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COMMON TIMBER SPECIES IN LOGGED-OVER FORESTS OF PENINSULAR MALAYSIA

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OVERVIEW

A secondary forest is one that has regrown naturally after a significant disturbance until the effects of the disturbance are no longer obvious. The disturbance (or disturbances) can be caused by both human interference such as logging activities and natural occurrences such as fire and landslides. In accordance with the sustainable forest management system, saplings of selected commercial timbers are commonly planted on disturbed sites following logging activities (Figure 1). The planting, unlike that of plantation forest, is neither conducted in systematic procedures nor programmed with specific silvicultural works. Although the restoration process of the forest is not completely natural, once these sites have developed into woodlands, they too are considered secondary forests. Secondary forests are also known as second-rotation forests, second-growth forests, or logged-over forests (Mohd-Jamil & Amir 2022).

A timber tree can be defined as any species of tree that can grow to a considerable size and is valued as a source of timber material. In tracts of secondary forests, the species composition of timber trees is different from the primary stands. Under sustainable forest management, tree species in logged-over forests mainly consist of protected trees, mother trees, leftover trees, planted trees, and pioneer trees (Sheikh Ibrahim 2006). In general, the species composition of logged-over forests has been altered favouring higher dominance of unpopular timbers. These timbers are sometimes referred to as secondary timber species (Antwi-Boasiako & Boadu 2016).

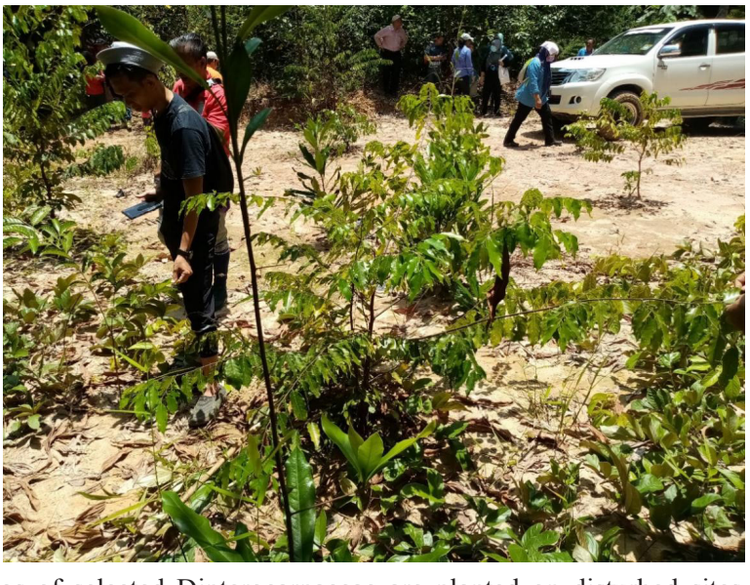

Figure 1 Saplings of selected Dipterocarpaceae are planted on disturbed sites following logging activities

PROBLEM STATEMENT

At present, have we properly identified the common timber species available in logged-over forests across the Peninsular? And if we do recognise them, what are their inferential numbers? For example, the timber trees of *Alstonia* spp. (locally known as pulai) grow abundantly on roadsides and open spaces. Many consider that a similar occurrence can be found within the logged-over forests (Lim et al. 1999, Sharmiza & Latifah 2019). However, the real statistic of the species is actually unclear. Other than that, some naturalised timber species such as *Acacia* spp. and *Leucaena leucocephala* are commonly developed at the forest edges, along tracks, and on open spaces. But can we certainly determine the number of trees of these species in logged-over forests?

However, in any technical assessment relating to timber groups, it is scientifically more favourable to separate these foreign species from the natives. For instance, from the forestry perspective, it is essential to distinguish the invasive timber species in order to evaluate tree colonisation and subjugation in forest growth. Similarly, the evaluation of tree health and pathological issues is closely related to the occurrence of introduced species, hence it is imperative to determine which are exotic plants and which are not. The discussion henceforth emphasises timber trees of the native species that are commonly found in secondary forests.

METHOD OF ANALYSIS

Providentially, upstream research has generated important data regarding the stocking and species composition of logged-over forests. The outputs are invaluable information that could ensure accurate discussion among experts and practitioners, and could properly steer the way forward for the national timber industry. Important information on common tree species in the secondary forests of Peninsular Malaysia was extracted from journals and cross-checked with the current timber data. The scientific information was then interpreted and presented herein, to link the upstream forestry findings with timber properties and applications. The data are based on four selected areas of production forests, namely Tekam Forest Reserve in Pahang, Cherul Forest Reserve in Terengganu (Samsudin et al. 2010), Ulu Muda Forest Reserve in Kedah (Mardan et al. 2013), and Piah Forest Reserve in Perak (Ramli et al. 2022). Below are the results of the analysis of the common timber species in logged-over forests that were statistically found to be more than 5 trees per hectare. Major references for the timber properties include MTIB (2009), Lee et al. (1993) Wong (2002). The list is indexed based on botanical names with respective standard/common Malaysian names (capital letters in brackets), as well as information on the properties of the timber.

INDEX OF COMMON TIMBER SPECIES IN LOGGED-OVER FORESTS

► *Aglaia* sect. *Aglaia* (PASAK)

A. elliptica (4 trees per ha)
A. hiernii (8 trees per ha)
A. tomentosa (3 trees per ha)

Vernacular name	Memberas
Tree	Small to medium-sized or sometimes large trees up to 40 (-50) m tall and 160(-200) cm in diameter.

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Timber colour	The sapwood is pale yellow-brown, light straw-coloured or light pink-brown and is moderately to sharply differentiated from the heartwood, which is light red, orange-red or red-brown and becomes dark red-brown or walnut-brown on exposure.
Timber classification	-
Density (air-dry)	770–995 kg m^{-3}
Modulus of rupture	-
Modulus of elasticity	-
Janka hardness	-
Durability	Moderately durable to durable when in contact with the ground or when exposed to the weather. The heartwood is very difficult to treat with preservatives.
Strength Group	-
Uses/potential uses	The timber is suitable for furniture, flooring, cabinet, turnery, decorative wall panelling, face-veneer for plywood. The heavier woods have been used for general construction such as beams, joists, rafters, boat building, agriculture implements and tool handles.

► *Aglaia* sect. *Amoora* (BEKAK)

A. forbesii (19 trees per ha)
A. rubiginosa (4 trees per ha)

Vernacular name	Kedondong kijau, merelang, pasak lingga
Tree	Small to medium-sized or sometimes large trees up to 40(-50) m tall and 160(-200) cm in diameter.
Timber colour	The sapwood is straw-coloured and sharply differentiated from the heartwood, which is brick-red or dark red and becomes dark red-brown or walnut-brown on exposure.
Timber classification	Medium hardwood
Density (air-dry)	705–1025 kg m^{-3}
Modulus of rupture (air-dry)	117 N mm^{-2} (based on *A. rubiginosa*)
Modulus of elasticity (air-dry)	16800 N mm^{-2} (based on *A. rubiginosa*)
Janka hardness (air-dry)	8410 N (based on *A. rubiginosa*)
Durability	Moderately durable.
Strength Group	SG 3
Uses/potential uses	The timber is suitable for light to medium construction, boat decking and planking, heavy duty flooring, parquet flooring. When treated, the timber is suitable for power line posts.

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► Annonaceae (MEMPISANG)

Monocarpia marginalis (23 trees per ha)
Polyalthia cauliflora (32 trees per ha)
Polyalthia cinnamomea (8 trees per ha)
Annonaceae (6–11 trees per ha)

Vernacular name	Antoi, jangkang, mangitan, manitan, mengkedi, mengkudang, meribut daun besar, pepisang bukit, pisang-pisang, terbak
Tree	Only some genera can grow to timber size, others are either shrubs or small trees.
Timber colour	The sapwood is normally not differentiated from the heartwood, which is light yellow-white or light yellow-brown, often with a green tinge.
Timber classification	Light hardwood
Density (air-dry)	370–975 kg m^{-3}
Modulus of rupture (air-dry)	85 N mm^{-2} (based on *Monocarpia marginalis*)
Modulus of elasticity (air-dry)	13800 N mm^{-2} (based on *Monocarpia marginalis*)
Janka hardness (air-dry)	4230 N (based on *Monocarpia marginalis*)
Durability	Non-durable under exposed conditions but very amenable to preservative treatment.
Strength Group	SG 5
Uses/potential uses	The timber is suitable for general light construction, sliced veneers, match boxes and splints, packing cases and crates. The heavier species can be used for parquet and strip flooring, tool handles and wooden mathematical instruments.

► *Aporosa* spp. (KAYU MASAM)

A. aurea (13 trees per ha)
A. benthamiana (1 tree per ha)
A. blume (3 trees per ha)

Vernacular name	Kaun semasak, sebasah, tebasah
Tree	Small to medium-sized trees up to 30(-50) m tall and 60 cm in diameter.
Timber colour	The sapwood is not differentiated from the heartwood, which is light yellow-brown, yellow-brown or brown with orange or purple-red tinge.
Timber classification	-
Density (air-dry)	570–890 kg m^{-3}
Modulus of rupture	-
Modulus of elasticity	-

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Janka hardness	-
Durability	Expected to be moderately durable.
Strength Group	-
Uses/potential uses	The timber has been used for rafters, household implements, tool handles, flooring and furniture.

► ***Archidendron* spp.**

A. contortum (1 tree per ha)
A. ellipticum (21 trees per ha)
A. splendens (15 trees per ha)

Vernacular name	Gardas, geduak, genuak, giring antan, jering, kerdas, keredas, kungkur
Tree	Shrubs or small to medium-sized or rarely fairly large trees up to 30(-42) m tall and 90(-150) cm in diameter.
Timber colour	The sapwood is white, greyish white, pale yellow or pale brown and is sharply differentiated from the heartwood, which is white with a pinkish tinge, yellowish or pale red-brown, darkening to deep brown with age. The timber is naturally lustrous.
Timber classification	Light hardwood
Density (air-dry)	350–860 kg m^{-3}
Modulus of rupture	-
Modulus of elasticity	-
Janka hardness	-
Durability	-
Strength Group	-
Uses/potential uses	The timber is use for light construction, interior joinery, furniture and cabinet work, fencing, household utensils and knife handles.

► ***Artocarpus* spp. (KELEDANG)**

A. integer (10 trees per ha)

Vernacular name	Bangkong, bangkung, cempedak, cempedak hutan
Tree	Small to fairly large trees up to 40(-60) m tall and 150 cm in diameter. Many of the species are cultivated for their edible fruits.
Timber colour	The sapwood is light yellow to yellow-brown, sharply defined from the heartwood, which is brown or orange-brown and turns to dark brown on exposure.
Timber classification	Medium hardwood

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Density (air-dry)	500–945 kg m^{-3}
Modulus of rupture (air-dry)	107 N mm-2 (based on *A. lanceifolius*)
Modulus of elasticity (air-dry)	15500 N mm-2 (based on *A. lanceifolius*)
Janka hardness (air-dry)	5960 N (based on *A. lanceifolius*)
Durability	Moderately durable (*A. integer* and *A. lanceifolius*) to non-durable, and the heartwood is difficult to treat.
Strength Group	SG 5
Uses/potential uses	The timber is highly prized as a high-class coffin timber. The timber is also suitable for flooring, parquet flooring, medium construction, furniture and panelling.

► *Baccaurea* spp. (TAMPOI)

B. griffithii (6 trees per ha)

Vernacular name	Asam pohong, asam tambun, jintek bukit, jintek-jintek, larah, mesekam, rambai hutan, tampoi kera
Tree	Small to medium-sized trees up to 30(-40) m tall and 70 cm in diameter.
Timber colour	The sapwood is not differentiated from the heartwood, which is light yellow-brown and darkening to brown with a purple-red or orange-yellow tinge.
Timber classification	Medium hardwood
Density (air-dry)	630–950 kg m^{-3}
Modulus of rupture	-
Modulus of elasticity	-
Janka hardness	-
Durability	Reputed to be durable and can be treated with preservatives.
Strength Group	-
Uses/potential uses	The timber is suitable for medium construction under cover, posts, beams, joists, rafters, furniture and plywood.

► Burseraceae (KEDONDONG)

Canarium littorale (10 trees per ha)
Dacryodes rubiginosa (8 trees per ha)
Santiria laevigata (6-8 trees per ha)
Santiria rubiginosa (1 tree per ha)
Santiria tomentosa (4 trees per ha)

Vernacular name	Kerantai, kerat telunjuk, senggeh
Tree	Medium-sized to large trees up to 35(-60) m tall and 120(-200) cm in diameter.

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Timber colour	The heartwood varied in colour from light yellow in *Canarium apertum* to yellow-green-brown in *Santiria griffithii* and *S. rubiginosa* to the common light red-brown and deep red-brown of the other species. The sapwood is usually lighter in colour and is not well defined from the heartwood. However, in *Santiria griffithi* and *S. rubiginosa*, the sapwood is well defined.
Timber classification	Light hardwood
Density (air-dry)	495–980 kg m^{-3}
Modulus of rupture (air-dry)	81 N mm^{-2} (based on *Santiria laevigata*)
Modulus of elasticity (air-dry)	12100 N mm^{-2} (based on *Santiria laevigata*)
Janka hardness (air-dry)	4450 N (based on *Santiria laevigata*)
Durability	Non-durable. The sapwood is amenable to preservative treatment but the heartwood is very difficult to treat.
Strength Group	SG 5
Uses/potential uses	The timber is suitable as a general utility timber for planking, cladding, plywood, particleboard, flooring, furniture, packing cases and pallets.

► *Diospyros* spp. (KAYU MALAM)

D. areolata (3 trees per ha)
D. buxifolia (4 trees per ha)
D. scortechinii (6 trees per ha)

Vernacular name	Buey, kayu arang, kumoi, kumoi bukit, meribut, sianggus, tuba buah
Tree	Small to large trees up to 40(-50) m tall and 70(-85) cm in diameter.
Timber colour	The sapwood is generally yellowish white to buff and not distinct from the heartwood. Some species produce a streaky core while some others produce a jet black core.
Timber classification	Medium hardwood
Density (air-dry)	595–1055 kg m^{-3}
Modulus of rupture	-
Modulus of elasticity	-
Janka hardness	-
Durability	The lighter coloured material is non-durable, while the darker material is expected to be durable.
Strength Group	-
Uses/potential uses	The darker streaked corewood is highly prized as a superior cabinet wood, suitable for high class decorative furniture, sliced veneers, panelling and other interior finishing. The lighter coloured material is suitable for furniture manufacture, plywood manufacture, pallets and other general utility purposes.

► *Dipterocarpus* spp. (KERUING)

D. kunstleri (6 trees per ha)

Vernacular name	Keruing gombang merah
Tree	Medium-sized to very large trees up to 65 m tall and 150(-260) cm in diameter.
Timber colour	The sapwood is lighter in colour than the heartwood and is invariably with a tinge of grey. The heartwood is red-brown to purple-red and darkens on exposure.
Timber classification	Medium hardwood
Density (air-dry)	690–945 kg m^{-3}
Modulus of rupture (green)	65 N mm^{-2} (based on *D. kunstleri*)
Modulus of elasticity (green)	14500 N mm^{-2} (based on *D. kunstleri*)
Janka hardness (green)	3030 N (based on *D. kunstleri*)
Durability	Moderately durable (depending on the species) to non-durable under exposed conditions in the tropics but very easily treated with preservatives.
Strength Group	SG 5
Uses/potential uses	The timber is suitable for heavy construction, posts, beams, joists, rafters, truck body construction, container flooring and when treated, suitable for railway sleepers, harbour works, bridges, power line and telegraph poles.

► *Elaeocarpus* spp. (SENGKURAT)

E. griffithii (6 trees per ha)
E. petiolatus (6 trees per ha)

Vernacular name	Medang kelawar, mendong, sanga burong
Tree	Small to large trees up to 40(-50) m tall and 80(-160) cm in diameter.
Timber colour	The sapwood is not differentiated from the heartwood, which is light yellowish white to pink-brown and mauve in *E.floribundus*.
Timber classification	-
Density (air-dry)	465–785 kg m^{-3}
Modulus of rupture (air-dry)	61 N mm^{-2} (based on *E. sphaericus*)
Modulus of elasticity (air-dry)	10300 N mm^{-2} (based on *E. sphaericus*)
Janka hardness (air-dry)	2670 N (based on *E. sphaericus*)
Durability	Non-durable and difficult to treat with preservatives.
Strength Group	SG 6
Uses/potential uses	The timber is suitable for general planking purposes, shuttering, boxes, crates, pallets, match splints, veneers and plywood manufacture.

► *Elateriospermum tapos* (PERAH)

Elateriospermum tapos (3–41 trees per ha)

Vernacular name	Perah ikan
Tree	A monotypic genus of medium-sized to large trees up to 30(-39) m tall and 60 cm in diameter.
Timber colour	The sapwood is light yellow-brown and sharply defined from the heartwood, which is dark brown with a red tinge and streaked alternately with lighter and darker stripes.
Timber classification	Medium hardwood
Density (air-dry)	735–1235 kg m^{-3}
Modulus of rupture	-
Modulus of elasticity	-
Janka hardness (green)	7290 N
Durability	Non-durable and susceptible to termite and powder-post beetle attacks.
Strength Group	SG 3
Uses/potential uses	The timber is suitable for medium and heavy construction indoors. Treated timber should be suitable for all heavy construction, railway sleepers, parquet flooring and fence posts.

► *Endospermum* spp. (SESENDUK)

Endospermum diadenum (8 trees per ha)

Vernacular name	Bebaru bukit, inchong perlis, membulan, sendok-sendok, sesundo
Tree	Medium-sized to large trees up to 40(-50) m tall 80(-150) m in diameter.
Timber colour	The sapwood is not differentiated from the heartwood, which is bright yellow when fresh, often with a green tinge and darkens to light brown on exposure.
Timber classification	Light hardwood
Density (air-dry)	305–655 kg m^{-3}
Modulus of rupture (green)	39 N mm^{-2} (based on *E. diadenum*)
Modulus of elasticity (green)	8500 N mm^{-2} (based on *E. diadenum*)
Janka hardness (green)	1560 N (based on *E. diadenum*)
Durability	Non-durable but extremely easy to treat with preservatives.
Strength Group	SG 7
Uses/potential uses	The timber is a popular species for the manufacture of match splints and boxes. The timber is also suitable for pattern making, manufacture of drawing boards, trays, plywood, crates, toys and wooden clogs. It is also used for the manufacture of disposable chopsticks.

► *Gonystylus* spp. (RAMIN)

Gonystylus affinis (10 trees per ha)
Gonystylus confusus (1 tree per ha)

Vernacular name	Dara elok, melawis, pinang baik, pinang muda
Tree	Small to medium-sized trees up to 42 m tall and 60(-120) cm in diameter.
Timber colour	The sapwood is lighter in colour and poorly defined from the heartwood, which is white to creamy yellow.
Timber classification	Light hardwood
Density (air-dry)	530–785 kg m^{-3}
Modulus of rupture (air-dry)	88 N mm^{-2} (based on *G. bancanus*)
Modulus of elasticity (air-dry)	15900 N mm^{-2} (based on *G. bancanus*)
Janka hardness (air-dry)	4580 N (based on *G. bancanus*)
Durability	Non-durable but easily treated with preservatives.
Strength Group	SG 5
Uses/potential uses	The timber has established a reputation as a first class joinery timber. The timber is suitable for furniture manufacture, panelling, flooring, stringers and stair threads, wooden mathematical instruments, drawing boards, toys, turnery and rotary peeled plywood.

► *Gordonia* spp. (SAMAK)

G. taipingensis (6 trees per ha)

Vernacular name	Kelat samak, samak pulut
Tree	Small to medium-sized or rarely large trees up to 30(-50) m tall and 70(-130) cm in diameter.
Timber colour	The sapwood is poorly defined from the heartwood, which is brown, red-brown or purple-red-brown.
Timber classification	-
Density (air-dry)	705–815 kg m^{-3}
Modulus of rupture (air-dry)	87 N mm^{-2} (based on *Adinandra dumosa*)
Modulus of elasticity (air-dry)	12300 N mm^{-2} (based on *Adinandra dumosa*)
Janka hardness (air-dry)	3650 N (based on *Adinandra dumosa*)
Durability	Non-durable and the heartwood is easy to impregnate with preservatives.
Strength Group	-
Uses/potential uses	The timber is suitable for flooring, panelling, door and window frames, planking, plywood manufacture, wooden pallets and charcoal manufacture.

► Lauraceae (MEDANG)

Cinnamomum rhyncophyllum (1 tree per ha)
Cryptocarya tomentosa (1 tree per ha)
Dehaasia pauciflora (2 trees per ha)
Litsea curtisii (5 trees per ha)
Litsea myristicaefolia (5 trees per ha)
Lauraceae (9–16 trees per ha)

Vernacular name	Kayu manis, teja
Tree	Shrubs or small to large trees up to 50 m tall and 125 cm in diameter.
Timber colour	The sapwood ranges from light straw to light yellow-green and is not distinct in some species but moderately sharply defined from the heartwood in the other species. The heartwood is variable in colour, the majority being light olive-brown to dark green-brown, while some *Cryptocarya* spp. and *Phoebe* spp. are light red-brown and some *Cinnamomum* spp. are pink to light red. *Beilschmiedia* spp. are yellow-white and *Actinodaphne* spp. are light yellow-green to dark olive-green.
Timber classification	Light hardwood
Density (air-dry)	350–880 kg m^{-3}
Modulus of rupture (air-dry)	64 N mm^{-2} (based on *Litsea firma*)
Modulus of elasticity (air-dry)	10100 N mm^{-2} (based on *Litsea firma*)
Janka hardness (air-dry)	2310 N (based on *Litsea firma*)
Durability	Non-durable and subject to fungal attacks. Some species are immune to termite attacks. The heartwood is difficult to treat.
Strength Group	SG 6
Uses/potential uses	The timber is suitable for decorative works such as interior finishing, panelling, furniture, cabinet making and plywood manufacture. The heavier species are suitable for medium construction under cover.

► *Lithocarpus* spp. (MEMPENING)

L. kunstleri (7 trees per ha)
L. lucidus (3 trees per ha)
L. maingayi (2 trees per ha)
Lithocarpus spp. (7 trees per ha)

Vernacular name	Empenit, galak tua
Tree	Medium-sized to fairly large trees up to 45(-52) m tall and 100(-150) cm in diameter.

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Timber colour	The sapwood is not always clearly defined but usually lighter in colour than the heartwood, which varies between yellow-brown and red-brown, sometimes quite dark red.
Timber classification	Medium hardwood
Density (air-dry)	575–1010 kg m^{-3}
Modulus of rupture (air-dry)	115 N mm^{-2} (based on *Quercus lamponga*)
Modulus of elasticity (air-dry)	19400 N mm^{-2} (based on *Quercus lamponga*)
Janka hardness (air-dry)	7830 N (based on *Quercus lamponga*)
Durability	Moderately durable under exposed conditions.
Strength Group	SG 4
Uses/potential uses	The timber is suitable for heavy and medium construction if protected from termite attacks. If seasoned properly, the timber is suitable for interior finishing, panelling and parquets flooring. It is also suitable for furniture manufacture and decorative veneers.

► *Macaranga* spp. (MAHANG)

M. gigantea (10–23 trees per ha)
M. hosei (33 trees per ha)
M. hypoleuca (7–20 trees per ha)
M. recurvata (6 trees per ha)
M. triloba (4 trees per ha)
Macaranga. spp. (7 trees per ha)

Vernacular name	Kubin, mesepat
Tree	Small to medium-sized trees up to 30(-40) m tall and 50(-70) cm in diameter.
Timber colour	The sapwood is not differentiated from the heartwood, which is light yellow-brown, occasionally with a pink tinge.
Timber classification	Light hardwood
Density (air-dry)	270–495 kg m^{-3}
Modulus of rupture (air-dry)	42 N mm^{-2} (based on *M. hosei*)
Modulus of elasticity (air-dry)	4940 N mm^{-2} (based on *M. hosei*)
Janka hardness (air-dry)	1380 N (based on *M. hosei*)
Durability	Reputed to be non-durable.
Strength Group	-
Uses/potential uses	The timber is suitable for the manufacture of match splints, pulp and paper, particleboard, cement-bonded board and production of plywood. Peeled mahang poles are frequently used for temporary construction and especially for parts of native houses not in contact with the ground. The timber is used for light framing, interior or trim, moulding and packing cases. It has been a favourite timber for wooden shoes.

► *Mallotus* spp. (BALIK ANGIN)

M. griffithianus (27 trees per ha)
M. kingii (19 trees per ha)
M. oblongifolius (3 trees per ha)

Vernacular name	Balek angin bopeng, perupok, serapoh
Tree	Small to medium-sized trees up to 25(-35) m tall and 50(-80) cm in diameter.
Timber colour	Sapwood is straw-coloured and not differentiated from the heartwood.
Timber classification	-
Density (air-dry)	365–815 kg m^{-3}
Modulus of rupture (air-dry)	101 N mm^{-2} (based on *M. muticus*)
Modulus of elasticity (air-dry)	15900 N mm^{-2} (based on *M. muticus*)
Janka hardness (air-dry)	6050 N (based on *M. muticus*)
Durability	Non-durable but extremely easy to treat.
Strength Group	SG 5
Uses/potential uses	The timber is suitable for wall panelling, solid door, domestic flooring, furniture and fittings, non-impact tool handles, wooden sandals and packing cases. The timber is also suitable for the manufacture of veneer and plywood.

► Myristicaceae (PENARAHAN)

Gymnacranthera forbesii (3 trees per ha)
Horsfieldia macrocoma (1 tree per ha)
Horsfieldia sucosa (5 trees per ha)
Knema hookeriana (5–9 trees per ha)
Knema intermedia (2 trees per ha)
Knema laurina (8 trees per ha)
Knema spp. (17 trees per ha)
Myristicaceae (6 trees per ha)

Vernacular name	Dara kerbau, medang kuning, mendarah, pala
Tree	A fairly large family of small to large trees.
Timber colour	The sapwood is lighter in colour and poorly defined from the heartwood, which is light yellow-brown or brown with occasional pink tinge and dark red-purple stripes. A blood-red core is found in some species.
Timber classification	Light hardwood
Density (air-dry)	370–770 kg m^{-3}
Modulus of rupture (green)	51 N mm^{-2} (based on *Myristica maingayi*)
Modulus of elasticity (green)	9380 N mm^{-2} (based on *Myristica maingayi*)
Janka hardness (air-dry)	4490 N (based on *Myristica gigantea*)

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Durability	Non-durable and subject to attacks by powder-post beetles and dry wood termites. Amenable to preservative treatment.
Strength Group	SG 5
Uses/potential uses	The timber is suitable for pattern making, packing cases, crates, plywood, light temporary construction, internal partitioning and flooring.

► *Ochanostachys amentacea* (PETALING)

Ochanostachys amentacea (7–21 trees per ha)

Vernacular name	Degong
Tree	A monotypic genus of medium-sized to sometimes large trees up to 30(-50) m tall and 60(-80) cm in diameter.
Timber colour	The sapwood is dark yellow-brown or light red-brown and moderately defined from the heartwood, which is red-brown to purple red-brown, darkening on exposure.
Timber classification	Medium hardwood
Density (air-dry)	800–1105 kg m^{-3}
Modulus of rupture	-
Modulus of elasticity	-
Janka hardness (air-dry)	6360 N
Durability	Moderately durable under exposed conditions.
Strength Group	SG 3
Uses/potential uses	The timber is suitable for piling, posts, heavy and medium construction under cover, furniture manufacture, strip flooring, pallets, boxes and crates.

► *Palaquium* spp. & *Payena* spp. (NYATUH)

Palaquium oxleyanum (7 trees per ha)
Payena lanceolate (11 trees per ha)
Payena maingayi (2 trees per ha)

Vernacular name	Bengku, ekor, mentua taban, semaram, sundik, taban, taban merah, taban puteh
Tree	Small to large trees up to 45(-50) m tall and 100 cm in diameter.
Timber colour	The sapwood is lighter in colour and moderately sharply differentiated from the heartwood, which is deep pink-red or red-brown.
Timber classification	Light hardwood
Density (air-dry)	400–1075 kg m^{-3}

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Modulus of rupture (air-dry)	79 N mm^{-2} (based on *Palaquium gutta*)
Modulus of elasticity (air-dry)	12200 N mm^{-2} (based on *Palaquium gutta*)
Janka hardness (air-dry)	5430 N (based on *Palaquium gutta*)
Durability	Moderately durable to non-durable and rated as difficult to treat.
Strength Group	SG 5
Uses/potential uses	The timber is very popular as a furniture and solid door. It is suitable for high class decorative interior finishing such as panelling and partitioning. Other uses include strip and parquet flooring, ceilings boat decking, rotary and sliced veneers, plywood and pallets.

► *Pouteria* spp. (NYATUH KUNING)

Pouteria malaccensis (12 trees per ha)
Pouteria paucinervia (7 trees per ha)

Vernacular name	Menasi, misi, nangka-nangka, nyatoh nangka
Tree	Shrubs to large trees up to 50 m tall and 100(-150) cm in diameter.
Timber colour	The sapwood is not differentiated from the heartwood, which is creamy white to light yellow.
Timber classification	-
Density (air-dry)	690–880 kg m^{-3}
Modulus of rupture (green)	61 N mm^{-2} (based on *P. maingayi*)
Modulus of elasticity (green)	13200 N mm^{-2} (based on *P. maingayi*)
Janka hardness (green)	5780 N (based on *P. maingayi*)
Durability	Non-durable under exposed conditions.
Strength Group	-
Uses/potential uses	The timber is suitable for medium construction under cover, interior finishing, panelling, partitioning, railings, shelves and mouldings. It can also be peeled for veneers and it is suitable for the manufacture of furniture.

► *Sapium* spp. (LUDAI)

S. baccatum (5–8 trees per ha)

Vernacular name	Gurah, mamah pelanduk
Tree	Medium-sized to large trees up to 30(-39) m tall and 60(-95) cm in diameter.
Timber colour	The sapwood is not differentiated from the heartwood, which is light yellow-brown, sometimes with a pink tinge.
Timber classification	-
Density (air-dry)	290–465 kg m^{-3}

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Modulus of rupture	-
Modulus of elasticity	-
Janka hardness (green)	1250 N (based on *S. baccatum*)
Durability	Non-durable under exposed conditions but can be treated with preservatives easily.
Strength Group	-
Uses/potential uses	The timber is suitable for boxes and crates and also for core veneer plywood manufacture. The timber is most likely to be suitable for pulp and paper manufacture.

► *Shorea* spp. (LIGHT RED MERANTI)

Shorea leprosula (8 trees per ha)

Vernacular name	Meranti tembaga
Tree	Emergent trees that can grow up to 60 m in height and 1.5 m in diameter with buttressing up to 2 m tall.
Timber colour	The sapwood is lighter in colour, usually greyish, and distinct from the heartwood, which is light pink to light red or light brown.
Timber classification	Light hardwood
Density (air-dry)	385–755 kg m^{-3}
Modulus of rupture (air-dry)	75 N mm^{-2} (based on *S. leprosula*)
Modulus of elasticity (air-dry)	13600 N mm^{-2} (based on *S. leprosula*)
Janka hardness (air-dry)	2940 N (based on *S. leprosula*)
Durability	Non-durable under exposed conditions.
Strength Group	SG 6
Uses/potential uses	The timber is very popular as a general utility timber, being suitable for furniture manufacture, interior finishing, panelling, partitioning, mouldings and skirtings. The timber is also suitable for veneer and plywood manufacture.

► *Shorea macroptera* (MELANTAI)

Shorea macroptera (5–17 trees per ha)

Vernacular name	Belantai, meranti melantai, meranti melantai damar hitam
Tree	Large trees of dipterocarp species that can grow between 40(-50) m in height and 70(-150) cm in diameter with buttresses up to 2.5 m high.
Timber colour	The sapwood is lighter in colour, moderately distinct from the heartwood, which is yellow-pink when freshly cut, weathering to a light pink colour with a yellow tinge.

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Timber classification	Light hardwood
Density (air-dry)	415–625 kg m^{-3}
Modulus of rupture (green)	60 N mm^{-2}
Modulus of elasticity (green)	11300 N mm^{-2}
Janka hardness (green)	2540 N
Durability	Non-durable under exposed conditions and difficult to treat with preservatives.
Strength Group	SG 6
Uses/potential uses	The timber is suitable for interior finishing, mouldings, panelling, rotary cut veneers and plywood, planking, shelving and the manufacture of doors.

► *Syzygium* spp. (KELAT)

S. griffithii (1 tree per ha)
S. kunstleri (16 trees per ha)
Syzygium spp. (32–60 trees per ha)

Vernacular name	Jambu, keriang
Tree	Shrubs to large trees up to 45(-50) m tall and 150(-200) cm in diameter.
Timber colour	The sapwood is not sharply differentiated from the heart-wood, which is light brown, pink-brown, red-brown or purple-brown with a grey tinge.
Timber classification	Medium hardwood
Density (air-dry)	495–1010 kg m^{-3}
Modulus of rupture (air-dry)	116 N mm^{-2} (based on *S. griffithii*)
Modulus of elasticity (air-dry)	17600 N mm^{-2} (based on *S. griffithii*)
Janka hardness (air-dry)	6540 N (based on *S. griffithii*)
Durability	Moderately durable under exposed conditions and does not absorb preservatives readily.
Strength Group	SG 3
Uses/potential uses	If properly treated, the timber is suitable for structural purposes like posts, beams, joists, rafters. The timber may also be suitable for tramways, railway sleepers, bridges, wharves and agricultural implements.

► *Vitex* spp. (LEBAN)

V. pinnata (11 trees per ha)
V. siamica (1 tree per ha)
V. vestita (11 trees per ha)

Vernacular name	Bunyak laban, halban, kulim papa, leban hutan
Tree	Shrubs or small to sometimes large trees up to 45 m tall and 125(-200) cm in diameter.

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Timber colour	The sapwood is moderately clearly defined and is lighter in colour than the heartwood, which is light straw-coloured to light yellowish brown.
Timber classification	-
Density (air-dry)	705–880 kg m^{-3}
Modulus of rupture	-
Modulus of elasticity	-
Janka hardness	-
Durability	Reputed to be durable, even in contact with the ground.
Strength Group	-
Uses/potential uses	The boles of the tree are normally short and crooked. The timber has been used for posts, turnery, handles for tools and is popularly used for carving and manufacture fancy articles.

► *Xanthophyllum* spp. (NYALIN)

X. affine (7 trees per ha)
X. kunstleri (12 trees per ha)
X. obscurum (8 trees per ha)
X. rufum (1 tree per ha)
Xanthophyllum spp. (4–11 trees per ha)

Vernacular name	Mengkapas, minyak berok
Tree	Small to big trees up to 50 m tall and 120 cm in diameter.
Timber colour	The sapwood is not differentiated from the heartwood, which is white to bright yellow when fresh and darkens to a strong orange-yellow.
Timber classification	Medium hardwood
Density (air-dry)	595–960 kg m^{-3}
Modulus of rupture (air-dry)	101 N mm^{-2} (based on *X. verrucosum*)
Modulus of elasticity (air-dry)	14800 N mm^{-2} (based on *X. verrucosum*)
Janka hardness (air-dry)	7700 N (based on *X. verrucosum*)
Durability	Non-durable under exposed conditions and susceptible to drywood termites.
Strength Group	SG 4
Uses/potential uses	The timber is suitable for medium or heavy construction, which is temporary or protected from attacks by drywood termites. Also suitable for panelling, parquet flooring, planking and plywood manufacture. The timber has been successfully used for the manufacture of blockboards.

SUMMARY

The information on common timber species in logged-over forests is a practical tool to encourage research and promotional efforts. Based on the aforementioned list, most of the species are categorised as lesser-known and lesser-utilised timbers. Besides, there is a clear indication of a lack of data on some timber species despite their abundance in the forests. With this highlight, potential timber species or groups are able to receive better attention and are set off for continuous evaluation, hence allowing for more effective marketing. Hopefully, the utilisation and market value of the lesser-known and lesser-utilised timber species will significantly improve through analysis and comparison with popular commercial timbers.

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Forestry research has generated important data regarding the stocking and species composition of logged-over forests. The outputs are invaluable information that could ensure accurate discussion among experts and practitioners and could properly steer the way forward for the national timber industry. This article provides some basic information on common timber species in the secondary forests of Peninsular Malaysia. The data are based on four selected areas of production forests, namely Tekam Forest Reserve in Pahang, Cherul Forest Reserve in Terengganu, Ulu Muda Forest Reserve in Kedah, and Piah Forest Reserve in Perak.

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