Import Substitution Project
Final report

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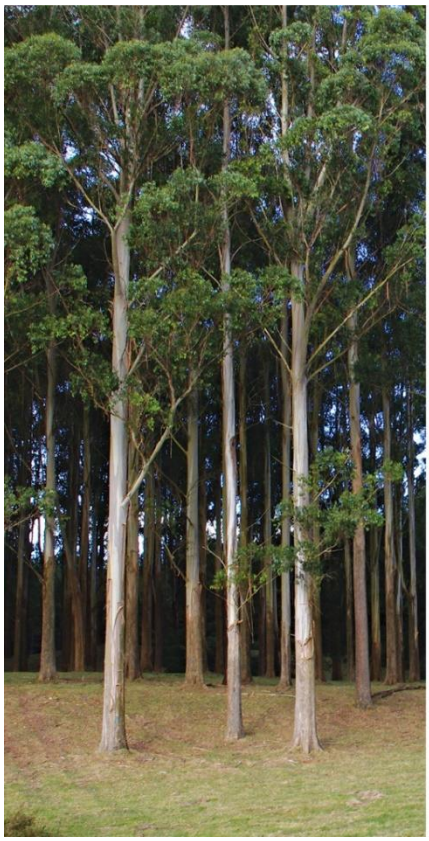

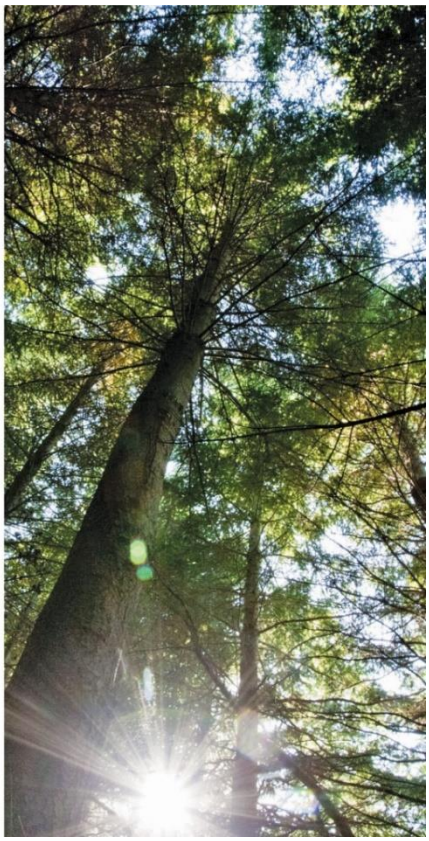

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EXECUTIVE SUMMARY

Exotic species were introduced throughout the late 19th and 20th centuries in order to supplement New Zealand's native timber supply, and support both domestic structural and specialty purpose applications. However, attempts to supply the domestic market with New Zealand-grown specialty purpose exotics, have been intermittent, with the exception of radiata pine volumes. Instead most of the specialty timbers used in New Zealand are now from imports.

Major concerns from the New Zealand wood sector to the utilisation of imported species are threefold:

- A reliance on old-growth tropical timbers, which may not be sustainably harvested, or which may be more difficult to source in future.
- The increasing volumes of imported timbers entering the domestic market, particularly in the decking, flooring and furniture markets.
- Exported New Zealand-grown radiata being re-imported into New Zealand in the form of higher-value products.

To address these concerns, an understanding of current requirements of timber importers and timber designers (architecture and furniture) that drive the use of imported timber was made to determine:

- What is the current specialty timber resource base within New Zealand?
    - Current species in the ground and being harvested
    - Imported timbers or finished goods available for use in building projects
- What timber species are being imported, and why?
- How are architects and designers selecting timbers for projects?

Results show the key factors driving timber imports are consistent and reliable supplies, short lead times for projects, dedicated sales agents, proven or known performance of the timber for the application, and an ability to provide a range of aesthetics (stains and surface treatments).

In contrast, the barriers to using New Zealand-grown timber supplies at scale include unknown current and future wood supply, unproven or inconsistent wood quality, lack of central marketing or sales support agency, and lack of clarity on how to source (by specifiers) or supply (to end users) the timbers.

Substitution of current imported species with New Zealand-grown specialty timbers will require:

- **improved mapping of the New Zealand-grown resource** to provide future in-ground estimates of timber availability,
- **the establishment of a dedicated 'sales desk' advocating timber species and products**, arranging New Zealand-grown specialty timber samples for supply chain visibility, and accessibility to local market,
- **a change in the way information concerning New Zealand-grown specialty timbers is presented** to specifiers, and
- **modification of some specialty timber species to improve wood properties** for use (e.g. densification, thermal modification etc.).

Key policy barriers are apparent in the ability of small growers and processors to gain FSC certification. There is also a distinct lack of supply chain integration from growers to specifiers, and a low sawmill conversion or grading segregation to separate processing pathways.

There are several options to approach a more aggregated regional specialty wood solution. As a start, *E. saligna* decking for Northland processing has been identified from the work and recommended to be progressed as a first action for the sector.

INTRODUCTION

New Zealand's building materials, including exterior cladding, decking and furniture items were manufactured locally throughout much of the 20th century. In many cases timber used in these projects was sourced from indigenous tree species. However, from the late 1970s it became apparent that reduced availability of native timbers would require New Zealand-grown wood supply to be supplemented from imported species and New Zealand-grown radiata pine (*P. radiata* D. Don). In addition, from the 1981 NZFS policy "Exotic Special Purpose Species", a range of species were advocated to be grown for specialty purposes to supplement imports (Refer Table 1).

Species	Common name	Expected uses
Acacia melanoxylon	Australian blackwood	Furniture, veneers, turnery
Cupressus lusitanica	lusitanica	Weatherboards, exterior joinery, boat building
C. macrocarpa	macrocarpa	
*Eucalyptus delegatensis**	delegatensis	Turnery, veneers
*E. fastigata**	fastigata	Furniture, veneers, turnery, handles
*E. regnans**	regnans	Furniture, veneers
*E. botryoides***	botryoides	Furniture, handles, engineering
*E. saligna***	saligna	Furniture, veneers, turnery, handles
Juglans nigra	black walnut	Furniture, veneers, turnery

Table 1: List of prioritised species for special purpose applications from 1986 FRI Bulletin 119
Source: Haslett, 1986

Despite this policy, and efforts to establish a supply of specialty purpose species, New Zealand-grown exotic specialty timbers have not made a major inroad into the specialty timber market. The dwindling supply of indigenous species has instead been largely replaced by import of high-value timbers and wood products (May, 2013).

It is important to note that to supplement native timbers used in house frames, New Zealand's exotic plantation forests specialised on volume production and tree growing efficiency from *Pinus radiata*, and to a smaller extent Douglas-fir (*Pseudotsuga menziesii*). Between 1970 and 2000, these species were processed primarily for domestic structural use, with lower pruned logs being used for appearance grades, and the upper logs used for pulpwood. Excess timbers established an export market mostly to Korea, Japan, Australia and the United States.

The current forest rotation has seen this model adjusted as the differential log price between pruned and unpruned logs has declined, and ready export markets for all log grades have become

established in Asia, most notably China. The predominant forest industry focus has therefore been on getting the commodity exotic timber markets established and thriving, with less emphasis for the development of our New Zealand-grown specialty timbers and markets. In conjunction, substitution of wood-based building products for other materials alongside more open trading conditions for secondary and tertiary processed items have led to a demise of the secondary processing and furniture manufacturing industry within New Zealand (FCANZ, 2011).

Some end uses will most likely always be met by imported timbers – particularly where locally grown timbers would struggle to meet the required strength or performance grades, and where there is an established and sustainable supply of specialty wood required by the market in very small quantities (e.g. rosewood (*Dalbergia spp.*), ebony (*Diospyros spp.*), in which case their displacement would make limited economic difference to the New Zealand timber sector, making the substitution effort not viable.

This project

This Import Substitution project investigates opportunities for displacement of imported timbers for locally grown and manufactured wood products, with a focus on: durable exterior products (e.g. decking and cladding); interior fitout; furniture; and miscellaneous wooden items. This study was instigated due to a rising awareness of the range and market share of imported timbers in bigbox hardware and furniture stores, including anecdotal reports of New Zealand-grown wood being imported back into New Zealand as a finished product after being processed overseas.

This report consolidates information sourced from three research strands, with the following objectives:

- What is the current specialty timber resource base within New Zealand?
    - Current species in the ground and being harvested
    - Imported timbers or finished goods available for use in building projects
- What timber species are being imported, and why?
- How are architects and designers selecting timbers for projects?
- What exemplars exist, and how can we learn from these?
- What are the next steps?

METHODS

What is the current specialty timber resource base within New Zealand?

Interviews were held with specialty sawmillers and timber wholesalers to establish current species and volumes entering the local market. In addition, Trade Me's timber marketplace was consulted and discussions were held with attendees at the New Zealand Farm Forestry Association (NZFFA) annual conference.

What species are being imported, and why?

Qualitative phone interviews were conducted with nine members of the Timber Importers Association and the Imported Timber Trade Group (ITTG). These established the species mix and rough split of species being imported by each firm, along with rationale for the species mix and timber and trade qualities importers were seeking most from their suppliers. The research team visited Bunnings Tower Junction in Christchurch and noted every item on the shelves and yard that was predominantly timber, recording into a spreadsheet where available the manufacturer, importer, species, dimensions, price and country of origin.

Websites of three major furniture bigbox stores were viewed to determine some of the key solid wood species being sold for dining, occasional tables, outdoor furniture and bedroom suites. The country of origin and any timber attributes mentioned in the sales description were also recorded into a spreadsheet.

How are architects and designers selecting timbers for projects?

Phone interviews were held with principals at three architecture studios, and a survey developed with assistance from the Warren and Mahoney Advanced Timber Unit and the Timber Design Centre. The survey was sent to project leads at Ignite and Warren and Mahoney asking for project details of projects within the past 2 years where timber was specified for fitout or aesthetic use (i.e. not internal structural members). This provided details from a total of ten recent projects.

Are there any exemplars, and what can we learn from them?

Visits were made to eight key experts in the NZ-grown specialty timber supply side, including specialty millers (MacBlack; Ruapehu Sawmills), processors of eucalyptus and other hardwood and softwood specialty species, including modified radiata into specialty value-added materials (Abodo), and programme leaders of large research programmes or co-operatives with an aim of improving the supply of specialty timbers (SWP; NZFFA; Drylands Forest Initiative).

In addition, an online workshop was held with 32 members of the specialty timbers value chain (specialty growers, millers, Māori, timber merchants, architects, research scientists and policy analysts). The workshop presented findings on resource, supply and demand trends from the project, while providing a forum to elicit reasons for the identified barriers present across the current supply chain.

What approaches should the sector take next?
Information was collated into a themed analysis to identify a range of barriers stopping substitution for imports. A set of potential 'strawmen' projects were proposed to the sector, and three of these were selected for discussion during the online workshop.

The workshop discussion sought to elicit potential pathways to address the barriers, while also providing a cross-chain set of perspectives on what needs to be considered and by who in providing solutions to the barriers.

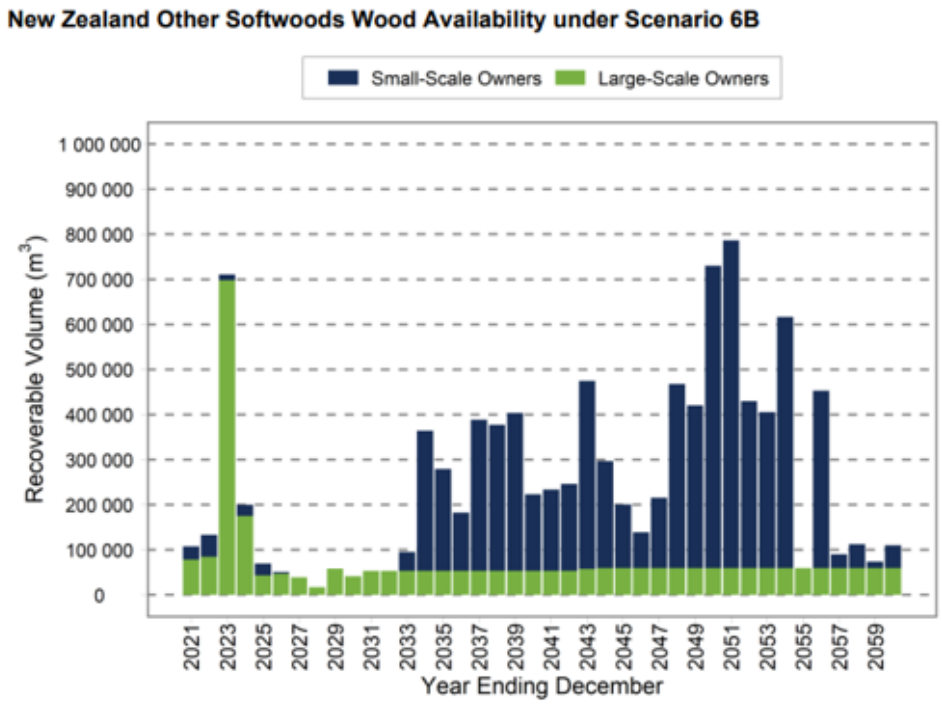
RESULTS

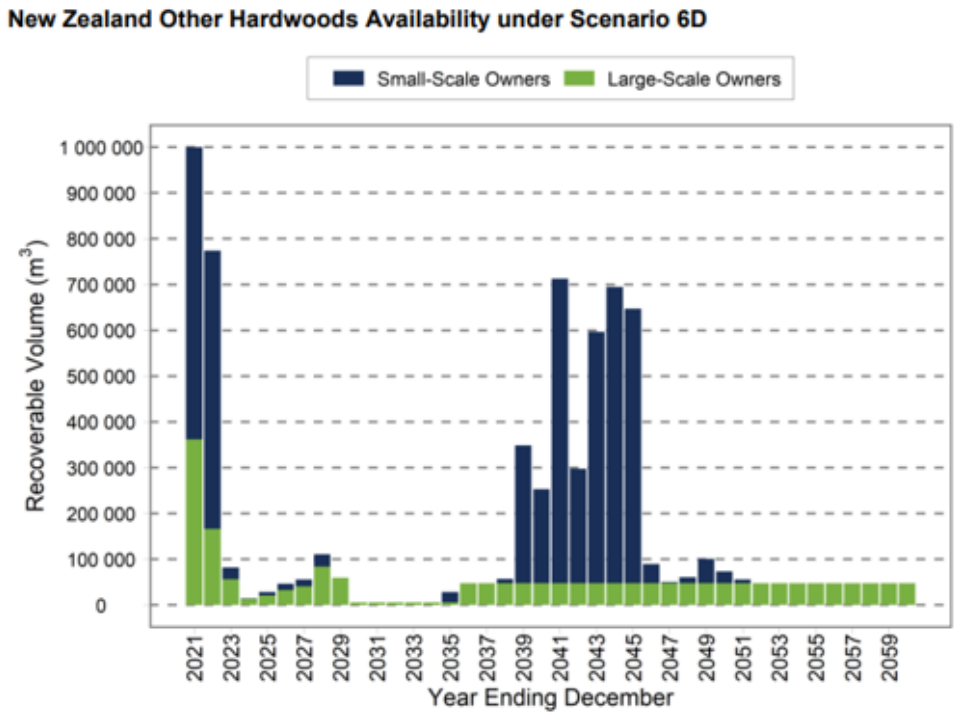
NZ resource base of specialty timbers

What are we growing?

Statistics from the Wood Availability Forecast (Margules Groome, 2021) indicate the majority of "other softwoods" are being grown by small growers. Figures are similar for "other hardwoods" (Fig 1). The figures indicate a sustained yield for other softwoods of 244,000m^3/yr and other hardwoods of 192,000m^3/yr.

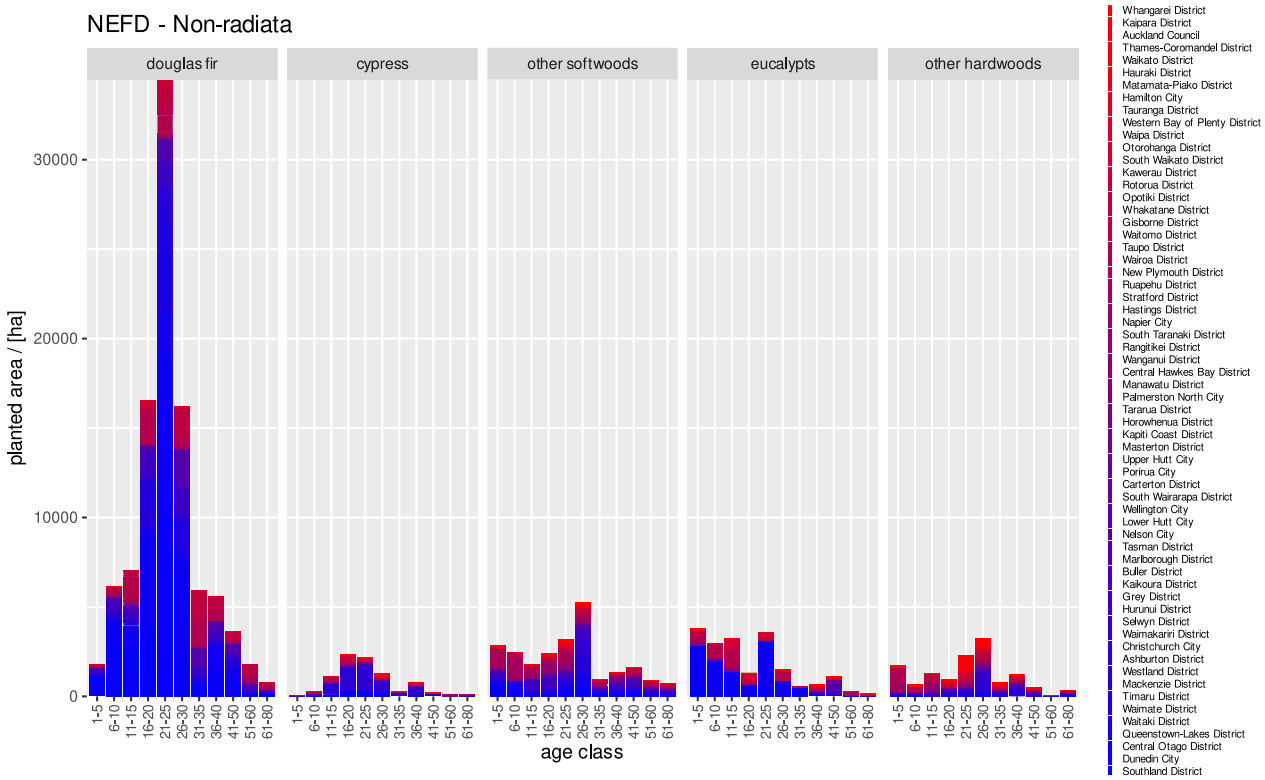
Figure 1: Forecast of timber availability of minor exotic species grown in New Zealand





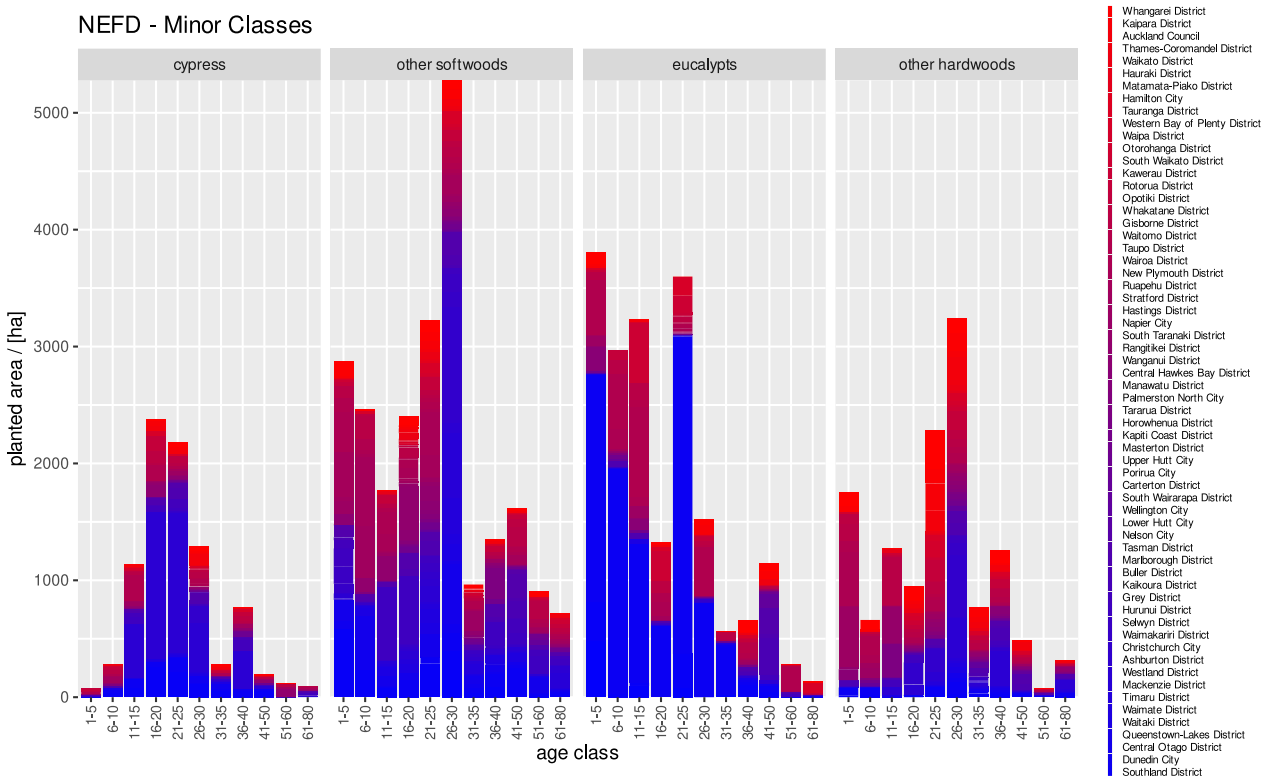
The National Exotic Forest Description (NEFD) does not distinguish well between the wide range of species that are being grown. Most of the alternative plantings to radiata pine are at very small scales, and as the NEFD itself notes the reliability and comprehensiveness of this data is uncertain. While the forecast does allow national-level wood availability for radiata, Douglas-fir, cypress *(Cupressus)* and *Eucalyptus spp*., all regional-level planting levels do not have species-level scenario forecasts, only ones for radiata pine. However, regional figures for age class distribution is available (Fig 2) which shows the majority of non-radiata exotic timbers grown in New Zealand are Douglas-fir, aged 16-30 years, growing in the Southern regions.

Figure 2: Age class distributions by region for non-radiata exotic species, 2022



Removing Douglas-fir from the equation, Figure 3 shows a very uneven age class structure and national distribution for other minor exotic species, totalling some 70,000ha. Of note also is the declining stocking of cypress, and low recent plantings; the maintained stocking of other softwoods (mostly *Sequoia sempervirens* (redwoods)) and the recent increased planting of *Eucalyptus spp*. To sustain any substitution requires confidence in ongoing wood supplies, where both cypress and Douglas-fir show defined peaks and troughs in supply structure.

Figure 3: Age class distributions by region for minor exotic species



Harvest data at species level

There are some high-level statistical figures available that speak to species-level harvesting within New Zealand. The official data from the MPI website (Table 2) provides harvested areas by species, however minor species are not distinguishable, being grouped as “other”.

Species (ha)	2018	2019	2020	Grand Total
Cypress species	68	39	30	137
Douglas-fir	1,430	1,451	1,007	3,888
Eucalypt	784	1,002	968	2,754
Other hardwoods	18	184	9	211
Other softwoods	578	337	151	1,066
Radiata pine	44,017	38,409	31,088	113,514
Grand Total	**46,895**	**41,422**	**33,253**	**121,570**

Table 2: Harvest levels of various species grown in New Zealand
Source: Ministry of Primary Industries website

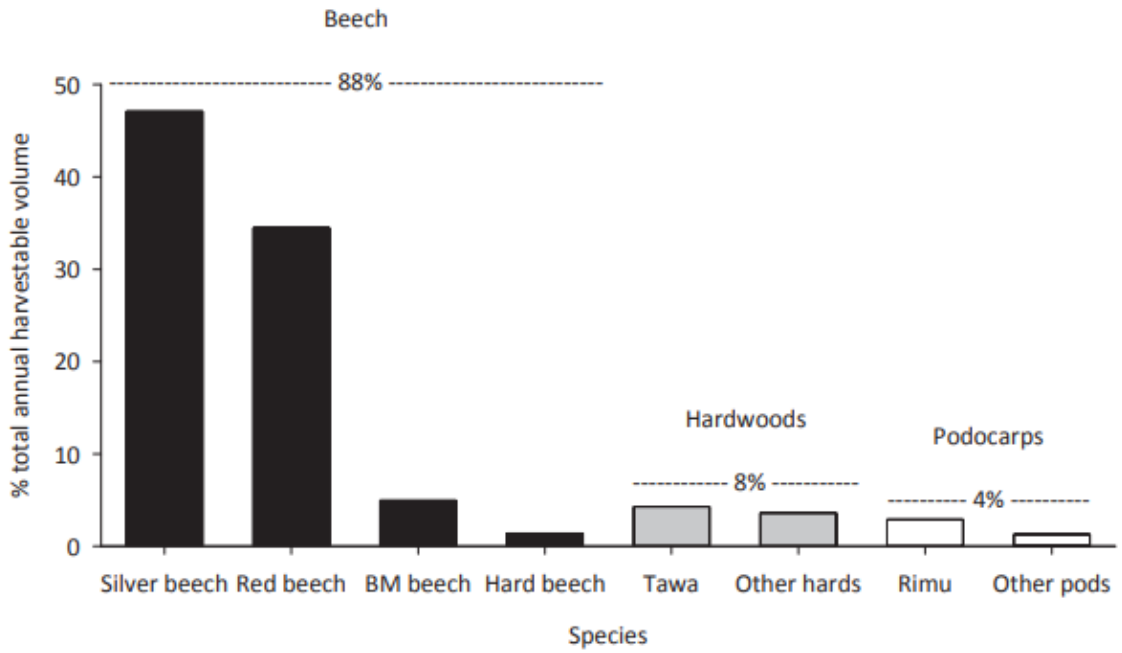
Based on interviews with specialty sawmillers, timber wholesalers and Trade Me’s timber marketplace, locally grown species traded include:

- Cypress (mostly *C. macrocarpa* and *C. lusitanica*)
- Blackwood (*Acacia melanoxylon*)
- *Eucalyptus fastigata*
- *Eucalyptus saligna*
- Redwood (*Sequoia sempervirens*)
- Poplar (*Populus spp.*)

Indigenous harvest volumes are subject to Sustainable Forest Management Permits, with 84,000 ha permitted for harvest, and around 10,000ha per annum harvested. In terms of species harvested from indigenous forest/ indigenous species, the majority is beech (*Nothofagus spp*) with similar species mix being taken over the past two decades (Fig 4 & 5). Limited amounts of rimu (*Dacrydium cupressinum*), and banksia (*Proteaceae*), are also available occasionally.

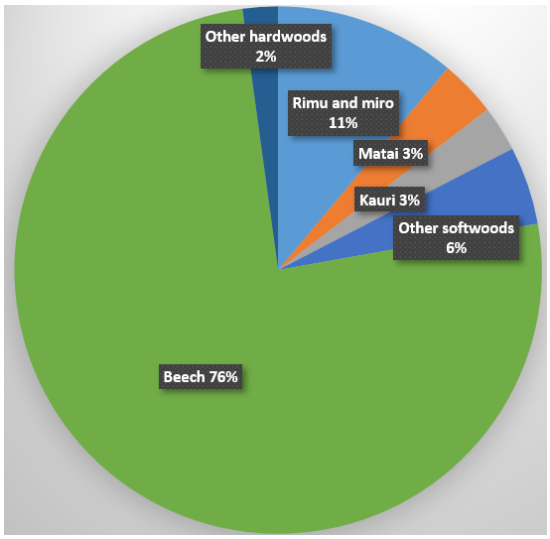
Supplies of recycled native timbers - mainly rimu, matai (*Prumnopitys taxifolia*), miro (*Prumnopitys ferruginea*), kauri (*Agathis australis*) - can be sourced from building demolitions.

***Figure 4: The mix of harvested indigenous species from MPI Sustainable management plans in 2006 Source:* Allen et al, 2013**



Summary of annual harvestable timber volumes (m^3) of indigenous tree species (BM = Black Mountain) included on approved sustainable management plans registered with the Ministry for Primary Industries, December 2006. Total volume = 80 007 cubic metres (from Richardson et al. 2011).

***Figure 5: The mix of harvested indigenous species as estimated by MPI in 2017.* Source: 2017 Ministry of Primary Industries**



The current market for specialty timbers in New Zealand

What's coming in and what's it being used for?

The official data sources from UN Comtrade, the Global Trade Atlas and MPI do not provide a consensus match on this question. In particular, the Harmonised Standard codes do not appear to be used consistently, there are differences in standard reporting timeframes between these datasets, and the data are self-reported by the traders. It would be very helpful if 10-digit HS codes were to be included in the raw MPI Quarterly trade data along with the "Product Group" and "Detailed Product" categorisation, for matching to other trade databases.

Despite these complexities, an attempt has been made from the data to show an estimate of the value of current imported product flows, the domestic consumption, and what is being re-exported. Figure 6 below also gives comparison to the size of the local harvest and export of all timbers:

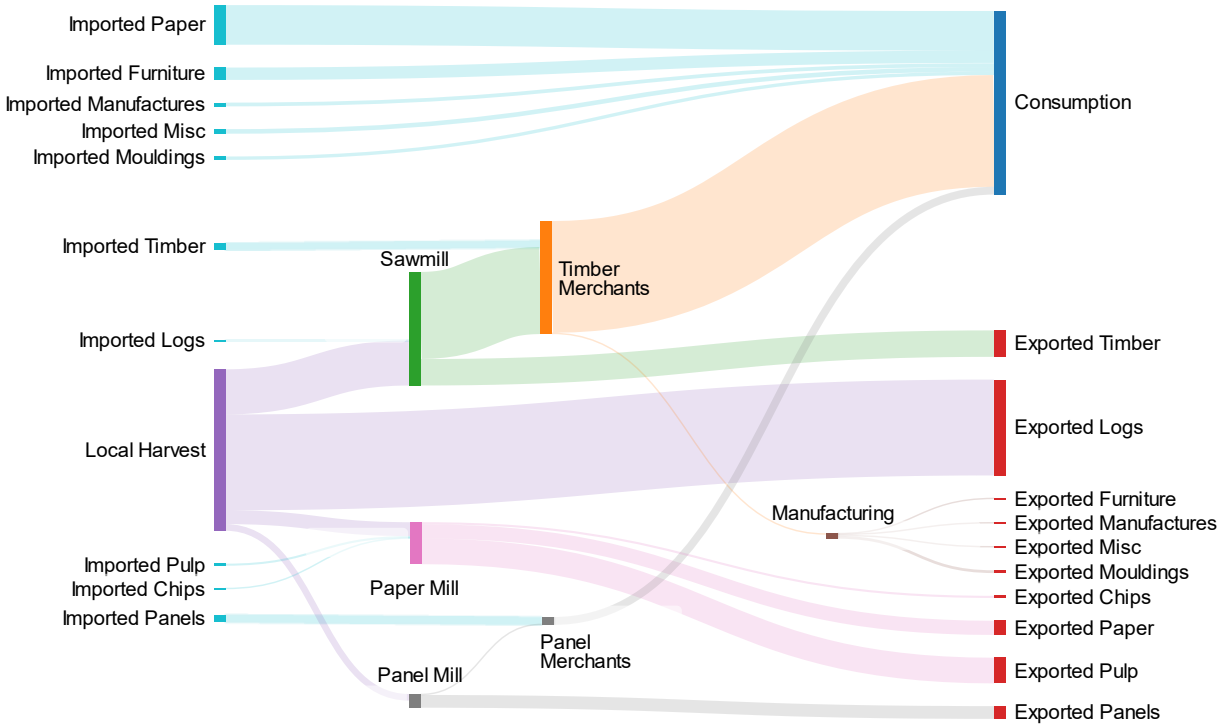


Figure 6: Sankey diagram of forest product value flows through New Zealand. Based on 2022 import and export data published by MPI.

We appear to import a significant value of specialty papers (due to low consumption scale and expense for capital establishment); as well as furniture (some $NZD395m). However, we import a similar value of mouldings to that exported, indicating that there is production capacity to produce local mouldings for domestic use New Zealand also has minimal imports of raw panel products, indicating that consumption is mostly supplied from domestic production. However, a high proportion of the imported furniture is in panelised form, though low value.
Timber merchants provided valuable insight into use by species (Table 3):

Species	Origin	Interior joinery	Furniture	Flooring	Decking	Cladding	Boat building	Misc products
Poplar *Populus spp.*	**China**	**x**						**Plywood core**
Hoop pine *Araucaria cunninghamii*	**China**	**x**						**Veneer**
Radiata pine *Pinus radiata (D Don.)*	**New Zealand; Chile; Netherlands**	**x**						**Veneer Glulam/CLT Accoya**
Russian Birch *Betula ermanii*	**Latvia**	**x**						**Veneer**
Siberian Larch** *Larix Sibirica*	**Russia**	**x**				**x**		
Okoume /Gaboon *Aucoumea klaineana*	**Gabon**						**x**	**Marine ply**
Falcajan/Falcata Sengon Wallabe *Eperua falcata*	**Indonesia** **The Guianas**						**x**	**Marine ply**
Victorian Ash / Tasmanian Oak *Eucalyptus spp.*	**Australia**	**x**	**x**	**x**				
Slash pine *Pinus elliotis*	**Brazil**						**x**	**Marine ply**
Western Red Cedar *Thuja plicata*	**Canada; USA**	**x**				**x**		

Species	Origin	Interior joinery	Furniture	Flooring	Decking	Cladding	Boat building	Misc products
Alaskan Yellow cedar *Chamaecyparis nootkatensis*	**Canada; USA**	**x**				**x**	**x**	
Tulipwood* *Liriodendron tulipifera*	**USA**					**x**		
Scots pine* *Pinus Sylvestris*	**Europe**					**x**		
Kwila /Merbau *Intsia spp.*	**Indonesia; Solomon Is**			**x**	**x**			**Poles; Beams**
Vitex *Vitex cofassus*	**Solomon Is**			**x**	**x**			**Poles; Beams**
Garapa *Apuleia Leiocarpa; Apuleia Mollaris*	**Peru;Brazil**				**x**			
Purpleheart *Peltogyne spp.*	**Guyana**				**x**			**Bridges and walkways**
American white oak *Quercus alba*	**Canada; USA**	**x**		**x**			**x**	
Tonka/Cumarra *Dipteryx odorata*	**South America; Peru**				**x**			
European Oak *Quercus spp.*	**Europe; Italy; Germany; Hungary**		**x**	**x**				
Taun *Pometia pinnata*	**Indonesia**				**x**		**x**	
Rosewood *Ptercarpus indicus* Tali Rosewood *Dalbergia sissoo*	**Solomon Is; Indonesia** **India**		**x**					**Fine wood working**

Species	Origin	Interior joinery	Furniture	Flooring	Decking	Cladding	Boat building	Misc products
Western Hemlock *Tsuga heterophylla*	**Canada**	**x**						
Azoke/Ekki *Lophira alata*	**Africa**							
Ayous* *Triplochiton scleroxylon*	**West Africa**							
American white Ash *Fraxinus americana*	**USA**		**x**					
Maple *Acer saccharum*	**USA**	**x**	**x**					
American Walnut *Juglans nigra*	**USA**	**x**						
American Cherry *Prunus serotina*	**USA**	**x**						
Chestnut *Castanea sativa*								
Iroko *Chlorophora excelsa*	**West Africa**	**x**			**x**	**x**	**x**	**Exterior use** **Marine piles**
European Beech *Fagus sylvatica*	**Eastern Europe**	**x**	**x**					**Tool handles**
Teak *Tectona Grandis*	**Burma** **India** **Thailand**	**x**	**x**				**x**	
Anegre *Aningeria spp*	**Ivory Coast**	**x**						
Balau *Shorea spp.*							**x**	**Marine ply**
Greenheart *Ocotea rodiaei*	**The Guianas**							**Marine bearers** **Exterior use**
Ipe *Handroanthus spp.*	**Brazil**			**x**	**x**	**x**		

Species	Origin	Interior joinery	Furniture	Flooring	Decking	Cladding	Boat building	Misc products
Jarrah *Eucalyptus marginata*	**Australia**	**x**	**x**	**x**			**x**	**Marine use Fine joinery**
Jatoba *Hymenaea courbaril*	**South America; Guianas**	**x**	**x**	**x**	**x**			
Kanda *Beilschmiedia congolana*					**x**			
Karri *Eucalyptus Diversicolor*	**Australia**	**x**		**x**	**x**	**x**		**Exterior**
Salu salu *Decussocarpus Vitiensis*								
Sapele *Entandrophragma cylindricum*	**West Africa**	**x**	**x**	**x**			**x**	**Ply**
Wenge *Millettia laurentii*	**Zaire**	**x**	**x**	**x**				
Zebrano *Brachystegia fleuryana*	**Gabon**	**x**	**x**	**x**				**Fine wood working**
Pacific rimu /Yaki *Dacrydium nidulum*	**Fiji**	**x**						
Pacific Kauri *Agathis borneensis; Agathis Vitiensis*	**Malaysia**						**x**	
Baltic Spruce* *Picea abies*	**Eastern Europe**	**x**		**x**				**Panel and sarking**

*Thermally modified timbers

Table 3: Overview of imported species and their applications

Interviews with architects and project managers at three architecture studios (Ignite; Warren and Mahoney and Chaplin Crooks) established that architects are also mainly sourcing veneered panels rather than solid timbers, with solid timber being used more for joinery features (bullnoses, mouldings, dividers, kickboards) and furniture items.

Flooring is largely moving to engineered timber over solid timbers. Flooring is predominantly imported engineered oak (*Quercus spp.)* or recycled solid native species. Furniture timbers are a mix of species, often American ash (*Fraxinus americana)*, oak or imported hardwoods (American hardwoods or Asian woods such as teak (*Tectona grandis*) and bamboo). These tend to have a large colour range and several finishes (Figure 7).

Architects will source flooring, panels and furniture directly from individual suppliers, rather than from timber merchants. However architects work in closely with shopfitters and joiners, who source from lumber yards and timber merchants, particularly for joinery timbers (including timbers for windows, interior doors and stairs).

***Figure 7: Woodrights range of solid Oak and Ash timber finishes for joinery and furniture manufacture* Source: Woodrights website**

In the case of furniture, Ignite furniture tend to get most furniture for their commercial interiors, as well as high-end residential fitout through Harrows in Ashburton. A large proportion of Harrows furniture is American ash. Ignite also have a good working relationship with Jacobsens flooring, and the sales reps for both Harrows and Jacobsens call in fortnightly to the three Ignite regional offices.

How much is coming in?

There are no known figures available at species level of the total imports coming into New Zealand, however, most importers were willing to share the split of their species mix with us (Fig 8 & 9).

Actual volumes sold of the timbers weren't shared as this is commercially sensitive. Figure 8 shows not all the importers are concentrating on the same species, though almost all importers will stock Kwila (*Intsia spp.*), Garapa (*Apuleia spp*.), Purpleheart (*Peltogyne spp*.), and Vitex (*Vitex cofassus)*; while most would stock Western Red Cedar and Oak (either American white oak (*Quercus alba*) or European oak (Quercus *robur*)) and various hardwoods. It appears BBS Timbers specialises in a very wide range of interior timbers; while Keyland are targeting the boat building and decking sector rather than interior markets.

Figure 8: Timber imports – species product mix for each of the larger timber importers, 2023

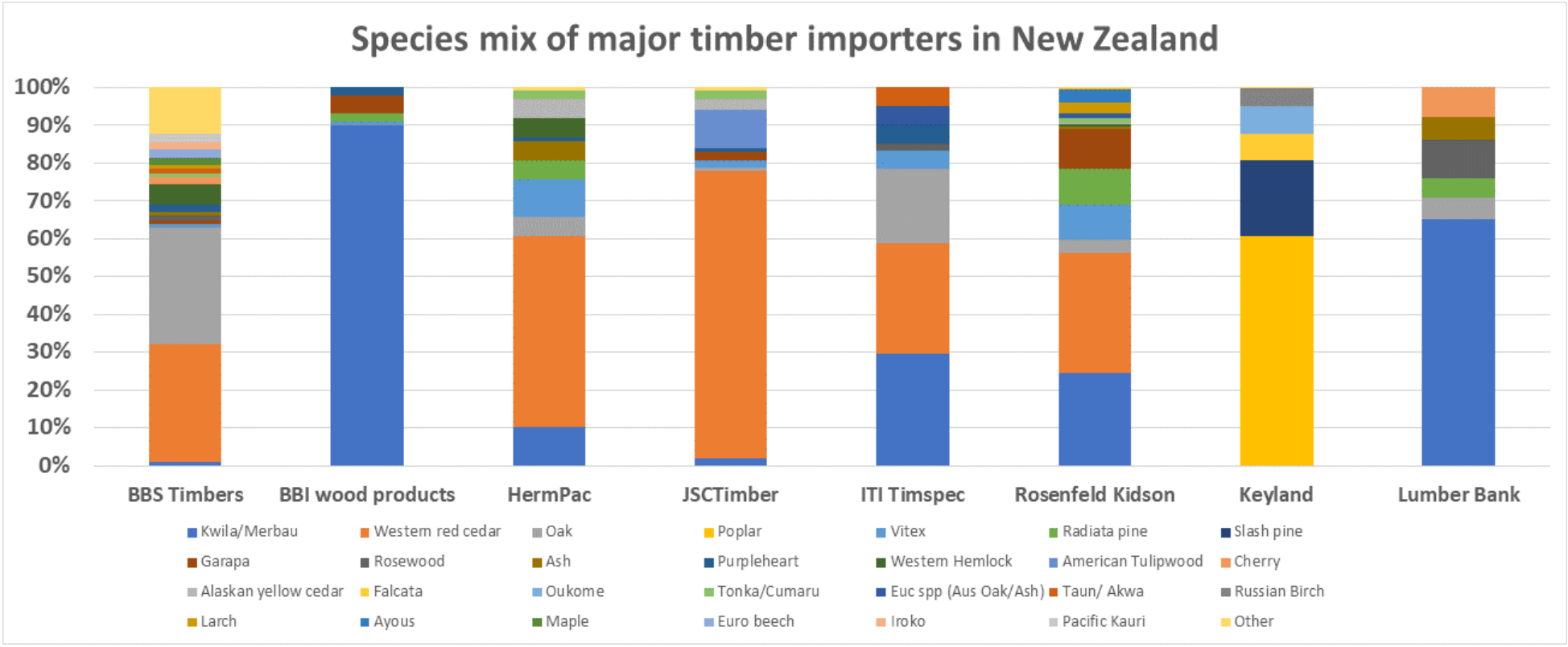
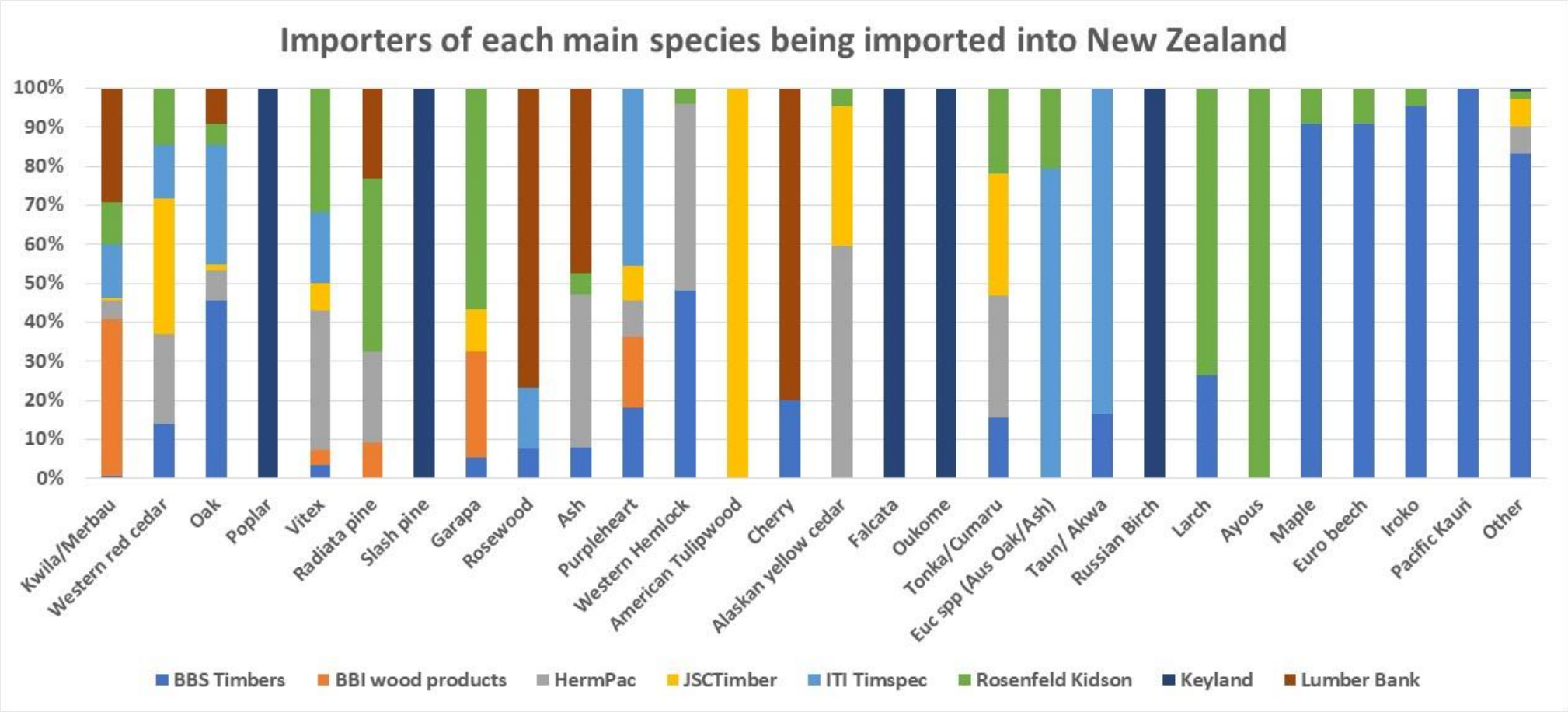
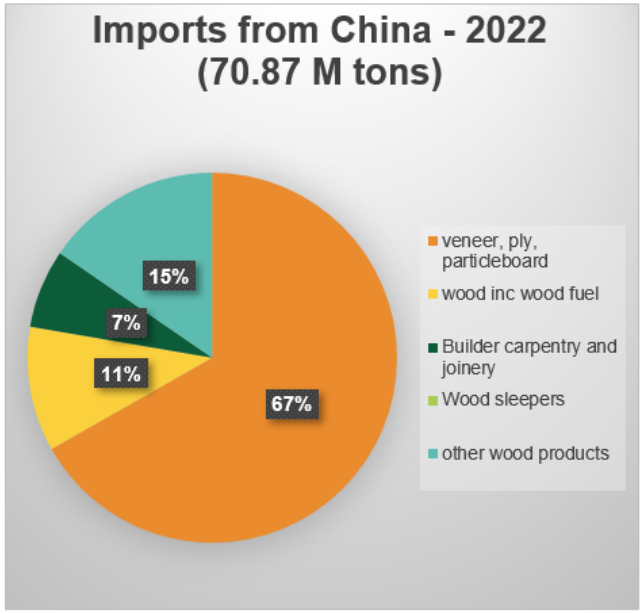


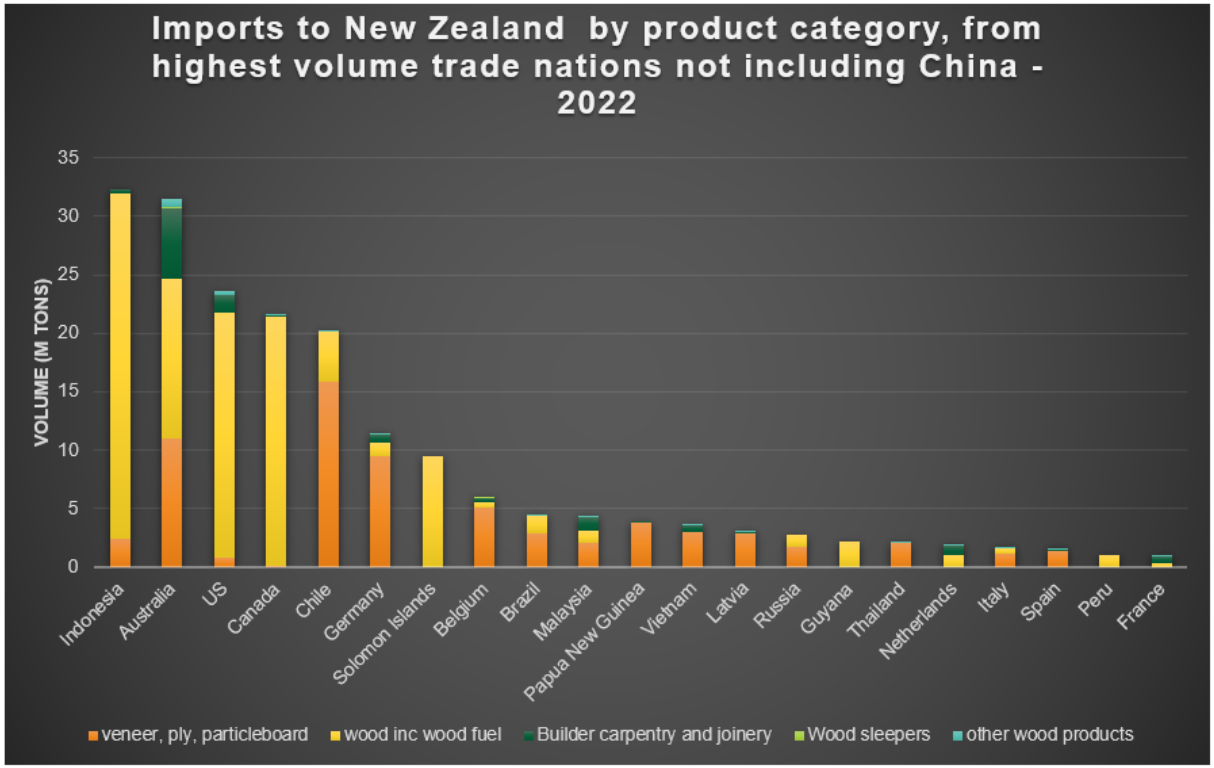
Figure 9: Timber imports by range of suppliers per species, 2023



Official figures from the Global Trade Atlas indicate some 101,000 ton of wooden materials entering New Zealand in 2022, or which 71,000 ton came from China (Fig 10).

Figure 10: Imported timbers coming into New Zealand by origin and product category – from the Global Trade Atlas





In considering trends in imported timbers, Table 4 collates information sourced from New Zealand Statistics using the 10-digit HS-codes along with a number of reasonable assumptions. However, the table doesn't distinguish source, or botanical taxonomy so Australian 'ash' and American 'ash' are in the same column. In addition, natural and modified timbers are not distinguished separately. However, this does highlight the difference in values between some common species. Western Red Cedar appears to be being substituted already with small quantities of Eastern red cedar (*Juniperus virginiana*).

Species	m3	NPV	$/m3		Species	m3	NPV	$/m3
western red cedar	26,526	72,140,414	2,720		other fir, spruce	145	346,407	2,389
other	6,750	12,295,351	1,822		Douglas-fir	275	213,491	776
other tropical hardwood	6,992	11,530,706	1,649		sapelli	84	209,364	2,492
kwila	3,299	9,894,569	2,999		maple	89	186,800	2,099
radiata pine	9,969	9,741,853	977		hickory, juglans	65	168,845	2,598
oak	3,609	9,305,105	2,578		eastern red cedar	135	161,245	1,194
eucalyptus	3,508	3,791,565	1,081		fir, spruce	180	149,225	829
other pine	5,029	3,725,319	741		other softwood	16	136,915	8,557
ash	2,122	3,642,420	1,717		keruing, etc	107	132,369	1,237
other hem-fir	1,628	3,409,513	2,094		balsa, etc	3,982	82,396	21
teak, etc	940	1,547,981	1,647		redwood	68	42,700	628
beech	1,227	1,401,416	1,142		poplar and aspen	10	17,387	1,739
larch	1,271	1,261,293	992		cherry	9	8,644	960
mahogany, etc	1,090	1,044,086	958		birch	18	8,210	456
iroko	268	698,587	2,607		meranti	1	538	538

Table 4: Value of imported species into New Zealand, 2023

Based on the same datasource, figures 11 and 12 show the volumes and value of various groupings of timbers being imported into New Zealand over the past three decades. Figure 12 has been adjusted for inflation. A notable trend is seen in the steady growth over the period in the import of hardwoods (kwila, garapa, etc. from Indonesia/Melanesia and South America; maple (*Acer spp.*), ash etc from North America). There has also been rapid growth in both cedar and modified radiata imports of the past decade. While prices have held firm or declined (in real terms), there are a number of outliers, some potentially quite significant (e.g. cedar price in 2022).

Figure 11: Imports of timber species by volume 1990 -2022

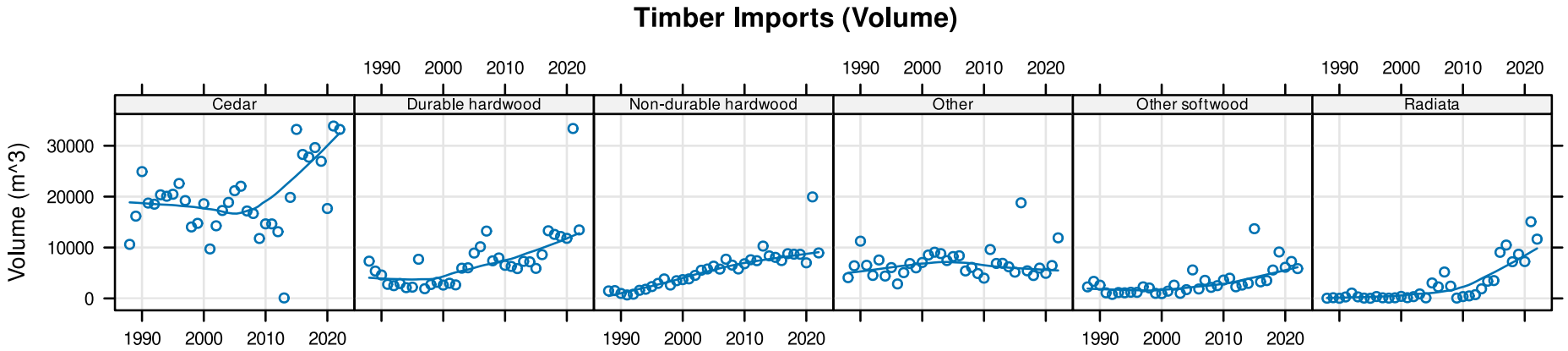
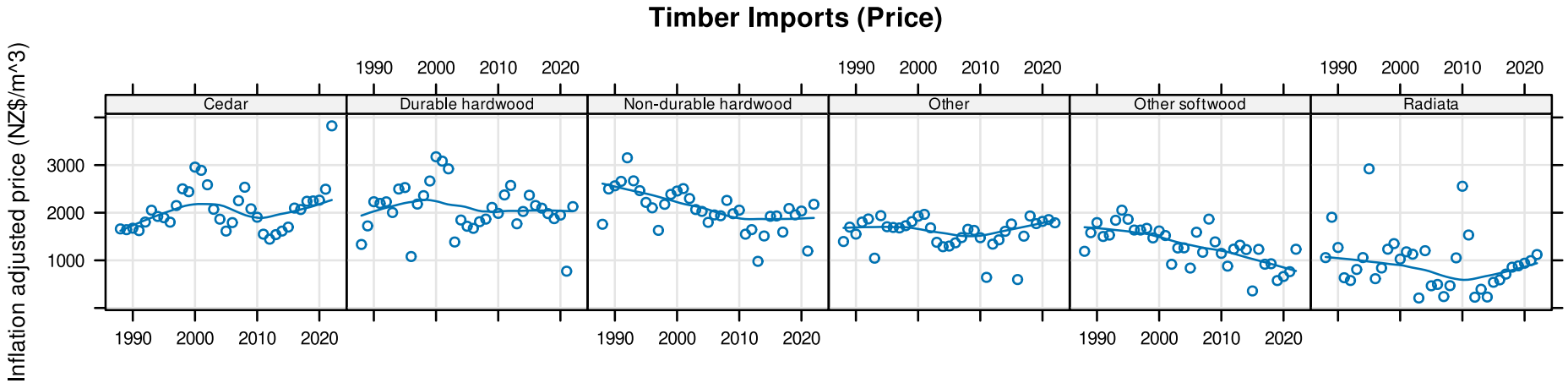


Figure 12: Imports of timber species by value 1990 -2022



What are the traits that lead to use?

Importers

Importers are very clear why they are importing a particular species. Factors such as consistency in appearance and grade, good durability or fit for purpose for all of New Zealand's climatic variances, cost and constant availability were mentioned a lot. Invariably importers are bringing in the bulk of timbers which are 'tried and true' species. These are species that have been introduced a long time ago and are popular in the New Zealand market (such as kwila and vitex decking; Western Red Cedar cladding) or species that are known to perform to the specific purpose internationally (such as American ash for furniture, oak flooring, boatbuilding timbers such as okoume (*Aucoumea klaineana*)).

Their main customers are the 'big 5' big box merchant stores –Placemakers, ITM, Bunnings, Mitre 10 and Carters– who dictate much of what is sourced into New Zealand in terms of veneered panels and sawn timber, especially for exterior use. Two of those we interviewed stated they also selected and imported North American timbers due to being raised in North America. One importer mentioned that sometimes they will do research on new species to import if they see a need or gap in the market.

In recent years, some newer options have emerged, such as thermally modified hardwood timbers; Accoya[1]; and substitute species from international supply routes to achieve sustainability and certification requirements. For example, plantation hardwoods, rosewood from Papua New Guinea, and other tropical woods of Australian and Pacific origin substituting for South American and African hardwoods supply.

Supplier selection for species were based on personal relationships, largely on trust. Sustainability credentials (i.e. having certification[2]) and having consistent high-grade materials drives selection in where to source timber from (international suppliers). The important customer qualities importers seek from a supplier are flexible supply arrangements, reliability, consistent wood quality and loyalty of the supplier.

<u>Certification</u>
When importing tropical hardwoods importers are very conscious of making sure that these timbers are certified. All tropical woods New Zealand importers source need 3rd party certification, and importers are all ITTG group members. One importer talked of the need for responsible harvesting and making sure no child labour was involved in harvesting. Most importers also belong to FSC and PEFC and seek 3rd party auditing in the certification process. Thus, when relevant, certification requirements are considered a very important requirement of the international tropical timber importer member group (ITTG).

Interestingly, most customers do not ask about certification as this is an expected quality of the timber they are purchasing from the importer. As stated by an employee at Hermpac "most customers expect the boxes to be ticked on certification, and do not request or insist on this specifically – it is a given".

<u>Grade</u>
Importers usually request photos of the logs or timber prior to purchase. They specify to grade, and seek consistency in grade and availability. This requirement is market driven, as importer's customers expect consistent quality. For example, kwila is almost always consistent in quality, which is a feature that led to its market popularity.

[1] Accoya – Acetylated timber manufactured in the Netherlands from New Zealand-grown radiata pine.
[2] From PEFC. FSC or other certification schemes

Wood attributes

The main attributes mentioned by many were the specific appearance and 'feel' of the different timbers (i.e. their visual characteristics), in addition, natural durability and weatherability and the capacity to be used in a range of exterior applications are key characteristics for exterior-use products. There is a current trend to expose wood grains even for exterior timbers, so the ability to take a clear coating is currently required. Therefore, even for exterior timbers, being visually pleasing, and dimensionally stable is desirable.

Other notable attributes sought by importers include consistent grain, colour, dryness/evidence of seasoning, and no defects (pinholes, splinters or checking). In terms of furniture and interior grades: gluability, no formaldehyde emissions from glues used (plywood etc.) and proven performance in use (i.e. is a timber known and well used for such applications). For decking and flooring: impact resistance (hardness) and strength properties of the timbers are considered more important qualities than weight or colour.

Architects and designers

The species selection is strongly guided by ensuring the timber options match the overall project aesthetic. Appearance is in turn influenced by current fashion trends, followed closely by past experience with the timber and supplier. Most project leads do not have a specific species in mind for projects, more a general feeling that timber is part of the aesthetic. They will then look towards colour pattern and grain that would suit the aesthetic of choice.

The architect relationship with key suppliers is integral to certain species being selected for a project. It was made clear that price is not a major factor, except in terms of price 'bracket', and that usually an architect will consider timber generically for a project, and then look at species options, in consultation with the project manager and shopfitter or builder on the job. Occasionally in retail or commercial projects, a client will specify a specific piece of furniture, and the whole aesthetic look will then centre around this central feature item.

Our survey on the consideration given to various wood attributes revealed the following ranking from most to least consideration:

1. Supply availability
2. Sustainability
3. Project cost
4. Dimensional stability
5. Fire
6. Price
7. The colour or tone
8. Environmental certification (FSC)
9. Finish (stain and coating options)
10. Imported versus local product
11. Available sizes
12. Carbon offsetting
13. Presence or absence of knot
14. Impact resistance
15. Fine or coarse grain
16. Uniform grain direction
17. Flexure/ ability to wrap or curve
18. Moisture resistance
19. Weight
20. Easy to machine
21. Importation requirement

From the table above it appears the preference for local over imported timbers is fairly low (ranked 10th), but of greater importance than many of the performance attributes provided by wood property traits such as grain, grain direction and impact resistance etc.

Some species-specific reasons that customers seek timbers:

Western Red Cedar – stability, durability and appearance.
Kwila – machining performance, durable decking.
Thermally modified tulipwood and Scots pine (*Pinus sylvestris*)– used as a cheaper option than tropical hardwood that gives superior stability and durability for price.
Alaskan yellow cedar *(C. nootkatensis)* – superior screw holding and nail holding capabilities.
Salu Salu (*Decussocarpus vitiensis*)– seen as a substitute for heart rimu
Meranti/*Shorea sp.p*- impact resistance, bending strength and surface finish characteristics. Very attractive, with an irregular grain pattern, and colour that can vary.
Gaboon ply – lighter weight than other tropical hardwoods, and can be obtained in lower grades.

What is the specification process for an architect for species selection?

Most architectural offices will stock a materials library. This contains samples left by sales representatives, and gathered when working on recent past projects. There is also brochures and books in the library featuring award winning projects to get ideas from. Architects use the library more for conceptual ideas on potential species and potential suppliers.

Architects will specify timber, and then consultation between the project manager, architect and shopfitter or builder will determine what species would be used, with additional advice coming from suppliers. At times there is just a brief on colour sought and what it will be used for, size or thickness, and then a timber yard or stockist will make a species recommendation, send samples or a sales rep will visit to finalise the selection.

Architects increasingly will consult the internet and Pinterest™, along with magazines for ideas and conceptual aesthetics they are seeking to create, rather than brochures or books. If they find something of interest, particularly a past award winning design or writeup, it often will state the species used or the supplier. Junior staff in a design studio rely on senior architects and principals, and their knowledge of how various timbers have performed in past projects, to help select species and supplier. This experiential knowledge, along with that of the builder and shopfitter is highly influential on species choice, second only to current trends and availability of timbers.

For public buildings, there is greater chance that New Zealand-grown timbers would be used. The reasons for this are: the need to match existing heritage elements; the ability to better ‘tell a story’ about the timber displayed in a public space; and to satisfy mana whenua/iwi requirements (usually this means the use of native species). In addition, timbers are often used both structurally and aesthetically in large open spaces, and increasingly mass timber elements and structural members such as plywood, LVL and laminated beams are included and clear coated. Where timber is used in these buildings, often radiata pine is selected for the laminated structural members and then interior elements will also be pine. Public buildings are being designed in timber mostly for sustainability credentials, with New Zealand pine selected for carbon storage/embodied energy attributes. Some architects follow Living Building Challenge (LBC) regenerative design frameworks, seeking biophilic, low-carbon materials that are New Zealand made – for wood this equates most readily to pine and is driving up the use of mass-timber radiata in architectural projects as a whole.

Do they prefer New Zealand-grown timbers? In what circumstances would they seek these out?

For most projects, the source of the timbers is irrelevant. The most important aspect for system selection after the aesthetic in many projects is lead time and availability. Imported timbers are easier

to supply on both these aspects i.e. reliable lead times and readily available, or easy to find an alternative substitute from the same supplier/supply chain partners upstream should there be a shortage.

For architects, the most important consideration is that the timber is of grade, arrives on site when needed, and that the builders know how to fit it without 'mucking about' with experimentation on site.

The majority of timber importers shy away from supplying locally grown native timbers that aren't recycled due to the following factors:

1. Availability – sporadic and unreliable supply of available timbers. "Hard to get hold of"
2. Variable durability – native timbers are not consistent in grade or performance across the country, so you don't really know what you are supplying. In contrast, grade specification to imported suppliers is met consistently. Inconsistent durability also means our native species often can only be used for interior use.
3. Certification – NZ woods lack certification, though they are legal and come from SFM forests. Only a few larger suppliers of native timbers are FSC certified. This is usually native beech.
4. One importer felt there was a demand for native species aesthetically but he "didn't want to go there" due to sensitivity in dealing with iwi, particularly concerning the Wai262 Claim (Waitangi Tribunal, 2011).

Specifiers are interested in using New Zealand-grown exotic woods more, *but only if the supply and lead times are reliable*. Some expressed interest in thermally treated woods, but want these from 'old growth' trees, not young plantations. There is already competition in this regard from thermally modified hardwood imports, sold to provide a cheaper alternative to tropical hardwoods. Many of the Warren and Mahoney architects have had good experiences with radiata pine used aesthetically/exposed, and would like to use this more.

Interestingly, most architects did not know who to contact or how to obtain information about the availability of New Zealand-grown exotic timbers that might be on offer. Where a known supplier was mentioned, it was largely through already established supply chain importers and timber merchants where New Zealand-grown exotic timbers were being offered alongside imported sawn timber and veneers.

Certain public projects, such as the Christchurch Cathedral repair, are specifying native timbers. It was interesting to note that although the original sarking is totara, the specification has broadened out to any locally available native podocarp species, in order to secure sufficient supply of the right quality. The species in this case was less important than the colour and grain matching, while retaining a New Zealand native supply.

Learning from Exemplars

Abodo

Abodo sell thermally modified New Zealand *Pinus radiata*. While the firm has been around for 20 years, they have only been selling timber for the past 10 year. This highlights the long lead in timeframe for such technologies to gain market acceptance and readiness. Abodo saw a growing architectural trend for timber cladding and raw timber cladding. They also identified the lack of quality cladding timber supply locally in New Zealand, and a decrease in supply globally of the most popular exposed cladding, Western Red Cedar. However, there is an abundance of radiata pine in New Zealand to thermally modify, so Abodo decided to try and make a radiata cladding that looked like cedar and performed to same durability.

Exposed timbers require a very high level of performance, because they don't have the same coating protections from stain or paints. It has taken 10-15 years of research and development to be able to

take radiata pine and make it as durable as needed for an outdoor cladding (15 years durability class) – this required large local investment. To upscale, guerrilla marketing was key, and Abodo signalled the need for upscaling production also. Abodo now sell to 35 countries around the world, including selling into Canada head-to-head with Western Red Cedar cladding. In New Zealand, Western Red Cedar is a growing market. In North American market pull is occurring over Western Red Cedar due to the customer desire for a sustainable plantation option. Their offering is therefore desired by certain consumers who are wary of supporting old growth harvesting.

Lindsay and Dixon

Lindsay and Dixon are established suppliers of sustainably harvested native beech timbers *(Lophozonia menziesii)*, having gained certification 20 years ago for native beech resource on a sustainable harvesting permit. The firm harvests exclusively silver beech off Waitutu Block in Tuatapere, Southland. Despite another beech supplier (Forever Beech) entering the market following Cyclone Ita, Lindsay and Dixon supply about 80-85% of the New Zealand indigenous timber production. Their beech timber is marketed as 'maple beech' and 'cherry beech' to substitute for imported maple and cherry hardwoods. Lindsay and Dixon have good recognition and reputation in the market, and have supplied multiple architectural projects, including the Supreme Court in Wellington. One factor that they attribute to early success is the 2005 Forest Industry Development Agenda funding source put in place by then Minister of Regional Development, Jim Anderton, to assist in New Zealand timber market access and key government projects.

To get around issues of complexity and market access in the supply chain, they deal with a major distributor in NZ that specialises in dealing with larger architectural firms – i.e. has an 'in' with the architectural supply chain.

Lindsay and Dixon saw the need to be FSC certified, as they export, and also recognise that it is increasingly a requirement of the NZ architectural sector. FSC criteria also links to Māori cultural values and ethos, which has significance to their business due to the Waitutu Trustees. Lindsay and Dixon didn't believe the company would survive without FSC certification, though it was "onerous, pedantic and costly" to achieve certification.

Drylands Forest Initiative

Drylands Forest Initiative (DFI) is a collaborative research and development programme with a vision of developing a sustainable multi-regional hardwood industry based on planting genetically improved durable eucalypt forests. The project was initiated 20 years ago to find a timber solution to power pole battens and to substitute CCA treated vineyard posts with naturally durable timbers. Their main focus has been on anticipated climate change impacts (both from lower suitability for radiata in warm regions, also erosion control and the resultant need for drier species for Marlborough (and other dry area) conditions – in particular diversifying timber supply with genetically improved *Eucalyptus spp*. DFI have identified 12 potential wood supply catchments with suitable environments for growing durable eucalypts (mostly in the North Island), and see a clear market need for more durable eucalyptus timbers.

There is an estimated market volume of 300,000 posts and poles and 400,000m3 in sawn timbers, however local market demand must gain traction towards increased use of non-radiata for the impacts to be fully realised. In addition, using MPI data, DFI estimate potential substitution of high value hardwood imports – over 72,000m3 lumber, 1,500m3 sleepers and 5,000 m3 posts/poles (MPI 2019). There is also an estimated $150 million opportunity in lumber and log export potential to replace Australian and tropical hardwoods with certified timber.

To sustainably supply a small-to-medium size sawmill the total forest area required in each catchment is around 5,000 hectares, which equates to new planting of around a 170 hectares per year for 30 years. In addition, DFI strongly advocate starting with the best possible seedlings – i.e.

don't plant unimproved material. To this end the DFI have developed Xylogene™ seedlings for improved durable hardwood.

Discussion of Import Substitution Opportunities (Strawmen)

The following 'strawmen' substitution opportunities were presented to attendees ahead of the online workshop:

1. A replacement for imported hardwood (mostly kwila or garapa) decking
    - Utilising a local hardwood (e.g. *E. saligna*) as a more sustainable, local option

2. Exposed exterior joinery and cladding to substitute for imported cedar.
    - Based on locally grown Western Red Cedar, redwood, thermally modified pine or poplar
    - Could also use Southern Douglas-fir and thermally modify – this has been done before, so proven technically and less of a time to market for research and development to prove case to standards committees etc.

3. Thermally modified hardwood cladding
    - Utilise low quality hardwood species off farmlots and thermally modify small clears

4. Boat building ply
    - Marine grade ply from locally grown and produced high-grade veneers, utilising small spindle-less lathe.

5. Outdoor furniture to compete with Southeast Asian hardwoods (teak, rubberwood, eucalyptus, acacia etc.)

6. Bamboo – locally grown bamboo to compete with imported timbers.
    - Targeting smallwoods (handles, bowls, utensils etc).
    - Would reinvigorate bespoke local production.

7. Thermally treated softwoods
    - An explosion in this technology globally, and only one supplier in NZ currently (Abodo). Get greater scale through additional suppliers of thermally treated radiata, and another large plant located in another region.

8. Prefabricated buildings
    - Most imports are cedar sheds, though many cheap and low-cost options at big box stores (kennels, chicken runs, hutches etc,)
    - $11m / yr imported from Estonia, China, Australia, Malaysia
    - Take Vaughan Kearn's cabin idea and commercialise it further down the supply chain as a finished unit.

9. Local furniture timber to replace imported American ash
    - Needs the look, and to modify for decent dimensional stability and take a finish etc.
    - Possibility to use a local eucalypt and stain to provide finishes required.
    - Could be a part of the mix for Eucalypt species grown for decking and flooring- segregate out potential furniture grade stock.

Hardwood decking

Using the example of *E. saligna* decking, the online workshop explored what it might take to produce decking timbers from this species into the marketplace, and the viability of this option.

The main requirement for any timber decking (or exterior cladding and joinery) in New Zealand is to comply with a 15-year durability requirement. *E*. *saligna* has already been listed in NZ3602 as a suitable timber species for this purpose since 2013. However, the specifiers in the workshop did not

seem to be aware of this fact, so an improvement in marketing and raising awareness of potential alternatives is needed.

Besides durability, there are a few other properties that any exposed decking timber would need to provide in service, to compete head-to-head with kwila, vitex, garapa and jarrah:

- No splintering
- No surface checks- this was seen as nearly impossible to achieve from softwood species, even modified softwoods
- A smooth surface and consistent colour that is more than surface layer, and needs to hold a stain or weather protection treatment well.
- Dimensionally stable – no nail popping or twisting and cupping of lengths
- Available in long clear lengths
- Small growth rings – this is connoted with quality and strength
- Attractive silvering over time is desirable
- Maintains the same high-quality look and feel throughout service life of the deck

However *"the expectation of the end consumer when it comes to timber is extremely high, or I think anything, I've been working in [this] space for a while, and raw timber, whether it's deck or cladding or balustrade or whatever it is, is well, you know, it's going through a lot out in the element, but the expectation of that end user as to what that will look like for that 15 years or 30 years that they expect it to be there is extremely, extremely high....And decking, decking is decking gets a hard life. It gets trodden on. It gets, chairs scraped across it. You know, so to hold to hold a stain on it's very hard because they're usually a smooth finish because you don't want to get splinters."* Sarah Buckley, Abodo.

Customers therefore have very high expectations of decking. They don't expect it to weather at all. Abodo have tried thermally modified radiata decking as a trial product, but it did develop surface checks. *E. saligna* is still a marginal species for decking (economically) due to splitting, checking, and having a compression core. Due to this the *E. saligna* logs are sold to sawmills cheap, and the middleman gets the margin not the grower. Cost is a large barrier to enable locally sourced decking timbers. Macblack has to charge 50-100% more for their decking than Kwila imports, in order to make sufficient margin. This is driven by conversion efficiency, and transport costs etc. It is unlikely that we would ever match the imported kwila price, so to achieve local *E.saligna* supply, the timbers would need to be marketed on alternate benefits that customers are willing to pay a premium for. To a customer, taking on an alternate species is risky. Kwila has been around for decades and has demonstrated good performance. Alternate species like *E. saligna* need to be proven to work as well as (or better than) kwila. An industry body could undertake performance testing to get other species/groups (including modified) to the standard of imports, and approved within the Standards as alternate solutions.

Could the government step in and regulate? One option is to stop the importation of kwila on environmental grounds, however this is fraught, as New Zealand supply would then need to prove legality, and enhanced sustainable forest management practice over tropical imports. Most small New Zealand suppliers (woodlots etc.) are not FSC certified, so this would be disadvantageous. While there was definite cause for concern in 2013 (May, 2013), increasingly, tropical timber supplies are certified (most kwila sold in NZ from importers is already from FSC-certified supply), and importers seek FSC-certified suppliers wherever possible, which reduces the ability to compete on the environmental upper hand. It is also probably more likely that a ban on imported kwila decking will just see more CCA radiata decking installed (given the log supply issues and costs of existing NZ non-radiata decking), and other imported FSC certified tropical products (such as garapa, jarrah etc.) becoming premium for a very small high-performance market segment. However, a tariff or restriction on kwila imports would certainly change the playing field - but how quickly could NZ gear up to meet the decking needs from locally grown resources? In addition, is the milling capacity there to support such scale up of *E. saligna* supplies? One option would be regionally based co-operative supply chains that can source and select required stands, mill efficiently, and consolidate milled timbers to meet orders.

Thermally modified timber

The online workshop also considered the option of increasing production (onshore) of thermally treated softwoods, for exterior cladding and joinery requiring a 15 year durability rating. The examples and experience from both Abodo and local trials with thermally modified timbers (poplar and cypress etc.) were highlighted and discussed.

The first point made is that it is very difficult to thermally modify hardwoods, although beech is modified internationally. The usual timbers used for modification are beech and spruce, and radiata pine. Any softwood used should have very small tight knots, but clearwood is preferred as knots will shrink and split during processing. The extreme heat around the knots will distort the surrounding timber, and also cause the wood surrounding to star check. The mature pruned radiata resource is getting scarcer, which lends support for complimentary alternate species that can provide long straight lengths for modification.

In terms of processing multiple species, it is important to have consistent size (thickness) in the kiln in a batch. Need to look at batch runs with similar species – mixing species and grades in the kiln is an issue if they are not of similar density, and ideally all pieces would be cut to same thickness.

What is the capacity in NZ to do the treatment? Costs are estimated to be high for small operators - $1,300/m^3 plus transport, though at scale the costs are more likely to be $200/m^3. CCA treatment only costs $150/m^3. It is difficult to scale up however, unless using only radiata pine, due to low volume of supply. However, many smaller batch runs of multiple species could be used, particularly if a treatment plant was portable. Vaughan Kearns is looking into a 6m3 capacity kiln to produce thermally modified wood in about 48 to 72 hours. The capital investment for such a unit is $400k. Ruapehu Sawmills is looking to get a government grant for half this cost. Ideally this would be portable and able to be moved around the resource base to modify wood from other sites.

With the grant, Vaughan Kearns estimates he should possibly have a transportable option within 12 months. Second-hand modification kilns from Finland (Avant Wood) are also available. These are smaller at 4m3 capacity, and are a portable option that fits in a forty-foot container, so could be transported on a truck around to woodlots or small sawmilling operations. The cost of these units is €500k and they process 2x 4m3 batches over two days. A larger unit is available that has 15m3 capacity, at a cost of €650k, however, this is less portable.

The largest barrier to use for these timbers in external environments is proving 15-year durability in service. We cannot wait 15 years for ground stake testing of multiple thermally modified timbers, so how can we prove effective for use? Would accelerated testing be sufficient? However, even a durability stake in ground testing doesn't equal a weatherboard on a house. How to do the most appropriate testing? The building code requires proof that a product will last to get approved as an Acceptable Solution. In addition, building inspection/territorial authorities can accept different levels of proof., as the Codemark process is not transparent.

CONCLUSIONS

Key learnings and pathway forward

1. Macroeconomic drivers

Besides fashion trends and the current aesthetic, four major drivers are currently impacting the specialty timber market:

- Russia Ukraine war – the conflict has halted imports of Siberian Larch, and diminished birch ply supply. Note, most commentators expect that current alternative sources used today to overcome war-driven supply chain issues will be reverted back to Russian supplies once the war ends.
- Increase in plantation hardwoods, and emphasis on certification – importers are sourcing and finding alternative supply that are certified, due to a primary emphasis from specifiers on selecting timbers with proven sustainability and certification. This differs somewhat from 2013 (May, 2013) where it was felt imports were a way for New Zealand customers to "transfer their environmental footprint offshore", and inadvertently give support to illegal logging. Certified supplies of plantation teak and rosewood have come onstream, along with alternative species being sold in place of 'true' rosewood and other endangered species.
- Thermally modified softwoods and hardwoods –growing in popularity and availability globally, and available in New Zealand.
- Climate change – the impacts of fire, insect outbreak and storm events on natural forests will increase, and place greater pressure on the ability to obtain reliable suppliers of high-quality specialty woods in future.

2. Need for a NZ timber 'sales front'

Specifiers can readily find a sales agency supplying imported timbers, and many building supply companies selling flooring, cladding, decking systems etc. have sales representatives that call in person to architectural firms every 2-3 weeks, giving presentations on the new product range, delivering samples and checking on current project requirements. In contrast, there is no obvious or advocated sales agency for New Zealand-grown specialty timbers, and certainly no sales reps or advocacy beyond timber design seminars or farm forestry demonstration days. These events also focus more on mass timber and structural elements, and the establishment and harvesting phase of timber supply than end use species and product options. In essence, the complexity and multitude of supply chain routes to deliver imported timbers into New Zealand is hidden from specifier view, and dealt with by the timber importers, while New Zealand specifiers still need to wade through the complexity to establish a supply route for New Zealand-grown timbers (Fig 13 & 14). It doesn't matter where in chain you get it from a specifier perspective, so long as it arrives on time and in grade – and importers take care of the supply chain 'mess' to ensure delivery.

It's important to note that rather than simplify the complexity, the sector should instead help form supply chain pathways through this, and create a dedicated assistance point for specifiers to go to. In this regard, we could look to the American Hardwood Association; or Australian Timber Wholesalers. There are a few importers and timber merchants that supply New Zealand timbers into the marketplace, but are not so prominent nationally, more localised in sales.

Figure 13: Furniture supply chain – the chain from forest to furniture production is navigated overseas with imports, so NZ specifiers only need to interact with the latter part of the chain **Source: Appelhanz et al. (2016)**

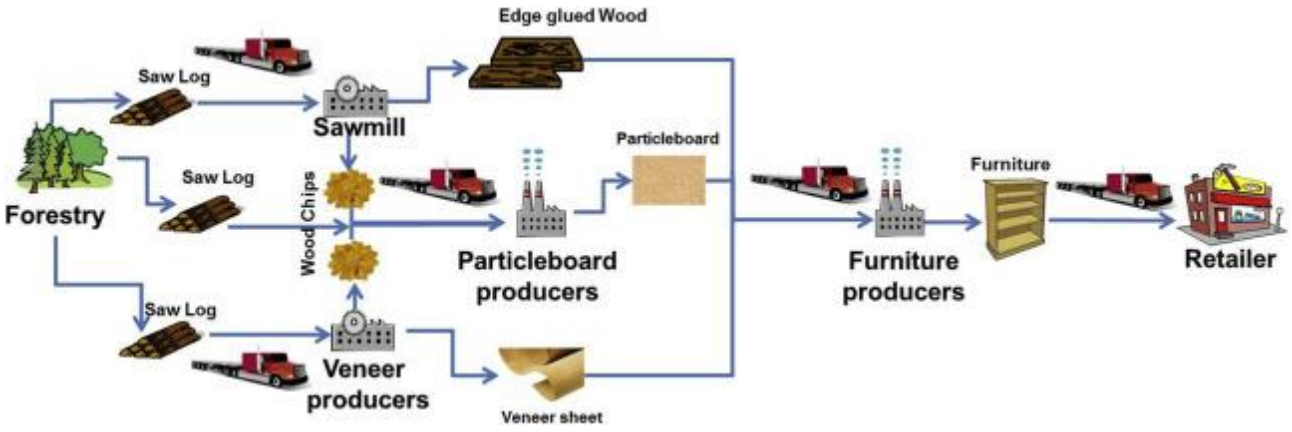
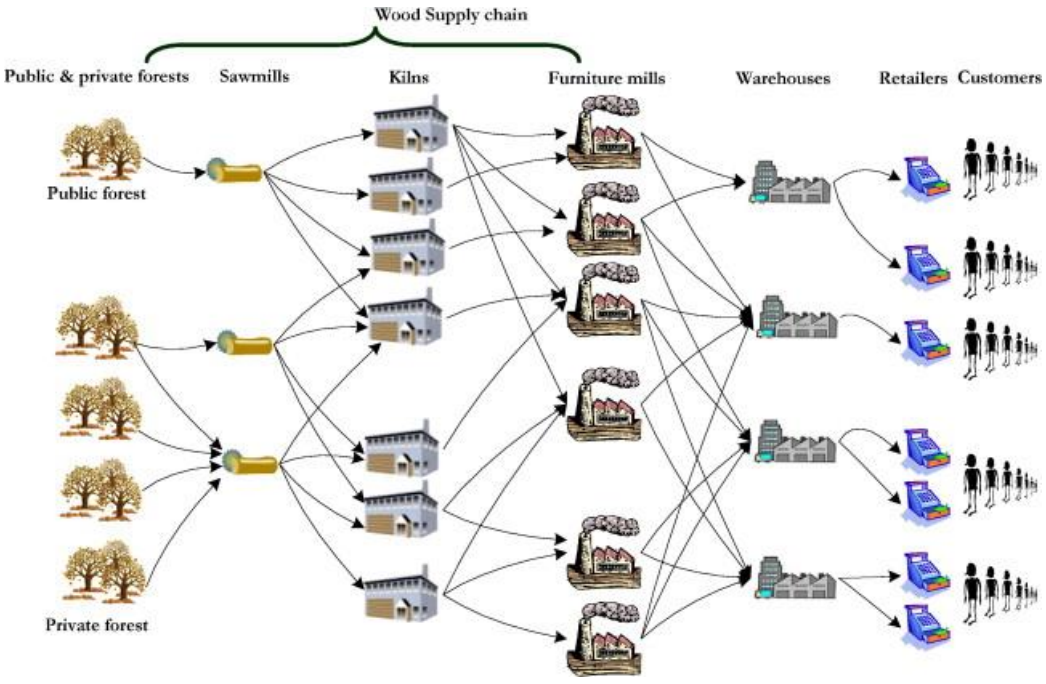


Figure 14: Furniture supply chain – the complexity and pathway to source domestic timbers for projects is not obvious to our specialty wood customers. New Zealand growers lack a clear route path through to customers they can easily navigate. **Source: Ouhimmou et al. (2008)**



3. Consistent Quality and Supply Aggregation

As well as an industry association for promotional purposes, technology could be leveraged to help drive down production costs, help ensure customer satisfaction, and ease issues associated with finding appropriately skilled labour. Elements of such a solution might include:

- A collective order book specifying what species/sizes/grades are desired
- A freely accessible national inventory with information about log supply, grades, sizes, age class, silviculture

- Recovery optimization software made available at a price point and via mechanisms suitable for small operations
- A product grader capable of ensuring consistent application of grading rules, facilitating aggregation of supply from multiple producers to meet larger orders, and avoiding customer disappointment/loss-of-faith

Essentially this technology is the equivalent of what is currently in use by much larger mills, but tailored for the needs of smaller producers with more diverse inputs.

4. Information needs for specification

In order to specify timbers, or at least to begin to select these as options, architects require quite different information than the usual technical specs on the timber attributes that have traditionally been provided from the forest industry. The main information to include in any sales documentation or promotion includes:

- Availability (is it always available or in limited stock)
- Lead times from ordering
- Price range
- Where to get it from/ who stocks this / contact information for a sales rep (someone that can visit them with samples or send them samples and field enquiries)
- Are samples available?
- Range of finishes – colour, stains, coatings etc. that can be supplied
- Compatibility with coatings and timber treatments
- Dimensions and grades available
- H Class and use specifications (durability, moisture zones and moisture protection needed, time onsite to season, installation requirements.)

5. Need for better in-ground estimates

In order to achieve the above (2), (3) and (4) would require fairly good oversight of what is available (harvested and in-ground), what is in stock and what is coming on stream. This is not essential if we focus on a few key species for supplying into one or two product applications, but needs to be much improved for a long-term sustainable timber supply into specialty applications coming from New Zealand-grown species. In addition, insight on quality and grade of available timbers will also require some improvement. Like the information requirements for architects, mills and secondary processors require some certainty of the availability and quality of resource coming onstream. As one workshop participant put it "*The paucity of information on quantity, location and quality is a problematic here because it's hard to sit down and say, if I put a mill here and I've got these transport costs this is the price at which I make a product*". The UC School of Forestry initiated research (Xu and Manley, 2022) to map specialty species in New Zealand using remote sensing and AI, which could be progressed further and integrated with a supply chain inventory and wood supply forecast database. On the ground assessments of resource quality are still required, however, as much of the current in-ground resource would have low grade recoveries (especially as many amenity plantings have been grown for shelter, erosion, riparian and other non-timber objective).

6. Difficulties with certification and regulatory barriers for small growers

Small growers, and mills taking log resource from a multitude of small farms are unable to certify their resource to the requirements of FSC certification standards, as required by the Green Building Council. Architects increasingly seek FSC certification as an industry benchmark for sustainable timber supplies. While one specialty sawmiller disputed the need for such certification for sustainably grown local exotic resource, this is now a downstream expectation by clients. It must also be noted that FSC covers more than only environmental standards and includes cultural and social elements of natural resource extraction and timber production. One workshop participant noted the pooling of small woodlot radiata pine logs in Northland with stocks being sold through larger forest corporates with FSC certification, and the whole of the resource being labelled "FSC". There was an

understanding during the online workshop that a certain small percentage of logs processed as FSC could come from unverified sources, which requires verifying with MPI. Without certification, the freedom to sell into some applications remains limited. It is perhaps a growing requirement for a local certification stamp to be introduced (like the National Hardwood Lumber Association or Appalachian Hardwood stamps in the USA, which state 'Verified legal') that can be used for local sales of homegrown timber, and be recognised by the New Zealand Green Building Council in lieu of FSC.

In addition. where homeowners and specifiers were looking to use alternative durable species for outdoor use, unless these had been verified and listed as an acceptable species within NZS3602, territorial authorities would often query the species suitability for application. The risk of such queries would deter specifiers from using alternative local resources over 'tried and proven' imports.

The online workshop also highlighted the lack of market 'gap' or specific need for locally grown species in the marketplace, so what is the local specialty purpose rationale? Local supply was ranked just 10/21 in terms of a desirable aspect by architects. In other words, all NZ timber users can readily find materials of sufficient quality, availability and consistency to meet current needs, largely by sourcing from imports. While the desire to have a higher proportion of timbers supplied domestically rather than through imports is strong in the growing sector, the driving needs for this are not fully clear and do not appear to be well described. Where legality and unsustainable supply of old-growth timbers have been mooted in the past (May, 2013) as the driver behind the need for greater domestic production, this doesn't seem to hold up with FSC certified imports compared to a lack of local certification, and the ability of timber importers to source old-growth alternatives from more sustainable plantation supplies (e.g. Fijian mahogany (*Swietenia macrophylla*), teak, Pacific rosewood etc.). If increased local production is a strong policy lever, the rationale would need to be on regional economic or 'NZ-Inc'/cultural grounds, not due to environmental qualities of imports, or lack of current material availability in the construction sector.

7. Modification technologies changing the game

A large body of knowledge exists to match natural timber properties of known species to end use requirements. Plantation fast-grown timbers, however, have very different properties to their old-growth counterparts, and the properties of the currently stocked New Zealand-grown minor exotic resource are still largely unknown (though some earlier small-scale clears trials and wood quality assessments have been undertaken). Chemical modification (sustainable timber treatments, acetylation, Indurite^{TM}); and thermal modification processes further change what the 'species' can do in service. This means that wood performance and specification is now less reliant on species categorisation, and more on how the timber properties can be best assessed, selected and sorted (i.e. graded), or further modified, for specified application.

8. Conversion rates low

The high cost of conversion to obtain sufficient timber of quality from young, small diameter logs, coupled with long freight cost to market was also highlighted. In sawmilling, even with radiata pine, the need to find useful markets for the bulk of the resource (i.e. grading sawlogs and value adding the top logs and the waste through chip, panel, pole or bioenergy markets) is essential. Given the low stocking of resource, and the few logs of each species being sawn, it is also very difficult to find sufficient stocks of the right grade from within one woodlot or farm supply. There is a need for regional aggregation, and standardised grading to select logs/timbers and distribute to a range of end market applications. This implies the requirement for working together as an industry to source logs, appropriately grade logs, and to aggregate market and distribute similar grade materials from multiple sources to fill orders. In a word, a local timber import and distribution business, but for local supplies. Aggregating species of similar properties together in one 'type' could also be undertaken, as was achieved for native flooring lots in the early to mid 20th century, where miro, matai and rimu were all sold together as tongue and grooved flooring stocks, or the SPF (Spruce pine fir) structural commodity lumber classification. In Canada, timber species are appearance graded according to similar colour and properties also (e.g Hem-fir; Dfir-Larch).

Possible forward approaches

There are three main approaches that we could take to raise the amount of New Zealand-grown wood used in domestic architectural fitout and design projects:

- Grow enough of a range of species, and the market will sort it out.

This could work if there was not already a clear and workable supply of imported timbers that can be selected from – why would the market turn to New Zealand-grown timbers just because they are available? In contrast to imports, New Zealand-grown timbers are as yet largely unproven in the market, and timber supply chains are not clear to specifiers. Without an incentive or clear reason to specify New Zealand-grown over imports, most specifiers will not respond to simply increasing the supply. Furthermore, the species listed in Table one of Haslett (1986) were grown and many are available in small quantity within New Zealand, but are not yet filling any market to a great extent.

- Grow the overall demand for wood vs other materials (rising tide), particularly as a structural material, and there will be a subsequent demand for New Zealand-grown specialty timbers.

The global building industry contributes around 18% of emissions, and architects are looking to use greater quantities of wood products in general. Tied to this is a current trend towards exposed timbers with clear finishes, lending to a desire for woodgrain to play a prominent part in the aesthetic. There is some precedent here in that where massive structural timber elements have been used in a project, the fitout also will incorporate exposed timbers, often clear plywood, OSB, or LVL (mostly made from New Zealand-grown radiata). However, in other project examples where wood is specified over other materials, the selected specialty species has clearly not been New Zealand-grown timbers but imports. There is a current architectural trend towards using more exposed wood, yet we have significant quantities of imported wood filling this need, rather than home-grown product.

- Specific targeting of 'low hanging fruit'

This seems the more sensible and specific route, and could take a few paths:

- Pick a few species that can cover a multitude of bases that are 'ripe' for substitution. Focus effort on these. (The online workshop highlighted *E. saligna*, and thermally modified poplar or cypress)
- Transition through imported/plantation species, then switch to NZ plantation resources once the volume of resource is there.
- Use lower grade material and improvement – ramp up Abodo[3] or Accoya or undertake thermal treatment of local exotic timbers that are poorer quality (eucalyptus, poplar, larch, acacia, redwood etc.) to substitute for imports.
- Promote on the supply risk 'buffer' as a supplement to potential future imported species shortages.

There is an apparent need to focus the initial efforts on a regional supply of *E. saligna* decking in Northland region, for the Auckland market, expanding to sell into the rest of New Zealand and export markets over time. While this market is being established, grow greater stocks of more suitable eucalypts (*E . microcorys and E. fastigata*) to eventually replace the *E. saligna* stocks, and allow E. *saligna* to be used for more suitable purposes such as flooring.

Having *E.saligna* in the NZ3602 is an obvious first consideration for substituting kwila, though some other timbers (*E microcorys* and *E. fastigata*) could be more suited to decking --due to *E. saligna*'s difficulty in drying and prone to surface checks -- but are not yet sufficiently stocked in Northland at the age class for ready harvest. It is also transparent that supplies will need to be 'ramped up' in volume, but in a planned way. In scaling up the volumes of sawn timbers available, the demand could easily outstrip supply and lead to market failure, in a similar manner to for example XLAM[4] or Accoya, should marketing increase demand for the specialty timbers above that which is reasonably available. It is also important to avoid uneven and fragmented supplies, which would create unreliable availability for customers, and could create a bullwhip effect in the supply chain.

[3] Thermally treated radiata pine product
[4] XLAM - A Cross laminated timber venture with 20,000m3 capacity that began in New Zealand before closing and moving to Australia.

A further consideration is to not list species in NZS3602, but to outline performance-based expectations, such that modified timbers can be listed as acceptable solutions.
Getting further timbers recognised as acceptable solutions in NZS3602 (through compilation of proven case studies in service or accelerated testing) would be very useful.

Thermal or chemical modification of species such as macrocarpa to meet the higher (non-durability) performance expectations bulleted above could also be considered, due to the lower cost and more plentiful supplies of cypress species. Ruapehu sawmill has shown the ability for thermal modification of low-grade species such as poplar, as well as a way to improve existing moderately durable timbers such as *C. macrocarpa* and *C. lusitanica*. Using thermal modification for improved dimensional stability of already durable woods could also help local species compete with the popularity of the highly stable cedar joinery market. Using thermal modification to provide a range of colours from the same species would also benefit architectural and furniture requirements.

It is apparent that a mobile grading machine should be developed to allow segregation of eucalyptus (and other key timber species) harvested stocks by processing path/ log and lumber grade. Such grading would allow for aggregation, identification and selection of suitable timber stocks for market application. This would necessitate a more linked up supply chain and database of what is being processed buy individuals, to provide sufficient resource from multiple processors across the Northland region.

Research efforts should be focussed to better integrate the supply chain, both in understanding resource in terms of location, age class and quality as well as designing ways to consolidate individual suppliers resource together for the purposes of efficient processing and marketing. Assisting in batch processing development of small portable TM kilns, and determining required grade class and grading machines for alternative New Zealand-grown species would also be a good use of government and industry funds.

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REFERENCES

Allen R. B., Bellingham, P. J., Holdaway, R. J., & Wiser, S. K. (2013). New Zealand's indigenous forests and shrublands. *Ecosystem services in New Zealand—condition and trends. Manaaki Whenua Press, Lincoln*, 34-48

Appelhanz, S., Osburg, V. S., Toporowski, W., & Schumann, M. (2016). Traceability system for capturing, processing and providing consumer-relevant information about wood products: system solution and its economic feasibility. *Journal of Cleaner Production*, 110, 132-148.

FCANZ (2011). Furniture and Cabinetmaking Association of New Zealand: Industry. Available: https://fcanz.wordpress.com/industry/

Haslett, A.N 1986 FRI Bulletin 119 "Properties and uses of exotic specialty timbers grown in New Zealand. Part 1: Notes on timber properties and test methods"

May. R. 2013. Timber Imports mean export of environmental impacts. Available : https://www.nzffa.org.nz/specialty-timber-market/headlines/timber-imports-mean-export-of-environmental-impacts/

Ouhimmou, M., D'Amours, S., Beauregard, R., Ait-Kadi, D., & Chauhan, S. S. (2008). Furniture supply chain tactical planning optimization using a time decomposition approach. *European Journal of Operational Research*, *189*(3), 952-970.

Waitangi Tribunal. (2011). Ko Aotearoa tēnei [electronic resource]: a report into claims concerning New Zealand law and policy affecting Māori culture and identity. *New Zealand. Waitangi Tribunal. Waitangi Tribunal reports*. Available: https://forms.justice.govt.nz/search/WT/reports/reportSummary.html?reportId=wt_DOC_68356054

Wood Availability Forecast – New Zealand 2021 to 2060. August 2021. Margules Groome: Auckland. 56pp

Xu, V and Manley, B. 2022. National forest owner survey and resource inventory of alternative species. Stage 2b: Mapping alternative species using remote sensing. Publication No: SWP-T143 Rotorua:SWP, February 2022 13pp