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The Commercial Exploitation of the
Philippine Hardwoods
by
Charles Freeland

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INTRODUCTION

The problem and purpose of this thesis:

Present information regarding Philippine lumbering is contained in a number of different sources, is voluminous, and contains much data not pertinent to one seeking general non-technical information.

It is the purpose of this thesis to make a collection of selected and condensed material covering, forest inventories, descriptions of woods and wood characteristics, past and present history of forest exploitation and exploitative control measures, lumbering methods and equipment, facts regarding the peculiarities of the industry, and the value of the industry to the islands economically. In short, the thesis is intended as an aid to those seeking general information of the Philippine lumbering industry.

The method of procedure was to read and pick out information deemed of value to the purpose of the thesis. The Bibliography serves to indicate the source of information, statistics, and data used. Specific credit is given in the body of the thesis itself.

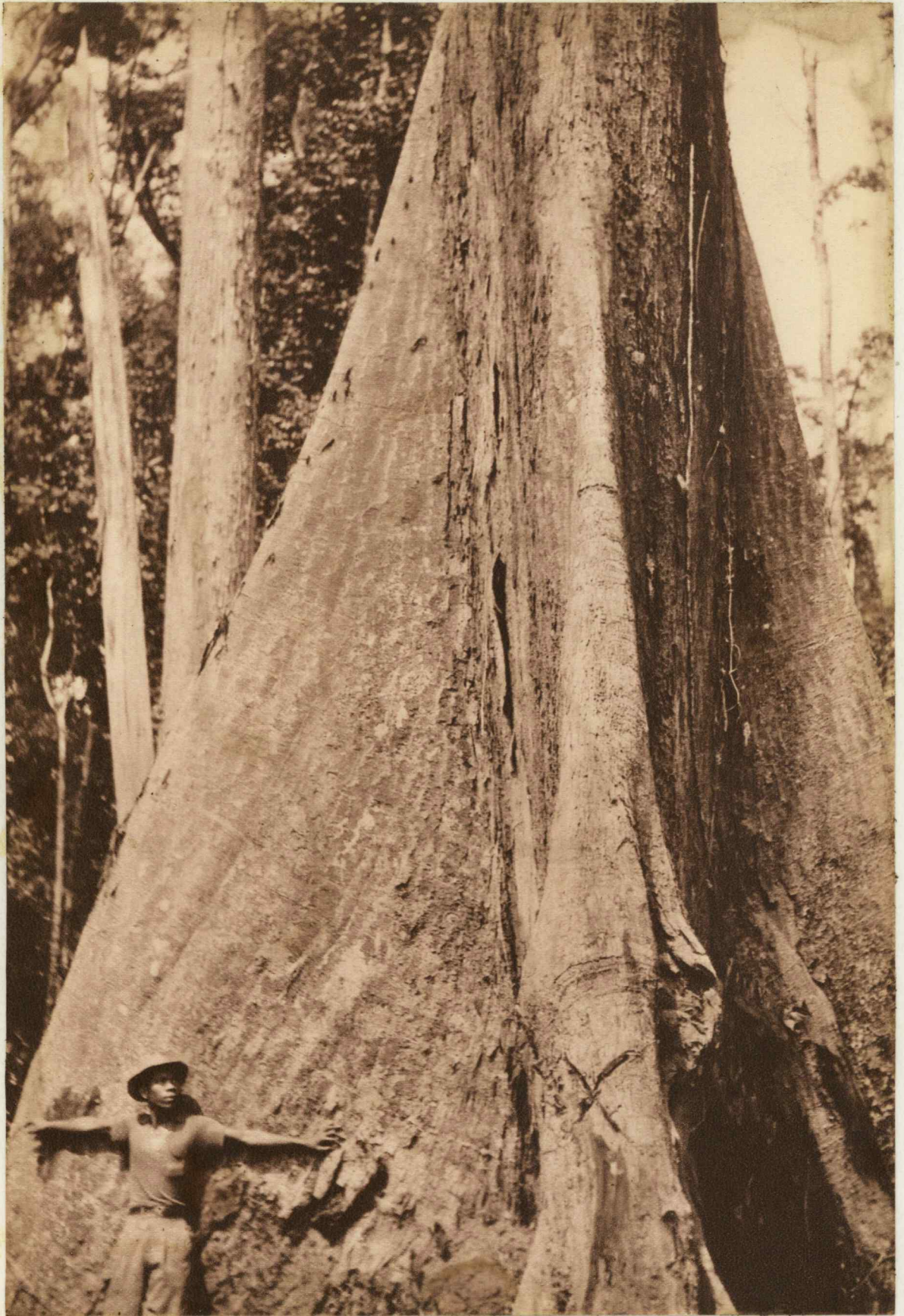
PREFACE

Nearly everyone knows something of the Philippine Islands. They know that there are quite a number of islands in the group and that Philippine mahogany comes from them, but it is not well known that these 3,141 islands contain some 114,326 square miles of land area scattered over a thousand miles of latitude. This means that there is as much difference in climate as there is between the Northern and Southern extremes of our own Pacific Coast. The average mean temperature is between 79 and 85 degrees and the rainfall varies from 75 inches at Manila to 113 inches at Lamao. With such conditions one might expect a typical tropical forest of such density of brush that profitable logging would be impossible. This, however, is not the case; the forests are dense but not with ground shrubs. In fact, the Philippines stand at the head of the list as a lumber producing country with a ratio of forest to land area of 63.1 percent or 72,224 square miles, while its nearest rival, Sweden, has but 54.8 percent forest area. It is not surprising, then, that the forestry industry is one of the ranking industries of the country. Nor is it surprising that this business is under the direct control of the government through the Bureau of Forestry, and is the only agency in which the government and business find themselves in goodfellowship.









I

Description of Woods

The Philippine lumber exported to the United States and other countries may be classified into two main divisions, Philippine Mahoganies, and Philippine hardwoods. The first group constitutes approximately 90% of the total export, and apitong, of the second group, the remainder.

In general woods classified as Philippine Mahoganies may be characterized as having a grain similar to genuine mahogany. That is, they have crossed or interlocking grain, light to dark red in color, moderately hard and heavy, and in addition, when examined in the cross section, there are white irregularly-spaced lines that run in the same direction as the growth rings. These lines are resin ducts and appear as white dots under the magnifying glass. There are two distinct types of Philippine mahogany; Dark Red Philippine Mahogany, and Light Red Philippine Mahogany.

Under Dark Red Philippine Mahogany no other woods are sold other than Tangile, Red Lauan, and Tiaong, while Light Red includes only White Lauan, Almon, Bagtikan, and Mayapis.

A further description of the woods follows as written in an article in the October 31, 1933 issue of the Manila Bulletin by Luis J. Reyes, Wood Technologist Bureau of Forestry, Manila. Mr. Reyes gives the following description:

"The Red Lauan is the darkest colored of the Dark Red Philippine Mahogany, generally dark red to dark brownish red. Grain, crossed or interlocking, showing a distinct "ribbon" when quartered; texture relatively coarse due to large pores, larger than those of genuine mahogany; glossy. It is moderately hard and heavy weighing about 36.5 lbs per cubic foot when air dried. Irregular white line on the cross-section present.

Tangile is dark red in color; grain crossed or interlocking, and, like the red lauan, shows distinct "ribbon" when quartered; texture moderately fine, very similar to those of genuine mahogany; lustrous especially when quartered. It is moderately hard and heavy, weighing about 35 lbs. per cubic foot.

Tiaong is hardly distinguishable from Tangile except in minor details, viz, in the irregular occurrence of resin ducts and dark red not purple, when examined in cross section. The wood weighs an average 30.4 lbs. per cubic foot. Tiaong constitutes the bulk of the so-called red lauan of South Mindanao where true red lauan has never been reported."

The Light red Philippine Mahogany group differs only in very minor details, chief of which is the color. This group is characterized by a light red or pinkish color. In grain, texture, hardness, and weight they are similar to the dark reds. Mayapis is the only exception; it is lighter and softer than any of the other Philippine mahoganys.

"Almon is light red or pinkish. It weighs approximately 35.5 lbs. per cubic foot. Almon differs from white lauan in having more redish tint and the pores largely oblong instead of rounded.

Bagtikan is the hardest, heaviest, and strongest of the Philippine mahoganies. The wood is light grey with a brownish cast. In some samples light brownish concentric bands 5 to 10 mm. apart are noticeable. The grain is crossed; texture moderately coarse; moderately hard and heavy, weighing an average of 38.6 lbs. per cubic foot. The wood is distinguishable from almon by its greater density.

White Lauan is very similar to almon, except that the wood is lighter in color. The grain is crossed; texture moderately coarse. A moderately hard and comparatively light wood, weighing about 33.6 lbs. per cubic foot.

Mayapis is intermediate in color between dark and light red mahogany. In grain, texture, and general appearance it is the same as the rest of the group. It has no distinct white lines because the resin does not harden, but volatilizes at ordinary temperatures. It weighs an average of 29.6 lbs. per cubic foot, making it the lightest and softest of the group. The wood is often mistaken for almon and tangile, but it can always be distinguished because of its lightness and softness, and because the resin ducts are empty, no white resin being present."

All other woods are sold under the name by which

they are officially known in the Philippines as Philippine hardwoods. Chief among these are Apitong and Guijo.

Mr. Reyes describes these two as follows:

"Apitong" is one of the most abundant of Philippine woods. It is reddish to dark brown in color; grain slightly crossed, occasionally wavy. When quartered, "ribbon" is often absent or wide apart. Texture, moderately fine to moderately coarse. Not glossy, has a slight resinous smell, but no distinct taste. It is moderately hard and comparatively heavy, weighing an average of 45.9 lbs. per cubic foot.

The resin ducts, instead of being in rows as in Philippine mahogany, are scattered. They are visible as white dots in the transverse, or cross section of the wood.

Guijo has a brownish red heartwood; grain crossed with a very distinct "ribbon" figure when quartered; texture moderately fine, fairly glossy. It is an hard, strong and heavy wood, weighing on the average 51 lbs. per cubic foot. Similar to tangile, except that it is a good deal harder and heavier. It can be distinguished from apitong by being more glossy and by the fact that the white lines are in rows."

From the same article the following Key to Identification of Philippine woods is also taken:

Identification Key

Philippine Woods

- I. RESIN DUCTS (white lines) NOT PRESENT IN CROSS SECTION------(2) D
- II. RESIN DUCTS OCCUR IN CROSS SECTION
 - (1) Moderately hard and heavy, similar to Mahogany
 - A. Dark Red Woods---Dark Red Philippine Mahogany
 - 1. Texture coarser than genuine mahogany-----Red Lauan
 - 2. Texture same as genuine mahogany
 - a. Cross section appears purplish in color-----Tangile
 - b. Cross section not purplish--Tiaong
 - B. Light Red Woods--Light Red Philippine Mahogany
 - 1. Wood reddish, moderately soft and light-----Mayapis
 - 2. Wood light red or grayish
 - a. Wood hard, distinct brown bands occasionally present----Bagtikan
 - b. Wood moderately hard, brown bands not present
 - 1. Wood very light red---Almon
 - 2. Wood grayish-----White Lauan
 - (2) Hard to very hard woods, similar in weight and hardness to white oak and hickory.
 - A. Reddish brown woods-----Guijo
 - B. Yellowish woods-----Yakal

- C. Large pores arranged in concentric rows following growth rings (yellowish to dark red)-----Narra
- D. Large pores not arranged in rows
1. Yellowish wood, sometimes with longitudinal rosey streaks--Palosapis
 2. Not yellowish
 - a. Pores large, very plainly visible to the naked eye--
 - (1) Grain straight, pores numerous when seen on the longitudinal plane-----Lumbayan
 - (2) Grain crossed, pore numerous on longitudinal plane-Kamatog
 - b. Pores moderately small, evenly spaced when seen on the longitudinal plane-----
 - (1) White dots present on transverse plane-----Apitong
 - (2) White dots not present on Transverse plane---Nata

Tests indicate that the Philippine woods rank very high in ability to resist decay and attack by insects. Starting in 1907 the Bureau of Forestry conducted tests on a number of species, burying them in the ground and piling debris around them to attract insects. Using Ipil, a well known wood for durability, as a base of 100 per cent the woods were classified on a percentage basis for durability. A partial listing of their findings follows:

Table I

<u>Very Durable</u>	<u>% Rating</u>	<u>Years durability</u> 10 or over	<u>% Grouping</u> over 90%
1. *Yakal	109		
2. Ipil	100		
3. Tindalo	100		
4. Molave	169		
<u>Durable</u>		5 to 10	46 to 90
1. Akle	90		
2. Alupang	70		
3. Banaba	60		
4. Narra	83		
5. Batitinan	50		
<u>Moderately Durable</u>		2 to 5	21 to 45
1. Agoho	30		
2. *Bagtikam	26		
3. Dao	25		
4. *Guijo	38		
5. *Palosapis	22		
6. *Red Lauan	21		
7. *Tangile	29		
<u>Perishable</u>		1 to 2	10 to 20
1. *Almon	15		
2. *Apitong	16		
3. *White Lauan	11		
4. Nato	15		

Very Perishable

less than 1 less than 10

- | | | |
|----|------------|---|
| 1. | Balakat | 9 |
| 2. | Baniti | 8 |
| 3. | White Nato | 5 |
| 4. | Malapapaya | 7 |

*Woods checked are commonly exported.

According to this classification all American woods tested come under the "perishable" grouping with relative values as follows:

Table II

1.	Big Tree Red Wood	16%
2.	California White Pine	18%
3.	Cedar	18%
4.	Lodge Pole Pine	18%
5.	Ponderosa Pine	16%
6.	Redwood	15%
7.	Spruce	14%
8.	Sugar Pine	14%
9.	Western Hemlock	17%
10.	White Spruce	16%

However, termites were chiefly responsible for the failure of species falling in the latter two groups; those falling in the moderately durable group failed partially because of insects and partly because of decay while those of the durable group failed principally due to decay.

This seems to indicate that the Philippine woods will give better service than our own woods under severe conditions of use. They also compare very favorably in strength properties with some of our stronger hardwoods.

Tests run at the State University of California at Berkley under the direction of Professor Raymond E. Davis as listed in the Cadwaller-Gibson Sales Manual, Page 10, shows the following data:

Table III

Static Bending

Wood	M.C.%	Sp. G.	M. of Rupture # per sq. "	ME M# per sq"
Apitong	12	.69	16,220	2,340
Light Red group	12	.60	13,700	1,920
Dark Red Group	12	.58	12,660	1,890

These results, compared with those for some of the best American hardwoods, as given in the U. S. Bulletin No. 556, taken under the same conditions, shows the comparison of strength qualities.

Table IV

Wood	M. C.	Sp. G.	M. R.	ME.
Alder--Wash.	12	.42	9,330	1,340
Ash--Tenn.	12	.57	11,420	1,520
Ash--Michigan--Wis.	12	.50	13,000	1,639
Birch--Paper--Wis.	12	.58	11,900	1,530
Birch--Yellow--Wis.	12	.63	17,100	2,090
Gun--Red--Mo.	12	.49	11,950	1,480
Hickory--Pecan--Mo.	12	.70	12,440	1,720
Hickory--Miss--Ohio	12	.71	17,790	1,900
Maple--Sugar--Ind. Penn--Wis.	12	.62	14,850	1,760
Oak--White--Ark.	12	.69	14,900	1,760
Walnut--Black--Ky.	12	.67	12,750	1,560

From these figures it may be seen that the Philippine woods have, in most cases, a slight advantage in resistance to failure in both the initial and final point of failure when under the pressure of a load. Apitong is especially well suited to uses in which rough heavy duty and strength are required.

Some of the Philippine woods are so dense they will not even float. Some of these woods, Dao, Guijo, Narra, and Lauan recently shipped to Portland for experimental veneer cuttings had to be cradled between other logs of less density in order to float them. This shipment in-

cluded 270 M. feet, and is the largest shipment of logs to reach the United States to date.

III

Forestry Inventories

An Inventory of the Philippine forests taken by the Bureau of Forestry in 1933 placed their estimation of standing commercial timber, 88.6% of total timber, at 484,874,000,000 board feet. The bulk (70%) of this timber belongs to one family, the *Dipero*carp or Lauan family, 11.4% is second growth. From a botanical standpoint, *dipero*carp forests are complex in composition, but from that of the lumberman they are comparatively simple, consisting only of four groups; Lauans, Apitongs, Yacals, and Palosapis. In this connection it is interesting to note that most of the lumber sold to the United States comes from the first two groups. The *dipero*carp forests occur in practically pure stands free from underbrush, and will run 35 to 45 M per acre. Thus the forests of the Philippines compare favorably with some of our own Pacific Coast stands of Fir.

"The Characteristics of the different species vary greatly according to climatic conditions, soil, rainfall, location and latitudes in which the trees are grown." For example "those grown on poorly drained soil, with heavy rainfall, and with the stimulation of humid tropical heat grow much faster and, consequently, are coarser in texture and lighter in weight."

"Generally speaking the woods grown in the Northern latitudes are firmer textured than those grown in the

Southern regions, but trees grown in the high altitudes of the South might be of greater density than trees grown in the lowlands of the Northern latitudes."

The Apitong group embraces some fifteen or seventeen very similar species of trees, and has many characteristics of Teak wood. Average diameters run from 24 to 48 inches, and, because of the peculiarities of growth in which the crown is restricted to the top and the long straight bole, exceptionally long clear timbers are obtainable, 6" or 8" x 14" cants up to 50' in length.

Trees of the "Dark Red Philippine Mahogany" group average from 24 to 60 inches in diameter.

It is not an easy matter to manage a business having 486 billion feet of standing timber and with an economic value of annual growth equal to more than ten times the amount cut each year. Yet that is the job of the Bureau Forestry. It manages 72.38% of the forest area, and 99% of the merchantable timber of the Islands.

The following tables give an idea of the vast problem the Philippine forest service exerts control over in one way or another: (tables made in 1933)

Table V

Monetary Items^{2.}

Standing timber	\$4,000,000,000
Annual growth	91,718,645
Minor forest products	3,019,737
Capital invested in lumber industry	23,835,102
Capital invested in minor products	1,026,337
Average yearly payroll of mills	5,000,000
Average Bureau revenues (1900-1932)	300,000
Average Bureau revenues last 23 years	500,000
Total Bureau surplus (1901-1932)	6,589,889
Total Bureau surplus (1915-1932)	5,367,506

Table VI

Bureau revenues & expenditures
during various years

<u>Year</u>	<u>Revenues</u>	<u>Expenditures</u>	<u>Profit to Government</u>
1901	\$99,686	\$24,995	\$74,691
1929	963,484	382,121	581,364
1931			507,051
1932	692,168	359,090	306,493

These figures show the large amounts of money the Bureau controls, either directly or indirectly. It also shows the business during the past few years has been declining. (A raise is indicated at present)

Table VII

Standing timber est. (commercial)	484,874,000,000	Bd. Ft.
Annual growth	17,153,561	" "
Total cut (1930) 8.5% of annual growth	1,460,619	Cu. M.
Total cut (1929) diperocarps only	1,096,547	" "
Cut (1906)	252,000	Bd. Ft.
Cut (1931)	71,000,000	" "

Table VIII

<u>Year</u>	<u>Species Used</u>
1906	12 to 15
1931	40 to 50

Table IX

Investments in Sawmills

<u>No. Mills</u>	<u>Nationality</u>	<u>Investment</u>	<u>Percent</u>	<u>Cu. M cut</u>
30	American	\$6,378,400	43.41	816,664
63	Filippino	3,276,150	22.30	470,330
6	Chinese	1,933,750	13.16	175,439
3	Japanese	631,500	4.29	108,348
8	Others	663,750	16.84	40,000

Variation of mills and cut over years

<u>No. mills</u>	<u>Year</u>	<u>Bd. ft. cut</u>	<u>No. mills</u>	<u>Bd. ft. cut</u>	<u>Year</u>
50	1927	189,103 M	105	147,343 M	1932
71	1928	227,068	110	172,305	1933
99	1929	252,273	108	221,343	1934
115	1930	208,372	111	247,913	1935
123	1931	132,979	115	292,106	1936

Table X

Workers Employed in Industry

Labor employed in lumber industry	35,000 people
Labor employed in minor products	12,635 people
Possible yearly yield if properly managed--	5 Billion Bd. ft.

Even without considering the annual growth it would take, at the present rate of cut, about one thousand years to cut the standing timber. When the annual growth is considered it appears that a perpetual supply of timber is going to be available under proper management.

IV

Exploitation control: the Bureau of Forestry

These tables illustrate the magnitude of the business under the supervision of the Bureau of Forestry. A brief review of the history of the service discloses these facts. Under the Spanish Regime the forest resources were not well managed due to lack of markets and modern machinery for the exploitation of the lumber, and lack of business enterprise.

Early in 1863 the Spanish government created a forest service which, however, was not very active because of the lack of trained men and information about the particular forests of the Philippines. Logging was done only by very primitive methods and did not need much control exerted over it.

However, as soon as the Armistice terminating the Philippino-American revolution was signed the American soldiers discharged from the army began to see the vast possibilities of lumbering in the Islands and started several enterprises. They were soon able to interest businessmen in furnishing capital from abroad for establishing well financed, large scale, production units with modern equipment and lumbering methods.

This new business trend naturally developed a demand for Philippine stumpage which was government owned. A system of granting licences and privileges to responsible operators was developed under the administration of the Bureau of Forestry.

The first stumpage sales took place on an optional log or mill scale, 15% added on the mill tally basis. This system suited the large operators very well because the loss in milling was always more than 15%, but it did not suit the small operator who had to buy on the log scale since he had no mill.

By 1915, however, this practice was discontinued in favor of a strictly log scale. The new system made it necessary for the Bureau to do most of the scaling themselves, and as a result Forest Stations were established in each of the larger mills so that a government scaler would be on hand to scale and identify all logs cut, encourage closer utilization, act as a forest protection agency, and supervise the method of cutting.

Lumbermen who are granted licences to exploit public forests pay forest charges to the government, under the present system, on the volume and group of the timber cut. Figures of the scale are taken either from their own or from the scalers the Bureau provides.

During 1933 there were 106 sawmills and logging operators scattered throughout the Islands under ordinary licence, 77 of which have their scaling done by the Bureau scalers with a cut reported at a valuation of \$209,213. The remaining 29 mills and 1674 small licences do their own scaling and report to the Bureau. (There are now 115 mills with a cut of 292,106 M board feet)

Since taxes are paid on a basis of these log scales it is necessary for the Bureau scalers to be very fair

and accurate. To assure this, the Bureau takes graduates of the School of Forestry at Los Baros who have had training in mensuration and log scaling in school. These men become Rangers attached to the mills and, after a short period of training, become Bureau scalers.

As a further precaution against unfairness in scaling the Bureau maintains a system of check scaling with older, more experienced scalers checking the rangers which tends to keep log scaling more or less uniform throughout the Islands.

Other activities of the Bureau of Forestry include such things as reforestation surveys, recreation work, forest promotion and advertising, public education in forest practices, research work in such things as wood utilization, growth statistics, composition and durability of the woods, seasoning schedules, and fire protection for which it assumes full responsibility. Each forest Ranger is given control over an area of some 200 square miles of land.

The system of licencing in effect since 1915 provides that a licence fee of \$1.00 be charged for the use of wood from the 703 Communal forests which have been established for the use of citizens of the country. No other charge is made on wood from these areas. Commercial licences, however, are arranged so that there will be a tax on woods on four different classifications, Durability, Supply, Value for Construction, and Cabinet woods, from the local standpoint. Forest charges are based on 10%

of the local market price and are paid on the following scales:

Table XI

Durability	\$3.75	per	M
Supply	2.25	"	"
Construction woods	1.50	"	"
Cabinet woods	.75	"	"

The present method of licencing (1933) provides that:

1. The operator prove his ability to carry on logging and milling at a high point of efficiency.
2. The licensee deposit sufficient bond as assurance of good faith.
3. At least 61% of the capital to be Filipino or American.
4. Only foreigners from countries be granted privileges whose own countries grant Filipinos like privileges.
5. All lumber must be marketed under its official name.
6. Licensees observe the rules and regulations of the Philippine government.

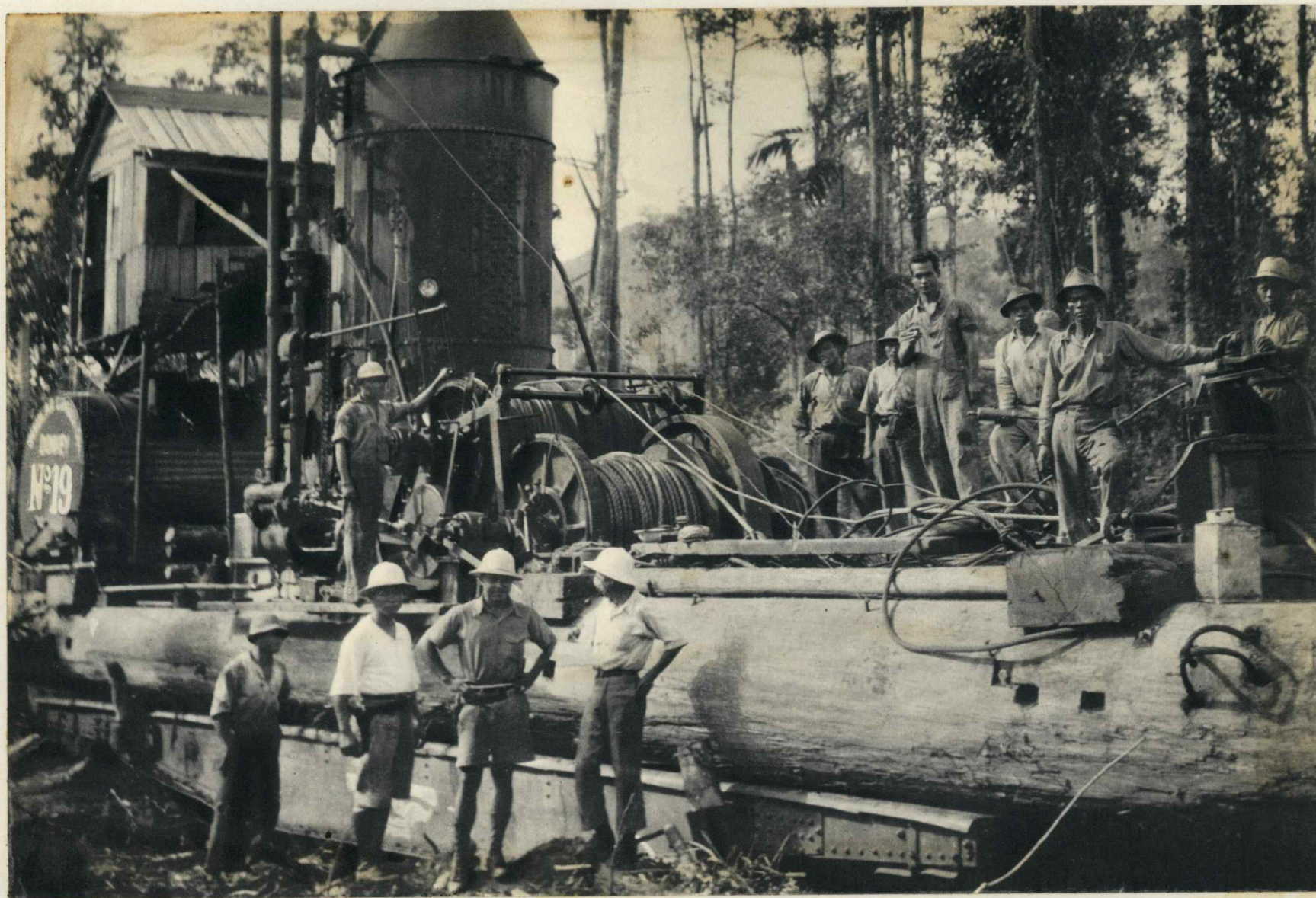
Licences may be issued for periods of one to twenty years with privilege of renewal if wished.

This system of licencing offers many distinct advantages to the operator. For example, it is not necessary for him to pay for stumpage until the timber is actually cut. This means that he does not have to tie his money up for years in standing timber. Another great advantage is that the Bureau assumes full responsibility in fire protection which relieves the operator of heavy expense and risk.

Taken on the whole, the Philippine system of forestry seems quite advanced and well managed from both the governmental and operator's point of view.













V

Logging Methods

A history of the present methods of logging is practically a history of the past methods. That is to say, nearly all of the primitive methods still exist as well as modern logging methods which the larger operations use.

An article in the Manila Bulletin for October 31, 1933 by Perfecto C. Clemente, an ex-Ranger of the Bureau of Forestry, gives a picture of present logging methods. To quote Mr. Clemente, "While lumber production and lumber trade have considerably developed in rapid pace, yet the same cannot be said of the progress made in the methods of logging employed. Of the 115 sawmills in operation in 1930, 77 still use carabao logging, 6 use tractors and 32 employ donkey engines and locomotives to transport their logs to the mill."

There are nine (9) methods of logging employed in the Islands today which are briefly described as follows:

1. HAND LOGGING--This is nothing more than the exertion of human effort by the use of cant hooks, peavies, and jacks to roll the logs from the woods to the log decks or mills. A skidway is cleared of all branches and stumps to facilitate the rolling of logs. The ease with which this system is handled depends on the size and species of logs and topography of the country. This method is still employed by small timber operators in places where

it is difficult to find forage for animals, near the ocean and rivers where logs are rafted and floated to the mill.

2. ANIMAL LOGGING--Carabaos, chiefly, are used in this method of logging operation. Logs are nosed and snipped to lessen the resistance to hauling. In some places however, a circular ring about 1 inch deep is cut around the log and a chain is fastened on. The chain, in turn, is tied to a sled which is pulled by the carabaos. Rope, but more often rattan, is used for hauling. About 4 to 12 carabaos are used at a time, depending upon the species of wood to be moved, size of the log, and topography of the country. This method is well adopted to places near the seashore or river where hauling distances are short, but impracticable where logging is done far in the interior. There, machines should be used.

3. RAFTING and FLOATING--As the name suggests, logs, when dumped into the seashore or river, are tied together by means of chains, ropes or rattans. If by chain, they are fastened together by iron clamps stuck in the logs. If by ropes or rattans, the logs are braced at the ends by poles of about 20 cm. in diameter. "Sinker" logs are usually rafted together with "floaters" and are towed to the mill by launches, or pushed by use of long poles which is, of course, a very slow process. Generally, the rafting and towing are done during high tide.

4. TRACTOR LOGGING--Timber operators are using tractors with apparent success in the islands. This method is quite advantageous on hard ground, during the dry seasons. Logs are usually in long lengths which are cut into shorter ones at the mill.
5. WOODEN TRAMWAY--This is nothing more than a graded road fitted with 2" x 4" wood rails. Use of this system is only adaptable to long haul operations in fairly level country. Logs are loaded on wooden cars with steel wheels, and are either pushed by men or pulled by carabaos.
6. CHUTES and TIMBER SLIDES--Due to rather expensive and difficult operation of this sy^stem, very few timber operators are employing it. This consists chiefly of round or sawn timbers supported by a framework forming a trough or saddle at the foot of which there usually is a creek, river, ocean, or deep dug-out into which the logs are dumped. One main objection to the chute is that logs often split because of the impact received in dumping, and logs quite often jump off the chute. This method is adopted to localities where the above methods and inclined railroad are impracticable.
7. STEAM LOGGING--The power used is steam furnished by donkey engines which pull yard logs up to a spar tree. The length of haul is usually 1000 feet. From here the logs are loaded on log cars and brought to the mill by steam logging locomotives.
8. AERIAL TRAMWAYS--Sometimes this is called tramline and is especially adapted to broken and rough country

and long distance hauling where the building of a railroad is impracticable or expensive. A big cable, about 4 inches in diameter, over which the logs are transported, is slung between tall spar trees and supported by inclined poles at intermediate points. Along this cable a wheel travels from which the logs swing above the ground. A powerful donkey engine is invariably assigned to operate this.

9. LOGGING RAILROADS--Every big and modern lumbering concern in the islands uses logging railroads. A rapid and continuous supply of logs calls for the building of railroads, especially where the forest is far from the mill. However, before building a railroad, the quality and quantity of timber available for exploitation, in a given locality, is previously examined and determined by expert surveyors and loggers. The railroad grade is usually from 2% to 5%. There are at present (1933) about 195.52 miles of logging railroad in the islands."

To show more clearly the importance of this type of logging to the larger companies, the railroad set-up of the Cadwaller-Gibson, and Findlay, Miller Companies, two of the larger concerns in the islands, is given. The former constructed 10 miles of main and branch lines during 1933, and, to continue operations, they plan to construct an additional $1\frac{1}{4}$ miles of track each month. The Findlay, Miller Company includes over 30 miles of lines in their holdings. On the main lines, which will

be in use for several years, permanent concrete bridges have been constructed, using top and bottom trusses with spans from 40 to 80 feet in length. This company operates a 45 ton Barclay locomotive, two 50 ton engines, and one 28 ton Shay switch engine especially geared for heavy grades.

VI

Milling Operations

To again quote Mr. Clemente--"There are two general types of sawmills in the Philippines aside from the crude and primitive method of hand sawing, namely the circular mills and the band mills.

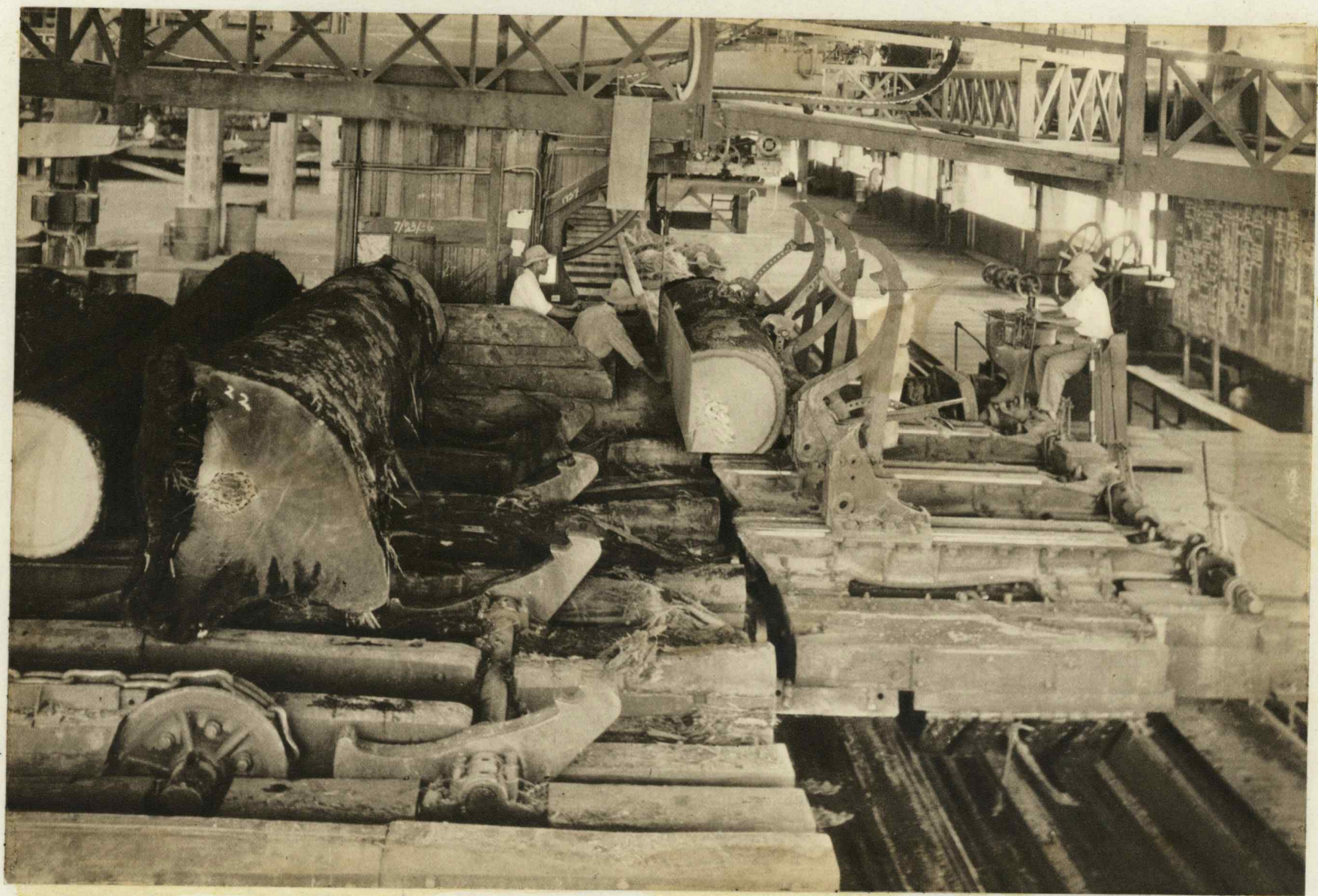
Circular saws are usually used in mills of small operation or out-put.....there are two types of band mills, single cutting and twin band mills."

The average circular saw mill has no gang trimmers, live rollers, or resaws. About all these mills have in the way of equipment is a boiler, log haul, log deck, carriage, and two circular saws, one above the other, so that large logs may be cut. The usual size of these saws range from 48 to 72 inches, and may be of either solid or inserted tooth type. The rated capacity of such mills may be anywhere from 5 to 50 M per day.

The larger saw mills, or band mills, include nearly all the equipment found in our own American mills of similar size. Some mills use twin band saws to speed up production by having the second saw to cut the smaller logs. Most band mills are provided with gang trimmers, edgers and resaws.

To again cite the Cadwaller-Gibson and Findlay, Miller operations as typical big mill operations, we find the following list of equipment in their mills. This list is only partial and does not include the complete equipment of either mill.



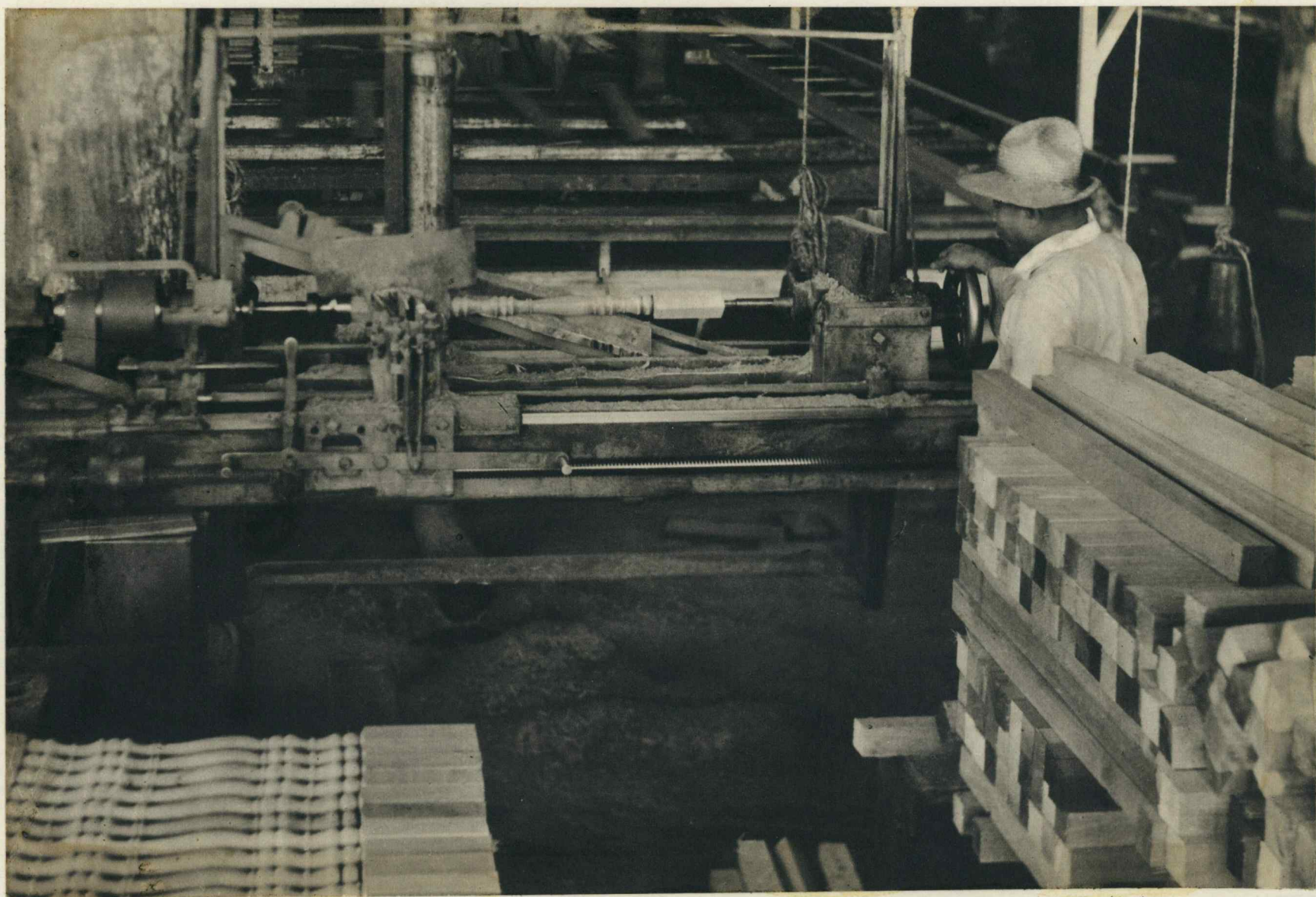


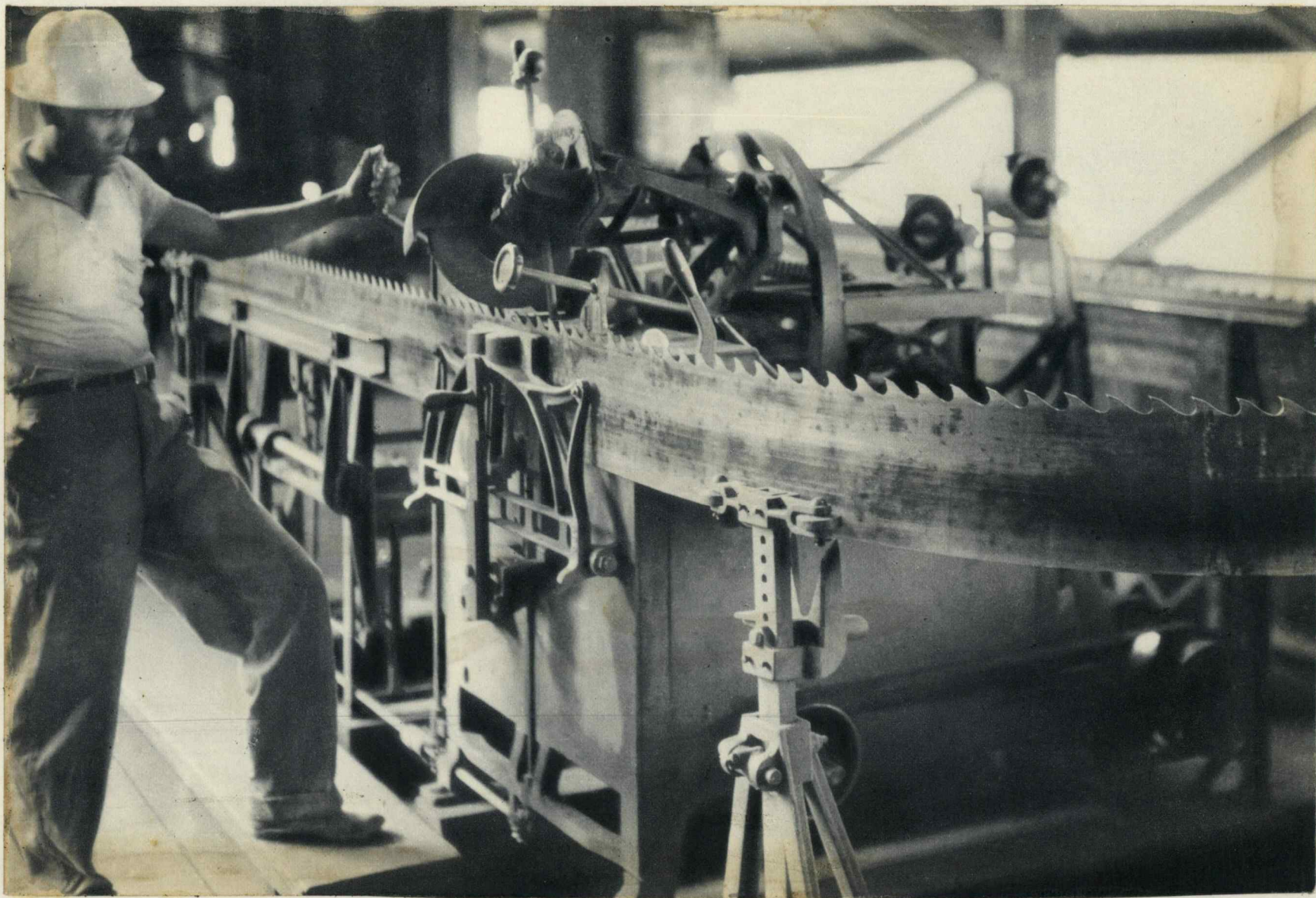


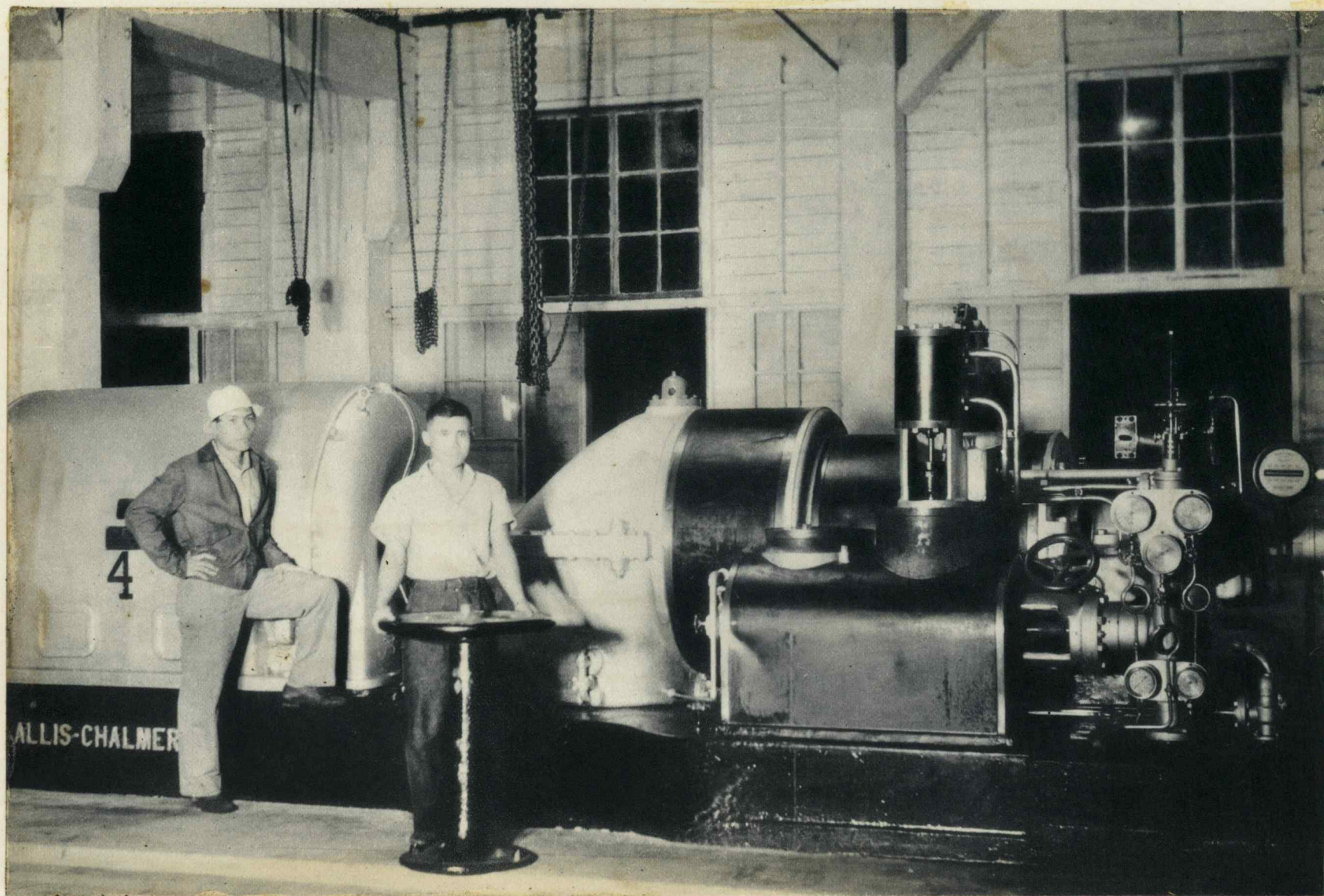




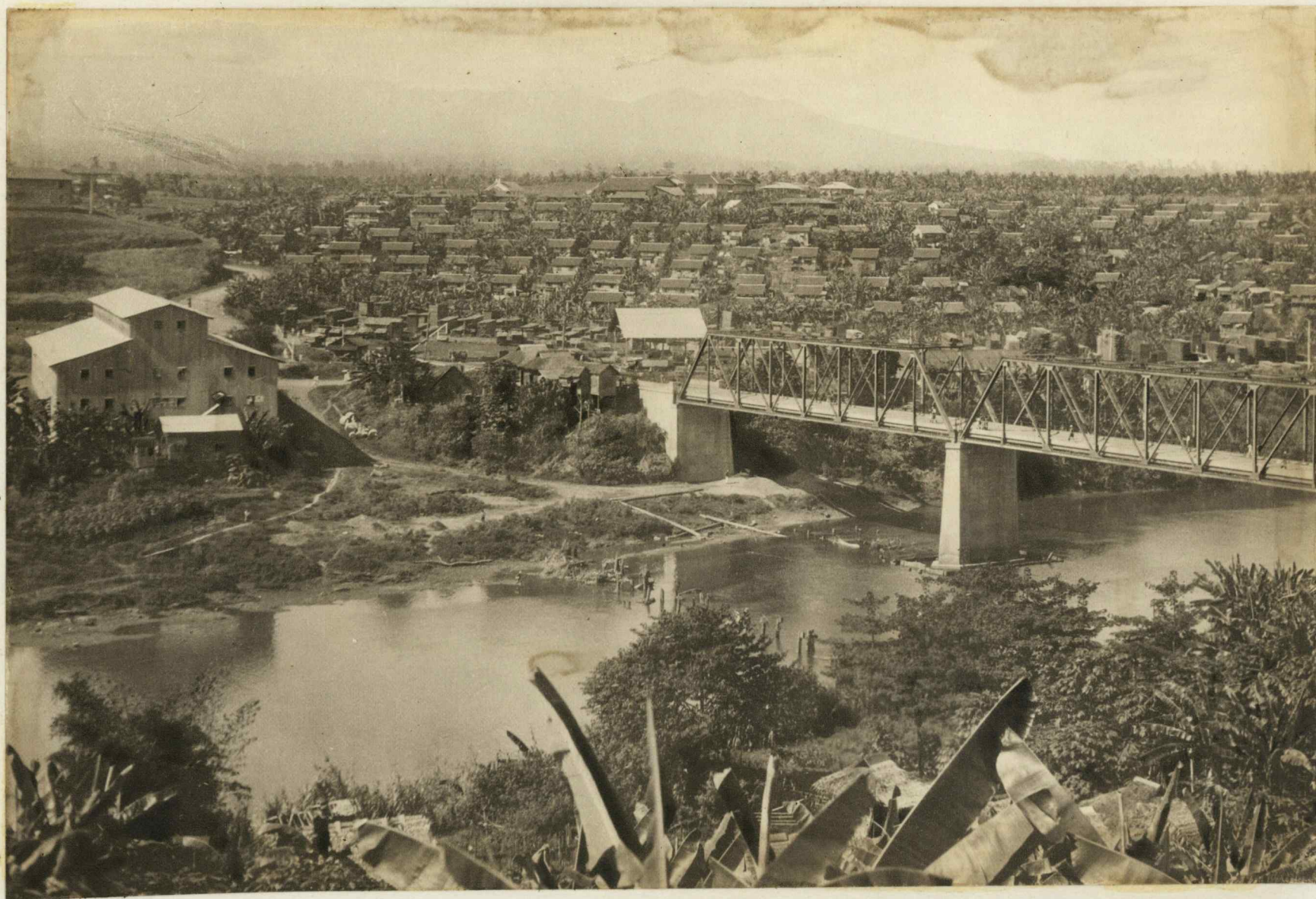














The Cadwaller-Gibson new plant at Tandoc, Camarines Sur which has an estimated capacity of 7,500 board feet of manufactured lumber per hour, or 3 million per month (actual cut at present), has as its main units, a 9' band-saw head-rig, two 8' resaws, two 8 x 60 edgers, one 11 saw slasher, a 17 saw trimmer plus hand trimmers, conveyors and miscellaneous equipment, a power house with four 250 horse boilers equipped to burn hog fuel and sawdust, two hogs, steam engines, and electric generators with auxiliary equipment. Other equipment includes dry kilns, and possible rotary veneer cutters in the future.

The Findlay, Miller Company's equipment consists of one each of left and right hand 8' bandmills, one 66' Prescott left hand screw-block log carriage with electric set work, a 72' right hand carriage and trailer, one 12" edger, two vertical resaws, one trimmer, slashers, log deck equipment, and a bull-chain log haul. The planing mill has one 4" edger, one 4'6 vertical band saw, one 6" x 15" planer and matcher, live rolls, and lumber transportation carriages.

It is declared that, in full operation, this plant will cut 125M per day on an eight hour shift. There are, of course, dry kilns and storage facilities which require equipment for the handling of lumber as well.

This partial listing of actual mill equipment is by no means the entire picture of a large company holdings

or investment in a mill site. Around these plants, regular cities are constructed and maintained. A part of plant properties include such things as deep water docks and wharfs, electrically lighted houses and streets, hospitals, stores and offices, a water system, fire hydrants, ice plants and cold storage units, a staff of doctors and nurses, seasoning yards and sheds, repair shops, artesian wells, restaurants, and houses for the employees. Beside the main plant many companies maintain yards and offices in the larger cities in the islands and abroad.

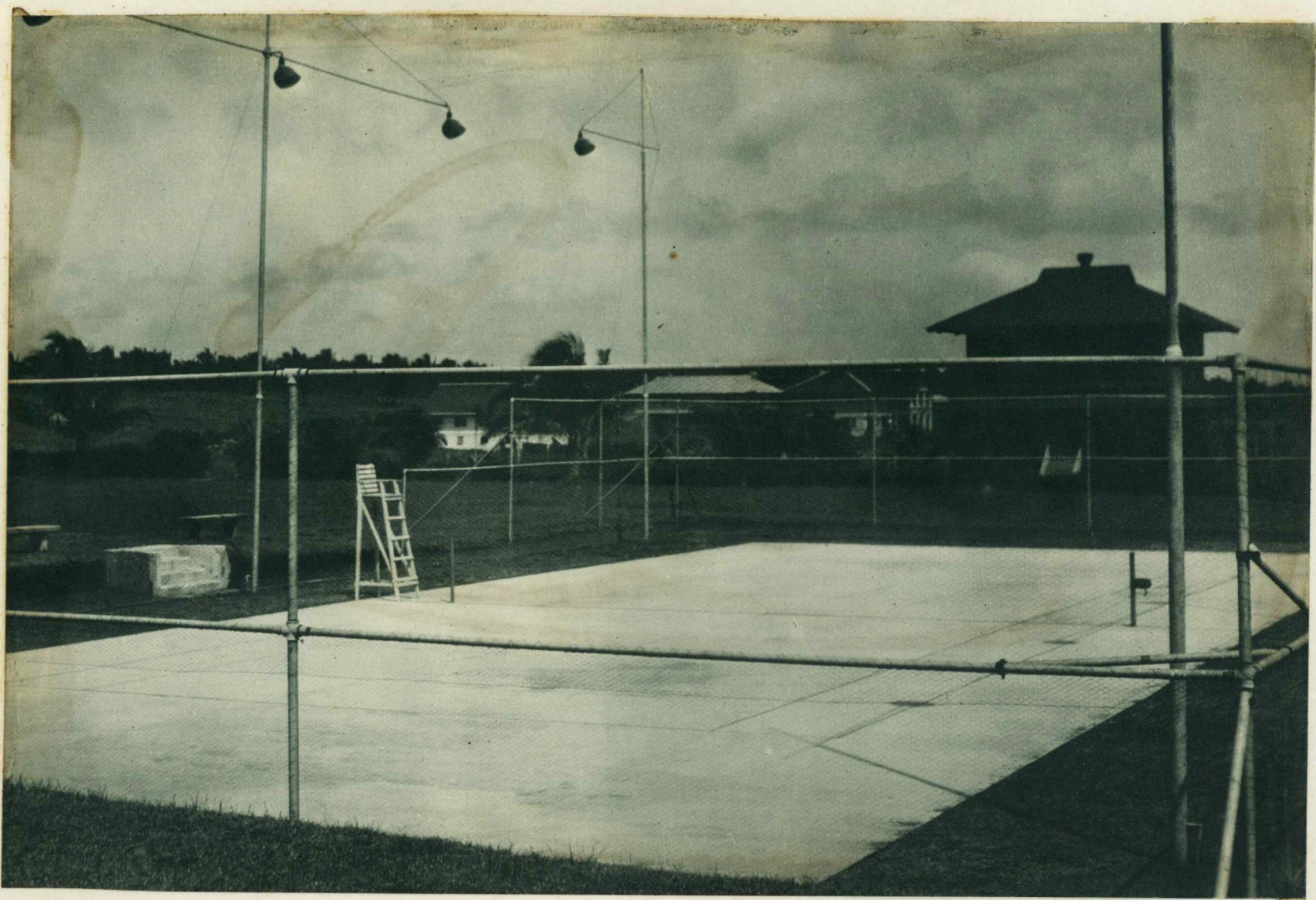
There are some 115 sawmills in operation (1937) of which 63 are owned by Filipinos, 30 by Americans, 6 by Chinese, and 11 by other or mixed nationalities.

Some of the minor industries may be grouped into two general classes; those which use wood in its natural form, and those which change the form of the wood.

Under the first class comes such industries as planing mills, veneer plants, cooperage, box factories, poles, ties, firewood, carving, and wooden shoes.

Under the second group such items are listed as paper pulp, tanning materials, distillation, charcoal, rayon, and the many press-wood items such as Masonite and Insolite.





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VII

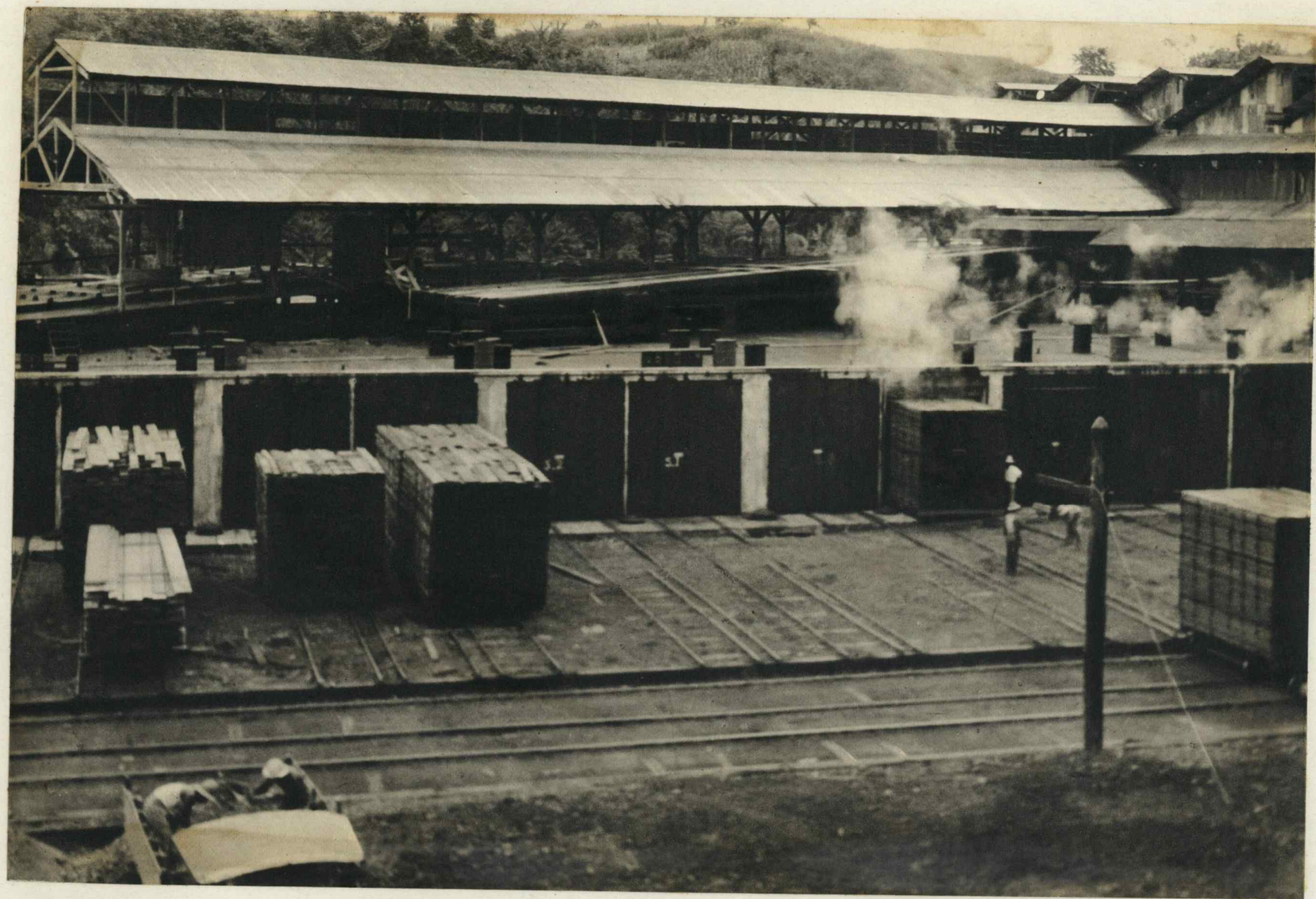
Lumber Seasoning

Kiln Drying

Kiln drying is the best means of seasoning, because lumber can be dried to a state of dryness suitable for any purpose for which lumber may be used, in a fraction of the time it would require in air drying in the yards. It minimizes degradations which usually arise in ordinary air drying. In mills located in sections where it rains the year around this is the only means of drying in order to avoid discoloration and decay.

Kiln drying involves controlling the rate of moisture evaporation from the lumber. This is accomplished through control of the three main factors of drying, heat, air circulation, and Relative Humidity.

In green boards of White and Red Lauan, just off the saw, the moisture content ranges from 50% to 90% of the total weight. It is present in the lumber in two forms, namely free water, and imbibed water. The former fills the vessels and cell cavities, and the latter is intimately related with the wood elements. The first stage of drying is the removal of this free water from the wood. This is a fairly rapid process and in these two species is fairly easy to do. When the water is evaporated down to about 30%, the fiber saturation point is reached. This is the critical







period of kiln drying, for, as the imbibed water evaporates, the wood shrinks, and too rapid uneven shrinkage may result in checking honeycomb, and other defects of drying.

As heat is applied to the surface of the lumber and evaporation takes place from the surface, an unbalanced condition of moisture between the outer and inner sections of the lumber is established, and the inner moisture moves toward the surface somewhat like oil travels up a wick, as it is burned at the end, in an attempt to equalize the moisture throughout the piece. After the fiber saturation point is reached the outer surface becomes lower in percentage of moisture, and, consequently, there is a steady flow of water from the inner portions to the outer surface. This is known as the moisture gradient; the faster the flow the higher the gradient.

In Luaun it is safe to bring the outer surface down to 18% or 20% while the inner portion is still above the saturation point (30%)--a steeper gradient will result in trouble such as checking.

To prevent this condition arising, control is maintained through the control of the Relative Humidity of the air. If more moisture is added to the air as it is brought to the wood, the amount of moisture it is capable of evaporating from the wood is lessened. This, in turn, controls the moisture gradient and rate of evaporation from the wood.

Circulation, the third factor of control, acts as a means of presenting air to the face of the lumber and

with it heat. The faster the air is presented the more heat and the more water evaporation, since the air also absorbs the water and carries it off. Air circulation also tends to equalize the heat and humidity throughout the kiln.

With this brief discussion of the problems presented in drying it is evident that certain drying schedules must be worked out and followed in order to get the best results out of kiln drying. For example, it is not wise to subject luauns to a temperature higher than 170 degrees Fahrenheit, while the boards contain moisture above the fiber saturation point. At different stages of the drying process, different temperatures are advisable. The Philippine Division of Forestry Studies and Research Bureau of Forestry have worked out the following schedules, for a fast circulation Progressive Kiln, for 8/4 and 12/4 inch stock 14" wide and wider.

Table XII

	<u>Green End</u>	<u>Middle</u>	<u>Dry End</u>	<u>Final MC.</u>
Temperature F.	125	145	165	6.2%
Depres. of Wet bulb F	3	6	125	
Relative Humidity %	90%	85%	50%	

<u>Thickness of board</u>	<u>Approx. days to 25%</u>	<u>Approx. No days to 6.2%</u>	<u>Total</u>
2"	14	10	
3"	23	18	
	<u>To 18%</u>		
2"	18		28
3"	28		46

Schedule for 8/4 and 12/4, 6" to 1" wide

	<u>Green End</u>	<u>Middle</u>	<u>Dry End</u>	<u>Final MC.</u>
Temperature F.	125	155	170	6%
Depres. of Wet bulb	6	10	21	
Relative Humidity	85%	76%	50%	

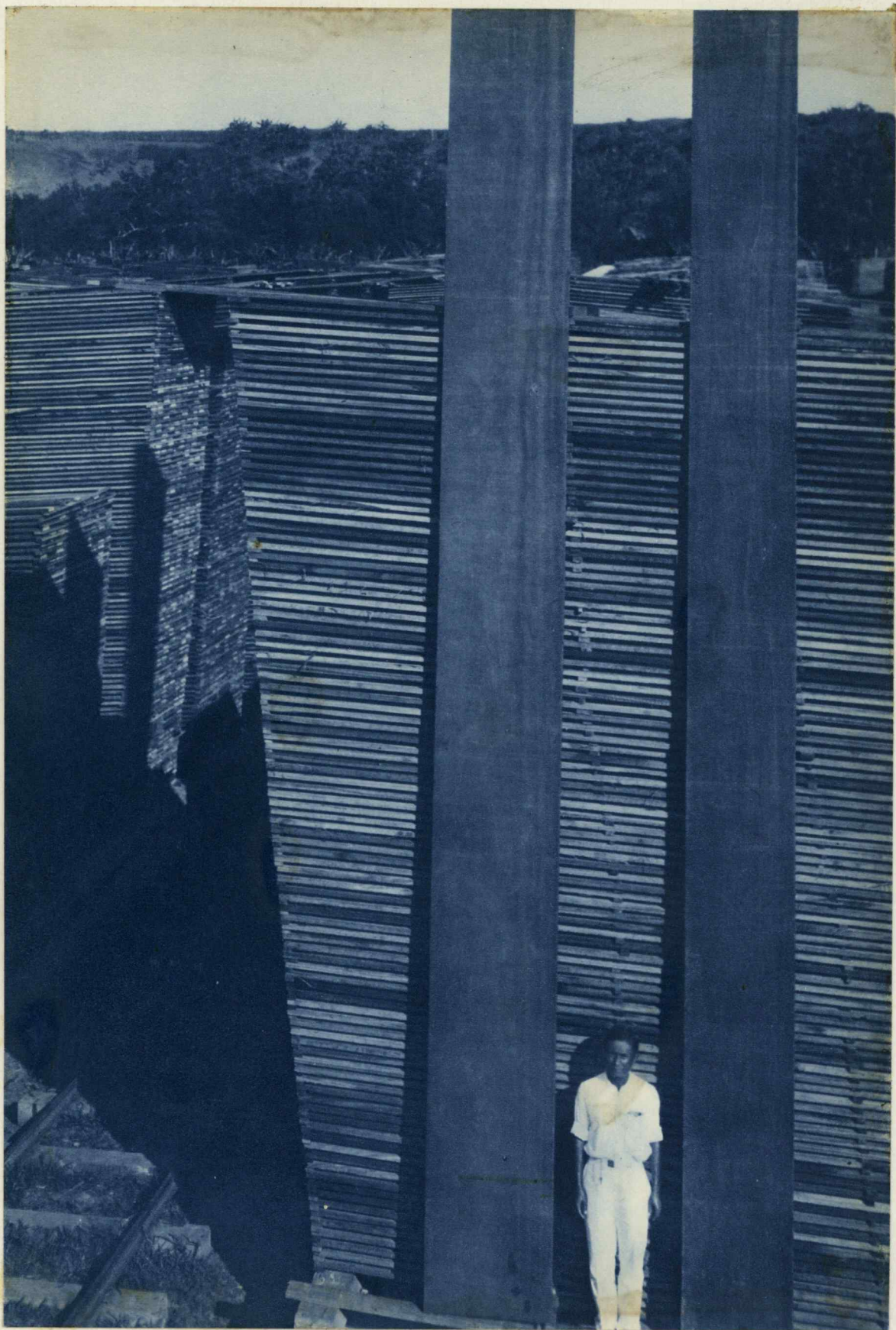
<u>Thickness of board</u>	<u>Days to 25%</u>	<u>Days to 18%</u>	<u>Days to 6%</u>	<u>Total days</u>
2"	11	15	7	22
3"	18	23	13	36

Yard or Air-Seasoning

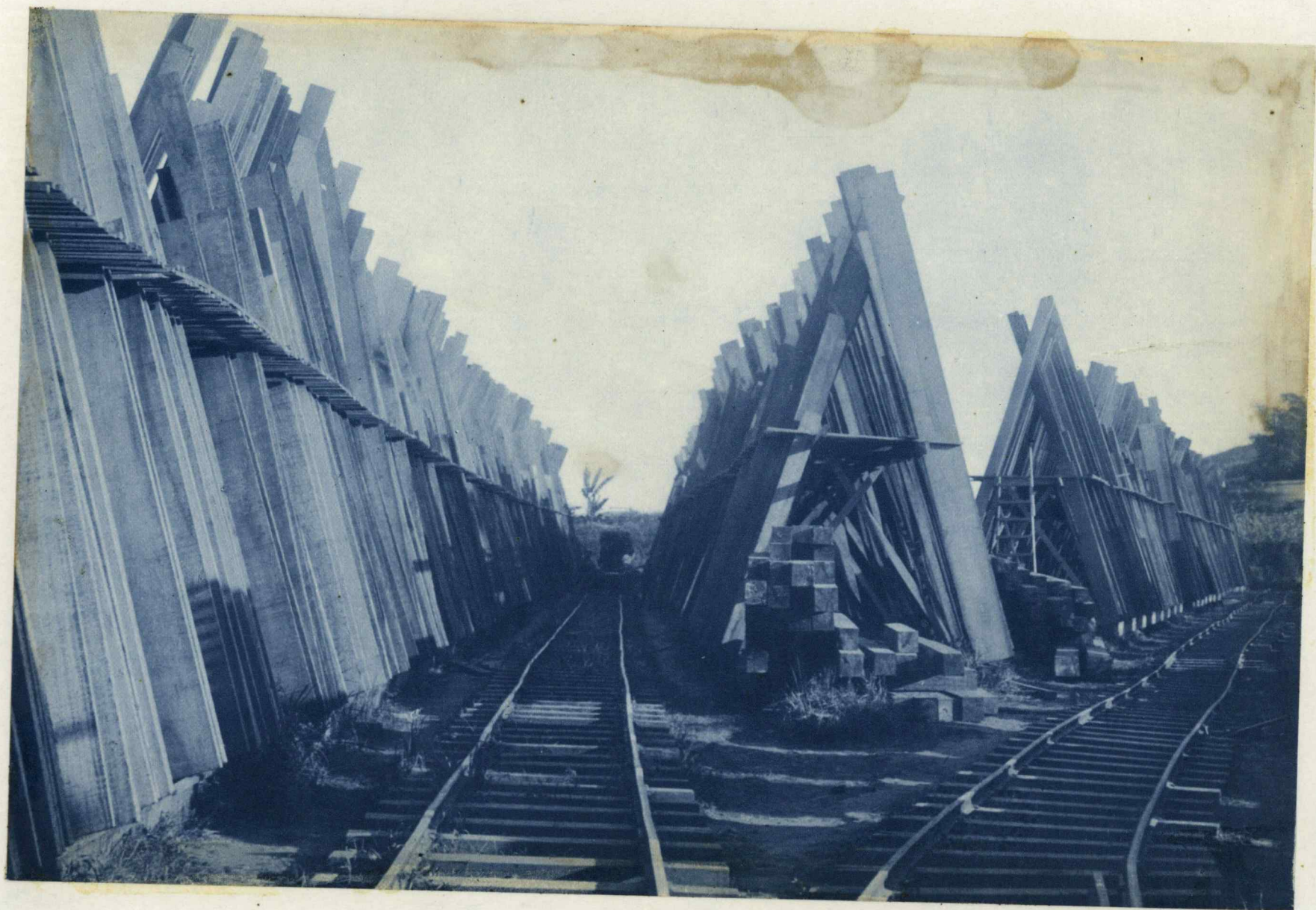
Air or yard drying, in contrast, offers the possibility of partial control of only one of the three factors of drying, circulation. Circulation may be controlled in the lumber yard, to a certain extent, by keeping an adequate air space around and under the lumber piles, proper stickering and method of piling such as end stacking, "A" stacking or flat stacking with stickers, observance of the prevailing winds and facing the piles to take advantage of the natural drafts and circulation of the yard site, and by keeping the decay breeding grounds as clean as possible.

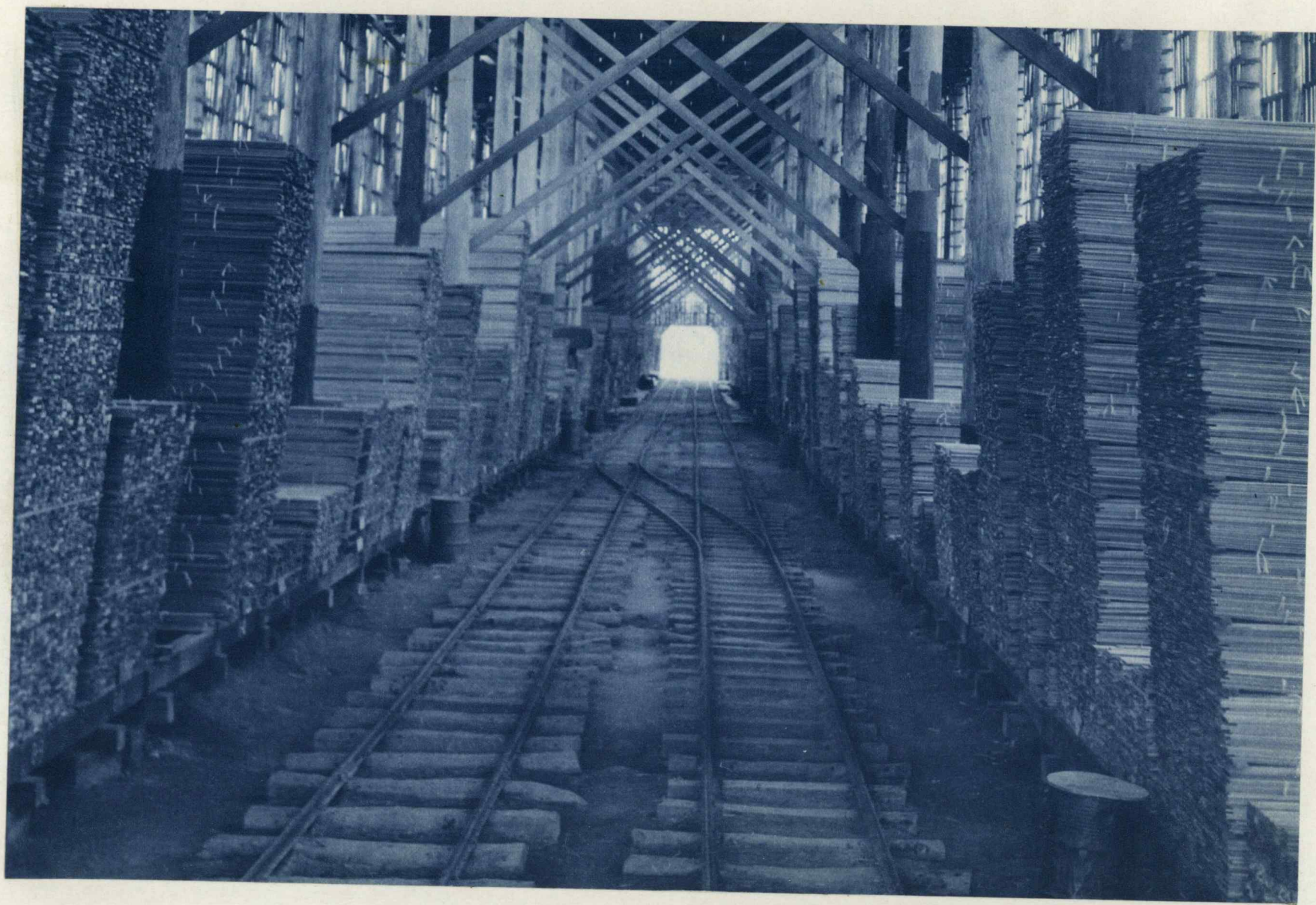
The item of greatest importance in seasoning is not in the method of drying. It is, rather, in preventing decay and insects from attacking the wood both before and after it is cut into lumber and sold. The question of yard and plant sanitation, therefore, plays an important part in the economic aspect of the Philippine lumber industry, and should be given some consideration.

The common defects in lumber such as sap-stain or blue stain, pinholes, shot-holes, grub holes, and decay are partly due to poor sanitary conditions of the lumber yards. A good yard should be well drained with good air circulation, and have convenient facilities for waste disposal.









Because many of the Philippine mills are located along the sea coast of rivers where the ground is low and swampy, it is a common practice to use all waste such as sawdust, slabs, trimms, and rotten logs in three general ways, as fuel for the boilers, as fillings for the low places around the grounds, and to throw the waste into the rivers of ocean.

Since such material affords an ideal breeding place for insects and fungi, extreme care must be taken in using it as a filler for low places; a thick layer of dirt or other material in which fungi will not breed must be thrown over it and kept well packed. Many of the larger operations put paved ramps and surfacing over considerable portions of their yards to keep decay down, and to assure firm foundation for transporting the lumber around the yard.

All organic matter should be removed and kept clear of the yard at all times. Even stickers, when not in use, should be stored in a dry place. Other precautions taken are the prompt replacement of all decaying timbers and wooden parts about the buildings, and the prompt disposal of logs soon after cutting in the woods. During the dry season logs may be left in the woods for a month with reasonable safety, but on wet days blue stain and insects will start working on the logs within a week's time. Logs should, therefore, be milled as soon as possible after cutting in the woods.

A few good rules to follow in preventing loss to decay and insect attack are:

1. Transport the timber from the woods to the mill soon after cutting. If this is not possible, pile the logs in the open or treat them with fungicide and insecticide combined.
2. Dump the logs without delay in the log pond or water while waiting to be milled.
3. Cover all fillings of sawdust, slabs, and decaying matter around the yard with soil.
4. Drain seasoning and storage yards well.
5. Remove and burn all decayed wood near lumber piles and buildings.
6. Provide good ventilation in order to hasten drying.
7. Do not pile green lumber solid; use cross-stickers.
8. Pile and keep stickers in a dry place when not in use. Use heartwood stickers only.
9. Inspect all lumber storage sheds and yards frequently to discover infected timbers or insect attacks. Remove and destroy infected material at once.

The average weight of air seasoned Philippine Mahogany is 3,400 pounds per M for the Dark Red woods, and 3,300 pounds per M for the Light Red woods.

The accompanying pictures showing milling, seasoning, and storage operations at the Insular Lumber Company plant in the Philippines will give a fair idea of the extensiveness of an average big mill operation.

VIII

Grades

Grading of lumber is an important phase of the growth of demand for Philippine Mahogany since it is now possible to buy with assurance that the lumber will be standard in both manufacture and grade. This is not true of some lumber producing countries which might otherwise be competitors to the Philippines.

As stated earlier in this report, Philippine Mahogany is sold in two general classes only, Dark and Light red Mahogany. To this is added Philippine Hardwoods which is comprised chiefly of Apiton. Of the Philippine Mahoganies there are two general divisions, No Defect and Wormy.

At the present time there are no universal grades for the Philippine Mahogany since the different importers mark the lumber under their own trade-marked names. For example, the Cadwaller-Gibson Company of Los Angeles, California uses the trade mark names of Bataam, Lamao, and Bagac to identify certain groups of wood. Lumber sold under these names include only the No Defect grades of the individual species.

In the Cadwaller-Gibson trade-mark classification the name Bataam includes two of the principal Dark Red Philippine mahoganies, Tangile and Red Lauan. Lamao includes Bagtican, Almon, and White Lauan of the Light red group, and Bagac indicates Apitong which is not a

mahogany at all. It should be understood that these trade-marked grade names do not refer to the Wormy grades which may be had under the title of Dark or Light Red Wormy Philippine Mahogany. These names serve as a sample of the grade names under which the lumber may be sold after it reaches the United States, and shows that a universal grade is not possible at present. The names themselves do not refer to botanical species; they may be names picked out of the thin air or, as in the case of at least one of these, the name of the district or town from which the lumber comes.

It is interesting to note that, according to a ruling by the Federal Trade Commission, the Philippine mahoganies can not be sold or offered for sale without including the name Philippine. That is, they can not be advertised as mahogany, it must be Philippine Mahogany. The same is true of all other mahoganies; only true mahogany may be advertised as "mahogany".

A few random notes taken from the Cadwaller-Gibson Sales Manual illustrate what may be expected of their grades of Philippine woods, and the uses to which these grades or woods are put. To make the facts more general the names Dark Red, Light Red, and Apiton have been substituted for the trade-mark names--Bataam, Lamao, and Bagac respectively.

Dark Red Philippine Mahogany is close-textured with a high percentage of straight ribbon figure of fine character, a beautiful wood. These woods stay unusually

straight and flat, and grade very high in both the Common and Select grades. The same may be said for the Light Red species, with the exception that these woods are not as close textured or of as uniform in coloring. To offset these, however, is the fact that they give a greater variety of finish, and stain more easily because of their light color. A few recommended uses for these woods are; furniture, millwork, cabinet work, bar tops, bar fixtures, store fixtures, in short, all work requiring a fine hard wood of great beauty which will turn, carve, machine, and finish smoothly and easily.

Apitong is an outstanding wood for any service requiring long life, great strength, resistance to abrasion and decay, long lengths, heavy thicknesses, and particularly clear pieces. There are practically no knots or defects in Apitong, and it is less subject to warping or checking than most heavy duty hardwoods. It is recommended for use in such things as auto truck parts, implement parts, boat decks, keels, and ribbing, warehouse floors, heavy duty timbers, and box car floors, but is not recommended for delicate machine work.

The Wormy grades are Needle Worm Hole, and Pin Worm Hole. Wormy grades are usually used for pattern work, and for trim in low-cost houses where a high quality product is not required.

IX

Exports

One thing that may account for the rise of the export markets is the fact that Japan has developed a policy of importing great quantities of logs to be cut in their own mills, and that a demand for the Philippine lumber has developed in the United States which absorbs most of the better grades of lumber. Both countries have been consuming a constantly increasing amount of exports.

It is interesting to note that in 1933 Japan used about 71% of the total exports, in the form of logs, and that United States, China, and the United Kingdom took 25% of the remainder.

The United Kingdom and South Africa are also fairly heavy importers. Australia, while only a recent customer, imported 1,270,304 bd. ft. from January to August in the year 1933. This indicates that it is apt to be a good market for future trade. It is especially significant in light of the heavy duties imposed on the Philippine woods. Such duties have tended to cut down the exports in recent years, but despite them the trade is still quite heavy. Some of the heaviest duties are:

Table XIII

Australia--imposed 1930--30%	ad valorem tax on logs
England----imposed 1932--10%	ad valorem tax on logs
Japan-----imposed 1933--\$1.00	per M bd ft.

While only 10 to 30% of the production is good export lumber, and about 80% is used locally, all grades of

lumber are in demand. The United States imports the majority of the better grades, Japan logs, and China the construction and cheaper grades. These countries, combined with the local market, make it possible to dispose of the cut of the local mills.

The following tables show the trend of exports over a period of years. It will be seen that 1929 was the early peak year, followed by a heavy drop in 1932, and since then there has been a steady increase in exports. In the United States there has been an increase of sales since 1934 of 250%

Table XIV

Exports

<u>Year</u>	<u>Board Feet</u>	<u>Value</u>	<u>Profit to Government</u>
1903			\$157,884
1918	7,080	\$ 325,898	158,219
1919	6,813	402,713	165,993
1920	13,862	917,148	234,196
1921	11,790	787,332	244,115
1922	18,285	833,970	231,216
1923	36,949	1,528,953	273,612
1924	50,759	2,041,845	366,877
1925	52,217	2,113,908	334,574
1926	62,709	2,549,226	358,469
1927	72,834	2,790,001	392,101
1928	85,898	3,129,409	531,182
1929	104,275	3,588,359	581,368
1930	82,351	2,789,462	492,393
1931	71,333	1,840,601	340,212
1932	50,228	834,740	303,518
1933	80,245	1,178,607	373,520
1934	121,991	2,171,395	608,159
1935	143,502	2,508,201	680,575
1936	196,060	3,099,145	836,591

Table XV
Imports by United States

Year	Board Feet	Value
1907	615,000	
1919	3,735,440	
1920	7,981,376	
1921	3,964,400	
1922	8,157,760	
1923	19,684,624	
1930	44,487,776	
1932		256,000
1933	15,411,000	491,000
1934	17,352,000	671,000
1935	25,816,000	983,000
1936	33,441,000	
1937 (June '36 to March '37)	24,589,000	

Summary:

(A) findings.

The forests of the Philippines represent one of its biggest natural resources which if properly managed will give a steady income to the government as long as there is a demand for Philippine woods.

The forests themselves are fairly free of undergrowth and come in fairly heavy stands. Of the commercial stands, the Philippine government controls 99% through its Bureau of Forestry which issues licences to operators. These licences give the operator stumpage reserved for him alone yet makes no charge to him until he actually cuts the timber. Charges are made on a basis of 10% of the local market valuation.

As for the logging and milling operations themselves, the methods and equipment are both of primitive and modern nature.

The woods are quite durable and strong, comparing well with other hardwoods and softwoods. Yet of greater importance, is their fine figuring and beauty as cabinet woods, and, as such, are exported chiefly to the United States, logs, to Japan and common grades to China.

These exports have had a more or less steady increase since 1906, and, with the exception of a few years drop from 1929-32, the value and volume has been constantly increasing.

The industry has been a good source of revenue to the government and promises to be even greater.

The methods of handling the exploitation of the Philippine woods is well thought out and well operated by the Bureau of Forestry, and should serve as a practical example to many other countries, including the United States, as to methods of handling and managing a natural resource which is apt to be exploited without regard for future supply.

The lumbering industry in the Philippines is a young industry but a rapid growing one which will bear watching in its future developments. It is an industry with a significant past, and, possibly, an even more significant future.

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Tables

- Table No. 1--The Durability of Philippine Woods--page 12
- Table No. 2--Comparative Durability of U. S. Woods--page 14
- Table No. 3--Comparative Strength Properties of Philippine
and U. S. Hardwoods--page 14
- Table No. 4--Comparative Strength Properties of Philippine
and U. S. Hardwoods--15
- Table No. 5--Monetary Items--page 19
- Table No. 6--Bureau Revenues and Expenditures--page 19
- Table No. 7--Inventories and general Valuation of
8, 9, 10 industry under Bureau Control--page 20
- Table No. 11--Basis of sale of timber cut--page 24
- Table No. 12--Kiln Drying Schedules--page 59
- Table No. 13--Tariff impositions by leading importers--page 70
- Table No. 14--Exports of Timber and Lumber--page 71
- Table No. 15--Imports of lumber by the U.S--page 72

Illustrations

- Pictures of the Forests--pages 2-5
- Pictures of the Logging--pages 25-30
- Pictures of Milling practice and Methods--pages 37-48
- Pictures of Community facilities--pages 51-53
- Pictures of Dry Kilning facilities--pages 55-57
- Pictures of Air Seasoning and Storage--pages 61 64
- Bibliography--page 74