This is to certify that the

dissertation entitled

A FORESTRY PROGRAM FOR NIGERIA

presented by

Ayodeji Adeniyi Fatunde

has been accepted towards fulfillment
of the requirements for

Ph.D. degree in Forestry

Leo M. James
Major professor

Date Aug. 6, 1986

A FORESTRY PROGRAM FOR NIGERIA

By

Ayodeji Adeniyi Fatunde

A DISSERTATION

Submitted to

Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Forestry

1986

ABSTRACT

A FORESTRY PROGRAM FOR NIGERIA

By

Ayodeji Fatunde

The consumption of forest products in Nigeria has been increasing faster than production. This is due mostly to rapidly increasing population and economic activity and the resultant increased need for products like fuelwood and charcoal, lumber, wood panels, paper and paperboard.

The increasing population also requires increasing space for agriculture, transportation, cities and other land uses. The more space taken up by these competing land uses, the less there is for forestry. Furthermore the prevalent practice of shifting cultivation degrades and depletes forests and exposes them to erosion, fires, etc.

No forest management is done outside forest reserves. Production inside reserves falls far short of potential because of shortage of personnel, funds, and facilities necessary for greater management intensity. Yet consumption is expected to keep increasing more dramatically. Although government realizes these trends and has taken steps towards correcting the situation, sectoral targets are not being met.

Ayodeji Adeniyi Fatunde

This study attempts to assess current and prospective trends in the forestry sector, identify the forces influencing the sector, and then use these to develop a program to better realize the objectives of the sector.

The assessment presented in Chapter 3 includes forecasts of consumption to the year 2010, and analysis of the condition of the resources base and forest industry. Forest management and institutions are examined in Chapters 4 and 5 respectively, followed by examples of successful forestry programs in chapter 6. Finally, in Chapter 7 a forestry program is presented based on the needs assessed. Elements of the program include forest reserves; private and community forestry; professional and technical education; forestry research; and processing and utilization.

If carefully implemented the forestry program prescribed will contribute significantly to the needs and objectives specified and thus improve the lives and welfare of Nigerians.

DEDICATED TO MY:

Mother - Adedapo

Father - Adekunle

Wife - Adejoke

Daughter - Oluwatomilade

Son - Olubadewa

ACKNOWLEDGEMENTS

I acknowledge with thanks the understanding and guidance of my advisor Professor Lee James, my Guidance Committee -- Professors Melvin Koelling, Milton Steinmueller and Karen Potter.

I am also very grateful for the support and suggestions of my wife, Adejoke.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

The Setting: Nigeria

The background information included in this chapter not only presents many of the assumptions upon which this study is based, but is an important basis for understanding by people unfamiliar with Nigeria. Such context is begun in this section by describing the economy, administration and natural resources of Nigeria.

Population and Economy

Nigeria's population, which rose from 55 million in 1963 to 95 million in 1985, is the largest in Africa. Over 80% of this population live in rural areas, engage in slash-and-burn agriculture and rely on fuel wood for cooking energy. Under-employment in the mostly subsistence agriculture results in rural to urban migration, and high density and unemployment in the urban areas, the expansion of which cut into agricultural and forest lands (Fatunde, 1976).

Nigeria's population is also characterised by a 25% literacy rate, life expectancy of 39 years, diversity in customs between ethnic groups, a growth rate of about 2.5% per year (World Bank) and an attitude that forest resources are inexhaustible.

At the lower rate of growth, population is expected to double every 30 years with implications for more pressure on the size of and

requirements from the forest estate, on overall environment and employment.

Pressure is also exerted on average level of income: Current GDP per capita is N317 ($412) compared to over $7000 in the United States. However, overall economic activity is increasing dramatically from GDP of N18,740 million in 1979 projected to N30,409.7 in 1985.

Such increase in economic activity and income implies production of considerably larger amounts of goods and services which, in turn, requires large increases in the availability of raw materials including forest products, and more adoption of improved techniques and appropriate technologies.

Administration

Figure 1 depicts the nineteen administrative states of Nigeria, each with its own government. Since the December 1983 coup that suspended the constitution and civilian rule, Nigeria now has a military government with three governing bodies. First is the Supreme Military Council (SMC) which combines the executive and legislative functions and is the highest policy making body. It rules by decree that precludes the judicial review even though the court system is still pretty intact. Second is the Federal Executive Council (FEC) of cabinet members each of whom heads a Federal ministry. The Federal Department of Forestry is within the Ministry of Agriculture. Third, the National Council of States (NCS) which is advisory to the SMC is made up of the

states' governors.

Nigerian governments influence the Forestry sector more directly through their spending decisions but also indirectly through regulations and taxation of economic activities. Thus, a genuine government commitment to Forestry is an essential requirement to Forestry sector development in Nigeria. Yet, it appears that Forestry ranks very low in competing with other major sectors for government attention, with only 0.1% in Federal government expenditure, and 0.6% of all state governments' expenditure compared to 1.9% and 3.3% respectively for Agriculture.

Natural Resources

Nigeria's vegetation is mostly determined by climate, especially by rainfall and severity of the dry season, but also by farming, fires and soils (Keay, 1959). Vegetation zones thus distinguished are depicted in Figure 2. These include:

i) The forest zone: this includes mangrove forest and coastal vegetation, freshwater swamp forest and lowland rain forest. Annual rainfall in these areas ranges between 1600mm and 3600mm. Due to difficulties of extraction, the swamp forests are thus far of limited importance in the commercial lumber economy of Nigeria. They are, however, valuable local sources of pit props and woodfuel.

The lowland rain forest, however, produces the bulk of Nigerias

commercial timber. In addition, rubber, coconut, cocoa, palm oil and kernel oil are also produced in this zone (Figure 3).

ii) The derived savanna zone: Annual rainfall here ranges from 1150 mm to 1500mm, and the dry season lasts about 3 months. Much of this zone was once lowland rainforest which was cleared for farming before converting to grassland after abandonment.

iii) The savanna zones: these are to the north of the derived savanna zone. It includes Guinea savanna with annual rainfall range of 1000mm to 1500mm and 4 to 6 months dry season; Sudan savanna with annual rainfall between 500mm and 1500mm and 5 to 7 months dry season: and Sahel savanna with annual rainfall of between 250mm and 500mm and 7 to 8 months dry season.

As can be seen from Figure 2 cattle and cotton dominate the economy especially in the Sudan and Sahel savanna. Very little tree crops other than woodfuel is currently produced in these areas.

Forestry in the Nigerian Economy

The objectives of the Nigerian economy since at least a decade (in both third and fourth national development plans) include:

Increasing citizens real income

More even distribution of income

Reducing unemployment and underemployment

Increase skilled manpower supply

Balanced sectoral and regional development

Increased participation by citizen in the ownership and management of productive enterprises

Greater self reliance

Development of technology

Increased productivity

Promotion of a new national orientation conducive to greater discipline, better attitude to work and cleaner environment.

Even though forestry may not be contributing as fully as it could to some of the above national objectives due to waste and public ignorance of many of its aspects, forestry's contribution to the economy is considerable.

Forest lands provide water, forage habitat for wildlife, sites for outdoor recreation and soil stability, thereby enriching the overall welfare of Nigerians. More measurable contributions of forestry to the above objectives are foreign exchange earnings by forest product exports (Table 1), their use as industrial and domestic raw materials and fuel, and, contributions to employment and value added (Table 2) and to the gross domestic product (Tables 3).

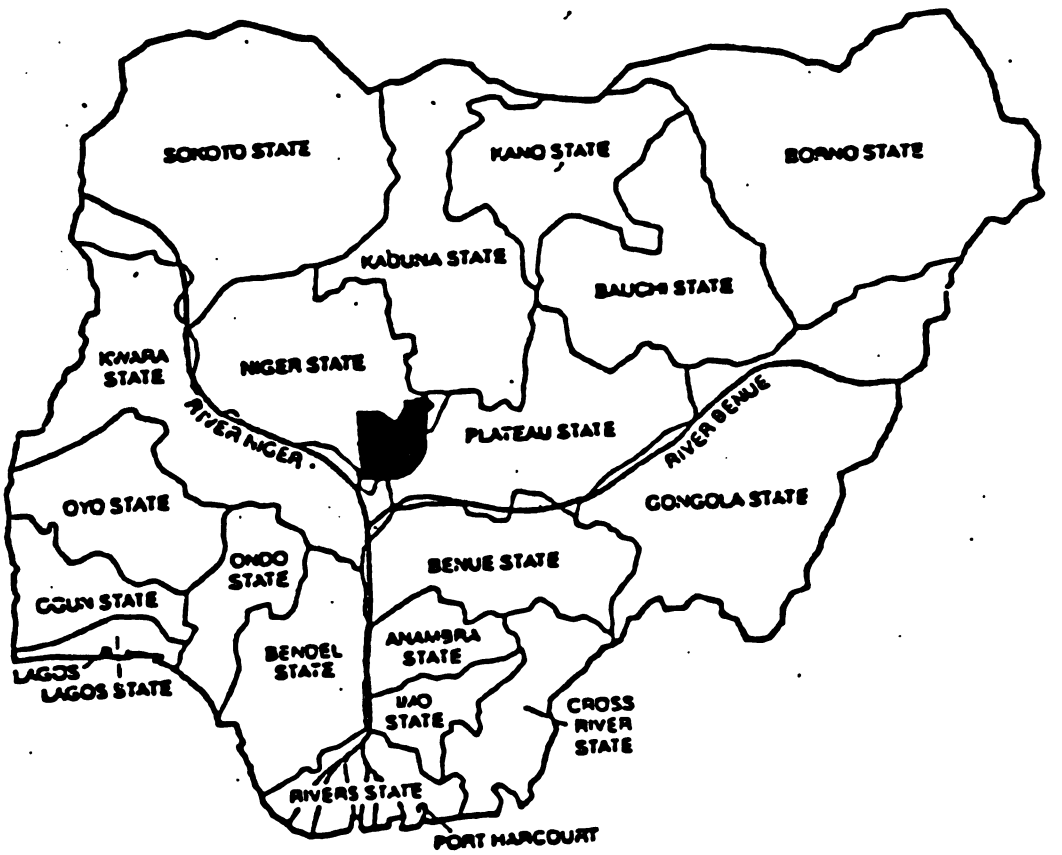

Figure 1. The 19 States Structure of Nigeria and the New Federal Territory.

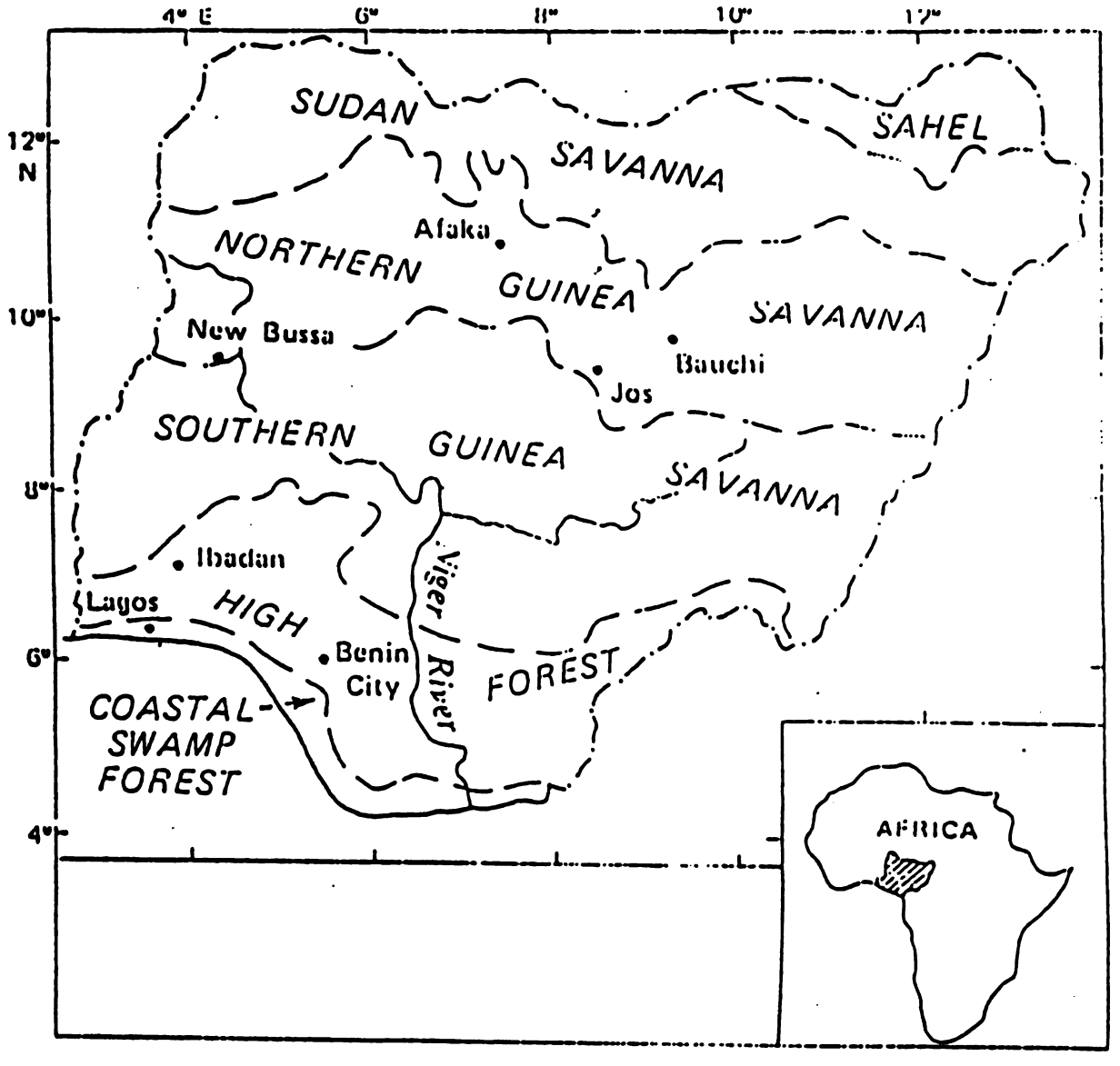

Figure 2. Forest Regions of Nigeria.

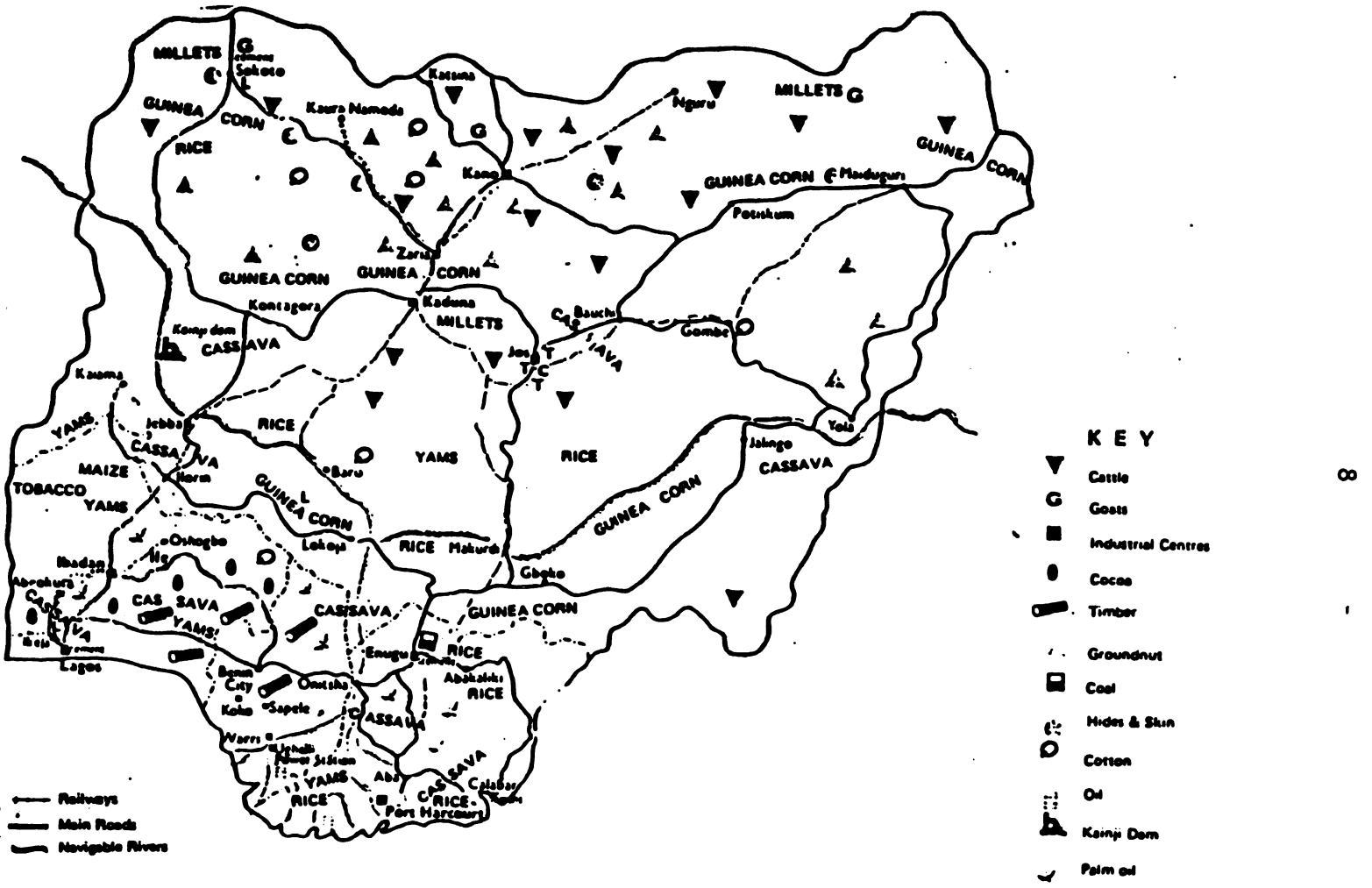

Figure 3. Natural Resources of Nigeria.

Table 1: Value of Exports of Major Commodities

Commodity	1975-76	1976-77	1977-78	1978-79	1979-80
			(million naira)		
Groundnut	-	0.2	0.2	-	-
Groundnut Cake	0.8	3.4	1.0	-	-
Cocoa Beans	181.0	218.9	306.8	405.3	434.8
Palm kernels	18.5	27.0	32.5	13.0	12.8
Rubber	15.2	14.4	9.9	13.5	14.3
Hides & Skins	6.8	6.8	5.4	4.5	3.7
Tin Ore & Metals	20.4	15.5	12.5	10.8	10.8
Crude Petroleum	4563.1	6321.3	6648.2	6253.4	10578.3
Timber, Logs & Plywood	4.8	1.4	0.5	0.1	0.1
Other	109.6	133.6	124.8	220.4	176.2

Source: National Planning Office, 1981.

Table 2: Proportion of Value Added, Employment, Net Capital Investment Due to Some Forest Industries, 1975

Industry	Value Added (%)	Employment (%)	Net Capital Investment (%)
Saw milling	2.60	5.62	5.09
Wooden Furniture and Fixtures	1.11	3.18	1.60
Paper and Products	2.51	2.08	1.45

Source: Third National Development Plan.

Table 3: Gross Domestic Product at Current Prices: 1980-85

Sector	1980	1981	1982	1983	1984	1985
	(% distribution)					
Agriculture	10.3	10.0	9.7	9.3	9.0	8.7
Livestock, Forestry & Fishing	7.4	7.2	6.9	6.7	6.5	6.2
Mining & Quarrying	32.9	31.6	30.3	29.0	27.7	26.4
Manufacturing	8.0	8.7	9.5	10.4	11.3	12.2
Utilities	0.4	0.4	0.4	0.4	0.4	0.4
Construction	6.9	6.8	6.7	6.6	6.5	6.4
Transport	4.3	4.6	4.8	5.1	5.3	5.6
Wholesale & Retail Trade	16.9	17.6	18.2	18.9	19.5	20.1
Housing	4.3	4.1	4.0	3.8	3.6	3.4
Producer of Government Services	5.7	6.0	6.3	6.6	6.9	7.2
Other Services	2.7	2.8	3.0	3.0	3.1	3.2
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: Fourth National Development Plan, 1981-85.

Table 1 shows a relatively small and declining contribution of forestry to the value of exports; this is due to factors like early exploitation with slow replacement of commercial species, large increases in local demand which ultimately led to a ban on export of primary wood products in 1980. Table 2 shows relatively more stability in the contribution of forest-based manufacturing to value added and capital investment. The specific contribution of forestry to GPD is clouded by its grouping with fishing and livestock but it ranks with agriculture, mining, trading, construction and manufacturing as the most important contributors.

Nature and Extent of the Problem

Although much effort and funds have been spent towards forestry development in Nigeria, many problems still remain. For example, deforestation and degradation of forests continue at a much faster rate than planting and rehabilitaton. In fact, outside forest reserves there may be no planting to replace trees removed. This leaves a wide gap between consumption and domestic production to the extent that export of logs was banned in 1976.

A major cause of these problems is the rapidly increasing population and rising income and expectations that make it difficult to maintain sufficient agricultural and forestry production by traditional methods. In the traditional agricultural method of shifting cultivation, a farmer cultivates his land to impoverishment and then shifts location - sacrificing more and more forest as he keeps moving.

Forests have also been reduced by wildfires, overexploitation, overgrazing and the various demands for space that come with urbanization. These reductions are aggravated by the belief of many that forests are inexhaustible free gifts of nature, owned by no one.

More importantly, overexploitation is helped by people's dependence on forest output, e.g. fuelwood for cooking, structural material for housing, wildlife for bushmeat. Also, the fact that many forest products are usable without much equipment and are accessible to whoever wants them makes them more susceptible to overexploitation.

As a consequence of the exposure of more and more land, soil erosion is rampant especially in the eastern states, silting and flooding particularly in the west, and wind erosion mostly in the north.

Moreover, the remaining forest estate is only 10% of Nigeria's land area. Included in this are hectares of species that are currently unusable. Only about 35 of the more than 100 known tree species in Nigeria are considered usable yet. Many of the other species in the natural forest are slow growing hardwoods with varying quality and marketability. Efforts are being made to gradually convert much of the natural forest to plantations but planting achievements frequently fall short of targets. Among the reasons for this are shortage and delay in the release of funds for projects; inadequate supply of trained personnel, weak coordination, slowness of bureaucracy, etc.

Outside of reserves, forest management is practically non-existent. This is partly due to the rarity of private forest owners in Nigeria which, in turn, is due to the special long term nature of forestry operations, lack of knowledge of necessary techniques, and lack of access to inputs, credits, etc.

The long-term nature of forestry and the associated delayed return from tree growing implies that individuals engaged in it may not be able to meet their immediate needs. Furthermore, the individual may not live to harvest the benefits. Besides, some of the benefits of forestry like

aesthetics and soil stability may accrue external to the individual. All these remove the incentive from individuals who typically prefer investments that have low risk, high rate of return and early payoffs.

Even forest industry is not yet noticeably investing in forestland. This is partly due to the small scale of many of the industrial operators who therefore are unable to enjoy scale economies.

Purpose and Objective of Study

The importance of forestry to the Nigerian economy and the gaps between its potential and current production and, hence, contribution to national objectives, call for periodic action programs to guide the orderly development and use of Nigerian forests. The broad objective of this study is to analyse the forest resource situation in Nigeria such that patterns of problems and opportunities become clear and, on the basis of these, develop an action program that could change undesirable outlooks in terms of national objectives.

More specifically, I will:

1. Assess the current and prospective trends in the consumption and condition of Nigerian forests.
2. Identify economic, institutional and biological forces changing the system.
3. Develop action programs to affect the system in ways that contribute most to Nigeria's objectives and values.

CHAPTER II

LITERATURE REVIEW

Issues and Concepts

Planning generally involves preparing for the future by estimating anticipated needs and exploring alternative means of meeting such needs. Modern forestry planning originated in central Europe (Convery et al, 1977) with its central concept as sustained yield - only cutting the growth over a given period: ".... the fundamental idea in forestry is that of perpetuation by wise use; that is of making the forest yield the best service possible at the present in such a way that its usefulness in the future will not be diminished, but rather increased" (Pinchot, 1905). The sustained yield objective was a response to the problems then faced by foresters, including a prevalent "cut out and get out" attitude and consequent fear of timber famine due to overcutting of most the accessible forests for agriculture, building construction and fuel.

Later recognition of other forest produce in addition to timber such as forage, water, wildlife and forest-based services like watershed protection, wind breaks, recreation and erosion control revealed the inefficiency in managing a forest for only one use (Hays, 1959). Hence, the concept of multiple use was introduced as an objective of forest management as reflected by the United States Multiple Use-Sustained Yield Act, 1960.

To meet the multiple use-sustained yield objective, public management was the means relied upon because private forestry was hardly economically feasible at the time as observed by Fernow (in Rogers, 1951):

> Forestry, after all, is as little matter of pleasure as mining or any other enterprise... Forest growing is not an undertaking for a day, even a decade; though from a well managed forest, near a good market, returns may be derived in a man's lifetime. A cultivated forest requires at least 70 or 80 years to be a profitable investment.... I write all this to persuade you that the time has not yet arrived when profit from forest-growing will induce private capital..... to arrest the devastation of our timberlands. The protection, therefore, of this factor of national wealth must be, at present, mainly expected from a sound, protective legislation....."

The issues and concepts discussed above indicate a biological and conservation orientation of forestry. Forestry was not yet conceived as a business as is evident in the description of forest resources management tasks by Pinchot (1905) as:

1. Provision of adequate regeneration after cutting.
2. Protection of forests from harmful agents, especially fire, overgrazing, thieves.
3. Regulation of a forest in terms of age and/or size classes.
4. Regulation of a forest in terms of stocking in each stand.

The above tasks prescribed by Pinchot were to stem the tide of harvesting with little regard for regeneration, stealing, overgrazing

and frequent fires on forestlands and little regulation for a sustained yield of timber products. The tasks also indicate a how-to-do-it aspect to forestry; hence, suggesting the need for professional and technical training as a tool in forest resource development.

The environment and justification of forest resource management changed since about the middle 1920's:

> No longer is forestry confined to public lands. The forest industries are turning to forests management as the only solution of their problem of future timber supplies (Dana et al, 1980).

With both private and public management of forests comes the coexistence of management for the greatest good of the greatest number and management for private gain. Nor did the sustained-yield objective remain as rigid as before. Along with multiplicity of overall goals of management came other changes such as substitute sources and products for wood. Also, species selection and use of fertilizer can accelerate wood production. However, other goals like self sufficiency, saving foreign exchange and protecting the environment may limit the use of substitutes and fertilizer.

Forestry's task thus changed from solely wood supply to how to best contribute to the changing needs of the economy and society. This further strengthened multiple use, private forestry, conservation and efforts to develop programs to promote them (Dana et al, 1980). Examples of these programs in the United States are those intensifying forest management like the Civilian Conservation Corps, those designed to fight

particular problems such as the Shelterbelt program and those designed to extend and secure public ownership and reafforestation of lands (such as rural relocation). In addition, there are programs designed to encourage private forestry such as cost sharing and preferential tax treatment, disease protection programs, programs of public and private research including those carried out at State Agricultural Experiment Stations, Land Grant Colleges and other Universities offering training in forestry.

The forestry sector was also affected when President Johnson (United States) asked Federal agencies to incorporate Program Planning and Budgeting systems into their management planning (Gregory, 1972). Thus, federal forest managers are to quantify management plans and programs in terms of economic costs and benefits. And in ecological terms too as required by the National Environmental Policy Act, 1969 (Alston, 1972).

Some Existing Forestry Programs

A forestry program is a set of information which includes a general direction for forest management, the activities needed to follow the directions and the resulting outputs and impacts (Olson, 1981). Development of such forestry programs generally followed reviews of the historical and prospective situations in the forestry sector which is done in order to elicit desirable changes where necessary. Before developing a forestry program for South Sulawesi, Indonesia, Junus's

(1978) review indicated that population growth and agricultural improvement both increased the need for all products and services from forest resources. His program was then based on estimates of projected population growth and wood consumption. Junus, however, only used existing estimates of present and projected wood consumption per capita from various sources. He then proposed a five-part forestry program including boundary marking, planting, acquisition, inventory and silvicultural research which if implemented could help meet South Sulawesi's needs for forest products and other forest benefits and services by the year 2000.

In their National Forest Management Plan for the Dominican Republic, Olson et al (1983) also used population projections as basis for their program. In addition, the plan:

> .....sets forth objectives for forestry in the Dominican Republic, evaluates the present forestry situation and estimates expected future demands on forest resources based on population projections. It also makes recommendations for forest management and reforestation to attain the stated objectives whose attainment will insure that forests and forestry will make the needed contributions to a better life for all Dominicans.

Both of the studies cited above base their consumption projections on population due to limited data on other demand determinants such as prices, disposable personal income, institutional and technological change, energy costs, etc. Given data limitations, qualitative evaluation of these variables could help improve judgements about resulting estimates.

Methods of Resource Assessment

It has long been recognized that the formulation and direction of resource development policies and programs ought to be based on an analytical assessment of the current and prospective condition of the resources. This is indicated for instance by the McSweeney-McNary Act (1928) which authorized and directed the United States Secretary of Agriculture to cooperate with states, private owners and other agencies and assess on a continuing basis the forest situation in the United States (USFS, 1982). That is:

> ... making and keeping current a comprehensive survey of the present and prospective requirements for timber and other forest products in the United States, and of timber supplies, including productivity of forested land therein and of such other facts as may be necessary in the determination of ways and means to balance the timber budget of the United States.

Over the years, the different methods of making such assessment can be classified after Duerr (1977) into four:

1. Growth-Drain method
2. Requirement method
3. Neo-Growth-Drain or Supply and Demand method
4. Planning method

Although Duerr identified each method with a period in history when it was more often the method employed, two or more of them can be employed together for different aspects of the assessment. The growth-drain method compares timber growth during a given period to

timber drain during the same period. Since the planning goal is to have at least a zero growth-drain statistic, a situation with negative statistic is usually regarded (U.S. Bureau of Corporation, 1913) as calling for intensification of forest management and improvement of timber utilization in logging and processing to avoid impending scarcity.

The growth-drain criterion of nonnegativity may be misleading in a region stocked by old growth which would normally have a negative statistic because its growth is expected to be zero. Moreover, if the level of output at which growth equals drain is too low, it may not meet the society's need for timber. The requirement method by having as its goal a specified quantity to be produced and/or consumed overcomes the latter point about the growth-drain method. The specified quantity or requirement can be derived by either the factor or regression technique (Row, 1977). The factor technique projects future requirements by multiplying simple measures like per capita consumption with projected population based on extrapolation of past trends. This method is appropriate if the factors assumed are stable over time. One may also use this method in the absence of adequate data to carry out regression analysis of say consumption on predictors like population, personal disposable income, etc.

Being absolute goals, requirements may be unrealistic to meet unless the society is willing and able to provide the means to reach it. Hence, use of this method should be accompanied by an evaluation of

the means available to achieve the requirement goal.

Zivnuska et al (1952) proposed a remedy to the requirements concept which considered both consumers willingness to pay by relating quantities demanded to price, and resource-cost constraint by relating quantities produced to price. Then the quantity of timber that equates supply and demand (marginal cost and marginal revenue) is the economically correct production goal because opportunities for improvement would still exist when supply does not equal demand. In the case of short supply, consumers' needs are not being met and there is upward pressure on price; thus, ceteris paribus, increasing supply to meet demand will improve consumers welfare.

However, operationalization of this model is very difficult where data is limiting and due to the long term nature of forestry which makes timber production respond more to the interest rate than to price (Duerr, 1960; U.S. Forest Service, 1963).

In using this Neo-Growth-Drain-method it should be stressed that a forestry program should not be based solely on the supply and demand situation of timber but also on other influences (U.S. Forest Service, 1982) including:

1. Opportunities for imports and exports, substitution, close timber utilization, and intensive management.

2. Recognition of the bearing of nontimber forest products, land use,

Given the above limitations and in spite of the use of the supply and demand method in studies like the 1982 Analysis of the Timber Situation in the United States, Duerr (1977) cautioned against using the method in forestry planning because:

> ...Supply and demand as social concepts were derived for an imaginary world in which the social interest could be served by private initiative. The concepts are highly useful for many purposes. But in an empirical model for regional forestry planning they are not useful. Even if timber-production analysis did not present special problems, the fact would remain that our world is too different from the supply-demand world. Our interest is in social planning. If we lived in a supply-demand world, we would have no need for such planning.

Instead of the supply-demand method, the planning method has a wider scope in that it sets timber in the context of all forest resources and forestry in the context of all major resources, and of people. Timber inventorying and projecting is but one aspect of the planning approach which is discussed in the next section.

Outline of Sectoral Analysis

Analysis of any defined sector of an economy seeks to figure out how to maximize the contribution of that sector to national objectives by pursuing certain programs within the sector, and to identify limits within which planning of development in the sector can take place (FAO, 1974).

Development of the programs needed to make a sector more effective involve such planning activities (Hall, 1975; Wengert in Beatty, 1979) as depicted in Figure 4:

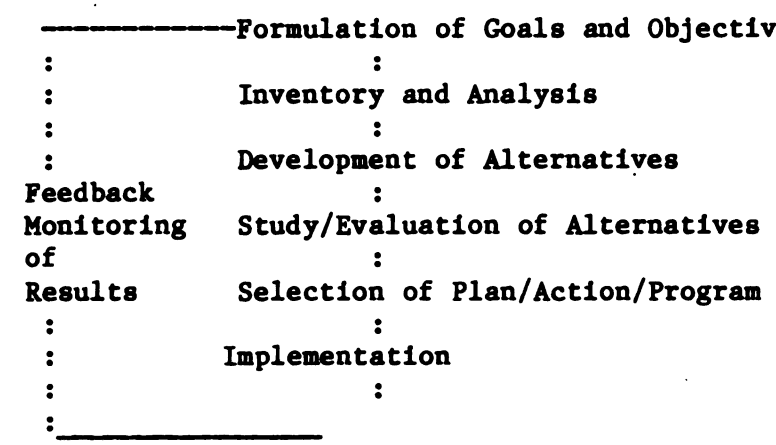

Figure 4: The Planning Process.

The above breakdown of the planning process will mainly guide my analysis of and program development for Nigerian forestry. Beyond the scope of this study are the implementation and monitoring of the action program recommended in the study; these steps are however also essential. In particular, they help to identify necessary modifications in the action program as the forestry situation keeps changing.

Goals and Objectives

Certain national, sectoral and peoples' goals and objectives are the ends towards which policies and programs are designed to achieve. For example, Worrell (1970) contends that the purpose of programs and policies in a society "is to try to assure that their actions will contribute as much as possible towards some ends which the society deems

desirable. Therefore, prior to any program, society must have a clear idea of what ends it wishes to attain and the possible effects on these ends of the program."

To be meaningful therefore, such goals and objectives should be clearly defined, attainable and, as much as possible, consistent and measurably expressed. This will also help in the development of programs and in evaluating to what extent the goals and objectives are being achieved.

Goals and objectives in decentralized and mixed economies are identified through a complex process of interaction involving elected and appointed officials (including planners), citizens and interest groups. For example, the United States Bureau of Land Management uses various sources in identifying goals and objectives for the use of the public lands for which they plan. Among these are: major national policy documents (e.g. the national laws, administrative policies), the policies and plans of other agencies, assessments of local population and industry requirements, dependencies, trends and problems as well as consultation with public and private groups and government organizations having an interest in the land unit being planned for (U.S. Dept of Interior, 1975). Such variety of sources indicate the likelihood of conflicts between the goals identified, Thus "What one would hope to achieve - in addition to identifying generally agreed upon goals - is explicit recognition that multiple goals do exist, an identification of any conflicts between those goals, and resolution of the conflict where

possible. Where conflicts cannot be resolved, decision makers should be provided with enough information so they are cognizant of the unresolved conflicts." (Roberts in Beatty, 1979)

Example of conflicting objectives include decisions of allocation of funds between wood and non-wood aspects of forestry; what combinations of non mutually exclusive products to produce especially where increased production of one results in a decrease of the other?, what tasks of which interest group to pursue? These examples also illustrate the necessity of prioritizing between objectives so as to allocate resources accordingly.

Some of the important goals and objectives that are relevant in forestry sector analysis can be classified as follows:

1. Adequate qualities and quantities of direct benefits from forests enough to meet current needs and ensure future supply. Examples of such desired direct benefits are: wood, vegetative cover, wildlife, water, recreation sites, flood reduction, soil stabilization, environmental amenity etc.

2. More basic national and human objectives such as: the national defense and security implication of being self sufficient, community stabilization, maintanance of political system, economic development, earning and saving foreign exchange, full employment, adequate housing, equitable distribution of income.

Inventory and Analysis

The purpose of inventory and analysis in a forestry planning study is to improve understanding of the amount and character of the demand that will be placed on forest resources and the capacity of the resources to support various uses.

The depth of inventory and analysis may be limited by the resources available for the study. Thus, to the extent that resources and data availability allow, analysis of the forestry sector calls for inventory and analysis of (USFS, 1982):

1. Important markets and uses of forest resources. Of relevance here are statistics and trends in markets such a housing, manufacturing, export-import and uses such as fuelwood, wildlife, recreation. This information provides data for projecting future trends in consumption of domestic forest resources.

2. Characteristics of the forest resources including statistics on the extent, location, ownership, condition and productivity of forest lands and resources and analysis of recent trends in area, inventories, growth and removal of forest resources. This information enables us to judge the result of on-going forestry programs, identify surplus and scarcity regions and project the trends in supplies from domestic forests.

3. Future consumption and wood supply. Consumption projections

indicate amounts of forest resources that would be consumed under the assumptions on future changes in determinants like population, economic activity, technology, and institutions. On the other hand, projections or judgments of future supply conditions are based on assessment of determinants like timber growth and mortality, resource inventory levels, trend in forestland area, public attitude, environmental and institutional constraints, continuation of current management practices and investment levels. Both the consumption and supply projections enable us to identify future gaps between consumption and supply of forest resources.

4. Consequences of continuation of current programs and opportunities for improvement. This is also a basis for evaluating alternative directions and developing an appropriate program.

Sources of data for the above inventory and analysis could be primary surveys or from secondary sources. The latter is used in this study because of financial and time constraint. Moreover, gaps in the available secondary data further limits the scope of the study.

Description and Evaluation of Alternatives

According to Olson (1981), development of alternative programs requires:

1. Identification and evaluation of current programs.

2. Development of information on what programs are needed to produce a range of higher or lower output as indicated by appropriate directions and evaluation of such programs.

3. Relation of alternative directions to important issues and evaluation of their impacts.

The inventory and analysis discussed earlier is helpful in indicating the achievements of current programs and indicating appropriate alternative directions. The contribution of the current programs can be evaluated using the following criteria (Worrell, 1970):

1. Effectiveness. This is the most fundamental criterion for judging policies, programs and organizations. A test of effectiveness seeks to determine whether or not the program is doing what it was designed to do, and to what extent? For example, we want to know whether a program designed to achieve a reforestation target will reach such target given the program's rate of reforestation, methods of planting, quantity and size of the planting stock, site preparation, survival and growth rate.

2. Efficiency. The effectiveness test only stresses the output (is the objective being met?) and ignores the fact that the inputs employed are not only scarce, but may be used elsewhere in the forestry sector or in the economy at large. The efficiency test introduce the input side by favoring programs that reach the desired objectives at minimum cost; or, maximizing the achievement

of the objective at the given budget. Hence, it is desirable for a program to be efficient, in addition to being effective. This emphasizes the relevance of alternatives (whether other programs could reach desired objective at less cost) and the need to minimize waste (whether exsisting programs could be implemented at lower cost).

3. Spillover effects. These are the unintended by-products of the program which may be desirable or not. A program is preferred, ceteris paribus, which has more beneficial spillover effects than alternative programs.

It is important to stress that the program evaluation should (Litchfield, 1970) as much as possible:

(a) Be related to the objectives (ends, values) the decision makers are attempting to achieve;
(b) Cover all the systems being planned;
(c) Cover all the affected sectors of the community;
(d) Consider both producers and consumers;
(e) Take account of all costs and all benefits and who pays; and
(f) Aim at determining the 'best' alternative in terms of effectiveness, efficiency and spillover effects.

Program Selection

On the basis of the evaluation above, the 'best' alternative is the program recommended for implementation. Design of the program should

recognize that program implementation occurs in the threefold framework environment developed by Barlowe (1978). This framework is discussed next.

Resource Development Framework

Under any state of technology, practical workability of land use programs depend on their meeting the threefold framework (Figure 5) of:

1. Physical and biological possibility.
2. Economic feasibility.
3. Institutional acceptability.

A physically and biologically possible forestry program is one that can operate under the given natural environment of an area; would not destroy the soil's productive capacity and takes into account the nature and characteristics of forest resources. For example, the long time scale of forestry and the unexcludable spatial distribution of some of its benefits restrict the scope of possible programs that can be applied to the resource. Thus, realistic programs must be those that fall within the limits set by physical and biological possibility.

Economic feasibility is also required if a forestry program is to work in practice. Unless a program can be done with available, acquirable and affordable inputs and infrastructure, the program is not worth starting at all. Moreover, a program that violates the acceptable

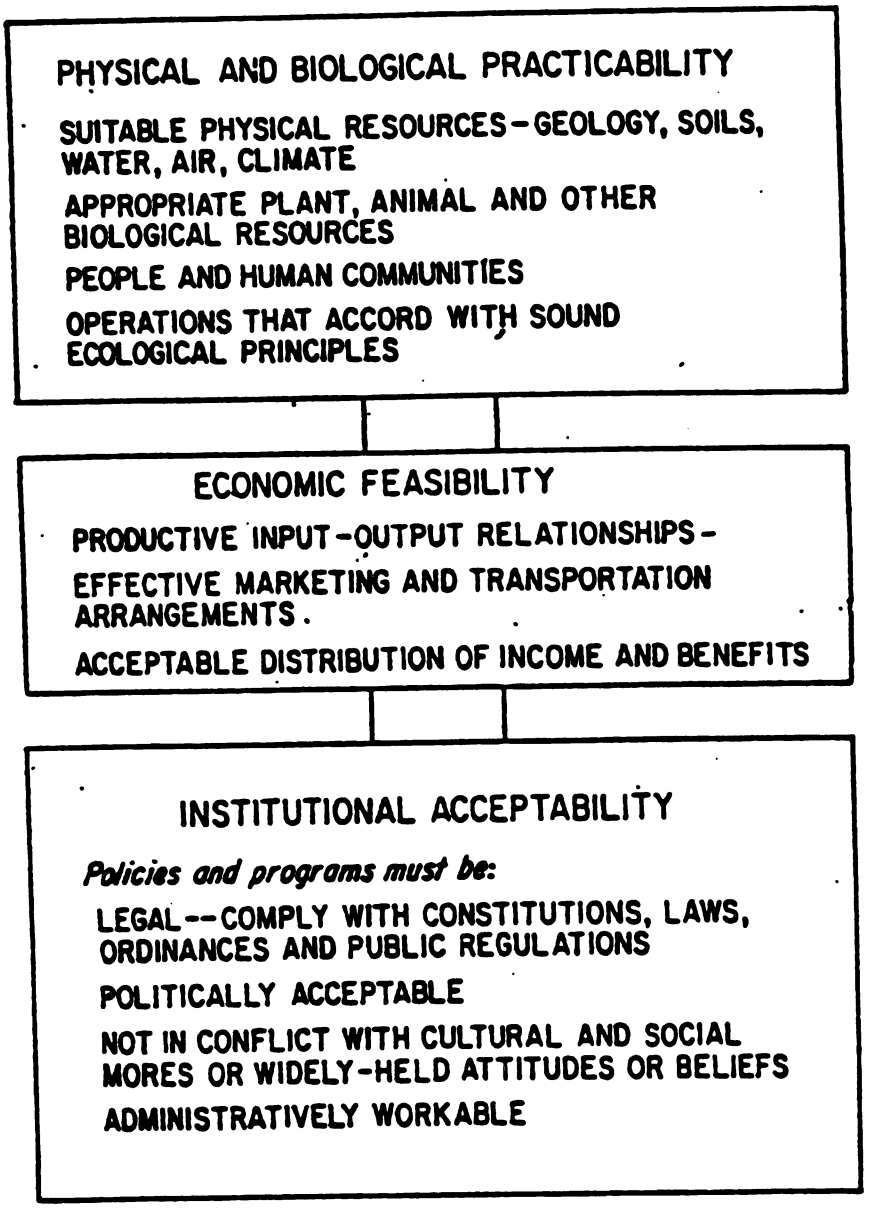

Figure 5: Threefold framework within which successful land use policies and practices must operate.

Source: Barlow, 1978.

distribution of income and benefits will be resented by the public. Thus, to be workable, a forestry program must be economically feasible in addition to being biologically and physically possible.

Finally, a forestry program must be legal or it cannot be done. It must not conflict with the unwritten rules, culture and institutions of the society in which it will operate. Vlasin et al (in Beatty, 1979) described such institutions this way:

> Institutions are the formal or informal means by which groups take action. They constitute the "rules of the game" by which individual or group actions are guided, facilitated or constrained. They range from being formal, such as the black-letter law to being informal such as customs, habits and attitudes. They also range from the general, such as a national goal or policy to the specific, such as specific laws and local ordinances and specific administrative regulations and procedures.
>
> Collectively, our institutions determine what occurs - in this case, what occurs on the landscape.

In other words, workability of a program that has passed the physical and economic feasibilty tests still depends on the presence of adequate administrative structure, required skills and sufficient trained personnel, appropriate legislation and regulations and effective enforcement of them as well as activities to implement the program that are consistent with current social patterns, attitudes and motivations in the society in question.

CHAPTER III

FOREST RESOURCE ASSESSMENT

In this chapter, an evaluation of Nigeria's forest resource situation will be done. This is to determine whether forest resources are adequate, inadequate or more than meeting the needs and wants of the people. That is, whether past and present programs continue to work or need be modified if not changed. Later, markets and uses of forest products are discussed in order to elicit emerging trends and estimate the need for processing facilities. First, the forest resource base is discussed in the next section; finally forest industry is described to see whether current capacities are adequate to meet the needs assessed.

Forest Resource Base

In this section, the characteristics and productivity of Nigerian forest resources will be examined in order to determine whether or not forest resources are growing scarcer and whether past solutions need modification. In addition, the ownership and management of forest resources and factors influencing intensity of mangement will be discussed.

Characteristics and Productivity

Up until the turn of the century, much smaller population pressure let destruction of Nigerian forests be so localized that they recovered before the next cycle of clearing, cultivation, etc. started. However,

with increasing population grew the number of people involved in shifting cultivation, the needs for fuelwood and the need to clear more land for agriculture to the extent that today "there is virtually no forest left that has not been exploited at one time or another" (FAO, 1979). This situation led to the creation of the state forest services for the primary purpose then of creating forest reserves in order to control exploitation and clearing.

Table 4 shows that areas of forest reserves created generally increased at a decreasing rate up until 1978. This may be due in part to the increasing current rate of population growth, urbanization and the associated needs of more land for agriculture and other purposes. In spite of this, more land may need to be brought into production towards meeting the projected demands in forest products.

Table 4: Area of Constituted Forests

Year	Forest Area	Ratio Forest to Total Land
	(KM^2)	(%)
1900	971	0.01
1910	2590	0.27
1920	8143	0.88
1930	29878	3.20
1940	57366	6.40
1950	73320	7.90
1960	85631	9.50
1970	93420	10.00
1978	96518	10.33

Source: Adapted from Adeyoju, 1975.

In Table 5, forest reserve area by vegetation zones is depicted. It shows only 20% of the forest reserve area is in moist tropical forest which contains most of the timber currently usable by industry. Yet lands outside reserves supply only about 30% (FAO, 1977) of timber volume currently cut because there is no management planning for such areas. Hence, off reserve areas cannot be counted upon for future supply. Nor can the reserves themselves because:

> Project studies on the balance between supply and demand show that the reserves of the moist forest zone will be exhausted by the end of the century if exploitation continues at the present rate. Furthermore, 20,000 KM of the reserves of the Guinea savanna have been set aside as conservation areas and will not be available for the supply of wood products such as firewood (FAO, 1979).

In the savanna, short trees of poor form are not industrially usable. Hence most of these are used for fuelwood whose supply could be increased by afforestation in the savanna to reduce the scattered occurrence of trees.

Table 5: Forest Reserve Area by Vegetation Zone

Zone	Reserve Areas	
	(KM^2)	(%)
Sahel	2581	3
Sudan	21247	31
Guinea	38271	39
Derived Savanna	3208	3
Moist Tropical:		
a. Ferruginous soils	7095	7
b. Ferralistic soils on Basement Complex	4326	4
c. Ferralistic Soils on Sedementary Formations	9022	9
Freshwater Swamp	256	3
Mangrove	522	1
Total	96518	100

Source: FAO, 1979.

In the moist tropical forest, there are over 560 species of trees which attain a height of at least 40 feet or a girth at breast height of 2 feet. Although 100 of these species are considered usable at present, only 35 species are being used. Logging of even those species is on selective basis because only about 5 to 7 species represent 85% of the volume harvested.

Current production is very low for all categories of forest

products, and some products like fiberboard are not being produced yet. Since 1980 the three integrated pulp and paper mills have been producing pulp, paper and board. However, given the expected increases in future consumption of these and other products new efforts to increase their production are urgently needed.

FAO (1981) listed production of forest products in 1980 as follows:

Product	Quantity (Million M^3)
Roundwood	
Saw logs and veneer logs	5.1
Other Industrial	2.3
Fuelwood	92.1
Lumber	2.7
Wood-based panels	.1
Wood pulp	—
Paper and board	—

Growth in the moist tropical forest is estimated at 0.33 million cubic meters compared to industrial wood drain up to 7.4 million cubic meters in 1980 — enough to exhaust all growing stock in less than 30 years. In fact, growing stock exhaustion is likely to be accelerated by the high growth rate of consumption.

This low growth and yield of natural forests and the high cost of management and production (due in part to the scattered occurrence of trees) is recognized in Nigeria. This has led to the establishment of plantations where species can be selected, volume concentrated and growth magnified. However, financial limitations and delay in releasing funds are slowing down plantation establishment rates. For example,

areas of plantation established by 1980 was 170,000 hectares, with 292,300 hectares expected by the end of 1985. Only about 24,000 hectares of these is in softwood and fast-growing hardwood species. Hence, more government commitment is needed to relax the financial constraints, and further research is needed into faster growing species.

Meanwhile, deforestation continues in the natural unreserved forests at the annual rate of 260,000 hectares. This compares to only 10,000 hectares in reserved moist forest which results from illegal encroachment by farmers, other planned land uses and unsuccessful plantations. In the savanna woodlands, another 100,000 hectares is deforested annually - mainly outside forest preserves.

Besides deforestation by man, Nigerian forest lands are subject to degradation by other agents including fires, insect and diseases in all regions, overgrazing and wind erosion in the savanna woodlands, and soil erosion mostly in the Southeast.

Ownership and Management

There are two main forms of forest land ownership in Nigeria:

i) State forests, which are owned, controlled and managed by state forestry departments.

ii) Local government reserves which are owned by various local government councils but are under dual control and management by the council and the state.

There is little, if any, private and industrial ownership of forestland as in the United States. Although in the United States most nonindustrial private forestland owners have various objectives other than timber management, the forest industries typically manage their property intensively for wood products and thus have the most productive forests (U.S. Forest Service, 1982).

Although private ownership of forestland is not expected to grow considerably before the end of this century, it may help to begin to address some of the issues that militate against private ownership. These include lack of capital, lack of information and knowledge about forestry as a business operation and lack of motivation to invest in a long term venture with tied up capital and slow returns.

Forest Products Markets and Industries

As a result of rapidly increasing domestic demand for wood products in spite of stagnating roundwood production (FAO, 1979), the export of all wood based products was banned by the Federal Government in 1976. Hence, the forestry sector now supplies only the domestic market in which marketing is exclusively done by the private sector.

Wood is the main forest product traded in the domestic market. Among the other products and services are wildlife, aesthetics, and many other minor forest products - so called because the consumption and trade in them are not properly recorded (Adeyoju, 1975). Examples of these are shea butter, gum arabic, beeswax, sheanuts, chewsticks, etc.

Many of these, and indeed much of the trade in many forest products do not go through formal markets. Hence, discussion of many products is limited to their uses since price information on them is unavailable.

Wood and logs have historically been used for fuel, transportation, shelter, food, medicine, tools, and paper. Some of these uses in Nigeria are discussed in the following sections.

Wood Fuel

Wood is the most important source of fuel in Nigeria, particularly in rural areas where 80% of the population lives. In these rural areas, fuelwood is the form mostly used. However, charcoal, woodchips and mill residues are mostly used in urban areas. In all, wood fuel (including charcoal) accounted for over 90% of domestic consumption of forest products in 1980 (FAO, 1981). And, in spite of the substitution of other methods of cooking and heating, fuelwood is likely to remain the most important forest product in terms of volume for the foreseeable future, with at least 70% of wood consumption in 1995 (FAO, 1979). FAO further found that the "... supply of fuelwood to meet the demand is unlikely to be a problem in the moist forest zone except in a few parts of Anambra and Imo states, but already the effects of overcutting can be seen near several towns and cities in the savanna zone."

However, since permits are not issued for fuelwood removals, and a lot more fuelwood is probably removed than recorded, fuelwood self-sufficiency calls for more fuelwood plantations even in the moist

forest zone. Use of efficient wood burning stoves and further recovery of residue could also contribute to self sufficiency by stretching available supplies.

Wood in Construction

Next to fuelwood, more wood is used in construction than any other single use (FAO, 1979). Most of the demand for construction wood is from residential housing construction and upkeep. For example, an unpublished report by the Federal Office of Statistics in 1964 estimated that housing takes up 80% of the sawnwood in the local market; furniture, 10%; bridges, 2%; boat building, 0.5%; coffins, 2%; other industries 5.5%.

Sawnwood is the most important wood-based industrial product in Nigeria, accounting for about 90% of industrial wood output (FAO, 1979). It is sold either directly from the mills through dealers or in the plank markets of the principal towns mostly on a cash basis. The quality of sawnwood varies and the prices have indicated an increasing trend (Table 6). This increasing price trend is expected to continue due to shortage of large logs and increasing transport distances as less accessible logs are removed (FAO, 1979).

Table 6: Prices of Sawntimber in Ibadan, Nigeria

Year	Utility Grade	Furniture
	(naira/m^3)	
1974	39-45	88-125
1975 (mid)	88	175-210
1975 (end)	140	280
1978	160	280-320

Source: FAO, 1979.

No data on housing starts is available in Nigeria. However, other indicators like rapidly increasing population, average family size of seven people, single-unit housing style, and high cost of mostly imported plastic, metals and masonry substitutes suggest increasing long term trends in housing and sawnwood demand.

Other Wood Products

In Nigeria, as worldwide, forest products are also important in communications, packaging, furniture, manufacturing, fibers, food and feed, utility poles, fencing, etc. For example, more than cotton, woodpulp and wood residues are now used in the production of printing and writing paper, newsprint, tissues and packaging boxes. Moreover, more tree species, including tropical hardwoods, are now used in pulp and papermaking as are wood chips and other byproducts of solid wood manufacture. This is an opportunity to explore the usability of the 536 species (James, 1983) that are currently little used other than for

fuelwood.

All woodpulp and paper products are distributed through the market; and demand in them is expected to grow with continued government and individual efforts to increase the spread of education as evidenced by the establishment of a university in every state of Nigeria.

Minor Forest Products

Although wood is the major forest product of Nigeria, there are a host of products used in many fields. These are so called minor forest products because the consumption and trade in them are not properly recorded (Adeyoju, 1975). Also, there is no consistency in different states and times respecting what is regarded as minor forest products. The eastern states, for example, include leaves and bamboo; yet these are excluded in the west where wild rubber, palm products, sheabutter, gum arabic, Niger gutta, beeswax, and Piassava at one time or the other made the list. Due to this inconsistency and lack of data on these minor forest produce, I will concentrate mainly on wood products in the rest of this study. Nevertheless, Adeyoju (1975) contends that the widespread use and overseas demand for minor forest products hold opportunities for their further development, particularly in savanna areas. He further summarized the advantages of such development as follows:

(1) The capital need is very small;

(2) A reserve of experience and skill exists in villages and can be

harnessed without much difficulty;

(3) It reduces unemployment, stems labor migration to cities and stabilizes rural economy; and

(4) It may enhance import substitution in the national economy and curtail unfavorable balance of payments.

Nontimber Uses

Wildlife and National Parks

The International Union for the Conservation of Natural Resources (1975) defined parks as areas:

a) Where one or several ecosystems are not materially altered by human exploitation and occupation, where plants and animal species, geomorphological sites and habitats are of special scientific, educative and recreative interest or which contains a natural landscape of great beauty, b) where the highest competent authority of the country has taken steps to prevent or eliminate as soon as possible exploitation or occupation in the whole area and to enforce effectively the respect of ecological, geomorphological or aesthetic features which have led to its establishment; and c) where visitors are allowed to enter, under special conditions, for inspirational, educative, cultural and recreative purposes.

Such national parks and game reserves are forest uses whose benefits are not yet widely realized in Nigeria. This led Charter (1970) to call them forgotten assets, in spite of wildlife's potential

benefits (Petrides, 1965) as sources of:

(1) Revenue from the export of live wild animals and animal products;

(2) Protein nutrients from the consumption of wildlife; and

(3) Aesthetic satisfaction from visits to game reserves.

In addition to actual benefits falling short of potential, many wildlife species are now rare or already extinct (Rosevear, 1953). Hence, more intensified scientific and business management of Nigeria's wildlife and national parks is urgent not only to protect endangered species but to maintain a commercial flow of such products like hides and skins, horns and ivory, etc.

Charter (1970) found that the six southern states of Nigeria depended on wildlife for the supply of 18.6% of their animal protein needs in 1965. This average figure even masks the considerably higher figures in some localities like Benin (82%), Uyo (84%), Calabar (80%), and Ondo (67%). The considerable amount of wildlife meat eaten is the main reason for the scarcity of game in Nigeria (Adeyoju, 1975). Another reason could be the lack of regulation of hunting times and places and accurate knowledge of the population of hunters and game animals.

Of all the twelve game reserves and national parks already constituted (Onweluzo, 1979), only the Yankari Game reserve in Bauchi State is fully equiped to handle tourists. Yet hardly any effort is spent on commercials to attract domestic, not to talk of foreign tourists. The result of this is seen in the modest number of visitors

to the park since its establishment in 1962 and the consequently low revenue (Table 7).

Table 7: Annual Visitors and Revenue, Yankari Game Reserve, 1962-1971

Year	Total Visitors	Total Revenue *
		(Naira)
1962-63	220	340
1963-64	685	1376
1964-65	1158	2056
1965-66	1572	2848
1966-67	4131	3468
1967-68	2864	2932
1968-69	4640	5984
1969-70	2785	5974
1970-71	3310	8076

Source: Chief Game Warden's Quarterly Report, Bauchi, 1972.

* Revenue comes from entrance fees, game viewing rides and the sale of maps and post cards.

Although the revenues have increased steadily, the total amount for each year seems small. Management cost for Yankari Game Reserve is unavailable but it is unlikely that revenues could cover both labor and operating costs for the park. A massive awareness campaign that attracts a lot more people to the park could improve its annual revenues.

Other Social and Environmental Uses

There are a host of other non-market uses of forest resources which are difficult to discuss in entirely quantitative terms. According to

Adeyoju (1975) the most important non-market benefits of forestry for Nigeria are those accruing from agroforestry or taungya system (raising forest crops in combination with agricultural crops), the prevention of erosion, protection of water catchment, farmland protection by shelterbelts, and the provision of roads, etc.

In Nigeria, taungya is a response to both the traditional system of shifting agriculture and the protagonists of dereservation in high forests. The clamour for dereservation came from areas in the south with limited land for agriculture in face of population growth. In the case of shifting agriculture, farm sites impoverished by repeated cropping are left fallow for a while in order to replenish their nutrients. In the meantime, the farmer shifts to another site which he again clears, burns and repeatedly farms. Again, he shifts to yet another site. Apart from inefficient use of land, such constant invasion of forests for temporary farm can decimate the forest.

Agroforestry is a way to prevent such consequences of shifting agriculture. Two forms of agroforestry practiced in Nigeria were described by Olawoye (1975). These are:

1. The "own your own crop" form. This is the most widely practiced type all across the vegetation zones of Nigeria. Participating farmers are assigned plots of between two to five hectares within a forest reserve by the State Department of Forestry. It is farmer's responsibility to do bush clearing, slash burning, site

preparation and planting of his crops in early spring (according to list and spacing specifications laid down by the Forestry Department). Then, using direct labour, the Forestry Department interplants forest trees between the farm crops. Weeding, clearing and tending operations are done by the farmers who are then alloted new plots after about three years on the original plot. In anticipation of this, the Forestry Department takes over tending of the trees in the second year.

2. "Farming for pay" or Direct taungya" form. Since this form was introduced in 1971, farmers are recruited as wage employees of the State Forestry Department which owns both trees and farm crops. The farmers are assigned to such phases of the program as nursery, bush clearing, site preparation, planting, harvesting, crop sales etc. They live in forest villages which are established by the Forestry Department and provided with social amenities like schools, water, electricity, etc.

No cash crops like cocoa are allowed in agroforestry because it is feared that increased benefits from such crops and possible damage to cash crops from timber exploitation could lead to a permanent appropriation of land for agriculture. Instead, yams, cassava, maize and vegetables are planted under the programs.

A similar form of land use, but with forestry and grazing together, occur in the savanna region of Nigeria (Imam, 1960). This was done to

Table 8: Export of Logs, Sawnwood and Plywood, 1962-1983

Year	Logs	Sawnwood	Plywood
		($1000M^3$)	
1962	585	66	23
1963	673	77	21
1964	781	87	22
1965	589	82	24
1966	560	74	21
1967	333	53	15
1968	313	60	17
1969	353	66	12
1970	219	47	21
1971	210	39	20
1972	192	39	20
1973	333	36	10
1974	263	28	17
1975	95	13	1
1976	27	2	
1977	10	2	
1978	10	2	
1979	10	2	
1980	10	2	
1981	10	1	
1982	10	1	
1983	10	2	

Source: FAO. Yearbooks of Forest Products, 1972 and 1983, Rome.

Furthermore, before the ban on wood products exports, Nigeria's international trade in wood products continued to show a deficit (Table 9). This is because while Nigeria imported high value products like pulp and paper, it exported mostly lower value products like logs.

Table 9: Value of Imports and Exports in Forest Products, 1962-1983

Year	Imports	Exports
	($1,000,000 U.S.)	
1962	7.3	19.5
1963	7.6	22.0
1964	8.4	25.4
1965	12.8	21.4
1966	12.2	19.2
1967	11.5	12.1
1968	12.1	12.1
1969	16.0	13.3
1970	28.0	11.3
1971	28.0	10.1
1972	30.8	10.4
1973	49.5	22.2
1974	87.1	24.4
1975	122.6	8.8
1976	172.5	2.2
1977	197.8	.8
1978	223.8	.8
1979	204.6	.8
1980	248.3	.8
1981	244.1	.8
1982	214.6	.8
1983	211.7	.7

Source: FAO. Yearbooks of Forest Products, 1972 and 1983, Rome.

In spite of the widening of the trade deficit (due to the ban on exports), resumption of exports is not promising in the short term because of the need to meet internal wood requirements (Kio, 1982) in the face of stagnating roundwood production (FAO, 1979). Even in the long term, the Center for Agricultural Strategy (1980) regards Nigeria's potential to supply the United Kingdom, Nigeria's largest timber market,

as poor. This is understandable because:

1. Nigeria's rapid population growth is expected to continue;

2. Some of the competition, like Brazil, Ivory Coast, Malaysia, etc., in tropical hardwood resources have good potentials for supplying the export market; and

3. Nigeria needs to improve its timber production and marketing efficiency (Enabor, 1972).

Hence, Nigeria should probably concentrate on the domestic market, development of new products in the home market and expansion of the number of useful species. This would also help Nigeria reduce its current partial dependence on imports, and reverse the increasing trend of the import bill for forest products.

Moreover, since most of the import bill is due to paper, paperboard and fiberboard imports, the increasing trend may already have been dampened by the establishment of three pulp and paper mills at Jebba, Hu and Iwopin where mixed species are used to produce 60,000 tons of industrial paper, 100,000 tons of newsprint, and 60,000 tons paper, respectively, per year. The Iwopin mill also produces 54,000 tons of short fiber pulp for export.

Apparent Consumption Trends and Forecasts

Apparent Consumption

In the absence of precise consumption figures apparent consumption of wood products (Table 10) summarizes recorded production plus imports less exports. Consumption figures on other forest products like wildlife are mostly lacking; hence, this section will concentrate on wood products.

Table 10 indicates a general increasing trend in the domestic consumption of wood products. Fuelwood and charcoal are the most consumed wood product with about 70 million cubic meters consumed in 1970, rising by 45% to 92 million cubic meters in 1980. Consumption over the same period doubled for paper products, more than doubled for industrial roundwood, increased more than 5 times for sawnwood and more than 17 times for wood-based panels.

In general, the rapid increase in wood consumption is mainly due to rapid economic and demographic growth during this period. Moreover, the products and quantities an individual consumes are shaped by his location with respect to rural and urban areas, his income, the availability and relative price of substitutes and complements for wood in various uses, and the level of education attained by the individual (Nwekele, 1975).

Table 10: Wood Products Consumption

Year	Fuelwood + Charcoal	Industrial Roundwood[1]	Wood-based Panels[2]	Sawn-wood	Paper and Paperboard
		($1000m^3$)		(1000 tons)	
1970	69446	2743	15	516	179
1971	71280	2995	39	527	221
1972	73191	3058	43	530	169
1974	77277	2755	56	768	251
1975	79451	4017	101	924	234
1976	81771	4139	156	937	334
1977	84160	4226	232	937	307
1978	86624	5648	245	1803	339
1979	89155	6097	256	1999	288
1980	92124	7350	263	2691	358

Source: FAO Yearbook of forest products, 1981

[1] Industrial roundwood here includes mostly sawlogs and pulpwood.

[2] Wood-based panels include veneer sheets, plywood, particle board and fiber board.

Rural residents use more fuelwood than urban residents who use more charcoal, and industrial, wood, panel and paper products. These rural residents also tend to fetch their wood directly from neighboring forests since they regard wood as a free resource. Their impact is large since they represent 80% of the population. Urban residents, particularly those with higher incomes, consume more processed wood and more fossil fuel than wood fuel. Use of nonwood fuel and other wood substitutes like metals, concrete, glass, plastics, and asbestos would dampen the consumption of wood products particularly if relative prices are in their favor. Although precise data is unavailable, current mass

production of plastics in Nigeria is eating into wood use in household utensils and furniture. Moreover, completion of the integrated iron and steel mills and fruition of the plan to tap the natural gas from petroleum drilling will further limit the growth of wood products consumption.

Projected Consumption

The conditional forecasts of apparent consumption (production + imports - exports) in this section answers the questions of what levels of forest products consumption are expected to prevail in Nigeria in future years, the expected patterns of demographic and economic growth in Nigeria during the specified period, and the observed relationship between the patterns of demographic and economic growth and the patterns of growth of consumption of forest products.

The projected consumption levels could provide a guide for decisions respecting manufacturing capacity, raw materials output, forest land area and productivity, capital, manpower and training needed to be able to satisfy such consumption levels. To do this, the form of the relationship between consumption, national income and demographics needs be specified and estimated.

The Regression Model

Regression is concerned with prediction, that is, the ability to build a statistical model which uses information about a set of independent or predictor variables in order to estimate the expected value of some dependent or response variable (Berenson et al, 1983). Hence, and after FAO (1969), the regression model will be used here to describe the relationship between forest products consumption — the response variable — and its determinants or predictor variables — population and gross domestic product. Such a multiple regression model of consumption can be represented with the form:

$C_i = f\ (GDP,\ POP,\ E_i)$

where C_i is consumption of product i in a specific year

f is specific functional form

POP is population for that year

GDP is gross domestic product for that year

E is residual, representing scatter above and below the regression equation.

The specific form of the above equation that is used is indicated by eyeballing data, drawing a scatter plot of the data, or theoretical considerations. The simplest and most widely used model specifies a linear functional relationship between the response and predictor variable, thus:

$$C_i = X + b_1\ GDP + b_2\ POP + E_i$$

where the unknown parameters X, b_1, b_2 are needed for determining straight lines. X is the true intercept representing amount of the response variable when all predictor variables are zero, b_1 and b_2 are true slopes each representing the amount that C_i changes per unit change in respective predictor variable.

Without access to the entire population of interest, we cannot compute the true parameters X, b_1, b_2. Thus we obtain their respective estimates $\hat{X}$, $\hat{b}_1$, $\hat{b}_2$ from the sample data using the method of least squares.

Data, Estimation and Results

The forest products for which consumption functions were estimated in this study include fuelwood and charcoal, industrial roundwood, woodbased panels, sawnwood, and paper and paper products. These were products for which data were readily available and which are more quantifiable.

Apparent consumption data for all the products were computed from Yearbook of Forest Products (1981). Population and GDP data from 1970 to '80 were from Nigeria's Third National Development Plan.

The functional form used is multiplicative:

$$C_i = X\ GDP^{b_1}\ POP^{b_2}\ E_i$$

This form was indicated by eyeballing the data and because it leads to

better statistical results than the linear form (Buongiorno, 1977). Since no model is truely linear until infinity, this Cobb Douglas type is a more realistic model of consumption. In general, the parameters are expected to have positive signs because, other things being equal, C should reach higher levels for higher values of GDP and POP.

In establishing the consumption functions, the natural log-linear transformation of the multiplicative function was used as follows:

$$\text{Log } C_i = \text{Log } X + b_1 \text{ Log GDP} + b_2 \text{ Log POP} + \text{Log } E_i$$

The log transformations enable us to interprete the estimated parameters as elasticities. That is, as percentage change in consumption associated with one percentage change in the respective predictor variable. For example, all else remaining the same, a one percent increase in population is expected to increase fuelwood and charcoal consumption by 1.09 percent, on average.

The computer package used to estimate the consumption functions (shown in Table 11) is the Michigan Interactive Data Analysis System (MIDAS).

Table 11: Estimated Consumption Function

Product	X	b_1	b_2	SIGNIF	R^2	SE
Fuelwood + Charcoal	.514 (2.10)	.014 (.586)	1.09 (15.492)	.000	.90	.002
Industrial Roundwood	7.872 (.641)	.775 (.624)	1.693 (.476)	.000	.88	.056
Wood-based Panels	25.697 (1.019)	2.855 (1.120)	3.246 (.444)	.000	.94	.115
Sawnwood	87.146 (5.476)	.553 (1.935)	8.849 (5.390)	.000	.94	.156
Paper and Paper Board	13.656 (1.063)	.231 (.178)	3.491 (.938)	.002	.78	.058

SE indicates standard error of estimates

R^2 indicates coefficient of determination

Numbers in parenthesis are t ratios

As can be seen from Table 11 the attained significance level is very small for all the consumption functions. Hence, we can reject the hypothesis that all the parameters simultaneously equal zero at the 99% desired significance level. Moreover, both the coefficients of determination and standard errors of estimates for all the consumption function (being high, and very small, respectively) indicate that the model specified fits the data very well.

Although all the parameters have the expected positive signs, most of the t ratios are rather small. This however should not affect our results too much particularly since the coefficients of determination

are very high, indicating that both population and GDP explain most of the variation in forest products consumption in Nigeria. The population parameters are bigger than GDP parameters indicating that demography influences consumption more.

Application to Forecasting

The consumption functions in Table 11 were used to compute conditional forecasts of the respective forest product aggregates to the year 2010 (Table 12). The model was used iteratively to calculate expected consumption in year 1990, 1995, 2000, 2005 and 2010. Two variants were done for each product: one was the low estimate which assumed a 2.5% annual growth in population during the period. The high estimate assumed 3% annual growth in population. GDP is assumed to grow at 5% per year under either variant.

These forecasts are not statements of what will happen in the future. Rather they are conditional on the assumed tendencies in the economy. The uncertainty respecting the assumed tendencies is one reason why both low and high forecasts were done for each product. Hence any changes in such assumptions will affect the forecasts. Thus it may be helpful to repeat the procedure say every five years as more information becomes available. Furthermore, the fact that product aggregates are used rather than disaggregated products like sawnwood, etc., should not be a major problem because as Buongiorno (1977) emphasized:

...when attempting to forecast the impact of alternative economic growth policies on the forest sector of a country or a region one is primarily concerned about the accuracy of the forecast for major subsectors, say total substructural wood and total paper and paperboard. Forecasts for each one of the disaggregated products are extremely important for project analysis, but less so for macroplanning.

Table 12: Projected Consumption of Wood Products

Year		Fuelwood +Charcoal	Industrial roundwood	Wood-based panels	Sawn-wood	Paper and paperboard
		(1,000,000 M^3)				(1,000 tons)
1990	Low	121	13	3	3	777
	High	121	14	3	3	778
1995	Low	139	19	7	8	1143
	High	139	19	7	8	1145
2000	Low	160	28	19	22	1682
	High	160	28	19	23	1684
2005	Low	183	40	49	56	2473
	High	183	40	49	57	2478
2010	Low	210	57	127	106	2327
	High	210	57	128	106	2645

Table 12 shows that as in the past, fuelwood and charcoal will continue to be the most important forest products in volume terms. However, its increase is not as fast as the rest of the forest products because increasing urbanization is expected to lower aggregate consumption of fuelwood while increasing consumption of industrial roundwood, wood-based panels and paper products. For example, for the low forecast, total consumption of fuelwood and charcoal in 2010 is expected to be 210 million cubic meters roundwood equivalent, more than

double the 92 million cubic meters consumed in 1980. Similarly, industrial roundwood, paper and paperboard and woodbased panels will rise more than 7, 10 and 480 times, respectively, in the same period to more than 57 million cubic meters, 3.6 million metric tons and 127 million cubic meters. The high forecasts are not much different from the low forecasts.

However, since Nigeria has to limit exports in order to narrow the gap between current consumption and production, meeting future consumption of the magnitude described above will require measures taken now to increase forest products supply at more than the rate that current programs could achieve.

Forest Products Industry

The forest products industry consists of solid wood sector (including lumber, panels, poles, furniture, construction wood, packaging, etc.) and the pulp and paper sector (including pulp, paper, paperboard, containers and boxes, etc). In Nigeria, forest products industry is concentrated in the Southwest near the main source of the raw material.

As is evident from Table 13 sawmilling accounts for 95% of the industrial roundwood converted in the industry and employs 64% of workers in the industry. None of the sawmills operate at full capacity because timber supply is insufficient for all mills. Bigger sawmills with a capacity of more than 5000 M^3/year are less than 30. These

generally have their own concessions and logging operations.

Table 13: Number of Plants, Workers and Annual Production of Nigeria's Forest Industry, 1981

Industry	No. of Workers	No. of Plants	Annual Production
			($1000M^3$)
Lumber	12,460	1,030	2929
Plywood	1,800	6	89
Veneer	300	6	5
Particleboard	250	2	55
			(1000 boxes)
Match factories	1,200	5	14
			(1000 tons)
Pulp and paper	1,000	1	121

Source: FDF, 1981.

FAO, 1979 found poor management, irregular logs supply, and low labor productivity prevalent in most of the mills. Moreover, small mills tend to take only logs 12 feet long and thus cause wastage of good wood in the forest.

Next to lumber, plywood plants employ the most workers; this is probably followed today by pulp and paper plants of which there are now three. Such increase in capacity will help reduce the dependence on imports for paper and products considerably but also will require more and reliable supply of pulpwood and mill residues.

CHAPTER IV

FORESTRY RESOURCE MANAGEMENT

Extent and Intensity of Management

Nigeria's forest estate is mostly the reserved natural forest. In these reserves control of exploitation and improvement of the growing stock are the main objectives of management. However, the extent of illegal exploitation occuring is illustrated in a memorandum (Adeyoju, 1975) which noted in Benin division alone that illegal felling amounts to: (1) 100 stumps of hardwood species and 500 stumps of abura, amounting to loss of $5,200 in Nikrowa charge, (2) 70 stumps of hardwood species and 500 of abura for an estimated loss of $4,000 in Benin charge; and (3) 70 stumps of hardwood in Sapoba charge, a loss of $1200.

Management proceeds with limited data and records of operations in spite of their importance in the preparation of management plans. Thus, some forests have no management plans and this could disturb planning and monitoring of progress.

The high forest contains only about 21 cubic meters per hectare of usable species which are highly scattered among currently unused species.

Areas outside of forest reserves are under no management at present even though it continues to be exploited and cleaned for farmland.

The slow growth and low yield of natural forests is shifting increasing attention to plantations. However, the plantations thus far developed are unimpressive in extent and pace. For example, in savanna regions where the need for plantations is greatest, less than 50,000 hectares have been planted.

More efforts need be directed towards protection from various agents. In 1977 for example, over 600 hectares of young Gmelina arborea were burned that could have been prevented with fire crews on standby in the very dry weather that occured then. Moreover, due to the reliance on few plantation species, the need for protection from insect and disease might increase.

Harvest and Intermediate Treatments

Harvesting is difficult in the moist forest zone when the soil is wet in the thick of rainfall season. Otherwise, there are fairly good networks of forest roads access for harvesting.

Felling is by axe or chain saw. Due to big buttresses axemen may stand on a structure of saplings and cut trees about 10 feet above ground. Then logs are cut 12 to 14 feet long before loading by hand winch and jacks into small lorries brought to the stump.

Most harvest operations are done by small-scale private operations. Hence costs are high and penetration and utilization of the forest poor. However there are a few large-scale operations which are

better equiped and organized.

Control of exploitation is by area and girth limit. This tends to encourage weaning of the largest desirable trees in the natural forest.

Casual labor and/or taungya farmers are used for tending operations. An expanded plantation program may need more permanent and reliable labor that can be counted on at this time.

Silvicultural Systems Used

Before 1900, most species were left to regenerate naturally after harvests. From 1906 series of rules were introduced to replant some harvested trees and tend the natural regeneration by thinning, weeding, freeing seedlings from shade, felling around mother trees, soil preparation, timber cutting, progressive poisoning, etc.

In 1944, the tropical shelterwood system was introduced on some areas while most areas were left to regenerate without silvicultural treatments. The tropical shelterwood system failed in many cases where the density of mother trees was low. Moreover forest openings under the system also favored the growth of weeds and climbers in addition to desired seedlings.

Where low stocking occured under T.S.S., enrichment planting was done to supplement the growing stock of desirable species.

With the increasing emphasis on plantation forestry, controlled use

of clearcutting may be needed to increase the pace of plantations especially in production forests. If regeneration is done quickly after harvest and if not too large an area is clearcut at a time, soil erosion and stream sedimentation could be minimized. Clearcutting also has the advantage of resulting in stands of uniform-sized trees that can be used for the same product. Moreover, since maximum volume is removed in one operation, clearcutting could be more cost-effective.

However, there may be multiple-use areas where clearcutting may not be appropriate. For example uniform stands may not produce desired kinds of wildlife habitat; and monocultures could increase susceptability to widespread insect or disease damage. Moreover, total removal of stands may remove the aesthetic appeal of trees. Hence, where clearcutting has to be done, efforts should be made to minimize these disadvantages by, for example, reservation of buffer strips along streams, maintenance of wildlife areas, and limiting the size of the harvest.

Supervision of Concessionnaires

In unreserved areas, concessionnaires have the right to extract timber without restriction. The supposition is that farming will take over such areas. In reserved forests, however, felling proceeds by area according to forest service plans. Nevertheless, concessionnaires sometimes can reenter previously logged areas. This could delay recovery and further lengthen the cutting cycle which has now been

reduced to 50 from 100 years.

Only reserved areas to be converted to plantations are released from concessions. Yet there is no close supervision of concessionnaires. Evidence of this is afforded by various problems like exceeding duration of permits, not obtaining proper approval, frequent transfers of timber licenses to third parties, retention of unoperated timber leases by priviledged persons who hold leases for speculative purposes, etc.

Under an expanded program, concessionnaires will need to be more closely supervised so as to reduce the problems enumerated above.

CHAPTER V

THE FORESTRY PROGRAM

Current Institutions

In 1897, recognizing the nature and extent of forestry problems in Nigeria, the first forestry department in Nigeria was recommended - to protect the existing forests and draw up plans for the reafforestation of denuded areas (Adeyoju, 1975). Following this recommendation, the inspector of forests that was appointed observed that:

> The farmer does not look at the land as his property to be improved and developed, but crops it without rest or rotation until absolutely exhausted and then sacrifices more forest. I think it would be good if forest land were vested in the acknowledged native authorities, that farmers were encouraged to register their farms, and that burning of new forest were utterly prohibited (Kennedy, 1942).

By the turn of the century, forest reserves were constituted to further regulate the unbridled exploitation of forests and bring selected areas under systematic management. These reserves represent the hub of Nigerian forest institutions many of which are discussed in this chapter.

Forestry Agencies

Forest reserves are now mostly owned and controlled by the Forestry Division of the Ministry of Agriculture and Natural Resources in each of the 19 states. Two federal agencies - Federal Department of Forestry (FDF) and Forestry Research Institute of Nigeria (FRIN)--link the states

with federal government, and engages in research, respectively. The University of Ibadan offers professional training in the Departments of Forest Resources Management and Wood Technology.

State Forestry Divisions

Each state charges its forestry division with management of forest reserves and wildlife, control of exploitation on and outside of reserves and extension services all within the state. In some northern states, both the state and local governments share control of forest reserves. This could cause overlap of some duties and omission of others due to unspecified responsibilities.

The states are frequently short of funds and personnel to meet their objectives. Moreover, due to tardiness of government accounting procedures, wages and other outlays are frequently paid late. These drawbacks will need to be addressed if an expanded program is to succeed.

Federal Department of Forestry

FDF was established in 1970 to coordinate forestry activities between the states, forestry industry and federal government. Its objectives include (FAO, 1979):

(1) Advising the federal government on (a) the preparation and periodic review of forest policy (b) legislation affecting forestry and wood-based industries.

(2) Collecting data for national forestry planning on forest resources supply, demand and processing.

(3) Planning and coordination of the development of forestry within the country, and the provision of funds for selected projects of national importance.

(4) Periodically reviewing trends in the use of forest products by wood-based industries, and advising federal and state governments on the regulation of these industries.

(5) Liaison between federal and state governments, the dissemination of information and organization of interstate forestry activities.

(6) Liaison with international bodies (e.g. OAV, FAO) and collecting information for national reports.

(7) Advising federal and state governments on wildlife policy, legislation, management and other matters concerning wildlife, national parks and recreation.

The FDF directorate in Lagos handles wildlife and central planning issues; otherwise, FDF is decentralized into four zonal divisions each of which gathers data through field offices in the states within its charge. In addition FDF has technical divisions which provide support services (including monitoring and control of FDF-funded projects, engineering, cartography, remote sensing, extension and trading) to zonal and field offices.

Although the decentralized organization of FDF could be very effective in meeting its objectives, fund and personnel shortages limit

its achievements.

FDF meets some of its objectives through the National Forestry Development Committee (NFDC) which meets every six months to review sectoral developments. Its membership includes the head of each State Division of Forestry, the Head of Departmemt of Forestry Resources Management at Univerity of Ibadan, a representative of the National Science and Technology Development Agency, the Director of FRIN, and the Director of FDF as chairman. Proposals of this committee need approval of the National Council on Agriculture before reaching the Federal legislative body for final authorization.

Other FDF committees are charged with monitoring the implementation of projects. These include the Pulpwood Plantation Development Committee and the Arid Zone Afforestation Committee.

Forestry Research Institute of Nigeria

As an institute, FRIN has more autonomy than FDF to pursue its objectives. However, some overlap of efforts could occur with works of FDF and the University. Moreover, gaps could occur between the research needs of states, industry and FRIN's research.

According to FRIN (1980) it does problem-oriented research on an inter-disciplinary basis. However for administrative convenience, it is organized into 12 divisions—Tree Crop Production, Economics and Management, Forest Ecology, Forest Pathology, Forest Products Research,

Soils and Tree Nutrition, Tree Management, Wildlife Ecology, Education and Training, Savanna Forestry Reserve, Shelterbelt Research, and Communication and Information.

Education and Training

Professional training is offered by the Departments of Forestry Resources Management and Wood Technology at the University of Ibadan. FRIN offers technical and vocational training at its forestry schools in Ibadan and Jos.

Given that FDF and the states have personnel shortage even under the current programs, an expanded forestry program may need expansion of the available training facilities at home since limited foreign exchange limits the option of training of personnel abroad.

Forest Policy and Law

The forest policy of Nigeria was developed by the working Group on National Forest Policy for Nigeria (under the NFDC) in 1971. The policy, as restated in 1974, can be summarized as follows:

(1) Reservation of more forest land for production and environmental improvement.

(2) Protection of forests from fire, insects and fungi, overgrazing, illegal felling and encroachment.

(3) Management of forest reserves, including the preparation of plans, the principle of sustained yield and data feedback from a continuous

inventory.

(4) Industries and the utilization of wood. The forest estate should be managed bearing in mind the requirements of industry. Local industry will be encouraged and preference will be given to those involving the greatest degree of domestic processing. Incentives will be given for the improvement of efficiency in forest industries.

(5) Employment promotion and the provision of housing and amenities.

(6) Private and communal forests will be encouraged outside the forest reserves.

(7) Public amenity and wildlife.

(8) Manpower development and training.

(9) New administration procedures and organization to meet the special demands of plantation forestry, and the need for the preparation of forest policies for each state, with local priorities.

The population and urbanization pressures on land outside forest reserves will probably hinder efforts to reserve more forestland; hence, the private and communal forest aspects of the policy statement could be pursued outside the forest reserves.

Multiple-use forestry and quantification of policy statements could be encouraged where possible. The forest policy statements need be updated periodically as more information becomes available.

Today, not all states have forest laws. In addition, what constitutes an offense in one state may be a right in another. Moreover, laws are needed with respect to environmental protection,

incentives to private and communal forestry outside the reserves, establishment of wilderness especially in areas needing protection, licensing of taungya farmers, data gathering from wood-based industries, forest operations in concessions, etc.

International Cooperation

Nigeria at various times received assistance from the Food and Agriculture Organization of the United Nations (FAO), the United Nations Development Program (UNDP) and the World Bank.

Project areas in which assistance was received include inventory, training, afforestation, protection and data processing. The forms of assistance include funds, equipment and materials and personnel.

More international assistance will be needed to meet the expanded plantation program recommended in this study.

Budget Constraints

As described earlier, forestry's share of national and state expenditure funds in Nigeria is low. This is due chiefly to the fact that forestry has to compete with other sectors of development capital but also because of low revenues in the forestry sector.

Apart from inadequacy of allocation, the irregular flow of funds is also a problem. This arises because like most agencies, forestry agencies are subject to civil service regulations and administrative

controls and hence have little control over budget planning. However, in view of the long-term nature of forestry and the high cost of delays of operations like regeneration after clearcutting, lump sum appropriation of funds may work better. Further, an expanded forestry program will need stronger financial commitment of the various governments.

Goals

The overall goal of the current program is self-sufficiency in wood products. This seems to be unrealistic considering that (1) Nigeria's forest estate is only 10% of total land area compared to 20 to 25% or more in many countries, and (2) the rapid increases in consumption of wood products compared with slowly improving resources.

In the current program, goals are not often stated in quantifiable terms such as how many hectares are to be planted or how much volume is to be produced. Periodic assessment and program development as done in this study is one way of quantifying goal statements Such quantification will contribute to better planning and monitoring the progress towards achievement of the goals. It will also prevent various officers from making their own assumption of goals, thereby limiting mistakes arising from vagueness of goals.

Achievements

Recognition of the inability of natural forests to meet domestic demands for wood products led to the establishment of plantations of fast-growing and high-yielding species. The present plantation program concentrated in the moist forest zone has progressed over time from 11,109 hectares up to 1960 to more more than 200,000 hectares up to 1981. These achievements are very low compared with the consumption requirements desired in Chapter 3. Annual rate of planting is currently about 45,000 hectares.

Deficiencies

Current annual plantation levels together with an annual natural forest yield of 2.2 million cubic meters will be unable to satisfy the projected demands for wood products in Nigeria. Hence, extension and acceleration of harvesting natural forests and establishing plantations will be necessary to contribute more to meeting projected needs.

Moreover, the species being planted include mostly Gmelina aborea and Tectona grandis. Others are Nauclea diderrichi, Terminalia spp. Pinus caribaea, etc. Since Tectona grandis and Nauclea diderrichi are slow growing, their proportion along with that of other slow growing species in the plantation program should be reduced considerably in favor of more fast-growing species, e.g., gmelina, pines and eucalyptus species.

CHAPTER VI

SUCCESSFUL FOREST POLICIES IN OTHER COUNTRIES

Prior to a discussion of the recommended forestry program for Nigeria, some of the policy approaches that have worked well in other countries are examined in this chapter. Although the situation in each country determines which particular approaches are relevant under such circumstances, there are many policy approaches used with great consistency in countries with successful forestry programs. Some of these approaches e.g. public forest ownership and management are being applied to some extent in Nigeria. Other approaches, also discussed below after James (1986), should be considered for possible adaptation in Nigeria.

Public Forestry

Public forest ownership and management is an important element of forestry programs in most countries, irrespective of whether such countries are under the capitalist, socialist or mixed economic system. To illustrate, public forest ownership applies to nearly 90% of the forest land in Canada, 25% in the United States and Sweden, 28% in Finland, 41% in Japan, 57% in West Germany and 44% in Great Britain. In the case of Great Britain, nearly all the public forest land was purchased from private individuals before planting and management could begin.

In many of these countries as in Nigeria, public forestry is the first significant approach to forest policy. Forest administrations were established to bring public forest lands under control and management. Usually, early emphasis was on protection - against fire, insects, diseases and other distructive agents, illegal entry, unauthorized timber felling, etc; then, management plans gradually evolved.

Moreover, in countries with highly developed forestry programs, public forest ownership and mangement has guaranteed sustained timber production on significant portions of the total forest areas, in addition, it has served as a source of inspiration and instruction to private landowners.

In order to support public forest management, professional forestry education and forestry research are among early developments which also usually occurred under public auspices while serving both the private as well as the public forestry sectors. Even protection against fire is usually offered under public auspices to all forest lands because individual may not be able to protect their private forest lands against fire from all sources.

The primary concern on public forest lands in countries with well developed forestry programs is still largely wood production. However, increasing attention is devoted to recreation, wildlife, and environmental interests such as watershed protection, soil erosion

control and landscape preservation. These nontimber demands inevitably reduce capabilities of public forests to produce timber and thus shift increasing attention to private forestry in order to meet national timber production goals.

Private Forestry

Many production limitations of public forests are largely responsible for the increasing attention private forestry is receiving in the countries with well developed forestry programs. These limitations include those of area and potentials for area expansion, location, increased emphasis on nontimber objectives and expanding national targets for timber production. In addition, private forests are usually more extensive, inherently more productive and, offer the best opportunities for expanding timber output.

General Education and Landowner Assistance

The purpose of general education is to create public awareness, interest, knowledge, and broad political support for forestry. Public assistance to landowners is intended to improve management practices and opportunities by landowners to grow and market timber profitably. These two approaches are of course interrelated to each other and to other approaches. For example, forestry extension programs serve both purposes as does publicly supported forest protection. Furthermore, other policy approaches such as financial subsidies for forestry and regulation of mangement practices are also means of accomplishing public

education and assistance to landowners.

Efforts in education and assistance in countries with well developed forestry programs are usually substantial, of long duration, and usually carried out by localized public bodies. Examples of such local bodies are County Forestry Boards in Sweden, District Forestry Boards in Finland, and Prefectural Forestory Divisions in Japan. The effectiveness of programs is often enhanced by other legal arrangements which enforce or encourage contact between forest landowners and forestry agencies. In Sweden and Finland for example, owners must have approval for their cutting and regeneration plans before harvest cutting can begin. In Japan, landowners have more leeway in management decisions; however, they must have management plans approved by prefectural forestry divisions if they wish to gain preferential treatment in taxation or the award of subsidy payments.

Effectiveness in education and technical assistance has been greatly enhanced in Sweden, Finland and Japan by the development of forest owner associations early in this century. Such associations were encouraged by government with legal recognition, technical assistance, and financial support or preferential treatment in the awarding of financial benefits. Thus, in these countries, a majority of forest landowners hold ownership in owner associations. This strengthens the associations which are then able to offer their own educational programs, and technical forest management and marketing services to their members.

In Sweden, some interesting features of their extension programs are worth noting. One is that grade school pupils are introduced to 6 to 12 weeks of practical preparatory training for forestry work such as seeding or planting. Also, each county forestry board in Sweden has a demonstration farm where good forestry practices are demonstrated to landowners, workers and the general public.

Financial Subsidies

Financial subsidies in the form of tax reductions, direct grants, and long-term low-interest loans are intended to expand forestry efforts. They are given for specific landowner practices considered to be desirable (such as afforestation, wetland drainage, preparation of managment plans, cleanings and thinnings, forest road buildings, etc) from the public point of view.

Use of financial subsidies as applied in the United States is summarized in Table 14. Cash, loan, and/or input subsidies are given to encourage farmers to adopt forest tree planting and management programs. This could be in form of sharing the cost of planting and timber stand improvement operations, provision of forest tree planting stocks, low cost credit, tax breaks, etc.

Table 14: Principal Public Incentive Programs for Private Forestry in the United States

Types and Examples	Comments
Direct, Fiscal (exemption, remission or deferred payment of taxes).	
1. Capital gains greatment for timber.	1. Of greatest importance to industrial ownership — involves procedures too complex to be of interest to many nonindustry small private forest land owners.
2. Yield taxes	2. Declining in acceptance.
3. Modified property tax laws	3. Increasingly popular approach.
4. Tax exemptions and rebate laws	4. Limited effectiveness as practiced — one of earliest forms — adopted by Michigan and Wisconsin in 1887.
Direct, Nonfiscal (subsidization of inputs through low-cost credit, outright subsidies, etc.).	
1. Forestry Incentives Program (FIP)	1. This is now main direct subsidy or cost-share for timber production.
2. Rural Environmental Assistance Program, Practices A-7 and B-10 (formerly ACP).	2. Main cash payment program for timber production.
3. FHA loans (and other subsidized loans).	3. Low interest, long term for forestry
4. Low cost seedlings.	4. Partly financed with federal funds.
Indirect (government research, training, technical assistance and extension, marketing information, etc.).	
1. Funding of extension foresters, Cooperative Forest Management (CFM) program.	1. Programs carried out in conjunction with states.
2. U.S. Forest Service, state and university applied research programs.	2. Effective dissemination of results through extension and other outlets.

3. Funding of production and marketing cooperatives.	3. These are also funded privately and with state funds—not, in general, successful to date.
4. Public cooperative forest protection programs such as Clarke-McNary Act and Forest Pest Control Act of 1947.	4. Necessary since fire, disease and insects do not recognize ownership boundaries and represent large risks without provision of protection strategies.

Source: Skok et. al. (1975).

A very striking use of financial subsidies, both because of the magnitude of the grants and the results achieved is Brazil - a developing country like Nigeria. Brazil launched a Fiscal Incentive Program in 1966 as a response to the problems of shortages of forest products and the disappearance and deterioration of forests in the southern regions of the country. Individuals and corporations could deduct the cost of reforestation up to 50% of taxes due. Although the percentage of tax benefit allowed was gradually reduced, the program cost in lost tax revenue was very large - U.S. $1.9 billion in the first 11 years of the program.

However, results achieved apparently justify the costs. For example, only 600,000 hectares were planted in the century before 1966, but since inception of the Fiscal Incentive Program, planting increased dramatically. More than 5 million hectares were planted from 1967 to 1980 and, as of 1981, a planting rate in excess of 400,000 hectares annually was being maintained. Industry, particularly pulp manufacture, has expanded rapidly. Much employment and income have been generated.

Net earnings in forest products trade reached U.S. $672 million in 1983 and have been projected, according to one estimate, to more than U.S. $8 billion annually.

Tax concessions have also accompanied some forestry gains in other countries, but the tax concessions offered and the forestry gains achieved do not compare with the program in Brazil. Other countries have achieved greater forestry successes with public loans and grants.

For example, in Japan, financial subsidies for reforestation and for various types of silvicultural works have been very effective. A grant program, covering 32 to 68% of the cost of the project was introduced in 1911. A loan program (with interest rates ranging from 3.5% for small private owners to 5.0% for municipalities and prefectures, and a repayment period of 30 to 35 years with a possible 20-year extension) was begun in 1951; loans could cover up to 80% of project costs. Both programs have been extensively used, particularly for reforestation. In the limited period 1971-78, grant funds were used to establish 985,000 hectares of plantation, two-thirds of the total planting on non-national forest lands. During the same period, grant funds were used to treat 840,000 hectares of forests silviculturally. Although program costs have been high (U.S. $540 million for the grant period 1971-78; U.S. $935 million for the loan program in 1972-78) the benefits in terms of improved forest management seem to be worthwhile.

Several grant schemes have been used by Great Britain to motivate

plantation establishment and subsequent management of private forests. Under the most recent of these, the Forestry Commission offers £100/hectare and £200/hectare for 25 years in conifer stands and 50 years in broadleaf stands. Only landowners that agree to dedicate their land to forestry in perpetuity and have their management plans approved by the Forestry comission can qualify for the grant. One benefit of this largely successful program is that more than half of all productive private woodland in Great Britain is now dedicated perpetually to forestry under approved management plans.

Finland has notably achieved extensive use of desireable forest management practices on private forests, mostly through grants and low-interest loans. About half of all silvicultural and improvement costs on private forest land in the 20-year period 1962-82 was covered by state grants (U.S. $347 million) and state loans (U.S. $298 million). Grants range from 15 to 65% of total expenditures by forest owners; loans must be repaid in annual instalments of 6% (3% interest and 3% amortization).

Among the countries with successful forestry programs, Sweden also uses grant funds extensively. Up to 50% of all forest owner's costs for desirable management practices are subsidized, amounting to U.S. $38 million in 1981 alone.

Regulation of Private Forestry

Regulation of forest management practices through legal and administrative controls is another means by which countries with successful forestry programs achieve improvements in private forest mangement levels.

Among the usual provision are restriction of cutting in immature stands to cleanings and thinnings. Only mature stands can be completely felled, and landowners are required to obtain satisfactory reproduction within a few years after the harvest cut. If reproduction is not achieved naturally, trees must be planted. Sometimes landowners are required to obtain licenses before harvesting fellings, and approved management plans may be required before licenses are issued.

Regulation of private cutting may not be a pertinent policy consideration in Nigeria at this time, but it is a policy that could be considered at a future time when private forestry becomes well established.

CHAPTER VII

A RECOMMENDED PROGRAM

An indication that the current forestry program is inadequate is the rapid increases in Nigeria's import and consumption of wood products at the same time that forest resources continue to deteriorate. Hence an expanded program is needed, not to attain self-sufficiency in forest products which would be an unrealistic goal at present, but to arrest further decline in forest resources and to achieve a substantial increase in sustained-yield production capacity while diminishing the need for costly wood imports.

The forestry program recommended here is visualized as an incremental one, to be accomplished over the 25-year period from now through the year 2010. In actual practice, any expanded program that might be adopted would set goals that would require review and modification periodically, perhaps every five years.

The expanded program should be a comprehensive one which considers all aspects of forest policy, namely: public forest ownership and mangement, general education and individual assistance, professional and technical forestry education, forestry research, and financial incentives. Each of these approaches is discussed largely independent of all others. It should however be understood that the various approaches are interrelated and need to be followed simultaneously.

Forest Reserves

Some 9.6 million hectares have been set aside in forest reserves, dedicated lands similar to national forests and grasslands (in the United States) in concept. The reserves represent about 10% of Nigeria's total land area.

The first requirement in a national forestry program is to place the reserves under firm control and management planning. In Nigeria such a program exists, but it is very inadequate in terms of needs met and the opportunities that exist.

Administration

At the moment, the forest services of each of the 19 states of Nigeria are autonomous. They are, however, responsible for the execution of all forestry programs including those financed by the federal government. One result of this is inadequate coordination between the various agencies responsible for forestry management which in turn complicates the problem of planning without facts - a development problem identified by Stolper (1966) in his "Planning Without Facts, Lessons in Resource ALlocation from Nigeria's Development". Moreover, as discussed in Chapter 5 many of the states services are frequently short of personnel and resources for adequate program planning and implementation.

Although likely to meet with political opposition at this time, an

alternative way that more effective forest administration could be achieved is to bring the administration of all reserves under one umbrella. That is unification of forest administration such that FDF, FRIN and the state forest services will belong to a national forest service. This would improve coordination, cut down on duplication, omission, inter-agency rivalries and save administrative costs thereby releasing more funds for field operations.

Protection

Reserve boundaries need to be clearly marked and protected from illegal entry and tree felling. The inadequacy of the existing program in this regard has led to loss of timber, revenue, etc. Unless existing values can be protected, there is little need for expansion.

More effective and expanded protection must be provided against fires, unauthorized cultivation, slash-and-burn agriculture and overgrazing. Stepped up protection from fire will involve increasing prevention, presuppresion and suppresion activities. A lot of emphasis should be put on prevention efforts such as general education of the population through the mass media, local leaders, etc., about the damaging effects of forest fires. Prompt prosecution of forest offenders should also be pursued as a deterrence to others. However, no amount of prevention will completely stop forest fires. Hence, more prsonnel training and equipment will be needed for prompt detection and control of fires once they occur.

Areas prone to serious soil erosion particularly in the east and wind erosion in the savanna areas could be zoned as protection forests where cutting, grazing and burning are prohibited.

Sanitation and salvage cutting should be carried out quickly to prevent the spread of disease and insects especially in plantations of single species.

To cut down on protection costs, people living in villages near reserves should be appointed as fire wardens for example to patrol the reserves and notify officials of protection problems. At least about two wardens will be needed per thousand hectares of reserve land for protection purposes alone.

Expanded taungya farming, provision of more forestry jobs by an expanded program and assistance resulting in improvement of farming practices could help reduce shifting cultivation. Also, where controlled grazing is a compatible use, permits should be issued and animal numbers, species and grazing period controlled to prevent overgrazing.

Management Planning

Some reserves have no management plans at the moment. Some others that have keep poor records and hence have inadequate data base. Thus, there is need for better records and management planning. Planning needs clarify management purposes - reservation of unique areas, game

lands, timber production, protection against erosion or specified multiple uses. For example, in the savanna areas, where grazing is permissible, it should be under license and limit number of animals by area; it should also look for compatibility with tree growing.

Primarily timber-producing areas need to be defined. At present, only 1.5 million hectares of reserve lands are productive closed forests. These should be maintained as such. Bulk of reserve land, however, is shrub land or mixed forest and grassland. The challenge is to turn these lands into productive wood-producing forests.

In the closed forests, a reexamination of concession logging is needed. Allowing concessionnaries to remove timber without restriction would not insure sustained yield. A better approach is for the forest service to mark the trees to be removed, and supervise concessionnaries more closely to check such abuses as exceeding duration and terms of permits, failure to obtain proper approval, transferring of licenses to third parties, speculative holding of leases, etc., that are currently rampant.

In game reserves, there is need for habitat manipulation in order to increase wildlife populations. In addition, hunting needs to be converted from exploitation to cropping. That is, hunter's numbers and hunting periods should be controlled, and animals in excess of carrying capacity should be considered surplus and harvested under controlled hunting. Moreover, to determine whether surplus or shortage of wildlife

exists, periodic census will be needed.

More research is also needed to determine the habitat requirement of different species, cutting and burning practices appropriate in multiple use areas.

Finally, management plans should include proper records of resource description, regulatory framework, and the action plan for the reserve. These records should be revised and updated as necessary.

Plantation Establishment

Due to the very slow growth and low yield of the natural forests and the failure of natural regeneration methods to insure sustained yields, conversion to plantations is gradually taking place in Nigeria. However, at an annual establishment rate of up to 45,000 hectares, the current pace of plantation establishment is too slow to contribute significantly to the projected requirements in wood-based products. For example by the year 2010 consumption of wood products is expected to be 210, 57, 127, and 105 million cubic meters, respectively, for fuelwood and charcoal, industrial round wood, wood-based panels, and sawnwood; and more than 2 million metric tons of paper and paperboard. Yet supply is today short of demand.

Thus the main objective of the plantation establishment program is to help increase the future supply of the various wood products. Further, plantation establishment could help to protect areas prone to

soil erosion particularly in the east or wind erosion of the north. It also generates employment and reduces wood imports.

Between 1960 and 1981, roughly 180,000 hectares of plantation were established. The plantation program proposed here is for the 25 years between now and the year 2010. In light of the huge expected consumption, a target of 3.7 million hectares is selected to be planted over the next 25 years. Then the annual planting program through the year 2010 would be 148,000 hectares. This target is chosen as a sort of compromise between the need for a big plantation program and the available and acquirable capacities to achieve it. At the moment there are about 9.6 million hectares of reserved land most of which is still under natural forests. Only about 180,000 of the 10 million hectares has been converted to plantations and more than 2 million are in game reserves.

About 100,000 of the 148,000 annual plantings could be expected to be planted in the moist forest zone while 48,000 would be planted annually in the savanna zones. Where it is required to fell natural forest before these planting, management inventory should be conducted in order to determine areas to be set aside as protection or production or multiple use forests.

Species recommended for the plantation program include fast growing species like Gmelina arborea, Terminalia ivorensis, Pinus caribaea, Eucalyptus spp., etc. Most of these could be used for sawnwood, panels

and fuelwood. Pinus caribaea can be used for pulpwood while Eucalyptus species can be used for fuelwood.

Adeyoju (1975) determined the average establishment cost per hectare for Gmelina arborea to be $761. This cost does not include seed collection, nursery establishment and transport of seedlings to plantations. Hence considering all these and inflation, if a cost of $1000 per hectare is assumed, and it is further assumed that there is little difference between the recommended species, then plantation establishment under the recommended program will cost 3.7 billion dollars over the next 25 years or 148 million dollars per year just for establishment costs.

Assuming an average rotation of 15 years, area regulation under even-aged management is calculated.

$$\text{Annual cutting area} = \frac{\text{Total Forest Area}}{\text{Rotation}}$$

To apply this formula to the 148,000 hectares of even-aged forests under this program suppose the species composition of the program and their plantation characteristics are as in Table 15 below:

Table 15: Species Composition and Plantation Characteristics of Recommended Program

Species	Rotation	% of Program	Area	Annual Growth
	(Years)		(Hectares)	(M^3/ha/yr)
Gmelina arborea	15	35	51,800	22
Eucalyptus camaldulensis	4	20	29,600	19
Terminalia ivorensis	11	25	37,000	15
Pinus caribaea	10	20	29,600	23

Annual cutting area is thus 34,531, 74,000, 3364, and 2960 hectares, respectively, for Gmelina arborea, Eucalpytus camaldulensis, Terminalia ivorensis and Pinus caribaea. Using the mean annual increment in Table 14, the annual yield under the program will be as shown below:

Species	M^3/year
Gmelina arborea	1,139,600
Eucalpytus camaldulensis	562,400
Terminalia ivorensis	555,000
Pinus caribaea	68,080
	2,325,080

Thus, even under the recommended program which triples the current program output, Nigeria is not expected to be self-sufficient in the year 2010. However, the increased production represents also savings in imports to the extent that they would have been imported otherwise.

The mean annual increments used in Table 14 are those obtained

under the current program. It may be possible to improve them a little with higher intensity of management than under the current program.

Expanded Reserves

The objective of this program is to extend the resource base that can be counted upon for perpetual protection and management under forests. The need to secure more land arises because of the current lack of management and protection outside reserves, the need to dramatically increase forest products supply, and to limit the conversion of forest land to other uses. There is also a need to distribute reserve areas more widely, particularly to insure adequate fuelwood supplies in a well distributed pattern.

Since attempts at further reservation will likely meet with some resistance, especially in areas with land hunger, a massive educational program aimed at the general public and target interest groups would be needed to demonstrate the urgency and importance of the problem. Another way of reducing pressure is to encourage the practice of taungya, for example, within some reserves.

Specific location of new reserves or annexes to existing reserves will depend on a more detailed study. In general, however, areas where governments own land already and lands are currently abandoned could be considered first as they are likely to encouter less public resistance, and may be more economical.

Given the substantial size of the problem, as much land as possible should be brought under reserves. For example, in Canada about 90% of the total land area is under public forest ownership and management compared to only 10% in Nigeria.

Implementation of the expanded reserves program will need additional professional, technical and vocational staff to operate them. The number needed will depend on the size, purpose of each and the total number of reserves eventually constituted.

The additional cost due to the expanded reserve program will depend on how many more reserves are eventually constituted among other things. However, benefits to be expected include increased contribution to the projected requirements of forest products and other services, increased income, import savings and employment; and addition to a secure forest estate.

Private and Community Forestry

Under the recommended plantation program, the planting target is to triple the annual achievement of the current program. In addition, public forests are limited in expansion possibilities; hence, contributions from private land owners and local communities will enhance realization of the target. This is so because much land area is still communally owned, and private ownership is increasing. Yet very little of the land in these categories is under any form of forest management.

The current dearth of private ownership in Nigeria is due in part to the fact that farmers do not think of trees as a farm crop. More importantly however, most people that may be interested in forestry lack the information, technical knowledge, and capital necessary for the growing of tree crops.

Furthermore, the long time scale of forestry is not always consistent with the short term horizon of individuals. In addition to this the difficulty of excluding other people from some benefits of forestry like aesthetics make it difficult to claim the price of the enjoyment.

Hence, in addition to local communities, the private forestry program also has the farmer in mind. Some of their problems listed above could be handled by the extension program discussed in the next section. For example, influence farmers to see fuelwood and other forest products and services as a farm forest crop and encourage farmers to adopt technical forestry principles and participate in the taungya system, etc.

The problem of capital and insurance of compliance with desirable practices have however been handled in other countries, as discussed in Chapter 6 through programs of tax concessions, public loans and grants, and public regulation of private forest management. Some of these approaches, particularly the loan and grant programs and the regulation of public forest management could be helpful to the situation in

Nigeria.

General Education and Landowner Assistance

The intent of this general education and extension program is to create - among policy makers and the general public - awareness, interest, knowledge and political support that is essential to implementing the recommended program.

One way to reach policy makers is through the preparation and distribution of pamphlets explaining the benefits of forestry and its role in rural development as well as its labor intensive nature. The general public can be reached by public information campaign through the mass media, cooperatives, forestry associations, community groups, and contacts with farmers by extension agents.

Different forms of extension services could include pilot projects implemented by forestry agencies that reflect local conditions and apply inputs that are necessary to achieve desired results. Moreover, a program of regular field visits by extension workers could also provide physical inputs (e.g. seeds, seedlings, fertilizers, organizational support, help in the management of general community forests, help in organization of timber sales, wood extraction and maintenance of machinery).

The extension divisions of forestry agencies could also organize training programs for farmers in form of short term courses, practical

demonstration, etc. Such programs should include coverage of items like use and maintenance of hand tools, planting techniques, forest improvement operations, use of appropriate felling techniques, and the observation of safety and environmental regulations. Traditional knowledge and attitudes should be related to the concepts and techniques introduced. Moreover emphasis should be put on the benefits to farmers that could result from the adoption of proposed measures. This is because whether or not people will adopt new measures depends among other things on their understanding of such measures and the fact that it could improve their situation, and is not a violation of their fundamental beliefs.

Financial Subsidies

Financial subsidies especially in the form of grants and low interest, long term loans, could be effective incentive to farmers, cooperatives, forest industry and community groups in Nigeria to plant trees as farm crops or in plantations. This is not only because of the public interest in expanding reforestation activities but also the long term nature of forestry and other factors, which discourage private investment in forestry. The specific rate of subsidies under the program will depend on how much the government is prepared to earmark. However, as is evident from Chapter 6 the financial commitment of governments in countries with successful private forestry programs have been very substantial. Although Nigeria may not be able to afford to spend as much as those countries at the moment, aid could be sought from

international organizations like FAO, UNDP, etc.

Tax concessions, particularly to forest industry could also help accelerate the private forestry program. More study is however needed in order to determine the optimum rate and amount of subsidies that will make the most difference in the Nigerian situation.

Professional and Technical Education

In Nigeria, vocational, technical and professional training are provided mainly by FRIN and the University of Ibadan. However, since there are shortages of personnel even under the current program it will be necessary to expand training facilities in order to implement the recommended program. As of 1978 the annual rate of output was 27 professional, 86 technicians and 60 vocationalists. Given the fact that the recommended plantation program is more than three times the current program and that personnel shortages still occur, six times the current annual output may be needed to provide personnel for the proposed program — 162 professionals, 516 technicians and 360 vocationalists. If such expansion is started right away, the first graduates from the expanded educational program will be available from 1988.

The areas in which expanded training are needed include genetic engineering, mensuration, management planning, budgeting and administration, silviculture, marketing and utilization, socio-economic aspects of forestry, etc. Continuing education through annual short courses, workshops, seminars should be further encouraged.

Forestry Research

Most of the forestry research in Nigeria is carried out at FRIN and the University of Ibadan. Although both institutions are well equipped, they are frequently short of funds for research projects. This situation can be improved through stronger government commitment and by private and industry groups paying for research projects carried out for them. Foreign assistance could also be sought from international agencies such as FAO, UNDP, and the World Bank.

There is urgent need for research involving genetic improvement of growing stock, species trials, species growth and yield, socio-economic aspects of forestry, lesser known species, soil-site evalutation, spacing and thinning operations and tree nurseries.

Processing and Utilization

Timber supplies can be extended in Nigeria by improving the efficiency in processing and utilization of wood. At present, only 35 of the 560 known species in Nigeria are being utilized. Timber supplies will be increased if use could be found for the currently unused species. Moreover, instead of the current practice of many small sawmills that only accept 12 foot logs, consolidation of these sawmills into bigger ones would be desirable. This could make them more capable of integration and hence make fuller utilization of materials, wood residues, and defective materials that are now left in the forest after

harvest.

Other areas in which efficiency could be improved are the increased recovery of primary products including lumber and plywood, from roundwood logs; the increased use of manufacturing residues for particleboard in particular since there is no fiberboard plant in Nigeria at present. Thus, the feasibility of starting fiberboard production should be studied. Moreover, paper recycling, improved efficiency in design of houses and other end uses should be encouraged.

REFERENCES

Adeyoju, S.K. (1975). Forestry and The Nigerian Economy. Ibadan University Press, Ibadan, Nigeria.

Alstor, T.M. (1972): "Forest - Goals and Decisionmaking in the Forest Service." USDA Forest Service Research Paper INT-128, Intermountain Forest and Range Experiment Station, Ogden, Utah.

Barlowe, R. (1978): Land Resource Economics. Prentice Hall Inc., Englewood Cliffs, New Jersey.

Beatty M.T., G.W. Petersen and Swindale L.D. (ed) (1979): Planning the Use and Management of Land. American Society of Agronomy.

Berenson, M.L., D.M. Levine, M. Goldstein (1983): Intermediate Statistical Methods and Applications: A Computer Package Approach Prentice Hall, New Jersey.

Buongiorno, J. (1977): Long-term Forecasting of Major Forest Products Consumption in Developed and Developing Economics in Forest Science, Vol 23, No. 1, pp. 13-25.

Center for Agricultural Strategy (1980): Strategy for the U.K. Forest Industry. CAS Report No. 6, University of Reading, Reading.

Charter, J.R. (1970): Economic Value of Wildlife in Nigeria. Paper presented at FAN Conference, University of Ibadan, Ibadan, Nigeria.

Convery, F.J. and C.W. Ralstoned (ed), (1977): Forestry and Long Range Planning. School of Forestry and Environmental Studies. Duke University, North Carolina.

Dana, S.T. and S.K. Fairfax (1980): Forest and Range Policy, McGraw Hill Book Company, New York.

Davis, K.P. (1966): Forest Management, McGraw Hill Book Company, New York.

Duerr W.A. (1977): Planning aan Escape from our Forest Production-goal Muddle. In Convery F.J. and C.W. Ralston (eds.) Forestry and Long Range Planning.

Duerr W.A. (1960): Fundamentals of Forestry Economics. McGraw-Hill Book Company, New York.

Earl, D.E. (1975): Forest Energy and Economic Development, Oxford University Press, London.

Enabor, E.E. (1972): The Trend of Nigerian Timber Export: 1947-1967. In The Impact of Forest Resources on the Development of Industries in Nigeria. FAN, Benin City, Nigeria.

FAO (1969): Provisional Judicative World Plan for Agricultural Development, 2 Vols., Rome.

FAO (1974): An Introduction to Planning Forestry Development. FAO/SWE/TF/18, Rome.

FAO 1979: Forestry Development NIGERIA Project, Findings and Recommendations. FO:OP/NIR/71/546, Rome, Italy.

Fatunde A.A. (1976): Land Use Problems with Particular Reference to Agriculture and Foresttry in Ibadan, Western State, Nigeria. B.Sc. Research Project, University of Ibadan, Ibadan, Nigeria.

Federal Republic of Nigeria (1975): Third National Development Plan 1975-1980. Vol. 1, Federal Ministry of Economic Devlopment, Lagos.

Forestry Research Institute of Nigeria (1980): Objectives of Forestry Research Institute of Nigeria in The Nigerian Trade Journal Vol. 27, No 4.

Hays, S.P. (1959): Conservation and the Gospel of Efficiency, Harvard University Press, Cambridge, Massachussetts.

Imam, A.J.K.G., (1960): The Use of Savanna Reserves, Special Reference to Northern Nigeria. Special Subject, Commonwealth Forestry Institute, pp. 53-65.

James, L.M. (1983): International Forestry Economics. Unpublished Class Notes, Michigan State University, East Lansing, Michigan.

James, L.M. (1986): Policies Used By Various Governments to Increase Sustained Timber Production on Private Lands. Michigan State University, East Lansing, Michigan.

Junus, H.M. (1978): A Forestry Program for South Sulawesi, Indonesia. Unpublished Ph.D. Dissertation, Michigan State University, East Lansing, Michigan.

Kio, P.R.O. (1982): Management Potentials of the Tropical High Forest with special reference to Nigeria, Cameroon and Zaire. Symposium on the Tropical Rain Forest, University of Leeds, Leeds, U.K.

Kennedy, J.D. (1942): The Development of Forest Legislation in Nigeria: An Outine. Farm and Forest, Vol. 3, No 31.

Litchfield, N. (1970): Evaluation methodology of Urban and Regional plans: A Review. J. Reg. Studies Assoc. 4(2):151-165.

Olson, K.P. (1981): Michigan's Statewide Forest Resources Plan: A Case Study in Innovation. Unpublished Ph.D Dissertation, Michigan State Univerity, East Lansing, Michigan.

Olson, K.P., L.M. James, V.J. Rudolph and M.R. Koelling (1983): A National Forest Management Plan for the Dominican Republic. Michigan State University, East Lansing, Michigan.

Petrides, G.A. (1965): Advisory Report on Wildlife and National Parks in Nigeria. Special Publication No. 18, A.C.I.W.P., Bronx, New York.

Pinchot, G. (1905): A Primer of Forestry, Part II, Bulletin 24, Bureau of Forestry. Government Printing Office, Washington, D.C.

Rogers, A.D. III and B.E. Fernow (1951): A Study of North American Forestry. Princeton University Press, Princeton, New Jersey.

Rosevear D.R. (1953): Wildlife, The Nigerian Handbook, Lagos, Nigeria.

Row C. (1977): "Balancing Supplies and Demands" in Clawson M. (ed) Research in Forest Economics and Forest Policy. Research Paper R-3. Resources for the Future, Washington, D.C.

Skok, R.A. and H.M. Gregersen (1975): Motivating Private Forestry: An Overview. Journal of Forestry, Vol. 73, No. 4.

Stolper, W.F. (1966): Planning Without Facts, Lessons in Resource Allocation From Nigeria's Development. Harvard University Press, Massachusetts.

University of Michigan Statistical Research Laboratory (1976): Elementary Statistic Using MIDAS, Ann Arbor, Michigan.

U.S. Bureau of Land Management (1975): Planning Systems Procedures, Sec. 1601, Department of the Interior, Washington, D.C.

U.S. Forest Service (1974): The Principal Laws Relating to Forest Service Activities. Agricultural Handbook No. 435, Department of Agriculture, Washington, D.C.

U.S. Forest Service (1982): An Analysis of the Timber Siotuation in the United States, Forest Resource Report No. 23, Washington D.C.

U.S. Forest Service, Forest Economics Research Div. (1983): Timber Trends in Western Oregon and Western Washington, Research Paper PNW-5, Pacific Northwest Forest Experiment Station, Portland, Oregon.

U.S. Bureau of Corporation (1913): The Lumber Industry, Part I, Department of Commerce, Washington, D.C.

Weaver, P. (1979): Agri-silviculture in Tropical in America. Unasylva, Vo. 32, No. 126.

Worrell A.C. (1970): Principles of Forest Policy. McGraw-Hill Book Company, New York.

Zivnuska J.A. and J.H. Vaux (1952): Forest Production Goals: a Critical Analysis. Land Economics, November 1952, pp. 318-327.