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Ibadan 24/10/94

Nigeria's Threatened Environment A National Profile

NEST 
Nigerian Environmental Study Action Team

Nigerian Environmental Study/ Action Team

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VEGETATION

- *Natural vegetation provides us with an array of products and services that are vital for our survival and balanced development.*
- *Vegetation untouched by human activity probably no longer exists in Nigeria.*
- *Farming, logging, grazing, hunting, exploitation for a variety of products, urbanization, and infrastructural development, all heightened by burgeoning human and livestock populations, have reduced our plant cover to a patchwork of farmlands, plantations, and secondary vegetation at various stages of regrowth and maturity.*
- *The most mature regrowth vegetation exists in forest reserves of which there are only 9.6 million ha or 10% of the country's land area; current policy is to increase the proportion to 20%; our wetland habitats (3 million ha) are largely excluded from the reserved areas.*
- *Both the forest vegetation which exists in the southern 20% of the country and the vast savanna covering 80% are fragile ecosystems, readily degrading under persistent human pressure.*
- *We have long regarded our natural vegetation as an inexhaustible bounty of nature and therefore treated it casually, cutting, burning and clearing it thoughtlessly; we lose up to 350,000 ha (an area about the size of Lagos State) of forest and natural vegetation annually.*



- *Loss of vegetation cover leads to desertification, soil erosion, declining soil productivity and loss of farmland, flooding and siltation of water bodies which are serious environmental problems in the country.*
- *Loss of vegetation also means loss of wildlife habitats, diminished supply of bushmeat and hence reduced protein intake in rural diets, erosion of gene resources, and extinction of plant and animal species that play important roles in our culture, or which may have been little explored for their industrial potentials.*
- *Conservation of our natural vegetation should be a shared concern between government and the public; government should view deforestation as a serious ecological disaster to be keenly monitored and redressed by adequately funding reforestation and adjusting policies to minimize people's need to deplete natural vegetation.*
- *Ultimately, every Nigerian has a responsibility to check population growth and actions that decimate natural vegetation.*

Natural vegetation provides us with an array of products and services that play important roles in our national economy and general well-being. Prominent amongst products from forests is wood, a versatile raw material, the use of which is almost infinite. Solid wood forms the basis of numerous labour-intensive industries like sawmills, plymills, industrial and residential construction, and furniture manufacture, all of which create employment and help to stem rural-urban population drift. Wood, as fibre, forms the basis of paper and paper products manufacture and, in some countries, wood is already being converted to plastics, certain synthetic textiles, glues, and bonding agents. Distilled wood yields a wide range of petrochemical substitutes and industrial chemicals.

Wood forms the principal cooking fuel for most of our people. Thus the availability of fuelwood is a critical element in community welfare. Although the three basic human needs are food, clothing, and shelter, neither food nor shelter can be assured without wood. Production of food without the means to cook and make it edible is a half-hearted attempt at achieving freedom from hunger.

New possibilities of converting wood cellulose and lignin into sugars, pentosans, alcohol, fodder, yeast, and other products through various biological and chemical means greatly increase the ultimate utility of wood. With the development of new chemical and chemico-technical methods of production, the number of useful forest products is steadily increasing. In the Soviet Union alone more than 2,000 forest products are now produced.

Non-wood components of forests and natural vegetation are also of importance. In many parts of Nigeria, leaves, fruits, nuts, and oils of wild plants provide a significant portion of the food supply for human, livestock, and wildlife consumption. The leaves and barks of many tropical forest trees also serve as sources of drugs, resins, gums and latex. Seed, pulp, wood and leaves of such fruit trees as *Irvingia gabonensis* and *Parkia* species are widely used in Nigeria for food, medicine, and inputs in rural industries. The bark of *Acacia senegal* produces gum arabic which is used in the manufacture of writing ink, hair glazing cream, mucilages for

pharmaceuticals, and glues in plywood industries, while the leaves and pods of the same species are used as livestock feed. Similarly, *Acacia nilotica* (*Bagaruwa*) yields tannin and has medicinal, fodder, fuel and industrial uses, while *Acacia albida* and *Piliostigma reticulatum* form good fodder, fuelwood, and industrial raw materials. The rubber tree, *Funtumia elastica*, produces latex which could be processed to produce tyres, gloves, and hoses, among other things. *Funtumia* was the main source of rubber export before the introduction of the exotic *Hevea brasiliensis*.

Okafor¹ lists over 150 mainly indigenous, Nigerian woody plants that have edible parts or serve other uses in our rural economies, while Ogigirigi² has examined the prospects of exploiting species with these potentials in the Sudano-Sahelian zones of the country. The leaves and barks of many of these plants serve particularly as sources of useful drugs and pharmaceutical preparations.

The vegetation cover of the country forms habitats for a great variety of wildlife which are of economic and aesthetic value. Many Nigerians depend on wildlife as their main source of animal protein.

In addition to the above functions, vegetation also plays indispensable roles in creating and preserving a stable and high quality environment. It moderates local climates, reduces soil erosion, and regulates stream flow by forming a protective screen over the land. Vegetation influences local climate by reducing wind speed and temperature extremes and by increasing atmospheric humidity.

By shielding the ground from the direct impact of rain-drops, offering obstruction to water moving on the ground, and holding the soil particles together with its roots, vegetation helps to reduce soil erosion. Vegetation also has a profound influence on water resources. It reduces the amount of rain water which runs down the slope and increases the amount which percolates deep down into the soil. The result is that river flow is more regular: maximum flow during the rains is reduced while minimum flow during the dry season is enhanced.

This all indicates that vegetation provides not only tangible products for our use and

consumption but also performs vital environmental protection functions. And yet vegetation is a very fragile element of the environment. All it takes is a man, a matchet, and a box of matches to reduce a forest or woodland, which may have developed over a long period of time, into charred tree stumps and heaps of ashes and charcoal within a few weeks. Unless the land is quickly re-covered with natural or planted vegetation, it can become an eroded wasteland after only one or two rainy seasons.

Because vegetation has been regarded as an inexhaustible bounty of nature, we have traditionally treated it casually. We have also regarded its protection functions and potential value for raw materials supply lightly. Yet, loss of vegetation cover is directly related to desertification, accelerated soil erosion, declining soil productivity and loss of farmland, flooding, and siltation of water bodies, which are serious environmental problems in the country. The great biological diversity of our natural vegetation, particularly of the rain forest type, offers considerable opportunities for developing new products: pharmaceuticals, foods, flavours, and dyes. Taken with new techniques in biotechnology and phytochemical research, they can form the cornerstone of multi-million naira enterprises which sustain cottage industries engaged in the collection and primary processing of such products.

Vegetation is abused largely because of the drive to meet short-term needs for farmland, fuelwood, timber, grazing, hunting, and gathering of natural products. The difficulty of overcoming the inertia of old practices and traditions also plays a part, as do infrastructure-building and activities related to urbanization and industrialization, particularly oil exploration and production. We need to know the main features of our vegetation resources, namely, their areal coverage, characteristic species, structure, and the pressures on

them. Then we would have a better grasp of the trends and levels of vegetation change. We would also be able to guide effectively both preventive and remedial action. Better knowledge of our vegetation resources will also help in generating factual awareness of, and in mobilizing popular action against, the threats to vegetation.

How "Natural" is Our Vegetation?

Some scientists believe that before human beings came with their growing numbers, economies, and cultures to dominate the environment, Nigeria was covered by three major types of vegetation:

- (i) Tropical Rain Forest, apparently covering the southernmost 39% of the country;
- (ii) Tropical Deciduous Forest immediately to the north and also covering about 39% of the country; and
- (iii) Tropical Xerophytic Woodland, covering the northernmost 22% of the country³.

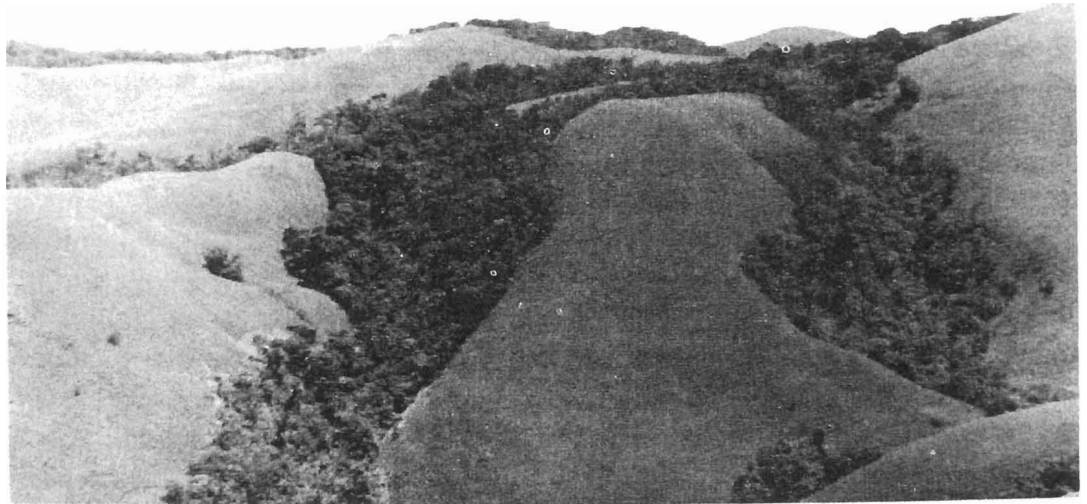
In none of the three was grass an important element. Even in the Tropical Xerophytic Woodland grass was limited to occasional patches only.

Human activities, such as bush burning, farming, grazing, and urbanization have, over sev-

eral millennia, changed this original vegetation cover. Thus, vegetation unaffected by human activity probably does not exist anywhere in Nigeria today. The plant cover of the country is a patchwork of farmlands, plantations, and secondary vegetation at varying stages of regrowth and maturity. Perhaps the most mature regrowth vegetation exists in the 10 percent or so of the country's land area that has been set aside as forest or game reserves, in fetish groves outside the reserves, or in remote, hardly accessible areas as in parts of the Oban Hills in Cross River State, in



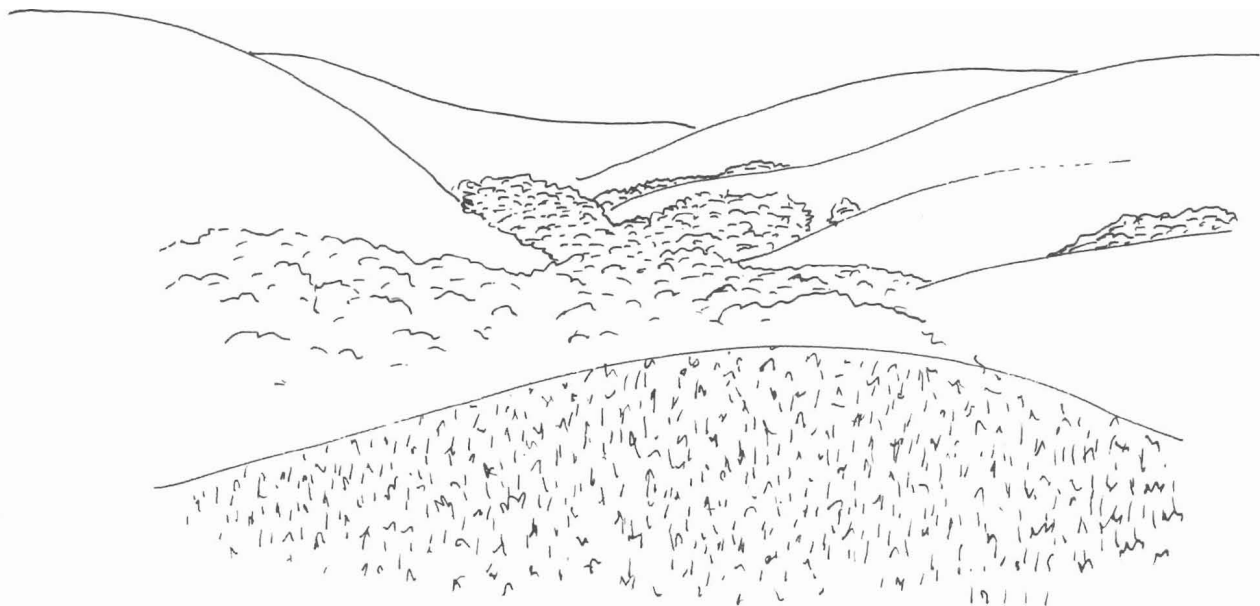
Plate 4.1
Scenic Landscape of the Obudu Plateau in Cross River state. Inaccessibility and ruggedness had until recently helped to preserve the natural vegetation of this area which is a mixture of forest and grassland. At 1500m above sea level, many of the plant and animal species are unique.



ravines and on hill tops in Jos, Mambilla, and Obudu Plateaux, on the Vogel Peak massif in Gongola State, and in the deltaic swamps in the south.

Even these relatively less disturbed areas have been selectively exploited to varying degrees, for timber, fuelwood, grazing, browse,

hunting, and gathering of non-wood forest resources. This sustains the rural communities and cultures near the areas. The plant cover of these less disturbed areas do, however, retain sufficient of their natural characters to permit their use in describing the features of our natural vegetation zones.



A country-wide remote sensing survey conducted by the Federal Department of Forestry provided a fair picture of the actual cover of the country's 92.4 million ha land area by vegetation types and different land uses (Table 4.1). This is now largely out of date as human pressure on vegetation has dramatically escalated since the survey was made over a decade ago. Clearly, an update of that survey is urgently required to give the true picture of the current status and coverage of our vegetation types and land uses. Until such an update is made, the information on our vegetation resources can only be approximate. However, even the casual observer will note the vast changes that are taking place.

FOREST

Forest vegetation is dominated by woody species, the majority of which are trees.

Not so long ago, in fact only about 50 years ago, such vegetation covered much of southern Nigeria. Logging, farming, particularly of the bush-fallow/land rotation type associated with

bush-burning, urban and infrastructural development and conversion to plantations have reduced the true forest area to patches found in forest reserves. The latter totals only about 2.4 million ha or about 10% of the forest land area. A survey conducted between 1973 and 1977, covering 1.3 million ha of these reserves revealed about 1.1 million ha of true high forest⁴. Much conversion of forest reserves to plantations of fast growing exotics has taken place in these reserves since 1977 so that the current area of true high forest in the south is probably not **much more than 1 million ha**. Outside the reserves, the vegetation in the forest zone is a mosaic of farms, fallow vegetation of various ages, and degraded or converted land. Relics of forest maintained as sacred groves are to be found scattered among farmlands, but these are usually small, often less than one hectare. Although management of these areas outside forest reserves is causing increasing concern, it is the mature forests in reserves that fully reflect the potentials of vegetation in the forest zone. The following account describes such mature forests .

Table 4.1 Land Use in Nigeria as Determined by Side-looking Airborne Radar (SLAR)

Formation	Area (ha)	% of Total
Grassland	12, 821, 302	14.1
Grassland/Shrubland Transition	1, 779, 382	2.0
Shrubland/Thicket	2, 288, 311	2.5
Wooded Shrub Grassland/ Woodland Transition	23, 747, 306	26.1
Woodland	4, 197, 209	4.6
Forest	8, 874, 255	9.8
Farmland	35, 870, 552	39.5
Plantations and Agricultural Projects	276, 500	0.3
Water, Rivers; Built-up Areas	1, 024, 231	1.1
	90, 879, 048	100.0

Source: FAO, *Land Use Area Data for Nigeria*. Based on the work of P.E.T. Allen and N.N. Shinde, Project Working Document No. 1, Vol. 2, FO: NIR/77/009, Federal Department of Forestry, Lagos, 1981.

Box 4.1 *Twilight of the Forest*

Prior to 1960, the policy of the Nigerian Government in conjunction with the Colonial Government and the timber extraction processors, was to manage the forest to sustain the supply of wood material in perpetuity by introducing a system of Periodic Blocks (PB) and Cycles, allocating forest every 25 years and exploiting it on a 50 years' cycle, assuming that on average it takes about 100 years for tropical hardwoods to reach maturity.

The forest allocations were scheduled to be made on the following basis:

First Period	(PB I)	1945-1970
Second Period	(PB II)	1971-1995
Third Period	(PB III)	1996-2020
Fourth Period	(PB IV)	2021-2045

The first 700 sq miles (1,813 sq km) allocation was made in 1945 and by natural regeneration of the tropical shelterwood system, was due to be re-allocated in 1996. The second allocation was made in 1970 (re-allocation due 2021) and the system worked very satisfactorily.

However, between 1980 and 1983 most of the forest reserved for the 1996 allocation was given out to a multitude of persons neither professionally engaged in wood processing nor capable of financing and operating wood-based industries. They became simply middlemen between the Government and the genuine wood processors, who were obliged to buy from them, or work their concessions at high hire rates in order to ensure adequate supply of suitable materials for their established industries.

The FAO reported during the 1960s that amongst States in Nigeria having tropical rain forests, Bendel was the best and most favorably placed for intensive forestry development from the points of view of suitability of soil, climatic conditions for tree growth, communications, etc. Yet today, just over 20 years later, Bendel State forest resources are depleted to the point of exhaustion and the high forest is in great

danger of becoming a faint memory of the past. The Okomu Forest Reserve, consisting of areas BC.9 and BC.10, constituted about 19% of the total Bendel Forest Estate of 650,000 hectares, which in itself is about 16.5% of the total State land area. This has been reduced by the formation of the Federal Oil Palm Project and by allocation of high forest there for rubber planting and *taungya* farming. The latter, because it is not managed properly by the authorities, will probably never revert to forest.

It may be too late to save most of the forests of Bendel State, but a serious attempt must be made to do so, led by honest and incorruptible Government officials who realize that a precious heritage is rapidly being destroyed through greed and corrupt practices. The following require urgent consideration and implementation, together with others too numerous to mention:

- (a) Plantation establishment, using both indigenous and exotic species covering large and protected areas.
- (b) Protection and regeneration of natural forest, particularly at Okomu and to include the Wildlife Sanctuary.
- (c) Vetting of those allocated forest to ensure they are bona fide processors, willing to assist in forest regeneration.
- (d) Total abolition of the *taungya* farming system in the forest estate.
- (e) Stiff penalties for illegal felling and trafficking in illegally-felled logs and for corrupt officials conniving with such nefarious activities.

The problem is international, but in Nigeria, it is worse in Bendel than other States. Worldwide, over half of the tropical rain forests have already been destroyed. By the year 2000 a further 15.2% will disappear, resulting in the extinction of many plant and animal species, soil erosion, flooding, drought and other types of natural global catastrophes and disasters we read and hear about daily....

Les Hodgson; General Manager, African Timber & Plywood (Division of UAC of Nigeria Ltd) Nigerian Conservation Foundation Newsletter, Vol. 1, (2), 1988.

Vegetation Types in the Forest Zone

The forest zone contains the following major types of vegetation:

- | | |
|------------------------|----------------------------------|
| (a) Coastal vegetation | (c) Freshwater swamp communities |
| (b) Mangrove forest | (d) Riparian forest |
| | (e) Lowland rain forest |

Coastal vegetation

This vegetation type is associated with the mangrove formation described below. It occurs mainly as strand vegetation dominated by halophytes (salt-tolerant plants) growing at the edges of the mangrove swamps, near the seaboard, or mixed with the mangroves themselves. Strand vegetation consists mainly of shrubs, such as *Conocarpus erectus* and *Hibiscus tiliaceus*, and herbs, such as *Ipomoea pes-caprae*. A recent study showed coastal vegetation at 25 beach stations taken along the entire coastline of Nigeria to be made up mainly of 43 plant species. The most common were *Ipomoea aquatica* and *Paspalum vaginatum*. The latter, together with *Sesuvium portulacastrum*, is located more landward than *Ipomoea*. Further landward, coastal vegetation consists of a mixture of climbers, sedges, and thickets of shrubs and trees.

The total width of this type of vegetation varies from a few metres to about 100 m. Per-

haps because of its small extent and simplicity, Nigerian strand vegetation has been infrequently described. This also places it in great danger of being totally eliminated by oil pollution which is now pervasive along the coastline. The extent to which strand vegetation contributes in stabilizing beaches against coastal erosion in Nigeria is not known, but could be significant.

Mangrove

Inland from the strand vegetation is mangrove, most of which occurs in the Niger delta, because such vegetation is best developed in the deltas of large tropical rivers where the vigour of the sea surf is broken by sandbars and where rain forest climate prevails. Mangrove also thrives in marine and brackish habitat, in the zone between the high and low tide marks, and may be seen as narrow strips, for several kilometres inland, along the banks of the major rivers in the delta.

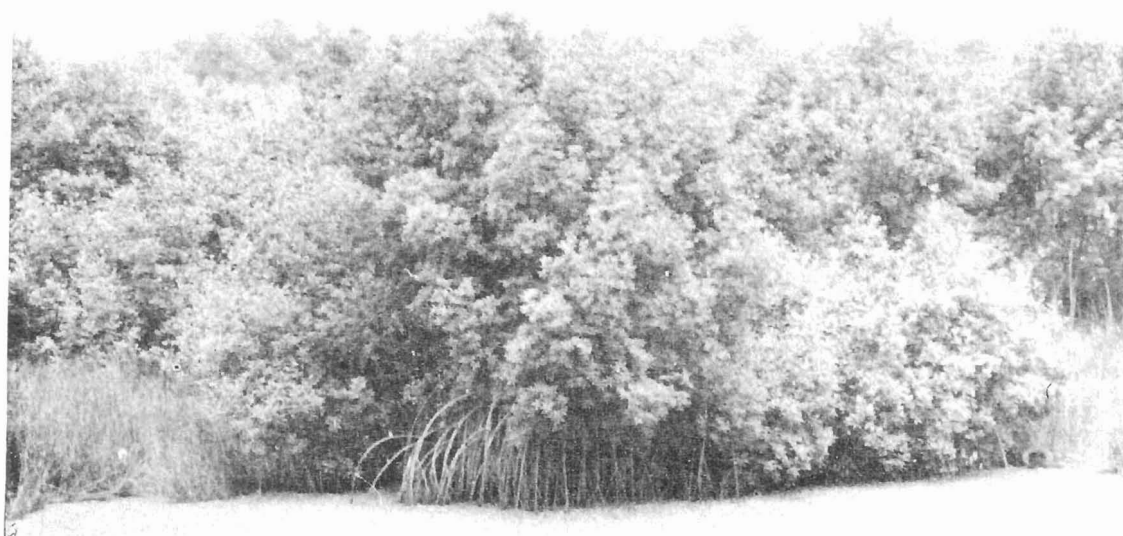


Plate 4.2

Remnant of mangrove vegetation within the vicinity of Lagos metropolis. Reedswamp in the foreground is traditionally harvested for mat-making. Draining and land-filling followed by building constructions in the Lagos area and petroleum exploitation elsewhere threaten the continued existence of mangrove.

Table 4.2 The Distribution of Mangrove Vegetation in Nigeria

State	Area of Mangrove (sq km)	Mangrove in Forest Reserve (sq km)
Bendel	3,470.32	143.75
Cross River and Akwa Ibom	721.86	67.19
Lagos	42.20	3.13
Ogun	12.18	-
Ondo	40.62	-
Rivers	5,435.96	90.62
Total	9,723.14	304.69

Source: FAO, 1981, *op. cit.*

Mangrove in Nigeria is dominated by red mangroves (*Rhizophoraceae*), in association with white mangroves (*Avicennia*) and *Laguncularia racemosa*. The red mangrove *Rhizophora racemosa* is the commonest species, covering over 90 percent of the mangrove area. It is the pioneer species, and is followed by *R. harrisonii* and *R. mangle*, respectively, as the land becomes drier towards the inner limits of the swamps. *Avicennia*, a smaller tree than *Rhizophora*, grows singly on firm land. The zonation of the *Rhizophora* species may be related to their salt tolerance, with *R. racemosa* being less tolerant than *R. mangle*. The other mangrove species, e.g. *Laguncularia*, are less abundant and occur mostly inland from the *Avicennia* belt. The only salt water fern in the world, *Acrostichum aureum*, occurs in older parts of the mangrove swamps, where dense swards of the fleshy herb, *Sesuvium portulacastrum*, also exist. The exotic but largely naturalized Nipa palm (*Nypa fruticans*) is replacing native mangroves especially along the Andoni and Bonny Rivers.

Seedlings of mangrove trees require newly deposited soft mud to establish themselves. The

root-mat formed by the fine rootlets into which stiltroots of *Rhizophora* spp. divide help to consolidate the mud into a firmer substrate, on which any colonizing seedlings develop poorly.

The high acidity (pH less than 4 when wet) of the acid sulphate soils (called *chikoko*) together with the salinity of the site excludes intolerant species. Hence only few species are found in mangroves. Over 80 percent of the mangrove swamps of the Niger delta is characterized by such acid soils which call for extensive liming before they can be effectively used for crop production or aquaculture.

At present only about 3 percent of our mangrove vegetation falls within forest reserves. An expansion of such reserved area, coupled with a regime of management for sustained production of benefits, is urgently required to develop our mangrove vegetation. Mangrove is perhaps the most extensive land ecosystem threatened by activities of the oil industry.

The landward boundaries of mangrove stands merge gradually with aquatic grasslands, herbaceous swamps, freshwater swamp forests, riparian forests, or forest-savanna mosaics, according to local conditions.

Plate 4.3

Freshwater forest community along the Epe-Lagos motorway killed by change in soil water regime as a result of the road construction. Similar destruction may be seen on most motorways throughout the country. Provision of adequate drainage at ecologically sensitive points when constructing roads can help to reduce this type of deforestation.



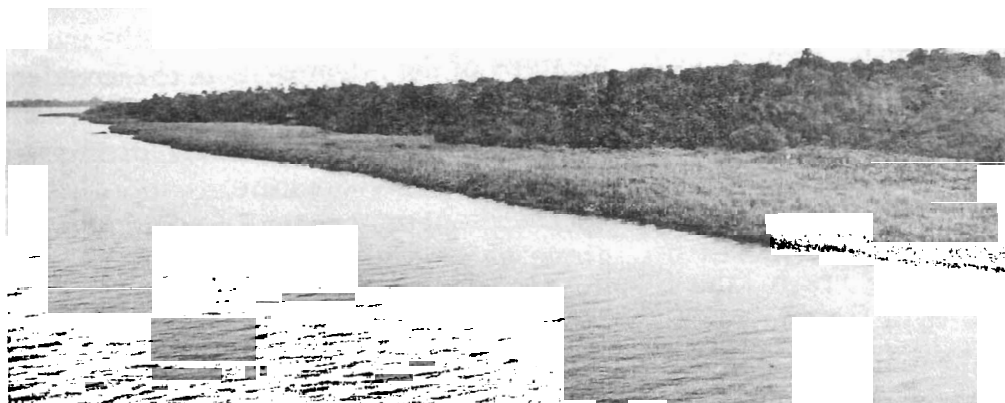


Plate 4.4
Freshwater swamp communities near Epe, Lagos State. Note aquatic grassland and herbage in the fore of the forest. This type of community harbours survivors from mechanical clearance of water hyacinth from the free water surface and forms the source for re-infestation.

Freshwater swamp communities

Aquatic grasslands, freshwater swamp forests, deltaic swamps, and undifferentiated swamps make up the freshwater communities that succeed mangrove and continue in low-lying places along waterways inland in the forest zone. Until recently, these communities were largely protected from human activities by the swampy ground on which they exist.

Now their continued existence in the delta region is seriously threatened by the ingress of sea water along canals constructed by the oil industry to facilitate transportation to the sea. Studies around the Tsekelewu Oil Field in the Niger Delta of Bendel State⁵ reveal massive destruction of vegetation because freshwater communities are exposed to saline water introduced through these canals.



Plate 4.5
The weed *Eichhornia crassipes*, water hyacinth, has completely taken over this section of the Lekki Lagoon, near Lagos, making access to several villages impossible and ruining the local fishing industry. The weed invaded Nigerian waters from the Republic of Benin about 1984 and has taken over more than 2000 km of fresh water, rivers and creeks cutting off villages and rendering thousands of fishermen jobless for upwards of four months in the year.

Close monitoring is required to determine whether the situation has stabilized, with new, tolerant communities regenerating in balance with the new levels of salinity, or whether the vegetation destruction will spread with continuing increase in salinity in the delta.

Elsewhere, road-building activities threaten freshwater swamp communities. Damming of waterways and siltation alter the water regimes of the soils, leading to the death of the communities. Such dead swamp communities are frequently seen along new roads throughout the forest zone.

tion also include *Nymphaea lotus*, *N. micranthus*, *Pistia stratiotes*, *Impatiens*, *Eleocharis*, *Salvinia*, *Lemna*, and *Utricularia* species. This is the habitat being increasingly invaded by the water hyacinth, *Eichhornia crassipes*.

(b) Terrestrial swamp forest: Terrestrial formations replace the aquatic communities described above inland from the water front. These formations have an outer fringe, close to the water edge, which is dominated by species of *Raphia*, *Pandanus*, *Calamus* and *Alchornea*. This fringing section of the swamp vegetation is seldom more

Table 4.3 Distribution of Freshwater Swamp Communities in the Forest Zone States of Nigeria

State	Area of Swamp Communities (sq km)	Swamp Communities in Forest Reserves (sq km)
Anambra	426.57	148.44
Bendel	7682.81	879.70
Cross River and Akwa Ibom	2178.19	500.00
Imo	625.01	46.88
Lagos	1504.73	-
Ogun	907.77	25.00
Ondo	1871.89	23.44
Rivers	5937.48	806.35
Total	21,134.45	2,429.81

Source: FAO, 1981, *op. cit.*

Nigerian freshwater swamp communities are largely non-peaty and cover only about 21,000 sq. km. of the forest zone. The following types are distinguished:

(a) Aquatic grassland and herbaceous swamps: These are commonly observed at the outer edge of swamp forests and frequently consist of floating vegetation of the grass *Vossia cuspidata*, large communities of *Cyperus* spp. or of grass vegetation consisting of *Acroceras amplexans*, *Paspalum* spp., *Echinochloa pyramidalis*, the aroid *Cyrtosperma senegalense*, the fern *Nephrolepis biserrata*, or dicotyledonous herbs such as *Jussiaea*, *Polygonum*, and *Ipomoea* species. Floating or submerged plants in this sub-type forma-

tion also include *Nymphaea lotus*, *N. micranthus*, *Pistia stratiotes*, *Impatiens*, *Eleocharis*, *Salvinia*, *Lemna*, and *Utricularia* species. This is the habitat being increasingly invaded by the water hyacinth, *Eichhornia crassipes*.

(b) Terrestrial swamp forest: Terrestrial formations replace the aquatic communities described above inland from the water front. These formations have an outer fringe, close to the water edge, which is dominated by species of *Raphia*, *Pandanus*, *Calamus* and *Alchornea*. This fringing section of the swamp vegetation is seldom more than 15 m tall. Behind this fringe, the freshwater swamp may attain a height up to 45 m. The best-known species of this formation is *Mitragyna ciliata* (the Abura of the timber trade). Other conspicuous and well-known species are *Symphonia globulifera*, *Lophira alata* (ironwood), *Alstonia boonei*, and *Nauclea gilletti*. Less well-known species include *Spondianthus preussii*, *Carapa procera*, *Uapaca* spp., *Garcinia* spp. (the sources of bitter kola and chewing sticks), *Cleistopholis patens* (used in canoe building) and *Oxystigma mannii*. Some of these trees have stilt roots (e.g. *Uapaca*), pneumatophores and bulging corky knee roots (e.g. *Mitragyna*). In places, *Oxystigma mannii*, *Raphia hookeri*, or *Pandanus candelabrum* form more or less pure communi-



Plate 4.6
Undifferentiated inland swamp forest. Note the much broken canopy and the dense tangles of shrubs and climbers.



Plate 4.7
Regeneration in a gap created by timber exploitation in lowland rain forest. Note abundant saplings of umbrella tree (*Musanga cecropioides*) in the foreground. Lowland rain forest once dominated most of southern Nigeria. Most of it has now been converted into farmland, oil palm bush, cocoa, cola and rubber plantations or, at best, degraded forest.

ties within the freshwater swamp formation; and where the formation occurs in the estuaries it may be distinguished as deltaic swamp.

(c) Undifferentiated inland swamps: Freshwater swamp forest farther inland in the Niger Delta is seasonally flooded. In the dry season, surface water is patchy or absent, while during the rainy season the forest is flooded. These seasonally flooded forests have an undifferentiated structure, being very irregular in the upper layers, superficially resembling broken or secondary forest. They are unsuitable for farming or habitation and thus have remained relatively

undisturbed. The main canopy of these forests is more or less open and, in the gaps, dense tangles of shrubs and lianas practically form an impenetrable growth. The undergrowth is mostly of climbing palms (rattans), *Alchornea cordifolia*, and species of *Urera*, *Cissus*, *Dalbergia*, *Combretum*, *Afromomum*, and *Megaphrynium*. Common weedy species include *Mimosa pudica*, *Costus afer*, *Aspilia africana*, *Asystasia* spp. and, increasingly, *Chromolaena odorata* (*Eupatorium*).

At Patani, the vegetation near the Forcados River, though a freshwater swamp community, has a well-defined structure, with trees including *Ceiba pentandra*, *Iringia grandifolia* and *Klainedoxa*

gabonensis reaching over 50 m height. It is possible that the apparent development of defined structure at Patani is due to human influence for which there is ample evidence in the form of farming. The vegetation in other places, such as Unenurhie, is more typical of the formation, having an open structure with abundant tangles dominated by *Raphia* palms, *Carthormion*, *Uapaca*, *Symphonia globulifera* and *Pterocarpus santanilloides*.

The dense gigantic masks of climbers, which completely cover and overhang the understory trees, is the most striking feature of this type of forest.

Riparian forests

These are closed stands of irregular structure, commonly found by stream banks. They are mature stands of trees with closed canopy and an open undergrowth. Riparian forests vary in their width along the water courses which they fringe. A typical example exists around Obrikom pontoon crossing in the delta area.

Riparian forests are less complex than the lowland moist forests of the forest zone, but denser than similar woodlands in the savanna

area. Characteristic tree species include *Brachystegia eurycoma*, *Cola laurifolia*, *Cleistopholis patens*, *Cynometra vogelii*, *Iringia grandifolia*, *I. smithii*, *Khaya grandifoliola*. *K. senegalensis*, *Myrianthus serratus*, *Pterocarpus santanilloides*, *Trichilia heudelotii*, and *Uapaca* spp. The term *kurmi* is sometimes applied to fringing forests along streams in the savanna.

Riparian forests could play a major role in conservation, by serving as corridors interconnecting forest blocks for the passage and protection of wildlife.

Lowland rain forest

The main block of the Nigerian forest formation at low and medium altitudes is called lowland rain forest. High human population densities have greatly transformed the complex structure and species richness of this vegetation type. Most of it has been converted into farmland, oil palm bush, cocoa and cola plantations or, at best, degraded forest. Mature patches remain only in some forest reserves or as isolated sacred groves.

Using categories designated by the FAO (1981) the lowland rain forest is distributed in the forest zone as in Table 4.4.



Table 4.4 Distribution of Lowland Rain Forest in Nigeria.

State	Land area (sq km)	Lowland rain forest area (sq km) ^(a)	Forest area converted to farmland etc. (sq km) ^(b)	Area of forest in reserves (sq km)
Anambra	17,078.13	1,756.24	10,373.43	23.45
Bendel	38,882.84	5,796.86	14,865.65	3,964.14
Cross River & Akwa Ibom	27,214.15	10,345.33	9,353.18	5,140.64
Imo	11,534.42	479.70	9,328.23	3.13
Lagos	3,514.16	45.31	798.46	0.0
Ogun	17,179.69	2,209.37	8,735.97	1,196.89
Ondo	20,070.00	5,414.07	9,607.83	2,640.65
Oyo	36,892.29	1,501.59	834.38	953.17
Rivers	17,687.51	135.93	3,845.31	150.01
Total	190,053.19	27,684.40	67,742.44	14,072.08

Source: FAO, 1981, *op. cit.*

Notes

(a) Forest mature, mature disturbed, immature, riparian and mosaic mature, disturbed/immature.

(b) Forest areas converted to farmland (excluding swamps, oil palm, and rubber plantations)



Plate 4.8

Under intense human pressure, most of The Tropical Rain Forest in Nigeria has given way to secondary vegetation types. One of these is the oil palm bush shown here near Owerri, Imo State. Because of its great economic value, the oil palm, *Elaeis guineensis* is normally left standing while the forest is cleared for farming. A few other tree species may also be preserved as in the far background. Note the tangled undergrowth in the foreground.

Only about 28, 000 sq km or 14.5 percent of the land area of the forest zone States is covered by this type of vegetation. The inventory made between 1973 and 1977 by the FAO showed that only 38 percent of the existing lowland rain forest could be classified as undisturbed by logging operations. The percentage must be much less than that now, over a decade later, given the general intensification of exploitation against the decline in forest management and

control of legal and illegal logging operations, since the inventory was made. Lowland rain forest is the country's main source of timber. Extensive traditional bush fallowing system of cropping has meant that over 60 percent of the lowland rain forest has been converted to farmlands at different stages of cultivation or regrowth to forest. In fact, some estimates suggest that not more than 10 percent of the lowland rain forest in Nigeria has escaped farming in recent times.

Extensive groves of the oil palm (*Elaeis guineensis*) mark areas that have been long under cultivation, and in eastern Nigeria, these groves are so dense that the palm belt appears to be a permanent replacement for lowland rain forest. Other more or less permanent conversions are the cocoa and kola farms that are extensively developed in western Nigeria, the rubber plantations in Bendel and Cross River States, oil palm plantations in various States, and plantations of forest trees, notably *Gmelina arborea* and *Tectona grandis* of which over 130,000 ha exist in the forest zone States⁶. Towards the northern limits of the forest, prolonged cultivation degrades the vegetation to wooded grassland.

The lowland rain forest belt extends from the western to the eastern boundary of the country, and is continuous with similar forest in the Cameroon Republic and beyond. It is of variable width being, together with the other forest formations described above, about 120 km at its western boundary, 300 km in the middle, and 345 km at the Cameroon border in the east. Lowland rain forest proper is nowhere more than 190 km wide. North of Ondo town, the farthest northward extension of the rain forest belt reaches slightly beyond the 8°N parallel. East of the River Niger, the northern limits are represented by Anambra Forest Reserve at Ogurugu (slightly north of Mamu Forest Reserve). Close to the eastern boundary, north of Ikom, the northern edge turns north to include the forests of Obudu, up to latitude 6° 30'N. Lowland rain forest occurs only below 900 m altitude, being succeeded by sub-montane and montane vegetation above this elevation.

Lowland rain forest consists of a great variety of species, of which such trees as the mahoga-

nies (*Khaya*, *Entandrophragma*), obeche (*Triplochiton*), afara (*Terminalia*), iroko (*Chlorophora* now *Milicia*), African walnut (*Lourea*), ekki (*Lophira*) and *Mansonia* have been some of the main sources of timber. The wealth of species includes many that yield spices (*Xylopia*, *Piper*, *Dennettia*, *Tetrapleura*) leaves, barks, roots, and fruits that play vital roles in our rural cultures, particularly in ethnomedicine and nutrition. From the numerous species in this forest belt may yet be discovered some plants that could be important for modern medicine, agriculture, and industry. Depletion of the rain forest belt is depriving us of the opportunity for such discoveries.

The species are arranged in a complex vertical structure of which we can sometimes make out an emergent layer of large trees (up to 60 m tall) with isolated crowns, a canopy layer of trees with touching crowns, and an understory of trees with spreading crowns, followed by shrubs and ground vegetation. The large number of woody climbers (lianas) binding many of the trees together, the abundance of epiphytes, and flowering and fruiting on the tree trunks (cauliflory) are some of the striking features of lowland rain forest. The intact forest structure protects the fragile soils from erosion in the high rainfall regime of the zone. Traditional uses of the forest essentially maintain this protective function, by permitting long fallow periods and using mixed cultivation practices in which trees are allowed to remain. High population densities have caused the shortening of fallow periods, and this, together with our inappropriate mechanized methods of land preparation and cultivation, is leading to acute problems of soil erosion in the rain forest belt.

Forest Outside the Forest Belt

Outside the forest belt there are forest outliers, which include riparian forests, or *kurmis*, and forest islands in the savanna zone. Some little known but extensive forest outliers exist within Gongola State in Amboine, Baissa, Bisaula, Gangumi, and Wurkam forest reserves. Better known outliers are to be found in several forest reserves in Benue State (e.g. Okura-Iyale, West Okura, Acharane and Dekina) directly north of the derived savanna in Anambra State.

In Kwara State similar forest outliers occur in Eba River, Olle, Gabo Escarpment, and Gbedege forest reserves. Other islands occur in Niger State, southern extensions of Kaduna and Plateau States, and in Gongola State. These forests mostly occupy moist lowlands or hollows and river valleys but may, as in part of Kainji Lake National Park, be found as relics on stony hill tops or other relatively inaccessible sites unsuitable for farming, e.g. Amboine forest reserve in Gongola State.

Above the altitudinal limit of lowland rain forest, moist sub-montane forest is found on the Jos, Mambilla, and Obudu Plateaux and on the Vogel Peak massif and outlying hills. On the Obudu Plateau, comprising extensive tracts of land over 1 500 m elevation, the vegetation is a mixture of forest and grassland, the latter resulting from human interference over a long period. Separating the two types of plant community is a rather distinctive transition zone. The highland of the Vogel Peak massif, sometimes known as Shebshi Mountains, rises over 1,525 m.

The vegetation here comprises riverine forest communities in the valleys within the massif, lowland savanna, sacred forest groves, and some montane plant communities on the plains. On the Mambilla Plateau, which lies between 1,220 and 1,836 m altitude, the forest has more or less disappeared, leaving small relics along stream courses and in deep, steep-sided valleys, such as the Ngel Yaki.

SAVANNA

Savanna occupies nearly 80 percent of the land surface of Nigeria, extending from about 6°N to the northern borders of the country. This is seasonal vegetation in which there is a closed or nearly closed cover of grasses at least 80 cm high with flat, usually cauline, leaves. Savanna is usually burnt annually and has various densities of trees and shrubs. On the basis of the density and proportion of woody species, savanna is usually distinguished into:

- (a) *savanna woodland*, with fairly closed canopy of trees and shrubs;
- (b) *tree savanna*, where the woody plants are scattered;
- (c) *shrub savanna*, where trees are absent; and
- (d) *grass savanna*, where woody plants are absent.

The various forms may exist side by side but tend to occur in varying proportions in the different zones into which savanna is subdivided. Keay's scheme⁷ is the basis for classifying savanna into zones from the south northwards into

- (a) Derived savanna;
- (b) Guinea savanna;
- (c) Sudan savanna; and
- (d) Sahel savanna

The highlands in the zone bear distinctive grassland/tree vegetation types.



Plate 4.9

Mature lowland rain forest maintained by difficult access across the Cross River at Ajassor beach. Even so role disturbance of the forest for farming to the left of the picture.

Derived savanna

The transitional forest-savanna mosaic, occurring immediately north of the lowland rain forest belt, is called Derived Savanna. The Derived Savanna belt covers parts of Ogun, Oyo, Kwara, Bendel, Anambra, Imo, Benue, Cross River and Gongola States, reaching 8°30'N in the west and 6°40'N in the east. It covers an area approximately 75,707 sq km (about 8 percent of the country) being the widest (about 240 km) north of Okigwe. The dry season in this zone is about 3 months and mean annual rainfall is 1,440-1,780 mm.

The vegetation of the zone is believed to have been derived from forest, through prolonged cultivation and annual burning. Fire-tender forest trees are replaced in the zone by fire-tolerant species, and the vegetation changes rapidly in character over short distances, such that low forests, dense woodlands, and thickets

alternate with open tree and grass savanna. The oil palm (*Elaeis guineensis*) is still abundant in this zone in which the typical savanna species are *Daniellia oliveri*, *Vitex doniana*, *Ficus capensis*, *Lophira lanceolata*, and *Hymenocardia acida*. Relict forest species include *Albizia* spp., *Cola* spp., *Milicia (Chlorophora) excelsa*, *Lonchocarpus* spp., *Combretum* spp., and *Dialium guineense*. The dominant grasses in this belt are *Andropogon tectorum* (southern gamba grass) and *Loudetia arundinacea*.

Guinea savanna

This is the most extensive vegetation zone in the country, covering 50 percent of the land area. It occurs immediately north of the Derived Savanna belt in an area where the dry season lasts 4 to 6 months and the annual rainfall varies from 1,020 to 1,520 mm. The Guinea Savanna encompasses much of the thinly populated middle belt region. Recent developments indicate increased immigration of farmers, particularly operators of large-scale mechanized farms, into the area and increased movement and incipient sedentarization of cattle rearers, encouraged by government programmes of tse-tse eradication and demarcation of grazing reserves. In the southern parts, *Daniellia oliveri* is a common tree while *Andropogon gayanus* replaces *A. tectorum* as the major grass. Northwards, *Azelia africana* and *Isoberlinia* spp. replace *Daniellia* as dominant trees, while *Hyparrhenia* spp., *Andropogon* spp., and *Schizachyrium* become co-dominant grasses. Guinea Savanna is thus sometimes divided into southern and northern zones, but on the bases of structure and species composition it may be grouped into:

- (a) mixed deciduous woodland, covering most of the Niger and Benue troughs;
- (b) *Azelia africana* and semi-deciduous forest, around Abuja;
- (c) *Isoberlinia* savanna, around Kaduna and extending southwestwards;
- (d) a patch of *Burkea africana* savanna, north of the Kainji lake; and
- (e) wooded savanna to the northeast of the zone.

Sudan savanna

Except in the northeast where Sahel Savanna occurs, this is the northernmost savanna belt in





Plate 4.10
Recently burnt savanna woodland and vegetation. Note how the ground is laid bare ready for destruction by torrential rains of the beginning of the rainy season. Early burning before the grass becomes tinder-dry has points to its favour: it helps to keep down tse-tse flies and it encourages the growth of new grass shoots for the pastoralist. The incompletely burnt grass also continues to afford cover to wildlife. However, late burning, such as here is destructive of the habitat.

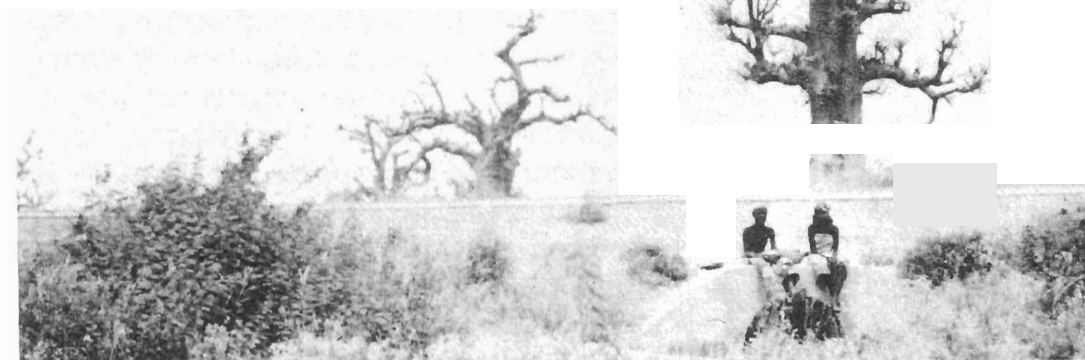


Plate 4.11
Baobab trees (*Adansonia digitata*) near Gumel, in Kano State in the Sudan Savanna belt. Note how the bark of the tree on the right has been partially stripped for rope-making, an important local craft industry. The baobab tree has other important uses: its leaves, fresh or dried, are widely used in making soup; the white pulp in its pod is used for seasoning corn meal (pap).

the country, covering a 250-km band running east to west. Mean annual rainfall is 510-1,140 mm, the dry season lasts 5 to 7 months. Increased seasonality and irregularity of rainfall impose semi-arid conditions on the zone. It is the belt currently being ravaged by desertification. There are extensive areas of seasonal swamps. The vegetation is typically mixed combretaceous woodland with *Vitellaria paradoxa* (formerly *Butyrospermum paradoxum*, shea butter), *Acacia senegal*, *Acacia albida*, *Zizyphus*, *Adansonia digitata* (baobab), and *Piliostigma reticulatum* being common trees. The common grasses in this zone, *Aristida*, *Brachiaria*, *Panicum*,

Chloris, *Digitaria*, and *Eragrostis*, are mostly short. Cultivation is intense, and, together with heavy grazing, bush burning and cutting for fuelwood and browse, has contributed to extensive desertification in the zone.

Sahel savanna

This exists in the northern part of Borno State. Here there is less than 500 mm annual rainfall and the dry season lasts 7 to 8 months. The main vegetation layer consists of low-growing shrubs, mostly *Acacia* spp., *Anogeisus leiocarpus*, *Balanites aegyptiaca*, *Commiphora quadricincta*, *Cordia rothii*, and *Salvadora persica*. *Sorghum* grass is domi-

Plate 4.12
Sahel vegetation in a forest reserve showing the effects of overgrazing in the very poor ground cover. Such land is subject to intensive sheet erosion.

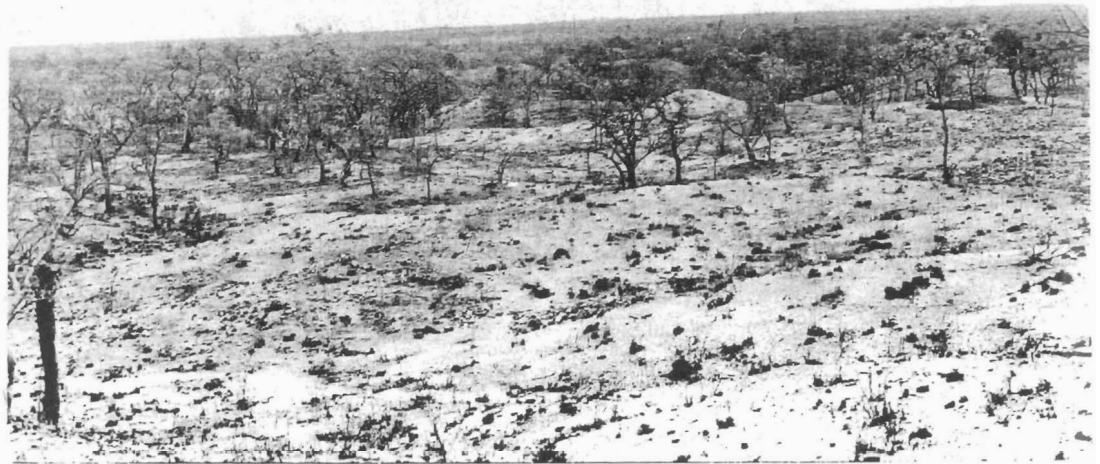
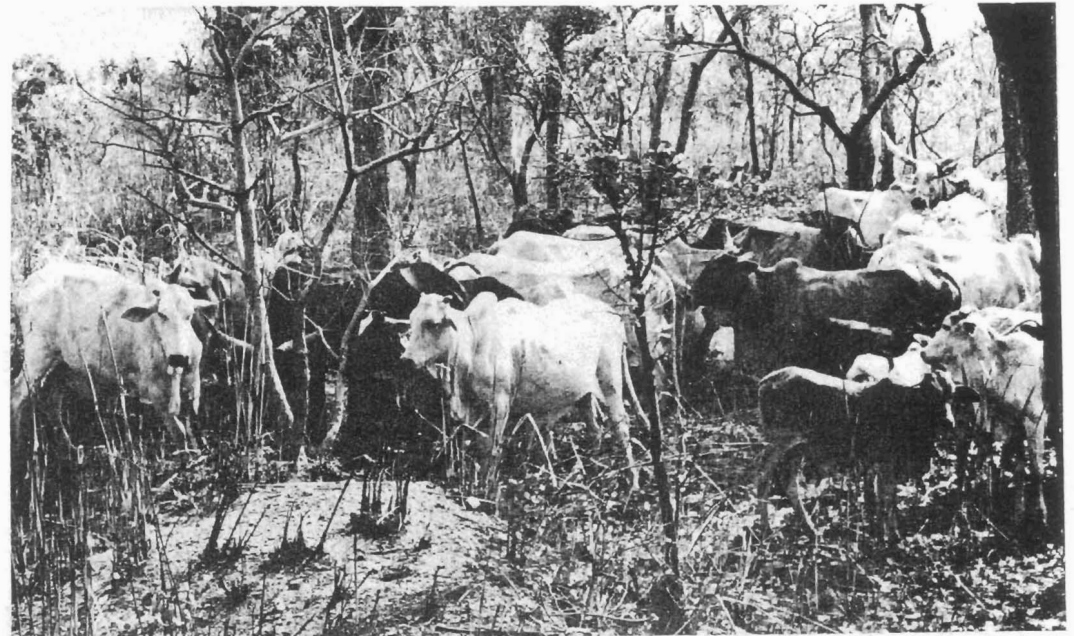


Plate 4.13
Grazing and bush burning are two of the several pressures which humans have brought to bear on the vegetation of the savanna. This picture shows Fulani cattle grazing in a recently-burnt woodland.



nant. The vegetation cover is sparse, the ground being bare and sandy under the short bushes.

Plateau Mosaic Vegetation

On the highlands rising to over 1000 m, such as Jos, Obudu, and Mambilla Plateaux, Vogel Peak Massif and Gotel Mountains, grasslands are mixed with leguminous woodlands, mostly *Isoberlinia*, to form distinctive sub-montane vegetation types that have however been much modified by deforestation, bush burning, and overgrazing. Grassland forms a continuous cover on these highlands, with a few low shrubs and trees (*Ficus* spp., *Euphorbia* spp.) but no climbers or scrambling plants⁸.

Effects of Land Practices on Savanna Vegetation

Savanna is used mostly as rangeland (69%) or farmland (30%). Irrigation is currently actively expanding the farmland area but there has been a general deterioration of the natural resource base in the savanna as a result of abuse and overuse of the land. Human activities remove the homeostatic mechanisms of the system, causing instability.

Cultivation, once practised with long periods of fallow, is now increasingly intensive as population pressure has increased. Intensive cropping and shortened fallow periods reduce the amount of organic matter in the soil and

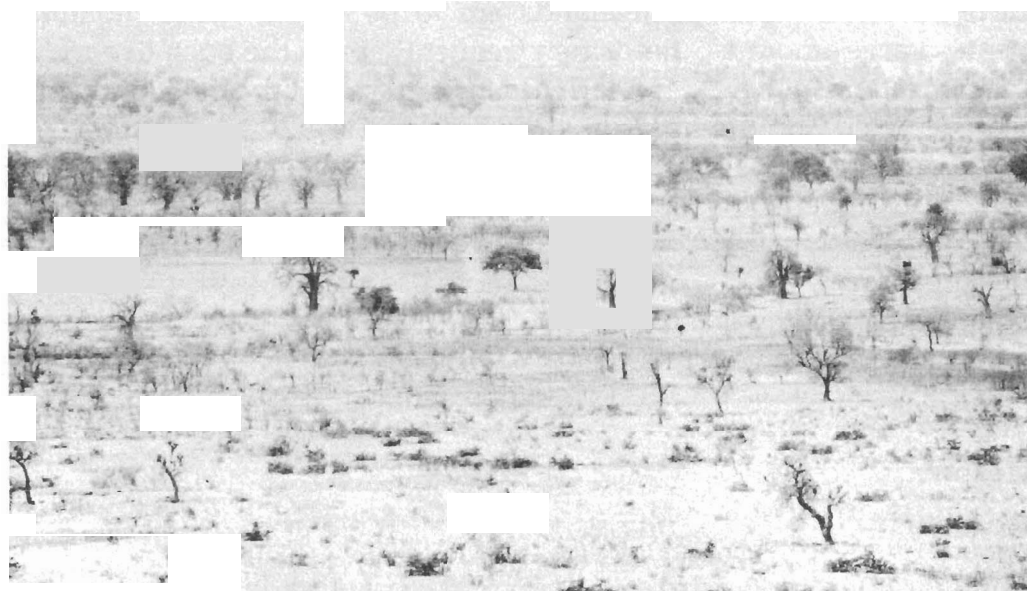


Plate 4.14

The original woodland vegetation of much of the savanna belt has given way to farmed parkland consisting of full-grown, self-sewn trees scattered about cultivated fields or fallow-land. The trees are preserved for their economic value and for shade. This picture shows farmed parkland vegetation within the Southern Guinea Savanna belt in southern Plateau State.

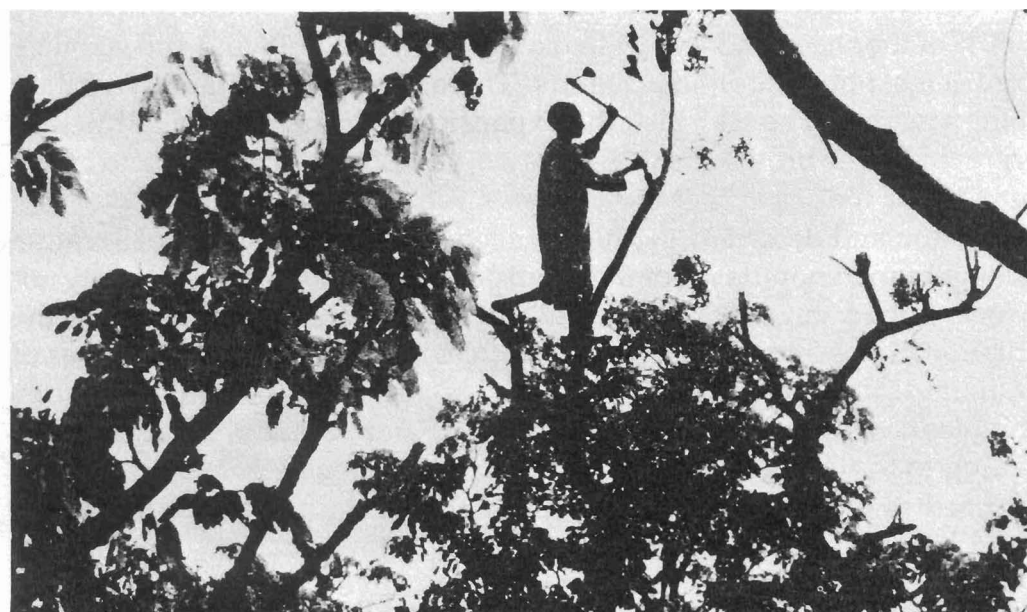


Plate 4.15

In the dry season, the supply of grass is reduced both in quantity and quality. The herdsmen lop down the foliage of trees, such as *Detarium* sp and Acacias, to provide supplementary feed for their animals. The tree leaves supply the animals with energy as well as nutrients.



Plate 4.16

A farmer returns home with a headload of split wood. Firewood is the most important source of energy in rural Nigeria.

Nigeria's Threatened Environment

increase soil acidity and the deficiency of potassium and some trace elements. Large amounts of nutrients are lost from the farmlands where soil organic matter has been depleted and the surface is uncovered. The harvesting of crop residues as building materials and for fuelwood further deprives the soil of sources of nutrient replenishment. With increasing loss of soil fertility, the abandoned farmland supports very little or no vegetation and is thus exposed to water and wind erosion.

In many savanna areas, traditional patterns of pastoralism have broken down in recent decades. As was indicated earlier in our discussion of Pastoralism, there are about 10 - 12 million cattle in Nigeria, 20 - 24 million goats, and 8 million sheep, not to mention other types of livestock (camels, horses, donkeys, etc.), with over 90% of the cattle and 60% of the sheep and goats being managed by traditional nomadic or transhumance systems in the savanna. The resulting pressure from overgrazing, over-browsing, and lopping of vegetation for fodder is a major contributor to deforestation and desertification. Pressure of increasing human populations and changing socioeconomic circumstances aggravate the situation. In some savanna areas, improvement in water supply through the sinking of boreholes has resulted in localized overstocking leading to the degradation of the sites. There is need to control the number, spatial spread, and kinds of animals and seasonal pattern of grazing, if the savanna

rangelands are to be saved. Also, nomadic herdsman frequently burn the bush to encourage early flush of grass. At the peak of the dry season such fires are so intense that they not only consume the grass vegetation and the litter, thereby exposing the soil to erosion, but they also destroy the trees of the woodlands.

Deforestation also results from overcutting of the woody vegetation for rough timber but especially for fuelwood. Deforestation is particularly intense along newly constructed roads which open up access for town dwellers for large-scale commercial cutting of firewood. Decreased density of woody plants, especially trees, increases wind speeds at ground level thereby facilitating wind erosion and invasion of sand dunes. Over 1,700 km of shelterbelts have been established at great cost, in the most northerly States to control the effects of wind and stabilize farmlands. Threats to savanna stability include also the expansion of irrigated agriculture, industrialization, urbanization, mining, and building.

There is need for coordinated use of savanna for these purposes to safeguard the integrity not only of the physical environment but also of the genetic resources of savanna. Wild relatives of fodder species (e.g. *Andropogon gayanus*, *Eragrostis tremula*, and *Schizachyrium exile*), edible fruit trees (*Vitex doniana*, *Adansonia digitata*, *Vitellaria paradoxa*) and numerous other useful plants are found in the savanna. Genetic improvement, for nutritive value, yield, resistance

Plate 4.17

A firewood market in one of the cities in the North. Firewood dealers truck in the commodity or bring it in on donkeys. It is sold to retailers who arrange for it to be split and tied up into bundles which are considered to be within the purchasing power of the urban poor. Dealers are having to go farther, and farther away to obtain supplies. In recent years the standard bundles have decreased in size while their prices have gone up. A rural energy policy incorporating alternative sources, the growing of trees for firewood and the development of simple energy-saving technology will go a long way to preserve what remains of our forests and woodlands.





Plate 4.18
Firewood depot near a village. Note the relatively small size of the trees which have been cut. In many areas the woodland vegetation is not allowed to regenerate. As soon as the coppice regrowth reaches a certain size, it is cut down for firewood.



Plate 4.19
In the past, firewood was freely available within a short distance of village settlements all over the country. The fact that it has increasingly become a commodity which is bought and sold in a village like the one in this picture is an ominous indication of increasing scarcity. Note the way the natural vegetation supplies, most of the building and fencing materials used in the village as well as the wood for the mortars and the pestle. The conservation of natural vegetation is of the utmost importance to a community such as this.



Plate 4.20
Commercial firewood collection to feed the cities, rather than village gathering is responsible for most of the deforestation from this enterprise in the savanna. Picture shows firewood collected, awaiting dispatch to town markets, along a new road in the Maiduguri area of Borno state. Sometimes the proprietors of the trade are town people for whom the villagers only serve as collectors. Newly made roads in particular attract settlements for such firewood gathering. Note the advancing front of the vegetation clearing for firewood to the right of main picture and in the inset.

to drought, pests, and diseases and the development of new technology, is usually based on the natural genetic variation of wild plants.

WETLANDS

The Ramsar Convention on Wetlands of International Importance defines wetlands as :

areas of marsh, fen, peatland, or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish, or salt, including areas of marine water the depth of which at low tide does not exceed six metres.

Usually the vegetative components of wetlands are specially endowed with structural and functional attributes which enable them to thrive in more or less continuously waterlogged, sometimes saline or acidic, soil conditions. Wetlands include marshes, swamps, floodplains, mudflats, estuaries and the littoral areas of large bodies of water.

Nigeria's wetlands fall into two main categories, namely, the saline coastal mangrove swamps and the freshwater floodplains. As shown in Table 4.5, the mangrove swamps, which have been more intensively studied, cover over 9,000 km² in the six coastal States: of Lagos, Ondo, Bendel, Rivers, Akwa Ibom, and Cross River States. The non-saline wetlands, which are scattered throughout the country, are less precisely demarcated. Nonetheless, some of the important ones include the Hadejia-Nguru (Baturiya), Lake Chad, Komadugu Yobe, Kainji Lake, Adiani-Nguru, Margadu/Kabak, Kirikasama-Nguru, Sokoto-Rima, Ogun, Oshun, Katsina Ala, Gongola, Imo, and Cross River floodplains. The floodplains of the Niger and Benue troughs and their tributaries are included in this category, as also the highly dispersed waterlogged interdune depressions of the north-east and the valley bottoms locally known as *fadamas* in the savanna region. The *fadamas* are sometimes not associated with rivers, but occur on impermeable clay pans. Some of them flood during the rains, supporting some vegetation, while others are semi-permanent and deep, with stunted vegetation. The areal extent of our wetlands is about 3 million ha.



Table 4.5 Distribution and Extent of Nigerian Wetlands

Coastal Saline Wetlands (Mangrove swamps)		Freshwater wetlands (Flood plains)	
Name	Extent (ha)	Name	Extent (ha)
Niger delta	617,000	Niger delta; Niger River	1,177,000
Cross River estuary }	95,000	Benue River	242,000
Imo River and Qua Iboe River } estuaries	36,000	Cross River	250,000
Others	110,000	Imo River	26,000
		Lake Chad	55,000
		Ogun/Oshun Rivers	380,000
Total	858,000		2,130,000

Source: Various.

The coastal wetlands are the most extensive. There are large lagoonal systems with mangrove swamps, raffia palm-*Pandanus* swamps, and reed swamps west of the Niger. The Lagos and Lekki lagoons are the most important examples of these systems. East of the Niger, the Niger delta itself and the estuaries of the Imo, Qua Iboe, and Cross River have large areas of mangrove forest and seasonally as well as permanently inundated freshwater swamps.

Wetlands sometimes support high forest vegetation. The coastal rain forests found mainly on the coastal sandy ridges along the Atlantic seaboard are such vegetation. They vary in width from less than one kilometre around Akassa to well over 10 km at the widest point south of the Ramos river.

Uses of wetlands

Nigeria's wetlands offer multiple benefits, many of which are little appreciated. These potentials have also remained largely unexploited. The coastal wetlands, for example, help to reduce coastal erosion and stabilize estuarine floodplains, while the detritus and the nutrients from these wetlands form the food base of many marine and freshwater organisms of economic importance. Estuarine wetlands form important spawning grounds for fish, while the in-

land floodplains are very important for both indigenous wildlife and Palearctic and Afro-tropical wildfowl. The Hadejia River system, a tributary of Lake Chad, is of international significance for fisheries, grazing, wildlife, and water resources. The wood resources of the mangrove and deltaic swamps, estimated at over 280 million m³, are yet to be developed.

In the Savanna zone, the *fadamas* support dry season gardens, bananas, sugarcane, and early maize; and paddy rice is grown during the rainy season.

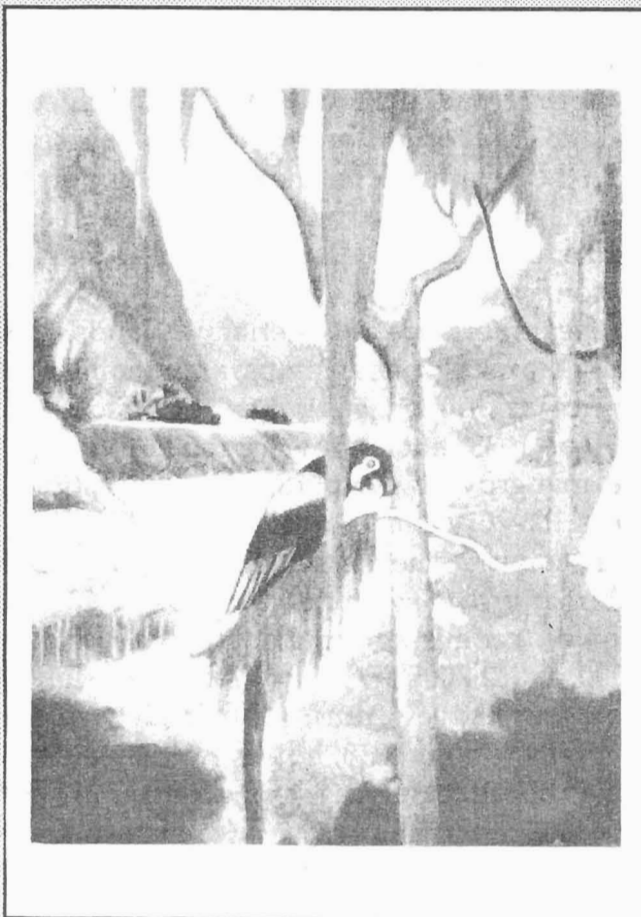
The importance of Nigerian wetlands, especially the mangrove swamps, as potential areas for rice production was long recognized. As far back as 1933, attempts were made to develop the mangrove swamp for rice cultivation in areas like Calabar, Oron, Warri, Mbiakpapa, and Oloibiri⁹. The trials on the Warri and Calabar mangrove swamps carried out in 1934 showed promising results. Yields averaged 2,000 and 2,700 kg/ha in Warri and Calabar areas, respectively, during the first few years of cropping. From 1938, however, the yields obtained began to decrease and, after about a decade, the Warri mangrove swamps appeared incapable of supporting further rice cropping¹⁰. In the coastal rain forest area, well-drained non-saline soils have been found suitable for cultiva-

Box 4.2 Where Are Nigeria's Wetlands of Major Importance?

Wetland areas of Nigeria include some of the most productive of the country's environments. They are:

(a) **The Baturiya (Hadejia-Nguru) Wetlands Game Reserve:** The Baturiya Wetlands Game Reserve, situated in the Hadejia River Valley in Kano State, is 297 sq kilometres. It contains the best-preserved piece of Sahelian woodland and is certainly one of the few remaining examples of this habitat in the Sahel. The area has been recommended as a candidate for The World Heritage List. At present, Baturiya is suffering from uncontrolled grazing by Fulani cattle and lopping of tree branches by the herdsmen. Furthermore, there has been no river flood in the area for two years due partly to reduced rainfall and the effect of drought which has been aggravated by off-take of water upstream. Consequently, the Hadejia River has not been high enough to flood the Keffin Hausa, the branch of the river which runs through the reserve. In addition, sediment has been deposited by the Hadejia at the entrance to the Keffin Hausa, thus hindering the renewing of water supply to the reserve.

(b) **The Margadu/Kabak Floodplain:** This area, approximately 100 square kilometres of marsh and ox-bow lakes, is intensively used by the local population for fishing, grazing and farming and supports a signifi-



cant number of both migratory Palearctic and Afro-tropical water birds during the wet and early stages of the dry season. The importance of the wetlands in this area for both wildlife and human population makes their conservation a clear priority.

(c) **Kirikasama/Nguru Wetlands:** This area of floodplain, about 75 square kilometres, is dominated by a large ox-bow lake which, being the largest area of water in the region, is of major importance throughout the dry season. *The permanent nature of the lake gives it considerable importance as a dry season refuge for fish which can then repopulate and breed in the wet season inundation zone.*

However, there is at present no control over fishing in any part of the river system, with the result that most fish stocks are very heavily exploited throughout the dry season.

(d) **Lake Chad Marshes and Sambisa Game Reserve:** In January 1985, the water edge in the Nigerian section of the lake was 40 km nearer the centre than in April 1984. The situation has deteriorated further and there is now virtually no water left. *The causes are two-fold: the poor rainfall and the construction of dams on the inflow to the lake.* Most of the inflow to Lake Chad comes from the Lagone and Chari Rivers in Cameroun. Both now have major dams which are being used for large-scale irrigation projects. If Lake Chad is ever to return to the Chad basin, the inflow in the Lagone, Chari, and Hadejia Rivers needs to be reviewed and corrective measures taken. *Whether this is possible will depend upon the extent to which the nations controlling the catchment area of the Lake (Cameroun, Nigeria, and Chad) can be convinced of the need to view and manage the waters of the Chad basin as an international resource, and of the long-term benefits of doing so.*

(e) **The Niger Delta Area:** This vast oil-producing region of Nigeria, embracing at least three States - Bendel, Rivers and Imo - and extending westward to Ondo and eastward to (Akwa Ibom and) Cross River, is by far the largest and most important wetlands area in the entire country. Oil activities, represented by oil spillage and pollution, are already spreading beyond the confines of the Delta Area into the Niger and up north. As a result of oil spillage, vast tracts of agricultural land have been laid waste, thus becoming unproductive. Surface water is invariably contaminated and polluted, rendering the water undrinkable; and aquatic life is destroyed. The inhabitants of the area have become impoverished and deprived and are compelled to emigrate elsewhere.

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tion of plantains, bananas, oil palm, coconuts, cassava, and maize.

In 1981, about 510,000 tonnes of fish was produced by artisanal fishermen in coastal and brackish water lagoons and rivers, using the traditional and outmoded canoe fishing methods, characterized by low output. The current fisheries development programme of the Federal government includes the modernization of the traditional methods, from the craft to the gear, and the provision of better methods of fish handling and preservation. In 1963, experiment was initiated into brackish water fish culture in Nigeria as a joint FAO/Federal Department of Fisheries Pilot Project and, by 1972, some success had been recorded on the culture of some fishes like the catfish, mullets, tilapia, and carpon. Recently attempts were made to use the mangrove *chikoko* soils to construct ponds for fish farming. The Shell Petroleum Develop-

capped by problems arising from drainage of the soil. Drainage is both difficult and expensive. It also tends to increase the acidity of the soil, with adverse effects on plant growth. The mangrove areas, usually characterized by soils with large quantities of iron sulphides, are stable as long as they remain submerged. They quickly become acidic on exposure to air because of oxidation of the sulphides. The resulting strongly acidic soil releases aluminium and other chemicals, which are toxic to plants and animals. This creates another set of ecological conditions and new management problems of choice of species and varieties and search for appropriate cultural techniques.

Research to develop appropriate soil management techniques to handle the above problem is necessary if we are to realize the enormous potentials of deltaic wetland for rice production. Similarly, fisheries development in

Box 4.3 Why Wetlands Are Important

The richness of wetlands is reflected in the fact that virtually all early civilizations (Egyptian, Tigris-Euphrates, Indus, Indochinese) were founded on their high productivity. Even today, many rural communities are dependent upon wetlands where they exploit their diverse communities including pasture and agricultural resources. Wetlands are key habitat areas for biological, hydrological, and economic reasons. However, the public value of wetlands goes beyond purely exploitable resources. The ecological services provided by many of them, particularly flood control and removal of excess nutrients, can, for any one wetland, add up to many millions of naira.

One of the most important benefits, yet difficult to quantify, is the recreational value. Millions of people in industrial societies all over the world use wetlands

each year for bird-watching, swimming, fishing, sailing, canoeing, wild fowling or simply to walk beside and admire their beauty.

Wetlands conservation is a prerequisite for the conservation of waterfowl, fish, and amphibians (many of them migratory species) and for many species of mammals and reptiles, as well as a wide variety of plants (many with important applications to human needs).

Economic benefits from fisheries, agriculture, water storage and flood control, tourism, and recreation are all directly related to wetland conservation. Their conservation is therefore of particular urgency.

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ment Company constructed one such farm on a pilot scale at Ode-Itsekiri. The Nigerian Institute of Oceanography and Marine Research is actively working on fisheries development in the coastal wetlands.

Future Prospects

Future development of Nigeria's wetlands to realize fully their potentials is constrained by several factors. Cultivation of rice and other arable crops in the deltaic swamps is handi-

Nigeria's wetlands could be limited by activities which pollute the water. The greatest threat in this regard is oil pollution accompanying oil exploitation. Oil spills on water have been found to cause the death of mangrove seedlings and trees, reduce productivity of phytoplankton and other aquatic flora, and disrupt detritus-based food webs of fish, all of which result in reduced fish yields.

Effluent disposal or sewage dumping destabilizes wetland ecosystems through the intro-

Nigeria's Threatened Environment

duction of excessive nutrient elements, which may lead to eutrophication. Fertilizers and pesticides from farmlands, which end up in wetlands through runoff also constitute sources of nutrient loading and pollution. Such enrichment can only encourage the explosive growth of such weeds as the water hyacinth (*Eichhornia crassipes*) which is currently a menace in the

coastal wetlands. In the same vein, the cultivation of the watersheds of these wetlands can lead to soil erosion which may result in siltation and ecological changes.

These features indicate that the wetland ecosystems are even more delicately balanced than other ecosystems in the country and that if they are to be exploited on a sustained basis, environ-

Plate 4.21
A fisherman battles water hyacinth for fishing space on Lekki Lagoon.

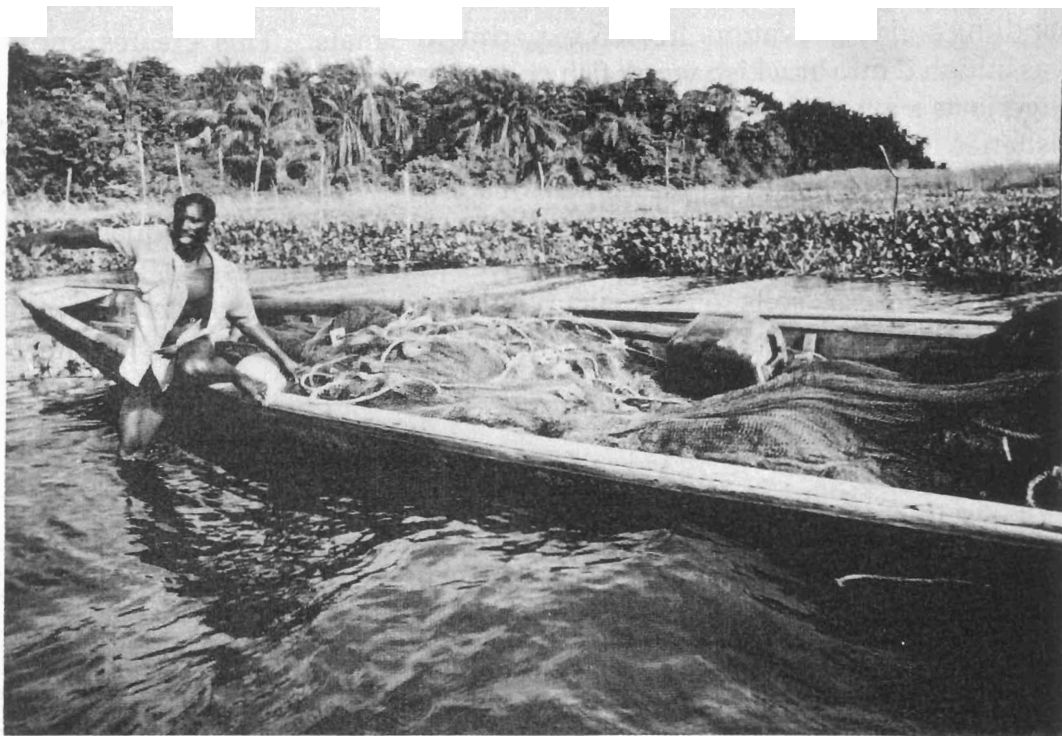
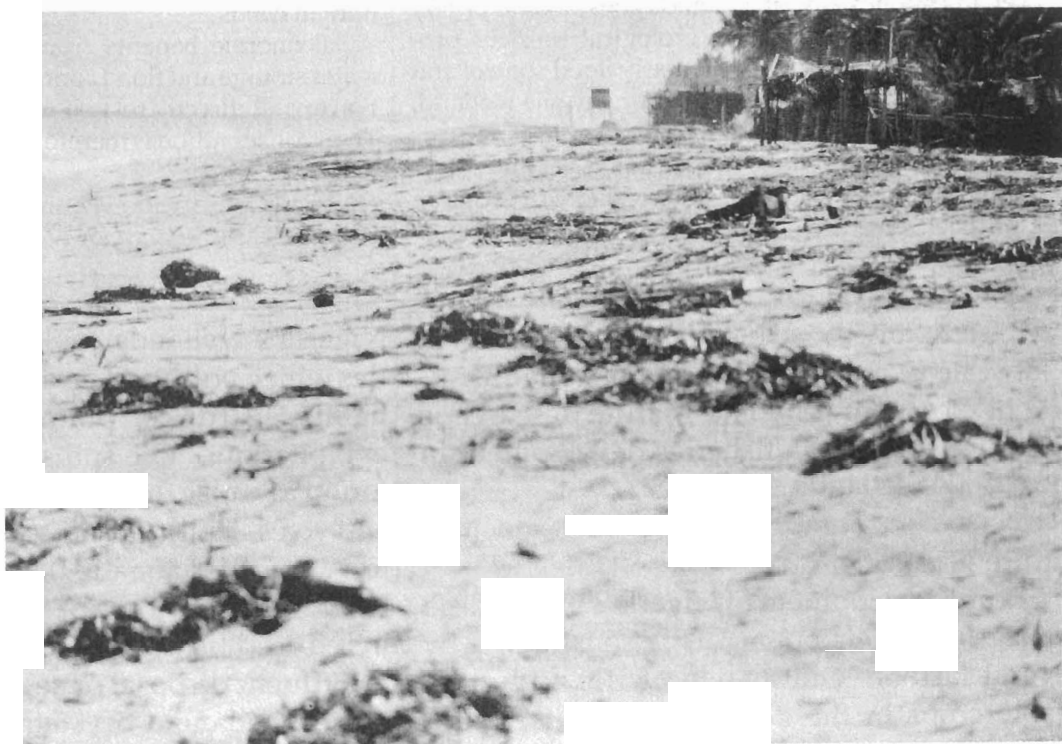


Plate 4.22
A water hyacinth-polluted beach on Lekki Peninsula, southeast of Lagos. The Atlantic Ocean now washes dead weeds swept into it from heavily-polluted fresh water creeks in south-western Nigeria onto high-value Lagos beaches.



Box 4.4 Water Hyacinth (*Eichhornia crassipes*): The Nigerian Experience

Water hyacinth entered Nigeria, it is believed, through Porto Novo creeks which flow into the Badagry creek en route to Lagos Lagoon. These lagoons and creeks stretch over 150 km and account for about 70 percent of the fish caught yearly in the coastal lagoons of southwestern Nigeria. As reported in *The Guardian* in January 1985, water hyacinth was first noticed in October 1984 by fishermen, and by January 1985 mats of the weed made fishing by cast net impossible. Scientists of the University of Lagos immediately started studying the unusual weed in the lagoon and creeks of Lagos. A report in *The Guardian* of January 13, 1985, identified the weed as water hyacinth but further observed that the weed is entangled and carried the common freshwater grass, *Vossia cuspidata*. About the same time, scientists of the Department of Wildlife and Fisheries Management, University of Ibadan, working on the nutritional potential of some locally-available aquatic weeds in fish feeding, encountered and took samples of water hyacinth from Lagos Lagoon along with other weeds and found that the weeds could supply up to 10.50% crude protein.

On further investigation into the mode of movement of water hyacinth, one of the scientists predicted that the weeds might soon extend to Epe, Lekki, and Mahin lagoons. So, the menace of water hyacinth became a national concern, with fears for its effects on navigation and fishing activities.

A committee to tackle the problem of the weed was set up after the scientists had made ad hoc suggestions for combating the weed. They had asked the Federal Government of Nigeria

- (a) to erect a physical barrier made of bamboo poles across the Badagry creek, close to the Nigeria/Benin Republic border, to hold the weed and let water pass;
- (b) to take steps to eradicate the weed in the Badagry creek and adjacent lagoons, i.e. Yewa and Ologe lagoons through mechanical systems;
- (c) to ensure that no channelization is undertaken without due attention being paid to the possibility of creating similar weed problems; and
- (d) to use part of the fund set aside to combat ecological disasters for further studies on this disaster and related problems.

Consequently, studies were initiated on various aspects of this weed of national concern. The multidisciplinary approach led to a mixture of successes and failures in combating water hyacinth. An international symposium on the theme: *Water Hyacinth: Menace and Resource* was held at the Eko Hotel, Lagos, from 7 to 12 August, 1988. This symposium was jointly sponsored by the Federal Ministry of Science and Technology, Lagos, Nigeria, the Economic Community of West African States (ECOWAS), and the Committee on Science

and Technology in Developing Countries (COSTED).

In recognition of the diverse interests that can provide the required solution to the menace of water hyacinth, the symposium brought together scientists, administrators, industrialists and representatives of the Nigerian Navy and Air Force. Also present were representatives from ECOWAS countries, Commonwealth Science Council, CAO International Institute of Biological Control, Australia, United Kingdom, and Holland. The main objective was to draw up a long-term programme for the national and sub-regional management of water hyacinth.

Progress so far made in tackling the problem in Nigeria and other ECOWAS countries was reviewed. It was noted that the surge of the weed from the Benin Republic into Nigeria would be an annual occurrence, between September and March. Water hyacinth had covered well over 60 square kilometres of water surface and a distance of more than 300 km along the southwestern coast of Nigeria, through Lagos, Ogun, Ondo, and Bendel States. There are fears that the weed is **spreading fast into new areas and might soon reach the Escravos (Niger Delta) and thence into agricultural irrigation systems in the country.**

Mechanical, chemical, and biological control methods are being considered. The mechanical method has received the greatest attention and several types of harvesters have been developed, but a lasting solution through this method is not in sight since escaped propagules readily regenerate to cause re-infestation. Chemical and biological approaches, which require a lot of capital and expertise, are environmentally hazardous.

While work is in progress to overcome these constraints, thought has also been given to utilizing water hyacinth as a resource. For example, the Federal Institute for Industrial Research, Oshodi (FIIRO), has reported the development of paper, cardboard, panel and ceiling boards from water hyacinth. Scientists from Obafemi Awolowo University, Ile-Ife, have reported the manufacture of briquettes for domestic and rural agro-industrial use as fuel. There are reports of medicinal uses of the weed, while scientists at the University of Ibadan have reported the compounding of livestock and fish feeds from the weed. In general, water hyacinth is known to have been used in the production of biogas, distilled water, fertilizer, engine gaskets, amino-acids, and detergents; and as a natural means of preserving fish stock in water.

Clearly, there is need to disabuse the minds of Nigerians of the idea that the water hyacinth, otherwise known as the Blue Devil, the Bengal Terror in India, the Florida Devil in South Africa, and the German Weed in Bangladesh, is as useless and menacing a weed as has been feared. Its potentials for beneficial use are gradually being realized.

Box 4.5 *New Opportunities From An Environmental Nuisance*

An illustration of how wetlands can work for us or how new approaches can turn wetlands problems into new opportunities, even new industries, is exemplified by the fact that instead of treating water hyacinth, which has lately bothered us in this country particularly in our creeks and lagoons in Badagry and at the Bar Beach, as an environmental nuisance, innovative scientists have found that:

(a) The water hyacinth effectively filters waste water and is used to eliminate tannery effluents in Madras, India, and to clean waste water from sugar refineries and rubber processing plants in Malaysia. The plants are even cleaning up after Mickey Mouse. Disney World in Florida uses five football field-sized canals filled with water hyacinths to clean and

recycle water.

- (b) A water hyacinth fertilizer used in the Sudan has increased production of groundnuts by 31 percent.
- (c) The plant is used to produce gas, animal and poultry feed. In the United States, methane from a 100 hectare water hyacinth farm will provide enough energy to power over 15,000 houses. In India, experiments are underway to produce hyacinth-pulp cement boards which could prove a major contribution to roofing materials, following the world-wide condemnation of asbestos as a health hazard.

Nigerian Conservation Foundation Press Release, September 17, 1985.

Box 4.6 *Threats to Nigeria's Wetland*

Chief threats to wetland species diversity include over-fishing, pollution, drainage, reclamation, increasing variability of flow, siltation due to watershed deforestation, diversion for irrigation, and damming for flood control and electricity generation.

Wetlands drainage is probably the most important and certainly the most evident of the many threats in the industrial world.

Rivers and wetlands have traditionally been used as disposal sites for industrial and domestic waste. But, increasingly, water draining from agricultural land into lakes and rivers now carries with it pesticides and fertilizers which lead to eutrophication, the process by which nutrient levels are greatly increased and which results in excessive algal growth. This leads to depletion of the oxygen content of water and mortality of aquatic life. With increased use of fertilizers, the problem of eutrophication, seen in Europe, will, in a warm tropical climate, be severely aggravated. Furthermore, pesticides, such as DDT, now banned in most industrialized nations, are widely used in developing countries like Nigeria with devastating effects

on fish populations, a major source of protein in these countries.

The construction of dams and irrigation systems in a bid to increase food output all too frequently destroys wetlands, and so the productivity upon which the expectations of these developments are based. As dams are built to provide irrigation water, the consequence upon the natural resources further downstream and the people dependent upon these can be catastrophic. Following the construction of the Aswan High Dam on the Nile, for example, the silt load carried by the river is now deposited in the lake itself and no longer provides an annual fertilization of delta lands. Agriculture in the delta now requires the increased use of fertilizers.

Since the benefits we obtain from wetlands habitats are many and varied, it is imperative that a major effort be made to ensure the continued existence of a sufficient number and diversity of wetlands throughout the country in order that we may continue to obtain these benefits.

Adapted from Nigerian Conservation Foundation Press Release, September 17, 1985.

mentally compatible management techniques should be developed and adopted.

DEFORESTATION

Deforestation is the removal of forest and other forms of vegetative cover from a site without its replacement. Although this phenomenon has occurred since the dawn of civilization, reports from various parts of the world indicate

that it is now on the increase due to increased socioeconomic activities. Very often, also, these reports show that the alteration of the landscape following deforestation has led to economic and environmental disasters.

Major causes of deforestation

In the final analysis the main causes of deforestation in Nigeria are population growth and



Plate 4.23

Mechanical logging with heavy equipment is practised by large-scale logging companies. Greater damage to the remaining vegetation and land is done by this method of logging, than is done by small scale operators who fell and saw logs on the site, without skidding. Large-scale operators open up the forest for small-scale loggers, shifting cultivators and ultimately deforestation. Small-scale loggers on the other hand waste wood by inefficient conversion by chain-saws. Provision of mobile sawing equipment to small-scale operators may make this method of logging preferable, from the point of view of sustainable logging of the forest.

the expansion of economic activities, including

- Logging or timber exploitation;
- Farming;
- Urbanization;
- Bush burning;
- Firewood collection;
- Grazing; and
- Infrastructural development.

During the oil-boom years of the 1970s, there was a massive increase in construction activity

back-to-land policy of the government to increase food production further aggravates the deforestation problem. These factors have created increases in the number of farmers requiring farmlands, with corresponding pressure on forest lands and the clamour for dereservation of forest reserves.

The last twenty years have witnessed the creation of new settlements and the large-scale expansion of existing ones, often taking over forests or some other form of natural vegetation.

Plate 4.24

Forest clearance for urban settlement along the Lagos-Ibadan expressway. Creation of new settlements or expansion of existing ones has, particularly over the last two decades, taken over much natural vegetation. Planned land use is needed to regulate conversion of natural vegetation to other uses.



which heightened the demand for both construction and furniture timber. Much of the timber came from the country's high forest estate in Ondo, Bendel, and Cross River States, but a substantial amount also came from outside forest reserves. There was a breakdown in the regulation of logging activities in both of these areas. And, as a result, the country's standing crop of valuable species (e.g. iroko and the mahoganies) of merchantable size has been severely depleted.

Outside constituted forest reserves, the main deforesting agent is the farmer who recklessly clears the forest for food. Over 75 percent of the total forest area cleared yearly is by these farmers. In the last few years, multinational companies and large-scale, mechanized farming enterprises have also joined the forest clearing bandwagon in the drive to derive raw materials locally and increase food production. The current

In Ajoda New Town in Ibadan; in Agbara, Ogun State; and, on a very much larger scale, in Abuja, the new Federal Capital Territory, forests and woodlands have been and are being destroyed to make way for new cities and industrial and housing estates. The phenomenal growth of Lagos along Badagry or Ikorodu roads amply illustrates the consequences of urban population growth. Nearly all the farmlands between Lagos and Ikorodu have been engulfed. Similar situations are found around Ibadan and Kano.

The construction of infrastructural facilities, such as roads, airports, educational establishments, and gas pipelines has consumed large areas of forest.

Bush burning is another notorious agent of deforestation in Nigeria. The burning results mainly from farmers who use it for land clearing, herdsmen who use it to regenerate grass, hunters to kill wildlife, and some villagers to

clear their surroundings. Under control, fire serves the above useful purposes. But more often than not, the fires get out of control to consume adjacent non-target vegetation. Ultimately, destructive bush burning derives from careless disregard for the value of vegetation, perhaps because of lack of awareness or the attitude that vegetation is "bush" and a symbol of lack of "development".

Overexploitation for firewood as well as overgrazing is a major cause of deforestation in the savanna. Clear-felling of trees for commercial firewood without any thought being given to regeneration is a common practice, even on land, such as the rocky slopes of the Naraguta Hills in Jos, which should have been allowed to remain wooded. On the Jos Plateau itself tree roots appear to have been "mined out" for fuel so that the possibility of self-regeneration is slim, even if the people could afford to set aside land for this purpose. Elsewhere, the problem with firewood exploitation is that of species attrition, i.e. the cutting of those tree species which are preferred as fuel, leaving behind a less balanced ecosystem.

Overgrazing is a serious problem in the Sudan-Sahel belt where overstocking around watering points often results in serious damage to the vegetation. In the high density livestock areas of the savanna, excessive lopping for browse has reduced many trees to mere skeletons.

Extent and implications of deforestation

Although the extent of deforestation in Nigeria is difficult to estimate owing to lack of any country-wide resource survey, available records indicate that the area involved is enormous.

Skoup & Co.¹¹ reported that in the previous 30 years, the country had been losing on the average, about 23,000 ha of the gazetted forest estate per annum through government dereservation alone. For example, a total of 21,500 ha was dereserved in Bauchi State between 1979 and 1986. In Bendel state, 3,350 ha were dereserved in Okomu, Obaretim and Ologbo

forest reserves for agriculture, 410 ha of Ogba forest reserves for government projects and airport expansion and another 14,650 ha in Orle, Ohosu, Emu-Ologholo, Ehor, and Urhonigbe forest reserves for agricultural development. In Borno State about 2,000 ha of Jaro forest reserve was sold by villagers and 200 ha of Pompai forest reserve was utilized for town expansion, while another 4,725 ha of forest reserves in various parts of the State have been converted to farmlands. The Army School of Artillery, the Nigerian Defence Academy, and the Police Mobile Training School have together claimed about 7,420 ha of forest reserves in Kaduna State. The Tiga Dam and the resettlement of the displaced people took about 7,000 ha of the Rurum Forest Reserve. Another 12,260 ha were dereserved for urban and town expansion, other dam construction, and cattle ranch projects in Kano State.

In Kwara State, about 18,390 ha of Ajaokuta Forest Reserve was taken over by the Steel Development Company, while the Ilorin airport took another 1,140 ha and urban and town expansion and school construction claimed an additional 826 ha in recent times. Similarly, the resettlement of people from the Abuja Federal Capital Territory has claimed at least 27,330 ha of forest reserves in Niger State. Added to all these are the toll taken by the NEPA national grid and the NNPC pipelines and other infrastructure throughout the country.

To be sure, the present Federal Administration has issued directives against such dereservation. However, a wide gap still remains between directives and their enforcement on the ground.

In addition to the effects of these government dereservations, indiscriminate bush burning clears large areas of forest land, leaving behind it colossal socioeconomic losses to the nation. For example, in the 1982/83 dry season, over 1,700 ha of forest plantations, including those of two Agricultural Development Projects, were burnt. Between 1980 and 1982, over 900 ha of *Gmelina* pulpwood plantation in Oluwa Forest Reserve, Ondo State, and 490 ha of pine pulpwood plantation in Anambra State, both established with loans from the World Bank, were lost to fire. Replanting of the destroyed areas increases the overall cost of pulpwood production, which becomes reflected in the prices of the final paper products derived from these plantations. Losses of agricultural crops in Bendel State alone were about N19 million, based on existing compensation rates in the State. In 1982/83 also, 3,575 ha of forest plantation were burnt in Niger and Plateau states and the loss incurred was estimated at over N3.6 million. On a nation-wide scale, available figures indicate that well over 350,000 ha of forests and savanna woodlands are deforested each year through clearance for farming, uncontrolled fires, or conversion to other forms of land use. The cumulative effect of all these is that Nigeria, which in 1897 had 60 million ha of forests and woodlands, now has only roughly 9.6 million ha of forest reserves, much of which is degraded, and only 2.4 million ha are in the forest zone - a loss of over 50 million ha in less than 100 years.¹² Between 1981 and 1985 closed forest was being converted at the rate of 5 percent per year in Nigeria.¹³

The socioeconomic implications of these deforestation processes are quite disturbing. Acute shortage of both industrial timber and fuelwood are already with us while deforestation is also robbing us of numerous shrubs and herbs of food and medicinal value, as well as valuable plant genetic resources.

The loss in biodiversity and genetic resources can be imagined from the list of 484 species in 112 families compiled by Gbile *et al.*¹⁴ as species threatened with extinction, the so called endangered plant species. Shortages of fuelwood, for instance, are already critical in the six Sudano-Sahelian States of Sokoto, Kano, Kaduna,

Katsina, Bauchi, and Borno where nearly 75 percent of the total cooking fuel is derived from plants. In this region, people have resorted to burning cow dung and farm residues, which should normally be recycled to the soil as badly-needed manure. Scarcity of fuelwood is also leading to the modification of cultural practices. The requirement in Hausaland for newly-delivered women to take hot baths infused with medicinal plants for forty days after delivery is gradually being abandoned for scarcity of fuelwood.

Deforestation is synonymous with the destruction of wildlife habitats and has drastically reduced animal populations, their productivity, and species diversity, while rare species are being threatened with extinction.

Deforestation automatically means the loss of the protection which the plant cover gives to the soil, as outlined at the beginning. This is what is largely responsible for accelerated erosion and the development of extensive gullies in various parts of the country, with the southeast - notably Agulu-Nanka in Anambra State and Ihtenansa in Imo State - being the most hard-hit area.

Accelerated runoff resulting from deforestation also gives rise to flash floods, very often with disastrous consequences to life and property. The Ogunpa flood disaster at Ibadan in 1980, which claimed no less than 200 lives, displaced over 50,000 people and destroyed a great deal of property. Oguntala and Oguntoyinbo¹⁵ attributed this disaster largely to the clearance of forests along the banks of rivers and streams as well as major catchment areas of Ibadan city, all of which resulted in increased rate of overland flow of water into the Ogunpa channel.

In the savanna areas, the reduced infiltration rates associated with deforestation adversely affect groundwater recharge and storage. This, very often, turns some formerly perennial rivers into seasonal or ephemeral streams.

In the Sudan-Sahel belt, exposure of the soil through deforestation predisposes it to wind erosion during the long dry season. It has been established that sandy soils tend to move readily when wind speeds attain or exceed 17.6 km/h or 22 km/h at heights of 15 cm and 1.5 m above the ground, respectively. Winds of these speeds



Plate 4.25
Eroded savanna landscape. Land which is deprived of its vegetation cover through misuse is subject to severe erosion under the torrential rains which characterize our climate. Sheet erosion may develop with time into rill and gully erosion as in this picture. It is both difficult and costly to restore eroded land. It is therefore better to prevent erosion by ensuring that the land is adequately covered by vegetation than to try to stop it once it has started.



Plate 4.26
Pulpwood harvesting in Cross River State. Conversion of natural forest to pulpwood plantations is now a major cause of deforestation in that forest-rich part of the country.

account for 25 percent of the total wind frequency in Sokoto, and 12-13 percent of those in Kano and Borno States. At these speeds, soil particles of about 0.1 to 0.5 mm are easily carried by the wind and used to create blinding sand storms. The sand is later deposited to cover roads, railways, houses, and farmland in Sokoto, Katsina, Kano, and Borno States yearly.

Mention must also be made of the effects of deforestation in general and of bush burning in particular on the atmosphere as discussed under Atmosphere earlier in the book.

REFORESTATION

One of the best ways of countering deforestation is reforestation. Figures presented by Nwoboshi¹² show that between 1981 and 1985 - a period that has witnessed the highest rate of reforestation ever - a total of about 30,000 ha, or about 10 percent of the annual deforestation rate, was reforested. The large gap between removal and renewal is due to lack of adequate funding, lack of cooperation by land users, and lack of appreciation by the public of the value of forests and forest cover, as well as the narrow perception of forestry practice by foresters. The

Plates 4.27

A pure-stand plantation of *Gmelina arborea*, a quick growing exotic tree species. It supplies the Nigerian Newsprint Manufacturing Company (NNMC) at Oku Iboku with wood for short-fibre pulp.



Plate 4.28

A truck conveying logs from the *Gmelina* plantation to the NNMC plant at Oku Iboku. The plant requires no fewer than 2,700 tree logs daily for making short-fibre paper pulp.



level of funding for reforestation depends on the political will of the government. The Nigerian government has realized that over-exploited areas need to be purposefully and vigorously reforested and has shown some willingness to check wanton deforestation. With increasing awareness that our forests and associated vegetative cover play key roles in our agricultural productivity, sustenance of water resources, and general environmental quality, Federal and State governments should substantially step up their financial commitment to

reforestation.

It has been suggested that a reforestation fund of one naira per taxable adult throughout the country, to be ploughed back into some targeted reforestation project, will not only be helpful in providing a reforestation fund but also be beneficial in driving home to everybody the need to check unnecessary deforestation. It is further suggested that the Federal and State governments should enlist the cooperation of large-scale farmers and open-cast miners by including in their concession agreements the

need to rehabilitate and reforest, with woody species, their areas of operation before quitting them.

Private individuals or communities should also be encouraged to establish and own woodlots by creating necessary incentives, such as free or subsidized supply of seedlings, operational machinery, or tax rebates. Ideas of social forestry should be fully developed to assist in tackling both the magnitude and the diffuse nature of the reforestation needed to address adequately the damages of deforestation. In the Sudan-Sahel States of Sokoto, Katsina, Kano, Bauchi, and Borno, where shortages of fuelwood are already critical, energy requirements could be met through the establishment of energy plantations or woodlots by the communities and diversification of energy sources.

Furthermore, since forest ecosystems mean much more than wood to the local inhabitants, conversion of natural forests to single species plantations will, as the natural forest areas diminish, constitute some form of deforestation in terms of loss of useful forest components like edible fruits, nuts, vegetables and medicinal plants. The wildlife population and diversity are also reduced in plantations. To remedy this situation, we herein call for the re-designing of the species composition and structure of our plantations in order to incorporate all these other forest components, including plant and animal species being threatened with extinction.

There is hardly any agricultural research institute in the country which has developed or is developing any system of managing abandoned farmland for quick recovery, beyond mucuna planting. Until recently, the rehabilitation of eroded sites and sand dune fixation were in the same plight. However, in the past 10-15 years, studies have been initiated on the reforestation of degraded farmlands and eroded sites through the process of agri-silviculture whereby arable crop production is integrated with tree planting for fruit, vegetable, fodder, poles or yam stakes. The adoption of agri-silviculture as an agricultural land use policy will be immediately helpful in checking deforestation and its adverse consequences, especially in the eastern States of Anambra, Imo, Akwa Ibom, and Cross River States as well as in Bendel State. Agroforestry practices, especially planting trees on farms, could also help in reforesting and rehabilitating large tracts of degraded farmland in the savanna, while contributing to further protect the environment from desertification.

Reclamation and stabilization of degraded savanna is increasingly being pursued through reforestation. Drought-hardy and relatively fast-establishing trees are required for this purpose. In addition to exotic species now being used (e.g. Eucalypts) local and naturalized trees which could be used include *Balanites aegyptiaca*, *Piliostigma reticulatum*, *Salvadora persica*, *Acacia* spp., *Anacardium occidentale*, and *Tamarindus indica*. In the same way, fire-tolerant species



Plate 4.29

Severe soil erosion under teak (*Tectona granas*) planted for watershed management at Eleiyele, Ibadan. Effective watershed management depends on appropriate choice of trees for planting, and management practices that enhance ground cover by vegetation. At Eleiyele teak planted at close spacing suppressed ground cover development; teak sheds its leaves in the dry season which provides fuel for forest fires, the absence of any management practice to keep out fires means that the forest floor is swept clean by fire every dry seasons. The teak canopy is leafless by the time the early rains begin leading to severe soil erosion. Adjacent natural forest to the above site did not have such serious signs of erosion.

could be planted in fire-prone areas and as firebreaks around plantations of fire-susceptible trees. *Monotes kerstingii*, *Uapaca togoensis*, *Maranthes* (formerly *Parinari*) *curatellifolia*, and *Combretum nigricans* appear to be such fire-tolerant trees.

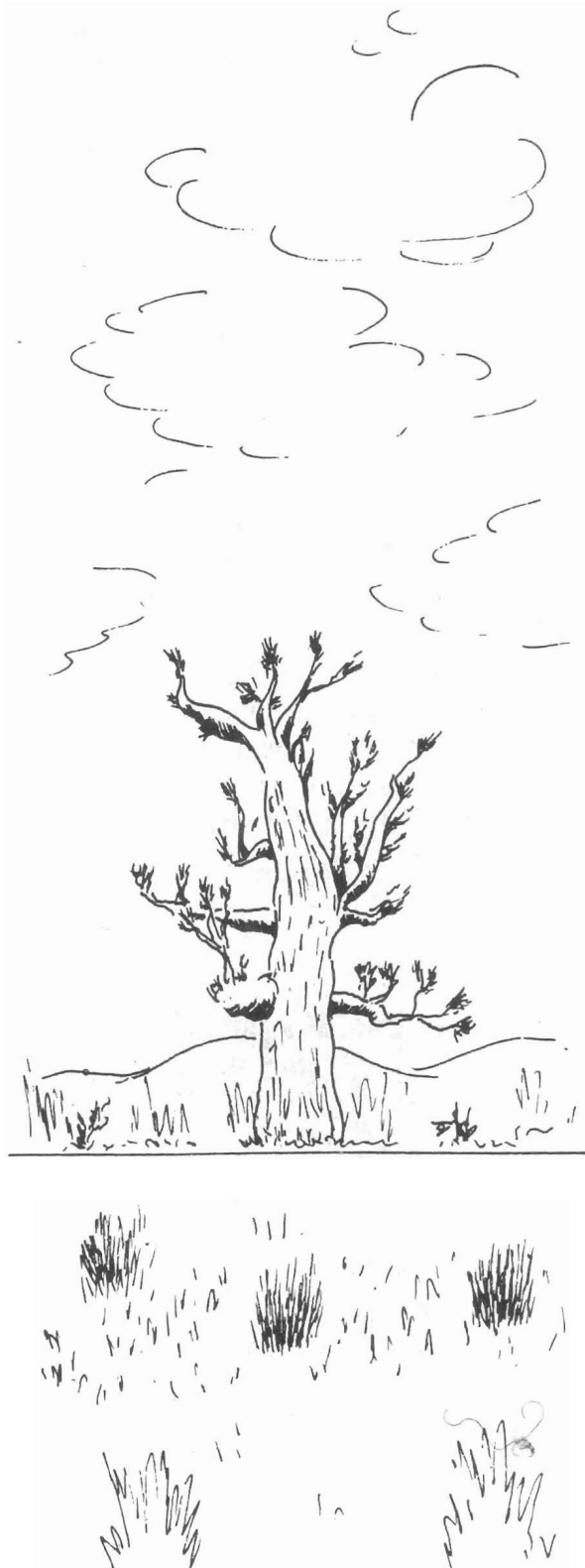
CONSERVATION

From the foregoing, it is quite clear that the vegetation cover of Nigeria, both within and outside forest reserves, on dry land and in wetlands, has increasingly been under threat in recent years. The average Nigerian appears to be either ignorant of the need to conserve this valuable asset or to lack the resources to do so.

Formal action to conserve Nigerian vegetation started at the turn of this century when the first forest reserve was created. By 1939, most of the existing forest reserves had been created. Today 9.6 million ha of land (a little more than 10 percent of the country's land area) exists under forest reserves. This includes the 1.7 percent or so of the country's land area protected specifically for wildlife conservation (game reserves, parks and inviolate plots)⁸. Along with the creation of reserves was the establishment of a system of administration and protection of the reserves. The first Forestry Ordinance was promulgated in 1901 and the foundations of the Forestry Department, whose officers were to be known as Conservators of Forests, were laid before the First World War began in 1914.

The 10 percent or so of land area now under forest reserves falls far short of the target of 25 percent originally proposed by policy. The first colonial foresters in Nigeria had come from India, and Indian experience had shown that a well-populated country, like Nigeria, needed to set aside "about 30 percent of its total land area to forestry if it were to be self-supporting in wood"¹⁶. Early protection actions were also motivated by the need to safeguard the species, *Funtumia elastica*, then the main source of natural rubber. The percentage of land reserved in Nigeria compares very poorly with those of some highly industrialized countries: for example, France 25 percent, West Germany 30 percent, United States of America 33 percent, Japan 67 percent. However, the current agricul-

tural policy for the country, published in 1988, does provide for increasing the area of "forest under conservation from 10 percent to 20 percent..."



Box 4.7 Is a Forest Reserve Such a Bad Thing After All?

The colonial administration, in an attempt to ensure that the country's forests and woodlands continue to perform their productive and protective functions in perpetuity, took steps to create government-controlled reserves in various parts of the country. However, the implementation of its policy of reserving 25% of the country's land area came up against the people's demands for agricultural land so that, in the end, only a small proportion of the land could be reserved. In some places, opposition to reservation was quite concerted. But where the people were taken into confidence, the reservation effort earned their sympathy and support quite readily, as the following account shows:

"Friday 9th March, 1956, at Mulgwe:

At 7 o'clock, the Village Area Head and the Village Head arrived with the village councilors and others. The people spoke neither Hausa nor English, but only Kanuri, so Zana L. interpreted for us. Zana L. is the Native Authority (N.A.) councilor responsible for forestry. He is completely self-taught, and has learned to read, write and speak fluent English. He started his career as timekeeper to a labour gang when Mr Macdonald, the present (in 1956) Chief Conservator of Forests, was Provincial Forest Officer in Borno.

Jock M. opened the meeting by asking the villagers if they knew what a forest reserve was for. When they answered "No", he asked them if they had a reserve of corn. They replied that they kept a reserve sufficient for 4 to 5 years. He asked how long it took to grow a crop of corn and they said 4 months. Then he asked how long a tree took to grow, to which they replied 25 or 30 years. He picked a young man and an old man from the audience, and asked the old man what the land was like when he was the same age as the young man, and received the reply "It was all bush". The P.F.O. drew their attention to the large area of existing farmland, and pointed out that 10 years previously a man farmed 1 acre to feed his family, but now farms 6 acres and sells the groundnuts. He tells them that it has been estimated that in another 10 years, the farmed area will be 6 times as great again. He asks the old man: "How far did your mother walk to collect firewood". The old man looks surprised but replies that she collected it just behind the house. The young man is asked how far his wife walked to collect firewood, and he replies, "One or two miles." Indicating a small boy who has joined the audience, the P.F.O. asks "How far will his wife have to walk to collect firewood?". What will they do when their women have to walk a long way to collect firewood? They replied that they will move the village. He points out that when the child of the young man has grown up, and the village and all the surrounding villages have increased their farmlands, there will be no bush remaining at all. There was murmuring in the audience. They understood. He explains how the reserve will be divided between the four major villages,

a quarter being the responsibility of each Village Head. This quarter will be subdivided into 25 parts and one part cut each year. Thus, when the last part has been cut, the initial part will be 25 years old and ready to be cut again; and in this way, they will have firewood and poles for building their houses in perpetuity. He tells them that when the wood outside the reserve is exhausted they must come to the Forestry Office and ask for their portion to be marked out for felling.

P.F.O. then asks the villagers what continuing rights they want in the reserve, and whether they have any questions. They ask if they can grow rice in the swampy parts, but he replies "No; if the reserve is to be for forestry, it must be kept for forestry work, or it will not be a forest reserve - can a man have his corn and eat it?" They ask if they can take the bark of kuka (baobab) for rope and *danya* (ebony) trunks for bowls and corn mortars. A man asks if he can cut hoe handles if he sees a crooked branch. The P.F.O. replies that as to kuka and hoe handles, although he cannot give permission, "What the eye does not perceive the heart does not grieve over". They laugh. Their minds skip from topic to topic, bringing up a new subject before the previous one is properly settled; but like a good chairman, he guides them from one point to another. They ask about leaves and fruits - they add leaves to their soups. The P.F.O. wonders if they have any cattle, but they say they are too poor and keep only sheep and goats. The P.F.O. chuckles and says to the Village Head: "You are half Fulani, do you mean to say that you have no cows? I do not care how many cows you have, I am not here to collect *Jangali* (cattle tax)". They admit it ruefully; and he tells them that they are allowed to graze their cattle in the reserve and also to cut grass for thatching houses and making mats. They can collect honey and put up hives, but when they smoke out the bees they should take care not to set fire to the surrounding bush, or there will be trouble because the Patrol Guard (Boundary Labourer) is the policeman of the bush. A man stood up and says that he has firm evidence that the fires are due to nomadic Fulani and Shuwa Arabs. The P.F.O. replies that he has equally firm evidence that when the man burned his farm last year, it spread into the surrounding bush! Everyone laughs and the man sits down nonplussed.

The P.F.O. assures the villagers that the reserve belongs not to him, not to Zana L., not to the Shehu nor to the Government, but to the N.A. and thus to the people who select the N.A. councilors, which includes members of this village. Is a forest reserve such a bad thing after all? They do not demur. The Government is not stealing the land - they agree.

We all stand up, and they disperse; and then we have breakfast".

R.G. Lowe, "Making Forest Reserves in Borno, Northern Nigeria - 1956", *The Nigerian Field*, 53, 1988

Emphasis is laid on forest reserves because they have been the most effective ways of conserving our natural vegetation. As indicated earlier, although vegetation untouched by human activity probably no longer exists in the country, the most mature natural vegetation types remain in forest reserves. Traditional methods of conserving natural vegetation, such as reserving certain areas for religious purposes, prohibiting firewood collection from certain areas and on certain days, or stipulating only seasonal collections of natural products from forests, have largely been overwhelmed by pressures from increased population and so called "enlightenment". Traditional farming practices had distinguished farming areas from protected forests which were exploited only for occasional collection of large trees for making such objects as large wooden gongs (*ikoro* in Igbo), logs for seats in town squares (*ogwe*), dug-out canoes, or totem poles. They had also depended on long fallow periods which permitted a high level of soil and plant regeneration between one period of cropping and the next. These benign systems of land use have, unfortunately, succumbed to the pressures of increased population.

Areas of preserved natural vegetation in forest reserves would have been far more extensive than they are today if forest management had not abandoned natural regeneration practice in favour of plantation forestry soon after independence in 1960, but especially after the civil war in 1970. The driving force was the growth of the economy which made unprecedented demands on forest resources. This was aided particularly by unrealistic expectations of wood production levels that could not be sustained, and economic analyses which took inadequate account of the social context or of the environmental or biological values of forests. This led to the drying up of funds for natural forest management, the abandonment of existing working plans, conversion of large tracts of prime rain forest to monocultures of so called fast-growing exotic species, and general relaxation of controls on legal and illegal logging and on encroachments on forest reserves.

The dereservation and deforestation discussed above are consequences of the abandon-

ment of regard for natural forest management. Apart from reforestation, which has already been discussed, several conservation measures may be suggested to tackle the problem of deforestation. They include effective monitoring of deforestation, public enlightenment, fuller utilization of available wood resources, the development of multipurpose forest ecosystems, and the enforcement of existing legislation.

The federal government should view deforestation as a serious ecological disaster. It should set up a monitoring system to collect data on deforestation and ensure that Federal assistance to ecological disaster areas includes full assessment and revegetation of all affected areas within and outside constituted forest reserves. Both Federal and State governments should sustain the present active campaign against deforestation down to the village level, emphasizing the benefits of vegetation and the disastrous consequences of deforestation without replacement.

Fuller utilization of available land resources could also help to check deforestation. For example, proper manipulation of fallow vegetation through the introduction of profuse litter-producing or nitrogen-fixing species would accelerate the pace of fallow recovery and thereby relieve pressure on forest lands.

Deforestation could also be checked through more efficient utilization of harvested wood resources. Since one of the major economic effects of deforestation is the rapid depletion of the stock of forest resources required by the economy, greater use of the enormous quantities of wood currently left in the forest by loggers or wasted in sawmills or burned in farming will help to extend the life of the existing forests.

Other conservation strategies yet to be fully explored include the development of multipurpose forest ecosystems that would support grazing, in addition to providing other benefits, especially in the Sudan-Sahel belt now experiencing acute shortages of browse material.

Conservation of our wetlands that is receiving less attention than that of our forests and farmlands deserves urgent attention. At present these unique habitats, that is the wetlands, are very poorly protected. IUCN⁸ suggests that Nigeria should (a) ratify the Ramsar Convention on Wetlands of International Importance,

(b) base the utilization and development of important wetlands on management plans, identified through discussions with the local people for the maintenance of sustainable fishing, grazing, or agriculture and protection of wildlife and (c) prepare a plan to guide the use of the Niger delta and its resources, as this area is of continental importance and it is necessary to maintain the flow of freshwater to the delta. In addition to the above, the protection of wetlands will be enhanced by promulgating, strengthening, or enforcing legislation against the discharge of untreated industrial effluents and urban wastes into Nigerian rivers and wetlands and regulating watershed exploitation to minimize siltation and sedimentation in wetlands.

Practical measures to conserve Nigerian wetlands recommended by the Nigerian Conservation Foundation include:

- identifying wetland sites, the major benefits of each, and threats to them;
- developing and promoting the concept of wetland inventories, compiling and monitoring existing information on the peculiar problems and current activities in the listed wetlands;
- convincing government of the crucial importance of ecologically sound, functioning wetlands to the long-term stability of agricultural development in the country; and
- lobbying for consideration of wetland values in land policies and the development and protection of specific key sites.

Conservation: a shared concern

Nigeria's forest reserves are managed and protected by State forestry services, which also control the commercial removal of forest products from lands outside forest reserves. At the Federal level, the Division of Wildlife Management of the Federal Department of Forestry and Agricultural Land Resources, in the Ministry of Agriculture and Natural Resources, has responsibility for conservation matters in the country. Research on "conservation of natural flora, fauna and vegetation types in different ecological zones" is, however, the responsibility of the Forestry Research Institute of Nigeria (FRIN) in the Federal Ministry of Science and Technology. FRIN also has a wildlife school at New Bussa, Kwara State, for training wildlife personnel.

The idea of environmental conservation as a shared concern between the government and the public was slow to catch on in Nigeria. The first non-governmental organization (NGO) with a commitment to conservation was the Nigerian Field Society, which was established in 1930. The next one was not established until 1970. One of the very happy developments of the last few years has been the formation of several organizations interested in promoting the conservation of natural vegetation in the country. Thus, from being a largely government affair, conservation has become a shared concern between government and people. Some of the most important organizations in this regard are:

(a) The Nigerian Field Society: Founded in 1930; publishes a regular journal, *The Nigerian Field*, which contains conservation articles; holds meetings and lectures on conservation-

Box 4.8 Nigeria Not Yet Party to Ramsar Convention?

Convention on wetlands of international importance especially as waterfowl habitat, concluded at Ramsar, Iran, 1971.

Depositary: UNESCO, Paris.

Instruments:

- (a) Signature without reservation as to ratification;
- (b) Signature subject to ratification followed by ratification;
- (c) Accession.

As of 1985, 42 countries were party to the convention. When will Nigeria become party to it?

related subjects and arranges visits for members to conservation sites of interest; has done more than any other organization in documenting and popularizing the natural history of the country.

(b) Forestry Association of Nigeria: Founded in 1970; plays a role in sensitizing government and the public on conservation issues; initiated the celebration of the World Environment Day and the tree planting campaign in the country; holds annual meetings to discuss forestry and conservation issues; has successfully influenced government policy on the environment.

(c) The Nigerian Man and the Biosphere (UNESCO) Programme: Initiated in 1971; responsible for the establishment of biosphere reserves and nomination of natural sites for the World Heritage List, as well as conservation-related research; only one biosphere reserve, the Omo Biosphere Reserve in the rain forest, has been established so far as part of UNESCO's international network of biosphere reserves; plans are advanced to establish a second biosphere reserve at the Akure Forest Reserve.

(d) The Nigerian Conservation Foundation: Founded in 1982; perhaps the foremost non-governmental conservation organization in the country; has been responsible for attracting attention and funds from international conservation organizations, government, and private donors for supporting conservation projects; played a major role in evolving the National Conservation Strategy and the National Conservation Education Strategy and in getting laws enacted; current major activities are the Hadejia-Nguru Wetlands Project, creation of the Okomu Wildlife Sanctuary in Bendel State, and creation of the Cross River National Park in Cross River State.

(e) The Nigerian Environmental Study/Action Team (NEST): NEST was founded in 1987 at a meeting held at the University of Ibadan by participants drawn from Nigerian universities, research institutions, the Nigerian Conservation Foundation, and CUSO, a Canadian development organization. The participants identified the environment as a priority programme area in Nigeria and were bound by the desire to take action, based on adequate understanding of the state of the Nigerian environment and

related issues, to raise awareness and influence public policy for better management of the environment. This environmental profile is a contribution by NEST towards achieving these aims.

(f) The Nigerian Society for Biological Conservation: Founded in 1989; includes as its objectives "To foster interest and public awareness in biological conservation through conferences, seminars, symposia, publications, and lectures", and "to collect, process, and preserve local plants and animals, especially those species threatened with extinction".

In addition, other non-governmental organizations, such as The Nigerian Environmental Society (NES), the Nigerian Society for Environmental Management and Planning (NSEMP), and numerous school and college clubs, among others, have general concern for the protection of the environment, which includes the conservation of natural vegetation. Increasingly also, international organizations have taken an interest in conservation in Nigeria. For example, the World Wide Fund for Nature (WWF) is currently involved in establishing the rain forest park in Cross River State; the International Council for Bird Protection (ICBP) and the Royal Society for Protection of Birds (RSPB) are both concerned with the protection of important wetland habitats, particularly in northern Nigeria.

Conservation action

Through the forest services, many States have enacted laws protecting natural vegetation from damage, particularly laws against bush burning. But damage to natural vegetation has continued, because of ineffective enforcement of these laws.

Besides the establishment of organizations for conservation, the most recent notable actions directly relevant to the conservation of vegetation are the formulation and adoption by the country of both a National Conservation Strategy and a National Conservation Education Strategy, and the promulgation of the Endangered Species (Control of International Traffic) Decree No 11 of 1985 (Box 4.9) and of the Natural Resources Conservation Council Decree 1989.

Box 4.9 Conservation Legislation Currently in Force in Nigeria

1. The Forestry Ordinance 1937 (Chapter 75)
2. The Eastern Region Forest Law 1955
3. The Forestry Ordinance with Amendments; Northern Region 1960
4. The Forestry Law (Eastern State) (Cap. 38)
5. The Forestry Amendment Edict; Western State 1969
6. The Forestry Amendment Edict; Western State 1973
7. The Wild Animals Preservation Law (Cap. 132)
8. The Sea Fisheries Decree 1971
9. Sea Fisheries (Fishing) Regulations 1972
10. Exclusive Economic Zone Decree 1978
11. The Wild Animals Preservation Law (Western Nigeria) 1959
12. The Wild Animals Law (Northern Nigeria) 1963
13. The Wild Animals Law (Eastern Nigeria) 1965
14. The Wild Animals Preservation Law (Lagos State) 1972
15. The Wild Animals Law Amendment Edict (Northeastern State) 1975
16. The Wild Animals Law Amendment Edict (Kano State) 1978
17. The Kainji Lake National Park Decree 1979
18. The Endangered Species Decree 1985
19. The Natural Resources Conservation Council Decree 1989.

National Conservation Strategy for Nigeria 1986

Aspects of the Conservation Education Strategy are already being implemented by the Nigerian Conservation Foundation. The functions of the Natural Resources Conservation Council are to:

- (a) coordinate matters concerning the conservation of natural resources in Nigeria;
- (b) formulate a national policy for natural resources conservation;
- (c) monitor regularly activities of the various natural resource conservation agencies with regard to implementation of their respective programmes and projects;
- (d) resolve any conflict that may arise in respect of any project implementation under paragraph (c);
- (e) carry out such other activities calculated to facilitate the effectiveness of the performance of the functions of the Council."

Nigeria is party to the following international treaties relating to conservation.

- African Convention for the Conservation of Nature and Natural Resources; Algiers, 1968 (came into force 1974).
Depositary: Organization of African Unity (OAU), Addis Ababa.

- Convention concerning the Protection of the World Cultural and Natural Heritage; Paris, 1972 (World Heritage Convention).
Depositary: UNESCO, Paris.
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES); Washington, 1973.
Depositary: Swiss Ministry of Foreign Affairs, Berne.
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention); Bonn, 1979.
Depositary: Foreign Office of the Federal Republic of Germany.

Nigeria is thus party to all but one of the relevant major international conventions concerning conservation. The notable exception is the Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Wetlands or Ramsar Convention) concluded at Ramsar in 1971, with UNESCO as depositary, Paris. Adherence to, and implementation of, the provisions of this convention by the country are urgently required to enhance conservation of our wetlands.



REFERENCES

1. J.C. Okafor. 1979. "Edible Indigenous Woody Plants in the Rural Economy of the Nigerian Forest Zone," in *The Nigerian Rain Forest Ecosystem. Proceedings of Man and the Biosphere Workshop* (D.U.U. Okali, editor) University of Ibadan, pp 262-300.
2. M.A. Ogigirigi. 1986. "An Approach to Development of Forest Resources of the Sudano-Sahelian Zone of Nigeria," in *The Challenge of Deforestation in Nigeria. Proceedings of the Forestry Association of Nigeria Conference*, (A.B. Oguntala, editor), pp 47-58.
3. J.O. Adejuwon. 1976. "Human Impact on African Environmental Systems, in *Contemporary Africa: Geography and Change* (C.G. Knight and J.L. Newman, editors), Englewood Cliffs, New Jersey: Prentice-Hall, pp 140-158.
4. FAO. 1979. "Forestry Development: Nigeria. Project Findings and Recommendations, "Food and Agriculture Organization, Rome.
5. A.A. Fagbami, E.J. Udo, and C.T.I. Odu. 1988. "Vegetation Damage in an Oil Field in the Niger Delta of Nigeria," *Journal of Tropical Ecology*, Vol 4, pp 61-75.
6. L.I. Umeh. 1989. "The Deteriorating Nigerian Environment: The Forestry Action Plan," Paper presented at the Workshop on Strategies for Environmental Forestry Management in Nigeria, Federal Department of Forestry, Kano.
7. R W J Keay. 1959. *An Outline of Nigerian Vegetation*. Lagos: Federal Government Printer.
8. IUCN. 1988. *Nigeria: Conservation of Biological Diversity*. Cambridge, England: World Conservation Monitoring Centre, International Union for the Conservation of Nature and Natural Resources.
9. F.A. Onofeghara. 1990. "Wetlands, Their Distribution and Potentials," in *Nigerian Wetlands.. Proceedings of Man and the Biosphere Workshop* (T.V.I. Akpata and D.U.U. Okali, editors), pp 14-20.
10. L.I. Okafor. 1990. "Structure and Function of Some Nigerian Savanna and Forest Wetlands," in *Nigerian Wetlands. Proceedings of Man and Biosphere Workshop* (T.V.I. Akpata and D.U.U. Okali, editors) pp 60-65.
11. Skoup and Company. 1986. "Feasibility Studies for National Forest Resources Survey." Federal Department of Forestry, Ibadan.
12. L.C. Nwoboshi. 1986. "Meeting Challenges of the Deforestation of Nigeria Through Effective Reforestation," in *The Challenge of Deforestation in Nigeria. Proceedings of the Forestry Association of Nigeria Conference* (A.B. Oguntala, editor), pp . 225-239.
13. World Resources Institute (WRI). 1987. *World Resources, 1987*, New York: Basic Books.
14. Z.O. Gbile, B.A. Ola-Adams, and M.O. Soladoye. 1981. "List of Rare Species of the Nigerian Flora," Research Paper (Forest Series) 47, Forestry Research Institute of Nigeria, Ibadan.

15. A.B. Oguntala and J.S. Oguntoyinbo. 1982. "Urban Flooding in Ibadan: A Diagnosis of the Problem," *Urban Ecology*, Vol 1, pp 39-46.
16. R.G. Lowe. 1984. "Forestry and Forest Conservation in Nigeria," *Commonwealth Forestry Review*, Vol 63, No 2, pp 129-136.