THE STATUS OF THE TIMBER TREE: *POMETIA PINNATA* AND ITS TRADE IN PAPUA NEW GUINEA



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ABSTRACT

Taun or *Pometia pinnata* is a widely distributed timber species on the island of New Guinea and the neighboring Asian and Pacific Island countries. Base on current taxonomic revision there are eight different forms recorded in the Asia-Pacific region. In Papua New Guinea four forms have recorded; *f. pinnata*, *f. tomentosa, f. glabra,* and *f. repanda.* However, there are evidence indicating another form (*form nov.*) that resembles both *f. pinnata* and *f. tomentosa.*

Taun is one of the highly priced tropical hardwood timbers on the market. Current market prices range from US$70 for round logs and up to US$400 per m^3 for processed logs. In Papua New Guinea, taun contributed up to 13% of the total volume exported. China is by far the biggest importer of saw/veneer logs. Australia and New Zealand are the main importer of processed taun timbers. There are no firm cases of illegal logging of taun although it was the case 20 years ago. However, there are minor discrepancies in shipment that may be categorized as illegal activities. The monitoring by SGS on behalf of the PNGFA has successfully minimized such discrepancies. The current analysis of taun concludes that, although there are laws, policies and regulating mechanisms already in place, these must be strengthen where necessary, then implemented by all stakeholders to manage this very important resource.

Key words: Taun, *Pometia pinnata*, taxonomy, species, forms, ecology, timbers, distribution, market, policies, Act.

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Cover Pictures: R-L drainage and habitat common for taun trees, middle – lowland rainforest showing two *Pometia* or taun trees, These can be singled out by the reddish or rufous crown; bottom right – stem of *Pometia* (Photos by Mr. Ted Mamu – WWF PNG); top right – seedling of *Pometia pinnata f. glabra* (Photo by D. Kipiro – PNGFRI).

Table of Contents

List of tables

List of Figures

1.0 Introduction

Forestry is a key sector, which, if properly managed, can continuously generate revenue for the people of Papua New Guinea. This is because forest resources are renewable national assets. This long held view is echoed by many people in the government and private sectors. Furthermore, this view is clearly stipulated in the country's constitution and defined approaches to forest management were legislated in the Forest Act 1991, as amended in 1993, 1996, 2000, and 2005, and the Environment Act 2000. However, there are still grey areas that have led to general abuses to forest resources such as illegal activities and non compliance to the Acts. While political interference, corruption, literal flaws in the Act (misinterpretation of the Act), and lack of human resources to implement forest policies appear to be key issues to sound forest management, information on major forest resources is also a key factor in terms of drawing up proper forest policies to safeguard the timber resources for future generations.

There are at least 100 native timber species occurring in mixed lowland and montane forests of Papua New Guinea (PNG), although taxonomic determination of timber species is inadequate, resulting in lumping of species under one genus. Of this total at least 30 timber species are commonly logged, and exported as round or processed logs. *Pometia pinnata* is one such timber species that is highly favored both in domestic and international markets. It is commonly known as taun, and has many uses especially in buildings, panel, veneer, joinery, furniture, cabinet work, boat building, moulding, interior finish, door, window frames, fibre-board, billiard tables and tool handles (Eddowes, 1977). The fruits are also edible.

This report reviews the status of *Pometia* and its trade in PNG. It draws together scattered information (published and unpublished) available on this species. The report does not pretend to present all information regarding *Pometia*. Nevertheless, it is envisaged that the information herein would open up our understanding of this species or stimulate further research into the scientific and trade aspects of this species.

2.0 Taxonomy

The genus *Pometia* in the family Sapindaceae is known by two species, *P. pinnata* and *P. ridleyi*. *Pometia ridleyi* is distributed throughout Malesia except for Singapore and *P.pinnata* is found in Ceylon, the Adamans and throughout Malesia to Samoa. In PNG, *P.pinnata* is common throughout the lowlands, and occurs on wide range of vegetation and soil types (Figure 1). *P. pinnata* is known by 8 different forms of which 4 have been recorded in PNG (Figure 2). These *are f. pinnata, f. glabra, f. repanda* and *f.tomentosa.* The species is well known throughout the lowlands of Papua New Guinea for its sweet succulent fruits as well as for it's timber quality. Several authors have worked on the genus, the latest of them being Jacobs (1962). The recognition of forms is not accepted by most foresters and the logging industry because the differences between various forms had not been adequately investigated. Much confusion exists in the distinctions between *f. pinnata* and *f. tomentosa*. The work on the genus by Jacobs, 1962 revealed that 4 different forms *pinnata, f. glabra. f. tomentosa, f. repanda* were known in Papua New Guinea. Among them, two have been commonly exported for timber*, f. glabra* and *f. pinnata*. The f*orm tomentosa* on the other hand has also been logged in area where it is seen.

Of the four forms in PNG, it was observed that the *f. tomentosa* and *f. pinnata* are very unique in their individual morphology. The description by Jacobs (1962) on leaflet characters was consistent throughout their respective localities. Recent work on the species by Damas, 1993 noted in the New Guinea Islands region (NGI) that *f. pinnata* and *f. tomentosa* had other relatives, similar in leaflet morphology but differing in their bole lengths and size of the fruits. The fruits of these relatives are large, somewhat as big as normal chicken eggs and have thicker arillodes which are edible unlike those of *f. pinnata, f. tomentose,* and *f. repanda.* All have some morphological similarities during their seedling and sapling stages, they differ morphologically as they mature. When the mature trees were observed, it was noted that the type *f. tomentosa* obviously differed from *f. pinnata* and its relatives by leaflet characters. Form *pinnata* and its NGI relative more or less maintain the leaflet characters but the fruit sizes differ. The *form repanda* was distinguished by the coriaceous texture of the leaflets and its leaflet shape and more or less repand margins. The type *P. pinnata f. glabra* (Jacobs, 1962) seemed to vary in various

localities in terms of bole length, crown formation and fruit size and color. The flesh in the fruits of this particular form was thicker and edible.

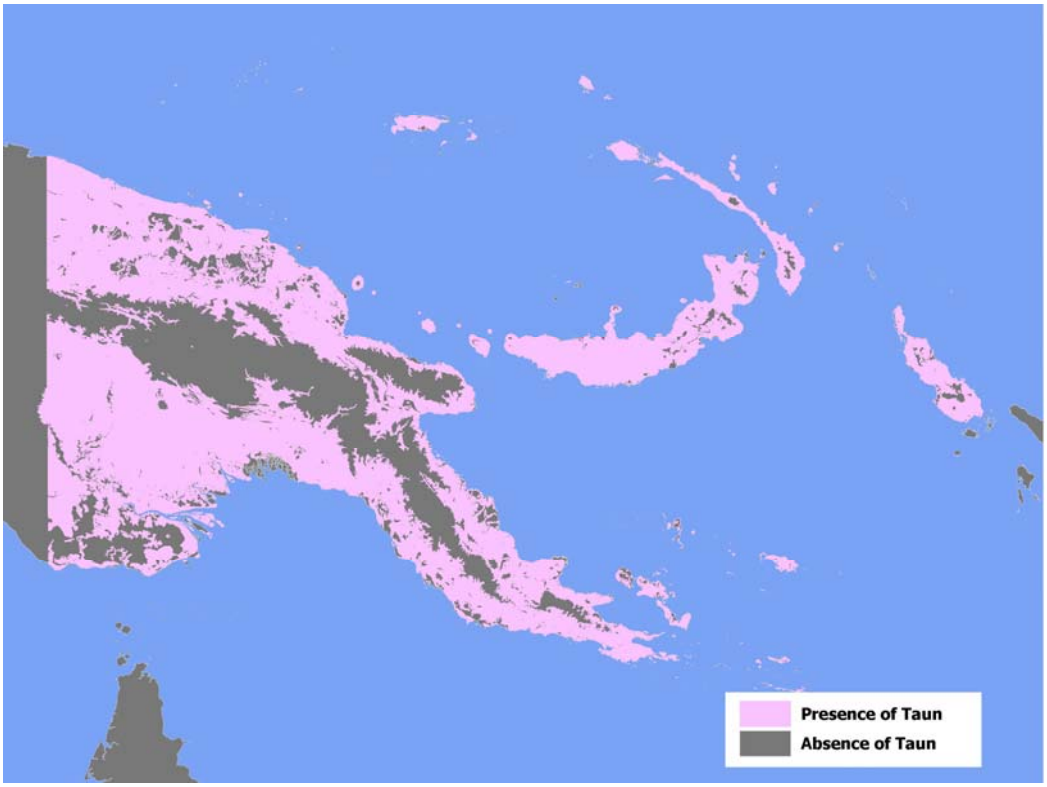

Figure 1. Distribution of *Pometia pinnata*. The dark shaded area depicts absence of *P.pinnata.*

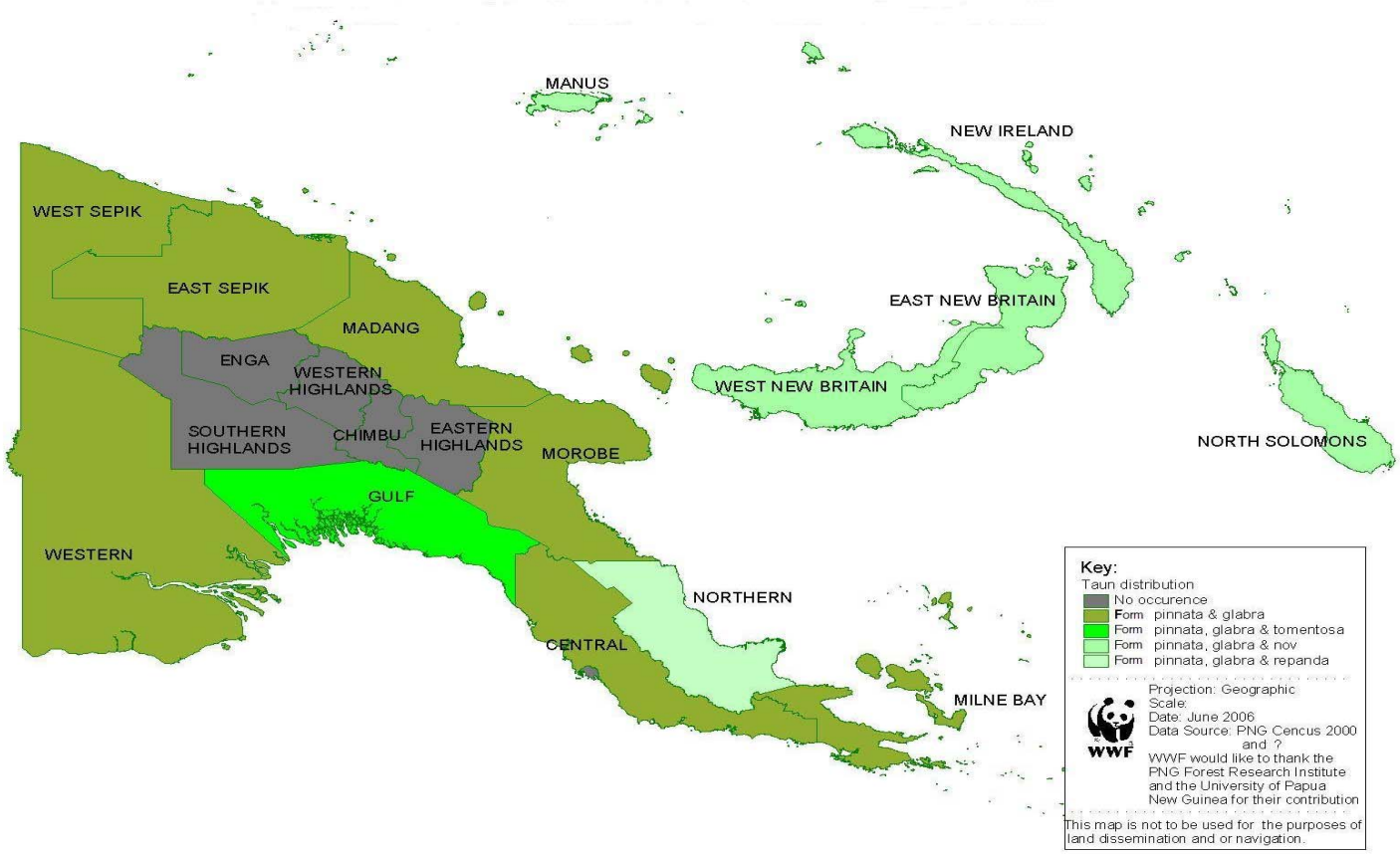

Figure 2. Distribution of *Pometia pinnata* and its forms in PNG.

2.1 Description of the Genus

***Pometia* J.R. & G. Forst.**

Pometia includes trees attaining big sizes often with large buttresses up to 1.5m or more. Often juvenile shoots or innovations have a bright reddish or purplish tinge,(hirsute) with distinct rather stiff or bristly hairs. Leaves compound, paripinnate up to 1 m long with 4 to 17 or more pair of leaflets. Leaflets coriaceous to herbaceous, often increased in size, on average 12 to 30 x 4 to 10 cm, sometimes larger, venations distinct with midribs and veins more prominent beneath; blade assymetrical, with acroscopial half being wider and more extended at the base. Inflorescence terminal or rarely axillary. Flowers polygamous. Male flowers about 4 mm across; calyx cup shaped with 5–8 lobes, with erect teeth, petals 5, rarely as long as the calyx lobes; disc thick, yellow, lacking ovary; stamens 5 – 8, early stage is sessile, later long exerted, about 5-6 mm long. Female flowers about 6-7mm; calyx lobes 5, petals 5, roundish, slightly exceeding the calyx lobes and wider than these, white; disk thick, yellow; ovay on disc 2-3 lobed surrounded by 5-8 staminodes; style 1 in the center of the ovary lobes, 5 mm long; stigma 2. Fruit 2-lobed, only one develops (rarely3) to egg shape, up to 5.0 x 3.0 cm, some are edible depending on the thickness of the flesh (aril) covering the seed.

Distribution: Pometia is a pantropic genus. Its distribution extends from Ceylon, the Adamans throughout Malesia to Samoa. Few scattered in N. Siam, S. Yunan, Indo-China and Formosa.

Ecology: Typical rain forest genus of low altitude, generally occurring below 500 m, rarely to 1,000 m. (highest record: 1,700 m in Atej) on limestone or loamy soils. Not so dominant in the forest in West Malaysia; in Malaya mainly riverine; in Borneo and Sumatra occasionally in fresh water swamp forests; in New Guinea not seldom dominant in forests partly under human influence.

Notes: The genus is recognized by two species i.e. *P. pinnata* and *P. ridleyi*. *Pometia* is well known for its witches broom which occur nearly in all the taxa (species and forms) that can be recognized from long distances. Witches – brooms originate from a leaflet (Bos 1975). The malformation is caused by viruses. This characteristic also appears on inflorescences.

Key to Pometia trees in Papua New Guinea

1.0 Bole rarely rounded, shorter in length, highly buttressed and sharply flanged. Fruits having thicker aril (edible flesh)

2.0 Leaflets symmetrical, glabrous

3.0 First basal pair auriculiform and suborbicular,. Only first few leaflets overlapping, later elliptic …*P.pinnata forma glabra*

3.0 Leaflets overlapping all along the rachis …form. nov.(NGI *relatives)*

1.0 Bole often rounded, longer in length, buttresses low and thickly flanged. Fruits with thin aril (not edible flesh)

2.0 Leaflets very symmetrical, slightly overlapping the rachis ,often hairy ……..*P. pinnata form tomentosa*

4.0 Leaflets asymmetrical, distinctly falcate. Leaflets over lapping the rachis all along ……. *P..pnnata form pinnata*

4.0 Leaflets over lapping only at the base, gradually becoming parallel at the tip ……*P. pinnata form repanda*

2.2 Description of the Forms

***Pometia pinnata form pinnata* Jacobs**

Tree, 20–30 m tall; twigs terete, hairy, when older completely glabrous or almost so, leaves 30–40 cm long (up to 100 cm); lealets corioceous, 10–11 pairs, fairly symmetrical, oblong to elliptic, rarely ovate, 20–25 x 7–8 cm, first pair usually sub – orbicular to elliptic, clasping the rachis–like stipules; base oblique, shallowly cordate; tip acute, sometimes acuminate; inflorescence terminal in glabrous or finely pubescent panicles, 30–50 am long; fruits lobes 5–6 cm across, flattened to globose, usually only one lobe is fully developed, 1.5–3 .5 x 1–3 cm ; exocarp leathery, inner fibrous–meaty, white or reddish; aril fleshy, white, pleasant tasting; seed irregular red-brown with a large hilum.

Field characters: heavily buttress, thin or sharply flanged, up to 3m or more; bole often not so straight, 50 –60 cm diameter, rarely rounded reaching up to 20 m before the first limb; bark more or less smooth, dark brown, branching low with heavily green foliage.

Distribution: Same as that of the genus. In Papua New Guinea occurring in almost all coastal regions.

Ecology: Predominent in primary forest on all kinds of soil, river banks or well drained limestone.

Note: Tree having long straight bole lengths, very good volume of sawn timber can be extracted from. The fruits with thin aril (flesh) so they are not much favoured.

***Pometia pinnata form tomentosa* (Bl.) Jacobs**

Tree, 30–40m tall, twigs terete, rusty– brown hairy; leaves 20–30cm long; leaflets 5-7 pairs per rachis; blade falcate, assymetrical, sometimes ovate to lanceolate, 15–25 x 6-9 cm; mature leaflets glabrous, junvenile leaflets pubescent; margin toothed but sometimes faintly; base cordate to obtuse, not overlapping the rachis, apex acute;

Inflorescence densely pubescent, 20-40 cm long pendulous; fruit 3–3.5 x 2–2.5 cm , sub-globose or ellipsoidal , red or brown when ripe, seeds oblong; testa reddish.

Distribution (Based on the material studied): Bulolo in the Morobe province and Kerema in the Gulf province.

Ecology: Primary lowland rain forest on alluvial flats or foothills and hilly slopes up to 200 m.

Notes: Buttress bluntly flanged, rarely up to 2 m or more; usually straight, rounded bole up to 30 m before the first limb; outer bark light brown, rough surface, branching less dense but usually heavily foliage lighter or somewhat yellowish green.

***Pometia pinnata form glabra* (Bl.) Jacobs**

Tree 17–40 m tall, dbh 60–70 cm. Branchlets when young brown-puberulose. . Leaf rachis 30 – 80 cm (or perhaps longer), sometimes sparsely puberulous. Leaflets coriaceous, 8-12 pairs, 4 mm stalked; the first (basal) pair like auricles, up to 3 cm long and suborbicular to elliptic, persistent; the largest more or less 25-32 x 8 (-13) cm, parallel sided; base subcordate to sometimes blunt, top sub acuminate; midrib and nerves always glabrous above, often sparsely puberulose beneath, nerves 18-25 pairs; marginal teeth minute to sometimes coarse. Inflorescence stiff and rather lax 30 –60 cm long, rather densely brown-pubescent, the main branches subtended by 1-2 pairs of reduced suborbicular leaflets like auricles, repeatedly branched. Fruit more or less 3.5 x 2.5 –3 cm.

Distribution: In Papua New Guinea occurring almost in all coastal regions as that of *form pinnata.*

Ecology: Same as that of *form pinnata*

Notes: Boles shorter in length than *form pinnata* and *form tomentosa.* Fruits are larger with thicker aril and are edible.

***Pometia pinnata form repanda* Jacobs**

Tree 23-35 m tall, dbh 40-75 cm. Innovation long glossy–brown pubescent, very early glabrescent. Branchlets not or shallowly grooved, 5mm thick. Leaf rachis slender, 13–27 cm (- 60 cm), with 6–8 leaflets on either side. Leaflets subcoriaceous, the first (basal) pair up to 1 cm long and falcate, the next 1–2 pairs somewhat longer but generally the lower leaflets caducous, the other leaflets mostly not overlapping one another, the largest 12–18.5 x 4–5 (-7) cm, mostly narrowed to both ends or sometimes parallel–sided; base acute to rarely sub cordate, top gradually acuminate; nerves 13–17 pairs, reddish tinged; marginal incisions 1 – 2 mm deep, rather repand than dentate; surface s glabrous all over. Inflorescence stiff, more or less sparsely woolly pubescent, 15–30 cm long, rather densely branched, the branches fairly short, not subtented by reduced leaflets, Fruits 2–2.5 x 1.5 cm.

Distribution: Philippines to New Guinea and Aru Islands. In New Guinea reported from Popondetta Northern province only.

Ecology: Same as *Pometia pinnata form pinnata.*

Notes: Previously known as *Pometia acuminata*.

***Pometia pinnata* form nov. (NGI relative)**

This form resembles *form pinnata* and *form tomentosa* in many of the characters accept that the bole length is shorter and the fruits are large and edible as that of *form glabra.*

Distribution: New Britain, Manus, New Ireland.

3.0 General Ecology

Pometia pinnata, commonly known in PNG as taun, is a highly valued timber species. It is a large tree generally growing to 50 m in height and 1.2 m in diameter (Havel, 1975). The tree is found in the lowlands of PNG, at altitudes ranging from 75 to 800 m above sea level (Damas, 1993) particularly in areas with mean annual rainfall

ranging from 1500 to 5000mm and mean annual temperature range of 22-28^{o}C (Thomson and Thaman, 2006).

Generally, *Pometia* or taun tolerates a wide edaphic range but attains its best development on well drained fertile loams and clay. In PNG, the commercially important form of *f. pinnata* is found on better drained sites, whereas the poorer forms mainly occur on river flats and low-lying areas (Havel, 1975; Thomson and Thaman, 2006).

In lowland forests of Papua New Guinea stockings of commercial sized trees (50 cm dbh and above) are quite high. In rather undisturbed, closed forests, seedlings establish and persist with slow growth. The species regenerates by discontinuous recruitment, favored by small-scale disturbance, but not large gaps. In forest situations the species has a moderately good self-pruning ability, as frequently exhibited by the long, clear bole in mature trees. In open situations young trees tend to develop a coarse, low branching habit and often have poor self-pruning.

Pometia density varies within its distributional range. The lowest density was reported in Western Province while the highest were recorded in parts of New Ireland and Madang Provinces (Hammermaster and Saunders, 1995). Inventory data in lowland rain forests of Managalas Plateaux, Oro Province indicate a range of 8 to 13 trees per hectare (Table 1) (Piskaut, 2005) which on average is anticipated in most potential production forests in PNG.

Table 1. Enumeration of *Pometia pinnata* within the Managalas Plateau, Northern Province (Piskaut, 2004, 2005).

	Kuia	Kadejama	Putei	Pongani
No. Individuals	6	6	4	0
No. merchantable. individivuals	3	2	3	0
Total Area (m^2)	2250	2500	2500	2500
Area (ha)	0.23	0.25	0.25	0.25
Tree density/ha	26.67	24	16	0
Timber density/ha	13.33	8	12	0

In terms of population structure, there appeared to be adequate recruitment into the merchantable form. Based on diameter structure, approximately 5 to 20 percent of *Pometia* trees are potential timbers (Figure 3) in the next cutting cycle of 40 years.

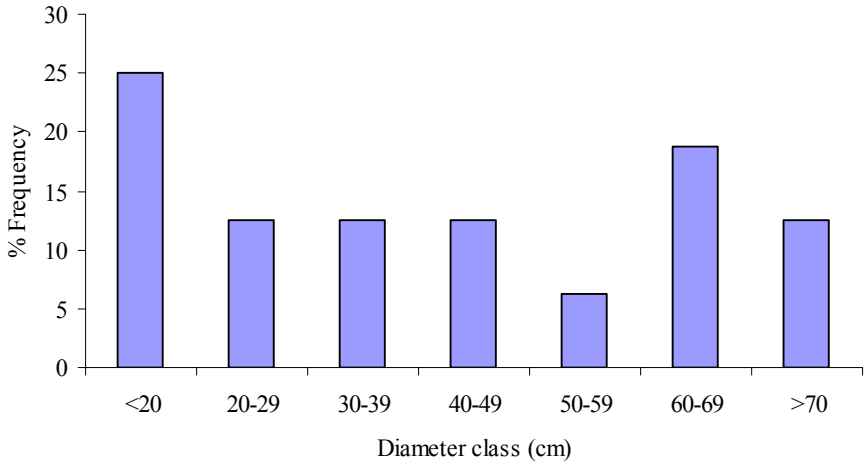

Figure 3. Diameter distribution of *Pometia pinnata* at Managalas Plateau, Northern Province.

4.0 Growth and Development

Early height growth is fast, about 2 m per annum on sites with good soil fertility and moisture levels and intermediate to high light levels. After the first few years, growth rates are typically 1–2 m in height per year. In field trials established at Kerevat, Dami and Madang, the annual stem diameter increment range from 1.8-3.0 cm (Yelu, 2001). Similarly, in the Solomon Islands the annual stem diameter increment was in the range of 1.6–2.5 cm, with growth declining with age. The fastest growing taun trees attained a diameter at breast height (dbh) of 30 cm in 13–16 years but had poor form and short boles to only 4–8 m.

The species copes well with competition from other trees and crops, but growth will slow in more heavily shaded conditions.

5.0 Conservation status

According to the UNEP World Conservation Monitoring Center (UNEP-WCMC) taun is not listed as vulnerable species. However, given heavy exploitation it may be wise to list the species under CITES.

6.0 Harvesting and Trade

6.1 Forest inventories and logging acquisition

Accessing information on forest resources and up to date forest inventories is difficult in Papua New Guinea. Any datasets generated from sampling plots in logged or unlogged forest areas are not readily shared between institutions. The lack of a central repository for such information made information gathering for this desktop study difficult. Information on commercial timber stands, density and volume is therefore limited and the best available information are extracted from the compilation of inventory data as presented by Hammermaster and Saunders (1995) and those conducted by forest developers themselves as part of the requirement under the Environmental Plan. Data on stand densities and volumes may not truly represent the actual timber stand. For instance, the timber volume datasets as presented by Hammermaster and Saunders (1995) contain extrapolations for areas or forest types where data were not available.

Taun is common and commercially exploitable volumes are reported in all coastal and island provinces. The commercially extractable volume of taun on average is estimated at around 15 million cubic meters or approximately 13% of all potential timber species put together. These figures are based on selected timber concession areas and do not represent the gross volume and density of taun in all forested areas in Papua New Guinea.

The current accessible and productive forest types are low altitude forest types on uplands. Table 2 below gives average merchantable taun volumes for low altitude forests compare to other lowland forest types. Note, the mean volumes for all timber species appear higher, reflecting assumed estimations for forest areas where data is

unavailable. Similarly the taun volumes also appear lower in most provinces. For instance, in a study conducted at the foot of the Schrader Range, East Sepik Province, an average taun volume of 1.6 m^3 was recorded in a 0.1 ha or 16 m^3/ha.

Overall, the merchantable taun volume varies from less than then 1 m^3/ha in Western Province to 25 m^3/ha in Madang. Other lowland forest types such as open woodland, forest on plains and fans, and swamp forests, appear to have more taun timbers than the more productive low altitude forest types.

Table 2. Comparison of merchantable taun volume per hectare (m^3/ha) in productive low altitude forests on uplands and other low altitude forest types for major timber resource provinces (data extracted from Hammermaster and Saunders,1995, otherwise as indicated).

Province	Productive low altitude forests on uplands (vol./ha)	Other low altitude forest types (vol./ha)	Mean vol./ha for all potential timber species
North Solomons	7.86	5.40	38.33
New Ireland	5.57	8.98	30.29
East New Britain	5.95	6.03	32.33
West New Britain	5.68	8.34	33.93
Manus	2.97	-	56.50
Milne Bay	3.28	2.95	17.98*
Central	5.26	4.40	21.65*
Gulf	2.71	2.29	20.24*
Oro	2.88	4.70	81.69*
Western	1.48	0.71	15.33*
West Sepik	4.23	3.34	36.69
East Sepik	3.69	3.96	33.42
Madang	8.13	24.83	56.42
Morobe	9.17	12.33	55.00
All Highlands	3.29	0.35	42.50

* Volume from 2002 annual working (*unpublished annual working plan reports, Southern Region*).

The acquisition of potential forest areas for forest development follows a very long process from landowner consultation through to the final issuing of the timber permit. The process referred to as the "Thirty Four Steps" (see Appendix I). According to the Forest Act 1991, all commercial harvesting of forest products require a permit issued

by the PNGFA. A permit is required regardless of whether the forest products involved are grown on state, freehold or customary land. Different permits are issued by the PNGFA that are applicable to the type of forest project. Important to the final approval and issuing of timber permits, the proponent or intending developer provides a forest working plan (FWP) and an Environmental Plan (EP) that takes into account the timber area's topography, the resource density and biological environment of the area. These plans serve as the benchmark for sustainable management.

The extraction of taun and other timber species in natural forests follows the coupe logging method or volume based harvesting system. This is the recommended method based on sustained yield management. Depending on the stand volume, coupes of varying sizes (from as low as 1000 ha to 15000 ha) are established. Sizes of coupes are determined by volume of timber on a per hectare basis. The volume of each coupe represents a 5 year cutting cycle and is divided into subunits called set-ups. Each set-up covers approximately 150 hectares of forests and represents a one year cutting cycle.

There are no set policies specific to the exploitation of taun and other timber species classified under the MEP group 1 timbers. However, the government has put in place general guidelines controlling the exploitation and export of taun. Base on timber volumes in logging concessions, the Forest Authority determines the maximum allowable exploitation or endorsed volume to be extracted. The endorsed volume differs for each timber species or species group and varies from area to area (SGS Reports 2002-2005) depending on stand densities and volumes.

6.2 Log Export

The log export industry in PNG initially focused on the Islands region because of high stocking densities and easy access. Although the area under concession quadrupled between 1982 and 1991 there was no corresponding increase in reported log export volumes.

The log export of all commercial trees peaked in the mid 1990's when log export levels reached about 3 million m^3 each year. However, since then there has been a

steady decline in export volumes to a low of 1.5 million m^3 in 2001. The years 2002 to 2005 experienced a slight increase in log export levels reaching 2 million m^3 (SGS Log Monitoring Reports: 2003-2004). This trend was very pronounced in taun (Figure 4). This was probably attributed to resource rich concessions being logged out and the companies being forced into less desirable forest areas with lower stockings.

It is difficult to ascertain the quantity of taun logs harvested in concession areas. The only records available are logs in shipments that were declared to the authorities. Since the engagement of SGS in the mid 1990s, there was a sharp reduction in undeclared log shipments and deliberate misidentification of species which has cost millions of kina in lost revenue to the government.

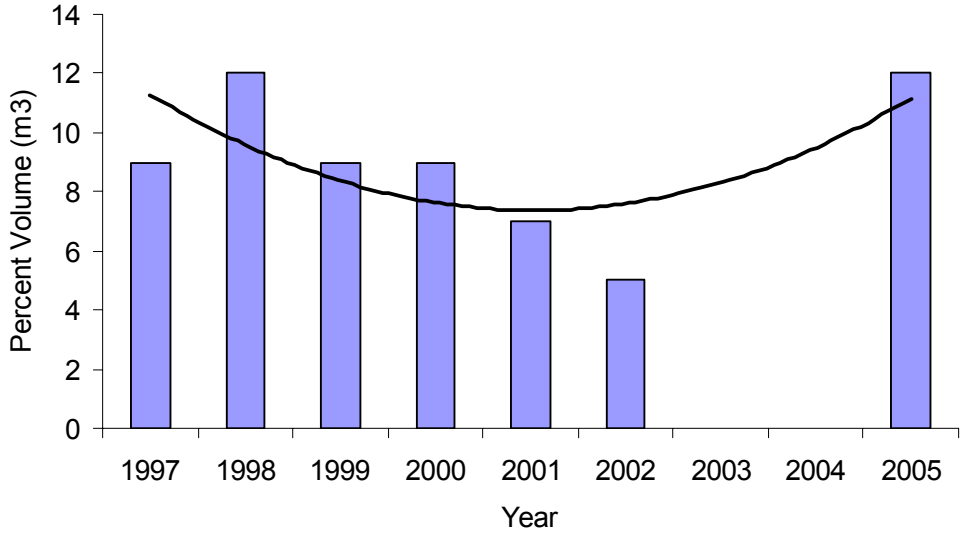

Figure 4. Percentage volume of taun exported from 1997 to 2005 (www.pngfia.org.pg, SGS Log Monitoring Report, 2002-2005).

Taun contributed between 5 to 12% of the total timber volume exported between 1997 and 2005. There was a slight decline in exported taun logs but increased again towards 2005 (Figure 4). From March 2004 and to March 2005, a total of 145,000 m^3 of taun was exported with a value of US$9.7 million. In comparison to all timber species, taun accounted for 12% of the total revenue of US$115 million collected during 2004 (Figure 5).

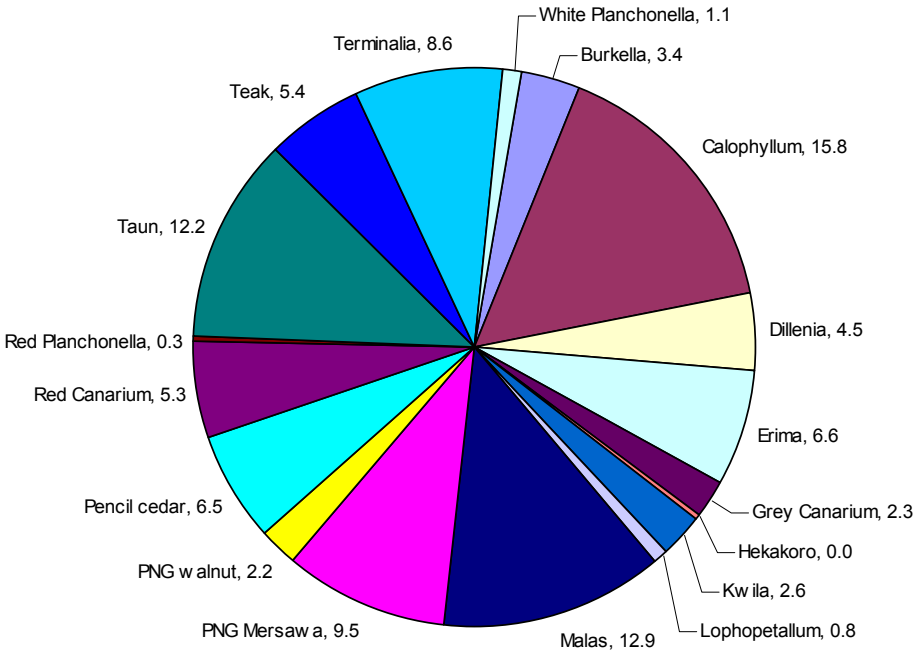

Figure 5. Percentage revenue contribution of major timber species exported in 2004 (*Source: SGS Log Monitoring Report 2004*).

6.3 Processed Taun Export

Table 3 gives a summary of processed taun timbers exported in 2001, 2002 and 2004 in Papua New Guinea alone. Total export volume varies from year to year as determine by market forces. In 2001 a total of 635 m^3 of processed taun were exported to Australia, New Zealand, United States and Vietnam. In 2004 only two countries imported processed taun; Australia and Japan.

Table 3. Export of processed taun from 2001 to August 2004 .

Country	US$/m3	Volume (m3)	FOB $
2001			
Australia	244	370	90,280
Japan	230	65	14,950
New Zealand	392	4	1,568
New Zealand	304	151	45,904
United States	613	4	2,452
Vietnam	345	41	14,145
Total		**635**	**169,299**
2002			
Australia	295	308	90,729
Canada	525	7	3,468
New Zealand	272	178	48,333
Total		**493**	**142,530**
2004			
Australia	359	18	6,432
Japan	69	1,200	82,800
Total		**1,218**	**89,232**

Source: www. fiapng.com.

6.4 Trade Flow

The major trade flow for taun based on SGS Log Export Monitoring statistics are presented in Figure 6. China is by far the main importer of tropical logs followed by Japan, and Korea. Up to 90% of PNG sawn logs were exported to China between 2004 and March 2005. Of this total up to 60% were taun timbers.

Figure 6. Trade flow in the international market of taun logs from PNG.

Of the processed logs, Australia and New Zealand are the two biggest importers of taun (Table 3). The processed taun are mostly exported as rough timbers, beams, flitches and as square logs.

6.5 Export Discrepancies

As taun is common throughout the island of New Guinea, and the satellite islands it is anticipated that a stocking of at least 8-13 merchantable stems would occur in a hectare. Current export records for January and March 2005 show that 7 to 11 logging companies were actively exporting taun timbers (SGS Log Export Monitoring Reports, 2005). The biggest exporters include Rimbunan Hijau (PNG) Ltd, Low Impact Logging Ltd, Vanimo Jaya Ltd, Ambogo Sawmill Ltd, Cakara Alam (PNG) Ltd and Kerawara Ltd.

However, within the same period these companies also recorded high discrepancies in shipment records (Table 4).

Table 4. Taun export discrepancies in volume exported for January and March 2005.

SGS Ref. no.	*Logging Company*	*Area*	*Permitted Volume (m^3)*	*Shipped Vol. (m^3)*	*Percentage Discrepancy*
8607	Low Impact Logging Ltd	BUHEM	200	481.46	140.7
8537	Cakara Alam (PNG) Ltd	ARAWE	100	181.86	81.9
8522	WTK Realty	VANIMO	500	797.77	59.6
8461	Rimbunan Hijau (PNG)	VAILALA	150	199.68	33.1
8536	Cakara Alam (PNG) Ltd	ARAWE	300	353.72	17.9
8546	Ambogo Sawmill Ltd	KUMUSI	3100	2546.47	-17.9
8538	Cakara Alam (PNG) Ltd	ARAWE	370	255.50	-30.9
8760	Cakara Alam (PNG) Ltd	ARAWE	40	179.34	348.3
8743	Low impact Logging Ltd	BUHEM	100	405.01	305.0
8715	Cakara Alam (PNG) Ltd	ARAWE	165	256.21	55.3
8746	Cakara Alam (PNG) Ltd	ARAWE	260	344.61	32.5
8720	Tutuman Dev. Ltd	CEN. NIP	1333.67	1051.93	-21.1
8727	Rimbunan Hijau (PNG)	VAILALA	130	59.99	-53.9
8691	Cakara Alam (PNG) Ltd	ARAWE	15	4.71	-68.6

Source: SGS Log Export Monitoring, March and April 2005

These discrepancies raise some questions for instance:

- the validity of the forest inventory survey – whether it was a case of over or underestimation of timber volumes.
- elements of illegal logging where companies are encroaching into areas outside the demarcated boundaries.
- volumes below approved permitted volumes may imply intentional lumping with lower grade logs. An interview with a former forester with a logging company confirms this usual but regular practice.

It is worth noting that, logging companies employ certified forestry officers who conduct inventory survey, prepare, organize and supervise log exports. Often

prepared export documents comprising species lists and volumes may be knowingly altered to favour the log exporters.

7.0 Management and Regulation

The fourth goal of the Papua New Guinea Constitution which states

> *"…for Papua New Guinea's natural resources and environment to be conserved and used for the collective benefit of us all, and to be replenished for the benefit of future generations."*

This is the cornerstone for forest policy formulation that ensures forest resources of the country are used and replenished for the collective benefit of all Papua New Guineans now and for future generations.

7.1 Statutory Requirements

The management and regulation of taun falls under the Forestry Act 1991 as amended in 1993, 1996, 2000, and 2005. This Act was introduced in response to the findings of a Commission of Inquiry in the 1989 that exposed widespread mismanagement and corruption in the forestry sector. The Act introduced a completely new statutory framework for the management and control of forest harvesting operations and established the PNG Forest Authority as the principle regulatory agency. Key requirements in the Act are*:*

- Conservation and renewal of forest resources as an asset for succeeding generations
- Administration of the management, development and protection of forest resources by the PNG Forest Authority
- Development of forest resources only in accordance with the National Forest Plan
- Timber harvesting allowed only under a permit or authority issued under the Act
- Other forest industry activities to be regulated by licenses
- Registration of all forest industry participants

The Act also provides a detailed framework for the development and allocation of timber harvesting rights and gives powers to enforce the Act against defaulting companies and individuals.

7.2 Informed Consent

In Papua New Guinea, local populations retain legal control of land under a system designated as 'customary land tenure.' Under this system, the rights to manage forest resources and to harvest and sell timber are bound to the land and are clearly vested in the people and not the State.

The Forestry Act 1991 clearly states that the rights of customary owners of the forest resource *'shall be fully recognized and respected in all transactions.* Under the Act, the first stage in the development of a timber harvesting project is for the State to acquire the forest management rights from the forest owners. This is done through a contract known as a Forest Management Agreement (FMA) that must be in writing. A FMA is a contract between forest owners and the PNG Forest Authority, where the forest owners agree to their forest being managed on a long-term basis for sustain wood production. Note, FMA does not set out all the monetary and other benefits the landowners will receive in return for giving logging and marketing rights to the State. These benefits are outlined in the Project Agreement (PA). A PA is a contract with the developer/investor and the PNG Forest Authority.

Regardless of the type of contract being sorted, it is the basic tenant of the 'Law of Contract' that binds all stakeholders in partnership. Thus, when landowners give their agreement in a legally binding contract they must be giving 'free and informed' consent. This means that they understand the nature of the contract and their rights and obligations under its terms.

However, given low levels of literacy and general education, effective communication presents special challenges to those seeking to obtain customary rights.

7.3 Sustained Timber Yield

The requirement in the Forestry Act for forest resources to be 'conserved and renewed as an asset for succeeding generations' has been interpreted in the National Forest Policy emphasizing that timber harvesting be managed on a sustained yield basis.

7.4 Harvesting Regulations

Compliance with harvesting regulations and other requirements relating to the planning and management of field operations is a key parameter in the assessment of the legality of forestry projects.

Papua New Guinea's policies, laws and regulations relating to the administration of forest management provide a detailed framework for the planning and conduct of harvesting operations and post-harvest assessments. This includes: requirements for detailed five-year and annual working plans; compliance with a Logging Code of Practice and key standards governing harvesting operations, road construction and post-harvest treatments; and approved Environmental Plans.

7.5 Contractual Requirements

Forest management in general and timber harvesting operations in particular are underpinned by a series of contractual relationships between the key stakeholders: resource owners, the State, the licensed holder of the timber harvesting rights and the logging company. The exact set of contracts to be found in any one forest management project can vary depending on the legislation that applied at the time the project was initiated, the form of the resource-owner mobilization, the type of license-holding entity and the size of the harvesting operation.

However, whatever the exact form of the contractual relationship, there is always at the core a series of obligations that the logging company owes to the resource owners, whether directly or indirectly, that are to be performed in return for the right to harvest and remove timber. These obligations invariably include three key elements:

1. Direct financial payments (royalties)
2. Building of infrastructure
3. Installation of timber processing facilities

7.6 Environmental Plans

A valid Environmental Plan for all timber harvesting operations is a legal requirement under the Environmental Planning Act and a legal prerequisite to the issuing of a Timber Permit under the Forestry Act.

7.7 Effectiveness of Forestry Act

The effectiveness of the above summarized sections of the Forestry Act was recently reviewed with regard to compliance by current logging companies. Evidence from the reviews indicates that although all timber harvesting operations may be officially licensed, there are serious issues of legal non-compliance at almost every stage in the development and management of these projects (Forest Trends, 2006). For these reasons the majority of forestry operations are considered illegal. Most, if not all companies have not complied with the national laws and regulations. The most widespread and manifest problems are the failure to secure informed consent and the inability of the State to ensure sustained yield management in natural forest areas. In order to be regarded as 'legal,' a timber harvesting operation needs far more than just an official permit or license. It is generally expected that the operator must be able to demonstrate:

- Broad compliance with prevailing legal principles in their instruments which underpin the operating rights;

- A general observance of statutory and regulatory controls in the harvesting operation itself; and
- A more general conformity to the legal standards governing all business operations in Papua New Guinea.

8.0 Recommendations

The following are offered as recommendations based on past experiences, the analysis presented above and possible loopholes in the forestry policies that can have negative effect on taun:

- More scientific research be conducted on taun to address the following important areas:
    - the impact of exploitation on taun population. This includes a detail comparative study on large scale and low impact logging such as portable sawmill, to validate the effects on taun and other timber species.
    - distribution and abundance and stand density studies.
    - regeneration capacity in log-over areas and growth rates.
    - silviculture treatment in natural forest.
    - phenology studies, seed dispersal and germination.
    - taxonomic revision of taun.
    - genetic resource pool studies.
    - create time series model to predict population trends base on volume and other physical and biological parameters.

- There is downward trend in taun volume indicating decline in population densities. Thus, there is urgent need to strengthen existing laws to control and regulate this high quality timber.

- For every concession area that is under negotiation, a proper and more reliable forest inventory data should accompany each Forest Working Plan and Environmental Plan.

- Proper and more frequent monitoring of logging operations by genuine government foresters. There have been instances where foresters employed by logging companies produce and make false declarations on shipping documents. Documents that lump group 1 timber species with low quality timbers thus increasing the risk of transfer pricing.

- Forest resource data, at least in Papua New Guinea, is lacking or outdated. There is urgent need to clearly define local distribution, density and volume and population viability in natural forest for individual timber species. According to the Forestry Act 1991, as amended in 1993, 1996, 2000, and 2005 the PNGFA should promote scientific studies and research into forest resources towards maintaining ecological balance consistent with the national development objectives. The PNG Forest Research Institute, the research arm of PNGFA is poorly funded and has not been able to address this situation adequately. Other institutions that can assist in research include the University of Papua New Guinea, University of Technology and Research based NGOs such as WCS, WWF, and TNC.

- Identify a central repository for all information relating to forest resources, research information and their harvest. This information should be accessed freely by the general public or any interested parties.

- Better networking between stakeholders to facilitate information sharing.

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Appendix I

The "**Thirty Four Steps**" is a step by step procedures of acquiring forest land for development purposes.

1	Landowner awareness campaign
2	Timber rights acquired through a Forest Management Agreement
3	Consent of customary landowners obtained
4	Certification of landowners consent and authenticity of their tenure
5	Ministerial approval
6	Development Options Study
7	Study provided to the Minister and local Forest Management Committee
8	Draft project guidelines prepared
9	Project guidelines approved
10	Project advertised
11	Project proposals lodged
12	Proposals referred to Provincial Committees for evaluation
13	Evaluation of project proposals
14	Invitation to provide further information
15	Detailed report to the National Board
16	Board consider the report and consults the Minister
17	Minister provides comments to the Board
18	Negotiation parameters set by Board and Provincial Committee
19	Board directs further negotiations
20	Project Agreement negotiated
21	Board considers the final draft Project Agreement
22	Agreement returned for further negotiations as necessary
23	Board consults with other stakeholders
24	Board obtains approval of the Minister for Finance
25	Project Agreement executed
26	Board recommends to the Minister to grant a timber permit
27	If Minister accepts the recommendation he/she invites the proponent to apply for a timber permit or
28	Refers the recommendation back to the Board if not accepted
29	Board considers the Ministers referral and makes a final recommendation
30	If the Minister accepts the recommendation he invites the proponent to apply for a timber permit
31	The Minister for Forest then grants a timber permit
32	If the Minister does not accept the recommendation it is referred to the National Executive Council
33	NEC can accept or reject the project proposals and give directions. If the Minister is directed to accept the recommendation he must invite the proponent to apply for a timber permit
34	If NEC rejects the proposal it is renegotiated or readvertised

Appendix II

Flowering, fruiting habits and other features of *Pometia pinnata*

Plate 1: Flower habit of *Pometia pinnata forma glabra*. Photo: D. Kipiro, PNG FRI.

Plate 3. Fruiting habit of *P. pinnata forma pinnata.* Fruits inedible. Photo: D. Kipiro

Plate 2: Fruiting habit of *P.pinnata forma glabra.* Fruit bearing form, inner flesh is thicker and is edible. Photo: D. Kipiro.

Plate 4. Dried fruits of *P.pinnata forma glabra.* Photo: D. Kipiro.

Plate 5. *P. pinnata f. tomentosa*. Lower surface of leaflets and flower habit. Picture courtesy: B. Conn and D. Kipiro

Plate 7. Fruit habit of *P.pinnata f. tomentosa*. Puture courtesy: B. Conn and D. Kipiro.

Plate 6. *P. pinnata f. tomentosa*. Upper surface of leaflets and habit. Picture courtesy: B. Conn and D. Kipiro

Plate 8. *P. pinnata f. tomentosa*. Bark Picture courtesy: B. Conn and D. Kipiro