Ministry for Primary Industries
Manatū Ahu Matua

Wood Availability Forecasts – **Northland** 2014

Prepared for the Ministry for Primary Industries
by Indufor Asia Pacific Limited

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New Zealand Government

Growing and Protecting New Zealand

Ministry for Primary Industries' Wood Availability Forecasts

A new series of Wood Availability Forecasts is being prepared by Indufor Asia Pacific, for the Ministry for Primary Industries (MPI), covering the period from 2014 to 2050. These forecasts are intended as a planning tool for the forest industry, councils, and infrastructure and service providers. New forecasts for all nine regional wood supply regions will be published over the next eighteen months, along with new national forecasts.

MPI is working in association with the National Exotic Forest Description (NEFD) Steering Committee to prepare the new regional and national wood availability forecasts. NEFD user surveys have emphasised that wood availability forecasts are the most used and valued product delivered under the NEFD programme. The previous regional and national forecasts were prepared between 2006 and 2010 and are available here: http://www.mpi.govt.nz/news-and-resources/statistics-and-forecasting/forestry/

MPI wishes to express its appreciation to the forest owners, managers and consultants of Northland for their support in preparing these wood availability forecasts. The work would not be possible without this assistance.

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ADDENDUM
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Under the section on data and methodology used to obtain forest areas it should also have been stated that areas of forest ages 20 and over, identified in the Small Forest Grower Survey, were removed. The Survey was undertaken in 2004 by AgriQuality (now AsureQuality). There is now concern over the reliability of this resource information.

Details on the methods used by AgriQuality are available in the *Small Forest Grower Survey Report* (AgriQuality, NZ, 2005).

Ministry for Primary Industries

Wood Availability Forecasts – Northland 2014

Report

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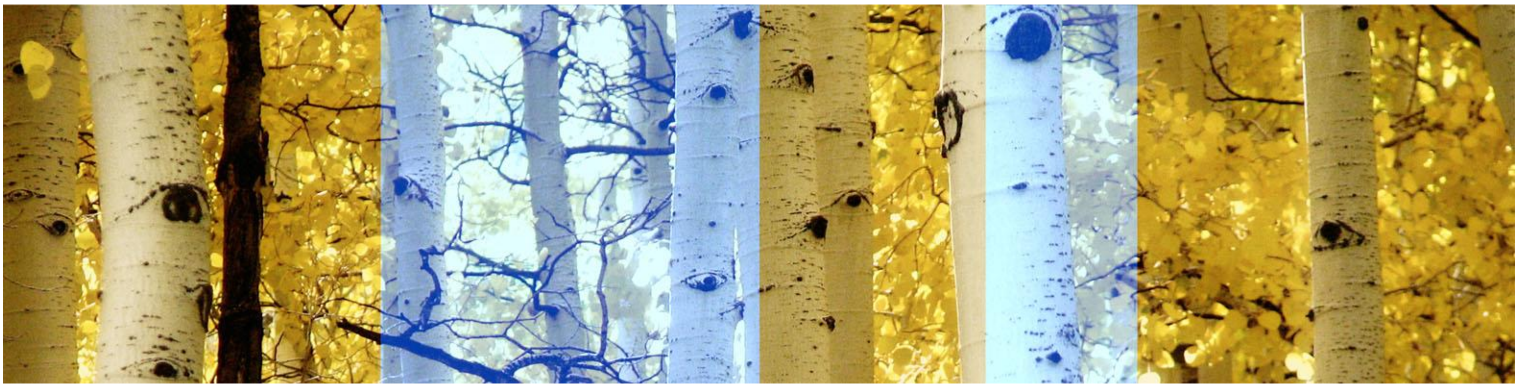

PREFACE

This report was prepared at the request of the Ministry for Primary Industries (the Client) by Indufor Asia Pacific Limited.

The project involved development of a series of regional and national wood availability forecasts for New Zealand's plantation estate.

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.

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1. INTRODUCTION

This report presents the findings from a 2014 wood availability study of the Northland planted forest estate based on the Ministry of Primary Industries (MPI) National Exotic Forest Description (NEFD) as at 1 April 2014. The study was undertaken by MPI, in association with the major plantation owners. The modelling supporting the study was undertaken by Indufor Asia Pacific Limited (Indufor).

Indufor prepared four production scenarios for radiata pine potential wood availability. The scenarios indicate how the forest resource in Northland could be harvested over the 2014 to 2050 period. The scenarios are based on the available resource in each region and a series of forecasting assumptions. Only radiata pine is included in the scenarios and wood availability forecasts. There are areas of other species in the Northland region, but these are not included in the availability forecasts[1].

The forecasts incorporate the harvesting intentions of the region's large-scale forest owners. Large-scale owners are defined as:

- Those with 1000 ha of forest or more in the region of interest, and
- With more than three age-classes, and;
- Not a part of a syndicate.

There was also consultation with forest managers and consultants to ensure the scenarios represented a realistic range of future wood availability.

The scenarios clearly show there are different ways for the forest resource to be harvested. In examining the scenarios, it is important to recognise that forests are normally managed in a way that maximises the benefits to the enterprise that owns them. Each enterprise has its own harvesting strategy based on the owner's objectives and market conditions. Any change in harvesting strategies by forest owners affects the age-structures and maturity of the forests they own. This in turn feeds back into future wood availability.

A key issue is the timing of harvesting by small-scale forest owners of their forests or woodlots. The harvest age can vary markedly, even between neighbouring properties. The timing of the harvest of these forests is driven by a range of factors, including individual forest owner's objectives, forest age, log prices, demand by local wood processing plants, and perceptions about future log prices and future wood supply.

There are different levels of uncertainty associated with the wood availability from each component of the estate. While the volumes forecast from larger forest owners are subject to alteration because of changes in harvesting intentions or changes in the resource description (for example, areas and yields), a higher level of confidence can generally be assumed for these forecasts than for the small-scale owners' estate. Not only are harvest intentions less clear for small-scale owners, the resource description is potentially less accurate.

[1] While availability forecasts for Douglas-fir are typically modelled, there are negligible quantities of this species in Northland (less than 10 ha).

2. SCENARIOS

Four wood availability scenarios have been modelled for radiata pine. These scenarios show the range of potential ways the forests in the region could be harvested in the future.

The scenarios were developed by the NEFD Steering Committee. Indufor undertook initial modelling of the scenarios, and these were presented to the major forest owners and consultants in the Northland wood supply region. Their feedback was taken into account in the final derived profiles.

There are 5 192 ha[2] of species other than radiata pine in Northland. The volumes from these species are not included in the wood availability forecasts.

2.1 Scenario 1: Large-scale Owners Harvest at Stated Intentions, Small-scale Owners Harvest at Age 28

Large-scale owners' wood availability is based on stated harvest intentions for the period 2014 to 2023 (calendar year estimates). After 2023, a modelling assumption is that the wood availability from large-scale owners will not decrease.

Small-scale owners are assumed to harvest their forest holdings at age 28.

This is similar to scenario 2 in the 2008 Wood Availability Forecasts, although the target rotation age for small scale owners was 30 years in the earlier analysis.

2.2 Scenario 2: Non-declining Yield (NDY) – Target Rotation 28 years

Large-scale owners' wood availability is assumed to be at stated harvest intentions for the period 2014 to 2023. After 2023, the wood availability from large-scale owners is assumed not to decrease (as for scenario 1).

For total radiata pine supply, the standard scenario 2 specified by the NEFD Steering Committee is that the supply is to be non-declining in perpetuity with a target rotation age of 28 years (30 years in scenario 3 in the 2008 Wood Availability Forecasts). However, due to the age-class distribution in Northland it is not possible to achieve such a profile without unrealistic variances in the clearfell age range. It was agreed that the non-declining yield constraint would be applied from 2020.

2.3 Scenario 3: Split NDY – Target Rotation 28 years

This is the same as scenario 2 except that the total wood availability of radiata pine from the region is allowed to decline after 2034 for a period of five years. Over this five year period, an annual change of up to 10% is allowed. The yield is then required to be non-declining from 2039.

2.4 Scenario 4: Target Rotation Age Variations

This is similar to scenario 3 except that target rotation ages of 26 and 30 years are also modelled (28 and 32 years in the 2008 Wood Availability Forecasts). After discussion with Northland region forest owners and consultants, it was agreed to set the target harvest age for small owners to 23 years rather than 26. It was felt that this would more accurately reflect the behaviour of this owner size group.

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[2] Douglas-fir: 10ha, Cypress: 386 ha, other softwoods: 947 ha, Eucalyptus: 601 ha, other hardwoods: 3 248 ha.

2.5 Discussion of the Scenarios - Radiata Pine

Figure 2-1A to Figure 2-1C illustrate the differences between Scenarios 1 to 3 (respectively) using the Northland radiata pine resource as an example (more detailed discussion is provided in Section 4).

In scenario 1 (Figure 2-1A), the forests owned by small-scale owners are assumed to be harvested at age 28. The scenario shows the "potential" availability of mature forest from small-scale owners in any given year. This scenario directly reflects the area of forest in the small ownership category in each age-class in the Northland region. For practical reasons, it is unlikely that the future harvesting would occur this way. The intention of this scenario is to show the potential magnitude of harvesting under favourable market conditions in any given year.

Scenarios 2 and 3 (Figure 2-1B and Figure 2-1C, respectively) are based on yield regulation. Yield regulation refers to where, when, and how these recoverable volumes should be extracted, and provides a more orderly harvesting volume profile that, to some degree, reflects logistical and market constraints. Under these scenarios, the future harvesting model is generally constrained to be non-declining: that is, each year the volume must either be the same or higher than in the previous year.

Scenarios 2 and 3 avoid the large year-to-year fluctuations in volume seen in scenario 1. A fundamental property of the forests in Northland (like many regions in New Zealand) is the large area of forests established during the 1990s. Scenarios 3 and 4 illustrate the harvesting of these forests by applying a non-declining yield constraint for the period 2020 to 2034. Then once the "bulge" of forest area planted during the 1990s has been harvested, the model lets the volume decline again.

The main limitations of scenarios 2 to 4 are that log prices and other market factors are significant determinants of harvesting in any given year. When log prices go up, harvesting will generally increase. When log prices fall, the level of harvesting will generally decrease. It is beyond the scope of this analysis to predict future log prices.

2.6 Scenario for Douglas-fir

There is no Douglas-fir resource of significance in Northland and therefore this scenario is not applicable.

Illustration of Wood Availability Scenarios (Northland Radiata Pine Forecasts)

Figure 2-1A: Scenario 1: Large-scale Owners Harvest at Stated Intentions, Small-Scale Owners Harvest at Age 28

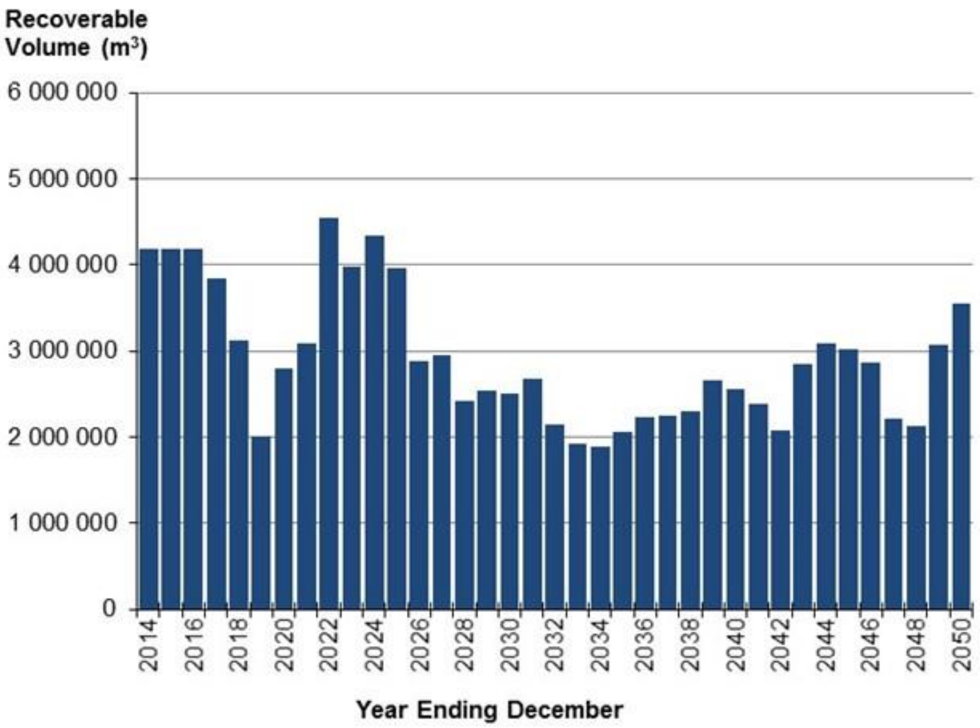


Figure 2-1B: Scenario 2: Large-Scale Owners Harvest at Stated Intentions. Overall Non-Declining Yield (from 2020) with a Target Rotation of 28 Years

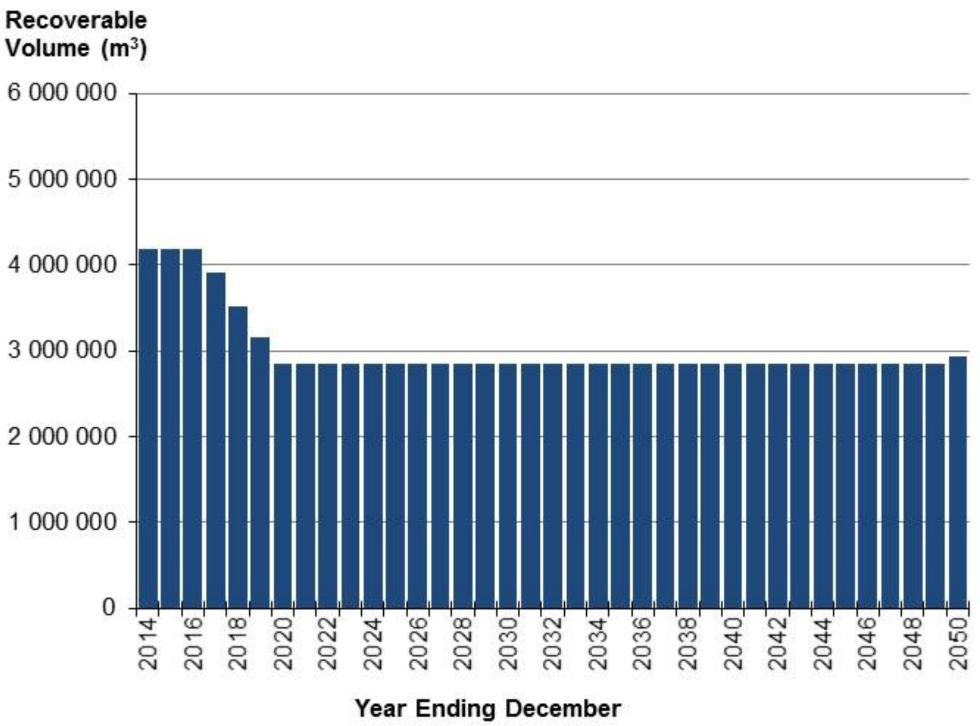
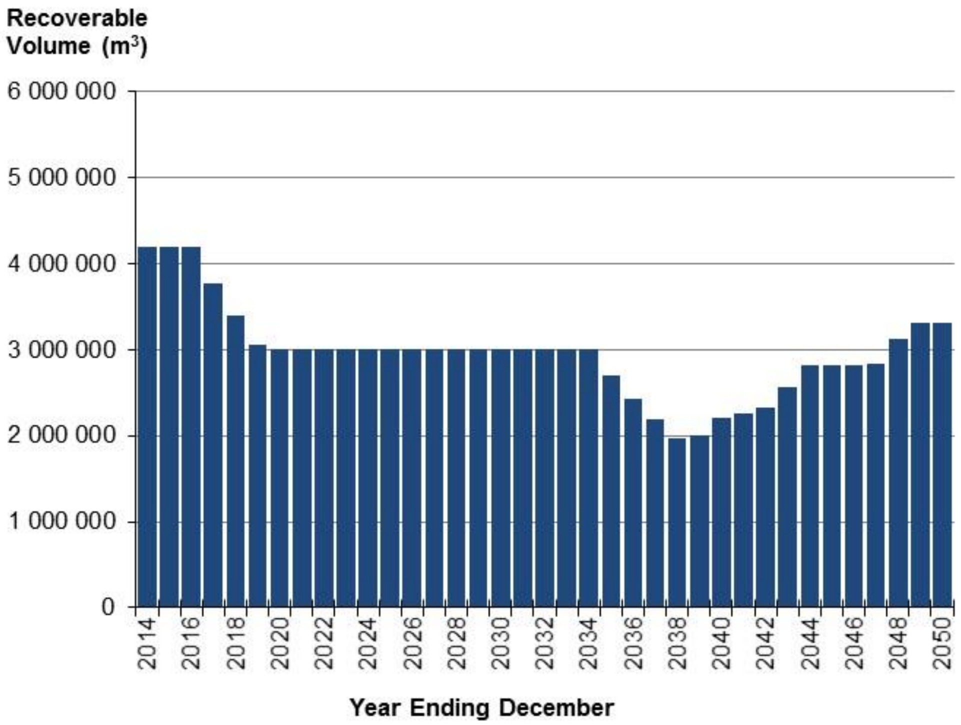


Figure 2-1C: Scenario 3: Large-scale Owners Harvest at Stated Intentions. Overall Split Non-Declining Yield (from 2020) with Target Rotation of 28 Years



3. DATA AND METHODOLOGY

3.1 Method Used to Obtain Forest Areas

The forest areas were sourced from the NEFD as at 1 April 2014 (MPI 2014). Only radiata pine areas are modelled. The area for the large-scale owners was unadjusted, while 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).

In addition to this, 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 further 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.

There has also been a change in the regional boundaries since the 2008 WAF were undertaken. In the 2008 WAF, Auckland was a separate region. In the 2014 WAF, the majority of the area has been transferred to CNI, with the exception of Auckland Council which is now part of Northland.

3.2 Method Used to Develop Yield Tables

For the 2008 WAF, new yield tables for Northland were developed in the following way:

- Large-scale forest owners provided yield tables for their forest estates.
- These tables were averaged on an area-weighted basis to derive regional yield tables for each crop-type.
- The area-weighted average regional yield tables for "old" radiata pine (planted before 1989) were then calibrated to match the harvest intentions data provided by large-scale owners. The assumption is that the harvest intentions data is the most accurate information available, as it is based predominantly on detailed inventory.
- The area-weighted average regional yield tables for "young" radiata pine crop-types (planted in 1990 and later) were also adjusted based on consultation with large-scale owners.
- The area-weighted average regional yield tables developed for the large-scale owners' estate were also applied to the small-scale forest owners' estate.

For the latest forecasts, the yield tables developed in 2008 were utilised, and were again calibrated to the latest harvest intentions information provided by large forest owners (essentially the process described in the third bullet point above was replicated to derive yield tables that reflected yields expected by the large owners).

3.3 Large-Scale Owners' Harvest Intentions

Large-scale owners were asked to provide details of their projected harvest volumes (by log grade, area and average harvest age) for the 2014 to 2033 period. The five largest owners all provided yearly (31 December) summary data for the project. Inclusion of actual levels of intended harvest by the large owners is considered a critical step, as it provides the best estimate of future wood availability for the first ten years (2014-2023) of the forecast horizon.

The large-scale owners who provided their harvest intentions are:

- Taumta
- Summit Forest Management
- Matariki Forests
- Greenheart Group
- GFP Mahoe II
- Parengarenga A
- Holyoake
- Waytemore Forests
- Whitford

3.4 Modelling Assumptions

The wood availability forecasts for Northland are based on the following assumptions:

- All areas are replanted, with a regeneration lag of one year. Replanting is as follows:
    - All radiata pine areas are maintained as radiata pine.
    - Large-scale forest owners: 100% of all pruned areas will be replanted as an unpruned regime
    - Small-scale forest owners: 25% of all pruned areas will be replanted as a pruned regime with 75% transferring to an unpruned regime
- Based on discussions with major forest owners and consultants in the region, it was determined that conversion of forests to other land uses has been and is likely to continue at a sufficient rate for it to be incorporated into the wood availability forecasts. 7 000 ha are assumed to be converted out of forestry by 2025.
- The area awaiting replanting as at 31 March 2014 is included as area at age 0 (that is, the area to be replanted in the 2014 planting season).
- Total roundwood removals in the Northland region were estimated to be 4.2 million m^3 for the year ended 31 March 2014. This was used to derive the harvest level for the first year of the model.
- Radiata pine area in the large-scale owners' estate aged over 35 years is assumed to be non-commercial and therefore will not be harvested.
- Radiata pine area in the small-scale owners' estate aged over 40 years is assumed to be non-commercial and therefore will not be harvested.

4. WOOD AVAILABILITY FORECASTS FOR NORTHLAND

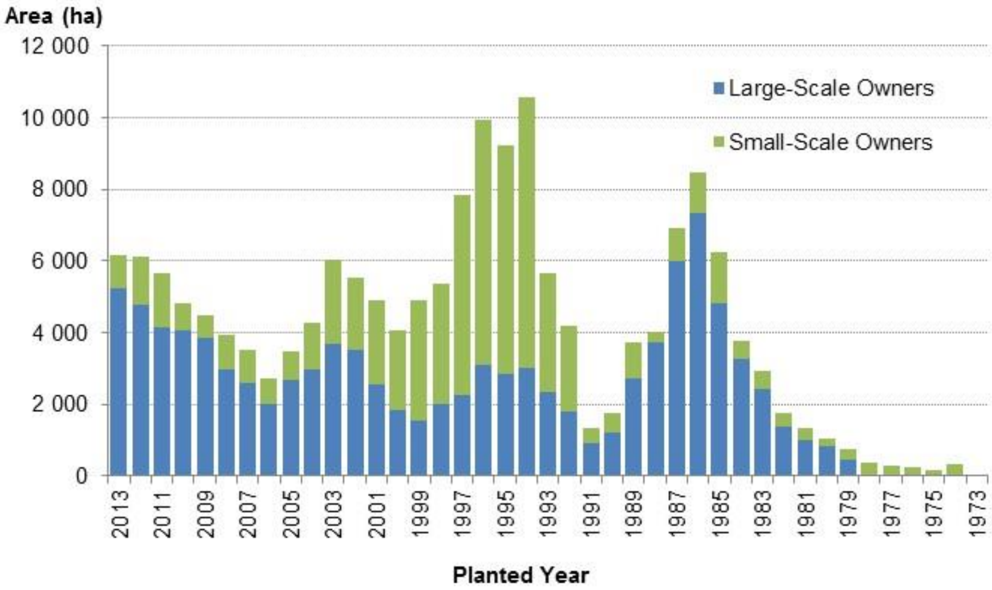
4.1 Northland Region Age-Class Distribution

The Northland region has a plantation resource of 191 512 ha (before deductions), spread across four territorial authorities – Far North District, Kaipara District, Whangarei District, and Auckland Council. Of this, 186 320 ha consists of radiata pine. Around half of the resource is located in the Far North district (85 866 ha as at 1 April 2014).

After the area deductions described in Section 3.1 are applied to the NEFD area, the modelled area reduces to 168 648 ha.

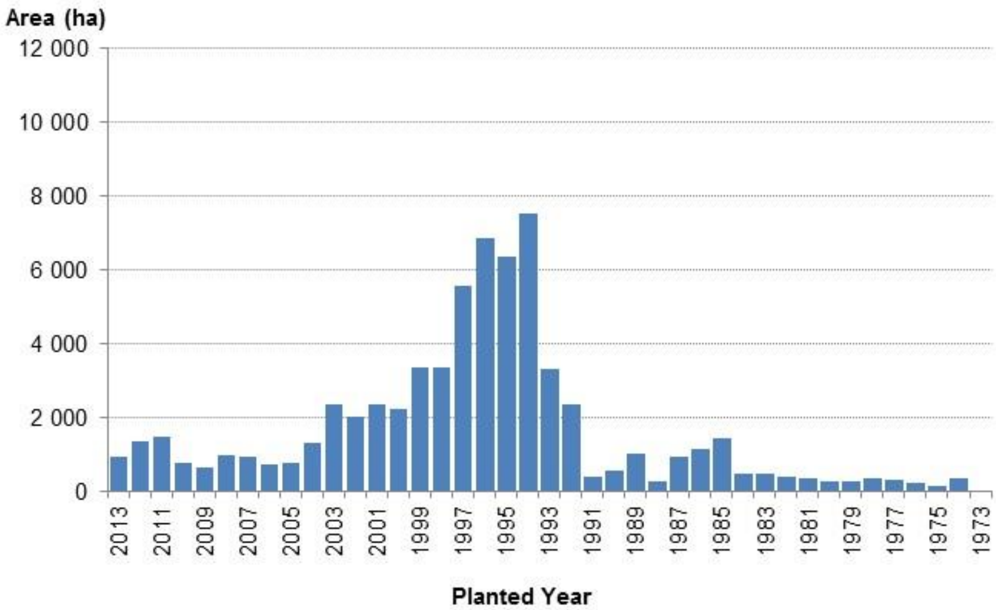
All the modelled resource consists of radiata pine. Figure 4-1 shows the age-class distribution for the Northland estate by owner size. 60% of the modelled resource is held by large owners and 40% by small owners. Figure 4-1 highlights the peak in planting in the mid-1980s in the large-scale owner resource.

Figure 4-1: Northland Age-class Distribution by Owner – All Species as at 1 April 2014



The age-class distribution of the small-scale owners' estate only is shown in Figure 4-2. This shows a peak in planting in the mid-1990s, with an average of 6 000 ha planted each year between 1992 and 1997 (currently 17 to 22 years old) and much less area in all other age-classes. The wood availability from this estate is significantly influenced by the timing of the harvest of the large area aged 17 to 22.

Figure 4-2: Northland Age-class Distribution of Radiata Pine – Small-Scale Owners as at 1 April 2014

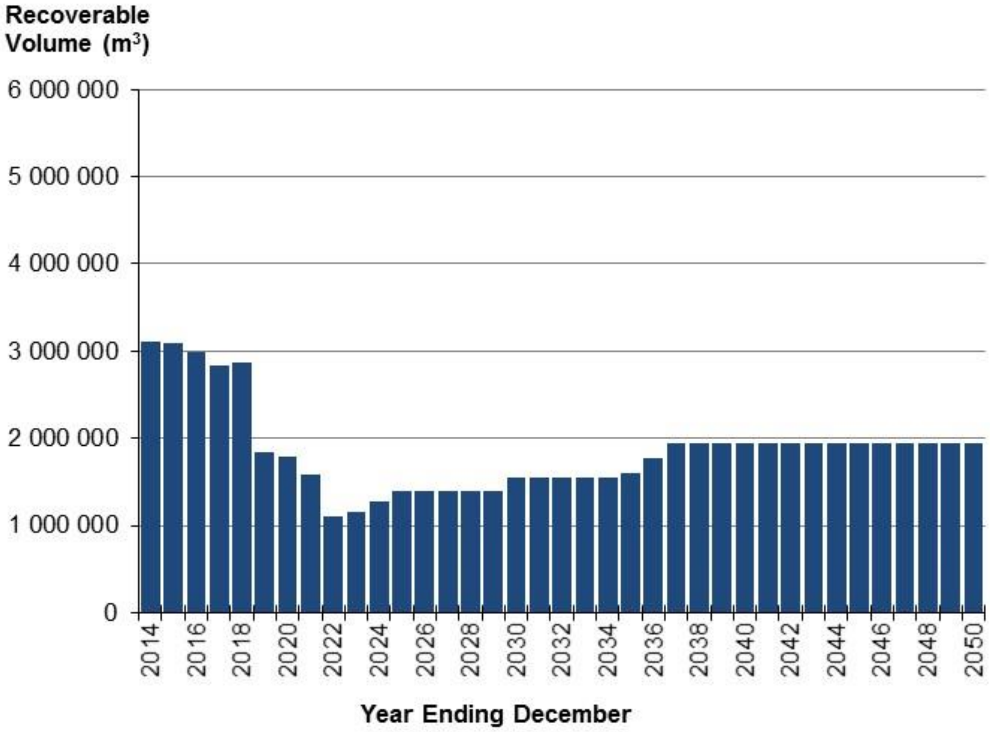


4.2 Scenario 1

For this scenario, the availability of wood from large-scale owners is based on their stated harvest intentions for 2014 to 2023. Thereafter the availability is constrained to be non- declining with a target rotation age of 28 years. The wood availability of large-scale owners (Figure 4-3) is forecast to decrease significantly after 2018, before gradually increasing again from 2023 to a sustainable yield of close to 2 million m^3 per annum.

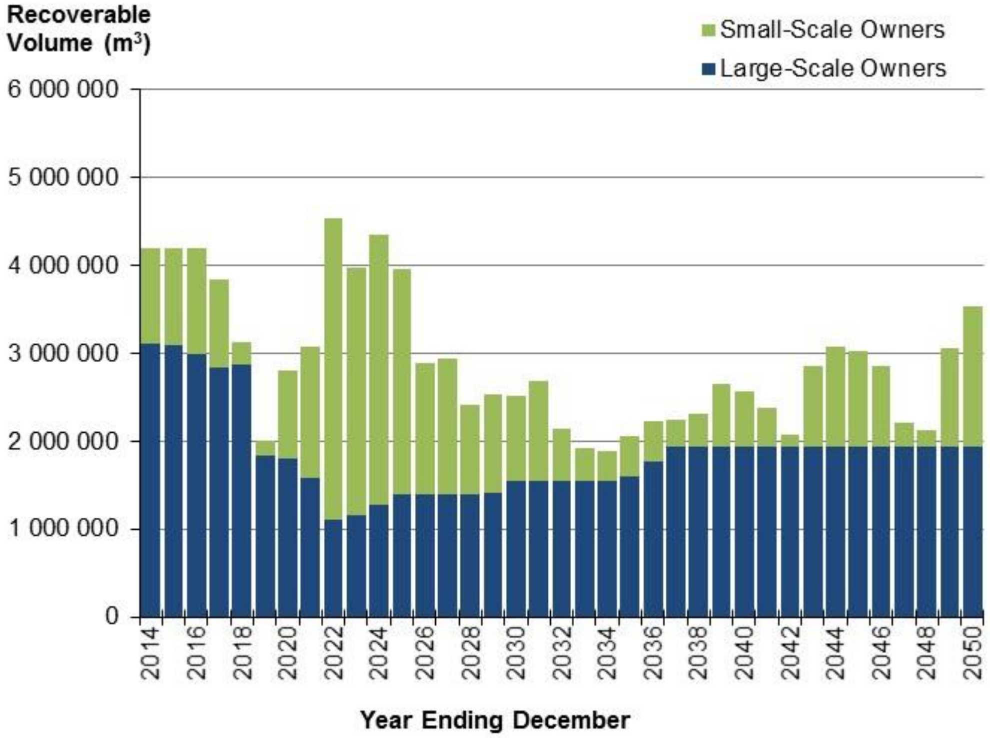
Small-scale owners harvest their forests at age 28.

Figure 4-3: Northland Radiata Pine Availability under Scenario 1 – Large-Scale Owners



The wood availability from all owners in Northland is presented in Figure 4-4. The large-scale owners' resource is shown as the "base" volume, and the forecasts match the volumes in Figure 4-3. The fluctuation in the total annual forecast volumes reflects the variation in the areas in each age-class of the small-scale owners' estate, and the assumption that this estate is harvested at age 28.

Figure 4-4: Northland Radiata Pine Availability under Scenario 1 – All Owners

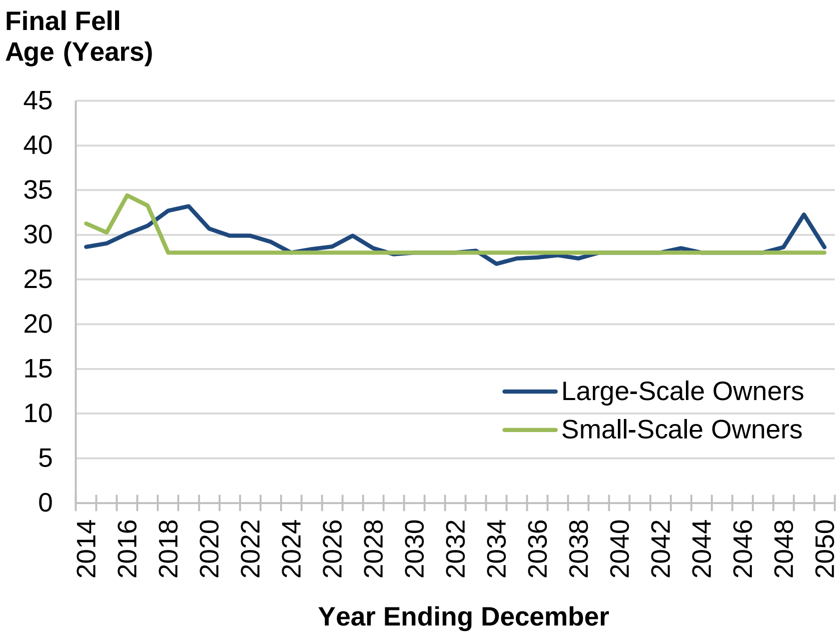


The large increase in harvest volume after 2019 (Figure 4-4) reflects the maturing of the small-scale owners' estate. For example, the increase in 2022 is a consequence of the 7 544 ha planted by small-scale owners in 1994 (Figure 4-2) being harvested at age 28 years.

Fluctuations in harvest volumes of the magnitude shown in Figure 4-4 would be impractical due to operational constraints (for example: availability of harvest machinery, harvesting crews and transport operators) and market absorption constraints (for example: limited domestic wood processing capacity, levels of export demand).

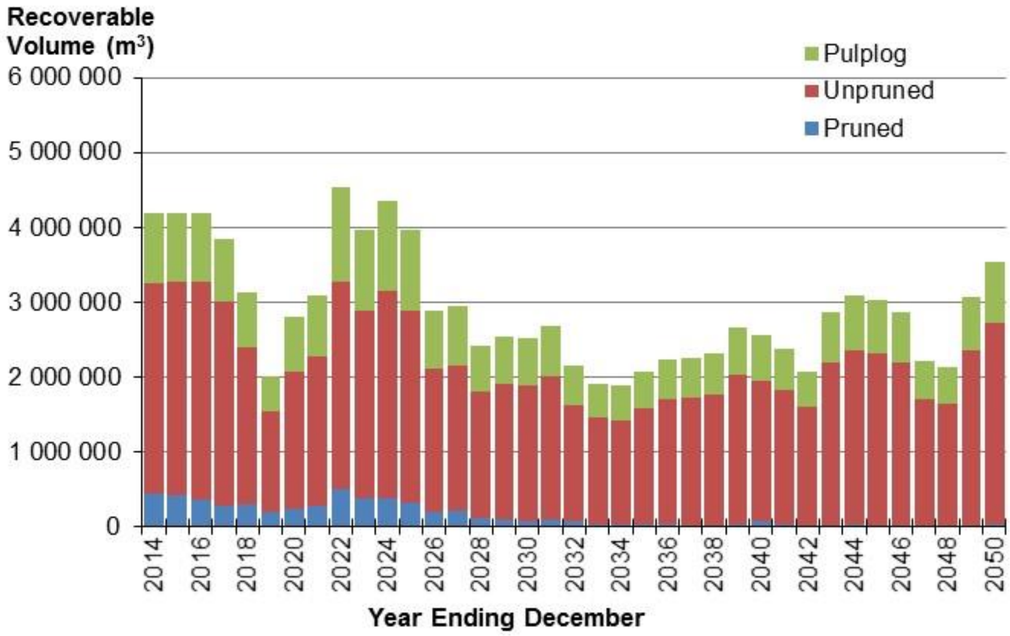
Figure 4-5 shows that, apart from the near-term harvest (which is constrained to the intentions of the large scale owners), the harvest age settles at the target of 28 years.

Figure 4-5: Northland Average Radiata Pine Clearfell Age under Scenario 1 – by Ownership Category



The harvest volumes forecast under scenario 1 are broken down by log grade in Figure 4-6.

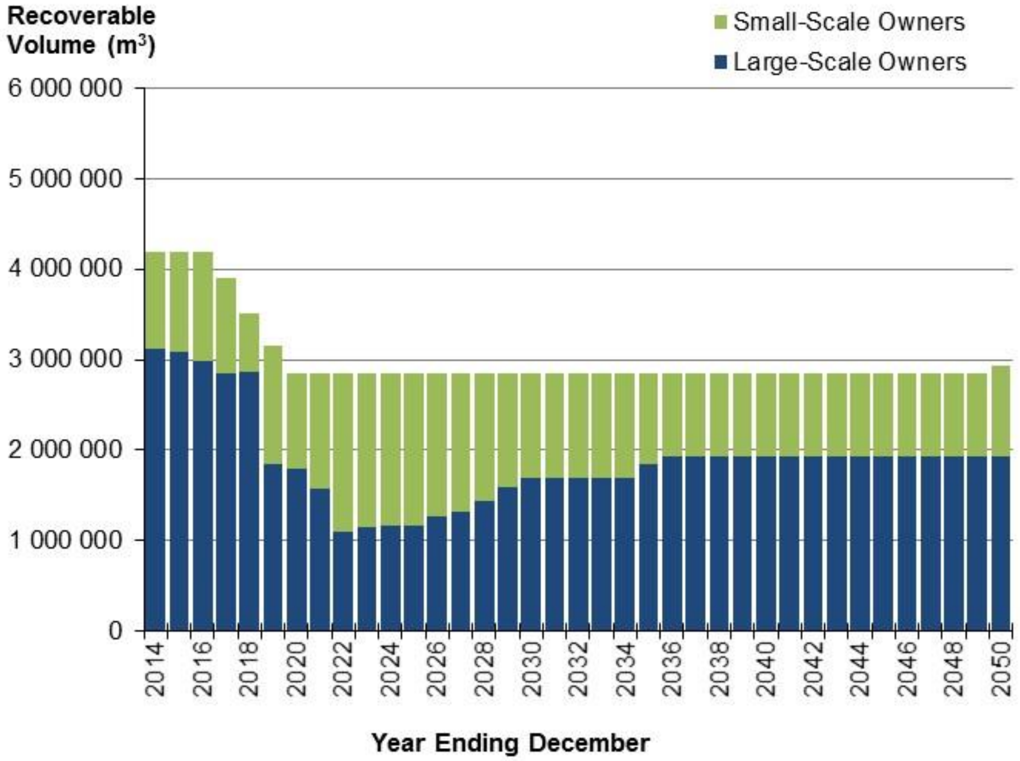
Figure 4-6: Northland Radiata Pine Availability under Scenario 1 – by Log Grade (all owners)



4.3 Scenario 2

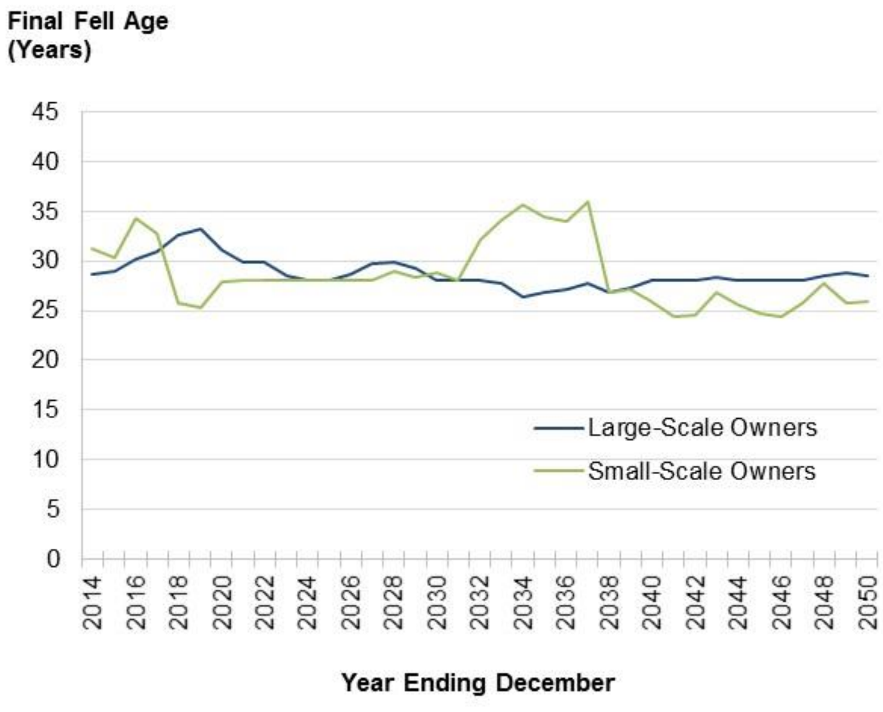
The second scenario assumes large-scale owners' resources are harvested as per their harvest intentions for the first 10 years, then a non-declining yield constraint is applied to the large-scale owners' estate after 2023. In addition, a non-declining yield constraint is applied to the total overall radiata pine estate from 2020, with a target rotation age of 28 years. Figure 4-7 indicates that a gradual increase in the harvest from the small-scale owners' estate could occur through to 2022 (from 1.2 million m^3 to 1.7 million m^3) and is maintained at a similar level for four years, before settling at a long term level of 0.9 million m^3 per annum.

Figure 4-7: Northland Radiata Pine Availability under Scenario 2 – All Owners



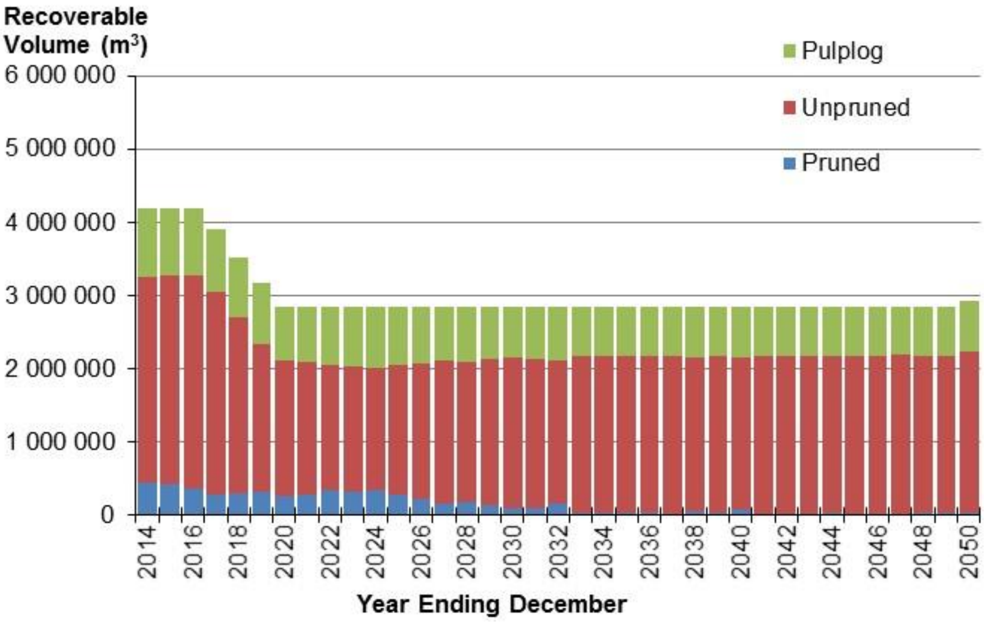
This scenario does at times require that the harvest age varies significantly from the target rotation of 28 years. This is especially the case for small-scale forest owners (Figure 4-8).

Figure 4-8: Northland Average Radiata Pine Clearfell Age under Scenario 2 – by Ownership Category



The harvest volumes forecast under scenario 2 are broken down by log grade in Figure 4-9.

Figure 4-9: Northland Radiata Pine Availability under Scenario 2 – by Log Grade (all owners)



4.4 Scenario 3

The third scenario again assumes large owners' resources are harvested in line with their harvest intentions between 2014 and 2023, and then non-declining after 2023. However, the overall yield is based on a split non-declining yield, with a target rotation age of 28 years. A drop in the overall harvest volume is allowed after 2034 for a five-year period (between 2035 and 2039 of no more than 10% per year). This scenario gives a forecast wood availability that is different to scenario 2 (Figure 4-10). Through the period 2019 to 2034, the wood availability is just over 3 million m³ (2.8 million m3 in scenario 2). Harvest volumes then dip to under 2 million m³ per year in 2038 before returning to the 3 million m³ level by 2048.

The main difference from scenario 2 is that the large area of young stands in the small-scale owners' estate is harvested over a shorter period of time, at a higher level of harvest (through to 2034). A consequence is that the average clearfell age for small-scale owners stays closer to the target of 28 years than in scenario 2 (Figure 4-11).

Figure 4-10: Northland Radiata Pine Availability under Scenario 3 – All Owners

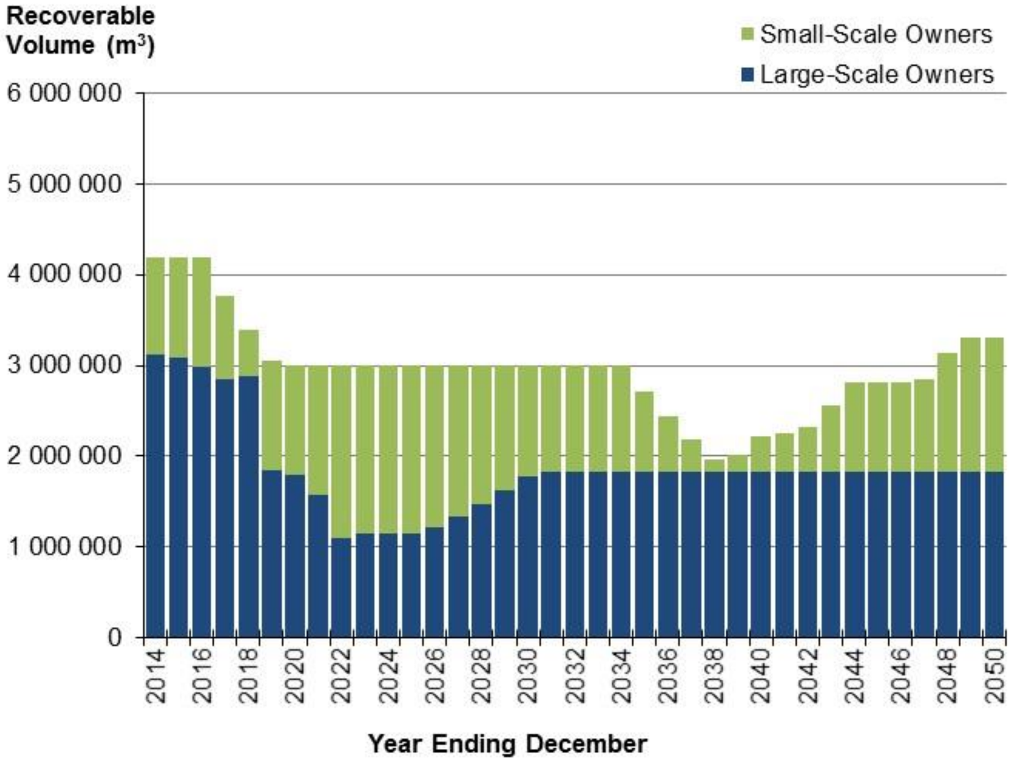
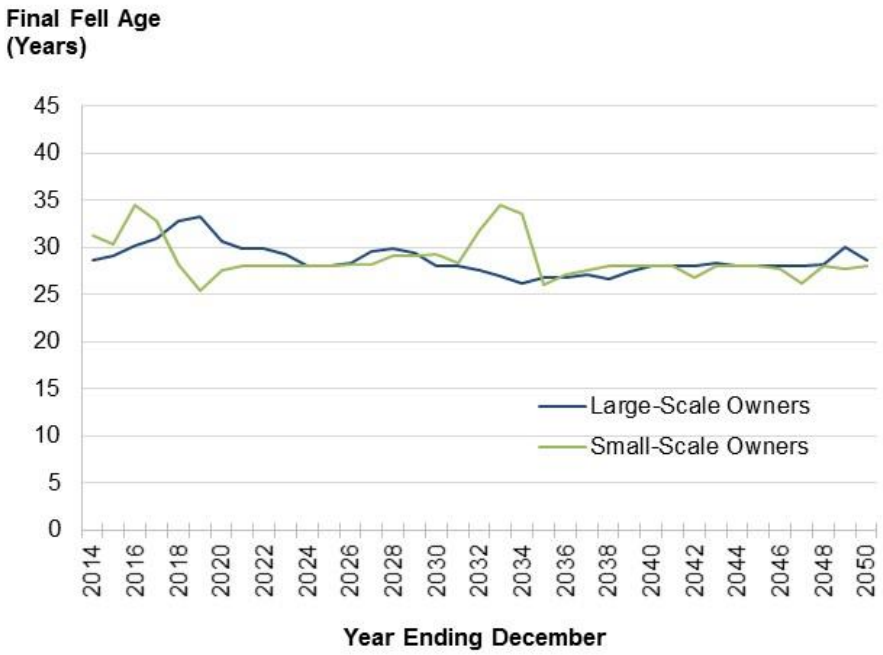
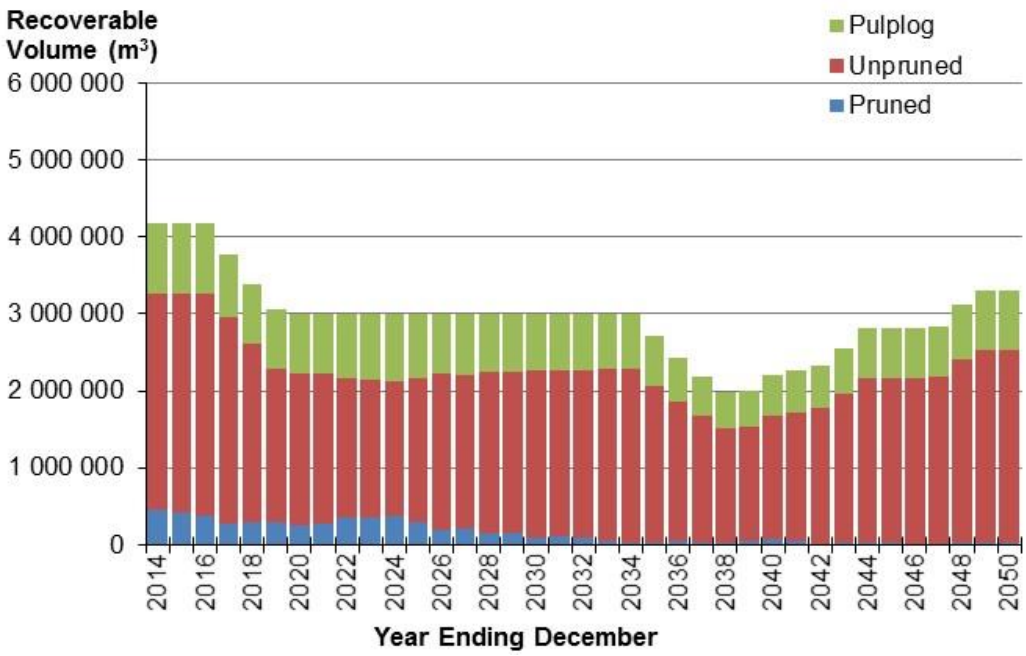


Figure 4-11: Northland Average Radiata Pine Clearfell Age under Scenario 3 – by Ownership Category



The harvest volumes forecast under scenario 3 are broken down by log grade in Figure 4-12.

Figure 4-12: Northland Radiata Pine Availability under Scenario 3 – by Log Grade (all owners)



4.5 Scenario 4

Target rotation ages of 26 (23 for small owners) or 30 years are used (rather than 28 years) and the same constraints are applied as in scenario 3 (Figure 4-13).

The harvest ages are somewhat constrained for the first ten years by the large-scale owners' harvest intentions and the requirement for a non-declining yield for the large owner's estate as well as the overall radiata pine estate. These constraints are slightly relaxed for the 26 and 30 year target rotations to allow the actual harvesting ages to more closely match the target rotation ages. Figure 4-14 still illustrates however the difficulty in achieving the desired rotation lengths within the overall harvesting constraints imposed by the scenario.

Figure 4-13: Northland Radiata Pine Availability by Target Rotation Age under Scenario 4 – All Owners

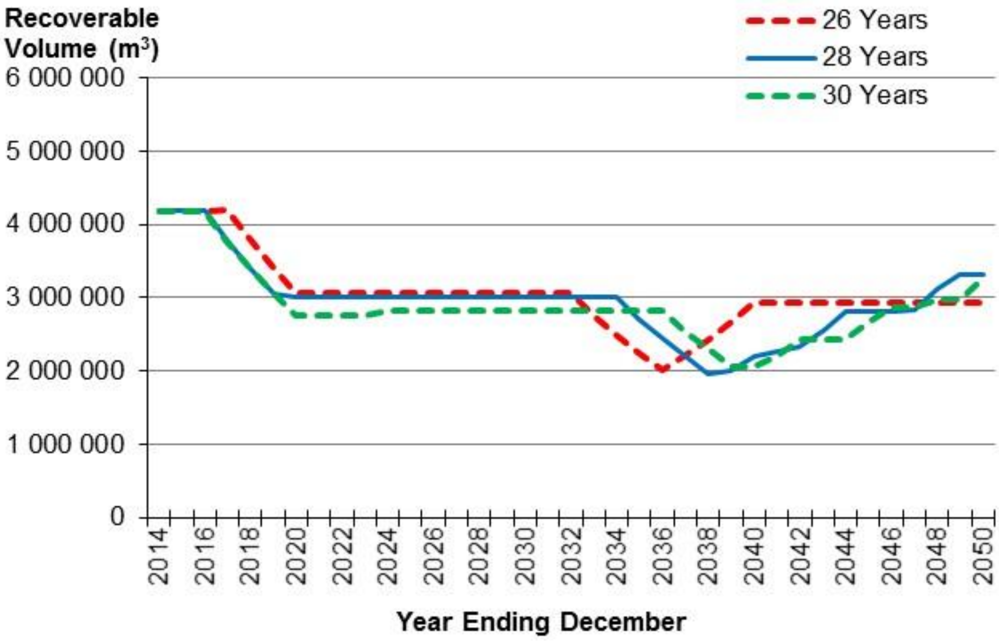
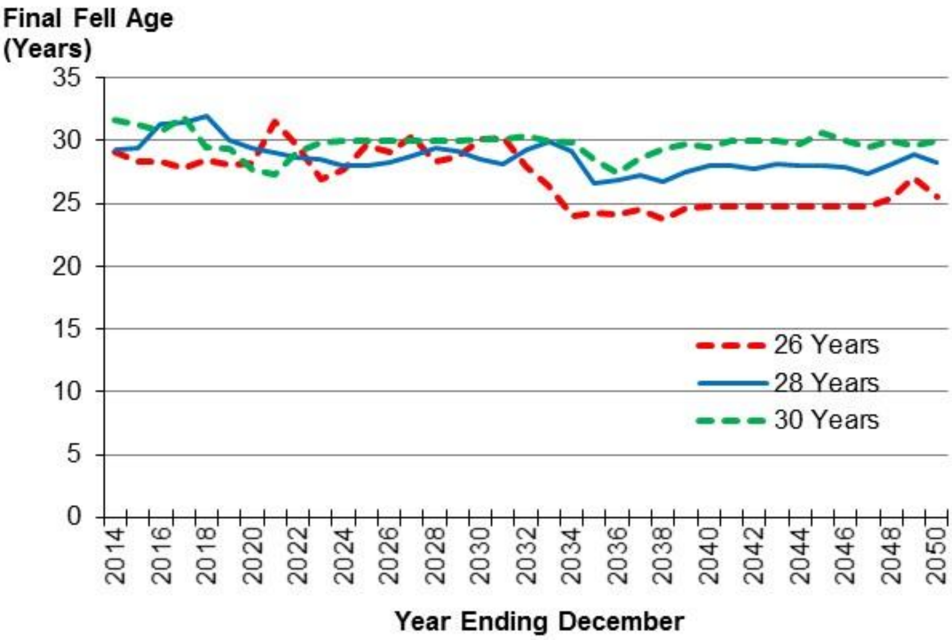


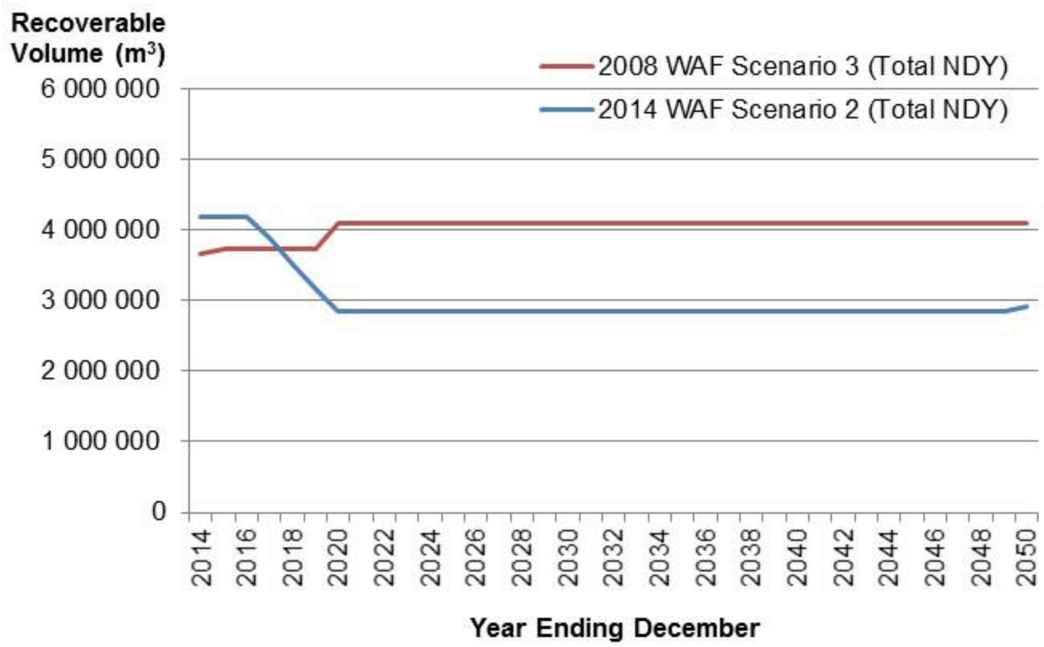
Figure 4-14: Northland Average Radiata Pine Clearfell Age by Target Rotation Age under Scenario 4 – All Owners



5. COMPARISON OF THE WOOD AVAILABILITY FORECASTS: 2008 VS 2014

The results of the 2014 wood availability forecasts were compared with the previous forecasts, undertaken in 2008 (Figure 5-1). The comparison is based on Scenario 2 (which is equivalent to the Scenario 3 in the 2008 forecasts). It can be seen that the wood availability from the 2014 forecasts settles at a level 1.2 million m^3 lower than that in the 2008 forecasts (a 30% decrease). Not shown in Figure 5-1 but of note, is that the actual roundwood removals for the period 2008 to 2014 were similar to the 2008 WAF (21 million m^3 compared to a forecast of 18 to 20 million m^3).

Figure 5-1: Wood Availability Forecasts (All Radiata Pine): 2008 vs 2014



There are several factors that are contributing to the variations. These factors include (refer Table 5-1):

- There has been a 10.7% reduction in modelled area since the 2008 WAF. This is mainly the result of the hand-back of areas post harvesting and conversion to non-forestry areas.
- There has been some maturing of the Northland resource; the average age has increased from 16.2 years in 2007, to 16.8 years in 2014. A comparison of the area-age class distribution at each reporting date is shown in Figure 5-2.
- The calibrated 2014 yield tables show a lower productivity compared to the equivalent yield tables used in the 2008 forecasts: 19% lower for unpruned, and 13% lower for pruned (see Figure 5-3 and Figure 5-4 respectively). The latest yield tables are based on a considerable quantity of inventory data and actual harvest yields from the large-scale owners, and are therefore assumed to provide a more refined estimate of future productivity.
- The target rotation age for the 2008 forecasts was 30 years, whereas the target rotation for the 2014 forecasts is 28 years. This is why the actual yield (at harvest age) shown in Table 5-1 shows a greater reduction than the productivity measures.

Table 5-1: Key Differences between 2008 and 2014 WAF

Item	2008 WAF (2007 NEFD)	2014 WAF (2014 NEFD)	Change
Stocked area (ha) (after deductions – see section 3.1)	188 951	168 648	-10.7%
Average Age (years)	16.2	16.8	4.0%
Yield Table Productivity (m^3/ha @ age 30 Unpruned)	674	546	-19.0%
Yield Table Productivity (m^3/ha @ age 30 Pruned)	566	492	-13.0%
Clearfell Age Target (years)	30	28	-6.7%
Actual Average Productivity (m^3/ha @ clearfell age)	670	494	-26.3%
Harvested Volume 2014-2050 (million m^3)	149.2	111.5	-25.3%
Harvested Area 2014-2050 (ha)	222 756	225 817	1.4%
Annual Sustainable Harvest (million m^3)	4.1	2.8	-30.4%

Figure 5-2: Area Age-Class Comparisons: NEFD 2007 vs NEFD 2014

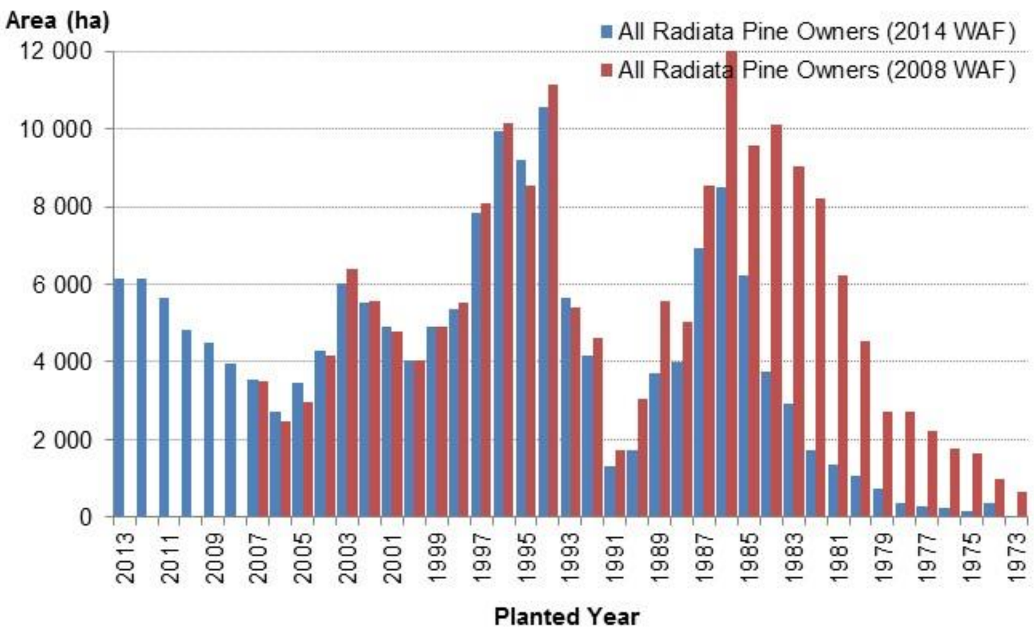
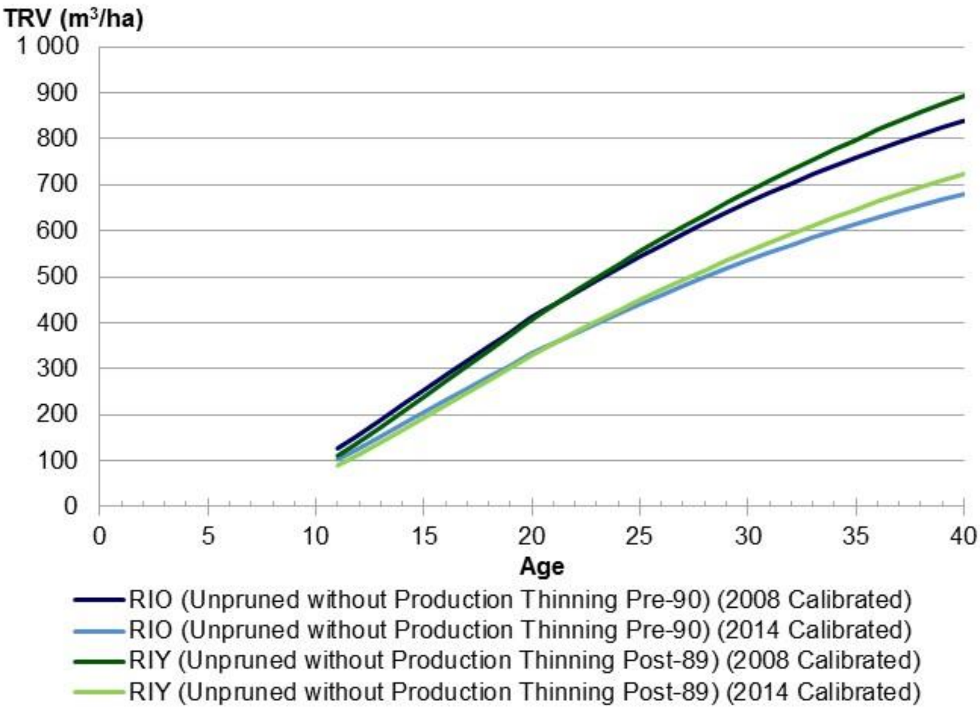


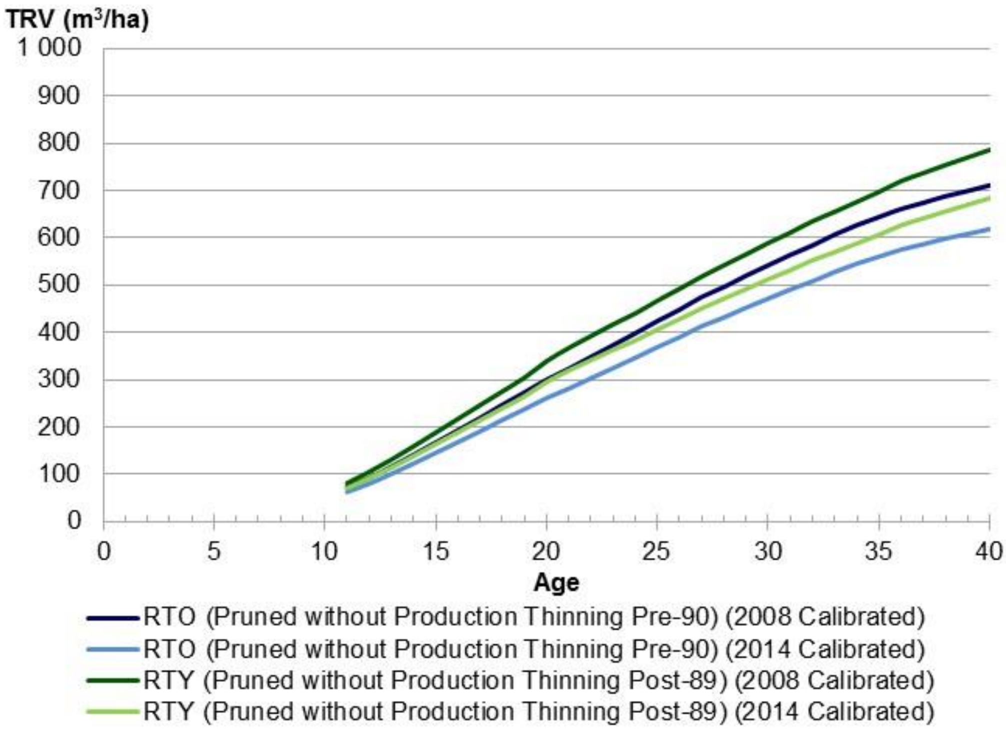
Figure 5-3: Unpruned Yield Tables: 2008 vs 2014 Wood Availability Forecasts



Note: RIO (2008) is incorrectly referenced on the MPI website as RMO

RIY (2008) is incorrectly referenced on the MPI website as RMY

Figure 5-4: Pruned Yield Tables: 2008 vs 2014 Wood Availability Forecasts



Note: RTO (2008) is incorrectly referenced on the MPI website as RIY

RTY (2008) is incorrectly referenced on the MPI website as RIO

6. CONCLUDING COMMENTS

Wood availability from the Northland wood supply region's planted forest resource is expected to decrease in the near future, and this is driven by the harvest intentions of the large-scale owners. Between 2014 and 2018, annual volumes from the large-scale owners are maintained at 2.8 - 3.0 million m^3, before declining rapidly, and then reaching a low point of 1.1 million m^3 in 2022. Scenario 1 showed that this deficit could be partially filled by the small-scale owner resource until the mid-2020s - a total harvest of around 3.5 million m^3 would be possible depending on smoothing assumptions. If a smoothed, non-declining harvest is targeted, then the total harvest settles at 2.8 million m^3 from 2020 (Scenario 2).

Scenario 3 showed that there is potential for a slightly higher harvest level (3.0 million m^3) through to 2034.

A more variable target clearfell age allows the harvest profile to be extended or retracted (Scenario 4a and 4b), although the periods of sustained harvest are at a similar level.

As with a number of the other wood supply regions, a significant portion of the future wood availability will come from the region's small-scale forest owners who established forests during the 1990s. Market conditions and logistical constraints will determine the actual rate of harvest increase, and what level is reached.

Furthermore, the area information from the NEFD as at 1 April 2014 has reported some variations from the NEFD as at 1 April 2007, which was used in the 2008 forecasts. MPI has applied a consistent methodology and approach in compiling the NEFD data in both 2007 and 2014. Therefore, these area variances are more likely due to how the forest owners have responded to the MPI survey.

Appendix – Northland Wood Availability Forecasts for the Period 2014 to 2050

Table 1: Northland Wood Availability under Scenario 1

(Assumes that large-scale owners harvest at stated intentions and then at non-declining yield, and small-scale owners harvest at age 28 years).

Year Ending December	Large-Scale Owners (000 m3 IB)	Small-Scale Owners (000 m3 IB)	All Owners (000 m3 IB)
2014	3 116	1 074	4 190
2015	3 090	1 100	4 190
2016	2 989	1 201	4 190
2017	2 843	997	3 840
2018	2 874	248	3 122
2019	1 840	169	2 009
2020	1 796	1 005	2 800
2021	1 581	1 502	3 082
2022	1 104	3 431	4 536
2023	1 153	2 820	3 973
2024	1 268	3 078	4 346
2025	1 395	2 566	3 961
2026	1 395	1 487	2 882
2027	1 395	1 551	2 946
2028	1 395	1 026	2 421
2029	1 404	1 129	2 533
2030	1 544	966	2 510
2031	1 544	1 136	2 680
2032	1 544	604	2 149
2033	1 544	372	1 916
2034	1 544	337	1 881
2035	1 607	460	2 068
2036	1 768	465	2 233
2037	1 945	310	2 255
2038	1 945	365	2 310
2039	1 945	718	2 663
2040	1 945	622	2 567
2041	1 945	440	2 385
2042	1 945	133	2 078
2043	1 945	914	2 859
2044	1 945	1 140	3 085
2045	1 945	1 081	3 026
2046	1 945	916	2 861
2047	1 945	265	2 210
2048	1 945	190	2 134
2049	1 945	1 125	3 070
2050	1 945	1 601	3 546

Notes:
m3 cubic metres
IB inside bark.

Table 2: Northland Wood Availability under Scenario 2
(Assumes that large-scale owners harvest at stated intentions and then at non-declining yield, and total wood availability is modelled at a non-declining yield).

Year Ending December	Large-Scale Owners (000 m3 IB)	Small-Scale Owners (000 m3 IB)	All Owners (000 m3 IB)
2014	3 116	1 074	4 190
2015	3 090	1 100	4 190
2016	2 989	1 201	4 190
2017	2 843	1 061	3 904
2018	2 874	640	3 513
2019	1 840	1 322	3 162
2020	1 796	1 050	2 846
2021	1 581	1 265	2 846
2022	1 104	1 741	2 846
2023	1 153	1 693	2 846
2024	1 158	1 688	2 846
2025	1 158	1 688	2 846
2026	1 274	1 572	2 846
2027	1 316	1 530	2 846
2028	1 448	1 398	2 846
2029	1 592	1 254	2 846
2030	1 694	1 152	2 846
2031	1 694	1 152	2 846
2032	1 694	1 152	2 846
2033	1 694	1 152	2 846
2034	1 694	1 152	2 846
2035	1 863	983	2 846
2036	1 925	921	2 846
2037	1 925	921	2 846
2038	1 925	921	2 846
2039	1 925	921	2 846
2040	1 925	921	2 846
2041	1 925	921	2 846
2042	1 925	921	2 846
2043	1 925	921	2 846
2044	1 925	921	2 846
2045	1 925	921	2 846
2046	1 925	921	2 846
2047	1 925	921	2 846
2048	1 925	921	2 846
2049	1 925	921	2 846
2050	1 925	1 005	2 930

Notes:
m3 cubic metres
IB inside bark.

Table 3: Northland Wood Availability under Scenario 3
(Assumes that large-scale owners harvest at stated intentions then at non-declining yield, and total wood availability is modelled at a split non-declining yield).

Year Ending December	Large-Scale Owners (000 m3 IB)	Small-Scale Owners (000 m3 IB)	All Owners (000 m3 IB)	Pruned (000 m3 IB)	Unpruned (000 m3 IB)	Chip Logs (000 m3 IB)	Total (000 m3 IB)
2014	3 116	1 074	4 190	450	2 809	931	4 190
2015	3 090	1 100	4 190	414	2 852	924	4 190
2016	2 989	1 201	4 190	379	2 894	917	4 190
2017	2 843	928	3 771	280	2 677	814	3 771
2018	2 874	520	3 394	295	2 317	783	3 394
2019	1 840	1 214	3 055	286	1 991	777	3 055
2020	1 796	1 210	3 006	261	1 963	782	3 006
2021	1 581	1 425	3 006	279	1 939	787	3 006
2022	1 104	1 902	3 006	362	1 795	848	3 006
2023	1 153	1 853	3 006	350	1 802	854	3 006
2024	1 153	1 853	3 006	367	1 756	883	3 006
2025	1 153	1 853	3 006	286	1 881	839	3 006
2026	1 218	1 788	3 006	186	2 035	785	3 006
2027	1 340	1 666	3 006	204	2 007	795	3 006
2028	1 474	1 532	3 006	152	2 087	767	3 006
2029	1 622	1 384	3 006	153	2 084	768	3 006
2030	1 784	1 222	3 006	86	2 188	732	3 006
2031	1 822	1 185	3 006	110	2 151	745	3 006
2032	1 822	1 185	3 006	81	2 194	731	3 006
2033	1 822	1 185	3 006	39	2 256	711	3 006
2034	1 822	1 185	3 006	30	2 264	711	3 006
2035	1 822	884	2 705	32	2 029	644	2 705
2036	1 822	613	2 435	41	1 809	584	2 435
2037	1 822	370	2 191	32	1 638	522	2 191
2038	1 822	151	1 972	22	1 482	469	1 972
2039	1 822	190	2 012	37	1 492	482	2 012
2040	1 822	391	2 213	66	1 607	540	2 213
2041	1 822	440	2 262	44	1 678	540	2 262
2042	1 822	505	2 326	14	1 772	540	2 326
2043	1 822	737	2 559	23	1 940	596	2 559
2044	1 822	993	2 815	32	2 124	659	2 815
2045	1 822	993	2 815	26	2 132	656	2 815
2046	1 822	993	2 815	14	2 151	650	2 815
2047	1 822	1 024	2 846	7	2 181	658	2 846
2048	1 822	1 309	3 130	33	2 367	731	3 130
2049	1 822	1 493	3 314	32	2 509	774	3 314
2050	1 822	1 493	3 314	36	2 503	775	3 314

Notes:
m3 cubic metres
IB inside bark

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Table 4: Northland Wood Availability under Scenario 4

(Assumes that large-scale owners harvest at stated intentions then at non-declining yield, and total wood availability is modelled at a split non-declining yield with target rotation ages of 26 (23 for the small-scale estate), 28 and 30 years).

Year Ending December	Recoverable Volume target age 26 (000 m3 IB)	Average Age (Years)	Recoverable Volume target age 28 (000 m3 IB)	Average Age (Years)	Recoverable Volume target age 30 (000 m3 IB)	Average Age (Years)
2014	4 190	29.0	4 190	29.3	4 190	31.6
2015	4 190	28.3	4 190	29.4	4 190	31.2
2016	4 190	28.3	4 190	31.4	4 190	30.8
2017	4 212	27.9	3 771	31.4	3 771	31.9
2018	3 791	28.5	3 394	32.0	3 394	29.5
2019	3 412	28.1	3 055	30.1	3 055	29.3
2020	3 071	28.2	3 006	29.5	2 749	27.7
2021	3 071	31.6	3 006	29.0	2 749	27.4
2022	3 071	29.6	3 006	28.7	2 749	29.1
2023	3 071	26.9	3 006	28.5	2 749	29.9
2024	3 071	27.7	3 006	28.0	2 832	30.0
2025	3 071	29.6	3 006	28.0	2 832	30.0
2026	3 071	29.1	3 006	28.3	2 832	30.0
2027	3 071	30.4	3 006	28.8	2 832	30.0
2028	3 071	28.3	3 006	29.5	2 832	30.0
2029	3 071	28.7	3 006	29.2	2 832	30.0
2030	3 071	30.1	3 006	28.5	2 832	30.1
2031	3 071	30.2	3 006	28.1	2 832	30.2
2032	3 071	28.0	3 006	29.3	2 832	30.3
2033	2 764	26.4	3 006	30.0	2 832	30.0
2034	2 487	24.0	3 006	29.2	2 832	29.9
2035	2 238	24.3	2 705	26.6	2 832	28.5
2036	2 015	24.1	2 435	26.9	2 832	27.4
2037	2 216	24.5	2 191	27.2	2 548	28.6
2038	2 438	23.7	1 972	26.7	2 294	29.3
2039	2 681	24.7	2 012	27.5	2 064	29.8
2040	2 933	24.8	2 213	28.0	2 064	29.5
2041	2 933	24.8	2 262	28.0	2 210	30.0
2042	2 933	24.8	2 326	27.7	2 421	30.0
2043	2 933	24.8	2 559	28.2	2 421	30.0
2044	2 933	24.8	2 815	28.0	2 421	29.8
2045	2 933	24.8	2 815	28.0	2 663	30.6
2046	2 933	24.8	2 815	27.9	2 865	30.0
2047	2 933	24.8	2 846	27.3	2 865	29.5
2048	2 933	25.4	3 130	28.1	2 967	30.0
2049	2 933	27.1	3 314	29.0	2 967	29.6
2050	2 933	25.5	3 314	28.3	3 263	30.0

Notes:
M3 cubic metres
IB inside bark
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