



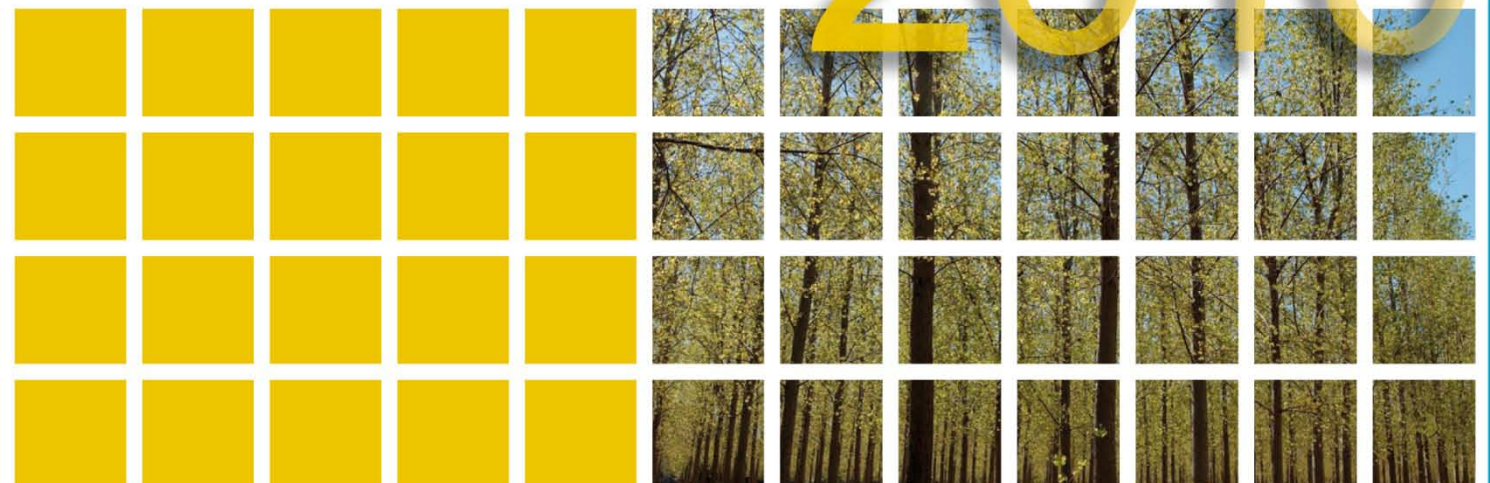
**Australian Government**

**Department of Climate Change  
and Energy Efficiency**

# Deforestation and Forestry

emissions  
projections

# 2010



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December 2010



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**Department of Climate Change  
and Energy Efficiency**

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## Executive Summary

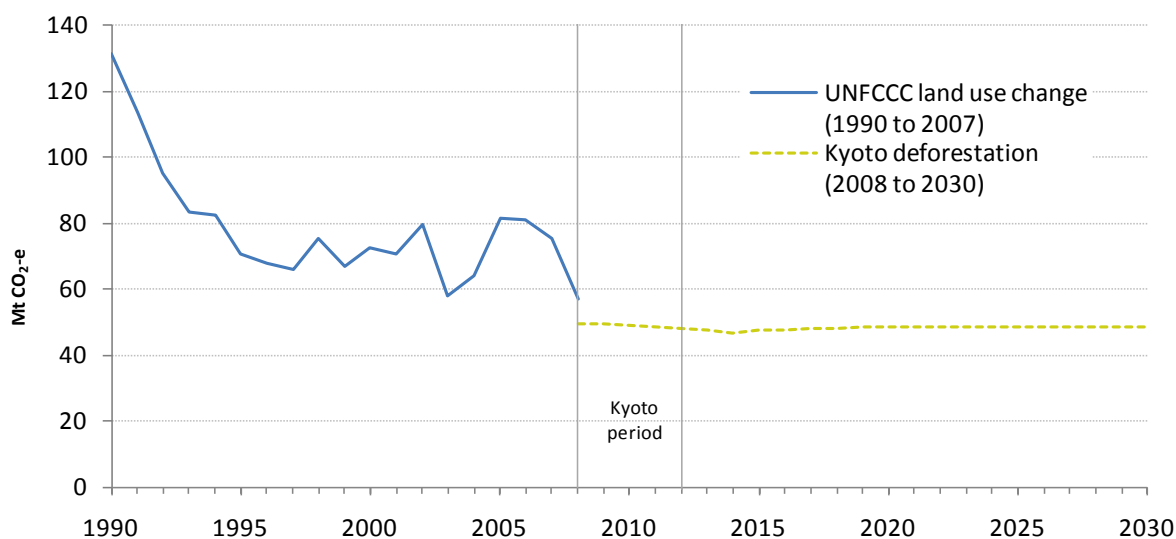
### Key Points

- Emissions from deforestation are projected to be 49 Mt CO<sub>2</sub>-e per year over the Kyoto period. This represents a 63 per cent decline from the 1990 base.
- Indicative modelling shows deforestation emissions are expected to stabilise at around 49 Mt CO<sub>2</sub>-e to 2030.
- Forestry sequestration over the 2008-12 Kyoto period with the application of the Kyoto Protocol harvest sub-rule is projected to be 21 Mt CO<sub>2</sub>-e per year.
- Indicative modelling suggests that forestry removals will decline to 7 Mt CO<sub>2</sub>-e in 2020 and stabilise at around 4 Mt CO<sub>2</sub>-e in 2030.

### Baseline projection

- Australia's National Carbon Accounting System provides estimates for land use change emissions (under UNFCCC reporting), deforestation emissions (under Kyoto accounting rules) and forestry activities eligible under Kyoto accounting rules (afforestation and reforestation).
- The methods used to report land use change to the UNFCCC are the same methods used to report deforestation under the Kyoto accounting rules but with different policy settings applied to meet the requirements of the Kyoto Protocol.
- The policy rules applied when accounting for deforestation under the Kyoto Protocol leads to some differences between Kyoto deforestation and UNFCCC land use change estimates (Figure 1).
- The historical emissions (1990 to 2007) are based on UNFCCC reporting for land use change. The projection for deforestation is based on estimates for 2008 to 2030.
- Kyoto Deforestation estimates were reported for the first time in the 2008 National Inventory Report (NIR). In this projection report, the Kyoto projection (2008 to 2012) is, for the first time, based on actual Kyoto deforestation estimates.
- Emissions from deforestation are projected to average 49 Mt CO<sub>2</sub>-e per year over the Kyoto period. This represents a 63 per cent decline from the 1990 base.
- In the longer-term (2020 and 2030), emissions are projected to remain stable at approximately 50 Mt CO<sub>2</sub>-e.

Figure 1 Baseline land use change and deforestation emissions, 1990 to 2030

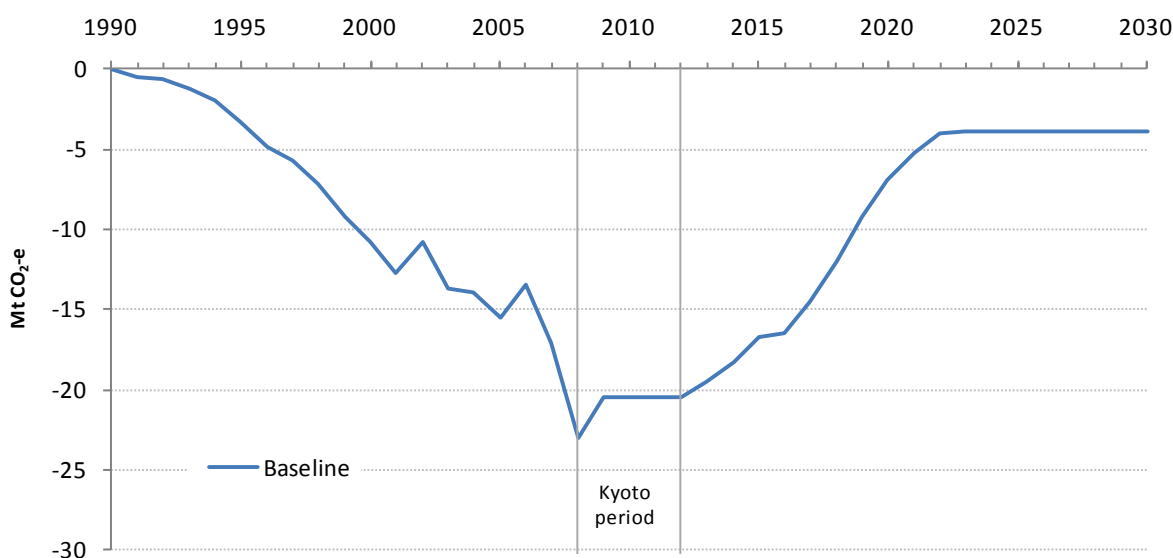


Note: Deforestation emissions under Kyoto accounting rules can only be calculated for the Kyoto period. UNFCCC reporting for land use change is presented in the chart to provide a historical time-series, although they are not strictly comparable. Unlike UNFCCC reporting, Kyoto accounting rules for deforestation include only deforestation of land that was forested in 1990.

Source: DCCEE analysis

- Removals from forestry (afforestation and reforestation) over the 2008-12 Kyoto period with the application of the Kyoto Protocol harvest sub-rule<sup>1</sup> are projected to be 21 Mt CO<sub>2</sub>-e per year (Figure 2). This is projected to decline to 7 Mt CO<sub>2</sub>-e in 2020 without the sub-rule. The indicative projection to 2030 shows that removals would average around 4 Mt CO<sub>2</sub>-e without the sub-rule by 2030.

Figure 2 Baseline forestry emissions, 1990 to 2030



Source: DCCEE analysis

<sup>1</sup> The Kyoto Protocol harvest sub-rule (paragraph 4 of the Annex to Decision 16/CMP.1) states “debts resulting from harvesting during the first commitment period following afforestation and reforestation since 1990 shall not be greater than credits accounted for on that unit of land”.

### Changes from 2009 projection

- Both the deforestation and forestry projections are largely unchanged from the previous projections released in *Australia's Fifth National Communication on Climate Change* to the UNFCCC.
- The data from the 2008 NIR provided confidence that the previous projections were accurate, therefore updating was not warranted.
- The small difference in the projection of the Kyoto period (2008-12) average of 0.6 Mt CO<sub>2</sub>-e per year is due to the incorporation of new information from the National Greenhouse Gas Inventory.

### Impact of measures

- The measures represented in the deforestation projections are land clearing reforms introduced by the Queensland and New South Wales Governments. The effects of those measures were assessed for the 2009 projections. The impact of the measures is estimated to be 18 Mt CO<sub>2</sub>-e per year in the Kyoto period and in 2030. This analysis has not been revised since the 2009 projections.
- The Government has committed to implement the Carbon Farming Initiative (CFI), which provides a mechanism for crediting abatement that occurs in the land sector. The Carbon Farming Initiative is expected to provide incentives for activities to increase removals from reforestation. The Government is working towards a scheme commencement by 1 July 2011.
- The Government has announced that it expects that methodologies for some reforestation sources could be developed, assessed and approved by December 2011, with the development and approval of methodologies for other sources to follow. Future projections updates for Land Use Change and Forestry will take into account progress in development of methodologies and any initial indications of project activity in response to the CFI.



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## Introduction

This paper presents projections of greenhouse gas emissions from deforestation and removals for forestry (also referred to as afforestation and reforestation under Kyoto accounting rules) and forms part of the 2010 emissions projections update.

Australia's National Carbon Accounting System provides estimates for land use change emissions (under UNFCCC reporting), deforestation emissions (under Kyoto accounting rules) and forestry activities eligible under Kyoto accounting rules (afforestation and reforestation).

Previously, deforestation emissions were estimated using the UNFCCC inventory sub-categories, forest land converted to grassland and forest land converted to cropland, to provide an indication on how emissions were tracking towards the Kyoto period. However, unlike other sectors, the Kyoto Protocol accounting for land use, land use change and forestry differs to UNFCCC reporting. As a consequence, it is not possible to provide a consistent post-1990 time-series comparison for emissions and the commitment period accounting.

With deforestation data available for the first time for 2008 in a true Kyoto accounting form, this is now the basis of the projections. The National Greenhouse Gas Inventory results for deforestation and forestry (released in 2010) correspond closely with the 2009 projection for the Kyoto period, indicating that the projection methodology provides for a robust assessment of emissions. The 2008 result for deforestation was within 0.1 Mt CO<sub>2</sub>-e of the projected emissions level. New projection analyses will be conducted in future years as further inventory results for the Kyoto period become available.

## Coverage of the sector

*Deforestation:* Under the Kyoto Protocol deforestation is defined as the emissions from the direct, human-induced removal of forest cover and replacement with pasture, crops or other uses on land that was forest on 1 January 1990. Emissions result from burning of removed forest cover, decay of unburnt cleared vegetation, and emissions from soil disturbed in the process of land clearing.

*Forestry:* Under the Kyoto Protocol accounting rules for Australia, the forestry sub-sector covers new forests established by direct human action on land not forested as at 1 January 1990 (afforestation and reforestation). No forestry sinks are included in the 1990 baseline, and only removals in forests established since 1 January 1990 are credited.

## Recent trends – National Greenhouse Gas Inventory

The latest National Greenhouse Gas Inventory report (May 2010) estimates total deforestation emissions for 2008 at 50 Mt CO<sub>2</sub>-e, accounting for 9 per cent of Australia's total emissions (with inclusion of all Article 3.3 land use, land use change and forestry activities).

The latest estimates for forestry removals for 2008 are 23 Mt CO<sub>2</sub>-e. This represents an increase compared to the 2007 inventory estimate of 21 Mt CO<sub>2</sub>-e. The increase reflects ongoing expansion of the plantation estate and some changes due to improved inventory methods since the previous inventory update. The improved method also led to recalculation of the entire time series including 2000, which is used as the base year for Australia's 2020 targets.

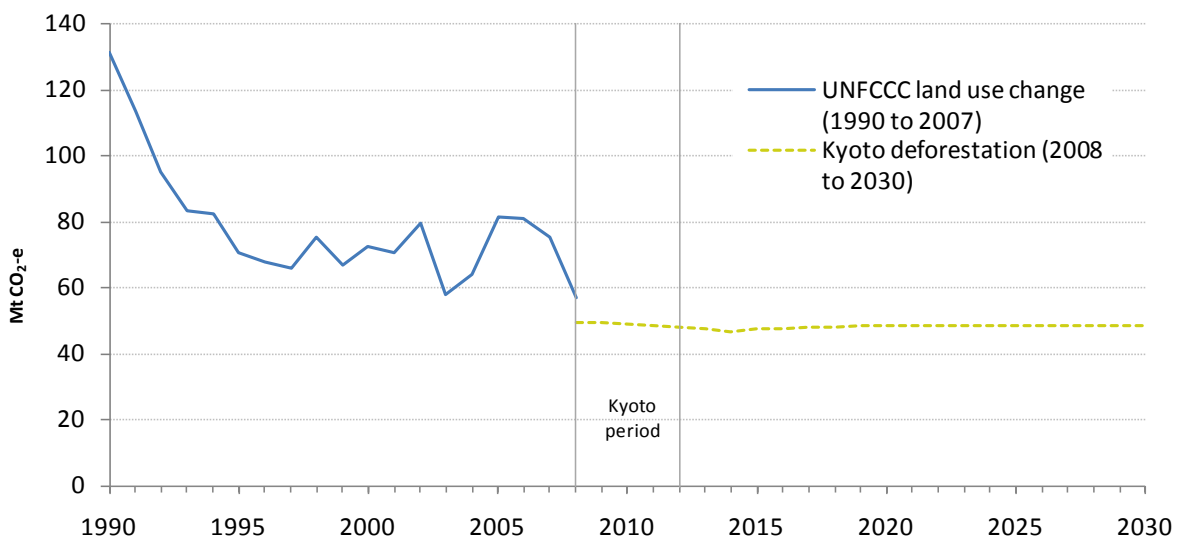
## Deforestation

Emissions from deforestation were estimated to be 50 Mt CO<sub>2</sub>-e in 2008, a reduction of 82 Mt CO<sub>2</sub>-e (62 per cent) from the 1990 base (132 Mt CO<sub>2</sub>-e). Annual rates of deforestation have decreased substantially since 1990 with consequent reductions in estimated emissions.

Emissions from deforestation are projected to average 49 Mt CO<sub>2</sub>-e per year over the Kyoto period (Figure 3). This represents a 63 per cent decline from the 1990 base. The impact of land clearing reforms introduced by the Queensland and New South Wales Governments have been included in these projections; however, the projection assumes that land clearing rates in other states continue at the same level as occurred on average between 2001 and 2006. Therefore, in the longer-term (2020 and 2030), emissions are projected to stabilise at around the Kyoto period level of 49 Mt CO<sub>2</sub>-e.

The projection for the Kyoto period is largely unchanged from the 2009 projection of 49 Mt CO<sub>2</sub>-e per year. The latest inventory data for 2008, which has for the first time been reported for Kyoto, has been incorporated, resulting in slightly lower Kyoto period average emissions than previously projected (0.1 Mt CO<sub>2</sub>-e lower).

**Figure 3** Baseline land use change and deforestation emissions, 1990 to 2030



Note: Deforestation emissions under Kyoto accounting rules can only be calculated for the Kyoto period. UNFCCC reporting for land use change is presented in the chart to provide a historical time-series, although they are not strictly comparable. Unlike UNFCCC reporting, Kyoto accounting rules for deforestation include only deforestation of land that was forested in 1990.

Source: DCCEE analysis

Table 1 Baseline land use change (1990) and deforestation (post 2008) emissions, Kyoto period average and 2020

	1990	2009	Kyoto period average 2008-12		2020	
	Mt CO <sub>2</sub> -e	Mt CO <sub>2</sub> -e	Mt CO <sub>2</sub> -e	Increase on 1990 (%)	Mt CO <sub>2</sub> -e	Increase on 2000 (%)
<b>Total</b>	<b>132</b>	<b>50</b>	<b>49</b>	<b>-63</b>	<b>49</b>	<b>-33</b>

Source: DCCEE analysis

## Forestry

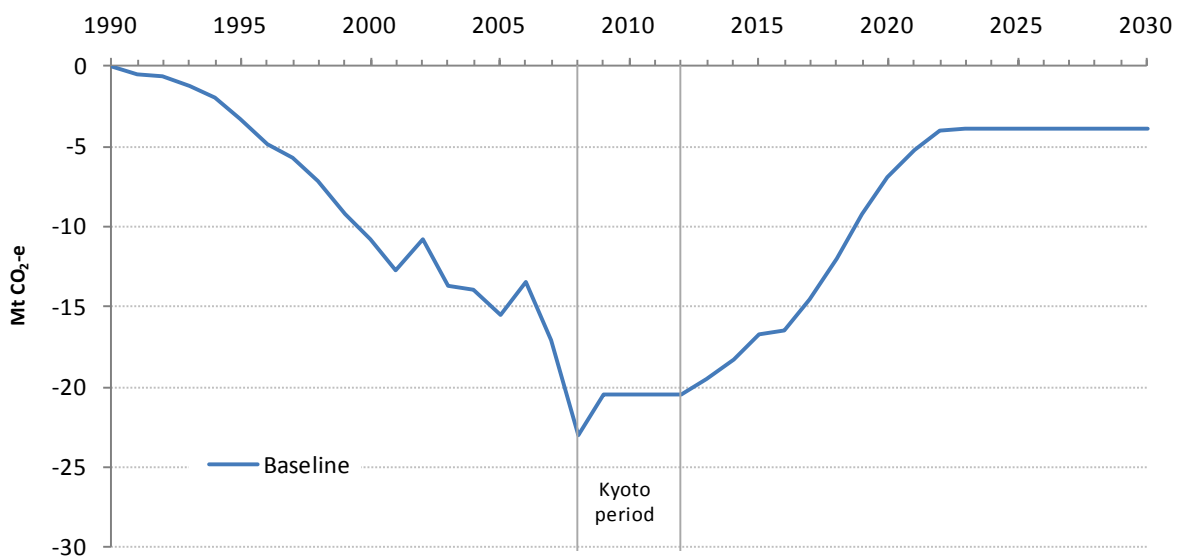
Removals (or sequestration) have been increasing in Australia since 1990; this reflects the large scale establishment of plantation forests established over that period.

Removals over the 2008-12 Kyoto period with the application of the Kyoto Protocol harvest sub-rule<sup>2</sup> are projected to be 21 Mt CO<sub>2</sub>-e per year, and 7 Mt CO<sub>2</sub>-e in 2020 without the sub-rule. The indicative projection to 2030 shows that removals would average around 4 Mt CO<sub>2</sub>-e per year by 2030.

The inventory estimate of 23 Mt CO<sub>2</sub>-e for 2008 is comparable to the projection of 21 Mt CO<sub>2</sub>-e once the 2 Mt CO<sub>2</sub>-e risk buffer (to allow for the risks of fire and climate effects) is incorporated in the projection. A substantial proportion of the forests contributing to the 2008 inventory estimate will likely be harvested during the first commitment period, which will reduce the amount of removals over the commitment period closer to the projected level.

The projection for forestry is reported on a five year rolling average of the annual modelled data, which better reflects the likely commercial harvesting behaviour.

Figure 4 Baseline forestry emissions, 1990 to 2030



Note: The data has been smoothed post-2012. This approach reflects the uncertainty which exists in relation to the post-2012 treatment of forestry under the Kyoto Protocol.

Source: DCCEE analysis

<sup>2</sup> The Kyoto Protocol harvest sub-rule (paragraph 4 of the Annex to Decision 16/CMP.1) states “debts resulting from harvesting during the first commitment period following afforestation and reforestation since 1990 shall not be greater than credits accounted for on that unit of land”.

For the purposes of this projection, it is assumed that the harvest sub-rule finishes at the end of the first commitment period, as the rules for any post-2012 period are currently the subject of international negotiation. This is a conservative approach which reflects the economic substance of the sink activity and is also considered the most appropriate interpretation of the Kyoto rules at this stage given current negotiations.

**Table 2** Baseline forestry emissions

	1990	2009	Kyoto period average 2008-12		2020	
	Mt CO <sub>2</sub> -e	Mt CO <sub>2</sub> -e	Mt CO <sub>2</sub> -e	Increase on 1990 (%)	Mt CO <sub>2</sub> -e	Increase on 2000 (%)
<b>Total</b>	<b>0</b>	<b>-21</b>	<b>-21</b>	<b>ne</b>	<b>-7</b>	<b>ne</b>

Source: DCCEE analysis

### Main drivers of sectoral activity

Land clearing rates in Australia are influenced by factors such as market forces, technology change, climatic events (e.g. drought) and government policy.

Reductions in land clearing rates since the early 1990s have resulted from factors such as commodity price fluctuations, climatic events and the introduction of new land clearing regulations as awareness of environmental degradation resulting from inappropriate clearing increased.

Commercial plantation forestry comprises most of the Kyoto forest estate, with smaller areas of forest established for non-harvest purposes. There have been significant changes in the forest industry over recent years. The global economic downturn has resulted in a downward trend in export markets for forest products such as woodchips, pulp and paper products. A drop has been reported in domestic production of logs, along with a significant reduction in domestic consumption of wood. In addition, in the past 18 months a number of substantial forestry managed investment scheme operations have ceased. It is not known at this stage what impacts these factors will have on the projection for forestry. These impacts should become clearer over the next couple of years.

Estimates for forestry under the Kyoto Protocol are particularly sensitive to the risk of fire and climate effects such as drought, as these forests are typically younger in age and established in regional clusters. The projected annual estimate of 21 Mt CO<sub>2</sub>-e sequestration during 2008-12 includes a risk buffer of 2 Mt CO<sub>2</sub>-e to allow for the risks of fire and climate effects.

## Business-as-usual scenario and measures estimates

The measures represented in the projections are land clearing reforms introduced by the Queensland and New South Wales Governments. The effects of those measures were assessed for the 2009 projections.

The Queensland Government enacted vegetation management legislation in 2004 that provided for the cessation of broadscale clearing of remnant vegetation by 31 December 2006 while allowing a range of ongoing clearing activities.

The New South Wales Government commenced legislation applying additional restrictions on clearing of remnant and protected regrowth vegetation in December 2005.

The impact of these measures is estimated to be 18 Mt CO<sub>2</sub>-e per year in the Kyoto period and in 2020. This analysis has not been revised since the 2009 projections.

The Government has also committed to implement the CFI and provide a mechanism for crediting land sector offsets, including from reforestation. The Government is working towards scheme commencement on 1 July 2011.

The CFI will provide incentives for reforestation, including forests established for harvest and non-harvest purposes. Future projection updates for Forestry will take into account initial indications of new reforestation activity in response to the CFI.

## Appendix A – Methodology for land use change and Deforestation

The projections for land use change have not been updated since the previous release (2009) in Australia's Fifth National Communication on Climate Change.

The 2009 projection was for the first time undertaken using the National Carbon Accounting System (NCAS) Tier 2 model that provides an approximation to the full NCAS model for projections purposes. The Tier 2 model projects Deforestation emissions on the basis of anticipated rates of initial forest conversion and regrowth clearing in each state, together with the historical relationships in the full NCAS model between these areas and emissions. Further details are provided in Australia's National Inventory Report.

The 2009 projection incorporated results of a preliminary NCAS assessment of emissions in southern Queensland in 2007. The projection for other states was based on a five-year average level of emissions from 2002 to 2006.

## Appendix B – Methodology for Forestry

The projection is derived using the NCAS methods for detection (through analysis of satellite imagery) of Kyoto forest establishment integrated with spatially explicit modelling of emissions and removals as used for the National Greenhouse Gas Inventory. Projections of areas of future forest plantation establishment on a regional basis are provided by the Australia Bureau of Agricultural and Resource Economics – Bureau of Rural Sciences.

The projection for Forestry is reported on a five-year rolling average of annual modelled data, which reflects the likely commercial harvesting behaviour.

Carbon sequestration in commercial forest plantations and environmental plantings is dependent on the area of the forestry estate, the contribution of forest growth in each year and the rate of harvesting. Projections rely on estimates of the amount of carbon sequestered in biomass, which differ by tree species and for different climatic and geographical conditions and management regimes.

The projection for 2008-12 incorporates a risk buffer to allow for the risk of fire and climate effects.

The projection for 2030 adopts the 2009 assumption that the Kyoto Protocol harvest sub-rule finishes in 2012 at the end of the first commitment period, as the rules for the post-2012 period are the subject of international negotiations.

## Appendix C – References

Australian Government 2010, *National Inventory Report 2008: The Australian Government Submission to the UN Framework Convention on Climate Change May 2010*, Department of Climate Change and Energy Efficiency, Canberra.

Australian Government 2010, *Australia's Fifth National Communication on Climate Change: A report under the United Nations Framework Convention on Climate Change*, Department of Climate Change, Canberra.

United Nations Framework Convention on Climate Change 2005, *Decision 16/CMP.1: Land use, land-use change and forestry*.

## Appendix D – Glossary

<i>Abatement</i>	Refers to emissions reductions made beyond that which would have been achieved in the business as usual scenario.
<i>Baseline</i>	Emissions given current policy settings.
<i>Deforestation</i>	Under the Kyoto Protocol deforestation is defined as the emissions from the direct, human-induced removal of forest cover and replacement with pasture, crops or other uses on land that was forest on 1 January 1990. Emissions result from burning of removed forest cover, decay of unburnt cleared vegetation, and emissions from soil disturbed in the process of land clearing.
<i>Forestry</i>	Under the Kyoto Protocol accounting rules for Australia, the forestry sub-sector covers new forests established by direct human action on land not forested as at 1 January 1990 (afforestation and reforestation). No forestry sinks are included in the 1990 baseline, and only removals in forests established since 1 January 1990 are credited
<i>Kyoto period average (KPA)</i>	The Kyoto period average refers to the average of emissions over the 5 year Kyoto Protocol reporting period, 2008-2012.
<i>Measures</i>	Refers to past, current or committed Australian, State/Territory or local government policy actions that have an impact on greenhouse gas emissions, causing them to deviate from the business-as-usual path after the base year of 1990.
<i>Mt CO<sub>2</sub>-e</i>	Megatonnes of carbon dioxide equivalent
<i>NIR</i>	National Inventory Report
<i>UNFCCC</i>	United Nations Framework Convention on Climate Change