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# SURVEY OF ECONOMIC TREES IN FRESH WATER SWAMP OF CALABAR

**E. A. OKON AND J. T. ABRAHAM**

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**ABSTRACT**

A survey of economic trees namely *Elaeis guineensis* (oil-palm) and *Colocasia esculenta* (taro) in fresh water swamp, Calabar was conducted. The survey area located in the vicinity of Cross River University of Technology (CRUTECH), Calabar premises covered an area of 0.5km x 0.2km was divided into five plots (A – E). Values of mean count and variance for *Elaeis guineensis* were 8.8/2.2; 6.0/2.0; 6.2/3.7; 6.0/2.0 and 6.6/2.3 for the plots respectively. *Colocasia esculenta* had mean count and variance of 127.2/74.7;194.4/180.8; 215.6/426.7; 158.0/69.5 and 169.8/19.2 respectively. The mean values were observed to be greater than respective variance except for plot C for *Colocasia esculenta* where the variance was greater than the mean. Mean densities (counts per $m^2$) of 0.084 and 0.216 were recorded for *Elaeis guineensis* and *Colocasia esculenta* respectively. Pattern of distribution is regular but for *Colocasia esculenta* which had contiguous distribution in plot C. These distributions which did not obey Taylor's power law of distribution show the different populations to be greatly affected by human activities.

**KEYWORDS:** *Elaeis guineensis* (Oil-palm); *Colocasia esculenta* (Taro); Taylor's power law; ecological niche; population.

## INTRODUCTION

Ecologists use the term habitat to mean the place where an organism lives and the ecological niche to mean the functions that it plays in the ecosystem. 'Ecological niche', in a nutshell, is the term commonly used to describe the total functions of a species in the community. The niche comprises all the bonds between the population and the community and the ecosystem in which it is found (Odum, 1977; Odum and Barrett, 2005; Turchin, 2001). The niche is the property of the community even though it is commonly defined in terms of the population inhabiting it. Different communities in the ecosystems characterized by similar environments are often exceedingly similar in their structure, and may contain one or more niches that are essentially similar (Pearman et al, 2008).

In any habitat, various species of organisms can be found. These organisms are related in one way or the other if equilibrium is to be achieved. Relationship among organisms of the same or different species often involve some level of dependency which may follow a gradient of best fit to less fit individuals during which the less fit are eliminated. If resources are adequate and evenly distributed, equilibrium position can be maintained for many generations. On the other hand inadequate and uneven distribution of resources may destabilize equilibrium position leaving only the best fit or better adapted individuals. Survivors of keen competition have specific and related functions. Relationships may be so acute and close that each individual cannot survive without the other (Begon et al. 2005; Pojar et al. 1987).

Population estimate depends upon resource availability because it determines the number of surviving individuals. This is true for all species of organisms in a given locality and many geographical settings where a particular species is distributed. Thus, statistical estimates of organisms may show different values of central tendencies and spread. The mean ($\mu$ or $\bar{X}$) of distribution may be greater than the variance and vice-versa. The former mode of distribution is described as even distribution while the latter case is described as contiguous distribution. In an even distribution all measures of central tendency lie on the same axis dividing the normal curve into two equal halves.

The aim of this study is to carry out a survey of two plant species of vital economic importance in fresh water swamp of Calabar namely *Colocasia esculenta;* used as local wrappers by market women which competes favourably with conventional polythene bags often used in the market and *Elaeis guineensis*; which has various uses such as; production of palm oil; making of broom, brushes, production of alcoholic wine and has local medicinal value. It is expected that by this survey the nature of the distribution and to that extent the effect of human activity on these economic trees can be assessed and evaluated.

## MATERIAL AND METHODS

This study was carried out from April to October, 2010 on the outskirt of CRUTECH land-mass covering an area of $0.10km^2$. It involves the survey of economic trees in the fresh water swamp forest of CRUTECH.The survey was carried out using ecological procedures that were deemed applicable in the area. The general plan was designed based on that suggested by Vandermeer and Goldberg, 2003. The survey area was divided into five (5) plots numbered A, B, C, D and E, each covering

**E. A. Okon,** Department. of Biol. Science, Cross River University of Technology, Calabar, Nigeria.
**J. T. Abraham,** Department. of Biol. Science, Cross River University of Technology, Calabar, Nigeria.

about 100m x 40m, that is about $0.004km^2$. Water, mud and the presence of climbers rendered the entire area impenetrable. The line transect method was applied in this study. Each line measured thirty (30) metres in length and each plot had five lines at intervals of 14.3 metres within a sample space. The number and spacing of line was to enhance unbiased collection of data.

**Plant Survey**

Direct counting method using line quadrat was applied. Each plot had 5 lines at 20m interval. *Elaeis guineensis* (oil-palm) and *Colocasia esculenta* (Taro) occurring along each line were counted and recorded.

**Statistical tool used:**

Mean $= \sum \frac{X}{\overline{N}} = \overline{X}$ ....................................................... (i.)

Where;

X = sum of individual plants observed
N = Total Number of samples

Variance $= S^2 = \sum(f)x^2 - \sum\frac{(f)x^2}{N}$ / N−1 … (ii.)

Where;

$\sum$ = Sum of factor
f = frequency of observation
X = various values of the number of plant samples
N = Total number of samples

Using Taylor's power law (Taylor, 1961):

$S^2 = a\overline{X}^b$. Thus, $\log s^2 = \log a + b \log \overline{X}$ ………….. (iii.)

Where a and b are constants, a is largely a sampling factor, while b appears to be true index of aggregation characteristic of the species (Duncan et al. 1989).

**Determination of Population distribution**

Population distribution of the two plant species, *Elaeis guineensis* and *Colocasia esculenta* was determined by estimated values of mean ( $\mu$ or $\overline{X}$) and variance ($S^2$) as described as by Bishop,1974.

When;

$\overline{X} > S^2$ = Even or normal distribution …………… (iv.)

Also; $\mu$ or $\overline{X}$ = $M_O$ = M (Fig. 1)

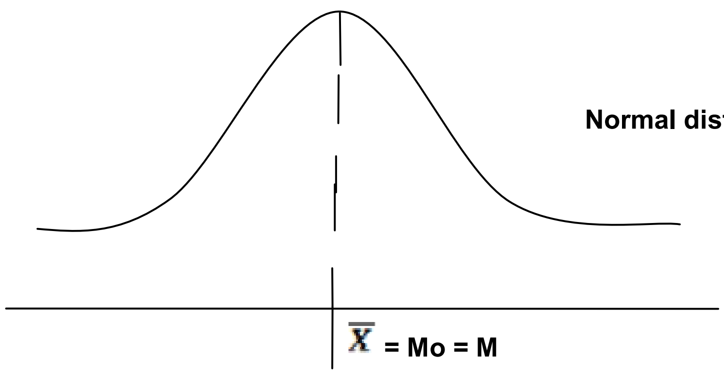


**Fig. 1:** Normal distribution curve

When;

$\overline{X} < S^2$ = Contiguous distribution …………………………………………………........ (v.)

Also;

$\overline{X} \neq M_O \neq M$

Where;

$\overline{X}$ = Sample of mean
$M_O$ = Mode
M = Median

## RESULTS

**TABLE I:** MEAN AND VARIANCE OF PLANT SURVEY DATA

**PLOT**

| | A | | B | | C | | D | | E | |
|---|---|---|---|---|---|---|---|---|---|---|
| Plant Species | $0_1$ | $0_2$ | $0_1$ | $0_2$ | $0_1$ | $0_2$ | $0_1$ | $0_2$ | $0_1$ | $0_2$ |
| Mean ($\overline{X}$) | 8.8 | 127.2 | 6.0 | 194.4 | 6.2 | 215.6 | 6.0 | 158.0 | 6.6 | 169.8 |
| Variance ($S^2$) | 2.2 | 74.7 | 2.0 | 180.8 | 3.7 | 426.7 | 2.0 | 69.5 | 2.3 | 29.2 |

**Key:** $0_1$ = *Elaeis guineensis*
$0_2$ = *Colocasia esculenta*

TABLE 1: shows the mean and variance values for the distribution of *Elaeis guineensis* ($0_1$) and *Colocasia esculenta* ($0_2$) implying a regular or uniform distribution of these plant species.

**TABLE II:** LOG VALUES OF MEAN ($\overline{X}$) AND VARIANCE ($S^2$) OF PLANT SURVEY DATA.

| PLOT | PLANT | $\overline{X}$ | $S^2$ | $10^{-1}$ LOG $\overline{X}$ | $10^{-1}$ LOG $S^2$ |
|---|---|---|---|---|---|
| A | $0_1$ | 8.8 | 2.2 | 9.4 | 3.4 |
| | $0_2$ | 127.2 | 74.7 | 21 | 18.7 |
| B | $0_1$ | 6.0 | 2.0 | 7.8 | 3.0 |
| | $0_2$ | 194.4 | 180.8 | 22.8 | 22.6 |
| C | $0_1$ | 6.2 | 3.7 | 7.9 | 5.6 |
| | $0_2$ | 215.6 | 426.7 | 23.3 | 26.3 |
| D | $0_1$ | 6.0 | 2.0 | 7.8 | 3.0 |
| | $0_2$ | 158.0 | 69.5 | 21.9 | 18.4 |
| E | $0_1$ | 6.6 | 2.3 | 8.2 | 3.6 |
| | $0_2$ | 169.8 | 29.2 | 22.2 | 14.6 |

TABLE II: shows the mean and variance values and their respective log values for the distribution of *Elaeis guineensis* ($0_1$) and *Colocasia esculenta* ($0_2$).

## DISCUSSION

During this study CRUTECH, Calabar environment experiences low temperature of 16 − 18°C, high rainfall of 28−36 in and high humidity of 92-96% (web ref. 2010). CRUTECH, Calabar forest is a pseudo forest having characteristics of rain and swamp forests. Throughout the period of survey, the entire swamp was water-logged.

The results obtained from the study, as recorded in Tables I for the trees (*Elaeis guineensis* and *Colocasia esculenta*) surveyed, showed a departure from the normal distri-bution of population which always have mean, median and mode of equal values. This implies that the variance of a population with evenly distributed individuals is always less than the mean.

The variance observed in this study, was always less than the mean for the two plants except in plot C where the variance ($S^2$) of *C. esculenta* was more than the mean ($\overline{X}$). This implies a more regular (or uniform or even) distribution and contiguous for *C. esculenta* in plot C. Most commonly, in ecological studies, the variance will be found to be larger than the mean, implying that the distribution is contiguous that is the population is clumped or aggregated **(**Hastings, 2007). Only in plot C was the distribution of *C. esculenta* contiguous showing a less disturbed setting sandwiched between others.

The general distribution of species of plant in the study was partly random and partly uniform. The clumping or aggregation of the population may not be unconnected to human activities due to the economic values of the species surveyed.

The data obtained from the survey of the CRUTECH, Calabar fresh water swamp showed that the overall habitat was greatly affected by human activities as reflected in the random and contiguous distribution (clumped or aggregated population) of the surveyed plant species. *Elaeis guineensis* (Palm trees), one of the economic plants surveyed in this study, reflected this pattern of distribution thus indicating that the trees must have been felled to give room for farming activities.

The survey of the ecological niches of the

CRUTECH, Calabar fresh water swamp depicted a dwindling number of ecological niches of the area. The harsh, water-logged environment of the swamp enhanced the survival of the highly specialized plants such as hydrophytes, *Colocasia esculenta.*

A combination of the harsh nature of the environment as well as human influences could be responsible for the overall sparse densities of the different species populations studied. Within the same habitat different species will usually show different dispersion patterns as has been found with leaf hopper on rice plants. These differences can arise from several biological causes. For example one species may aggregate more than another in the same habitat because it disperses less or it reproduces more or because only certain parts of the habitat are suitable for it.

## CONCLUSION

Man has a considerable influence on the taxonomic competition of many ecosystems not only urban ones but remote ones in which he may be but a minor inhabitant. Man influences his natural environment in two ways either by developing an artificial environment (towns, cities, reservoirs etc.) or poisoning it by releasing toxic chemical substances into it. Urban spread will continue so long as human populations soar as they have done in the past**.**

The number of ecological niches in a given habitat is a function not only of evolution but also of habitat productivity. Furthermore, it must be emphasized that the ecological niche is a functional characteristic of a biological population not a physical location.

Until a habitat is occupied by at least one species population, it does not contain any ecological niches. Observation made in CRUTECH, Calabar fresh water swamp signified a threat to the habitat by the biotic factors − man's influence. There should be a check to the threat by conservation method to avoid the environmental disaster that may follow.

There are more to be done in this area particularly on the effect of other biotic and abiotic environmental factors to this habitat. Many plants and animals are yet to be surveyed. The forest may have more potentials for economic support.

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