GEOG357 Project planning outline Fall 2025

a. **Geographic area** (province / country / region) ?

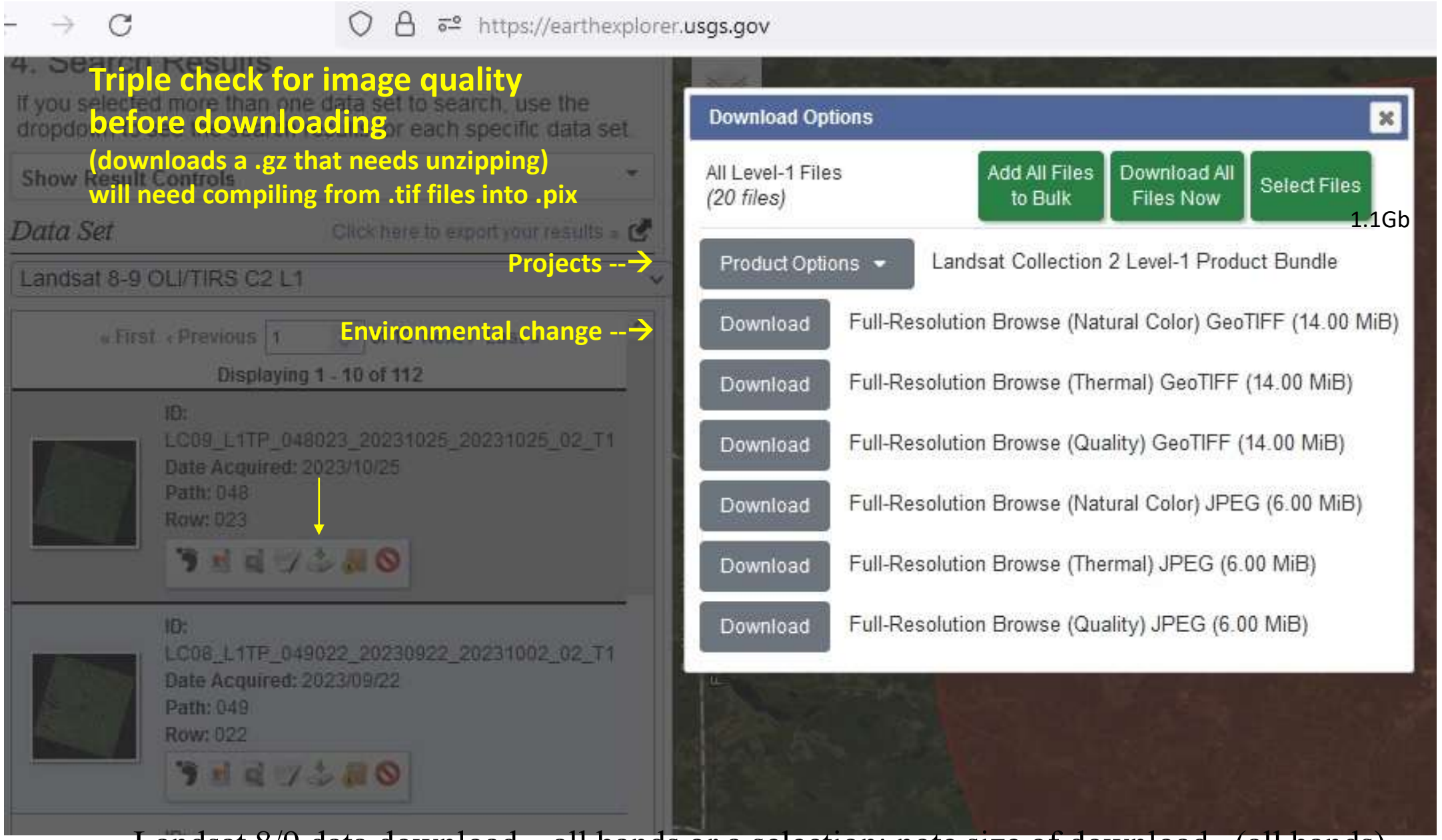
b. **Application area** e.g. forestry, habitat (landcover), glaciers, urban

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 [could double with another course]
Image sources: Landsat 5, 7, 8, 9 (30m pixels); Other: e.g. ASTER, from earthexplorer.usgs.gov (15m)
Sentinel-2: https://dataspace.copernicus.eu (10m)



Landsat 8/9 data download – all bands or a selection: note size of download (all bands)
Smaller for Landsat 5 … why – 2 reasons ? 8-bit vs 16 bit; fewer bands

Possible focus of project

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

1. Select imagery for area / date (s) – download, assemble … clip

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 ?

2. 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. ~ 1800 x 1200 pixels = ~50 x 30 km – smaller for Sentinel with 10m pixels (20x12)

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 2.5D images using DEM ? possible inclusion of Google maps/earth image for context.

Dec 3: Present 3 minute summary in last class; write up text / summary

Project Output Summary

Introduction: A brief summary of your project – goals, area and result

Study Area and Data Source

- Study area description
- The data you need for the project (including image dates)
- Comments on image quality (clouds, time of year etc.)

Data methods and analysis

- brief description of methods (could use point form)
- the primary resulting channels from analysis e.g. ratio or classification

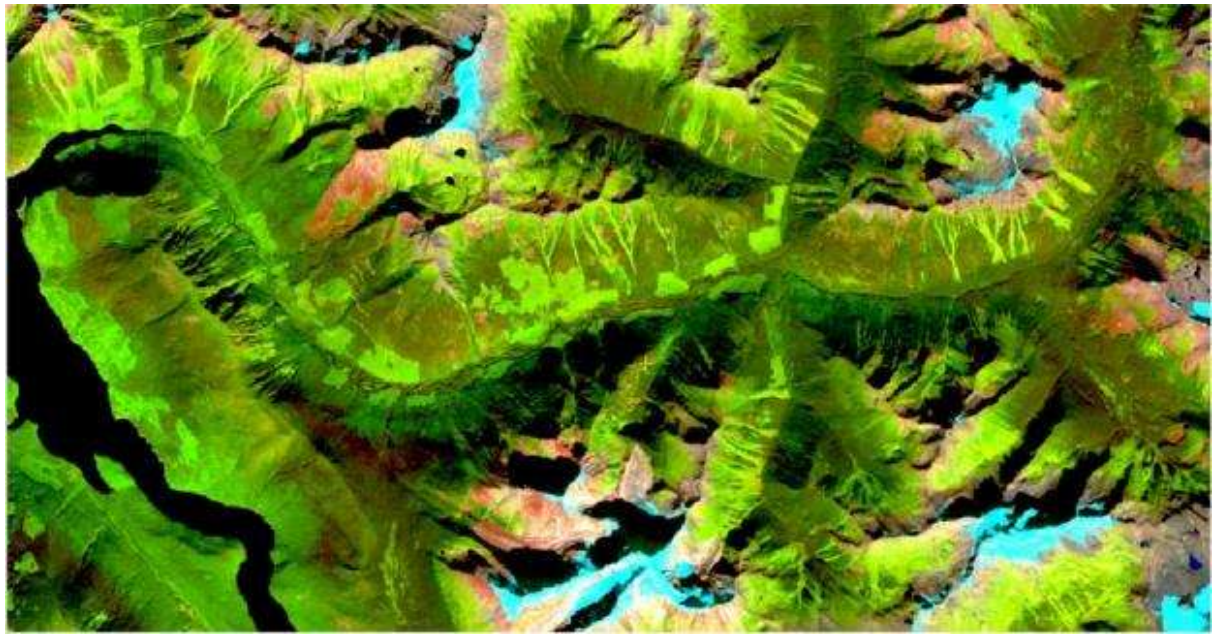
Results

- Discussion of results
- Final image display e.g. vectors on image
- Final conclusions of successes or limitation

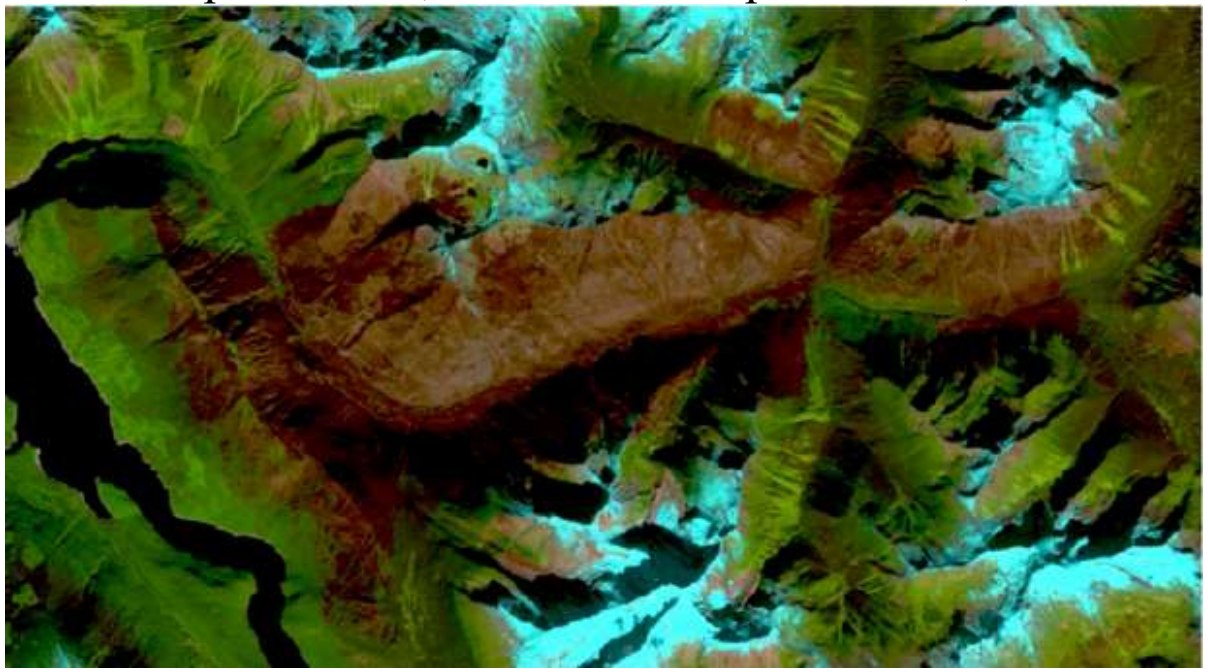
submit project as word doc and pdf in case of minor edits, pdf for final presentation

Project examples in the following slides; more in the labs on report details

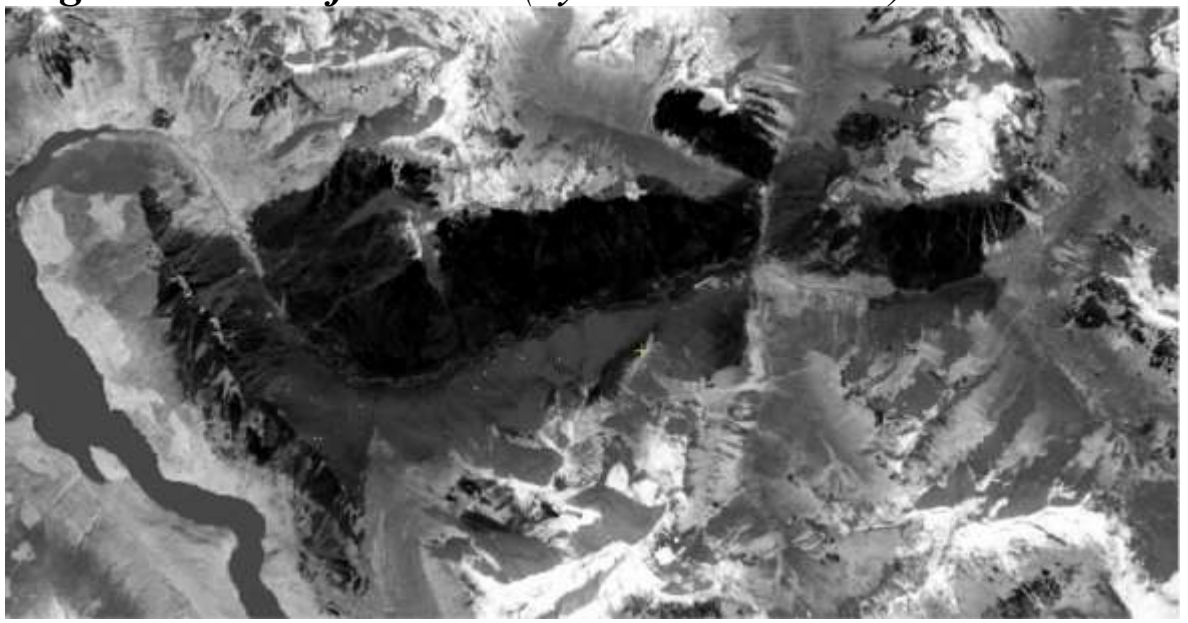
***Hugh Allen Wildfire** 2018 (by Kinbasket Lake): Landsat 8*



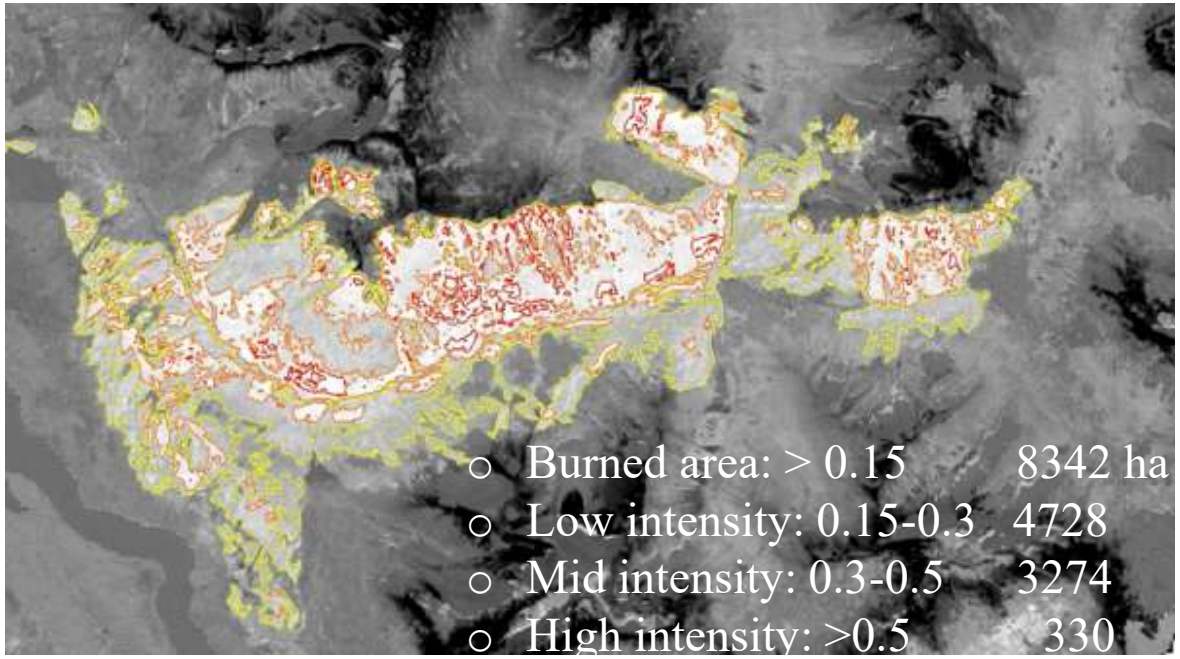
a. September 13, 2016



b. September 19, 2018

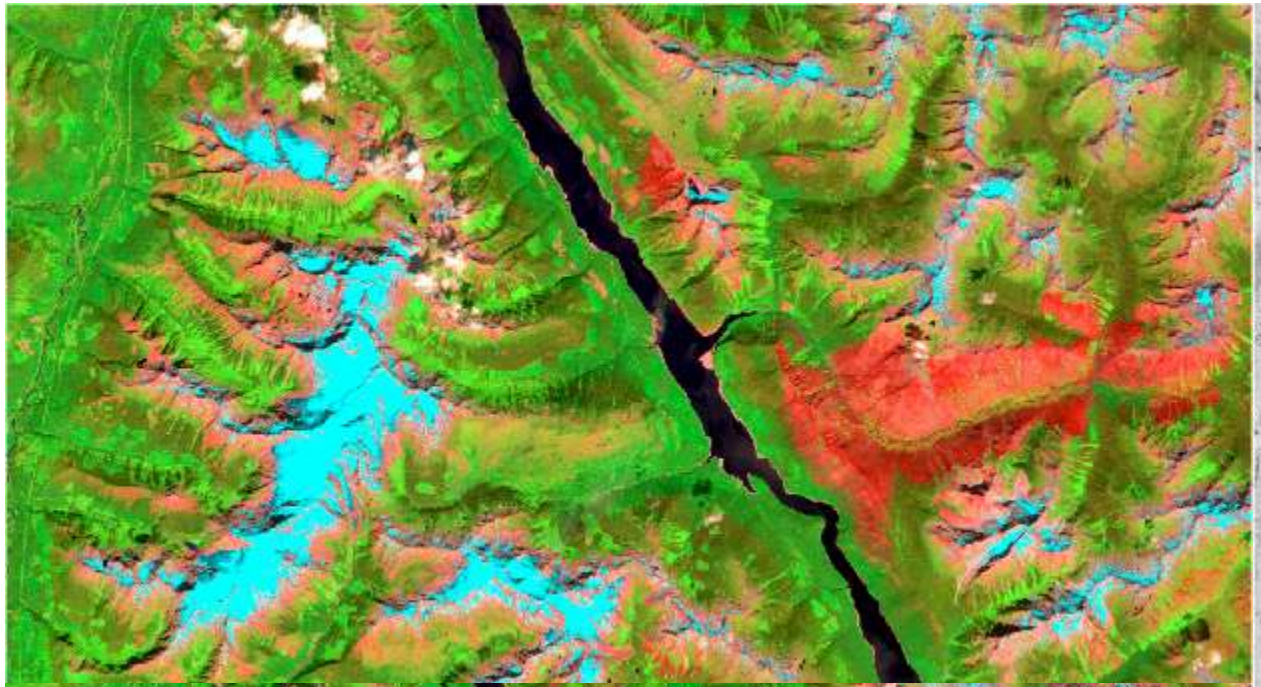


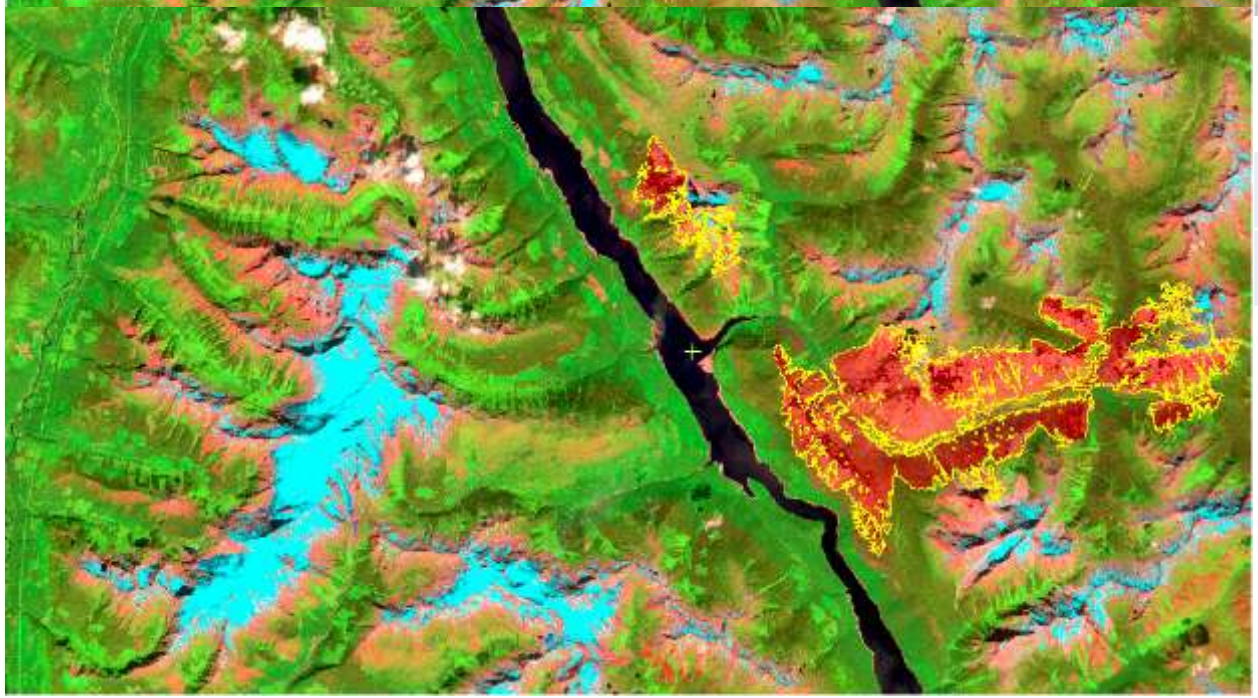
c. NBR 2018



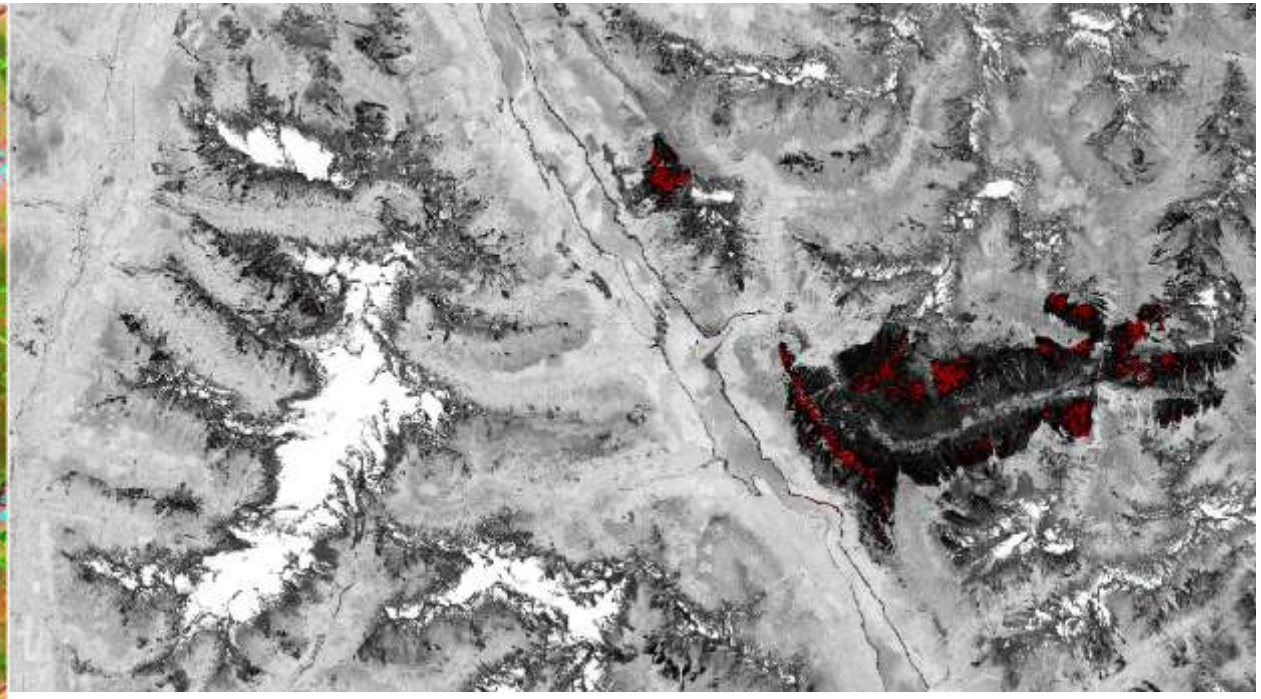
d. dNBR = NBR 2016 – NBR2018

Hugh Allen Wildfire *2018 - Sentinel 2 Bands 12 (SWIR2), 8 (NIR), 4 (Red)*





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

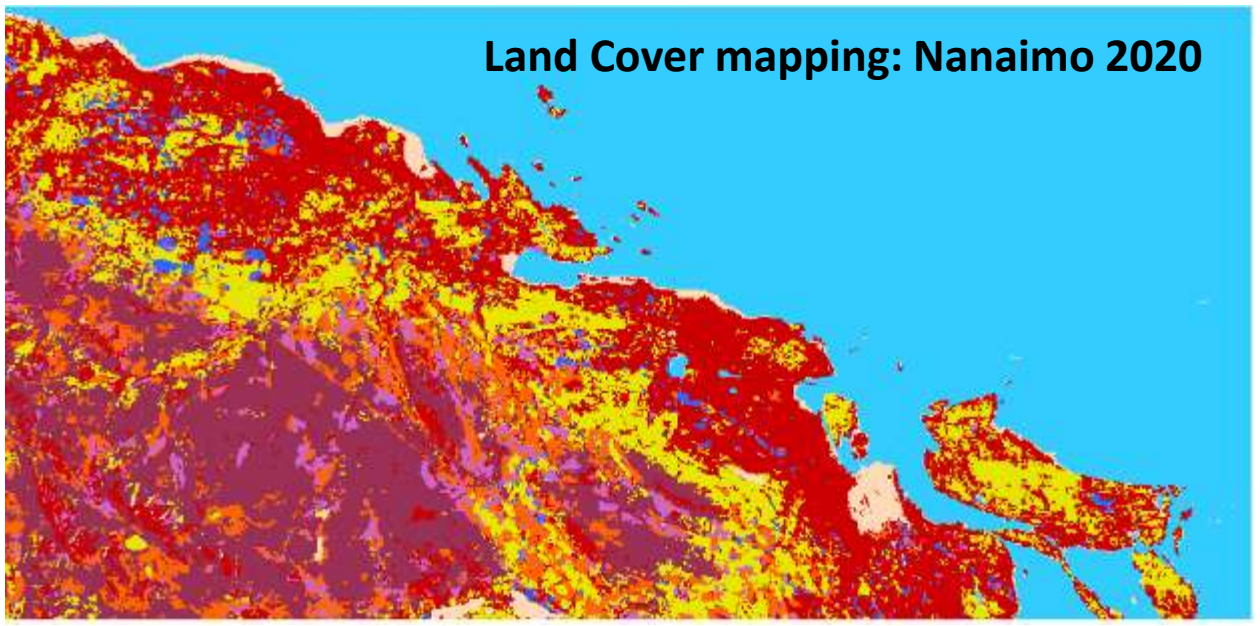


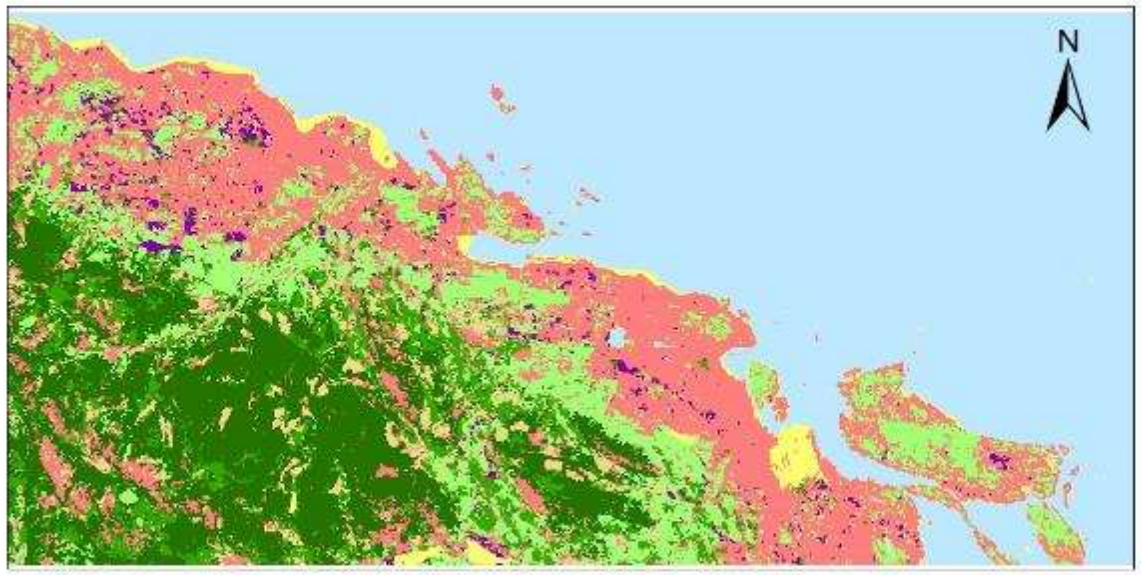
Normalized Burn Ratio and High Severity Burn Area Polygons

	Low Severity Burn	Medium Severity Burn	High Severity Burn
DN Values	0 to 0.23712133	0.23712133 to 0.47424267	0.4742427 to 0.711364

The total burn area was 102.27 km^2 or 10,226.56 hectares.
The severely burned area was 3.33 km^2 or 333.47 hectares

Avoid overkill precision ☺



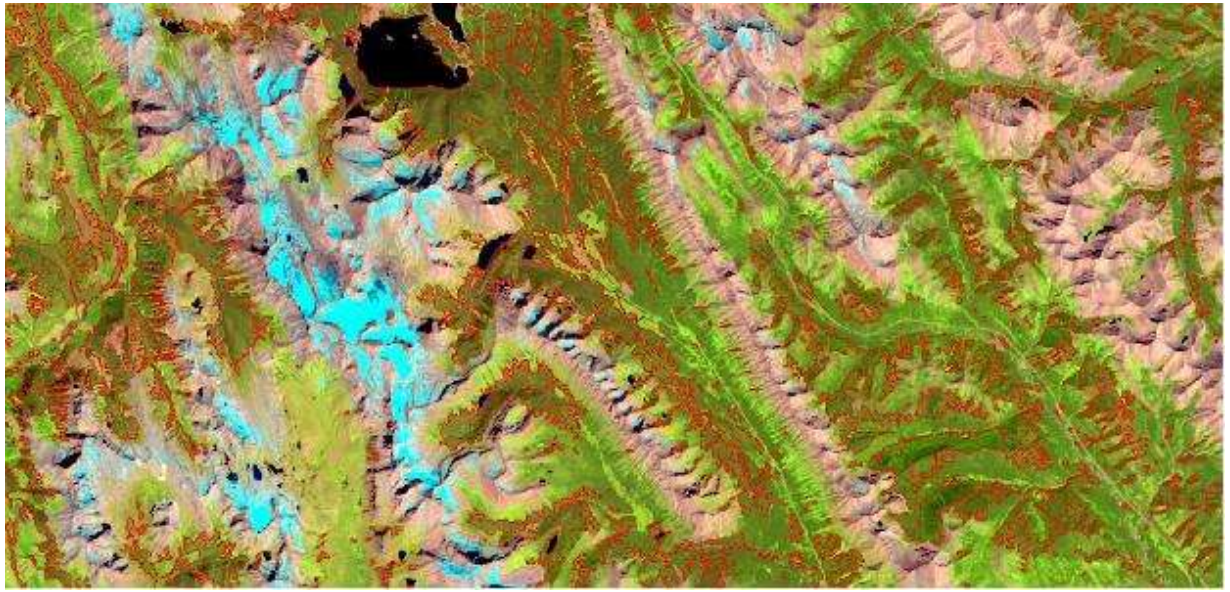


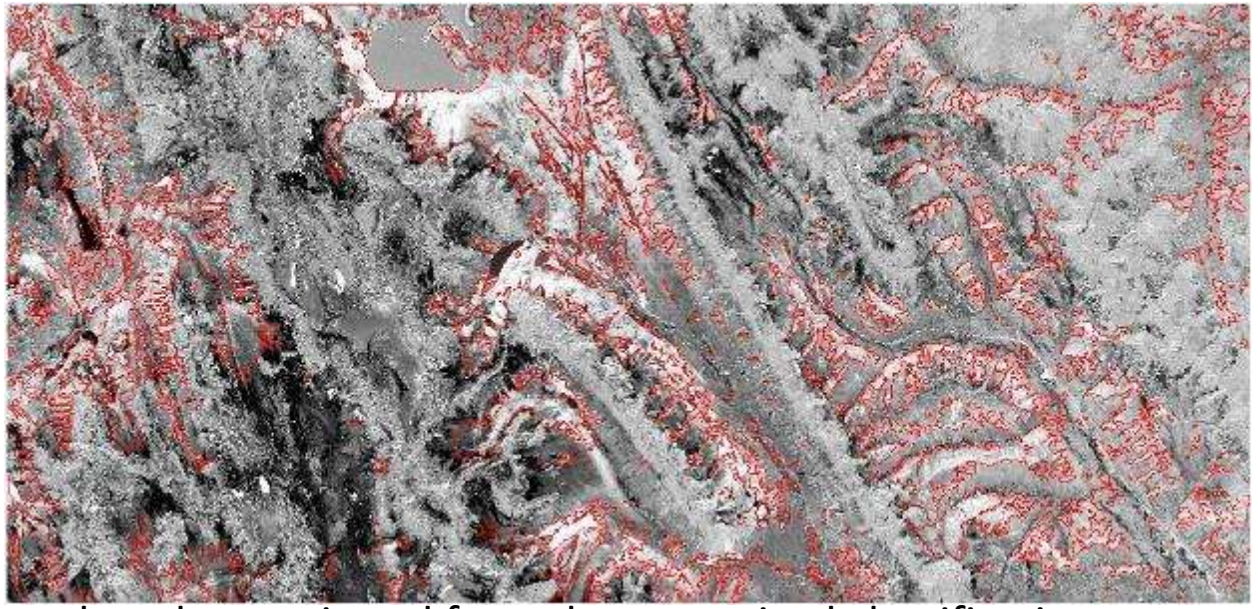
ID	Value	Name	Color	Threshold	Bias	Imported Sig	Description
1	1	water		3.00	1.00		
2	2	urban		3.00	1.00		
3	3	decid forest		3.00	1.00		
4	4	agriculture		3.00	1.00		
5	5	beach		3.00	1.00		
6	6	open fields		3.00	1.00		
7	7	cleared forest		3.00	1.00		
8	8	mixed forest		3.00	1.00		

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



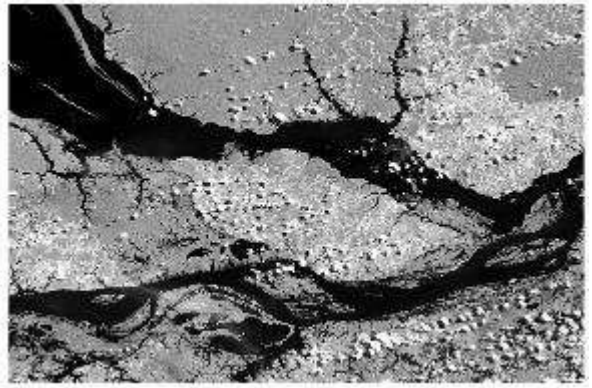


2020 image and NDVI difference 2020 -2018 with spruce beetle polygons in red from the supervised classification

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

July 08, 2009

Landsat 5 (Flood season)

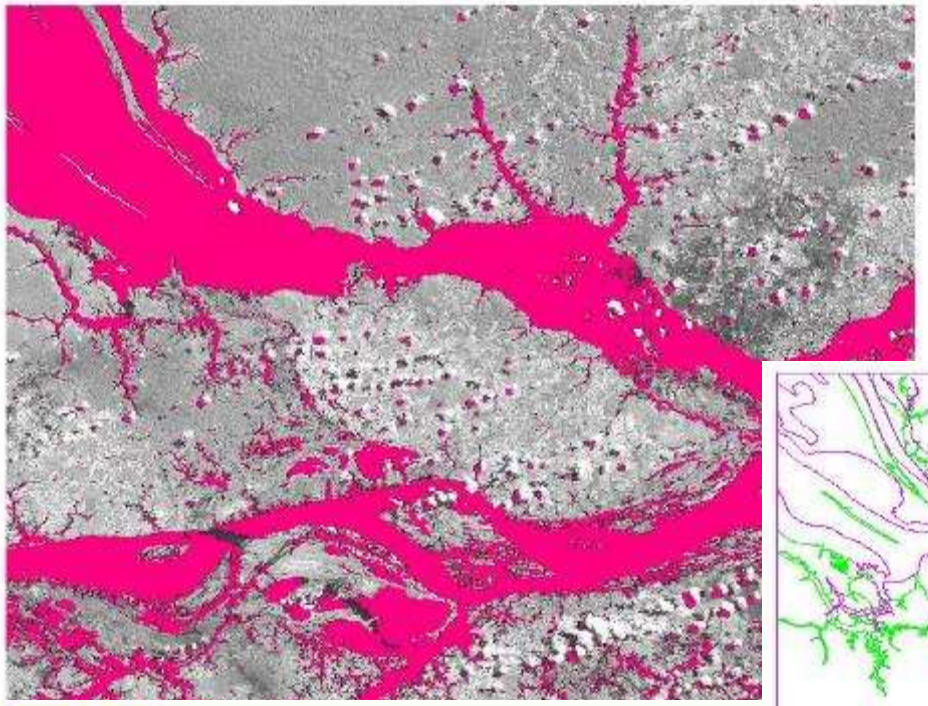


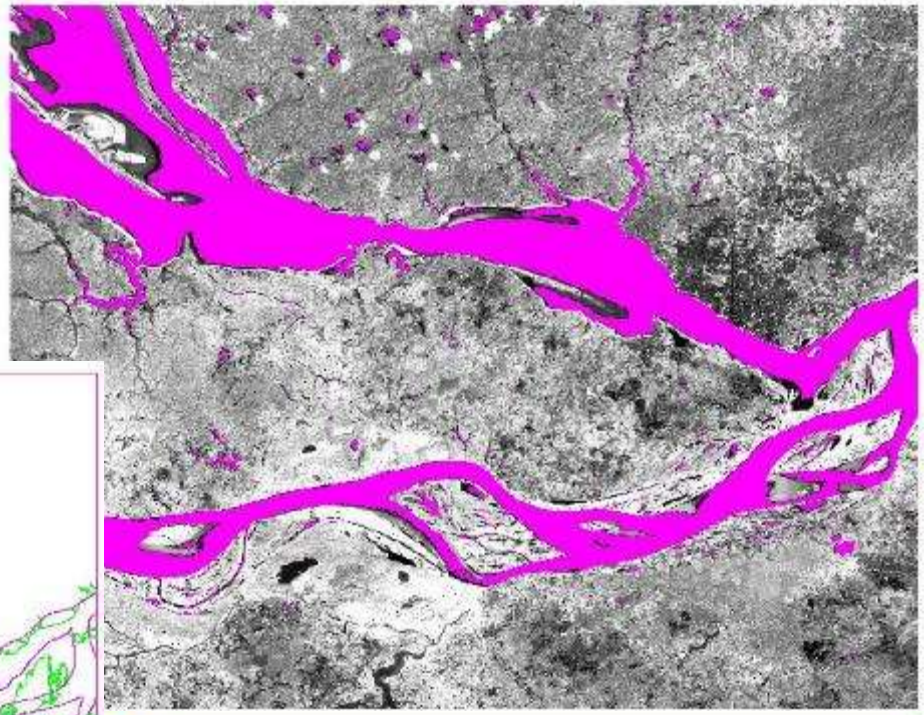
November 29,2009

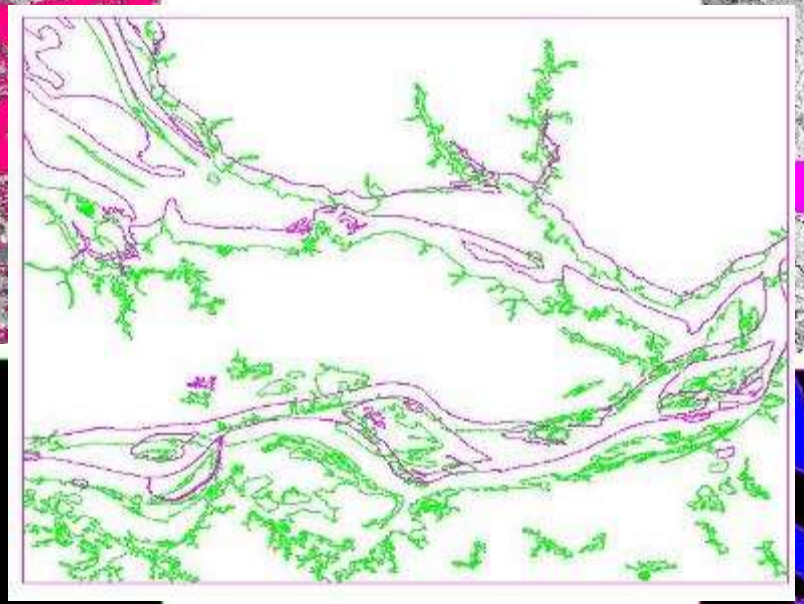
Landsat 5 (Dry season)

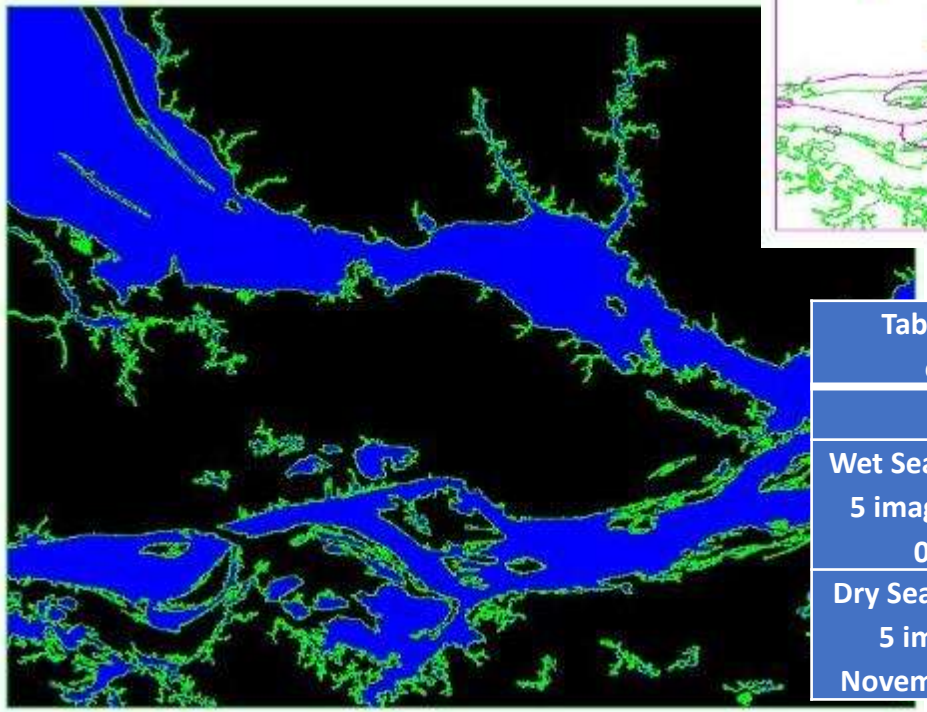
NDWI

Bitmaps and vectors : wet and dry season









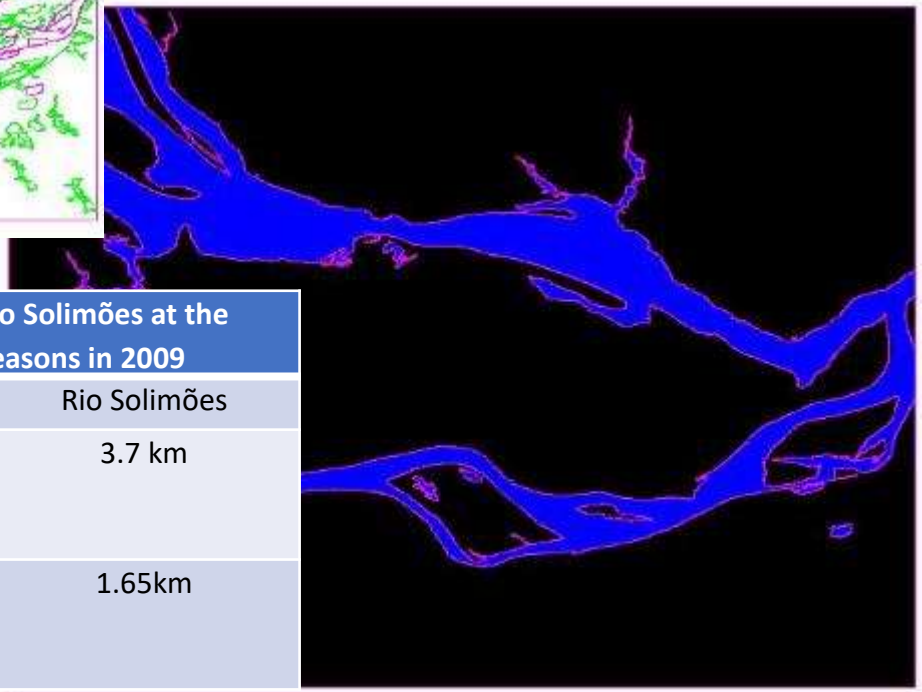
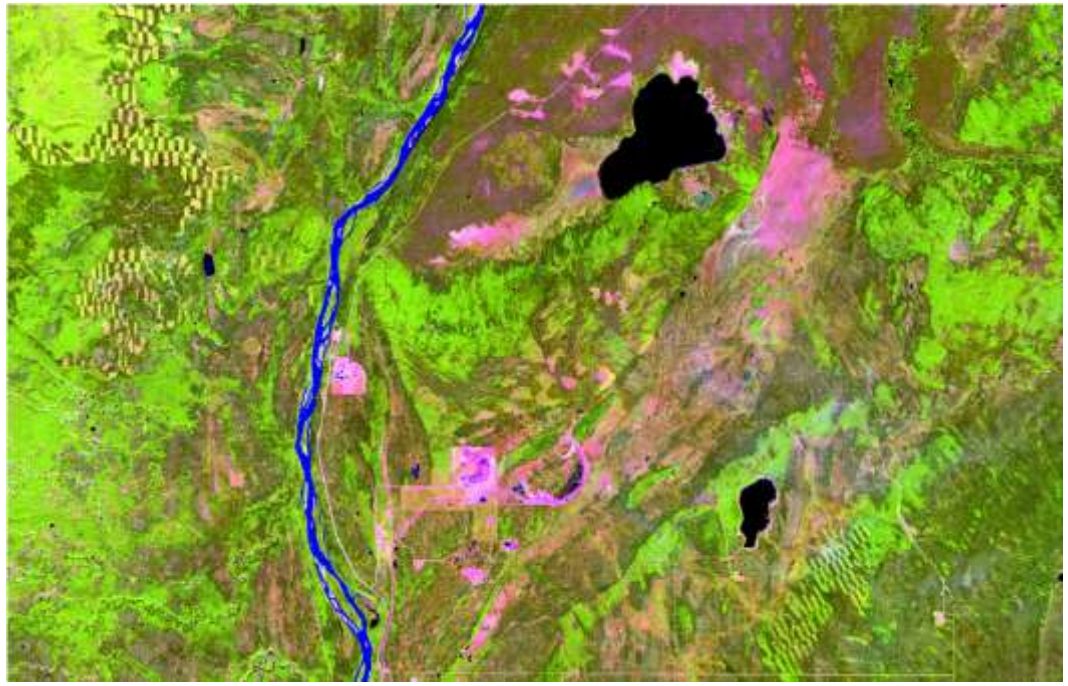
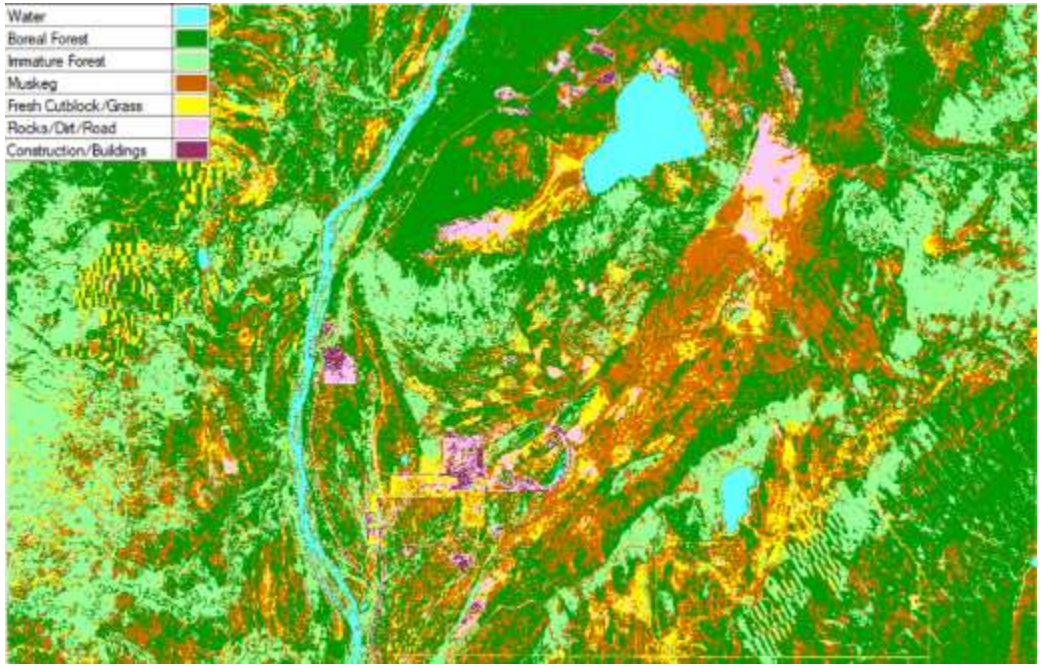


Table 1- The width of the Rio Negro and Rio Solimões at the confluence between the wet and dry seasons in 2009		
	Rio Negro	Rio Solimões
Wet Season- Landsat 5 image from July 08,2009	2.55 km	3.7 km
Dry Season- Landsat 5 image from November 29,2009	2.15 km	1.65km

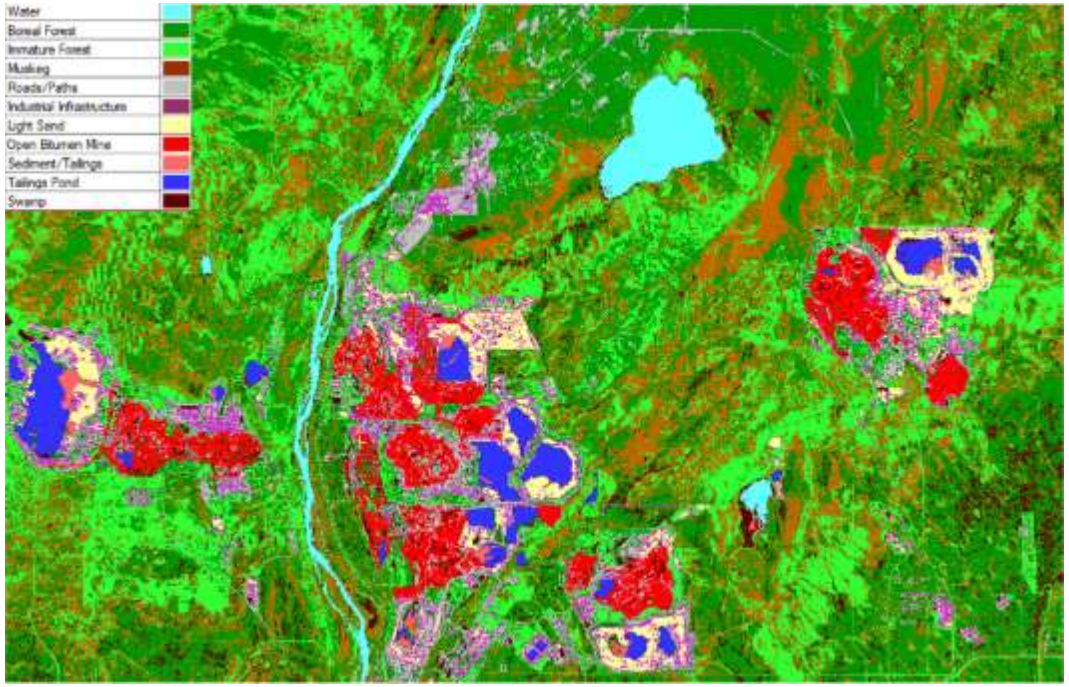
Oil Extraction in Fort MacKay Alberta, ~50km north of Fort McMurray
August 18, 1999 LANDSAT 5 and August 18, 2020 LANDSAT 8

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



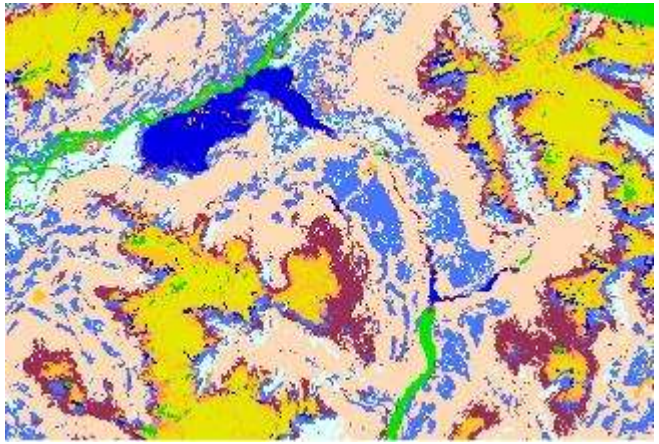

Water
Boreal Forest
Immature Forest
Muskeg
Fresh Cutblock/Grass
Rocks/Dirt/Road
Construction/Buildings

1999


Water
Boreal Forest
Immature Forest
Muskeg
Roads/Paths
Industrial Infrastructure
Light Sand
Open Bitumen Mine
Sediment/Tailings
Tailings Pond
Swamp

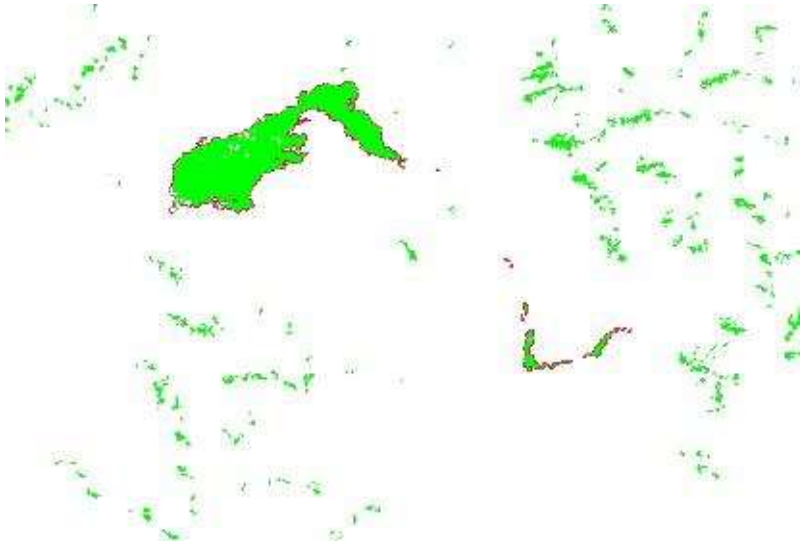
2020

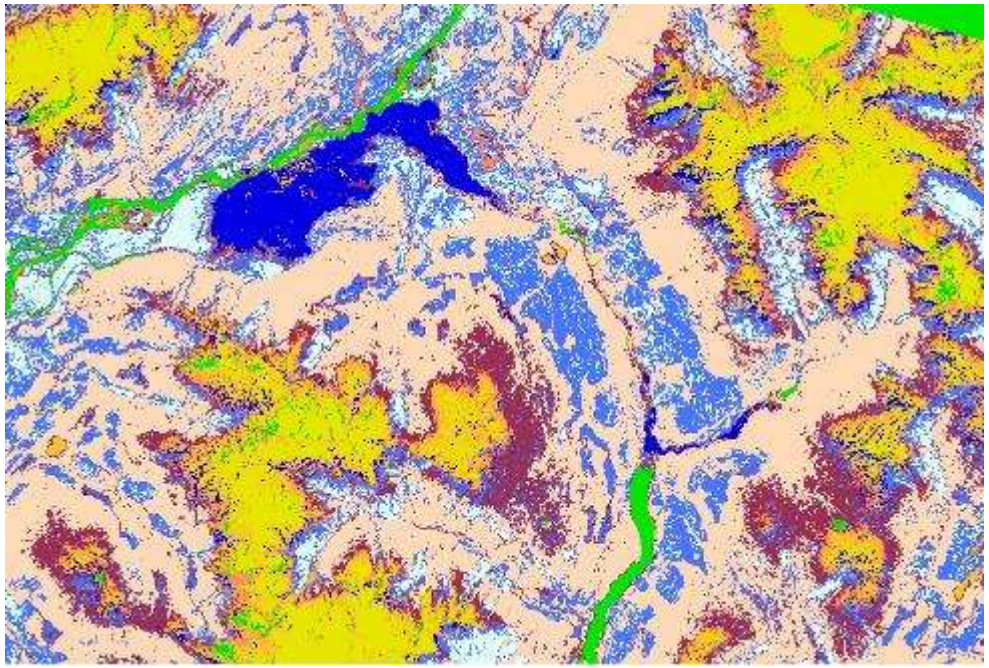
Extraction of Lava Bed Area in Nisga'a Memorial Lava Bed Provincial Park (~1700 eruption)



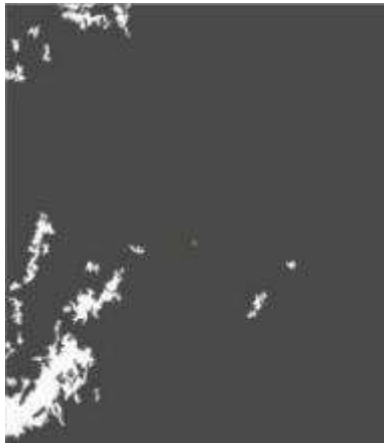
Sieved classification

Lava beds polygons



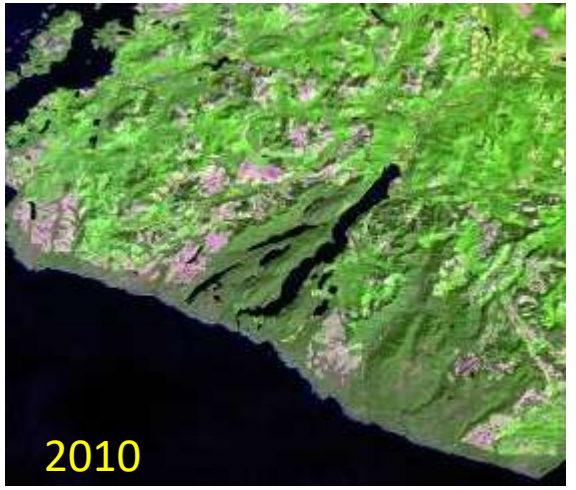


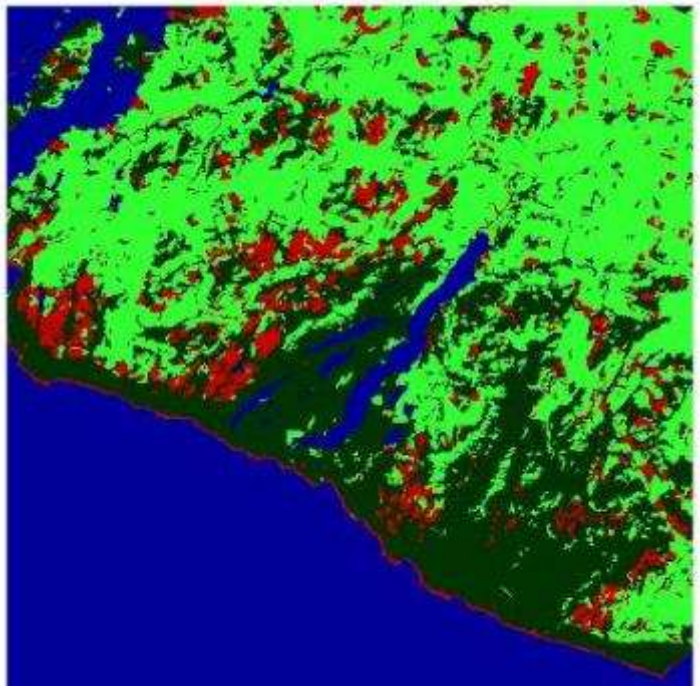
Extraction of Glaciers, Water, and Vegetation - the Southeast Coast of Greenland

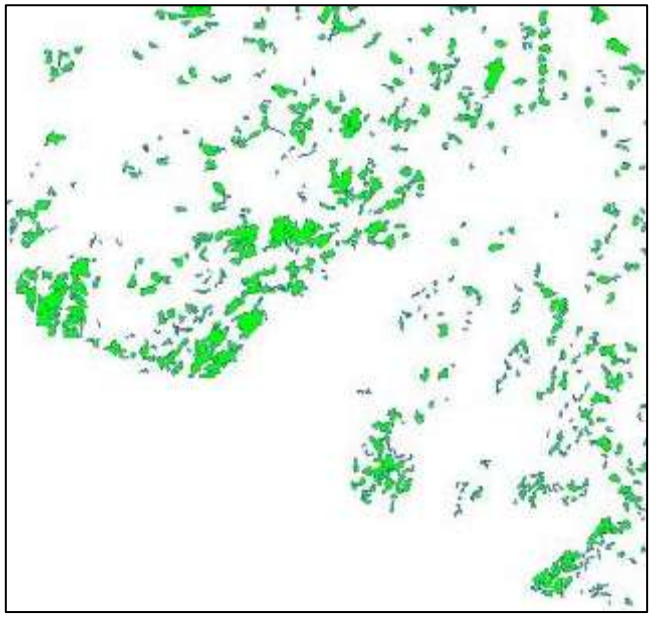


Threshold images for ice, water and vegetation derived from ratios

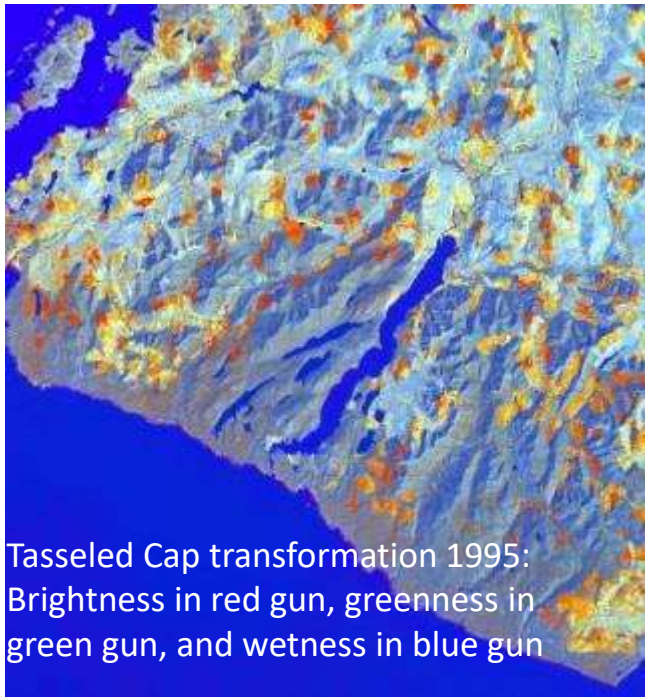
Anthropogenic changes in vegetation around the West Coast Trail, 1995-2010



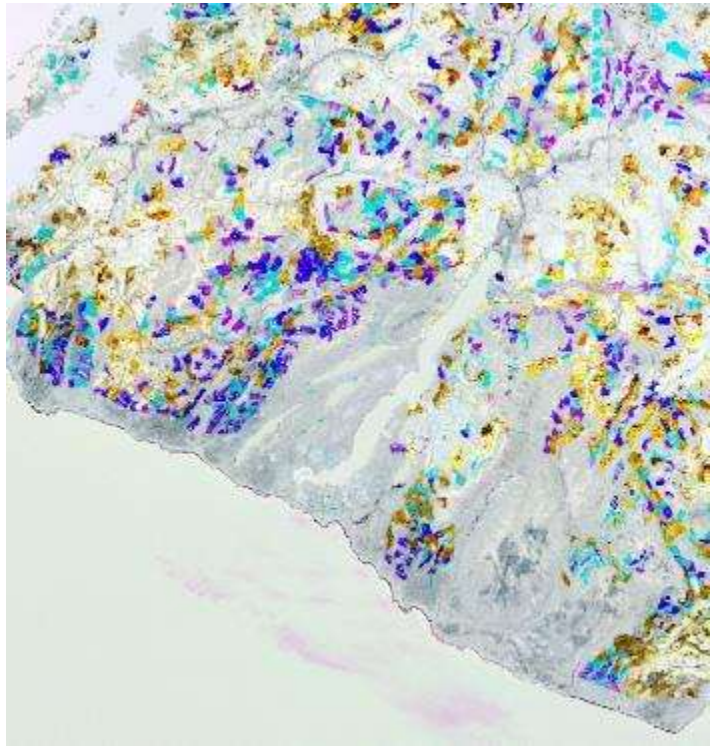




Cutblock vectors, 2010

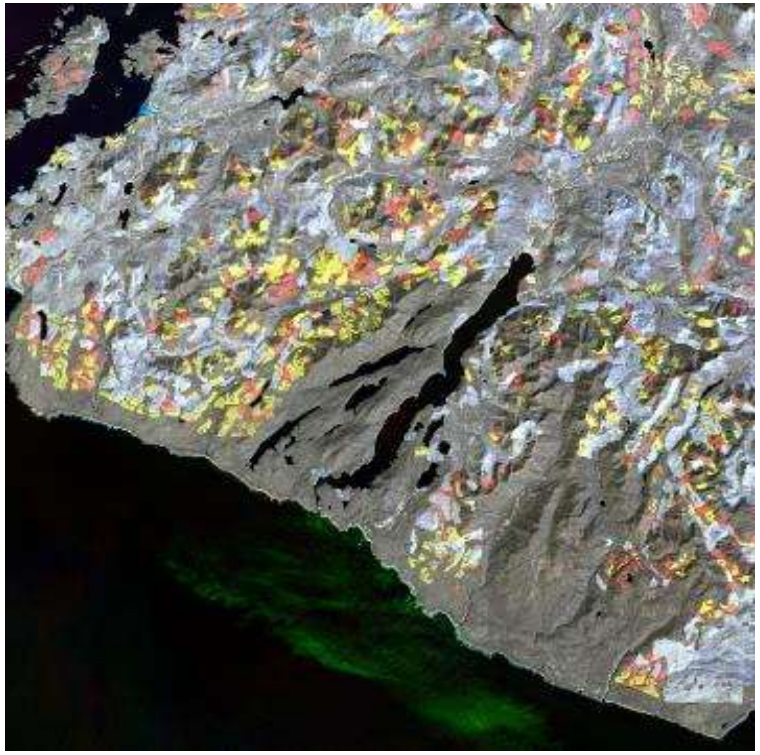


Tassel Cap images to extract cutblocks for 1995, 2004 and 2010

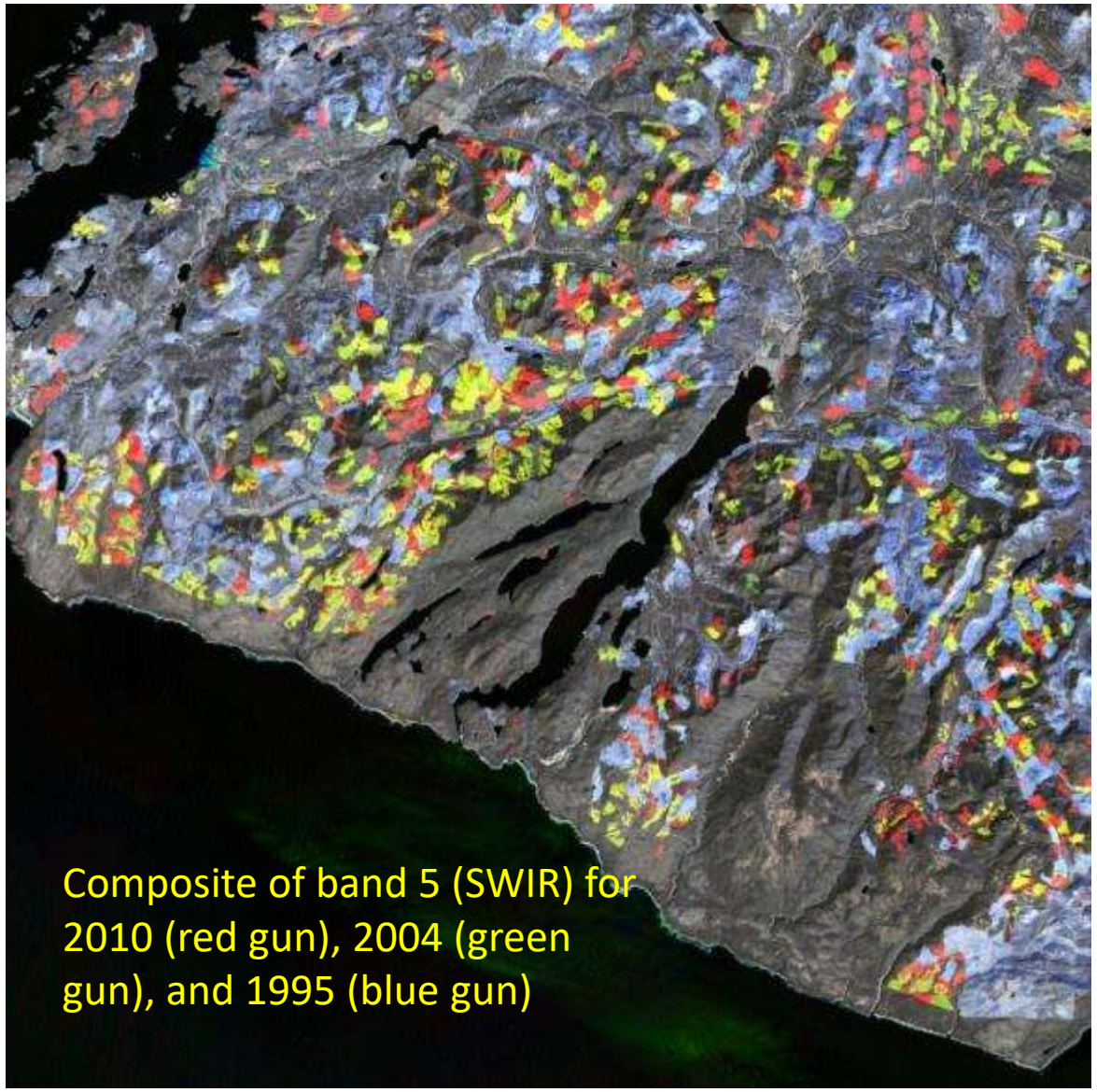


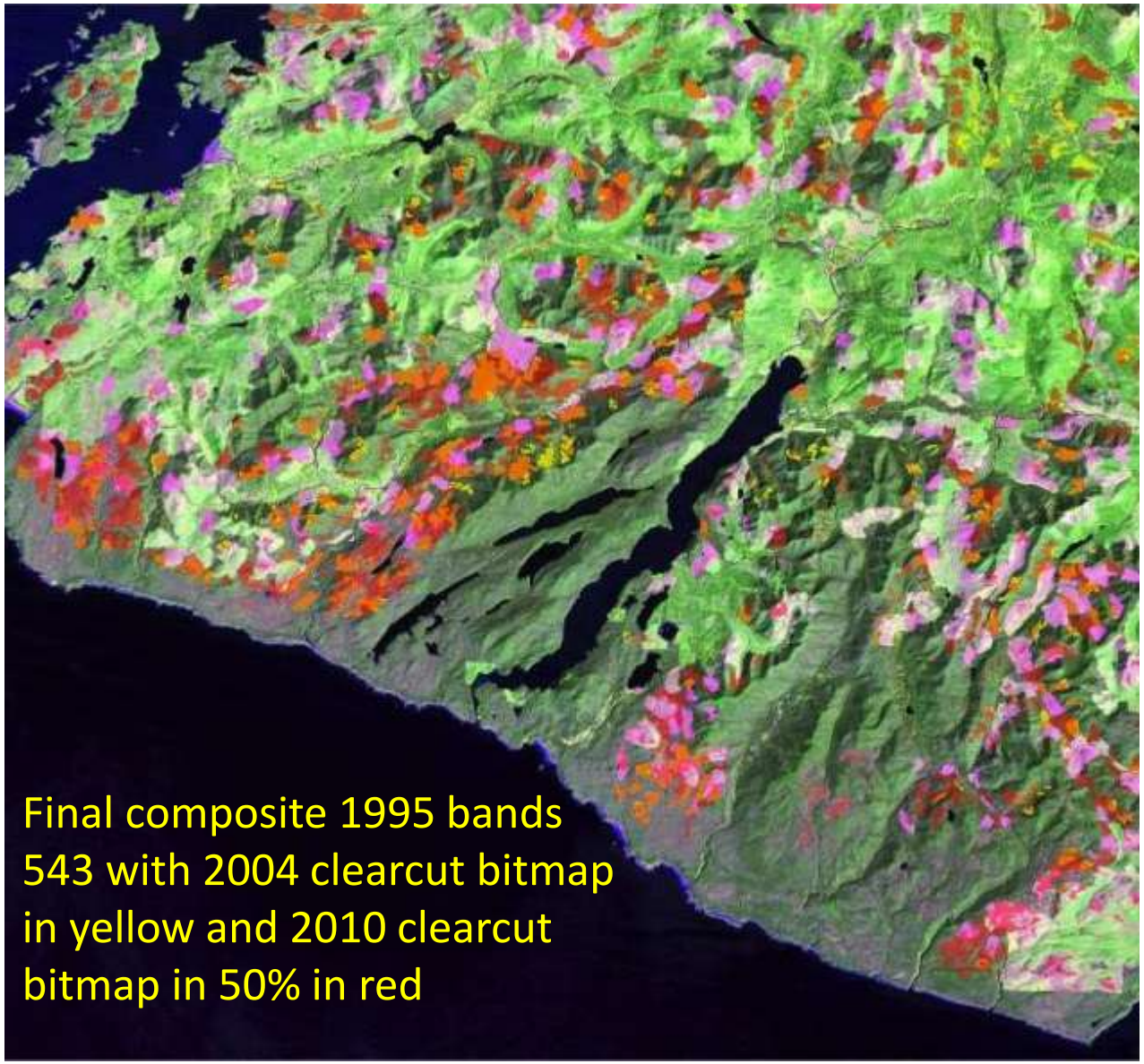
Brightness: 2010 in red gun, 2004 in green gun, and 1995 in blue gun

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

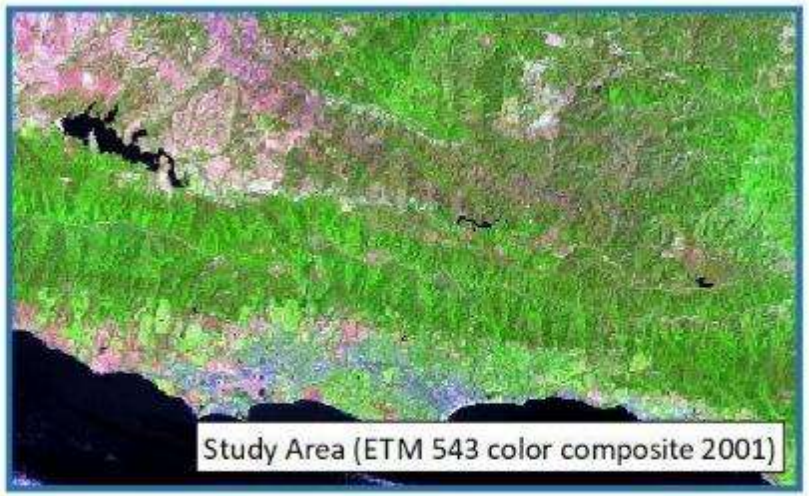


Wetness: 2010 in red gun, 2004 in green gun, and 1995 in blue gun


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).

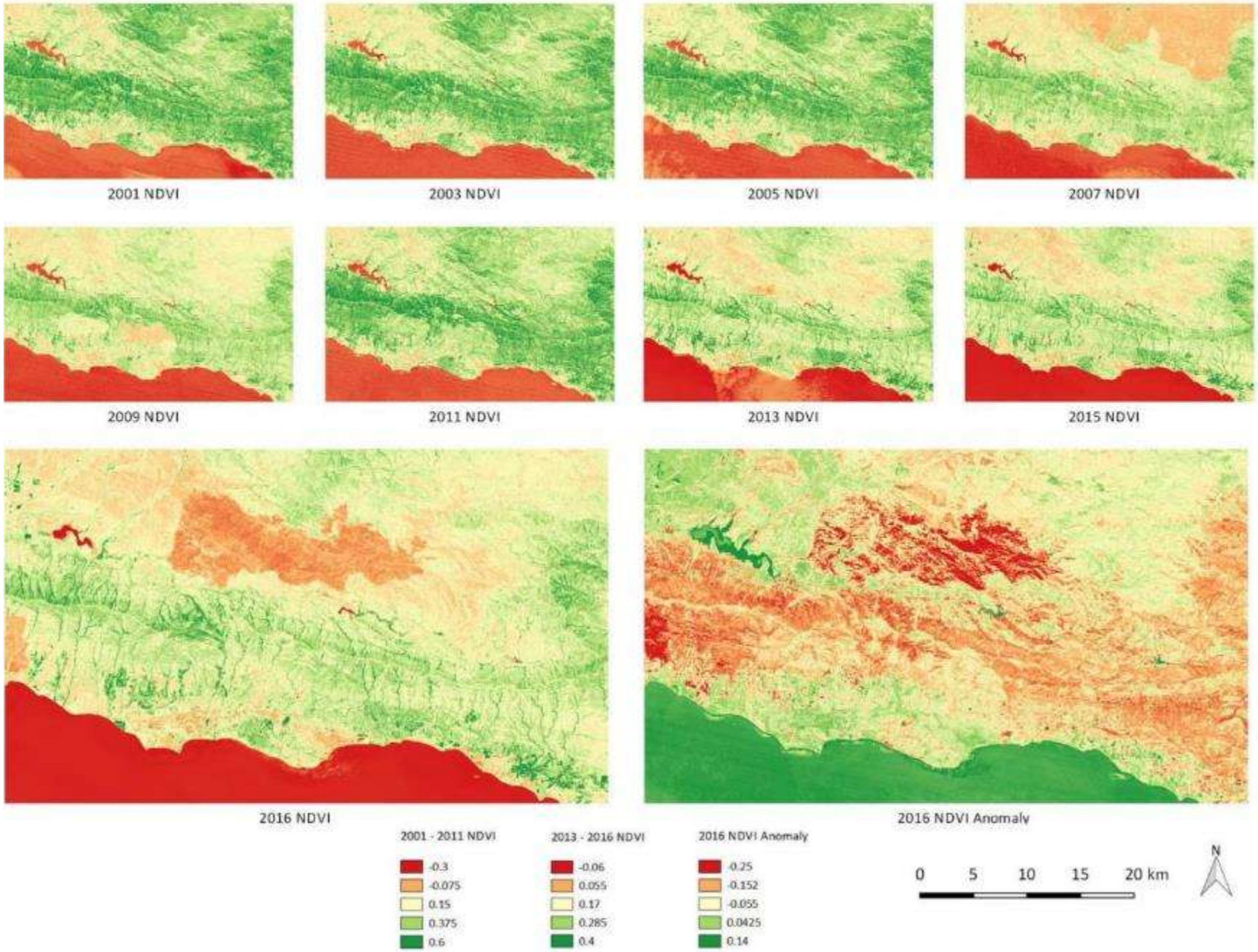


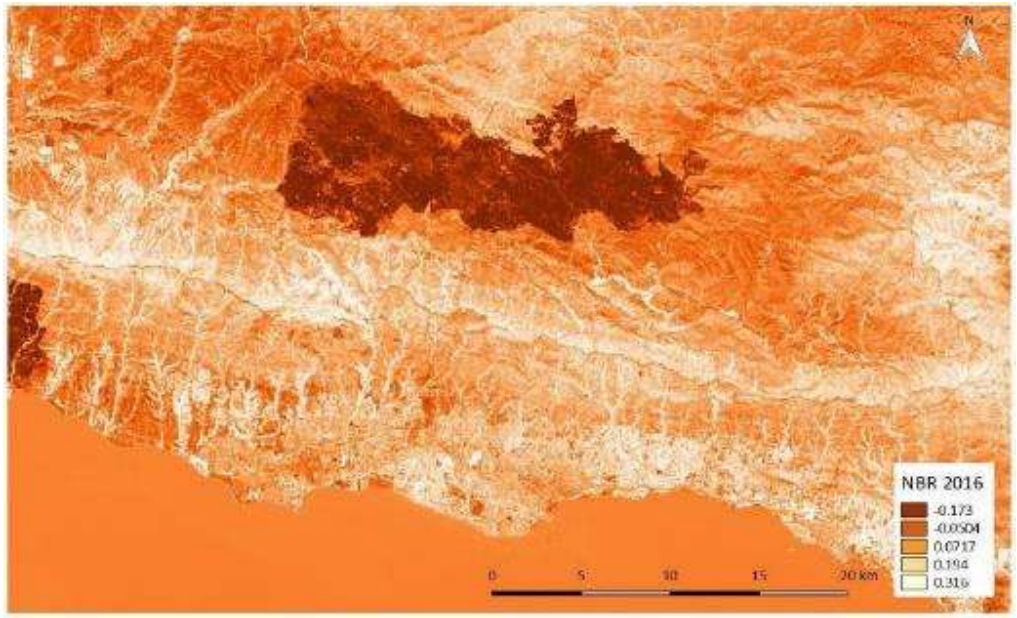
A series of 8 NDVIs, from Landsat images every other year, serves as an average for 16 years of biomass condition 2001-2015, subtracted from the NDVI for 2016, to calculate the anomaly for 2016.

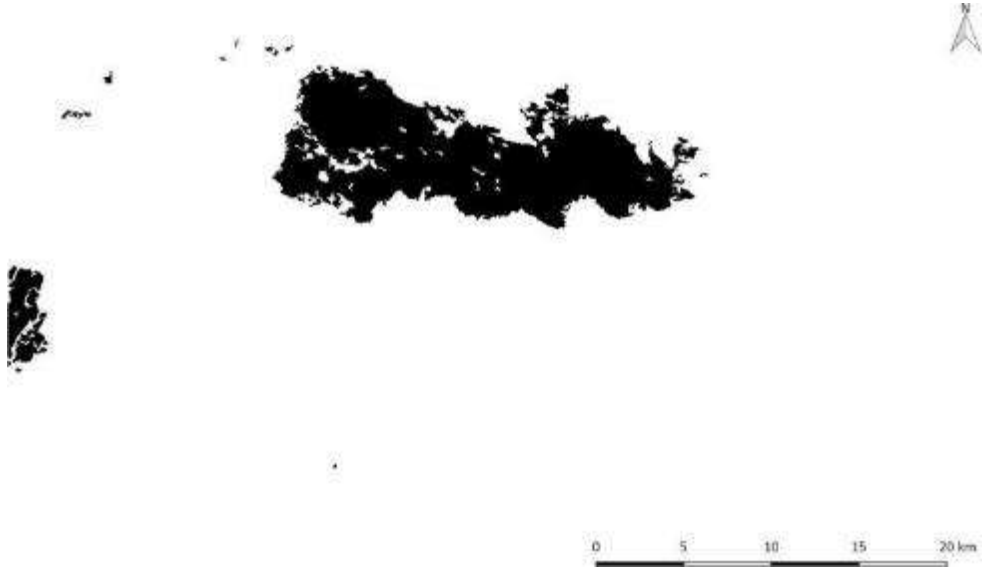
2001-11: Landsat 5
2013-2016: Landsat 8

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.



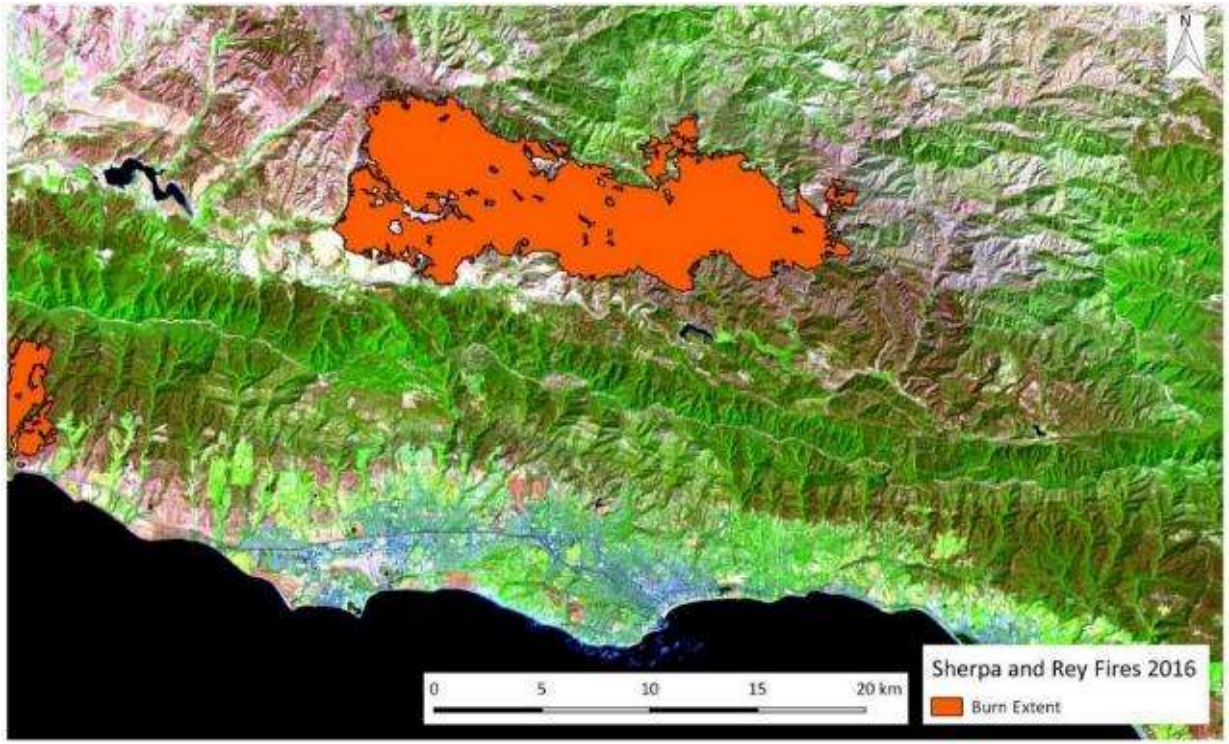




NBR and threshold images

NBR: The extent of the burned area is 125.4141 km²

overlain 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

5% for each of these sub-sections (total 25%)

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