Wood supply and timber processing options in the Hawke's Bay

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Abstract

The existing and projected future wood supply in the Hawke's Bay could support expanded timber processing. Unpruned log supply is forecast to dip between 2034 and 2044, but planting 10,000 ha of radiata pine over the next five to 10 years under a short to mid-length rotation regime could stabilise this supply. Increasing afforestation would open up options for establishing processing clusters with other industries, using wood and forest residues to replace industrial fossil fuels and produce liquid biofuels such as diesel. Increasing processing options would lead to increasing employment, contribute to New Zealand's gross domestic product (GDP) and reduce greenhouse gas (GHG) emissions.

Introduction

The Hawke's Bay has an existing plantation forestry resource of around 133,710 ha and an associated wood processing industry. The age class distribution of the existing forest resource is uneven and therefore the potential harvest volume over time is uneven. Approximately 98% is planted in radiata pine. The other species established as plantations in the Hawke's Bay are Douglas-fir (446 ha), cypresses (372 ha), 919 ha of other softwoods, 927 ha of *Eucalyptus* and 498 ha of other hardwoods.

The current harvest is around 3 million m^3/p.a., which equates to around 4,600 ha/year. Onshore processing takes around 1.3 million m^3/p.a. (~44% of the annual harvest). The rest is exported, largely as logs. Logs are also supplied to other regions when log demand and forest locations make sense for this to happen (e.g. northern part of Wairoa District to Gisborne).

Establishing new plantation forests to address issues of hill country soil erosion, water quality, water supply and carbon capture will increase the volume and types of wood available. In this paper, we assess the existing planted forest resources and wood processing infrastructure and the potential for expanded onshore processing with increasing afforestation.

Wood supply

Available log volume over time in the Hawke's Bay can be estimated using the Ministry for Primary Industries (MPI) National Exotic Forest Description (NEFD) (MPI, 2018) and MPI yield tables. Further data is available from the MPI wood availability forecast for the Hawke's Bay (MPI, 2014). We used Scenario 3 from the Hawke's Bay wood availability forecast (MPI, 2014) to estimate *Pinus radiata* resources, as it was considered the most likely of the possible future wood supply and harvest volume options and is similar to most of the other scenarios (2, 4 and 5). The exception is Scenario 1, which has no smoothing of the peak in wood supply associated with the 1990s planting boom. Volumes of forest harvest residues can also be derived from the potential harvest volumes based off estimates of the proportion of a crop that is discarded on cutover and at landings (Hall, 1994, 1998 & 1999). Estimates for volumes from other species were derived from the 2018 NEFD (MPI, 2019).

Log supply variation

The potential log supply over time in the Hawke's Bay is shown in Figure 1. Pruned log volumes decline over time with long-term sustainable availability to the order of 250,000 m^3/p.a. Pulp log supply is relatively steady with long-term availability at around 500,000 m^3/p.a. Unpruned log supply drops significantly between 2034 and 2044, but is likely to be more than 1.5 million m^3/p.a. in the long term. The unpruned sawlog grades (S, A and K) have similar trends (not shown).

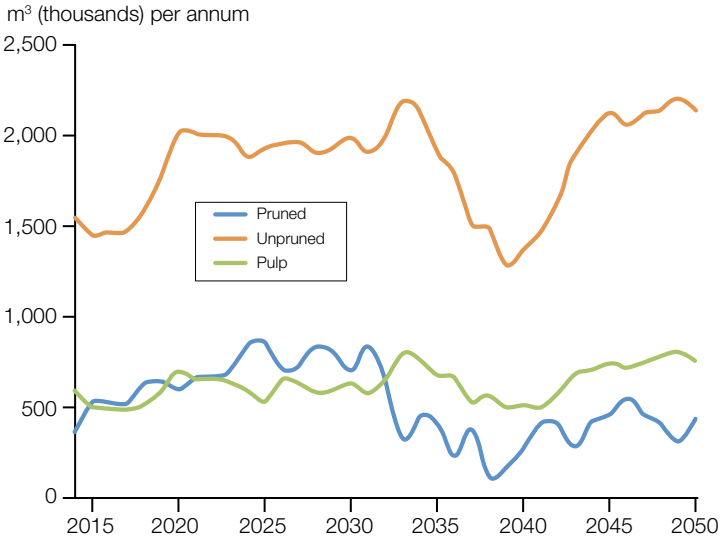

Figure 1: Estimated log supply in the Hawke's Bay

The inconsistency in supply by log grade is a problem when it comes to developing expanded domestic wood processing. However, the reduction in supply occurs around 2035 to 2037 onwards. The log supply could be stabilised at its the current level by planting 10,000 ha of radiata pine over the next five to 10 years. Utilising a 16 to 17-year rotation, and a stocking rate of 500 stems/ha with no thinning, could give a harvest volume of around 500 m^3/ha depending on the site (West, 2018a & 2018b). This regime gives a mix of log grades, including small knot logs.

The long-term wood supply available for expanded wood processing under this medium length rotation scenario would be in the order of 1.6 to 1.7 million m^3/p.a. of unpruned saw logs.

Expanding wood processing

The wood processing industry is dynamic and a complete dataset of all processors is not publicly available. However, 12 were identified in the Hawke's Bay (processing about 1.3 million m^3/p.a.) using the Scion wood processing database (Scion, 2017), which captures all major wood processors along with many of the smaller and secondary ones. The log surplus of around 1.8 million m^3/p.a. is currently mostly exported from Napier. This surplus could support expanded processing, especially if the wood supply is smoothed out as suggested above.

The opportunities for expanding wood processing can be modelled using the WoodScape model (Jack et al., 2013), which estimates the expected returns from various wood processing options from a common basis. The principal measure used is return on capital employed (ROCE). We modelled the primary and secondary solid wood processing of radiata pine, including mills that would fit with the long-term wood supply from the existing plantation resource. Large pulp and fibre panel mills were not included as their volume demands are larger than the supply.

The processing options with high-risk adjusted ROCEs (>20%) that fit with wood resources were:

- Manufacture of big squares from K grade logs
- Optimised Engineered Lumber™ (OEL™) using K grade logs
- Appearance and/or structural sawmill with a CLT plant, or one that is involved in the remanufacture of appearance grade products
- Where adequate log supply for the plywood mill is marginal, but has a ROCE of 29%, the mill would have to use a mix of log grades to make an industrial ply.

If this expanded wood processing was taking around 700,000 m^3/p.a., it would provide about 430 to 440 direct jobs and contribute $440 to $450 million to the country's gross domestic product (GDP).

New radiata planting impact on processing opportunities

Smoothed wood supply

Increasing long-term wood supply in the Hawke's Bay to approximately 3.0 million m^3/p.a., by eliminating the dip in wood supply around 2035 to 2045, would allow timber processing to expand further to about twice the size of that based off the current estate.

The expanded wood supply would have a minimal effect on the ROCEs of the various timber processing options listed above, meaning the selection of these options would not change. A plywood mill taking around 600,000 m^3/p.a. of log intake might be considered, but with an ROCE of about 29% under current conditions this is marginally lower than the return from the sawmilling, cross-laminated timber (CLT) and remanufacture options.

Planting for erosion control

If half of the approximately 130,000 ha of erodible land in the Hawke's Bay that has been identified as suitable for afforestation were planted in radiata pine, a considerable future resource would come online in the next 20 to 30 years. A forest establishment plan spreading the planting and using regimes with different rotation lengths could ensure a stable wood supply of 4.5 million m^3/p.a. The expanded estate would allow a significant expansion of onshore wood processing in the long term.

Beyond timber processing

Industrial symbiosis

An 'industrial symbiosis' is a local collaboration where different industries provide, share and reuse materials, energy, water and/or by-products to create shared value. Resources are used more efficiently by the group than by any individual company. The possibilities of establishing industrial clusters to reduce

Milled tōtara

waste and greenhouse gas (GHG) emissions, create jobs and contribute to New Zealand's bottom line are substantial.

Opportunities for industrial symbiosis based around wood processing have been identified in the Hawke's Bay using maps of forestry resources and industrial process heat demands, a model to estimate wood and harvest residue supply, and the WoodScape model (Figure 2).

The significant quantity of logs being exported from the Hawke's Bay via the Port of Napier (and wood and forest residues) represents an opportunity to expand wood processing and use wood resources for industrial heating. This could replace the coal that is currently being used for industrial heating at Awatoto near the port of Napier, and at Wairoa.

There are sufficient residues from in-forest harvesting to meet two-thirds of the demand for industrial heating at Awatoto if the suite of wood processing options (sawmill, CLT, remanufactured wood and OEL™) mentioned above was established. While these processing plants would require substantial capital investment (~NZ$204 million), they could provide up to 566 direct jobs and up to 1,503 indirect. The total increase in GDP would be in the order of $518 million p.a. and GHG reductions around 15,000 tonnes/p.a.

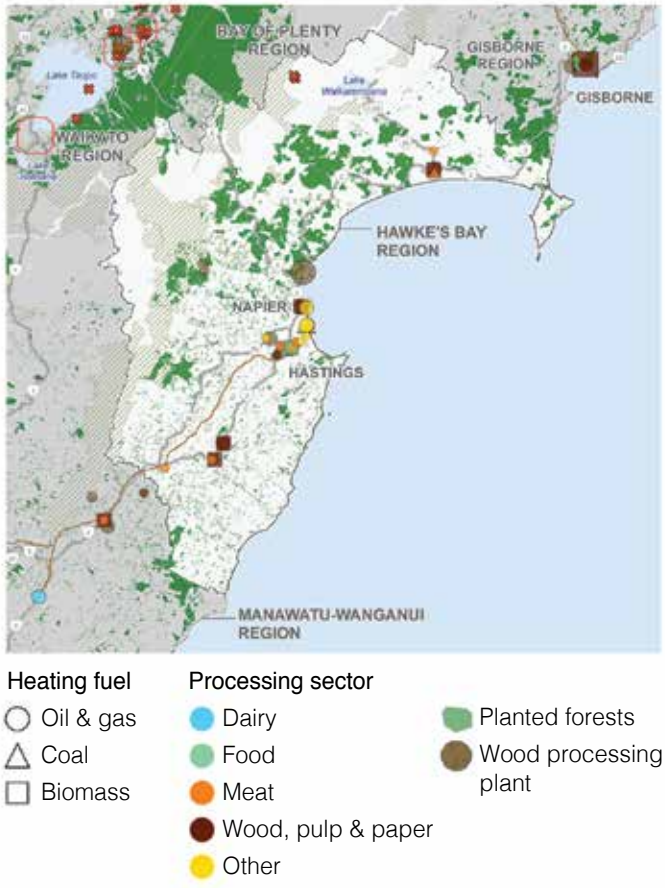

Figure 2: Planted forests and existing wood processing and other industries in the Hawke's Bay – opportunities for wood energy industrial symbiosis

In Wairoa, there is sufficient wood supply and in-forest residues to allow expanded wood processing and meet the energy demand of the local coal-fired meat works. A plant at Wairoa would require around $57 million of capital investment and could have up to a 30% return on investment. It would provide 81 direct jobs and 216 indirect, while adding $159 million to GDP, and reduce GHG emissions by 30,000 tonnes/p.a.

Biofuel opportunities

Biofuel production from forestry waste is another processing option. The Scion report – *New Zealand Biofuels Roadmap: Growing a Biofueled New Zealand* (Scion, 2018) – found that large-scale biofuel production to produce drop-in diesel, petrol and other fuels was feasible. The work started from the premise that fuel would still be needed for vehicles such as heavy trucks, farm and construction vehicles, and machinery and shipping that may be difficult or impractical to electrify. Using heat to reduce biomass to a crude bio-oil (pyrolysis), followed by upgrading the bio-oil, was found to be one of the most promising technologies, especially when primary processing was located close to forests.

The most suitable places for planted energy forests included the Hawke's Bay and the East Coast. In one scenario for Gisborne/East Coast, establishing biofuel production would require an extra 75,000 ha of forest, building pyrolysis and upgrading plants (with nearly one billion dollars in capital investment), and create over 1,000 jobs.

Non-radiata pine timber species

Non-radiata pine timber species are in a catch 22 situation. Small volumes and processing uncertainty affect price certainty, which in turn tends to limit planting.

The current supply volume in the Hawke's Bay region is very modest (Table 1). The only species that have current attractive financial metrics for wood processing are some *Eucalyptus* species and coast redwood. Cypresses from some stands are not attractive for processing, largely due to the comparatively low recovery rates of quality lumber that sometimes occur. Douglas-fir has limitations on where it should be planted due to its propensity to create wildings.

Table 1: Long run supply volume (m^3) – no new planting

Region	Douglas-fir	Cypresses	Eucalypts
Hawke's Bay	2,000	3,000[1]	1,000

[1] = after 2038

Options for processing timber from other species will depend on the volume available on an annual basis. For quantities up to 10,000 m^3/p.a., a portable sawmill is a viable option. Tōtara, cypresses, *Eucalyptus* etc could be milled this way. Another processing option could be a small (<25,000 m^3/p.a. of logs in) specialty mill able to process a range of species, or a small sawmill with

a head rig with the ability to process a mix of species with a capacity of 30,000 to 50,000 m^3/p.a. Ideally, sawmills would be aligned with secondary processors manufacturing value-added products suited to the species, such as using cypress for cladding/outdoor furniture, tōtara for furniture or carving, *Eucalyptus* for flooring, and coast redwood for cladding or to export to the US. Any mill/processor would need the capacity to carry out specialist drying regimes. *Eucalyptus*, for example, often require long periods of air drying.

New non-radiata pine forest impact on processing opportunities

The impact of any new plantings of non-radiata pine timber species on processing opportunities can only be assessed after analysis of the area to be planted and the planting schedule. This impact is unlikely to change the processing type, or the cost of logs, and will have no effect on the price of the products. However, it may influence the scale of the operations that are possible. Larger operations tend to have some advantage from economies of scale.

If there is the desire to promote the planting of different species mixes, it is important that the Hawke's Bay Regional Council (HBRC) and Hawke's Bay Regional Investment Company Ltd (HBRIC) consider options for primary and secondary processing, as well as the marketing of specialty timber, well in advance.

Summary and recommendations

The Hawke's Bay has a significant planted forest estate of around 133,000 ha, the vast majority of which is radiata pine. The log supply varies over time. A dip forecast for the 2030s could be smoothed by planting 10,000 ha of radiata pine over the next five to 10 years and growing them under a medium length rotation regime of 16 to 17 years. Under this scenario, 1.6 to 1.7 million m^3/p.a. annum of unpruned saw logs could be produced from the existing and potential new forest estate.

Expanded timber processing is possible as currently the supply of radiata pine saw logs exceeds local processing demand and around 700,000 m^3/p.a. are exported. Based on the existing planted forest estate, sawmilling coupled with CLT and the remanufacturing of lumber were assessed as being financially attractive, along with OEL™ and the sawing of L grade logs into big squares for export. Expanded timber processing would provide in the order of 430 to 440 direct jobs and contribute about $440 to $450 million to GDP.

Smoothing the supply using a medium length rotation regime would allow timber processing to expand to about twice the size of that based on the current estate.

Further production forestry planting of around 60,000 ha for erosion control (half the land identified as highly vulnerable) adds to the resources available, and it opens up the possibility of building energy self-sufficient primary production processing clusters. Clusters near Napier and Wairoa would reduce the reliance on fossil fuels (reducing GHG emissions) and contribute hundreds of jobs and hundreds of millions of dollars to the country's GDP. Turning forests and forest residues into liquid biofuels is a further option for utilising forest biomass.

Only a few thousand hectares in the Hawke's Bay are planted in non-radiata timber species. Of those, only some *Eucalyptus* species and coast redwoods have attractive financial metrics for timber processing. If the regional council and other bodies are serious about developing an alternative timber industry, there is a need for investment in developing options for primary and secondary processing and market development.

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