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Upscaling the Australian softwood sawmill industry

Feasibility and implications for future plantation investment

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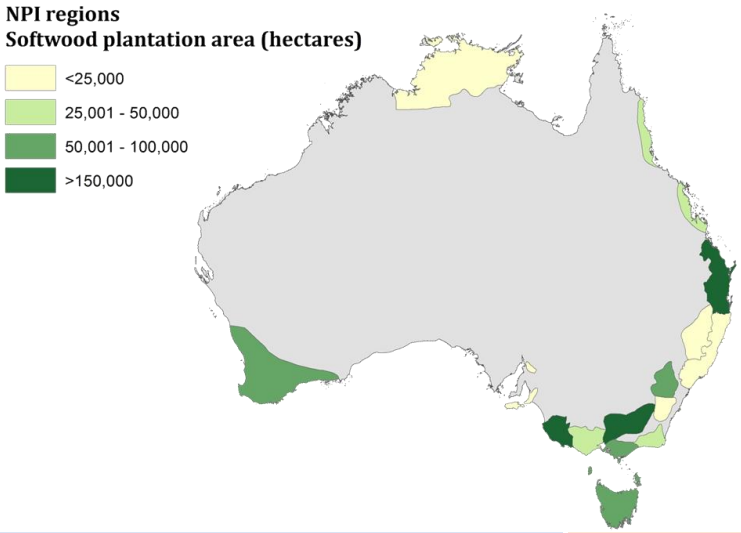
Evidence suggests **that only a fraction softwood sawmills are big enough** to be internationally competitive—potentially resulting in higher processing costs and less competitive product prices.

So ABARES estimated the optimal area of softwood plantations needed to support a world-scale sawmill in the largest plantation regions.

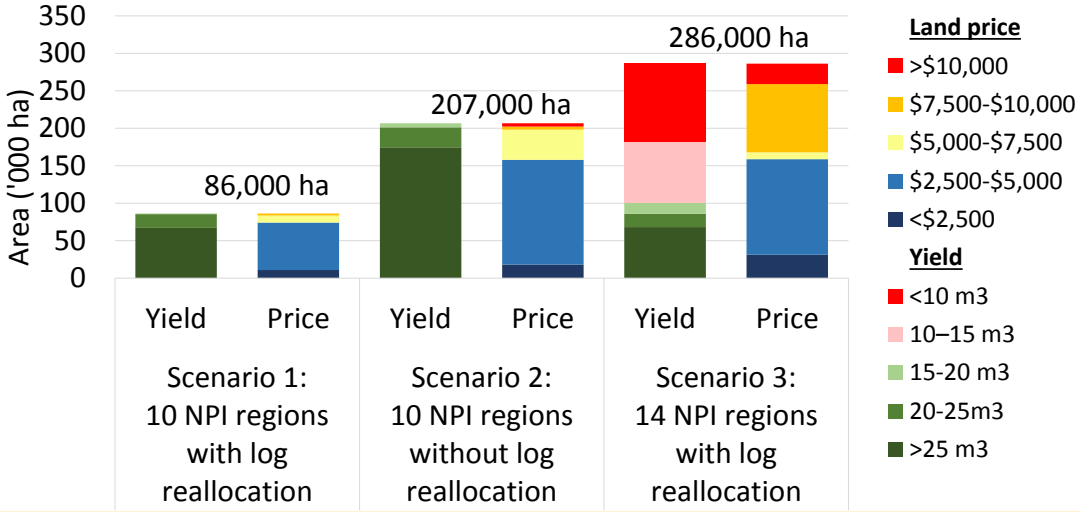


ABARES found that supporting a world-scale sawmill in the 10 largest plantation regions (Scenario 1), would optimally involve establishing **86,000 hectares by 2050** as well as drawing on logs from other mills.

If logs cannot be drawn from other mills (Scenario 2), the optimal area of new plantings increases to **207,000 hectares by 2050**.

Supporting a world-scale sawmill in all plantation regions except the Northern Territory (Scenario 3), would require **286,000 hectares by 2050**. This is unlikely to be economically viable, however, as 185,000 hectares would yield less than 15 m^3 per year and 118,000 hectares would costs more than $7,500 per hectare.

New softwood plantation area in 2050, by land price and productivity



Any **efforts to increase the scale of the domestic softwood sawmill industry should be targeted at specific regions**, taking into account the current resource, sawmill infrastructure and area of viable land.

Summary

The volume of global trade in wood products continues to grow, putting increased pressure on the Australian softwood sawmilling industry to remain internationally competitive. However, many softwood sawmills in Australia operate at much smaller scales than overseas competitors, potentially leading to higher processing costs and less competitive product prices (EY 2016).

This report was jointly commissioned by Forest and Wood Products Australia and the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) to estimate the area of new softwood plantations required to support a world-scale softwood sawmill in selected National Plantation Inventory (NPI) regions. It builds on previous work undertaken by ABARES (Whittle, Lock & Hug 2019) using the same framework but imposes additional conditions on the operation of world-scale sawmills.

The area of new softwood plantations established depends on the number of NPI regions required to support a world-scale softwood sawmill and the extent to which logs can be reallocated between mills. Three alternative scenarios were considered. The first scenario assesses the optimal approach to supporting a world-scale softwood sawmill in the 10 NPI regions that currently have softwood estates larger than 30,000 hectares. No limits are placed on the reallocation of logs between mills under the first scenario. The second scenario imposes an additional constraint that logs cannot be reallocated between mills. This requires a larger area of new softwood plantations to be established. The third scenario assumes that a world-scale sawmill must operate in all NPI regions except the Northern Territory and that logs can be reallocated between mills.

The analysis in this report includes estimates of the optimal area of new softwood plantations established under the three scenarios. The area of new softwood plantations is broken down by NPI region, land price and productivity. The report also presents estimates of the total volume of softwood sawlogs harvested, the volume of softwood sawlogs reallocated between mills (where applicable) and the potential impacts on sawnwood production and trade.

Policymakers and industry can use the findings in this report to better understand the potential barriers to and implications of upscaling the domestic softwood sawmill industry.

Key findings

There is an abundance of agricultural land but not all of it is economically viable

Australia has millions of hectares of cleared agricultural land but only a small portion is likely to be suitable for establishing commercial softwood plantations. Based on ABARES assumptions about plantation establishment costs, log prices and transport distances, less than 500,000 hectares of agricultural land is potentially economically viable for conversion to softwood plantations. However, in a previous analysis undertaken by ABARES which took into account further constraints such as nearby mill capacity and regional demand, it was estimated that establish only around 24,000 hectares of softwood plantations by 2050.

The most efficient way to upscale the softwood industry would involve a combination of new plantation establishment and log reallocation

ABARES modelling suggests that in many cases redirecting logs away from other wood processing facilities or log exporters can be more efficient than establishing new plantations—once the costs of establishment, the product mix of existing mills and final product prices are taken into account.

For example, under the condition that a world-scale softwood sawmill operates in each of the 10 selected NPI regions (Scenario 1), ABARES estimates that it would be optimal to establish around 86,000 hectares of new softwood plantations by 2050 and reallocate an average of 1.7 million cubic metres of softwood sawlogs each year from other facilities.

Most of the plantation estate established under Scenario 1 is estimated to be concentrated in a handful of regions, with around 44,000 hectares or more than half of this area in North Queensland alone. A further 37,000 hectares or 43 per cent is estimated to be established in Western Australia, Tasmania and East Gippsland–Bombala. Regions that do not currently have significant softwood estates are more likely to need additional plantations established to support a world-scale softwood sawmill.

Without log reallocation more plantations would need to be established

To support a world-scale softwood sawmill in 10 NPI regions without reallocating logs between mills (Scenario 2), ABARES estimates that establishing around 207,000 hectares of new softwood plantations by 2050 would be optimal. This is around 120,000 hectares more than under Scenario 1 which allows logs to be reallocated between users.

Restricting log reallocation is likely to have a greater effect on the area of new softwood plantings in some regions than others. For example, in the absence of log reallocation (Scenario 2) 65,000 hectares of softwood plantations are estimated to be established across Central Victoria and East Gippsland–Bombala by 2050. This is around 57,000 hectares more than under Scenario 1 which allows log reallocation. Similarly, the total area of softwood plantations estimated to be established across Western Australia, Tasmania and North Queensland by 2050 was 46,000 hectares higher under Scenario 2 than Scenario 1.

A world-scale softwood sawmill is unlikely to be economically viable in some regions

ABARES modelling suggests that supporting a world-scale sawmill in all NPI regions except the Northern Territory (Scenario 3) is unlikely to be feasible. This is because of inadequate existing log supply and insufficient area of potentially viable agricultural land in some regions. As such, any efforts to increase the scale of the domestic softwood sawmill industry should be targeted at specific regions, taking into account the current resource, sawmill infrastructure and area of viable land.

Australia will likely continue to export and import sawnwood products

Australia will likely continue to export and import sawnwood products in the future, due to regional disparities between supply and demand for specific sawnwood products.

Under the condition that a world-scale softwood sawmill operates in each of the 10 selected NPI regions (Scenario 1), ABARES estimates that the annual volume of softwood sawlogs harvested

would fall short of domestic log equivalent domestic demand by an average of 557,000 cubic metres per year from 2050 to 2054. With log exports estimated to be around 1.2 million cubic metres per year, the average annual domestic softwood sawlog supply shortfall is estimated to be around 1.7 million cubic metres per year from 2050 to 2054.

In contrast, in the absence of log reallocation (Scenario 2), ABARES estimates that the annual volume of softwood sawlogs harvested from 2050 to 2054 would exceed domestic log equivalent demand by an average of 2.4 million cubic metres per year. However, with annual log exports estimated to increase to around 2.5 million cubic metres per year, the domestic softwood sawlog supply shortfall is still estimated to average 77,000 cubic metres per year.

Introduction

The volume of global trade in wood products is continuing to grow, putting more pressure than ever on the Australian softwood sawmilling industry to remain internationally competitive. However, many softwood sawmills are operating at much smaller scales than overseas competitors, potentially leading to higher processing costs and less competitive product prices (EY 2016). Failure to achieve the necessary economies of scale to remain internationally competitive could have significant implications for the long-term profitability and sustainability of the Australian softwood industry.

In light of this, Forest and Wood Products Australia and the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) jointly commissioned this report to estimate the area of new softwood plantations required to support a world-scale softwood sawmill in selected National Plantation Inventory (NPI) regions. Based on a report commissioned by Forest and Wood Products Australia (Omega Consulting 2018), the analysis in this report assumes that softwood sawmills are internationally competitive or world-scale if they have annual input capacities equal to or greater than 800,000 cubic metres.

This report builds on previous work undertaken by ABARES (Whittle, Lock & Hug 2019) that examined the potential for new plantation establishment under different economic conditions. However, the modelling framework in this report includes additional constraints on log reallocation and the operation of world-scale sawmills.

If softwood sawlogs from the current softwood plantation estate are expected to be fully utilised, the logs required to support world-scale softwood sawmills must either come from newly established plantations or redirected from other wood processing facilities or log exporters. The extent to which logs can be reallocated between mills will affect the optimal area of new softwood plantations established.

For this reason, three alternative scenarios were considered. The first scenario imposes the condition that at least one world-scale softwood sawmill must operate in the 10 NPI regions with current softwood estates larger than 30,000 hectares over the period 2050 to 2080. No limits are placed on the reallocation of logs. The second scenario is the same as the first but does not allow logs to be reallocated between users, relative to the base case. The third scenario allows logs to be reallocated between users but requires that all remaining NPI regions, except the North Territory, also have a world-scale sawmill operating from 2050 to 2080.

The analysis in this report determines the optimal trade-off between establishing new plantations and reallocating logs using the Forest Resource Use Model (FORUM)—a spatial economic model of the Australian forest and wood processing industry. FORUM determines the optimal allocation of wood resources to mills and final markets by considering harvesting, transport and processing costs, mill capacity and recovery rates, mill investment opportunities and final demand for wood products. Other factors such as the impacts on other agricultural sectors, regional communities and the environment are not accounted for. More detailed descriptions of the FORUM framework can be found in Burns et al. (2015) and Whittle, Lock & Hug (2019).

The findings presented in this report provide a number of important insights into the potential area of new softwood plantations planted to support world-scale softwood sawmills and the characteristics of the land these plantations are established on. It also sheds light on the potential impacts on log exports and trade in sawnwood. Policymakers and industry can use the findings of this report to better understand the potential barriers to upscaling the domestic softwood sawmill industry.

Chapter 1 provides a brief background on the current softwood plantation estate and softwood sawmill industry in Australia while Chapter 2 discusses the modelling approach and scenarios. Chapter 3 presents estimates of the potential area of new plantation establishment in NPI regions, and associated log and sawnwood production and trade. Chapter 4 highlights some potential considerations in interpreting these findings.

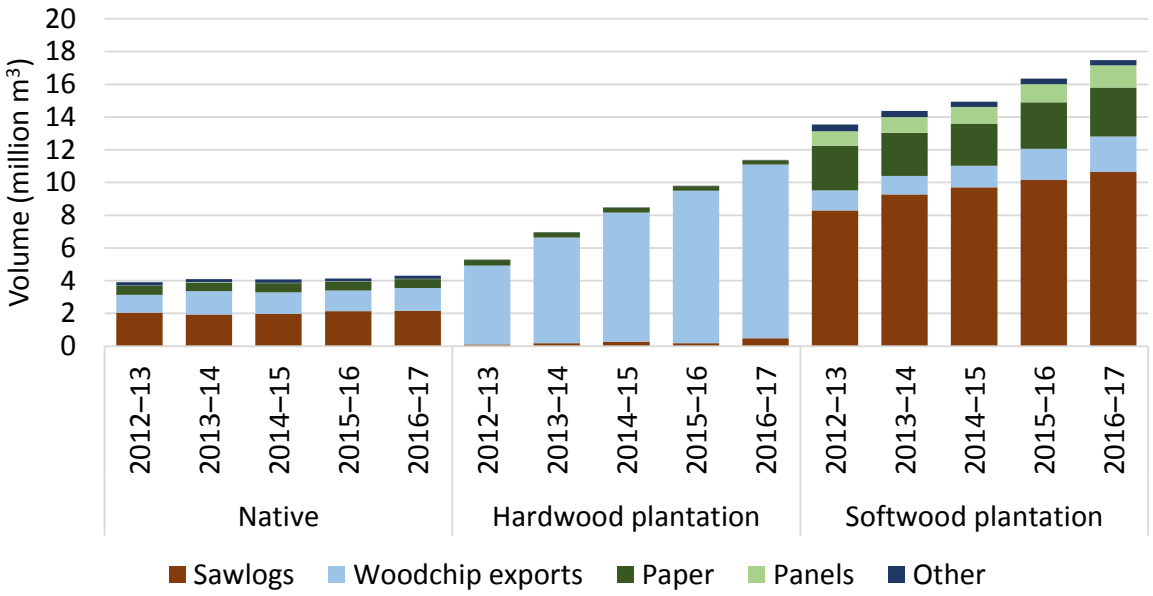
1 Australian softwood industry

1.1 Current softwood estate and infrastructure

The softwood plantation estate is large but concentrated

The softwood plantation estate is currently the largest on record. In 2016–17 the estate was estimated to be over 1.0 million hectares (ABARES 2018) and accounted for more than half of all logs harvested in Australia and 80 per cent of all sawlogs (Figure 1). The vast majority of softwood sawlogs harvested in Australia are processed domestically, with sawnwood products primarily being used by the residential construction and furniture manufacturing industries.

Figure 1 Log harvest volume, by forest type and end use, 2012–13 to 2016–17

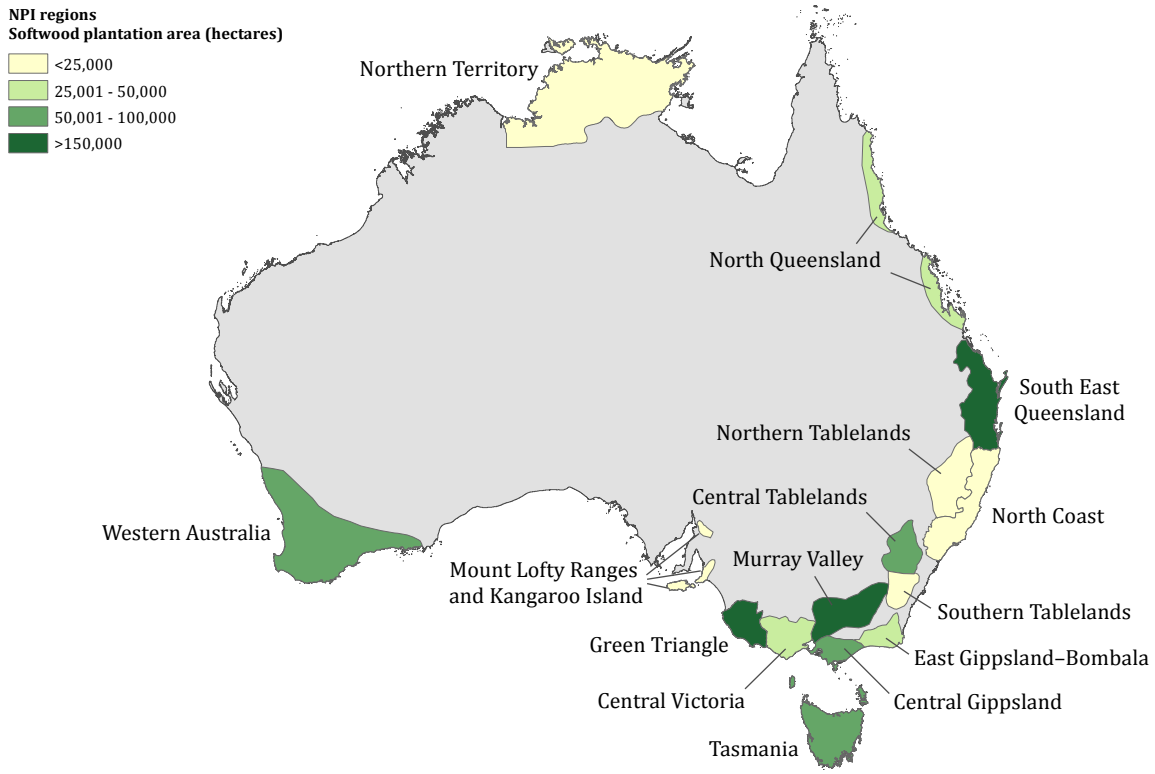


Note: Native includes cypress pine sawlogs. Sawlogs include logs sold domestically and exported. Years refer to financial year ending.
Source: ABARES 2018

The softwood plantation estate is relatively concentrated in a handful of NPI regions. More than half of the 1.0 million hectare estate (ABARES 2018) is located in only three NPI regions—Murray Valley, the Green Triangle and South East Queensland (Map 1 and Figure 2). Each of these regions has between 150,000 and 200,000 hectares of softwood plantations. Western Australia, the Central Tablelands, Tasmania and Central Gippsland have smaller but still substantial estates (between 50,000 and 100,000 hectares) and account for a further 31 per cent of the national softwood estate. The remaining 18 per cent (or around 182,000 hectares) of the estate is spread across eight regions.

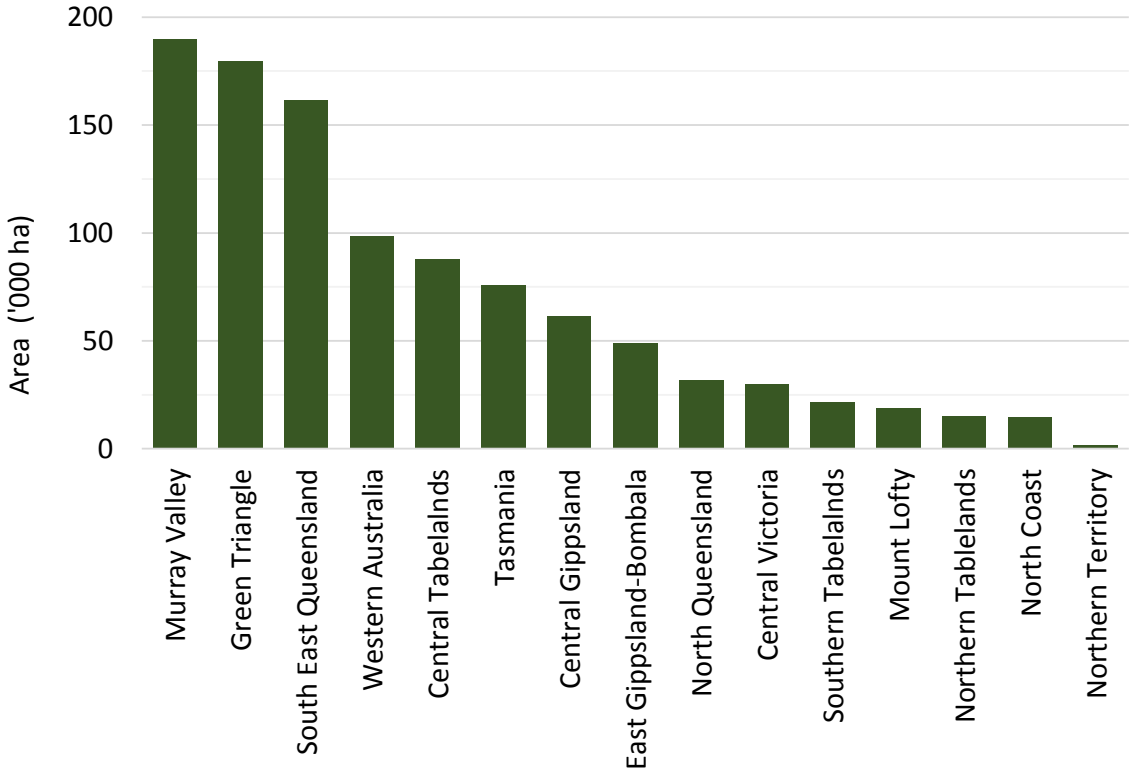
As a result, ABARES estimates that most regions are unlikely to have the necessary volume of softwood logs to support a world-scale softwood sawmill. The softwood plantation estates in Murray Valley, Green Triangle, South East Queensland, Western Australia and Central Gippsland are estimated to generate more than 800,000 cubic metres of softwood sawlogs per year, but other regions are estimated to generate less (ABARES 2016). As a result, most regions would need to expand their current softwood estates or draw logs from mills in neighbouring regions to support a world-scale softwood sawmill.

Map 1 National Plantation Inventory Regions and softwood plantation estate, 2016–17



Source: Downham and Gavran (2018)

Figure 2 National Plantation Inventory Regions and softwood plantation estate, 2016–17

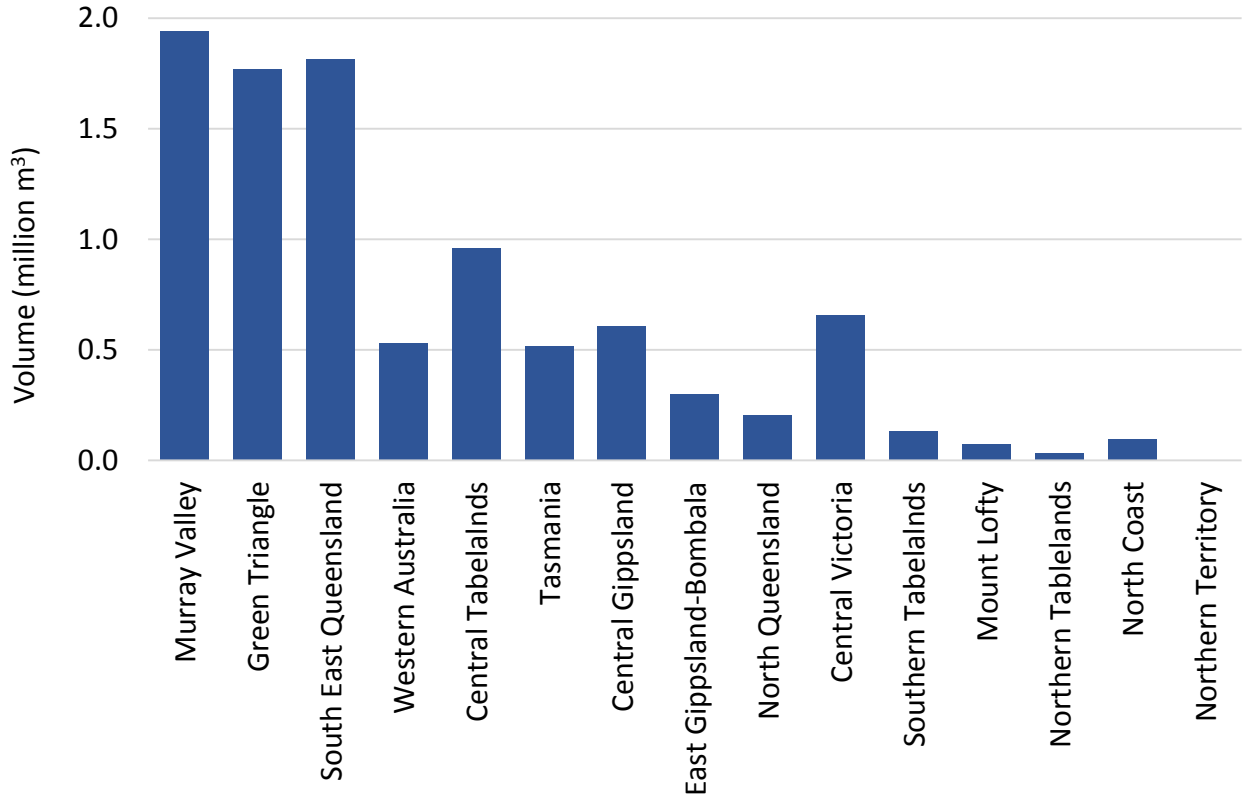


Source: Downham and Gavran (2018)

Most regions do not have a world-scale softwood sawmill

The distribution of softwood sawmill capacity around Australia loosely matches the distribution of the softwood plantation estate. That is, NPI regions with large softwood estates also tend to have larger processing capacity (Figure 3).

Figure 3 Softwood sawmill capacity by NPI region, 2016–17



Source: Updates of Gavran et al. 2014

For example, the Murray Valley, Green Triangle and South East Queensland NPI regions are home to more than half of Australia's total softwood sawmilling capacity. ABARES estimates that each of these regions has the infrastructure needed to process over 1.7 million cubic metres of softwood sawlogs per year and has at least one softwood sawmill capable of operating at or near world-scale.

Western Australia, the Central Tablelands, Tasmania, Central Gippsland and Central Victoria also have substantial estates and infrastructure capable of processing between 500,000 and 1 million cubic metres of softwood sawlogs each year. Each of these regions is estimated to have at least one sawmill with an annual input capacity greater than 400,000 cubic metres.

The remaining seven NPI regions have total softwood sawmill capacities less than 300,000 cubic metres per year and the largest softwood sawmill in most of these regions has an annual input capacity less than 100,000 cubic metres.

The current softwood estate and infrastructure may not meet future demand

The current softwood estate and infrastructure may not be sufficient to meet growing demand for softwood sawnwood. In previous analysis (Whittle, Lock & Hug 2019) ABARES estimated that the volume of softwood sawlogs available to the domestic market would fall short of

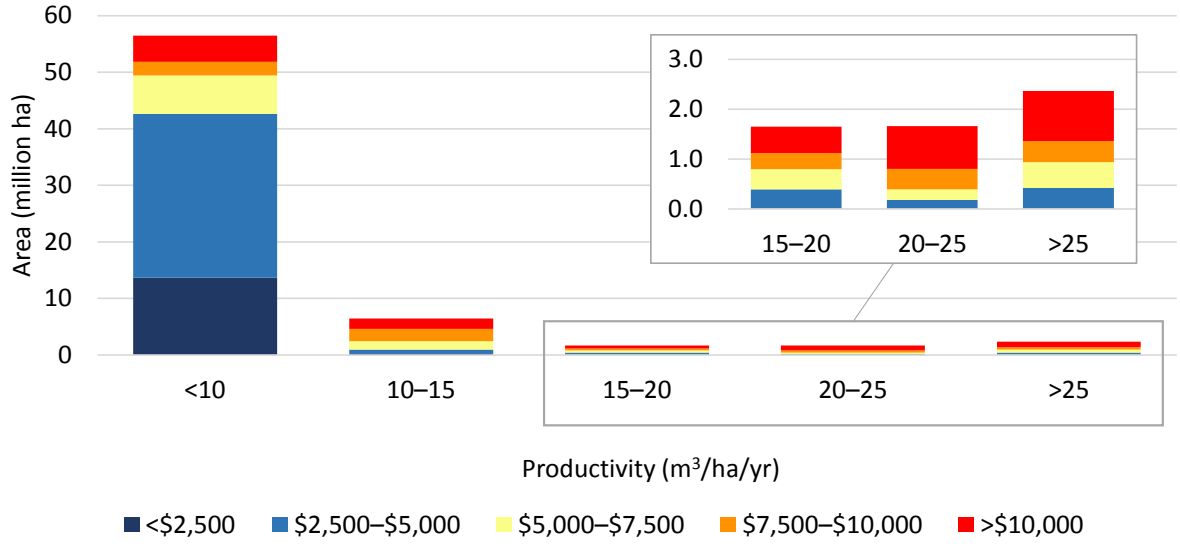
demand by an average of 3.4 million cubic metres per year from 2050 to 2054 if softwood sawlog exports remain at 2015–16 levels. A shortfall of this magnitude would require an additional 200,000 to 250,000 hectares of new softwood plantations by 2050 (based on an assumed growth rate of 13.5 to 17.0 cubic metres of sawlogs per hectare per year). However, given the uncertainty around future softwood sawlog supply and log equivalent demand in 2050, it has been proposed that the required area could be as high as 490,000 hectares (Omega Consulting 2017).

1.2 Area of available agricultural land

The area of potentially suitable land is limited

Australia has millions of hectares of cleared agricultural land, but a large portion of this area is unlikely to be suitable for establishing commercial softwood plantations. Potential barriers include low yields, high land prices and long distances to primary processing (Whittle, Lock & Hug 2019). For example, ABARES estimates that there is around 69 million hectares of cleared agricultural land in NPI regions, but the vast majority of this land has estimated annual growth rates less than 10 cubic metres per hectare and average land prices greater than $5,000 per hectare (Figure 4).

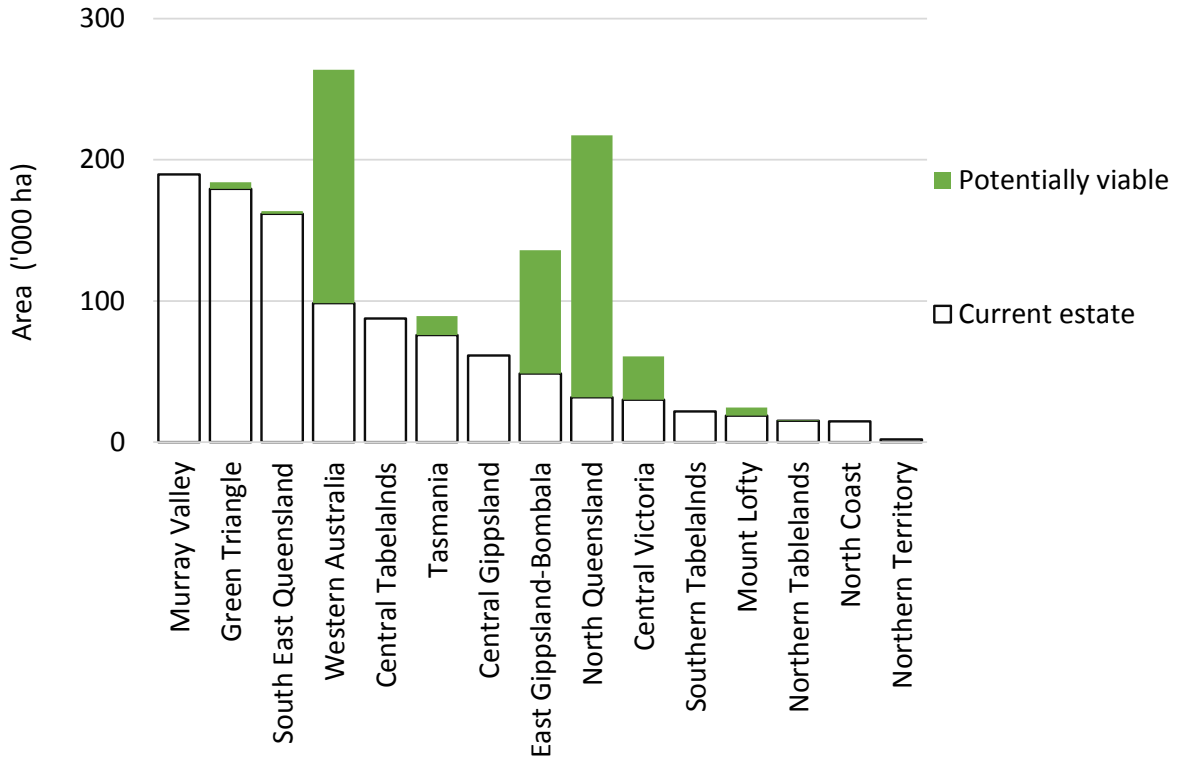
Figure 4 Area of agricultural land, by land price and productivity



Note: Productivity refers to mean annual increment (MAI), which is the volume of wood grown each year per hectare.

Taking into account transport costs and the trade-off between land price and productivity, the area of agricultural land that could potentially be viable for conversion to softwood plantations is likely to be small and concentrated in only a handful of regions. For example, using average milldoor log prices from the ABARES 2016–17 Gross Value of Production (GVP) Survey and assuming average transport distances of 75 kilometres from forest to mill, ABARES estimates that around 495,000 hectares of agricultural land could potentially be viable (Figure 5). ABARES estimates that around 438,000 hectares or 88 per cent of this area is located in North Queensland, Western Australia and East Gippsland–Bombala. Central Victoria and Tasmania are also estimated to have significant areas of potentially viable agricultural land (31,000 and 13,000 hectares respectively). The remaining 10 NPI regions are estimated to have less than 13,000 hectares of potentially viable agricultural land, combined.

Figure 5 Current softwood estate and potentially viable agricultural land, by NPI region

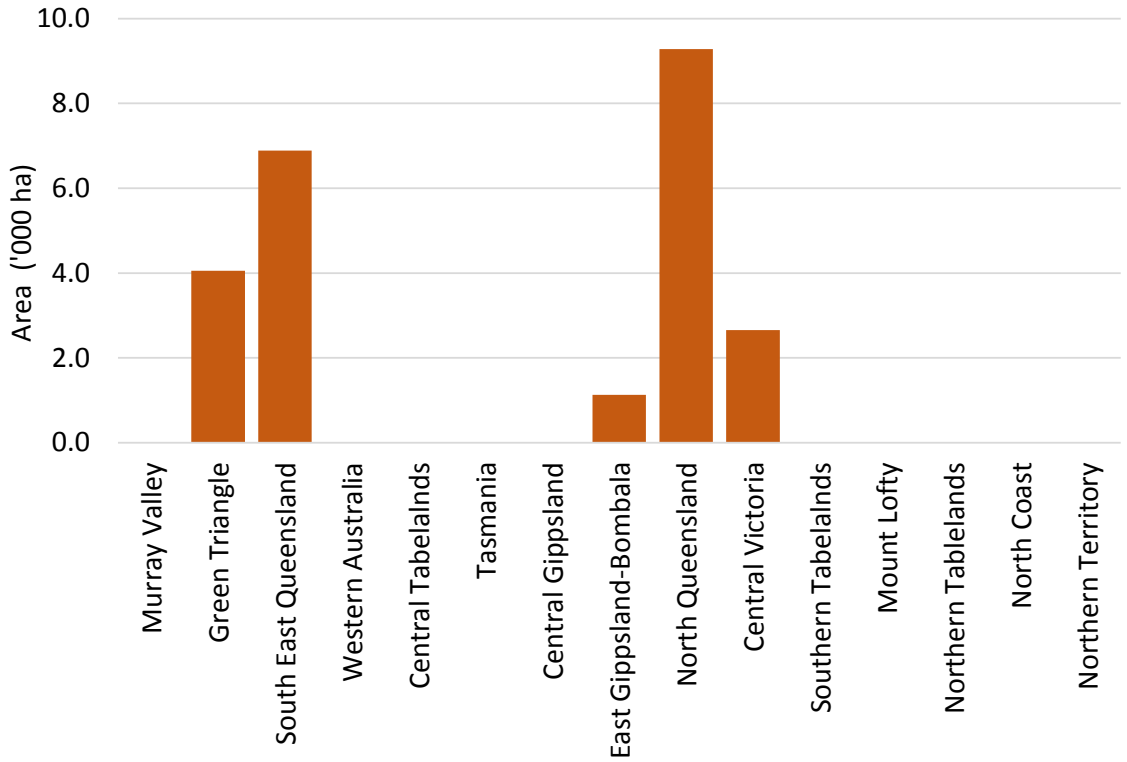


Note: Potential softwood plantation estate refers to potentially economically viable agricultural land. Estimates of economic viability are based on average milldoor log prices from ABARES 2016–17 GVP survey, ABARES yield models, and an assumed transport distance of 75 kilometres from forest to mill.

The optimal area of new softwood plantings could be even smaller

Additional costs and regional constraints make the optimal area of new softwood plantings much smaller than the estimated 495,000 hectares of potentially viable land. For example, a previous analysis undertaken by ABARES (Whittle, Lock & Hug 2019), which took into account local mill capacity, capital costs for new mills and regional demand for wood products, estimated that establishing only around 24,000 hectares of softwood plantations by 2050 would be optimal if current market conditions persist. These additional plantings were estimated to be established across only five of the 15 NPI regions—North Queensland, Central Victoria, the Green Triangle, South East Queensland and East Gippsland–Bombala (Figure 6).

Figure 6 Additional area of softwood plantations in 2050, by NPI region, base case



Source: Whittle, Lock & Hug 2019

1.3 Economies of scale in the softwood sawmill industry

Economies of scale refer to savings in average per-unit processing costs that arise from increased production. Economies of scale occur when there are fixed operating costs that do not vary with output (for example, overheads) and depend on the technology employed and operating practices.

Previous international research provides empirical evidence supporting the existence of scale economies in sawmill processing abroad. Campbell and Jennings (1990) and Bigsby (1994) provide evidence for the existence of scale economies within the Australian sawmilling industry.

The Australian softwood sawmill industry is already consolidating

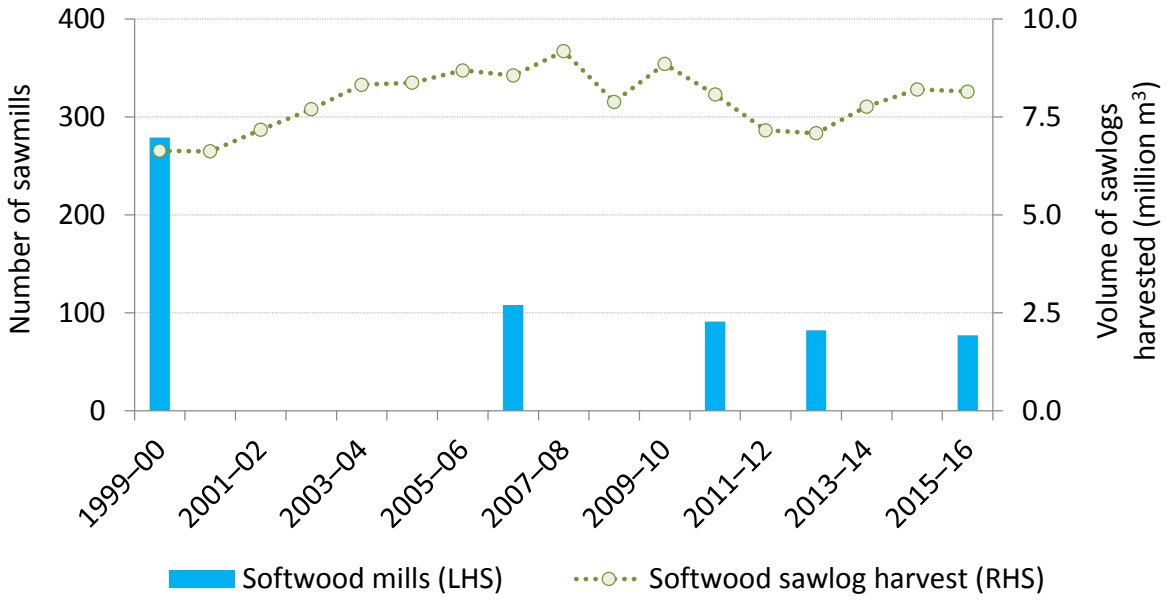
Increases in the total volume of sawlogs processed, in conjunction with decreases in the number of wood processing facilities, suggests that some consolidation has already occurred in the softwood sawmill industry. For example, between 1999–2000 and 2015–16 the number of softwood sawmills in Australia decreased from 279 to 77, although the total volume of softwood sawlogs harvested for domestic production increased by 23 per cent to 8.1 million cubic metres in 2015–16 (Table 1; Figure 7). The decline in the number of mills was primarily due to a decrease in the number of softwood sawmills with log input capacities of less than 15,000 cubic metres per year.

Table 1 Number of softwood sawmills by capacity, wood-processing survey years

Mill input capacity	1999–2000	2006–07	2010–11	2012–13	2015–16
Less than 15,000	219	54	33	34	31
15,000 to 45,000	27	21	25	18	18
45,000 to 75,000	8	8	7	5	4
75,000 to 100,000	3	3	2	4	4
Greater than 100,000	22	22	24	20	20
Total	279	108	91	81	77

Note: Softwood includes cypress pine.
Source: ABARES

Figure 7 Volume of sawlogs harvested for domestic production and number of sawmills, 1999–2000 to 2015–16



Note: Softwood includes cypress pine.
Source: ABARES

There is scope for more consolidation of softwood sawmills

The analysis in this report assumes that softwood sawmills with annual input capacities equal to or greater than 800,000 cubic metres are internationally competitive or world-scale. This is based on a report commissioned by Forest and Wood Products Australia (Omega Consulting 2018), which determined that reductions in processing costs start to plateau at annual input capacities of 800,000 cubic metres per year. Only a handful of softwood sawmills in Australia operate at this scale (Gavran et al. 2014), so further consolidation could potentially lead to significant efficiency gains.

2 Modelling investment in softwood sawmills

2.1 FORUM framework

The analysis in this report is based on simulations run using the Forest Resource Use Model (FORUM)—a simplified modelling framework designed to reflect resource allocation decisions made by agents operating in the forestry sector. ABARES developed FORUM to assess the optimal use of Australia's forest resources for wood production. It is used to forecast future harvest volumes, assess future processing investment opportunities and determine the most economically efficient mix of domestic production and net trade to meet Australia's future demand for wood products.

Future investment may take many forms, including new wood-processing facilities or modifications and improvements to existing infrastructure. This report considers a limited set of investment options consistent with those used previously by ABARES (Whittle, Lock & Hug 2019). ABARES determined site locations for potential new wood-processing facilities by evaluating region-specific surplus log availability, current processing capacity and previous simulations. It did not consider other factors such as cost of electricity, gas, water or labour or the environmental or social impacts of particular investments.

Recovery rates and wood-processing costs are based largely on existing practices. Potential technological advances allowing production of existing products from lower grade logs, or new products from existing log types, were out of scope.

This is primarily a nation-wide study, so many region-specific factors were not incorporated into the analysis. Distinct land use restrictions and environmental or developmental regulations for major infrastructure projects apply in many states, territories and regions. Some investments may also need additional inputs or resources, such as available labour force, road or port infrastructure or water availability. ABARES did not model these factors directly, but they were considered when determining the set of available investment options.

Modelling investment in softwood sawmills

FORUM allows for investment in mills of varying size. It is assumed that new softwood sawmills can be established with annual input capacities ranging from 300,000 cubic metres to 1.2 million cubic metres. This covers a range of potential new softwood sawmills with the exact capacity determined endogenously in the model.

Based on analysis undertaken by Omega Consulting (2018) and industry consultation, the costs of establishing new softwood sawmills is assumed to be $23 million per 100,000 cubic metres of processing capacity. The cost of establishing a new softwood sawmill with annual input capacity of 800,000 cubic metres (that is, a world-scale softwood sawmill) is then assumed to be $184 million.

The processing characteristics of new softwood sawmills were derived from responses to the ABARES 2012–13 Wood Processing Survey (Gavran et al. 2014) and information provided by industry representatives (Omega Consulting 2018). New softwood sawmills are assumed to

incur costs of $40 per cubic metre of high-quality sawlog and $53 per cubic metre of low-quality sawlog processed. These processing costs include maintenance, labour and energy but exclude capital depreciation and log costs.

In many cases, expanding the input capacity of an existing sawmill is more economically viable than establishing a new one. For the analysis presented in this report, existing sawmills are assumed to be able to expand their current processing capacity by incremental amounts each period. Based on consultation with industry, the analysis in this report assumes the costs of expanding the input capacity of an existing sawmill to be $33 million per 100,000 cubic metres of annual input capacity.

Where expansion of existing capacity is undertaken, recovery rates and processing costs are assumed to remain unchanged. Although significant expansion of capacity would likely result in lower processing costs, the analysis in this report places a limit on the cumulative increase in capacity from upgrades to twice the current estimated capacity. This restricts the set of sawmills capable of upgrading to a world-scale sawmill to those with current annual input capacities of 400,000 cubic metres or more. Increases in processing capacity beyond twice the current capacity may be possible but are more likely to result in changes in processing costs, recovery rates and product mix.

2.2 Scenarios considered

The analysis in this report presents results for three scenarios differing in the number of regions supporting a world-scale sawmill and assumptions around whether logs can be redirected from other processing facilities.

Identifying designated sites for world-scale sawmills

For each NPI region, a single softwood sawmill site was chosen as the designated site for a world-scale facility based on previous modelling (Whittle, Lock & Hug 2019). These sites included existing sawmills and potential new sawmill sites.

In nine of the 14 NPI regions considered (Northern Territory was excluded), the designated site for the world-scale sawmill was the softwood sawmill that processed the largest volume of logs under the previously estimated base case (Whittle, Lock & Hug 2019). In two regions, the largest softwood sawmill was estimated to process more than 800,000 cubic metres per year from 2050 to 2080. In these regions, no reallocation of logs or new plantations would be needed to support a world-scale softwood sawmill. In four regions, the largest softwood sawmill was estimated to process between 500,000 and 800,000 cubic metres per year. In three regions, the largest softwood sawmill was estimated to process around 300,000 cubic metres or less per year.

In the remaining five regions considered, which had smaller softwood sawmill industries, the chosen mill sites were new softwood sawmills that, in most cases, were not realised under the base case.

Scenario 1: World-scale sawmills in 10 NPI regions

The first scenario in this report assesses the optimal area of new softwood plantations and volume of log reallocations under the condition that a world-scale softwood sawmill operates in 10 selected NPI regions, over the period 2050 to 2080. The 10 regions were chosen on the basis of their existing softwood sawmill infrastructure and softwood plantation estate. Each of the 10

regions has more than 30,000 hectares of softwood plantations (Figure 2) and at least one existing softwood sawmill capable of processing more than 100,000 cubic metres per year. Additionally, three of these regions (North Queensland, East Gippsland–Bombala and Western Australia) have the largest areas of potentially viable agricultural land (Figure 5).

To ensure that the 10 selected world-scale sawmill sites process at least 800,000 cubic metres per year, ABARES estimates that an additional 2.9 million cubic metres of softwood sawlogs would be needed each year from 2050. Under Scenario 1, these additional logs processed by world-scale softwood sawmills are assumed to be sourced from other wood processing facilities or log exporters, rather than new plantations, if it is more efficient for the industry as a whole.

Scenario 2: World-scale sawmills in 10 NPI regions without log reallocation

The second scenario is identical to the first scenario but assumes no reallocation of logs between users, relative to the base case. As a result, the 2.9 million cubic metres of softwood sawlogs needed each year to ensure that the 10 selected world-scale softwood sawmill sites actually operate at world scale must exclusively be sourced from new plantations. Based on assumed annual growth rates of 20 to 25 cubic metres per hectare and typical sawlog to pulplog ratios (ABARES 2016), this would require an additional 173,000 to 216,000 hectares of new softwood plantations by 2050. Annual growth rates of 20 to 25 cubic metres per hectare are higher than those observed for the current estate but they are likely to be required to make the establishment of new plantations economically viable under current market conditions (Whittle, Lock & Hug 2019).

Scenario 3: World-scales sawmill in all NPI regions (except Northern Territory)

The third scenario is identical to the first but assumes that a world-scale softwood sawmill operates in an additional four NPI regions—Southern Tablelands, Mount Lofty and Kangaroo Island, Northern Tablelands and North Coast. Each of these regions currently have softwood plantation estates less than 30,000 hectares and would require investment in a new softwood sawmill. The Northern Territory was not considered in any of the scenarios because it lacks a sufficient softwood estate, existing processing capacity and suitable agricultural land to support a world-scale sawmill.

3 Optimal approaches to scaling up the softwood sawmill industry

This section presents estimates of the area of new softwood plantations established and volume of softwood sawlogs reallocated to support a world-scale softwood sawmill in selected NPI regions from 2050 to 2080. It also presents estimates of changes in the volume of softwood sawlog exports, and production and trade of softwood sawnwood.

Estimates are presented for the three scenarios described in Section 2.2, which differ in the number of NPI regions assumed to support a world-scale softwood sawmill and whether logs may be reallocated to support these world-scale sawmills. Detailed results are presented in Appendix A.

The modelling results are indicative of the optimal area of new plantation establishment and volume of logs reallocated from other wood processors or log exporters subject to the modelling assumptions. The results are not necessarily representative of the trajectory that the industry would take because the uptake of new plantation establishment will depend on availability of suitable agricultural land for purchase, permissions to establish commercial timber plantation and sufficient labour and capital (Polglase et al. 2011).

3.1 Scenario 1: World-scale sawmills in 10 NPI regions with log reallocation

A combination of new plantations and log reallocation would likely be optimal

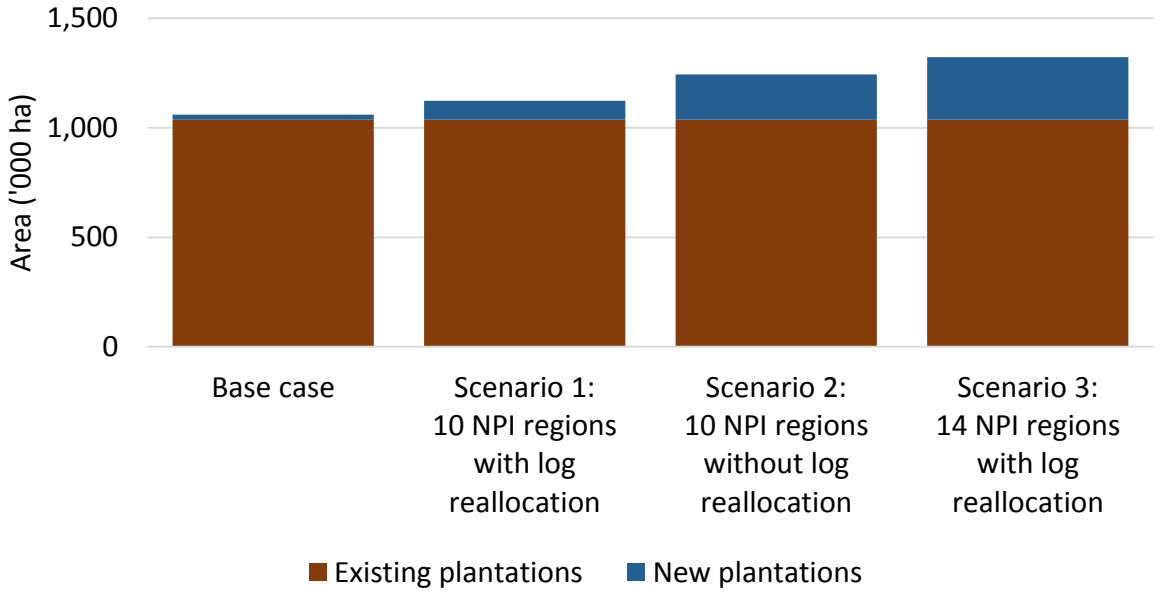
Under the condition that a world-scale softwood sawmill operates in 10 NPI regions (Scenario 1), ABARES estimates that establishing around 86,000 hectares of new softwood plantations by 2050 (Figure 8) and reallocating an average of 1.7 million cubic metres of softwood sawlogs from other facilities each year (Figure 9) would be optimal.

The 86,000 hectares of new softwood plantations is estimated to generate, on average, 1.6 million cubic metres of softwood sawlogs per year from 2050 to 2080 (Figure 9). The average annual volume of softwood sawlogs harvested from 2050 to 2054 is estimated to be around 14.0 million cubic metres per year (See Table A7). This is 557,000 cubic metres less than projected annual domestic log equivalent demand over the same period (Whittle, Lock & Hug 2019). Around 1.2 million cubic metres of softwood sawlogs are estimated to be exported each year from 2050 to 2054, leaving a domestic softwood sawlog supply shortfall of around 1.7 million cubic metres per year.

These results suggest that reductions in softwood sawlog exports could play a relatively small role in supporting world-scale sawmills. Of the 1.7 million cubic metres of softwood sawlogs reallocated from other wood processing facilities and log exporters each year, from 2050 to 2080, only 103,000 cubic metres is estimated to come from log exporters. It is often more efficient to reallocate softwood sawlogs (and in particular low-quality softwood sawlogs) from other wood processors rather than log exporters, once log export prices, domestic recovery

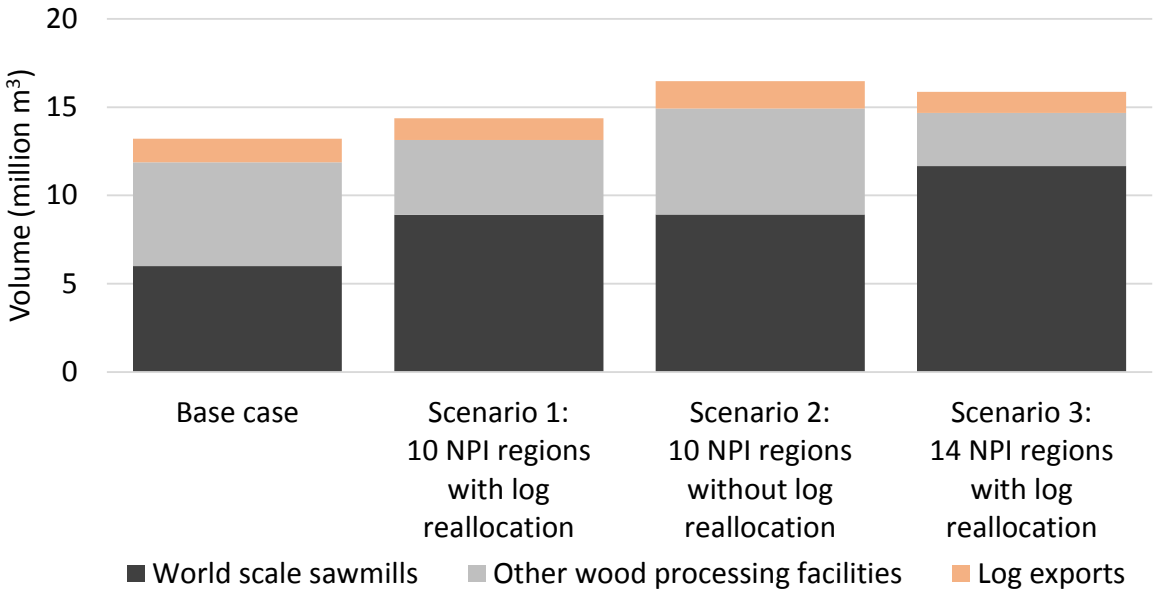
rates and processing costs are taken into account. In practice, some sawmills may not be able to process certain types of low-quality sawlogs without investing in new equipment.

Figure 8 Softwood plantation estate in 2050—base case and various scenarios



Note: Base case results are from Whittle, Lock & Hug 2019

Figure 9 Average annual volume of softwood sawlogs processed and exported, 2050 to 2080—base case and various scenarios

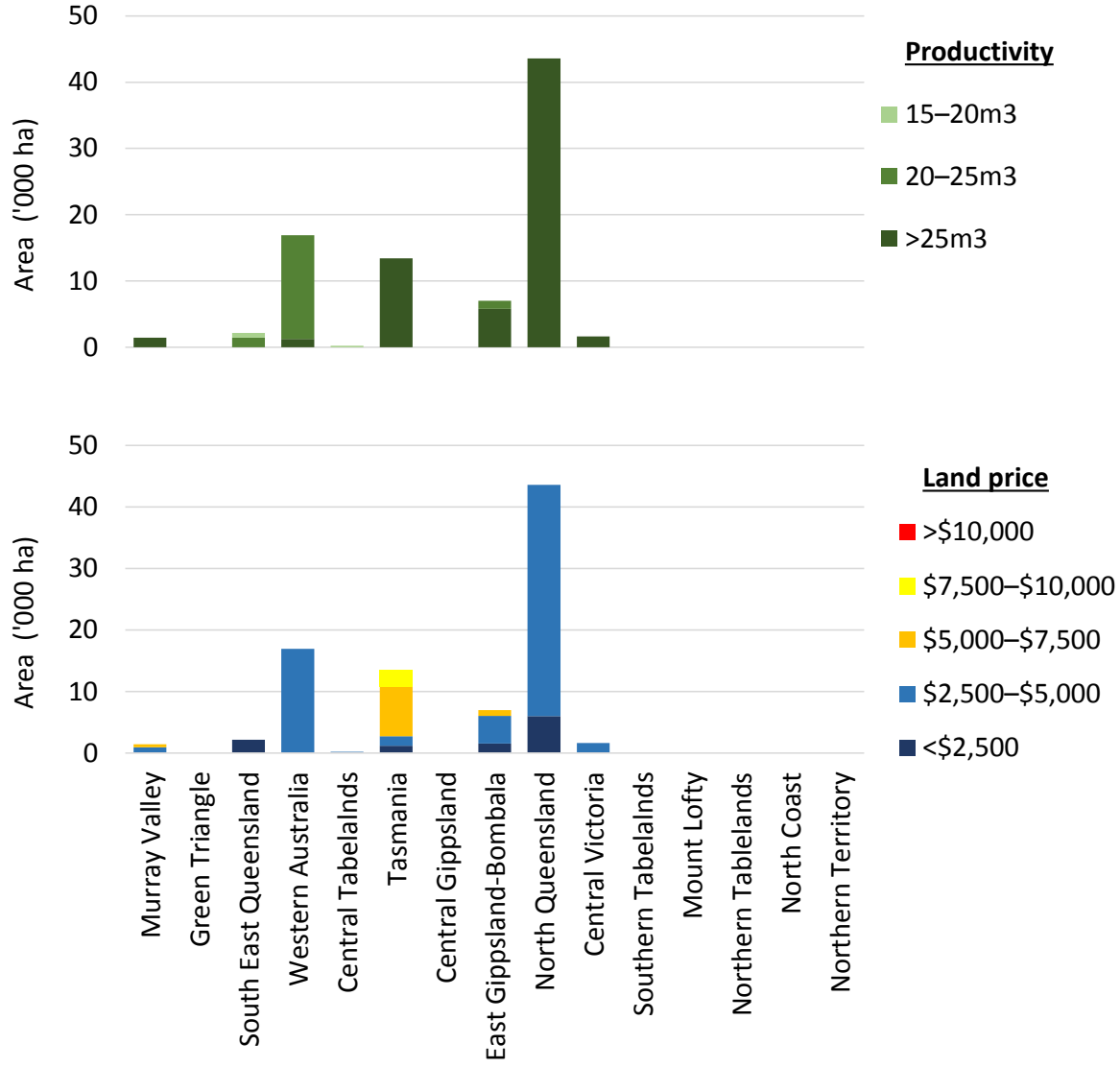


Note: Base case results are from Whittle, Lock & Hug 2019

New softwood plantation establishment would be concentrated in a few regions

Under Scenario 1, most of the new plantation area is concentrated in only a handful of regions (Figure 10). ABARES estimates that more around 44,000 hectares or 51 per cent of the new softwood plantation area would be established in North Queensland, which has an abundance of cleared agricultural land that is potentially economically viable. All of the land established in North Queensland is estimated to have a Mean Annual Increment (MAI) in excess of 25 cubic metres per hectare and worth less than $5,000 per hectare. –

Figure 10 New softwood plantation area in 2050, by region, productivity and land price—Scenario 1



Note: Productivity refers to mean annual increment (MAI), which is the volume of wood grown each year per hectare.

Around 37,000 hectares or 43 per cent of the new softwood plantation area is estimated to be established in Western Australia, Tasmania and East Gippsland–Bombala. Similar to North Queensland, Western Australia and East Gippsland–Bombala also have a large area of potentially economically viable agricultural land. All of the land converted to softwood plantation in these two regions is estimated to have an MAI in excess of 15 cubic metres per hectare and almost all

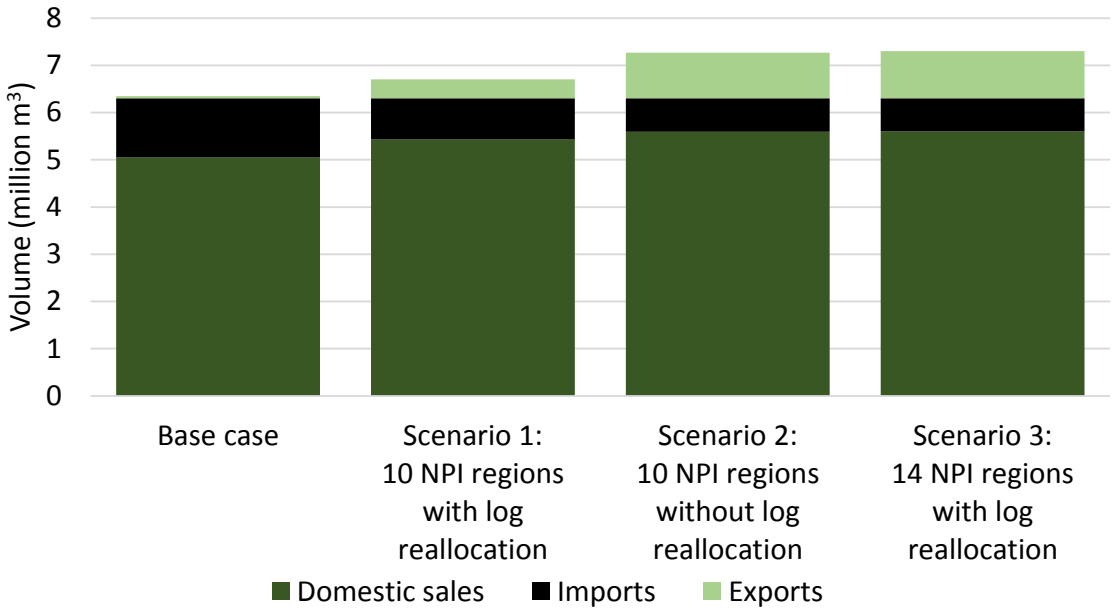
of the land is also worth less than $5,000 per hectare. However, although much of the available land in Tasmania is highly productive, more than 80 per cent of the land converted to softwood plantations in Tasmania is worth in excess of $5,000 per hectare.

Almost all of the land converted to softwood plantations under the Scenario 1 is estimated to have a Mean Annual Increment (MAI) in excess of 20 cubic metres per hectare per year and, therefore, be suitable for growing softwood species. The majority of the converted land (74,000 hectares or 86 per cent) is also worth less than $5,000 per hectare. However, a small area (around 9,000 hectares) is estimated to be worth between $5,000 and $7,500 per hectare and 3,000 hectares is estimated to be worth between $7,500 and $10,000 per hectare. This high-value land is primarily located in Tasmania.

Sawnwood production would increase but Australia would still rely on imports

Australia's total softwood sawnwood production is estimated to increase as a result of the expansion of the softwood estate and increase in processing capacity. Under Scenario 1, ABARES estimates that total annual softwood sawnwood production would increase by around 734,000 cubic metres, or 14 per cent, to 5.8 million cubic metres per year from 2050 to 2080 (Figure 11). However, imports of softwood sawnwood are estimated to still play an important role in meeting regional domestic demand. Only around 379,000 cubic metres or half of the additional sawnwood produced each year from 2050 to 2080 is estimated to be sold in the domestic market, reducing imports by the same amount. The remaining 354,000 cubic metres of additional annual sawnwood production is estimated to be exported. Sawnwood is both imported and exported due to differences in regional demand and supply for different sawnwood products.

Figure 11 Average annual sawnwood production and trade, 2050 to 2080—base case and various scenarios



Note: Base case results are from Whittle, Lock & Hug 2019

3.2 Scenario 2: World-scale sawmills in 10 NPI regions without log reallocation

Without log reallocation more plantations would be established

Under the condition that a world-scale softwood sawmill operates in 10 NPI regions without log reallocation (Scenario 2), ABARES estimates that establishing around 207,000 hectares of new softwood plantations by 2050 would be optimal (Figure 8). This is around 120,000 hectares more than under Scenario 1 (which allowed for log reallocation).

The 207,000 hectares of new softwood plantations is estimated to generate, on average, 3.6 million cubic metres of softwood sawlogs per year from 2050 to 2080 (Figure 9). The average annual volume of softwood sawlogs harvested from 2050 to 2054 is estimated to be around 17.0 million cubic metres per year (See Table A7). This is around 2.4 million cubic metres more than projected annual domestic log equivalent demand over the same period (Whittle, Lock & Hug 2019). However, around 2.4 million cubic metres of softwood sawlogs are estimated to be exported each year from 2050 to 2054, leaving a domestic softwood sawlog supply shortfall of around 77,000 cubic metres per year.

Restricting log reallocation is likely to have a greater effect on the area of new softwood plantings in some regions than others. This can be seen by comparing estimates of new plantation establishment under Scenario 1 and Scenario 2. For example, in the absence of log reallocation (Scenario 2) 65,000 hectares of softwood plantations are estimated to be established across Central Victoria and East Gippsland–Bombala by 2050 (Figure 12). This is around 57,000 hectares more than under Scenario 1 (Figure 10) which allows log reallocation. Similarly, the total area of softwood plantations estimated to be established across Western Australia, Tasmania and North Queensland by 2050 was 46,000 hectares higher under Scenario 2 than Scenario 1. Although these regions have enough potentially economically viable agricultural land to support a world-scale sawmill, redirecting logs away from other wood processing facilities or log exporters is more efficient when the costs of plantation establishment, the product mix of existing mills and final product prices are taken into account.

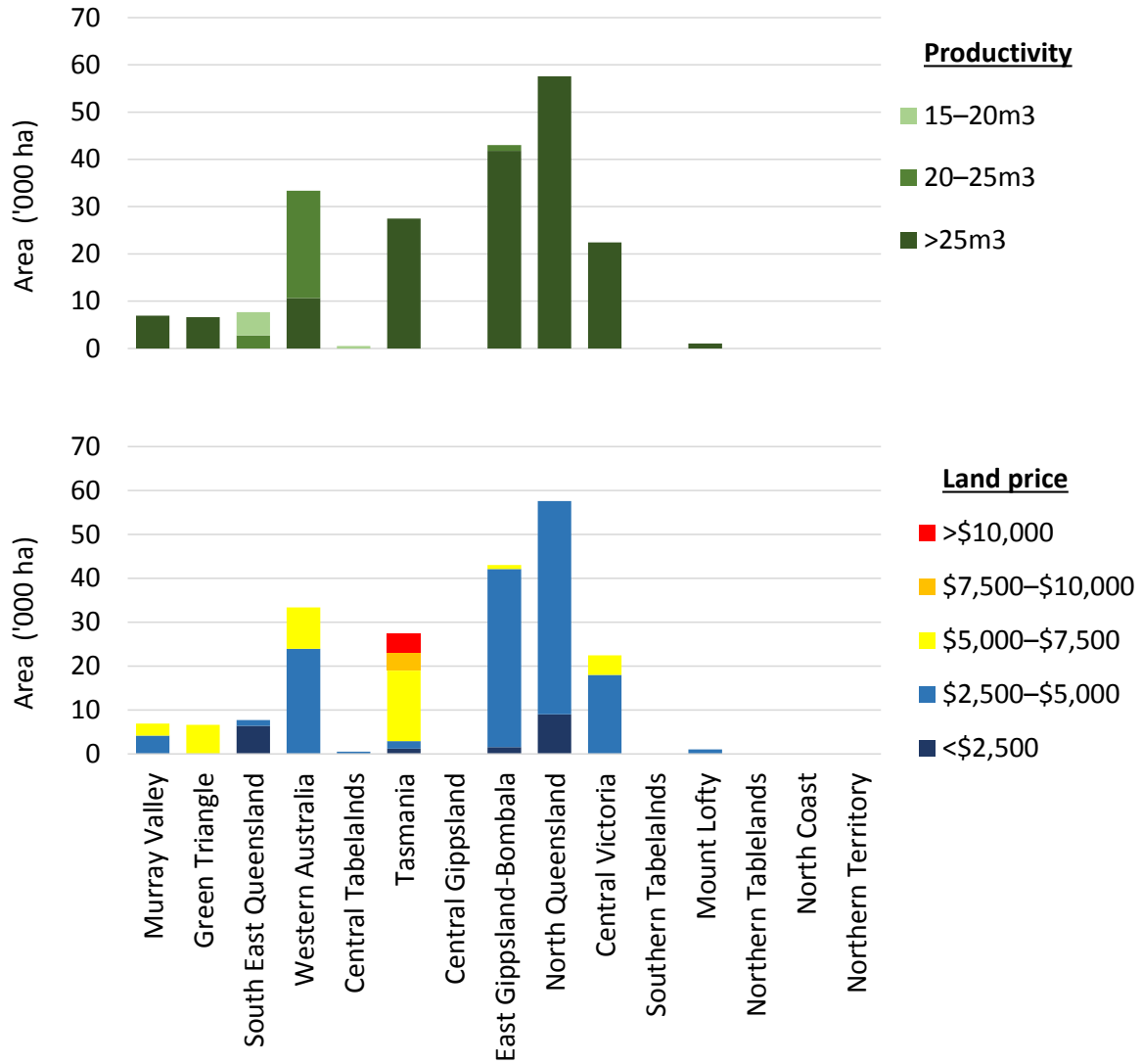
Plantations would need to be established on high value land

Regardless of whether logs are reallocated between mills, all of the land converted to softwood plantations is estimated to be highly suitable for growing softwood plantations (that is, land with an MAI in excess of 15 cubic metres per hectares).

However, in the absence of log reallocation, high land costs may make it economically unviable to support a world-scale sawmill in some regions. ABARES modelling indicates that around 9,000 hectares of new softwood plantations would need to be established on land that is worth more than $7,500 and around 4,000 hectares would need to be established on land that is worth more than $10,000 (Figure 12). All of this land is confined to Tasmania and, at current log prices, would not be economically viable to convert.

A large area of new softwood plantations would also need to be established on land with prices between $5,000 and $7,500 per hectares. In total, ABARES estimates that over 40,000 hectares of new softwood plantations would need to be established on land in this price range. These plantations may or may not be economically viable at current log prices, depending on the exact log prices negotiated with mills.

Figure 12 New softwood plantation area in 2050, by region, productivity and land price—Scenario 2



Note: Productivity refers to mean annual increment (MAI), which is the volume of wood grown each year per hectare.

Australia would continue to export sawlogs and import sawnwood

ABARES estimates that, without log reallocation, an additional 224,000 cubic metres of low-quality softwood sawlogs would be exported each year from 2050 to 2080, bringing the total volume of softwood sawlog exports up to 1.6 million cubic metres per year (Figure 9). Exporting low-quality softwood sawlogs, rather than reallocating logs from other wood processing facilities, can be more profitable once log export prices, domestic recovery rates and processing costs are taken into account.

Even with substantial increases in the softwood plantation estate and volume of softwood sawlogs harvested, ABARES estimates that imports of softwood sawnwood would still play an important role in satisfying domestic demand. ABARES modelling indicates that average annual softwood sawnwood production would increase by around 1.5 million cubic metres, to 6.6 million cubic metres per year, from 2050 to 2080 as a result of the greater volume of softwood sawlogs processed domestically (Figure 11). However, only around 546,000 cubic metres of this additional annual sawnwood production is sold into the domestic market, with 925,000 cubic

metres expected to be exported. Sawnwood is both exported and imported due to differences in regional demand and processing capacity for specific sawnwood products. As a result, Australia is estimated to import an average of 713,000 cubic metres of various softwood sawnwood products each year from 2050 to 2080.

3.3 Scenario 3: World-scale sawmills in all NPI regions except the Northern Territory

Some regions may be incapable of supporting a world-scale softwood sawmill

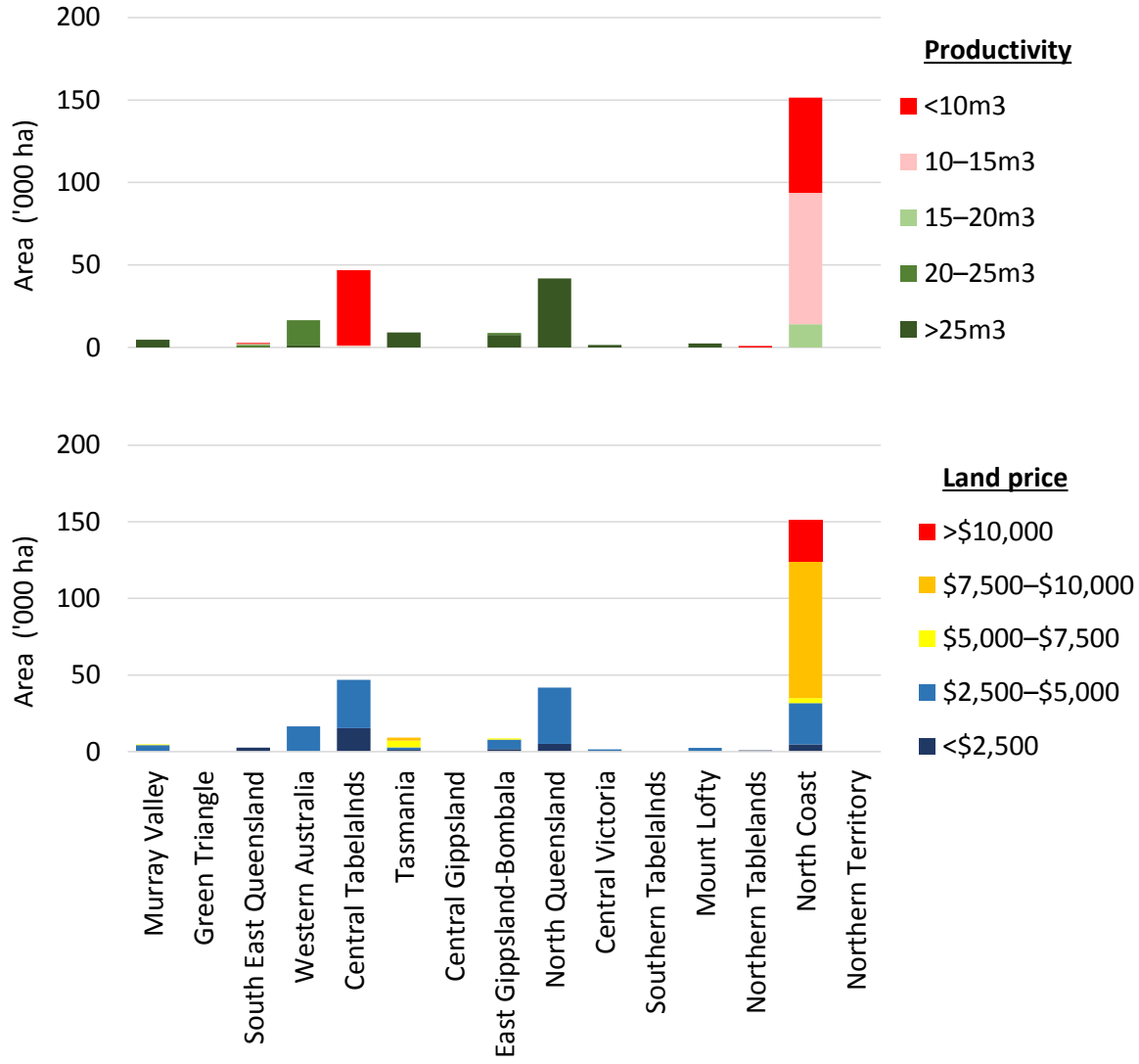
ABARES modelling suggests that supporting a world-scale sawmill in almost all NPI regions (excluding the Northern Territory) would optimally involve establishing 286,000 hectares of softwood plantations by 2050 (Figure 8) and reallocating an average of 3.0 million cubic metres of logs from other uses each year, from 2050 to 2080 (Figure 9).

However, this approach would require the establishment of new plantations on land that would be too low yielding and too expensive to be viable (Figure 13). ABARES estimates that around 207,000 hectares or 69 per cent of new softwood plantations would be established on land with an MAI less than 15 cubic metres per hectare or prices greater than $5,000 per hectare.

Relative to Scenario 1, the additional softwood plantations established under Scenario 3 are almost exclusively planted in the Central Tablelands and North Coast regions (Figure 10 versus Figure 13). Despite the land in these regions being low yielding (and in the case of the North Coast expensive) establishing new plantations in these regions, and reallocating softwood sawlogs between facilities, is still more cost effective than establishing plantations in Mount Lofty or the Northern or Southern Tablelands regions.

These findings suggest that any efforts to increase the scale of the domestic softwood sawmill industry should be targeted at specific regions, taking into account the current resource, sawmill infrastructure and area of viable land in those regions.

Figure 13 New softwood plantation area in 2050, by region, productivity and land price—Scenario 3



Note: Productivity refers to mean annual increment (MAI), which is the volume of wood grown each year per hectare.

4 Caveats

4.1 Strengths and limitations of the framework

Strengths

The analysis presented in this report uses the Forest Resource Use Model (FORUM), a modelling framework developed and used at ABARES to assess the optimal uses of Australia's forest resources for wood production.

FORUM uses comprehensive ABARES datasets on the forestry sector, including logs harvested, processing infrastructure, forest areas, and log availability from native forests and plantations. This ensures that the model accounts for real world biophysical and infrastructure constraints in determining optimal plantation investment.

The model incorporates forecasts of domestic demand and prices, so it accounts for the relative returns to supplying domestic versus export markets and relative costs of sourcing products from domestically versus overseas. In estimating the extent of new plantation investment, FORUM also incorporates a range of factors critical to the viability of plantations, including productivity of land for growing trees, value of land under existing agricultural production and proximity of land to timber-processing facilities and markets.

Limitations

FORUM has several limitations that should be considered when interpreting the results. For example, many regions, log types and wood products have been aggregated in this analysis because of data limitations. As a result, the modelled allocation of logs, residues and products will often differ from reality. ABARES calibrates model outputs to current market conditions, but this process is approximate.

Model projections are contingent on projections of future log availability, wood product demand and prices, as well as the price, productivity and availability of agricultural land. ABARES projections are based on the best available data, but actual conditions in 2050 and beyond are highly uncertain and will depend on numerous economic, environmental and policy factors.

The optimal allocation of logs and wood products is based on maximisation of net returns at the industry level. It does not reflect other considerations that may affect investment in plantations or the allocation of logs among wood-processing facilities, such as long-term supply agreements between forest managers and wood processors or other regional constraints. How profits are shared between forest managers and wood processors (through negotiated log prices) will play a critical role in determining whether new plantations are actually economically viable.

The framework does not explicitly consider the impacts of climate variability, potential carbon abatement opportunities or water use. ABARES has examined some of these issues in previous research (for example, ABARES 2012). However, the analysis necessary to adequately incorporate future climate variability impacts, carbon abatement opportunities and water allocations costs was too complex and broad to be within the report scope and time frame. Future research could consider the impacts of carbon abatement opportunities and water allocation costs.

The framework does not assess some potential future market opportunities and assumes that current technologies will remain in place. For example, downstream value-adding opportunities such as development of innovative engineered wood products and bioenergy products and use of mill and harvest residues may become more important over time. These opportunities could provide the forestry sector with new products that could change the structure of the domestic wood-processing industry.

4.2 Interpreting the results

A world-scale softwood sawmill in each NPI region is not necessarily optimal

The scenarios considered in this report are hypothetical and not intended to represent optimal targets for the industry. In each of the scenarios presented constraints were imposed on the model that forced the operation of world-scale sawmills in selected regions. In the absence of these constraints, ABARES found that it would be optimal for world-scale sawmills to operate in only a small number of regions.

The findings presented in this report also depend on the sites chosen to be the location of potential world-scale softwood sawmills. Different mill sites may be closer to, or further from, existing plantations, sawmilling infrastructure or potentially economically viable agricultural land. As such, selecting alternative sites for world-scale sawmills will affect the estimated optimal area of softwood plantation establishment and reallocation of logs. However, determining the optimal number and specific location of world-scale softwood sawmills was not possible within the project time frames and modelling framework.

Processing costs aren’t everything

Although the reduction in per unit processing costs associated with increased production can be substantial, other important factors affect profitability. For example, many smaller sawmills have higher recovery rates and produce higher value niche products. Additionally, many smaller sawmills fully utilise residues from their operations. In these cases, achieving world-scale can often be infeasible due to limited demand for niche products and the increased costs of multiple cutting techniques.

Appendix A: Detailed results

A.1 Plantation establishment

Table A1 New softwood plantations established by 2050 by productivity and land price—base case and various scenarios

Scenario	MAI (m^3)	Land price ($/ha)					
		Less than $2,500	$2,500–$5,000	$5,000–$7,500	$7,500–$10,000	Greater than $10,000	**Total**
Base case	Less than 10	0	0	0	0	0	**0**
	10–15	0	0	0	0	0	**0**
	15–20	1,944	0	0	0	0	**1,944**
	20–25	2,217	1,223	0	0	0	**3,519**
	Greater than 25	9,120	3,165	4,054	0	0	**16,339**
	Total	**15,487**	**4,467**	**4,054**	**0**	**0**	**24,009**
Scenario 1: 10 NPI regions with log reallocation	Less than 10	0	0	0	0	0	**0**
	10–15	0	0	0	0	0	**0**
	15–20	719	209	0	0	0	**928**
	20–25	2,634	15,679	0	0	0	**18,313**
	Greater than 25	7,539	47,382	9,432	2,668	0	**67,021**
	Total	**10,892**	**63,270**	**9,432**	**2,668**	**0**	**86,262**
Scenario 2: 10 NPI regions without log reallocation	Less than 10	0	0	0	0	0	**0**
	10–15	0	0	0	0	0	**0**
	15–20	4,933	533	0	0	0	**5,466**
	20–25	2,634	23,997	0	0	0	**26,631**
	Greater than 25	10,561	115,255	40,256	4,221	4,341	**174,634**
	Total	**18,127**	**139,785**	**40,256**	**4,221**	**4,341**	**206,731**
Scenario 3: 14 NPI regions with log reallocation	Less than 10	16,655	54,478	0	27,977	5,570	**104,680**
	10–15	4,675	3,822	0	61,139	10,882	**80,518**
	15–20	719	236	3,257	0	10,844	**15,056**
	20–25	2,634	15,228	0	0	0	**17,862**
	Greater than 25	6,623	53,763	5,813	2,018	0	**68,217**
	Total	**31,307**	**127,526**	**9,070**	**91,134**	**27,296**	**286,333**

Note: MAI (Mean Annual Increment) is the volume of wood grown each year per hectare.

Table A2 New softwood plantations established by 2050 by NPI region, productivity and land price—base case

NPI region	MAI (m^3)	Land price					
		Less than $2,500	$2,500–$5,000	$5,000–$7,500	$7,500–$10,000	Greater than $10,000	**Total**
Green Triangle	Greater than 25	0	0	4,054	0	0	**4,054**
South East Queensland	15–20	4,150	0	0	0	0	**4,150**
	20–25	1,439	1,302	0	0	0	**2,741**
East Gippsland–Bombala	20–25	778	0	0	0	0	**778**
	Greater than 25	350	0	0	0	0	**350**
North Queensland	Greater than 25	8,770	511	0	0	0	**9,281**
Central Victoria	Greater than 25	0	2,654	0	0	0	**2,654**
Australia	15–20	4,150	0	0	0	0	**4,150**
	20–25	2,217	1,302	0	0	0	**3,519**
	Greater than 25	9,120	3,165	4,054	0	0	**16,339**
	Total	**15,487**	**4,467**	**4,054**	**0**	**0**	**24,009**

Note: MAI (Mean Annual Increment) is the volume of wood grown each year per hectare.

Table A3 New softwood plantations established by 2050 by NPI region, productivity and land price—Scenario 1

NPI region	MAI (m^3)	Land price					
		Less than $2,500	$2,500–$5,000	$5,000–$7,500	$7,500–$10,000	Greater than $10,000	**Total**
Murray Valley	Greater than 25	0	937	477	0	0	**1,414**
South East Queensland	15–20	719	0	0	0	0	**719**
	20–25	1,439	0	0	0	0	**1,439**
Western Australia	20–25	0	15,679	0	0	0	**15,679**
	Greater than 25	0	1,234	0	0	0	**1,234**
Central Tablelands	15–20	0	209	0	0	0	**209**
Tasmania	Greater than 25	1,188	1,526	8,010	2,668	0	**13,392**
East Gippsland–Bombala	20–25	1,195	0	0	0	0	**1,195**
	Greater than 25	350	4,500	945	0	0	**5,795**
North Queensland	Greater than 25	6,001	37,567	0	0	0	**43,568**
Central Victoria	Greater than 25	0	1,619	0	0	0	**1,619**
Australia	15–20	719	209	0	0	0	**928**
	20–25	2,634	15,679	0	0	0	**18,313**
	Greater than 25	7,539	47,382	9,432	2,668	0	**67,021**
	Total	**10,892**	**63,270**	**9,432**	**2,668**	**0**	**86,262**

Note: MAI (Mean Annual Increment) is the volume of wood grown each year per hectare.

Table A4 New softwood plantations established by 2050 by NPI region, productivity and land price—Scenario 2

NPI region	MAI (m^3)	Land price					
		Less than $2,500	$2,500–$5,000	$5,000–$7,500	$7,500–$10,000	Greater than $10,000	**Total**
Murray Valley	Greater than 25	0	4,172	2,750	0	0	**6,922**
Green Triangle	Greater than 25	0	0	6,636	0	0	**6,636**
South East Queensland	15–20	4,933	0	0	0	0	**4,933**
	20–25	1,439	1,312	0	0	0	**2,751**
Western Australia	20–25	0	22,685	0	0	0	**22,685**
	Greater than 25	0	1,234	9,443	0	0	**10,677**
Central Tablelands	15–20	0	533	0	0	0	**533**
Tasmania	Greater than 25	1,188	1,743	16,007	4,221	4,341	**27,500**
East Gippsland–Bombala	20–25	1,195	0	0	0	0	**1,195**
	Greater than 25	350	40,538	945	0	0	**41,833**
North Queensland	Greater than 25	9,022	48,539	0	0	0	**57,561**
Central Victoria	Greater than 25	0	17,980	4,476	0	0	**22,455**
Mount Lofty	Greater than 25	0	1,050	0	0	0	**1,050**
Australia	15–20	4,933	533	0	0	0	**5,466**
	20–25	2,634	23,997	0	0	0	**26,631**
	Greater than 25	10,561	115,255	40,256	4,221	4,341	**174,634**
	Total	**18,127**	**139,785**	**40,256**	**4,221**	**4,341**	**206,731**

Note: MAI (Mean Annual Increment) is the volume of wood grown each year per hectare.

Table A5 New softwood plantations established by 2050 by NPI region, productivity and land price—Scenario 3

NPI region	MAI (m^3)	Land price					
		Less than $2,500	$2,500–$5,000	$5,000–$7,500	$7,500–$10,000	Greater than $10,000	**Total**
Murray Valley	Greater than 25	0	4,172	477	0	0	**4,649**
South East Queensland	Less than 10	502	0	0	0	0	**502**
	15–20	719	0	0	0	0	**719**
	20–25	1,439	0	0	0	0	**1,439**
Western Australia	20–25	0	15,228	0	0	0	**15,228**
	Greater than 25	0	1,234	0	0	0	**1,234**
Central Tablelands	Less than 10	15,292	30,366	0	0	0	**45,658**
	10–15	0	877	0	0	0	**877**
	15–20	0	236	0	0	0	**236**
Tasmania	Greater than 25	1,188	1,526	4,391	2,018	0	**9,124**
East Gippsland–Bombala	20–25	1,195	0	0	0	0	**1,195**
	Greater than 25	350	6,207	945	0	0	**7,502**
North Queensland	Greater than 25	5,085	36,703	0	0	0	**41,788**
Mount Lofty	Greater than 25	0	1,515	0	0	0	**1,515**
Northern Tablelands	Less than 10	0	2,405	0	0	0	**2,405**
North Coast	Less than 10	861	0	0	0	0	**861**
	10–15	0	24,112	0	27,977	5,570	**57,659**
	15–20	4,675	2,945	0	61,139	10,882	**79,641**
Australia	Less than 10	16,655	54,478	0	27,977	5,570	**104,680**
	10–15	4,675	3,822	0	61,139	10,882	**80,518**
	15–20	719	236	3,257	0	10,844	**15,056**
	20–25	2,634	15,228	0	0	0	**17,862**
	Greater than 25	6,623	53,763	5,813	2,018	0	**68,217**
	Total	**31,307**	**127,526**	**9,070**	**91,134**	**27,296**	**286,333**

Note: MAI (Mean Annual Increment) is the volume of wood grown each year per hectare.

A.2 Softwood sawlog harvest and processing

Table A6 Average annual volume of softwood sawlogs processed and exported, 2050 to 2080—base case and various scenarios

Scenario	Processed by world-scale softwood sawmills ('000 m³)	Processed by other wood processing facilities ('000 m³)	Exported ('000 m³)	Total harvest ('000 m³)
Base case	5,997	5,882	1,333	**13,212**
Scenario 1: 10 NPI regions with log reallocation	8,909	4,235	1,231	**14,375**
Scenario 2: 10 NPI regions without log reallocation	8,928	5,999	1,558	**16,485**
Scenario 3: 14 NPI regions with log reallocation	11,669	3,005	1,202	**15,875**

Table A7 Average annual volume of softwood sawlogs processed and exported, 2050 to 2054—base case and various scenarios

Scenario	Processed domestically ('000 m³)	Exported ('000 m³)	Total harvest ('000 m³)
Base case	11,278	2,233	**13,512**
Scenario 1: 10 NPI regions with log reallocation	12,824	1,177	**14,000**
Scenario 2: 10 NPI regions without log reallocation	14,480	2,491	**16,971**
Scenario 3: 14 NPI regions with log reallocation	14,386	1,213	**15,599**

A.3 Sawnwood production and trade

Table A8 Average annual volume of softwood sawnwood production and trade, 2050 to 2080—base case and various scenarios

Scenario	Produced and sold domestically ('000 m³)	Imported ('000 m³)	Exported ('000 m³)
Base case	5,048	1,258	40
Scenario 1: 10 NPI regions with log reallocation	5,427	879	395
Scenario 2: 10 NPI regions without log reallocation	5,594	712	965
Scenario 3: 14 NPI regions with log reallocation	5,601	705	998

Glossary

Term	Definition
ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
Economies of scale	Reductions in per-unit processing costs due to increased production
FWPA	Forest and Wood Products Australia
Greenfield investment	New infrastructure investment on land with no existing infrastructure
GVP	Gross value of production—value of logs harvested at mill door prices
MAI	Mean annual increment—average annual rate of tree growth per hectare measured in cubic metres
Recovery rate	Proportion of product yield from raw materials processed
World-scale	Softwood sawmills with annual input capacities greater than 800,000 cubic metres

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