The Hardwood Plantation Program in Southern Queensland

A summary of the current and future plantation estate, its wood flow and product potential, and the potential role this resource could play in a future Queensland timber processing sector in the period 2025 - 49

Department of Agriculture & Fisheries

Review of the Hardwood Plantation Program

DAF1474 - Summary Report

June 2015

1. Background

The Queensland government initiated a hardwood plantation program in 1999 to underpin a future hardwood processing sector, and to provide an alternative resource after 2025 to that currently being supplied by State-owned native forests in southern Queensland within the South East Queensland (SEQ) and Western Hardwood Region (WHR) log supply areas.

The former Department of Agriculture, Fisheries and Forestry commenced a project in late 2014 to facilitate with major stakeholders, including growers, processors and government, a common understanding of the current and future Queensland hardwood plantation estate in southern Queensland, its wood flow and product potential, and the possible role this resource could play in the future Queensland timber processing sector in the period 2025 – 49.

GHD Pty Ltd (GHD) was engaged by the Department to undertake the review, which was identified as a priority action under the Queensland Forest and Timber Industry Plan. GHD engaged SFM Forest Products and other technical advisors to assist with aspects of the review.

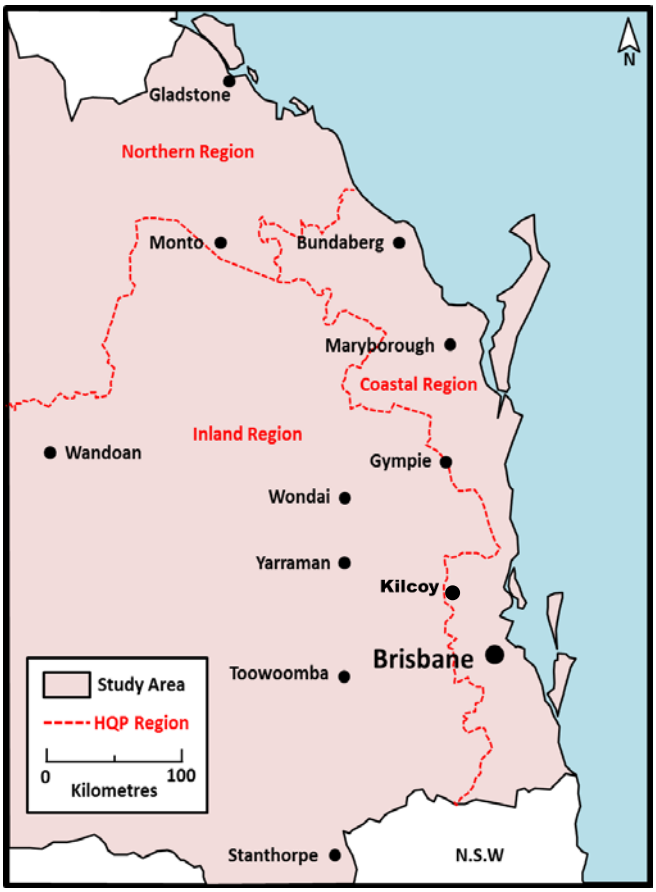
The key objective for the review was to provide both industry and government with the required information and understanding to better determine needs in relation to further investment in plantation establishment, product and market development, processing technology, and research and development that may be required to support Queensland's future industry.

The key questions driving the review were:

- What are the volume, nature and timing of the expected plantation resource?
- What products can be produced from the resource, and what are the markets for these products?
- What are the most feasible future scenarios involving uptake of the plantation resource?
- What risks could compromise the program's contribution to the hardwood processing sector?

The plantations within the scope of the review were primarily those managed by HQPlantations, who took over the State-owned hardwood plantation program under an agreement entered into with the Queensland Government in 2010.

Plantations established under various Managed Investment Scheme (MIS) programs – primarily established from 2000 to 2008 for short-term pulpwood production – were also reviewed to determine their potential to contribute to future wood flows post 2025. The study area, which corresponds with the central and eastern extents of the combined SEQ and WHR geographic areas, is shown in Map 1.



Map 1. Study area for the Review of the Hardwood Plantation Program in southern Queensland.

2. Expected plantation resource

Use of a State government Agriculture Land Audit spatial database, combined with field inspections and an understanding of the current status and future intentions for existing plantation estates, identified that a net (stocked) hardwood plantation estate of around 19,400 hectares could make a contribution to a future processing industry over the period 2025 – 49. This includes around 500 hectares of smallholder and ex-MIS plantations planted with sawlog-suitable species that might make a contribution to future wood flows post 2025, and around 4,500 hectares yet to be planted by HQPlantations under their agreement with the Queensland government.

The existing 14,500 hectares of this expected hardwood plantation estate, established primarily from 2000 to 2014 but with a small area planted from 1995 to 1999, is primarily located at the southern end of the Wide Bay – Burnett region, with the remainder generally dispersed across the northern ends of the Wide Bay – Burnett, South-East Queensland and Darling Downs regions. Following commercial harvest of the existing Araucaria crop, HQPlantations' current intention is to establish the remaining 4,500 hectares on "non-core" plantation areas over the period 2015 – 24. Current planning is for around half of this area to be established at Gallangowan (half way between Gympie and Yarraman), with the remainder to be established at Yarraman, Deer Reserve (near Kilcoy) and Kalpower (near Monto).

Of the 19,400 hectares of expected plantation estate, it is estimated that 84% will be located within the Inland Region, 9% in the Coastal Region and 7% in the Northern Region (see Map 1 for HQPlantations regions). It is also estimated that around 70% of the expected plantation estate could fall within 100km radii centred on either Wondai or Yarraman, with around 50% estimated to fall within a 100km radius centred on Gympie. The expected plantation estate will be established across a range of land tenures and commercial arrangements, with around 65% established on either HQPlantations' or other freehold land, and the remainder established on State-owned land.

The distribution of species across the expected plantation estate (shown in Table 1) demonstrates that the future resource will be dominated by Spotted Gum, the primary native hardwood sawlog and round-wood pole and pile species currently harvested from State-owned and private forests in southern Queensland. The Gympie Messmate and Blackbutt plantings are also recognised native hardwood sawlog species. The small area of "other hardwood species" is primarily planted in research and demonstration plantings established across the Inland Region. In the Inland and Northern Regions, HQPlantations primarily establish areas of land not suited for Spotted Gum (e.g. frost prone areas) with Western White Gum and to a lesser extent Dunns White Gum. Western White Gum is not harvested commercially and Dunns White Gum is a pulp-wood plantation species with some potential for veneer production.

Table 1. Projected plantation area and mean annual increment (MAI) by species

Species	Projected plantation area (%)	Projected whole tree MAI @ age 15 (m^3/ha/yr)		
		Inland / Northern Regions	Coastal Region	Weighted (by area)
Corymbia citriodora ssp variegata (Spotted Gum)	62%	5.8	7.8	6.0
Eucalyptus argophloia (Western White Gum)	26%	2.6	2.6	2.6
E. cloeziana (Gympie Messmate)	6%	7.9	15.1	10.1
E. dunnii (Dunns White Gum)	4%	10.0	16.0	11.1
E. pilularis (Blackbutt)	1%	9.4	21.3	17.0
Other hardwood species	1%	4.0	11.2	4.5
Total	**100%**	**6.1**	**11.8**	**6.8**

Although limited by the availability of long-term growth data and models, a review and analysis of inventory data combined with targeted field inspections were used to derive estimates for projected mean annual increments (MAIs) for each species to age 15 (see Table 1). MAIs are routinely used by forest managers to estimate the likely volume per hectare at rotation age. For example, a plantation growing at an MAI of around 10 m^3/ha/year over a rotation length of 25 years could yield approximately 250 m^3/ha at harvest.

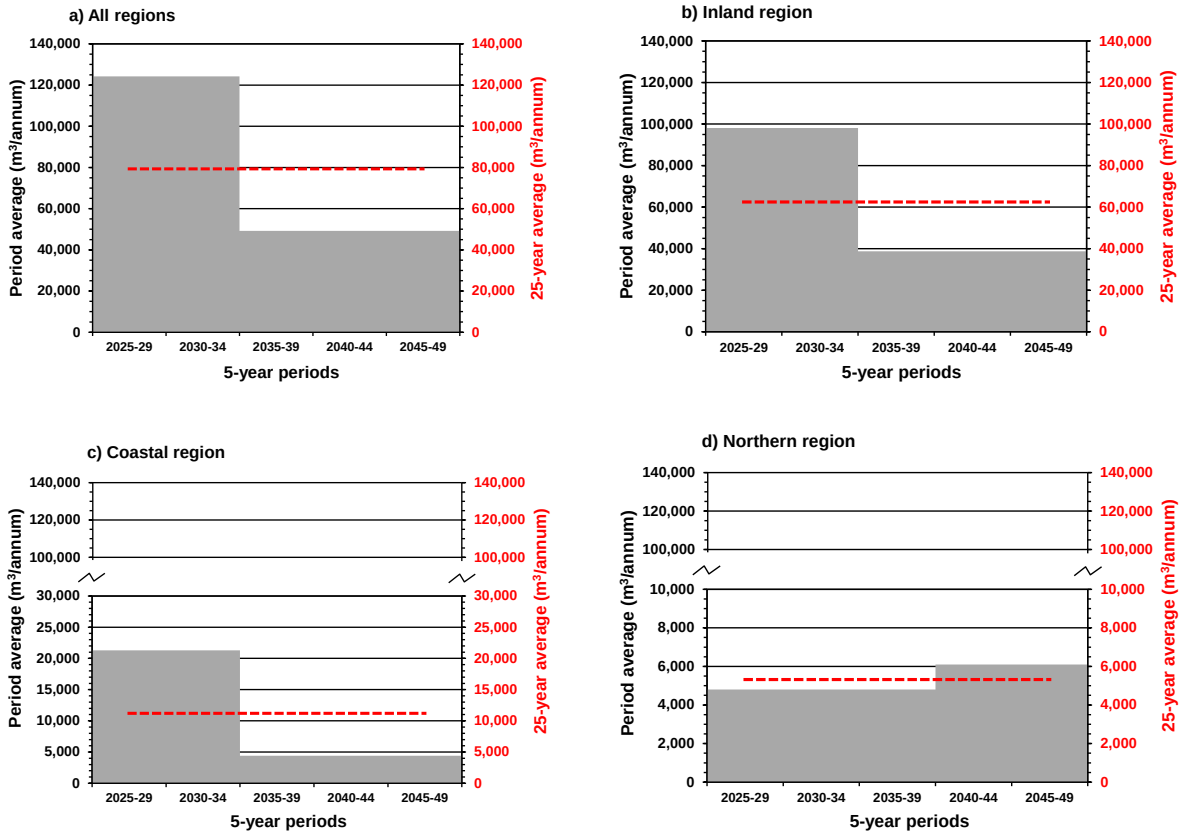
Given these are estimates of "whole tree" versus "merchantable" MAIs, other than perhaps for the Dunns White Gum, Gympie Messmate and Blackbutt plantations established in the higher rainfall Coastal Region, all other MAI estimates came out at the low (e.g. Spotted Gum) to very-low (e.g. Western White Gum) end of the growth spectrum for timber plantations grown in Australia.

A significant portion of the plantations included in the above estimates are being managed using direct thinning and high pruning regimes to produce sawlogs that might yield traditional solid wood timber products, or which could be peeled into veneers to produce engineered wood products such as plywood. Low moisture availability and species-site factors, combined with the very early status of the domestication (including breeding) programs for these species in Queensland, are likely to be the primary factors contributing to the low observed growth rates. Other factors, including use of direct thinning regimes, may account for some marginal loss of growth.

3. Projected log volume and quality

Using area statements and the whole-tree MAI estimates for the expected plantation area, it was possible to estimate the total tree volume that could be produced in each region over the 25-year period 2025 – 49 (see Figure 1).

Figure1. Projected annual total tree volumes expected by region and period, including 25-year average



Notes: Assumes: 25-year rotation; 80% of predicted area harvested; 50% of age-15 MAI for Dunns White Gum

As identified in the notes at the foot of Figure 1, only 50% of the age-15 MAI observed for Dunns White Gum was factored into future wood estimates to age 25. This species was observed to be in decline at some sites at ages 12 to 13 and expert opinion for this species suggests that mortality could significantly affect many plantings by age 20. It was also considered reasonable to estimate that only 80% of the overall expected plantation area may be realised at full rotation due to various risk factors, including: storm, fire, drought or pest damage; and possible harvest access issues for some plantings. This also allows for the potential overestimate of growth rates for some other species.

The variation in the expected average volume over the supply periods 2025 – 34 (10 years) and 2035 – 49 (15 years) as shown in Figures 1 a) – c) reflects the fact that over half of the expected plantation estate was established across the Inland and Coastal regions in the initial 10-year period 2000 – 09. This results in around 60% of the volume being available in the first 10-year period. The more even trend for the Northern Region (Figure 1 d) is due to the low level of planting in that region in the first 10-year period being balanced out by the expected planting of around 800 hectares at Kalpower (near Monto) in the final 2015 – 24 period. While the plantation estate has an uneven establishment pattern, smoothing to a 25-year average has been adopted for modelling purposes.

As described below in Table 2 and Figure 2, three different log utilisation categories were developed to allow for characterisation of the total tree resource across each region as described in Figure 1. For each utilisation category ("Standard Grade Butt Log", "Utility Grade Butt Log" and "Residual Grade Log") the total-tree volume for each species was allocated to notional log products, taking account of assumed log sizes and potential species/log quality, to provide a basis for evaluating potential processing scenarios.

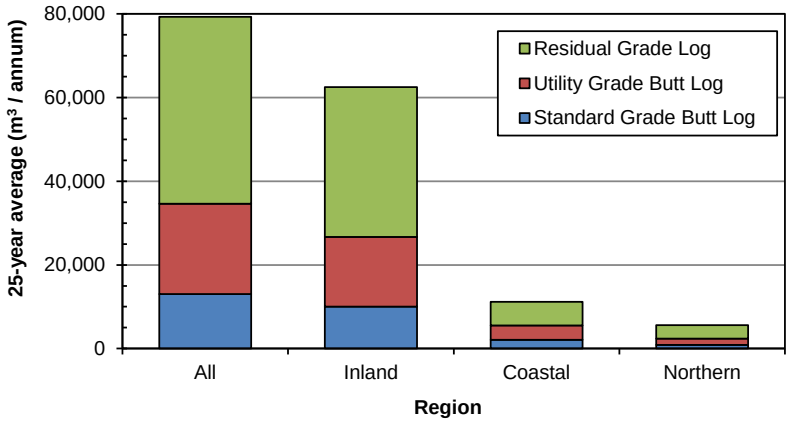
As noted at the foot of Table 2, the low growth rates and observed stem form and quality for Western White Gum indicate that this species is unlikely to make a contribution to the Standard or Utility Grade Butt Log supply.

Table 2. Basis used to allocate standing tree 25-year volume for each species to notional log products

Species	Proportion of resource	Log product (notional allocation)		
		Standard Grade Butt Log	Utility Grade Butt Log	Residual Grade Log
Spotted Gum	70%	T&P	T≠P	Top
Western White Gum	13%			T&P, T≠P, Top
Gympie Messmate	11%	T&P	T≠P	Top
Dunns White Gum	3%		T&P, T≠P	Top
Blackbutt	2%	T&P	T≠P	Top
Other hardwood species	1%		T&P, T≠P	Top

Notes: **Butt = 5.7m log at base of tree (6m standing minus 0.3m stump) Top = all log in tree above 6 metres**
T&P = stands thinned AND carry-up pruned (to 6m) T≠P = stands unthinned AND/OR unpruned
Assumed that low growth rates and poor form for Western White Gum do not yield merchantable butt logs

Figure 2. Projected average total-tree volumes for each region broken up by notional log product



Using projected MAIs, stand heights and a target stocking rate of 150 stems per hectare, it was estimated that a 25-year-old typical 5.7 m Standard Grade Butt Log in the Inland Region would have a large-end diameter under bark of approximately 40 cm and a small-end diameter under bark of approximately 30 cm. This is comparable to small sawlogs currently harvested from native forest sources. A review of recent departmental technical reports identified that the wood density and performance properties of these pruned logs outside of a potential 15 to 20 cm "knotty core" could be similar to the native forest material currently available to the industry. This is more likely the case for trees grown to 30 years or more, than for those harvested at 25 years. Ongoing realisation of annual volumes of Standard Grade Butt Log is dependent upon prescribed thinning/pruning standards being maintained by the grower into the future.

While the Utility Grade Butt Log category might display similar dimensions and wood properties to its pruned counterpart in thinned stands, the likely prevalence of knotty material in these logs could limit this product category to structural or "high feature" end use applications. This factor, along with smaller overall log dimensions, would also impact on the potential utilisation of the Residual Grade Log, derived predominantly from tree tops.

4. Processing options / opportunities

Industry stakeholders consulted during the review were unanimous in their belief that the small-scale nature of this hardwood plantation estate means that no attempt should be made to compete directly with products produced from the large-scale softwood plantation estate. This consideration rules out any potential options for truss / frame manufacture from the hardwood plantations or the development of primary markets for the production of landscaping roundwood and fencing products.

No potential was identified for use of the hardwood plantation product in current facilities manufacturing chip or fibre board products from softwood. The dominance of Spotted Gum in the hardwood plantation estate, with low pulp yields, rules out consideration of primary markets for wood chip or pulp-log export for paper manufacturing. The estimated 200 to 250 km average distance from plantations to the existing ports of Brisbane or Bundaberg, combined with low yields per hectare, would limit development of sustainable saw/ply log export markets.

The remaining processing options and opportunities worthy of more detailed investigation include: sawn timber; dry veneer / plywood; fuel / pellets; and poles / piles. The relatively low projected harvest volumes of 100 to 150 m^3/ha, combined with the widely dispersed nature of plantings, significantly impacts on harvest/ haul costs across the plantation estate and dictates that "within region" processing is the only viable option for most products. The exception is for high value poles which can be economically transported greater distances.

Sawn timber

The prevalence of relatively small diameter logs, compared with the current native forest supply, would favour the production of 100 x 25 mm and 100 x 38 mm floor boards or decking material from the resource. Current sawmilling technology would be suitable. Recent market experiences suggest that the production of narrow, high feature (i.e. knotty) boards may have limited market appeal. Hence supply would need to be limited to the Standard Grade Butt Logs unless an effective niche marketing campaign could be developed for the high feature material likely to be produced from the Utility Grade Butt Logs.

It is estimated that a new (greenfield) sawmill processing green-off-saw timber (green mill) would require a minimum throughput of 30,000 m^3/year and that a sawmill processing air- or kiln-dried timber (dry mill) would require a minimum log input equivalent of 50,000 m^3/year. While Figure 2 shows that around 27,000 m^3/year of Standard and Utility Grade Butt Log is available within the Inland Region over a 25-year average supply outlook, only 10,000 m^3/ year would be Standard Grade Butt Log which best matches the wood properties from small logs currently sourced from native forest.

Taking into account both log volume and quality, this resource is considered marginal for investment in a green mill and insufficient to support investment in a dry mill. However, there are existing green and dry mill processing facilities in the region that could process this material in addition to their current native forest resource, particularly if the hardwood plantations are grown over rotations of 30-years or longer.

Dry veneer / plywood

Around 50,000 m^3/year of resource is estimated to be required to underpin any greenfield investment in a dry veneer mill, whereas around 100,000 m^3/year of log equivalent would be required to support investment in a plywood mill producing structural / form ply material as used in the construction industry. However, only around 27,000 m^3/year of Standard and Utility Grade Butt Log combined (Figure 2) is available over a 25-year average supply/investment timeframe, with 60% available in the first 10 years (Figure 1 b)). This volume is half that required for a dry veneer mill.

Given the high strength grade properties intrinsic within the hardwood plantation resource, there may be opportunities to process this material in association with a veneer/ply facility established primarily for softwood, which has lower strength grade properties. However the future availability of this hardwood plantation resource is unlikely to significantly influence the case for establishing such a plant in the region. The production of economic "A bonds" as required for adhesion of veneers in external use applications also remains technically challenging for Spotted Gum.

Fuel / pellets

Fuelwood, in the form of chip or pellets, is an outlet for forest and processing plant residues. The proportion of log not taken as Standard or Utility Grade Butt Log is potentially available for fuel from the forest, as well as the residue from the green and dry mill operations. Around 100,000 m^3/ year would be required to underpin investment in an export focused fuel pellet operation. Estimates indicate that less than 50% of this amount would be available, requiring supplementation from either native forest or softwood plantation residues. The viability of export pellet production is highly sensitive to delivered wood costs, which does not favour the widely dispersed Queensland hardwood estate with low yields per hectare.

Domestic markets would therefore need to be found for both plantation and sawmill residues. Potential domestic markets include production of energy (linked to renewable electricity targets), heating and for animal loafing, and could be serviced over short distances with chip. There are small markets for pellets used in domestic heating and animal loafing which may expand, but these could presumably be serviced with product diverted from the existing export pellet plant south of Maryborough which adjoins the Hyne Tuan softwood sawmill.

Poles / piles

Electricity and transmission poles can be produced from hardwood plantations and the production of plantation-grown poles could easily be integrated with the ongoing harvest and processing of native forest poles. There would be no minimum scale necessary for investment in a pole plant while existing treatment facilities are available that rely on native forest or softwood plantation resource. The selective removal of high value poles from plantations could however impact on the viability of other products such as sawlog material. Piles, which are used to provide foundations for civil construction, can also be produced from plantation material. However, in contrast to poles, piles are a very low value product.

5. Key conclusions

While there is around 27,000 m^3/year of Standard and Utility Grade Butt Log available within the Inland Region over a 25-year average supply outlook, only 10,000 m^3/ year of this volume would be the higher quality Standard Grade Butt Log which best matches wood properties from small logs sourced from native forest. Taking into account the projected log volume and quality, and that around 60% of the available resource is available in the initial 10-year supply period, this plantation resource is considered inadequate to support investment in a greenfield sawmill (either green mill or dry mill).

The resource would also be insufficient to justify investment in a greenfield dry veneer or plywood plant. Any investment in such a product line would be driven instead by the availability of other resources such as softwood butt logs supporting construction of a veneer / ply plant, with plantation hardwood veneer only seen as an opportunistic add-on.

The volume, quality, location and timing of the projected hardwood plantation estate mean that this resource will not directly replace the native forest resource as currently sourced from State land. The most likely outcome is that existing green and dry mill facilities in the Inland Region could process the higher quality proportion of this material for sawn timber in addition to their current native forest resource allocations. This would particularly be the case if hardwood plantations are grown over 30-year rotations or longer and if sawmills have an existing small-log processing capability. A portion of the resource in the Inland Region could also be utilised for poles and piles for supply to existing treatment facilities. In the other regions, the plantations could provide an opportunistic but limited supply of poles and some sawlogs.

There remains a significant volume of lower grade plantation material that is likely to prove problematic in finding a viable domestic or export market.

The low growth rates achieved for most species, particularly in the Inland Region, would tend to discourage any significant replant or expansion of the expected hardwood plantation estate. Given the poor growth of Western White Gum, and the potential mortality of Dunns White Gum, further planting of these species is considered unlikely to make any useful contribution to future wood supply for the Queensland hardwood processing sector.

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