

**FLORISTICS AND STRUCTURE OF THE REMNANT FORESTS OF THE  
OBAFEMI AWOLowo UNIVERSITY CAMPUS, ILE-IFE NIGERIA AND THEIR  
POTENTIAL FOR CONSERVATION.**

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**ABSTRACT.**

The floristic composition and the girth sizes of the woody plants in seventeen sample forest plots at the Obafemi Awolowo University, Ile-Ife, Nigeria were studied with a view to making recommendations on the conservation of the forest. The 120 species found are those typical of drier lowland forest of southern Nigeria. Twenty-six species occurred in 8 of the 17 plots while 28 occurred in one plot each and could be regarded as rare. About 70% of the stems are less than 30 cm girth at breast height, an indication of recent disturbance. *Brachystegia eurycoma* dominated the  $\geq 120$  cm girth class and was found on hilly slopes that were unsuitable for farming. The benefits of conservation of the Campus forest include protection of an important watershed and teaching and research.

**INTRODUCTION**

The need to conserve representative samples of natural Vegetation as units of biodiversity is an issue of global interest. The rationale for the conservation of biodiversity used to be based on its several economic benefits but this basis for biodiversity valuation is now being questioned. According to Erhenfeld (1988), value is an intrinsic part of diversity and does not depend on the properties of the species in question, the uses to which it may or may not be put or the alleged roles in the balance of global systems. Biodiversity should thus be conserved for both perceived economic benefits and for its intrinsic value which may not be immediately realisable.

Nigeria's natural vegetation is being lost at a very fast rate (Ola-Adams and Iyamabo 1977) with the Akure Forest Reserve, for example, losing 260 hectares per year to cultivation. Species loss could be attributed to over-exploitation and non replacement of natural vegetation due to failure of natural regeneration. But by far the most important factor in the loss of natural vegetation is rotational slash and burn agriculture which is responsible for 70% of all deforestation in Africa (Hadley & Lanley 1983). Tropical moist forest occupies about a third of Nigeria's 92 million hectare land area. Only about 2 million hectares of the forest remain, mainly in reserves (NEST 1991).

The fate of the forest vegetation at the Obafemi Awolowo University, Ile-Ife typifies the national trend of deforestation. The University is in the lowland forest zone according to Keay (1959), semi-deciduous moist forest of Charter (1969) and what White (1983) described as Guinea-Congolian forest, drier type. The Ile-Ife area belongs to the dry forest sub-group rich in

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trees of the families Sterculiaceae and Moraceae (Hall 1977) and also the Ulmaceae (Keay 1957). Swaine (1992) also discusses the characteristics of such dry forests. The dry nature of the Ife forest is demonstrated by the fact that wherever the soil is shallow, as on the slopes of inselbergs, humid savanna vegetation develops (Adejuwon 1971).

The University Campus (Fig. 1) occupies an area of 5600 hectares of which the built-up, central campus and the University farms occupy 3349 hectares. As at 1985 re-growth forest, most of it around two (Hills I and II) of the three inselbergs on the northwestern corner of the central campus, occupied an estimated 1234 hectare. The largest patch of forest is around Hill I and it is within it that the Biological Gardens, comprising a Zoo and a Botanical Garden are located. Most of the forest is no more than fifty years old (Sijuwade, personal communication.) except for the top of Hill I where shallow soils must have limited farming in the past. Some of the forests are much younger having been farmed up to the time the University took possession of the land in the mid 1960's.

Most of the forest has now been disturbed by rotational slash and burn crop farming. There was very little farming in the campus before the introduction of the 'Operation Feed the Nation' programme in Nigeria in 1977. Farming is often accompanied by uncontrolled bushfires which have devastated the vegetation in many areas (Isichei *et al.* 1986). There has also been an upsurge in logging activity since the University established a sawmill in 1982. Farming and associated fires, logging and persistent firewood gathering have contributed to the reduction of forest area and resulted in gaps in the uncleared parts and a general denudation of the forest.

There has recently been some concern over the disappearing campus forest and efforts are now being made towards the conservation of the remnants. Such a concern is largely due to the fear that the lake created by damming Opa River which is the source of drinking water to the University community, may be silted up from eroding cleared lands. There are also fears that chemicals dangerous to humans may be used in the farms and may eventually drain into the lake. This study takes an inventory of the remnants of the secondary forest with a view to identifying the species composition and structure of the forest. The nature of the disturbed vegetation and thus the pattern of succession in the area will also be examined. Subsequently, it will be possible to examine the relationship between vegetation physiognomy and water erosion sediment yield in the campus river basin system.

Floristics and structure of fallow have been used to describe the course of succession in West Africa as those two vegetation attributes could also be indicative of site potential in terms of land use (Hall & Okali 1979). This study will thus consider floristic composition and aspects of vegetation structure that will enhance the description of the Ife forests in the context of the dry forests of western Nigeria.

## MATERIALS AND METHODS

## (i) The Study Area

The study was carried out at the Obafemi Awolowo University, Ile-Ife (7° 31'N latitude and 4° 31' E longitude) in Osun State, Southwestern Nigeria. The area is underlain by metamorphic rocks of the Precambrian Basement Complex. The rocks consist of banded gneiss and migmatite quartzites, quartz, mica schists and related rocks (Smyth and Montgomery 1962). The soils are moderately to strongly leached and have low to medium humus content, weakly acid to neutral surface layers and moderately to strongly acid sub-soils (Smyth and Montgomery 1962).

The climate of the area is humid tropical with distinct dry and wet seasons. The wet season starts from around mid-March to late October and the rainfall pattern is bi-modal with peak periods in July and September. The dry season runs from November to March but a short dry spell usually occurs in August (Jeje and Agu, 1982). The mean annual rainfall is about 1400mm. The mean

Table 1. The most common species and their percentage frequencies of occurrence in 17 study plots in the remnant forest at the Obafemi Awolowo University, Ile-Ife.

Species	%Frequency	Stem Density ha <sup>-1</sup>
<i>Albizia adianthifolia</i> (Schumach) W.F. Wright	47	22
<i>Albizia zygia</i> (DC) J.F Macbride	76	106
<i>Alstonia boonei</i> De Wild	71	19
<i>Antiaris africana</i> Engl.	76	90
<i>Baphia nitida</i> Lodd	59	37
<i>Bombax buonopozense</i> P.Beauv	59	23
<i>Bosquiea angolense</i> Ficalho Wass	53	18
<i>Celtis zenkeri</i> Engl	71	41
<i>Cola millenii</i> k. Schum	100	120
<i>Dialium guineense</i> Wild	53	27
<i>Elaeis guineensis</i> Jacq	59	18
<i>Funtumia elastica</i> (Preuss)Staff	76	313
<i>Holarrhena floribunda</i> (G.Don)Dur. & Schinz	47	36
<i>Lecaniodiscus cupanioides</i> Planck. ex Benth	94	85
<i>Microdesmis puberula</i> Hook.F. ex Planch	59	20
<i>Monodora tenuifolia</i> Benth.	47	33
<i>Myrianthus aboreus</i> P.Beauv	53	50
<i>Nepoleana vogelii</i> Hook & Planch	47	27
<i>Newbouldi laevis</i> (P.Beauv)Seemann ex Bureau	82	38
<i>Olax subscorpioidea</i> Oliv	53	78
<i>Rauvolfia vomitoria</i> Afz	53	31
<i>Ricinodendron heudelotii</i> (Baill)Pierre ex Pax	59	20
<i>Rothmania longiflora</i> Salisb.	53	16
<i>Sterculia tragacantha</i> Lindl.	82	98
<i>Tabernamontana pachysiphon</i> Stapt.	59	57
<i>Manihot glaziovii</i> Muell. Arg.	18	126

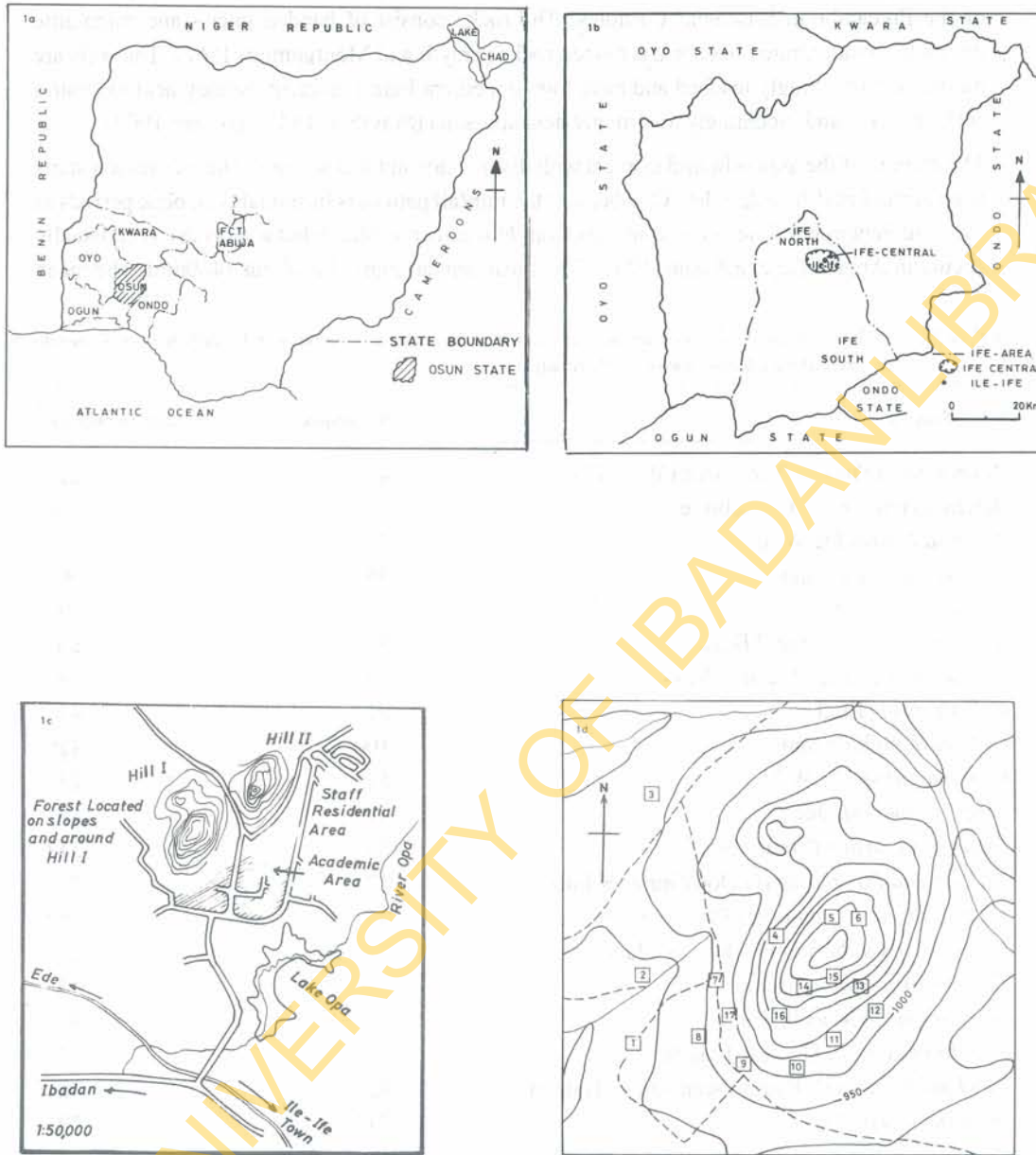


Fig.1. (a) Map of Nigeria showing the location of Osun State; (b) Osun State showing Ife Central Local Government where the Obafemi Awolowo University is located; (c) the Obafemi Awolowo University Campus, and (d) Details of the sampling location around Hill 1 and the 17 sample plots.

maximum temperature of 33°C is recorded between February and March while the mean minimum temperature (27°C) is recorded between July and September.

(ii) *Selection of Study Plots*

Hill I and the surrounding forest cover approximately 306 hectares. Seventeen 25 m X 25 m plots subjectively chosen to ensure representation of all stages of forest maturity and to cover all sides of the hill with their differing slopes were used for the study (Fig. 1).

(iii) *Floristic Survey and Measurement of Vegetation attributes.*

In each plot, all woody plants  $\geq 2$  metres in height were counted, identified and their girths at breast height (gbh) measured with a tape. A woody plant once enumerated was marked with a number in such a way that different species as well as their individuals were distinguished. The following vegetation attributes were extracted from the enumeration: species diversity index, total basal area per species and per plot, percentage contribution of the most abundant species and percentage contribution of the five most abundant species.

Species diversity index was calculated as the Shannon-Wiener ( $H^1$ ) index (Shannon and Wiener,

$$1949): H^1 = - \sum P_i \ln P_i$$

where  $P_i = n_i/N$ ;

$n_i$  = Number of individuals of the  $i$ th species.

$N$  = Total number of individuals in the plot.

Ordination of the seventeen plots based on their composition was carried out using Principal Components Analysis. In the ordination, data were standardized to zero mean and variance using the Z-score transformation.

## RESULTS AND DISCUSSION

(1) *Species Composition and Diversity*

One hundred and twenty different woody plant species were observed in the 17 plots used for the study. The species most frequently encountered in the plots are listed in Table 1. Twenty-five species occurred in eight or more of the 17 study plots.

*Cola millenii*\*, *Lecaniodiscus cupanioides*, *Newbouldia laevis* and *Sterculia tragacantha* were the most frequent species. Also found in many plots were *Albizia zygia*, *Antiaris africana*, *Celtis zenkeri* and *Funtumia elastica*. *Manihot glaziovii* occurred in just three plots but had a large population in each of these confirming its gregarious character in early successional plots (Isichei et al 1986). *Funtumia elastica* also has a large population in the study area. The species encountered are typical of the drier-type, semi-deciduous moist, lowland forest found in western

\* Species nomenclature is after Hutchinson and Dalziel, (1954 - 1972)

Table 2. Vegetation attributes of the seventeen sample plots used to characterize the forest vegetation of the Obafemi Awolowo University Campus, Ile-Ife.

Plot	Shannon-Wiener Diversity index	No of species	Total basal area (cm <sup>2</sup> )	%basal area contributed by most abundant species	%basal area contributed by 5 most abundant species	Mean girth (cm)
1	2.914	38	13601.74	31.7	51.8	1291.9
2	2.937	38	22110.44	23.1	54.4	1384.9
3	1.875	22	19371.49	47.9	83.0	781.3
4	3.210	34	14839.57	10.8	41.2	1278.3
5	2.820	22	9855.68	15.1	52.7	914.7
6	2.470	16	48831.32	25.0	63.8	1491.1
7	3.234	41	11727.40	10.8	43.3	990.1
8	2.914	49	18111.99	36.7	56.1	1754.8
9	2.903	27	7516.26	19.2	51.9	680.4
10	2.569	25	7975.71	28.2	65.7	598.9
11	2.611	19	11358.98	19.6	60.6	874.0
12	2.704	19	5750.58	22.5	50.0	526.4
13	3.355	45	15249.22	10.8	38.2	1197.2
14	3.108	29	8827.66	12.7	41.1	1101.9
15	3.112	37	23499.56	14.6	49.0	1342.7
16	3.180	37	13770.03	14.4	46.8	1200.5
17	2.641	39	19467.45	47.4	63.5	1099.3

Nigeria (Hall 1977, Hall & Okali 1979). Notably absent from the Ife forests is *Sterculia rhinopetala*, a typical Sterculiaceae tree typical of the dry forest zone of western Nigeria. Hall (1970) published a list of 146 tree species for the University campus. The present total is close to that total number if all the repetitions, inclusions of non-woody plants and exotic trees are removed from Hall's list. It cannot be claimed that we have exhaustively reported all the component woody species of the Obafemi Awolowo University campus but our observations agree with earlier reports for the area (Isichei *et.al* 1986).

Ordination by principal components analysis of the plots based on their species composition is shown in Figure 2. On the first ordination axis, plots on the western slopes of Hill I (1,8,9,2,7,17) which are similar in species composition are separated from those on the crest of the hill (plots 5,6,14,15). Plots on the crest had lower stem densities but the proportion of trees with 120 cm girth at breast height is higher. On the second axis, the plots on rocky, sloped surfaces (Plots 4,5,6, and 15) are separated from those with high density of stems on the western slopes (Plots 1,2,3,7,8,9, and 17).

Table 2 shows the level of species diversity and woody stem basal area in the 17 plots. Plot 6 has the highest basal area while Plot 12 has the least. In some of the plots where the species diversity

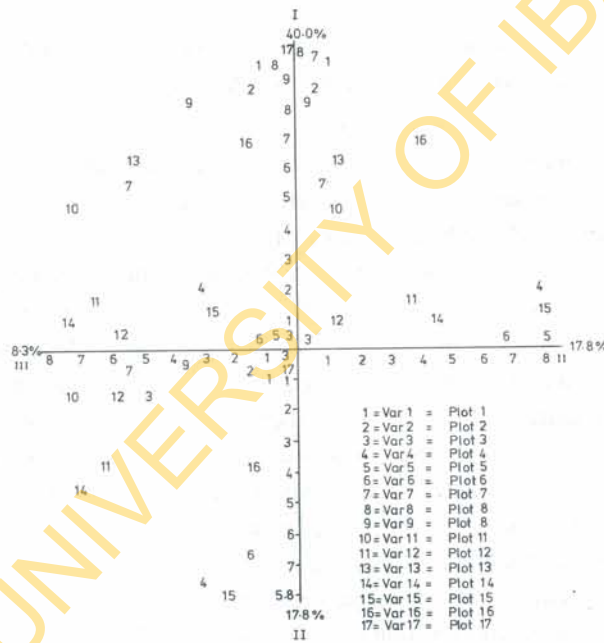


Fig. 2. Ordination by principal components analysis based on the woody species found in 17 sample plots used to characterize the remnant forest vegetation at the Obafemi Awolowo University Campus, Ile-Ife.

index is low, just one of the species contributes over a third of the total basal area while in most of the plots the five most abundant species contribute over half of the basal area. Species  $\leq 30$  cm girth at breast height are much more numerous than the higher girth classes (Fig. 3) and make up over 70% of stem in the sample plots but they contribute a small proportion of the total basal area. For example, in Plots 4 stem  $\leq 30$  cm gbh make up 79.4% of the total stem number but contribute 4.77% of the basal area. In this plot there are 10 trees  $>120$  cm gbh (9.8% total stems) but they make up 87.65% of the woody stem basal area of the plot. This contrasts with Plot 10 where there are no trees greater than 70 cm gbh and where trees  $\leq 30$  cm contribute 65% and 32% to the total number of stems and total plot basal area, respectively (see Hall and Okali 1979 for a comparative result). The pattern of distribution of stem numbers in the various girth-size classes further portrays the disturbed nature of the forest, the 50 to 100cm girth-size classes being grossly under-represented.

Of interest are rare species, that is, those that occur as single individuals in just one plot (Table 3). Some of the species such as *Khaya grandifoliola*, *Hylodendron gabunense* and *Canarium schweinfurthii* are relatively important commercial timbers while *Monodora myristica* and *Carpolobia lutea*, for example, are rare and could be described as endangered.

It is thus clear that the study area is a regrowth forest most probably disturbed by cultivation, tree felling and bush burning. The plots at the crest of Hill I and on the steep slopes are, however, not as disturbed. There the soil is shallow making cultivation unattractive. The dominant tree in such locations is *Brachystegia eurycoma* which attains girths of over 120 cm.

Since conservation is one of the main concerns of this study the rare species have been listed in Table 3. Some of the 28 species are valuable as timber and/or for ethnobotanical purposes. While it is admitted that the area of the remnant forest in the Obafemi Awolowo University is nowhere near the minimum area recommended for Strict Nature Reserve, National Park or Forest Reserve, there is evident need to conserve it. In the first place, Osun State where the University is located does not have any reserve as at now most of the reserves having been converted to industrial plantations. The remnant forest could qualify as Protected Landscape, Managed Nature Reserve or Managed Resource Area (Okali 1990). One of the stated aims of conservation of a renewable resource such as forests is to understand the biology of their component species such that the trees will later be managed the way agriculture crops are managed today. The University forests will provide the much needed stock for autecological studies. Furthermore, Janzen (1988) has observed that tropical dry forests are the most endangered major tropical ecosystems because of their deciduous nature and the attendant complicated species interactions. The forest is also a valuable scientific tool for the study of the relationship between vegetation cover and erosion in watershed management. The case for conservation is made stronger by the fact that such richly endowed private estates are rare in Nigeria.



Table 3: Species found in just one plot (out of 17) and are represented by only one individual in the remnant forest of the Obafemi Awolowo University, Ile-Ife.

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<i>Albizia glaberrima</i> (Schum. & Thonn) Benth
<i>Allophylus africanus</i> P.Beauv
<i>Blighia welwitschii</i> (Hiern) Radlk.
<i>Bridelia atoviridis</i> Muell. Arg.
<i>Caloncoba</i> Sp Gilg.
<i>Canarium schweinfurthii</i> Engl.
<i>Canthium</i> Sp Lam.
<i>Carpolobia lutea</i> G.Don
<i>Cassia podocarpa</i> Guill. & Perr
<i>Combretum</i> Sp Loefl.
<i>Cnestis ferruginea</i> DC
<i>Daniellia ogea</i> (Harms) Rolfe ex Holland.
<i>Drypetes</i> Sp Vahl.
<i>Grewia pubescens</i> P.Beauv.
<i>Hildegardia barteri</i> (Mast.) Kosterm.
<i>Hylodendron gabunense</i> Taub.
<i>Irvingia gabonensis</i> Baill
<i>Khaya grandifoliola</i> C.DC
<i>Milletia thoningii</i> Baker
<i>Monodora myristica</i> Dunal
<i>Morinda Lucida</i> Benth
<i>Ouratea flava</i> (Schum. & Thonn.) Hutch. & Dalz
<i>Phyllanthus mullerianus</i> (O.Ktze.) Exell
<i>Pierrodendron africanum</i> (Hook.F.) Little
<i>Pseudospondias Microcarpa</i> (A.Rich.) Engl
<i>Rothmania whitfieldii</i> (Lindl.) Dandy
<i>Strombosia Postulata</i> Oliv.
<i>Uvariopsis</i> Sp Gilg.

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There are no indications that these points are appreciated by the University as there are no policy guidelines to enhance conservation. The dangers of farming around Opa Lake are well appreciated and there is a regulation banning farming in the vicinity of the lake. The University saw-mill has also been closed down but this is more of an economic decision than concern for conservation. Tree felling for firewood and timber is very much rampant around the campus and conservation will be very much enhanced if land use is properly planned along with measures against tree felling. Such planning will demarcate areas for farming and areas to be conserved.

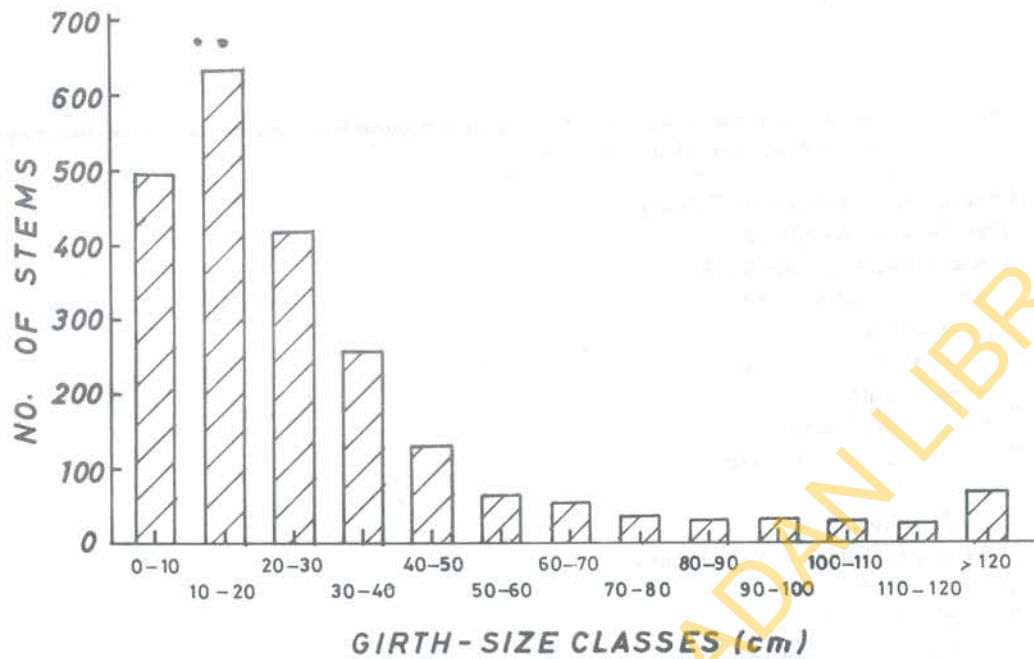


Fig. 3. Size class distribution of girths of woody stems in the 17 sample plots in the remnant forest at the Obafemi Awolowo University, Ile-Ife.

A study focused on typical young regrowth communities within the campus is in progress to assess the effects of deforestation on species composition and structure. This will make it possible for species losses under the current management regimes to be fully appreciated.

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