ASSESSMENT OF GROWTH DYNAMICS OF TREE SPECIES IN SNR2, AKURE FOREST RESERVE, NIGERIA

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Abstract

The study assessed the growth dynamics of tree population in SNR2, Akure Forest Reserve, Ondo state, Nigeria between 1974 and 2004. Each of the seven blocks [A-G] were enumerated in 2004 for their stem frequencies and girth at breast height, these were compared with corresponding measurements in 1974. They were used to calculate the Survival Percentages, Mean Annual Increment, and Mortality Rates. The results showed that there were 2580 stems in 2004 as against 3678 stems in 1974. The enumerated species frequency encountered in 2004 showed a reduction in all the blocks against 1974. The Survival Percentage ranged from 92, 90, 82, 53, 52, 50, and 50 in blocks C, B, D, A, E, G and F respectively in descending order. The Mortality Rate per year over the period are 9, 8, 7, 7, 3, 2 and 2 in blocks G, F, E, A, D, B and C respectively. The results further from showed that there was an average of 157 stems lost in each block for the period [1974-2004]. The study recommended the current protection status should be maintained so as to enhance the management of the forest on sustainable basis.

Keywords: Tree population, girth at breast height, Mean Annual Increment, Survival Percentage and Mortality Rates

Introduction

Like all living things, a tree must grow, reproduce and die. The rate of growth of a tree varies with many factors, environmental, physiological and inherited. Primary environmental factors are the amount of sunlight, soil moisture, soil temperature and availability of nutrients. Some of risks of mortality always exist for trees; even when healthy they can be killed by fire or storms. The risk of death increases, however, when trees grow poorly. Disturbance of various kinds is commonly the chief cause of forest instability and this may involve floods, windstorms, fire, landslides, drought, and human intervention (Condit *et al*. 1995, Whitmore & Burslem 1998, Gomes *et al*. 2003). Continual tree mortality (at about 1-2% annually.) permit further growth of the surviving trees and recruitment of new trees (Swaine and Lieberman.1987). Nigeria has been losing on the average of about 23000ha of gazetted forest estate per annum through the desertification alone.

The direct impact of human beings on forest such as clearing of forests, intensive logging, pollution of large areas, fragmentation of forests and elimination older stands of trees. We need to evaluate what these changes will mean to the forests themselves and to the biological diversity they contain. There are two conditions confined. First the diversity or evenness (Haenpler, 1982) is

a measure of the pattern of plant species composition in plant community.

Secondly, the diversity is a measure of difference of floristic or morphological characteristics between plant communities. This conform to the alpha (species) and beta (community) diversities of Whittaker (1965, 1970), but includes morphological features.

Natural and semi-natural tropical rainforest are structurally stable, maintaining an approximately logarithmic decline in number of trees with increasing size.

Forests are important sources of fuel, building materials, paper, and fiber. Forests have many functions. They provide habitat for wildlife and endangered species of plants and animals; they control erosion; they provide water resources, and they offer opportunities for recreation of many kinds. People enjoy forests and value their beauty. A lot of food is derived from forest; it is also the source of medicine.

Measuring the growth of trees provides a ready means for comparing the performance of trees in different situations. It determines how long one must wait to harvest a tree, and it also useful as an index of volume growth. It is easily shown that the product growth is the height, diameter; they are commonly the major components of volume growth of a tree. Since tree diameter often is a dominant element in determining marketability and economic maturity, the importance of diameter growth is evident.

These objectives were achieved; assessment of the floristic composition in all the blocks, tree frequency were compared in each block in 1974 and 2004, and also mortality and survival rates of trees between 1974 and 2004 were determined.

MATERIALS AND METHODS

Study Area

Akure Forest Reserve is located between longitude 5 East and latitude 70 north and falls within the high forest zone of Nigeria. It is located along Akure- Ondo and about 1km away from Cocoa Research Institute of Nigeria. [CRIN] Owena substation. The reserve was gazetted as forest reserves by order number 2 of 9th January 1936 of the Western region of Nigeria.

The Forest Reserve covers an area of 65.93km and is located within the old Akure Local Government bounded in the west and east by the Owena and Apomu rivers respectively. Both the northern and southern boundaries are free areas. The Reserve lies within the Southwestern part of Nigeria populated by the Yoruba race most of whom are farmers.

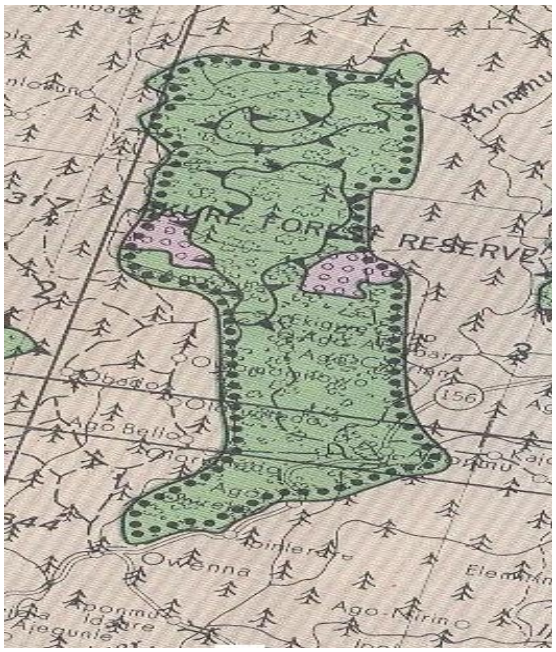

Fig. 1: Map Showing SNR2, Akure Forest Reserve, Nigeria

Data Collection

The Forest Reserve is divided into seven blocks [A-G]. The enumeration involved girth measurement of all tagged standing trees.

Mortality Rate

The tree mortality for each species was computed as a difference between the number of stem per species in 1974 and in 2004 for individual block. The purpose of this was to determine the stem per species that presently exist in 2004 as against those measured in1974.

Tree mortality = population [2004] minus population 1974.

Survival Percentage

This is the number of stems enumerated in 2004 divided by the stems in 1974. The purpose is to determine trees that withstand competition and suppression. The survival growth on those trees that were alive at both measures.

$$\text{Survival Percentage} = \frac{\text{Stem enumerated in 2004}}{\text{Stem enumerated in 1974}}$$

Mean Annual Increment (MAI)

The Mean Annual Increment was computed as the difference in girth of each tree between 1974 and 2004 divided by 30years. This can be expressed below;

$$\text{MAI [girth of each tree]} = \frac{[\text{girth in 2004} - \text{girth in 1974}]}{30}$$

Proportion of Individual [Pi]

Of all the species enumerated during the study. All species above 25 were used. The aim is to know the proportion of individual species per block. Proportion of individual can be expressed below;

$$\text{The proportion of individual [Pi]} = \frac{ni}{N}$$

Where ni = number of individual ith species enumerated

N = total number of all the species

RESULTS

Stem Frequency

The results showed that there were 2580 stems in 2004 as against 3678 stems in 1974. The species frequencies in 2004 are 552, 482, 403, 378, 282, 244 and 239 in blocks C, B, A, D, E, F and G respectively, this was against 600, 537,603, 462, 543,486 and 447 in the respective blocks in 1974.

Mortality Rate

Table 2 showed the mortality rate of species per block for 2004 at SNR2 Akure Forest Reserve Nigeria. It was found out that block G has a highest number of mortality rate of 261 while block C has the least with 48. Half of juvenile mortality in the tropical forest may be due to physical changes. The mortality rate per year over the period are from 9, 8, 7, 7, 3, 2 and 2 in blocks G, F, E A, D, B, and C respectively. The results further showed that there is an average of 157 stems lost in each block for the period (1974 - 2004). This is the average summation of the mortality rate of all blocks (A-G). Mortality is continuous at a relatively low level, with death occurring mainly in individuals or small groups of trees.

Table 1: Stem Frequency of Trees in 1974 and 2004 at SNR2, Akure Forest Reserve, Nigeria.

BLOCKS	1974	2004
A	603	403
B	537	482
C	600	552
D	462	378
E	447	282
F	486	244
G	543	239

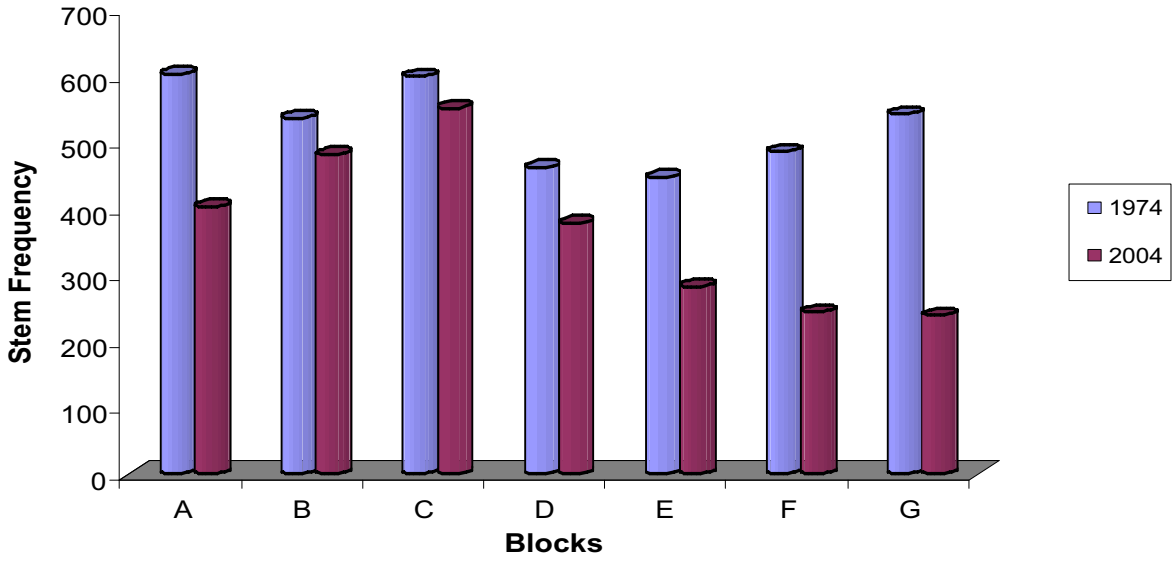

Fig 1: Stem Frequency of Trees in 1974 and 2004 at SNR2, Akure Forest Reserve, Nigeria.

Table 2: Mortality Rate of Trees between 1974 and 2004 at SNR2, Akure Forest Reserve, Nigeria.

BLOCKS	MORTALITY RATE (MR)	MR/ YEAR/ PERIOD
A	200	7
B	55	2
D	84	3
E	208	7
F	242	8
G	261	9

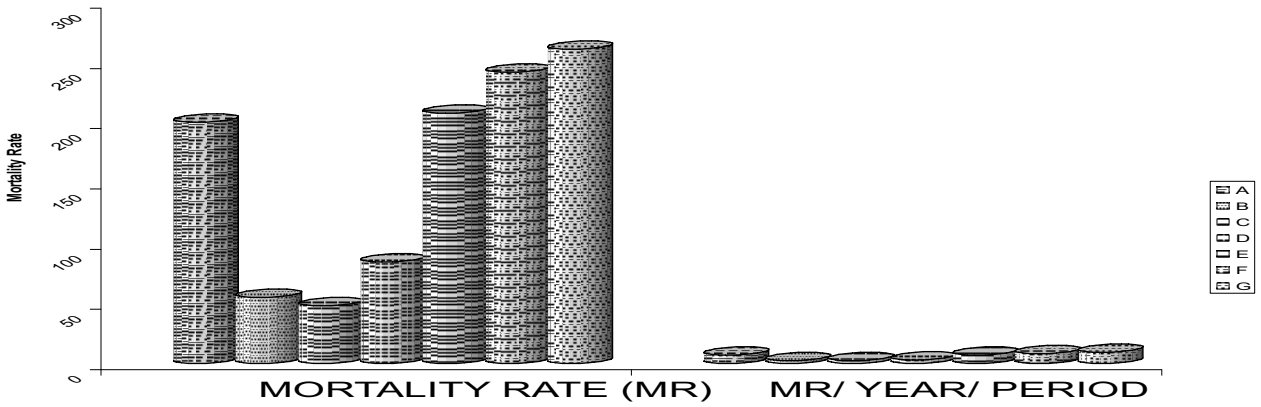

Fig.2 : The Mortality Rate of Trees Between 1974 and 2004 in SNR2, Akure Forest Reserve, Nigeria.

Survival Percentage

The result shown in table 3 indicates that block C has the highest survival percentage of 92, while block F has the least of 50. This is shown in table 3 fig. 3 below.

Mean Annual Increment (MAI)

The Mean Annual Increment (MAI) per stem over the period was shown in table 4 below. This is calculated as the difference in girth between 1974 and 2004 divided by the number of trees present in 2004.

Table 3: The Survival Percentage of Trees between 1974 and 2004 at SNR2, Akure Forest Reserve, Nigeria.

BLOCKS	SURVIVAL PERCENTAGE
A	67
B	90
C	92
D	82
E	53
F	50
G	52

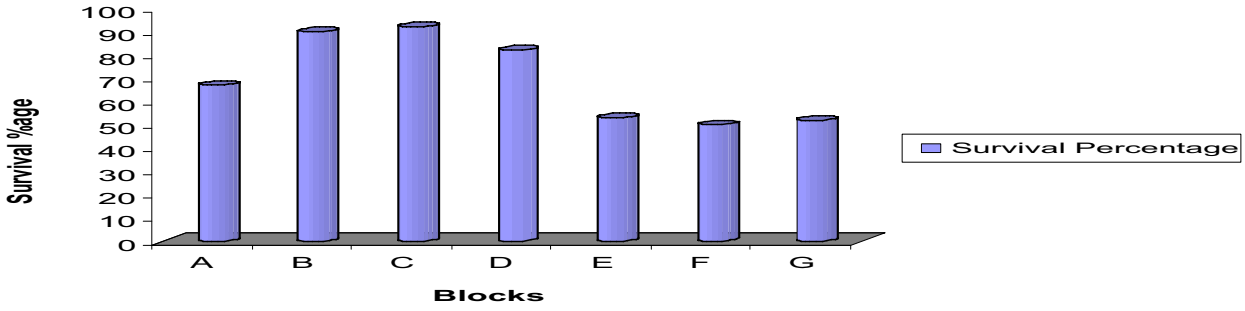

Fig. 3: The Survival Percentage of Trees between 1974 and 2004 at SNR2, Akure Forest Reserve, Nigeria.

Table 4: The Mean Annual Increment of Trees between 1974 and 2004 at SNR2, Akure Forest Reserve, Nigeria.

Blocks	Mean Annual Increment (MAI)	Average Increment per Stem
A	1180	2.93
B	863	1.79
C	1155	2.09
D	663	1.75
E	441	1.85
F	492	2.01
G	462	1.64

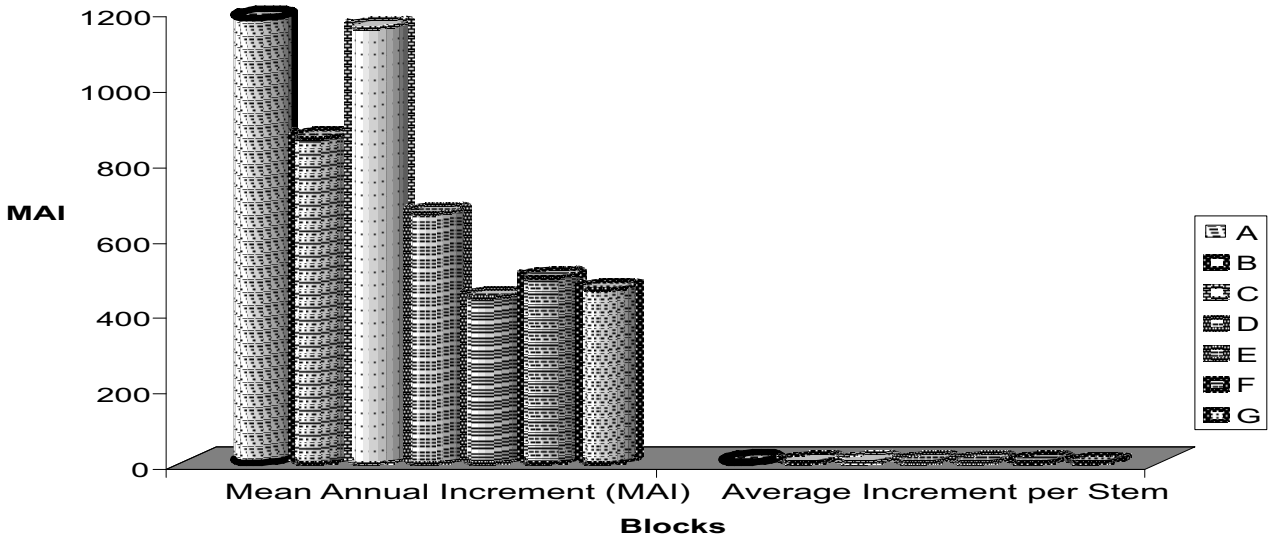

Fig.4: The Mean Annual Increment (MAI) of Trees between 1974 and 2004 at SNR2, Akure Forest Reserve, Nigeria.

DISCUSSION/ CONCLUSION AND RECOMMENDATION

The growth and yield models are a synthesis of dynamic inventory data indicating growth, mortality and changes in the SNR2 stand composition and structure. Many changes have occurred in the last 30 years due to mortality, diameter increment from 2004 stem enumerated. Many changes has occurred in the last 30 years due to mortality, diameter increment from 2004 stem enumerated, there were small size trees found under crown which are not shade tolerant. Howard and Valerio (1992) reported similar study for mixed tropical forest in Costa Rica. This assertion was supported by Botrel *et al.* (2002) that the increasing ranges of diameter classes proposed for semi deciduous forests of the same region were used to make up for the strong decline in tree density towards larger diameter classes.

However, no part of the sampled areas (blocks) left free from human influence by the way of

collecting non-wood forest products, yet, a restriction is still placed on the study area. The species composition of the study area shows that *Cola glabra, Diospyros dendo, Annonium manni, Celtis zenkenri, Sterculia rhinopetala, Drypetes principum, Hunteria umbelata, Guarea cedrata, Cordial milenii, Strombosa pustulata, Octolobus spectabilis, Cola acuminata* among others are abundant at the initial enumeration (1974). Nevertheless, some are fast disappearing with less than 10 stems across all the blocks (A-G) in the entire SNR. Some of these disappearing species include *Distemonanthus benthanianus, Zanthoxylum leprieurii, Alstonia bonmei, Amphilimas pterocarpoides, Piereodendron africanum, Cylicodicus gabonensis* among others. However, this might be because of environmental problems, human influence, and drop off tags attached to sample stems, which could not allow easy identification. There is tendency for each block to exhibit some variability in the area of frequency and location, this would influence other analyses. Trees as living thing must grow, reproduce or die. This is a phenomenon of living things.

The study concluded that the reserve should be managed the more, this would enhance more future benefits.

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