PERCEPTIONS AND INVOLVEMENT OF NEIGHBOURING COMMUNITIES OF KAINJI LAKE NATIONAL PARK TOWARDS THE PARKS CONSERVATION PROGRAMMES.

Akosim, C. Bode, A.S. Kwaga, B.T. and Dishan, E.E.
Department of Forestry and Wildlife Management, Federal University of Technology, Yola

ABSTRACT
This study investigated the level of awareness of the neighbouring communities of Kainji Lake National Park about the reasons for the establishment of the park and the laws protecting it. The study also assessed the local residents' perception of the park's programmes, the impacts of the programme on the socio-economic status of the residents and their developmental needs with a view to eliciting their support for the park's programmes. Multi stage sampling techniques involving the use of structured questionnaires and oral interviews were used in obtaining information from the residents in the 21 communities surrounding the park. Results obtained depicted a very high level of awareness about the existence of the park (96.8%), reasons for creating the park (94.3%) and the laws governing the park (91.6%). In spite of the respondents claim that the park project has made them poorer (68.7%), majority of them (66.8%) still felt strongly that the project is a good one and therefore supported its existence. The most desirous of the developmental needs that could elicit the support of the local residents include; electricity, credit facilities, agricultural inputs, water, education and health in that order. The provision of these social and economic needs will no doubt ensure a harmonious coexistence with the support zone communities with the attendant accomplishment of the goals of the National park Project.

Keywords: Perception, Involvement, Neighbouring Communities, National Park, Conservation programmes.

INTRODUCTION

Conservation can be defined as the use of natural resources to provide the higher quality of living for mankind. It aims at both material and spiritual enrichment of live for man on earth (Raymond, 1967). Outright conflict between conservation and indigenous objectives has been the major problem of conservation in Nigeria. Communities have been expelled from national parks or denied the use of resources within the parks in line with the principle of conservation of resources in National Parks. Protected areas or national parks and resource in them were considered as island of wilderness amidst the sea of people. Once demarcated, the people forfeited their traditional rights to the use of resources inside the parks and reserve (King Mahendra Trust for Nature Conservation, 2005). Child (2002) however, observed that if ecological reserves are to survive, each must become an integral part of the socio-economic environment in which it is embedded. Instead of being a bastion of nature conservation, it should become a bridgehead for better land use and instead of being a black hole for scarce natural resources; it should become an engine for rural development and poverty alleviation. Oseomeobo (1992) reported that the right of the surrounding communities to exploitation of flora and fauna resources in game reserves and national parks were extinguished following their establishment, hence the conflicts which reflect the people's sharp reaction against the discriminating government policies on their own land. Abubakar et al. (1993), reported that such reactions as they observed in Kainji Lake National park were expressed in the form of

illegal activities in the conservation area, such as grazing, poaching, and farming.

Prior to the conversion of these lands to game reserves and national park, they had served as the people's source of livelihood through extraction of forest resources such as medicinal plants, fruits, herbs, building materials and fuel wood. It is therefore logical to reason that, if the new status of the land will halt the ownership and free access by the surrounding communities to these lands, then some form of compensation that will guarantee an alternative means of livelihood be provided for the neighbouring communities. It is the opinion of the authors that neighbouring communities should be made to benefit sufficiently from the conservation programmes that have taken over the land that once served as their means of livelihood . This study therefore , investigated the causes of conflicts between neighbouring communities and Kainji Lake National Park as observed by Abubakar et al. (1993) with a view to determining the solutions so that harmonious co-existence can be established between the people and the park.

MATERIAL AND METHODS

Area of Study

Location

Kainji Lake National Park lies approximately between Latitude 9 40^{0} ' and 10^{0} 30 ' N and Longitude 3^{0} 30' and 5^{0} 50'E. It lies at the extreme west of the wooded savannah region and in an area generally refereed to as the middle belt of Nigeria (Fig.1). It is characterized by relatively sparse population, tsetse fly infestation and abundant wild animals.

The park covers a total land area of 5,340 km^{2}. It is made up of two non-contiguous sectors (Borgu and Zugurma sector). The Borgu sector which is the sector currently being used for tourism purpose lies between Borgu and Baruten Local Government areas of Niger and Kwara states and coves an area of 3,970 km^{2}. It is bordered to east by Kainji Lake and in the west by Republic of Benin (Fig. 2). The Zugurma sector, on the other hand occupies a relatively small area of 1,370.80km^{2} and is situated in mairiga Local Government area of Niger state. There are two distinct seasons (wet and dry seasons). The wet season starts around mid-April and ends early November giving about seven months of wet season while the dry season lasts 5 months from late November to early April. The temperature during the dry season is about 37 ^{0}C and drops to about 28 ^{0}C during the wet seasons being influenced predominantly by the north-east harmattan wind (Development Research Bureau-DRB, 2003). The mean annual rainfall is 1200mm. The amount of rainfall increases to the south-east from Borgu towards Niger valley. This is due to leeward nature of the park site being east of Yoruba hills. The number of rainy days averages about 200.

STUDY DESIGN AND DATA COLLECTION

Data for the study was derived from primary data. The primary data was collected using structured questionnaires. A multi stage random sampling method was used to elicit information from1486 respondents drawn from the park neighbouring communities.

The entire neighbouring communities around the park were divided into seven (7), five (5) under Borgu and two (2) under Zugurma sector. Each range contains a minimum of six

(6) villages. A random selection of three villages was done from each community. Hence, under Borgu sector, 15 villages were selected namely, Kuble, Sansani, Lumma, Kali, Woro, Wawa, Duruma, Kemenji, Tinibu, Doro, Malale, Loko-mini, Wuro-Makoto, Nuku and Vera while six (6 villages were selected under Zugurma sector viz Ibbi, Patiko, Shafini, kulho, Fanga and Mazakuka. In each village, structured questionnaires were administered randomly on farmers, traders, civil servants, students, pastoralist, fishermen and artisans without gender discrimination. In each village, households were randomly selected and structured questionnaires were administered among the respondents. Number of respondents was selected proportional to the population of the village. The population sampled per sector is as follows: seven hundred and twenty (720) respondents (120 in each village) in Borgu sector (Consisting of Woro, Duruma, Doro, Malde and Kali village). While Loko mini village was served with 150 scheduled questionnaires. A total number of 240 questionnaires were administered in Zugurma sector (consisting of Patiko and Fanga village) while Mazankuka was served with 150 scheduled questionnaires. All questionnaires administered were recovered because the authors waited and retrieved the questionnaires from the respondents on completion.

DATA ANALYSIS

The analytical tools used for achieving the objectives of this study include descriptive statistics (percentages, mean and graphs).

RESULTS AND DISCUSSION

The results of the socio -economic characteristic of respondents in both Borgu and Zugurma sector (Table 1) of the park indicate that (73.8%) of the respondents were male while (26.2%) were female. The low number of female respondents was not unconnected with the culture and religion of the people, which limits the exposure of women. Many of the women exhibited shyness and consequently rejected the study questionnaires. Majority of the respondents were Muslims followed by Christians and finally by traditionalists. The dominance of Muslims in the population is expected to favour the conservation of primates as the religion forbids the eating of primates. Further more, majority of the respondents (63.2%) fall within the age group of 21-45 years. This is the most productive segment of the population. This result agrees with the findings of Giroh (2007) who reported high productivity among young rubber tapers. Due to low level of industrialization in the study area, this group is more negatively affected and in turn affect the resources of the park adversely. Result on marital status indicates that 68.5% of the respondents were married and of these, 42.0% and 26.5% were into monogamous and polygamous marriages respectively. This result is indicative of a possible fast population growth in the community, given the number of polygamous marriages. This therefore means more pressure on the park resources. This observation agrees with the findings of Ijomah and Akosim (2000) on the relationship between population growth and resource conservation. Results on literacy level showed that majority of the respondents (61.8%) attended only primary school. This will also imply low level of awareness of conservation values among the people, a situation that may be deleterious to the park resources. Furthermore, since majority of the

respondents (76.4%) were farmers, food was not rated as one of their predominant needs (Table 3). The rapid growth in population and the involvement of the preponderance of the population in agriculture implies that encroachment into park land area is inevitable in the absence of alternative means of livelihood.

Results of respondent awareness level (Table 2) of the existence of the park (96.8%), the reason for establishing the park (94.3%) and knowledge of the laws protecting the park (91.6%), in spite of the low literacy level, suggest that the park authority has expended a great deal of efforts in educating the local residents. This is further corroborated by the majority opinion (66.8%), that the park is a good project and that the existence of the park should be supported (71.7%) (Figs. 4&5). This attitude is based on the anticipation that things could change and that they will likely benefit in future from the park project. The findings, therefore, raise the hope for sustainable conservation of wildlife resources in the study area. Similar observations were made by Alexander (2000) in Belize while working on a community baboon sanctuary.

However, the identification of illegal activities in the park, perpetrated by the local residents (Fig. 6) suggests that the management programmes of the park are yet to adequately take care of their needs. The results in Tables 3 and 4 indicate the socio-economic needs of the respondents. According to responses of the local residents, these are factors that would improve on their living standard and generate support of the members of the local communities towards the park project. This is because the provision of these social and economic facilities will boost their income; make them economically self-reliant among other attendant benefits. The ultimate result is that the desire to trespass into the park will reduce, hence the harmonious existence of the park and the neighbouring communities would have been achieved. Based on the responses of the respondents, the social and economic needs were analyzed and presented in the preference ranking order (Table 5). The implication is that the provision of these needs should follow the preference ranking order to quickly and easily elicit support from the local residents.

Results of the willingness or unwillingness of the residents to participate in the management of the park (Table 6) indicate that participation of local residents in the day to day running of the park affairs is also crucial for the survival of the park project. John et al. (1982) reported that the action of the local residents tend to conflict with the goals of the conservation programme, if they are neglected in the management of the park project.

CONCLUSION AND RECOMMENDATION

This study has revealed that the long-term survival of wildlife resources in Kainji Lake National Park can only be achieved by adequately involving the residents of the neighbouring communities in the management of the park project and provision of economic empowerment programmes and social amenities. The park authority should therefore step up their effort in providing economic empowerment project that will generate alternative mean of livelihood and social amenities currently lacking in the support zone communities. For example, it is believed that if the above are

provided, the negative tendencies of local residents towards the park resources will be virtually eliminated because the attention of the respondents who are predominantly farmers will likely shift away from the national park since they could now argument their income through other activities rather than poaching in the park.

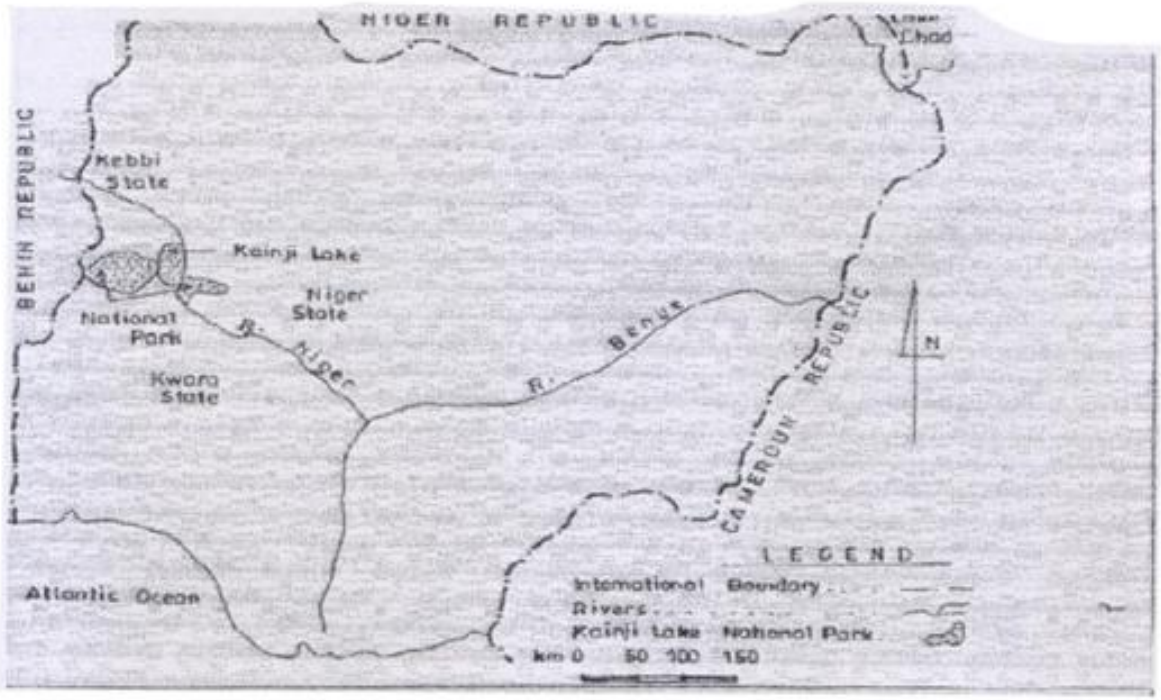

Fig. 1 Map of Nigeria Showing the Location of Kainji Lake National Park.
Source: Development Research Bureau (DRB) 2003

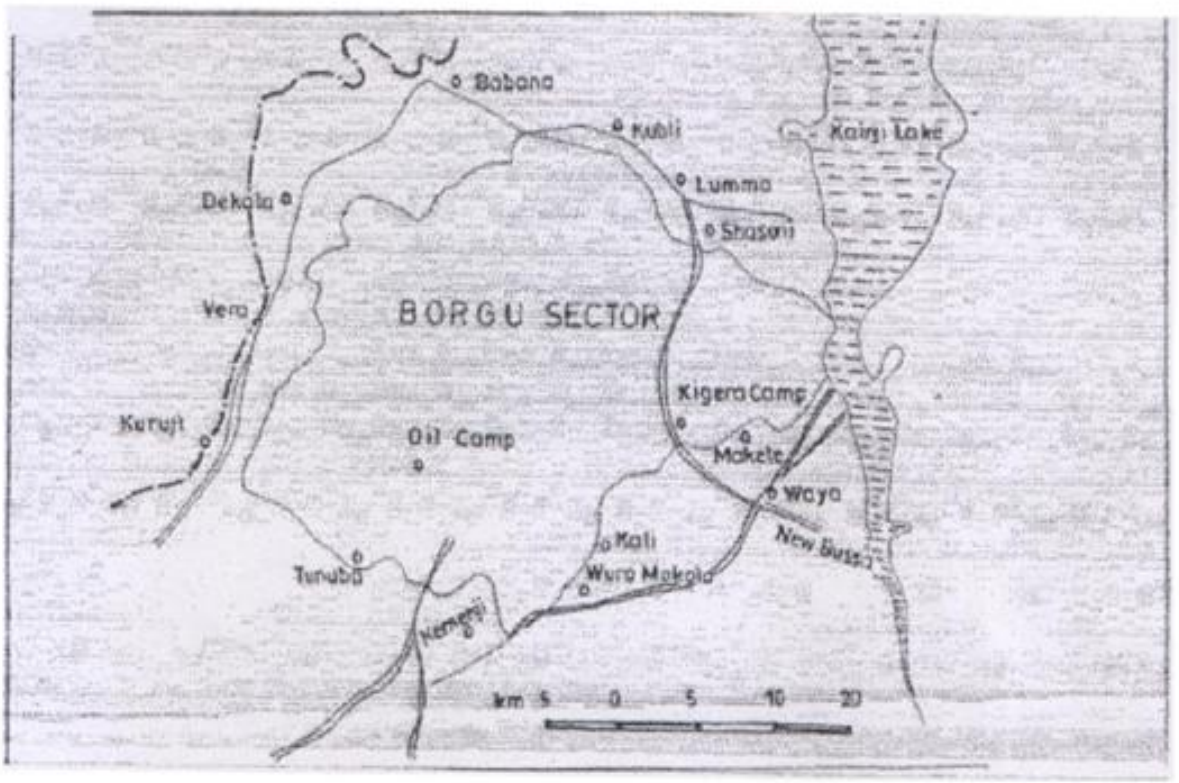

Fig. 2 Map Showing Borgu Sector with the Neighbouring Communities
Source: Development Research Bureau (DRB) 2003

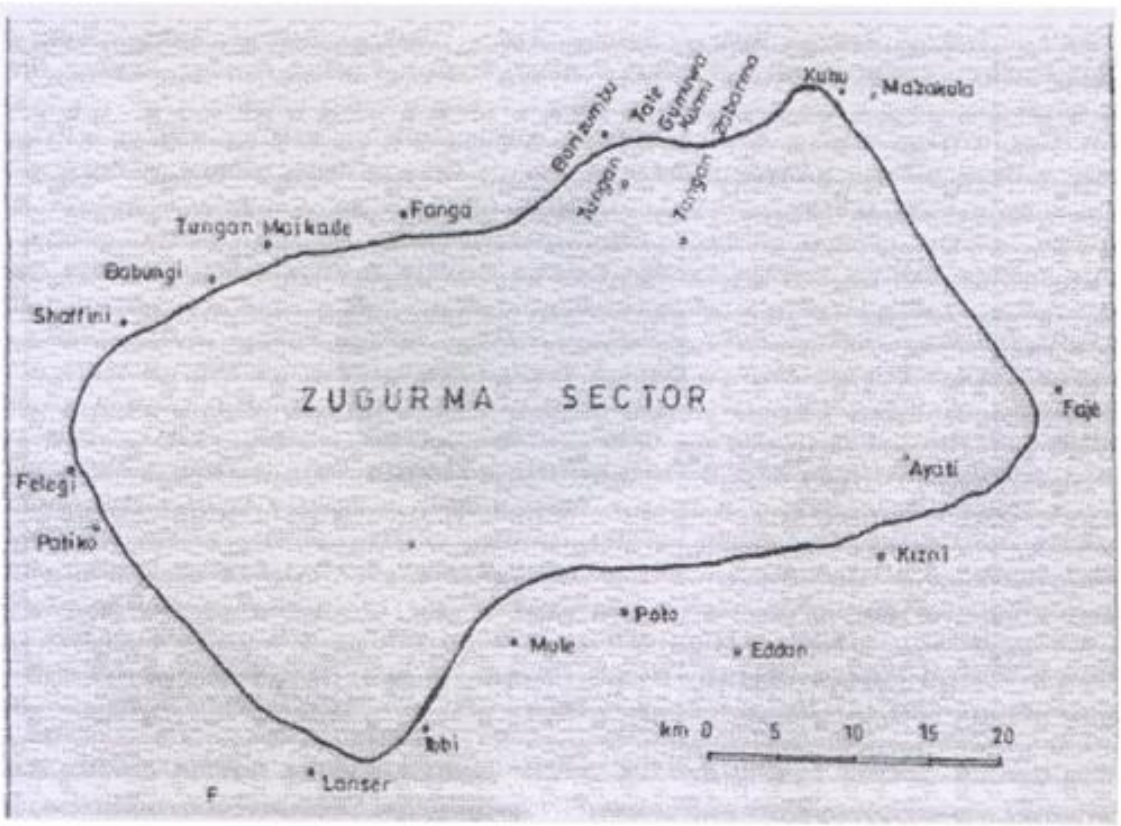

Fig 3 Map Showing Zugurma Sector with the Neighbouring Communities
Source: Development Research Bureau (DRB) 2003

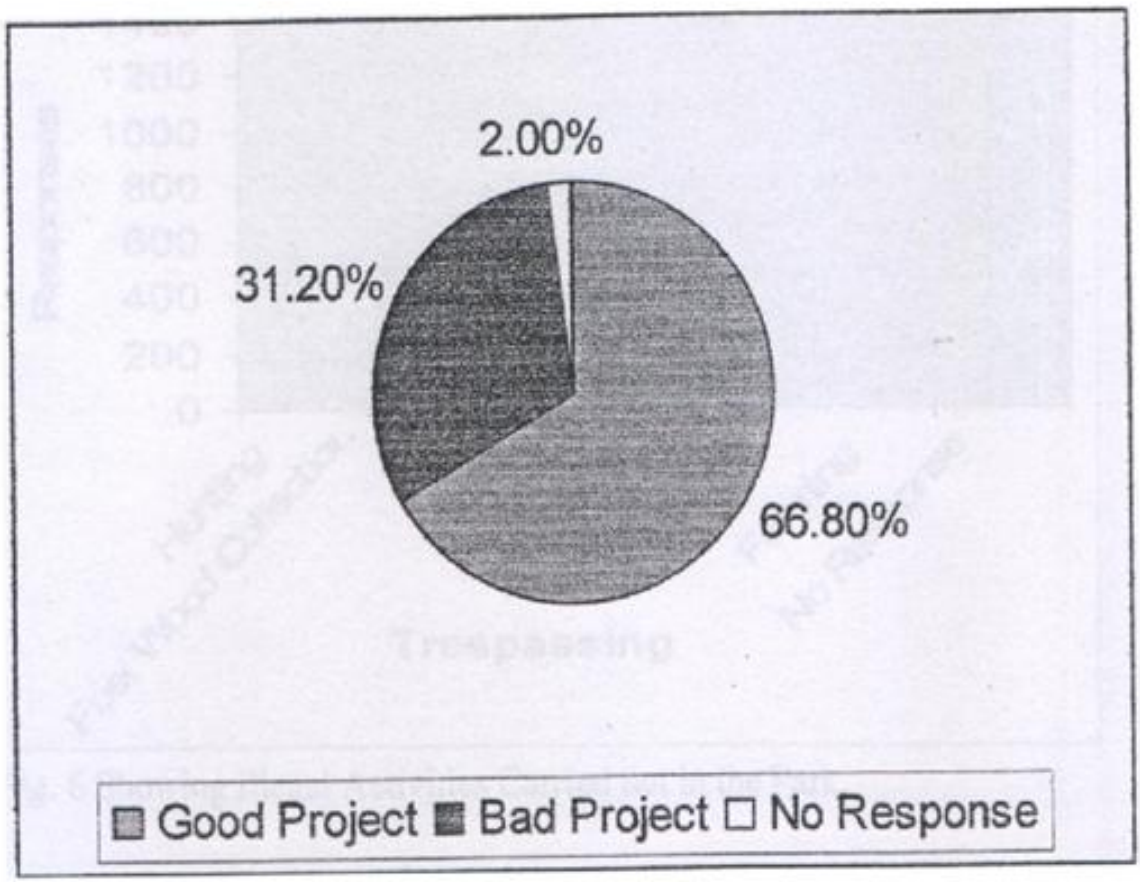

Fig. 4 Respondents' Opinion on whether the Park is a Good or Bad Project

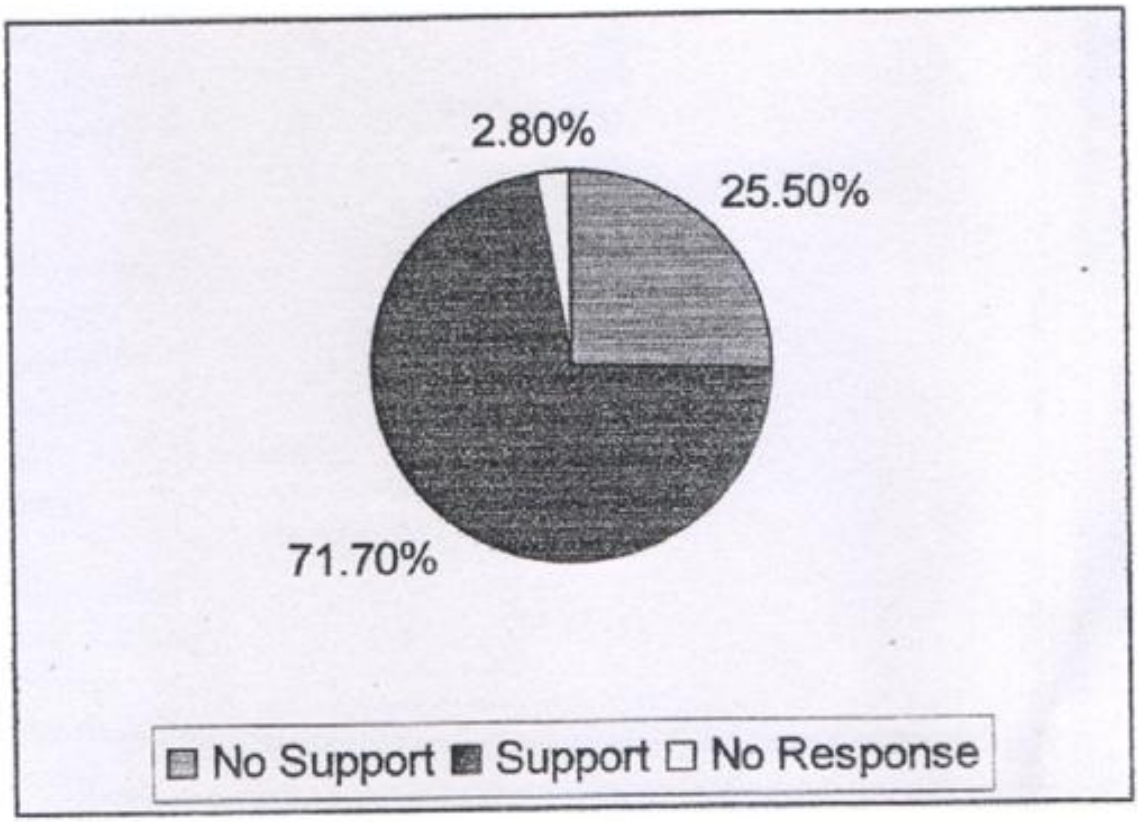

Fig. 5 Respondents' Opinion Showing Support to Park Project

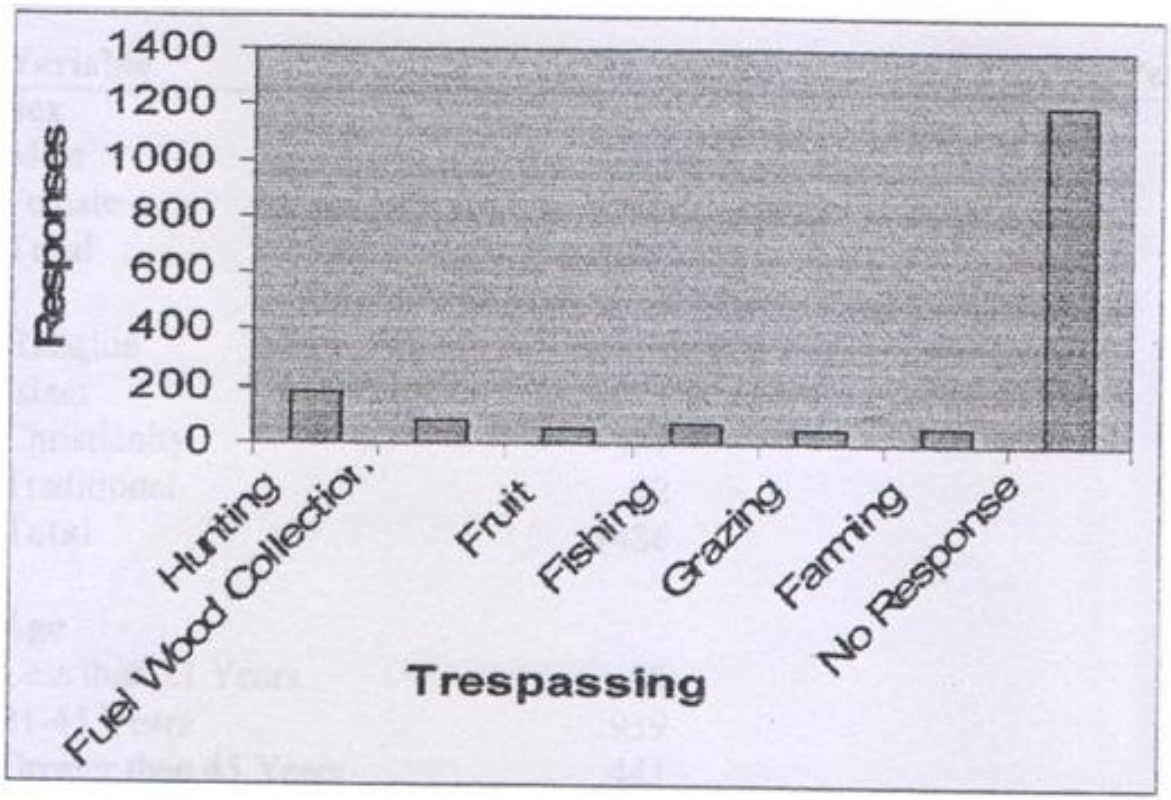

Fig. 6 Showing Illegal Activities Carried out in the Park

Table 1: Social-economic Characteristic of the respondents in the study Area

Variable	Frequency	Percentage (%)
Sex		
Male	1097	73.8
Female	387	26.2
Total	1486	100
Religion		
Islam	1073	72.2
Christianity	381	25.6
Traditional	32	2.2
Total	1486	100
Age		
Less than 21 years	85	5.7
21 45 years	939	63.2
Greater than 45 years	441	29.7
No Response	21	1.4
Total	1486	100
Married Status		
Monogamous	624	42.0
Polygamous	394	26.5
Widow/Widower	16	1.1
Divorced	18	1.2
Unmarried	413	27.8
No Response	21	1.4
Total	1486	100
Education		
Primary	918	61.8
Secondary	432	29.1
Tertiary	71	4.8
None Formal Education	65	4.4
Total	1486	100
Occupation		
Crop Farming	1021	68.0
Fishing	63	4.2
Livestock Farming	51	3.5
Others	351	23.6
Total	1486	100

Table 2: Respondents Awareness on Kainji Lake National Park

Variable	Frequency	Percentage(%)
Knowledge on Park Existence		

Aware	1438	96.8
Not Aware	32	2.2
No Response	16	1.1
Total	1486	100
Knowledge on why the Park was Created		
Aware	1402	94.3
Not Aware	66	4.2
Not Response	22	1.5
Total	1486	100
Knowledge about Laws Governing the park	1361	91.6
Aware	97	6.5
Not Aware	28	1.9
Total	1486	100

Table 3: Social Needs of the Respondents

Needs	Borgu Sector	Zugurma Sector	Total	Percentage (%)
Electricity	765	298	1065	31.1
Water	557	239	796	23.3
Education	368	213	581	17.0
Roads	342	161	503	14.7
Health	305	91	396	11.6
Communication	29	10	39	1.1
Town Hall	18	11	29	0.8
No Response	9	5	14	0.4
Total	2393	1028	3421	100

Table 4: Economic Needs of the Respondents

Needs	Borgu Sector	Zugurma sector	Total	Percentage(%)
Credit Facilities	596	305	901	27.5
Agricultural Inputs	609	217	827	25.5
Farm Implements	549	158	707	21.6
Market	288	132	420	12.8
Cottage Industry	307	90	397	12.8
Not Response	9	12	21	0.64
Total	2358	914	3272	100

Table 5: Ranking and Developmental Needs as Suggested by Local Residents

Mean Values of Developmental Needs as Suggested by Respondents

	Electricity	Water	Education	Roads	Health	Communication	Town Hall	Credit Facility	Agric. Inputs	Farm Machinery	Market	Cottage Industry
	50.6^{a}	38^{bc}	27.6^{de}	23.9^{ef}	18.9^{fg}	3.3^{i}	2.4^{i}	42.9^{b}	39.3^{bc}	33.7^{cd}	20^{efg}	18.9^{fg}
Ranking	3		5	6	7	8	8	2	3	4	6	7

Table 6: Willingness or Unwillingness of Respondents to Participate in the Management of the Park

Variable	Frequency	Percentage (%)
Participation		
Willing	1364	91.8
Not Willing	75	5.0
No	47	3.2
Total	1486	100

Source: Field Survey, 2006

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YIELD ASSESSMENT OF *Rhizophora* L TREE SPECIES IN A NATURAL MANGROVE FOREST IN ONNE, RIVERS STATE, NIGERIA

Ariwaodo, J.O; Aluko, A.P and Ige, P.O*
Forestry Research Institute of Nigeria, P.M.B 5054, Jericho Hill, Ibadan, Oyo State
*Corresponding Author: E-mail: igeup@yahoo.com. Phone No: +2348035826907

ABSTRACT
Yield of three major tree species (Rhizophora racemosa, Rhizophora harrisonii and Rhizophora mangle) of the mangrove forest in Onne, Rivers State was assessed. The data used were mensurational data from ten randomly selected sample plots from transects (20m apart) lay perpendicularly to the mangrove river bank to cover each growing zone of the respective species. The volume yield of each tree species were 56.16 m^3/ha, 426.88 m^3/ha and 6936.80m^3/ha for R. mangle, R. harrisonii and R. racemosa respectively. Also, their respective basal areas are 29.42m^2/ha, 83.20m^2/ha and 642.08m^2/ha. Meanwhile, the regression models fitted are the logarithmic model which was adjusted the best based on their regression statistics. The models are $lnV = 0.51H + 2.07lnDbh + 0.02BA^{-1}$ 0.60, $lnV = 0.22H + 1.54lnDbh$ BA^{-1} + 0.70 and $lnV = 0.11H + 1.84lnDbh$ $0.89BA^{-1}$ + 1.22 with adjusted coefficient of determination (adj. R^2) of 0.99 each for R. mangle, R. harissoni and R. racemosa respectively. The equations obtained were significant (P = 0.05). The study suggested potential use for these species such as timber and environmental protection services for community dwellers and other managerial options for better use of the forest. To enhance this, proper monitoring and conservation of the forest estate are recommended.

Keywords*: Mangrove forest, growth and yield, regression models, environment, management*

INTRODUCTION

Mangroves are halophytes occupying tropical and subtropical coastlines. Global estimate of the mangroves is put at about 15million hectares (UNSLYVA, 1986). However, recent report indicates that 50% of the original mangrove areas in many countries are gone (WRI, 2001). Nigeria is ranked to have the 3rd largest concentration of mangrove forest in the world and the largest in Africa with an area extending about 9,730km^2 approximately 970,000ha (WCMC, 1988; Ekeke *et al*, 2008). In Nigeria, most of the country's mangrove forests are found along the coastal belt covering about nine (9) States (Cross River, Rivers, Ebonyi, Bayesa, Akwa Ibom, etc).

Among the occurring mangrove plant families, the family *Rhizophoraceae* is the most dominant and is of economic importance in terms of management of the mangrove areas for timber and other tangible and non tangible forest products. Keay (1989) identified three known tree species belonging to the genera *Rhizophora* namely: *Rhizophora racemosa*, a pioneer and the largest of all other species; (*R. racemosa* grows on the soft bank of the brackish creeks) , the comparatively shorter *Rhizophora harrisonii* and *Rhizophora mangle* stands which progressively prefer drier habitat. For centuries, mangrove ecosystems have provided goods and services both on the community, as well as national and global levels (Kairo, et al, 2001). Many of these services include collection of building materials and fuel wood, gathering of shells to produce lime and wild honey collection and filter land run-off and control coastal erosion (Table 1). Westoby (1988) and Okeke (1996) also identified its direct utilization which includes: for constructional purposes, railway

sleepers, pilling, poles, tannin (used in local leather industries), scaffolding, charcoal production, fodder production (particularly *R. racemosa*), pit props in coal production and

reconstituted wood products such as particle board and cement bonded materials

Today in Nigeria, regular management in the mangrove is scarce compared to other forest types that have easy access and higher diversity of economic tree species. Pioneer work on *Rhizophora* tree species in Nigeria began in the early 1960's when the Niger Delta Development Board (NDDB) was founded. However, the data files, the prepared stock maps and volume tables for *Rhizophora* tree species of the board (NDDB) mangrove forest survey was lost by disastrous influences (Skoup, 1980). The board survey was a reconnaissance survey and was not designed to provide information with a high degree of precision. Okigbo (1984) reported a yield estimates to vary between 210m^3/ha and 543m^3/ha in the mangrove forest. Generally, there exist scanty information on the yield of *Rhizophora* tree species in Nigeria to assist in the sustainable management of the resources. Furthermore, the lack of valuable quantitative data, monitored over a number of years from the various inundation allotment in the nation's mangrove forest limits effective forest management based on quality classes occasioned by the zoning pattern and site variation under growing *Rhizophora* tree species (Ariwaodo, *et al* 2007). It is against this background that this study was embarked upon to carry out assessment of the growth and yield of *Rhizophora* (L) tree species in a natural mangrove forest in Onne, Rivers State, Nigeria to provide a baseline data for further investigations

METHODOLOGY

Study Area

The study was conducted within the natural mangrove forest in Onne, Rivers State and lies between latitude 4^{0}30'N and 4^{0}50'E along the Ikpokiri-Onne creek, Rivers State. The mean maximum and minimum temperatures are 30^{0}C and 25^{0}C respectively with a mean rainfall of about 2,500mm, one of the highest in the country. The relative humidity is high with a mean value of 75% in February and 80% in July (ICRAF/IITA weather report cited by Ariwaodo *et al*, 2007). The vegetation of the site is mangrove swamp forest dominated by *Rhizophoraceae, Avicenniaceae, Combretaceae and Aracaceae* (Obot *et al*, 1999).

Data Collection

Ten temporary sample plots each of 25m X 25m were randomly selected from transects (20m apart) lay perpendicularly to the mangrove river bank to cover each growing zone of the respective species. Growth parameters such as total height, diameters at breast height, base, middle and top (DBH, Db, Dm and Dt respectively) were assessed in each plot.

Data Analysis

The data collected were analyzed using descriptive statistics and regression equations were developed to ascertain the relationship between the growth variables estimated and predict the volume table for further use. Basal area and volume of individual trees were estimated according to Avery and Burkhart (2002):

$$\text{Basal Area} = \frac{Dbh^2}{4}$$

$$\text{Volume} = H \left| \frac{Db^2 \quad 4\,Dm^2 \quad Dt^2}{24} \right.$$

RESULT AND DISCUSSION

Three *Rhizophora* species were majorly encountered in the study area. These include *R. mangle, R. harissoni* and *R. racemosa*. The result of their respective growth variables shows appreciable values for their potential uses. Height of the species ranges from 1.5m to 2.5m for *Rhizophora mangle*, 3.2m to 7m for *Rhizophora harissoni* and the highest was estimated for *Rhizophora racemosa* which ranges from 5m to 14m (Table 2). This accounted for their use for timber and firewood purposes since height is crucial in determining the number of logs and volume of a tree and these are important in determining their market value. Turner (2001), noted that one of the criteria that has been used to group tropical tree species is their commercial value as determined by their utility potentials and prevailing market values. The natural characteristics of these species include fairly high density and high resistance to insects attack. These made the timber species preferable choices and highly sort by loggers (Ayodeji, 2000). These characteristics made them suitable for building constructions and for making furniture items. The diameter at breast height (Dbh) of each species also shows that *Rhizophora racemosa* has the highest mean Dbh (m) of 4.30±1.41 while *Rhizophora harissoni* and *Rhizophora mangle* have the respective values of 1.62±0.06 and 0.87±0.15. These are responsible for corresponding value of volume of each species since volume of tree is a function of its DBH and height (Avery and Burkhart, 2002). This also accounted for its high Basal Area. As a result of this, the result of yield of these species revealed the highest value for *Rhizophora racemosa* with 6936.80m^3/ha and 642.08m^2/ha for volume and basal area respectively (Table 3). This negates the report of Okigbo (1984) that yield estimates vary between 210m^3/ha and 543m^3/ha in the mangrove forest. The yield result of this study has been probably as a result of its use for recreational purpose, erosion control and protection from storm damage in the community. This made them conserve the forest to this extent. Simple linear regression equations were fitted for the growth variables of each species (Table 4). All equations developed are significance ($p = 0.05$). The suitable models are those with high F-ratio and relatively high coefficient of determination (r^2), (Phillip, 1994). These were therefore selected and used to predict yields for the selected species in the study area. The equations are the double-log equation which involved the logarithmic transformation of the dependent (volume) and the independent (height, Dbh and Basal area) variables. Such transformation of data having curvilinear relationships permits the usual application of the ordinary least squares method of regression analysis (Akindele, 2003). The equations are useful for predicting both current and future yield of the selected mangrove species in the study area. When current values of total height, Dbh and basal area are used in the equation, an estimate of the current yield (Volume per hectare) is obtained. The models developed in this study are useful aid for making sound management decision in mangrove forest area for the selected species.

CONCLUSSION AND RECOMMENDATION

The study has identified three major tree

species in the mangrove forest of the study area. The yield of these species has shown a potential use for timber and other community beneficiary services in the study area most especially environmental services. The study has shown that the yield of the selected tree species could be reasonably predicted from tree total height, Dbh and basal area per hectare. These three variables should be considered when carrying out yield studies for the selected species in mangrove forest area of Nigeria. In comparison, the result revealed that *R. racemosa* has the highest yield follow by *R. harissoni* and the least was *R. mangle.* The equations developed for each species would be very useful in all stages of management assessment of the mangrove forest. Proper monitoring and conservation of this forest is paramount for the forest to provide its necessary and expected services. The equations are therefore recommended for future use in the study area.

Table 2: Summary of growth variables of individual selected tree species

Tree species	Growth variables		Minimum	Maximum
Rhizophora	Height (m)		1.50	2.50
mangle	DBH (m)	0.87	0.64	1.37
	BA (m^2)		0.32	1.47
	Volume (m^3)		0.57	2.94
Rhizophora	Height (m)		3.20	7.00
harissoni	DBH (m)		1.15	2.48
	BA (m^2)		1.03	4.84
	Volume (m^3)		3.51	33.02
Rhizophora	Height (m)		5.00	14.00
racemosa	DBH (m)		1.91	7.64
	BA (m^2)		2.86	45.83
	Volume (m^3)		14.32	641.63

Table 3: Summary of yield assessment of the selected tree species

Tree species	Total Volume (m^3/ha)	Total Basal Area (m^2/ha)
Rhizophora mangle	56.16	29.42
Rhizophora harissoni	426.88	83.20
Rhizophora racemosa	6936.80	642.08

species in the mangrove forest of the study area. The yield of these species has shown a potential use for timber and other community beneficiary services in the study area most especially environmental services. The study has shown that the yield of the selected tree species could be reasonably predicted from tree total height, Dbh and basal area per hectare. These three variables should be considered when carrying out yield studies for the selected species in mangrove forest area of Nigeria. In comparison, the result revealed that *R. racemosa* has the highest yield follow by *R. harissoni* and the least was *R. mangle.* The equations developed for each species would be very useful in all stages of management assessment of the mangrove forest. Proper monitoring and conservation of this forest is paramount for the forest to provide its necessary and expected services. The equations are therefore recommended for future use in the study area.

Table 2 : Summary of growth variables of individual selected tree species

Tree species	Growth variables	Mean	SD	Minimum	Maximum
Rhizophora	Height (m)	1.91	0.27	1.50	2.50
mangle	DBH (m)	0.87	0.15	0.64	1.37
	BA (m^2)	0.61	0.23	0.32	1.47
	Volume (m^3)	1.17	0.48	0.57	2.94
Rhizophora	Height (m)	4.75	0.97	3.20	7.00
harissoni	DBH (m)	1.62	0.06	1.15	2.48
	BA (m^2)	2.17	0.99	1.03	4.84
	Volume (m^3)	11.12	7.77	3.51	33.02
Rhizophora	Height (m)	9.64	2.43	5.00	14.00
racemosa	DBH (m)	4.30	1.41	1.91	7.64
	BA (m^2)	16.05	10.60	2.86	45.83
	Volume (m^3)	173.42	138.98	14.32	641.63

Table 3 : Summary of yield assessment of the selected tree species

Tree species	Total Volume (m^3/ha)	Total Basal Area (m^2/ha)
Rhizophora mangle	56.16	29.42
Rhizophora harissoni	426.88	83.20
Rhizophora racemosa	6936.80	642.08

Table 4: Result of linear regression models developed for tree growth variables.

TREE SPECIES	EQUATION	R	R^2	F-RATIO	RMK
Rhizophora mangle	lnV = 0.51H + 2.07lnDbh + $0.02BA^{-1}$ 0.60	0.99	0.99	10664.44	**
Rhizophora harissoni	lnV = 0.22H + 1.54lnDbh BA^{-1} + 0.70	0.98	0.99	12420.80	**
Rhizophora racemosa	lnV = 0.11H + 1.84lnDbh $0.89BA^{-1}$ + 1.22	0.96	0.99	5161.34	**

** Significant at P d 0.05

lnV = Volume (m^3), H = height. BA (m^2) = Basal Area and DBH (m) = Diameter at breast height

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