Projected balance of emissions units during the first commitment period of the Kyoto Protocol

and

Appendix B: Methodology report for forest sink projections as provided by the Ministry of Agriculture and Forestry

Extracted from

http://www.climatechange.govt.nz/resources/reports/projected-balance-emissions-jun06/html/page7.html and

http://www.climatechange.govt.nz/resources/reports/projected-balance-emissions-jun06/html/page12.html

5 Projected removal units from forest sinks

Removals of carbon dioxide via forest sinks is a key component in how Parties can meet their commitments under the Kyoto Protocol. New Zealand is in a relatively unique situation having planted a substantial area of forest since 1990. It is estimated that between 1990 and 2005 675,000 hectares of new plantation forest have been established as a result of afforestation and reforestation activities.

Projected removals from the land use, land-use change and forestry sector are based on data and assumptions from the Ministry of Agriculture and Forestry and the Ministry for the Environment. The forest carbon modelling was undertaken by Ensis (formerly Forest Research). The underpinning science incorporated in the forest carbon models used in these projections, along with scientific assumptions, come from work carried out by Ensis and Landcare Research.

Forecasting is a challenging task. Forecasts are greatly influenced by prevailing conditions and those that have existed over the last one to two years. As described below the economic and policy environment in which New Zealand forest owners have been operating has been changeable. This makes forecasting the future less certain than when a stable operating environment prevails.

These forest sink projections cover the likely range of the major contributing factors to land use, land-use change and forestry sector removals and emissions (forest sinks) based on the current economic environment, policy settings and the state of scientific knowledge.

5.1 Forest sector operating environment

The New Zealand forest growing sector has seen difficult trading conditions over the last three to four years. A high exchange rate, increasing costs, particularly shipping costs, along with competitive and changing international markets have adversely affected forest growing profitability in New Zealand. In addition there has been the largest number of forest sales since state forest privatisation in the late 1980s. There is now a greater separation between forest ownership and land ownership than has been the case historically. Land owners are looking to maximise value from the land by realising some of the increased land value through forest land sales. Livestock farmers are currently prepared to pay higher land prices than commercial forest owners. The net result of these changes and a somewhat uncertain future has led to:

- A significant decline in the rate of afforestation. Afforestation has fallen from a 30-year annual average (1974 to 2004) of 43,000 hectares to just 6,000 hectares in the year to December 2005.
- The new phenomenon of deforestation where plantation forest land is converted to alternative land uses, particularly pastoral grazing. In the year ended March 2005, an estimated 7,000 hectares of deforestation occurred. Historically there has been little plantation deforestation.

A climate change policy review was undertaken by the Government in the second half of 2005. While policy changes have been signalled, at this point climate change policy development is still underway. These projections do not account for future changes to climate change policy settings and are based largely on prevailing policy.

5.2 Forest model description

Projected forest sink removals were calculated using a simulation model of the Kyoto forest estate. The model was based on a carbon yield table which describes the per-hectare carbon stock at each age for a typical Kyoto forest stand. To calculate the carbon stock in a given year, values in the yield table are multiplied by the net stocked forest area at the corresponding age, and then summed. The distribution of areas by age class is defined by the new planting rate - the simulation advances these areas through annual time periods (1990 to 2012). Net carbon uptake is calculated as the stock change in the first commitment period.

5.3 Scenarios and results

Most likely, upper and lower scenarios have been used to quantify the likely range of carbon dioxide removals by forests and carbon dioxide emissions from deforestation during the first commitment period.

Table 7 represents current efforts to quantify the likely range of the major contributing factors to estimating LULUCF sector removals and emissions. The scenarios attempt to anticipate the results from when the New Zealand Carbon Accounting System (NZCAS) is in operation. The progressive implementation of the NZCAS will replace and likely revise all values reported in Table 7.

Table 7: Calculation of projected removal units during the first commitment period

Projected removal units	Mt CO_2-e		
	Upper	Base	Lower
Total removals from simulations combined in model	**60.4**	**78.2**	**114.5**
Projected deforestation emissions	38.5	21.0	6.3
Net removals (RMUs)	**21.9**	**57.2**	**108.2**
Effects of different input assumptions			
Total sequestration under different planting rates (0, 5k, 20k ha/yr)	95.4	96.6	98.0
Factor adjustments to total sequestration (see assumptions below for details)			
Kyoto forest growth rates	-9.7	0.0	29.5
Soil carbon change with afforestation	-9.5	-3.0	0.0
Planted forest not meeting the Kyoto Forest definition (Ineligible Kyoto Protocol planting)	-20.3	-15.5	-7.7

Note: Factor adjustments to total sequestration do not add to total removals because assumptions have been combined in the model to account for the interrelationships between the assumptions. For further details see Appendix B.

A large source of uncertainty for carbon removals by forest sinks is due to uncertainty around the value to apply for growth rates (of Kyoto Forests). The uncertainty range suggests some scope for higher carbon sequestration due to higher forest growth rates than currently assumed in the most likely scenario. The current most likely scenario uses data on growth rates from older (non-Kyoto) forests. Post-1990 forests may be more

productive than older (non-Kyoto) forest due to improved knowledge of forest management, more fertile soils and improved genetic stock. The true growth rate for post-1990 forest will be better known once the New Zealand Carbon Accounting System is fully operational, and permanent plots have been installed and measured in the Kyoto forests.

Another key source of uncertainty is the value used for soil carbon losses from afforestation. Current research is showing that when a new forest is planted there is a loss of soil carbon. The lower case is there is no loss of soil carbon, however there is downside potential for soil carbon losses due to afforestation that has to be accounted for in the treatment of uncertainty. The range around soil carbon losses from afforestation represents a source of uncertainty in these projected carbon removals.

Any new forest planted from 2005 onwards will only have a small impact on total carbon removals during the period 2008 to 2012 because newly planted forest will not absorb as much carbon as forests that are a few more years into their life cycle. Hence the results are not particularly sensitive to varying the planting rate assumptions for new forests.

5.4 Forestry assumptions

Further details on these assumptions are contained in Appendix B of this report.

Kyoto forest growth rates

The most likely scenario uses a national carbon yield table developed from the National Exotic Forest Description (NEFD) yield table database.

The NEFD yield tables better represent the growth of forests on traditional forestry sites. The generally held view is that post-1990 plantation stands have higher growth rates than earlier plantings.

Analysis of forest growth data suggests that fully stocked stands planted after 1990 show a 15-35 percent improvement in productivity over stands currently being harvested, as a result of genetic improvement, better site quality and improved forest management. The upper end of this range was used to develop the lower scenario, which is based on a growth model projection for pruned radiata pine growing on an ex-pasture site. Compared with the NEFD-based yield table, the high yield table has:

- higher volume at maturity
- lower carbon for a given volume (trees on fertile ex-pasture sites have lower wood density and therefore carbon content)
- higher rate of growth in the second half of the rotation.

The upper scenario yield table was set at 10 percent lower than the NEFD yield table. This assumed:

- no increase in volume productivity over stands currently harvested
- no reduction in wood density (and therefore carbon) due to ex-pasture sites

- same pattern of growth as assumed by the NEFD derived yield table.

The growth rate scenarios are broadly indicative only. Accurate modelling of forest carbon removals requires representative sampling of the post-1990 forests. This will not be available until a representative plot network has been established and measured in New Zealand's Kyoto Forests.

Planting rate

The most likely estimate in the May 2005 projection report was based on a planting rate of 10,000 hectares per year. It is provisionally estimated that 6,000 hectares were planted in 2005. The assumptions for planting rates used in this projection are shown in Table 8. The average planting rate over the last thirty years has been 43,000 hectares per year. A future afforestation rate of 5,000 hectares per year is low in the historical context.

Table 8: Afforestation rate assumptions (hectares)

Calendar year	Upper	Base	Lower
2005(p)	6,000	6,000	6,000
2006	0	5,000	5,000
2007	0	5,000	10,000
2008	0	5,000	15,000
2009	0	5,000	20,000
2010	0	5,000	25,000
2011	0	5,000	30,000
2012	0	5,000	35,000
Average	0	5,000	20,000

P Provisional estimate for 2005

Soil carbon

A loss of 3.0 Mt CO_2 (range 0 to -9.5 Mt CO_2) is included for a loss of soil carbon through the afforestation of "grassland". This is based on research by Landcare Research. Landcare Research was commissioned to review the loss of soil carbon and this value has been revised from last year's most likely estimate of -2.2 Mt CO_2. The most likely scenario assumes a loss of soil carbon following afforestation of 4.7 tonnes carbon per hectare over a 20-year period.

Ineligible Kyoto Protocol planting

A loss of 15.5 Mt CO_2-e is included for plantation forests planted into existing forest. Field studies and a national analysis in a geographic information system have suggested that a proportion of existing planted forests, estimated at up to 16 percent nationally, were

planted in scrub that could meet the definition of forest in the Kyoto Protocol, ie, the planting was not onto "grassland". There is anecdotal evidence that the ineligible Kyoto Protocol planting estimates may be too high; however, in the absence of better quantitative evidence the more conservative estimate has been retained. Better estimates will not be known until the NZCAS is in operation. The upper and lower estimates use estimates of 21 percent and 8 percent of forests being planted in existing forest as well as new forest planted from 2006 onwards.

Deforestation

At the time of these projections, the deforestation cap is Government policy. Based on this the cap of 21.0 Mt CO_2 has been used for the base scenario. The upper scenario assumes an emission liability of 38.5 Mt CO_2. This is based on a deforestation intentions survey completed in December 2005. The results from this survey indicated that under current conditions, forest owners intended to deforest about 47,000 hectares during the first commitment period (2008-12). This scenario allows for the removal of the deforestation cap and for current market conditions to prevail. The calculation of 38.5 Mt CO_2 is based on all deforestation being mature forest and all emissions being instantly emitted.

The projections include a lower scenario of 6.3 Mt CO_2 to show the effect of changes in either forest policy or improved forest growing profitability. In absence of any better figure the lower scenario is based on 1,500 hectares of deforestation each year, slightly higher than the historical deforestation rate.

No allowance has been made for deforestation of indigenous forest or shrub land that meets New Zealand's adopted Kyoto forest definition. Under current legislation (eg, Resource Management Act 1990, Forests Act 1949 amended 1993) and/or codes of practice (eg, The New Zealand Forest Accord), any significant deforestation of indigenous forest is, in practice, difficult to do.

Other assumptions

These projections assume an average harvest age of 28 years. Harvesting forest stands younger than 22 years old prior to 2012 would result in harvesting emissions during the first commitment period. These have not been accounted for in these projections.

5.5 Impact of the Permanent Forest Sinks Initiative

The Permanent Forest Sink Initiative (PFSI) provides an opportunity for landowners to establish permanent forest sinks and obtain tradable Kyoto Protocol compliant emission units in proportion to the carbon sequestered in their forests.

At the time of writing this report the Climate Change Response Amendment Bill had passed its first reading in Parliament and had been reported back from Select Committee. If the Bill proceeds through its final Parliamentary stages, regulations will need to be developed for the PFSI to become operational.

There is potential for some of the existing Kyoto-compliant forests to enter the Permanent Forest Sink Initiative. Any switching of these forests to the Permanent Forest Sink Initiative will result in the devolution of those credits and their removal from the Crown's balance of units. However, given the various risks and uncertainties associated with the initiative that existing forest owners will need to consider, it is not possible to provide an estimate of the area of existing forest that might switch to the Permanent Forest Sink Initiative at this stage.

5.6 Current data limitations

There are acknowledged weaknesses in some of the data used in these LULUCF sector projections due to information gaps and scientific uncertainty.

The National Exotic Forest Description database and Land Cover Database continue to be used for projecting forest sink carbon dioxide removals until the NZCAS becomes operational. The NEFD database was designed to forecast future wood supply, not for forest carbon accounting purposes. Much of the information required for carbon accounting purposes is currently unavailable. The NEFD describes the pre-1990 forests, where the ownership is dominated by larger forest growers' forests well. NEFD information on the plantation forests established since 1992 by a large number of smaller-scale forest owners is of poorer quality.

With funding confirmed for the further development of the NZCAS in August 2005, the Ministry of the Environment commenced implementing the NZCAS during the 2005/06 year. The NZCAS is being designed to provide robust land use, land-use change and forestry sector inventory data specifically for Kyoto carbon accounting purposes. This is a long-term, large-scale project that will take some years before being fully operational. In protest over Government's climate change policies, forest owners currently have a ban on the installation of forest carbon inventory plots in their forests. This has delayed the implementation of some NZCAS work streams. Delays in implementing the NZCAS will mean that it will take longer to reduce the uncertainty of some elements of estimating and projecting land use, land-use change and forestry carbon dioxide removals and emissions.

There is still scant information on forest carbon stocks and fluxes in New Zealand's 6.5 million hectares of indigenous forest and 2.6 million hectares of shrubland.

5.7 Accounting for Article 3.4 forest management

Under Article 3.4 of the Kyoto Protocol, New Zealand has until 2007 to elect which additional Article 3.4 land use, land-use change and forestry activities, if any, it wishes to account for in the first commitment period. The election of these activities is voluntary for Annex I parties. Forest management is one such activity and would include accounting for emissions and removals from forests not eligible under Article 3.3 over the first commitment period. The Government has agreed in principle not to account for these activities in the first commitment period. However, a final decision will not be made until closer to 2007, when further information is available.

At present, there is considerable uncertainty in the data on carbon stocks and carbon stock changes for forest land. The available data suggest that carbon stocks are likely to be in a steady state or a slight decline. An assessment of the significance to New Zealand of Article 3.4 forest management activities concluded that the balance lay somewhere between -92 Mt CO_2-e to 11 Mt CO_2-e over the first commitment period. New Zealand is also subject to a cap of 1.0 million tonnes carbon (equivalent to 3.67 million tonnes carbon dioxide equivalent) for Article 3.4 forest management activities during the first commitment period.

Whether New Zealand will be obliged to account for such activities in subsequent commitment periods is a matter for future international negotiations. If New Zealand is obliged to account for pre-1990 forests and these forests are in fact losing carbon, then this would add to New Zealand's emissions liabilities.

Appendix B: Methodology report for forest sink projections as provided by the Ministry of Agriculture and Forestry

Projected removals from the land use, land-use change and forestry sector (2008-2012)

a. Introduction

This appendix provides forecast projections of carbon dioxide removals and emissions from New Zealand's land use, land-use change and forestry (LULUCF) sector. These projections are based on data and models used in the latest greenhouse gas (GHG) inventory submitted to the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat on 13 April 2006.

The UNFCCC GHG inventory estimates New Zealand's GHG emissions and removals for the period 1990 to 2004. This report provides scenario-based forecasts (projections) of removals and emissions for the LULUCF sector for the period 2008 to 2012. The projections are based on the best available information as at May 2006.

Projected removals from the LULUCF sector are based on data and assumptions from the Ministry of Agriculture and Forestry (MAF) and the Ministry for the Environment (MfE). The carbon modelling was undertaken by Ensis (formerly Forest Research). The underpinning science incorporated in the forest carbon models used in these projections, along with scientific assumptions, come from work carried out by New Zealand's Crown Research Institutes, predominantly Ensis Research and Landcare Research.

Forecasting is a challenging task. Forecasts are greatly influenced by prevailing conditions and those that have existed over the last one to two years. As described below the economic and policy environment in which New Zealand forest owners have been

operating has been changeable. This makes forecasting the future more uncertain than when a stable operating environment prevails.

In order to incorporate scientific uncertainty, knowledge gaps and the range of possible future outcomes (particularly for afforestation and deforestation), a scenario-based approach has been used. The scenarios presented are upper, base and lower. These scenarios are today's best attempt to cover the likely range of the major contributing factors to estimating LULUCF sector removals and emissions based on the current economic environment, policy settings, knowledge of land-use patterns, and the state of scientific knowledge.

b. Operating environment

The last three to four years have been difficult for the New Zealand forest-growing sector. A high exchange rate, increasing costs, particularly shipping costs, along with competitive and changing international markets have adversely affected forest growing profitability in New Zealand.

There has been the largest volume of forest sales since state forest privatisation in the late 1980s. New Zealand's two largest corporate forestry companies (Fletcher Challenge and Carter Holt Harvey) have both sold forests. In the case of Fletcher Challenge all forests were sold. The pattern of forest ownership is changing. With Weyerhaeuser announcing the sale of its Joint Venture Nelson forests and the recent sale of Carter Holt Harvey to the Rank Group, further changes are anticipated. Superannuation funds and timber investment management organisations (TIMOs) have purchased large areas of plantation forests in New Zealand. TIMOs now own around 20 percent of the total planted forest area in New Zealand.

There is now greater separation between forest ownership and land ownership than has been the case historically. Land owners are looking to realise some of the increased land value through forest land sales. In some locations pastoral farmers are currently willing to pay higher prices for land than commercial forest owners.

The net result of all of these changes along with an uncertain future has led to:

- A major decline in the rate of afforestation. Afforestation has fallen from a 30-year annual average (1974 to 2004) of 43,000 ha to just 6,000 ha in the year to December 2005.

- The new phenomenon of deforestation where plantation forest land is converted to alternative land uses, particularly pastoral grazing. In the year ended March 2005, an estimated 7,000 hectares of deforestation occurred. This was predominantly in the Central North Island and Canterbury regions. Historically, little plantation deforestation has occurred.

On the policy side there has been strong opposition from the forest industry towards Government's climate change and forest policies. This is likely to have had both real and perceived impacts on forest growing investment decisions.

A climate change policy review was undertaken by the Government in the second half of 2005. While policy changes have been signalled, at this point climate change policy development is still underway. These forecasts do not account for future changes to

climate change and forest policy settings; the projections are based on the prevailing policy settings as of the time of publication.

c. Forest model description

Projected forest sink removals were calculated using a simulation model of the Kyoto Forest estate. The model was based on a carbon yield table which describes the per-hectare carbon stock at each age for a typical Kyoto forest stand. To calculate the carbon stock in a given year, values in the yield table are multiplied by the net stocked forest area at the corresponding age, and then summed. The distribution of areas by age class is defined by the new planting rate - the simulation advances these areas through annual time periods (1990 to 2012). Net carbon uptake is calculated as the stock change in the first commitment period.

d. Projection results

Table 1 provides a breakdown of the major contributing factors on which the removal and emission forecasts are based.

Removals from the LULUCF sector for the period 2008 to 2012 are projected to be in the range of 60.4 Mt CO_2-e to 114.5 Mt CO_2-e. The base scenario is projected to be 78.2 Mt CO_2-e. Emissions from forecast deforestation for the period 2008 to 2012 are projected to be in the range of 6.3 Mt CO_2-e to 38.5 Mt CO_2-e. Current Government policy is to cap its liability for deforestation of pre-1990 forests at 21.0 Mt CO_2-e.

Table 1: LULUCF projected CO_2 removals and emissions (Mt) in CP1 (2008-2012)

Contributing factor	**Upper scenario**	**Base scenario**	**Lower scenario**
Total removals from simulations in combined model 1	60.4	78.2	114.5
Less deforestation emissions	-38.5	-21.0 (cap)	-6.3
Removals less deforestation emissions	**21.9**	**57.2**	**108.2**
Removals based on afforestation only	**Upper scenario**	**Base scenario**	**Lower scenario**
Kyoto planted forest CO_2 removals (based on existing 675,000 ha)	95.4	95.4	95.4

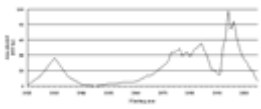
Future afforestation (2006 to 2012) (0, 5k, 20k ha/yr)	0	1.2	2.7
Adjustment factors (see assumptions below for further details)			
Kyoto forest growth rates	-9.7	0	+29.5
Soil carbon change with afforestation	-9.5	-3.0	0
Ineligible planting	-20.3	-15.5	-7.7
Total removals from simulations in combined model [The combined model results account for interrelationships between adjustment factors (growth rates, new planting, soil carbon changes, over planting, and scrub clearance during site preparation). The removals attributed to each factor are not additive, because some factors are correlated. For example, the impact of soil carbon decline due to afforestation is -3.0 Mt CO_2 under the base new planting assumption, but falls to -2.5 Mt CO_2 under the base over-planting scenario, because the area planted is reduced. Three separate simulations were run using all of the upper, base and lower assumptions respectively to produce the combined model results.]	**60.4**	**78.2**	**114.5**

e. Assumptions

Future afforestation (plantations)

The average new planting rate over the last 30 years has been 43,000 hectares per year. In the period 1992 to 1998 new planting rates were high; during this period new planting averaged 69,000 hectares per year. Since 1998 new planting has declined. Afforestation in 2005 was 6,000 ha, down from 10,600 ha the year before and the lowest level since 1960.

Fig 1: New forest planting (1920 to 2005)



See figure at its full size (including text description).

Table 2 below shows the afforestation rates used in the 2006 projections.

Table 2: Future plantation afforestation (hectares)

Calendar year	Upper	Base	Lower
2005(p)	6,000	6,000	6,000
2006	0	5,000	5,000
2007	0	5,000	10,000
2008	0	5,000	15,000
2009	0	5,000	20,000
2010	0	5,000	25,000
2011	0	5,000	30,000
2012	0	5,000	35,000
Average	0	5,000	20,000

P Provisional estimate for 2005

The upper scenario assumes no further afforestation occurs after 2005. The base scenario assumes annual afforestation of 5000 hectares. The lower scenario assumes average afforestation of 20,000 hectares per year between 2006 and 2012.

Growth rates (plantations)

The base scenario uses a national carbon yield table developed from the National Exotic Forest Description (NEFD) yield table database.

The NEFD yield tables better represent the growth of forests on traditional forestry sites. The generally held view is that post-1990 plantation stands have higher growth rates than earlier plantings.

Analysis of forest growth data suggests that fully stocked stands planted after 1990 show a 15-35 percent improvement in productivity over stands currently being harvested, as a result of genetic improvement, better site quality and improved forest management. The upper end of this range was used to develop the lower scenario, which is based on a growth model projection for pruned radiata pine growing on an ex-pasture site. Compared with the NEFD-based yield table, the lower yield table has:

- higher volume at maturity
- lower carbon for a given volume (trees on fertile ex-pasture sites have lower wood density and therefore carbon content)
- a higher rate of growth in the second half of the rotation.

The upper scenario yield table was set at 10 percent lower than the NEFD yield table. This assumed:

- no increase in volume productivity over stands currently harvested
- no reduction in wood density (and therefore carbon) due to ex-pasture sites
- the same pattern of growth as assumed by the NEFD derived yield table.

The growth rate scenarios are broadly indicative only. Accurate modelling of forest carbon removals requires representative sampling of the post-1990 forests. This will not be available until a representative plot network has been established and measured in New Zealand's Kyoto forests.

Soil carbon changes

Soil carbon levels are a function of climate, land use and soil type. Most pasture to radiata pine afforestation occurs on erodible hill country where soil properties are inherently variable, including that of soil carbon. Work is currently underway to improve New Zealand's approach to determining change in soil carbon with afforestation.

At present New Zealand uses two methods to estimate the change in soil carbon with afforestation.

The first estimation method is the New Zealand Soil Carbon Monitoring System (SCMS) - a model that uses historical soil data from the National Soils Database (NSD). These data are coupled with the key factors that influence soil carbon. The SCMS generates estimates of soil carbon change associated with afforestation as well as for a range of other land-use changes and the system has been described in peer-reviewed international journals. Recent scrutiny of the model predictions for localities where most of the pasture to radiata pine land-use change occurs, has led the developers and officials to suspect that the predicted soil carbon reduction associated with afforestation is overstated. The limited number of historic soil data in such localities (erodible hill-country) is the prime reason for these views. It is because of this issue that the estimate produced by the SCMS (a loss of 20±6 tC/ha) is considered to be the most pessimistic estimate of likely soil carbon change with afforestation.

The second means for estimating soil carbon change with afforestation analysis of the soil-paired plot database - a cache of purpose-collected data intended to be used as validation of the SCMS estimates. The difference between the estimate provided by these data (a loss of 4.7±2.9 tC/ha) and that derived from the SCMS provides a strong case for accepting the SCMS value as the most pessimistic estimate. The specific nature of the data collected in those localities where afforestation takes place leads to the decision to call this estimate (a loss of 4.7± 2.9 tC/ha) the **base** value.

The soil-paired plot database, that provides an estimate of soil carbon loss of 4.7±2.6 tC/ha, contains several outliers, all of which indicate substantial carbon losses. If these outliers are excluded form the calculation of soil carbon change with afforestation the estimate becomes a gain of 0.2±2.5 tC/ha (95 percent confidence). For the purposes of this report, the lower scenario of soil C change with afforestation is accordingly considered to be 0 tC/ha.

Ineligible planting

Initial investigation has indicated that some plantation afforestation since 1990 may have occurred on land that, from a definitional perspective, already met the New Zealand Kyoto adopted forest definition. Under carbon accounting rules, any land planted after 1990 where the land was already "forest land" under the Kyoto forest definition, does not qualify as "Kyoto" forest.

The estimates of the proportion on "ineligible" exotic forests used in the 2005 net position report were 16 percent (base), 8 percent (lower) and 21 percent (upper).

The base and upper figures were based on the use of two national classifications to test the representativeness of a pilot mapping project in Nelson-Marlborough, in terms of post-exotic forest planted into possible forest land. The two sources of data were the 1987 Vegetation Cover Map and the 2001/02 Land Cover Database. Spatial intersection of these indicated the likely area of post-1990 forest planted into possible forest land being: nationally 16 percent; Marlborough region 21 percent; and the Gisborne region 15 percent. Some anecdotal information at the time suggested that the levels could be a low as 8-10 percent, and this was used for the lower figure. These estimates were made at a time when it had not been decided how New Zealand was going to interpret, and map, the Kyoto forest classes as defined in the Marrakech Accords (which defines the Kyoto forest definition).

Table 3: Percentage of existing forest (shrubland) ineligible under the Kyoto Protocol

	Upper	**Base**	**Lower**
Percentage of afforestation since 1990 planted onto shrublands that could meet NZ's Kyoto Forest definition	21%	16%	8%

Last year industry commentators expressed the view that the proportion of "ineligible" Kyoto forests was too high. However to date no further quantitative information has become available to provide improved estimates of the area of forest over-planting. In light of this, these projections use the 2005 scenarios again in 2006. Indications from further preliminary analysis suggest that the proportion of ineligible forests may be reduced once further land use mapping for the NZCAS is undertaken and completed.

A closely related issue is the requirement under the Kyoto Protocol to account for emissions from burning and decay of scrub biomass that is cleared for afforestation. That is, if the previous land use does not meet the definition of forest but still contains significant carbon stocks, the carbon stock change due to afforestation must be accounted for. An allowance has been made for this in the combined model results.

Future deforestation (plantations)

Historically, little plantation forest deforestation occurred in New Zealand. In 2002 the Government's publicly stated deforestation policy was to cap liabilities that it would accept for pre-1990 forests at 21 Mt CO_2 over the first commitment period (2008-12). If

deforestation looked likely to occur at levels above expectations the Government would consider its policy options to manage deforestation emissions within the cap.

The relatively new trend of not replanting forest after harvesting, and in some cases converting immature forest to pasture, started on a larger scale in 2004. New Zealand has always had a relatively dynamic landscape so changes in land-use are not unusual. However, historically little conversion of planted production forest land has occurred. The 2005 NEFD survey estimated that 7,000 hectares of forest clear-felled in the year ended March 2005 will not be replanted. This area represents 18 percent of the area harvested, and compares with historical information indicating that only about 2 to 3 percent of the area harvested has not been replanted in the past.

Government is currently reviewing climate change policies, including deforestation policy. Potential alternative deforestation policy options are due to be reported back to Ministers later this year. At the time of these projections, the deforestation cap is Government policy. Based on this the cap 21 Mt CO_2 has been used for the base scenario.

The upper scenario assumes an emission liability of 38.5 Mt CO_2. This scenario is based on a deforestation intentions survey completed for the Ministry of Agriculture and Forestry in December 2005. The results from this survey indicated that under current conditions forest owners intended to deforest about 47,000 hectares during the first commitment period (2008-12). This scenario allows for the removal of the deforestation cap and for current market conditions to prevail... The calculation of 38.5 Mt CO_2 is based on all deforestation being mature forest and all emissions being instantly emitted.

The projections include a lower scenario of -6.3 Mt CO_2 to show the effect of changes for forest policy or a future improvement in forest growing profitability. In absence of any better figure the lower scenario is based on 1550 ha deforestation each year, slightly higher than the historic annual deforestation area.

No allowance has been made for deforestation of indigenous forest or shrub land that meets New Zealand's adopted Kyoto forest definition. Under current legislation (eg Resource Management Act 1990, Forests Act 1949 amended 1993) and/or codes of practice (eg, The NZ Forest Accord) any significant deforestation of indigenous forest is, in practice, difficult to do.

f. Limitations of current data

There are acknowledged weaknesses in some of the data used in the LULUCF sector projections due to a lack of current knowledge and scientific uncertainty. With funding confirmed for the further development of the NZCAS in the August 2005, the Ministry for the Environment commenced implementing the NZCAS during the 2005/06 year. The NZCAS is being designed to provide more robust LULUCF sector inventory data specifically for Kyoto carbon accounting purposes. This is a long-term and large-scale project that will take some years before being fully operational. In protest at the Government's climate change policies forest owners have banned the installation of forest carbon inventory plots in their forests. This has delayed the implementation of some NZCAS work streams. Delays in implementing the NZCAS may mean it will take longer

to reduce the uncertainty of some elements of estimating and projecting LULUCF carbon dioxide removals and emissions.

Because the NZCAS is not yet generating data, existing forest resource information such as the NEFD database and Land Cover Database (LCDB) continue to be used for projecting LULUCF carbon dioxide removals. It is important to note that the NEFD database was designed to forecast future wood supply and is not designed for forest carbon accounting purposes. This means that some of the information required for carbon accounting purposes is currently unavailable. The NEFD describes the pre-1990 forests, where the ownership is dominated by larger forest growers' forests, reasonably well. NEFD information on the plantation forests established since 1992 by a large number of smaller-scale forest owners is of poorer quality. In addition there is relatively scant information on New Zealand's 6.5 million hectares of indigenous forest and 2.6 million hectares of shrubland.

The 2005 projections were subject to a number of reviews last year. The most comprehensive review was undertaken by AEA Technology from the United Kingdom. While the AEA Technology review identified a number of improvements that could be made in producing future projections, most of which have been incorporated in producing this year projections, the overall finding of the review was that "the methodologies employed to project emissions and sinks across the different sectors [are] generally sound and reasonable in their approach". The review noted the uncertainties inherent in all countries' approaches to projecting future greenhouse gas emissions, and that it is "not uncommon" for projections to change on re-analysis. The reviewers provided a number of useful suggestions for improving the accuracy and robustness of future forecasts. They recognise that many of their recommendations build upon improvements already in train. The key conclusions for the AEA Technology LULUCF review were:

- "Methodologies and input assumptions are reasonable and the resulting removal and emission projections are of a good standard;
- A single document should be produced for any future projection estimates that provides a detailed basis and sources for all calculations;
- Four key issues will require further consideration to minimise uncertainty in future projections:

1. reasons and drivers for the downward trend in new forest planting;
2. the areas of post-1990 forest planting at a national scale into existing shrublands that meets the Kyoto Protocol definition of forest;
3. estimation of areas deforested and drivers for this process;
4. time patterns of loss of carbon soil after afforestation.

- The New Zealand Carbon Accounting System will provide valuable data in assessing removals and emissions for land use land-use change and forestry."

g. Impact of the Permanent Forest Sinks Initiative

The Permanent Forest Sink Initiative (PFSI) provides an opportunity for landowners to establish permanent forest sinks and obtain tradable Kyoto Protocol compliant emission units in proportion to the carbon sequestered in their forests.

At the time of writing this report the Climate Change Response Amendment Bill had passed its first reading in Parliament and had been reported back from Select Committee. If the Bill proceeds through its final Parliamentary stages, regulations will need to be developed for the PFSI to become operational.

There is potential for some of the existing Kyoto-compliant forests to enter the Permanent Forest Sink Initiative. Any switching of these forests to the Permanent Forest Sink Initiative will result in the devolution of those credits and their removal from the Crown's balance of units. However, given the various risks and uncertainties associated with the initiative that existing forest owners will need to consider, it is not possible to provide an estimate of the area of existing forest that might switch to the Permanent Forest Sink Initiative.

h. Accounting for Article 3.4 forest management

Under Article 3.4 of the Kyoto Protocol, New Zealand has until 2007 (when it submits its 'Initial Report' to the UNFCCC) to elect which additional Article 3.4 land use, land-use change and forestry activities, if any, it wishes to account for in the first commitment period. The election of these activities is voluntary. Forest management is one such activity and would include accounting for forests not eligible under Article 3.3 over the first commitment period. The Government has agreed in principle not to account for these activities in the first commitment period.

At present, there is uncertainty in the data on carbon stock and carbon stock changes for New Zealand's indigenous forests. Available data suggest that the carbon stocks are likely to be in a steady state or possibly in slight decline. An assessment of the significance to New Zealand of Article 3.4 forest management activities concluded that the balance lay somewhere between -92 to 11 Mt CO_2-e over the first commitment period. New Zealand is also subject to a cap restricting the maximum amount of carbon dioxide removals it can claim in the first commitment period to 3.7 Mt CO_2 under Article 3.4 forest management but potential emissions are uncapped.

[ends]