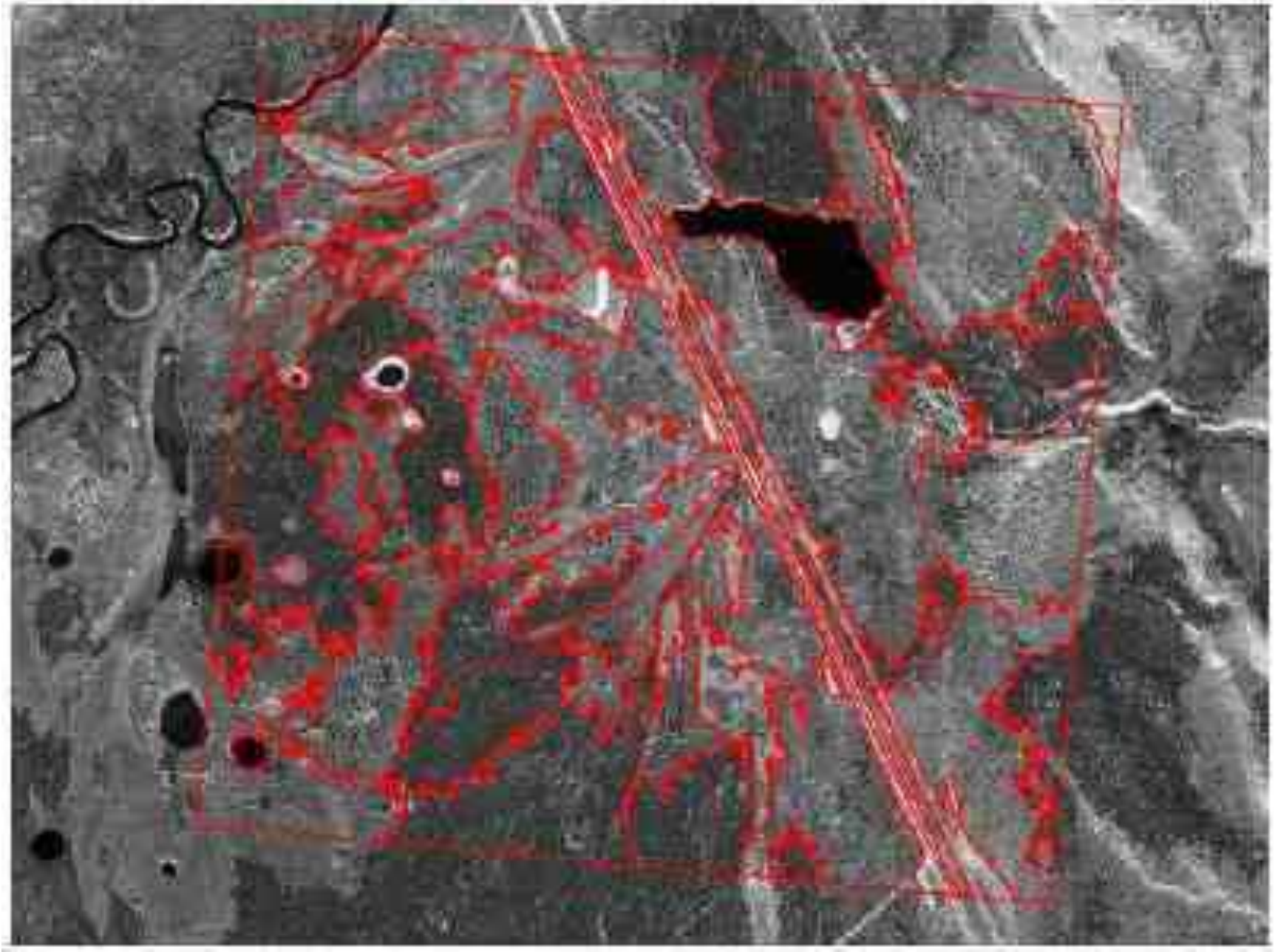
Feature Extraction

"The identification of geographic features and their outlines in remote-sensing imagery through post-processing technology that enhances feature definition, often by increasing feature-to-background contrast …. or using pattern recognition software."

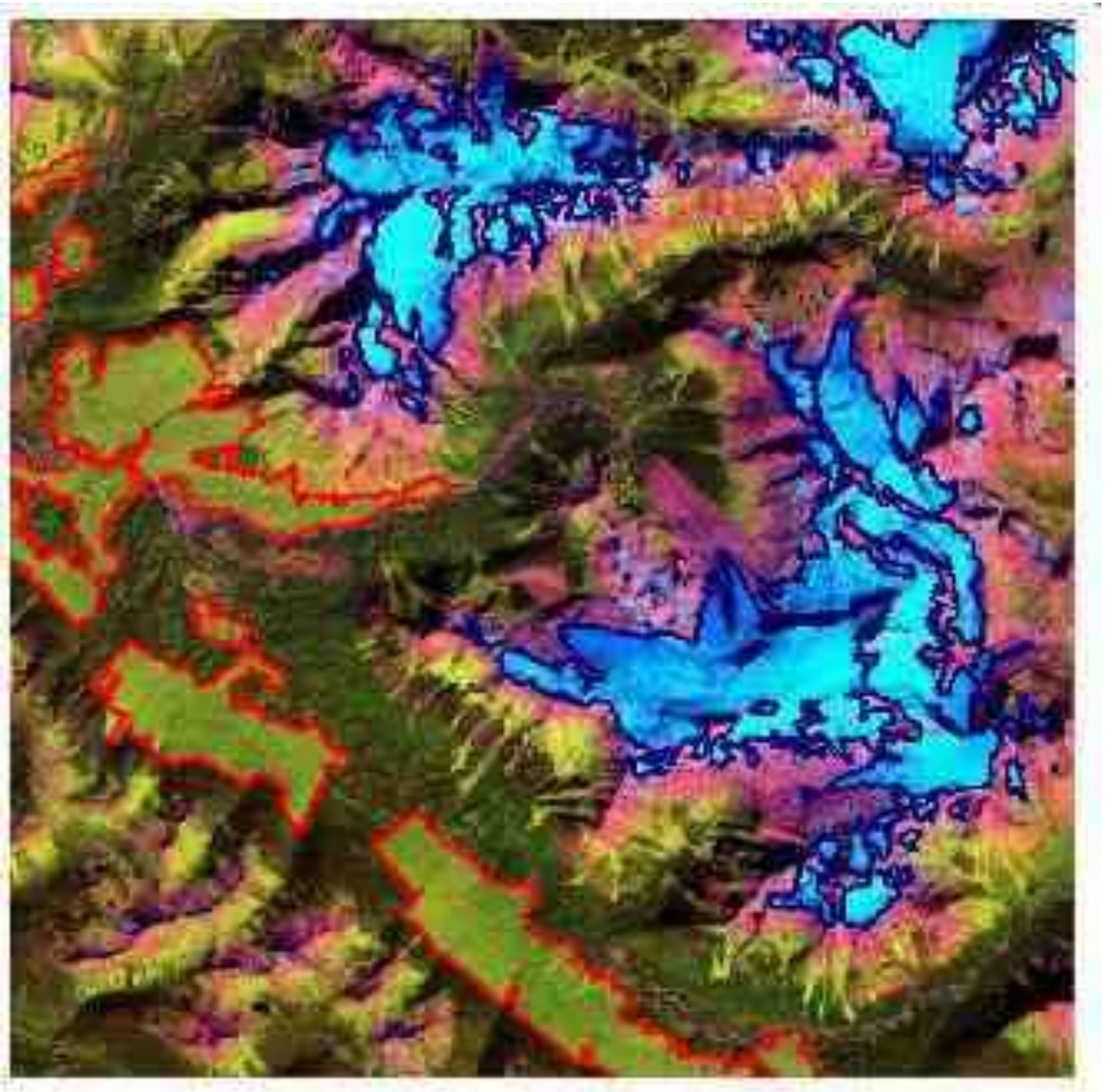
ESRI GIS

definitions

Manual ‘feature extraction’ by photo interpretation e.g. BC TRIM



Digital ‘feature extraction’ by ratio enhancement



Completion of the 1:50,000 National Topographic Database

with satellite Imagery 2000-2012

But used as background, not classifiable image data Why not ?

Figure 12 illustrates the evolution of the Northern mapping project that began in 2004 up (light green to dark green). Complete map coverage will be achieved with the 2011-2012 production plan utilizing SPOT5/HRS and Radarsat-2 data sources (Figure 13)

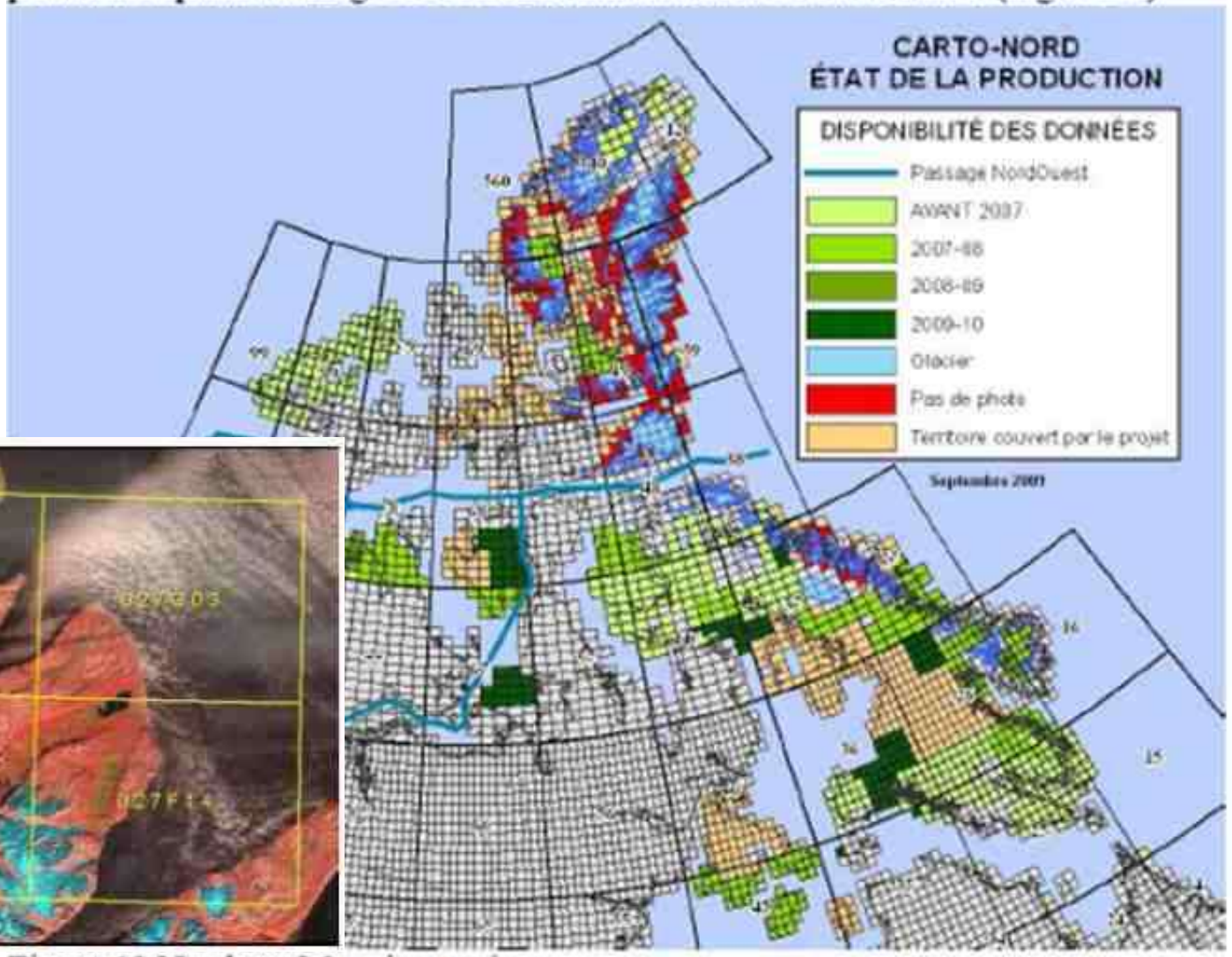


Figure 12 Northern Mapping project

Feature extraction (digitising) from aerial photography is the most tedious part of mapping ….. why hasn't remote sensing been used more to update GIS data layers ?

Principles of GIS: Aronoff (1986) – the first GIS textbook*

data are not well understood

data are too expensive

insufficient resolution

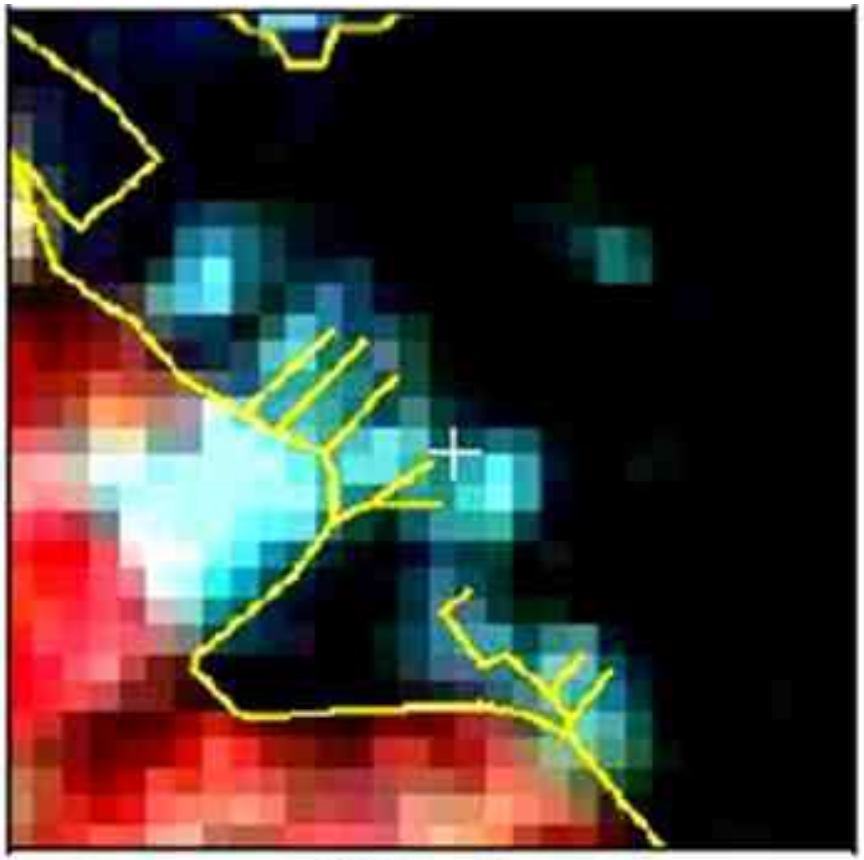
classification accuracies

complexities of reality

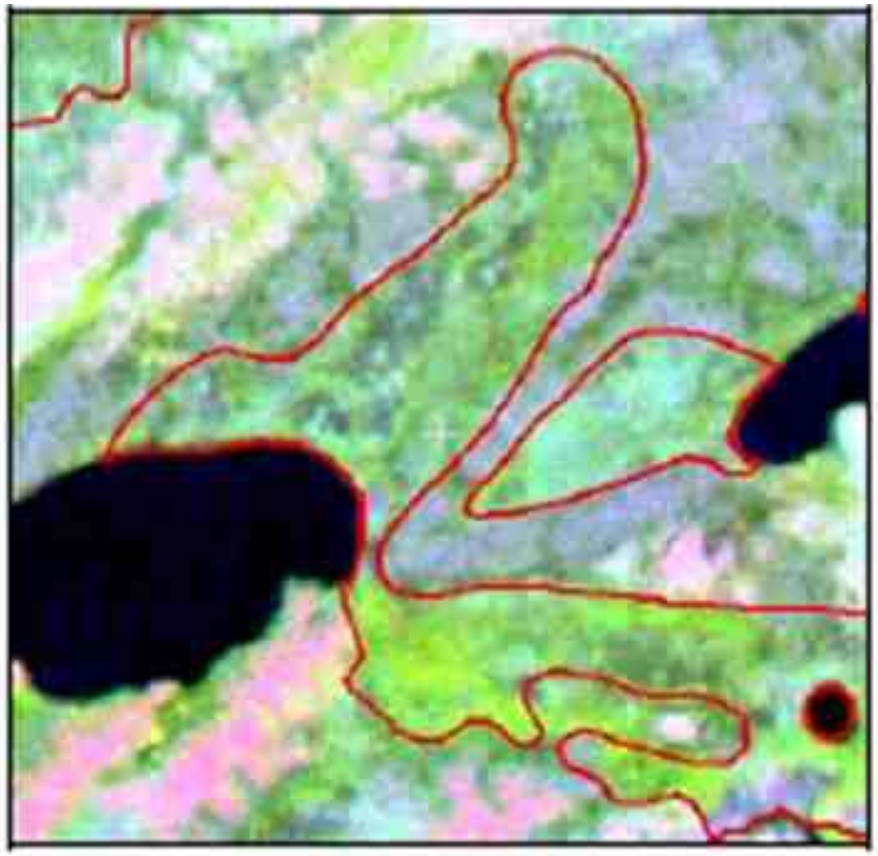
– lack of homogeneity / contrast

** Stan Aronoff is a Canadian remote sensing author / expert*

Examples of resolution and complexity of reality



Wharfs



Wetlands

Higher resolution might help a. (left), but not b. (right)

BC: updating of Vegetation Resource Inventory

where does it work?

-Feature **simplicity**
Consistent shape, contiguity

- Feature **homogeneity**
Consistency inside feature

- Feature **certainty**
Contrast with other features

Below is an example of the spatial change coverage from the Lillooet TSA. The delineated cutblocks are shown in white overlaid on the 15m panchromatic band.

Oy vei, not the Bowron again …

- **Feature simplicity** e.g. cutblocks? alluvial fan deltas
- **Homogeneity** e.g. lakes, bare rock (sunlit)
- **Feature certainty** e.g. avalanche tracks, glaciers (?)

Process for creating feature vectors from image data:
(one could also manually digitise from digital imagery… boring / subjective)

- 1. Select bands / channels to maximise feature contrast
- 2. Classify (multispectral) or threshold (single channel)
- 3. Create feature raster channel or bitmap
- 4. Clean results -> sieve or filter (generalise)
- *… we've done all these …*

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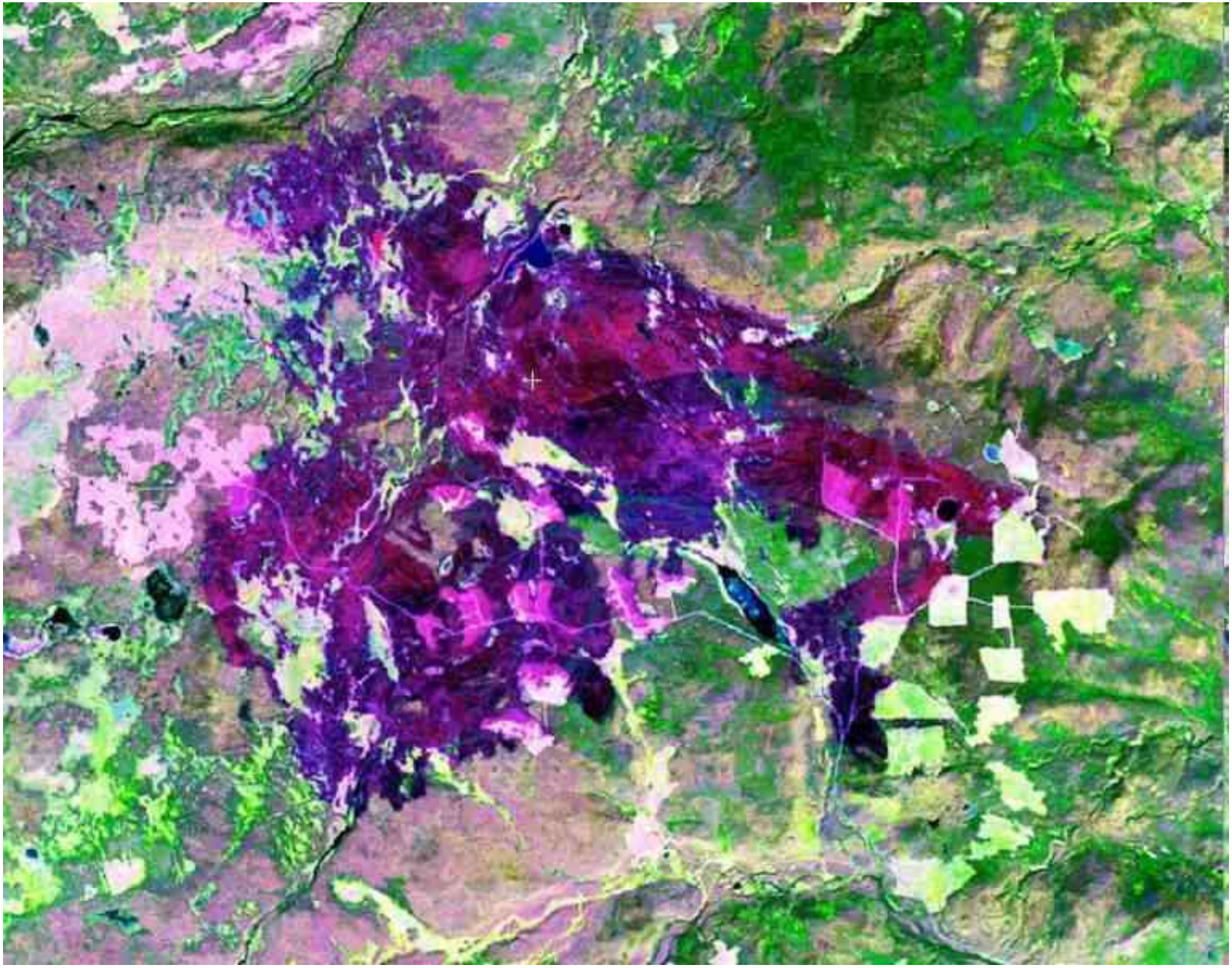
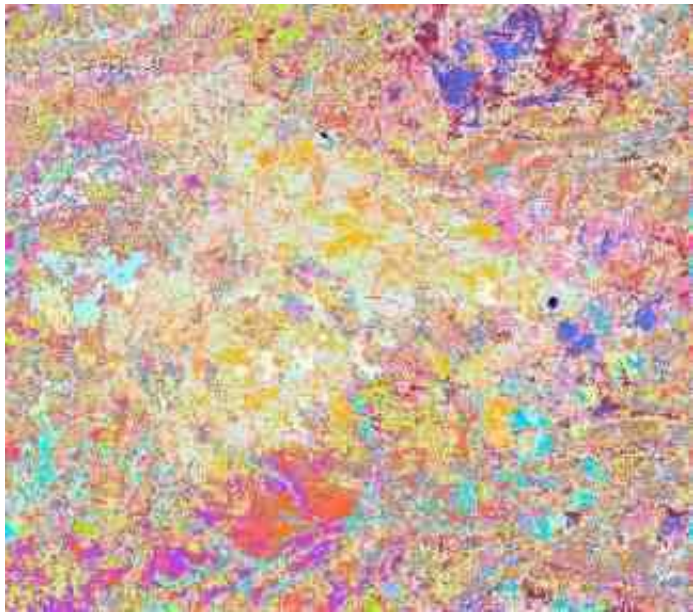
We are doing these 5-7 below in the next lab

- 5. RTV -> Raster to Vector conversion -> polygons …
- 6. Smooth lines / generalise -> export to GIS
- 7. Massage attribute table / calculate areas etc.. (GIS)

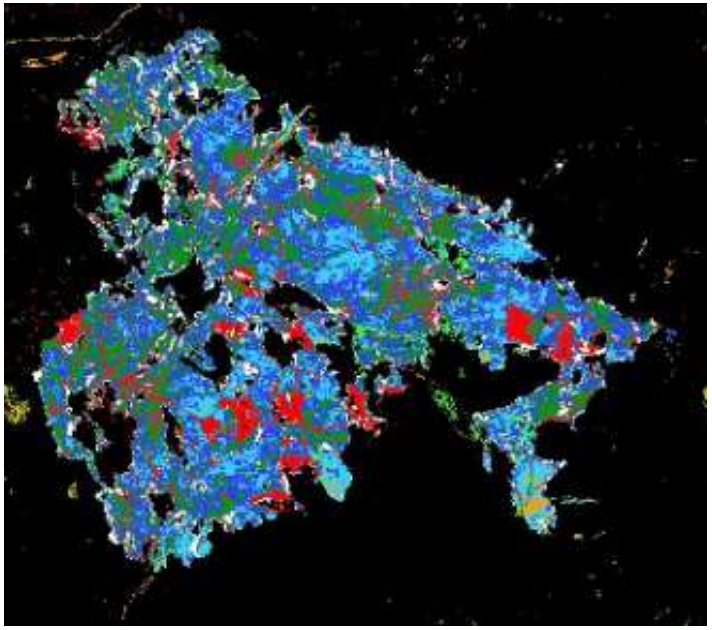
Project example to automatically map a complex fire polygon



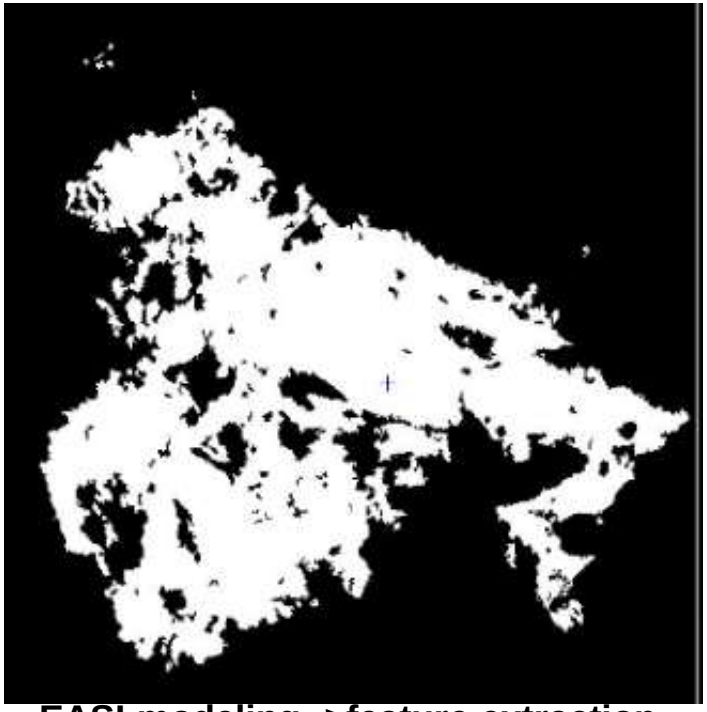
One approach: Normalised Difference Burn Ratio (NIR-MIR)/(NIR+MIR)



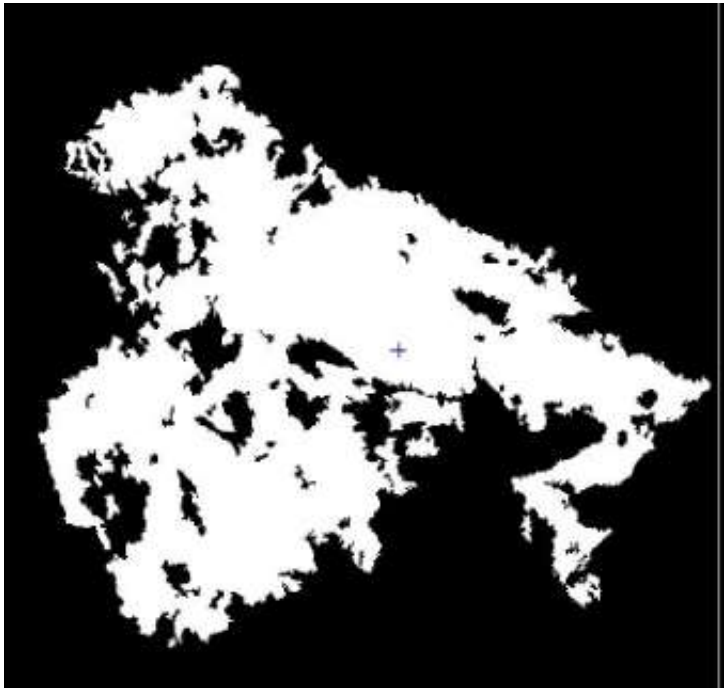
ISODATA classification showing 50 classes



Clusters 5, 7, 12, 15, 20, 25, 37 -> burn extent

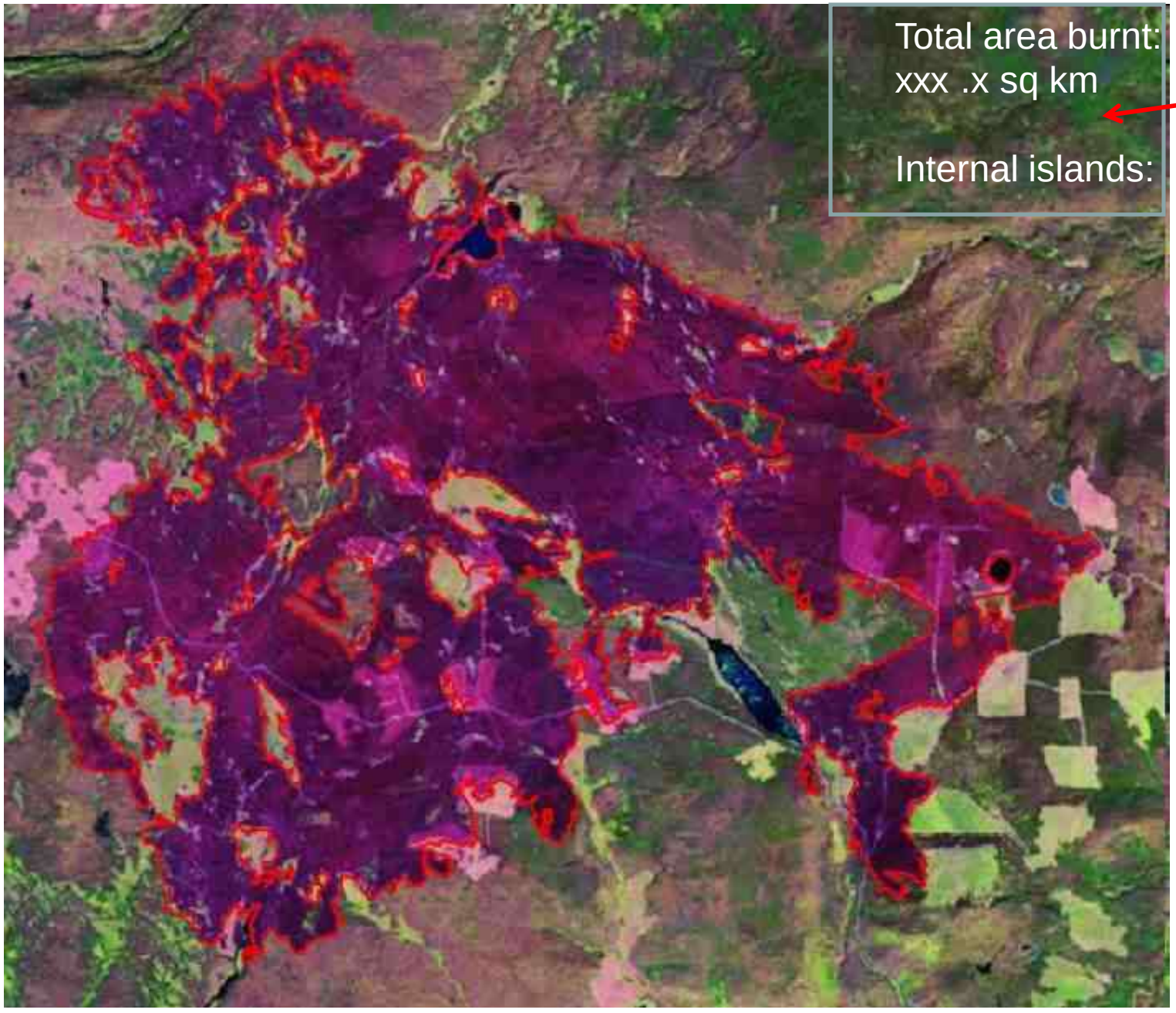


EASI modeling ->feature extraction



Sieve

5,6,7: RTV: Raster to vector conversion, smoothing, and tabulation



GIS tends to do this easier !

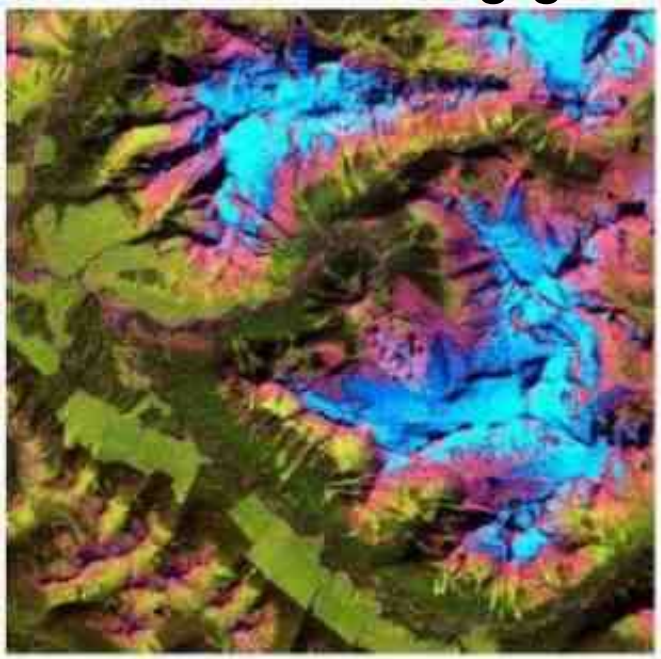
6. Generalise 'Smoothing the jaggies' ... e.g. algorithm: smmcmaster

- Robert McMaster, derived from Douglas-Poiker algorithm

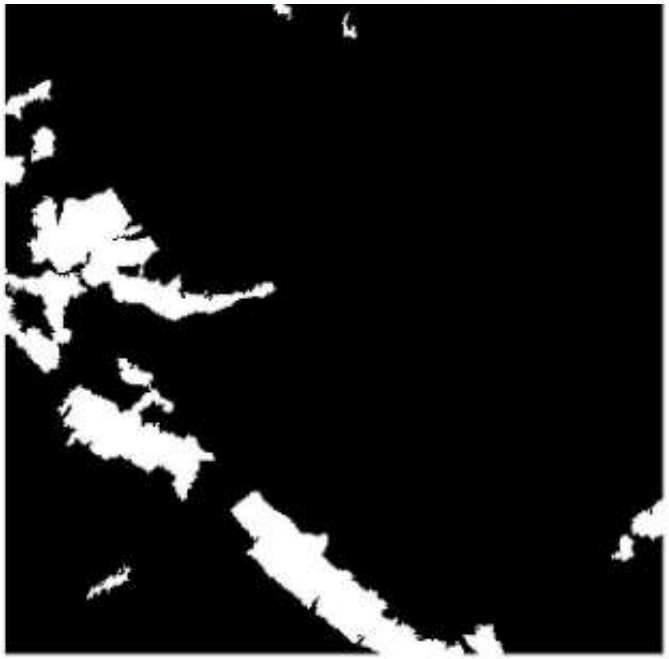
Several different algorithms for line generalisation (from GIS history)

Smoothing – more faithful to geography, but is it as accurate ?
- Compare with higher resolution PAN band if available or Google maps

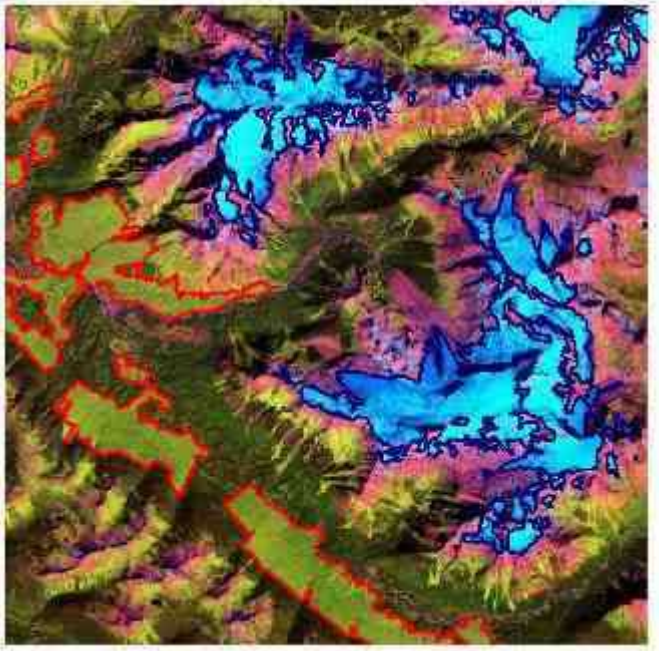
Extracting glaciers and cutblocks in Kakwa



Glaciers/snow
TM 3/5
ratio -> 2.0



Cut blocks
-Deciduous
<-TM 4/3
ratio > 2.0



Extraction of Glaciers, Water, and Vegetation - the Southeast Coast of Greenland

Threshold images for ice, water and vegetation derived from ratios

Mt. Edziza, BC

Land cover boundaries

Based on: Classification or Greenness
a. 4/3
b. NDVI
c. TCA 2

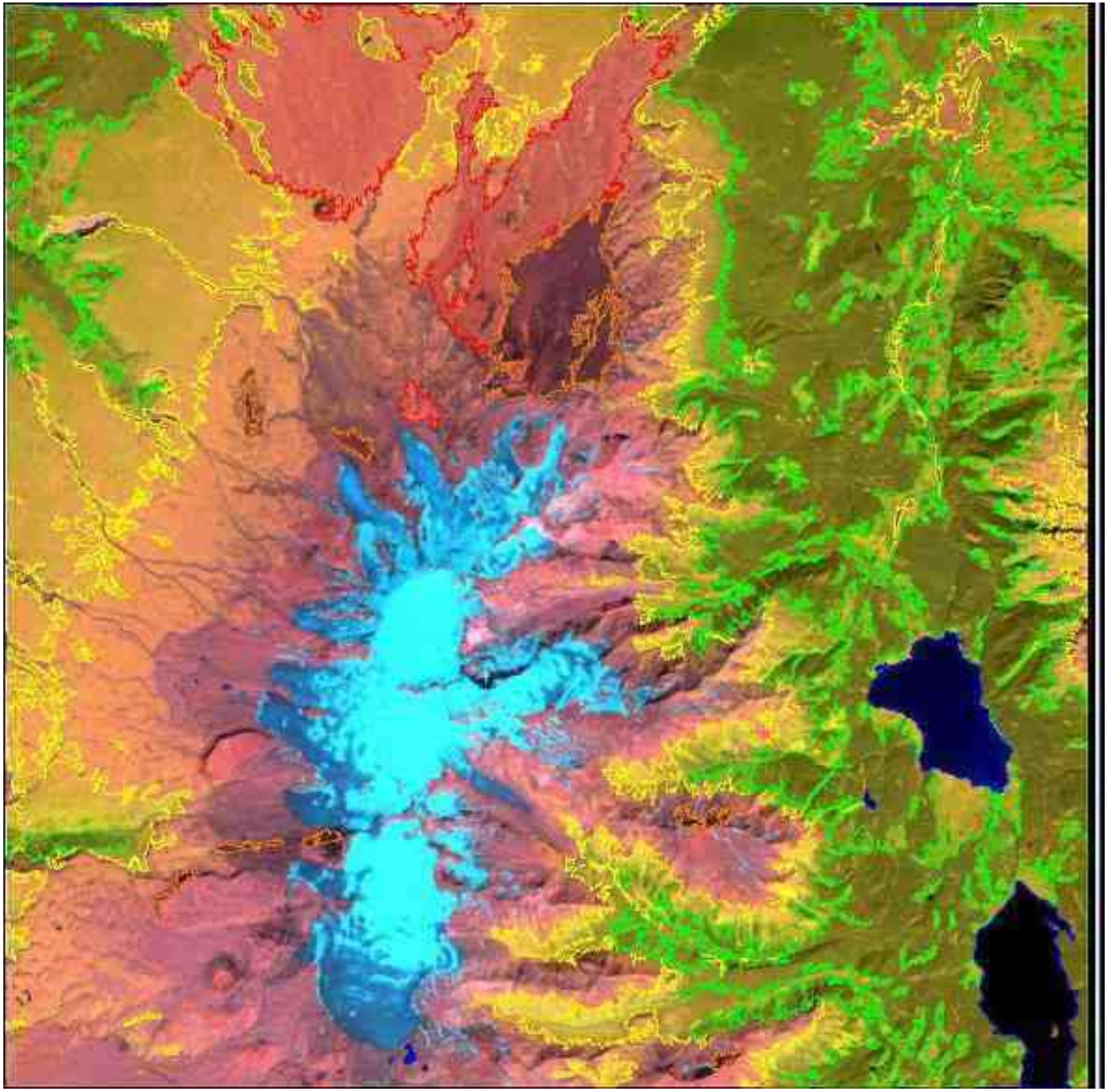
- Lava flows

- Bare ground

- Deciduous

- **Coniferous**

- **(Glaciers)**

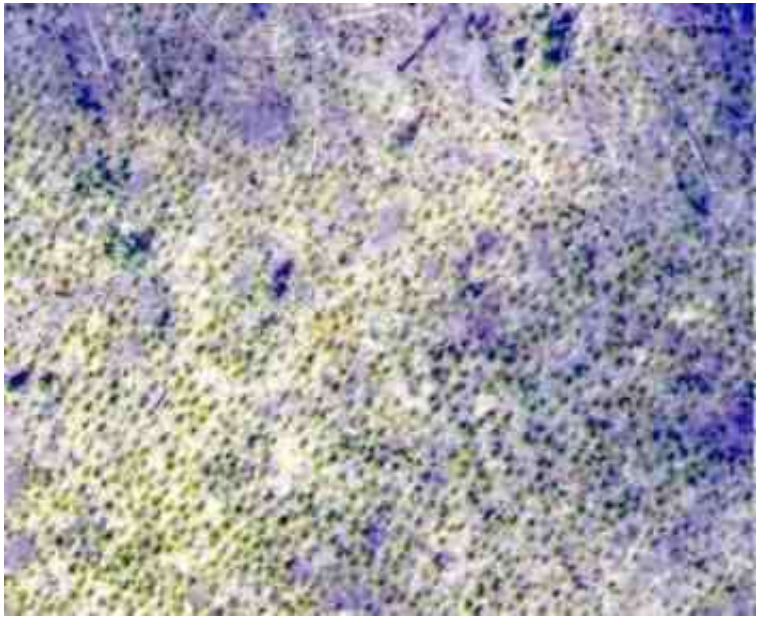


Extraction of road networks – lines – not easy!

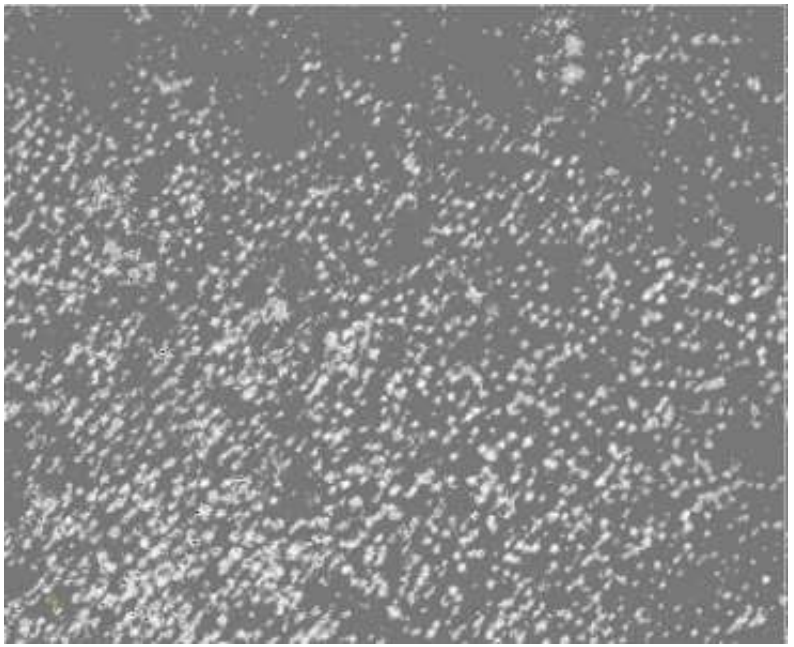
http://www.gis.unbc.ca/courses/geog432/projects/2006/jaminf/index.htm

Experiment to extract trees as points to avoid digitising

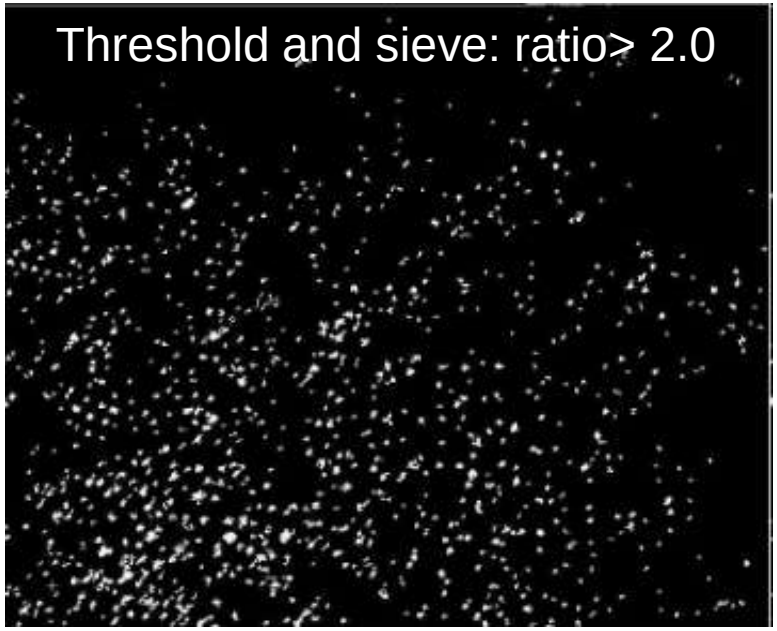
RGB Colour photo



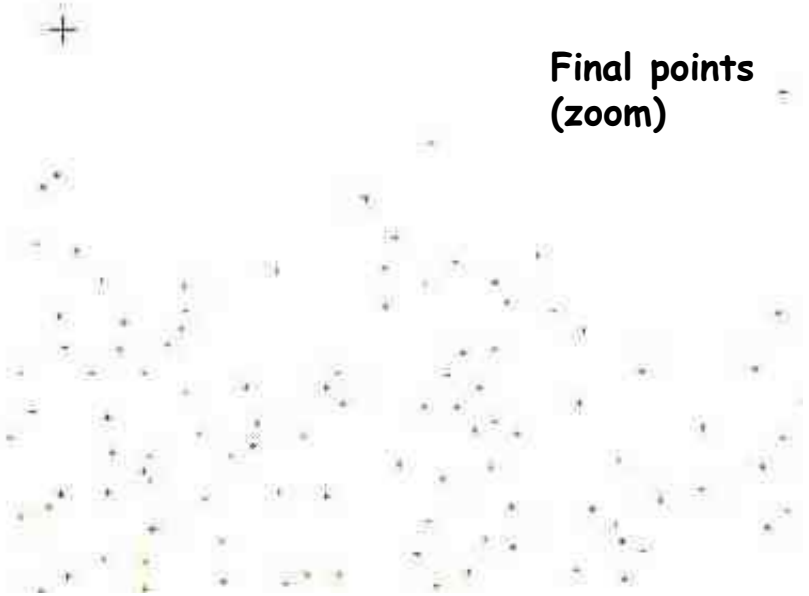
Green / red ratio



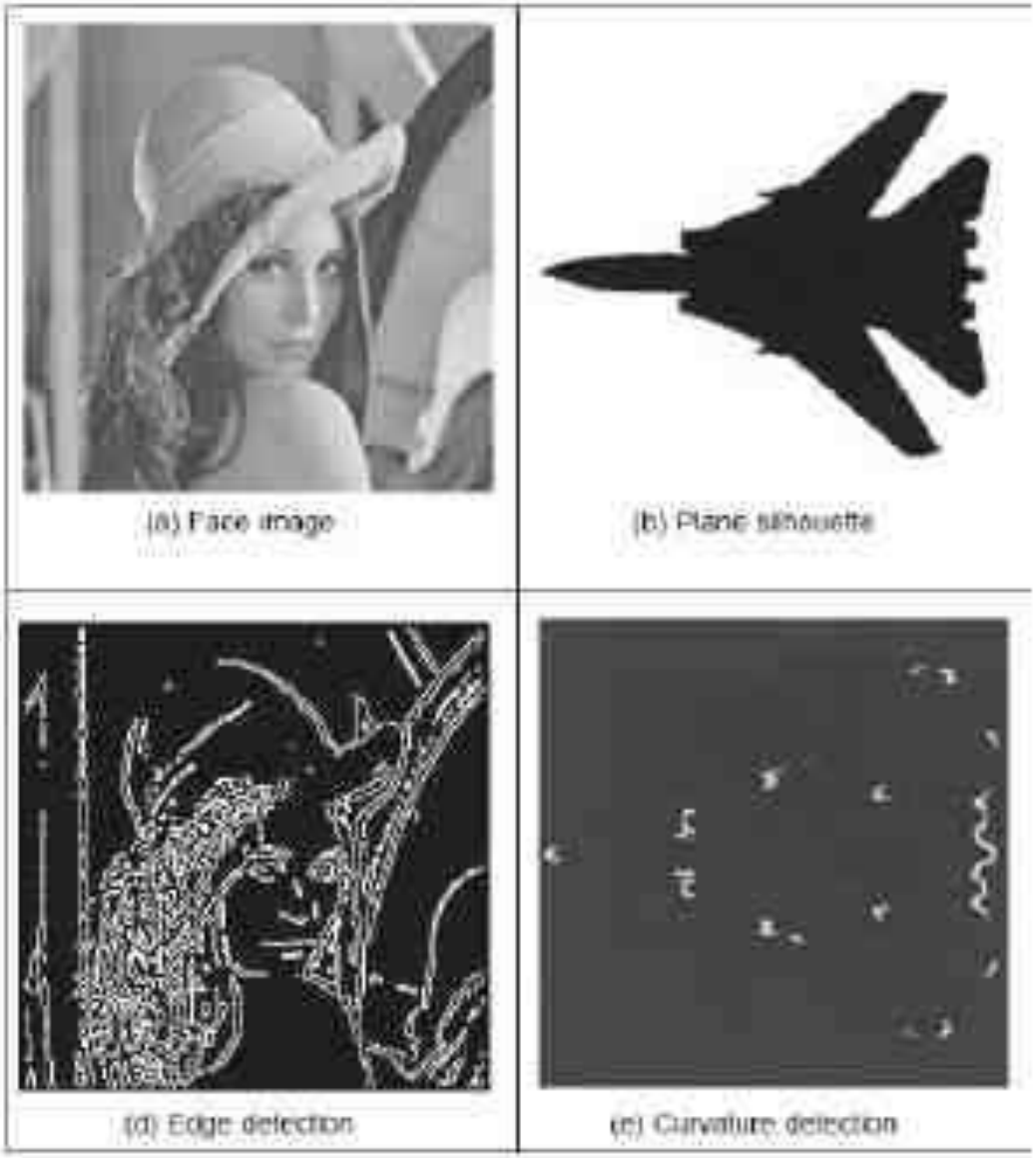
Threshold and sieve: ratio> 2.0



Final points (zoom)



Feature extraction – other applications



http://www.ualberta.ca/~szepesva/CMPUT412/ip2.pdf