



# **Carbon Accounting Design Considerations in New Zealand: forest definition, monitoring land-use change, forest inventory and modelling, reporting methods.**



**New Zealand Climate Change Office**  
Te Tari Rerekētanga Āhuarangi o Aotearoa



*Ministry for the*  
**Environment**  
*Manatu Mo Te Taiao*

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# Overview of Presentation

1. New Zealand's national circumstances
2. Forest definition for LULUCF Kyoto Protocol Reporting
3. Forest Inventory for LULUCF reporting under Kyoto
4. Soil Carbon inventory for LULUCF reporting under Kyoto
5. Mapping LULUCF activities under Kyoto
6. Estimated costs
7. Summary



# Where is New Zealand?



# New Zealand's national circumstances

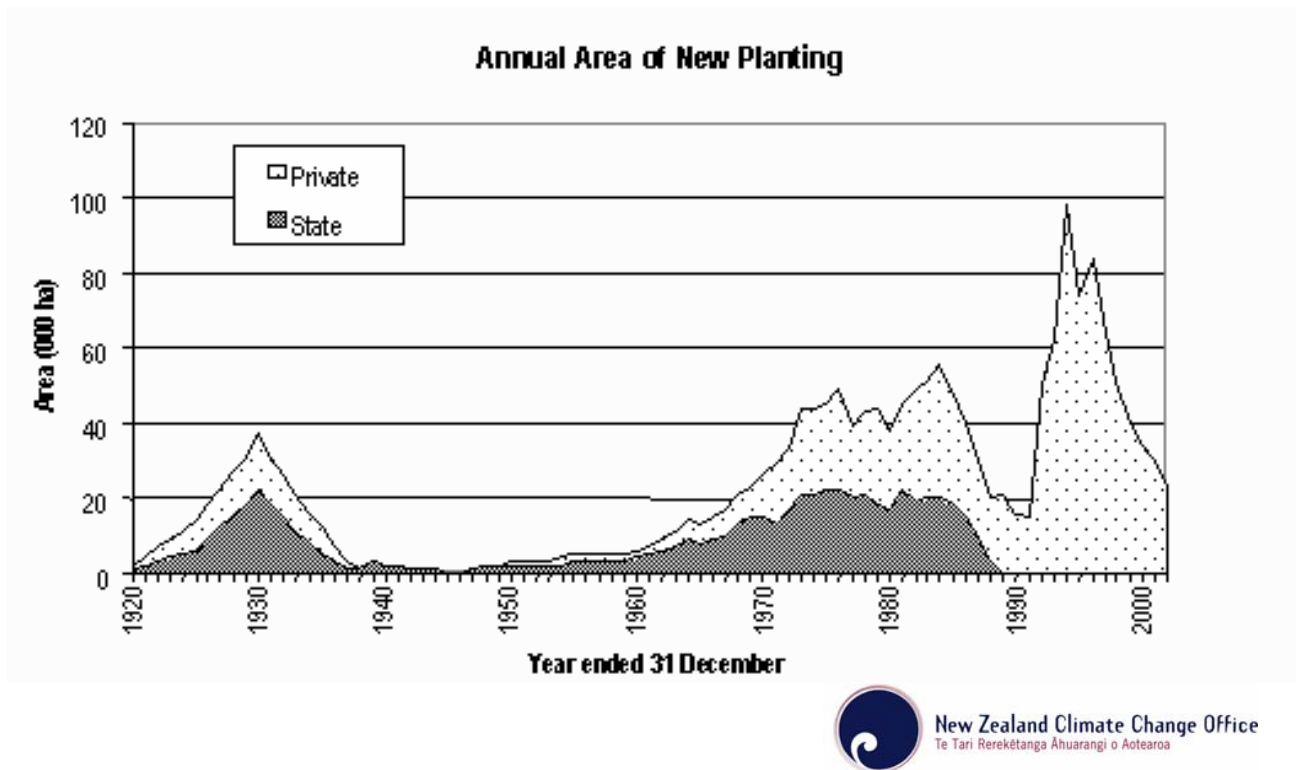
- Rapid changes in land use since 1840s
- All forests are managed (23% (6.4 million ha) natural, and ~ 6 % (2 million ha) planted)
- No national forest inventory (on traditional European NFI model)



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# New Zealand's national circumstances (contd)

- Considerable afforestation since 1990 (~ 0.6 m ha)
- No current statutes or economic instruments to influence A, R or D activities
- No database/analysis system that would meet good practice guidance for LULUCF activities



# Forest definition for LULUCF Kyoto Protocol Reporting

New Zealand has settled on the upper limits of the forest definition parameters (though yet to confirm):

- 1 ha
- 30 % with trees
- 5 m height, and
- 100 m width

Parameters determined with respect to:

- large area of non-forest land at 1 January 1990
- shrublands, many of which are < 5 m, and
- to exclude shelterbelts and riparian plantings



# *Forest Inventory for LULUCF Reporting*

Despite differences in form, function, and management of natural and planted forests, aim is to develop a non-Tier 1 method that is as consistent and transparent as possible. Features of the method that approximates Tier-3 includes:

- Permanent plots established on regular grid system (8 km grid for natural, and 4 km grid for planted (especially post-1990 forests))
- Plot size to be 0.04 ha, with cluster (4) used for post-1990 planted forests.
- Measure DBH, height, coarse woody debris (and decay class), litter and soil C.
- Wood density measured for natural forests, and estimated for planted exotic forests from mean annual temperature and soil fertility measurements
- System well-documented, including field manuals and specialised training for field crews.





**NEW ZEALAND  
CARBON MONITORING SYSTEM**  
Indigenous Forest and Shrubland  
Data Collection Manual



Ian J. Payton, Claire L. Newell, Peter N. Beets



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# ***Forest Inventory for LULUCF Reporting (cont'd)***

- Estimates of woody biomass using allometric equations adjusted for species, wood density (including coarse woody debris), and management regime
- Forest floor litter by plot-based sampling of 30 cm quadrats
- Repeat measurements (planted forests 3 yrs, natural forests 5-10 yrs)
- Develop models as an independent means of verification, for forecasting, and for adjustment of annual reporting in response to inter-annual climate variation



# Soil Carbon Inventory for LULUCF Reporting

- Development of a Soil Carbon Monitoring System (Soil CMS)
- Based on a New Zealand-specific extension of the IPCC default methodology, a Tier 2 method
- Involves use of national spatial coverages of soil type, land use/land cover, climate, and topography
- Underpinned by soil carbon database (in part derived from national soil database), soil-paired plots, specific studies and validation
- Best predictive equation is an additive model: soil type-climate + land cover + slope



# Soil Carbon Inventory for LULUCF Reporting (cont'd)

## Assumptions:

- Soil carbon will attain 'quasi-steady' state under long-term land use, and further changes can be disregarded;
- The system must measure only soil carbon changes (Flux) caused by land-use change.
- The system must account only for soil carbon changes caused by human-induced land-use change



# Soil Carbon Inventory for LULUCF Reporting (cont'd)

Land Use	Land-Use Effect (Mg C ha <sup>-1</sup> )
Grazing land	0
Planted Forest	-16 ± 7
Natural	
- Shrub	-12 ± 5
- Forest	-1 ± 5
Cropland	-11 ± 8
Horticulture	-9 ± 7

Mean soil carbon level for grazing land is 109 ± 2 Mg C ha<sup>-1</sup> (0.3m)

Under-represented cells are being sampled when field teams install and measure forest plots



# Mapping LULUCF activities under Kyoto

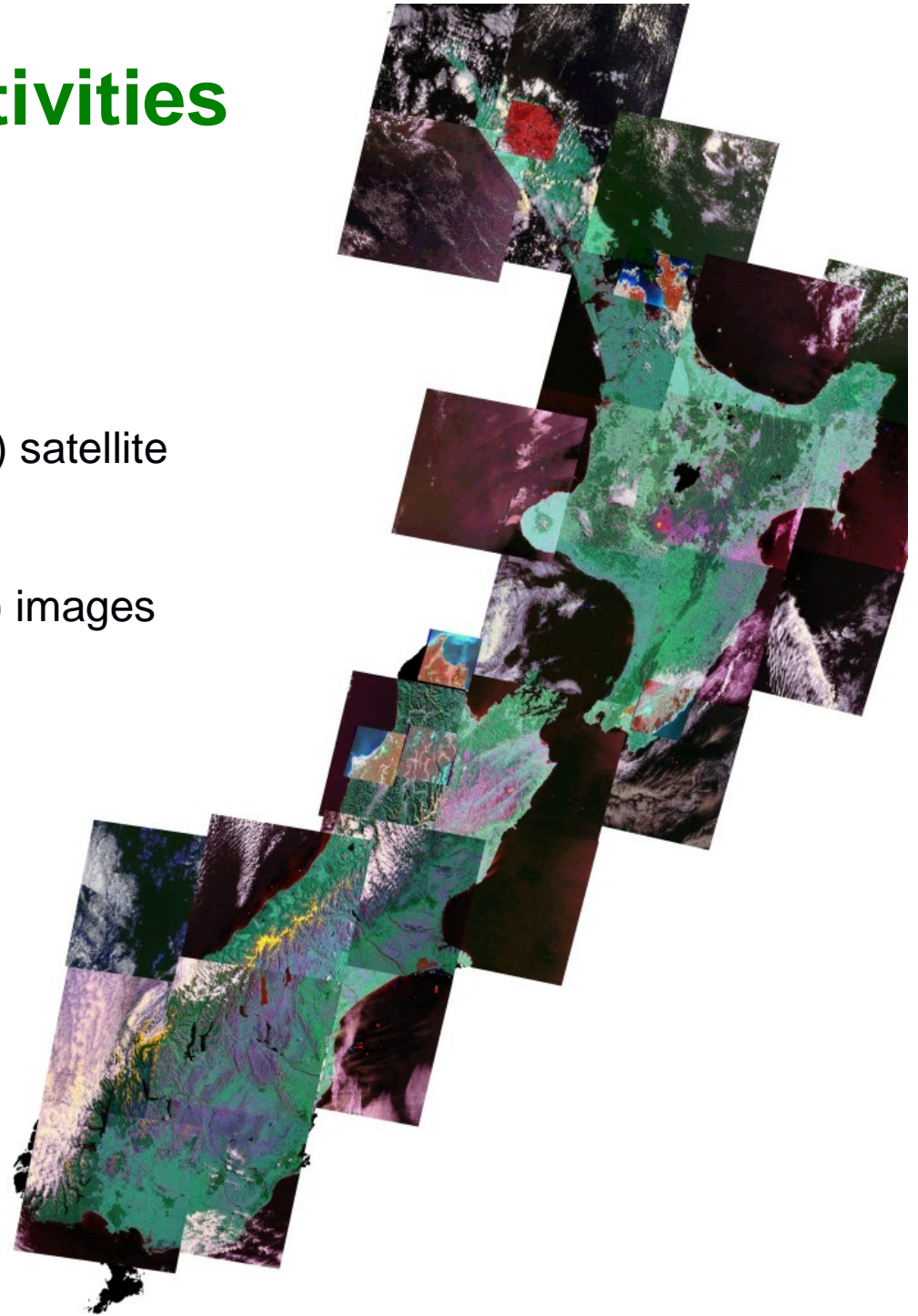
- Wall-to-wall mapping (Approach 3) of LULUCF activities
- Use of remotely-sensed data, field measurements, observations and land-use history
- Imagery to be fully calibrated
- Will need to update 1990 baseline and re-calculate as evidence becomes available that mapping is incorrect
- 1990 LULUCF map needs to be consistent with 2008 and 2012 maps
- Deforestation mapping, using radar and high resolution imagery (0.5m).
- Intention to use polygons to denote units of land and:
  - Reporting Method 1 for A and R, either for each Island or 12 local Government regions, and
  - Reporting Method 2 for deforestation



# Mapping LULUCF activities under Kyoto (cont'd)

Showing thumbnails of Landsat 4 (30 m) satellite imagery coverage, New Zealand.

Most “good” (high sun angle, cloud-free) images acquired in December 1990

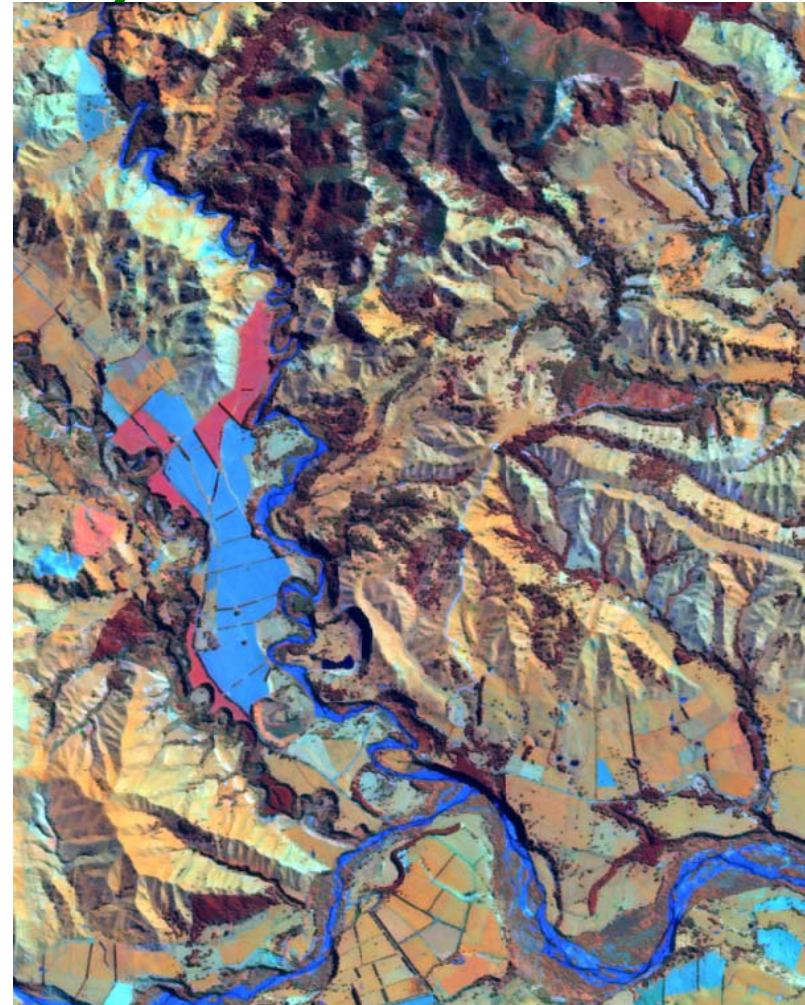


# Mapping LULUCF activities under Kyoto (cont'd)

SPOT 5 (10 m) for 2008 and  
2012 LULUCF mapping



Simulated Radarsat 2 for  
deforestation mapping



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# Estimated Cost

Indicative total cost (1997-2014) is NZ\$63 million\*\*. Proportion of total cost for key modules of the New Zealand Carbon Accounting System is:

Planted forest inventory and QA	20 %
Natural forest inventory and QA	25 %
Soil Carbon Monitoring System	7 %
Specific underpinning research	11 %
LULUCF mapping (A, R), 1990, 2008, 2012	22 %
Deforestation mapping (D)	8 %
Database/Analysis system	7 %

\*\* *Cost includes some Whole-of-Government benefits to biodiversity, tree health and general mapping*



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# Summary

- Carbon accounting system is being developed to meet good practice guidance, and to reflect New Zealand's national circumstances
- New Zealand welcomes suggestions that would assist us in meeting good practice guidance
- We welcome the opportunity to host visitors, so we can demonstrate our national circumstances and how we are meeting good practice guidance for LULUCF



