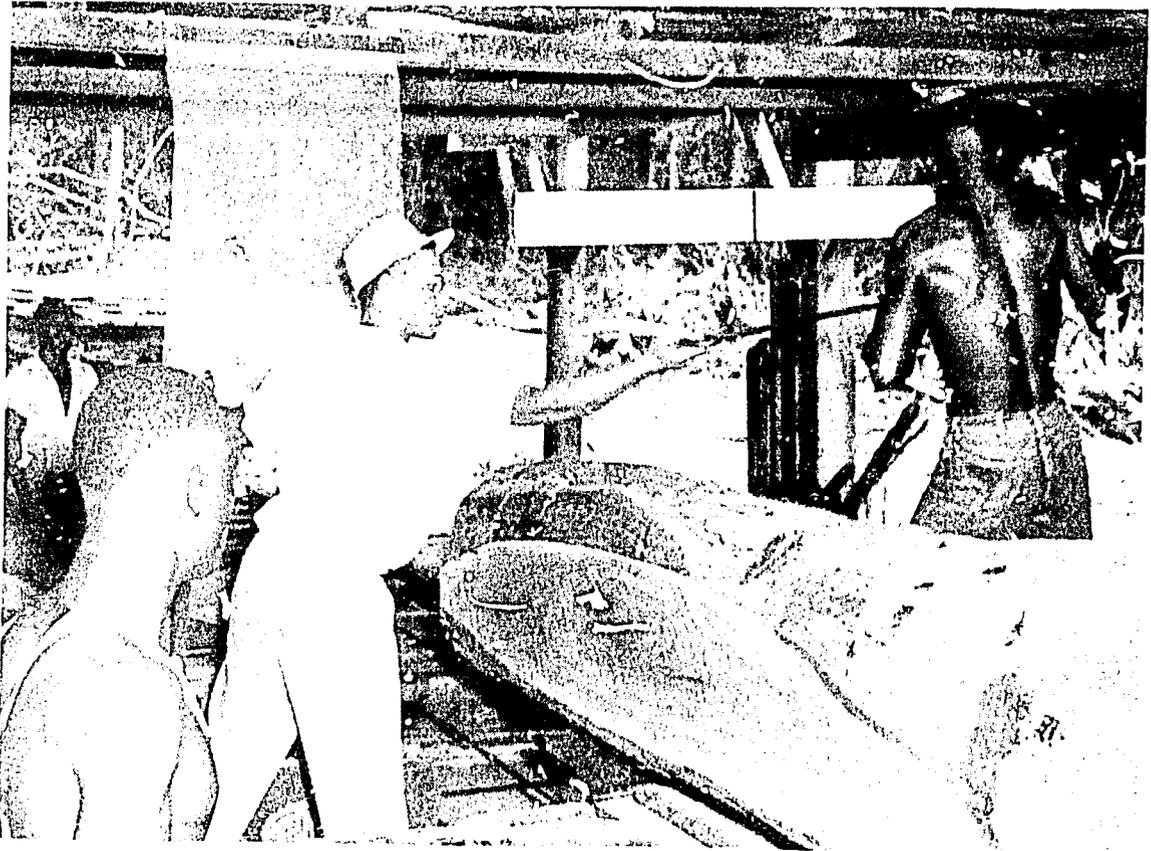


# THIRD REPORT ON FORESTRY PROGRESS IN LIBERIA 1951 - 1959



International Cooperation Administration  
Washington 25, D.C.

A.I.D. HISTORICAL AND  
TECHNICAL REFERENCE  
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## PREFACE

Liberia has rich forest resources, and a program for their conservation and development that is a tribute to Liberian wisdom.

The United States Operations Mission to Liberia is proud to have assisted in developing this forestry program. Mr. Torkel Holsoe, for over eight years USOM/L's chief forestry advisor, deserves the major credit for whatever help the U.S. technical assistance program has been able to give Liberian forestry; this is the report of his work.

Mr. Holsoe was zealous in establishing forestry objectives for the joint Liberia-U.S. Commission for Economic Development. His knowledge of Liberia's natural resources and her social, political and economic factors helped the progress of Liberian forestry toward those objectives -- toward utilization of the forests as a renewable resource. His foresight helped establish professional forestry education; his interest brought other foresters to Liberia; his direction helped make Liberian businessmen eager to use forest products.

This report by Mr. Holsoe is presented by USOM/Liberia to tell the story of one of the Mission's most successful projects -- and one of Liberia's most successful programs.

JAMES O. BABCOCK  
Director  
USOM/Liberia

## FOREWORD

Mr. Torkel Holsoe came to Liberia in 1951 after interest had been established in the forest resources of the country, but means of use had not come into reality. It was very timely that the United States Technical Assistance Program should bring a forestry advisor to Liberia of the character and leadership capacity of Mr. Holsoe.

Mr. Holsoe's assistance in respect to the forestry project was not toward commercial development alone; but in a much broader sense, emphasis was placed on giving Liberia administrative and legislative preparation for forest industrial development inevitably to come.

In his daily contacts with Liberians of all walks of life, exerting his leadership through a capacity for inexhaustible energy, Mr. Holsoe contributed toward the following achievements:

1. Creating high ideals of performance by Liberians within the staff of the Bureau of Forest Conservation and providing for up-grading of personnel through professional training.
2. Encouraging Liberian entrepreneurs in mobilizing forest industry.
3. Developing program with the Joint Commission for Economic Development motivating support of forestry in its place amidst natural resource development.
4. Supporting professional forestry education in development of curriculum, staff, and facilities for the School of Forestry at the University of Liberia.
5. Developing Liberian forest policy in line with experience of other West African Territories.

It is felt that present forestry development in Liberia, including administration and industry, will continue with technical assistance programs and Liberian resources to reach the productive capacity of the forests for the over-all benefit of the Liberian people.

STEPHEN A. TOLBERT  
Secretary of Agriculture & Commerce  
Department of Agriculture & Commerce  
Republic of Liberia

## ACKNOWLEDGMENT

This report covers the observations and activities of the entire forestry staff -- those who have been assigned or are assigned under the United States Operations Mission to Liberia. The writer arrived in Liberia in August 1951 and spent the first two years' assignment as the sole forester at the mission. Mr. E. W. Fobes, Assistant Forestry Advisor, arrived in Liberia in December 1953, while Messrs Frank W. Lara, Robert A. Schirck and James A. White, Forestry Assistants, came to Liberia during July and August 1954. From November 1956 Mr. White, now Forestry Advisor (Management), and the writer were the two foresters with the mission until July 1959 when Mr. Boyd M. Witherow, Forestry Advisor (Utilization) arrived in July 1959. The credit for the accomplishments in the fields of forestry should be given the members of the forestry staff.

The Liberian Government has shown great interest and extended the fullest cooperation in matters pertaining to the forestry project. Special acknowledgment, however, is due:

Honorable Stephen Tolbert, Secretary of Agriculture and Commerce, fellow forester, who during his time as Assistant Secretary of Agriculture and since as the Director of the College of Forestry, has been able to promote, direct, and lend prestige to the development of forestry in Liberia, and

Honorable John W. Cooper, former Secretary of Agriculture and Commerce, under whose auspices forestry was established in Liberia. His deep interest and understanding of the importance of forest conservation have constituted a decisive factor in the development of forestry in Liberia.

TORKEL HOLSOE

February 1961

In May 1954 Forestry Opportunities in the Republic of Liberia by Mr. Holsoe was published. The supply of this publication was quickly exhausted. Instead of reprints, a new publication, Forestry Progress and Timbering Opportunities in the Republic of Liberia, by Mr. Holsoe was published in January 1956. Now Mr. Holsoe has A Third Report on Forestry Progress in Liberia ready for the press in which much more material has been incorporated.

Mrs. Mary P. Langford, Foreign Agricultural Service, United States Department of Agriculture, has been of great help in arranging, editing, and preparing these three reports for reproduction.

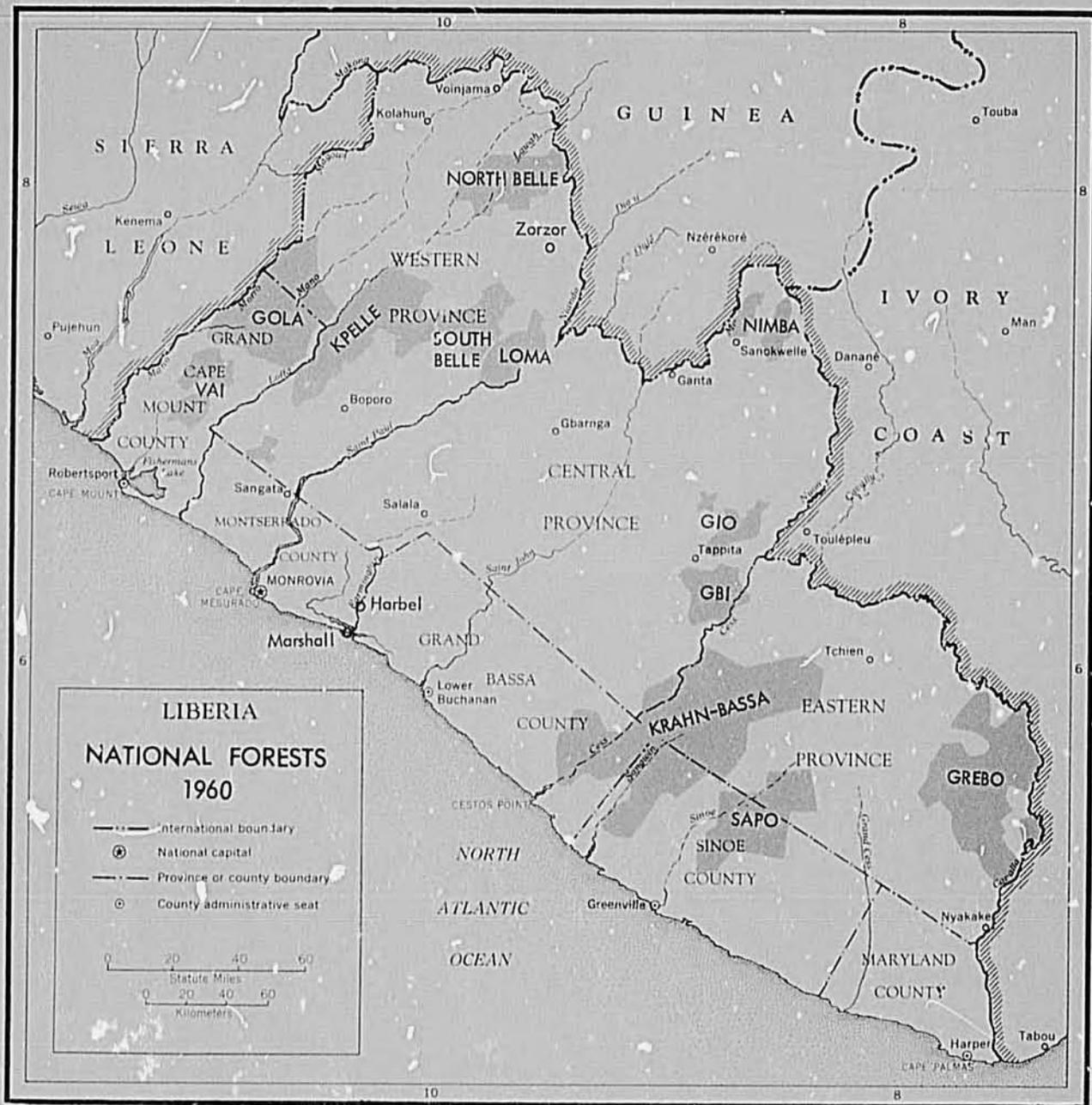
Note: Photographs in this report were furnished by Mr. C. R. Lockard of the U.S. Forest Service and by the author, Mr. Torkel Holsoe.

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## REFERENCES



## INTRODUCTION - GEOGRAPHY

### Geography, General

Liberia, the oldest independent African republic, is located on the western coast of the continent between 4°30" and 8°30" north of the Equator. It is bordered by the Atlantic Ocean on the southwest for about 350 miles, while on the northwest it has a joint boundary with the British colony of Sierra Leone, and on the northeast it is bounded by the Republic of Guinea. The Cavalla river is the common boundary between Liberia and the Ivory Coast Republic on the east. The greatest width of Liberia is about 150 miles extending in from the Atlantic Ocean.

Liberia is crossed by several large rivers, most of which have their origins outside the boundaries of the country. However, several of the smaller rivers, which are also evident along the coast, originate in the more hilly and mountainous parts of the interior of Liberia. Although these rivers serve as means of transportation on a limited scale for the movement of local produce for short distances, rapids and waterfalls prevent their use for major transportation. Five to ten miles inland from the Atlantic Ocean, the rivers become so turbulent that any large scale navigation is impossible. The exception to this is the Cavalla river, which is navigable for shallow draft vessels for about 30 miles. Although there are great fluctuations in the water levels of the rivers during the rainy and dry seasons, the larger rivers still carry a considerable volume of water during the dry season.

The oldest cities, which were founded by the settlers from the United States more than one hundred years ago, are located along the coast. The capital city of Monrovia, named for President James Monroe, established on Cape Mesurado, is a city with modern conveniences such as running water, a sewage system, electric lights, a telephone system, several modern hotels and paved streets. Its population is about 45,000. Other cities along the Atlantic coast are Robertsport near Sierra Leone, and southeast of Monrovia are Marshall, Buchanan, River Cass, Greenville and Harper.

In the interior, a number of tribal villages have grown into towns with some western-type houses and populations probably over 5,000. The most important of these are Kakata, Gbarnga, Saniquellie, Voinjama, Zorzor, Ganta and Tappita.

Although no regular census has been taken, the total population of Liberia is estimated at 1,000,000.

### Topography

Liberia has a general and rather gentle slope from the interior towards the Atlantic Ocean. The highest point, reaching probably an elevation of

4,500 feet, is found in the Nimba mountains on the eastern boundary between Liberia and Guinea. Other mountain ranges or individual mountains of volcanic origin may reach elevations from 2,000 to 3,000 feet. In general, however, the country is rolling, with rounded ridges interspersed by smaller streams. In the central part of the country a number of small swamps are found near the streams. In most locations the topography does not offer difficulties as far as road building is concerned, although small cuts and fills will have to be made when major highways are constructed.

Along the coast there are swamps and lagoons which are occupied by mangrove and which are formed by estuaries of rivers and streams. These swamps and lagoons are subject to tidal influence of the Atlantic Ocean and extend several miles inland along some of the rivers. In other places along the coast there are promontories such as Cape Mount close to the border of Sierra Leone, Cape Mesurado at Monrovia and Cape Palmas near the mouth of the Cavalla river. Outcrops of metamorphic rock are common along the coast. These outcrops have been helpful in the construction of the port of Monrovia, Greenville, and Cape Palmas, and have formed the basis for the planning of the port at Buchanan.

The ports in operation at the present time are the Free Port of Monrovia, the port at Greenville, and one at Cape Palmas. The Free Port of Monrovia is considered one of the best harbors on the west coast of Africa. This port of Monrovia has a draft of 28 feet, while the port at Greenville has a draft of 24 feet and the port at Cape Palmas 14 feet. The port at Buchanan will have an estimated draft of 36 feet. Most of Liberia's export of rubber, iron ore and palm kernels are shipped from the port of Monrovia, which was opened in 1948. The balance of Liberian exports are shipped from other coastal cities by employing surf boats to load the ships standing by off shore.

### Vegetation

At one time the entire land area of Liberia was probably covered by virgin high forest. This vegetation, however, was later broken by shifting cultivation, which has caused an ever increasing amount of destruction to the forest resources as population and means of communication increased. However, over large areas of Liberia it is still possible to find original forest growth.

Along the coast inlets, lagoons and mangrove swamps are formed by the tidal movement of the ocean; this dams up the water from small rivers and streams, thereby inundating the lowlands. These swamps are covered by Rhizophora spp., recognizable by their prop roots. It is typical of these mangrove areas that the trees grow much taller close to the river channels, while

in other inundated areas the growth usually stagnates at a total height of six to eight feet. Near large towns these trees are cut for fire wood during the dry season.

Where no agricultural activities have taken place, the high ground from the coast to the northeastern boundary is covered by virgin forest. Most of Liberia, with the exception of the extreme northern area, lies within the rain forest belt. This rain forest of West Africa is a narrow belt reaching its greatest width in Liberia, where it extends about 150 miles inland from the Atlantic Ocean. The rain forest is found in areas receiving a minimum of 60 inches of rainfall per year; it extends from the southern part of Sierra Leone through Liberia, Ivory Coast, and ends in Ghana where it is found some distance inland from the coast. The coastal region near Accra receives about 25 inches of annual precipitation, a rainfall that is not sufficient to sustain luxurious forest growth. The high forest starts again along the coast of Nigeria and continues through the Cameroons into the Congo basin. All in all, the rain forest area of Central Africa is only a small percentage of the entire land area. Liberia is the only country in West Africa that is almost entirely situated in this belt. Throughout the African continent only 4.8 percent of the area is covered by forest that will produce beyond requirements of the population or permit export of timber products to other regions.

The savannah area extends into the interior of Liberia in a few places, particularly in the northern part. It is reasonable to believe it is found here due to earlier agricultural activities. In these areas it is common to see elephant grass, Pennisetum purpureum Schum take over abandoned farm land, thereby preventing the forest from reestablishing itself. The fact that elephant grass takes over after the forest has been cut and burned shows that such regions are in the transition belt between the forest growth and the savannah. In areas with greater rainfall forest growth will immediately take over any abandoned farm land.

There is, however, one exception to the rule. Along the Atlantic coast the soil is generally very sandy compared to the lithoritic soil types found generally throughout Liberia (8). On these sandy areas, which previously were covered by high forest and where the forest in some places still reaches down to the coast, a drastic change in vegetation takes place after the areas have been utilized for agriculture. After cutting and burning these areas and after harvesting the first rice crop, the areas produce grass rather than woody species. The timber will not regenerate on these sandy soils. The heavy growth of grass is highly inflammable; these grass flats are burned over during dry seasons. The result is that the upper few inches of the soil consist of sterile white sand. Below this layer a darker sand and sometimes a loamy sand,



Large Liberian town. The circular huts made of plastered mud on a stick structure is the old-fashioned way of constructing them. The larger house to the left is made from mud bricks. Palm nuts are left on the ground to be cleaned by the rain before being cracked for the extraction of the palm kernels.



can be found. Very little, if any, growth of bushes or trees will come into these areas unless they are protected from fire. These man-made savannahs are in evidence along the length of the coast of Liberia.

Although much of the high forest has been cleared for agricultural purposes, about one-third of the land area of Liberia is still covered by this original vegetation.

### Climate

Meteorological observations have been made for only a short time in a few places in Liberia. Noteworthy are the records kept at the Methodist Mission Station at Ganta, which was established by Dr. George W. Harley, about 90 miles inland from the Atlantic coast and the Botanical Research Station of Firestone Plantations, Harbel, about 15 miles inland from the coast (Appendix V).

Since most of the high forest is situated in areas that have annual precipitation within the ranges of these two stations, the above mentioned data will serve as an indication of what may be expected. The precipitation for the Monrovia area, however, is considerably heavier than any of these two stations, since this area probably receives more rainfall than any other place on the West Coast of Africa, except a small area in the Cameroons. During the few years meteorological observations have been made in Monrovia, the annual rainfall has ranged from 129-241 inches. It is believed the average is about 180 inches annually. For the purpose of forest operations, however, the rainfall near Monrovia is of minor importance, since very few forest areas are situated in the extreme coastal area.

During 1952 a large number of meteorological field stations were established by the Liberia Meteorological Service under the direction of K. N. Vestal, Meteorologist with the USOM/Liberia. Data from these stations have now been received in sufficient quantity to indicate the average annual precipitation in various places in Liberia. Figure 1 shows the various rainfall belts which indicate the considerable drop in precipitation from the Atlantic Ocean towards the interior of the country.

From Appendix V it can be seen that most of the rainfall occurs during the months of June to October. It is not uncommon that the rainfall during a single month in Monrovia may reach or exceed 45 inches. In spite of this heavy precipitation, it does not rain continuously. It is common to have sunny days even during the months when the rain is heaviest. Although the rainy season may slow forestry field activities, it is only along the coast that such work will be disrupted for any length of time. In the interior of Liberia heavy showers

may occur, but it is seldom that it will rain for a whole day. However, after a heavy shower in the morning the roads will dry and get dusty during the afternoon due to the porosity of the soil. Consequently, transportation need not be hampered if proper drainage of a road system is maintained.

Temperatures in Liberia are not oppressive. Along the coast temperatures seldom exceed 90°F. Since there is usually a wind either from the ocean or a cool breeze from inland during the nights of the dry season, the climate is quite tolerable and much of the time very pleasant. In general, the temperatures are cooler during the rainy season. However, with higher humidity during the middle of the day, the difference is not so noticeable.

The night temperatures in Liberia are cool, since there are usually wind movements during that time. The average minimum temperatures for Monrovia range from 70° to 75°F. In the interior of Liberia the range of temperatures during the dry season is greater. Although the temperature may exceed 100 degrees during some days, the heat is not oppressive, since the humidity here is lower. Furthermore, the nights are always cooler in the interior than in the coastal region.

### Political Units

The coastal area of Liberia is divided into five counties with Grand Cape Mount bordering on Sierra Leone followed by Montserrado, Grand Bassa, Sinoe and Maryland. Maryland County extends to the Cavalla River, which is the boundary between Liberia and French Ivory Coast. The interior of Liberia is divided into provinces: Western, Central and Eastern. Western Province is divided into Kolahun, Voinjama, Zorzor, and Bopolu districts; and Eastern Province into Tchien and Webbo districts; and Central Province into Saniquellie, Gbainga, Salala, and Tappita districts. Each county is directed by a superintendent; provincial commissioners have charge of the provinces, and district commissioners of the districts. All directives to the superintendents and commissioners either originate or pass through the Secretary of Interior.



Farm houses or "half town" built in a new farm clearing in the interior of the forest. A few of the large trees not cut in the clearing operations are shown.



Sandy areas along the Atlantic coast were covered by forest before being cleared. Oil palms invade the areas after they are abandoned. Cassava under the palms in this sand show poor development.

## LIBERIAN FORESTS

As mentioned above, the natural vegetation for the most of Liberia is forest cover. Probably at no time in recent centuries, however, has the entire land area of the country been covered by forest vegetation, since the population has derived part of its livelihood from agricultural crops. The agricultural activities and the extent and character of forest cover have had a certain relationship due to the practice of shifting cultivation, which, as far as is known, always has been customary in this part of the world. Some parts of the forest show signs of agricultural activities, although most of the present high forest in Liberia seems to have been undisturbed. Other parts show signs of activities that may have taken place so long ago that there are new stands of excellent timber on former clearings.

Prior to 1947 very limited information was available in regard to forest resources of Liberia. In that year Karl R. Mayer (7) was assigned as forest products specialist to the United States Economic Mission to Liberia. By travelling thousands of miles on foot and by correlating his field observations with study of aerial photographs, Mayer estimated that the land area of Liberia was divided approximately as follows:

Condition Class	Total Area (acres)	Percentage of total land area
High forest (old growth)	8,950,000	37.6
Broken forest	4,850,000	20.4
Low Bush (second growth)	5,250,000	22.1
Non-forest	4,750,000	19.9
	23,800,000	100.0

The high forest is the original, completely undisturbed forest, or forest that perhaps a hundred years or more ago might have re-established itself after the land had been used for agricultural purposes. This high forest contains volumes per acre ranging from 5,000 to 20,000 board feet for trees of 18 inches and over in diameter measured at breast height. The broken forest, which Mayer characterized as forest with broken canopy and a gross volume per acre of 5,000 board feet or less, has originated from partial cuttings made for the purpose of clearing areas for agricultural purposes. Low bush refers to areas which recently have been farmed and which now are re-occupied by forest growth.

The tropical high forest is completely different from any forest in the temperate zone. The idea that it is composed of enormous trees is erroneous.

Like most virgin or old second-growth forest, it is composed of trees of all sizes. Here and there, there will be a giant tree reaching 200 feet or more in the air and having a diameter of six feet or more, but most of the trees will measure less than four feet. There are plenty of small trees, which seem only to be waiting for the big trees to die, so they can utilize the space and light taken up by them. This situation is favorable for practicing forest management, since the composition of the mature trees and the younger trees is much alike. In other words, if all the mature trees were cut, another crop of trees would grow up, which would have about the same composition as the crop that preceded it.

Another fallacy is that the tropical forest is impenetrable. True, often there is heavy undergrowth and it would be difficult to run a straight line through the high forest. However, most trees are without branches for quite a height, since shade has killed off the lower ones. Where a large tree has fallen, often there is a thicket. Such thickets can usually be avoided and it is not too hard to travel off the trails, since dense shade from the larger trees excludes much ground vegetation.

The high forest areas of Liberia can be classified according to vegetational zones, which more or less run parallel to the coast line and are closely related to annual precipitation.

As already mentioned, mangrove swamps are found in the lagoons and along some rivers in the immediate vicinity of the Atlantic Coast. Although these areas probably never will produce any valuable forest crop, they do have importance in a negative sense, since they often hinder transportation of forest products from the interior of the country to the coast.

#### The Evergreen Rain Forest

On the high ground along the Atlantic Coast and stretching inland for about 50 miles the forest stands are classified as evergreen tropical rain forest. The average annual rainfall in the belt ranges from a maximum of 180 inches down to about 100 inches along the interior boundary of the belt. The trees are broadleaved and are usually covered with foliage. However, there is a constant shedding of leaves that takes place during the entire year; in a few cases certain species may even be without leaves for a few weeks.

There are numerous species growing to commercial sizes. Some of these have been used in the commercial trade, while many more have the properties

for certain uses but have not yet been introduced on the market. There are probably 150 or more species which reach dimensions commonly used in the trade. There are no pure stands of any particular species; but some tree species are more common than others. In certain areas it is not uncommon to see stands where a considerable proportion of the volume may consist of Azobe (Lophira alata Banks ex Gaertn f.); Niangon, (Tarrieta utilis Sprague); or Ekop (Tetraberlinia tubmaniana Leonard). Seventy or eighty percent of the volume may be distributed among 15 or 20 species, while the balance of the volume may be distributed among many times this number.

While certain species are found throughout Liberia, others are definitely confined within a certain annual rainfall belt. Species such as Azobe; Niangon; Berlinia spp.; Corkwood (Musanga cecrepieides R. Br.); Dabema (Piptadenias-trum africanus Hook f. Brenan); Abura (Mitragyna stipulesa O'Kuntze); Bilinga (Nauclea trillesii Pierre Merrill); and Rikio (Uapaca guineensis Mull. Arg.) are found throughout Liberia.

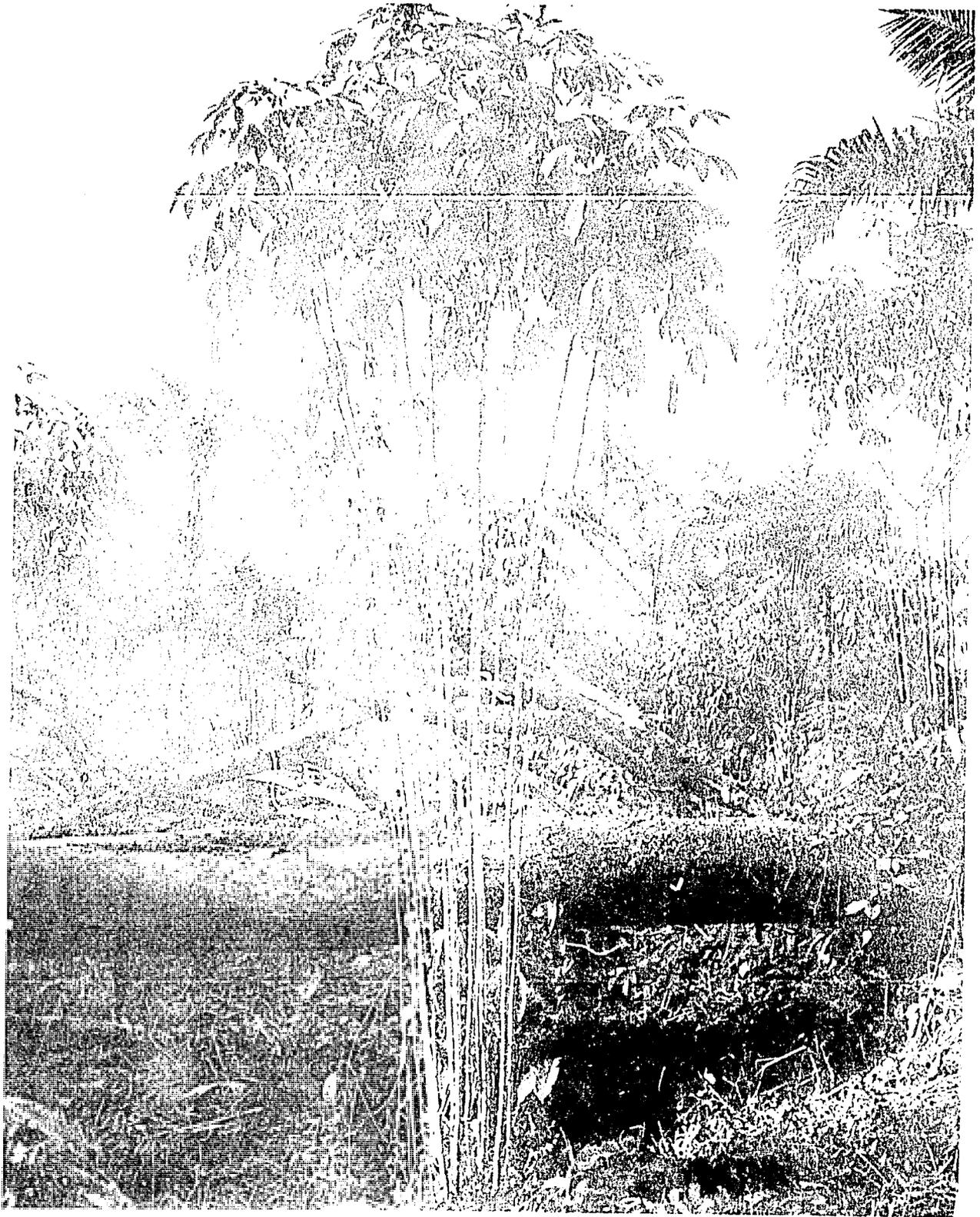
Peculiar to the evergreen rain forest are species like Naga (Brachystegia spp.) Aiele (Canarium schweinfurthii Engl.); Haplormosia monophylla (Harms); Oboto (Mammea africana Sabine); Ozouga (Sacoglottis gabonensis Baill. Urb.); Pentadesma butyracea; and Anopyxis klaineana Pierre Engl.)

#### The Transition Forest

The borderline between the evergreen and the deciduous forest zones is not well defined. However, beyond approximately 50 miles from the coast, where the rainfall has dropped to about 100 inches per year, it is apparent that the fall of leaves at certain times of the year is heavier than at other times, a thing that is not noticeable close to the coast. Particularly during the beginning of the dry season, many trees will be without leaves for a few weeks.

It is in this zone that certain species appear for the first time, while other species do not occur until the regular deciduous forest has been reached. The transition zone is characterized by the occurrence of Framire, (Terminalia ivorensis A. Chev.); Sipo (Entandrophragma angolense Welw. C. DC.); Dibetou (Lovoa trichilioides Harms); Bosse (Guarea cedrata A. Chev. Pellegr.); and Makore (Dumoria heckelii A. Chev.); and by the absence of the Khaya spp. and Obeche (Triplochiton scleroxylon K. Schum).

In the Western Province the transition forest appears to extend much further inland than in the Eastern Province, where the width seems to be about 20 miles.



Cassava plants in a typical upland farm. Logs and tree tops still remain after burning. Rice was harvested before cassava was planted.



A typical trail in the high forest of Liberia.  
Such trails are usually found between larger  
towns.

## The Deciduous Forest

The typical deciduous forest is found in areas where the annual precipitation ranges between 70 and 90 inches per year. The trees in the overstory are definitely deciduous at certain times of the year. This condition occurs usually at the end of the rainy season or at the beginning of the dry season. As far as some trees are concerned, the time the trees are without leaves coincides with the time the fruit is ripe and the seed ready for dissemination. Sipo, Azobe, and Fromager (Ceiba pentandra Linn. Gaertn.), growing in this zone, will be without leaves for several weeks during the period from January to March when the fruits are ripe and the seed ready to be disseminated by the wind. The limiting factor which causes the Entandrophragma spp. to be confined to the dryer forest areas seems to be the humid weather during the time when the fruit is ripe. It can be noted when the fruit is ripe during January and February; it will be open only when the weather is dry and the sun is shining. Only on such days will the seed be spread by the wind; while if a moist period occurs while the fruits are ripe, the entire fruit will fall unopened to the ground and the seed will rot within the fruit. However, Entandrophragma species will grow well in the moister zones if planted; chances of natural regeneration at a later date are uncertain.

Other species typical of this semi-deciduous zone are: Obeche, Makore, Dibetou, and widely scattered African mahoganies such as Khaya ivorensis A. Chev., and K. Anthotheca Welw. C.DC. The species mentioned under the transition zone are also found in the semi-deciduous forest, and are the ones which are already recognized on the world market. There are numerous other species which without doubt will be commercially important.

The forest in this vegetational zone gives the impression of being more open and not having as much undergrowth as the forest areas found closer to the coast. It is, however, difficult to judge, since it primarily depends on the moisture condition of the different places. In swampy areas, the trees are usually farther apart, making light available for denser undergrowth. On dry ground the forest in the interior has a dense crown cover, but is open below making it easy to walk through it. The general opinion that tropical forests are a mass of vines does not hold true for the high forests of Liberia. Although it may take some cutting to walk through on a straight line, it is usually easy to move about without using a machete or cutlass if occasional thickets are avoided.

On his travels through Liberia Mayer (7) estimated the volume of the forest stands in various parts of Liberia. The results of this ocular estimate were as follows:

ESTIMATED ACREAGE AND OPERABLE VOLUME OF MAJOR  
LIBERIAN FOREST <sup>1/</sup>

<u>Forest Units</u>	<u>Acres</u>	<u>Total Volume M Board Feet</u>	<u>Vol. Per Acre Board Feet</u>
EASTERN PROVINCE			
Great Eastern	4,275,000	85,500,000	20,000
Iboke	240,000	5,280,000	22,000
CENTRAL PROVINCE			
Great Eastern	800,000	13,600,000	17,000
Nimba	150,000	2,400,000	16,000
Sanckwelle	80,000	1,120,000	14,000
Gio	175,000	4,400,000	16,000
St. John	180,000	2,340,000	13,000
Bong	170,000	2,040,000	12,000
Salala	120,000	1,320,000	11,000
Bassa	85,000	850,000	10,000
Du River	15,000	180,000	12,000
WESTERN PROVINCE			
Walo	100,000	1,400,000	14,000
Gola-Maher-Kondessu	2,430,000	21,870,000	9,000
Morti River	30,000	360,000	12,000
Total	8,950,000	142,660,000	

<sup>1/</sup> The volume estimates include trees of all species 2 feet or more in diameter outside bark, at a point 4 1/2 feet above ground level or 1 foot above butt flare, and containing at least one merchantable 16-foot log. Volumes are computed by International 1/4-inch log rule for average all species of form class 35. Gross volumes reduced 10 percent to secure net volume.

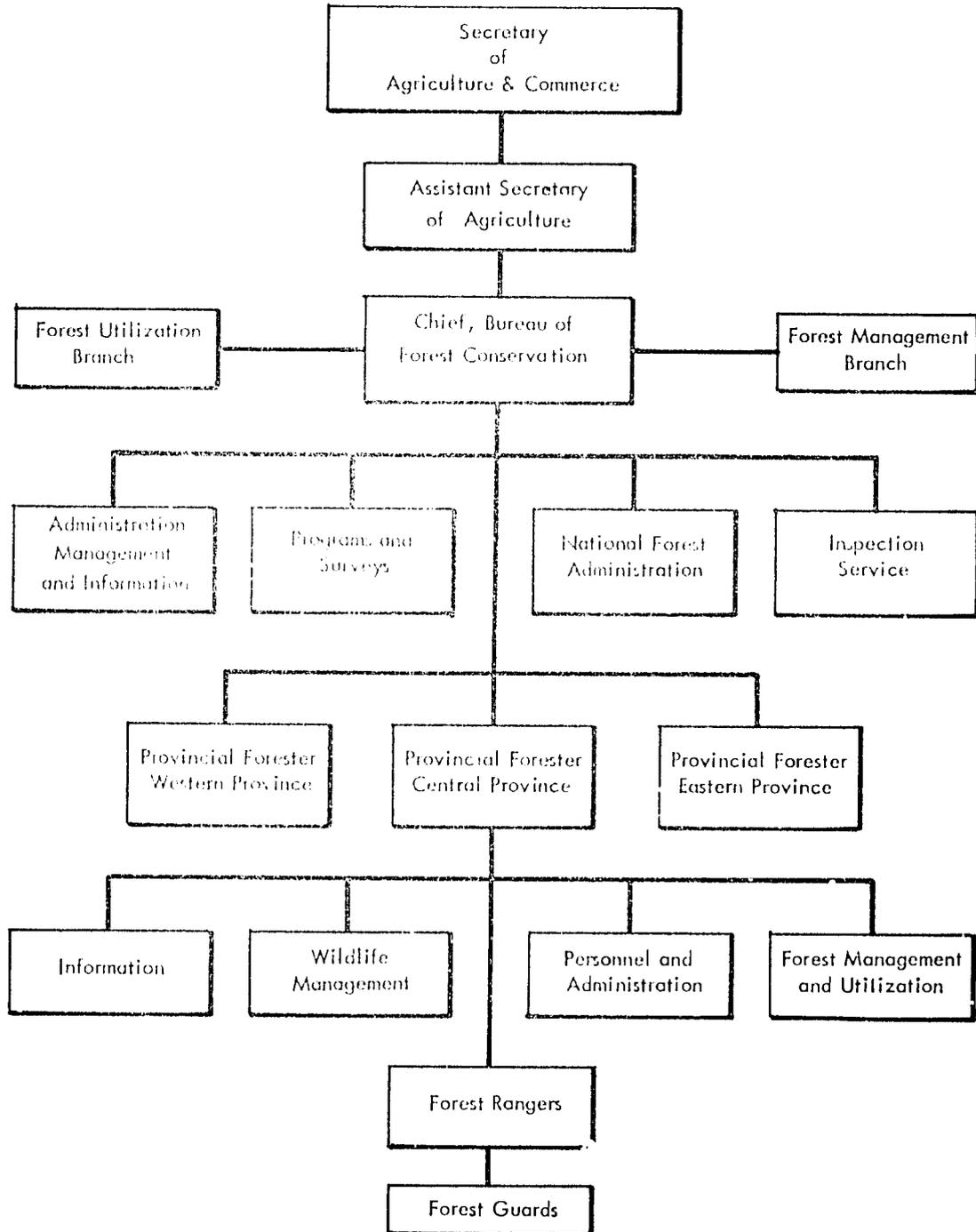
Although no inventory has yet been made of the national forest, indications of the volumes have been gained from sample plots which have been taken as a measure of routine for every five chains of boundary survey made. Although these volumes are not in any way comprehensive, they do indicate the volumes that can be expected within the national forests. Wherever it has been possible,



Farm houses or "half town" established in the middle of the high forest. In a few years all high forest in the vicinity will be cut down except around the water supply for the village.

*Da*

BUREAU OF FOREST CONSERVATION  
DEPARTMENT OF AGRICULTURE AND COMMERCE  
REPUBLIC OF LIBERIA



these figures have been compared with Mayer's figures, that are shown above, with the result that it seems likely that Mayer's estimate is accurate. Until comprehensive inventory figures are available, Mayer's figures can be used as good indications of the available volumes in the various forest areas.

## SHIFTING AGRICULTURE AND FOREST LAND USE

Most of the rice grown in Liberia is the upland variety, planted on dry soil, unlike the swamp rice grown in Asia and some other African countries. Mayer estimated that each year approximately 50,000 acres of high forest are destroyed by rice farmers while establishing farms. During this activity they cut down the trees and burn over the area before planting rice. The establishment of farms does not follow any orderly or geographical pattern. A farmer and his family may leave their village and wander into the high forest for several miles before settling down and starting to clear an area. This work of clearing is done entirely by the man. Vines, brush and bushes are first cut. After these have dried thoroughly most of the trees are cut. It is not uncommon for the farmer to leave certain trees with tall clear stems and small crowns, particularly when the trees have exceptionally hard wood. It is common to see Azobe and rough-skinned plum (Parinari excelsa Sabine) standing after other trees of 4'-5' in diameter have been cut. All cutting is done by axes, many of which are home made. Since the purpose of cutting is to eliminate shade on the ground and provide for cleared space in which to plant rice, no effort is made to cut the trees close to the ground or to grub out the stumps. Furthermore, many of the trees in Liberia have huge buttresses, which made it difficult to cut the trees close to the ground. In order to fell the tree, a scaffold is built so that the cutter stands high enough to cut the tree above the buttress.

The resulting so-called cleared farm is an area on which tall stumps from large trees are standing and stems of large trees crisscross the ground. In among the stumps and stems the brush and branches are stacked and burned, making it possible to plant rice in small patches. The burning is done during March and April, and immediately after, rice is seeded by broadcasting and grubbed in with short-handled hoes. After the cutting and burning, which is the work of the men, the women take over, performing all duties until the rice is harvested.

The rice is usually ripe and ready for harvesting in September or October. In some sections of Liberia cassava is planted in with the rice, when the first weeding is done. In other sections the rice is grown without any weeding and

the cassava is planted at the time rice is seeded. Cassava starts to ripen in January or February, but is often left to grow for as long as a year or more, so it can be used in case the rice supply should fall short. After the cassava is finally harvested, the usefulness of the clearing is ended, since the easily soluble salts from the wood ashes have been used or have leached into the sub-soil making the ground unsuitable for another annual crop. Another area of the old clearing or an extension may be started several miles away moving farther into the high forest for the clearing for the next season's rice crop. These individual farms are found scattered throughout otherwise uninhabited areas.

Such farming as has been described is necessarily wasteful. Since normally the high forest areas, which are cleared for farming, will have timber stands of at least 15,000 board feet per acre, it means that each year about three-quarters of a billion board feet are cut down, burned and wasted. Based on present regulations, this amount of timber if processed would give a revenue to the government of Liberia amounting to more than \$2,000,000, and if it were sold, it would have a market value of about \$50,000,000. The yield the farmers obtain from growing rice on these areas amounts to about 500 pounds of rice per acre, with an average price of \$6.00 per hundred pounds. In other words, the farmer has an income of about \$30 per acre for his efforts or only a few cents per hour for his and his family's working time; this sum may be compared to \$45 per acre which would be the excise tax obtained by the Liberian Government from the sale of the timber. If the timber were cut and sold it would represent a gross value of \$1,500 per acre.

In addition to establishing farms in the high forest, farmers also use much of the broken forest and low bush area for their crops. The customary procedure is to abandon any farm area for a new one as soon as one crop of rice and one crop of cassava have been grown. The abandoned area is usually left fallow for 7-8 years during which time bushes and trees again cover the ground; the fertility of the soil is thus partially restored by the residue of organic matter produced by the tree growth. The area is again cleared and another crop of rice and cassava is grown.

Although broken forest and low bush area are much easier to clear and cultivate than the high forest, farmers usually prefer to clear high forest land. One reason is the belief that a greater crop return can be obtained from these virgin areas. In certain parts of the country, particularly in the high rainfall belt, this may be true; but in much of the interior of Liberia excellent crops are grown in low bush areas. The main reason for preferring to clear the high forest seems to be that it is considered more a man's work to cut large trees than to clear areas on which there are only small trees.



Wildlife Regulations protect the chimpanzees.

12a



Scaffolds were built so that the tree, a Parinarium excelsa Sabine, could be cut above the buttress roots. Crosscut saws are seldom used for felling trees.

In order to improve the yield, conserve the forest resources and eliminate much of the work in clearing areas, a swamp rice program was initiated in 1952. Mr. Gabriel C. Meaux (8), Rice Production Specialist with USOM/Liberia, was in charge of this work.

The yield from rice grown in the swamps, according to Meaux, is between 1,500 and 2,000 pounds per acre, or 3 to 4 times more than the yield on the cleared high forest areas. Furthermore, since the original vegetation in the swamps does not consist of as large or as numerous trees as are found in the upland high forest, the clearing of land is less time consuming. Then, too, the swamp areas will be able to sustain rice crops year after year without having to revert to bush condition between crops. It is gratifying that many of the chiefs in the interior realized the value of the program. The President of Liberia, William V. S. Tubman, time after time has urged the rural population to refrain from cutting high forest and to confine their rice growing to the swamps.

## FORESTRY LEGISLATION

Mayer (7) realized the necessity of forest legislation in order to prevent the great destruction of forest resources which takes place every year in Liberia. If the present sporadic methods of clearing land for farms in the interior of the high forest continues and is not replaced by an orderly expansion around the present villages, the high forest will eventually be broken up by farms. Furthermore, as the planning and surveying for highways progress, claims along the roads will destroy further valuable forest areas. Mayer submitted to the Liberian Government in 1949 a draft of a forest conservation law. Among other things this law provided for partial control of shifting agriculture by establishing national forest reserves in which the clearing for farms could be controlled or eliminated. This draft had not been enacted into law in 1951, at the time of the writer's arrival in Liberia.

At the suggestion of Hon. Stephen Tolbert, then Assistant Secretary of Agriculture, and after changing minor details in Mayer's draft, it was routed through Hon. John W. Cooper, then Secretary of Agriculture and Commerce, to President William V. S. Tubman. In November 1951 the President forwarded the draft to the Liberian Senate with his recommendation for its passage. However, due to other pressing matters, action on the forestry legislation was postponed until the next legislative session. During the time between sessions the writer had the opportunity to discuss forest conservation problems with President Tubman and various members of the cabinet. Through the efforts of the Secretary of Agriculture and Commerce and the Assistant Secretary of Agriculture, the Forest Conservation measure was again brought to the attention of the Liberian Legislature during the 1953 session. In March 1953, the Act was passed unanimously by both legislative bodies. It became law on April 17, 1953, by the signature of the President of the Republic of Liberia. (Appendix II)

It may be well to discuss at this point the term "reserve" as used in the Act. A forest reserve is generally considered to be an area in custodial status, namely, one locked up for a rainy day. The present national forest system of the United States originally was established as a series of reserves in this sense.

In 1906 a policy of use rather than protection only was adopted, and the term "reserve" was changed to "national forest." Under this policy these public areas have been developed for use in growing and harvesting crops of trees, controlling water run-off, and furthering the development of fish and game.

Although the 1953 Liberian Forest Conservation Act uses the terms "reserve" and "reserved areas", it clearly states that scientific forestry will be practiced on the "reserved areas." The Liberian concept of the public forest is that they are national forests, and not untouchable stores of timber.

Under Section IV of the Forest Conservation Act, the Government of Liberia will be able to control and manage the publicly owned lands "to their most productive use for the permanent good of the whole people considering both direct and indirect forest values." Furthermore, the government is now empowered to "stop needless waste and destruction of forest and associated resources, . . .". Through this law it will be possible for the government to avoid the destruction of the high forest caused by the activities of rice farmers and so confine their farming activities to low bush areas. Since much of the upland farming already is done in low bush areas, it is believed that through strengthening the Bureau of Forest Conservation by use of more funds and more personnel, and an education program, it will be possible to save much of the forest resources. A section which would devote its time to this specific program in the Bureau of Forest Conservation should be established.

Following the passage of the Forest Conservation Act, rules and regulations were formulated for the purpose of implementing the Act. Based on the outline made by Mayer and incorporating suggestions made by Hon. Stephen Tolbert, then Assistant Secretary of Agriculture, the Forest Rules and Regulations were submitted to Hon. John W. Cooper, then Secretary of Agriculture and Commerce. On February 28, 1957 "An Act Supplemental to An Act for the Conservation of the Forest of the Republic of Liberia" (Appendix II ) was passed by the Liberian Legislature and signed by the President of the Republic of Liberia.

Immediately after the passage of the Forest Conservation Act, a forestry office was established in the Department of Agriculture and Commerce. The passage of the rules and regulations made it possible to elevate this office to a Bureau of Forest Conservation. Mr. Anthony T. Sayeh was commissioned as

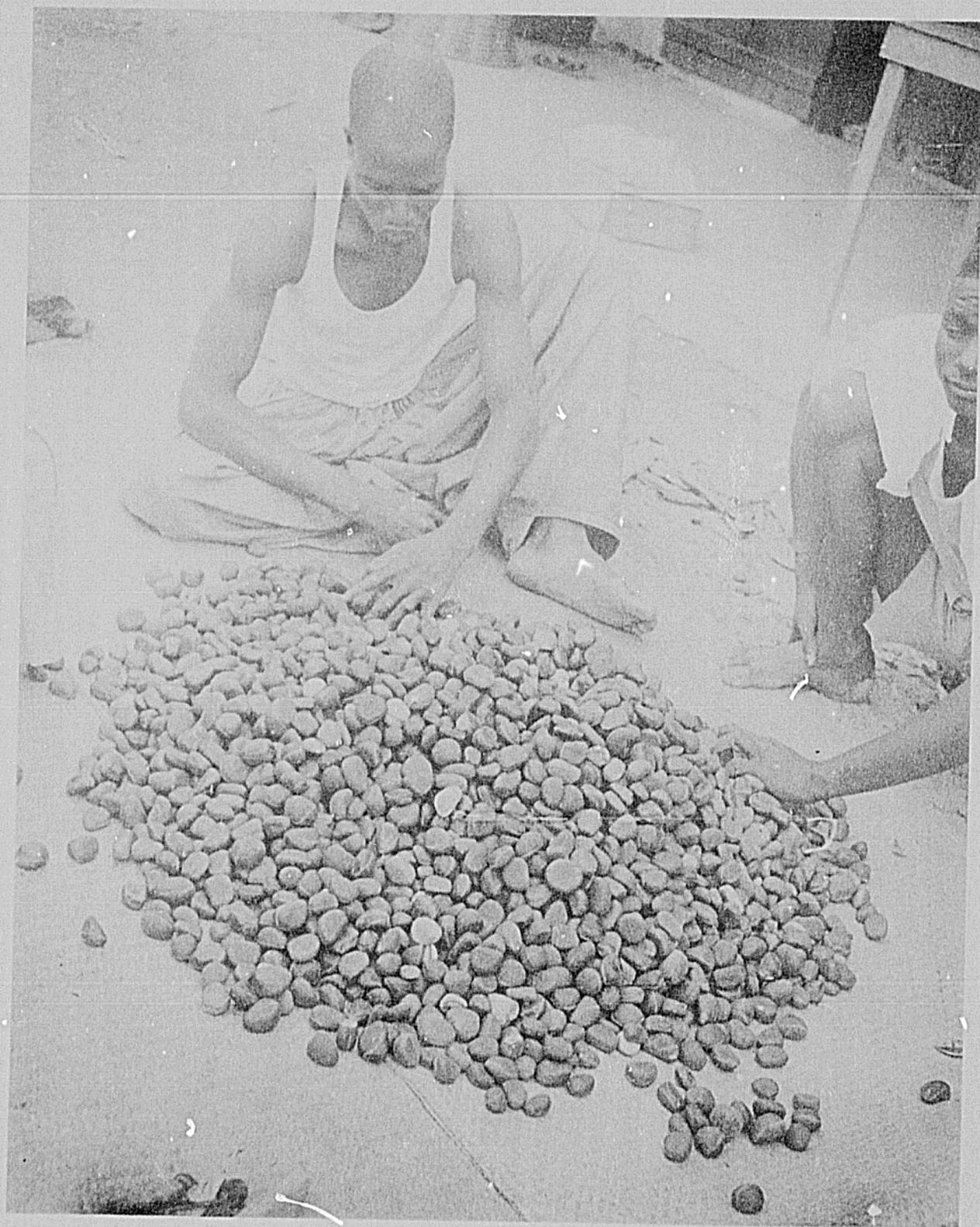
Chief of the Bureau. Mr. Sayeh and several other young Liberians had been working with USOM foresters for some years and had received training in various forestry activities.

In close coordination with Hon. Stephen Tolbert, Mr. Sayeh has enforced the Wild Life Regulations pertaining to game animals held in captivity. Announcements were published in newspapers that all such animals should be registered and that no more game animals were to be caught and offered for sale. Animals that were properly registered before a certain date were authorized for export, while animals not registered were to be confiscated. The action was taken for the purpose of protecting the population of chimpanzees, which, according to official opinion, had been reduced due to indiscriminate killing while catching baby chimpanzees. Although some violations of the regulations have resulted in confiscation of animals, the number of chimpanzees held in captivity in Liberia has been reduced in recent years. The only legal trapping of chimpanzees at present is for use by the Liberian Institute of Tropical Medicine at Harbel. This institute also has received all confiscated chimpanzees.

The main function of the Bureau of Forest Conservation during the years immediately after the passage of the forest conservation laws has been the establishment of the national forests of Liberia.

## ESTABLISHMENT OF NATIONAL FORESTS

Liberia is exceptionally fortunate as far as forest resources are concerned, since one-third of the land area is covered by high virgin forest containing large volumes of many different species, some of which have already been accepted on the world market. Liberia is among the exceptions to the rule that a people do not start thinking about conserving and managing their forest resources until they are nearly dissipated. Usually, the first step is to build up devastated forest areas, so that they will be able to serve the nation later. Liberia has been foresighted in this respect. The Government of Liberia has realized if the natural resources were not conserved, Liberia would be confronted with devastated forest areas as have so many other countries. During the 1940s the Tubman administration sent Hon. Stephen Tolbert to the United States to study forestry at the University of Michigan. In 1947 Liberia requested the United States Economic Mission to make a survey of the forest resources. This survey was conducted by Mr. Karl R. Mayer (7).



Cola nuts are a major item of trade in the interior of Liberia. A Mandingo trader is examining the nuts before placing them in leaf-lined hampers for export to French Guinea.

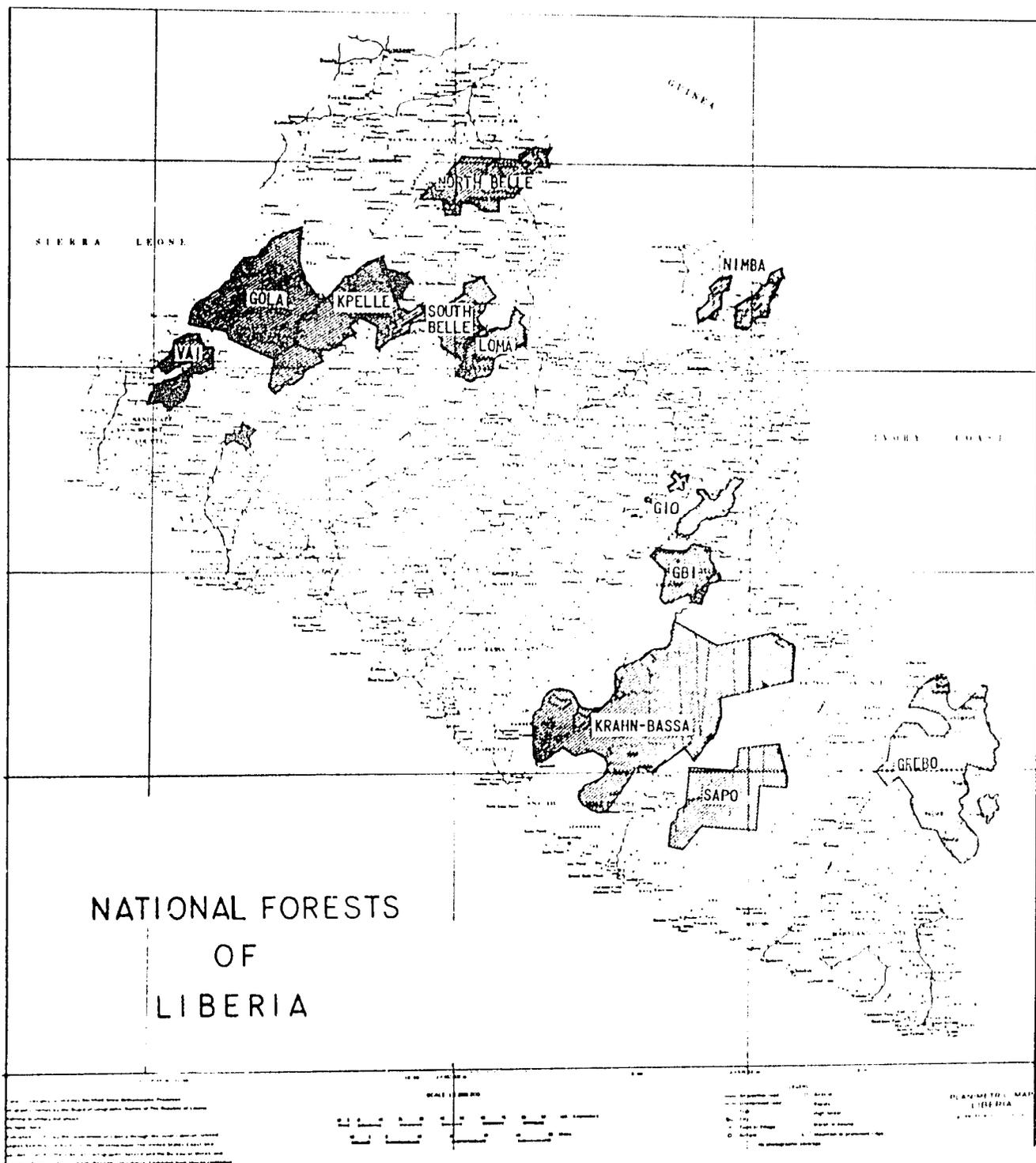


Figure II

When the writer was assigned as forestry advisor to USOM/Liberia mission in 1951, the most important work seemed to be to conserve the remaining virgin forest areas. However, much preparatory work had to be done before any boundary survey could be made for the purpose of establishing national forests. One professional forester and two untrained technical aides would not be able to make much headway on such a task, which involved surveying many hundreds of miles of boundary. A proposal was submitted to the Joint United States-Liberian Commission for Economic Development in November 1951 outlining a program for placing three to four million acres of high forest in national forests, as one means of assuring a continuing supply of high-grade timber products. Under this proposal, the United States Government would furnish through ICA several junior foresters to act as chiefs of field parties in establishing the boundaries of the national forests; the Liberian Government would furnish transportation and housing for these employees, Liberian forestry technicians, and laborers for the surveys. The Liberian Government expressed willingness to set aside \$25,000 yearly for this project. The Liberian members of the Joint Commission were unanimously in favor of the proposal, since they recognized the importance of halting the wastage of the nation's forest resources. It was especially urgent during the interim until transportation facilities were improved to the point where forests could be managed rationally and their products marketed properly.

Although great interest in the proposal for setting aside national forests was evident, the delay in the passage of the Forest Conservation Act postponed any action until the spring of 1953. However, before the passage of the Act, Hon. John W. Cooper, then Secretary of Agriculture and Commerce, suggested and President Tubman agreed that work should be started on a boundary survey of the first national forest. The President approved a small sum of money for the initial boundary survey of the Gio National Forest. This high forest area was selected for several reasons. First, the Gio Forest has one of the heaviest stands of timber in Liberia. Second, the timber species in this forest are generally of higher commercial value than those found in many others. Then, too, the writer's observations made on several trips proved that aggressive farming activities were rapidly destroying portions of the best timber there.

From aerial photographs made by the Aero Service Corporation of Philadelphia, Pennsylvania, which had flown over and photographed the entire country, a temporary boundary map of the forest was made to serve as guide for the survey; boundary lines were drawn in such a way that all current agricultural development activities were excluded from the proposed national forest. The actual work of

surveying boundaries was started during the latter part of April 1953 by a field party under the direction of the writer.

During the survey two Liberian aides received training in running the staff compass and using the surveying chain. After working on the survey for some time under instruction, the two Liberian aides learned the field work sufficiently well so they could handle the line establishment. About 20 men were employed cutting ahead of the front chain man, cleaning the brush from the path for sighting the compass, and finally clearing all underbrush from the boundary line, a six-foot path. On the boundary line, cola nuts were planted at intervals of 33 feet. The thought was that when cola trees were developed on the boundary lines, the country people in harvesting the nuts would keep the lines clean. Unfortunately, it showed later, that shade and root competition on these lines were so severe the cola trees did not develop properly. However, immediately after establishment of boundary lines it was noticed that hunters started to use the paths for hunting trails. Such use is being encouraged since persons travelling in the bush in Liberia always carry a cutlass. They cut off saplings and branches which interfere with their progress as they go and also so they can find their way out in case they should lose their directions. Another matter of interest was that when these boundary lines were revisited several years after, they were still fairly clear of vegetation. It seems that heavy shade in the high forest prevents fast growth of underbrush. However, wherever the boundary lines led through swamps, these lines were extremely difficult to keep clean. After experience on the Gio forest, few boundary lines were placed through swampy areas.

Although the men worked hard, it was possible to complete only a maximum of three quarters of a mile of survey line per day. Some delay was due to the swampy terrain which had to be crossed. At times there was a solid wall of saw grass, rattan, and vines in front of the cutters. The saw grass in particular slowed progress. This grass has knife sharp edges that will cut through the skin at the slightest touch, many times infecting the wound. The rattan, a climbing palm, has a stem covered with long sharp spikes and long sharp hooks on the tips of the fronds. Quite frequently, too, the thickets would be inhabited by large, red ants that seemed to take a delight in falling on and starting to chew the person struggling through the path. In high forest areas on dry land progress is more pleasant and it is possible to establish up to a mile of boundary line per day.

Running a boundary-line survey of this kind involves quite a logistic problem. The nearest towns are usually several miles away and can be reached only by following winding hunters' trails. Since there are seldom any farms in the vicinity, it is necessary to have along a large supply of rice and palm oil, which from time to time may be replenished in order to keep the workers supplied. Furthermore, since such a diet is not sufficient, usually a hunter is hired for procuring meat for the party. The amount of work the crew produces is dependent on the efficiency of the hunter. Usually the hunter brings in two monkeys or some deer each day, which is enough to provide meat for all. The workers have their main meal at night after work. This meal is prepared by the camp cook so it is ready for the men when they return from work just before dark. A light ration of rice and meat left over from the evening meal and smoked over the fire will be eaten before work starts in the morning.

On several occasions, President Tubman expressed concern over the state of Liberia's forest reserves and resources. In August 1953 at a council meeting in Tappita at which several district commissioners and more than 300 chiefs were gathered, he brought up the matter and spoke at length on the benefits to be derived from the forest. He discussed their possible revenue, their game as a food supply, and their general benefits for the people of Liberia through soil conservation and water retention. He urged everyone to grow rice in swamps, instead of cutting down the high forest for rice fields. Finally, the President asked all the chiefs who would cooperate with him in this conservation program to so indicate by a standing vote. He was answered enthusiastically by the chiefs all getting to their feet.

C. R. Lockard, Forestry Consultant, (6) pointed out in his 1953 report on forestry problems in Liberia that first priority in regard to the establishment of national forests should be dictated by agricultural pressure. If the establishment of national forests does not keep ahead of clearing for rice farms, large virgin forest areas will be destroyed and the permanent forest estate seriously reduced. Furthermore, Lockard noted that in order to get this work done, it would be necessary to assign an assistant forestry advisor and three forestry assistants in addition to the forestry advisor already in Liberia.

Based on this suggestion in part and further recommendations from various agencies interested in the project, USOM/Liberia decided to go ahead with the arrangement. Eugene W. Fobes, U. S. Forest Service, was appointed Assistant Forestry Advisor. He arrived in Liberia during the latter



This is but a glimpse of High Forest near the Loffa River in the Western Province.



This field crew was ready to take off for a neighboring town for work in the high forest.

part of December 1953. Arrangements were made to have three forestry assistants assigned to Liberia. During July and August 1954, Frank W. Lara, Robert A. Schirck and James A. White, U.S. Forest Service, arrived in Liberia for two-year assignments. Along with this increase in U.S. personnel a corresponding increase in Liberian forestry personnel was made.

The Liberian foresters were trained on the job while surveys were being made (see section below on education) until they could handle the work with little supervision by the American advisors. From 1954 to the present there have been from three to five crews in the field during each dry season. Since it costs about \$400 per month to keep such a crew going, it can be seen that the Liberian Government has spent a considerable amount of money on these surveys. By the end of 1959 the following national forests had been established (see Figure II).

<u>Name</u>	<u>Acres</u>	<u>Miles of Boundary</u>
NORTH BELLE	151,927	54.4
GBI	150,656	61.1
GIO	81,370	82.2
NORTH GIO	11,800	25.4
GOLA	511,485	67.4
GOLA YOMA DISTRICT	36,665	31.5
GREBO	643,266	185.5
MANO	400	4.5
KPELLE	432,000	119.8
KRAHN-BASSA	1,270,000	195.0
LOMA	107,500	42.0
	<hr/>	<hr/>
Total surveyed:	3,397,069	867.8
NORTH BELLE	80,964	27.1
NIMBA-EAST	76,598	50.3
NIMBA-WEST	34,680	28.4
SOUTH BELLE	164,283	57.2
SAFO	353,000	113.7
VAI	119,335	76.9
	<hr/>	<hr/>
Total mapped, but not yet surveyed :	828,860	353.6
GRAND TOTAL:	4,225,929	1,221.4

In order to facilitate the work of the crews and keep up the morale of the personnel, portable radio-telephones were acquired. These sets were manufactured especially for the USOM/Liberia by Radio Specialty Company, Portland, Oregon. A set in a wooden box weighs a total of 40 pounds. It is operated by dry cell batteries and has a possible range under good conditions of 200 miles. Each of the field crews was furnished such a set and each morning at a designated time contact was established between the crews and the main office in Monrovia. Although usually the crews were located in the high forest and had just stretched the aerial from one tree to another, contact was still maintained with them. Through this means of communication it has been



Tree length skidding with caterpillar tractors is the usual method used in bringing out timber. The trees are cut into logs at the landing.



A leader of a Boundary Survey Crew sights with a staff compass while workers clear the line already established.

possible to know when the crews were in need of supplies or funds or when special help was needed with the establishment of starting points or other technical matters. When it is considered that most of the crews were out for several months without interruption and during that time were located in the high forest, where they seldom saw anyone except the crew members, living almost constantly in the damp shade of the high forest, it was remarkable work. For the first few months American foresters were with the crews, but during the last few years almost all the work was done entirely by Liberian foresters. It is the hardship these men have endured that has created the "esprit de corps" that is so evident in the Bureau of Forest Conservation when compared to any other organization of the Liberian Government.

The national forest system is constantly being enlarged in order to serve the industrial development in Liberia. When Liberia Mining Company established itself at Bomi Hills, it erected a saw mill for the purpose of producing ties for the railroad and lumber construction. Many people settled along the road built from Monrovia to Bomi Hills. As soon as any logging was done by the saw mill, people would immediately come in and start rice farms; the areas were thus lost for future timber production. The situation got so serious due to the increased distance of the logging operation, that the Liberia Mining Company decided to move the mill. In order to assure a constant supply of timber, the Bureau of Forest Conservation suggested to the Company that a national forest be established, and that timber be furnished to the Company on a timber sales contract. In 1955 the Yoma District of the Gola National Forest was established for this purpose. This district contains 36,665 acres and is within six miles of the iron ore mine of the Company. This forest has been experimental in regard to maintenance of the boundary. A forest patrolman was assigned to the area to protect it against trespassing. On two occasions there was trespassing by farmers who tried to start rice farms within the forest. However, in each case the patrolman has brought the offender to the District Commissioner, who has cooperated and fined the farmer. As soon as this procedure was established, no more offenses were reported. The result is that the Liberia Mining Company is now producing timber under temporary management plans which should assure continuing production for an indefinite time.

Similar national forests are now being established for the Liberia Enterprises, Inc., another mining company that is ready to develop iron ore from a deposit near the Sierra Leone border; and for the Liberian American-



A boundary line after being cleared will stay clear for several years due to heavy shade from the trees above.

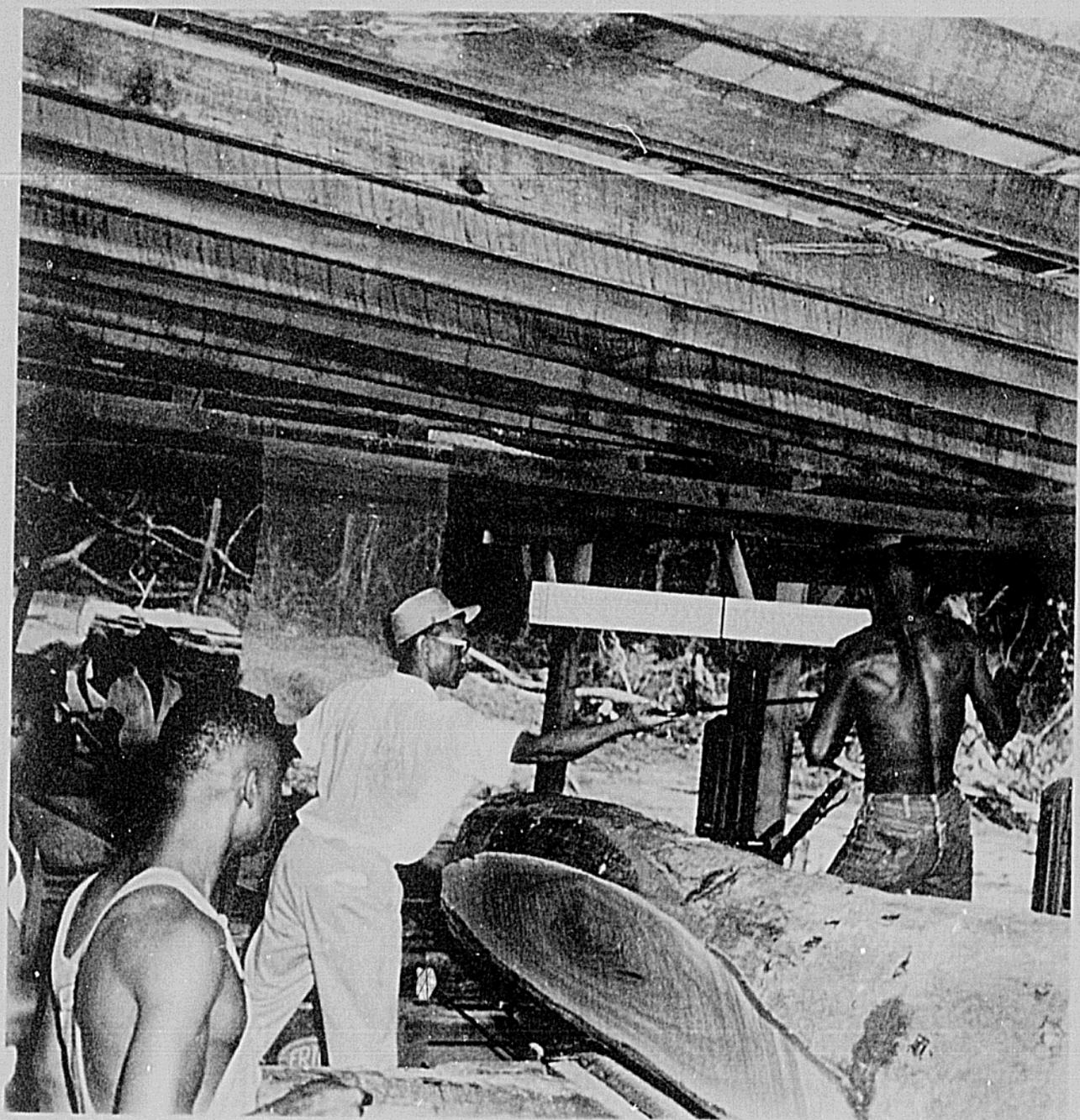


Sample plots are established on which volume estimates are made during the survey of boundary lines.



Logs are trucked down such roads as these from log landings to mill.

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The Liberian American Agricultural Industrial Corporation established this circular mill near Bopolu, Western Province.

Swedish Mining Company (LAMCO), which is to operate in the Nimba Mountains. These national forests, the Vai National Forest and the Nimba National Forest, are so large they will be able to furnish through sustained yield management all the timber requirements for these two enterprises.

In order to care for the increasing number of national forests, the Bureau of Forest Conservation has grown so that at present there are 70 employees. It is organized this way:

The Chief of the Bureau, Mr. Anthony T. Sayeh, has his office in the Department of Agriculture and Commerce; with him are various staff officers, who work as his assistants in various fields, such as the Information Office, the Program and Surveys Office, foresters who help with the National Forest Administration and the Inspection Service. The last two offices will dispatch foresters who will represent the Chief in any forestry matter of legal nature that may come before courts of district commissioners.

The Forest Utilization and Forest Management Branches use the knowledge gained by research conducted both in Liberia and other West African countries. In a region where little has been done in regard to economical methods for silvicultural management for insuring a sustained yield in forest areas, a real task confronts a Forest Conservation Bureau - a Bureau which was established to manage more than 4,000,000 acres of virgin forest. Although it is not intended that experimental research will be conducted by the Bureau, it will be the work of the Bureau to test on a production scale any experimental procedure recommended for forest management by the research branch of the School of Forestry. The Forest Utilization Branch will recommend to industry the uses of less known species based on experimental work done by the above mentioned research branch.

Directly under the Chief are the Provincial Foresters who are located in each of the provinces. Directly under the Provincial Forester are the forest guards and patrolmen who guard and inspect the boundary lines of the national forests and report to the Provincial Forester if any trespassing takes place. It is the responsibility of the Provincial Forester to inspect the boundary lines to assure their maintenance.

## FOREST POLICY AND THE DEVELOPMENT OF FOREST RESOURCES

Prior to 1951 when there were few roads, most of which were impassable during the rainy seasons, the forest resources were not accessible. Furthermore, the Liberian Government wisely had placed an export duty of 2 cents per board foot on logs and lumber, realizing that until a Bureau of Forest Conservation had been established, it would be best to place a prohibitive duty on export of forest products, thereby preventing the destruction of the forests. The result was that the forests remained in tact; a forestry organization was established for the wise use of the resource before any considerable commercial cutting took place.

In 1957 when the bases for a Bureau of Forest Conservation had been established and a start had been made on the surveying of boundaries for national forests, this prohibitive export duty had served its purpose. It was then repealed and replaced with an export duty or excise tax of \$5 per 1,000 board feet for export logs and \$3 per 1,000 board feet for partially manufactured forest products. This stipulation is a part of the "Act Supplemental to "An Act For the Conservation of the Forest of the Republic of Liberia." This supplemental act was passed and approved on February 28, 1957.

This delay in the exploitation of the forest resources has given Liberia the advantage of learning from happenings in other West African countries. During the last 25 years great volumes of timber products have been exported from countries such as Gabon, Nigeria, Ghana and the Ivory Coast. Although forest regulations were established in these countries, much destruction and depletion has taken place due to the fact that the central government in some areas has not had control over the forest areas.

In Ghana, for instance, considerable competition for land exists between the cocoa growing interests and the forest interests, with the result that much of the timber areas that have been allotted as concession areas for timber extraction to commercial companies have been taken over by the cocoa growers. Although the government imposed cutting regulations on the timber-using companies during the beginning of the contract, these were eliminated, the areas were considered salvage areas due to the encroachment of the cocoa growers. This meant that such areas are lost as far as future timber production is concerned. Not only will this have a serious effect on long-range planning for economical development based on renewable resources, but

it will also constitute a serious hazard as far as water conservation and climatic factors are concerned. Particularly in Central Africa this is a serious situation when it is realized that the desert areas steadily are encroaching on the savannah areas; these in turn are taking over forest areas, a process which has been particularly rapid during recent centuries.

It may be well at this point to examine what has happened to the vegetation belts in Africa during historic and prehistoric times.

The recent findings of rock paintings in the central Sahara, as described by Henri Lohte (5), have yielded considerable information. These rock paintings are located halfway between Tripoli on the Mediterranean coast and Gao on the Niger river in the Ahaggar and the Tassili-n-Ajjer mountains.

Although many cultural periods are represented in these rock paintings, it is possible to get a clear idea of the fauna which lived in this area in prehistoric times. The first period which is presented shows a great variety of animals such as elephants, giraffes, wild oxen, hippopotamuses, lions, warthogs and many others.

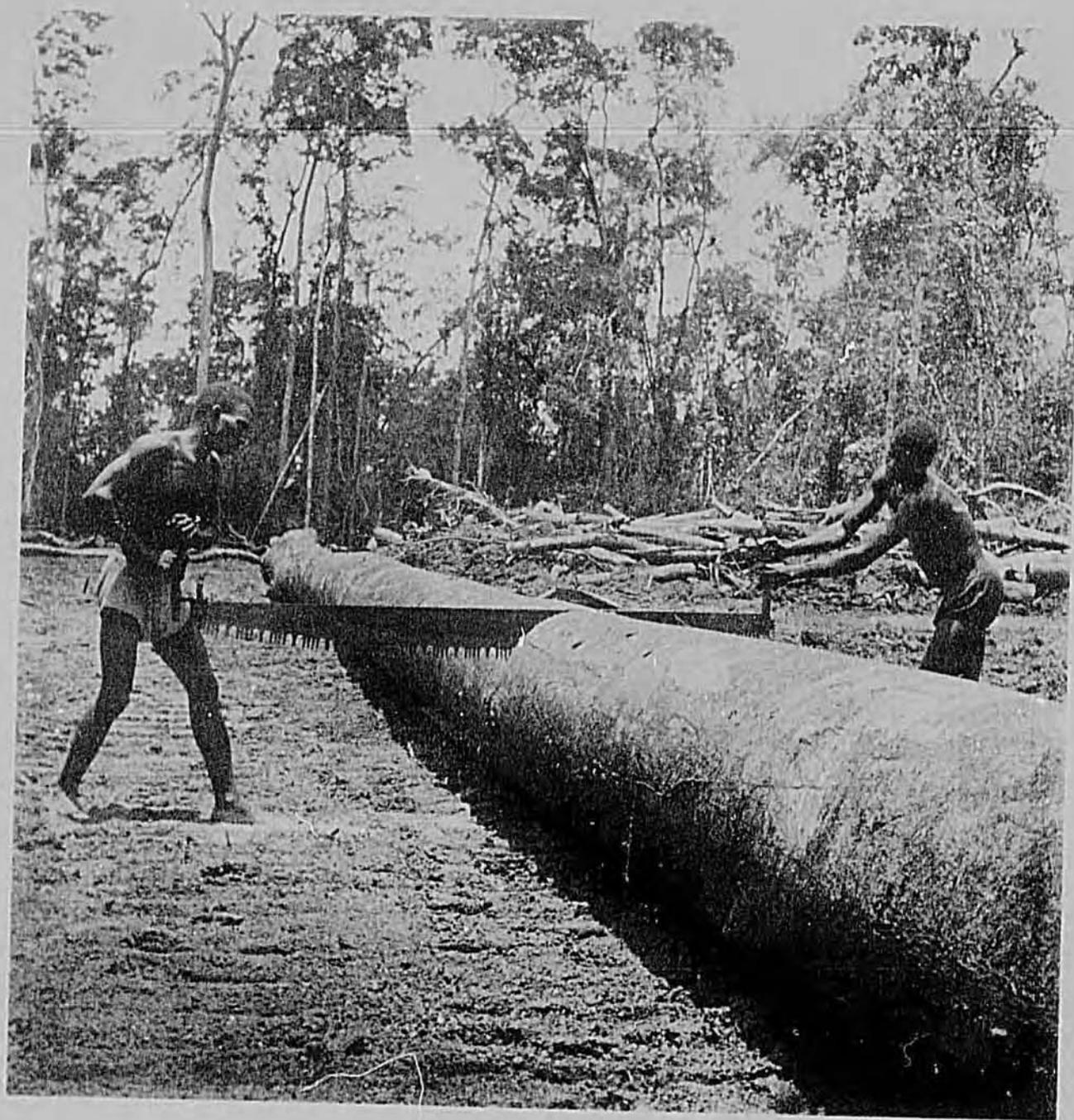
At about 3500 B.C. a new phase occurs which shows that great herds of domesticated cattle roamed over the areas. One large painting shows 65 head of cattle guarded by herdsmen.

Later paintings depict horse-drawn chariots and in the same paintings are also shown cattle, indicating that grazing of domesticated animals still took place at that time. It is known that horses first appeared in Egypt about 1800-1700 B.C. and that they were brought from Asia, which means that they probably appeared in the central Sahara at that time or later.

Based on these findings Lohte makes the statement, ".....that the evidence of the cattle pictures is so significant, for we are surely justified in thinking that the presence of oxen must have been fatal to the vegetation. We can, indeed, see today in the Sudan steppes how vegetation fades away in areas where herds of cattle graze..... Herdsmen have ever been the great destroyers of vegetations and if we admit (as the evidence of the Tassili paintings suggests) that thousands of oxen wandered about in the Sahara for thousands of years, we may well assume their destructive action to have been so great that it contributed largely to the desiccation of the whole region. It



This 5-year old Sipo Entandrophragma utile (Dawe and Sprague) Sprague was planted in high bush under fairly open crown cover of Parinari excelsa Sabine .



A tall tree of *Tetraberlinia tubmaniana* Leonard is being bucked into logs. Long straight stems are characteristic of this species.

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would, of course, be absurd to regard cattle as solely responsible, climatic changes being the prime cause, but they played no small part."

E. W. Bovill (2) states: "The desert is also rich in rock drawings which, like the Roman mosaics of the north, show that at one time the country had a rich and varied fauna, comparable with that of central Africa today. It included the elephant, rhinoceros, horses, goats, sheep, and cattle. These drawings also picture horse-drawn chariots as described by Herodotus, and may therefore be contemporary with the recorded history of the north. This, and the close correlation of the residual fauna of today with the animals shown in the drawings, suggest that the Sahara was possibly less arid in the days of the Carthaginian and Roman occupations of the Maghreb than it is today."

Considering this evidence of a more flourishing vegetation in former times in Africa, and realizing that the drying out of the savannah is still taking place, it is of the greatest importance that the remaining high forest is protected since it virtually is only a small remnant of what existed centuries ago. Countries in West Africa should join in the effort of conserving the remaining forest area and thereby protect the countries from floods, erosion, and possible climatic changes. Liberia has a great opportunity to take the leadership in this effort since she still has large forest areas and through the establishment of a College of Forestry and a vigorous Bureau of Forest Conservation, has shown the awareness of this serious challenge.

Another reason for the deterioration of forest resources in West Africa is that only a few of the many timber species available are being utilized, while the larger part of the volume in the forest stands remains; most of the available species do not have an export market. This means that the residual stands will contain a much smaller amount of the premium timber species than the original ones.

With the expansion of the road system and the improvement of roads in the Western province, almost all of the Central province and part of the Eastern province are now open. Through the establishment of several ports along the Atlantic coast and with the possibility of having the contemplated railroad from Buchanan to Nimba mountains opened for use as a public carrier, large areas of the forest resource are accessible.

Due to these developments which have made possible economic development of the forest areas in Liberia, a good response from timber-using industries has been shown. During the last few years in Liberia several large companies have been established through concession agreements and are now ready to utilize part of the timber available in the vicinity of the transportation system.

It is a great credit to the Liberian government that the multiple uses and benefits of the forest resources are realized; as is shown in the forestry legislation that was passed in 1953, and in 1957 in addition to strong support that has been given the newly established Bureau of Forest Conservation in the Department of Agriculture and Commerce.

It is indeed fortunate that the President, his cabinet and many others in Liberia are aware of the many benefits that are derived from the forest resources. A definite desire has been expressed to conserve these values. In a country like Liberia that is crossed by numerous rivers and streams, many of which originate within the country, serious damage through floods and erosion would result, if the restraining effect of forests on water flow was eliminated. As it is now, even if there is a great difference in the flow of water between the rainy and dry seasons, there still is a considerable flow of water in the rivers during the height of the dry season. Without the water retention and its water conserving effects of the high forest areas, this would definitely not be the case. As mentioned in an earlier chapter, there has been some encroachment of the savannah in the northeastern part of the Western province due to upland rice farming and because the rainfall in this area and general moisture of the soil are so low that volunteer trees do not come in after agricultural activities have started. While flying from Monrovia to Kolahun in the Western province, it is evident the forest stands lose their density on approaching Kolahun; elephant grass rather than tree growth take over the abandoned upland rice fields.

This should be interpreted as a danger sign; if possible it would be well if the Government of Liberia could establish regulations that would restrict future farming activities in this particular section to areas that have already been farmed and decree that any high forest area that now exists should remain as such, and not to be destroyed. This would create a natural barrier against the further advance of the savannah vegetation with its constant danger of extended and uncontrolled fires during the dry season; it would, furthermore, have a strong controlling influence on the flows of the rivers originating or running through this province.

The policy of the Government of Liberia in regard to the exploitation of timber resources is to utilize first those that are outside the national forests before cutting takes place within the national forests. Based on estimates made by Mayer (7), more than 4 million acres of virgin forests are located outside the national forests. The reason these have not been incorporated into the national forests is that the areas are interspersed by agricultural developments and small villages, which otherwise would have been abandoned. Such a situation is advantageous to any commercial development, since there will be labor available in the villages. At present the timber industry in Liberia is not very well developed. Most of the established sawmills are owned by companies whose main interest is to provide lumber for their own use.

Recently some sawmills have been set up in the vicinity of Monrovia with the intent of supplying lumber to the local market. At present the local requirements in Monrovia and vicinity amount to approximately 6,000,000 board feet annually. Lumber is furnished from the band mill owned by Liberia Mining Company from where any surplus, that is not used by the Company, is sold in Monrovia. The Liberia Industrial Forestry Corporation which owns a band mill in Monrovia and a circular sawmill in the vicinity of Bomi Hills, provides lumber and construction timber for the local market. This company recently established an export trade of logs and timbers of Azobe to Denmark and Holland. During the last couple of years the Liberian American Agricultural Industrial Corporation has been operating a circular sawmill in the vicinity of Bopolu, from which place lumber and construction timber has been shipped to Monrovia. This company is ready to establish a pressure treating plant and will soon go into the manufacturing of railroad ties for local consumption. The total production that is sold in Monrovia from these companies does not amount to much more than 2,000,000 board feet or about one-third of the consumption. The result is that anything that is cut can be sold green on the market. Cured local lumber is not available. The going price at present is \$120.00 per M board feet for mill run of mixed species while special species usable for furniture manufacturing sell for \$150.00 per M board feet.

In addition to the sawmill produced lumber a large quantity of pit sawn lumber is being sold. This lumber which comes from different species and usually from relatively small trees is very seldom accurately sawn. There may be a variation of as much as one-half inch on a two-inch plank. However, still the price obtained is about \$120.00 per thousand board feet.

Firewood is in considerable demand within the cities of Liberia. Almost all cooking is done over wood fires except in the modern homes. Firewood is carried as headloads to the roads and then from there by truck to the cities. A standard cord of firewood sells from \$10 to \$15 in the cities. Any sawmill located within reasonable shipping distance of a larger population center should find a ready market for its slabs and edgings.

Through the passage of the Forest Rules and Regulations certain stipulations govern all timber cutting in Liberia, both in concession areas and in the national forests. These stipulations specify the lower diameter limits to which the various timber species may be cut. These limits are quite liberal and will not interfere with any well-managed timber operation. The Rules and Regulations also provide that any forest area that is being operated for forest products shall remain in forest production and cannot be cleared for agricultural purposes. This regulation is in effect both for private timber concessions and the national forests. On a concession area it is up to the concessionaire to have the boundary lines surveyed and patrolled. It is the concessionaire's responsibility to see that no trespassing takes place and that no clearings are made. On the national forests, the boundary lines already have been established and forest patrol men have made the farmers acquainted with the lines. The areas outside the national forests, however, are usually better located in regard to transportation facilities and will, therefore, be of greater attraction to the timber-using industry. Furthermore, timber concessions are normally granted for a period of 40 years with a renewable clause allowing an additional 20 years. A timber sales contract is granted for a much shorter time.

According to the supplementary act for the conservation of the forest of the Republic of Liberia, Section 10 (b):

Any timber product cut for commercial use and sold whether locally or for export will be assessed a stumpage price or excise tax in the sum of \$3 per thousand feet for lumber, planks, timber or partially manufactured products and \$5 per thousand feet for logs intended for export.

This is the only tax there is imposed on any timber operation that takes place within the national forests. On concession areas there is an additional

land use tax that ranges from 6-10 cents per acre per year. In addition, any company operating in Liberia is subject to the ordinary corporate taxes. This tax at present amounts to 25 percent.

As mentioned earlier, the forest stands in Liberia are composed of many species, some of which have not yet been recognized on the world market, while others have been used for many years. Testing and research have already shown that many of the species not yet in use commercially have special uses; they may prove superior to most of the recognized species. On the other hand, it is not possible to state that certain species are found in specified amounts in particular areas; no detailed surveys have been made. It can be stated, however, that per acre the volume of trees above 24 inches in diameter range from 10 M to 20 M board feet and that about 20 percent of this volume is of trees now recognized on the world market as furniture woods. Within about 50 miles of the coast the major volume of timber is distributed among a smaller number of species than farther up country. A timber industry which considers coming to Liberia should investigate the possibility of utilizing as many as possible of the available species reaching commercial size, since selecting only one or two species of high commercial value will not create an economical operation. It will be desirable to investigate markets not only in the United States but in North and South Africa and Europe before a large-scale operation is undertaken in Liberia. This is particularly true because there are prospects of a favorable future market in Europe for planks and other heavy construction materials. Such materials can easily be produced from many different species in Liberia. Some of these species have been tested both by the Forest Products Laboratory, Madison, Wisconsin and by British and French tropical forest products laboratories. They were found to have greater strength in comparison to their weight than American red and white oaks. Many of them have a structure which renders them suitable for preservative treatment. Where the European market is concerned, the geographic location of Liberia is most favorable; it is the nearest source of tropical timber products.

Since most of the species that are exported from Ghana and Nigeria to the United States and Europe grow also in Liberia, it may be worth the time and effort expended to compare the forest resources in Liberia with those in Ghana and Nigeria.

An interesting statistical analysis of the forest areas in Ghana and Nigeria has been presented by Buckle (3). Compare the figures for the forested areas of these countries with the areas given for Liberia by Mayer (7).



The high forest consists of trees of all sizes.  
The tree in the center is a Red Ironwood  
(Lophira procera).

30-a



Main highway entering Gbanga. Remnant  
of high forest (Piptadenia africana) still  
present.

	Liberia	Ghana	Nigeria
Area within the rain forest belt, acres:	23,800,000	19,200,000	28,160,000
Closed forest areas, acres:	8,950,000	6,791,400	6,765,000
Forest reserves in the rain forest belt, acres:	4,226,000	3,840,000	2,472,300

It is interesting to note that in 1947 the closed forest area in Ghana was estimated at 10,816,000 acres, which was reduced to 6,791,400 acres in 1957. The reduction in area is, according to Foggie (4), caused entirely by clearing for farming and not by harvesting timber. The value of the timber export from Ghana in 1957 based on F.O.B. value amounted to £10,000,000 (\$28,000,000).

Based on these statistics and realizing that the composition of the forests in Ghana and Liberia are similar, it indicates that Liberia is indeed a very potential timber producing country.

Foggie (4) further estimates that by 1976 all the unreserved forests of Ghana will have been fully exploited and will not be able to furnish further products for export. By that time he estimates the reserved forest in Ghana will be able to take care of the local consumption only. This again will place an additional burden on the forests of Liberia. The 1957 export of timber products from Ghana amounted to about 250,000,000 board feet. Foggie (4) estimates that this export will come to a halt within twenty years.

Based on the growth figures applied to annual forest growth of twelve commercial species in Ghana, it can be estimated that the national forests in Liberia will annually produce a minimum of 430,000,000 board feet when all forests are under management. This figure would be greatly enlarged if all commercially-sized species were taken into consideration. With the efforts of the Government of Liberia to enlarge the national forest area by applying the same rules and regulations to concession areas as to the national forests, the production figure will be greatly increased for the entire country.

The concession areas eventually will be incorporated into the national forest system after the concession agreements expire.

The German Economic Aid which starts in 1960 is expected to inventory the national forests in Liberia. This inventory will be of great value both to the coming timber industry for which it will serve as a guide line, and for the Bureau of Forest Conservation which can then make management plans for continuing production of timber from the national forests.

### EDUCATION OF LIBERIAN FORESTERS

In 1951 Honorable Stephen Tolbert was the only professionally trained forester in Liberia. He received his training at the University of Michigan and finished with a Master's degree in forestry. Upon his return Mr. Tolbert was made Assistant Secretary of Agriculture. This position placed him in charge of the promotion of forestry. It was through Secretary Tolbert's interest in forestry that technical aid in this field was requested when the projects were outlined under the general agreement between the United States and Liberia.

When the additional American forestry advisers arrived in 1954, new Liberian foresters were recruited and trained.

In order to secure the best talent of the younger Liberian generation, entrance examinations were given to applicants between eighteen and thirty years of age, who had graduated from high school and contacted the Liberian Department of Agriculture and Commerce for positions in the forestry program. On two occasions a total of 135 Liberians were tested by having them take "The Modern Achievement Test" established by Teachers College, Columbia University. The subjects which were tested were: Reading Speed and Accuracy, Reading Comprehension, Arithmetic Computation and Reasoning, and Spelling. The greatest deficiency in Liberian high school graduates lies in the reading speed, which generally is about sixth grade level. Arithmetic computation, however, was generally rather high. Competence in mathematics has shown itself later in work of the aides in that a generally high comprehension and accuracy was the rule.

The names of the candidates who obtained the highest grades were submitted to Secretary Tolbert along with testimonials from former employees of the applicants. The accepted candidates were selected entirely from these records.



The faculty and the 1959 graduating class of the School of Forestry, University of Liberia, get together on commencement day.



President William V. S. Tubman presents a diploma to George Okoye, member of the first graduating class of the School of Forestry.

Immediately following recruitment, USOM foresters conducted an indoctrination course for the technical aides in which fundamental forestry subjects were taught. Furthermore, based on the entrance examination the educational weaknesses of the individual aide were brought to his attention and training in the particular subjects was emphasized. Text books in various forestry subjects of special interest to the aides were made available to them, when they were not otherwise engaged. Comprehensive testing of the abilities of the aides has been done from time to time with the result that most of the personnel have shown improvement.

Since the major part of the work of the forestry section at that time was concerned with the establishment of national forests, emphasis was put on surveying with staff compass and chain, and interpretation of aerial photographs and mapping. Furthermore, introduction in dendrology, wood identification and forest mensuration were introduced, so the aides would have a foundation on which to build while they were getting on-the-job training. Since survey crews were working during the dry seasons delineating boundary lines for the national forest, the aides were made crew members so they could learn from the procedure used through actual work. After some days of instruction in work with survey crew leaders, the aides were able to perform some of the duties. When they were well acquainted with one phase of the survey work, they were transferred to another. In addition, in order to teach them the organizational work of administering a field crew consisting of twenty or more workers, all the work in connection with the management of the camp and crew was turned over to the aides.

Each day a different aide was camp director and had to look after the problems which arose, such as giving out the rice to the workers, seeing to it that there would be enough provisions for the next day, sending out a purchasing crew to the nearest town, settling minor disputes among the workers, keeping order in the camp and seeing to it that the camp was properly swept and cleaned, and that the workers reported to work on time. All such functions require tact and understanding of the customs of the Liberian country people. For a young Liberian who may have lived most of his life in one of the cities and who has had no experience in supervising personnel, these things are not always easy to do, particularly since city people and country people in Liberia generally differ in ways of life and habits.

While several misunderstandings developed in the beginning, when the Liberian aides were placed in charge of camp management, these matters were settled and mistakes corrected. After a time an understanding developed between the aides and the workers and everything went more smoothly.

While in Monrovia the aides participated in the planning and preparatory work in connection with the boundary surveys. They received training in using aerial photographs and in interpreting information from these in regard to forest conditions and topography. All the detailed mapping and computation prior to the surveys, closing the surveys and drawing the final maps were done by the aides under close supervision of the American forestry personnel.

In addition to this technical work, the training program has also emphasized the necessity of the aides performing the phases of manual work necessary to forestry activities. They have participated in actual planting work where each aide received an assignment to plant a certain number of trees; they have helped in establishing nurseries by working with shovels and rakes while forming nursery beds; and they have planted the seed and weeded the nursery beds, so they know how this work is done. The thought behind this is that no one can instruct a laborer in doing things properly without first having done it himself.

It was highly advantageous to have three young American forestry assistants as members of the USOM forestry team. These foresters, who were about the same age as the Liberian aides, were assigned certain Liberian aides for a limited length of time after which a change was made. These associations have been helpful in bringing about discussions on forestry. A mutual understanding and respect have developed between the American foresters and the Liberian forestry aides in spite of their completely different backgrounds. After the initial training the Liberian foresters were divided into smaller groups, each of which had one U.S. forester as chief of party. This training continued for several years. Now the Liberian foresters are able to do the work themselves with a minimum of supervision.

After on-the-job training had been in effect for a time, and 10 young Liberians had received intensive training by working with the American forestry technicians on surveys and other forest projects, it became evident that the Liberian aides were capable of assimilating and applying technical forestry knowledge. It seemed logical to investigate the possibilities of establishing a formal training course in forestry in order to build a profession of forestry in Liberia. It was deemed necessary to have such a profession here in order to bring about the proper respect for forestry and to place it on the same level as the medical and law professions; the forest resources of Liberia are of such magnitude and great potential importance to the country. Without such a status it would have been difficult to promote the forestry program in Liberia and to have assured the reforms to progress necessary to its success.

At an early stage of the work it was recommended that some of the Liberian forestry aides, who had shown considerable aptitude, be given

scholarships to attend American forestry schools. However, it was realized that with the expansion of the forestry project, many professional foresters would be needed after the contemplated 4,000,000 acres of national forests and timber-using industries were established in Liberia; factors which would require application of management to the forest areas. Education of qualified Liberians in forestry schools in the United States is very expensive. Furthermore, although this education is excellent, it would still be necessary for the graduate to spend considerable time in the field in Liberia before being able to apply the knowledge acquired in the United States, where forestry conditions are different. Since it would be impossible to send a large number of Liberians to the United States, it was suggested that instruction in forestry be established at the University of Liberia. This plan would give many students a forestry education at much less expense per student. As an added advantage, it would also give the students the training and knowledge of forestry conditions of the region; something they would otherwise have to spend additional time to acquire if educated abroad. Such a professional school could be self sustaining as far as instruction was concerned, since some of the best qualified students could take over the instruction after acquiring practical experience and perhaps additional training abroad.

The matter was discussed with Secretary Tolbert who placed his influence behind the proposal. On January 19, 1955 the matter of founding a School of Forestry was presented to the Administrative Council of the University of Liberia by Secretary Tolbert and the writer. The Council approved the matter and referred it to the Board of Trustees of the University. After this proposal had been approved by the Trustees the curriculum for the first two years of study was adopted. It was based largely on curricula of American forestry schools, though most of the non-forestry courses were fitted in with the courses already given at the University of Liberia. In February 1955 the School of Forestry started with 12 students registered as freshmen.

In order to provide instructors for the forestry school, Secretary Tolbert contacted United Nations agencies such as UNESCO and FAO. Honorable Nathaniel Massaquoi, then Assistant Secretary of Public Instruction and Liberia's representative to UNESCO in Paris suggested that this organization furnish instructors for the School of Forestry. However, since UNESCO is mainly interested in furnishing instructors in the basic sciences, the matter was referred to FAO in Rome. During a meeting there, where Honorable

Tolbert represented Liberia, the matter was brought up and help was promised. However, due to previous commitments it was not possible for that organization to furnish any help until February 1956. From February 1955 and for a year thereafter, Secretary Tolbert and the USOM foresters were instructors in several courses such as Introduction to Forestry, Biology, Forest Mensuration and Mechanical Drawing. Further delays in the arrival of FAO instructors resulted in USOM foresters again carrying the instruction during the first half of 1956. During this year the Introduction to Forestry, Biology, Forest Botany, Forest Surveying and Mechanical Drawing were again taught by USOM foresters. This effort paid off; from then on FAO professors took over. From 1956 to 1958 two FAO professors took care of the instruction; from 1958 on there have been four FAO professors to give all the forestry courses.

In September 1959 Mr. Edward Benson returned to Liberia after having gained a bachelor's degree in forestry at Michigan State University. Mr. Benson has now joined the staff at the College of Forestry, University of Liberia.

On November 25, 1959 the first six students received their degree of Bachelor of Science in Forestry. The President of the Republic of Liberia was present at the graduating exercise and personally handed the diplomas to each of the graduates.

Immediately upon graduation the new foresters were employed. Five of them were engaged by the Bureau of Forest Conservation in order to raise the standards within the Bureau. The sixth forester was engaged by Firestone Plantations Company as an assistant superintendent, who may after a period of two years work up to the level of an American or European superintendent engaged by the Company.

In order to raise the standards of the sub-professional foresters, who have been with the Bureau for several years and on whose shoulders the burden had rested in regard to the establishment of the national forests, several were sent to Puerto Rico to the Tropical Forestry Short Course being given by the U.S. Forest Service. After spending three months in training there, they were sent on observation tours in the United States under the guidance of the U.S. Forest Service. During their stay in the United States, they received instruction in administrative procedures in connection with the management and administration of national forests, or studied utilization in timber-using industries at the Forest Products Laboratory at Madison, Wisconsin. These

foresters, who have shown initiative and ability are now being placed as Acting Provincial Foresters or staff foresters in the office of the Chief of the Bureau. It is believed they will be able to work alongside the Liberian trained professional foresters since they have had long service and added experiences abroad. In the future, however, only professional foresters will be hired by the Bureau for supervisory positions.

Through the energetic leadership of Mr. Anthony T. Sayeh, Chief of the Bureau, this organization has grown and is functioning very effectively. The Bureau has 70 employees, the major part of whom are forest guards and patrolmen. The professional foresters will be manning the Forest Utilization and Forest Management branches and report directly to the Chief.

The College of Forestry, the only professional forestry school in tropical Africa, is now in position to attract students from other English speaking countries in Africa. Plans are being formulated and funds have been made available by ICA for the construction of a forestry building which will house both the college and research laboratories and facilities. Here the forestry professors and Liberian technicians will have the opportunity to conduct research. Considering Liberia's vast, untouched forest areas, this institution offers good opportunities to add to the knowledge of management of forests in West Africa and utilization of many of the species that are still unknown on the world market. This thought was further strengthened when President William V. S. Tubman in his inaugural address on January 4, 1960 expressed himself as follows:

"We propose a detailed survey of the resources for education, training, and research which exist in Africa and we suggest the pooling of those resources so that each nation might have access to existing institutions of education and training and contribute to their support, enlargement and improvement in proportion to its size and ability to use such an institution. For example, Nigeria has the Medical School at Ibadan; Ghana, the new business administration course at the University; Liberia, the new Forestry School and Guinea, the Mali Federation and other African States with such specialized institutions as they have, without committing any unit to refrain from establishing such schools for themselves later (the need will increase with time for more and more schools so this seems inevitable), the purpose would be to enlarge and make widely available the facilities which now exist."



When planting in low bush areas, lines require continuous cleaning.  
In the foreground a Niangon, Tarristia utilis Sprague, has survived the  
dense shade.



When timber is cut to a diameter limit in an even-aged stand of *Tetraberlinia tubmaniana* deconard only a few trees remain. These trees will be cut and burned next, (Stage I in the Taungya System).

## FOREST MANAGEMENT AND WOOD UTILIZATION RESEARCH

Arriving in a strange country where no one can help with the identification of tree species poses a problem to a forester. This is especially true if there are no books available on local flora and the only reference books of any value have been written on the flora of neighboring countries. Furthermore, for the forester who is interested in immediate identification, books dealing with dendrology and systematic botany are of little value, since most of the characteristics used in identification relate to the structure of flowers and fruits. Flowers are almost impossible to obtain in the virgin tropical forest, and only periodically is it possible to collect fruits. These characteristics, however, may be useful on logging operations when it is possible to examine the tops of the trees. Mayer (7) was able to identify about 200 tree species attaining 12 inches or more in diameter through continued efforts during his more than two years in Liberia. Much of the herbarium material which Mayer collected was photographed and served as a final check on identification for the writer, when he worked with the dendrology of Liberia. The largest wood collection available on Liberian tree species is the collection of 138 wood samples at Yale University, collected in 1928 by G. Proctor Cooper. In order to make available the information which could be obtained from these wood samples, a card sorting key was constructed. The basis for this key was the macroscopic wood characteristics. McBee sorting cards with perforated edges were used, with one wood characteristic assigned to each of the perforations. About 125 wood samples were sorted and recorded in this way and a complete check was made of the keyed data on the cards against the wood samples before the cards were taken to Liberia.

It was found that by cutting out a small wood sample from the tree and using the wood identification card sorting key, it was possible to identify many of the Liberian species. As an initial means of identification this aid served exceedingly well. However, without the valuable help extended by Dr. and Mrs. George W. Harley at the Ganta Methodist Mission in Liberia, this identification work would have been prolonged considerably. Dr. and Mrs. Harley have made extensive botanical studies; through the saw milling activities at the Mission Dr. Harley has acquired a comprehensive knowledge of many Liberian tree species.

Identification of timber species in a country like Liberia leads to great surprises. For instance, for many years Liberia Mining Company has been

cutting and utilizing a timber species which has only been known as "African Pine" although it has no relation or resemblance to the conifers. Several attempts had been made to identify the species without success until in February 1954 a sample of the wood was brought to Centre Technique Forestier Tropical at Nogent-sur-Marne, France for identification. Not until July 1957 could the flowers of this species be obtained, which made it possible for the Center through the effort of N. Didier Normand (9) to identify the species. Since the species was found first in Liberia and is an economically important species, it was named *Tetraberlinia tubmaniana* with the consent of the President of Liberia, William V. S. Tubman. Undoubtedly, there are many other unnamed species in Liberia which later will be found, identified and utilized.

Much thought has gone into regeneration of tropical forest stands in various parts of the world. In West Africa Taylor (11) has developed a tropical shelter wood system for Ghana. This system, which specifies various cuttings for a number of years for the purpose of bringing forth regeneration of commercially valuable species, has been tried out on an experimental basis with favorable results. Bergeroo-Campagne (1) in the Ivory Coast has described enrichment planting done there as a means of increasing the percentage of commercially valuable species.

In Liberia experimental work in regard to methods of improved regeneration has been started during recent years by the USOM forestry staff. Several plantings of valuable species have been made under various conditions. It has been found that the growing characteristics of Liberian timber species varies and that the selection of species for different conditions is of great importance.

In this connection it can be mentioned that in pilot plantations done for observation purposes, the most successful ones were planted according to the so-called Taungya system. This system is used in conjunction with the common practices of farmers in growing rice crops. On forest areas that may have been logged, but where little valuable reproduction is in evidence, farmers are allotted a certain portion on which to perform their usual practice of cutting down and burning the remaining trees. After the area is prepared for planting rice, which is done by seeding, the Bureau of Forest Conservation personnel will stake off the area, usually at a spacing of 16' x 16', and plant either striplings or seed at stake. The farmers will then seed their rice,

leaving small clear areas around the stakes. This planting takes place during April and May, at the beginning of the rainy season. During the following months both rice and tree seed will germinate and the trees will get established. The rice is normally cut in October and November and the area is then abandoned by the farmers. In order to enhance the chances of success it has been the practice to place five seeds around each stake. The result has been satisfactory; about 57 percent of the stakes have had live plants growing during the middle of the following dry season. Although it may be necessary to do some re-planting where larger areas are without tree seedlings, there seems to be enough volunteer growth of valuable species so that in most areas additional planting will not be needed. Utilizing this method it is possible for the tree seedlings to get a start before volunteer weeds take over the area. It can only be done with fast growing species such as *Framire* and perhaps a very few other species.

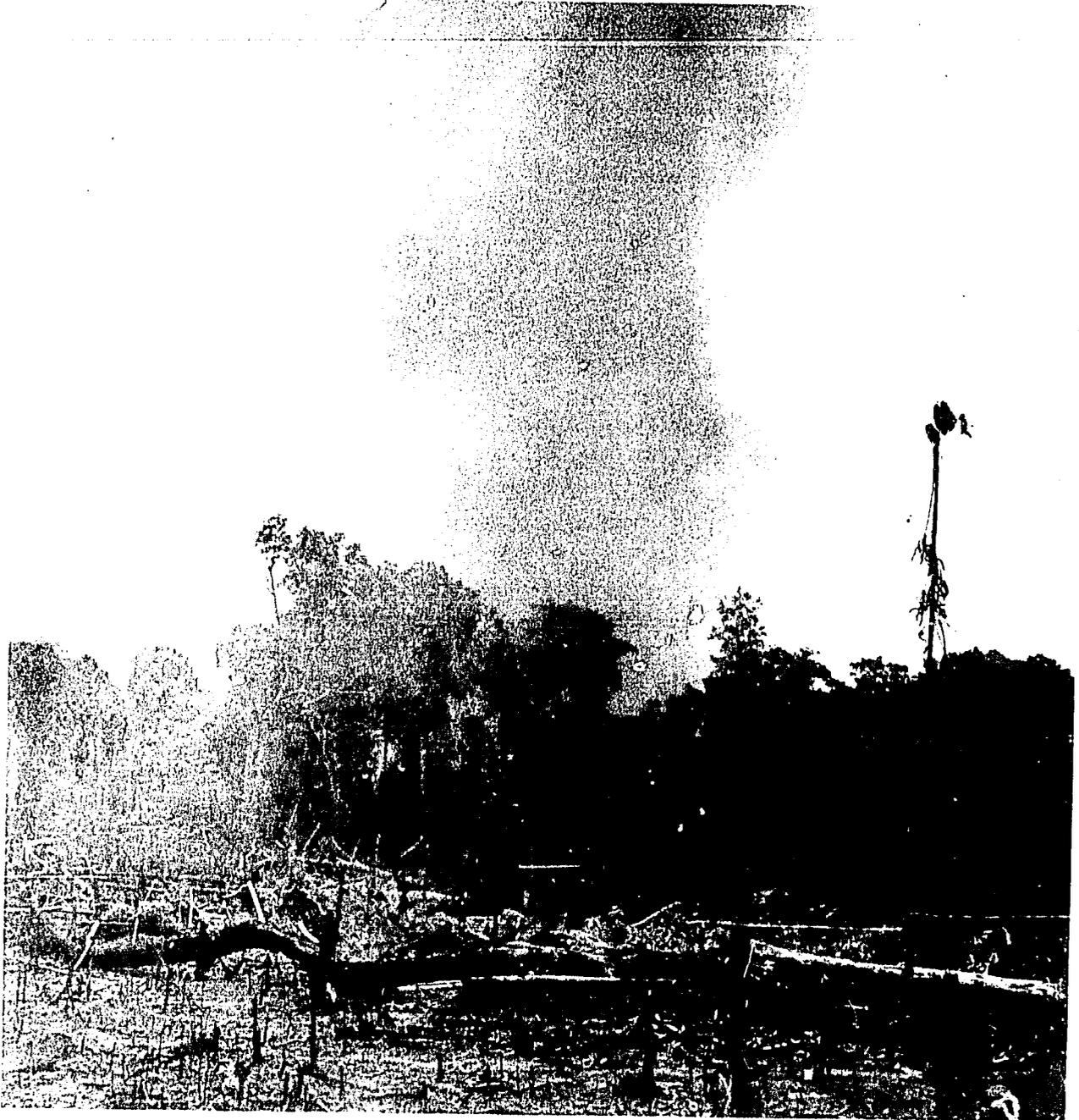
In order to explore the possibilities of enrichment plantings, trees have been planted in lanes that have been cut through low bush areas. The plantings were successful and a large percentage of the trees survived the first year of growth, but it has proven very expensive to release the planted trees from the volunteer growth, since the latter grow much faster than most planted trees and cleanings are needed several times during the year.

Recently experimental enrichment plantings have been made in high forest areas for the purpose of observing the growth of various species under shade. Although the oldest of these plantings are only four or five years old, excellent results have been obtained through planting *Khaya ivorensis* and *Entandrophragma utile*. These trees have reached up to 40 feet in height and do not show any damage from insects or other pests. Although the growth has been remarkable during the past years, it may take some release cuttings so these trees will continue to grow.

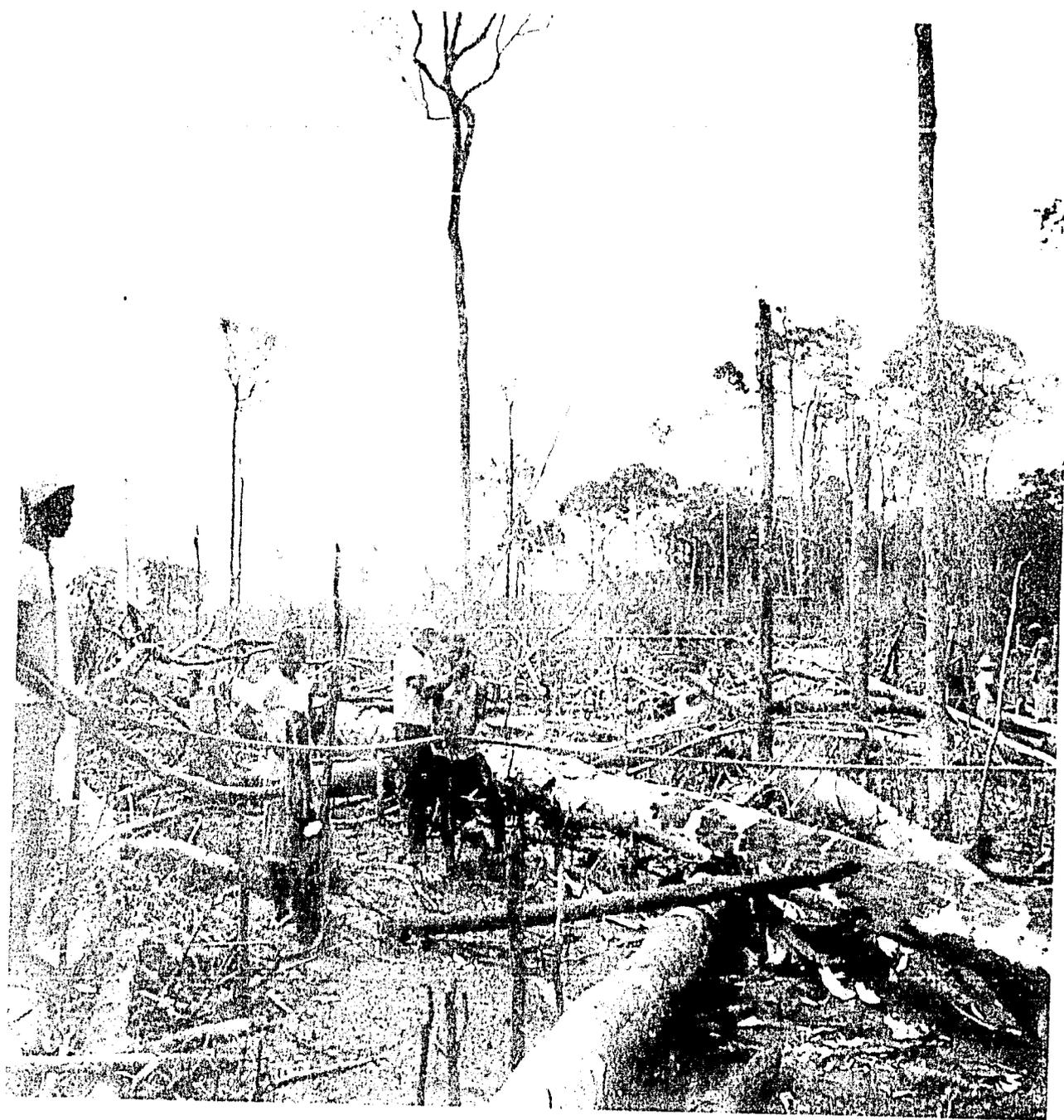
Dr. George W. Harley, who cooperated with the forestry research effort in Liberia before his retirement, had established some successful plantations of *Khaya ivorensis* and *Tarrietia utilis* in low bush areas by cutting lanes through and planting the trees in these lanes. Although the planted trees have been outgrown by the volunteer growth, still excellent growth has been obtained; both species are rather shade tolerant. However, in order to bring these trees to greater size, it will be necessary to make release cuttings at a later stage in order to make available more space.



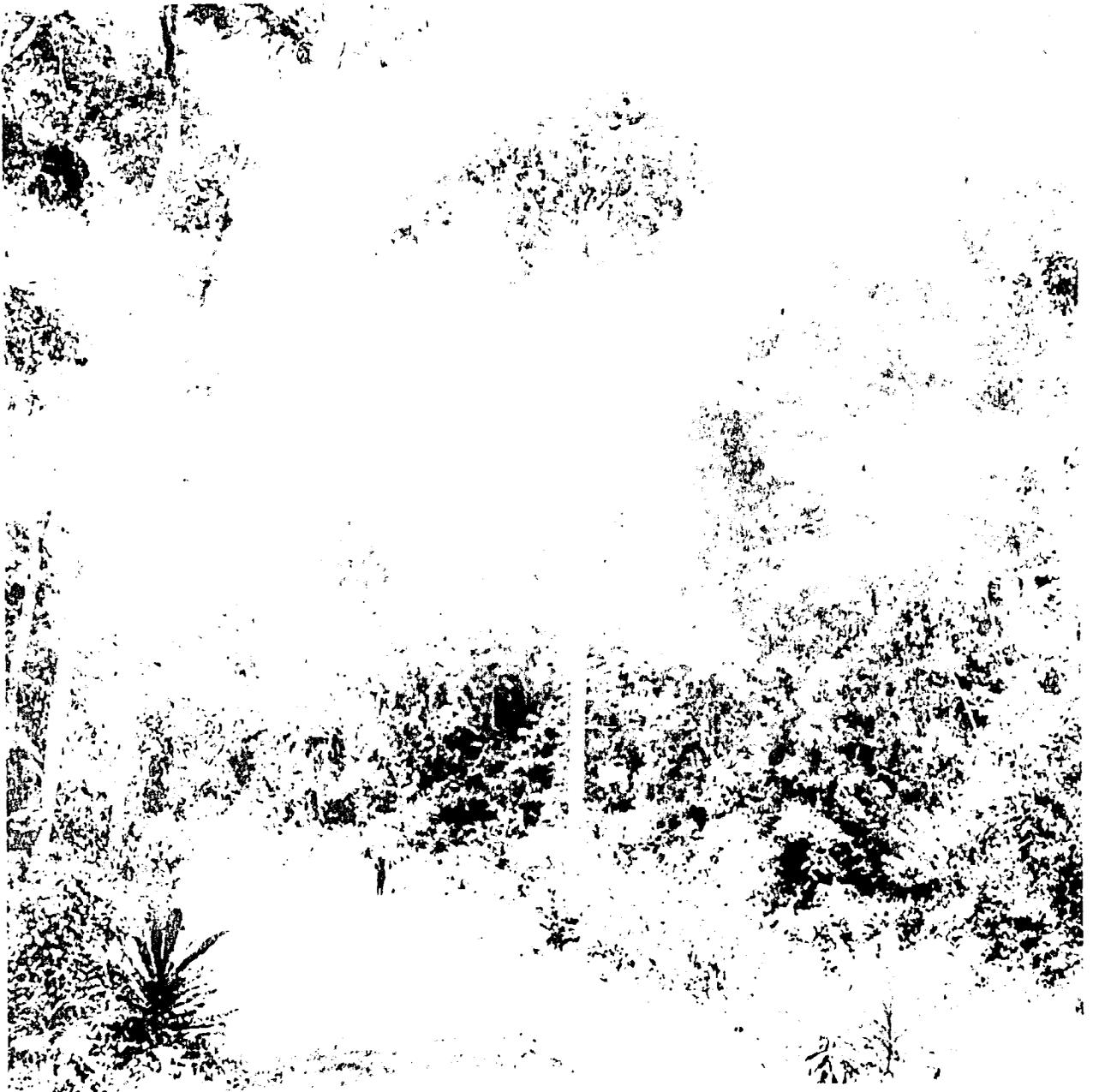
After logging operations have been completed all trees and brush are cut and the area is ready for burning (Stage II in the Taungya System).



After logging operations, trees left standing were cut and burned in preparation for planting according to the Taungya System (Stage III). Smoke from burning on a more distant cut-over area is rising in the background.



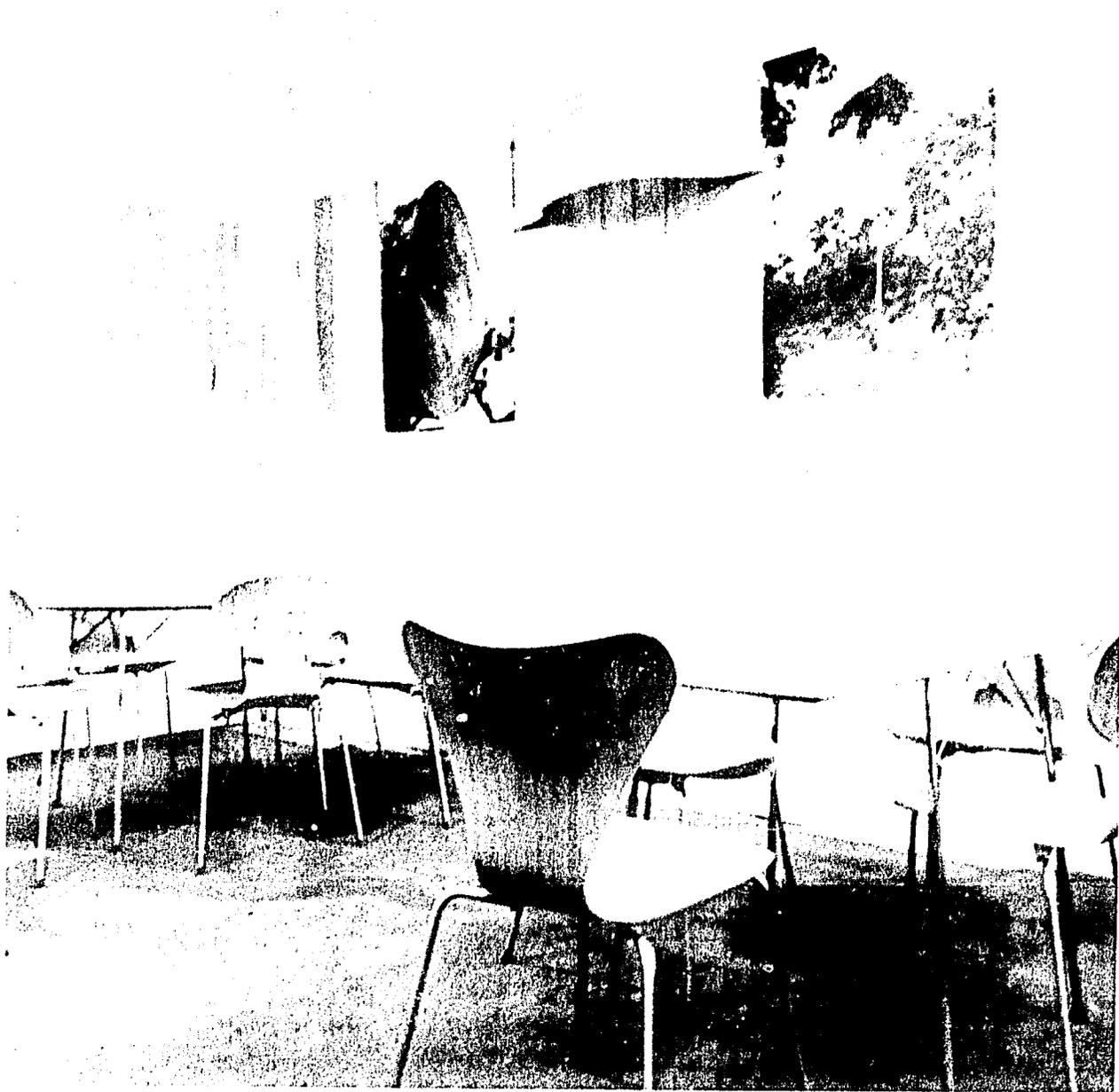
After the area was burned over, it was staked off so tree seed could be planted around each stake (Stages IV and V of the Taungya System).



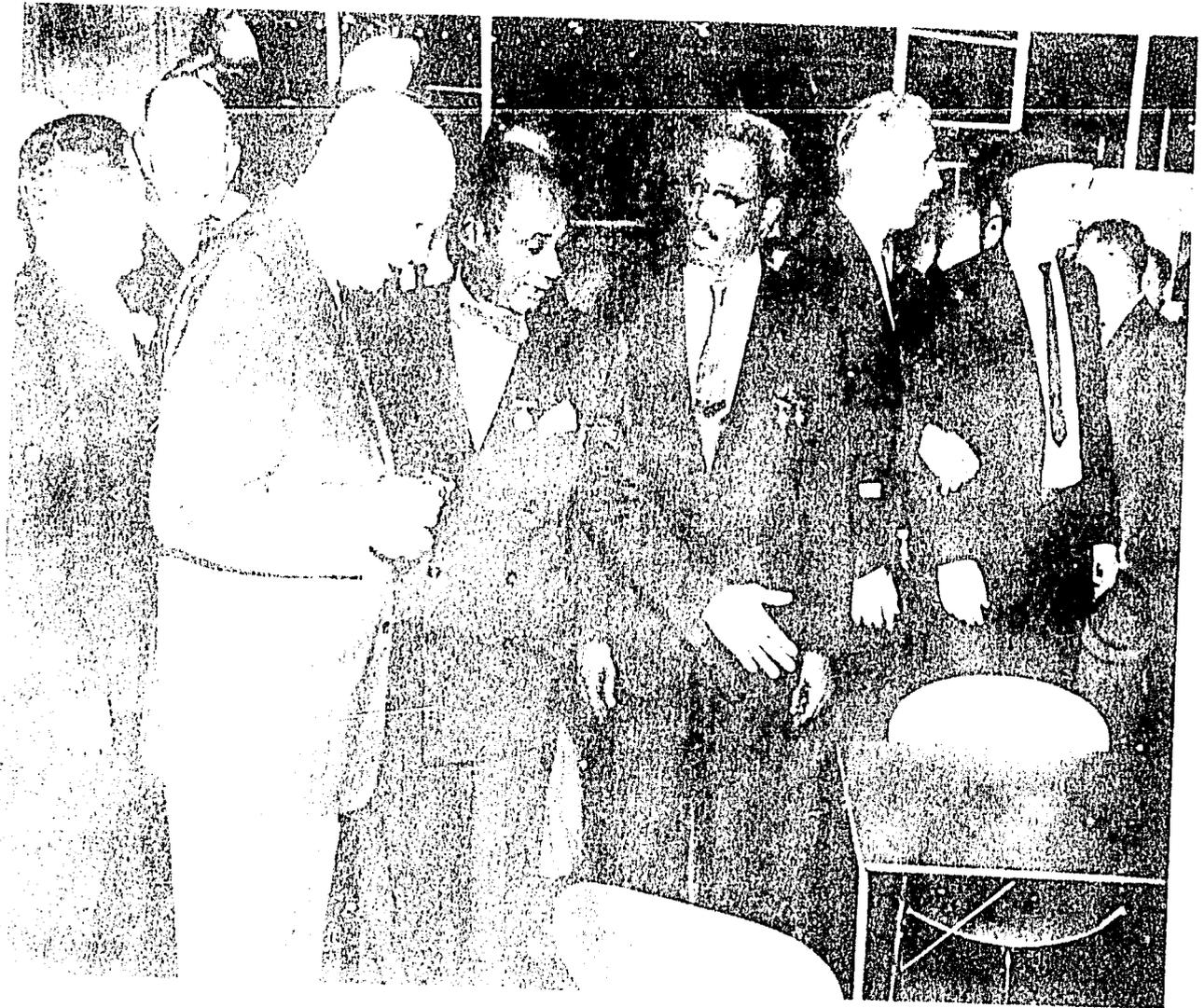
Ekop Tetraberlinia tubmaniana Leonard, grows well near Bomi Hills, Western Province. It is believed possible to introduce this species on the world market for use in manufacturing furniture.



Stripling of Obeche, Triplochyton scleroxylon  
K. Schum, grew to the height shown in four  
months after planting the trees and rice in the  
Taungya System.



Modern furniture manufactured from Ekop Tetraberlinia tubmaniana Leonard, by Fritz Hansens Eft. Company, Copenhagen, Denmark was exhibited at the New York World Trade Fair in 1959.



President Dwight D. Eisenhower was presented some Danish furniture by the Honorable John W. Cooper, then Secretary of Agriculture and Commerce.

Although experimentation is continuing in an effort to gain fuller knowledge of the best methods of regenerating and improving the composition of the natural stands, it is possible now to outline in general terms some of the observations made:

1. Volunteer growth following agricultural crops is extremely fast and will cover the entire area within a few months. Unless planted stock is favored in some way, planted trees will not survive.
2. It is necessary to avoid this competition either by planting trees in high forest areas where volunteer growth is kept down due to the reduced light reaching the ground, or to establish the trees well in advance of the start of the volunteer growth. The first method is achieved by enrichment plantings in the high forest; the second condition is successful through the taungya method.

Experimentation is being continued to find new methods of establishing preferred timber species, and in turn the growing characteristics of these species are being studied in order to find the optimum light and soil conditions under which the best development can be obtained.

During the last few years while plans were being formulated for the construction of the railroads from Buchanan to Nimba and from Bomi Hills to the Mano River for the purpose of exploitation of the iron ore deposits there, the question of railroad ties has been discussed at length. Ordinarily, it would not be necessary to discuss this question since species similar to the Liberian are being used with great success in Ghana and Nigeria for railroad ties. However, in 1949 when the railroad was constructed by the Liberia Mining Company from Monrovia to Bomi Hills, indiscriminate use was made of untreated timber for ties. The result was, that many of the ties did not last much longer than six months while others lasted longer. This experience gave Liberian timber the reputation of being unusable for ties; for several years thereafter creosote treated ties were imported from abroad.

In a country where one-third of the area is covered by virgin forest and where the species found are used for railroad ties in neighboring countries,

it did not seem reasonable to import ties. The forestry section of USOM/L, therefore, concentrated on collecting information in regard to strength and treatability of various Liberian timber species of common occurrence. Since the latter characteristic was not one generally known for most Liberian timber species, a cooperative program was initiated between the Forest Products Laboratory in Madison, Wisconsin and the USOM/L through which the treatability of some timber species was studied. The species tested in this way were:

Calpocalyx aubrevillei Pellegrin  
Gilbertiodendron sp.  
Erythrophleum sp.  
Pachyodanthium staudtii Engl. and Diels  
Parinari sp.  
Parkia bicolor A. Chev.  
Piptadeniastrum abicanum (Hook.L.) Brenar  
Tetraberlinia tubmaniana Leonard

In all instances the wood from the species absorbed the prescribed minimum amount of creosote, indicating that all the tested species can be made resistant to wood destructive agencies. For the purpose of railroad ties where certain strength characteristics are necessary Erythrophleum, Parinari and Piptadeniastrum were recommended.

Early in 1959 Liberian American-Swedish Mining Company (LAMCO) announced that the company would use Liberian timber for the 600,000 ties needed for the railroad. Liberian Enterprises, Inc., the company that will be exploiting the iron ore deposits on the Mano river, announced at the same time, they would accept properly treated Liberian timber ties for the railroad to be built by their Company. This meant that if facilities were available it would be possible to produce railroad ties valued at \$3,000,000 within Liberia instead of spending the money abroad. At present LAMCO has not yet let bids for railroad ties; Liberian Enterprises, Inc. is negotiating with the Liberian American Agriculture and Industrial Corporation (LAAIC) for the manufacture of pressure treated railroad ties.

The tests performed by the Forest Products Laboratory in Madison, Wisconsin brought out an interesting fact about Parinari excelsa, one of the most common species in Liberia. The test showed that heartwood of this species was able to absorb 17.7 pounds of creosote per cubic foot under a

regular treating schedule, an amount that indicates complete penetration is obtained. This species had previously been tested for its resistance against marine borers along with several other species in the Port of Monrovia; it had shown it has a natural resistance. As a matter of fact where Parinari excelsa was placed side by side with Azobe it showed much greater resistance to marine borers than ironwood. This is particularly interesting, when it is considered that Azobe from West African and Greenheart from British Honduras are the only two species approved by the U.S. Navy for marine work and harbor building. Since Azobe is too dense to receive treatment with creosote it indicates that Parinari excelsa may have great possibilities of being used for marine construction. Comprehensive testing has now been initiated with sample boards of the two species in the Port of Monrovia; the cooperation from the Navy has been invited.

Based on results gained from Liberia Mining Company's carpentry shops where Tetraberlinia tubmaniana had been used for making furniture, contact was made with Fritz Hansens EFT. Company in Copenhagen, Denmark for the purpose of having this species tested for veneering. The results were so favorable that furniture made from this species was shipped to the World Trade Fair in New York in 1959. The furniture which was of modern design attracted attention at the Fair. A set of furniture was presented to President Eisenhower by Honorable John W. Cooper, then Secretary of Agriculture and Commerce. By sending additional logs to Copenhagen further testing is now being done in the belief that it will be possible to introduce this species on the world market for use in furniture manufacturing.

Experimentation is being continued for development of markets for some common but commercially unknown Liberian timber species.



Seedlings of Fransire Terminalia ivorensis, shows excellent development 5 months after seed was planted at stake.

## SUMMARY

Although forestry in Liberia is less than ten years old, the program has made phenomenal success. The main impetus to this development has been given by the realization by Liberians that conservation measures were needed if this valuable and renewable resource was to be of benefit to present and future generations of Liberians. This opinion has been reflected in the excellent support of the various forestry measures which were planned jointly by the Liberian Department of Agriculture and Commerce and the forestry staff of USOM/Liberia.

The foundation for a sound forestry program has been initiated. A Bureau of Forest Conservation, which now has more than 70 employees, has been established to protect and manage the 3.4 million acres of national forests, and to survey the remaining 800,000 acres of national forests, which have been mapped.

In order to have a profession of foresters, who will safeguard the forest resources of Liberia, a professional College of Forestry was founded in 1955. This college which has 5 forestry professors and more than 40 students, conferred in November 1959 the degree of Bachelor of Science in Forestry on six young Liberians, who had fulfilled the requirements.

The first export of timber products was made in 1959, when logs for harbor construction were exported. A concession agreement has been reached with one foreign timber-producing company and several other agreements will probably be concluded within a short time. With the several new ports along the coast and with the improved road system, it is safe to assume that a considerable timber production both for local consumption and for export will be placed in priority rank.

The expenditure made by the Governments of Liberia and the United States of America towards forestry progress in Liberia since 1951 and including the calendar year of 1959 for Liberian funds and fiscal year 1959 for U.S. funds amount to the following:

Government of Liberia	United States	Total
\$315,000	\$243,000	\$558,000



This Framire Terminalia ivorensis grew from seed to this size in 1-1/2 years in a modified Taungya area. A few remaining Tetraberlinia tubmaniana Leonard are shown in the foreground.

In addition to these funds the United States has also programmed \$181,000 for a Forestry building. However, these funds have not yet been spent.

Discounting all other developments in forestry and only considering the establishment of national forests against this expenditure, the following may prove of interest:

For every dollar spent jointly by the two governments 6.1 acres of national forests have been set aside through surveys and patrolling.

On an average, each acre of high forest contains 10,000 feet of merchantable timber. When this timber is processed the Government of Liberia will receive at least \$3 per 1,000 board feet in revenue. Consequently, it can be stated that for every dollar spent jointly, the Government of Liberia potentially will receive \$183 in revenue from products which will be worth \$ 7,320.

## RECOMMENDATIONS

### FOREST RESOURCES

In order to fully utilize the forest resources before a part is destroyed through shifting cultivation, the timber outside the national forests should be utilized first, before logging and lumbering operations are begun in the national forests. Exceptions to this general recommendation are the national forests which have been established specifically for the purpose of furnishing timber products for specialized industries such as iron ore mining companies.

Forest Concession areas should be incorporated into the national forest system at the expiration of the concession agreements, thereby enlarging the permanent forests of the country.

No timbering operation, whether on a national forest or on a timber concession area, should be undertaken solely for the purpose of producing logs for export. All timbering agreements should specify that manufacturing of dimension stock through sawmilling should constitute an integral part of the operation; and that all timber species of commercial size should be utilized. If this is not prescribed, only timber species of high value will be used with the result that the residual stands will contain a decreasing number of the premium timber species.

All stumpage payments should be determined by log scale rather than mill scale; any straight and sound log more than 12 ft. in length and with a top diameter of 12 in. or over shall be utilized.

It should be required of all companies operating on publicly owned land to initiate silvicultural practices for the purpose of establishing either natural or

artificial regeneration, when such methods have been tested and approved for general use by the Bureau.

Based on the Forest Conservation law of 1953 the Government of Liberia through the Bureau of Forestry, Department of Agriculture and Commerce, should take steps to eliminate all cutting of high forest areas for the purpose of shifting agricultural practices.

Through conservation education to be done by the Bureau of Forest Conservation and Agricultural Extension, farmers should be encouraged to use low bush areas for their activities, thereby conserving the high forest and maintaining the beneficial effects gained from this vegetation.

## LEGISLATION

From time to time, the Forest Rules and Regulations should be revised to include new cutting regulations; in accordance with management recommendations developed by the Forestry Research Section and approved by the Management Section of the Bureau.

## FORESTRY RESEARCH

The forestry research effort in Liberia should be continued and enlarged. It is important that ICA assign at least two full-time foresters for this purpose. These foresters should coordinate their research activities with those of the staff of the College of Forestry, University of Liberia.

Develop experimental areas on national forests where methods for natural and artificial regeneration are tested.

Test on a commercial scale any method that has shown promise of usefulness while under experimental test.

Silvicultural research should be conducted to determine any reaction on individual trees or forest stands caused by the availability of additional light afforded by commercial logging.

Methods of enrichment plantings prior to logging operations and the combined reaction on planted material and residual trees should be investigated for the possible development of economical and profitable methods for use of such combinations.

Continue experimentation by using different indigenous species in conjunction with the Taungya system.

Continue investigations on possible uses of common Liberian timber species which have not yet attained recognition on the commercial market. The wood technological laboratory in the new forestry building will be a great asset in investigating special characteristics of these species and should help in finding the best suitable uses for such species.

Develop standards for all weather logging roads and determine average cost per mile of roads for the purpose of having the estimates available for timber concerns contemplating operations in Liberia.

## COLLEGE OF FORESTRY

It is of great importance that the College of Forestry be closely connected with an institution which has a first rate science department in order to make available for the forestry students the basic courses before instruction in the specialized courses is started.

Furthermore, it is of value for field training for forestry students that the location of the College of Forestry is such that one-day field trips for the purpose of instruction can be made to national forests where commercial timbering operations take place.

The electric power requirements for the wood testing laboratory is another requirement that takes high priority. This factor will have to be considered when the location of the College of Forestry is determined.

Appendix I.

AN ACT FOR THE CONSERVATION OF THE FORESTS  
OF THE REPUBLIC OF LIBERIA.

APPROVED April 17, 1953.

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MONROVIA

AN ACT FOR THE CONSERVATION OF THE FORESTS OF  
THE REPUBLIC OF LIBERIA.

WHEREAS, our forests are among our greatest natural resources and may best contribute to our economic and social welfare by being devoted to their most productive use for the permanent good of the whole people, and

WHEREAS, no program now exists for the protection, development, and utilization of these resources, and they therefore remain almost wholly unproductive, yet suffer from gradual depletion, and

WHEREAS, the conservation and utilization of these resources should be brought about promptly, efficiently, and wisely, under such restrictions as will insure perpetual benefits from this heritage,  
THEREFORE:

It is enacted by the Senate and House of Representatives of the Republic of Liberia in Legislature assembled:

Section I. That this Act be cited as "An Act For the Conservation of The Forests of the Republic of Liberia".

Section II. That in this Act, the following words have the meaning indicated unless the context otherwise requires:

**Forests** - All areas supporting woody vegetation other than planted or cultivated crops, regardless of the composition, age or density of the vegetative cover.

**Forest Products** - The materials yielded by forests, as follows:

- (a) Trees, which include seedlings, saplings, brushwood, palms and canes.
- (b) Timber, including trees fallen or cut down, stumps and wood in any shape or form.
- (c) Charcoal, wild rubber, wood oil, resin and gums.
- (d) Leaves, flowers, fruits, seeds and all other parts of trees not hereinbefore mentioned.
- (e) Plants, other than trees (including grass, vines, reeds and moss) growing in the forest which are not cultivated for agricultural purposes, and all parts and products of such plants.

**Commercial use** - Any use other than the direct use for private purposes, whether such other use involves barter, sale, or any other disposition of forest products.

**Fish Resources** - All non-mammal aquatic forms of animal life found living in waters of any description.

Wildlife Resources - Wild mammals, birds, and reptiles of every description, but not including other lower terrestrial forms of animal life.

Section III. That the President, under the authority granted him by Section 4, Chapter XVII of the Acts passed by the Legislature of the Republic of Liberia during the session 1947-48 entitled: "AN ACT TO CREATE A DEPARTMENT OF AGRICULTURE AND COMMERCE", does hereby establish, and the action is hereby approved, a BUREAU OF FOREST CONSERVATION within the Department of Agriculture and Commerce.

Section IV. That the initial policies and primary objectives of the program to be carried out by the Bureau of Forest Conservation shall be to:

- a. Establish a permanent forest estate, made up of reserved areas, upon which scientific forestry will be practiced.
- b. Devote all publicly owned lands to their most productive use for the permanent good of the whole people considering both direct and indirect forest values.
- c. Stop needless waste and destruction of forest and associated natural resources, and bring about the profitable harvesting of all forest products while assuring that supplies of these products are perpetuated.
- d. Correlate forestry to all other land use and adjust the forests economy to the overall national economy.
- e. Conduct essential research in conservation of forests and pattern action programs upon the results of such research.
- f. Give training in the practices of forestry; offer technical assistance to all those engaged in forestry activities; and spread knowledge and acceptance of forestry and the conservation of natural resources throughout the country.
- g. Conserve recreational, fish and wildlife resources of the country concurrently with the development of a forestry program.

Section V. That the functions of the Bureau of Forest Conservation shall be to :

- a. Take all action necessary to permit the creation of Government Forest Reserves, Native Authority Forest Reserves, Communal Forests, and National Parks;

- b. Administer all such reserved areas so as to best satisfy the policies and objectives set out in Section IV;
- c. Enforce all laws and regulations for the conservation of our forests and the development of their resources with impartiality, industry, and dispatch;
- d. Carry out a program for the wise use and perpetuation of the forest, recreational, fish and wildlife resources of the country.

Section VI. That the President is hereby empowered to create and establish GOVERNMENT FOREST RESERVES embracing any portion of the forests of the country, such reserves to be bounded and described at the time of their establishment and thereafter to be administered and protected as a permanent forest estate, in accordance with such rules and regulations as may be promulgated by the Secretary of Agriculture and Commerce for that purpose. All such Government Forest Reserves shall be created and established by presidential proclamation after all rights and claims of the original owners have been heard in a court settlement. Upon the adjudication of all such rights and claims and the proclamation of these reserves, all rights, title, and interest in them shall be vested in the Government.

Section VII. That the President is also hereby empowered to authorize the creation and establishment of NATIVE AUTHORITY FOREST RESERVES embracing forests lying in one or more tribal chiefdoms, such reserves to be bounded and described at the time of their establishment by presidential proclamation. Thereafter, such Native Authority Forest Reserves shall be protected as potential Government Forests Reserves in accordance with such rules and regulations as prescribed by the provision of this Act. The rules and regulations affecting reserves of this type shall be designed to minimize damage to the reserved forests and avoid unnecessary depletion of their resources pending the establishment of a Government Forest Reserve embracing the concerned area.

Section VIII. That the President is also hereby empowered to authorize the creation and establishment of Communal Forests to be administered by the concerned native authorities. Such forests shall be limited to small described forest areas immediately adjacent to one or more native villages, and use of these forests will be confined to the local population under such rules and regulations as prescribed by the provision of this Act. Said rules shall be designated to assure the perpetuation of such communal forests as a source of forest products for the private use of the local inhabitants and to prohibit any and all commercial use of forest products taken from these areas.

Section IX. That the President is also hereby empowered to appoint and commission, upon the recommendation of the Secretary of Agriculture and Commerce, Forest Officers to perform all the duties and functions requisite to the accomplishment of the policies and objectives established for the Bureau of Forest Conservation. All such Officers shall be authorized to exercise the powers necessary to fulfill their duties, and all shall be public servants in the employ of the Republic of Liberia. The categories of Forest Officers may<sup>1</sup> include Chief, Bureau of Forest Conservation, Deputy Chief, Bureau of Forest Conservation, Forest Conservator, Assistant Forest Conservator, Forest Ranger, and Forest Guard. The salaries of all Forest Officers shall be fixed from time to time in the general budget in common with other public servants of the Republic.

Section X. That the President is also hereby empowered to create and establish National Parks embracing any areas of the country having such outstanding scenic, recreational, scientific or other pertinent values that it is deemed wise and expedient in the national interest to set aside as permanent parks to be retained insofar as is practicable in their existing condition. Such National Parks shall be created by presidential proclamation after all rights and claims of the original owners have been heard in a court of settlement. Upon the adjudication of all such rights and claims and the proclamation of these parks, all rights, title and interest in them shall be vested in the Government.

Section XI. That the Secretary of Agriculture and Commerce with the approval of the President, will describe and promulgate all rules and regulations as may be required to insure the accomplishment of all the purposes of the present Forest Conservation Act. The Secretary of Agriculture and Commerce shall also prescribe the form of all licenses, permits, agreements, and other instruments dealing with the use of forest, recreational, fish and wildlife resources; control the issuance of such instruments, and determine the conditions under which such instruments may be granted, exercised, produced, revoked, or returned. He shall also control the transportation or export of the products of forests by land, water or air, and he is responsible for the imposition and collection of all fees in connection with anything done under the rules and regulations cited above.

Section XII. That any person who contravenes any rule or regulation made under Section XI above, or fails to comply with the condition made a part of any license, permit, agreement, or other instrument issued or entered into under any such rule or regulation, for which no penalty is expressly provided in the rules and regulations, shall be deemed guilty of a misdemeanor and prosecuted according to law. Where any person is convicted of any offense against any of the rules and regulations promulgated under this Act, the Court may in addition to or in lieu of the imposition of any fine or term of imprisonment, order that the whole or any part of the forest products, in respect

to which the offense was committed, be confiscated and forfeited to the Government, to be sold or otherwise disposed of in such manner as the Secretary of Agriculture and Commerce may prescribe.

Section XIII. That the law herein created and established shall become effective thirty days after it shall have been approved by the President and shall be published in handbills.

Any Law to the contrary Notwithstanding.

Approved April 17, 1953.

## Appendix II

### AN ACT SUPPLEMENTAL TO "AN ACT FOR THE CONSERVATION OF THE FOREST OF THE REPUBLIC OF LIBERIA," PASSED AND APPROVED APRIL 17, 1953

WHEREAS, it has become apparent that since the passage into Law of the Forest Conservation Act entitled "An Act for the Conservation of the Forests of the Republic of Liberia" approved April 17, 1953, for the conservation and utilization of our forests, animal wildlife and other natural resources, certain intricate problems and conditions, nor previously envisaged nor contemplated, have arise: which demand the necessity for a supplementary legislation to implement the principles and objectives of the above cited Act; Therefore,  
It is enacted by the Senate and House of Representatives of the Republic of Liberia in Legislature assembled:

#### PART I. TITLE

Section 1. That from and immediately after the passage of this Act entitled "An Act for the Conservation of the Forest of the Republic of Liberia" passed and approved April 17, 1953, be and the same is hereby amended and this Act shall be cited as the "SUPPLEMENTARY ACT FOR THE CONSERVATION OF THE FORESTS OF THE REPUBLIC OF LIBERIA."

#### PART II. DEFINITIONS

Section 1. Words used in the singular form in this Act shall be deemed to import the plural, and vice versa, as the case may demand. For the purpose of this Act the following words shall be construed, respectively, to mean:

- Secretary - The Secretary of Agriculture and Commerce.
- Bureau - The Bureau of Forest Conservation within the Department of Agriculture and Commerce.
- Forest Officer - Any duly appointed officer of the Bureau of Forest Conservation.

- Person - Any individual, firm, corporation, company, society, Association, or other organized group of any of the foregoing.
- Forest - All areas supporting woody vegetation other than planted or cultivated crops, regardless of the composition or age.
- Reserve Forests - Forests within the boundaries of all publicly owned forests including those established by the National Government known as Government Forest Reserve, Native Authority Forest Reserves, National Parks and Communal Forests.
- Granted - All forest areas covered by a timber concession agreement between the Government or other owners and a commercial timber operator.
- Permittee - Person granted a permit to perform specified acts upon or in reserved forest.
- Timber Sale Operator - Person or permittee authorized to harvest and utilize timber. Such authorization shall be covered by a timber sale agreement between the timber sale operator and the Government where the sale of National Forest timber is involved.
- Commercial Use - Any use other than direct use for personal purposes, including uses involving barter sale, trade or any other disposition of forest products for which remuneration is received.
- Take Timber - To cut down, cut the branches, girdle or otherwise injure any tree, or remove any timber from a tree.
- Girth - Circumference of Tree outside the bark, at a point 4-1/2 feet above the average ground level or at a point 1 foot above the butt swell.

- Diameter or Breast High or DBH - Diameter or distance through a tree outside bark, at a point 4-1/2 feet above the average ground level or at a point 1 foot above the butt swell.
- Protected Trees - A tree which may not be cut down, pruned, girdled, damaged in any way, or removed after felling without the permission of a responsible authority.
- Seed Tree - A tree left uncut at the time of forest operations in order to provide natural regeneration.
- Property Mark - A mark placed upon a tree or timber or log to denote ownership, usually made with a marking hammer or axe.
- Soil - This term shall include all inorganic material such as sand, dirt, gravel, minerals and similar material.
- Wildlife - Wild mammals, birds, fish, and reptiles of every description, but not including other lower terrestrial forms of life within the land area of the Republic of Liberia.

### PART III, PERMITS

SECTION 1. A written permit must first be obtained before any act can be done that disturbs the vegetation, wildlife or soil on any Public Forest Reserve or National Park. This shall include a strip 200 feet wide outside the established boundary line.

SECTION 2. Authorized forest officers may issue permits for the following acts on Government Forest Reserves or National Parks. All permits shall be subject to the approval of the Chief, Bureau of Forest Conservation and the Secretary.

- (a) Collect, convey, remove, or subject to any manufacturing process any forest products of plant origin.
- (b) Cut down or damage any trees.
- (c) Set fire to vegetation, logging slash, etc.

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- (d) Dig in the soil or prospect for minerals, coal or oil.
- (e) Make a dam across a river, creek or other waterway.
- (f) Reside, or build any structure necessary in connection with authorized forest harvesting operations.
- (g) Build road, trails or railroads.

SECTION 3. Permission granted to perform any of the acts listed in Section 4 shall be subject to such written conditions as may be imposed by a forest officer, with the approval of the Chief, Bureau of Forest Conservation and the Secretary.

SECTION 4. Permits for the development of mineral resources on forest reserves will be issued by the Mining Board of the Republic of Liberia with the consent of the Secretary; and subject to such provisions as deemed necessary for the protection of surface uses as provided for in an Act to Revise the Mining Laws of the Republic of Liberia, Section V, Article 2 of March 26, 1952.

SECTION 5. Authorized Forest Officers may issue permits to perform any of the acts listed in Part III, Section 2 on or within Native Forest Reserves.

All permits shall be subject to such written conditions as may be imposed by the Forest Officer with the approval of the Chief, Bureau of Forest Conservation, and in consultation with the responsible Native Authority.

SECTION 6. Permits or authorizations issued to any person to cut or remove timber from Government Forests shall be in the form of a Timber Sale Agreement or Contract covering the following points:

- (a) Name and address of permittee.
- (b) Location and area covered.
- (c) Cutting regulations including diameter or girth limits, etc.
- (d) Amount and kind of timber to be removed.

- (e) Method of designating trees to be cut.
- (f) Method of measurement, whether by tree count, cubic foot or board foot.
- (g) Amount of money to be paid per unit or measurement.
- (h) Utilization requirements so as to cause the least waste.
- (i) Waste disposal, sawdust, slabs, brush, etc.
- (j) Responsibility of Permittee to prevent trespass, damage, fire, unauthorized use, etc. during the term of this contract.
- (k) The Permittee shall be responsible to provide for the regeneration of tree species removed during cutting operations so that provision is made for the future maintenance of stand composition existing at the beginning of the operations covered by said timber sale agreement.
- (l) Such additional clauses as may be required to cover special conditions pertaining to the particular area.

SECTION 7. Free use permits, issued without charge, shall be issued by the Chief, Bureau of Forest Conservation with approval of the Secretary of the Department of Agriculture and Commerce of the Republic of Liberia to take timber from reserved forests in public ownership for use in public works or the construction of public buildings. Such permits shall contain the same information required in Section 8.

SECTION 8. A permittee or Grantee may not cut down any tree held to be a sacred tree or a medicine tree by the local population, nor may he cut down any tree growing within 100 yards of a village or market place, unless permission to do so is given by both the forest officer and the concerned tribal authorities.

SECTION 9. No person shall commit any of the following acts on Government Forest Reserves, National Park, Native Authority Forest, Communal Forest or Timber Concessions.

- (a) Damage or destroy any Government property, including boundary markers, notices, corner posts, boundary trees, etc.

- (b) Alter, deface, or obliterate any mark placed on a tree.
- (c) Cut down tree or burn any area to make a farm or plantation.
- (d) Fell and leave trees or other obstructions across any trail, road, railroad, or water.
- (e) Enter a reserve or park with the intent to do any of the foregoing acts.

SECTION 10. No person shall make commercial use of forest products taken from a Communal Forest.

SECTION 11. No person shall allow sawdust, mill waste or other material that is harmful to fish, to enter any stream in Liberia.

SECTION 12. No person may possess, sell, buy, exchange, barter, or export any forest products which have been taken in violation of any of the Forest Rules and Regulations.

#### PART IV. PROPERTY MARK

SECTION 1. No person may use a hammer or other tool to place property mark upon any tree unless the property mark has been properly registered with the Bureau, and the person using it authorized to do so.

SECTION 2. No person can register or use any of the following property marks:

RL	(Republic of Liberia)
RLNP	(Republic of Liberia National Park)
RLGR	(Republic of Liberia Government Reserve)
RLNA	(Republic of Liberia Native Authority)
RLCF	(Republic of Liberia Communal Forest)

These property marks are reserved for the exclusive use of the Liberian Government and may not be used by anyone except an authorized Forest Officer.

SECTION 3. Each timber sale or concession agreement must specify the property mark or marks to be used on the area covered by the agreement

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and no property marks may be used outside the sale or granted area without specific authorization of a Forest Officer.

SECTION 4. When a property mark has been placed on a tree with a registered hammer, it cannot be altered in any way except with the consent of the owner of the mark and a Forest Officer.

SECTION 5. The stump and each log of every tree cut for commercial purposes shall be stamped with the registered property mark specified in the timber sale or concession agreement.

#### PART V. REVENUES AND RECEIPTS

SECTION 1. Any and all revenues accrued from Government Forest Reserves shall be deposited with the Bureau of Revenues, and a Flag Receipt obtained therefore, prior to the issuance of any permit.

SECTION 2. Any and all revenues obtained from Native Authority Forest Reserve will be divided equally between the Government of Liberia and the proper responsible Native Authority on whose land the operation takes place. The amount due to the Republic of Liberia will be deposited with the Collector of Revenues.

#### PART VI. GENERAL REGULATIONS

SECTION 1. All rights, title and interest, to any timber to which a permittee or grantee would otherwise be entitled, but not removed from the designated area, shall revert to the Government at the time of the expiration of the relative permit or agreement.

SECTION 2. No person shall, anywhere in Liberia unless it is otherwise stated in the timber sale or concession agreement or permit issued by the Chief, Bureau of Forest Conservation, and approved by the Secretary, cut or fell for the purpose of commercial conversion into sawn products any growing tree the girth of which is smaller than the following dimensions at a point one foot above the convergence of the buttress, if any, or at a point four and one half feet above average ground level where there are no such roots.

- (a) In the case of the following species the girth of 8 feet or 30.55 inches in diameter.

Canarium schweinfurthii	Lovoa klaineana
Entandrophragma sp.	Mimusops djave
Khaya sp.	Mimusops heckelii

(b) In the case of the following species a girth of 7 feet or 27 inches in diameter.

Anopyxis ealaensis	Lophira procera
Chlorophora excelsa	Oldfieldia africana
Combretodendrum africana	Piptadenia africana
Erythrophloeum guineense	Sarcocephalus diderichii

(c) In the case of the following species a girth of 6 feet or 23 inches in diameter.

Berlinia sp.	Parinarium sp.
Mitragyna stipulosa	Saccoglottis gabonensis
Ochrocarpus africanus	Terminilia superba
Terminalia	

(d) In the case of all other species a girth of 4-1/2 feet or 17 inches in diameter.

(e) If a grantee cuts for commercial purposes any tree below the above specified girth limit, he will be assessed for each tree a penalty excise tax equal to three times the stumpage price set forth in the timber sale agreement. This penalty must be paid into the Bureau of Revenues by the grantee and upon his failure to do so within thirty (30) days he shall be prosecuted before any court of competent jurisdiction within the Republic for the recovery of the same.

## PART VII. CONCESSION

SECTION 1. Any grantee, having received the rights from the Government to forest areas for the utilization of forest products, has the responsibility to protect these forest areas from destruction and encroachment by other persons. It shall also be the responsibility of the grantee to ensure that the forest areas under his agreement are maintained for forest production.

SECTION 2. The description of all boundaries located on the ground shall be filed with the Bureau. Any disputes arising from such

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boundary location work will be handled according to existing laws of the Republic of Liberia.

SECTION 3. Grantees are wholly responsible for any and all damages arising directly from their forest industry operations on land on which no valid timber rights have been obtained.

SECTION 4. A grantee operating a granted area is responsible for the determination and demarkation on the ground of the exterior boundaries of the gross area granted, as well as the boundaries of all interior trees not owned by the grantor, or otherwise excluded from the granted area. These boundary surveys shall be completed within 2-1/2 years from the day the concession contract was approved by appropriate signatures.

SECTION 5. The grantee is responsible for the taking of adequate precautions to prevent the occurrence and spread of fires in connection with any and all of his operations within or outside a granted timber area. Any damages resulting from fires caused by the grantee or anyone in his contract or employ, through carelessness or negligence shall be paid or satisfied by the grantee.

SECTION 6. It shall be the grantee's responsibility to assure that only trees, the taking of which is authorized by the concerned timber concession agreement, are cut and removed from any granted area.

SECTION 7. No unnecessary damage shall be done to young growth or to trees left standing on granted areas as a result of the grantee's operations. In all operations on a granted timber area, the grantee is responsible for the cutting of trees so as to cause the least practicable waste in stumps; to utilize all cut trees to as small a diameter in the tops as practicable; and to vary the length of logs so as to secure the greatest possible utilization of merchantable material.

SECTION 8. All roads and trail in or adjacent to a granted timber area shall be kept free of logs, brush, and other debris resulting from the grantee's operations. Any road, trail, or structure thereon not constructed by the grantee and damaged beyond ordinary wear and tear as a result of his operations shall within seven days be restored to its original condition by the grantee at his own proper cost and expense.

SECTION 9. All structures, improvements, or facilities constructed or operated by a grantee in connection with his forest industry operation within a granted timber area, shall be located and operated subject to conditions as may be imposed by an authorized Forest Officer to protect forest and water resources.

SECTION 10. In any area where the Government has granted rights for a specified time to an individual or a concern for the purpose of development, the following regulations will govern:

- (a) After consultation and approval by a forest officer the grantee may cut any tree irrespective to the girth limits as long as it is used in the granted area for construction purpose. Cutting trees below the girth limit, however, shall be confined to a minimum and will be done only when the particular construction makes it necessary to use such smaller trees.
- (b) Any timber product cut for commercial use and sold whether locally or for export will be assessed a stumpage price or excise tax in the sum of \$3.00 per thousand board feet for lumber, planks timber or other partially manufactured products and \$5.00 per thousand board feet for logs intended for export. Item 3 and under title III of the Export Schedule of the Republic of Liberia Customs Tariff Act of 1940 which assesses 2¢ per board foot of logs, timber and planks, be and the same is hereby repealed, and the above assessments substituted therefore.
- (c) The grantee will be held responsible for furnishing the Chief, Bureau of Forest Conservation with monthly reports containing information sale of products divided into the two classifications mentioned in paragraph (b).
- (d) Authorized Forest Officer will make periodic inspections of grantee's operations for the purpose of assuring compliance with this Act.

SECTION 11. In any area where a permanent real estate deed has been granted the owner has the right to sell locally any timber product emanating from his property without paying a stumpage or excise tax. The

Bureau of Forest Conservation will assist the owner in applying sustained yield forest management. However, if timber products are exported from Liberia from such property the owner must pay \$3.00 per thousand board feet for lumber, planks, timber or other partially manufactured products, or \$5.00 per thousand board feet for logs.

#### PART VIII. WILDLIFE RESOURCES

SECTION 1. All regulations pertaining to wildlife resources shall originate from the office of the Secretary and after approval by the President shall be administered by the Bureau. Such regulations shall be binding on all lands of the Republic.

SECTION 2. Licenses - No person shall be permitted to sell, barter or trade or exchange Big Game, dead or alive, without having first obtained a commercial license issued by the Bureau.

(1) Big Game Hunting - \$100.00 per annum.

SECTION 3. No permits will be issued to any person for the taking of live game animals out of the Republic except that the Secretary may issue special permits to take live game animals for medical or scientific purposes, and it shall be the responsibility of the applicant to give documentary and/or satisfactory evidence to that effect in the event where the said applicant is an agent of a Scientific or Medical Institution.

SECTION 4. Item 4 of Schedule A of the Act entitled: "An Act supplemental to an Act approved December 14, 1938" which Act was approved December 16, 1940, amending the Revenue Code of 1937 which imposes a license fee of \$375.00 for Big Game Hunting, be it and the same is hereby repealed.

SECTION 5. Live Game Animals taken under Section 4 cannot be exported without first obtaining an export permit from the Secretary.

SECTION 6. Any one having a live game animal in captivity at the time this Act becomes effective must within 90 days of this date register each animal with the Secretary.

SECTION 7. Any unregistered live game animal found in captivity after the specified time set out in Section 6 of this Act shall be

confiscated and disposed of by the Bureau.

SECTION 8. No person shall hunt elephant without first having obtained a permit from the Secretary of Agriculture and Commerce. Foreigners shall be restricted to a limit of one elephant per year.

SECTION 9. Prohibited acts - All persons are prohibited from committing any of the following acts:

- (a) Dynamiting or poisoning of water as a means of catching fish. Setting any animal traps, snares or similar devices in such a place as to endanger human beings. Adequate warning marks should be placed around such traps.
- (b) Setting any gun, explosive, bow and arrow traps.
- (c) No chimpanzees shall be hunted, trapped or molested except as provided for in Section 3.
- (d) No female monkey with suckling young shall be shot or trapped within the forest reserve. Any person apprehended for violation of these Acts shall be taken before the District Commissioner or Justice of the Peace and upon conviction be fined in the sum of \$5.00 for the first offence, and \$25.00 for any repetition of the same offense.

SECTION 10. No hunting, trapping, shooting or molesting of wild animals or commercial fishing shall be allowed in National Parks.

SECTION 11. No person without written permission of an authorized Forest Officer, may perform any of the following acts within a Government Forest Reserve.

- (a) Hunt, shoot or set traps or snares for any wildlife.
- (b) Fish, set traps or in any way catch fish.

SECTION 12. Any Big Game shot or killed must be reported to the Town Chief of the nearest town within two days after the killing took place. The Town Chief will be required to report to the District Commissioner

each month the total number of Big Game killed according to species. The Commissioner will submit monthly report to the Bureau covering the number of Big Game species killed in his district.

SECTION 13. Portions, or all of any National Forest within each of the Provinces shall be proclaimed a Wildlife Refuge for the purpose of maintaining the wildlife found in Liberia. Absolutely no hunting shall be permitted on these refuges and it shall be the responsibility of the Bureau to maintain scientific control of the species population contained therein.

SECTION 14. An Advisory Conservation Committee shall be appointed within each county or province with the County Superintendent, District or County Commissioner as Chairman. The purpose of the Committee is to provide means of communicating to proper authorities the ideas, desires and opinions of the people on matters pertaining to forest and wildlife conservation and to exercise general supervision of the enforcement of Wildlife Regulations.

#### PART IX. FOREST OFFICERS' DUTIES AND RESPONSIBILITIES

SECTION 1. It is the duty and responsibility of the Chief, Bureau of Forest Conservation, to see that all the forest rules and regulations are carried out. It is also his duty and responsibility to see that every member of his organization is fully acquainted with these regulations and any changes that may be made.

SECTION 2. It is the duty and responsibility of every Forest Officer to impartially enforce these regulations and report every offense to his superior officer. Failure to do so will be considered just cause for disciplinary action.

SECTION 3. Every Forest Officer is hereby authorized and empowered to arrest any person whom he finds or reasonably suspects of violating any of the provisions of any regulation hereunder; and shall immediately take such person before the court of the County Superintendent, District Commissioner, Tribal Authority, Justice of the Peace or a court of competent jurisdiction.

SECTION 4. It shall be discretionary with the Bureau of Forest Conservation to cancel or annul a certificate or permit issued in favor of any person or persons at any time when security or administrative reasons render it necessary.

SECTION 5. A Forest Officer may fell, cut, damage, tap or destroy trees within Government Forest Reserves, Native Authority Forest Reserves, Communal Forest, and National Parks, make clearings or remove timber therefrom for the purpose of planting trees, improving the growth of trees, or for the general better management of reserved forests.

SECTION 6. Any person convicted of any of the offenses declared in this Act shall be fined a sum not less than five dollars (\$5.00) nor more than three hundred dollars (\$300.00) or imprisonment for a period not exceeding eighteen months nor less than fifteen days.

ANY LAW TO THE CONTRARY NOTWITHSTANDING

Approved February 28, 1957

Appendix III. Scientific Names and Trade Names of Commercially  
Recognized Liberian Timber Species

Afzelia	Afzelia, Aligna, Apa, Azɔɔɔau, Linguɛ, Papao
Albizia spp.	Okuro, Ouochi, Pampena, Uwowe
Alstonia congensis	Ahun, Awun, Duku, Emien
Amphimas pterocarpoides	Lati
Anopyxis klaineana	Bodioa, Kokoti
Antiaris africana	Akede, Akɔ, Antiaris, Chenchen, Kyenkyen
Baphia nitida	Camwood, Okoue
Berlשמiedia mannii	Atiokous, Bogo
Berlinia spp.	Melegba, Berlinia, Ebiara, Pocouli
Brachystegia spp.	Akume, Meblo, Okwen, Naga
Canarium schweinfurthii	Abeul, Aiele, Canarium, Elemɪ, Papo
Carapa procera	Crabwood
Ceiba pentandra	Cottontree, silk cotton
Chlorophora excelsa	Abang, Iroko, Mandji
Chlorophora regia	Odoum, Odum
Combretodendron	Abale, Abine, Essia, Owewe
Cylicodiscus gabonensis	Adoum, Denya, Okan
Cynometra ananta	Apome
Daniella thurifera	Daniella, Faro, Ogea, Oziya
Distemonanthus benthamianus	Anyan, Ayan, Barre, Movingui, Satinwood
Dumoria heckelii	Abaku, Baku, Makore, Asaka, idinam, Ipaki
Entandrophragma candollei	Heavy Sapele, Kosipo, Omu
Entandrophragma cylindricum	Aboudikro, Sapele, Sapelli
Entandrophragma angolense	Edinam, Gedu Nohor, Tiama
Entandrophragma utile	Sipo, Utile
Erythrophleum spp.	Alui, Erun, Potrodom, Tali
Guarea thompsonii	Guarea
Gilbertiodendron spp.	Ekpogoi, Limbali
Haplormosia monophylla	Larme
Khaya spp.	Acajou blanc, African Mahogany
Klainedoxa gabonensis	Eveuse

<i>Lophira alata</i>	Akoura Azobe, Bongossi, Eba, Ekki, Kaku
<i>Lovoa trichilioides</i>	African Walnut, Apopo, Dibetcu
<i>Mitragyna stipulosa</i>	Abura, Bahia, Elelom, Subaha
<i>Musanga cecropioides</i>	Corkwood, Parasolier
<i>Mammea africana</i>	Bompegya, Djimbo, Mammee apple, Oboto
<i>Nauclea trillesil</i>	Badi, Kusia, Opepe, Bilinga
<i>Nesogordonia papaverifera</i>	Apru, Danta, Epro, Kotibe, Otutu
<i>Oldfieldia africana</i>	Dantoue
<i>Parinari excelsa</i>	Sougue
<i>Piptadeniastrum africanum</i>	Agboin, Dabema, Dahoma
<i>Pycnanthus angolensis</i>	Akomu, Ilomba, Otis, Pycnanthus
<i>Sacoglottis gabonensis</i>	Akouapa, Atala, Ozouga, Tala
<i>Tarrietia utilis</i>	Cola Mahogany, Niangon, Nyankom, Ogoje
<i>Terminalia ivorensis</i>	Afara, Emeri, Framire, Idigbo
<i>Terminalia superba</i>	Afara White, Akom, Frake, Limba, Ofram
<i>Triplochiton scleroxylon</i>	Abachi, Ayous, Obeche, Samba, Wawa
<i>Uapaca</i> spp.	Assam, Rikio

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African Tropical Timber, Organization for European Economic Cooperation, Paris, 1951.

Appendix IV. Commercial Names and Corresponding Scientific Names  
of Recognized Liberia Timber Species

Abachi	<i>Triplochiton scleroxylon</i>
Abaku	<i>Dumoria heckelii</i>
Abale	<i>Combretodendron africanum</i>
Abang	<i>Chlorophora excelsa</i>
Abeul	<i>Canarium schweinfurthii</i>
Abine	<i>Combretodendron africanum</i>
Aboukikro	<i>Entandrophragma cylindricum</i>
Abura	<i>Mitragyna stipulosa</i>
Acajou	<i>Khaya ivorensis</i>
Acjou blanc	<i>Khaya anthotheca</i>
Adoum	<i>Cylicodiscus gabunensis</i>
Afara	<i>Terminalia superba</i>
Afzelia	<i>Afzelia</i> spp.
Agboin	<i>Piptadenastrum africanum</i>
Ahun	<i>Alstonia congensis</i>
Aiele	<i>Canarium schweinfurthii</i>
Akede	<i>Antiaris africana</i>
Akem	<i>Berlinia</i> spp.
Ako	<i>Antiaris africana</i>
Akom	<i>Terminalia superba</i>
Akomu	<i>Pycnanthus angolensis</i>
Akouapa	<i>Sacoglottis gabonensis</i>
Akoura	<i>Lophira alata</i>
Akume	<i>Brachystegia</i> spp.
Aligna	<i>Afzelia</i> spp.
Alstonie	<i>Alstonia congensis</i>
Alui	<i>Erythrophleum</i> spp.
Antiaris	<i>Antiaris africana</i>
Anyan	<i>Distemonanthus benthamianus</i>
Apa	<i>Afzelia</i> spp.
Apome	<i>Cynometra ananta</i>
Apopo	<i>Lovoa trichilioides</i>
Apru	<i>Nesogordonia papaverifera</i>
Asaka	<i>Entandrophragma angolense</i>
Assam	<i>Uapaca</i> spp.

Atala	<i>Sacoglottis gabonensis</i>
Atiokouo	<i>Beilschmiedia mannii</i>
Awun	<i>Alstonia congensis</i>
Ayan	<i>Distemonanthus benthamianus</i>
Ayous	<i>Triplochiton scleroxylon</i>
Azobe	<i>Lophira alata</i>
Azodau	<i>Afzelia</i> spp.
Badi	<i>Nauclea trillesii</i>
Bahia	<i>Mitragyna stipulosa</i>
Baku	<i>Dumoria heckelii</i>
Barre	<i>Distemonanthus benthamianus</i>
Berlinia	<i>Berlinia</i> spp.
Bodica	<i>Anopyxis klaineana</i>
Bogo	<i>Beilschmiedia mannii</i>
Bompega	<i>Mammea africana</i>
Bongossi	<i>Lophira alata</i>
Camwood	<i>Baphia nitida</i>
Canarium	<i>Canarium schwenifurthii</i>
Chenchen	<i>Antiaris africana</i>
Corkwood	<i>Musanga cecropioides</i>
Cotton tree	<i>Ceiba pentandra</i>
Crabwood	<i>Carapa procera</i>
Dabema	<i>Piptadeniastrum africanum</i>
Dahoma	<i>Piptadeniastrum africanum</i>
Daniella	<i>Daniella thurifera</i>
Danta	<i>Nesogordonia papaverifera</i>
Dantoue	<i>Oldfieldia africana</i>
Denya	<i>Cylicodiscus gabunensis</i>
Dibetou	<i>Lovoa trichilicoides</i>
Djombo	<i>Mammea africana</i>
Duku	<i>Alstonia congensis</i>
Eba	<i>Lophira alata</i>
Ebiara	<i>Berlinia</i> spp.
Edinam	<i>Entandrophragma angolense</i>
Ekki'	<i>Lophira alata</i>

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Ekpogoi	Gilbertiodendron spp.
Elelom	Mitragyna stipulosa
Elemi	Canarium schweinfurthii
Emeri	Terminalia ivorensis
Emien	Alstonia congensis
Epro	Nesogordonia papaverifera
Erun	Erythrophleum spp.
Esaka	Entandrophragma angolense
Essia	Combretodendron africanum
Eveuss	Klainedoxa gabonensis
Faro	Daniella thurifera
Frake	Terminalia superba
Framire	Terminalia ivorensis
Gedu nohior	Entandrophragma angolense
Guarea	Guarea thompsonii
Indigbo	Terminalia ivorensis
Ilomba	Pycnanthus angolensis
Ipaki	Entandrophragma angolense
Iroko	Chlorophora excelsa
Kaku	Lophira alata
Kokoti	Anopyxis spp.
Kosipo	Entandrophragma candollei
Kotibe	Nesogordonia papaverifera
Kusia	Nauclea trillesii
Kyenkyen	Antiaris africana
Larme	Haplormosia monophylla
Lati	Amphimas pterocarpoides
Limbo	Terminalia superba
Lingue	Afzelia spp.
Mahogany, African	Khaya ivorensis
Mahogany, Cherry	Dumoria heckelii
Mahogany, Cola	Tarrietia utilis
Makore	Dumonia heckelii

Maligba	Berlinia spp.
Mammee apple	Mammea africana
Manji	Chlorophora excelsa
Meblo	Brachystegia spp.
Melegba	Berlinia spp.
Movingui	Distemonanthus benthamianus
Niangon	Tarrietia utilis
Nyankom	Tarrietia utilis
Obeche	Triplochiton scleroxylon
Oboto	Mammea africana
Odoum	Chlorophora excelsa
Odum	Chlorophora excelsa
Ofram	Terminalia superba
Ogea	Daniella thurifera
Ogoue	Tarrietia utilis
Okan	Cylicodiscus gabunensis
Okoue	Baphia nitida
Okuro	Albizzia spp.
Okwen	Brachystegia spp.
Omu	Entandrophragma candollei
Opepe	Nauclea trillesii
Otie	Pycnanthus angolensis
Otutu	Nesogordonia papaverifera
Ouochi	Albizzia spp.
Owewe	Combretodendron africanum
Oziya	Daniella thurifera
Ozouga	Sacoglottis gabonensis
Pampena	Albizzia spp.
Papao	Afzelia spp.
Papo	Canarium schweirifurthii
Pa rasolier	Musanga cecropioides
Passee	Mammea africana
Pocouli	Berlinia spp.
Potrodom	Erythrophloeum spp.
Pycnanthus	Pycnanthus angolensis

Rikio	Uapaca spp.
Samba	Triplochiton scleroxylon
Sapele	Entandrophragma cylindricum
Sapele, heavy	Entandrophragma candollei
Sapelli	Entandrophragma cylindricum
Satin wood	Distemonanthus benthamianus
Silk cotton	Ceiba pentandra
Sipo	Entandrophragma utile
Sougue	Parinari excelsa
Subaha	Mitragyna stipulosa
Tala	Sacoglottis gabonensis
Tali	Erythrophleum spp.
Tiama	Entandrophragma angolense
Ukutu	Ochrocarpus africanus
Utile	Entandrophragma utile
Uwowe	Albizia spp.
Walele	Pycnanthus angolensis
Wawa	Triplochiton scleroxylon
Walnut, African	Lourea trichilioides
Wismore	Tarrietia utilis

Appendix V

Average rainfall at Ganta Methodist Mission and Firestone Research Station near Harbel. 1/

	Ganta Methodist Mission	Firestone Research Station
January	.61	1.19
February	1.62	1.50
March	4.59	4.88
April	4.93	6.37
May	7.58	11.32
June	10.58	15.26
July	9.71	15.96
August	11.59	18.91
September	14.61	23.78
October	10.19	15.82
November	4.09	7.43
December	.96	3.25
Yearly Average	81.06	125.67

1/ The Ganta data are based on records kept over a 15 year period while the Firestone records are based on 11 years of observation.

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## Appendix VI

### TRAVEL IN THE INTERIOR

Since all forestry work for years to come will be done far away from roads in Liberia, and since there are certain customary forms and manners that should be observed while travelling in the interior, the following account may serve as a guide for travelers and other technicians who are in Liberia.

The investigations of forest composition and timber volume in Liberia is a time-consuming but interesting work. Since few of the high forest areas are in the vicinity of the present road system, travel through Liberia is on foot. Much of the way is over native trails with porters headloading the necessary equipment. During this assignment in Liberia the writer covered about 1,000 miles on foot.

Before starting on a bush trip it is well to contact the Department of Interior to explain to the Secretary or his assistant the purpose of the trip and to give the intended route. It will facilitate matters if a letter is obtained from the Department of Interior to the Commissioner in whose district the travel will take place. The first stop on the trip will be to call on the Commissioner, who is always helpful in the matter of obtaining laborers. Usually, he will call in the paramount chiefs and request a certain number of carriers from them. After these carriers have been obtained and a head man has been selected, the loads will be placed on the ground in the Commissioner's compound and a load will be assigned each man. A guide who knows the route will be selected as number two man. He will lead the way, while the head man usually will stay behind to see that all loads reach their destination by night.

Bush travel is usually planned so that a village is reached after a day's travel of about 25 miles. Upon arrival, an official visit is made to the chief's quarters, where the traveller will be received by the chief, the elders in the village, and the clerk, who usually acts as interpreter.

The purpose of the trip is explained to the chief and his cooperation is requested in obtaining housing for the party. The chiefs in the villages are always most cooperative, and the request is always granted, after which

the field party gets ready for the night. Usually gifts or "dashes" in the form of a chicken, eggs, fruits or other food will be brought from the chief or important people in the village. Rice for the carriers is purchased through the chief from some of the townspeople. Before leaving the next morning in order to reciprocate for the "dashes", it is customary for the field party to "dash" each give a small amount of money. A conference is held with the chief before taking leave, telling him where the party is going and expressing thanks for the good reception. Payment for the stay in the village is then given the chief and the party is ready to start off again. In the meantime, the head man has lined up all the carriers, each having his load in front of him and the party is off. If it is not possible to reach a village by dark, as happens in large forest areas, the party must camp out. Leaders of the field party use jungle hammocks, while the carriers generally build lean-tos out of branches, leaves and thatch. Beds are made of sticks and elevated from the ground in order to prevent attacks from driver ants which may be attracted by the refuse from the evening meal. When such camping is contemplated, it is necessary to have rice, palm oil, and perhaps some meat for the carriers. Ordinary water buckets substitute well for cooking utensils.

Travel over trails frequently requires guides, for in some cases trails are merely marked by broken twigs or a few cut-off branches visible only to the guides. Even the best guide may get lost. Therefore, aerial photographs or sketches made from them are carried on bush trips. By using a compass and keeping track of the distances travelled either by pacing or estimating speed, safe arrival into town is generally assured. On rainy days the guides seem to have particular difficulty in finding their way. It sometimes happens that it is necessary to depend on a compass and the travel record for the day to get to the destination before dark.

Most of the travel in the high forest is undertaken during the dry season. This does not mean that no rain will be encountered during this period, for oftentimes violent showers occur, drenching both men and loads. The run-off in Liberia is extremely fast, even in the forest areas. Where before there were almost dry creek beds, roaring streams quickly develop after such showers. Since the carriers do not hesitate to cross streams by walking through them, many crossings were made with the swiftly running water reaching to the chest or higher.

A most remarkable characteristic of the people in the interior of Liberia is their complete honesty. In all the writer's travels, he never had a single item stolen. Money, always carried in the form of coins, was kept in a wooden box. This box would be loaded on some carrier's head in the morning and usually did not come into sight again until night. In spite of the fact that everyone knew about the money box, and knew that the box could be opened easily, nothing ever was missing. Although life in the bush is very strenuous and primitive, it is very rewarding. There is no better way of getting to know the country people of Liberia than to live with them in close quarters, as is the case on such expeditions. Through such close associations mutual respect is developed. As soon as the country people find out that the traveller treats them fairly and is interested in matters that may bring progress to the community, they are willing to work hard, even beyond normal requirements.

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## Appendix VII

## CURRICULUM

THE SCHOOL OF FORESTRY

<u>FIRST SEMESTER COURSE</u>	<u>HOURS</u>	<u>SECOND SEMESTER COURSE</u>	<u>HOURS</u>
<u>FRESHMAN YEAR</u>			
MATHEMATICS 101	3	MATHEMATICS 102	3
ENGLISH 101	3	ENGLISH 102	3
GENERAL PHYSICS 101	4-1/2	GENERAL PHYSICS 102	4-1/2
GENERAL CHEMISTRY 101	4-1/2	GENERAL CHEMISTRY 102	4-1/2
FOR. 101 (Introduction)	1	FOR. 102 (Introduction)	1
WORLD GEOGRAPHY 101	3	CONT. CIVILIZATION	3
R.O.T.C.	1	R.O.T.C.	1
	20		20
<u>SOPHOMORE YEAR</u>			
ENGLISH 201	3	ENGLISH 202	3
MATHEMATICS 201	3	MATHEMATICS 202	3
FOR. 201 (Botany)	4	FOR. 202 (Botany)	4
FOR. 203 (Surveying)	4	FOR. 202 (Surveying)	4
AFRICAN HISTORY 201	3	AFRICAN HISTORY 202	3
R.O.T.C.	1	R.O.T.C.	1
	18		18
<u>JUNIOR YEAR</u>			
FOR. 301 (Utilization)	3	FOR. 302 (Utilization)	3
FOR. 303 (Silviculture)	3	FOR. 304 (Silviculture)	3
FOR. 305 (Mensuration)	3	FOR. 306 (Mensuration)	3
FOR. 307 (Dendrology)	3	FOR. 308 (Dendrology)	3
FOR. 309 (Engineering)	3	FOR. 310 (Engineering)	3
FOR. 311 (Economics)	3	FOR. 312 (Economics)	3
	18		18
<u>SENIOR YEAR</u>			
FOR. 401 (Utilization)	3	FOR. 402 (Utilization)	3
FOR. 403 (Silviculture)	3	FOR. 404 (Silviculture)	3
FOR. 405 (Wood Technology)	3	FOR. 406 (Wood Technology)	3
FOR. 407 (Management)	3	FOR. 408 (Management)	3
FOR. 409 (Mapping)	3	FOR. 410 (Mapping)	3
FOR. 411 (Administration & Policy)	3	FOR. 412 (Administration & Policy)	3
	18		18

FOR. 414 (Rubber Culture) 2 hours. (To be given every other year during second semester. Required course for junior and senior students.)