New Zealand

A Submission to the Ad-Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol (AWG-KP)

Land Use, Land Use Change and Forestry (LULUCF)

14 September 2009

Introduction

1) The AWG-KP encouraged Parties to share information, particularly data where available, before its ninth session (28 September to 9 October 2009), in order to enhance understanding of the implications of the options and proposals for the treatment of LULUCF.

2) To facilitate this sharing of information, the AWG-KP invited Parties to submit relevant information to the secretariat for publication on the UNFCCC website.

3) In this submission we provide the context for LULUCF in New Zealand so that others can better understand and interpret New Zealand data and the impacts of various LULUCF rule proposals on New Zealand's accounting for the land use sector. While this request focused on projections to 2020 we are extending this to 2025 as in New Zealand the carbon flux within the forestry sector is very sensitive to the assumptions around the harvest age of the forest and a slightly longer forecast period gives a much better indication of the carbon stock fluxes possible from the forest sector.

4) These projections have been revised since New Zealand's 26 May 2009 submission. These revisions have occurred as a result of new data being available as part of the Land Use and Carbon Analysis System (LUCAS) programme[1], and additional scenario modelling of the potential responses of the forest sector to a range of carbon prices. In addition projections have also been improved regarding the linkages between the planted production forests that are classified as pre-1990 and post-1989 forest.

Context

5) A brief discussion of New Zealand's forest sector follows. This is to provide the context for the subsequent discussion on LULUCF accounting rules.

6) New Zealand has two main types of forest cover:

   a) Protected natural forests, consisting of indigenous species; and

   b) Planted production forest, consisting primarily of introduced species.

[1] http://www.mfe.govt.nz/issues/climate/lucas/

Protected natural (indigenous) forest

7) New Zealand retains 8.1 million hectares of natural, representing 30% of our land area[2]. Of this 6.3Million hectares is high indigenous forest and the remainder is mixed shrubland and scrubland. The vast majority of the indigenous forests is 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 less than 0.7%[3].

8) Our most recent evidence indicates that, overall, the natural indigenous forests of New Zealand are not a source of emissions and may be a slight sink, with a possible sequestration of approximately 5 Mt per year (under 1 tonne per hectare). There is, however significant uncertainty within this figure, of the order of ±30%, arising from both the methodology (a single sample) and size of that sample (151 data plots). These figures will be revised as information from re-measurement of the plot network as part of New Zealand's Land Use and Carbon Analysis (LUCAS) occurs over the next five years.

9) For reporting under the Convention, and based on current information we report these forests as being in a steady state. These indigenous forest will not be considered further within this submission.

Planted production forests

Historical context

10) The widespread planting of forests for wood production began in the mid 1920s to ensure the maintenance of a timber supply while progressively phasing out of the harvesting of indigenous forests. From the mid-1920s to 1990 around 1.4 million hectares of planted production forests were established. Since 1990 it is estimated a further 0.566 million hectares have been established, almost exclusively on pastoral land. These areas are currently being revised as new information is generated by the LUCAS programme[4]. To comply with our Kyoto Protocol reporting requirements, research and reporting of the post 1989 planted production forest areas have been the focus of the work to date.

[2] This figure has been revised since the May 2009 submission reflecting the most recent information arising from the LUCAS classifications. The principal change has been due to the better classification of the 'scrub' and 'shrub' lands in 1990, with the majority being classified as pre-1990 forest due to their species mix and the fact these species have the 'potential to reach a minimum height of 5 meters at maturity (Forest definition,16CMP1).

[3] This figure is subject to revision as part of the improvement process being carried out under LUCAS, and may not be statistically significant.

[4] http://www.mfe.govt.nz/issues/climate/lucas/

11) Today the total cover of planted production forests is around 1.8 million hectares (7% of New Zealand's land area)[5]. 93% of the forests are privately owned with 65% of the total area controlled by large companies, Maori entities[6] or local government bodies. The remaining forests are managed by a wide variety of small companies, local government, partnerships, joint ventures and thousands of small-scale forest owners. *Pinus radiata* (radiata or Monterey Pine) dominates the planted production forests (89% by area), followed by Douglas-fir (6% by area).

Age class of historical afforestation.

12) New Zealand has experienced three periods of significant afforestation (refer to 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, seeking to create export-oriented forest industries. A final planting 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 afforestation have created a large age class legacy that will continue to affect New Zealand's planted production forests well into the future. This legacy affects both the pre 1990 and post 1989 forest data and the potential supply of timber.

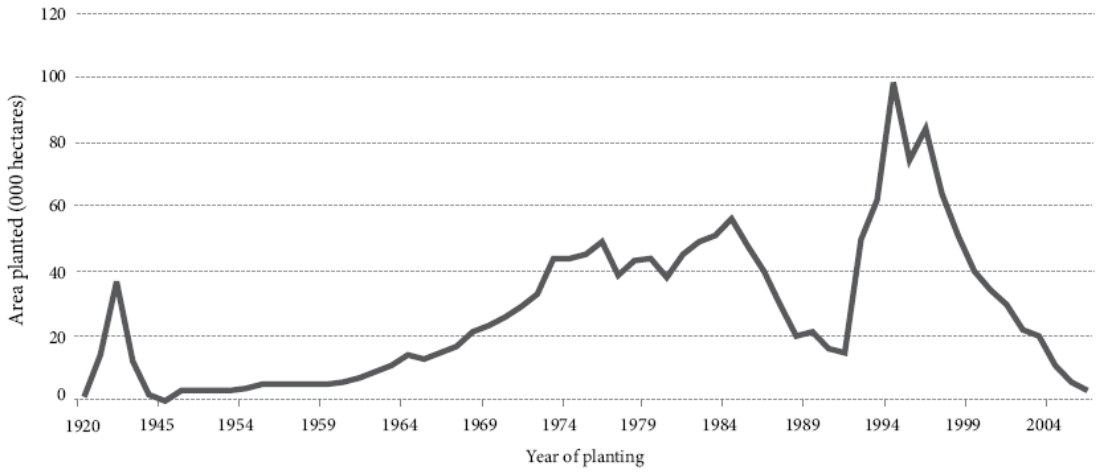


Figure One: Afforestation rates of planted production forest

The need for a consistent supply of timber and how this effects modelling

[5] Ministry of Agriculture and Forestry, 2009, A National Exotic Forest Description as at April 2008, http://www.maf.govt.nz/mafnet/publications/nefd/national-exotic-forest-2008/index.htm. Initial results form the LUCAS programme indicate a higher total figure, but this is still under review.

[6] Maori are New Zealand's indigenous people. These entities hold land and assets on behalf of the Maori owners to promote and facilitate the use and administration of the land in the interests of the owners.

13) A conclusion of a recent Forest Sector[7] report was that the harvested volume from plantation forests has consistently increased to the present day (refer Figure two), with some variation in response to short term events in the international market.[8] Driving the harvest have been three key considerations:

a) The total available timber supply (i.e. what is available for harvest).

b) The prevailing timber market conditions

c) The requirement for continued production

14) Assumptions around the total timber supply and the need for a continuity of production are possible, while projecting prevailing market conditions has proven much more difficult.

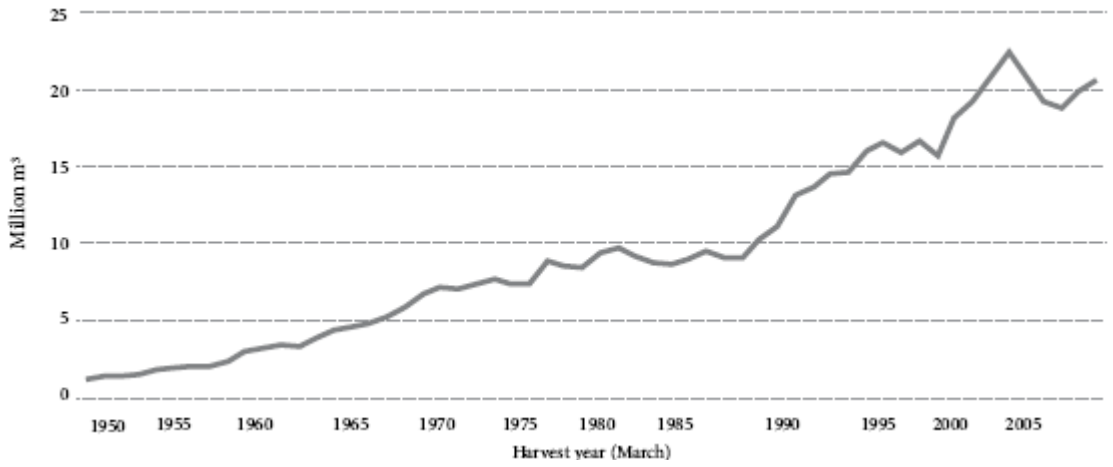


Figure Two: Harvesting from planted production forests in New Zealand.[9]

15) This submission uses the results of a supply-based modelling of New Zealand's planted production forests. Modelling results are influenced by the yield regulation constraints applied and the assumptions used for future activities (after 2009) that may occur in the pre 1990 and post 1989 forests. In this modelling timber supply and continuance of production are combined into a scenario referred to as 'non-declining yield'. Under the non-declining yield methodology the total harvest can increase or decrease by a maximum of 10%[10] per year in response to the forests reaching a desired target harvesting

[7] Ministry of Agriculture and Forestry, 2009, *A Forestry Sector Study*, http://www.maf.govt.nz/forestry/publications/forestry-sector-study-2009/

[8] These are driven not only by overall demand but also the specific policies of other nations and how this effects the global availability of timber.

[9] A March harvest year matching the tax year in New Zealand, and is often used in reporting.

[10] This meets the continuance of supply requirement

age[11]. These limitations on the rate of change means some forest stands may be harvested early (to maintain supply), and others after the target age (if a large amount of timber is of harvestable age). The alternative approach, 'unconstrained yield', where forests are harvested as soon as they reach the target age leads to large shifts in production between years and makes projections less reliable. The non-declining yield approach has been used for many years in New Zealand for modifying future timber supply.

16) While the non-declining yield approach is useful in considering the total timber produced from all planted production forests, when we consider the harvest of the pre-1990 and post-1989 forests separately, the carbon flux projections, and implications for New Zealand's net position, become much more complex. The planting spike in the mid-1990s dominates the age class of the post-1989 forest. As these post 1989 forests approach harvest age it may lead to a decline in the pre-1990 forest harvesting rate[12]. An extreme example of this substitution can be seen in Figure thee below. The timing of the post-1989 harvest is unknown, and there is a confounding new effect of carbon pricing which makes projections even more difficult.

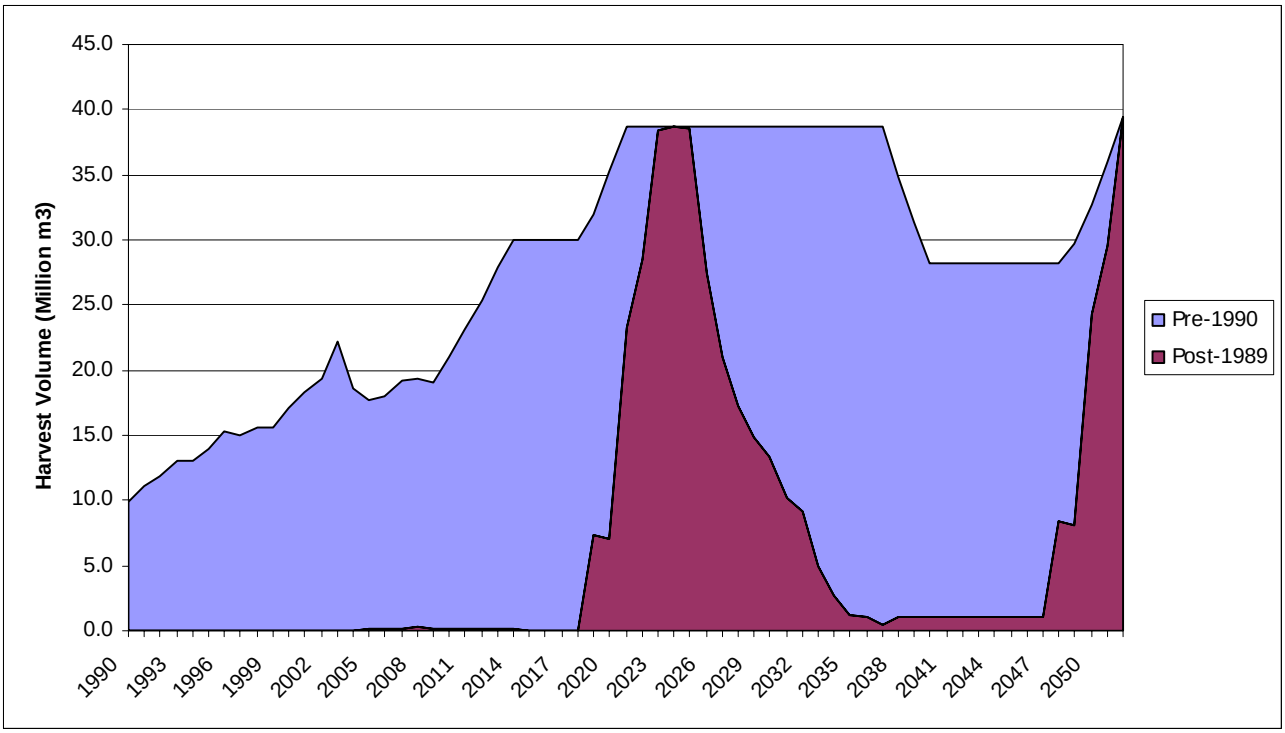


Figure Three: An example of a harvesting regime that results in large changes in the pre 1990 carbon flux due to harvesting of the post 1989 forests around age 28.

[11] This reflects the total timber supply and the age profile of the forest. Assumptions around the desired harvest age have not included the effect of carbon prices on harvesting decisions.

[12] This is due to the constraint of a maximum 10% change in timber supply and the saturation of the available harvest with post-1989 wood which is at the target harvest age

17) Figure Three is an extreme projection of the mix of pre 1990 and post 1989 timber in New Zealand's harvest at a mean age of harvest 28 years. Under this extreme scenario all post 1989 forests that becomes available for harvest is harvested displacing the pre 1990 forest harvest. This results in continued harvest of the pre-1990 forest in the 2030s as harvest age is returned to the average. Such an outcome is highly unlikely, especially given at least some post-1989 forest owners in New Zealand will be exposed to the full marginal carbon price under the New Zealand's Emissions Trading Scheme[13]. The scenarios does, however, illustrate the effect on various carbon stocks of assumptions about the mix between pre-1990 and post-1989 forest harvest.

Accounting framework for Forest Management, Article 3.4 (pre 1990) forests

18) The accounting treatment of pre-1990 (Article 3.4) forests is a key determinant of New Zealand's accounting position. There is currently a range of accounting approaches proposed for pre-1990 forest for the second commitment period. Options include:

a) Gross-net with caps (assumed existing caps for this analysis)

b) Gross-net;

c) Net-net (assumed 1990 base year for this analysis); and

d) The Bar.

Gross-net with caps

19) This considers the gross change in net carbon stock in the forests over the accounting period. However before the commitment period begins Parties, via a CMP decision, would have a limit (cap) placed on the total removals that can be credited or emissions that can be debited.

20) Gross-net with caps is the current approach to Forest Management accounting of pre-1990 forests.

Gross-net

21) This considers the change in carbon stock in the forests over the accounting period. It rewards all net removals and creates a liability if there are net emissions.

Net-net (assumed a 1990 base year)

[13] For more information on the Forestry components of the New Zealand Emissions Trading Scheme visit: http://www.maf.govt.nz/sustainable-forestry

22) This considers the net change in carbon stock in the forests over the accounting period compared to the base year or period. In New Zealand's case this is assumed to be the sequestration that occurred in 1990 for this analysis.

23) As part of the continued inventory improvement New Zealand has refined the estimates of our 1990 removals. The most recent estimate, reported in New Zealand's 2009 National Inventory Submission[14] is that our removals from forests in 1990 was 18,673Gg CO_2eqv (from all forests).

The Bar

24) To take account of New Zealand's national circumstances (especially the age class legacy) New Zealand considers the Bar, as applied to New Zealand, should represent the best estimate of carbon stock change (net emissions and removals) in the pre-1990 forest still in existence at 31 December 2012 that can be expected to occur over the next (and possibly subsequent) commitment period(s) under business as usual management. Other formulations of the Bar would be appropriate for other countries recognising their own unique circumstances.

25) As this would reflect the harvesting of these forests as business as usual management, the bar could be set as an emission for some periods. The carbon stock would be restored in subsequent periods as sequestration occurs in replanted trees, meaning that in future periods the bar could be a sequestration.

26) In the case of New Zealand we would expect that the net result of crediting and debiting would be close to zero in any given period and across multiple periods, unless there was some significant management change. A negotiated band could be applied around the bar, acting in a similar way to the caps under the 'gross net with caps' proposal. If the BAU changes in carbon stock were to occur there would be no reward, though the reward or liability for departure from BAU would be limited. Under this proposal a means to address changes in the baseline may need to be incorporated, to allow for improvements in the analysis of business as usual, methodologies and data availability[15].

Impact of different accounting rules on New Zealand's accounting

27) To illustrate the effect that different accounting approaches would have on New Zealand's accounting position we have provided the following analysis. Figure four provides a visual representation of net-stock change in New Zealand's pre-1990 forests assuming a 28year target harvest age for all forests within New Zealand. The full data table can be found in the appendix to this submission. Table 1 is a projection of the net-stock change in New Zealand's pre-1990 forests over successive five year periods. Tables 2, 3 and 4 combine this projection with the different accounting approaches to assess the impact on

[14] http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/4771.php

[15] For example, the projections within the document are based on carbon yield tables developed for our Kyoto Protocol reporting, i.e. our post-1989 forests. It is believed that the carbon yield in our pre-1990 forest will be different due to differences in site quality and silviculture regime. The LUCAS programme will be gathering information on these forests during 2010.

New Zealand's accounting position. We also provide New Zealand's first commitment period AAUs as a useful comparison with which to measure the magnitude of the impacts.

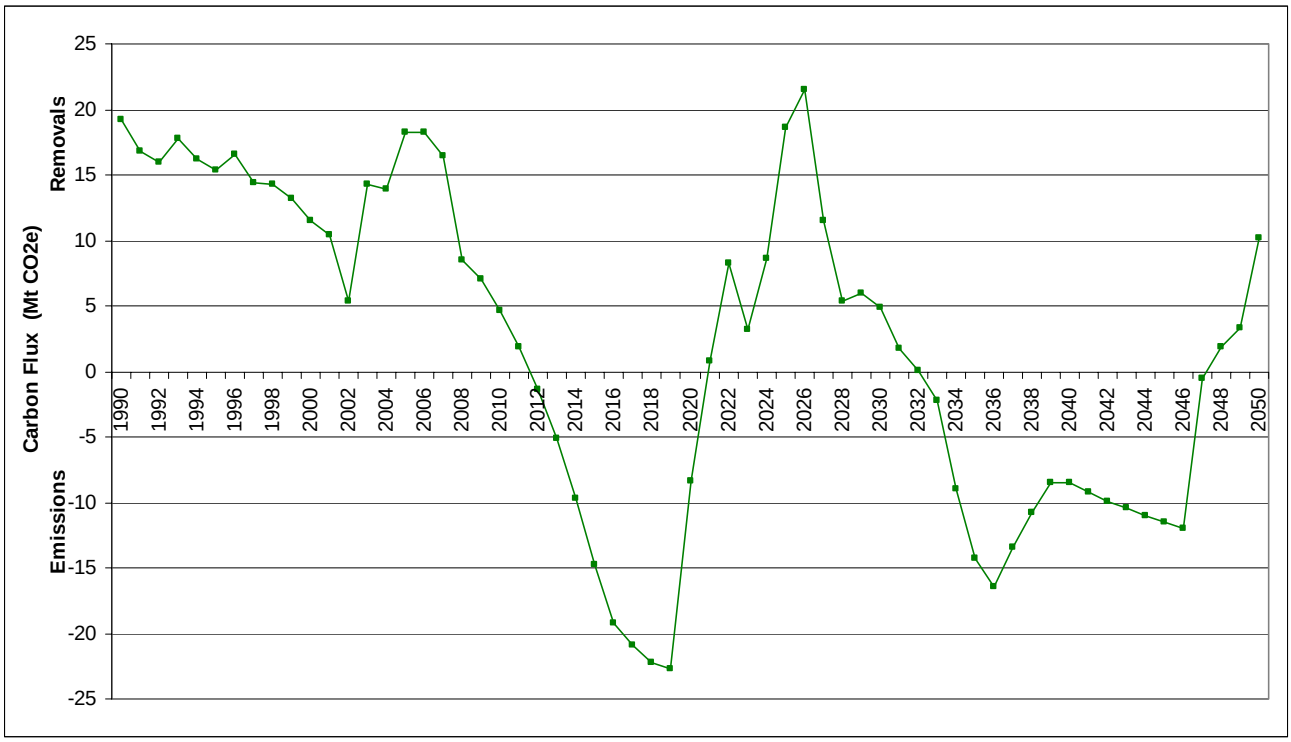


Figure Four: Projection of carbon flux in the Forest Management (Article 3.4. forests).

Table 1: Projected net stock change in *pre-1990* forests by five year period (Mt CO_2)

Period	Projected change in carbon stock
1990-2007	267.9
2008-2012	20.7
2013-2017	-69.8
2018-2022	-44.2
2023-2028	63.6

This table summaries the information found in Annex 1 to this paper, for Forest Management, and assumes a 28 year rotation period.

Table 2: Impact of different accounting rules on New Zealand's accounting position over the period *2013 to 2017* arising from pre-1990 forests (Forest Management)

Rule	Gross-net with caps (Mt CO_2e) (assuming status quo continues)[16]	Gross net (Mt CO_2e)	Net-Net (Mt CO_2e)	Bar (Mt CO_2e)
Projected change in carbon stock in pre-1990 forest	-69.8	-69.8	-69.8	-69.8
Change to Assigned Amount due to shift to net-net	NA	NA	-93.4	NA
Allowance for BAU carbon stock change under the bar	NA	NA	NA	-69.8[17]
Effect on New Zealand's net accounting position from pre-1990 forest accounting.[18]	-3.7[19]	-69.8	-163.2	0
New Zealand's AAUs in CP1 (for comparison)	309	309	309	309
Percent of CP1 AAUs	1%	23%	52%	0

[16] In the Appendix to 16CMP1 New Zealand's cap is 0.2 Mt of carbon per year. This equates to the 3.67Mt of CO_2eq
[17] An allowed reduction in the carbon stock of -69.8Mt, matching that expected in the first commitment period.
[18] A negative number means additional liabilities.
[19] Note: a negative number equates to an accounting liability

Table 3: Impact of different accounting rules on New Zealand's accounting position over the period 2018 to 2022 from *pre-1990* forests (Forest Management)

Rule	Gross-net with caps (Mt CO_2e) (assuming status quo continues)	Gross net (Mt CO_2e)	Net-Net (Mt CO_2e)	Bar (Mt CO_2e)
Projected change in carbon stock in pre-1990 forest	-44.2	-44.2	-44.2	-44.2
Change to Assigned Amount due to shift to net-net	NA	NA	-93.4	NA
Allowance for BAU carbon stock change under the bar	NA	NA	NA	-44.2
Effect on New Zealand's net accounting position from pre-1990 forest accounting	-3.67	-44.2	-140.4	0%
New Zealand's AAUs in CP1 (for comparison)	309	309	309	309
Percent of CP1 AAUs	1%	14%	45%	0%

Table 4: Impact of different accounting rules on New Zealand's accounting position over the period 2023 to 2028 from *pre-1990* forests (Forest Management)

Rule	Gross-net with caps (Mt CO_2e) (assuming status quo continues)	Gross net (Mt CO_2e)	Net-Net (Mt CO_2e)	Bar (Mt CO_2e)
Projected change in carbon stock in pre-1990 forest	63.6	63.6	63.6	63.6
Change to Assigned Amount due to shift to net-net	NA	NA	-93.4	NA
Allowance for BAU carbon stock change under the bar	NA	NA	NA	63.6
Effect on New Zealand's net accounting position from pre-1990 forest accounting	3.67[20]	63.6	-32.4	0
New Zealand's AAUs in CP1 (for comparison)	309	309	309	309
Percent of CP1 AAUs	1%	21%	10%	0%

28) Moving to net-net accounting for the period 2013-2017 would increase New Zealand's international obligations by 163.2Mt CO_2e purely as a function of New Zealand's age class legacy. The Bar approach would enable New Zealand to account more appropriately for cyclical fluctuations in emissions and removals associated with harvesting and replanting, though there would be significant care needed to ensure that updates in the science can be incorporated in the Bar calculations.

[20] A positive number means an accounting credit.

29) The results presented above are somewhat different from those in the May submission, refer figure five for a comparison. This is principally caused by refinement to the modelling of the harvesting in 2000 to 2007 to take into account the business as usual harvesting peak in 2002-2003, which then reduced. This means that the BAU harvesting dropped below projected levels, increasing sequestration and delaying the emissions for a few years, though the cyclical pattern clearly remains[21]. This can be seen on the graph below. In addition, carbon yield tables, timber yield information, area within the 1990 planted production estate and assumptions around afforestation and deforestation have also been updated since May.

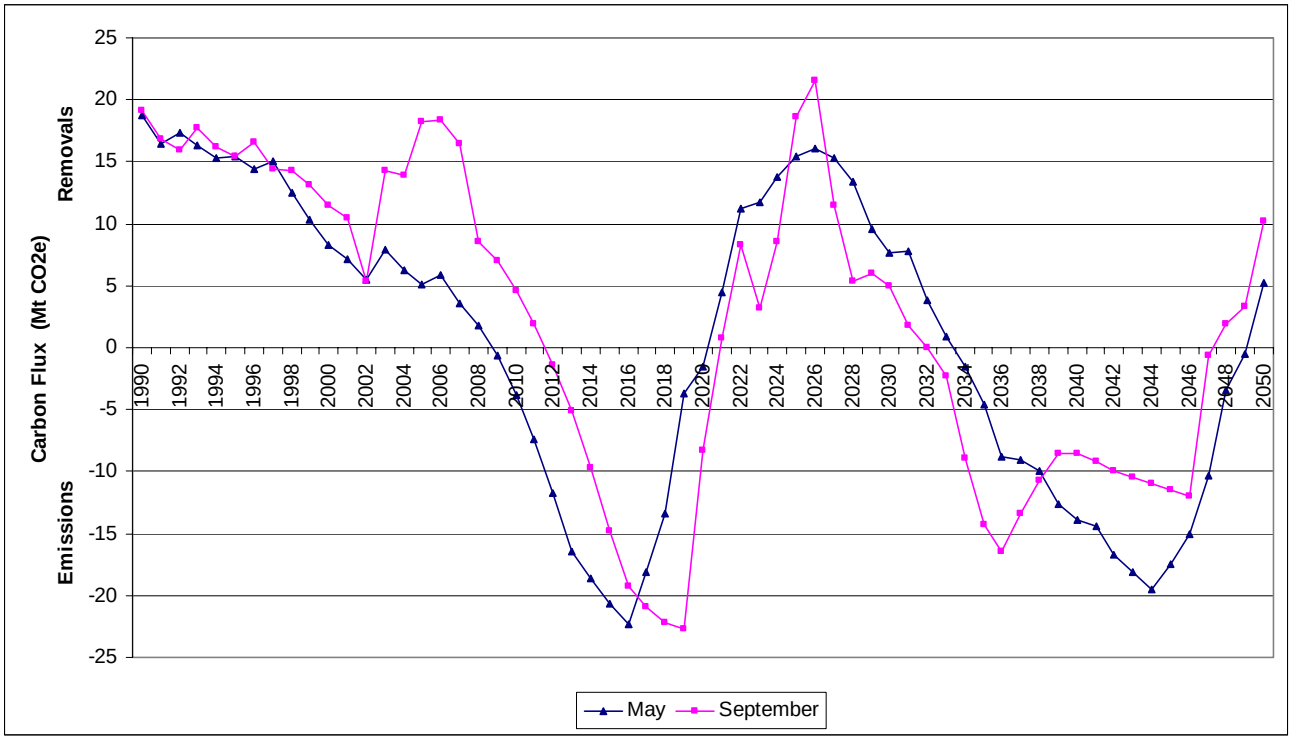


Figure five: comparison of the underlying data used in the May and September Data submissions.

Afforestation/Reforestation (Article 3.3)

30) Historically Afforestation and Reforestation has been correlated to the internal rate of return (IRR) the forest sector is expecting when the trees are planted. New Zealand currently has very low rates of afforestation by historic standards reflecting sustained low rates of returns from timber and ongoing uncertainty about the long term value of carbon credits from forests. Afforestation in New Zealand is a commercial activity driven by market rates of return. The inclusion of carbon benefits (including subsequent liabilities upon harvest) is expected to increase the IRR of new forest establishment.

[21] The annual fluctuations around 2022 to 2028 are caused by the harvest of the post 1989 forest, replacing pre-1990 forest over a short period of time,

31) Projecting afforestation rates, and therefore credits (and debits) under afforestation and reforestation, requires projecting product prices so that IRRS can be estimates. Such projections of prices have been extremely difficult. This difficulty is greatly compounded by the need to also project forest derived carbon credit prices. In addition, there has been uncertainty around the future place of forestry in the international climate change effort. Due to the time scales of the investment in forestry, consistency in the economic signals the sector receives will be very important.

32) In this modelling we consider four possible afforestation scenarios (from 2009) under assumed 'high' and 'low' carbon prices and 'high' and 'low' timber prices. We are assuming there is consistency in the treatment of forestry and the carbon and timber prices have an underlying consistency in the trends. In all of these scenarios we assume a continuous increase in afforestation above the baseline with a small amount of afforestation at the current rate (around 1,000 hectares per year).

The four afforestation rates modelled are:

		Carbon price faced by foresters	
		Low	High
Timber price	Low	5,000 new hectares year	15,000 new hectares year
	High	15,000 new hectares year	30,000 new hectares year

Note that these afforestation and reforestation rates are in addition to an assumed restocking of the harvested pre-1990 areas.

33) Emissions and sequestration from the post 1989 estate (i.e. Afforestation and Reforestation under Article 3.3) is governed not only by the amount of planting undertaken but also by the harvest age of these forests, with the age of harvest dominating the effects on carbon stocks in 2020. Figure six graphically displays the information found in the Annex.

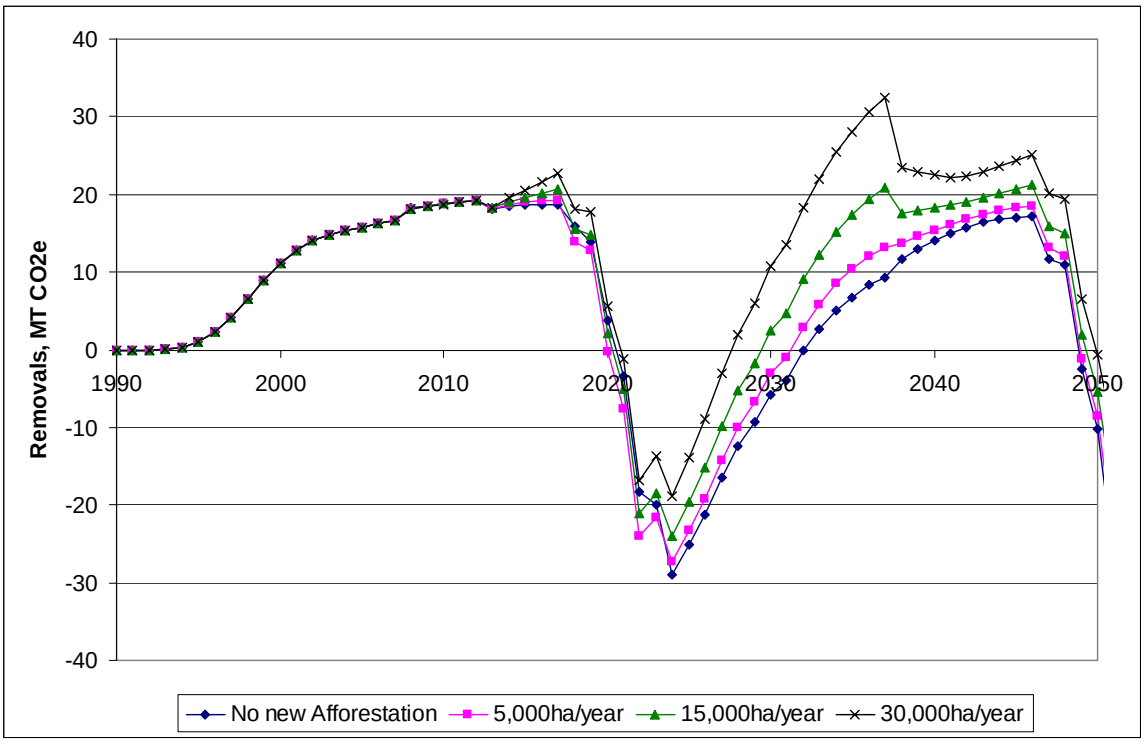


Figure 6: Effect of different afforestation/reforestation rates on removals and emissions in Afforestation and Reforestation (Article 3.3 forests).

34) As would be expected, high rates of afforestation will lead to increased sequestration. While there is little effect on the 2020 emissions under different afforestation rates as the trees are still young, there is a significant impact on the emissions from the forestry sector post 2020.

35) Changing assumed harvest ages also significantly affects net emissions or removals from the Afforestation and Reforestation. Figure seven shows a 28year rotation, consistent with the forest management modelling, though altering assumed harvest age shifts the emissions through time. At higher carbon prices and assuming a high proportion of foresters join the New Zealand Emissions Trading Scheme[22], the effect of carbon prices on harvesting decisions may be significant.

[22] Foresters who do not join the New Zealand Emissions Trading Scheme are not exposed to carbon prices and therefore are not influenced buy carbon price changes.

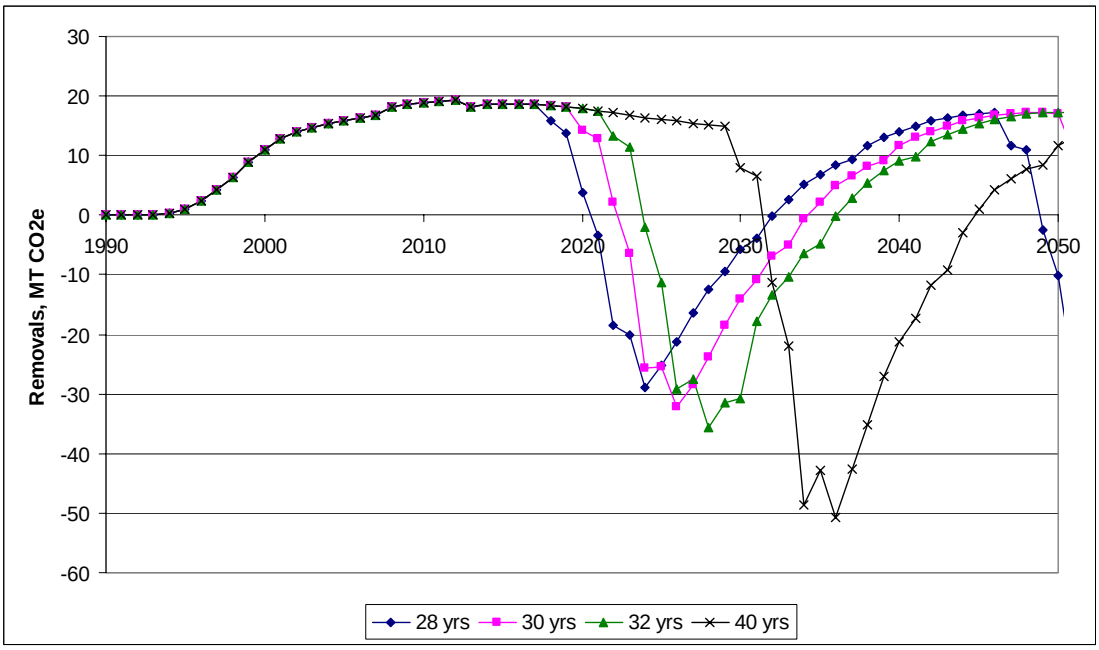


Figure Seven: Effect of different harvesting ages on the removals and emissions in Afforestation and Reforestation (Article 3.3 forests).

36) If the target age of harvest is lengthened then New Zealand's net position to 2020 is improved. However this increased sequestration is repaid when the forests are eventually harvested so the long term New Zealand net position is largely neutral. This age effect is observed at all afforestation rates. In order to illustrate the effect of harvest age this graph assumes no additional afforestation after 2009.

37) In reality the credits and debits from Afforestation and Reforestation will be heavily influenced by afforestation rates, participation rates in the New Zealand emissions trading scheme, harvest age decisions (at a stand level), timber prices and wood supply from the pre-1990 planted forests. Each of these influences is in turn driven by factors that are themselves impossible to predict with clarity, including:

a) Carbon prices

b) Timber prices

c) Fuel prices

d) The foreign exchange rate for the New Zealand dollar

e) International trade rules

f) International climate change rule negotiations

Specific proposals relating to the rules

Force Majeure/ natural disturbance

38) As New Zealand has traditionally had a low level of natural disturbance to our forests, consideration of how frequently a 'force majeure' definition may be applied, and the quantum of carbon covered, is difficult. New Zealand considers that a key criterion in applying any 'force majeure' rule would be compliance risk. New Zealand believes it unlikely, at the national level, that natural disturbance events would will lead to a 'compliance at risk' event, given the tendency for disturbance events to the relatively localised. One exception would be a major volcanic eruption.

39) Some projections[23] of the effect of climate change indicate that the risk factors[24] associated with significant disturbance may increase by the late 2080.

Harvesting and wood products

40) New Zealand's proposal for the treatment of Harvesting and Wood Products, the Emissions to Atmosphere Approach (ETA), can be found in our August 2008, February 2009 and April 2009 submissions. For projections of the effect of the rules changes we note that:

a) all carbon harvested from the forest is emitted, and accounted for. This means that considering only a single point in time as a reference for the effect of the accounting rule changes fails to capture the full impact of it.

b) the proposed accounting framework will match the tiered approach of the good practice guidance. It is proposed that tier one will mirror the current instant oxidation approach. New Zealand hopes to have a full description of the work required to include the ETA into GPG during October 2009.

c) exported timber is incorporated only when robust, verifiable information becomes available. If this information is not available exported timber must be instantly oxidised.

d) it is only applied to forests accounted for under the Kyoto Protocol (or successor)..

41) As the currently available data, particularly around product lifetime, for New Zealand is limited, our ability to project the effect of this rule change at a given point in time is also limited. Figures eight and nine show the stock changes modelled for a single hectare of the 'mean' planted production forest in New Zealand[25] and a coarse mix of products (paper, timber and raw logs). Here we

[23] E.g. http://www.maf.govt.nz/climatechange/slm/ag-production/index.htm

[24] E.g. wind (traditionally the greatest risk factor), temperature, overall water supply and variation in time, and pest species.

[25] These mean carbon per hectare values are in line with the current values, though the underlying data will likely change in response to the quality assurance and quality control processes occurring as part of the LUCAS programme

represent the non-emitted wood products as being transferred into an additional pool associated with an area of land. This, we believe, is the easiest way to visually represent the data.

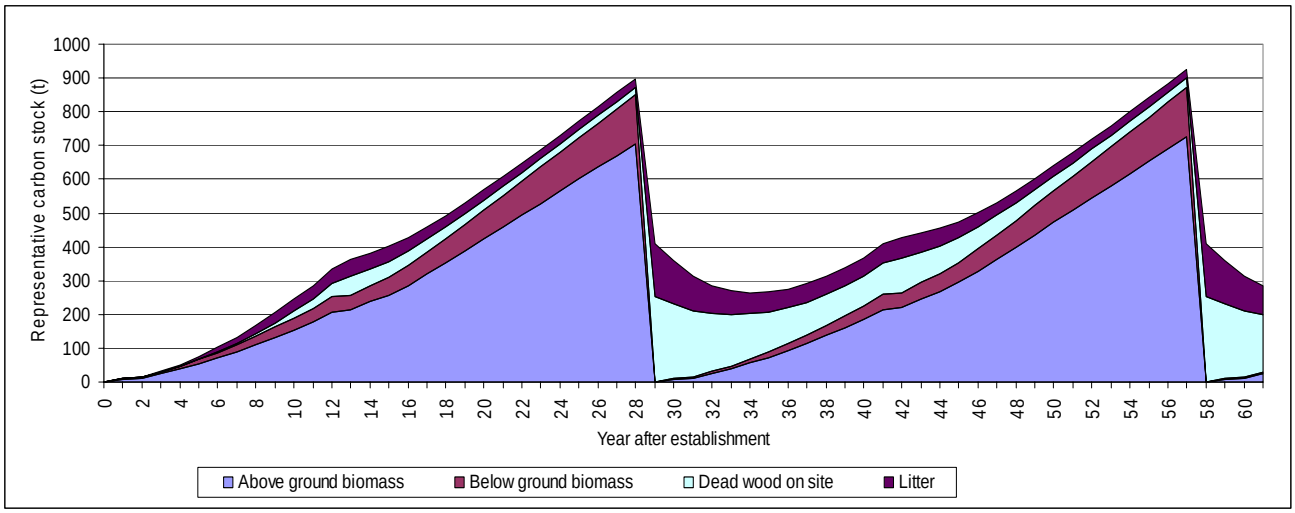


Figure 8: The current pools associated with a hectare of planted production forest, using the pools as described by the IPCC's 2003 Good Practice Guidance for Land Use, Land-Use Change and Forestry

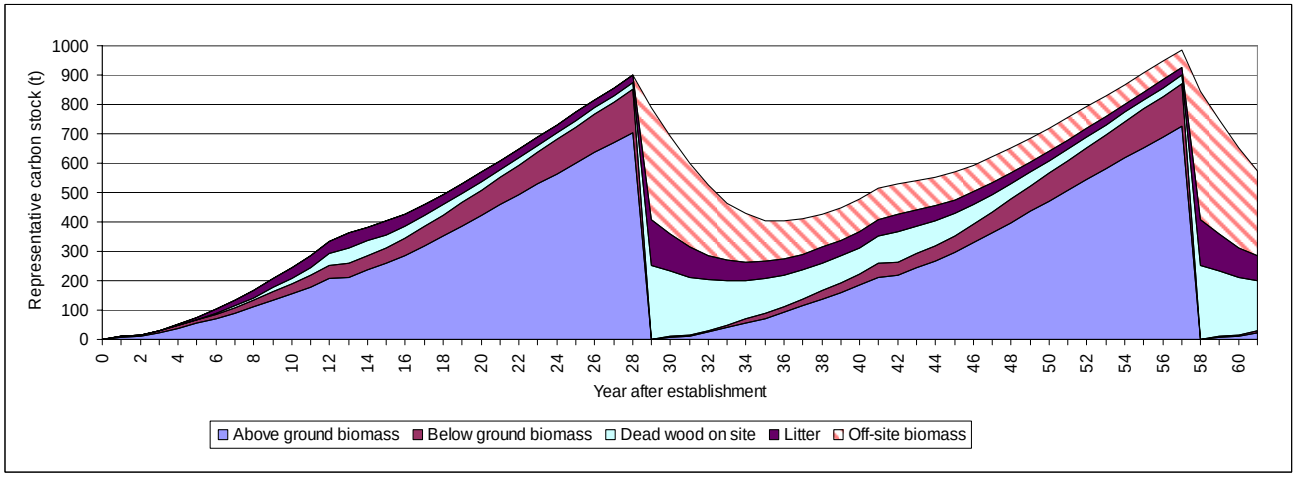


Figure 9: Visualising the ETA approach treating the Emissions to Atmosphere as an additional biomass pool associated with a hectare of planted production forest.

42) As can be seen from the previous two graphs the ETA approach, as proposed by New Zealand, does delay liabilities much beyond a single harvesting cycle, and does not build up a large pool of stored carbon. If countries wish to do this they would need to extend the in-use lifetimes of the wood products beyond BAU.

43) A nation that produces a large number of short lived products will receive little benefit from accounting for timber using the ETA approach. However there would be strong incentives to promote the shift to producing longer lived

products. This is one of four means identified in the IPCC's Forth Assessment Report as a means to reduce emissions from the forestry sector. [26]

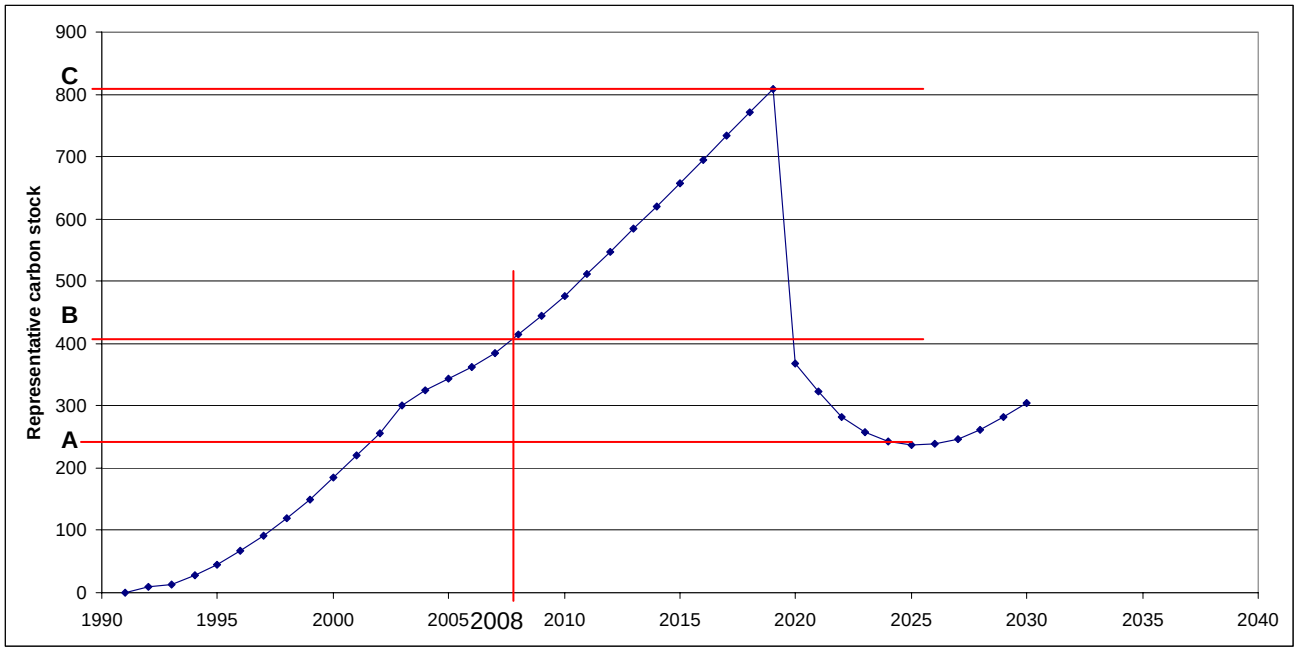
The A/R debit credit rule

44) Parties to the Kyoto Protocol receive credits for the increases in the carbon stock in trees planted after 1990, but also have to take responsibility for greenhouse gas emissions as these trees are subsequently removed via harvesting or deforestation.

45) Under the rules of the Kyoto Protocol, Parties are only credited for the amount of carbon that is removed by these additional forests since the start of the first commitment period (2008) and not for all the carbon that has accumulated in the forest since their establishment.

46) The Afforestation/Reforestation (A/R) Debit-Credit rule acts to limits liabilities that a Party faces as a result of harvesting activities in forests established since 1990. Without this rule, liabilities from these post-1990 forests could be greater than the amount of credits that are received for carbon stored in these forests.

47) Figures ten and eleven below illustrate the Afforestation/Deforestation Debit-Credit rule on a per hectare basis for a representative hectare of forest experiencing business as usual harvesting



[26] Working Group 3, Chapter 9 identifies reducing emissions from deforestation and degradation, enhancing sequestration in existing and new forests, using wood fuels as a substitute for fossil fuels and substituting wood for emissions intensive products.

Figure 10: How the Afforestation/Reforestation Debit Credit rule is applied to a stand of post 1989 forest.

48) Figure 10 shows the carbon stock within a stand of post 1989 forest, established around 1991. The stand has sequestered carbon without receiving credits to a total amount B. As amount B is above carbon stock after harvest (A) the most credits requiring to be surrendered to cover the emissions will be equal to the difference in the maximum carbon stock (C) and B. This does not create any additional credits.

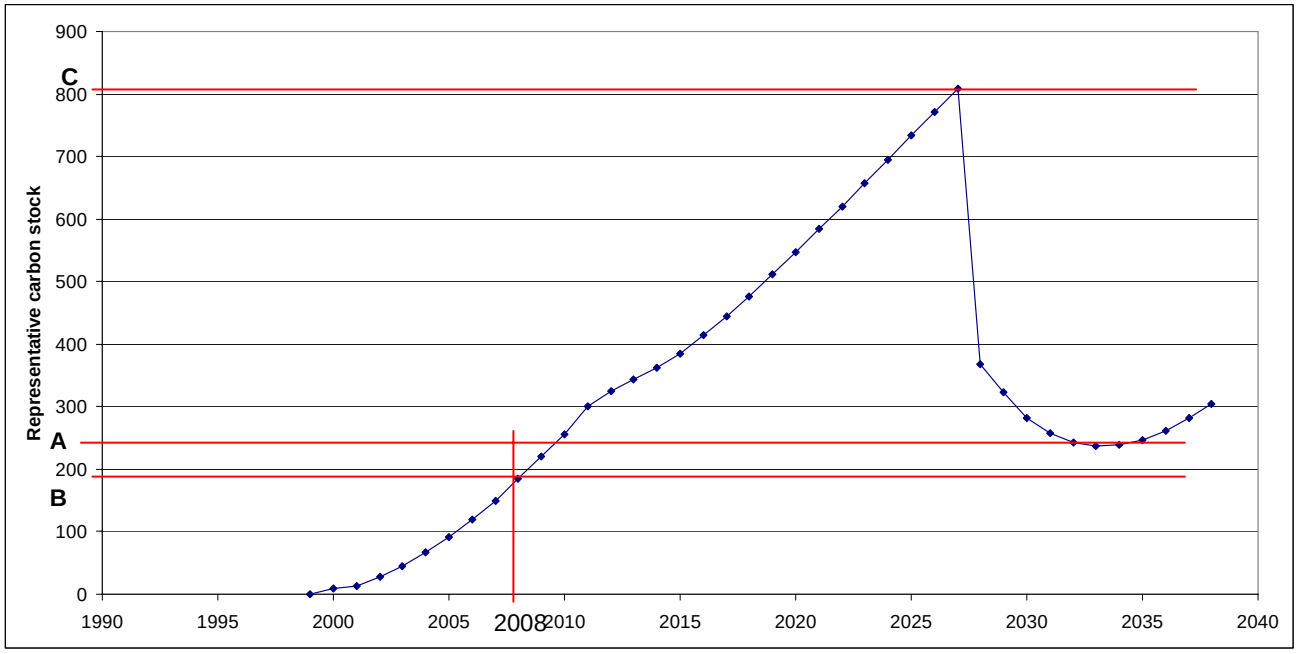


Figure 11: A hectare of post 1989 forest where the Afforestation/Reforestation Debit Credit rule is not applied.

49) Figure 11 shows the carbon stock within a stand of post 1989 forest, established around 1999. The stand has sequestered carbon without receiving credits to a total amount B. As amount B is below carbon stock after harvest (A) the number of credits received covers the emissions (the difference between the maximum carbon stock (C) and A). Afforestation/Reforestation Debit Credit rule has not been used for this area of forest.

50) Figures 10 and 11 show the application of the Afforestation/Reforestation Debit Credit is dependent on the carbon sequestered in a stand, the maximum carbon stock reached before harvest and the minimum carbon stock after harvest. Projections of the application of the Afforestation/Reforestation Debit Credit is difficult as we do not know the total carbon stocks at time of harvest (point C in the figures), as this is effected by the age of the forest at harvest, nor do we know the minimum carbon stock (point A in the figures) as this is effected by the amount of dead wood left on site, and the species the forest is replanted

in. However the Afforestation/Reforestation Debit Credit rule will never create new credits if it is applied.

Other LULUCF accounting

51) In our 2009 National Inventory Report New Zealand used a Tier 1 approach for estimating carbon in biomass for all land uses that are not planted forest. We currently lack specific information relating to the carbon flux in biomass within cropland and grazing land. New Zealand has a comprehensive programme to improve data on the carbon stock changes in these lands, which will allow a Tier 2 approach to be used once the data has passed review. The review process will take time, and data retain significant uncertainties, as New Zealand has a wide range of soil types and management practices.

52) Currently land areas are calculated using a two existing land-cover maps of New Zealand. These land-cover databases were mapped for 1997 and 2002. Data for all other years was extrapolated from the changes observed between 1997 and 2002.

53) These databases are a wall-to-wall mapping[27] of New Zealand, but they were not specifically developed for use in UNFCCC/Kyoto Protocol reporting. Currently they are the only national land-cover/land-use spatial databases available that provide recent information and that can be adapted for this purpose.

54) As part of the Land Use and Carbon Analysis System (LUCAS) New Zealand is continuing a work programme to produce land use maps for 1990 and 2008 based on satellite data which are more suitable for UNFCCC reporting. Preliminary land cover results have been published.

55) From 2008 to 2012, New Zealand will continue to add data to the LUCAS database, particularly improving the descriptions of carbon stocks associated with specific areas of land and a wide range of land uses.

56) Despite the increase in the availability of information on land use in 1990 it is unlikely that New Zealand will have sufficient data to calculate the actual soil carbon stock change in 1990 for all land uses. With regard to the 1990 baseyear when applying various accounting rules New Zealand cannot create data for carbon stock changes for 1990 for land uses other than forests.

[27] Approach 3 as described in GPG-LULUCF

Appendix: Data table of net removals in planted production forests.

57) The following table provides annual estimates of the net removals or emissions within those sub-sectors where we are able to provide projections.

58) The table does not display the uncertainty associated with these values for three reasons:

a) The uncertainty in the data before 2007 is described within our National Inventory Reports under the UNFCCC;

b) The LUCAS programme is currently improving the reporting for LULUCF under the Convention as well as enabling New Zealand to meet the supplementary reporting requirements of the Kyoto Protocol. The overall uncertainties associated with the reporting from LUCAS will be included in New Zealand's 2010 submission of the greenhouse gas inventory and will not be finalised until the true-up report.

c) The future values represent a set of scenarios based around a set of existing models and available information. These not only have uncertainties caused by methodological issues they also are contingent on assumptions of future behaviour. There is no way to provide an estimate of the size of these uncertainties, though they are likely to be large and their interactions complex.

59) Two tables are presented:

a) Forest management (pre 1990) carbon dioxide stock change

b) Afforestation and Reforestation (post 1989) carbon dioxide stock change

Forest management (pre 1990) carbon dioxide stock change (Gg)

	28year target age	30 year target age	32 year target age
1990	19,181.78	19,181.60	19,181.60
1991	16,840.03	16,839.88	16,840.29
1992	15,937.65	15,937.88	15,937.50
1993	17,717.98	17,718.21	17,718.39
1994	16,211.37	16,211.10	16,211.10
1995	15,402.32	15,402.67	15,402.26
1996	16,538.69	16,538.28	16,538.72
1997	14,375.35	14,375.35	14,375.47
1998	14,266.97	14,267.44	14,267.32
1999	13,175.54	13,175.71	13,175.83
2000	11,446.71	11,446.24	11,446.30
2001	10,421.63	10,421.63	10,421.45
2002	5,317.12	5,317.12	5,317.24
2003	14,270.73	14,270.61	14,270.67
2004	13,856.05	13,856.28	13,856.58
2005	18,201.86	18,202.21	18,201.74
2006	18,312.30	18,311.70	18,311.55
2007	16,457.80	16,453.94	16,456.52
2008	8,535.37	10,513.55	9,666.78
2009	7,030.25	8,008.84	7,326.28
2010	4,612.09	4,979.82	4,125.47
2011	1,878.41	1,422.28	3,730.27
2012	-1,394.15	-3,152.95	2,440.94
2013	-5,085.20	-4,657.43	3,096.30
2014	-9,748.67	-6,597.68	2,677.69
2015	-14,814.75	-7,129.70	1,648.09
2016	-19,231.42	-7,001.17	1,520.23
2017	-20,963.43	-7,160.65	-649.49
2018	-22,187.46	-7,277.18	-1,209.68
2019	-22,696.74	-6,669.02	-314.59
2020	-8,351.73	1,726.25	-1,313.19
2021	785.26	-1,622.64	-5,007.58
2022	8,242.60	14,007.69	913.25
2023	3,237.04	17,826.69	-2,228.61
2024	8,608.91	26,978.34	14,088.62
2025	18,668.57	29,175.11	18,264.10

Afforestation and Reforestation (post 1989) carbon dioxide stock change (Gg)

	28year harvest age	28year harvest age	28year harvest age	28year harvest age	30year harvest age	32year harvest age	40year harvest age
Afforestation after 2010 (ha per year)	0	5,000	15,000	30,000	0	0	0
1990	-816.77	-816.77	-816.77	-816.77	-816.77	-816.77	-816.77
1991	-829.06	-829.06	-829.06	-829.06	-829.06	-829.06	-829.06
1992	-828.77	-828.77	-828.77	-828.77	-828.77	-828.77	-828.77
1993	-735.52	-735.52	-735.52	-735.52	-735.52	-735.52	-735.52
1994	-441.55	-441.55	-441.55	-441.55	-441.55	-441.55	-441.55
1995	247.75	247.75	247.75	247.75	247.75	247.75	247.75
1996	1,498.02	1,498.02	1,498.02	1,498.02	1,498.02	1,498.02	1,498.02
1997	3,345.09	3,345.09	3,345.09	3,345.09	3,345.09	3,345.09	3,345.09
1998	5,637.26	5,637.26	5,637.26	5,637.26	5,637.26	5,637.26	5,637.26
1999	8,043.07	8,043.07	8,043.07	8,043.07	8,043.07	8,043.07	8,043.07
2000	10,257.62	10,257.62	10,257.62	10,257.62	10,257.62	10,257.62	10,257.62
2001	12,003.80	12,003.80	12,003.80	12,003.80	12,003.80	12,003.80	12,003.80
2002	13,221.53	13,221.53	13,221.53	13,221.53	13,221.53	13,221.53	13,221.53
2003	14,067.94	14,067.94	14,067.94	14,067.94	14,067.94	14,067.94	14,067.94
2004	10,939.42	10,939.42	10,939.42	10,939.42	10,939.42	10,939.42	10,939.42
2005	6,633.27	6,633.27	6,633.27	6,633.27	6,633.27	6,633.27	6,633.27
2006	7,178.92	7,178.92	7,178.92	7,178.92	7,178.92	7,178.92	7,178.92
2007	2,589.03	2,589.03	2,589.03	2,589.03	2,589.03	2,589.03	2,589.03
2008	16,745.05	16,742.03	16,735.98	16,726.90	16,745.05	16,745.05	16,745.05
2009	17,072.01	17,062.93	17,044.78	17,017.56	17,072.01	17,072.01	17,072.01
2010	17,343.31	17,329.10	17,300.68	17,258.06	17,343.31	17,343.31	17,343.31
2011	17,577.39	17,562.43	17,532.51	17,487.63	17,577.39	17,577.39	17,577.39
2012	17,801.01	17,799.16	17,795.46	17,789.90	17,801.01	17,801.01	17,801.01
2013	18,076.53	18,125.94	18,224.76	18,372.98	18,076.53	18,076.53	18,076.53
2014	18,569.91	18,725.50	19,036.68	19,503.45	18,569.91	18,569.91	18,569.91
2015	18,694.47	19,004.89	19,625.73	20,557.00	18,694.47	18,694.47	18,694.47
2016	18,699.92	19,194.99	20,185.14	21,670.35	18,699.92	18,699.92	18,699.92
2017	18,605.36	19,288.28	20,654.10	22,702.84	18,605.36	18,605.36	18,605.36
2018	15,904.05	16,760.84	18,474.42	21,044.78	18,419.59	18,419.59	18,419.59
2019	13,824.85	14,834.10	16,852.60	19,880.35	18,182.64	18,182.64	18,182.64
2020	3,813.08	4,960.11	7,254.16	10,695.24	14,327.84	17,885.00	17,885.00
2021	-3,345.57	-2,061.46	506.75	4,359.07	12,787.46	17,571.92	17,571.92
2022	-18,366.36	-16,941.45	-14,091.65	-9,816.94	2,100.70	13,345.12	17,204.50
2023	-20,012.42	-18,440.91	-15,297.88	-10,583.34	-6,467.67	11,408.76	16,800.58
2024	-28,989.40	-27,264.27	-23,813.99	-18,638.59	-25,753.99	-2,051.01	16,379.57
2025	-25,164.70	-23,280.34	-19,511.60	-13,858.49	-25,454.41	-11,216.66	16,026.34