Ministry for Primary Industries
Manatū Ahu Matua

# Pre-Feasibility of a Mechanical Pulpmill Complex in Northland

## Local Impact Component

## Resource Analysis

## Market Analysis

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*Growing and Protecting New Zealand*

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Indufor ...forest intelligence

# Northland Inc

# Report

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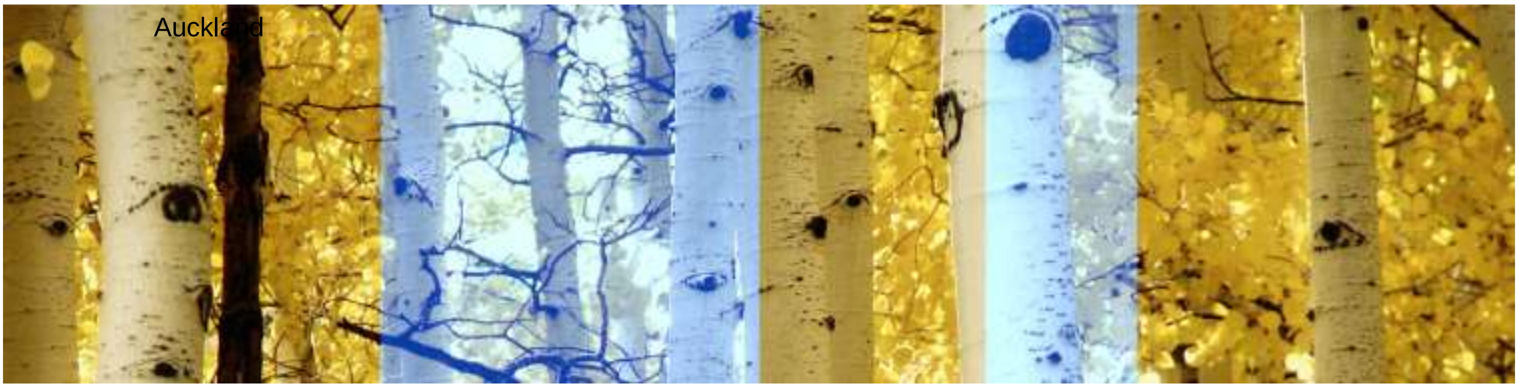
## Market Analysis

03 November 2016

A15-10911 Northland Inc.

Auckland



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## PREFACE

This report was prepared at the request of Northland Inc. (the Client) by Indufor Asia Pacific (Indufor). The intended user of this report is the Client. No other third party shall have any right to use or rely upon the report for any purpose.

New Zealand Trade and Enterprise (NZTE), in collaboration with Northland Inc. and Top Energy, approached Indufor to undertake an opportunity analysis of the potential for a wood processing facility in Northland in September 2014. From this process the concept for a world class integrated cut-of-log sawmill and mechanical pulpmill to be located at the Ngawha geothermal field near Kaikohe was validated as the most viable greenfield opportunity of scale for the region's wood processing industry. The analysis showed that mechanical pulping appears to have the highest Wood Paying Capability (WPC), while of the sawlog/peeler log activity, sawmilling is most attractive. This opportunity was listed in the Northland Regional Growth Study released in February 2015.

It should be noted that alternative processing options could prove more attractive to an investor, depending on their own product requirements and market position. This is particularly the case for MDF and/or HDF operations. These operations are to a large extent very similar to a mechanical pulping operation, relying on low cost fibre and energy to be competitive. In addition, today's MDF or HDF mills are of a scale similar to that of a mechanical pulpmill.

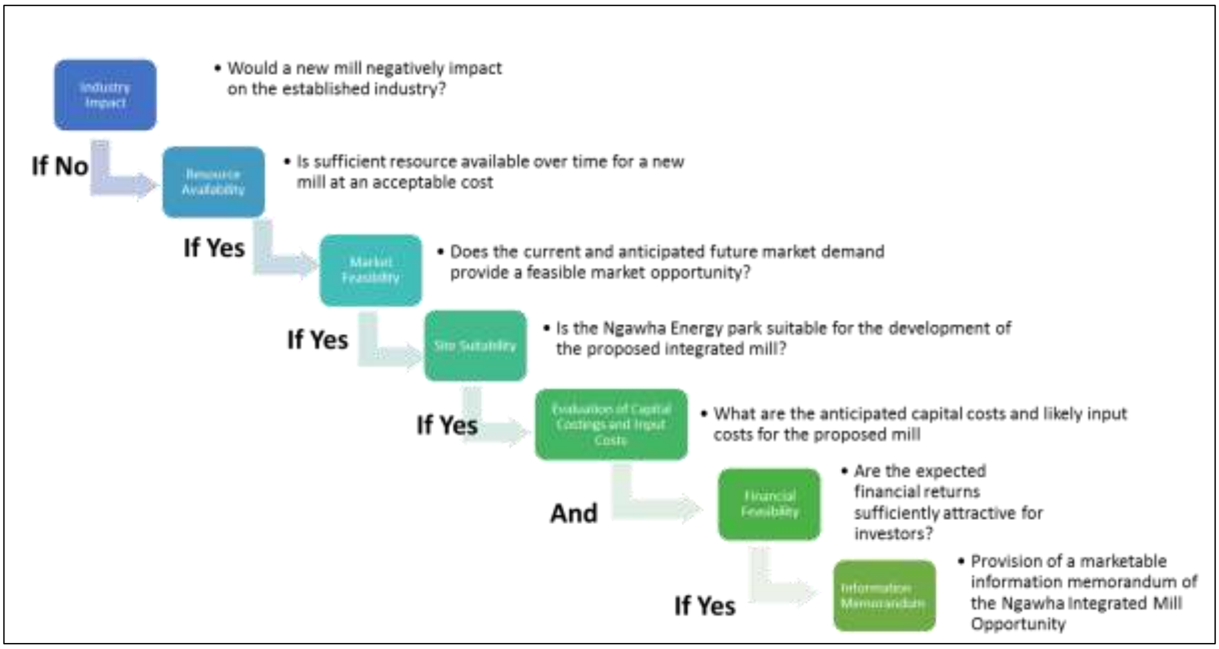
In its initial concept the facility was envisaged as having a capital value of approximately NZD750 million and would use geothermally generated electricity and heat to process 0.8 to 1 million $m^3$ of industrial and pulp grade logs. It was also based on the development of an 'energy park' within the vicinity of Top Energy's Geothermal Power Plant near Ngawha.

NZTE and Northland Inc., in collaboration with the Ministry for Primary Industry (MPI) (collectively the project sponsors) engaged Indufor to undertake a more detailed assessment of the Northland opportunity. The objective of the detailed pre-feasibility study is to evaluate the potential for establishing a sustainable and profitable integrated sawmill and pulpmill complex at Ngawha. The pre-feasibility assessment would include the following elements:

1. The impact of a new industry at Ngawha on the local community, resource owners, forestry industry supply chain and the local and regional economy.
2. Resource availability and implications for resource owners
3. Market demand
4. Site analysis
5. Technical optimisation/costing
6. Financial viability

From discussion with the project sponsors it was decided that initially the first three project elements would be undertaken, followed by an evaluation from the project sponsors to decide whether the analysis should proceed to completion or be stopped. This is not inconsistent with the overall rationale to stage the pre-feasibility assessment (Figure S-1).

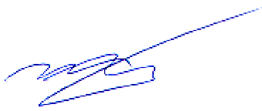
**Figure S- 1: Pre-Feasibility Staged Approach**




During early 2016 Indufor undertook the work associated with the first three elements of the pre-feasibility study. This report focuses on those first three elements, assessing the impact of a new industry at Ngawha on the local community, resource owners, forestry industry supply chain and the local and regional economy.

This report may only be used for the purpose for which it was prepared and its use is restricted to consideration of its entire contents. The conclusions presented are subject to the assumptions and limiting conditions noted within.

**Indufor Asia Pacific**

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## EXECUTIVE SUMMARY

### Key Findings

Northland presents a real opportunity for the development of a new wood processing industry.

A Northland located industry would benefit from the availability of competitively priced sustainable geothermal power, the availability of suitable resource and good infrastructure and export facilities.

Potential processing options that would best utilise those competitive advantages are pulpwood processing activities such as MDF/HDF and mechanical pulp, as well as sawmilling options not competing with the currently well-established industry focused on structural lumber and high density veneer logs.

Indufor's research indicates that the combination of the proposed plant types would:

- Yield significant economic benefit for Northland through the provision of new jobs and purchases of goods and services.
- Provide the highest wood paying capacity for both forest owners and the investor among all the opportunities previously assessed.
- Not compete directly with other Northland wood processors because it would use export logs and local residues as its feedstock.
- Help stabilize the industry by providing forest owners with a large customer for logs and chip that currently have a very limited internal market in Northland.
- Be able to access sufficient wood-fibre, provided that fluctuations in volume supplied between large scale corporate forests and fragmented private forestry suppliers, could be managed over the life of the proposed mills.
- Require an investor to embark on a number of targeted wood-sourcing strategies to ensure that sufficient volumes could be obtained from private forest owners including iwi when corporate harvests were lower and annual harvest variations smoothed.
- Reduce heavy log traffic for export through the region to Northport at Marsden Point, replacing it with lighter container trucks.
- Need to adhere to environmental guidelines and consent conditions to minimise adverse impact on land, air and water.

### Local Impact Analysis

To develop an understanding of the local and regional views on the development of such an industry, a local impact assessment was carried out. A range of potential stakeholders was interviewed and the impact of a new mill was discussed (Figure S-1)

Key findings from this assessment indicate that half (50%) of the people and local entities interviewed would require a more concrete understanding of the actual industrial development before being able to better form their opinion, while some 42% could see potential benefits to them or the local and regional communities.

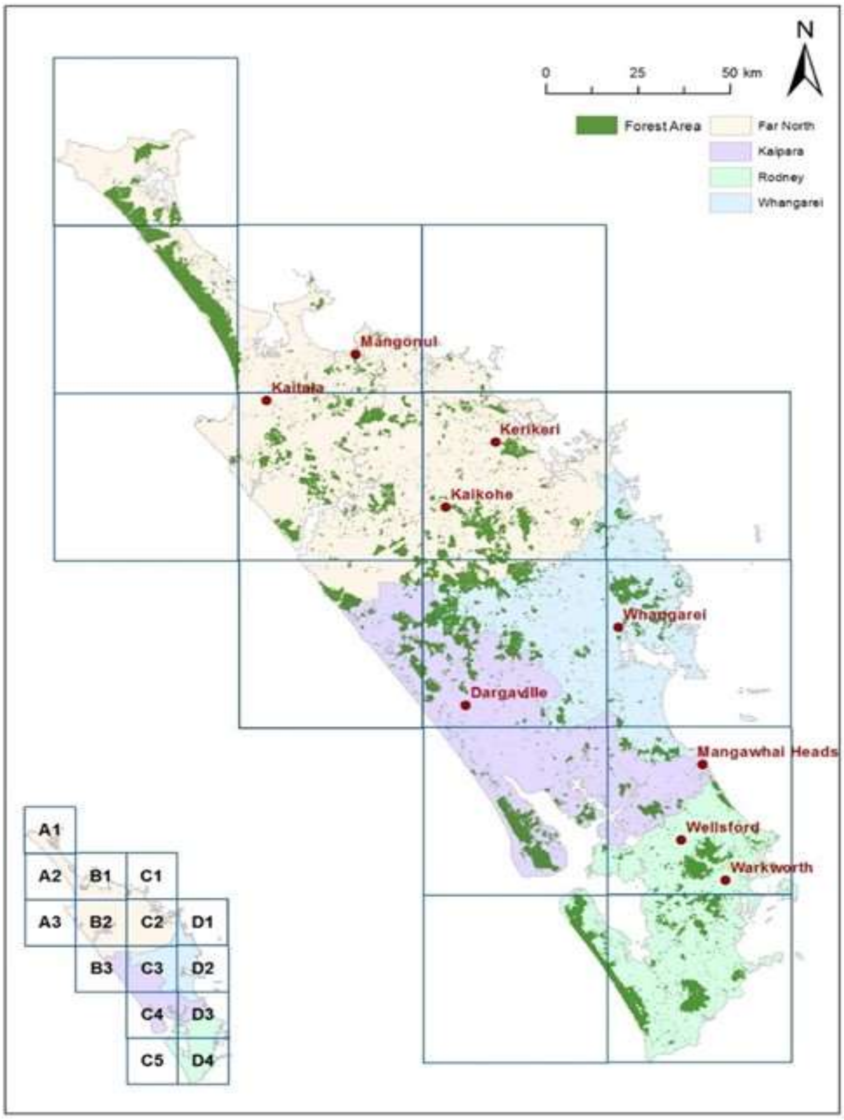
It was clear that important considerations for all interviewed were that a new industry should not have negative impacts on the environment, local and regional communities, infrastructure and, importantly, the established local industry. In addition, there was a clear indication of a desire by the regional land owners to have some form of direct involvement.

### Resource Availability

In terms of the available resource in Northland, the resource analysis shows that there is sufficient resource available to develop a new industry. It should be noted that such an industry will compete directly with log exports and, as such, will only be able to access the required volumes by outcompeting export markets.

To enable a more refined description of wood flows to be developed, the Northland region was divided into 15 grid squares or cells (Figure S-1). Separate area, yield and cost estimates were developed for each grid square.

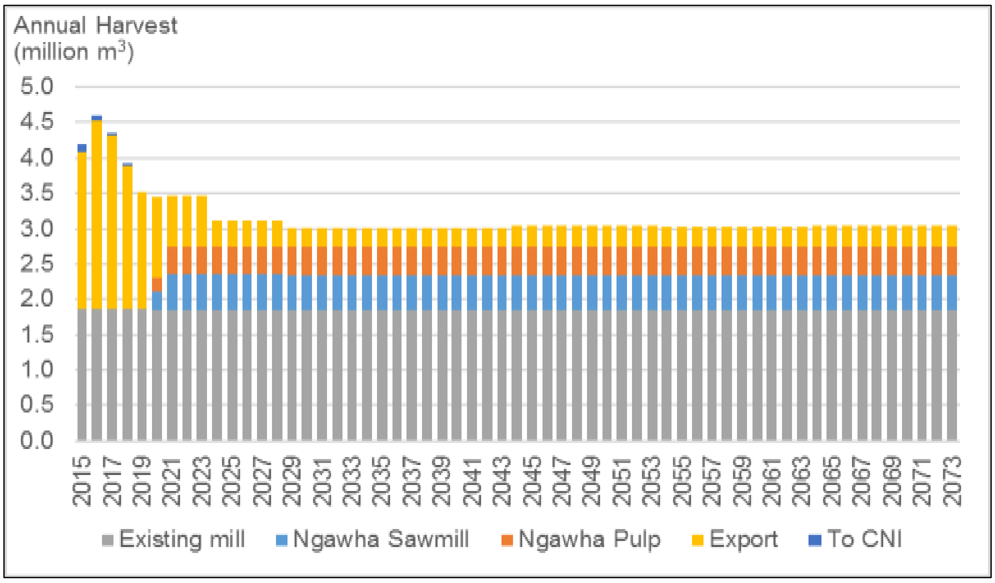
**Figure S-1: Grid Layout - Northland Region**




Indufor analysis suggests there would be sufficient volume to support the proposed new Ngawha mills as well as the existing mills in Northland. Figure S-2 shows the resulting wood flow when both existing and the proposed new mills are supplied[1].

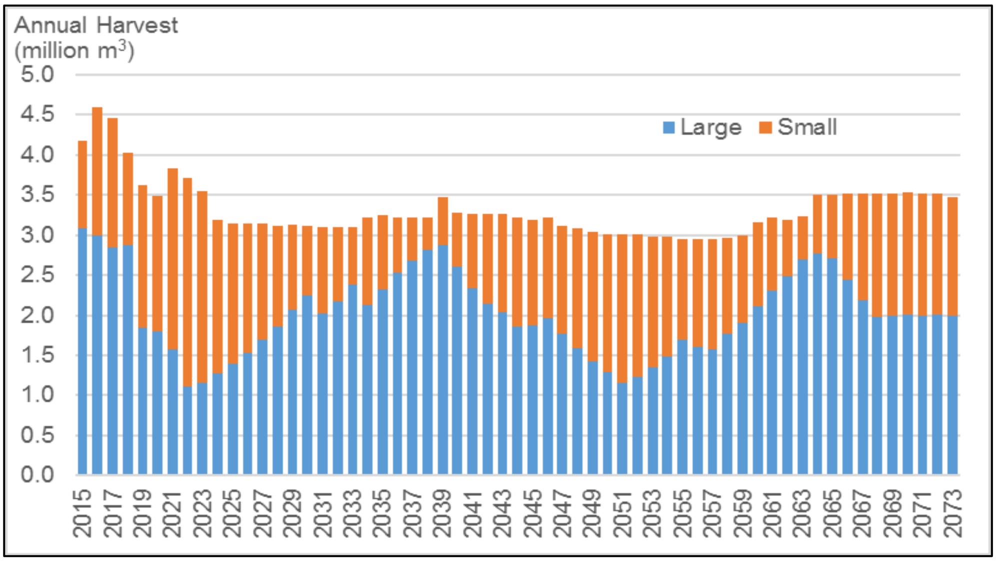
[1] Resulting wood flow also includes some block smoothing constraints to reduce annual volatility in harvest levels

**Figure S-2: Northland Wood Flow - Existing and Ngawha Mills Supplied**




Over the next 7 to 8 years an increasing proportion of the Northland harvest will come from owners with relatively small areas (less than 1000 ha). This will present some challenges in securing supply as it is unlikely that any one owner will be able to provide consistent volumes over a long timeframe. Prevailing log prices will be a key determinant of the extent to which these small owners decide to harvest. The proposed new mills are likely to come on stream at close to the time when supply from the major forest owners are near their minimum levels (Figure S-3).

**Figure S-3: Northland Wood Flow by Ownership Size Class[2]**




The Ngawha site is well located with respect to large parts of the Northland estate. Indufor estimates log transport cost savings in the range of NZD90 million to NZD118 million could accrue from delivering to the Ngawha site rather than export. It is likely this cost saving would

[2] The wood flow presented includes the option for alternative silvicultural management but does not include any new planting

be shared between the forest owner, through reduced costs and therefore higher stumpages, and the log buyer (i.e. the Ngawha mill) through lower delivered log costs.

A further consideration would be the mix of log grades utilised by the mills. While there is sufficient fibre available there would be a need for flexibility in the specifications of the logs consumed. This would include log grade/quality, diameter and length. Length is likely to be a key aspect with domestic mills typically preferring longer lengths.

Figure S-4 shows the mix of log grades resulting from this modelling exercise that might be supplied to the Ngawha pulpmill. Figure S-5 shows the potential supply by grade to the Ngawha sawmill. The log mix will ultimately be strongly influenced by the relative pricing paid by the mills, but it does provide an indication of the log types that would need to be utilised if existing Northland facilities were to continue to be supplied with the current log demands.

**Figure S-4: Potential Log Grade Mix Delivered to Ngawha Pulpmill**

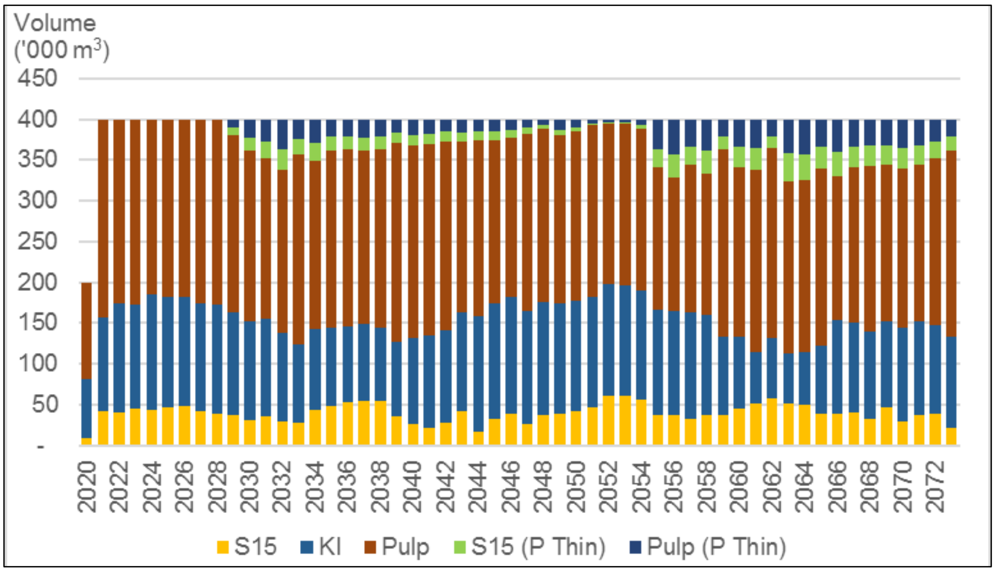
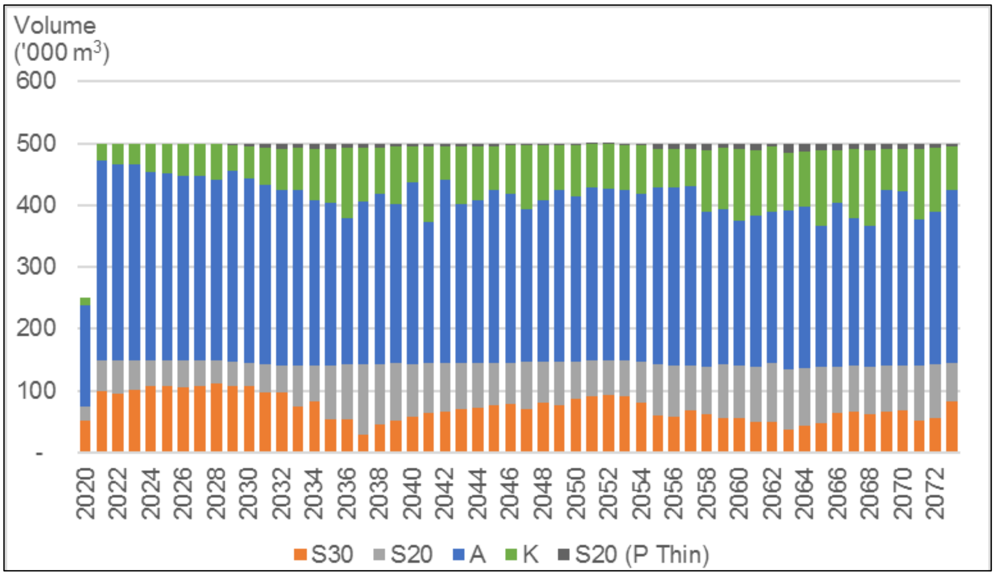



**Figure S-5: Potential Log Grade Mix Delivered to Ngawha Sawmill**




Costs of production, including logging, roading construction and maintenance and harvest management and marketing, average around NZD47/m$^3$ for logs supplied to the Ngawha facility during the first 10 years of operation. Similarly, transport costs average close to NZD14/m$^3$.

With the prices assumed in this exercise this would result in delivered log prices to the pulpmill of NZD64.69/$m^3$ and NZD112.14/$m^3$ to the sawmill. The corresponding stumpage returns to the forest owner are NZD3.79/$m^3$ and NZD51.12/$m^3$, respectively.

**Market Analysis**

Markets for mechanical pulp and sawn timber in Asia are forecast to continue to expand. Markets for radiata pine BCTMP pulp will be driven by increasing demand for packaging grades of paper and board.

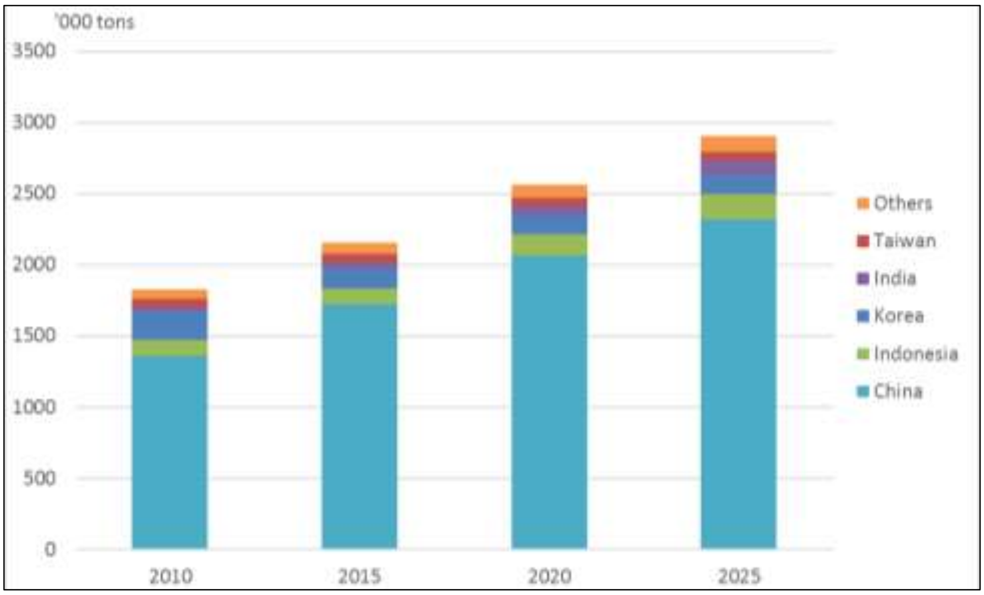
Indufor's analysis determined that the current market for mechanical pulp (market mechanical pulp) is around 4.5 million tonnes. Over the past decade and a half demand has been increasing at an average rate of 2.4% per annum.

The main features of global market mechanical pulp consumption are:

- Around 70% of the total current consumption is essentially BCTMP type pulp made from hardwood.
- Around 3.2 million tonnes (71%) of all the market mechanical pulp is consumed in Asia and India.
- China alone accounts for 50% of the world's current consumption.

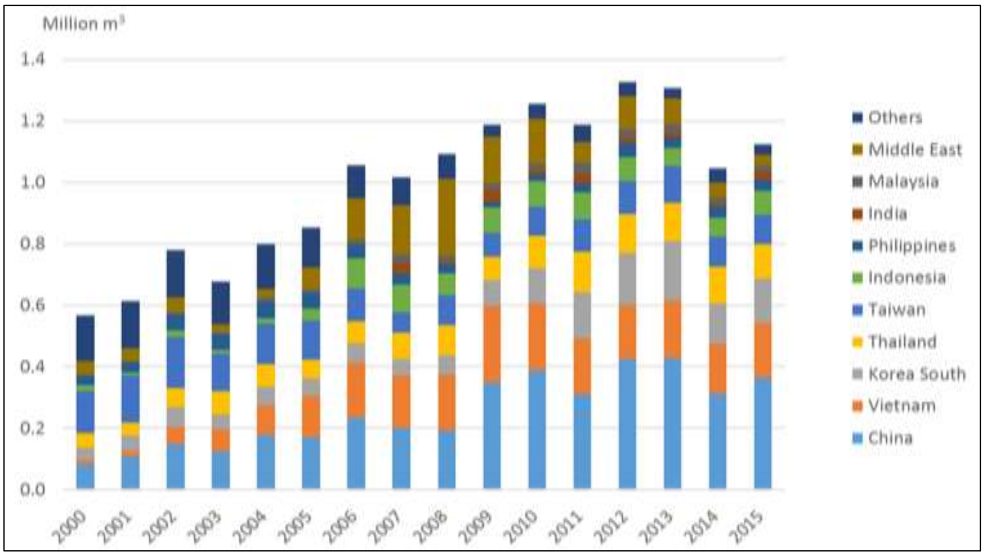
Within Asia, most of the market pulp consumed in the region is in China (Figure S-6) although India is now a recognised and growing market. The China market has grown by around 5.2% annually since 2010 while India has been developing at a slower pace of 4.2%/a.

**Figure S-6: Market Pulp Demand in Asia**




New Zealand is a major exporter of radiata pine lumber and over recent years the share of industrial grades of lumber has increased considerably. Exports of industrial grade lumber were estimated at some 1.1 million $m^3$ in 2015.

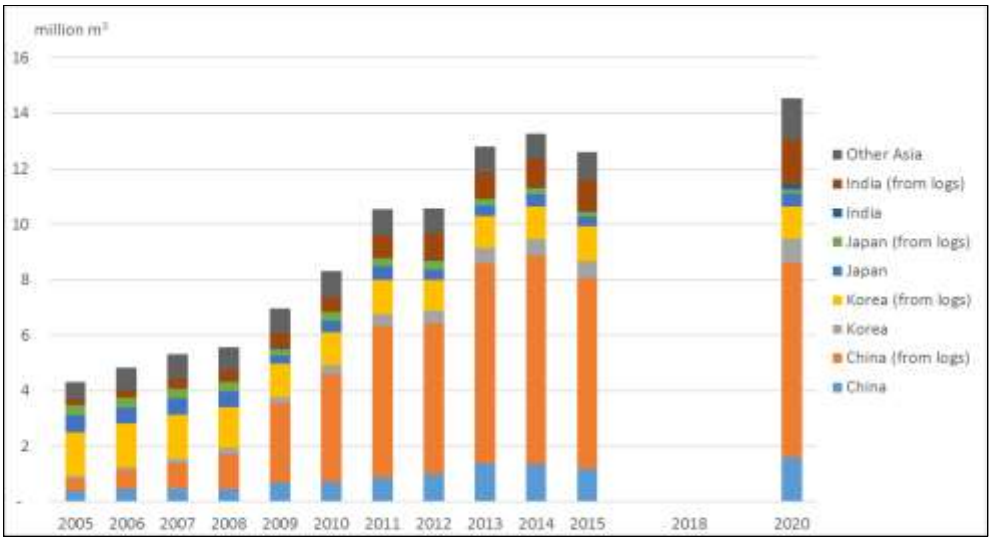
**Figure S-7: New Zealand Exports of Industrial Grade Lumber by Destination**




Source: GTIS and Indufor Research

Radiata pine has a significant market presence in Asia, as lumber is supplied from New Zealand, Chile and to a lesser extent Australia. This supply is augmented by a very large domestic (in Asia) production of radiata pine lumber produced from imported logs. The total radiata pine lumber market in Asia is estimated to have reached 13 million $m^3$ in 2014 (Figure S-8). China is by far the single largest market for radiata pine lumber accounting for 68% of total radiata pine lumber demand in 2014.

**Figure S-8: Radiata Pine Lumber Market in Asia**




Currently, most radiata pine is used in lower value lumber end uses such as temporary construction and packaging. End uses in Vietnam are noticeably different, wherein most the imported radiata pine lumber is used in furniture manufacture. However, the industry does import lower value lumber, and defects, and re-cuts this to produce the clearwood required.

Although demand in the last year has eased, the longer-term outlook is positive. Radiata pine is a well understood lumber species that is competitive against major competing softwood and certain hardwood alternatives in Asia.

As in-country production costs increase overseas, the opportunity to supply kiln dried lumber from New Zealand will continue to improve over time.

## ABBREVIATIONS AND GLOSSARY OF TERMS

| Term | Explanation |
|---|---|
| /a | Per annum, or year |
| /d | Per day |
| ADt | Air Dry tonnes |
| AMG | At Mill Gate |
| APMP | Alkaline Peroxide Mechanical Pulp |
| BCTMP | Bleached Chemi-Thermo-Mechanical Pulp |
| BHKP | Bleached Hardwood Kraft Pulp |
| CAGR | Compound Annual Growth Rate |
| C&F | Cost and Freight |
| CIF | Cost Insurance and Freight |
| COL | Cut of Log |
| CTMP | Chemi-Thermo-Mechanical Pulp |
| FBB | Folding Box Board |
| FOB | Free on Board |
| Ha | Hectare (10 000 $m^2$) |
| m2 | Square mete |
| $m^3$ | Cubic meter |
| NZTE | New Zealand Trade & Enterprise |
| P&W | Printing and Writing |
| P-RC APMP | Pre-conditioning Refiner Chemical Alkaline Peroxide Mechanical Pulp |
| RCF | Recycled fibre |
| t | Tonnes, metric |
| t/a | Tonnes per annum |
| t/h | Tonnes per hour |
| TMP | Thermo Mechanical Pulp |

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**Appendices**

# 1. INTRODUCTION

## 1.1 Context

New Zealand Trade and Enterprise (NZTE), in collaboration with Northland Inc. and Top Energy, approached Indufor to undertake an opportunity analysis of the potential for a wood processing facility in Northland in September 2014. Currently only about a third of the timber harvested in the Northland region is processed locally, predominantly into structural timber products such as graded sawn timber and LVL. There was a view that, given the size of the forest estate in Northland, the region has the potential to absorb additional wood processing capacity.

The opportunity analysis identified the possibility of establishing an integrated sawmilling and mechanical pulpmill processing facility located at a proposed ‘energy park’ within the vicinity of Top Energy’s Geothermal Power Plant near Ngawha. The analysis showed that of all the pulpwood/residue using industries, mechanical pulping appears to have the highest Wood Paying Capability (WPC), while of the sawlog/peeler log activity, sawmilling is most attractive.

Therefore, the key outcome from this initial research was the validation of a concept for a world class integrated cut-of-log sawmill and mechanical pulpmill to be located at the Ngawha geothermal field near Kaikohe. This was perceived to be the most viable greenfield opportunity of scale for the region's wood processing industry, taking into account the specific need not to detract from the viability of other wood processing facilities in the Northland region.

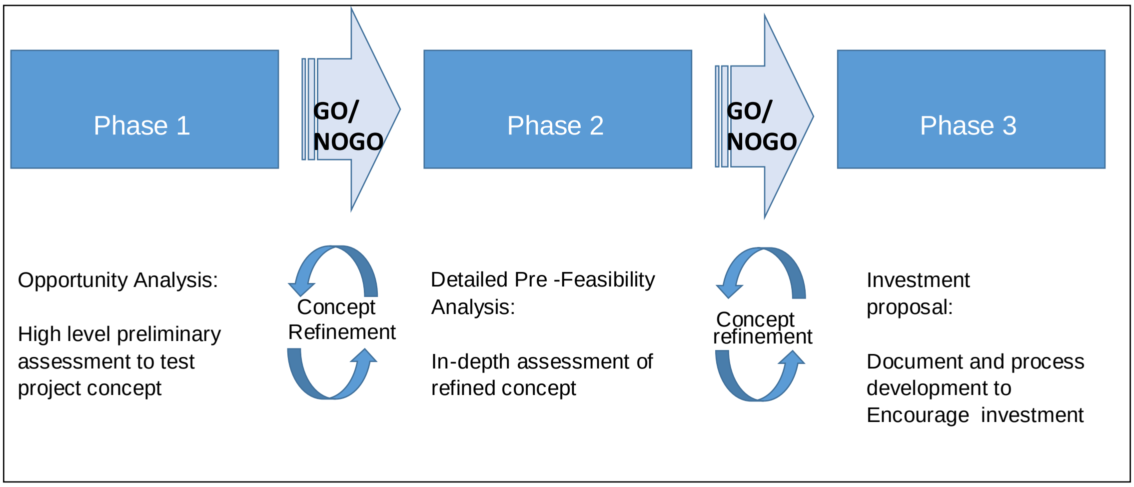
In its initial or conceptual stage, the facility is envisaged to have a capital value of approximately USD750 million and would use geothermally generated electricity and heat to process 0.8 to 1 million $m^3$ of industrial and pulp grade logs, which are currently exported unprocessed.

Map 1-1: Northland Region Forests


In February 2015 the New Zealand Government released the Tai Tokerau Northland Growth Study Opportunities Report (the Northland study). This report is part of a wider programme which is focused on identifying and progressing opportunities to achieve growth in investment income and employment in these regions. A key recommendation of the Northland study is the potential for a new sawmill and pulpmill facility at Ngawha.

NZTE and Northland Inc in collaboration with the Ministry for Primary Industry (collectively, the project sponsors) are now looking to carry out a more detailed analysis (detailed pre-feasibility) of the concept, as part of an overall framework for project evaluation and promotion. Although there appears to be an opportunity for this new greenfield processing facility the integrated mechanical pulpmill and sawmill would still need to be able to secure sufficient resource and power and have access to markets, to be viable.

**A Phased Approach to Project Evaluation and Promotion**




## 1.2 Pre-Feasibility: The Task Objective

The aim of the detailed pre-feasibility study is to evaluate the potential for establishing a sustainable and profitable integrated sawmill and pulpmill complex at Ngawha. The assessment of the proposed integrated sawmill and pulpmill project was to include the following elements:

1. The impact of a new industry at Ngawha on the local community, resource owners, forestry industry supply chain and the local and regional economy.
2. Resource availability and implications for resource owners
3. Market demand
4. Site analysis
5. Technical optimisation/costing
6. Financial viability

## 1.3 Work Approach

Following discussion with the project sponsors it was decided that the work done for the pre-feasibility stage of the engagement would also follow a staged approach with focus directed on the first three elements of the assessment. This will allow for a detailed approach with clear Go and No-Go steps.

**Stage 1: The impact of a new industry at Ngawha on the local community, resource owners and Forest Industry in the context of local and regional economy**

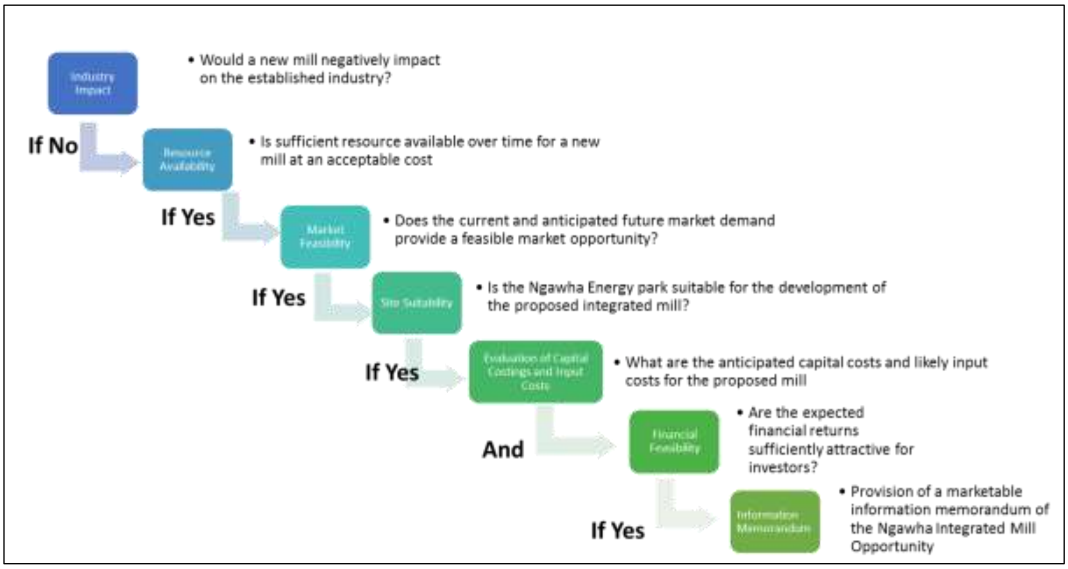
It is important to establish how the proposed concept would fit within the existing forestry and wood processing industry structure in Northland and the impacts that it would have on the industry and the community. The first stage of the pre-feasibility therefore undertook to evaluate and discuss:

- The strategic fit of the proposed mill within the Northland forestry sector
- How existing sawmills and other wood processors would be affected by the proposed additional processing capacity.

- The direct and indirect impacts on local communities in terms of training needs, job creation, stability of jobs in the mill and supply chain operations as well as wider social impacts.
- Opportunities available for the use of existing sawmilling capacity or new or modern used plant capacity for the proposed sawmill.
- The scope for Iwi participation in and benefit from the proposed project as forest owners and log producers and suppliers of other goods and services, including labour.

Stage 1 includes a range of interviews with key stakeholders such as local and regional forest owners, processors, training providers and various Iwi and their associated commercial arms. An important aspect of undertaking the local impact assessment as a first stage is that work outputs will form important inputs to Stage 2 of the work approach.

**Figure 1-1: Pre-Feasibility Staged Approach**



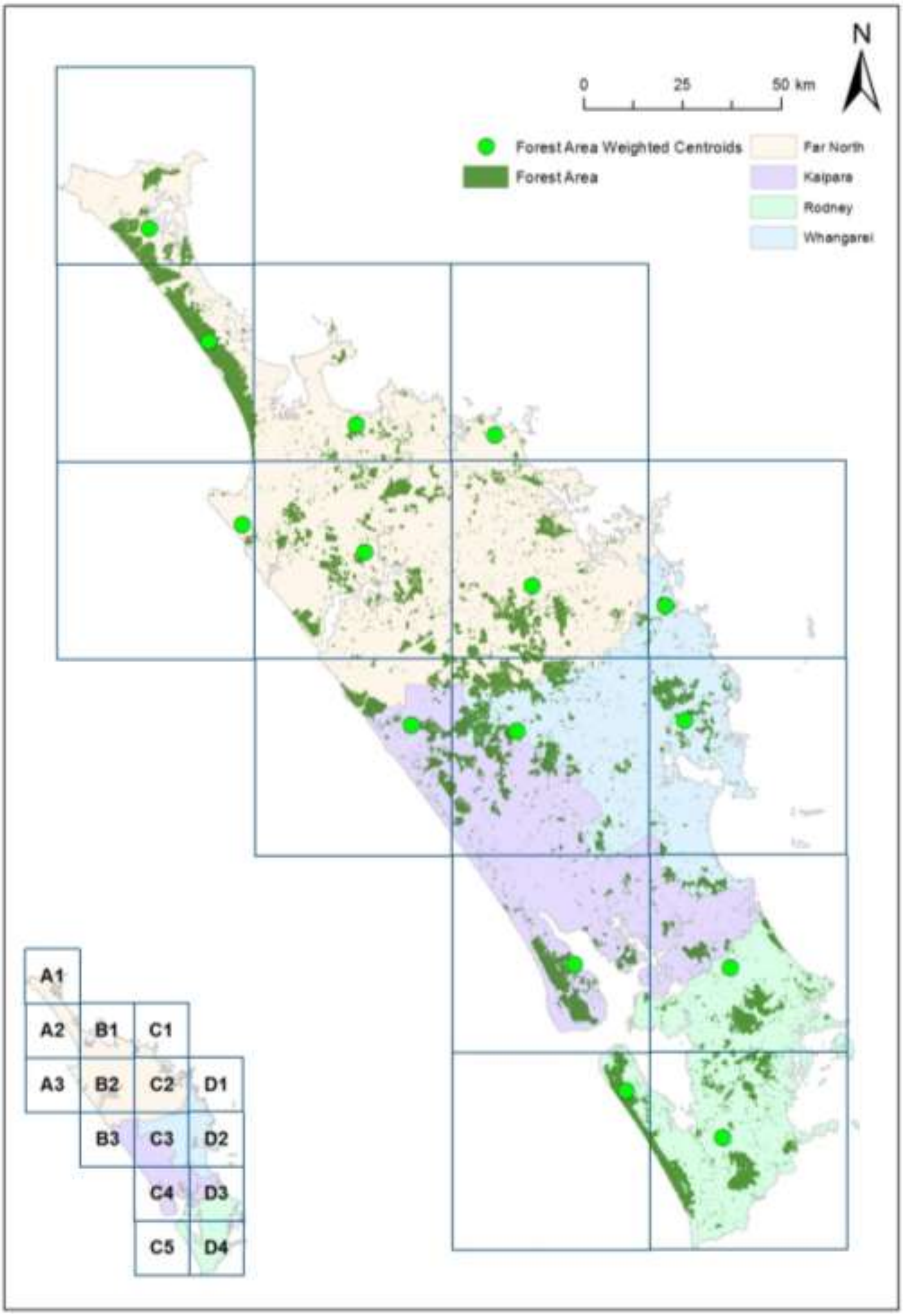

**Stage 2: Resource Availability**

Combining Stage 1 inputs, the second stage of the pre-feasibility assessment involves developing a wood flow supply model for a mill located at Ngawha. The model will be interrogated to develop a clear understanding of:

- Anticipated wood availability by grade and source over time
- Inter-regional wood flows
- Resource supply location over time
- Anticipated wood density over time
- Supply cost of the resource over time
- Factors that will influence the future quantity and quality of wood supply including replanting of former Crown Forest Licence Land acquired by iwi and reassignment of export logs
- How changes in supply would affect the feasibility of additional processing capacity
- The impact of new plantings, and potential for shorter rotation regimes.

The model utilises the latest available data from MPI regional supply forecasts, geographical known location of plantations, and yield tables based on those developed by MPI, modified to account for productivity differences in Northland. Indufor grouped the Northland resource into 15 individual cells. Within each cell Indufor developed a number of appropriate yield curves to provide best estimates of the wood supply by log grade over time. Information on age-class structure and tending regimes employed in Northland was developed using a combination of data published in the NEFD and other non-confidential information sources.

**Map 1-2: Breakdown of the Northland Wood Supply Region into 'Cells'**




**Stage 3: Market Demand**

Indufor carried out market studies into both mechanical pulp and sawn timber markets. The research focused on proving the market demand viability for the proposed integrated mill and was a combination of desk based study and targeted industry interviews, both telephone and face-to-face. The face-to-face interviews were seen as crucial to define the appetite of the potential major customers and end users of the mechanical pulp and lumber products for either equity investment in, or take-off agreements for potential products from the proposed Ngawha mill.

The key variables evaluated in the market analysis include, but are not limited to:

- Current and future demand for mechanical pulp and sawn timber grades likely to be produced by the Northland facility.
- Identification of likely key competitors and competitive position of the Northland mill against those international competitors.
- Current and future prices for mechanical pulp and sawn timber.
- Identification of the appetite from potential markets and investment partners for the proposed Ngawha mill project.

### 1.4 Reporting

Although the intention was to sequentially evaluate each stage, the idea being that project feasibility was to be validated at each stage before work on the next stage was undertaken, the practical application of the work as discussed with the project sponsors saw the first three stages being undertaken more or less simultaneously. Reporting for each stage therefore necessarily was separated into independent subject matter reports.

This report focuses on Stage 1; The impact of a new industry at Ngawha on the local community, resource owners and forest industry in the context of the local and regional economy, collectively grouped as local impact.

# 2. SECTION ONE: LOCAL IMPACT ASSESSMENT

## 2.1 Methodology

The local impact assessment was undertaken as a combination of desk and field work with the primary objective being the collection and analysis of views expressed by stakeholders within the Northland region.

## 2.2 A New Mill

The local impact assessment has been made without the stakeholders having detailed knowledge on the actual mill, other than a high level concept.

The ultimate mill concept, design and scale will be decided upon by the investor(s). However, it has been assumed that the new mill should not, and will not have a negative impact on the existing industry. As such, in all the analysis it has been assumed that all current operators remain, and will have the potential to increase log intake. The mill would have to compete in the market for logs – and the main competitor is assumed to be the export market. As a result of this the new mill would significantly reduce the availability for logs to export. This will impact on the Marsden Point port operations, reducing log export volumes – but potentially increasing lumber and pulp exports.

Utilising a wider range of log grades within Northland should ultimately improve returns to forest owners, increasing the attractiveness of investments in forestry.

Having a major local demand for residues should assist existing processors, allowing them to increase competitiveness and with that their market opportunities.

Increasing the volumes of logs being processed in Northland will result in an increase of local employment opportunities. This will come through direct employment by the processing industry as well in the various support services for the industry.

## 2.3 Field Interviews

Structured and semi structured interviews, whether conducted in person, by telephone or through e-mail correspondence were undertaken from February to early April.

Although a few themes (employment issues, investment appetite, plantation development plans and environmental concerns) were considered in advance to facilitate the interview process, the intent of the interviews was to allow interviewees to provide spontaneous responses to the project. The perspective of the interviewer was therefore one of a disinterested party. Following a description of the proposed concept and the pre-feasibility work being undertaken, the role of the interviewer became one of a documenter, listening and recording viewpoints, impressions, concerns and aspirations under objective conditions[3] and in the absence of judgement.

In total 32 entities were contacted (Figure 2-1), the majority being iwi, hapu and associated asset holding companies or trusts set up to administer assets returned to iwi as part of treaty claim settlements. Many of these entities currently own forest resources or land which is presently forested. The main Northland forest owners or managers were also contacted along with some smaller entities contacted through Te Taitokerau Māori Forestry Collective. Other

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[3] When conducting interviews it is not always possible for interviewers to be completely objective. In some cases, interviewees, who may be struggling with understanding the requirements, require initial guidance and encouragement to facilitate the response process. However, this could lead to response bias where only a limited range of suggested themes are focussed on. Further it is frequently necessary for the interviewer to affirm that the interviewee is providing useful feedback. However, even a seemingly innocuous statement such as “these comments are what we are hoping to elicit” could have a bias by encouraging further commentary in a particular direction, potentially at the expense of other thought pathways. Indeed, any input by the interviewer could potentially introduce bias to the interview process. Fortunately, nearly all the interviews undertaken for this project required minimal input, interviewees providing their dissertations without the need for prompts.

entities that were contacted included education providers, local and central government representatives and the Taitokerau Māori Forestry Collective.

Not all contacted parties were prepared to be interviewed. In total Indufor secured meetings with 26 entities, carrying out 20 interviews (Table 2-1). The response rate to interview requests was around 81%. Most interviews involved one-to-one discussions but in some instances (in particular where an iwi board and their associated asset holding company or trust were being interviewed) interviews were conducted with two or more entities represented. Of Northland Maori stakeholders, six of the nine mandated iwi (Government recognised iwi of the Northland Region from the Fisheries settlement) were interviewed. Additionally, two hapu with significant forest holdings were also interviewed.

Meetings with forest resource or land owners also included Maori land trusts along with the four major forestry organisations owning and harvesting trees in Northland. Numerically, sawmills dominate most of the wood processing in Northland and also represent the largest user (by group) of logs processed domestically. Not surprisingly then, most of the meetings made with wood processors were with sawmilling entities, some of which are in private Maori ownership.

Indufor considered the interviews to be of good quality with two notable exceptions, one where the interviewee represented an entity with minimal interest in the project and limited stakeholding. The second was where it was difficult to motivate interviewees to provide feedback, and where corrections to the interviewees concept of the project was necessary. In all other cases, responses tended to flow unprompted, and were generally highly relevant to the concept being evaluated. The findings of the research were used to derive the outcomes of the local impact assessment.

**Figure 2-1: Distribution of Entities Contacted**

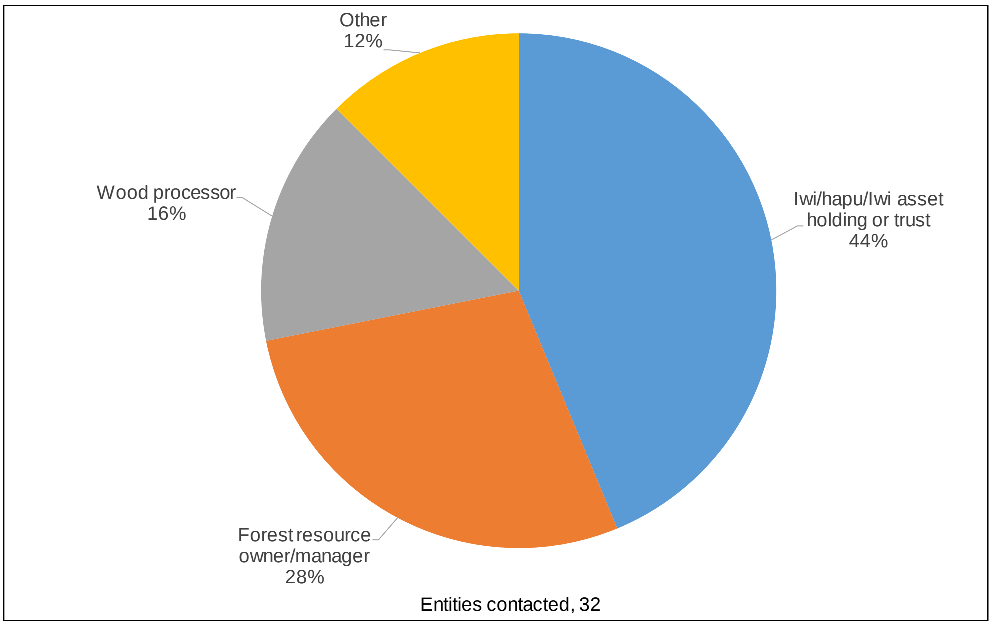



**Table 2-1: Entities Contacted and Interviewed**

| Entity Grouping | Number Contacted | Number Interviewed |
|---|---|---|
| Iwi/hapu/Iwi asset holding or trust | 14 | 10 |
| Forest resource owner/manager | 9 | 8 |
| Wood processor | 5 | 4 |
| Other | 4 | 4 |
| **Total** | 32 | 26 |

### 2.4 Desk Based Research

A limited review of published documents was undertaken to augment the findings from the interview process. The research targeted documents alluded to or considered relevant by interviewees in relation to the proposed project. Examples included documents released by the Te Taitokerau Forestry Collective, Northland's Council of Iwi Chiefs, various iwi trust annual reports and published documentation by individuals and land owner trusts in relation to:

- Strategic use of land
- Economic strategy for Northland
- Directives and charters focussed on future self-determination
- Diversification and stationarity of resources.

The findings of the research were not treated as a stand-alone body of evidence. They were incorporated with the research outcomes of the field interviews to derive the outcomes of the local impact assessment.

Details of the field interviews and desk based research are presented in Appendix 1. The following sections summarise the findings.

### 2.5 Interview Outcomes

#### 2.5.1 Receptiveness to the Proposed Project

Generally the interviewees were partly receptive to the concept and the potential to help develop Northland's economy. Around 42% of the entities interviewed were of a favourable disposition, at least at this preliminary stage. Around 8% of respondents were not in favour. The balance (50%) did not indicate a position either way. The conclusion at this stage is that local stakeholders are undecided, and could be in favour, impartial or against the planned project depending on future information and project development.

Additionally, interviewees expressed favourable responses in terms of the potential for the proposed project concept to:

- Generate employment
- Promote education
- Support/drive infrastructure development and use.

Around 42% of respondents noted that the proposed concept would be beneficial in terms of generating direct and indirect employment. Around 8% felt the project would lead to job losses elsewhere in the forest industry in Northland. Some 15% of respondents felt the project would provide momentum to improve the level of education in Northland. Around 19% of respondents felt the proposed project concept would also provide momentum for the development and improvement of Northland's transport infrastructure, or help in reducing road traffic on main arterial routes, especially around Whangarei. Few interviewees anticipated any negative implications for infrastructure other than concerns that there will be increased noise and road traffic on local feeder roads and that such roads may be damaged if not properly upgraded for heavy traffic.

In terms of generating investor interest, half of the Iwi or their associated trusts expressed interest in at least considering the potential for investment in the project. Those that did not cited only financial constraints as being the key preventative factor. Fundamentally most Northern Maori executives did not demonstrate opposition to the proposed project at least at this stage.

The insightful responses of one respondent regarding the potential benefits of the proposed project indicated such a proposed facility at the suggested scale will, for a long period, provide the basis for moderating wood flows, stabilising price movements and providing long term employment. The potential benefit of the proposed project could then extend for decades.

Receptiveness to the proposed mill concept was caveated by many respondents, whether they overtly registered their receptiveness to the project. Key responses included:

- The proposed project would be supported if it does not adversely affect local processing.
- The proposed project would be supported if there is sufficient wood available to support the development of the facility. Emphasis should be on reducing log exports in favour of domestic processing.
- The proposed project will need to ensure air, water, soil and geothermal areas will be protected to the satisfaction of local communities.
- Effort will be required on behalf of the government to ensure infrastructure is adequate for the project, not only in respect to the transport of logs to the mill but also for the transport of goods to port and facilitating the movement of labour to and from the mill.
- The impact of employment will need to be additive. That is, there will be support for the project only if it increases the employment opportunities in Northland over and above the existing level of employment.

If the proposed mill concept and project does not meet or address these concerns, support for the project will diminish.

### 2.5.2 Concerns

Many interviewees raised concerns in relation the proposed mill project. These included the following:

- Is the proposed concept the best use of the Northland pine resource? Should alternative mill processing be considered, including different business concepts?
- The proposed mill scale may be too ambitious.
- Are there really markets for the proposed products, BCTMP in particular?
- The proposed new mill facility will compete with existing processing and could affect operations and employment by drawing employees to the facility.
- Is the mill concept the right economic model for Northland in terms of integration with processing and forestry?
- The new facility may cause problems with road noise, dust, congestion and damage to infrastructure.
- Is there sufficient water to support the project and what will its impact be on existing water resources?

These observations are not necessarily critical to the decision on whether the project proceeds to further investigative stages. They do, however, raise important issues that will need to be discussed with the local communities or considered at later stages of the prefeasibility assessment. For example, questions raised with respect to scale and concept selection could be addressed through forum discussion with local stakeholders. Environmental concerns could be addressed at the latter stages of the prefeasibility study.

One particular concern may require specific attention. Some entities mentioned the economic model for the proposed project should take into account and consider important aspects such as the supply chain, integration of forest resources, collectivisation concepts, mill scale, and encouragement of local industry. This broadens the project concept beyond the consideration of a stand-alone wood processing facility to something that encapsulates the forestry value chain from the land to tree planting, management, harvesting and sale of logs.

It may not be possible to formulate the business concept in such a holistic fashion as it does not necessarily reflect the practical intention of interviewees who raised the questions. It may also create a business concept or model that at an overview level may sound inspired but in detail may be unwieldly and difficult to implement efficiently. Nonetheless the sentiments indicate that any tangible development of a new wood processing facility (whatever the mill concept) should be considered in the context of the aspirations and desires of Northland's forest resource owners. This represents an important opportunity for the proposed project.

### 2.5.3 Other Considerations and Opportunities for the Project

While much of the discussion with interviewees was directed at forests and forest resources, many of the issues and concerns raised regarding forestry were not directly related to the proposed mill concept at all. They do, however, present important considerations regarding the proposed project and important guidance to the overall project strategy for any potential investor. Indufor notes the following:

- Respondent commentary suggests that less pine is being replanted in Northland, once areas are harvested. A variety of alternative land uses are being considered by local Maori stakeholders (diversification strategies) and, with respect to smallholders, areas harvested now may never be replanted at all. The implication is that future wood flows from Northland's pine resource may be less than currently anticipated.
- At the same time, there is interest in expanding pine plantations, particularly with groups interested in taking a greater share of the value held in the tree as well as those who have undeveloped or idle land, or are awaiting treaty settlements which will include the return of Crown land assets.
- The large-scale forest owners and managers are implicitly aware of the benefit of a large scale domestic processing industry to facilitate long term stable wood demand.
- Generally, Maori land owners are not satisfied with the forestry business paradigms currently in place. The general feeling is that they have not benefited sufficiently from the employment of their land with forestry and, in isolated cases, have lost out financially.
- Maori interests (whether at the tribe, trust board or local ownership levels) have noted the importance of time (the strategic focus is intergenerational) sustainability and developing forestry models that allow the land owners greater self-determination through capturing or being involved in much more of the forestry value chain. These concepts have been documented, particularly in the Maori Forestry Collectives' strategic plan and the Northland Action Plan. The message is clear in terms of what is important to individual Maori land owner groups regardless of whether they have forest resources on their land or even have any interest in collectivisation as a strategy for scale.
- Maori have also articulated the importance of social outcomes - lifting education, employment, health and wellbeing of Northland's Maori community. There is a strong intention for Maori to retain ownership of their land for their family, sub tribe or tribe. Strategic concepts of intergenerational focus and social objectives have been eloquently iterated by the Northland Chief Executives Consortium.

Investors in the proposed mill concept should be aware of the potential for reduced pine plantation harvests in the future, as well as the opportunity to be a part of or encourage new pine plantation development or changes in silvicultural practices that could mitigate supply issues. Such investors should also be aware of what matters to land and forest owners, in particular the Maori land owners who represent at least one fifth of the forest resource in Northland. Such an awareness will create opportunities to develop forest business models that are appropriate and acceptable to forest owner and wood processor alike, strengthening the long-term project viability. For a proposed integrated pulpmill-sawmill facility this is paramount.

# 3. SECTION TWO: RESOURCE

**Despite the expected reduction in harvest levels in Northland in 2 to 3 years' time, there is sufficient wood fibre available in the region to support new processing facilities at Ngawha.** There is enough volume to support a sawmill processing up to 500 000 $m^3$/a of sawlogs, and a pulpmill requiring up to 400 000 $m^3$/a of logs to supplement residues from the sawmill and other Northland mills.

An important consideration, however, is securing supply from small owners (those owning less than 1000 ha) who will make up an increasing proportion of the Northland harvest volume in the next 5 to 10 years.

The mills will also need to be sufficiently flexible to utilise a range of log grades and sizes. While the total volumes are adequate, there will be a range of log grades, diameters and lengths available. It will be necessary for both the pulpmill and sawmill to be able to handle a range of grades to ensure there is sufficient volume. Log length will be a key consideration with shorter lengths often exported due to not being preferred by domestic processors.

Forest management practices such as retaining a higher stocking or undertaking production thinning on suitable sites has the potential to provide additional volume. Embarking on a programme of additional planting will also help to fill any gaps in supply.

The Ngawha site is well positioned with respect to large parts of the Northland estate, which is likely to lead to substantial transport costs savings that are a benefit to both the forest owner and the Ngawha mill.

## 3.1 Information Sources

### 3.1.1 National Exotic Forest Description

The National Exotic Forest Description (NEFD) is published annually by the Ministry of Primary Industries (MPI) and is overseen by a steering committee with members nominated by the NZ Forest Owners Association and the MPI.

The report provides a detailed description of New Zealand's planted production forests as at 1 April each year. It represents the net stocked area of the planted exotic production forest estate – those forests whose primary purpose is the production of wood or wood fibre. The report includes detailed tables that show the plantation forest area by age class and territorial authority. This information is provided for key species. For radiata pine, the area by age-class tables are also provided by broad silvicultural categories.

### 3.1.2 MPI Wood Availability Forecasts

MPI published updated wood availability forecasts (WAFs) for Northland in 2015 (forecasts were previously completed in 2009).

The WAFs use forest description information from the NEFD as the basis for modelling. The studies make the distinction between large and small owners, with part of the modelling process involving surveying the harvest intentions of large-scale forest owners (owners with over 1000 ha in Northland).

A key aspect of the WAFs is the "calibration" of the regional yield tables. This involves adjustment of the yield tables so that the resulting yields closely match the harvest intentions of the large-scale owners. An assumption is made that the small owners will realise the same yield for the same silvicultural regime classes.

### 3.1.3 New Zealand Land Use Classification

In 2008, a land use map (LUM) was produced by the Ministry for the Environment (MfE) to provide information which would enable New Zealand to report on land use and land use change under the Kyoto Protocol. The current version of the LUM is v011, which was last updated in March 2015.

The LUM is produced from the classification of satellite imagery, allowing the distinction of exotic plantations (forestry land use) from other land uses across New Zealand to within one hectare. The LUM enables the distinction of pre-1990 and post-1989 exotic forests and these have been verified through the emissions trading scheme.

The NZ Land Resource Inventory (NZLRI) dataset was also utilised. The NZLRI contains information on soil types and slope classifications. The dataset was produced by Landcare NZ and is available in the public domain. The NZLRI was last updated in June 2010.

### 3.1.4 Land Information Database

To enable the wood flow modelling to meet the objectives of this assignment, Indufor has assembled a 'Forest Information Spatial Database' (FISD), which combines various databases into a GIS environment. This has assisted in the estimation of wood density, yields, and harvest systems and costs.

The database fields and sources of data are shown in Table 3-1.

**Table 3-1: FISD Fields**

| Data | Source |
|---|---|
| 50 km x 50 km Grids | GIS generated grids |
| Territorial Authority (District) | NZ GIS boundary dataset |
| Pre-1990/post-1989 forest | LUCAS New Zealand Land Use Map 1990 2008 2012 (v011) |
| Slope (degrees) | New Zealand Land Resource Inventory (NZLRI) |
| Soil Type (clay or sand) | NZLRI |
| 300 Index[4] | Future Forests Research (FFR) |
| Site Index[5] | FFR |
| Altitude | Landcare Research New Zealand |
| Latitude (degrees) | Calculated from polygon centroid (GIS) |
| Area (ha) | Calculated from polygon size (GIS) |

Some of the layers utilised in the analysis are illustrated in Figure 3-1 to Figure 3-4.

[4] 300 Index – defined as the stem volume mean annual increment at age 30 years for a defined reference regime of 300s/ha. The reference regime involves pruning trees to 6m in a timely manner, thinning after pruning is completed (before about 11m in height) to a stocking that will result in a final crop stocking of 300s/ha at age 30 (around 340s/ha)

[5] Dominant height of stand at age 20

**Figure 3-1: Soil Type**

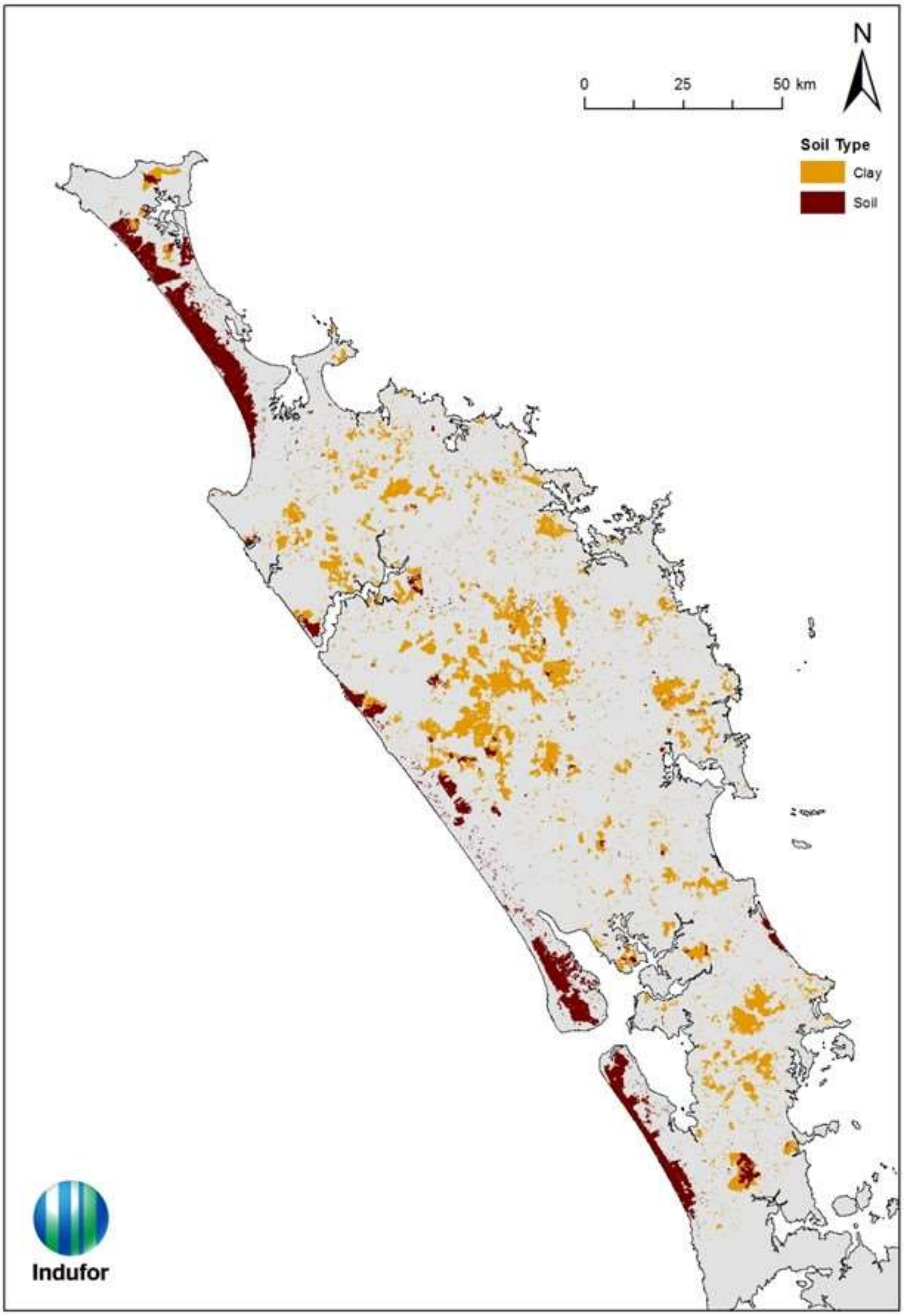


**Figure 3-2: Slope Class**

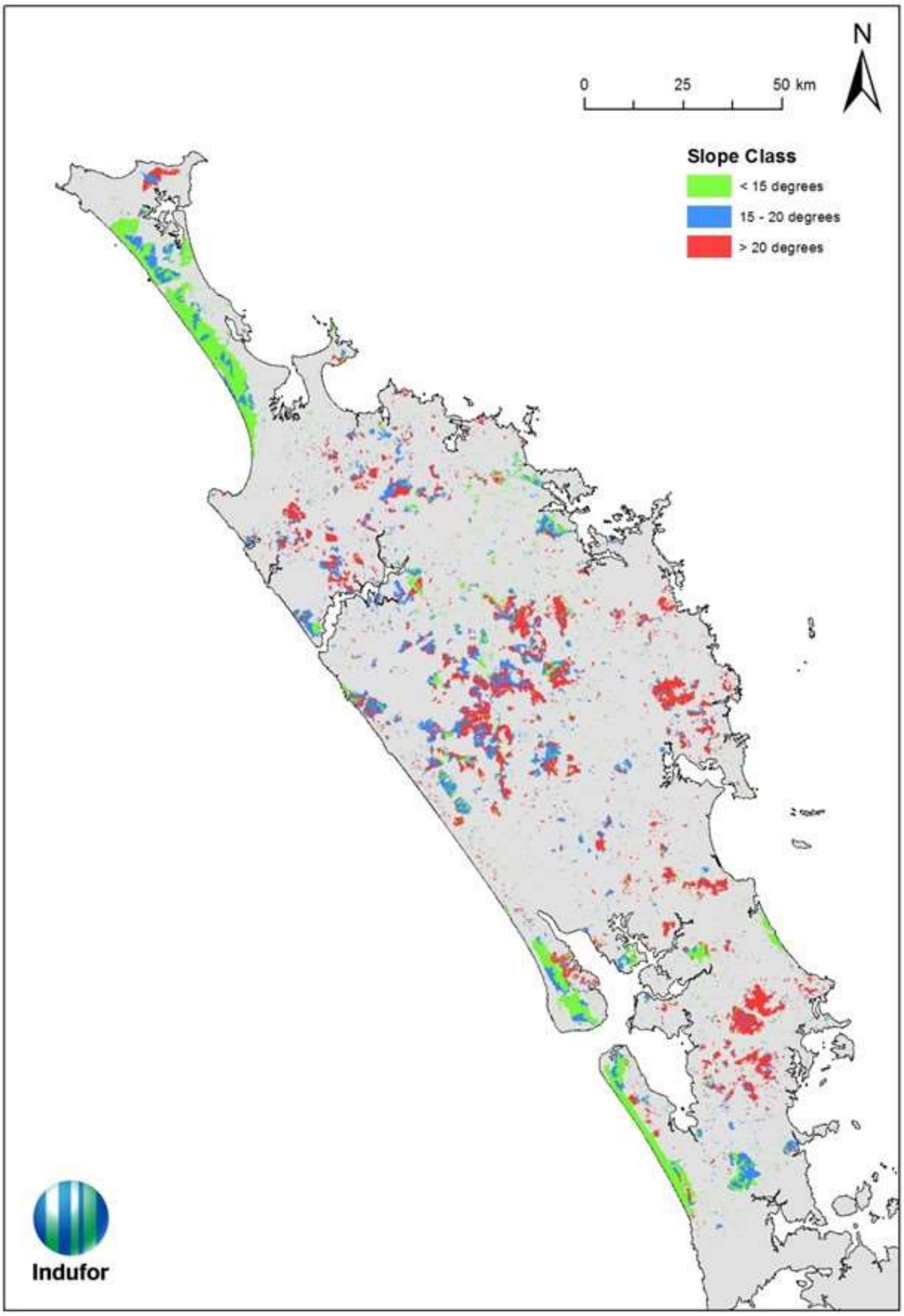


**Figure 3-3: 300 Index**

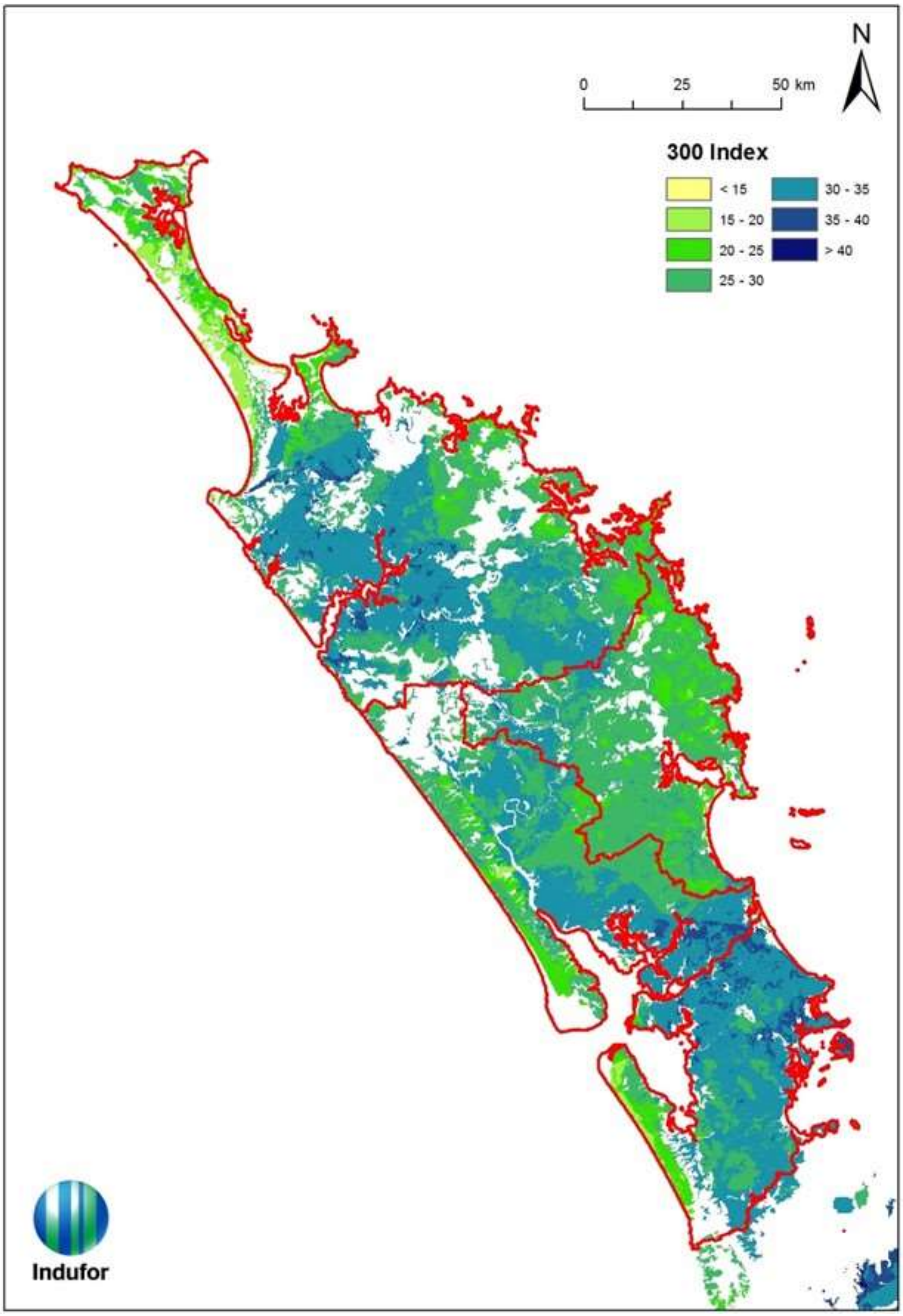
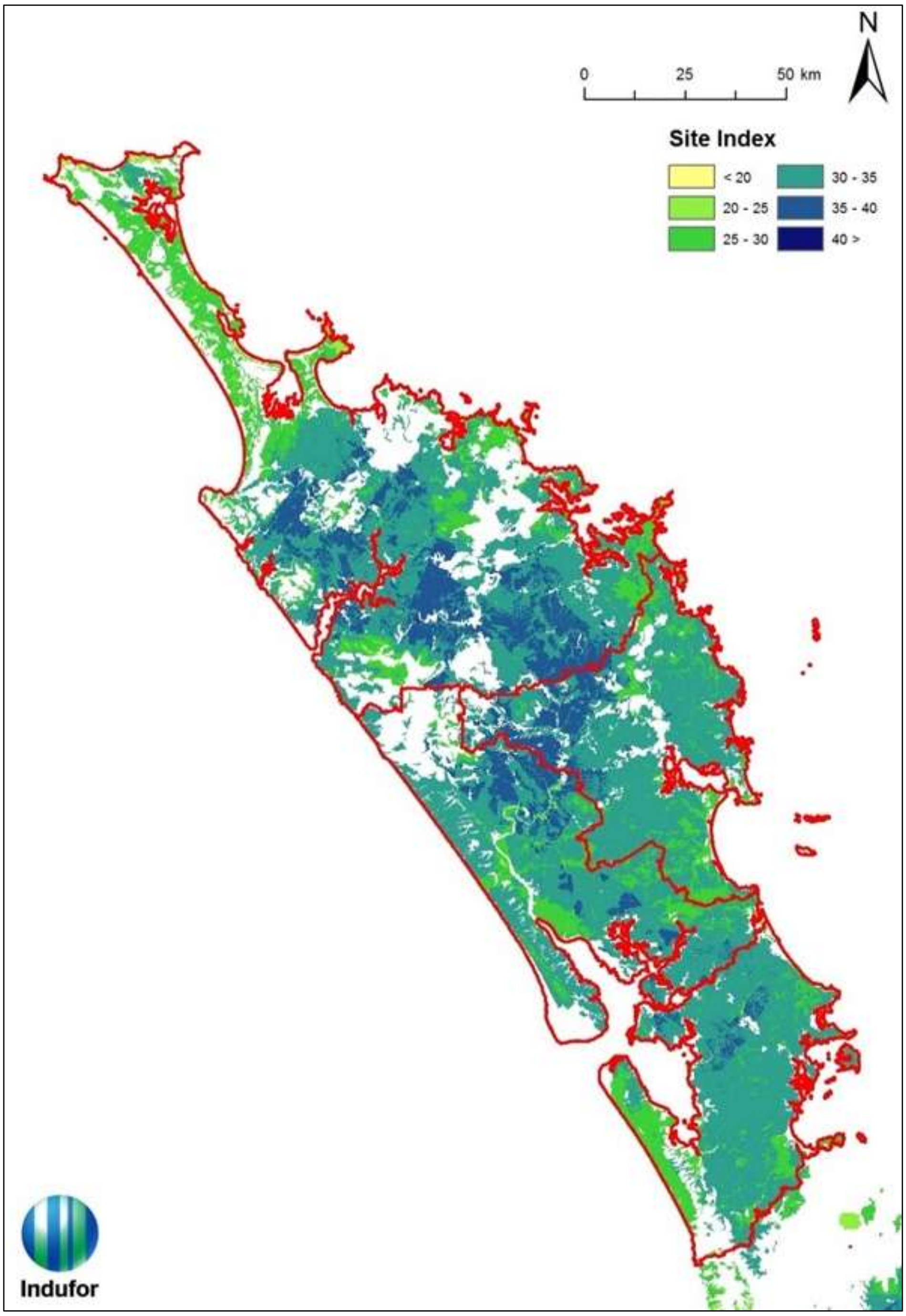


**Figure 3-4: Site Index**




## 3.2 Area Derivation

Indufor has primarily relied on the area information provided in the 1 April 2014 NEFD. The NEFD base tables show stocked area at the following reporting levels:

- By district or territorial authority (TA)
- By age-class (in five year groups)
- By species
- By tending regime

For confidentiality reasons, ownership size (large or small) is not defined at a detailed level in the area information. Indufor has therefore estimated this based on the area by owner size charts contained within the WAF reports.

### 3.2.1 Area Adjustments

The WAFs include adjustments to the base NEFD area for each region as follows:

- The area for the small-scale owners' estate was reduced by 15%. This adjustment was made as small-scale owners generally report on a gross area basis rather than net stocked areas (excluding unplanted areas, areas not successfully established, streams, roads and wetlands).
- Reductions were made to the area of over-mature stands. For large-scale owners, areas older than 35 years of age were considered non-commercial and excluded. For small-scale owners, the maximum age was 40 years.
- A downwards adjustment of 5% was applied to all areas age 1 to 4 to reflect losses in stocked area due to factors such as erosion, slips, and various setbacks.

The area information that is publicly available is not at a sufficiently detailed level to allow these adjustments to be reproduced exactly. Indufor has therefore applied the overall reduction that has resulted from these adjustments on a pro-rata basis by territorial authority and age class.

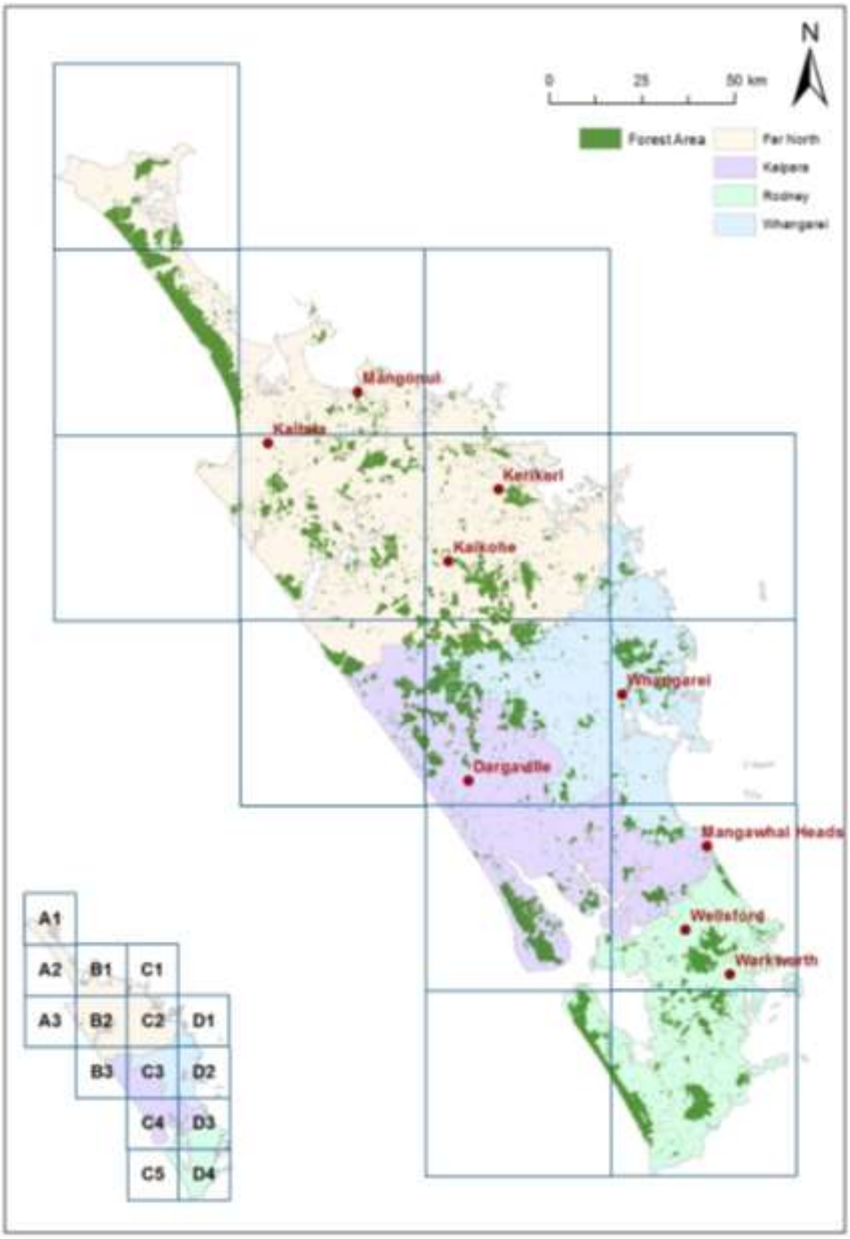
### 3.2.2 Regional Distribution of Forests

To allow a more refined estimation of the costs of delivery to the proposed Ngawha facility, Indufor has divided the Northland region into 15 grid squares as shown in Figure 3-5. This has allowed GIS overlays of several variables on the forests in each grid. These include:

- Soil type (sand/clay)
- Slope class
- Altitude
- 300 Index, and
- Site Index

Characteristics such as ownership size, age class and silviculture class/regime, which are derived from the NEFD, are allocated on a pro-rata basis based on the territorial authority in which they occur.

**Figure 3-5: Grid Layout - Northland Region**




Because the NEFD data is only provided in 5-year age class bands, Indufor has necessarily assumed an equal area in each of the years within the 5-year age classes. Table 3-2 shows the estimated split between large and small owners in each of the grids, while Figure 3-6 shows the assumed age class distribution by grid and Figure 3-7 the age class distribution by ownership size class.

**Table 3-2: Forest Area by Ownership Size Class**

| Grid | Ownership Size: Large | Ownership Size: Small | Total |
|---|---|---|---|
| | Area (ha) | | |
| A1 | 5 333 | 2 972 | 8 304 |
| A2 | 10 431 | 5 812 | 16 243 |
| A3 | 286 | 159 | 445 |
| B1 | 2 887 | 1 609 | 4 496 |
| B2 | 13 821 | 7 702 | 21 523 |
| B3 | 5 762 | 3 599 | 9 361 |
| C1 | 420 | 234 | 654 |
| C2 | 12 233 | 6 844 | 19 077 |
| C3 | 19 549 | 12 062 | 31 611 |
| C4 | 7 651 | 4 971 | 12 622 |
| C5 | 3 302 | 2 677 | 5 979 |
| D1 | 861 | 538 | 1 399 |
| D2 | 5 228 | 3 272 | 8 500 |
| D3 | 9 384 | 7 007 | 16 391 |
| D4 | 10 669 | 8 651 | 19 321 |
| **Total** | **107 817** | **68 110** | **175 926** |

**Figure 3-6: Area-Age Clase by Grid**

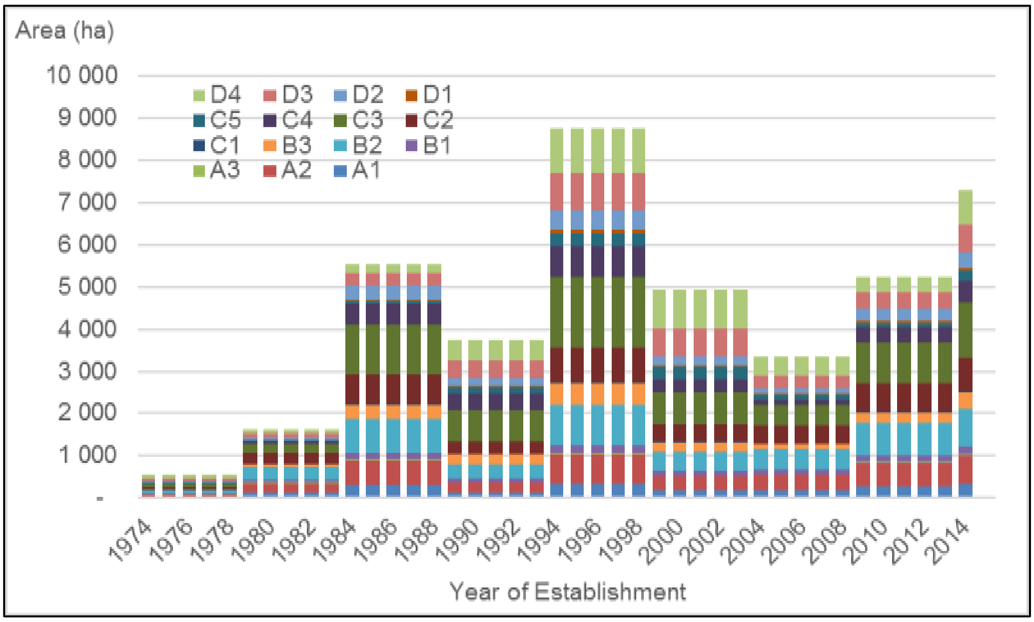
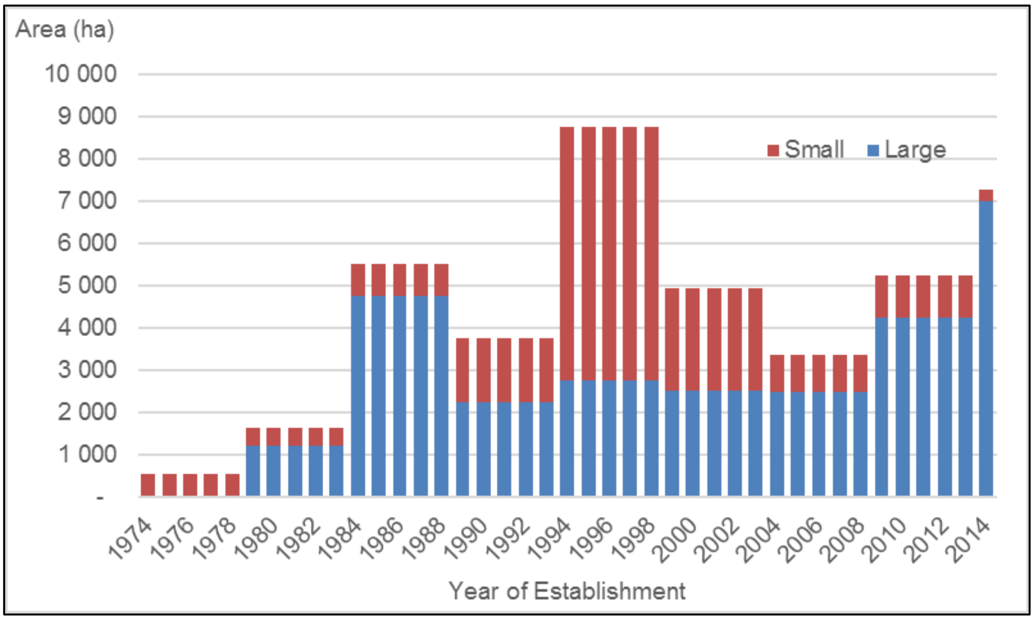


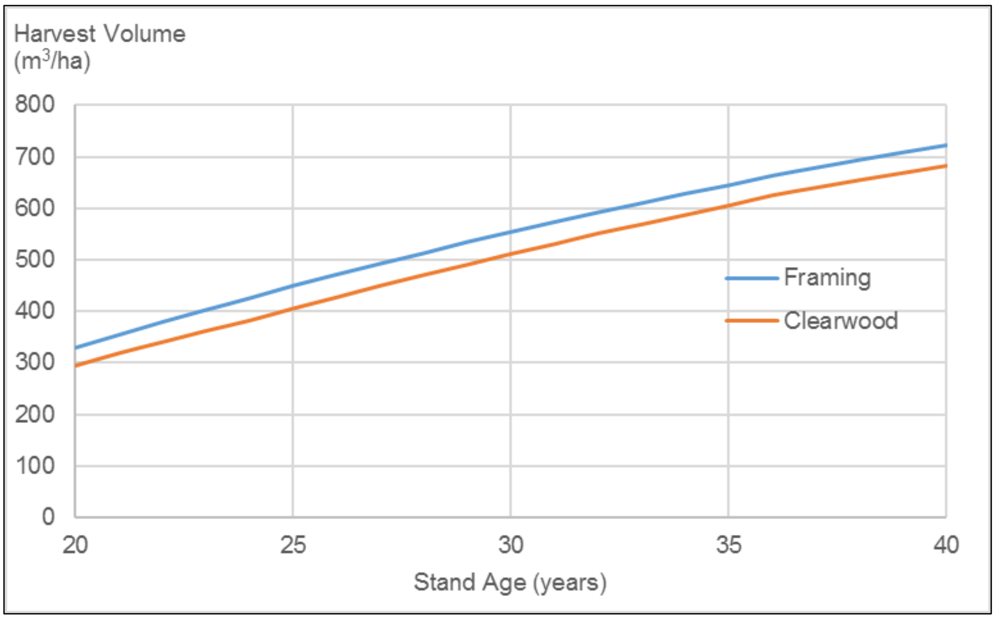
Figure 3-7: Area-Age Clase by Ownership-Size Class




## 3.3 Yield Derivation

Indufor has used the NEFD calibrated yield tables as the basis for deriving a range of yield tables for the Northland estate. The total recoverable yields associated with framing and clearwood regimes in Northland, utilised in the MPI wood availability forecasts, are shown in Figure 3-8.

**Figure 3-8: MPI Predicted Northland Yields by Regime**




The MPI yield tables only differentiate between pruned, unpruned and pulplogs. Indufor has applied estimated grade-mix ratios for Northland to the MPI yields to attain more detailed log outputs.

The specifications for the log grades modelled are summarised in Table 3-3.

**Table 3-3: Log Grade Specifications**

| Log Grade | SED (cm) | Maximum Branch Size (cm) | Sweep |
|---|---|---|---|
| Pruned | 35 | 0 | SED/4 |
| S30 | 30 | 7 | SED/4 |
| S20 | 20 | 7 | SED/4 |
| S15 | 15 | 7 | SED/4 |
| A | 30 | 12 | SED/4 |
| K | 20 | 12 | SED/4 |
| KI | 25 | 25 | SED/2 |
| Pulp | 10 | | SED/3 |

The assumed log grade mix by regime, at age 30, is presented in Table 3-4.

**Table 3-4: Assumed Grade-Mix by Regime (age 30)**

| | Framing | | Clearwood | |
|---|---|---|---|---|
| **Log Grade** | **$m^3$/ha** | **Portion of Total** | **$m^3$/ha** | **Portion of Total** |
| Pruned | 0 | 0% | 79 | 15% |
| S30 | 130 | 23% | 98 | 19% |
| S20 | 99 | 18% | 80 | 16% |
| S15 | 20 | 4% | 33 | 7% |
| A | 153 | 28% | 80 | 16% |
| K | 46 | 8% | 16 | 3% |
| KI | 24 | 4% | 34 | 7% |
| Pulp | 82 | 15% | 92 | 18% |
| **Total** | **555** | **100%** | **512** | **100%** |

### 3.3.1 Yields by Grid

The yields described in the previous section were assumed to be representative of the Northland region as a whole. To provide a better representation of the wood flows within Northland Indufor developed yield tables for each of the grid squares described in Section 3.2.2. This was done by comparing various productivity measures and factors affecting growth rates between each of the grids. The Radiata Pine Calculator v3 was used for this.

Initial analysis was based on inputs that represented the overall average from forests in the Northland region as follows:

- 300-index 27.0
- Site index 31.5 m
- Rotation age 30.0 years
- Altitude 88.0 m

Regimes that were thought to represent past management in Northland were then used to simulate the forecast yield using the Radiata Pine Calculator v3.

The regimes were as follows:

**Framing Regime**

| | |
|---|---|
| Stems/ha (sph) planted | 1000 sph |
| Age at thinning | 9.0 years |
| SPH after thinning | 318 sph |
| Production or waste (P/W) | W |
| Target final crop stocking | 300 sph |

**Clearwood Regime**

| | |
|---|---|
| Stems/ha planted | 1000 sph |
| Age at pruning | 5.5, 6.8 and 8.0 years |
| Pruned height | 2.4 m, 4.6 m, 6.0 m |
| Stems per hectare pruned | 450, 350 and 320 sph |
| Age at thinning | 8.8 years |
| SPH after thinning | 285 sph |
| Target final crop stocking | 270 sph |

The outputs were then recalibrated to approximate the total yields predicted in the MPI yield tables. It was found that clearfell yields needed to be reduced by around 35% in order to achieve yields comparable to the MPI predictions.

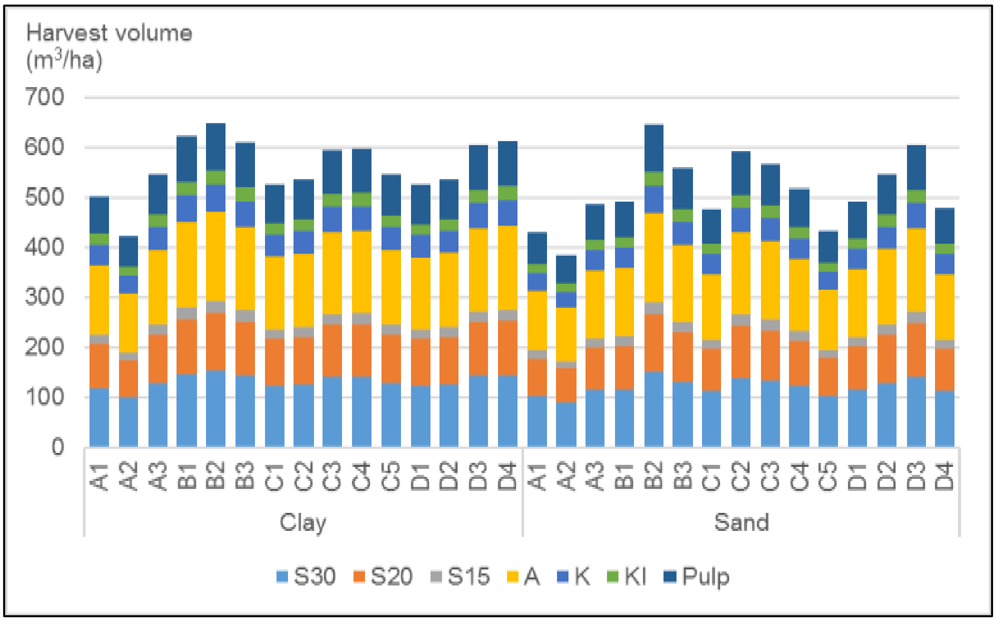
Once re-calibrated the expected yield for each of the grids was estimated by inputting the measures of the 300 Index, Site Index and altitude for the grid square. This was calculated separately for clay and sandy soils in each grid. The averages for forest plantations in each grid are summarised in Table 3-5.

**Table 3-5: Plantation 300 Index, Site Index and Alitude by Grid**

| Grid | Clay | | | Sand | | |
|---|---|---|---|---|---|---|
| | 300 Index | Site Index | Altitude (m) | 300 Index | Site Index | Altitude (m) |
| A1 | 24.2 | 28.0 | 45.2 | 20.6 | 27.3 | 35.5 |
| A2 | 20.2 | 26.0 | 44.1 | 18.2 | 26.7 | 30.4 |
| A3 | 26.5 | 29.9 | 81.8 | 23.5 | 29.1 | 65.9 |
| B1 | 30.5 | 31.9 | 71.2 | 23.8 | 28.6 | 46.7 |
| B2 | 31.9 | 34.1 | 92.8 | 31.7 | 33.5 | 98.4 |
| B3 | 29.8 | 31.9 | 99.8 | 27.3 | 32.4 | 77.8 |
| C1 | 25.5 | 29.5 | 97.1 | 23.0 | 27.3 | 62.6 |
| C2 | 26.1 | 32.6 | 128 | 29.0 | 32.7 | 105.7 |
| C3 | 29.2 | 34.0 | 81.8 | 27.8 | 32.6 | 42.6 |
| C4 | 29.2 | 32.0 | 64.6 | 25.2 | 31.0 | 51.7 |
| C5 | 26.3 | 27.3 | 126.9 | 20.9 | 29.3 | 43.2 |
| D1 | 25.5 | 30.9 | 80.3 | 23.8 | 29.9 | 56.3 |
| D2 | 26.1 | 31.3 | 92.6 | 26.6 | 30.5 | 37.3 |
| D3 | 29.6 | 32.0 | 71 | 29.5 | 31.1 | 58.8 |
| D4 | 29.9 | 31.2 | 85.9 | 23.1 | 29.4 | 94.1 |

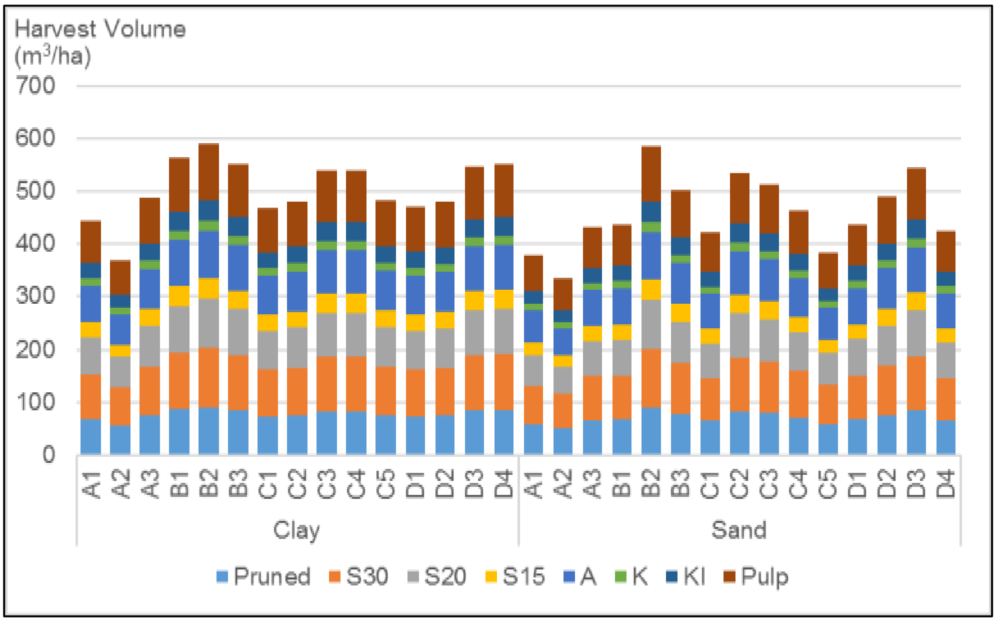
The estimated yields at age 30 are presented in Figure 3-9 (framing) and Figure 3-10 (clearwood). The estimated yield for framing stands varies from 383 m$^3$/ha (sand in grid A2) to 650 m$^3$/ha (clay B2) at age 30.

**Figure 3-9: Estimated Average Yields by Grid - Framing Stands (Age 30)**




For clearwood stands the predicted yields vary from 334 m$^3$/ha (sand A2) to 589 m$^3$/ha (clay B2) at 30 years of age.

**Figure 3-10: Estimated Average Yields by Grid - Clearwood Stands (Age 30)**




### 3.3.2 Regime Impacts

Similarly, the impact of adopting alternative silvicultural regimes was assessed. Two alternative framing regimes were considered, one where stands were left at a higher final stocking and a second that also included production thinning. These are summarised in Table 3-6. This did not include an analysis of the optimal financial return, rather the high stocking regime was included as an alternative because of the observation that many forest owners and managers are adopting higher stocking regimes. The production thinning option was included to examine the potential to supply near term volume to the proposed pulpmill.

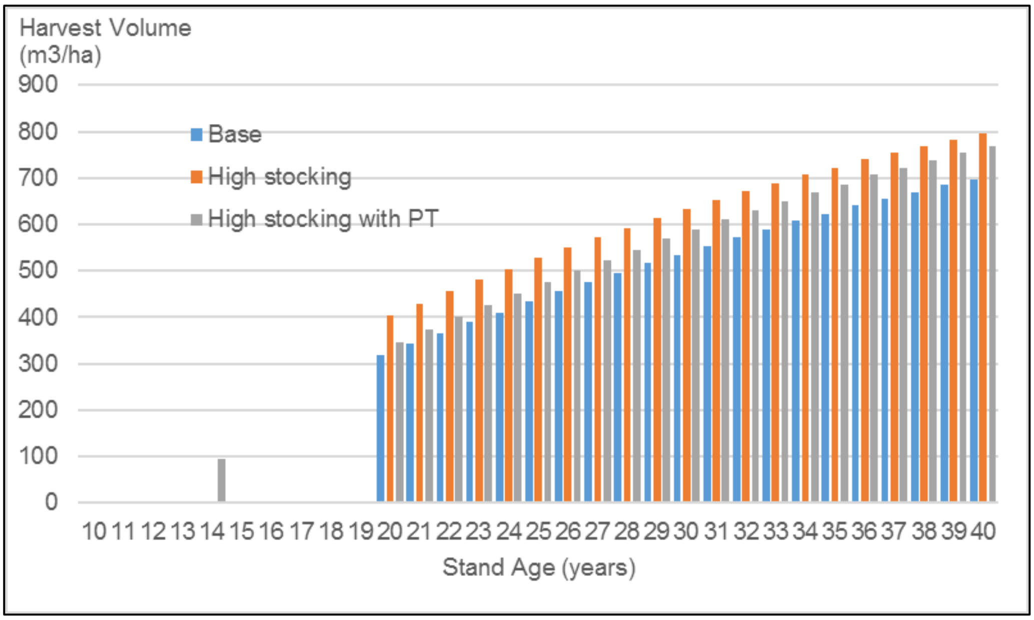
**Table 3-6: Alternative Silvicultural Management Options**

| Operation | Base Framing Regime | High Stocking | High Stocking with Production Thin |
|---|---|---|---|
| Stems/ha planted | 1000 | 800 | 1000 |
| Age at thinning (years) | 9.0 | 9.0 | 14.0 |
| SPH after thinning | 318 | 551 | 455 |
| Production or waste (P/W) | W | W | P |
| Target final crop stocking | 300 | 455 | 400 |

Figure 3-11 (clay soils) and Figure 3-12 (sandy soils) provide representative examples of the recoverable volume estimates developed for each of the regimes.

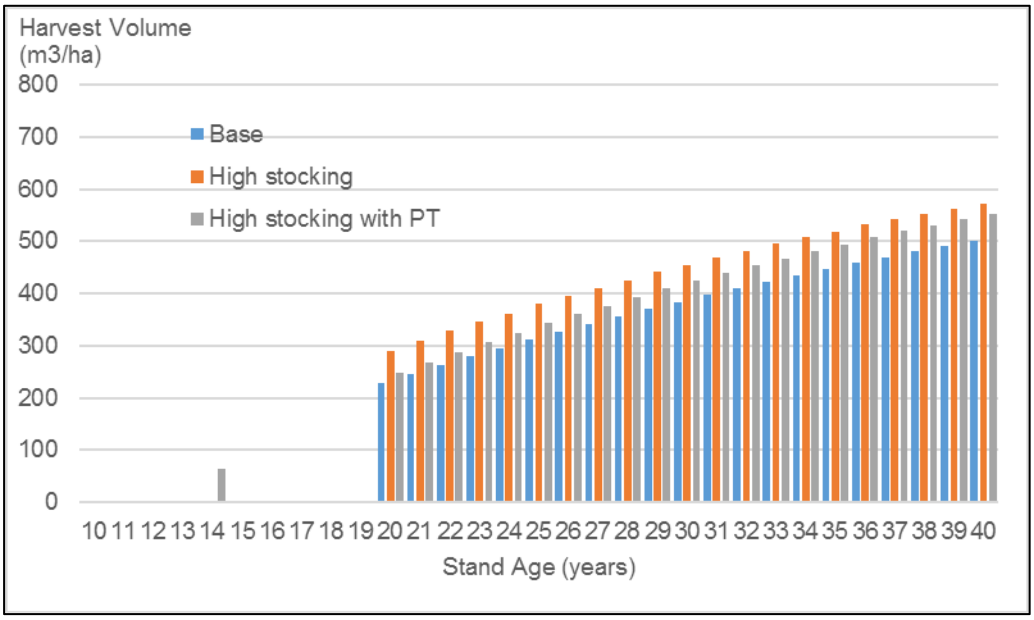
**Alternate Regimes - Clay soils – Grid C2**

**Figure 3-11: Predicted Yield from Alternative Regimes - Grid C2, Clay Soils**



### Alternate Regimes - Sandy soils – Grid A2

**Figure 3-12: Predicted Yield from Alternative Regimes - Grid A2, Sandy Soils**



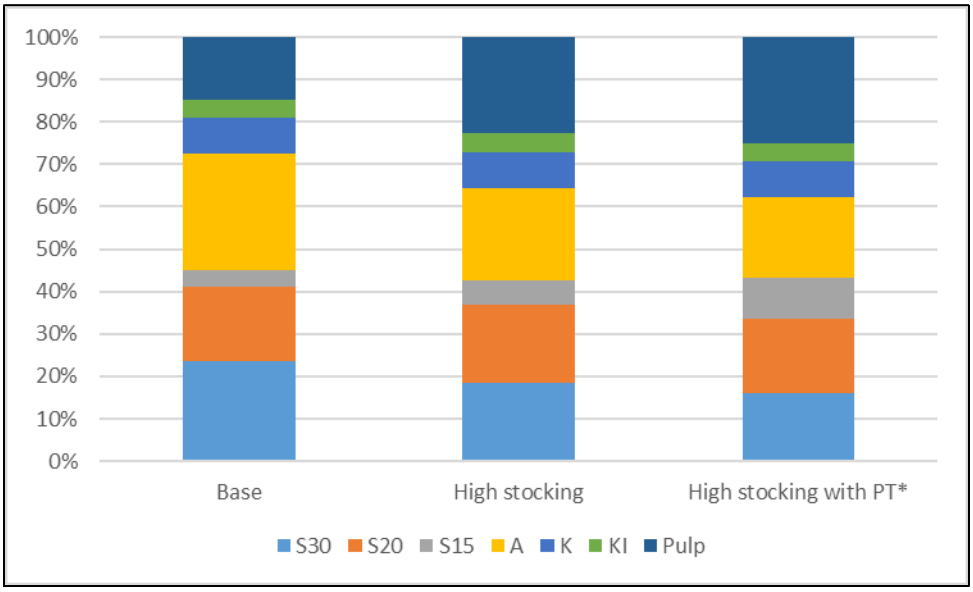

The analysis suggests that by retaining a higher stocking an 18% increase in the clearfell volume at age 30 could be achieved. The increase in the clearfell volume would not be as great under the production thinning regime (10%) but when combined with the volume from thinning there would be an increase of around 28% over the whole rotation. There would, however, be impacts on the log grade out-turn, with a higher proportion of pulplogs produced and a lower proportion of large sawlogs. Table 3-7 and Figure 3-13 illustrate the impacts on log grade out-turn under each of the regimes.

**Table 3-7: Log Grade Out-turn by Regime (Clearfell Age 30) - Grid C2, Clay Soils**

| | **Base** | **High Stocking** | **High Stocking with Production Thinning** |
|---|---|---|---|
| **Log Grade** | **Clearfell Volume (age 30) – m$^3$/ha** | | |
| S30 | 125.5 | 117.4 | 110.2 |
| S20 | 95.3 | 116.2 | 114.7 |
| S15 | 19.7 | 35.8 | 30.7 |
| A | 147.6 | 138.0 | 129.6 |
| K | 44.8 | 54.6 | 53.9 |
| KI | 23.4 | 28.5 | 28.1 |
| Pulp | 79.0 | 143.2 | 122.9 |
| **Total Clearfell** | **535.2** | **633.6** | **590.2** |
| | **Production Thinning Volume (age 14) – m$^3$/ha** | | |
| S20 | | | 5.6 |
| S15 | | | 35.3 |
| K | | | 5.0 |
| Pulp | | | 49.9 |
| **Total Thin** | | | **95.9** |
| **Total Clearfell + Thin** | | | **686.1** |

**Figure 3-13: Log Grade Out-turn by Regime (Clearfell Age 30) - Grid C2, Clay Soils**




* includes production thinning volume at age 14.

## 3.4 Costs

Costs that impact on the outcome have been included in the wood flow optimisation. The main costs that affect harvesting decisions relate to costs of production – both harvesting and transport. Generic establishment costs have also been included in the modelling, although these will have little impact on the wood flow or delivered wood costs. Overhead and administration costs have not been included and nor have costs associated with land use (such as rental payments, real or notional, and land rates), as they will not influence the future wood flows.

### 3.4.1 Harvest Costs

Harvesting costs include the process of logging and loading logs as well as harvest road construction and maintenance. The costs of both logging and harvest road construction are influenced by the soil type and terrain, which also affect the logging system used to harvest the trees. Indufor has examined recent logging rates from several major forest owners in the Northland region and estimated the rates that would apply over a range of slope classes. Rates have been determined separately for sand and clay soils. These rates are summarised in Table 3-8.

**Table 3-8: Logging and Harvest Roading Rates**

| Description | Slope | Log & Load | | Roading | |
|---|---|---|---|---|---|
| | | Clay | Sand | Clay | Sand |
| | | NZD/m$^3$ | | | |
| Flat to gently undulating | 0-3° | 25 | 23 | 5 | 4.5 |
| Undulating | 4-7° | 27 | 25 | 5 | 4.5 |
| Rolling | 8-15° | 30 | 26 | 5 | 4.5 |
| Strongly rolling | 16-20° | 35 | 35 | 8 | 8 |
| Moderately steep | 21-25° | 40 | 40 | 10 | 10 |
| Steep | 26-35° | 43 | 43 | 11 | 11 |
| Very steep | 36-42° | 49 | 49 | 12 | 12 |

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Using the rates outlined in Table 3-8, area weighted log and load and roading costs were calculated for each of the grids described in Section 3.2.2. The resulting rates are summarised in Table 3-9.

For second rotation areas it has been assumed roading costs will be 50% less than the first rotation, due to the roads having already been largely constructed.

**Table 3-9: Logging and Harvest Roading Rates by Grid**

| Grid | Log & Load | Harvest Roading Construction & Maintenance – 1st Rotation | Harvest Roading Construction & Maintenance – 2nd and Subsequent Rotations |
|---|---|---|---|
| | (NZD/m³) | | |
| A1 | 30.81 | 6.45 | 3.23 |
| A2 | 27.21 | 5.19 | 2.60 |
| A3 | 35.44 | 8.19 | 4.10 |
| B1 | 34.87 | 7.96 | 3.98 |
| B2 | 36.63 | 8.65 | 4.33 |
| B3 | 35.13 | 8.00 | 4.00 |
| C1 | 35.88 | 8.22 | 4.11 |
| C2 | 35.80 | 8.25 | 4.13 |
| C3 | 37.07 | 8.81 | 4.41 |
| C4 | 31.66 | 6.67 | 3.34 |
| C5 | 28.24 | 5.79 | 2.90 |
| D1 | 39.65 | 9.85 | 4.93 |
| D2 | 38.80 | 9.51 | 4.76 |
| D3 | 37.59 | 8.94 | 4.47 |
| D4 | 33.29 | 7.34 | 3.67 |
| **Overall** | **34.56** | **7.86** | **3.93** |

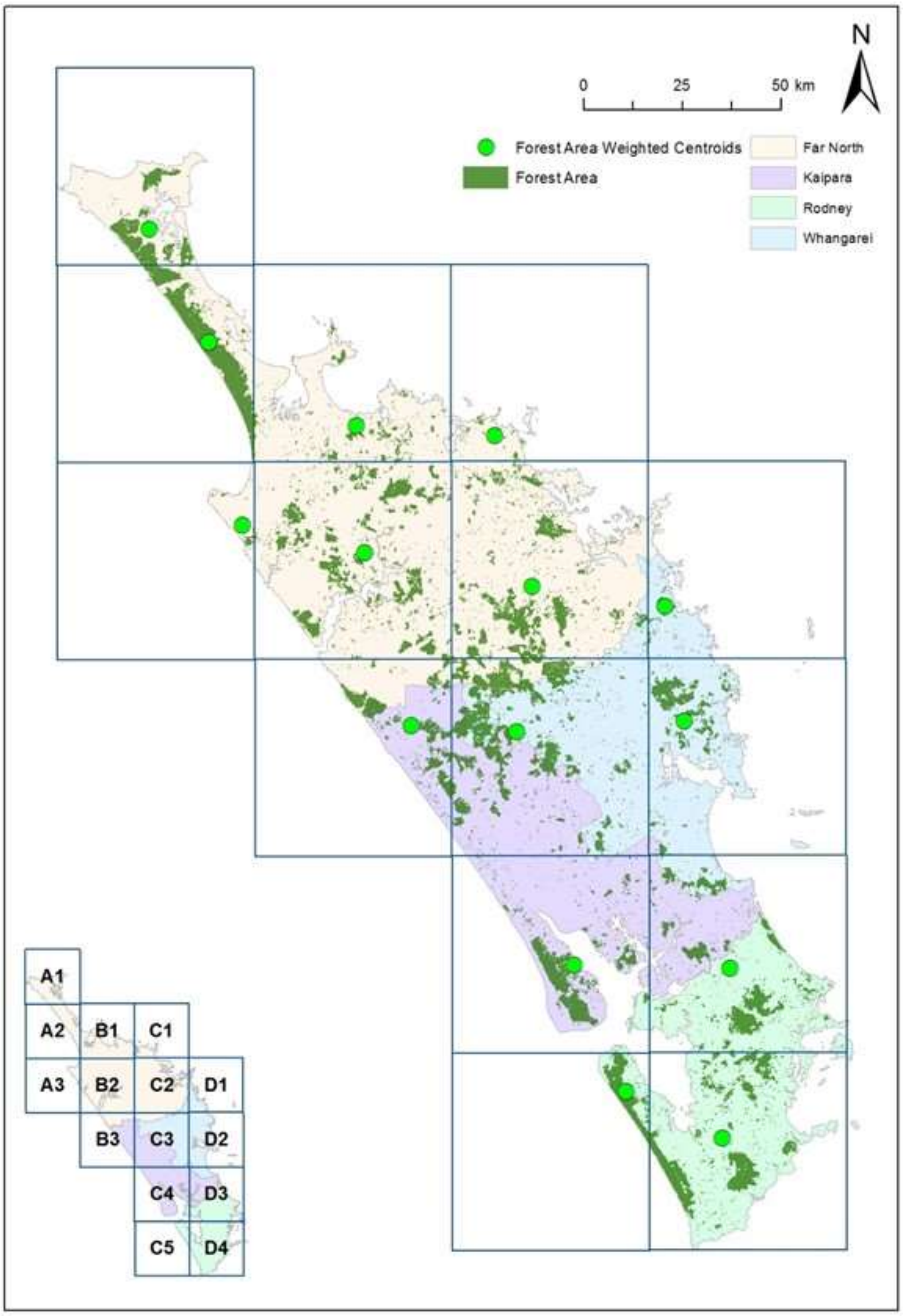
These are consistent with costs currently observed in the Northland region.

In addition to the harvesting and roading costs a $4/m$^3$ harvest management and marketing cost has been applied to all areas.

### 3.4.2 Transport Costs

Transport costs have been estimated by calculating the distance from the forest area weighted centroid of each grid to key market destinations. The centroids for each grid are shown in Figure 3-14.

Figure 3-14: Forest Area Weighted Grid Centroids




Using the calculated distances, and prevailing Northland transport rates the cost of transporting logs was calculated for each origin (centroid)-destination (mill/port) combination. The assumed rates are summarised in Table 3-10. Costs of transport to the central North Island incorporate the potential for back-haul opportunities.

**Table 3-10: Northland Log Transport Costs**

| Destination | Origin | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A1 | A2 | A3 | B1 | B2 | B3 | C1 | C2 | C3 | C4 | C5 | D1 | D2 | D3 | D4 |
| | (NZD/m³) | | | | | | | | | | | | | | |
| CHH LVL | 45.1 | 42.1 | 55.5 | 35.0 | 32.2 | 25.2 | 29.9 | 21.3 | 15.9 | 26.5 | 29.4 | 17.8 | 12.4 | 14.6 | 22.9 |
| CHH Whangarei | 42.6 | 37.6 | 31.5 | 29.9 | 27.1 | 21.3 | 24.8 | 16.3 | 12.2 | 22.8 | 32.7 | 12.8 | 6.6 | 17.7 | 26.0 |
| Crofts | 41.8 | 35.9 | 29.9 | 28.3 | 25.7 | 22.6 | 23.3 | 14.8 | 12.0 | 24.0 | 34.0 | 11.2 | 6.6 | 19.0 | 27.3 |
| Herman Timber | 41.0 | 34.8 | 28.8 | 27.3 | 24.5 | 23.4 | 22.3 | 13.7 | 13.5 | 24.7 | 35.1 | 10.1 | 7.5 | 20.1 | 28.4 |
| JNL Triboard | 17.7 | 11.7 | 9.9 | 10.0 | 14.5 | 26.8 | 18.8 | 20.1 | 26.3 | 39.7 | 49.9 | 30.6 | 30.7 | 42.3 | 46.6 |
| JNL Veneer | 17.7 | 11.7 | 9.8 | 10.0 | 14.5 | 26.8 | 18.8 | 20.1 | 26.3 | 39.7 | 49.9 | 30.6 | 30.7 | 42.3 | 46.6 |
| Kaihu Valley | 42.9 | 38.1 | 32.0 | 33.2 | 27.8 | 11.9 | 28.1 | 21.3 | 10.6 | 13.3 | 35.6 | 22.1 | 16.1 | 20.7 | 29.1 |
| Marsden Port | 45.1 | 42.1 | 55.5 | 35.0 | 32.2 | 25.2 | 29.9 | 21.3 | 15.9 | 26.5 | 29.4 | 17.8 | 12.4 | 14.6 | 22.9 |
| Marusumi | 43.2 | 38.9 | 32.8 | 31.2 | 28.4 | 21.5 | 26.2 | 17.5 | 12.2 | 22.8 | 31.9 | 14.1 | 8.5 | 17.0 | 25.3 |
| Max Birt | 58.3 | 55.1 | 52.1 | 51.2 | 49.8 | 43.8 | 48.7 | 44.3 | 41.6 | 44.5 | 22.9 | 42.6 | 38.1 | 24.2 | 18.3 |
| Mt Pokaka | 31.7 | 25.5 | 19.6 | 16.7 | 15.3 | 17.4 | 11.7 | 8.6 | 16.9 | 30.2 | 44.1 | 19.1 | 19.3 | 31.7 | 40.0 |
| Northpine | 45.5 | 42.4 | 37.2 | 35.6 | 33.0 | 25.8 | 30.6 | 22.0 | 16.7 | 27.3 | 26.6 | 18.5 | 13.2 | 11.9 | 20.2 |
| Pinepac Kumeu | 54.9 | 51.8 | 48.7 | 47.9 | 46.5 | 39.4 | 45.4 | 40.5 | 35.1 | 40.8 | 13.3 | 36.9 | 31.5 | 17.7 | 8.6 |
| Pinepac Whenuapai | 54.9 | 51.8 | 48.7 | 47.9 | 46.5 | 39.4 | 45.4 | 40.5 | 35.1 | 40.8 | 13.3 | 36.9 | 31.5 | 17.7 | 8.6 |
| Resource Enterprises | 45.1 | 42.1 | 55.5 | 35.0 | 32.2 | 25.2 | 29.9 | 21.3 | 15.9 | 26.5 | 29.4 | 17.8 | 12.4 | 14.6 | 22.9 |
| Rosvall | 42.7 | 37.9 | 31.9 | 29.6 | 27.5 | 22.6 | 25.2 | 16.6 | 13.5 | 24.0 | 34.3 | 13.0 | 4.7 | 19.4 | 27.8 |
| Topuni Timber | 47.8 | 44.7 | 41.6 | 40.2 | 37.4 | 25.5 | 35.1 | 26.5 | 21.2 | 26.8 | 22.5 | 23.1 | 17.6 | 7.3 | 16.0 |
| Waipapa Pine | 31.7 | 25.5 | 19.6 | 16.7 | 15.3 | 17.4 | 11.7 | 8.6 | 16.9 | 30.2 | 44.1 | 19.1 | 19.3 | 31.7 | 40.0 |
| CNI Pulp | 45.0 | 45.0 | 45.0 | 40.6 | 40.7 | 39.7 | 40.7 | 39.9 | 38.8 | 39.9 | 33.4 | 39.2 | 38.0 | 33.9 | 31.7 |
| Ngawha pulp | 31.5 | 25.3 | 19.4 | 20.4 | 15.1 | 13.0 | 15.5 | 8.5 | 12.5 | 25.7 | 43.1 | 18.9 | 19.5 | 29.7 | 38.2 |
| Ngawha sawmill | 31.5 | 25.3 | 19.4 | 20.4 | 15.1 | 13.0 | 15.5 | 8.5 | 12.5 | 25.7 | 43.1 | 18.9 | 19.5 | 29.7 | 38.2 |

### 3.4.3 Forest Establishment and Tending Costs

Establishment and tending costs cover operations such as land preparation, planting, releasing, fertilising and thinning. These costs will have limited impact on the potential wood flow from the Northland resource, although they may have some influence on the timing of harvest due to the cost of replanting that will subsequently occur. Indufor has included generic establishment and tending costs, which differ by soil type and silvicultural regime, and are based on observed costs for the Northland region. These costs are outlined in Table 3-11.

**Table 3-11: Establishment & Tending Costs**

| Operation | Year of Operation | Clay | | Sand | |
|---|---|---|---|---|---|
| | | Clearwood | Framing | Clearwood | Framing |
| | | NZD/ha | | | |
| Site prep & planting | 0 | 2200 | 2200 | 1750 | 1750 |
| Maintenance | 1 | 35 | 35 | 15 | 15 |
| Pruning | 6 | 950 | | 950 | |
| | 7 | 860 | | 860 | |
| Thinning | 8 | 650 | 650 | 650 | 650 |
| Fertiliser | 8 | 400 | 400 | | |

## 3.5 Northland Market

The Northland region has a processing sector comprising several large mills and a number of smaller wood processors. The major wood processing operations include:

- Sawn timber and veneer processing facilities with a combined input capacity of almost 1 million $m^3$ per annum.
- Laminated veneer lumber (LVL) production consuming around 200 000 $m^3$ per annum.
- Triboard and strandboard products totalling 200 000 $m^3$ log intake per annum.
- Export woodchip operations at Marsden Point currently exporting chip derived from around 150 000 $m^3$ of roundwood per annum along with chip residues from local mills.

The major sawn timber facility in the region is the Carter Holt Harvey (CHH) sawmill at Whangarei (actually comprising two mills on the one site). CHH's LVL facility at Marsden Point is also a major consumer of unpruned saw/veneer logs. Juken New Zealand operates its own integrated facility comprising a sawmilling and veneer operation and triboard plant with most of its log requirements provided from the resources located in the Far North. The major pruned sawlog processor in the region is Rosvall sawmill. There are also a number of smaller sawmills around Northland and Auckland dependent on log supply from the Northland region.

Pulpwood markets are largely limited to the Marusumi chip export facility at Marsden Point, although there are several roundwood producers, and the export market for KIS grade logs consumes a large proportion of what was previously regarded as pulp. The Juken New Zealand triboard facility consumes chip logs from resource located in its vicinity.

The port at Marsden Point has well developed infrastructure for log exports. In the year ending December 2015, 2.6 million $m^3$ of logs were exported through the port, as well as additional volumes of triboard, sawn timber and LVL.

Indufor has included all mills within the wood flow modelling as potential destinations for the harvest volume. The estate modelling software can optimise allocation to these mills within other constraints set for the model. Indufor's estimates of the mills' current log demand for Northland logs are outlined in Table 3-12, along with the principal log grades utilised by those mills. Some of the mills located in the south of the region also source logs from the Central North Island that are additional to the volumes presented in Table 3-12. For some mills additional constraints have been applied, limiting the portion of some grades that can be supplied.

**Table 3-12: Current Log Demand - Northland Mills**

| Mill | Mill Demand/Capacity for Northland Region logs ('000 $m^3$/year) | Log Grades Consumed |
|---|---|---|
| CHH LVL (Marsden Point) | 270 | Pruned, S30, S20 |
| CHH Sawmill (Whangarei) | 275 | S30, S20, S15, K |
| Crofts | 60 | S30, S20, S15, K |
| Herman Timber | 10 | S30 |
| JNL Triboard | 130 | S20, S15, Pulp |
| JNL Veneer | 265 | Pruned, S30, S20, A, K |
| Kaihu Valley | 20 | S30 |
| Marusumi | 250 | S15, Pulp |
| Max Birt | 15 | S30 |
| Mt Pokaka | 140 | S30, S20, S15, K |
| Northpine | 40 | Pruned, S30 |
| Pinepac Kumeu | 25 | S30, S20, S15, K |
| Pinepac Whenuapai | 80 | Pruned, S30, S20 |
| Resource Enterprises | 70 | S30, A, Ki |
| Rosvall | 90 | Pruned, S30 |
| Topuni Timber | 12 | S20, S15, K |
| Waipapa Pine | 80 | S30 |

Some Northland pulplogs are also expected to be transported to the Central North Island where demand currently exceeds supply. Indufor envisages this situation will only persist until 2018 beyond which the requirements of central North Island mills will be able to be met from within the region.

It is assumed all log grades could alternatively be exported through Marsden Point.

### 3.5.1 Log Prices

The same delivered log prices, for sawlog grades, have been assumed to all possible destinations. While Indufor recognises this is not always the case, by keeping the prices the same it is possible to see where there might be logistical advantages in supplying certain mills. The prices assumed for each of the yield table grades are shown below:

| | |
|---|---|
| Pruned | NZD160/$m^3$ |
| S30 | NZD115/$m^3$ |
| S20 | NZD102/$m^3$ |
| S15 | NZD85/$m^3$ (NZD75/$m^3$ for export) |
| A | NZD115/$m^3$ |
| K | NZD102/$m^3$ |
| Ki | NZD90/$m^3$ |
| Pulp | NZD50/$m^3$ |

An alternative approach has been taken for pulplogs. The price paid for pulplogs tends to reflect the cost of transport, with pulpmills purchasing from increasingly distant resources until such point as the mill's demand is met. To model this Indufor has assessed the transport cost differential between export and the local mill. Half of this differential has then been deducted from the export price – the assumption being that any transport cost saving will be shared between the pulplog seller and buyer. The effect is that where there is a transport cost saving the price is lower, but this is more than offset by the reduced transport cost.

The reverse is true when there is a higher transport cost to supply a local mill compared to export – the delivered log price is higher but not by a sufficient amount to offset the increased transport cost. The delivered log price is therefore not only dependent on the grade, but also the origin and destination of the logs (which determines the transport cost). The resulting prices are summarised in Table 3-13. Indufor does not suggest these are the actual prices paid by Marusumi or JNL but has applied them on this basis to provide an indication of the relative transport savings that could apply to each compared to export.

**Table 3-13: Assumed Pulplog Prices**

| | Ngawha | | | | Marusumi | | JNL | | |
|---|---|---|---|---|---|---|---|---|---|
| **Origin** | **Pulp** | **S15** | **Ki** | **K*** | **Pulp** | **S15** | **Pulp** | **S15** | **S20** |
| | **(NZD/m$^3$ AMG)** | | | | | | | | |
| A1 | 43.21 | 68.21 | 83.21 | 86.42 | 49.05 | 74.05 | 36.29 | 36.29 | 88.29 |
| A2 | 41.65 | 66.65 | 81.65 | 83.29 | 48.41 | 73.41 | 34.84 | 34.84 | 86.84 |
| A3 | 31.94 | 56.94 | 71.94 | 63.88 | 38.65 | 63.65 | 27.19 | 27.19 | 79.19 |
| B1 | 42.75 | 67.75 | 82.75 | 85.49 | 48.13 | 73.13 | 37.51 | 37.51 | 89.51 |
| B2 | 41.46 | 66.46 | 81.46 | 82.91 | 48.13 | 73.13 | 41.14 | 41.14 | 93.14 |
| B3 | 43.92 | 68.92 | 83.92 | 87.84 | 48.16 | 73.16 | 50.82 | 50.82 | 102.82 |
| C1 | 42.78 | 67.78 | 82.78 | 85.55 | 48.13 | 73.13 | 44.46 | 44.46 | 96.46 |
| C2 | 43.56 | 68.56 | 83.56 | 87.12 | 48.10 | 73.10 | 49.39 | 49.39 | 101.39 |
| C3 | 48.30 | 73.30 | 88.30 | 96.60 | 48.15 | 73.15 | 55.20 | 55.20 | 107.20 |
| C4 | 49.59 | 74.59 | 89.59 | 99.18 | 48.15 | 73.15 | 56.60 | 56.60 | 108.60 |
| C5 | 56.86 | 81.86 | 96.86 | 102.00 | 51.22 | 76.22 | 60.25 | 60.25 | 112.25 |
| D1 | 50.57 | 75.57 | 90.57 | 102.00 | 48.15 | 73.15 | 56.38 | 56.38 | 108.38 |
| D2 | 53.54 | 78.54 | 93.54 | 102.00 | 48.05 | 73.05 | 59.17 | 59.17 | 111.17 |
| D3 | 57.58 | 82.58 | 97.58 | 102.00 | 51.21 | 76.21 | 63.86 | 63.86 | 115.86 |
| D4 | 57.64 | 82.64 | 97.64 | 102.00 | 51.20 | 76.20 | 61.83 | 61.83 | 113.83 |

* K-grade price is reduced by a further NZD2/m$^3$ compared to export to provide a disincentive to supply this grade to Ngawha - so only supplies if required to meet demand.

## 3.6 Potential Wood Flows

Indufor has modelled the wood flows from the resource using the *Tigermoth*[6] forest estate modelling software.

The area, yield, cost and price assumptions described in this report have been loaded into the model, along with a series of harvesting and demand constraints. These constraints are set to ensure that the wood flows are not dissimilar to what is expected in the Northland region in the short to medium term and longer term, to ensure a realistic harvest profile. These constraints are described in the following sections.

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[6] Tigermoth is a licensed product of Stewart Murray Limited.

### 3.6.1 Replanting Constraints

To be consistent with the MPI Wood Availability Forecasts, Indufor has assumed a 3% area loss from between the first and second rotation, to account for area losses due to road and harvest landing construction.

Indufor has also assumed all the large-owner forests will be replanted as framing regimes i.e. none will be pruned once replanted, as in the MPI forecasts. For small owners, just 25% of what is currently pruned will be pruned in the next rotation (the rest being managed under a framing regime).

As in the Northland Wood Availability Forecasts, a total of 7 000 ha is not replanted. This principally relates to the non-replant of areas previously under Crown Forest Licences reverting to the land owner.

Investors into a new processing plant, as well as existing processors can play an active role in limiting the level of deforestation, and potentially reversing the trend and increasing the afforestation rate. Achieving this would require active engagement between the industry and the current and future forest owners and other stakeholders to ensure that the benefits accruing from afforestation will be fully recognised, and shared equitably.

### 3.6.2 Harvesting Constraints

The harvest age has been constrained to be within 25 to 35 years of age for large owners (up to 40 years prior to 2023). For small owners the range is wider – 24 to 40 years.

The harvest levels for large owners until 2023 are set to match those in the MPI Wood Availability Forecasts, as these are based on the owner's stated intentions.

In 2014 and 2015 the model is constrained to match actual Northland harvest levels.

Smoothing constraints have also typically been applied as follows:

- Annual fluctuations in the harvest level of 10% are allowed until 2020.
- From 2020 to 2023 annual increases of 10% are allowed but no drop in volumes.
- Two five-year blocks follow – from 2024 to 2028 and 2029 to 2033, where stable wood flows are required within the 5-year periods and a 10% variation between 2028 and 2029.
- Harvest levels are constrained in 10 year blocks thereafter, with constant wood flows within the periods and a 10% fluctuation allowed from one 10-year period to the next.

The impacts of allowing greater levels of annual variation have also been investigated.

### 3.6.3 Allocation Constraints

Supply to existing Northland mills has been capped at levels outlined in Table 3-12. In some instances the mix of log grades to an individual mill has been constrained to match mill requirements (e.g. limited proportion of small logs).

Pulplog supply to the Central North Island has been constrained so the following allocations must be met:

- 2016 = 75 000 $m^3$
- 2017 = 50 000 $m^3$
- 2018 = 25 000 $m^3$
- 2019 onwards = 0 $m^3$

An additional scenario has also been assessed whereby a minimum of 90% of the volumes outlined in Table 3-12 are supplied to existing mills.

**Proposed Ngawha Mills**

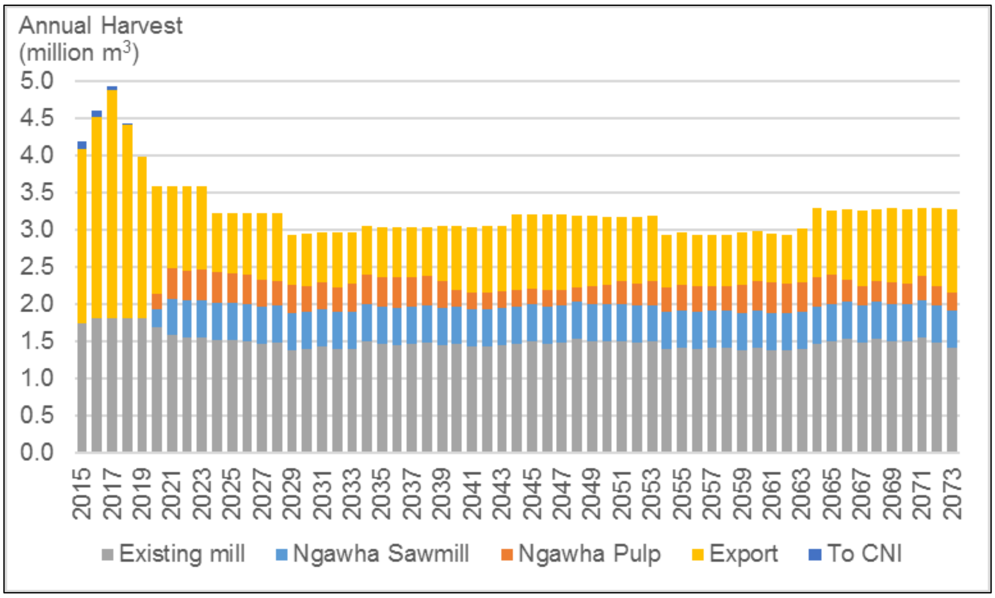
It is assumed the Ngawha pulpmill will require 400 000 m$^3$ of logs annually to supplement residue chips from the proposed sawmill and other Northland mills.

The sawmill is assumed to require 500 000 m$^3$ per year, comprising a mix of sawlog and export grades.

## 3.7 Demands from Existing Facilities

Figure 3-15 illustrates the resulting wood flows when no minimum allocation requirements are set to the existing or proposed Ngawha mills. Under this scenario the Ngawha sawmill requirements are fully supplied and a large part of the pulpmill demand. This reflects the potential transport cost advantages associated with a facility located at Ngawha. There is, however, some variation in the volumes supplied to domestic mills annually.

**Figure 3-15: Northland Wood Flows - No Minimum Supply to Existing Mills**




It is not reasonable to expect mills will survive with large variations in the volume of logs supplied from one year to the next. Figure 3-16 shows the impact on wood flows if a minimum of 90% of the mills requirements are supplied. This results in a minimum of 1.71 million m$^3$ being consumed by domestic mills annually. MPI figures indicate that in 2015 harvests in Northland totalled 4.18 million m$^3$ of which 2.61 million m$^3$ were exported through Northport. This implies domestic consumption was 1.56 million m$^3$ suggesting the minimum allocation assumed by Indufor should be sufficient to meet current demands.

Notably, there is little impact on the volumes supplied to the Ngawha mills (the sawmill is still fully supplied) with the additional volume requirements being largely diverted from exports, again emphasising the relative transport cost advantages for delivery from much of the Northland estate to a Ngawha based facility compared to export.

**Figure 3-16: Northland Wood Flows - Existing Mills Supplied**

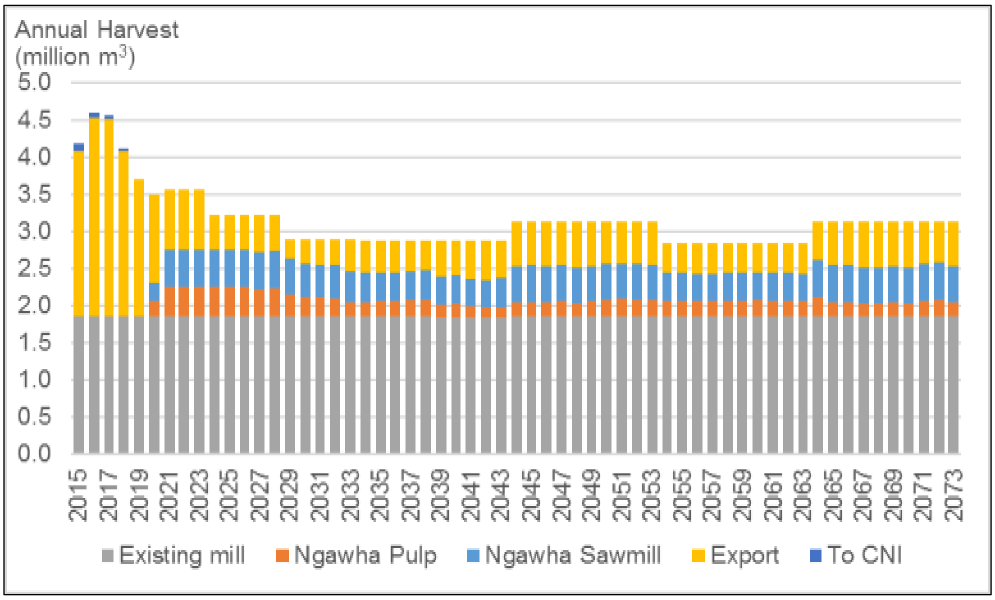
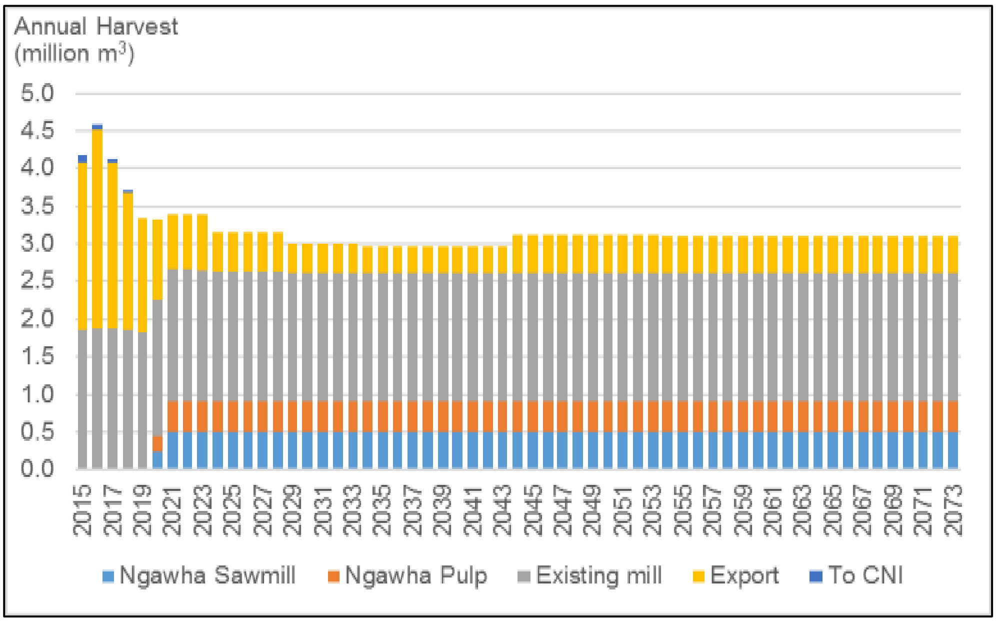



Figure 3-17 illustrates the impacts on wood flows if the Ngawha mills also have to be supplied. The Northland resource has the ability to supply both existing and proposed new mills and to maintain exports at a level of around 500 000 m³/a.

**Figure 3-17: Northland Wood Flows - Existing and Ngawha Mills Supplied**




## 3.8 Alternative Regimes

Indufor has also investigated the effects of adopting alternative regimes on the future wood flows. This has not included examination of what would be the most commercially attractive regime for the forest owner. Two possible alternative regimes have been considered:

- A framing regime where a higher final crop stocking (around 455 sph) is retained than has historically been the case. Indufor has observed several forest owners adopting similar regimes
- A regime incorporating production thinning.

Both regimes are described in more detail in Section 3.3.2. The optimisation process has the option of transferring framing stands that have been planted since 2008 (including future rotations) to the higher stocking regime.

The production thinning can be undertaken on newly planted framing stands. However, this can only be undertaken in grids where more than 20% of the sand or clay forests are relatively flat (<15˚). Furthermore, it is constrained to be no more than half the flat area in those grids.

Figure 3-18 shows the potential impact on Northland wood flows from adopting alternative thinning regimes. The dark blue line shows the wood flows when smoothing constraints are relaxed (this would not be realistic if the domestic mills were to be supported). Initially there is little difference between the regimes because the supply from large owners is constrained to match their harvest intentions in all scenarios. Note that in this comparison a minimum allocation is not required to existing or proposed mills.

**Figure 3-18: Northland Wood Flows – Impacts of Alternative Regimes**

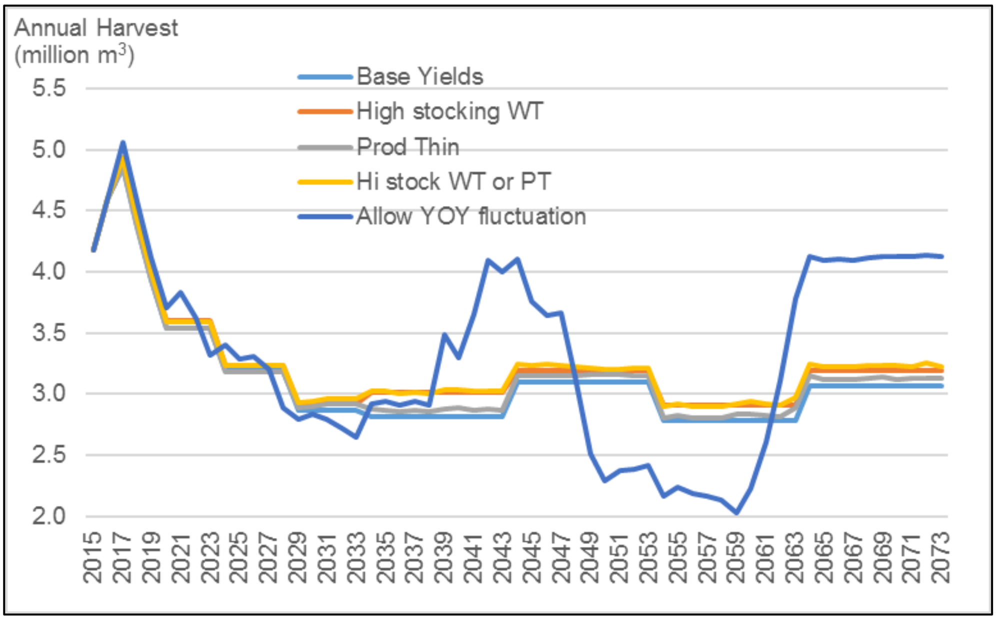



Figure 3-19 shows the impact on Northland wood flows from adopting alternative regimes, and allowing annual fluctuations in harvest levels, when both existing and proposed Ngawha mills are supplied. The increase in the potential supply resulting from the alternative regimes is evident when the resulting harvest profile is compared with Figure 3-17. The wood flows presented in Figure 3-19 allow either regime to be adopted and also relax smoothing constraints (although the year-on-year variation is muted due to the requirement to supply all mills).

Figure 3-19: Northland Wood Flows – with Alternative Regimes

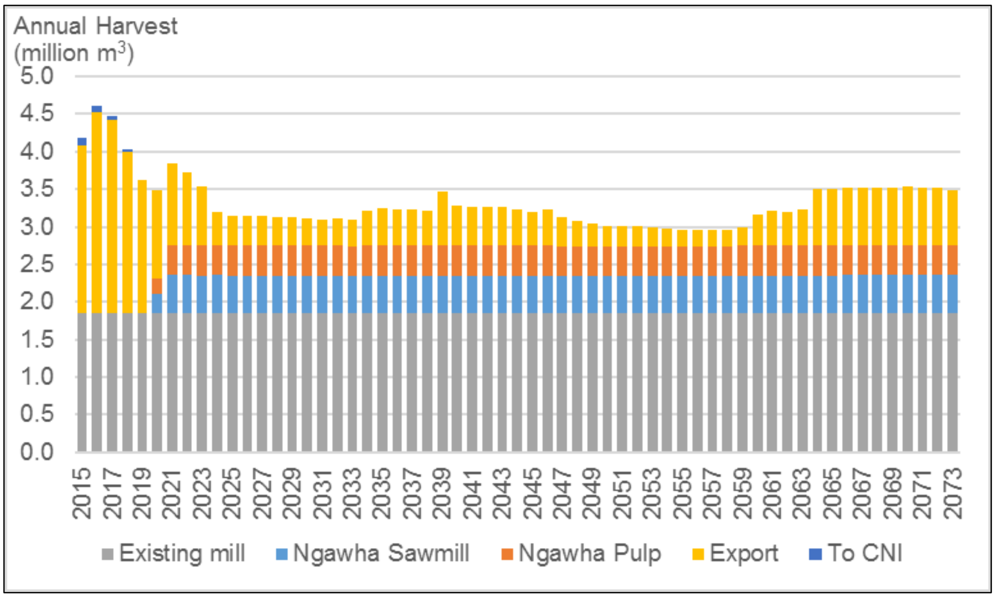
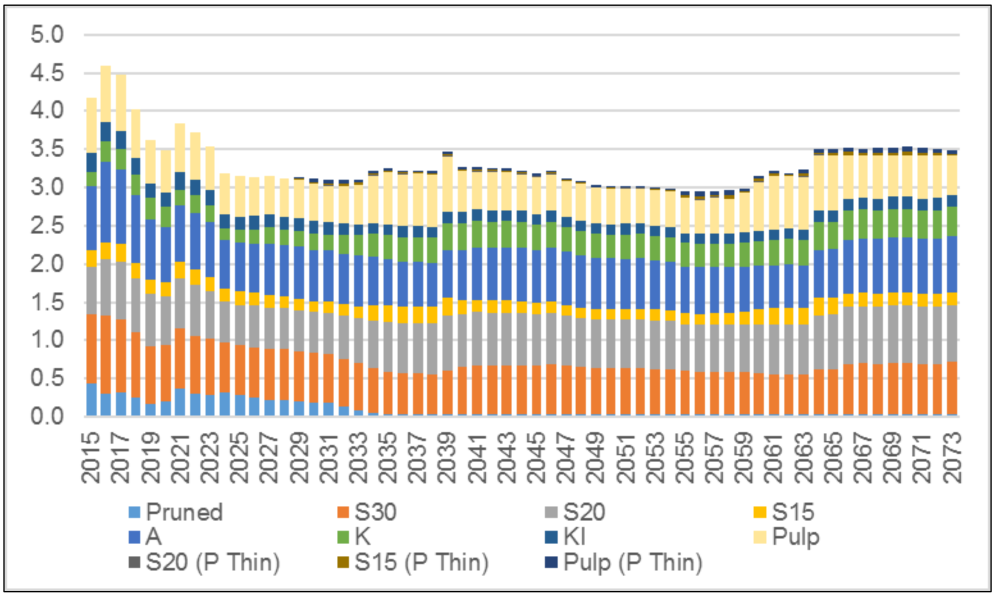



Figure 3-20 shows the mix of log grades produced when alternative regimes are adopted. The supply of pruned logs diminishes from current levels of around 300 000-400 000 $m^3$ annually to approximately 19 000 $m^3$ per year from 2040 onwards.

**Figure 3-20: Northland Wood Flows – by Log Grade**




## 3.9 Ownership Size

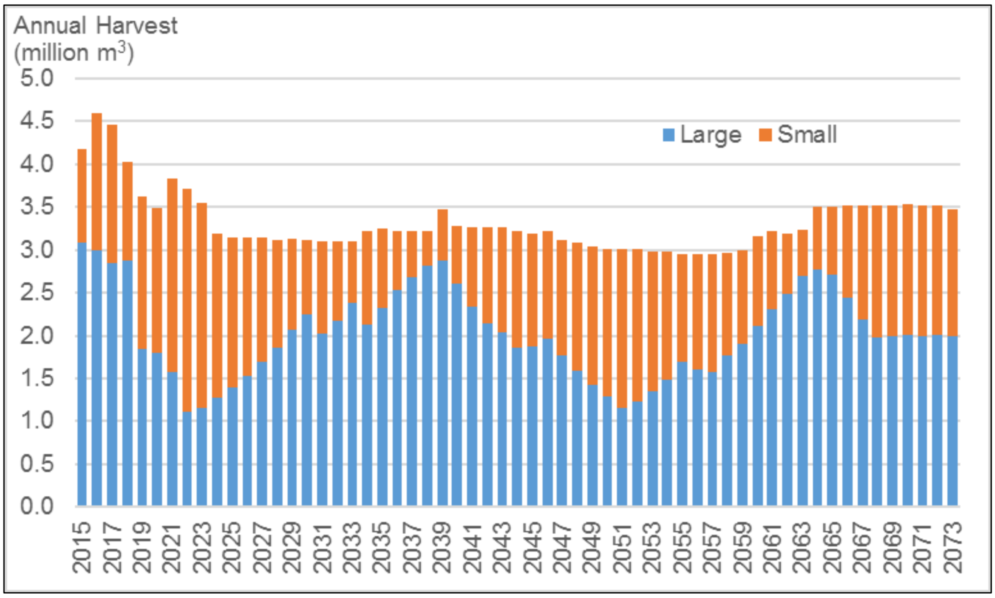
The Northland region has a significant proportion of the estate owned by entities with small areas. Around 19% of the total estate area is owned by bodies that have less than 40 ha, and 36% is held by owners with less than 1000 ha. Much of the area in the hands of small owners was established in the 1990s so is imminently reaching a harvestable age. This corresponds to an anticipated downturn in the harvest intentions of the larger owners. The harvests of large owners are expected to decline from their current levels of around 3 million $m^3$ per year to just over 1 million $m^3$ by 2022.

It is likely that the proposed new mill at Ngawha would commence production at a time when harvest volumes from large owners were nearing their lowest levels (Figure 3-21). Therefore, it would be important that initially the new mill secure volumes from these small resource owners.

A further feature of the forecast harvest profile is the increase in harvest volume predicted in 2016 and 2017. This is contingent on increased harvest levels from small owners (those owning less than 1000 ha) Figure 3-21. Large-owner harvests are predicted to decline gradually until 2018 before dropping off significantly by 2022. The extent to which the increased harvest from small owners occurs will be influenced by prevailing log prices, as small forest owners tend to be more opportunistic – timing harvests to correspond to higher log prices. If market demand is depressed harvesting by small owners is likely to be delayed.

**Figure 3-21: Northland Wood Flows by Ownership Size Class**




Attracting the supplies of the smaller owners will require targeted wood sourcing strategies. These wood sourcing strategies can take multiple forms but are likely to include some or a combination of the following options available to a mill:

- Purchasing of forests (both freehold or leasehold)
- Purchasing of resource on a stumpage basis
- Operating and managing harvesting operations specialising in harvesting smaller forestry lots
- Operating and managing forest management and forestry services advisories for smaller owners
- Log swapping arrangements with other processors
- Log purchasing co-operatives with other regional processors.

The approach taken by the mill investor is likely to depend on in-house skills and experience developed in other locations as well as financial considerations.

## 3.10 Wood Density

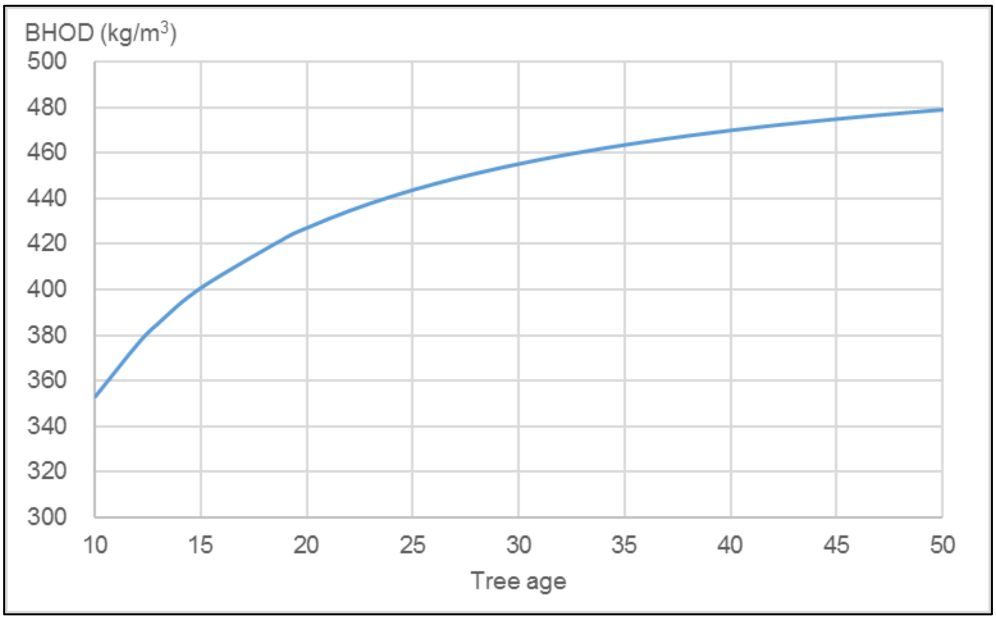
An important feature of the Northland resource in general is its relatively high wood density when compared to other regions of New Zealand. This influences both pulp yield (for a given volume of logs) and the strength and stiffness of solid wood products. Indufor has used information from several Scion studies (previously NZ Forest Research) to derive estimates of variation in wood density within Northland and how this will change with the age of harvest.

The following function from FRI Bulletin 50[7] is used to estimate breast height outerwood density (BHOD):

BHOD = 737 - (6.5 x Latitude) – (0.07 x Altitude)

The FRI function does not include an age component and is assumed to apply at a generalised average clearfell age (Indufor has assumed age 30). The average latitude and altitude within each grid described in Section 3.2.2 was used to calculate the expected BHOD at clearfell. Wood density is also known to vary with age. Figure 3-22 shows the nature of the relationship[8].

**Figure 3-22: Breast Height Outerwood Density Variation with Tree Age**




Indufor has used this relationship to estimate the likely wood density for each of the grids at varying harvest ages. Table 3-14 summarises the derived BHOD values. The results suggest an average BHOD of greater than 480 kg/m$^3$ will be achieved by age 25 in all parts of Northland. For some end uses, such as LVL, it may be desirable to have a BHOD density of above 500 kg/m$^3$. Other than in the Far North this is likely to require rotation lengths closer to 30 years.

[7] Radiata Pine Wood Properties Survey, FRI Bulletin 50, Ministry of Forestry, 1991

8 Xin Tian, D.J. Cown and D.L. McConchie (1995) Modelling of *Pinus Radiata* Wood Properties, Part 2 Basic Density, New Zealand Journal of Forestry Science 25(2), 214-30

**Table 3-14: Predicted Wood Density**

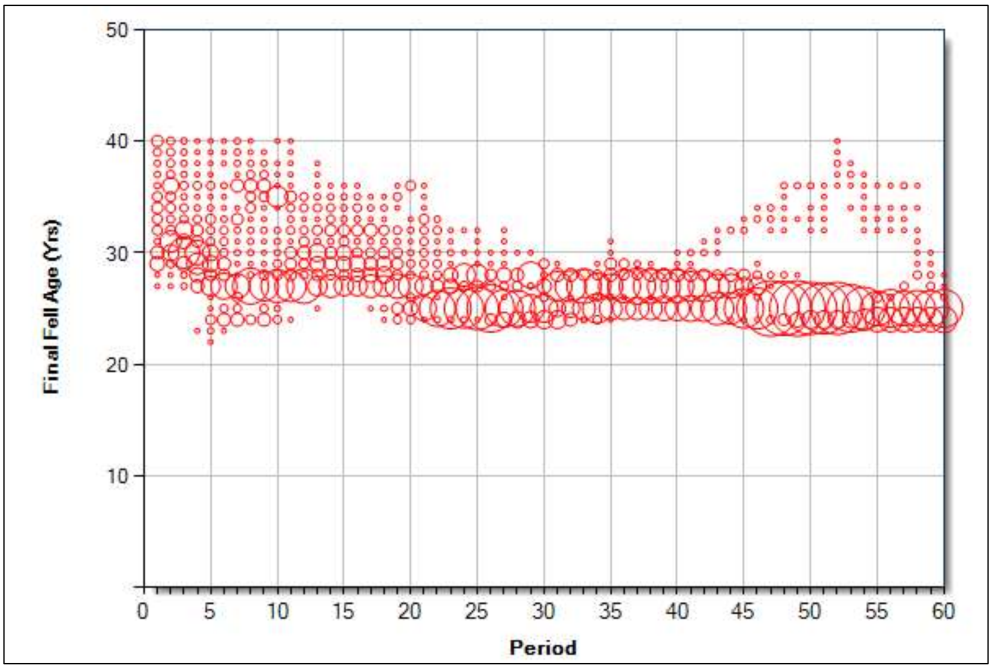
| | Stand Age (years) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Grid** | **19** | **20** | **21** | **22** | **23** | **24** | **25** | **26** | **27** | **28** | **29** | **30** | **31** | **32** | **33** | **34** |
| | (BHOD kg/m³) | | | | | | | | | | | | | | | |
| A1 | 477 | 481 | 485 | 489 | 492 | 495 | 498 | 501 | 503 | 505 | 507 | 509 | 511 | 513 | 515 | 517 |
| A2 | 476 | 480 | 484 | 488 | 491 | 494 | 497 | 499 | 502 | 504 | 506 | 508 | 510 | 512 | 514 | 516 |
| A3 | 470 | 474 | 478 | 482 | 485 | 488 | 491 | 494 | 496 | 499 | 501 | 503 | 505 | 506 | 508 | 510 |
| B1 | 473 | 477 | 481 | 484 | 488 | 491 | 493 | 496 | 499 | 501 | 503 | 505 | 507 | 509 | 511 | 512 |
| B2 | 469 | 473 | 477 | 480 | 484 | 487 | 489 | 492 | 495 | 497 | 499 | 501 | 503 | 505 | 507 | 508 |
| B3 | 466 | 471 | 475 | 478 | 481 | 485 | 487 | 490 | 492 | 495 | 497 | 499 | 501 | 503 | 504 | 506 |
| C1 | 471 | 475 | 479 | 482 | 486 | 489 | 492 | 494 | 497 | 499 | 501 | 503 | 505 | 507 | 509 | 511 |
| C2 | 466 | 470 | 474 | 478 | 481 | 484 | 487 | 489 | 492 | 494 | 496 | 498 | 500 | 502 | 504 | 506 |
| C3 | 467 | 472 | 476 | 479 | 482 | 485 | 488 | 491 | 493 | 496 | 498 | 500 | 502 | 504 | 505 | 507 |
| C4 | 465 | 469 | 473 | 477 | 480 | 483 | 486 | 489 | 491 | 493 | 496 | 498 | 499 | 501 | 503 | 505 |
| C5 | 463 | 467 | 471 | 475 | 478 | 481 | 484 | 486 | 489 | 491 | 493 | 495 | 497 | 499 | 501 | 503 |
| D1 | 469 | 473 | 477 | 481 | 484 | 487 | 490 | 492 | 495 | 497 | 499 | 501 | 503 | 505 | 507 | 509 |
| D2 | 466 | 470 | 474 | 478 | 481 | 484 | 487 | 490 | 492 | 494 | 497 | 499 | 500 | 502 | 504 | 506 |
| D3 | 464 | 468 | 472 | 476 | 479 | 482 | 485 | 488 | 490 | 492 | 495 | 497 | 498 | 500 | 502 | 504 |
| D4 | 460 | 465 | 468 | 472 | 475 | 478 | 481 | 484 | 486 | 489 | 491 | 493 | 495 | 497 | 498 | 500 |

BHOD over 500kg/m³

BHOD over 480kg/m³

Figure 3-23 shows the harvest ages associated with the wood flows illustrated in Figure 3-19.

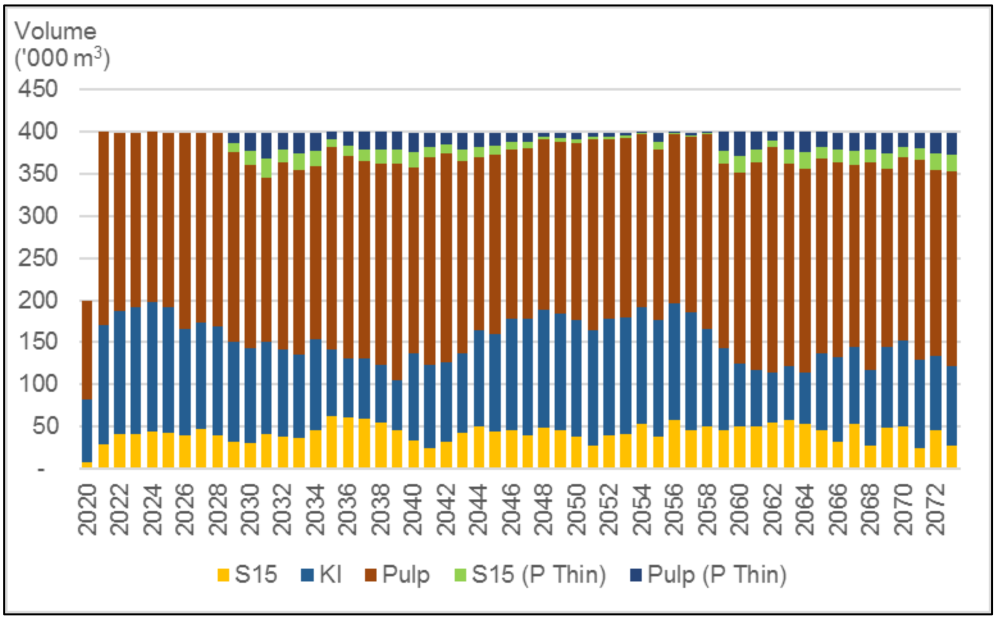
**Figure 3-23: Harvest Age**




## 3.11 Delivered Log Grades and Costs

The ability of the Northland resource to meet the proposed Ngawha mill's volume requirements will be contingent on the mill's ability to utilise a range of log grades. The actual mix of logs delivered to the mills will be dependent on the relative pricing paid for the differing log grades. However, with the assumptions relating to yield, cost and price described in other sections of this report, Figure 3-24 shows the possible mix of log grades that might be supplied to the Ngawha pulpmill. Of note is the relatively high proportion of industrial grade (KI) logs that would be utilised.

**Figure 3-24: Potential Log Grade Mix Delivered to Ngawha Pulpmill**



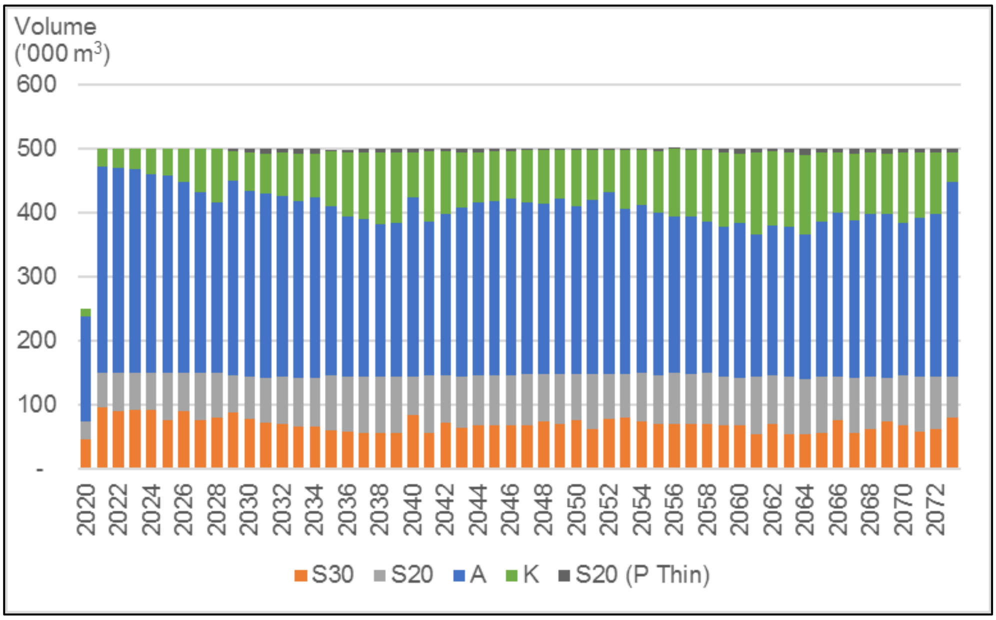

The pulpmill wood supply strategy would always aim to maximise log utilisation within the lower grades – and hence lower priced log grades. Achieving this will require a wood supply strategy that would encompass a range of tools, including log and chip trading with other processors, encouraging silvicultural management that would increase pulpwood supplies (i.e. commercial thinnings and clearfell at a lower age), evaluating the possibility of utilising hardwoods within the fibre mix and/or encouraging pure pulpwood plantation regimes.

There is likely to be some flexibility around the grades of sawlog supplied to the sawmill due to the volumes that would otherwise be exported. The mix will be influenced by the price paid by the mill, but there will be a need to accommodate a range of log sizes, grades and lengths in order to meet the mill's volume requirements. Log length is likely to be a key consideration, with many of the domestic mills requiring longer lengths and the surplus shorter lengths often exported. The ability to utilise shorter length logs would greatly enhance the mills ability to meet its volume requirements.

Figure 3-25 shows the potential supply by grade to the Ngawha sawmill, with the log prices and costs assumed previously.

Figure 3-25: Potential Log Grade Mix Delivered to Ngawha Sawmill

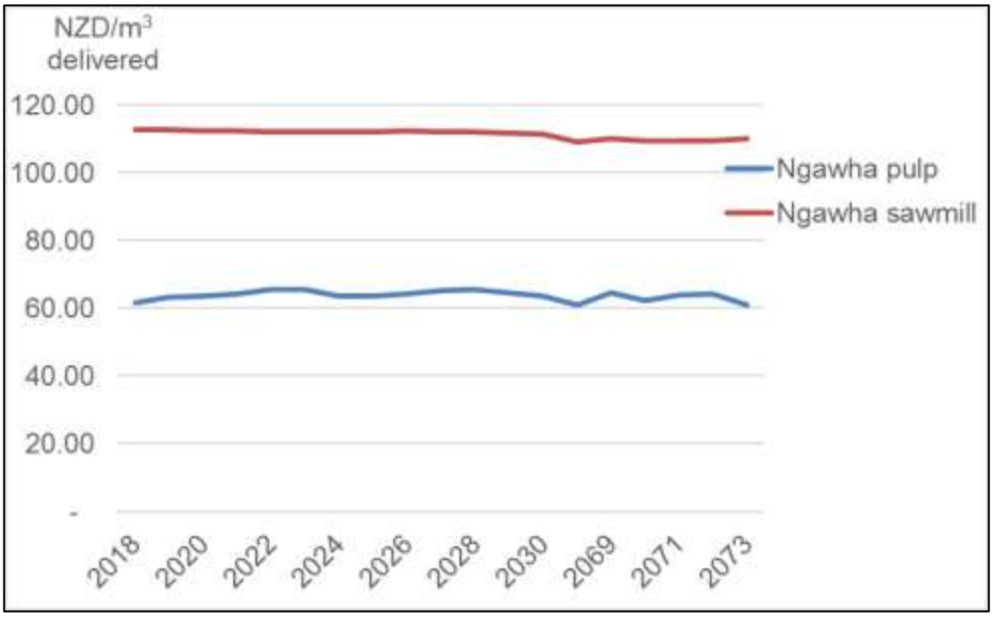



As in the case of the pulpmill, a sawmill would aim to secure its log supply as competitively as possible. In addition, the mill's design has to be aligned with the expected log grade mix. Modern mills are typically optimised to take a certain log grade, although modern scanning and mill setting technology is reducing some of the need for this.

As with the pulpmill, securing a stable supply of logs within the desired log grades is essential for the optimal operation of the mill. Ensuring this supply is likely to involve advanced securing of log supplies from forest owners, working with other wood processors to ensure the various mills require the grades acquired through swapping of logs and a range of other potential strategies, including long term forest ownership as discussed earlier.

As can be observed from Figure 3-26 the log costs to the mill are expected to remain relatively stable. However, prices will be directly influenced by the price levels achieved for logs in the export markets.

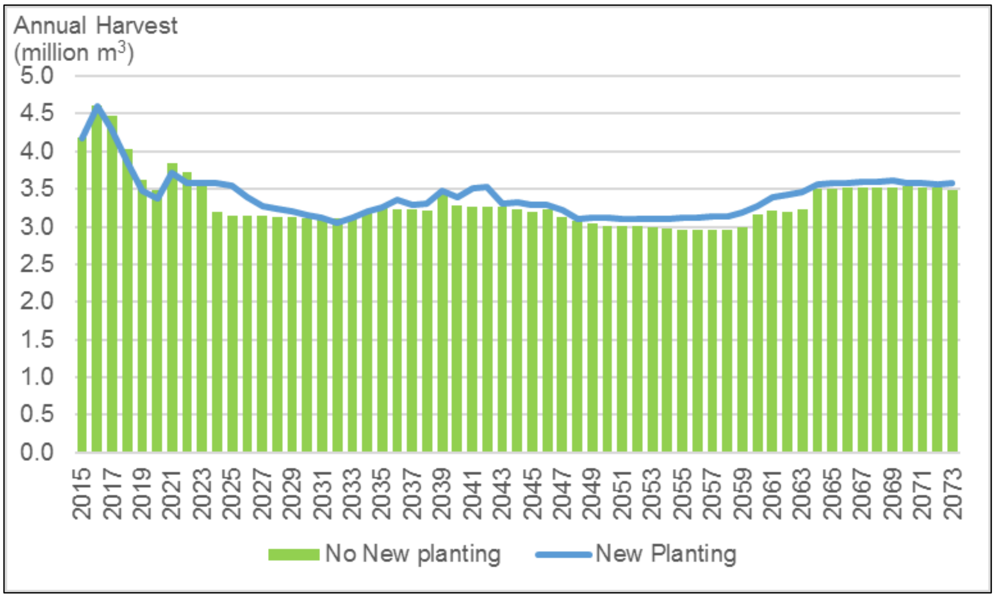
Figure 3-26: Calculated Average Delivered Log Cost for the Ngawha Pulpmill & Sawmill



## 3.12 Impact of New Planting

The impact of undertaking new planting has also been assessed. Figure 3-27 shows the impact of undertaking 500 ha of new planting per year from 2016 to 2036 when compared to the wood flows incorporating alternative framing and production thinning regimes.

**Figure 3-27: Northland Wood Flows – Impact of New Planting**




### 3.12.1 Impacts on Export Volumes

In 2015, approximately 2.61 million $m^3$ were exported through Northport. This is expected to decline in the near term as total harvests in the region drop from their current levels of around 4.2 million $m^3$/a to approximately 3.5 million $m^3$/a by 2019 and 3.0 million $m^3$/a by 2029. The following charts show the predicted export levels if the Ngawha project were implemented. Longer term it would be possible to continue to export around 0.5 million $m^3$ of sawlogs (Figure 3-28), but there will be periods in which all available pulplogs could be utilised by domestic processors (Figure 3-29).

**Figure 3-28: Northland Sawlog Exports**

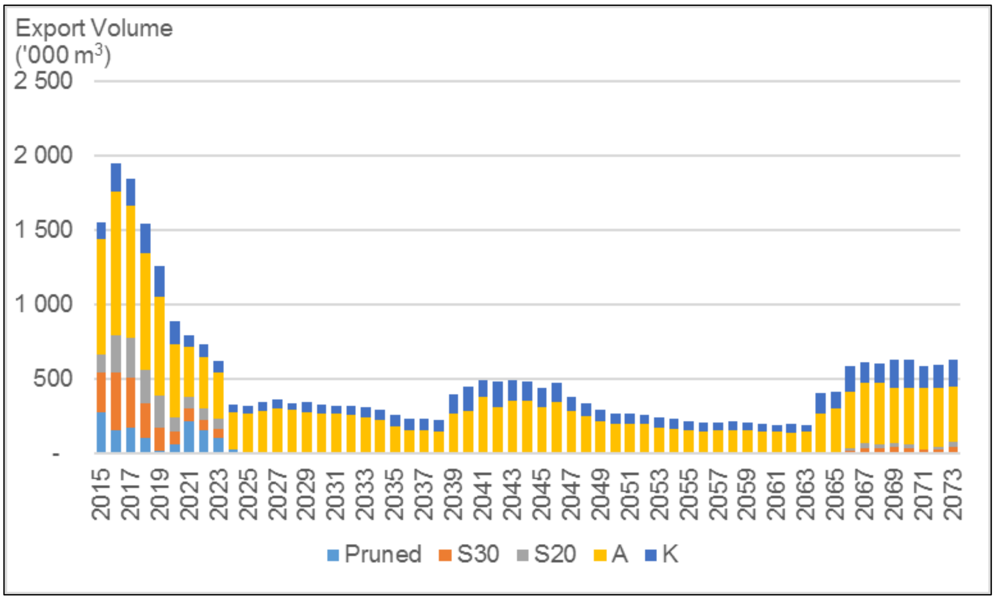
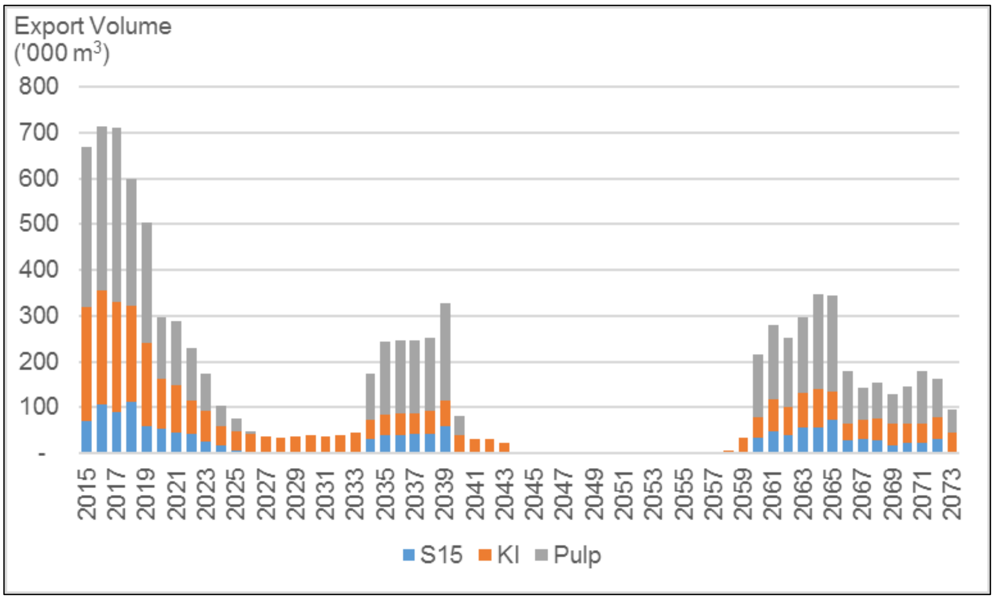


**Figure 3-29: Northland Pulplog Exports**




## 3.13 Transport Cost Savings

Indufor has assessed the potential transport savings from having mills located at Ngawha. The total transport cost savings between 2020 and 2030 from delivering logs to Ngawha rather than exporting would be between NZD90 million to NZD118 million. The higher end of the range assumes all logs delivered to Ngawha would otherwise have to be exported. The lower end of the range allows for full optimisation of the reallocation of the supply in the absence of the Ngawha mill.

Figure 3-30 compares the total transport costs for logs delivered to a Ngawha mill to the alternative of exporting. Figure 3-31 shows the same comparison for pulplogs.

**Figure 3-30: Sawlog Transport Costs – Ngawha mill vs Export**

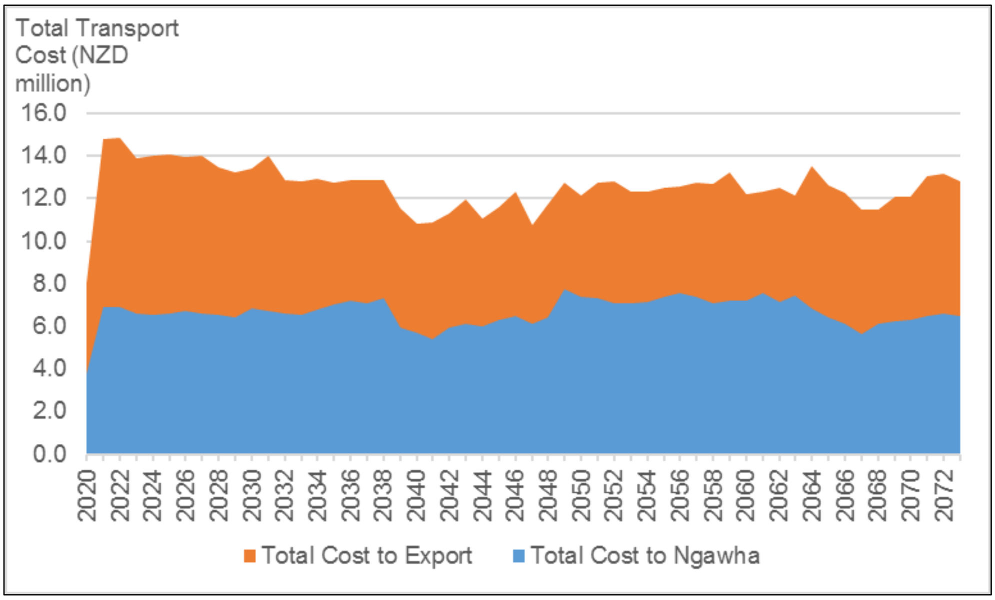
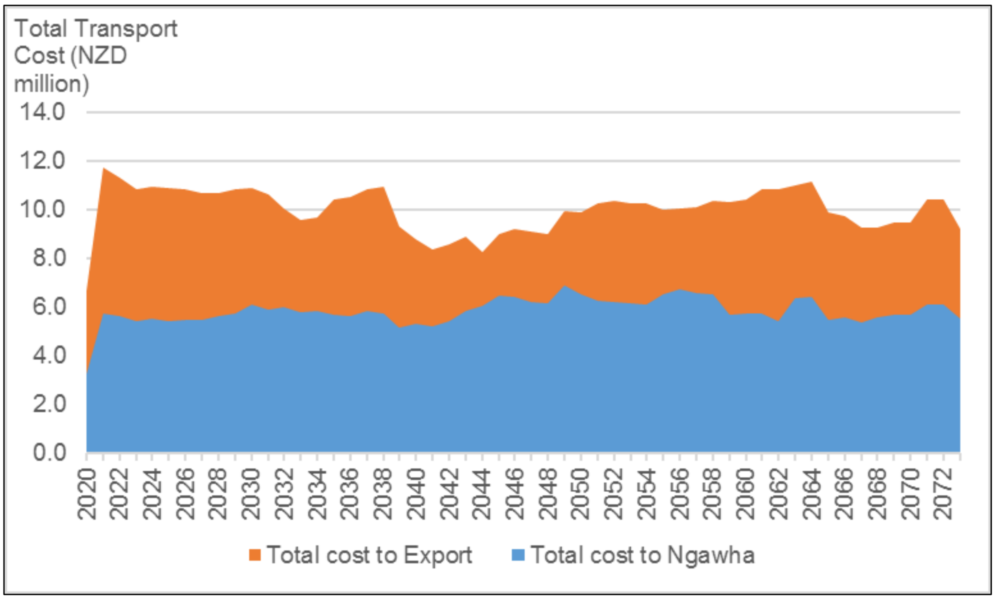


**Figure 3-31: Pulplog Transport Costs – Ngawha Mill vs Export**




These savings may accrue to the forest owner through a reduction in their transport costs, or may benefit the mill through lower delivered log prices. The most likely outcome is that the benefit would be shared between forest owner and the mill.

### 3.14 Delivered Log Costs and Stumpage Returns

Annual production costs for logs delivered to the Ngawha site range between NZD44.80/m$^3$ and NZD48.30/m$^3$ during the first 10 years of operation. The average is around NZD47/m$^3$. This includes logging, loading, roading construction and maintenance, and harvest management and marketing. An expected reduction in roading costs for second rotation stands will see costs drop to around \$44/m$^3$ longer term (in NZD 2015 terms).

Transport costs vary between NZD12.50/m$^3$ and NZD16.50/m$^3$ with the average being around NZD14.00/m$^3$.

Under the pricing assumptions described in Section 3.5.1 the average delivered log price to the pulpmill during the first 10 years of operation is NZD64.69/m$^3$. This reflects both how the prices of pulplogs have been set (with transport cost savings split between the buyer and seller) and the mix of log grades sold to the mill (the log mix includes higher priced KI grade logs). The stumpage to the forest grower over that period averages \$3.76/m$^3$. It is not uncommon for pulplogs to have a stumpage close to zero or even slightly negative. It may be that a lower delivered log cost could be achieved if a larger proportion of the transport cost savings resulted in lower log prices, or if a higher proportion of lower priced pulplogs were purchased.

The average delivered log price to the sawmill during the first 10 years of operation, under the pricing assumptions described in Section 3.5.1, would be NZD112.14/m$^3$. This results in a stumpage of NZD51.12/m$^3$, which is comparable to that achieved with sales to other sawmills in the region. Log prices do, however, have significant fluctuations from year to year and are strongly influenced by demand in export markets, shipping rates and exchange rates.

Indufor

# 4. SECTION THREE: MARKET DEMAND FOR MECHANICAL PULP

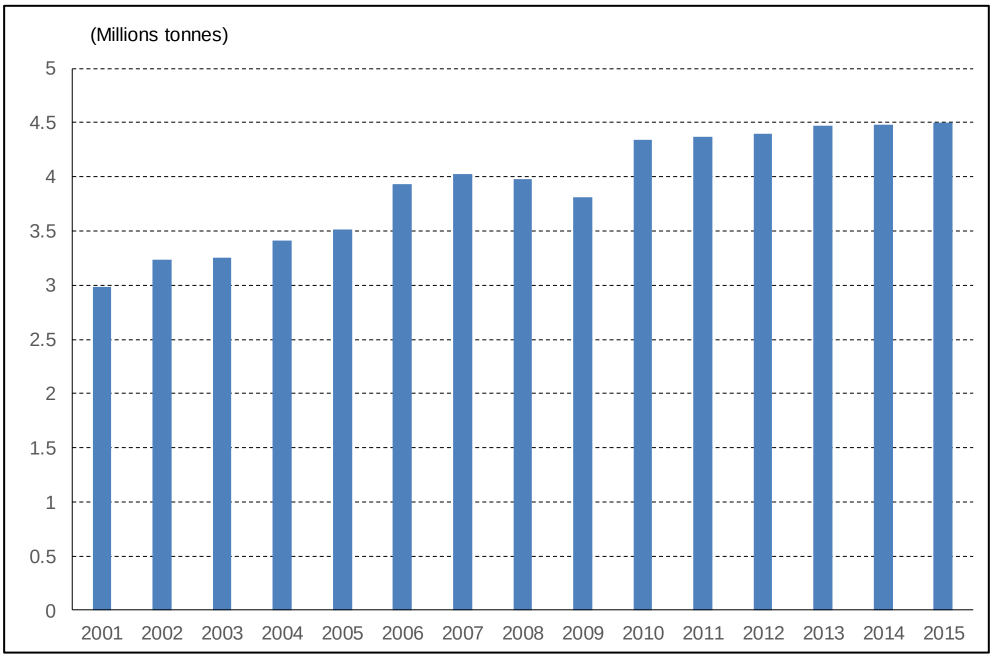
## 4.1 Global Mechanical Pulp Market

### 4.1.1 Global Mechanical Pulp Demand

Global market pulp consumption based on virgin fibre amounted to around 54 million tonnes in 2015. Of this, approximately 4.5 million tonnes were mechanical pulp, approximately 8% of the total produced from virgin fibres. Most of the world's mechanical pulp is produced then consumed within mills that are directly integrated with the product manufacture (for example pulp and paper). However, some is produced by stand-alone facilities for sale into the market whether domestic or international. This is referred to as market mechanical pulp[9]. For this project it is the market mechanical pulp segment of the total market that is relevant.

Currently global demand for market mechanical pulp is around 4.5 million tonnes. Over the past decade and a half demand has been increasing at an average rate of 2.4% per annum (Figure 4-1) although growth over the last five years has slowed considerably.

**Figure 4-1: Global Market Mechanical Pulp Consumption**



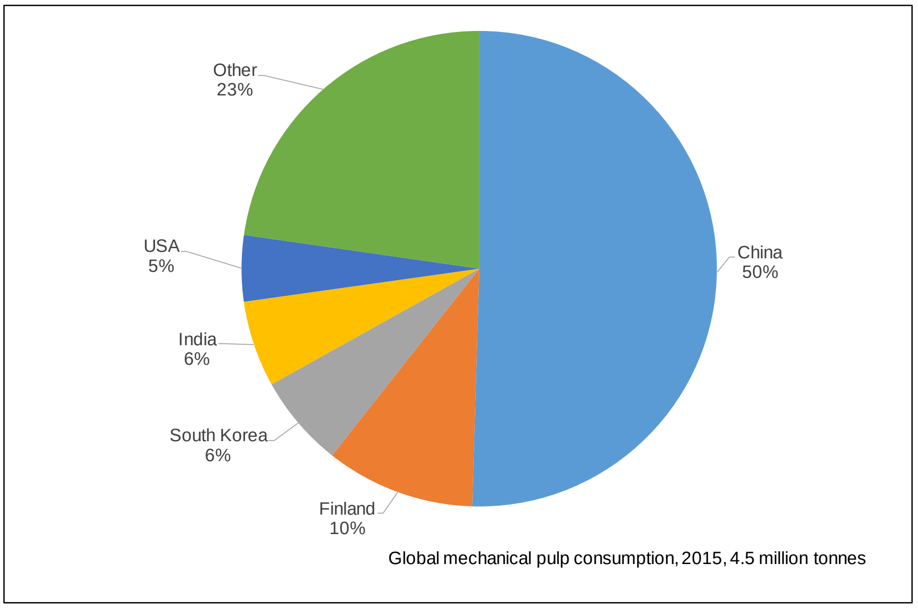

Source: Indufor analysis

Most of the market mechanical pulp that is consumed is APMP/BCTMP market pulp. Combined, these forms of mechanical pulp constitute around 70% of the total current consumption.

Half of the world's demand for market mechanical pulp is consumed in China (Figure 4-2). The next largest market, Finland is roughly one fifth of the size of China's market. Around 71% of all the market mechanical pulp is consumed in Asia and India.

[9] Market pulp refers to pulp that is traded between companies either domestically or traded across international borders. Mechanical pulp made primarily by mechanical methods to separate the fibre bundles in pulpwood. Mechanical methods can include refining or grinding. Chemicals are used in some mechanical processes (for example for producing a bleached pulp using an alkaline peroxide) but the overriding feature of mechanical pulp is that most of the lignin remains in the pulp. Specific types of mechanical pulp include; Chemi-Thermo Mechanical Pulp (CTMP), Bleached Chemi-Thermo Mechanical Pulp (BCTMP), Alkaline Peroxide Mechanical Pulp (APMP) and Thermo-Mechanical pulp (TMP). From a market perspective BCTMP and APMP are practically identical so these are generally not distinguished.

**Figure 4-2: Market Mechanical Pulp Consumption by Country**




Source: Indufor analysis

### 4.1.2 Global Mechanical Pulp Supply

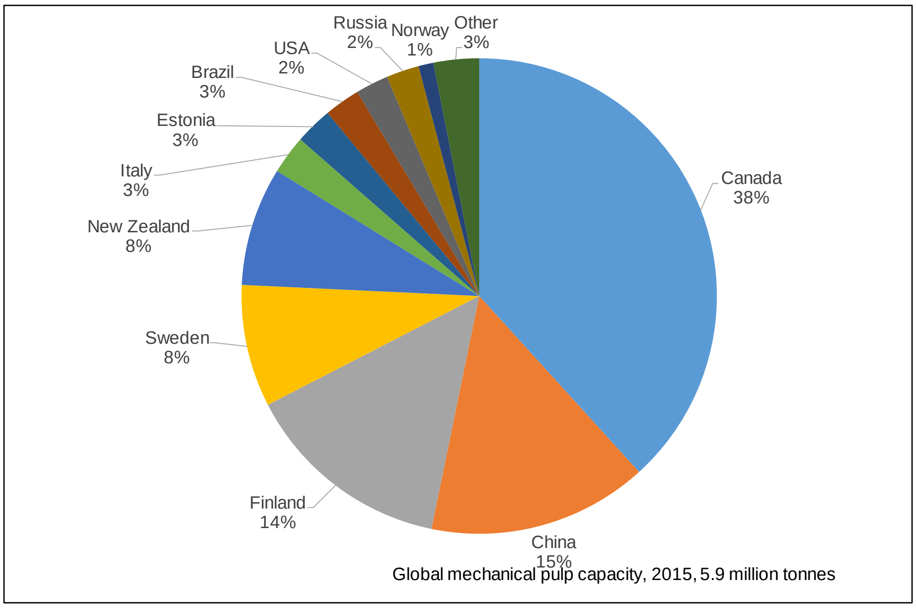
There are some 33.7 million tonnes per annum of mechanical pulping capacity installed around the world today. Most of this is in countries such as Canada, the USA, China, Sweden and Finland. Much of this capacity is integrated but around 17% is dedicated to providing the international market with mechanical pulp. Of the world's market mechanical pulp production capacity 38% is located in Canada (Figure 4-3). Other countries with significant mechanical pulp production capacity include China, Sweden, Finland and New Zealand. Europe as a whole constitutes roughly a third of all global production capacity, second only to Canada.

Currently around 76% of global installed market mechanical pulp production capacity is actively employed in making pulp. The leading producers of market mechanical pulp constitute 65% of global production capacity focussed only in three countries, Finland, Canada and New Zealand. Canada is the largest producer of market pulp, supplying some 46% of current demand (Figure 4-4). Scandinavian countries are also an important producing block with New Zealand currently the third largest producer by country. Producers such as Millar Western, Canfor, Tembec and Paper Excellence (which has become the leading producer of market pulp after the reopening of the formerly Tembec owned Chetwynd hardwood mechanical pulpmill) are exclusively located in Canada (Figure 4-5). Both Metsa and UPM-Kymmene's market mechanical pulp capacity is situated in Finland.

As noted, most of the supply is BCTMP pulp manufactured from hardwood species, although all the production in New Zealand is from softwood. Market mechanical pulp producers in countries such as Canada, New Zealand and the US are operating at or close to capacity.

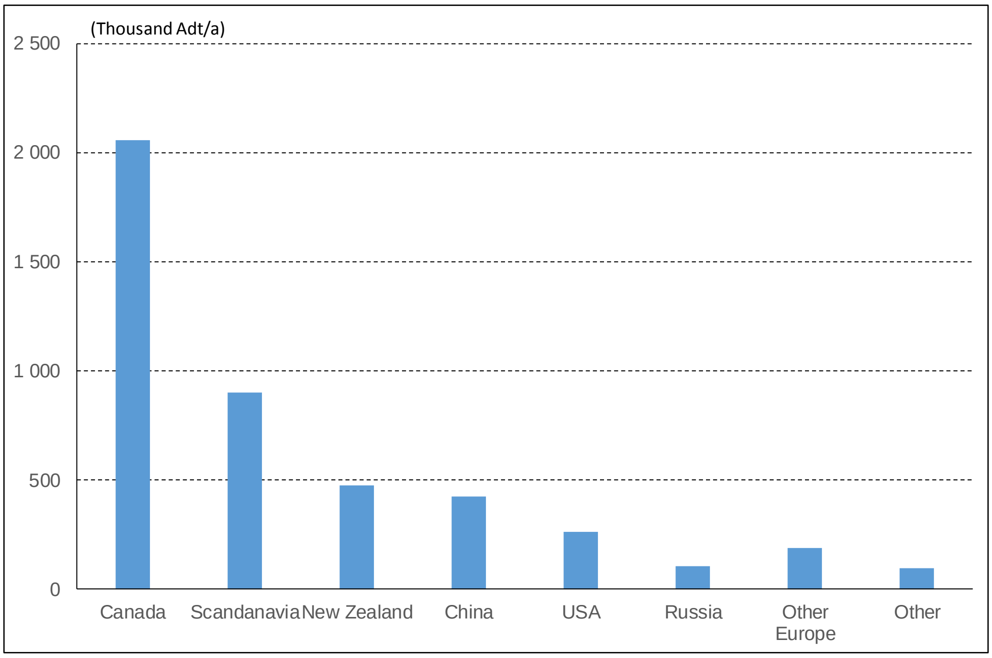
The two New Zealand producers, Winstone Pulp International Ltd. (WPI owned by Ernslaw One, a subsidiary of the Malaysian organisation Rimbunan Hijau), and Pan Pac Forest Product Products limited (owned by Oji Green Resources, a subsidiary of Oji Holdings Limited) are located in Ohakune and Napier, respectively. Not all the leading mills produce pulp exclusively for the market (some being used within their own integrated paper operations) but both WPI and Pan Pac are exclusively focussed on manufacturing for the international market.

**Figure 4-3: Global Installed Mechanical Pulp Capacity**



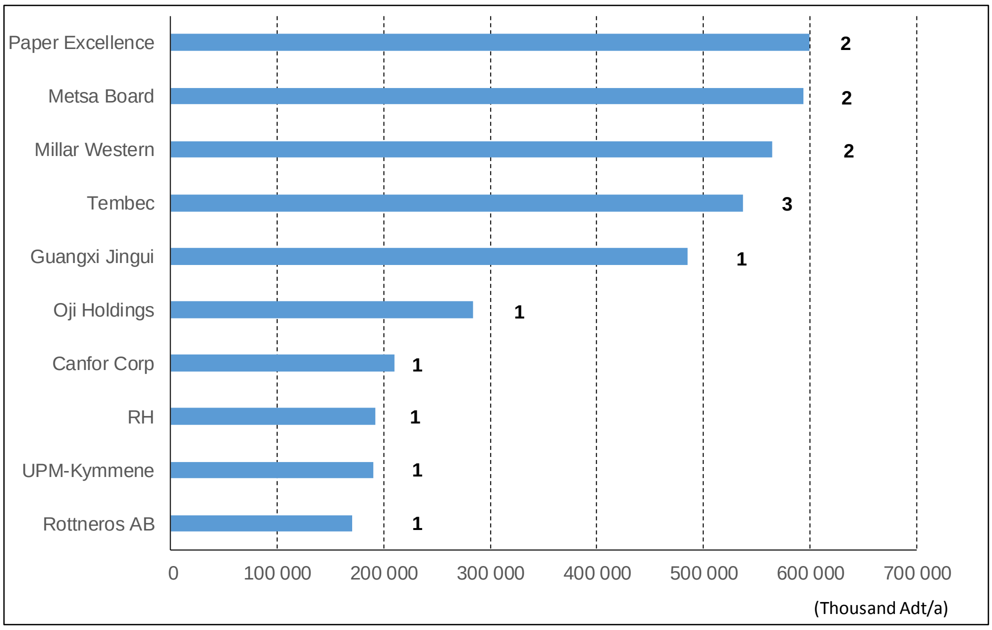

Source: RISI, Directory of Pulp and Paper Mills, Indufor data, and publicly available media releases and reports

**Figure 4-4: Global Market Mechanical Pulp Production**




Source: Indufor analysis

**Figure 4-5: Leading Suppliers[1] of Market Mechanical Pulp, 2015**




Note 1) Number in the graph indicates the number of mills represented in the mill capacity
Source: RISI, Directory of Pulp and Paper Mills, Indufor data, and publicly available media releases and reports

Generally, mechanical pulpmills of international scale are much smaller than their chemical pulp counterparts. Globally, the average mechanical pulpmill size is around 160 000 tonnes, although mills of half a million ADt/a or more exist. Typically, market mechanical pulpmills of scale range between 150 000 ADt/a and 300 000 ADt/a in capacity.

## 4.2 Asia-Pacific Mechanical Pulp Market

### 4.2.1 Mechanical Pulp Demand

Nearly 3.2 million tonnes (71%) of market mechanical pulp is currently being consumed in the Asia region. As noted earlier, most of the consumption is in China (Figure 4-7), although increasingly India is a recognised and growing market. Other markets such as Indonesia and South Korea have been relatively stable over the last decade while some, such as Japan and Taiwan, have been declining steadily since the turn of the century. Overall the Asian market has grown by 3% year on year since 2010. The China market has grown by around 5.2% annually over the same period. India, the other key growth market, has been developing at a slower pace of 4.2%/a.

At least 95% of the demand is believed to be for BCTMP pulp, indicating that while BCTMP is the most important category of mechanical pulp in the world, it almost exclusively dominates market mechanical pulp consumption in Asia.

Within the Asia Pacific region mechanical pulp is primarily used in the production of folding box board (FBB), as well as printing and writing paper (Figure 4-6)[10]. Together these end uses constitute between 85% and 95% of the end uses for mechanical pulp in Asia. Compared to

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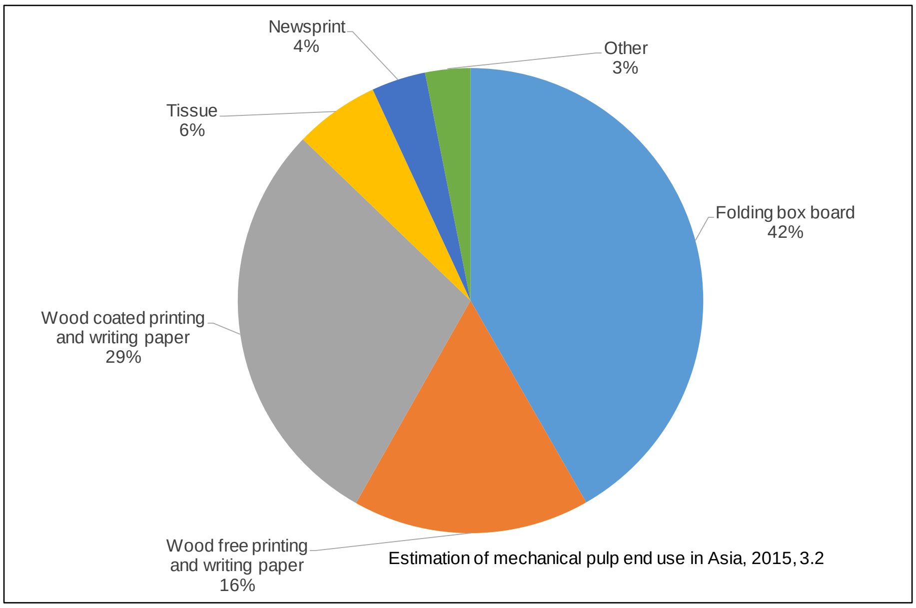
[10] The range of recognised paper grades around the world is wide. Those relevant to the use of mechanical pulp include newsprint (for newspapers, telephone directories and similar items), uncoated printing and writing paper (used in books, photocopy paper, magazines and commercial printing), coated wood free paper (used in books, magazines and commercial printing and considered primarily high value), tissue paper (for household sanitary applications and covers, toilet/facial paper, kitchen handy towels and serviettes etc.) and cartonboard (with a wide range of grades from lower quality recycled fibre based boxboard to virgin pulp based folding boxboard (FBB). FBB is a significant user of mechanical pulp and typical products to be packed include cosmetics, cigarettes, pharmaceuticals, confectionery and food. FBB typically has three layers, with mechanical pulp in the middle layers and chemical pulp for the exterior layers.

chemical pulps such as BHKP, mechanical pulp (BCTMP specifically) has additional advantages of higher bulk and opacity. This provides the paper and board manufacturer with flexibility to customise their paper products by blending chemical pulp with mechanical pulp to meet specific customer requirements. As indicated by one mechanical pulp producer, this has led to a fair degree of specialisation even within the manufacture of the pulp in order to meet user requirements.

**Figure 4-6: Estimation of End-use Segmentation for Mechanical Pulp in the Asia Region**




Source: Indufor analysis

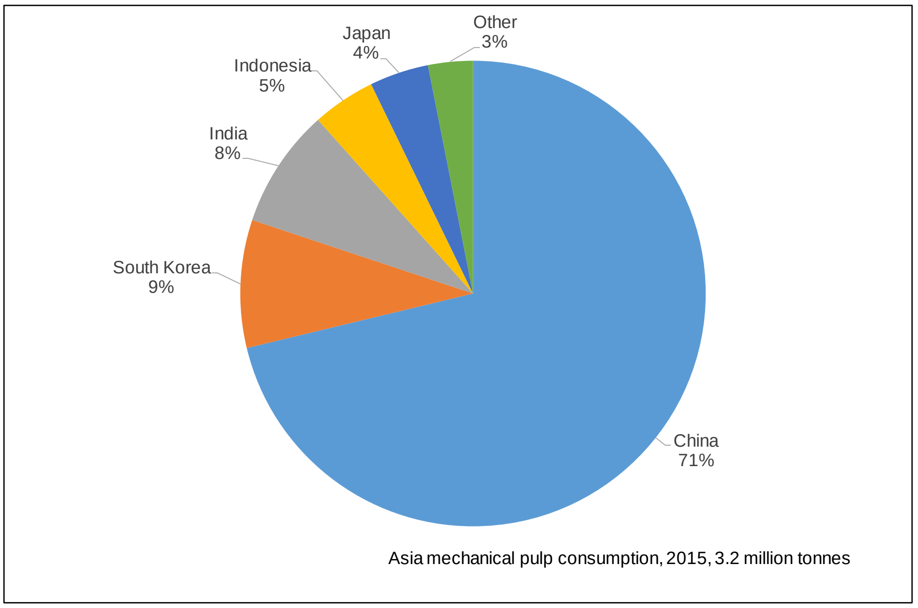
### 4.2.2 Mechanical Pulp Supply

The supply of mechanical pulp to Asia comes from outside the region with the exception of domestic market mechanical pulp production in China (estimated to be around 425 000 tonnes in 2015, of which 420 000 tones is believed to have been consumed in China), and Japan (approximately 10 000 tonnes in 2015). There is no market mechanical pulp production in Taiwan, Indonesia, India, Korea or other Asian countries.

Canada, EU producers (mainly from Scandinavia) and New Zealand are the key suppliers to the region. Sizeable volumes of mechanical pulp from the US are also traded, as well as some from Russia (Table 4-1).

As indicated in the previous section, most of the market mechanical pulp consumed in Asia is BCTMP. Around 72% of all mechanical pulp consumed is derived from temperate hardwoods. Of the balance, just over 50% is made from radiata pine.

**Figure 4-7: Mechanical Pulp Consumption in Asia[1]**




Note 1) the category "other" includes Pakistan, Taiwan, Malaysia, the Philippines, Vietnam and Thailand. It also includes domestic market pulp production consumed within the country of origin.

Source: Indufor analysis, Eurostat and GTA databases

**Table 4-1: Internationally Traded Mechanical Pulp In Asia, 2015**

| | Imports (thousands of tonnes) | | | | | | |
|---|---|---|---|---|---|---|---|
| **Trading Partner** | **China** | **South Korea** | **India** | **Indonesia** | **Japan** | **Taiwan** | **Other[1]** |
| Canada | 1 244 | 215 | 74 | 85 | 23 | 30 | 16 |
| EU | 139 | 22 | 114 | 8 | 4 | 3 | 34 |
| New Zealand | 278 | <1 | 38 | 46 | 93 | 3 | 4 |
| USA | 183 | <1 | 7 | 1 | 3 | 2 | 7 |
| Russia | 6 | 39 | 31 | - | - | - | - |
| Other Trading Partners[2] | <1 | 5 | 1 | - | - | - | - |
| **Total** | **1 851** | **283** | **264** | **140** | **123** | **38** | **61** |

Note 1) The category I "Other" includes Pakistan, Malaysia, the Philippines, Vietnam and Thailand. Trade to Taiwan is included as a separate country in this table.

2) The category "Other Trading Partners" includes China, Brazil and Japan.

Source: Indufor analysis of Eurostat and Global Trade Atlas data 2015

Future growth in supply of market pulp is challenging, as fibre availability in one of the main traditional supply areas (Canada) is under pressure, and limited opportunities exist for expansion of mechanical pulp production in new locations.

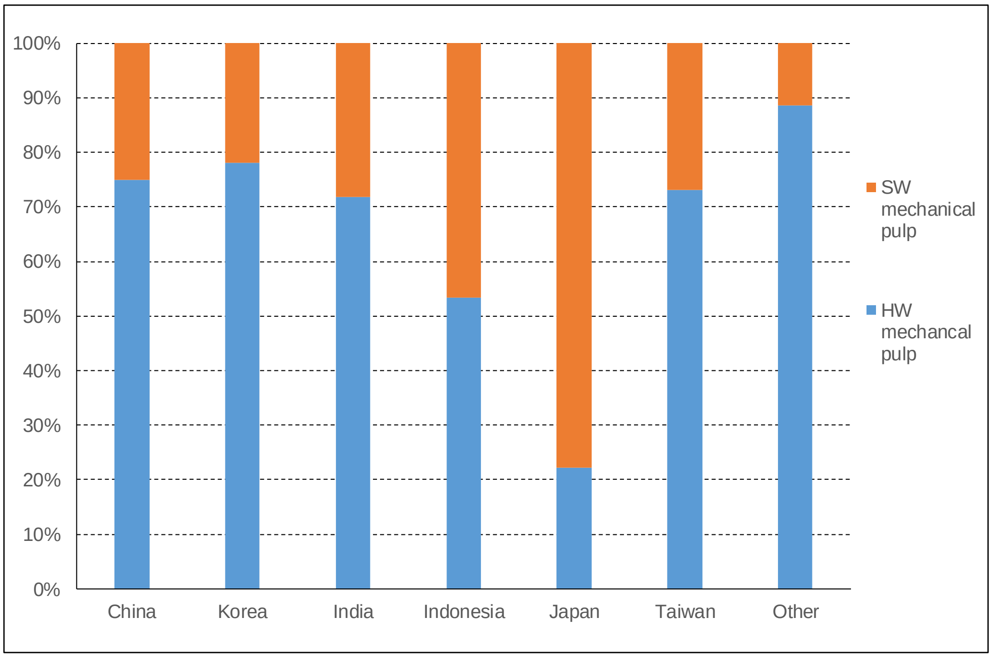
For a new mill to be able to effectively enter the market, it would require a unique combination of competitively priced fibre and power as well as low cost supply routes to the main markets.

## 4.3 Outlook for Demand

The global economy is the driver for pulp demand, especially economic growth, global fiscal policies and policy implementation, oil prices and developments, as well as fluctuations in exchange rates. These factors combine to impact on buyer spending on products in which paper is used.

GDP growth is an important indicator of economic wellbeing and is a useful reflection of the impacts of a wide variety of factors, including those indicated above. Historically regional GDP growth has been strongly aligned with the "emerging economy" nations. Although by 1980 Japan was already considered a dominant economic force within Asia, markets in Taiwan and South Korea were also growing rapidly. By 2005 the mantle of emergent market had passed comprehensively to countries such as China, India, Indonesia, Malaysia and Thailand (Figure 4-9). Today, and specifically in the market mechanical pulp consuming nations of Asia, it is China, Indonesia and India where much of the economic growth has occurred. Going forward, economic growth in these countries will remain important, even if the rate of growth in countries such as China is expected to tail off.

**Figure 4-8: Split Between Hardwood & Softwood Mechanical Pulp Consumption, Asia**

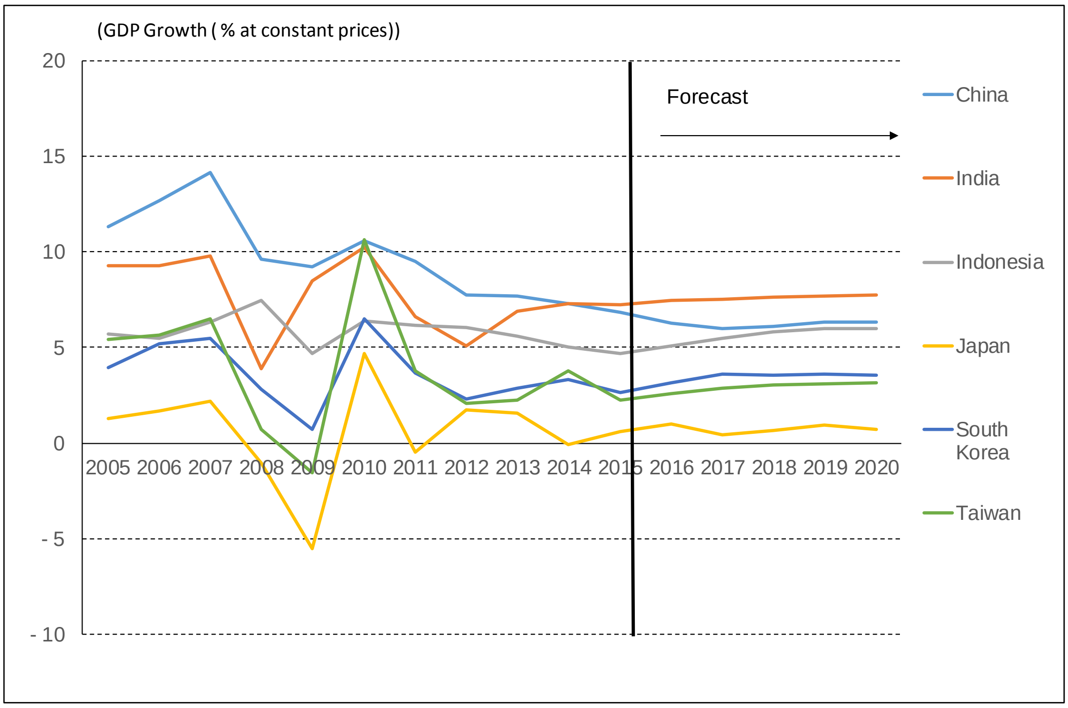



Source: Indufor analysis

The historical rate of growth in Asian market mechanical pulp has reflected GDP developments, particularly with respect to the slowing in global demand reflecting the slowing growth in China and economic status in Europe and North America. It is also important to note that the use of cut size paper (for printing and writing), a traditional market for mechanical pulp is noticeably in decline in economically advanced markets such as the US. The same trends are now emerging in growth markets such as China and India. Technology and its application has been changing the way people collect, store and use information as well as learn, communicate and conduct business. This in turn has led to reduced needs for 'hard copy' materials. The impacts are also seen as generational, with the youngest generations since the advent of the personal computer relying increasingly on devices rather than paper.

Despite the recent slowdown in demand for market mechanical pulp, Indufor's expectation is that the market will continue to grow at a rate similar to that experienced over the last five years. By 2020 the expectation is that demand for market mechanical pulp in Asia will reach approximately 3.7 million tonnes. Thereafter demand in the region is expected to slow further although by 2025 the overall size of the market for mechanical pulp could reach 4 million ADt/a. China will continue to dominate the market, while the importance of India as a destination for market mechanical pulp is expected to grow. Traditional markets such as Taiwan, Japan and Korea are expected to remain steady or will decline, commensurate with economic growth and population driven changes (Table 4-2). The market is expected to remain overwhelmingly BCTMP pulp with hardwood remaining as the dominant fibre furnish for the market pulp.

**Figure 4-9: Historic and Forecast GDP Growth, for Selected Asian Countries**




Source: IMF

Globally there is currently unutilised supply capacity that potentially could meet the needs of the expected demand increase in Asia over the coming 10 years. Much of this spare capacity is in Europe. Supply from countries closer to the Asian market is already at or in some cases beyond existing capacity. With announcements in future market mechanical pulp capacity largely limited to Europe at present, indications are that the gap between demand and regional supply capacity (as represented by Canadian, US, New Zealand and Chinese producers) is likely to expand from the current 0.9 million ADt/a to 1.73 million ADt/a by 2025.

**Table 4-2: Forecast Market Mechanical Demand Pulp within the Asia Region**

| | 2015 | 2020 | 2025 |
|---|---|---|---|
| | Future Demand (thousands of tonnes) | | |
| China | 2 271 | 2 774 | 3 063 |
| Korea | 283 | 276 | 276 |
| India | 264 | 308 | 357 |
| Indonesia | 140 | 101 | 101 |
| Taiwan | 38 | 15 | 15 |
| Japan | 131 | 124 | 113 |
| Other | 61 | 89 | 98 |
| **Total** | **3 188** | **3 688** | **4 023** |

Source: Indufor analysis

This perceived gap is important as it suggests there is potential for new regional supply capacity to be installed to meet future anticipated demand. The caveat is that much of this anticipated future demand will take place in China and India, two countries where information on future capacity development plans is not well known. In China, there is an existing market mechanical pulp industry that is presently well underutilised.

## 4.4 Prices for Mechanical Pulp

### 4.4.1 Price Drivers

Supply and demand and the balance between these is the key price driver for market pulp. In turn supply and demand are principally affected by the general economic indicators. As noted, GDP development is well recognised as influencing business cycles and is an important driver for paper consumption. Inflation affects costs and therefore nominal price development.

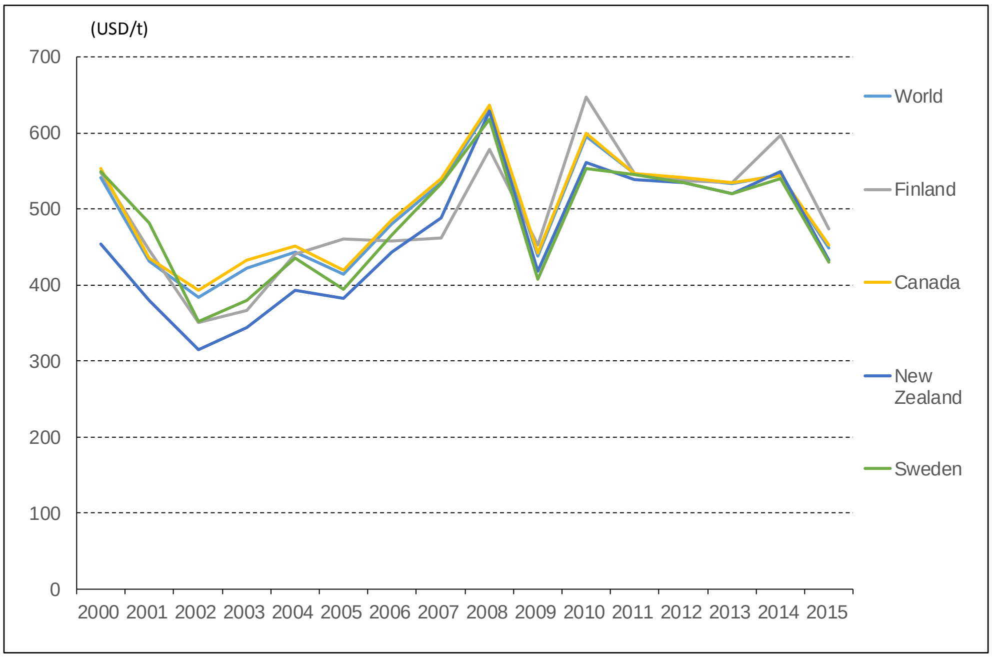
### 4.4.2 Historic Price Trends

A common feature of pulp grades and types is that a wide range of factors dictate the price paid for the pulp. With respect to BCTMP, for example, prices for different grades vary with brightness point. Such variation can be significant (up to USD3/ADt for every brightness point). Price also varies with freeness level and to a very limited extent higher tensile and bulk properties might attract a price premium. The end use is also important, with pulp destined for FBB applications being traded at prices that could be up to USD20/ADt less than pulp traded for paper making.

There are also regional differences, with market prices varying from country to country depending on purchasing power and prevailing competitive considerations. For example, it is appreciated that non-wood pulp prices as well as locally traded mechanical pulp prices can influence overall market prices for mechanical pulp within a country. The extent of price discounting and performance rebates also affects the actual price at which pulp transacts. According to RISI, contract discounts vary from country to country and month by month. Discounts can be as little as 1-3% or as high as 25%.

Figure 4-10 shows the nominal price trend for the aggregate of BCTMP pulp grades delivered to China. Trends suggest that supplier influences are relatively small. Prices in recent years have varied between USD400/ADt and USD600/ADt.

**Figure 4-10: Aggregated Grade Delivered Mechanical Pulp Prices CIF China**

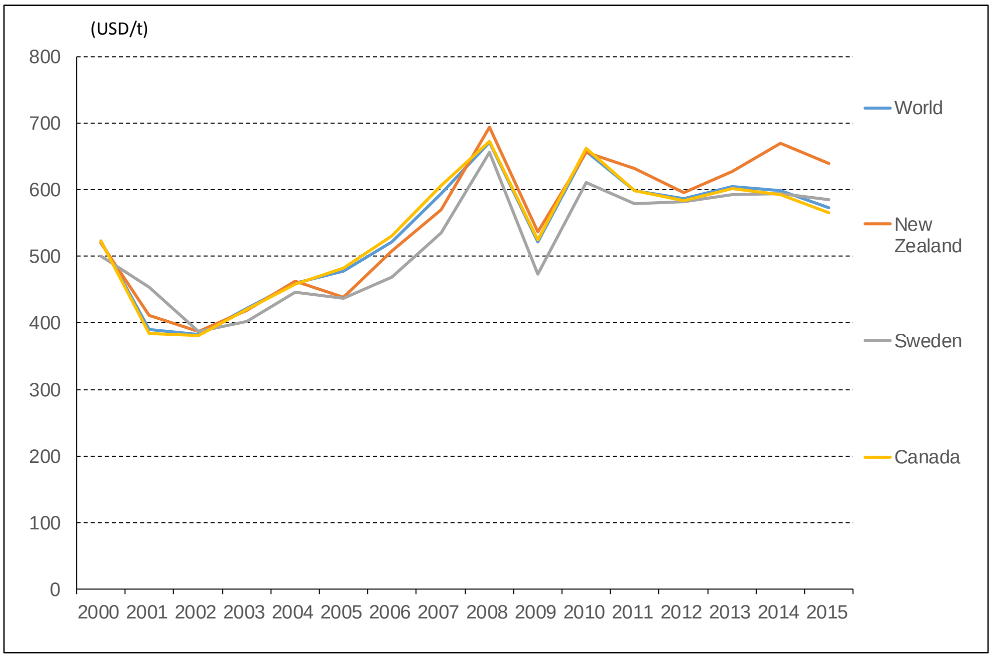



Source: GTA

In China, the sales point is cost and freight (C&F) Chinese port. Most sales are based on annual contracts, and the share of spot sales is quite small. Discounts for BCTMP generally vary from 1 – 5% but mostly below 3%, with no discount on spot sales. Letter of credit (L/C) dominates payment terms for import business.

Similar price information from Japan suggests a degree of market differentiation from China. Weighted average CIF prices were on average USD125/ADt higher (Figure 4-11).

**Figure 4-11: Aggregated Grade Delivered Mechanical Pulp Prices CIF Japan**




Source: GTA

### 4.4.3 Forecast Price Trends

Trend prices reflect the longer-term price level required to provide a sufficient profit for new capacity over time. Generally, the following price influences hold true for most commodities in an open market free of supply or demand constraints:

- In the commodity environment the emphasis is on cost competitiveness. Therefore, there is a tendency toward -
    - Larger mill capacity in order to realise economies of scale
    - New production capacity gravitates toward lower cost production centres
    - Emphasis on controlling or lowering cost inputs, or at least maintaining constant costs in real terms.

  These factors are seen as having a tendency to drive a negative trend in long term commodity prices as over time prices trend toward the most cost competitive position. However, the pressure between supply and demand can lead to price movements counter to this trend.

- Supply and demand balance is the most important factor for mapping long term price trend development, although exchange rate fluctuations impact on price movements in real terms over the short to medium term.
- Sales terms, discount practices and other such factors affecting the prices are not explicitly predictable, and therefore are considered to remain the same over time and across all trades and markets.

Indufor anticipates that future prices for BCTMP (as an aggregate of grades common to the market place is likely to remain between USD400/ADt and USD600/ADt CIF over the near to mid-term for markets such as China. Long term prices could increase significantly, especially if the gap between demand and regional supply opens to 1.2 million ADt/a. Prices could shift above USD600/ADt in real terms between 2020 and 2025. A similar price trend is expected in other Asian markets, although for those markets that are in a steady state prices are expected to be USD50-100/ADt higher than the more competitive and dynamic China market.

### 4.5 Regional Appetite for Mechanical Pulp and Potential Investment Partners

Off-take agreements are a mechanism for improving the viability of any new pulpmill concept. An -off-taker would typically take an annual tonnage at a fixed price or indexed to some long-term average. Depending on who the off-taker is they may or may not resell the pulp on their own terms. Off-takes can therefore be:

- Non-integrated paper and paperboard producers that purchase all their fibre needs from the open market. These are large, regular buyers and prime targets for mechanical market pulp suppliers. Quality, service and price are important to attract and keep these customers.
- Integrated paper producers who have their own pulp facilities (typically chemical wood and non-wood pulp). They purchase small volumes of mechanical pulp to improve the properties of the paper they produce (for example improving opacity) or to manufacture specific grades as required by their customers.
- Market pulp traders of scale. These organisations can buy tens of thousands of tonnes at a time for sale to smaller paper mills either unable or unwilling to purchase directly from a pulpmill. While these buyers are large, they tend to vary their purchase volumes and sources based on market conditions, and often conduct speculative buying and hold stock for the purpose of managing market prices. A low price focus is important to these buyers.

#### 4.5.1 China

Presently there are just over 3 million ADt/a of mechanical pulp capacity installed in China. Most of this is either APMP or BCTMP and most is associated with integrated facilities producing paper. It is these integrated producers that are the likely purchasers of market BCTMP (even though they make their own). It is expected that, from time to time, their own production capacity may be limited by raw material availability, or that demand may outstrip capacity from internal supply. Price may also be an important factor, particularly if the market pulp proves to be cheaper.

Non-integrated paper mills are also likely buyers particularly where the focus is on paper and FBB production and where there is neither the desire nor the capital to invest in integrated pulp production capacity.

Examples of potential off-takers include companies such as:

- Shandong Chenming
- Nine Dragons
- Foshan Huafeng
- UPM
- Hongta
- Shandong Huajin
- Shandong Taishan
- Tiger Forest & Paper
- Oji

Amongst these companies Nine Dragons, Foshan Huafeng, UPM, RGE, Hongta, Shandong Huajin, Shandong Taishan and Oji do not have integrated BCTMP to date. It is estimated that these companies could collectively consume around 600 000 ADt/a of BCTMP.

Companies such as Hongta, Shandong Huajin and Foshan Huafeng have significant FBB production capacity requiring mechanical pulp. Others, such as Oji, Shandong Taishan and

UPM use mechanical pulp in the production of their printing and writing paper. Nine Dragons, which is focussed on the containerboard segment, has no in-house BCTMP supply. Nine Dragons operates both FBB and printing and writing production capacity, and demand from this company alone is at least in the order of 100 000 ADt/a.

In addition to the non-integrated capacities, a large potential demand of about 300 000 ADt/a comes from integrated mills such as Shandong Chenming and Tiger Forest & Paper. Although Shandong Chenming has its own integrated BCTMP pulp capacity, the size of its printing and writing paper production, as well as FFB production capacity, means that it is still likely to require significant amounts of market BCTMP to meet production requirements. Similarly, Tiger Forest & Paper produces printing and writing paper of the order of a million tonnes per annum. It requires around 160 000 to 200 000 ADt/a of BCTMP of which its own integrated capacity can supply roughly half. The balance is understood to be purchased from the market.

RGE is another significant paper and FBB producer but the status of its market pulp needs is uncertain since this is largely dependent on the company's own capacity to produce mechanical pulp. It is believed that the Rizhou mill does not have integrated mechanical pulp capacity yet, and as there are no imports of mechanical pulp from Indonesia the only logical alternative is supply from RGE's Canadian operations.

### 4.5.2 Markets Outside China

There are off-take opportunities outside China. The other main Asian markets for market BCTMP include India, South Korea, Indonesia, and Taiwan. These countries depend entirely on imports, mostly hardwood BCTMP.

#### India

The majority of the mechanical pulp consumed in India is used for FBB and liquid packaging board production, with softwood BCTMP grades predominantly used. Consumption of hardwood mechanical pulp is mostly for printing and writing paper and some newsprint.

Examples of users of mechanical pulp include ITC Ltd (an important user of hardwood BCTMP for its cartonboard), Century Pulp and Paper and Balkrishna Industries (cartonboard producers, dependent on market mechanical pulp). The trend for Indian cartonboard producers is toward higher quality products and this is leading to a shift away from the use of recovered fibre or non-wood pulp-based grades towards using more virgin wood-pulp-based grades. The demand for market BCTMP in India is growing as a result.

#### South Korea

In volume terms, South Korea will remain an important market for hardwood BCTMP in the coming decades. The primary consideration for the Korean market is that the main end-users are producers of printing and writing papers, including leading local paper producers, such as Hansol, Moorim, Hankuk and Hongwon.

#### Indonesia

FBB is the predominant end-use for market mechanical pulp in Indonesia. APP and Gudang Garam are users of BCTMP for their cartonboard production. Although hardwood is the dominant form, nearly half of the demand for market mechanical pulp was for softwood market pulp.

#### Taiwan

Yuen Foong Yu is the largest user of hardwood BCTMP in Taiwan, using the pulp for printing and writing paper and a small amount of FBB. Cheng also uses mechanical pulp for printing and writing paper. There has not been much in the way of expansion in paper or board production within the country and demand for BCTMP has been steadily declining. Therefore, Taiwan is not considered a significant market and its importance going forward is likely to diminish further.

**North America and Europe**

Change in the competitive environment is likely to see greater interest by the North American and European market mechanical pulp producers in evaluating alternative manufacturing locations.

Of those, Paper Excellence (Canada) is currently a large producer of mechanical market pulp, and could well be interested in a new production facility outside of Canada.

Miller Western(Canada) has been at the forefront of developing end uses for mechanical pulp grades and radiata pine mechanical pulp could be a valuable addition to its product mix.

Tembec (Canada) is focused on the production of mechanical hardwood pulps. This might limit their potential interest in a softwood based mechanical pulp,

Canfor (Canada) is a major producer of pulp, including mechanical pulp. However, Asia sales including China are handled by UPM through the Fibre United cooperative sales and marketing agreement. Hence, UPM would be more likely to take the lead in an investment to produce pulp for the Asian market.

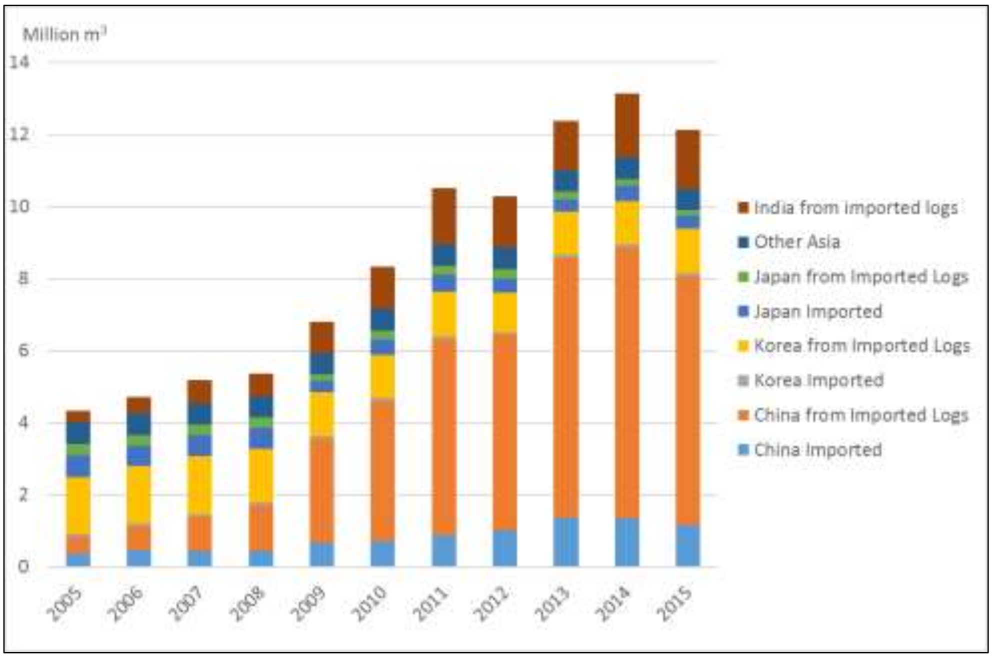
Metsä Board is a Finnish company focused on the production of paperboards. Sale of mechanical pulp is not its core business, and as such it is unlikely to have any great desire to invest in a mill producing market mechanical pulp.

# 5. SECTION FOUR: RADIATA PINE LUMBER MARKETS

In the following analysis, the focus is on the export market for industrial, and lower grade radiata sawn timber. This analysis excludes structural, clear and re-manufactured lumber products.

The Asian market for radiata pine lumber is large, reaching some 13 million m$^3$ in 2014 (Figure 5-1). The single biggest market is China, and most this market is supplied by lumber produced in China from imported logs.

**Figure 5-1: Asian Radiata Pine Lumber Market**




Source: GTIS and Indufor Research
Key assumptions used:

1) 75% of logs imported into China are used to produce lumber, Chinese recovery rate is 75%
2) 75% of logs imported into S Korea and Japan are used to produce lumber and recovery rate is 55%
3) 100% of logs imported in India are used to produce lumber and recovery rate is 75%

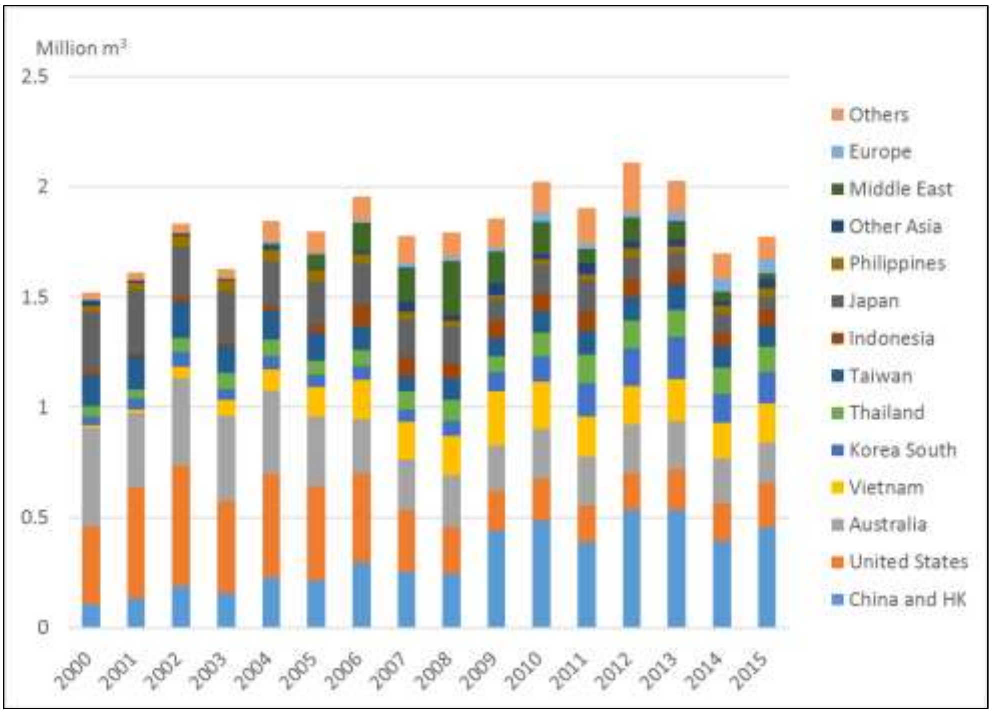
Traditionally, the New Zealand lumber industry has focused on the production of structural lumber and appearance grade lumber, while industrial lumber was a by-product in the production of those main grades.

As the traditional export market for structural lumber (Australia) became increasingly competitive, and the markets for clearwood in the US declined following the GFC, New Zealand sawmillers had to increasingly focus on selling lumber into alternative markets. Many of those markets in Asia and the Middle East do not use structural lumber and have a strong demand for industrial and cut of log (COL) grades.

## 5.1 New Zealand Exports

Overall exports of lumber have remained remarkably steady over the past decade, although the mix of destinations has changed remarkably. Traditional markets such as Australia and the US have declined considerably in importance in favour of Asian and Middle Eastern markets (Figure 5-2). It should be noted that 2014 and 2015 exports have been significantly impacted upon by the reduction in the competitive position of New Zealand, due to consistently high exchange rates.

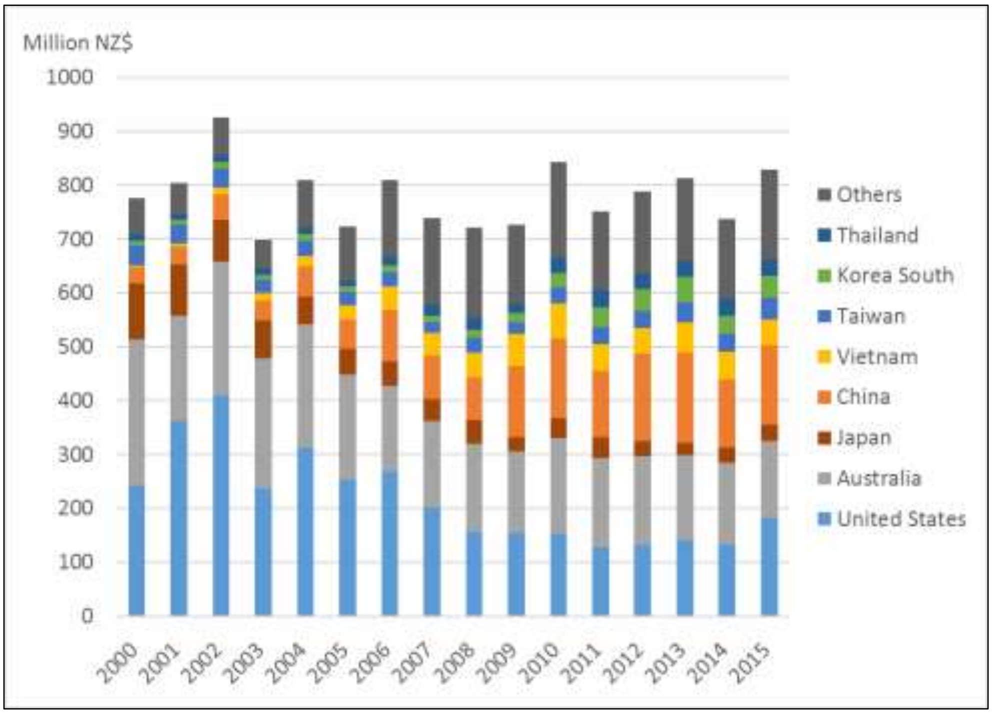
**Figure 5-2: New Zealand Exports of Lumber by Destination**




Source: GTIS and Indufor Research

When evaluating the change in exports market based on the total value of exports, the change from the traditional New Zealand lumber markets of Australia, the US and Japan to the new markets in Asia becomes even more apparent (Figure 5-3).

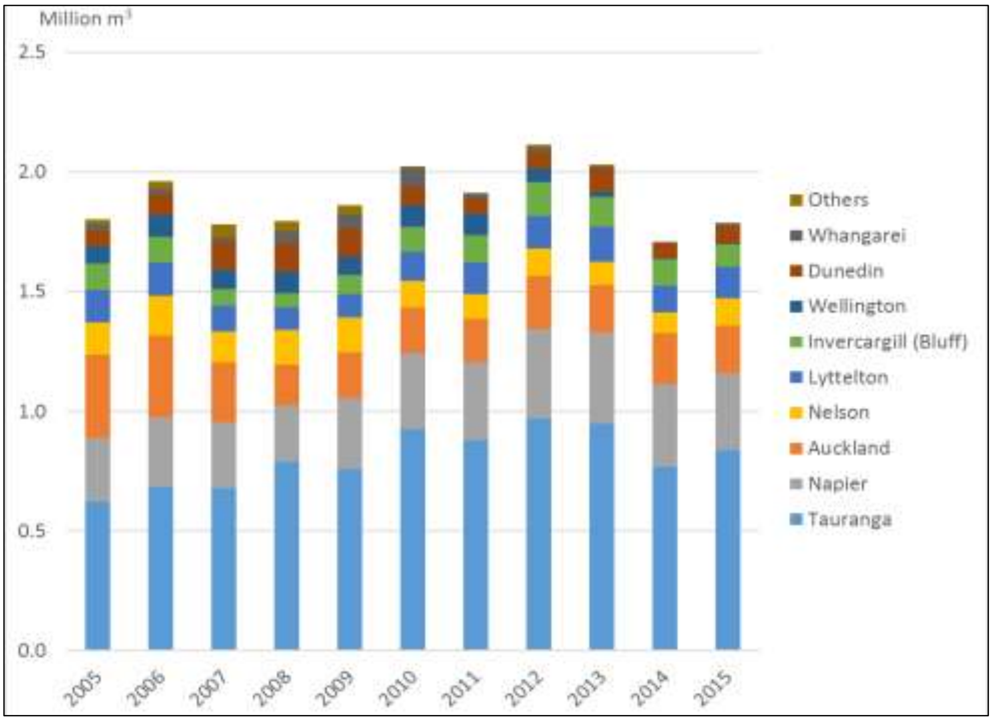
**Figure 5-3: New Zealand Exports by Value (NZ$)**




Source: GTIS and Indufor Research

New Zealand's export lumber industry is predominantly located in the Central North Island and the Hawke's Bay area. Exports through Auckland include lumber from mills in Northland as well as mills located South of Auckland (Figure 5-4).

**Figure 5-4: New Zealand Lumber Export by Export Port**

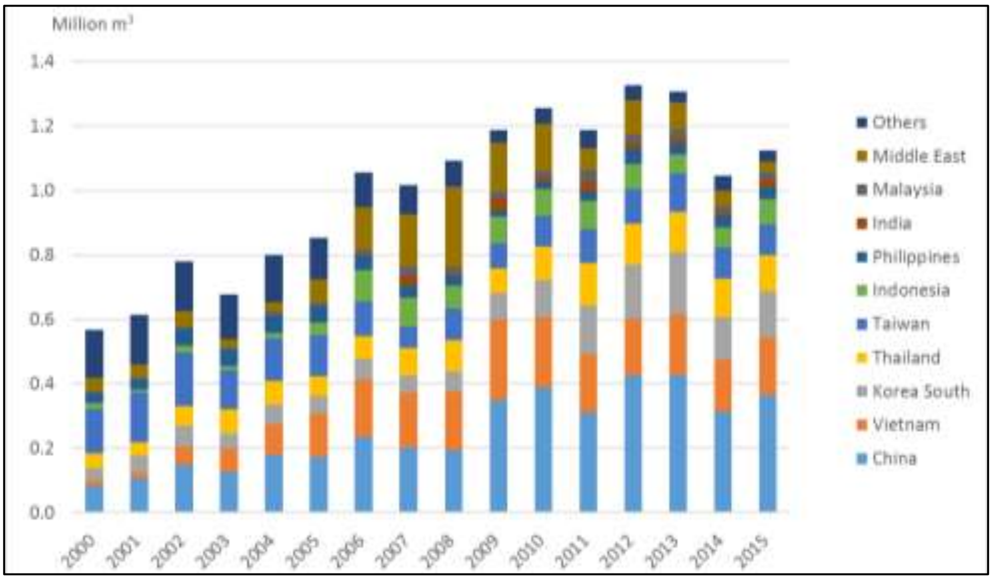



Source: GTIS and Indufor Research

New Zealand has become a sizable exporter of industrial lumber. Figure 5-5 provides an estimate of the growth in exports of industrial lumber in the past decade. The number of markets supplied has increased greatly, and this trend is expected to continue over the coming years.

Key markets for New Zealand industrial lumber are China, Vietnam, South Korea, Thailand the Middle East and other SE Asian countries.

**Figure 5-5: New Zealand Exports of Industrial Grade Lumber by Destination**




Source: GTIS and Indufor Research

## 5.2 China Lumber Market

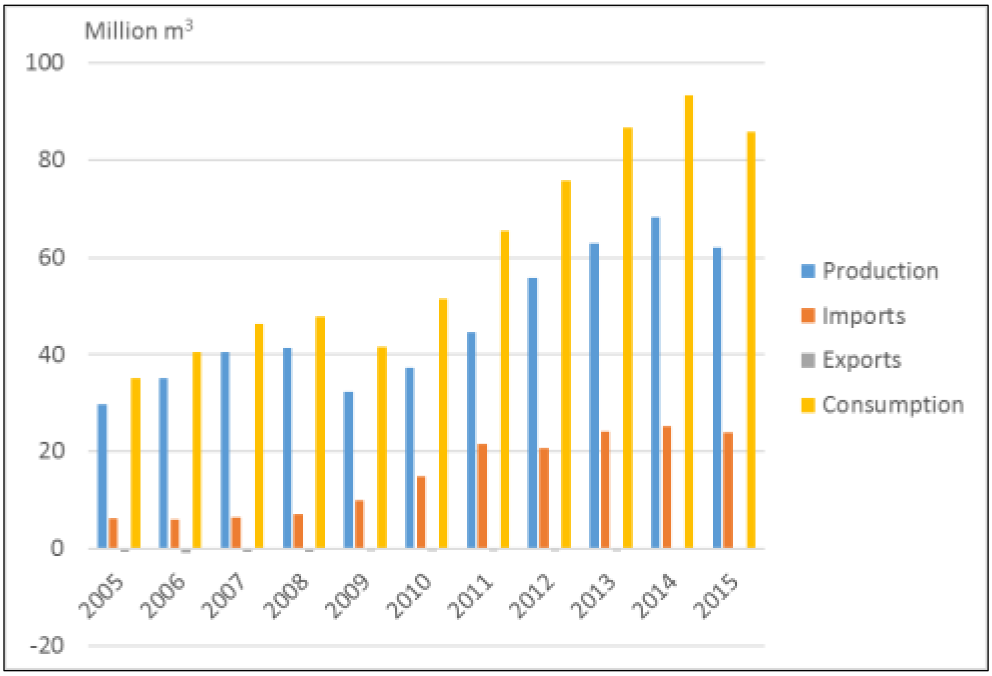
China has very large domestic industry. Local lumber was traditionally from natural forest but this is gradually changing to include ever more managed and plantation forest wood. Production includes both softwood species such as masson pine and Chinese fir, as well as poplar, eucalyptus and more traditional species such as oak and ash.

The domestically produced lumber represents the majority of the wood used within construction for temporary use such as formwork and permanent use such as joinery. It is also largely used by the furniture and packaging industries. Production of lumber is estimated to have exceeded 68 million m$^3$ in 2014, but declined in 2015. Lumber is produced from the domestic species as well as imported logs from New Zealand, Russia, Canada and tropical countries in Asia and Africa.

China only exports small volumes of lumber. Consumption of lumber exceeded 90 million m$^3$ in 2014, but declined in 2015 as the overall growth in the Chinese economy decreased (Figure 5-6).

The strong growth of lumber production has come primarily from the local milling of imported logs, as domestic log production has declined due to ever increasing harvesting restrictions within the traditional Chinese production forests.

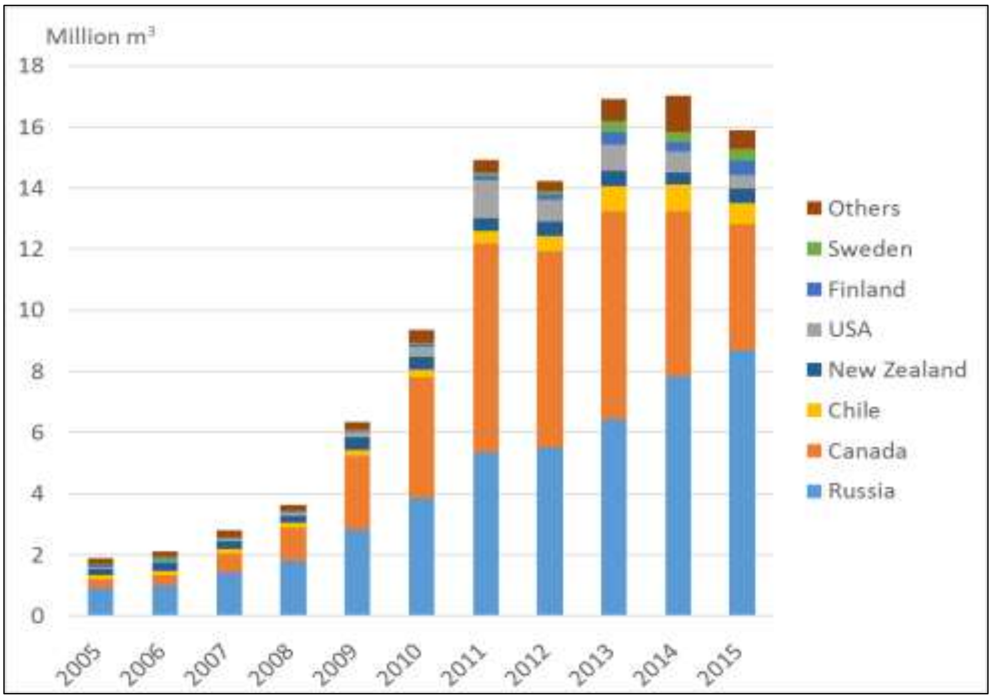
**Figure 5-6: China Lumber Production, Trade & Consumption**




Source: GTIS and Indufor Research

Canada and Russia have dominated softwood lumber supply to the Chinese markets in recent years. Russian growth has been supported by Russia imposing export tax on logs and promoting domestic manufacturing. Canadian supply expanded strongly in 2010 and 2011 (Figure 5-7) as large volumes of beetle killed logs were processed in Canada producing lumber not suitable to be used in structural applications. The strong demand for low grade lumber in China proved to be an ideal outlet for this material.

**Figure 5-7: China Softwood Lumber Imports**

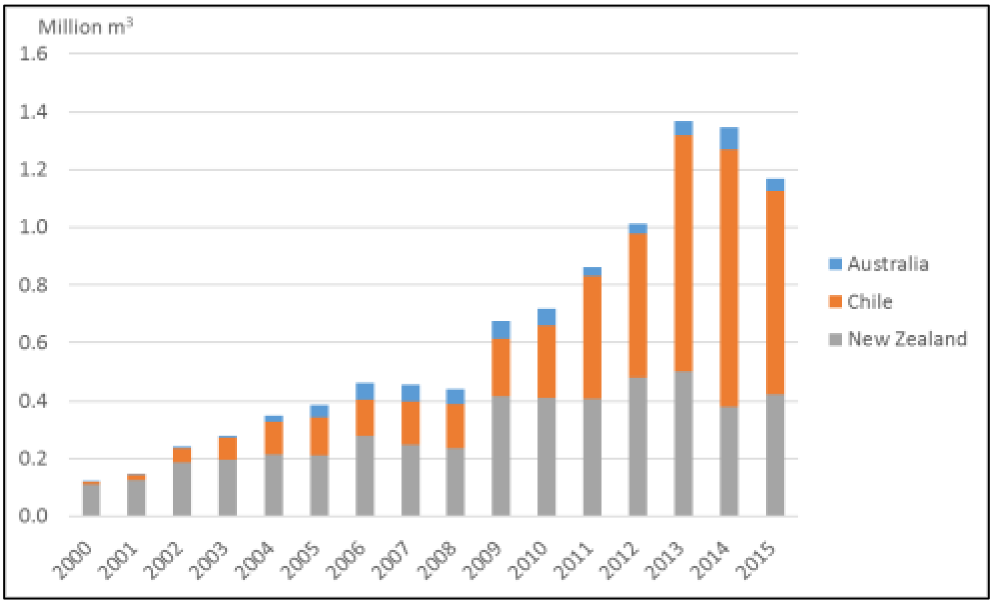



Source: GTIS and Indufor Research

## 5.3 China Market for Radiata Pine Lumber

The Chinese market for radiata pine lumber has also developed strongly over the past years (Figure 5-8) with Chile developing into the largest supply country. Total radiata pine lumber imports peaked in 2013 at 1.4 million $m^3$, but have since declined.

**Figure 5-8: Imports of Radiata Pine Lumber into China**

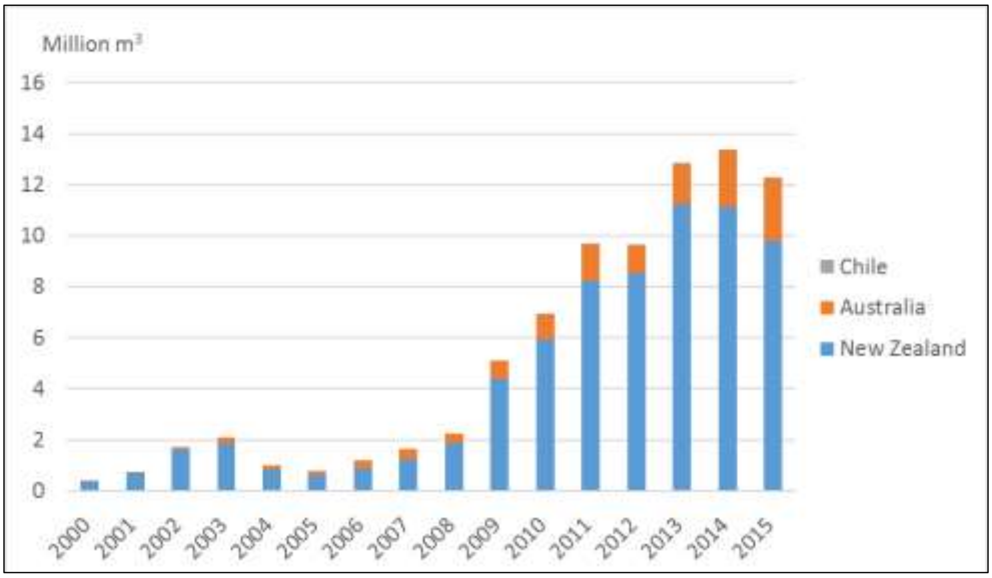



Source: GTIS and Indufor Research

When evaluating the Chinese radiata pine lumber market, it is important to take into account the volumes of radiata pine logs imported as well, as a large share of those imports are converted into lumber in China. As is the case with lumber, radiata pine log Imports peaked in 2014 (Figure

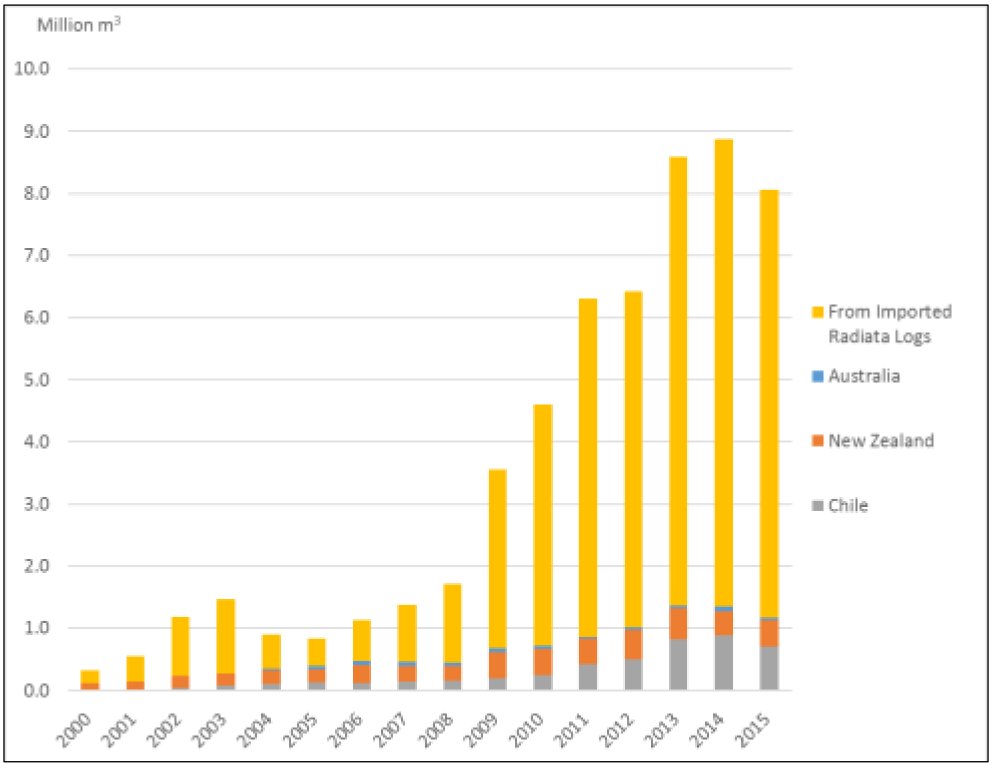
5-9) with New Zealand being the dominant supplier. By Indufor's estimates, up to 75% of all radiata pine logs imported into China are converted into lumber. This provided an additional 6 to 7 million m$^3$ of radiata pine lumber to the Chinese market. This would indicate that total demand for radiata pine lumber in China peaked at some 9 million m$^3$ in 2014 (Figure 5-10), making China by far the single largest radiata pine lumber market globally.

**Figure 5-9: China Radiata Log Imports**




Source: GTIS and Indufor Research

**Figure 5-10: China Radiata Pine Lumber Market by Source**




Source: GTIS and Indufor Research

Radiata pine lumber usage in China is dominated by temporary construction use (mainly concrete formwork), and other non-structural construction use. Other large end use categories include packaging while furniture is estimated to account for some 10% of total radiata pine lumber use in China.

It should be noted that, especially in the construction end uses, there are limited barriers to substitution and radiata pine lumber is readily substituted by softwood lumber sourced from North America, Russia or Europe and domestically produced softwood lumber from domestic logs, or imported logs. Key to the success of radiata pine lumber in China has been its availability and competitiveness.

In furniture end uses, many of the producers prefer the importation of kiln dried lumber, as this provides them with stain free lumber. Depending on the actual end uses, China imports both higher value clear lumber and lower value industrial and COL grades.

**Dimensions and Grades**

- All lumber sizes, in thickness of 17,19, 21, 25, 32, 40 mm in lengths of 2.0 m and up.
- Grades – Industrial, Cut of Log (COL), blanks, blocks and clears
- MC – 8-12%

**China Market Outlook**

The Chinese market for radiata pine lumber has eased from recent high levels, as overall lumber demand in China has declined due to a significant slowdown in nationwide infrastructural spending and construction activity.

However, China is expected to remain a very large market for softwood lumber, providing strong opportunities for radiata pine lumber. Over time, New Zealand based efficient sawmillers are expected to be able to effectively compete against the Chinese sawmills, especially those located in the higher cost (power and wages) regions of Coastal and Southern China.

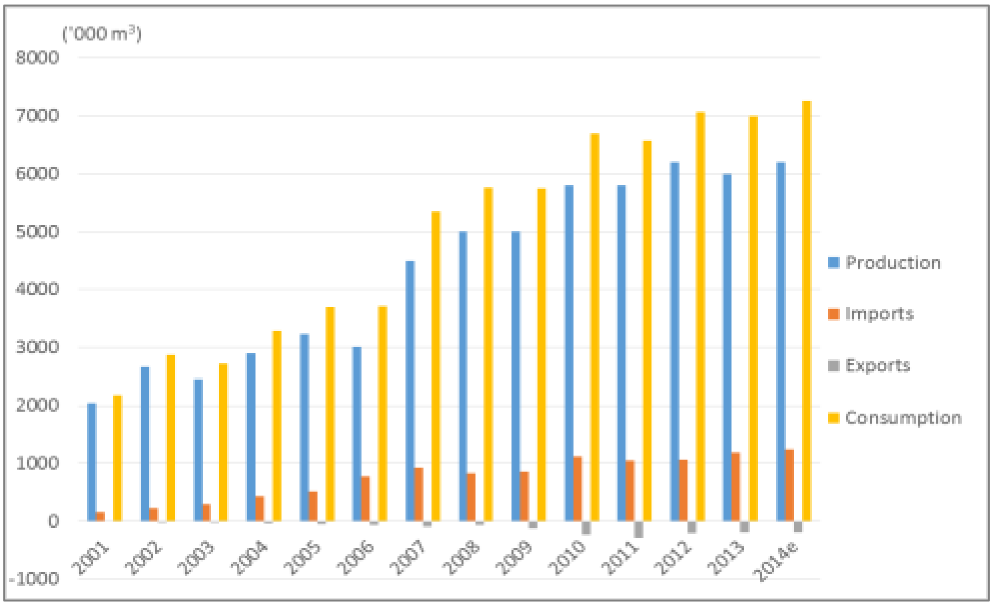
## 5.4 Vietnam Lumber Market

Vietnam has significant local lumber production capacity. Local lumber production is predominantly hardwood, utilizing domestically grown plantation material. *Acacia mangium* was the dominant species for many years, but other hardwoods such as rubberwood and eucalyptus are growing in importance. In addition, Vietnam imports some logs for milling locally.

The domestically produced lumber represents the majority of wood used within construction for temporary use such as formwork and permanent use such as joinery. It is also largely used by the furniture and packaging industries. Production of lumber is estimated to have exceeded 6 million $m^3$ in 2015, with most of this lumber used domestically.

Vietnam only exports small volumes of lumber, mainly to China. Consumption of lumber, exceeded 7 million $m^3$ in 2015, and growth in demand is driven by the furniture industry, packaging and constructing industries.

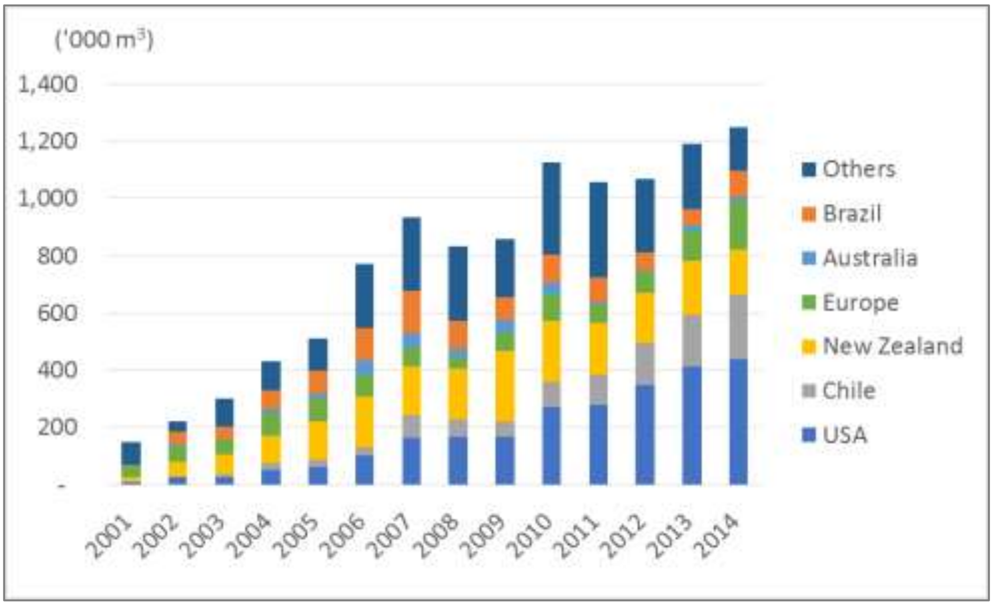
**Figure 5-11: Vietnam Sawn Lumber Production, Trade & Consumption**




Source: GTIS and Indufor Research

Sawn lumber imports are sourced globally, and a significant portion of this is used by the local furniture industry.  Key sources for lumber include the US and Europe (dominated by hardwood lumber), Chile and New Zealand (radiata pine) (Figure 5-12).

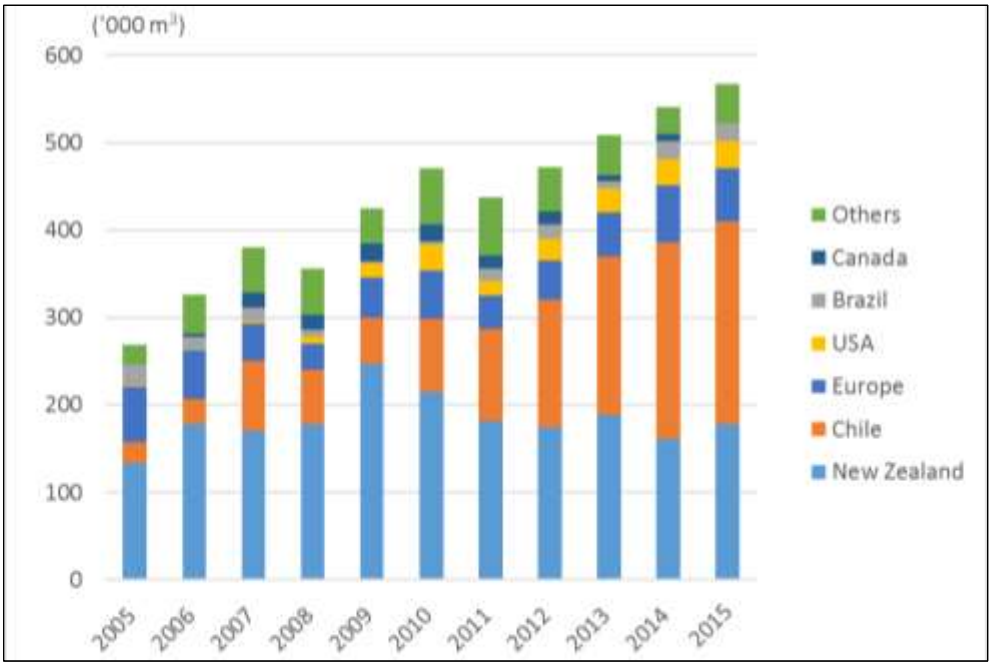
**Figure 5-12: Vietnam Lumber Imports**




Source: GTIS and Indufor Research

Of the softwood used in the Vietnamese furniture industry, radiata pine from both Chile and New Zealand dominates (Figure 5-13). The industry accesses a range of qualities, depending on its use in manufacture, from cut-of-log to long length clears. However, all is supplied kiln dried to 8-12% MC. Other softwoods used include SPF, SYP and western red cedar (WRC).

**Figure 5-13: Vietnam Softwood Imports**




Source: GTIS and Indufor Research

In Photo 5-1 sawn lumber from various sources can be observed, including Canadian, Chilean and New Zealand sourced lumber.

**Photo 5-1: Softwood sawn lumber at Vietnamese lumber yard**

The Vietnamese buyers/manufacturers are accustomed to purchasing lumber from competing suppliers, such as Europe and Chile, at the dimensions and specifications they require. New Zealand dominates the market with furniture blanks, boards and thinner stock, shop grade and metric. The Europeans are known for better quality and also supply metric.

Wood use for urban construction is minimal partly due to current subdued construction activity. Small volumes of predominantly locally sourced wood are used in formwork and temporary construction. This will change once economic development gathers pace. Within the countryside, wood is still used extensively for house construction, but wood used for this is locally sourced and does not represent an opportunity for Canadian lumber (Photo 5-2 and Photo 5-3).

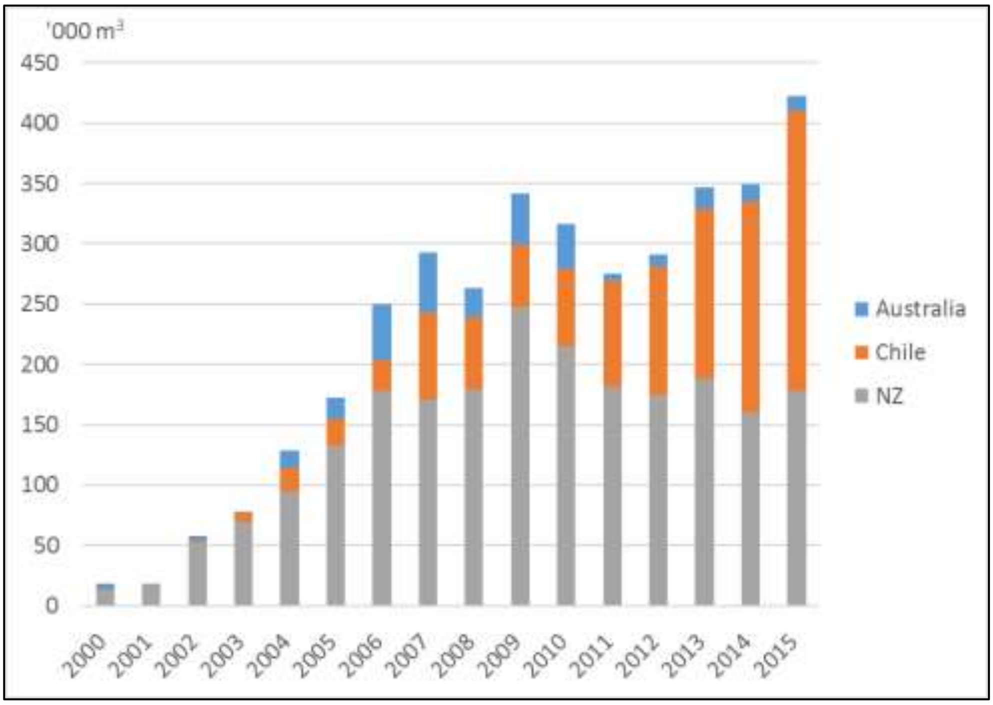
**Photo 5-2: Traditional rural Vietnamese houses**

**Photo 5-3: Typical Vietnamese building materials in urban construction**

## 5.5 Market for Radiata Pine Lumber

The Vietnamese market for radiata lumber has developed strongly over the past decade, in line with the strong growth experienced within the furniture industry.

**Figure 5-14: Imports of Radiata Pine Lumber into Vietnam**




Source: GTIS and Indufor Research

Radiata pine usage in Vietnam is concentrated on furniture, with smaller volumes being used by the packaging industry.

Vietnam has been recognised as a competitive location for furniture production, and the industry has seen strong growth, supported by low labour costs and efficient infrastructure. This has seen many Taiwanese and Chinese furniture manufacturers re-locate to Vietnam as well as the successful development of the domestic Vietnamese industry.

The furniture producers prefer to purchase kiln dried lumber, and most softwood using furniture industries will purchase their requirements directly from overseas suppliers. Radiata pine is the preferred softwood species, although other softwood species are also used.

### Dimensions and Grades

- All lumber sizes, in thickness of 17,19, 21, 25, 32, 40mm in lengths of 1.8 m and up.
- Grades – Industrial and Cut of Log (COL)

  MC – 8-12%

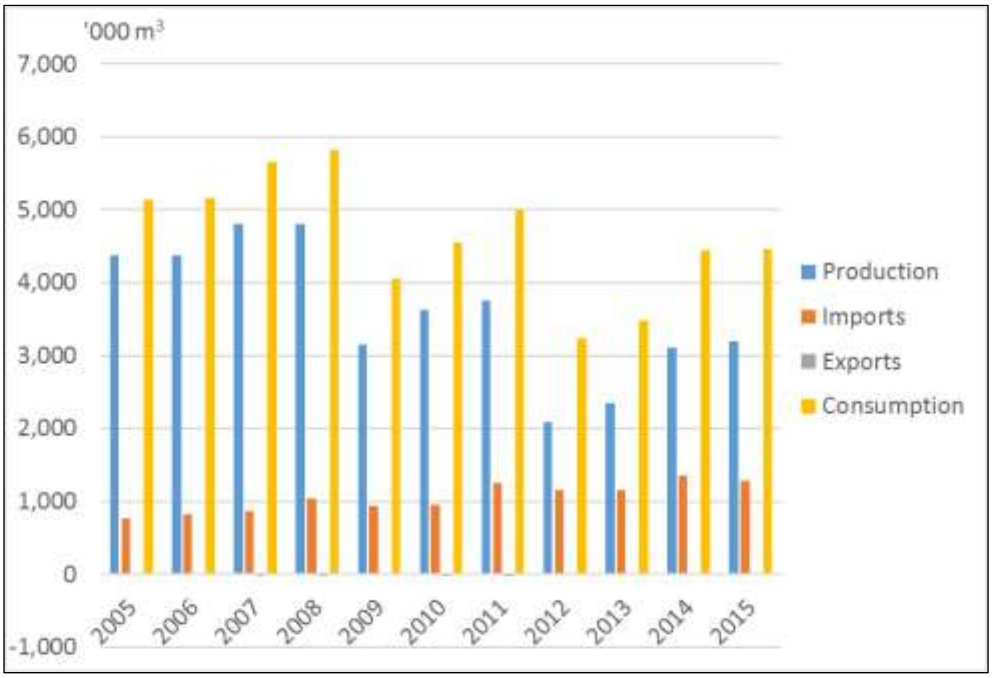
## 5.6 South Korea Lumber Market

S Korea has a sizable local lumber production capacity. Local lumber production is predominantly softwood, utilizing imported logs. Local log availability is limited.

The domestically produced lumber represents the majority of wood used within construction for temporary use such as formwork and permanent use such as joinery. It is also largely used by the furniture and packaging industries. Production of lumber is estimated to have exceeded 3.1 million $m^3$ in 2015, with most of this lumber used domestically.

S Korea has minimal exports of lumber. Consumption of lumber exceeded 4.4 million $m^3$ in 2015, and growth in demand is driven by the packaging and constructing industries.

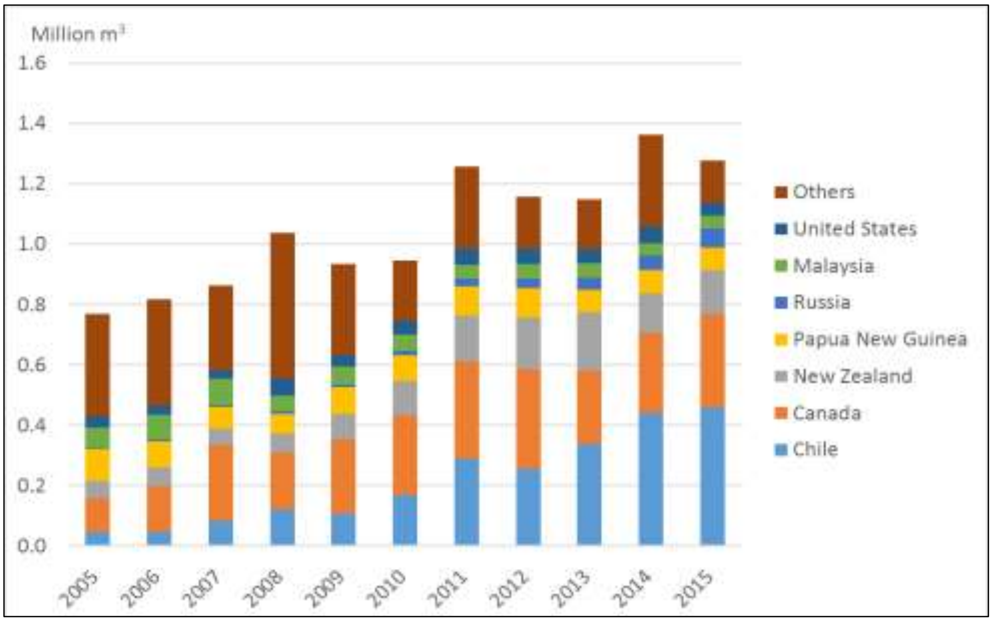
**Figure 5-15: South Korea Lumber Production Trade and Consumption**




Source: GTIS and Indufor Research

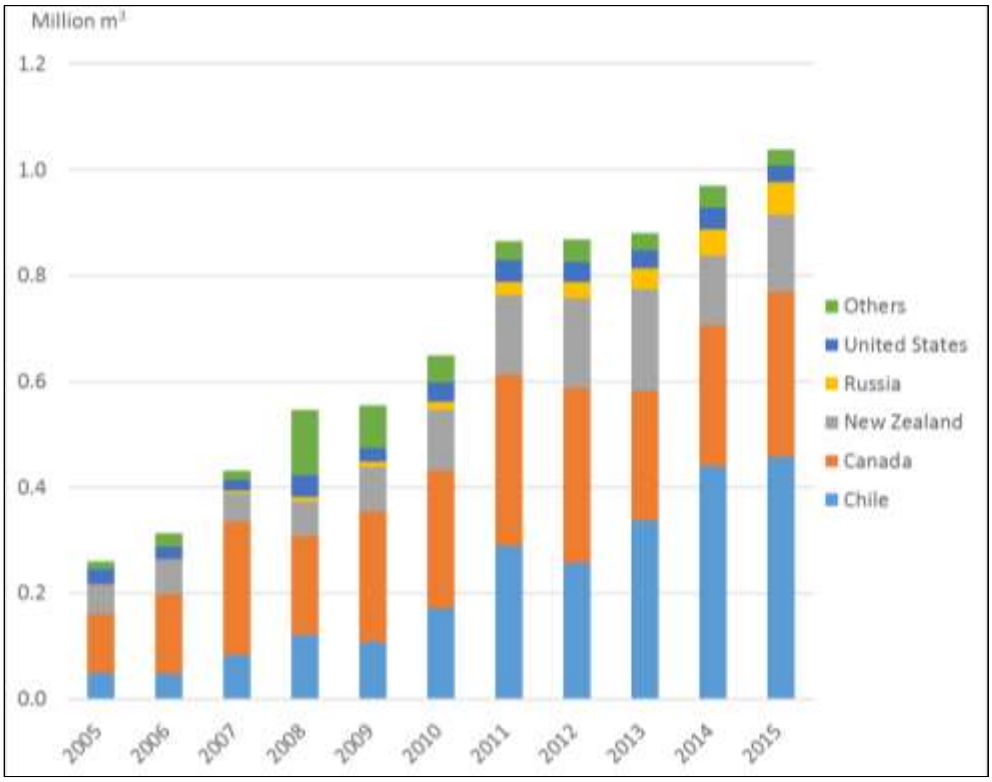
S Korea imports of lumber have gradually increased at the expense of local production. Most lumber imported is softwood lumber. Chile dominates the lumber market, although Canada is also a large supplier to the S Korean market (Figure 5-16). The imported radiata pine lumber (from Chile and New Zealand) is predominantly used in packaging and temporary construction, while Canadian lumber is used more extensively in permanent construction applications.

**Figure 5-16: South Korea Lumber Imports**




Source: GTIS and Indufor Research

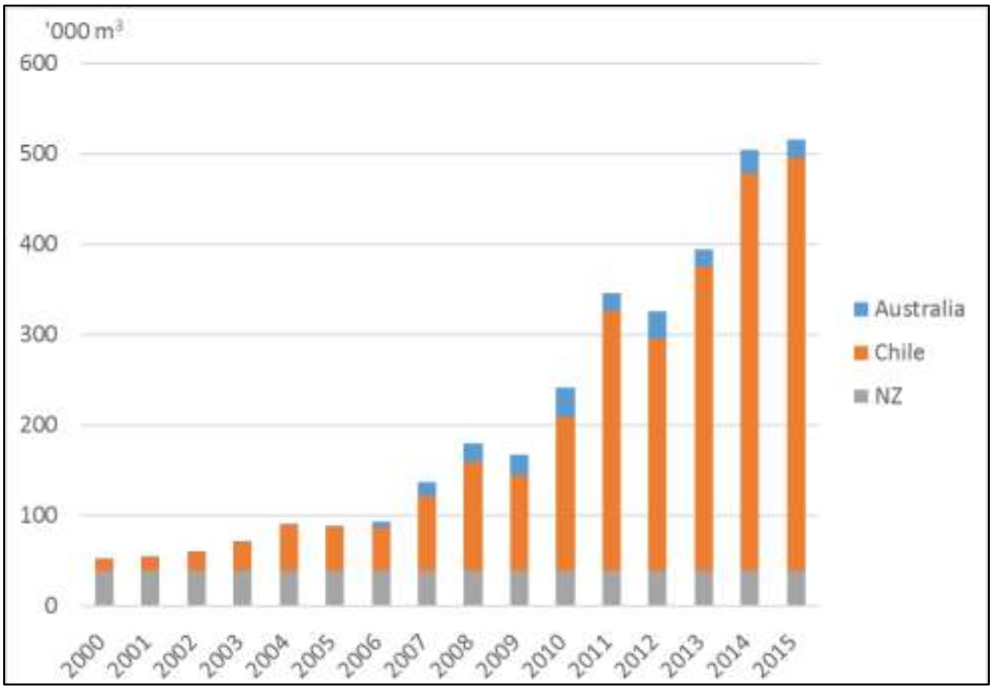
**Figure 5-17: South Korea Softwood Lumber Imports**




Source: GTIS and Indufor Research

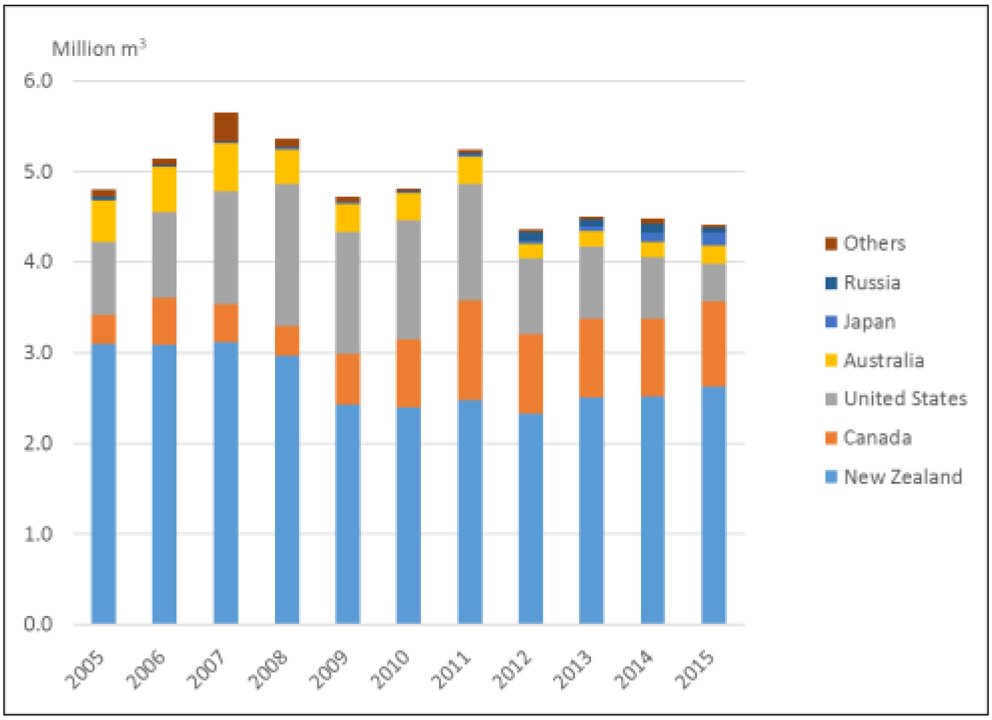
It is noticeable that New Zealand exports of lumber have had little success in S Korea, while Chile has managed to significantly grow its lumber exports over the past 10 years. This is in sharp contrast to the log sales. New Zealand has managed to remain a major log supplier to the S Korean market, increasing its market share over time (Figure 5-19).

**Figure 5-18: South Korea Radiata Pine Lumber Imports**




Source: GTIS and Indufor Research

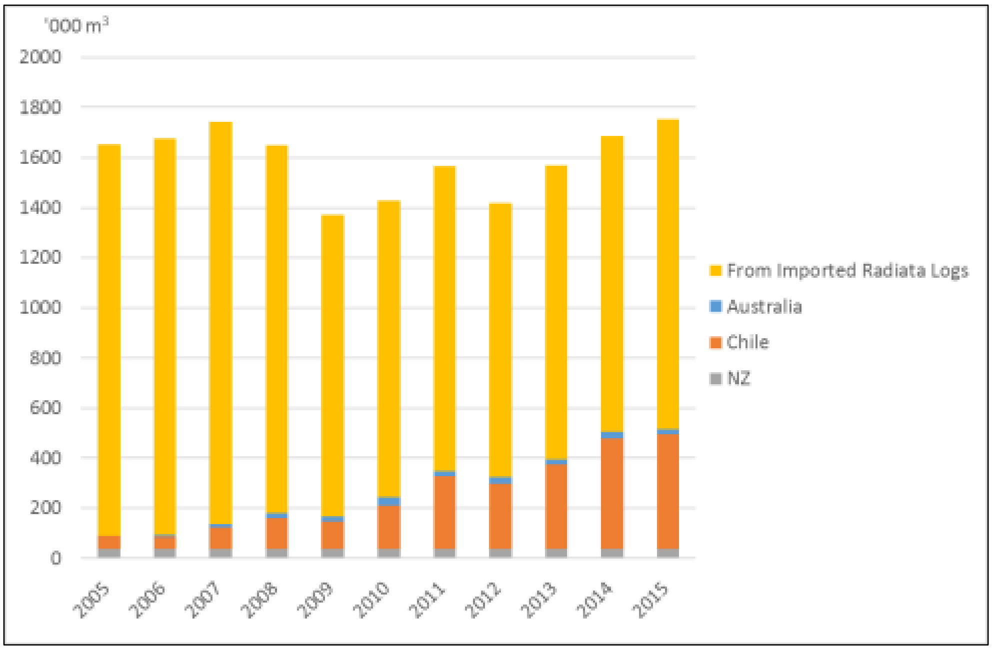
**Figure 5-19: South Korea Softwood Log Imports**




Source: GTIS and Indufor Research

Total demand for radiata pine lumber in S Korea reached some 1.75 million m$^3$ in 2015, with most of this demand supplied by S Korean domestic sawmills processing imported radiata pine logs.

**Figure 5-20: South Korea Radiata Lumber Market**




Source: GTIS and Indufor Research

## 5.7 Thailand

### 5.7.1 Sawn Lumber

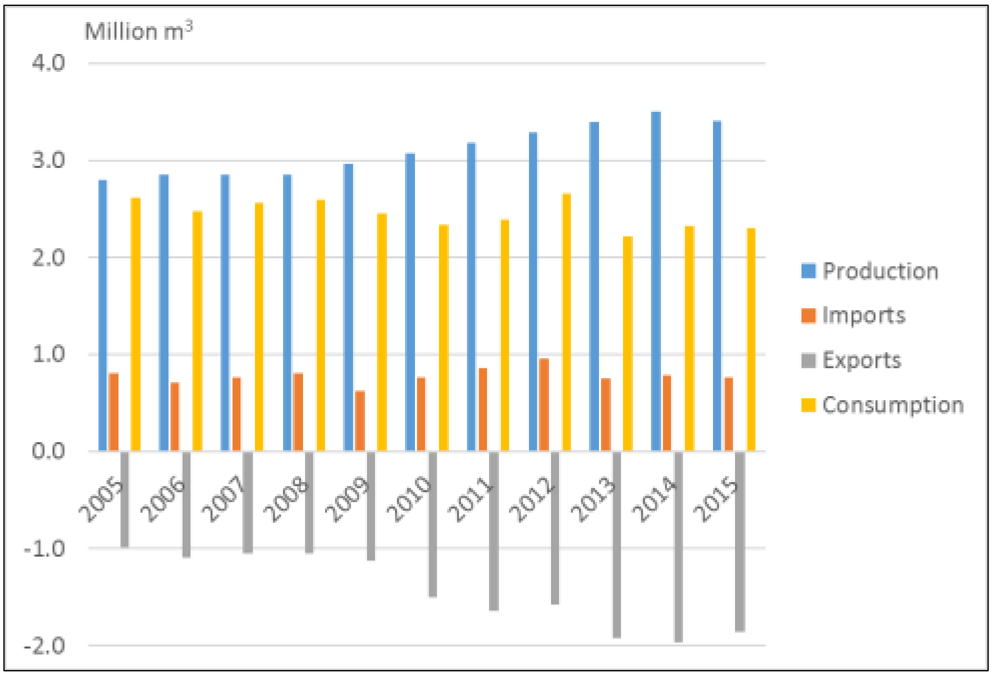
The Thai sawmilling industry has a long history of utilising natural forest sourced hardwood, including teak. Harvesting from natural forests has been halted, and no natural forest logs are allowed to be harvested, transported or sold.

The current sawmilling industry is solely based on the utilisation of plantation wood and rubberwood as well as imported logs from Myanmar (mainly teak). However, since late 2014 Myanmar has banned all log exports, and those mills relying on those logs are closing. As the main plantation species do not require any official reporting in relation to harvesting, transport or processing, actual data and statistics on production within the estimated 242 industrial scaled sawmills in Thailand is unavailable.

Production of rubberwood sawn lumber is estimated at some 2.5 to 3 million $m^3$, while the remainder is made up of eucalyptus and various other plantation species. Imports of logs from other countries, including Canada, have increased in recent years, but overall import levels are still relatively small. Thailand is unlikely to develop a major industry on imported logs, due to the relatively high local manufacturing costs.

The market for sawn lumber in Thailand appears to have declined over the last years. This would be in line with the general Thai economy and is also partly a function of a decline in the availability of low cost local sawn lumber, further exacerbated by strong growth in exports of rubberwood to China.

**Figure 5-21: Thailand Sawn Lumber Production, Trade & Consumption**




Source: GTIS and Indufor Research

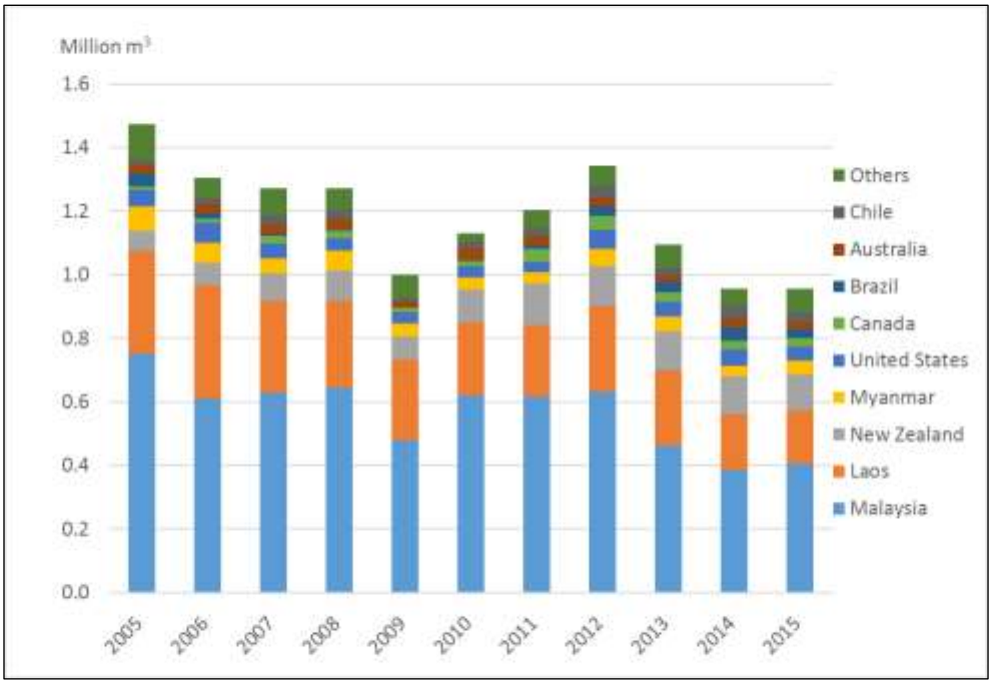
#### Exports

Thailand has grown its exports of sawn lumber extensively over the past decade. This trade is dominated by the export of rubberwood to China. Total exports reached 1.9 million $m^3$ in 2014, but declined slightly in 2015. China accounted for 98% of all exports. This strong demand for rubberwood by China has impacted on the local furniture industries, which must compete for this raw material. The main end use for the rubberwood exported to China is for furniture.

## Imports

Thailand sources its sawn lumber globally. Key tropical hardwood sawn lumber suppliers are Malaysia, Laos and Myanmar, while softwood is predominantly sourced from New Zealand, the US, Brazil and Chile. In addition, temperate hardwood is sourced from the US and Europe. In 2015 imports reached some 950 000 m$^3$, which was down from the previous year.

**Figure 5-22: Thailand Sawn lumber Imports by Source**



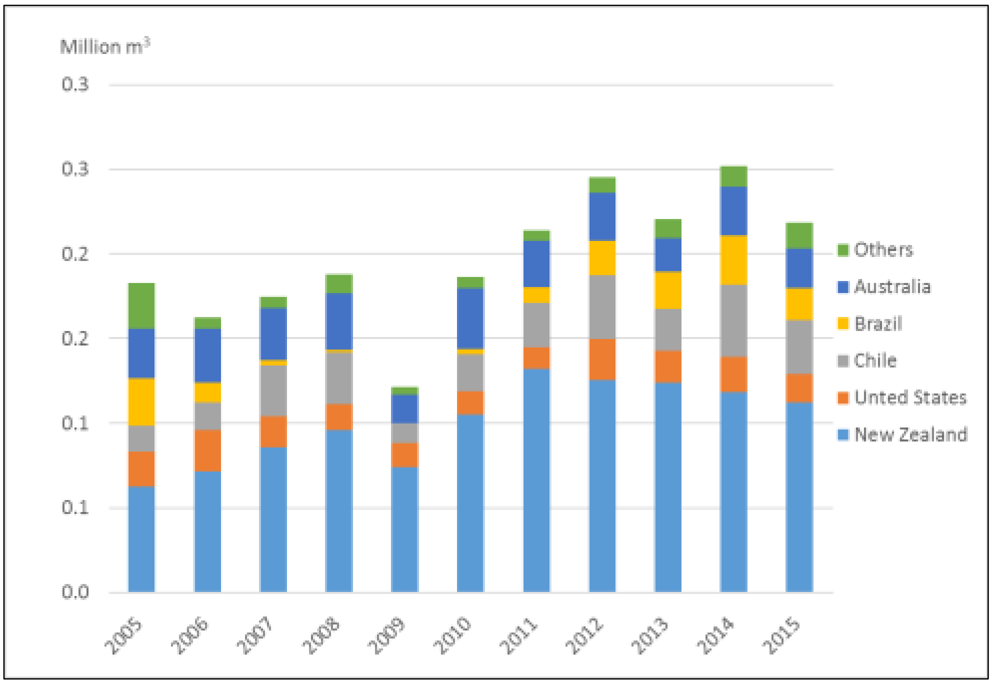

Source: GTIS and Indufor Research

Tropical hardwood sawn lumber is used widely, including joinery (doors and windows), mouldings and furniture. However, use of tropical hardwood is declining in furniture, as consumer trends move away from tropical hardwoods to temperate hardwoods and softwoods.

Temperate hardwoods are used exclusively for furniture and flooring manufacture. From interviews, it appears that the market for temperate hard wood flooring is growing strongly in Thailand. This is both for solid wood and engineered wood flooring.

Softwood lumber is predominantly used in packaging end uses as well as non-structural and structural construction applications.

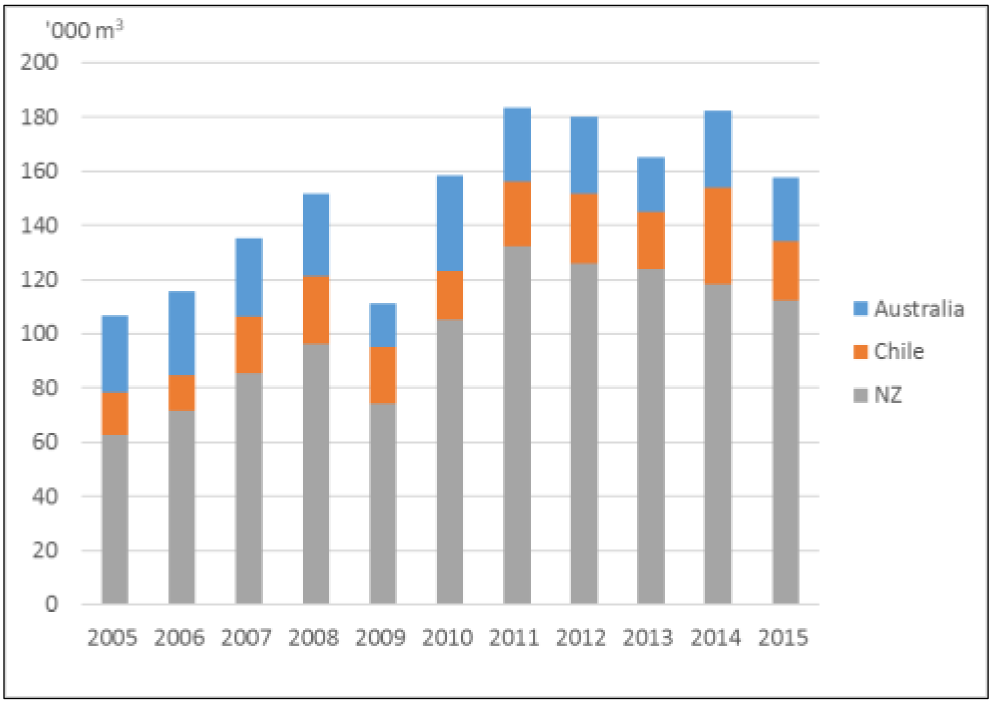
Figure 5-23: Softwood Lumber Imports into Thailand




Source: GTIS and Indufor Research

New Zealand is the dominant source of softwood in Thailand (Figure 5-24). Much of sawn lumber exported from New Zealand to Thailand is industrial and COL grades with small volumes of other grades, including structural. Currently, the main end use for New Zealand's sawn lumber is for packaging and concrete formwork.

Figure 5-24: Radiata Pine Lumber Imports into Thailand




Source: GTIS and Indufor Research

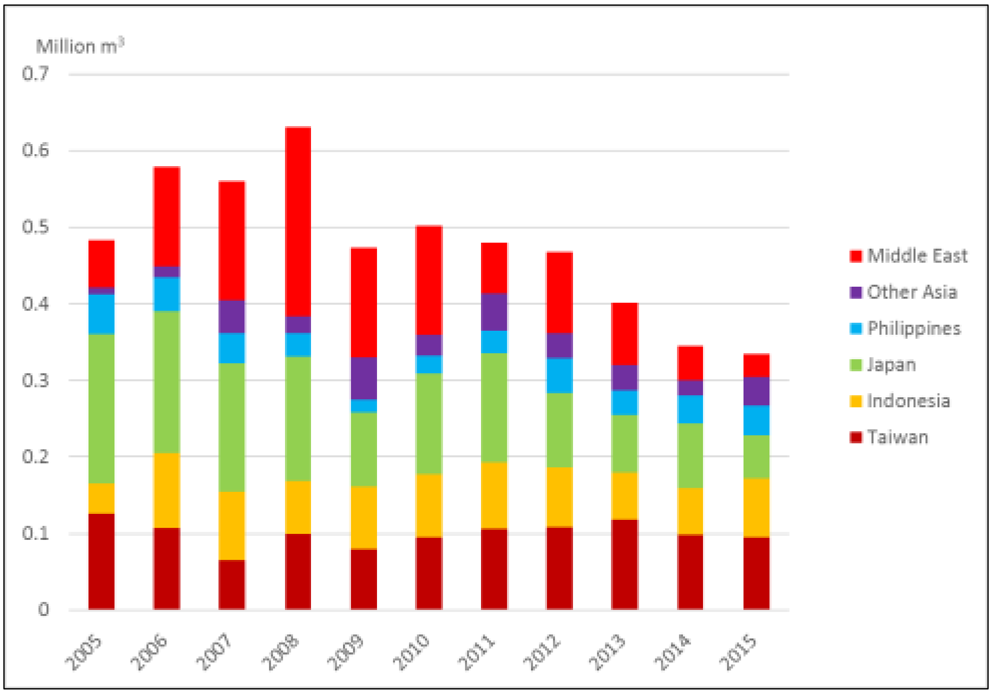
**Dimensions and Grades**

Most radiata lumber exports to Thailand are industrial and COL grades, in a wide range of sizes.

## 5.8 Other New Zealand Radiata Pine Lumber Export Markets

Over the past years, New Zealand's exports to many other Asian countries has seen a gradual decline. Key drivers behind this decline have been weak demand in the export markets and a declining competitive position of New Zealand suppliers as well as an increased focus on the previously described Asian markets of China, Thailand and S Korea.

**Figure 5-25: Other New Zealand Export Markets**




Source: GTIS and Indufor Research

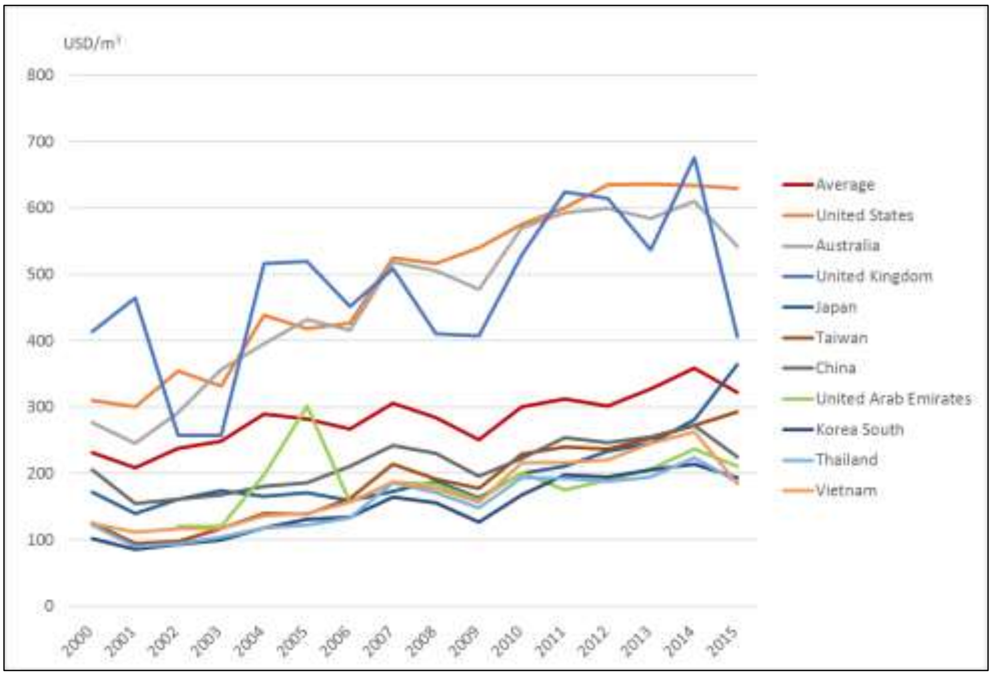
Over time it is expected that the SE Asian countries such as Indonesia, the Philippines, Malaysia and others will expand. It is likely that the initial grades required by these markets will be the lower value grades, such as industrial and COL.

## 5.9 Radiata Pine Price Developments

The export market for radiata pine lumber has always had clearly divided product groups -,the higher value structural and clearwood products, and the lower value products such as industrial grades and COL.

As can be seen in Figure 5-26, sales to the Australian and the US markets obtained the highest price levels, while sales into Asia and the Middle East obtained relatively low prices. For a proposed mill at Ngawha producing industrial and/or COL, the obtainable price levels will be at the lower end of the spectrum. Indufor suggests that for a feasibility analysis, price levels of USD200/$m^3$ (FOB) would be a correct indicative price.

**Figure 5-26: New Zealand Export Prices for Radiata Pine Lumber**




Source: GTIS and Indufor Research

## 5.10 Outlook for Radiata Pine Lumber

The global outlook for radiata pine lumber is very positive. Demand globally is expected to continue to expand, while global supply is close to having peaked.

The greatest opportunity for any sawmilling operation located in New Zealand is to replace some of the lumber currently produced in Asia utilising imported radiata pine logs sourced from New Zealand. A long term strongly competitive operation is key in achieving this.

The proposed Northland mill will have to use a range of log grades due to the likely resource availability. This will require the mill's design to take account of this. A positive will be that the mill could potentially provide a wider range of dimensions to the market.

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