

# Disturbance and ecosystem characterization with Landsat imagery

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With: White, Ortlepp, Andrew, Henley, Falkowski, Mora, Alvarez, Orka, Gomez  
(CFS); Coops, Hilker, Bater, Coggins (UBC); Nelson, Stewart, Long (UVic)

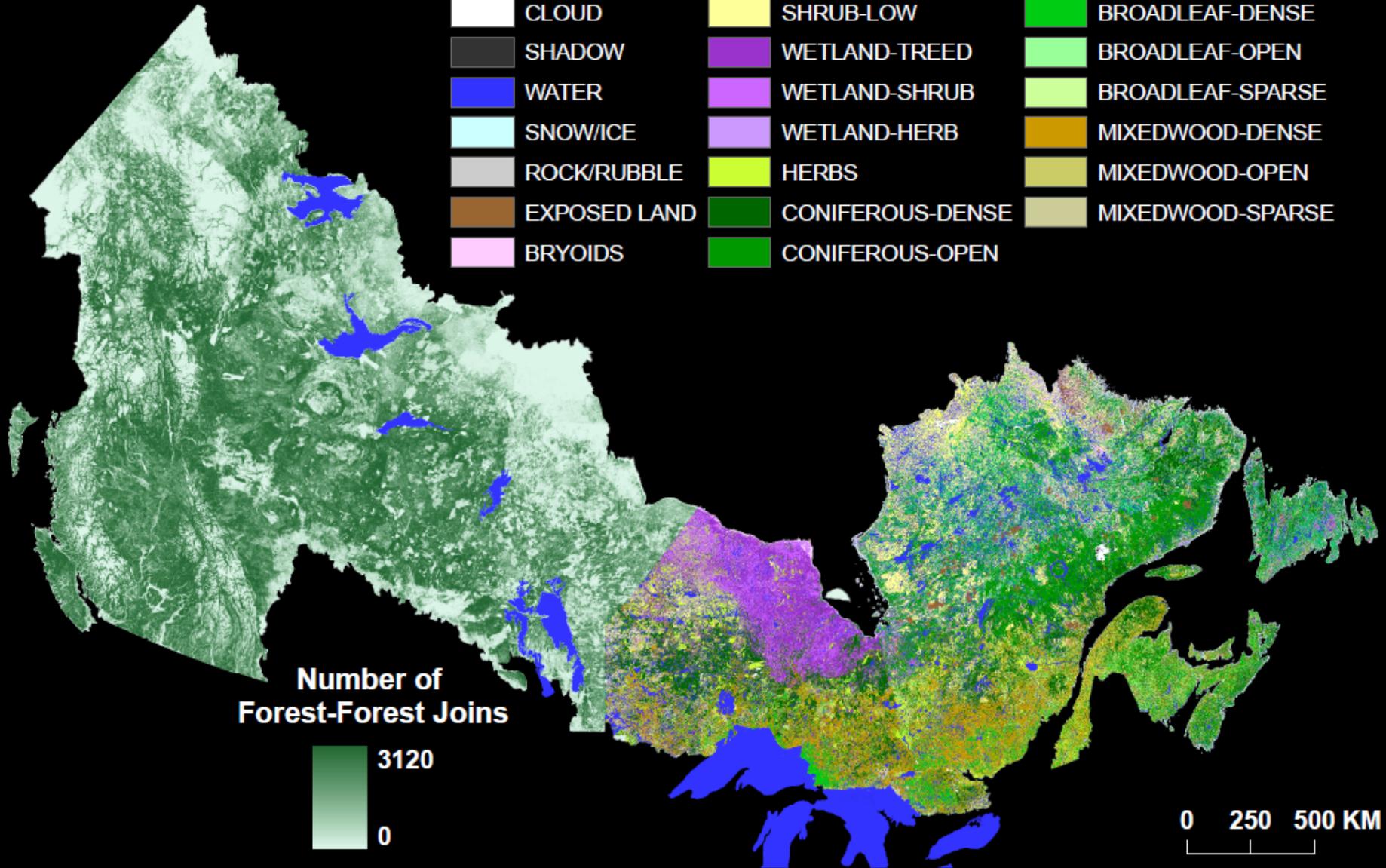
# Background / Outline

- Lidar
  - High spatial resolution
  - Landsat (cover, change, time-series, fire, insects, phenology, biophysical ...)
  - MODIS
  - Integration
- 
- Meeting a range of information needs
  - Working across a range of spatial and temporal scales
- 
- 1. National level fragmentation trends
  - 2. Informing on habitat status and change

# THE FORESTED AREA OF CANADA

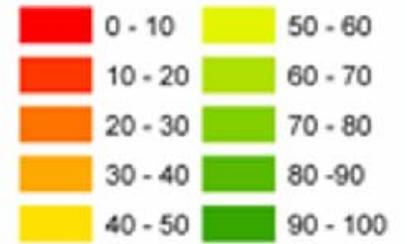
## EOSD Land Cover Classes

NO DATA	SHRUB-TALL	CONIFEROUS-SPARSE
CLOUD	SHRUB-LOW	BROADLEAF-DENSE
SHADOW	WETLAND-TREED	BROADLEAF-OPEN
WATER	WETLAND-SHRUB	BROADLEAF-SPARSE
SNOW/ICE	WETLAND-HERB	MIXEDWOOD-DENSE
ROCK/RUBBLE	HERBS	MIXEDWOOD-OPEN
EXPOSED LAND	CONIFEROUS-DENSE	MIXEDWOOD-SPARSE
BRYOIDS	CONIFEROUS-OPEN	



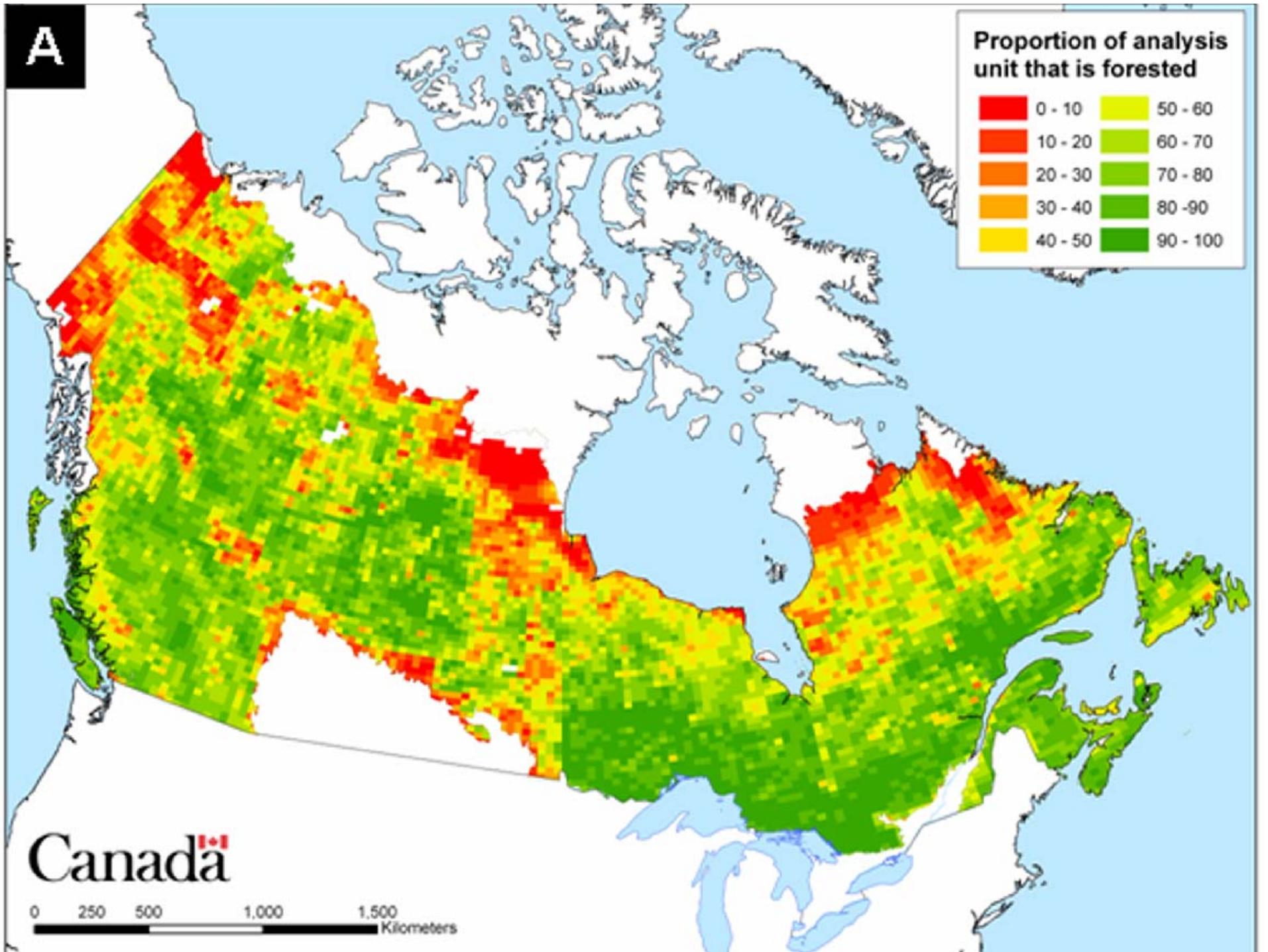
A

Proportion of analysis unit that is forested



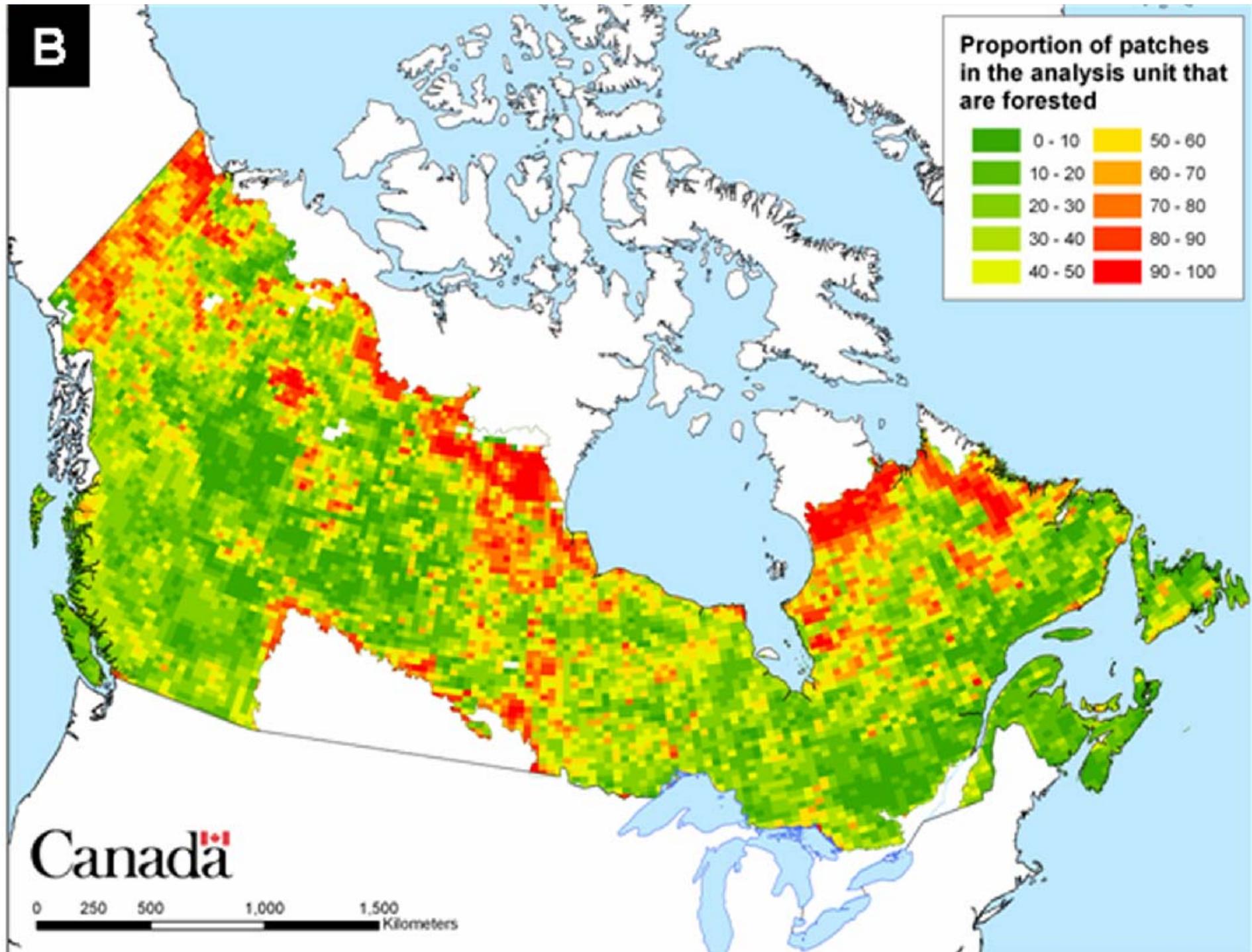
Canada

0 250 500 1,000 1,500  
Kilometers



**B**

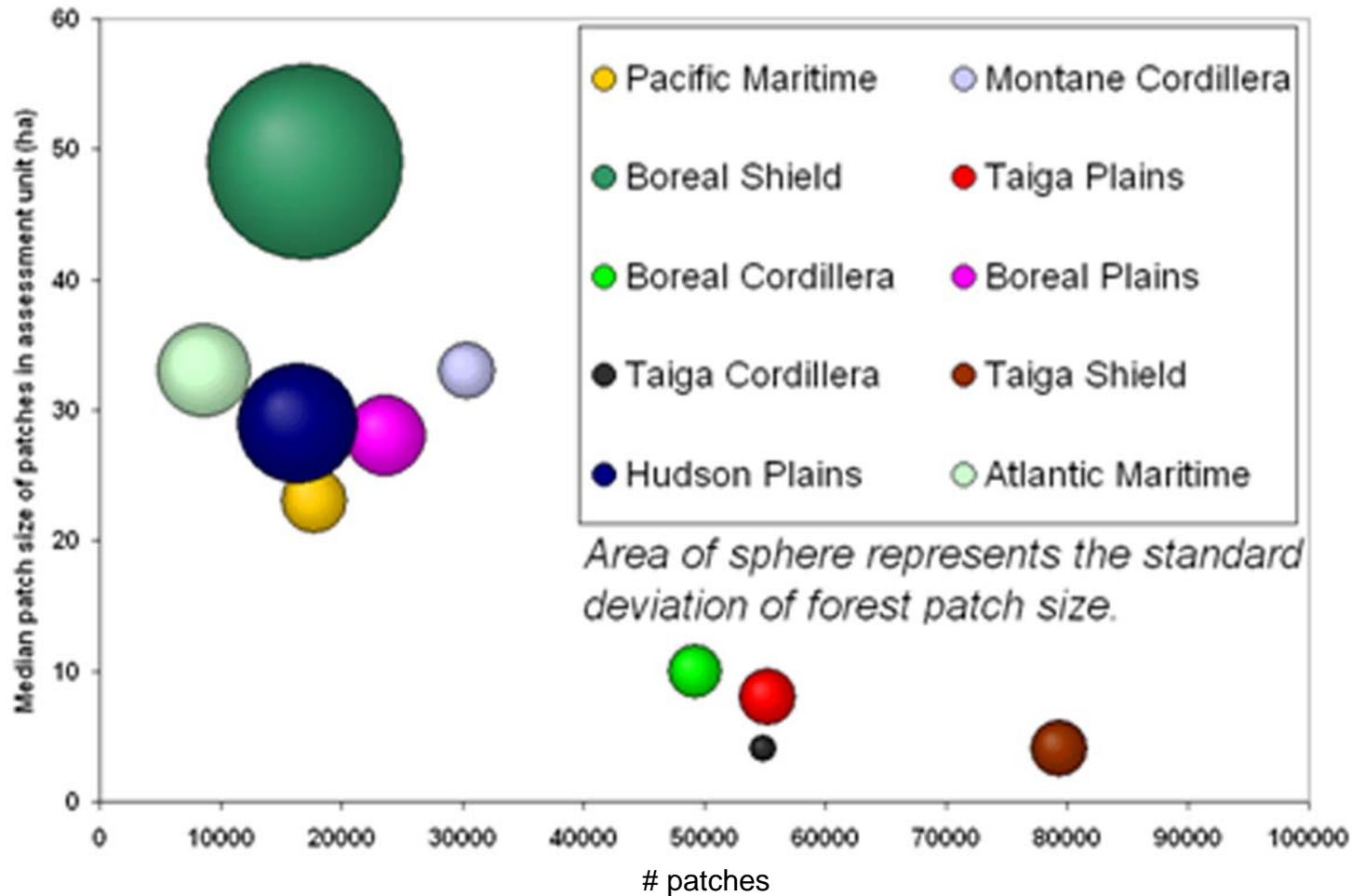
**Proportion of patches  
in the analysis unit that  
are forested**

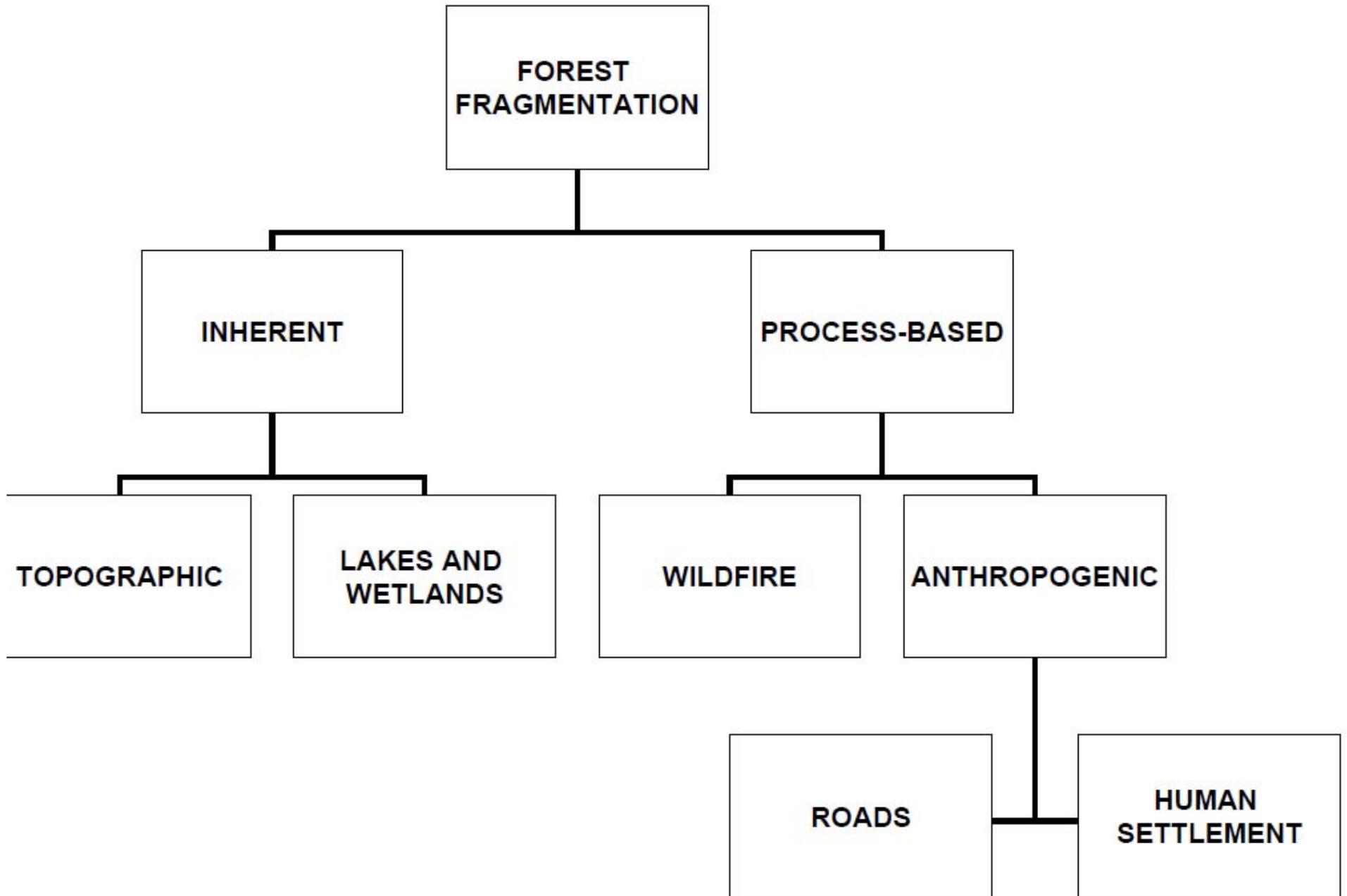


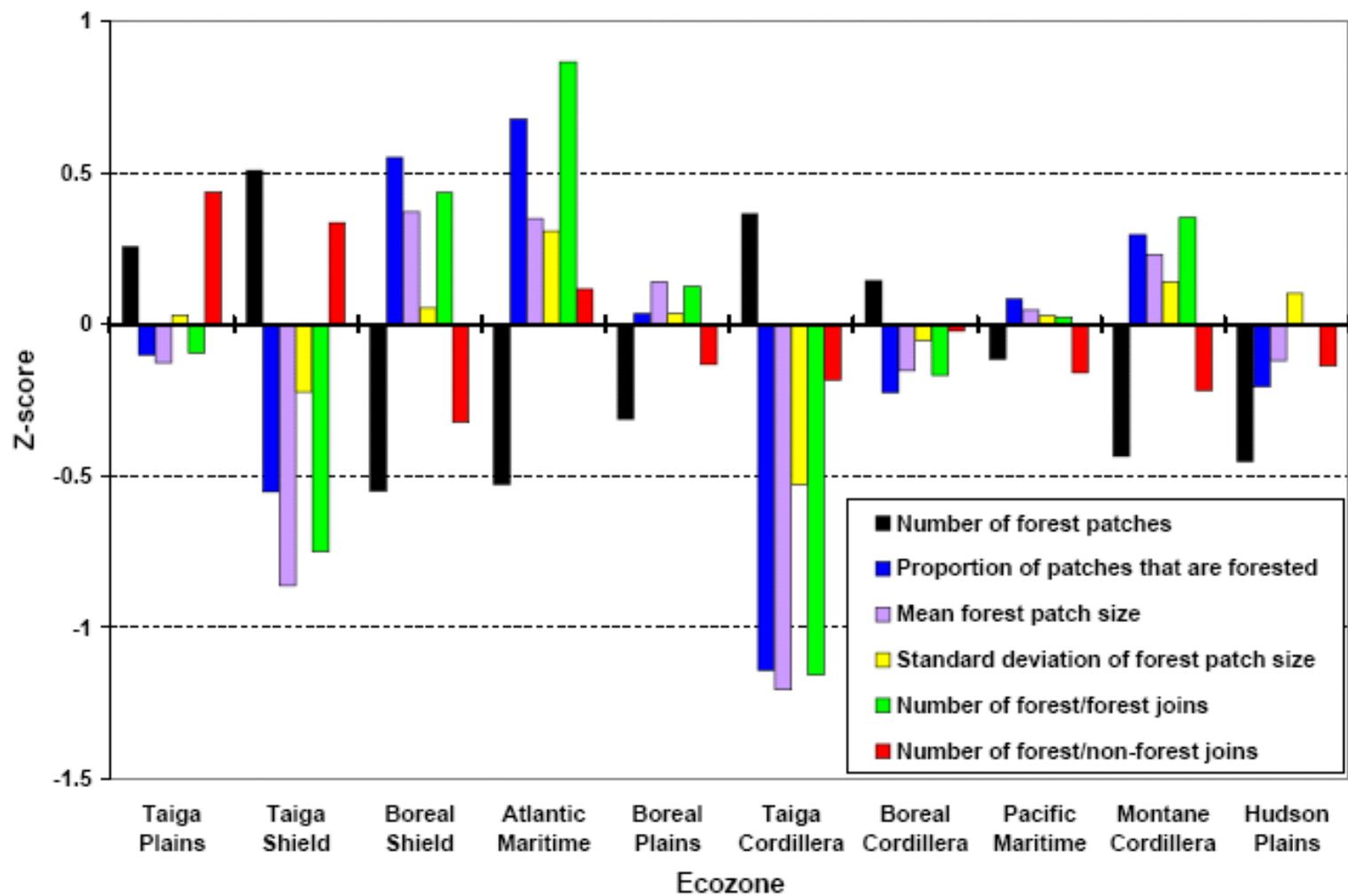
**Canada**

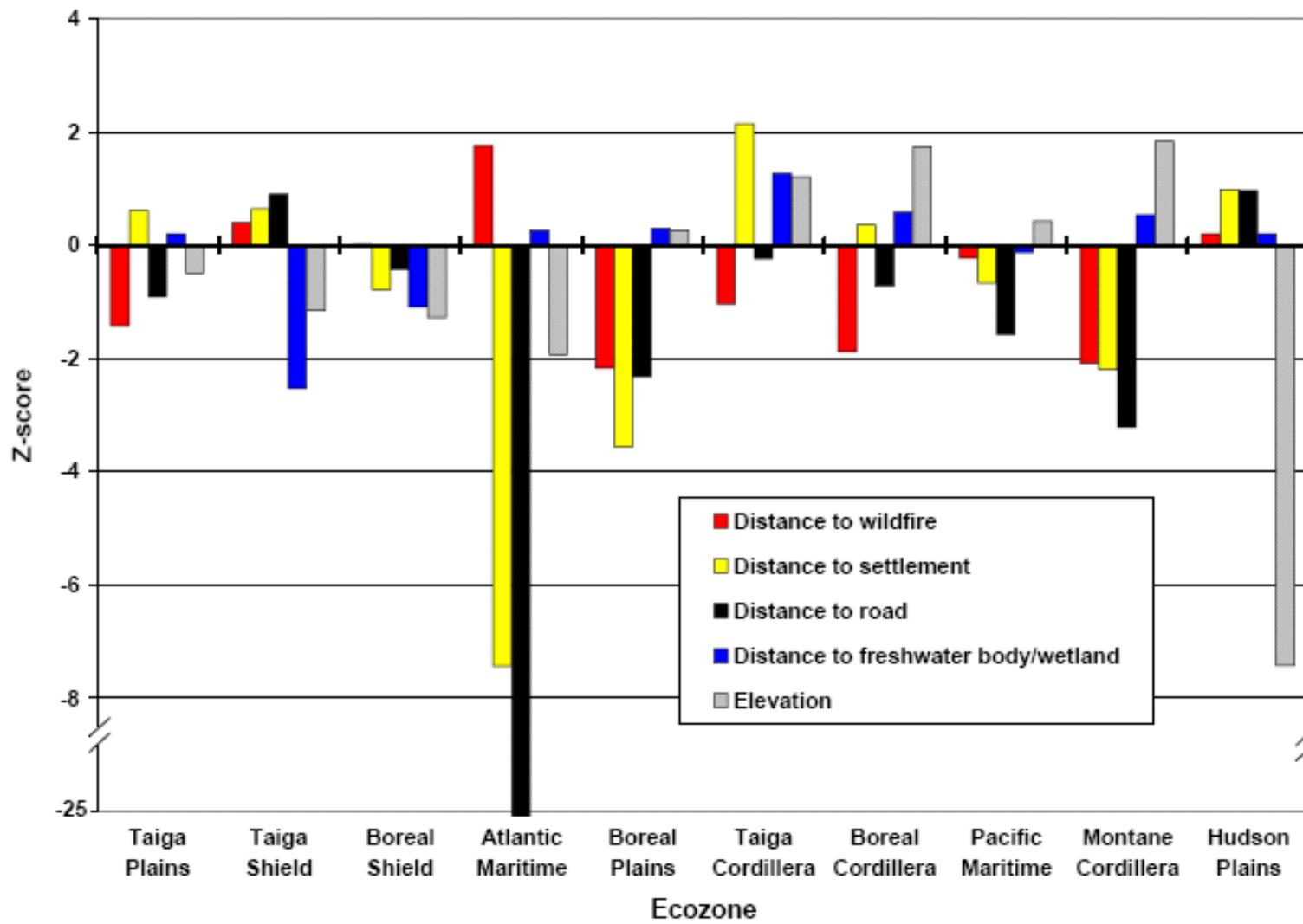


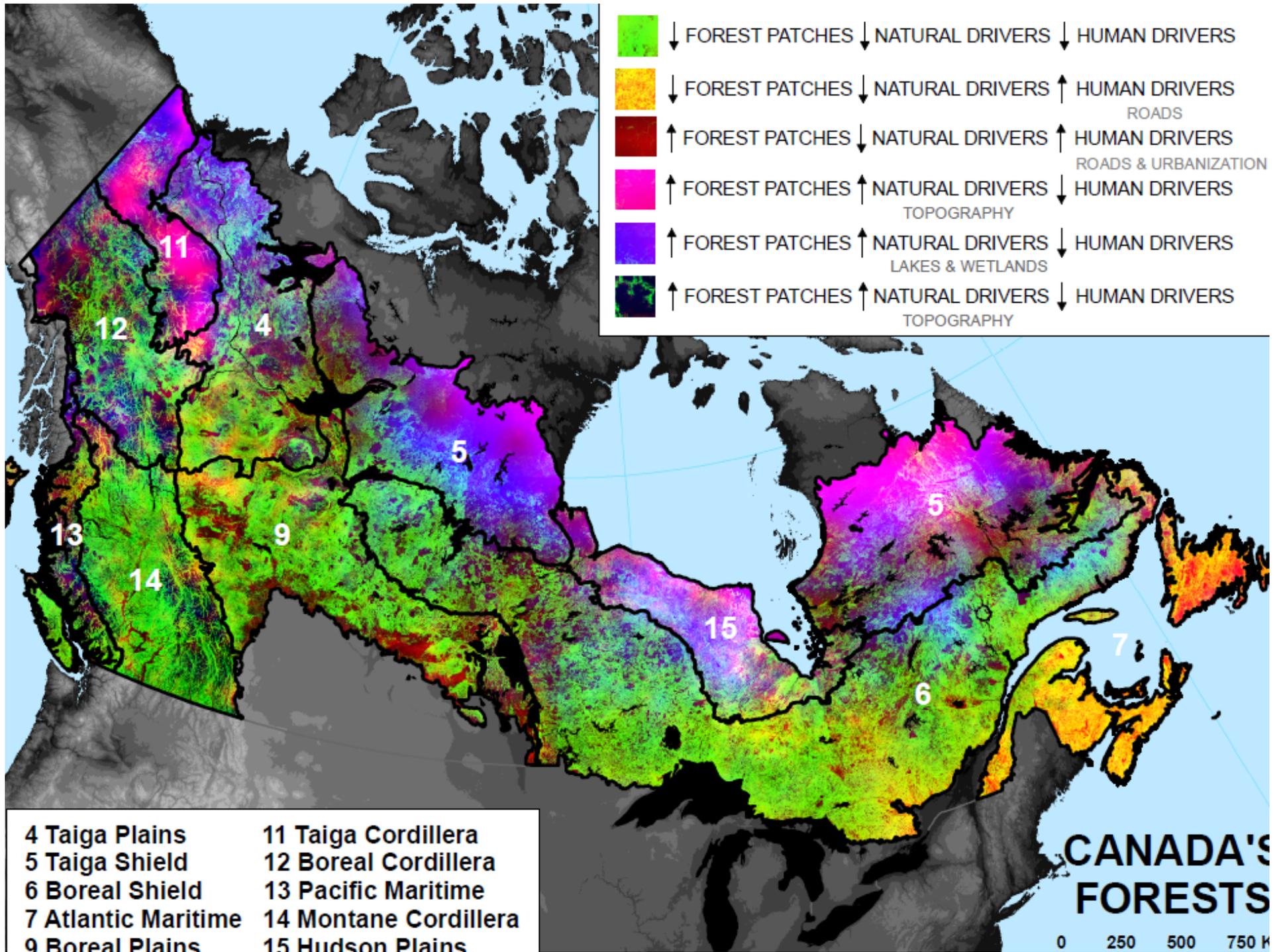
# Distribution trends by metric











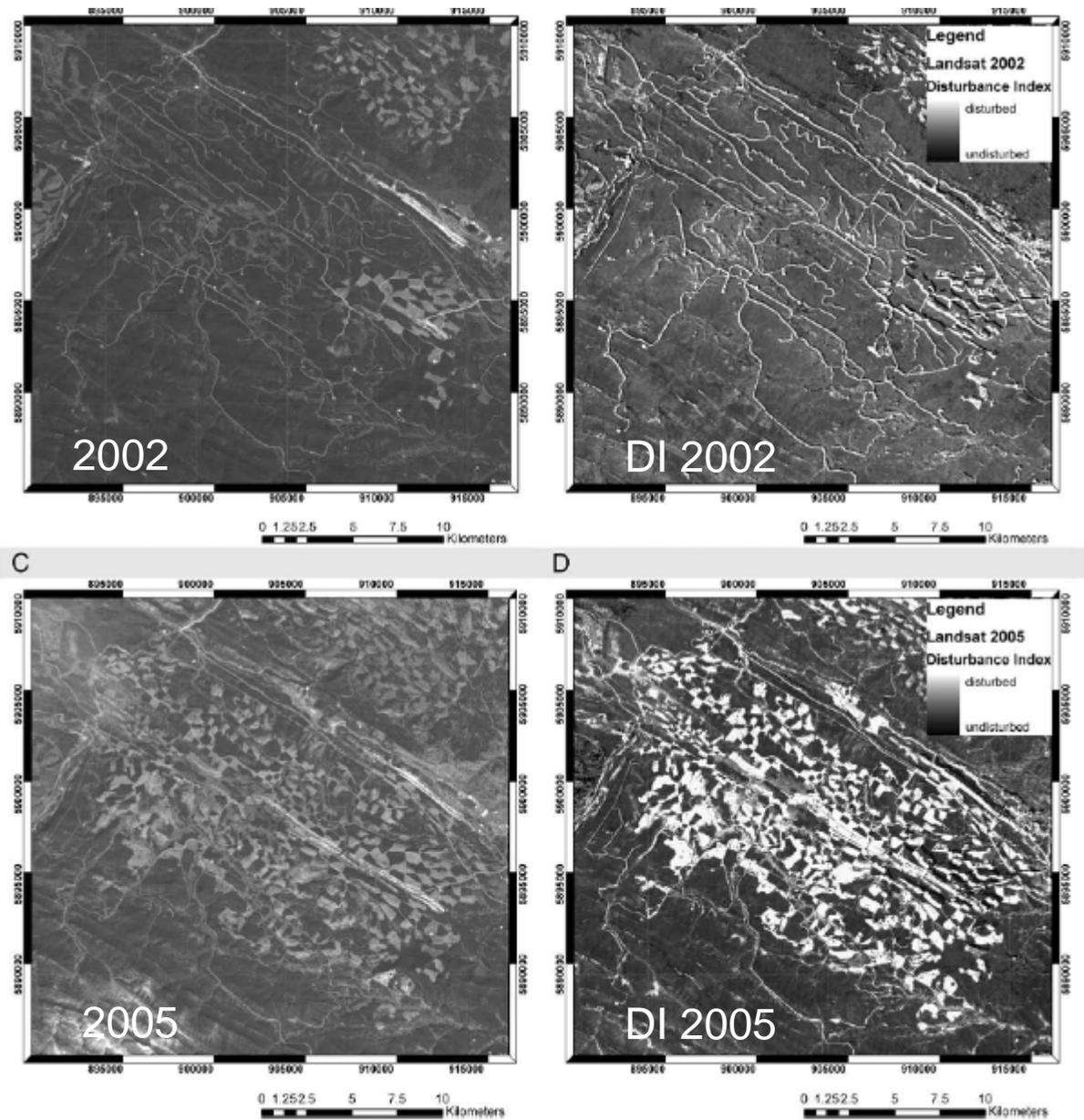
# The Changing Forest Landscape

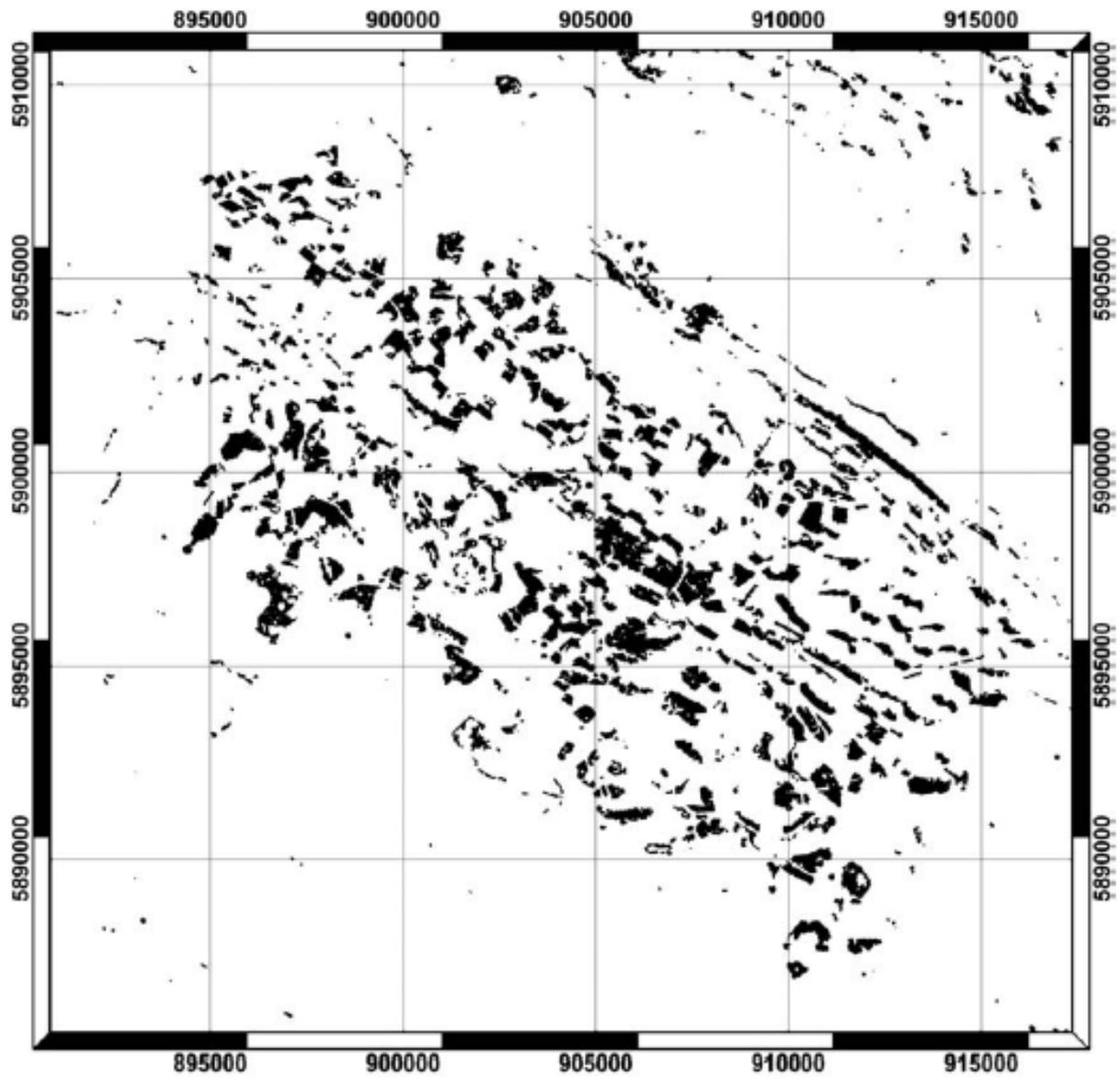
**Approaches to monitor the ongoing changes in the forested landscape using modelling and remote sensing**

Current developing operation methods to capture the high revisit capacity of MODIS, at the high spatial resolution of Landsat  
(with Hilker, Coops, Gao, Masek)

Aim: To provide coverages of disturbance, and attribute that disturbance, at 16 day intervals through the growing season

- Two Landsat scenes. 2002 and 2005
- Disturbance index transformation applied





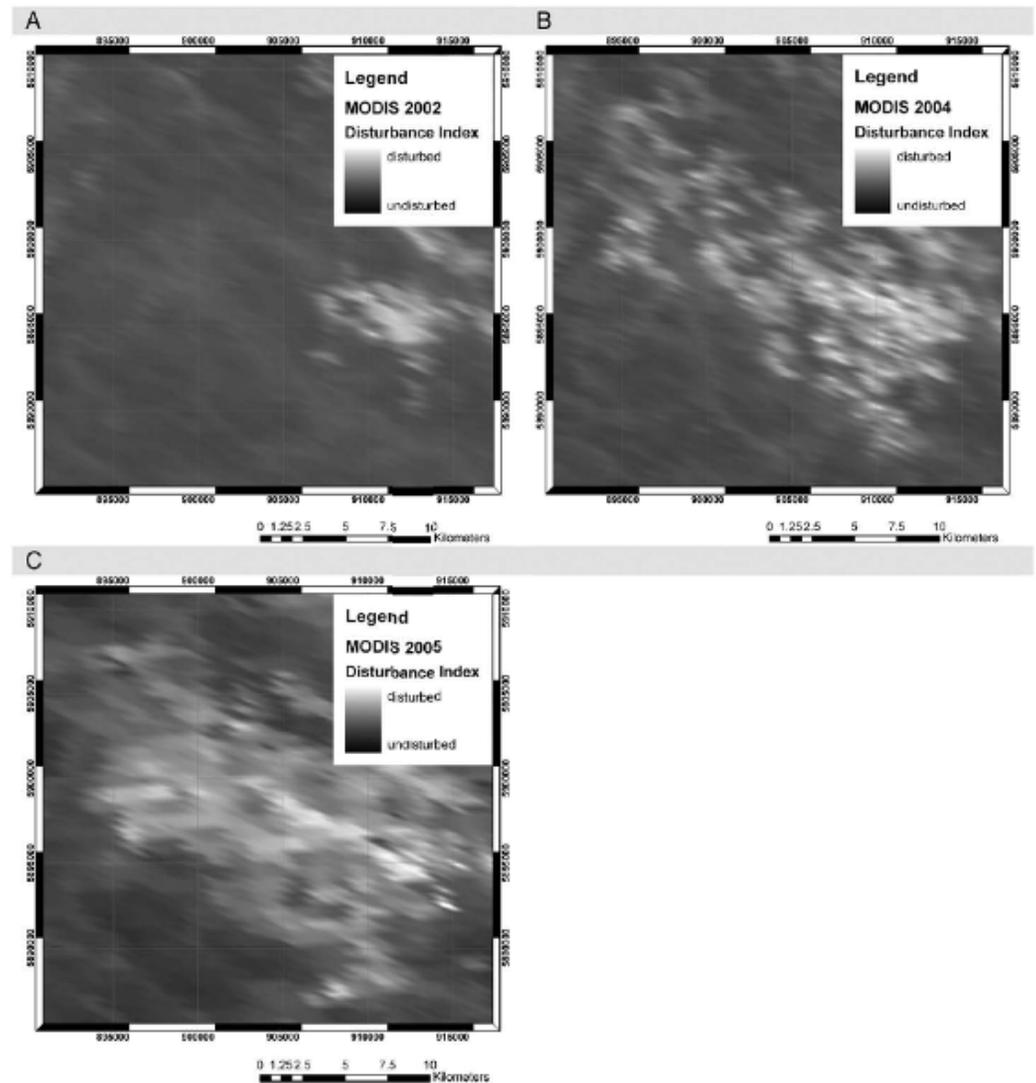
25m Change between 2002 and 2005

0 1.25 2.5 5 7.5 10  
Kilometers

# The Changing Forest Landscape

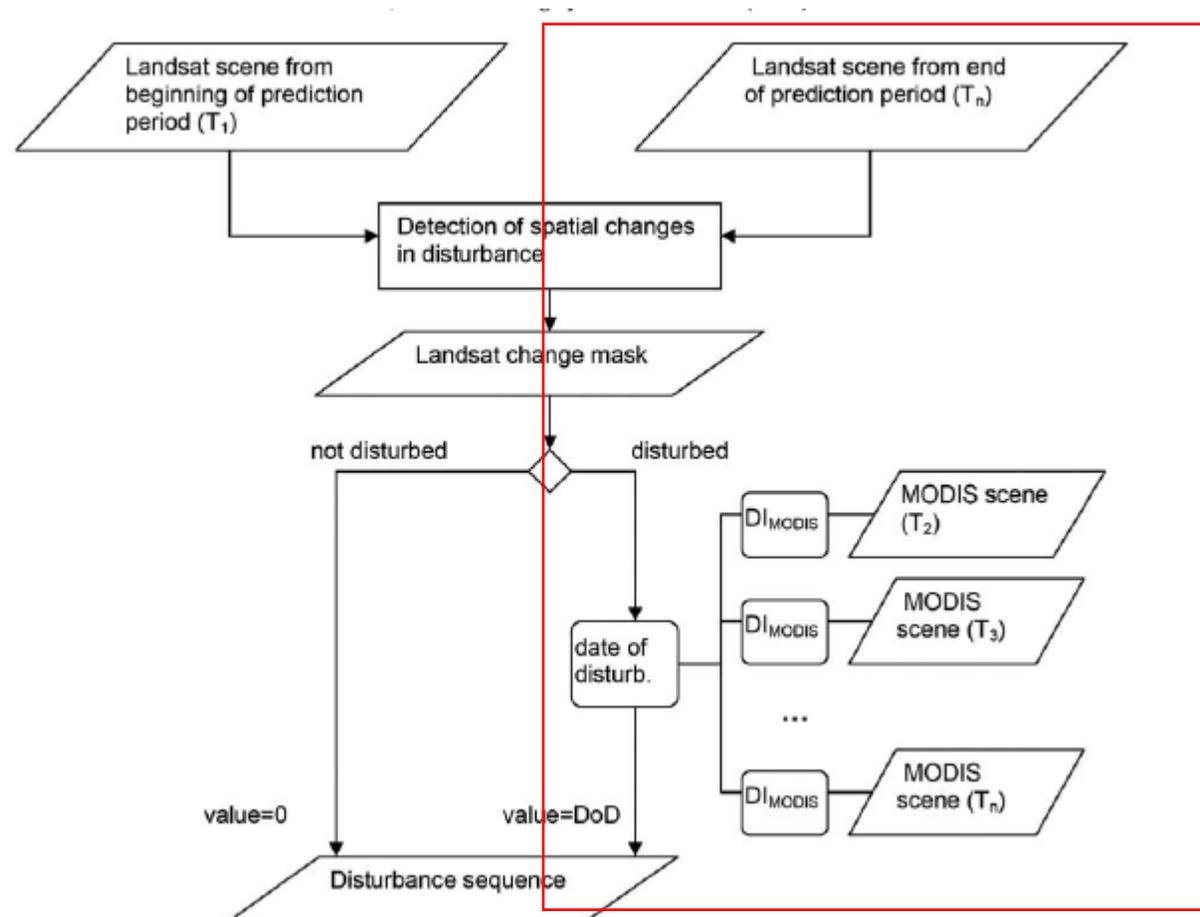
Approaches to monitor the ongoing changes in the forested landscape using modelling and remote sensing

Examples of MODIS Imagery over the same time period

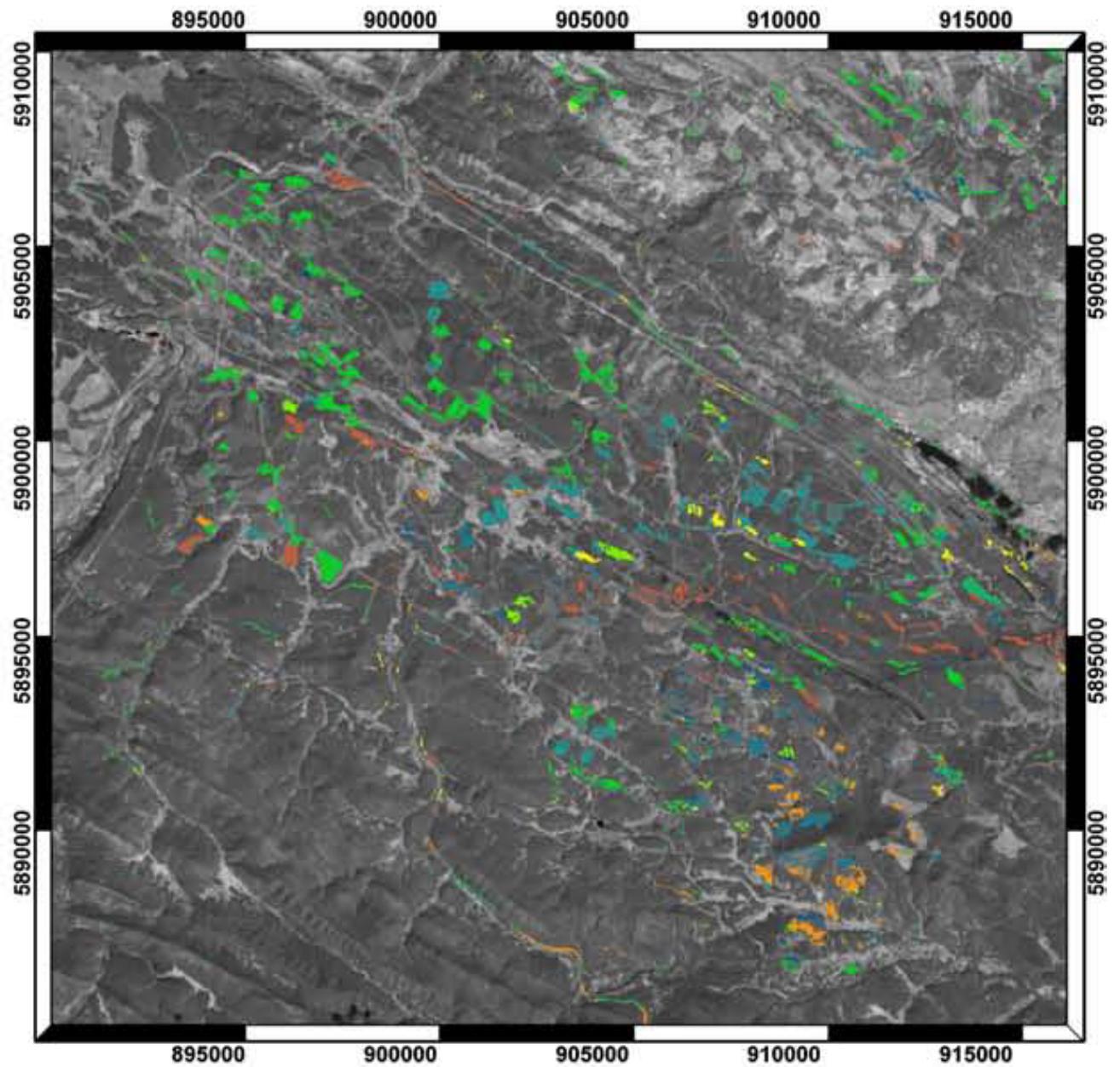
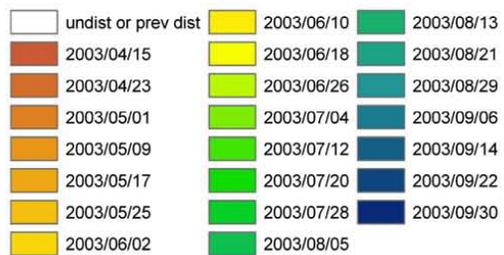


# The Changing Forest Landscape

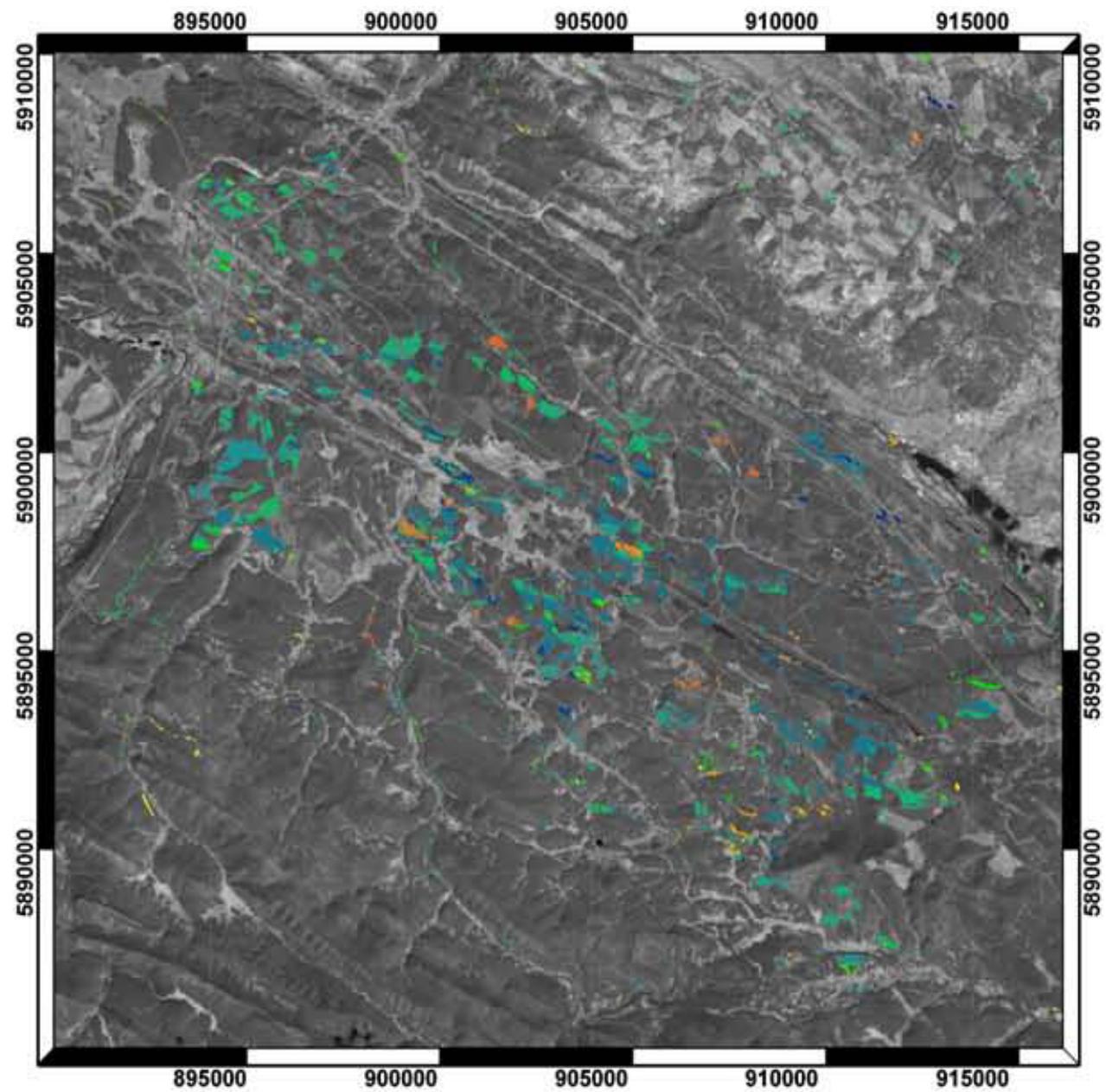
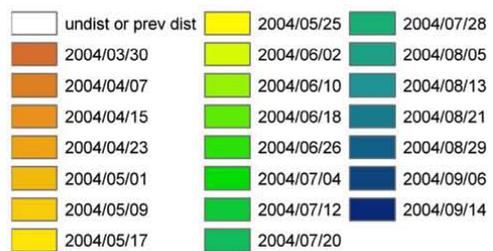
Approaches to monitor the ongoing changes in the forested landscape using modelling and remote sensing



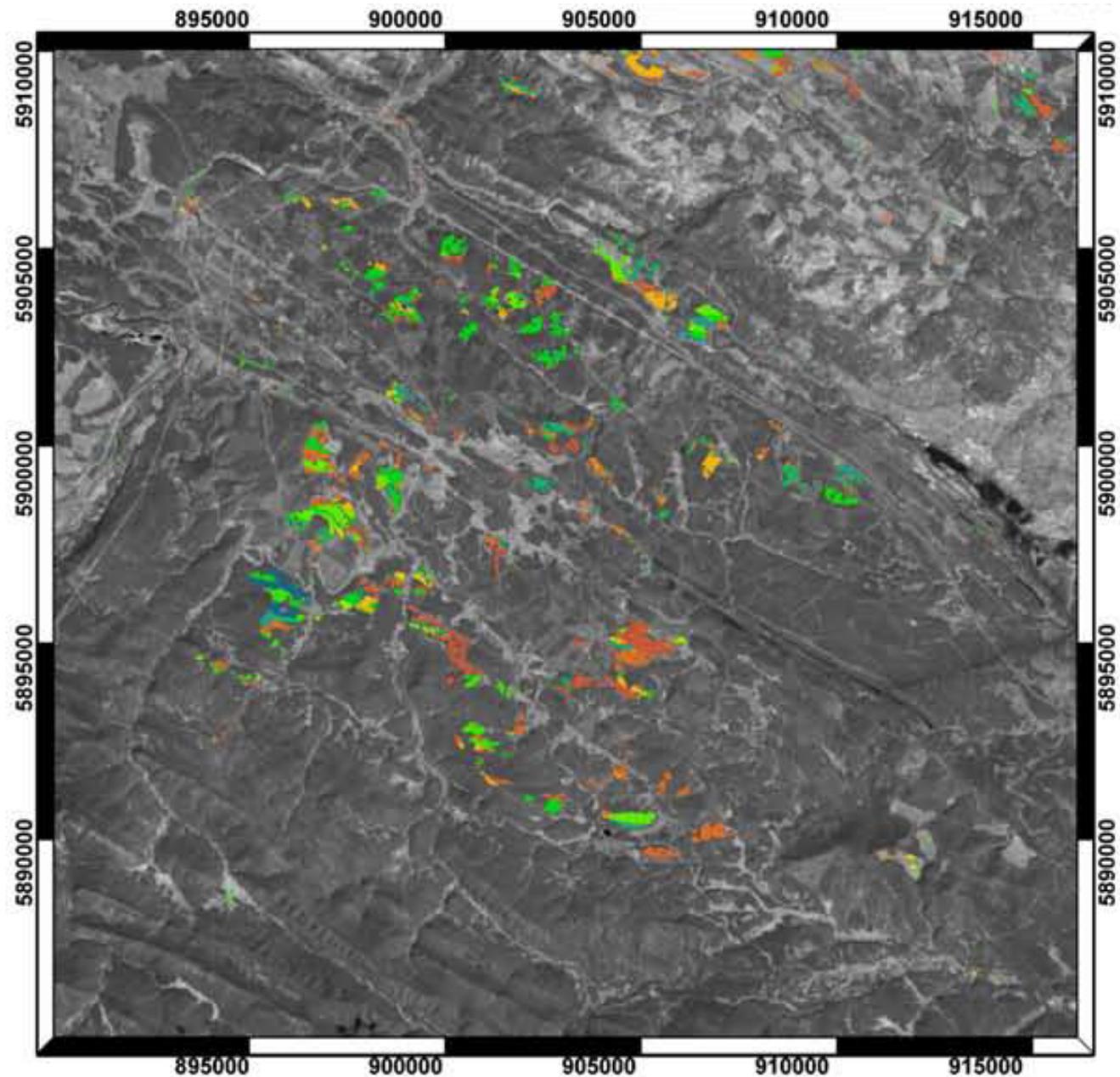
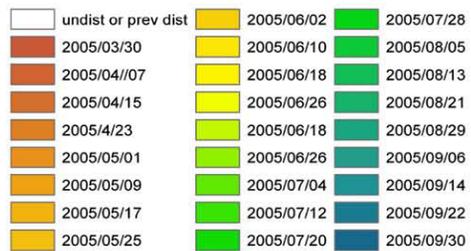
**Disturbances 2003**

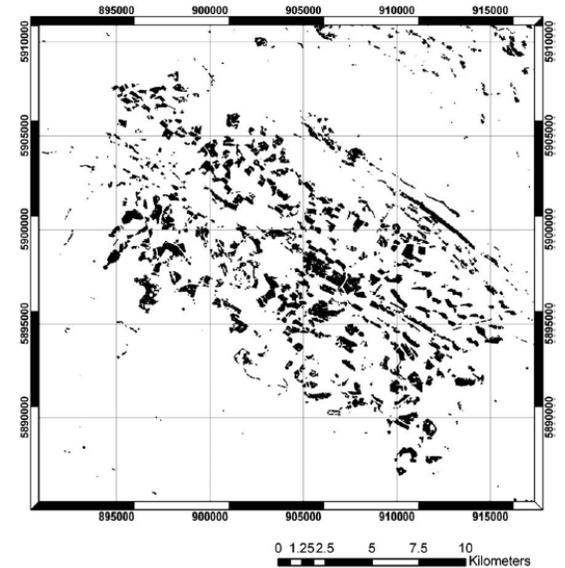
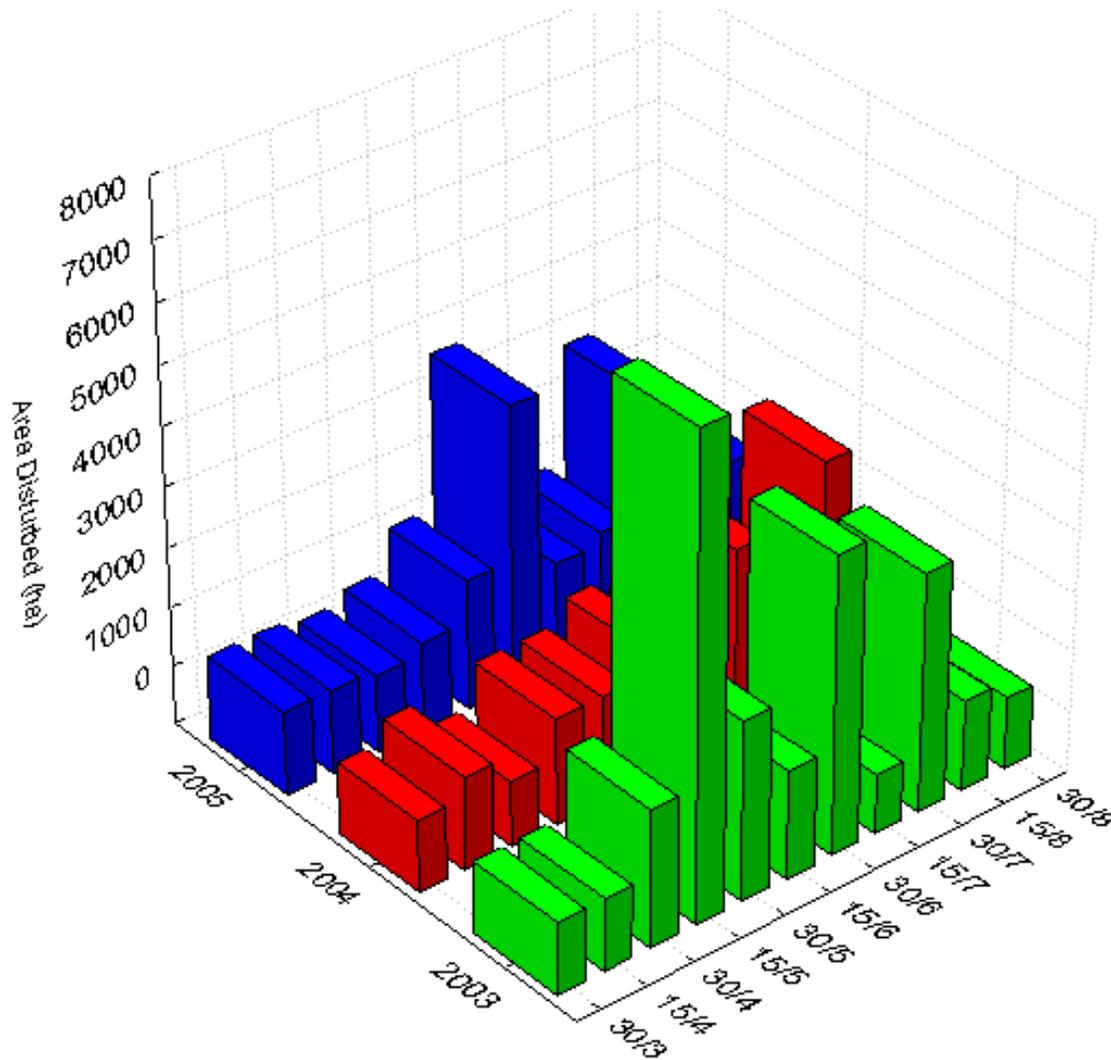


### Disturbances 2004



**Disturbances 2005**





Total disturbed area per 16 day time step for 2003, 2004 and 2005, respectively. Most disturbance events occurred during the early summer months, while the total disturbed area per 16 day interval decreases towards the end of the growing season. The peak in the mid-May data from 2003 corresponds to a wildfire.

# The Changing Forest Landscape

**Approaches to monitor the ongoing changes in the forested landscape using modelling and remote sensing**

## Change Attribution:

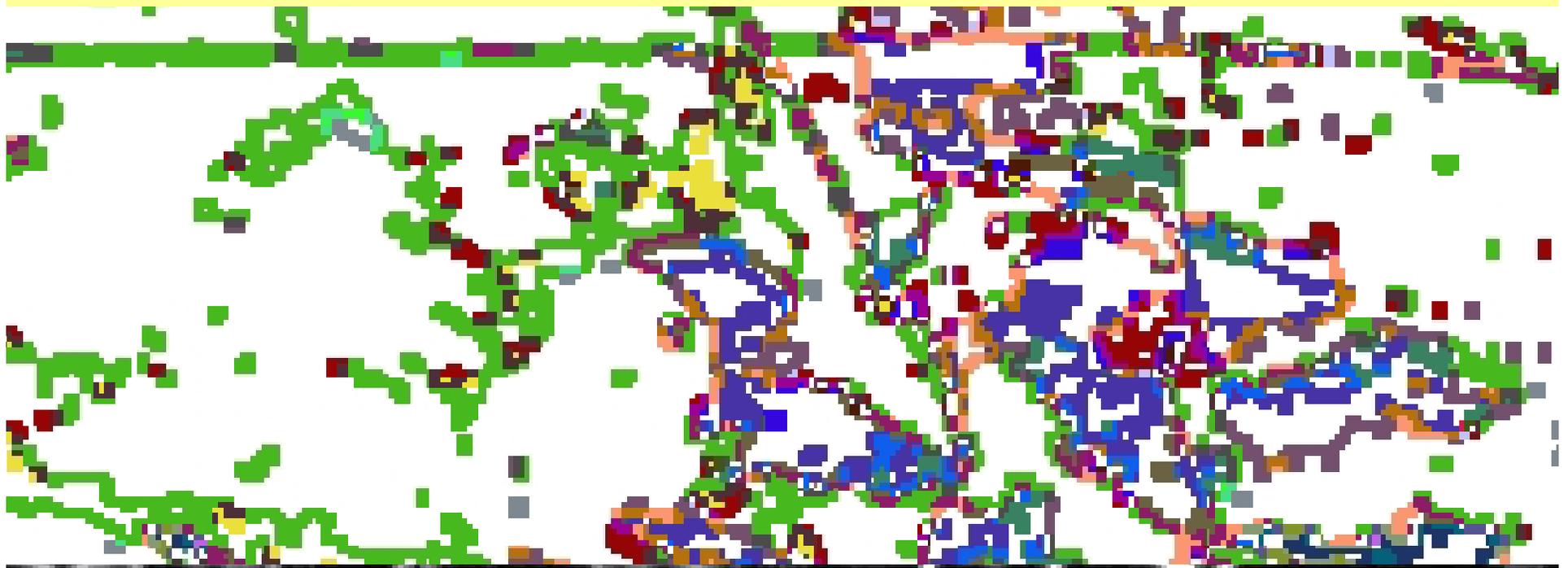
- approaches have been developed to:
  - find change (as with standard procedures or STAARCH)
  - label changes
    - 1. using spatial information;
    - 2. using image fusion
- result is detection and labelling (e.g., well site, cut block, road) of changes in an increasingly automated fashion

# The Changing Forest Landscape

**Approaches to monitor the ongoing changes in the forested landscape using modelling and remote sensing**

## Quantitative Edge Development

- Edges inform on habitat characteristics
- Consistent and quantitative development desired
- Can use edge detection and integration with land cover products to:
  - Produce edges and edge strength (Wombling)
  - Generate class transitions (classes on either side of edge)
  - Combine edges, strength, and transitions



- Classified image data;
- Tasseled Cap Wetness (based on image spectral values);
- Wombed edges (brightness relates strength);
- Class transitions at edge locations and combine with model input, describe outputs / trends

# The Changing Forest Landscape

**Approaches to monitor the ongoing changes in the forested landscape using modelling and remote sensing**

- All of these spatial data layers, can be combined with information on
  - bear presence / absence,
  - abundance and
  - home ranges
- To provide additional context to conservation efforts.
  - Inputs to Resource Selection Function models

# Thank you

## Contact Information:

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<http://cfs.nrcan.gc.ca/subsite/wulder/>

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