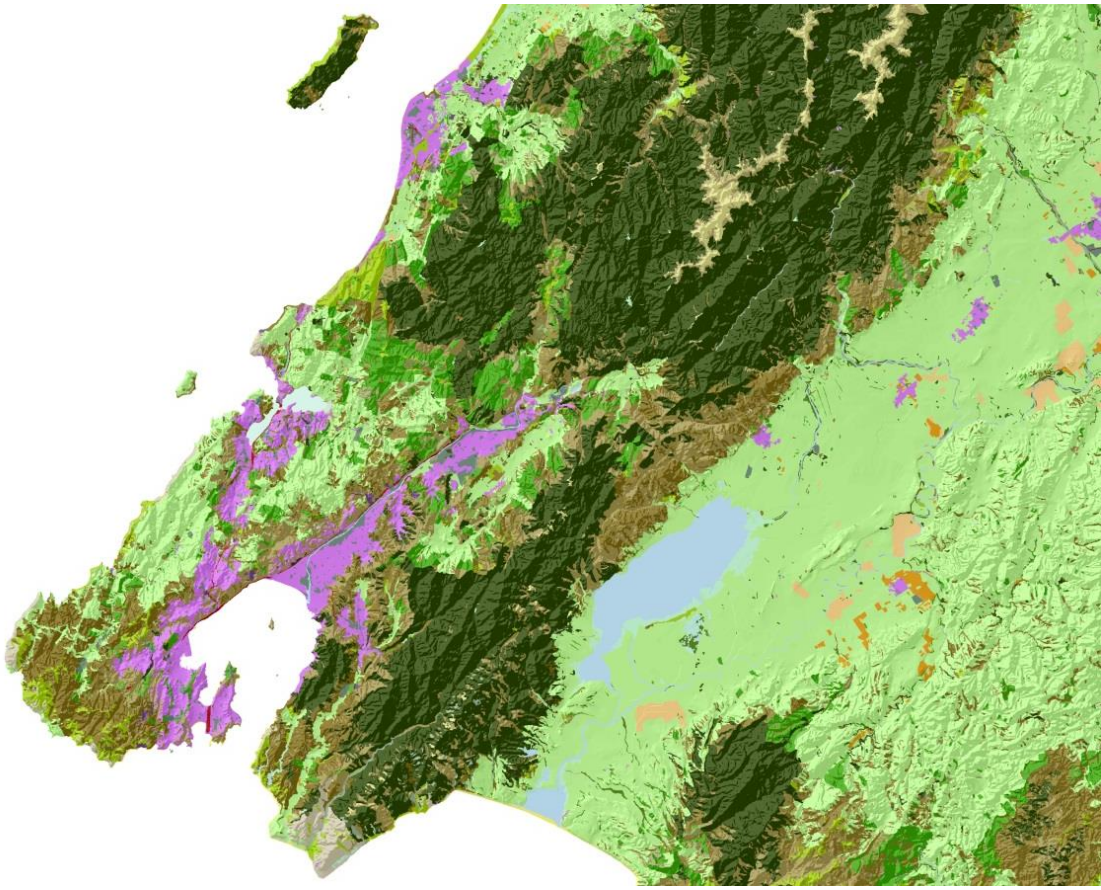
Landcare Research
Manaaki Whenua

Time and Trees on the Map
Land Cover Database 4

Talk Outline

- Key steps producing
  - LCDB v3.0, v3.3 & v4.0
- What's planned in v4.1
- Applications using LCDB
- Data quality feedback
- Research results
  - Satellite data processing
  - Timed mosaics
  - Smart polygon editing
  - LiDAR
- Research direction
- Beyond current contract

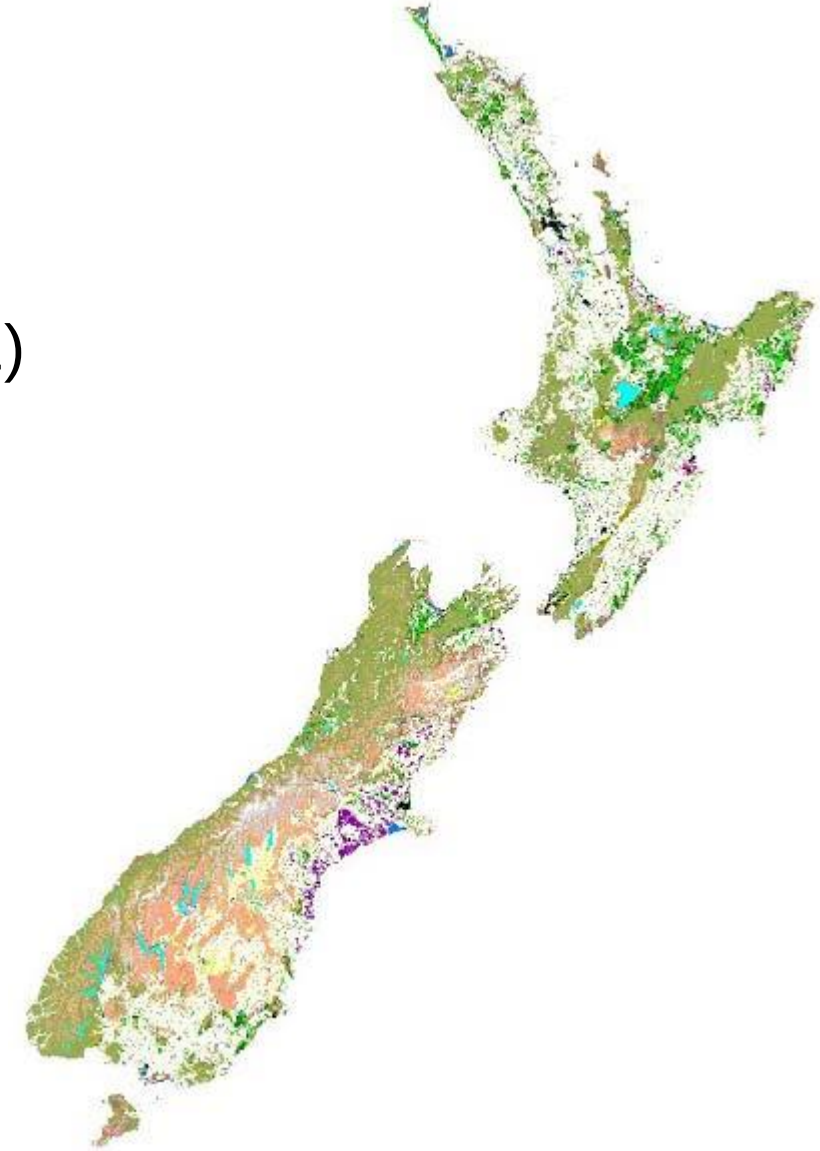


Looking Back…

LCDB v2 Inheritance:

- 43 Land Cover Classes
- Two time steps (1996, 2001)
- 428,000 polygons
- Supporting imagery

Our task was to take custody of this database, improve it, and deliver two further time steps (2008, 2012). Also, to develop processes to make this sort of mapping more efficient in future



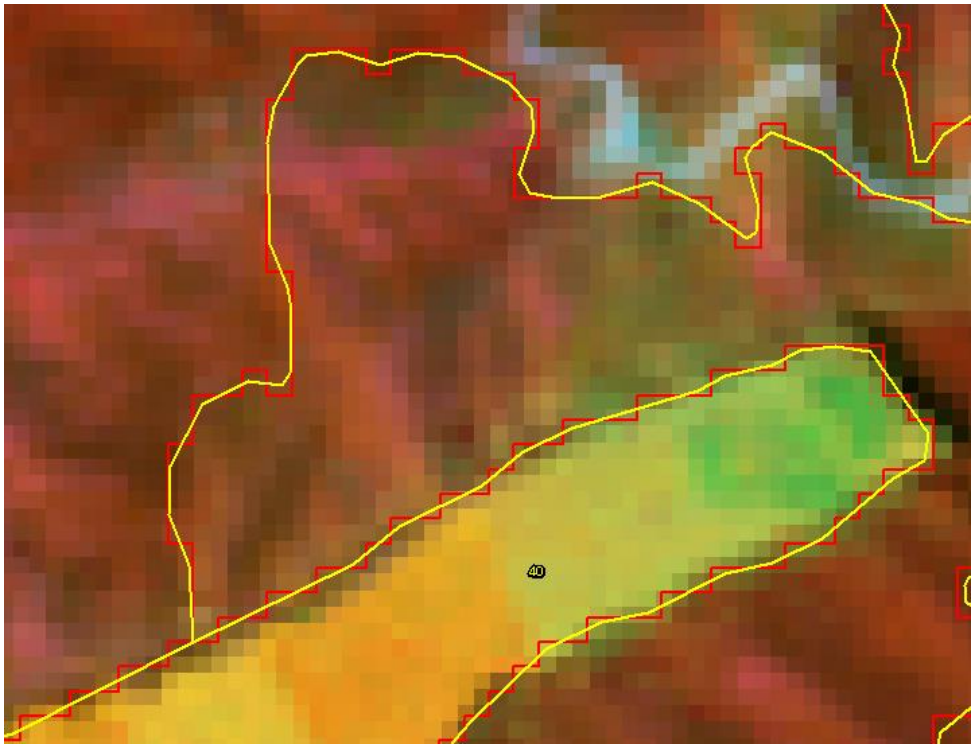
First Steps…

De-clutter, by:

- Removing Regions & Districts → down to 403,000 polys
- Eliminating (<0.05ha) fragments → down to 340,000 polys
- Smoothing line-work

None of these altered the land cover map, but the next steps would.

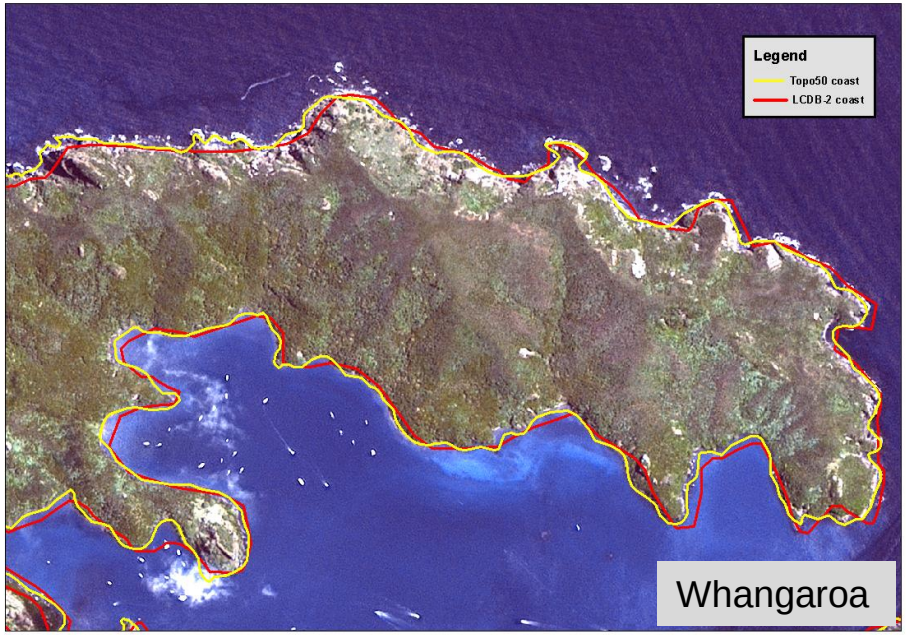
Stakeholders & our advisory group were party to all these decisions…

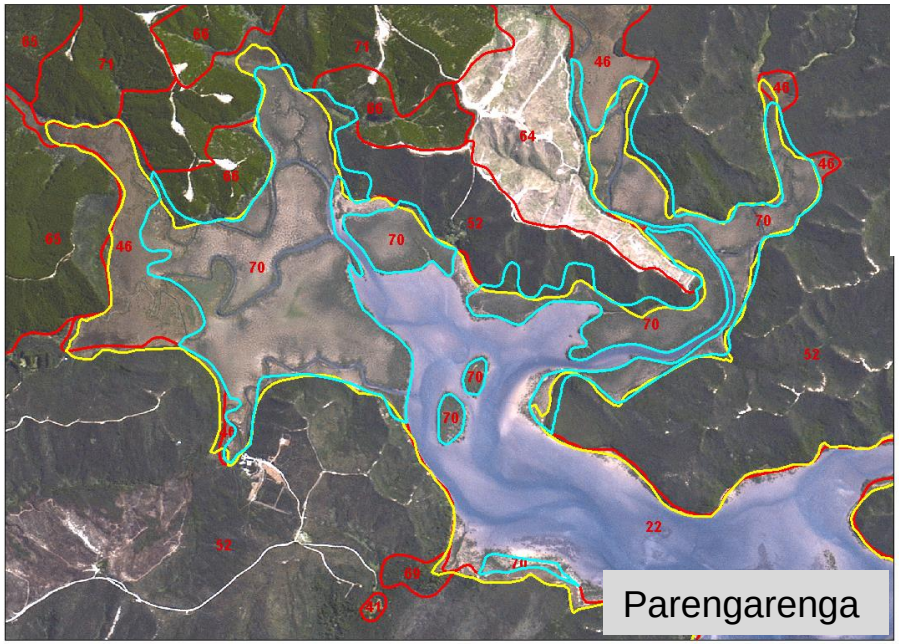


Next Steps…

- Rationalise classification
  - → down to 33 classes
- Rationalise coastline
  - → unify with Topo50
- Offshore vegetation
  - ↓

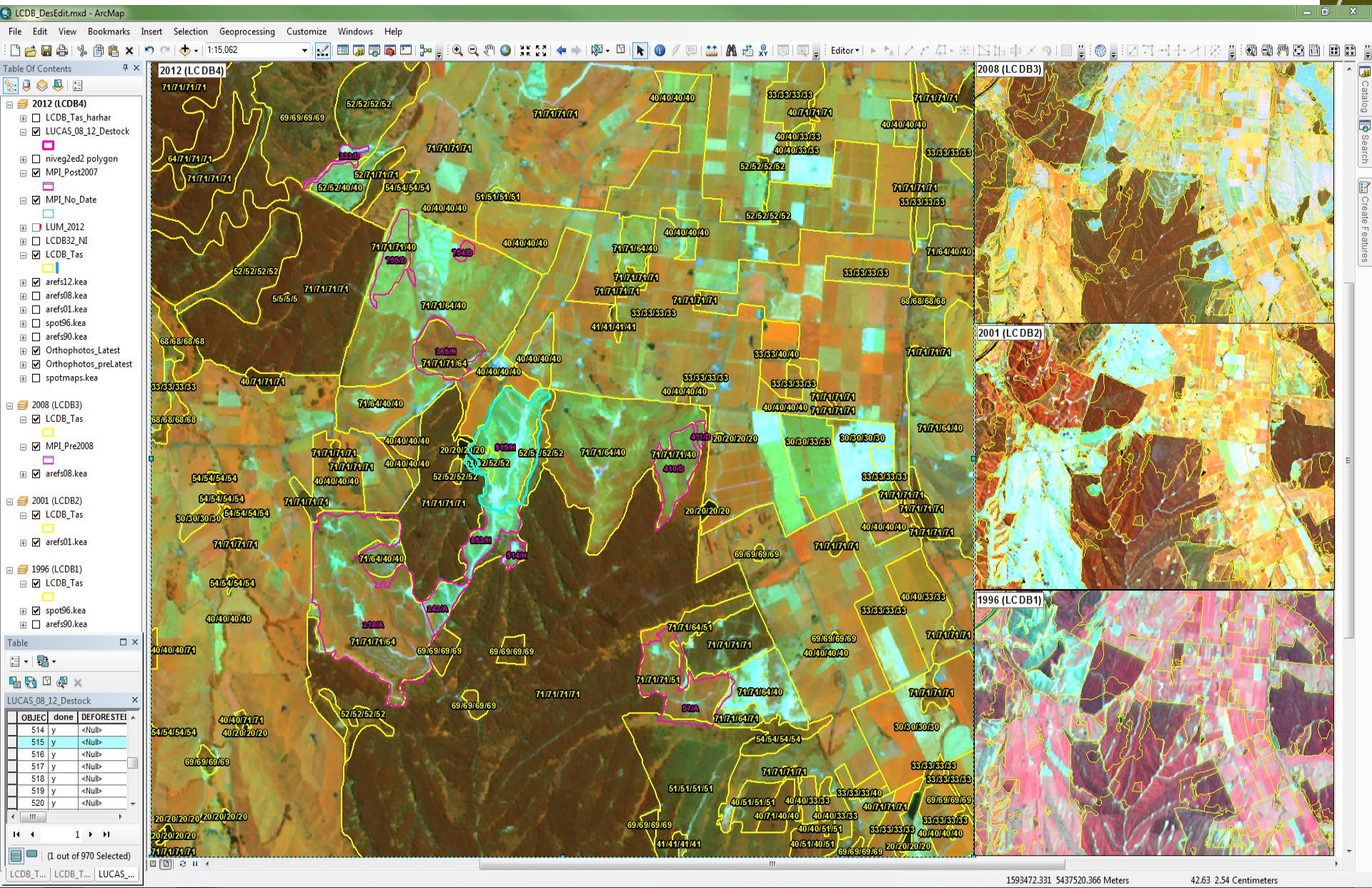
	LCDB v2 class	LCDB v3 class
Bare or Lightly-vegetated	*Coastal Sand and Gravel* *River & Lakeshore Gravel and Rock* *Landslide* *Alpine Gravel and Rock* *Permanent Snow and Ice* *Alpine Grass/Herbfield*	*Sand and Gravel* *Gravel and Rock* *Landslide* *Permanent Snow and Ice* *Alpine Grass/Herbfield*





→ created an ‘onshore’ attribute

LCDB Mapping Environment (using ArcGIS)



Mapping processes 2011-2014 (LCDBs v 3.0-4.0)

2011-12

- Restructure database
- Rubber-sheet offset areas
- Change 2001-08
- Harvesting c2008
- 2001 harvesting review

LCDB v3.0

2012-13

- >20ha change review
- Crop/settlement update (ex LUM)
- SI grassland errors
- SI grassland improvement 2001-08
- User-notified corrections

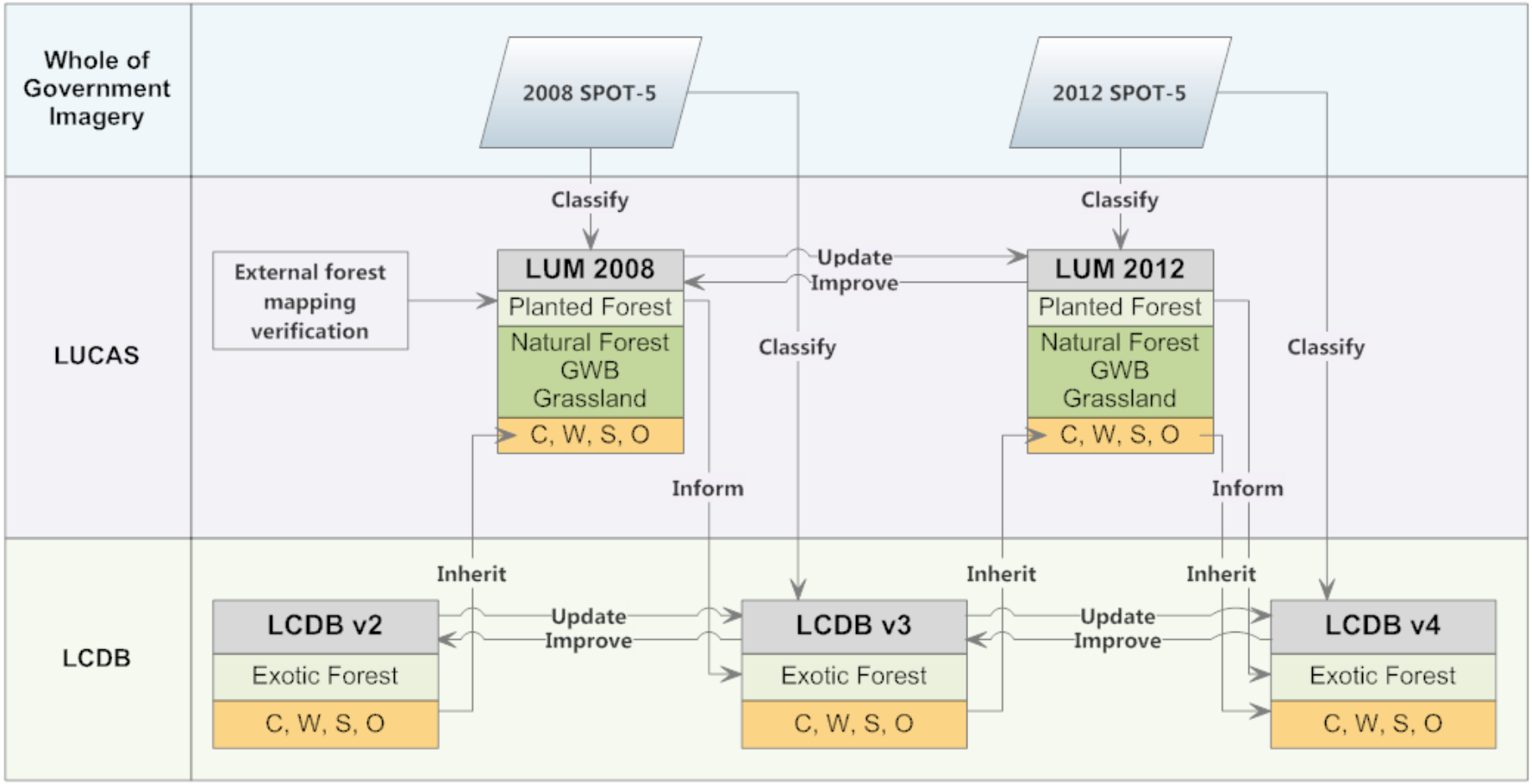
LCDB v3.3

2013-14

- Wetland upgrade (5½ regions)
- QA error corrections
- Change 2008-12 (ex LUM)
- Forest de-stock c2012 (harvest/deforest, ex LUM)
- 2008 harvesting review
- Urban update (ex LINZ)
- Local ‘green fields’ improvement
- User-notified corrections (e.g. Geographx)

LCDB v4.0

LCDB and LUCAS-LUM harmonisation



Note: C, W, S, O = Cropland, wetland, Settlements, Other.

Looking ahead…

2014-15

- Accuracy assessment
- LCDB/LUM class matrix corrections
- Chatham Islands
- User corrections
- More wetlands (3-4 regions?)
- Woody-on-pasture features?
- Rewrite User Manual…?

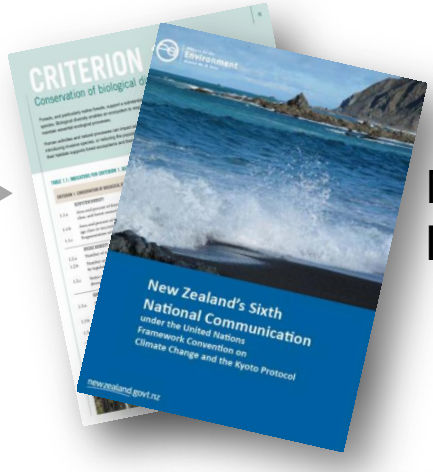
LCDB v4.1

2015-?

- LCDB v5… when?
- Classification review (rationalise/subdivide classes)?
- Mapping fidelity review?
- Integrate with LUM?
- …?

LCDB Applications

National Reporting



MfE
MPI…

Environmental Research

NIWA
Cawthron
Aqualinc
Freshwater Sol'n
Plant & Food
Scion…

Environmental Protection

Doc
Rural Fire
Regional Councils…

Smart Business

Atlas
EcoFX…

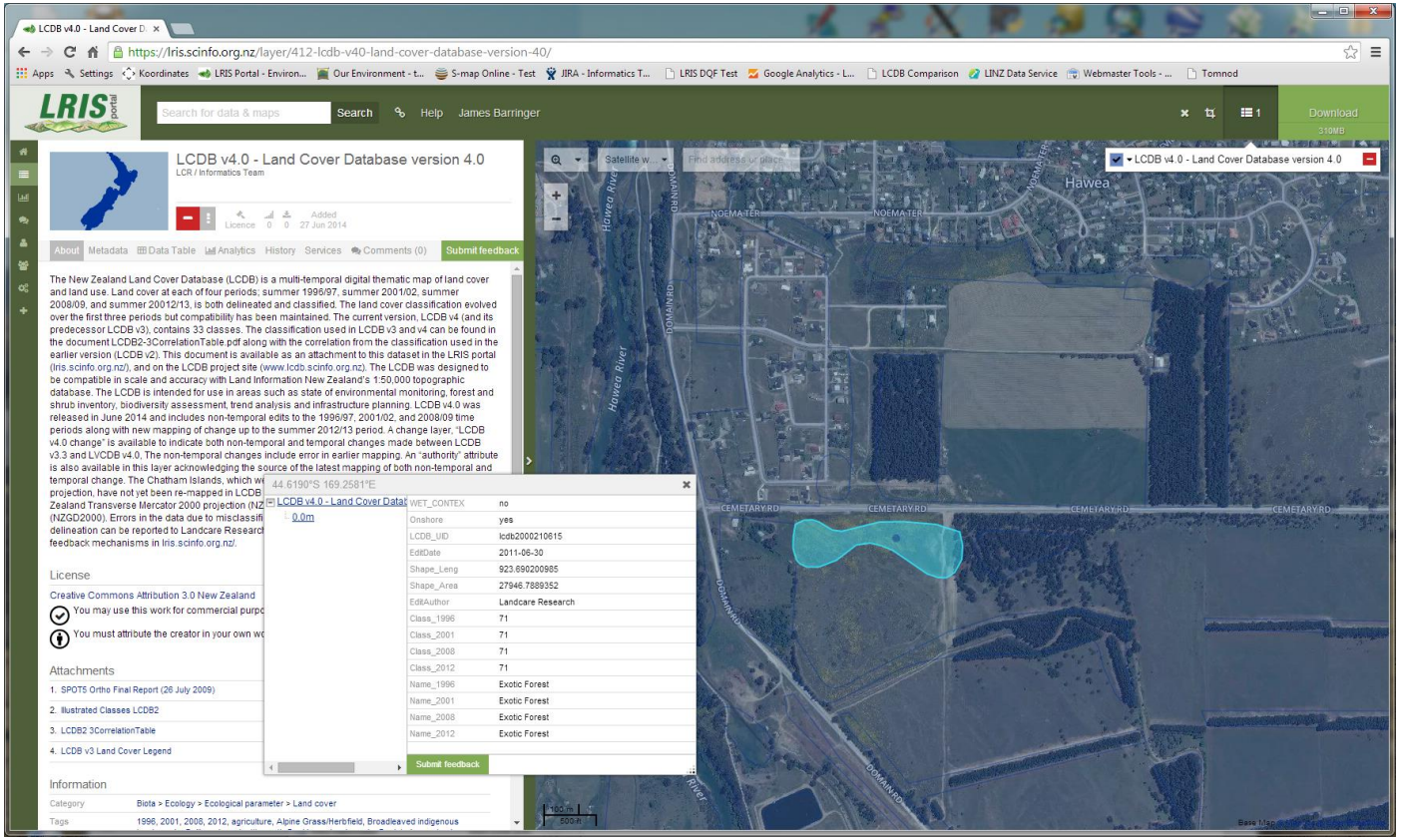
Better Maps

LINZ
Geographx
Ngai Tahu
Regional Councils…

Data Quality Feedback

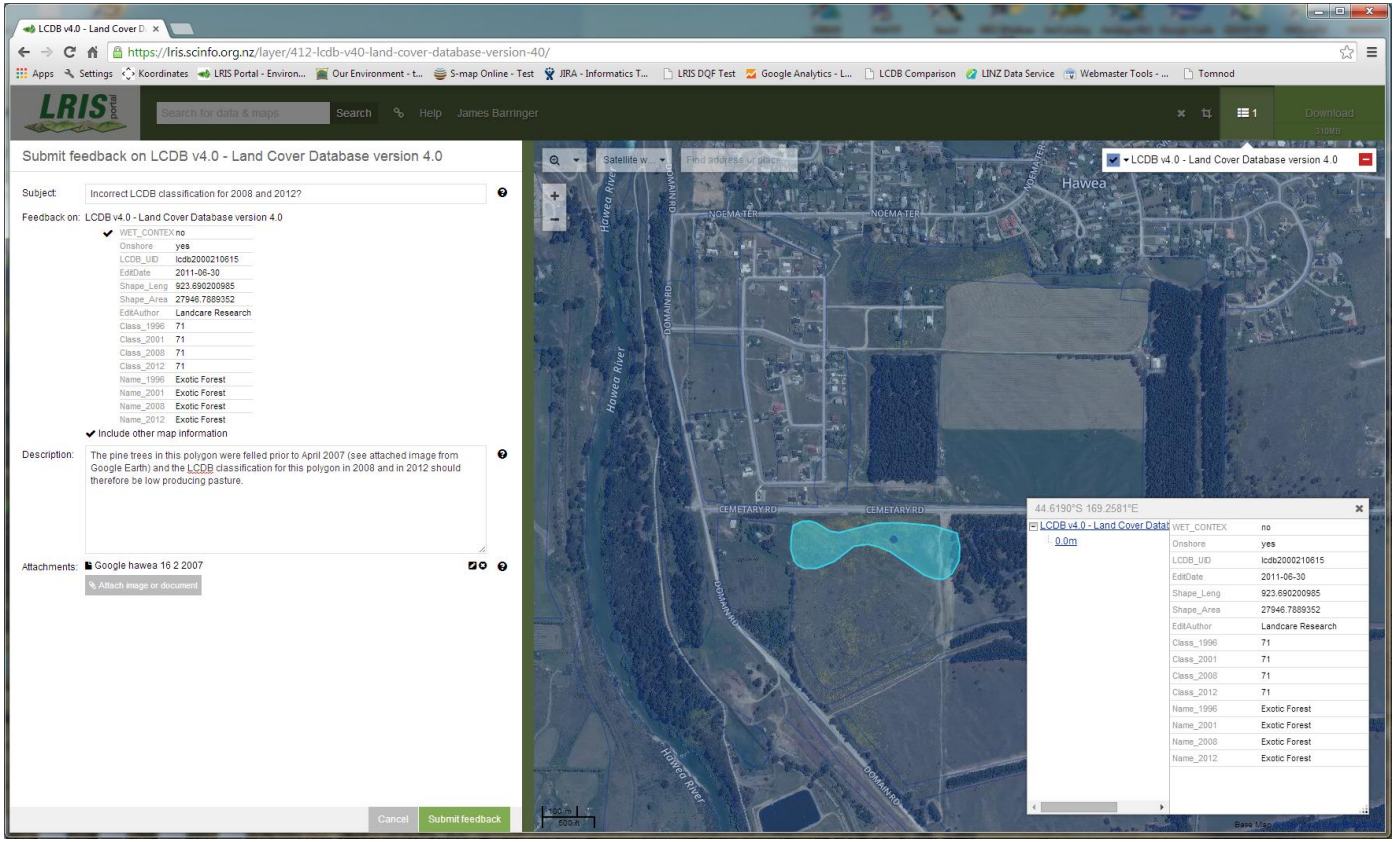
- Formal error feedback
  - Improved engagement
  - Trackable, Updatable

Full instructions on LCDB site and LRIS portal



Data Quality Feedback

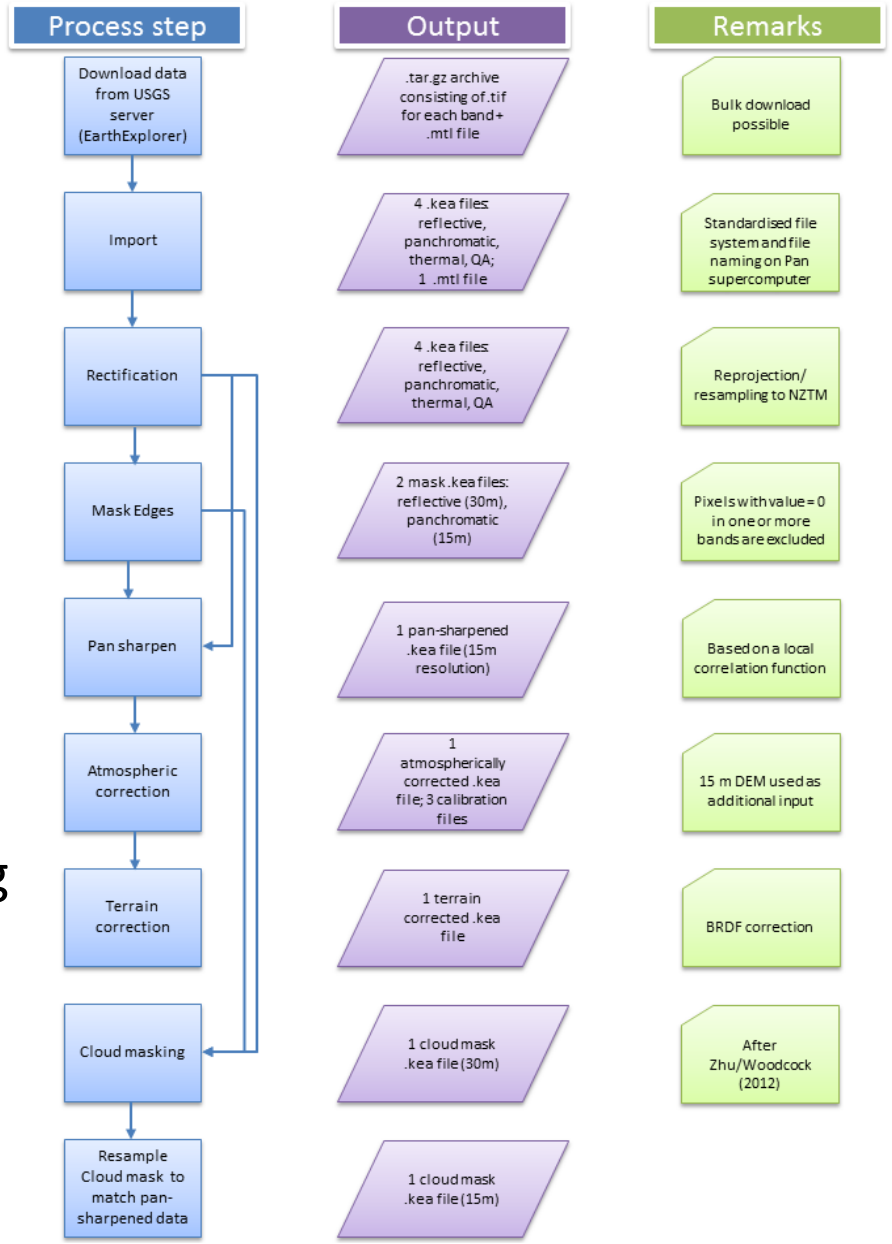
- Information sought
  - Confirm dates (don't rely on background image)
  - Provide evidence; screenshots, pictures, documents



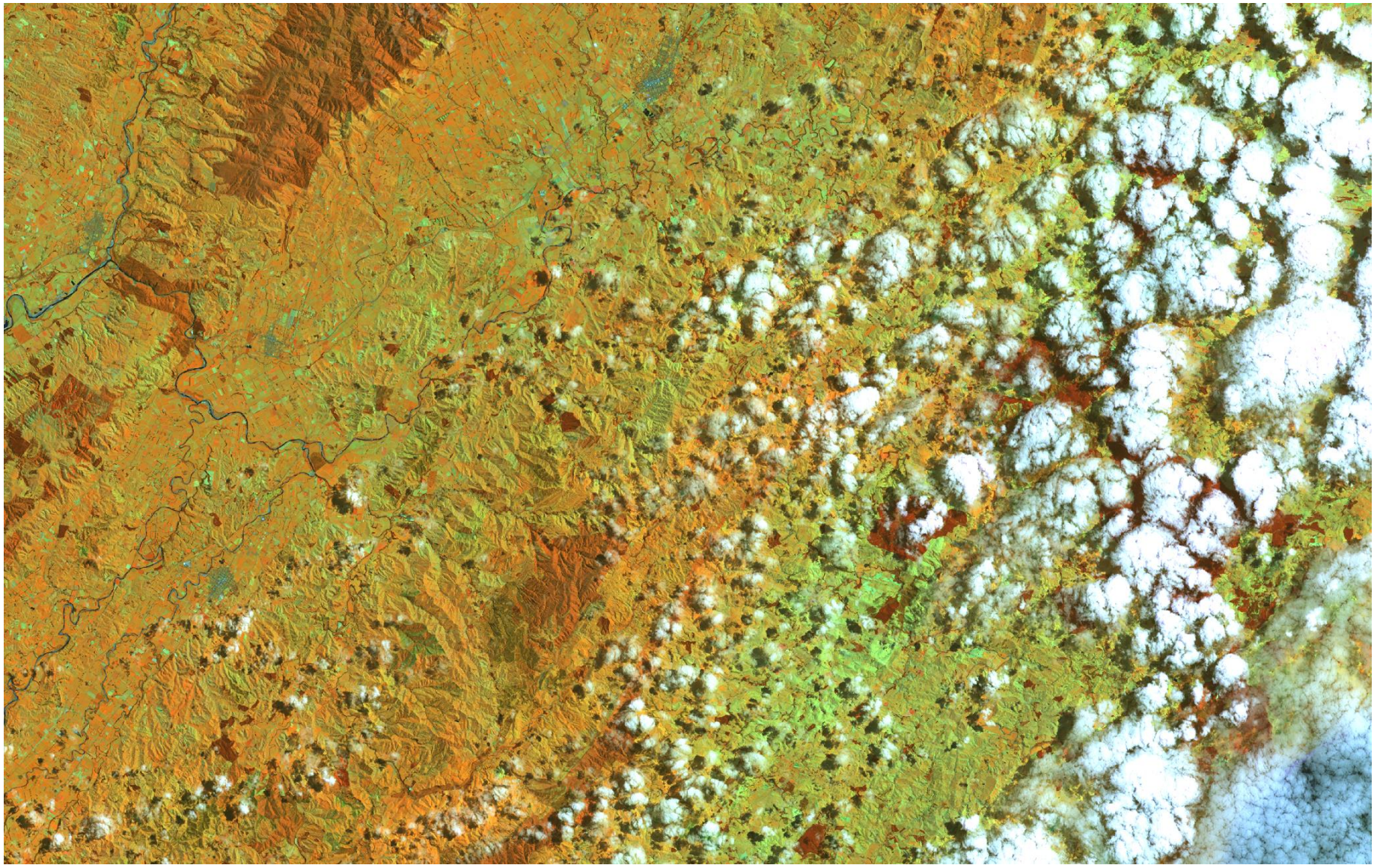
www.lcdb.scinfo.org.nz

Satellite data processing – HPC workflows

- Very automated
- Produces
  - Cloud masks
  - Calibrated imagery
  - Flattened imagery
- 1600 Landsat-4,5,7,8
  - 4.8 TB
- Temporal trend
  - **Much** more data (free)
  - Different approach to processing
  - e.g. better cloud clearing
  - Lots of opportunities
  - Future LCDB



Satellite data processing – Cloud clearing



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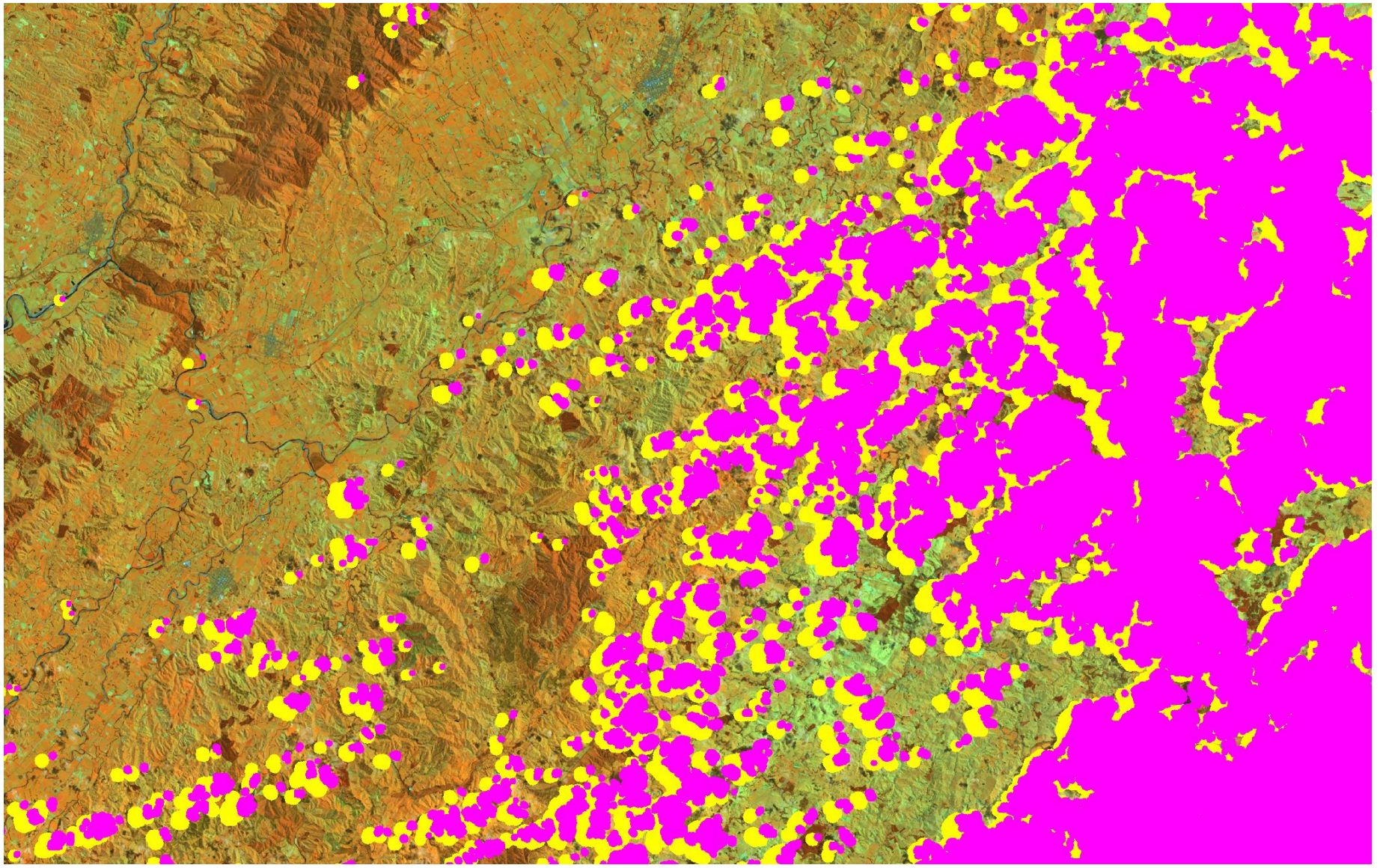
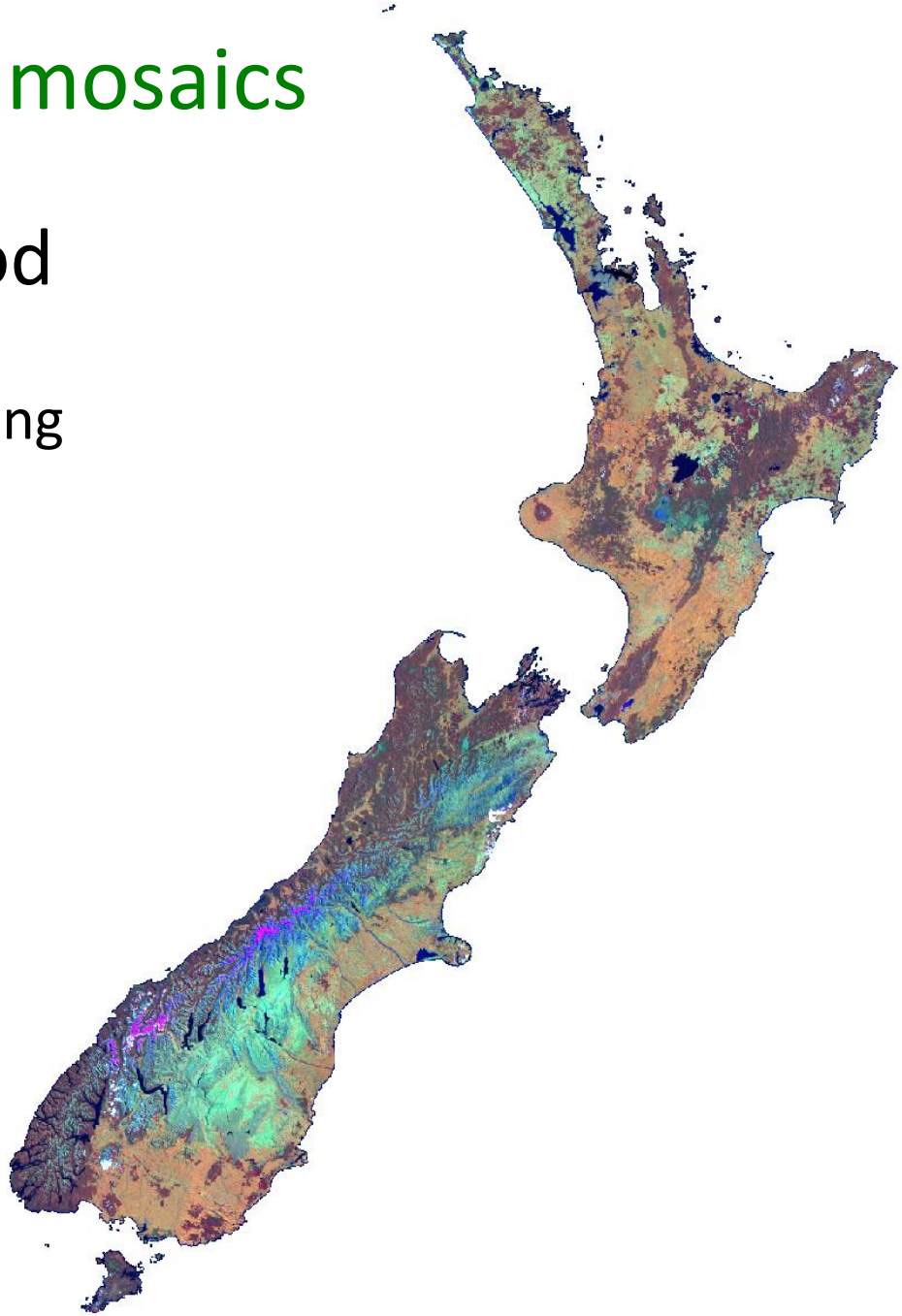
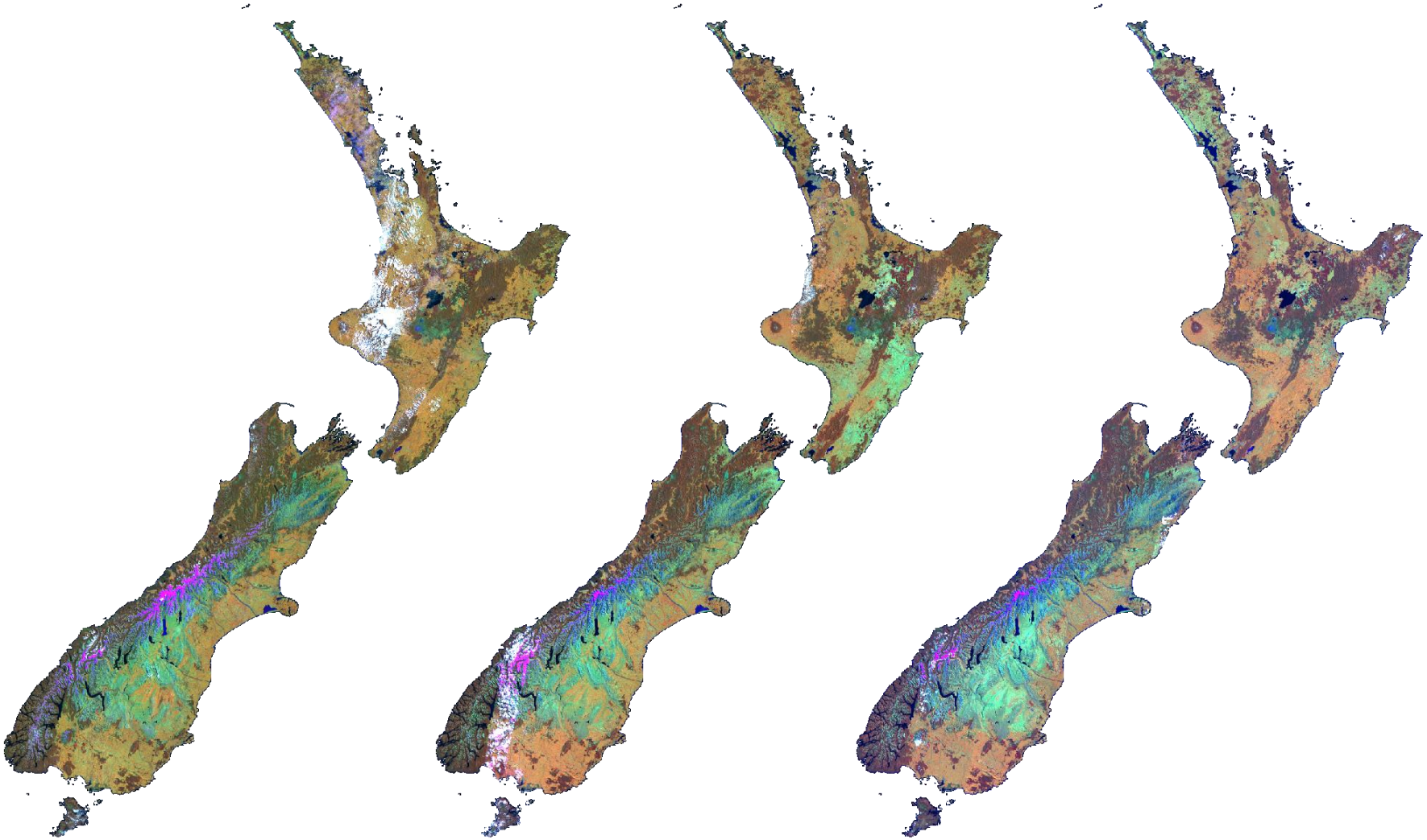


Timed mosaics

- Select over limited period
  - Rank images
  - Mosaic on cloud masks/ranking
- Uses
  - Enhance phenology
  - Report specific period



Timed mosaics



2011/12
Oct 11 – Feb 12

2012/13
Oct 12 – Feb 13

2013/14
Nov 13 – Feb 14

Timed mosaics – control masks

137
Landsat 7
SLC-off scenes

178
Landsat 7
SLC-off scenes

146
Landsat 8
scenes

Smart polygon editing

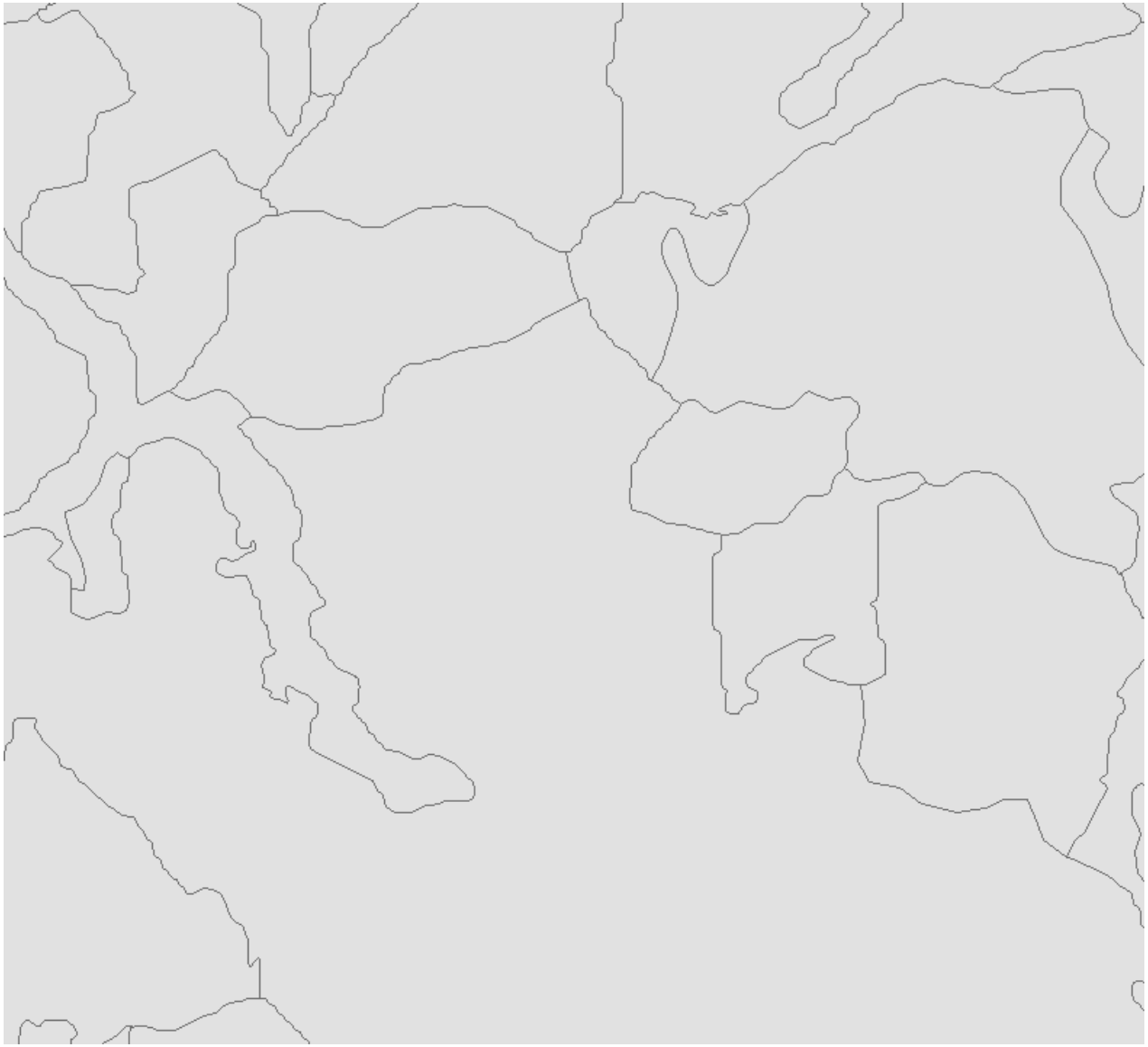
- Semi-Automated method to integrate
  - Change polygons (from remote sensing)
  - Replacement polygons (e.g. from another dataset)

- Select, Insert, Clean
  - across wide area (very confident of results)
  - Screen at a time (operator keeps track of results)

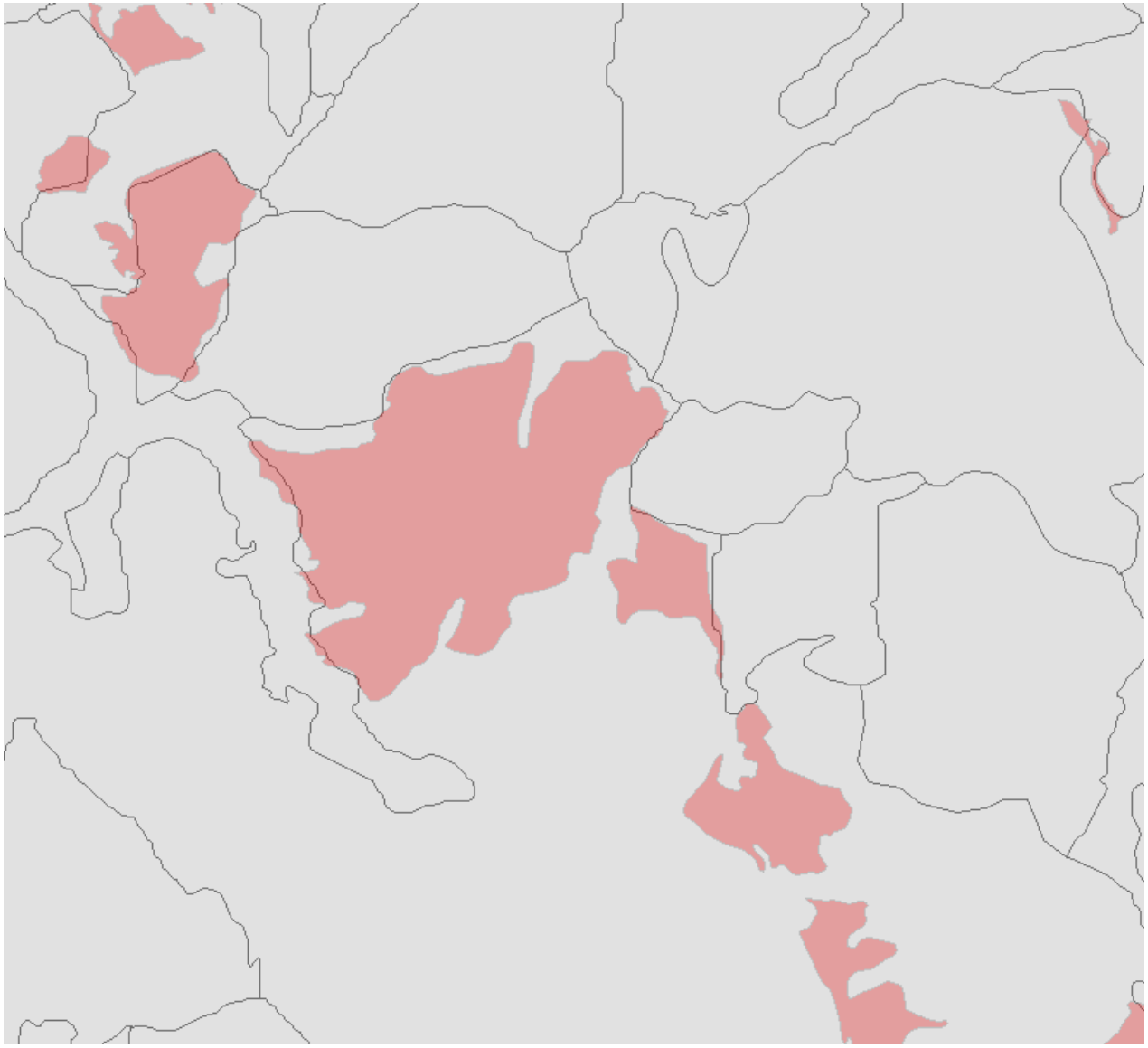
Smart polygon editing – LCDB v3.3

- Exotic
- Indigenous
- Broadleaf
- Gorse
- Manuka
- Pasture low
- Pasture high

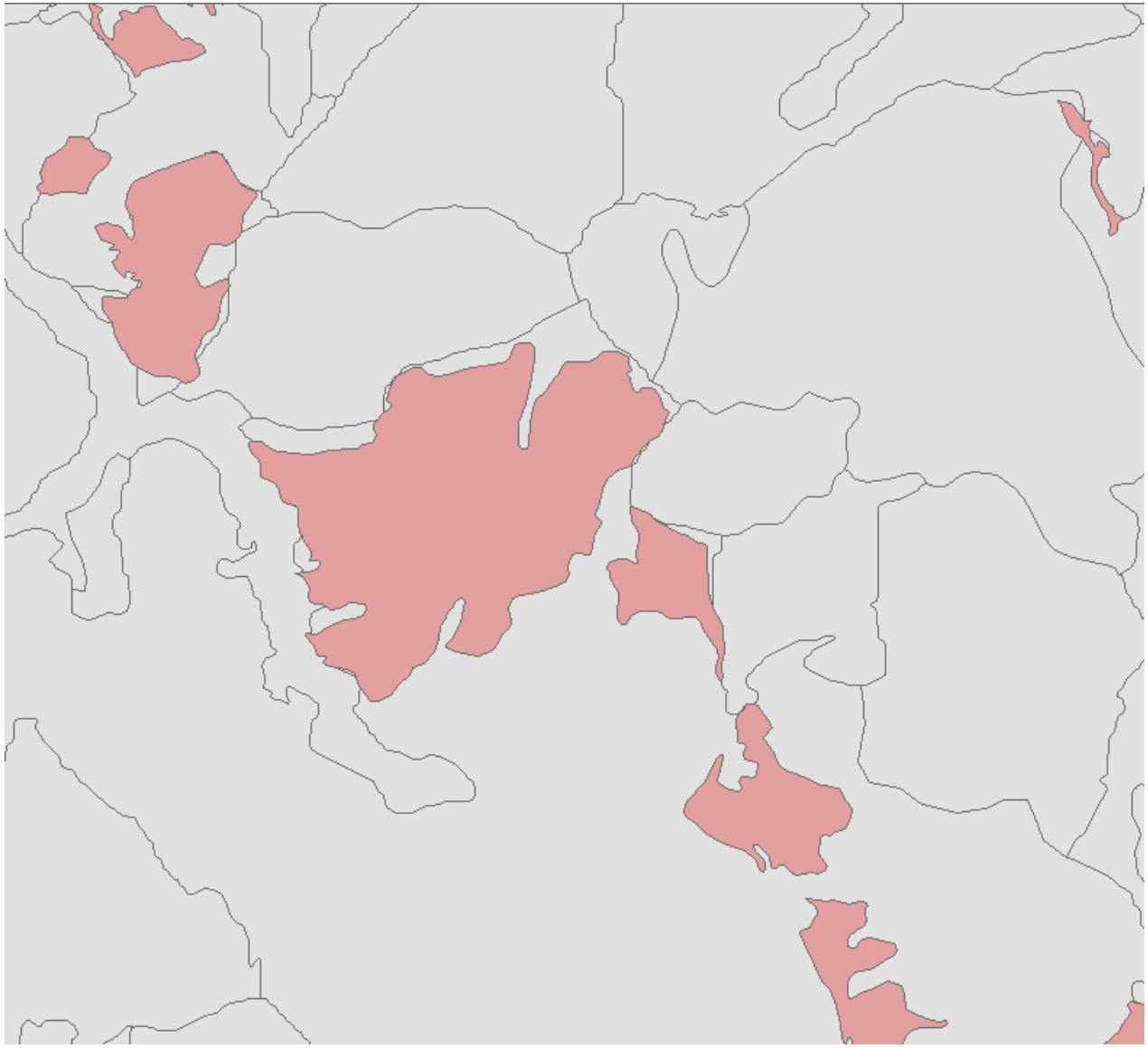
Smart polygon editing



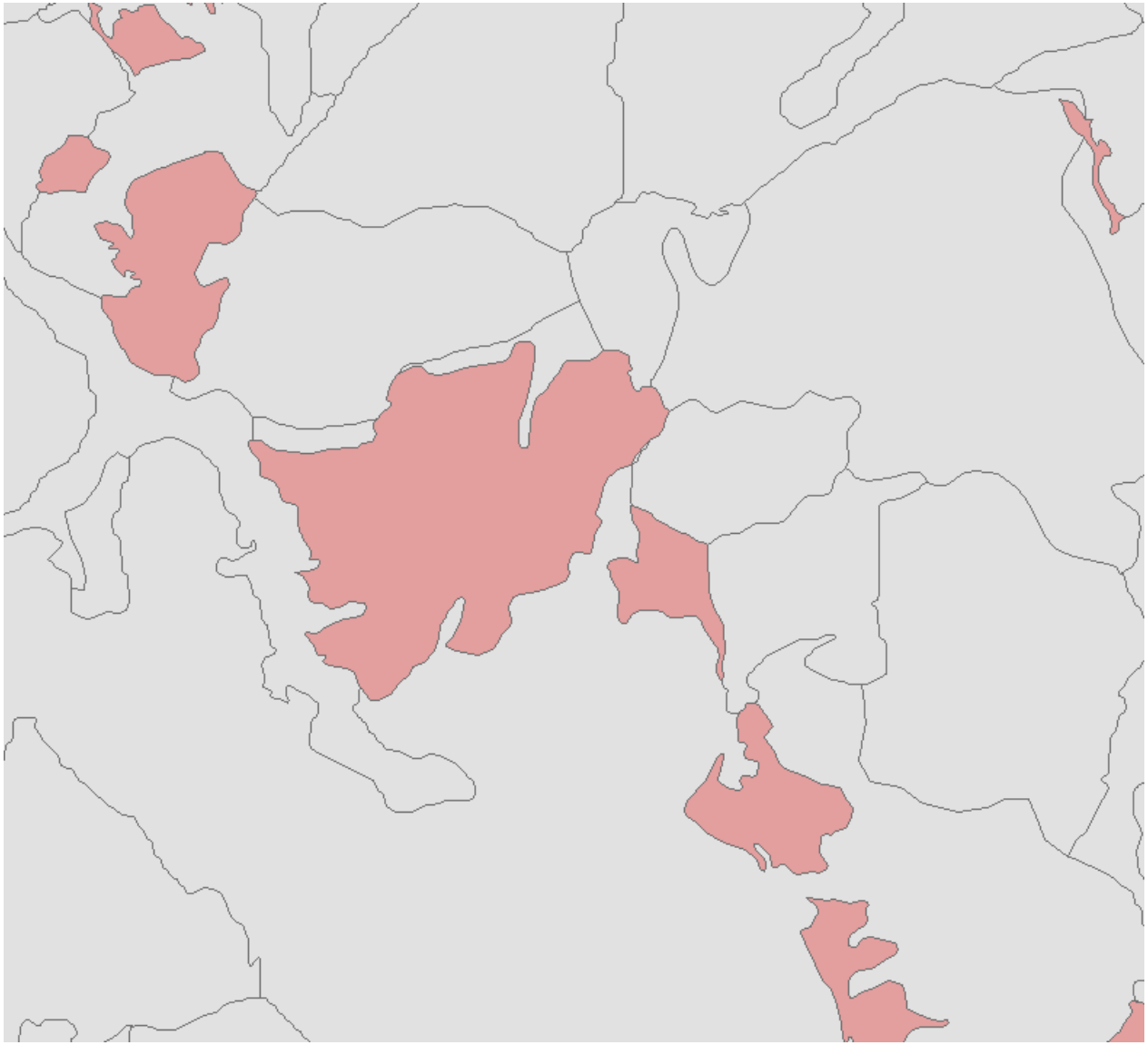
Smart polygon editing – change polygons



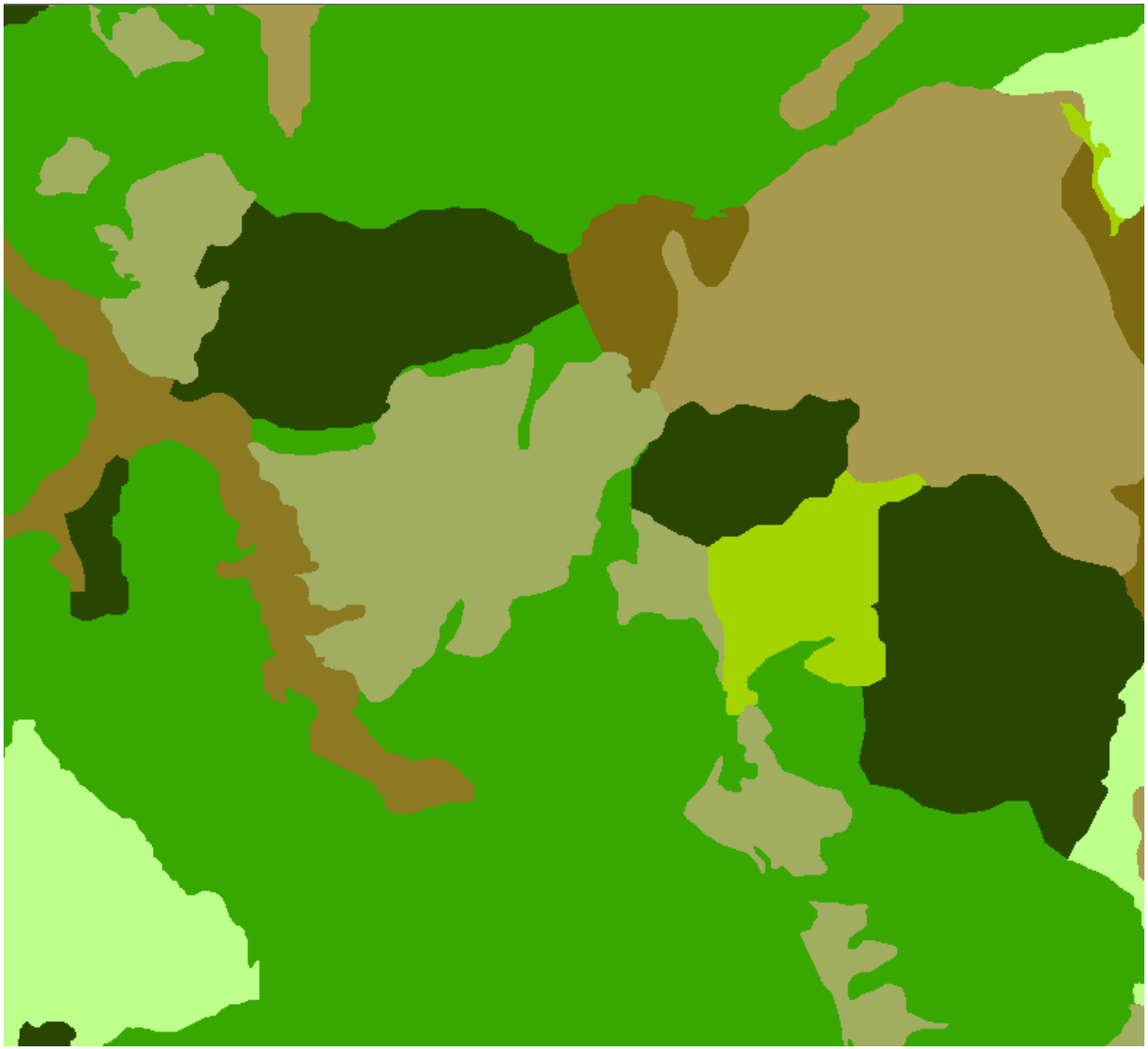
Smart polygon editing – burnt



Smart polygon editing – cleaned

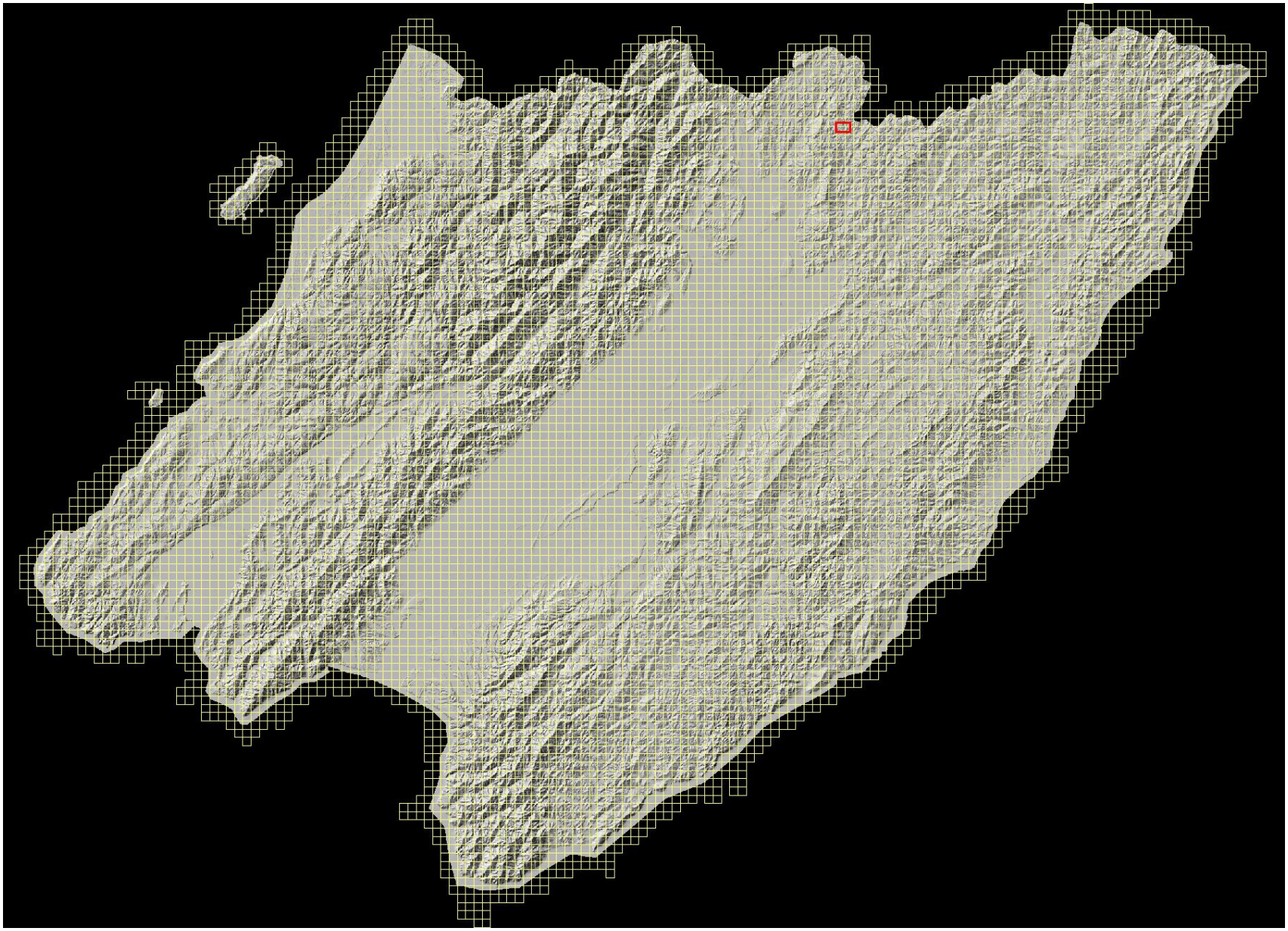


Smart polygon editing – cleaned



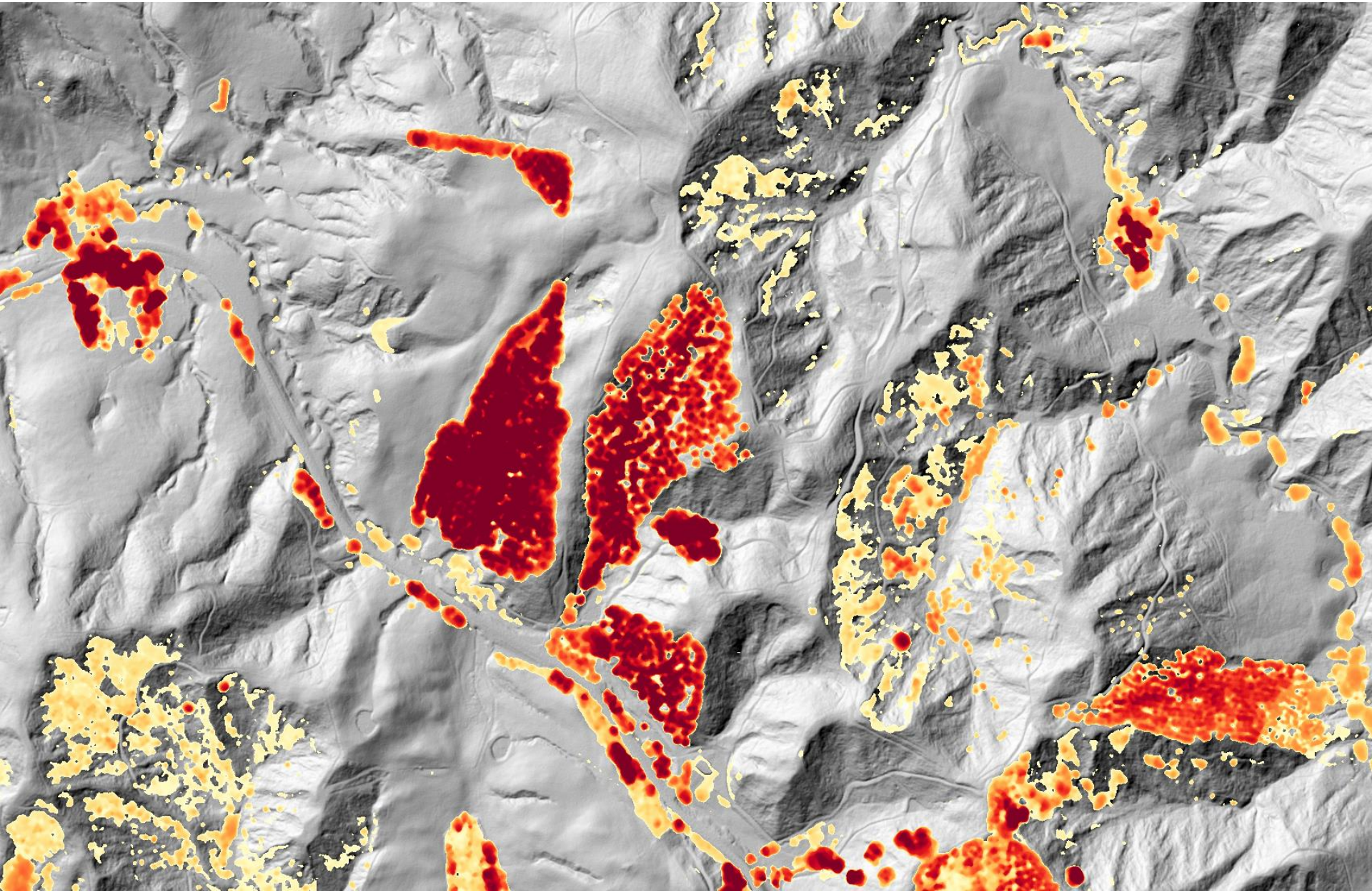
- Exotic
- Indigenous
- Broadleaf
- Gorse
- Manuka
- Pasture low
- Pasture high
- Harvested

LiDAR Processing / Research

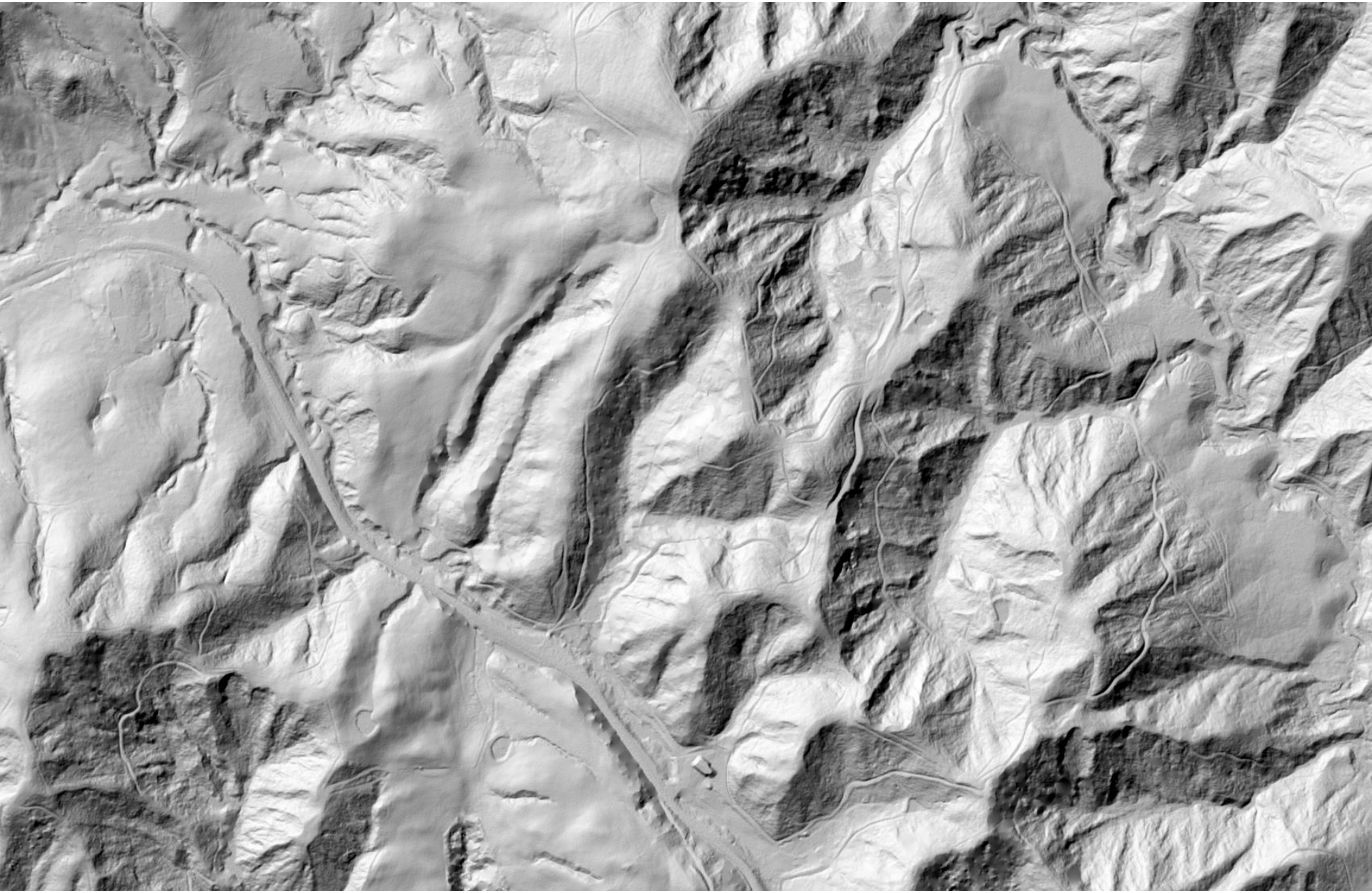


Wellington survey - colour aerial

Canopy height and DEM

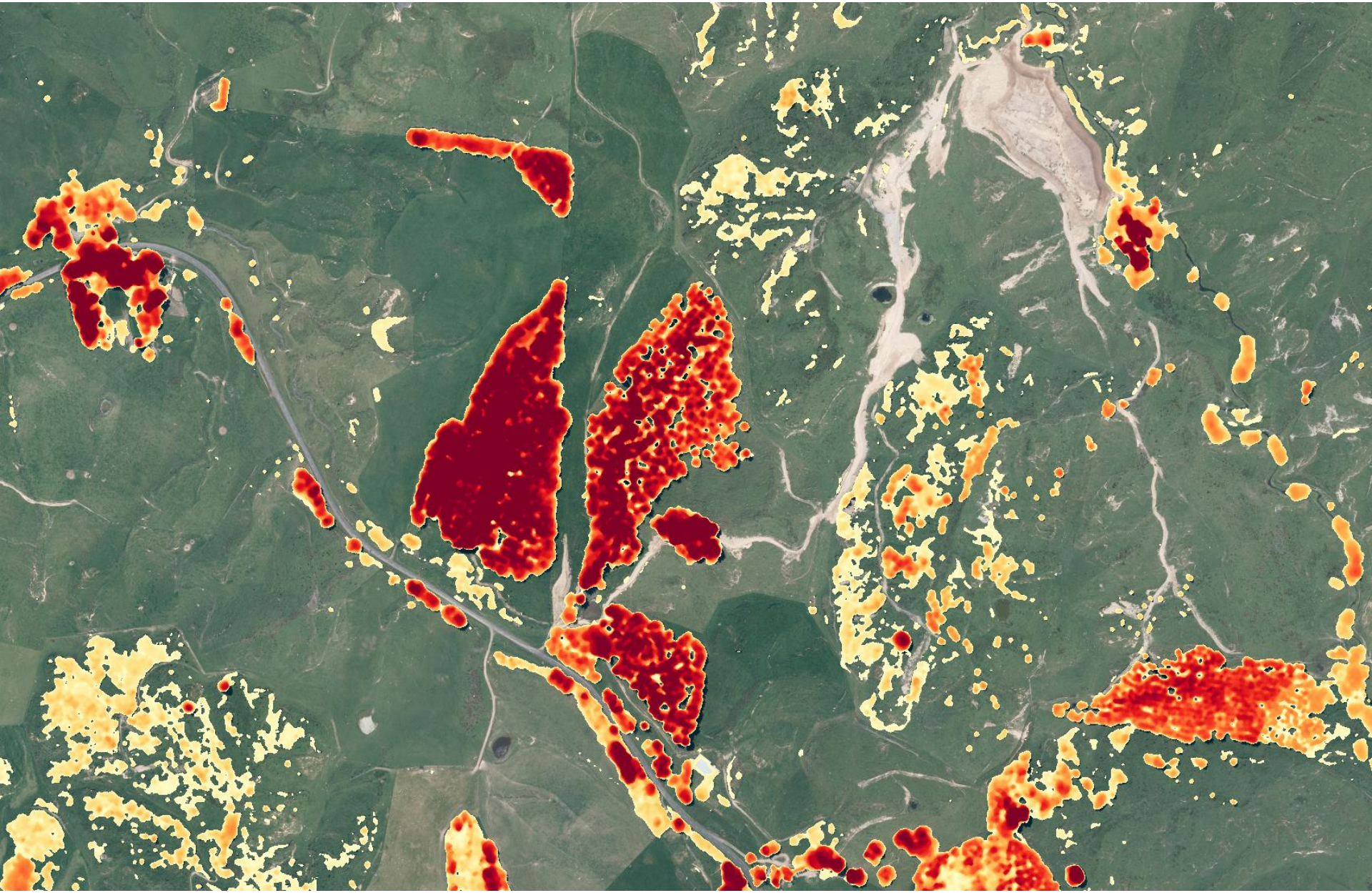


Wellington survey - DTM



Wellington survey - colour aerial

Wellington survey - canopy height



Research directions – this year

- Accuracy assessment
  - Paper on appropriate use
- Improve woody patches (from radar)
- Regional assessment of smart-editing
  - semi-automated LCDB update 3 -> 4
- Indigenous forest Alliances from LiDAR
  - Structures, Carbon, Large Trees

Beyond current contract

- Land use inference from land cover
  - External datasets (RS and other)
  - Sub-classification or attribution; not necessarily in LCDB itself
  - E.g. pasture → irrigated; or dairy
  - Indigenous forest → forest alliances (29)
  - LCDB/LUM integration

- Support new satellites
  - Workflows – image pre-processing
  - Inter-calibration / extend slope, sun angle envelope

Summary

- LCDB v4.0 and how did we get here
- How is it used and by who
- Selected research results
- Immediate future
  - LCDB v4.1
  - Research
- Beyond the current contract


Questions?