POPULATION STRUCTURE OF WOODY PLANTS IN BLOCK A FOREST OF INTERNATIONAL INSTITUTE OF TROPICAL AGRICULTURE (IITA) IBADAN, OYO STATE, NIGERIA

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Abstract
The study was conducted in Block A forest of International Institute of Tropical Agriculture (IITA), Ibadan to investigate the population structure of woody plants species in the forest. Systematic random sampling method was employed to collect the vegetation data. A total number of 30 plots measuring 10m x 10m were sampled along three lines transect {D, E (0°N) and F (180°W)}of 500m long each. In each plot, all woody plants (trees and shrubs) with diameter at breast height (dbh) greater than or equal to 10cm (dbh $\geqslant$ 10cm) were identified, enumerated and diameter at breast height were measured and recorded. The data collected were analysed with descriptive statistics and Size Class Distribution (SCD) followed the visual graphical method. The results showed that 389 woody plants per 0.3 ha of forest were encountered. 47.06% of the woody plant species are rare, 30.88% species are commonly available and 22.06% are regarded available. 31 species are useful for medicine, timber, edible fruits, vegetables, chewing sticks, implements/ handcrafts, cleaning agents, poles and fuel wood. The population structure of woody plants community in the forest is in a partial stable state, it is in the secondary stage of regeneration. However, the regeneration and recruitment potential of woody plants in the forest could be hampered if the trend of anthropogenic activities is allowed to continue. Therefore, sustainability and conservation of forest should be given due attention to allow the forest to grow into full maturity stage particularly in Ibadan where most of the original forest cover have almost disappeared.

Key-words: Woody plants, Population structure, Transects, Anthropogenic, Regeneration and Recruitment

Introduction

Woody plants play an integral part of livelihood strategies for rural people, providing fruit, fodder, firewood, timber, traditional pharmaceutical products and many other products that are used locally or sold for monetary income (Ræbild *et. al*., 2007). The exploitation of these resources affects the population structure of woody plants in the forest. The structure of a population of plants may be described in terms of the age and size of the population, and the form of its life stages. Since the fecundity and survival of plants are much more closely related to size than age (Harper and White, 1974; Harper, 1977; Weiner, 1986), some authors have argued that it is preferable to classify the life history of a plant by size rather than by age (Werner and Casswell, 1977; Casswell 1986; Shaltout and Ayyad, 1988; Shaltout *et. al*., 2009). Size-class distribution of trees has traditionally been employed in studies of forests specifically as an indicator of changes in species composition (Anonymous, 1983; Newbery and Gartlan, 1996; Poorter *et. al*., 1996; Lykke, 1998). A reverse J-shaped size-class distribution curve is usually characteristic of a species with good regeneration and continuous replacement, whereas distribution curves deviating from such a reverse-J shape tend to indicate a lack of recruitment and may indicate changes in species composition (Hall and Bawa, 1993; Lykke, 1998). Like all ecosystems, forests undergo changes brought about by a combination of endogenous and exogenous processes (Richard and Daniel, 2004). The population size structure of a woody species reflects regeneration processes and, when compared with the spatial structure of the forest, can reveal important insights regarding forest dynamics (Takahashi *et. al*., 2001; Hou *et. al*., 2004).

For effective conservation of forest, it is important to have long-term monitoring data on the impact of human exploitation on the forest resources. However, such data are often unavailable. In the absence of long standing demographic data on population trends, standing-tree size distributions have been shown to be a potential and reliable tool for predicting species' responses to disturbance and resultant changes in population structure (Obiri *et. al*., 2002; Sokpon and Biaou, 2002; Feeley *et. al*., 2007; Tabuti, 2007; Venter and Witkowski, 2010). From a single survey of size-class distributions (SCD) which can be easily assessed, parameters such as health, viability, stability, composition, regeneration potential and population structures of woody plant tree species can be revealed.

SCD of trees in a stand is a static representation of population composition at a certain moment in time and can be problematic in estimating rates of change (Sokpon and Biaou, 2002). Regardless, from such data, direct observations can be attained that reveal how plant populations may be affected by extractive activities or other land-uses (Dalle *et. al*., 2002; Obiri *et. al*., 2002; Feeley *et. al*., 2007; Tabuti, 2007).

The Block A forest of IITA covers an area of about 50 hectares and is open to villagers living at the adjoining villages of IITA perimeter fence for collection of non-timber forest products (NTFPs) such as firewood, bamboo, waterleaf, palm kernel etc. and also to IITA staff for collection of poles, pegs and firewood for experimental field. These activities have been ongoing for about fifty years. However, it is important to know the current situation of woody plants in the forest. Besides, no research work has been undertaken to know the structure of woody plants in the forest. For this reason, the aim of this paper is to report on the study of the population structure and stability of Block A forest of IITA, using SCD. The results are important for the development and promotion of efficient management practices aiming at a sustainable use and conservation of the forest.

Materials and Methods

Study Area

The study area is Block A forest of International Institute of tropical Agriculture (IITA), Ibadan, Oyo State, Nigeria. IITA is located at longitude 7° 30'8"N, latitude 3° 54' 37"E and 243m above sea level (Tenkouano and Baiyeri, 2007).

Climate: The site falls within humid tropical lowland region with two distinct seasons: the longer wet season and shorter dry season. The wet season lasts for eight months and it extends from March to October while the dry season lasts for four months from November to February. The rainfall pattern is bimodal with an annual total which ranges from 1,300-1,500mm most of which falls between May and September. The average daily temperature ranges between 21°C and 23°C while the maximum is between 28°C and 34°C. Radiation is about 5285MJ/m^2/year. Mean relative humidity is in the range of 64% to 83%.

Vegetation: The natural vegetation in this area could be classified as a tropical semi-deciduous forest with various pockets of vegetation types ranging from derived savanna, secondary forest, and riparian types. According to Ezealor (2002), the area resembles mature Guinea-Congo lowland rainforest with scattered emergence of trees which include *Ceiba, Milicia* and *Terminalia* spp. Large clumps of bamboo (*Bambusa vulgaris)* are common; stands of *Raphia vinifera* are found along watercourses while scattered oil-palms *Elaeis guineensis* grow in both low-lying and the relatively better-drained upland areas. Thickets of climbers grow in openings where the secondary nature of the forest is most apparent.

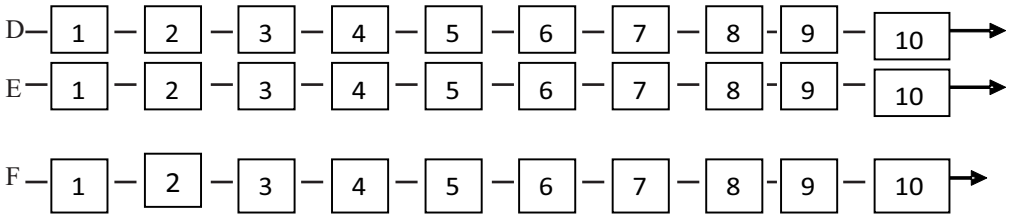
Tools: The following tools were used during the field survey: Prismatic compass for taking bearings, Meter rule, Cutlass, file, Flagging tape, Marker, Global positioning System (GPS), Recording sheets and Pencils.

Vegetation Data Collection

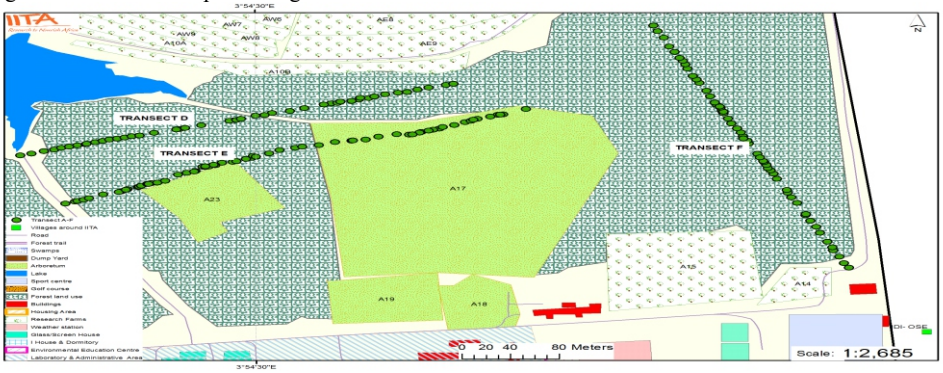
A reconnaissance survey was made in the forest to collect information on site conditions and determine sampling sites. Systematic sampling method (Mueller-Dombois & Ellenberg, 1974; Kent & Coker, 1992) was employed for an inventory of woody species in the study area. Three transects D, E (0°N) and F (180°W)}were constructed with the aid of prismatic compass in the forest. The transects were established with minimal disruption to the environment and marked with flagging tape at every 10m. Each transect was 500m long. 10 sampling plots of 10m by 10m each were demarcated along each of the transect making a total number of 30 sampling plots (3 transects by 10 plots). A distance of 40m was left between each of the plot to minimize repetition of plant species while 20 m was left at the beginning and at the end of each transect as the border row to minimize edge effects (figure 1). Also, in each sample plot, all woody plants (trees and shrubs) with diameter at breast height (dbh) greater than or equal to 10cm (dbh $\geqslant$ 10cm) were identified, counted and measured. The identification of plant species was carried out with the assistance of retired taxonomist from Forestry Research Institute of Nigeria. Samples of woody plants that cannot be identified on the field were coded and taken to the Forestry Research Institute of Nigeria, Ibadan (FRIN) herbarium for proper identification. The dbh was measured at 1.3 m above the soil level. Where the tree was on a slope, the diameter was measured from the uphill side of the tree. For fluted or buttressed trees, diameter measurement was taken 30 cm above the point where the flute or buttress disappeared into the stem. The number of each woody plant species was extrapolated to per hectare basis. Geographical Positioning System (GPS) was used to take the coordinates of transects at every 10 m intervals, this was plotted on the GPS arc view to know the position of each transect within the forests and to obtained the study location map (figure 2).

Data Analysis: The data were analyzed using descriptive statistics such as tables, frequency counts, percentages and graph.

Size-Class Distribution (SCD): Analysis of SCD followed the visual graphical method of Obot, (1994); Ariyo, (2007); Ariyo *et. al.,* (2011) and Ariyo, (2018). Data on Dbh were assembled in ten diameter size classes of 20 cm intervals (10- 30, 31-50, 51-70, 71- 90 etc). All individual with Dbh larger than 190 cm were grouped into a single class of greater than 190 cm. SCD was plotted on a graph against the number of individual woody plants to allow visual comparison. The interpretation of the shape of the graph gives an indication of the population structure of woody plants in the forest.



Legend: - Each line D, E and F are 500m long transect while 1, 2, 3, --------10 are plots of 10m by 10m each.
Figure 1: Transects and plots design



Source: Field Survey, 2017
Figure 2: Map of Block A forest showing the location of transect D, E and F

Results and Discussion

The list of tree species with their families and frequency of occurrence in the forest is presented on Table 1. The table showed a total number of 389 trees and shrubs with diameter at breast height (dbh) $\geqslant$ 10 cm belonging to 68 species and 27 families. Transect D and E had equal number (40 species) of woody plants from 21 and 20 families and total number of 124 and 144 individual woody plants respectively. Transect F had 45 species of woody plants from 21 families and a total number of 121 individual. This showed that Transect F had the highest number of woody plant species while Transect E had the highest number (144) of individual woody plants. However, the number of species, families and individual woody plants overlaps in each of the Transect D, E and F respectively. In a similar forest (Onigambari forest reserve) located at Ibadan, Oduwaiye and Ajibode (2015) recorded 68 woody plant species belonging to 33 families. The woody plant with the highest number of occurrence in this study is Newbouldia laevis, representing 33 individuals. This was followed by Lecaniodiscus cupanioides (28), Antiaris toxicaria var. africana (26) and Sterculia tragacantha (22). Others such as Albizia zygia Cola millenii and Trichlla monadelpha had 19, 18, and 16 individuals respectively. Some other species like Albizia adianthifolia, Allophyllus africanus, Alstonia boonei, Psydrax parviflora, Cassia fistula L., Ceiba pentandra, Cleistopholis patens, Euadenia trifoliolata, Kigelia africana, Lannea welwitschii, Leea guineensis, Mallotus oppositifolius, Morinda lucida, Nesogordonia papaverifera, Gmelina arborea, Rauvolfia vomitoria, Rothmannia hispida, Rytigynia umbellulata and Triplochiton scleroxylum occurred once in the forest (Table 1).

Table 1: Checklist of tree species, families and their occurrence at Block A forest of IITA

S/n	Woody Plant Species	Family	Form	TD	TE	TF	Total
1	*Albizia ferruginea (*Guill. & Perr.) Benth.	Fabaceae- Mim.	Tree	1	2	4	7
2	*Albizia adianthifolia var. adianthifolia*	Fabaceae- Mim.	Tree	.	1	.	1
3	*Albizia zygia* (DC.) J.F. Macbr.	Fabaceae- Mim.	Tree	3	14	2	19
4	*Alchornea cordifolia* (Schumach. & Thonn.) Mull.Arg.	Euphorbiaceae	Shrub	2	.	1	3
5	*Alchornea laxiflora* (Benth.) Pax & K.Hoffm.	Euphorbiaceae	Shrub	2	3	3	8
6	*Allophylus africanus* P.Beauv.	Sapindaceae	Shrub	.	.	1	1
7	*Alstonia boonei* De Wild.	Apocynaceae	Tree	1	.	.	1
8	*Anthonotha macrophylla* P.Beauv.	Fabaceae- Caes.	Tree	2	2	2	6
9	*Antiaris toxicaria var. africana Scott -Elliot ex A.Chev.*	Moraceae	Tree	6	13	7	26
10	*Blighia sapida* K.D. Koenig	Sapindaceae	Tree	2	2	2	6
11	*Blighia unijugata* Baker	Sapindaceae	Tree	1	.	1	2
12	*Bombax buonoposence* P. Beauv.	Bombacaceae	Tree	3	.	2	5
13	*Brachystegia eurycoma* Harms	Fabaceae- Caes.	Tree	.	2	.	2
14	*Bridelia micranthra* (Hochst.) Baill.	Euphorbiaceae	Shrub	.	1	2	3
15	*Psydrax parviflora* (K. Schum.) Bullock	Rubiaceae	Shrub	.	.	1	1
16	*Cassia fistula L.* Lam.	Fabaceae Caes.	Tree	.	.	1	1
17	*Ceiba pentandra* (L.) Gaertn.	Bombacaceae	Tree	.	.	1	1
18	*Celtis zenkeri* Engl.	Ulmaceae	Tree	4	7	3	14
19	*Cleistopholis patens* (Benth.) Engl. & Diels	Annonaceae	Tree	1	.	.	1
20	*Cola gigantean* A. Chev.	Malvaceae	Tree	.	.	2	2
21	*Cola millenii* K. Schum	Malvaceae	Tree	3	2	13	18
22	*Daniellia ogea* (Harms) Holland	Fabaceae- Caes.	Tree	1	.	1	2
23	*Dichapetalum madagascariense* Poir	Dichapetalaceae	Shrub	3	.	.	3
24	*Diospyros monbuttensis* Gurke	Ebenaceae	Shrub	2	3	.	5
25	*Elaeis guineensis* Jacq.	Palmae	Tree	3	4	2	9
26	*Euadenia trifoliolata* (Schumach. & Thonn.) Oliv.	Capparidaceae	Shrub	.	.	1	1
27	*Ficus exasperata* Vahl	Moraceae	Tree	3	2	5	10
28	*Ficus mucuso* Welw. Ex Ficalho	Moraceae	Tree	2	2	.	4
29	*Funtumia elastic* (Preuss) Stapf	Apocynaceae	Tree	3	2	2	7
30	*Glyphaea brevis* (Spreng.) Monach.	Tiliaceae	Shrub	2	.	1	3
31	*Grewia pubescens* P. Beauv.	Tiliaceae	Shrub	2	.	.	2
32	*Holarrhena floribunda* (G.Don) T.Durand & Schinz	Apocynaceae	Tree	3	4	2	9
33	*Hura crepitans* L.	Euphorbiaceae	Tree	.	.	1	1
34	*Kigelia africana* (Lam.) Benth.	Bignoniaceae	Tree	.	.	1	1
35	*Lannea welwitschii* (Hiern) Engl.	Anacardiaceae	Tree	.	.	1	1
36	*Lecaniodiscus cupanioides* Planch. Ex Benth.	Sapindaceae	Tree	3	17	8	28
37	*Leea guineensis* G. Don	Leaceae	Shrub	.	1	.	1
38	*Leucaena leucocephala* (Lam.) de Wit	Fabaceae- Mim.	Tree	.	3	3	6
39	*Philenoptera cyanescens* (Schum. & Thonn.) Benth.	Fabaceae- Pap.	Shrub	2	.	.	2
40	*Lonchocarpus sericeus* (Poir.) DC.	Fabaceae- Pap.	Shrub	5	7	2	14
41	*Mallotus oppositifolius* (Geiseler) Mull. Arg.	Euphorbiaceae	Shrub		1		1

42	*Manihot glaziovii* Mull. Arg.	Euphorbiaceae	Tree	.	2	2	4
43	*Microdesmis puberula* Hook.f.ex Planch	Pandaceae	Shrub	.	2	2	4
44	*Millettia thonningii* (Schum. & Thonn.) Baker	Fabaceae-Pap.	Tree	.	2	3	5
45	*Monodora tenuifolia* Benth.	Annonaceae	Tree	2	3	2	7
46	*Morus mesozygia* Stapf	Moraceae	Tree	.	2	.	2
47	*Myrianthus arboreus* P.Beauv.	Moraceae	Tree	1	2	1	4
48	*Napoleona vogelii* Hook. & Planch.	Lecythidaceae	Shrub	8	.	.	8
49	*Morinda lucida Benth.*	Rubiaceae	Tree	.	1	.	1
50	*Nesogordonia papaverifera* (A. Chev.) Capuron ex	Malvaceae	Tree	1	.	.	1
51	*Newbouldia laevis* (P.Beauv.) Seem.	Bignoniaceae	Tree	19	11	3	33
52	*Gmelina arborea* Roxb.	Lamiaceae	Tree	.	1	.	1
53	*Oxyanthus tubiflorus* (Andr.) DC.	Rubiaceae	Shrub	.	2	.	2
54	*Pavetta corymbosa* (DC.) F.N.Williams	Rubiaceae	Shrub	.	3	.	3
55	*Pisdium guajava* Linn.	Myrtaceae	Tree	.	2	.	2
56	*Pycnanthus angolense* (Welw.) Warb.	Myristicaceae	Tree	2	.	2	4
57	*Rauvolfia vomitoria* Afzel.	Apocynaceae	Shrub	1	.	.	1
58	*Ricinodendron heudelotii* (Baill.) Heckel	Euphorbiaceae	Tree	.	.	3	3
59	*Rothmannia hispida* (K. Schum.) Fagerlind	Rubiaceae	Shrub	.	.	1	1
60	*Rytigynia umbellulata* (Hiern) Robyns	Rubiaceae	Shrub	1	.	.	1
61	*Senna siamea* (Lam.) H. S. Irwin & Barneby	Fabaceae-Caes	Tree	1	.	2	3
62	*Spondias mombin* Linn.	Anacardiaceae	Tree	2	3	.	5
63	*Sterculia tragacantha* Lindl.	Malvaceae	Tree	13	5	4	22
64	*Strombosia pustulata* Oliv.	Olacaceae	Tree	.	.	2	2
65	*Trichlla monadelpha* (Thonn.) J.J. de Wilde	Meliaceae	Tree	4	3	9	16
66	*Trilepisium madagascariense* DC.	Moraceae	Tree	1	3	5	9
67	*Triplochiton scleroxylum* K. Schum	Malvaceae	Tree	.	1	.	1
68	*Voacanga africana* Stapf ex Scott-Elliot	Apocynaceae	Tree	2	3	2	7
	Total			**124**	**144**	**121**	**389**
	Number of species			**40**	**40**	**45**	**68**
	Number of families			**21**	**20**	**21**	**27**

Source: Field Survey, 2017
TD = Transect D, TE= Transect E and TF= Transect F

Classes of Species According to their Distribution

The species were further classified into three groups according to their distribution as presented in Table 2. The species that are available in all transects are regarded as commonly available, those that occurred in only two transects are regarded as available while those that occurred in only one transect are regarded as rare. The table showed that 32 (47.06%) species of the inventoried trees are considered rare because they occurred in only one transect. 21 (30.88%) species are commonly available because they are sighted in all the three transects while only 15 (22.06%) species were recorded from two transects and are regarded as available. This is in line with the report of ***Oduwaiye and Ajibode*** (***2015***) in their study of Composition of tree species and regeneration potential at Onigambari forest reserve, Ibadan, found 31 tree species available, 27 tree species rare and 10 tree species commonly available respectively.

Table 2: Classes of Species According to their Distribution

Commonly available in all transects (D, E & F)	Available in 2 transect (D & E, D & F, E & F)	Rare species except in one transect
Albizia ferruginea	*Alchornea cordifolia*	*Albizia adianthifolia*
Albizia	*Blighia unijugata*	*Allophylus africanus*
Alchornea laxiflora	*Bombax buonoposence*	*Alstonia boonei*
Anthonotha macrophylla	*Bridelia micranthra*	*Brachystegia eurycoma*
Antiaris toxicaria	*Daniellia ogea*	*Psydrax parviflora*
Blighia sapida	*Diospyros monbuttensis*	*Cassia fistula L.*
Celtis zenkeri	*Ficus mucuso*	*Ceiba pentandra*
Cola millenii	*Glyphaea brevis*	*Cleistopholis patens*
Elaeis guineensis	*Leucaena leucocephala*	*Cola gigantean*
Ficus exasperata	*Manihot glaziovii*	*Dichapetalum madagascariense*
Funtumia elastic	*Microdesmis puberula*	*Euadenia trifoliolata*
Holarrhena floribunda	*Millettia thonningii*	*Grewia pubescens*
Lecaniodiscus cupanioides	*Pycnanthus angolense*	*Hura crepitans*
Lonchocarpus sericeus	*Senna siamea*	*Kigelia africana*
Monodora tenuifolia	*Spondias mombin*	*Lannea welwitschii*
Myrianthus arboreus		*Leea guineensis*
Newbouldia laevis	**Total =15 species=22.06%**	*Philenoptera cyanescens*
Sterculia tragacantha		*Mallotus oppositifolius*
Trichlla monadelpha		*Morus mesozygia*
Trilepisium madagascariense		*Napoleona vogelii*
Voacanga africana		*Morinda lucida*
		Nesogordonia papaverifera
Total= 21 species = 30.88%		*Gmelina arborea*
		Oxyanthus tubiflorus
		Pavetta corymbosa
		Pisdium guajava
		Rauvolfia vomitoria
		Ricinodendron heudelotii
		Rothmannia hispida
		Rytigynia umbellulata
		Strombosia pustulata
		Triplochiton scleroxylum
		Total= 32 species = 47.06%

Source: Field Survey, 2017

Analysis of Population Structure of Woody Plants in the Forest

Plant population structures help to understand the general trend of population dynamics and also provide valuable information about their regeneration, recruitment and viability status that could be used for developing evidence-based conservation and management strategies (Popma *et.al.*, 1988; Yineger *et. al*., 2008). The Population structure of woody plants followed a specific predictable pattern of size class (cm) distribution. The stable plant community is expected to exhibit a reversed "J" curve of age distribution in which there are enough seedlings and saplings to replace the mature trees when they eventually die (Obot, 1994; Ariyo, 2007, Ariyo, *et. al.*, 2011).Woody plant size class distribution in each transects and Block A forests (Figure 3) approximately show a stable plant population because they exhibit a reversed "J" curve of size (age) class distributions with more trees at the lower diameter class, followed by a general decrease in number of trees at the upper diameter class. Analysis of the population structure of the woody plant species in the forest revealed a stable plant community with deviation in all the transects and in the forest as a whole.

The deviation in transect D, E and F in the forest as revealed on Table 3 showed that transect D and E recorded 5 and 8 number of woody plants in the size class of 131-150 cm which were higher than the value of 3 each obtained in the size class of 91-110 cm and 111-130 cm for transect D while transect E recorded 6 and 4 number of woody plants in the same size classes. No woody plants were found in transect E and F at the size class of 171-190 cm, the same for a size class of 151-170 cm for transect D. Transect D, E, and F, had 4 equal number of woody plants in the size class of 71-90 cm, 111-130 cm and 91-110 cm respectively. Also, the same

trends were observed in size class of 171-190 cm, > 190 cm for transect D, 151-170 cm, 131-150 cm for transect E and F with 2 number of woody plants respectively. Transect F had 5 as the highest number of woody plants in the size class of > 190 cm as compared to 2 and 1 obtained in transect D and E. However, when the value of the three transects was pooled together, it showed that 8 number of woody plants were encountered in the size class of > 190 cm which was higher than the valued (4 and 2) recorded in the size class of 151-170 cm and 171-190 cm respectively. The highest frequency of woody plants (73, 59 and 44) encountered in transect D, E and F were found in the size class of 10-30 cm. The table generally showed that the larger the size classes the lower the frequency of occurrence of woody plants in all transects apart from little deviations as explained above.

The 3.86% of woody plants encountered in the size class of 131-150 cm was higher than 2.83% and 3.34% obtained in the size classes of 111-130 cm and 91-110. Also, the number of woody plants recorded (2.06%) at the size class of > 190 cm was equally higher than the number encountered (0.51% and 1.03%) in 171-190 cm and 151-170 cm size classes. The table further revealed that transect D, E, and F had 124, 144 and 121 woody plants which equals to 389 woody plants per 0.3 ha of the forest. This follows that 648 woody plants (trees and shrubs) will be encountered in one hectare of the forest.

Generally, the woody plants population structure of the forest represents an inverted J-shape distribution although there are limited numbers of woody plants in the middle and higher diameter classes of 151 cm – 170 and 171 cm - 190 cm. This might be due to anthropogenic disturbance such as selective cutting of young and matured individual trees for different purposes. It might be due to firewood removal by the women living in the adjoining villages of IITA perimeter fence, stakes/ poles removal by the IITA staff for experimental fields. This kind of inverted J-shape population structure implies a good reproduction and recruitment status of the species in the forest (Zegeye *et. al*., 2011; Gurmessa *et.al*., 2012; Fisaha *et. al.,* 2013; Tadele *et. al*., 2014).

The size differences in woody plant populations of each transect revealed in this study may be caused directly or through differences in growth rates due to age differences, genetic variation, and heterogeneity of resources, competition, and anthropogenic impacts. This agreed with the findings of Weiner (1985). As reported by Gray (1975), the topography and relative abundance of plants with a dense crown, along with the frequency and abundance of rainfall and human impacts are among the important variables to be accounted for in an attempt to quantify the capacity of species for regeneration. Human impact in forest environments frequently leads to vegetation changes that take place faster than natural vegetation transformations, as human impact-caused disturbances often occur in the form of continuous and widespread stress, e.g. cutting, frequent fires, grazing, and construction of roads and buildings. In environments where population changes are significant, the impact of population change on vegetation structure might override other demographic parameters (Lykke, 1998).

Table 3 : Distribution and Number of Woody Plants Encountered in Block A forest of IITA with their Size Classes

Size class	TD	TE	TF	BAF	% BAF
10-30	59	73	44	176	45.24
31-50	30	27	32	89	22.88
51-70	16	16	17	49	12.60
71-90	4	7	11	22	5.66
91-110	3	6	4	13	3.34
111-130	3	4	4	11	2.83
131-150	5	8	2	15	3.86
151-170	0	2	2	4	1.03
171-190	2	0	0	2	0.51
>190	2	1	5	8	2.06
Total/0.1ha	124	144	121	389/0.3 ha	100
Total/ ha	207	240	202	648	

Source: Vegetation survey, 201 7

TD – Transect DTE = Transect FTF = Transect F BAF = Block A forest

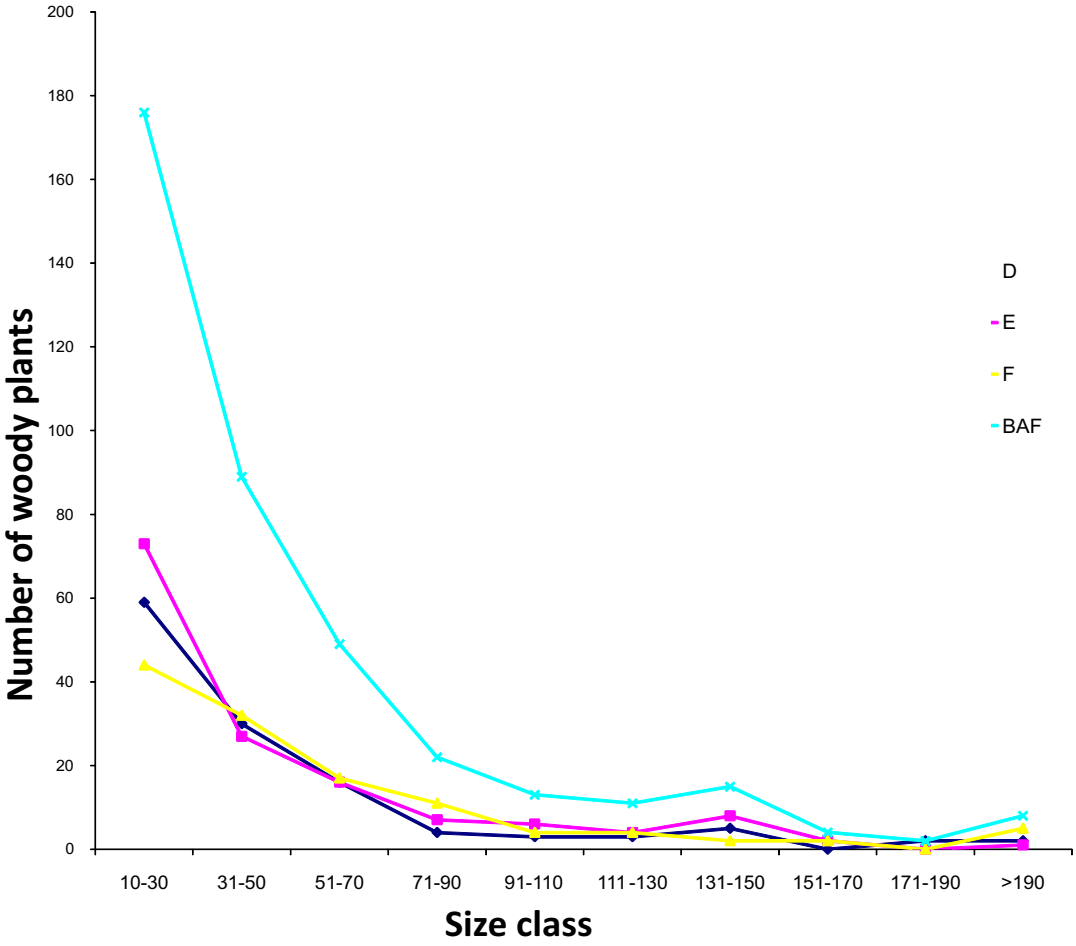


Figure 3: Woody plant size (age) class distribution in Block A forest of IITA

Usefulness of Some of the Tree Species

The usefulness of some of the species is presented on Table 4. Thirty one species are useful and are used as medicine, timber, edible fruits, vegetable, chewing sticks, implements/ hand crafts, fencing, cleaning agents, pole and fuel wood. The medicinal plants formed the majority (20 species) and are used singly or in combination with other plants in the treatments of malaria, typhoid fever, yellow fever, pile, erectile dysfunction and backache. Some species are used to treat cough, sickle cell symptoms, hypertension, skin rachis, ulcer and intestinal worm. Others are used for poles, to clear dark tongue and for sound sleep.

Table 4: U sefulness of some of the Tree Species

S/n	Species	Uses
1	*Alchornea laxiflora*	Medicinal: Squeeze the fresh leaves with water and drink to treat malaria
		Medicinal: The bark of the plant is soaked in undiluted palm wine, with small local pepper for about 6-7 hours. Drink a glass cup 2 times daily to treat malaria. If galic (*Allium sativum*) and *Allium ascalonicum* (*alubosa elewe*) are added, the liquid is used to treat typhoid fever and yellow fever
2	*Alstonia boonei*	Timber
3	*Antiaris toxicaria*	Timber, Edible fruits
4	*Blighia sapida*	Timber
5	*Bombax buonoposence*	Medicinal: Used with other herbs in the treatment of Pile, Erectile dysfunction, Tonsillitis, Measles and for coating tongue.

6	*Bridelia micranthra*	Used as fuel wood and chewing stick,
7	*Cassia fistula*	Medicinal: Used with other herbs in the treatment of Pile, Erectile dysfunction
8	*Ceiba pentandra*	Timber, Vegetable
9	*Cola millenii*	Edible fruits
10	*Daniellia ogea*	Timber
11	*Diospyros monbuttensis*	Implements: The stems are used for gun butt, axe handle, pestle and also used to trap animals with wire. Medicinal: Used with other herbs in the treatment of Cough, rheumatism. Palm kernel oil used with other herbs in the treatment of snakebites The seedling of palm tree uprooted at once is squeeze with water and drink to treat backache
12	*Elaeis guineensis*	Fuel, Implement/ handcraft, Fencing, Oil, Medicinal: Cut the root into pieces and put it in plastic bottle with water. Or squeeze fresh tender leaves in water and drink to cure cough.
13	*Ficus exasperata*	Used as Timber and Cleaning agent.
14	*Funtumia elastic*	Timber
15	*Gmelina arborea*	Pole, Timber
16	*Holarrhena floribunda*	Timber
17	*Kigelia africana*	Medicinal: Used with other herbs for the treatment of sickle cell and hypertension
18	*Lannea welwitschii*	Medicinal: Used with other herbs for the treatment of skin rachis
19	*Lecaniodiscus cupanioides*	Medicinal: Used with other herbs in the treatment of erectile dysfunction, typhoid fever Used for Implement- hoe, axe handle Used as fuel wood.
20	*Philenoptera cyanescens*	Medicinal: Used with other herbs for the treatment of Malaria Medicinal: Used with other herb in the treatment of intestinal worm (worm expeller or deworming)
21	*Mallotus oppositifolius*	Medicinal: Used with other herbs in the treatment of erectile dysfunction
22	*Microdesmis puberula*	Medicinal: Squeeze the fresh leaves with small stout and drink to cure malaria.
23	*Morinda lucida*	Used with other herbs to treat malaria
24	*Newbouldia laevis*	Medicinal: Used with other herbs in the treatment ulcer
25	*Pisdium guajava*	Medicinal: Used with *Spondias mombin* to treat cough Edible fruits. Medicinal: Collect the latex in a small bottle and use it with cotton wool to clear dark tongue.
26	*Pycnanthus angolense*	Used for Timber
27	*Rauvolfia vomitoria*	Medicinal: Cook the fresh leaves of the plant and that of bamboo and drink for sound sleep
28	*Ricinodendron heudelotii*	Used for Timber
28	*Senna siamea*	Medicinal: Used with other herbs in the treatment of Erectile dysfunction

Conclusion and Recommendation

It can be concluded from the results of the findings that a total number of 389 trees with diameter at breast height (dbh) $\geqslant$ 10 cm belonging to 68 species and 27 families were encountered in the forest. *Newbouldia laevis* had the highest number of occurrence. 32 species of the inventoried trees are considered rare, 21 species are commonly available and 15 species were regarded available. Majority of the species are used for medicinal purposes. Generally, the observed representative population structure of woody plant species in Block A forest are indicators for the need to take appropriate conservation measures by the forest unit of IITA. Though the population structure of woody plants in the forest is in a partial stable state, it is in the secondary stage of regeneration. However, the regeneration and recruitment potential of woody plants in the forest could be hampered if the trend of anthropogenic activities is allowed to continue. Therefore, sustainability and conservation of forest should be given due attention to allow the forest to grow into full maturity stage particularly in Ibadan where most of the original forest cover have almost disappeared.

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