

GEOG357 Project planning outline 2024 – to be submitted by Nov 15 via Moodle for 5%

- a. **Geographic area** (province / country / region) ?
- b. **Application area** e.g. forestry, habitat (landcover), glaciers, urban
- c. **Image requirements** – expected year(s), could include change but not required
- d. **Anticipated processing** e.g. classification, ratios, transforms, indices
- e. **Expected outcomes** e.g. extracted features or classes, and attribute values

Notes: area should be of interest – not limited to BC or Canada.

Image sources: Landsat 5, 7, 8, 9; Other: e.g. ASTER, from earthexplorer.usgs.gov

Sentinel 2: <https://dataspace.copernicus.eu/>

Possible focus of project

- Supervised classification with full accuracy assessment, and possible vector extraction
- Possible before/after classifications and use of 'MAT' (matrix tool)
- Feature extraction – water bodies, glaciers, fires, cutblocks etc..
- Alpine habitat mapping (Roger bias !) ... also the North (UNBC bias)
- Change detection and use of ratios / indices / transforms
- Inclusion of DEM channels in mountain area classification and feature mapping
- All projects should include some tabular results and vectors (not just images)

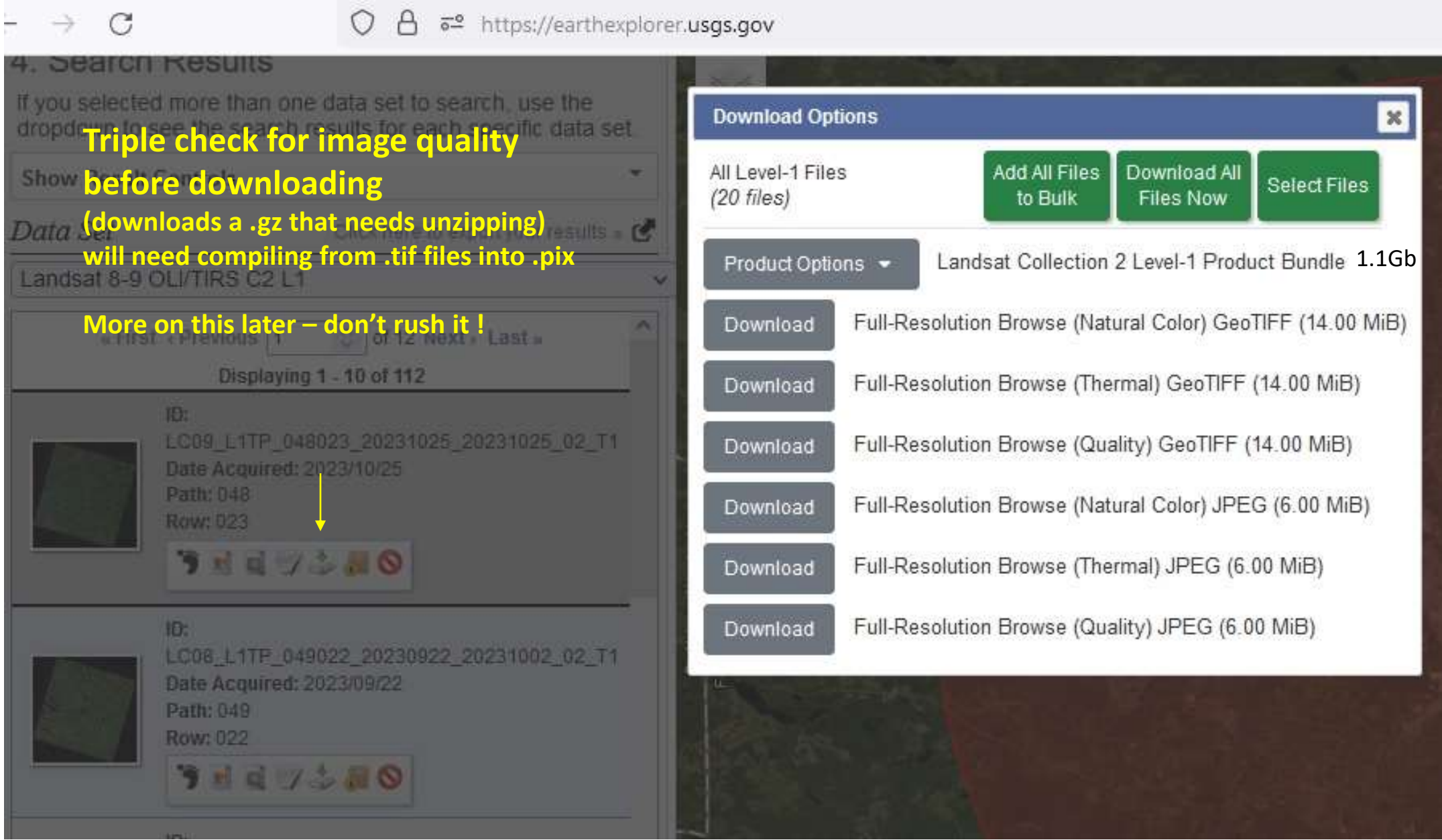
Lab 10-12: Lab Steps for project

Week 1: Preview and Download imagery, convert to pix file and clip to fit – I recommend a screen size study area to avoid excessive pan and zoom
e.g. $\sim 1800 \times 1200$ pixels = $\sim 54 \times 36$ km (or 50×30 km)

Week 2: Image processing: classification, ratios/indices, transform etc., (change detection) feature extraction, vector creation and tabulation

Week 3: Final images and results – e.g. vectors overlain on optimal image, calculation and presentation of results; possible 3D images using DEM ? possible inclusion of Google maps/earth image for context.

Dec 3: Present summary in last class; write up text and image summary



Triple check for image quality
before downloading
(downloads a .gz that needs unzipping)
will need compiling from .tif files into .pix

More on this later – don't rush it !

Landsat 8/9 data future download – all bands or a selection: note size of download (all bands)
Smaller for Landsat 5 ... why – 2 reasons : fewer bands, only 8-bit data

first steps: Select imagery for area / date (s) – download, assemble ... clip

Followed by general image processing steps as covered in labs

- Select bands and channels to maximise your feature contrast
- Classify (multispectral) or threshold (single channel) / transform
- Create single DN channels or bitmaps for information classes / features
- Clean results -> e.g. sieve
- Raster to vector conversion and smooth
- Manage attribute tables and results
- Overlay vectors on initial imagery as example for presentation
- Incorporate DEMs in graphics and/or analysis ?

Past project examples in the following slides; more to follow in the labs on report details

Vegetation Regrowth on the Hope Slide (1965)



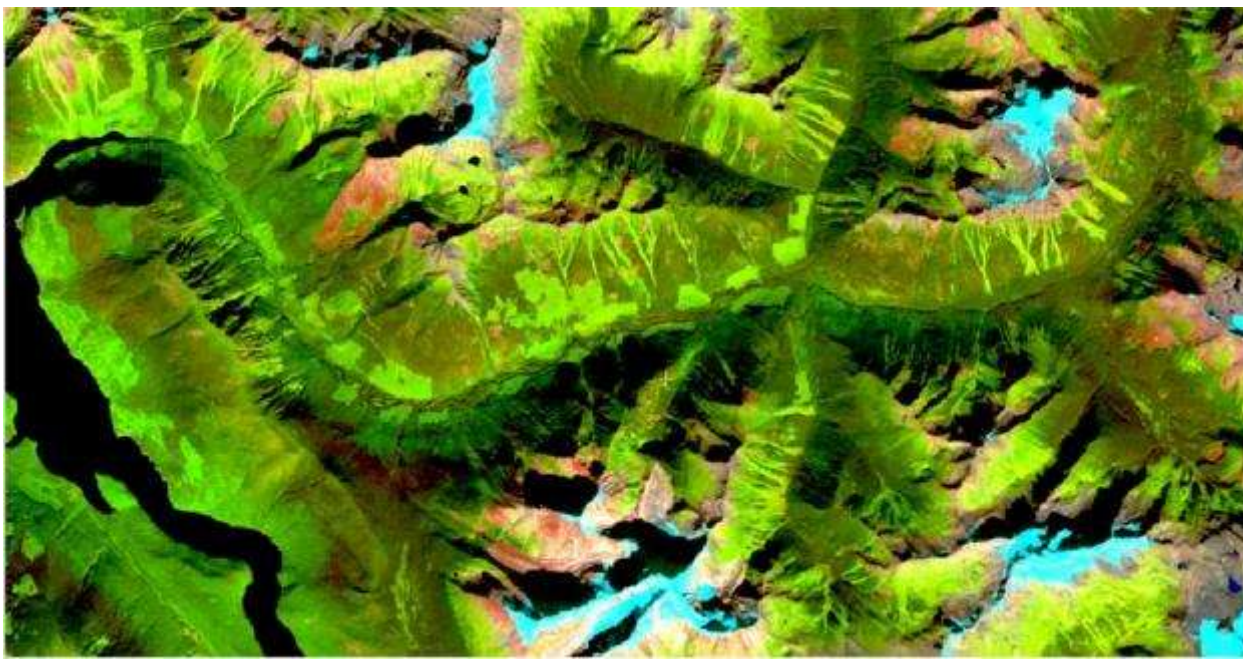
Generated bitmap for bare rock –

From the original 2.44km² area, there was some regrowth on 0.60km² ; remaining area of bare rock in the scar is 1.84km²

Note: need to match area size with suitable image pixel resolution

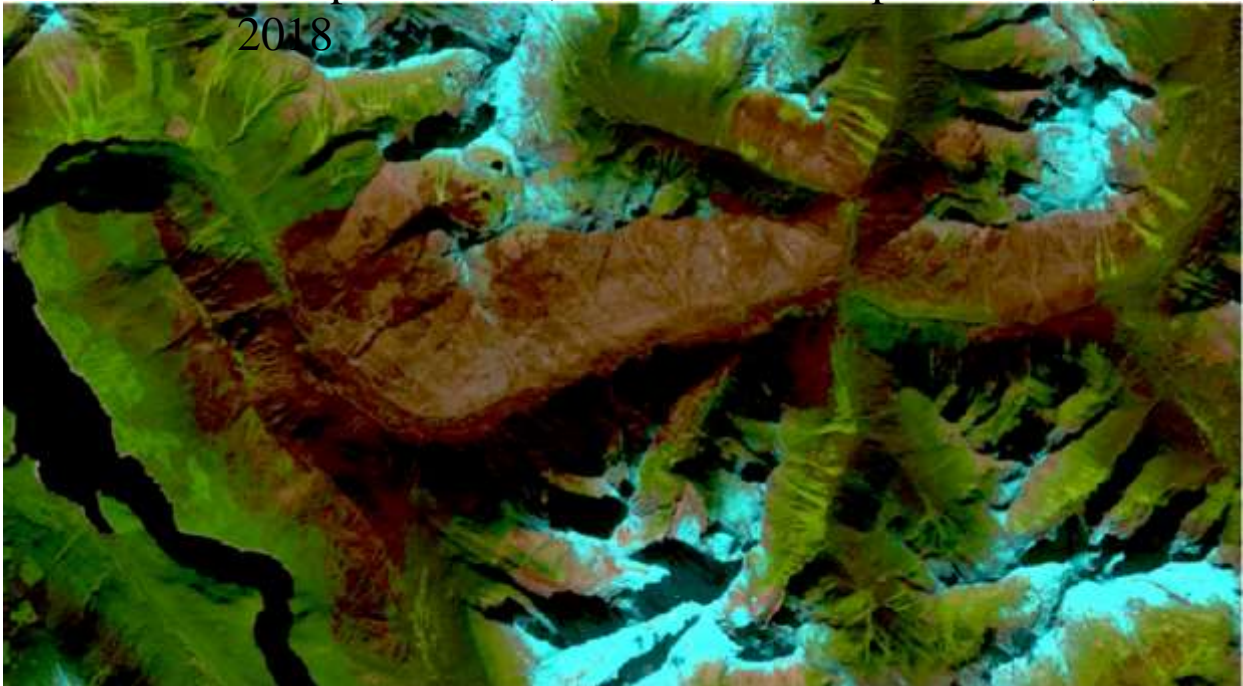


Hugh Allen Wildfire 2018 (by Kinbasket Lake)

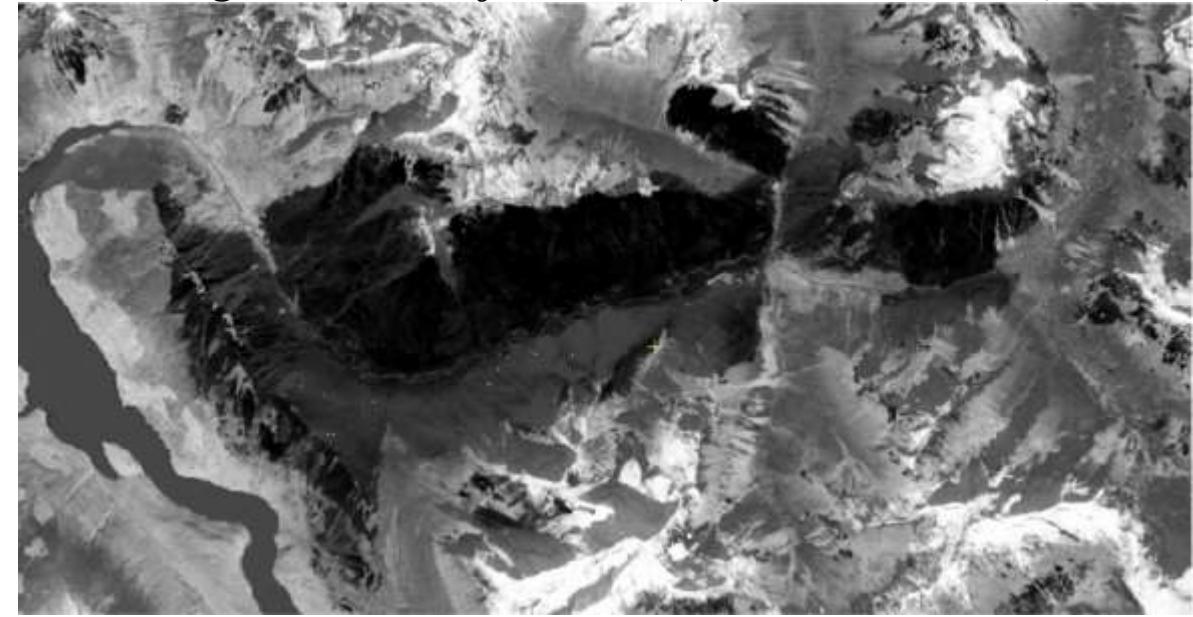


a. September 13, 2016

b. September 19, 2018

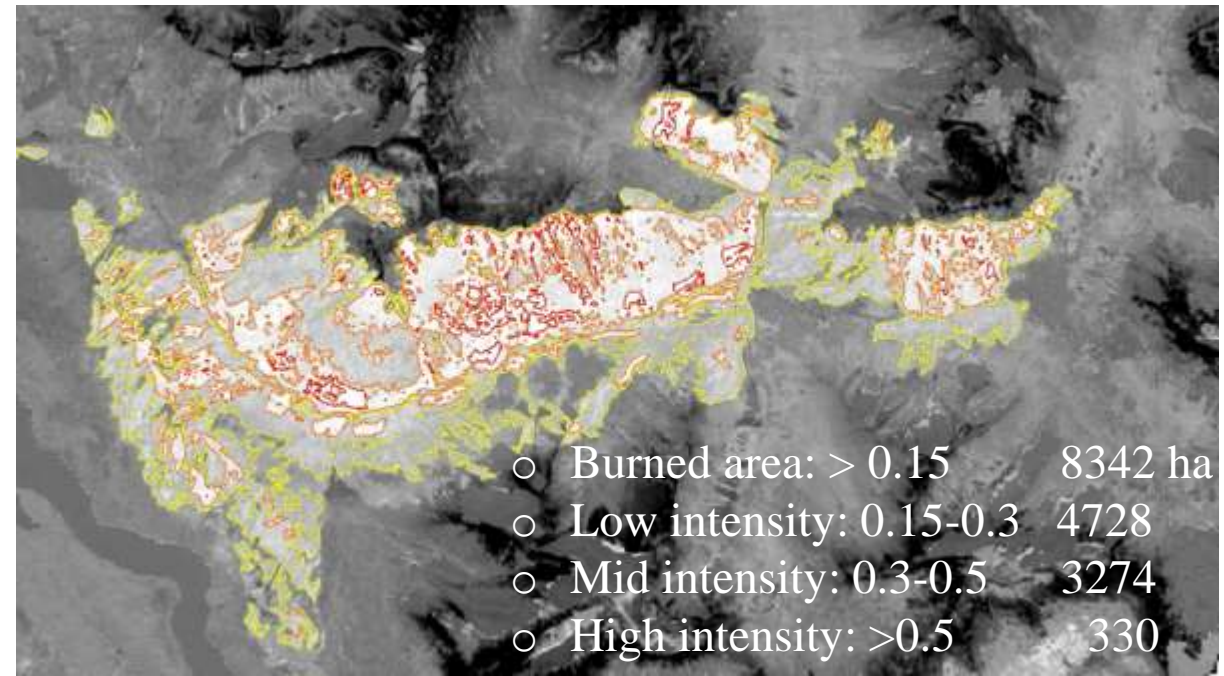


2018

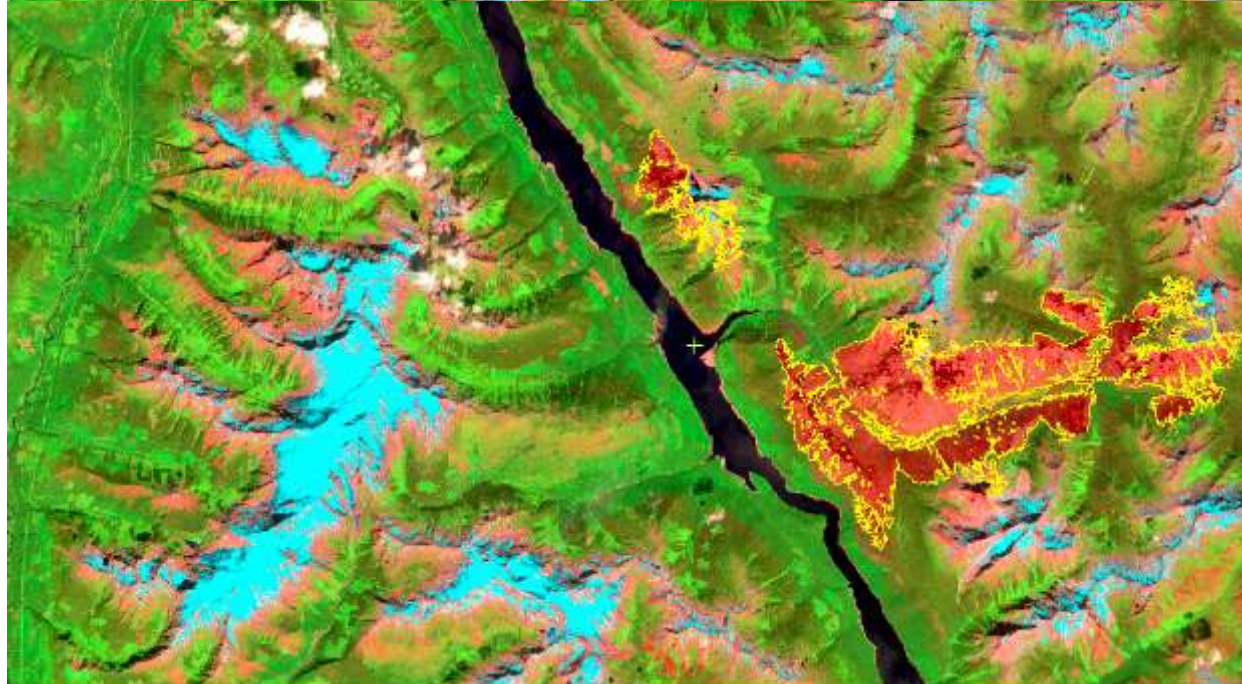
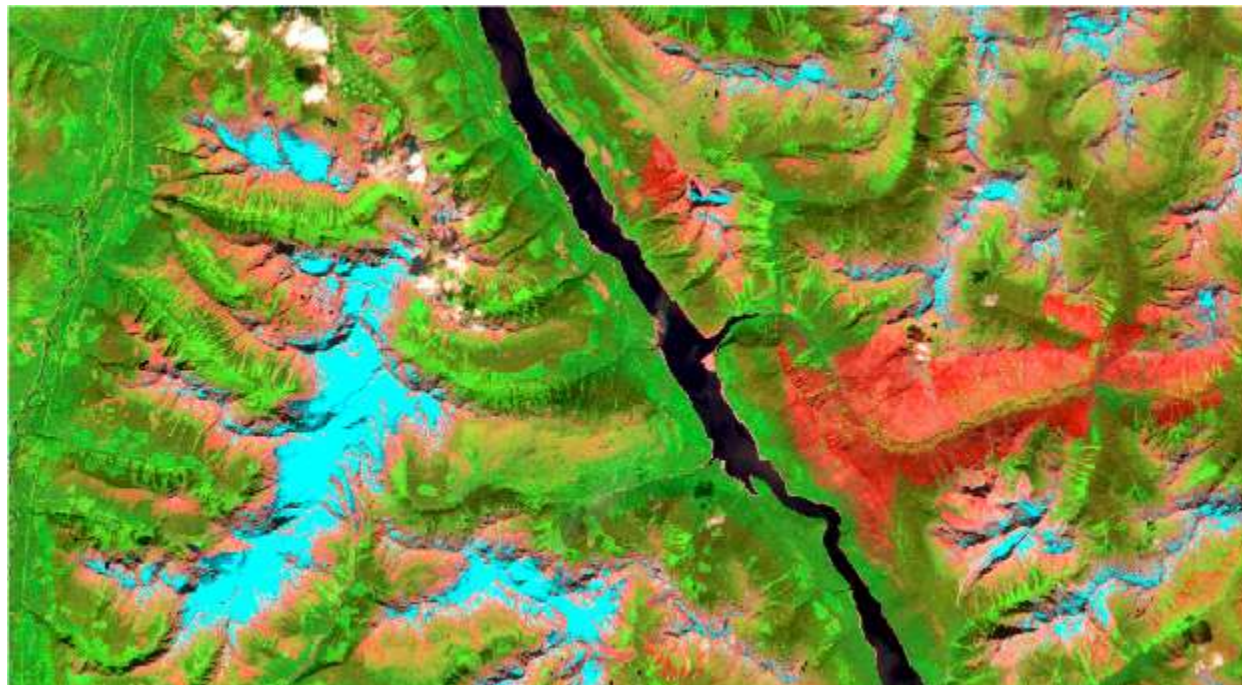


c. NBR 2018

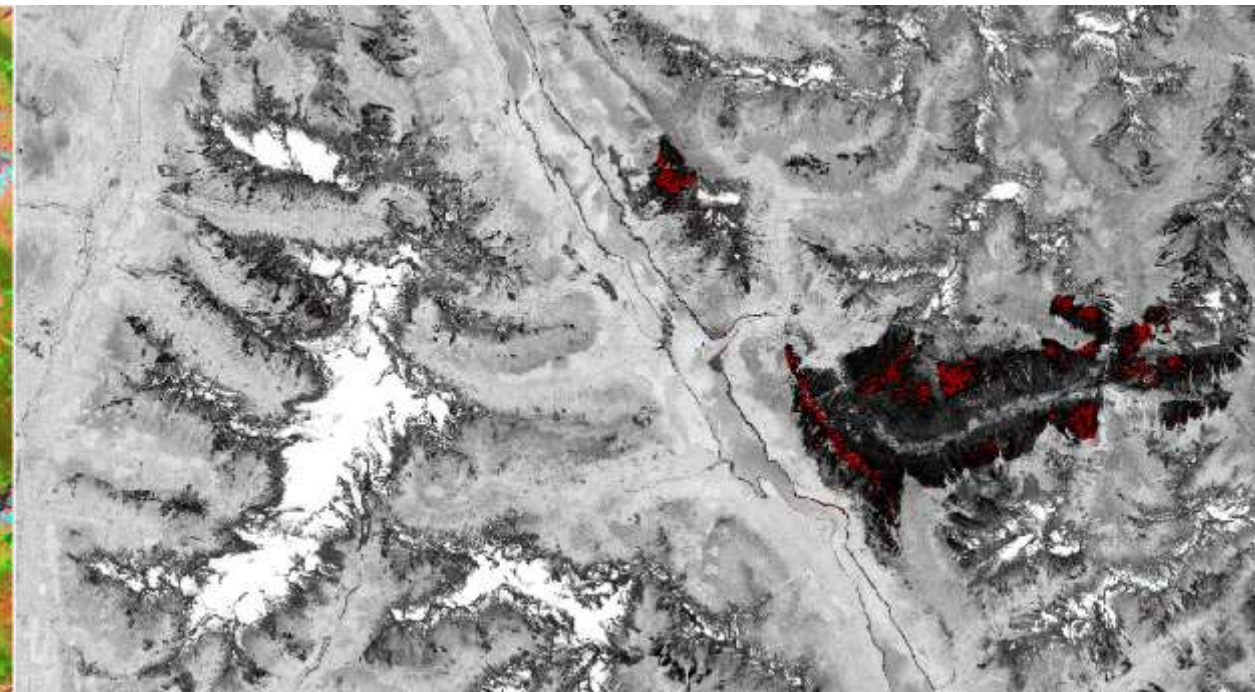
d. dNBR = NBR 2016 - NBR 2018



Hugh Allen Wildfire 2018 - Sentinel 2 Bands 11 (SWIR2), 4 (NIR), 3 (Red)



Normalized Burn Ratio (8-12) / (8+12)



Normalized Burn Ratio and High Severity Burn Area Polygons

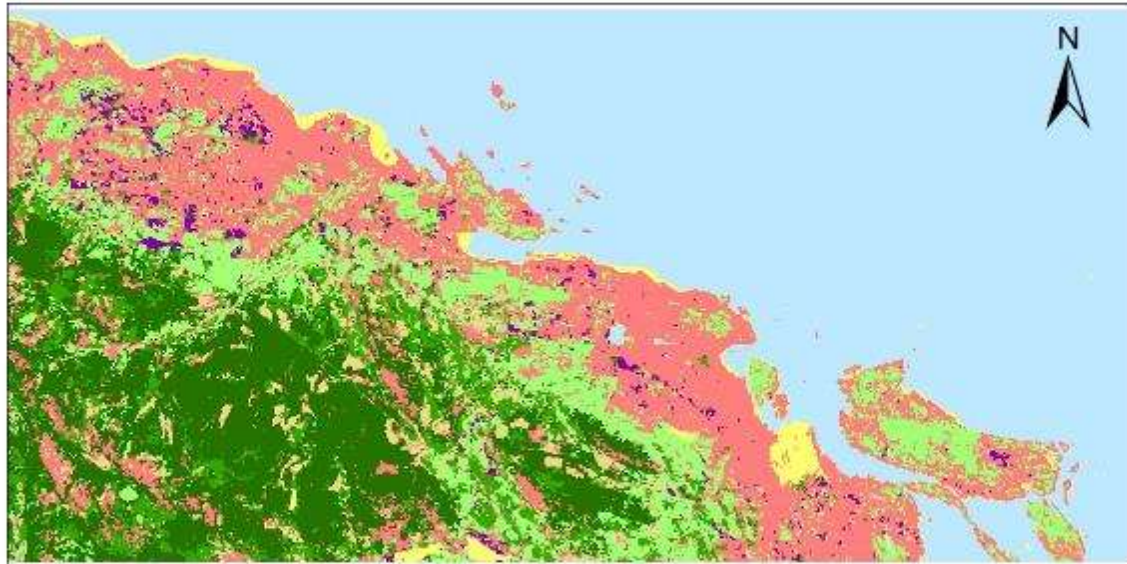
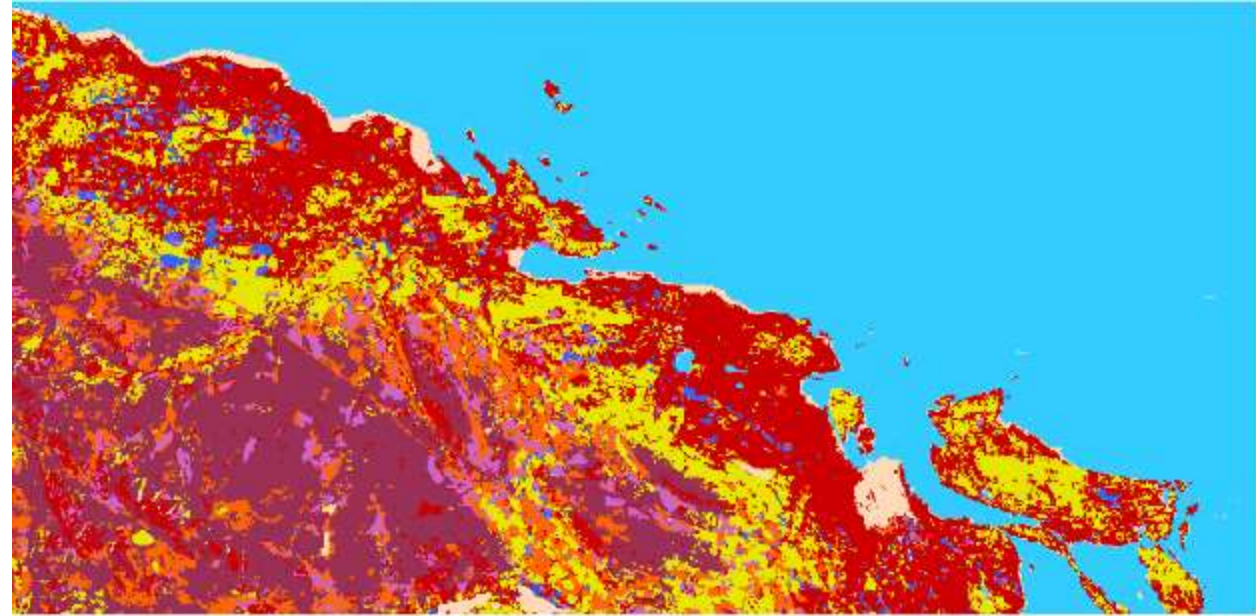
	Low Severity Burn	Medium Severity Burn	High Severity Burn
DN Values	0 to -0.23712133	-0.23712133 to -0.47424267	-0.47424267 to -0.711364

The total burn area was 102.27 km² or 10,226.56 hectares.
The severely burned area was 3.33 km² or 333.47 hectares

Land Cover mapping: Nanaimo 2020



from July 29, 2020



Legend

 water	 beach
 urban	 open fields
 decid forest	 cleared forest
 agriculture	 mixed forest

0 2 4 8 12 16 Kilometers

Remote Sensing Final Project
UNBC Fall 2020

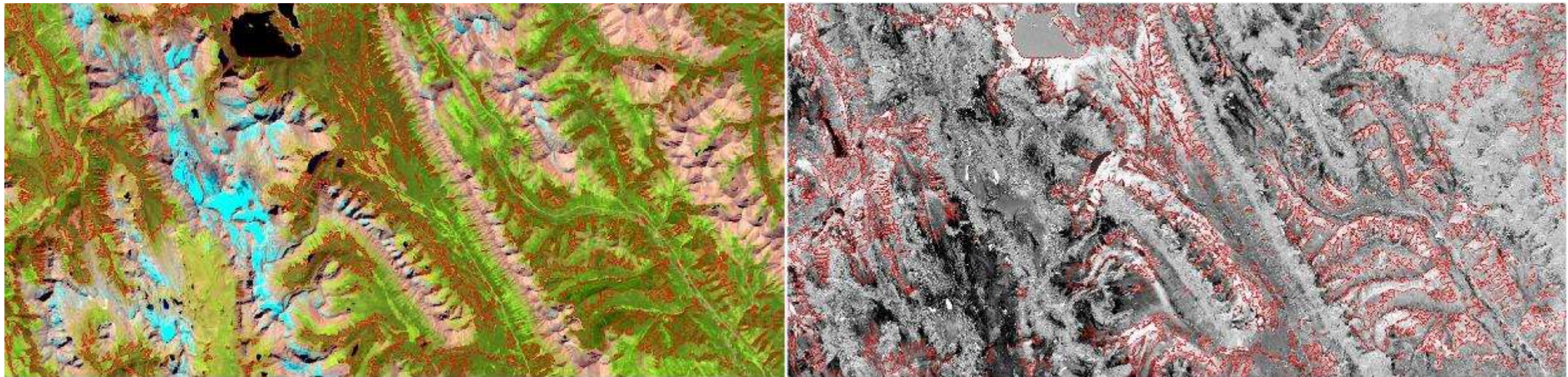
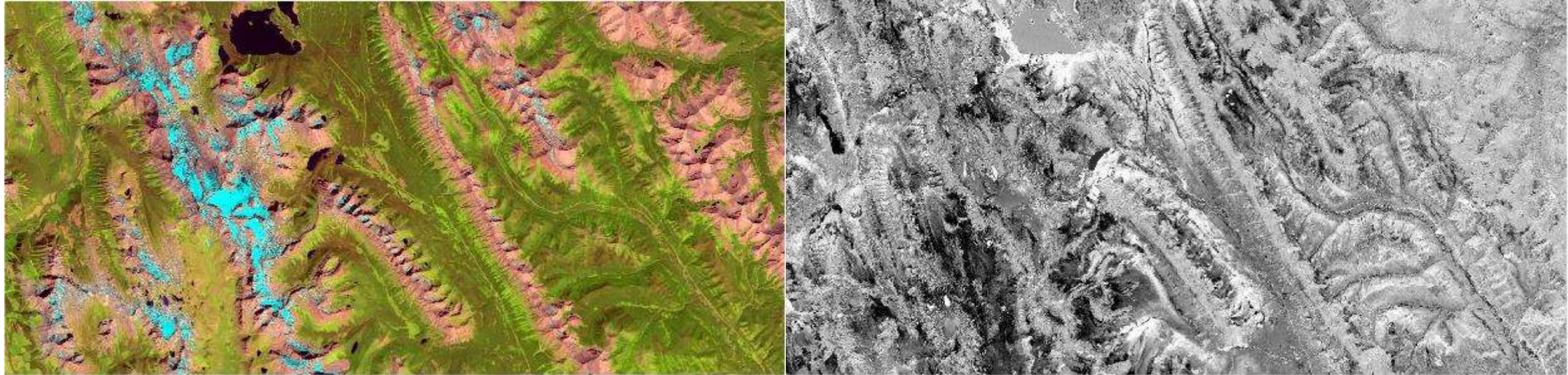
Training Site Editor

Class Edit Tools

ID	Value	Name	Color	Threshold	Bias	Imported Sig	Description
1	1	water		3.00	1.00		
2	2	urban		3.00	1.00		
3	3	decid forest		3.00	1.00		
4	4	agriculture		3.00	1.00		
5	5	beach		3.00	1.00		
6	6	open fields		3.00	1.00		
7	7	cleared forest		3.00	1.00		
8	8	mixed forest		3.00	1.00		

Classification	Percentage of Land Use including Water	Percentage of Land Use Excluding Water
Water	44.20%	0.0%
Urban	18.21%	32.64%
Deciduous Forests	10.56%	18.92%
Mixed Forest	12.98%	23.26%
Cleared Forest	6.05%	10.85%
Beach	1.79%	3.22%
Agriculture	3.83%	6.87%

Classification of Spruce Beetle Infested Trees in Southeastern BC - 2018/2020 images: using NDVI difference
Spruce beetle polygons from supervised classification: lakes, bare rock, ice/snow, open vegetation, forest, diseased spruce

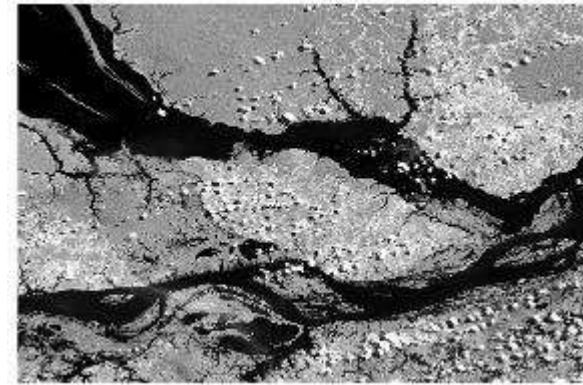


2020 image and NDVI difference 2020 -2018 with spruce beetle polygons in red from the supervised classification

Seasonal Changes on Width at the Confluence of the Rio Negro and Rio Solimões, Amazon Basin, Brazil



July 08,2009
Landsat 5 (Flood season)



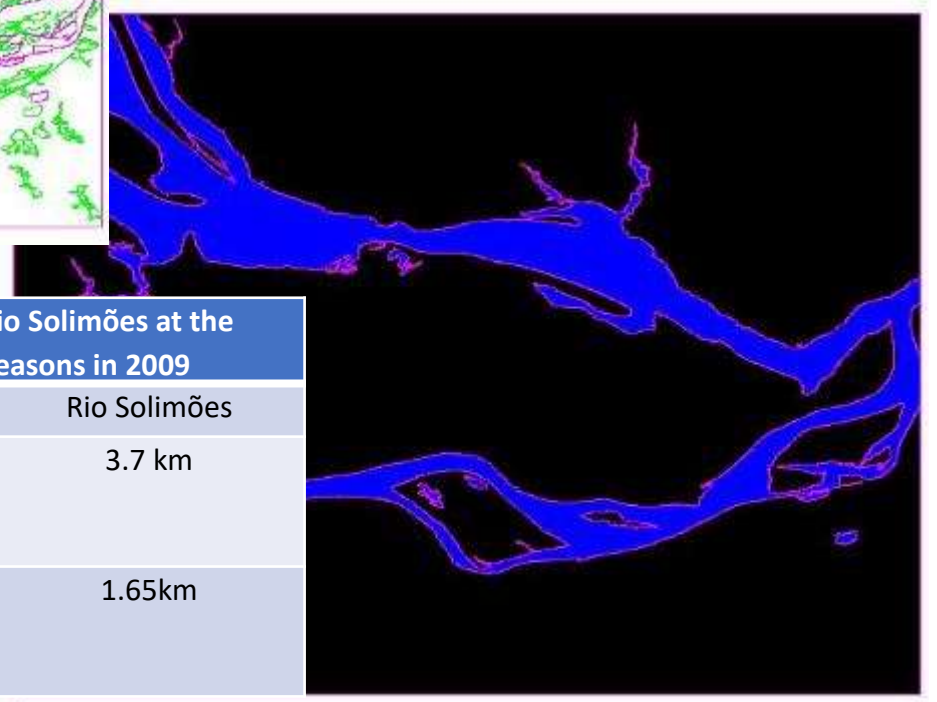
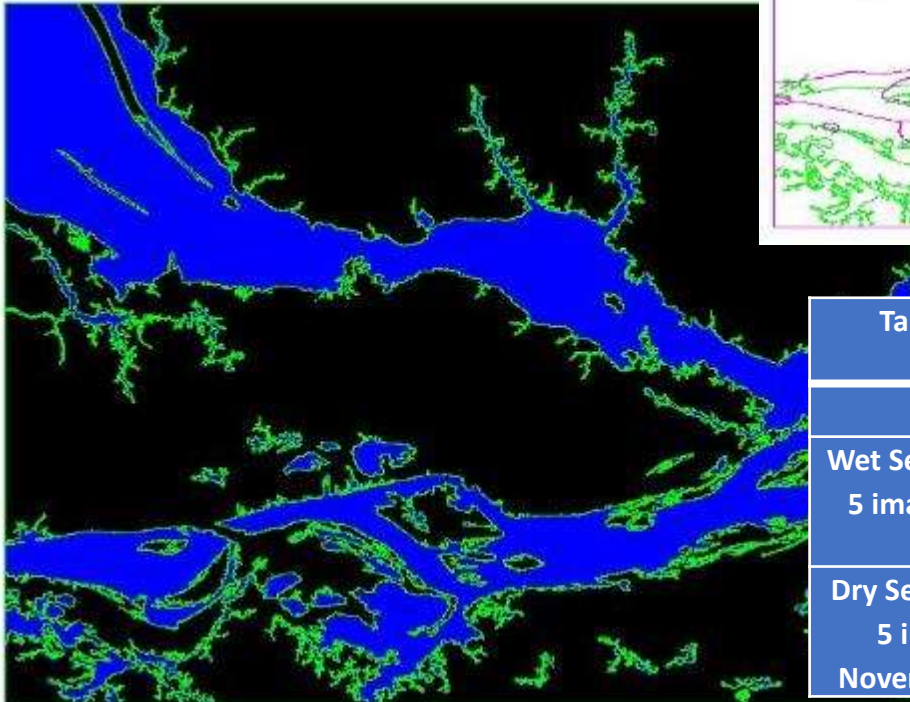
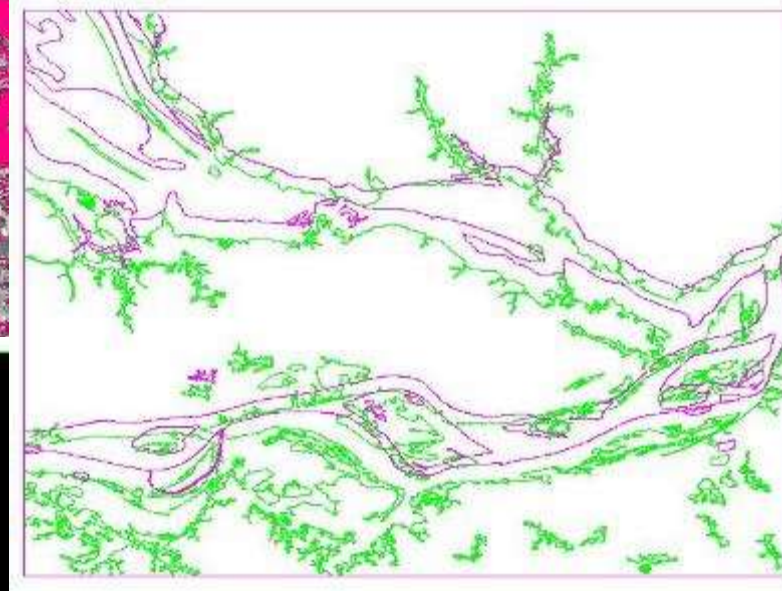
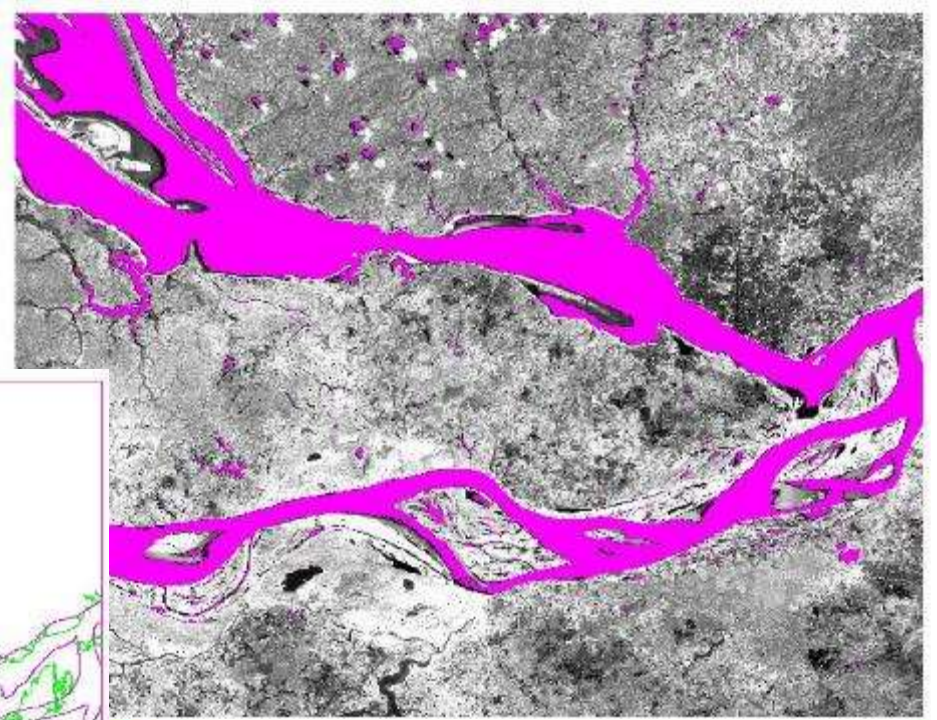
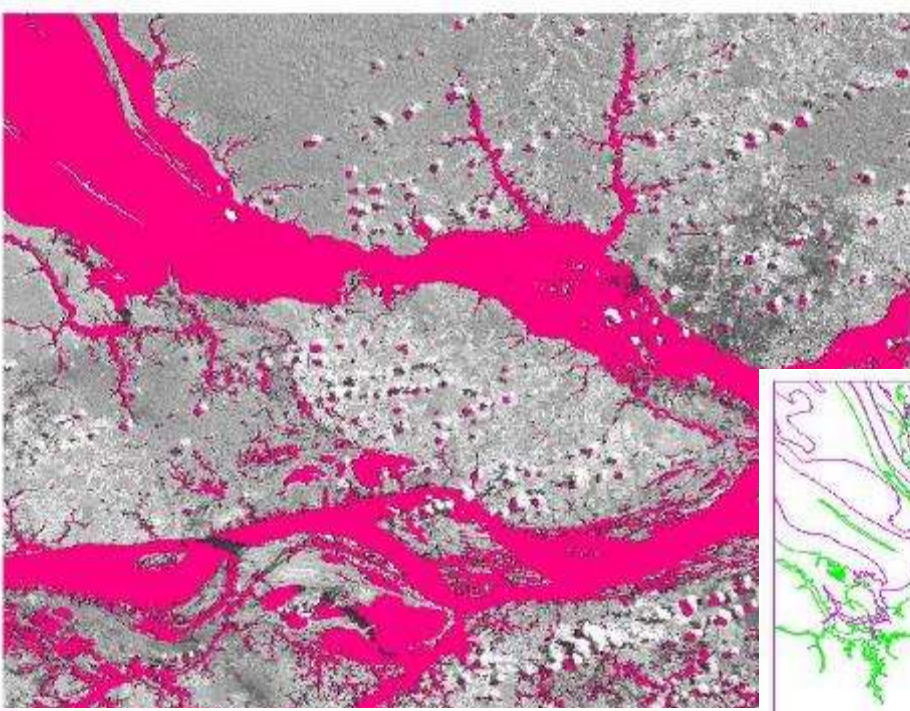
NDWI



November 29,2009
Landsat 5 (Dry season)



Bitmaps and
vectors : wet
and dry season



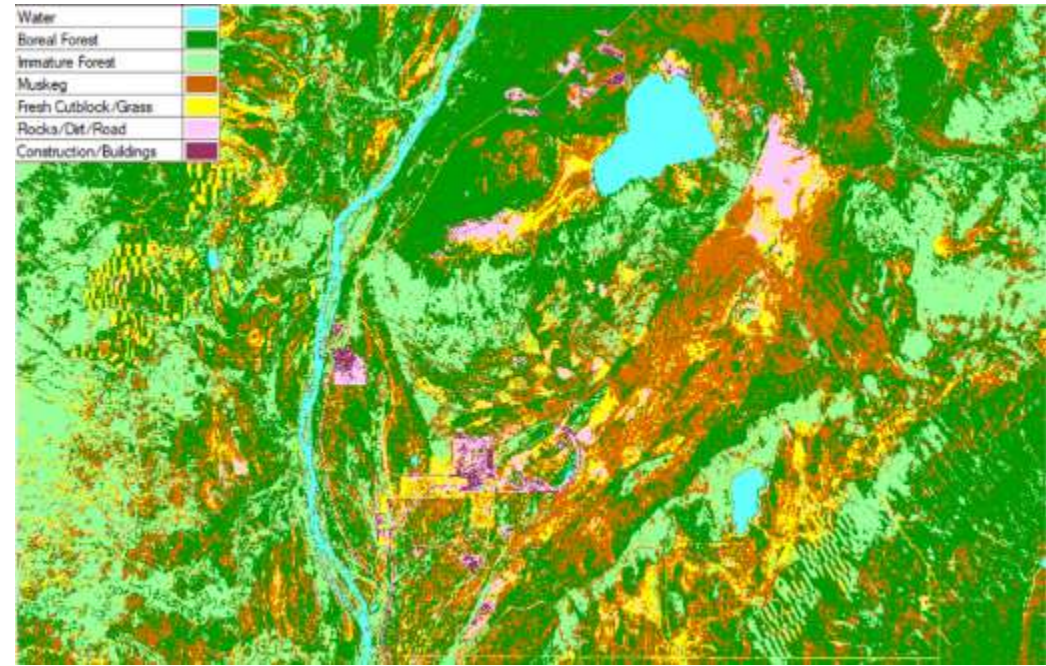
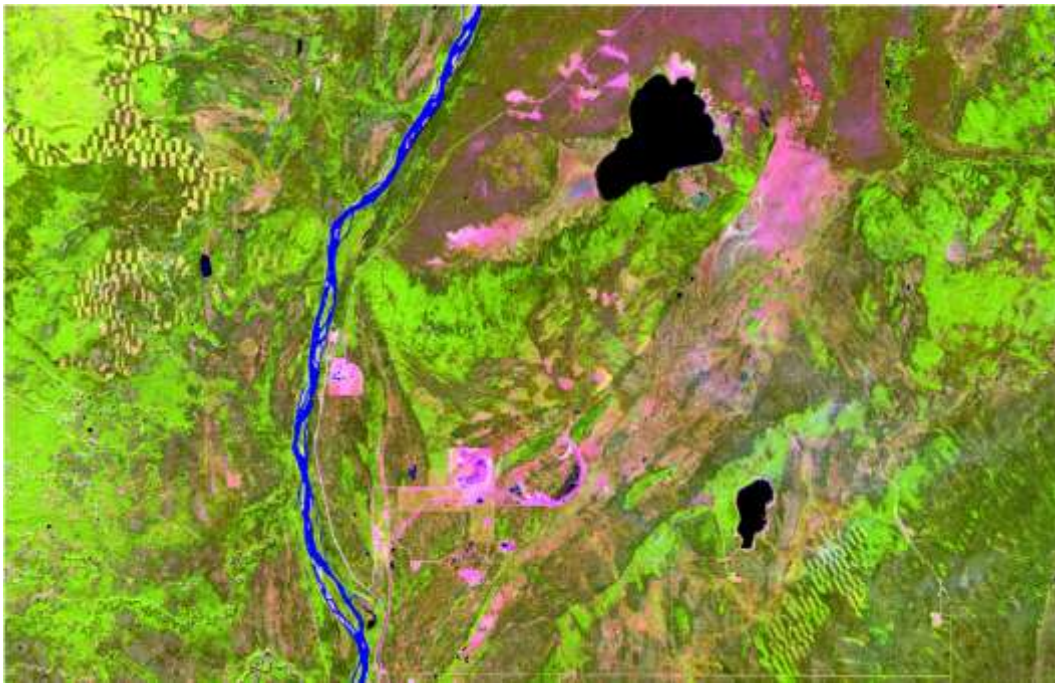
	Rio Negro	Rio Solimões
Wet Season- Landsat 5 image from July 08,2009	2.55 km	3.7 km
Dry Season- Landsat 5 image from November 29,2009	2.15 km	1.65km

Oil Extraction in Fort MacKay Alberta, ~50km north of Fort McMurray
August 18, 1999 LANDSAT 5 and August 18, 2020 LANDSAT 8

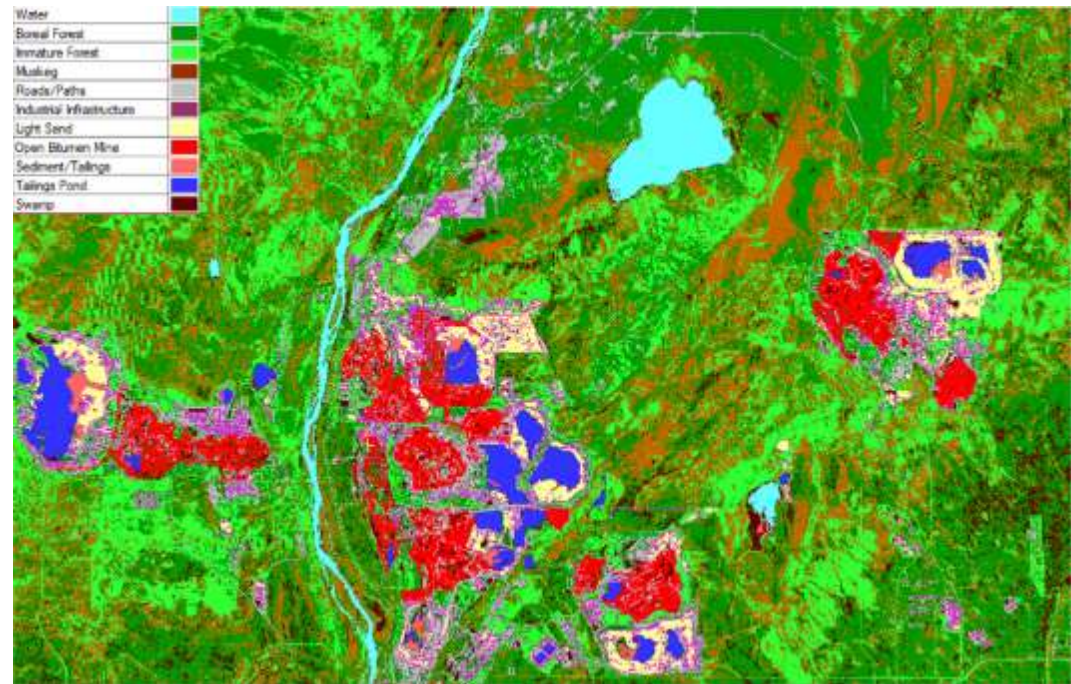


Objects	1999 Area (km ²)	2020 Area (km ²)
CNRL Horizon (West)	0	115
Suncor Fort Hills & CNRL Albian Sands (Center)	8.7	292
Kearl Oil Sands (East)	0	79
Athabasca River	34.4	35.2
McClelland Lake (North)	30.8	31
Kearl Lake (Southeast)	5.5	3.5
Miscellaneous Lakes	3.5	3.3

and next slide ...

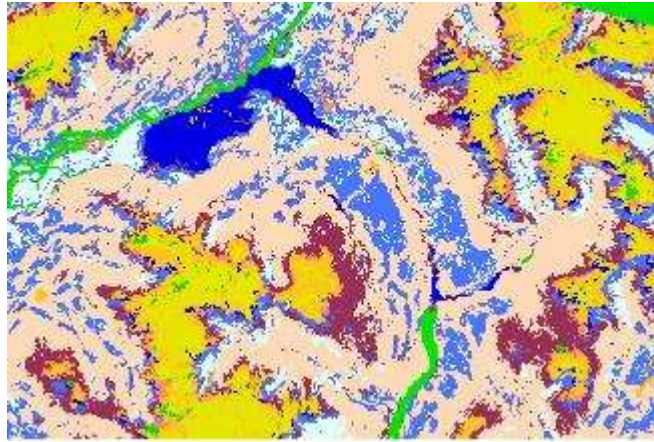


1999



2020

Extraction of Lava Bed Area in Nisga'a Memorial Lava Bed Provincial Park (~1700 eruption)

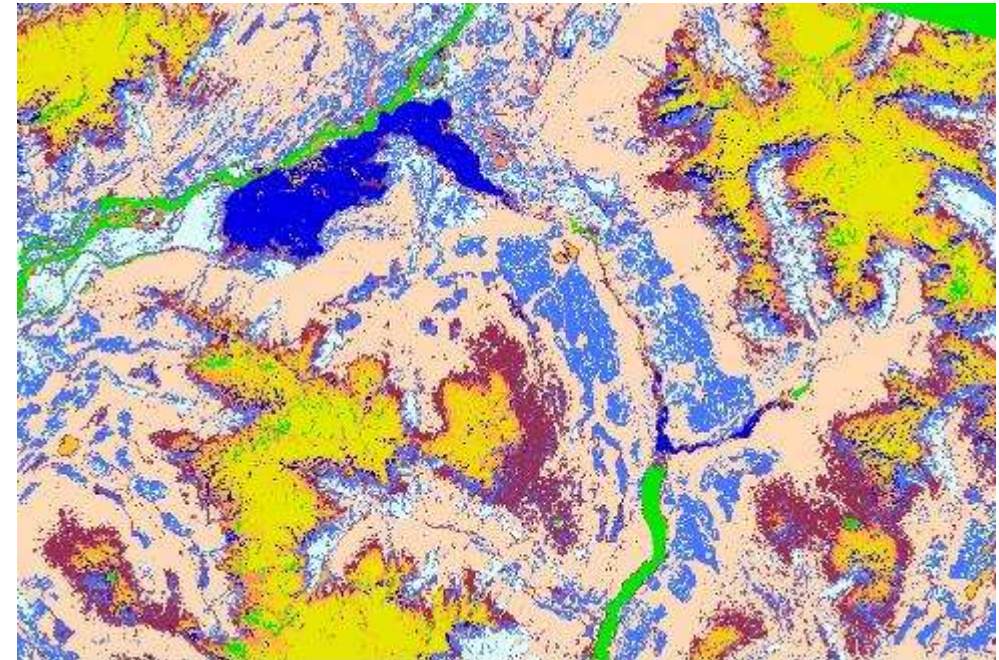


- Lava bed
- Water
- Coniferous Forest
- Ice and Snow
- Bare Rock
- Cut Block
- Deciduous Forest
- Townsite
- Alpine



Sieved classification

Lava beds polygons



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:

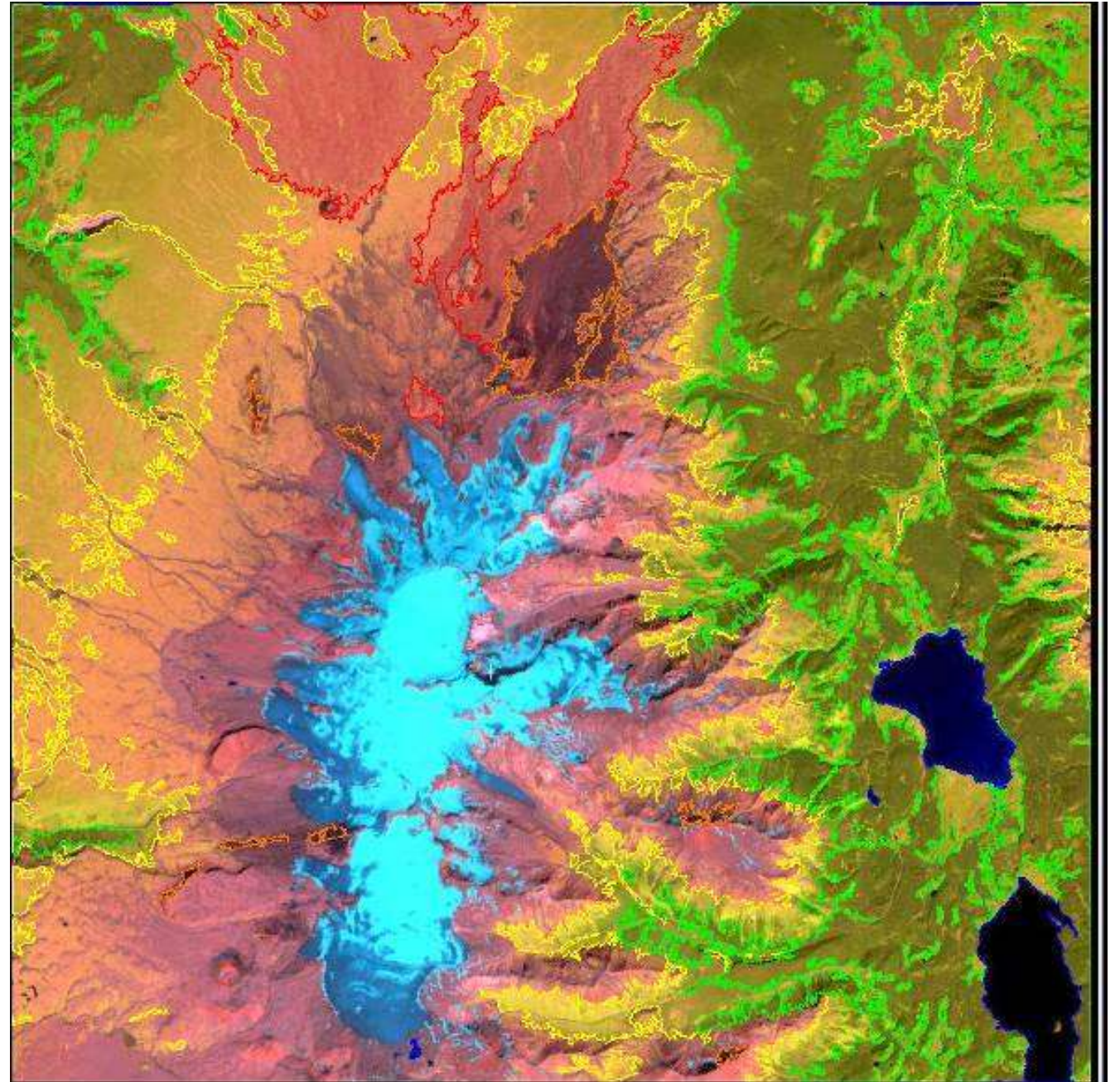
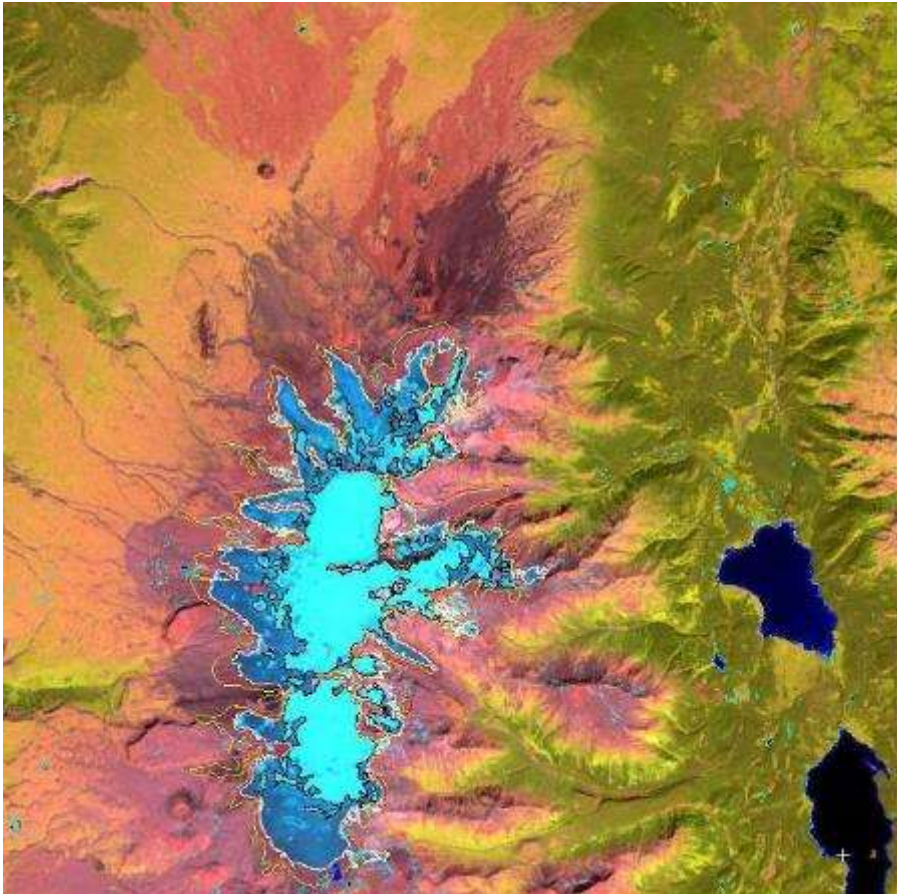
Classification and/or Greenness

a. 4/3

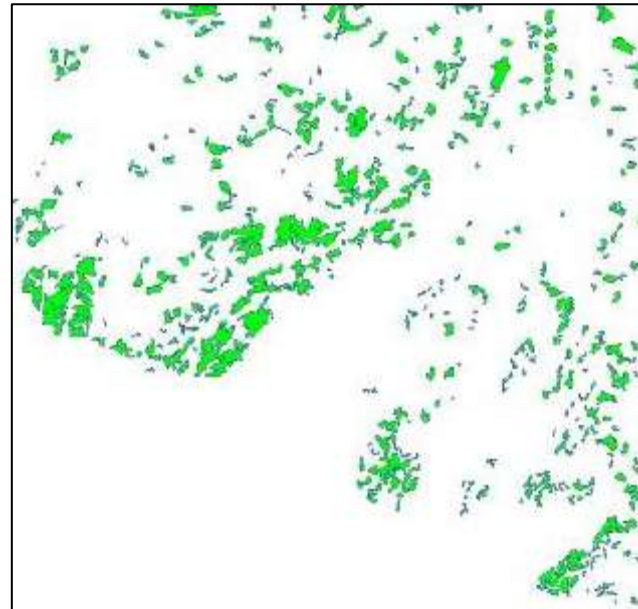
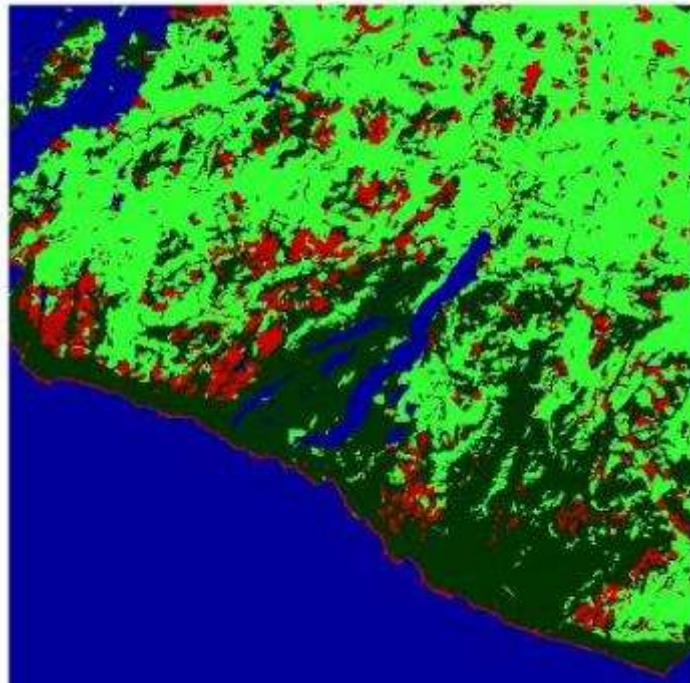
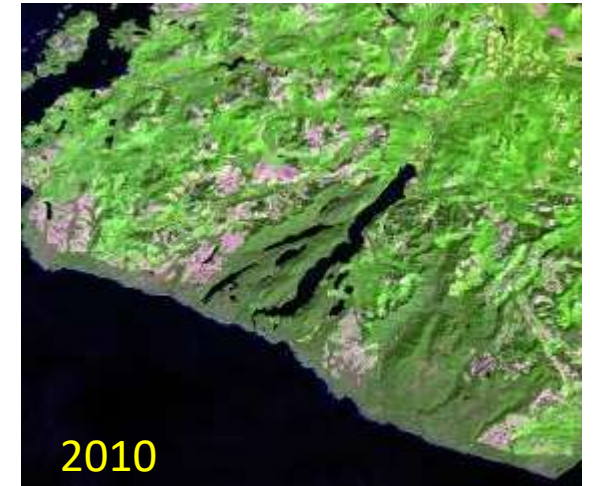
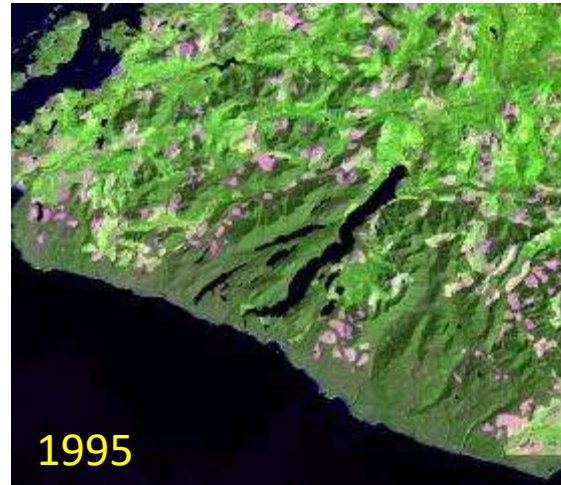
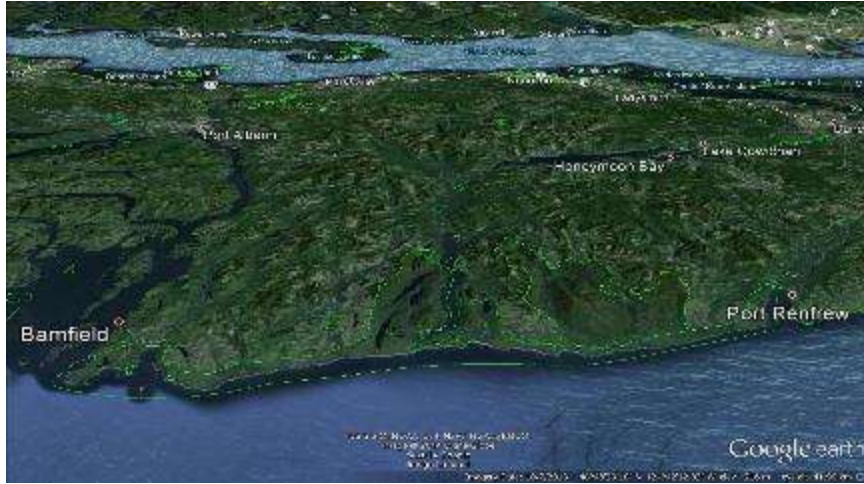
b. NDVI

c. TCA 2

- Lava flows
- Bare ground
- Deciduous
- Coniferous
- (Glaciers)



Anthropogenic changes in vegetation around the West Coast Trail, 1995-2010

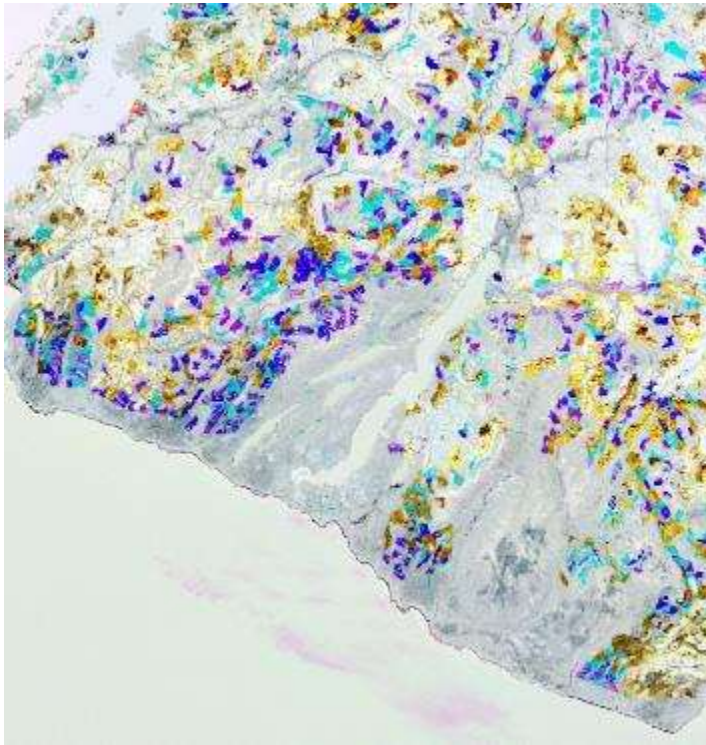


Cutblock vectors, 2010

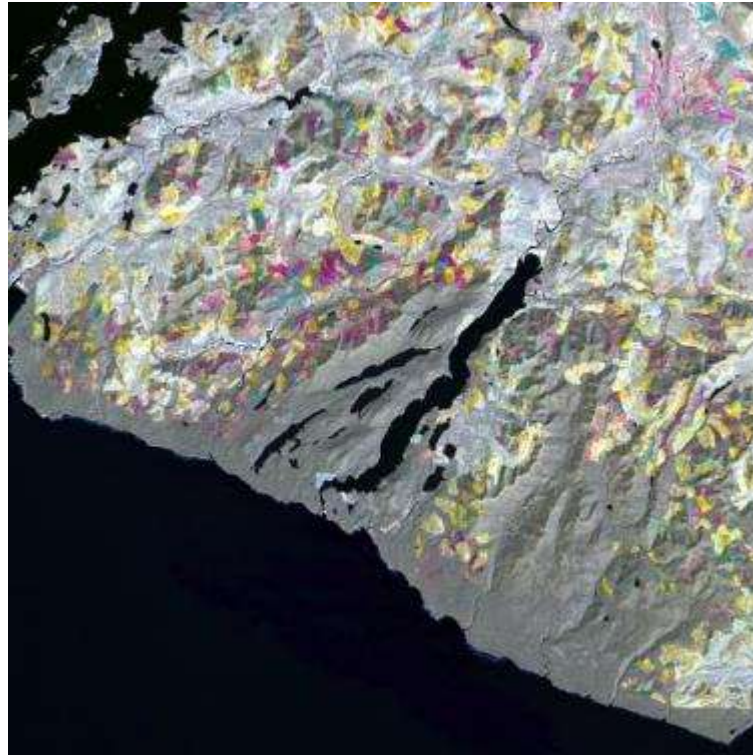


Tasseled Cap transformation 1995:
Brightness in red gun, greenness in green gun, and wetness in blue gun

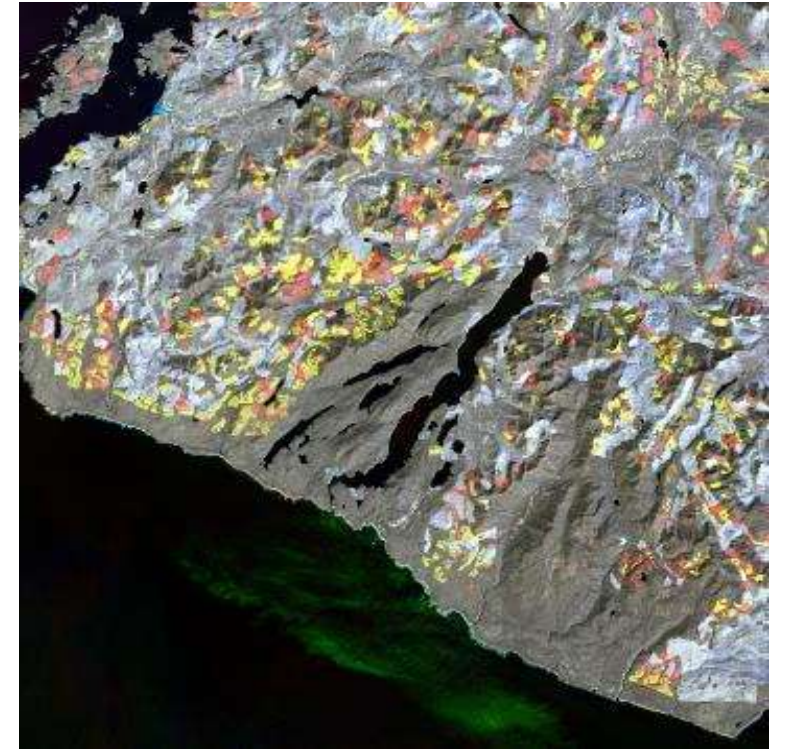
Tassel Cap images to extract cutblocks for 1995, 2004 and 2010



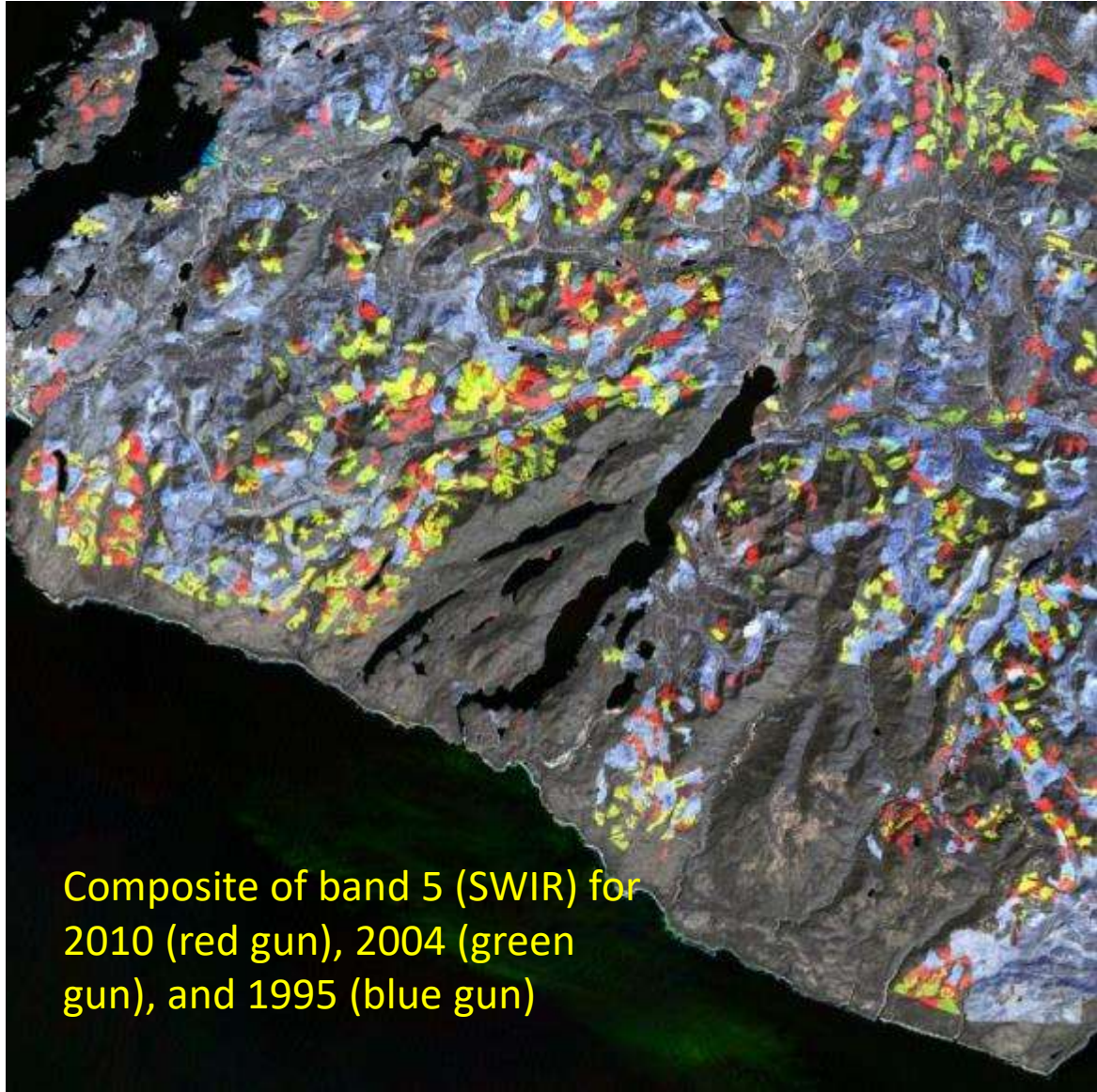
Brightness: 2010 in red gun, 2004 in green gun, and 1995 in blue gun



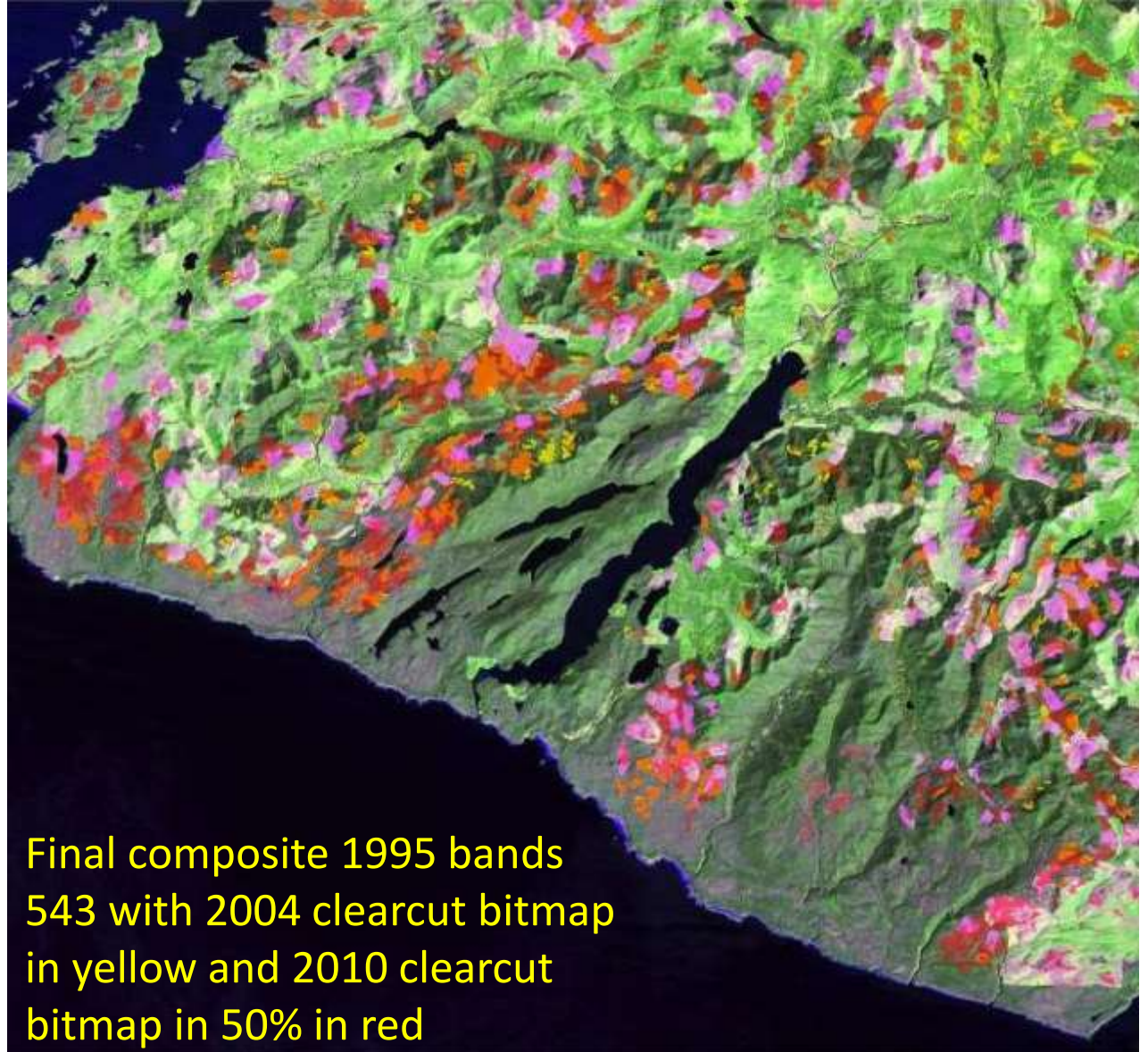
Greenness: 2010 in red gun, 2004 in green gun, and 1995 in blue gun



Wetness: 2010 in red gun, 2004 in green gun, and 1995 in blue gun

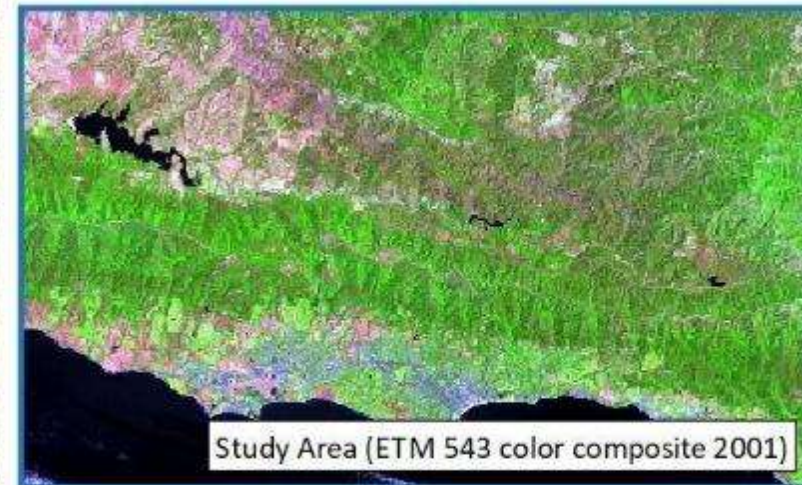
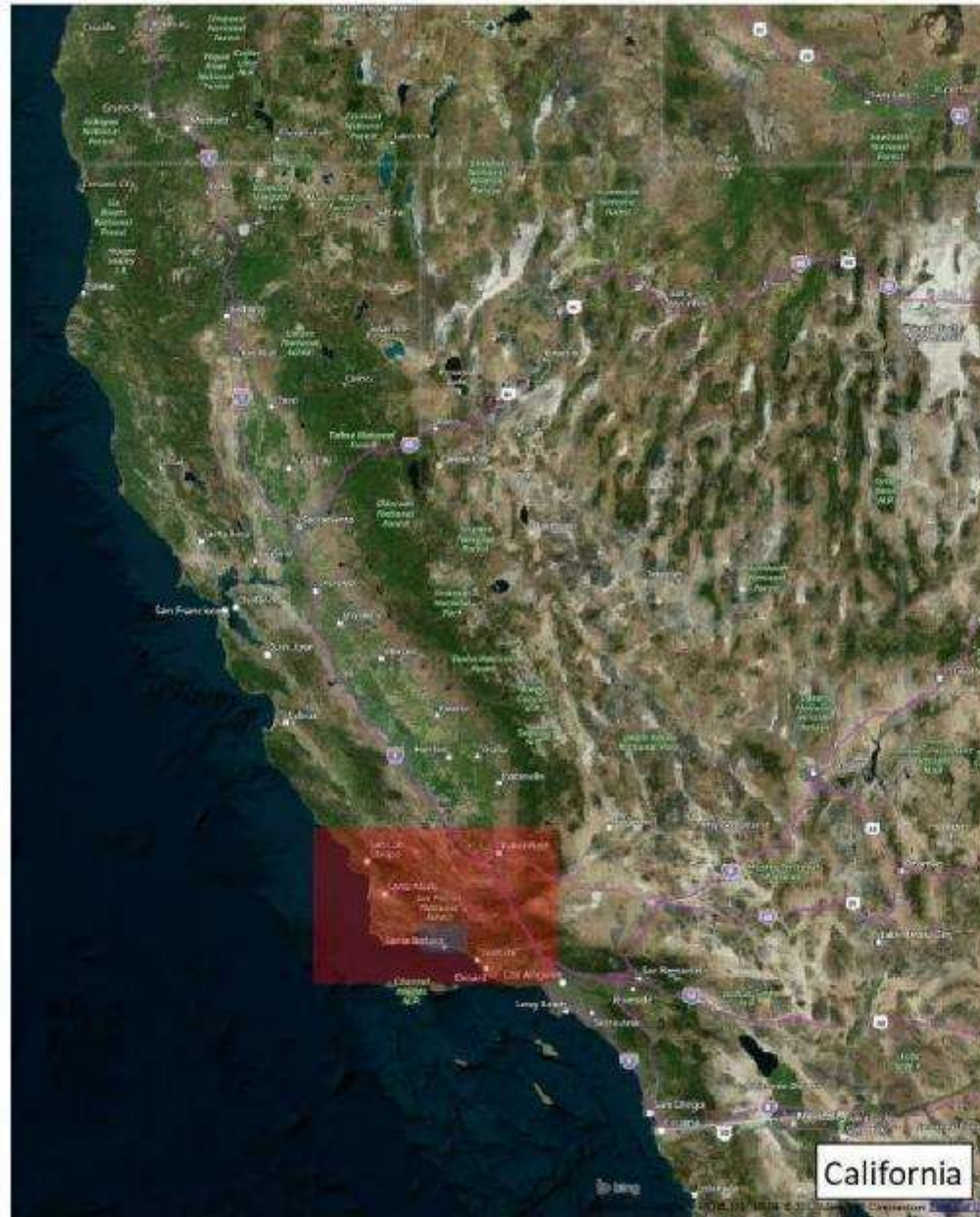


Composite of band 5 (SWIR) for 2010 (red gun), 2004 (green gun), and 1995 (blue gun)



Final composite 1995 bands 543 with 2004 clearcut bitmap in yellow and 2010 clearcut bitmap in 50% in red

Drought in the Santa Barbara area, California 2016, with a time series of Normalized-Difference-Vegetation-Indices (NDVI).

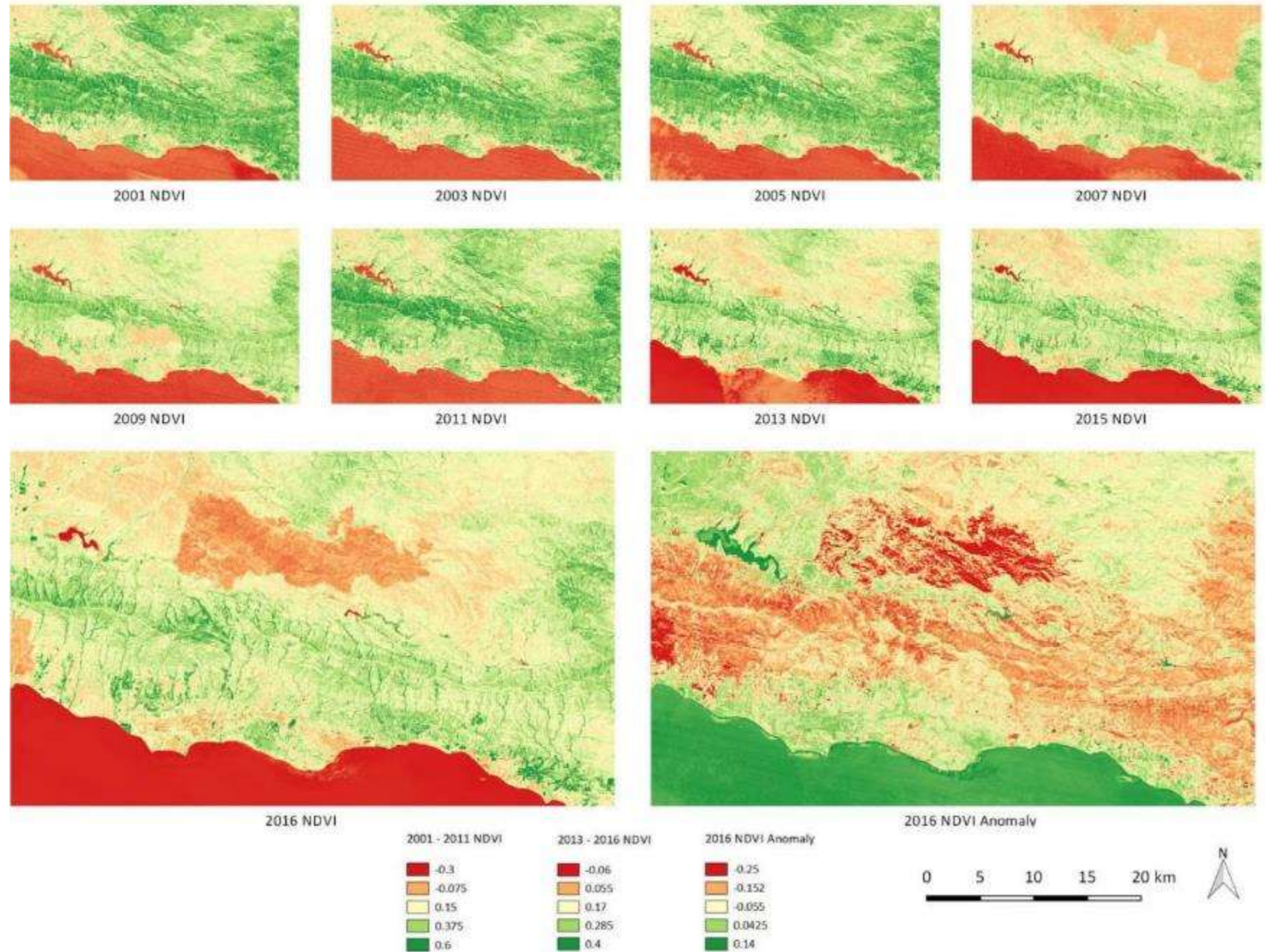


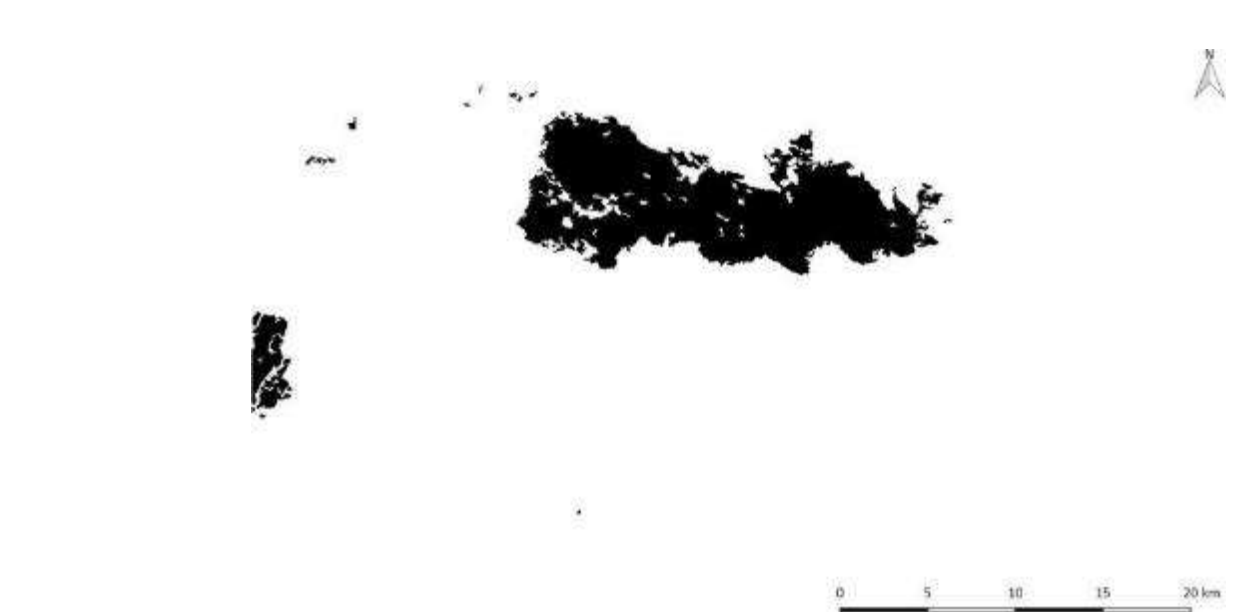
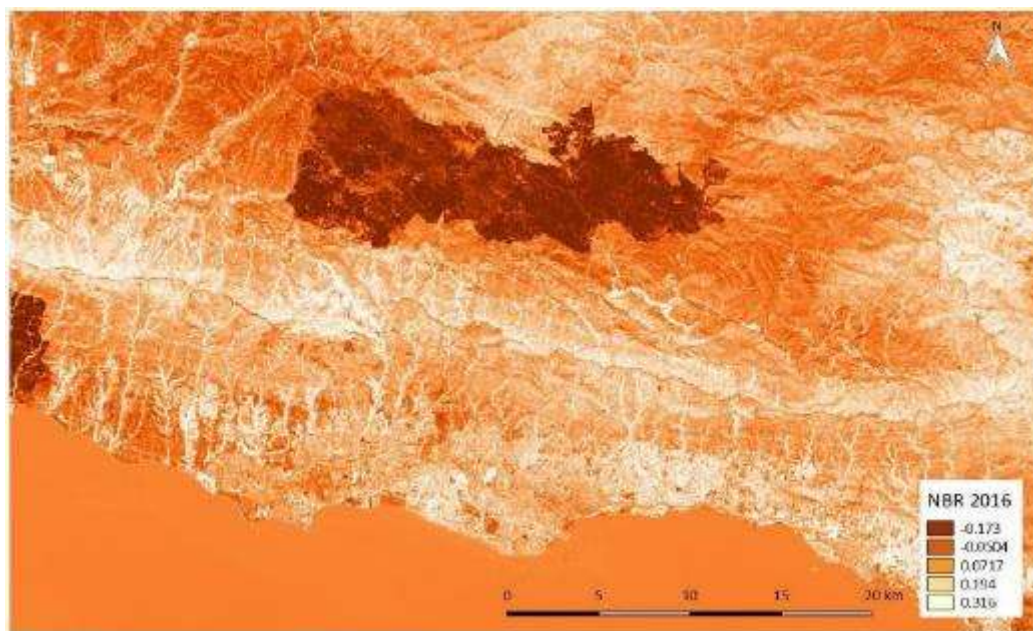
A series of 8 NDVIs, from Landsat images every other year, serves as an average for 16 years of biomass condition 2001-2015, subtracted from the NDVI for 2016, to calculate the anomaly for 2016.

2001-11: Landsat 5
 2013-2016: Landsat 8

The higher spectral resolution of OLI bands creates some discontinuity between 2011-13

The NDVI time series shows a continuous decline of biomass in the mountains north of Santa Barbara.





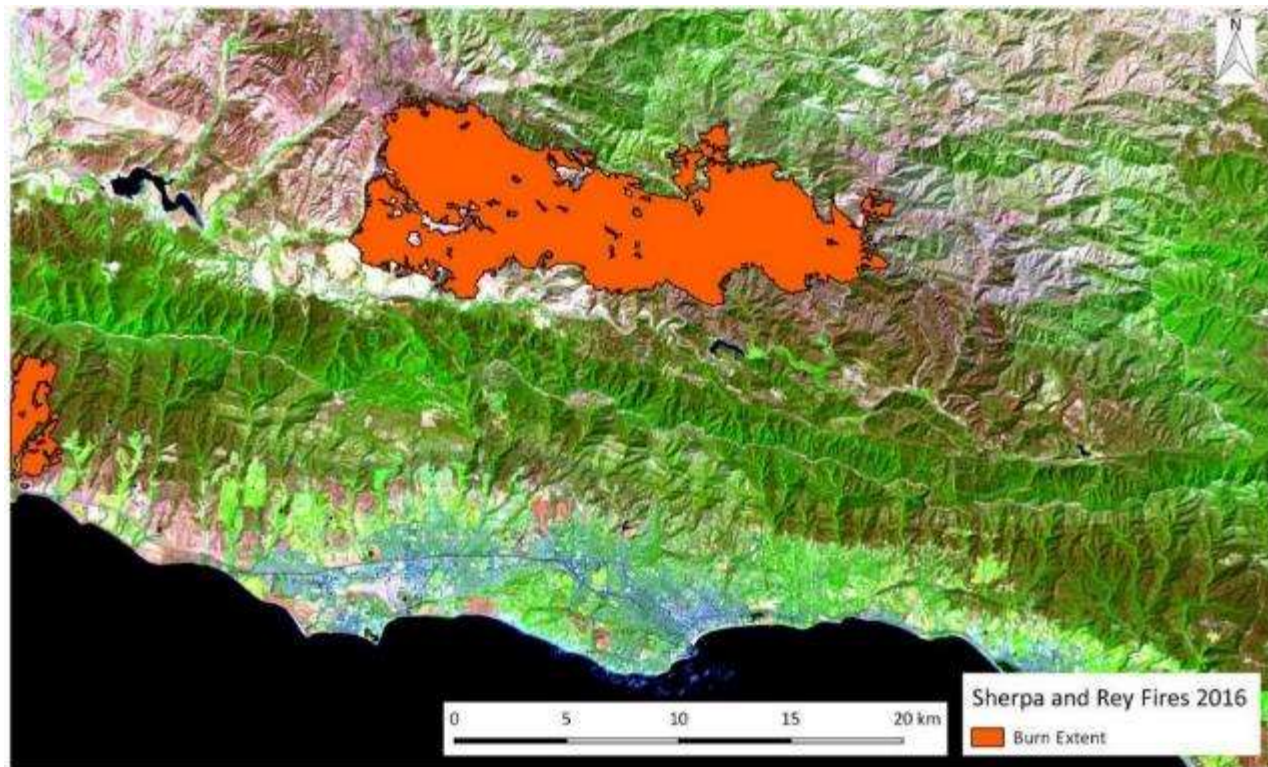
NBR and threshold images

NBR: The extent of the burned area is 125.4141 km²

overlay on a 2016 6-5-4 Landsat 8 OLI color composite

NASA, n.d.: Measuring drought with the NDVI. Accessed Dec. 2017: https://earthobservatory.nasa.gov/Features/MeasuringVegetation/measuring_vegetation_3.php

Santa Barbara County Water Agency, 2017: Drought. Accessed Dec. 2017 <http://waterwisesb.org/drought.wwsb>



Project report – suggested length 6-10 pages including graphics – template to be provided

Approx. 4% for each of these sub-sections (total 20%)

- Summary – Introduction – rationale
- Selection of area and image data
- Image processing techniques and complexity
- Presentation of images/ graphics
- Discussion of results

5% for outlin

Due Wednesday 4 December