Portable sawmilling of locally grown alternative timber species

A report on the potential for a sustainable small-scale regional industry in Hawke's Bay Region

Prepared for Hawke's Bay Regional Council

and

Hawke's Bay Regional Investment Company Ltd

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April 2020

SWP Technical Report

Ref: SWP-T100

This report was commissioned by Hawke's Bay Regional Council and Hawke's Bay Regional Investment Company Ltd.

Funding from Te Uru Rākau's One Billion Trees (1BT) programme has helped make this report possible. The 1BT programme provides grants and partnership funds to encourage tree planting across New Zealand.

The Specialty Wood Products Research Partnership (SWP) is managed by Forest Growers Research and is a Ministry for Business, Innovation and Employment (MBIE) and industry-funded research and development partnership. It aims to increase the productivity and profitability of NZ-grown specialty timber species.

The SWP provides funding to Marlborough Research Centre, which in turn manages the NZ Dryland Forests Initiative's durable eucalypt tree breeding and research programme.

Executive Summary

This report provides a high-level review of the potential for a sustainable small-scale regional industry in the Hawke's Bay Region based on portable sawmilling of locally grown alternative timber species for sale to niche high-value domestic markets.

The report includes an assessment of the scale of the existing resource of small plantations and woodlots of alternative species in the region. These forests could provide the foundation of a sustainable supply for portable sawmilling. The report also examines the types of portable sawmills in use in New Zealand and how their increased use, combined with small-scale harvesting, could produce an increasing sustainable supply of locally grown timbers that could substitute imported timbers.

- Two recent reports commissioned by Te Uru Rākau 1BT Partnerships fund and the Hawke's Bay Regional Investment Company (i) *Planting eroding hill country in the Hawke's Bay region: Right Tree, Right Place, Right Purpose,* and (ii) *'Assessment of afforestation and future wood processing opportunity with non-radiata species - Wairoa District'* both highlight the strong case for growing alternatives to radiata pine in Hawke's Bay Region.
- Portable sawmills provide a relatively low-cost entry into sawmilling, and are highly suited to processing alternative species (also called 'specialty species') grown in farm woodlots and small plantations.
- New Zealand has an enviable reputation in the manufacture of portable sawmills, with three well-established and innovative companies manufacturing and selling portable sawmills at home and overseas.
- New Zealand also imports sawmills including one brand from the USA, and one from Australia.
- In total over 1100 portable sawmills are reported to have been purchased by New Zealanders since the late 1980s, and the manufacturers claim that most of these are still in working order. An estimated 15% of use is by commercial sawmilling operators with the remainder in part-time or only occasional use.
- Portable sawmill manufacturers and portable sawmill operators in New Zealand have experience and capability which is founded on innovation in engineering and technology. Developing a successful commercial portable sawmilling business requires good decisions in terms of choice of sawmill, operator skill and experience, and an overall sound business model. A number of examples of successful business models are provided in this report including three in Hawke's Bay.
- The lack of accurate data to describe the alternative species resource in Hawke's Bay Region (and throughout New Zealand) is a significant constraint. What data are available indicate an estimated 2,745 hectares of alternative species exists, with a significant proportion (1,194 hectares) under the age of 10 years in 2019. Of the 860 hectares over the age of 21 years, some 550 hectares are recorded as mature.
- The total 2,745 hectare area of alternative species estimated in the National Exotic Forest Description (NEFD 2019) in Hawke's Bay comprises 1,285 hectares of cypresses and other softwoods, and 1,460 hectares of eucalypts and other hardwoods. The main species growing in Hawke's Bay are cypresses, redwoods, eucalypts and other hardwoods including poplar. Further investigation is required to accurately assess the actual potential of these forests.
- Indicative calculations made in the report indicate that a full-time *in situ* portable sawmilling operation would annually require an area of about 3.4 hectares of softwood forest, or 2.25 hectares of hardwood forest, to ensure a sustainable log supply. However, feedback received from portable sawmillers suggests that, due to productivity constraints, a mobile commercial contractor operates successfully on about half this area annually.

- Based on the NEFD 2019 estimates of Hawke's Bay's areas of alternative species and their age distribution, over the next 20 years the region's softwood forests could sustainably support three full-time *in situ* portable saw-milling operations and one part-time operation; and the region's hardwood forests could support four full-time *in situ* portable sawmilling operations and one part-time operation.
- In 2017 New Zealand imported about 72,000 cubic metres of sawn lumber products worth over $122.5M. This figure would have been higher if not for the existing portable sawmilling operations. Using data supplied by sawmill manufacturers on the number that operate commercially, sawn production by these mills is estimated at up to 80,000 cubic metres annually of alternative NZ grown timbers. The value of this timber is estimated at $85.76M based on an average green sawn value of $1,072 per cubic metre.
- Two recent research projects at the University of Canterbury School of Forestry have featured portable sawmills and are summarised in this report. Both projects featured an *in situ* portable bandsaw mill used to saw (i) *Eucalyptus nitens* in one study and (ii) radiata pine in the other. Each of the studies produces evidence of the economic potential for successful portable sawmilling of these species.
- However, there has been no research into the overall economic contribution made by New Zealand's portable sawmilling sector, for example in terms of manufacturing and sales of mills, the volume and value of timber produced and sold and the employment generated.
- Given the number of portable sawmillers in New Zealand, there is significant potential to establish an industry association. This could encourage greater industry participation and grow members capability through providing technical support, safety and training resources, annual events and awards as well as co-ordinated branding and marketing of high-quality locally grown alternative species timbers.
- There is a lack of any structured education and training options to support existing users of portable sawmills or attract and train new people for a career in this industry. Formal training and education that provides a broad mix of skills and knowledge would increase NZ's portable sawmilling capability to add value to NZ's forest resource of alternative timbers.
- There is an urgent need for accurate information of Hawke's Bay Region's alternative species forest resource so as to enable and encourage the expansion of portable sawmilling and other wood processing businesses, thereby adding value to this modest but potentially valuable resource.
- Concurrently, part of the region's 'Right Tree, Right Place, Right Purpose' programme could include encouragement to landowners to plan and establish forests of alternative species on sites suitable for small-scale sustainable harvesting to supply a future portable sawmilling sector.
- Commitment to planting alternative species will be most successful if a professional, thriving and well organised small-scale sawmilling industry is developed and promoted.

This report concludes that portable sawmilling has the potential to be a sustainable small-scale regional industry in the Hawke's Bay Region. Other New Zealand regions have a similar alternative species resource, face common challenges, and also need opportunities for regional development such as portable sawmilling. A national approach is therefore worth considering.

The potential for regional development of portable sawmilling would be enhanced by further research and development. This needs to include an inventory of existing alternative species and their quality and quantity, a survey of portable sawmilling businesses, and a survey of forest owners and their aspirations. More information will enable planning and promotion of optimal management and sustainable harvesting of the alternative species resource.

Involvement of the Specialty Wood Products Research Partnership in preparing this report demonstrates interest from the forestry industry in the possibility of progressing further work on portable sawmilling at a national and regional level. The next step could be to draft an industry development plan for consultation with all stakeholders that identifies priorities for collaborative action, based in part on information provided in this report.

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1. Introduction

Portable sawmilling opportunity for a sustainable small-scale regional industry in Hawke's Bay

The Hawke's Bay forest industry is centred on 131,700 hectares of plantations most of which 128,500 hectares (97.5%) is radiata pine (*Pinus radiata*) (NEFD 2019). Radiata pine is highly productive in Hawke's Bay Region due to the relatively warm temperatures and moderate rainfall. The region's radiata forests provide a sustainable harvest of logs to regional sawmills and processing plants and for log export mainly via the Port of Napier.

The *Planting eroding hill country in the Hawke's Bay Region: Right Tree, Right Place, Right Purpose* study (2019) identified that establishing plantations of alternative exotic timber species could be one option to diversify forestry in the region and to create the opportunity for future regional sawmilling and value-added processing facilities.

The report identified a number of alternative species which are well-suited to Hawke's Bay and therefore worth some focussed research, for example into (i) the scale of forest area which needs to be planted over 30 years, (ii) protocols for successful forest establishment and management, and (iii) what regional scale sawmilling and processing options are possible for these species.

Both domestic and global markets are increasingly demanding naturally durable timbers i.e. timbers that do not need preservative chemicals. Since the early 2000s the New Zealand Redwood Company (NZRC) and the New Zealand Dryland Forests Initiative (NZDFI) have been investing in planting new redwood and eucalypt forests to provide a sustainable log supply for future regional wood processing industry producing naturally durable timber.

The Hawke's Bay study identified the Wairoa District as having the best potential for growing alternative species with the largest area of land in need of afforestation. The report '*Assessment of afforestation and future wood processing opportunity with non-radiata species - Wairoa District'* (Peter Hall, Scion, March 2020) provides information on the potential for establishing new forests to produce a non-radiata wood resource aligned with a wood-processing operation based in Wairoa. This study focused on redwoods and NZDFI durable eucalypts and assessed the forest area required to be established over the next 30 years to ensure a sustainable log supply.

While research and development initiatives into different afforestation options for Hawke's Bay Region are on-going, this report assesses the potential to develop a sustainable small scale regional industry in Hawke's Bay based on portable sawmilling of locally grown alternative timber species with minimal environmental impacts compared to large-scale radiata pine forestry.

However, little is known about New Zealand's current portable sawmilling capability and the annual volume and value of sawn timber production. And little is known about the potential of New Zealand's existing forests of alternative species to supply a sustainable small-scale regional industry based on producing local timber for sale to domestic markets (substituting imported timbers) and to export markets. Therefore, a high-level review of New Zealand's portable sawmilling industry has been undertaken and is presented in this report. This includes an outline of the development of portable sawmilling in New Zealand and the types of sawmills in common use including those sold by New Zealand sawmill manufacturers and those imported.

There is a modest forest resource of alternative species growing in Hawke's Bay (see Section 3) and a few local portable sawmillers already add value to this resource by producing timber for local sale or on-farm use. This report presents an indicative analysis of the region's forest resource, which is recorded in MPI's National Exotic Forest Description, and uses this to estimate the possible log supply and scale of portable sawmilling that could be sustainable into the long-term future.

Finally the report highlights what further action HBRIC and HBRC can consider to encourage development of a sustainable industry in the Hawke's Bay Region. The first action that could be taken is wider dissemination of this report to inform and encourage existing farm foresters and new forest growers to establish more alternative species on suitable sites where small-scale harvesting can be combined with portable sawmilling.

2. Portable Sawmilling In New Zealand

History of development and use in New Zealand

There has been a long history of development and use of portable sawmills (also called 'mobile sawmills') in New Zealand. This started with the very first bush sawmills in native forests in late 1800s through to the design and manufacture of a range of portable sawmills in the early-to-mid 1900s and the widespread use of modern chainsaws in 1950s including their use to mill large logs into slabs (so-called 'Alaskan mills'). (See Neil Barr's '*Growing Eucalypt Trees for Timber on New Zealand Farms (1996)* for a description of some of these early mills). While chainsaw mills are common today their use is not included in this report due to very low production in sawing logs.

The stimulus for development and use of modern portable sawmills now operating throughout New Zealand occurred during the 1970s and 1980s. Over these two decades the production of native timber from publicly owned forests declined dramatically due to political changes that finally put an end to the logging of most native forest on public land in 1993. Native forest logging on private land also became highly regulated and only single trees or small groups can now be felled. In 1975 the former NZ Forest Service (NZFS) started planting alternative exotic specialty timber species to replace the declining high quality timbers cut from native forests. So from 1975 until 1987 the NZFS established many small areas of alternative species throughout their pine plantation forests. Following the dissolution of NZFS in 1987, these plantations were sold to international forestry companies that still own these areas today.

Earlier than this, in the mid-1950s, members of the NZ Farm Forestry Association started planting a range of alternative species woodlots, and their activity has continued to the present day, meaning that, throughout New Zealand, and including in the Hawke's Bay Region, there are many small woodlots of alternative species, of different ages, quality and timber potential.

Today, New Zealand's alternative species forests are a modest but potentially valuable resource. Species planted include cypresses, eucalypts, redwoods, poplars, Tasmanian blackwood and others, all of which have been, and continue to be sawn with portable sawmills (see Section 3). These small-scale value chains supply locally grown and processed high-quality timber to a range of mainly domestic markets.

Advantages of portable sawmilling

Portable sawmills can be moved onto farms and forests and set up close to where the trees have been growing. Alternatively, they can be operated *in situ* at a semi-permanent site, and logs transported to that site.

Some of the advantages of portable sawmills are as follows:

- they can cut a large variety of timber sizes and species
- a small volume of high-value logs can be economically sawn on-site with low roading costs
- provide an option for adding value to small woodlots and plantations provided that harvesting can be matched to sawmilling rate and markets are available
- milling on-site can reduce transport cost as only half the volume of timber compared to logs needs to be loaded and trucked for further timber processing or sale
- timber storage costs can be very low if stacked for drying on the farm or in the forest as most alternative species can be stored without the risk of decay for months or even years
- production can be increased by adding another sawmill
- experienced operators can extract maximum value from different types of logs
- taper sawing can maximise the production of straight grained heartwood and colored grades from logs of high-value species

- low capital purchase and running costs compared to other wood processing options
- low environmental effects and very small 'footprint' compared to other wood processing operations
- some training offered by sawmill manufacturers and plenty of informal on line education available
- suitable for a family or whanau-based business.
- can supplement farmer or contractor income during seasonal lows.

Disadvantages of portable sawmilling

There are a number of potential disadvantages or risks associated with portable sawmilling, some of which could arise simply from poor practice during sawmilling and with timber handling and storage. Others are the working environment, market place and business sector challenges. Examples include:

- large kerf (caused by thicker sawblades on some circular blade mills) means loss of volume of recovered sawn timber as sawdust
- lack of industry timber sizes and grades for most alternative timbers
- inexperienced operators risk reducing recovery rate (conversion and value) by poor cutting decisions
- risk of timber being stored in sub-optimal conditions e.g. if farmers don't understand storage requirements of different species
- large flat area required for at least 6 months air drying timber for softwood boards with a year minimum for larger sizes and hardwood
- working outside can be more difficult in wet weather and winter
- lack of industry profile and effective representation of the portable sawmilling sector
- lack of marketing; therefore lack of awareness by architects and designers of species and products
- difficult to sell to timber merchants due to irregular supply and/or unknown timbers not in building code
- lack of research, education and training on sawmilling, including best practice for different types of mills and species as well as health and safety.

Portable sawmills manufactured in New Zealand

The decline in native log supply combined with interest in growing alternative exotic timbers also sparked innovation by New Zealand engineering firms, and led to the design and manufacture of several makes of portable mills operating throughout New Zealand today. These include:

- Peterson Portable Sawmills based in Rotorua (https://petersonsawmills.com)
- Mahoe Sawmills based in Kerikeri (https://sawmills.co.nz/)
- Turbo Sawmills, based in Tauranga (http://turbosawmill.com/)
- Rimu Engineering based in Blenheim (no longer in business).

Peterson, Mahoe and Rimu all started development and production of circular multi-blade and swing-blade portable mills in the 1980s. These NZ-designed and manufactured mills were successful and became popular in New Zealand as well as other countries. Their success was followed by Turbo Sawmills, a Tauranga-based company, starting up in 2007.

Currently a range of Peterson, Mahoe and Turbo portable sawmill models and accessories are produced and sold in New Zealand. The mills and accessories are also exported to many other countries.

Portable sawmills imported into New Zealand

'Wood-Mizer' portable band sawmills established in 1982 in America. These mills were developed for sawing high-value US native hardwoods (https://www.woodmizer.com.au/). Early Wood-Mizer models were imported into New Zealand soon after. Within the US these mills are now used extensively by hundreds of inter-generational

private forest owners and small-scale timber processing companies. The companies include sawmillers, veneer producers, moulding and flooring producers, traders who amalgamate timber and have kilns, or combinations thereof. Together members of this industry are united in the American Hardwood Export Council, an organisation that markets and exports more than 20 commercially available hardwood species in baulk (squared timber beams, by container) to over 50 countries worldwide. The most important volume species are the oaks, maples, ash, tulipwood, cherry, alder and walnut (https://www.ahec.org/about-ahec).

Following the early import and promotion of Peterson swing blade sawmills in Australia, a similar portable mill design was developed in 1994 by 'Lucas Mills' (https://www.lucasmill.com/) and these started to be imported to NZ. These sawmills were developed due to the demand from private owners of native forests for small-scale portable sawmilling. Similar harvest reductions to New Zealand were beginning to be imposed on Australian publically owned native forests managed for timber production, so smaller coupes and selective harvesting within private forests increased.

There are some custom-made mills operating, and other brands that have been imported (e.g. Woodlands). However, the portable sawmill manufacturers highlighted in this report are likely to have sold the bulk of sawmills now operating in New Zealand, including some operating in the Hawke's Bay Region – see examples in Appendix 2.

Current status of portable sawmilling in New Zealand

Since the 1980s New Zealand portable sawmill manufacturers have been selling their mills to hundreds of companies and individuals throughout New Zealand, as well as exporting to many other countries. Some can be transported either by towing with a ute or SUV while others can break down for transport on a trailer. In most cases, they can be easily set up on farm or in the forest within less than an hour to accurately saw timber. However, there are larger commercial models that are designed for semi-permanent or *in situ* use. Some have an attendant loader, forklift, or farm tractor to enable log handling, and the stacking and loading out of sawn product.

All manufacturers produce a range of different models and accessories. Small manual models range in price from $6,000 to $12,000 while at the top end of the range there are commercial multi-saw models with power feed and computer headworks that cost around $20,000 to $25,000 and commercial band-saw models with power feed, computer headworks and hydraulic log handling which can cost between $60,000 to $120,000 depending on the model and the US$ exchange rate.

Informal consultation was undertaken with portable sawmill companies in preparing this report and the information presented in this section is a summary of their feedback and knowledge of the current industry.

Table 1. Portable sawmill sales in New Zealand

Make of sawmill	Country of manufacture	Numbers sold in New Zealand to March 2020	Estimate of use by owners
Peterson	New Zealand	446	10% full time, 20% regular use, 40% occasional, 30% rarely or never used
Turbo	New Zealand	60-100	10% full time, 80% part-time, 10% rarely
Mahoe	New Zealand	Not available	Not available
Rimu	New Zealand	137 (until business ceased in 2013)	Not available
Woodmizer	USA	150 (including 60 since 2000)	50% full time; 40% part-time, 10% occasional
Lucas	Australia	371	Not available
Total sawmill sales		1164 - 1204	

Both the NZ-made and imported mills have proven to be well manufactured: some companies commenting that there are many working mills now over 30 years old. A core part of the success of these businesses is a high level of customer support and some manufacturers include training for new sawmill purchasers. The support continues in providing parts for servicing and maintenance. Also marketing of second-hand sawmills is offered but most sawmills remain with the original purchaser. There are also custom-built portable sawmills and chainsaw mills operating.

Fig 1: Justin Wells (Logs2Lumber) band sawing *E. fastigata* pruned log grown at Tai Tane Forest.

Fig 2: Five-metre lengths of freshly sawn *E. fastigata*.

Feedback from portable sawmill manufacturers on use of their portable sawmills in New Zealand

Layla Robinson, Marketing Manager of Peterson Sawmills advised that the *'Industry/Interest breakdown'* of those using Peterson sawmills is**:**

- *Farmers – using own trees to create timber for their farm, yards, buildings & home*
- *Builders – milling timber for their business that is a lower cost and generally better quality*
- *Arborists/firewood merchants – making best use of valuable trees rather than chipping or cutting for firewood*
- *Professional sawmillers – producing timber for sale, or contract milling*
- *Timber merchants – can cut special sizes to suit orders*
- *Landscapers – cut timber to suit purpose, i.e. sleepers, posts, poles, decking, fences*
- *Hobbyists/retirees – having fun with wood*
- *Military – emergency bridges, buildings, shelters, disaster relief (the New Zealand Army are customers of ours)*
- *Furniture makers – turning logs into high quality custom furniture*
- *Fencers – milling posts and battens*
- *Woodlot owners (farm foresters) – utilising trees on their property for direct income rather than bringing in crews.*

Jake Peterson of Turbo Sawmills advised '*that our largest sales are all from export. We focus on export. For our domestic sales we would only sell around 5-10 machines per year into New Zeal*and.'

Stephanie Bergman of Mahoe Sawmills advised *'our Sawmills are commercial machines. The bulk of them go to full time operations.'*

Paul Marshall, Sales Manager for Wood-Mizer in New Zealand advised that *'Wood-Mizers cost a bit more (than other mills) in the first place so business planning is done and 50% of Wood-Mizer operators saw full time.'*

Matthew de Jager of Lucas Mills advised '*we don't keep records on the potential use of machines'* but have '*a very broad customer base from farmers with a small plot of trees to contractors who travel cutting trees for clients and everything in between. A lot of our customers seem to hold on to their machines.'*

Portable sawmill operators in New Zealand

Many portable sawmills are owned by sawmilling contractors (part-time and full-time). These people contract cut for small scale farm foresters and forest owners. Some of these advertise services and products on the Trade Me web site.

Some commercial portable mill operators also buy logs from mature alternative species plantations or from certified native forests (where regionally available) to mill and sell the timber. Some small-scale timber processors and timber merchants have set up and use a portable mill *in situ*, some with an electric motor, and a roof overhead, as these mills are a low capital investment and offer flexibility in being able to saw any timber species.

Some farm foresters and small forest growers buy sawmills to process their own trees into timber for buildings, fences, yards and other projects. Firewood merchants buy mills to saw timber from the better formed or more valuable firewood logs they source.

The current number of portable sawmills operating throughout New Zealand is unknown. Therefore, the volume of timber whether produced for local markets or used for DIY projects is unavailable; however the anecdotal figures provided by sawmill companies in Table 1 give an indication of how much the mills sold were being used by their client base.

A survey of the commercial portable sawmill owners and local farm foresters in Hawke's Bay would provide valuable information about the current scale and capability of portable sawmilling operations in the region, the sources and species of logs being milled, and the applications and markets they produce timber for.

Summary: portable sawmill manufacturers in New Zealand

Consultation with the sector has confirmed that there are three New Zealand-based portable sawmill manufacturers with a sales and service business for many hundreds of operators throughout New Zealand. The mills are used to process locally grown alternative timbers. The three manufacturing companies are a diverse mix of well-established professional small-scale businesses which compete effectively with larger overseas companies including US-based Wood-Mizer, a company that has sold over 80,000 sawmills worldwide. All three NZ companies also export sawmills but their export figures were not requested for this report.

It appears New Zealand's portable sawmill manufacturers are successfully competing on swing-blade design, quality engineering and manufacture, and a high standard of customer service and support. They state that this is demonstrated by how many machines have only one owner and are proving to have a long working life.

The NZ manufacturers continue to be innovative with the design and development of modern commercial mills which include computer technology and a wide range of accessories to increase the efficiency and accuracy of portable sawmilling. They also produce low-cost manual models suited to part-time or occasional use that feature smart design and high-quality manufacturing.

Fig 3: Macrocarpa boards fillet stacked for drying.

Fig 4: Panel of decorative knotty cypress timber.

3. Alternative Species in Hawke's Bay and Their Potential for Portable Sawmilling

Some of the mills sold in New Zealand are already operating in Hawke's Bay albeit only a small number. However, there is potential to encourage and promote regional expansion of portable sawmilling of alternative species timbers based on the modest but potentially valuable existing forest resource, so that locally grown and processed high quality timber can be supplied to a range of niche domestic and export markets.

The existing alternative species forest resource in Hawke's Bay Region

The former NZ Forest Service (NZFS) planted small areas of alternative plantations of exotic alternative species in the Hawke's Bay forests that were established from the 1960s through until 1980s. This includes Mohaka, Esk, Kaweka and Gwavas forest with the majority of the cutting rights now owned by Pan Pac Forests.

In addition, there was impetus for planting alternative species by early farm foresters and this increased once a local branch of the NZFFA was formed in 1956 (*Guide to Successful Farm Forestry: A Hawke's Bay perspective*. NZFFA 2005).

Some of the NZFS and farm forestry blocks planted have already been harvested and while some of the logs have been sold for export, others have been supplying local portable sawmilling and timber processing businesses that sell to domestic markets. Also some local farm foresters are felling and using the timber for their own purposes. Evidence of this happening in Hawke's Bay is provided in the examples in Appendix 2 of this report.

National Exotic Forest Description (2019) data for Hawke's Bay

The National Exotic Forest Description (NEFD) is compiled by the Ministry for Primary Industries for the purpose of maintaining an authoritative, high quality database of New Zealand's production forests. It has been published annually since 1985 and provides statistics on New Zealand's exotic planted production forest estate at district and regional level.

The most recent National Exotic Forest Description (NEFD) published by MPI in 2019 records that in Hawke's Bay there are 550 hectares of these early plantings of alternative species which are now mature forests of 30-80 years old. In addition there are over 2,000 hectares of semi mature and young forests of alternative species, of which over half are less than 10 years old (Table 2).

Table 2. Hawke's Bay Region alternative timber forests: areas by age class and species (MPI NEFD 2019)

Species	Age class (years)				Total area by species (ha)
	1-10	11-20	21-30	30+	
Cypress	20	289	38	21	**368**
Other Softwoods	312	186	172	247	**917**
Eucalypt	690*	151	9	111*	**961**
Other Hardwoods	172*	65	91	171*	**499**
Total area by age class (ha)	**1,194**	**691**	**310**	**550**	**2,745**

* figures include areas listed as Confidential in NEFD data so an 80:20 split between young and old age classes of the NEFD total for eucalypt and other hardwoods has been assumed by the author.

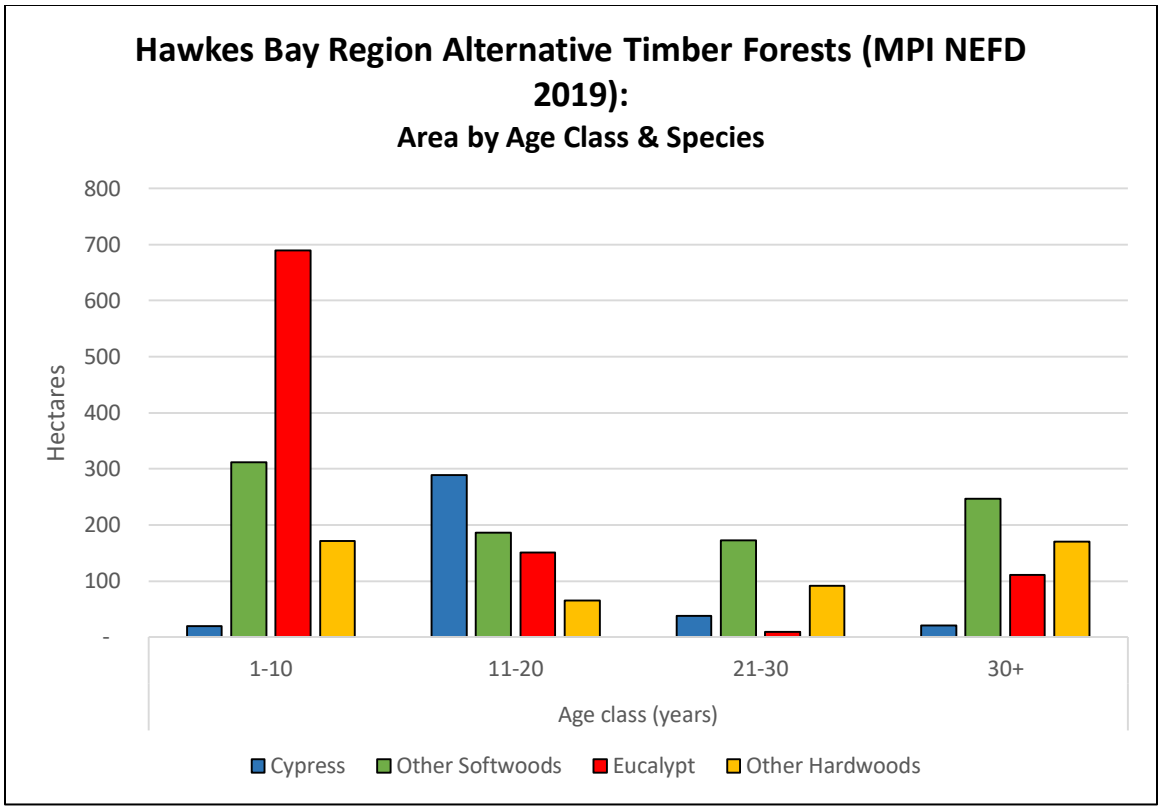


Fig 5: Hawke's Bay Region alternative timber forests – areas by age class and species (NEFD 2019)

The potential for these forests to produce a sustainable supply of logs for portable sawmilling is dependent on the accuracy of the NEFD data, as well as the forest locations, species and log quality.

Unfortunately the NEFD provides no information other than that shown in Table 2 and Fig 5. Also there are the issues as to the reliability of NEFD data and the lack of use of scientific names for categorising alternative species.

The NEFD data has been compiled from 1985 and is based on a combination of methodology extending from full surveys of forest owners with 40 ha or more while smaller forests (under 40 ha) are based on estimates. The survey runs on a two yearly cycle, where all known foresters with 40 hectares of forest are surveyed one year, and only owners with 1,000 or more hectares the next. Also the reliability of data decreases as forest sizes reduce as forest owners of larger forests (greater than 1,000 ha) generally have mapping and records to provide good quality data compared to those with small forestry blocks.

Forest area data for forests smaller than 40 hectares comes from three sources, listed below in order of total area represented:

1. *New planting imputations from 1992 to 2006*
2. *A survey of small forest growers from 2004*
3. *Forests previously surveyed for the NEFD but which have dropped below 40 hectares.*

Owners of small forests are classified as those with less the 40 hectares of forest. If a forest drops below the 40 hectare cut-off it is no longer part of the survey frame but the data is retained (MPI 2019).

The accuracy or otherwise of the NEFD data means that it can only be interpreted as indicative of the actual scale and age class of the existing alternative species forest resource. For example, the majority of the poplar resource growing in the Hawke's Bay, planted predominantly for erosion control on many properties, is unlikely to be accounted for in the NEFD data. However, accessible poplars are a favourite species for portable sawmilling, with one operator in the Hawke's Bay milling only poplar and producing a range of products for on-farm use, and sale.

In addition, the forest categories used in the NEFD survey for forest owners to provide data on their alternative species forests are inadequate for describing what actual species are growing. The species categories used are:

Cypress: includes macrocarpa, lusitanica and other cypress species.
The 'other cypress species' will include Lawson's cypress and Ovens cypress that has been planted in more recent years.

Other Softwoods: includes conifers e.g. pine, firs, larch and redwood. (Excluded: radiata pine, Douglas-fir.)
This is a very broad category representing a diversity of species with only some that are suitable for portable sawmilling. Furthermore, there are some omissions – e.g. there is no reference to exotic cedars, found in numerous small woodlots and plantations in New Zealand. These could either be included in this category or have not been accounted for.

Eucalypts: includes all eucalypt species.
At least ten main species of eucalypts have been planted for forestry in New Zealand over the last fifty years, plus many more species planted on a small scale, including some areas planted for firewood. These have a wide range of wood properties and suitability for portable sawmilling. The bulk of the older forests in Hawke's Bay are likely a mix of these species.

The significant increase in planted area of eucalypts in the last ten years, has been a result of the establishment of *E. fastigata* and *E. regnans* as carbon forests (including forests planted by HBRC at Waihapua) and many small blocks (less than 40 ha) of NZDFI durable eucalypts planted including *E. globoidea*, *E. bosistoana* and *E. quadrangulata.* These small blocks may or may not be included in the NEFD.

Other Hardwoods: includes broad-leaved trees e.g. wattle (Acacia) including Tasmanian blackwood, walnut, oak, poplar, willow, paulownia, birch, alder and elm.
This is a very broad category that represents a diversity of species with only some *Acacia* (which is the botanical name for wattle) including Tasmanian blackwood and silver wattle, walnut, oak, poplar, paulownia and elm likely to be suitable for portable sawmilling.

Summary: area of alternative species in the Hawke's Bay Region

In summary, there is currently insufficient definitive information on the area and species of alternative species to readily guide an initiative to encourage investment in portable sawmilling.

In order to accurately assess the potential of the existing forests, significant further research is required. This could include undertaking an investigation into where these forests are located; who owns them and their plans for harvest; the species, age class, log quality and whether ground based harvesting is possible, as this will be preferable for small scale logging. The results of this investigation would produce a more accurate assessment of what quantity and quality of log supply is possible from these forests.

Annual volume and forest area required to produce a sustainable log supply for a commercial portable sawmilling operation

Maximum annual production is achieved by portable mills that are used *in situ* and under cover so they can be sawing all year round. Whereas, a portable sawmilling contractor who is mobile spends time travelling, setting up on site then packing up to move to another site. Bad weather can mean no sawing at all on some days, and can cause delays with being able to get onto a site. Therefore, the annual volume needed for a sustainable supply to operate a portable sawmilling operation does vary with the type of commercial use.

In addition, time required for break down and sawing of different log sizes and species varies widely as a matter of course, and also depends on the type of portable mill and operator skill. These factors add to the variance in annual log volume required to operate a portable sawmilling operation.

There is also further variation between sites and species that make it difficult to estimate the area of mature forest that is required for sawing all year round. This variation is due to:

- Different species grow at different rates with eucalypts, redwoods and poplar able to grow at similar rates to radiata pine on optimal sites, while cypresses have slower growth rates. In addition, a range of other species including Tasmanian blackwood, oaks and some cedar are slow growing by comparison but can be productive on the right sites.
- The same species produce greater merchantable volumes on optimal sites compared to sub-optimal sites with growth of any alternative species on poor sites as much as 50% less by volume than optimal sites.
- For example radiata pine is suitable across much of the Hawke's Bay Region but is especially suited in the northern areas and along the southern coastal areas (Harnett 2019). These areas have some of the highest radiata pine productivity in New Zealand. Therefore, it is likely that existing woodlots and plantations of alternative species growing in northern and coastal areas of Hawke's Bay will have greater merchantable volume than those of the same age growing on the drier and cooler southern inland areas.
- The age class of the forest is important: over a long rotation the merchantable volume can increase significantly from age 30 to age 50 particularly with fast growing species on optimal sites. For example, both redwood and eucalypt forests can reach 500 cubic metres per hectare by age 30 and grow on to exceed 800 cubic metres per hectare by age 50.

In order to provide some indicative figures for this report, two scenarios have been developed to calculate the possible annual volume and forest area required to support a full time *in situ* portable sawmilling operation. The average output daily of sawn timber used in these scenarios includes allowing for time the operator spends:

- moving logs, cutting to length (log making) and loading onto mill
- tailing out (removing the cut timber from the saw), docking and fillet stacking by size and grade
- moving sawdust and slab wood away from the mill site
- refuelling the mill and changing blades; also blade sharpening and other maintenance.

Scenario One - Softwoods: a medium size commercial swing-blade operation with a sawmiller and one assistant cutting good quality softwood sawlogs to produce a mix of sizes including larger beams and boards that maximise the recovery rate with a target average output daily of 3 sawn cubic metres of timber. Assuming that their conversion is about 50% then the daily log volume required is 6 cubic metres, giving a total of 30 cubic metres per week, which is about one standard log truck and trailer unit. Assuming then that the portable sawmiller's target is to operate for 45 weeks per year this would equate to requiring a total of 1350 cubic metres of softwood logs annually.

The logs for this scenario are a mix of all grades of merchantable logs harvested from a 3.4 ha 30-year old softwood woodlot with an estimated 400 cubic metres of logs per hectare (see Table 3).

All 400 cubic metres are assumed as suitable for portable sawmilling, so based on the sawmiller's annual requirement of 1350 cubic metres per annum then it would take one year for felling and sawmilling to complete harvesting of the 3.4 ha woodlot stand to produce 675 cubic metres of sawn timber.

Scenario Two - Hardwoods: a medium size commercial portable bandsaw operation with a sawmiller and one assistant cutting good quality hardwood sawlogs to produce a mix of sizes including 55mm thick for furniture/joinery applications and 28mm for flooring that maximises the recovery rate with a target average output daily of 2 sawn cubic metres of timber. Assuming that their conversion is about 50% then the daily log volume required is 4 cubic metres with a total of 20 cubic metres per week, which is about one standard log truck and trailer unit every eight working days. Assuming then that the portable sawmiller's target is to operate for 45 weeks per year this would equate to requiring a total of 900 cubic metres of hardwood logs annually.

The logs for this scenario are a mix of all grades of merchantable logs harvested from a 2.25 ha 30-year old eucalypt woodlot with an estimated 500 cubic metres per hectare (see Table 3).

It is assumed that only 80% of the logs are of sufficient quality for milling so only 400 cubic metres per hectare is sawn. Based on the woodlot area, there are 900 cubic metres of merchantable logs, which is the sawmiller's annual requirement so there is one year of felling and sawmilling to complete harvesting of the 2.25 ha woodlot.

The possible volume of merchantable logs and the grade of a mature woodlot or plantation of hardwoods, eucalypts for example, will vary with age, site, species and silvicultural management. Using the estimate of 400 cubic metres per hectare of sawlogs then harvesting of 2.25 hectares of mature hardwood forest annually could supply a full time portable sawmilling business that could produce 450 cubic metres of sawn hardwood timber annually.

Summary: the average area of hardwood and softwood forest needed to support a full-time portable sawmilling operation

The two scenarios above have been used to calculate an average area of mature forest required to support full-time commercial portable sawmilling contractor by assuming that a mix of softwoods and hardwoods are sawn and that annual production is only 50% of *in situ* mill production (Table 3 below).

Table 3. Estimates of the areas of softwood and hardwood forest needed to support a full-time portable sawmilling operation.

Scenario	Forest Type	Average sawlog yield m^3 per hectare at 30 years	Logs required annually for portable mill operation (allowing for 50% conversion)	Area of forest required (hectares) annually for harvesting	Annual sawn timber output m^3
Scenario 1 *In situ* mill	Softwood	400	1350	3.4	675
Scenario 2 *In situ* mill	Hardwood	400	900	2.25	450
Mobile mill estimate 50% of average	Softwood/Hardwood	200	562.5	1.41	281.25

Indicative assessment of the potential for the Hawke's Bay alternative species resource to support portable sawmilling

The NEFD data is the only data available, so despite some likely inaccuracies identified earlier in this report it has been used to provide some indicative calculations as follows:

- NEFD data shows that there are 550 hectares of 30 plus year old (some stands recorded are 80 years old) alternative species forests in Hawke's Bay Region. Cypresses or other softwoods cover 268 hectares and eucalypts or other hardwoods the balance of 282 hectares.
- In the age category 21-30 years there are only 210 hectares of cypresses or other softwoods, and 100 hectares of eucalypts or other hardwoods, giving 310 hectares of alternative species in total. This lower area of semi-mature forest is a constraint on developing a sustainable supply for sawmilling. In twenty years' time, however, the supply could increase as there are 1885 hectares 1-20 years old.
- Therefore, a potential 20-year sustainable supply needs to be estimated from the combined total area of forests that are 21-30 and 30 plus years old which is 860 hectares.

If **only about fifty percent of these forests** were accessible; suitable for milling and the forest owners keen to harvest, there could be about 239 hectares of cypress and softwoods and 191 hectares of eucalypts and hardwoods available over the next twenty years for felling and portable milling. This equates to approximately 11.95 hectares per annum of cypress or softwood and 9.5 hectares per annum of eucalypts and hardwoods.

- Based on the area of forest required annually for an *in situ* commercial softwood portable milling operation being 3.4 hectares then a tentative calculation can be made that the cypress and other softwood forests, if sustainably logged by small scale harvesting, could support 3 full time *in situ* operations and another part time (50%) operation.
- Based on the area of forest required annually for an *in situ* commercial hardwood portable milling operation being 2.25 hectares then a tentative calculation can be made that the eucalypt and other hardwood forests if sustainably logged by small scale harvesting could support 4 full time *in situ* operations and another part time (30%) operation.
- These figures would be double if all of the forests were sawn by commercial portable sawmilling contractors who were mobile, and moved from site to site (Table 4 below).

Table 4. Estimate of number of portable sawmilling operations supported by existing mature alternative species in Hawke's Bay.

NEFD Forest type	Area available over next 20 years in Hawke's Bay for milling (50% of total area in Table 2)	Annual area available under a sustainable harvest	No. of *in situ* portable sawmill operations possible	No. of mobile portable sawmill operators possible
Cypresses & softwoods	239 ha	11.95 ha	3.5	7
Eucalypts & hardwoods	191 ha	9.5 ha	4.3	8.6
All forests	430 ha	21.45 ha	7.8	15.6

However, in reality this modest forest resource could support a mix of commercial operations and these are just scenarios. The real opportunity can only be calculated on the basis of the alternative species forest inventory recommended and also by surveying the capability of the existing portable sawmilling operations in the region.

Developing a viable portable sawmilling business

The economic viability of a portable sawmilling business will depend on a number of aspects. These include:

- whether the sawmiller is getting paid simply for milling timber or whether there is some sort of value chain involved – e.g. buying logs to mill and market sawn product
- the ability, skill and experience of the sawmiller to maximize the recovery from any given log/s
- the choice of sawmill type and model and the likely local log supply
- the species, quality and dimensions of logs available to be milled.

If planning to undertake portable milling then it is important to consider that high sawn output isn't always going to improve the economics of the operation. This is because of the 'log to sawn timber' conversion rate; the sizes sawn and the grade recovery (recovery rate) also impact on potential value of the timber produced. The recovery rate depends on the ability, experience and skill of the miller, the type of the mill, species of tree cut, dimensions of the sawn timber cut and quality and dimensions of the log input.

Successful commercial portable sawmilling ventures are based on the business selecting a mill and model size that is matched to the likely log supply and grades. This will ensure a high conversion to saleable sawn timber in dimensions that optimize the proportion of outputs with the highest value. A commercial contract sawmiller may want to offer custom milling services or alternatively a farm forester or small forest owner may have mature trees of alternative species and want to establish a new on-site portable sawmilling and timber sales business. Or a hobby sawmiller or furniture maker may want to source logs occasionally and saw these to produce timber for their own projects.

The species, quality and dimensions of the logs (and purchase cost) to be sawn are important factors affecting the operator's capability to operate a productive and accurate milling operation on an economical or commercial basis. Multi-blade (quarter saw) and swing-blade sawmills are very efficient for sawing large logs of medium to low grades to produce large-dimension sizes for sale or further processing using other equipment. They are particularly suited to sawing large softwood logs including cypresses and redwoods as these are generally stable during sawing and drying.

Bandsaws offer greater flexibility, being able to saw any alternative species (including hardwoods) to maximize log conversion into a wide range of timber sizes and grades that optimise the value possible in local markets.

Therefore logs from mature well-managed woodlots or plantations are particularly suitable provided that these can be supplied at a rate that matches the portable sawmill's production rate.

Conversion rates from log to sawn timber are influenced by the type of sawmill and the quality and dimensions of logs. Based on sawing a log >50 cm in diameter then conversion is likely to be:

- 40-50% for quarter saws
- 50-60% for swing saws
- 55-65% for bandsaws.

The higher conversion offered by bandsaws should be considered: a high conversion into clear and dressing grade boards is possible from good quality pruned and knotty logs of high value species, increasing the overall value of the sawn timber output.

Practicalities of operating a portable sawmilling business

Small scale harvesting to supply an on-site portable milling venture

Generally, harvesting radiata pine forests requires good quality road access for logging trucks, and large skid sites. Harvesting crews produce hundreds of cubic metres of logs per week which need to be sorted into multiple product types on the skid; the logs must be easily accessible and delivered to market as soon as possible after harvest because of the risk of timber degrade if they are stored for more than a few weeks.

In contrast, harvesting small plantations to supply a portable sawmill requires much less investment in roads and skids because daily harvest volumes can be a fraction of those typically harvested in radiata pine operations. In addition, the logs of many alternative species can be stored (with appropriate care taken) before milling, taking the pressure off owners to dispatch the logs as soon as possible after the trees are felled.

At present, one of the challenges for small scale alternative species woodlot owners is to find a small logging crew prepared to work at the scale and rate to suit portable milling operations.

Options available to farm foresters or forest growers include:

- owners could purchase suitable harvesting equipment and become trained to use it
- a portable sawmilling contractor could be equipped to do the logging as well as sawmilling
- a small harvesting crew of two people plus one medium-sized machine could fell and log trees directly to the portable sawmilling site.

Felling and skidding logs to the milling site is the most dangerous part of forestry: training and experience is essential. Training may be available in some parts of New Zealand but not others. A valuable area of research could be to investigate the technology and systems for best practice small-scale logging to supply a portable milling venture.

Optimal road, space and other requirements for a portable sawmilling site

New roading and access tracks are beneficial but expensive. However, good access can allow easier harvesting with smaller machines that have less impact on soils and lower running costs and emissions.

One large milling site is often the preferred option, with logs skidded to it from the forest. Preferably the site has all-weather road access and is large enough for everything to be laid out. Sufficient flat land is needed for the sawmilling operation with an area for tailing out and for logs to be measured and cut to length and rolled into the mill. Log making is a critical step as the lengths of the logs need to be matched to the standard lengths of timber for sale and preferably the highest value by grade. While logs are generally straight from some species, there are species that produce high-quality timber that may have defects (kinks, forks or sweep) that will determine the optimal log lengths able to be cut.

Additional logs need to be stacked nearby and timber stacked ready to be trucked out or moved to a storage area. This is likely to require a circular area of about 20 to 30 metres wide depending on the sawmill type and the number of logs to be milled. This amount of area can be difficult in steep country with a site best excavated and levelled well in advance of sawmilling if there are more than a few trees to be milled. Additional flat land will be required if sawn timber is to be stored on site.

Larger forests or discontinuous woodlots on a large farm could have multiple sites to decrease the distance that felled trees need to be skidded to the mill site. A suitable machine is essential for moving logs and loading packets of timber. For smaller blocks a farm tractor can be used for loading logs into the mill with cut timber stacked directly on to a trailer or fillet stacked, strapped and lifted with a front end loader and moved to a storage area.

With high value native and exotic timber heli-logging is used in some parts of New Zealand. This can be either flying the mill into the forest and the packets of timber out, or flying the logs to a central mill site. See section below about mill registration for native timber milling.

Handling sawn timber

Once the timber of alternative species has been milled, boards or beams need to be fillet stacked (thin narrow strips of timber are used to separate each layer in a stack) so they can air-dry before being saleable. Larger sizes can also be sawn and dried for sale to processors for re-sawing and machining for a particular application. Also drying of poplar (and radiata pine) is needed before preservative treatment for use in outdoor applications.

Drying timber requires sufficient flat storage area for the volume that is planned to be held in stock. Wooden bearers are needed and timber packs need to be covered with corrugated iron or stored in a large open drying shed for final seasoning. Some commercial operators using *in situ* mills have invested in kilns for drying, including solar kilns.

There may also be local markets for green sawn timber of some species (timber straight off the saw). Selling green sawn timber reduces the labour needed for air drying timber prior to sale and thereby increases sawn production.

Relevant legislation

Any person or business conducting a portable sawmilling venture needs to ensure their compliance with the Health and Safety at Work Act 2015. This includes having an operational health and safety plan and effective risk assessment and management systems to protect all those employed, or assisting without pay, in the harvesting and sawmill activities. This will also require using appropriate personal protective equipment, and installing signs, first aid equipment and other equipment like fire extinguishers.

There is no specific licensing or regulation of commercial portable sawmillers except for native timber milling. However, while it may be that temporary portable sawmilling operations on a farm or in a forest can be undertaken within a rural zone as a 'permitted activity', further advice can be sought from the local district or regional authority. Any permanently set up (*in situ*) mills will need to comply with the local government permitted activities for the zone they plan to operate in or alternatively they will require a resource consent.

Portable sawmillers cut native timber in some New Zealand regions. Sawmills milling indigenous timber must be registered with MPI. A registered sawmill may mill any indigenous timber which has harvesting or milling approval from MPI.
https://www.mpi.govt.nz/growing-and-harvesting/forestry/indigenous-forestry/harvesting-and-milling-indigenous-timber/

Milling native timber at an un-registered mill is an offence under the Forests Act. Resource consents are also likely to be necessary for the felling or clearance of indigenous trees.

(N.B. Appendix 3 provides checklist of things to consider when contemplating setting up a portable sawmilling business.)

4. Alternative species timbers: markets and marketing

The demand for high-value alternative timber in New Zealand

In the last thirty years, the massive drop in supply of native timbers for a wide range of applications was met in part by an equally significant increase in timber imports. In 2017 New Zealand imported around 72,000 cubic metres of lumber products. These products had a value of NZ$112.5M, giving an implied value for the imported lumber of $1,591 per cubic metre for the hardwood imports (43% of the volume) and $1,473 per cubic metre for softwood imports (57% of the volume) (Hall 2020).

These imports are meeting significant domestic market demand for timbers for a wide range of applications that require specific wood properties. This includes decorative timbers with colour and grain and others that are naturally durable, thus avoiding the need for preservative treatments. There are a number of imported softwoods sold by NZ timber merchants with the most common being western red cedar. This low density naturally durable and stable timber is prized for cladding and outdoor joinery applications. New Zealand also imports a wide range of hardwoods for specialty applications, including flooring, wall panelling, indoor joinery and furniture. Some of these hardwood imports are naturally durable for use in high grade decking, outdoor joinery and furniture. Also critical infrastructure products such as cross arms for power poles and rail sleepers that underpin NZ's electricity and rail networks.

The scope and value of this demand for imported timber reinforces the scope and scale of domestic markets that could be supplied with NZ grown alternative timbers. And this is already happening.

Alternative species and their market potential

There are already many locally grown exotic alternative timbers being sawn and sold to local markets.

The most popular are likely to be cypresses, redwood, eucalypts and to a lesser extent poplar. There is a lot of information available 'on line' about these timbers.

A brief summary of the main species of interest is included here.

Cypresses and timber use

Cypresses were recognised as a species with potential to produce high-value softwood in New Zealand after early farm shelterbelts were milled and the timber properties were assessed by the NZ Forest Service in 1950s. Then the NZFS promoted cypresses in 1970s and early 1980s with increased planting by forest growers and farm-foresters with the largest area of new planting occurring throughout the 1990s. Planting rates have decreased in recent years.

Macrocarpa (*Cupressus macrocarpa)* is probably the most popular and widely produced NZ-grown timber milled by portable sawmillers. This timber is a well-known specialty timber, appreciated for its unique properties, including a rich gold to yellow brown colour, aroma and appearance. Typical applications include cladding, decking, appearance beams, rafters and framing, along with timber joinery such as fittings and indoor and outdoor furniture.

Along with timber sawn from *C. lawsoniana* and *C. lusitanica*, it is covered in the NZ Building Code for enclosed framing, weatherboards and decking. Macrocarpa has given long service in use as bee boxes. Sleepers have also become popular for vegetable gardens where growers want to avoid the potential for soil contamination by CCA-treated timber.

There is a small trade in logs with China with modest volumes being exported for up to a 40% premium over the prices received for equivalent grades of radiata pine. Such premiums can be attributed to specific desirable wood properties and demand for cypress timber required for high value uses including caskets for traditional burials.

However, despite the value and demand for cypress timbers, planting rates have decreased in recent years. Growers who planted cypresses during 1970-1995 may have lost enthusiasm for planting the species due to widespread emergence of canker that impacted on mid rotation and younger stands (particularly in the North Island). In the last 20 years new planting has been largely with the canker resistant clones, the main one being Ovens cypress.

Redwood and timber use

Redwood is used for interior panelling, exterior cladding (permitted under NZ Building Code), decking, and fencing. Redwood timber has a lovely rich red colour that makes it sought after for interior and decorative uses.

Natural durability means redwood can be used outdoors (though not recommended for ground contact). Wood treated with toxic chemicals can be avoided and this is another reason redwood is so popular.

Low rates of shrinkage, warping or checking are a particularly important characteristic of redwood. Stability of wood exposed to the weather is one of the reasons it is so popular for decking and outdoor joinery.

NZ redwood is sold domestically in small volumes e.g. https://www.theredwoodguys.co.nz/

There are a number of existing redwood stands throughout New Zealand with recent sawmilling research of NZ grown trees by NZ Redwood Company (NZRC) and Scion demonstrating that these can produce broadly similar wood properties to those of Californian-native grown timber. Since 2000 an estimated 10,000 hectares of new redwood forest has been planted in New Zealand with about 3,000 hectares planted by the NZRC and the balance by farm foresters and other forest growers. These forests will significantly increase the potential supply from 2030.

Eucalypts and timber use

Eucalypt timbers are hardwoods and have several sought-after timber characteristics, being hard and stiff, with attractive colour options and in some cases naturally durable.

Early interest in growing eucalypts in New Zealand led to dozens of species being tested by early settlers followed by plantings by the former New Zealand Forest Service and Department of Railways during the 1920s and 1930s. Interest in durable eucalypts was revived in the 1970s by the NZFS and NZFFA who promoted several species and these now form much of the modest but mature resource in NZ today.

The bulk of the current NZ resource by area comprises *E. fastigata, E. regnans* (in Central North Island) and *E.nitens* (in Southland). These plantations are largely destined to be chipped for pulp and paper production or are carbon forests, but there are some portable sawmilling operations that produce sawn timber from these species for sale or their own use.

New Zealand-grown eucalypt timber species produce broadly similar wood properties to those of Australian-native grown timber. In addition to *E. fastigata, E. regnans* and *E. nitens* the principal species currently being sawn are *E. saligna, E. pilularis, E. muelleriana and E. globoidea*.

The New Zealand Dryland Forests Initiative (NZDFI) was established in 2008 to undertake a tree breeding and research programme of three principal species that can produce high-quality, naturally ground-durable hardwood

for potential markets in New Zealand and high-value markets overseas. However, while planting of these species is increasing, these forests will not increase the current log supply until around 2040.

Poplars and timber use

Poplars were an early introduction to New Zealand in the 1830s and were planted widely as ornamental trees and for farm shelter. In the 1930s the New Zealand Forest Service imported more species to investigate their timber potential. Poplars can be planted using poles, grow quickly and can be pruned for fodder. As a result, planting on erodible farmland was encouraged from the 1950s onwards. Research and breeding also began to develop new cultivars and this continues today under the NZ Poplar and Willow Trust. The most successful cultivars are hybrids of either Black poplar (*Populus nigra*) or Chinese poplar (*P. yunnanensis*) and these now comprise the majority of trees seen on hill country farms (McIvor 2010).

Poplars produce low density hardwood that is generally straight grained but there are differences between hybrids and species in the texture, density, strength, wood quality traits, and sometimes the colour. While lacking in durability, the generally light coloured timber has been used in New Zealand for a range of interior applications. It has also been used for truck and trailer decking as it is tough and resistant to wear. And it can be successfully treated and used in outdoor applications on farm for stockyards and fencing. In some countries it is widely used for pulp and paper products, furniture making, as a packaging material and in veneers and plywood.

Many farms throughout New Zealand now have extensive poplar woodlands including Hawke's Bay. These were planted at wide spacing and older plantings are now mature trees and could be a potential resource for increased portable sawmilling by small scale harvesting. There are also some mature pruned woodlots that were planted and managed by farm foresters and can produce good quality sawlogs. In 2019, the NZ Poplar and Willow Research Trust produced a video on the opportunity that on-farm portable sawmilling offers landowners with mature poplar trees. This video was made with assistance of Tim Forde who features in Appendix 2, Example 3.

https://www.poplarandwillow.org.nz/documents/new-zealand-poplar-farm-milling-the-full-length-video

Native species

Native species are not covered in this report. Where native timber can be sustainably and legally harvested, portable mills are already in use and have been proven economical. The Totara Industry Pilot, based in Northland, was established to adding value to the resource of regenerating totara forests growing on private land. There may well be lessons for exotic alternative species initiatives from this innovative project.

Domestic marketing of alternative timbers

New Zealand-grown alternative timbers produced by portable sawmillers already supply local markets. This is either through portable sawmillers contract cutting for timber merchants or timber merchants who run their own portable sawmill from locally sourced logs. Also farm foresters using their own sawmill or a commercial contractor can produce timber from sale or for their own use.

Several larger timber merchants in New Zealand source a range of NZ grown native and exotic timbers and promote the availability of these timbers on their web sites alongside imported timbers. For example, Halswell Timber based in Christchurch and Nelson offer the following native timbers: beech, kahikatea, matai, rimu and totara as well as NZ grown macrocarpa, larch, Lawson cypress and *E. saligna* (Douglas fir and radiata pine are also listed). Some of these timbers they saw using their own portable sawmill and they offer a sawmilling service. https://www.halswelltimber.co.nz/species.php

But New Zealand's large DIY and building supply stores (Mitre 10, Bunnings and ITM) only offer radiata pine products with the occasional exception being the sale of macrocarapa and redwood sleepers.

Much of the commercial activity around alternative species timbers is 'below the radar' of New Zealand's main wood processing and sales industry. This is not surprising as the Wood Processors and Manufacturers Association of NZ caters only for those selling radiata pine products. So there are no statistics available of sales and value of locally grown, sawn and processed alternative timbers.

In the absence of an industry group focused on marketing NZ grown exotic timbers and sustainably harvested native timber, the NZ Farm Forestry Association fostered the establishment of the Farm Forestry Timbers Society with this underway by 2015. This is a '*not-for-profit incorporated society and industry body for promoting and facilitating distribution of locally grown specialty timbers in New Zealand*.' https://www.nzffa.org.nz/specialty-timber-market/participate/

One of the main functions of the Society is to provide information about many of the alternative timbers that have been grown in New Zealand. https://www.nzffa.org.nz/specialty-timber-market/showcase/

Information on portable sawmilling of softwoods and hardwoods is also available. https://www.nzffa.org.nz/specialty-timber-market/information-resources/sawmilling/

A virtual 'marketplace' also operates on the NZ Farm Forestry Association web site where members can offer their timber for sale and/or portable sawmilling and other timber processing services. Currently there are 15 individuals and companies advertising on the market place https://www.nzffa.org.nz/adverts/

The mix of those participating includes:

- six timber merchants who purchase, saw and sell alternative timbers for sale as well as offer portable sawmilling services
- six farm foresters operating part time or full time portable sawmills to produce alternative timbers from their forest and selling this locally
- one commercial portable sawmilling contractor
- one wholesale specialist tree nursery selling cypress plants
- one architect offering a specialist design service that includes timber.

Unfortunately, the Society is unable to offer records of successful sales, prices for various timbers and other market information.

Probably the most effective general marketing of alternative timbers for sale and promotion of portable sawmilling services is provided by one of NZ's most popular web sites, Trade Me.

Trade Me is already used for selling NZ-grown alternative timbers. For example, at the time of writing, a general search of 'macrocarpa' produced 408 results that included boards, beams, decking slabs, sleepers, furniture and firewood sales. Many of the products on sale had been sawn on portable sawmills. A search of 'redwood timber' also produced about 30 different results with a similar offer of timber products to that for macrocarpa.

However, a search of 'poplar timber' and 'blackwood timber' produced only a small number of results as did 'gum timber' while 'eucalypt timber' didn't get any results.

An analysis of timber prices could be made from this and other sources but this is beyond the scope of this report.

A search of 'portable sawmilling' produced six operators offering contract services, all located in the northern North Island.

Professional industry association and branding opportunity for sawmillers of locally grown alternative timbers

While there are the Farm Forestry Timbers market place and Trade Me web sites, those with existing businesses and any new entrants to a commercial sawmilling business will need their own brand and website and other marketing to promote sale of their products.

There appears to be an opportunity to increase the profile of NZ's portable sawmilling industry and of the locally grown alternative timbers they produce. This could be through the establishment of a professional industry association for alternative timber sawmillers and processors. The association could brand and market both native and exotic timbers to increase demand and sales beyond present domestic sales.

There is a strong sustainability story that can be promoted around trees that have been locally grown with low-impact harvesting (and are re-planted or regenerate) and then processed into natural timber products. This story could be the basis for development of an industry-wide branding strategy that could use a trademark or several trademarks with rules for use overseen by the suggested association. The association could be responsible for developing and implementing a plan for the trademark(s) (IP) and be responsible for oversight of the trademark use, web site development for marketing, a regular newsletter and other industry activities including an annual portable sawmilling event with awards and regional field days similar to some of those run by the NZFFA. One task could also be to lobby for changes to the NZ Building Code to permit the wider use of these alternative timbers, a task that is currently been undertaken only by the NZFFA.

Some forest growers may already have Forest Stewardship Council (FSC) certification. However, it may be possible for the association to have membership category that offers certification of NZ forest growers to use the trademark with standards/rules that promote sustainable forestry and low-impact small-scale logging. Then as certified growers they can promote the sales of their logs to the sawmillers.

The establishment of an association would need to be led by those already actively involved commercially in the portable sawmilling sector. But for this to happen a plan and process needs to be developed for all those in the industry to collaborate to establish such an association and thereby grow the scale of the current industry so that it can better compete with the increasing supply of timber imports.

The Forest Industry Contractors Association , formed in 2002, is an example of industry association that provides a common voice on issues important to members and fosters development and improvement of the industry. The New Zealand Arboriculture Association is another association, formed in 1989, that represents a similar sector to portable sawmilling. The activities and structures of both these associations could guide the development of a process to establish a new association of professional portable sawmillers. However, any new organisation could also be like the American Hardwood Export Council (AHEC) and include timber processors and merchants of NZ grown alternative timbers. An AHEC type structure would allow for industry grades, timber branding and marketing to be developed as well as chain of custody certification.

Potential size and value of New Zealand's current portable sawmilling sector

It is difficult to accurately quantify the current size and value of alternative timber produced by NZ's portable sawmilling sector, due to absence of any statistics.

The only statistics available from MPI are for native sawn timber in the *Production of indigenous forest rough sawn timber for all species* (MPI Wood processing statistics 2017). These show total sawn timber production of 8,138 cubic metres for the year ended 2017. The data provides no information around who was responsible for sawing the timber. Some 80% of the indigenous sawn timber produced is beech (6,141 cubic metres): it is rational to assume the majority of this production is by Lindsay and Dixon, a medium size sawmilling company based in Southland with a sustainably managed, certified native log supply. Most of the remaining 20% is likely to have been sawn by small mills including portable mills on the South Island's west coast and some other NZ regions.

In the absence of any records, an indicative approach has been developed to quantify the current size and value of NZ's portable sawmilling sector for this report. This approach is based on combining the figures for the number of portable sawmill sales that were estimated by the various manufacturers and calculating estimates of annual sawn production based on the percentage of use by the various owners (Table 5 below).

Table 5. Estimated level of use of portable sawmills in New Zealand.

Make of sawmill	No.s sold in New Zealand 1980s to March 2020	Full-time use		Regular use		Occasional use		Rarely used	
		%	No. of users	%	No. of users	%	No. of users	%	No. of users
Peterson	446	10	45	20	89	40	178	30	134
Turbo*	60	10	6		0	80	48	10	6
Woodmizer	150	50	75	40	60	10	15	0	0
Lucas**	371	10	37	20	74	40	148	30	111
Total			**163**		**223**		**390**		**251**

* lower estimate of number of mills sold in NZ supplied by Turbo ** estimate by author
Note: Table excludes Mahoe, Rimu, custom built and other imported sawmills, as data are not available.

The next step is to calculate an estimate of the annual sawn volume produced by these many owners. In the absence of individual production figures the average annual production figures calculated in Scenarios 1 and 2 have been applied. While there are portable sawmills in NZ operating *in situ*, for the purposes of this report, the average annual sawn production of 281.25 cubic metres calculated for a mobile commercial portable sawmilling contractor is assumed the production of all full-time users (see Table 3, page 13).

In addition, the annual sawn production of regular users is assumed to be only 50% of full-time users, with occasional users estimated to produce only 5% of a full-time sawmiller. Table 6 provides a summary of the estimated production of different types of sawmiller, with the estimated total annual sawn production calculated to be 82,688 cubic metres.

Table 6. Estimated annual sawn production by portable sawmills.

Type of user	Number of users in NZ	Annual sawn production estimate per user (m^3)	Estimated total annual production (m^3)
Full-time	163	281	45,844
Regular part-time	223	141	31,359
Occasional	390	14	5,484
Rarely	251	0	0
Total	**1,027**		**82,688**

As no figures are available, there is no account made in this estimate for production by Mahoe and Rimu sawmills, nor for custom-made or other imported models being used in New Zealand.

Estimate of the value of timber sawn by portable sawmills

MPI's records of native sawn timber production (8,138 cubic metres in 2017) do not record how much of this total is sawn by portable sawmillers, but it is unlikely to exceed 2-3,000 cubic metres because of the large proportion that is native beech sawn by Lindsay and Dixon (see previous section).

Radiata pine will also be sawn by some portable sawmills. There are a small number of *in situ* Wood-Mizer sawmills that are set up to saw pruned radiata pine logs. High conversion by these mills ensures maximum recovery of clear boards which are a high value product. These milling operations are also capable of much higher average annual production than that of the softwood scenario used in this report (see page 13). Section 5 of this report describes the results of a research project focused on a radiata pine operation using a Wood-Mizer. In addition, large old pine trees are sought after by some swing-blade portable sawmillers as these produce resinous heartwood timber to make bee boxes that are used untreated and in demand due to the recent growth of the mānuka honey industry (Vaughan Kearns pers. com.).

However, so as to develop a value for the timber sawn, it is assumed that a large proportion of the estimated annual production of 82,688 cubic metres in Table 6 will be NZ-grown alternative species.

The value of this estimated annual production has therefore been calculated as follows:

- if 2,688 cubic metres of the total estimated annual production is native sawn timber, then an estimated (82,688-2,688) = 80,000 cubic metres can be assumed to be exotic species. As there is no figure for calculating how much of this volume is radiata pine, it is assumed that the majority of this is likely to be higher value clear grades i.e. for specialty uses.
- the average value of imported hardwoods is $1,591 per cubic metre and imported softwoods is $1,473 per cubic metre, giving an average value for both types of $1,532 per cubic metre
- by applying a 30% deduction in value for NZ-sawn exotic species, then the value of the sawn timber can be estimated as $1,072 per cubic metre. (In the authors experience this figure is a fair value for the value of green sawn dressing grade macrocarpa while top grades of alternative species timbers and native timbers can be worth over $2,000 per cubic metre. A green sawn value of radiata clears has not been investigated for this report but is likely to be in the order of $600 to $800 per cubic metre)
- **based on this figure of $1,072 per cubic metre, the estimated annual value of 80,000 cubic metres of NZ grown alternative species timber is around $85.76M**.

There are both commercial sawmillers and timber merchants that add further value by drying and processing into timber products worth significantly higher prices per cubic metre. This annual value does not account for any added value but if this were estimated then the annual value of NZ grown and produced alternative sawn timber products may exceed the value of imported timbers.

The possible scale and value of this existing industry poses some interesting questions that have not been addressed in the scope of this report, for example:

- What is the actual total sales volume and value of alternative species timbers?
- What is the current log volume by species and region that is being harvested to supply the portable sawmilling sector?
- What is the current level of added value processing of alternative species timbers?
- What forest resources are available in each region to supply an expanded sustainable alternative species/portable sawmilling sector?
- Is a NZ-wide survey of alternative species forests warranted given the inaccuracies of the NEFD?

5. Portable sawmilling: previous research in New Zealand and Australia

While portable sawmills have had limited use in New Zealand research projects, there has been no research into domestic or export sales of portable sawmills, their value, and the employment generated by NZ-based portable sawmill manufacturing. Nor has there been research into the volume and value of timber produced and sold by commercial portable sawmillers and the employment generated.

This is a significant gap in knowledge of the collective regional economic and employment benefits generated by this part of the forestry sector.

On the other hand, New Zealand sawmill manufacturers have undertaken significant commercial research and innovation: the first portable swing-blade sawmill was in fact designed and developed into commercial production by Carl Peterson, an American who came to live in New Zealand. Currently there are many different models of this simple yet innovative design manufactured and sold extensively by Peterson Sawmills and Turbo Sawmills as well as Lucas Mills in Australia.

There has also been significant on-farm and in-forest research by NZFFA members on the potential use of portable sawmills for producing both native and exotics timbers and their application. Their knowledge and experiences have been extensively covered in the NZFFA's web site under this link.

https://www.nzffa.org.nz/farm-forestry-model/the-essentials/milling-drying-and-marketing/#Treegrower-articles

The only New Zealand published research involving the economics of using portable sawmills has been conducted by the University of Canterbury's School of Forestry. In two different studies an *in situ* portable bandsaw mill was used to saw (i) *Eucalyptus nitens* and (ii) *Pinus radiata*. Both these studies produce evidence of the economic potential for successful portable sawmilling of these species and are discussed further below.

Evaluating profitability of solid timber production from 15 year old pruned and thinned *Eucalyptus nitens* in Canterbury – 2015 research project

This research project was conducted by Dean Satchell for his Masters thesis at the University of Canterbury (UC) School of Forestry. He evaluated the potential for milling young *E. nitens*, a fast growing eucalypt species planted throughout NZ. The project was undertaken in collaboration with John Fairweather, Specialty Timber Solutions located near Christchurch (see Appendix 2, Example 5).

The project involved milling logs on a Wood-Mizer LT 40 bandsaw in tandem with a twin-blade edger. A sawing pattern developed by Satchell for sawing small diameter eucalypt logs that is only possible with a bandsaw mill was successfully used. Each log was first sawn through the centre into four quarters. These quarters were then slabbed before being run through the edger to produce straight boards. Following sawing, the timber was dried, profiled and graded to evaluate the recovery and value of saleable product.

Satchell concluded that *E. nitens* has potential as a profitable plantation species for solid timber production provided that the small-scale processing methods applied in this project were followed. '*Outcomes included a reasonably favourable return on investment for the grower. However, this depended on a number of factors such as land price, distance from processor, product prices, grading methods, drying methods and level of sawmill profit'* (Satchell 2015).

The full thesis is available on line https://ir.canterbury.ac.nz/handle/10092/10821

The potential of small-scale sawmills milling radiata pine in New Zealand – 2017 research project

A UC School of Forestry forestry engineering student, Caleb Bergström, undertook an in-depth study for his Honours dissertation into a North Otago firm's radiata pine sawmilling operation using a Wood-Mizer LT 70.

This project highlighted the knowledge gap there is in using small-scale mills to process radiata pine, and set out to investigate the capacity, productivity, work flows, and economic viability of the operation.

The company involved, North Otago Sawmilling Ltd, mills pruned radiata pine logs on contract for a second local company, Great Southern based in Oamaru. Great Southern uses the timber for a range of building projects and farm supplies, and prefers timber milled by the Wood-Mizer because of the high quality produced. North Otago Sawmilling operates a Wood-Mizer LT 70 in tandem with a twin-blade edger, and as well as producing sawn timber, slabwood is sold for firewood as a significant bi-product. Four people are employed in the operation and on-site research was conducted over four days.

The results produced by Bergström included:

- the sawmill processed an average of 19 cubic metres of logs per day, producing 11.8 cubic metres of sawn timber (an average conversion ratio of 62%)
- total annual production was estimated at 2,725 cubic metres of sawn timber and 1,317 cubic metres of firewood
- potential increased efficiencies identified during the study could lead to an additional 1.8 cubic metres of sawn timber being produced daily, giving a potential daily output of 13.6 cubic metres of sawn timber
- the profitability of the operation depended on the contract cutting rate, productivity, and costs
- costs of production were estimated at $93 per cubic metre for the sawn timber, and $16 per cubic metre for the firewood
- while the contract cutting rate remained confidential, it was likely to be well above the $93/cubic metre needed to break-even, and the $113/cubic metre needed to give an acceptable (20%) return on investment calculated by the author (contract rates of $150-$200/cubic metre are common)
- the operation was deemed to be comfortably financially viable, although somewhat high-risk in that it was entirely dependent on a single market – Great Southern.

The research identified the potential output in terms of cubic metres of sawn timber per day of an *in situ* Wood-Mizer band-saw operation albeit with high-quality and uniform logs as in-feed, and a relatively limited range of products being sawn. Bergström concluded there is potential for small sawmills to mill radiata pine elsewhere in the country.

Relevance of this research to Hawke's Bay Region

With 128,500 hectares of radiata pine forests in Hawkes Bay, this type of small-scale sawmill set up could be further investigated as a means to add value to some of this existing resource and to create new employment. This set up could be particularly advantageous for remote forests with a long haul distance to existing processing plants or the Port of Napier. This approach is likely to work best if used to increase the supply of sawn timber to an existing wood processing business (as is the case with North Otago Sawmilling contract sawing for Great Southern).

Also it may be possible for slab wood to be cut into firewood or chipped by a mobile unit and then sold, or sold as slab and transported to a chipping plant. Another option that could be investigated is the potential to establish a pellet-producing plant that uses the slabwood from a number of small-scale mills. However, a major constraint is the need to kiln dry or treat radiata pine sawn timber as soon as possible following sawing to prevent the

development of blue stain, a common fungus that infects the sapwood of freshly sawn boards (this is unlike most alternative timber species which can be sawn and stored without any degrade).

The sawn output calculated in the Bergström study is almost 400% higher than the potential daily output production figures assumed for alternative softwoods in the scenario set out in Section 3 of this report – 3 cubic metres sawn timber output daily. This lower production rate is based on a portable sawmill operated by one or two people and with no edger.

However, it would be useful to conduct similar economic analyses of a number of existing portable sawmilling operations to develop a better understanding of sawmill productivity of the major alternative species and how this impacts on profitability and value of products that are currently sold for a range of applications. Even with low daily production and high production costs, small portable sawmilling businesses selling alternative timbers appear to be profitable by producing high value specialty timber products.

Bergström's study did provide an estimate of $168,405 for the total capital cost of equipment needed for the setting up of an *in situ* milling and firewood operation (including a new sawmill and two vehicles but not buildings/infrastructure): this figure provides a useful indication the order of magnitude of investment needed to establish a small-scale sawmilling business based on using a larger commercial Wood-Mizer.

Likely start-up costs for a professional mobile sawmilling contractor could be less than half the amount calculated by Bergström given the current price of new smaller commercial mills and starting out with a second hand 4WD ute.

Recent SWP research: regional supply of alternative species and economics of different wood processing options

The Speciality Wood Products Research Partnership (SWP)is a seven year partnership between Forest Growers Research and the Ministry of Business Innovation and Employment. This was established in 2015 with support from the NZ Forest Growers Levy Trust and other forestry businesses and organisations. The research programme is focused on some of the alternative species described in this report including eucalypts and cypresses and aims to encourage greater investment in growing and processing these species.

Two recent SWP reports (i) *SWP-T068– Identfying processing opportunities for key specialty tree species - resource analysis*, and (ii) *SWP-T073 - Identfying processing opportunities for key specialty tree species – processing options analysis using the WoodScape model*, used NEFD data to project the supply of cypresses and eucalypts by region over the next 40 years, and then used Scion's WoodScape model to assess the economics of various processing options for these species.

The first report highlights the modest and variable age class of the cypress and eucalypt forests available in the Hawke's Bay over the next few decades; the economic analyses in second report generate results on the viability of using a portable sawmill combined with various drying methods to manufacture differentwood products.

While useful for indicative purposes, the first report is based on the NEFD data (and its limitations) and excludes any analysis of two significant categories by area being 'other softwoods' and 'other hardwoods'. In the second report analysis is made of timber pricing based on generic sawn products and possible grade recovery by volume. This is conservative by excluding any value for sales of high grade cypress clears. Also the capacity of a portable sawmill used for the analyses (10,000 cubic metres of logs per annum) is at the very top of the range for any portable sawmill available in New Zealand, so does not represent current levels of portable sawmilling capability.

Relevant research into portable sawmilling in Queensland

With only limited industry research of portable sawmilling in New Zealand, a review of two research projects conducted by Smorfitt, Herbohn & Harrison (1998 and 2003) that focused on portable sawmilling in Queensland is included here. Their research was undertaken at a time when there was little formally documented research on the use of portable sawmills despite their widespread use.

They reference a report by Forestry Technical Services Pty Ltd prepared in 1994 on *Commercial Potential for Plantations of High Value Rainforest Timbers in North Queensland- Assessment of Market Opportunities for Plantation Grown Wood Products*. This was prepared for the North Queensland Afforestation Project Joint Board and this report noted that '*portable sawmilling in Australia was a highly informal sector and thus the characteristics are difficult to quantify'*. The same statement can be made today about New Zealand's portable sawmilling sector.

Another reference they commented on was *The International Portable Sawmillers Guide, 1st Edition* published in 1997 by V.D. Laidlaw who was based in Victoria. Laidlaw had reported *'that Forestry Tasmania does not permit portable sawmilling of any kind in State Forests in Tasmania. This is because such an activity is a potential source of fire and portable sawmilling is difficult to regulate'.* In New Zealand, mitigating the risk of fire from an on-farm or in-forest portable sawmilling operation needs to be planned for with good practice and equipment a necessary part of any operation.

A review of both research projects and their relevance in regard to New Zealand's existing industry follows below.

Factors in the acquisition and utilisation of portable sawmills in Queensland (1998)

This research followed a significant increase in the use of portable sawmills from 1995, recorded by the Queensland Department of Primary Industries through issuing the licenses required for sawmilling of native softwood and hardwood timbers. The project focused on understanding how these portable or mobile sawmillers, often sourcing from private landholders and willing to mill most timbers, were contributing to the sawmilling sector.

The authors noted that in addition to the 114 licensed mobile sawmills at that time, '*there are many other portable sawmills which do not fall within the definition of a sawmill as per the Sawmill Licensing Act (Qld) 1936. Goodman (pers. comm. 1998) estimates that there are approximately 300 unlicensed portable sawmills in Queensland.'*

The authors investigated the role of portable sawmills and factors to consider if purchasing and operating a portable sawmill. They also investigated the advantages of portable sawmills over fixed-sited mills and undertook *'critical appraisal of the role of portable sawmills which includes a discussion of recovery rates, costs, and throughput of fixed-site versus portable sawmills.'*

The paper provides a good discussion of all the key aspects to consider before investing in a portable sawmill. This includes the types of sawmills available and their relative advantages. One of the most critical aspects identified was that of recovery rate. They reported as follows:

'Recovery rate is important to sawmillers as it impacts on both cost and revenue. The sawn timber equivalent of a firm paying $50/m' stumpage for round log inputs, with a recovery rate of 30%, is $167/m3. If a recovery rate of 35% is achieved, the sawn timber equivalent decreases to $143/m3. From a revenue viewpoint, the increased recovery rate results in 5% more sawn timber being produced which is a 17% improvement on the 30% recovery.

The additional timber recovered when multiplied by the selling price for the particular species of timber sold, increases revenue.'

However, they also noted that recovery rates varied significantly with log quality and the lack of standardisation of logs due to Queensland's high species native diversity being logged at the time resulting in low recovery rates.

Portable sawmills in a high-value rainforest cabinet timber industry in north Queensland (2003)

Their second research project was conducted to investigate '*practical and policy issues associated with sawmilling in north Queensland and the role that portable sawmills may play*' and to '*further examine the operational framework for portable sawmills and report on their current uses in north Queensland'.*

In Queensland, all sawmills including portable mills are required to be licensed to operate and figures for 1996-97 '*were 276 fixed-site and 112 portable sawmills licensed in the state, with some licensed portable sawmills operating at fixed locations'*. However, the study noted that *'licensing is not mandatory'* for portable sawmills '*where the blade moves over a stationary log'*. This includes sawmills like New Zealand's Peterson and Mahoe sawmills that could well have been in use at this time.

For the 2003 project a total of 19 fixed-site and portable sawmillers were surveyed including users of portable circular saw and band saws. The most critical issues faced by sawmillers were:

- lack of log resource security due to no logging in public forests and logging restrictions imposed on private native forest due to environmental pressures
- a belief that the many associated rules and regulations result in production costs far exceeding those in the developing countries
- low priced imported timbers. This is not the case for New Zealand where high priced imported timbers now dominate domestic markets, having replaced NZ native timbers which are now very high priced and scarce
- old equipment with no new investment due to the uncertainty of log supply. Hence the importance of surveying NZ's existing alternative species resource
- low milling recovery with portable sawmills reporting an average of 42.6%. This was due to the log supply being from a wide range of native forest species with trees harvested being neither high-quality or uniform. However, New Zealand portable sawmilling operations cutting good quality saw logs grown in plantations can produce much higher recovery rates than this.

This study concluded that '*potential exists for greater use of portable sawmills as complementary to fixed-site mills to reduce transport and other milling costs' and 'The increased use of on-site milling may also hold environmental benefits with reduced volume of timber being milled and larger volumes of biomass being retained in the forest.'*

An update on the current status of sawmilling in north Queensland was provided for this report by the chair of the Australian Forest Growers who lives in the Atherton Tablelands region, an area included in the 2003 study. He advised that there are only a very small number of portable sawmills now operating in north Queensland. These are owned by landowners sawing small numbers of trees of high-value species logged from private forests and even single trees felled and removed from urban locations. However, there are only limited local markets with the main markets being Sydney (2,800 kms away) and (Melbourne 3,600 kms away) (Kevin Harding pers comm.).

6. Portable sawmilling: education and training opportunities in New Zealand

While some portable sawmill manufacturers offer training to their customers, and there is plenty of informal on-line information available, there are no structured education options or career pathway to support either existing users of portable sawmills or new entrants to the trade. Provision of formal education and training could enhance the productivity of sawmillers who are already adding value to NZ's forest resource of alternative timbers, and could help attract new people interested in a career in this industry.

A broad mix of skills and knowledge is needed to be successful at portable sawmilling. It is a labour-intensive activity and an operator needs to be fit and strong. However, there is also creativity in sawing timber and generally those working in this industry are very passionate about the wood they saw.

Education and training is available in some related areas - for example, Competenz is one of New Zealand's main industry training organisations and works with more than 3,500 companies and 20,000 learners in 36 industries to build skills, careers and businesses. Forestry is one of the Competenz suite of industries.

Most learning takes place on-the-job, both via apprenticeships and other training certificates. Competenz works with employers, apprentices, and schools, and manages course delivery, training providers and assessors across the country.

Competenz oversees well-defined training pathways for people working in forest harvesting (see for example https://www.forestrycareers.nz/training/on-the-job/)**:** training opportunities in wood processing are fewer but include three different certificates in wood processing:

- Solid wood manufacturing (i)
- Solid wood manufacturing (ii)
- Sawmilling

However, there is no training pathway in portable sawmilling, and no qualification available.

Another tertiary training organisation that offers forestry and sawmilling courses is Toi Ohomai based at their Waipa campus near Rotorua. The author visited this facility last year where they offer courses in logging skills and also solid wood manufacturing but principally with radiata pine. Again there is no course offered in portable sawmill operations.

A web search of education and training options offered overseas produced the following:

- Timber Training Creswick is based in New South Wales. This is Australia's only dedicated training sawmill and drymill for wood machining apprentices. It offers a *Small Scale (Portable) Sawmilling* 5 day course '*based on practical milling of logs using a Lucas Mill portable sawmill… to develop skills and gain an appreciation of the market potential of various timbers*. There are two related courses. One of these *enables participants to grade timber to Australian Standard 2796.2-2006 "Seasoned Hardwood Milled Products*". The other is on timber drying.
- USDA Forest Service produced an undated *Developing a Custom Portable Sawmill Enterprise* (Jonathan Kays) Natural Resource, Agriculture, and Engineering Service Cooperative Extension, New York, NRAES–134.

This guide reviews key considerations when investigating options to develop a portable sawmill enterprise. Information is arranged in the following sections: Developing a Business Plan; Selecting and Purchasing Your Mill; Efficient Production; Business Considerations; Safety; Insurance and Liability; and Financial Analysis.

In the introduction there are comments on why this publication was developed. '*Portable sawmills have become an attractive enterprise option in recent years. With improved technology, a small unit run by one or two persons can economically produce high-quality lumber*. *Many owner-operators have retired relatively young and are in relatively good health. Others are young people looking for a different opportunity or a new business after the loss of a job. Physical labor at a job that is production oriented may offer an enjoyable break from an office career. Most operators are sole owners with sole proprietorships, which also fosters a sense of independence. Having said this, many owner-operators of custom sawmills have emphasized that it is important for potential operators to be mechanically inclined and passionate about wood.*

An insight of what NZ-based training in portable sawmilling could foster can be gained from a look at the NZ-based education and training offered in arboriculture. In this case the training is undertaken by the Primary ITO that leads the training of more than 28,000 people, across 30 primary industries that are agriculture, horticulture and seafood based.

A number of modules are offered: https://www.primaryito.ac.nz/courses-for-you/horticulture/arboriculture/

This type of training only started in the late 1980s but was quickly followed by the establishment of a professional association for New Zealand's arboricultural industry in 1989 https://www.nzarb.org.nz/ which has a role in training delivery. Some skills learned in arboriculture do overlap into small-scale harvesting but in this case there is no training in logging machinery use and log making.

As far as forestry education and training provision in the Hawkes Bay Region goes, the Eastern Institute of Technology offers both a Certificate in Forest Harvesting (Level 3), and a Certificate in Logging Truck Driving (Level 3). With some investment in staff skills and equipment, it would appear to be potentially well-placed to provide practical training in the use of portable sawmills.

There is also the potential to develop a regional event to promote the 'alternative timbers value chain' so that the people, businesses and supporting organisations who are already involved can promote what they are doing to the wider public. This could include those growing and harvesting alternative species, also portable sawmillers and manufacturers; wood processors and timber merchants as well as joiners, furniture makers and artisans. There is already an event like this held in Golden Bay in the Nelson region. This event, the Living Wood Fair was first held in 2018 and '*is a celebration of all things wood.'* The event features workshops, talks, forums, demonstrations and information stalls. Its promotion aligns with Golden Bay's alternative lifestyle culture.

A similar event themed on Hawke's Bay culture and lifestyle could be staged to engage those who grow forests of alternative species, those who like harvesting and sawmilling high quality timbers, and those who enjoy using it.

Summary: portable sawmilling education and training needed in New Zealand

Recent research by University of Canterbury's School of Forestry (see Section 5) on *The Potential of Small Scale Sawmills, Milling Radiata Pine: A case study of North Otago Sawmilling Ltd* (Bergström 2017) established that small scale sawmilling (using an *in situ* portable sawmill) of radiata pine is a viable economic investment. Our examples in Appendix 2 confirm that portable sawmilling of alternative species is providing sustainable businesses and employment in many regions.

The viable businesses operating today provide evidence which aligns with the purpose of this report: to demonstrate that portable sawmilling is already adding value to NZ's alternative species forest resource, and there is significant potential to further expand portable sawmilling activity.

Having greater knowledge of the alternative species resource would further inform those already working in the portable sawmilling sector, and inform government and councils where and how much regional development of portable sawmilling could be possible.

However, while the cost of capital for set-up is low, portable sawmilling requires a high labour input. But this could be a good match for New Zealand's new economic future and the need for new employment opportunities in the regions. Portable sawmilling offers a healthy outdoor occupation that can be undertaken with social distancing practices. For this to be possible, people need to learn new skills and knowledge that can be best provided by education and training.

In order to encourage this to happen in Hawkes Bay, there could be support for the establishment of a local training programme in portable sawmilling of alternative timbers and for staging a regional event to stimulate broader local public interest in this vibrant but under-appreciated sector.

Fig 6: Mahoe mill in action during a farm forestry field-day, Ruapehu Sawmills.

Acknowledgements

The author wishes to acknowledge the input of the following people into the preparation of this report:

- Layla Robinson, Marketing Manager and Greg Sheehan, Sales Consultant for Peterson Sawmills
- Jake Peterson, Director, Turbo Sawmills
- Stephanie Bergman, Mahoe Sawmills
- Paul Marshall, Wood-Mizer's Sales, Fiji, New Caledonia and New Zealand
- Karen Ward-Trabant, Marketing Manager, Lucas Mill Pty Ltd

Information has also taken from the web sites of these five principal portable sawmill manufacturers.

Also thanks to Kevin Harding, Chairman of Australian Forest Growers for his feedback on the current status of north Queensland's native forestry and sawmilling industry.

And the sawmillers/forestry managers who agreed to be profiled in Appendix 2: John Fairweather, Tim Forde, Andrew Watts, Vaughan Kearns, Tim Meredith, Brett Soutar, Richard Thompson, Justin Wells and Gordon Williams.

The valuable experiences of many farm foresters that are reported in NZ Tree Grower articles are listed on the NZ Farm Forestry Association web page link https://www.nzffa.org.nz/farm-forestry-model/the-essentials/milling-drying-and-marketing/

A further source has been the author's own experience in establishing a family-based business partnership with his brother Ash Millen in 1984 to plant and manage a small scale mixed exotic timber species continuous cover forest. Since 2003, an on-site portable sawmilling operation using a local contractor has been developed to produce high quality alternative exotic timbers that are marketed and sold locally for niche applications under their own sales company. Link https://www.marlboroughtimbers.co.nz/

Harriet Palmer for feedback on early drafts; editing the report and assisting with documenting the sawmilling examples shown in Appendix 2.

Dr Clemens Altaner, University of Canterbury School of Forestry, for feedback on early draft.

Kevan Buck – Buck Forestry, for producing information on Hawkes Bay National Exotic Forest Description.

James Powrie - RedAxe Forestry Intelligence, for his guidance in developing this report and feedback.

Fig 7: Pruned cypress at Tai Tane Forest.

Appendices

Appendix 1: Portable mill types and their pros and cons

There are two main types of portable mill:

i. circular sawmills (multi-blade and swing-blade)
ii. bandsaw mills

i. Multi-blade (quarter saw) and swing-blade circular sawmills

Multi-blade (quarter saw mills) and swing-blade circular sawmills are known for their relatively low cost and well proven capability to be very portable, efficient and productive sawmills. These mills have a small motorised saw that runs on track supported by a light-weight aluminum frame that can be trailer mounted or partially broken done into sections for transport on a trailer. These mills can be taken to any location and set up quickly over the top of a log or a log rolled into position for sawing.

Quarter saws, or double-bladed mills, like the Mahoe models have one horizontal blade and one vertical blade. The vertical blade is the larger one, with a smaller blade in a horizontal position. These mills have a hydraulic system that generates a power feed so that the sawmill tracks along a log cutting horizontally in one direction and vertically in the other.

Swing-blade have a single circular blade that is mounted on a track and is powered or pushed to saw along a log by cutting horizontally in one direction and then it can be pivoted at the end of the log to then saw vertically in the other with the second cut intersecting with the first cut so as to saw a board or beam of standard dimensions.

The Peterson automated swingblade mill has automated feed and sizing so the saw makes horizontal and vertical cuts, changes the size or depth of the cut, and removes the previously cut board, all at the touch of a button by the operator. The drive speed is controlled with a lever and as the operator is no longer pushing, there is much less fatigue at the end of the day. This mill also operates with a mechanism which returns boards to either end of the mill making it able to be run by a single person.This mill can be set up for fixed site milling using an electric motor.

Photo: A JP Peterson swing blade sawmill in action cutting redwood.

Photo: The swing blade circular saw in horizontal cutting position.

Advantages of multi saws include:

- They are easy to learn to use, one-person operation, and low maintenance make them well suited to farm foresters who want to make the most out of the trees on their property.
- Can saw large dimension logs, some as much as 1.5m in diameter with high production rate.
- a single swing blade sawmill can use a smaller motor than a quarter saw running with two or three blades,
- Less blade and machine maintenance than band saws.

Disadvantages of multi saws include:

- Greater amount of sawdust (waste) due to the circular blades making a wide cut (kerf) compared to band saws especially if cutting 25mm thick boards.
- Logs cannot be easily positioned for optimal sawing or turned during the sawing process.
- Quartering of eucalypts to reduce growth stress so as to saw straight boards is not possible.
- Accurate sawing small dimension logs (less than 30 cm diameter) is not feasible.
- Swing-blade sawmills (e.g. Lucas, Peterson) cannot cut wide boards or large dimension stock and Multi-blade sawmills (e.g. Mahoe, Rimu) cannot cut wide (bark to bark) slabs from logs.

ii. Bandsaw mills

Portable bandsaw mills such as the Wood-Mizer are very versatile and can cut everything from large beams and wide slabs to clear and dressing grade boards.

There is a wide variety of bandsaw models tailored to suit everyone from the farm forester or hobby sawmiller wanting to mill a few logs occasionally to models designed for commercial sawmillers. The band saw is mounted horizontally with petrol or diesel motor on top driving the belts to power the band. Compact low cost mills are set on ground tracks and capable of sawing only small logs with manual loading and handling of logs while sawing.

Larger production mills are built on a single axle and frame with a tow ball and the motor also powers the mill's chain drive and the hydraulic system for log loading and handling. They include a powered head controlled with a computer headworks. These features remove a lot of the labour needed to use the smaller manual mills and remove the inaccuracy of reading off a scale and manually setting the height of each cut as required.

This mill can be set up for fixed site milling using an electric motor. Commercial sawmillers will often use a large model mill in combination with a twin blade edger (double blade table saw) to increase productivity.

Photo: A Wood-Mizer band sawmill in action quartering a pruned blackwood log.

Photo: A large pruned macrocarpa log being sawn with a Wood -Mizer.

Advantages that band saws offer include:

- Less sawdust (waste) due to the thin saw blade making a narrow cut (kerf).
- Small dimension logs (minimum 2.1m long and 15 cm SED) can be cut so recovery of sawn timber is possible from smaller trees.
- Conversion has been estimated up to 20% more timber cut from a log than circular saws. This is a significant advantage for sawing larger valuable pruned logs.
- Large models can roll and clamp logs during sawing and allow for precision sawing of whatever size is required.
- Very suitable for taper sawing.
- Capable of quartering logs to remove growth stresses and maximise the recovery of straight and stable timber from eucalypts and other hardwoods.

Disadvantages of band saws include:

- The operator needs to be skilled to ensure optimum sawing conditions at all times – sharp teeth, correct tooth setting, correct tension and correct feed speed. If any of these are not right, the flexible band will result in uneven wavy boards.
- Even large models are not capable of sawing very large dimension logs i.e. exceed 1m in diameter.
- The bands require frequent sharpening and replacement costs are high.
- There is a high level of maintenance required to ensure these mills operate accurately and efficiently.

Appendix 2: Examples of portable sawmilling ventures in New Zealand

Example 1: Tim Meredith, Hawke's Bay

Tim Meredith operates a mobile portable sawmill on a part-time basis, covering a large part of the Hawke's Bay Region. He mills on contract mainly for farmers and farm foresters, producing timber for on-farm use such as posts, and yard rails; planks which will converted into weather boards; and some specialty uses. Main species sawn are cedar, macrocarpa, pine and poplar.

His sawmill is a Wood-Mizer LT40HD, now around 30 years old, which he originally operated in England, mainly sawing oak and other English hardwoods. Tim chose a Wood-Mizer because of its high recovery rates and impressive versatility, as well as rapid set-up time (less than 10 minutes). Disadvantages include the limited size of log that can be sawn (maximum 90 cm diameter); also the fact that it does require a high skill level to operate.

Tim estimates he saws around 190 cubic metres a year. His target is to mill around 3 cubic metres a day. Sharpening blades and other maintenance takes up a significant part of each milling day, but Tim charges on out-turn rather than by the hour.

"*My observation is that people using on-site sawmilling tend to try and mill low quality logs, which results in a low-quality product,"* says Tim. "*The grade rules that apply to export timbers are a really good guideline as to what a sawlog is and what is not. I reserve the right to reject logs if I don't think they will be worth my while to mill.*"

See also Example 2 – Pāmu (Landcorp) mobile sawmilling of oak to produce fence posts

Tim Meredith Ltd chasatim@xtra.co.nz

Example 2: Portable sawmilling by Pāmu (Landcorp) at Edenham, Hawke's Bay

Pāmu (Landcorp Farming Ltd) have a number of organic dairy farms which cannot use treated pine fence posts and strainers and therefore need an alternative.

In 2019 Gordon Williams, Pāmu's Forestry Manager, decided to have some mature English oak (*Quercus robur*) growing in a small woodlot on Edenham farm in Hawke's Bay harvested and milled on-farm to produce some fence posts and strainers. English oak timber has Class 2 natural durability meaning it can provide at least 15 years of in-ground service. The woodlot was in a flat location with good summer access.

Following a pre-harvest inventory, forestry management company PF Olsen marked 65 trees for harvest with an estimated volume of 178 cubic metres. PF Olsen then engaged Hawke's Bay Forestry Contractors Ltd, and they were there for 5 days total. There were 2 or 3 men involved (depending on operation on the day) and a 30-tonne grapple digger. They felled, trimmed, cut to length and stacked the logs, and completed clean-up of the site afterward.

Tim Meredith, a local commercial portable sawmilling contractor, was engaged to saw the logs on his Wood-Mizer LT 40 bandsaw mill (see more about Tim in Example 1). Tim spent four weeks sawing the logs. He used his own loader to load logs onto the saw mill. He was only assisted by Bryan Lorenz, Edenham's farm manager, who moved the sawn packs of timber to where they could be picked up by a truck.

The log volume sawn was estimated about 140 cubic metres based on a 50% conversion as this would have produced around 70 cubic metres of sawn posts and strainers. However, some logs that were sawn were low grade and produced a low conversion rate but resulted in higher overall timber volume being sawn from the trees that were felled.

The target sizes for this operation were standard post and strainer lengths with the following number produced of each of the following:

- 259 posts @ 100mm x 100mm x 2.4m
- 2350 posts @ 100mm x 1.8m
- 392 strainers @ 150mm x 2.4m

On completion of the sawmilling, the fence posts and strainers were sold to two other Pāmu farms at these farm gate prices: 2.4m post - $21.00; 1.8m post - $16.00; 2.4m strainer post - $48.00.

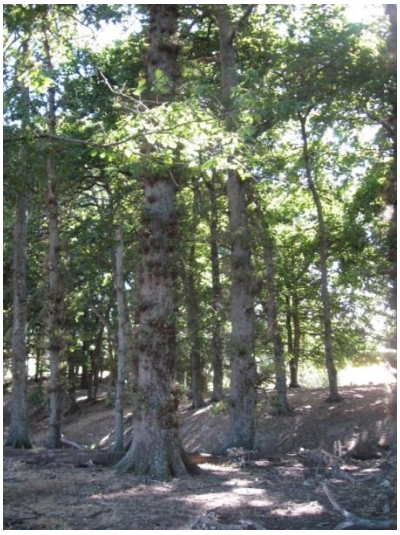
The harvesting and sawmilling costs were recovered, and the balance from the sale of the sawn timber (stumpage value) was paid to the Edenham farm's account. In addition there was a large volume of oak slab wood left for firewood at the farm.

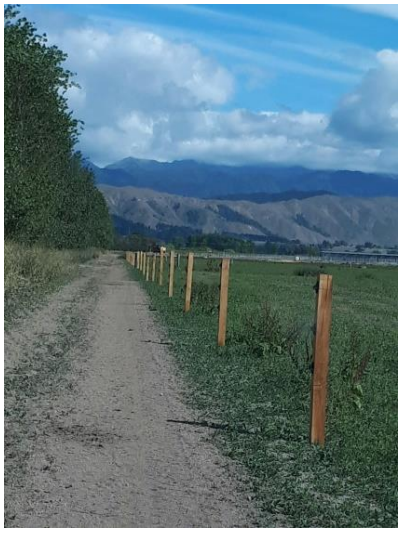
An economic analysis of this sawmilling operation was undertaken by Gordon and is summarised below.

Operations	**Cost/Revenue**	**Cost/revenue per sawn cubic metre**
Felling and log making including management (140 cubic metres logs)	($15,336)	$219 (With 50% conversion; $109.50 per cubic metre logging cost)
Sawmilling	($16,110)	$230
On farm support and administration (7.5%)	($1,887)	$26.95
Total costs	**($33,333)**	**$476**
Total sales revenue	**$61,855**	**$883**
Net stumpage paid to Edenham	$28,522	$407 (based on estimated saw log volume of 140 cubic metres the stumpage value was $203 per cubic metre)

PF Olsen forest manager Chris Perry undertook the pre-harvest inventory and coordinated the harvest and portable sawmilling. Chris advised that it was a novel job and only small scale. Costs for a similar operation could be kept to a minimum if a farmer learns how to engage and support a portable sawmilling operator. However, a professional stand appraisal should still be sought beforehand, or inventory and advice as to whether portable sawmilling is an economic option.

Gordon Williams, Pāmu's Forestry Manager, said about the job: "*The organic dairy farms supplied were not only able to source the materials at more than competitive prices, but they also really liked the look of the milled posts. We will have an internal market for these for a long time. The exercise will lead to us looking around all of our farms for what resource we may have suitable for on-site milling, in the future.*"





Example 3: Tim Forde, Forde Ltd, Elsethorpe, Hawke's Bay

Tim Forde became interested in mobile sawmilling when he purchased a farm in the Hawke's Bay which included many large, mature poplars. He now contracts a Lucas sawmill, milling almost exclusively poplar from his own property. Products are sold locally to farmers and other markets.

Tim prefers a Lucas mill because it enables high conversion and grade recovery of the sawn products he produces – these include sheep and cattle yard rails, fence posts, decking and battens, all of which have to be treated to enhance durability – this is done by Tumu Ltd in Hastings. Non-treated products include sales for polo mallets, truck-decking, interior panelling, furniture and toy-making.

The mill is mobile, and is moved between various sites on the farm, as well as other properties. On average Tim produces 75 cubic metres of sawn timber annually.

Tim is a huge enthusiast for poplar and its products, and says "*the market is growing but more education is needed. People are surprised at how strong and yet light weight poplar is, and what it can be used for.*"

Tim recently featured in a series of education and training videos made by the NZ Poplar and Willow Research Trust. The videos include information about how to select trees to mill, set-up and use of the mill, and milling products that poplar is suitable for.

https://www.poplarandwillow.org.nz/library/filter/videos

In 2017, Tim also was the subject of a full-length Countrylife feature:

https://www.rnz.co.nz/national/programmes/countrylife/audio/201847795/popular-poplars

Example 4: Andrew Watts, Watts to Mill, Waipukarau, Hawkes Bay

Andrew Watts has been in the business of portable sawmilling for some 20 years. His sawmilling business, 'Watts to Mill, operates from the former railway grain store in Waipukurau, Hawke's Bay, which provides covered storage for wood processing machinery and drying timber.

Andrew runs a Mahoe mill on a regular part-time basis, sawing almost exclusively large macrocarpas which he says the mill is well suited to. Logs are sourced from within Hawke's Bay, and sawn for a range of products. Landscape timbers such as sleepers are sold green off the saw for raised garden beds, whereas high-value dressing/clear grades are dried. There is minimal wastage, with firewood also marketed.

Ten years ago he was selling a much greater volume of timber supplied by over 20 other mobile portable mills operating throughout Hawke's Bay, Gisborne and Manawatu. Much of this came from farm shelterbelts and woodlots, and the majority of this resource was harvested to supply the sleeper market in Auckland. There is now a diminishing supply of large macrocarpa logs with few sawmillers left and new demand for these logs for export to China.

He says: "*I heard just before lockdown that the [export] market for macro logs was well over $200 per tonne for all grades. This would make local operators redundant unless the price for clears say was over $4000 a cubic metre*."

Andrew also commented about the lack of industry profile and cohesion. He laments the lack of national grading system and pricing for all alternative species and the many sawn products, believing the lack of standards allows some in the industry to sell low quality grades that are not fit for purpose. This results in product failure that reflects badly on alternative species.

Andrew has sawn other species including eucalypt, redwood, various cypresses and cedars to investigate possible alternatives to sawing and selling macrocarpa. He thinks these all have great wood properties for different products but has stuck to sawing macrocarpa as his core business.

Andrew has reduced his business as he's planning to retire. For several years he has tried to attract a younger person to come into business to take it over but has not been successful even though his business is well established with a good client base.

Example 5: Richard Thompson, MacBlack Timber Ltd, Whanganui

MacBlack Timber Ltd is a specialty timber business established by Richard Thompson, who began by milling alternative species from his own woodlot. The business operates full-time from a base in Aramoho, Whanganui, and employs several people. Products include sawn and processed timber and also joinery such as doors and benchtops.

The sawmill of choice at MacBlack is a Lucas 7-23, which is around nine years old. The mill is moved frequently to both urban and on-farm or forest milling sites. The Lucas suits Richard's operation as it can handle large trees from farm woodlots and shelterbelts. It is also reliable, and well-designed for safe, efficient work. Its portability is another distinct advantage. Disadvantages include that is that it is not so good for small logs, so for example logs from production thinning are not handled optimally. Also the mill is not ideal for slabs or board dimensions larger than 200mm.

The MacBlack team covers a large geographical range in the southern and central North Island, but Richard points out that it is important to weigh up whether it is more cost-effective to take the mill to a distant site and cart sawn timber back to his yard, or to have the logs delivered. "*The transport costs of getting sawn timber back to our yard is one of the main disadvantages of travelling to logs,"* says Richard.

Between 300 and 500 tonnes of logs are milled a year, with macrocarpa followed by poplar and redwood being the most commonly milled species. In order of volume, products are sawn timber, processed timber (panelling, flooring), solid wooden doors, benchtops, shelves and other joinery. Products are sold right across New Zealand – often direct to the customer but MacBlack also deals with builders, architects and designers, timber merchants (e.g Bunnings, Mitre 10), joiners, and sometimes to other millers.

"*We are growing*," says Richard. "*so this is a snapshot of where we are at presently. I expect us to get larger, which will make us more economically efficient. It would be good to see if we could set up a kind of supplier portal where any of us can put out a call for timber to meet an order they can't supply, or can only supply part of. For example, yesterday I had a request from someone wanting 400Lm of poplar TGV ex 200x25. We don't have dry timber of that width in stock and they don't want to wait, so that opportunity has gone*."


(Photo credits: Richard Thompson)

MacBlack Timber Ltd

macblack.co.nz

Example 6: John Fairweather, Specialty Timber Solutions, Sefton, North Canterbury

John Fairweather operates from a permanent base near Sefton, North Canterbury, where he runs a sawmilling and timber processing business. John mills mainly eucalyptus, sourced from around North Canterbury and his own woodlots. Products include kiln-dried T & G flooring, wall and ceiling linings, decking and benchtops. Typically John sells to people building houses, and to builders or architects.

The business runs two mills – a Wood-Mizer LT 70 and a Mahoe Supermill, both reasonably new machines. There is also an edger, solar-powered kilns, and processing machinery to enable him to produce the T & G flooring.

John considers the Wood-Mizer (along with the edger) allows for sawing of eucalypts in a way that reduces internal tension in the wood. There is low wastage thanks to the thin kerf (blade thickness), and the Wood-Mizer provides more options of how to cut each log. The Mahoe is simple to operate and maintain compared to the Wood-Mizer, and is good for large logs but is not so good for handling tension.

Daily output when milling is around 3 cubic metres (or two pallets) per day. The operation is part-time, so John estimates his output is about 150 cubic metres per year.

"*I suspect the majority of portable sawmills sold in NZ are not really being used, despite what the manufacturers say*," says John. " *Many start with enthusiasm but in a year or two probably do only occasional milling. It is hard to make a viable business of portable sawmilling. My supporting observation is the low price of second hand mills*."

John Fairweather displays his T & G floorboards, and the range of coloured flooring available when wood stains are used.

Specialty Timber Solutions

http://specialtytimbers.co.nz/gallery/

Listen to John talking to Cosmo Kentish Barnes, RNZ Country Life, April 11th 2020.

Example 7: Justin Wells, Logs2Lumber Ltd, Wakefield, Nelson

Justin Wells, a Wakefield (Nelson)-based sawmiller, operates as Logs 2 Lumber on a full-time basis throughout the northern South Island. Justin estimates that he spends some 70% of his time contract milling, and the remaining 30% of his time milling his own stock to sell.

Justin runs a Wood-Mizer LT-40 Super, approximately 27 years old, He considers the Wood-Mizer to enable excellent recovery rates from difficult hardwood logs: large eucalyptus logs are what he mills most often. The Wood-Mizer can handle logs from as small as 12cm LED (large end diameter) to around 1 metre LED and is excellent for grade sawing, but Justin acknowledges that it does take some time to learn how to use the mill well.

In the past year, Justin estimates he milled around 500 cubic metres of logs, with clients including farm foresters, commercial forest owners for whom species other than pine are a problem, farmers, and home owners wanting specialty timbers. He generally operates with at least one other person helping.

Products include solid wood flooring, sarking, and joinery grade timber. Justin markets products via the internet and word of mouth, and also has an outlet at the local woodworking school.

"*Although Covid-19 may cause a some markets too slow up for a while, I still have confidence to take on 300 cubic metres of eucalyptus logs, as good solid wood flooring never seems to go completely out of style in new houses or renovations*," says Justin.

Logs 2 Lumber Ltd

https://justin49585.wixsite.com/logs2lumber/services

https://www.facebook.com/logs2lumberltd/

Example 8: Brett Soutar, Short Back n Sides, Waihi Beach, Bay of Plenty

Short Back n Sides is an arboricultural business that offers small -scale tree felling and portable sawmilling to produce timber for clients or logs removed and sawn for sale**.** Owned by Brett Soutar, the business is based in Waihi Beach, Bay of Plenty, and covers an area of the central North Island within 200 km of its coastal base.

Brett started with a portable chainsaw mill which was used to produce slabs, and since then has owned a number of different mills. He is currently operating a Woodlands mill - a small manual bandsaw imported from Canada - along with a recently-purchased Peterson wide-cut slabbing saw which can handle logs up to two metres diameter.

The business employs seven full-time staff and an independent sub-contractor, with two staff running the sawmills. The focus is on recovery of urban trees, and trees are often obtained free as home owners or local authorities want to have trees removed and don't see the value in them. Some of these trees can be milled to produce high quality and rare timbers.

Brett estimates that they mill around 50 cubic metres of timber a year, but emphasises that he is very selective about what trees he mills. Preferred species include cedar, redwood, elm, oak, blackwood, grevillea, avocado, cherry, plum as well as some native timbers like tanekaha and pohutakawa. Main products are slabs, boards and beams, while craft timbers are produced from poor-form logs and branches. He markets the sawn timbers to a range of customers including builders, joiners, furniture makers, luthiers, boat builders and master carvers. The business also produces firewood, with over 700 tonnes sold last year. Sawdust is sold for mulch.

"There's a lot of interest from people wanting to use their own timber and using wood that doesn't need to be treated," says Brett, *"so I'm planning on buying a swing-blade sawmill for specialised farm timber sawing."*

Short Back n Sides, 15 Didsbury Drive, Waihi Beach, Bay of Plenty

http://www.shortbacknsides.co.nz/index.htm

Example 9: Vaughan Kearns, Ruapehu Sawmills, Raetihi

Vaughan Kearns and the Mahoe mill at a recent open day at Ruapehu Sawmills.

Vaughan Kearns is a well-known figure in specialty timber sawmilling business, and operates an alternative species milling and processing business - Ruapehu Sawmills – from a permanent base in Raetihi, central North Island. Vaughan bought the business, including a 1948 Varteg circular saw, in 1998, and continued operating on a relatively small scale for about 15 years. However, over the last few years he has expanded his sawmilling and wood processing capability.

The business offers a full range of services - timber transport, sawmilling, kiln drying, machining and profiling, resawing, and sales of timber and products.

Now operating *in situ* at the Raetihi site, along with the still-operating Varteg, are a 1994 Mahoe Twin Blade mill, able to saw logs up to 7.8 metres long, two Wood-Mizer band saws – a LT 40 and a LT 70, and a laser-controlled edger. This combination of mills results in high levels of productivity and grade recovery, as different machines and milling regimes can be chosen to suit any species, size and grade of log. Vaughan has also recently invested in a new JP Peterson for mobile sawmilling.

Four staff are employed at Raetihi, with one additional person now required for the mobile mill. Some 500-600 tonnes of logs a year are milled – these are generally sourced from the Ruapehu area, and include macrocarpa and other cypresses, redwood, eucalypts, cedars and totara (the mill is licensed to saw native timber).

Products include structural timber, flooring timber, timber for glue laminating, decking timber and cladding timber, timber for furniture/joinery, panelling timber, and timber for structural glulam. All these products are graded.

"It's through joining the Farm Forestry Association that I have been able to meet many people who have spent their lives growing stands of good quality alternative species with a vision to create greater diversity in New Zealand forests, in turn meaning greater diversity in NZ-grown wood products. I share that vision and have expanded my business with the goal of being capable of sawing any species to make any product of timber of a quality sufficient to replace the use of imported timbers."

The Wood-Mizer LT 70 and edger at Ruapehu Sawmills.

Vaughan Kearns, Ruapehusawmills@xtra.co.nz

Appendix 3: Questions to consider if planning a portable milling venture

The following questions have been included, based on the author's own experience of portable sawmilling, to guide anyone considering setting up a portable milling venture.

- What will be the costs for setting up the venture including capital cost for mill, accessories and other equipment?
- What will be the operator and running costs for a commercial business venture including using a suitable towing vehicle and any additional workers if required?
- How many weeks annually do you plan to use the mill?
- What is the projected hourly rate for running the mill on an annual basis?
- What is the hourly rate planned to pay the operator and a support person where required?
- Are you going to be moving the sawmill around or will it be in one fixed position?
- Will electricity be available to the site or will the sawmill need to have a petrol or diesel motor?
- If the sawmill is to be moved from site-to-site, will the terrain affect the ease of setting it up?
- What size logs will be cut, and will the logs fit into the mill?
- What size boards are you expecting to cut and what will they be for?
- What is realistic in terms of the recovery rate that you can expect from the log supply?
- Do you want to cut larger sizes to be broken down later, or sleepers out of second grade logs not suitable to retrieve clear boards from?
- Is there a market if you cut (and sell) firewood from the slab wood or strap into bundles to sell?
- Do you want to slab any of your logs, and if so do you need a bandsaw, a dedicated slab saw or an attachment?
- Do you want to saw as much of your logs as possible, for example, can fillets, stakes or fence battens be part of your cutting list?
- Will you need to cut to the taper of the log to gain the best wood from the outside of your logs?
- Do you or your sawmill operator have practical experience of sawmilling and if not can that be provided by the manufacturer?
- Check on the capability of the sawmill and buy a reliable brand with good back-up service and availability of spare parts.
- Some mills require flat ground to be set up, and this is a factor to consider when purchasing your sawmill.
- How will you economically and safely harvest the trees to supply your mill?

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