



Government announces LCDB mapping programme

Environment Minister Nick Smith and Science and Innovation Minister Wayne Mapp announced a four-year Land Cover mapping and Research Programme on 11 August. Destined to apply "the best in modern technology" to the mapping of New Zealand's changing land cover, the programme will cost \$1 million a year for the next four years

"The Land Cover Research Programme will provide vital information about our rural and urban environment for the natural resources sector, regional councils and research organisations to use," Smith said. "Using the best in modern technology, we can thoroughly map New Zealand's changing land use so we can quantify the pressures on water quality and biodiversity."

"Up-to-date information about vegetation, water sources and the built environment is critical for the success of natural resource industries such as agriculture and forestry," said Mapp.

The Land Cover Research Programme is led by Landcare Research, with the involvement of the Ministry for the Environment, the Department of Conservation, the Ministry of Agriculture & Forestry, the Fire Service, and regional councils. It will build on the Ministry for the Environment's Land Use and Carbon Analysis System (LUCAS), developed to report New Zealand's carbon emissions to the United Nations, by re-using imagery collected for the 2008 and 2012 LUCAS time steps.

What is the Land Cover Database?

The New Zealand Land Cover Database (LCDB) contains detailed information on categories of land cover and their boundaries and is a record of land cover changes over time. It is a digital map of the surface of New Zealand derived from satellite imagery. The first two editions, LCDB-1 and LCDB-2, show the state of New Zealand's land cover in 1996-1997 and in 2000-2001 respectively. These digital maps underpin many activities within central, regional and local government, industry and research institutions. The information is used for land, water, and biodiversity management, pest control and monitoring, wildfire threat and risk analysis, and environmental monitoring and reporting.

The new LCDB programme – what will it deliver?

This new programme will deliver two more editions of LCDB. Both these leverage off the significant investment by MfE in research and imagery for their Land Use & Carbon Analysis System (LUCAS) programme. LCDB-3 will be derived from the 2008 LUCAS satellite imagery and delivered in July 2012. LCDB-4 will use 2012 LUCAS imagery and will be completed in July 2014.

By 2015 it is envisaged that the new LCDB editions will provide the authoritative record of land cover and land cover change in New Zealand.

At the same time, parallel research will be developing improved ways of generating land cover information so that future LCDB editions can leverage improvements in satellite technology and data processing to become even more accurate and reliable.

This research has spin-off benefits for other applications that require spatial analysis and segmentation of imagery. These include the monitoring of sustainable land use, habitat analysis, agricultural applications, economic modelling, and disaster response planning.

Who is involved?

LCDB is led by David Pairman (Lincoln) and Peter Newsome (Palmerston North), while James Shepherd leads the research arm of the programme. A number of other Landcare Informatics Team members are also involved.



David



Peter



James

Collaborators MfE, DOC, MAF, the NZ Fire Service and regional councils will actively participate in the programme, contributing data and carrying out specific activities, especially ground-truthing (ground verification of satellite data interpretation). In addition, a governance group representing these partners will guide future development of the LCDB and the research priorities required to deliver it. MSI has invited the above organisations to nominate representatives to form this governance group. A wider stakeholder advisory group will also be formed to help determine the priorities for future LCDB editions.

Initial timetable

Most of the LCDB-3 mapping must be done before Christmas as the staff also need to process new LUCAS imagery that is collected this summer by June 2012. So timelines are tight! Our current plan is:

- August 2011 – MSI instigated the formation of the governance body which formed and met mid to late September.
- 12 September 2011 – LCDB-3 mapping program commenced. This is being done on a region by region basis and released to the collaborators (above) as each region is completed.

- Mid November 2011 – Establish procedures for checking and updating preliminary results, set up a help desk for, and collect QA/QC data from our collaborators ,
- Mid February 2012 – All regions completed and distributed to collaborating organisations.
- Mid April 2012 – Collaborating organisations complete checks and identify errors/updates required
- End June 2012 – Finalised LCDB-3 publically released.
- End September 2012 – Publish results of accuracy study for LCDB-3

Since starting in September, the LCDB-3 initial mapping has been proceeding at pace. The update is being done regionally and the plan is for each region to be released to collaborating organisations for checking as soon as it is available. Good progress has been made and the following regions are ready for checking; Nelson, Auckland, Taranaki, Marlborough, Hawke's Bay, Bay of Plenty. We will be encouraging organisation checking these earlier regions to return results by the end of February to avoid a bottleneck in mid April when all checking results are due so that we can publically release LCDB-3 in June.

The research program

Specific priorities will be set by the governance body, with input from the stakeholder advisory group for research, and is expected to improve the LCDB in areas such as

- Image understanding and automatic feature extraction
- Smart vector editing
- Specialist layers for specific applications (LCDB+)
- Mapping accuracy & polygon precision
- Web based delivery & feedback
- Use of future sensors

As the delivery of LCDB-3 is the priority during the programme's first year, the research component is limited. The impact of the research programme will be more apparent in LCDB-4 and beyond.

LCDB-3 classes

The LCDB-3 classes shown in the table below resulted from a sequence of user forums conducted in 2010 and aims to address some of the issues with the LCDB2 set while maintaining some consistency with the LCDB-1 & 2 classes.

The rationalised LCDB-3 classification means that, for example, mines will not be distinguished from dumps as they were in LCDB-2. In addition, the age-class breakdown of exotic forests (of interest largely to the forestry industry) will not be maintained. A map-to-image automated change detection process is being used to highlight areas for operator investigation.. This detection method often highlights errors present in LCDB-1 & 2 and correction of these errors is part of the LCDB-3 mapping process.

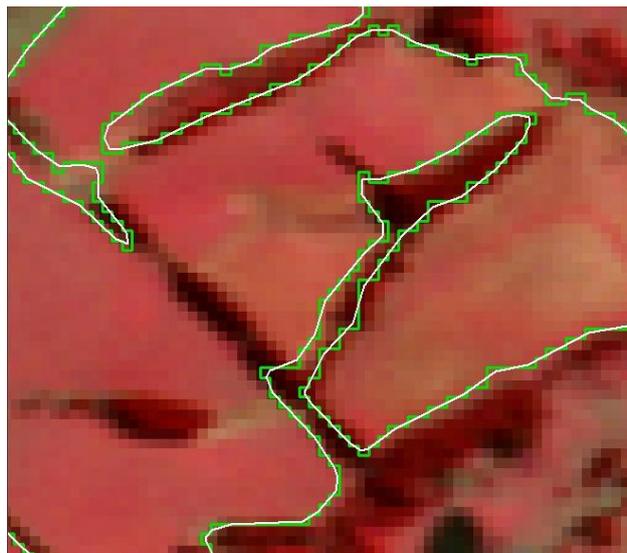
Land Cover classifications of LCDB-1 and LCDB-2 and LCDB-3

	LCDB-1 (16 classes)	LCDB-2 (43 classes)	LCDB-3 (33 rationalised LCDB-2)
<i>Artificial Surfaces</i>	<i>Urban Area Urban Open Space Mines and Dumps</i>	<i>Built-up Area (settlement) Urban Parkland/Open Space Surface Mine Dump Transport Infrastructure</i>	<i>Built-up Area (settlement) Urban Parkland/Open Space Surface Mines and Dumps Transport Infrastructure</i>
<i>Bare or Lightly-vegetated Surfaces</i>	<i>Coastal Sand Bare Ground</i>	<i>Coastal Sand and Gravel River and Lakeshore Gravel and Rock Landslide Alpine Gravel and Rock Permanent Snow and Ice Alpine Grass/Herbfield</i>	<i>Coastal Sand and Gravel River and Lakeshore Gravel and Rock Landslide Alpine Gravel and Rock Permanent Snow and Ice Alpine Grass/Herbfield</i>
<i>Water Bodies</i>	<i>Inland Water Coastal Wetland Inland wetland</i>	<i>Lake and Pond River Estuarine Open Water</i>	<i>Lake and Pond River Estuarine Open Water</i>
<i>Cropland</i>	<i>Primarily Horticulture</i>	<i>Short-rotation Cropland Vineyard Orchard and Other Perennial Crops</i>	<i>Short-rotation Cropland Orchard Vineyard & Other Perennial Crops</i>
<i>Grassland, Sedgeland and Marshland</i>	<i>Primarily Pastoral Tussock Grassland</i>	<i>High Producing Exotic Grassland Low Producing Grassland Tall Tussock Grassland Depleted Grassland Herbaceous Freshwater Vegetation Herbaceous Saline Vegetation Flaxland</i>	<i>High Producing Exotic Grassland Low Producing Grassland Tall Tussock Grassland Depleted Grassland Herbaceous Freshwater Vegetation Herbaceous Saline Vegetation Flaxland</i>
<i>Scrub and Shrubland</i>	<i>Scrub</i>	<i>Fernland Gorse and/or Broom Manuka and/or Kanuka Matagouri Broadleaved Indigenous Hardwoods Sub Alpine Shrubland Mixed Exotic Shrubland Grey Scrub</i>	<i>Fernland Gorse and/or Broom Manuka and/or Kanuka Broadleaved Indigenous Hardwoods Sub Alpine Shrubland Mixed Exotic Shrubland Grey Scrub</i>
<i>Forest</i>	<i>Planted Forest Major Shelterbelts Willows and Poplars Indigenous Forest</i>	<i>Minor Shelterbelts Major Shelterbelts Afforestation (not imaged) Afforestation (imaged, post LCDB1) Forest - Harvested Pine Forest - Open Canopy Pine Forest - Closed Canopy Other Exotic Forest Deciduous Hardwoods Indigenous Forest Mangrove</i>	<i>Exotic Forest Deciduous Hardwoods Indigenous Forest Mangrove</i>

Smoother boundaries

LCDB-1 was manually digitised and its boundaries are reasonably smooth. However, LCDB-2 used a number of semi-automated techniques and some of these introduced boundaries aligned to the pixels in the source data – 15 metre orthorectified satellite data. This caused staircase boundaries (15 metre steps) which look wrong on the resulting map and also imply a level of detail not supported by any objective interpretation of the data.

So, the LCDB-1 & 2 line work has been generalised to smooth out these “staircases”. This process does not change the number of polygons, but just smooths the boundaries. As each polygon has attributes for its class membership at each LCDB level, comparisons between levels can still be readily made.



Boundary smoothing, showing the pixelated boundary in green and the improved smoothed boundary in white

Territorial boundaries removed

We also made the decision to dissolve out the territorial boundaries. This is because the actual boundaries can change over time, so burning them in created difficulties as to which date they apply to. If they are needed for a specific purpose, it is a relatively trivial GIS exercise to re-introduce any specific set of territorial boundaries by merging with the LCDB dataset.

Website for the LCDB programme

A website at lcdb.scinfo.org.nz is being developed to help communicate progress on the new edition of the LCDB. The site will also keep stakeholders and other interested parties in touch with any issues as they arise.

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Or via the contact section of the website at lcdb.scinfo.org.nz/contacts.