

FORESTRY

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1903-04

# REPORT

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## CHIEF OF THE BUREAU OF FORESTRY

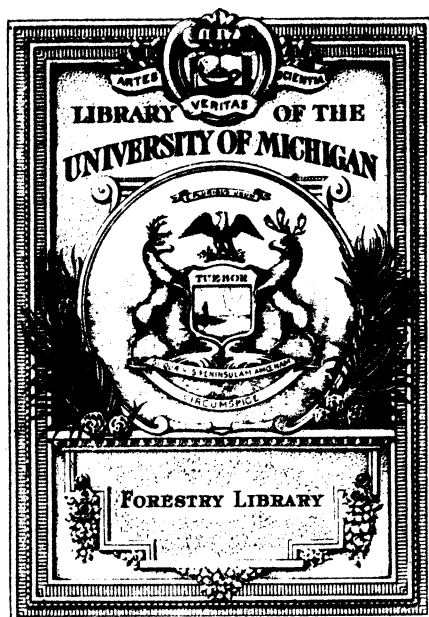
OF THE

PHILIPPINE ISLANDS

FOR THE PERIOD FROM

SEPTEMBER 1, 1903, TO AUGUST 31, 1904.

MANILA:  
BUREAU OF PUBLIC PRINTING.  
1905.







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## REPORT OF THE CHIEF OF THE BUREAU OF FORESTRY.

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MANILA, P. I., *August 31, 1904.*

SIR: I have the honor to submit herewith a report of the work of the Bureau of Forestry for the period from September 1, 1903, to August 31, 1904:

The year has been marked by the accomplishment of several important factors in the betterment of the forest service. The Forest Act was promulgated by the United States Philippine Civil Commission, May 7, 1904; and by means of its wise provisions a rational system of forest management can be inaugurated, and the future welfare of the forests secured. It received the careful scrutiny of the legal minds connected with the law-enacting branch of the Civil Government with a view to protecting and conserving the rights of the humblest licensee while granting to lumber companies and heavy individual investors considerable latitude in timber operations.

The visit of Mr. Gifford Pinchot, Chief of the United States Bureau of Forestry, to the Philippines, resulted in much benefit to the forest service, due to his assistance in preparing the present Forest Act.

The requirements of the Forest Act having changed, it became necessary to revise the Forest Regulations, and a Forest Manual, containing both Forest Act and Forest Regulations, indexed and annotated, with extracts from other laws bearing upon forest revenue or service, and some additional notes, was compiled and gratuitously distributed to all forest officials and licensees. The publication is of convenient pocket size, with leather cover and inside flap, and in this latter is inserted each license as issued. Among forest officers, having charge of money and property accounts, it was deemed prudent to distribute a similar-sized publication, giving specific instructions for uniform and systematic returns, and this was likewise prepared and issued by the Bureau.

In the Forest Act several important changes may be noted, which it is confidently hoped will give an impetus to forestal development. Not the least of these is the reduction of the tariff on forest products of about 35 to 60 per cent; the rearrangement of the native woods into four groups; elimination of a "superior group" (a classification in continual conflict with "first group"); the adoption of the metric system of weights and measures, in conformity with the revised United States

Statutes and with similar action on the part of most advanced nations; the division of the provinces into two classes, "A" and "B;" and granting licenses for a period within the discretion of the Secretary of the Interior and Chief of the Bureau, for a period, not to exceed twenty years.

The liberality of these provisions may be seen at a glance, especially the first and last. In dividing the provinces encouragement to licensees has governed action. The provinces in Class B are those in which it is desirable that the larger timber operations be carried on, and provision is also made for exclusive license where the party at interest will have sole privilege of gathering certain forest products on the area of public forest designated. The tax on beeswax, honey, diliman, wood for shoes, and orchids has been repealed.

It is cause for congratulation that at every step the Civil Commission has been in thorough sympathy with a rational forest policy. This is further shown by the Public Land Act (926), which provides that public woodlands shall not be entered, sold, or leased until a certificate is received from the Bureau of Forestry that the land is more valuable for agricultural than for forest purposes. The removal of valuable timber from leased land is also subject to regulation of this Bureau.

Much time was consumed during the first half of the fiscal year by the foresters and workshop in preparing the exhibit for the Louisiana Purchase Exposition at St. Louis, Mo. Due to the lack of transportation facilities in all parts of the Islands, the exhibit gathered represents a vast amount of very trying work by the few men engaged in it. The workshop, but recently organized, was without woodworking machinery, fine oils, and varnishes, all of which had been ordered from the United States, but not received.

During the first part of the year a forest map, 16 by 13 feet (scale, 6 miles to the inch), was made made of the Philippine Islands by the draftsmen of the Bureau. The forest areas, cultivated and uncultivated, were shown in different colors, and the various forest stations and district headquarters were also indicated. This map was sent to the Exposition at St. Louis, and a copy, one-half the size of the original, was made for use in this office. Forest maps of five forest districts, comprising the Provinces of Bataan, Zambales, Tayabas, Ambos Camarines, Mindoro, and Masbate, have been made in detail, and the limit of public forest granted to each holder of a timber license shown thereon. Forest maps of nine other provinces have been made with less detail, and, in time, forest maps, on a uniform scale, will be made of all provinces. Copies of maps, such as the above, are sent to forest officers for their information, and for any additional notes and corrections which they may be able to make. By this means the Bureau will make substantial and valuable addition to the knowledge of the location and value of Philippine forest resources.

The additional force authorized during the past year consisted of 1 civil engineer, at \$2,400 per annum; 1 inspector, at \$2,000 per annum; 4 assistant inspectors, at \$1,400 per annum each; 1 clerk, at \$1,200 per annum; 1 skilled workman, at \$900 per annum.

On August 31, 1904, the authorized force was—

1 Chief of Bureau .....	
1 assistant chief .....	\$3, 000
6 foresters (each) .....	2, 400
1 inspector .....	2, 000
4 inspectors (each) .....	1, 800
2 clerks (each) .....	1, 800
1 clerk .....	1, 600
1 assistant engineer .....	1, 400
4 assistant foresters (each) .....	1, 400
5 employees (each) .....	1, 400
3 assistant inspectors (each) .....	1, 400
6 clerks (each) .....	1, 200
4 assistant inspectors (each) .....	1, 200
1 skilled workman .....	1, 200
4 clerks (each) .....	900
6 assistant inspectors (each) .....	900
1 skilled workman .....	900
4 assistant inspectors (each) .....	720
4 clerks (each) .....	600
13 rangers (each) .....	600
8 skilled workmen (each) .....	480
40 rangers (each) .....	420
2 draftsmen (each) .....	360
6 skilled workmen (each) .....	360
6 clerks (each) .....	300
75 rangers (each) .....	300
12 skilled workmen (each) .....	240
1 laborer .....	180
5 laborers (each) .....	150
3 messengers (each) .....	150
1 laborer .....	120

During the past year the following changes have been noted: Eighty-six appointments, 48 promotions, 30 resignations, 28 transfers from Bureau (includes launch crew), 15 transfers to Bureau, 5 deaths, and 38 removals.

Eleven persons were given temporary appointments in the Bureau for periods ranging from one day to five months. Four of these employees were Igorrotes, employed during the dry season as fire wardens in the pine region of Benguet Province.

A civil-service examination was held in the United States, in April, 1904, for positions in the Bureau. Fourteen eligibles signified willingness to enter the service, and a cablegram was sent to the Chief of the Bureau of Insular Affairs to select eight eligibles for the following vacancies: Two foresters, at \$1,800 per annum each; 4 assistant foresters,

at \$1,400 per annum each; and 2 assistant inspectors, at \$1,200 per annum each.

The appropriation act for the fiscal year 1904-5 necessitated a reduction of 24 rangers; 4 additional assistant foresters were authorized.

The launch *Philadelphia* was assigned to this Bureau in October, 1903, and was of great assistance in reaching places distant from points usually visited by coasting steamers. The launch, however, was not suitable for sea trips during the typhoon season and has recently been transferred to the Board of Health. The undersigned hopes that some time in the future a Coast Guard cutter will be assigned to this Bureau for the use of its foresters and inspectors.

### DIVISION OF INSPECTION.

The personnel of the division of inspection consists of 3 inspectors, 12 assistant inspectors, 10 first-class rangers (formerly designated as assistant foresters), 40 second-class rangers, 69 third-class rangers, and 7 clerks, being an increase over last year of 1 inspector, 1 assistant inspector, 1 first-class ranger, 11 second-class rangers, and 19 third-class rangers. Two assistant inspectors who were in charge of the Manila dispatching office on August 31, 1903, are now performing duty in the field, having been relieved by two clerks. During the past year the difficulty in securing natives for duty in the provinces has considerably diminished.

The following changes in forest stations have been made:

#### *Stations established.*

Station.	Province.	Date.
Alaminos.....	Pangasinan.....	Dec. 21, 1903
Calauag.....	Tayabas.....	Jan. 18, 1904
Cervantes.....	Lepanto-Bontoc.....	July 21, 1904
Daet.....	Camarines.....	Jan. 20, 1904
Goa.....	do.....	Jan. 24, 1904
Hermosa.....	Bataan.....	Nov. 28, 1903
Pasacao.....	Camarines.....	Mar. 3, 1904
Tagbilaran.....	Bohol.....	May 15, 1904
Unisan.....	Tayabas.....	Jan. 1, 1904

#### *Stations transferred.*

Norzagaray to Angat.....	Bulacan.....	Nov. 21, 1903
Orani to Balanga.....	Bataan.....	Nov. 27, 1903
San Isidro to Cabantuan.....	Nueva Ecija.....	June 21, 1904
Lagatic to Capiz.....	Capiz.....	July 4, 1904
Bacolor to Guagua.....	Negros Occidental.....	Feb. 12, 1904
Santa Cruz to Iba.....	Zambales.....	Do.
Iba to Masinloc.....	do.....	Mar. 10, 1904
Jolo to Bongao.....	Jolo.....	Nov. 7, 1903

#### *Stations abandoned.*

Bongao.....	Moro.....	Mar. 4, 1904
Isabela.....	do.....	Oct. 12, 1903

The use of the metric system, instead of the Spanish measure, will materially decrease the work of appraising the Government charges on timber.

A uniform inspection of forest stations has been inaugurated by the introduction of a form containing thirty-one questions. This report keeps the central office in close touch with the work of each forest station. The first part informs when and by whom station was last inspected, and the last station inspected by the officer rendering the report, as well as the date of his last inspection; then follows the reporting officer's itinerary from the date of his last inspection to the date of the one he is reporting. A number of questions are devoted to outside inspections, and from the answers the central office may easily learn with what degree of efficiency the ranger has patrolled the municipalities within his jurisdiction, as well as to what extent he has required the payment of Government charges on forest products gathered with and without license; the remaining questions are relative to the manner in which the four registers, i. e., licenses, letters, manifests, and daily operations, are kept, and the condition of the files, etc.; the last part of the report is grouped as follows:

1. Character of each employee at station.
2. Needs of station.
3. Conditions throughout territory subject to station; forest fires; places where cuttings should be prohibited, etc.
4. Investigated under special instructions.
5. Recommendations.
6. Other remarks.

The reports now on file in this office testify to the satisfactory manner in which the documentary work at the various forest stations has been performed during the year.

All manifests of the last issue were numbered serially by the Public Printer, and the rangers in charge of stations held accountable for the numbers sent to their station. They were printed in triplicate. The original is for delivery to the owner of the forest product, the duplicate for transmittal to the central office, and the triplicate for the files of the station.

The forms for reappraisal of timber at destination, orders of payment, and orders of discharge are also numbered serially, and forest officers are charged with numbers received and required to account for same.

During the past year inspectors and assistant inspectors have, when practicable, spent not over one-sixth of their time at headquarters attending to correspondence and office work, devoting the remainder to inspecting other forest stations and various municipalities of their districts.

This office files two cards for each station, containing the following data:

Card No. 1: Name of station; date station was opened; employees on duty thereat and dates of their arrival, relief or departure; name of officer in charge; dates inspected; names of officers making inspections, and amounts of Government charges collected, by months, on timber, firewood, and other products originating within the jurisdiction of the station.

Card No. 2: A tabulated list of the municipalities in the station's jurisdiction; the number and class of licenses granted in each municipality, and notations opposite said towns of the inspection of the municipalities made monthly by inspectors, assistant inspectors and rangers. Officers in charge of districts keep this office advised as to the frequency with which the various municipalities of their respective field of operation should be inspected. This information is also duly entered, so that in addition to the reports of inspection of a forest station these cards show at a glance the work accomplished by each station.

Instructions defining the duties of the municipal presidents, as provided by section 31 of the Forest Act, have been prepared, and it is hoped that coöperation of the municipal officials with forest officers will be of considerable value in the way of authenticating manifests, reporting unauthorized forest operations, and restricting the making of "cain̄gins" (clearings of public woodlands by fire for agricultural purposes) to land not valuable for forest purposes.

There were over 27,000 lots of forest products officially manifested since August 31, 1903.

The following is a comparative statement of Government charges collected on forest products for the fiscal years 1902-3 and 1903-4:

Month.	1902-3.	1903-4.
July .....	\$41,318.61	\$74,311.26
August .....	24,930.23	43,441.72
September .....	34,599.59	50,253.66
October .....	45,221.54	45,896.38
November .....	37,202.90	46,213.59
December .....	46,000.79	56,361.17
		<sup>1</sup> 316,477.78
January .....	42,593.52	<sup>2</sup> 31,228.50
February .....	35,300.13	41,668.56
March .....	52,536.42	49,389.29
April .....	47,778.12	43,795.61
May .....	55,632.52	44,230.06
June .....	64,300.48	42,747.63
Total .....	<sup>1</sup> 527,414.85	<sup>2</sup> 253,057.65

<sup>1</sup>Mexican currency.

<sup>2</sup><sup>P</sup>253,057.65 Philippine currency, reduced to Mexican currency, at the average official rate of exchange during that period, equals \$283,002.80, which amount plus \$316,477.78, collected during the first half of the fiscal year 1903-4, makes a total of \$599,480.58, Mexican currency.

NOTE.—Government charges on forest products were assessed in Mexican currency until January 1, 1904, on which date Act No. 1032 became effective, providing that all public dues, \* \* \* forest taxes, \* \* \* be assessed and collected in Philippine currency and at the same amounts as had been theretofore fixed by law in Mexican currency.



## RECORDS.

The card-index system is used and affords systematic record. Papers relating to any one subject can be readily obtained. As official papers pass from each division they are initialed by person dictating, copying, translating, or checking same, and are not filed unless properly stamped.

All outgoing mail, without reservation, passes over the desk of the undersigned, and if satisfactory, is initialed.

The offices of the Bureau were moved during the latter part of May from the Intendencia Building to the Oriente Building. The new quarters are more commodious and satisfactory than those formerly occupied.

## DIVISION OF FOREST MANAGEMENT.

The work of the division of forest management during the first half of the year was mainly confined to examination of forest areas assigned to various licensees, and the marking of timber for felling within the same. Due to the small force available for this work, the ground covered was necessarily small, and work of the above nature was confined to five forest districts, comprising the Provinces of Zambales, Bataan, Tayabas, Ambos Camarines, and Masbate. In marking, an attempt was made to limit the cutting of superior and first group woods, and in all cases where it would not prove to be too great a financial burden upon the licensee, the removal of a certain per cent of inferior species was required.

It is only by some method of selection, by competent forest officers, that the forest conditions of the Islands can be improved, since to allow the indiscriminate cutting of the better grade woods, would soon cull the forests of desirable species and leave the same composed only of trees of inferior classes, which have but little market value, and which in many cases, due to the heavy transportation charges, can not be put upon the market except at a loss.

In places where much cutting has been done in the past and where certain species are liable to extermination under present lumbering methods, the felling of such species may be prohibited for a certain length of time, or the amount cut curtailed for a period of years, in order that the forest may have an opportunity to again recover.

The forests of these Islands are unlike those usually found in temperate climes, in that no one species, excepting the genus *Pinus*, is gregarious; that is, found in pure stands. The general rule is that on any one acre a great variety of tree species, 8 inches and over in diameter, is found, with but few members of each species represented. Such forests are naturally operated as "selection" forests—that is, forests in which clear cutting does not take place, and the lumberman seeks for cutting desirable trees which he finds scattered here and there. Such trees are usually

those of middle diameters, from 24 to 40 inches, thus leaving in the forest only young trees, too small to cut, and overmature trees which are generally defective, and which should have been the first ones removed as the timber in the same becomes less valuable each year. The seeds of these old trees, the source of reproduction, generally do not produce as vigorous seedlings as do seeds from trees in the prime of life. Under the native methods of lumbering, after the felling of the medium-sized trees of the desirable classes, we generally find left on each acre a great number of trees which are of little merchantable value at the present time. These present a serious difficulty in that these trees frequently bear a great amount of seed and at an earlier age than do trees of the better species. In marking and selecting trees for felling the forester attempts to avoid the bad effects above mentioned by insisting upon the removal of as much of the poorer grades as possible, and attempts to aid the reproduction of the better species in every reasonable way.

As marking the beginning of lumbering operations in the Islands along rational forestry lines, the work of the Iloilo Electric Company in Negros Occidental, is of interest. This company has erected a mill on the Gimogon River in the above province and also has a wire cable logging outfit in the forest on the same river. The operations of this company were inspected during January, 1904, and though they had temporarily suspended operations, enough work had been done up to the time of the inspection to prove the feasibility of the project.

#### MILL.

The company at the present time has a mill (capacity, 20,000 feet, board measure, per day)  $7\frac{1}{2}$  miles from the mouth of the Gimogon River, to which point a launch drawing 6 feet can proceed, passing over the bar at the mouth of the river at high tide. This mill consists of one circular saw, with a top saw, one edger, and a saw-filing machine. The mill presumably is not a new one, and is lacking in a number of modern improvements, viz, a suitable "nigger" for handling logs on the carriage, a chain operating from overhead being used. The carriage is operated by a cable, and not by the "shotgun" feed in common use to-day in the United States. Rollers to carry lumber to the edger are not "live," but boards are run along dead rollers by native help, and the edger used is of old pattern. Logs are brought into the mill by means of a cable on an inclined slide, and not by an endless chain, as is customary.

Owing to the lack of timber the mill has not run to its capacity at any time, the daily cut being from 4,000 to 5,000 feet, board measure. About January 1 a flood occurred, the river rose at least 15 feet, flooded the mill, and submerged most of the machines, resulting in considerable damage to the belts, which since that time have caused much trouble by

breakage. A portion of the river bank near the mill was washed out, necessitating the removal of the mill to some other spot. The mill force consists of one American sawyer, who knows but little regarding such work; one American foreman, and another American who acts as engineer, etc. Three Filipinos work on the carriage, two at the edger, one as fireman, and three or four as general hands. At the present time they have no one who thoroughly understands the running of a mill, no one who can properly file saws and do general machine work, and hence the machines do not work smoothly.

The above conditions are largely due to disappointment in men brought from the United States, who have proved to be incapable and have been returned. The mill can not be successfully run until expert help is secured; men who thoroughly understand millwork and the repairing of machinery, and especially a saw filer who can keep the saws—a vital part in a mill—in good condition. Up to the present time, between 60,000 and 70,000 feet, board measure, has been sawed in this mill, the greater part being shipped to Iloilo, though some sawn timber has been used in the construction of three or four dwelling houses and a roof for the mill, and some was lost during the recent flood, being carried out to sea. Fifty or sixty logs were also lost in this manner, and most of this will be a dead loss to the company, as a good part of the timber is scattered beyond recovery.

Timber can be cut, taken to the mill, and sawed at a cost, the undersigned is informed, of from one-half to three-fourths of a cent, gold, per foot, board measure, and it is claimed with suitable skilled labor it can be done for less. Freight in lorchas to Iloilo varies from \$5 to \$6, gold, per 1,000 feet, board measure. Government charge for stumpage averages less than \$1.50, gold, per 1,000 feet, board measure. This timber finds a fairly good sale at from \$30 to \$35, gold, per 1,000 in Iloilo, but at a somewhat lower price would sell more readily; the above price being about the same as similar classes of timber can be secured from other lumber merchants who use whip saws in sawing.

A readier sale for timber could be found in material sawed to order, as many buyers desire dimension stuff, planks, etc., which the company has not on hand in any quantity, as each individual desires different dimensions and classes. Sawing dimension stuff to order would be one advantage in having the mill at Iloilo; they could saw timber by contract with other parties. It is partly a question as to the cost of rafting logs to Iloilo, and the possible loss of rafts during bad weather prevailing at certain times of the year, as to whether the placing of the mill in Iloilo would be best. If logs are not rafted during the season when storms occur a large number must be collected during the good season and operations suspended in the woods for several months during the year.

In sawing timber it has been found that logs up to 2½ feet are generally sound, but that logs over that size are frequently either partly rotten at the center, or else, as in balacbakan (red lauan, so called), from 6 to 8 inches of the heart is very brittle and of no use except as fuel for the boilers, and a 2 by 4 by 12 inch sawn from the center of one of these trees will frequently, when supported only at the two ends, break from its own weight.

#### LOGGING OPERATIONS.

The company started operations in the forest at a point about 8½ miles from the mouth and on the west bank of the Gimogon River. Here a rollway was made, the bank raising almost perpendicularly from the river to a height of 150 feet; much steeper than is desirable. In order to also have the logger available for skidding logs to the main haul, the "donkey" was placed near the edge of the timber, about 1,500 feet due west. This logger is of recent pattern, No. 614, and made by Washington Iron Works, Seattle, Wash. The horsepower of the same was unknown by the parties at the mill. The main cable used for the "donkey" to the rollway is 1 inch, and the "haulback" cable three-fourths of an inch; the cable at the rollway passing through a simple block firmly fastened to a stump. Radiating from the "donkey" in several directions are logging trails where timber has been taken out for a few hundred feet back, the longest of these trails being about 1,200 feet, and trees only close to it cut. A three-fourths-inch cable is used to skid the timber down to the main cable.

A much more satisfactory arrangement would be a skidding engine, placed on site of present "donkey," to be used in skidding the timber to the main haul, and the "donkey" placed at the rollway, instead of as at present in the forest. As soon as possible this change will be made, but possibly financial difficulties will interfere for a time in securing the additional equipment.

The force in use at the logger when it was in operation consisted of 1 American engineer; 2 natives to cut firewood for the boiler; 3 native water carriers, who transported the water from a small stream about 1,500 or 2,000 feet distance; two cutting gangs of 2 men each; swamper; 8 men at the rollway, who saw up long logs as they come from the forest and then roll them into the river, and a dozen or so general men (the number varying more or less), who dragged the skidding cable back into the forest from the "donkey." This required from 12 to 15 men, according to the distance necessary to drag it. Three carabaos were tried for this work at first, but were not able to haul the cable.

But little timber has been cut in the forest so far, as the "donkey" was placed in an old burn, where a good number of large trees stood, and about all of these were cut. All the trees have been cut at the upper termination of the root swelling, which in cases left them pretty high,

but the undersigned does not think it justice to the lumbermen in the Islands that the Bureau should require them to cut through the large buttresses in order to secure a lower stump. One present evil is that a large number of poles are cut to build a scaffolding around each tree in order that the sawyers can work some feet above the ground. No attention is paid to the species, and where the larger trees stand fairly dense almost every pole is cut. This practice should be absolutely prohibited, except for woods of the fourth group, and a severe penalty imposed for the cutting of other woods. The merchantable timber in all trees felled has been utilized, but no use has been made of the larger branches. There appear to be a fairly good reproduction of most species where cutting has taken place in the forest, but the saplings and poles have been damaged to quite an extent by the large-limbed trees, when felled. It would seem to be necessary that a minimum diameter limit of 18 inches be established and rigidly adhered to, and that the timber in the future be marked in order that there may be assured a sufficient number of seed trees per acre; this may not, and probably will not, occur if cutters are permitted to select the timber themselves.

In a more or less dense forest such as found here, where all the mature timber is removed, there remain but few trees, and many of these will be more or less maimed through the falling of the other trees, or else their growth will be retarded by the large trees to such an extent that they will not be available for a few years as seed trees; hence, trees capable of producing seed at present and in abundance must be protected, in order that the blanks may be properly filled with seedlings before weeds and undesirable species have completely covered the space. These seed trees will also be available as shade for the younger growth present.

One man could mark in two weeks a sufficient amount of timber to run the company for at least six months, but it is advisable that an inspection be made of the tract at least four times per year, in order that suitable control may be maintained over the cutting operations.

By measuring the logs before the same leave the rollway the Bureau insures itself against possible loss by floods carrying off timber previous to its measurement, as happened during December, 1903. From 10 to 20 per cent of each of the larger logs are found to be worthless for lumber, and as the Bureau does not secure payment for this, as payment is made on sawn timber, plus 15 per cent, in the opinion of the writer, some scale just to both the interested parties and the Bureau could be devised which would more nearly be adopted to the existing conditions.

In scaling the timber some arrangements should be perfected whereby allowance for defects in timber can be made, and all timber measured in the log at the rollway before it is put into the river. By making allowance for defects the company can afford to take out more or less defective logs, which otherwise they would leave, and payment for

forest charges on the full volume of timber would result in a hardship, due to the general defective character of the center of large logs. The logger so far has taken out from 4,000 to 5,000 board feet per day, but with a competent man to manage the skidding engine a much larger amount of timber could be taken out. Two men can fell and saw an average of two trees, 3 feet in diameter, per day, the same being four or five log trees. These logs are frequently left in 24 to 36 foot lengths, sometimes longer, and skidded to the rollway, where they are then sawed into the proper lengths of 12, 14, or 16 feet.

The natives have been found to be very apt in learning the work, and received much praise from all Americans under whom they were working. Both Mr. Nichols and Mr. Kearney stated that for work in the woods they desired no better men. They have also picked up the millwork very readily and made good mill hands, but they have not a proper regard for the danger attending machinery, and hence must be carefully watched in order to protect them against injury. Wages are paid to all workers at the rate of 65 cents, local currency, per day, without food.

A gratuitous license has been granted to the company for lumber to be used in the sawmill and buildings connected with it, as the mill and necessary buildings are a benefit to the community, and can be considered in the light of general improvements.

An indispensable part of such a skidding and logging outfit is a machine shop where broken parts of machines can be repaired without a long trip to Iloilo, consuming several days and entailing a large expense. Frequently the parts can not be found in any shop in these Islands and must be made, causing a further loss of time and additional expense. Such a delay has occurred with the machines at this point, and in the near future a machine shop will be added to the equipment.

Parties contemplating the installation of plants should be prepared to fully equip the same with duplicate parts, and have a machinist capable of repairing any part of the machinery. It is very difficult and expensive to attempt to carry on the business in any other way in this country where transportation is deficient, and failure will undoubtedly result unless the subject is very thoroughly investigated beforehand.

#### LICENSES.

The division of forest management has direct supervision over the granting of licenses and the logging operations of licensees, but before the issuance of licenses the same are submitted to the Secretary of the Interior for his approval.

During the past year licenses to cut, gather, or remove the following forest products from public lands were granted, viz: Timber, firewood, charcoal, tanbark, dyebark, dyewoods, gums, resins, vegetable oils, diliman, beeswax, honey, orchids, stakes for fish corrals, and wood for

shoes. The new Forest Act provides that the last six products may now be gathered without license.

At the commencement of the fiscal year new forms of applications for licenses were forwarded to the forest stations, and by them distributed to all applicants, and to the municipalities.

All applications for licenses pass first through the hands of the local forest officer, who places his recommendation upon the same and forwards to the main office.

Applications made personally in the Manila office are forwarded to the local station for the recommendations of the forest officer of the province where the applicant desires to cut.

The same policy as adopted in former years regarding preference in granting licenses has been followed during this year, viz: Old licensees who are residents of the town in which they desire to cut are given first consideration; new applicants living in the town in which they desire to cut are given second consideration; old licensees who are residents of the province, but not of the town in which they desire to cut, are given third consideration; and nonresidents fourth consideration.

In this way an attempt is made to favor actual residents as far as possible, and parties who can personally superintend operations in the forest.

A system of regular examinations by forest officers of the cutting area of each licensee was inaugurated and full reports, on forms provided for that purpose, were submitted, stating the method of logging, whether any new and modern appliances were being used, general condition of the forest, business standing of the licensee, and the places where timber was marked, etc. A careful record of all infractions of each licensee was kept in this office and the same filed with the above report, so that at any time a complete history of any one licensee can be obtained, and the above reports are carefully examined before a new license is issued to any party. Foresters, inspectors, and assistant inspectors have instructions to take a native ranger with them when making these examinations, in order that the rangers may become familiar with this class of work.

The forest officers in charge of twelve forest districts, covering thirty-five of the forty provinces, continued to grant ordinary timber licenses not to exceed 13 cubic meters to each person. They were also authorized to grant firewood and gratuitous licenses not to exceed the above amount.

In the five forest districts, viz, Bataan, Zambales, Ambos Camarines, north and south Tayabas, and Masbate, where the lumbering is heaviest, all applications were forwarded through the forester in charge, who inspected the locality where the applicant desired to operate, and then reported to this office upon the territory desired by the licensee, stating the approximate area which should be granted him, describing the forestal and topographical conditions of the same, and locating the limits of the tract, as closely as possible, by natural boundaries. The

species and amounts of timber of which should be cut annually in this tract, and the minimum diameter of all trees to be felled, were stated. Each applicant was granted but one tract in which to cut, so that the responsibility for any damage to the forest could be readily placed, but in consideration of the special rules applied to such tracts, every effort was and is made to protect the licensee in the area allotted to him, in order that he may enjoy the full benefits to be derived from any improvements such as roads, trails, etc., made by him.

In the above forest districts several of the larger operators, who closely followed the rules laid down by the forester in charge, were permitted to remove, under license, an amount of timber in excess of the amount granted by the original license.

The number of applications for licenses received and granted during the present fiscal year has greatly exceeded that of the past year. Many applications for the renewal of former licenses were disapproved for violations of the Forest Regulations during the past year. All timber licensees were allowed four months from the date of the license in which to commence operations, and a number of licenses were canceled for failure to comply with this provision.

Due to the partial or total destruction by wind and fire of various towns throughout the Islands, there was a notable increase in the number of gratuitous licenses granted to needy residents, the demands of the afflicted residents for timber to reconstruct their homes being granted as promptly as conditions permitted.

In several of the provinces where the greatest damage was inflicted, the forest officers in charge of the districts traveled over the entire province and issued gratuitous licenses to several hundred needy residents in each town.

A statement of all licenses granted during the fiscal year ending June 30, 1904, is attached hereto; also a list of company licenses granted, showing the amount of timber granted each company, and the amount cut.

*List of licenses granted during the fiscal year 1903-4.*

Province.	Timber.		Gratuitous.		Firewood.		By-products.	Total.
	By Bureau.	By sub-ordinates.	By Bureau.	By sub-ordinates.	By Bureau.	By sub-ordinates.		
Albay	21		2		9		2	34
Abra	34	7	7	34		15	3	100
Antique	4		1			3		8
Bataan	37		3	25	2	18	2	87
Batangas	16		2		17		1	36
Bulacan	19		1		8		20	48
Benguet	9		7		1		2	19
Bohol	4		2	11		2		19
Cavite	5		1		15			21
Cebu	12		1			10		23
Capiz	20	4	11	1		12	5	53
Cagayan	30	18	4	24		3	2	81
Camarines	22	25	7	27		41	12	134
Cotabato	4				3	1	13	21
Davao	11		1	3			33	48
Ilocos Norte	27	20	9	88		8		152



## List of licenses granted during the fiscal year 1903-4—Continued.

Province.	Timber.		Gratuitous.		Firewood.		By-products.	Total.
	By Bureau.	By subordinates.	By Bureau.	By subordinates.	By Bureau.	By subordinates.		
Ilocos Sur	10	51	5	5		17	1	89
Iloilo	33	5	6	83		61	36	224
Isabela	16		2					18
Jolo							1	1
Laguna	27		35		14		1	77
Leyte	30	17	3	31		22	3	106
Lepanto-Bontoc	4		4					8
Mindoro	37		6		32		39	114
Masbate	38	10	4	30		23	15	120
Misamis	21		1				1	23
Nueva Ecija	26		6		7		2	41
Negros Occidental	71	38	12	22		63	25	231
Negros Oriental	34	11	3	6		17	3	74
Nueva Vizcaya			1					1
Pampanga	29		3	2	18	14	1	67
Pangasinan	29		7	2	37	2	7	84
Paragua	26	18	4	28		15	22	113
Rizal	27		55		21			108
Romblon	21		2		6		5	34
Sorsogon	22		3		21			46
Samar	41	20	4	62		18	2	147
Surigao	19	7	3	10		4	3	46
Tarlac	31		11	10	41		4	97
Tayabas	55	32	21	45		44	32	229
Union	27		4		2			33
Zamboanga	28	18	3	16	1	18	17	101
Zambales	50	3	15	58		37	40	203
Total	1,027	304	282	623	255	468	355	3,314

## Company licenses, 1903-4, and amount of timber cut.

Company.	Location granted.	Amount granted.	Amount cut.
Benguet Commercial Co.	Baguio, Benguet	<i>Cu. ft.</i> 50,000	<i>Cu. ft.</i> 39,173
Philippine Lumber and Development Co.	Dalupaon, Ambos Camarines	100,000	95,016
Calvo y Compañía	Ragay, Ambos Camarines	60,000	46,406
Inchausti & Co.	Ajuy, Iloilo	50,000	4,105
Divilican Lumber and Development Co.	Divilican Bay, Isabela	100,000	3,990
Diamond Lumber and Development Co.	Puerto Galera, Mindoro	100,000	17,957
Mindoro Commercial Co.	Bongabong, Mindoro	100,000	31,198
Alvisse Lumber and Development Co.	do	100,000	2,453
Insular Trading Co.	Abra de Ilog, Mindoro	50,000	
Visayan Commercial and Development Co.	Cadiz Nuevo, Negros Occidental	60,000	
Iloilo Electric Co.	Sagay, Negros Occidental	100,000	27,894
Weinman, Alejandrino & Co.	Arayat, Pampanga	100,000	10,074
Bertran de Lis & Murga	Babayán and Tinitian, Paragua	100,000	34,087
Mindoro Lumber Co.	Baler, Tayabas	100,000	13,773
Gerena & Co.	Calauag, Tayabas	100,000	25,710
Compañía Maderera de Luzon	Guinayangan, Tayabas	75,000	61,599
Basilan Lumber Co.	Isabela, Moro	100,000	36,900
Masinloc Improvement and Development Co.	Bungaán, Zamboanga	100,000	473
Philippine Lumber and Commercial Co.	Santa Maria, Zamboanga	100,000	7,519

General reports containing information regarding the character of the districts, short descriptions of the forest areas, various silvicultural notes, and recommendations for the following year were submitted by each forester on December 31, 1903. Two of these reports are here given, in order that a general idea may be obtained of the work being carried on in the various forest districts. They are of especial interest in that the work being done marks the beginning of the first attempt ever made to carry out a policy of rational forest management in the Philippine Islands.

## FOREST DISTRICT OF BATAAN AND ZAMBALES.

### I. GENERAL DESCRIPTION OF DISTRICT.

The forest district of Bataan and Zambales, comprising an area of 1,068,200 acres, can best be described under two separate areas, comprising distinct physiological conditions:

The district of Zambales occupies a long, rather narrow strip along the western coast, having a general northern and southern trend 110 miles in extent, and an average width of 20 miles. A long, nearly continuous mountain chain forms its eastern boundary, from which radiate, in a general westerly direction, numerous valleys with small rivers. The altitude of the main range varies from the sea level to about 4,000 feet.

*Soil.*—The soil of this region may be described under double caption: (1) That of the high slopes and ridges; (2) alluvial soils of the plains and valleys.

The former is a loose, sandy, porous soil, easily washed, leaving numerous rocks on the surface. Traces of copper are generally found, which give it a dark-brown color.

The soil of the lowlands and valleys is a loose, coarse sand, quite porous, containing but little humus even in the dense forests, and practically free from rocks.

*Rocks.*—The character of the rock is similar, being a relatively hard sandstone, cropping out here and there in the ravines and river beds. Limestone deposits, bearing traces of coral, are found near Masinloc, showing that the sea formerly extended farther inland. Rocks of large size are uncommon, but small surface rocks are plentiful.

The long coastal plain between the base of the mountains and the sea is practically devoid of forest growth, or when such growth occurs, it is always semiopen and of poor quality. This area is generally well adapted to agriculture and for grazing purposes, while the immediate shore line is devoted, in many places, to the growing of cocoanuts.

In the region of Masinloc and Iba, sugar cane grows well, while farther south, on the low plains near San Narciso and San Marcelino, the culture of rice is carried on extensively.

*Social.*—Zambales is peopled by an extremely cosmopolitan population, the general location of the various tribes being as follows: Zambal at Santa Cruz, Iba, and Botolan; Pangasinan at Dasol; Ilocano at San Antonio, San Marcelino, and San Narciso; Tagalog at Iba and Subig.

The Zambales dialect, which is in general use, differs but little from the dialect of the Negritos, who inhabit the forests of the southern part of the province. Speaking generally, the people are extremely poor, and the Zambalesé (Zambal) are indolent and worthless laborers; entire families living crowded together in a smallnipa house.

### II. FOREST AREA.

The forest areas in different parts of Zambales differ greatly in quality and density. Large prairies, covered with tall cogon grass and without a single tree, occur in places on the mountain sides and on the lowlands, and these are frequently burned over to improve the pasturage.

The absence of any forest growth on such prairies may be due to the presence of large quantities of copper in the soil and rock, as the soil is frequently deep and moist, and otherwise favorable to tree growth.

The mountains and slopes east of Santa Cruz, extending south almost to Iba, are densely forested. After a short broken interval, the forest begins again near

Botolan, and, with few exceptions, covers the mountains of eastern Zambales to the southern limit. The leading species in order of abundance are as follows:

Apitong (*Dipterocarpus grandiflorus*, Blanco).

Tanguile (*Shorea talura*, Roxb.).

Guijo (*Anisoptera guiso*, A. D. C.).

Lauan (*Anisoptera thurifera*, Blume).

Banaba (*Lagerstroemia flos-reginæ*, Retz.).

Acle (*Pithecolobium acle*, Vidal).

Yacal (*Hopea plagata*, Vidal).

*Stand.*—The stand of timber is generally dense, many species growing in common and utilizing all the area. The trees, especially the family Dipterocarpaceæ, of which the forest is mainly composed, form tall, straight, clear stems, with heavy short crowns. With the exception of yacal, naturally more or less knotty, the forest trees are free from defects, such as heart rot, and when cut but little waste results from such cause. Pure stands of any considerable extent are not found, although some species tend to form groups.

Altitude, which is an important factor in forming zones or types, does not have as decided an effect in the Tropics as in colder climes. However, we see instances where it is effective, such as in the pineries on the high mountain slopes of Zambales, at and above an elevation of 1,600 feet. In such places this species tends to form pure stands, open in character, with scarcely any associated species. This appears to be a matter of soil influence, as one sees in the same region areas practically devoid of any tree growth except pine.

*Apitong* is found under various conditions and seems to be affected but little by the influences of altitude, slope, or density, always having the characteristic long, straight, clear bole peculiar to the species. It forms the greater part of the stand, occurring either individually or in small groups. *Apitong* ranges in height from 150 to 280 feet, with clear lengths of more than 100 feet, and maximum diameter of 60 inches, breast high. Unless found in very dense stands this species suffers but little from shade; on the other hand, it thrives fairly well in the semiopen when soil conditions are favorable.

*Apitong* is an abundant seeder, with a high germination per cent. For its best development it prefers a low, moist location, with deep, loose soil, but reliable natives have informed me that the timber is more durable when taken from high rocky slopes. This seems to apply equally well to other species.

*Tanguile* is found on the higher slopes, growing in deep, rich, moist soil, and attains a height of 180 feet, with clear lengths of from 80 to 90 feet. This tree, where conditions are favorable, is found growing in association with other species. For its best development, it requires, a rather dense stand where the soil is not exposed to drought. The crown is rather short, heavy limbed, and, with panao and apitong, forms an upper story in the forest. It flowers during March or April, the fruit ripening in August.

*Tanguile* does not reproduce abundantly under normal conditions. Seedlings and succeeding stages grow more abundantly when not exposed directly to the sun, but they must have a moderately open condition for best development.

*Guijo* has a wide distribution, growing independently and occasionally forming small groups. In appearance it resembles palosapis (*Shorea* sp.), but attains a larger size, having clear lengths ranging from 60 to 90 feet. The trunk is ordinarily straight, cylindrical, and free from defects. The crown is moderately long and spreading when not growing in dense stands. Reproduction is abundant in seedling stage. This species is moderately light demanding, but in the open it develops a poor form. I have found seeds falling in February from trees abundantly stocked, but the time of seeding seems to be quite variable.

*Lauan* is probably the most widely distributed species of commercial importance in this region, due to its ability to grow under varying conditions of light and soil. It is found growing singly on the high slopes as well as on the low flats, occasionally occurring in groups of limited extent. The bole is long, clear, and generally straight, tending to form large root buttresses in exposed situations or where the soil is not sufficiently deep to allow the tap root to develop. This root swelling does not extend for more than 8 feet above the ground, the remainder of the bole being cylindrical. The average clear length of mature trees of this species is about 65 feet. The crown is long and tends to spread when space permits. Observations have shown this tree to be a rather poor seeder, but seeds which mature have a high germination per cent. Lauan reproduces well and trees of all ages are found in good condition where proper seed trees abound. Large overmature trees of this species are commonly infested with certain destructive fungi, which, entering at broken branches and places where the bark has been removed, through injury, gradually cause the decay of the center of the tree.

*Acle* forms an important forest tree in northern Zambales, but is only used for local consumption. It prefers a moderately dense forest on the lowlands, occasionally being found on the higher slopes, and tends to form small groups irregularly distributed through the forest. The bole is short, averaging in clear length 30 to 35 feet, while specimens with a diameter of 50 inches are occasionally found. The trunk is rough and frequently covered with large burls, which, however, do not necessarily injure the quality of the timber. The crown is long, with slender, spreading branches, and in general appearance this species resembles the common wild cherry (*Prunus serotina*) of America.

*Acle* is a fairly abundant seeder, the fruit being borne in large pods which fall in September, but owing to their heavy character they are not adapted to distribution through natural means, and, therefore, do not reproduce abundantly, probably due to the fact that some of the large seeds are consumed by birds, and others, falling in damp places, the characteristic location of the trees of this species, soon become sterile.

*Yacal* occurs on the steep rocky slopes and ridges where there is sufficient moisture and shade to prevent the soil from becoming too dry. It is a tree of the high slopes and I have never found it growing on flats or near the seacoast. Pure stands of great extent do not exist, but in certain localities, offering favorable conditions for its development and growth, it is found in abundance with such association as tanguile, apitong, and lauan.

The quality of *yacal* in northern Zambales is superior to that of the southern part, generally being less defective. Clear lengths of from 50 to 70 feet are common. Owing to the thin soil in which it grows, *yacal* forms large root buttresses, which necessitate the leaving of high stumps when the trees are cut. The crown is moderately long and rather dense. Reproduction is abundant in moderately shady places possessing a moist, sandy-loam soil. I have not observed this species in fruit, but judging from the amount of young growth, it must seed rather abundantly.

### III. LUMBERING.

In Zambales lumbering for the general market is confined largely to that portion of the province south of Iba, the majority of the licensees being located in the Subic Bay district.

The lumbering conditions in Bataan Province are very similar to those in Zambales.

No modern lumbering methods have been introduced in this region, and all trees, with few exceptions, are felled and hewn with the native ax. The style

of ax employed is a clumsy affair with a narrow bit, which, however, is quite effective in the hands of a good native axman. The hard character of the wood does not permit the use of the broad-bitted American ax in felling. In a few instances, where valuable timbers are secured and where labor is scarce, a few of the more intelligent licensees have successfully used saws for felling trees and sawing out timbers.

After felling and squaring the tree to the largest size possible, the log is hauled, generally by carabaos, to the nearest river and floated to a common rafting place on the coast. Short round rollers, cut from small trees growing near the trail, are used in transporting the timbers from the forest, and as no care is exercised in selecting them, many good species are sacrificed.

Small holes are cut in the front end of the logs for the purpose of attaching ropes, and the under surface is "sniped," in order that the log may easily pass over obstructions in the trail. In rocky places where carabaos are unable to work, large logs are frequently taken out by men, aided by rollers and block and tackle. In such cases trees near the water, where the slope is steep, are usually selected for felling.

In regions, as at Subic, where there is scarcely any business other than the cutting of timber, it is comparatively easy to secure laborers at from 50 to 60 cents, Mexican currency, per diem; but normally, in places remote from commerce, labor is more scarce and demands higher remuneration, even though it be unskilled. A number of licensees have expressed a desire to cut in places where timber could be readily secured, but have been handicapped by these conditions.

A large part of the timber cut in this district is of the third group, and owing to the proximity of the district to the Manila market and the transportation facilities available, good profits are realized. The average price paid per cubic foot for timber delivered on the beach, for second group woods such as guijo, is from 12 to 14 cents, local currency, and for third group timbers, 10 cents. There is some variation in price according to the size of the log, larger pieces bringing slightly more per cubic foot than the smaller ones.

In certain localities in Bataan, especially at Bagac, lumbering is confined almost entirely to cutting timber for bancas or for local house construction. Many bancas are required at this place for local use, but some are also constructed for the market. The following species are those generally preferred for banca construction: Lauan, tanguile, calantas, and palosapis.

*Season of cutting.*—The season of timber cutting is practically dependent on the rice crop, and in regions where rice is grown extensively timber cutting is secondary, not only because labor at harvest time is not available but also from the fact that during planting dams are constructed here and there for irrigation purposes, which retard the transportation of timber by water. The above conditions prevail largely in eastern Bataan and to a certain extent on the western coast. At Subic, where but little rice is grown, the cutting and hauling of timber is carried on throughout the year.

#### IV. LICENSES.

In Bataan Province 36 licenses have been granted, with a combined volume of 351,000 cubic feet.

Two hundred and forty thousand seven hundred and sixty-seven cubic feet of timber have been marked for 23 licenses in Bataan, of which amount 35,125 feet had been cut by the above licensees up to December 1, 1903.

In Zambales Province there are 51 timber concessioners who were granted a total volume of 469,000 cubic feet of timber; 265,035 cubic feet was marked for 30 concessioners, of which amount 164,435 cubic feet was cut up to December 1, 1903.

## V. WORK MAPPED OUT FOR NEXT SIX MONTHS.

During the next six months a general inspection of the district is contemplated, the main object being to review the work done by licensees during this present season. The results obtained by the apportionment of forest tracts to licensees will be investigated and future plans will depend largely upon the conditions found at the time of inspection. Licensees who have not exercised proper care in carrying out their contract will be recommended for suspension, and such areas as show a too severe selection will be recommended for reserve.

On trips such as this work will require, notes will be made on the outline and topography of forest areas, with a view to perfecting the forest map of this district. As time permits, studies will be made of the more important forest trees, especially of the family *Dipterocarpaceæ*, and others of commercial importance.

In the past the forest regulations have been practically ignored, especially those intended to improve forest conditions, and in the future considerable attention will be devoted to spreading a knowledge of the regulations among the lumbermen in order that at least the rudiments of the same may become generally known.

## VI. FOREST STATIONS IN DISTRICT AND ADMINISTRATION OF SAME.

The following is a list of forest stations situated in the district of Bataan and Zambales:

The station located at Masinloc, near the northern end of Zambales, has jurisdiction over all towns as far south as Iba. This section is characterized by valuable forests, but as yet only minor forest products, such as charcoal, firewood, and small quantities of resins are taken from the public forests for market purposes. Concessioners holding ordinary timber licenses in this section cut timber largely for local consumption.

Subic forest station, at Subic, near the southern extremity of Zambales, has its north section limit at Botolan, Zambales, and includes all towns as far south as Moron, Bataan. District headquarters are also located at this point, as the town is the most central location in the district.

The section yields the greater part of timber shipped from the district, only small quantities of minor forest products being gathered. Two rangers were assigned to it.

The forest station at Hermosa, near the eastern coast of Bataan, includes the towns from Dinalupijan and as far south as Samal. It is in charge of one ranger.

The southern forest station of eastern Bataan is located at Balanga, in charge of one ranger, and includes those towns south of Samal, on the east coast, and Bagac, on the southwest coast of Bataan.

Where forest stations support two rangers, the senior ranger is in direct charge, while the districts are under the care of the forester. The foresters, working under the direction of the Bureau of Forestry, have charge of the administration of the forests and supervision over the forest products of their districts. Rangers are required to visit various towns and forests of their section as frequently as time will permit, such results as are obtained being given on the monthly report of each ranger. Stations supporting two rangers permit one to be absent from the station on inspection trips.

## VII. CLEARINGS, FIREWARDENS, ETC.

The problem of regulating the making of "cainḡins" in the public forests is one difficult to solve in a satisfactory manner, and owing to various conditions

of locality as affecting their value, and the conditions of natives making them, it seems that one general law with the idea of solving the question would be too sweeping to be effective.

In quite a number of cases the clearing of an area of forest is of extreme importance from many standpoints, and stringent means should be adopted to prevent it. Take, for example, the immediate region of Subic. In the past, clearings of considerable extent have been made adjacent to the coast, while within a profitable lumbering distance, practically virgin stands are still found. In these instances the forest area has been so denuded by lumbering that but little expense and labor is necessary to complete the devastation and prepare the land for agricultural purposes. Such tracts, in the course of a few years, are deserted and grow up in a dense, worthless tangle, generally with species poor in form and quality.

On the other hand, one sees clearings of considerable extent farther inland where the greater part of the stand is not better than third group, and, according to present methods, can not be removed profitably.

During the year some eighty persons have been apprehended in this district for making clearings on public lands, and while much dissatisfaction was apparent on the part of the trespassers, yet a noticeable decrease has taken place in transgressions.

During the past year numerous fires have occurred in the forests, especially during the dry season where large areas had not previously been cut. These fires were generally small, consuming only the dry tops and refuse left after felling, and in no case did fire spread into the virgin forest.

It seems that firewardens (especially in certain districts) where much cutting is done would be of great value. Such men could also serve the purpose of scouts and report any illegal use of timber. These wardens could be subordinated to the rangers of the section, and a careful record kept of all operations, such as places visited, extent of damage caused by fire, and name of guilty party.

#### VIII. RECOMMENDATIONS.

From the experience gained during the short term in which marking has been in operation, it is obvious that at least certain sections of forest area should be marked, in order to show approximate sustained yield. Owing to indiscriminate cutting by concessioners and others in the past, even reduction of number of concessioners in any one section would not alone suffice.

There are a number of licensees who are considerably isolated; and where there is a large scope of practically virgin forest from which to select the necessity of marking timber for felling is not apparent. In such cases, the forester who is thoroughly acquainted with his district should be able to decide. This is especially applicable where the forest is composed of trees below the first group, or would hold true when trees of better groups were largely in evidence. Such a plan, having been tried and found unsatisfactory, one could impose a higher diameter limit in order to suit the locality. In many cases ordinary timber licenses are solicited which call for greater amounts than can at present be granted by a forester, and I believe that the forester should be allowed to grant ordinary timber licenses not to exceed 1,000 cubic feet.

Owing to the large amount of timber shipped from this district, I recommend that at least one assistant inspector be provided.

WM. M. MAULE, *Forester.*

NOTE.—Report submitted December 31, 1903.

## THE FOREST DISTRICT OF SOUTH TAYABAS.

### I. GENERAL DESCRIPTION OF THE DISTRICT.

The forest district of south Tayabas extends from the south boundary of the Province of Batangas to the southern end of the Tayabas Peninsula, with a total coast line of about 90 miles, and an average width of 7 miles.

In the north end of the district Mount Banahao, an extinct volcano, rises to a height of about 5,000 feet, and from it extends a central ridge running through the whole province, with an average height of about 500 feet. Beginning at Laguimanoc, the ridge extends farther back into the interior, and a row of low hills runs along the coast. Many rivers, some of them of considerable size, come down from the central sierra and break through the low hills along the coast. In some of the rivers the tide water runs back a distance of 8 miles, such rivers being available for floating timber to the coast. Beginning at Cata-nauan, grass lands extend between the mountains and the coast.

All the rivers have more or less a swamp forest on the lower part of their course; back of these are clearings and cocoanut plantations, and finally the forest, which to a large extent is already deprived of its valuable species.

Nowhere in this district is lumbering being done on a large scale, 30,000 cubic feet being the greatest amount of timber cut by any one licensee during the previous year. In Unisan, Pitogo, and Laguimanoc there are shipyards where sailboats and small steamers are being built; five licensees are engaged in this business, each one finishing about one boat in two years.

There is a small sawmill with one circular saw in Lucena, but it does little business. The owners buy the greater part of the timber and only run the mill when they have orders for a certain amount of sawn material, all of which is used locally.

Considerable firewood and some resin are gathered in this district and shipped to Manila.

The most important industry in this part of the Province of Tayabas is the trade of copra, and many thousand acres are planted with cocoanut palms, about one-half of which are bearing fruit at the present time.

### II. FOREST AREA.

*Description of stand, silvicultural features, reproduction, etc.*—The total forest area comprises about 300 square miles, one-half of which, due mainly to the great distance from the shore of some of the timber, and also the lack of suitable transportation, is virgin forest.

In that part of the forest where lumbering is carried on at present, and which has been lumbered for almost one hundred years, very few of the valuable species are left, and those remaining are mostly rotten or of such large size that they can not be taken out.

The greater number of trees in the stand belong to the second and third groups. The family Dipterocarpaceæ is largely represented by the following species: Yacal, apitong, lauan, and hagachac. The most important of the other species found are narra, dungon, supa, banaba, guijo, and macaasin. The reproduction in general is fair and that of the family Dipterocarpaceæ good.

The underbrush, with few exceptions, is very dense, consisting mostly of bejuco (at least three different kinds), palma brava, timac, and saplings.

In most instances the underlying rock is limestone, sometimes soft, sometimes very hard tufa. Sandstone and quartzites are also found in a few places. The soil varies from an almost pure sand to heavy clay loam. The latter becomes very soft during the rainy season and cracks when exposed to the sun.



During the first part of the year studies were made on the reproduction and the silvicultural conditions of the more important timber trees, principally in the vicinity of Laguimanoc, where extensive cutting has taken place for almost one hundred years. Half-acre areas were measured and every tree down to a diameter of 3 inches calipered. Several of these areas were selected for each species, giving different conditions of altitude, slope, exposure, and soil. In these areas there were subdivided two small squares, each containing one one-hundred and twenty-eighth of an acre, and every seedling counted. These squares were selected so that one was in the lightest and the other in the shadiest spot on the half acre. The following silvicultural notes have been taken from the original report submitted on the studies made:

*Molave* (*Vitex altissima*).—Generally found on slopes with different exposures, in shallow, loamy sand with underlying limestone, at altitudes from sea level to 900 feet. Reproduction is fair in places where much light can reach the soil; in old clearings and along trails a sufficient number of saplings can be found to insure a good aftergrowth. The largest tree found had a diameter of 50 inches, the maximum height was 85 feet, and the greatest clear length 25 feet, but as this wood is very valuable, the large and crooked branches find a ready market.

*Narra* (*Pterocarpus vidalianus* Rolfe).—Found on all kinds of exposures, slopes, and altitudes up to 1,500 feet. It grows best in deep sandy loam, overlying limestone and sandstone. Reproduction is very good in open places, more than 200 saplings having been found around one tree in an opening. The largest saplings need a little shade for their best development. *Narra* reproduction is also found in abundance in old clearings, but here it is generally shaded too much by other quick-growing species, and a thinning of the latter would be of great advantage. The maximum diameter of all trees measured was 60 inches, with a maximum height of 90 feet and a clear length of 40 feet.

*Banaba* (*Lagerstræmia speciosa* Pers.).—Generally found on level or gentle slopes, somewhat protected from strong winds. It grows in a deep sandy loam overlying limestone at altitudes from 50 to 600 feet. It is never found in wet places. Reproduction from seed is good in open places, where young growth of all sizes can be found. It reproduces also by sprouts. It is sometimes found in almost pure stands. Maximum diameter, 25 inches; maximum height, 80 feet; maximum clear length, 35 feet.

*Supa* (*Sindora wallichii* Benth.).—Found on moderate and steep slopes, but only near the sea; in few cases along flats near the shore, but never higher than 300 feet. It thrives equally well on all exposures on a shallow sandy loam overlying limestone tufa. The reproduction is good, but best under a medium shade. Seeds are numerous, but the germination per cent is small, seeds rotting quickly when exposed to much rain. The greater part of the seedlings reach the pole-wood stage, at which time they should be thinned. Maximum diameter, 45 inches; maximum height, 95 feet; maximum clear length, 42 feet.

*Yacal* (*Hopea plagata* Vidal).—Generally found on steep and rocky slopes on all exposures, at elevations from 50 to 600 feet. It grows best in a deep, dry, loamy sand overlying limestone, and in a few places sandstone on tufa. Reproduction is good under medium dense shade, the seeds germinating equally well in light and shaded places, but the seedlings die after one or two years if light conditions are unfavorable. Maximum diameter, 40 inches; maximum height, 110 feet; maximum clear length, 60 feet.

*Malabayabas*.—Generally found on ridges at altitudes from 500 to 1,000 feet, on a deep, heavy, loamy soil with underlying limestone. *Malabayabas* is one of the few trees which occasionally occur in pure stands. In one instance more than 300 trees of a diameter of 3 inches and over were found on 1 acre. Repro-

duction is fair under average conditions, but best under a medium shade; the seeds, most of which live, germinate without any cover. The stand can be dense, as the foliage of Malabayabas is very open and does not give much shade. Maximum diameter, 41 inches; maximum height, 90 feet; maximum clear length, 30 feet.

*Dungon* (*Heritiera littoralis*, Dryf.).—Found on moderate to very steep slopes, on all exposures, at altitudes varying from 50 to 1,000 feet. It grows best in a rich, loamy sand mixed with rocks of all sizes. The soil does not need to be deep and must not be too wet. Reproduction is good for all age classes. Young trees can stand a large amount of shade, but strong sunlight will kill them, while pole wood and larger trees need a great amount of light. Maximum diameter, 35 inches; maximum height, 120 feet; maximum clear length, 50 feet.

*Macassan* (*Eugenia* sp.).—This most numerous of all important trees is found everywhere, under all sorts of conditions, up to an elevation of 1,000 feet. Exposure, slope, and soil do not seem to affect its best development. The tree is only absent in the flats near the seacoast. It produces freely under medium shade, but can stand heavy shade better than too much sun. The seeds need a little cover of leaves or soil to germinate. Maximum diameter, 45 inches; maximum height, 105 feet; maximum clear length, 60 feet.

*Guijo* (*Shorea guiso* Blume).—Found on gentle and moderate slopes at altitudes ranging from 50 to 500 feet. The best soil is a compact, sandy loam with a subsoil of limestone. Reproduction is good and seedlings are numerous. Saplings and pole wood are present in abundance. Seedlings can endure a dense shade, while saplings need considerable light. Maximum diameter, 40 inches; maximum height, 120 feet; maximum clear length, 85 feet.

### III. LUMBERING IN THE DISTRICT.

Lumbering in this district is conducted only on a small scale, the largest amount taken out by any one concessioner during any previous year being about 30,000 cubic feet. The majority of the licensees kept within the limit of the license granted them (10,000 cubic feet). The usual method of lumbering followed here is the same as in other parts of the Islands. The licensees tell the woodsmen what kind of timber they desire, and the laborers go out and select trees of a moderate size that can be easily hauled out. The majority of the logs are squared in the woods, and only a small amount of round logs are hauled to the beach. Timber is seldom cut farther than 3 miles from the water. Only in one case did I find trees cut as far as 6 miles from the nearest river.

The logs are skidded by carabaos to the nearest river and from there brought down to the sea either with the aid of bancas or bamboo floats. A part of the timber is used in the small towns along the coast for house and ship building; the other part, especially the more valuable species, is sent by sailboats to the Manila market.

The average price of timber delivered on the beach is 15 centavos per Spanish cubic foot, and to this must be added 30 to 35 centavos per cubic foot for transportation to Manila. From this it follows that only such timber as will bring in that market more than 40 centavos per cubic foot can be shipped.

The sawing of timber into boards is done by hand, laborers being paid from 6 to 10 centavos per square foot, the price varying with the hardness of the wood. At this price two men can earn from 2½ to 3 pesos per day of twelve hours.

The money paid for the logs is usually equally divided between the cutters and the owners of the carabaos.

## IV. LICENSES.

From April to June, after the reproduction studies were finished, an inspection trip was made through the whole district and all licensees visited. Reconnaissance trips were made from each town into the adjacent forests in order to be able to decide how much timber could be cut in each section and what licensees were deserving of new licenses. Later, when the application for new licenses came in, the province was divided into subdistricts, rivers in the most cases forming the boundaries.

There are twenty-two timber licenses granted in this district. The areas assigned to each licensee vary with the density of the forest and the facilities of the licensee for lumbering. At present all ordinary timber licenses are limited to 10,000 cubic feet, but some of the licensees will receive permission to cut more as soon as the new forest law becomes effective. The smallest area contains about 10 square miles, and the largest about 40, the latter consisting of about 75 per cent of grass land while the former is densely timbered.

Marking began July 20 and was entirely finished November 18. In all cases as much of the timber was marked as the concessioner will be allowed to cut in case the new forest law is passed, the largest amount being 25,000 cubic feet and the smallest 10,000. A total of 2,276 trees were marked, which will furnish approximately 290,000 cubic feet of timber. These marked trees are distributed among the different groups as follows: Superior group, 6.44 per cent; first group, 0.76 per cent; second group, 50.40 per cent; third group, 33.88 per cent; fourth group, 8.52 per cent; and so far, 30,000 cubic feet of the above-marked timber has been cut and brought to market.

In marking the timber in this district I was not able to mark all trees which should have been removed from a silvicultural point of view. The idea I always kept in view was to leave enough seed trees of the important species, but many of the inferior species which should have been removed could not be marked, as the concessioner was unable to take them out without great financial loss. The trees which could be marketed to good advantage were scattered over so large an area that I was not able to mark more than forty, on an average, in a day of ten hours. The majority of the trees selected for cutting had a diameter from 20 to 30 inches; none had less than 15 inches, and only a few more than 40.

## V. WORK MAPPED OUT FOR THE NEXT SIX MONTHS.

The work mapped out for the next six months is, first, reconnaissance trip to that part of the district north of Lucena, and if possible to the top of Mount Banahao (5,000 feet); and, second, an inspection trip to other districts in which marking has been done.

## VI. FOREST STATIONS.

There are two stations in this district—one at Lucena and the other at Unisan.

## VII. FIRE PROTECTION.

A few fires were started to clear up old "cañingins" in the months of March and April, but no damage was done to the surrounding forests. Firewardens will not be necessary here, as the forest is always damp, even in the dry season, and in several instances where fire had been started to burn over grass land it stopped as soon as it reached the forest.

## VIII. RECOMMENDATIONS.

Foresters should have more authority. They should be able to grant timber licenses and gratuitous licenses for public-construction use up to at least 2,000

cubic feet, and an unlimited amount of firewood licenses, and all licenses for other minor forest products. The foresters are on the ground and know better how much to grant in each case than the main office at Manila.

Further, foresters should have authority to place the rangers assigned to their districts in places where they may be used to the greatest advantage.

The more intelligent of the rangers should be instructed so that they will be able to do some marking under the direction of the forester.

The licensees should be allowed to cut a certain amount of third and fourth group trees, even if they are not marked.

If the taxes on timber are to be decreased in some districts the reduction should not be made equal for all trees, but those of the superior and first groups should remain the same, those of the second group reduced 25 per cent, and the remainder 50 per cent. This would induce the licensees to cut more of the inferior species.

The name "superior group" should be abolished and this group called "first group," as the natives always confuse these two groups, calling the "superior group" "first group."

A better kind of marking ax should be furnished, those in use at present being useless after a few days' work.

A bulletin should be published giving the result of all timber tests made during the last two years, as it is very probable that some of the trees which are not in the market at present can be used for some purpose.

Finally, the metric system should be adopted exclusively. At present the measurements made by the foresters are in English feet, the timber is measured in Spanish feet, and the firewood in meters. The metric system was made legal in the United States in 1866, and its use will probably be universal eventually. Errors in cubication would be less frequent, and as the natives are partly accustomed to the meter they could certainly learn its use more readily than the complicated English system.

W. KLEMME, *Forcster*.

NOTE.—Report submitted December 31, 1903.

#### LAMAO FOREST RESERVE.

The Lamao Forest Reserve was set aside by proclamation of the Civil Governor July 26, 1904.

Work was begun by this Bureau in the Lamao Valley in August, 1903, since which time three nurseries have been started, type areas established, and roads built, nearly all of which have been carried on under the supervision of Mr. Thomas L. Richmond, who possesses a good knowledge of botany, scientific agriculture, and nursery work. His assistant, Mr. William P. Sherlock, is also very capable, and is competent to take charge of the routine work of the stations in the absence of Mr. Richmond who will leave about the middle of September on a six-weeks' tour of Singapore, Java, and Ceylon for the purpose of studying nursery work in the Tropics. Much valuable information and time may be gained from the experience of others who have worked out the problems which now confront us, and careful observations will be made regarding every detail of nursery work, methods of preparation of seeds and plants for shipment, garden implements, sprays, etc. He will also make arrangements with botanical gardens and like institutions for the exchange of seeds and plants. Careful notes will be made regarding the character of the work-

ing reference library at each of these places, in order that suitable working libraries may be secured for the station at Lamao and other points in the Islands where forest reserves may be set aside and nurseries started.

The services of Mr. Thomas Hanley, an experienced landscape gardener, have recently been secured, and he will, under Mr. Richmond's supervision, improve the appearance of the reserve, beginning his work near the beach station.

Between fifteen and twenty Filipinos are employed in the regular nursery work. The botanical collector has three Filipino assistants and Mr. Hanley six.

At present a field party of four is making a map of the reserve, showing the location of the holdings claimed by private parties, in order that said claims may be adjudicated before the Court of Land Registration.

A botanical survey of the reserve has been planned and started by the Bureau of Government Laboratories, the botanist of the Bureau of Government Laboratories, with the coöperation of the employees of this Bureau, carrying forward the work. The plan outlined is as follows:

1. A land survey showing boundaries, etc.
2. An ecological survey showing the various plant societies and cultivated areas. This is to be accompanied by a colored map. A careful land survey will give best results.
3. The physiographic relations of these societies to each other.
4. Climatic conditions, soil, other factors, and their physiological importance.
5. A careful survey of the very limited areas in each society showing actual distribution of trees and numerical importance of each.
6. The relation of animal life to vegetation, such as influence of swine, etc., on soil.
7. Humus conditions and its relation to vegetation.
8. Photographs of various plant societies, individual plants, etc.
9. Study of silviculture, habits of principal forest trees, seedling conditions, relations to moisture, etc.
10. Systematic descriptions, with key of tree, and, if practicable, other species in the area.
11. Economic plants, agricultural and forestry conditions.

The following is an interesting extract from a letter of Mr. Copeland, botanist in the Bureau of Government Laboratories, to the Superintendent of the same:

FEBRUARY 5, 1904.

Dr. PAUL C. FREER,

*Superintendent of Government Laboratories.*

DEAR SIR: Pursuant to your informal request for a statement on the subject of our need of a botanical garden, and of the desirability of the Lamao River Valley as its site, I have the honor to submit the following:

\* \* \* \* \*

If the garden were located in the valley of the Lamao River, Mount Mariveles

would be a part of its resources, and I include it among the advantages of the site. It furnishes a range in altitude of nearly a mile, and with this a considerable range in temperature and a very great one in that much more important element of a Philippine plant, the moisture. At every altitude there is virgin forest, with all the wealth of tropical vegetation which that implies, thriving without delay or expense to us, better than it could ever be made to do in an artificial garden. Practically all the surrounding country is already owned by this Government. The proximity to Manila is all that can be expected of such a tract of virgin forest, and, as happens everywhere, its accessibility will increase with the need of it. There is abundant water, and irrigation is possible with almost no expense.

More important than any other one reason for locating the botanical garden in the valley of the Lamao is its already having been chosen for the most careful work of the Bureau of Forestry. The greater usefulness of both the Bureau of Forestry and the botanical garden is dependent on their not merely respecting each other's rights but in their cordial coöperation in the furtherance of each other's interests. If they are separated it will be at a needless expense to the Government and a sacrifice of the best work of both.

A considerable part of the work of the Department of Agriculture of the Federal Government will fall to the botanical garden rather than to the Bureau of Agriculture, as the scientific work of the several Bureaus is organized here; this includes all the work which demands laboratory facilities and technical botanical training, such as study of the nutrition of plants, their diseases, breeding, and acclimatization. Such work is already well begun by the Bureau of Forestry.

As evidence of the excellence of this location for the garden and the facilities it offers for work, I will mention some of the lines of work which the material I have found has suggested. The many vines, in all the great groups of flowering plants, furnish subjects for conclusive experiments on the mechanism of the ascent of water in trees. The numerous epiphytes invite a study of their source of mineral food, our ignorance concerning which is probably the chief difficulty in the way of their cultivation. There is more material than has ever been used for a study of the distribution, mechanism, and function of hydathodes, or water excreting and absorbing organs. Besides all the climbing devices I have ever seen described, at least two others occur here; one of these depends upon the setting up of a permanent pressure by a growth curvature in a way which would be impossible if the current theories on the mechanism of growth here were sufficient. A wild citrus of the neighborhood in its present state is well worthy of cultivation if it will bear well; and at any rate it offers a valuable stock on which to graft more highly developed related fruits; also a race with which, if necessary, the best California oranges (which will thrive here) may be crossed to produce their excellencies. With the mature native trees at hand young hybrids can be made to flower and show their qualities by grafting them on to the mature trees, avoiding years of waiting. Similar opportunities for breeding are offered by the native cucurbits; but the most immediate result of work with them will probably explain the diseases attacking introduced melons and squashes. Questions of greater concern to the forestry interests, but demanding the attention of a botanist, are rate and season of native-tree growth; its propagation, when, as in the case of *Agathis*, it is an important matter, and the diseases of timber. The *Polyporaceæ*, the fungi most destructive to timber, are more numerous in this region than anywhere else in the world; and *Merulius* and *Trametes*, two most mischievous genera, not hitherto known in the Philippines, I have found in this valley.

Scientists coming to the Tropics for a season's work will come here if facilities are better than they can find elsewhere. I have touched on the advantages only in lines with which I am most familiar. For morphological and systematic work the rich and varied flora presents opportunities which can nowhere be excelled. The work of this Laboratory has been focused on the Lamao Valley as nowhere else, and we have scratched the field in but a few places.

For the purely scientific work of the garden the best spot I have found is the uppermost of the clearings made by the Forestry Bureau. It is at an elevation of about 330 feet, where a large creek joins the river from the south. The Chief of the Bureau of Forestry has expressed his readiness to turn this clearing over to us, and the work already accomplished will necessitate a very small expenditure to make it answer our immediate needs. For agricultural botany, the best site is certainly between the two stations where such work is now being undertaken; but the work at all these places is necessary for the interpretation of the results at any one.

The Bureau of Forestry will erect a suitable house for the botanists and another for the field laboratory and reference herbarium on a site within the reserve selected by Mr. Copeland.

There has been more or less confusion existing among the many tree species found throughout the Islands, and almost a total lack of data regarding the qualities of any but the better and more common timbers. The various common names applied to different trees are of little value to a forester in that they vary with different localities in the same province, and the same tree has a different name in almost every native dialect. In order that detailed studies of the silvicultural and reproductive features of the important tree species might be made, an experimental tract near Manila seemed desirable and very necessary. Foresters could there become acquainted, within a short time, with the leading species and their main characteristics, facts in their district work which might take years to accumulate could be brought out promptly, and many experiments carried on which would be of great value to the service. Such a station would also be valuable in giving new inspectors and foresters a chance to become rapidly acquainted with the forest conditions and methods of forest work in practice in the Islands.

The majority of inspectors are men who, up to the time of taking the position, have never done any forest work, and a few weeks' training, such as could be secured on the reserve, would render the man of much more value in a short time than could be possible if he secure the necessary knowledge by experience.

Such a tract should comprise a wide range of elevation from seacoast to mountain top; contain virgin forest, different stages of lumbered forest, brush lands, and open country; present a variety of exposures, and, for the proper administration of the same, should be situated within a short distance of Manila.

A suitable tract was found in Bataan Province in the basin of the Lamao and Alangan Rivers, where elevations from 0 to 4,500 feet existed.

The distance from Manila by water being but 22 miles, it can be readily reached by launch in three hours.

A botanical collector of the Bureau has been stationed there for several months and is engaged in laying out type areas for the study of individual tree species. These areas are being laid out mainly after the plan followed in the famous botanic garden in Java, a visit having been made to the same by the former botanist of this Bureau in order to secure this and other necessary information.

The result of his observations are published in Bulletin No. 1 of the Bureau of Forestry, entitled "Report on Investigations in Java, 1902."

Work on the first type area at Lamao is well under way, having been started some months ago. It begins about 4 miles back from the coast at an elevation of 500 feet, and extends up the north side of one ridge and down the other, and also for a distance along the top of the ridge, thus giving several different exposures.

Some 750 trees have been labeled and more or less botanical and other material secured. Instead of following the Java method of taking a tree at random it was decided to mark every tree within a certain area. In this way a number of trees of each species, of various sizes, will be frequently included, and studies on the rate of growth and other physiological problems carried on in connection with the type area.

Even with the small amount of work accomplished to date, various new species of trees (about fifty) not previously reported from the Islands have been identified, among them several of the genus *Palaquium*, which yields gutta-percha, generally of a good grade. The tract promises to be rich in species and will be especially valuable for instruction purposes later on. In order to improve the native personnel of the Bureau, it is proposed to establish on the reserve, as soon as possible, a forest school for rangers, where instruction in forest work can be systematically carried on. Such a school is essential to existing conditions, as the force of rangers know little of technical forest work, their entire training in the past being bureaucratic rather than toward direct supervision in the forest of logging operations.

For American and European botanists and botanical collectors who plan to work in the Philippines, Lamao is an ideal situation for preliminary work, the location being healthy and the heat not excessive. There they may become acquainted with the Philippine flora, the characteristics of the vegetation, the peculiarities incident to the preparation of botanical material under tropical conditions, how to deal with the natives, and secure other information only to be acquired by experience, which it is well to assimilate before attempting work in regions distant from Manila. The flora of the Lamao region is very rich, and from the various camps the collectors can thoroughly explore the country from the seashore to the top of Mount Mariveles—an elevation of 4,500 feet. Anyone desiring to make botanical or forest investigations will be given full opportunity



to do so, and can make their headquarters at any one of the permanent camps.

The vegetation of the coast region, extending back from the seashore for a distance of 3 or 4 miles and to an elevation of 300 or 400 feet above the sea, is very diversified, consisting mostly of shrubs and small trees, bamboo thickets, and open grassy parks rich in herbaceous plants. This country can be readily worked by making headquarters at the lower camp, and from this lower camp if anyone desires to study the strand flora, the strand region is easily accessible. At a distance of from 3 to 4 miles from the seashore and at an elevation of about 300 feet the character of the vegetation abruptly changes. From this point to the summit of the mountain magnificent and unbroken forests occur, especially rich in the species of *Dipterocarpea*. These forests bear a marked similarity to the deciduous forests of the northern United States, except, of course, the undergrowth of characteristic tropical plants, such as the palms, screw pines, etc. As one approaches the summit of the mountain there is a second decided change in the character of the vegetation. Trees occur at the very summit, but on the exposed regions and peaks they are very much reduced in size. Everywhere one finds a profusion of epiphytic and terrestrial orchids, ferns, shrubs, and herbaceous plants. Several species of the palms of the genera *Pinanga* and *Calamus*, and the pitcher plant (*Nepenthes*) emphasize the tropical character of the vegetation, yet, on the other hand, such genera as *Rubus*, *Rhododendron*, *Clethra*, and others generally characteristic of temperate countries are represented. The trunks of the trees, bowlders, cliffs, and ground in many places are covered with a great profusion of mosses and lichens, not found at lower elevation. Especially interesting plants are the species of *Gnetum*, *Podocarpus*, *Agathis*, etc., and several species of plants inhabited by ants, such as *Dischidia pectinoides* and other species, *Polypodium* sp., and *Myrmecodia enchinata*.

Trails have been established from sea level to an elevation of 2,000 feet, where a permanent camp and nurseries have been located. From this place, on the head waters of the Lamao River, the summit of the mountain is easily accessible, and there is an excellent opportunity to study the rich flora of the upper ridges and summit. If one desires to study the forest flora, a magnificent opportunity is proffered, as near the upper camp a type area has been established and within it all the trees are numbered and labeled with their native and scientific names.

#### NOTES ON LAMAO FOREST RESERVE, LAMAO, BATAAN PROVINCE, P. I.

[By R. S. WILLIAMS, Collector, New York Botanical Gardens.]

The writer spent a number of months on the Lamao River, and the region proved to be one of much interest to a botanical collector. The lower land near the coast is covered with brush, bamboo, and small trees, but back a mile or two a fine forest begins that extends without interruption to the bush-covered summits

of the mountains, at an elevation of something over 4,000 feet. Taken as a whole, the trees of this region are not of such great size as often occur in the Tropics, but they are more easily collected on that account, and as to variety there seems to be an endless number of interesting species coming into bloom or fruit in constant succession almost the year round. Trails, often very ancient, apparently, run in all directions, and the trouble usually is not that one is unable to find a trail to a locality but to remain on the right trail, especially when returning from a trip. A few roving Negritos are the only inhabitants, and they usually keep well out of sight. Of lower animals, occasionally a small monkey is encountered, also deer and wild pigs; all, however, are very timid animals. Of snakes, my experience here has been very similar to that in Bolivia, namely, they are so rarely met with as to be scarcely worth mentioning. What is perhaps more remarkable, we were not troubled with mosquitoes or other insects that so often make life a torment in tropical countries. There are many kinds of ants, but I have never been badly stung by them, and there are none that at all compare with some of the fiery South American species. The nights at 200 or 300 feet elevation are so cool as to require a good single blanket over one, and at 2,000 or 3,000 feet a good double blanket is often needed. At this latter height are fine streams of clear, cool water that almost make ice a superfluous luxury for drinking purposes. On the whole, this region is quite an ideal collecting ground for a tropical country, and while its forests are its chief attraction, there are many fine ferns to be obtained. Numerous species of the larger fungi are splendidly developed, and mosses are abundant on the upper streams and slopes.

#### GROUND S AND LOCATION OF STATIONS.

The reserve contains approximately 12,000 acres, extending from sea level to an elevation of 4,500 feet at the highest point. Adjoining the seacoast for a distance of 3 miles inland the land is fairly level, varying to moderate slopes toward the base of the ridges. From this point to the top of the mountain the surface is characterized by long and steep ridges, heavily timbered. Along the coast region the timber has been cut away, leaving a dense growth of bamboo, shrubs, and guava bushes. Numerous small clearings are found throughout this region, some of which are cultivated by the natives in bananas, pineapples, and other fruits; but many of these clearings have been deserted and are now spaces overgrown with cogon grass.

The Lamao River on the south side and the Alangan River on the north furnish an abundant source of water supply for the reserve during the dry season.

Three stations have been established—one on the beach at Lamao, the second  $2\frac{1}{2}$  miles inland at an elevation of 250 feet above the sea level, and the third 10 miles from the bay at an altitude of 2,000 feet.

#### BUILDINGS AND IMPROVEMENTS.

The grounds along the beach will be devoted almost exclusively to ornamental purposes, and the salt marshes near by will be utilized in the furtherance of this object.

The nipa palm thrives in this locality, is of economic importance, and is very attractive in appearance.

The building at the first station consists of a two-story frame cottage with two or three smaller buildings used as storerooms. The grounds surrounding the cottage are fenced, and a good beginning has been made in the way of improving the appearance of the place by constructing a gravel walk, sodding the yard, and planting a few ornamental shrubs and flowers.

At the second station four houses have been built for the laborers—one dwelling house; a stable 18 by 40 feet, with shelter room for wagon and implements; a lath propagating house 15 by 35 feet; and an orchid house 18 by 45 feet. In addition to the buildings on the grounds, a permanent camp, with several small houses, usually occupied by botanical collectors and visiting botanists, has been established on the river about 1 mile above this station.

The grounds and nursery at this station have been fenced in only on the lower side, being partially protected on the upper side by the river.

The construction of canals for irrigating purposes at the first and second stations will be started in October, and when completed will furnish an unlimited amount of water for nursery work. The length of the main ditch at the first station will be about 1,400 yards, including the ditch through the gardens. There are several streams between the grounds and the point at which the water will be taken from the river, so that flumes will have to be constructed across these streams. The length of the ditch at the second station will not exceed 800 yards, as it is not necessary to go a greater distance up the river to get ample fall to carry the water, and only one flume will be required.

Most of the material used in the construction of buildings and in making improvements was secured on the reserve, thus saving cost and transportation.

Early in the spring a wagon road was constructed from the first to the second station, and three bridges built over the intervening streams.

This road has been extended to the third station, but is not in condition for vehicle travel beyond the second station, as the steep hills and narrow ridges encountered toward the top of the mountain make the construction of a roadway for wagons too expensive an undertaking at the present time. The present road furnishes a very good pathway for pack trains, and answers all the requirements for the time being. It is planned to continue the trail to the top of the mountain at an early date for the use of botanists and collectors who may wish to work in that region.

Two small houses were recently built at the third station, a tract of land cleared, and several acres planted in fruit trees and nursery stock, a large part of the imported nursery stock being put out at this station. After getting the work well under way a reliable Filipino was placed in charge, who is competent to take care of the nursery and orchard under proper direction.

The grounds of the third station, at 2,000 feet elevation, can not be irrigated so easily as at the lower stations. The small stream from which the supply of water will have to be secured is 40 or 50 feet below the level of the grounds, and it will be necessary to raise the water by mechanical means and pipe it to the grounds.

#### THE NURSERY.

Including recent plantings there are over 500 species in the nursery, the larger proportion of which are native timber trees and plants of economic importance. In addition, the list comprises a general collection of ornamental shade trees, palms, orchids, ferns, and flowers.

The native species were collected almost entirely by employees of this Bureau, but some contributions have been made by botanists of the Bureau of Government Laboratories while collecting in this province. Special effort has been directed to increase the number of native timber trees, and a circular letter issued requiring all employees in the field to make collections of seeds for this purpose. By this means our collection steadily grows in volume, and the condition in which seeds are received affords valuable information as to the requirements of the various species.

At the nursery notes are taken on the work along the following lines:

1. Time and conditions required for germination by the various species.
2. Effect of light and shade; depth of planting; rate of growth.
3. Insects and fungi affecting seeds and seedlings.

From this record it has been found that the period required for germination varies in different species from a few days to months. The germination of certain species like aele and tindalo may be considerably hastened, if desirable, by soaking in hot water for a period of twenty-four hours before planting.

It is a difficult matter to secure sound seed from some of the more common timber trees of this region—notably the *Dipterocarpeæ*. There are many species belonging to this family growing on the reserve from which mature seeds have never been collected, as the seed seems to have been destroyed by insects or fungi before reaching maturity. The absence of seedlings under the parent tree may be partly accounted for in this way, though there are, of course, other factors to be considered.

Occasionally seeds are collected which are apparently sound in every respect, yet fail to germinate. A large quantity of seed was collected from banaba trees growing on the reserve; no seed at all germinated from some of the trees, and only a small per cent from some of the others, the explanation seeming to be that trees of certain localities do not bear fertile seed. It has been observed that seed of others—the alupag (*Nephelium litchi*), for example—must be planted soon after falling from the tree in order to secure the germination of the same. It is believed that further investigations along this line will be of some value in study-

ing the distribution of timber in the natural forests and help to explain facts not clearly understood at this time.

Exchanges have been made with several botanical gardens in the East by means of which we have increased our list of plants and introduced new plants into the Islands, some of which, at least, will prove of economic value.

Seeds desired for exchange purposes are laid aside from each collection.

#### TROPICAL FRUITS.

An ideal location near the markets of Manila naturally suggested, in connection with forestry work, the inauguration of a few experiments in tropical fruit culture, with a view to improving the native varieties and introducing new fruits.

Many excellent fruits are found in the Philippine Islands growing in a comparatively wild state, and hitherto little, if any, effort has been made to improve them. Large tracts of land on the reserve are well suited to growing mangoes, cocoanuts, bananas, pineapples, and other fruits, and in proof of this statement it is only necessary to point to the groves of such fruits growing, with little attention and no cultivation, on the reserve.

A large area has been planted with selected varieties of bananas and pineapples, the pineapples being planted between the rows of bananas, the latter being intended to furnish the required shade for the former. The soil in this plot is a good sandy loam, and was thoroughly prepared before planting. Seven hundred papaya seedlings were put out on the same plot, 200 of which were grown from seed of an Indian variety which is equal in flavor and more than twice the size of the native.

There are growing two varieties of Honolulu bananas, but these have not proved to be equal to the best native varieties.

For comparison with native pineapples, there are three of the best varieties from Ceylon, one of which (Giant Kew) is said to produce fruits weighing 40 pounds.

Seedlings in considerable quantities of the following fruits are growing in the nursery: Oranges, lemons, anonas, cocoanuts, chico, cashew nut, and others of less importance.

The mango is without question the best of all tropical fruits, and, although a native of India, travelers assert that it reaches its best development in the Philippines. Like many of the temperate-climate fruits, the mango does not come true to seed, hence to propagate the better varieties it is necessary to graft them, and 5,000 seedlings have been planted for this purpose.

Experiments are being conducted with the native citrus plants, oranges and lemons of a fair quality being grown in many parts of the Islands, and it is believed that these fruits can be greatly improved by the prop-

agation of selected trees. Two-year-old seedlings of the "Bontoc" lemon are bearing fruit on the reserve this year.

While it is not advisable to make extensive plantings in the Tropics of fruits from temperate climes, yet there are some worth trying at high altitudes, and a few hardy varieties of deciduous fruits have been imported for this purpose.

In the vicinity of the third station, at an elevation of 2,000 feet, wild raspberries grow in abundance. From this it seems probable that such fruits as blackberries, raspberries, and strawberries can be grown. A tract of land has been cleared at this station and 2 or 3 acres planted in deciduous fruits, 500 coffee trees, and several varieties of the best varieties of California oranges and lemons. The coffee trees are from hardy dwarf varieties, imported from Java and India, and it is hoped that a variety will be found which will be able to resist the blight diseases which have been so disastrous to the coffee interests of these Islands in the past.

#### FORAGE PLANTS.

Owing to the high prices of hay in the Islands, it is important that our own forage be grown on the reserve. From results of the experiments at the Singalong experiment station, teosinte (introduced last year by the Philippine Bureau of Agriculture) promises to supply this demand. A crop of 30 tons of free fodder was secured from the first cutting on 1 acre, and eight cuttings were obtained from the trial plots during the year. Our first crop shows that equally as good results can be attained under similar condition.

We are growing six varieties of sugar cane imported from Honolulu with a view of introducing more profitable varieties than are cultivated in the Islands at present.

Incidentally some experiments have been conducted with garden vegetables. American sweet potatoes were grown in comparison with the native "camote," the result showing that the American potato is equally as prolific as the native potato and far superior in quality.

#### INSECTS AND FUNGI.

It is not surprising to find insects abounding where conditions are so favorable for their development. Scale insects are especially numerous, and it is not uncommon to find several species on a single palm. In such cases the general appearance of the plant plainly indicates the injury done by the insects. Fleshy fungi are in evidence on every hand, both in the forest and among the cultivated plants, and further investigation may show that the failure of certain trees, such as the lauau, to develop mature seeds is traceable to the effects of some fungus. Among cultivated plants fungous diseases are particularly destructive to melons, squashes, and cucumbers, the failure to introduce improved varieties of

watermelons and cantaloupe into the Islands being no doubt due more to this than to any other cause. The native melons appear to be more resistant to the attack of fungous diseases, but yield a fruit of very inferior quality.

Standard solutions commonly used as sprays in temperate climates can not be applied in the Tropics, and it is a difficult matter to make a spray of sufficient strength to kill insects, particularly scale insects, without severely injuring the foliage of the plants. It is not the purpose of this report to give a lengthy discussion of the subject, but merely to call attention to the importance of this feature of the work.

#### SOIL ANALYSIS.

Samples of soil from the three stations have been submitted for analysis. The analyses of samples from the first and second stations were made by Mr. A. M. Sanchez, soil physicist of the Bureau of Agriculture, and samples from the third station by the Bureau of Government Laboratories, the following results being obtained:

Station.	Parts per million of oven-dried soil.			
	Phosphoric acid (PO <sub>4</sub> ).	Nitric acid (NO <sub>3</sub> ).	Potassium (K).	Calcium (Ca).
No. 1 .....	31.50	52.50	8.40	39.37
No. 2 .....	22.45	8.55	7.11	20.15

#### *Analyses by Bureau of Government Laboratories.*

##### STATION NO. 3.

	Sample No. 1.		Sample No. 2.	
	Top soil.	Subsoil.	Top soil.	Subsoil.
	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
Moisture .....	9.30	9.06	9.04	9.44
Loss on ignition .....	17.94	12.72	13.36	15.63
N .....	.305	.187	.137	.172
CaO .....	.21	.12	.006	.21
P <sub>2</sub> O <sub>5</sub> .....	.155	.101	.083	.113
Na <sub>2</sub> O .....	.337	.259	.249	.212
K <sub>2</sub> O .....	.084	.044	.034	.098
Fine earth .....	74.4	77.7	69.0	70.8

#### LABOR.

The natives in this part of the province generally follow the occupation of hunting and fishing, and, since both game and fish are abundant, they find no difficulty in making an easy living in this way. Some trouble, therefore, was encountered at first in getting reliable workmen, who had to be secured in adjoining provinces.

The force now employed is doing very satisfactory work and is paid at the rate of 18 to 24 pesos per month, without board. Laborers could

be employed perhaps for a little less money, but the nature of the work requires reliability, and experience has shown that cheaper labor can not be depended upon.

The plants in the following list, including both the native and foreign tree and plant species, have been planted in the nurseries at Lamao during the last few months:

*Native timber trees.*

Scientific name.	Common name.	Scientific name.	Common name.
Pithecolobium acle .....	Acle.	Pygeum latifolium .....	Aning ng-ay.
Pithecolobium dulce .....	Camanchile.	Pithecolobium lobatum .....	Anagap.
Eugenia sp .....		Canarium .....	Pili.
Cordia subcordata .....	Banalo.	Myristica cuningii .....	Linsin.
Ormosia calavensis .....	Babay.	Cambretum squamosum .....	Malatalang.
Azelia rhomboidea .....	Tindalo.	Moringa oleifera .....	Malatumbaga.
Mimusops elengi .....	Cabiqui.	Dipterocarpus grandiflora .....	Balunggay.
Cassia javanica .....	Caña pistula.	Do .....	Apitong.
Parkia roxburghii .....	Cupang.	Koordersiodendron pinna-	Liamog.
Casalpinia sappan .....	Sibucan.	tum.	Amuguis.
Albizia retusa .....	Languil.	Eugenia sp .....	Tambalao.
Oroxylum indicum .....	Pincapincahan.		Malaruhatnaputi.
Albizia saponaria .....	Languil.		
Azelia bijuga .....	Ipil.	Canarium luzonicum .....	Pili
Garcinia .....	Piris.	Dracontomelum mangife-	Lamio.
Do .....	Paitan.	rum.	
Garcinia binucao .....	Bilucan.	Calophyllum inophyllum .....	Palo maria.
Canarium sp .....	Salong.		Malasomat.
Pterocymbium javanicum .....	Mala sapsap.		Malocmaloc.
Diospyros pilosanthera .....	Bolongeta.	Litsa chinensis .....	Puso puso.
	Malacamanga.	Artocarpus odoratissima .....	Anubing.
Bridelia stipularis .....	Lubalub.	Dipterocarpus mayapis .....	Mayapis.
Terminalia calamansanay .....	Calamansanay.		
	Suho suho.		

*Imported timber trees.*

Scientific name.	Common name.	Country.
Santalum album .....	Sandalwood .....	Ceylon.
Sterculia acuminata .....		Do.
Tristania laurina .....	Water gum .....	Do.
Strandia sudlichon .....	Black cypress pine .....	Do.
Eucalyptus behrnia .....		Australia.
Eucalyptus rostrata .....	Murray red gum .....	Sibpur.
Eucalyptus maculata .....		Australia.
Eucalyptus diversicolor .....	Kaingum .....	Sibpur.
Eucalyptus robusta .....	Swamp mahogany .....	Australia.
Eucalyptus citriodora .....	Lemon-scented gum .....	Sibpur.
Eucalyptus marginata .....	Zarrah .....	Sibpur.
Eucalyptus resinifera .....	Red gum of New South Wales .....	Australia.
Eucalyptus amygdalena .....	Peppermint gum .....	Australia.
Eucalyptus corynocalyx .....	Sugar gum .....	Do.
Eucalyptus globulus .....	Blue gum .....	Do.
Eucalyptus aximia .....		Do.
Eucalyptus sideraphloca .....	Red iron bark .....	Do.
Eucalyptus pilularis .....	Black butt .....	Do.
Eucalyptus tereticumis .....	Forest red gum .....	Ceylon.
Tristania laurina .....	Water gum .....	Do.
Melaleuca leucadendron .....	Teak tree .....	Do.
Lyncaripa laurefolia .....	Turpentine tree .....	Do.
Casuarina glauca .....	Acacia .....	Australia.
Albizia lucida .....		Sibpur.
Dalbergia sissoo .....		Do.
Thesperia populnea .....	Tulip, tree .....	Do.
Manihot glaziovii .....	Ceara rubber .....	Ceylon.
Hevea brasiliensis .....	Para rubber .....	Do.
Ficus elastica .....	East India rubber .....	Do.
Castilleja elastica .....	Central American rubber .....	Do.
Sterculia acerifolia .....		Australia.
Callitris varrucosa .....		



*Native ornamental trees.*

Scientific name.	Common name.	Scientific name.	Common name.
Poinciana regia	Fire tree.	Pithecolobium saman	Rain tree.
Caesalpinia pulcherrima	Caballero.	Orania philippinensis	Barangol.
Cassia florida	Acacia.	Sterculia foetida	Calumpang.
Lagerstroemia speciosa	Banaba.	Bixa orellana	Achioté.
Leucaena glauca	Ipil falso.	Jatropha curcus	Tuba.
Pandanus	Pandan.	Jatropha multifida	Mavia.
Erythrina indica	Dapdap.	Cananga odorata	Ilang-ilang.
Areca catechu	Betel-nut palm.	Sesbania grandiflora	Catural.
Caryota cumingiana	Taguipan.		

*Imported ornamental trees.*

Scientific name.	Common name.	Country.
Acacia arabica	Acacia.	Ceylon.
Acacia decurrens	do.	Do.
Grevillia robusta	Silky oak	Do.
Aleurites cordata		Hongkong.
Kadsura chinensis		Do.
Heteropanax grageans		Do.
Albizia lebbek		Do.
Enkianthus quinque floras		Do.
Rhodalia championi		Do.
Bauhinia acuminata		Do.
Caesalpinia nuga		Do.
Cancellia reticulata	Tea oil tree	Do.
Stillingia sebriferum	Paper mulberry	Do.
Peltaphorum ferrugineum		Ceylon.
Cinnamomum camphora	Camphor tree	Do.
Swietenia macrophylla	Mahogany	Japan.
Caesalpinia		Sibpur.
		Australia.

*Native ornamental plants and flowers.*

Scientific name.	Common name.	Scientific name.	Common name.
Crinum asiaticum	Crinum.	Justicia gardenia	Gardenia.
Crinum gigantum	Do.	Panax fruticosum	
Canna iridiflora	Canna.	Boehmeria nivera	Rami.
Canna variegata	Do.	Graptophyllum hortense	
Rosa sp.	Native rose.	Gardenia florida.	Sulipa.
Plumeria maritima		Hibiscus rosa sinensis	Hibiscus.
Orchids, 100 species	Not identified.	Hibiscus tricolor	Do.
Ferns, 20 species	Do.	Hibiscus ruber plenus	Do.
Asplenium nidus	Birds'-nest fern.	Hibiscus creuntes ninatus	Do.
Asparagus plumosus nanus	Asparagus fern.	Aralia cordata	Aralia.
Caladium sp.	Caladium.	Cordylone terminalis	
Viola cornuta	Violet.	Asparagus plumosus blampeldi.	Asparagus fern.
Caladium bulbosum	Caladium.	Laurus camphora	Camphor.
Colocasia indica	Do.	Plumiera acutifolia	Calasul.
Colocasia antiquarium	Do.	Alternanthera paronchio-	Border plant.
Begonia rex	Begonia.	des.	
Begonia rosea	Do.	Cudrania javanensis	Tahid la buyo.
Colcus barbatus	Colcus.	Psychotria tacho	Tagpo.
Ipomoea canaca	Convolvulus.	Bridellia	Lando.
Ipomoea sp.	Cypress vine.	Gilricidia maculata	Cacauate.
Thunbergia grandiflora		Abrus precatorius	Pagasaga or wild rice.
Clitoria ternatea	Calocanting.	Celosia sp.	Cockscomb.
Sampanium sambac	Sampaguita.		
Lonicera	Honeysuckle.		
Codiaeum variegatum	Codeum.		

*Imported ornamental plants and flowers.*

Scientific name.	Common name.	Country.
<i>Azalia japonica</i>	Japonica	Japan.
<i>Paeonia officinalis</i>	Peony	Do.
<i>Chrysanthemum frutescens</i>	Chrysanthemum	Do.
<i>Magnolia grandiflora</i>	Magnolia	Do.
<i>Hydrangea hortensis</i>	Hydrangea	Do.
<i>Camellia japonica</i>	Camellia	Do.
<i>Calycanthus</i>	Calycanthus	California.
<i>Deutzia crenata</i>	Deutzia	Do.
<i>Spiraea digitata</i>	Spirea	Do.
<i>Clematis hybrida</i>	Clematis	Do.
<i>Lonicera</i>	Honeysuckle	Do.
<i>Hedera</i>	Ivy	Do.
<i>Wisteria chinensis</i>	Wisteria	Do.
<i>Rosa</i> sp.	Roses	Do.
<i>Prunus</i> sp.	Flowering almonds	Do.
	Crape myrtle	Do.
<i>Ampelopsis quinquefolia</i>	Ampelopsis	Do.
<i>Bignonia argyræa</i>	Bignonia	Do.
<i>Lonicera</i>	Honeysuckle, variegated	Do.
<i>Dolichos lablab</i>	Purpurea	Australia.
<i>Dolichos</i> sp.	Punces Helen	Do.
<i>Helix</i>	Lilac	California.

*Native fruits.*

Scientific name.	Common name.	Scientific name.	Common name.
<i>Ananassa sativa</i>	Piña.	<i>Streblus asper</i>	Callus.
<i>Anona squamosa</i>	Ates.	<i>Memecylon edule</i>	Coles.
<i>Anona muricata</i>	Sour sop.	<i>Mangifera altissima</i>	Paho.
<i>Psidium guayaba</i>	Guayaba.	<i>Spondius mangifera</i>	Alubihon.
<i>Diospyros discolor</i>	Mabolo.	<i>Spondius purpurea</i>	Sirihuelas.
<i>Mangifera indica</i>	Mango	<i>Cocos nucifera</i>	Cocoanut.
<i>Citrus medica</i>	Lemón, Buyag.	<i>Eugenia jambolana</i>	Duhat.
<i>Citrus aurantium</i>	Orange, Suha.	<i>Euphoria cinerea</i>	Alupag.
<i>Musa sapientum</i>	Banana.	<i>Muntingia calabura</i>	Cerezas.
<i>Artocarpus integrifolia</i>	Jak fruit.	<i>Manihot utilisima</i>	Camoting cahoy.
<i>Tamarindus indicus</i>	Tamarind.	<i>Anacardium occidentale</i>	Casoy.
<i>Carica papaya</i>	Papaya.	<i>Sandoricum indicum</i>	Santol.
<i>Achras sapota</i>	Chico.	<i>Artocarpus incisa</i>	Latuan.
<i>Terminalia catappa</i>	Talisai.	<i>Terminalia edulis</i>	Calumpit.

*Imported fruits.*

Scientific name.	Common name.	Country.
<i>Citrus nobilis</i>	Orange	Japan.
<i>Citrus aurantium</i>	do	California.
<i>Diospyros kaki</i>	Persimmon	Japan.
<i>Prunus pseudo</i>	Plum	Do.
<i>Alea smapaca</i>	Olive	California.
<i>Musa cavendishii</i>	Banana	Honolulu.
<i>Coffea arabica</i>	Coffee	Ceylon.
<i>Ficus carica</i>	Fig	California.
<i>Rubus villosus</i>	Blackberry	Do.
<i>Rubus invedus</i>	Raspberry	Do.
<i>Ribes rubium</i>	Currant	Do.
<i>Prunus persica</i>	Peach	Do.
<i>Nigrus communis</i>	Pear	Do.
<i>Prunus amygdalus</i>	Almond	Do.
<i>Hicoria pecan</i>	Pecan	Do.
<i>Castanea vera</i>	Chestnut	Do.
<i>Punica granatum</i>	Pomegranate	Do.
<i>Citrus aurantium</i>	Orange	Do.
<i>Citrus medica</i>	Lemon	Do.
<i>Persea gratissima</i>	Alligator pear	Honolulu.
<i>Aleurites triloba</i>	Candle nut	Ceylon.
<i>Ananassa sativa</i>	Pineapple	Do.

*Miscellaneous plants and native vegetables.*

Scientific name.	Common name.	Scientific name.	Common name.
Musa textilis	Abacá.	Sesamun indica	Languis.
Ipomoea batatas, 4 varieties	Sweet potato.	Diospyros pilosanthera	Bolongeta.
Cucurbita maxima	Squash.	Gnetum gnemon	Collat.
Citrus vulgaris	Watermelon.	Aleurites trisperma	Bulacanag.
Solanum melongena	Eggplant.		Bitac gubat.
Lycopersicum esculentum	Tomato.		Malacap.
Phaseolus vulgaris	Patani.		Balangasay.
Zea mays	Corn.		

*Forage plants, fibers, and imported vegetables.*

Scientific name.	Common name.	Country.
Artriplex numularis	Salt bush	Australia.
Euchlaena luxurians	Teosinte	America.
Sorghum vulgare	Sorghum	Do.
Saccharum officinarum	Sugar cane, 6 varieties	Honolulu.
Gossypium herbaceum	Cotton	America.
Asparagus officinalis	Asparagus	Do.
Beta vulgaris hortensis	Beets	Do.
Lactuca sativa	Lettuce	Do.
Ipomoea batatas	Sweet potato, 3 varieties	Do.
Cucurbita melapepo	Pumpkin	Do.
Solanum melongena	Eggplant	Do.
Lycopersicum esculentum	Tomato	Do.
Hibiscus esculentum	Okra	Do.
Phaseolus vulgaris	Lima bean	Do.
Zea mays	Corn	Do.
Vigna catjang	Field peas	Do.

**TIMBER-TESTING LABORATORY AND WORKSHOP.**

The work of the laboratory and workshop during the first half of the year was devoted largely to the preparation of the forest exhibit for the Louisiana Purchase Exposition. The work was nearly all hand work, the wood-working machines not being installed until late in February.

The testing of timber was suspended to a large extent during the preparation of the forest exhibit and was resumed late in April, since which time it has progressed very satisfactorily. Up to April 22, 1904, 150 tests had been made of 82 different species. Since April 22 the work of timber testing has been under the supervision of Mr. Rolland Gardner, who has made 113 tests on 58 kinds of woods, 46 of which tests were made on 13 different species of Borneo woods. The results of the above tests have been tabulated and are appended. These tests, being made from a small number of specimens of each kind of wood, are merely approximations, but a more complete and systematic series of tests has recently been inaugurated. One hundred specimens  $4\frac{1}{2}$  by  $4\frac{1}{2}$  inches by 6 feet of each of the six leading native construction woods have been secured from Manila markets and tests on the same will be started at once. Specimens will also be secured from different provinces: complete data concerning each will be noted, including botanical and silvicultural notes, location of forest from which specimen is secured, photographs showing

tree form, bark, etc., as well as the uses of wood, prevailing prices in the log, and of the manufactured lumber, etc.

The statistics compiled by this Bureau show that during the past four years more than 700 kinds of native woods have entered the Manila market. Of this large number, 37 species represent fully 75 per cent of the total amount marketed. Complete tests of these leading woods will be made within the next two years, but with the limited force at our command the tests on the first 20 can not be completed until June, 1905. As complete results are obtained, it is intended to publish the same in bulletin form, along with complete notes on the silvicultural characteristics of the tree species, uses to which the timber is put, character of by-products yielded by the tree or bark, and any other information available from a botanical or forestal point of view. In testing woods the methods adopted by the United States Government will be followed so far as practicable.

Sets of wood samples have been prepared of more than 80 species, which have been botanically determined, and the same will be distributed to scientific and other institutions in the near future. As a rule, a section 3 feet in length of the log which is sent in with the botanical material is taken and placed in the exhibition room in the laboratory. This section is so cut as to expose the sapwood and heartwood in plane surface and in cross section.

One fact was noted in examining the native construction woods for moisture contents, viz, the woods that are used in ordinary construction in Manila are not seasoned, but are put into use immediately on being brought in from the forest. A recent test on a piece of lauan showed that it contained 73 per cent moisture, and a large number of pieces in the average lumber yard in Manila will show from 40 to 60 per cent moisture.

A fairly complete set of woodworking machines was received from the United States in February and installed in the workshop. Since that time the work in the shop has progressed rapidly and with excellent results, the receipts for work done amounting to about ₱3,000 during the last five months, and in a short time the shop will be able to place itself on a paying basis.

This shop was established with two objects in view: First, to show the value and beauty of our more important woods and to find uses for woods which are not popular at present in the market, but which are found in abundance in the forests of the Islands; second, to train Filipinos as carpenters and as cabinetmakers, and also to teach them the use of different woodworking machines. The second object has not been successfully attained, due to the fact that the workmen will not remain long enough in one position to thoroughly master the work. This constant change of workmen suggested the idea of combining the work of this

shop with the proposed furniture factory to be started at Bilibid Prison in Manila. This change has been approved and our three master cabinet-makers will, after October 1, transfer all our woodworking machines and supplies to Bilibid, and, combined with the machines ordered from the United States for the furniture factory and with the assistance of a large force of prisoners, they should be in a position to accomplish results much more rapidly than is possible in the present workshop.

A recent inventory gives the value of the woodworking machines at ₱11,622.69; value of supplies, not including lumber and logs, ₱3,546.96; value of lumber and logs in the yard and in the kiln, ₱3,015.21.

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Table of results obtained at the Bureau of Forestry timber-testing laboratory, Manila, P. I., during the period June 1, 1902, to January 28, 1904.

Common name.	No.	Botanical name.	Date of test.	Com- pres- sion end- wise, pounds per square inch.	Cross bending.			Strength in ten- sion, pounds per square inch.	Strength in shear, pounds per square inch.	Specific gravity of beam.
					Strength at elastic limit, pounds per square inch.	Strength at rup- ture, pounds per square inch.	Modulus of elasticity, pounds per square inch.			
Acle	1	Pithecolobium acle	Feb. 10, 1903	5, 490	10, 910	15, 500	1, 076, 000	10, 730		0.67
Agoho	2	Casuarina equisetifolia	July 6, 1903	12, 890	11, 500	13, 500	1, 674, 000	16, 480		.96
		do	June 22, 1903	12, 550	9, 650	10, 800	2, 102, 000	21, 800	940	1.08
Alupag	3	Euphorbia cinerea	do	11, 260	4, 490	10, 260	1, 429, 000	13, 550	660	1.02
		do	Nov. 20, 1902	15, 110	17, 620	19, 700	2, 448, 000	17, 600		.96
Amugus	4	Koordersiodendron pinnatum	Aug. 11, 1903		10, 910	15, 500	1, 567, 000			.82
Anilao	5	Columbia blancol	Apr. 2, 1903	5, 140	8, 390	8, 380	1, 034, 000		440	.46
		Columbia serratafolia	Dec. 3, 1902	2, 930	2, 080	2, 080	502, 000	2, 190		.42
Apitong	6	Dipterocarpus grandiflorus	Sept. 17, 1902	5, 100	5, 960	8, 420	1, 753, 000	9, 250		.72
		do	Sept. 19, 1902	4, 630	4, 530	9, 800	1, 625, 000	9, 290		.70
		do	Nov. 13, 1902	10, 660	10, 200	14, 580	2, 472, 000	11, 050		.77
		do	Mar. 9, 1903	8, 245	11, 500	16, 800	1, 870, 000	640		.76
		do	do	8, 760	12, 300	14, 220	1, 670, 000	530		.72
Antipolo	7	Artocarpus incisa	Nov. 21, 1903	6, 000	9, 830	11, 800	1, 781, 000	13, 800		.78
		do	Nov. 25, 1903	5, 080	4, 200	4, 680	726, 000	5, 350		
		do	Jan. 27, 1904	3, 481	3, 940	5, 340	826, 000			
Aranga	8	Homalium villarium	Mar. 31, 1903	10, 030	12, 220	7, 700	2, 042, 000		340	.89
Balay bayan	9	Pterospermum diversifolium	Apr. 2, 1903		7, 700	8, 320	1, 368, 000			.87
Balete	10	Ficus clusoides	Jan. 27, 1904	5, 827	11, 450	13, 280	1, 449, 300	8, 610		
Baliti	11	Ficus indica	Feb. 10, 1903	6, 580	5, 900	7, 110	1, 340, 000		770	.69
Balobo	12	Dipodiscus paniculatus	Feb. 14, 1903	6, 840	5, 100	5, 660	1, 140, 000			.63
Banalo	13	Thespesia populnea	Dec. 19, 1902	5, 030	7, 410	9, 280	1, 027, 000	7, 650		.56
Bancal	14	Nauclaea	May 12, 1903	7, 110	130	6, 450	1, 261, 000		430	.44
Bancoro	15	Nauclaea blancol	Nov. 14, 1902	7, 640	1, 700	12, 740				
		do	Nov. 18, 1902	9, 140	11, 970	11, 970	2, 117, 000	13, 630		.71
Bancudo	16	Morinda bracteata	Feb. 10, 1903	8, 430	10, 660	14, 220	1, 990, 000		690	.65
Bangat	17	Pterocymbium tinctorium	Jan. 22, 1903	5, 310	4, 600	7, 440	1, 086, 000		230	.52
Banitan	18	Xylopia dehiscent	May 21, 1903	1, 880	2, 910	3, 740	722, 400	4, 090		.39
Batino	19	Astonia macrophylla	Jan. 21, 1903	7, 990	4, 620	11, 000	2, 134, 000	11, 920		.64
Betis	20	Illipe betis	Mar. 20, 1903	9, 365	10, 750	11, 000	1, 366, 000		780	.88
		do	Apr. 22, 1903	6, 630	6, 460	6, 590	1, 502, 000		360	.93
Bibit	21	Engelhardtia spicata	June 1, 1903	1, 450	9, 190	8, 340	1, 638, 000	20, 300	940	.90
Bihonang	22	Ocoteles sumatrana	May 4, 1903	8, 690	6, 970	10, 310	1, 880, 000	15, 490	710	.96
		do	Jan. 20, 1903		5, 250	6, 360	958, 000	4, 075	605	.37

Bitanhol (a) (b)	23	Calophyllum wallichianum do	Feb. 13, 1903 July 24, 1903	9, 670 9, 510	2, 290	6, 730 10, 450	11, 220	1, 840, 000 2, 050, 000	9, 000	610	.81 .73
Calamansalay	24	Terminalia calamansalay	Dec. 3, 1902	10, 370				14, 410		580	.74
Calantas	25	Koordersiodendron pinnatum	Nov. 11, 1902	6, 160				10, 990			.53
Calingag (a) (b)	26	Cinnamomum mercadoi do	Nov. 19, 1902 Dec. 26, 1902	5, 680 5, 230	7, 700	8, 280 6, 810	8, 280 10, 000	1, 191, 000 1, 335, 000	7, 940		.52 .67
Calius	27	Undetermined	June 1, 1903			11, 950	11, 950	1, 156, 000			.64
Calumpit (a) (b)	28	Terminalia edulis do	Aug. 1, 1903 Jan. 28, 1904	6, 790 1, 465	1, 600	10, 030 8, 230	10, 030 8, 710	1, 073, 000 1, 613, 000	10, 400	920	.64
Camagon	29	Diospyros discolor	Nov. 17, 1902	6, 850	1, 460	6, 450	6, 450	1, 258, 000	4, 110	530	.61
Camanguanis (a) (b)	30	Clausena excavata do	May 4, 1903	6, 850 5, 480	1, 680	7, 730 8, 020	8, 690 9, 470	1, 324, 000 1, 471, 000	4, 150 4, 850	680 890	.59 .39
Cupang	31	Parkia roxburghii do	Nov. 25, 1902 Dec. 10, 1902	5, 190 4, 230		8, 445 4, 790	8, 445 6, 400	1, 873, 000 1, 240, 000	7, 110		.43 .38
Cupang Bondoc	32	Albizia	Apr. 27, 1903	5, 060	724	6, 460	6, 460	1, 970, 000	7, 110	480	.59
Dayat Iaya	33	Nitragyne	Jan. 23, 1903	10, 410		5, 630	5, 630	2, 603, 000	9, 480	800	.84
Dilang butiqui (a) (b)	34	Eugenia claviflora do	Nov. 21, 1902 Jan. 23, 1903	9, 435 10, 120		13, 390 13, 390	13, 780 19, 910	2, 603, 000 2, 158, 000	11, 420 10, 100		.87 .63
Divalat na atim	35	Dysoxylum	May 12, 1903	7, 960	2, 440	6, 590	6, 590	1, 452, 000	11, 420	540	.63
Duguan (a) (b)	36	Myrsine sp do	Jan. 27, 1904 Jan. 28, 1904	3, 992 5, 930		5, 612 4, 130	5, 884 4, 130	1, 189, 000 1, 674, 000			.67
Duhat	37	Syzygium jambolana	Feb. 13, 1903	5, 930		4, 780	4, 780	787, 000			.51
Dungon	38	Tarrietia sylvatica do	Mar. 6, 1903	7, 080		9, 720	11, 090	1, 186, 000			.98
Dungon late	39	Heritiera littoralis	Apr. 17, 1903	6, 080	3, 920	6, 540	10, 530	1, 615, 000		660	1.03
Guijo (a) (b)	40	Shorea guiso do	July 24, 1903 Mar. 6, 1903	7, 480 7, 480	2, 150	960	4, 720	7, 660		1, 760	.84
Ipil (a) (b)	41	Azella bijuga do	Jan. 6, 1904 Apr. 15, 1903	7, 480 6, 530		11, 720	13, 140	2, 019, 000		650	.89
Jannah	42	Eucalyptus do	June 1, 1903 July 6, 1903	6, 530 8, 290	910	7, 170 4, 110	7, 170 4, 110	1, 444, 000 1, 243, 000		620	.62
		do	Dec. 11, 1902	5, 980	2, 270	8, 640	8, 640	1, 527, 000	12, 670	580	.59
		do	Dec. 16, 1902	6, 060		6, 310		1, 429, 000	14, 425		.75
		do	Feb. 2, 1903	6, 130		8, 240		1, 147, 000	12, 600		
		do	do	6, 970		8, 800		1, 505, 000	9, 240	1, 130	.88
		do	Mar. 27, 1903	8, 520		10, 000		1, 815, 000		960	.87
		do	Sept. 10, 1902	6, 540		6, 100		1, 601, 000		460	.80
		do	Mar. 21, 1903	5, 670	680	5, 540	6, 730	1, 274, 000	9, 000		.80
		do	May 12, 1903	5, 990	840	7, 530	7, 530	1, 892, 000		500	.67
		do	do	7, 280		7, 530		1, 274, 000		360	.49
		do	May 22, 1903	3, 960	1, 050	6, 350	6, 350	1, 495, 000	10, 180	370	.35
		do	do	3, 960		910		1, 495, 000	6, 180	240	.67
		do	July 23, 1903	4, 970	1, 070	6, 350	6, 350	1, 294, 000	8, 760	260	.65
		do	June 1, 1903	5, 610	1, 040	9, 920	10, 560	1, 342, 000			.52
		do	June 22, 1903	8, 250	970	3, 920	3, 920	1, 049, 000	10, 270		.74
		do	do	8, 360		2, 120		1, 709, 000	7, 940	530	.72
		do	July 6, 1903	8, 360		6, 570	8, 350	1, 548, 000		500?	.73
		do	June 1, 1902			7, 540	7, 540	1, 687, 000	12, 960		.71
		do	do			18, 470	22, 340	2, 575, 000			1.02
		do	Apr. 27, 1903	8, 210	1, 940	8, 250	8, 250	1, 702, 000		710	.84
Lisong insac (a) (b) (c) (d)	45	Sapotaee do do do	June 1, 1903 June 22, 1903 July 6, 1903	8, 250 8, 150 8, 360							
Liusin (a) (b)	46		Apr. 27, 1903								

Table of results obtained at the Bureau of Forestry timber-testing laboratory, etc.—Continued.

Common name.	No.	Botanical name.	Date of test.	Compression end-wise, pounds per square inch.	Compression side-wise, pounds per square inch.	Cross bending.				Strength in shear, pounds per square inch.	Specific gravity of beam.
						Strength at elastic limit, pounds per square inch.	Strength at rupture, pounds per square inch.	Modulus of elasticity, pounds per square inch.	Strength in tension, pounds per square inch.		
Luan (?)	47	Bucanania florida	Jan. 22, 1904	5,590	---	7,400	10,240	1,453,000	5,600	802	0.81
Macassin	48	Eugenia	Jan. 27, 1903	6,390	---	7,950	11,760	1,855,000	20,120	---	1.01
---	---	do	Apr. 2, 1903	9,675	---	10,540	13,250	1,131,000	---	540	90
---	---	do	Apr. 7, 1903	---	---	12,620	15,780	1,921,000	6,510	---	90
---	---	do	Jan. 28, 1904	5,688	1,450	7,900	8,410	1,650,000	---	---	84
Macassa	49	Cleidion javanicum	May 4, 1903	6,710	3,750	5,580	5,580	1,122,000	3,000	390	58
Macapali	50	---	May 22, 1903	10,340	7,660	14,500	14,500	2,270,000	15,580	550	1.32
---	---	do	July 24, 1903	---	---	14,530	14,530	2,394,000	---	---	1.27
---	---	do	do	11,660	6,240	15,040	15,040	3,049,000	14,850	1,540	1.77
Magalat	51	Harpullia blancoi	Feb. 10, 1903	6,210	---	4,720	6,250	1,560,000	4,760	---	72
Malabino	52	Alstonia	May 12, 1903	7,860	---	3,670	5,670	1,835,000	---	---	67
Matasaguin lalagui	53	Vidalia	July 6, 1903	7,370	1,940	4,740	7,860	1,226,000	3,320	450	74
Matemoyan	54	Casuarina	Mar. 27, 1903	7,620	3,250	13,200	13,320	1,500,000	---	690	73
Mamboog	55	Nuclea blancoi	May 6, 1903	5,600	---	7,470	8,150	1,275,000	---	---	49
Mangasinoro	56	Fagraea	Feb. 13, 1903	4,130	---	3,010	---	1,382,000	---	---	81
---	---	do	Mar. 31, 1903	4,680	1,200	6,820	8,520	1,253,000	7,010	---	69
Marumances na lalague	57	Undetermined	July 24, 1903	11,570	2,610	8,610	8,610	2,175,000	---	1,010	1.02
Molave	58	Vitex littoralis	May 21, 1903	6,450	3,350	9,240	9,910	1,097,000	2,560	440	1.12
Narra pula	59	Pterocarpus echinatus	May 12, 1903	5,990	1,170	4,800	4,800	1,065,000	---	330	1.44
Paitan	60	---	Jan. 6, 1904	3,573	---	---	---	---	---	---	---
---	---	do	do	3,540	---	---	---	---	---	---	---
Palo Maria	61	Calophyllum inophyllum	Mar. 18, 1903	8,070	2,750	5,770	---	1,183,000	---	780	71
---	---	do	Jan. 6, 1904	8,070	---	---	---	---	---	---	---
---	---	do	Jan. 8, 1904	4,495	---	---	---	---	---	---	---
Palosapis	62	Dipterocarpus palosapis?	Aug. 11, 1903	5,340	1,120	3,210	9,290	844,800	850	---	60
---	---	do	Jan. 22, 1904	7,511	460	11,550	11,550	2,074,850	12,980	---	58
Palasanguin	63	Canarium cumingii	Jan. 28, 1904	7,310	---	7,220	7,220	1,647,000	---	---	58
Pamiasin	64	Leguminosae	July 4, 1903	5,530	800	10,940	10,940	1,529,000	7,580	430	63
Pangui	65	Turpinia pomifera	May 17, 1903	3,300	---	4,490	4,490	1,165,000	4,340	230	55
Parua	66	Pinus mercurii	Feb. 17, 1903	8,470	---	6,070	8,400	944,000	---	---	69
---	---	do	Apr. 23, 1903	8,470	---	10,710	10,710	1,863,000	---	300	63
---	---	do	Apr. 25, 1903	8,610	1,550	10,180	10,180	1,908,000	---	600	61
---	---	do	June 22, 1903	7,410	1,550	6,200	6,200	1,648,000	11,070	410	61
---	---	do	do	6,730	1,390	5,530	5,530	1,108,000	4,840	410	59
---	---	do	do	7,560	1,510	9,990	13,480	1,975,000	9,910	590	66
---	---	do	July 6, 1903	7,410	1,560	9,520	9,520	1,101,000	11,640	780	61
---	---	do	do	7,410	---	---	---	---	---	---	---



Payina (a)	67	Xylopia deliensis	July 24, 1903	7, 750	2, 360	7, 450	1, 083, 000	10, 800	72
do (b)		do	do	4, 650	1, 080	11, 370	2, 170, 000	480	73
Piri piri	68	Canarium luzonicum	Sept. 20, 1903	6, 235		3, 820	434, 500	3, 410	75
Redwood, California	69	Sequoia sempervirens	May 22, 1903	2, 540		5, 730	66, 720		57
Santol	70	Sandoricum indicum	July 24, 1903	5, 239		5, 500	1, 126, 000		50
(a)		do	Jan. 22, 1904			7, 420	1, 508, 000	7, 070	54
(b)		do	Jan. 28, 1904			8, 950	1, 383, 000		48
(c)		do	June 1, 1903			5, 850	2, 110, 000	11, 800	90
(d)		do	Jan. 23, 1903	7, 220		10, 580	1, 838, 000	1, 350	85
Saguin nang calao	71	Myristica	Mar. 18, 1903	10, 100	2, 530	14, 560	1, 137, 000	9, 670	72
Supa (a)	72	Sindora wallichiana	Jan. 6, 1903	6, 070		7, 460	227, 000	4, 710	35
(b)		do	Jan. 22, 1903	3, 750	1, 260	5, 770			48
Talisay	73	Terminalia catappa	Jan. 6, 1903	2, 860		3, 440	575, 000	2, 595	88
Taloto	74	Pterocymbium tinctorium	Nov. 17, 1902	8, 275		8, 150	2, 100, 000	12, 860	36
Tangisen	75	Mallotus moluccanus	Jan. 2, 1903	8, 800		4, 820	792, 000	3, 835	92
Taquit asin	76	Azela rhomboides	Nov. 21, 1902	3, 940		4, 070	770, 000	17, 180	90
Tinaan Pantay	77	Dolichandrone spathacea	Jan. 17, 1903	7, 170		9, 090	1, 951, 000	16, 670	1, 015
Tindalo	78	do	Jan. 30, 1903	7, 490		9, 420	1, 861, 000		60
Tua (a)	79	Agavea clarkii	Feb. 12, 1903	6, 550		11, 250	1, 300, 000	11, 230	
(b)		do	Jan. 30, 1903			9, 000			
Tucan calao	80	Albizia littoralis							
Yacal (a)	81								
(b)	82								

REMARKS.—At the test of antipolo, No. 7, on November 25, 1903, the average specific gravity of two blocks was found to be 0.49. At the test on January 27, 1904, the average specific gravity of three blocks was found to be 0.47. At the test of baleta, No. 10, on January 27, 1904, the average specific gravity of five blocks was found to be 1.04. At the test of calantas, No. 25, on November 11, 1902, the average specific gravity of two blocks was found to be 0.455. At the test of camagon, No. 29, November 17, 1902, the average specific gravity of three blocks was found to be 0.79. At the test of jarrah, No. 42, December 11, 1902, the average specific gravity of five blocks was found to be 1.04. At the test on December 16, 1902, the average specific gravity of six blocks was found to be 0.99. At the test of paitan, No. 60, on January 6, 1904, the average specific gravity of three blocks was found to be 0.98. At the test of palo maria, No. 61, on January 8, 1904, the average specific gravity of six blocks was found to be 0.87. At the test of tua, No. 79, on November 21, 1902, the average specific gravity of two blocks was found to be 0.39.

Table of results obtained at the Bureau of Forestry timber-testing laboratory, Manila, P. I., during the period April 26, 1904, to June 30, 1904.

Common name.	Botanical name.	Specific gravity of beam when tested.	Percent of moisture.	Cross bending.			Compression endwise (pounds per square inch).	Compression sidewise (pounds per square inch).	Tension (pounds per square inch at failure).	Shear along the grain (pounds per square inch).	Specimens sent from provinces.
				Stress at elastic limit (pounds per square inch).	Stress at rupture (pounds per square inch).	Modulus of elasticity (pounds per square inch).					
Alupac	Euphorbia cinerea	1.05	7	12,950	12,950	1,985,000	12,870	5,370	14,275	1,826	Zambales.
Alupac	do.	1	6.3	8,100	8,950	2,080,000	11,910	4,970	14,400	1,023	Do.
Aninapia	Albizia lebbek	.71	10.6	8,400	11,650	1,428,000	6,260	1,705	13,150	1,080	Do.
Apitong	Dipterocarpus grandiflorus	.765	10.4	9,000	12,400	1,730,000	6,300	1,735			Do.
Do	Dipterocarpus grandiflorus	.795	12.4	10,450	14,450	2,500,000	7,410	2,260			Do.
Aranga	Homalium brandae	.81	8.8	8,400	12,600	1,500,000	7,465	2,260			Tayabas.
Aninapia	Albizia lebbek	.683	10.1	8,200	8,200	1,270,000	6,620	1,685	11,700	1,270	Do.
Bagas	Sternilia	.51	8.2	6,400	7,300	1,160,000	5,110				Mindoro.
Babay	Ormosia calavensis	.60	10	9,150	11,420	1,470,000	7,140				Tayabas.
Do	do.	.602	10.5	5,700	5,700	1,560,000	6,345				Do.
Do	do.	.60	10.3	7,700	11,100	1,450,000	6,920				Do.
Balete	Ficus indica	.85	20.7	9,500	12,800	1,620,000	7,370	1,540	12,400	705	Do.
Bayoc	Pterospermum niveum	.58	10.7	8,950	9,560	1,300,000	6,300	930	17,675	1,127	Masbate.
Do	do.	.545	5.3	9,750	1,300	1,880,000	7,840	1,190	12,000		Tayabas.
Betis	Palaquium	.615	15	6,000	6,000	1,120,000	5,280	1,480	13,300	780	Do.
Do	do.	.72	8.6	9,100	10,400	1,500,000	7,840	2,870	9,350	825	Do.
Bohave	Dysoxylum decandrum	.625	8.7	( <sup>1</sup> )	( <sup>1</sup> )	1,460,000	4,690	940			Masbate.
Bolongta	Diospyros pilosanthra, Blanco	.806	16	8,050	12,410	2,410,000	5,932	1,365	14,900	670	Zambales.
Bugo	Dracontomelum mangiferum, Blume	.99	68	6,850	8,000	1,680,000	3,760	1,570	10,050	550	Masbate.
Calumanog	Odina?	.70	18	7,800	10,500	1,390,000	5,990	1,510	12,975	1,345	Do.
Do	do.	.708	18	6,000	9,000	1,200,000	6,000	1,555	11,025	1,052	Do.
Calumpit	Terminalia edulis, Blanco	.63	3.2	( <sup>1</sup> )	( <sup>1</sup> )	1,120,000	6,950				Tayabas.
Camangsi	Artocarpus camansi? Blanco	.74	7.9	7,600	10,000	2,140,000	8,460				Do.
Cupang	Parkia roxburgii	.345	10	( <sup>1</sup> )	( <sup>1</sup> )	800,000	3,425	493	17,700	1,500	Zambales.
Do	do.	.44	4.3	6,500	8,200	1,140,000	5,440		9,175	415	Do.
Dalindangan	Shorea sp	1.02	16.6	12,750	17,400	2,160,000	9,200	2,700	20,650	875	Zambales.
Duguan	Myristica	.58	12	7,200	7,200	1,100,000	4,636	2,945		( <sup>2</sup> )	Do.
Do	do.	.573	8.2	6,300	6,300	1,260,000	6,275	2,700	8,150	1,120	Tayabas.
Dulitan pula	Palaquium	.60	6	9,250	9,250	1,600,000	9,010	1,595	12,425		Do.
Dulitan	Cratoxylum blancoi	.95	6.5				5,730	1,725	7,885	940	Do.
Guyon guyon	Gyrocarpus jacquini, Roxb	.64	11	6,550	7,100	1,340,000		( <sup>3</sup> )			Do.
Hanagdon		.245		1,540	1,540	3,200,000	1,685	( <sup>3</sup> )			Do.

<sup>1</sup> Beam sheared.<sup>2</sup> Poor piece.<sup>3</sup> Poor piece, badly checked.

Lanutan	Anonacee	58	14	5,350	7,200	1,100,000	4,500	1,120	7,700	1,345	Do.
Do.	do.	575	11.5	5,800	6,800	1,025,000	5,085	1,265	7,950	1,240	Do.
Do.	do.	785	6.4	7,400	9,700	1,890,000	9,975	3,300	18,450	1,285	Do.
Lanutan	Xylopiia delhiscens, Merr.; Xylopiia bian-	79	8.5	7,250	11,400	1,790,000	11,035	3,550			Mindoro.
	col, Vidal.										
Ligan	Zizyphus zoniatus	68	8.7	9,100	9,350	1,560,000	5,270	2,075	9,330	790	Tayabas.
Lingo lingo		96	8.8	8,700	12,000	1,860,000	7,740	3,525		1,620	Zambales.
Do.		57	9.5	6,500	8,000	1,370,000	5,690	2,075		1,365	Do.
Liscac	Nauclaea glaberrima	52	12	7,100	8,700	1,506,000	5,575		8,200	865	Tayabas.
Nacaasin	Eugenia	57	11	5,650	5,650	1,113,000	4,556	1,105	7,150	945	Do.
Do.	Eugenia operculata ?	91	25	9,200	12,740	1,550,000	6,470	2,015	15,000	890	Do.
Do.	Eugenia	925	29	7,700	11,100	1,760,000	5,080	1,915	13,450	600	Masbate.
Mala-banuyo or Mala-iba	Myristica	486	6.5	5,450	6,550	911,000	4,780		5,300	605	Tayabas.
Malacadios	do.	895	28	6,600	7,250	2,660,000	6,775		14,800	642	Do.
Do.	do.	80	10.3	9,800	13,600	2,250,000	7,100				Camarines.
Malapaho	Mangifera	655	3.9	9,500	12,000	1,700,000	7,650	1,875		775	Zambales.
Malapali or Macapali		1.26	7.6	15,500	15,500	2,740,000	13,500				Tayabas.
Malapayao	Cymometra	985	12	9,380	10,830	2,500,000	8,120	3,100	13,000	1,140	Do.
Malagueum	Aglaia	765	12			1,623,000	6,640	1,730	13,600	1,270	Do.
Malugay		59	12			1,220,000	3,530	1,080	8,500	1,020	Do.
Margabulo		78	7.8	7,450	9,330	2,450,000	10,275				Masbate.
Do.	Canarium	72	13.2	12,000	16,200	1,800,000	6,900	1,605	8,500	650	Do.
Do.	do.	75	21.8	7,300	10,600	1,550,000	3,930	1,290	13,150	550	Do.
Pagsanguin		588	12	6,900	7,940	1,365,000	5,440	1,370	9,500	570	Do.
Pangunpangun	Canarium cuningii	60	8.9	9,050	10,200	1,580,000	5,850				Zambales.
Pili		915	12	20,000	10,200	2,700,000	9,235				Do.
Do.	Canarium luzonicum, Miq.	57	11	6,300	8,450	1,715,000	5,900	1,080	6,825	651	Masbate.
Do.	do.	63	10.1	7,600	9,300	1,530,000	5,915	1,490	5,250	740	Tayabas.
Do.	do.	57	9.7	6,740	9,400	1,700,000	5,640	1,365	10,260	570	Masbate.
Tambon tambon	Parnarium salicifolium, Miq.	77	10.5	8,400	10,700	1,860,000	6,315	2,090	14,750	1,115	Do.
Do.	do.	814	12	8,250	11,800	1,750,000	7,260	2,425	13,450	938	Do.
Tamaayan		638	12.4	7,000	7,000	1,328,000				651	

Due to the large amount of Borneo lumber imported into the Philippine Islands during the past year, it is deemed desirable to submit the following result of a series of tests made on the same:

#### TESTS OF THIRTEEN BORNEO WOODS.

The pieces were sawed to  $4\frac{1}{2}$  by  $4\frac{1}{2}$  inches and then placed in the dry kiln for about six days, after which they were dressed to 4 by 4 inches.

For the tests in flexure, the span in each case was 57 inches and the load was applied at the rate of 0.3 inch per minute.

The elastic limit was taken at the point where a very small increase of load produced 50 per cent greater deflection than the same increase of load produced when the loading of the beam was started. The results given under "Stress at elastic limit" are the stresses at the outer fibers, in pounds per square inch. The results given under "Stress at rupture" are the stresses at the outer fibers, in pounds per square inch, when failure occurred.

The blocks tested in compression along the grain were 4 by 4 by 8 inches. The results given are in pounds per square inch, when failure occurred. The loads were applied at the rate of 0.06 inch per minute.

The shear tests were in double shear along the grain, an area of  $3\frac{1}{2}$  square inches being sheared in each case. The results tabulated are in pounds per square inch.

#### SELANGAN BATU.

[Also known as "Borneo yacal."]

Test.	Moisture.	Specific gravity.		Stress.		Modulus of elasticity.	Compression along the grain.	Shear.
		Moist.	Dry wood.	At elastic limit.	At rupture.			
No. 1-----	<i>Per ct.</i> 30.9	0.93	0.71	9,700	12,600	1,880,000	7,640	753
No. 2-----	24.2	.82	.66	9,550	11,800	2,080,000	7,430	673
No. 3-----	27	.88	.69	9,730	12,700	2,080,000	7,515	708
No. 4-----	28.5	.885	.696	9,400	12,200	2,070,000	7,085	890
Average-----			.689	9,595	12,325	2,027,000	7,420	755

#### PENAGAH.

	<i>Per ct.</i>							
No. 1-----	10.8	0.608	0.56	7,780	9,100	1,148,000	5,955	854
No. 2-----	10.8	.675	.625	7,800	8,850	1,060,000	5,985	916
No. 3-----	10.9	.64	.588	8,450	9,700	1,350,000	6,575	900
No. 4-----	14	.69	.604	7,480	7,780	1,000,000	5,560	847
Average of Nos. 1, 2, and 4-----			.594	7,880	8,860	1,140,000	6,020	880

## MERABAU.

[Also known as "Borneo ipll."]

	Per ct.							
No. 1-----	22.2	1.16	0.95	13,800	18,400	2,475,000	8,425	1,123
No. 2-----	18.2	1.16	.98	15,200	19,200	2,520,000	10,490	872
No. 3-----	83.7	.85	.64	8,380	12,000	1,800,000	7,005	694
No. 4-----	22.6	1.18	.965	13,000	18,900	2,520,000	8,185	1,098
Average of Nos. 1, 2 and 4 <sup>1</sup> -----			.965	14,000	18,830	2,505,000	9,035	1,030

<sup>1</sup>The results of test No. 3 were not averaged in with the others, owing to the high per cent of moisture and the low specific gravity of the specimen.

## CAMPHOR.

	Per ct.							
No. 1-----	20.9	0.725	0.60	8,450	11,600	1,960,000	6,810	459
No. 2-----	20	.725	.605	8,470	11,900	1,890,000	6,495	539
No. 3-----	20.6	.75	.623	8,850	12,400	2,020,000	6,450	673
No. 4-----	23.3	.75	.61	8,050	10,650	1,730,000	6,450	558
Average-----			.61	8,455	11,490	1,900,000	6,540	557

## BILLIAN.

[Also known as "Ironwood."]

	Per ct.							
No. 1-----	28.9	1.12	0.87	16,100	19,700	2,150,000	11,035	598
No. 2-----	22.3	1.2	.98	18,200	21,000	2,570,000	11,910	920
No. 3-----	19.2	1.19	1.	18,100	22,000	2,565,000	12,025	1,090
No. 4-----	19.7	1.18	.99	13,600	15,950	2,250,000	10,200	970
Average-----			.96	16,500	19,660	2,384,000	11,290	895

## KRUEN.

	Per ct.							
No. 1-----	23.4	0.645	0.524	5,770	8,700	1,600,000	4,805	645
No. 2-----	24.5	.68	.547	6,830	9,400	1,800,000	5,195	545
No. 3-----	24.3	.68	.548	5,700	8,100	1,575,000	4,925	857
No. 4-----	18.8	.645	.548	5,640	8,600	1,440,000	4,440	564
Average-----			.542	5,985	8,700	1,604,000	4,840	653

## SERAIAH MIRA.

[Also known as "Borneo cedar."]

	Per ct.							
No. 1-----	15.9	0.564	0.48	5,770	7,600	1,145,000	4,860	734
No. 2-----	15.1	.555	.583	6,370	8,700	1,350,000	5,030	650
No. 3-----	16.1	.57	.49	4,950	6,500	1,350,000	4,845	470
No. 4-----	17.9	.56	.475	5,500	7,000	1,350,000	4,955	603
Average-----			.507	5,650	7,450	1,299,000	4,920	614

## SERAIAH PUTEH.

	Per ct.							
No. 1-----	32.2	0.66	0.492	6,300	9,650	1,570,000	5,300	604
No. 2-----	26.1	.61	.485	7,040	9,600	1,528,000	5,225	570
No. 3-----	23.3	.605	.492	6,360	9,400	1,570,000	5,035	470
No. 4-----	31	.66	.505	6,700	8,900	1,550,000	5,220	544
Average-----			.493	6,600	9,390	1,554,000	5,195	547

## SELANGAN KACHA.

	<i>Per ct.</i>							
No. 1.....	27.4	0.72	0.568	8,700	11,600	1,645,000	6,700	690
No. 2.....	27.3	.71	.56	7,900	10,950	1,770,000	6,555	630
No. 3.....	25.9	.71	.568	8,050	11,200	1,800,000	6,540	570
No. 4.....	28.9	.71	.568	7,700	10,400	1,710,000	6,225	557
Average.....			.563	8,090	11,040	1,731,000	6,530	612

## OBAR SULUK.

	<i>Per ct.</i>							
No. 1.....	19.3	0.665	0.56	6,800	8,900	1,150,000	5,040	1,070
No. 2.....	16.6	.69	.595	7,700	10,850	1,440,000	5,450	560
No. 3.....	18.3	.70	.59	5,860	9,580	1,260,000	5,325	883
Average.....			.582	6,620	9,780	1,283,000	5,270	840

## RUNGUS.

[Also known as "Borneo rosewood."']

	<i>Per ct.</i>							
No. 1.....	28.6	0.68	0.55	7,700	8,700	1,890,000	5,555	633

## GAGIL.

	<i>Per ct.</i>							
No. 1.....	33.2	0.63	0.424	5,370	7,540	1,350,000	4,955	646
No. 2.....	30.0	.585	.435	6,380	8,600	1,420,000	4,970	784
Average.....			.43	5,875	8,070	1,385,000	4,960	715

## GRITING.

[Also known as "Borneo oak."']

	<i>Per ct.</i>							
No. 1.....	28.2	0.875	0.685	10,400	14,100	1,488,000	7,800	716
No. 2.....	26.6	.905	.72	8,800	10,450	1,485,000	7,425	897
No. 3.....	25.6	.898	.72	8,800	11,800	1,750,000	7,470	936
No. 4.....	22.5	.86	.70	9,130	11,100	1,620,000	7,675	1,075
Average.....			.706	9,280	11,860	1,586,000	7,590	906

## DIVISION OF ACCOUNTS.

This division has charge of all disbursements for the Bureau, as well as the care of the public property for which the Chief of the Bureau is accountable. To equip and maintain the large Manila office and 59 forest stations and pay the traveling and incidental expenses of more than 100 forest inspectors and rangers requires a force of 2 American and 2 Filipino clerks.

A card system is kept which will show at a glance the personal account of salary and traveling expenses of every employee in this Bureau, with all needful information pertaining thereto.

A monthly report by the disbursing officer is rendered to the undersigned which covers the expenses of the different divisions of the Bureau.

Some inconvenience has been experienced since the enactment of Act 1040, which provides for the retaining of salary due for vacation leave until after the expiration of six months, and accrued leave, two years.

New employees are being continually sent out in the provinces who have not served six months, and salaries for periods of absence of these employees must be retained as per the provisions of Act 1040. The salaries of these employees are forwarded on the last day of the month, but reports from employees thus stationed are not received until after the check has been sent, so that in cases of absence deductions must be made from the salary of the next month and the amounts so collected taken up by certificate. This could be avoided by the payment of salaries to employees on the 15th of the following month, thus giving them ample time to render their reports.

A letter from the Executive Bureau, under date of May 19, 1903, states that employees through whose hands public funds pass in the offices of all cashiers and disbursing officers should be bonded. In view of the above letter it is recommended that one other employee in this division be bonded. While he, as a rule, will not have the handling of official funds, it is occasionally necessary to intrust him with comparatively large sums of money.

In the past it has been the policy of this office to require employees who were incurring traveling expenses to send in their expense accounts without completed vouchers. Vouchers were then made out in this office and returned to them for signature and oath. This was done on account of lack of experience in making out such accounts, but it has entailed an enormous amount of work for the small force in this office, necessitating working overtime and delaying the payment of accounts, as well as adding to the volume of correspondence. This is gradually being changed, as a manual has been prepared which contains complete instructions covering all the different accounts for reimbursement of expenses incurred in an official capacity.

*Expenditures for the Bureau of Forestry from July 1, 1903, to June 30, 1904.*

Salaries and wages .....	\$227, 371. 18
Transportation .....	23, 121. 76
Contingent expenses .....	34, 378. 81
Maintenance of launch .....	8, 894. 42
Printing .....	11, 097. 20
Total .....	304, 863. 37

Very respectfully,

GEORGE P. AHERN,  
*Captain, Ninth United States Infantry,*  
*Chief, Bureau of Forestry.*

The SECRETARY OF THE INTERIOR,  
*Manila, P. I.*





# APPENDIX.

## Number and area of private woodlands registered in the Bureau of Forestry.

Province.	Number of estates.	Hectares.	Areas.	Centares.
Tarlac	26	47,024	73	39
Mindoro	2	24,185		
Isabela	7	14,052	20	5
Pampanga	72	8,703	42	3
Rizal	1	4,651	20	12
Zamboanga	2	2,459		
Davao	2	1,150		
Camarines	1	923	60	72
Nueva Ecija	5	859	62	58
Romblon	2	649	92	50
Bulacan	2	644	96	73
Pangasinan	1	479	90	15
Bataan	2	364	76	37
Negros Occidental	2	368	32	46
Laguna	1	195	71	62
Capiz	2	97	99	26
Manila	1	54	56	
Zambales	1	12	44	37
Total	132	106,877	38	35

The largest estate is that belonging to Marcelino Santos, located in the Provinces of Tarlac and Nueva Ecija; area, 13,202 hectares 44 areas.  
1 hectare = 2.47 acres.

## Quantities of forest products taken from the public lands of the Philippines during the fiscal year July 1, 1903, to June 30, 1904.

Province.	Timber (made-ras).	Firewood (leñas).	Char-coal (car-bon).	Dyewood (sapan nigue).	Tanbark (cascas-lote).	Dammar gum copal (almaciga).	Gutta-percha (guta-percha).	India rubber (goma elastica).
	<i>Cu. ft.</i>	<i>Cu. m.</i>	<i>Cu. m.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>
Abra	53,087	930	4					
Albay	75,699	1,535						
Antique	8,344	2,353		2,211	6,050			
Bataan	317,133	18,225	58					
Batangas	10,786	5,233	9					
Benguet	48,114	66						
Bohol	92,536	1,886			4,539			
Bulacan	193,434	8,087	2,623			92,478		
Cagayan	163,031	1,514			23,167			
Camarines	269,060	7,178	12			43,496		
Capiz	44,760	6,693		6,500		3,288		
Cavite	8,425	5,206	10					
Cebu	60,012	1,203			15,813			
Cotabato	11,903	2,134					15,322	8,372
Davao	3,357			150		1,537,866		
Ilocos Norte	48,135	241						
Ilocos Sur	34,738	1,031						
Iloilo	120,210	32,785	1,060	10,310,085	137	140		
Isabela	45,263							
Jolo	1,909	71			5,500		471	221
Laguna	98,752	1,022						
Leyte	180,226	3,138			1,407			
Masbate	166,290	6,824		8,200	27,566			
Mindoro	201,181	5,172	113	33,060		1,533		
Misamis	67,101	29						
Negros Occidental	431,954	29,692			7,261	1,580		
Negros Oriental	39,595	930			5,528			
Nueva Ecija	70,354	2,990			1,600	16,213		
Pampanga	142,107	29,481	10		1,644			
Pangasinan	120,129	5,314	158	2,800	4,521			
Paragua	76,128	501		12,700	13,692	34,161		
Rizal	46,611	19,545	23			2,329		
Romblon	46,589	222				18,855		
Samar	87,324	1,298			42,344	13,478		
Sorsogon	95,831	1,443						
Surigao	33,600	391			84,378			
Tarlac	153,290	5,984				5,617		
Tayabas	600,494	13,925	4		113,923	15,057		
Union	35,825	872						
Zambales	409,683	4,134	2,665	43,880				
Zamboanga	200,562	1,139		200	37,299	4,995	35,063	
Total	4,916,562	230,417	6,749	10,419,786	396,369	1,791,086	50,856	8,593

## Quantities of forest products taken from the public lands, etc.—Continued.

Province.	Breas, resins (balsam and allied prod- ucts).	Oils, panao wood oil (lum- bang).	Beeswax (cera).	Rattan (dillman bejuco).	Honey (miel).	Stakes for fish corrals (esta- cas).	Orchids (para- sitas).	Zuecos (wood for shoes).
	Lbs.	Liters.	Lbs.	Lbs.	Liters.	Cu. m.	No.	Cu. m.
Albay				520				
Antique				71,400				
Batangas			1,291					
Benguet							58	
Bohol		170				20		
Bulacan								263
Cagayan							9	
Camarines	2,200		611			3		
Capiz		234				475		
Cebu		516		2,530		21		
Cotabato			27,023				2	
Davao			64,698		18			
Ilocos Norte			129				5	
Ilocos Sur	150		150					
Iloilo	11,110			26,200		221	16	
Jolo	661		1,169			1		
Laguna				4,200			950	
Leyte		3,344		1,800		559		
Masbate	76,067					382	140	
Mindoro			3,498	158,961	864	2		88
Misamis			100					
Negros Occidental		79,585		87,030		180		
Negros Oriental		4,053		7,923				
Nueva Ecija								65
Pampanga						314		
Pangasinan						26		
Paragua			2,643	2				
Rizal							1,000	
Romblon			336					
Samar	1,450		461	180				
Sorsogon		324						
Surigao		138	497				18	
Tarlac							49	
Tayabas	175,183		13,048				51	
Zambales						187	47	11
Zamboanga			33,404			114		
Total	266,821	88,364	149,058	370,746	882	2,505	2,345	427

Province.	Gratuitous—			Private estates.				
	Timber.	Fire- wood.	Tan- bark.	Timber	Fire- wood.	Char- coal.	Tan- bark.	Stakes.
	Cu. ft.	Cu. m.	Lbs.	Cu. ft.	Cu. m.	Cu. m.	Lbs.	Cu. m.
Abra	6,451							
Bataan	3,253							
Batangas	286	269		3,712	591		150	
Benguet	149,791							
Bulacan	9,863			11,377		70		
Cagayan	5,716							
Camarines	15,450							
Cotabato	2,436							
Davao	401							
Ilocos Norte	41,353			2,642				
Ilocos Sur	4,164			506				
Iloilo	1,650	3,691						
Isabela				573				
Laguna	6,046			525				
Masbate	7,803							
Mindoro	1,259							
Misamis	3,347	26						
Negros Occidental	1,293			90,522	1,204			
Negros Oriental	2,143							
Nueva Ecija	12,237			4,382	3,429			
Pampanga	1,525			4,026	42,381	5,208		95
Pangasinan	11,968			2,793				
Paragua	4,435							
Rizal	4,034			10,256	4,720			
Romblon				9,922				
Samar	22,490							
Sorsogon	1,419							
Surigao	3,616		7,955					
Tarlac	4,472			217,825	672			
Tayabas	17,976							
Zambales	17,928	120,902						
Total	364,755	124,888	7,955	359,061	52,997	5,278	150	95

*Imported into the Philippines during the fiscal year ending June 30, 1904.*

Timber, dutiable .....	cubic feet ..	192, 354
Lumber, dutiable .....	feet B. M. ....	15, 939, 000
Lumber, Government free entry .....	do .....	11, 890, 000

*List of most important Philippine woods received in the market during the four preceding years, arranged in order of quantity.*

No.	Tree species.	Relative order in fiscal year—				Total amount cut during the four years.
		1900-1.	1901-2.	1902-3.	1903-4.	
						<i>Feet B. M.</i>
1	Lauan .....	1	1	1	1	2, 310, 937
2	Apitong .....	4	2	2	2	1, 421, 770
3	Guijo .....	2	4	3	3	1, 036, 508
4	Molave .....	10	3	4	4	826, 044
5	Yacal .....	15	7	5	5	558, 448
6	Narra .....	13	5	6	6	438, 182
7	Tanguile .....	20	6	7	8	363, 351
8	Ipil .....	26	12	8	7	315, 186
9	Dungon .....	5	9	11	9	262, 885
10	Sacat .....	12	11	9	20	207, 978
11	Malasanto .....	3	14	12	21	197, 882
12	Macasin .....	6	25	10	12	187, 417
13	Calantas .....	11	15	16	10	185, 288
14	Supa .....	7	8	15	33	177, 189
15	Balacat .....	8	13	14	24	154, 546
16	Tindalo .....	22	19	13	14	150, 103
17	Bacao .....	30	10	37	11	143, 147
18	Amuguis .....	17	32	17	15	130, 129
19	Acle .....	34	24	20	16	122, 563
20	Mangachapuy .....	24	20	24	17	121, 999
21	Malabonga .....	19	18	26	19	117, 370
22	Palo Maria .....	36	29	23	13	109, 336
23	Balinhasay .....	21	23	21	30	104, 594
24	Palosapis .....	25	17	28	22	99, 163
25	Betis .....	33	21	22	26	97, 276
26	Calumpit .....	23	34	19	28	94, 098
27	Malaanonang .....	35	16	18	37	92, 232
28	Panao .....	9	36	32	27	85, 022
29	Bansalaguin .....	14	35	25	32	84, 077
30	Banaba .....	37	33	27	18	84, 044
31	Daluisi .....	18	27	29	35	79, 695
32	Nato .....	27	22	31	31	77, 682
33	Malabulac .....	16	26	35	36	74, 800
34	Cupang .....	28	30	30	34	65, 997
35	Aranga .....	31	31	36	25	63, 746
36	Banuyo .....	29	37	33	23	60, 425
37	Batitinan .....	32	28	34	29	59, 832

*Average Manila prices of timber per cubic foot and per 1,000 English board feet.*

[Prices are stated in United States currency.]

Class.	In the log, per cubic foot.	Sawed lumber, per 1,000, B. M.	Class.	In the log, per cubic foot.	Sawed lumber, per 1,000, B. M.
Ipil .....	\$0. 50	\$141. 25	Amuguis .....	\$0. 21	\$56. 50
Molave .....	. 48	162. 50	Sacat .....	. 25	55. 00
Narra .....	. 47	128. 15	Aranga .....	. 25	87. 50
Tindalo .....	. 50	143. 75	Bansalaguin .....	. 26	94. 00
Yacal .....	. 40	111. 15	Balanhat .....	. 16	62. 50
Calantas .....	. 31	156. 50	Betis .....	. 56	94. 00
Dungon .....	. 40	100. 00	Banaba .....	. 31	56. 50
Acle .....	. 37	85. 00	Paitan .....	. 31	56. 50
Guijo .....	. 31	80. 00	Calumpit .....	. 25	44. 00
Palo-maria .....	. 31	90. 50	Cupang .....	. 25	44. 00
Apitong .....	. 31	60. 00	Magarilao .....	. 25	125. 00
Batitinan .....	. 37	125. 00	Nato .....	. 25	62. 50
Mangachapuy .....	. 37	125. 00	Malac malac .....	. 16	47. 00
Macasin .....	. 20	122. 00	Batiti .....	. 18	109. 00
Lauan .....	. 20	48. 50	Calamansanay .....	. 37	156. 50
Supa .....	. 28	81. 50	Toog .....	. 18	62. 50
Pasac .....	. 31	81. 50	Batino .....	. 16	75. 00

*Prices quoted for native and American lumber in the Manila newspapers.*

NATIVE LUMBER.

[Prices are stated in United States currency.]

Species.	Per 1,000, B. M.	Per 100, S. C. M.	Species.	Per 1,000, B. M.	Per 100, S. C. M.
Molave .....	\$160.00	-----	Supa .....	\$90.00	-----
Narra, red .....	150.00	-----	Amuguis .....	83.00	-----
Narra, white .....	120.00	-----	Nato .....	45.00	-----
Yacal .....	125.00	-----	Lauan .....	37.50	-----
Ipil .....	125.00	-----	Tanguili .....	-----	\$50.00
Guijo .....	70.00	-----	Apitong .....	-----	45.00

AMERICAN LUMBER.

Class.	Per 1,000, B. M.	Class.	Per 1,000, B. M.
Oregon pine:		Redwood (merchant No. 1)—Cont'd.	\$71.50
Rough, all sizes .....	\$40.00	Rough clear .....	-----
S. 1 S. and T. and G., $\frac{1}{4}$ inch .....	41.50	Redwood (merchant No. 2):	-----
S. 2 S. ....	42.00	\$2.50 less per 1,000 feet, B. M., on	-----
S. 3 S. ....	33.50	above prices.	-----
S. 4 S. ....	44.00	Hemlock:	-----
T and G., rustic .....	51.00	Rough, all sizes .....	40.00
Redwood (merchant No. 1):		S. 1 S. ....	41.00
Rough, all sizes .....	47.50	Cedar shingles, bundles of 250, per 1,000 .....	6.50
S. 1 S. and T. and G., $\frac{1}{4}$ inch .....	48.50	Lath, bundles of 100 .....	.65
S. 2 S. ....	49.50	Molding, per inch, linear foot .....	.01
S. 3 S. ....	50.50	Doors:	-----
S. 4 S. ....	51.50	6 feet 8 inches .....	4.25
T. and G. and rustic .....	60.00	6 feet 10 inches .....	4.50

*Bejuco (rattan).*

[All prices mentioned are in Philippine currency. A pico is equal to 137.5 Spanish pounds. A roll is equal to about 100 Spanish pounds.]

Province.	Local name.	Use.	Importance.	Cost of securing.	Local market price.	Average amount utilized during one month.
Abra	Uay, batarag, barit, col-layot	For tying purposes and for whips.	Abundant	₱0.50 per laborer per day.	₱0.10 per roll	2,500 rolls.
Albay	Tomarong, burubagacay rimuran, lapnic, nucut, samulig, daanán, and tandarora.	For building and for tying poles of hamp.	do		₱5 to ₱6 per 1,000	No information.
Ambos Camarines	Tumarong, tararora, palanog, and gatasan.	For building, tying hamp, fencing purposes, and manufacture of beds.	do	₱1 per day	₱4.50 per 1,000	Do.
Benguet	Digui, labney, talictic, cul-layot, batarag, and baret.	For walking canes, manufacture of baskets, hammocks, and especially for building purposes.	do	₱0.20 per day	₱2 per 1,000	20,000 picos.
Bulacan	Dahongway, picapeo, way, bugtong, gatasan.	For tying purposes, manufacture of ropes, hats, cigarette cases, etc.	do	₱3.50 per 100 rolls.	₱7 per 100 rolls	5,000 rolls.
Cagayan	Appapit, alimuran, batarag, barit, push, uay, afugan, zita and barit.	For baling tobacco, building purposes, fish corrals, etc.	do	₱0.25 per 100	₱0.50 per 100	400,000 picos.
Capiz	Oay and juag	For tying purposes	Not very abundant.	₱1 per 1,000	₱2.50 per 1,000	No information.
Cebu	Rungaoong, minalay, passan, pudlos, and balabá.	For baling hamp, roofing, walking cases, etc.	do	By the job.	From ₱0.40 to ₱1.25 per roll of 100.	Do.
Ilocos Norte.	Oay, parsic, batarag, bogbog, barit, and nito.	For tying and building purposes, manufacture of chairs, baskets, whips, walking canes, etc.	do	No information.	₱0.05 to ₱0.10 per piece.	Do.
Ilocos Sur	Uay	For tying purposes and manufacture of chairs, beds, etc.	No information.	do	No information	Do.
Iloilo	Tamalula, tambulagan, odiongan, tumalum, calapc, catidit, uay, jaguaya, and saguli.	For tying purposes, manufacture of chairs, ropes, tying of balsas, and for baling goods.	Abundant	₱0.50 to ₱0.60 per 100.	₱0.40 per 100.	Do.
Laguna	Paricanim, and alimuran.	For tying purposes and manufacture of hammocks.	Scarce	₱2.50 per 1,000	₱3 per 1,000	5,000 picos.
Masbate	Tumaron, uay-babae, calapi, palasim, magtaguictic, gatasan, lucuan, and tundalora.	For tying and baling all kinds of goods, especially hamp.	Abundant	₱1.50 to ₱2 per 1,000.	₱2 to ₱3 per 1,000.	40,000 picos.

*Bejuco (rattan)*—Continued.

Province.	Local name.	Use.	Importance.	Cost of securing.	Local market price.	Average amount utilized during one month.
Mindoro	Tumalim, talola, sumulid, gatasan, ditau, palasan, pidilis, and balin-uay or huag.	For manufacture of ropes, chairs, baskets, hammocks, etc.	Abundant	₱0 10 per roll.	₱0.15 per roll.	100 rolls.
Moro (districts of Cotabato, Davao, and Zamboanga).	Naŋga, kaninura, neket, rauan, palasan, icog-icog, sambauutan, casisi, nucot, tandau-da or tandatola, capit, sega, purilus, tamatula, tamuling, and balabali.	For tying purposes, manufacture of ropes for carabao, baskets, etc.	do	₱2 per 1,000.	₱12 per 1,000.	3,000 picos.
Negros Occidental.	Uay, gatasan, labuanan, magnao, loutoc, budlos, bulungan, bugtong, palasan, yamung-yaming, bagacayon, calape, malpac, tambungga.	For baling goods, roofing, fish corrals, walking canes, etc.		₱2 to ₱8 per 1,000	₱0.50 to ₱2 per 100.	30,000 picos.
Negros Oriental.	Malabutong, hanamham, bulunganon, tagasoon, and oay.	For tying purposes and manufacture of rope, etc.	Abundant	₱1.75 to \$2 per 1,000.	₱9 per 1,000	200,000 picos.
Pampanga	Palasan, bubuyan or mamucton, colaclin, palimanaco, auay, and balinguay.	For tying purposes, etc.	Not very abundant	No information.	₱0.18 per 100.	
Pangasinan	Babuyan na peteg, babuyan na bogtong, nocy, bugbog, bart, salungsungan, culacing, and batatag.	For tying purposes, walking sticks, whips, baskets, chairs, etc.	Abundant	₱1.25 per 100	₱1.75 per 100.	100,000 picos.
Paragua Samar	Sica, sic-sic, butrin, palasan.	do	No information	₱2.50 per pico	₱3.60 per pico	35 picos.
Surigao	Uway, tagsaon, malabagaca, talolora, palanog.	For tying purposes and manufacture of fish corrals.	Scarce	₱2 per 100	Not sold	
	Tumayrom, tagsajon, palasan, palanog, bagagan, uayban, qui-os, taniguid, and pudlus.	For baling tobacco and other goods, walking canes, and manufacture of chairs and beds.	Abundant	₱2.50 to ₱3 per 1,000.	₱4 per 1,000	50,000 picos.
Tarlac	Yantuc, ane, babuyan	For tying purposes and manufacture of baskets and tumpies.	Not very abundant.	No information.	No information.	10,000 picos.
Tayabas	Tumalim, talula, palasan, locoon, apas, panlis, palac lacanin, tandula, sipal, bogtonguin, lambutan, samuling, dichan, sambolagat, simuran, taguictic, lucuan, palasan, duanan, and nito.	For tying purposes, twine, etc.	Abundant	₱1.50 per 100.	No information.	No information.
Zambales	Panlaut, albit, palasan, bulalit, hamol, yantoc, boloxan, manogton, babuoi, simoran, apis, ditan, bucton, yantoc-na-pula, yantoc-na-puti, abangan, and babuyan.	For tying purposes and manufacture of rope; is also used in construction of rafts.	do	No information.	₱15 per 1,000.	5,000 picos.

*Junco (rush).*

		For walking sticks	Abundant	₱0.02 per piece	₱0.05 per piece	10 pieces, No information.
Abra	Borog	No information	No information			Do.
Albay	No information	No information	Scarce			Do.
Ambos Camarines	Marogui, botong, cauayan, and daso	For roofing purposes	Abundant	No information	₱0.10 per 1,000	Do.
Benguet	Led-da, rono, and loacan	For walking sticks	Not very abundant	do	No information	Do.
Bulacan	Palasan and bubuyan					
Cagayan	None	No information	No information	No information	No information	Do.
Capiz	Unknown	do	do	do	do	Do.
Cebu	None	No information	do	do	do	Do.
Ilocos Norte	No information	do	do	do	₱0.12 per piece	Do.
Ilocos Sur	do	do	do	do	₱16 per 100	Do.
Iloilo	do	do	do	do	No information	Do.
Laguna	do	do	do	do	₱12 per 1,000	Do.
Moro (districts of Cotabato, Davao, and Zamboanga).	Taniguid, balala, nito, banban, jagnaya, quili, and ayuma.	For walking canes, etc.	Abundant	₱2 per 1,000		None.
Pangasinan	Palasan	No information	Scarce	No information	No information	No information.
Samar	Parasan	For tying purposes and roofing.	Very scarce	do	Not sold	None.
Tarlac	Culacling and ayi	For tying purposes	Abundant	₱12 per 1,000	₱1.50 per 100	2,000 pieces.
Tayabas	Balangut	For tying purposes, etc.	No information	No information	No information	No information.

*Caña (cane).*

		For building, roofing, and fencing purposes.	Abundant	₱0.40 per day	₱0.05 per piece	14,000 pieces, No information.
Abra	Caoayan, bayug, bolo, puser, and ingrio	For building purposes	do		₱14 to ₱15 per 100	No information.
Albay	Marurgni, butong, orás	For building purposes and manufacture of chairs and beds.				
Ambos Camarines	Marogui, botong, cauayan, and daso	For houses, fish corrals, and fences.	Not very abundant	₱0.60 per day	₱2 per 100	Do.
Benguet	Cawayan, bolo, napnap, bayto, mangnao, and muica.	No information	Scarce	No information	No information	Do.
Bulacan	Bujo and bucaue	For fences, corrals, and manufacture of hats.	Abundant	₱0.50 per 100	₱2 per 100	3,000 canes.

Province.	Local name.	Use.	Importance.	Cost of securing.	Local market price.	Average amount utilized during one month.
Capiz	Botong, cauayan, bolo, and bagacay	For building and fencing purposes, fish corrals and manufacture of chairs and beds.	Abundant	₱1 per 100	₱8 per 100	No information.
Cebu	Cauayan, lunas, butong, and bagacayó	For fish corrals, fences, balsa, etc.	do	₱0.25 to ₱0.75 per day.	₱8 to ₱20 per 100	Do.
Iloilo	Cauayan, gutong, and bolo	For building fences and balsa.	do	₱12 per 100	No information	Do.
Moro (districts of Cotabato, Davao, and Zamboanga)	Bentung, apus, tamlan, kiring, diana, bayawan, nanap, rebuk, bantacan, bujo, patung, and lahi.	For fences, fish corrals, and manufacture of baskets and balsa.	do	₱10 per 1,000	₱50 per 1,000	None.
Negros Oriental	Bulos, alanianis, and butong	For building, fish corrals, balsa, etc.	Not very abundant.	₱3 per 100	₱9 per 100	No information.
Pangasinan	Bolo and bical	No information	No information	No information	₱3 per 100	5,000 pieces.
Samar	Cawayan	For fish corrals	Scarce	do	₱25 per 100	None.
Tarlac	Bulu and bical	For building and manufacture of saul.	Abundant	₱11 per 1,000	₱13.50 per 1,000	No information.
Tayabas	Bulang-china, matinic, sina, taynanac, ruju, anas, bolon, and tuyumanac.	For building, fish corrals, manufacture of baskets, etc.	No information	₱5 per 100	₱6 per 100	Do.
Zambales	Bojo, caña, and balto	No information.	do	No information	₱10 per 100	Do.



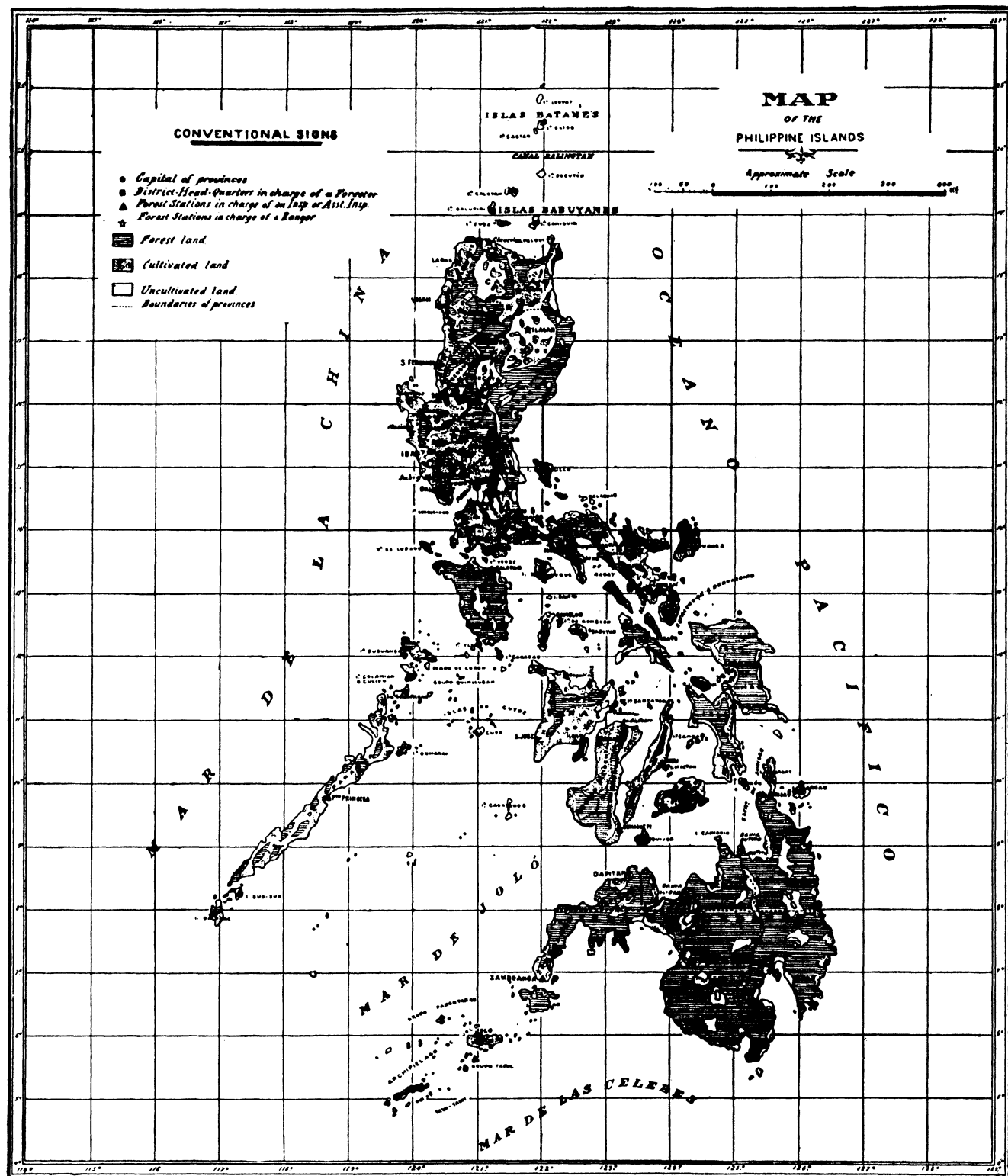






PLATE I.

Building a road through the forests, near Atimonan, Tayabas.



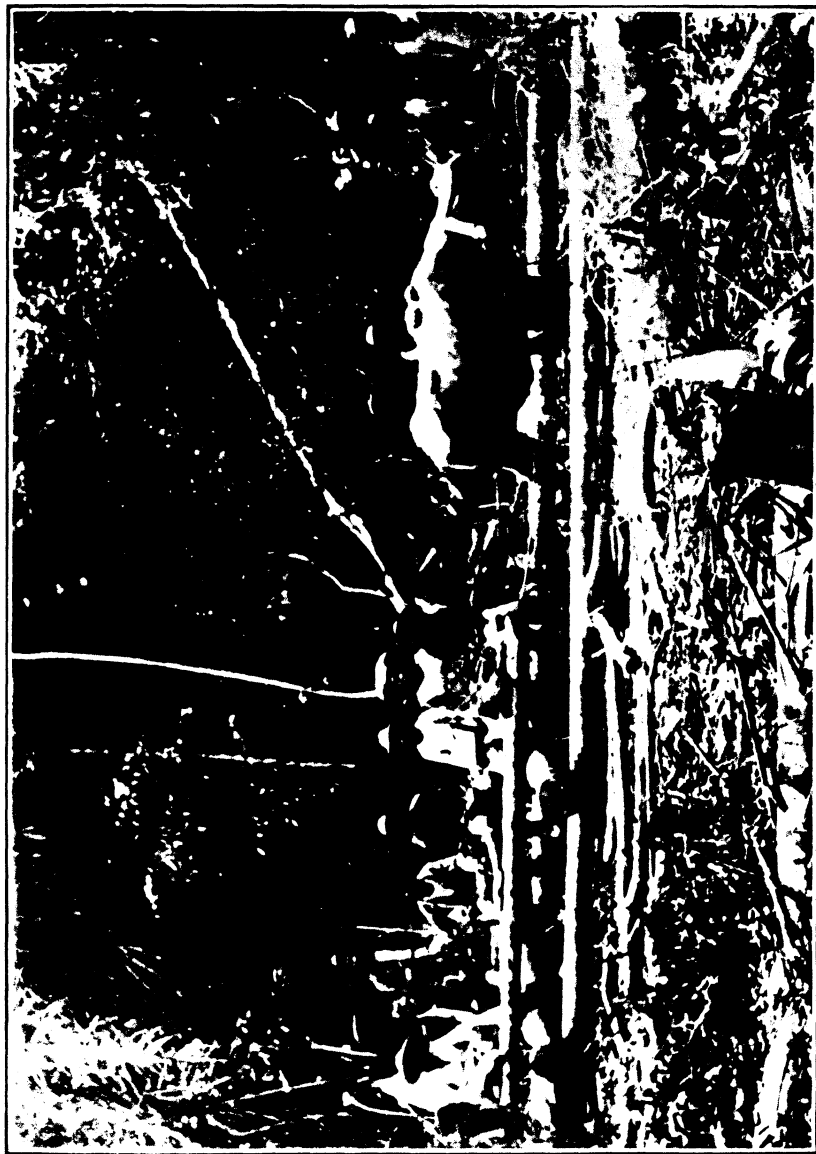


PLATE II.

Primitive logging railroad in the cutting district of the Alvisee Lumber and Development Company, southeast coast of Mindoro.

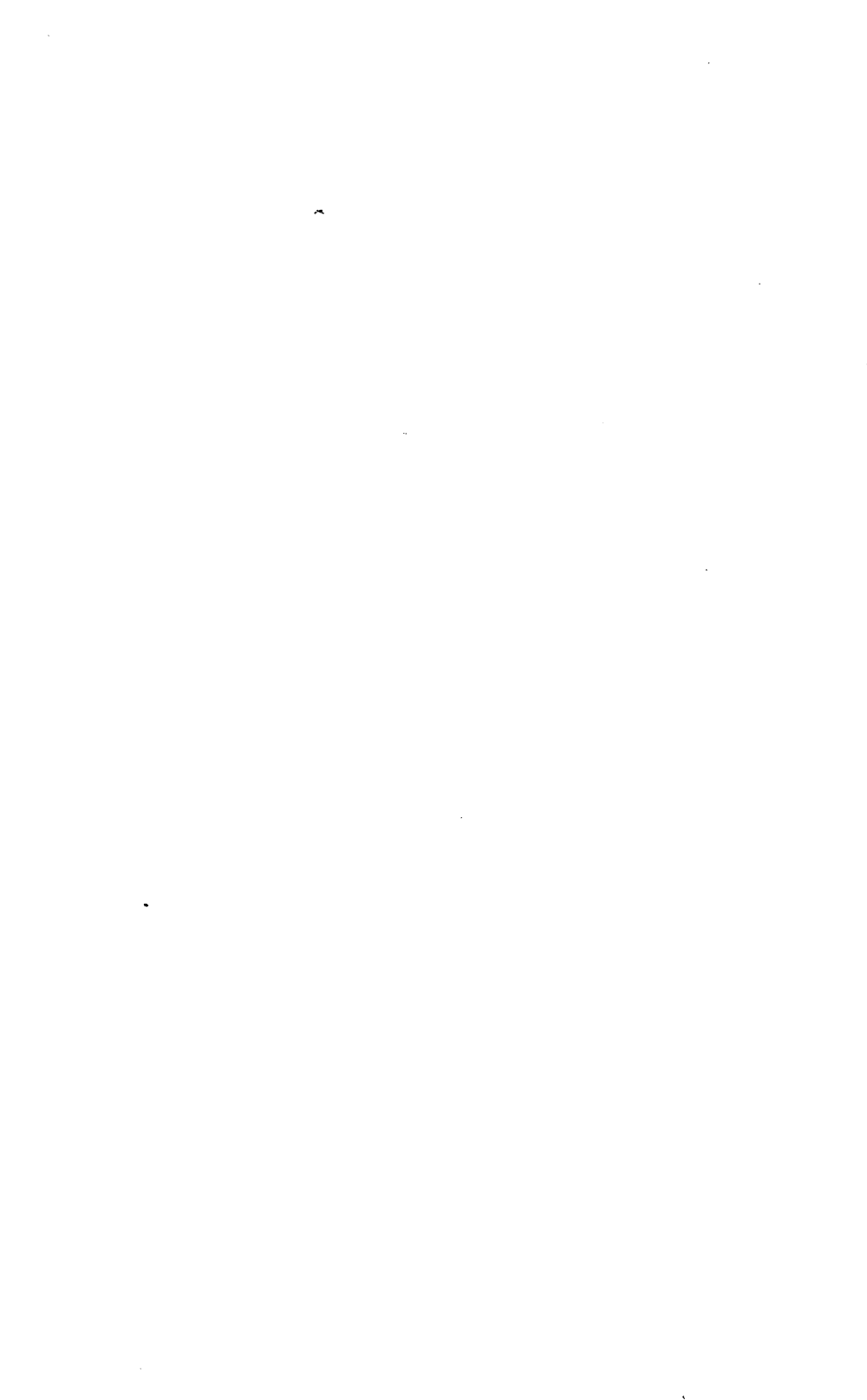




PLATE III.

View along the main haul from near the roll-way, showing skidding engine near the edge of the forest. Logging plant operated by Insular Company, Gimogon River, Negros Occidental.









PLATE IV.

View of skidding engine used by Insular Company, Gimogon River, Negros Occidental.

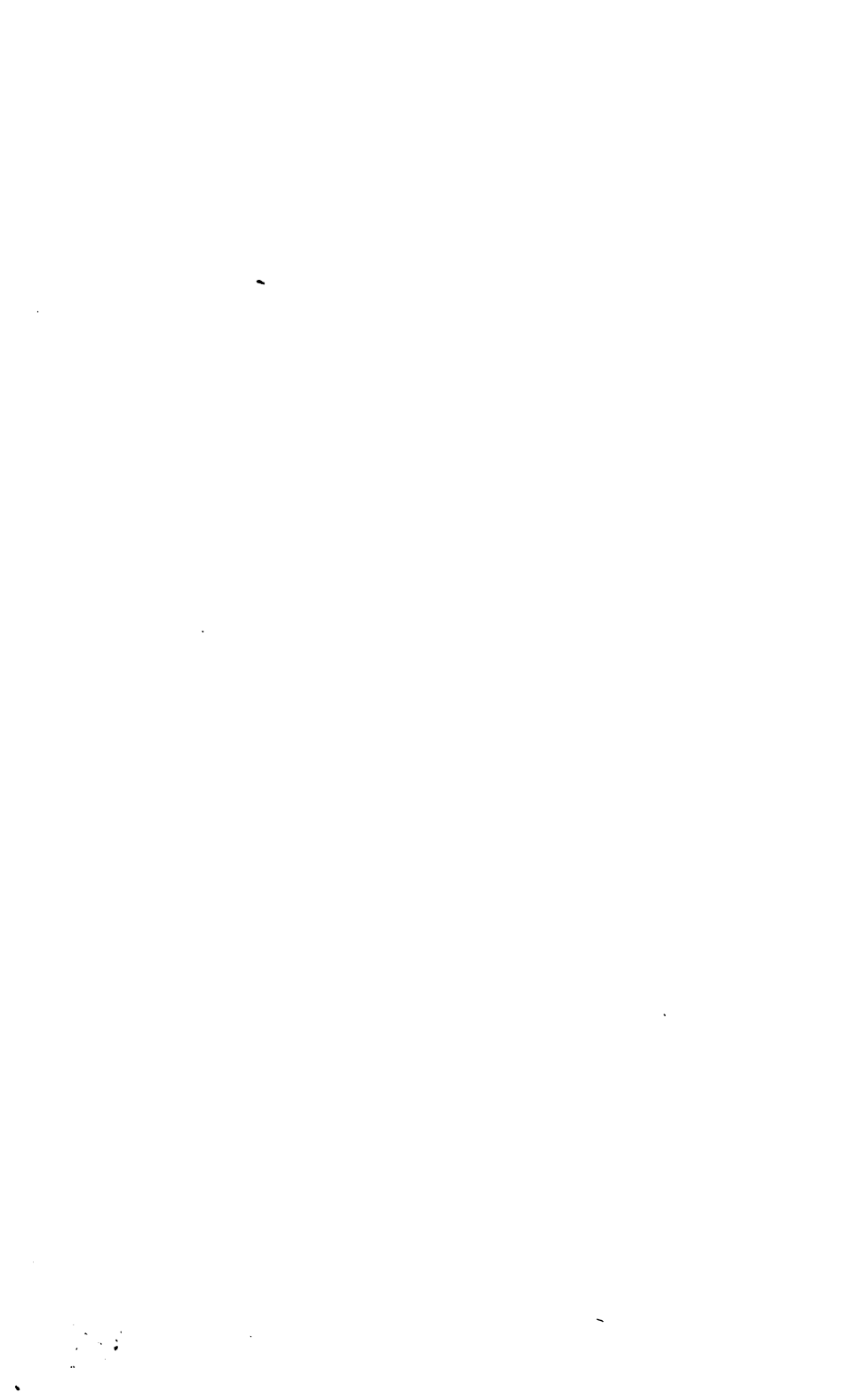






PLATE V.

Lauan (*Anisopatera thurifera* Blume), on extreme left. Apitong (*Dipl. racarpus grandiflorus* Blanco), in foreground. Forest view in logging district of Insular Company, Gimogon River, Negros Occidental.



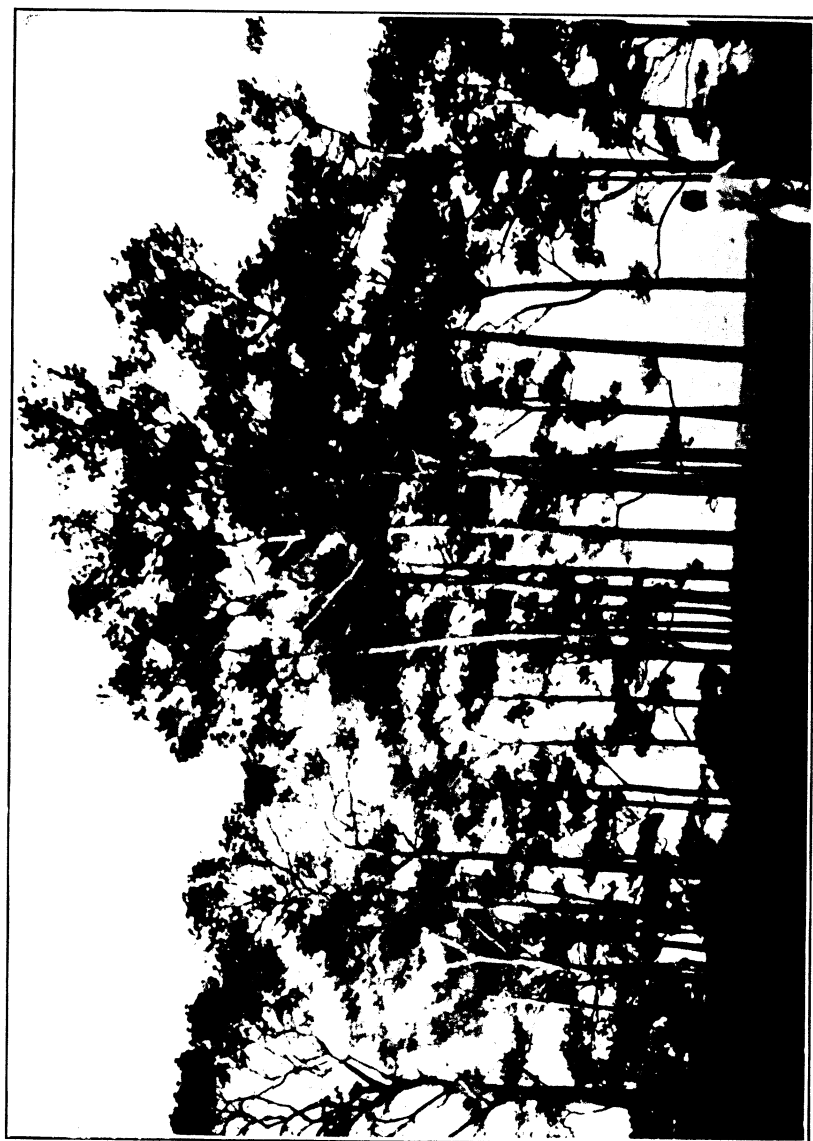


PLATE VI.

Pine (*Pinus merkusii*); open stand near Santa Cruz, Zambales.



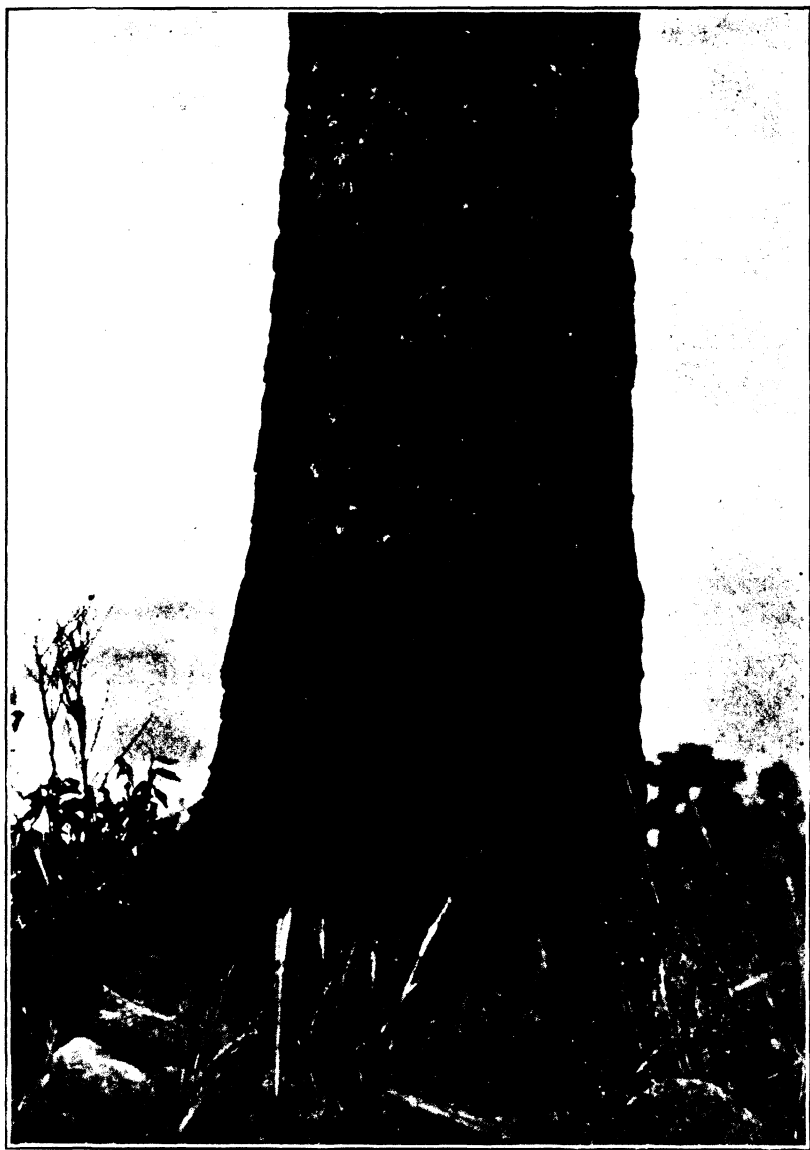


PLATE VII.

Pine (*Pinus merkusii* J. and de V.), showing character of trunk and bark. Zambales Province.









PLATE VIII.  
Preparing to remove a banca from the forest. Batuan Province.







PLATE IX.

"Cahugin" or clearing in forests made by burning. Coconut palms in background damaged by fire.







PLATE X.

Root system of mature agoho (*Casuarina equisetifolia* Forst.). The roots have been uncovered by the action of the sea, and although they have been exposed for several years, the trees are thrifty and bearing fruit.







PLATE XI.  
Transporting logs in the Pagsubangan River, Tayabas, by means of carabao.







PLATE XII.

Red malabayabas (*Carfenia* sp.). Pagbilao, Tayabas. Almost pure stand of red malabayabas and macaasin.







PLATE XIII.

Skidding logs on sled with carabaos yoked American fashion, Mindoro.







PLATE XIV.

Skidding sled used by American lumbermen, Mindoro.







PLATE XV.

Method of marking trees on the type area. Lamao Forest Reserve.



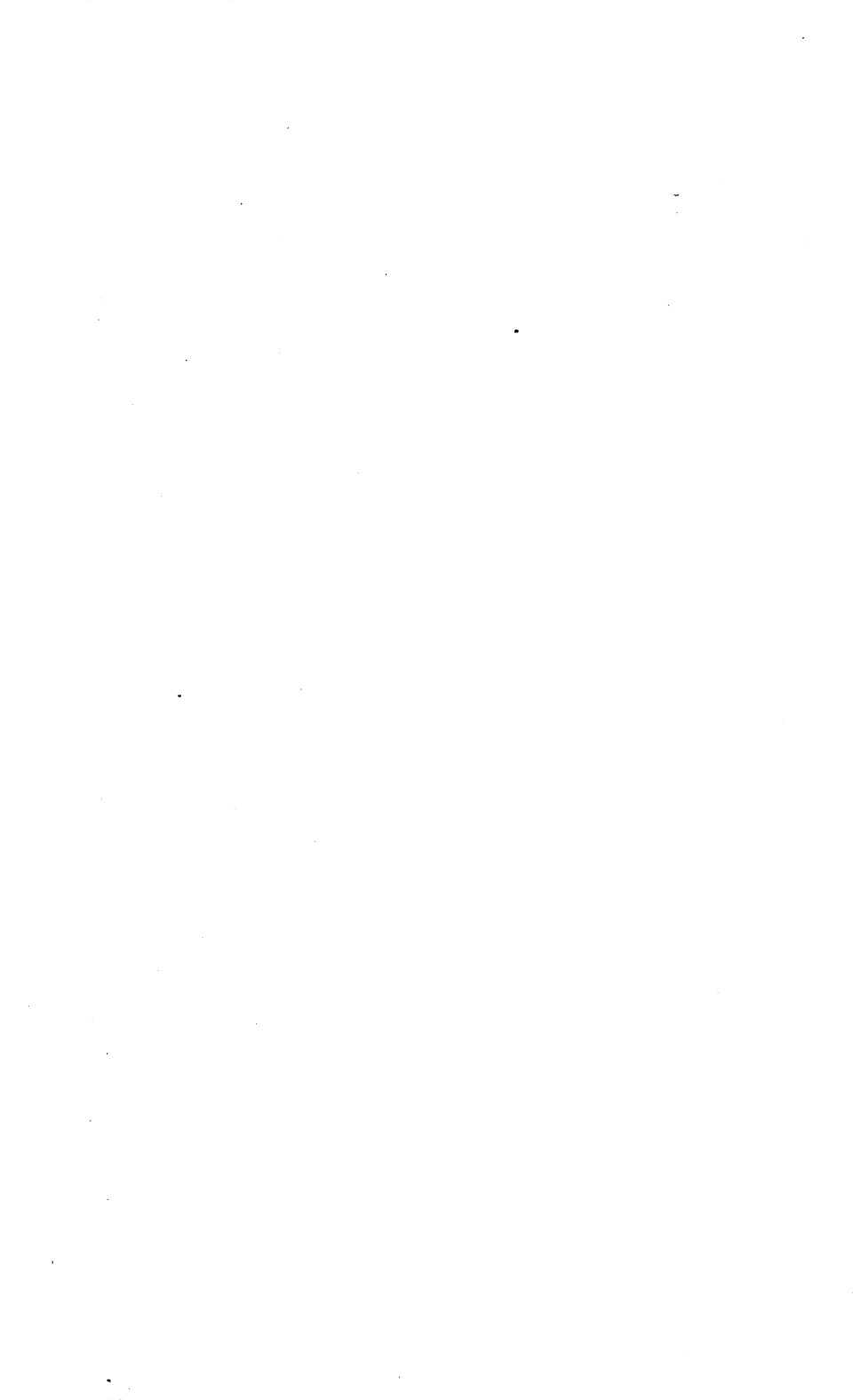






PLATE XVI.

Method of climbing very large and high trees in collecting botanical material. Palae palae (*Palaequium latifolium* Blanco). Lamo Forest Reserve.



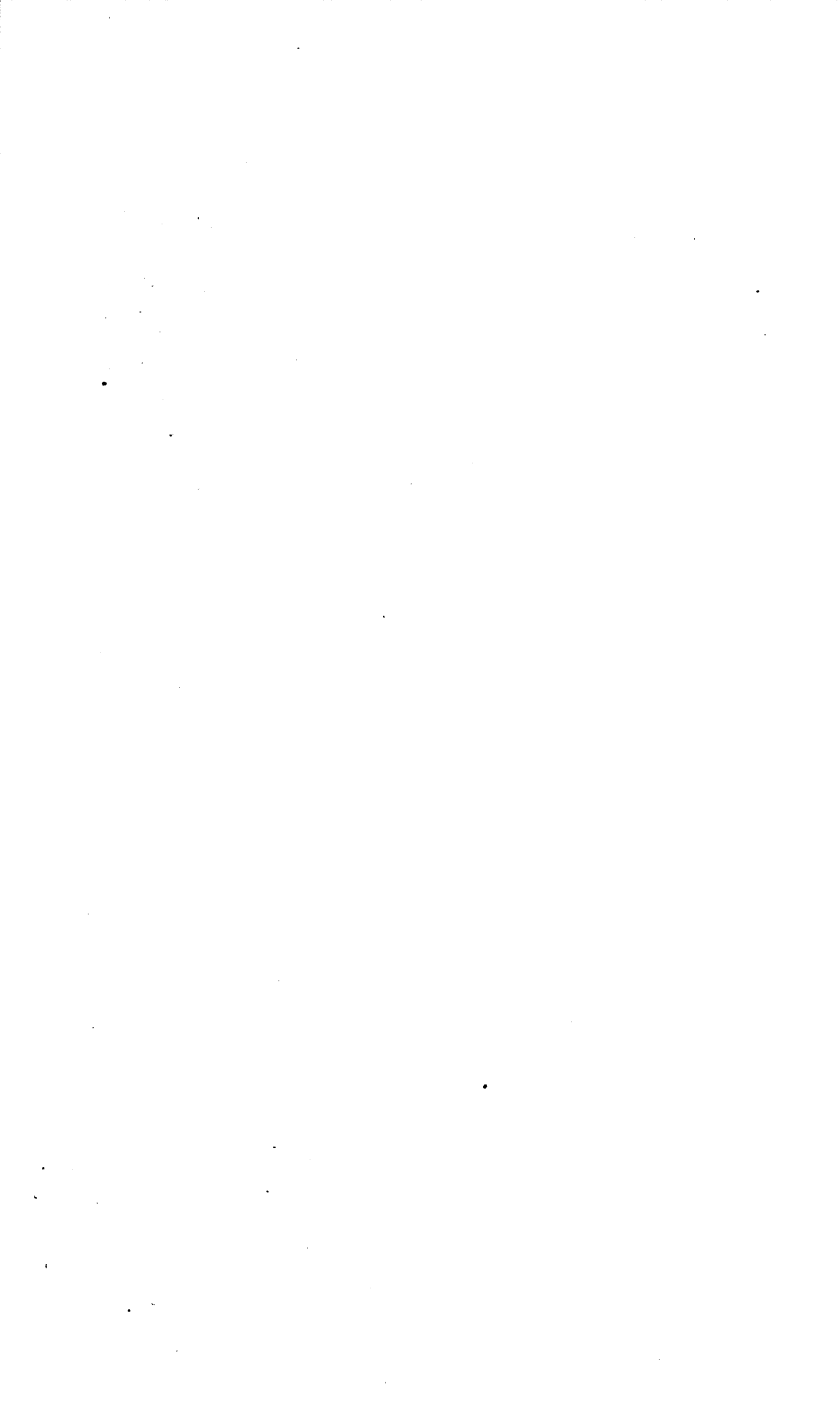




PLATE XVII.

Type area, Lamao Forest Reserve: No. 97, panao (*Dipterocarpus vernicifluus* Blanco). No. 98, guijo (*Shorea guiso* Blanco). No. 101, bolong-eta (*Diospyros pilosanthera* Blanco). No. 102, tocut langkut (*Polyscias nodosa* Seem.). No. 103, undetermined. No. 114, alupag (*Euphoria cinera* Radlk.). No. 115, lauan (*Anisoptera thurifera* Blume).

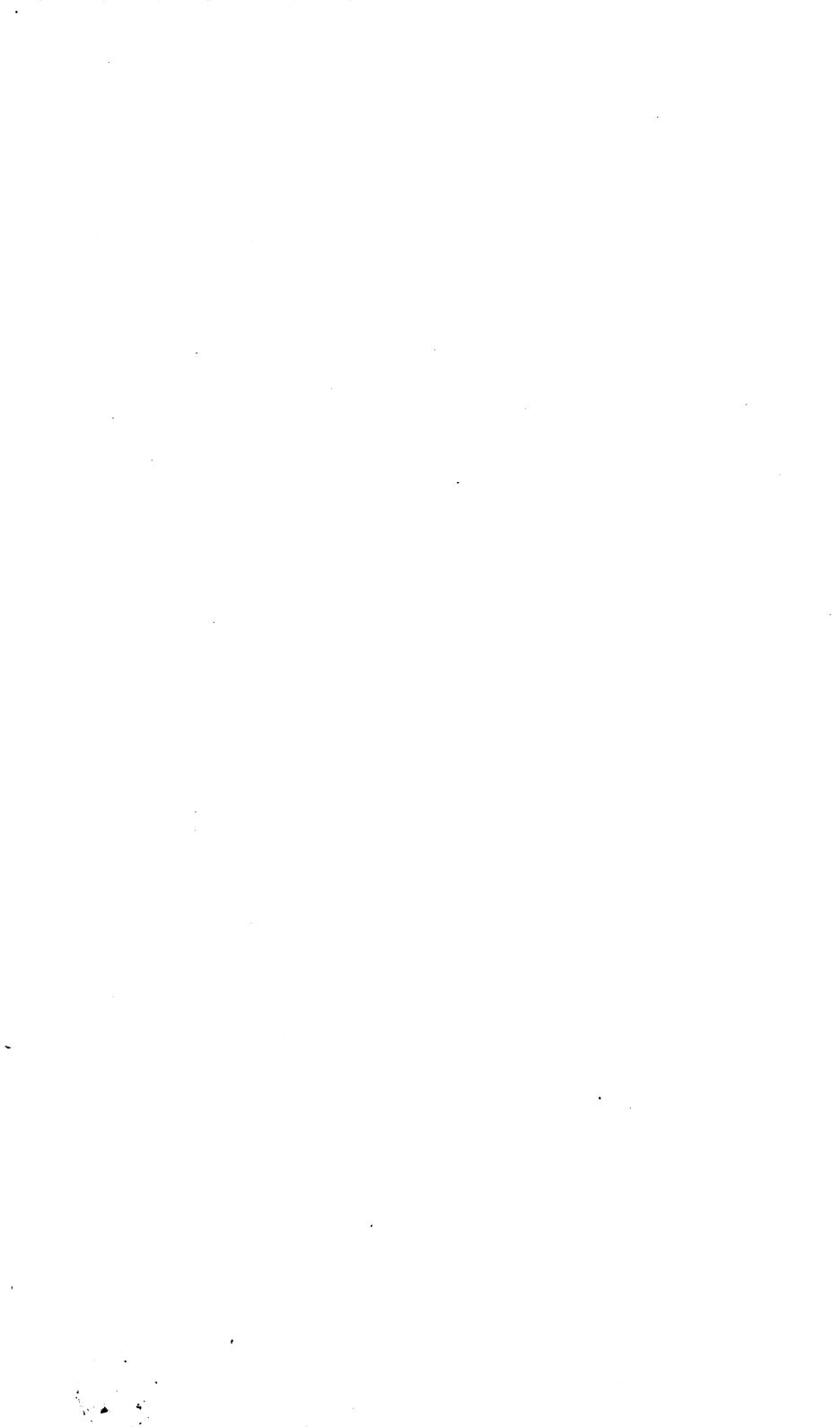




PLATE XVIII.

No. 288, malacmac (*Palauquium oléiferum* Blanco); palac palac (*Palauquium latifolium* Blanco) (tree to the right). No. 288 has been slashed for the collection of gutta-percha. Lanao Forest Reserve.





PLATE XIX.  
Forest scene in the upper part of Lamao Forest Reserve.









PLATE XX.

Camp of visiting botanists. Lmao Forest Reserve.





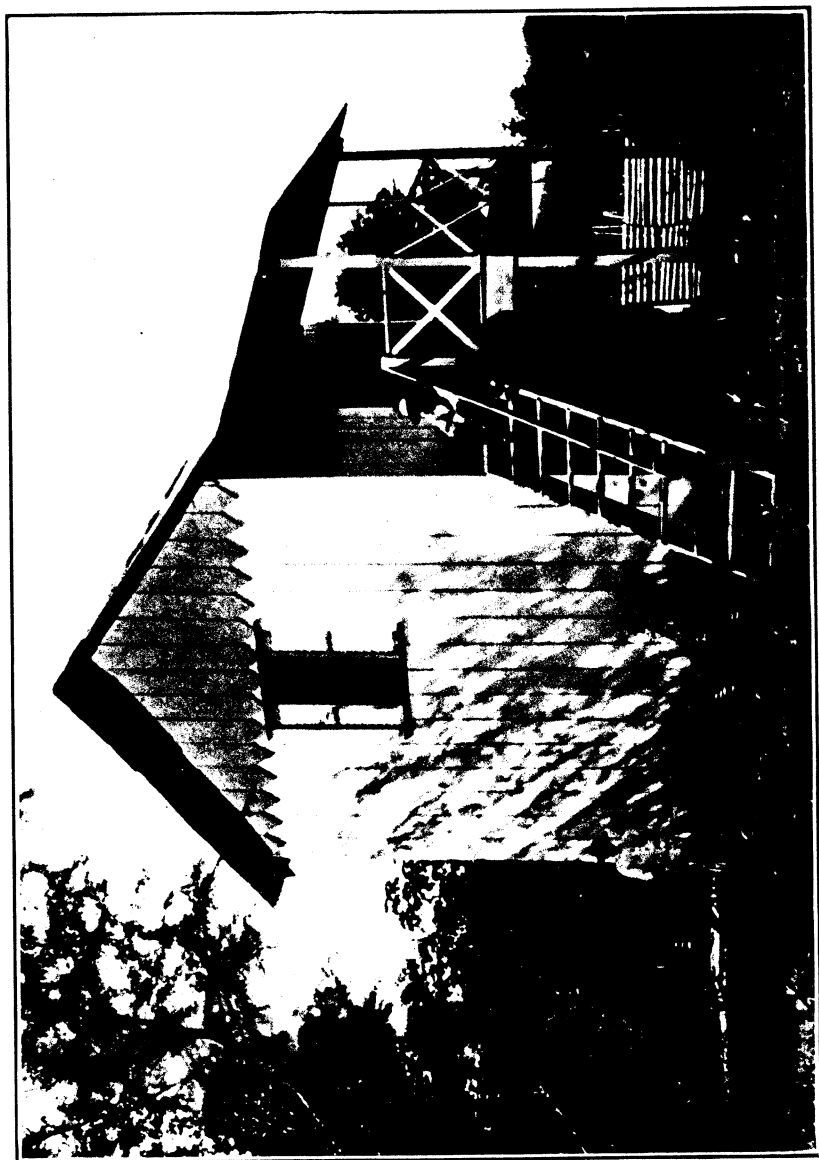


PLATE XXI.

Lamao Forest Reserve. House at lower or first station; near seacoast.



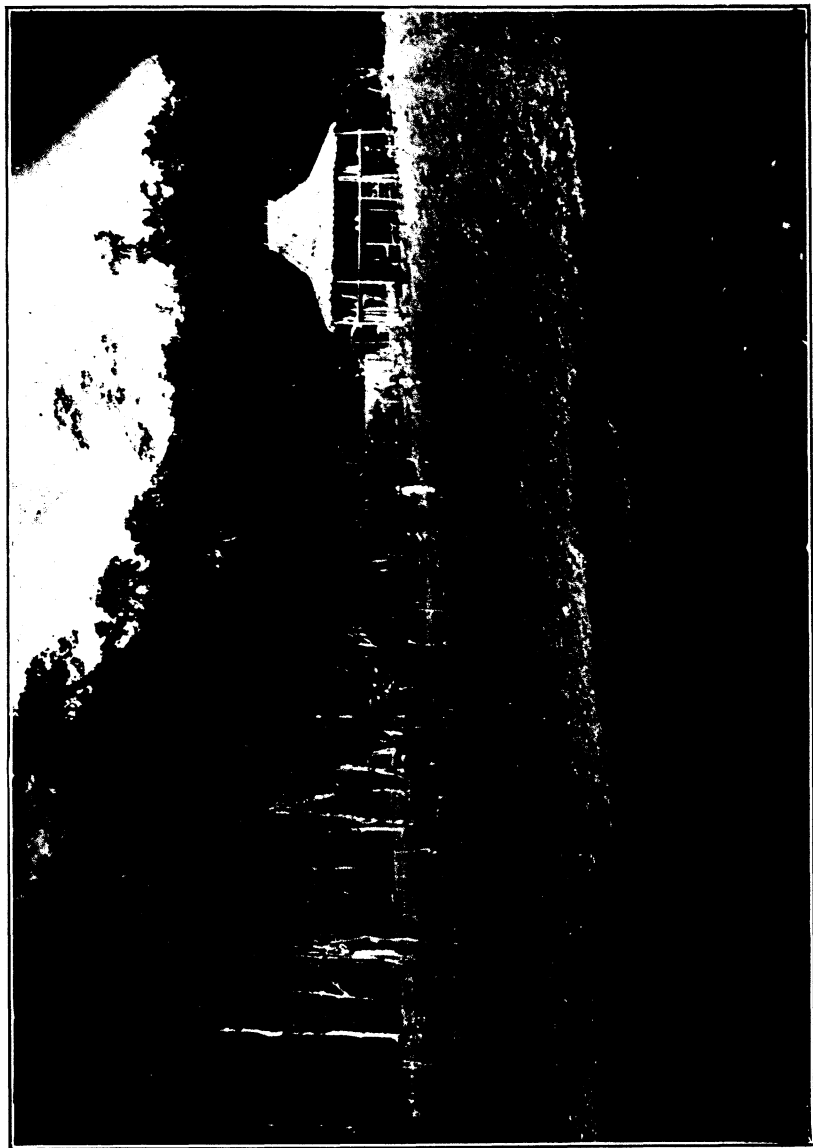


PLATE XXII.

Dwelling house of nurseryman in charge. Station No. 2, Lamao Forest Reserve.





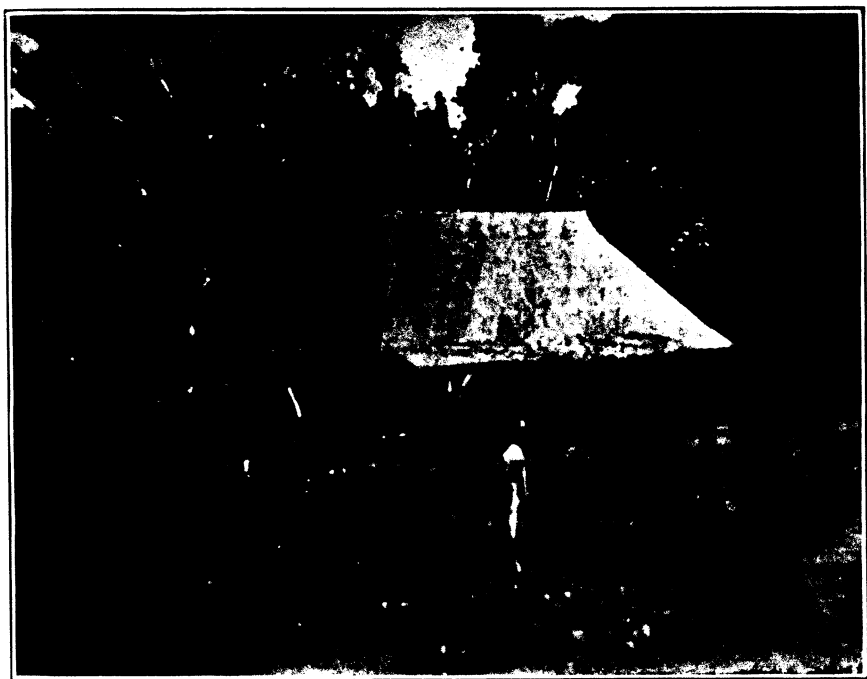


PLATE XXIII.

Propagating house at station No. 2, Lamao Forest Reserve.









PLATE XXIV.

Panao (*Dipterocarpus vernicifluus* Blanco). Lamao Forest Reserve.





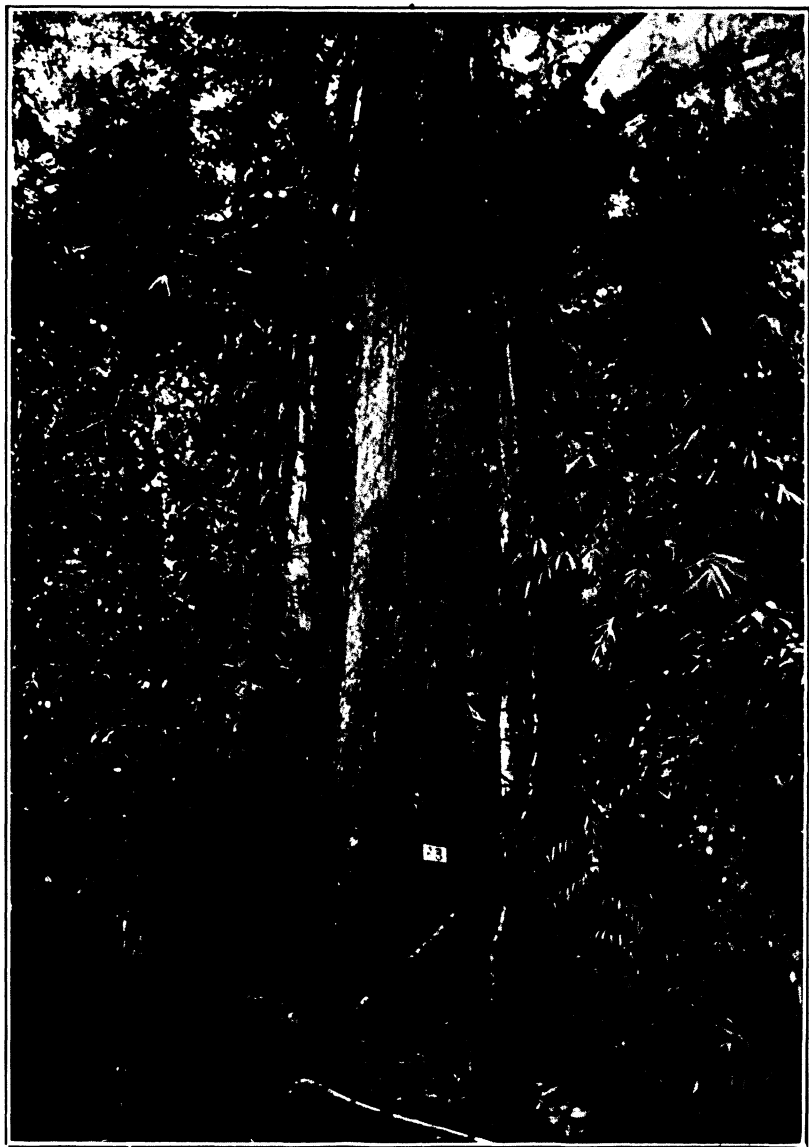
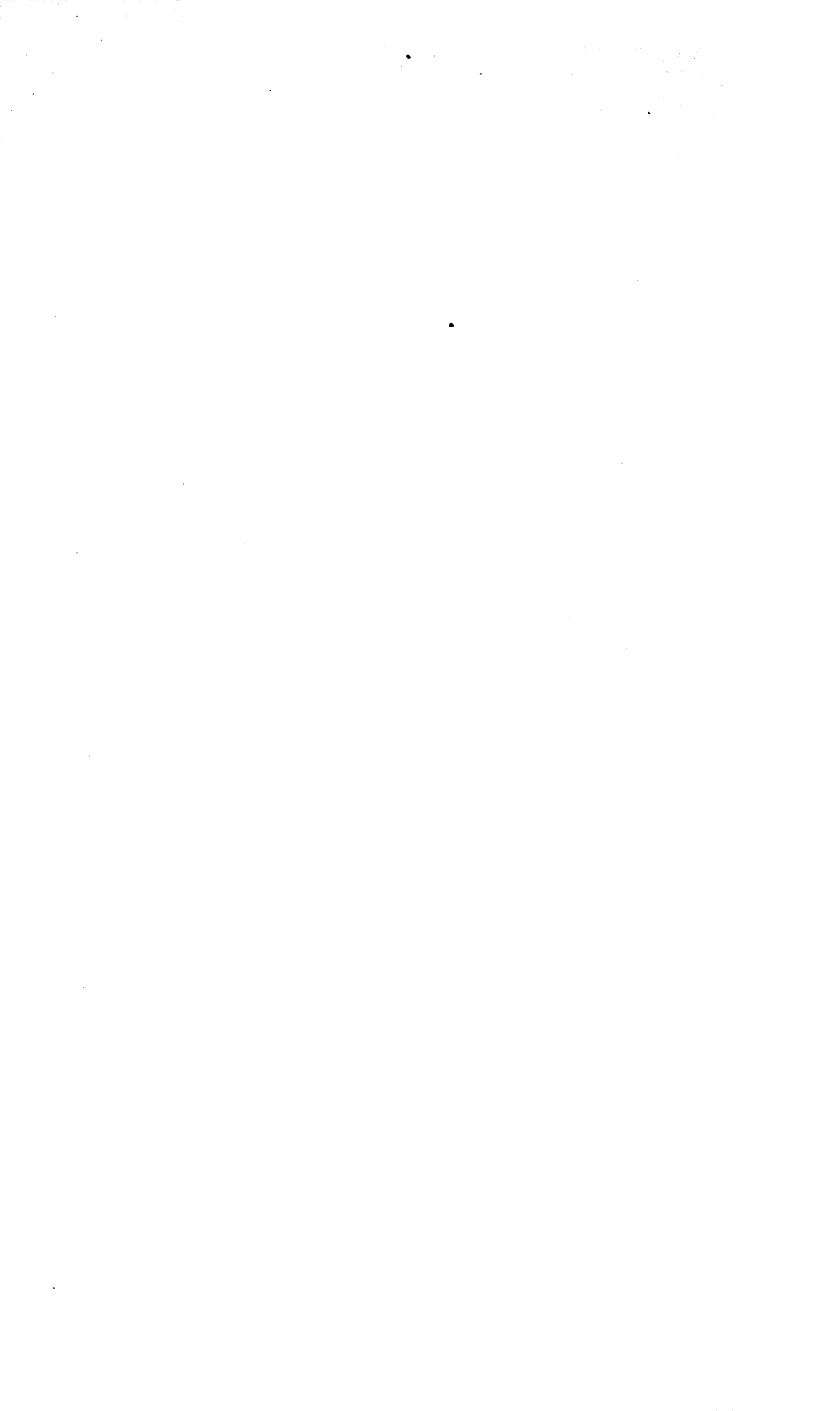


PLATE XXV.

Tagatoy (*Palauquium luzoniense* Vidal). No. A 3 on type area. Lamao Forest Reserve.











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