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VEGETATION AND AGRICULTURE OF LIBERIA AND ADJACENT WEST AFRICA

ROBERT M. WARNER

This paper treats agriculture in its broadest sense, including the useful plant products of the native vegetation as well as those which are actually cultivated by the native peoples. The vegetation, climate, and geography, as well as the agriculture of Liberia, are intimately related to that of the whole West Africa. For this reason the discussion, although chiefly concerned with Liberia, is not confined to its narrow boundaries. As the native vegetation is considered, the natural products from it are discussed.

I. GEOGRAPHY

At first glance West Africa does not seem to be a particularly well defined geographical unit. However, by examining the map it may be observed that from the Cameroons the shore line extends due westward for over a thousand miles just above the 4° N. latitude as far as Cape Palmas, then extends in a northwesterly direction to Dakar. The region is bounded on the north by the Sahara desert just above the Senegal river and the north bend of the Niger river. The Greenwich meridian passes very near Accra, the capital of Gold Coast.

Politically West Africa is divided into French and British colonies, with the exceptions of Portuguese Guinea and the negro Republic of Liberia. French West Africa consists of Senegal, French Guinea, Ivory Coast, Dahomey, and French Sudan. British West Africa includes Gambia, Sierra Leone, Gold Coast, and Nigeria. After the first World War the German colonies of Togo and Kamerun were both divided and half placed under the French and the British as Protectorates. The old name of Grain Coast was applied to what is now Liberia, and the name Slave Coast to what is now Dahomey and Nigeria. Liberia is about the size of the State of Ohio. It occupies about 350 miles of coast line which faces South America, and lies in between French Ivory Coast and British Sierra Leone.

There are no high mountains in West Africa. Most of the surface is a part of a low plateau, from 600 to 1500 feet in elevation. In a few places in French Guinea and the Ivory Coast the mountains rise above 3000 feet. The outcropping rocks are mostly Archaean, in which no fossils occur, some early Paleozoic, and a few Mesozoic, in which sandstone is prominent. There have been no volcanic deposits reported in West Africa. Alluvial deposits are found near the mouths of many of the rivers, especially the Niger. There is a narrow margin of low coastal plain, usually less than 25 miles wide, and the lower Niger basin which are below 600 feet in elevation.

II. CLIMATE

The climate varies from humid tropics along the coast to a desert at the upper bend of the Niger. The precipitation decreases regularly from south to north, the lines of equal rainfall running roughly east the west. The coastal belt of 25 miles or less of Liberia and Sierra Leone and of southeastern Nigeria receive 120 to 190 inches per year. Within one hundred miles from the east the precipitation drops to below 80 inches per year. At Timbuctu and northward there is less than ten inches per year.



Figure 1. Mangrove swamp at high tide. The tangled mass of prop roots make penetration very difficult. On the left aerial roots extend down to the mud from branches 20 feet above.

The seasons are divided very definitely into wet and dry. From April to October the trade winds sweep in from the southwest laden with moisture which is precipitated in quantities near the coast. There are two rainfall peaks, one in June and one in September. The streams overflow their banks, covering the lowlands of the already drenched jungles. The temperature remains between 70° and 80°F. and the relative humidity is between 90 and 100 per cent day and night. Between the June and September rainfall peaks there is usually a period of 4 to 6 weeks during which the rains are less intense and much less frequent. This is known locally as the "middle dries." The sun occasionally breaks through the clouds with scalding

directness which sends most animal life scurrying for shade.

A gradual shifting of the prevailing winds from southeast to northwest heralds the dry season. The dry season proper begins in December with gradual decrease in the frequency and intensity of the rains. The change of seasons is often accompanied by violent winds (tornadoes). The storms move from east to west and are frequently destructive. In January and February the sky is clear and the sun's rays are intensely hot, making work of any kind difficult. After sunset the temperature drops quickly and several blankets are often needed for comfortable sleeping. Heavy fogs and dew are usual during the night and early morning.

A dry hot wind called the Harmatan blows off the desert occasionally, reaching the coast between mid-December and February. The grass dies or becomes dormant, palm trees wilt, and wooden structures dry and crack during these brief periods. Even the heavily shaded jungle floor becomes comparatively dry. Electrical storms and tornadoes in March and April gradually end the dry season and usher in the rainy season.

III. THE NATIVE VEGETATION AND ITS PRODUCTS

1. *Beach vegetation*

Along the beaches of Liberia are low dunes and occasional rocky cliffs. The dunes, and to some extent the rocks, are covered with creeping sedges and legumes, grasses, shrubs and the dwarf date palm, *Phoenix reclinata* Jacq., the fruits of which are sometimes eaten. *Sanseveria liberica* Ger & Labr. grows profusely at the very edge of the beach. A strong, white, elastic fiber called bowstring hemp is obtained from it.

2. *Mangrove swamps*

Behind the sandy beaches there are extensive lagoons of shallow tide water in which grow the mangroves, *Rhizophora racemosa* G. F. W. Meyer, and *Avicennia nitida* Jacq. Their masses of interlaced spreading prop roots make penetration almost impossible (figure 1). The trees grow to a height of 50 feet or more. Roots 4 or 5 feet long may be seen dangling from the seeds before they fall from the parent plant into the alluvial mud and brackish water below. A hard durable wood is obtained from *Rhizophora*, and tannin and a red dye are obtained from its bark.

3. *Pandanus-Raphia Swamps*

On slightly higher ground just above the tide level the screw pine *Pandanus candelabrum* Beauv. grows in dense stands. Its prop roots and dense spirally arranged leaves, which bear sharp spines, make a formidable barrier (figure 2). The leaves are split and woven into soft mats and bags by the natives.

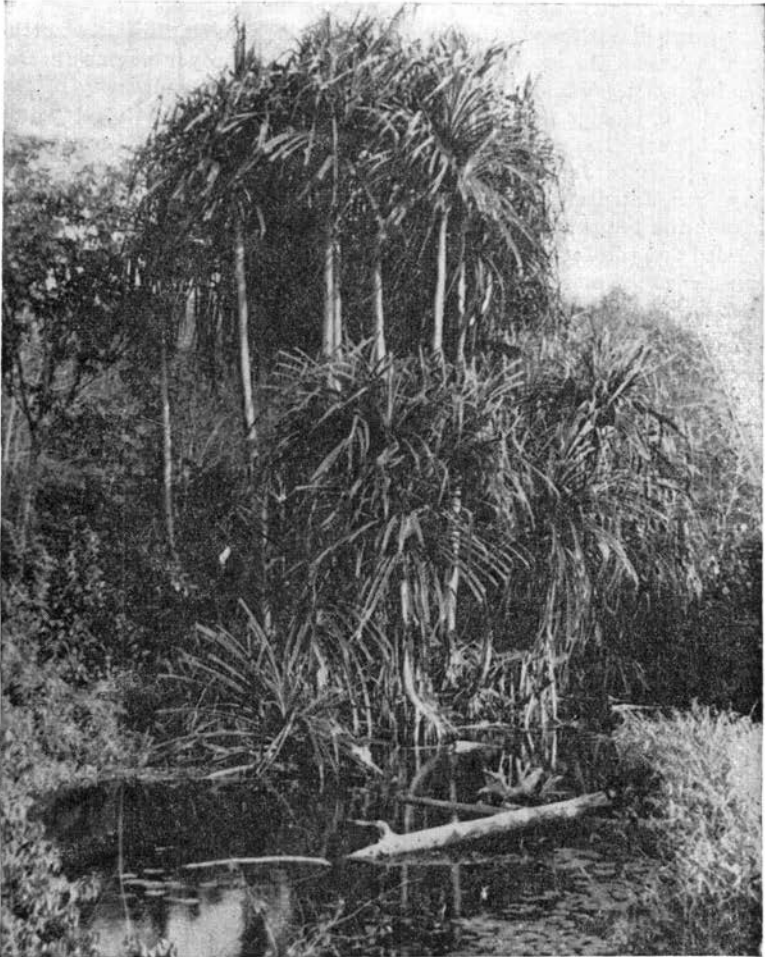


Figure 2. *Pandanus candelabrum*, the screw pine, growing on a stream bank.

Associated with the screw pine and extending into the interior with it for some distance on poorly drained areas are the wine or bamboo palms, *Raphia gigantea* A. Chev. and other species formerly grouped under *R. vinifera*. The trunk of these palms which is 15 to 20 feet in height, supports large leaves 20 or more feet long. The petioles of these leaves may be 1 to 3 inches in diameter and are light and strong. They provide the "bamboo" which is used by the natives for rafters, light construction, chairs, beds, and fences. Mats and fish traps and wicker baskets are made from the split cortical layers (figure 3). The pithy centers contain long separate vascular bundles which are pitted out and cleaned for piassava. Piassava is

a valuable fiber used everywhere for stiff brooms and brushes. It is used in the steel industry because it leaves no ash upon burning.



Figure 3. Crayfish traps are woven from the split cortical layer of the bamboo-palm petioles. Several finished baskets are shown on the right. In the background are native hand sawn black gum boards.

Raffia is obtained from the young, unopened leaves of this palm, plucked just as they are emerging from the leaf cluster. Raffia is the pale colored cuticle of the upper surfaces which is stripped off, dried and exported to Europe where it is used as a tying material in horticulture. It is not as strong as the raffia from *Raphia Ruffia* Mort, of Madagascar but is easier to harvest. The natives weave "rice" bags, mats, belts, purses, rope and hammocks (figure 4) from it, often dyeing it first with red, yellow, blue or black dyes which are also obtained from native materials.

"Palm cabbage" is obtained from these palms and from the oil palm, *Eleais guineensis* Jacq., by cutting out the growing tip of the tree. The crisp tender tip is not unlike the heart of a cabbage. Palm wine is obtained by cutting into the side of the growing tip of palms and drawing the exuded sap into a gourd. Wild yeast quickly develops, converting the sap into a frothy alcoholic (2-3%) beverage which is highly prized both by the natives and the wild chimpanzees. The "wine" is used as a source of baker's yeast by the resident Europeans.

Also found growing in the swamps of the coastal region is the



Figure 4. A hammock being made from raffia rope. The colored strands have been dyed red with camwood. Native houses in the background.

rattan or climbing palm, *Calamus deeratus* Mann. & Wendl. Although its stem has a diameter of less than an inch it climbs to the tops of the highest trees by means of a recurved teeth on the long leaf stalks which shoot ahead of the growing tip. A fair quality of cane is obtained by splitting off the cortical layer of these stems. It is used as a tie material in building houses, making baskets and fish traps, as well as cane for chairs.

4. Coastal Grasslands

Behind the beaches and among the mangrove and screw pine swamps are rather extensive grasslands, very much resembling prairies and wet meadows in appearance. The grasses grow to 3 or 4 feet in height and are made up of 7 or 8 dominant species. Sedges and rushes share dominance with grasses in the wet meadows. The soil for the most part is a sterile sand in which the water table is near the surface. In some places the grasslands extend over lateritic hills which would indicate that soil conditions are not the critical factors in persistence of these grasslands in a tropical rain forest climate. During the dry season the grass becomes like tinder and hot fires sweep over the areas (figure 5). These probably discourage the growth of seedlings and the advance of the jungle. The only tree which is found in these grasslands is a species of *Parinari* Aubl.

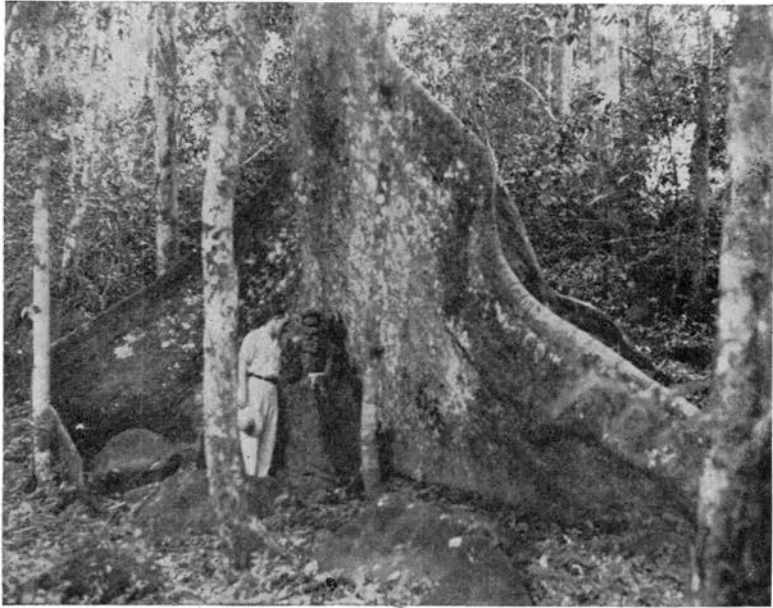


Figure 5. The buttressed base of a rain forest tree spreads like walls in all directions. The altar at the center contains sacrifices of the nearby village to the spirit of the village which is thought to dwell in this forest giant.

which apparently is able to withstand the heat of the grass fires. These grasslands were mentioned by Sir Harry Johnston (5) forty years ago. The land is worthless for crops, and, in the absence of cattle and sheep, is of little economic importance.

5. *Tropical Rain Forest*

This forest formation occurs along the coastal regions where the rainfall is 80 inches or more and the elevation is under 2000 feet. It is a narrow strip along the coast of French Guinea becoming broader in Sierra Leone and is widest in Liberia and the Ivory Coast. Its occurrence is spotty in the Gold Coast and Togo but it broadens out again from the Niger delta eastward.

The rain forest is characterized by a close grouping of trees 100 to 150 feet in height with a dense undergrowth of smaller trees. Over these grow lianas 6 to 8 inches in diameter (figure 7). Where openings occur there is a dense matted undergrowth and the extensive development of a climbing sedge or "saw grass" which cuts like a razor if one tries to brush past it or through it. There are many epiphytic as well as terrestrial ferns and orchids. The vanilla orchid, *Vanilla crenulata* Rolfe, a close relative of the cultivated vanilla of Madagascar, climbs its zigzag path up shaded tree trunks.



Figure 6. Thick woody vines are characteristic of the tropical rain forest. *Landolphia* and *Clitandra* are tapped for their rubber-bearing latex.

The forest floor is moist and dank from the decaying vegetation.

Passage is made difficult by the buttressed roots which sprawl like undulating walls in all directions from the giant trees (figure 6). Here is found the malagueta pepper or grains of paradise, *Aframomum melegueta* K. Schum, one of the spices which lured the first Portuguese explorers and traders to visit what is now Liberia and name it the "Grain Coast" (1). The large pink flowers and later the bright red fruits come up from hidden rhizomes and seem to have no connection with the nearby leafy shoots.

One of the most common of the under-story trees is the oil palm, *Elaeis guineensis* Jacq. It is also perhaps the most important indigenous plant of the rain forest from the standpoint of the native population, which depends upon it as a source of oil in their diet and fuel for their lamps. It is found from Sierra Leone to the Congo tributaries wherever there is 60 inches of rainfall distributed over 8 months or more of the year (1). It grows best in well-drained soils but can survive in semi-swamps.

The tree is 30 feet or more in height with a terminal growth of irregular feathery leaves 10 to 15 feet long, pinnately divided into 50 or 70 narrow lance-pointed leaflets. The leaf stalks are stout with spiny-toothed margins. The monoecious flowers are numerous on a short spadix. The male inflorescence consists of 10 to 15 thick finger-like branches 8 to 10 inches long covered with numerous gray flowers. The female inflorescence has numerous branches on which about 150 to 200 fruits develop. The fruits are reddish or red-orange, thin-skinned dupes with a red or golden colored pulp surrounding the black, hard shelled stone or nut. Within the nut are one to three white oily kernels of about the flavor and consistency of brazilnuts.

Palm oil is exported to Europe and America and is used in making soap, candles, etc., and in the tin plate industry. It is obtained from the fleshy outer portion of the fruit. The extraction is carried out soon after the fruit becomes ripe enough. There are two methods employed by the natives:

1. The hard oil process in which the bunches are cut from the trees and allowed to ripen until the fruits come out of the bunches easily. Then they are heaped into piles or placed in pits and allowed to ferment. They are mashed and the oil runs or is squeezed out. In this method 55 to 65 per cent of the oil is obtained.

2. The soft oil process in which the ripened fruits are boiled and pounded and boiled in water again. The oil rises to the surface and is skimmed off. This method gets not more than 55 per cent of the oil but it is of better quality. With modern heavy machinery as much as 85 to 90 per cent of the oil may be obtained.

Soft oil has a low content of free fatty acid, not more than 12-18 per cent. The hard oil often has 55 or 60 per cent of free fatty acid, chiefly palmitic acid. Palm oil has a melting point of 80°F. or above and a specific gravity of about 95 (1).

The Palm kernels are obtained by cracking the nuts after they have cooled and dried from the palm oil extraction. Palm kernels are usually exported to Europe or the U. S. for extraction. They

yield up to 50 per cent of their weight in oil. The oil is yellowish and fatty, but contains no fatty acid when fresh. However if left exposed to the air it soon becomes rancid. The oil is similar to coconut oil or peanut oil and is used in margarine and a culinary oil. It is also used in soaps, chocolate products and perfumes (1).

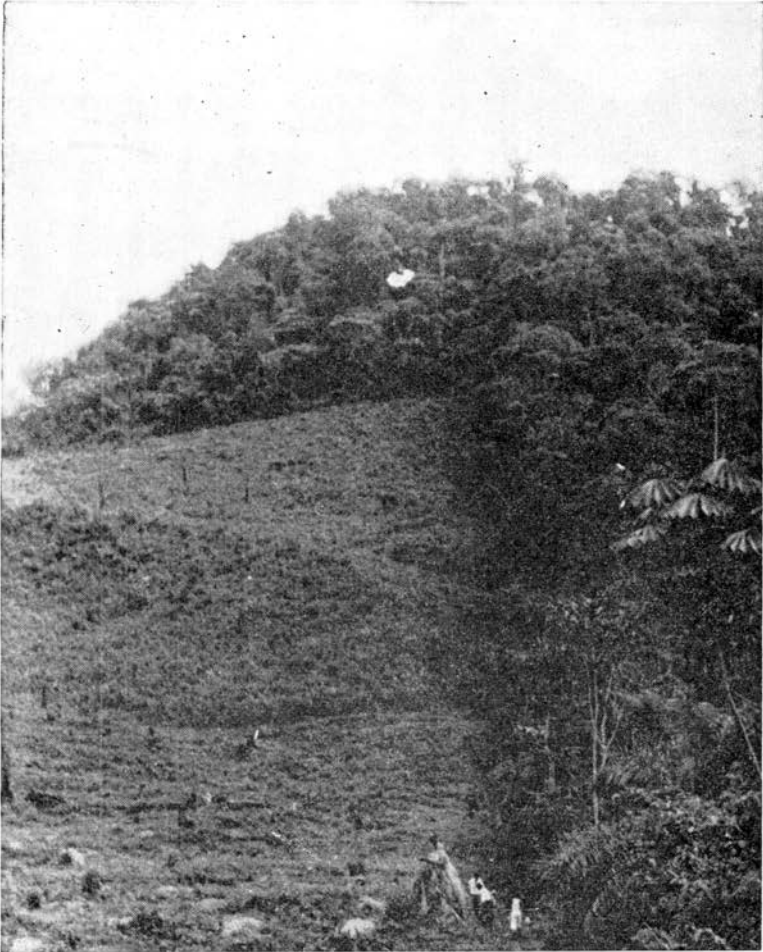


Figure 7. At left is a cut over area covered with "Saw grass". Top of the hill is virgin jungle. Foreground right, second growth forest. The tree with large palmate leaves is *Musanga smithii*.

Another medium sized tree of the rain forest is the cola. The cola nuts, which are widely used by the natives as a stimulant, are exported in quantity to Europe and America to be used in several well known beverages. There are a number of species of cola but *Cola*

nitida A. Chev. and *Cola accuminata* Schott & Endl. produce the seeds of commerce. The former is found in Liberia, Ivory Coast, and the Gold Coast. The latter is found principally in Nigeria and Gabon (1).

The fruits are follicles the shape and color of peaches but larger. They contain several red-violet or white seeds, more or less elongated, of the size and texture of the kernel of a large chestnut. They are eaten by the native peoples in all parts of West and Central Africa. They have a very bitter flavor at first but later taste sweet and give the saliva a bright red-orange color. The action is that of a mild stimulant seeming to lessen hunger and fatigue, and to temporarily increase the physical capacity. The cola of commerce is the dried cotyledons. They contain about 2 per cent caffeine and a glucoside called kolatine which acts as a heart stimulant. There are apparently no detrimental after effects.

The West African rubber tree, *Funtumia elastica* Stapf. and the rubber bearing vines *Landolphia variensis* Beauv., and *Clitandra cymulosa* Benth. are found abundantly in this tropical rain forest (4). They were extensively exploited before the advent of plantation rubber, but destructive tapping methods and poor transportation facilities have limited production (figure 7). The wood of *Funtumia* is much used by the natives in carving masks and idols. If carved green it will not crack when the wood dries out.

Among the largest trees of the forest are species of *Bombax* and *Ceiba* which grow to be over 200 feet high and often have the first limbs 150 feet above the ground. *Ceiba pentandra* Gaertn. is the chief source of kapok, both in West Africa and in the Dutch East Indies where it was introduced. Before the present war, plantations of *Ceiba* produced 80 per cent of the world's supply of kapok. It is a large tree having soft wood and yellow or dirty white flowers. The fruit is a capsule with fine fibers surrounding but not attached to the seeds. The tree is suited to plantation culture because it produces fruits in the second year and in 6 to 7 years, yields the maximum crop of 5 to 10 pounds of kapok per tree. About 100 pods are required to furnish 1 pound of the floss. The floss is light, resilient, and resistant to vermin. It is non-absorbant and buoyant, having five times the carrying capacity that cork possesses. Two pounds in a life belt has a carrying capacity of 50 pounds. After 30 days in water it loses only 10 per cent of its buoyancy. It has the disadvantage, however, of being very inflammable when dry. The uses of kapok include linings, upholstery, and "down" quilts, in addition to life saving apparatus.

Bombax flammeum Ulbrict. and *Bombax bonopozense* P. Beauv. also produce kapok of excellent quality (1). Unlike *Ceiba*, however, the pods open on the trees and their great height makes harvesting difficult. All three species are found generally over West Africa in the rain forest regions, but have been exploited only in French West Africa. In 1930, 2315 tons of kapok were exported (7).

Of the timber producing trees, the African Mamogonies are the

most important. They are all members of the *Meliaceae*. Mahogany from *Khaya ivorensis* A. Chev., the "Acajou d'Afrique" of the French, is the most widely accepted in the European and American markets. Its strong, fine figured wood is in great demand. The chief sources of this wood are Gabon, Ivory Coast and Liberia. Cedar mahogany, *Entandophragma cylindricum* Sprague has the odor of cedar. The heart wood is a red brown to a dark brown, well figured, heavy, and good for veneered panelling. The wavy grained mahogany or "acajou frise", *Entandophragma macrophyllum* A. Chev. is comparable to *Khaya*, but the rays are more uniform. Brown mahogany, *Entandophragma utile* Sprague, is scented and attractively banded. It is scented and attractively banded. It is not as hard as the others but its working qualities are excellent. African walnut, *Lovoa klaineana* Pierre ex Sprague, resembles mahogany in grain and has a fine golden-brown luster but it is lighter in color and softer (1).

There are three important species of ebony in the tropical rain forest: *Diospyros crassiflora* Hiern of Nigeria, and Benin ebony which has black wood; *D. gabunensis* Gurke, and *D. kamerunensis* Gurke, of Liberia and Gold Coast, having pinkish wood with heart wood frequently becoming black. They are used for carving and for tool handles.

One of the most valuable trees of wide distribution is the West African Mulberry, *Chlorophora excelsa* Benth. & Hook. The sap wood is yellow and the heart wood is greenish to red brown becoming chocolate or red brown. It is hard, durable, resistant to water, termites, and fungi, and takes a fine polish.

Satinwood or brimstone, *Terminalia ivorensis* A. Chev. is a large tree with yellow wood. It splits easily and makes good shingles. The bark yields a red-yellow dye. *Terminalia superba* Eng. also produces shingle wood. It grows to 160 feet in height and 3 to 5 feet in diameter.

The wishmore or red cedar, *Terrietia utilis* Sprague, produces a beautifully patterned wood with good working qualities. It is widely used in local carpentry and furniture making and would seem suitable for export. Liberian black gum, *Haplormosia monophylla* Harms, is a tree producing an excellent furniture wood resembling American walnut.

The famous sasswood or ordeal tree of Africa, *Erythrophleum guineense* G. Don., is common throughout the rain forest zone. This leguminous tree produces a highly soluble alkaloid called erythro-phleine in its bark. It makes a red colored infusion which is administered to persons accused of serious crimes. They are considered innocent if they are able to vomit the poisonous liquid. If the poison does not kill a "guilty" person he is disposed of in other ways. The wood is tough, fibrous and hard to work but is suitable for bridge and boat building as it is almost imperishable (1).

Lophira alata Banks, the so called "red oak", produces a very hard, heavy wood suitable for piles and wharves. It is termite proof but is difficult to work. The tree is of medium size in the forest but



Figure 8. A rainy day in a native village. The houses are constructed of a pole and stick framework tied with rattan and covered with mud. Palm leaves are tied on to make the thatch roof. Nails are used only in the construction of the door. In the background are rice farms in which a few forest trees are left standing.

becomes the "scrub oak" of the savanna. An edible oil is obtained from the seeds (1).

One of the understory trees of the rain forest is the camwood, *Baphia nitida* Ladd. The heartwood of this tree was formerly an important source of red dye for bandanas and calicos. It was exported to Europe to compete with the American logwood. Camwood is heavy and hard and has a fine even grain well suited for carving.

In cut over areas in rain forest the secondary growth is often dominated by the corkwood tree, *Musanga smithii* R. Br. (figure 8). It frequently occurs in pure stands and seems to have definite possibilities as a source of pulpwood. It grows to six inches or more in diameter in two or three years. Perhaps the most striking shrubs of cut over, fairly moist situations are species of *Mussaenda* Linn. because of a white, much enlarged, sepal on each flower. The yellow tubular corollas are comparatively inconspicuous. The *Mussaenda* is so common along the roadsides and trails that it has been suggested as the national flower of Liberia (5).

6. Park Savanna

Interior and northward from the heavily forested belt the stands

of trees become more open and less tall and finally give way to a park savanna land where grasses cover much of the ground (8). The rain forest continues in the river valleys. The shea butter tree, *Butyrospermum parkii* Kotschy, is found in the park savanna formation. It is a medium sized tree with broad, simple leaves. The fruit is about the size of a peach and consists of an edible fleshy pericarp surrounding a core containing the large oil bearing seeds. The oil is extracted by the natives from the dried and roasted seeds. They are crushed and the pulp is boiled in water. When cool the oil is about the consistency of lard. The shea butter is used by the natives in cooking, soap making, and as an illuminant. For export, the kernels are dried and shipped to Europe where the oil is expressed. Belgium is the consumer of most of the oil. The shea butter tree is important to the natives because it furnishes an edible oil in large areas in which the oil palm cannot grow (1).

Mention should be made of the bark cloth tree, *Antiaris africana* Engl., a large elm-like tree in the park savanna regions. The bark is beaten until the bast fibers are inter-meshed and a coarse cloth like material results. It is an item of commerce in the Ivory Coast and the Gold Coast (1).

7. Savanna

North of the park savanna, where there is less than 30 inches of rainfall, the grasses and thorn trees become co-dominant in the true savanna. The boabab tree, *Andansonia digitata* Linn. is the most characteristic feature of the landscape. Its tremendously thick trunk and the pendant fruits are well-known. It has the ability to store up water in its trunk during wet periods which tides it over the dry seasons. In the savanna there are 3 to 5 months of very low rainfall. The grasses grow from 5 to 20 feet in height during the rainy sea-

IV. NATIVE AGRICULTURE

Agriculture in the tropical rain forests is, and necessarily must be, a hoe-culture. It is safe to say that Liberia, which is typical of the tropical rain forest regions, has probably not a single plow. There are several reasons: There are no draft animals, principally because sleeping sickness is so prevalent. If land were cleared well enough for plows to pass through the soil the intense heat of the sun, erosion, leaching, and cropping, would make it unsatisfactory for cultivated crops within one or two years. Thus whatever cultivation is done, must be accomplished with a crude handmade hoe supplemented by the ever present cutlass.

In practice the jungle is cut during the middle or latter part of the dry season. The trees and undergrowth are felled and allowed to dry in place as long as possible before they are burned. Burning just before the rainy season begins gives most satisfactory results. If they are burned too early, troublesome sprouts shoot up from

the roots and stumps causing extra labor in removing them and the weeds which develop. Virgin jungle is preferred for such farming because in it the undergrowth is less abundant and sprouts which develop are less numerous. As a result, little of the virgin jungle remains in populated districts.

Rice is by far the most important food crop cultivated in the tropical rain forest both in number of acres planted and in the amounts consumed by the people. It is planted by broadcasting the seed and stirring it into the soil at the beginning of the rainy season. It grows quickly and may be weeded once or twice by hand, if at all. Irrigation or flooding is practically unknown. The family is usually the working unit. The man cuts and burns the forest. His wives plant,



Figure 9. A native Bassa chief carves spoons and bowls from the wood of the wild rubber tree, *Funtumia elastica*. The robe is cotton cloth hand woven in narrow strips and dyed with native indigo and camwood.

weed and harvest the grain. The children, especially the boys, watch

over the ripening grain and try to keep away the numerous small birds which come to feed upon it.

When the grain is ripe the women walk through and cut off the ripe heads one at a time with a small "rice knife". These heads are tied into bundles, transported to the "rice kitchen" and stored between the rafters and the thatched roof. The heat from the sun above and the cooking fire below dries the rice until it is ready for threshing. The heads are then stripped and placed in wooden mortars and beaten with the end of small poles. The rice is fanned in special fanners or shallow baskets and the chaff separated from the grain (figure). It is then stored in raffia bags, or carried to the coast for sale or trade.

There are a number of varieties of *Oryza sativa* Linn, grown in Liberia. Most of them are the types grown on uplands without flooding or irrigation. The red skinned grains predominate. White skinned rice is considered sacred and is used for festivals and in making sacrifices to the idols. Some of the rice is awned and some is awnless. There are also differences in the growth habits of the plants such as drooping or erectness of the fruiting panicles. Most varieties mature in about nine months, but one variety matures in a little over three months. This variety is called "hungry time" rice because it ripens when the improvident native has consumed all the previous season's crop and the main harvest is still months away. Many of the rice varieties have special ecological requirements which are recognized by the women who plant it.

There are two species, *O. barthii* A. Chev. and *O. stapfii* Roschev., which are formed as weeds in rice fields. They are considered by the natives to be indigenous because they eventually survive alone when rice is left unharvested in abandoned fields (1).

Second to rice, cassava or manioc, *Manihot utilissima* Pohl, is the most important food plant of the tropical rain forest regions of Africa. Its starchy roots furnish an even supply of food throughout the year. Fair-sized roots are produced in 8 to 10 months but the maximum yield is obtained at the end of 18 months to 2 years. The roots keep well in the soil and may be dug as needed. The plant is propagated vegetatively by setting out sections of the stem after the roots have been dug. Two sections of four nodes each are planted in hills three or four feet apart. It is frequently planted in fields along with rice. The rice is then harvested before the cassava matures.

There are a number of varieties of cassava, based principally on the degree of sweetness. The bitterness is caused by a substance which upon decomposition produces hydrocyanic acid. The bitter varieties are used as sources of starch and tapioca. The sweet varieties are used directly for food. Baking or boiling seems to destroy the poisonous element (1).

The other food plants of this region are mostly of the village garden type. Sweet potatoes and yams are raised in fair quantities for local use. Varieties of maize are grown generally over West Africa, the white being most common although yellow and red varieties are

found. Sugar cane is grown extensively near population centers to supply the demand for rum. In Liberia the preachers supplement their incomes by running stills and selling the product. Beans, peanuts, tomatoes, cucumbers, cabbage, eggplant, ginger, peppers, and squash are grown in the small gardens by the huts. Bananas, papayas, mangoes, and pineapples are the common fruits. The citrus fruits, avocado, guava, breadfruit, soursop, cashew, and jack fruit have been introduced along the coast but are not grown in sufficient quantities to supply the local population. The British and French colonies have made much more progress along these lines.

There are two plants, okra and roselle, native to West Africa, which deserve special mention. Okra, *Hibiscus esculentus* Linn., produces the edible pods so well known to the southern states as an ingredient in gumbo soup. The bark yields a good fiber used locally for fishlines, traps and hammocks. Roselle, *Hibiscus sabdariffa* Linn., is found in several varieties. One variety produces a strong, silky, light brown fiber which can be used as a substitute for jute in both the paper and textile industries (1). Other varieties produce a fleshy calyx, after the flower fades, which has a refreshing cranberry flavor and is used by the Europeans as a substitute for cranberries and rhubarb.

The large seeded or Liberian coffee, *Coffea liberica* Bull, is indigenous to West Africa. It was formerly cultivated on plantations but its production is now limited mostly to local consumption. It is considered to be an inferior coffee and was used largely for blending with other coffee.

The coconut is distributed generally along the coastal regions. In Liberia the quantities produced are not sufficient for the local demand. It is used mainly for food. A fiber, called coir, may be obtained from the unripe fruit by beating and cleaning the husk after it has soaked several months in salt water. Coir is a light, elastic, water resistant fiber used in making ropes and mats (1).

The domestic animals include sheep, goats, under-sized chickens, muscovy ducks, Guinea fowl, dogs and cats. There are usually one or two pet monkeys in each village. Any kind of a pet may be bought, sold or eaten at anytime unless it happens to be a taboo for that person or his tribe. Cattle do not survive long in much of West Africa because of the sleeping sickness organism which is carried by the tsetse fly. Cattle for beef are brought in from areas free of the tsetse fly. There is a good deal of hunting and trapping by the natives of antelope, elephant, buffalo and monkeys as a source of meat. The women construct baskets and nets from palm leaves and rattan with which they catch small fish and crayfish. Some of coastal tribes fish with hooks from their small boats off the coast. Smoked fish and smoked elephant hide are common items in the native markets.

In southern Liberia, Ivory Coast and Gold Coast, the rainfall is perhaps less in quantity but more uniformly distributed throughout

the year. The region is well adapted to the cultivation of cacao. Plantations have recently been started and are producing quantities of cocoa (1). There are some banana plantations in the Ivory Coast which shipped to Europe until the outbreak of the war. One planter then installed a dryer and sold his entire crop to the Germans during Rommel's campaign in North Africa. The oil palm has been developed to some extent as a plantation crop in Nigeria. In the accompanying paper the plantation culture of Hevea rubber in West Africa is discussed at length.

In the savanna and park savanna regions cotton is, in terms of value and quantity produced, the most important product grown for export. Senegal, and the dryer regions of Nigeria and Gold Coast are important producing regions. The most widely planted variety is *Gossypium punctatum* Schum. & Thonn. var. *nigeria* Watt. The species best adapted to the southwestern sections, Liberia and Ivory Coast are the Ishan varieties, *G. vitifolium* Lamk, and *G. barbadense* Linn. The only species which seems to be indigenous to West Africa is *G. anomalum* Wawra & Peyr, which develops a short line if any and is worthless as a crop (1). In most of the forested regions cotton is raised only for local use (figures 12 and 13).

The culture of cotton and the methods of weaving seem to have reached West Africa before it was introduced into Europe by the Arabs. The methods of weaving are pre-Islamic. The cloth is woven in narrow strips about 4 inches wide and 36 yards long. In this form it is often used as a medium of exchange. Chiefs in the hinterland frequently place fines of so many "cloths" for infractions of the tribal code. The Hindus in India were the first people to weave cotton into cloth. The Indians have used cotton since 1800 B. C. However our word cotton came from the Arabic word "qutn". (3).

Another fiber plant, *Agave sisalana* Perrine, has recently been introduced into West Africa from the West Indies. A fine white fiber is obtained from the older leaves. Three year old leaves are cut, beaten and their fiber extracted by machinery. There is some export of this product from French West Africa.

Guinea corn or sorghum is grown as a staple food in the savanna regions (3). *Sorghum margitiferrum* Stapf. is the best known grain sorghum in the western area. Meal from the grain is made into a porridge or into cakes eaten by the natives (1).

The castor plant, *Ricinus communis* Linn., has been grown commercially in West Africa. As many as 16 varieties have been recognized, including small and large seeded varieties. The oil content of the seeds is not consistent because of the great heterogeneity within varieties and the marked responses to differences in climate and soil. This crop seems suited best to culture by the native farm families because of these uncertainties and the large amount of hand labor involved (1).

Peanuts are grown quite extensively over the park savanna and

savanna regions. Large quantities are exported from French West Africa and Nigeria.

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