

Appendix 5a: Land use area figures identified by the LUCAS mapping programme (for release).



Ministry for the
Environment
Manatū Mō Te Taiao

Land use area figures identified by the LUCAS mapping programme

Date:	20 July 2009	MfE Priority:	Moderate
Security Level:		Number of Attachments:	Nil
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Action Sought

	Action Sought	Deadline
Minister for the Environment Hon Dr Nick Smith	Note the Land use area figures identified by the LUCAS mapping programme to inform the net position report and the 2020 target.	20 July 2009

Ministry for the Environment Contacts

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Executive Summary

- 1 The LUCAS (Land Use and Carbon Analysis System) programme was established to enable New Zealand to meet its reporting and accounting obligations under Article 3.3 of the Kyoto Protocol for Land Use, Land-Use Change and Forestry (LULUCF) activities. LUCAS tasks are being undertaken in a manner designed to meet Intergovernmental Panel on Climate Change Good Practice Guidance (IPCC GPG) – (IPCC 2003).
- 2 The LUCAS programme involves mapping land use at 1990, and then to map land-use changes for the time periods 1990-2007 and 2008-2012 (the first Commitment Period). All mapping has involved the extensive use of satellite imagery, some aerial photography and other spatial data.
- 3 The 2008 National Inventory Report due for submission in April 2010 will be the first time LULUCF sector data has come from LUCAS.
- 4 Previous Inventory reports have used the National Exotic Forest Description (NEFD) developed and administered by the Ministry of Agriculture and Forestry (MAF), which has proven to be a good proxy until the LUCAS data was delivered.
- 5 LUCAS has mapped post-1989 forest (Kyoto forest) area as 566,106 hectares. This is 18,000 hectares lower than the estimate of eligible Kyoto forest area used in the 2009 Net Position report based on the NEFD.
- 6 The new LUCAS Kyoto forest area figures would reduce the estimated uptake by the post-1989 forests by approximately 3 million tonnes CO₂ over the period 2008 to 2012. Everything else being equal this would reduce the Kyoto surplus from 9.6 million units to about 6.6 million units.
- 7 A complete update of the net position is due early 2010. Emissions projections for all sectors will be revised using updated input assumptions (including land area), for the 2010 update. The change to the estimate of the land area input assumption alone is not sufficient to prompt an update to the net position.
- 8 The results of the LUCAS mapping is shown in Table 1 below:

Table 1: Summary of key land use categories (hectares) mapped by LUCAS

Class	Description	1990	2008	Difference
71	Natural Forest (key category)	8,141,990	8,087,091	-0.7%
72	Planted Forest - pre 1990 (key category)	1,478,847	1,451,900	38%
73	Post-1989 Forest (key category) Kyoto eligible forest		566,106	
74	Grassland - with woody biomass (key category)	1,151,909	1,029,415	-10.6%
>74	Non key classes	15,979,770	15,618,003	-2.3%
	Total	26,752,516	26,752,516	

- 9 The area of Kyoto eligible forest is expected to increase further because there is up to 150,000ha of pre-1990 Planted forest yet to be assessed for Kyoto eligibility. This area largely comprises small forest blocks (<20ha in size) where higher resolution data is required to definitively classify the areas into pre or post-1989 area.
- 10 The area reported in Table 1 includes deforestation that occurred up to 31 December 2007. Mapping of deforestation for 2008 is still in progress and is due to be completed by September 2009. Mapping and reporting of deforestation will occur annually through the Commitment Period but the final area of deforestation will not be defined until 2013 when the second tranche of land use mapping from newly acquired satellite imagery has been completed.
- 11 Our estimate is that allowing for the additional Kyoto eligible forest that could be derived from the pre-1990 Planted forest refinement work mentioned in paragraph 9 above and the potential deforestation activity, the 566,106ha could increase by 3% to 5% (16,980ha – 28,300ha) when our final report is tabled in April 2014.

Recommended Action

We recommend that you:

- (a) **Note** that LUCAS has determined there is at least 566,106 hectares of Kyoto eligible forest. This is 18,000 hectares lower than the estimate of eligible Kyoto forest area used in the 2009 Net Position report but falls within the range provided for the 2020 Target Cabinet paper and consultation round.
- (b) **Note** that as a result of the LUCAS mapping data and if all other things remain equal, the Net Position would fall by 3 million tonnes compared to the 2009 published position.
- (c) **Note** that as New Zealand elected to report at the end of the First Commitment Period, the LUCAS programme has scheduled activities to refine the land use area numbers throughout the first commitment period. This refinement of less than 20 ha blocks and allowing for an estimate of deforestation through the period could further increase the area of Kyoto eligible forest by 3% to 5% (16,980ha – 28,300ha).

Todd Krieble
Director, Information

20 July 2009

Referred to Ministry Communications Staff:

No

Hon Dr Nick Smith
Minister for the Environment

Background

- 1 The Land Use and Carbon Analysis System (LUCAS) programme was established to enable New Zealand to meet its reporting and accounting obligations under Article 3.3 of the Kyoto Protocol for Land Use, Land-Use Change and Forestry (LULUCF) activities. LUCAS tasks are being undertaken in a manner that is designed to meet Intergovernmental Panel on Climate Change Good Practice Guidance (IPCC GPG) – (IPCC 2003).
- 2 LUCAS involves mapping land use at 1990, and then to map land-use changes for the time periods 1990-2008 and 2008-2012. All mapping has involved the extensive use of satellite imagery, some aerial photography, along with other spatial data.
- 3 As part of this first iteration of mapping to establish the 1990 baseline and 2008 position, there are four target land use categories that have been mapped – natural forest, planted forest (separated into pre-1990 and post-1989), and grassland with woody biomass. All other land uses have been derived from the New Zealand Land Cover Databases (versions 1 & 2) and Land Information topographic layers.
- 4 The parameters New Zealand has agreed to use to define forest land are: minimum area of 1 ha, crown cover of 30 percent and a minimum height of 5 metres. The 1990 land use mapping is complete. The 2008 mapping was completed in mid July 2008. Final quality control and accuracy assessment activities are yet to be completed and are planned for completion within the next 6 months.
- 5 The 2008 National inventory Report due to be submitted in April 2010 will be the first time the LULUCF sector data from LUCAS. Previous Inventory reports have used planted forest areas from the National Exotic Forest Description (NEFD) administered by MAF.
- 6 In early July LUCAS provided a set of preliminary a Kyoto eligible forest area range of 518,000 to 570,000 hectares as input into 2020 Greenhouse Gas Target forecasts.
- 7 The lack of supplementary evidential spatial data for 1990 (because it simply doesn't exist) was a major challenge in establishing the 1990 land use map. So the 1990 land use map has been compiled by mapping and verifying change with respect to an already-established year 2000 reference map. Other datasets such as the New Zealand Land Cover Databases and 1996 satellite imagery were used in classification decision making.

LUCAS results and comparison to previous estimates

- 8 The total national estimate of planted forest area at 2008 as mapped by LUCAS is 2.02 million hectares. This is gross area (which includes unstocked gaps within forest boundaries) where as the NEFD area of 1.81 million hectares (as at 1 April 2008) is a net stocked area. The total LUCAS planted forest area is 11.5% higher than the NEFD 2008 estimate.
- 9 The LUCAS estimated post-1989 forest (Kyoto forest) area is at least 566,106 hectares. This is 18,000 hectares lower than the estimated eligible Kyoto forest area used in the 2009 Net Position report (based on the NEFD). The

difference between LUCAS estimate and NEFD estimate is not considered to be significant.

- 10 With planned improvements during the commitment period, the LUCAS estimate is expected to increase by 3% to 5% as more evidence becomes available. Currently the key limitation is the inability to identify young forests that might have been planted between 1989 and 1992 (those younger than 3 years).
- 11 Table 1: Summary of key land use categories (hectares) mapped by LUCAS

Class	Description	1990	2008	Difference
71	Natural Forest (key category)	8,141,990	8,087,091	-0.7%
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- 12 The area of Kyoto eligible forest is expected to increase further because there is up to 150,000ha of pre-1990 Planted forest yet to be assessed for Kyoto eligibility. This area largely comprises small forest blocks (<20ha in size) where higher resolution data is required to definitively classify the areas into pre or post-1989 area.
- 13 The area reported in Table 1 includes deforestation that occurred up to 31 December 2007. Mapping of deforestation for 2008 is still in progress and is due to be completed by September 2009. Mapping and reporting of deforestation will occur annually through the Commitment Period but the final area of deforestation will not be defined until 2013 when the second tranche of land use mapping from newly acquired satellite imagery has been completed.
- 14 Our estimate is that allowing for the additional Kyoto eligible forest that could be derived from the pre-1990 Planted forest refinement work mentioned in paragraph 9 above and the potential deforestation activity, the 566,106ha could increase by 3% to 5% (16,980ha – 28,300ha) when our final report is tabled in April 2014.

Limitations

- 15 The use of remote sensing does limit the ability to identify young forest (especially those younger than 3 years) due to the low resolution of the imagery. The second major limitation results from cloud cover.
- 16 In the 1990 imagery, key areas such as Otago, Northland and Gisborne had a high incidence of cloud and no alternative imagery could be obtained. LUCAS mapping therefore relied on analysing other datasets such 1996 SPOT and 2001 Landsat 7 satellite imagery to determine the land use classes at 1990 where there were clouds and in instances where a forest might have been planted between 1989 and 1993. However, the approach does have limitations in that the decision process introduces a degree of subjectivity which could

result in misclassification. The most likely scenario is misclassification of post-1989 forest and pre-1990 forest.

- 17 Noting that this is the first iteration of the LUCAS land use mapping, there are areas of uncertainty. There is a plan for making iterative improvements during the commitment period.

Planned improvement for LUCAS mapping

- 18 As noted in previous sections, the mapping approach is designed to eliminate errors of omission as much as possible. However, the subjectivity in classification cannot be completely eliminated and will have introduced some misclassification errors.
- 19 The results presented from LUCAS are derived from the best available data at the current time, and do require improvement. Planned improvements include:
 - a. integration of data being collected through Forestry Emissions Trading Scheme, Permanent Forest Sink Initiative and other sources.
 - b. review where conversions occurred to non-woody categories.
 - c. the mapping of grassland with woody biomass, deforestation, and land use changes occurring in areas less than 5 ha in size
- 20 A second tranche of mapping for the 2012 position will start in the summer of 2011 (October-December) to map land cover as at 31 December 2012. This tranche of mapping is not scheduled to be finalised until June 2013.

Additional Information

- 21 The LUCAS programme is using remote sensing technologies to produce “wall to wall” maps of New Zealand to identify, measure and report on land use, land change and forestry (LULUCF) to fulfil United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol obligations.
- 22 Prior to establishing the LUCAS Programme, New Zealand has reported on the LULUCF sector using MAF’s National Exotic Forest Description (NEFD) database which is based on surveys of forest owners. The NEFD area of Kyoto eligible forest is considered to have an uncertainty range of +/- 15%.
- 23 Mapping to establish the 1990 benchmark position was undertaken using satellite imagery from data collected in years on and about 1990. Where there is significant cloud cover that casts a shadow on the land, additional images (“tiles”) must be collected to ensure there is a cloud free image for processing.
- 24 There are 31 tiles that make up the complete satellite picture for New Zealand as at 1990. This 1990 imagery has coarse ground resolution (30m x 30m pixels) compared with the imagery resolution being used for 2008 comprising 161 tiles and (10m x 10m pixels).
- 25 The 1990 mapping work commenced in September 2008 and was completed on 30 March 2009 when a draft map was completed.

- 26 Mapping of the 2008 position was commenced in December 2008 and was completed on 26 June 2009. A much higher resolution image is available for 2008 than 1990 and so are 161 tiles required to make up the complete picture for New Zealand as at 1 January 2008.
- 27 The international guidance notes that uncertainty estimates are an essential element of a complete greenhouse gas emissions and removals inventory. The purpose of uncertainty information is not to dispute the validity of the inventory estimates, but to help prioritise efforts to improve the accuracy of inventories in the future and guide decisions on methodologies.
- 28 The final land use area figures must be reported to the Secretariat of the United Nations Framework Convention on Climate Change on or by 15 April 2014. Until that report is tabled, New Zealand's Inventory data (including Kyoto data) can and will be adjusted as the dataset is improved by the refinement of existing data and the collection and analysis of new data, all of which is part of the LUCAS programme of work.