

Recent Observations on Forestry in Tropical America

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During recent months members of the Tropical Forest Research Center staff have travelled to many of the countries of the Caribbean area. The purposes of these trips have been to see trees, forests, and silvicultural and utilization practices that might be useful in Puerto Rico, to collect data on forest plantations for the Latin American Forestry Commission of FAO, and to obtain information of value to the forestry training program of the Center, set up to serve this area through the cooperation of the International Cooperation Administration. Forest management work and plantations were studied in the Yucatán Peninsula of Mexico, Central America, Colombia and Ecuador, the lower Amazon Valley of Brazil, Surinam, British Guiana, Trinidad, St. Lucia, Martinique, and Jamaica. Forest utilization was observed in Trinidad, British Guiana, and Surinam.

Mexico

Observations in Mexico were confined to Yucatán, Campeche, and Quintana Roo. At Colonia Yucatán interest has been shown in forest management since the development of the plywood plant in 1946. Studies have been made of natural regeneration, direct seeding, and planting Spanish-cedar (*Cedrela odorata* L.). The forest contained an unusually high concentration of commercial-size cedar trees (9 per hectare) probably as a result of past Maya cultivation. Natural regeneration of cedar after cutting was found to be unsatisfactory. Planting in recent clearings has failed primarily because of isolation and shoot borer (*Hypsipyla grandella* Zeller) attack. Failures have also resulted

in planting in lines opened up in selectively cut forest because of shade and competition. However, plantings made in lines cut in low second-growth vegetation look promising. Recent direct seeding trials in abandoned logging roads and cleared strips in the forest also appear successful.

Mahogany is not native to this area of northern Yucatán but it is growing vigorously where planted in lines cleared through second-growth vegetation. It has failed where planted in the open or under selectively cut forest.

In Campeche experimental plantings of cedar and mahogany were seen at the Agricultural Experiment Station of Cayal and in the area of Escancega. Interesting direct seeding experiments are underway in the Branson area near Escancega, under a high shelterwood and in cleared lines in second-growth vegetation. Where seedlings were planted in cleared lines through selectively cut forest the success appeared to be associated with the density of the forest cover. Good survival and vigorous growth of planted trees in the area called Tormento appeared to be a result of light upper canopy cover allowing for abundant light in the understory. At kilometer 20 on the Escancega-Chetumal road the planting appeared much less successful due to heavier shade in the lower canopy levels.

Mahogany plantation success appeared to be correlated with shade conditions also in the area of Laguna San Felipe in Quintana Roo Territory. Forest inventories carried out by the Quintana Roo Forest Department in this region are of real interest because of the complete enumeration made of mahogany of all sizes.

At the Chetumal forest nursery bigleaf, or Honduras, mahogany (*Swietenia macrophylla* King) has been planted in mixture with small-leaf, or West Indies, mahogany (*S. mahagoni* Jacq.) to determine whether cross pollination and hybridization take place. The progeny of these trees will be of interest.

British Honduras

Projects of special interest as yet unreported except in the Annual Reports of the Forestry Department are the pine forest management program at Augustine and the hardwood forest management program in the Chiquibul area. Forest inventories have been made and the rate of cutting is adjusted to the capacity of the forests to produce on a continuous and permanent basis. Studies of reproduction, tree growth, and methods and effects of fire control have been set up in both areas to gather information to guide forest management.

A more recent development is the announcement of the offering for bids of a long-term forest management license for the Cockscomb Basin area. The area includes 180 square miles of tropical forest with a total volume of 378,790,000 board feet of mixed tropical hardwood timber. To obtain and hold the license an operator must fulfill certain conditions, such as the establishment of a local woodworking industry and the maintenance of a productive forest. If these conditions are met the right to exploit the forest may be held by the licensee in perpetuity.

This important prospective development in the general effort to establish permanent woodworking industries based on the utilization of mixed tropical forests will be watched with great interest.

Guatemala

In the highlands of Guatemala the tree most extensively established in plantations is cypress (*Cupressus lusitanica* Mill.). This

tree has been planted with some success on sites varying from the subtropical dry forest at 1500 meters elevation all the way to the tropical montane wet forest at 3000 meters. Logs of commercial size are being cut from a 64-year-old plantation near Antigua. Data is not yet available to predict the productivity of cypress plantations on various sites, but there is little doubt that this will be an important species in the development of forestry programs in the Caribbean area where sites are similar to those on which the tree is found in Guatemala.

From the tropical zone of the Pacific slope several recent shipments of primavera logs (*Cybistax donnell-smithii* [Rose] Seibert), called "palo blanco" locally, have revived interest in this wood. The logs came from plantations approximately 30 years old and were reported to have produced veneer of excellent quality. This tree is widely planted in the lower part of the coffee zone in Guatemala but no longer exists in commercial quantities in the natural forest. In this same area promising young teak (*Tectona grandis* L.) and mahogany plantations should provide valuable information for future forest management projects.

The distribution of the Pacific-coast type mahogany (*Swietenia humilis* Zucc.) was found to extend to the Atlantic slopes of Guatemala in the Departments of Progreso, Chiquimula, and Zacapa. Seed was collected for comparative studies in Puerto Rico.

Honduras

Probably the most extensive experimental reforestation in Central America has been that of the United Fruit Company. In Honduras teak is the species planted on the largest scale, more than 2000 acres. Plantations up to 15 years of age at various spacings clearly show that a minimum of care is needed to obtain an adequate yield of first class products. Plantations with wide initial spacing (15 x

15 feet and 10 x 20 feet) tend to produce trees with short boles and excessive branching. Younger plantings spaced at 6 x 6 feet have, because they were not thinned, produced excessively tall thin trunks that will now be difficult to manage.

Trial plantings of more than 20 tropical species have been made, some of which could become important plantation species in the Caribbean area. On well drained sites *Eucalyptus naudiniana* F. Muell (Syn.: *E. deglupta* Blume) has made exceptional height and diameter growth in the tropical moist forest and in the wetter margins of the tropical dry forest. *Limba* (*Terminalia superba* Engl. & Diels) has grown more than one inch in diameter per year in the early stages of development on well drained sites in the tropical moist and tropical dry forests. Long, straight boles with rapid self pruning of lower branches are characteristic. *Terminalia ivoriensis* A. Chev. has shown similar growth characteristics on a small scale in the tropical moist forest. Individual trees of *Khaya ivoriensis* A. Chev. and *Entandrophragma rederi* Harms have shown remarkable development and deserve more extensive trials.

Nicaragua

A program of land classification under way in Nicaragua should point up the importance of forestry in obtaining a product of economic importance from non-agricultural land. In northern Nicaragua pine stands have been mapped. A program of fire control is under way to increase pine reproduction. Complete elimination of fire will probably be found not to be possible nor necessary.

On the Río Escondido important experimental plantings of teak and bigleaf mahogany are found on the lands of the El Recreo Experiment Station and of the Cukra Development Company.

Costa Rica

In the highlands of Costa Rica plantations

of *Eucalyptus globulus* Labill, *Cupressus lusitanica*, and *Alnus jorullensis* H.B.K. present outstanding examples of what can be expected from forest plantations in lower montane wet and montane wet forests. An introduction of nogal (*Juglans* sp.) from Nicaragua shows remarkable development near San José with diameters up to 20 inches and heights to 90 feet in 18 years.

On the tropical lowlands of the Pacific coast well developed plantations of teak are found on United Fruit Company divisions of Quepos and Golfito.

Panamá

At Puerto Armuelles the Chiriquí Land Company has established 1,500 acres of teak plantations that show excellent development. Smaller plantations of Spanish-cedar and mahogany show less spectacular results but will provide important information on these trees if protected until the end of one rotation. The Summit Gardens in the Canal Zone of Panamá has been an important center for the distribution of forest tree seed both native and exotic, but there are no forest plantations of interest on this area. It is unfortunate that a part of the 35 square miles within the Canal Zone has not been dedicated to at least small demonstration projects in forest management. No other productive use is made of this land.

Land classification and watershed management studies in Panamá will no doubt provide a basis for natural resource development that depends to a considerable extent on the forests, one of the country's most important natural resources.

Colombia

The domestic paper industry in Colombia is important and is growing rapidly. An experimental program of establishing plantations of exotic conifers is directed toward reducing

imports of long-fiber pulp needed for the local paper industry.

Outstanding *Eucalyptus globulus* plantations are found in abundance in the highland savanna country around Bogotá, most of them on private land. Many plantations need improved management if maximum production is to be achieved. The need for thinning operations are particularly obvious in some locations.

Ecuador

Ecuador probably has more extensive plantations of eucalyptus than any other Latin American country except Brazil. *E. globulus* plantations are found under a variety of site conditions, a wide range of age classes, and with many types of treatment.

In the Department of Guayas plantations of tropical species of *Ceiba*, *Prosopis*, *Swietenia*, *Cedrela* and *Tectona* have been established on a small scale.

Jamaica

Jamaica is especially interesting to a visiting forester from Puerto Rico because of the very close similarity of sites and conditions. In addition a great deal of forestry work has been done, too much to be examined thoroughly in one short visit.

The central plateau, in the Christiana-Gourie area, is about 3000 feet¹ above sea level. The soils vary from friable clay loam to very heavy clays. The underlying limestone presents outcrops occasionally, especially on steep slopes, and is responsible for the sinkholes which are so common in the Gourie plantation area.

Mahoe (*Hibiscus elatus* Sw.) planted about 1950 has developed very well in the bottoms of the sinkholes, but vigor decreases rapidly with distance up the slope. Wood

grown here is thought to be denser and stronger than that grown on the better sites, and a sample collected had a specific gravity of 0.49 compared to 0.36 for a sample collected in the eastern mountains.

Eucalyptus species and patula pine (*Pinus patula* Schl. & Cham.) planted about the same time on the upper slopes and ridges have been disappointing. Since 1954 many of these areas have been re-planted with Honduras pine (*P. hondurensis* Loock), which has been much more promising to date.

Santa Maria (*Calophyllum brasiliense antillanum* [Britton] Standl.) planted in this area made a slow start but has improved tremendously since replacement pine has begun to afford it some shade and site protection. There are tentative plans for direct seeding Santa Maria under established pine plantations for a second crop.

The difficulty of obtaining seed has severely limited the acreage of Antillean pine (*P. occidentalis* Sw.) which has been planted, but the few plantations established show perhaps the most promise of any species planted in this region.

The cockpit country, because of its rugged local relief, contains most of the virgin and near-virgin forest left in Jamaica. Among other interesting species is goldspoon (*Antirrhoea jamaicensis* [Gr.] Urb.) which is reported to attain a dbh (diameter breast high) of 24 inches and produce a clear, straight bole of more than 35 feet on steep rocky slopes where most associate species are worthless brush.

Most of the plantations established are mahoe; the growth and form, especially in the bottoms and lower slopes of the glades, are excellent.

Of the small-leaf mahogany seen on the northwest coast about half had typical leaves and half had an intermediate leaf form appreciably larger. This, combined with the

^{1/} Elevations, rainfall, soil and other background information given is often based on informed estimates or extracted from mental files and is subject to a certain amount of error.

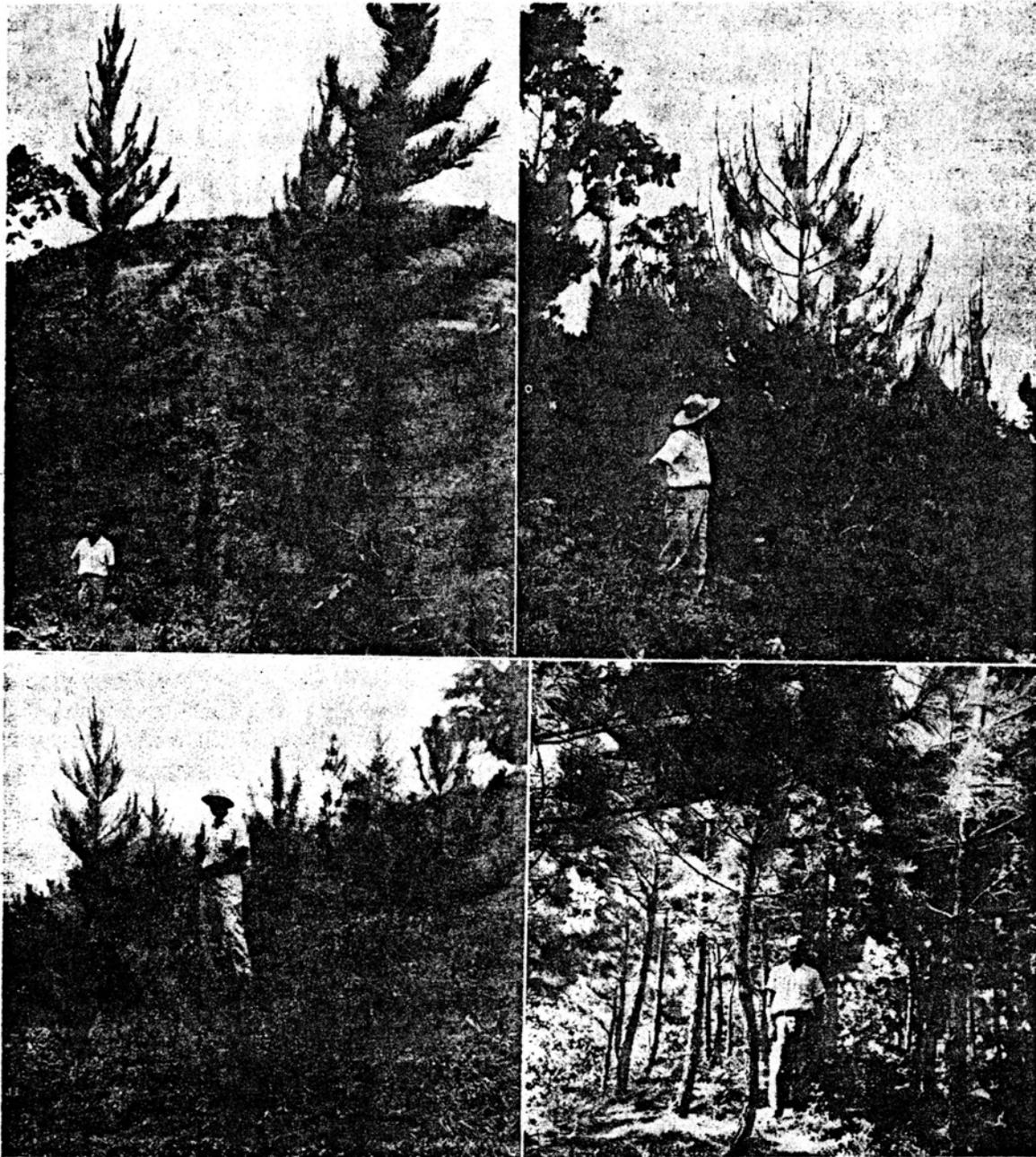


Figure 1. — Pines in Jamaica. Upper left. Honduras pine (*Pinus hondurensis*), 6 years old, Gourie Plantation. Upper right. Patula pine (*P. patula*), 10 years old, Gourie Plantation. Lower left. Radiata pine (*P. radiata*), foreground, and Honduras pine, 3 and 2 years old, respectively, Resort. Lower right. Uyam pine (*P. merkusii*), 6 years old, Belle Vue.

widespreading branches and short bole, indicates that these trees, previously considered to be naturally established from native parents, may well have been planted.

The arboretum near Moneague in the eastern mountains has several species of interest: Antillean pine is as promising here as it is on the central plateau, averaging 4

inches dbh and 35 feet tall at age 6. Honduras pine 5 years old is up to 6 inches dbh and 40 feet tall; this year it is producing its first fruit. *Eucalyptus patentinervis* R. T. Baker (Syn.: *E. kirtoniana* F. Muell.), at age 6, is up to 11 inches dbh and 60 feet tall. *Melic compositae* Willd. averages about 6 inches with a maximum of 14 inches at age 5.

Near Resort, goldspoon and *Terminalia latifolia* Sw., are off to a good start. Honduras pine has shown much better initial survival and growth than Monterrey pine (*P. radiata* Don.). Underplanted Spanish-cedar has made an excellent start, but has not yet reached merchantable size. This area contains many acres of excellent mahoe, including some outstanding glade stands. Even on upper slopes in this area mahoe plantations 15 years old are up to 8 inches dbh and with 32 feet of clear bole.

Near Bell Vue, Masson Pine (*P. massoniana* Lambert) is growing adequately at about 4500 feet elevation but produces a rather knotty bole. Uyam pine (*P. merkusii* Jungh.) at 5200 feet has a periodic annual increment of 6 feet in height and one inch in dbh. Because of the near-constant winds on this exposed ridge, many stems are deformed, but a great many are as straight as could be desired. *Eucalyptus patentinervis* on moist, well-drained soil in a protected swale has a periodic annual increment of 10 feet in height and nearly 2 inches in dbh. The same species on a nearby ridge is quite inferior. Mahoe has not developed satisfactorily in this area except where underplanted *Eucalyptus* has outgrown it and now affords protection.

Of special interest to a forester from the southern United States is the longleaf pine (*P. palustris* Mill.) growing at Cinchona above 4000 feet elevation, whereas its native site seldom approaches 400 feet. *Eucalyptus globulus* has been planted fairly extensively in this area, down to about 3400 feet, but apparently this is below its optimum site as development is quite patchy. The native

juniper (*Juniperus gracilior* Pilger) can be found both natural and planted in this area. Possibly as a result of past selective cutting, most remaining trees have very poor form; however, a few, especially in one young plantation, are excellent.

Here, as elsewhere on the island, development of patula pine has been disappointing, but a small area on a moist, protected site has basal area near 200 square feet per acre and tremendous cubic-foot volume at age 7.

Masson pine has a higher specific gravity, 0.48, than Honduras pine or uyam pine which average about 0.38, but the bole form is inferior to either of the faster-growing lighter-wooded species.

Summarizing, Jamaica has the oldest and some of the best planted pine seen. Honduras pine has done well everywhere tested, and limited trials of Antillean pine indicate that it may be even better: initial growth of uyam pine above 5000 feet is very promising. The mahoe plantations certainly seem to have justified their establishment, but more information is needed on the site requirements and wood quality of the species. *Eucalyptus* have shown the fastest growth here, as elsewhere, but the lack of present or foreseeable markets severely limits their usefulness.

Martinique

Plantation work in Martinique continues, as in the past, to be concentrated on bigleaf mahogany. Most new plantations are being established through the taungya system, with seedlings grown in temporary nurseries near the planting sites. There are perhaps 2500 acres of mahogany plantations now established, up to about 32 years old. Practically all the plantings have been pure mahogany, and shoot-borer damage has been fairly extensive. Damage appears to be more extensive on windward slopes, and tree form is better to the leeward. In addition variations in tree form suggest that seed source varied from year to



Figure 2. — Bigleaf mahogany (*Swietenia macrophylla*) in Martinique, showing variation in form; 16-18 years old, Deux Choux.

year. Natural reproduction is common throughout the plantations. It is especially imposing on a cove site in the southeastern portion of the island, at about 700 feet above sea level. There advanced reproduction is abundant and of outstanding form.

In this same area simaruba (*Simaruba amara* Aubl.) has excellent form and volunteer reproduction in mahogany plantations is completely undamaged even where the mahogany is severely infested by the shoot-borer.

Work has begun recently with pine, but has not continued long enough to do more than indicate some promise.

St. Lucia

Time was very limited here, but excellent teak was seen barely outside the city limits of Castries, and at the Barre de L'Isle nursery area were excellent *Eucalyptus resinifera* Smith, mahoe, and simaruba. Mahoe stands are being thinned to a lower residual density here than elsewhere, and their comparative development will be of interest.

Trinidad

It would be needlessly repetitious to review again the excellent work being done in

Trinidad with teak and Honduras pine (Beard, 1943; Brooks, 1939, 1941a, 1941b; Cater, 1941; Chalmers, 1958; and Ross, 1958), as well as the Tropical Silviculture being tested in the Arena Reserve. However, certain points have not been accentuated previously. Honduras pine has a soft, even texture with a very pleasing birds-eye figure when cut from very young thinnings. If sufficient quantity becomes available in the future, it should command a premium price for special uses. The lumber being manufactured from thinnings in teak plantations 15 years and older is remarkably free from defects. Even boards from the heart center are graded almost entirely on the presence or absence of pith rather than through any consideration of knots.

Of the other species tried on a more limited basis than the extensive plantations of teak and pine, bigleaf mahogany has shown severe cankering which appears superficially to be caused by a virus. The fact that this disease makes a tree completely worthless combined with the importance of mahogany in Latin America as a whole suggests that for the benefit of the entire region studies should be undertaken to determine the nature and control of the disease.

Simaruba, which was seen in good natural stands and plantations on clay soil in Martinique and St. Lucia respectively, also can be seen in an excellent plantation on the very sandy soils in the Arena Reserve in Trinidad.

On clay soil derived from limestone at about 900 feet elevation are excellent small plantings of Spanish-cedar, *Cordia alliodora* R. & P. (Cham.), *Gmelina arborea* Linn., and *Enterolobium cyclocarpum* Gris. At age 12, the cedar is up to about 10 inches diameter breast high, the *Cordia* about 7 inches, and the *Gmelina* 24 inches; at age 11 the *Enterolobium* is up to 29 inches dbh. All these species have satisfactory form, at least for short logs; the *Gmelina* is definitely the least desirable.

In the field of utilization one of the most significant developments in the Caribbean area is the success of the Brickfield forest industry in Trinidad utilizing small teak logs (Ross, 1958). Teak is being used extensively in reforestation in this area and the utilization of thinnings is already a problem elsewhere. The Brickfield installation, organized and operated by the Trinidad Forest Department, consists of a gangsaw, a resaw, a hot-and-cold creosote treating plant, and a picket fence factory. During 1959 this plant produced from teak thinnings 27,400 treated fence posts, 19.5 miles of wirebound picket fencing, and 187,000 board feet of lumber at a net profit of \$19,450.00. The fence posts and pickets are produced largely from thinnings from 5- and 10-year old plantations. The sawlogs, with a 5.5 inch minimum diameter, come from thinnings in the 15-year or older plantations. The main product of the sawmill is 2 x 4 inch dimension stock. However, 1/2 x 2, 1 x 2, 1 x 3 and 1 x 4 inch boards are also produced. The 2 x 4's are bought up by the construction trade, and the 1-inch lumber goes into furniture, flooring, and miscellaneous items.

The freedom from knots and other defects indicates that high quality teak lumber will be produced from the mature trees when they reach rotation age. Consideration is being given to the possibility of diverting the larger sawlogs to a local band mill in order to improve the grade of the material recovered from these logs.

The Brickfield plant serves as an example of what can be done to utilize small material from forest plantations in other areas of the Caribbean where raw material and market conditions are similar. It is an important link in the chain of development required to maintain forest land in a productive state.

In Trinidad a total of 12,397 acres of teak have been planted since 1928, with 770 acres established in 1959. In recent years increasing interest has been shown in planting pines, especially on sandy soils unsuited for

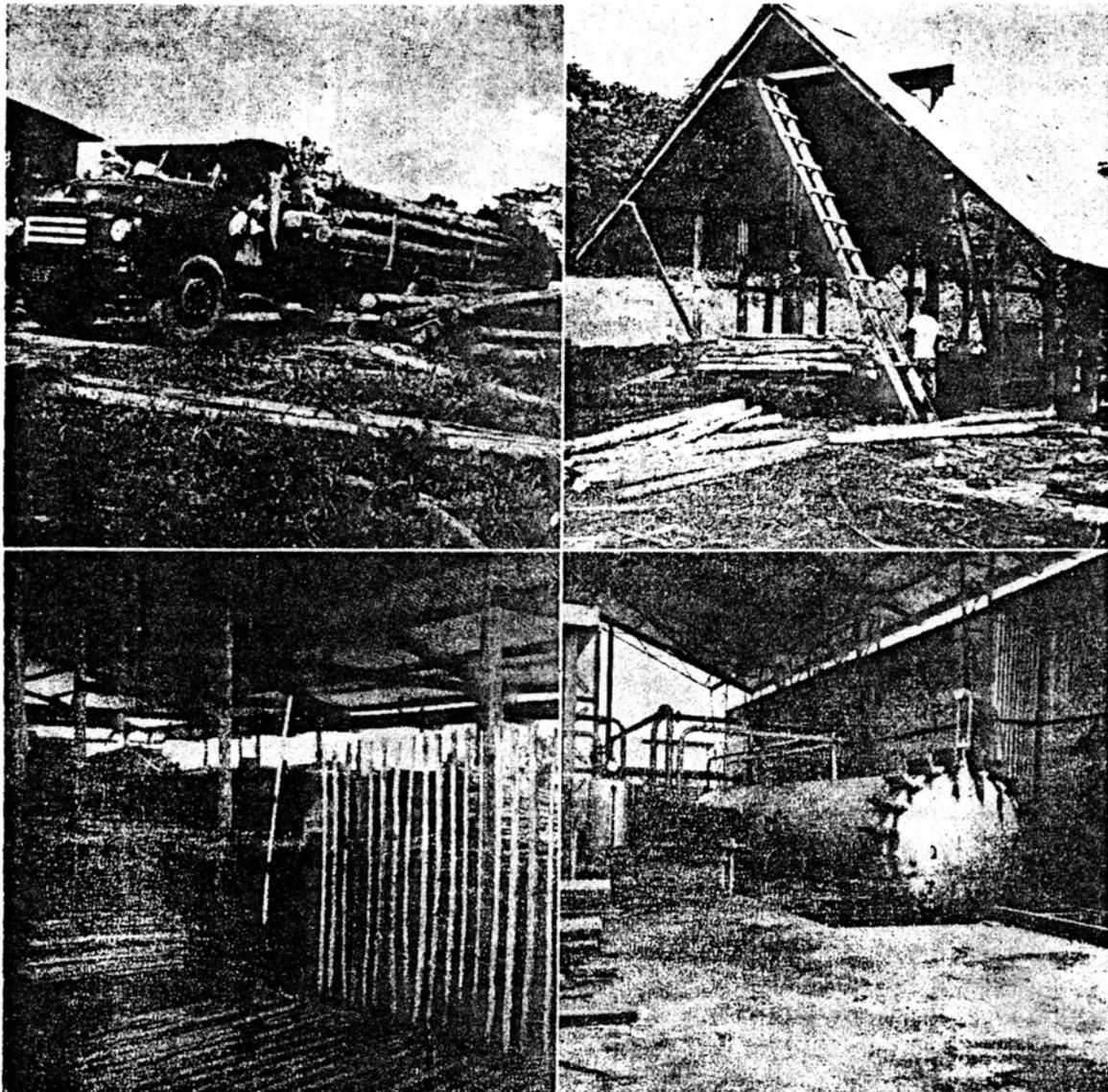


Figure 3. — Utilization in Trinidad. Upper left. Teak (*Tectona grandis*) logs being delivered to post treating plant, Brickfield. Lower left. Fabrication of fence from teak thinnings, Brickfield. Lower right. Pressure treating cylinder, Port of Spain.

teak. The oldest plantations are 12 years old, with 465 acres planted to date.

The publicly owned forest reserves of Trinidad amount to over 328,000 acres or 26 percent of the land area. From these forests 3,450,100 cubic feet of timber, 904,700 cubic feet of fine wood, and 227,700 cubic feet of other split wood were cut in 1959.

The total sawtimber cut from all lands amounts to 31.5 million board feet. Nearly all of this was consumed locally. An additional 1,505,000 cubic feet of coniferous timber, mostly from British Honduras, was imported.

A pressure treating plant is in operation in Port of Spain using Wolman salts as a pre-

servative and treating about two million board feet of lumber yearly. Plans for a second plant are being developed for San Fernando, the second largest city of Trinidad. This indicates the favorable reception of treated lumber in the Trinidad market. Lumber is treated to retain 1.5 pounds of the Wolman salts per cubic foot and the lumber is air-dried to 20-22 percent moisture content.

British Guiana

Recent work in timber inventory from aerial photographs in British Guiana has given some of the most encouraging results yet reported from mixed tropical forests. More than 25 different forest associations have been distinguished on the photos, and estimates of greenheart (*Ocotea rodiaei* [Rob. Schomb.] Mez) volume from the pictures have shown

excellent correlation with actual volumes available.

Natural regeneration of greenheart following cutting has been good. In the area visited greenheart appears to be on the way toward making up a higher proportion of the stand in the cutover areas than it was in the original forest.

Pine plantings have been made in the last five years. Growth is better on the brown sandy loams, but even on the white sands which support a very inferior native vegetation pines are promising; slash pine is off to a faster start than Honduras pine. The most important problems to date are the high cost of site preparation and the coushi (*Atta spp.*) ants which defoliate the pines, especially after they have been cleaned of competing weeds and brush. The ants are poisoned in their

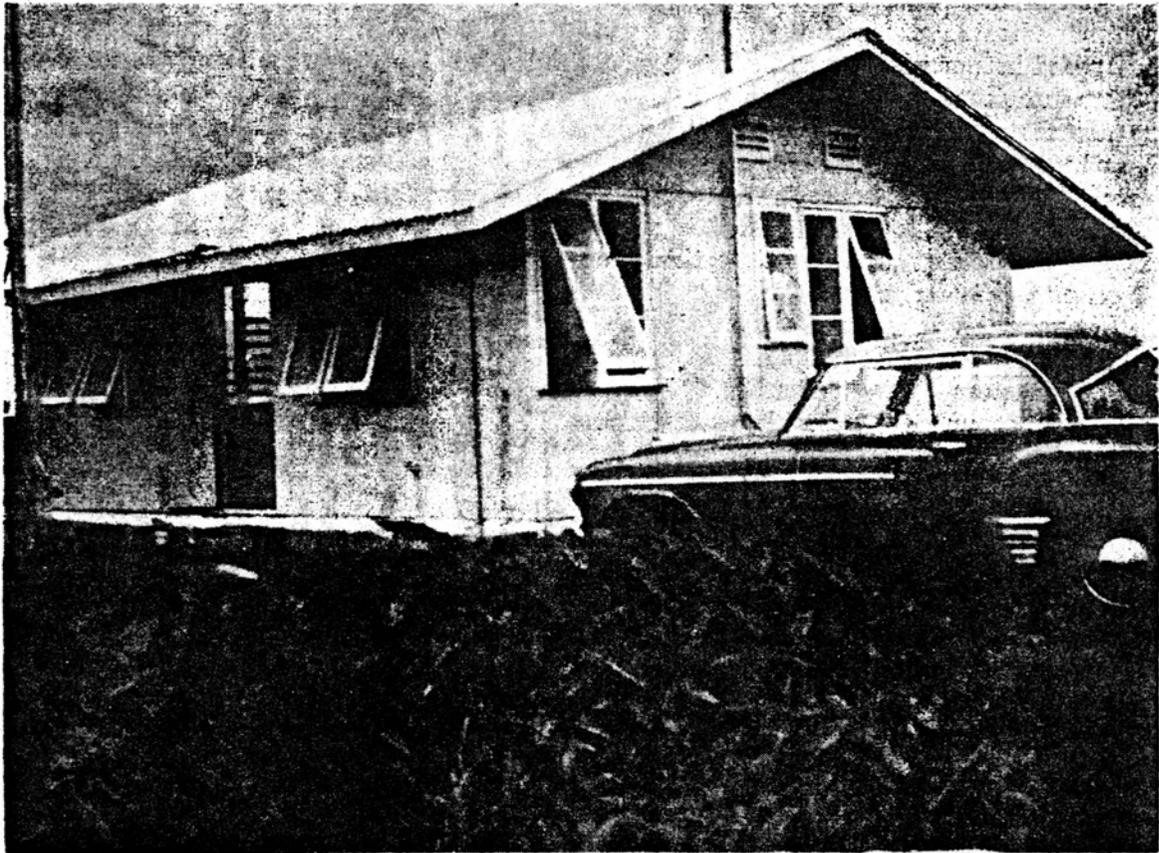


Figure 4. — Prefabricated house, British Guiana Timber Corporation.

Other promising species are *Ocotea rubra* Mez., *O. caniculata* Mez., simaruba, *Tapirira* spp., and *Peltogne* spp. The latter is apparently a very rapid grower for a wood of such high specific gravity.

The Forest Department operates the Central Timber Manufacturing Plant on an experimental basis to interest the local market in a wider variety of species. This installation is comparable to lumber concentration yards found in the southern United States where rough ungraded lumber is bought from small mills, then sorted, dried, surfaced and graded for resale. The plant now handles about 23 species. The price paid to the small mills depends on the species, type of sawing, and whether or not the lumber is of export grade.

In 1958 1,609,000 board feet of lumber were purchased and 1,019,000 sold with about one million board feet remaining in inventory. The spread between buying and selling prices appears sufficient to provide for a profit. Some adjustments can perhaps be made in administrative, machining and other costs to improve the picture. A concentration and re-manufacturing yard prospers in a market where specialization and prefabrication are a part of the manufacturing process. Some educational effort in the local market will probably be required to sell the advantages of well manufactured, dry lumber.

Of the commercial sawmills the British Guiana Timber Corporation mill is one of the largest. It is a band mill with two head saws, cutting mostly greenheart for export. This material is well manufactured and treated against splitting with end coating. The lumber for local consumption is not so carefully prepared. This company also has an experimental pre-fabricated house program, based on a pilot model prepared by the Forestry Department, which should contribute to the utilization of non export lumber.

A particle board plant using wallaba (*Eperua* spp.) has recently started production. The panels being produced appeared some-

what darker and heavier than the product found on the general world market.

The furniture industry producing for local consumption is not well developed. A considerable portion of the furniture is made in small home shops.

It should be noted in passing that the Georgetown museum contains some interesting wood exhibits well worth seeing.

Surinam

Tremendous strides are being made in the utilization of the Surinam forests. Harvesting is carefully planned and controlled for economical cutting of the forest without unnecessary waste. Silvicultural studies are in progress for improving the composition of the existing overstory, obtaining natural reproduction of the desirable species, enrichment planting of the high forest following selective cutting, and establishing pure plantations of native and exotic species, besides more basic studies of the phenology and growth of the more important species.

In cooperation with a Netherlands paper company an extensive trial is being made of Honduras pine on the white sands. Results to date are very encouraging on the better sites and some small tests of densa pine (*P. elliotii densa* Little & Dorman) have been made on the drier ridge sites; test plantings of slash pine (*P. elliotii elliotii* Engel.) are being considered for moist flats and along waterway margins. The best of the Honduras pine, near Jodensavanna, have a periodic annual increment of 9 feet in height and 1.5 inches dbh. Branches seem a little more persistent than elsewhere for this species.

Of the other species being tested in plantations, okoume (*Aucoumea klaineana* Pierre), baboen (*Virola surinamensis* Warb), *Carapa guianensis* Aubl., and simaruba are the most promising.

In Surinam the wood utilization picture

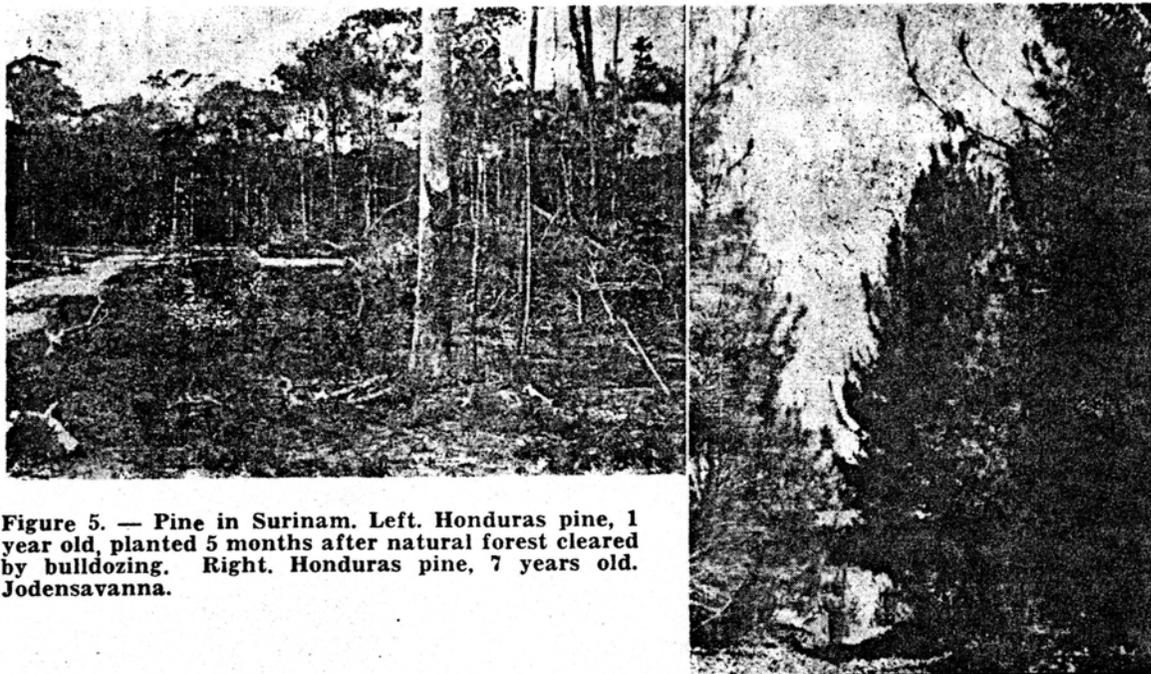


Figure 5. — Pine in Surinam. Left. Honduras pine, 1 year old, planted 5 months after natural forest cleared by bulldozing. Right. Honduras pine, 7 years old. Jodensavanna.

burrows with liquid dieldrin but complete control on these porous sands is very difficult. is dominated by the Bruynzul plywood and particle board plant. This is an outstanding woodworking installation producing products to exacting specifications. The principal raw material is baboon. Waste from the plywood plant provides the bulk of the raw material of the particle board plant. A gang-mill and flooring mill are also in operation producing end-matched and parquet flooring of high quality.

The Forestry Department has specialists to advise the local woodworking industry. The furniture plants visited showed the results of this technical help. Although small and with limited equipment, these factories turn out well designed, well made furniture. Care was used in organizing and assembling the parts, and the latest resin adhesives were using used to turn out a pleasing product.

There is a wood treating plant in Surinam using both Wolman salts and copper naphthenate. This plant treats flooring, panelling,

lumber, and poles.

Brazil

On the grounds of the Instituto Agronomico do Norte, Belem, some small plantings of forest tree species have been made in recent years. Brazilnut (*Bertholletia excelsa* H.B.K.), bigleaf mahogany, cumarú (*Coumarouna odorata* Aubl.), *Eucalyptus alba* Reinw., *E. tereticornis* Sw., *Tabebuia serratifolia* (Vahl) Nicholson, and Spanish-cedar, have made a promising start. Eight-year old stands of jacaranda (*Jacaranda copaia* [Aubl.] D. Don) and simaruba are up to about 6 inches dbh and 50 feet tall, with truly excellent bole form. Most of these plantings are spaced 1 meter by 3 meters, which permits cleaning them with a tractor-mounted rotary mower.

At Santarém studies are being made of enrichment of natural forest, and of pure plantations. On heavy black soil *Gmelina* and simaruba look best in plantations; on red clays jacaranda grows as rapidly as the local species of *Cecropia* and attains a larger size and better

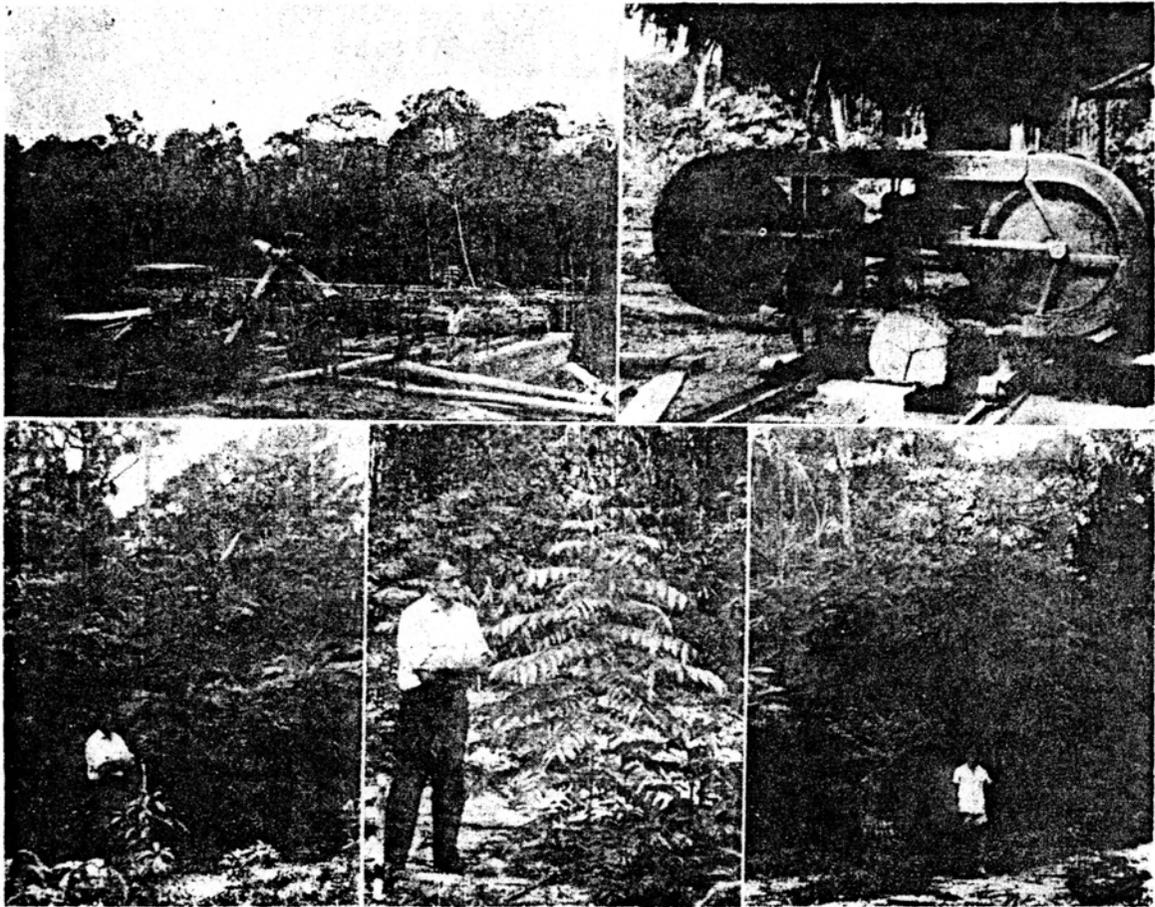


Figure 6. — Curuá silvicultural operation. Upper left. Loading logs on barge for shipment to Santarém. Upper right. Cutting logs, bandmill on moving carriage with log fixed. Lower left. Simaruba (*Simaruba amara*), 26 months old. Center. Cupiuba (*Goupia glabra*), 14 months old. Lower right. Jacaranda (*Jacaranda ceapaia*), 26 months old.

form. Several species show promise underplanted under high forest, but the Spanish-cedar is outstanding.

A sawmill here has made an excellent start in studying the properties and working characteristics of some of the lesser known Brazilian woods. Logs are being supplied from the Curuá Silvicultural Study Area.

The silvicultural studies being made at Curuá, like the studies at Santarém, are being conducted by the FAO Forestry Mission in cooperation with the Brazilian Forest Service. The basic pattern of study at Curuá is essentially the same as in Surinam: improve-

ment of the high forest by eliminating weed trees, striving for natural regeneration of the best native species, and enrichment planting under the native high forest; at the same time studies are being made on a limited scale on the establishment of pure plantations.

Bigleaf mahogany, Spanish-cedar, and *Carapa* have all shown promise in the underplantings.

Many of the more than forty species tested in pure plantings are promising, but cupiuba (*Goupia glabra* Aubl.), jacaranda, and simaruba are outstanding. Several eucalypts have shown their usual rapid growth but have

relatively poor form and have suffered frequent damage from leaf-cutting ants; of these, *E. citriodora* Hook has shown the most promise.

Progress in forestry in the Caribbean area, as elsewhere, depends to a considerable extent on the interchange of ideas and information among foresters. Here, more than in most regions, distance and language present obstacles to free exchange of ideas. The inspections reported here were made to help bridge these gaps in communication.

More detailed reports on successful plantations will be found in the second report on Forest Plantations in Latin America of the Regional Committee on Forest Research, Latin American Forestry Commission, FAO. This

report is now in preparation at the Tropical Forest Research Center.

It is hoped that additional material will be submitted for publication in the Caribbean Forester as a result of the stimulating discussions that developed from the contacts made in the area. If only a part of the information available in the minds and files of the foresters visited could be published it would provide an important stimulus to the practice of forestry in the Caribbean area and elsewhere.

The staff of the Tropical Forest Center take this opportunity to express their thanks for the cordial hospitality and the stimulating and helpful assistance given during the visits and hope that they in turn may extend similar courtesies in Puerto Rico.

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