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Stem Diameter Distribution and Regeneration Potentials of the Most Abundant Timber Trees in Oban Forest Reserve, Cross River State, Nigeria

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Abstract

Sustainable management of the remaining areas of tropical rainforest is being canvassed globally. Quantitative and qualitative ecological data on the forests are indispensable for the actualisation of sustainable management. Accordingly, this study assessed the population structure and regeneration potentials of the most abundant timber trees in Oban Forest Reserve, Cross River State, Nigeria using transect and quadrat techniques for data collection on mature trees and regeneration. Data collected were subjected to descriptive statistical analysis and also fitted to regeneration potential function to determine regeneration potential index of each species. A total of 19 species were found to be the most abundant, with Celtisintegrifolia having the highest population density of 53 tree stands/ha, while Brachystegia eurycoma, Enantiachlorantha and Vitex grandifolia had the least of 5 per/ha each. Stem diameter-class of 20 – 29cm had the highest

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contractors due to their wide variety of species and sizes (Akinsanmi and Akindele, 2002; Olajide and Akpan-Ebe, 2006;Agyeman, 2013). Consequent upon the upsurge in human population, pressures have been placed on the tropical rainforest to meet the wood need of man for construction, furniture, packaging,shelter and energy. The pressures have culminated in widespread degradation, denudation and destruction of rainforest in many regions of the world, examples, Nigeria, Cameroun and Brazil.

The availability of wood products from the trees in the rainforest ecosystem on sustainable basis is dependent on the sustainable management of the remaining areas of the ecosystem. Sustainable natural forest management is predicated on the availability of quantitative and qualitative ecological data on the constituent trees, which include tree population density, stem diameter distribution and tree regeneration potentials. According to Betti *et al.* (2016), knowledge of the distribution of stems by diameter class is important for the effective management of a given forests, because it shows the structure of the population and helps in identifying deficiencies in regeneration capacity. Moreover, diameter class distributions provide a basis for designing timber harvesting regime and the adoption of silvicultural interventions (Olajide and Akinyemi, 2007; Betti *et al.*, 2016).

Thus, this paper is the report of a research on the population structure, stem size distribution and regeneration potentials of the most abundant timber tree species in Oban Forest Reserve (Rainforest Reserve), Southeastern Nigeria. It is hoped that the information obtained would help sustainable management of the forest.

of each belt transect were identified, enumerated and measured for diameter at breast height. It therefore translated to an area of 20,000m^2 assessed around each belt transect, and gross total of 60,000m^2 (6ha) enumerated for adult trees. Forty 5m x 5m quadrats were randomly alternately laid on both sides of each belt transect, and subsequently enumerated for regeneration of juvenile trees (< 20cm dbh). Thus, a total area of 3,000m^2 (0.3ha) was enumerated for tree regeneration. The data collections were made between years 2015 and 2016.

Data Analysis

Tree species having frequency of 30 individuals in the total sampled area were deemed the most abundant species. The population density of adult stands of individual tree species per hectare was calculated from the population in the whole sampled area (6ha). The population density of regeneration or juvenile stand of each tree species in the total sampled area (0.3ha)was computed and extrapolated to density per hectare. The stem size distribution was analysed by classifying the stems diameters into nine (9) diameter-classes and coded as follows: 20 – 29cm (class 1), 30 – 39cm (class 2), 40 – 49cm (class 3), 50 – 59cm (class 4), 60 – 69cm (class 5), 70 – 79cm (class 6), 80 – 89cm (class 7), 90 – 99cm (class 8) and 100 (class 9).

Natural regeneration potential index on per/ha basis was determined for each tree species using the modified function of Osho (1996) in Olajide *et al.,* (2010). The modified function is expressed as:

Table 1: Population density of the most abundant timber trees in Oban Forest Reserve, South eastern Nigeria

S/N	Trees species	Population in sampled area (6ha)	Population (per/ha)
1.	*Berlinia confuse*	49	8
2.	*Berlinia grandiflora*	265	44
3.	*Brachystegia eurycoma*	31	5
4.	*Celtis brownie*	92	15
5.	*Celtis integrifolia*	323	53
6.	*Coelocaryon preussii*	48	8
7.	*Coula edulis*	287	47
8.	*Diospyros mespiliforms*	232	38
9.	*Enantia chlorantha*	31	5
10.	*Irvingia gabonensis*	52	8
11.	*Pausinystelia johimbe*	48	8
12.	*Pterygota macrocarpa*	50	8
13.	*Pycnanthus angolensis*	118	19
14.	*Staudti astipitata*	46	7
15.	*Tabernaemontana pachysiphon*	93	15
16.	*Uapaca guineensis*	49	8
17.	*Uapaca staudtii*	54	9
18.	*Vitex ferruginea*	43	7
19.	*Vitex grandifola*	30	5

Table 2: Stem diameter distribution of the most abundant timber trees in Oban Forest Reserve, South eastern Nigeria

S/N	Species	Diameter class								
		1	2	3	4	5	6	7	8	9
1.	*Berlinia confuse*	12	15	10	5	4	2	-	1	-
2.	*Berlinia grandiflora*	53	63	55	34	12	12	9	7	23
3.	*Brachystegia eurycoma*	4	5	7	5	3	4	-	-	9
4.	*Celtis brownie*	31	26	23	6	5	1	-	-	-
5.	*Celtis integrifolia*	115	81	71	26	13	10	2	3	2
6.	*Coelocaryon preussii*	12	14	5	2	2	1	3	1	8
7.	*Coula edulis*	82	75	64	28	17	7	8	4	5
8.	*Diospyros mespiliforms*	77	68	59	15	9	2	-	-	2
9.	*Enantia chlorantha*	5	6	10	-	5	2	3	-	-
10.	*Irvingia gabonensis*	4	14	10	6	2	5	1	2	8
11.	*Pausinystelia johimbe*	15	18	6	3	3	-	2	-	1
12.	*Pterygota macrocarpa*	9	10	9	4	2	3	1	2	12
13.	*Pycnanthus angolensis*	33	24	19	7	7	4	1	5	20
14.	*Staudtia stipitata*	7	11	16	2	2	1	1	-	6
15.	*Tabernaemontana pachysiphon*	29	26	23	9	4	2	-	-	-
16.	*Uapaca guineensis*	5	12	12	10	4	4	-	1	2
17.	*Uapaca staudtii*	12	8	10	15	2	4	1	2	1
18.	*Vitex ferruginea*	6	12	4	6	3	3	-	3	7
19.	*Vitex grandifola*	7	6	8	5	2	1	-	-	1
	Total	**522**	**498**	**424**	**188**	**101**	**68**	**32**	**31**	**107**

Diameter-classes: 1 (20-29cm); 2(30-39cm); 3(40-49cm); 4(50-59cm); 5 (60-69cm); 6 (70-79cm); 7(80-89cm); 8 (90-99cm) and 9 (≥100cm)

Discussion

The abundance or rarity, stem size distribution and population structure (mature stands and regeneration) of a tree species in a tract of tropical rainforest are functions of the degrees of intensity of perturbation of the forest and exploitation of such tree species, and availability of favourable micro-climate for its regeneration and growth. It was observed in this study that the majority of the trees are of smaller stem diameter of 20 - 49cm, which indicates intense exploitation of many big trees for commercial timber production. This finding agrees with Etigale *et al.* (2014) that most of the trees in a reserved rainforest, which have been subjected to timber exploitation in the eastern bloc of Nigerian rainforest are of small stem diameters of between 10cm and 40cm. Moreover, similar findings had earlier been reported by Ogbonnaya (2002), Adekunle *et al.* (2002) and Newin (2014). The high population density of regeneration of some of the tree species is an indication of prevalence of canopy-gaps with favourable micro-climate which include infiltration of sunlight into the forest floor and availability of needed temperature for tree regeneration. Agyeman (2013) reported that, there was a preponderance of regeneration of many popular timber tree species in a logged rainforest in Ghana. According to Nwoboshi (1982) and Parthasarathy and Karthikeyan (1997), tree species that has a regeneration potential index of not less than 0.1 is deemed to have sustainable natural renewal capability. This implies that ten regeneration individuals out of 100 regeneration individuals of a tree species in a hectare will make it to the mature stage. Accordingly, only nine of the tree species (Table 4) have regeneration potential indices indicating sustainable natural regeneration capability.

The poor sustainable natural regeneration potentials of some of the tree species may be ascribed to the paucity of good microsites for the germination of their seeds and survival of their

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