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POLICY PAPER

Pioneer Tree Species: Their Potential Uses and Harvesting Constraints*

Robert A. Natividad[1]

SUMMARY

Commonly growing pioneer tree species (PTS) in the Philippines are characterized in terms of tree size, wood properties, and potential utilization as a guide for selecting possible species for plantation development. Most of the 24 PTS covered in this paper have light colored wood, straight grained with fine to moderately fine texture. The majority also fall under low to moderately low relative density. Recommended end-uses were given per wood density classification. A number of the PTS presented have been commercially utilized even before the 2011 implementation of EO 23, otherwise known as moratorium on timber harvesting in natural-growth forests in the Philippines. These include Malapapaya (Polyscias nodosa) and Gubas (Endospermum peltatum) for making veneered products; and Bagalunga (Melia dubia) for furniture and housing components. These species have been raised in plantations by private companies and community organizations to sustain their raw material supply. Also discussed in this paper are the technical, environmental, and marketing constraints when PTS are harvested from natural-growth forest. A review of the policies on diameter limits for timber harvesting in natural forests is recommended.

INTRODUCTION

Within the context of vegetation succession, pioneer tree species (PTS) together with other pioneer plants are the first to colonize a disturbed or damaged ecosystem. These plants readily acclimatize to bare soil and have the ability to grow and regenerate in poor soil sites and adverse environmental conditions.

The first trees to grow become the initial component of a new forest (mostly under botanical family Euphorbiaceae, Moraceae, Sterculiaceae, etc.). These usually comprise shrubs and inferior scrubby trees and are often totally removed or controlled in a prescribed forest management plan or timber stand improvement operation to prepare the area for higher quality tree regeneration or establishment of tree plantation. However, if the area is left undisturbed and eventually as the site condition improves, succeeding invasion of better quality trees follows until a climax vegetation cover is established, *e.g.* dipterocarp forest.

This paper presents some important PTS in the Philippines. Their potential uses are discussed as a guide for selecting possible species for plantation development. Also included are some technical, environmental and marketing constraints in the harvesting of naturally-grown PTS.

[1]Chief Science Research Specialist,
Forest Products Research and Development Institute,
DOST, College, Laguna
ranfprdi@yahoo.com

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Wood Properties and Potential Uses

The list of PTS presented and discussed in this paper was based largely on the author's knowledge and experiences as a researcher and log/wood sample collector for research and development (R&D) projects at the Forest Products Research and Development Institute (FPRDI); and technical services/ consultancy involvements in the wood-based industry; and in the conduct of forest inventories or vegetation cover studies in community-based forest management (CBFM) areas, protected areas, and mining areas in the Philippines.

Physical properties and recommended end-uses

Based on secondary data from FPRDI publications (FORPRIDECOM 1980; Meniado *et al*. 1981; Tesoro & Aday 1990; Rojo 1999; Alipon & Bondad 2008), the physical properties of 24 PTS under 11 botanical families are shown in Table 1.

Majority of the PTS listed have light colored wood with no distinct color variation between the sapwood and heartwood. Almost half of the total PTS listed are also straight-grained with fine to moderately fine texture. Most of them fall under low to moderately low relative density (RD) but some have medium RD classification.

RD is one of the best indicators of wood quality for the most suitable end-uses for a particular wood species. It is a reliable indicator of strength, hardness, shrinkage and swelling,

Table 1. Physical properties and strength grouping of some pioneer tree species.

SPECIES (Common Name/ Scientific Name)	Size Classification	Color		Grain	Texture	Relative Density (RD) 12% MC	RD Class
		Sapwood (S)	Heartwood (H)				
Alim (*Melanolepis multiglandolosa*)	m-t (X)	Not distinct from heartwood	Buff	S	MF	0.455	IV
Anabiong (*Trema orientalis*)	m-t (x)	Light Colored	Buff colored	S	MC	0.324	V
Antipolo (*Artocarpus blancoi*)	l-t (x)	Light buff	Bright yellow (fresh russet on exposure)	C	MC - C	0.508	III
Anubing (*Artocarpus ovatus*)	m-t (x)	Light colored	Bright yellow (fresh) nearly black with age	S or slightly C	MC	0.54	III
Bagalunga (*Melia dubia*)	m-t (x)		Reddish	C	MC	0.444	IV
Banai banai (*Radermachera pinnata*)	m-t (x)	Not distinct from heartwood	Light reddish yellow turns cinnamon, buff upon exposure	C	MF	0.571	III
Balanti (*Homalanthus populneus philippinensis*)	s-t (x)	Not distinct from heartwood	Light buff	S or slightly C	MF	0.38	V
Batino (*Alstonia macrophylla)*	l-t (x)	Lighter colored	Pale yellowish brown	C often W	MF	0.671	II
Bayok bayokan (*Pterospermum niveum)*	s-t (x)	Lighter colored	Light drab or purplish	Slightly C	MC	0.540	III
Bayok (*P. diversifolium*)	m-t (x)					0.46	IV
Binuang (*Octomeles sumatrana*)	l-t(x)	Similar to heart-wood	Light buff	C – I	MC	0.277	V
Binunga (*Macaranga tanarius*)	s-t (x)	Not distinct from heartwood	Light yellowish brown with pink tinge	S	F	0.380	V
Binungang pula (*M. sinensis)*	s-t (x)	Not distinct from heartwood	Light yellowish brown with pink tinge	S	F	0.291	V
Hamindang (*M. bicolor)*	m-t (x)	Not distinct from heartwood	Light yellowish brown sometimes with pinkish tinge	S - I	MF	0.305	V
Dita (*Alstonia scholaris*)	l-t (x)	Not distinct from heartwood	Light yellowish brown	S some-times Curly	MC	0.31	V
Gubas (*Endospermum peltatum*)	l-t (x)	Not distinct from heartwood	Buff to pale or-ange yellow with greenish tinge	S	MC	0.320	V
Hinlaumo (*Mallotus resinoides*)	m-t (x)	Buff colored	Brown	S	F	0.551	III
Hinlaumong- Laparan *M. confusus*	s-t (x)						
Loktob (*Duabanga moluccana*)	l-t(x)	Not distinct from heartwood	Creamy to yellowish	S	MF	0.370	V
Malapapaya (*Polyscias nodosa*)	m-t (x)	Not distinct from heartwood	Light buff to pinkish buff	S	F	0.39	V
Marang (*Litsea cordata*)	m-t (x)		Reddish	C	MC	0.454	IV
Rarang (*Erythrina subumbrans*)	l-t (x)	Similar to heartwood	Buff	W to slightly C	C	0.245	V
Taluto (*Pterocymbium tinctorium*)	l-t (x)	Similar to heartwood	Pinkish buff to light ochraceous buff	S	MC	0.291	V
Tangisang-bayawak (*Ficus variegata*)	l-t (x)	Light colored	Light reddish	S or slightly C	C	0.30	V

Source: Compiled from published and unpublished reports of researches conducted at FPRDI.

Legend:

Grain
S - straight
C - crossed
W - wavy
I - interlocked

Texture
F - fine
MF - moderately fine
VF - very fine
C - coarse
C - moderately coarse

RD Class
II – High (≥ 0.700)
III - Moderately high (0.601-0.700)
IV - Medium (0.501 – 0.600)
V- Low (≤ 0.400)

Size Classification
l-t = diameter over 40 cm; ht over 15m
m-t = diameter 30-40 cm; ht 5-15 m
s-t = shrub or small trees
dia 3-30 cm ht 2-5cm
x = wood sample at FPRDI

workability, and pulp yield (Dinwoodie 1980). Thus, based on RD, the recommended end-uses (Alipon *et al.* 2005) for the PTS covered in this paper may be gauged below.

I. High (RD ≥ 0.700)
The PTS are used for heavy duty construction where both strength and durability are required; also for ship-building, railway slippers, paving blocks, tool handles, friction and bearing blocks, pulley sheaves and rollers, bridge and wharf timbers, posts, beams, girders, trusses, door and window sills, balustrades, flooring and stairs, salt and fresh water piles, and telecommunication poles.

II. Moderately High (RD 0.601 – 0.700) – *e.g. Batino*
These are utilized for house and building construction such as posts, beams, trusses, studs, door panels and flooring; also for automobile and truck bodies, veneer and plywood, bobbins, spindles, bowling pins, bridge and wharf timber piles and other uses requiring hard and strong wood

III. Medium (RD 0.501 – 0.600) - *e.g. Antipolo*, *Anubing*, *Banai-banai*, *Bayok-bayokan*, *Hinlaumo* and *Hinlaumog-Laparan*

These species are used for high-grade furniture and cabinets such as radio and phonograph cabinets; also, for paneling, automobile bodies and interior trim of boats, bodies of musical instruments, mouldings and other ornamentals.

IV. Moderately low (RD 0.401 – 0.500) - *e.g. Alim*, *Bagalunga*, *Bayok* and *Marang*. They are used in the production of pulp and paper as well as of toys, venetian blinds and veneer; also for medium grade furniture and cabinets, millworks, picture frames, paneling, mouldings, flooring, sidings, doors, windows sash.

V. Low (RD ≤ 0.400) - *e.g. Anabiong*, *Balanti*, *Binuang*, *Binunga*, *Binungang pula*, *Hamindang*, *Dita*, *Gubas*, *Loktob*, *Malapapaya*, *Rarang*, *Taluto* and *Tangisang-bayawak*

They are mainly used for pulp and paper production, toys, pencil slats, match sticks, toothpicks, ice-cream spoons, popsicle sticks, venetian blinds, core veneer, wooden shoes, cigar boxes.

Some commercially–used PTS
There are some PTS in the country which have been commercially-used. The physical and mechanical properties of these species are summarized in Table 2. *Gubas* is solely used for making match boxes and match splints as well as toothpicks in the country by Kasilayan Softwood Corporation and Royal Match Company. It is grown in their plantations in Agusan del Sur. Large-diameter *Gubas* logs were also used for core and back veneer of plywood by the Industries Development Corporation in Casiguaran, Aurora before the 2011 moratorium on timber harvesting in the natural-growth forests. During said period, included among the other PTS used by the plywood industry for the same purposes were *Loktob*, *Binuang*, *Anabiong* and *Rarang*.

Anabiong, *Binunga* and *Alim* were also processed into cement-bonded boards (CBB) by Carag Constuction Inc. in Solana, Cagayan in the late 1990s.

Malapapaya has been traditionally used as raw material for many products requiring low density, straight-grained, pale color and fine-textured wood. These include chopsticks, toothpicks, ice cream spoons, lollipop and popsicle sticks which are being manufactured by JOPA Enterprises in Pagsanjan, Laguna and the Gumaca Woodcraft MPC in Gumaca, Quezon. From 2001 to 2013, MPWoods Philippines in Gumaca, Quezon processed this species into cabinets or *tanaita*; finger-jointed boards for mouldings and engineered doors; disposable lunch boxes or *bento* and laminated veneer lumber (LVL) for export to Japan (PCAARRD 2013).

Malapapaya grows naturally in forest gaps, under coconut plantations and raised in plantations by MPWoods Philippines and *Malapapaya* Growers Cooperatives in Laguna and Quezon. Mr. Carlos Teraoka, MPWood Philippines' manager and proprietor, has a 140-ha *Malapapaya* plantation in his farm in Mangatarem, Pangasinan.

Bagalunga is another PTS which is reportedly being cultivated in Leyte (Razal *et al.* 1996). It is one of the raw materials for exportable furniture in Cebu. The wood is also suitable for light-to-medium house construction (walling, door and flooring), manufacture of agricultural implements, carts and tool handles, toys, venetian blinds, mouldings, core veneer for plywood, picture frames, pencil slats, and cigar boxes.

It is worth mentioning that *Anabiong* was found suitable by FPRDI for making guitars (Carandang 1991). It has a better quality rating than Yemane or Gmelina – a well-known tree plantation species used for this product in the Philippines since 1991. *Malapapaya* is currently being tested by the UP College of Music in collaboration with FPRDI for its suitability in the making of classical guitars (Manimtim *et al.* 2015).

Harvesting Constraints

As mentioned earlier, a number of PTS are being commercially utilized in the country. However, their intensified utilization in the wood-based industries, like those trees classified as lesser-used species (LUS), is affected by technical, environmental and marketing constraints (Natividad 1998).

Technical Constraints
Most PTS are classified as shrubs or small to medium-sized trees. They cannot reach the policy determined 60-cm diameter at breast height (dbh) limit for timber harvesting no matter how long they are left to grow in the forests. Bureau of Forest Development Administrative Order (FAO) No. 74 issued in 1973 provides guidelines for calculation of annual allowable cut (AAC) in natural forests where 60 cm is the minimum dbh for harvestable timber. There is a need to review the said policy which is based on inventory of virgin or old-growth forests but logging has been banned in old growth forests by virtue of Department of Environment Administrative Order (DAO) No. 24 of 1991.

Harvesting of PTS, except those grown in plantations, is also restricted under Executive Order (EO) No. 23 which called for a moratorium on timber harvesting in naturally-grown forests since 2011.

Table 2. Technical properties and end-uses of some commercially-used PTS.

	Species						
Official Common Name	**ANABIONG**	**BATINO**	**BINUANG**	**DITA**	**LOKTOB**	**RARANG**	**MALAPAPAYA**
Scientific Name	*Trema orientalis* (Linn.) Blume	*Alstonia macrophylla* Wall.	*Octomeles sumatrana* Miq.	Alstonia scholaris (L.) R. Br.	*Duabanga moluccana* Blume	*Erythrina subumbrans* (Hassk.) Merr.	*Polyscias nodosa* (Blume) Seem.
Family Name	Ulmaceae	Apocynacea	Datiscaceae	Apocynaceae	(Sonn.) Sonneratiaceae	Leguminosae	Araliaceae
Tree Characteristics	Large tree; height 15 m or more, DBH up to 60 cm; bole cylindrical, bark smooth and grayish brown; buttress nil to almost absent.	Attains a diameter of 65 cm: Bole straight, regular, about m long	Large tree, height35 to 60 m; DBH 100 cm or more; bole long and cylindrical, tapering crown small, buttress high.	A large tree attaining a diameter of 90 cm or more. Bole straight, 10 to 15 m long. Buttress small.	A large tree attaining a diameter of 90 cm and a height of 50 m. Bole regular, usually straight up to 15 m high. Buttress high.	Large tree: height up to 30 m diameter at breast eight up to 80cm, bole cylindrical, erect, tapering. Buttress low.	Medium-sized tree; height up to 30 m, DB up to 50 cm
Technological Properties							
Relative Density	0.36 low RD. Class V	0.640, Moderately high RD, Class II	9.265, Low RD, Class V	0.34 . Low RD, Class V	0.341 low RD, Class V	0.236, Low RD, Class V	0.39 low RD. Class V
Volumetric Shrinkage	10.20% Moderately low VS, Class II	14.50% High VS, Class V	10.0% Moderately low VS, Class II	9.30% Moderately low VS, Class IV	11.10% medium VS, Class III	5.70% low VS, Class I	10.4% Moderately low. VS Class II
Bending Strength	35.8 Mpa, Low strength, Class V	84.0 MPa. Class II	31.9 MPa, Low strength, Class V	35.79 MPa Low. Class II	43.00 MPa, mod. low strength, Class IV	24.60 MPa, Low strength, Class V	44.5 MPa
Compressive Strength	13,9 Mpa	20.2 MPa	16.0 MPa	12.00 MPa	19.60 MPa	11.90 MPa	20.0 MPa
Shear Strength	5.28 Mpa	10.6 MPa	3.64 MPa	3.57 MPa	5.74 Pa	3.65 MPa	5.57 MPa
Hardness	21.80 kN	5.7 kN	1.50 kN	1.90 kN	3.98 kN	1.12 kN	7.02 kN
Toughness	27.00 Joule/ Specimen	43.1 Joule/Specimen	16.90 Joule/ Specimen	17.2 Joule/ Specimen	21.60 Joule/ Specimen	11.50 Joule/ Specimen	20.10 Joule/ specimen
Sawing	Easy to saw, Class I	Moderate to saw, Class II	Easy to saw, Class I	Easy to saw, Class I	Easy to saw, Class I	Easy to saw, Class I	Easy to Saw. Class I
Drying	Moderately difficult to dry , Class II	Difficult to dry, Class III	Easy to dry, Class I	Easy to dry, Class I	Easy to dry, Class I	Moderately difficult to dry, Class II	Easy o dry. Class I
Machining	Very good machining property Class II	Good machining property, Class II	Good machining property, Class II	Very good machining property, Class I	God machining property, Class II	Good machining property, Class II	Very good machining property, Class I
Finishing	Fair, Class II	Good, Class I	Good. Class I	No available data	Fair, Class II	No available data	Easy to finish, Class I
Natural durability	Perishable, less than 1 year, Class V	Moderately durable 2.5 to 4 years, Class II	Perishable less than 1 year, Class V	Perishable less than 1 year, Class V	Perishable, less than 1 year, Class V	Non-durable, Class IV	Perishable (less than one year)
Treatability		Easy to treat Class I	Easy to treat. Class I	Easy to treat. Class I	Easy to treat, Class I	Easy to treat, Class I	Easy to treat, Class I
Uses	*Pulp and paper, particle board, wooden shoes, fish net floats, boxes and crates and some toys.*	*Beams, joists, rafters, and household implements, high grade furniture and cabinets, bobbins, floor parquet louvre doors, balusters frames, toys, coaster set, cups, bowls, fruit and candy trays, chess pieces, pencil holders, table tops and moulding.*	*Veneer and plywood, matchboxes, fishnet floats, dugouts, pulp wood and wooden clogs.*	*Match boxes and sticks, wooden shoes, ceiling, partition walls, boxes and crates, moulding, buoys and floats, veneer and plywood (core), pulp and paper.*	*For core veneer For plywood, fishnet floats, for rafting heavy logs, light and temporary construction, Boxes and crates for fish and Vegetable*	*Insulator boards, veneer, chopsticks, popsicle sticks, ice cream spoons, toothpicks, matchboxes and sticks, pulp, boxes and crates, and fishnet floats.*	*Wooden clogs, matchsticks and boxes, lollipop and popsicle sticks, toothpicks, chopsticks, ice-cream spoon, pencil slats, decorative and utility boxes, and crates.*

Environmental Constraints

To date, there is a growing concern and demand from various local/national/international organizations for the conservation of the tropical forest due to ecological reasons. Harvesting of PTS could result to vegetation cover retrogression or cyclic colonization of the area by shrubby or weed trees. Excessive biomass extraction in the area also enhances soil erosion, depletion of essential soil nutrients, and reduction of biodiversity if this is not accompanied by effective forest management.

Marketing Constraints

The marketing of timber in the local/export market is typically species oriented. For successful industrial utilization and to find a niche market for PTS, the following should be satisfied: a) technical information i.e. species identity and wood quality; b) resource availability at regular quantity and quality (grades) required; and c) price competitiveness.

Among the most critical factors that affect PTS marketing is item b. Raw material sustainability could be ensured only through plantation development of preferred PTS in tenured areas (Integrated Forest Management Agreement [IFMA], Socialized Industrial Forest Management Agreement [SIFMA], Community-Based Forest Management Agreement [CBFMA]) and tree farms.

CONCLUSIONS AND RECOMMENDATIONS

Industrial tree plantation development in the country should consider the use of PTS or indigenous and multipurpose trees. Some of the PTS presented in this paper have similar or better wood quality than popular tree plantation species like Yemane (*Gmelina arborea*), mangium (*Acacia mangium*) and moluccan sau (*Paraserianthes falcataria*).

Gubas, *Malapapaya* and *Bagalunga* are among the PTS which have been commercially utilized for the local and export market. Information on PTS wood properties, processing and utilization are available at FPRDI. Technologies on their propagation and plantation development are also available from the Ecosystems Research and Development Bureau (ERDB) and Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAAARRD), Los Baños, Laguna. As mentioned, technical, environmental, and market issues constrain the utilization of PTS to sustain the supply and compete in the local or export market. At the moment, EO 23 does not allow timber harvesting in natural forests, hence, PTS can only be harvested in plantations. If the logging moratorium is lifted, there is need to review existing policies on harvesting of PTS in natural forests.

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Photos of some of the pioneer tree species.