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THE MARIA CRISTINA FALLS

# Traditional and New Uses of Philippine Woods[1]

by
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SUMMARY

Eight fast-growing broadleaved species, namely:

1. African tulip [*Spathodea campanulata* Beauv.]
2. Anabo [*Abroma augusta* (L.) Wild.]
3. Gubas [*Endospermum peltatum* Merr.]
4. Hinlaumo [*Mallotus ricinoides* (Pers.) Muell.-Arg.]
5. Ipil-ipil [*Leucaena leucocephala* (Lam.) de Wit]
6. Kaatoan-bangkal [*Anthocephalus cadamba* (Roxb.) Miq.]
7. Kapok [*Ceiba pentandra* (L.) Gaertn.]
8. Moluccan sau [*Albizia falcata* (L.) Back.]

were studied as to their suitability for pulp and paper production using, for comparative purposes, two conifers, Benguet pine [*Pinus insularis* Endl.] and Mindoro pine [*Pinus merkusii* Jungh. and de Ver.].

All these eight broadleaved species are suitable for pulp and paper production based on their fiber dimension studies and derived values and pulping trials. Outstanding among them is kaatoan-bangkal which grows very fast, registering an average increase in wood volume of 0.032 cu. m. per tree per year at 9 years of age and 0.063 cu. m. per tree per year at 15 years of age.

INTRODUCTION

There are about 3,500 different wood species found growing in Philippine forests, majority of which may attain a diameter of 30 cm. or over at breast height (7)[3]. But Philippine loggers or lumbermen deal only with less than 100 commercial species (8). The rest are classified as "weed" or non-commercial species and are used only for fuel, fencing, charcoal making, and for other minor purposes because not much data or information on their physical, mechanical, chemical and biological properties have been gathered thus far. Consequently, no sane businessman would invest a sizeable capital in logging unknown wood species lest he "loses his shirt" in the venture because of unsuitable market for them.

The Forest Products Research Institute (4) conducts researches on forest products, particularly on wood, to find ways and means of fully, profitably, and wisely utilizing them in order to enhance the national economy. One of its major projects is to determine which Philippine cellulosic raw materials are suitable for conversion into pulp and paper.

This paper presents the results of paper-making studies on eight fast-growing Philippine hardwoods and, for comparative purposes, on two native conifers.

MATERIALS

Eight Philippine hardwoods[4] of undetermined ages, African tulip, anabo, gubas, hin-

[1] Paper presented at the Araneta University Foundation Symposium held at the NSDB Science Hall, Herran St., Manila on February 2, 1967.

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[3] Underscored numbers refer to literature cited at the end of this paper.

[4] Their scientific names are given in the preceding summary.

laumo, ipil-ipil, Kaatoan bangkal, kapok, Moluccan sau and two conifers, Benguet pine and Mindoro pine, were used in this study. These hardwoods are fast growers as shown by the following data obtained from the Forest Research Division of the Philippine Bureau of Forestry:

| Species | Average annual diameter increment (cm.) | No. of yrs. to attain 15 cm. d.b.h. |
|---|---|---|
| 1. African tulip | 2.5 | 6 |
| 2. Anabo | — | — |
| 3. Gubas | 2.0 | 7½ |
| 4. Hinlaumo | — | — |
| 5. Ipil-ipil | 2.0 | 7½ |
| 6. Kaatoan bangkal | 2.74 | 5½ |
| 7. Kapok | 2.5 | 6 |
| 8. Moluccan sau | 4.8 cm./yr.[5] | 3-4 yrs. |
| 9. Benguet pine | 1.05 | 14 |

[5] Based on 2-year old trees in Mt. Makiling.

## METHOD

### *Fiber Mensuration*

Fiber dimensions were determined on all these species, using the standard procedure of the Forest Products Research Institute.

From these fiber measurements, Runkel ratios and Muhlsteph groupings, which indicate suitability or non-suitability of these woods to papermaking, were derived.

### *Chemical Analysis*

Representative wood samples were taken from each species and proximate chemical analysis conducted on them using appropriate TAPPI (11) standard methods.

### *Pulping*

The logs were hand-barked and chipped separately by means of a pilot size "Sumner" chipper. The chips were screened in a "William" chip classifier to obtain uniform-sized chips of about 5/8" along the grain.

The sulfate process of pulping was employed in this study, using 15% NaOH and 5% $Na_2S$ based on the oven-dry weight of the chips. The liquor to wood ratio was 4:1.

Pulping was conducted in an 0.8 cu. ft., steam jacketed, stainless-steel, cylindrical digester tumbling at one revolution per minute. The temperature inside the digester was raised from room temperature to 170°C in 1.5 hours and maintained at this level for 1.5 hours.

At the end of each cook, a representative sample of the spent liquor was taken for analysis to determine the chemical consumption based on the chemicals charged.

The pulp from each cook was thoroughly washed and screened, dewatered, and a representative sample taken for dry-solid determination. Pulp yield was calculated based on oven-dry chips.

Tests on strength characteristics were performed on the unbleached sulfate pulp handsheets in accordance with appropriate TAPPI methods.

### *Bleaching*

Portions of the unbleached pulp of each wood species (except from anabo and Kaatoan bangkal) were bleached by a 3-stage process of chlorination, caustic extraction, and hypochlorite treatment.

The total percentage of chlorine employed for bleaching was one-half of the permanganate number of the pulp that was bleached.

Physical tests were conducted on the bleached-pulp handsheets, following appropriate TAPPI methods. The results are presented in Table IV.

Experimental kraft papers were made on the Institute's 8.5 inch wide midget Fourdrinier paper machine that has a speed of from 5 to 20 feet per minute. After processing the unbleached pulp in the beater, 1% rosin and 2% alum, based on the moisture-free pulp, were added to and stirred thoroughly in it before the pulp furnish was sent to the fourdrinier paper machine for the production of kraft paper.

Physical tests, according to TAPPI methods, were done on the unbleached kraft papers produced.

RESULTS AND DISCUSSION

*Fiber Dimensions and Derived Values*

Dimensions of wood fibers (length, fiber width, lumen width, and cell-wall thickness) and their derived values, flexibility ratio (1/D), felting power (L/D), Runkel ratio (2w/1), and Muhlsteph groups have been recognized as criteria in predicting the suitability of fibrous raw materials, such as wood, bamboos, etc., for pulp and papermaking (9, 12, 6, 5, and 3). The flexibility ratio influences tensile strength (5) and, to a certain extent, burst strength (9). Tear strength is influenced by fiber length, particularly of softwoods and bamboos and some agricultural crops, which are long-fibered. With short-fibered hardwoods, however, this is not so but felting power influences tear strength (9). Based on overall strength of handsheets, Runkel ratio gives an indication of the suitability of woods for papermaking, having a significance similar to Muhlsteph groups 1, 3, and 4 (9), as follows:

| Runkel groups | Runkel ratio value | Relative thickness of cell-wall | Relative papermaking quality of pulps | Equivalent Muhlsteph groups |
|---|---|---|---|---|
| 1 | Less than unity | Thin | Very good | 1 |
| 2 | About equal to unity | Medium | Good | 3 |
| 3 | More than unity | Thick | Poor | 4 |

Muhlsteph group 2 covers fibers having cell-wall areas ranging from 20 to 80% of total area, as is typical of pulp fibers from conifers and hence these pulps combine properties of those from woods in the other three groups.

Table 1 shows the fibers dimensions and derived values of eight hardwoods and two softwoods of the Philippines. By the Runkel and Muhlsteph classifications, it is evident that these hardwoods are very promising for pulp and papermaking. Muhlsteph 2 classification indicates that the two softwoods are decidedly as promising as these hardwoods.

Among the hardwoods, it may be noted in Table 1 and 3 that kapok, with low felting power (28), has a lower tear strength (tear factor 63) than ipil-ipil (90), with comparatively very much shorter fiber length (1.01 mm.) and higher felting power (42). In flexibility ratio, despite ipil-ipil (63) and kapok (62), having almost identical low flexibility ratios, ipil-ipil, having the shortest fiber, has the lowest tensile strength (breaking length, 730 m.). Both species, however, have almost identical burst strengths (burst factor 55 and 53) as well as low flexibility ratios.

Between the two softwoods, Mindoro pine, with the greater felting power (91) and fiber length (4 mm.), has higher tear strength (tear factor 170) than that (tear factor 104) of Benguet pine, with lower felting power (84). In both tensile strength and burst strength, Benguet pine, with the greater flexibility ratio (71), has higher tensile strength (breaking length 10,000 m.) and burst strength (burst factor 87) than those of Mindoro pine (9500 m. breaking length and 72 burst factor).

*Chemical analysis*

Table II presents the proximate chemical analyses of the 10 wood species dealt with in this study.

The holocellulose contents reported herein range from 61.6% (kapok) to 70.5% (hinlaumo). The percentage of holocellulose is obtained by subtracting from 100 the sum of the percentages of ash, alcohol benzene and hot water extracts, and lignin.

Lignin content ranged from 21.2% (African tulip) to 29.8% (Benguet pine).

Pentosans content ranged from 11.3% (Mindoro pine) to 20.6% (ipil-ipil).

Ash content ranged from 0.2% (Benguet pine) to 3.4% (kapok).

Inasmuch as the fibers involved in papermaking consist largely of cellulose, other things being equal, the higher the holocellulose content of a species, the more suitable it is for conversion into pulp; conversely, the lower the lignin content, the better for pulping purposes. Pulping and bleaching are processes used to dissolve the lignin (substance cementing fibers within wood) thus, freeing the cellulosic fibers or pulp. In other words, other factors remaining the same, as far as chemical pulping is concerned, the lower the lignin content and the higher the cellulosic content of the wood, the less pulping chemicals are needed, and the greater will be the pulp yield from that wood.

*Pulping*

It can be seen from Table III that the chemical consumption, based on the chemicals charged, ranged from 83.2% (Benguet pine) to 96.8% (kapok). Total pulp yield ranged from 43.7% (African tulip) to 61.9% (anabo).

*Unbleached Pulp Physical Characteristics*

Also in Table III are presented the physical tests on the unbleached pulps.

Burst factor ranged from 53 (kapok) to 100 (hinlaumo); tear factor, 63 (kapok) to 170 (Mindoro pine); double folding endurance, 275 (kapok) to 2500 (African tulip); and tensile strength, 730 (ipil-ipil) to 14,300 (hinlaumo).

*Physical Tests on the Bleached Pulps*

Table IV shows that burst factor ranged from 28 (Moluccan sau) to 84 (Benguet pine); tear factor, from 40 (kapok) to 105 (Benguet pine); double folding endurance, from 15 (kapok) to 1500 (Benguet pine); and tensile strength, from 6350 (ipil-ipil) to 12,100 (gubas).

G.E. brightness (for some reasons, only 3 specimens were tested) ranged from 72% (African tulip) to 78% (hinlaumo and Moluccan sau).

*Kraft Papers*

The physical properties of the kraft papers reported in this study are presented in Table V.

Burst factor ranged from 23.6 (Mindoro pine) to 57.3 (gubas); tear factor, from 56.9

(hinlaumo) to 169.8 (Benguet pine); tensile strength or breaking length in meters, 5080 (Mindoro pine) to 8430 (gubas); folding endurance, 29 (hinlaumo) to 986 (African tulip); and porosity, from 4.1 (Moluccan sau) to 232 (Kaatoan bangkal).

It may be of interest to know that, for bag papers, higher porosity is essential. Kaatoan bangkal may be promising in this respect.

### SOME OBSERVATIONS

Considering the papermaking potential of these eight hardwoods, it is essential to know as well their other uses, availability, growth and/or wood production, regeneration, and probable plantation characteristics.

On the slope of Mt. Makiling, it has been observed that these broadleaved species above-mentioned are fast growing.

For example, Kaatoan bangkal trees showed an average increase in wood volume of 0.031 cu. m. per tree per year from data obtained in growth studies of 26 9-yr. old trees near the Forest Products Research Institute.

If planted 2½ m. x 3 m., this species may yield a wood-volume increase of 40.92 cu. m. per hectare per year.

Kaatoan bangkal is a prolific seeder. Its seeds are tiny and, by actual count, there are about 17,000 air-dried seeds per gram.

African tulip and Moluccan sau are easily blown down, or their top branches broken, by typhoons. On the other hand, Kaatoan bangkal is much more resistant to strong winds.

Kaatoan bangkal has several uses, namely, for pulp and paper, veneer and plywood, wooden shoes, carvings, pencil slats, and match sticks. It is easily treated with chemical preservatives such as creosote.

### CONCLUSION

1. The eight fast growing broadleaved species dealt with in this study, namely, African tulip, anabo, gubas, hinlaumo, ipil-ipil, Kaatoan bangkal, kapok and Moluccan sau are suitable for pulp and paper production.

2. Kaatoan bangkal, aside from Moluccan sau, is recognized as the fastest grower among the rest. It can withstand fairly strong typhoons, judging from its behavior in the premises of the Forest Products Research Institute.

### LITERATURE CITED


1. Anonymous, 1960. Pulp and paper prospects in Asia and the Far East, FAO Pulp and Paper Conference in Tokyo, 1960.
2. ------------ Philippine Bureau of Census and Statistics for 1964 and 1965.
3. Dinwoodie, J. M., TAPPI 49: 57-67 (1966).
4. Garcia, Carlos P. 1957. Executive Order No. 257 implementing Reorganization Plan No. 77 (1954) of the Philippine Government.
5. Peteri, P., TAPPI 35: 157-160 (1952).
6. Runkel, R. O., TAPPI 35: 174-178 (1952).
7. Salvoza, Felipe M. 1963. Lexicon of Philippine Trees. FPRI's Bulletin No. 1.
8. Tamesis, F. and L. Aguilar, 1953. Important commercial timbers of the Philippines, Bureau of Printing, Manila. 85 pp.
9. Tamolang, F. N., *et al.* TAPPI 43: 527-534 (1960).
10. Tamolang, F. N. and F. F. Wangaard. TAPPI 44: 201-216 (1961).
11. TAPPI Standard and Suggested Methods, New York.
12. Wangaard, F. F. TAPPI 45: 548-556 (1962).

TABLE I. FIBER DIMENSIONS

| Common Name | Felting power L/D | Flexibility ratio I/D | Length mm. | Width mm. | Lumen width | Cell wall thickness mm. | Runkel's ratio | Muhlsteph Classification % | Muhlsteph Classification Group |
|---|---|---|---|---|---|---|---|---|---|
| *Hardwoods:* | | | | | | | | | |
| 1. African tulip | 34 | 82 | 0.99 | 0.029 | 0.023 | 0.003 | 0.26 | 33 | III |
| 2. Anábo | 41 | 73 | 1.23 | 0.030 | 0.022 | 0.0039 | 0.35 | 27 | I |
| 3. Gúbas | 38 | 78 | 1.64 | 0.044 | 0.032 | 0.006 | 0.38 | 56 | III |
| 4. Hinlaúmo | 38 | 69 | 1.11 | 0.029 | 0.020 | 0.005 | 0.50 | 52 | III |
| 5. Ipil-ipil | 42 | 63 | 1.01 | 0.024 | 0.015 | 0.0045 | 0.53 | 61 | III |
| 6. Kaatoan bangkal | 41 | 74 | 1.43 | 0.035 | 0.026 | 0.004 | 0.31 | 50 | III |
| 7. Kapók | 28 | 62 | 1.61 | 0.031 | 0.023 | 0.0045 | 0.35 | 35 | III |
| 8. Moluccan sau | 46 | 71 | 1.11 | 0.024 | 0.017 | 0.0035 | 0.41 | 41 | III |
| *Softwoods:* | | | | | | | | | |
| 1. Benguet pine | 84 | 71 | 3.45 | 0.041 | 0.029 | 0.006 | 0.41 | 50 | II |
| 2. Mindoro pine | 91 | 64 | 4.00 | 0.044 | 0.028 | 0.008 | 0.57 | 60 | II |

TABLE II. CHEMICAL ANALYSIS

| | Holo-Cellulose[a] % | Lignin % | Pentosans % | Alcohol-Benzene % | Solubility in Hot Water % | Solubility in 1% NaOH % | Ash % | Silica % |
|---|---|---|---|---|---|---|---|---|
| *Hardwoods* | | | | | | | | |
| 1. African tulip | 68.0 | 21.2 | 15.6 | 4.6 | 4.4 | 19.1 | 1.8 | 0.1 |
| 2. Anábo | — No data — | | | | | | | |
| 3. Gúbas | 66.3 | 27.7 | 16.6 | 1.9 | 2.8 | 15.4 | 1.3 | 0.1 |
| 4. Hinlaúmo | 70.5 | 23.4 | 16.4 | 2.0 | 2.8 | 22.1 | 1.3 | — |
| 5. Ipil-ipil | 64.2 | 26.4 | 20.6 | 5.9 | 2.7 | 20.5 | 0.8 | — |
| 6. Kaatoan-bangkal | 68.5 | 24.5 | 20.0 | 3.7 | 2.5 | 21.1 | 0.8 | — |
| 7. Kapók | 61.6 | 23.4 | 18.4 | 2.1 | 9.5 | 25.1 | 3.4 | — |
| 8. Moluccan sau | 68.0 | 27.9 | 17.2 | 2.4 | 1.2 | 16.0 | 0.5 | — |
| *Softwoods* | | | | | | | | |
| 1. Benguet pine | 66.4 | 29.8 | 11.6 | 2.4 | 1.2 | 12.8 | 0.2 | — |
| 2. Mindoro pine | 64.0 | 28.5 | 11.3 | 4.5 | 2.5 | 17.5 | 0.5 | — |

[a] By difference = 100 — (ASH + ALCOHOL BENZENE EXTRACT + HOT WATER EXTRACT + LIGNIN)

TABLE III. PULPING DATA AND PHYSICAL TESTS ON THE UNBLEACHED PULPS

| Common Name | Chemical consumption, based on chemicals charged | Pulp yields in percent | | | Beating time in minutes | C. S. Freeness in c.c. | Density g/c.c. | Burst factor | Tear factor | Double folding endurance MIT | Tensile strength in meters |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Accepts | Rejects | Total | | | | | | | |
| *Hardwood species* | | | | | | | | | | | |
| 1. African tulip | 84.2 | 43.1 | 0.6 | 43.7 | 16 | 300 | 0.92 | 76 | 70 | 2500 | 11,850 |
| 2. Anábo | 93.6 | 57.2 | 4.7 | 61.9 | 62 | 300 | 0.56 | 73 | 166 | 815 | 9,650 |
| 3. Gúbas | 94.5 | 45.2 | 0.3 | 45.5 | 28 | 300 | 0.80 | 73 | 92 | 750 | 9,200 |
| 4. Hinlaúmo | 93.3 | 52.7 | 0 | 52.7 | 62 | 300 | — | 100 | 79 | 1950 | 14,300 |
| 5. Ipil-ipil | — | 47.7 | 0.4 | 48.1 | 54 | 300 | 0.74 | 55 | 90 | 450 | 730 |
| 6. Kaatoan-bangkal | 88.2 | 51.0 | 0.7 | 51.7 | 90 | 300 | 0.82 | 85 | 76 | 974 | 12,290 |
| 7. Kapók | 96.8 | 35.5 | 6.2 | 41.7 | 22 | 300 | — | 53 | 63 | 275 | 8,350 |
| 8. Moluccan sau | 85.4 | 55.4 | 0 | 55.4 | 42 | 300 | — | 55 | 72 | 420 | 8,900 |
| *Softwood species* | | | | | | | | | | | |
| 1. Benguet pine | 83.2 | 51.5 | 0 | 51.5 | 45 | 300 | 0.76 | 87 | 104 | 1560 | 10,000 |
| 2. Mindoro pine | 85.4 | 45.0 | 0.4 | 45.4 | 67 | 300 | 0.61 | 72 | 170 | 735 | 9,500 |

TABLE IV. PHYSICAL TESTS ON THE BLEACHED PULPS

| | Time Processed (minute) | CS Freeness (ml.) | Density g/cc | Burst Factor | Tear Factor | Double Folding Endurance MIT | Tensile Strength BLM | G. E. Brightness (percent) |
|---|---|---|---|---|---|---|---|---|
| *Hardwoods* | | | | | | | | |
| 1. African tulip | 25 | 300 | 0.73 | 59.5 | 64 | 470 | 9550 | 72 |
| 2. Anábo | | | — No data — | | | | | |
| 3. Gúbas | 72 | 300 | 0.76 | 79 | 78 | 1230 | 12,100 | |
| 4. Hinlaúmo | 25 | 300 | 0.82 | 51 | 49.5 | 57 | 6900 | 78 |
| 5. Ipil-ipil | 39 | 300 | 0.68 | 34 | 68 | 41 | 6350 | |
| 6. Kaatoan-Bangkal | | | — No data — | | | | | |
| 7. Kapók | 18 | 300 | 0.76 | 30 | 40 | 15 | 7050 | |
| 8. Moluccan sau | 18.5 | 300 | 0.74 | 28 | 54 | 17 | 6850 | 78 |
| *Softwoods* | | | | | | | | |
| 1. Benguet pine | 54 | 300 | 0.76 | 84 | 105 | 1500 | 10,200 | |
| 2. Mindoro pine | 31 | 300 | 0.73 | 57 | 99 | 675 | 8100 | |

## TABLE V. PHYSICAL PROPERTIES OF THE EXPERIMENTAL UNBLEACHED KRAFT PAPERS

| Test No. | Machine Run | Pulp furnish | Basis Weight gms/sq.m | Thick-ness (Mils) | Density gm/cc | Burst factor | Tear factor | Tensile strength or breaking length (meters) | Folding endurance (MIT) double folds | Porosity (Sec.) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | HARDWOODS: | | | | | | | | |
| 92 | 57 | 1. African tulip | 96.6 | 4.2 | 0.960 | 53.1 | 71.8 | 7803 | 986 | — |
| | | 2. Anábo | | No data — lack of material for conversion into paper. | | | | | | |
| 435 | 446 | 3. Gúbas | 65.5 | 3.6 | 0.73 | 57.3 | 88.7 | 8430 | 392 | 76 |
| 484 | 498 | 4. Hinlaúmo | 66.8 | 3.5 | 0.76 | 38.5 | 56.9 | 7530 | 29 | 123 |
| 125 | 141 | 5. Kaatoan-bangkal | 70.7 | 3.3 | 0.841 | 34.9 | 65.6 | 6900 | 161 | 232 |
| 308 | 303 | 6. Kapók | 60.7 | 3.4 | 0.709 | 52.2 | 111.2 | 7050 | 179 | 65.4 |
| 222 | 223 | 7. Moluccan sau | 66.3 | 3.8 | 0.696 | 32.4 | 79.1 | 6170 | 95 | 4.1 |
| | | SOFTWOODS: | | | | | | | | |
| 258 | 260 | 1. Benguet pine | 70.9 | 4.1 | 0.681 | 37.3 | 169.8 | 6020 | 828 | 38 |
| 119 | 137 | 2. Mindoro pine | 74.0 | 3.9 | .740 | 23.6 | 162.9 | 5080 | 424 | 14.4 |

# Proper Use of Wood in House Construction*

by

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ABSTRACT

**Some important housing features including design details, and the structural characteristics of wood are discussed to provide homeowners, designers and builders alike with guiding principles in the use of wood as building material. Sound and bad practices in timber house construction are illustrated.**

INTRODUCTION

Foremost among the many dreams of the average Filipino family is perhaps that of owning a house. It is an urge as irresistible as it is a necessity which few families can afford to ignore and still live in full complacency. A house can vary from the extremes of sophistication, furnished with all the modern-living appliances and conveniences, to the inexpensive, unostentatious yet functional structure primarily for providing shelter and protection from the elements.

Since there are no fixed rules in its design, nor are aesthetic features limited to any one style, a house can be constructed well within a given family's means. Ultimately, a house can be a subtle manifestation of the living standard of the family and its aspirations.

The construction of a house is, of course, not an easy undertaking. It entails countless hours of preparation to arrive at the proper design that will conform with the family taste and standard as well as requirements for shelter and comfort. As a rule, the homeowner simply expects that every peso expended is fully commensurated by satisfactory performance of the house in service with as little repair and maintenance as possible.

For all these necessary preparations, however, seldom does a newly constructed house incur no misgivings in its performance. This is a consequence common to houses built primarily of wood. While any unsatisfactory performance may be remedied or prevented through proper design and construction, the fact remains that so many designers and builders lack sufficient knowledge of the fundamental structural characteristics of wood when used in house construction.

Design details of many important modern housing components are often taken for granted, and their construction are usually left at the discretion of carpenters whose working knowledge of wood is oftentimes acquired on a trial-and-error basis. As a result, many housing defects are attributed to wood when these, in fact, should have been ascribed to faulty design and construction of the house.

There is a need, therefore, to provide prospective homeowners, as well as designers and builders, with some guiding principles in the use of wood in building construction. Presented here are some important housing features to point out samples of bad and good construction practices. Construction details of timber structures and components are so numerous that only those most likely to be overlooked and misunderstood are discussed.

* This paper was read during the FPRI 10th anniversary symposium held at the Forestry Pavilion.

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### SELECTION OF TIMBER SPECIES

Selecting timber species as source of wood materials for various parts of a house is important in building construction.

The different parts and components that make up a house require different strength and performance characteristics of the wood members. Thus, one species of timber is preferred over others for a particular job. For instance, columns and beams have different property requirements, the former assessed for their crushing strength parallel to the grain, while the latter for their strength in bending and bearing perpendicular to the grain. On the other hand, wood species for non-structural members such as jambs, sills and headers, and other millwork and trim items are selected for their shrinkage, warping, splitting, nailing, appearance and other inherent characteristics.

Although quite a number of Philippine wood species are available commercially for construction material, only a few are well-known in the building industry. Most often, timbers of some species are mixed with and marketed under one of the more commercially known species group, such as the yakal, guijo, tañgile and apitong groups. In general, the better-quality lumber commands relatively higher prices, and this should be taken into consideration in the selection of lumber for the various parts of a wood-framed house.

Based on strength and performance characteristics and requirements, the following species are recommended for use in the different parts of a house:

| *Parts of a house* | *Species to be used* |
|---|---|
| Post | Yakal, guijo, apitong |
| Floor girders and roof girts | Yakal, guijo, apitong |
| Floor joists | Yakal, guijo, apitong, bagtikan |
| Roof rafters | Yakal, guijo, tañgile |
| Roof trusses | Apitong, bagtikan |
| Purlins | Apitong, bagtikan |
| Exterior wall framing and partition studs | Apitong, bagtikan |
| Ceiling joists | Tañgile, apitong |
| Base plates | Yakal, guijo |
| Door and window jambs, headers and sills | Yakal, narra, guijo, tañgile |
| Millwork and trim items including door and window frames | Narra, dao, dalingdingan, tañgile, red lauan, almon, white lauan, mayapis, palosapis |
| Flooring | Yakal, guijo, narra, dao, bagtikan, tañgile, red lauan, malugai, nato |
| Sidings | Tañgile, red lauan, bagtikan, white lauan, mayapis, almon |
| Stair stringers and treads | Narra, guijo, yakal, manggachapui |

### SELECTION AND STORAGE OF LUMBER

The quality of the material to be used is of primary consideration for a well-built wood-framed house. Only decay-free lumber should be used, unusually light pieces should be rejected. Extra care should be exercised in the selection of lumber that will be used as structural members of the house, such as posts, floor beams, roof girts and trusses or rafters. Each piece should be examined for defects and other characteristics that would impair its strength properties. As much as possible, no sapwood should be used unless properly coated or treated with the right preservatives.

Wood in service eventually attains a moisture content in equilibrium with the surrounding environment. To avoid the occurrence of unsightly seasoning defects, such as splitting, twisting and warping, especially in the construction of window and door framings, and other exposed finishing works, it is advisable to use lumber that is properly seasoned or kiln-dried. In many parts of the country, the equilibrium moisture content to which lumber should be seasoned ranges from about 14-19%. When green lumber is to be used, it should be air-dried for as long as possible.

Whenever practicable, stacks of lumber should be stored in an adequately roofed make-shift shed and piled on stickers about half a meter above the ground that is free from vegetation, rotten wood and debris to prevent decay and termite infestation and minimize seasoning degrade.

### WATER-DRAINAGE AND AIR-VENTILATION

Indirectly related to the proper use of wood in residential construction is the drainage aspect of design. The building lot should be well drained to keep the ground beneath and around the structure always dry. The ground surface should slope away from the house. Rain water coming from the roof should be conveyed through downspouts into concrete pipes or gutters and discharged at least four feet away from footings and walls (Fig. 1).

Accumulation of water within or around wood structures is not only conducive to decay but may even result in the settlement of foundations. Uneven settlement, in turn, causes unsightly cracks in masonry works which, if large enough, may provide a passage for subterranean termites. Other undesirable consequences include distorted frames, sticking of doors and windows and loosening of joints.

Another design aspect to consider is the provision for air-ventilation. Partitioning of houses should be designed to allow free circulation of air. Fully closed attics, rooms and compartments promote rapid accumulation of moisture, especially during the summer months, which may eventually induce decay in the wood. Whenever practicable, portions of houses floored with wood should be constructed with an unobstructed "crawling space" underneath, about one meter high from the ground line, to allow continuous circulation of air and permit occasional inspections for termite infestation.

### WOOD IN CONTACT WITH CONCRETE

Poured concrete, concrete blocks and other masonry units have become a common sight in many housing constructions. Footings, columns, walls and floor slabs are some of the most important parts of a house where this type of material is most commonly preferred. Because wood is an indispensable material in many housing components, it is inevitable that some wooden members and framed components are placed directly in contact wtih concrete. Examples of wood-to-concrete construction are those of timber posts bearing on concrete footings, timber beams on reinforced concrete columns, wooden door and window frames on concrete hollow block walls, and wooden sleepers on concrete slab floors.

Since concrete has the propensity for absorbing moisture from humid air and soil, wooden members in contact with it becomes susceptible to fungal attack. Furthermore, "honeycomb" and cracks in concrete works even provide a hidden passageway for termites. It is advisable, therefore, to use wood species that are inherently resistant to decay and termite attack, or to use lumber properly treated with appropriate preservatives.

However, naturally durable species are not easily available in the market, while pressure-treated timbers are far more expensive than untreated ones. An alternative method, which oftentimes proves cheaper and more practicable, is to follow sound concrete-to-wood construction practices.

Wooden base plates, anchored and set evenly on mortar laid on top of concrete walls, prevent direct fungal infestation on load-bearing wooden members (Fig. 2). The transfer of moisture from the concrete wall to the base plate may be minimized by coating the face of contact with an oil-based preservative. This treatment also provide, to some extent, protection against subterranean termites. When the wall is constructed with concrete hollow blocks, the base plate should be set evenly on a poured concrete cap to seal voids inside the hollow blocks, which may serve as passageways for termites (Fig. 2A).

In constructions built directly on concrete-slab floors, wooden posts, door jambs, studs and partition based plates should be placed on elevated concrete bases (Fig. 3A). Wooden members embedded in or set flush with concrete-slab floors are susceptible to decay due to possible accumulation of water on the floor, while those placed through the concrete slabs in contact with the ground are prone to both fungal and termite attacks.

If wooden flooring is laid over a concrete slab on fill (Fig. 4), there should be a damp-proof membrane, preferably in the upper part of the slab, otherwise, the slab surface should be thoroughly coated with tar or asphalt materials. In some instances, lumped charcoal is spread on concrete slab to act as moisture absorbent. In this particular construction, only the heartwood of naturally durable species or pressure-treated wood should be used for floor sleepers.

### PARTS OF HOUSE EXPOSED TO RAIN

Sound construction design calls for the protection of wood as much as practicable from rain water. In general, a design that allows the least possible entrance and retention of rain water is essential to good building. Thus, sufficient overhang must be provided at both the eaves and gable ends. In most cases, an overhang of about one meter from the exterior walls offers enough protection from free-falling rain. For houses provided with roof gutters, a sufficient number of downspouts should be placed strategically along the exterior walls to convey rain water coming from the roof down to the ground-water drainage.

Wetting, however, of some parts of the house, especially exterior walls and window sills, from wind-blown rain is unavoidable. While the degrading effect of cyclic wetting and drying on wood can be easily minimized through proper design, it is often taken for granted in construction.

Figure 5 illustrates the good and bad construction practices in placing wooden stone-cut and V-cut sidings in walls. Vertically-oriented sidings have an obvious drawback because wind-blown rain may find its way through the lap joints, especially after some shrinkage has taken place. This may be minimized either by using properly-seasoned-lumber sidings or by proper orientation of the sidings from the prevalent rain direction (Fig. 5A).

Figure 6 shows in detail an ideal design for window sills, complete with three distinct desirable features, to minimize possible entry of rain water. The elevated portion, embedded in the window jambs, keeps water from getting inside, the bevelled surface facilitates free drainage of run-off water, while the notch underneath prevents water from dripping into the lower exterior walls.

For window sills, resting on concrete or masonry walls, care should be taken in order not to plug the notch with excess mortar.

### STRUCTURAL FRAMEWORK

The structural framework provides the basic strength and rigidity for the satisfactory service performance of a house. Individual load-bearing members should be designed adequately to carry an expected system of loads in service, and that various wood joints and connections be properly detailed in working plans to allow easy supervision in construction.

Vertical studs can be designed as load-bearing members to help support the roof system rather than to serve simply as nailing strips for wall sidings. The wall sidings, on the other hand, contribute to the stiffness of the house and hold the studs in proper alignment. Further reinforcing of walls is effectively accomplished with diagonal "let-in" brace (1 in. by 4 in. or 1 in. by 6 in.) used at all corners of the house (Fig. 7). Horizontal pieces carelessly inserted and toe-nailed between vertical studs do not constitute good bracing.

To achieve a structurally well-designed frame house, all parts should be adequately joined. The principal fastenings in a wood-framed house consist of bolts and nails. Good nailing practice involves the determination of both correct size and number of nails, as well as the arrangement and direction in which they are driven into adjoining members.

Figures 8 and 9 illustrate some correct nailing practice, using common wire nails. The nailing specified for many of the joints is based on judgment and experience. For instance, two 2½" nails, when toe-nailed through each side of the studding to the base plate, have been found to be generally adequate. However, where high resistance to uplift as well as to side-thrust is required, steel straps or metal plates in conjunction with nails, such as those shown in Fig. 10 are necessary.

Good construction practice also requires proper anchorage, particularly in areas where very strong winds develop during storms or typhoons. To assure a structures of its reasonably good resistance to stresses caused by wind action, wooden base plates should be anchored to concrete foundation or masonry walls by bolts of not less than ½ in. diameter, with average embedment in the concrete of 8-18 in. (Fig. 2). Spacing should not be more than 8 ft.

Properly toe-nailing the roof framework to the roof girts in wooden walls or to base plates in concrete walls is usually sufficient for roofs having a slope of 30° or more. For relatively low-pitch roofs, however, the use of steel straps similar to that shown in Fig. 2 is necessary to supplement the nails so as to provide good resistance to uplift and thrust forces.

Figure 11 illustrates a typical post-girder-and-rafter system of wood framing, showing the proper method of connecting, fastening and anchoring the different structural parts of a building.

### OTHER HOUSING FEATURES

The roof is about the most important part of a house. False economy in its construction often leads to disastrous results in the overall performance of the house. Roof valleys and ridges should be properly constructed because roofing damages, resulting from rain water leakages, involve major repairs. Several types of roofing materials are available in the market but no single material meets all the roofing requirements. In most parts of the country, however, the performance of corrugated G.I. sheets and asbestos sheets have been found to be widely acceptable.

In home building, it is not uncommon to find water pipings, heating ducts, electrical conduits and other plumbing necessities interferring with some structural members. To avoid weakening the structural adequacy of the framework, which may result from unwarranted cutting or sawing of structural members to make way for pipes and the like, the plumbing and electrical needs of a house should be carefully planned well in advance.

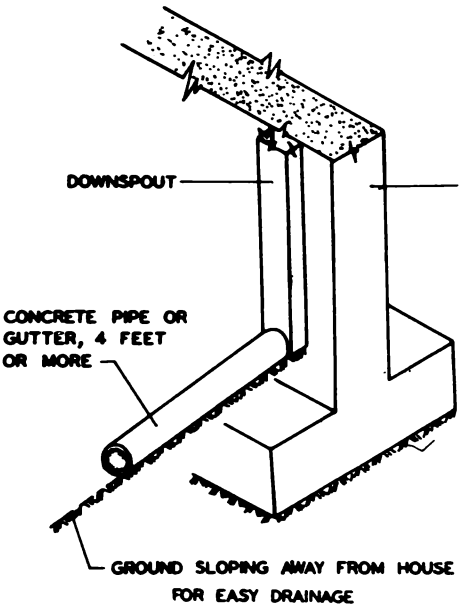



FIG. 1 - PROPER DRAINAGE IN HOUSE CONSTRUCTION

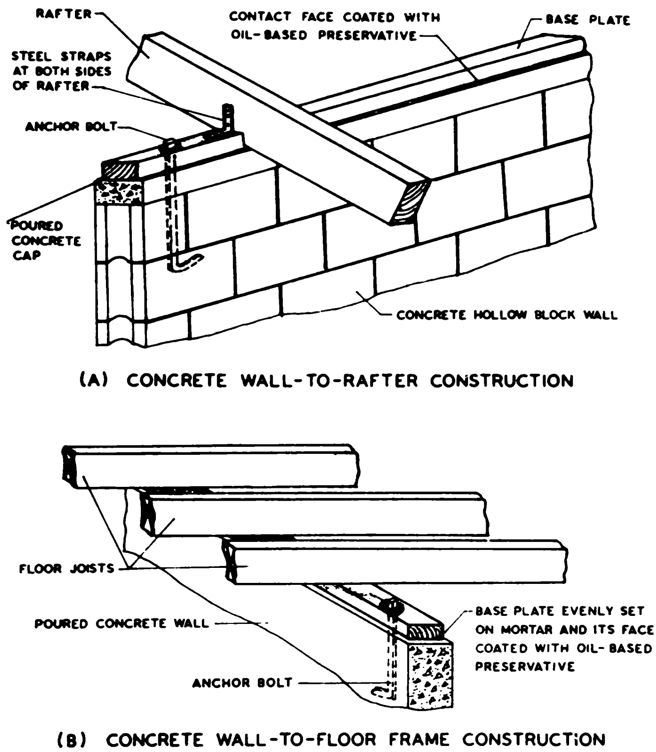



FIG. 2 - GOOD CONSTRUCTION PRACTICE OF SETTING WOODEN BASE PLATES ON CONCRETE OR MASONRY WALL.

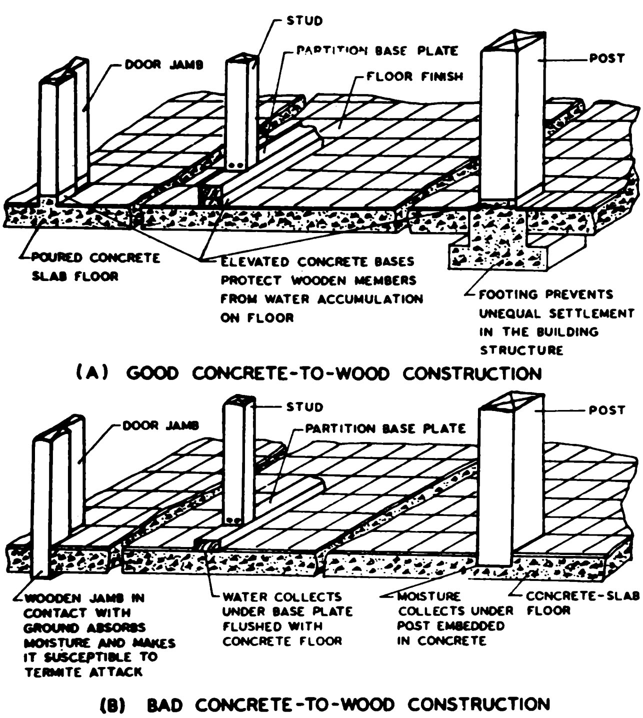



FIG. 3 - GOOD AND BAD CONSTRUCTION PRACTICES OF PLACING WOODEN MEMBERS IN CONTACT WITH CONCRETE FLOOR SLAB.

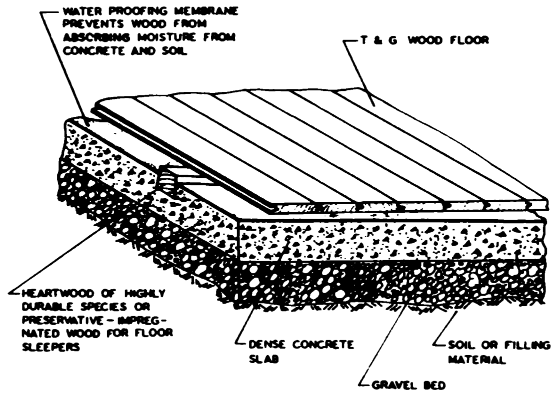
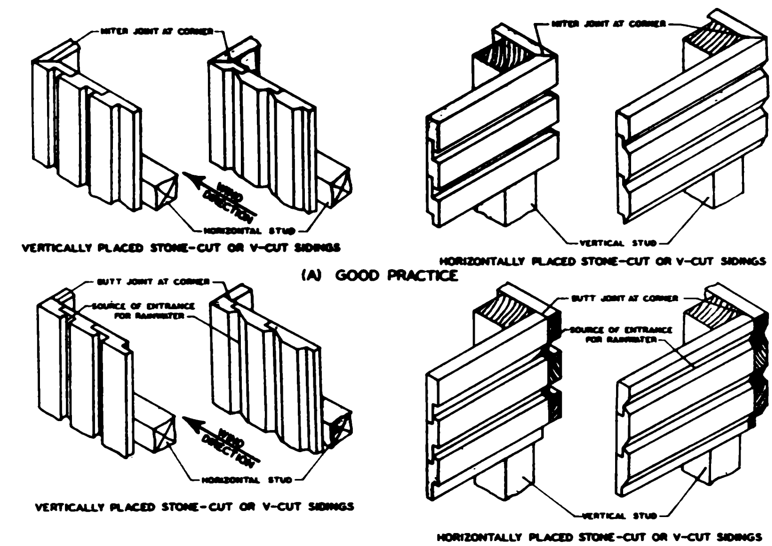
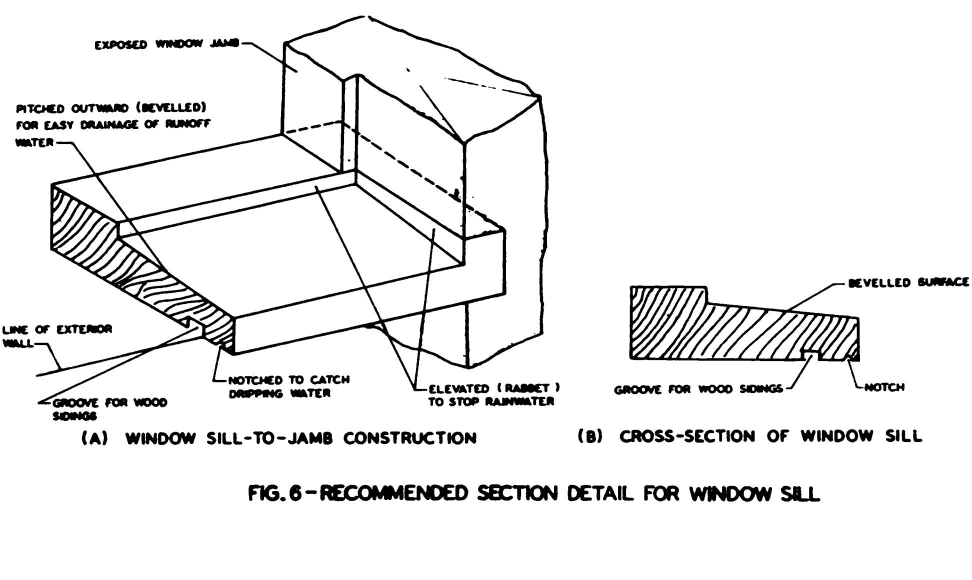



FIG. 4 - GOOD CONSTRUCTION PRACTICE WITH FLOOR ON CONCRETE SLAB




(B) BAD PRACTICE

FIG. 5 - GOOD AND BAD CONSTRUCTION PRACTICES OF EDGE-LAPPING EXTERIOR SIDINGS




(A) WINDOW SILL-TO-JAMB CONSTRUCTION (B) CROSS-SECTION OF WINDOW SILL

FIG. 6 - RECOMMENDED SECTION DETAIL FOR WINDOW SILL

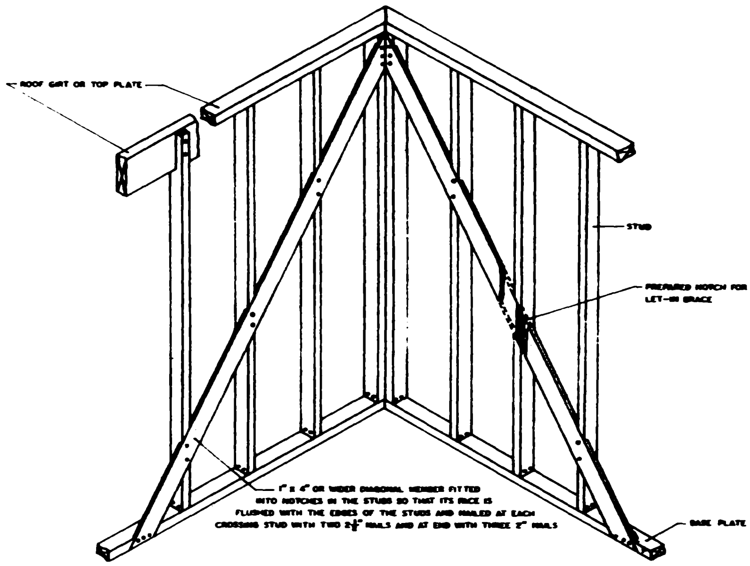



FIG. 7-CORNER LET-IN BRACING CONTINUOUS FROM TOP TO BOTTOM FOR ADDITIONAL RIGIDITY

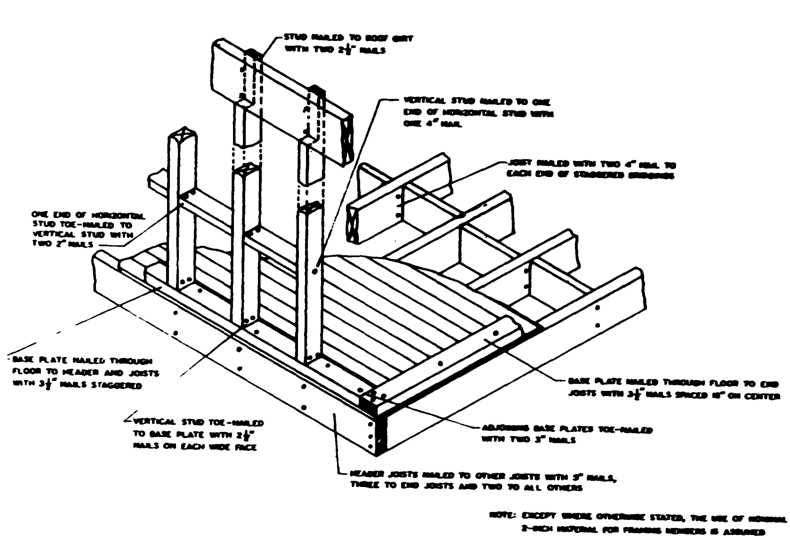



FIG. 8-RECOMMENDED PRACTICE FOR NAILING TOGETHER STRUCTURAL PARTS OF WOODEN-FRAMED HOUSE

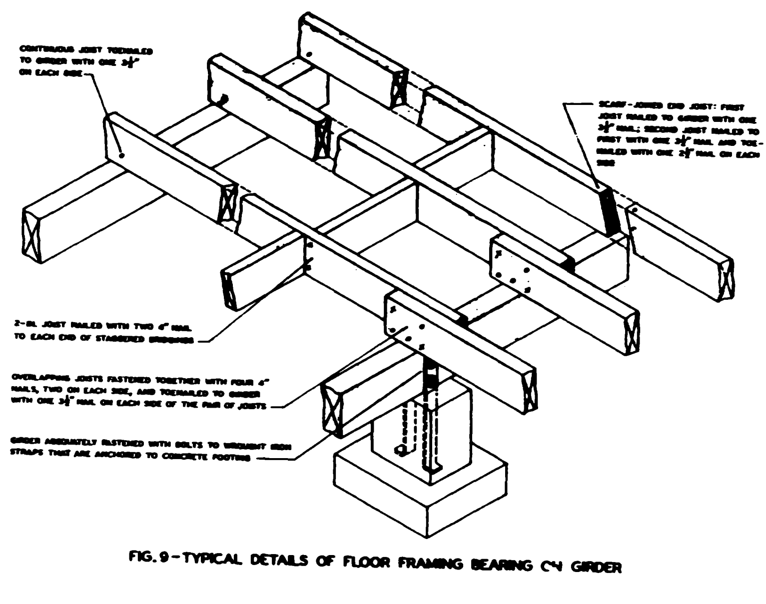
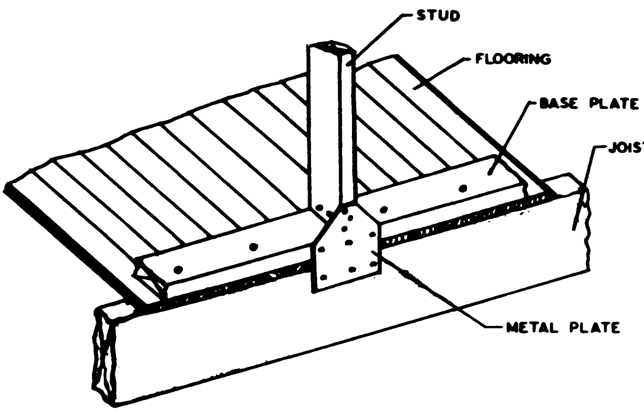
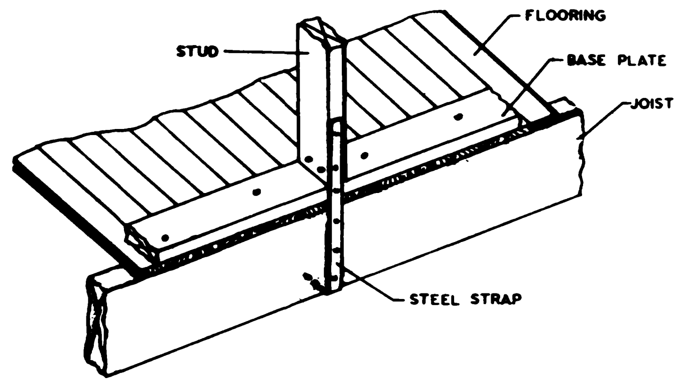



FIG. 9-TYPICAL DETAILS OF FLOOR FRAMING BEARING ON GIRDER




(A) FRAMING CONSTRUCTION USING METAL PLATES




(B) FRAMING CONSTRUCTION USING STEEL STRAPS

FIG. 10 - TYPICAL DETAIL OF STUD-TO-JOIST FRAMING CONSTRUCTION WHERE HIGH RESISTANCE TO UPLIFT AND SIDE THRUST IS REQUIRED.

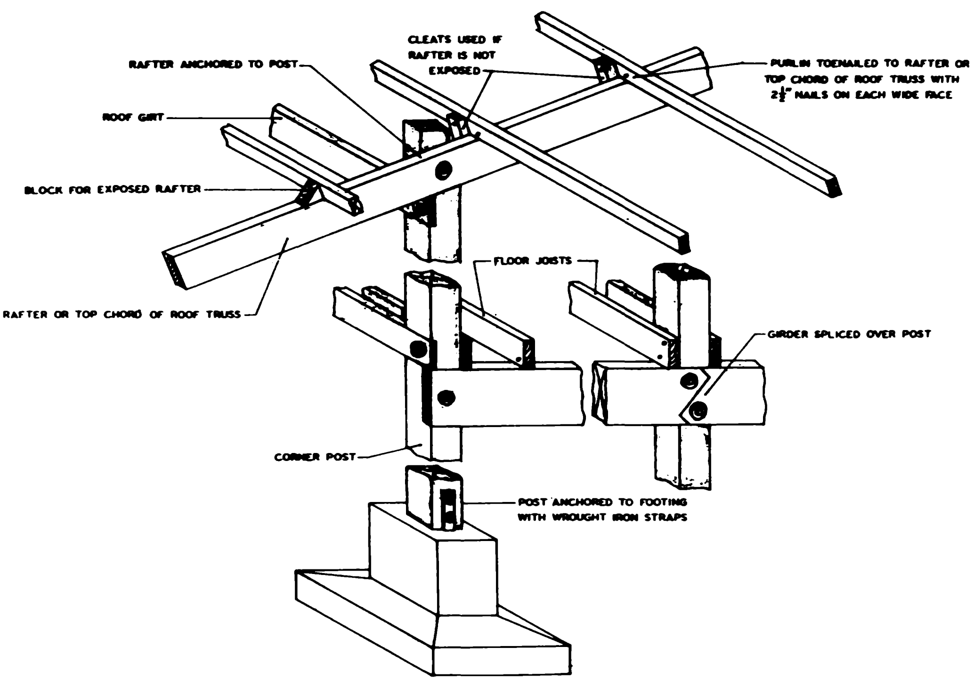



FIG. 11 - TYPICAL DETAILS OF WOOD FRAMING CONSTRUCTION

# Some Aspects on Long-Fiber Research

by

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SUMMARY

The Philippines has been importing the long-fibered softwood pulps needed for the manufacture of paper bags (cement), wrapping papers, and for blending with short-fibered materials in the production of other various papers. To help the country abate this perennial importation, the Forest Products Research Institute has directed its long-fiber research on local materials such as Philippine woods, agricultural plants and minor forest products. Sulfate pulps of Benguet pine, a local softwood, was found suitable and as good as imported long-fibered material. Recently, pulps of some species of banana and abaca were found as good as Benguet-pine pulp. The "FPRI Defibering Scheme" made it possible to extract their fibers without the use of chemicals.

INTRODUCTION

The Philippines, like other tropical countries, is short of long-fibered softwoods for the production of paper bags, wrapping papers and for blending short-fibered materials for making various other types of papers. Only a few softwoods, particularly Mindoro and Benguet pines, are found scattered in isolated higher places in Abra, Mt. Province, Zambales and Mindoro. As a consequence, the Philippines has been importing long-fibered softwood pulps from other countries, a perennial shortage problem plaguing the Philippine pulp and paper industry. To find new sources of long-fibers that would be economically attractive to this industry, the Chemical Investigations Division of the Institute has launched its new program of intensive search and evaluation of promising local fiber plants, based on their chemical composition, morphology of their fibers and other pertinent data as a pulping material. Only those that are prospective to be grown in plantation with high fibrous yield per unit area, high alpha-cellulose content and satisfactory technical characteristics are given high priority attention.

In view of the current acute needs for long-fibered materials in the Philippines and the desire to reduce importation, perhaps the public may want to know the progress of this newly initiated research program. To date, substantial information have been accumulated to augment our knowledge about long-fiber materials.

This report deals particularly on the evaluation (morphology, chemical composition and pulping) of Benguet pine, and the stalks[2] of some banana species (saba, matsing, latundan and pakol) and abaca.

SOURCE AND EVALUATION OF FIBROUS MATERIALS

The fiber dimensions of the materials, determined by the Wood Technology Divi-

[1] Researchers of the Chemical Investigations Division.

[2] Inasmuch as the banana and abaca stalks contain parenchymatous cells which do not contribute to pulp and papermaking, but consumed pulping chemicals and produced color reversion in pulp and papers it was imperative to remove these impurities before pulping. For comparison, however, the sulfate pulping of whole abaca stalks was also undertaken.

sion of the Institute (1, 2)[3], are given in Table 1. The chemical composition, pulping quality and evaluation of the pulps, determined by the Chemical Investigations Division, are shown in Tables 2, 3 and 4, respectively.

### BENGUET PINE (PINUS INSULARIS)

*Source*

Benguet pine is found in pure stand at elevations of 2,500 - 7,000 ft. in Abra and the Mountain Province where the climate is cool (62 - 66°F.). The economic rotation is estimated to be about 50 years but because of transportation problems, rotation is 40 years (regeneration period of 2 years and cutting age at 38 years). During the 40 years, the average annual increment is about 9 m³ per hectare, with a total production of 360 m³ of which 320 m³ can be used for pulp. In a plantation of 2 x 2 m., 25-year old thinnings may be used. However, if the forest stands are far from roads and rivers, it may be necessary to use 25-30-years old stands without thinning (3, 4).

*Pulping*

The Benguet pine was pulped in a rotary, cylindrical, steam jacketed, stainless steel digester of 0.8 cu. ft. capacity at a liquor-material ratio of 4:1 with a pulping liquor containing an active alkali of 15.6%. The chips were cooked at a maximum temperature of 170°C. for a duration of 180 minutes (90 minutes from room to maximum temperature and another 90 minutes at this temperature). After cooking, the pulp was washed thoroughly and the washed pulp was pressed to about 70% moisture content. The pulp yield, permanganate number and the strength properties of the screened pulp were determined.

### BANANA SPECIES

*Source*

The principal banana producing provinces in the Philippines (5) are as follows:

| | Hectares | No. of hills | Estimtaed Production (kilos) |
|---|---|---|---|
| 1. Misamis Oriental | 5,570.7 | 2,115,474 | 63,201,144 |
| 2. Camarines Sur | 10,590.7 | 3,710,110 | 47,821,920 |
| 3. Agusan | 5,904.6 | 2,588,134 | 45,764,782 |
| 4. Cavite | 6,254.6 | 2,554,448 | 44,958,517 |
| 5. Oriental Mindoro | 6,508.3 | 2,842,009 | 39,127,900 |
| 6. Samar | 10,658.8 | 4,141,656 | 34,631,127 |
| 7. Palawan | 3,060.3 | 1,347,707 | 34,561,515 |
| 8. Negros Occidental | 8,724.3 | 3,531,584 | 28,729,550 |
| 9. Southern Leyte | 4,655.7 | 2,023,869 | 28,502,439 |
| 10. Cotabato | 8,316.2 | 3,354,414 | 27,740,810 |

The table above indicates that large amount of banana stalks are found mostly in Luzon (southern part), Palawan, Visayas and Mindanao. If the banana stalks are used as pulping materials, it is necessary that, in each region where banana plantation is located, there should be a central defibering station or, better still, a portable defibering machine, pulled by a jeep, that could be taken easily to the plantation when whole cutting of the banana stems are to be done. After defibering, the fibers are brought to a central station, thoroughly washed, dried and baled ready for pulping.

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[3] Numbers in parentheses indicate the literature reference the end of this paper.

[3] Pulps were prepared by Brown and Co., Berlin, N. H., U.S.A. which was used as a reference.

*Pulping*

Both the "pakol" and the "matsing" fibers were pulped by the sulfate process. The "saba" and the "latundan" fibers, however, were pulped by the soda process, using the same digester that was used in the pulping of the Benguet pine.

ABACA

*Source*

For comparison, abaca stalks were also pulped by the sulfate process in the same digester used in the pulping of the other materials. The whole abaca was pulped without removing the parenchymatous cells.

The first ten abaca producing provinces in the Philippines (5) are as follows:

| | Province | Plantation Area (Hectares) | Production (Kilos) |
|---|---|---|---|
| 1. | Davao | 27,977.5 | 17,960,740 |
| 2. | Leyte | 11,059.3 | 8,293,799 |
| 3. | Sorsogon | 17,602.7 | 8,085,003 |
| 4. | Samar | 13,257.2 | 8,028,280 |
| 5. | Camarines Sur | 19,192.6 | 7,944,418 |
| 6. | Catanduanes | 13,585.1 | 7,586,371 |
| 7. | Albay | 15,993.9 | 7,127,902 |
| 8. | Bukidnon | 11,170.2 | 4,749,544 |
| 9. | Cotabato | 6,116.3 | 4,629,578 |
| 10. | Lanao del Sur | 3,994.9 | 4,307,349 |

Like the banana stalks, the abaca contains a large amount of parenchyma cells. Hence, when abaca is used as a pulping material, a portable defibering machine which removes the parenchymatous cells should be available in each plantation when the whole cutting is to be done.

*Pulping*

The abaca (sabahon) fibers as well as the whole abaca stalks were pulped in the cylindrical digester by the sulfate process at a liquor-material ratio of 4:1. The other cooking conditions used are indicated in Table 3.

DISCUSSION OF RESULTS

*Fiber Morphology (Table 1)*

Except pakol, the banana fibers were longer than those of abaca stalks. However, the abaca (sabahon) fibers (average fiber length, 4.71 mm.) were longer than those of the whole abaca stalks. It is a well known fact that generally, tear depends much on fiber length and cell-wall thickness but the strength data (Table 4) show that there may be other factors that influence tear.

*Chemical Composition (Table 2)*

The latundan fibers were the highest in holocellulose content compared with the Benguet-pine fibers, the lowest. Also, the latundan fibers were the highest in solubility in hot water as well as in 1% caustic soda, indicating that they consumed higher amount of pulping chemicals than the Benguet pine and the other banana fibers. Although Benguet pine was the highest in lignin content, it was much lower in solubility in hot water and in 1% NaOH than the other materials. Apparently, less pulping chemical were needed in pulping Benguet pine.

*Benguet Pine Pulp*

The Benguet pine was easily pulped by the sulfate-pulping process, giving a pulp yield of 48.9% and a pulp permanganate No. of 27 (Table 3). The pulp produced was of good quality comparable to a commercial kraft pulp from the softwoods spruce and fir[3]. In strength properties, the Benguet pine sulfate pulp had lower folds but higher burst, tear and tensile strength than the reference pulp (Table 4).

Comparatively, the pulp from the Benguet pine was harder to beat than the reference pulp and the pulps from banana fibers. Also, it had higher permanganate No. than those of the banana fibers, indicating that the banana fibers pulps would be easier to bleach than the Benguet pine sulfate pulp.

*Banana Pulps*

The banana pulps were easier to beat than the reference pulp. The tearing, burst and tensile strengths of the banana fiber sulfate pulps were slightly lower than those of the Benguet pine but the folds were higher (Table 4). Although the bursting strength and the folding endurance of the banana fiber sulfate pulps were lower, the tearing and tensile strengths were higher than those of the reference pulps.

The strength properties of the banana fiber pulps could be improved by changing the pulping process or the pulping variables.

*Abaca Pulps (Table 4)*

Whole abaca-stalk pulp was easy to beat and took only 11 minutes to beat it to 200 ml. freeness (C.S.) as compared to 96 minutes for the sabahon fiber pulp and the average of 28 minutes for the banana fiber pulps.

The strength properties of the abaca (sabahon) fiber pulp were much higher than those of the whole abaca-stalk pulp. This shows the importance of removing the parenchymatous cells not only to remove these extraneous materials which consume pulping chemicals and produce color reversion in pulp and papers but, also, to improve the strength properties of the pulp and papers made from the abaca stalks.

The pulps from both the whole abaca stalks and the abaca fibers were stronger than these from the banana fibers, Benguet pine and the kraft pulp from spruce and fir.

## CONCLUSIONS

1. The banana species, "saba, matsing, latundan and pakol", the Benguet pine and abaca are promising sources of long fibers for the pulp and paper industry.
2. Benguet pine sulfate pulp is stronger than the commercial kraft pulp from the softwoods, spruce and fir.
3. Good quality bleachable pulps, comparable to a softwood kraft pulp from spruce and fir, were produced from the fibers of "saba, matsing, latundan and pakol", and abaca fiber and stalks.

## REFERENCES


1. Tamolang, F. N., *et al.* 1958. Tappi 41 (10): 616.
2. Tamolang, F. N., *et al.* 1962. Tappi 45 (2): 139.
3. Buggs, B. S. 1955. "The development of the pulp and paper industry in the Philippines, Technical Annex No. 5 U.N. Technical Assistance Administration, FAO of U.N. New York (pp. 6-7).
4. Hvid, A. 1955. The development of the Pulp and Paper Industry in the Philippines. Technical Annex No. 4. U.N. Technical Assistance Administration, FAO of the United Nations, N.Y., U.S.A.
5. Census of the Philippines. Summary. 1960. Agriculture. Vol. II. Dept. of Commerce and Industry, Bureau of Census and Statistics, Manila.

TABLE 1. FIBER DIMENSIONS AND DERIVED VALUES

| Materials | Length L mm. | Width D mm. | Lumen width l mm. | Cell Wall thickness w mm. | Slenderness ratio L 100 D | Flexibility ratio l 100 D | Runkel ratio 2w/l |
|---|---|---|---|---|---|---|---|
| Benguet pine | 3.45 | .041 | .029 | .0060 | — | — | — |
| Banana fibers: | | | | | | | |
| "Saba" | 6.71 | .028 | .022 | .0030 | 240 | 79 | 0.27 |
| "Matsing" | 4.40 | .025 | .016 | .0045 | 176 | 64 | 0.56 |
| "Latundan" | 5.55 | .025 | .019 | .0030 | 222 | 76 | 0.32 |
| "Pakol" | 3.09 | .023 | .015 | .0046 | 173 | 65 | 0.53 |
| Abaca species, sabahon | 4.71 | .023 | .016 | .0035 | 205 | 70 | 0.44 |
| Whole abaca (Musa textilis nee) | 3.15 | .020 | .013 | .0035 | 158 | 65 | 0.54 |

TABLE 2. CHEMICAL COMPOSITION OF BENGUET PINE, AND THE FIBERS OF SABAHON, SABA, MATSING, LATUNDAN AND PAKOL

| | Ash | Solubility in: | | Lignin | Solubility in Hot-water (unleached) | 1% NaOH extract | Pentosans | Holocellulose |
|---|---|---|---|---|---|---|---|---|
| | | Alcohol benzene | Hotwater (leached) | | | | | |
| | %[2] (1) | %[2] (2) | %[2] (3) | %[2] (4) | %[2] (5) | %[2] (6) | %[2] (7) | %[2, 3] (8) |
| 1. Benguet pine | 0.2 | 2.2 | 1.6 | 29.3 | 2.1 | 15.6 | 10.7 | 62.8 |
| 2. Banana fiber: | | | | | | | | |
| Saba | 2.7 | 1.24 | 4.28 | 14.8 | — | 26.43 | 17.99 | 76.97 |
| Matsing | — | — | — | — | — | — | — | — |
| Latundan | 2.53 | 1.1 | 4.89 | 13.13 | — | 27.0 | 17.1 | 78.4 |
| Pakol | — | — | — | — | — | — | — | — |
| 3. Abaca species: | | | | | | | | |
| Sabahon | .79 | 0.92 | 1.19 | 12.86 | — | 22.6 | 17.62 | 84.24 |
| 4. Whole abaca (Musa Textilis nee) | 12.13 | 6.2 | 13.5 | 10.49 | 16.1 | 12.4 | 16.54 | 57.68 |

[2] Basis: moisture-free material.

[3] The holocellulose was determined approximately by subtracting the sum of the percentage of ash, alcohol-benzene, hot-water (leached) and lignin from 100, i.e., holocellulose = [100 — (1 + 2 + 3 + 4)].

TABLE 3. PULPING DATA

| Materials | Cook | Active chemical % | Liquor-material ratio | Duration: Room to max. temp. (min.) | Duration: at max. temp. (min.) | Max. temperature °C | Pulp yield [3] % | Permanganate No. of pulp |
|---|---|---|---|---|---|---|---|---|
| Benguet pine | | 15.6 | 4:1 | 90 | 90 | 170 | 48.9 | 27.00 |
| Matsing fiber | | 15.6 | 6:1 | 90 | 90 | 170 | 56.74 | 6.33 |
| Pakol fiber | | 15.6 | 6:1 | 90 | 90 | 170 | 40.90 | 8.33 |
| Saba fiber | | 13.18 | 6:1 | 90 | 90 | 170 | 56.30 | 10.29 |
| Latundan fiber | | 13.18 | 6:1 | 90 | 90 | 170 | 53.6 | 7.51 |
| Whole abaca stalks | | 9.4 | 4:1 | 90 | 90 | 170 | 66.75 | — |
| Sabahon fiber | | 12.4 | 4:1 | 90 | 90 | 160 | 56.0 | 5.82 |

[3] Basis: Moisture-free basis of the raw material.

TABLE 4. PHYSICAL PROPERTIES OF PULPS

| | Processing time min. | Freeness (C.S.) ml. | Density (g./cc.) | Burst factor | Tear factor | Folds (MIT double | Breaking length (m) |
|---|---|---|---|---|---|---|---|
| Benguet pine | | | | | | | |
| Sulfate pulp | 59 | 500 | .660 | 80 | 132 | 835 | 11800 |
| | 68 | 400 | .660 | 81 | 121 | 840 | 11800 |
| | 78 | 300 | .665 | 81 | 114 | 845 | 11600 |
| | 88 | 200 | .680 | 81 | 108 | 850 | 11200 |
| Matsing fiber | 1 | 500 | .640 | 68.8 | 126.5 | 1260 | 9050 |
| Sulfate pulp | 5 | 400 | .680 | 76.5 | 112.5 | 1350 | 9500 |
| | 13 | 300 | .720 | 83.5 | 104.0 | 1560 | 10100 |
| | 23 | 200 | .740 | 91.0 | 101.5 | 1980 | 10750 |
| Pakol fiber | 4 | 500 | .630 | 53.5 | 132.5 | 730 | 7950 |
| Sulfate pulp | 9 | 400 | .680 | 65.0 | 114.7 | 1030 | 8800 |
| | 15 | 300 | .690 | 73.0 | 105.0 | 1290 | 9550 |
| | 23 | 200 | .700 | 76.5 | 103.5 | 1510 | 10100 |
| Saba fiber | 5.0 | 500 | .651 | 58.5 | 128.5 | 1245 | 9100 |
| Soda pulp | 9.5 | 400 | .700 | 67.0 | 112.8 | 1530 | 11100 |
| | 16.0 | 300 | .720 | 74.8 | 101.8 | 1790 | 10750 |
| | 26.0 | 200 | .740 | 80.0 | 96.5 | 1895 | 11175 |
| Latundan fiber | 7 | 500 | .620 | 48.5 | 111.5 | 750 | 8250 |
| Soda pulp | 14 | 400 | .670 | 58.5 | 110.0 | 1050 | 9050 |
| | 24 | 300 | .720 | 64.0 | 102.8 | 1450 | 9000 |
| | 42 | 200 | .750 | 65.0 | 96.0 | 1870 | 10100 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sabahon fiber | 28.5 | 500 | .615 | 79.8 | 253.0 | 2338 | 9800 |
| Sulfate pulp | 47.00 | 400 | .645 | 85.0 | 207.0 | 2938 | 10725 |
| | 69.5 | 300 | .665 | 87.5 | 179.0 | 3275 | 11205 |
| | 96.0 | 200 | .690 | 86.5 | 176.0 | 3238 | 10975 |
| Abaca stripped fiber | 34 | 500 | .640 | 115.0 | 280.0 | 3350 | 11800 |
| Sulfate pulp | 52 | 400 | .690 | 112.5 | 226.0 | 3400 | 12150 |
| | 72 | 300 | .720 | 108.0 | 214.0 | 3500 | 12000 |
| | 92 | 200 | .730 | 102.5 | 209.0 | 3950 | 11650 |
| Whole abaca stalks | 0 | 480 | .570 | 80.0 | 182.0 | 1780 | 9650 |
| Sulfate pulp | 2 | 400 | .600 | 81.5 | 171.0 | 2180 | 11400 |
| | 6 | 300 | .630 | 87.5 | 157.0 | 2580 | 12450 |
| | 11 | 200 | .650 | 96.5 | 135.5 | 2950 | 13000 |

REFERENCE PULP. Kraft pulp (commercial) from Spruce and fir (From Brown Co., Berlin, --- H., U.S.A.)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 26 | 500 | .740 | 71.2 | 123.5 | 1300 | 3050 |
| | 37 | 400 | .795 | 76.0 | 107.0 | 1900 | 4400 |
| | 46 | 300 | .830 | 79.0 | 98.0 | 2150 | 5700 |
| | 57 | 200 | .800 | 80.8 | 95.3 | 2200 | 7300 |

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# Bending Solid Wood and its Potentialities*

by
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ABSTRACT

The process of bending wood to form has not been fully utilized in the production of curved wood products in the Philippines. This is due to lack of information on the bending properties of local woods and of technical know-how attendant to bending. Aware of this, the Forest Products Research Institute (FPRI) has initiated a series of studies on the bending properties of Philippine woods. Results of the first test are given here. Basic principles and bending methods and processes applicable to local woods are also briefly discussed.

INTRODUCTION

Wood, in solid, laminated, or plywood form, could be utilized in many ways if processed according to specifications or requirements. Wood processing demands a knowledge of two basic concepts; first, the features of the wood to be utilized in production and, second, the proper techniques. Wood products manufacturer, therefore, must be able to handle his production for certain uses and of course, for profit, if he is conversant with those fundamental concepts. Some basic information on the chemical, physical and mechanical properties of Philippine woods, which can be used to advantage by the local wood-using industries, are now available at the FPRI.

* This paper was read during the FPRI 10th anniversary symposium held at the Forestry Pavilion.

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Not much is known about bending properties and methods of bending local woods to form. Curved components of locally-manufactured structures, furniture and fixtures are machined to profile from massive straight-glued laminated assemblies or from solid-wood stock. This method entails enormous waste of materials and production time. Wood fibers are torn and the surface of wood members are disfigured when machined; thereby reducing the strength of curved stress-members as well as marring the beauty of wooden novelties, furniture and fixtures.

Bending of wood after plasticizing treatment in boiling water or wet steam is considered as the most economical and efficient means of making a bent wood component. In Europe, the United Kingdom and the United States, steam-bending is widely applied in building boats, in the manufacture of furniture, tool handles and athletic goods and equipment.

The objective of this paper is to enlighten the local wood-using industries on the possibilities of local wood species for bent works and on some basic aspects of bending the wood of these species to form. The principal source of information is the study being conducted by the author, and augmented by available literature on wood bending. Observations, too, on factory operations and the practical experience of the manufacturers of furniture and other bent wood products also proved valuable sources of information.

PRINCIPLES OF WOOD BENDING

During the bending operation, the transverse plane section remains plane and normal to the longitudinal fibers, that is, the end sections originally squared remain square (2)[2]. In the bent state of wood, the lengths of the concave and the convex faces are not equal as when they were first cut. The shortening of the concave face and the elongation of the convex face are results of the compressive and tensile stresses induced on the fibers, respectively.

Wood, in its natural state, possesses elastic properties within a restricted stress range. When the applied forces are released, the strain disappears and the stock assumes its original state and dimensions. Within elastic limits, a bend produced on the stock will recover its shape when the bending forces are released. However, when the stress is exceeded, the proportionality between strain and stress does not hold true. Upon removal of the stress, permanent deformation usually takes place. Further stressing will induce strain and ultimately cause fracture on the piece of wood. For any given thickness of wood, maximum strain will occur on its extreme inner and outer surfaces as the radius of curvature decreases.

Very often, timber, in its natural state, cannot be bent to a very small radius of curvature without fracturing. However, after undergoing heat treatment in the presence of moisture, like boiling water or wet steam, most timbers become semi-plastic. Their compressive properties are improved. Heat treatments, however, bear little effect on the tensile properties of wood.

## BENDING STOCK

### *Selection of Stock*

The suitability and availability of the species govern the selection of wood to be used in fabricating bent wood products. If the curvature is severe, the bending qualities of the wood will dictate the selection of the stock. The bending properties of wood varies within the same species; more so among the different species. Complete data are not yet available to allow the classification of Philippine woods in the order of their bending property. However, as far as solid bending is concerned, hardwoods are found generally better than softwoods, which explains why the latter is seldom utilized (1).

Bending stock that contains strength-reducing defects, such as decays, knots, worm holes, shake, cross grain, pitch, surface checks, brash wood and others must be avoided. On either mild or severe bends, minor defects such as small pitch streaks, burls and small checks may be allowed beyond the part to be bent or on the convex side. If located on the concave face of a severe bend, such defects will cause localized stresses and compression fracture will occur.

### *Seasoning the Stock*

Almost all bent members can be made from green stock. However, wood is likely to split, check and shrink if the moisture content of the stock is not suitable for the setting method required to attain the moisture content desired of the finished product. To minimize bending defects, the stock should be seasoned to a moisture content favorable to the bending method and the angle and radius of curvature. For instance, in hot-press bending, where the curvature is mild and drying conditions severe, the allowable moisture content of the stock is lower than that of stock bent over forms by hand or by machine. Generally, satisfactory results are obtained at moisture content of 25 to 30 per cent (3).

### *Machining the Stock*

If practical, the sawing, surfacing and shaping operations should be done on the straight piece before it is bent. The stock should be machined to about final shape and dimensions so that the operation after set-

[2] Numbers in parenthesis denote references cited at the end of this article.

ting and conditioning would be limited to sanding.

In machining the stock, the following guidelines will serve best (1): (a) cut stock to the minimum thickness, with due allowance for distortion and shrinkage after bending; (b) cut stock accurately to length that will fit tightly in the bending equipment; and (c) machine to uniform thickness and remove saw marks that may induce bending failures.

*Plasticizing the Stock*

Plasticizing treatment is essential to soften the wood fibers and to enable the wood to absorb compressive deformation needed to make the curve. As far as wood bending is concerned, hot wood is easier to bend than cold wood, and wet wood better than dried wood. A combination of heat and moisture is considered most effective for softening wood. Softening with saturated steam at 212 degrees °F. at atmospheric pressure in a steam box or cylinder is the process commonly used. There seemed to be no advantage in steaming at a pressure higher than atmospheric, and higher temperature may be detrimental to the wood (2, 3).

In bending stock of the same species, steaming period varies with the thickness and moisture content of the stock as well as with the radius of curvature involved. As a general rule for well-known foreign bending timber like beech, steaming time of one-half hour for green and one hour for dry stock per inch of thickness proved enough to plasticize the stock (3); and this is presumed to be applicable to many Philippine woods. The additional heating period for dry stock is necessary not only in the heating process but also in the penetration of moisture through the surfaces.

Softening wood by submerging it in boiling water for a comparable time is equally effective as steaming. It is particularly advantageous when only a section of the stock is to be bent, as in tool handles, sporting goods and furniture components.

BENDING METHODS

*Free Bending*

The first of two broad processes of bending is free bending. It is bending without the aid of a metal supporting or restraining strap. This process is effective where the curvature is slight, but it entails enormous failures when the curvature is severe. A simple example of this method is clamping one end of the stock to a male form and bending the piece to the shape of the form then wedging it at the other end.

The process may be done in a hot-press provided with steam heating jackets or electric heating elements, as is usually done in bending chair backs. When the curvature is severe, the stock may be pressed in a pan provided with end pressure (3). The shape may be retained by drying the bend under restraint.

*Bending with Restraining Strap and End Pressure Device*

In this process end pressure is applied through a supporting strap. For most bending, the supporting strap and end pressure device are necessary to absorb the tensile stress and to provide the required compression, respectively (1, 2, 3). Many machine bending devices employ this principle.

The following are the general classes of bends for which this process is specially applicable: (a) simple bend on a single plane; (b) re-entrant or "S" type bend in a single plane; and (c) compound bend in more than one plane (1, 2). These different types of bends demand different methods of bending, strapping and restraining while conditioning and fixing the shape. Single bend in one plane may be bent singly by hand or heated press; or in multiple of the required widths to be sawn later into single pieces.

### Bending Machine

Bending machine are usually of two distinct types, namely, the lever-arm and the revolving-form. Whichever type of bending machine is used, the principles underlying the wood bending process remain the same. The advantage of using a bending machine over a simple bending device is that mass production can often be made and that bending of large-sized stock can be done easier.

## SETTING OF BENDS

### Drying Bent Works

Drying is one of the two basic phases involved in the setting of bends. During the plasticizing treatment, the stock absorbs considerable amount of moisture. Setting can be accomplished by removing the moisture in excess of that encountered in subsequent service, and by cooling the bent piece. In some respects, this is a reversal of the softening process, when the stock is heated in the presence of moisture (2).

Drying of bent works depends on the intended use. Curve components of boats and ships are dried on the framework of the vessels. Elaborate drying rooms are seldom provided in boat and ship building because the components, anyway, are exposed to water while in service. Some bent members are allowed to dry at ordinary shop conditions. On the other hand, chair and radio and television cabinets are dried in a temperature-humidity controlled room or chamber.

### Fixing the Bent Piece

Fixing, the second phase in the setting of bends, simply means retaining the shape of the bent stock. Somehow, while still hot and moist, a bent stock will partially straighten up if the restraining force is released. An incompletely-set bend of sharp curvature is likely to fail in tension upon release of the restraining force. To check these faults, steam-bent stock are set by holding them with tension straps or tie rods in a heated chamber until they are dry.

Allowing the inner or concave face to dry faster than the outer will help much in retaining the curvature of the bend (1). This may be done by removing the form, only leaving the metal strap on, or by using perforated forms to allow free air movement. As the inner face dries, it sets uniformly along the whole length of the stock.

Regardless of the drying method, the bend should be kept or fixed at the desired shape until the desired moisture content is attained. No definite period of fixing can be given as this depends on many factors: such as room temperature, size and moisture content of the stock and many others. It is generally advisable to carry out a preliminary test to determine the most suitable fixing time for any particular bend (2).

## TESTS AT THE FPRI

The timber species tested at the FPRI were almaciga (*Agathis philippinensis* Warb), bagtikan (*Parashorea plicata* Brandis), mayapis [*Shorea squamata* (Turcz) Dyer], panau (*Dipterocarpus gracillis* Blume), red lauan (*Shorea negrosensis* Foxw) and white lauan [*Pentacme contorta* (vid) Merr & Rolfe].

Three sets of tests were conducted to evaluate the bending qualities of these woods. In the supported bending test (Test 1), specimens, 1 by 1½ by 40 inches, were steamed for 45 minutes at 212 degrees F. at atmospheric pressure. After steaming, the specimens were set up in the metal supporting strap, then the strap was tightened by means of the end pressure device and the specimens were gradually bent to the shape of the form. Steam-softening process similar to that done under Test 1 was done on specimens 1 by 1 by 46 inches in size for Test 2, after which one end of each specimen was clamped directly to the bending form and the other end pulled by hand to the shape of the form. In both tests, the specimens were at 25 per cent moisture content, and the radius of the bending form was decreased from 20 to 4 inches, by increments of ½ inch.

In the test for determining the limiting radius of curvature of thin laminae (Test 3), the specimens, at 12 per cent moisture content and 1/8 by 1 by 24 inches in size, were bent gradually by hand through an angle of 180 degrees around each radii (starting from the longest) of a wooden mandrel. The radius of the mandrel was decreased from 8 to 3 inches by increments of about 1/4 inch.

In all test, the specimens were bent to a degree of failure that rendered the samples useless as bent components. Test results (summarized in Table 1) were treated statistically, and the percentage breakage, expressed as percentage of the total, was plotted against the critical bending radii. The regression line, which could fit the points, was also determined and a measure of the degree of correlation (coefficient of correlation "r") was computed. From the intercepts of these graphs, the radius of curvature corresponding to 5, 10, 15 and 20 per cent breakage, was determined.

In all the species tested, percentage breakage was highly correlated ($r = -0.914$ to $-0.996$) with the radius of curvature. The negative values of "r" indicate a decreasing tendency of breakage for an increasing radius of curvtaure. The relationship established between the two variables studied is represented by a simple linear equation.

To facilitate comparison between Tests 1 and 2 and to obtain a numerical assessment of the improvement brought about by the use of the supporting strap and end pressure device, an "Improvement Factor" was determined by dividing the critical bending radii obtained in Test 2 by the corresponding values from Test 1 in all levels of percentage breakage. The values obtained are shown in Table 2. Values less than one were arbitrarily considered as indicating no improvement in bending.

It was shown that with the use of a restraining strap and end pressure device, the bending properties of almaciga and white lauan were not improved. There was marked improvement in the qualities of the four other species. Failures that were generally compression observed in Test 1 for the six species indicate that the device served well its purpose. The classification as to bending qualities of these species is given in Table 1.

The critical bending radii obtained from this study will serve well as a guide in utilizing these native woods for bending purposes. A one-inch thick stock of white lauan, for example, can be bent to obtain a chair back with about 19 to 19½ inches radius, based on the results of Test 1 and 2 of the study. In like manner, based on the results of Test 3, a 1/8-inch thick red lauan laminae may be used in making an 8-ply laminated steering wheel with a nominal diameter of about 16 inches. In both cases, however, the operator may expect a breakage of about five per cent of his stock during the bending operation. Since the bending tests were done under strictly controlled laboratory conditions, a reasonable factor of safety must be applied when referring to these bending radii.

Although entirely independent of bending characteristics, slight discoloration due to steaming and staining upon contact, while still hot, with the metal strap and the resin exudations on bagtikan, mayapis and panau samples are some factors which must be considered when bending lumber of these species for articles where beauty is a prime requisite. In bending wood of these species with metal supporting strap, it is advisable to line the inner surfaces with aluminum sheet or other suitable materials to prevent staining. A strap made of 18 SWG spring steel is suitable for stock up to 1½ inches thick and 14 SWG for thicker stock. The strap should always be wider than the wood stock and all parts of the stock to be bent must be fully supported (2).

In utilizing the wood of these six species for solid bending, the principles discussed above must be taken into consideration. Other factors, such as the drying rate of the respective species, rate of recovery in shape, dimensional stability and other physical properties, must be considered.

LITERATURE CITED


1. Peck, Edward C. 1957. Bending solid wood to form. Forest Service, U.S. Dept. of Agriculture, Agricultural Handbook No. 125, 37 pp.

2. Stevens, W. C. and Turner N. 1948. Solid and laminated wood bending. DSIR, FPRL, Princes Risborough, Bucks, England. HMSO, London, 71 pp.

3. Wangaard F. F. Feb. 1952. The steam bending of beech. Beech Utilization Series No. 3. Northeastern Technical Committee on the Utilization of Beech, in coopertion with the Northeastern Forest Experiment Station, Forest Service, U.S.D.A., 25 pp.


TABLE 1. Summary of Bending Test Results of Six Philippine Wood Species

| *Almaciga* | *Test 1* | *Test 2* | *Test 3* |
|---|---|---|---|
| Average moisture content at test (%) | 25 | 25 | 12 |
| Radius inches at which breakage amounted to: | | | |
| (*a*) 5% of total | 18.87 | 18.26 | 3.11 |
| (*b*) 10% " " | 18.55 | 17.85 | 3.04 |
| (*c*) 15% " " | 18.22 | 17.43 | 2.97 |
| (*d*) 20% " " | 17.89 | 17.02 | 2.91 |
| Square of correlation coefficient, "r" | 0.929 | 0.899 | 0.994 |
| Classification based on the radius at which 5% breakage occurred | Fair | | Very good |
| *Bagtikan* | | | |
| Average moisture content at test (%) | 25 | 25 | 12 |
| Radius inches at which breakage amounted to: | | | |
| (*a*) 5% of total | 15.63 | 21.28 | 6.9 |
| (*b*) 10% " " | 15.12 | 20.82 | 6.69 |
| (*c*) 15% " " | 14.62 | 20.36 | 6.48 |
| (*d*) 20% " " | 14.12 | 19.89 | 6.27 |
| Square of correlation coefficient, "r" | 0.962 | 0.792 | 0.951 |
| Classification based on the radius at which 5% breakage occurred | Fair | | Fair |

| *Mayapis* | | | |
|---|---|---|---|
| Average moisture content at test (%) | 25 | 25 | 12 |
| Radius inches at which breakage amounted to: | | | |
| (*a*) 5% of total | 18.59 | 18.92 | 3.96 |
| (*b*) 10% " " | 18.24 | 18.59 | 3.83 |
| (*c*) 15% " " | 17.89 | 18.25 | 3.69 |
| (*d*) 20% " " | 17.55 | 17.91 | 3.58 |
| Square of correlation coefficient, "r" | 0.976 | 0.996 | 0.956 |
| Classification based on the radius at which 5% breakage occurred | Fair | | Very good |

| *Panau* | *Test 1* | *Test 2* | *Test 3* |
|---|---|---|---|
| Average moisture content at test (%) | 25 | 25 | 12 |
| Radius inches at which breakage amounted to: | | | |
| (*a*) 5% of total | Below 5 | 19.44 | 5.09 |
| (*b*) 10% " " | " | 19.15 | 4.94 |
| (*c*) 15% " " | " | 18.25 | 4.79 |
| (*d*) 20% " " | " | 18.56 | 4.65 |
| Square of correlation coefficient, "r" | | 0.994 | 0.943 |
| Classification based on the radius at which 5% breakage occurred | Very good | | Good |

| *Red lauan* | | | |
|---|---|---|---|
| Average moisture content at test (%) | 25 | 25 | 12 |
| Radius inches at which breakage amounted to: | | | |
| (*a*) 5% of total | 19.49 | 19.99 | 7.99 |
| (*b*) 10% " " | 18.87 | 19.71 | 7.67 |
| (*c*) 15% " " | 18.25 | 19.43 | 7.36 |
| (*d*) 20% " " | 17.62 | 19.15 | 7.04 |
| Square of correlation coefficient, "r" | 0.945 | 0.889 | 0.835 |
| Classification based on the radius at which 5% breakage occurred | Fair | | Poor |

| *white lauan* | | | |
|---|---|---|---|
| Average moisture content at test (%) | 25 | 25 | 12 |
| Radius inches at which breakage amounted to: | | | |
| (*a*) 5% of total | 19.42 | 18.61 | 5.13 |
| (*b*) 10% " " | 19.02 | 18.38 | 4.99 |
| (*c*) 15% " " | 18.62 | 18.16 | 4.86 |
| (*d*) 20% " " | 18.21 | 17.93 | 4.73 |
| Square of correlation coefficient, "r" | 0.982 | 0.986 | 0.951 |
| Classification based on the radius at which 5% breakage occurred | Fair | | Good |

TABLE 2. Improvement in Bending Brought About by the Use of a Metal Supporting Strap and End-Pressure Device

| SPECIES | Improvement factor Ratio of bending radius from Test 2 to those from Test 1 | | | | |
|---|---|---|---|---|---|
| | Levels of Failure | | | | Remarks |
| | 5% of total | 10% of total | 15% of total | 20% of total | |
| Almaciga | 0.97 | 0.96 | 0.96 | 0.95 | No improvement |
| Bagtikan | 1.36 | 1.38 | 1.39 | 1.41 | Marked improvement |
| Mayapis | 1.02 | 1.02 | 1.02 | 1.02 | " " |
| Panau | 3.89 | 3.83 | 3.65 | 3.71 | " " |
| Red lauan | 1.03 | 1.04 | 1.06 | 1.09 | " " |
| White lauan | 0.96 | 0.97 | 0.98 | 0.98 | No improvement |

# Economic Perspective of Preserved Wood

by

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ABSTRACT

Wood preservation, an important industry, was introduced in the Philippines about 50 years ago. Unfortunately, this has not been fully taken advantage of and appreciated by wood users because of indifference, lack of means, or ignorance of the benefits derived from it.

To promote this industry, the Forest Products Research Institute has delved into the problems of wood preservation of Philippine timber species and conditions of use. Investigations showed that this industry has a boundless prospects. However, due to inadequate educational promotion, considerable obstacles are expected. Like other industries, standardization of treated wood products is the key to wide acceptance. The formation of trade association on wood preservation, which will thresh out common problems for their mutual benefit and will serve as a watchdog for unethical business practices is imperative.

INTRODUCTION

The lack of knowledge about wood preservation and the lukewarm acceptance by countless consumers, especially architects, engineers, and contractors to use wood suitably treated with preservatives is lamentable. This has resulted in the loss of immeasurable volume of timber because of the use of less durable species under severe service conditions. If such timbers have been properly treated with wood preservative before installing them in service, substantial savings in material, labor, money, and transport could have been realized.

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From the time man learned to use wood he has been beset and incessantly pestered by the destruction caused by insect, fungi, and marine borers. Before, the economic aspects of replacements were not seriously considered since labor was cheap or even free and timber supply was bountiful. Because of man's diligence and technical ingenuity he managed to produce noncellulosic construction materials that are admittedly invulnerable to the ravages of harmful organisms. The use of concrete, steel, bricks, plastics, and fiberglas as construction materials has tentatively placed wood in the backseat. Not to be outdone, proponents of wood find means to make wood at par with, if not excel, these competing materials through the science of wood preservation.

Wood preservation, in a nutshell, refers to any process whereby the useful life of wood in service is appreciably extended through the application of chemical wood preservatives which make wood unpalatable or uninhabitable to wood destroying organisms.

*Trends in the Use of Treated Wood*

In spite of the emergence of competitive materials, wood will still persist as a construction material provided we adhere to this slogan: "Use wood where it serves the purpose best." While wood is not the answer to all construction and building needs, it possesses some attributes or properties for a job more favorable than or at least equal to most other materials of similar end uses.

Timber preservation is now becoming an important trade involving broad complicated subjects encompassing a wide range of knowledge such as wood chemistry, mechanical engineering, and the biology of wood destroying insects, fungi, and marine borers. Such fields of study are indispensable for the development and improvement of preservatively treated products. Lately, treated wood entered the field of nuclear science with pronounced versatility, indicating that wood preservation will remain as an important industry.

In the United States, Canada, Australia, Japan, and all European countries, treatment of railway ties provided a sufficient volume of business that attracted capital and facilitated the erection of treating plants. In the Philippines, the main bulk of business is the treatment of telecommunication and power line poles, and lumber to some extent. The Philippine National Railways is an untapped potential market for treated wood products especially railway ties. The PNR program for expansion and the perennial problem of procuring the much-favored molave (*Vitex parviflora*) ties for replacements alone, may change its antiquated adherence to the use of untreated tie. The rural electrification project, if pushed through, is another undertaking that will require millions of treated poles. Prefabricated school buildings and low-cost housing units are an undisputable outlet for treated lumber. The use of suitably and properly treated wood in these projects is a vital factor in the overall economy of the incumbent or coming administration. The rationale of this claim is simple. An untreated ordinary lumber will last 3 to 4 years compared to a treated lumber which may last for 20 years or more. This means that the use of treated wood would give tremendous savings from the needless replacement of wood structures severely attack by wood destroying organisms.

These savings, can be channeled to other socio-economic projects of the administration requiring immediate attention.

There are many permanent and semi-permanent governmental projects both national and provincial in nature and private undertakings which can take the full advantage of preserved wood. Among these are bridges for feeder roads. The nation-wide athletic activities similarly call for stadiums with wooden bleachers. It has been noted that school and provincial authorities appropriated large sum of money in building costly stadiums with wooden grandstands and bleachers which rot after a year or two. This problem could have been prevented if treated wood were used. Experience in foreign countries showed that open stadiums with 50,000 to 100,000 seating capacity made of treated wood have resisted weathering and biological deterioration for more than 30 years.

Science and economy demand the use of preserved wood. The day of the very durable species is passing and the available supply of such is lessening. The wood preservation industry converts to usefulness the vast quantities of otherwise inferior woods. The growth of this industry will depend upon the maximum development of our domestic market and by the inducement of government and private entities and prospective house owners to embark on a full scale utilization of treated wood.

*Wood Treatment Research in the FPRI*

In the treatment of wood with preservatives, the problems are numerous. These however, have been gradually solved. Wood species differ in their ability to accept the preservative. Some are readily permeated with the preserving liquid while others offer considerable resistance. In the classification of the relative ease of treatment of wood species, various external factors governing the entry of preservative solutions involving such variables as pressure pressure-period and temperature were investigated. Several commercial timber species have been tentatively classified as to their treatability. More basic studies are contemplated on the intrinsic factors in the wood that obstruct the passage of liquid. Among these are the anatomical structure of wood in relation to the effect of extractives and wood structures to treatability. The Institute is now exploring the possibility of treating very refractory species using pressures up to 70 kg/cm$^2$ (1000 psi). Conventional treating pressure is 14 kg/cm$^2$ (200 psi).

The general concern of the Forest Products Research Institute is to encourage the rationalization of known and tried wood preservatives by studying how they maybe applied to Philippine timbers for different service requirements. Whenever possible or advisable, promotion of new and promising preservatives and treating processes are tested and investigated for the benefit of the public and private utilities and government agencies using large percentage of treated and untreated timber.

Service tests of timber used as railway ties and telecommunication and power line poles are undertaken whenever cooperation can be secured from users of treated and untreated wood. Laboratory and field tests of preservatives have been initiated. Comprehensive results approximated closely the conditions of actual service. Such tests provided data for the development and improvement of treated wood species.

In the absence of more revolutionary development in treating processes and wood preservatives, an extension of the market for treated wood can be expanded by the development and sale of specific treatments for specific purpose.

*Wood Preservation for Forest Conservation*

The preservative treatment of wood indirectly transcends its main purpose as it also concerns the conservation and utilization of our forest resources. The late Theodore Roosevelt said, "A nation without trees would face a future almost as hopeless as a nation without children." The Philippines is fortunate because it is not a nation without trees, nor need she ever be without abundant supply of timber for all her uses. However, if this Utopian condition is to be perpetuated, it is necessary that steps be taken to balance forest growth and forest drain. Wood preservation in this respect has long started in this direction. There is no accurate estimate in the Philippines of the annual monetary loss due to frequent replacement of destroyed or deteriorated timber caused by wood destroying agents. Such loss could have been minimized by using preserved wood. It is needless to point out the economic benefit derived from the use of treated wood and its role in forest conservation. One could not help but notice the creosoted poles along the highways or roads in cities and towns. Such poles were treated to last 30 to 50 years, providing ample time for the second-growth or reforested stock to be harvested. Forest conservation implies not only an adequate supply of timber for national requirements but also in the wise use of timber to attain its maximum utilization. It is, therefore, evident that wood preservation is an essential and integral part in the forest conservation policy of our government.

*Prospects for the Industry*

The extent and availability of our forest resources and the rate and nature of their use, create industrial opportunities for wood preservation. Much more, the rapid depletion of our more durable timber species is steadily creating larger and better opportunities for our wood preservation industry. Finally, the need of substituting low grade and second growth species for the less available high grade stock will certainly create tremendous opportunities in the field of wood preservation. In meeting this demand, the preserving people will not only amplify the economic utility of grown material but can be of great assistance to our forest policy makers in solving problems concerning the policy of sustain-yield management. In this effect, the high cost of high grade durable timber will tend to decrease proportionately with the cost of preservative treatment in the final investment of treated railway ties, poles, marine structures, and buildings. Generally, the greater the cost of structural materials, the greater will be the attractions to prolong its period of service.

It is indicative of the insights of the leaders of forest products utilization that they recognized clearly the direct relationship of the tremendous social and economic problem of a diminishing supply of timber in the Philippines and constant or increasing consumption of its products. The industrial opportuntiy presented by these problems is shared jointly by the expert timber technologists and the foresters. Timber, not largely utilized now, will forge its way into service (and the timber replaced if still in sufficient supply) and will be available fo other forms of use where no substitute in its kind is practicable.

In the near future, the bulk of business will be focused towards retailing which will necessitate a complete transition of the industry from contracting to merchandizing. Another potential market is in the field of residential construction. The use of treated wood for long life and fire-resistance in houses awaits only progressive trade promotion and establishment of distributing channels for easy procurement. The house builder must be educated to take full advantages of treated wood and he must be able to secure it conveniently.

*Recommendations*

For wood preservation to prosper as an important industry, a trade association must be created to meet the business problems of the industry. The organization must be developed to meet business needs — one that can be soundly coordinated and effectively directed for better business and profits on a sound basis.

Information on wood preservatives must be made available to architects, engineers, and prospective wood users as a broad educational propaganda. Much of the available information do not reach the professional men who generally specify the materials and when it does, it is usually not in the form which they can readily avail of. Publicity, education, demonstration, advertisement, increased demand, satisfied owners, and confidence established is the logical sequence in promoting wood preservation.

More applied research are required to establish suitable treating schedules and define field and service performance of various preservatives and processes as a basis in the standardization of treated wood and wood products.

The establishment of treating plants in well distributed areas in the Philippines is highly recommended This will curb the rising cost in transportation which is the real measure of timber depletion. It is the most stable and permanent cause of high timber prices. This condition is being felt by present wood preservers that are converged in one locality.

The government should give a second thought on the economic benefits that can be derived from preserved wood if used in public projects. Efforts geared towards the use of treated wood in semi-permanent and permanent structures will effect financial savings on the part of the government and other end users. All such efforts will redound to the socio-economic development of the Philippines.

Unless these basic recommendations are executed the "voice of wood preservation would just be a whisper in an opera chorus of competitive materials."

# *Silvical Characteristics of Kaatoan Bangkal*

by
NICOMEDES F. PAA and
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The genus *Anthocephalus* and the species kaatoan bangkal (*Anthocephalus cadamba* Roxb.) Miq.) (13)[2] of the family Rubiaceae are new additions to our present knowledge of Philippine botany.

*Anthocephalus cadamba* (Roxb.) Miq. is not mentioned by Dr. Merrill in his "An Enumeration of Philippine Flowering Plants" having available or corresponding indigenous species in the Philippines.

For a long time, the identification of this species remained elusive. As soon as it was finally identified, it became popularly known as the "wonder" tree (11). Others have described this tree as a "tree-guinea-pig" because it has shown in 12 years a strange growth performance of 45 cms. average diameter at breast height and an average height of 26.2 meters (3).

At first, the kaatoan bangkal trees growing in the Makiling National Park, College, Laguna were thought to be species of cinchona (*Cinchona succirubra* Pav.) but botanists observed and found that the botanical identifications of this species of cinchona did not entirely fit the botanical nomenclature of kaatoan bangkal. Pending further botanical studies and investigations, kaatoan bangkal was given another botanical name *Nauclea horsfieldii* (Miq.) Brem. Result of long and rigid observation and investigation on the same plants, conducted by the Forest Products Research Institute, College, Laguna and the U.S. Forest Products Laboratory finally concluded that the species alleged to be *Cinchona succirubra* Pav. and later named *Nauclea horsfieldii* Miq. is actually *Anthocephalus cadamba* (Roxb.) Miq.

The phenomenal growth of kaatoan bangkal in the Makiling National Park as well as in Mindanao, its known natural habitat, and other parts of the country today has triggered a scramble among farsighted logging enterpreneurs to propagate this "wonder tree" in order to regenerate logged-over areas. It is a fast growing species. It lends itself naturally to coppice method of reproduction hence, it is fast becoming a promising tree for local forest plantations. In forest plantations, kaatoan bangkal is easy to tend like the common ipil-ipil (*Leucaena leucocephala*) (Lam) de Wil.).

It is reported that it grows 20 times faster than the long fibered Benguet pine (*Pinus-*insularis Endl.) or 10 times faster than most short-fibered hardwoods (15).

Other local names of kaatoan bangkal in recent or current use in various provinces are: Kaatoan bangkal (Tagalog); magalablab, Manuloko (Bagobo); and sapauan (Mandaya) (11). The official common name kaatoan bangkal is adopted after the combined name of the place of origin which is barrio Kaatoan in Malaybalay, Bukidnon and bangkal which is a very familiar tree often seen near rice-paddies. Bangkal (Nauclea) species closely resembles kaatoan bangkal. The first kaatoan bangkal seeds sown in the Forestry Campus, College, Laguna were originally collected in Kaatoan, Malaybalay, Bukidnon in or about November, 1948.

### DISTRIBUTION

The well-known natural habitat of kaatoan bangkal is Mindanao, particularly in the provinces of Bukidnon, Davao, Basilan, Cotabato and Zamboanga. It is found in primary forests at an altitude of 1000 meters above sea level. In Laguna, it thrives in altitudes ranging from 100 to 400 meters above sea level. It is also reported found in Malay Peninsula, Sumatra, Borneo, New Guinea and India. It is chiefly distributed in Terae and outer hills of Sikkim to 3,000 feet. Evergreen forests of North Kanara, Northern Circars, Cuddapah and Karnul. It is also found in the eastern slopes of the Peguyoma (*8*).

### BOTANICAL DESCRIPTION

*Habit.* — Kaatoan bangkal is tall and fast growing. It reaches a height of 15 to 30 meters and a diameter at breast height of 40 to 60 cms. The trunk is straight, more or less cylindrical and unbuttressed with somewhat regular bole. The branches are decusate, horizontal, dark green when young and becoming brownish at maturity (*8*). It sheds off its unnecessary branches naturally. Kaatoan bangkal trees reported to be 1 year and 4 months old in the Makiling National Park, College, Laguna has already attained an average diameter breast height of 8.5 cms. and an average total height of 6.31 meters.

*Leaves.* — Simple, opposite, coriaceous, dark green above and pale green to yellowish-green beneath. It is 20 to 25 cms. long, 11 to 15 cms. wide. Shape is obovate to oblong, base obtuse to rounded, apex acute to acuminate, margins entire to slightly repand, veins distinct underneath. Midrib prominently ridged below, greenish-white in color, petioles robust, cylindrical, 4 to 5 cms. long and 2 to 4 mm. thick; stipules slightly flattened at the base, lanceolate at the twigs. The inflorescence has robust peduncle, 2 to 3 cms. long, terminal capitate, forming a globose, fleshy mass about 5 cms. in diameter.

*Flowers and Fruits.* — Flowers perfect and fleshy, surrounding a fleshy mass. Fruits are minute, coalescing into a mass which are inserted numerous closely packed few-seeded capsules. The tree is a prolific seeder. Seeds not winged. In Los Baños, Laguna, it is observed to flower from April to June. Fruits begin to ripen from September through February.

*Bark.* — Thin, slightly rough, grayish to light brown in color, with dark corky postules (*8*).

### HABITAT CONDITIONS

#### CLIMATIC

Kaatoan bangkal thrives well in localities reaching an altitude of 1000 meters above sea level like in Mindanao, particularly in the provinces of Bukidnon and Cotabato as well as in localities of altitudes ranging from 100 to 400 meters above sea level like in Los Baños, Laguna. Very limited report is available regarding the habitat of kaatoan bangkal.

The average Philippine monthly temperature is 80.4° to 82.6°F during warm months (April to October); and 77.7° to 79°F during cold months (November to March). Mean annual precipitation is 93.15 inches after an average of 159 rainy days (5) (6).

TABLE A. Table showing the monthly average number of rainy days in Los Baños, Laguna[6]

| MONTH | Average Number of Rainy Days |
|---|---|
| January | 12 |
| February | 7 |
| March | 6 |
| April | 6 |
| May | 13 |
| June | 16 |
| July | 22 |
| August | 21 |
| September | 20 |
| October | 17 |
| November | 16 |
| December | 17 |

TABLE B. Table showing the monthly average rainfall (inches) in Los Baños, Laguna.[6]

| MONTH | Average Monthly Rainfall |
|---|---|
| January | 2.70 inches |
| February | 1.33 inches |
| March | 1.32 inches |
| April | 1.48 inches |
| May | 6.54 inches |
| June | 7.25 inches |
| July | 11.26 inches |
| August | 9.59 inches |
| September | 9.08 inches |
| October | 10.49 inches |
| November | 7.76 inches |
| December | 7.17 inches |

#### EDAPHIC AND PHYSIOGRAPHIC

Kaatoan bangkal thrives well on a variety of soils ranging from sandy to clay-loam soil. It grows well also in places where limestone deposits crystalized by volcanic action are found like in the Makiling National Park.

#### BIOTIC

There is no report available regarding the specific tree associates of kaatoan bangkal but since it was previously observed as an obscure weed tree, it is probable that it occurs on nearly all site conditions in the country with no particular tree associates. In the Makiling National Park it is found scattered and vigorously growing on various site conditions. At much higher elevations like Mindanao, it thrives well in association with different species.

#### LIFE HISTORY

### *Seeding Habits*

*Seed.* — It is minute in size. Its length is 0.63 mm. and its diameter is 0.47 mm. The seed is borne in a fleshy fruit made up of ovaries of several flowers, more or less coalesced into a mass, known as multiple fruit. It is reported that a gram contains as much as 17,000 seeds (air dry) (*11*).

*Seed production and dissemination.* — Seeds are produced by mature and vigorous trees. As the tree continue to mature and remain vigorous, it produces more seeds. The Forest Products Research Institute, College, Laguna found that if all seeds collected readily germinate and grow into harvesting age, it is estimated that about 8,000 potential pulpwood trees may grow from an average sized fruit, containing 0.463 grams of seeds (*11*).

It is reported that in India, the ripe fruit is edible.

Ripe fruits readily drop to the ground. At this instance, it should be picked as soon as possible because the seeds are relished by ants. The minute size of seeds require a special technique of extraction from the fleshy ripe fruit. This involves maceration of the outer pulpy portion of the fruit containing the seeds. Clear water is necessary to effectively separate the seeds from the pulp.

The following method of maceration is reported by the Forest Products Research Institute:

1. The outer portion of the fleshy ripe fruit, bearing the fine seeds, is rubbed lightly against a 1/2 inch mesh wire screen, leaving the hard sterile core. The grated pulpy mass mixed with the seeds is later collected in basin filled with tap water.
2. The pulpy mass is repeatedly rubbed against the palm of the hands to hasten the separation of seeds from the pulp.
3. The batch or the pulp mixed with the the seeds is placed in a 16-mesh wire screen box supported over a large basin. While water is poured over the batch, continuous stirring is done to continue separating the seeds from the pulp effectively. Only the finely macerated pulp remains on the screen. The coarse pulp remains on the screen. The process is repeated until there is no more seed left in the pulp.

Seeds that lump together float. Fine pulp material still mixed with the seeds will remain suspended in the water. Greater bulk of the seeds will sink at the bottom of basin. Floating seeds may be scooped and poured into a fine mesh screen either made of cloth or metal. The floating pulp may be thrown away. The water is replenished and with thorough rotary manipulation of the basin, the seeds can be made to float and later discarded. The process is repeated until all seeds have already transferred to the screen.

4. After air-drying the seeds indoors, they are winnowed to remove whatever lighter foreign materials are mixed with the seeds.

5. The air-dry seeds are then kept in air-tight bottles and stored under a refrigeration until sowing time. It is reported that seeds kept for 2 years under this storage conditions retained their viability (*11*).

   The seeds are easily disseminated by wind because they are tiny and light. During rainy days, seeds are disseminated by gravity and water. On sloping areas, seeds are carried down by rain. This method of dissemination partly explains the occurence of scattered kaatoan bangkal trees in various forest types and in association with different species.

*Vegetative reproduction.* — It is principally reproduced by seed. Studies, although still limited, show strong indications that it may be reproduced by sprouts from its stumps, called coppices. More intensive work and observation is still being done along this line.

*Seedling germination development.* —In a study on the germination and growth development of kaatoan bangkal by the Bureau of Forestry, Los Baños Forest Experiment Station in Laguna, seeds sown in seedboxes on November 16, 1961 in a mixed soil of 50-50 per cent sand with ph 6.2 started germinating on December 11, 1961 and continued through until December 30, 1961. One month after germination, the seedlings were ready for transplanting in the field. At this stage, the seedlings already attained a height ranging from 4.3 cms. to 23.0 cms. (*9*).

On June 10, 1966 or after three and one half years after planting, the trees attained an average diameter of 11.03 cms., basal area attained is 12.21 sq. cms., average total height of 8.75 meters and a total clear length of 6.52 meters.

One tree fruited in July, 1965 or barely two and one half years after planting (*9*).

Under conditions obtaining in the Park, it is reported that the 9-year old stand inside the Forest Products Research Institute compound, consisting of 26 trees, tree diameter attained ranged from 10.00 cms. to 42.20 cms. or average of 25.31 cms., the total height ranged 9.53 meters to 26.70 meters or an average of 17.61 meters; clear length ranged from 2.0 meters to 14.90 meters, or an average of 7.97 meters. The trees subsequently attained a clear length of volume of from 0.013 to 0.733 cu. m., or an average of 0.284 cu. m. The average annual diameter increment was 2.81 cms. or 1.11 inches; annual clear length increment was 0.89 meters; an average annual increment in merchantable volume of 0.032 cum. m. (*11*).

Considering the minute size of the seeds, it should be sown in shaded seed boxes. Rich garden soil with similar texture, like the seeds, is suggested in order to hasten germination. Watering should be regulated and in fine mists, so that the fine seeds will not be buried in the soil.

Studies conducted at the Forest Products Research Institute showed that seeds germinate into tiny seedlings 12-30 days after sowing. After one and one-half months, the seedlings are ready for potting. For this purpose, the Institute suggests plastic molds (polyethylene bags) or stapled cylindrical veneer pots (2" x 6") to be used. After another one and one-half months since potting, the seedlings are ready for transplanting.

#### SAPLING STAGE TO MATURITY

*Size attained.* — Kaatoan bangkal is a fast growing "wonder" tree. It attains a height of 15 to 30 meters and a diameter at breast height of 40 to 60 cms.

In the watershed tree farm of the Canlubang Sugar Estate, Canlubang, Laguna, it is reported to have grown so rapidly that in four years, they can already be harvested as pulpwood (1).

*Natural enemies.* — Similar to other forest trees, the most destructive natural enemy of kaatoan bangkal is man. In the forest, kaiñgineros do not spare this tree. Most often, it is cut for fence posts.

The tree is windfirm but its seedlings are susceptible to damping-off. Because of this, it is suggested that boiled or clean water should be used to ward off damping-off.

#### HYBRIDS AND VARIETIES

No report on the hybrid or variety of kaatoan bangkal has as yet been gathered. So far, it is the only species of the Rubiaceae family bearing the generic name *Anthocephalus.* It is possible that natural hybridizations or variations have occured, but have not yet been observed.

#### PROPERTIES OF THE WOOD

The Forest Products Research Institute released the following report on the properties of kaatoan bangkal wood:

| | |
|---|---|
| *Average of 1 tree* | Source: Forestry Campus |
| *Condition: Green* | |
| *Static bending* | |
| Fiber stress at proportional limit | 237 kg/cm$^2$ |
| Modulus of rupture | 352 kg/cm$^2$ |
| Modulus of elasticity | 51800 kg/cm$^2$ |
| *Compression paralled to grain* | |
| Specific gravity | 0.314 |
| Fiber stress at proportional limit | 112 kg/cm$^2$ |
| Maximum crushing strength | 165 kg/cm$^2$ |
| Modulus of elasticity | 57100 kg/cm$^2$ |
| *Compression perpendicular to grain* | |
| Fiber stress at proportional limit | 24.6 kg/cm$^2$ |
| *Hardness* | |
| Radial | 136 kg. cm. |
| Tangential | 226 kg. cm. |
| Nail withdrawing power (six penny c.w. nail) | |
| Side grain | 23.8 kg./cm. of Penetration |
| End grain | 15.9 kg./cm. of Penetration |

*Durability.* —Classified as very perishable under "graveyard" conditions. Its average life is 8.4 months.

*Treatability* — Easy to treat with creosote by the fullcell process both in green (Boultonized) and air-dried conditions. Average retention is 39.00 lb/cu ft. Preservative is uniformly distributed and treatment degrade is nil.

*Seasoning* — Seasons very easily by kiln--drying green from the saw with very little degrade in the form of loosening of knots, warping and collapse (*11*).

STRUCTURE OF WOOD

For purposes of comparison the following are some gross and microscopic features of *Anthocephalus cadamba* and *Nauclea horsfieldii* woods as described by Valbuena & Meniado both of the Wood Technology Division, Forest Products Research Institute as reported by Dr. F. N. Tamolang, et al. (*14*).

| Characteristics | *Anthocephalus cadamba* | *Nauclea horsfieldii* |
|---|---|---|
| Color | Buff or straw | Buff or straw |
| Pore size (ave. max. tangential diam.) | 199.87 | 185.25 microms |
| Pore No. per sq. mm. (ave.) | 6.4 | 6.1 |
| Ray structure | Heterogeneous; 1-4 cells wide; rays of 2 kinds, uniserate & multiserate rays, 49 cells; no. of rays per mm. 14-15 cells sheath cells as wide as bi-, tri- or 4-seriate parts. | Heterogeneous; 1-4 cells wide; rays of 2 kinds, uniserate & multiserate; ave. max. height of multiserate rays, 34 cells. no. of rays per mm. 15. sheath cells as wide as bi-tri- or seriate parts. |
| Intervessel plittings | 4-5 microns alternate | 4-5 microns generally arranged in uniseriate rows. |

Based on studies of plantation grown for artificial limbs and for pulp and paper making, the following morphological properties of the wood fibers is also reported:

| | |
|---|---|
| Average fiber length | 143 mm. |
| Average fiber width or diameter | 0.035 mm. |
| Average lumen width | 0.026 mm. |
| Average cell wall thickness | 0.004 mm. |
| Runkel ratio | 0.31 mm. |
| Coefficient of flexibility | 71 mm. |
| Felting power | 42 mm. |
| Prospect for papermaking | Promising |

The following are the general macroscopic features of kaatoan bangkal:

Sapwood and heartwood indistinguishable, pale straw; growth rings not distinct: texture fine: grain straight and fissile: wood soft to cut; specific gravity 0.35. light to moderately light in weight; match-size splinters burned to grayish ash.

Pores are intermediate to large; visible to naked eye; few solitary and in radial multiples of 4 but mostly 3; it has scanty tyloses and no deposits. Parenchyma is diffuse in very short lines. Rays are narrower than pores, not visible to the naked eye unless with lens and not conspicuous on the radial surface.

The following are its microscopic features:

Vessels about 25 percent solitary and in radial multiples typically of 2 to 3, although at times 4; solitary vessels oval in form; about 6 per sq. mm; average maximum tangential diameter 225 microns; vessel member length 641 microns; intervascular pitting minute about 6 microns, and alternate; perforation plate is simple.

Parenchyma is apotracheal diffuse; cells are arranged in vertical groups of 1 or 2; not storied with the fibers and rays; crystals and other deposits absent; pittings similar to intervascular pits.

Rays up to 4 cells wide; heterogenous multiseriates with numerous marginal rows of square to upright cells; average maximum height 27 cells; numbering 12 to 21 rays per mm.; sheath cells abundant; crystals absent; resin absent; vessel-ray pits similar to intervascular type.

Fibers not stored with rays and parenchyma; thin-walled; wall norrower than lumen; average length 1.44 mm.; diameter in 30 to 35 microns range; generally non-septate although a few are septate, pits small not distinctly bordered (*11*).

## USES

The fast growth of Kaatoan bangkal indicates that it is a promising species for reforesting barren and denuded areas as well as critical watersheds.

In eastern Mindanao, it is observed that molouccan sau (*Albizzia falcata* (L.) Back.) and kaatoan bangkal are planted in cleared areas in order to prevent the invasions of "bulakan" or creeping and climbing vines which may interfere in the favorable growth of dipterocarp species (*16*).

For watershed protection, kaatoan bangkal may be tried in fertile sites. It may even do good for streambank protection and riverbank stabilization.

Aside from reforestation and watershed protection purposes, the Forest Products Research Institute found that its drying and gluing characteristics is ideal for veneer and plywood manufacture. Pulping studies also showed that it is good for pulpwood material. In a series of studies conducted at the Institute, of species based on their fiber dimensions and possibilities for pulp and paper making, kaatoan bangkal was among the species studied. The other species studied and observed suitable for pulp and paper making manufacture are african tulip (*Spathodea campanulata* Beau.), *Anabo* (*Abroma augusta* (L) Willd.), gubas (*Endospermum peltatum* Merr.), hinlaumo (*Mallotus recinoides* (Pers.) Muell. — Arg.), ipil-ipil (*Leucaena leucocephala* (Lam.) de Will), kapok (*Ceiba petandra* L.) Gaernt.), and molouccan sau (*Albizzia falcata* (L.) Back.)

The carving industry in Paete, Laguna reported that the wood of kaatoan bangkal is suitable for wood carving. It is also found suitable for match sticks, pencil slats and for the manufacture of bakya or wooden shoes.

## LITERATURE CITED

1. COSICO, A.B.
1967. Key to maximum economic benefits from our timber resources. The Phil. Lumberman, Manila, Philippines, April, 1967. pp 10-12.

2. FPRI TECHNICAL NOTE
1963. "Fiber identification for the Phil. pulp and paper industry". FPRI Tech. Note No. 43, May, 1963. Coll., Laguna, pp 1-5.

3. ——————
1964. Prospective pulpwood species for plantation in the Philippines. FPRI Tech. Note No. 60. Oct., 1964. Coll., Laguna, pp 1-3.

4. GUZMAN, E de
1959. The study of vegetative characters and their taxono-

mic importance of the family Rubiaceae in the forestry campus. Unpublished.

5. JUNI, R.A. and J.A. GERARDO
1964. Silivical characteristics of Tindalo (*Afzelia rhomboidea* Blanco.). Silvical Leaflet No. 8, April, 1964. Bur. of Forestry, Research Div., Manila, Philippines. pp 1-19.

6. KINTANAR, L. L.
1963. Monthly average rainfall and rainy days in the Philippines, Climatological Division, Dept. of Commerce and Industry, Weather Bureau, Mla, Philippines. pp 1-12.

7. KLEIN, G.
1961. Alkaloid-bearing plants and their contained alkaloids. Tech. Bull. No. 1234., Agric. Res. Service, Dept. of Agric., USA.

8. LEE, L.O.
1963. Study of the vegetative characters and their taxonomic importance of the different species of the family Rubiaceae in the College of Forestry, Dept. of Agric. and Nat. Res., Q.C., Philippines. Vol. 19, Nos. 1-4, pp 129-172.

9. LOS BAÑOS FOREST EXPERIMENT STATION
1961. Germination and growth development of kaatoan bangkal. Los Baños For. Expt. Sta., Coll., Laguna, Station Report. pp. 1-10. Unpublished.

10. MERRIL, E.D.
1913. Studies of Philippine Rubiaceae. Phil. Jour. of Science. Vol. 8, No. 1: pp 21-63.

11. MONSALUD, M.R. and F.R. LOPEZ
1967. Kaatoan bangkal—A "Wonder" Tree. The Philippine Lumberman, Manila, Philippines. January, 1967. pp. 60-64.

12. REYES, M. R.
1952. Cinchona grows, too, in Mt. Makiling Forestry Leaves, Coll., Laguna, Vol. 5

13. SALVOSA, F.M.
1963. Lexicon of Phil. Trees. Forest Products Research Institute, Coll., Lag., Bull. No. 1. pp 44-85.

14. TAMOLANG, F. N., et al
1961. Kaatoan bangkal grows in Mt. Makiling. Forestry Leaves, Coll., Lag., Vol. XII, No. 10, pp 67-70.

15. ——————
1967. "Miracle" tree. Philppine Farms and Gardens, Phil. Vol IV, No. 5, May 1967, pp 26-28.

16. UTLEG, J.L. and M.R. REYES
1967. Evolution and trends in sivicultural techniques applied to natural forest in the Philippines. The Phil. Lumberman, Manila, Philippines. April, 1967, pp 32-44.

# The Response of Dipterocarp Seedlings when Released from Competing Vegetation

by
EULOGIO TAGUDAR[1]

## INTRODUCTION

The Dipterocarp species are considered the country's best known trees and commercially they are its most valuable woods. These trees, known throughout the world for their straight grain and beautiful texture, are firmly established in the world market. As a result, it has been used extensively for veneer, plywood or furniture manufacture and many other uses. Presently, it ranks second as a dollar-export earner of the country. To lose it, through improper management and forest destruction, would be a very big blow to our economy. To fail to improve it would be a serious sin of omission on the part of our foresters.

These species can be made as a permanent asset of the Nation if properly managed and a favorable environment can be provided for their development. Their perpetuation and extension should, therefore, be of prime importance to us. What is a favorable environment for the development of the dipterocarp seedlings? Is it a gradual and partial release, complete release or no release at all from the overhead and understory vegetations?

## REVIEW OF LITERATURE

Many studies have been conducted to find the responses of seedlings when freed from competing vegetation. For example, Hatchell (1) found that 2-year-old loblolly pine seedlings freed from overstory competition were 2 times taller than unreleased seedlings. Leak (2) in his study on cutting the overstory and understory vegetations to free the white ash regeneration found that light cutting (20 percent of basal area) was better than a heavier (40 percent) cutting. Rose and Dejarnette (5) reported that the best environment for later growth of spruce-subalpine fir was in the clearcut areas not in partial cut. McConkey (3) found that release of young white pine seedlings from hardwood competition grew by as much as 2.2 times the overtopped checked seedlings. Williams (9) in his study on height growth of yellow-poplar seedlings when released from competing vegetation found that seedlings in the high-release and complete-release plots grew very much faster than those in the check plots. Released trees were three times as tall as the unreleased trees.

In 1959, a study (6) was conducted by the Bureau of Forestry, in collaboration with the Aras-asan Timber Company at Surigao del Sur, on the response of saplings and poles of dipterocarps when subjected to different intensities of treatments. Three plots, ranging from an area of 0.9 to 1.0 hectare each, plus a control plot, were established at a five-year old logged-over area. Each treatment was replicated. The three silvicultural treatments were as follows:

1. Light Treatment. —Only vines, rattans and palms species were cut.
2. Medium Treatment. — Vines, rattans, palms and micellaneous species, having

[1] — The study is conducted by the Bislig Bay Lumber Company, Inc., inside its concession

the same height as the dipterocarps were cut.

3. Heavy Treatment.—It includes Nos. 1 and 2 above, in addition to the following procedures:

   a. Girdling all surviving defective (cull) trees of the commercial and weed trees not acceptable for sawtimber.

   b. Cutting or girdling all badly shaped, damaged, diseased or inferior trees of the dipterocarp species and other useless trees, 10 cms. in diameter and over.

The results of the study are enumerated at Table 1 below:

TABLE 1. —*Average diameter growth in centimeters per tree per year of a four-year old stand of young Dipterocarps and other desirable species at Aras-asan, Surigao del Sur*

| Block (r) | TREATMENTS (t) | | | | Block Totals |
|---|---|---|---|---|---|
| | Control | Light | Medium | Heavy | |
| | (A) | (B) | (C) | (D) | |
| I | 0.41 | 0.46 | 0.32 | 1.08 | 2.27 |
| II | 0.53 | 0.89 | 1.18 | 1.77 | 4.37 |
| Treatment Totals | 0.94 | 1.35 | 1.50 | 2.85 | 6.64 |
| Treatment Means | 0.47 | 0.68 | 0.75 | 1.42 | — |

*Note*: 1. A vs D is highly significant at 1 percent level
2. B vs D is significant at 5 percent level

The study was analysed statistically and it showed that the difference in the average diameter growth between control and heavy treatment is three times over the control. 1 percent level — that — growth in the heavy treatments is three times over the control. The treatments recommended are as follows (4, 8):

1. A combination of the medium and heavy treatments is more advisable than the individual application of light or heavy treatments.

2. Light treatments should never be applied because the response of the Dipterocarps was very negligible. This is due to the dense miscellaneous species and the overstory which were left uncut.

3. Heavy treatment should also not be applied because of the resurgence of vines, herbaceous species and the fast-growing sprouts which gained the upper hand in a much faster pace than the Dipterocarps.

The result of the above study was the preparation in 1964 of a paper entitled, "Timber Stand Improvement Guide of Dipterocarp Secondary Forest"[2].

### APPLICATION AND FURTHER STUDY ON THE 1964 TSI GUIDE

The opportunity to test further the applicability or practicability of the results of the study inside the concession of the Bislig Bay Lumber Company, Inc. came when the author joined the company in 1964. One of the studies conducted was the general

[2] — This Guide was published in the December 1963-January 1964 issue of the Lumberman, with Foresters Martin R. Reyes and Eulogio T. Tagudar as the authors.

application of the guide as a regular operational work, that is, a crew was formed, headed by a forester, and they were trained to cut, slash or girdle the undesirable species and release the seedlings from overhead and understory competitions. The other is the establishment of plots, having 6 stand density levels and replicated 3 times. The stand density levels are 60, 84, 104, 132 and 156 stems per 750-square-meter plot, and one control. All the overhead and understory vegetations, except the required number of stems per plot and Dipterocarp seedlings, saplings and poles, were cut or girdled. This study not only included the observation on responses of saplings and poles of dipterocarps but also the dipterocarp seedlings. Hence, this study and report.

## STUDY AREAS, STAND CONDITION, METHODS AND MEASUREMENTS

A. *Study Areas*:

The areas treated are located inside the concession of the Bislig Bay Lumber Company, Inc. They were logged in 1956, 1957, 1958, 1959, 1960 and 1963. Sometime in 1963, these areas were heavily regenerated or seeded by all the species of the *Dipterocarpaceae* family. Many portions of the areas treated are so heavily stocked with Dipterocarp reproductions that, when a random sampling was conducted, there are approximately from 5,000 to 30,000 seedlings per hectare. Seventeen separate areas, ranging from a hectare to 20 hectares or more and distributed in the logged-over areas, were subjected to the regular timber improvement measures as prescribed in the 1964 Guide. Another set of plots, with 6 stand density levels and replicated three times, were also established.

B. *Stand Conditions of the Areas* (*4*, *7*):

Five years and over after logging, the logged-over areas had been transformed into:

1. A Gubas-Malabanato-Binuang dominated stand. — Patches of forest, ranging from one hectare to 20 hectares, are dominated by *Endospermum, Mallotus, Octomeles, Duabanga spp.* and other fast-growing trees. After more than 5 years of stand development, these young stands had developed from a thicket of dense-jungle-woody growth to a dense uneven-aged or even-aged stand of young poles no longer dominated by vines and herbaceous species and it has naturally thinned out to permit free movement below the canopy. It is well established that the composition of the future forest can be easily predicted because the Gubas, Binuang, Loktob and many other desirable species have already dominated the stand. Here, the future crop trees can easily be distinguished from other trees. Underneath these stands are reproduction of Dipterocarps.

2. *"Islands" of unlogged forests which are densely stocked with Dipterocarp seedlings.* — In these areas, there are healthy residuals, scattered old growth timber, injured trees and non-commercial species. Associated with these overstory trees are palms and vines which cover practically the whole tree or trees. The forest floor is densely stocked with stunted Dipterocarp reproductions. Because of the thick overhead canopy, sunlight cannot penetrate into the forest floor. Hence, the seedlings have little chance of development without man's assistance.

3. *Patches of degraded stands.* — These areas are so devoid of commercial species and are presently stocked with thick stand of deformed and low-shade-casting crowned trees and very dense growth of herbaceous species, vines and climbing bamboos. The re-

growth is so dense that there is practically no prospect of Dipterocarp seedlings which fall into these areas to germinate, survive and develop.

C. *The Timber Stand Improvement Measures*:

The TSI measures applied in each stand condition classes are as follows:

1. *Gubas-Malabanato-Binuang Stands*:

(1) Cutting or slashing all vines, climbing bamboos, wild bananas, rattans and palms which are overtopping or hindering the growth of dipterocarp seedlings, saplings and poles.

(2) General cutting of useless undergrowths or elimination of herbaceous species.

(3) Cutting all suppressed, or diseased gubas, malabanato, binuang, loktob and anabiong.

(4) Cutting all other miscellaneous species, less than 10 cms. in diameter which are deformed, diseased and short-boled and with low-shade-casting branches or crowns.

(5) Girdling trees, bigger than 10 cms. in diameter which are directly interfering with favored species.

(6) Trees, 15 meters or latter, with clean boles and the crowns of which are way up the general crown level of the young stand, are not girdled. Obviously, these trees, if evenly distributed or spaced in the stand, do not hinder anymore the growth of the young trees and reproductions.

2. *"Islands" of unlogged forests densely stocked with reproductions*:

(1) Cutting all palms, rattans, climbing bamboos, vines and all non-commercial and worthless trees less than 10 cms. in diameter.

(2) Girdling all non-commercial species which are deformed, diseased and short-boled with low-shade-casting branches or crowns, more than 10 cms. in diameter.

(3) Cutting all herbaceous and useless species directly hindering the growth of dipterocarp seedlings.

3. *Patches of degraded stands.* — Because of lack of knowledge on the management of these stands, they were left as they were encountered during the cultural operations. (Recently, however, the company is experimenting on improving this kind of a stand by cutting and girdling all the useless trees, leaving some few trees, more or less evenly distributed in the area, to act as nurse trees. These areas shall be planted with Narra. Dipterocarp wildlings, or other desirable species.

D. *Study Plots and Interval of Measurements*:

a. *Inside Regular Timber Stand Improvement Areas*:

1. Twenty two observation plots (10-meter radius) were established inside the improved or treated areas. All live trees, 5 cms. in diameter and larger inside each plot, were tallied as to diameters and heights. Each tree was numbered with aluminum tag and plotted in a plot location chart.

2. Dipterocarp regenerations were tallied in each 88 sub-plots (2 x 2 meters) inside each treated plot. These plots are established at the North, South, East and West lines,

5 meters from the center of the plot. Eight sub-plots (2 x 2 meters) were also established in untreated areas to determine the growth of overtopped checked seedlings. The number of seedlings found inside each plot were tallied in accordance with the standard-height classifications adopted by the Bureau of Forestry as follows:

(a) Small seedling — Less than 50 centimeters tall;

(b) Large seedling — From 50 cms. to 1 meter tall;

(c) Small pole — From 1 meter to 3 meters tall;

(d) Large pole — From 3 meters tall to 10 cms. DBH.

3. The plots were first measured on on August, 1965 and remeasured on August, 1967.

b. *Inside Different Stand Density Level Plots*:

Fifteen reproduction plots were established inside each replicated plot and three reproduction plots inside three control plots. Measurements and recordings of young poles and seedlings have the same procedures as those in the plots established inside regular TSI areas.

c. The next measurement shall be August, 1970, after which the final measurements shall be analyzed statistically.

RESULTS

Two years after the seedlings were released from both the understory and overstory vegetations, the following heights growth comparisons are possible:

I. *At Regular Timber Stand Improvement Areas:*

| | | CONTROL | | | | TREATED AREAS | | |
|---|---|---|---|---|---|---|---|---|
| | | No. of Seedlings | | Total Heights (Meters) | | No. of Seedlings | | Total Heights (Meters) |
| At Present, 1967 | — | 401 | — | 107.75 | — | 1,151 | — | 1,523.25 [3] |
| Original, 1965 | — | 368 | — | 115.50 | — | 1,030 | — | 524.00 |

| | | CONTROL (Meters) | | TREATED (Meters) |
|---|---|---|---|---|
| Average Present Height (1967) | — | 0.27 | — | 1.32 |
| Average Original Height (1965) | — | 0.31 | — | 0.51 |
| Growth (2-year period, 1965-'67) | — | (-0.04) | — | 0.81 |
| Growth (2-year period, Control vs Treated) | — | — | — | 1.01 |
| Average Growth per Seedling per year | — | (-0.02) | — | 0.55 |

[3] — Increase in the number of seedlings were due to some Dipterocarp trees that seeded during the intervening years.

II. *At Different Stand Density Levels:*

| | | CONTROL | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Seedlings No. of | | Total Heights (Meters) | | Seedlings No. of | | Total Heights (Meters) |
| At Present, 1967 | — | 95 | — | 38.25 | — | 368 | — | 687.25 [4] |
| Original, 1965 | — | 101 | — | 37.25 | — | 107 [5] | — | 41.75 [5] |

| | | CONTROL (Meters) | | TREATED (Meters) |
|---|---|---|---|---|
| Average Present Height (1967) | — | 0.40 | — | 1.87 |
| Average Original Height (1965) | — | 0.37 | — | 0.39 |
| Growth (2-year period, 1965-'67 | — | 0.03 | — | 1.48 |
| Growth (2-year period, Conrtol vs Treated) | — | — | — | 1.50 |
| Average Growth per Seedling Per year | — | 0.02 | — | 0.70 |

[4] — Inside treated plots, 3 representative plotswere established in 1965 and 12 plots in 1966.
[5] — Based on 3 representative plots.

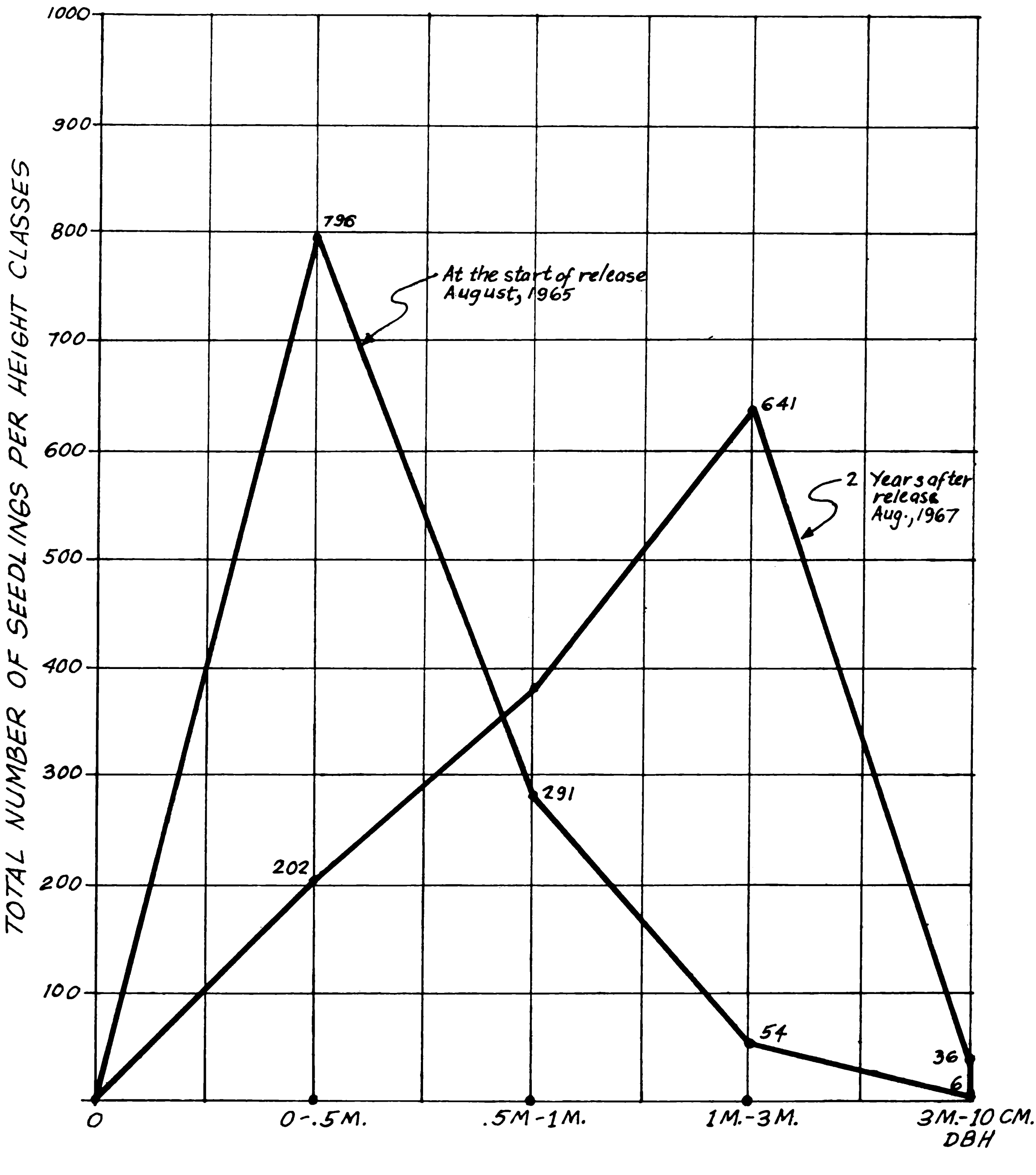
DISCUSSION

The partial reduction of the overstory and completed elimination of the understory vegetations is a major factor influencing the rapid increase in height growth of the dipterocarp regenerations. Two years after the treatment was conducted, the average height of released seedlings inside regular timber stand improvement areas is 1.32 meters while the overtopped checked seedlings is only 0.27 meters. The rate of increase in height growth of the released seedlings is 4.9 times over the checked seedlings (Figure 1 and 5). Inside the replicated plots, the average height of released seedlings is 1 87 meters while the overtopped seedlings is only 0.40 meters. The rate of increase of height growth of the released seedlings is 4.7 times over the overtopped, checked seedlings. The released seedling were also stouter, greener, and more robust (Figure 3-A). The overtopped checked seedlings seemed not to have grown at all, are sickly, stunted and leaves are yellowish and whorled in a circle at the tip (Figure 3-B and 4). Once the seedlings are freed from competing vegetations, the movement of seedlings from one height class to the next is very rapid (Figure 2).

Although this conclusion is based only on 2-year measurement period, following cleaning, weeding, girdling and thinning treatments the remarkable responses in height growths of the released seedlings appear to be conclusive, and encouraging enough for an extension of the application to sizable areas under similar conditions. The company is presently releasing wider areas of densely stocked Dipterocarp reproductions which had been suppressed for over a period of four years.

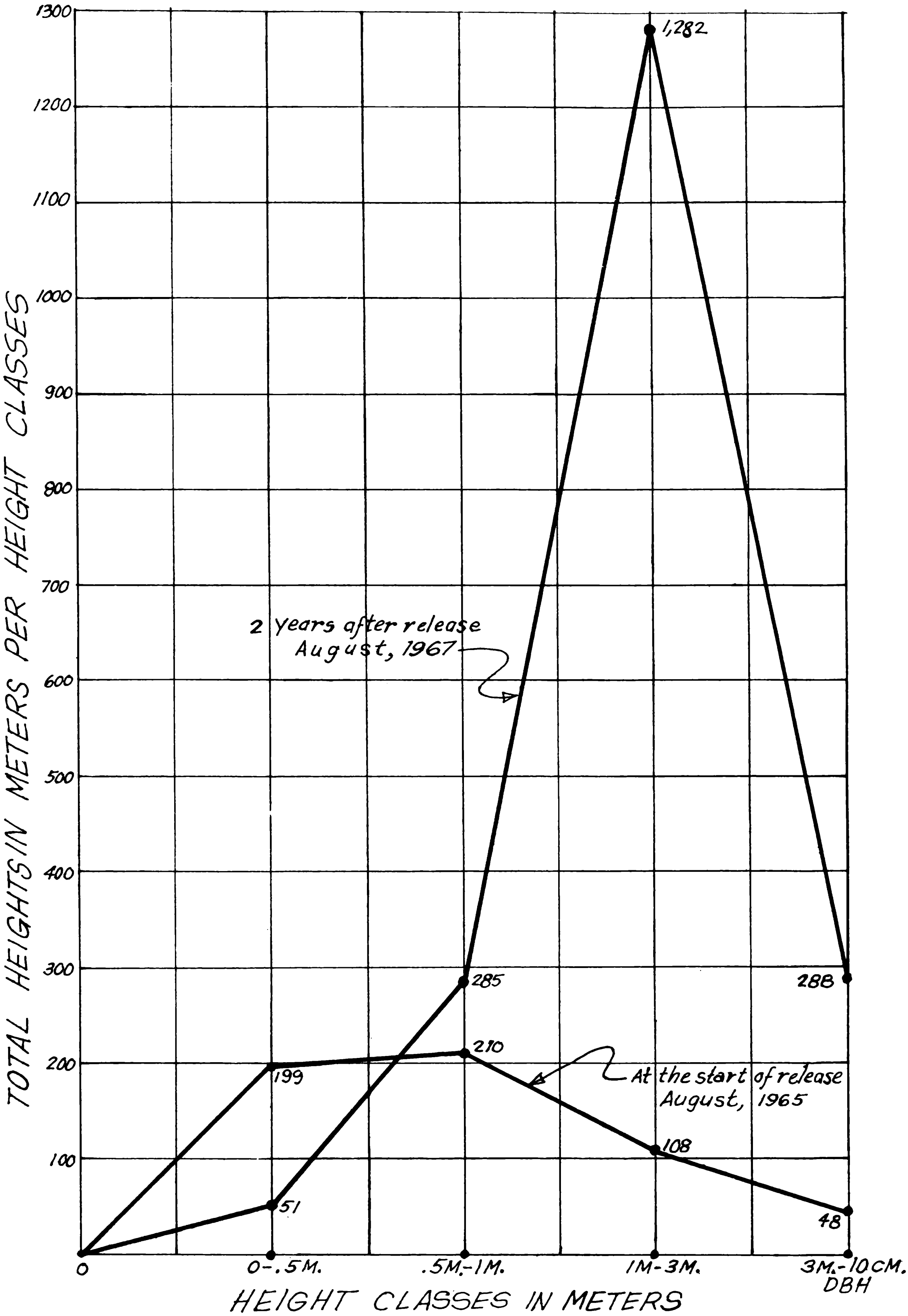
From this study, the following additional tentative conclusions are indicated:

1. Partial opening of the overhead canopy minimizes or prevents the resurgence of vines, an operation necessary for the growth of the desirable seedlings.




HEIGHT CLASSES IN METERS

Graph showing the response of Dipterocarp seedlings, 2 years after releasing them from overhead and understory vegetations (Bislig Bay Lumber Co., Inc.)



TOTAL HEIGHTS IN METERS PER HEIGHT CLASSES
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
0-.5M.
.5M.-1M.
1M-3M.
3M.-10CM. DBH
HEIGHT CLASSES IN METERS
1,282
2 years after release August, 1967
285
288
210
199
At the start of release August, 1965
108
51
48

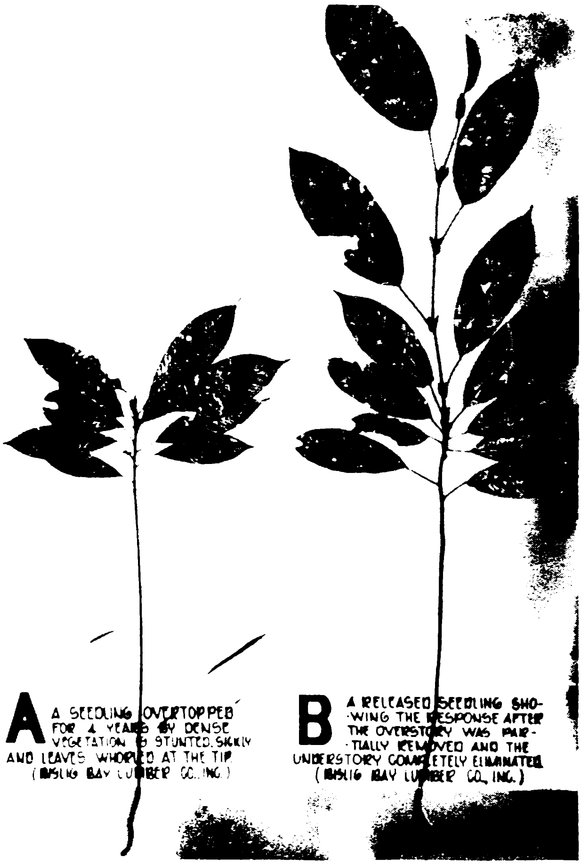
A plot of released Dipterocarp seedlings.

Another plot of released Dipterocarp seedlings.

Two views of released Dipterocarp seedings. Average heights range from 1.32 to 1.87 meters after 2 years of being freed from overstory and understory vegetations. Note the white- graduated and numbered-meter pole used in the measurement of heights.

A close-up view of rele^sed Dipterocarp seedlings under a regular timber stand improvement operation.

Released Dipterocarp seedings along a spur road in a regular timber stand improvement operation. Note the abundant seedlings growing vigorously under partial shade.




A dipterocarp **seedling overtopped for 4 years by** dense vegetation is stunted, sickly **and** leaves are whorled at the tip.


A released Diptercarp **seeding** showing the response after **the overstory was partially removed and** the understory completely eliminated. Note **the** distances between the alternate leaves which was due to fast growth after it was released.


**Stunted** and overtopped **Dipterocarp** seedlings. **Average** heights range from 0.27 to 0.37 meters after 4 years **under** thick overstory and **understory** vegetations. Note **the** white-graduated and **numbered**-meter pole used **for** the measurement of heights.

2. Inspite of 2 to 3 years of suppression or of stunted growth, Dipterocarp seedlings can still respond remarkably when freed from excessive overhead and understory vegetations (Figure 6).

3. Cutting the understory vegetation frees the dipterocarp seedlings from early competition, thus giving them the advantage to gain the upper hand over the sprouts and vines.

4. Only the middle story and ground useless vegetations should be eliminated either by cutting or girdling. It seems desirable to reduce partially the overstory completely eliminate the understory vegetation.

5. No attempt should be made to open up the logged-over areas too wide as vines and other herbaceous species will surely overtop the dipterocarp regenerations.

### RECOMMENDATIONS FOR FUTURE WORK

1. The use of weed killers, like 2, 4-D, sodium arsenite or 2, 4, 5-T should be tried to kill unwanted species in TSI areas. Some of the trees we girdled, even after 2 years, are still living and seem to be healthy.

2. As a complement to the timber stand improvement measures, under-planting of dipterocarp wildlings should be tried inside TSI areas. If naturally regenerated Dipterocarp seedlings can grow vigorously under partial shade, it is quite possible that transplanted dipterocarp wildlings may survive and grow well, too.

3. As a concomitant to selective logging practices, timber stand improvement as indicated in this paper should be carried out in all timber license areas with the assistance and leadership of the Bureau of Forestry. This will probably greatly increase the growth rate of all the residual stands, thus allowing a justifiable increase in the harvest rate of the virgin forest. The additional income to the nation may very well be very substantial.

### ACKNOWLEDGMENT

The author wishes to acknowledge his indebtedness to the Resident Manager, Mr. W. S. Godinez, Bislig Bay Lumber Company, Inc. for his valuable suggestions and constructive criticisms on this paper and to the Foresters of the Company for their assistance in the establishment and remeasurement of the plots.

### LITERATURE CITED

1. Hatchell, G. E. 1965. Immediate release needed for maximum growth of seeded loblolly pine. Tree Planters Notes No. 66 Southern Forest Experiment Station, U. S. Forest Service, U.S.D.A. Pp. 19-20.

2. Leak, W. B. 1963. Effects of seedbed, overstory and understory on white ash regeneration in New Hampshire. Research Paper NE-2. Northeastern Forest Experiment Station, U. S. Forest Service, U.S.D.A. 13 pp.

3. McConkey, T. W. 1960. Release, browse damage and growth of young white pines. Forest Research Notes No. 108. Northeastern Forest Experiment Station, Forest Service, U.S.D.A. 2 pp.

4. Reyes, M. R. and E. T. Tagudar. 1964. Timber stand improvement guide for dipterocarp secondary forest. December 1963-January 1964 Issue, Lumberman, Quezon City, Philippines, Pp. 58, 60, 62.

5. Roe, A. L. and G. M. Dejarnette. 1965. Results of regeneration cutting in a spruce-subalpine fir stand. Research Paper INT-17.

# Wood Plastic Combination[1]

by

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*Phil. Atomic Research Center*

WOOD PLASTIC COMBINATION

Among our fabled rich natural resources, one of the most abundant is wood in its many forms and sizes. That trees improve our landscape is well recognized; that they bring in a not insignificant amount into our material coffers may not be as widely appreciated. But the fact remains that Philippine woods are among our most stable dollar source. This is mainly due to the many well-known varieties we have in natural abundance here.

Lately, we have been hearing of a miracle wood species. Like the miracle rice, it is not without its own shortcomings. As researchers, we are interested in finding ways to improve these products. Being chemists, we do not attempt to do this by breeding, the way agriculturists would; rather, we look into the chemical properties of the product and see how we can modify its inherent properties by chemical process.

Since the Philippine Atomic Reseach Center (PARC) is a government agency, our research objectives are geared to the program and functions of government as spelled out by our national leaders. With economic development as today's battle cry, we have, at the Center, slanted our research projects toward this goal. In our applied researches we have considered using nuclear techniques on local products — and this is how we stumbled on wood and incidentally, on the *Kaatoang* Bangkal — the miracle tree which however, cannot in its present state, be of much commercial use being a very porous type. So we tried experimenting with it and came up with a much hardened, more water resistant, and more dimensionally stable, products which is called WPC for Wood Plastic Combination. How we did this, I'll try to explain in the following paper.

Wood is the supporting and conducting tissue for the tree. About 90% of wood tissue is composed of strong, relatively thick-walled long cells. Chemically, the cell wall tissue of wood is a complex mixture of two groups of polymers, like polysacharrides and lignin. The former, known collectively as holocellulose, is composed of cellulose and and other polysacharrides known as hemi-cellulose. Cellulose is a high molecular weight linear polymer composed of glucose anhydride units while hemi-cellulose is a mixture of shorter chain polymers.

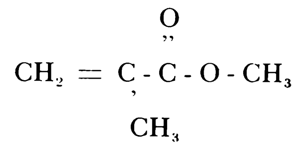
Lignin is a polymer of condensed, substituted phenols. It serves as the adhesive material of the wood, cementing the fibers and other cells together. Extraneous materials may be found in the cavities of the cells, large amounts being present in some species.

Wood plastic combination involves the impregnation of wood with monomer, and its subsequent polymerization by gamma-irradiation.

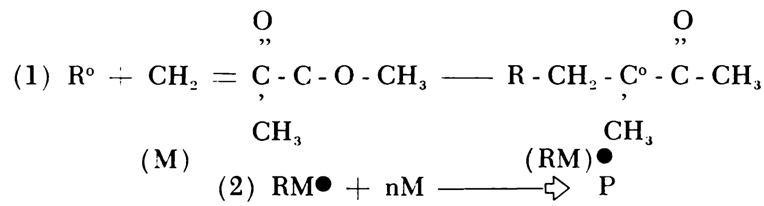
In wood plastic combination, the monomer is the chemical that impregnates wood and forms the basic building blocks of the plastic (polymer) produced by irradiation. There are many commercially available monomers. Among them are methylmethacrylate, vinyl acetate, styrene, acrylonitrile and ethyl acrylate. In our initial experiments at

[1] Paper presented at the Forestry Research Symposium held at College, Laguna Aug. 29-30, '67.

PARC, we used methylmethacrylate, a member of the family of acrylic monomers and polymers. The structure for methylmethacrylate is:



The basic process by which monomer is built up into a polymer is shown below:



R● represents an initiator radical, M, the monomer, and P, the polymer. In the formation of WPC, the initiator radical R● is produced by the action of the high energy radiation on the wood cellulose and on the monomer itself.

Three (3) types of polymerization reactions take place in WPC system. (1) Radiation will produce radicals on wood and these can react with methylmethacrylate monomer to produce graft copolymers as depicted below.

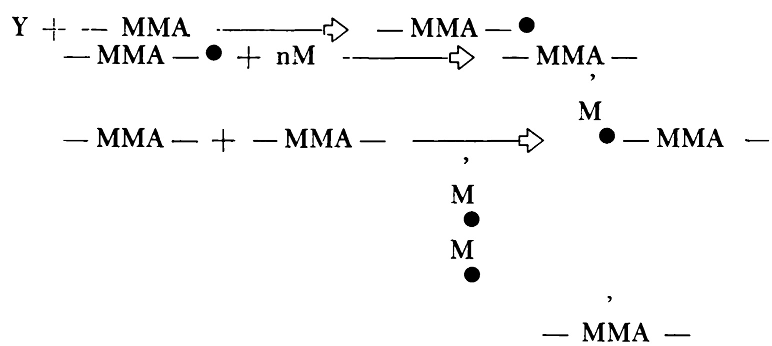
$$\text{Cellulose} + V \longrightarrow \text{Cellulose}\bullet$$

$$\text{Cellulose}\bullet + M \longrightarrow \text{Cellulose } M\bullet$$

$$\text{Cellulose } M\bullet + nM \longrightarrow \text{Cellulose } P$$

In this reaction a chemical modification of the wood structure actually occurs and may impart desirable and unique properties to the product.

(2) Radiation will initiate radicals on the methylmethacrylate polymers which can reset with other monomers or polymers to give crosslinked material as shown below:



(3) Third, other monomers can be introduced into the wood along with methylmecrylate which will react to form copolymers with a variety of properties. Both reactions (1) and (2) take place during the formation of WPC using methylmethacrylate on *Kaatoang Bangkal.*

In the PARC experiments we arrived at this result after a series of trials involving the following four basic steps namely:

1. Pre-treatment of wood
2. Impregnation of wood with the monomer

3. Irradiation to effect polymerization

4. Drying

*Pre-treatment of Wood*

Wood samples of *Kaatoang Bangkal,* 2" x 2" x 12" are weighed and placed in an aluminum cylindrical vessel 16" long having a wall thickness of 1/4". The vessel is welded close at one end and provided with a flange and bolted cover at the other. An outlet is provided for introducing and draining of the monomer. Once the wood sample is inside the cylinder, it is evacuated using an ordinary vacuum pump to a pressure of about 21 mm. Hg. for 30 minutes. Evacuation of the wood samples serves two purposes:

1. It removes air from the pore spaces of the wood to make room for the liquid monomer, and

2. It eliminates most of the oxygen from the wood.

Oxygen has a marked inhibitory effect on the subsequent polymerization.

*Impregnation of the wood with the monomer*

While the system is under vacuum the cylinder is flooded with sufficient monomer to completely immerse the wood. Nitrogen gas is passed through the system. The wood is allowed to soak in the monomer overnight and the system is vented to atmospheric pressure and the excess monomer drained off. The wood is then weighed and once again placed in the cylindrical vessel and flushed with nitrogen gas.

*Irridiation*

The cylinder containing the wood is then positioned in a 500°C Co-60 source and exposed until it receives a total dose of 3.5 megarads.

*Drying*

After irradiation, with the wood is still in the cylinder, it is vacuum dried for about 2 days and then removed from the cylinder and weighed.

Our results with methylmethacrylate experiments were very encouraging. The finished wood product retains most of the desirable characteristics of the wood, and now possesses besides, many improved properties. For example, the wood is much harder, the increase in weight of the WPC being about 200%. Its dimensional stability has been enhanced with its susceptibility to shrinking and swelling due to changes in moisture content having been reduced. Another additional improvement is in the compression strength which was increased considerably to about 6 times. Other properties of the wood have not been tested but we expect to do this later. We also intend to try other monomers, possibly, cheaper ones.

There are still a number of problems before this new find can be harnessed for there is the big factor of cost and its concommittant difficulties. What matters to us researchers is that we have initially succeeded in our project. Since we are not commercially oriented, I'm afraid we do not think in terms of economics. We leave this to other sectors who are more competent in this regard than we are.

# Spectrum of Forest Products Research in the Philippines

by FRANCISCO N. TAMOLANG[1]

INTRODUCTION

Forest products research in the Philippines has been growing progressively like the famous Philippine mahogany which grows from an obscure seed to a leafy plant capable of producing valuable timber of many uses and adjunct benefits. This growth is attributed to the "fruits of the years" in terms of accomplishments of the Forest Products Research Institute (FPRI) since its establishment in 1957, which have substantially advanced the development of forest-based industries. An overall evaluation of these worthy accomplishments convinces us that the nest of these "golden eggs" is the very strong foundation of the FPRI research program for industrial development.

This paper presents the FPRI objectives, research activities and accomplishments in an effort to draw the response of its sister agencies, the forest-based industries and the public, to the need for more research on timber and other forest products in order to push onward the economic development and prosperity of the country.

BASIC GOALS AND SCHEMES

In brief, the Forest Products Research Institute aims "to discover and determine the most efficient method of utilizing our numerous timber species and minor forest products, to minimize wood waste and to find the potential values of wood residues as raw materials for new industries, new jobs, and new products which can greatly contribute to the national economy." The ultimate goals are the maximum utilization and wise use of timber and minor forest products for the greatest good and benefits of our country, our generation and those yet to come.

Aiming at these goals, the structural organization of the Institute stands paramount to achieve a scheme of simultaneous research activity on a scientific and/or technical problem so as to obtain results at the earliest time possible with the best use of funds available. On this consideration, the FPRI discharges its scientific and technological responsibilities throug five technical divisions: Chemical Investigations, Industrial Investigations, Timber Physics and Engineering, Wood Preservation, and Wood Technology, as its potent research centers. The tactical approach is to work on authentic timber and other forest products, collected throughout the country according to a well-conceived plan of having sufficient representative samples for scientific study by these divisions. Consequently, when timber is collected and brought to the Institute, it is systematically sawn in accordance with appropriate log-cutting diagrams so that all divisions get their corresponding wood specimens and materials and, simultaneously, conduct their respective tests and studies. In this way, time, effort and money are used wisely to obtain the greatest results possible.

A noteworthy scheme is the research program, prepared annually, upon which the five technical divisions concentrate their research activities. It is flexible to the availability of personnel, funds, materials and equipment. The research projects in this

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program are kept attuned to the current needs of forest-based industries, the consuming public and the country's forest management.

Since 1957, the research projects programmed annually rose from 63 to 153, an increase of about 143% (Table 1). Also, the continuing or long-term projects increased from 25 to 55. Overall, the annual average of short-term projects was 41 and the annual average of completed projects was 11.8 or 31.38%. All these show that forest products is not an easygoing concern to realize the research or solutions to scientific, technological, and industrial problems, unlike in a "diploma mill." Every accomplished project passes through a rigorous grind of careful statistical analysis, evaluation, interpretation, and critical and realistic analysis of results. Unsuspectingly, all these boil down to the vital essence of fertile curiosity, onward-searching, and exploration into uncharted areas of knowledge and technology, which lead to discoveries, "breakthroughs" and to revolutionary solutions to problems that baffle us. For example, who knows that, from its obscurity, one of our fast-growing minor forest products will become the potential source of our vitally needed long fibers for pulp and paper, particularly newsprint and cement bags and, thereby, supplant the popularly known and imported softwood long fibers? Prospectively, if this is realized, it will redound to the country's self-sufficiency in long-fiber-using pulp and paper products, increase in literacy as well as in national income.

FPRI BREAKTHROUGHS

FPRI was able to penetrate successfully certain frontier areas, the discovery of which could be useful and helpful to the industry.

To mention a few, a binder formulation was found very effective to produce charcoal, coal and ore briquettes without the necessary conventional process of drying them in a drier (Phil. Patent No. 2673). A carbide-waste additive in the formulation itself takes care of the drying process. This fomulation has been commercially used by the Maria Cristina Chemical Industries since 1963.

Tanpowder-flour-dust coconut husk was found useful as a binder for praticle board manufacture (Phil. Patent No. 1592). Timex Inc. will soon try it commercially in its plant in Zamboanga City. If successful, this waste product is expected to revolutionize this industry.

In its long-fiber research, the FPRI was able to develop a cheap method of defibering tree barks and agricultral fiber-producing raw materials particularly abaca, bananas, pineapple, *agave* spp., etc. No chemical is needed in the process. The defibering machine is portable and can be brought to the plantation to eliminate cost of transporting raw materials from the plantation to the factory.

From Benguet pine oleoresin, rosin size was produced and found good for sizing paper. However, scout trials indicate that almaciga rosin size has propects as paper sizing provided it is blended with Benguet pine rosin rize in a proportion of 60:40. This is encouraging, considering that our Benguet pine rosin-size potential may be doubled besides fostering a new use for almaciga resin.

A bamboo parquet block (Phil. Utility Patent No. 386), a bamboo-faced floor tile, consisting of wood veneer core and back, with bamboo as face was developed in the FPRI. This points out a unique use of bamboo for exquisite flooring of buildings.

In an effort to help the small wood-using industries, solar-drying was found promisingly effective in reducing the drying time of 1-inch thick lumber to 33% and of 2-inch thick materials to 40-60%, of that required for air-drying. This suggests that solar energy can he harnessed for drying lumber in some parts of the country where the intensity of solar radiation is relatively high.

To the list of known destructive termites and beetles, the FPRI adds four newly-discovered species namely: *Glyptotermes franciae* Snyder, G. *magsaysayi* Snyder, G. *cruzei* Snyder, and *Platypus franciae* Browne. By knowing them, you know what to do: Beware of their destructive activities in your homes; otherwise, woe unto you.

At long last, the controversial identity of *tiaong* was resolved. It is no longer *Shorea teysmanniana* Dyer or S. *polysperma* forma *tiaong* Foxworthy but S. *agsaboensis* Stern. The stern warning is: Never mistake it for tañgile (S. *polysperma* Merrill).

In anticipation of a hand-made paper industry in the Philippines, a local mucilage as good as the Japanese commercial synthetic mucilage, Viimal-H, was discovered. The local mucilage could be produced from barks of anabo (*Abroma augusta* (L.) Willd.) and kulotkulotan (*Triumfetta bartramia* L.).

To improve oleoresin production and accelerate the growth of the local naval stores industry, Benguet pine was tapped by bark chipping with acid stimulation. Results showed that sulfuric-acid treatments stimulate oleoresin exudation and increase oleoresin production by about 66-99%. This shows the hopeful feasibility of tapping our Benguet pine forest to produce part of our paper-sizing needs and, thereby, reduce our rosin-size importation.

#### TECHNICAL ASSISTANCE TO INDUSTRY

In 1957, our veneer and plywood industry, numbering only 16, was practically moribund and could not export its below-standard products. With the technical assistance of the Institute, it has been possible for the industry to produce good-quality products acceptable for export. The list of suitable species for plywood manufacture has been increased as well as the productive capacity of the mills. Today, there are about 42 veneer and plywood mills throughout the country, which are now producing veneer and plywood for local consumption and for export.

Conscientiously, the FPRI has been servicing the different pulp and paper mills throughout the country. In its continuous program of training technical personnel from the forest-based industries, 101 came from the pulp and paper industries.

The determination of logging waste and residue, the first of its kind in the country, gives us some helpul hints. In two big operations in Basilan Island, it was found that for every 100 cubic meters (M/3) of harvested logs (net scale), there were left in the logged-over areas about 58 M/3 in wood-waste residue, 51 M/3 of which were usable and 7 M/3 were too badly damaged and mutilated to be of any use. This shows the great potential of increasing the country's wood utilization by creating new integrated industries.

Similarly, in sawmills, sawdust alone has been found to be the largest waste material, amounting to 42% of the total waste. Other wastes are slabs, amounting to 22%; edgings, 20%; and lumber trim, 16%. The integration of secondary industries to the sawmill should be encouraged to utilize these enormous waste residues.

To date, basic stresses and allowable working values for 23 commonly used structural species have been determined to aid engineers, architects, contractors, and builders in their various constructions. For the layman's enlightenment, this would mean efficient, safe and wide use of wood. For example, where 10 trees could be used to build an ordinary house in the past, it is not improbable now to build about 5 similar houses because of efficient and economical design.

Since the establishment of the Institute, the public has been more conscious about properly kiln-dried lumber and properly-treated wood for construction purposes. Technical assistance has been directed toward these fields for the mutual benefit of both the public and the producers.

The FPRI, as the recognized wood identification agency, identified a total of 9,643 wood samples for the public during the last decade. It also identified pulp and paper samples for the Bureau of Customs, Tariff Commission, printers, publishers, and the pulp and paper industries. This saved the country from possible losses in customs duties and commercial deals as a consequence of attempts of unscrupulous dealers to "hoodwink" the government.

In a humble way, a "Lexicon of Philippine Trees" FPRI Bulletin No. 1, has been published for the benefit of foresters, botanists, lumbermen, students, etc., in connection with their work on trees and other related fields.

## ARCHITECTURE OF FOREST PRODUCTS RESEARCH

It must be realized that we cannot rest on past achievements. We must build on them as we explore new concepts, hit upon new ideas and develop them vigorously especially those that are promisingly leading to new solutions and approaches in fulfilling our goals and our obligations to the forest-based industries and the public. The march forward should be to enhance the utility of timber and other forest products for their full contribution to human welfare.

On this basis, the five FPRI technical divisions have amassed, for the past 10 years, a conglomeration of research projects in the spectrum of forest products research in the Philippines. In graphic representation, forest products research is like a growing tree with 5 main branches, representing the technical divisions I, II, III, IV, and V (Fig. 1). Each branch bears three secondary branches which represent the types of projects (1, 2, 3). From the secondary branches sprout tertiary branches, representing the fields of study (A). These tertiary branches also bear branchlets, representing mainline projects (a). The branchlets branch out to mini-branchlets, representing specific research projects (*1, 2,* etc.). The mini--branchlets may bear fruits, depending upon the vigor of the tree. The "fruits of the years" are the completed research projects.

To keep track of these research projects, it is imperative to identify them systematically. The FPRI numbering system has been adopted for the last 10 years and, lately, as the FPRI commences its second decade of operation, this has been revised so as to include regular projects, technical assistance, and cooperative projects in order to facilitate filing of working plans, data sheets, test results, final reports and related information (Appendix A). It also serves to catalog the various *fields of study* and *mainline projects* under which *specific research projects* are being conducted by the different technical divisions. It can also serve for making a checklist of specific research projects already conducted or to be conducted under each mainline project to enable every researcher follow-up past projects, the progress of current work, and assign numbers to new projects with facility.

It may be noted that the fields of study enumerated are broad and defined so that a number of related mainline projects may be listed under each field. The enumeration of fields of study and mainline projects in this system has not been exhaustive, but the system is flexible so that new fields of study and mainline projects pertinent to forest products research may be added at any time.

In this system, the five technical divisions are represented by the following respective pairs of capital letters:

CI = Chemical Investigations Division,

II = Industrial Investigations Division,

PE = Timber Physics and Engineering Division,

WP = Wood Preservation Division, and

WT = Wood Technology Division.

A letter or letters in parentheses, after any of the above pairs of capital letters, indicate sections in the corresponding division. For example, CI(C) means Chemical Investigations Division, *Chemical Composition Section.* The first arabic number immediately following these letters stands for the *field of study,* and the second arabic number stands for the *mainline project.*

Thus, for a specific research project, the numbering system (Appendix A) is referred to. For example, "Studies on the lignin from Philippine fibrous materials. I. Philippine Mahogany" may be written according to the system as follows:

| | | |
|---|---|---|
| CI(C)-4 | : | CHEMISTRY OF LIGNIN |
| CI(C)-4-1 | : | Properties and characteristics |
| CI(C)-4-1-1.1 | : | Studies on the lignin from Philippine fibrous materials. I. *Philippine Mahogany* |

The third arabic number stands for the specific research project which apparently seems to be still broad and can be subdivided into smaller groups or units, such as *I. Philippine Mahogany, II. Family Burseraceae,* etc. These smaller units are represented by the fourth arabic number preceded by a decimal point.

Apparently, forest products research is dynamic and progressive. Some fields of study may not be worked on now for lack of equipment and personnel, but they are listed obviously to be worked on later should the proper occasion arise.

Technical assistance and cooperative projects are likewise numbered. In both cases, the numbering indicate the technical division involved, the year the assistance is made, the section in the division, technical assistance or cooperative project number, and the division report number.

Examples:

| | |
|---|---|
| CI-67-(C-TA-1)-1 | for CID |
| CI-67-(C-CP-1)-1 | for CID |
| II-67-(P-TA-1)-1 | for IID |
| II-67-(P-CP-1)-1 | for IID |
| PE-67-(M-CP-1)-1 | for TPED |
| PE-67-(M-CP-1)-1 | for TPED |
| WP-67-(S-TA-1)-1 | for WPD |
| WP-67-(S-CP-1)-1 | for WPD |
| WT-67-(A-TA-1)-1 | for WTD |
| WT-67-(A-C-P-1)-1 | |

The letters and figures outside the parentheses represent: *Division involved, year* in abbreviated form, and *report* No. of division. Those inside the parentheses represent: *Section involved, technical assistance* or *cooperative project* as the case may be, and *report No.* of the section. The Section numbers its technical assistance or cooperative projects consecutively as reports on them are submitted by the different Sections.

### PROSPECTS OF COOPERATION

Knowing the spectrum of forest products research in the Philippines, as herein presented, it is hoped that the forestry sister-agencies, the forest-based industries, and the public may be able to appraise its value and its deficiencies, if there are any. Suggestions are very much welcome from them in the expectation that they will add new ideas and improve it to suit their needs, particularly the growing forest-based industries and the expectant public.

There is no escaping the situation that some forestry sister-agencies may find certain phases of forest products research run parallel to theirs. There should be no alarm or sentiment about this as a case of duplication of work. Truly enough, it is a common stigma of bad taste as to arouse some suspicion and even jealously among themselves but, in scientific and technological undertakings, duplication of effort should not and actually does not exist in terms of objectives and goals.

For example, two researches have the same tenor in their titles but their objectives and goals are different. Essentially, they are complementary and the results are obtainable in a shorter time by two sister-agencies than by only one. It is, therefore, fortunate that one sister-agency can turn to the other and vice-versa, considering that one may be dealing with science while the other on technological essence, particularly the application of research findings. In other words, the situation is a healthy enthusiasm, although there is still much to be desired for adequately responsive action to develop fresh wellsprings of fundamental and technological knowledge.

We need more research on timber and other forest products, which await exploration and study of their inexhaustible potential uses. However, we have to fan brighter the flame of scientific and technological inquiry to unravel the desired bounties from these forest resources for the country's economic development and prosperity. The prospect is bright and the challenge is ours to carry this through in harmonious cooperation.

As a token of cooperation on the part of the government, it has to recognize and realize that forestry researchers are well-trained, capable, and deserving scientists. Their efforts should be acknowledged and compensated for with as much substantial remuneration of scientists, now being enjoyed by their co-equal in the NSDB, NIST, PAEC, and some industrial laboratories. Only then can "equal pay for equal work" in our democratic system of gevernment be realistically fulfilled.

REFERENCES

1. Forest Products Research Institute. 1957. Research Program for Industrial Development, FY 1957-58.
2. ———————. 1958. Research Program for Industrial Development, FY 1958-59.
3. ———————. 1959. Research Program for Industrial Development, FY 1959-60.
4. ———————. 1960. Research Program for Industrial Development, FY 1960-61.
5. ———————. 1961. Research Program for Industrial Development, FY 1961-62.
6. ———————. 1962. Research Program for Industrial Development, FY 1962-63.
7. ———————. 1963. Research Program for Industrial Development, FY 1964-65.
8. ———————. 1964. Research Program for Industrial Development, FY 1965-66.
9. ———————. 1965. Research Program for Industrial Development, FY 1965-66.
10. ———————. 1966. Research Program for Industrial Development, FY 1966-67.
11. ———————. 1967. Research Program for Industrial Development, FY 1967-68.
12. ———————. 1965. Forest Products Research Institute (Brochure).
13. ———————. 1967. Revised Numbering System for Research Projects, Technical Assistance and Cooperative Projects.

TABLE 1. Research Projects of the Forest Products Research Institute for the Period 1957-1968.

| FISCAL YEARS | NUMBER OF PROJECTS | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CID* | TPED* | IID* | WPD* | WTD* | Total | Discontinued | Long Term | Short Term | Completed | | Cooperative |
| | | | | | | | | | | No. | % | |
| 1957-58 | 10 | — | 9 | 24 | 20 | 63 | 1 | 37 | 25 | 15 | 60.00 | -- |
| 1958-59 | 17 | — | 13 | 36 | 23 | 89 | 1 | 56 | 32 | 10 | 31.25 | |
| 1959-60 | 21 | 15** | 25 | 43 | 21 | 125 | 9 | 77 | 39 | 20 | 51.29 | - |
| 1960-61 | 22 | 16 | 24 | 28 | 29 | 119 | 8 | 83 | 28 | 12 | 42.85 | |
| 1961-62 | 31 | 14 | 24 | 32 | 31 | 132 | 20 | 77 | 45 | 17 | 35.55 | -- |
| 1962-63 | 32 | 13 | 23 | 29 | 30 | 127 | 9 | 74 | 44 | 11 | 25.00 | 3 |
| 1963-64 | 30 | 19 | 25 | 31 | 30 | 135 | 11 | 77 | 47 | 14 | 29.79 | 9 |
| 1964-65 | 30 | 19 | 22 | 31 | 31 | 133 | 7 | 76 | 50 | 4 | 8.00 | 18 |
| 1965-66 | 30 | 18 | 24 | 35 | 31 | 138 | 9 | 74 | 55 | 8 | 14.55 | 26 |
| 1966-67 | 29 | 21 | 24 | 32 | 28 | 134 | 10 | 79 | 45 | 7 | 15.56 | 5 |
| 1967-68 | 32 | 26 | 32 | 35 | 28 | 153 | | | | | | |
| | | | | | | | Average | 55 | 41 | 11.8 | 31.38 | 12.5 |

* Technical Divisions: Chemical Investigations (CID), Timber Physics and Engineering (TPED), Industrial Investigations (IID), Wood Preservation (WPD), and Wood Technology (WTD).

** This division was created during this fiscal year.

## Appendix A

## NUMBERING SYSTEM FOR FOREST PRODUCTS RESEARCH PROJECTS

### CHEMICAL INVESTIGATIONS DIVISION (CI)

*Chemical Composition Section*

CI(C)-1: *Chemical Analyses of Fibrous Materials* (Studies on the chemical composition of fibrous materials and methods of analyses)

1-1: Chemical analyses of hardwoods
1-2: Chemical analyses of softwoods
1-3: Chemical analyses of bamboos
1-4: Chemical analyses of agricultural materials

CI(C)-2: *Chemistry of Cellulose* (Studies on isolation methods for cellulose, properties and characteristics of cellulose)

2-1: Properties and characteristics
2-2: Isolation methods
2-3: Cellulose solvents

CI(C)-3: *Chemistry of Hemicelluloses* (Studies on isolation, properties and characteristics, and utilization)

3-1: Properties and characteristics
3-2: Isolation methods
3-3: Utilization

CI(C)-4: *Chemistry of Lignin* (Isolation of lignin, properties and characteristics, and utilization)

4-1: Properties and characteristics
4-2: Isolation methods
4-3: Utilization

CI(C)-5: *Inorganic Matter in Wood* (Determination of inorganic matter content of Philippine woods and bamboos)

5-1: Qualitative and quantitative analyses

CI(C)-6: *Chemico-Physical Property Relations* (Studies on the correlation of chemical composition of wood with its physical and chemical properties)

6-1: Chemisorption

*Minor Chemical Products Section*

CI(M)-1: *Technical and Economic Surveys* (Statistics, surveys on minor chemical wood product utilization and problems)

1-1: General survey
1-2: Charcoal
1-3: Distillation
1-4: Charcoal briquette
1-5: Tannins and dyes
1-6: Naval stores

CI(M)-2: *Charcoal* (Production methods, recovery of by-products, calorific values,, physical and chemical properties of raw and activated charcoal, and charcoal activation methods)

2-1: Charcoal production
2-2: Charcoal briquetting
2-3: Charcoal activation
2-4: Distillation

CI(M)-3: *Tannins* (Studies on tannin-utilization)

3-1: Tannin production
3-2: Tannin chemistry
3-3: Tannin utilization

CI(M)-4: *Naval Stores* (Production methods, chemistry of naval stores, and utilization)

4-1: Production and purification methods
4-2: Chemistry of naval stores
4-3: Utilization of naval stores

CI(M)-5: *Wood Extractives* (Methods of extraction, chemotaxonomic studies, chemistry and utilization)

5-1: Extraction methods
5-2: Chemotaxonomic studies
5-3: Chemistry of wood extractives
5-4: Utilization

*Pulping Section*

CI(Pg)-1: *Technical and Economic Surveys* (Statistics, surveys of raw materials, plant sites, pulp mills, and problems)

1-1: General surveys
1-2: Raw materials
1-3: Pulp mill sites
1-4: Pulp mills

CI(Pg)-2: *Paper Pulps* (Studies of pulping processes, and development of processes)

2-1: Chemical processes
2-2: Semi-chemical processes
2-3: Chemi-groundwood processes
2-4: Mechanical processes

CI(Pg)-3: *Bleaching* (Studies on bleaching paper pulps, and on development of processes)

3-1: Chemical pulps
3-2: Semi-chemical pulps
3-3: Chemi-grounded pulps
3-4: Mechanical pulps

CI(Pg)-4: *Dissolving Pulp* (Studies on dissolving potentials of Philippine woods and other fibrous materials)

4-1: Hardwoods
4-2: Non-wood materials
4-3: Cellulose derivatives

CI(Pg)-5: *Pulps for Structural Boards* (Studies on processes of making pulp for structural boards and testing of boards)

5-1: Fiberboard from wood species
5-2: Fiberboard from non-wood materials

CI(Pg)-6: *Instrumentation* (Design of instruments)

6-1: Mechanical instruments
6-2: Electrical instruments

*Papermaking Section*

CI(Pm)-1: *Papermaking* (Studies on paper making, pulp blending, pulp refining and testing)

1-1: Printing and writing papers
1-2: Bag wrapping papers
1-3: Paper boards

CI(Pm)-2: *Specialty Paper Making* (Studies on specialty paper making, methods, pulp bleaching, pulp refining and testing)

2-1: Cigarette paper
2-2: Glassine paper
2-3: Absorbent paper

CI(Pm)-3: *Paper Coatings* (Studies on coating materials and binders, their properties and formulations)

3-1: Coating materials
3-2: Binder formulations

CI(Pm)-4: *Instrumentation* (Design of instruments)

4-1: Mechanical instruments
4-2: Electrical instruments

INDUSTRIAL INVESTIGATION DIVISION (II)

*Plywood and Gluing Section*

II(P)-1: *Technical and Economic Surveys* (Statistics, surveys of mills, facilities, practices, and problems)

1-1: General surveys
1-2: Veneer and plywood mills
1-3: Laminated lumber mills
1-4: Veneered product factories

II(P)-2: *Wood Waste* (Studies on wood waste disposal and utilization)

2-1: Veneer and plywood mills
2-2: Laminated lumber mills
2-3: Veneered product factories
2-4: Utilization of wood waste

II(P)-3: *Veneer Cutting* (Studies on cutting variable and veneer quality, development of cutting techniques and adjustments)

3-1: Rotary veneer cutting
3-2: Veneer slicing
3-3: Rotary-veneer cutting variables
3-4: Veneer slicing variables

II(P)-4: *Veneer Drying* (Studies on drying methods, effects of drying, and rates of drying veneer)

4-1: Mechanical drying
4-2: Jet drying
4-3: Solar drying
4-4: Kiln-drying
4-5: Pre-drying

II(P)-5: *Adhesive* (Studies on the properties of wood adhesives, adhesive mixtures and formulations)

5-1: Phenolic resins
5-2: Urea resins
5-3: Protein glues

II(P)-6: *Gluing of Veneers* (Studies on suitability of species or combination of species)

6-1: Gluing of veneers with urea resin glues
6-2: Gluing of veneers with phenolic resin glues

II(P)-7: *Plywood Gluing Variables* (Studies on wood-glue relationships and factors affecting gluing of veneer into plywood)

7-1: Pressure, temperature and pressing time
7-2: Moisture content
7-3: Assembly time
7-4: Veneer stock temperature
7-5: Prepressing

II(P)-8: *Plywood Exposure Tests* (Durability tests of plywood)

8-1: Plywood exposure outdoors
8-2: Plywood exposure indoors
8-3: Plywood marine exposure

II(P)-9: *Quality Control Tests for Plywood* (Performance and strength tests of plywood )

9-1: Type I plywood
9-2: Type II plywood

II(P)-10: *Timber Lamination* (Studies on the gluing of lumber of individual Philippine species)

10-1: Gluing of lumber with urea-base adhesive
10-2: Gluing of lumber with phenol-resorcinol glues
10-3: Gluing of lumber with casein glues
10-4: Gluing of preservative-treated lumber

*Quality Evaluation Section*

II(Q)-1: *Technical and Economic Surveys* (Statistics, surveys of plants, facilities, and problems)

1-1: Secondary wood products industries
1-2: Wood machining practices
1-3: Wood bending practices
1-4: Paints and finishes

II(Q)-2: *Wood Waste* (Studies on wood waste disposal and utilization)

2-1: Secondary wood-using industries
2-2: Wood machining
2-3: Wood bending

II(Q)-3: *Secondary Wood Products* (Studies on secondary wood products, design, development, evaluation, and quality improvement)

3-1: Philippine woods for secondary wood products
3-2: Product development
3-3: Manufacturing process evaluation
3-4: Quality improvement

II(Q)-4: *Wood Machining* (Studies on machining methods and characteristics of Philippine woods)

4-1: Machining properties of Philippine woods
4-2: Methods

II(Q)-5: *Wood Bending* (Studies on wood bending methods and bending characteristics of Philippine woods)

5-1: Bending properties of Philippine woods
5-2: Improvement of bending properties
5-3: Bent-wood products

II(Q)-6: *Wood Finishing* (Studies on qualities of wood finishes, finishing characteristics of Philippine woods, and development of wood finishes)

6-1: Wood finishing
6-2: Finishing qualities of Philippine woods

*Sawmill Improvement Section*

II(S)-1: *Technical and Economic Surveys* (Statistics on sawmills, surveys on logging, sawmill equipment, practices, trends, and problems)

1-1: General surveys
1-2: Logging practices and problems
1-3: Sawmill practices and problems
1-4: Sawmill equipment

II(S)-2: *Logging* (Studies on aspects of logging related to efficient extraction of timber)

2-1: Efficiency of logging systems
2-2: Economics of logging
2-3: Logging plans

II(S)-3: *Wood Waste* (Studies on disposal and utilization of wood waste)

3-1: Logging waste
3-2: Log storage waste
3-3: Sawmill waste
3-4: Utilization of waste
3-5: Utilization of sawdust

II(S)-4: *Lumber Manufacture* (Studies on the sawing characteristics of Philippine timber, sawing methods, lumber handling, grading, and quality control)

4-1: Sawing characteristics of Philippine woods
4-2: Sawing methods
4-3: Lumber grading
4-4: Quality control

II(S)-5: *Sawing Variables* (Studies on various saw factors affecting efficiency)

5-1: Saw blade performance
5-2: Saw blade design
5-3: Power requirements

TIMBER PHYSICS AND ENGINEERING DIVISION (PE)

*Mechanical Properties Section*

PE(M)-7: *Instrumentation* (Design, construction and modification of testing equipment used in evaluating mechanical properties of solid wood and other wood products)

1-1: Design and construction of testing equipment
1-2: Modification of testing equipment

PE(M)-2: *Strength Properties* (Determination and correlation of strength and related properties of solid and modified wood products to accumulate data and information essential to their varied uses)

2-1: Strength properties of Philippine woods
2-2: Strength property relations
2-3: Strength properties of wood-based and modified wood products
2-4: Elastic constant of Philippine woods

PE(M)-3: *Factors Affecting Strength* (Evaluation of the effect on strength properties of the factors known to influence such properties as basis in the derivation of basic stresses and formulation of stress grading rules)

- 3-1: Effect of moisture content on the strength properties of wood
- 3-2: Methods of test
- 3-3: Effect of preservative and method of treatment on the strength of wood
- 3-4: Effect of specific gravity on the strength of wood
- 3-5: Variability of clear wood
- 3-6: Natural defects
- 3-7: Duration of load

*Physical Properties Section*

PE(P)-1: *Instrumentation* (Design, construction and modification of testing equipment for determining the physical properties of solid wood and other wood products)

- 1-1: Design and construction of testing equipment
- 1-2: Modification of testing equipment

PE(P)-2: *Specific Gravity* (Determination of specific gravity of solid wood and wood based products in order to provide information that will estimate strength, pulp yield, shrinkage and other properties which may be useful in assessing the commercial values of the different Philippine wood species)

- 2-1: Specific gravity of solid woods
- 2-2: Specific gravity of modified wood products

PE(P)-3: *Dimensional Stability* (Determination of the shrinkage and swelling characteristics of solid and modified wood products to improve their usefulness for various purposes)

- 3-1: Shrinkage of solid woods
- 3-2: Swelling of modified wood products

PE(P)-4: *Electrical Properties* (Determination of the electrical resistance and dielectric constants for solid and modified wood products which are essential for specific uses)

- 4-1: Electrical resistance of solid woods
- 4-2: Dielectrical constants of solid woods

PE(P)-5: *Vibration Properties* (Determination of the acoustic, resonant frequencies and damping characteristics, and dynamic mechanical properties of solid and modified wood products in relation to their uses for musical instruments and for the development of non-destructive testing methods)

- 5-1: Resonant frequencies and damping characteristics of solid woods
- 5-2: Acoustic properties

PE(P)-6: *Thermal Properties* (Evaluation of the thermal conductivity of solid and modified wood products to determine their suitability as insulating materials and for other specific use)

- 6-1: Thermal conductivity of solid woods
- 6-2: Thermal conductivity of modified wood products

PE(P)-7: *Friction Coefficients* (Evaluation of the static and kinetic friction coefficients of solid and modified wood products specifically required for industrial uses)

- 7-1: Static and kinetic friction coefficients of solid woods

PE(P)-8: *Correlation Studies* (Correlation investigations among the different physical properties and between physical and other properties of solid and modified wood products to obtain basic information for their efficient use)

- 8-1: Correlation studies between physical properties
- 8-2: Correlation studies between physical properties with other properties

*Timber Engineering Section*

PE(E)-1: *Instrumentation* (Design, construction and calibration of equipment for testing structural size wood members and building components)

1-1: Design and construction of testing equipment

PE(E)-2: *Joint and Fastenings* (Strength evaluation and development of various types of joints to obtain design criteria for optimum efficiency in timber joints)

2-1: Nailed joints
2-2: Bolted joints
2-3: Timber connectors
2-4: Wood screw
2-5: Metal plate connectors
2-6: Solid wood gusset plate
2-7: Modified wood gusset plate

PE(E)-3: *Design and Testing of Structural Members* (Determination of the structural adequacy of load-carrying members in wood construction including built-up and laminated members for safe and efficient use of timber as an engineering material))

3-1: Beams
3-2: Columns

PE(E)-4: *Design and Testing of Building Components* (Design analysis and testing of prototype structural systems to evaluate their performance characteristics to develop better and improve design methods in timber engineering)

4-1: Trusses
4-2: Lamella
4-3: Floor system

PE(E)-5: *Design Stresses* (Derivation of basic and working stresses and development of a stress-grading system for structural lumber for a more rational design of timber structures)

5-1: Basic stresses
5-2: Stress grading and working stress
5-3: Design factors

PE(E)-6: *Timber Structures and Construction* (Development of timber structures including composite wood construction and their methods of construction making maximum use of the good engineering properties of wood and modified wood building products)

6-1: Housing

PE(E)-7: *Packaging* (Studies on packaging materials for the development of economical and adequate shipping containers.

7-1: Survey

WOOD PRESERVATION DIVISION (WP)

WP(S)-1: *Technical and Economic Surveys* (Surveys of wood seasoning plants and equipment, practices and problems)

1-1: General surveys
1-2: Air-seasoning practices
1-3: Kiln-seasoning practices
1-4: Plant equipment

WP(S)-2: *Seasoning Processes* (Studies on the drying rate of wood, establishment of drying schedules for Philippine woods)

2-1: Air-seasoning
2-2: Kiln-seasoning
2-3: Solar drying
2-4: Low-temperature drying
2-5: Forced-air drying

WP(S)-3: *Seasoning Mechanics* (Control of variables to speed up or improve the drying of woods)

3-1: Pre-steaming
3-2: Kiln-variables
3-3: Drying stresses

WP(S)-4: *Wood-Moisture Relationships* (Variations in the moisture content of Philippine woods; properties of wood affecting drying; shrinking and swelling characteristics)

4-1: Moisture contents of Philippine woods
4-2: Shrinking and swelling characteristics of Philippine woods
4-3: Properties of wood affecting movement of water

WP(S)-5: *Stabilization of Wood* (Treatments for stabilizing wood in service)

5-1: Bulking agents
5-2: End-coatings
5-3: Surface coatings

WP(S)-6: *Development of Drying Techniques, Apparatus* (Developmental studies on drying techniques and equipment)

6-1: Solar dryer
6-2: Steam heated lumber dryer
6-3: Electricity-heated lumber dryer
6-4: Furnace-type kiln
6-5: Vapor-drying
6-6: Controlling instruments

*Wood Treatment Section*

WP(T)-1: *Technical and Economic Surveys* (Surveys of wood treating plants and equipment, practices, and problems)

1-1: General surveys and statistics
1-2: Treating plant operations
1-3: Wood preservatives
1-4: Installation practices for treated wood

WP(T)-2: *Treating Processes* (Treatability studies of Philippine woods by various treating methods)

2-1: Treatability of Philippine woods by pressure methods
2-2: Treatability of Philippine woods by hot and cold bath treatments
2-3: Treatability of Philippine woods by cold soaking treatments
2-4: Treatability of Philippine woods by momentary dip - diffusion treatments

WP(T)-3: *Factors Affecting the Penetration and Retention of Preservatives in Wood* (Studies on variables affecting treatability of Philippine woods)

3-1: Extrinsic factors
3-2: Intrinsic factors

WP(T)-4: *Non-Biological Agents of Wood Deterioration* (Studies on the causes of failure of treated wood materials due to non-biological agents)

4-1: Mechanical wear
4-2: Heat
4-3: Chemical decomposition

WP(T)-5: *Wood Preservatives* (Chemical analyses and properties of wood preservatives)

5-1: Chemical analyses
5-2: Formulations
5-3: Corrosive effect
5-4: Strength effect
5-5: Paintability and finishing quality
5-6: Leachability

WP(T)-6: *Durability Studies* (Exposure tests of treated and untreated woods)

6-1: Natural durability of Philippine woods
6-2: "Graveyard" tests of treated Philippine woods
6-3: Service records of treated and untreated Philippine woods
6-4: Marine exposure tests
6-5: Weathering tests

WP(T)-7: *Fire Resistance Studies on Philippine Woods and other Composite Wood Products* (Determination of fire resistance, fire behavior, etc.)

7-1: Natural fire resistance tests
7-2: Fire retardant treatments and tests
7-3: Pyrolysis of wood

WP(T)-8: *Development of Treating Processes, Equipment, and Standards* (Developmental studies on treating processes and equipment)

8-1: Treating processes
8-2: Treating standards
8-3: Treating equipment
8-4: Plant lay-out

*Entomology Section*

WP(E)-1: *Economic Surveys of Wood-Destroying Insects and Related Organisms* (Surveys of infestations, case histories; economic evaluation and control practices)

1-1: General surveys
1-2: Dry-wood termites
1-3: Subterranean termites
1-4: Powder-post beetles
1-5: Ambrosia beetles
1-6: Cerambycid beetles
1-7: Buprestid beetles
1-8: Lepidopterous borers
1-9: Hymenopterous borers
1-10: Marine borers

WP(E)-2: *Collection, Morphology and Taxonomy of Wood-Destroying Insects and Related Organisms* (Collection and identification of important forest products insects, studies on morphology, and maintenance of collection)

2-1: Insect museum
2-2: Taxonomic studies

WP(E)-3: *Biology and Ecology of Wood-Destroying Insects and Related Organisms* (Life histories, life cycles, seasonal abundance, effects of environmental and biological factors on insect populations)

3-1: Dry-wood termites
3-2: Subterranean termites
3-3: Powder-post beetles
3-4: Ambrosia beetles
3-5: Cerambycid beetles
3-6: Buprestid beetles

WP(E)-4: *Insect-Wood Relationships* (Host specificity or wood preferences; effects of infestations on physical and other properties of wood; factors and conditions in wood favoring insect attack;; susceptibility and natural resistance of wood to insect attack)

4-1: Dry-wood termites
4-2: Subterranean termites
4-3: Powder-post beetles
4-4: Ambrosia beetles
4-5: Cerambycid beetles
4-6: Buprestid beetles

WP(E)-5: *Physiological and Biochemical Studies of Wood-Destroying Insects and Related Organisms* (Hormonal systems, sex attractants, internal symbionts, enzymatic inhibitors, etc.)

5-1: Dry-wood termites
5-2: Subterranean termites
5-3: Powder-post beetles
5-4: Ambrosia beetles
5-5: Cerambycid beetles
5-6: Buprestid beetles

WP(E)-6: *Behavioral Studies* (Behavioral responses and orientation to various stimuli such as light, odor, color, sound, humidity, temperature, etc.)

6-1: Dry-wood termites
6-2: Subterranean termites
6-3: Powder-post beetles
6-4: Ambrosia beetles
6-5: Cerambycid beetles
6-6: Buprestid beetles

WP(E)-7: *Chemical Control of Wood-Destroying Insects and Related Or-*ganisms (Studies on the toxicity of insecticides, formulations, and methods of treatment)

7-1: Dry-wood termites
7-2: Subterranean termites

7-3: Powder-post beetles
7-4: Ambrosia beetles
7-5: Cerambycid beetles
7-6: Buprestid beetles

WP(E)-8: *Non-Chemical Control of Wood-Destroying Insects and Related Organisms* (Studies on biological control with the use of parasites, predators, and diseases of insections; on effective structural designs, and other methods)

8-1: Dry-wood termites
8-2: Subterranean termites
8-3: Powder-post beetles
8-4: Ambrosia beetles

WP(E)-9: *Utilization of Insects for Beneficial Purposes* (Studies on the beneficial uses of insects)

9-1: Poultry feed
9-2: Muchrooms from termite mounds

WP(E)-10: *Development of Techniques for Pest Control and Entomological Research* (Developmental studies and research techniques and equipment)

10-1: Pest control equipment
10-2: Research techniques

*Pathology Section*

WP(P)-1: *Economic Surveys of Wood-Destroying and Staining Fungi and Related Organisms* (The prevalence of various types of fungi affecting wood and wood products and the damages and losses they incur on houses, factories, wooden bridges, railroad ties, lumber yards, sawmills, mining, pulp and paper plants, ice plants, and other wood-using industries and establishments)

1-1: General surveys
1-2: Wood-decaying fungi
1-3: Wood-staining fungi
1-4: Soft-rotting fungi
1-5: Molds

WP(P)-2: *Collection, Morphology and Taxonomy of Fungi* (Collection and identification of important Philippine fungi associated with wood and wood products, their distribution and frequency on different wood products, the maintenance of a herbarium of sporophores and pure cultures and the compilation of information on the cultural characteristics of isolates from authenticated specimens of these fungi)

2-1: General collections
2-2: Wood-decaying fungi
2-3: Heart rot fungi
2-4: Wood-staining fungi

WP(P)-3: *Physiology and Biochemistry of Fungi* (Distinctive physiological characteristics of wood-destroying fungi, stains, molds, etc; nutrition; enzymes; respiration; growth in relation to pH and moisture; effect of temperatures; influence of environmental factors, oxidase reactions, etc.)

3-1: Wood-decaying fungi
3-2: Wood-staining fungi

WP(P)-4: *Wood-Fungi Relations* (Effects of decay and stain on physical properties and calorific value of wood; effect on appearance, chemical changes induced by fungi; effect on microstructures of wood, etc.)

4-1: Effect on the physical and mechanical properties of wood
4-2: Natural durability of wood by laboratory methods
4-3: Substrate specificity of wood-inhabiting fungi
4-4: Succession of attack and synergism among xylophagous fungi
4-5: Antagonism among wood-rotting and wood-staining fungi

WP(P)-5: *Fungicides and Preservatives* (Toxicity of fungicides and preservatives; and preventive and applied control)

5-1: Bioassay of wood preservatives by laboratory methods
5-2: Chemical control of fungi and other related organisms

WP(P)-6: *Non-Chemical Preventive Measures* (Determination of other means of preventing or rendering xylophagous fungi ineffective as destructive agent of wood and wood products)

6-1: Biological control
6-2: Building designs
6-3: Proper handling practices of logs and lumber

WP(P)7: *Utilization of Fungi for Beneficial Purposes* (Studies on the beneficial effects of xylophagous fungi)

7-1: As source of food
7-2: As source of antibiotics
7-3: As tools for converting sawdust and other cellulosic materials to useful products
7-4: As tools for genetic studies

WP(P)-8: *Techniques* (Development of laboratory techniques for pathological research)

8-1: Presevation of stock cultures
8-2: Method for evaluating wood preservatives

WOOD TECHNOLOGY DIVISION (WT)

*Wood Anatomy Section*

WT(A)-1: *Wood Structure* (Observation of the macroscopic and microscopic features, including the general characteristics and properties of wood; revision of "Philippine Woods" and to put up manuals, etc. for reference)

1-1: Normal wood
1-2: Revision, enlargement and development of manuals and technical bulletins
1-3: Inclusions

WT(A)-2: *Section Slides Collection and Wood Identification* (Building a collection of wood-section slides for microscopic studies, and developing systems for indentification of Philippine woods)

2-1: Preparation and collection of section slides
2-2: Systems for identification of wood by cardsorting keys

WT(A)-3: *Development of Techniques* (Develop techniques in staining, mounting, etc., sharpening microtome knives to obtain good quality slides; and to determine possible media of identifying woods)

3-1: Microtechnique
3-2: Wood identification techniques

*Forest Products Collection Section*

WT(C)-1: *Collection* (Build up and maintenance of herbarium and wood library)

1-1: Herbarium
1-2: Standard working wood collection and maintenance

WT(C)-2: *Taxonomy* (Identify, classify, and name tree species; determine flowering and fruiting season; and derive, enlarge, and develop manuals)

2-1: Taxonomic studies
2-2: Phenology
2-3: Revision, enlargement and development of manuals and technical bulletins

WT(C)-3: *Structure-Property Relations* (Study of abnormal wood; physical characteristics and variability of species)

3-1: Brash center
3-2: Reaction wood
3-3: Grain, texture, color, and figure
3-4: Sapwood-heartwood studies
3-5: Variability of species

*Fiber Characteristic Section*

WT (F)-1: *Fiber Studies* (Determination of fiber dimensions for use in the prediction of the suitability of species for pulp and papermaking, gather data and information on the fiber length distribution by Bauer-McNett Classifier, and determine the relationships between fiber characteristics and pulp-sheet properties of Philippine woods and other plants)

1-1: Fiber characteristics and properties
1-2: Fiber length distribution
1-3: Fiber relationships

WT(F)-2: *Identification* (Identify pulp and paper samples as to kind of cook by color reaction tests, and as to species, if possible, by its fiber characteristics)

2-1: Identification of pulp and paper samples

WT(F)-3: *Fibrary* (Prepare and build up collections of mounted fibers (including foreign materials, through exchange), pulps, handsheets and paper samples of wood and other plant species to serve as a reference in fiber identification)

3-1: Fiber collection

WT(F)-4: *Development of Techniques and Processes* (Developmental studies on methods and processes for preparing fibers)

4-1: Maceration
4-2: Staining

*Minor Forest Products Section*

WT(M)-1: *Technical and Economic Surveys of Minor Forest Products Industries* (Survey of the production, collection, marketing and problems)

1-1: General surveys
1-2: Survey of individual minor forest products industries

WT(M)-2: *Minor Forest Products* (Study on the yield, properties and characteristics of each kind of minor forest products)

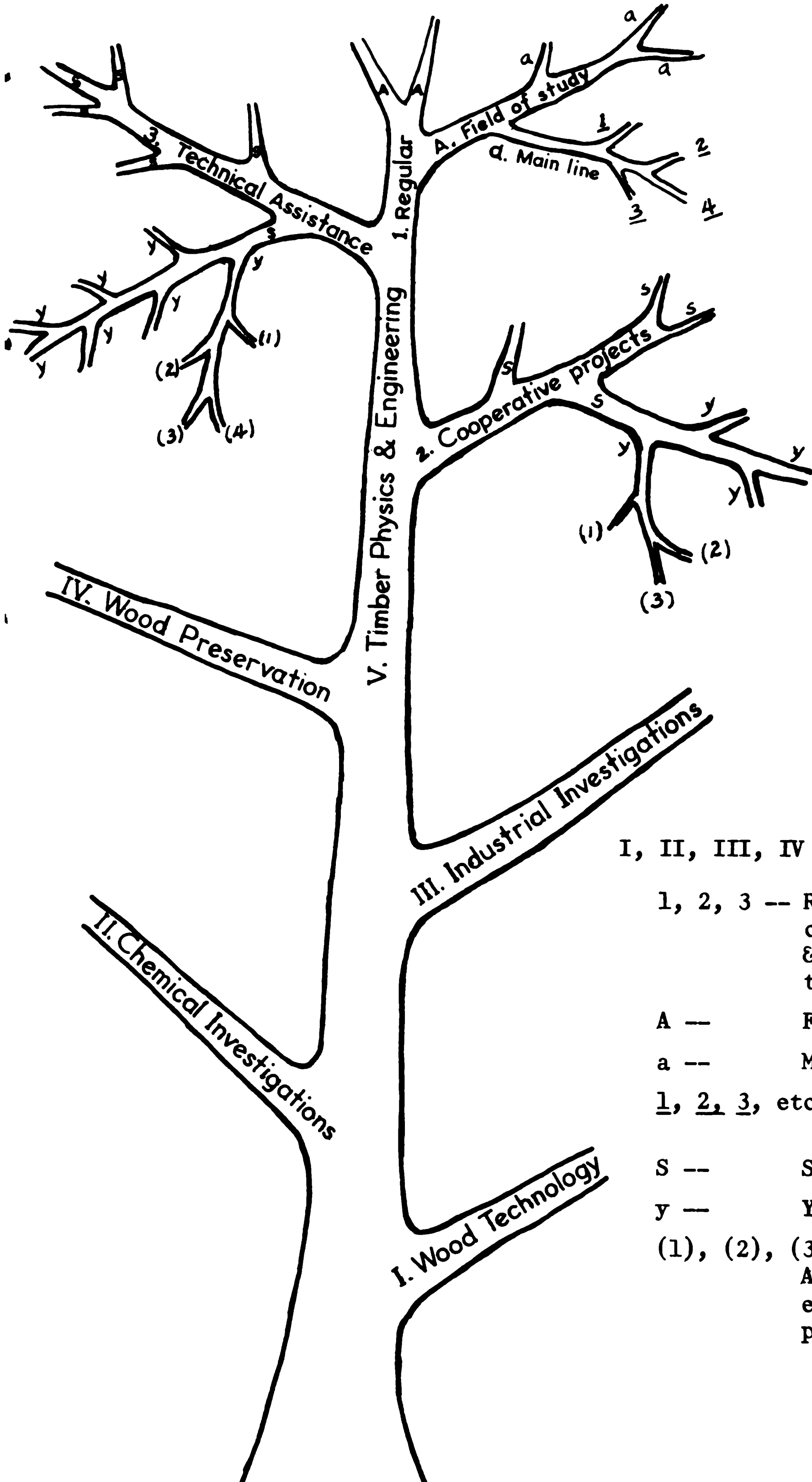
2-1: Fibers and fiber plants
2-2: Barks
2-3: Resin and related exudates
2-4: Latex products
2-5: Bamboos
2-6: Palms and rattans
2-7: Miscellaneous useful wild plants in Philippine forests

WT(M)-3: *Development of Techniques, Tools, and Equipment* (Developmental studies on techniques and methods, and equipment)

3-1: Gadgets
3-2: Tools
3-3: Bast and structural fiber extraction
3-4: Chipping
3-5: Splitting
3-6: Weaving

WT(M)-4: *Collection* (Build up a collection of minor forest products supported by herbarium vouchers)

4-1: Minor Forest Products Museum




LEGEND

I, II, III, IV -- Technical Divisions

1, 2, 3 -- Regular projects, cooperative projects, & Technical Assistance, respectively.

A -- Field of Study

a -- Main line project

1, 2, 3, etc. -- Regular Specific projects

S -- Section of Division

y -- Year

(1), (2), (3), etc. -- Technical Assistance or cooperative Specific projects.

**Fig. 1. Architecture of Forest Products Research.**

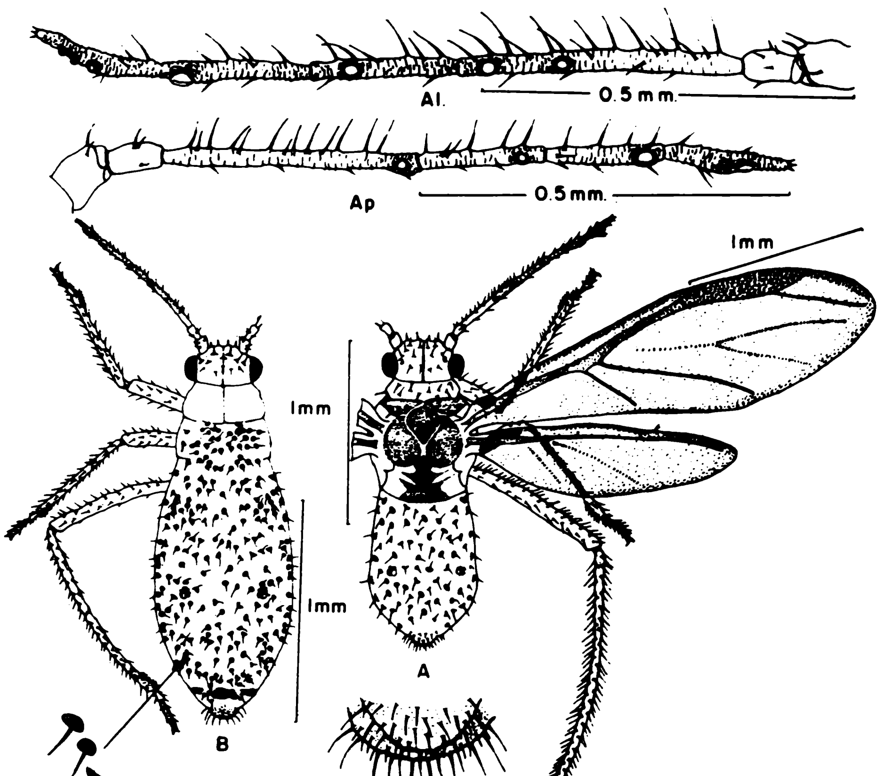



Photo of the glass slide illustrating the external anatomy of apterous and alate viviparous female of Benguet Pine Aphid. *(Eulachnus thumbergili Wil.)*

# A Note on the Taxonomy and Biology of Benguet Pine Aphideulachnus Thumbergii Wilson

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## Introduction

It is strange that this family of insect has received so little atttention considering its e-conomic importance. The amount of loss caused by aphids to agriculture is too well known. The importance of aphid as plant pest and transmitter of virus disease is fully recognized. But very little is known of the bionomics of many potential pest alone, less still of the very large number of a species found on forest trees. Not a single aphid species has been reported attacking forest trees in the Philippines. This paper is an at-tempt to describe the aphid found at San Jo-se Reforestation on Benguet Pine plantation, Puncan, Caranglan, on November 13. 1963 infesting 8-10 years old Benguet Pine trees Owing to extreme difficulty in observing these aphids throughout its life cycle only li-mited observation on bionomics is presented.

This study was conducted in connection with the Survey of Insect Fauna of Benguet Pine and to lay a basis for future work on this group.

## *Materials and Methods*

*Collecting Method* --

These aphids were detected in association with black ants and concealed on the base of the needle. Collection was made possible with the aid of wet cotton attached to the end of a stick. The stick was thrust gently on the aphid to make it adhere to the cotton.

The collected specimens were directly preserved in vials of 70% ethanol. Winged adults were placed in separate vial. Each vial was provided with a label containing the following data, locality, collection date, host plant and portion attacked.

Some apteroid nymphs were taken alive with a portion of the attacked twig and brought to the laboratory for rearing. Seve-ral kinds of rearing techniques were used. The ordinary method which consists of a vial plugged with cotton was used but was found impractical for this aphid which is very much unlike other aphids which are sedentary because of its erratic behavior inside the vial. Potted Benguet Pine seedlings which were enclosed with fine cloth were found suitable for the purpose.

*Mounting method* —

Alcohol preserved specimens were placed in a 6 ml. porcelain casserole dish half filled with Essig's aphid fluid and heated for 30 mi-nutes over an alcohol lamp. Then these were transferred to a syracuse dish filled with ab-solute ethanol and allowed to remain here for 20 minutes. After this treatment the s-pecimens were cleared in clove oil for 10-15 minutes and then mounted directly in Ca-nada Balsam. The slides were dried at 55 degrees centigrade in a slide warmer for at least two weeks. To remove the excess mounting medium around the edges of the cover glass a scalpel was used and the slide cleaned with xylene.

*Measuring of specimens* —

The measurements were marked with a magnification of 10 x / 0.25 using an ocular micrometer in which 1 unit represented 0.0143 mm. The measurements of the body parts are all in mm. and were taken as follows:

1) Length of the body: The distance from the apices of the frontal tubercles to the apex of the cauda.

2) Length of the antenna: The sum of the length of all the segments.

3) Length of the cauda: The distance from the line conecting the dorsal base to the apex.

4) Length of the cornicle: The distance from the line connecting the base to the apex

5) Length of the forewing: The distance from the line conecting the base of insertion to the apex.

6) Length of the restral apex: The sum of the length of segments IV and V.

Discussion

*Distribution* —

R.Takahasi (1921) reported the presence of Eulachnus thumbergii in Formosa, Japan and Korea attacking Pines in these regions. In the Philippines, intensive survey on its distribution has not been conducted to other Benguet Pine regions in Bo. Puncan, Carranglan, Nueva Ecija.

These aphids appear only during the cooler months usually from October to February.

*Damage* —

The common deformity observed on Benguet Pine infested with Eulachnus thumbergii are the yellowing and abnormal droppings of needless. Attacked twigs were stunted and break off easily.

*Description* —

The forms of female observed in the colonies of these aphids (1) an alate viviparous female and (2) an apterous viviparous female. Not a single apterous oviparous female was observed throughout the study. The apterous viviparous female are of two kinds: the "fundatrix" or "stem mother" and the progenies or "virgogenia". The elongated and narrow body is 1.80 mm. long and 0.69 mm. wide, bearing many pointed long setae which arises on circular sclerotic dark patches. The head has no tubercles but bear many long stiff setae. The antenna bears long bristles and segment III, IV and V has a single rhinaria near their apices. Segment VI possesses the largest rhinaria near the small thumb-like processus terminalis in addition to smaller marginal rhinaria below it. The relative length of the antennal segment are as follows: 0.07, 0.09, 0.36, 0.16, 0.19 and 0.17 mm. respectively. The rostrum reaches the third pair of coxas which has 0.10 mm. obtuse apical segment. The siphumculi is encircled with a dark, narrow and sclerotic cone-like ring. The rounded cauda is 0.11 mm. long which bear several stiff and moderately long hair. The legs are long, dusky and with stiff bristles.

The alate viviparous female has the following characteristics. The body is 1.50 mm. long and 0.50 mm. wide which bears similar setae as in the apterae. The head bears numerous stiff hairs. The antenna also bears long stiff hairs with an imbricated, circular to subcircular large rhinaria on each antennal segments. The third antennal segment possesses 1-3 rhinaria while segment IV-VI has only one rhinaria. The thumb-like processus terminalis is short and blunt. The relative lengths of each antennal segments are as follows: 0.09, 0.42, 0.21, 0.22 and 0.19 mm. respectively. The rostrum barely reaches the second pair of coxas which is only 0.99 mm. long and with an obtuse apical segment. The cornicle, cauda and legs are similar to the apterae. The four wings was once forked but hardly discernible. The first and second oblique are present. In the his wings both the oblique are present but hardly discernible. The stigma is large and the radial sector straight.

(*Continued on page* 88)

# The Role of the Reforestation Development in Community Administration

by
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A big portion of our populace still have a meager knowledge about the role of our public forests and their relation to the national economy of the country.

The Community Development Center has given the Reforestation Administration an opportunity to inform the people about the role of reforestation in community development.

A good many people think forests are nothing but sanctuaries of outlaws and wild animals. There are others who would want the forest to be wiped out because they are considered obstacles to agriculture. Still there are some who believe that our forests are so abundant that they are inexhaustible.

Anyone could belie the claim that forests are inexhaustible. The annual forest destructions estimated by the National Economic Council of more than 170,000 hectares is enough proof of what the future has in store for our forest resources. Putting it plainly, the Reforestation Administration can only reforest a minimum of 35,000 hectares per year. And you have here more or less a steady drain of 135,000 hectares yearly — clear and brutal forest devastation.

Our forests materially play a major role in the development of the national economy. The lumber industry, which solely depends on the forests for its raw materials, provide employment to about 60 thousand people excluding thousands of others employed in wood-processing plants. Timber export has recently been placed as second major export of the country — copra being first and sugar at present, third. Our timber exports netted the government no less than half a billion pesos each year during the last few years.

But what is considered even more important is the fact that our forests are veritable reservoirs of intangible benefits which affect almost all phases of human life. Those who advocate the conversion of our forest lands into agriculture do not realize that without the former, the latter can hardly survive. Areas denuded of forest cover are easily susceptible to erosion. And it is elementary knowledge that erosion is detrimental to agriculture. Forests have favorable influence upon stream flow and erosion, the conservation and enrichment of the soil and the tempering of climate. They also serve as shelter, refuge, and habitats for wildlife and game animals, provide hunting grounds and fishing areas and offer healthful outdoor recreational opportunities for the people.

The Reforestation Administration under the Department of Agriculture and Natural Resources, was created by virtue of Republic Act No. 2706 which took effect on June 18, 1960. This agency is charged by law with the responsibilities to "reforest and afforest bare and denuded public domain especially critical watersheds, sources of water for hydro-electric power, irrigation and domestic use, thereby minimizing soil erosion and occurrence of destructive floods; to administer, manage and provide adequate protection to areas reforested; to determine and recommend to the Secretary of Agriculture and Natural Resources for approval for reservation areas of the public domain that need to be reforested and afforested; to establish permanent boundaries of reforestation project so that they could be declared by the President as not subject to alienation; to participate in community programs, seminars, workingshops and other activities, and prepare informative materials for distribution in order to make the public tree-conscious and imbibe the value of reforestation and conservation; to cooperate with other government agencies, public and private schools and institutions, civic and religious organizations and individuals interested in tree planting and to perform general administrative work."

Referring to Forestry Statistics (Fiscal Year from July 1, 1963 to June 30, 1964), our country's total land area is 29,741,290 hectares, 8,257,556 hectares of which are commercial forests, 4,102,021 hectares are non-commercial forests, 5,509,216 hectares are cogon land including brushland, 662,447 hectares are swamps and 11,210,050 hectares are cultivated and other lands.

The vast denuded timber lands of our country need immediate attention. It is for this basic purpose that the creation of the Reforestation Administration was deemed necessary. To effectively administer efficient reforestation program, the agency has divided its resources into eight regional offices scattered throughout the archipelago. Each of these offices is manned by a regional officer who controls the activities of the several reforestation projects located at strategic points in the country. There is in every region a Department of Agriculture and Natural Resources Employees Association known as DANREA of which the Reforestation Administration is a member. This organization is actively helping the Government implement its rural improvement program.

As re-organized, the Reforestation Administration is composed of seven functional divisions, namely; (1) Reforestation Management Division, (2) Reforestation Research Division, (3) Statistics and Extension Division, (4) Accounting Division, (5) Administrative Services Division, (6) Budget and Fiscal Division, and Legal Staff.

The objectives of the Reforestation Administration may be stated in a more comprehensive manner. The needs of the present and the future Filipinos for fruits, raw materials, water and other tangible and intangible products set forth the objectives of the Reforestation Administration. The program of action to meet these needs as framed by men of vision was contained in the early preceding discussion. If there were any changes at all, such were essentially dictated by new foresights. Corollary to the need and demands of the time, objectives have undergone some modifications which will result ultimately in their realization. The objectives have served as guide for the implementation of the agency's work program. And there is necessity for enumerating them in the write-up. The real objectives of the Reforestation Administration may be summed up as the "immediate successful restoration of productive forests and forest sites so that such forests and site could provide multiple benefits to a larger number of people over a longer period of time." In other words, the objectives of the Reforestation Administration is to make productive our barren and denuded public forests to provide multiple material benefits and to perpetually sustain the demand of wooden materials of the present and future generations.

The Reforestation Administration manages and provides adequate protection to areas reforested. It is here where the full support and cooperation of the residents of the barrios and municipalities where such reforestation projects are established is essentially needed. The rural people must have a constant supply of water and wood for daily use. As a farmer, he needs wood to build or repair his home and barn where he stores his harvest, wood to make his farm implements and to provide his fuel. He also needs pasture for his working animals and other livestock to supplement his food supply.

In the enforcement of Reforestation Administration laws and the apprehension of forest law violators, our agency enlists the cooperation of the national and local law enforcement agencies, especially the Philippine Constabulary. Our agency seeks the aid of the Philippine Air Force in our reforestation job. In the past, and for expediency, air seeding is done by airplanes. By the way, our 69 reforestation projects all over the country give away thousands of various forest trees seedlings to interested parties. Our Technical personnel are always available for advice in cooperative planting activities.

There can be no better cooperators in our forestry educational campaign than the public and private schools, the Agricultural Information Division, the Bureau of Agricultural Extension, now Agricultural Productivity Commission, the National Media Production Center and the press, TV and radio.

The agency has continued implementing its plan for a more extensive reforestation work. Artificial reforestation is being done and intensified in the 69 reforestation projects. Our Regional Officers have been given more discretion so that the public may be attended to with dispatch.

Considering that our denuded forests are so vastly scattered, it is next to impossible for the limited number of our personnel to administer all the needs of our projects, to guard every inch of our areas from destruction and much less free them from squatters and kaingineros. However, the problem can be solved with the cooperation of responsible elements of society. Some people destroy the forests because they do not realize their importance and value. These people, therefore, should be made to understand that forests are our precious heritage that must be handed down from one generation to another. In this task, the Reforestation Administration looks up to all professional government employees, public and private citizens for cooperation. They can be of greater service to the country if they will help spread the gospel of forest conservation. They can tell their neighbors and friends about the value of our forest, the evils of forest destruction and the wisdom of planting trees in every portion of vacant unproductive lands and even backyards.

In short, the group of people who can best help the Reforestation Administration are the Community Development Workers because they are much closer to the hearts of our rural folks. The able government employees have been doing a commendable job in the improvement of the rural communities. We hope that they will include in their agenda of activities the potentialities of reforestation work and forest conservation.

All the bureaus under the Department of Agriculture and Natural Resources, are, by the nature of their functions, in the forefront of the rural improvement program. We are all government employees sworn to public service by mutual cooperation in the establishment of a progressive society in a democratic country.

# FPRI Technical Notes

## DIRECTIONS OF WOOD PRESERVATION RESEARCH

*By* F. C. FRANCIA AND R. F. CASIN

### INTRODUCTION

Wood and forest products are of great economic importance as well as of high utilitarian values to man. They enter into world commerce in an ever-increasing volume, bringing wealth to forest owners, log and lumber producers, and manufacturers of and dealers in various articles of wood and products derived from wood. The industries dependent on wood provide jobs to thousands of people and support the government in taxes.

Wood has been in close association with man's economic progress since time immemorial. It has proved itself to be a very versatile material, fashionable at all times. It has always contributed to man's comfort, be he poor or rich, in the forms of shelter, fuel, furniture, tools and numerous domestic articles. Even in this age of synthetics and substitutes, wood still enjoys the many demands of man for his basic needs.

However, man has a flair for taking for granted what is common and abundant. In his quest for wealth and lands for agriculture, vast tracts of valuable forest lands have been cleared or laid to waste and timber therein burned and destroyed. It is only in recent years that man began to appreciate the values of forest and take steps toward forest conservation by wise use.

The depletion of forests, combined with the rising demand for wood and forest products, particularly lumber, for building construction and furniture-making purpose and logs for processing into veneer, plywood, pulp, etc., has focused attention on the importance of wood preservation as a means of prolonging the life of wood in service and obtaining more wood from the forest annual production for purposes other than repairs and replacements.

Wood preservation makes wood serve better and last longer in service. Recorded instances are numerous to mention where untreated wood lasts for only one to two years, treated wood lasts from 25 to 35 years. Significantly, too, in almost every country, power and telecommunication transmission poles, railway ties, marine pilings, bridge timber, fence posts, structural timber etc., are still serving their purpose years after they have been preservative-treated and installed.

## FPRI WOOD PRESERVATION DIVISION

The Wood Preservation Division of the Forest Products Research Institute is composed of four sections: Wood Seasoning, Wood Treatment, Entomology and Pathology. Its technical personnel consist of mechanical engineers, chemical engineers, chemists, pathologists, entomologists and foresters, some of whom have advance academic degrees, such as Ph.D. and M.S. A number of them have had specialized training in other countries: United States, Canada, Germany, France, Japan, Australia and India.

Direction and coordination of sectional research projects are undertaken by the Chief and Assistant Chief of the Division. Periodic reviews of projects are made by conferring with the Section Chiefs, and attention is given not only to new approaches to the investigation of research problems, or to results of research but also to old and new problems that hamper the progress of research work.

Technical problems of the wood-using industries may often become the concern of the Division. They vary in nature, from plant establishment and operation to product testing, evaluation and improvement. The approaches to and the solutions of the problems may be simple, requiring no more than an understanding of the limitations of available plant equipment and know-how of operators; of the basic properties of wood; and of standard practices that have been developed from the results of local and international research. They may also be complicated, requiring designs of several experiments and tedious laboratory and field studies.

Much of the early research projects of the Division, some of which are still being continued, involved survey and classification works: ease of air-seasoning and kiln-drying Philippine woods; treatability of Philippine woods by pressure; natural durability of Philippine woods against fungi, insects and marine borers; relative effectiveness of various treatments, preservatives, fire retardants, fungicides and collection and identification of Philippine wood-destroying fungi and insects.

The information resulting from these early projects has already been disseminated for the benefit of wood users. Also, it has given rise to basic problems requiring further research and study.

## Wood Seasoning Section

The Wood Seasoning Section is responsible for research on: the seasoning or drying characteristics of Philippine woods; the mechanics of kiln and other drying methods with a view to developing efficient drying schedules and improving the quality of dried wood; relationships between factors in wood affecting removal of moisture; and various remedies for warping, cracking, checking and other seasoning defects of wood.

### *General considerations for research*

Freshly sawn lumber is often wet and heavy. It contains much water in its cell cavities. Wet or fresh wood is not only costly to ship but also not fit for use for numerous purposes. Furthermore, it is subject to fungal deterioration when stored.

As the water in wood is gradually lost due to evaporation, there comes a point (called fiber saturation point or f.s.p.) when only the fibers are saturated with water. The fiber saturation point varies with the species of wood. It ranges from 25 to 32% moisture content. Further drying below the f.s.p. causes the wood to shrink in all directions, more so in the tangential, along the growth rings direction. The loss of moisture below the f.s.p. is unavoidable because wood is hygroscopic, i.e., it loses moisture to or absorbs moisture from the surrounding atmosphere depending upon its relative humidity. The loss of moisture in wood stops when its moisture content comes in equilibrium with that of the atmosphere. This point is known as equilibrium moisture content or e.m.c. Following are examples of the relation between the relative humidity of the air and the approximate e.m.c. of wood.

| Relative humidity of air Percent | EMC of wood |
|---|---|
| 90 | 20.6 |
| 80 | 16.1 |
| 70 | 13.1 |
| 60 | 11.0 |
| 50 | 9.2 |
| 40 | 7.7 |

To have the minimum shrinkages of wood in service, it has to be dried to a moisture content equal to that of the atmosphere to which the wood will be exposed. If the wood is to be exposed in a locality where the prevailing relative humidity is 70%, the wood has to be dried to 13% MC. However, if wood dried to 13% MC is exposed in a locality where the relative humidity is higher than 70%, it will absorb moisture and cause it to swell.

There are numerous problems involved in drying wood. While air-drying is the simplest and cheapest way to dry wood, it is not commercially profitable. Air-drying takes several months to attain the objective.

The proven commercial way of drying wood is kiln-drying. Kiln-drying takes only a few days. Knowledge, however, of the drying characteristics of various species of wood is a must for dry kiln operators. Without it low quality and defective dried lumber may result from their kiln operations.

### *Synopsis of research work*

Air drying studies to determine the drying rates of 1-inch and 2-inch thick lumber of several apitong species and 20 other commercial species have been conducted under conditions prevailing in the FPRI compound.

Three distinct drying periods have been observed in College, Laguna: (1) rapid drying period — February to April; (2) moderate drying period — May to June; and (3) slow drying period — July to January. The drying rates of wood, regardless of species, have been found to vary with the period of exposure. For 1-inch thick lumber, it takes 30 to 70 days, and for 2-inch thick lumber, 50 to 130 days, to attain "shipping" dry (30% MC condition.

Kiln drying studies of the Institute are conducted with the use of 7 experimental kilns (two 60-bd. ft., one 200-bd. ft., one 400-bd. ft., two 1000-bd. ft., and one 2500-bd. ft. capacity) and 2 steaming chambers.

Kiln-drying schedules have been developed and tested commercially for the following groups of wood species:

(1) White lauan, almon, manggasinoro, palosapis, binuang, almaciga, Spanish cedar, pahutan and others of the same density.

(2) Tañgile, red lauan, mayapis, nato, and other similar refractory species.

(3) Apitong, bagtikan,. bitaog, palomaria, balakat, lanutan, narra, and aranga.

(4) Malugai, malayakal, karaksan, raintree, balobo, antipolo, and toog.

(5) Yakal

(6) Yakal-saplungan.

Solar-drying studies with a 480-bd. ft. solar dryer have been undertaken in two localities: Quezon City and Lingayen, Pangasinan. The results obtained from the limited studies showed that 1-inch thick lumber, with an initial moisture content of 70%, could be dried to 18% MC in 15 days, and that 2-inch thick lumber, with initial MC of 68%, could be dried to 18% MC in about 40 days. Duplicate specimens of 1-inch thick lumber and 2-inch thick lumber took 25 days and 55 days, respectively, to dry to 18% MC.

Another known method, pre-steaming, for shortening the drying period of wood in dry-kiln, has been tried. Green bagtikan and tañgile lumber pre-steamed for 2 hours at 212°F saturated condition could be kiln-dried to 6 — 8% MC in 8 days. Without pre-steaming, these materials ordinarily take 10 days to dry.

The use of polyethelene glycol 1000 (PEG-1000) in water solution as a bulking agent or stabilizer against cracking of carvedwood items has proved effective.

## Wood Treatment Section

The Wood Treatment Section conducts researches on the treatability, especially by pressure, of different Philippine woods; on the mechanics of treatment as affected by a number of factors; on natural durability; on the relative effectiveness and treatments under various exposure conditions; and on the fire resistance of both treated and untreated woods.

### *General considerations for research*

Wood as a construction material has many desirable attributes and one chief shortcoming: it is susceptible to rapid deterioration by insects, fungi, and marine organisms. Exposed to conditions favoring fungal decay and termite attack, wood does not last longer than a few years. Exposed to fire, wood burns and turns into charcoal and ashes.

It is man's characteristic to protect his personal possessions from destruction, to want maximum returns from his investments, and to want useful things to last forever. In the use of wood, be it for shelter, furniture, power and communication transmission pole, wharf timber, railway tie, etc., he wants it to last for as long a time as possible. By experience, durable woods have been known and used. The supply, however, of durable timber is now very limited.

Non-durable timber abounds in our forests. For that matter, the bulk of commercially available lumber in the market is considered non-durable under severe exposure conditions. Ways must then be found to make them last longer in use. One of these ways is treatment with a good preservative.

### *Synopsis of research work*

Studies on the comparative treatability of Philippine woods by pressure employ the following schedules: Initial vacuum of 25 to 29 inches Hg for ½ hr.; pressure of 180 psi for 2 hrs.; temperature of 190 ± 4°F, and final vacuum of 25 to 29 inches Hg for ½ hr. Based on these studies, a classification of treatability of some Philippine timber has been made:

1. Heartwood very easy to treat:

| | |
|---|---|
| Acacia | Kaatoan bangkal |
| Apitong * | Lanutan-bagyo |
| Bagalunga | Malaanonang |
| Bagtikan | Malaikmo |
| Balete | Malapanau * |
| Balikbikan | Manggasinoro * |
| Balobo | Panau * |
| Bolon | Pianga |
| Kalumpit | Sakat |
| Liusin | Toog |
| | White lauan |

2. Heartwood moderately difficult to treat:

| | |
|---|---|
| Albizzia sp. | Dungon |
| Almaciga | Lingo-lingo |
| Benquet pine | Mayapis * |
| Dangkalan | Mindoro pine |
| | Narig * |

3. Heartwood very difficult to treat:

| | |
|---|---|
| Agoho | Malabayabas |
| Almon * | Malakatmon |
| Banaba | Malak-malak |
| Binggas | Manggachapui |
| Dagang * | Manggasinoro * |
| Dalingdingan | Molave |
| Dangula | Palosapis * |
| Guijo | Red lauan |
| Sangilo | Tañgile* |
| Ipil | Ulaian |
| Kamatog | Yakal-gisok |
| Mahogany | Yakal-saplungan |

*(Woods being commercially pressure-treated in the Philippines. Note that manggasinoro has 2 classifications).

The sapwood of the different woods thus far studied has been found very easy to treat.

One significant point from this classification that could be taken advantage of by buyers of treated lumber is that treated lumber should not be planed or cut when put to use. If the treated lumber is almon, mayapis, manggasinoro (the three are often sold locally as white lauan), palosapis, red lauan, or tañgile, processing after treatment removes the preservative coating and renders the wood vulnerable to deterioration. It is advantageous for the wood-user to buy treated S4S, cut-to-size lumber. Then he can be sure of getting good treated lumber.

On non-pressure treatments, various methods of treating wood are known. But they are not as effective as pressure treatment. One exception is the diffusion method for treating green or fresh lumber. Many chemicals are used, but boric acid is commonly used in combination with borax in water solution.

Comparative tests on various wood preservatives and methods of treatment have shown that (1) under severe (graveyard) conditions of exposure, woods treated with the following preservatives last for over 7 years:

Boliden S-25 at 0.99 lb/cu. ft.
Boliden K-33 at 0.39 to 1.01 lb/cu. ft.
Tanalith C at 0.81 to 1.00 lb/cu. ft.
Creosote at 12 lb/cu. ft.

(2) Against marine borers, the following treatments gave protection to wood for over 4 years:

Boliden K-33 at 0.73 lb/cu. ft.
Boliden S-25 at 0.76 lb/cu. ft.
Tanalith C at 0.75 lb/cu. ft.
Creosote at 15.45 lb/cu. ft.

All the treated wood specimens are still under exposure.

Service tests on untreated and treated power transmission poles and railway ties, started 9 years ago, are being continued. Some 613 poles pressure-treated with either creosote or Tanalith C are being service tested in various locations in Luzon. Railway ties of various wood species, as well as apitong ties treated with creosote, are also being service tested in the Northern and Southern lines of the Philippine National Railways. Encouraging results have already been obtained for creosoted apitong ties. Since the supply of molave ties now poses a serious problem, creosoted apitong ties stand ready for use.

## Entomology Section

The Entomology Section undertakes researches on the identification, biology, ecology, physiology, behavior and control of insects injurious to wood and forest products. Researches are conducted both in the laboratory and in the field.

### *General considerations for research*

Insects are among the groups of wood-destroying organisms. In the Philippines, there are numerous species of termites (drywood and subterranean) which cause serious damage to wooden dwellings and structures; of powder-post beetles which destroy wooden and rattan furniture, plywood and stored wooden articles; and of ambrosia and other beetles which degrade logs for veneer and for export.

The problems caused by insects are complicated. If they occur in the forest, they not only upset forest administration and management plans but also affect forest economics and other forestry practices. Timber extraction, logging, or harvesting, is affected in many different ways "Hot logging" may have to be practiced most of the time to avoid insect damage to logs and maintain their grade for various purposes. The tedious removal of bark may have to be done where grub worms are serious hazards. Schedules for logging and loading may have to be modified when delays spell insect infestations and monetary losses. Production of sawn lumber may be greatly affected as a result of modifications in sawing patterns or of thick slabbing in order to remove defective sapwood materials.

The same is true in veneer cutting. Marketing may also be affected as the grade and price of insect-damaged products are reduced. Trade difficulties may also ensue from quarantine restrictions of importing countries. Delay in the clearance of log and lumber shipments also always means extra demurrage cost, inconvenience, reduced patronage and loss of reputation.

If the problems occur in the construction of an expensive building, they pose structural and legal problems. Structural failure due to insect attack is annoying and expensive to correct. Court litigations often happen when owners of newly constructed buildings discover insect infestations and presume that the building contractors used cheap insect-infested lumber.

### *Synopsis of research work*

As research work of the Section often involves proper identification of wood-destroying insects, a museum for forest products insects was established. Surveys on insect infestation problems were conducted in residential buildings, housing projects, wood-using industries, lumber yards, sawmills in logging areas. In all these places insect infestations were commonly found.

Studies on the biology of a powder-post beetle, *Heterobostrychus aequalis*, a serious pest of veneer and plywood, and on termite-fungus relationships, have been conducted to gain knowledge that may be applicable in formulating control measures.

Screening tests of various insecticides for the control of ambrosia beetles and termites are being continued. Lindane (the gamma isomer of benzene hexachloride) has been found effective at a concentration of about 3.0% in water solution against ambrosia beetles. Several insecticides have also been found effective as soil poisons against termites. Among these insecticides are: aldrin, 0.5 to 1.0%; lindane, 1%; chlordane, 2.0%; and dieldrin, 0.5 in water solutions.

## Pathology Section

The Pathology Section studies the taxonomy, morphology, physiology and biochemistry of Philippine wood-decaying and staining fungi. It also conducts laboratory tests on the toxicity and effectiveness of various wood preservatives and anti-stain chemicals.

### *General considerations for research*

The destructive capacity of wood-inhabiting fungi cannot be overlooked. They commonly depreciate large quantities of lumber and other forest products which are exposed to humid and warm conditions. The value of wood damaged by fungi and of wood that goes to annual replacements or repairs represents enormous loss worth millions of pesos to the wood industry and to homeowners.

Where strength is of primary importance in some structural uses of wood, the occurrence of fungal decay even in a small portion of the wood could make the whole piece unsuitable for use.

Wood-decaying fungi and fungal-deteriorated wood are common all over the Philippines. Even before a timber is felled and sawn into lumber, it may have already been seriously infected with decay. Heartrots of standing trees are predominant features of our hardwood forest.

Another type of fungi which causes economic losses to the wood-using industries is the staining fungi. Several species of these fungi affect and discolor light wood materials. Stain is common in lumber, bamboo, rattan, wooden shoes and other carved-wood items.

### *Synopsis of research work*

The broad objectives of the Pathology Section are to find the best solution to the pathological problems of many important wood and wood products involving decay, stain; to evaluate preservatives and fungicides, and to maintain stock cultures of important Philippine wood-destroying and wood-staining fungi for use in the different laboratory studies.

Most of earlier studies were on pathological problems affecting the lumber and rattan industries. Because of the enormous loss encountered by collectors and exporters of rattan poles due to staining, extensive studies were conducted to control stain infection.

Results of these studies indicated that the required minimum concentration of sodium pentachlorophenate for complete prevention of stain in 0.63% when applied within 7 hours after cutting. However, when the application is made within 24 or more hours after, prevention of stain is not complete even with a chemical concentration higher than 0.63%. These findings were considered significant in minimizing the downgrading of rattan poles, especially those for export.

A number of earlier research projects were survey in nature, to gather first-hand information on pathological problems directly affecting the wood-using industry and to determine possible control measures. Surveys were made on wood products establishments, lumber yards and "wet" industries such as cooling towers, ice plants, soft drink plants, paper mills and storage houses. Among the problems encountered which are of economic importance are those on the occurrence of decay on wood parts exposed to intermittent and prolonged wetting. Soft rot was also found in cooling towers which have been in service for more than 5 years.

The use of highly durable wood species was suggested for the "wet" industries. However, a great number of these species are considered unsuitable because they are too heavy for cooling towers. Another solution suggested is to treat the wood with highly fixed water-borne preservatives.

To conduct studies on the biology of wood-decaying and wood-staining fungi, evaluate the effectiveness of fungicides and preservatives, and for identification purposes the collection of Philippine fungi associated with decay of wood and wood products has been intensified. To date, the mycological herbarium has a total collection 679 fruiting bodies, 287 of which were identified up to the species, 272 up to the genus and 120 up to the family. Duplicates of some collections were sent to mycological herbaria in the U.S. for verification of tentative identification.

Of importance also to the wood industry the study on the effect of fungal stain on the anatomical and strength properties of white nato were completed. Results showed that their decrease in strength properties for one-month and three-month periods, respectively, are: toughness, 36.72% and 71.65%; modulus of rupture, 17.17% and 25.-11%; and modulus of elasticity, 3.05% and 1.-50%.

Also under study are those on the toxicity of fungicides and preservatives to determine the threshold values and comparative tolerance of some wood-destroying fungi to some commercial preservatives by the soil block method. So far, tests on five concentrations of four commercial preservatives on five wood-decaying fungi by soil-block method were terminated.

## FUTURE GOALS

During the past ten years, emphasis on the research program in the Wood Preservation Division was more on the applied side. However, future success in applied research and development will depend upon the quantity and quality of basic research accomplished. On applied and basic research, Dr. James S. Bethell of the National Science Foundation of the U.S., said: "Creation of new products, improvement of existing products, and development of better processing method results from applied research. When a problem is identified, applied research draws upon scientific knowledge from principles, theories, facts, and techniques for a solution. It is the storehouse of scientific knowledge, however, that provides the drive for applied research. If the reserviors of basic scientific knowldege are inadequate, progress in applied research and product and process development will be slow, and frequently the research itself is sterile."

Studies are needed in the Seasoning Section on wood-moisture relationship, the mechanism influencing the movement of water in wood, anatomical structure affecting the permeability of wood, stress-strain relationships affecting drying conditions, mechanism of heat transfer during drying, and many other. In the Treatment Section, studies are required on anatomical features of wood as they relate to treatability; effect of various factors on the residual effectiveness of preservatives; search for non-leachable water-borne preservatives; new ways of treating wood, etc. The Entomology Section will have to consider studying the behavior of wood-destroying insects; the attractant factors in wood; the control of insects by sterilization and other means. The Pathology Section will be involved in research work on the nature of wood decay including heart-rots; the synergism and antagonism among wood-destroying and wood-staining fungi; the biochemical control of fungi, etc.

To achieve these goals, an enlistment of intellectual resourcesfulness is needed. Incentives are necessary to keep capable and promising technologists in the Institute.

Vigorous attention must be given to the needs of researchers for laboratory supplies, materials, and equipment. These facilities often underlines the difference between productivity and sterility of research work. As Dr. Jose O. Juliano once aptly put it: "Scientists are no supermen and unless given the necessary tools for research all their education and training soon become obsolete; their enthusism and drive crumble, and they become unproductive."

## WHAT'S NEW IN WOOD RESEARCH

### *"Forest" on Sea Bed*

Just imagine, a "wood-working factory" on the seashore. Lorries will be carrying plywood, pressed wood-fibre plates, etc., from it along the roads. But there will be no forests nearby. The raw material will be provided by the sea.

This is fantasy today. But the skin-divers of Moscow and Kiev made a most interesting experiment last summer: in one of the bays at Odessa on the Black Sea they established a sea-weed farm.

After clearing the bottom, the skin-divers sowed the spores of sea-weeds. Already, in a few days' time, the first shoots appeared. The brown marine plants grew very rapidly. In a week they were already three meters high. Soon the first harvest was reaped. And what a harvest! It was found that a hectare of common forest.

Sea-weed farming offers bright prospects. The sea bed is not affected either by frosts or dry winds. In the water, however, it is warm; plenty of light and nutritive substances are dissolved in the water. The sea bed can be transformed into a tremendous hot bed, one which is inconceivable on the shore. To grow timber for the industry nearly 100 years are required. Sea-weed yields 50 full-grown generations a year.

On the Barents Sea, the Soviet Union has already set up a factory for processing sea-weed. Experimental sea-weed farms are being set up in the Pacific Ocean, the Baltic Sea and the Black Sea. But this is only a beginning. In the not-too-distant future the profession of marine silviculture will become common.

Soviet Land, Vol. XIX, No. 18. Excerpted by the Indian Forester, Dec. 1966)

### *Insect resistance to insecticides*

Fluorescent insecticides to measure effects of such chemicals on insects will be developed under a three-year grant from the U.S. Department of Agriculture to the University of Georgia. The project, directed by Dr. Chester M. Himel, may provide better insights into insect resistant to insecticides. In recent years, insects have developed varying degrees of immunity to some of the older insecticides. Thus, the scientists are hoping to develop highly fluorescent phosphate and carbamate forms of insecticides which can be traced through an insect's body. This technique, if successful, will provide a new and much more sensitive way to determine how insecticides will interfere with vital life processes.

From the Chemical & Engineering News, Page 43, March 6, 1967

### *Tree Bandage*

A bandage 2 feet by 4 feet is being manufactured by Forestry Enterprises in St. Paul Park, Minn. Used to protect the groundline section of utility poles from fungi and bacteria, the bandage contains a wood preservative that looks like a grease and consists of pentachlorophenol and some proprietary ingredients.

Incorporated in the preservative is fumed colloidal silica CAB-O-SIL (Cabot Corp.) to thicken it. This procedure helps the bandage stay in place even when held vertically, restrains it from bleeding as it ages, and controls release of the pentachlorophenol into the wood to ensure maximum penetration into and protection at the vulnerable area of a pole. The preservative's protection ability has been known to last for as long as 15 years.

From the Chemical & Engineering News, Page 110, March 6, 1967

An ounce of prevention is worth a pound of cure. . .

A new prevention against the attack of leeches has recently been proven highly effective. It is a repellent consisting of 25% Deet (N-N-Diethyl-m-toluamide) and 75% lanolin. Deet is an insect repellent widely used, and lanolin makes it more difficult for the leech to become attached to the skin.

When leeches attach themselves to a person's skin, they usually inflict a Y-shaped wound into which an anti-coagulant is injected. They suck blood and cause bleeding, though not associated with disease transmission.

Although there is not much to be afraid of in leeches attack, they irritate the skin and oftentimes cause panic, especially to women and children. To prevent this, it is advisable for those who work in the ricefields, riverbanks, forest and beaches, to apply this repellent on their skin.

From: USDA Agricultural Research, 1966, 14(7): 11

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## MOST PRIZED POSSESSION

In medieval times, a king, after conquering a town, decided to execute all the men old enough to bear arms. He decreed the women and children would be spared but were to be banished from their homes.

Someone pointed out that the Christmas season was approaching and the victor relented a little. He refused to reprieve the men, but promised that every woman could take any prized possessions she could carry.

The next day the king was chagrined to see each sturdy peasant woman march through the gates with a man on her back — wives carried husbands, sisters carried brothers, girls in love, their sweetheats. No man was left behind.

To the everlasting credit of the disappointed king, he kept his word.

# FPRI Highlights

## FPRI OBSERVES 10TH ANNIVERSARY CELEBRATION

A three-day celebration to mark the 10th foundation anniversary of the Forest Products Research Institute (U.P.) was oberved on July 3-5.

Theme of the Institute's anniversary celebration was Forest Products Research for Economic Progress.

Highlighting the affair were an open house of the Institute and display of various exhibits including those of participating commercial firms and institutions, and a convocation on July 5, which was capped in the afternoon with a scientific symposium on the anniversary theme.

The morning convocation at the Forestry pavilion was featured with the awarding of certificates and medals by the guest of honor to former officials and consultant as well as to certain employees.

The FPRI Employees' Day on July 4 also highlighted the 3-day affair, which featured a whole day's round of social and athletic activities among the employees themselves, and the awarding of prizes and certificates to deserving FPRI personnel.

Coordinating the varied anniversary activities was the executive committee led by Dr. Francisco N. Tamolang, asisstant director, as chairman, and the members, all ranking FPRI officials, composed of: Dr. A.N. Ramos, Jr. (vice-chairman), Dr. F.C. Francia, V.B. Elchico, R.R. Valbuena, L.A. Ynalvez, D.C. Faustino, J.P. Laranang, P.V. Bawagan, J.O. Siopongco, R.F. Casin and P.D. Cardenas.

According to Director Manuel R. Monsalud, the Institute was created by virtue of Reorganization Plan 77 and implemented by Executive Order No. 257 when then President Carlos Garcia signed it on July 5, 1957. Its first director was Forester Eugenio de la Cruz, who is now director emeritus and technical consultant of the Institute.

### FPRI Holds Convocation-Scientific Symposium

Scores of guests representing a cross-section of the scientific, educational and industrial sectors attended the convocation and scientific symposium on July 5 at the Forestry pavilion in College, Laguna under the auspices of the Forest Products Research Institute (U.P.).

Hilarion M. Henares, Jr., former NEC chairman and president of the Araneta Pulp and Paper Co., was the guest speaker at the convocation-symposium.

The affair climaxed the three-day celebration of the 10th foundation anniversary of the Institute, which was created by virtue of Reorganization Plan 77 and implemented by Executive Order No. 257, dated July 5, 1957.

During the scientific symposium five technical papers dealing on the varied aspects of the symposium theme — Forest Products Research for Economic Progress — were presented.

With Dr. Faustino C. Francia as moderator, the technical papers were read by their respective authors, all research staffers of the Institute:

1. Exequiel Mendoza — "Bending Solid Wood and Its Potentialities"; 2. Felino Siriban — "Economic Perspective of Preserved Wood"; 3. Joaquin Siopongco — "Proper use of Wood in House Construction"; 4. Lauro Ynalvez — "Some Aspects of Long-Fiber Research"; and 5. Felipe Lopez — "Improved Pine Oleoresin Extraction and Its Prospects in the Philippines."

An open forum followed, with the panel of discussants composed of: Bernardo Burgos, Mr. Cayabyab, Dominador Cepeda, Hugh Curran, Jr. Francisco Monge, Justino Seguerra, Carlos Sulit and Napoleon Vergara.

## FPRI BARES TRAINING PROGRAM

Director Manuel R. Monsalud of the Forest Products Research Institute (U.P.) has announced plans of the Institute for practical training of foresters, engineers and chemists along applied forest products technology and research at the FPRI laboratories.

According to Director Monsalud, there is at present a dearth of technicians with practical training along these lines and that various local wood-using industries are clamoring for personnel adequately trained in the various aspects of forest products processing and manufacture to man their plants and factories.

He said that those interested will be trained at the FPRI laboratories in such specialized fields as pulp and paper production, veneer and plywood manufacture, wood treatment and seasoning, wood identification, sawmilling, timber testing and stress grading, and other allied fields.

He added that the laboratory equipment and facilities of the Institute, which is one of the best-equipped laboratories of its kind in Southeast Asia, are adequate enough for the above-mentioned types of training, and that competent personnel will supervise the work of the trainees.

The Institute, for the past years now, has from time to time been training small groups of researchers and technologists mostly coming from the local wood-using industries and a few from other countries.

According to Monsalud, the long-standing policy of the Institute to afford training opportunities to interested parties, free of charge, is in line with its desire to serve better the fast-growing wood-using industries, in particular, and the nation as a whole.

For particulars on the forthcoming training program, interested parties amy write to the Director of the Institute in College.

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## A NOTE ON THE TAXONOMY . . .

(*Continued from page* 76)

*Classification —*

Calilung (1965) identified the Benguet Pine aphid under sub-family Aphidinae; under tribe Lachini; sub-tribe Euclachnina; under genus Eulachnus.

*Biological note —*

The life cycle of the aphid is difficult to observe due to its spasmodic occurence and other factors that inhibit its normal development. Changes in temperature seems to be the limiting factor as shown by the stunted growth of aphids reared under Montalban condition. Like most aphid partenogenesis is the mode of reproduction of Benguet Pine aphid. Adult viviparous female produces 5-7 nymphs per day and these continues for 14-17 days. Under favorable condition it can be readily seen that a huge progeny may result. Winged female called "fundatrigenia" was observed to fly off to neighboring pine trees and start to reproduce asexually.

*Natural enemies —*

Some species of spider and other insect preyed upon these aphid but these predators appear only in sufficient number to control the aphids when they have increased to such an extent that the plant they infest has been seriously damaged.

### RECOMMENDATION

I hope this work will be useful and will stimulate researchers to study forest aphids which is not only full of interest but of considerable economic importance to forestry.

### REFERENCES

1920 — Baker, A. C., Generio clasisfication of the Hemipterons Family Aphidae, USDA Bull. 826, p. 15, *Eulachnus* Del Cuercio.

1921 — Takahasi, R., Aphidadae of Formosa, pt. 1, p. 80., *Eulachnus* Del Guercio.

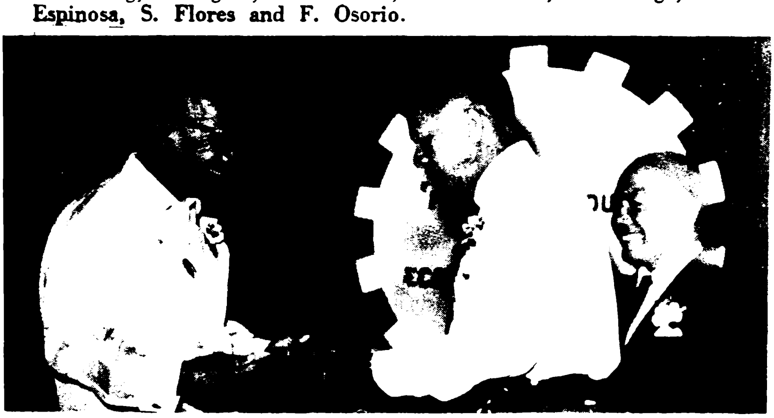
1965 — Paik, W. H., Aphids of Korea p. 116, *Eulachnus* Del Guercio.

# Here & There

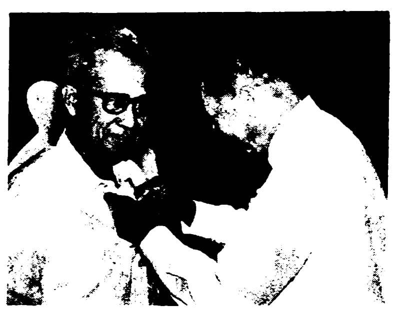
Members of the 11-man experts mission sponsored by the ECAFE, which recently toured Thailand, Malaysia, Singapore, Indonesia and the Philippines in the course of their two-month survey of suitable sites for regional projects for pulp for paper or rayon manufacture, pose for photo during their visit at the Forest Products Research Institute.

They are, left to right, first row: M. S. Wee of Singapore, M. Nasution of Malaysia, A. Slamet of Indonesia and M. R. Monsalud of the Philippines. Second row, left to right: E. J. Crane of Australia, D. L. Stacey of New Zealand (FAO), H. P. J. Moorhead of Canada, T. Premrasani of Thailand, D. N. Tjian of Singapore, Y. Yonesawa of Japan and U. Tin Nyunt of Burma (ECAFE).

Civic leaders and barrio captains from Central and Northern Luzon currently training at the Community Development Center in Los Banos, Laguna recently toured various laboratories of the Forest Products Research Institute to observe firsthand the Institute's research activities. In above photo, Asst. Director F. N. Tamolang (3rd from left) briefs the community leaders on some forest products researches highly useful to the economic upliftment of the rural areas. Among the visitors are Salvacion Lantican of CDC, N. Vilda, F. V. Dioco, G. Caporno, M. R. Tidor, C. M. Cuaresma, M. Nacino, A. Vanguardia, W. Sidang, B. Lagera, C. Casanova, M. Dimalanta, M. Umaga, S. Cabanilla, F. Lomibao, P. Nuezca, A. Espinosa, S. Flores and F. Osorio.



PROF. EUGENIO DE LA CRUZ, (left), former Director and director emeritus of the Forest Products Research Institute (U.P.), receives his plaque of merit from Jose Sanvictores, FPRI board member, while Director Manuel R. Monsalud of the Institute looks on. The awarding rites for De la Cruz highlighted a convocation-symposium to mark the Institute's recent 10th anniversary, for "his dedicated service and enduring contributions" to the FPRI as its first director and technical consultant.

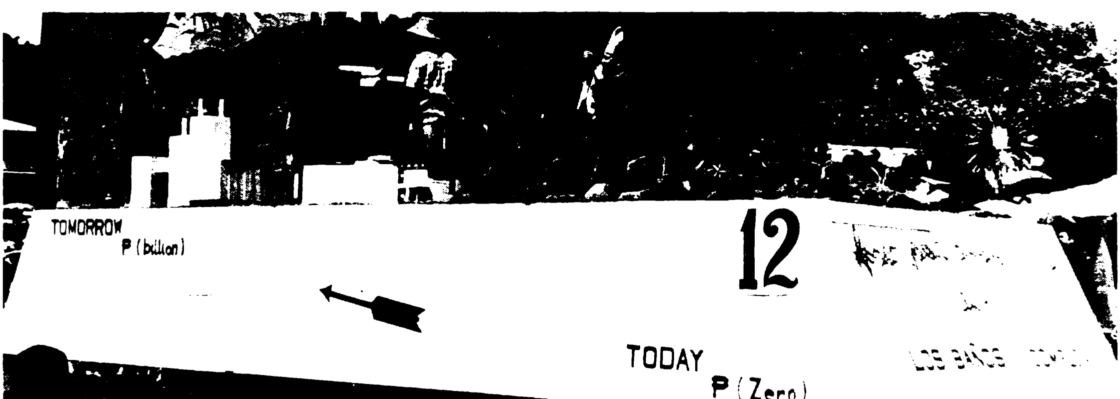


LAURO A. YNALVEZ, a division chief of the Forest Products Research Institute (U.P.), receives his gold service pin symbolizing his forty (40) years "of satisfactory and continuous service to the government" from Jose Sanvictores, FPRI board member. The awarding rites highlighted a convocation-symposium held recently to mark the Institute's 10th anniversary.

MRS. REMEDIOS CEPEDA, civic leader and wife of a member of the Forest Products Research Institute board, cuts (above photo) the ceremonial ribbon marking the opening of the Institute's recent three-day exhibit on the various uses of wood, as part of FPRI's 10th anniversary celebrations. Flanking her are, from left, Mesdames Amparo B. Tamolang and Nilda Flores, and Director Manuel R. Monsalud of the Institute.


Regent Florencio Tamesis underscores the fact that many of the trees "around us" could be made wonder or miracle trees, like the Kaatoan bangkal, with proper utilization and technical know-how, during his extemporaneous speech as guest of honor.

UPCF Dean Domingo Lantican makes brief remarks to introduce Regent F. Tamesis, guest of honor.



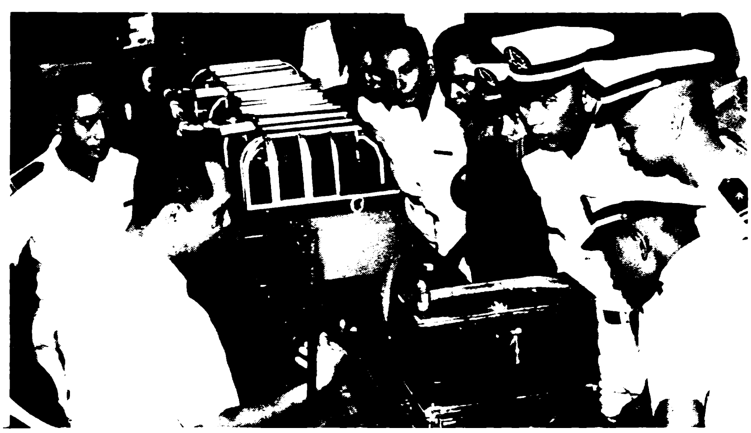

LOYALTY PARADE WINNER

The neat and sleek float put up by the Forest Products Research Institute bested a dozen other floats presented by other government agencies in the Los Banos (Lag.) complex for the first prize, during the recent U.P. Loyalty Day celebration held in Los Banos. Following the "Days" theme: Los Banos —Today and Tomorrow—the FPRI float symbolically relates today's deplorable widespread Kaingin system with tomorrow's productive "Miracle forest" for a more viable and industrialized Philippine economy. Playing their respective roles above as scientist, Kainginero and politician are Miss Josefina Jimenez, Arsenio Tongacan and Boanerges Aveno.

FPRI hosts, led by Asst. Director F. N. Tamolang, conduct a guided tour of the exhibits. Here Mesdames R. Cepeda, N. Flores and A. Tamolang are shown some wooden novelties.

Officials of the Forest Products Research Institute underscore the important role of trees in the nation's socio-economic scheme when, in appropriate rites, they plant a seedling of a highly useful and fast-growing tree that originated from Australia—*Eucalyptus grandis* or Rose Gum—in the Institute compound in observance of the recently-concluded Arbor Week. Here (above photo), before FPRI employees, Director Manuel R. Monsalud does the spadework ritual, assisted by Asst. Director F. N. Tamolang (left) and F. R. Lopez.

High noon of July 5—the day the Institute was founded ten years ago—saw FPRI hosts tendering a solid luncheon for their guest, VIP and near VIPS alike, at the cozy FPRI canteen, of which above photo is typical of said affair.



OFFICERS of the Philippine Navy stationed at the Cavite Naval Base recently toured various laboratories of the Forest Products Research Institute (U.P.) in College, Laguna to observe firsthand the research activities of the Institute. Led by Commander B. R. Vergara, the naval brass (above photo) are being briefed by Asst. Director F. N. Tamolang (left) on the complex process of paper manufacture with the Institute's experimental paper machine.

Mrs. Lourdes O. Mabesa on behalf of former Dean C. Mabesa, donates forestry books to the College of Forestry library (l to r: former Dean Zamuco, Mrs. Mabesa, Mrs. J. Ranit, College Librarian, Prof. Napoleon Vergara (acting chairman of Forestry Extension Dept. C.F.) and Domingo Jacalne (former F. E. Chairman).

Thirty-eight barrio captains from Quezon Province hear the U.P. College of Forestry professors talk on forest conservation, reforestation and the contribution of forests to the national economy on August 16, 1967 at the College Auditorium. Prof. Napoleon T. Vergara, chairman of the Forestry Extension Department, (second from right, second row), talked on Forest Conservation in Dean Domingo Lantican's stead.

Regional Sealers Seminar from May 15 to June 15, '67 held in the College of Forestry Administration Building. Regional Director Enrique Santos no. 2 in front row was in charge, assisted by lecturers from the different forestry agencies.

APC Regional Officials and the UPCF Training staff pose with the rural clubs agents of APC Region V before the APC Office at Lignon Hill, Legazpi City, site of the Second regional forestry training held in August 22-25.

Prof. Dr. W. Liese of the Federal Research Organization for Forestry and Forest Products, University of Hamburg, West Germany (standing) giving a short talk during luncheon tendered by the Forest Products Research Institute in honor of the foreign delegates (foresters and scientists) to the seminar on "Planning Forestry and Forest Industries in Tropical Regions."

At his left is FPRI's Director Manuel R. Monsalud and second from his right is Dean Domingo M. Lantican of the UP College of Forestry.


Participants to the Forestry Research Symposium (Aug. 29-30, '67) held in the College of Forestry, U.P. Among the participants were Regent Florencio Tamesis (standing center of middle row), flanked by Foresters M. Maun, M. Nastor, J. Claveria (Chief of Div. of Sawmill and Licenses), C. Abella (Chief, Div. of Watershed Management) and M. Y. Gulcur (F.A.O. Watershed Management Expert) (at his right): Asst. Dir. J. Utleg, Reg. Dir. E. Elayda, Fors. F. Milan, C. Tadeo and others (at his left). Sitting from l. to r., Prof. L. Quimbo, Fors. B. Jasmin, P. de la Cerna, FPRI Asst. Dir. F. Tamolang, For. M. Reyes (Chief, Div. of Forest Research), F. Nañagas, E. Tagudar, W. Agbayani, N. Paa & B. Postrado.

Director A. Quejado addressing the B.F. Manila personnel. Behind him are division chiefs M. Reyes, S. Nablo, C. Abella, J. Ravelo and others.

Director Quejado planting his tree in front of the Reforestation Administration Office. Looking on are DANR undersecretary of Agriculture D. Umali, Foresters T. Santos, R. A. Administrator J. Viado and For. M. Baja.

# Forestry in the News

## BATAAN LOGGER DEFIES THE PC

*Balanga, Bataan,* July 20 — Just when will the New Pantingan Sawmill operated by a a Chinese named Se Ba with Filipino partners stop sawing logs in this province is being asked by some people here who are apprehensive about the denudation of this province's forests.

According to the local constabulary command, the management of the sawmill dared the PC to stop its operation, saying that only the court can do so.

### Modus operandi

The sawmill's permit to operate is only up to June 30 of this year, it was learned.

The PC opined that it is the bureau of forestry which can determine whether the sawmill is operating legally or illegally.

It was found out that the sawmill operator is buying cut logs from timber smugglers by the thousands of board feet which he stocks in the sawmill's log ponds, then ask for grace periods, to finish sawing the accumulated logs.

### No apprehension

The modus operandi was uncovered by the PC but corresponding action by proper authorities has not yet been made.

With the operation of the sawmill, timber smuggling and illegal cutting of logs are abeted, it was told.

"There are no more forests in Bataan," one forestry official said, which prompted the transfer of forestry office to San Fernando, Pampanga.

What remain of this province's forests are the areas within the jurisdiction of the 34,000-hectare Bataan National Park.

### Permit cancelled

Forestry Director Antonio F. Quemado has cancelled all forestry permits in this province.

Meanwhile, some 1,500 logs owned by the Forestry Battalion of the Philippine Army are floating in the China Sea in the vicinity of Morong — (BCO)

## ILLEGAL LOGGING OPERATIONS, EXPORTS GO ON UNCHECKED

By Satur C. Ocampo

Large-scale illegal logging that destroyed part of the Mt. Apo National Park in Davao, illegal log exportation that defrauded the government of substantial revenues, and connivance between a logging firm and bureau of forestry and Parks & Wildlife officials to effect illegal logging and export operations in 1961-1964 have been reported to the National Bureau of Investigation.

Curiously enough, almost four months after the complaint — supported by vouchers, financial reports, official documents — has been submitted to the NBI, the agency has not acted upon it.

### *Documents culled*

The documents were culled and analyzed by a young Manila lawyer, Nicomedes P. Agag, who has tried to attract the attention of national officials to irregularities in the country's logging areas. In an apparent frustration over NBI inaction on his complaint, Agag has appealed to the Manila Times to assist him in exposing the irregularities he has so far uncovered.

"There is the possibilitiy," he said "that the irregularities in this particular instance may be duplicated many times more in other logging areas and national parks."

### *The findings*

Briefly, Agag's findings show the following:

1. A big Mindanao logging firm, allegedly financed by aliens, and with licenses of questionable authenticity, produced seven million board feet of timber from the Mt. Apo National Park, without paying fines and penalties collectible on his production, amounting to ₱250,000

2. The logging firm failed to pay long-overdue stumpage and reforestation charges — ₱3,797.07 in 1959 alone — and yet it was allowed to continue logging operations and log exportation up to 1964, without paying 300 per cent surcharges for cutting without license and 50 per cent surcharges and penalties.

3. The logging firm, or its president, failed to properly present its true income from logging ope-

rations and instead made misdeclarations, defrauding the government of the correct tax it should have paid.

### *Without license*

4. Parks and Wildlife officials and personnel allowed continued logging even without license by the firm from 1962 to 1964, and the Bureau of Forestry official allowed the exportation of illegally-cut logs, amounting to 13 million board feet, without imposing some ₱75,000 in surcharges due on them.

5. To effect the illegal logging and log exportation, the Mindanao logging firm entered into a contract with an alien-controlled timber company with the latter paying a royalty to the former for operation of the timber license.

While the alien-controlled firm produced more than 18 million board feet of logs in 1962 from the supposedly licensed areas, sales invoices issued by the logging firm covering the logs produced showed "spurious price" at ₱25 per thousand board feet (MBF). This invoicing was interpreted as an attempt to evade taxation.

### *Huge royalty*

Agag pointed out that the president of the logging firm in 1962 received ₱235,581.13 in royalty from the alien-controlled firm at the rate of ₱12.50 per thousand board feet, plus ₱15,000 as reimbursement for repairs of roads and bridges in the license area, or a total of ₱250,581.13.

Instead of declaring this amount as royalty, the firm president reported to the government the sale of logs at ₱25 per MBF "so that the basis of 7 per cent sales tax would be less when the export prices was no less than ₱250 per MBF."

Agag said this procedure of income declaration was done for three years, 1962 to 1964, the pirates concerned, he said, appear to have defrauded the government of "enormous income in the form of taxes legally due from them.

### *Tax evasion*

Tracing the methods by which systematic tax evasion was practiced by the logging firm and the contracting party. Agag did not exclude certain bureau of forestry personnel from culpability. He cited the following:

1. In 1962, the bureau of forestry allowed the exportation of more than 8,000 cubic meters of timber (three million board feet) by the alien-controlled firm. The logs were allegedly in excess of the amount granted for timber cutting for the year 1961-62 and should therefore have been slapped ₱20,000 representing the 300 per cent surcharges and 50 per cent penalty. The surcharges were never paid.

### *No penalties*

2. In 1962-63, the firm was allowed to export 4,000 cubic meters (two million board feet), also in excess of allowable cut, in addition to one million board feet exported by the principal firm or a total of three million board feet which should have been taxed ₱20,000. No surcharges was paid.

3. In 1962-63 the alien-controlled firm exported more than seven million board feet, invoiced under licenses other than the origin of sources of the logs, without paying surcharges of ₱35,000.

Agag observed that "all additional cuts granted should exclusively be taken from the alienable blocks covered by the license and violation thereof would subject the timber cut to fines and penalties."

### *Denuded areas*

He further pointed out that in a letter of Vicente Marababol, chief forest management division to the district in Cotabato City, dated April 3, 1962 areas released as alienable or disposable are no longer forested. It would be concluded, he said, that it would be unprofitable to exploit such areas commercially and for these areas to be sources of heavy log exports "would be doubtful."

## FLAGRANT VIOLATIONS OF LOGGING LAWS CITED

### *Misdeclared income*

Through an exclusive sales agreement entered into by the lisensee and the timber firm, under which the latter was to buy all the production of the former in his 2,900-hectare licensed area at ₱25 per thousand board feet, the logger, according to records, received a royalty of ₱235,581.13 for 18.8 million board feet of logs exported by the timber company in 1962 alone, aside from other monetary considerations for the use of his license.

Agag charged that the logger willfully misdeclared his true income not only in 1962 but also in the succeeding years, thereby defrauding the government of enormous taxes.

### *Other charges*

Agag also charged the same logging concessionaire with:

1. Overcutting of timber in his area on the pretext of relogging alienable or disposable areas and private woodlands, which should be subjected to 300 per cent surcharge for cutting in violation of the terms and conditions of the grants;

2. Invoicing of timber cut in excess of authority under operated licensed areas other than the sources of timber which should be subjected to 300 per cent surcharge for cutting without license;

3. Excess cut over the allowed grant of 8,413 cubic meters in 1962 and 6,500 cubic meters in 1963, which were exported by the timber company, again subject to 300 per cent surcharge for cutting without license; and

4. Fraudulently declaring to inspecting forest officials that machineries of his operator found in in the cutting areas were his own to show that he was financially capable to maintain such operation and to facilitate his forestry requirements.

### *Execessive cutting*

Despite the fact that the logger was allowed only an annual cut of 2,900 cubic meters of timber, plus an additional of 11,600 cubic meters, or a total of 14,500 cubic meters a year, the timber firm produced an average output of 1.5 million board feet of logs, or about 3,500 cubic meters a month (42,000 cubic meters a year), "enough to denude the area in quick time," Agag pointed out.

"Even residual trees marked by foresters were cut down, thereby defeating the purposes of good forest management through willful violations," Agag said. What was more serious, he aded, was that the violations were financed by aliens who never had concern for preserving the patrimony of the nation in their quest for wealth.

### *Officials misled*

He said that in the logging operations of the timber company, the licensee was not allowed to intervene except by cooperating in the disposition of the logs if necessary to legalize the excessive cutting of timber. The exclusive sales agreement, he said, was so worded "to mislead forestry officials and other government officials from the illegality of the contract."

Agag charged that the issuance of sales invoices by the licensee on logs exported by the firm at ₱25 per thousand board feet "was to effect the serious acts of evading taxes due legally on the incomes derived from the true nature of the transactions."

### *₱4-million income*

Since the timber exporter produced more than 18 million board feet of logs in 1962, it realized earnings of more than ₱4 million, Agag said. But because of the invoices issued by the licensee to the firm, it eluded payment of the correct taxes due on its exportations, which cost no less than ₱250 per thousand board feet.

## LUMBER FIRM TRAINS RANGERS

NASIPIT, Agusan, May 23 — (PNS) — There will be no brain drain at a pioneer forest products company here, thanks to its conservation-conscious general manager, Dr. Florencio Tamesis.

The former director of forestry announced the completion of the first phase of Nasipit Lumber Company's forestry ranger course patterned after a similar curriculum at the UP College of Forestry in Los Baños.

This is the only known forestry training school at college level completely financed and operated by a forest products company in the Philippines.

### *16 graduates*

Tamesis said 16 out of an original class of 20 students earned credits for the first year ranger course. These "pensionados" are all children of Nasipit employes who had shown proficiency while at the company-operated high school at its forest concession compound Barrio Tungao, upstream by the Agusan river.

This unique "brain" project was another first at Nasipit. The company already has the distinction of spending millions of pesos annually in scientific research and reforestation program to produce its own tree farms in Tungao. It has an integrated wood processing industrial complex here.

### *Two-phase plan*

Tamesis said the first phase of the technical manpower resources development program consisted of a 10-month intensive theoritical classroom and laboratory work.

The second phase will consist of a two-month actual practical work as ranger-trainees at the Nasipit concession with minimum-wage stipend. Those successful will be awarded certificates indicating their lines of specialization in various phases of ranger work.

Instructors in this training course are all university graduates. The headmaster of the school is Prof. Calixto Mabesa, retired dean of the UP College of Forestry.

## OIL-PRODUCING TALAHIB PROJECT

TAYUG, Pangasinan, May 23 (PNS) — Some 400 hectares of sub-marginal lands within the Cojuangco estate in Bayambang, Pangasinan, will be planted to "talay," a variety of talahib grass, which produces citronilla oil.

Domingo P. Muñoz, a chemical engineer in charge of the project, said that the citronilla oil venture will be the first of its kind in the province. He said the project would pave the way for the conversion of vast tracks of similarly barren lands in Pangasinan to oil-producing "talay" plantation.

Citronilla oil is an essence extracted from "talay" grass which grows wild and in abundance in many parts of Pangasinan.

This oil is used in the manufacture of toilet articles such as soap, pomades and perfumes.

Muñoz said that "talay" crop could mature in three months. This would mean that a piece of land planted to "talay" could have three harvests a year.

He said citronilla oil also is in great demand in other highly industrialized countries.

## STUDENT VOLUNTEERS JOIN REFORESTRATION

Last summer, a group of college and high school students, ranging in age from 14 to 19, decided to do something good for a change.

Their previous summer vacations were no fun at all simply because there was nothing constractive and creative to do.

So last summer 13 girls and 18 boys joined the first reforestation project of the School Volunteer Program (Philippines) (SVP) in the new Province of Benguet.

### *Volunteer work*

Headed by Angel Penetrante, 19, a student leader from Pasay City High school, the group stayed for 14 days in the mountains, cooking their own food. working in the nursery grounds, bringing Benguet pine seedling up in the mountains, crossing dangerous rivers, riding in dug-out (canoes), and planting trees in the government reforestation project there.

Besides planting trees, the volunteers also cut cogon grass to construct a fire line (or prevent the spread of forest fire) between plantations.

### *Enjoyed job*

Luningning Bautista, 17, a student-nurse from Far Eastern University and leader of Group II, said:

"I loved the work we did most especially in Bokod, Benguet with Oscar Hamada, the forester-in-charge in the government reforestation plantation located 50 kilometers away from Baguio City."

### *Simple living*

Group I leader Efren Sespeña, 16, from Mapua Institute of Technology, recalls:

"In the mountain house, we were lodged on the second floor of the government FA office. We were devoid of all city conforts . . . no electric light, so we used candles. We had to take turns cooking our own food. Laundry was done every afternoon, using the running water of a nearby brook located near the house.

Group I included Melinda Gonzales, 15, of Pasay City high school; Rosella Reyes, 14, the youngest of the volunteers PCHS; Mildred Arafiles, 15 PCHS; Antonio Hamos, 15; Nestor Mendoza, 15; PCHS; Resencio Miranda, 17, Philippine College of Criminology; Dante Canedo, 16, also from PCCR; James Francisco, 16, PCHS.

### *Group II members*

Group II, under Luningning, included Antonia Ogaya, 16; from Philippine College of Commerce; Corazon Lorenzo, 16, UST; Edna Montillano, 16, UE; Nick Acuña, 17, MIT; Rosito Bartolini, 17, UP; Jose Martinez, 19, UST; Isagani Bautista, 17, UST.

CESAR SANTIAGO, 17, of PCHS, was the leader of Group III. This group planted tree seedlings on the top of a huge mountain in Camp 3, Tuba, Benguet.

Members of Group III were Carolina Marte, 17, of PCC; Linda de la Cruz, 19, UE; Julie de la Cruz, 17, formerly of Meycauayan Institute (Bulacan); Archimedes Velasco, 15, PCHS; Eriberto Icasiano, 17; Estelito Bautista, 15; Renato Dimalanta, 16, PCC; Rudy Dizon, 17, PCC; Pacita Onate, 19, the best cook in the group; Erlinda Abagat, 16, UE.

### *Officials joined*

Mrs. Marina Flores volunteered to join the reforestation project which was financed by the Philippine chamber of Wood Industries and many other donors, especially from schools and colleges.

Renato Damian, a senior executive of the Philippine Public Schools Teachers Association, also stayed with the volunteers for two weeks.

Dr. P. Rimando, chief of the forestry management division of the Reforestation Administration, made the necessary arrangements with Administrator Jose Viado and regional RA officer Ciriaco Galutira of Region I (Baguio City).

### *Forestry lectures*

Assistant Forestry Director Juan Utleg and forester Meimban provided technical assistance by giving lectures on watershed, management of forests, importance of watershed for hydroelectric plant and other subjects.

## LOGGER-PWO CONNIVANCE BARED

For five consecutive years — 1959 to 1964 — a logger with an expired license continued to cut and export logs from the Mt. Apo National Park under the very noses of Parks and Wildfire officials.

There were even records showing that the logs exported were certified as taken from Mt. Apo.

### *Cases cited*

In 1960 alone, as reflected from the consolidated profit and loss statement of the logging firm, it appeared that the firm produced ₱221,644.85 worth of timber for export and ₱38,239.01 for manufacture into lumber and sold them for ₱610,-053.29 and ₱58,793.91, respectiveely, thus making a gross profit on sales of ₱335,405.58.

This specific case, plus many others, were cited by lawyer Nicomedes P. Agag in his complaint filed with the National Bureau of Investigation, to show instance of complicity between a logger and PWO officials resulting in denudation of portions of Mt. Apo National Park.

### *NPO permit*

Agag pointed out that the logger (identified in the report) was issued National Park Ordinary License No. 1-59 in 1958, and his son, NPOT No. 28-59, each with allowable cut of only 950 cubic meters of timber annually. The licensees, according to Agag, failed to settle their accounts with the government representing stumpage and reforestation charges and consequently, their licenses were not renewed in the succeeding years.

Despite the non-renewal of the licenses, the logger continually engaged in timber cutting and exporting from the national park up to 1964 with the apparent tolerance of PWO officials.

### *Sans license*

Since no license was issued to him during the five-year period, his logging operations should have been subjected to the 300 per cent surcharge and other penalties which from 1962 to 1964 would amount to about ₱250,000. No record, however, would show that the logger paid the surcharge and penalties.

Furthermore, according to Agag, the logger "never" declared his true income from this operation and therefore "defrauded the government of enormous taxes legally due from him."

Agag cited the following facts on the logging operation of the licensee:

1. In December 1962, 1.5 million board feet of timber allegedly cut by the logger and certified by an official of PWO as taken from Mt. Apo were exported by the timber firm (also identified in report).

### *Shipment stopped*

The PWO official had earlier stopped the shipment pending investigation of the unauthorized cutting from Mt. Apo, He, however, later allowed the exportation and even certified that the timber came from Mt. Apo. No fine or penalty was imposed on the shipment.

— Manila Times—July 24, 1967

## SALARY HIKE FOR FORESTERS URGED BY FM

President Marcos has ordered the upgrading of the salary scales of officials and employes of the bureau of forestry which he said, was one of the three major sources of government revenues.

The President made the assurance when he addressed last Friday the foresters at the closing program of their annual conference held at the Heroes' Hall of Malacañang. The President after his address witnessed a demonstration of the various aspects of forest management program conducted by forestry experts under the supervision of Antonio A. Quejado.

The delegates were presented to the President by Director Quejado who was assisted by Assistant Director Juan L. Utleg. project coordinator Severino U. Nablo and Segundo P. Fernandez.

— Sunday Time—July 9, 1967

## PULP EXPERTS MEET

BANGKOK, July 24 — (Reuter) — A group of 10 pulp experts met here today to draw up proposals for the establishment of one or more plants to make pulp for paper and rayon products in Asia, the United Nations Information Service announced.

The group, organized by the Economic Commission for Asia and the Far East (ECAFE), is headed by Harold Moorehead, vice president of a leading firm of consulting engineers of Vancouver, Sandwell and Company Limited.

### *Other members*

Other members of the group are J. F. Crane, manager of the Fairfield Mill of the Australian paper manufactures limited, Achmad Slament of the Indonesian department of light industries, Yasumasa Yonezawa of Japan's ministry of agriculture, Mariano P. Ramiro of the Philippine national economic council, Michael Wee of the Singapore economic development board, Thanom Premrasamee of Thai forest department, and D. L. Stacey, forestry officer of the Food and Agriculture Organization (FAO).

After preliminary discussions in Bangkok for one week the group will visit Malaysia, Singapore, Indonesia and the Philippines.

### *Regional basis*

Returning to Bangkok at the end of August the group will visit plants in Thailand. On the basis of their findings the experts will submit a report on the possibilities of developing a pulp industry on a regional or sub-regional basis, the announcement added.

The group will also call the meeting of an action group of July 25 for the development of the iron and steel industry in Southeast Asia, another announcement said.

— Manila Times—July 25, 1967

## OVERCROWDED LOG PONDS IN JAPAN HIT

Overcrowding in Japan log ponds accounts for the delay in the unloading of log-carrier vessels resulting in the subseqeunt lateness in the picking up of Philippine log cargo.

This was reported by Jose G. Puyat, president of the Philippine Chamber of Wood Industries (PCWI) who arrived recently from a one-week business trip to Japan to observe market conditions for logs in that country.

Puyat said that the delay in the unloading causes losses of about $600 to $800 a day.

He said that in 1966, log imports of Japan rose by more than 30 per cent, but that consumption did not rise quite as rapidly resulting in the present high level of inventories.

Commenting on the price tendencies in Japan. Puyat said that some importers hope that the prices would remain steady while others expressed belief that decline in prices must take place.

"Quality logs, suitable for plywood faces are still moving well," Puyat added, "but the lower grades, such as LSQ (local sawmill quality) are difficult to sell at present."

Philippine producers, he continued, would probably do well to try and process these "mill-grade" logs locally.

The PCWI president observed that "the Japanese today are more receptive than ever to the idea of importing processed wood, rather than logs only."

Some of the Japanese are already buying sawn lumber and peeled veneer from the Philippines, he said.

— Philippine Herald—May 31, 1967

## LOG SCALERS, GRADERS OPEN TRAINING SEMINAR

Some 1,000 scalers and lumber graders all over the country started their one-month training seminar on log scaling scaling and lumber grading techniques yesterday.

This will cap the Bureau of Forestry's massive in-service training program for fiscal year 1966-1967 designed to enhance the morale of forestry field personnel and keep them abreast with modern techniques and procedures governing forestry activities in the country.

Forestry Director Antonio A. Quejado said the 10 regional seminars on scaling and lumber grading started simultaneously at Masinloc, Zambales for Region I; Taggat, Claveria, Region II. Los Baños, Laguna, Region III; Daet Camarines Sur, Region IV; Fabrica, Negros Occidental, Region V; Dumaquete City. Region VI; Pasonanca Park, Zamboanga del Sur, Region VII; Maco, Davao, Region VIII; Cagayan de Oro City, Region IV; and Tuñgao, Butuan City, Region X.

According to Quejado, scaling and lumber grading are among the important activities of the bureau. He said any error in scaling or lumber grading may result in the loss of revenue due the government, or allow the exportation of defective or undesirable logs and lumber which may prove detrimental to the whole lumber industry.

— Philippine Herald—May 17, 1967

## FORESTERS LOOK AHEAD

### Mass Producing Timber for Mass Needs

Rome, 28 March — The problems of matching national forest planting programmes to the dramatically growing need for wood for industry will take some of the world's leading foresters to Canberra, Australia, for a fortnight's conference next month (April 14-25).

The meeting, in the form of a symposium, has been arranged by the Food and Agriculture Organization against the background of the fact that by 1975 the world's industrial wood consumption will have increased by 50 percent in 15 years. It will then be running at 1,500 million cubic metres per year. Since many countries expect a shortage of wood from natural forests in the next 10 to 20 years, the main burden of supplies will fall on man made forests, and one of the questions the delegates will try to answer is how great their reserves are and what technical problems must be conquered to achieve the required production.

A tentative estimate is that this mass-production timber at present covers some 200 million acres, of which mainland China accounts for more than a third, with the USA and the USSR each having about an eighth. The conference will be told that the most rapid rate of increase will be required in the developing countries, principally of the tropics and sub-tropics. Australia, with her great range of climates and soils and experience in afforestation, thus provides an ideal avenue for the symposium. By means of study tours delegates will be able to see for themselves how some of the technical problems there have been tackled.

## FORESTRY BUREAU PATROLS HUNT TIMBER SMUGGLERS

*By* Guillermo Mamoyac

BAGUIO CITY, Oct. 15 — President Marcos has ordered acting Director of Forestry Antonio A. Quejado to stop the rampant timber smuggling in Eastern Mindanao, particularly in the provinces of Surigao and Agusan.

Que ado, who was with President's party in his recent Mindanao tour, visited the forestry headquarters here and met with District Forester Leonidas B. Rodriguez and other district personnel over the weekend.

### All facilities

The forestry head said that President Marcos has authorized the bureau of forestry to use all available facilities of the armed forces, including the patrol boats of the Philippine Navy, in its drive against timber smuggling in Eastern Mindanao.

In pursuance to the presidential directive on anti-smuggling of timber, Quejado said that he has organized special mobile forestry task force, which he will personally supervise in the field, with the assistance of top forestry officials, including Assistant Director Juan Utleg.

The forestry special task force will have a mobile base, using private planes of Mindanao timber operators, whose cooperation Quejado has enlisted in the prosecution of the anti-smuggling campaign.

### Syndicate

Quejado had admitted the existence of a timber smuggling syndicate in Eastern Mindanao, which has been the object of an investigation earlier by a special committee created by him. He expected the committee report to be submitted to him early this week.

The existence of the timber smuggling syndicate has been uncovered by Quejado in the course of his frequent inspection trips to Mindanao in line with the new policy of the bureau on special land uses.

### Released urged

Under the bureau's "zonification" program, the agency will release developed swamp lands and other areas for fishponds, bathing establishments, hotel sites and other special uses to enhance the administra tion's economic development program.

The release of these areas would enable the government to realize greater income in the form of forestry fees and rentals or the use of the areas for special purposes, Quejado said.

— Manila Times, Oct. 16, 1967

## FOREST INVASION BARED

BAYOMBONG, Nueva Vizcaya, Oct. 2 — A ranking bureau of forestry official here today revealed the destruction of some 200 hectares of choice forest in this province by 300 families of settlers from Benguet, Ifugao, and Kalinga-Apayao.

"Our forest rangers are helpless because the kaingineros are being protected by politicians," he said, requesting that his identity be withheld for the time being "for obvious reasons."

### Unforgivable

"I can understand the position of the politicians this being an election year but the denudation being caused by the kaingins is something unforgivable," the forestry official added.

He said the settlers mostly were those dislodged from the Ambuklao forest reserve project in Mountain Province as well as from the Benguet towns of Lagawe and Kiangan.

They have been migrating to Nueva Vizcaya over a six-month period.

### 6 towns

The forestry man said the forest reserves affected are within the jurisdictions of Quezon, Bayombong, Bagabag, Villaverde, Kasibu, Dupax and Aritao towns.

In Bagabag alone, more than a hundred families have settled down in clearings.

Forest reservations in barrios Kabua-an, Paitannao in Quezon town and barrios Kabua-an (Paitan and La Torre of this capital town are also hard hit.

In Barrio Ron-rono no smaller than 80 hectares of forest have been burned.

#### Personnel lack

New forest guards were hired this year but they are not enough to patrol the forest reserves of the six towns affected.

Cases have been filed against 64 Igorot settlers for violation of the forestry laws but they are still pending owing to the intervention of politicians.

"We are blamed for the floods by the politicians themselves and yet they are the ones hampering the forest protection campaign," the Hometown News source said.

### Determination

The forestry official, however, expressed his determination to continue filing cases against the kaingineros.

"We will perform our duty and let the evil consequences be on the conscience of the politicians," he said.

— Manila Times, 10-2-67

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## WOMEN AS SCALERS

BAGUIO CITY, Oct. 2 — Acting Director of Forestry Antonio A. Quejado has a novel idea of hiring women in extensive proportion for scalers in the forestry bureau.

Reason: women are more honest than men.

Honesty is of paramount consideration in the employment of scalers, because their work is income-producing, Quejado explained.

If the forestry scalers, who are predominantly men, would short-scale the timber measured by them in favor of the timber licensees, the government will stand to lose considerably in the form of forest charges.

Quejado said that this employment novelty has proven to be successful in some districts in the south, where women scalers have been utilized in measuring logs or timber cut under license by concessionaires.

Besides being honest, women scalers are generally prompt in the preparation of their reports. For, unlike men, who usually take to drinking after office hours, their women counterparts go home direct from the office, compute their scale figures in preparation of their reports the following day.

Also in line with the policy of opening other forestry activities to women, Quejado said that women employees of the Bureau of Forestry with an educational attainment of not lower than high school graduate may file their application for admission to the forest guard examination to be given on October 14, 1967, by the Civil Service Commission. — GEM

— Manila Times, 10-2-67

# College Notes

## SLIGHT DECREASE IN UPCF ENROLMENT NOTED

The enrolment of the College of Forestry slightly decreased to 571 as compared to last year's 597. This was disclosed by the Secretary's Office after the late registration.

Summary of the college enrolment runs as follows:

| | |
|---|---|
| New Freshmen (BSF) | 132 |
| " " (Ranger) | 47 |
| Old Freshmen (BSF) | 32 |
| " " (Ranger) | 61 |
| Sophomores (BSF) | 56 |
| " (Ranger) | 61 |
| Juniors | 61 |
| Seniors | 40 |
| Special Student | 1 |
| Graduate Students | 7 |
| Cross-Registrants | 67 |
| TOTAL | 571 |

## MACARANAS ELECTED FSBO PRESIDENT

Florencio Macaranas, the Forestry Leaves editor, and the standard bearer of the Student Party, won by a slim margin of 4 votes over his arch-rival for the FSBO presidency, Isaias Domingo of the Duty Above All Party, in an election held on Aug. 4, 1967.

Supported by the Zeta Beta Rho, Alpha Phi Omega, and Upsilon Sigma Phi, the Student Party garnered six seats insuring a simple majority in the FSBO council.

Meanwhile, the Duty Above All Party, solely propped by the Beta Sigma Fraternity, obtained three positions, while the Independent Party, spearheaded by the U.P. Varrons Ltd., grabbed two seats to round up the magic circle of 11 officers.

The elected officers with their party designation run as follows:

| | |
|---|---|
| *President* | Florencio Macaranas (SP) |
| *Vice-President* | Eddie Abugan (DAAP) |
| *Secretary* | Edgardo Aquino (DAAP) |
| *Treasurer* | Virgilio Ramos (SP) |
| *Auditor* | Alfredo Pascual (SP) |
| *Business Manager* | Eddie Principe (SP) |
| *P R O* | Vicky Tamolang (IP) |
| Ath. Mgr. | Mat Saagundo (IP) |
| *Sgt.-at-Arms* | Cenon Padolina (DAAP)<br>Prescillano Bongbonga (SP) |
| *College Councilor* | Carmelito Sagrado (SP) |

## DEAN LANTICAN INDUCTS PENSIONADO CLUB OFFICERS

Dean Domingo Lantican inducted into office the officers of the Pensionado Club in a party held Aug. 19, 1967, at the Forestry Pavilion at 7:00 in the evening.

The ten officers mostly composed of the "older set" are as follows:

| | |
|---|---|
| *President* | Apolinario Marquez Jr. |
| *Vice-President* | Eddie Abugan |
| *Secretary* | Victoria Tamolang |
| *Treasurer* | Wilfreda Solis |
| *Auditor* | Sofronio Andalis |
| *Business Manager* | Isaias Domingo |
| *P R O* | Alfonso Oriel |
| *Sgt.-at-Arms* | Juan Ablaza |
| *Rep. to SBO* | Tito Babiera |

Meanwhile, Mr. Allen Torrenueva, a fresh graduate from this college and instructor of Dendrology, was unanimously elected adviser of the group.

## SECRETARY'S OFFICE BARES LIST OF SCHOLARS

The Office of the College Secretary released the names of students who are enjoying various scholarship grants.

The following are the Reforestation Administration scholars:

Seniors:

1. Jeremias Canonizado
2. Florencio Macaranas

Junior: 1. Catalino Blanche

Sophomores:

1. Melanio Castro
2. Louis Laudencia
3. Antonio Oliva
4. Abraham Saguid

Freshmen:

1. Stella Villa Agcopra
2. Aida Baja
3. Florendo Barangan
4. Fe Celeste Bayta

5. Tito Cabasagan
6. Jose Giducos
7. Epimaco Pacunio
8. Roberto Rapera

The Bureau of Forestry scholars are the following:

Seniors:

1. Jose Arances
2. Mariano Machacon
3. Eduardo Principe
4. Ildefonso Solis
5. Celedonio Suetos

Juniors:

1. Jaime Molina
2. Carmelito Sagrado
3. Gregorio Tabuena
4. Rodolfo Toribio
5. Jacob Zabala

Sophomores:

1. Edgardo Aquino
2. Eufresina de Leon
3. Aurea Magbojos
4. Alfredo Pascual
5. Virgilio Ramos
6. Rene Ibalig
7. Alejandro Salinas
8. Victoria Tamolang
9. Gualberto Tortoza
10. Rolando Uy, Jr.

Freshmen:

1. Oswaldo Dira
2. Aristeo Fernando
3. Cosme Santiago
4. Ricardo Umali

Others who are enjoying private and government scholarships are the following:

1. Raul Quimbo .............. (PICOP)
2. Annuar Abdul Razak .. (Asia Foundation Scholarship)
3. Philip Toe .. (NEC-AID SCHOLARSHIP)

## UPCF CO-HOST FORESTRY SYMPOSIUM

About 96 delegates from government and private forestry agencies attended the symposium on forestry research held recently at the UP College of Forestry auditorium.

Jointly sponsored by the Bureau of Forestry and the UP College of Forestry, the two-day symposium was aimed at the following objectives:

1. To keep the forest researchers abreast of forest researches going on in both private and government sectors in the Philippines;
2. To effect better coordination of research work for more effectiveness and consequently to consider what researches to coordinate, integrate, or replicate, and to be given priority with reference to the present and coming needs of industry and forest conservation; and
3. To foster closer relationship, understanding, and communication among forest scientists.

The symposium featured 27 speakers who discussed various aspects of research on forestry.

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## GERMANS USE ANTS TO PROTECT WOODS

Conservation officials have deployed an army of 15,000.000 red ants in the woods outside Mannheim, in a new kind of campaign to protect West German forests against vermin

Prof. Karl Goesswald, the country's foremost authority on ants, has been appointed scientific adviser to a special agency formed to deal with forest conservation. As part of the campaign, huge colonies of ants are being shifted from areas where they are numerous to those where they are scarce.

The red wood ant, Formica Rufa to the scientists, is ideally suited for the task assigned it by Professor Goesswald. A single nest needs a daily catch of about 100,000 insects or larvae to subsist and, besides, its fecundity is such that new ant colonies can be bred quickly.

Vermin cause millions of dollars worth of damage to the German forests. Once the vermin have gained the upper hand, it is too late to put the antsto work. So Professor Goesswald believes that ants' nests should be settled every 165 feet or so throughout the country's wooded areas.

Someone has figured out that this would mean a total of 25,000,000 anthills to safeguard the country's timber, and a total cost of about $25,000,000 for the vast job of resettlement proposed by Professor Goesswald. He has not found anyone willing to contemplate putting up anything like this sum.

# Literary Attempts

## THE RANDOM TREE

*The random tree is the reverend spy*
*Burdening the eye,*
*Hardening the sigh,*
*The farthest faith is the occasional sky.*
*Nearer than near your loss to me;*
*question the sea*
*And the seldom tree-*
*What, in separation, unites you to me.*
*But random as sky sprung summerly,*
*Over the ghost of a tree*
*Doomed by the serious sea:*
*Lone picks the thought that I whisper tenderly.*
*Though of sky and this summer, random glee,*
*Combing the seashore secretly.*
*Lying 'neath the seawaves gentle, gently;*
*No uncertain tree shall unveil me to thee.*

— ROMEO SILVESTRE NAVARRO

## IT WAS SIX O'CLOCK ON THE RAILWAY

The sun had already set,
Shadows against the twilight
Appeared around, and
The town was massed up with
Receding voices.
The noisy jeepneys passed by, and
On the juke box raucously sang
While the teeners were still laughing —
As the Angelus bells rang.
Brakes of crying wheels
Grated my astonished ears
Suddenly! Screams of those capricious
Women burst into serene
Prayers
Alas! One jeepney tumbled down.

*By* RODRIGO Z. DE LA CRUZ

———o———

# IN LOVE WITH A TREE

*By* MARIANO T. MACHACON

They say that it is hard to forget someone particularly the one we dearly love. Lovers may die because of despair and frustration, and yet their love remains unchanged. When we are in love with someone, we tend to believe that we could no longer find someone like him. Perhaps this is a natural human feeling. But all that has been mentioned above is love between man and a woman. Not between a man and a tree.

But wait. As a human being, man is by nature a lover of green environment. It is an instinctive attitude for every individual to stare freely upon his surrounding. With this awareness, he has been engulfed with the wonders and mysteries of trees. However, man refuses to discover his own feeling and his inner self. Or is man not aware that he is really a lover of the forest? Perhaps we must yet discover our own love for our forests before we could stop their rapid denudation.

How many of us are aware of the fact that trees are the sources of medicine, food, clothing and shelter? A scientist, a naturalist and a forester perhaps. A layman may appreciate a tree when it is converted to firewood particularly when it gives heat to neutralize the cold month of December. A painter may admire trees because of its landscape. On the other hand, lovers love only the trees where they engrave their names and hearts in the park. In other words, we often associate our love of trees with its sentimental value. No wonder trees in the park, along the highways and in some rest and recreational center are more cherished. So much so that they suffer the slightest destruction from us and at the same time they nourish the greatest love and care. But how about those trees in the mountains? They always suffer the greatest destruction from man besides the numerous typhoons of mother earth. Perhaps these trees love us more than we love them. In a popular language of a forester, they protect us from floods, typhoons and storms. If we have to evaluate all these benefits, it is an unpardonable crime for man not to manage and love his forest resources.

In some instances, we may consider that a poet is the greatest lover of trees. It is in the words of countless poems that man has reflected his die hard love for a tree. Joyce Kilmer for example said that he shall never see a poem lovely as a tree.

So man loves trees for many valid reasons. To man, despite his rank as the greatest enemy of trees, he has still that unending love and obsession for the earth's natural cover. To us, trees are there with meaning and with so many wonders and mysteries of its own.

Among the rarest tree lover is the forester.

# Yuletide Memories Abroad

*By* JOSE B. BLANDO

When I moved to the Wittler Home, on 2212 E. Galer, in Seattle from the Sigma Kappa Sorority House where I had been working as a houseboy, earning fifteen dollars a month plus free board and room, little did I know that the series of incidents at Galer that were to follow, climaxing in an unforgettable Christmas, eleven months later would entirely change my impressions of life in the United States and my opinion of the American families in America.

Four years before, my first Christmas in Seattle was spent on the cold streets, looking for any job that could give me some hot food for a very hungry stomach. I just had a piece of stale bread which I shared with my companions in a dingy room in Seattle's Chinatown where we decided to hole in for the winter. Where Carias picked the bread, we did not bother to ask, nor did we care so long that it was something to fill our empty stomachs. Three days before, we got a job on the farm, at Mountview, several miles outside of Seattle, picking carrots, but the farmer, who happened to employ us, was a Scotch, and for our six to six work, out in the field, he paid us a dollar each, a day. He had told us that we would have "good grub" and a warm room. The good in the grub was the mashed "taters" and the warm room, a pile of straw near the stall where he kept his horses in an old barn. We felt that we were being exploited and so we quit. Some of our companions who wanted to put something over the old man filled the sacks of carrots with stones, earth, sticks and tops of carrots. Once in Seattle we had one hearty laugh wondering what the Old Farmer said when he opened the sacks in the barn, where he stored them.

It was bitterly cold that first Christmas morning out on the streets. Although there was no snow (the first time for years, old timers said) I kept blowing into my hands to keep them warm. There was a slight drizzle and my toes were getting numb. I kept wiggling them inside my shoes. I can still remember to this very day the two holes in the sole of my left shoe which I tried to cover with a piece of cardboard from a shoebox, but once out on the cold pavement, soon wore off and again the ice-cold water started seeping in. Despite the festive mood in the gaily decorated shop windows, in the throng of people with packages under their arms, the greeting of friends and laughter of children showing off their toys to one another, the city looked bleak and unfriendly.

And for one like me, a total stranger and a recent arrival, unacquainted with the ways of an American city, an indescribable feeling of nostalgia and sheer loneliness, bordering on despair, gripped my soul. And so I walked on and on to wear off my heartache.

I kept thinking of what I was going to do with my last dime. As I walked, I kept feeling its serrated edges just to make sure that it was still there. I wanted to hold on to it until I could get another job. But as I was passing by a hamburger stand (they were called "filling stations"), where coffee and doughnuts and sandwiches were served, I felt suddenly hungry and, without knowing it, I entered the shop where a tray of crisp and scrumptious doughnuts made me part with my dime. I gingerly held the paper bag that contained two doughnuts as I walked out of the shop. I debated with myself whether to go home and share the doughnuts with my companions or to eat them in the park by myself. I decided on the latter.

Except for a handful of hoboes, the park was deserted, and sitting on a bench, partly hidden by an old newspaper which I pretended to read, I had my christmas dinner. To make the taste last longer on my tongue, I nibbled at the doughnut, letting each nibble linger long in my mouth. Two doughnuts were not very much, but for me, at that time, it was the most delicious meal on Christmas.

Two other Christmases followed this unforgettable Christmas, and although I did not experience the same feelings of gnawing hunger and nostalgia, they were uneventful. When Christmas came around, the girls in the Sigma Kappa had already gone to their homes, and the sorority house was so quiet and lonely in the evening, that my companion, another Filipino boy, and I had to leave our room, in the basement, and eat our Christmas dinner in a Chinatown restaurant. Of course, the girls had not forgotten to give us a few Christmas packages before they left for home. These were the only reminders that Christmas had come and gone.

Four years later, already a senior at UW, I found a new home at Galer st. An uncle of mine who had been working here had decided to join his brother in Chicago. Not wishing to leave the Wittlers without any help, he went to the sorority house and begged me to take his place.

"Mrs. Wittler is all right," he said, "but you must be careful with Mr. Wittler. He has peptic ulcer and can be mean at times."

Once at Galer, I had to work hard to show the Wittlers that I was a better boy for Mrs. Wittler used to praise my uncle. Mr. Wittle as my uncle had warned me could be mean. In the evening when I served them supper, and he would ask for water, I would pour what I thought was ice cold enough from the refrigerator, but he would shout, "Jose, this is so hot, you can boil chicken in it."

### Boiling Inside

It was not the chicken but I that was boiling inside, but I managed to smile. Mrs. Wittler would come to my rescue by getting one of the bottles from the ice box herself and pour the water into Mr. Wittler's glass. But there were times when Mr. Wittler could be very "nice." In the evening after supper, he would ask me if I had any library assignment and when I told him that I had, he would drive me in the family car to the University Library.

On Saturdays, he would tell Mrs. Wittler to let me have my afternoon off so I could see the football game, of which, he knew, I was very fond. And the whole day Sunday, he would ask Mrs. Wittler to prepare a Sunday lunch box for me, and showing me a map of Seattle point to a park or place where I and my friend Mac could spend the day profitably, never failing to hand me two dollars for our fare and the movies in the evening.

Whenever they went out on Sunday outings, they took me along, and when I could not go with them, they brought home something for me. Then something came to pass to further endear me to them. Mr. and Mrs. Wittler, during the summer, had to go to New York on a very important business trip, on which his promotion depended, it seemed. While they were away, their two children, Jean, aged seven, and Muriel, two, had the measles.

Their grandmother, Mrs. Steffens, Mrs. Wittler's mother, who was left to take care of them became so frantic that she wanted me to wire the parents. I could not call in a doctor because they were Christian Scientists, and I refused to wire them for fear it would disturb them and send them scurrying home. I assured Mrs. Steffens that I would help her take care of the children.

For over ten days, we had to spend days and nights together, ministering to their needs. Upon Mr. and Mrs. Wittler's return, they had already completely recovered. When Mrs. Steffens was telling them how I took care of them, I noticed the gleam of gratitude in their eyes. From that time on, I felt that I had endeared myself to them.

On Christmas Eve, I experienced, for the first time, helping an American family dress a Christmas tree. I wondered at the deftness of Mrs. Wittler's fingers in converting a bare pine tree into the most beautiful Christmas tree I had ever seen, and when the lights were put on, I gasped in wonder.

The children had been told to go to bed early, otherwise Santa Claus would not come down the chimney and load their socks with gifts. Jean and Muriel did as they were bidden. And once assured that they were already asleep, Mr. and Mrs. Wittler began filling the socks with gifts.

### Letter For Santa

Suddenly I heard something coming down the stairs, and I warned Mr. Wittler. He immediately put out the lights, and the whole living room was enveloped in total darkness. He rushed out to meet the intruder. It was Jean who told her Daddy that she had forgotten to write something to Santy.

"All right," said the Father, "go to bed."

The letter read,

"Dear Santy,

I forget to ask you for a box of crayons. I need them for my coloring books.

Jean"

Mr. Wittler was nonplussed, and of all things, at that time of the night, Jean asking for Santy a box of crayons. Something flashed in his mind. "Why not write an answer?" he said smiling.

He wrote,

"Dear Jean,

I am sorry that I have run out of crayons. Here's a dollar with which to buy them.

A very merry, merry Christmas.

Santy"

This he placed in the sock, labeled "For Jean."

Knowing the temperament of Jean, I was afraid that the dollar would not please her and that, instead of shouting with joy at the sight of the dollar, she would be crying her heart out to beat the band.

Once Mr. and Mrs. Wittler had gone to bed. I put on my overcoat and went out into the streets. There on the moonlit snow-covered street, I remembered my first Christmas four years before. This time I felt very happy because I was going to play Santa Claus. I walked about half a mile to the nearest drugstore, which was already being closed when I reached it.

Christmas morning saw the whole family in the room. You should have seen the children hallelujah with joy. Then Mr. Wittler began distributing the gifts, starting with the children's. As he inserted his hand into the sack, he expected to find his letter. Instead he found a beautifully gift-wrapped box. Jean upon opening it jumped with joy.

Mr. Wittler scratched his head in disbelief. As he looked at me, and I looked back at him, he smiled understandingly.

"Merry Christmas!" he shouted.

"Merry Christmas!" we echoed.

As I sat with them, for the first time, at the dining table, no longer as a houseboy but as a member of the family, sharing with them the most delicious Christmas dinner I had ever tasted, I kept saying to myself, "Am I not the luckiest and happiest Filipino houseboy today?"


# FORESTRY LEAVES

*Organ of the Student Body and Alumni of the College of Forestry, College, Laguna*

# From the Mail Bag

Republic of hte Philippines
Deparmtent of Agriculture and Natural Resources
BUREAU OF FORESTRY
P. O. Box 2069, Manila
College, Laguna

Z—Publication October 31, 1967

The Editor
Forestry Leaves
College of Forestry
College, Laguna

S i r :

This is in connection with the letter dated October 6, 1967 of Mr. Ser E. Collado, Circulation Manager of the "Forestry Leaves". We would like to know your standing policies regarding the sending of complimentary copies of your publication. In previous years we had been receiving one or two complimentary copies of the Forestry Leaves for our Library; but since about three years ago, we had been missing copies of the said publication.

As the Forestry Leaves is one of the most used forestry references particularly by our visitors, we will appreciate it if you can furnish us regularly even one complimentary copy for our library.

Very truly yours,

ANTONIO A. QUEJADO
Acting Director of Forestry

* * *

UNIVERSITY OF THE PHILIPPINES
COLLEGE OF FORESTRY
COLLEGE, LAGUNA
DEPARTMENT OF FORESTRY EXTENSION

October 5, 1967

The Editor
Forestry Leaves
U.P. College of Forestry
College, Laguna

S i r :

The youth's contribution to the national welfare can not be underestimated. There had been manifestations of their efforts to help in nation-building. Forestry is one of the most neglected profession in the country simply because people are not interested in it. The move to include Forestry as one of the projects of 4-H Club is a laudable one, for then the people's interest in forestry is aroused while they are young.

May this article find space in your publication. This may attract the youth to join the 4-H Club and take Forestry for their project.

Very truly yours,

ABRAHAM B. VELASCO

* * *

## FORESTRY IN 4-H

By Abraham B. Velasco

February 19, 1964 was another milestone in the progress of forestry extension in the Philippines. It was on this date that the Agricultural Productivity Commission and the University of the Philippines College of Forestry joined efforts "to promote and develop 4-H Club work in the areas of forestry and forest resources conservation in the country".

The memorandum that binds the two state agencies in agreement which was signed by then APC Commissioner Eloy Baluyot and Vice President for Agricultural and Forestry Affairs Dioscoro Umali states the responsibilities of each agency as follows:

> For the Agricultural Productivity Commission "to conduct a program of 4-H Club forestry through the Rural Clubs Division in accordance with the procedures and organization already established for 4-H Club work; to develop and make available to youths of 4-H Club age projects in the practice of forestry techniques and in the principles of forest resources conservation; to direct 4-H Club personnel to encourage the formation of 4-H forestry clubs and participation in 4-H forestry projects; to produce and make available to 4-H Club leaders and members appropriate literature and materials for the support of 4-H forestry projects; and to schedule training in 4-H forestry club work for APC 4-H club personnel and local 4-H club leaders."
>
> For the U.P. College of Forestry "to develop proposals for 4-H Club projects in forestry techniques and forest resources conservation de-

signed to reach youths of 4-H Club age in school or out of school; to provide technical assistance for the development of 4-H forestry project manuals and supporting materials; to provide training in 4-H forestry club work for 4-H Club personnel and local forestry club leaders; to seek cooperation in the 4-H forestry club progam by other forestry agencies through the Joint Committee on Public Information and Education in Forestry and the General Forestry Committee; to furnish free tree seeds and seedlings for forestry projects when needed; and to supply technical assistance in the establishment and care of tree plantings, demonstration of forestry practices, and the conduct of tours, field days, and exhibits."

### WHY THE 4-H CLUB

It has long been a problem of forestry extension work to disseminate or preach the gospel of forest conservation to the masses—the grassroots. While it is true that articles on forestry appear in the newspapers and magazines and forestry news are aired over the radios from time to time, not a few segment of the country's populace, especially the rural folks, read or hear to them. They are still ignorant about forestry. Perhaps, they haven"t even heard the word "forestry" all their life. So, in an effort to reach the grassroots, the UP College of Forestry through the Department of Forestry Extension elected and sought to coordinate with an agency which has direct contact with the masses, and which has already established reputation and gained the people's support. The Agricultural Productivity Commission, formerly the Bureau of Agricultural Extension, was the "chosen" agency. The reason is obvious: the 4-H Club of the Philippines operates under the APC's Rural Clubs Division and it has numerous in-school and out-of-school youth members with ages ranging from 10 to 20 all over the country.

The 4-H Club, since its organization in the Philippines, has not included forestry as a project of its members. Agriculture, home industries, domestic animal-raising projects have been in the list of 4-H Club projects all the past years. Yet, unlike the 4-H Clubs in some parts of the United States which engage in such projects as tree farming, the 4-H Club of the Philippines had not explored the field of forestry as possible project for its members. Furthermore, one cannot disregard the services that the youth can render to their community. The youth are the enlightened, idealistic and enthusiastic members of the society. They want to distinguish themselves by way of initiating worthwhile projects in their community. As such, they are always on the search for avenues through which they can channel their energies and in the process feed their inquisitive minds with additional knowledge. They join the 4-H Club and other youth organizations and they, under the direction and guidance of their leaders, embark on laudable projects and strive to seek new ones. Forestry, being a new field for them was, therefore, readily accepted into the fold of 4-H Club projects.

### THE 4-H FORESTRY TRAININGS

This year marks the implementation of what has been agreed upon by the AFC and the UPCF some three years ago. Since Forestry is a new project to the 4-H Club, a need for an in-service training of rural clubs agents of the APC all over the country is in order. These rural clubs agents are the Provincial Rural Youth Officers (PRYO's), Rural Youth Officers (RYO's), and the Land Reform 4-H Team Supervisors, in areas where land reform is being implemented. They are the persons who are directly responsible for the organization of 4-H Clubs and therefore are concerned with the implementation of the forestry projects. Their cooperation and support must be gained.

There are nine regional offices of the Agricultural Productivity Commission with 60 provincial rural youth officers and about 430 rural youth officers as of June, 1967. Considering the large number of rural clubs agents, the training was proposed to be held on the regional level. The PRYO's and RYO's should be trained first after which it would then be incumbent upon the PRYO's to train their subordinates—the RYO's who had not attended the training. The RYO's who attended the training would then impart the knowledge they have acquired to the volunteer adult leaders and 4-H club members whom they have recruited.

### THE FORESTRY PROJECTS

There are five different forestry projects, namely, Tree Appreciation, Tree Identification, Wood Collection, Christmas Tree Growing, and Firewood Production. These projects are described in two 4-H forestry manuals—"Let's Know our Trees and Woods" and "Tree Planting For You"—prepared by Mr. Felix M. Eslava Jr., staff member of the Department of Forestry Extension.

The first three projects are designed for Junior 4-H club members from 10 to 15 years of age. The last two projects are for Senior 4-H club members whose ages range from 16 to 20. According to Mr. Eslava, the general purposes of the forestry projects are: 11) to promote the appreciation of trees and forests; 2)) to teach through demonstrations the importance of trees and forests to agriculture and industry; 3) to educate the youth on the necessity and importance of forest conservation; 4) to furnish profitable employment and to teach 4-H club members to make money from trees; and 5) to promote closer relationship among 4-H Club members for effective citizenship.

The Tree Appreciation project introduces the junior club members to the various characteristics of the tree's leaves, flowers, and fruits, and the use of these characteristics in tree identification. Tree Identification project involves learning the names of trees and appreciating the uses of their wood, hence, the third project, Wood Collection which is devoted to learning the distinctive physical properties and characteristics of the wood species and affords the club members the opportunity to work with wood.

For the senior club members, the Christmas Tree Growing and Firewood Production Projects offer a profitable business. Christmas trees, usually Benguet pines, are greatly demanded in the market during the Yuletide season. Firewood, on the other hand, is an everyday necessity in the homes. By undertaking these projects, the enterprising club members would actually be reaping money from their trees.

How to undertake the Forestry projects is the main lesson taken during the 4-H Forestry trainings. Demonstrations, field trips, and practicum work are scheduled to supplement the lectures and have the trainees feel the thrill of "learning by doing'" which, incidentally, is the Club's slogan.

Four regions of the Agricultural Productivity Commission so far have received formal trainings in 4-H Forestry. The first training was conducted for Region III and was held at Olongapo Reforestation Project, Olongapo City, on July 24-29, 1967. It was attended by provincial rural youth officers, rural youth officers, and land reform 4-H team supervisors from the land reform districts of Pampanga. The second training was held for Region IV at Ligñon Hill, Legazpi City from August 22 to 25; the third training was held for Region I at Vigan Ilocos Sur from August 28 to September 1. The fourth training was held for Region VII at Osmeña Reforestation Project, Camp 7, Minglanilla, Cebu from September 6 to 9. Only the rural clubs agents of the province of Cebu, however, attended the training. Each of the other five APC regions is expected to have its training also.

The training staff is composed of regional officials of the Agricultural Productivity Commission, instructors and professors from the U.P. College of Forestry led by Prof. Napoleon T. Vergara, Chairman of the Department of Forestry Extension. Field officials of the Reforestation Administration and the Bureau of Forestry are likewise invited as resource speakers during the trainings.

Forestry is now a part of the 4-H Club projects in the country. The crusade for forest conservation involving the youth, who may in turn influence their folks, has been launched.

We hope to see the Philippines green again!

* * *

December 4, 1967

Dear Prof. Blando,

We are thanking you for the Forestry Leaves that you are donating to the FPRI library.

Rest assured that this kind gesture of yours will go a long way. It will greatly help both our technical men and the students in their research activities on forestry and allied fields.

Sincerely,

(Mrs.) FELISA R. MORENO
*Librarian*

* * *

———o———

"If you want my opinion on the mystery of life," says a character in Peter DeVries' *Let Me Count the Ways*, "here it is in a nutshell. The universe is like a safe to which there is a combination — but the combination is locked up in the safe."

— Published by Little, Brown

# Sunshine Corner

## PRESENCE OF MIND

Well, said the young husband as he bit into some pastry his bride had baked, "I must say these are fine biscuits."

Later the bride's mother stopped him in the hall and asked in a whisper, "Goodness, John, how could you say that those were fine biscuits?"

"But I didn't say they were fine," he pointed out. "I merely said I must say so."

° ° °

## ABARMECIDE FEAST

A woman I know went to a diet specialist in Hollywood who was famous for her near-miraculous results. "I've heard so much about you," she said to the specialist, "that now I'm prepared to place myself completely in your hands. Only tell me this, Doctor. What is the secret of your success?" The doctor smiled pleasantly. "Eat whatever you want," he explained. "Only don't swallow it."

° ° °

## DISTRACTION & ATTRACTION

Conductor Sir Thomas Beecham prefers to get along without women musicians in his orchestra. When he was asked to consider a woman harpist, he refused.

"But she's an excellent musician," a colleague protested.

"It would never work out," said Beecham. "If she is pretty, the men would be distracted. And if she isn't, it would distract me."

° ° °

## WRONG PLACE

A fluttery little lady approached the manager of a pet shop and said, "I have a pair of canaries — one female and one male, but how can I tell which is which?"

"Well," said the manager, "why don't you put a pair of worms in the cage? The male bird invariably picks the female worm and vice versa."

"But how on earth will I know which is the female and which is the male worm?"

"Madam," said the man coldly. "This is a bird shop. I suggest you take that question to a worm shop!"

° ° °

## TELL IT TO A WOMAN

One woman to another: "I won't go into all the details. In fact, I've already told you more about it than I heard myself."

° ° °

## ILLEGAL ADVICE

*Lawyer*: "Well, your appeal was denied but I intend to carry your case to the highest court of the land."

*Convict*: "What do you think of my chances?"

*Lawyer*: "Well, I'll do my best, but meanwhile, I suggest that you try to escape."

° ° °

## MERRY WIDOW

In a Remote section of the country an elderly native died. Word of his passing reached the country seat. The coroner, a tall, strapping young fellow, got into his car and drove out to the deceased home.

"Did Sam Williams live here?" he asked the weeping young widow who opened the door.

"Yes," replied the woman between sobs.

"Well," said the coroner, "I've come for the remains."

The woman's crying died down as she slowly sized up the handsome young fellow standing in the doorway. "Well," she explained, "I am the remains, but you'll have to wait until I pack my clothes."

° ° °

When interviewing a new prospect, an insurance man used this effective introduction:

"I'm just an ignorant fellow," the salesman would begin. "I don't know much about insurance, but I'm interested in your children and how they're going to get along in later years." Then he would proceed to wade into an enthusiastic and high powered sales talk.

On one occasion, he was interrupted by an old farmer who remarked:

"You say you don't know much, brother, but I declare you sure do seem to believe in what little you do know!"

° ° °

## BUSINESS BLACKMAIL

As a last resort the store sent a final dunning note to a delinquent customer stating: "If you don't pay your bill, we'll tell all your other creditors you did."

° ° °

# THE IMAGE WE LIVE FOR

*When we were children, we dreamt of becoming men. Strong, honest, courageous and kind — knights in shining armor. When we grew a little older we wanted to become a soldier, a doctor, a teacher, an engineer, a scientist, a priest and a lawyer.*

*When were children we never thought of becoming a forester. When we were a little older, we never dreamt of being a forester. Why, we didn't even know the profession existed. Or if we did, it didn't seem worthy of being aspired for.*

*Now we are men and have added some knowledge to our fragile brain. Perhaps we came to know about things worth living for and worth aspiring for or even worth dying for. Perhaps we cannot live, aspire or much more. die for the forestry profession, but at least we can do so for the principles that make it breath, survive and withstand the onslaught of the inevitable forces.*

*Or are its principles not worth their salt? How else can we live with a profession whose principles we don't really believe in? We may really, but do we? Do we act the way we believe? If we don't, then it's useless believing the way we do.*

*The forestry profession is still very much unknown especially in the urban and metropolitan areas. And where there is lack of ignorance, there seems to be an utter disregard for it. even to the point of being scoffed at.*

*Why?*

*Is it because the work is rooted in the wilderness where only the primitive civilizations exist? Or is it because the work is too easy and so only those low people should engage in it? The presence of synthetic foresters is another case in point. One does not need a degree to practice the profession. Forestry can be easily learned by experience they say. A degree is important only in the desire for promotions, in the struggle for a higher salary. Is it?*

*Maybe. Afterall, the fact is that congress has never passed the bill professionalizing the practice of forestry. We wonder why. Somebody's pulling a leg somewhere. And the proposed forestry commission has yet to see the light of dawn. Foresters have always been united no doubt, but who leads who?*

*In the field of wood science and tech nology, where are our foresters? In the wood-using industries, one could hardly find a forester in demand — at the veneer and plywood plant, at the wood preservation plant, at the sawmill plant, at the dry kilns, the pulp and paper plants, the furniture factories and wood-utilization processors. Maybe we should leave the study of wood to other than foresters. Should we?*

*Our forestry education is presently inadequate at the moment. But as more and more students come to realize the promise that is in the profession, somehow we can get better results soon. The new five-year curriculum in forestry might be an improvement.*

*Meanwhile our recruitment teams in the College of Forestry are encountering difficulties. There is still that negative attitude towards the profession. Perhaps our foresters in the field have not projected enough image for admiration.*

*Time is running out on our forests. —fm*

# RATIONALE OF A FORESTRY DEPARTMENT IN A CONCESSIONAIRE'S ORGANIZATION

*Notwithstanding the requirements of the Government, a forestry department is a necessity now of the concessionaire, in order to give more attention to the vital* element of raw material — wood on which such business depends. *For the stability and longevity of a wood business, it must engage in and inject into its system raw material production and protection.*

*While the Bureau of Forestry has the inherent responsibility in wood material production, the company, not only for the privilege it enjoys, but also as a part of the community, has an obligation to do its part in making the patrimony of the Nation render maximum and continuing benefits to the people.*

*The reorganization it will entail may, it is hoped, result also in a more efficient administration of the business.*

— *Martin Reyes*

# TIMBER INDUSTRY'S DOLLAR EARNING POTENTIAL

*Unknown to most people, especially our economists and officialdom is the timber industry's potential to double its present dollar earnings. In* 1966, *it was the No.* 2 *dollar earning industry of the country. Dollar receipts for this year were:* (1) US$280,-000,000 *for coconut products,* (2) US$229,557,000 *for logs and processed wood products, and* (3) US$123,690,000 *for sugar. This industry together with the coconut and sugar industries composed the "Big Three", so to say, among the dollar earning industries of the country. However, to our mind, the coconut and sugar industries have almost reached the ceilings of their developments. Their additional dollar earning potentials do not look as good as the timber industry.*

*Per latest Bureau of Forestry figures, the* Commercial Forested Area *of the Philippines is* 11,750,000 *hectares, with a total merchantable timber stand of* 1,031,000,000 *cubic meters* (55 *centimeters and over in diameter). The* Annual Allowable Cut Capacity *of the production forest for sawtimber only (with very conservative* 40% *safety factor) could be* 15,000,000 *cubic meters. The* Actual Timber Cut *in* 1966 *was* 7,400,000 *cubic meters and the corresponding dollar earning for this year from exportation of logs, lumber, veneer, plywood and other processed wood products was* $229,557,000. *The actual cut of* 7,400,000 *cubic meters is about one-half* (1/2) *of the potential annual allowable cut of* 15,000,000 *cubic meters. If the actual cut therefore, will equal the potential annual allowable cut, it is logical to expect that the timber industry's dollar earnings will double from* $229,557,000 *to* $459,114,000. *The latter figure is* $55,424,000 *more than the* $403,690,000 *combined* 1966 *dollar earnings of the coconut and sugar industries.*

*It is to be mentioned that out of* 191 *timber licensees as of October,* 1967 *(after the consolidation of small timber licensees to minimum size of* 20,000 *hectares) there are no more than* 20 *timber licensees in the country with well-organized logging operations and processing plants. If the timber industry will be fully up-graded, it is not only the dollar earnings that will improve but also other economic benefits such as increased and stabilized employment, increased taxes and fees paid to the government, etc.*

*The government, therefore, should start adopting the necessary measures that will improve this industry by creating the right climate that will hasten its healthy growth and development.*

— *Artemio Cosico*

Republic of the Philippines
Department of Public Works and Communications
BUREAU OF POSTS
Manila

## SWORN STATEMENT
(Required by Act 2580)

The undersigned, FLORENCIO MACARANAS, editor of FORESTRY LEAVES (title of publication), published quarterly (frequency of issue), in English (language in which printed), at College, Laguna (office of publication), after having been duly sworn in accordance with law, hereby submits the following statement of ownership, management, circulation, etc. which is required by Act 2580, as amended by Commonwealth Act No. 201.

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1. Sent to paid subscribers ..............................................
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Total ..............................................

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1. Sent to paid subscribers ........................................ 520
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LORENZO AGALOOS
Business Manager
(Title of designation)

SUBSCRIBED AND SWORN to before me this 29th day of September, 1967, at Los Baños, Laguna, the affiant exhibiting his Residence Certificate No. A-5000663 issued at Los Baños, Laguna, on February 2, 1967.

GENARO V. CATALAN
*Mayor, Los Baños, Laguna*
(Officer Administering Oath)

NOTE: THIS FORM IS EXEMPT FROM THE PAYMENT OF DOCUMENTARY STAMP TAX. ACT 2580 REQUIRES THAT THIS SWORN STATEMENT BE FILLED WITH THE BUREAU OF POSTS ON APRIL 1 AND OCTOBER 1 OF EACH YEAR.

# ERRATA

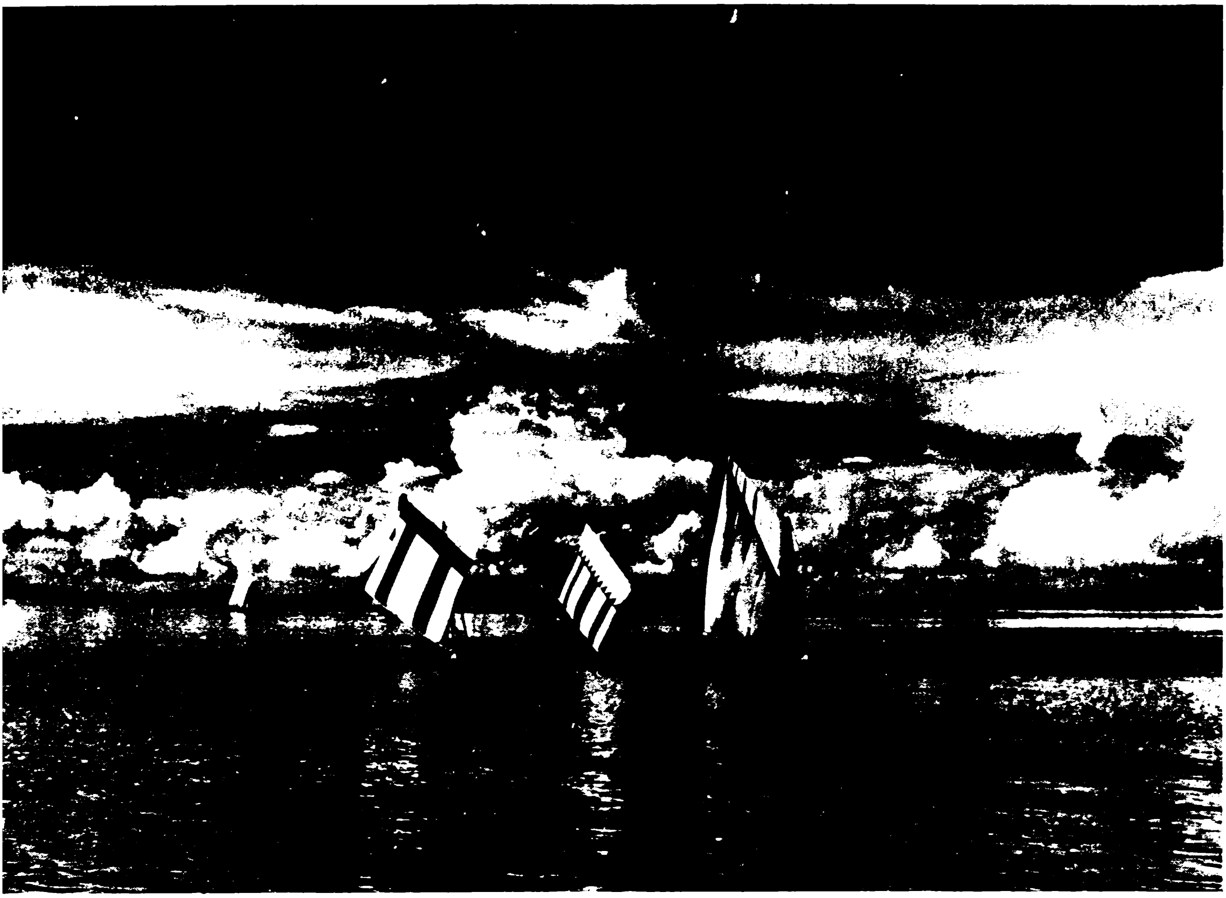
The title "Traditional and New Uses of Philippine Woods" by Manuel Monsalud should read "Pulping and Papermaking Characteristics of Some Philippine Fast Growing Wood Species."

"A Note on the Taxonomy and Biology of Benguet Pine Aphid-Eulachnus Thumbergii Wilson" should be "A Note on the Taxonomy and Biology of Benguet Pine Aphid-(Eulachnus thumbergii) Wil.

Below the name of the Author, Bienvenido Postrado, "Plant Pathologist" should read "Plant Entomologist, II."

On page 76 under the *Damage* topic, in the 4th sentence the word "needless" should be "needles" and in the sixth sentence from the bottom under the *Description* topic, *four* should be "fore".

The Correct Volume and Number of this issue should be VOL. XVIII, Nos. 1 & 2 instead of VOL. XIII.



*"Be glad of life because it gives you the chance to live and to work and to play and to look up at the stars; to be satisfied with your possessions but not content with yourself until you have made the best of them; to despise nothing in the world except falsehood and meanness, and to fear nothing except cowardice; to be governed by your admirations rather than by your disgusts; to covet nothing that is your neighbor's except kindness of heart and gentleness of manner; to think seldom of your enemies, often of your friends, and every day of Christ; and to spend as much time as you can with body and spirit in God's out-of-doors these are little guidepaths to peace."*

Henry Van Dyke