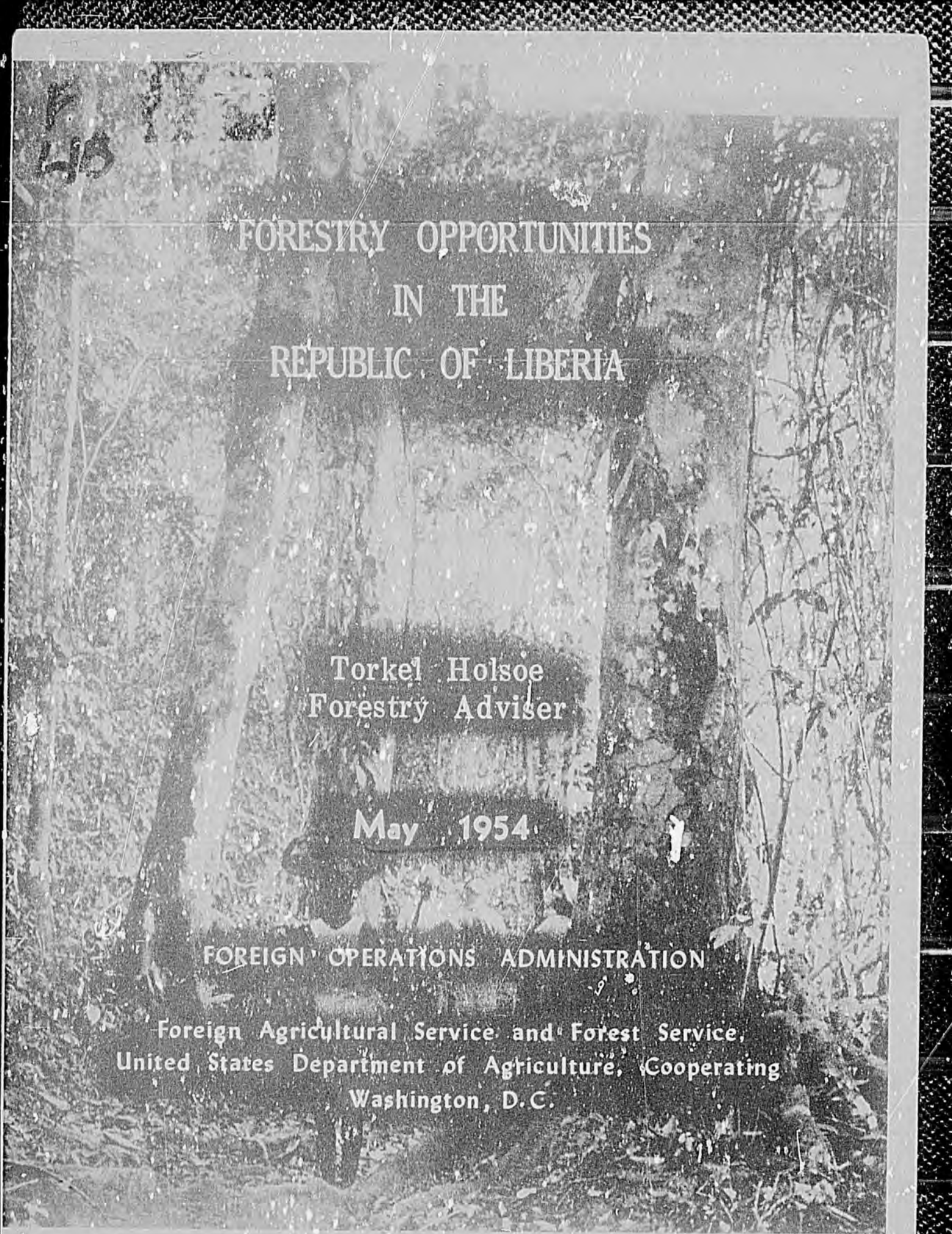


FORESTRY OPPORTUNITIES IN THE REPUBLIC OF LIBERIA

Torkel Holsoe
Forestry Adviser

May 1954

FOREIGN OPERATIONS ADMINISTRATION

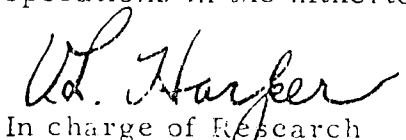
Foreign Agricultural Service and Forest Service,
United States Department of Agriculture, Cooperating
Washington, D.C.

FOREWORD

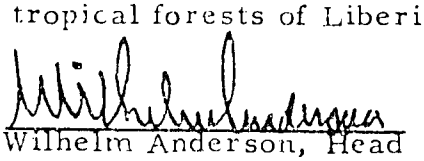
The rational management of forest resources, with the attendant contributions to national strength and well-being, are more often than not a goal rather than an achieved objective. In fact, many of the countries with which FOA is concerned are characterized by a dearth of forests to manage, and forest wealth can be obtained only, if at all, by a slow process of what amounts to reclamation. Liberia is one of the more fortunate countries with regard to its forest resources. In spite of a shifting agriculture, typically destructive of the forest, this West African Republic still retains a body of almost untouched forest, extensive enough to constitute a resource adequate for the needs it may be called upon to fulfill in the Nation's expanding economy.

This report describes the activities, discusses the problems, and reports progress of an FOA forester who has been aiding the Liberian Government to initiate a progressive forestry program starting "from scratch." The author, Torkel Holsoe, brought a considerable and varied experience to his Liberian assignment. He received his basic professional forestry training in Denmark. In 1932, he came to this country on a Harvard scholarship, received the degree of Master of Forestry in 1934, and later became an American citizen. During the Emergency Conservation Work, he supervised the silvicultural work of twenty CCC camps in Indiana. From September 1935 to July 1936, he was instructor in Forestry at Ohio State University. In 1938, after two years as a Forester in private industry, he joined the staff of the Division of Forestry at West Virginia University as Instructor. From 1942-45, he served as an intelligence officer in the U. S. Army Air Corps. In 1946, he returned to West Virginia University as Professor of Silviculture in the University and Silviculturist at the Agricultural Experiment Station. For several years, in addition, he managed the West Virginia Forest Products Association, a cooperative organization which conducted complete forest management work for private forest land owners. He is author of a number of technical and scientific papers and bulletins.

This report of Mr. Holsoe's activities in Liberia from 1951-53 should be of interest not only to other foresters on FOA assignments, but also to wood-using industries interested in establishing operations in the hitherto unexploited tropical forests of Liberia.



In charge of Research
Forest Service



Wilhelm Anderson, Head
Far East Section
Foreign Agricultural Service

AUTHOR'S ACKNOWLEDGEMENTS.

The author has received invaluable assistance and advice from many friendly and capable persons. Forestry in Liberia is a new activity, and if a newly assigned technician were unable to draw upon the knowledge and experience of other people, comparatively little would be accomplished. The generous help and guidance of the following persons have been especially appreciated:

Hon. Stephen Tolbert, Assistant Secretary of Agriculture, Republic of Liberia, and fellow forester, whose interest and sound advice have been very helpful in getting the forestry program in Liberia underway.

Dr. Clayton R. Orton, who, as former Director of Agricultural Research in Liberia under TCA during most of the period of my first assignment, was always most helpful with advice and technical knowledge. His direct approach to problems guided much of my work.

Mr. Frank E. Pinder, Agricultural Adviser under the TCA program, who has always given me the fullest benefit of his great store of knowledge of Liberia, and has helped me in innumerable ways in extending technical assistance in forestry.

Mr. C. R. Lockard, who, as forestry consultant from the Forest Service, United States Department of Agriculture, spent two months with me in Liberia and gave most helpful technical backstopping services. His continuing efforts after returning to Washington have helped greatly in advancing the forestry program for Liberia. Most of the photographs appearing in this report were taken by Mr. Lockard.

Mr. A. C. Cline, who, as liaison official for the Forest Service, United States Department of Agriculture, with the agencies sponsoring technical assistance, has given much valuable help in coordinating the technical backstopping of forestry in Liberia.

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

Torkel Holsoe

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Washington, D. C.
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LIBERIAN FORESTS

Liberia was at one time covered with tropical forests. The country is located between 4 and 8 degrees north of the equator in a heavy rainfall belt, and all the forests along the coast are classified as tropical evergreen rain forests. Farther inland, where the rainfall is considerably lower, the forest trees are more or less deciduous, losing their leaves at certain times. The best timber in Africa is found in this equatorial belt.

Due to the practice of shifting cultivation by the natives, much of the forest has been cut over, so that at present only a little more than one-third of the country is covered by high forest, or old growth. Much of this high forest is composed of virgin timber, while other parts were cleared as much as a hundred years ago, reverted to forest, and thereafter were left undisturbed. Still other forest areas that have at one time or another been exposed to shifting cultivation now support what is termed "broken forest," containing stands which range in volume between 2,000 and 7,000 board feet of commercial timber per acre. Through proper forestry practices these areas could form an important part of the country's permanent forest estate. The so-called "low bush" is found on areas more recently cleared for farms and abandoned, and seldom contains trees more than 40 or 50 feet high. The species which first reclaim these clearings are usually poor timber trees. Low bush areas have ordinarily been used repeatedly for agricultural purposes, and, in view of the presence of large areas of high forest and broken forest, the low bush areas might well be considered as prospective agricultural land and unavailable for forestry purposes.

Until 1947, there was very limited information generally available on the forest resources of Liberia. Karl R. Mayer in the period 1947-49 carried on extensive explorations and published his findings in Forest Resources of Liberia. 1/

1/ Mayer, Karl R.: Forest Resources of Liberia, United States Department of Agriculture, Information Bulletin No. 67, 1951.

Mayer travelled thousands of miles on foot, and by correlating his field observations with study of aerial photographs, estimated that the land area of Liberia was divided approximately as follows:

Condition class	Total area (acres)	Percent 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
Total	23,800,000	100.0

Mayer further estimated that each year approximately 50,000 acres of high forest are destroyed by rice farmers in establishing farms, cutting down the trees and burning over these areas in their efforts to produce food. This activity, known as shifting cultivation, is about the only factor operating to reduce the high forest area of Liberia, but it is an effective one. The establishment of farms does not follow any prescribed 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 is done by first cutting vines and bushes. After these have dried, the trees are felled. Although many of the trees reach diameters of four or five feet, most of them will be cut down. A common exception is red ironwood (Lophira alata), which is too hard for the farmers to cut with an ax.

After all this material has partially dried, the burning starts, during March or April. In the first burning all the smaller material is consumed. During successive fires, the remaining material is re-piled and further consumed. Most of the logs from the larger trees still remain where felled, but some of the ground will be clear among the logs. All this clearing work is done by the men. The planting of the rice and the harvesting of it is done by the women. During May the women will start grubbing the earth with small hoes. They place seed rice in the ground and cover it up in the same operation. During its entire growth, the rice has to be protected from various enemies. For this purpose a small hut is built in the middle of each field, where constant guard is kept. Bush cows may come in during

New farm in what was formerly high bush, near Bomi Hills, Liberia.

the night to graze on the rice; these animals are scared away by the beating of drums or by other noise makers. Later, especially when the rice kernels are maturing, large flocks of rice birds may settle down on the field to eat the greater part of the crop, if it seems unguarded. To protect the rice from groundhogs, the field is usually fenced in by surrounding it with it with three to four-foot sticks laid closely side-by-side.

The rice is usually ripe and ready for harvesting in September or October. Immediately after rice harvesting, cassava is planted on the same ground. The cassava crop ripens in about 8 or 9 months. After that, the usefulness of each little clearing has ended, since the fertility of the soil is nearly exhausted. Consequently, a new area must be cleared for the next season's rice crop. This may be an extension of the old clearing, or as above stated, it may be started several miles away in the middle of the high forest. The result is that often these individual farms are found scattered throughout otherwise uninhabited areas.

Besides establishing farms in the high forest, the farmers also use much of the broken forest and low bush areas for their crops. The customary procedure is to abandon any farm area as soon as one crop of rice and one crop of cassava have been grown on it. The abandoned area is usually left for about seven or eight years, during which time bushes and trees again cover the ground and the fertility of the soil is thereby partially restored. Then the area is again cleared and another crop of rice and cassava grown.

Although the broken forest and low bush areas are much easier to clear and cultivate than high forest, many farmers still 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 being grown in the low bush areas. The main reason for preferring to clear the high forest seems to be that it is considered more of a man's work to cut large trees than to clear ground on which there are only small trees. Through this clearing of high forest, about 500 million board feet of timber are wasted each year.

FORESTRY LEGISLATION

Mayer realized the necessity of forest legislation in order to prevent the great destruction of forest resources which takes place every year. If the present sporadic methods of clearing land for farms in the interior of the high forest continues indefinitely, and is not replaced by an orderly expansion around the present villages, the high forest will eventually be broken up by farms. Mayer, therefore, submitted to the Liberian Government

in 1949 a draft for a forest conservation law which would, among other things, control the shift of agriculture to some degree by establishing national forest reserves in which clearing could be controlled or eliminated. This draft had not been enacted into law in 1951, at the time of arrival of the writer.

At the suggestion of Hon. Stephen Tolbert, Assistant Secretary of Agriculture, minor details in Mayer's draft were changed and the draft sent through the Secretary of Agriculture, Hon. John W. Cooper, to President Tubman. In November 1951, the President forwarded the draft to the Liberian Senate with a recommendation for its passage. However, due to a lengthy discussion of the annual budget, the Act was passed over in that legislative session. During the following year, the writer had an opportunity to discuss forest conservation problems with the President and various members of the Cabinet. Through the efforts of the Secretary and 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. 1/

The Forest Conservation Act empowers the federal government to establish forest reserves in various parts of Liberia. It furthermore provides for the establishment of a Bureau of Forest Conservation in the Department of Agriculture and Commerce to administer the Act.

The term "reserve" as used in the Act should be discussed at this point. A forest reserve is generally considered to be an area in custodial status, that is, 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 abandoned in favor of "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 term "reserve" and "reserved area," it clearly states that

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1/ "An Act for the Conservation of the Forests of the Republic of Liberia", approved April 17, 1953. Published by Authority, Government Printing Office (Department of State), Monrovia.

scientific forestry will be practiced on the "reserved areas" and that they, along with other publicly owned lands, will be devoted "to their most productive use for the permanent good of the whole people considering both direct and indirect values." The Liberian concept of the public forests, thus, is that they are national forests, as in the United States and not untouchable stores of timber.

Immediately after the passage of the Forest Conservation Act, Forest Rules and Regulations, to implement the Act, were formulated. These were based on suggestions made by Mayer as a result of his studies of the problems. The Rules and Regulations were approved by Hon. Stephen Tolbert, Acting Secretary of Agriculture and Commerce, and have been submitted to President Tubman for his approval. The nature of these rules and regulations will be discussed later in this report.

A budget for the Bureau of Forest Conservation for the calendar year 1954 has been submitted to the President for inclusion in his budget. This provides for the employment of one Deputy Bureau Chief, three Forest Conservators and three Forest Rangers.

THE HIGH FOREST AREAS

At one time all of Liberia was undoubtedly covered with high forest. Shifting cultivation has reduced this virgin forest so that at present only a little more than one-third of the country is still covered with undisturbed high forest. The Liberian high forest contains numerous species, 150 or more of which reach commercial timber size. Due to the great variation in rainfall throughout the country, its composition varies greatly.

The Evergreen Forest

Along the Atlantic coast and stretching inland for about 50 miles, the forest can be classified as evergreen tropical rain forest. In this belt the rainfall ranges from about 150 inches to over 200 inches yearly.

The most common species found is red ironwood (Lophira alata), which already has been exported from other West African countries and used extensively in harbor construction in Africa and Europe. In certain locations along the coast

Musanga Smithii (cork wood) invading recently abandoned farm near Totota, Liberia.

of Liberia, red ironwood occurs in almost pure stands (which is rather unusual for tropical forests in which composition generally is extremely mixed). Other species found in this coastal belt include Saccoglottis gabonensis, Anopyxis ealaensis, Afromosa monophylla, Parinarium excelsum, Ochrocarpus africanus and Tarrietia utilis. Most of these species are valuable for heavy construction work; the last mentioned is the only one which is considered suitable for other uses, including possibly furniture manufacture. Since the coastal area at present is the only area on which timber operations may be profitably conducted, owing to the difficult transportation from the interior, the lack of woods of recognized high value probably explains why large-scale logging operations have not yet been started in Liberia.

The Transition Forest

Between 50 and 100 to 150 miles inland the annual precipitation drops to from 100 to 150 inches yearly. The Forest in this belt is a transition between the coastal evergreen rain forest and the deciduous forest found farther in the interior. Some of the species in this belt are deciduous for a few weeks out of the year, while others shed their leaves gradually as new ones develop and stay green throughout the year. Forest composition is quite different from that of the coastal belt. Here several valuable species for furniture manufacture are found. Among them are Terminalia ivorensis and T. superba, Canarium Schweinfurthii, Mimusops Heckelii and Chlorophora excelsa, all of which have been utilized by the furniture industry in Europe. Besides these species several valuable for construction timber, particularly Piptadenia africana, are found.

The Deciduous Forest

The real deciduous forest is found in a belt having less than 100 inches of precipitation per year; this is about 150 miles from the Atlantic Coast in the Western Province, while in the south-eastern part of Liberia it is found about 100 miles inland. The most valuable timber species in West Africa are found in this belt. Here are several species of Entandrophragma, which are being exported currently from the Gold Coast as "Sapele" and "Utile" and used under the name of "mahogany" in Europe. Besides these, there are also Lovoa klaineana (brown mahogany), Triplochiton scleroxylon, Sarcocephalus diderrichii, and occasionally Khaya ivorensis and K. anthotheca, the last two being the true African mahoganies. In addition, such important species of the transition zone as Mimusops Heckleii, Terminalia ivorensis, T. Superba, Chlorophora excelsa, and Canarium Schweinfurthii are found here. The composition and stand volumes of these interior deciduous forests compare favorably

Lophira alata (red ironwood) near Diala, Liberia.

with those of any stands being utilized for commercial purposes in West Africa.

Although the occurrence of certain important timber trees is well defined according to the rainfall belts, others are found throughout Liberia. In particular this is true of such species as Lophira alata, Anopyxis ealaensis, Parinarium excelsum and Tarrietia utilis. However, since these species are not currently of the highest value, the important determinants of utilization possibilities are the occurrence of the species listed above, or the discovery of new species or new markets for species hitherto considered secondary.

TRAVEL IN THE INTERIOR.

Investigation of forest composition and timber volume in Liberia is a tedious and time-consuming job. Since most of the high forest areas are far away from the present road system, the only form of travel possible is on foot. Much of this is done over native trails with porters headloading the necessary equipment. During the two-year assignment in Liberia, the forestry adviser covered about 700 miles on foot. Bush travel is usually planned in such a way that a village is reached after daily travel of about twenty-five miles. Experience has shown that Chiefs in these villages will always cooperate with travelers to the fullest extent. For instance, they will generally make several houses available to a field party. It is common procedure for the Chief and other important people to bring gifts or "dashes" (a chicken, eggs, rice and other foods) to a party once it is settled for the night. In order to reciprocate for these "dashes" it is customary for the field party to "dash" each giver with a small amount of money before leaving town the next morning. If it is not possible to reach a village by dark, as in an uninhabited forest area, the party must camp out. Leaders of the field party use jungle hammocks, while the natives generally build lean-tos.

Travel over trails frequently requires native guides, for in some cases trails are merely marked by broken twigs or a few cut-off branches, visible only to guides. And even native guides can get lost. Therefore, aerial photographs, or sketches made from them, are often carried on bush trips. By using a compass, and keeping track of distance travelled, by pacing or estimating average speed, safe arrival into towns is generally assured. Particularly on rainy days, the native guides seem to have difficulty in finding their way. However,

the keen eyesight of the native Liberian was often reason for real amazement. Time and again a native can see game animals or birds virtually invisible to the untrained eye. Usually the native would be quite patient about the writer's "poor eyesight," but when he was unable to see a monkey well within shooting range, the native would become quite impatient, since missing such a shot would deprive him of his favorite meat.

Most of the travel in the high forest is done during the dry season. This does not mean that no rain will be encountered during the 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 developed after such showers. Since the native does not hesitate to cross streams by walking through them, many crossings are made with swiftly running water reaching to the chest or even above. However, due to the warm climate, colds never result from the wettings, even though, in spite of efforts to dry the clothes at night by the fire, they often remained damp.

The 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 not seen again until night. In spite of the fact that every one of the carriers knew where the money was and that the box could be opened easily, nothing was ever missing. Although life in the bush is very strenuous and primitive, foresters must be prepared to spend a considerable portion of their time there. Not only is this necessary in order to collect technical information, but it is necessary that there be understanding of the people and their culture.

The tropical high forest is completely different from any forest in the temperate zone. The idea that it is all composed o f enormous trees is erroneous. Like most virgin or old second-growth forests, 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 4 feet in diameter. There are plenty of small trees which seem to be waiting for the big trees to die, so they can utilize the space and light taken up by them.

Canarium Schweinfurthii (African elemi) near Diala, Liberia.

Another fallacy is that the tropical high forest is impenetrable. It is true there often is heavy undergrowth and that it would be difficult to run a straight line through the high forest. Most trees are without branches for quite a distance up, since shade has killed off the lower branches. However, where a large tree has fallen recently, there will be a thicket. But such thickets can generally be avoided and it is not too hard to travel off the trails.

When travelling alone in the high forest, one is impressed by the stillness. Only in the early morning or at night will there be noises from monkeys and birds. At noon birds are resting and there is almost complete silence, only occassionally broken by the sound of a falling branch. On bush trips with carriers, who often number as many as twenty, there is little quiet. Although these carriers are vitally interested in shooting game, they like to talk or sing. In order to be happy the Liberian native must have sound--preferably rhythmic sound. With it, they work much better. Although they are aware that nobody can shoot game while there is noise, they continue to beat out a rhythm on a small drum or stick so that they may forget the heavy loads on their heads.

While hunting, the native will strip down so that no light colored clothing will show. He can move noiselessly through the densest forest to bring himself and shotgun within range of the game. Antelopes, monkeys, and even leopards are hunted this way. Liberian hunters hunt so as to waste little ammunition, since a shotgun shell costs 25 cents, almost a day's pay.

ESTABLISHMENT OF PUBLIC FOREST RESERVES

The writer, as Forestry Advisor, has placed considerable emphasis on the importance of establishing certain public forest reserves in Liberia, before the best remaining timber land is cut over by rice farmers. In November 1951, a proposal was submitted to the Joint United States-Liberian Commission outlining a program for placing some 3 or 4 million acres of high forest in national forest reserves, as one means of assuring a continuing supply of high-grade timber products. Under this proposal, the United States Government would, through TCA, furnish six junior foresters to act as chiefs of field parties in establishing the boundaries of the reserves, while the Liberian Government would furnish transportation and housing for these employees. The Liberian Government expressed its willingness to set aside about $25,000 yearly for this project. The Liberian

members of the Joint Commission were unanimously in favor of the proposal for they recognized the importance of halting the wastage of the nation's forest resources during the interim until transportation facilities were improved to the point that forests could be managed rationally and products properly marketed.

An adequate forestry program for Liberia offers many great benefits. Through good forest management applied to the present high forest area of about 9 million acres, it should be possible eventually to extract 2 to 3 billion board feet of timber per year indefinitely. Assuming a conservative sale value of $60 per M board feet at port, in form ready for market, the annual value of such production would amount to $120,000,000 or more. This income to a large extent would be distributed throughout Liberia in the form of wages. If the Liberian Government were to obtain $3 per M board feet in stumpage(the rate proposed in the Forest Rules and Regulations), the revenue would be $6,000,000 or more. The estimated revenue cannot be obtained in the near future, since adequate transportation facilities and markets are lacking. The figures are given to indicate the importance of possible benefits. If a forest conservation program is aggressively carried forward by Liberia now, the forest area necessary to export the annual cuts indicated will be available when conditions become favorable for management.

Although great interest in the proposal for setting aside public forest reserves has been evident among Liberians, the delay in the passage of the Forest Conservation Act postponed any action until the spring of 1953. But before the passage of the Forest Conservation Act, Hon. John Cooper, Secretary of Agriculture and Commerce, suggested and President Tubman agreed that work should be started on a boundary survey of the first Forest Reserve. The President approved a small sum of money for the beginning of the boundary survey of the Gio Forest Reserve. This high forest was selected for several reasons. First, the Gio forest contains about 15 M board feet per acre, according to Mayer. Second, the species found in this area are among the more valuable ones. Furthermore, the writer's observations made on several trips were that aggressive farming activities were rapidly destroying portions of the best timber.

From the aerial photographs made by Aero Service Corporation of Philadelphia, Pa., a temporary boundary map was made to serve as guide for the survey. The boundary lines were drawn in such a way that all current agricultural developments were excluded from the proposed forest reserve. The total area of the reserve will be about 80,000 acres. The actual job of

surveying the 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 compass and using the surveying chain. After working on the survey for a few days under instruction from the writer, two Liberian aides learned to run compass and use a chain sufficiently well so that they could handle 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 the boundary line, a six-foot path free of all underbrush. On the boundary lines, cola nuts were planted at intervals of 33 feet. It is believed that in six or seven years, when the cola trees will start bearing, the native population will travel along the boundary line to collect the highly prized cola nuts, and thus keep the lines clear thereafter.

Although the men worked hard, it was not possible to complete as much as one mile of survey line per day. Some of the 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. In more open high forest, it will be possible to progress faster than a mile a day; however, a mile per day average for all conditions is considered good progress.

During the first of May the rains were heavy, and, although the workers built shelters for the night, they were unable to keep dry during the downpours. Because of lack of sleep, the work suffered following heavy night rains. The work was therefore discontinued, to be resumed during the next dry season.

About 10 miles of boundary survey was completed. Some valuable experience was gained from this beginning which will be helpful in the planning of future survey work. The most serious problem on such jobs is providing food for about 25 men. It is necessary to carry provisions for about a week and to replenish from time to time from towns in the vicinity. From the food standpoint, the most favorable time for a boundary survey is during the beginning of the dry season, since at that time rice is plentiful and easy to purchase. In future surveys it will be advisable to set up a purchasing unit consisting of one responsible native with carriers, which can be depended upon for a source of staple provisions. In addition, a hunter must be employed to secure meat.

Piptadenia africana (African Green heart) near Ganta.

C. R. Lockard, Forestry Consultant, in his report on forestry problems 2/ pointed out that first priority in line establishment should be dictated by agricultural pressures. The current highway building program has shown that wherever a highway is to be built, claims of property rights are made as soon as surveys have been completed. In many cases the area involved is valuable high forest. Once claims are entered, the first activity is to cut down the high forest for rice fields. If the establishment of forest reserves does not keep ahead of such farms, large virgin forest areas will be destroyed, the permanent forest estate seriously reduced, and problems of reserve administration increased.

As shown by the initial work in running a boundary line, this work is most time consuming. In order to delineate the forest reserve areas which are most severely threatened by shifting cultivation, it will be necessary to have more forestry personnel for the work. The original proposal which envisaged using American junior foresters for this task still appears to be sound. Through their work it will be possible to establish forest reserves in the high forest areas which are under the greatest pressure and at the same time train Liberians, who, in a few years, will be able to proceed with the work until permanent forest estate. Prospects that the establishment of the program may be effectuated are good, for on several occasions President Tubman has expressed concern over the state of Liberia's forest resources. Recently, at a Council meeting at Tappita at which several District Commissioners and more than 300 Chiefs were gathered, he brought the matter up, and spoke at length on the benefits to be derived from the forests. He discussed their ability to provide revenue and labor, food through game, and general benefits through soil conservation and water retention for the people of Liberia. He urged every one to grow all their rice in the swamps, instead of cutting down the high forest for rice fields. Finally, the President asked those native Chiefs who would cooperate with him in this conservation program to so indicate by standing. He was answered enthusiastically by all Chiefs getting to their feet.

It is hoped that this first step in the conservation effort can be pursued vigorously at the present time. Establishment of public forest reserves is important in Liberia for this country is one of the few in the world which still has the opportunity of establishing a forest estate in virgin forest areas. It will not be necessary to go through with a program of forest rehabilitation before a profitable timber management program can be started.

2/ Lockard, C. R.: Some Forestry Problems of Liberia. Unpublished report. United States Department of Agriculture, 1953.

Entandrophragma Sp. (red mahogany) near Diala, Liberia.

The opportunity is enhanced because Liberia possesses valuable timber species which for a long time have been exported from various other countries in West Africa, where the supply is now decreasing.

OTHER ACTIONS BY THE LIBERIAN GOVERNMENT IN FORESTRY.

Shortly after the passage of the Forestry Conservation Act, Hon. Stephen Tolbert, Assistant Secretary of Agriculture, requested a comprehensive plan showing high forest areas which might be included in National forest reserves. By excluding areas which at the present time are granted as option areas for commercial interests, a system of forest reserves was tentatively laid out. These reserves were generally placed in the interior of Liberia, since by far the most valuable tree species are found there. Also, by locating them on the upper watersheds of rivers they would serve best in protection against soil erosion. Erosion is becoming a serious problem in Liberia. According to accounts from the native population, the rivers and streams are becoming increasingly muddy during the rainy seasons, and in recent years there have been many serious floods. It is reasonable to believe that there is a relationship between the continued clearing of the high forest and these observed conditions.

As indicated earlier, immediately upon passage of the Forest Conservation Act a set of Forest Rules and Regulations was submitted to the Assistant Secretary of Agriculture. Several conferences were held with him and a final draft proposal was worked out and submitted to President Tubman for his approval.

The Forest Rules and Regulations apply to reserves and concession areas as well. They specify, among other things, diameter or girth limits of various tree species when cut for commercial use on concession areas. They specify that concessionaires engaged in commercial timber operations are obligated to keep in forest production any area which has been utilized for this purpose. This restriction will tend to keep out any farming activities, and, furthermore, assure a continuous forest growth on these areas. A special section deals with hunting rights and measures for game conservation. It was considered essential to establish this game conservation program on the forest reserves, since the native population is greatly dependent on game for its meat supply. Hunting on

Triplochiton scleroxylon in Gio forest near Quipie, Liberia.

forest reserves will be permitted, but will be controlled by the issuance of permits and by required reporting of the amount of game killed.

In order to implement this program, a proposal including a budgetary estimate for the establishment of a Bureau of Forest Conservation under the Department of Agriculture and Commerce was submitted to the President. The personnel suggested for the calendar year of 1954 has previously been stated. The position of Chief was left out until a Liberian trained in forestry could be found to fill this post. In addition to this personnel, the budget proposal also included clerical help, automotive equipment, travel allowances, and other items necessary for the operation of the Bureau. It was deemed advisable to start with a small staff until such time as the activities made it necessary to enlarge it. It is planned that upon establishment of a given forest reserve, a forest conservator and a ranger will be stationed within the reserve to initiate activities.

Although the initial establishment of the Bureau of Forest Conservation may at first cause a net expenditure on the part of the Liberian Government, the payment of a stumpage tax on all commercial timber cutting will soon bring in revenues in excess of the expenditures. The Forest Rules and Regulations specify that any one cutting timber as a commercial enterprise will pay to the Government a stumpage tax. This tax will be $3 per M board feet for partially converted timber (such as lumber, planks, and ties), while logs for export will be taxed at $5 per M board feet.

Liberian personnel for the Bureau of Forest Conservation will be recruited by the Liberian Department of Agriculture and Commerce, in consultation with the FOA Forestry Adviser. Entrance examinations have been formulated in order to screen the applicants. These tests have already been used for the selection of Liberians now working with the Forestry Adviser. Applicants considered at the present time are required to have an equivalent of a high school education. Although most of the questions are based on eighth-grade arithmetic (according to United States standards), it was found that a 60 percent completion was above average. It has, however, been proved that through training and education, it is possible to advance the knowledge of interested young Liberians rather rapidly. It is significant that there is a great desire, almost a hunger, among them for knowledge. One expression of this is constant requests to most FOA technicians for technical reading matter.

Major trail (hammock road) through high bush, between Diala and Duelo, Liberia.

Prior to arrival in Liberia, the writer was aware of the lack of information in regard to identification of Liberian tree species. The only botanical reference books which were available were Hutchinson and Dalziel's Flora of West Tropical Africa, which covered entire West Africa, and Aubreville's La Flore Forestiere de la Cote d'Ivoire, which deals with Ivory Coast trees only. Mayer, during his stay in Liberia, was able to identify about 200 species of trees that reach diameters of 12 inches or more. Much of the herbarium material was photographed. Although these pictures are available, they are only helpful in the final identification according to general characteristics. The best available material on Liberian tree species is considered to be the

Entrance to a native village in Liberia.

collection of 138 wood samples at Yale Univeristy. These samples were collected in 1928 by G. Proctor Cooper and described by G. Proctor Cooper and Samuel J. Record in The Evergreen Forests of Liberia, Yale University, School of Forestry Bulletin No. 31, New Haven. 1931.

In order to make available the information which could be obtained from these wood samples, a card-sort identification key was constructed. The basis for this key were the microscopic wood characteristics of the Yale samples. McBee sorting cards with perforated edges were used, with one wood characteristic designated to each of the perforations. About 125 wood samples were 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 along to Liberia.

Typical road conditions in Liberia during rainy season.

This card-sort key was augmented with 10X enlarged photographs of end sections. Through cooperation of the Tropical Forestry Institute at Princes Risborough, Great Britain, about 100 photographs of end sections of West African timber species were obtained. These, together with photographs taken of the wood samples at Yale University, gave enlarged end pictures of most of the various wood samples for attachment to the perforated cards.

It is extremely difficult to identify all tree species, since current botanical identification systems use leaves, flowers and fruits and since many trees reach immense dimensions in Liberia. It is not unusual to find the lowest leaf-bearing branch situated a hundred or more feet up in the air. Flowers and fruits when available are usually located even higher up. Identification based on these characteristics is therefore tedious or impractical.

The writer found that by cutting out a small wood sample from the base of a tree and using the wood identification card-sort key he had developed, many of the species were readily identifiable. To check identifications made in this manner, photographs of leaves and fruits taken by Mayer were used when herbarium material could be obtained. The identification key now has been enlarged, so that it contains cards for 175 Liberian timber trees. The procedure for using this key is simple and easy to learn; it has been possible, for example, to teach the Liberian aides to identify tree species with it.

The key thus is a useful tool for training purposes. In order to augment the card-sort key based on wood characteristics, another type of key also using cards has been constructed. This is based on visible gross tree characters, such as forms of buttress, texture of bark, color of inner bark, presence of sap and latex, and their color if present. On the back of the cards, pictures of the buttresses and the leaves will be attached in order to make the identification more definite. It is obvious that this key will be even more important to foresters than the wood-character key. It is planned to have this key available so that any one travelling through the forest will be able to identify the trees with little difficulty.

In order to facilitate further the identification of Liberian timber species, a dictionary for six different languages covering the names of tree species has been prepared. This covers the Mano, Pelle, Bassa, Gio, Vai and Mandingo languages. Many times, the native name will designate immediately the identification of the certain tree species. However, implicit identification cannot be made through the native name, since often the same name will apply to several species. It will, however, in many cases be of great help.

As a guide to the utilization of Liberia timber, such technical data on strength properties and other physical factors as are available in the literature of American and European laboratories have been collected and compiled for 36 commercial species. This work is almost completed and ready for publication.

NURSERY PRACTICES WITH CERTAIN TROPICAL TIMBER SPECIES.

In order to provide planting material for experimental forest plantings, a nursery was established at Camp Johnson near Monrovia. Seed of Entandrophragma utile and Mimusops Heckelii were collected from trees in Liberia; seed of Entandrophragma cylindricum and Khaya ivorensis was obtained from the Gold Coast, and seed of Tectona grandis and Pterocarpus indicus (East Indian Rosewood) from Indonesia. Each of these species has its own peculiar growth characteristics which are reflected in differences in required nursery practice.

Entandrophragma and Khaya species will germinate quite readily if they are lightly covered in seed beds, shaded and watered daily to prevent drying out. As soon as the first leaves develop, the seedlings should be transplanted. If the transplanting is delayed, seedlings of these species are very difficult to move safely. Even when the transplanting is done at the prescribed time, extreme care has to be exercised. If possible, a lump of dirt should cover the roots during the transplanting operation. When seedlings of these species are transplanted to the field, it has been found that transferring the plants with lumps of dirt in paper bags will improve chances of survival. Furthermore, it is absolutely necessary to reduce the leaf surface of the plants before transplanting in the field, by eliminating all but two of the leaflets of each leaf; otherwise, the entire plant will wilt, either causing the death of the plant or serious reduction in vigor. All transplanting in the field should take place during the month of August, which is one of the heaviest rainfall months of the rainy season.

Mimusops Heckelii is handled differently in the seed bed. Although the seed is about two inches long and one inch in cross section, the best germination is obtained by covering only half of the seed with dirt, the rest remaining uncovered. This species germinates well, and therefore the seed can be planted in the seed beds at a spacing which makes transplanting unnecessary. The transplanting to the field is done in the same way as with the two above-mentioned species.

Tectona grandis (teak) requires still different handling. The teak fruit is a round capsule about half an inch in diameter containing three or four seeds. To obtain good germination, it is necessary to place this fruit on top of the ground exposed to full sunlight. Best germination is obtained during the dry season when the sun is particularly hot. The fruit must be soaked thoroughly every evening, but allowed to dry out completely during the day time. It is only when the fruit is alternately dried out and soaked that germination will take place. If the fruit is planted in a conventional way under shaded conditions, little germination results.

As soon as the teak seedlings have started, they must be transplanted, with a lump of dirt, into baskets about 8 inches in diameter. They remain in these until they are large enough to be transplanted into the field. If any other method is used, the large teak leaves will invariably wilt, with the result that the plant often dies.

Pterocarpus indicus (Indian Rosewood) is a very hardy leguminous plant which will stand almost any treatment. The seed received showed excellent germination, with rapid seedling growth. In six months many of the seedlings were six feet or more in height. These trees were transplanted in paper bags, mainly because they had to be transported for more than 100 miles to the planting site. With shorter hauling distance, it is believed that even this precaution may not be necessary.

Although the intention in the establishment of a nursery was to provide material for experimental plantings, it was not possible to obtain enough seed of all species so these plantings could be repeated enough times to satisfy the requirements of a sound experimental design. Arrangements have now been made so that enough seed of Khaya ivorensis, Entandrophragma utile, Mimusops Heckelii and Tectona grandis will be available to establish large enough plantations to permit statistical analysis of results.

The object of these experimental plantings is to test the various species in the different rainfall belts of Liberia. For example, at the present time, Khaya and Entandrophragma species are only found in places where the annual rainfall is less than 80 inches per year. It will be of importance to know whether they will grow where heavier rainfall occurs. If this is the case, improvement of stand composition could be made by introducing

them in areas where there are logging operations, by planting in openings created through cutting.

In order to utilize the available planting material, demonstration plantings of the several species listed were made at Zinta, situated near Kakata, in an area which receives about 175 inches of rainfall per year; at Suakoko Agricultural Experiment Station, which has a rainfall of about 120 inches; and in the vicinity of Ganta, where the rainfall is about 80 inches per year.

Considerable interest has been shown in Liberia in regard to the planting of cacao. This tree crop requires light shade throughout its entire life. In 1953, a start was made at introducing valuable timber species along with the planting of cacao, in places where cacao has been planted in low bush areas and the natural cover reaches a height of about 30 feet. The purpose of the experiment is to determine whether or not it is possible for the valuable timber trees to create a cover or over-story for the cacao plants, so that a combined timber and cacao crop can be grown at the same time. This experimentation will be continued and established with enough replication so that statistical analysis of results can be made.

BOTANICAL INVESTIGATIONS

In cooperation with Dr. G. W. Harley, medical missionary at the Ganta mission, botanical studies have been initiated in order to clarify the nomenclature of certain valuable Liberian timber species. Dr. Harley, who has spent 28 years in Liberia, is probably the person most familiar with a native timber species at the present time. It has already been found that although only the one species of Tarrietia - T. utilis (Whismore)-- is listed by botanists, there are at least two or perhaps three species of this genus present in Liberia. Since the two species already found vary considerably in growing characteristics and in wood properties, this study has definite practical application. For the purpose of developing trade in this valuable timber, it will be necessary to distinguish between the species of Tarrietia. Final description will be concluded when flowers and fruits are available.

In the case of Terminalia and Entandrophragma species, both considered valuable for furniture and cabinet work, a clarification is needed. Although only two Terminalia species of commercial importance are listed for Liberia, one or two more species have been found. Although at present both Terminalia ivorensis and T. superba are used as furniture timber, it is possible that the other Terminalia species may have physical properties entirely different. The same is true of the Entandro-

phragma species.

EXPLOITATION OF LIBERIAN TIMBER

As pointed out by Mayer, about 58 percent of the land area of Liberia is covered with forests which under usual harvesting practice could be operated commercially today if accessible. About half of this area is in stands located in the coastal region and containing mainly timber species particularly suited for construction purposes, while the other half is located in the interior of the country and contains a number of species known to be of great value for the furniture industry.

At the present time there is only one road leading from Monrovia, where the harbor is located, into the interior. This road goes to Ganta, about 180 miles into the interior, where it branches; one branch leads in a northeasterly direction to Sanoquelli, the other southeasterly to Tappita, 60 miles from Ganta. Most of the high forest areas which in earlier days were along this road have been cleared and taken over for agricultural use. This conversion occurred within a few years after the construction of the road. Frequently, the road is impassable during the rainy season, and, particularly on account of the low weight-limits of the many bridges, commercial loads of logs and lumber cannot be transported over it at the present time. Thus, opportunities for commercial harvesting of the timber resources in the interior of Liberia are lacking at present. A highway program is, however, now underway which within a few years may improve roads to such an extent that transportation of timber products by heavy trucks from the interior of Liberia may be a routine operation. It is in order to assure the rational harvesting of the remaining timber resources, particularly in the interior of Liberia, that the program of public forest reserves has been initiated.

Besides the forests which will be included in the reserves, there will still be large areas available for private industrial timber operations. It is still possible to select high forest concession areas in the interior. These areas may, however, be broken up during the next few years when the road from Tappita to Chien is put through. As mentioned previously, the timber species in this part of Liberia compare favorably with valuable species available in other West African countries.

There are vast forest areas which in some places reach within a few miles of the Atlantic Coast. Although there are numerous rivers in Liberia, only one is navigable for more than 5 to 10 miles. This one is the Cavalla river, which forms the boundary

between Liberia and the French Ivory Coast. This river, which maintains a rather steady flow, is navigable during the entire year for shallow draft barges for a distance of about 40 miles from the Atlantic coast. This river is the only present means of reaching some of the high forest containing the most valuable woods.

The forest areas along the Atlantic coast now represent the most likely areas to be first exploited. The main difficulty is that the species available are comparatively unknown on the commercial market. Certain species, such as Lophira alata (red ironwood) and Tarrietia utilis (Whismore), are already known on the European market, but most of the rest have never been introduced anywhere. This condition is due to the fact that many of the timber species present in commercial quantities in the coastal area of Liberia are more or less peculiar to this particular area. This situation may be due to the fact that the rainfall in this part of Liberia is almost twice as great as in any of the neighboring countries. Because they are unknown in world trade, it will be necessary to carry out various seasoning, strength and machining tests of many of these coastal Liberian species to establish their probable usefulness, and to do much promotional work before they will be accepted on the commercial market.

This work has already been started with the assistance of FOA in Liberia. Samples of the lumber of several species likely to be of importance to the construction trade have been shipped to various manufacturers in the United States and Europe in order to explore the possibilities of commercial use. Liberia has possibilities of ranking high in timber production, because it is a country having a large tropical hardwood timber resource which lies in closer proximity to the European market than that of any other country. For the American trade also, Liberian timber will have importance, since the shipping distance is shorter than that from other timber-producing West African countries.

TRAINING OF LIBERIAN PERSONNEL

Each agricultural technician working in Liberia on the FOA program has assigned to him two or three Liberian aides. These aides are selected by the Department of Agriculture and Commerce for final approval of the individual technician. In most cases, the aides are young Liberians with high school educations. Usually, all selected personnel have been

eager to learn. The writer has had two aides assigned to him. Their training has been, for the most part, of the "on-the-job" type, through participation in FOA forestry activities. In addition, during the rainy season, assignments and tests have been given in elementary subjects, such as arithmetic and simple algebra, subjects necessary for forestry calculations. Various text books, such as in elementary silviculture and mensuration, have also been assigned for study. The forestry aides participated in the development of the card-sort identification key. After training in the recognition of wood characteristics as seen under a hand lens they were able to identify Liberian tree species.

Before starting out on bush trips, aerial photographs were oftentimes consulted. The aides were given a special short course in the use of these photographs, after which they were able to use stereoscopes and locate forest areas, and even to recognize a few of the tree species from the photographs. The planning of bush trips, finding the villages which were to be used for stop-overs during the night, and analysis of the timber stands along the course of travel would be done in consultation with the aides, since many times they had local knowledge of the terrain. Whenever a certain forest area was to be studied, the aides were able to lay out the aerial photographs so that they were all properly matched, thereby greatly facilitating the work.

Before the establishment of the boundary of the Gio Forest Reserve was started, the forestry aides were given elementary training in the use of a staff compass and a two-chain trailer tape. During the work on the boundary line, the aides soon learned the simple techniques of sighting in the compass and measuring distance with a tape. This relieved the writer to some extent, making it possible for him to check other activities in conjunction with the establishment of the boundary line.

The forest tree nursery at Camp Johnson has had two major functions--the growing of planting material and the training of forestry aides in nursery work. The aides did all the work of carrying in top soil, establishing a palm frond shade, making seed beds, seeding, and caring for and transplanting the seedlings. The aides showed considerable initiative; on their own, they established small experiments in which they successfully grew Tectona and Terminalia plants from cuttings.

During the rather limited field planting program which was carried out during the rainy season of 1953, the aides surveyed the planting plots and supervised the planting of the seedlings with but little supervision. One of the aides has shown definite aptitude in nursery and planting work, while another could with more training be developed into a good surveyor and timber cruiser. Through all this work they have shown very good, though different, aptitudes for various phases of forestry, which looks promising for the future.

It is hoped that soon scholarships will be available for promising young Liberian foresters in order that they may take advantage of higher forestry training given at Aschimota College in Accra on the Gold Coast. With proper training, Liberians can be made into foresters capable of taking over the work which is now being done by the FOA forestry advisers.

In this connection, it might be mentioned that a forestry training program is being planned when additional FOA forestry personnel arrive in Liberia. During the rainy season, a more comprehensive forestry course will be undertaken in Monrovia in which personnel being considered for the Bureau of Forest Conservation will participate. The Forestry aide system discussed above should be used to give additional men on-the-job training during the dry season. It is believed that enough Liberians could be so trained to fill the needs of the Bureau for the subordinate positions in a reasonably short time.

CONCESSIONS INVOLVING TIMBER LAND

Firestone Plantations

During the latter part of the 1920's, the Firestone Company was granted option areas in three parts of Liberia. The clearing of the forest started in about 1928 on two of these, one located near Harbel in the vicinity of the present location of Robertsfield and, the other near Cape Palmas. The third area, on the Sangwin River, was not developed and finally was turned back to the Governmemt of Liberia in 1952.

Although much of the Firestone concession area near Harbel was covered with high forest at the time of the establishment of the rubber plantations, little of the timber was utilized. However, valuable information was obtained from this clearing

Remnants of high forest trees along highway north of Ganta.

operation. Through a joint project of Firestone and Yale University, G. Proctor Cooper spent about a year collecting botanical materials from the trees cut during the operation, which formed the basis of the Yale Bulletin, The Evergreen Forests of Liberia. 3/ This is one of the outstanding works on forest trees of the coastal region of Liberia.

At the present time, the Firestone Plantations occupy about 85,000 acres in the Harbel area and about 15,000 acres in the Cape Palmas area. These areas are planted mostly to rubber trees (Hevea brasiliensis). In the Harbel plantation the Firestone Company has established a research area under the direction of Dr. K. G. McIndoe. Dr. McIndoe, who is a man of many interests, has introduced numerous plants and trees from all over the world. A number of small plantations of valuable forest species have been established here. Several samples of seed have been obtained from Dr. McIndoe.

Liberia Company Cacao Plantation

The Stettinius interests began the establishment of a cacao plantation near Flumpa, between Ganta and Tappita, in about 1948. The area occupied, comprising about 25,000 acres, is about equally covered with high forest and low bush. At the present time about 3,000 acres have been planted to cacao. In conjunction with this operation, the Liberia Company has established a small circular sawmill, mainly for the purpose of supplying building materials for construction of houses on the plantation. Since the plantation is situated in the low rainfall belt, many excellent tree species have been sawed. Most of the production has been in Entandrophragma utile, Lovoa Klaineana, Sarcocephalus Diderrichii, Terminalia ivorensis, Tarrietia utilis and other species of accepted high value. Some of the lumber has been brought to Monrovia for sale, over more than 200 miles of poor roads and with a transportation cost of about $40 per M board feet. Although the price in Monrovia for this lumber amounts to about $140 per M board feet, it is still possible to compete with wood imported from the Gold Coast, since the price of the latter is about $170. However, the lack of capacity of the Liberia Company mill prevents a large trade from being established.

The local officials of the Liberia Company have shown much interest in establishing a tree crop of valuable trees along with cacao. As a consequence, and as mentioned previously,

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3/ Cooper, G. Proctor and Record, Samuel J. The Evergreen Forests of Liberia, Yale University, School of Forestry, Bulletin No. 31, New Haven, 1931.

Red Ironwood (Lophira alata) near coast at Baffu Bay.

some small exploratory plantations were established in 1953. The species used included Khaya ivorensis, Mimusops Heckelii, Tectona grandis and Pterocarpus indicus. If these initial plantings prove successful, it is the intention of the Company to make further plantations along these lines. Since the rotation of a crop of cacao is about 25 years, it is estimated that three or four crops of cacao can be grown to one tree crop, so that the trees can be felled simultaneously with the cutting of the cacao and both crops started together. The results of such experimentation will guide operations on other cacao plantations.

Liberia Mining Company

This Company started its operation in 1949 after many years of investigation related to the iron ore deposits at Bomi Hills, situated about 43 miles north of Monrovia. It established as one of its initial operations a bandsaw mill for the purpose of providing ties for the railroad and construction materials for the many structures to be built at the mining site. Since the railroad is now built and most of the other construction work completed, this mill has been considered as the likely means through which an export trade of timber products could be developed. After several conferences, Mr. Langdell K. Christie, President of the Liberia Mining Company, indicated a willingness to put the sawmill into commercial operation, thus providing timber products for local consumption and the export trade. This mill is the sole means in Liberia through which it is possible to produce market lumber at the present time.

During the last year, sizable volumes of lumber have been brought to Monrovia and placed on the local market. Contacts have been entered into with European firms for the export of the mill's products. The FOA/Monrovia has furnished technical information and wood samples to prospective purchasers of Liberian timber products. Up until the present time the requests have mainly been for railroad ties. A Spanish company expressed interest in obtaining 100,000 ties per month. Since the capacity of the mill would not permit handling such a large order, the company is willing to purchase 15,000 ties or more monthly.

Within the last few months, the Liberia Mining Company has shipped samples of lumber of the most common species from the Bomi Hills area to the United States, for the purpose of having them tested by the United States Navy and certain manufacturers. If favorable results are obtained, an export

trade in Liberian timber products may gradually be established. In the meantime, further contacts are being made with the European market, since it is believed that the heavy construction timber may have a more ready market in Europe than in the United States.

In order to get an estimate of the timber resources in the Bomi Hills concession area, the general manager and the sawmill manager of the Liberia Mining Company have visited Camp Johnson and studied the recently completed aerial photographs. From these photographs it was possible to make preliminary estimates of the timber potentials in the Bomi Hills area and a sketch map of the forests. Based on study of the photographs, it was recommended to Company officials that if the Company intended to engage in logging and sawmilling operations it would be advantageous to move the mill to a more central location.

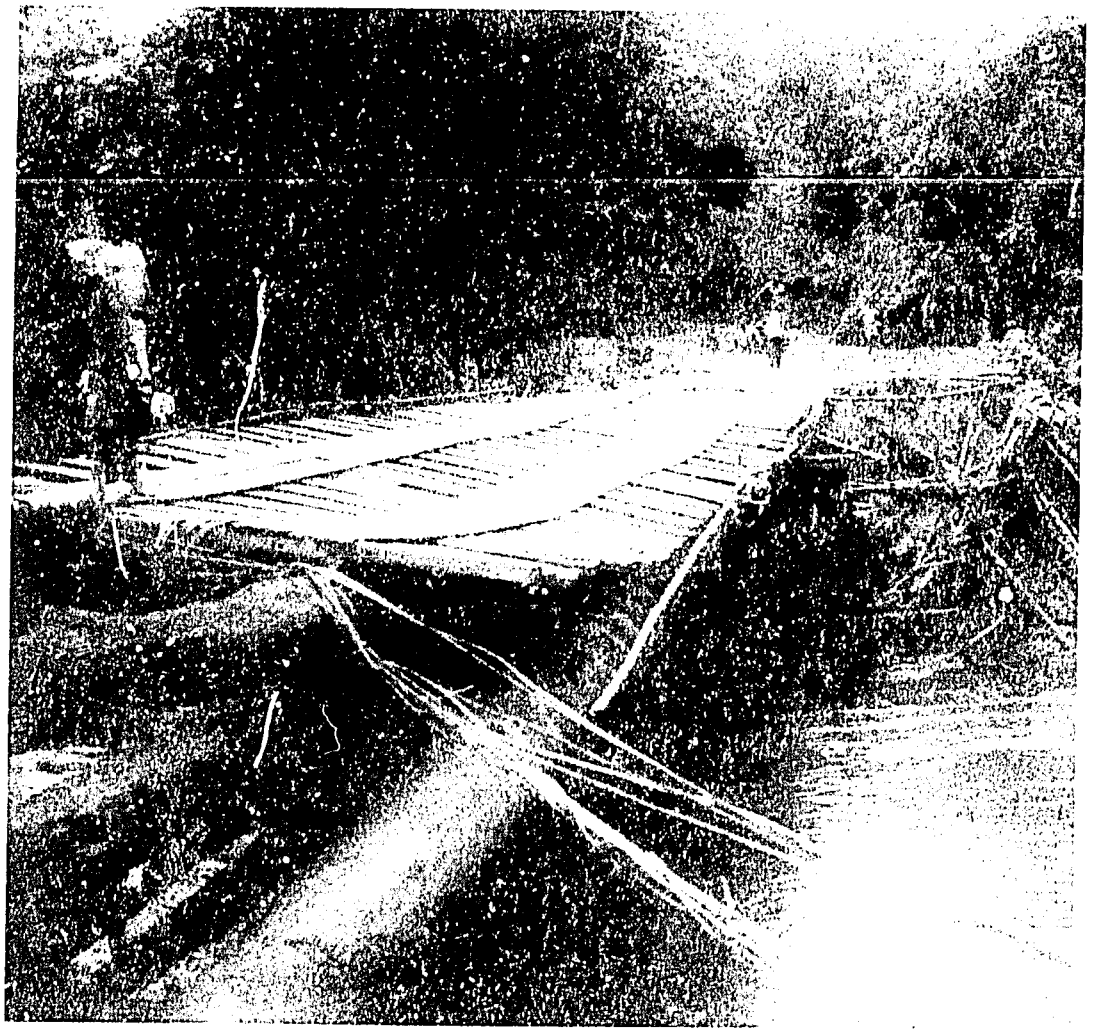
Dugout canoe on Cavalla River.

Considerable destruction of timber resources has taken place in the area already logged by the Liberia Mining Company. Rice farmers follow the timber operations and as soon as the timber trees are cut they start clearing the underbrush and smaller trees in order to establish their farms. These logged areas are much more advantageous to use for rice growing, since the farmer is saved much of the trouble of clearing the land. The continuation of this practice would seriously interfere with forestry operations, because it prevents the cleared areas from producing future saw-timber crops. However, the Forest Conservation Law now prevents farming under such circumstances. The Commissioner of the Bomi Hills District issued an order to the Chiefs to inform the people that all farming on the timber-operated land was prohibited by law. Since then no farmers have tried to enter the area to make farms.

This incident, which can be considered a test case for what will happen when the public forest reserves are established, shows the nature of the native population. It indicates that if the native people are properly informed very little, if any, difficulty will be experienced with trespassers or squatters.

LeTourneau of Liberia, Inc.

Prior to the arrival of LeTourneau personnel in Liberia, in 1952, the writer made several exploratory trips through the high forest of the Baffu Bay area. This territory is remarkable in that the high forest reaches within half a mile of the Atlantic coast, and in places there are almost pure stands of red ironwood. The composition of the forest was analyzed and descriptive reports on the species were prepared for LeTourneau representatives. It was pointed out that the predominating species were well suited for heavy construction, but that only one or two were acceptable for furniture and similar use. After the arrival of the land-clearing machinery and personnel at Baffu Bay, several trips were made to the area at the request of the officials of LeTourneau for the purpose of giving advice relative to the identification of timber species and their possible uses. Recommendations were also made that LeTourneau of Liberia hire a forester and a logging superintendent and install a bandmill which could handle the large ironwood logs found in the area. Mr. R. G. LeTourneau, President, took a great personal interest in developing special tree-felling and logging machinery which was tried out at Baffu Bay as the



Bridge damaged by high water.

land clearing got under way. There are good possibilities in this concession for developing a sizable timber operation on a long-term basis.

According to the contract between the Liberian Government and LeTourneau of Liberia, the latter has the right to establish operations on 500,000 acres during thirty years from the date of the agreement. During the first year of operations, LeTourneau of Liberia has designated the first 50,000 acres along the Atlantic coast at Baffu Bay. The intention of LeTourneau, according to the contract, is to establish agricultural crops for the purpose of improving the living standards of the people as well as for developing export markets. There are no provisions for the cutting and utilization of timber products, except that any such activity will be covered by a special agreement. During the first

year's operation, LeTourneau of Liberia has shipped about 130,000 board feet of logs of Lophira alata (red ironwood) and Anopyxis calaensis to the United States for the purpose of exploring the potential market for these species and also for testing the sawing of logs in a band mill being constructed in the United States for possible use in Liberia.

The African Fruit Company

This Company entered into an agreement with the Liberian Government whereby the company acquired an option on 1.5 million acres situated in three areas in the vicinity of Sangwin River, in Sinoe, and near the Cavalla River. From this option area the company is to select 600,000 acres to be developed during the next thirty years. At the present time the company is working in the Sinoe area, where they already have cleared 300 acres for banana nurseries. There is no limitation on the cutting of timber for the purpose of setting out banana plantations. However, if the company intends to establish an export trade with forest products, a special agreement is to be written for this purpose. Much of the wood obtained from clearing the land will be used for the fuel in manufacturing banana flour. The Company is planning to establish a railroad for the purpose of carrying fruit from the three main holdings to Greenville, where plans call for the development of a port.

Spanish Concession near Sangwin River

During the latter part of 1952 negotiations were started between Spanish interests and the Liberian Government for an option area on about 100,000 acres near the Sangwin River. The contract gave the right to the Spanish company to select an operations area of 1,000 acres each year for a period of ten years, making the concession area a total of 10,000 acres. This was later amended to a period of two-and-a-half years during which the operation area of 10,000 acres should be decided upon. The contract calls for a special agreement between the Liberian Government and the Spanish Company if the latter decides to exploit timber resources for exports.

Other Concession Activities

On several occasions the Assistant Secretary of Agriculture has requested that prospective concessionaires visiting

Liberia be given help by the forestry adviser during exploration of timber resources in connection with operation planning. Several trips have been made on such exploratory missions, since it has been considered that part of the development of Liberia will have to be the responsibility of private interests. As long as these operations are in accordance with the Forest Conservation Law, they aid constructively in the country's industrial development.