



AUSTRALIA

Land Use, Land-Use Change and Forestry (LULUCF)

Informal Data Submission September 2009

Australia welcomes the opportunity to provide an informal data submission on LULUCF. This data submission includes emission and removal estimates from 1990 to 2007 for relevant United Nations Framework Convention on Climate Change (UNFCCC) land categories and Kyoto Protocol land activities that are applicable to Australia. Projection estimates to 2020 for some land activities and categories are also provided. The data in this submission is collated from previous publications of the Australian Government and is publicly available.

This submission also includes worked examples of Australia's symmetrical exclusion proposal for the treatment of natural disturbances and Australia's inclusion in target proposal for incorporating LULUCF in Parties' mitigation commitments.

The structure of the submission is:

1. Data on emissions and removals from 1990 to 2007
2. Projections to 2020
3. Application of Australia's proposals:
 - a) Symmetrical exclusion treatment of natural disturbance
 - b) Inclusion of LULUCF in calculation of assigned amount

1. DATA ON EMISSIONS AND REMOVALS FROM 1990 TO 2007

Collated emission and removal data for the UNFCCC land categories Land-Use Change (deforestation), Forest Land, Cropland and Grassland are provided in Table 1.

The Forest Land category encompasses all forested land, including emissions and removals from Forest Land remaining Forest Land and Land converted to Forest Land (afforestation and reforestation). The Forest Land data comprises of: emissions and removals from Harvested Native Forests, Plantations, and Other Native Forests; emissions from Fuelwood Consumption, Prescribed Burning and Wildfires in forests; and removals from Recovery Post-Fire. The uncertainties for the Forest Land data were estimated to be $\pm 30\%$ for CO₂ for 2007.

The trends observed in the Forest Land data are influenced by a mix of human-induced and non-anthropogenic emissions and removals. The impacts of inter-annual variability and natural disturbance largely conceal any underlying patterns of human activities that could be observed in the Forest Land category.

Table 1: Net emissions and removals (Mt CO₂-e per year) for selected UNFCCC land categories 1990 to 2007

Category	1990	1991	1992	1993	1994	1995
Land-Use Change (deforestation)	132.159	114.437	96.537	84.123	82.840	71.410
Forest land	-47.343	16.689	-36.646	-86.380	-74.988	-77.564
Cropland	-0.256	3.423	10.536	-4.360	-14.322	0.208
Grassland	89.088	116.586	90.116	91.851	49.649	182.217

Category	1996	1997	1998	1999	2000	2001
Land-Use Change (deforestation)	69.121	67.070	76.504	67.710	72.827	70.904
Forest land	-70.937	-65.368	-61.878	-77.432	-62.400	-87.480
Cropland	5.189	-5.644	19.746	2.682	-12.366	-12.932
Grassland	53.847	17.248	175.314	31.739	-12.655	24.847

Category	2002	2003	2004	2005	2006	2007
Land-Use Change (deforestation)	79.453	58.381	64.365	82.556	84.463	77.128
Forest land	-6.526	115.298	-131.557	-95.720	-104.686	-18.916
Cropland	58.596	-23.250	-27.264	-43.705	20.440	23.565
Grassland	234.993	25.174	-31.322	214.015	103.868	282.703

Source: Australia's 2009 National Inventory Report and the Australian Greenhouse Emissions Information System¹ (accessed 9/9/2009).

¹ <http://climatechange.gov.au/inventory/index.html>

The Cropland category data reported in Table 1 is made up of the sub-categories Cropland remaining Cropland and Land converted to Cropland. The Grassland category data reported in Table 1 is made up of Grassland remaining Grassland and Land converted to Grassland. Both Land converted to Cropland and Land converted to Grassland include emissions from the Land-Use Change (deforestation) category data reported in Table 1. The uncertainties for Cropland remaining Cropland and Grassland remaining Grassland are estimated to be medium.

The trends observed in the Cropland remaining Cropland and Grassland remaining Grassland data are primarily driven by inter-annual variability and natural disturbances, which mask underlying patterns in the LULUCF sector directly associated with human activities. These impacts are more obvious in years of extreme conditions (such as drought) and can continue to influence our accounts for several years. This variability does not represent an error in the reporting, but is due to Australia's complex land systems, highly variable climate and the large land areas included.

Australia has estimated the removals from 1990 for the Kyoto Protocol activities of Afforestation and Reforestation to help track the contribution of these activities towards Australia's obligations for the first commitment period. The collated net removal data for the Kyoto Protocol activities Afforestation and Reforestation are provided in Table 2.

Table 2: Net removals (Mt CO₂-e per year) for Kyoto Protocol activities Afforestation and Reforestation 1990 to 2007

1990	1991	1992	1993	1994	1995	1996	1997	1998
-2.046	-3.927	-5.578	-7.100	-8.541	-9.359	-10.322	-11.329	-12.751
1999	2000	2001	2002	2003	2004	2005	2006	2007
-13.287	-15.001	-17.146	-19.605	-21.252	-21.753	-22.960	-22.794	-21.150

Source: Australia's 2009 National Inventory Report and the Australian Greenhouse Emissions Information System (accessed 9/9/2009)¹.

For the Afforestation/Reforestation data in Table 2, the time series trend included in areas entering the Kyoto account since 1990 provides insight into the age-class distribution of the current areas that are eligible under Article 3.3. When considering the emissions and removals from Afforestation/Reforestation it is important to consider the future impacts of both harvesting, which will become increasingly influential through the first commitment period, and increasing areas of land entering the account until the end of the first commitment period.

Australia has not elected the Kyoto Protocol accounting activity Forest Management for the first commitment period. An application of the definition for Forest Management is yet to be determined for Australia.

2. PROJECTIONS

Table 3 is a compilation of projections out to 2020 for the Kyoto Protocol land activity Afforestation/Reforestation, and the UNFCCC land categories Land-Use Change (deforestation) and Forest Land. Projections are not available for the Cropland or Grassland land categories.

Table 3: Projected emissions (Mt CO₂-e per year) for selected UNFCCC land categories and Kyoto Protocol land activity A/R for 2010, 2015 and 2020

Category/Activity	2010	2015	2020
Afforestation/Reforestation	-20.5*	See Figure 1	-6.9
Land-Use Change (deforestation)	49*	47	48.6
Forest land	-42	See Figure 2	See Figure 2
Cropland	Not estimated	Not estimated	Not estimated
Grassland	Not estimated	Not estimated	Not estimated

*estimated annual average over the first commitment period (2008-2012).

Source: Australia's 2020 Projections (Tracking to Kyoto and 2020 Report, August 2009)² and Australia's Fourth National Communication on Climate Change³.

Projections for Forest Land under the UNFCCC

The projection for Forest Land is a partial representation of the UNFCCC Forest Land category data shown in Table 1. The projection for Forest Land in Figure 1 consists of a subset of forest categories that cover a portion of the anthropogenic emissions and removals of total Forest Land. The projection in Figure 1 does not include inter-annual variability due to climate or fires.

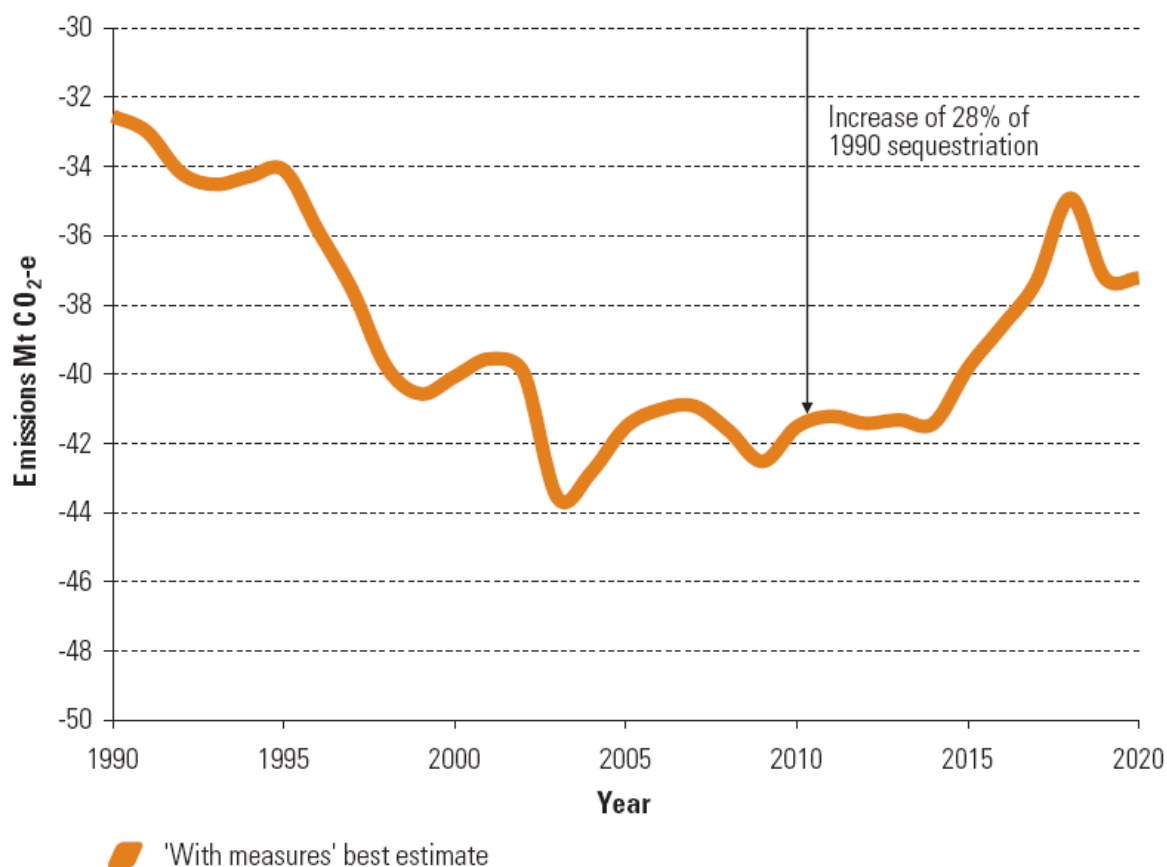
Using UNFCCC estimation methods, the 'with measures' projection for the Forest Lands subsector is 42 Mt CO₂-e of net removals in 2010, an increase of approximately 9 Mt CO₂-e net removals compared to 1990 levels (Figure 1). This estimate is based on actual or planned forestry plantings data and includes the impact of measures to increase environmental plantings by 2010.

Removals from commercial plantation forestry, environmental planting and harvested native forests are dependent on the area of the forestry estate, the contribution of forest growth in each year and the rate of harvesting. In all cases, projections rely on estimates of the amount of carbon stored in biomass, which differ by tree species and for different climatic and geographical conditions.

² <http://climatechange.gov.au/projections/pubs/tracking-to-kyoto-and-2020.pdf>

³ <http://www.climatechange.gov.au/international/publications/fourth-comm.html>

Figure 1: Historic and projected emissions (Mt CO₂-e per year) from the Forest Land category, 1990 to 2020 (UNFCCC estimation method)



Source: Australia's Fourth National Communication on Climate Change, 2005³.

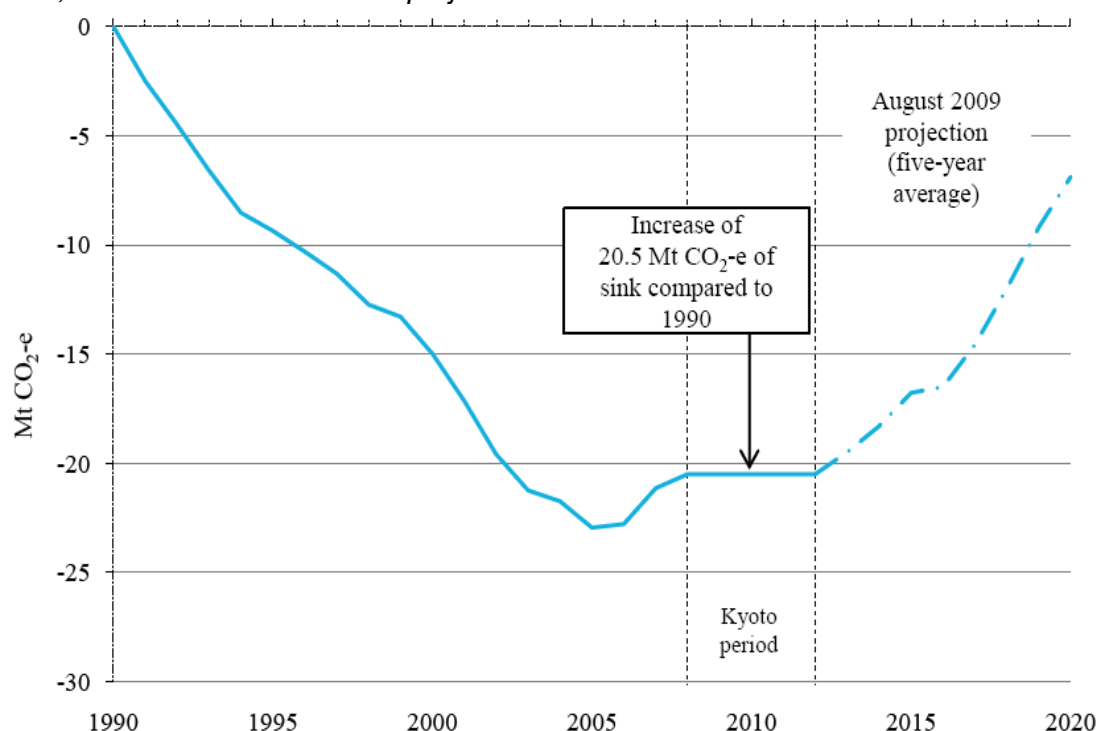
Projections for Afforestation/Reforestation under the Kyoto Protocol

Afforestation and Reforestation under Kyoto accounting rules covers new forests established by direct human action on land not forested in 1990. For the first commitment period, no forestry sinks are included in the 1990 baseline, and only Afforestation and Reforestation occurring since 1 January 1990 is credited.

The projections to 2020 for Afforestation and Reforestation (Figure 2) assume that the harvest sub-rule finishes in 2012 at the end of the first commitment period. The projection for Afforestation and Reforestation is reported on a five year rolling average of the annual modelled data, which reflects the likely actual commercial harvesting behaviour.

Estimates for Afforestation and Reforestation 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. For this reason, the projected annual estimate of 20.5 Mt CO₂-e sequestration during 2008-2012 includes a buffer of 1.8 Mt CO₂-e to allow for potential fire and climate effects.

Figure 2: Net removals (Mt CO₂-e per year) from Afforestation and Reforestation 1990 to 2020, based on 2007 and 2009 projections.



Source: *Tracking to Kyoto and 2020 Report, August 2009*².

3. APPLICATION OF AUSTRALIA'S PROPOSALS

(a) *Symmetrical exclusion treatment of natural disturbance*

Australia's proposal for the symmetrical exclusion of emissions and removals from natural disturbance is presented in paragraph 19 ter, pp 24 - 25, FCCC/KP/AWG/2009/10/Add.3 Annex II.

The overarching principle for this proposal is that only anthropogenic emissions and removals should be accounted for.

Operation of this principle requires:

- A Party can exclude from their national accounts non-anthropogenic greenhouse gas emissions and removals.
- Non-anthropogenic greenhouse gas emissions and removals are generated by a major natural disturbance that is not direct-human induced.
- Carbon dioxide emissions from a major natural disturbance are excluded from a Party's accounts, and subsequent carbon dioxide removals are excluded until the same amount of carbon dioxide has been removed from the atmosphere as was emitted from the major natural disturbance.

- Non-carbon dioxide emissions from major natural disturbance are excluded from a Party's accounts. As non-carbon dioxide emissions are not removed from the atmosphere, these emissions are excluded permanently from the Party's accounts.
- If a land-use change follows a major natural disturbance, the Party will include in their national accounts the full amount of non-anthropogenic greenhouse gas emissions and subsequent removals associated with the major natural disturbance.
- A Party shall continue to account for greenhouse gas emissions from direct-human induced events on the land subject to the major natural disturbance.

Accessing the symmetrical exclusion proposal

To access the proposal, a Party needs to be able to identify and estimate non-anthropogenic emissions and removals from major natural disturbances on lands subject to Article 3.3 activities and elected Article 3.4 activities.

This would require a Party to identify the location, scale and reason for (explanation for) the major natural disturbance from which the emissions and removals are excluded and how the major natural disturbance is distinguished from background emissions and removals. This information may include spatially referenced location data, environmental data, climatological data and historic records. The environmental and climatological indicators should explain the scale of the greenhouse gas emissions from the disturbance.

The threshold level(s) for a major natural disturbance is supplied by the Party. It would demonstrate that the major natural disturbance was an anomalous event differentiated from background emissions.

The Party would provide this information in its national inventory. The information would be subject to the same review procedures as the rest of the inventory.

The Party would provide evidence to show that no land-use change has occurred following the major natural disturbance.

For example, for a major wildfire Australia would provide:

- Spatially explicit information, such as satellite images, identifying the location and scale of impact.
- Information justifying that the wildfire was not direct human-induced and was a major event, including historical records for the location with the following weather and climatic data: temperature; rainfall; wind speed; and vapour pressure deficit. Information about environmental conditions such as fuel load and fuel moisture will also be important.

The data provided would show that a threshold level for the relevant weather/ climatic criteria was reached indicating that a major disturbance had occurred, triggering access to the provisions for symmetrical exclusion. This threshold is supplied by the Party.

For example, for a major drought Australia would provide:

- Spatially explicit information, such regional climate and crop yield/ animal stocking data, identifying the location and scale/extent of impact.
- Information justifying that the drought was not direct human-induced and was a major event, including historical records for the location with the following weather and

climatic data: temperature; rainfall; soil moisture, and information on crop yields/ animal stocking levels.

- The data provided would show that a threshold level for the relevant weather/ climatic criteria was reached indicating that a major disturbance had occurred, triggering access to the provisions for symmetrical exclusion. This threshold is supplied by the Party.

Two examples of symmetrical exclusion using wildfire

Details are provided below in examples 1 and 2 on when and how the emissions and removals from major natural disturbance would be reported, including how the point of symmetry is determined for accounting purposes.

Any subsequent direct human-induced emissions would be included in the Party's accounts. All emissions and removals would be reported in CRF tables in a Party's inventory.

The following examples use historical years for illustrative purposes only. The examples relate to carbon dioxide emissions and removals only.

Example 1 – Fire only

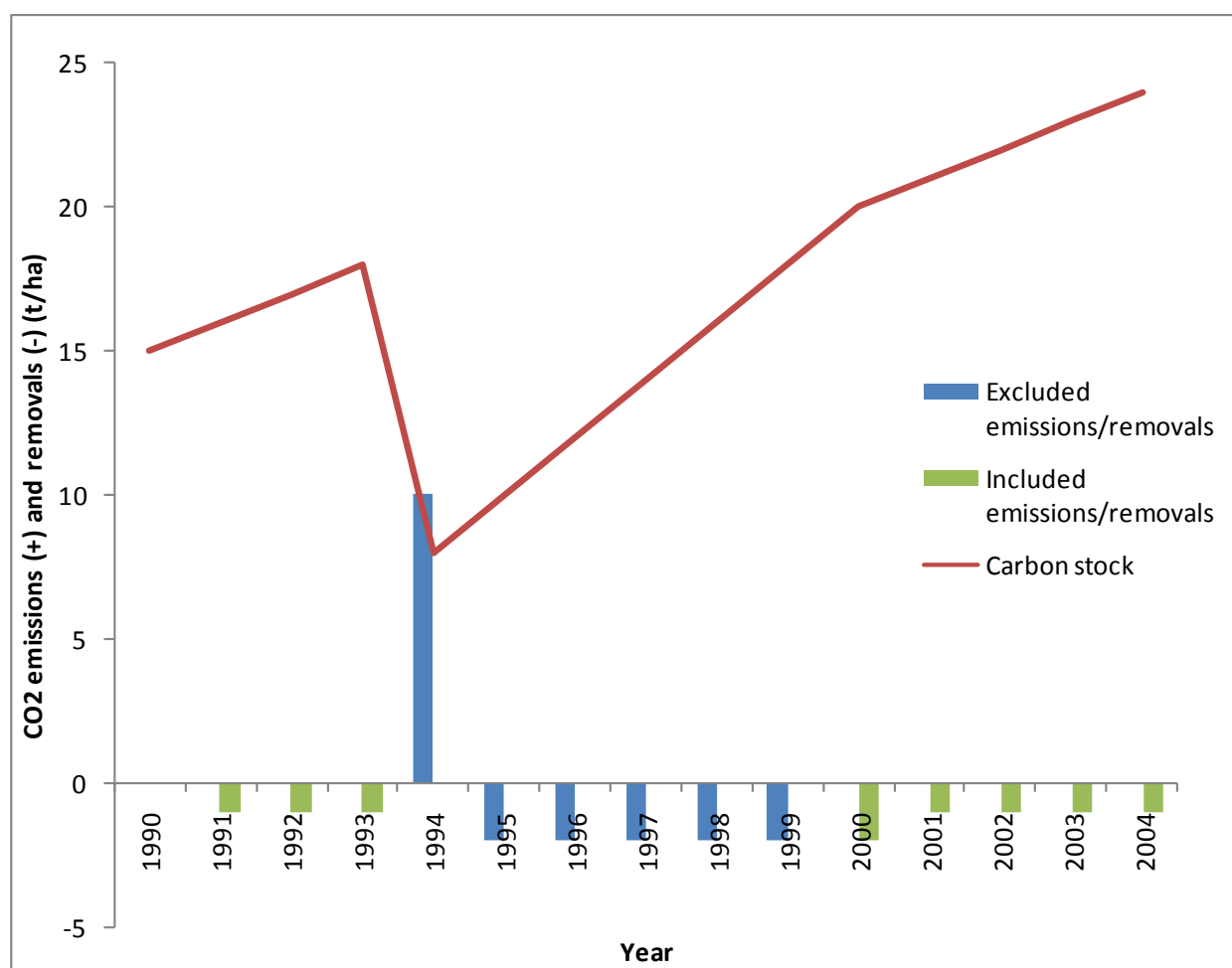
The example land unit was subject to a 'major natural disturbance' fire in 1994 and then recovered the carbon linearly over 5 years. In this case, based on symmetrical exclusion, the accountable emissions and removals on this unit of land would be held to zero from 1994 when the fire occurred, until the year 1999 when the carbon stock emitted in the fire has been recovered to its pre-fire level.

Table 4 and Figure 3 show the time-series treatment of emission trend under symmetrical exclusion for this example.

Table 4: Example time-series of a fire using symmetrical exclusion.

Emissions (+) and removals (-) for a single unit of land (tCO ₂ /ha)															
Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Accountable emissions	0	-1	-1	-2	0	0	0	0	0	0	-2	-1	-1	-1	-1
Symmetrical Exclusion	0	0	0	0	10	-2	-2	-2	-2	-2	0	0	0	0	0
Total emissions	0	-1	-1	-2	10	-2	-2	-2	-2	-2	-2	-1	-1	-1	-1

Figure 3: Example of a fire using symmetrical exclusion.



Example 2 – Fire, salvage log and slash burn

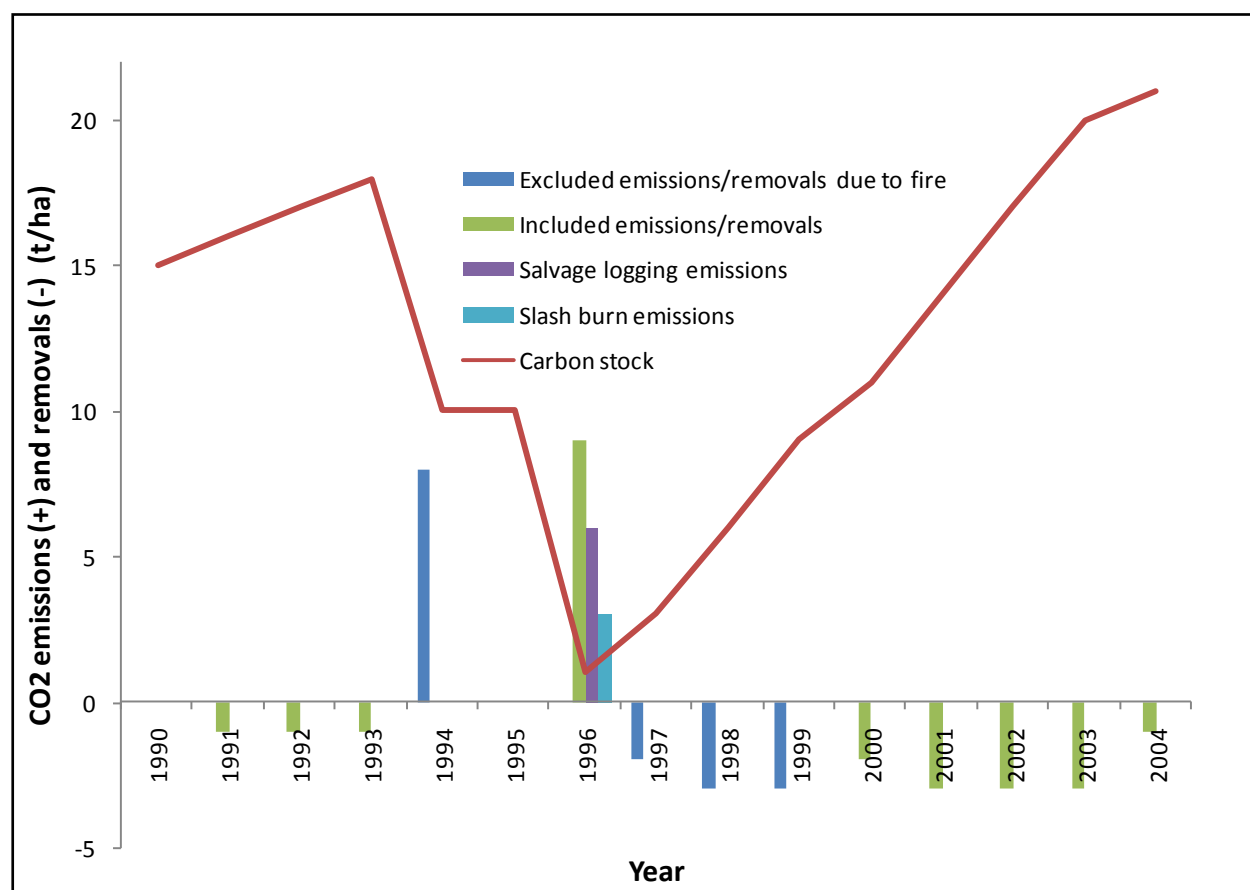
In this example a fire occurs in 1994, which is then followed by a salvage logging and slash burn both in 1996. Due to the logging and slash burn the carbon stock losses from the fire do not begin to be recovered until 1997. As the logging and slash burn are anthropogenic, the emissions from these actions are included in the accountable emissions.

Table 5 and Figure 4 show the time-series treatment of emission trends under symmetrical exclusion for this example.

Table 5: Example time-series of a fire, salvage log and slash burn using symmetrical exclusion.

CO2 emissions (+) and removals (-) for a single unit of land (tC/ha)															
Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Accountable Emissions	0	-1	-1	-1	0	0	9	0	0	0	-2	-3	-3	-3	-1
Symmetrical Exclusion	0	0	0	0	8	0	0	-2	-3	-3	0	0	0	0	0
Salvage logging	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0
Slash burn	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0
Total emissions	0	-1	-1	-1	8	0	9	-2	-3	-3	-2	-3	-3	-3	-1

Figure 4: Example of a fire, salvage log and slash burn using symmetrical exclusion.



(b) Inclusion of LULUCF in calculation of assigned amount

Australia's proposal for the inclusion of LULUCF in the calculation of Parties' assigned amounts is presented in the following paragraphs of FCCC/KP/AWG/2009/10/Add.3 Annex II: 1 ter, Section A bis, p 15; 2 bis Section B, p 15; 9 quater Section C, p 18.

The overarching principles for this proposal is that rules must be agreed before targets and that there should be consistency of treatment across sectors and Parties (Add.3 Annex II, paragraph 1 ter). The first commitment period rules for LULUCF do not align well with these principles.

Accessing the proposal

All Parties subject to economy wide mitigation commitments would include in their baselines to calculate their assigned amount all mandatory and any elected categories of LULUCF emissions and removals.

This approach does not preclude the possibility of special baselines provisions for particular land sector categories, for example the use of a base-period instead of a base year (examples 1 and 2 below present different baseline options for illustrative purposes only). These provisions would need to be collectively agreed by the Parties.


The following method would be used to implement Add 3, Annex II, paragraphs 2 bis and 9 quater.

- LULUCF emissions and removals would be treated in broadly equivalent terms to other source/sector categories.
- Parties would estimate net emissions and removals from mandatory activities and any elected activities in the agreed base year, base period or other baseline. The result would be the Party's LULUCF net baseline amount.
- The Party's LULUCF net baseline amount would be added together with the baseline amounts from all other sectors (as per Annex A) to give the Party's total baseline amount.
- The Party's total baseline amount would be multiplied by the Party's quantified emissions reduction or limitation commitment (QELRC) as per Annex B (or equivalent), and multiplied by the number of years in the next commitment period. The result would be the Party's initial assigned amount for a post-2012 agreement.
- The above information would be detailed in the Party's report to enable the establishment of its post-2012 assigned amount.


Two examples of the inclusion in target proposal

The following examples demonstrate how Parties could include LULUCF in the calculation of their assigned amounts. The two examples include hypothetical numbers for imaginary Parties, for illustrative purposes only.

Example 1: Assigned amount for a Party with net LULUCF baseline sink

Party's net LULUCF baseline amount	-10 Mt CO ₂ e
<i>For example comprising:</i>	
<i>Afforestation/Reforestation in [1990][2000]</i>	-1 Mt CO ₂ e
+ <i>Deforestation (land-use change) in [1990][2000]</i>	3 Mt CO ₂ e
+ <i>Elected FM [average of 2001-2005][Reference Level]</i>	-12Mt CO ₂ e
+ Baseline amount from other sectors	210 Mt CO₂e
= Total baseline amount	200 Mt CO₂e
	
Total baseline amount	200 Mt CO ₂ e
x Party's target (QELRC)	75%
x Number of years in commitment period	5 years
= Party's assigned amount	750 Mt CO₂e

Example 2: Assigned amount for a Party with net LULUCF baseline source

	Party's net LULUCF baseline amount	5 Mt CO ₂ e
	<i>For example comprising:</i>	
	<i>Afforestation/Reforestation in [1990][2000]</i>	<i>-2 Mt CO₂e</i>
	+ <i>Deforestation (land-use change) in [1990][2000]</i>	<i>1 Mt CO₂e</i>
	+ <i>Elected Cropland Management in [1990][avg of 1990-1994]</i>	<i>6 Mt CO₂e</i>
+	Baseline amount from other sectors	95 Mt CO ₂ e
=	Total baseline amount	100 Mt CO₂e
		
	Total baseline amount	100 Mt CO ₂ e
x	Party's target (QELRC)	75%
x	Number of years in commitment period	5 years
=	Party's assigned amount	375 Mt CO₂e