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The Development of Spiny Lobster Fishing
in Belize, 1920-1977

Belizean Heroes and Patriots:
Dr. Frederick Gahne

Forestry in Belize, Part I: Beginnings
of Modern Forestry and Agriculture, 1921
to 1954



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Beginnings of Modern Forestry and Agriculture, 1921 to 1954

Lumbering is the oldest industry in Belize. It began with the logwood (Haematoxylon campechianum) cutters of the mid-1600's but later shifted emphasis to mahogany (Swietenia, Carapa and Tapirira species). Still later cedar (Cedrella mexicana) and pine (Pinus species) took on important but secondary status to mahogany. The rapid growth and regeneration of most wood species (as measured in their life cycles), coupled with a sparse population of people in Belize throughout its history, allowed lumbering to develop as the dominant industry with little concern for formal intensive forest management. It was an industry requiring a rather minimal capital investment yet turning out large volumes of raw and milled lumber for foreign and domestic markets.

For almost 300 years forest management methods remained fairly constant. Premium trees were given exclusive priority by the commercial wood cutter. Little concern or interest was shown for moderate or lower grade trees. Natural regeneration was the prime method of forest recovery after cutting. In many cases ease of access by rail, water or land route was the main criterion for selecting an area for cutting. If access were too difficult, even premium trees were left unharvested. Mahogany became the gem of

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the lumber industry and Belizean mahogany earned international repute for its quality and beauty. Prize woods of lesser known species like Ziricote (*Cordia dodecandra*), Rosewood (*Dalbergia stenensonii*), Mayflower (*Tabebuia pentaphylla*) and Santa Maria (*Calophyllum brasiliense*) abounded in the forests but found almost no international market when put in competition with mahogany and cedar for use in furniture and construction. The world was simply unaware of the beauty of these woods and the world market reflected this ignorance.

This 300 year period saw a gradual change as the Lumber Industry expanded to become a Forest Industry, and secondary forest products also found an important place in the economy of Belize. Among the most important of these was chicle which was gathered in raw latex form by tapping the Sapodilla (*Achras* and *Lucuma* species) trees and heated to form the rubbery base of chewing gum. It was a product whose harvest did not destroy the tree and could be re-harvested every 5 to 10 years (13). Other secondary forest products yielded an annual harvest from the same trees. In this important category were plants such as oil palms, and among these the coconut (*Cocos nucifera*) and cohune nut (*Orbignya cohune*) yielded oils used extensively for medicinal and industrial purposes. Resins and naval stores from pine and other conifers also provided raw materials for industry. All of these secondary forest products brought in residual income to complement the main forest product, lumber.

Secondary industries closely tied to Forestry also arose in Belize. These included boat making, furniture and cabinet manufacture, and carved wood products. They were run primarily by highly skilled artisans operating in a small business context with 10 or less employees.

The forests seemed inexhaustible. Lumber of various species was there for the taking. The country had a healthy lumber supply and a thriving forest industry. They reached the peak of their importance in the late 1800's.

After about 1900 Forestry as an industry began to decline. It found itself in stiff competition with agriculture. Commercial agriculture, especially the production of citrus, sugar and cocoa, began to show appreciable growth (3). Before this time agricultural enterprises were small subsistence in many cases, serving to fulfill local demand for food. Little if any food was shipped out of the country.

The decline in forest production was due to many prob-

lems within the industry itself. These included the fact that the quality of lumber in the most easily accessible areas had begun to seriously decline. The annual volume production of forest products was thus declining (3). Lumbermen had to go into less accessible areas. Correspondingly this caused an increase in lumbering costs and made Belizean woods less competitive on the world market (11).

Commercial Agriculture and Forestry competed for available land. Under management conditions existing in the late nineteenth and early twentieth centuries, agriculture was destined to win this competition because of resources, especially high-fertility soils. In 1958 the industries reached parity as the value of agricultural products equalled that of forest produce (3).

MODERN FORESTRY

The forests were being cut faster than natural regeneration methods could provide premium logs. Forestry as an industry would die if trees, its raw material, were depleted. To prevent this depletion it was possible to either stop all cutting, or to intensify all management factors so as to effect faster and better forest regeneration while making use of all grades of timber.

A balance between these two possibilities was first suggested in the Hummel Report of 1921 (11). In a basic four point outline the report planted the seeds of Modern Forestry in Belize. The main points were:

1. To improve existing conditions of the forests and logging methods so that cost of forest exploitation would decrease and therefore make competition on the world market easier.
2. To concentrate gradually mahogany production on favorable areas, to increase mahogany stock and output.
3. To find a market for useful secondary woods.
4. To improve communication by more systematic exploitation.

During the 10 year period from 1923 to 1933 implementation of these recommendations was begun on Crown lands with the hope that private lands owners would also adopt them. This in fact happened, but its process was slow.

A crucial idea, especially in regard to mahogany lumbering, began to develop; that of Sustained Yield Management. It allowed for the use of those management meth-

ods that helped tree regeneration to keep up with volume cut so that depletion of lumber inventories would cease. Management techniques could be imported from temperate areas of the world like Europe where Forestry, especially Silviculture as a science had been practiced for centuries. But many of these techniques just did not work in the tropics. Thus there arose the need for experimentation and development of techniques especially suited to the economy, climate, soils, tree species and peoples of Belize.

SILVICULTURE

Silviculture, or tree cultivation, is a cultural tool of Forestry that can take any number of forms. The Tanguya Method was one of the first and most fascinating of these forms. Although the degree of success with which it met was usually quite low, it was one of the first attempts at mahogany regeneration through reforestation. Quite simply it involved giving a milpero (shifting agriculturalist) tree seedlings (usually mahogany). The milpero went about his usual task of cutting and burning a section of "bush" in preparation for planting a cash crop. But as he planted his crop (usually corn) he also set these seedlings about 10 feet (3 meters) apart in rows and 10 feet between rows. The plot was usually abandoned after the first crop and the trees had to survive on their own (4, 8, 11, 12, 13). But during the year of growth with the crop, the mahogany or other tree species could get a strong start because of the decreased competition from "bush" weeds. Problems usually arose because the young mahogany generally grew slower than the regenerating "bush," and a weed control program usually in the form of vine removal was necessary about 3 to 6 years later if the stand was to have any chance of success.

A variation of this method involved the use of cocoa as the cash crop (4, 13). Cocoa was planted with the mahogany seedlings, and harvesting of cocoa pods began about 3 to 4 years after planting. The cocoa continued to be grown until the mahogany trees reached the pole stage of growth. Using cocoa as the cash crop offered the advantage of longer care of the plot thus giving the mahogany a stronger start in its competition with the regenerating "bush." A major problem however was the fact that most milperoes were unwilling to invest the time involved in long-term cultivation of the cocoa patch before a harvest began. Corn and other annual cash crops offered a quicker return.

The Tanguya method was dependent on inexpensive labor which was quite plentiful under the old colonial rule (12),

but as colonialism began to die Tanguya preceeded it to the grave. It was, however, a beginning.

Forestry was a generally depressed activity during the 1930's, 40's and 50's (2). The world depression of the 1930's exerted a great effect. However, lesser recessions during this 30 year period were also felt and the economy of Belize suffered. A resurgence in forest industries began in the late 1950's but this was set back by hurricane Hattie in 1961, which destroyed vast forest areas (2). Still, efforts continued in research and management, always plagued by a lack of funds, to find methods and species which would improve the productivity of the forests.

Modern Silviculture took another step forward with the introduction of the Plantation Method of tree growing. It was first begun in the late 1920's and early 1930's on both Crown and private lands and initially involved primarily mahogany (8, 12, 13). The technique entailed clearing a piece of land and planting seedlings of a single tree species. These trees were the main crop in which the entire investment of labor and capital was placed. Unlike the Tanguya method, no companion crop was grown. The plot was tended every one, two, or three years or as needed to control the bush (but not eliminate it) and allow the plantation trees to dominate. Unfortunately those plantations begun from about 1928 to 1933 were almost totally wiped out by hurricanes and had to be replanted by 1942 (12). The system was used both for hardwood and soft coniferous species but lent itself especially to the culture of the latter (particularly pine). From 1942 to 1954 an average of 380 acres (153 hectares) was planted to pine (13). By 1958 an average of 1100 acres (444 ha) of plantations, both pine and other woods, had been established each year since about 1942 (8).

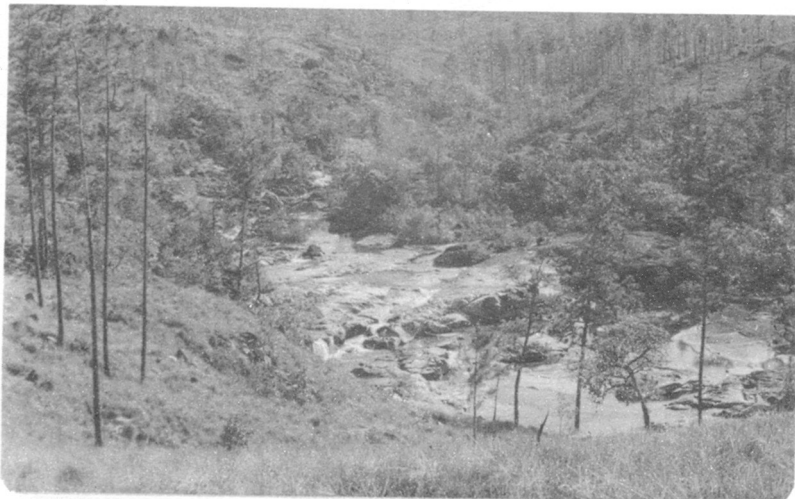
A major problem encountered using the Single-species Plantation Method was the rapid spread of diseases and insects in pure stands of trees. This problem had been encountered in Temperate Zone tree plantations but it was accentuated by the heat and moisture in the Tropics. Lumbermen today, both government and those from private companies, bear out this analysis. They conclude that many of the pure hardwood, Single-species plantations existing from the 1940's and 50's now produce woods whose quality is about the same as that being harvested before the initiation of Single-species stands (7, 12). The possible effects of disease are suggested by the fact that in many cases Sustained Yields in hardwood plantations have not

been achieved under the Single-species Plantation Method (7).

Correction of the problem of mass destruction due to disease and insects was fairly simple. Instead of planting a single species, the plantation could be composed of mixed species randomly interspersed over the area. Different tree species vary in their susceptibility to the same disease. Thus an insect or disease striking a highly susceptible species in a pure stand of trees would spread through the stand unchecked, wipe it out, and cause complete loss of the capital (money and labor) invested in that stand. However, in a Mixed-species Plantation the spread of any one disease or insect pest would be slower because host trees would be farther apart. Trees of the same species would also tend to be separated by trees of other species and this mixing would help fight total elimination of any one species in the plantation by making transmission of disease more difficult. The different species would "buffer" the effects of disease on one another. However, even if a disease or insect wiped out an entire species in a Mixed-species Plantation, total economic disaster would tend to be avoided because the other species would usually remain to yield some kind of harvest.

Disease and insect cycles are critical problems facing foresters in the tropics of Belize. Mixed-species plantations became a way of dealing with and controlling their devastating effects especially with hardwoods whose long life cycles (regarding time from planting to harvest) might take 60 years or more. Once established, a Mixed-species Plantation could be managed by simple intensive cutting of mature trees, pest control and natural regeneration of seedlings.

However, with short-cycle species like pines and other conifers where a veneer log with a diameter of 24 inches (60 cm) or more might be produced in only 20 years or less, the use of pure, Single-species Plantations was worth the risk if adequate protection were provided. In fact, the growing of pure conifer plantations was especially suited to the Mountain Pine Ridge where plantations were inexpensive and easy to establish (13). The area was quite free of any major weed problem. Wild fires would be a major threat until trees were 3 or 4 years old, by which time most would be big enough and strong enough to withstand the effects of most fires. Controlled burning in the area was even found to encourage regeneration of conifer in many cases.



The Mountain Pine Ridge is an area well suited to the production of pine and other softwood conifers. Underbrush and weeds are minimal, but soils tend to be poor, especially in phosphates. Natural tree growth tends to produce spindly, slow growing trees as seen in the foreground of the picture above. The use of fertilizer, especially superphosphate, can correct this.



Hardwoods such as Ceiba or cotton trees (Ceiba pentandra, above) exhibit buttressing to various degrees when nearing maturity. The buttresses (support-type structures at the base of the tree) measured over 10 feet (3 meters) from the base up the trunk.

Poor soils, especially low in phosphates, were the main problem. This was corrected by using about 2 ounces of superphosphate fertilizer per tree. Along with controlling encroaching "bush" for the first 3 or 4 years, these became the main management tools for young conifer plantations on the Mountain Pine Ridge. After that age, controlled burns served to keep down weeds. Naturally regenerating seedlings even permitted sustained yields in many areas.

The Tanguya and Plantation methods were only two of many cultural management systems to develop in the 1920's, 30's and 40's. Variations on these methods became common. Some failed and some succeeded. Their major importance lay in the fact that they reflected honest efforts to solve problems plaguing Forestry and begin intensive Silviculture.

CUTTING MANAGEMENT

Along with new growth management practices like the Tanguya and Plantation method, cutting management practice also became important tools of modern Forestry. One of the most important of these was the Girth Limit. By legislating a minimum girth or circumference below which no tree of a particular species could be legally cut, it was thus hoped that lumbermen would harvest only those trees that were mature, nearing the end of their growth or life cycles. Mature trees grow very slowly, occupy a great deal of space and are much more susceptible to disease than young trees. Cutting of such trees would open a stand and encourage seedling regeneration.

A point of measurement had to be established for uniformity. Measurement at the base of a young tree gave far different dimensions than did measurement at breast-height. A further complication was the fact that most tropical species (including the mahoganies) tend to "buttress" (i.e. develop support structures at their base extending 2 to 4 meters up the trunk) (see photo). Thus measurement including any part of the buttresses were much greater than those taken only around the unbuttressed trunk. But heavily buttressed young trees might have a small trunk and still be at a point of rapid growth in their life cycles. Further, different species at the same age varied greatly in the length of their growth cycles and the volumes of usable wood they contained (10). Mahogany might take 70 or 80 years to mature whereas pines might mature in 25 or 30 years.

Still, old trees had to be identified and cut when

mature in order to control the spread of disease more efficiently and open stands for faster regeneration of seedlings. A painstaking task began of finding the best point of girth measurement plus the ideal minimum girths at which the major economic species should be cut.

A uniform point of measurement for mahogany was set at one foot (30 cm) above the highest buttress (9). Minimum girths were far more difficult to establish not because life cycles varied in length only, but because the same species grew at different rates on different soils and under different moisture conditions. As late as 1952 Wright found two minimum girth limits being enforced for mahogany. In the north a tree had to measure at least 7 feet 6 inches (225 cm) while in the south 9 feet (270 cm) was the legal minimum (13). Today this minimum stands at 6 feet 6 inches (200 cm) throughout the country for mahogany (9).

EXOTICS

Cutting and growth management practices were important tools in improving Forestry in Belize and upgrading quality of wood produced in the forests. But along with these, the 1930's, 40's and early 50's saw an increased interest in the introduction and testing of exotics (i.e. foreign, non-indigenous species) into Belize. Promising species with already established world markets could complement the mahogany, cedar and conifer species and add to the income derived from forest products.

One of the first exotics studied was Teak (Tectona grandes). Introduced from Burma in the 1940's, it proved to be an excellent hardwood species that, although growing slow overall, produced an excellent quality wood and did well in plantations (6, 7, 12). Tests at the Silkgrass reserve showed that it grew 5 or 6 feet in height (150 to 180 cm) in a 6 month period (6). Such results warranted further testing.

Gmelina (Gmelina arborea), although indigenous to Southeast Asia, was introduced from Sierra Leone, Africa in 1954. Some 7 acres (2.8 ha) were planted and the species quickly became known as the best fast-growing broadleaf in Belize (9, 12). A "hardwood" with a relatively low density and light color, it did very well in plantations if the "bush" were cut and burned, and the cleared land were seed to Gmelina before the wet season (4). Young stands had to be cleaned of bush about 3 times and then grew well on their own, eventually producing a closed canopy plantation (4). Along with the native Mayflower, Gmelina was



Massive logs of Mahogany, Cedar, Santa Maria, etc., before sawing, show beneficial effects of minimum girth limits in allowing only mature trees to be used for lumber.



Exotics of various species have been tried over the years with varying degrees of success. Above, in the foreground, a grove of young Eucalyptus with their distinct light colored bark, will produce good poles. However, the tendency for the trunks to twist makes Eucalyptus a poor lumber producer.

found to thrive especially well in gullies and areas of high moisture (5). It thus lent itself well to soil conservation programs on certain highly eroded and erodable soils. As a wood it became especially suitable in rough construction wood for crates and general low cost furniture (9, 12).

Eucalyptus is a genus of which 4 species were introduced and tested at the Silkgrass reserve. These 4 species were Eucalyptus pilularis, E. grandis, E. cloeziana, and E. saligna. E. saligna has been the most successful. Although eucalyptus grows well in Belize, the quality of wood is generally poor because the stems tend to twist as they grow thus resulting in a poor log. It is, however, very well suited to the production of poles that withstand harsh climatic and soil conditions (12).

Other exotics of lesser success and importance include slash pine (Pinus elliottii) imported from Louisiana in the U. S. Although not growing as rapidly as the native Pinus caribaea, it was found to grow more evenly than the latter (6). Cupressus lusitanica, imported from Costa Rica, showed good potential on chemically basic, limestone soils (6). Other exotics were tried and either failed or met with limited success. Those that succeeded made the entire testing program for exotic species worthwhile, because an advantage of exotic species in commercial operations seems to be that they lend themselves better to single-species plantation culture than do indigenous species. This, because the exotics seem less susceptible to disease and pests that attack indigenous species.

SUMMARY

These initial efforts in modern Forestry and Silviculture were aimed primarily at saving the dying lumber industry and helping Forestry diversify and grow. Many of the efforts in species introduction, stand establishment, maintenance and exploitation, cutting regulation and market development met with failure. This failure was usually due to factors both within and outside of Belize. The entire undertaking in Silviculture was experimental. But those efforts which proved successful could be further investigated and expanded.

A major success began in the area of cutting regulation where girth limits encouraged lumbermen to remove old, mature trees. This regulation had the threefold advantage of opening forest canopies to encourage faster regeneration of seedlings, of encouraging faster growth of

young trees, and of causing removal of mature trees which were more susceptible to attack by disease and insects.

Another major concept born at this time was the idea of Sustained Yield Management of forests so as to maintain forest yields, increase lumber stocks where necessary, and improve quality of lumber products. Achieving sustained yields is especially difficult because it involves no one planting, cultural or harvesting method. Sustained Yield Management involves a variety of methods adapted to different parts of Belize. Because of long life cycles for trees, testing of these methods takes anywhere from 25 to 80 years or more. But as such, it has far reaching effects on Forestry directly and on the entire economy in general.

By 1954 Sustained Yield Management Forestry was only an idea whose varying methods were still under investigation. The Forest Industry was still in serious trouble, but problems were being acknowledged and efforts by both public and private foresters were initiated in hopes of correcting the problems. Forestry lay at a new frontier in Belize in 1954, and that frontier was to be ushered in by a sweeping new policy affecting both Crown and private foresters.

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