

WHITE LAUAN AND WHITE SERAYA

1. — NAMES

1.1. — WHITE LAUAN — WHITE SERAYA

— *Commercial names* : WHITE LAUAN and WHITE SERAYA (1) (A.T.I.B.T. code, Great Britain, France).

WEISSES LAUAN, WEISSES SERAYA (West Germany),
LIGHT RED PHILIPPINES, « MAHOGANY » BAGTIKAN (USA).

— *Botanical names* : Parashorea malaanonan Merr. (= Parashorea plicata Brandis), Parashorea macrophylla Wyatt-Smith ex. Ashton and Parashorea tomentella Meier, Shorea contorta Vidal (= Pentacme contorta Merr. and Rolfe and Pentacme mindanensis (Foxw.). DIPTEROCARPACEAE family.

REMARKS :

1) Shorea almon Foxw (ALMON) is sometimes also considered as WHITE LAUAN. The same holds true for Shorea ovalis Bl. and Shorea parvifolia Dyer.

2) Shorea pauciflora King, called TIAONG in the Philippines and usually considered as RED MERANTI, is classified as WHITE LAUAN, in some cases.

3) MAYAPIS (Shorea palosapis Merr.), when pale, can be commercialized as WHITE LAUAN (See « Commercial list of SHOREA and PARASHOREA »).

— *Local names* : WHITE SERAYA, URAT MATA (Sabah), URAT MATA (Sarawak), WHITE LAUAN, BAGTIKAN, LAUAN MALAANONAN, MINDANAO WHITE LAUAN (Philippines), WHITE MERANTI, PENDAN (Kalimantan, Indonesia).

REMARK :

In Indonesia, WHITE MERANTIS usually include, besides Parashorea of WHITE SERAYA type, SHOREA of Anthoshorea and Richetia sub-genera.

(1) WHITE LAUAN is generally used for timber from the Philippines and WHITE SERAYA for timber from Malaysia (Sabah and Sarawak).

1.2. — HEAVY WHITE SERAYA

All these woods correspond to the *Parashorea* genus and differ from WHITE SERAYA mainly by their higher density : 640-800 vs 400-655 kg/m³ (See commercial list of SHOREA and PARASHOREA).

- Commercial names : HEAVY WHITE SERAYA (A.T.I.B.T. list and all countries).
- Botanical names : *Parashorea parvifolia* Wyatt-Smith ex. Ashton, *Parashorea smythiesii* Wyatt-Smith, *Parashorea densiflora* Sloot and Sym., *Parashorea lucida* (Miq.) Kurz, *Parashorea stellata* Kurz.
- Local names : = GERUTU (Malaysian peninsula),
HEAVY WHITE SERAYA, URAT MATA BATU (Sabah),
URAT MATA BUKIT (Sarawak), KHAI KHEO (Thailand).

2. — HABITAT AND ORIGIN

WHITE LAUAN corresponding to *Shorea contorta* (former *Penctame contorta* and *P. mindanensis*) only occurs in the Philippines ; it has a very wide distribution in primary forests, in plains and hills at an altitude as high as 700 m, in association with *Dipterocarpus* (APITONG) and *Shorea* (LAUAN).

Parashorea malaanonan also occurs widely in the Philippines in the parts of the isles where the dry season is not marked, in deep or semi-deep soil, from sea level up to an altitude of 500 m.

This species also occurs widely in the island of Borneo (Sabah, Sarawak, East Kalimantan) in forests subject to periodic flooding or on rocky soil.

Parashorea macrophylla occurs only in the island of Borneo, especially in Brunei, near rivers and creeks.

Parashorea tomentella is a tall tree, less common than *P. malaanonan*. It is found in Borneo and Indonesia, in the *Dipterocarpaceae* forests below 200 m.

HEAVY WHITE SERAYA has a greater distribution : *Parashorea stellata* is found from Western Burma — even in India (under the name of THINKADU) to Indochina (Viet Nam, Cambodia, Laos), in Thailand and the Malaysian peninsula. The generally tall trees are abundant in *Dipterocarpaceae* forests at low or moderate altitude, up to 650 m.

Parashorea parvifolia preferably grows on well-drained hills or tops, but is also found at low altitude, in scattered or small groups, in the island of Borneo only.

Parashorea smythiesii, locally abundant in Sabah and Sarawak, is found near rivers and creeks at moderate altitude up to 700 m.

Parashorea lucida corresponds to tall trees in the *Dipterocarpaceae* forests of Sumatra and Borneo, at low altitude only — up to 70 m — whereas *Parashorea densiflora*, also present in Sumatra (Indonesia) is frequent in the southern Malaysian peninsula up to 500 m above sea level.

3. — LOG CHARACTERISTICS

WHITE LAUAN - WHITE SERAYA logs are generally straight and well-formed. The bark is thick, grey or almost black, with longitudinal splits.

The ends of the logs are greyish or brownish grey. The slightly paler sapwood is rather well defined, 2 to 4 cm thick on average.

The log dimensions are always relatively important : 60 to 150 cm in diameter, 8 to 10 m long on average, although the commercial log is about 18 to 25 m long. The wood density at green state averages from 650 to 1,000 kg/m³.

WHITE LAUAN - WHITE SERAYA are damaged by dark-colored pin-holes borers (Platypodae family) on standing trees or during a prolonged stay in forest (Lobang pusing) with pin-hole borer damage extending into the heartwood especially on large logs.

HEAVY WHITE SERAYA logs have a rather similar aspect : similar well-formed trunk, large dimensions (80 to 130 cm in diameter, 10 to 12 m long), with similar longitudinal splits on the grey or almost black bark.

The ends of the logs are a rather yellowish brown, fairly dark with rather wide (6 to 8 cm) paler, often blue-stained sapwood.

The density of HEAVY WHITE SERAYA at green state is higher than that of WHITE LAUAN : from 800 to 1,100 kg/m³ on average.

HEAVY WHITE SERAYA logs are generally less damaged (less dark-colored pin-holes), but in large diameter logs damage may extend to heartwood.

4. — ASPECT OF WOOD

WHITE LAUAN - WHITE SERAYA heartwood is yellowish white or rosy white that darkens with light and appears pale brown. The whitish or slightly yellowish sapwood, difficult to distinguish from the heartwood, is not very thick (2 to 4 cm).

HEAVY WHITE SERAYA heartwood is darker, pale golden brown that darkens with light to a dark brown, whereas the pale yellow sapwood, which can be distinguished from the heartwood, is rather wide (6 to 8 cm).

The texture of both woods is fairly coarse and the grain is rarely straight. In WHITE LAUAN, there often is an interlocked grain that gives a broad ribbon stripe (1.5 to 2 cm) when quarter sawn, which is not found in HEAVY WHITE SERAYA.

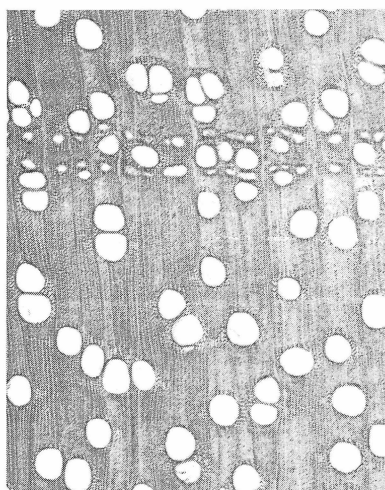
On WHITE LAUAN, the silver figure is quite visible when quarter cut because of its darker, slightly purplish color. White streaks (ring white resin canals) can be seen especially at the end. Their frequency varies.

5. — WOOD STRUCTURE

Pores are scattered, isolated or radially joined in 2 or 3, very big (200 to 250 μ on average) and not numerous (3 to 5 per mm²). The diameter of the intervascular perforations is about 7 .

Parenchyma is associated to pores in a thin sheath with often two short side extensions. Cells are nearly always laid in storeys. Constant presence of crystals, in long chains in Parashorea genus.

Rays, that number 4 or 5 per mm, are 4 to 6 cell wide ; they have a heterogeneous structure. Radiovascular pits have a similar or sometimes bigger size than



Transversal cut, $\times 14$.

intervascular pits. There are crystals in variable quantity.

Fibers are 400 to 1,800 μ long, 24 to 28 μ wide, and their flexibility ratio is generally between 45 and 65.

Ring white resin canals can be seen easily. Their frequency varies.

Among off-white wood of Dipterocarpaceae family, WHITE LAUAN broadly-speaking differ from WHITE and YELLOW MERANTI and YELLOW LAUAN by the lack of radial canals (except for *Parashorea smythiesii* species) or silicious corpuscles in ray cells.

6. — PHYSICAL AND MECHANICAL CHARACTERISTICS

The physical and mechanical characteristics of WHITE LAUAN - WHITE SERAYA were determined on *Shorea contorta* (6 trees) and *Parashorea malaanonan* (4 trees) from the Philippines. The trials were carried out according to French AFNOR standards.

There are unfortunately few data on HEAVY WHITE SERAYA, they all come from foreign laboratories, and especially from Forest Research Institute of Kepong (Malaysia) : the trials were carried out mainly on *Parashorea lucida* (LEE et al., 1974) according to the American ASTM-D 143-52 standard, but also on *Parashorea densiflora* and *Parashorea globosa* (DESCH, 1941).

— Physical characteristics

The mean data for WHITE LAUAN - WHITE SERAYA are given in table I. The wood is light-weight or moderately heavy, with moderate density : 587 kg/m^3 , *Shorea contorta* being the lightest.

Total volumetric shrinkage, with a 15 % mean value, can be characterized as moderate to high. The volumetric shrinkage ratio, which indicates volume variation for a 1 % variation of moisture content, is 0.52 % ; so WHITE LAUAN has a « medium movement » on the whole, *Parashorea malaanonan* seemed to have the « largest movement ».

Total Tangential and Radial shrinkage are moderate ($T = 9\%$ and $R = 4.7\%$). T/R ratio, whose mean value is under 2, indicates that distortion risk during wood drying is not high.

As for HEAVY WHITE SERAYA, the trials carried out on *Parashorea lucida*, *P. densiflora*, and *P. globosa* gave the following results :

Species	Number of trees	Density at 15 % M.C. (kg/m^3)
<i>P. densiflora</i>	3	769
<i>P. globosa</i>	2	673
<i>P. lucida</i>	8	689
HEAVY WHITE SERAYA		710 (moderately heavy)

TABLE 1

PHYSICAL CHARACTERISTICS OF WHITE LAUAN (Shorea contorta + Parashorea malaanonan)
(CV = coefficient of variation)

Species	Density at 12 % humidity (kg/m ³)	Hardness Chalais-Meudon scale	Shrinkage				
			Total volumetric B %	Volumetric ratio v %	Total Tangential T %	Total Radial R %	Ratio T/R
SHOREA CONTORTA (n = G)	545 (CV = 10 %)	2.0 (CV = 17 %)	14.5 % (CV = 11 %)	0.49 % (CV = 8 %)	8.8 % (CV = 9 %)	4.7 % (CV = 18 %)	2.0 (CV = 13 %)
	Light	Soft	Moderate	Medium	Moderate	Moderate	Normal
PARASHOREA MALAANONAN (n = 4)	650 (CV = 8 %)	2.9 (CV = 18 %)	16.1 % (CV = 10 %)	0.57 % (CV = 7 %)	9.5 % (CV = 9 %)	4.8 % (CV = 15 %)	2.0 (CV = 5 %)
	Moderately heavy	Soft	High	Large mvt	Moderate	Moderate	Normal
WHITE LAUAN	587 (CV = 13 %)	2.4 (CV = 25 %)	15.1 % (CV = 12 %)	0.52 % (CV = 11 %)	9.1 % (CV = 17 %)	4.7 % (CV = 17 %)	2.0 (CV = 11 %)
	Light	Soft	High	Medium mvt	Moderate	Moderate	Normal

Total tangential shrinkage of HEAVY WHITE SERAYA, whose mean value is 10 %, is higher than that of WHITE LAUAN, but radial shrinkage is the same. T/R ratio is thus slightly higher, about 2.3, which indicates distortion risk during wood drying.

— Mechanical characteristics

The results of the tests on WHITE LAUAN - WHITE SERAYA are given in table 2.

Compression strength and bending strength are moderate, but if density is taken into consideration, WHITE LAUAN has a higher static bending ratio ($C/100 D = 8.5$) and a moderate bending ratio ($F/100 D = 19.9$).

Last, shock resistance is good, the dynamic bending ratio ($K/D2 = 1.5$) corresponds to a resilient wood.

The available values for HEAVY WHITE SERAYA are those for Parashorea lucida (Malaysian peninsula).

Compression strength is higher than that of WHITE LAUAN - WHITE SERAYA : its mean value averages 70 N/mm² (high resistance) at 12 % moisture content.

As for bending strength, HEAVY WHITE SERAYA is clearly more resistant than WHITE LAUAN ($F. 12 = 184$ N/mm²) on average = high resistance).

TABLE 2

MAIN MECHANICAL CHARACTERISTICS OF WHITE LAUAN
(Shorea contorta + Parashorea malaanonan) (CV = coefficient of variation)

	Compression strength (N/mm ²)	Bending strength (N/mm ²)	Modulus of elasticity MOE (N/mm ²)	Resilience K/O2
SHOREA CONTORTA (n = 6)	46.2 (CV = 10 %)	108.3 (CV = 8 %)	94.00 (CV = 11 %) (n = 5)	1.5 (CV = 23 %)
PARASHOREA MALAANONAN (n = 4)	52.8 (CV = 5 %)	124.4 (CV = 10 %)	10.000 (CV = 16 %)	1.5 (CV = 24 %)
WHITE LAUAN	48.8 (CV = 11 %)	114.8 (CV = 11 %)	97.00 (CV = 14 %)	1.5 (CV = 24 %)
	Moderate	Moderate	Poor	Resilient

7. — CHEMICAL CHARACTERISTICS

The sample of WHITE LAUAN - WHITE SERAYA studied was Parashorea malaanonan from East Kalimantan (Indonesia).

The wood was virtually non-silicious (0.006 %), but had a significant ash ratio (1.5 %). The water and solvent extractable products were low (2.2 %). Lignin ratio was moderate for tropical hardwoods (30 %).

The determinations of pentosane percentage were 15.2 % on P. malaanonan from the Philippines, and 14.2 % on Shorea contorta (MENIADO et al., 1974).

8. — DURABILITY AND PRESERVATION

At freshly felled state, *WHITE LAUAN* - *WHITE SERAYA* and *HEAVY WHITE SERAYA* sapwood may be damaged, e.g. with dark-colored pin-hole borers (occurring especially on logs after felling) or with blue staining. The damages are more or less frequent and severe according to the season ; the need for temporary protection against insect and fungus should be assessed especially in respect of time between felling and processing, i.e. highly recommended in case of long periods, unnecessary if the latter are short, and during the dry season where insect attacks are much less frequent.

WHITE LAUAN logs, and to a lesser extent those of *HEAVY WHITE SERAYA*, are frequently damaged by underbark attacks of *Cerambycidae* (*Lobang pusing*), but whose importance is relatively minor. Attacks due to *Bostrychus*, commonly called « powder post attack », occur either in logs, or sawn timber, but are strictly limited to sapwood.

Besides, *WHITE LAUAN* and *HEAVY SERAYA*, except sapwood, are not vulnerable to *Lyctus* attacks.

The resistance to termites of these species is low. The same holds true for resistance to decay.

As these species are rather difficult to treat chemically because of poor impregnability, especially *HEAVY WHITE SERAYA*, they should be used for indoor purposes only, for which the risk of biological degrade is insignificant, under the condition, however, that sapwood parts are treated against *Lyctus*.

Resistance to borers and other marine borers is nearly nil.

9. — MACHINING

Because of its low hardness and negligible silica content, *WHITE LAUAN* can be sawn easily. As it is harder, *HEAVY WHITE SERAYA* is slightly more difficult to saw than *WHITE LAUAN*, but because of its negligible silica content, it causes no blunting of tools.

At resawing, there may be risks of tearing fibers out while cutting up *WHITE LAUAN*. During edging, *WHITE LAUAN* tends to give a fibrous woolly surface, especially if the edges are not kept sharp. Resawing *HEAVY WHITE SERAYA* presents the same adverse effects, but the latter are less important.

WHITE LAUAN - *WHITE SERAYA* may be difficult to plane on sections, with some risks of tearing up which can be avoided if cutting angles are reduced to 20°. This problem is not encountered with *HEAVY WHITE SERAYA* if the teeth are always sharp.

Boring and drilling can be easily performed with *HEAVY WHITE SERAYA* as well as with *WHITE LAUAN*.

WHITE LAUAN presents no specific problems at rotary peeling after steaming at 85°. *HEAVY WHITE SERAYA* does not usually peel, because of its higher density and hardness.

10. — DRYING

HEAVY WHITE SERAYA dries slowly, with risk of distortion and splits.

WHITE LAUAN - *WHITE SERAYA* dries more rapidly but with risk of cupping.

The Centre Technique Forestier Tropical did not carry out any experimental drying tests on these two species ; however the drying tables suggested by LEE et al. (1974) shown in Table 3 and FARMER (1972) in Table 4 can be mentioned.

TABLE 3

DRYING TABLE SUGGESTED FOR HEAVY WHITE SERAYA
(board thickness = 25 mm). For thicknesses between 38 to 75 mm,
relative humidity should be increased by 5 % at each stage

Moisture content of wood (%)	Temperature dry bulb (°C)	Temperature wet bulb (°C)	Relative Humidity of the air (%)
Green	40.5	38	85
60	40.5	37	80
40	43.5	39	75
35	43.5	38	70
30	46	39.5	65
25	51.5	43	60
20	60	47.5	50
15	65.6	45	40

TABLE 4

DRYING TABLE SUGGESTED FOR WHITE LAUAN — WHITE SERAYA
(board thickness = 25 mm). For thickness between 38 to 75 mm,
relative humidity should be increased by 5 % at each stage

Moisture content of wood (%)	Temperature dry bulb (°C)	Temperature wet bulb (°C)	Relative Humidity of the air (%)
Green	48.5	44	75
60	48.5	43	70
40	51.5	43	60
30	54.5	43	50
25	60	46	45
20	65	51	40
15	76.5	58	40

11. — JOINTING AND FINISHING

Traditional jointing with nails and screws can be performed without any difficulty, for HEAVY WHITE SERAYA and WHITE LAUAN as well; nails are held well.

No problem was mentioned for gluing for either of these species.

As for finishing, HEAVY WHITE SERAYA paints and varnishes well. The grain of WHITE LAUAN - WHITE SERAYA should be filled first.

12. — PAPER CHARACTERISTICS

The sample studied by the C.T.F.T. (1976) came from Indonesia (East Kalimantan). It was *Parashorea malaanonan*.

As this sample was limited, the following results are given for indication only.

With Kraft standard cooking process (Total alkali = 22 %, Bearing = 1.30 h at 170 °C), the following results were obtained :

Net yield (%)	:	47.5
Total yield (%)	:	47.7

Screenings on dry wood (%)	: 0.15
Remaining soda (g/l)	: 5.2
MnO ₄ K number	: 16.4
Unbleached pulp photovolt	: 30.5

As for paper characteristics (at 40° SR) of unbleached pulp, here are the results :

Breaking length	: 8 700 m
Bursting	: 55 *
Tearing	: 95 **
Folding d.	: 240
Porosity	: 2.8
Bulk	: 1.3
Stretching (%)	: 3.7
Jokro beating time	: 21 minutes.

The sample could thus be said to have satisfactory paper characteristics on the whole, as for its pulp yield as well as its paper quality.

The sample was classified among suitable hardwoods for paper pulpwood.

It should be noted however that chemical pulp only was studied. It might have been interesting to know the capacity for high yield from this species.

Besides, no test was performed on HEAVY WHITE SERAYA by the Centre Technique Forestier Tropical.

(*) Old standard. For new standard : divide by 10.

(**) Old standard. For new standard : multiply by 10.

13. — UTILIZATION

WHITE LAUAN - WHITE SERAYA is famous in Europe for its use in veneering (for plywood) and in interior joinery.

It is also used for furnishing and chipboard making.

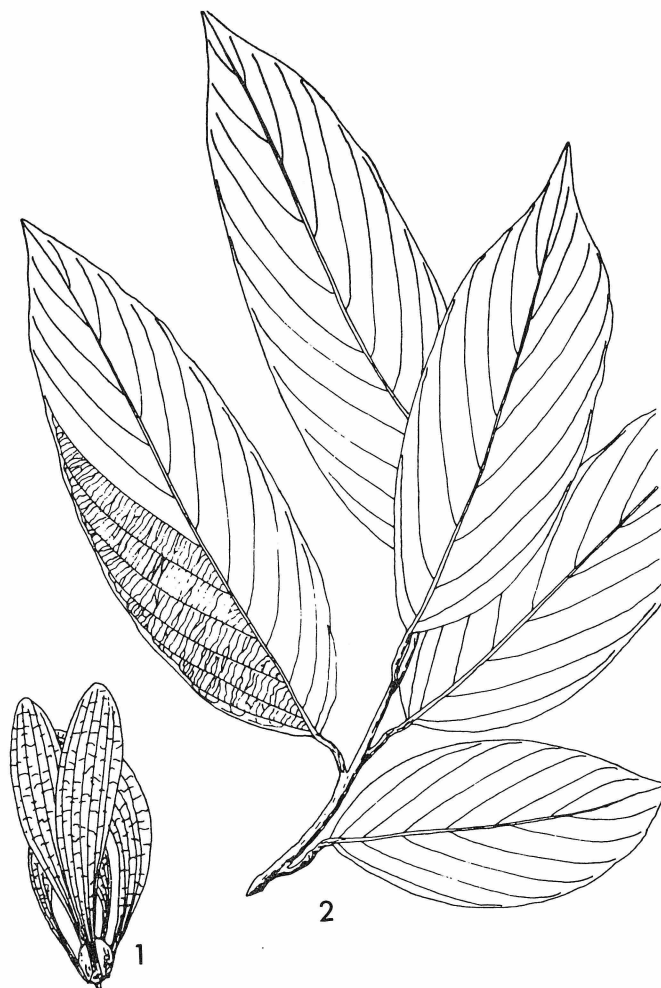
HEAVY WHITE SERAYA, because of its mechanical properties, is mainly considered as building wood, especially in South East Asia. It is also used in joinery for interior decoration and general purpose flooring.

14. — TREE CHARACTERISTICS

Parashorea malaanonan, the most frequent and widespread species, yields first-growth trees which can be over 40 m high with up to 2 m in diameter. The stem is straight, cylindric, sometimes over 20 m long with up to 4 m buttresses. The gray, almost black bark has longitudinal splits, horizontal cracks, i.e. with a rather characteristic criss-cross pattern. Deposits of pale yellow resin frequently occur near buttresses. The yellowish or pinky brown inner bark progressively turns into yellow near the cambium. The leaves, whose shape and size (8-12 × 5-6 cm on average) vary, are single, alternate, glabrous, sometimes slightly whitish on the inner side.

The secondary veins, which are from 8 to 13 pairs, are connected between each other via a network of parallel veinlets. The fruit is a fairly spheric seed, of about 2 cm in diameter, surrounded with 5 wings (the sepals which grew a lot), with 2 of them being shorter and narrower.

Parashorea lucida, which forms the most abundant species of HEAVY WHITE SERAYA in the Malaysian peninsula, also yields very tall trees, 20 to



WHITE LAUAN (*Parashorea malaanonan* Merr.)

1. — Fruit $\times 1/2$; 2. — Leaves $\times 1/2$.

40 m tall with 1 to 2 m in diameter. The stem is straight, well formed ; it can reach 20-25 m and is vested at the stump with high buttresses often covered with characteristic lenticels. The bark of a dark, nearly black color is also thick, with some longitudinal splits.

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