Satellite observation of boreal land cover: methods, data sets and application

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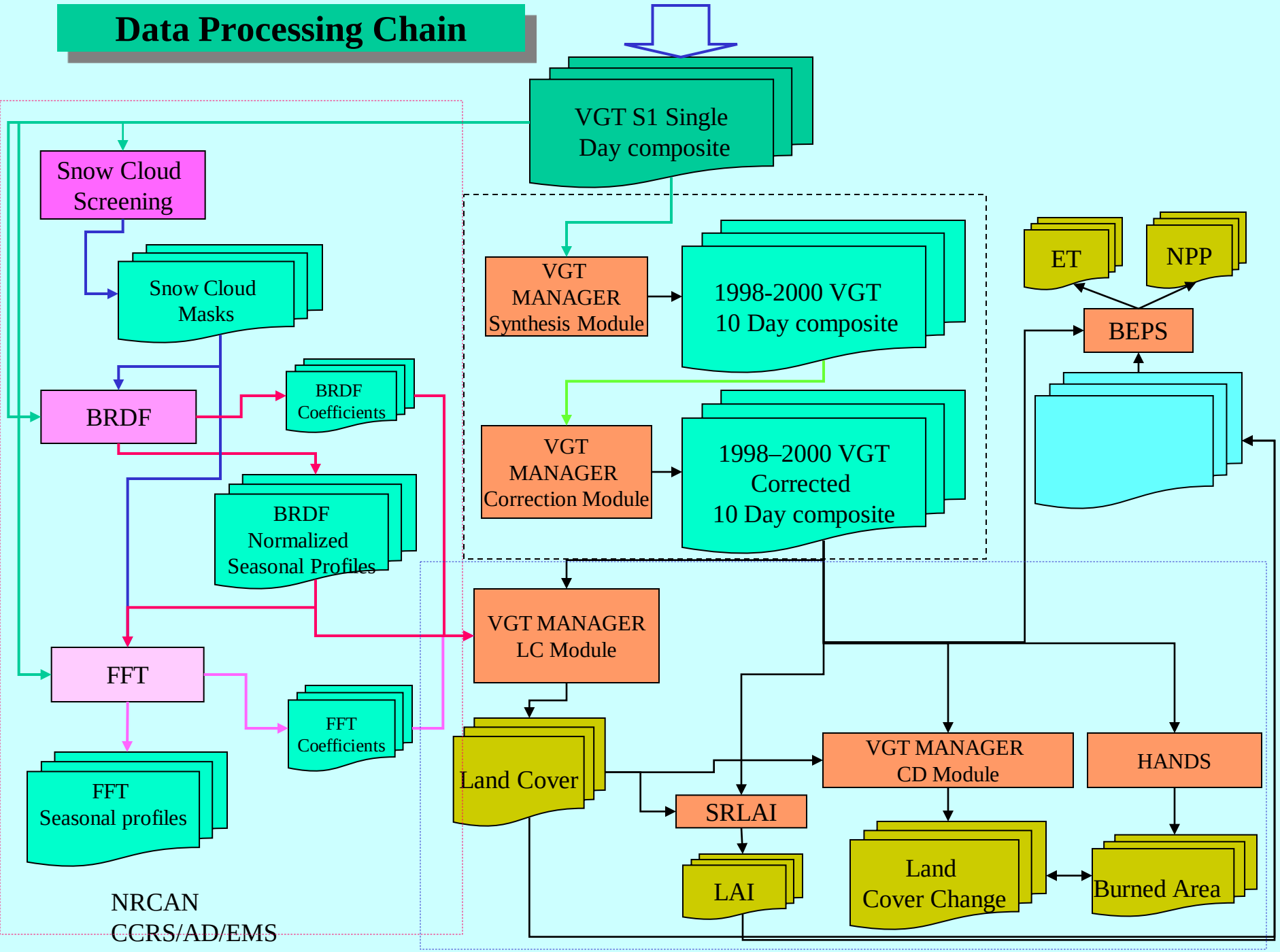
Objectives

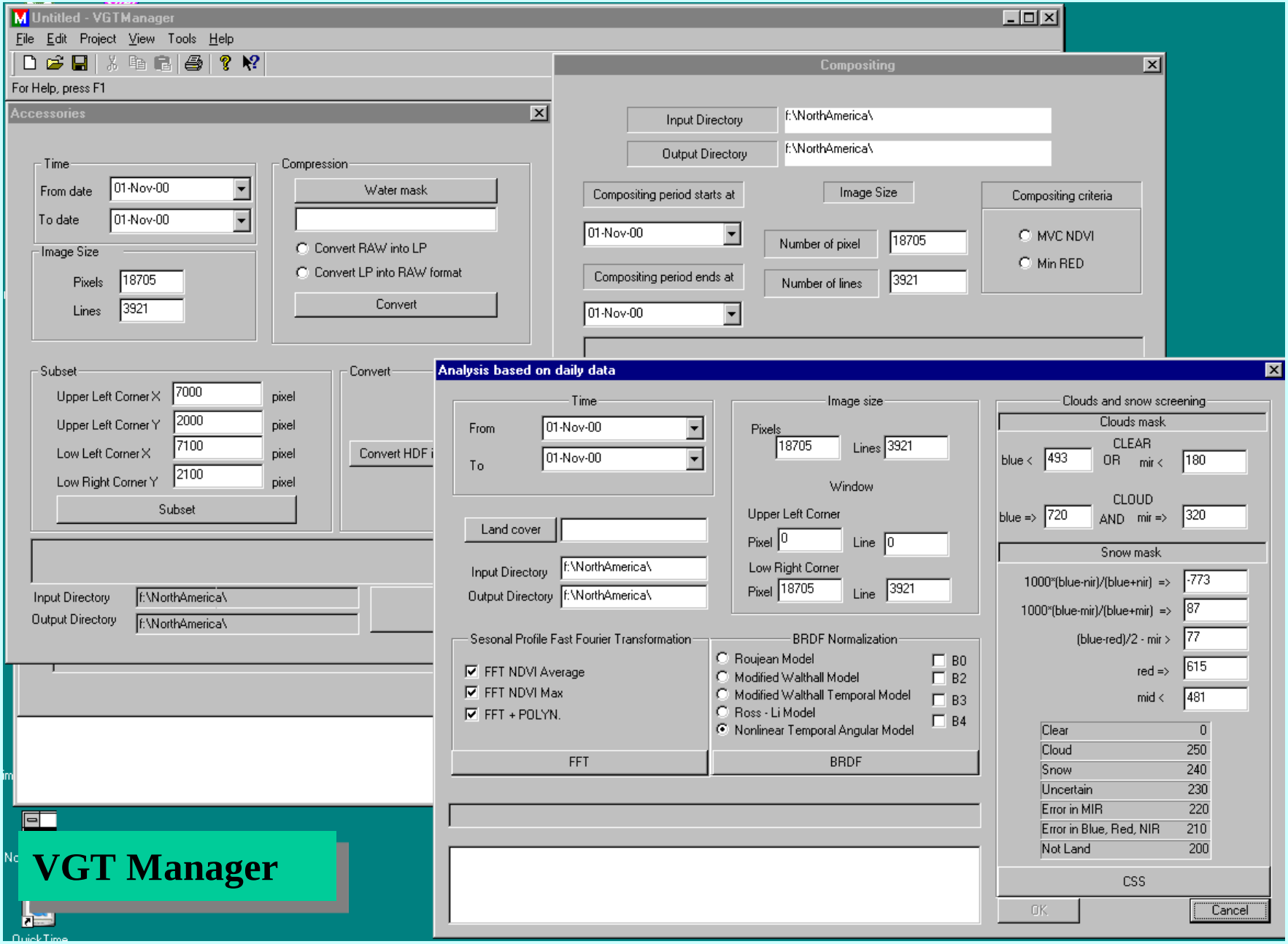
1. To develop an objective, robust, operational method for producing forest and other land cover information at the regional level.
2. To produce land cover maps over the 1993-2001 period using coarse resolution satellite data
3. To prepare a database of wetland distribution for Canada using a combination of remotely sensed and other data types
4. To develop methods for quantifying the content of coarse resolution land cover maps using high resolution satellite data or other information sources
5. To obtain statistic for land cover distribution at national, provincial and sub-provincial level using an optimum combination of coarse and high resolution data
6. To use the land cover information for deriving higher level products and to study surface-atmosphere interaction and the role of land cover in carbon and hydrological cycle

Objective 1, 2 and 5

Systematic data correction procedure for temporal studies
Land cover classification
Land cover change detection

Data Processing Chain





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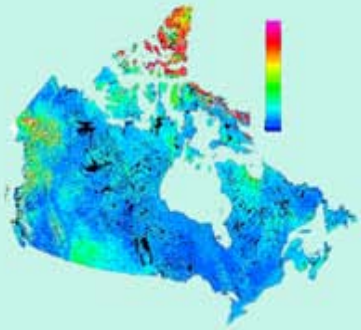
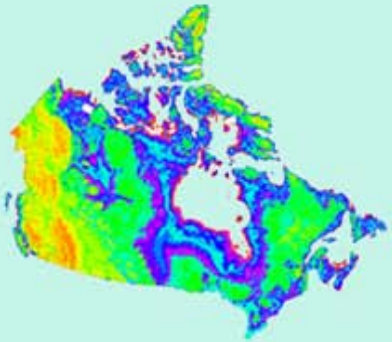
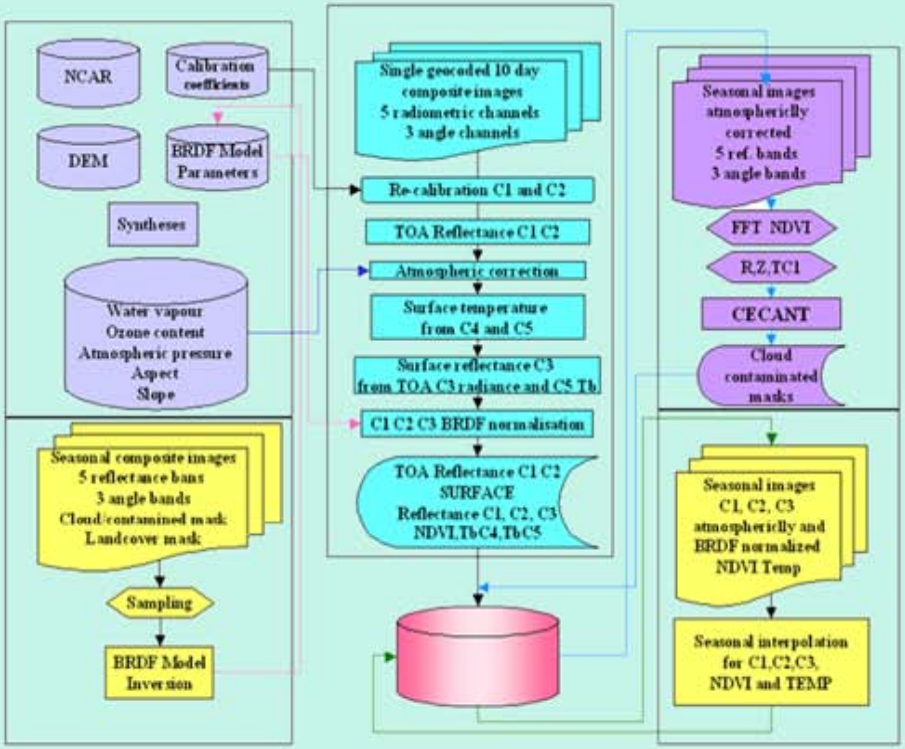
ABC3V2 Methodology

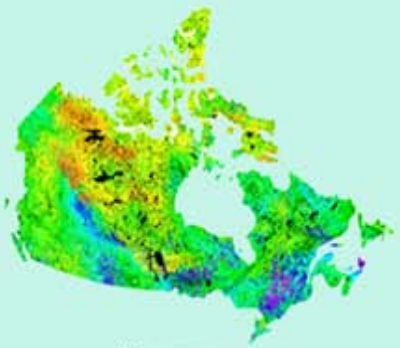


Top of Atmosphere Reflectance

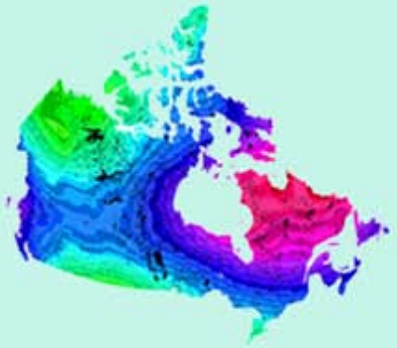


Pressure

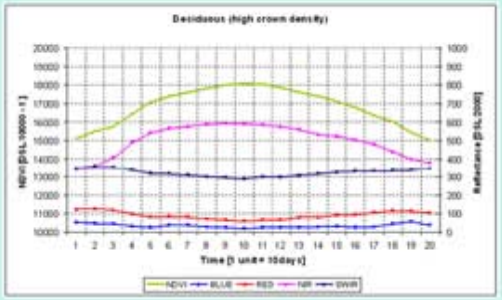


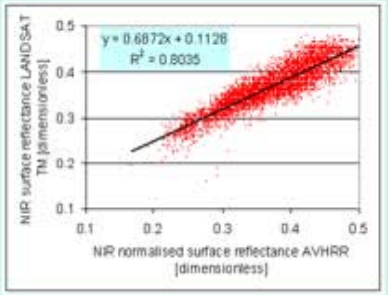


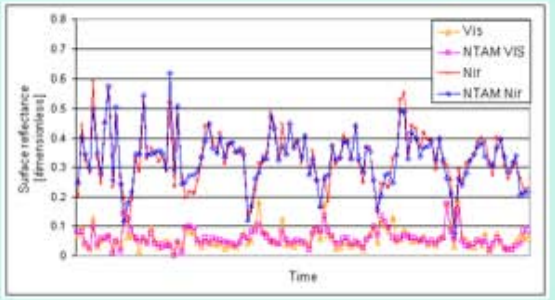
Water vapour



Ozone







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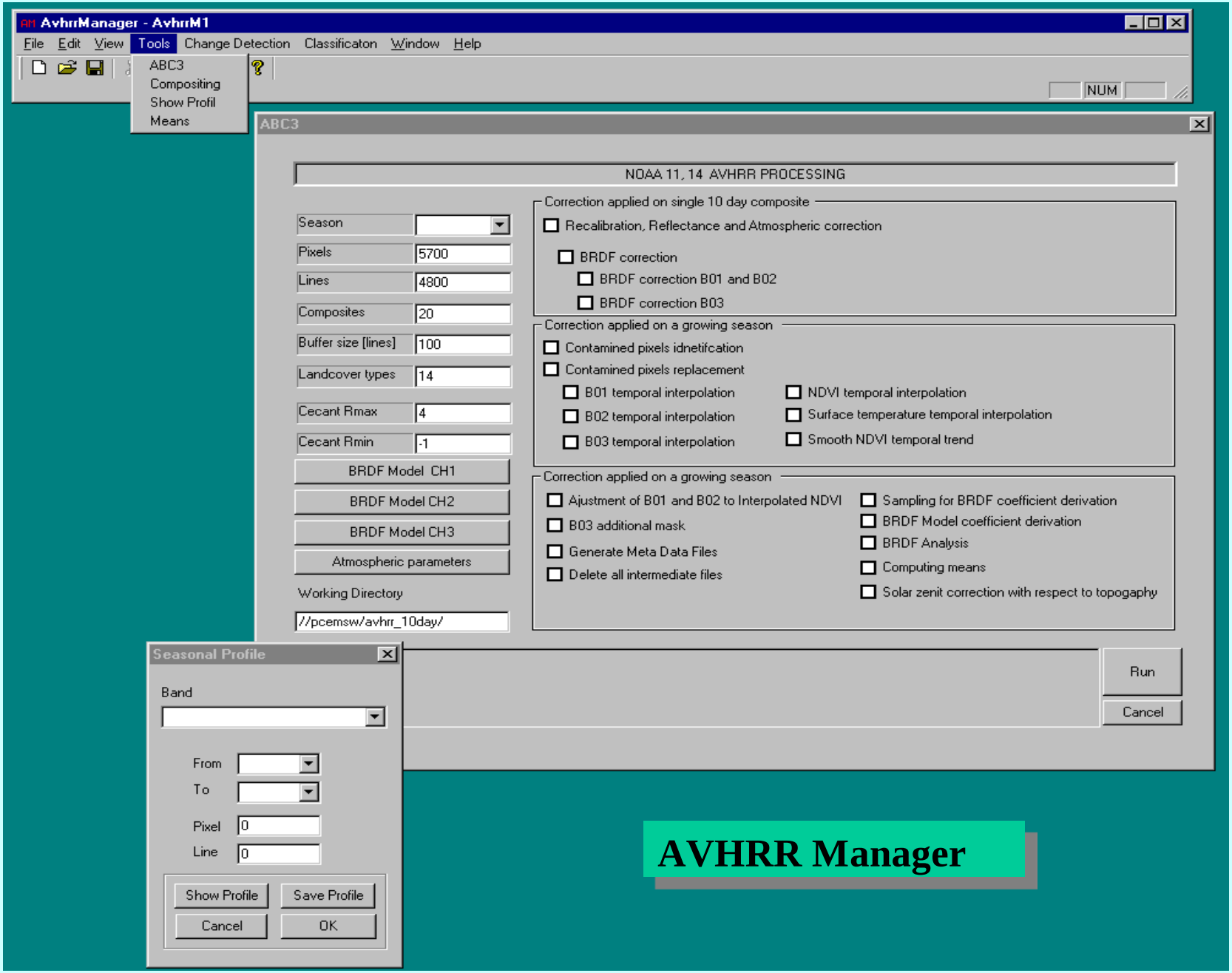

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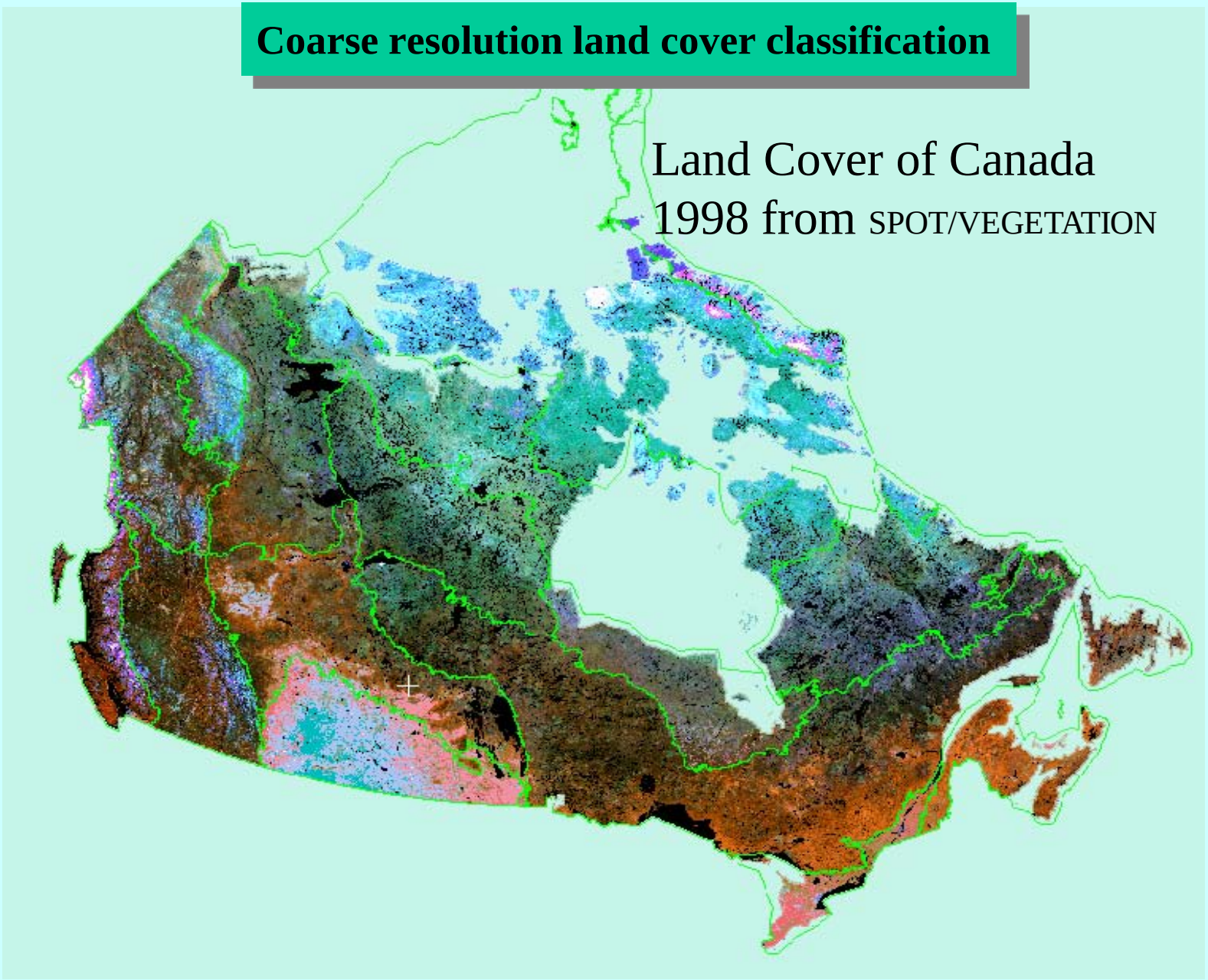
Coarse resolution land cover classification



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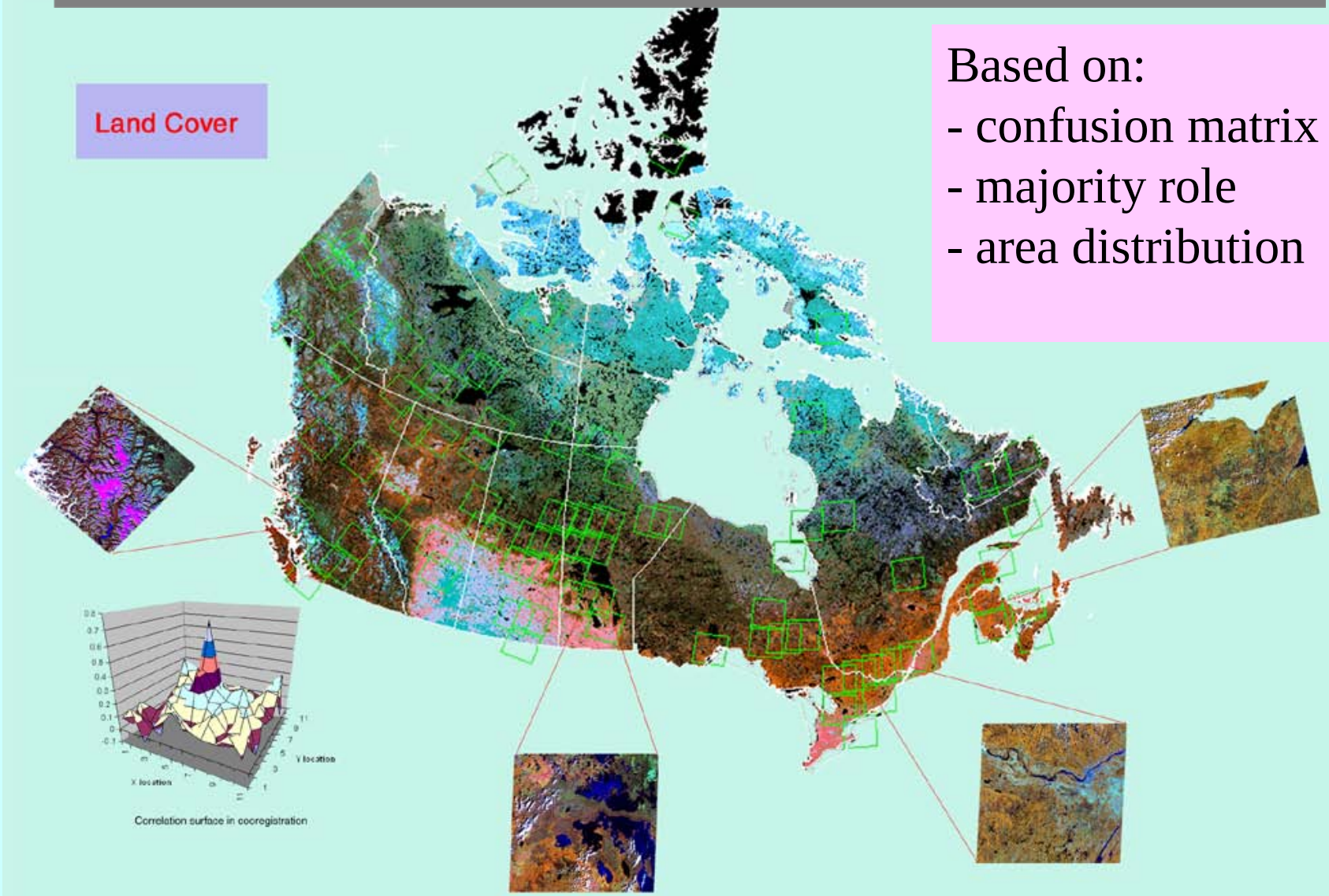
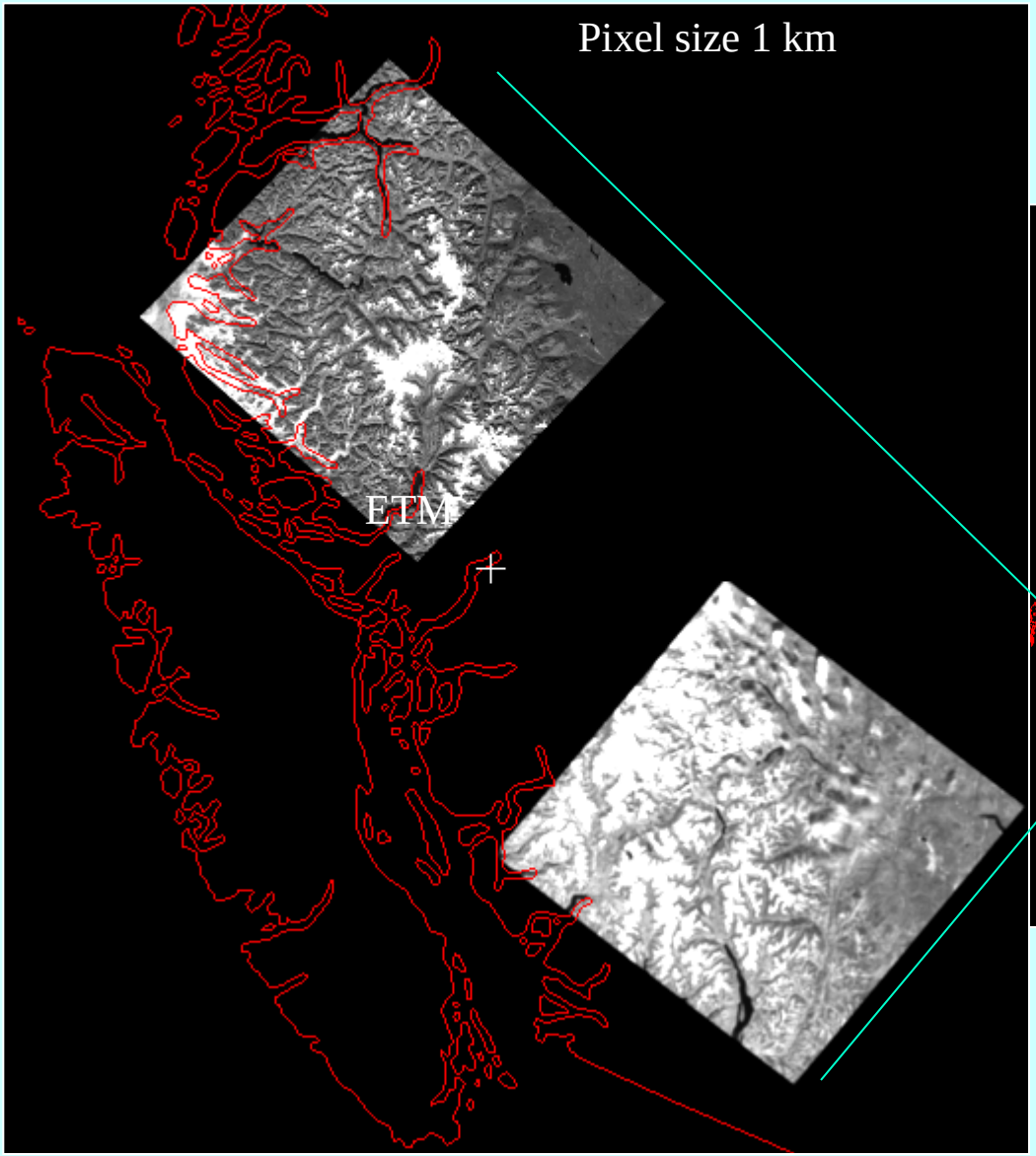
Accuracy assessment using fine resolution land cover classification



Based on:
- confusion matrix
- majority role
- area distribution

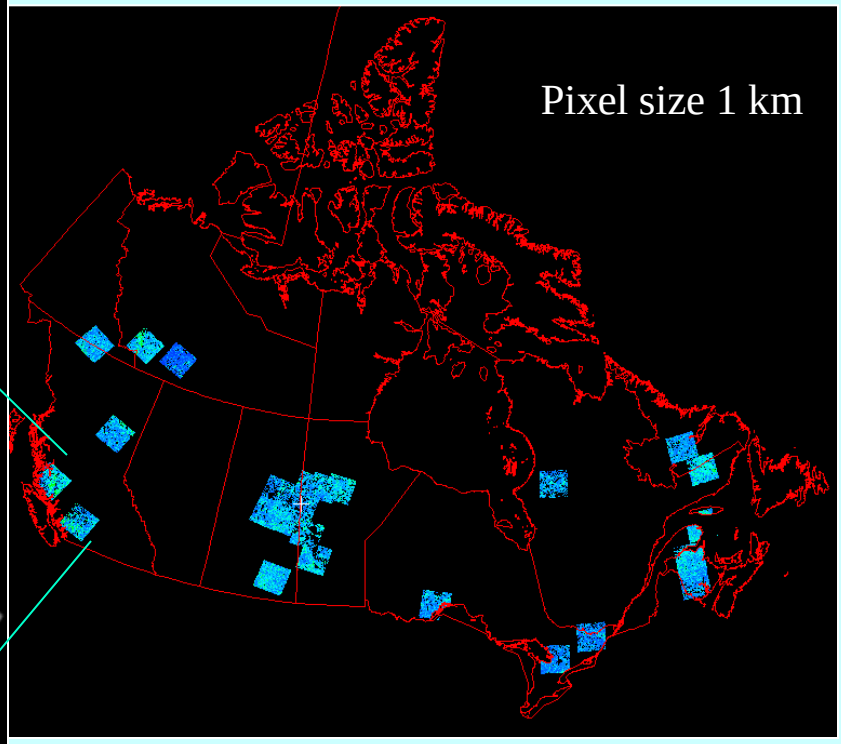
Preprocessing



Georeferencing

Co-registration

Re-sampling



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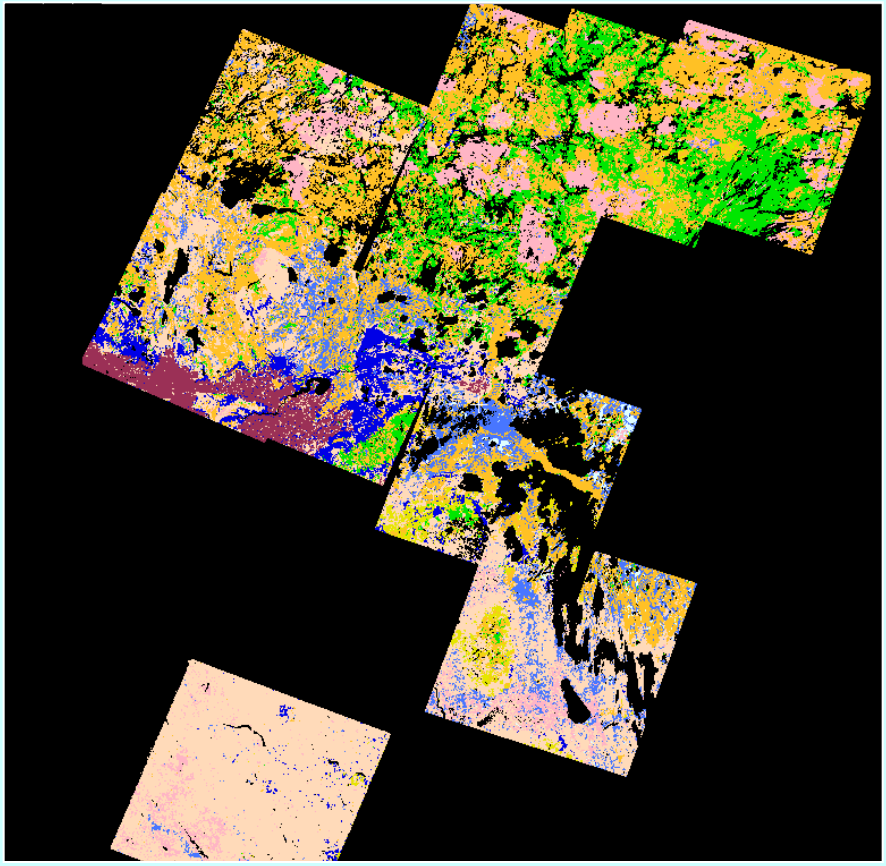
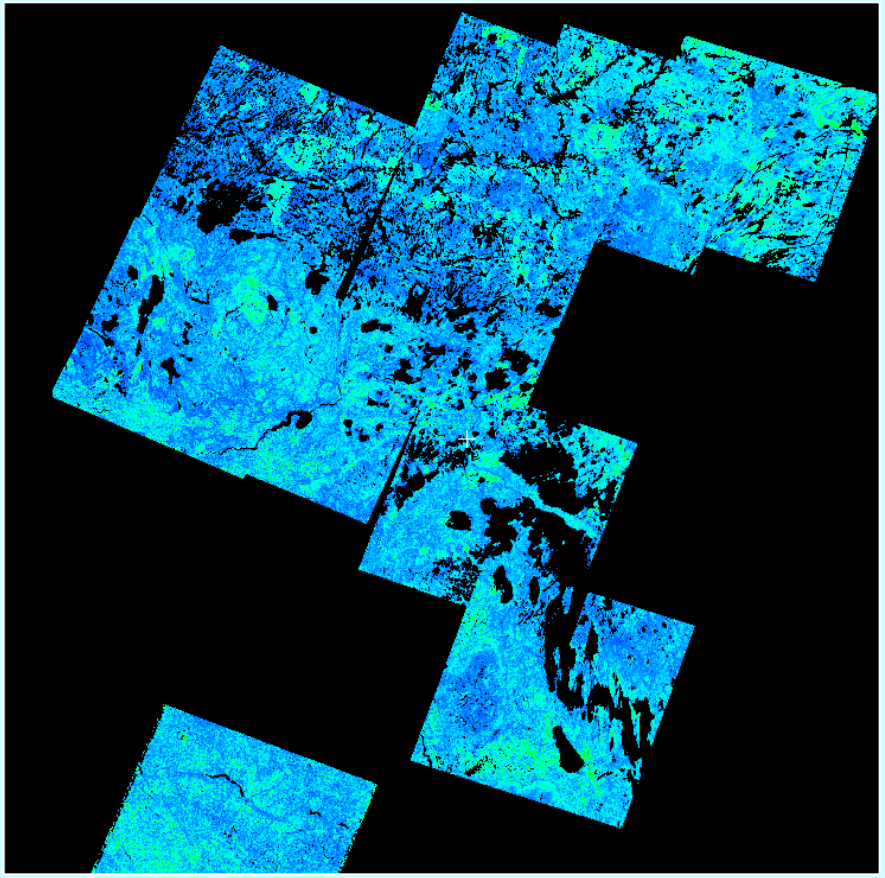
Majority role



Most frequent type in 1 km pixel derived from Landsat TM



Percent of occupied area by the most frequent type in 1 km pixel

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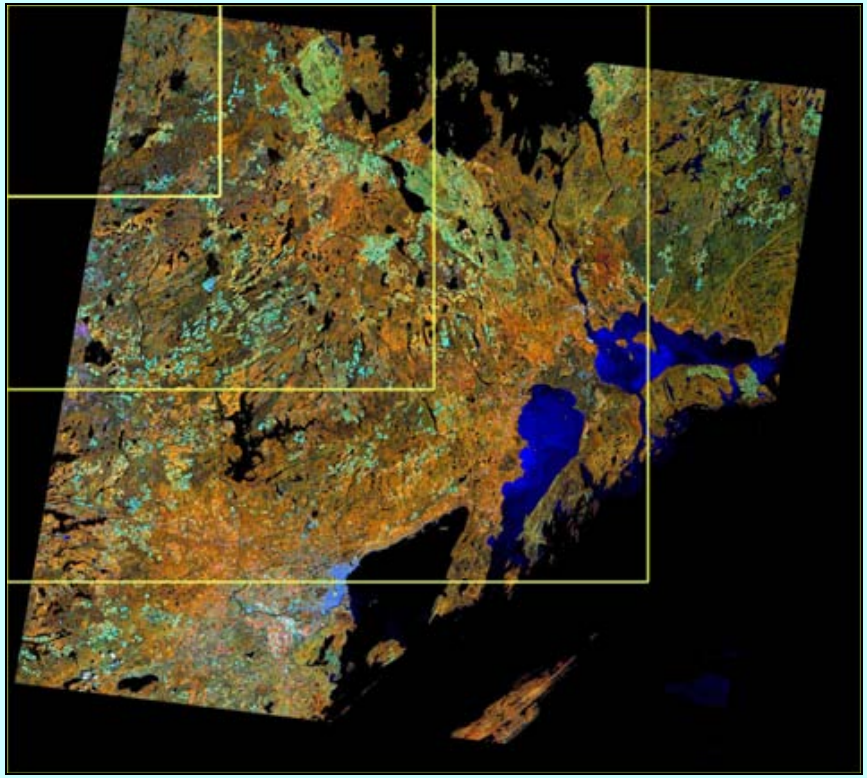
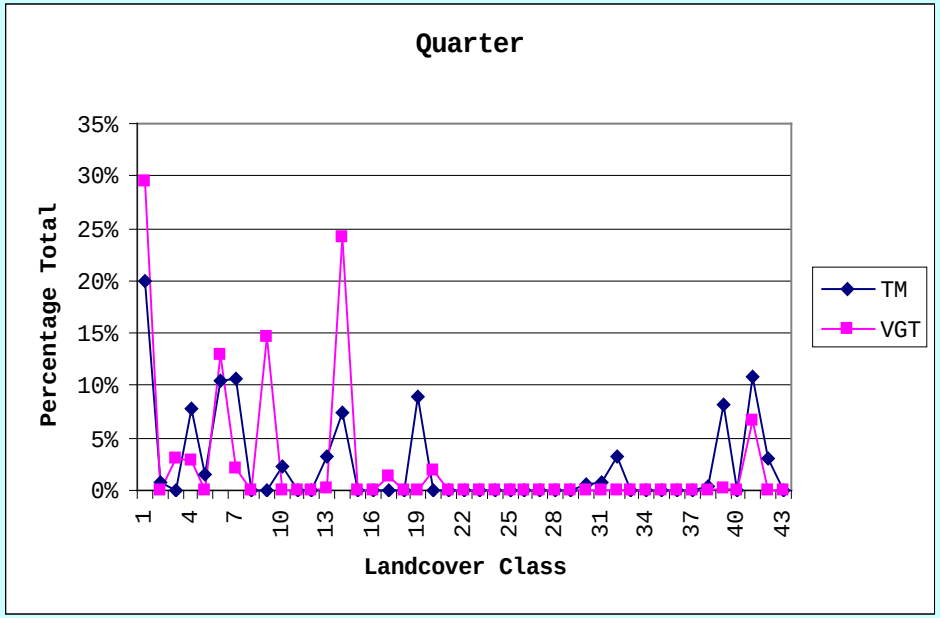
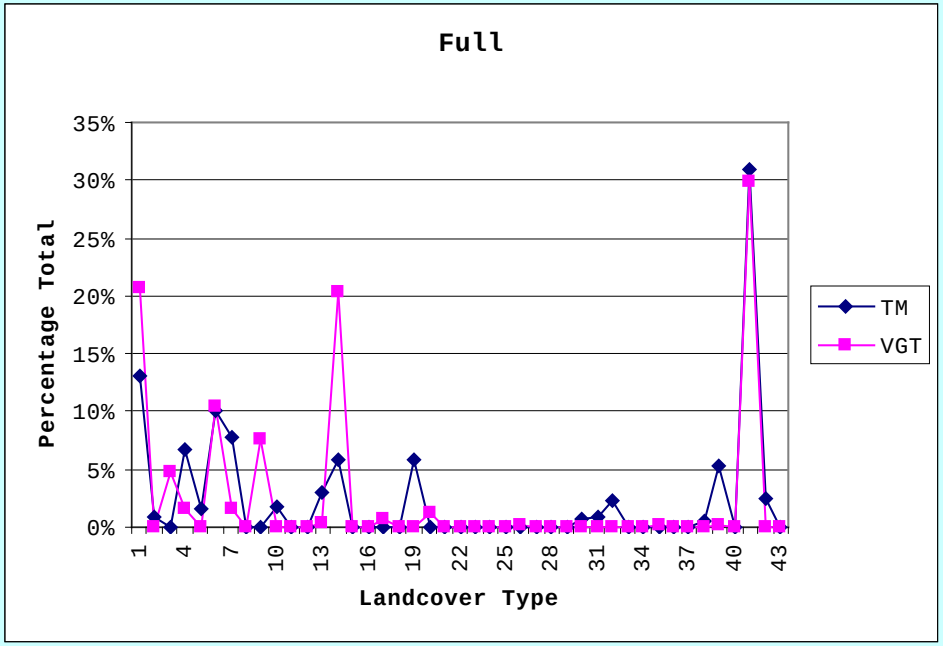
Area distribution







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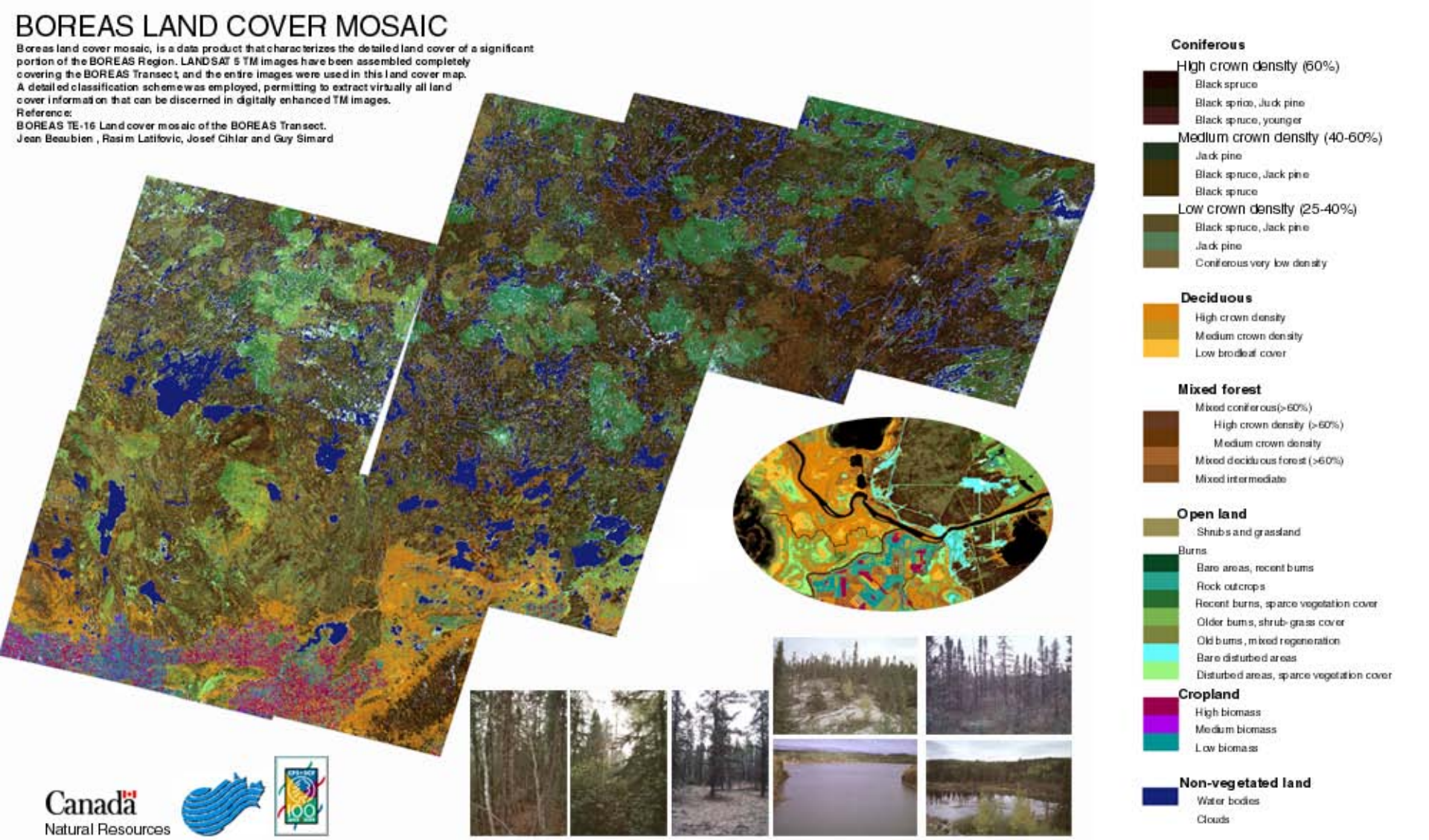

ECM - Enhancement Classification Method
CPG - Classification by Progressive Generalisation
MFM-5-Scale - Multiple-Forward-Mode 5-Scale approach

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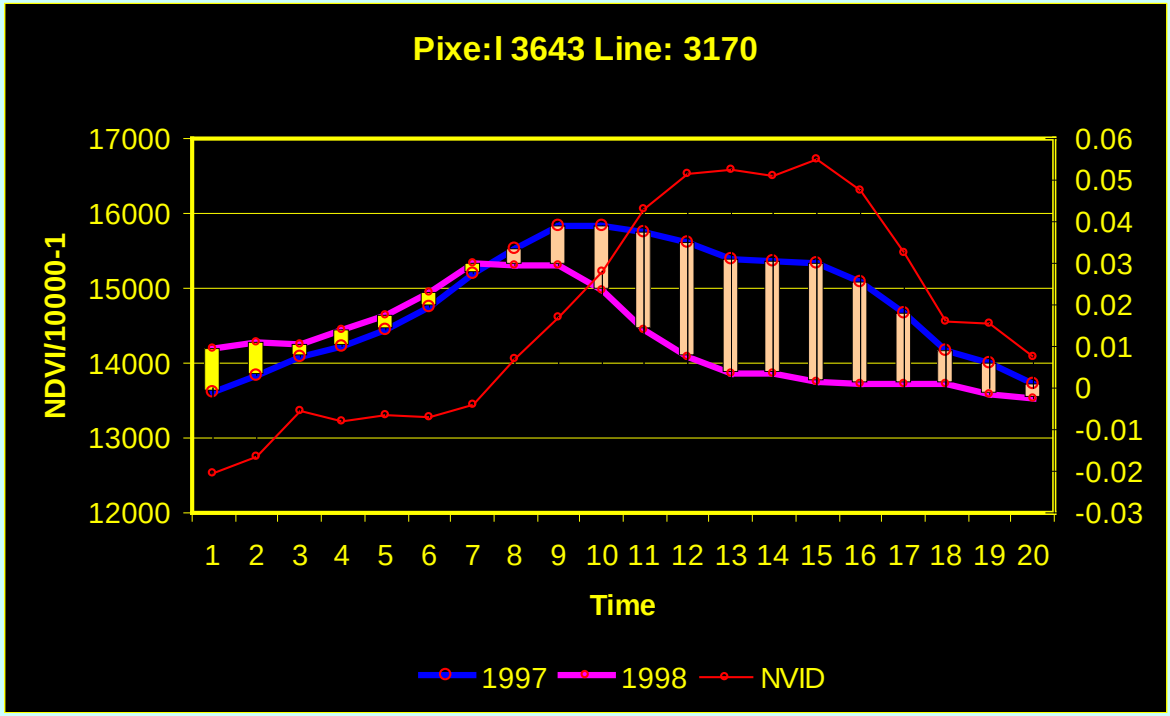
Spectral change detection methods

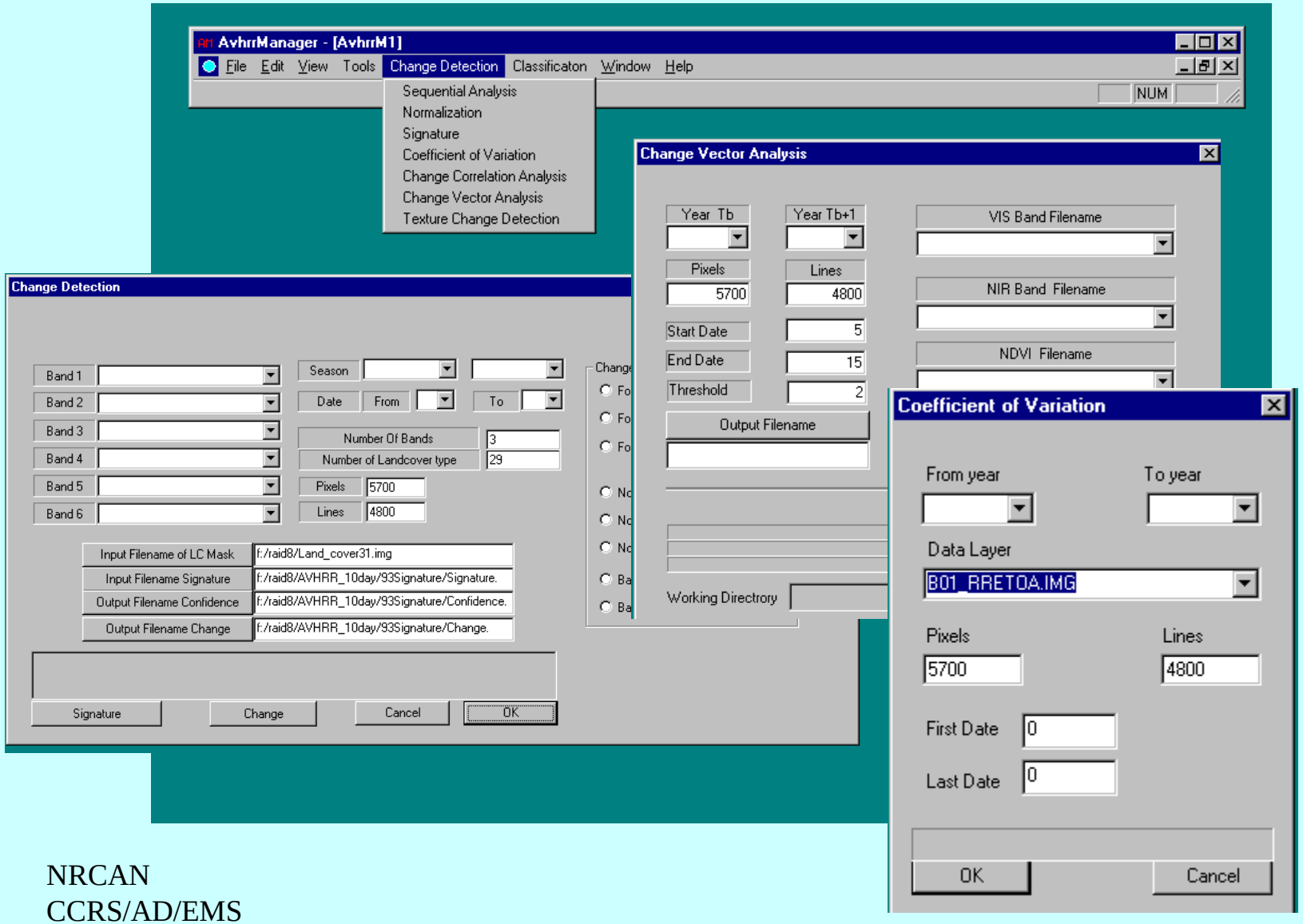
- *Multi Temporal Vector Change Detection Method*
- *Correlation Analysis Change Detection Method*
- *Texture Change Detection Method*
- *Pixel Fraction Change Detection Method*

Multi Temporal

Change detection algorithms based on temporal profiles assume that land cover type (spectral cluster) has relatively stable profile in VIS and NIR band over years. Change detection methods are implemented on the successive time trajectories represented as vector in multidimensional measurement spaces.



AVHRR Manager an analytical environment for change detection research



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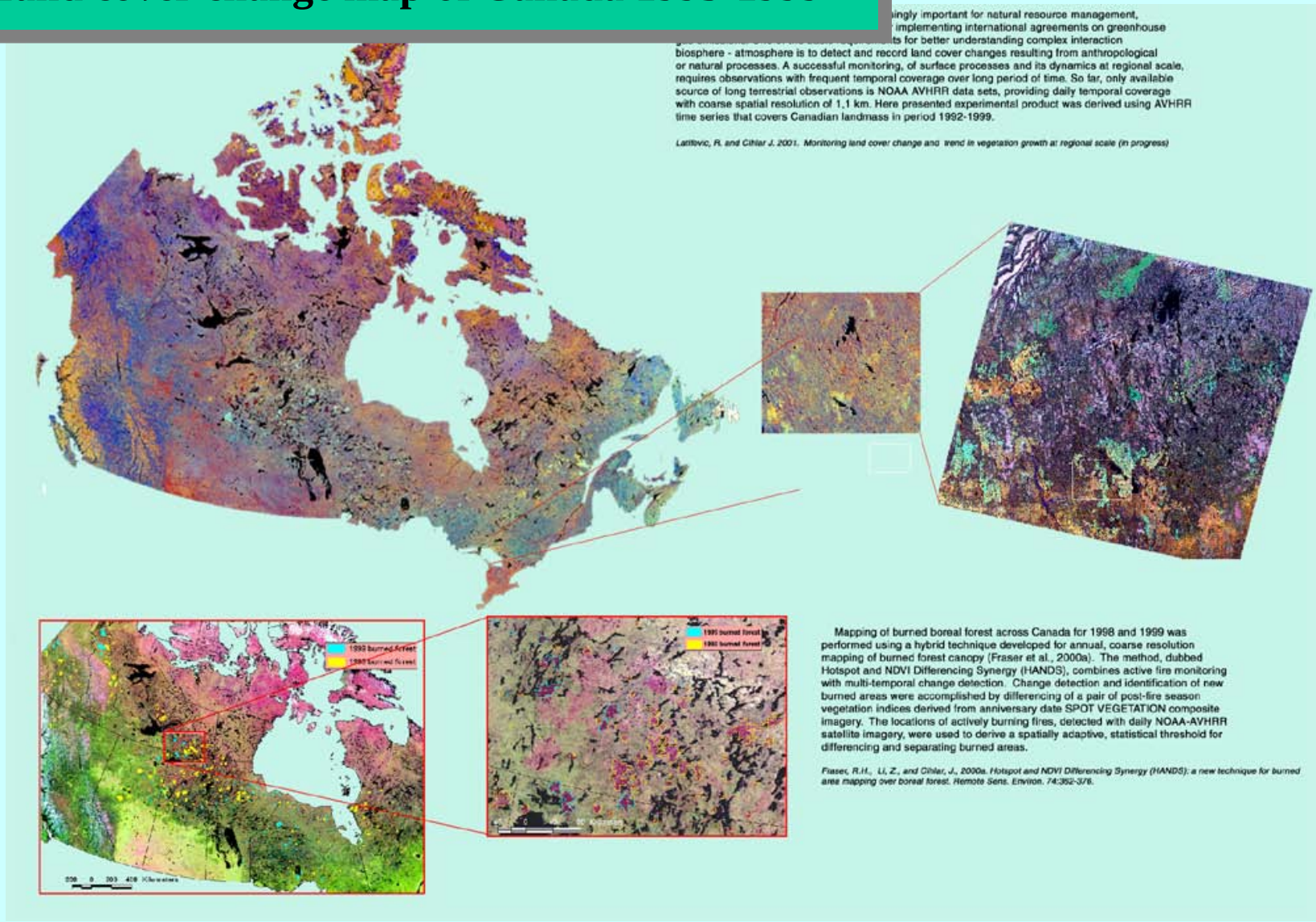
Land cover change map of Canada 1993-1999



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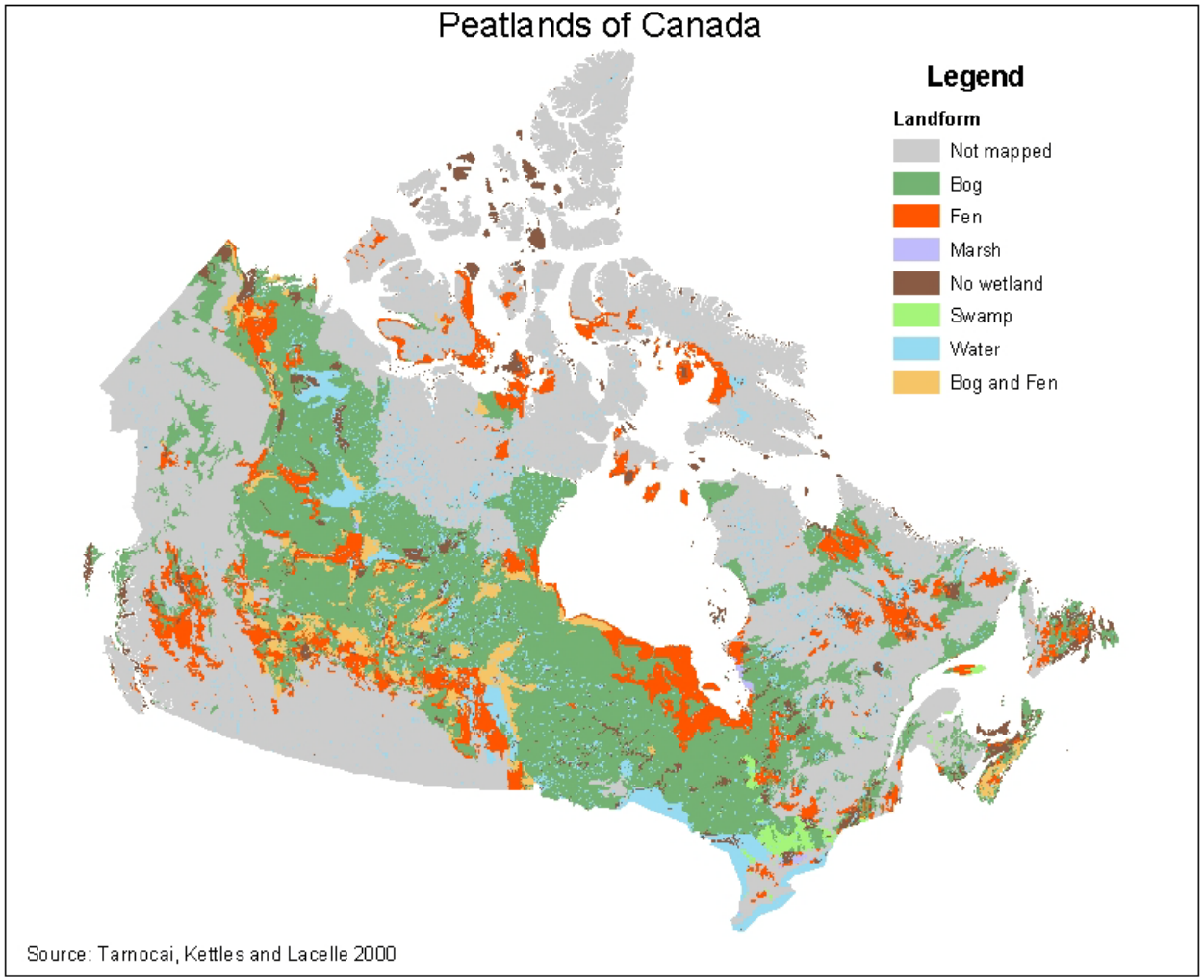
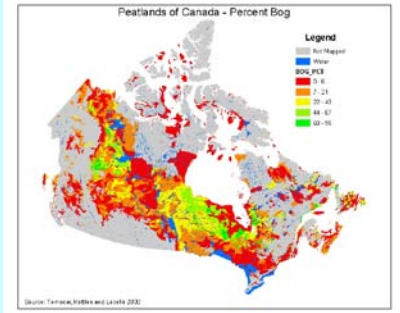
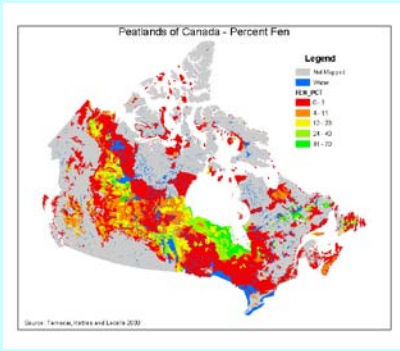
Objective 3,4

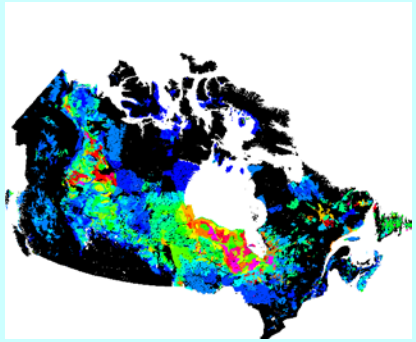
Wetland distribution data base for Canada
Fractional land cover and continuous mapping

Wetland distribution for Canada









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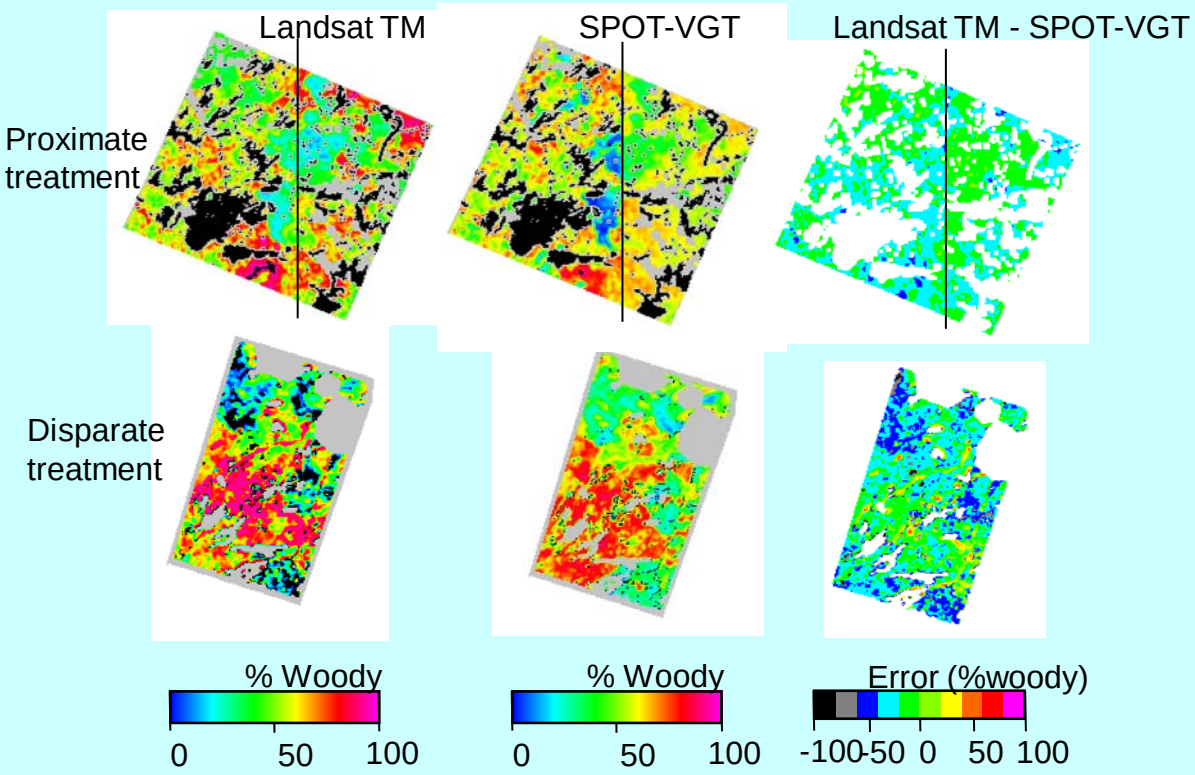
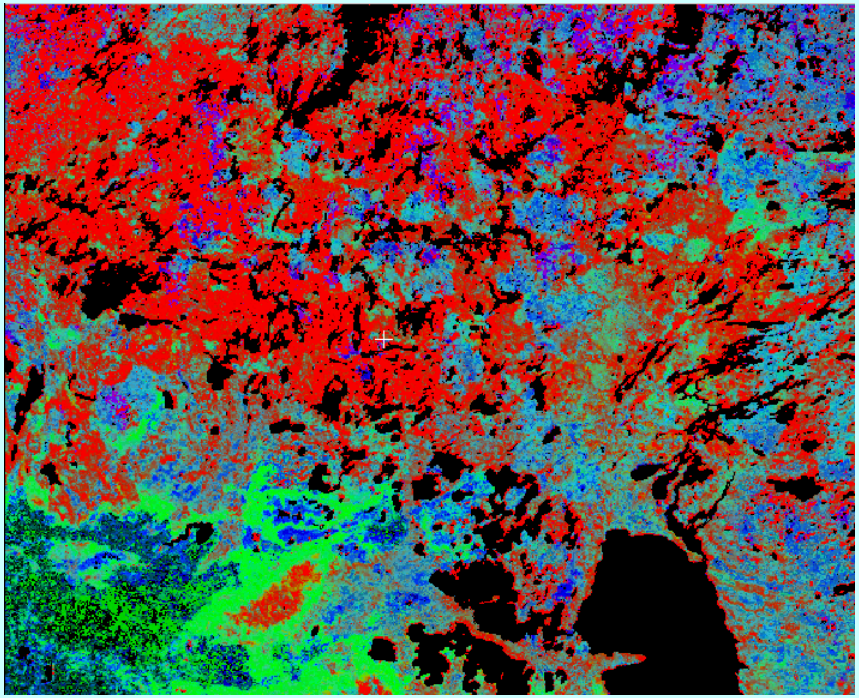
Approaches to fractional land cover and continuous mapping

1. Multivariate regression
2. Linear last squares inversion
3. Look-up table
4. Neural network
5. Hard' per pixel classifier

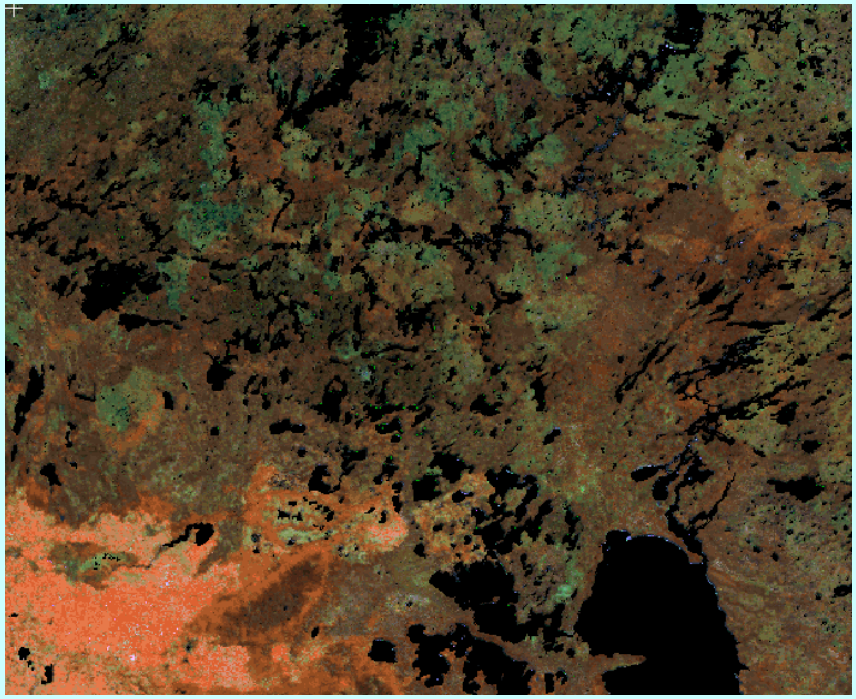


Land cover characterization carried out by estimating the proportions of major cover type within each 1 km pixel

Fractions



Classification



Coniferous

Shrub and grass

Deciduous

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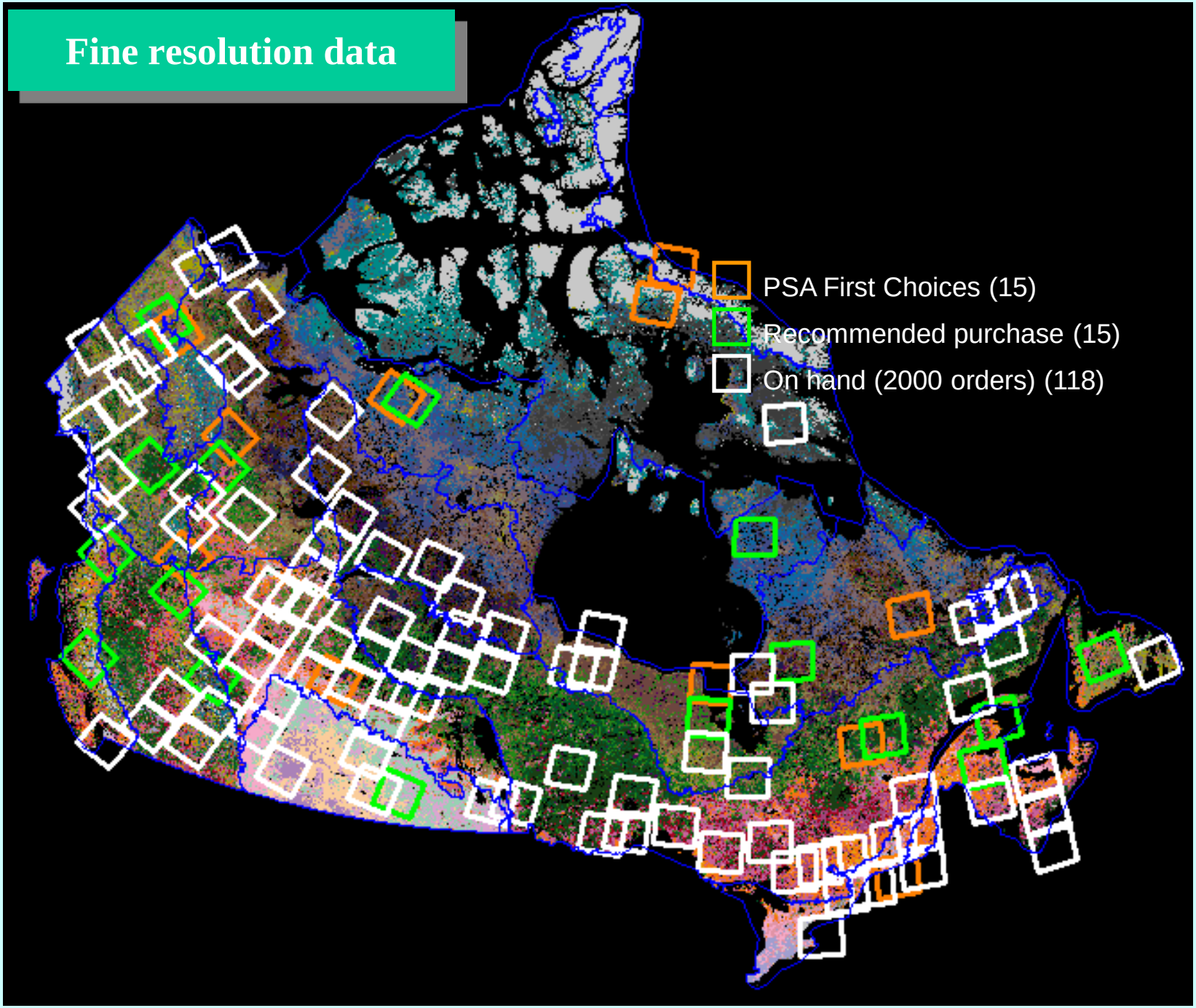
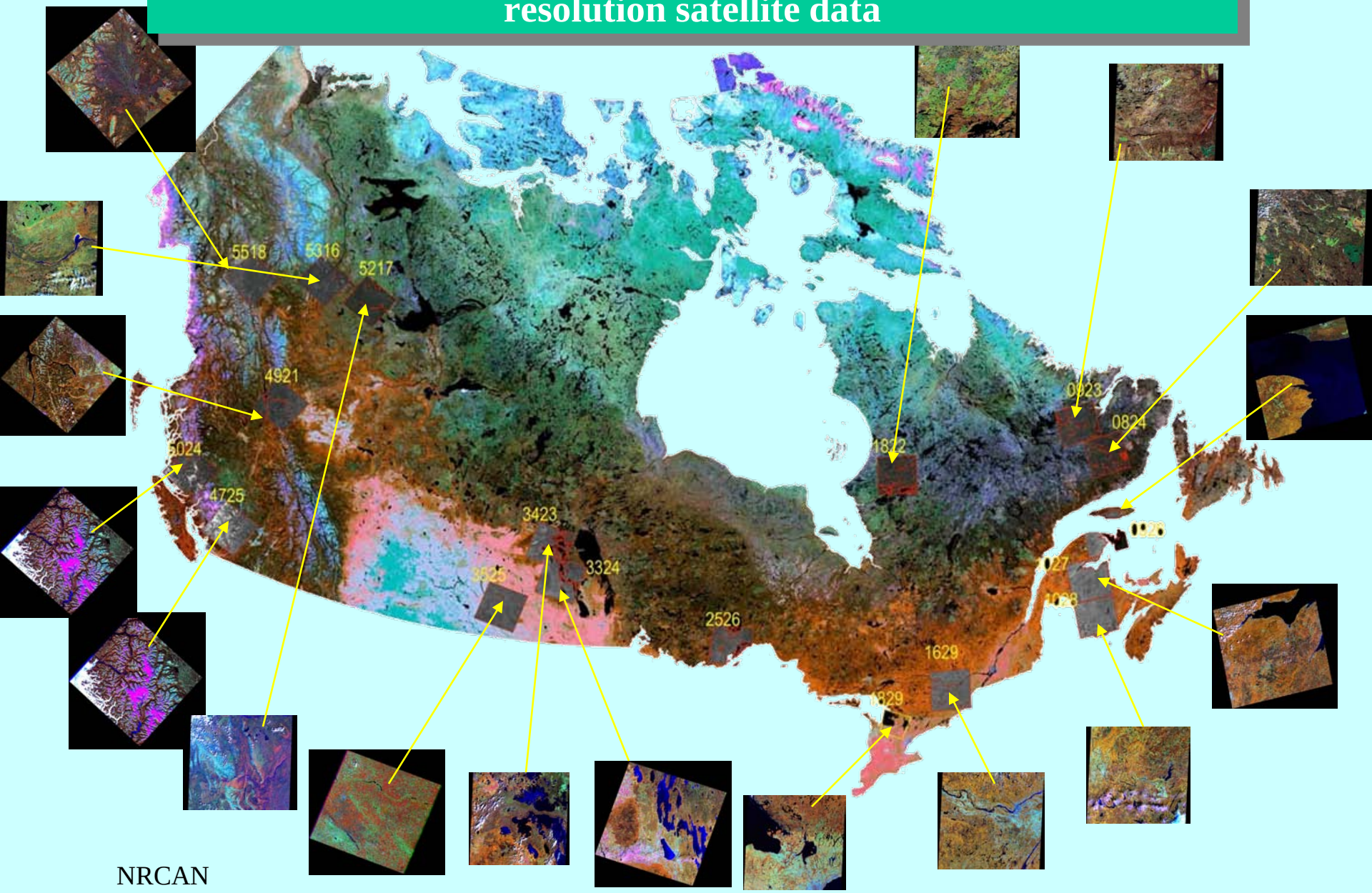
Fine resolution data



Land cover fractions in coarse resolution maps using high resolution satellite data



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Summary of major products and their progress

Product	Classification Legend	Source Imagery	Pre-Processing System and Methodology	Classification strategy	Validation	Accomplishment
Coarse Land Cover Map	Classification System (hard)	SPOT/VGT 1998–(+2000)	VGT-Manager ABC3V2	ECM/CPGcs	TM	80%
Coarse Land Cover Map	Fraction	SPOT/VGT 1998–(+2000)	VGT-Manager ABC3V2	New	TM	50%
Coarse Land Cover Map	Fraction	MODIS 500+250		New	TM	20%
Coarse CD	Change detection	AVHRR/VGT 1993-2001	AVHRR-Manager	MTCV	TM, field	60%
Wetland	Wetlands	MODIS JERS-1	TBD	TBD (blended Product)	Airphotos TM, GIS	40%
Fine (scaling)	Hard/scale or continuous field	TM	Radiometric correction + intrascene normalisation	ECM/CPGcs MFM- 5 Scale	GIS maps field	70%
Fine (mosaic)	MRL/land cover change	MSS/TM	Radiometric correction + intrascene normalisation	TBD	GIS Maps field	

Summary

1. The project is on schedule at this point
2. Our current priorities
    a. Completion of the TM sample set classifications
    b. Generation and validation of fractions data for Canada
    c. Continuation of land cover change detection
    d. Testing methods for land cover change monitoring (various options, with coarse+fine resolution data)

In parallel:

    e. Continuing development of large volume TM classification methodology (focus on radiometric 'homogenisation' and labeling efficiency)
    f. Development or related Canada-scale products at 1km (species, disturbances, site index,…)

3. Our feature priorities may be affected by program refocusing presently underway at CCRS