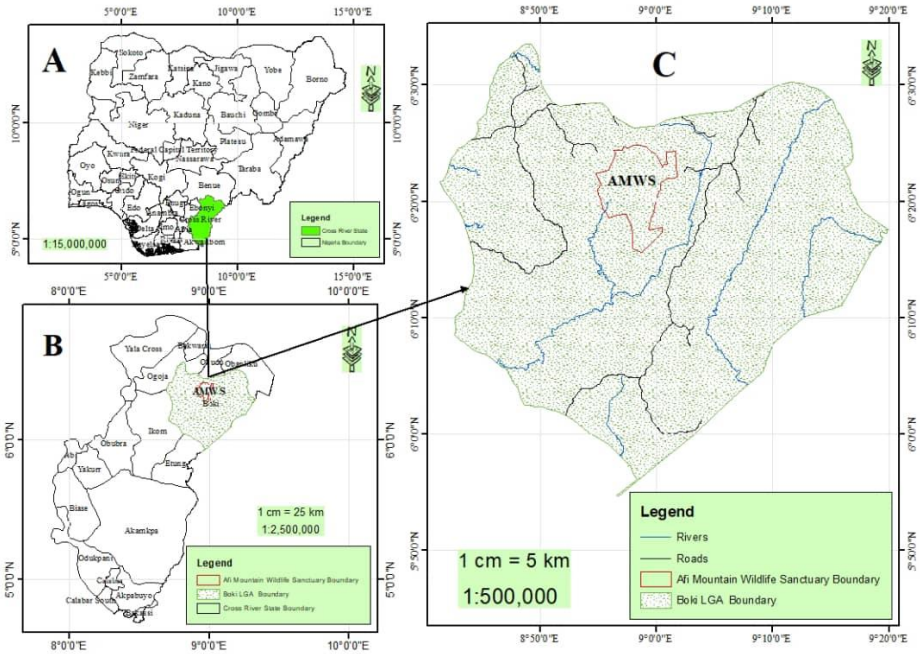

Figure 1. Map of Nigeria showing the Study Area Afi Mountain Wildlife Sanctuary.

The vegetation of AMWS is mainly primary forest but this has been modified by human activities of farming and logging (Edet, 2011) Typical tree species includes: Dysperos spp. Khyaya spp., *Anona* spp. and *Irvingia* Spp. The climate of AMWS is characterized by an extreme rainfall pattern. Mean annual rainfall range between 3,500mm - 5,000mm. However, as observed by Ettah, (2008) and Ogogo *et al*. (2010), sometimes there can be a prolonged dry season of up to 5 month (November-March). Mean annual temperature of AMWS can reach 27^{o}C

Experimental Design

Sample Plots Establishment

Ten sample plots measuring 50 m x 30 m where established in a North-west orientation in the study area. This was due to the difficult terrain of the study area. With the help of the GPS, the orientation was established in each of the plots location and the 50m forestry tape was used to determine the distances in an anti-clockwise direction. The location and size of the plots, as well as the elevation 100m-980m Above Sea Level (ASL), to determine if elevation is connected or related with illegal logging activities in the study area

Data Collection

However, data was collected in eight out of the ten plots. This was because two of the plots suffered severely from wild fire after they have been established before the data collection period. The methods used for data collection was the total enumeration of all tree species, with dbh ≥ 150 cm, placement and numbering of tags on each enumerated tree (Figure 2). Trees were identified to species level, the Global positioning system (GPS) apparatus was used to take coordinates of large (big) trees. The location of the trees was either designated as highland if the location is greater than or equals to 500 m (ASL) or lowland if the location is less than or equals to 500 m (ASL).

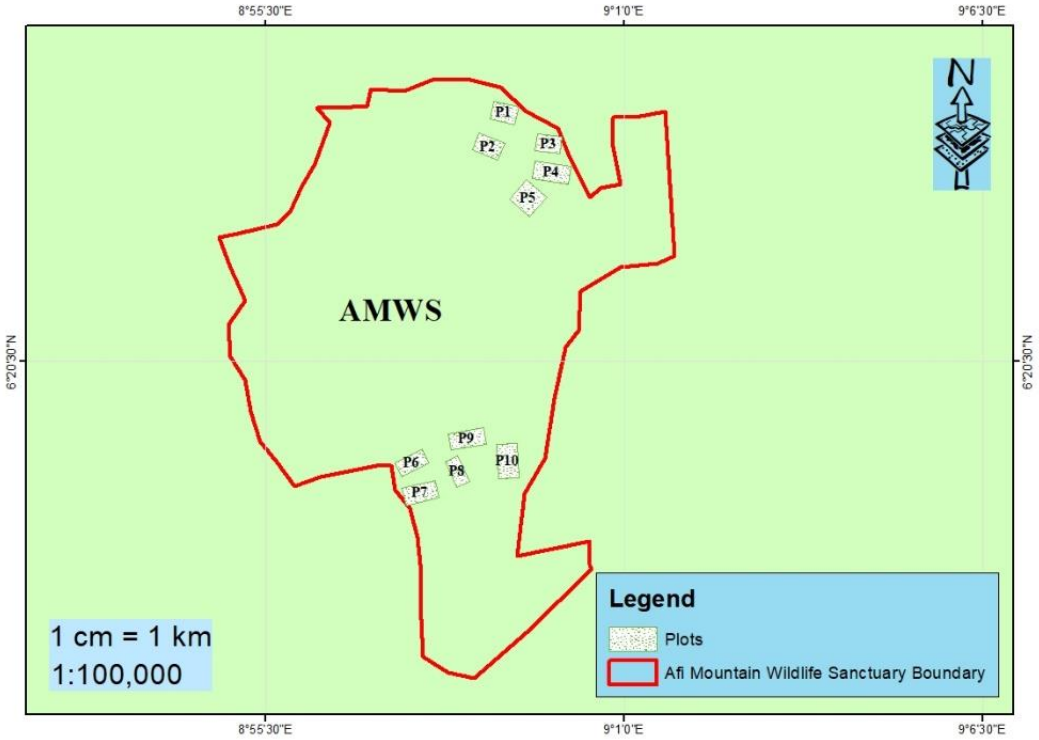

Figure 2. GPS location of the sample plots in the study area.

RESULTS

Big trees abundance in the study area.

The results on the abundance of big trees in the study area is presented in table 1. The results of big trees abundance in the study area Table 1, shows that sixty three (63) tree species were enumerated in the study area. The most abundance tree species were those of *Ananodium manii*, *Parkia bicolor* (10%) , *Canerium schweinfurthii and Irvengia gabonensis* (8%), and Antiaris toxicaria (6%).

Table 1: Large trees abundance in the study area.

S/No.	Tree species	Number	Percentage abundance (%)
1	*Canerium schweifurthii*	5	8
2	*Hanoa kleinniena*	2	3
3	*Enanthie chlorantha*	1	2
4	*Pilostigma pilosum*	1	2
5	*Chrysophylum welwitchii*	1	2
6	*Uvariopsis bakerienna*	1	2
7	*Antidesma vogolianum*	1	2
8	*Gossweilidendron balsamiferum*	1	2
9	*Cleistopholis patens*	2	3
10	*Coelocaryon preussii*	1	2
11	*Xylopia quintasii*	1	2
12	*Staudtia stipitata*	1	2
13	*Duboscia glusciencenes*	1	2
14	*Neoboutonia glabrescens*	1	2
15	*Parkia bicolor*	5	8
16	*Astonia boonie*	1	2
17	*Terminalia ivorensis*	1	2
18	*Sterculia tragacanta*	1	2
19	*Cola digitata*	1	2
20	*Milicia excelsa*	1	2

S/No.	Tree species	Number	Percentage abundance (%)
21	*Antiaris toxicaria*	4	6
22	*Irvengia gabonensis*	5	8
23	*Ananidium manii*	6	10
24	*Sterculia oblonga*	2	3
25	*Eliaes guinensis*	1	2
26	*Hylodendron gabonensis*	1	2
27	*Entantrophragma cylindricum*	1	2
28	*Panda oleosa*	1	2
29	*Xylopia aethiopica*	1	2
30	*Chrysophyllum delevoyi*	1	2
31	*Mamea africana*	1	2
32	*Ficus obtusifolia*	1	2
33	*Brachystegia nigerica*	1	2
34	*Guarea glumerutata*	1	2

Big Trees Distribution in the study area.

The results on the distribution of big trees in the study area is presented in table 2. The results of big trees distribution in the study area shows that of the sixty three (63) big trees enumerated in the study area, 42 (66.7%) were distributed or located in the Highland area while 21 (33.3%), were located in the lowland area.

S/No.	Tree species	Location	DBH(cm)	GPS Coordinates
1.	*Canarium schweinfurthii*	Highland	282	N 06’ 18.350 E 008’57.491
2.	*Hanoa kleinniena*	Highland	410	N 06’ 18.347 E 008’ 57.481
3.	*Enanthie chlorantha*	Highland	220	N 06’ 18.348 E 008’ 57.482
4.	*Pilostigma pilosium*	Highland	190	N 06’ 18.344 E 008’ 57.484
5.	*Chrysophylum welwitchii*	Highland	*210*	N 06’ 18.341 E 008’ 57.487
6.	*Uvariopsis bakerienna*	Highland	180	N 06’ 18. 341 E 008’ 57.486
7.	*Antidesma vogolianum*	Highland	195	N 06’ 18. 344E 008’ 57.486
8.	*Gossweilidendron. Balsamiferum*	Highland	170	N 06’ 18.345 E 008’ 57.489
9.	*Cleistopholis patens*	Highland	213	N 06’ 18.345 E 008’ 57.489
10.	*Coelocaryon preussii*	Highland	*201*	N 06’ 18.345 E 008’ 57.502
11.	*Xylopia quintasii*	Highland	188	N 06’ 18.350 E 008 57.486
12.	*Staudtia stipitata*	Highland	156	N 06’ 18.352 E 008’ 57.476
13.	*Duboscia glusciencenes*	Highland	210	N 06’ 18.350 E 008’ 57.478
14.	*Neoboutonia glabrescens*	Highland	260	N 06’ 18.414 E 008’ 57.713
15.	*Parkia bicolor*	Highland	156	N 06’ 18.416 E 008’ 57.708
16.	*Astonia boonie*	Highland	246	N 06’ 18.414 E 008’ 57.713
17.	*Uvariodendron callophyllum*	Highland	317	N 06’ 18.419 E 008’ 57.713
18.	*Terminalia ivorensis*	Highland	178	N 06’ 18.419 E 008’ 57.722
19.	*Sterculia tragacanta*	Highland	247	N 06’ 18.422 E 008’ 57.726
20.	*Cola digitata*	Highland	304	N 06’ 18.420 E 008’ 57.728
21.	*Milicia excelsa*	Highland	206	N 06’ 18.427 E 008’ 57.732
22.	*Antiaris toxicaria*	highland	184	N 06’ 18.418 E 008’ 57.730
23.	*Irvengia gabonensis*	Lowland	160	N 006’ 19.004 E 008’ 58.749
24.	*Ananidium manii*	Lowland	190	N 006’ 19.003 E 008’ 58.756
25.	*Cleistopholens patens*	Lowland	180	N 006’ 19.000 E 008’ 58.756
26.	*Sterculia oblonga*	Lowland	160	N 006’ 18.006 E 008’ 58.756
27.	*Sterculia oblonga*	Lowland	155	N 006’ 18.000 E 008’ 58.767
28.	*Eliaes guinensis*	Lowland	170	
29.	*Parkia bicolor*	Lowland	200	
30.	*Carnarium schweinfurthii*	Lowland	155	
31.	*Hylodendron gabonensis*	Lowland	160	
32.	*Ananidium mannii*	Lowland	150	
33.	*Antiaris toxicaria*	Lowland	157	N 006’ 19.002 E 008’ 58.750

S/No.	Tree species	Location	DBH(cm)	GPS Coordinates
34.	*Ficus obtusifolia*	Lowland	175	N 06’ 18.533 E008’ 58. 006
35.	*Entantrophragma cylindricum*	*Lowland*	350	N 06’ 18.533 E 008’ 58. 006
36.	*Canerium schweinfurthii*	Lowland	361	N 06’ 18.549 E 008’ 57.998
37.	*Panda oleosa*	Lowland	348	N 06’ 18.548 E 008’ 57.997
38.	*Xylopia aethiopica*	Lowland	304	N 06’ 18.552 E 008’ 58.002
39.	*Eribroma oblonga*	Lowland	196	N 06’ 18.544 E 008’ 57. 993
40.	*Hylodendron gabonensis*	Lowland	353	N 06’ 18.542 E 008’ 58.800
41.	*Terminalia ivorensis*	Lowland	332	N 06’ 18.533. E 008’ 58.021
42.	*Triplochiton scleroxylon*	Lowland	203	N 06’ 18.501. E 008’ 58.017
43.	*Hanoa klainniana*	Highland	*288*	N 006’ 18.899 E 008’ 58.560
44.	*Olax subscodate*	Highland	183	N 006’ 18.902 E 008’ 58.560
45.	*Enantia chlorantha*	Highland	172	N 006’ 18.902 E 008’ 58.560
46.	*Mamea Africana*	Highland	383	N 006’ 18.901 E 008’ 58.570
47.	*Arvingia gabonensis*	Highland	357	N 006’ 18.905 E 008’ 58.569
48.	*Triplochiton scleroxylon*	Highland	315	N 006’ 18.894 E 008’ 58.568
49.	*Antrocaryon micraster*	Highland	*200*	N 006’ 18.894 E 008’ 58.569
50.	*Xylopia quintasii*	Highland	*198*	N 006’ 18.894 E 008’ 58.568
51.	*Canerium schweinfurthii*	Highland	*195*	N 006’ 18.897 E 008’ 58.559
52.	*Chrysophyllum delevoyi*	Highland	*200*	N 006’ 18.897. E 008’ 58.559
53.	*Neoboutania glabrescens*	Highland	*410*	N 006’ 18.899 E 008’ 58.550
54.	*Trilepisium madagascariense*	Highland	*275*	N 006’ 18.897 E 008’ 58.550
55.	*Ananidium manii*	Highland	*158*	N 006’ 18.899 E 008’ 58.548
56.	*Piptadeniastrum africanum*	Highland	*262*	N 06’ 18.994 E 008’ 58.758

Evidence of illegal logging activity in the study area.

The results on evidence of illegal logging activity in the study area is presented in plates 1 and 2. The results of evidence of illegal logging activity in the study area Plates 1 and 2., shows that some level of illegal logging activity is going on in the study area, especially the lowland areas of the study area.

Plate 1. Illegally logged timber in the periphery of AMWS

Plate 2. Illegally sawn stump of *Afzelia africana*, near one the sample plots.

DISCUSSION

The presence of several big trees was noticed by the authors, Table1. These tree species in the study area, have been reported by several other *authors* including Daniel *et al.*, (2012), Bukie etal, (2017) and Bukie., (2019) However, the most abundance tree species enumerated by Edet et al., (2012) was that of *Afzelia bipendensis* in the study area. This could be because of the location of the plots in this study and that of Daniel *et, al*., (2012). Also, Adeyemi *et al*., (2015), reported similar tree species composition in the adjacent Cross River National Park (Okwango Division) with trees in different conservation status, from abundance to endanger. On the distribution of big trees species in the study area, Table 2, shows that majority of the big trees were located in the highland area of the Sanctuary. On evidence of illegal logging activities in the study area, plates 1 and 2, shows that there is some level of illegal logging activities going on in and around the lowland areas of the Sanctuary.This is because, there is increased anthropogenic activities in the lowland areas of the study area.This situation was reported by Bukie, (2019), and WCS., (2020 and 2021). Anthropogenic activities in the study area included illegal farming, logging and hunting in the study area.

CONCLUSION

In conclusion, it has been shown that there are large trees in the study area, and that these are distributed more in the highland than in the lowland area of the study area. It has also been shown that there is evidence of illegal logging activity in the study area, this could be the main reason why there are fewer big trees in the lowland than in the highland area of the sanctuary.

RECOMMENDATIONS

Based on the findings provided above, it is recommendation that, for the sustainability of the sanctuary and for posterity, strict enforcement of the Cross River State Forestry Law Cap11 of 2011. The rangers and law enforcement officers should be mandated to arrest and prosecutes all offenders. The State Forestry Commission would also see it as a matter of urgency to start a reforestation programme, to replant the logged as well as the destroyed areas of the sanctuary through bush burning. Finally, further study in the area of both flora and fauna abundance and distribution in the study area is required.

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