



EUROPEAN COMMISSION
DIRECTORATE-GENERAL
DEVELOPMENT

VIII



**Data Collection and Analysis for Sustainable Forest Management in ACP
Countries - Linking National and International Efforts**

**EC-FAO PARTNERSHIP PROGRAMME (1998-2002)
Tropical forestry Budget line B7-6201/97-15/VIII/FOR
PROJECT GCP/INT/679/EC**

Forest Resource Situation Assessment of Nigeria

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**April 1999
Abuja, Nigeria**

This report has been produced as an out put of the EC-FAO Partnership Programme (1998-2002) - Project GCP/INT/679/EC Data Collection and Analysis for Sustainable Forest Management in ACP Countries - Linking National and International Efforts. The views expressed are those of the authors and should not be attributed to the EC or the FAO.

This paper has been minimally edited for clarity and style

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Abbreviations

ADB	African Development Bank.
DBH	Diameter at Breast Height.
FAO	Food and Agriculture Organisation.
FEPA	Federal Environmental Protection Agency.
FGN	Federal Government of Nigeria.
FORMECU	Forestry Management Evaluation and Co-ordinating Unit.
FRA	Forest Resource Assessment.
FRIN	Forestry Research Institute of Nigeria.
FRS	Forest Resources Study.
GIS	Geographic Information System.
GWV	General Woods and Veneer.
IFTs	Indigenous Fruit Trees.
MAI	Mean Annual Increment.
MU	Management Unit.
NGOs	Non-Governmental Organisations.
NIFOR	Nigerian Institute For Oilpalm Research.
NP	National Parks.
PIG	Preliminary Information Gathering.
PPAs	Potential Plantation Areas.
RRIN	Rubber Research Institute of Nigeria.
SFDs	State Forestry Departments.
SIU	Study Implementation Unit.
SNR	Strict Nature Reserves.
SRS	Stratified Random Sampling.
TOR	Terms Of Reference.

1. Forest Resource Situation Assessment of Nigeria

Background

Following the receipt of a letter (Reference GCP/INT/679/EC) from the FAO Representative in Nigeria (Hashin A-Ashami) by the Federal Director of Forestry, Abuja (Mr. G. O. Igugu), we (Messrs. Olaleye and Ameh) were contacted to prepare a Forest Resource Situation Assessment Report for Nigeria. To facilitate our release and speedy implementation of this assignment, necessary approvals were sought and obtained from the Permanent Secretary, Federal Ministry of Agriculture and Natural Resources, Abuja. A contract for the assignment was then signed by the Federal Director of Forestry, Mr. G. O. Igugu.

1.1. Terms of References (TOR)

Under the general supervision of the Director, Forest Resources Division, Forestry Department and the direct supervision of the Co-ordinator EC FAO Partnership Programme on Data Collection and Analysis for Sustainable Forestry Management in ACP Countries and in close collaboration with Forestry Officers involved in the implementation of the EC-FAO Project, the incumbent will:

- ◆ Collect and compile available data on forest and vegetation cover:
- ◆ Provide forest and vegetation classification scheme used in the country as well as the current status of each forest/vegetation classes; and
- ◆ Report on the forest volumes (growing stock, increment and harvesting intensities for each type of forest class at national level and if possible at sub-national level (regions).

For this study, the incumbent will carry out a review of the existing documents and information from 1992 up-till now. Besides, it is requested that relevant source information (inventory reports, maps and) should be duplicated and made available for FAO. In support of this study, two FRA/FAO technical papers are herewith (see attachment)

- a) FRA 2000; Guidelines for assessments in tropical and sub-tropical countries; and
- b) FRA 2000; Terms and Definitions.

Expected Output: A report on the subject with a detailed bibliographic review.
Entry on Duty: ASAP (February 1999)
Duty Station: Nigeria
Working Language: English

1.2. Methodology

In line with the directives of the TOR “to carry out a review of the existing document and information from 1992 up till now”, visits were made to several libraries and documentation units of governmental agencies/departments and Universities concerned with forestry, land use and the environment, to source for reliable and current information on the forest resources situation assessment in the country (see appendix 1).

1.3. Main documents used for the FAO Input Data and Report.

A. FORMECU, 1998 The Assessment of Vegetation and Land Use Changes in Nigeria between 1976/78 and 1993/95. Report prepared by Geomatics International of Canada for FORMECU of the Federal Department of Forestry, Abuja, Nigeria (Final Report).

B. Beak Consultants, 1998. Forest Resources Study of Nigeria. Report prepared for FORMECU of the Federal Department of Forestry, Abuja, Nigeria (Draft Report) Vol .1-4, Management Plans and Maps.

C. World Bank, 1997. Implementation Completion Report, Nigeria, Second Forestry Project (Loan 2760-UNI). Report No. 16532.

D. General Woods & Veneer (GWV), 1994. Review of Wood-Based Sector in Nigeria. Report Prepared for FORMECU of the Federal Department of Forestry, Ibadan, Nigeria.

E. World Bank, 1992. Federal Republic of Nigeria. Forestry Sector Review. Confidential Report No. 10744-UNI.

In addition to the above, other supporting documents were used. These are listed in the Bibliography.

1.4. Limitations of the assignment

During the course of this assignment, seven major limitations were encountered. These include:

1.4.1. Limited source of documents.

Available documents on the forest Resource Situation are few and are scattered in different organisations located in different parts of the country.

1.4.2 Lack of complete and up-to-date information on forest resources

The most current information on the Forest Resource Situation in Nigeria is provided in **draft** report by Beak Consultants of Canada who have just completed the inventory of the high forests and plantations in Nigeria. This implies that their reports are yet to be appraised by the Federal Government of Nigeria.

1.4.3. Limited coverage of the forest inventory.

The inventory exercise conducted by Beak Consultants of Canada covered only twenty-eight (28) states of the Federal Republic of Nigeria. The inventory did not include eight (8) arid states of Northern Nigeria.

1.4.4. Comparable Recent Forest Resource Information not available.

The last inventory of the high forests in Nigeria was done about 20 years ago by the FAO and UNDP. The degree of reliability of information from the recent inventory may be difficult to assess due to many factors including modern technology.

1.4.5. Time constraints.

Sufficient time was not available for the assignment, particularly to source for information from various locations in Nigeria.

1.4.6. Production delays.

Production delays were encountered during the preparation of this report due to frequent and prolonged power outages in Ibadan.

2. FAO Input Data

This chapter deals with all the questionnaires associated with the FAO Input Data. Relevant documents are attached where necessary. All input tables were produced using Microsoft Excel. Answers have been provided for all the sections (1 -) based on available information (see Appendix 3).

3. A Report on the Forest Resource Situation Assessment of Nigeria

3.1. Introduction:

Nigeria is one of the countries in the West Africa sub-region. It is located between Latitudes 4⁰-14⁰N and Longitude 2⁰-14⁰E. It has a total area of 923,768km². The population of Nigeria is estimated to be 90 million (1991 Census). It is bounded by the Republic of Chad and Niger Republic in the north, Benin Republic in the west, the Republic of Cameroon in the east and by the Atlantic Ocean in the south.

3.2. Administrative subdivision of Nigeria.

The Federal Republic of Nigeria is currently divided into 36 states and a Federal Capital Territory called Abuja as shown in Table 1 below. The States are further sub-divided into 776 local government areas.

Table 1: States in Nigeria/Area Status

S/N	State	Area (km²)
1)	Abia	6,320
2)	Adamawa	36,719
3)	Akwa-Ibom	7,081
4)	Anambra	4,844
5)	Bauchi/Gombe*	64,605

6)	Benue	34,059
7)	Borno	70,898
8)	Cross River	20,156
9)	Delta	17,698
10)	Edo	17,802
11)	Enugu/Ebonyi*	12,831
12)	Imo	5,530
13)	Jigawa	23,156
14)	Kaduna	46,053
15)	Kano	20,131
16)	Katsina	24,192
17)	Kebbi	36,800
18)	Kogi	29,833
19)	Kwara	36,825
20)	Lagos	3,345
21)	Niger	76,363
22)	Ogun	16,762
23)	Ondo/Ekiti*	20,959
24)	Osun	9,251
25)	Oyo	28,454
26)	Plateau/Nasarawa*	58,030
27)	Rivers/Bayelsa*	21,850
28)	Sokoto/Zamfara*	65,735
29)	Taraba	54,473
30)	Yobe	45,502
31)	Abuja (FCT)	7,315
	Total	923,572

Source: Adapted from the Annual Abstract of Statistics, Federal Office of Statistics, 1993.

*States derived from further sub-division

3.3. Ecological Zones of Nigeria

The major ecological zones of Nigeria are as follows:

1. Freshwater swamps Forest
2. Lowland Rainforest
3. Mangrove Forest
4. Montane Savanna
5. Sudan Savanna
6. Guinea Savanna
7. Jos Plateau
8. Derived Savanna
9. Sahel Savanna.

3.4 Vegetation Classification:

The vegetation classification of Nigeria is very similar to the ecological classification shown in Figure 2 above. Vegetation classes are derived from the modification of the ecological zones by human interference.

3.5. Forest Types in Nigeria

The most recent classification of forests in Nigeria was done by Beak Consultants (1998) for FORMECU. Eight major forest types are recognised in the Forest Resources Study Area, which consists of about 28 States of the country. The States excluded from the study are the eight arid states in the northern part of the country namely: Sokoto, Zamfara, Katsina, Jigawa, Yobe, Borno, Gombe and Bauchi. The forest classification types are listed below:

- Savanna and woodland
- Lowland Rain Forest
- Freshwater Swamps Forest
- Mangrove Forest
- Montane Forest
- Riparian Forest
- Plantation (agriculture)
- Plantation (Forest)

4. Status of vegetation and forests in Nigeria.

4.1. Status of Vegetation in Nigeria

The most current status of vegetation in Nigeria can be inferred from Table 2 below.

Table 2 Vegetation and Land use Classes for 1976/78 and 1993/95, Nigeria

	1976/78		1993/95		Changes (km ²)
	Area (Km ²)	% of country	Area (km ²)	% of country	
Intensive (crop) Agriculture	322794	35.5	365491	40.2	42697
Extensive (grazing) Agriculture	166326	18.3	187236	20.6	20910
Dominantly Shrub/Grasses	113880	12.5	81694	9.0	-32186
Dominantly Trees/Woodlands/Shrubs	151293	16.6	81386	9.0	-69907
Floodplain Agriculture	9451	1.0	20918	2.3	11467
Disturbed Forest	14573	1.6	18990	2.1	4417
Gullies	122	<0.1	18517	2.0	18395
Forested Freshwater Swamp	18316	2.0	16499	1.8	-1817
Undisturbed Forest	25951	2.9	12114	1.3	-13837
Dominantly Grasses	12549	1.4	11983	1.3	-566
Discontinuous Grassland	6137	0.7	11248	1.2	5111
Mangrove Forest	9994	1.1	9977	1.1	-17
Shrub/Sedge/Graminoid Freshwater Marsh/Swamp	16899	1.9	9248	1.0	-7651
Extensive Agriculture with	3518	0.4	9206	1.0	5688

Denuded Areas					
Grassland	1034	0.1	7989	0.9	6955
Natural Waterbodies	6591	0.7	7851	0.9	1260
Montane Forest	6762	0.7	6759	0.7	-3
Urban (major+minor)	2083	0.2	5444	0.6	3361
Riparian Forest	7402	0.8	5254	0.6	-2148
Sand Dunes	812	0.1	4829	0.5	4017
Montane Grassland	1739	0.2	3112	0.3	1373
Reservoir	1327	0.2	2888	0.3	1561
Rock Outcrop	1424	0.2	2632	0.3	1208
Agricultural Tree Crop Plantation	830	0.1	1641	0.2	811
Forest Plantation	997	0.1	1573	0.2	576
Teak/Gmelina Plantation	628	0.1	1156	0.1	528
Irrigation Project	147	0.1	988	0.1	841
Graminoid/Sedge Freshwater Marsh	4882	0.5	871	0.1	-4011
Saltmarsh.Tidal Flat	4	<0.1	545	0.1	541
Rainfed Arable Crops	16	<0.1	485	0.1	469
Alluvial	487	0.1	269	<0.1	-218
Livestock Project	52	<0.1	139	<0.1	87
Mining Areas	0	0.0	62	<0.1	62
Canal	2	<0.1	29	<0.1	27

Source: FORMECU 1998. *The assessment of vegetation and land use changes in Nigeria between 1976/78 and 1993/9*

4.2. Status of forests in Nigeria.

The current status of forests in Nigeria is based on the work of Beak Consultants for FORMECU titled “The Forest Resources Study (FRS) of Nigeria”. Table 3 below shows the area of various forest types in the forest reserves and free areas. The total areas of these forest categories are also provided.

Table 3: Forest types and their distribution within the FRS Study Area, Nigeria.

S/N	Forest Type	Area in Forest Reserves (ha)	Portion of Total Forested Area in Reserves (%)	Area in Free Forest Areas (ha)	Total Areas of Forest Types in FRS Study Area (ha)	Portion of Total Forested Area in FRS Study Area (%)	Portion of Total Forested Area in FRS Study Area (%)
1	Savanna woodland	1,424,029	52.0	6,922,663	58.8	9,736,158	58.0

2	Lowland rain forest	832,237	30.4	1,580,928	13.4	2,881,755	17.2
3	Freshwater swamp forest	226,242	8.3	1,430,436	12.1	1,656,499	9.9
4	Mangrove forest	48,859	1.8	945,592	8.1	997,451	5.9
5	Montane forest	18,271	0.7	466,036	4.0	685,150	4.1
6	Riparian forest	46,583	1.7	431,537	3.7	509,415	3.0
7	Plantations (agriculture)	0	0	0	0	164,100	1.0
8	Plantation (forest)	144,666	5.3	704	0.0	145,379	0.9
	TOTAL	2,740,887	100.20	11,777,896	100.10	16,775,907	100.00

Source: Beak Consultants 1998. Forest Resources Study, National Report (draft), Vol. 1

5. Forest Reserves, Free Areas and Conservation Areas

5.1. Forest Reserves

It is estimated that the total area of these forest reserves is 10 million ha which is about 10% of the total land area of Nigeria (World Bank 1992). It should be noted that forest reserves within the forest reserves vary according to ecological classification. Hence, forest reserves in the Savanna and Sahel regions may not necessarily have adequate timber resources like those in the lowland rain forest areas of southern Nigeria. These forest reserves are owned by the State Governments and managed the State Forestry Departments (SFDs) who have professional and technical staff including uniform guards for performing their various responsibilities. The reservation of land for forestry purposes was at its peak during colonial times. Efforts to increase the size of the reserves (forestry estate) since then have not been too successful. Hence, only about 10% of the land area of the country is currently under forest reserves. As shown in Table 3 the total area in forest reserves of the FRS Study Area is 2,740,887 ha.

It should be noted that the bulk of the forestry products and services are obtained from the management of the forest reserves. Some of the major products include poles, sawnwood, veneer and fuelwood. However, these products are still obtainable from “free areas “ of the country.

5.2. Free Areas

Free areas are forested areas that are not under strict management by the SFDs. However, permission to exploit trees from free areas still have to be obtained from SFDs. As can be seen in Table 3, the total area in free forest areas in the study area is 11,780,896 ha. They provide additional sources of forest products and services. In fact, they are considered to be very

important for private forestry development. Some of the areas have been targeted as Potential Plantation Areas (PPAs).

5.3. Conservation Areas

Conservation areas in Nigeria include National Parks, Game and Wildlife sanctuaries, proposed Game Reserves/Wildlife Sanctuaries and Strict Nature Reserves (SNR). Table 4 is an updated list of conservation areas in the country.

Table 4 - Updated List of Conservation Areas in Nigeria

S/No.	Name	Area (ha)
	<i>National Parks:</i>	
1.	Kainji Lake	534,082
2.	Old Oyo	251,200
3.	Cross River	280,000
4.	Gashaka-Gumti	640,248
5.	Yankari	224,410
6.	Chad Basin	225,800
	Subtotal	2,155,740
	<i>Games Reserves/Wildlife Sanctuaries:</i>	
7.	Alawa	29,620
8.	Dagida	29,422
9.	Falgore	92,300
10.	Gilli-Gilli	36,200
11.	Kambari	41,400
12.	Kwale	340
13.	Kwaimbana	261,400
14.	Lake Chad *	38,000
15.	Lame-Burra	205,967
16.	Ologbo	19,440
17.	Opara	110,000
18.	Orile	5,440
19.	Pai River	70,000
20.	Pandam	22,400
21.	Sambisa	51,800
22.	Udi-Nsukka	5,600
23.	Wase Rock	92
24.	Okomu	11,200
	Subtotal	1,030,621
	<i>Current proposed Games Reserves/Wildlife Sanctuaries:</i>	
25.	Ifon	28,270
26.	Akpaka	19,400
27.	Ebba-Kampe	121,730
28.	Kamuku	112,700
29.	Moko	96,610
30.	Taylor Creek	30,000
31.	Ohosu	47,100
32.	Okeleuse	11,440
33.	Opanda	10,520
34.	Stubbs Creek	21,000
35.	Afi River	10,000
36.	Kashimbila	139,600
37.	River Benue	154,000
	Subtotal	802,370
	<i>Strict Nature Reserves:</i>	
38.	Akure	32

39.	Bam Ngelzarma	142
40.	Bonu	145
41.	Lekki	78
42.	Milliken Hill	49
43.	Omo (Biosphere Reserve)	460
44.	Ribako	170
45.	Urhonigbe	64
	Subtotal	1,140
	Grand Total	3,989,871

Source: *Adapted from World Bank, June 1992. Federal Republic of Nigeria: Forestry Sector Review. Confidential Report No. 10744-UNI and Nigeria National Parks, Annual Calendar (1998). 13pp.*

* Lake Chad is now part of Chad Basin National Park.

This list is based on the World Bank Report (Forest Sector Review) of 1992. As shown in Table 4, the total area under conservation is 3,989,871 ha.

It is worth noting that there are now six National Parks (NP) in Nigeria namely: Kainji NP (534,082 ha), Old Oyo NP (251,200 ha), Cross River NP (280,000 ha), Gashaka-Gumti NP (640,248 ha) Yankari NP (224,410 ha) and Chad Basin NP (225,800 ha). The total area occupied by the six National Parks in the country is 2,155,740 ha.

The National Parks Service manages all National Parks. Each of the National Parks is headed by a General Manager and supported by professional and technical staff. Apart from National Parks, other conservation areas include Game Reserves/Wildlife Sanctuaries and Strict Nature Reserves (SNRs). These categories of conservation areas are managed mainly by the wildlife sections of the SFDs. However, foreign organisations and Non-governmental organisation (NGOs) are very active in the management of SNRs.

Generally, conservation areas in Nigeria are still considered to be inadequate to protect biologically diverse environments in the country. Of particular interests are the Niger-Delta area and the Hadeja-Nguru wetlands. Oil exploration activities have adversely affected the environment in the Niger Delta areas. Human activities such as bush burning and shifting cultivation are destroying the ecosystem of the Hadejia-Nguru wetlands. Hence, the area is now gradually being destroyed as habitat for migratory birds from Europe.

6. Land Ownership and Tenure

The Land Use Decree No 6 of 1978 guides land ownership and tenure. By this decree, the authority to own any piece of land, including forestry land, is exclusively vested on the Governor of the State where the land is located. "The objective of this Decree was to make land easily accessible to every Nigerian for development purposes in any part of the country and to vest the control of such development in the State Government so that the use of the land would be monitored and controlled" (World Bank, 1992). The implication of this decree as far as forest reserves are concerned is that, these lands belong to the various State Governments. In addition, this implies that private investors should not have difficulties in obtaining land for forestry development.

7. Inventory of the High Forests and Plantations in Nigeria

7.1. Overview

In March 1993, the African Development Bank (ADB), Abidjan, approved a grant of UA 1.72 million for the implementation of a study tagged “The Forest Resources Study of Nigeria”. The overall objective of the study is to enhance industrial forestry development in the country and to facilitate management of its remaining forest resources in all efficient and environmentally adequate way. Essentially, the study consists of three major components namely: -

A. Inventory of the high forest areas in the southern one quarter of the country i.e. about 20,000 km². The following States constitute the study area concerning high forest: Lagos, Oyo, Ogun, Osun, Ondo/Ekiti, Edo, Anambra, Delta, Rivers/Bayelsa, Imo, Akwa-Ibom, Abia, Cross River and Enugu/Ebonyi.

B. Inventory of forest plantations throughout the country, except those in the arid north. Specifically, the States involved include all states inventoried for the high forest and the following States: Kwara, Niger, Kogi, Benue, Taraba, Adamawa, Plateau/Nasarawa, Kaduna, Kano and Kebbi.

C. Sub-studies, which include private sector involvement and socio-economic assessment, wood-based industrial sector review, market and pricing policy assessment, review of forest legislation, survey of indigenous fruit trees (IFTs), and silvicultural investigation of selected IFTs.

The following States in the arid north are not covered by the study: Sokoto/Zamfara, Katsina, Jigawa, Yobe, Bauchi/Gombe and Borno).

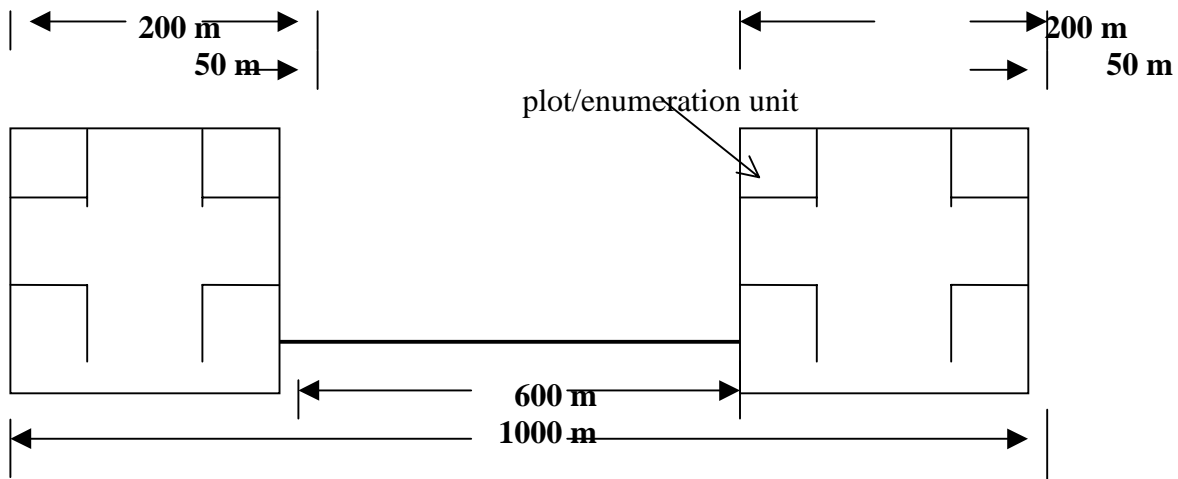
The FRS was implemented as a consultancy assignment by Beak Consultants of Canada with the support of the Federal Government of Nigeria (FGN). Some of the specific obligations of FGN include provision of relevant documents to facilitate the study, establishment of a study implementation unit (SIU), secondment of appropriate staff (mainly inventory officers) and financial resources to pay staff emoluments. The FRS was expected to be completed in 24 months with effect from December 1995. The results of this study is urgently needed for providing adequate and up-to-date information on the forest resource situation in the country and for defining the future role of the forestry sub-sector in the social and economic development of Nigeria. It may be recalled that the last inventory exercise in Nigeria was conducted about 20 years ago by the Food and Agricultural Organisation (FAO) and the UNDP. Draft reports of the FRS are now being assessed. It is hoped that a Final Project Completion Workshop will be held by May 1999.

7.2. Inventory of the High Forests

Prior to the inventory of the high forests and plantations, a Preliminary Information Gathering (PIG) exercise was conducted to facilitate stratification of forest types, densities and site characteristics. Geographic Information System (GIS) technology was also used to isolate specific

forest strata. Stratified Random Sampling (SRS) was used for the high forest inventory. The only limitation imposed for this inventory approach was the requirement to distribute inventory plots across the 14 High Forest States. In order to perform the exercise efficiently, sampling units were taken as point clusters. Each cluster of size 1km by 200 m in area, was composed of two tracts (each of 200 m by 200 m) located 600 m apart at either end of the 1 km line. Within each tract, four plots of 50 m x 50 m were established at the corners to serve as recording unit for the enumeration as shown in Figure 6.

Figure 6: Schematic diagrams of high forest cluster/tract/plot configuration.



Source: Beak Consultants 1998, Forest Resources Study, draft of main report Vol. II, page 217.

Beak Consultants (1998) noted that each cluster, therefore, consisted of 8 plots or enumerating units. Because of the difficult terrain in the Mangrove, Forested Fresh Water swamp and Riparian Forests the size of the cluster was reduced by half i.e. the size of the cluster reduced to 500m x 100m while those of the tract and plot were 100 m x 100 m and 25 m x 25m respectively. The sampling intensity used for inventory of the high Forest was estimated at 0.01% (Beak Consultants 1998).

7.3. Inventory of Forest Plantations

Beak Consultants (1998) used stratified random sampling to undertake the inventory of forest plantations in the study area. The PIG exercise also facilitated the stratification of plantations according to ecological zones, species, density, soil type and age. In order to satisfy the objectives of this inventory, more plots were established within a plantation to capture variability within than to establish fewer but larger plots. Plots of 0.01 ha were therefore randomly established in selected plantations proportional to the plantation size as shown in Table 5.

Table 5: Number of plots established according to plantation size.

Plantation Size (ha)	No. of Sample Plots
Less than 50	4
51 to 150	5
151 to 300	6
301 to 500	7
501 to 700	8
701 to 1000	9
Greater than 1000	10

Source: Beak 1998. *Forest Resources Study, Main Report Vol. II page 2 – 15.*

According to Beak Consultants (1998), a total of 958 plots were enumerated each measuring 0.01 ha in size. A total area of 9.58 ha was enumerated thus giving a sampling intensity of approximately 0.01%.

8. Inventory Results (High Forest)

8.1. High Forests

Tree volume estimation data were used to estimate the volume of individual trees of the high forest. Several equations were tested but most were derived from the basic one below:

$$\ln (V_n) = a + b \ln (H_n) + C \ln (D)$$

Where V_n = net volume

H_n = net height

D = Diameter (cm) at breast height (dbh, 1.3m) or above buttress.

These equations were used to calculate Stand Tables, Stand Volumes, Industrial volumes, Mean annual Increment (MAI) and Annual Allowable cut (AAC).

8.1.1. Stand Tables

The average number of stems per hectare by forest type, density class and utility class is shown in Table 6 while Table 7 depicts the average basal area (M^3) per unit area by forest type, density class and utility class.

Table 6. Average number of stems per unit area (ha) by forest type, density class, and utility class.

Productivity Zone	Forest Type	Density Class	Utility Classes 1-5	Utility Classes 6.9 ¹	Total
East	Freshwater swamp	A ²	33.3	250.0	283.3
West	“	A ²	77.7	88.1	165.8
East/West ³	“	A ²	67.4	151.6	219.0

East	Lowland	1	51.5	108.3	159.8
West	“	1	84.6	81.1	166.4
East/West ³	“	1	79.7	86.4	166.1
East	“	2	54.4	83.9	138.3
West	“	2	7.01	49.8	119.9
East/West ³	“	2	62.8	66.4	129.2
East	“	3	48.1	35.4	83.5
West	“	3	55.3	34.7	90.0
East/West ³	“	3	52.0	35.1	87.1
East/West ³	Mangrove	A ²	0.0	190.7	190.7
East	Riparian	1	24.0	80.8	104.8
West	“	1	4.0	84.0	88.0
East/West ³	“	1	18.2	81.7	99.9
East	“	2	-	-	-
West	“	2	19.7	22.0	41.7
East/West ³	“	2	19.4	21.9	41.3
East	“	3	5.3	16.8	21.9
West	“	3	6.6	64.3	70.9
East/West ³	“	3	5.6	34.7	40.3

¹ Utility class 9 includes all previously unclassified species

² Average of all density classes

³ Weighed average (by number of plots) of productivity zones east and west.

⁴ No data available

Source: Beak Consultants 1998, Forest Resources Study, Main Report Volume II (Draft).

Table 7: Average basal area (m²) per unit area (ha) by forest type, density class and utility class.

Productivity Zone	Forest Type	Density Class	Utility Classes 1-5 (m ² /ha)	Utility Classes 6-9 ¹	Total
East	Freshwater swamp	A ²	2.28	14.20	16.48
West	“	A ²	14.49	15.39	29.88
East/West ³	“	A ²	11.17	15.07	26.24
East	Lowland rain	1	8.04	10.69	18.73
West	“	1	16.45	7.08	23.53
East/West ³	“	1	15.14	7.64	22.78
East	“	2	9.24	9.36	18.60
West	“	2	12.28	4.48	16.76
East/West ³	“	2	10.82	6.83	17.65
East	“	3	4.33	2.75	7.08

West	“	3	13.10	3.21	16.31
East/West ³	“	3	8.71	2.97	11.68
East/West ³	Mangrove	A ²	0.00	14.57	14.57
East	Riparian	1	4.50	9.92	14.42
West	“	1	0.22	7.29	7.51
East/West ³	“	1	3.27	9.17	12.44
East ⁴	“	2	-	-	-
West	“	2	7.06	5.24	12.30
East/West ³	“	2	7.06	5.24	12.30
East	“	3	0.97	3.20	4.17
West	“	3	0.88	5.13	6.01
East/West ³	“	3	0.93	3.92	4.85

Source: Beak Consultants 1998, Forest Resources Study, Main Report Vol. II, page 9-1

¹ Utility Class 9 includes all previously unclassified species.

² Average of all density classes.

³ Weighted average (by numbers of plots) of productivity zones east and west.

⁴ No data available.

8.1.2. Standing Volume

From the FRS, Beak Consultants have developed two types of volume tables for each of the 11 high forest species groups identified from the inventory data. They include double entry (Table 8) and single entry (Table 9) volume tables. The single entry tables are diameter based only while the double entry tables relate diameter to height. It should be noted that these volume tables exclude the bark. Table 10 is the high forest gross volumes (excluding bark) by the forest designation and type.

Table 8: Double entry volume table Species group: 1

Dia. Class (cm) dbh	Volume (cu.m) by Height Class (m)									
	1-1.9	2-2.9	3-3.9	4-4.9	5-5.9	6-6.9	7-7.9	8-8.9	9-9.9	10-10.9
0.0-4.9	0.000	0.001	0.002	0.003	0.004	0.006	0.008	0.010	0.013	0.016
5.0-9.9	0.000	0.002	0.003	0.006	0.009	0.013	0.018	0.023	0.030	0.037
10.0-14.9	0.001	0.002	0.005	0.009	0.014	0.020	0.028	0.037	0.047	0.058
15.0-19.9	0.001	0.003	0.007	0.012	0.019	0.027	0.038	0.050	0.063	0.078
20.0-24.9	0.001	0.004	0.008	0.015	0.024	0.034	0.047	0.062	0.079	0.098
25.0-29.9	0.001	0.005	0.010	0.018	0.028	0.041	0.057	0.074	0.095	0.118
30.0-34.9	0.002	0.005	0.012	0.021	0.033	0.048	0.066	0.087	0.111	0.137
35.0-39.6	0.002	0.006	0.013	0.024	0.038	0.055	0.075	0.099	0.126	0.157
40.0-44.9	0.002	0.007	0.015	0.027	0.042	0.061	0.084	0.111	0.141	0.175
45.0-49.9	0.002	0.007	0.016	0.029	0.046	0.068	0.093	0.122	0.156	0.194
50.0-54.9	0.002	0.008	0.018	0.032	0.051	0.074	0.102	0.134	0.171	0.213
55.0-59.9	0.003	0.009	0.020	0.035	0.055	0.080	0.111	0.146	0.186	0.231

60.0-64.9	0.003	0.009	0.021	0.038	0.060	0.087	0.119	0.157	0.200	0.249
65.0-69.9	0.003	0.010	0.023	0.041	0.064	0.093	0.128	0.169	0.215	0.268
70.0-74.9	0.003	0.011	0.024	0.043	0.068	0.099	0.136	0.180	0.230	0.286
75.0-79.9	0.003	0.011	0.026	0.046	0.073	0.106	0.145	0.191	0.244	0.304
80.0-84.9	0.003	0.012	0.027	0.049	0.077	0.112	0.154	0.202	0.258	0.321
85.0-89.9	0.004	0.013	0.029	0.051	0.081	0.118	0.162	0.214	0.273	0.339
90.0-94.9	0.004	0.013	0.030	0.054	0.085	0.124	0.170	0.225	0.287	0.357
95.0-99.9	0.004	0.014	0.032	0.057	0.089	0.130	0.179	0.236	0.301	0.374
100+	0.004	0.015	0.033	0.059	0.094	0.136	0.187	0.247	0.315	0.392

Source: Beak Consultants 1998. Forest Resources Study, Vol. IV (Appendixes).

Table 9: Single entry volume table Species group 1

Species Group	Diameter Class (cm)	Volume (cu.m)
1	0.0-4.9	0.002
1	5.0-9.9	0.013
1	10.0-14.9	0.043
1	15.0-19.9	0.097
1	20.0-24.9	0.181
1	25.0-29.9	0.298
1	30.0-34.9	0.452
1	35.0-39.9	0.646
1	40.0-44.9	0.885
1	45.0-49.9	1.170
1	50.0-54.9	1.505
1	55.0-59.9	1.891
1	60.0-64.9	2.333
1	65.0-69.9	2.832
1	70.0-74.9	3.390
1	75.0-79.9	4.010
1	80.0-84.9	4.694
1	85.0-89.9	5.444
1	90.0-94.9	6.262
1	95.0-99.9	7.151

Source: Beak Consultants 1998. Forest Resources Study, Vol. IV (Appendices).

Table 10 – High forest gross timber volumes (excluding bark) by forest designation and forest type.

Forest Designation	Land	Forest Type	Area (ha)	Gross Volume (m3)
Forest Reserve		Freshwater swamp	224369	23353102
		Lowland rain	757740	98599957
		Riparian	2547	169101
Free Area		Freshwater swamp	1424739	150814914
		Lowland rain	912094	109544813
		Mangrove	5314	443860
		Riparian	80368	4526678
Game Reserve		Lowland rain	12365	1633706
		Riparian	5492	386513
National Park		Lowland rain	369412	46878597
Total			3,794,440	436,351,241

Source: Beak Consultants 1998. Forest Resources Study, Vol. II page 9-3.

8.1.3. Industrial Volume Calculations (High Forest)

A sample of the Industrial Timber Volumes (by diameter class) is shown in Table 11.

Table 11: Industrial volume for east productivity zone by traditional utility classes and diameter classes.

Forest Type	Utility Class	Volume (cu.m) by Diameter Class (cm)			Total Volume (cm)	Butress Volume (cu.m)
		60-79	80-99	>100		
Freshwater Swamp Forest	UT1	0	0	0	0	0
Freshwater Swamp Forest	UT2	1354735	0	0	1354735	0
Freshwater Swamp Forest	UT3	0	0	0	0	0
Freshwater Swamp Forest	UT4	0	0	0	0	0
Freshwater Swamp Forest	UT5	0	0	0	0	0
Freshwater Swamp Forest	UT6	0	0	0	0	0
Freshwater Swamp Forest	UT7	2720724	447889	0	3168612	0
Freshwater Swamp	UT8	0	0	0	0	0

Forest						
Freshwater Swamp Forest	UT9	929612	0	0	929612	0
Lowland Rainforest	UT1	1230532	85299	415202	1731034	0
Lowland Rainforest	UT2	113221	35519	190545	339285	0
Lowland Rainforest	UT3	1063640	660970	114654	1839263	0
Lowland Rainforest	UT4	1856426	1014619	3679175	6550220	0
Lowland Rainforest	UT5	21143	64013	7184720	7269876	0
Lowland Rainforest	UT6	0	0	0	0	0
Lowland Rainforest	UT7	7606808	836830	546678	8990315	0

Source: Beak Consultants 1998. Forest Resources Study appendix 2-9-12-1

However, the summary of high forest industrial volume is depicted in Table 12.

Table 12 High Forest Industrial Volume Summary.

Forest Type	Utility Classes 1-5 (m ³)	Utility Classes 6-9 (m ³)	Total Volume (m ³)	Buttress Volume (m ³)
Freshwater swamp	41,280,434	27,180,686	68,461,120	1,221,216
Lowland rain	96,464,890	17,748,828	114,213,718	5,003,505
Mangrove	0	77,626	77,626	477
Riparian	1,737,639	1,335,717	3,073,356	11,528

Source: Beak Consultants 1998. Forest Resources Study of Nigeria Vol. 2, page 9 –4.

8.2. Inventory Results (Plantations)

Inventory data from plantations in the study area were used to estimate tree volumes of plantations. The processes followed by Beak to accomplish this task include:

- (a) Preliminary data analysis
- (b) Data screening
- (c) Correlation analysis
- (d) Construction of site index curves
- (e) Development of site index equations
- (f) Modelling of volume-Age Relationship and
- (g) Yield projection models.

It is worth noting that only six plantation species were considered for subsequent analysis. These were *Gmelina arborea*, *Tectona grandis*, *Pinus* spp., *Eucalyptus* spp., *Terminalia ivorensis* and *Nauclea diderrichii*.

8.2.1. Stand Volume Table, Major Species

Stand Volume Tables were developed for each of the six major plantation species. Table 13 depicts the Stand Volume Table for *Gmelina arborea*.

Table 13: Stands volumes table for *Gmelina arborea*

Age (years)	Volume (m ³)	Age (years)	Volume (m ³)
2	115.7	40	647.8
4	156.4	42	648.5
6	205.8	44	649.0
8	262.5	46	649.3
10	323.4	48	649.5
12	384.5	50	649.7
14	441.5	52	649.8
16	491.5	54	649.9
18	532.4	56	649.9
20	564.7	58	650.0
22	589.2	60	650.0
24	607.1	62	650.0
26	620.1	64	650.0
28	629.2	66	650.0
30	635.6	68	650.0
32	640.1	70	650.0
34	643.2	72	650.0
36	645.3	74	650.0
38	646.8	76	650.0

Source: Beak Consultants 1998. Forest Resources study. Appendices (Draft).

8.2.2. Yield Projection, Major Species

Yield Projection Tables were also developed for each of the six major species at different site indices and classes. Table 14 shows the Yield Projection Table for *Tectona grandis* (site index, 28, class 1).

Table 14 – Yield (m3/ha) projection table for *Tectona grandis*, site index 28, site class 1.

Age (year)	Basal Area (m ² /ha)																				
	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44
4	91.6	108.3	125.0	141.7	158.4	175.1	191.9	208.6	225.3	242.0	258.7	275.4	292.1	308.8	325.6	342.3	359.0	375.7	392.4	409.1	425.8
6	97.8	114.5	131.3	148.0	164.7	181.4	198.1	214.8	231.5	248.2	265.0	281.7	298.4	315.1	331.8	348.5	365.2	382.0	398.7	415.4	432.1
8	104.0	120.7	137.4	154.1	170.8	187.6	204.3	221.0	237.7	254.4	271.1	287.8	304.5	321.3	338.0	354.7	371.4	388.1	404.3	421.5	438.3
10	110.1	126.8	143.5	160.2	176.9	193.6	210.3	227.1	243.8	260.5	277.2	293.9	310.6	327.3	344.0	360.8	377.5	394.2	410.9	427.6	444.3
12	116.1	132.8	149.5	166.2	182.9	199.6	216.3	233.0	249.8	266.5	283.2	299.9	316.6	333.3	350.0	366.7	383.5	400.2	416.9	433.6	450.3
14	122.0	138.7	155.4	172.1	188.8	205.5	222.2	238.9	255.7	272.4	289.1	305.8	322.5	339.2	355.9	372.6	389.4	406.1	422.8	439.5	456.2
16	127.8	144.5	161.2	177.9	194.6	211.3	228.0	244.8	261.5	278.2	294.9	311.6	328.3	345.0	361.8	378.5	395.2	411.9	428.6	445.3	462.0
18	133.5	150.2	166.9	183.6	200.4	217.1	233.8	250.5	267.2	283.9	300.6	317.3	334.1	350.8	367.5	384.2	400.9	417.6	434.3	451.1	467.0
20	139.2	155.9	172.6	189.3	206.0	222.7	239.4	256.1	272.9	289.6	306.3	323.0	339.7	356.4	373.1	389.9	406.6	423.3	440.0	456.7	473.4
22	144.7	161.4	178.2	194.9	211.6	228.3	245.0	261.7	278.4	295.1	311.9	328.6	345.3	362.0	378.7	395.4	412.1	428.8	445.6	462.3	479.0
24	150.2	166.9	183.6	200.4	217.1	233.8	250.5	267.2	283.9	300.6	317.3	334.1	350.8	367.5	384.2	400.9	417.6	434.3	451.1	467.8	484.5
26	155.6	172.3	189.1	205.8	222.5	239.2	255.9	272.6	289.3	306.0	322.8	339.5	356.2	372.9	389.6	406.3	423.0	439.8	456.5	473.2	489.9
28	161.0	177.7	194.4	211.1	227.8	244.5	261.2	278.0	294.7	311.4	328.1	344.8	361.5	378.2	394.9	411.7	428.4	445.1	461.8	478.5	495.2
30	166.2	182.9	199.6	216.4	233.1	249.8	266.5	283.2	299.9	316.6	333.4	350.1	366.8	383.5	400.2	416.9	433.6	450.3	467.1	483.8	500.5
32	171.4	188.1	204.8	221.5	238.3	255.0	271.7	288.4	305.1	321.8	338.5	355.3	372.0	388.7	405.4	422.1	438.8	455.5	472.2	489.0	505.7
34	176.5	193.2	209.9	226.7	243.4	260.1	276.8	293.5	310.2	326.9	343.6	360.4	377.1	393.8	410.5	427.2	443.9	460.6	477.4	494.1	510.8
36	181.6	198.3	215.0	231.7	248.4	265.1	281.8	298.5	315.3	332.0	348.7	365.4	382.1	398.8	415.5	432.3	449.0	465.7	482.4	499.1	515.8
38	186.5	203.2	219.9	236.7	253.4	270.1	286.8	303.5	320.2	336.9	353.6	370.4	387.1	403.8	420.5	437.2	453.9	470.6	487.4	504.1	520.8
40	191.4	208.1	224.8	241.6	258.3	275.0	291.7	308.4	325.1	341.8	358.5	375.3	392.0	408.7	425.4	442.1	458.8	475.5	492.2	509.0	525.7

Source: Beak Consultants 1998, Forest Resources Study of Nigeria, Vol. IV (Appendices).

8.3. Timber Supply From High Forests and Plantations

A summary of the timber supply from high forest in the FRS high forest states projected for 2000-2010, is shown by Table 15 while the summary of timber supply from plantations of FRS states are depicted in Table 16 while a summary of the total timber supply (from high forests and plantation) from FRS states is shown in Table 17.

Table 15 – Summary of the timber supply from high forests of the FRS high forest states, projected for the years 2000 and 2010.

State	2000						2010					
	Fuelwood	Poles	Sawnwood	Veneer	Total without Fuelwood	Total with Fuelwood	Fuelwood	Poles	Sawnwood	Veneer	Total without Fuelwood	Total with Fuelwood
Abia	378	2	21	15	38	416	378	2	21	15	38	416
Akwa Ibom	278796	1328	13472	13080	27880	306676	278796	1328	13472	13080	27880	306676
Anambra	60900	290	2241	3559	6090	66990	60900	290	2241	3559	6090	66990
Cross River	111374	530	4955	5652	11137	122511	111374	530	4955	5652	11137	122511
Delta	342279	1630	14128	18470	34228	376507	342279	1630	14128	18470	34228	376507
Edo	5369994	25571	252178	259250	536999	5906993	5369994	25571	252178	259250	536999	5906993
Enugu/Ebonyi	10605	51	599	411	1061	11666	10605	51	599	411	1061	11666
Imo	1638	8	46	110	164	1802	1638	8	46	110	164	1802
Lagos	8274	39	234	554	827	9101	8274	39	234	554	827	9101
Ondo/Ekiti	3542028	16867	170482	166854	354203	3896231	3542028	16867	170482	166854	354203	3896231
Ogun	270564	1288	12392	13376	27056	297620	270564	1288	12392	13376	27056	297620
Osun	109211	520	5277	5124	10921	120132	109211	520	5277	5124	10921	120132
Oyo	278796	1328	13472	13080	27880	306676	278796	1328	13472	13080	27880	306676
Rivers/Bayels a	611562	2912	17478	40766	61156	672718	611562	2912	17478	40766	61156	672718
Total	10996399	52364	506975	540301	1099640	12096039	10996399	52364	506975	540301	1099640	12096039

Table 16 - Summary of the timber from plantations of the FRS states, projected for the years 2000 and 2010.

State	2000						2010					
	Fuelwood	Poles	Sawnwood	Veneer	Total without Fuelwood	Total with Fuelwood	Fuelwood	Poles	Sawnwood	Veneer	Total without Fuelwood	Total with Fuelwood
Abia	1199	1199	215808	0	217006	218205	1694	1694	171995	0	173689	175382
Adamawa	1040	1040	34205	0	35244	36284	1180	1180	27271	0	28451	29631
Akwa Ibom	5498	29218	12325	0	41543	47041	327	327	16332	0	16659	16986
Anambra	6366	6366	127336	0	133702	140068	7556	7556	137346	0	144901	152457
Benue	1658	4884	54655	0	59538	61196	1071	2905	56314	0	59220	60291
Cross River	917	917	637914	0	638830	639747	1126	1126	646256	0	647382	648507
Delta	424	0	94085	0	94085	94509	0	1776	120124	0	121900	121900
Edo	2418	2418	896198	0	898617	901035	2619	2619	852307	0	854927	857546
Enugu/Ebonyi	0	0	539483	0	539483	539483	0	1626	556914	0	558539	558539
Imo	0	0	55850	0	55850	55850	0	0	56826	0	56826	56826
Kebbi	3138	3138	6277	0	9415	12554	4720	3908	7816	0	11724	16444
Kaduna	0	0	109088	0	109088	109088	0	0	116167	0	116167	116167
Kogi	2471	3231	189150	0	192381	194852	2865	10348	88794	0	99142	102008
Kano	5668	4759	13890	0	18649	24316	4808	7868	21092	0	28960	33768
Kwara	836	1902	286609	0	288511	289347	1179	22082	292296	0	314379	315558

Lagos	1861	1861	96332	0	98193	100054	2614	2614	5388	0	8002	10615
Niger	308	308	295847	0	296155	296462	399	843	171805	0	172647	173046
Ondo/Ekiti	122850	225276	872416	0	1097691	1220541	0	0	594893	0	594893	594893
Ogun	148076	48383	1726178	0	1774561	1922637	131	1019	1380922	0	1381941	1382072
Osun	5494	23417	288864	0	312280	317775	279	3298	182707	0	186005	186283
Oyo	25640	25343	378199	0	403542	429182	33518	33518	124299	0	157818	191336
Plateau/Nasarawa	1966	4950	48319	12274	65543	67509	2343	11792	42355	31367	85514	87857
Rivers/Bayelsa	0	0	0	0	0	0	0	0	0	0	0	0
Taraba	757	615	39125	0	39740	40497	0	1013	31301	0	31313	32313
Total	338585	389225	7018153	12274	7419647	7758232	68429	119112	5701520	31367	5851999	5920425

Table 17: Summary of the timber supply (high forests and plantations) from FRS states, projected for the years 2000 and 2010.

State	2000						2010					
	Fuelwood	Poles	Sawnwood	Veneer	Total without Fuelwood	Total with Fuelwood	Fuelwood	Poles	Sawnwood	Veneer	Total without Fuelwood	Total with Fuelwood
Abia	1577	1201	215829	15	217044	218621	2072	1696	172016	15	173727	175798
Adamawa	1040	1040	34205	0	35244	36284	1180	1180	27271	0	28451	29631
Akwa Ibom	284294	30546	25797	13080	69423	353717	279123	1655	29804	13080	44539	323662
Anambra	67266	6656	129577	3559	139792	207058	68456	7846	139587	3559	150991	219447
Benue	1658	4884	54655	0	59538	61196	1071	2905	56314	0	59220	60291
Cross River	112291	1447	642869	5652	649967	762258	112500	1656	651211	5652	658519	771018
Delta	342703	1630	108213	18470	128313	471016	342279	3406	134252	18470	156128	498407
Edo	5372412	27989	1148376	259250	1435616	6808028	5372613	28190	1104485	259250	1391926	6764539
Enugu/Ebonyi	10605	51	540082	411	540544	551149	10605	1677	557513	411	559600	570205
Imo	1638	8	55896	110	56014	57652	1638	8	56872	110	56990	58628
Kebbi	3138	3138	6277	0	9415	12554	4720	3908	7816	0	11724	16444
Kaduna	0	0	109088	0	109088	109088	0	0	116167	0	116167	116167
Kogi	2471	3231	189150	0	192381	194852	2865	10348	88794	0	99142	102008
Kano	5668	4759	13890	0	18649	24316	4808	7868	21092	0	28960	33768
Kwara	836	1902	286609	0	288511	289347	1179	22082	292296	0	314379	315558
Lagos	10135	1900	96566	554	99020	109155	10888	2653	5622	554	8829	19716
Niger	308	308	295847	0	296155	296462	399	843	171805	0	172647	173046
Ondo/Ekiti	3664878	242143	1042898	166854	1451894	5116772	3542028	16867	765375	166854	949096	4491124
Ogun	418640	49671	1738570	13376	1801617	2220257	270695	2307	1393314	13376	1408997	1679692
Osun	114705	23937	294141	5124	323201	437907	109490	3818	187984	5124	196926	306415
Oyo	304436	26671	391671	13080	431422	735858	312314	34846	137771	13080	185698	498012
Plateau/Nasarawa	1966	4950	48319	12274	65543	67509	2343	11792	42355	31367	85514	87857
Rivers/Bayelsa	611562	2912	17478	40766	61156	672718	611562	2912	17478	40766	61156	672718
Taraba	757	615	39125	0	39740	40497	0	1013	31301	0	32313	32313
Total	11334984	441589	7525128	552575	8519287	19854271	11064828	171476	6208495	571668	6951639	18016464

Source: Beak Consultants 1998. Forest Resources Study. Main Report Vol. II page 9-31.

9. Other Results

9.1. Forest Resources Management Plans and Maps

Beak Consultants have identified three types of management units in the high forest areas of the country. These units are based on major forest types, which closely relate to the ecological zones within Nigeria. These management units are designated as follows-

- (a) Lowland rain forest MU1
- (b) Fresh water Swamp forest MU2
- (c) Mangrove forest MU2

Table 18 is a list of the high forest States with their associated management unit

Table 18 – High forest states with associated management units.

S/N	State Name	Management Unit ¹	Forest Reserve Name	Forest Reserve Area (ha)
1	Abia	1	Mgbeagu	112
2		1	Obeaku	1700
3		1	Ohambele	118
4		2	Obieze-Isu	2720
5	Akwa-Ibom	1	Obeaku	841
6		2	Stubbs Creek	29477
7	Anambra	1	Mamu River	8183
8		2	Anambra	15748
9		2	Osomari	14177
10	Cross River	1	Afi River	53605
11		1	Agoi	5490
12		1	Cross River North	16422
13		1	Cross River South	29119
14		1	Ekinta River	38263
15		1	Ikrigon	1882
16		1	Oban Group	73257

17.		1	Ukpon River	34274
18.		2	Lower Enyong	2747
19.		2	Uwet Odot	25088
20.	Delta	1	Ogwashi-Uku	258
21.		1	Okpe-Urhobo	13962
22.		2	Gilli-Gilli	554
23.		3	Olague	29023
24.	Edo	3	Uremure Yokri	35401
25.		1	Ebue	10422
26.		1	Ehor	38578
27.		1	Ekiadolor	24720
28.		1	Ewohinmi	1235
29.		1	Igbuobazuwa	32199
30.		1	Obaretin	11352
31.		1	Ohosu	51519
32.		1	Ojogba-Ugun	1154
33.		1	Okhuesan	2718
34.		1	Okomu	113766
35.		1	Ologholo-Emu-Urho	12044
36.		1	Ora-luleha-Ozalla	14540
37.		1	Owan	30780
38.		1	Sapoba	53406
39.		1	Ubiaja	960
40.		1	Udo	2137
41.		1	Urhonigbe	30791
42.		1	Urohi-Ojogba	3195
43.		1	Usonigbe	3159
44.		2	Ekenwan	
45.		2	Ekenwan	20997
46.		2	Gilli-Gilli	30927
47.		2	Ologbo	17784

48.		2	Orle River	42621
49.	Enugu and Ebonyi	1	Effium	724
50.		1	Mamu River	2556
51.		2	Ibaji-Ojoko	24
52.	Imo	2	Obigbo Obokofia	42
53.		2	Ofili-Anozie 1	418
54.		2	Ohaji	1163
55.	Lagos	2	Ologe Lagoon	4427
56.		3	Yelwa	122
57.	Ogun	1	Omo	134730
58.	Ondo/Ekiti	1	Akure	7870
59.		1	Akure-Ofosu	39236
60.		1	Ala	20858
61.		1	Aramoko	3282
62.		1	Ada 1	668
63.		1	Ada 2	401
64.		1	Egbe	2836
65.		1	Idanre	56092
66.		1	Ipele-Idoani	3340
67.		1	Irele	2410
68.		1	Ise	5263
69.		1	Little Ose	2723
70.		1	Ogbese	6256
71.		1	Okeluse	16944
72.		1	Oluwa	84636
73.		1	Onishere	11521
74.		1	Owo	24061
75.		2	Eba Island	2042
76.		2	Ejigbobini	2046
77.	Osun	1	Ago-Owu	24847
78.		1	Ife	8383

79.		1	Ikeji-Ipetu	4849
80.		1	Oba Hills	5225
81.		1	Shasha	30834
82.	Oyo	1	Gambari	17984
83.		1	Igangan	40645
84.		1	Ijaye	25546
85.		1	Lanlate	10880
86.		1	Osho	3822
87.	Rivers and Bayelsa	1	Lower Imo River	8124
88.		1	Proposed Otamiri River	18131
89.		1	Upper Imo River	10384
90.		2	Apoi Creek	7080
91.		2	Edumanom	9324
92.		2	Egbedi Creek	6718
93.		2	Ikebiri Creek	19673
94.		2	Lower Orashi River	4220
95.		2	Nun River	9692
96.		2	Proposed Sombriero	14206
97.		2	Taylor Creek	22566
98.		2	Upper Orashi River	10384
	Total	114		862,537

¹ MU 1 – Lowland Rain Forest – Freshwater Swamp Forest, MU3 – Mangrove Forest

² Includes mangroves with tress and without trees.

Source: Beak Consultants 1998. Forest Resources main Report (Draft) Vol. II page 5-9.

Beak Consultants of Canada have prepared management plans for each of the 24 study states. Estimates have been made for Gross standing volumes, industrial timber Volumes and Plantation information for the States. Tables 19a, 19b, 19c, 19d and 19e provide these estimates for Osun State. A forest resources map for each of the FRS State was also prepared by Beak Consultants showing major forest resources. The scales of the state maps are not uniform.

Table 19a: Gross timber volumes by forest designation and forest type for Osun State.

Forest Designation	Land	Forest Type	Area (ha)	Gross Volume (m ³)
Forest Reserve		Lowland rain	56,158	9,319,313
Free Area		Lowland rain	106,274	14,729,485
Total			162,432	24,048,798

Table 19b Stand volumes in forest plantations in Osun State.

S/N.	Species	Area (ha)	Volume (m ³)
1.	Cedrela odorata	4	439
2.	Gmelina arborea	1777	844019
3.	Nauclea spp.	14	1518
4.	Pinus caribea	427	120567
5.	Pinus spp.	4	1129
6.	Tectona grandis	6170	1440683
7.	Terminalia ivorensis	302	68388
8.	Terminalia spp.	541	138414
9.	Triplochiton scleroxylon	20	10260
	Total	9,259	2,625,417

Table 19c: Industrial timber volume by forest typr, utility class, and bole quality for Osun State.

Forest Type	Utility Class	Volume (m3) by			Total Volume (m3)	Total Utilisable Volume 1 (m3)
		BQ1	BQ2	BQ3		
Lowland rain	1	2841129	1481272	546371	4868772	3581765
Lowland rain	2	469395	322271	80568	872234	630530

Lowland rain	3	1756085	887691	212274	2856050	2199930
Lowland rain	4	979915	680123	268470	1928508	1319976
Lowland rain	5	1416692	472231	177086	2066009	1652807
Lowland rain	6	0	0	0	0	0
Lowland rain	7	537951	457300	332582	1327832	766600
Lowland rain	8	0	0	0	0	0
Lowland rain	9	82059	69756	50732	202547	1169370

Source: Beak Consultants 1998. Forest Resources Study, Osun State Forest Management
Plan. *Page* *3-1,*

3-2,

3-5

Table 19d: Timber supply from high forests for Osun State (m3/yr)

Product	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Fuelwood	8169	8169	8169	8169	8169	8169	8169	8169	8169	8169	8169	8169
Poles	39	39	39	39	39	39	39	39	39	39	39	39
Sawnwood	395	395	395	395	395	395	395	395	395	395	395	395
Veneer	383	383	383	383	383	383	383	383	383	383	383	383
Total w/o fuelwood	817	817	817	817	817	817	817	817	817	817	817	817
Total with fuelwood	8986	8986	8986	8986	8986	8986	8986	8986	8986	8986	8986	8986

Table 19e: Timber supply from plantations for Osun State (m3/yr)

Product	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Fuelwood	2050	3037	2344	2117	1698	982	1622	269	272	274	277	279
Poles	20697	15730	106892	16816	8782	9053	9407	17840	14302	14216	13508	3298
Sawnwood	68223	226079	236937	249632	312533	204940	493267	208216	70612	162420	46156	119894
Veneer	0	0	0	0	0	0	0	0	0	0	0	0
Total w/o fuelwood	88921	241809	343829	266448	321315	213992	502674	226056	84914	176636	59664	123192
Total with fuelwood	90971	244846	346174	268565	323013	214975	504296	226324	85186	176910	59940	123471

Source: Beak Consultants 1998. Forest Resources Study, Osun State Forest Management *Plan*. Page 3-7.

10. Conclusion

The Forest Resource Situation Assessment of Nigeria as at April 1999 has been presented above. This assessment is based on the most recent information available in the country i.e. the Reports of Beak Consultants of Canada (1998). These Reports include Main Reports, (I and II), Appendices, State Forest Management Plans and Maps (24) and six sub-studies reports. These reports are yet to be evaluated by the Federal Government of Nigeria. Therefore, some cautions need to be exercised in the use of the information until the reports are accepted by the Federal Government of Nigeria.

Other documents used for this assessment are listed in the bibliography. In addition relevant data concerning the assessment have been photocopied and attached in appendix 2.

BIBLIOGRAPHY

- FORMECU 1998, The assessment of vegetation and land use changes in Nigeria between 1976/78 and 1993/95; Unpublished report prepared by Geomatics International Inc; and Unilag Consult 220P.
- FORMECU June 1994, Review of the wood-based sector in Nigeria. Final Report prepared by General woods and Veneer Consultants Ltd., Canada and Department of Forest Resources Management, University of Ibadan, Nigeria for FORMECU, FMANR, Abuja, Nigeria. 420PP.
- Beak Consultants 1998. Forest Resources Study of Nigeria, Draft main Report-volume 1 (Overview). Unpublished report prepared by Beak Consultants Limited of Canada for FORMECU, Federal Department of Forestry, Abuja, Nigeria 69PP.
- Beak Consultants 1998. Forest Resources Study, Nigeria Draft Main Report – Volume II (Forest Inventory, Management Planning and Recommendations. Unpublished Report prepared by Beak Consultants of Limited of Canada for FORMECU, Federal Department of forestry, Abuja Nigeria 196PP.
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- ADB. 1993. Terms of Reference, Forest Resources Study, Federal Government of Nigeria. 25pp.
- Beak Consultants 1997. Forest Resources Study, Nigeria. Forest Inventory Training

Manual. 45pp + appendices.

Rubber Research Institute of Nigeria. 1998. Rubber plantation status in Nigeria-
Unpublished statistical document of RRIN Benin City, Nigeria.

Nigeria National Parks 1998. Annual Calendar 13pp.

World Bank. June 1992. Federal Republic of Nigeria: Forestry Sector Review.
Confidential Report No 10744-UNI 96pp. +

Appendix 1 List of organisations visited to source for relevant information on the assignment.

Forestry Management evaluation and Co-ordinating Unit (FORMECU) of the Federal Department of Forestry, Abuja.

Federal Department of Forestry, Area 11 P. M. B. 135 Garki, Abuja.

Department of Forest Resources Management, University of Ibadan, Ibadan.

Department of Wildlife Management and Fisheries, University of Ibadan, Ibadan.

Federal environmental Protection Agency (FEPA), Abuja and Ibadan.

National Parks Services Headquarters, City Gate, Abuja.

Old Oyo National Parks office, Oyo, Oyo State.

Forestry Research Institute of Nigeria (FRIN), P. M. B. 5051, Ibadan, Oyo State.

Rubber Research Institute of Nigeria (RRIN), Benin City, Edo State.

Nigeria Institute for Oilpalm Research (NIFOR), Benin City, Edo State.

Federal Department of Land Resources, Area 11, P. M. B. 135, Garki, Abuja.

Geomatics Nigeria Ltd. P. O. Box 36528, Dugbe Post Office, Ibadan, Oyo State.

Appendix 2 Other documents used for the report.

1. FORMECU 1998, The assessment of vegetation and land use changes in Nigeria between 1976/78 and 1993/95; Unpublished report prepared by Geomatics International Inc; and Unilag Consult 220P.

- a. Dominant Vegetation and Land Use Changes between 1976/78 and 1993/95 Nigeria.
- b. Summary of National Vegetation and Land Use Change Statistics.
- c. Trend Analysis.
- d. State Boundary Changes, 1991.
- e. Index of 1: 250,000 scale map sheets for Nigeria.
- f. National Index of 1:250,000 Maps.

2. FORMECU June 1994, Review of the wood-based sector in Nigeria. Final Report

prepared by General woods and Veneer Consultants Ltd., Canada and Department of Forest Resources Management, University of Ibadan, Nigeria for FORMECU, FMANR, Abuja, Nigeria. 420PP.

- a. Assumed Land Occupancy and Remaining Forest Cover.
- b. Assumed Commercial Forest Areas.
- c. Distribution of Forest Types 1993.
- d. Current Estimates of Remaining Forest Stocking 1993.
- e. Current Best Estimates of Wood Resources available on an annual Basis (1993)-Sawlogs.
- f. Current Best Estimates of Wood Resources available on an annual Basis (1993)-Veneer Logs.
- g. Current Best Estimates of Wood Resources available on an annual Basis (1993)- Poles.
- h. Net available Volume per year for Industrial Wood-based Sector.
- i. Net available Volume per year to the Formal Wood-based Sector.
- j. Best Estimates of Fuelwood Production.
- k. Summary of Forest Plantation Resources in Nigeria.
- l. Specie Mean Annual Increment and Net Extractable Volume per Year.
- m. Resource Quality Assessment by Type.
- n. Summary of Annual Forest Plantation Production by Type of Products.
- o. Net available Volume per Year to the Informal Sector.
- p. Tentative Wood Allocation Model – Commodities Products – Reference Year 1993.
- q. Estimated Wood Requirements – Nigeria (in ‘000 m³) Round wood equivalent.
- r. Revised wood requirements – Nigeria (thousand m³).

1. Nigeria National Parks: (Brochure).

- a. Synopsis on the Parks.
- b. A checklist of some Animals.
- c. Species in the National Parks.
- d. Brief on the National Parks.

Appendix 3

Standing Volume of Industrial Roundwood derived from Inventory.

STATE	SPECIES	AREA (ha)	Volume (m ³)
1. Lagos	1. Gmelina arborea	223	86412
	2. Mitragyna spp	419	82949
	3. Tectona grandis	7	1926
	4. Terminalia spp	400	110582
	Total	1,049	281,869
2. Ogun	1. Cedrela odorata	41	3778
	2. Gmelina arborea	28877	13400559
	3. Nauclea diderrichii	120	12145
	4. Pinus caribaea	82	6917

	5. Tectona grandis	10965	3393053
	6. Terminalia ivorensis	62	14151
	Total	40,147	16,830,603
3. Oyo	1. Cedrela odorata	4000	1142427
	2. Gmelina arborea	907	526267
	3. Tectona grandis	1836	501273
	Total	6,743	2,169,967
4. Osun	1. Cedrela odorata	4	439
	2. Gmelina arborea	1777	844019
	3. Nauclea spp	14	1918
	4. Pinus caribaea	427	120567
	5. Pinus spp	4	1129
	6. Tectona grandis	6170	1440683
	7. Terminalia ivorensis	302	68388
	8. Terminalia spp	541	138414
	9. Triplochiton scleroxylon	20	10260
	Total	9,259	2,625,817
5. Ondo & Ekiti	1. Gmelina arborea	18840	7220063
	2. Pinus spp	299	92651
	3. Tectona grandis	4034	949556
	4. Terminalia ivorensis	177	27759
	5. Terminalia superba	224	31785
	Total	23,574	8,321,814
6. Edo	1. Gmelina arborea	13021	7920392
	2. Lova trichilioides	224	61912
	3. Nauclea diderichii	269	72032
	4. Nauclea spp	100	20146
	5. Tectona grandis	6057	1856848
	6. Terminalia ivorensis	1611	524077
	7. Triplochiton scleroxylon	240	153660
	Total	21,522	10,609,067
7. Delta	1. Gmelina arborea	173	110719
	2. Tectona grandis	3268	999119
	3. Terminalia ivorensis	573	181843
	Total	4,014	1,291,681
8. Rivers & Bayelsa	NIL	NIL	

9. Cross. Rivers	1. Cassia spp	80	24394
	2. Cedrela odorata	50	13371
	3. Gmelina arborea	11943	7030677
	4. Lova trichilioides	50	11245
	5. Nauclea diderrichii	50	11245
	6. Pinus spp	135	27697
	7. Tectona grandis	1488	413203
	8. Terminalia ivorensi	50	18085
	9. Terminalia spp	468	151754
	10. Terminalia superba	50	14913
	Total	14,364	7,716,584
10. Akwa-Ibom	1. Cassia spp	2	294
	2. Gmelina arborea	1941	598738
	3. Lova trichilioides	50	10073
	4. Nauclea diderrichii	6	631
	5. Nauclea spp	15	1392
	6. Pinus caribaea	112	34705
	7. Pinus spp	6	376
	8. Tectona grandis	67	8798
	9. Terminalia superba	30	4406
		Total	2,229
11. Imo	1. Gmelina arborea	1024	647996
	2. Pinus caribaea	58	17973
	3. Tectona grandis	170	26228
	Total	1,252	692,197
12. Abia	1. Gmelina arborea	3040	1849743
	2. Mitragyna spp	281	53367
	3. Nauclea diderrichii	295	50985
	4. Nauclea spp	98	52963
	Total	3,714	2,007,058
13. Anambra	1. Cedrela odorata	427	110419
	2. Gmelina arborea	2081	1252975
	3. Khaya ivorensis	427	137963
	4. Nauclea diderrichii	428	110678
	5. Pinus caribaea	15	4747
	6. Tectona grandis	22	6030
	7. Triplochiton scleroxylon	427	273328
	Total	3,827	1,896,140
14. Enugu/Ebonyi	Gmelina arborea	10033	6193030

	Pinus spp	60	18986
	Tectona grandis	2542	1103831
	Eucalyptus spp	355	77377
	Pinus caribaea	760	205210
	Total	13,750	7,598,434
15. Benue	1. Azadirachta indica	62	38884
	2. Cassia spp	21	7659
	3. Eucalyptus camaldulensis	13	3865
	4. Eucalyptus spp	4	751
	5. Gmelina arborea	1150	628446
	6. Khaya senegalensis	25	5036
	7. Tectona grandis	951	2338475
	Total	2,226	3,023,116
16. Kwara	1. Eucalyptus spp	600	85720
	2. Gmelina arborea	8670	4520167
	3. Khaya senegalensis	204	39579
	4. Tectoma grandis	246	62636
	Total	9,720	4,708,102
17. Kogi	1. Azadirachata indica	2	983
	2. Eucalyptus spp	5	1130
	3. Gmelina arborea	1513	828014
	4. Khaya ivorensis	329	108776
	5. Tectona grandis	3165	702131
	6. Terminalia ivorensis	404	131928
	7. Terminalia spp	49	11416
	8. Terminalia superba	31	8411
	9. Triplochiton scleroxylon	5	2037
	Total	5,503	1,794,826
18. Niger	1. . Azadirachata indica	12	7146
	2. Cassia siama	35	8404
	3. Cassia spp	8	2149
	4. Gmelina arborea	3548	1977679
	5. Khaya senegalensis	18	3235
	6. Pinus spp	6	2003
	7. Tectona grandis	1868	462136
	8. Terminalia spp	38	10792
	9. Terminalia superba	86	23110
	Total	5,619	2,496,654
19. Kebbi	1. Accacia senegal	266	38067

	2. Anacardium occidentale	50	4721
	3. Azadirachta indica	182	102385
	4. Gmelina arborea	195	104955
	5. Tectona grandis	198	39693
	Total	891	289,821
20. Kaduna	1. Eucalyptus camaldulensis	2409	673351
	2. Pinus caribaea	1881	619912
	3. Pinus ocarpa	8	2344
	4. Tectona grandis	1568	677861
	Total	5,866	1,973,468
21. Kano	1. Acacia senegal	5	653
	2. Acacia spp	5	998
	3. Azadirachta indica	348	156558
	4. Cassia siamea	4	834
	5. Cassia spp	138	26872
	6. Dalbergia sissoo	293	81911
	7. Dalbergia spp	183	49114
	8. Eucalyptus camaldulensis	4	759
	9. Eucalyptus spp	666	128211
	10. Gmelina arborea	25	12940
	11. Khaya spp	60	16584
	12. Tectona grandis	30	9348
	Total	1,761	484,782
22. Ibadan/Nasarawa	1. Eucalyptus spp	1433	343366
	2. Gmelina arborea	2393	1369293
	3. Pinus caribaea	1500	383724
	4. Tectona grandis	1612	368715
	Total	6,938	2,465,098
23. Adamawa	1. Azadirachta indica	97	49794
	2. Dalbergia sissoo	28	8838
	3. Eucalyptus camaldulensis	47	11387
	4. Eucalyptus spp	1068	298496
	5. Khaya senegalensis	9	1813
	Total	1,249	370,328
24. Taraba	1. Eucalyptus spp	1096	275254
	2. Gmelina arborea	143	84436

	3. Tectona grandis	155	38441
	Total	1,394	398,131

Source: Compiled from FRS State Forest Management Plans, Table 3.4

FAO Input Table 1: Updated List of Conservation Areas in Nigeria

S/No.	Name	Area (ha)
	<i>National Parks:</i>	
1.	Kainji Lake	534,082
2.	Old Oyo	251,200
3.	Cross River	280,000
4.	Gashaka-Gumti	640,248
5.	Yankari	224,410
6.	Chad Basin	225,800
	Subtotal	2,155,740
	<i>Games Reserves/Wildlife Sanctuaries:</i>	
7.	Alawa	29,620
8.	Dagida	29,422
9.	Falgore	92,300
10.	Gilli-Gilli	36,200
11.	Kambari	41,400
12.	Kwale	340
13.	Kwaimbana	261,400
14.	Lake Chad	38,000
15.	Lame-Burra	205,967
16.	Ologbo	19,440
17.	Opara	110,000
18.	Orile	5,440
19.	Pai River	70,000
20.	Pandam	22,400
21.	Sambisa	51,800
22.	Udi-Nsukka	5,600
23.	Wase Rock	92
24.	Okomu	11,200
	Subtotal	1,030,621
	<i>Current proposed Games Reserves/Wildlife Sanctuaries:</i>	
25.	Ifon	28,270
26.	Akpaka	19,400
27.	Ebba-Kampe	121,730
28.	Kamuku	112,700
29.	Moko	96,610
30.	Taylor Creek	30,000
31.	Ohosu	47,100
32.	Okeleuse	11,440
33.	Opanda	10,520

34.	Stubbs Creek	21,000
35.	Afi River	10,000
36.	Kashimbila	139,600
37.	River Benue	154,000
	Subtotal	802,370
	<i>Strict Nature Reserves:</i>	
38.	Akure	32
39.	Bam Ngelzarma	142
40.	Bonu	145
41.	Lekki	78
42.	Milliken Hill	49
43.	Omo (Biosphere Reserve)	460
44.	Ribako	170
45.	Urhonigbe	64
	Subtotal	1,140
	Grand Total	

Source: Adapted from World Bank, June 1992. Federal Republic of Nigeria: Forestry Sector Review.

Confidential Report No. 10744-UNI and Nigeria National Parks. Annual Calendar (1998). 13pp.

*Lake Chad is now part of Chad Basin National Park. See attached FAO Input Figure 2.

FAO Input Table 2: Forest types and their distribution within the FRS Study Area, Nigeria.

S/N	Forest Type	Area in Forest Reserves (ha)	Portion of Total Forested Area in Reserves (%)	Area in Free Forest Areas (ha)	Total Areas of Forest Types in FRS Study Area (ha)	Portion of Total Forested Area in FRS Study Area (%)	Portion of Total Forested Area in FRS Study Area (%)
1	Savanna woodland	1,424,029	52.0	6,922,663	58.8	9,736,158	58.0
2	Lowland rain forest	832,237	30.4	1,580,928	13.4	2,881,755	17.2
3	Freshwater swamp forest	226,242	8.3	1,430,436	12.1	1,656,499	9.9
4	Mangrove forest	48,859	1.8	945,592	8.1	997,451	5.9
5	Montane forest	18,271	0.7	466,036	4.0	685,150	4.1
6	Riparian forest	46,583	1.7	431,537	3.7	509,415	3.0

7	Plantations (agriculture)	0	0	0	0	164,100	1.0
8	Plantation (forest)	144,666	5.3	704	0.0	145,379	0.9
	TOTAL	2,740,887	100.20	11,777,896	100.10	16,775,907	100.00

*Source: Beak Consultants 1998. Forest Resources Study, National Report (draft),
Vol. 1.*