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Ministry for Primary Industries

Wood Availability Forecast – New Zealand 2021 to 2060

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PREFACE

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We trust our report proves useful to you and we would be pleased to provide assistance to you again on future assignments.

ashell

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Appendix 1 – New Zealand Wood Availability Forecasts from 2021 to 2060



1 INTRODUCTION

New Zealand has a planted production estate of approximately 1.665 million ha as at 1 April 2020. Radiata pine makes up 90% (1.499 million ha) of this area and Douglas-fir 6% (0.100 million ha). The remainder of the area (0.067 million ha) is planted in eucalypt species, cypress species, and numerous other softwood and hardwood species.

Radiata pine and Douglas-fir make up 96% of the total planted production estate, and the forecasts are primarily for these species. Wood availability forecasts (WAF) at a regional level have been constructed for these species, and the national forecast is a summation of the individual regional forecasts. At a national level only, forecasts for other (minor) species have also been constructed.

Figure 1-1 shows the age-class distribution for the New Zealand resource used in the WAF modelling. The two peaks reflect both the high level of planting that occurred in the mid-1990s. The older peak (right) shows the area in that age-class that remains, while the peak to the left reflects both the increased level of recent harvesting of this age-class and the increased level of greenfield planting that has occurred over the last few years. Harvesting of this age-class spike has been early, compared with what was previously forecast (see Section 5).

Figure 1-1:



New Zealand Age-class Distribution by Species

The following forecasts show a range of harvest volumes potentially available from the planted forest estate. The forecasts are supply-based but do incorporate harvesting intentions of the larger-scale owners for up to 20 years. In utilising these



forecasts, users need to recognise that market conditions will be the ultimate determinant of harvesting levels at any point in time.

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Figure 1-2 shows historic harvest levels from 2010 to 2020 and the previous and current wood availability forecasts through to 2050 and 2060 respectively (under Scenario 3). The graph shows that harvest levels have increased between 2010 and 2020 but fluctuations have occurred year to year in response to market conditions such as log and lumber prices, shipping costs, and movements in exchange rates. The large drop in harvest level in 2020 is from the impact of the COVID-19 lockdown.

The forecasts indicate that the availability of radiata pine from the New Zealand forest estate will likely continue to increase over the next five years. Thereafter the New Zealand radiata pine availability will likely decrease to a low of around 25 million m³ in 2034. From 2034, the available volume will then likely increase again to a longer-term sustainable harvest level of approximately 32.5 million m³.

Figure 1-2:





Forecasts have been produced separating large-scale forest owners (owning 3 000 ha or more) and small-scale owners. Generally, forecasts are less certain and resource description data less accurate for small-scale forest owners than for large-scale forest owners.

The peak in wood availability in the next five years is largely driven by the small-scale owner forests which are geographically dispersed. These blocks are likely to be more expensive to harvest than the existing large contiguous forests that have both scale and existing roading and other infrastructure already in place. Forests that realise lower delivered log costs are likely to be harvested in preference to forests which are more expensive to harvest.



Some forests may not be harvested. For instance, forests on steep terrain, distant from processing plants/ports, small in size, or without existing roads may be uneconomic to harvest if logging and transport costs are higher than the market value of the forests' recoverable log volume.

A further unknown is the extent to which the New Zealand Emissions Trading Scheme (ETS) could impact future harvesting decisions. The New Zealand Government banned the use of foreign credits for ETS compliance purposes as of 1 June 2015, and all sectors required to surrender units under the ETS are now obligated to surrender one New Zealand Unit (NZU) for every tonne of carbon emitted (previously this was under a two-for-one system).

The fixed price option for buying NZUs is also no longer available, and a new auctioning system has been introduced with an effective price cap of New Zealand dollar 50/NZU for 2021, set to increase by 2% each year. Already, as of July 2021, the spot price for NZUs is close to this cap. At this price, decisions around harvesting of post-1989 forests may change, and forest owners who have entered their forests into the ETS may decide to lengthen the age that they harvest their forests or could decide not to harvest.

From early in the forecast period (post-2025) the total harvest is projected to decline under Scenario 3. This is in line with the age-class distribution of the resource. The timing (and level) of decrease will depend on the rate at which the remaining forests planted in the mid-1990s are harvested.

The previous series of WAFs were undertaken between 2014 and 2015 (termed the '2014 forecasts' in this report). Some of the assumptions and scenarios that were applied in those forecasts have been modified in the current forecasts (the '2021 forecasts'). A comparison between the two forecast series is provided later in this report (Section 5).

Readers who intend using the WAFs for planning or investment decisions are urged to thoroughly review the forecast, or to engage the services of a professional forestry consultant who is able to interpret the forecasts in the context of specific planning or investment decisions.





2 SCENARIOS

Seven wood availability scenarios have been modelled in total: four scenarios have been modelled for radiata pine; one scenario for Douglas-fir; and two scenarios for minor species (although the first of these includes four sub-scenarios, one for each minor species group).

The scenarios were developed by the National Exotic Forest Description (NEFD) Steering Committee. Margules Groome undertook initial modelling of the scenarios, and these were presented to the major forest owners and consultants in the wood supply region. Their feedback was considered in the final derived profiles for each region.

These forecasts show a range of harvest volumes potentially available from the planted production forests for the period 2021 to 2060. Individual forecasts have been published separately for nine wood supply regions (eleven sub-regions) across New Zealand¹. The wood supply regions are Northland, Central North Island, East Coast, Hawke's Bay, Southern North Island, Nelson and Marlborough, West Coast, Canterbury, and Otago and Southland².

The WAFs are based on each region's forest resource and the forecasting assumptions described later in this report. The forecasts have been developed to incorporate the harvesting intentions of the large-scale³ forest owners in each region. The forecasts also incorporate the feedback received from each region's forest managers and consultants. This feedback was critical for ensuring that the forecasts represent a realistic range of future wood availability scenarios.

A key issue is the timing of harvesting by the small-scale forest owners. The ageclass distribution of the small-scale owners' estate is irregular, and in some regions, contributes a significant proportion of the total wood availability. This is particularly the case over the near term as the forests planted during the planting boom of the mid-1990s have now largely reached a harvestable age.

2.1 Radiata Pine Scenarios 1 to 4

2.1.1 Scenario 1: Large-scale Owners Harvest at Stated Intentions, Small-scale Owners Harvest Forests at Target Harvest Age

In Scenario 1, large-scale owners harvest in line with their stated intentions for a given period (depending on the region) between 2021 to 2041 (calendar year estimates). After this period, a modelling assumption is that the wood availability from large-scale owners will not decrease, but harvesting is expected to occur close to the target harvest age for large-scale owners. Small-scale owners are assumed to harvest their forest holdings at the target harvest age for small-scale owners.

¹ There were previously 12 sub-regions. For the 2021 Wood Availability Forecasts, the Otago and Southland subregions were combined and treated as one region after feedback from forest owners in that region.

² The wood supply regions are illustrated in Figure 2 of the NEFD (1 April 2020).

³ Large-scale owners are defined as exotic plantation owners with 3 000 ha or more of forest in the region of interest, with more than three age classes, and not a part of a syndicate.



2.1.2 Scenario 2: Non-declining Yield (NDY) – Target Rotation Age

Large-scale owners' wood availability is assumed to be at stated harvest intentions for the periods described above. After this period, the wood availability from largescale owners is assumed not to decrease (as for Scenario 1). The total wood availability of radiata pine is also assumed to not decrease while targeting the rotation ages described above.

2.1.3 Scenario 3: Split NDY – Targe Rotation Age

In Scenario 3 the total wood availability of radiata pine is allowed to increase and decrease by the amounts for the given durations shown in Table 2-1.

Wood Supply Region	Duration	Large-scale Owners	All Owners
	2021-2026	Harvest intentions	NDY
Northland	2026-2039	Harvest intentions then NDY	20% increase/decrease
	>2039	NDY	NDY
	2021-2025	Hanvast intentions	NDY
Control North Joland	2024-2029	Traivest intentions	10% decrease
Central North Island	2029-2035	NDY	10% increase/decrease
	>2035	NDT	NDY
	2021-2028	Harvest intentions	NDY, 10% increase/decrease
East Coast	2028-2046	Harvest intentions then NDY	10% increase/decrease
	>2036	NDY	NDY
	>2022		<4.5 million
	2021-2026	Harvest intentions	NDY
Hawke's Bay	2026-2040	Harvest intentions	10% increase/decrease
	>2040	NDY	NDY
	2021-2029	Harvest intentions	NDY
Eastern Southern North Island	2029-2033	Harvest intentions then NDY	20% increase/decrease
	>2033	NDY	NDY
	2021-2028	Hanvast intentions	NDY
Western Southern North Island	2028-2039	Harvest Intentions	20% increase/decrease
	>2039	NDY	NDY
	2021-2028	Harvest intentions	NDY with max 300 000 m ³ increase/decrease
Nelson	on 2028-2030		Max 300 000 m ³ increase/decrease
	>2030	NDY	NDY

Table 2-1:Scenario 3 Constraints by Wood Supply Region

Wood Supply Region	Duration	Large-scale Owners	All Owners	
	2021-2028	Hanvast intentions	NDY with max 300 000 m ³ increase/decrease	
Marlborough	2028-2032	Harvest intentions	300 000 m ³ increase/decrease	
	>2032	NDY	NDY	
	2021-2021		NDY with max 20%	
	2022-2024	Harvest intentions	increase/decrease	
	2025-2030		20% increase/decrease	
Canterbury	2030-2038		20% increase/decrease	
	2039-2044		NDY with max 20% increase/decrease	
	2044-2055	NDY	NDY	
	2056-2056		20% increase/decrease	
	>2060		NDY	
West Caset	2021-2060	Harvest intentions	NDV	
west Coast	2022-2060	NDY	NDT	
	2021-2027	Harvest intentions	NDY	
Otago-Southland	2027-2044	Harvest intentions then NDY	10% increase/decrease	
	>2038	NDY	NDY	

2.1.4 Scenario 4: Target Rotation Age Variations

In Scenario 4, the target rotation age is decreased by two years (Scenario 4A) and increased by two years (Scenario 4B) from the initial target rotation ages and the same constraints are applied as in Scenario 3.

2.1.5 Discussion of Radiata Pine Scenarios

In Scenario 1, the forests owned by small-scale owners are assumed to be harvested at the regional target rotation age. 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 each region. For practical reasons, it is unlikely that the future harvesting would occur in this way. The intention of this scenario is to show the magnitude of potential harvesting under favourable market conditions in any given year.

Scenarios 2 and 3 are based on yield regulation and avoid the large year-to-year fluctuations in volume seen in Scenario 1. 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 Scenario 2, the future harvesting is constrained to be non-declining (where possible): that is, each year the volume must either be the



same or higher than in the previous year. However, this can lead to large fluctuations in the average rotation ages and is unlikely to be a realistic outcome.

The constraints placed on Scenario 3 are designed to keep the average rotation age close to the target rotation age while maintaining a more realistic flow of wood. This scenario is considered to be the most realistic of the three scenarios.

A fundamental property of almost all regions within the New Zealand forest estate is the large area of forests established during the early 1990s, followed by very little new planting after that period. The remaining forest area planted during the 1990s has now either been harvested or will be harvested in the next five to seven years. This is leading to record harvest levels in most regions. Once this harvesting has been completed, Scenario 3 lets the volume decline again.

The main limitation of all scenarios is that log prices and other market factors are a significant determinant of harvesting in any given year. When log prices go up, harvesting generally increases. When log prices fall, the level of harvesting generally decreases. It is beyond the scope of this analysis to predict future log prices, yet it is important to note how prevailing market conditions will be a significant determinant in how the actual woodflows occur.

2.2 Douglas-fir Scenario 5

Scenario 5 is based on harvest intentions of large-scale owners for years in which Douglas-fir is expected to be harvested over the next 10 years (if available). The yield regulation constraints placed on Douglas-fir vary regionally. In regions with only small areas of Douglas-fir, a maximum volume constraint is applied to the total volume.

In regions with a large area of Douglas-fir, the wood availability from large-scale owners is modelled in a five-year period non-declining yield block (i.e. 2031-2035, 2036-2040, etc). Except for the Central North Island region, the total wood availability of the combined estate is also modelled to be non-declining within each of the five-year period non-declining blocks.

2.3 Minor Species Scenarios 6 and 7

The four minor species groups reported in the NEFD are cypress, other softwoods, eucalypts, and other hardwoods.

Two scenarios have been modelled for each of these species groups: Scenario 6 which is very similar to Scenario 1 for radiata pine (large-scale owners harvest at stated intentions, and small-scale owner resource is harvested at target rotation ages as per Section 3.3.1), and Scenario 7 which is the equivalent of Scenario 2 for radiata pine (large-scale owners harvest at stated intentions, overall harvest is constrained to be non-declining).

Minor species were modelled (and constraints applied) at the national level rather than the regional level.



3 DATA AND METHODOLOGY

3.1 Development of Forest Areas

The forest areas were primarily sourced from the NEFD as at 1 April 2020 for all regions. The available NEFD areas were adjusted to derive the modelled areas. These adjustments are described below.

3.1.1 Small-scale Forest Owners (<1 000 ha) Area Adjustments

Mapping studies carried out by Manley et al.⁴ between 2015-2020 showed that the small-scale owners' resource NEFD areas are sometimes overstated or understated (specifically those with less than 1 000 ha).

The likely error in the NEFD comes from data on forest owners with less than 40 ha. These owners were not surveyed in the NEFD process; instead, data for these forests is collected from three sources:

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

The portion of the area which is assigned as either "new planting imputations" or from the "2004 Small Forest Owner Survey" varies from region to region; both were designed at the time to improve the accuracy of the NEFD.

The new planting imputation was estimated by subtracting the known new area planting (in the NEFD survey) from an estimate of total new planting calculated from the annual MPI nursery survey. The estimated new planting was calculated by dividing a nominal planting stocking (for radiata plantation development) into the total number of seedlings sold.

In 2004, AsureQuality ran a survey of small forest owners with less than 40 ha (2004 Small Forest Owner Survey). The survey results were subsequently included in the NEFD area statement alongside the New Planting Imputation.

It is Margules Groome's understanding that the NEFD does not currently have a process for harvesting and replanting of these areas as would typically occur in forest management. As such, these NEFD areas remain unchanged from 2004 which in reality is highly unlikely.

While further work is required to improve the accuracy of small-scale forest ownership in New Zealand, to improve the area description for the purpose of this wood availability forecast, Margules Groome has made the following adjustments:

1. The "New Planting Imputations" and "2004 Small Forest Owner Survey" areas have been modified so that the total area of the small-scale owners' resource

⁴ Manley, B., Morgenroth, J., & Xu, C. Map of the small-scale forest estate of New Zealand. New Zealand Journal of Forestry, May 2021, Vol 66, No. 1.





less than 1 000 ha is equal to the regional percentages (Table 3-1) of the area of the reported NEFD as at 1 April 2020.

2. All standing forests derived from "New Planting Imputations" and "2004 Small Forest Owner Survey" with an age equal to or greater than 24 years were assumed to be harvested and removed from the NEFD data. The residual area (less regional deforestation (Table 3-1)⁵) was assumed to have been replanted in equal amounts over the last five years.

Table 3-1 shows the small-scale owner area modifications and deforestation percentages that have been applied by region to improve the accuracy of the area associated with owners of less than 1 000 ha.

Wood Supply Region	Mapped Area Percentage of NEFD Area (%)	Deforestation (%)
Northland	110	2.8
Central North Island	76	10.6
East Coast	83	2
Hawke's Bay	87	11
Eastern Southern North Island	102	13
Western Southern North Island	101	13
Nelson	106	3.3
Marlborough	94	2.1
West Coast	100	11
Canterbury	56	1.7
Otago	96	7.4
Southland	75	9.4

Table 3-1: Small-scale Owner (less than 1 000 ha) Area Reductions and Deforestation

Source: Manley et al (2021), Ministry for the Environment (2018)

The small-scale owners' area of between 1 000 ha and 3 000 ha, and large-scale owners' area were unadjusted by this method.

3.1.2 Over-mature Areas

Area reductions were made to allow for 'over-mature' stands. Any areas above the specified maximum age are considered unlikely to be commercially viable, and were removed from the modelled areas. Age maximums are as follows:

- Radiata pine, large-scale owners: 35 years
- Radiata pine, small-scale owners: 40 years
- Douglas-fir, all owners: 60 years
- Other species, all owners: 60 years

⁵ The deforestation assumption was sourced from the 2015-2016 Ministry for the Environment deforestation mapping report (Ministry for the Environment. 2018. Deforestation Mapping 2015 & 2016 – Final Report. Submitted by Indufor Asia Pacific for the Ministry for the Environment).



3.1.3 Immature Age-class Reductions

An area reduction 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. These adjustments were made following discussion with regional forest owners and consultants.

3.1.4 Second Rotation Adjustments

Following the harvest of first rotation forests there is typically slightly less area reestablished into the subsequent crop. This reflects the establishment of new roads and landings, setbacks from streams, and inaccessible areas. For the 2021 forecasts, a reduction was applied to the East Coast and Canterbury regions based on feedback from each region. The reduction was 3%.

3.1.5 Large-scale Owners' Harvest Intentions

Large-scale owners were asked to provide details of their projected harvest volumes for all species for the period 2021 to 2041. The survey specifically asked for:

- Radiata pine:
 - Domestic grades pruned, unpruned, pulp
 - Export grades A, K, KI, KIS
 - Split by pruned/unpruned area if possible
- Other Species:
 - Douglas-fir domestic and export grades
 - Other Softwoods and Hardwood: Sawlog, pulp
- Additional questions to assist with modelling.

The area associated with the large-scale owners covers around 57% of the total New Zealand NEFD area. Inclusion of the actual levels of intended harvest by the large-scale owners is considered a critical step, as it provides the best estimate of future wood availability for the first ten to twenty years (2021-2041) of the forecast horizon.

The large-scale owners' harvest intentions were included in the forecasts for at least 10 years (to 2030) and were used as a guide for when the harvest level could resume a non-declining yield constraint. The duration of inclusion of the intentions varied by region, as can be seen in Table 3-2.





Table 3-2:Harvest Intentions Timing by Wood Supply Region

Wood Supply Region	Harvest Intentions Duration (Large-scale Owners)
Northland	2021-2030
Central North Island	2021-2032
East Coast	2021-2031
Hawke's Bay	2021-2041
Eastern Southern North Island	2021-2031
Western Southern North Island	2021-2040
Nelson	2021-2031
Marlborough	2021-2031
West Coast	2021-2030
Canterbury	2021-2030
Otago-Southland	2021-2032

3.2 Development of Yield Tables

The 2015 NEFD yield tables were used for the 2021 wood availability forecasts. These yield tables supplied by MPI were originally developed in the following way:

- Large-scale forest owners provided yield tables for their forest estates.
- The large-scale owner yield 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 1990), and Douglas-fir were 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 croptypes (planted in 1990 and later) were adjusted based on consultation with large-scale owners.
- The area-weighted average regional yield tables developed for the large-scale owners' estate were applied to the small-scale forest owners' estate under the assumption that large-scale owner data is regionally representative across all sizes of forest owner.

As part of the 2021 forecasts, the 2015 NEFD yield tables were calibrated against the yields (m^3/ha) calculated from the large-scale owners' harvest intentions. In the case of Canterbury, Northland, and Western Southern North Island, some adjustments were made to the 2015 NEFD yield tables.

Yield tables for the minor species were created using a range of publicly available sources calibrated against the large-scale owners' harvest intentions for minor species.



3.3 Modelling Assumptions

3.3.1 Target Rotation Age

In the 2014 forecasts, standard target rotation ages were used across all owners and regions. The radiata pine target rotation was 28 years (used for Scenarios 1 to 3), and the Douglas-fir target rotation was 40 years.

In the current forecasts, the target rotation ages vary regionally, and in some regions, also vary by ownership type. These target rotation ages were based on the large-scale owners' harvest intentions survey and feedback from the regional meetings. The target rotation ages used in the current forecasts are listed in Table 3-3.

Table 3-3:

Target Rotation Age by Scenario and Region

		Species and Scenario					
	Padiata Pino			Douglas	Minor		
		Raulala Fille			-fir	Softwood	Hardwood
Region	Ownership	S-1-3	S-4A	S-4B	S-5	S-6-7	S-6-7
Northland	Small	26	24	28	NI/A		
Northland	Large	28	26	30	IN/A		
Central North Island	All	27	25	29	38		
East Coast	All	31	29	33	40	35	15-25
Hawke's Bay	All	27	25	29	40		
Southern North	Small	26	24	28	40		
Island	Large	30	28	32			
Nelson	All	27	25	29	35		
Marlborough	All	27	25	29	35		
West Coast	All	27	25	29	50		
Canterbury	All	27	25	29	43		
Otago	All	28	26	30	43		
Southland	All	28	26	30	43		



3.3.2 Regeneration Species

In almost all cases radiata pine areas are maintained in this species upon replanting. The regeneration assumptions for Douglas-fir are set out in Table 3-4. Most or all Douglas-fir areas are re-established to radiata pine after harvest.

Table 3-4: Douglas-fir Replanting Assumptions

	All Owners			
Wood Supply Region	Douglas-fir replanted to:			
	Douglas-fir (%)	Radiata Pine (%)		
Northland	0	100		
Central North Island	15	85		
East Coast	0	100		
Hawke's Bay	0	100		
Eastern Southern North Island	10	90		
Western Southern North Island	10	90		
Nelson	10	90		
Marlborough	10	90		
West Coast	0	100		
Canterbury	0	100		
Otago	100	0		
Southland	100	0		

3.3.3 Regeneration Regime

Areas managed under an unpruned regime are expected to be replanted back into an unpruned regime following harvest. Regeneration rules for pruned regimes vary by region and ownership class. The regeneration regime percentages shown in Table 3-5 reflect the general consensus of forest owners, managers, and consultants from each region. The general pattern is for a migration from pruned to unpruned silvicultural management in replanted areas.

Table 3-5:Replanting Regime by Region and Ownership Class

	Large-sca	le Owners	Small-scale Owners		
Wood Supply Region	From Pr	uned to	From Pruned to		
Nood Capply Region	Pruned (%)	Unpruned (%)	Pruned (%)	Unpruned (%)	
Northland	0	100	25	75	
Central North Island	25	75	50	50	
East Coast	0	100	50	50	
Hawke's Bay	25	75	50	50	
Eastern Southern North Island	50	50	35	65	
Western Southern North Island	5	95	50	50	
Nelson	0	100	10	90	
Marlborough	0	100	10	90	
West Coast	0	100	0	100	
Canterbury	0	100	5	95	



	Large-sca	le Owners	Small-scale Owners		
Wood Supply Region	From Pr	uned to	From Pruned to		
Nood Capply Region	Pruned (%)	Unpruned (%)	Pruned (%)	Unpruned (%)	
Otago	40	60	70	30	
Southland	40	60	70	30	

3.3.4 Afforestation and Deforestation

No future afforestation or deforestation has been included in the 2021 forecasts.



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For Scenarios 1 to 4, the total modelled net stocked area of radiata pine (i.e. after adjustments identified in Section 3) was estimated to be 1.432 million ha. Large-scale owners accounted for approximately 61% and small-scale owners accounted for around 39% of the total net stocked area of radiata pine. The age-class distribution by ownership is shown in Figure 4-1.

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Figure 4-1: Age-class Distribution of Radiata Pine as at 1 April 2020

The age-classes of the large-scale owners (Figure 4-2) are more evenly distributed than the small-scale owners (Figure 4-3), as the mid-1990s planting boom primarily occurred in the small-scale owner forest resource.











Small-Scale Owners







4.1 Scenario 1: Radiata Pine

The constraints applied to Scenario 1 are described in Section 2.1.1. The wood availability under Scenario 1 is presented in Figure 4-4.

Based on the harvest intentions provided by the large-scale owners, at a national level, the annual wood availability from large-scale owners is relatively steady at around 20 million m³.

Under Scenario 1, all forests in the small-scale owners' estate are assumed to be harvested at the regional target rotation ages. The fluctuations in the total volume harvested reflect the variations in the age-class distribution of the small-scale owners' estate. Changes in annual supply levels of this magnitude are unlikely to occur because of market and logistical constraints. For instance, there would be insufficient harvesting and transport capacity to handle such large year-on-year increases in volumes. Nevertheless, the scenario illustrates the theoretical potential availability level.

Figure 4-4: New Zealand Radiata Pine Availability under Scenario 1



4.2 Scenario 2: Radiata Pine

The constraints applied to Scenario 2 is described in Section 2.1.2.

Large-scale owners' wood availability is assumed to be at stated harvest intentions for the periods described in Table 3-2. After this time, the wood availability from large-scale owners is assumed not to decrease (as for Scenario 1). Unlike Scenario 1, the total availability of radiata pine wood from each region is modelled to be non-declining in perpetuity. Figure 4-5 indicates a long-term sustainable harvest of around 32 million m³ per annum is possible from the national radiata pine resource.







Figure 4-5: New Zealand Radiata Pine Availability under Scenario 2

The average rotation age⁶ for the large-scale owners' estate is close to the average target age of around 28 years (Figure 4-6). The small-scale owners' estate is being harvested at rotation ages significantly higher than the average target age of around 28 years during the 2030s.

⁶ National average clearfell age is calculated on an area-weighted basis from the results of the regional models.







4.3 Scenario 3: Radiata Pine

The constraints applied in Scenario 3 are described in Table 2-1 of Section 2.1.3. Figure 4-7 shows radiata pine availability for all owners under Scenario 3. The total harvested volume increases over the next four years to around 39 million m³ per year for two years, then declines over a six-year period to a low of around 25 million m³/a for a duration of six years. The annual availability then increases back to a sustainable annual cut of around 32 million m³/a. These fluctuations are driven by the harvesting of the small-scale owner resources.

Figure 4-8 shows radiata pine clearfell age by ownership category under Scenario 3. The average rotation age of both ownership resources is maintained closer to the national average target rotation age of 28 years.













Figure 4-9 shows radiata pine availability by log grade for all owners. The proportion of pruned volume stays relatively constant for the next six years, after which time



the proportion decreases. The long-term annual pruned volume is just over 20% of the current pruned volume.

Figure 4-9:

New Zealand Radiata Pine Availability by Log Grade under Scenario 3

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4.4 Scenario 4: Radiata Pine

Different wood availability profiles are generated from that seen in Scenario 3 if the target rotation age is changed to either plus or minus two years for each region (Figure 4-10). Because of the limitations imposed by the current age-class distribution and large-scale owners' stated harvest intentions, it takes some time to achieve separation of average clearfell age (Figure 4-11) among the different target rotation lengths.

As shown in Figure 4-10, a lower target harvest age (minus two years) allows volume to be brought forward in comparison to the base case average age of 28 years; a higher target harvest age (plus two years) delays the harvest.









Figure 4-11: New Zealand Radiata Pine Clearfell Age under Scenario 4





4.4.1 Production Thinning for Scenario 3

Potential volumes from production thinning are shown in Figure 4-12 for Scenario 3 (radiata pine only).

Figure 4-12:

New Zealand Radiata Pine Production Thinning Volume under Scenario 3



4.5 Scenario 5: Douglas-fir

The constraints applied to Scenario 5 are described in Section 2.2.

The total modelled net stocked area of Douglas-fir (i.e. after adjustments identified in Section 3) was estimated to be 94 075 ha (as at 1 April 2020).

Wood availability forecasts for Douglas-fir were developed for each region except Northland, where the specie makes up less than 10 ha. The approach to yield regulation varied by region, depending on the age-class distribution and whether there was an intention to replant harvested areas back into Douglas-fir. Figure 4-13 shows the national age-class distribution of Douglas-fir while Figure 4-14 shows the modelled national wood availability for Douglas-fir. Figure 4-15 shows the average clearfell age for Douglas-fir by ownership class.

Figure 4-13: Age-class Distribution of New Zealand Douglas-fir as at 1 April 2020

Figure 4-14: New Zealand Douglas-fir Wood Availability

Figure 4-15: New Zealand Douglas-fir Average Clearfell Age

4.6 Scenarios 6 and 7: Minor Species

The total modelled net stocked area for minor species (i.e. after adjustments identified in Section 3) was estimated to be 66 243 ha (as at 1 April 2020).

In the NEFD, minor species are classified into the following groups:

- A. Cypress (i.e. macrocarpa, lusitanica, and all other cypress species)
- B. Other Softwoods (i.e. various pine, fir, larch, redwood, and cedar species, etc.; and excluding radiata pine and Douglas-fir)
- C. Eucalypts (i.e. *Eucalyptus nitens, E. fastigata, E. regnans,* and all other eucalypt species)
- D. Other Hardwoods (i.e. acacia, walnut, oak, poplar, willow, paulownia, birch, alder, and elm)

The potential harvest profile is highly dependent on the underlying age-class distribution of each minor species group. The age-class distribution for Cypress, Other Softwoods, Eucalypts and Other Hardwoods are presented in Figure 4-16, Figure 4-17, Figure 4-18 and Figure 4-19 respectively.

The constraints applied to Scenarios 6 and 7 are described in Section 2.3.

Scenarios 6A to 6D are very similar to Scenario 1 for radiata pine, except they are developed for the four minor species groups, where large-scale owners' wood availability is based on stated harvest intentions for the period 2021 to 2031. After 2031, a modelling assumption is that the wood availability from large-scale owners

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will not decrease. Small-scale owners are assumed to harvest their forest holdings at various target rotation ages (see Table 3-3).

Figure 4-16:

Age-class Distribution of New Zealand Cypress

Figure 4-18: Age-class Distribution of New Zealand Eucalypts

4.6.1 Cypress Wood Availability (Scenario 6A and 7A)

Figure 4-20 and Figure 4-21 present the national woodflow availability for cypress under Scenario 6 and 7 respectively. The wood availability for cypresses will be mainly harvested from the large-scale owner resources. The long-term national sustainable cut of cypress is just over 120 000 m³/a under Scenario 7.

Figure 4-20:

New Zealand Cypress Wood Availability under Scenario 6A

4.6.2 Other Softwoods Wood Availability (Scenario 6B and 7B)

Figure 4-22 and Figure 4-23 present the national woodflow availability for other softwoods under Scenario 6 and 7 respectively. The wood availability for softwood will be mainly harvested from the small-scale owner resources. The long-term national sustainable cut of other softwoods is just under 250 000 m³/a under Scenario 7.

Figure 4-22: New Zealand Other Softwoods Wood Availability under Scenario 6B

Figure 4-23: New Zealand Other Softwoods Wood Availability under Scenario 7B

4.6.3 Eucalypts Wood Availability (Scenario 6C and 7C)

Figure 4-24 and Figure 4-25 present the national woodflow availability for eucalypts under Scenario 6 and 7 respectively. Figure 4-24 show that there is a significant area of older eucalypts small-scale owner resource that can be harvesting in the next five years. The woodflow availability for eucalypts has been constrained at 1 million m³/a for presentation purposes. The long-term national sustainable cut of eucalypts is just over 410 000 m³/a under Scenario 7.

Figure 4-24:

New Zealand Eucalypts Wood Availability under Scenario 6C

Figure 4-25: New Zealand Eucalypts Wood Availability under Scenario 7C

4.6.4 Other Hardwoods Wood Availability (Scenario 6D and 7D)

The forest description and harvest intentions applicable to the other hardwoods estate is not well-understood. It is likely to be a combination of short-rotation hardwood species such as acacia, birch, poplar, willow, and paulownia; and some longer rotation hardwood species such as walnut, oaks, and elm.

Figure 4-26 and Figure 4-27 present the national woodflow availability for other hardwoods under Scenario 6 and 7 respectively. The long-term national sustainable cut of other hardwoods is just under 200 000 m³/a under Scenario 7.

Figure 4-26: New Zealand Other Hardwoods Availability under Scenario 6D

5 ADDITIONAL ANALYSIS

5.1 Comparison of the 2014 and 2021 WAFs (Radiata Pine)

The unadjusted areas of radiata pine in the 2021 forecasts have decreased from those used in the 2014 forecasts, especially in the Central North Island, West Coast and Western Southern North Island regions (Table 5-1).

The potential future harvest levels are different to the 2014 WAFs (Figure 5-1, Figure 5-2, and Figure 5-3). This is because the harvest level over the past five years was considerably higher than was forecast, resulting in less area available to be harvested over the near term.

While there is a greater proportion of the radiata pine estate moving into the higher yielding post-1989 unpruned regime, which is expected to have a higher productivity on a cubic metre per hectare basis than the pre-1990 age group, this does not make up for the lower average age of the radiata pine estate (now 14.8 years), which limits the near-term harvest potential.

As described in Section 3.3.1, the target rotation age in the 2014 WAF for the main scenarios was 28 years for all regions and ownership categories. This was amended in the current 2021 WAF to vary by region and in some instances, by ownership category, with an average target rotation age of 28.

Wood Supply Region	2014 WAF Unadjusted NEFD Area (ha)	2021 WAF Unadjusted NEFD Area (ha)	Area Variance (ha)	Change (%)
Northland	186 320	184 321	-1 999	-1
Central North Island	555 144	534 738	-20 406	-4
East Coast	151 139	150 806	-333	0
Hawke's Bay	128 841	127 673	-1 168	-1
Eastern Southern North Island	66 124	74 553	8 429	11
Western Southern North Island	91 154	85 756	-5 398	-6
North Island Total	1 178 722	1 157 848	-20 875	-2
Nelson	85 820	83 432	-2 388	-3
Marlborough	70 317	71 561	1 244	2
West Coast	22 451	20 620	-1 831	-9
Canterbury	72 546	71 634	- 912	-1
Otago	86 755	94 744	7 989	8
Southland	43 591	45 264	1 673	4
South Island Total	381 480	387 254	5 774	2
New Zealand Total	1 560 202	1 545 102	-15 100	-1

Table 5-1: Planted Area – Radiata Pine (2014 vs 2020 NEFD Area)

Figure 5-3 compares the results from Scenario 3 in the 2021 forecasts against the 2014 forecasts for this scenario where both scenarios are based on a similar average target rotation of 28 years.

Figure 5-3: Comparison of 2021 Forecast vs 2014 Forecast for Scenario 3

5.2 Comparison of 2014 and 2021 WAFs (Douglas-fir)

The unadjusted area of Douglas-fir used in the 2021 forecast is 6% less than the area used in the 2014 forecast. Area reductions are largest in the Eastern Southern North Island, Marlborough, Nelson and Central North Island regions, continuing a trend seen in the previous WAF (Table 5-2).

Additionally, most of the large-scale forest owners have elected not to replant Douglas-fir, apart from some owners in the Otago/Southland, and Canterbury regions, although even in these regions, the preference is to replant most Douglas-fir areas in the *Pinus radiata x attenuata* hybrid. As a result, the national wood availability of Douglas-fir from the 2021 forecast is expected to be lower than in the previous forecasts (Figure 5-4). In Figure 5-4, the 2014 forecast has been used to estimate the 2015-2020 actual harvest.

Wood Supply Region	2014 WAF Unadjusted NEFD Area (ha) ⁷	2020 WAF Unadjusted NEFD Area (ha)	Area Variance (ha)	Change (%)
Northland	10	10	0	0
Central North Island	21 661	15 754	-5 907	-27
East Coast	1 903	2 090	187	10
Hawke's Bay	428	483	55	13
Eastern Southern North Island	303	189	-114	-38
Western Southern North Island	700	862	162	23
North Island Total	25 005	19 388	-5 617	-22
Nelson	7 973	5 411	-2 562	-32
Marlborough	2 133	1 320	-813	-38
West Coast	1 451	1 539	88	6
Canterbury	16 903	16 770	-133	-1
Otago	29 696	32 767	3 071	10
Southland	25 209	25 042	-167	-1
South Island Total	83 365	82 848	-517	-1
New Zealand Total	108 370	102 236	-6 134	-6

Table 5-2:Planted Area – Douglas-fir (2014 vs 2020 NEFD Area)

⁷ Based on NEFD areas available for each region at the time the forecast was produced (2014-2015)

Figure 5-4: Comparison of 2021 Forecast vs 2014 Forecast for Douglas-fir (Scenario 5)

5.3 Comparison of 2014 and 2021 WAFs (Minor Species)

Table 5-3 shows that since 2014, the area planted in minor species has increased very slightly. This is largely driven by a significant area increase in Other Softwoods in the North Island. This increase in area ends the downward trend that was seen in the 2014 WAF between the 2005 and 2015 NEFD areas. The area planted in other species remains low when compared to the area in either Douglas-fir or radiata pine, but the area also now appears to have potentially stabilised.

Min on One size One	Lesster	Unadjusted NE	Change in	
Minor Species Group	Location	2014 NEFD	2020 NEFD	Area (%)
Cuproco	North Island	2 783	2 279	-18
Cypress	South Island	7 340	7 755	6
Other Softwoods	North Island	8 474	10 961	29
	South Island	13 887	13 658	-2
Eucalypts	North Island	9 667	9 390	-3
	South Island	13 593	12 367	-9
Other Hardwoods	North Island	7 523	7 639	2
	South Island	4 969	5 188	4
	New Zealand Total	68 236	69 237	1%

Table 5-3:	
Planted Area by Minor Species Group (2014 vs 2020 NEFD Area))

Table 5-4 shows the comparison of the long-term sustainable cut for the minor species groups. The increases are likely driven by increases in the area in the case of other softwood or differences in the yield tables for eucalyptus and other hardwoods.

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Table 5-4: Approximate Long-term Sustainability Cut for Minor Species Comparison (2014 vs 2020 NEFD Area)

Minor Species Group	Long-term Susta	Change in Volume	
winter species Group	2014	2021	(%)
Cypress	120 000	120 000	0
Other Softwoods	230 000	245 000	7
Eucalypts	390 000	415 000	6
Other Hardwoods	190 000	195 000	3

6 CONCLUSION

6.1 Radiata Pine and Douglas-fir

The concluding remarks in the previous WAF (2014) stated that the harvest level since the previous forecast had been higher than forecast, reaching 30 million m³ by 2015 instead of 32-35 million m³ by 2019 as forecast. This trend has continued, and the comparison shown in Figure 5-3 highlights the continued increase beyond the expectations of the 2014 forecast. This unexpected increase was largely due to unprecedented market demand from China, and subsequent high price, driving the harvest level in New Zealand upwards.

For this forecast, several changes in the modelling process were intended to limit unrealistic constraints being applied. In particular, regional level target harvest ages were set and where appropriate, these were also split by ownership class. For Scenario 3, the method of smoothing the woodflow was also adjusted regionally. The result of this process, it is hoped, is a woodflow that better reflects regional nuances, both in terms of age-class distribution (reflected in the smoothing of the woodflows) and growth rates (reflected in the target harvest age).

Scenario 1 of the current (2021) forecasts indicates that the radiata pine harvest level could increase briefly to over 65 million m³ (an increase compared to the 2014 forecast). The highly-regulated Scenario 2 suggests a long-term sustainable yield of around 32 million m³/a is achievable (a level very similar to the equivalent scenarios for both the 2008 and 2014 WAFs). Scenario 3, intended to be more realistic, shows that the harvest could continue to rise to 39 million m³/a, but can only be sustained at this level for around six years before declining to a low of around 25 million m³/a.

As mentioned previously in this report, the actual level of future harvest will depend on market conditions and having suitable infrastructure and supply chains in place to cope with the harvest volumes. The demonstrated rate of increase in the national harvest since the previous WAF indicates that under favourable market conditions, the supply chain can readily adapt to significant changes in harvest level.

The national harvest level continues to be highly dependent on the behaviour of the small-scale forest owners. Scenario 2 shows that around one third of the ongoing harvest is from this ownership class. For these owners, there is more uncertainty over the stocked area and yield from their forests. As well, their harvesting activity tends to be more opportunistic and reactive to changes in market conditions than large-scale owners.

Since the previous WAFs were produced in 2014, the national estate has declined in area only slightly. This trend likely reflects the combined impacts of the ETS and the rising price of NZUs (and therefore the cost of deforestation of pre-1990 forest lands), and the strong market for lumber over the past six years.

6.2 Minor Species

Minor species harvest volumes make up a small proportion of the national harvest, although at a regional level they may be significant (such as eucalypts in Southland).

The harvest of cypress has the potential to reach levels of just over 120 000 m³/a by the mid-2030s. Supply is mainly dominated by the large-scale owners. The wood availability of eucalypts from large-scale owners is expected to fluctuate in the next ten years before reaching a long-term sustainable level of over 400 000 m³/a.

There is considerable uncertainty over the wood availability of other softwoods and hardwoods. Ownership is dominated by small-scale forest owners, and in comparison to the more mainstream species, yield table development is at a basic level only. Based on the assumptions used in the current wood availability, each species group could provide a long-term harvest level of around 200 000 m³/a.

7 REFERENCES

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Appendix - New Zealand Wood Availability Forecasts for the Period 2021-2060

Table 1: New Zealand Wood Avaliability under Scenario 1

(Assumes that large-scale owners harvest at stated intentions and then at non-declining yield, and regional target harvest ages)

Year Ending	Large-Scale	Small-Scale	All
December	Owners	Owners	Owners
	(000 m ³)	(000 m ³)	(000 m ³)
2021	19 468	16 360	35 828
2022	19 637	46 677	66 314
2023	20 005	22 765	42 770
2024	20 150	14 542	34 692
2025	20 062	12 255	32 317
2026	20 280	14 438	34 718
2027	20 574	11 772	32 346
2028	20 893	8 802	29 695
2029	20 449	9 810	30 258
2030	19 446	7 738	27 184
2031	20 181	8 249	28 430
2032	19 887	4 877	24 764
2033	19 989	4 266	24 255
2034	19 771	3 129	22 901
2035	19 912	5 390	25 303
2036	19 878	4 037	23 915
2037	19 591	4 964	24 555
2038	19 615	5 716	25 331
2039	19 612	7 473	27 085
2040	19 438	4 900	24 338
2041	19 734	8 314	28 048
2042	19 775	13 438	33 213
2043	19 833	16 303	36 136
2044	19 849	15 886	35 735
2045	19 811	17 117	36 929
2046	19 808	12 699	32 508
2047	19 762	12 930	32 692
2048	19 801	12 208	32 009
2049	19819	24 986	44 805
2050	19 841	38 612	58 453
2051	19 915	20 934	40 849
2052	19 989	13 963	33 952
2053	19 980	12 665	32 646
2054	20 010	10 741	30 /51
2055	19 990	14 892	34 882
2056	19 982	10 625	30 607
2057	19 985	68/1	20 855
2058	19 960	8 534 7 000	28 494
2059	19 958	/ 903	2/861
2000	19 934	5 986	25 921

Notes:

Table 2: New Zealand Wood Avaliability 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	Large-Scale	Small-Scale	All
December	Owners	Owners	Owners
	(000 m ³)	(000 m ³)	(000 m ³)
2021	19 438	13 474	32 912
2022	19 627	12 974	32 601
2023	19 984	12 597	32 581
2024	20 130	12 488	32 618
2025	20 058	12 557	32 615
2026	20 280	12 401	32 680
2027	20 574	12 118	32 692
2028	20 893	11 724	32 617
2029	20 449	12 145	32 594
2030	19 472	12 363	31 835
2031	19 653	12 182	31 835
2032	19 378	12 471	31 848
2033	19 598	12 239	31 837
2034	19 391	12 444	31 835
2035	19 402	12 436	31 837
2036	19 421	12 415	31 835
2037	19 116	12 719	31 835
2038	19 158	12 677	31 835
2039	19 095	12 144	31 239
2040	19 615	11 901	31 516
2041	20 026	11 669	31 694
2042	20 058	12 156	32 214
2043	20 150	12 168	32 318
2044	20 196	12 162	32 359
2045	20 207	12 152	32 358
2046	20 206	12 152	32 358
2047	20 227	12 145	32 372
2048	20 227	12 145	32 372
2049	20 236	12 136	32 372
2050	20 248	12 124	32 372
2051	20 261	12 110	32 372
2052	20 270	12 110	32 381
2053	20 284	12 110	32 395
2054	20 291	12 110	32 402
2055	20 284	12 097	32 382
2056	20 282	12 092	32 374
2057	20 292	12 092	32 384
2058	20 279	12 092	32 372
2059	20 292	12 092	32 384
2060	20 292	12 092	32 385

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Notes:
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Table 3: New Zealand Wood Avaliability under Scenario 3

(Assumes that large-scale owners harvest at stated intentions and then at non-declining yield, and total wood availability is modelled at a split non-declining yield)

Year Ending	Large-Scale	Small-Scale	All	Pruned	Unpruned	Pulp Logs
December	Owners	Owners	Owners			
	(000 m ³)					
2021	19 468	16 306	35 775	5 027	22 988	7 759
2022	19 627	18 123	37 750	5 476	24 343	7 931
2023	19 974	18 972	38 946	5 035	25 576	8 335
2024	20 195	19 166	39 361	5 049	25 975	8 337
2025	20 058	19 336	39 394	5 140	25 913	8 342
2026	20 280	18 129	38 409	5 010	25 101	8 299
2027	20 574	16 541	37 115	4 514	24 671	7 930
2028	20 893	14 105	34 998	4 237	23 318	7 443
2029	20 449	12 268	32 716	3 196	22 064	7 456
2030	19 446	10 684	30 130	2 626	20 618	6 886
2031	20 068	7 208	27 276	2 450	18 727	6 099
2032	19 897	6 688	26 585	2 060	18 370	6 155
2033	20 071	6 271	26 342	1 573	18 572	6 197
2034	19 865	5 592	25 457	1 507	17 847	6 103
2035	19 875	5 647	25 522	1 547	17 997	5 977
2036	19 894	6 205	26 099	1 624	18 372	6 102
2037	19 590	6 849	26 439	1 782	18 457	6 200
2038	19 632	7 480	27 112	1 833	19 004	6 274
2039	19 569	9 066	28 635	1 597	20 375	6 663
2040	19 427	10 876	30 302	1 816	21 279	7 207
2041	19 770	11 540	31 311	2 095	22 021	7 195
2042	19 803	11 974	31 777	2 151	22 288	7 338
2043	19 803	12 196	31 999	1 880	22 668	7 451
2044	19 804	12 195	31 999	1 203	23 039	7 757
2045	19 814	12 185	31 999	1 412	22 688	7 899
2046	19 814	12 465	32 280	1 468	23 099	7 712
2047	19 834	12 445	32 279	1 282	23 281	7 716
2048	19 834	12 487	32 322	1 201	23 325	7 795
2049	19 835	12 927	32 762	1 709	23 309	7 744
2050	19 834	13 027	32 861	1 367	23 540	7 955
2051	19 838	13 023	32 861	1 218	23 663	7 981
2052	19 847	13 023	32 870	1 309	23 663	7 899
2053	19 861	13 023	32 884	1 360	23 586	7 938
2054	19 926	12 965	32 891	1 183	23 646	8 062
2055	20 012	12 859	32 871	1 154	23 754	7 963
2056	20 004	12 859	32 863	1 158	23 583	8 122
2057	20 014	12 634	32 648	1 511	23 419	7 718
2058	20 002	12 453	32 455	1 099	23 461	7 895
2059	20 015	12 309	32 323	1 205	23 265	7 854
2060	20 015	12 309	32 324	1 397	23 373	7 554

Notes:

Table 4: New Zealand Wood Avaliability 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 regional target rotation ages, - 2 and + 2 years)

Year Ending	Recoverable	Average	Recoverable	Average	Recoverable	Average
December	Volume Target	Age	Volume Target	Age	Volume Target	Age
	Age - 2 (000 m ³)	(Years)	Age (000 m ³)	(Years)	Age + 2 (000 m ³)	(Years)
2021	35 659	27	35 775	29	34 529	30
2022	39 882	28	37 750	28	36 710	29
2023	41 108	27	38 946	28	37 510	29
2024	41 643	28	39 361	28	37 923	29
2025	41 657	28	39 394	29	37 165	29
2026	39 124	27	38 409	29	36 124	29
2027	36 689	29	37 115	28	35 912	29
2028	34 005	29	34 998	29	34 612	29
2029	31 004	29	32 716	28	33 408	29
2030	28 081	27	30 130	28	31 289	29
2031	26 463	27	27 276	28	29 382	29
2032	25 575	28	26 585	29	28 075	29
2033	25 403	28	26 342	28	26 405	29
2034	24 995	28	25 457	28	25 108	29
2035	25 551	27	25 522	29	24 641	29
2036	26 827	27	26 099	28	25 858	29
2037	27 913	26	26 439	28	27 345	29
2038	28 725	28	27 112	28	27 726	29
2039	29 629	26	28 635	28	28 330	29
2040	31 245	26	30 302	27	29 562	28
2041	31 306	26	31 311	27	30 429	28
2042	31 477	26	31 777	27	31 181	28
2043	31 561	26	31 999	27	31 557	29
2044	31 618	26	31 999	28	31 945	29
2045	31 956	26	31 999	28	32 447	29
2046	31 979	26	32 280	27	32 503	29
2047	31 978	27	32 279	27	32 545	29
2048	31 978	26	32 322	27	32 545	29
2049	31 978	26	32 762	27	32 545	29
2050	32 008	26	32 861	27	32 545	29
2051	31 981	26	32 861	27	32 545	29
2052	32 008	26	32 870	28	32 545	29
2053	31 993	26	32 884	28	32 817	29
2054	31 994	26	32 891	28	33 103	29
2055	31 978	28	32 871	28	33 104	29
2056	31 978	27	32 863	28	33 111	29
2057	31 774	27	32 648	28	32 850	29
2058	31 637	27	32 455	28	32 640	30
2059	31 482	26	32 323	28	32 493	30
2060	31 609	26	32 324	28	32 480	30

Notes:

Table 5: New Zealand Wood Avaliability for Douglas-fir

(Assumes that large-scale owners harvest at stated intentions with yield regulated and regional target harvest ages)

Year Ending	Large-Scale	Small-Scale	All	Average
December	Owners	Owners	Owners	Age
	(000 m ³)	(000 m ³)	(000 m ³)	(Years)
2021	900	360	1 261	43
2022	927	430	1 357	40
2023	885	90	975	40
2024	940	9	949	41
2025	979	31	1 011	41
2026	1 204	11	1 214	44
2027	1 236	33	1 269	42
2028	1 041	135	1 176	43
2029	814	71	886	35
2030	612	435	1 047	41
2031	602	625	1 228	41
2032	614	441	1 055	40
2033	612	443	1 055	40
2034	855	559	1 415	39
2035	956	494	1 450	39
2036	962	660	1 622	39
2037	964	551	1 515	39
2038	856	552	1 408	40
2039	1 156	631	1 787	41
2040	1 059	862	1 921	42
2041	1 010	818	1 828	41
2042	974	858	1 833	42
2043	1 012	858	1 870	42
2044	1 274	825	2 099	42
2045	1 225	712	1 937	42
2046	1 225	746	1 971	43
2047	1 141	782	1 922	43
2048	1 125	715	1 840	43
2049	1 265	265	1 530	44
2050	1 223	295	1 518	44
2051	1 223	366	1 589	43
2052	1 223	279	1 503	43
2053	1 223	185	1 408	46
2054	1 023	258	1 282	46
2055	973	797	1 770	45
2056	908	69	978	49
2057	812	257	1 070	46
2058	630	707	1 337	40
2059	431	248	679	45
2060	516	227	744	43

Notes:

Table 6: New Zealand Wood Avaliability under Scenario 6A for Cypresses

(Assumes that large-scale owners harvest at stated intentions and then at non-declining yield, and target harvest age of 35 years)

Year Ending	Large-Scale	Small-Scale	All
December	Owners	Owners	Owners
	(000 m ³)	(000 m ³)	(000 m ³)
2021	123	0	123
2022	131	7	138
2023	96	6	102
2024	85	28	112
2025	87	11	98
2026	33	10	43
2027	0	17	17
2028	17	63	80
2029	0	56	56
2030	5	56	61
2031	80	19	99
2032	80	40	120
2033	80	60	140
2034	80	55	135
2035	80	31	111
2036	80	38	118
2037	80	86	166
2038	80	52	132
2039	80	113	193
2040	80	26	106
2041	80	16	96
2042	80	45	125
2043	80	27	107
2044	80	12	92
2045	80	28	108
2046	80	16	96
2047	80	35	115
2048	80	13	94
2049	80	35	115
2050	80	45	125
2051	80	62	142
2052	80	54	134
2053	80	9	89
2054	80	0	80
2055	80	0	80
2056	80	0	80
2057	80	0	80
2058	80	0	80
2059	80	0	80
2060	80	0	80

Notes:

Table 7: New Zealand Wood Avaliability under Scenario 6B for Other Softwoods

(Assumes that large-scale owners harvest at stated intentions and then at non-declining yield, and target harvest age of 35 years)

Year Ending	Large-Scale	Small-Scale	All
December	Owners	Owners	Owners
	(000 m ³)	(000 m ³)	(000 m ³)
2021	67	31	98
2022	92	54	145
2023	50	20	70
2024	22	23	46
2025	1	14	16
2026	14	0	14
2027	39	0	39
2028	899	0	899
2029	58	0	58
2030	42	0	42
2031	49	0	49
2032	49	0	49
2033	49	42	91
2034	49	311	360
2035	49	226	275
2036	49	130	179
2037	49	335	385
2038	49	324	374
2039	49	350	400
2040	49	170	219
2041	49	181	230
2042	49	193	242
2043	49	508	557
2044	49	294	343
2045	49	157	206
2046	49	80	130
2047	49	105	154
2048	64	124	188
2049	64	392	456
2050	64	670	734
2051	64	744	807
2052	64	700	763
2053	64	346	409
2054	64	557	621
2055	64	0	64
2056	64	190	254
2057	64	13	77
2058	64	0	64
2059	64	35	98
2060	64	0	64

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Notes: m<sup>3</sup> = cubic metres inside bark
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Table 8: New Zealand Wood Avaliability under Scenario 6C for Eucalypts

(Assumes that large-scale owners harvest at stated intentions and then at non-declining yield, and target harvest age of 15-25 years)

Year Ending	Large-Scale	Small-Scale	All
December	Owners	Owners	Owners
	(000 m ³)	(000 m ³)	(000 m ³)
2021	238	762	1 000
2022	238	762	1 000
2023	194	806	1 000
2024	198	802	1 000
2025	126	874	1 000
2026	151	138	289
2027	134	128	261
2028	134	178	312
2029	252	84	335
2030	122	433	555
2031	122	245	368
2032	122	13	136
2033	122	168	291
2034	122	152	274
2035	122	0	122
2036	122	390	513
2037	122	390	512
2038	122	419	542
2039	122	461	583
2040	122	463	585
2041	122	642	765
2042	122	138	261
2043	122	128	250
2044	122	178	300
2045	122	84	206
2046	122	433	555
2047	122	245	368
2048	122	13	136
2049	122	168	291
2050	122	152	274
2051	122	0	122
2052	122	390	513
2053	122	390	512
2054	122	419	542
2055	122	461	583
2050	122	463	585
2057	122	64Z	/05
2058	122	138	261
2059	122	128	250
2060	122	1/8	300

Notes:

Table 9: New Zealand Wood Avaliability under Scenario 6D for Other Hardwoods

(Assumes that large-scale owners harvest at stated intentions and then at non-declining yield, with target harvest age of 15-25 years)

December Owners Owners Owners	
2 2 7	
(m [°]) (000 m [°]) (000 m [°]))
2021 362 638 1	000
2022 166 608	774
2023 56 26	82
2024 13 2	15
2025 21 8	29
2026 33 14	47
2027 41 15	56
2028 84 27	111
2029 60 0	60
2030 6 0	6
2031 6 0	6
2032 6 0	6
2033 6 0	6
2034 6 0	6
2035 6 22	28
2036 47 0	47
2037 47 0	47
2038 47 10	57
2039 47 301	349
2040 47 206	253
2041 4/ 665	/13
2042 47 250	297
2043 47 549	597
2044 47 647	695
2045 47 600	047
2046 47 42	90
2047 47 3	50
2048 47 13	01 101
2049 47 55	101 72
2050 47 20 2051 47 8	75 56
2051 47 8	30 47
2052 47 0	47
2054 47 0	47 47
2055 47 0	47
2056 47 0	47
2057 47 0	47
2058 47 0	47
2059 47 0	47
2060 47 0	47

Notes:

Table 10: New Zealand Wood Avaliability under Scenario 7A for Cypresses

(Assumes that large-scale owners harvest at stated intentions and then at non-declining yield, and total non-declining yield with target harvest age of 35 years)

December Owners Owners Owners	5
(000 m ³) (000 m ³) (000 m ³)	[•])
2021 93 0	93
2022 93 0	93
2023 88 5	93
2024 72 21	93
2025 80 13	93
2026 65 28	93
2027 45 48	93
2028 3 90	93
2029 41 52	93
2030 5 88	93
2031 79 16	95
2032 79 31	110
2033 79 31	110
2034 79 31	110
2035 79 31	110
2036 79 31	110
2037 79 31	110
2038 79 31	110
2039 79 31	110
2040 79 31	110
2041 79 31	110
2042 79 31	110
2043 79 31	110
2044 /9 31	110
2045 79 31	110
2046 79 31	110
2047 79 31	110
2048 79 31	110
2049 79 31	110
2050 79 51 2051 70 21	110
2051 75 51	110
2052 79 51 2052 70 21	110
2000 75 01 2007 70 21	110
2054 75 51 2055 70 31	110
2055 75 51	110
2057 79 31	110
2057 79 31	110
2059 79 31	110
2060 79 31	110

Notes:

Table 11: New Zealand Wood Avaliability under Scenario 7B for Other Softwoods

(Assumes that large-scale owners harvest at stated intentions and then at non-declining yield, and total non-declining yield with target harvest age of 35 years)

Year Ending	Large-Scale	Small-Scale	All
December	Owners	Owners	Owners
	(000 m ³)	(000 m ³)	(000 m ³)
2021	98	126	224
2022	130	94	224
2023	224	0	224
2024	171	53	224
2025	132	92	224
2026	168	56	224
2027	146	78	224
2028	153	71	224
2029	17	207	224
2030	42	183	224
2031	51	173	224
2032	51	173	224
2033	51	173	224
2034	51	173	224
2035	51	173	224
2036	51	173	224
2037	51	173	224
2038	51	173	224
2039	51	192	244
2040	51	192	244
2041	51	192	244
2042	51	192	244
2043	51	192	244
2044	51	192	244
2045	51	192	244
2046	51	192	244
2047	51	192	244
2048	51	192	244
2049	51	192	244
2050	51	192	244
2051	51	192	244
2052	51	192	244
2053	51	192	244
2054	51	192	244
2055	51	192	244
2056	51	192	244
2057	73	170	244
2058	73	170	244
2059	82	161	244
2060	82	161	244

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Notes: m<sup>3</sup> = cubic metres inside bark
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Table 12: New Zealand Wood Avaliability under Scenario 7C for Eucalypts

(Assumes that large-scale owners harvest at stated intentions and then at non-declining yield, and total non-declining yield with target harvest age of 15-25 years)

Year Ending	Large-Scale	Small-Scale	All
December	Owners	Owners	Owners
	(000 m ³)	(000 m ³)	(000 m ³)
2021	60	359	418
2022	87	331	418
2023	225	193	418
2024	204	214	418
2025	134	284	418
2026	177	241	418
2027	228	190	418
2028	312	107	418
2029	214	204	418
2030	53	366	418
2031	84	335	418
2032	117	301	418
2033	117	301	418
2034	117	301	418
2035	117	301	418
2036	117	301	418
2037	117	301	418
2038	117	301	418
2039	121	298	418
2040	125	293	418
2041	125	293	418
2042	125	293	418
2043	125	293	418
2044	125	293	418
2045	125	293	418
2046	125	293	418
2047	125	293	418
2048	125	293	418
2049	125	293	418
2050	125	293	418
2051	125	293	418
2052	125	293	418
2053	125	293	418
2054	125	293	418
2055	125	293	418
2056	125	293	418
2057	125	293	418
2058	125	293	418
2059	125	293	418
2060	125	293	418

Notes:

Table 13: New Zealand Wood Avaliability under Scenario 7D for Other Hardwoods

(Assumes that large-scale owners harvest at stated intentions and then at non-declining yield, and total non-declining yield with target harvest age of 15-25 years)

Year Ending	Large-Scale	Small-Scale	All
December	Owners	Owners	Owners
	(000 m ³)	(000 m ³)	(000 m ³)
2021	56	135	192
2022	56	135	192
2023	56	135	192
2024	56	135	192
2025	73	119	192
2026	79	112	192
2027	76	115	192
2028	69	123	192
2029	49	143	192
2030	41	151	192
2031	41	151	192
2032	41	151	192
2033	41	150	192
2034	41	150	192
2035	41	150	192
2036	41	150	192
2037	41	150	192
2038	41	150	192
2039	41	150	192
2040	41	150	192
2041	45	147	192
2042	47	145	192
2043	47	145	192
2044	47	145	192
2045	47	145	192
2046	47	145	192
2047	47	145	192
2048	47	145	192
2049	47	145	192
2050	47	145	192
2051	47	145	192
2052	47	145	192
2053	47	145	192
2054	47	145	192
2055	47	145	192
2056	47	145	192
2057	47	145	192
2058	47	145	192
2059	47	145	192
2060	47	145	192

Notes: