

New Zealand Government Submission - Forest Management Reference Level

Introduction

1. The following submission has been prepared by the New Zealand Government as requested by the Conference of the Parties, serving as the meeting of the Parties to the Kyoto Protocol, at its sixth session. It sets out and documents New Zealand's revised forest management reference level.

Forest management reference level value

2. New Zealand's forest management reference level is a projection of business as usual (BAU) forest management activities. This is consistent with New Zealand's previous submissions².
3. The reference level has been revised to reflect updates and revisions to New Zealand's pre-1990 planted production forestry data. These are a result of, amongst other things, improved data and a better understanding of the harvesting dynamic between our pre-1990 and post-1989 planted production forests.
4. New Zealand's revised reference level is an average of 11.15 million tonnes of carbon dioxide equivalent per year in the period 2013 to 2020.

Table One: New Zealand's reference level expressed as an annual average in million tonnes of CO₂.

Time period ³	December 2009 submission ⁴	Revised reference level
2013-2017	15.03	10.78
2013-2020	17.05	11.15

Note : In line with the Common Reporting Format a positive number is an emission.

General description

Protected natural (indigenous) forest

5. In 2009 New Zealand had around 8.1 million hectares of natural forest, representing 30% of the land area. Of this 6.3 million hectares is '1all' indigenous forest and the remainder is shrubland or scrubland. The vast majority of indigenous forests are either protected as part of the Government's conservation estate, which is not harvested or available for conversion, or privately held, with strict legal requirements placed on harvest. Less than 0.1% of the volume of wood produced by New Zealand comes from privately held indigenous forests. Since 1990 the area of indigenous forest has reduced by less than 0.7%.

¹ Decision 2/CMP.6, Land use, land-use change and forestry – see <http://unfccc.int/resource/docs/2010/cmp6/eng/12a01.pdf#page=5>

² http://unfccc.int/meetings/ad_hoc_working_groups/kp/items/4907.php

³ In order not to prejudice the outcome of the negotiations, reference levels for commitment periods of five and eight years are provided.

⁴ The reference level in New Zealand's December 2009 submission is an average for the period 2013 to 2020. For the purposes of comparison, a reference level derived from the same dataset, but for a five year commitment period is now provided.

6. The carbon stored in New Zealand's pre-1990 natural forests is assumed to be in steady state. There is some evidence to suggest that these forests may have been a slight sink since 1990, sequestering carbon at a rate of less than 1 tonne per hectare per year on average (a total of approximately 5 megatonnes per year). However, there is significant uncertainty within this figure (of the order of ±30%), as a result of the methodology (a single sample), the size of that sample (151 data plots), and that only tall forest was sampled.

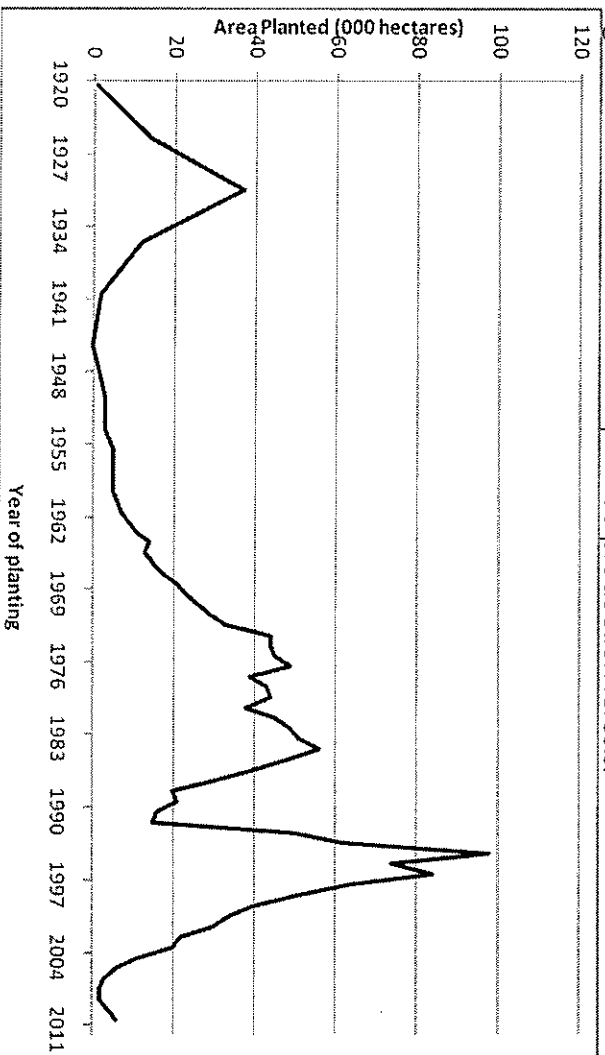
7. New Zealand is undertaking further analysis of the natural forest estate.

Planted production forests

8. From the mid-1920s to 1990 around 1.2 million hectares of planted production forests were established in New Zealand⁵. A further 0.58 million hectares have been established since 1990, almost exclusively on pastoral land.

9. New Zealand has experienced three periods of significant planting (see Figure One). In the late 1920s to the 1940s exotic forests were established with a view to developing and utilising a plantation forest resource to substitute for indigenous timbers. A second planting boom occurred during the 1970s and 1980s as an export-oriented forest industry was established. A final boom occurred in the mid 1990s in response to continued global demand for sustainably produced wood products, a growing awareness of the environmental services of forests, and the perception of high rates of returns to forest owners. These periods of increased planting have created a large forest age-class legacy that will continue to affect New Zealand's planted production forests well into the future. This legacy is significant for both the pre-1990 and post-1989 forest estates and the potential supply of timber.

Figure One: Afforestation rate of planted production forests.



Note that prior to 1950 only 5 yearly totals are available. Source: National Exotic Forest Description (2010), table 9.1

⁵ This area is less than that reported in New Zealand's Greenhouse Gas Inventory 1990-2008 for reasons discussed in paragraph 29.

The application of footnote 1 of Decision 2/CMP.6

10. New Zealand's reference level takes into account the elements of footnote 1 in the following ways:
- (a) 'Removals or emissions from forest management as shown in New Zealand's Greenhouse Gas Inventory and relevant historical data':
 - natural forests are modelled and included in the submission in line with New Zealand's current UNFCCC reporting practice i.e. the carbon stored in natural forests is assumed to be in steady state; and
 - modelling pre-1990 planted forests required departing from the historical data in New Zealand's Greenhouse Gas Inventory 1990-2008, so as to ensure the most realistic projections possible (information in the inventory is still under development).
 - (b) 'Age-class structure':
 - New Zealand's pre-1990 planted production forest age-class structure at 1 January 2009 has been used⁵ (see Appendix 2);
 - (c) 'Forest management activities already undertaken':
 - New Zealand's pre-1990 planted forests are subject to three main forest management activities: clear fell harvesting and deforestation; replanting following harvest; and standard silviculture practices (e.g. thinning of small trees and pruning of low branches).
 - (d) 'Projected forest management activities under BAU':
 - New Zealand included the following activities under the BAU scenario:
 - the proportion of trees harvested as a percentage of trees available is based on previous harvest levels and estimates of future supply trends;
 - replanting occurs in the calendar year after harvest; and
 - current silviculture practices will continue (and changes between pools as a result of silviculture practices are incorporated in yield tables).
 - (e) 'Continuity with the treatment of forest management in the first commitment period':
 - New Zealand did not elect to account for forest management in the first commitment period.
 - (f) 'The need to exclude removals from accounting in accordance with decision 16/CMP.1, paragraph 1':
 - New Zealand considers that the use of BAU projections and continuous improvement of carbon yield tables will achieve the intention of factoring out in accordance with paragraph 1(h) (i) and 1(h) (ii) of decision 16/CMP.1.

New Zealand has not included force majeure in the reference level.

⁵ This is based on the National Exotic Forest Description (2008). It has been matched to the calendar year of planting, with Article 3.3 forests (post-1989) excluded. 'First rotation' forests are differentiated from those that have been harvested (second and third rotation), as the former have no harvest residue and a smaller dead wood pool.

Pools and gases

11. New Zealand's reference level includes all pools reported in New Zealand's Greenhouse Gas Inventory 1990-2008, being: above ground biomass; below ground biomass; dead wood; litter; and soil carbon.

12. New Zealand's reference level is based on the pre-1990 planted forest biomass carbon and soil carbon density table in Appendix 1A and 1B. The amount of carbon in the pre-1990 forestry estate is assigned between IPCC pools as follows:

Above ground biomass

- Stem carbon
 - 85% of stem carbon and bark is assumed to be removed from site and instantly oxidised (this is approximately 58% of above ground biomass).
 - 15% of stem carbon and bark are assigned to the deadwood pool, and (approximately 25% of above ground biomass).
 - All other non-stem above ground carbon is assigned to the litter pool.
- Non-crop species
 - Carbon stock of non-crop trees in plantations is estimated using sampling from New Zealand's Article 3.3 reporting.
 - All non-crop biomass is assumed to be instantly oxidised after harvest.

Below ground biomass

- Carbon in fine roots is instantly emitted on harvesting (it is indistinguishable from soil carbon).
- Coarse roots are allocated to the dead wood pool at harvest.

Dead wood

- Harvest residues
 - Decay is assumed to be at a rate of approximately 12% of the remaining stock emitted each year from the dead wood pool, and at a rate of approximately 19% from the litter pool.

Soil carbon

- Soil carbon is assumed to reach steady state twenty years after conversion and so all soil under pre-1990 planted forest is assumed to be at steady state after 2010. In addition, all pre-1990 planted forest is assumed to be on mineral soils.

13. Emissions of non-CO₂ gases were not included in the reference level.

Approaches, methods and models used

Model

14. New Zealand used the FOLPI model⁷ in constructing the reference level. FOLPI was also used to project future harvest rates, and emissions and removals for New Zealand's Fifth National Communication (December 2009). As will be discussed below, FOLPI has also been used to estimate historical emissions for New Zealand's Greenhouse Gas Inventory reports.
15. FOLPI is a linear programming model that projects the management of planted production forest estates over time. It uses the initial age-class and yield tables to generate volumes of timber harvested. It assumes the timber supply does not materially decline over 30 years and smoothes the age-class of the harvested areas accordingly. This limits inter-annual variability in the harvest volume.
16. The information about how New Zealand's forest estate would be managed has been improved in line with New Zealand's Wood Availability Forecast 2010 -2040 (published in 2010)⁸. This approach differs from that adopted in New Zealand's previous submissions, where projections reported in New Zealand's Fifth National Communication were used. The Wood Availability Forecast was developed by New Zealand's Ministry of Agriculture and Forestry to assist with future regional forest industry planning. The forecasts were produced in association with New Zealand's major forest growers and consultants.
17. New Zealand considers that the Wood Availability Forecast improves forecasting of harvesting, as it, amongst other things, provides a more sophisticated disaggregation of the forest estate (on the basis of different species and owner types).
18. New Zealand's net emissions/removals from natural forests are assumed to be zero, as carbon stored in natural forests is assumed to be in steady state.
19. New Zealand's reference level includes all emissions and removals associated with the harvesting of pre-1990 planted production forests irrespective of whether the harvested production forest is subsequently subject to land-use change. This is consistent with paragraphs 33-35, 'Integrated version', Chapter II (Land use, land-use change and forestry), FCCC/KP/AWG/2010/CRP.4/Rev.4. The implication of applying this provision is that all emissions and removals associated with the moving of planted production forests will be accounted for under forest management.

⁷ Forestry Oriented Linear Programming Interpreter (FOLPI) (Garcia O. 1984, Nagumo H et al (eds), FOLPI: a forestry-oriented linear programming interpreter. *UFFRO symposium on Forest Management, Planning and Managerial Economics*. University of Tokyo: Japan. 293–305. and Manley B, Papps S, Threadgill J, Wakein S. 1991. *Application of FOLPI, A Linear Programming Estate Modelling System for Forest Management Planning*. Ministry of Forestry, FRI Bulletin No. 164). A more detailed description can be found in the New Zealand's National Greenhouse Gas Inventory 1990-2006 and National Greenhouse Gas Inventory 1990-2007.

⁸ Available from <http://www.maf.govt.nz/news-resources/publications.aspx>

Data

20. New Zealand did not elect to account for Article 3.4 forest management during the first commitment period of the Kyoto Protocol. As a consequence, New Zealand's data in relation to pre-1990 forests is less comprehensive than that for post-1989 forest.
21. New Zealand has historically collected and reported forest data to serve the planning needs of the Government, forest sector and industry. The Ministry of Agriculture and Forestry has maintained a National Exotic Forest Description (NEFD) database since 1985⁹. The NEFD database focuses on timber availability, and is based on forest area, forest age-class distribution, silviculture, and harvest rates, as reported by the forestry sector.
22. The NEFD is currently the most complete data set available for pre-1990 planted production forest in New Zealand. The NEFD data has therefore been used in constructing New Zealand's reference level.
23. The NEFD was not designed for reporting/accounting under the Kyoto Protocol. New Zealand has developed and implemented the Land Use and Carbon Analysis System (LUCAS) for this purpose. The LUCAS measurement programme has to date focused on gathering data for New Zealand's reporting requirements under Article 3.3 of the Kyoto Protocol. As a result, at this time, LUCAS data is not appropriate for use in constructing New Zealand's forest management reference level. LUCAS data for pre-1990 forest (using national plots) is currently undergoing analysis, and will be presented in New Zealand's Greenhouse Gas Inventory 1990-2010 (April 2012 submission).
24. The NEFD and LUCAS currently use different data sets and yield tables. The NEFD data is based on a net stocked area (i.e. the area excludes non-planted production forest areas such as roads, rivers, skid sites etc), and has a related yield table. The LUCAS area data is based on a gross stocked area approach (i.e. the area mapped according to land cover and includes areas such as roads and skid sites). Differences between the data sets are to be expected.

Description of the construction of New Zealand's reference level

A description of how each of the following elements were considered or treated in the construction of the forest management reference level, taking into account the principles in decision 16/CMP.1

Area under forest management

25. New Zealand reports 'forest land remaining forest land' as part of its reporting requirements under the United Nations Framework Convention on Climate Change. This includes post-1989 forest (Article 3.3), and pre-1990 planted and

⁹ <http://www.maf.govt.nz/news-resources/statistics/forecasting/statistical-publications/national-exotic-forest-description-provisional-rel.aspx>

pre-1990 natural forest (Article 3.4). In constructing New Zealand's reference level, forest areas not accounted for under Article 3.3 are classified as pre-1990 forest. All of New Zealand forest is considered to be managed for either production or conservation.

Emissions and removals from forest management¹⁰

26. New Zealand's Greenhouse Gas Inventory 1990-2008 used NEFD yield tables and harvest data for pre-1990 planted forests, with the LUCAS forest area and methodology¹¹. Prior to this, only NEFD data was used by New Zealand in Greenhouse Gas Inventory reports.
27. In New Zealand's Greenhouse Gas Inventory 1990-2007, pre-1990 and post-1989 forest were reported as plantation forest. In this report only forest land in its second rotation was reported as 'forest land remaining forest land: plantation', with all first rotation forests, which may have been planted as far back as the 1960s, classified as 'land converted to forest land'.
28. In New Zealand's Greenhouse Gas Inventory 1990-2006, all forest land that had not been converted in the reporting year was described as 'forest land remaining forest land: plantation'.
29. There have been a number of improvements to New Zealand's LUCAS data since New Zealand's latest Greenhouse Gas Inventory was submitted in April 2010. The main differences are:
 - the use of historical land use data to model land-use change since 1962;
 - improvements to deforestation area through polygon-specific mapping;
 - a correction to the area of pre-1990 forest harvested; and
 - improvements to the mapping of pre-1990 planted production forest and post-1989 areas.

Forest characteristics and related management activities

30. Age-class structure: the planted forest age-class distribution and yield tables used in constructing New Zealand's forest management reference level are set out in Appendix 2 & 3.
31. Rotation length: the harvest age of New Zealand's planted production forest averaged 27.8 years between 1995 and 2010, and ranged between 26.8 and 28.4 years.

Historical harvesting rates and assumed future harvesting rates

32. New Zealand expects the total annual quantity of wood available for harvesting will increase by around 19 million cubic metres by 2020. The

¹⁰ Emissions and removals from forest management and the relationship between forest management and forest land remaining forest land as shown in GHG inventories and relevant historical data, including information provided under Article 3.3., and, if applicable, Article 3.4 forest management of the Kyoto Protocol and under forest land remaining forest land under the Convention.

¹¹ Refer section 7.1.2 and Table 7.1.2.3 of New Zealand's Greenhouse Gas Inventory Report 1990-2008

projected increase in volume reflects the age-class structure of New Zealand's forests, with approximately half the planted production forest area established after 1980 and yet to be harvested (that is, first rotation). New Zealand's pre-1990 planted production forest area increased 45 percent between 1980 and 1989.

33. New Zealand expects that by 2020, even in the presence of a carbon price, post-1989 forests would begin to provide significant volumes of timber for harvest (around one third of the total volume - in line with their proportion of the estate). Consequently, the volume of pre-1990 forest harvested would decline as a proportion of total harvest, but would still be 25% more than the current volume.

Harvested wood products

34. New Zealand supports the accounting methodology for harvested wood products included in the 'Integrated version', Chapter II (Land use, land-use change and forestry), FCCC/KP/AWG/2010/CRP.4/Rev.4. New Zealand has however not been able to collate a data set consistent with this approach in time for it to be used in constructing the reference level set out in this submission. Once this data is available, New Zealand intends to incorporate a harvested wood products pool into the reference level. Such a change would be subject to an ex-post technical adjustment.

35. As an interim measure, New Zealand has therefore assumed that biomass removed from site is instantly oxidised, as per the IPCC default. This assumption has been applied to both the historical and projected data.

Disturbances in the context of force majeure

36. New Zealand's historical forest data does not include an event that could be classified as 'force majeure'. A level of natural disturbance is included in New Zealand's reference level, as the yield tables are based on observed volume of wood and carbon stocks in our forests.

Factoring out in accordance with paragraph 1(h) (i) and 1(h) (ii) of decision 16/CMP.1

37. As noted in New Zealand's Greenhouse Gas Inventory 1990-2008, New Zealand does not factor out indirect and natural greenhouse gas emissions and removals²¹. New Zealand considers that the use of BAU projections and continuous improvement of carbon yield tables will achieve the intention of factoring out in accordance with paragraph 1(h) (i) (elevated carbon dioxide concentrations) and 1(h) (ii) (indirect nitrogen deposition) of decision 16/CMP.1. Any increase in either carbon dioxide concentrations or indirect nitrogen deposition that has an effect on the forest growth rate will be reflected in New Zealand's carbon yield tables. Changes of this type will be factored out as part of the ex-post review process.

²¹ Ministry for the Environment, New Zealand's Greenhouse Gas Inventory 1990-2008, Wellington, New Zealand, page 224.

Policies included

Pre-2010 domestic policies included

38. The New Zealand Government regulates the removal of timber from natural indigenous forests under the *Forests Act 1949*. Timber can only be harvested from forests that are managed in a way that maintains continuous forest cover and ecological balance. Approximately 300,000 hectares of natural indigenous forest are managed under the *Forests Act 1949*. In addition, 57,000 hectares of natural indigenous forest were transferred to South Island Māori under the *South Island Landless Natives Act 1906*, which provides for the harvesting of this forest subject to the provisions of the *Resource Management Act 1991*.

39. New Zealand's Emissions Trading Scheme (ETS) includes forestry. The ETS is legislated under the *Climate Change Response Act 2002*. Owners of exotic pre-1990 forest who deforest are liable under the Act for emissions associated with that activity. This is the only obligation on pre-1990 exotic forest owners under the ETS.

40. New Zealand's current biofuels policy does not interact with the forest sector, and will not affect the forest area included in New Zealand's forest management reference level. Feedstocks are most likely to be derived from dairy industry by-products, tallow, used cooking oil, and from rapeseed grown as a break crop¹³. The timber processing sector uses waste from the milling of logs as fuel in combined heat/electricity generators. This is not the result of a biofuel policy as such, but makes good business sense for the timber processing sector, providing both a renewable energy source and a means of waste disposal.

Confirmation of factoring out policies after 2009

41. New Zealand has not adopted or implemented any new policies since 31 December 2009 that would impact New Zealand's forest management reference level.

Conclusions

42. New Zealand is pleased to submit this revised reference level in accordance with Decision 2/CMP6. We welcome the review process, which is necessary to ensure transparency and openness. New Zealand reserves the right to submit a revised reference level on the basis of improved data, changes to the accounting rules, or if the guidelines are changed.

¹³ <http://www.eeca.govt.nz/eeca-programmes-and-funding/programmes/renewable-transport-energy/biofuels>

Appendix 1A: Net Stocked carbon yield table used to develop New Zealand's Forest Management Reference Level for pre-1990 exotic planted production forests aged 0 to 40.5 years

Age	Total per hectare excluding soil carbon	Above Ground biomass		Below Ground biomass	Dead organic matter from current rotation		Soil carbon
		Crop	Non crop species		Deadwood	Litter	
0.5	1.25	0.85	0.05	0.35	0	0	115.5908
1.5	3.2	2.15	0.15	0.9	0	0	115.0123
2.5	5.8	4.1	0.25	1.3	0	0.15	114.4338
3.5	10.2	7.35	0.35	1.85	0	0.65	113.8553
4.5	15.75	11.15	0.45	2.65	0	1.5	113.2768
5.5	22.2	15.05	0.55	3.55	0.25	2.8	112.6983
6.5	29.45	19.25	0.7	4.5	0.8	4.2	112.1198
7.5	37.6	24.15	0.85	5.6	1.55	5.45	111.5413
8.5	46.75	29.5	1	6.85	2.6	6.8	110.9628
9.5	56.4	34.9	1.15	8.05	4.1	8.2	110.3843
10.5	66.25	40.4	1.3	9.25	5.9	9.4	109.8058
11.5	77.5	46.75	1.45	10.8	8.1	10.4	109.2273
12.5	87.2	50.9	1.6	11.5	11.55	11.65	108.6488
13.5	93.05	54.65	1.8	11.6	13	12	108.0703
14.5	97.95	60	2	12.6	11.95	11.4	107.4918
15.5	103.8	65.9	2.15	13.95	11.05	10.75	106.9133
16.5	111.05	73.45	2.3	15.5	10	9.8	106.3348
17.5	119.1	81.45	2.5	17.15	9.05	8.95	105.7563
18.5	127.8	89.7	2.7	18.85	8.25	8.3	105.1778
19.5	137.3	98.25	2.95	20.7	7.6	7.8	104.5993
20.5	147.15	106.95	3.2	22.5	7.05	7.45	104.31
21.5	157.15	115.65	3.4	24.3	6.6	7.2	104.31
22.5	167.2	124.2	3.6	26.15	6.25	7	104.31
23.5	177.5	132.8	3.85	28.05	5.95	6.85	104.31
24.5	188	141.5	4.1	29.9	5.75	6.75	104.31
25.5	198.45	150.1	4.35	31.75	5.6	6.65	104.31
26.5	208.95	158.7	4.6	33.65	5.45	6.55	104.31
27.5	219.5	167.2	4.85	35.55	5.4	6.5	104.31
28.5	230	175.55	5.15	37.4	5.4	6.5	104.31
29.5	240.25	183.65	5.4	39.2	5.5	6.5	104.31
30.5	250.1	191.45	5.65	40.95	5.6	6.45	104.31
31.5	259.9	199.2	5.95	42.75	5.65	6.35	104.31
32.5	269.65	206.85	6.25	44.55	5.75	6.25	104.31
33.5	279.2	214.35	6.55	46.25	5.85	6.2	104.31
34.5	288.45	221.6	6.85	47.9	5.95	6.15	104.31
35.5	297.5	228.65	7.15	49.6	6.05	6.05	104.31
36.5	306.5	235.6	7.5	51.25	6.2	5.95	104.31
37.5	315.25	242.35	7.85	52.85	6.35	5.85	104.31
38.5	323.8	248.95	8.15	54.45	6.5	5.75	104.31
39.5	332.3	255.45	8.5	56	6.7	5.65	104.31
40.5	335.5	258.25	8.85	56	6.85	5.55	104.31

Tonnes of carbon per hectare in each pool at 31 December

Ages are reported to the half year as New Zealand's planting season is near the middle of the calendar year, and therefore reflects the carbon stock within each pool at the 31 December.

Appendix 1B: Net Stocked carbon yield table used to develop New Zealand's Forest Management Reference Level for pre-1990 exotic planted production forests aged 41.5 to 80 years

Age	Total per hectare excluding soil carbon	Above Ground biomass		Below Ground biomass	Dead organic matter from current rotation		Soil carbon
		Crop	Non crop species		Deadwood	Litter	
41.5	335.05	257.6	9.2	55.9	7	5.35	104.31
42.5	335.55	257.4	9.55	56.55	7.2	4.85	104.31
43.5	335.8	257.55	9.9	56.8	7.35	4.2	104.31
44.5	336.45	257.85	10.3	57.25	7.45	3.6	104.31
45.5	337.1	258.15	10.7	57.6	7.55	3.1	104.31
46.5	337.9	258.5	11.05	57.95	7.65	2.75	104.31
47.5	338.8	258.95	11.4	58.25	7.75	2.45	104.31
48.5	339.85	259.4	11.8	58.6	7.85	2.2	104.31
49.5	340.95	259.85	12.2	58.95	7.95	2	104.31
50.5	341.8	260.3	12.4	59.2	8.05	1.85	104.31
51.5	342.35	260.65	12.4	59.45	8.1	1.75	104.31
52.5	343	261.05	12.4	59.75	8.15	1.65	104.31
53.5	343.75	261.5	12.4	60.05	8.25	1.55	104.31
54.5	344.35	261.85	12.4	60.35	8.3	1.45	104.31
55.5	344.95	262.2	12.4	60.6	8.35	1.4	104.31
56.5	345.6	262.6	12.4	60.85	8.4	1.35	104.31
57.5	346.25	263	12.4	61.1	8.45	1.3	104.31
58.5	346.85	263.35	12.4	61.35	8.5	1.25	104.31
59.5	347.25	263.6	12.4	61.55	8.5	1.2	104.31
60.5	347.6	263.75	12.4	61.7	8.55	1.2	104.31
61.5	347.95	263.9	12.4	61.9	8.6	1.15	104.31
62.5	348.25	264.05	12.4	62.1	8.6	1.1	104.31
63.5	348.55	264.15	12.4	62.3	8.65	1.05	104.31
64.5	348.9	264.3	12.4	62.5	8.7	1	104.31
65.5	349.25	264.45	12.4	62.7	8.7	1	104.31
66.5	349.6	264.6	12.4	62.9	8.7	1	104.31
67.5	349.9	264.75	12.4	63.05	8.75	0.95	104.31
68.5	350.2	264.9	12.4	63.2	8.8	0.9	104.31
69.5	350.55	265.05	12.4	63.4	8.8	0.9	104.31
70.5	350.9	265.2	12.4	63.6	8.8	0.9	104.31
71.5	351.2	265.35	12.4	63.75	8.8	0.9	104.31
72.5	351.5	265.5	12.4	63.9	8.8	0.9	104.31
73.5	351.85	265.65	12.4	64.1	8.8	0.9	104.31
74.5	352.15	265.8	12.4	64.25	8.85	0.85	104.31
75.5	352.45	265.95	12.4	64.4	8.9	0.8	104.31
76.5	352.75	266.05	12.4	64.6	8.9	0.8	104.31
77.5	353.05	266.2	12.4	64.75	8.9	0.8	104.31
78.5	353.35	266.35	12.4	64.9	8.9	0.8	104.31
79.5	353.6	266.45	12.4	65.05	8.9	0.8	104.31
80	353.7	266.5	12.4	65.1	8.9	0.8	104.31

Tonnes of carbon per hectare in each pool at 31 December

Ages are reported to the half year as New Zealand's planting season is near the middle of the calendar year, and therefore reflects the carbon stock within each pool at the 31 December.

Appendix 2: Net stocked area in each age-class of pre-1990 exotic planted production forests as at 1 January 2009

Age class	Hectares	Percentage of total area	Age class	Hectares	Percentage of total area
0 (area awaiting restocking) ¹⁴	30990	2.71	41	1389	0.122
1	30990	2.71	42	1175	0.103
2	34611	3.03	43	1137	0.100
3	32071	2.81	44	1016	0.089
4	34215	3.00	45	1383	0.121
5	37427	3.28	46	698	0.061
6	39589	3.47	47	525	0.046
7	39668	3.47	48	433	0.038
8	37917	3.32	49	655	0.057
9	35550	3.11	50	354	0.031
10	30164	2.64	51	203	0.018
11	30884	2.70	52	220	0.019
12	32044	2.81	53	88	0.008
13	32578	2.85	54	98	0.009
14	27787	2.43	55	88	0.008
15	30638	2.68	56	112	0.010
16	24029	2.10	57	134	0.012
17	21220	1.86	58	49	0.004
18	20899	1.83	59	381	0.033
19	20407	1.79	60	101	0.009
20	40536	3.55	61	47	0.004
21	33774	2.96	62	64	0.006
22	42272	3.70	63	13	0.001
23	55209	4.83	64	32	0.003
24	55831	4.89	65	76	0.007
25	57253	5.01	66	40	0.004
26	49073	4.30	67	20	0.002
27	43427	3.80	68	23	0.002
28	32617	2.86	69	398	0.035
29	24255	2.12	70	42	0.004
30	16882	1.48	71	69	0.006
31	15851	1.39	72	40	0.004
32	10008	0.88	73	27	0.002
33	7374	0.65	74	36	0.003
34	6863	0.60	75	47	0.004
35	3673	0.32	76	99	0.009
36	3074	0.27	77	144	0.013
37	2340	0.20	78	91	0.008
38	1876	0.16	79	57	0.005
39	1919	0.17	80	933	0.082
40	1905	0.17			
Total area under 41years	1129692	98.90	Total area over 40 years	12538	1.10

¹⁴ This is an assumed value, as it was not possible to derive a number from existing data sources.

Appendix 3: Proportion of total pre-1990 exotic planted production forest harvested

	Percentage area	Age at harvest
2013	5.22	28
2014	5.65	28
2015	5.66	28
2016	5.69	28
2017	5.70	28
2018	5.62	28
2019	5.18	28
2020	4.98	28