Environmental change – monitoring with RS

The extended record of remotely sensed imagery enables:
a. Map current and past land cover
b. Monitor change e.g. since 1984 (Landsat 5 TM)

There are always changes, but more so with increasing population, resource extraction and impacts e.g. global warming.

These have various characteristics e.g.

a. long/short term

b. gradual/catastrophic

c. local/global

d. single event/cyclical

e. Natural / human induced

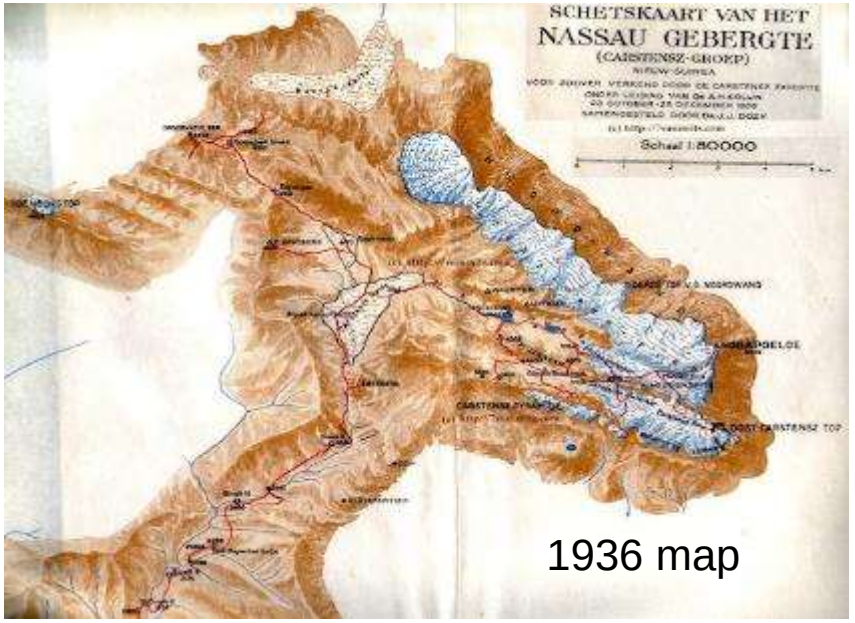
Landsat program (since 1972/1984)

Satellite imagery

- Minimal distortion
- Similar time of day =~ consistent lighting
- Consistent scale
- Multispectral data
- Calibrated system

Example from Landsat 5

Puncak Jaya, Indonesia 4°S, 137°E elevation m. asl: 4884m



1936 map


1972


Landsat 5, 1988


Landsat 8, 2017
Grasberg gold Mine – largest in the world, diameter 2.3 km

GEOG357: Environmental change exercise 2022

… the world is your oyster.
Pick a good example

Goal: identify an event or change somewhere in (1972) 1984 - 2022, and find/download/clip a before/after image … see below

This could also be before/after and then beyond (but not required)
e.g. before / after fire -> and also regrowth

Download and prepare images in Lab 5: Oct 24
Send your slides to me by Nov 2, 6pm

Give a 3-4 minute summary in class on Nov 8*
* Nov 10 if you can't make it to class on Nov 8

Google Earth Time Lapse 1984-2016

33 years of Landsat images; 55,000 images - 1 petabytes of data

https://earthengine.google.com/timelapse/

Note: mountain areas comparison are less effective due to seasonal snow

Ft. MacMurray: https://www.smithsonianmag.com/smart-news/google-earths-new-tools-shows-32-years-changing-planet-180961251/

Why not just use the sequence on Google Earth time lapse ?

https://earthengine.google.com/timelapse/

Skill testing question, and you might guess right:

1. GE uses only visible (RGB) i.e. no IR .. you know why that's poor

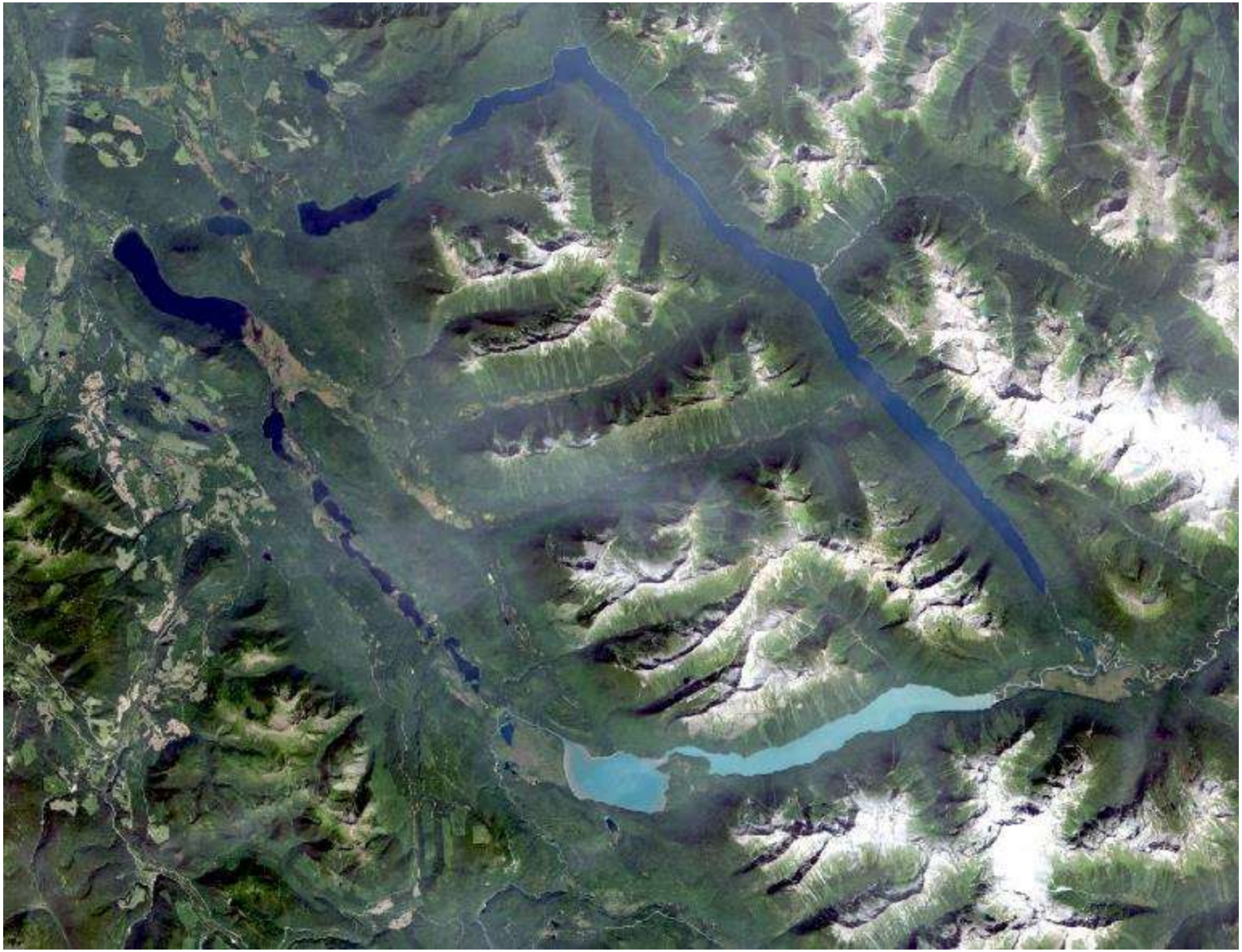
2. In cloudy climates e.g. mountains, GE images has clouds - snow

3. Mosaics may include Landsat 7 ETM … with stripes

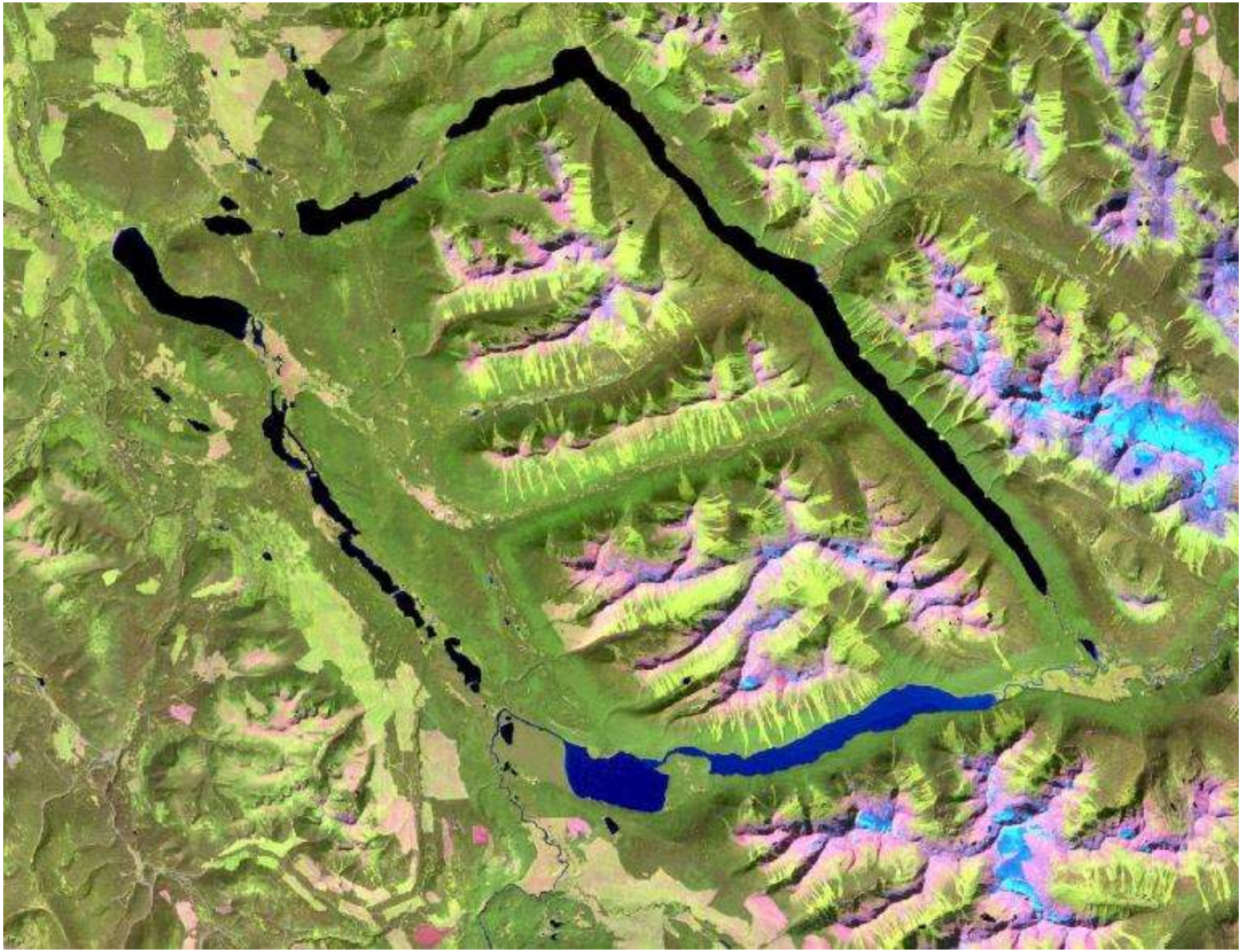
you can use GE timelapse to help identify an area of interest

The slides below include student examples from previous years

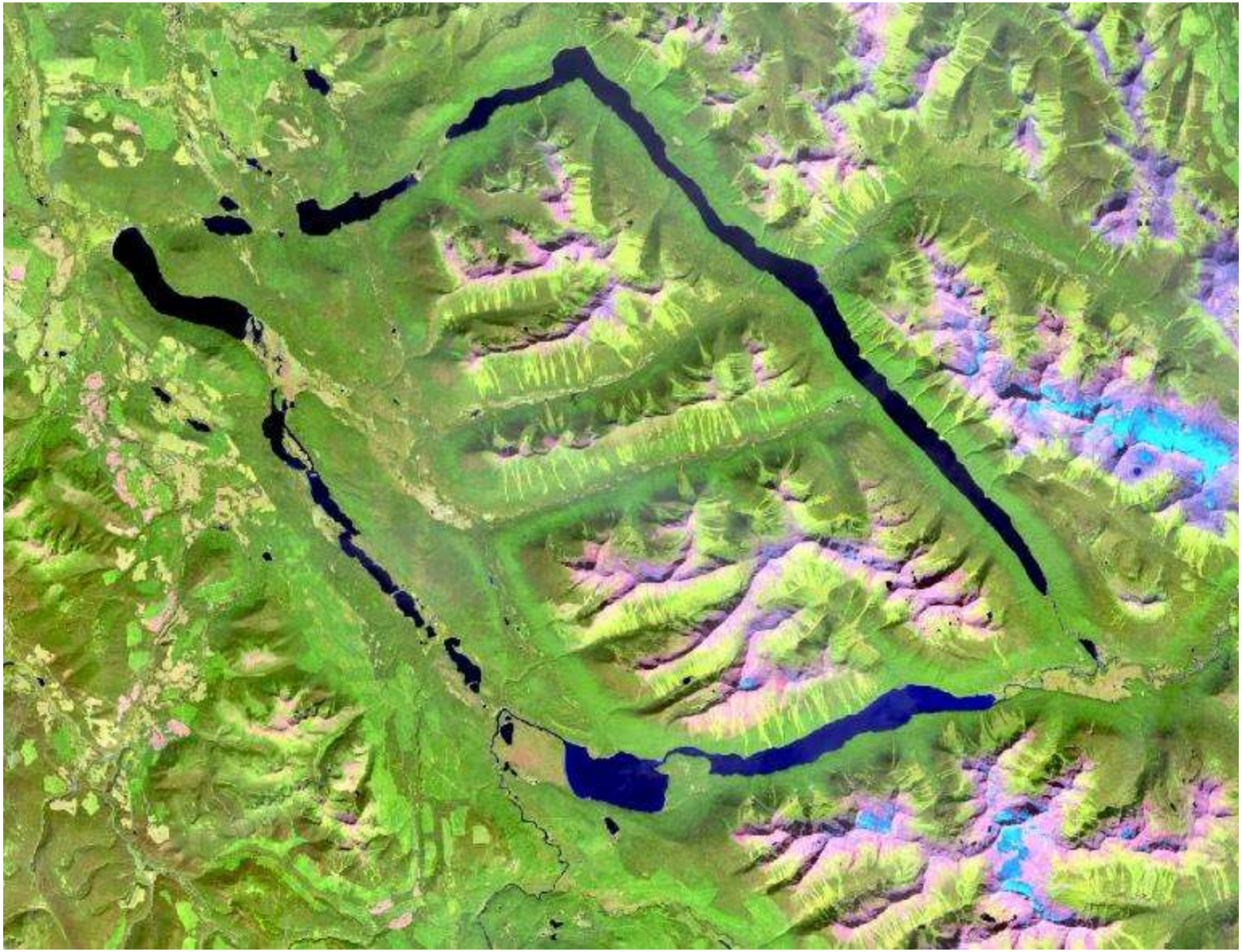
Bowron Lakes 19 August 2016 – visible bands (as in Google Earth)



Bowron Lakes 17 August 1992

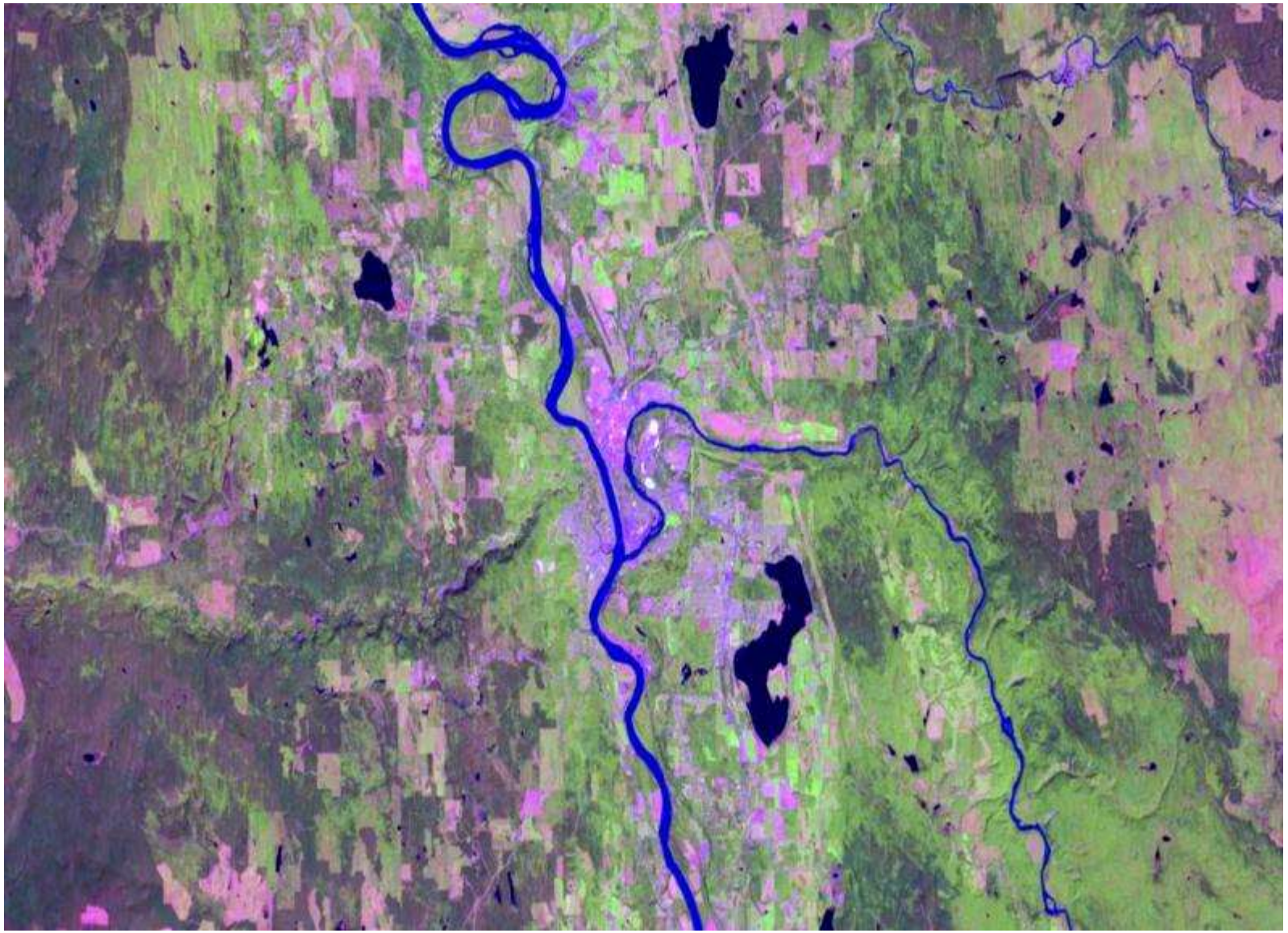


Bowron Lakes 19 August 2016

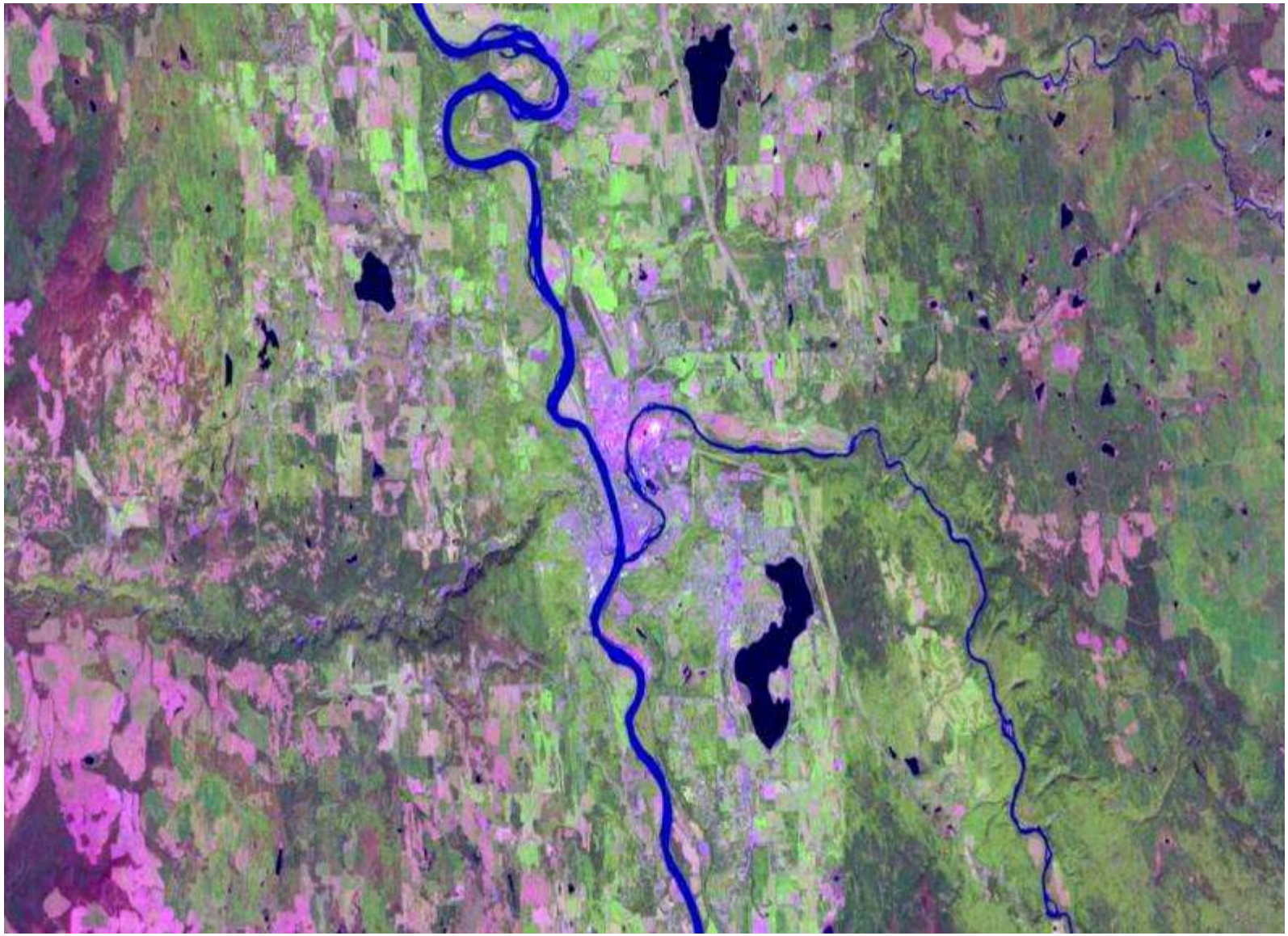


Changes not that dramatic …

Quesnel: June 2, 1985



Quesnel: June 4, 2009

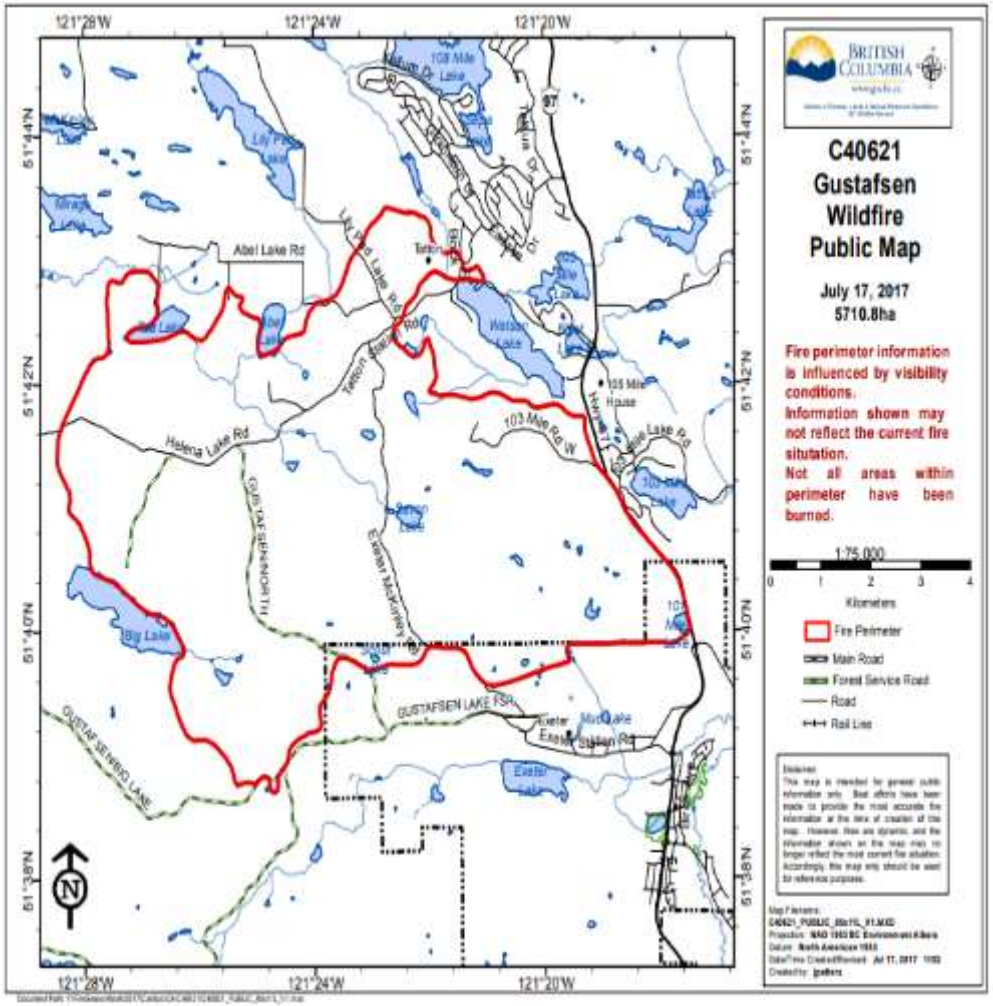


Gustafsen wildfire

summer 2017: started from **firearm use** July 6th, 2017, **burned 5,700 ha**. Out by July 30th, 2017.

Between 108 Mile Ranch and 100 Mile House (about 15 km apart), North of Kamloops and south of Williams Lake.

My parents ranch and my home is near Williams Lake

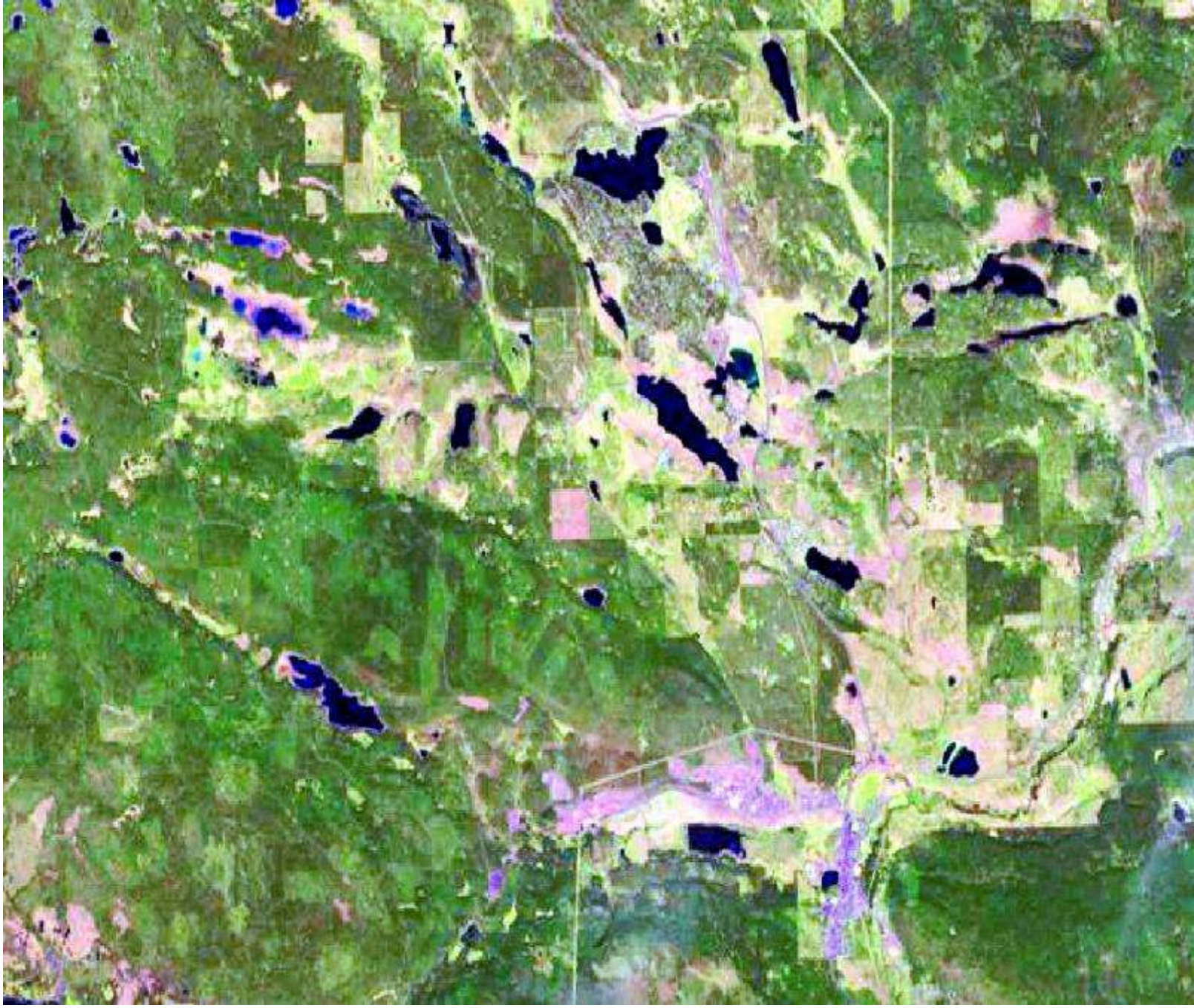


References:

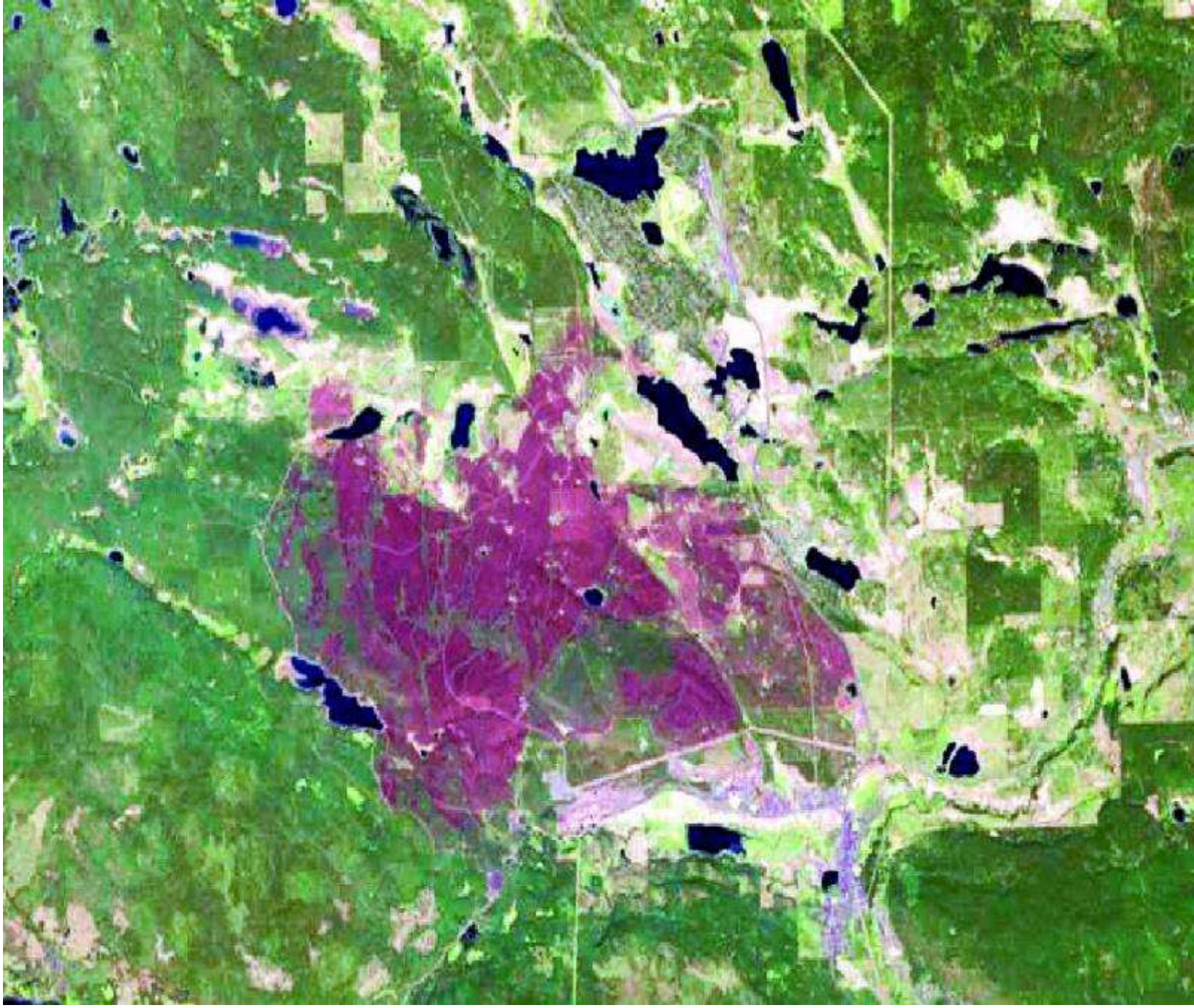
https://www.wltribune.com/news/2017-gustafsen-wildfire-was-caused-by-firearm-use-foi-documents-confirm/

http://bcfireinfo.for.gov.bc.ca/hprScripts/WildfireNews/OneFire.asp?ID=619

Landsat 8
August 19, 2016
South Cariboo



Landsat 8
August 22, 2017
South Cariboo



Selected sensors and available dates

Landsat 1-3 MSS 1972-84 (80m no mid-IR)

Landsat 5 TM 1984-2011

Landsat 7 ETM 1999-2002 (afterwards striped except for centre strip)

Landsat 8 OLI 2013->

Landsat 9 OLI 2022->

Sentinel 2 2015-> (higher resolution 10m)

ASTER 2000-> (no SWIR bands after 2008)

MODIS 2000-> 500m- 1km resolution

For visual display, these can be mixed/matched with similar bands

Change monitoring Considerations 1

Timing (day/season)

- Time of day affects horizontal sun angle (azimuth)
  … it is consistent with most satellites e.g. Landsats

- Time of year affects vertical sun angle /shadow (zenith)
- Image data should be collected near Anniversary Dates

- Seasonal phenology – can change by ±2 weeks each year

- Seasonal ground cover – vegetation, snow, crops

Change monitoring considerations 2

Frequency / type of Changes

- short term versus long term e.g. lakes, snow, crops
- local versus global e.g. retreat of arctic ice, desertification
- gradual versus catastrophic - e.g. soil slip v landslide
- cyclical changes – urban, agricultural and forest
- Weather is NOT interesting and clouds are the enemy

Dubai has the world's largest artificial island, Palm Jumeirah, which is shaped like a palm tree and adds close to 50 miles to the city's coastline. The island is packed with luxury hotels, beachfront villas, and apartments.

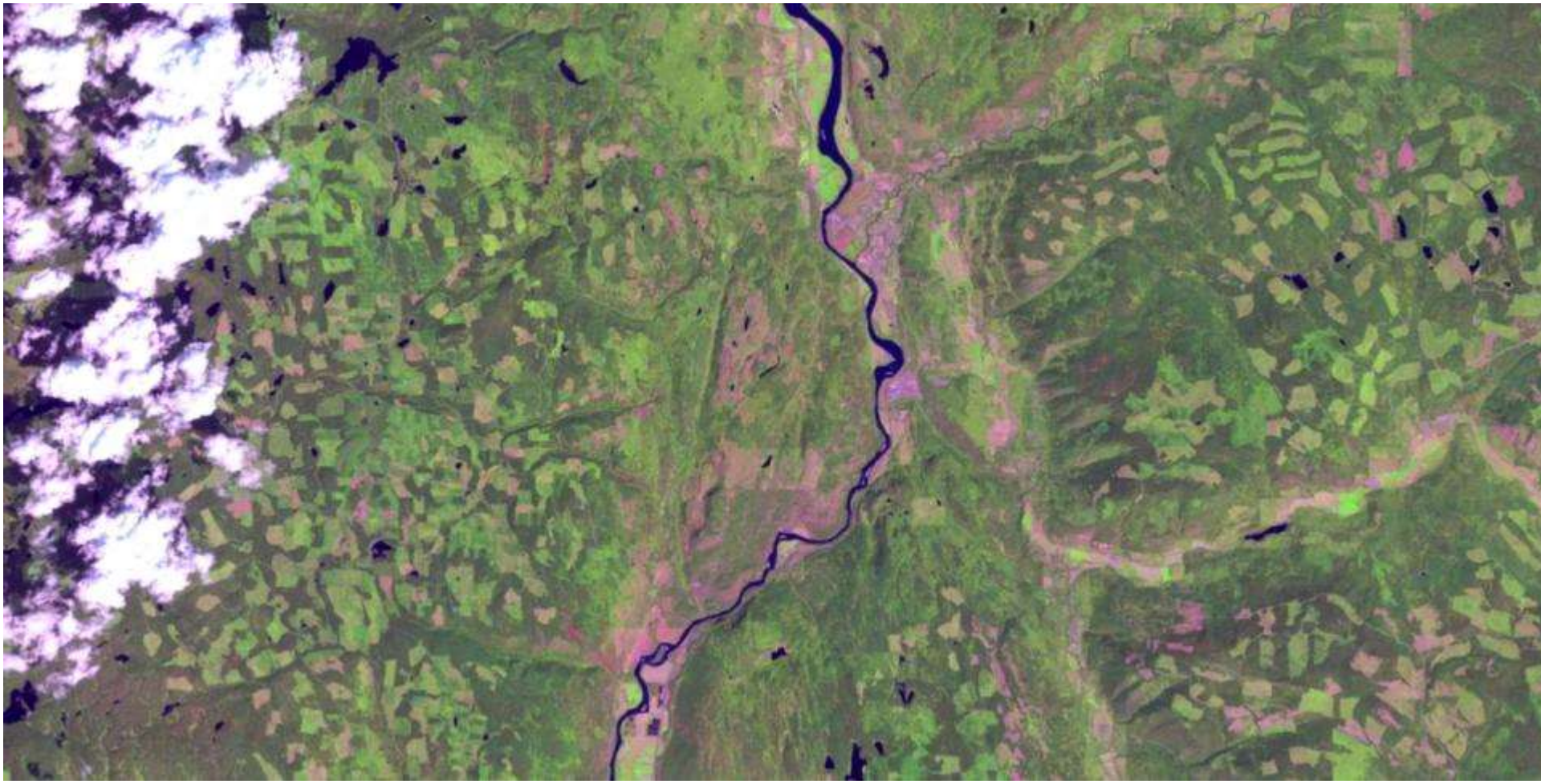
Dubai

August 24, 2001

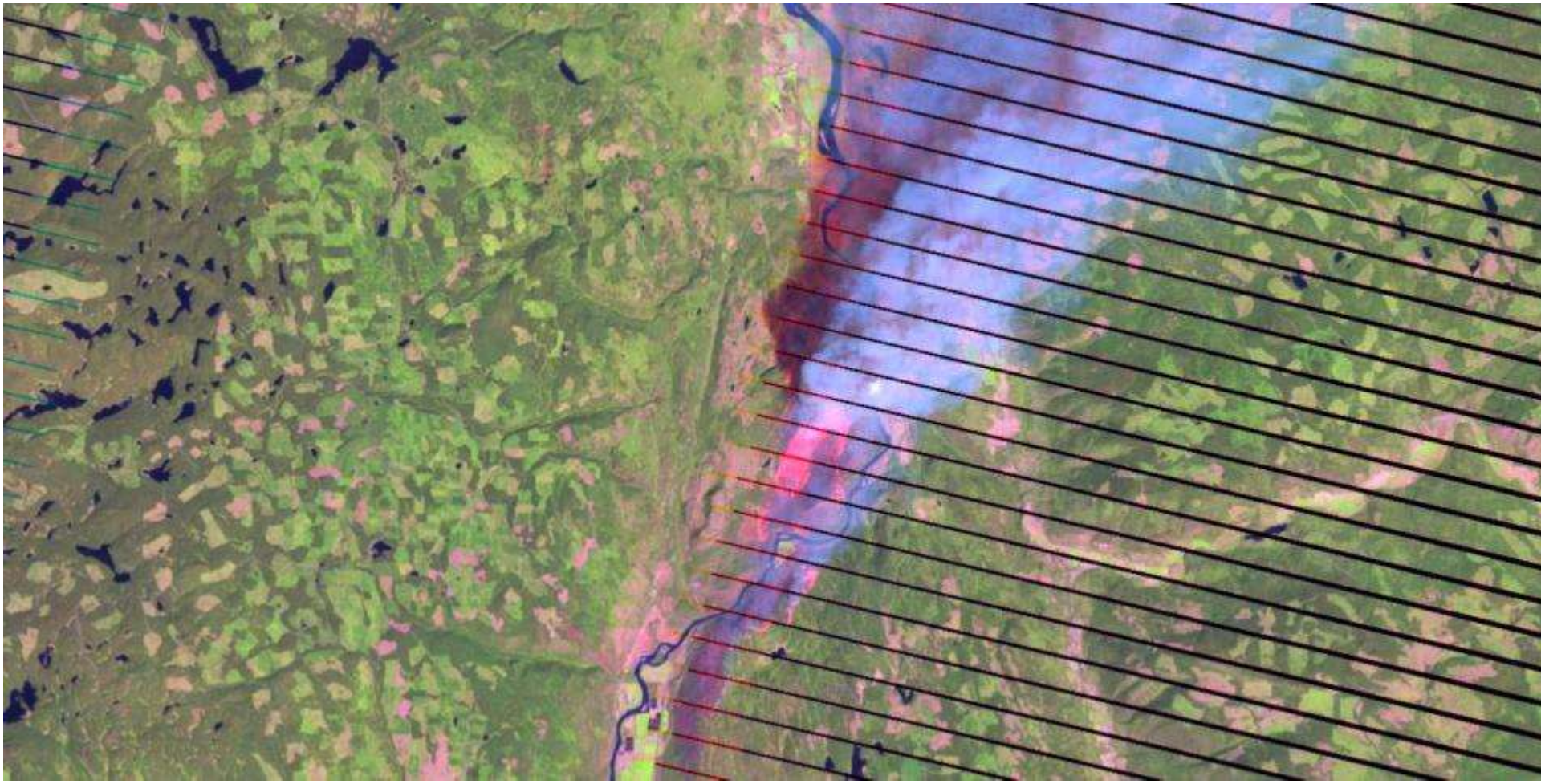
Dubai – best to find similar dates by year -> **August 23, 2017**


naparte Lake
Bonaparte
Provincial
Park
Barriere
Louis
Creek
McLure

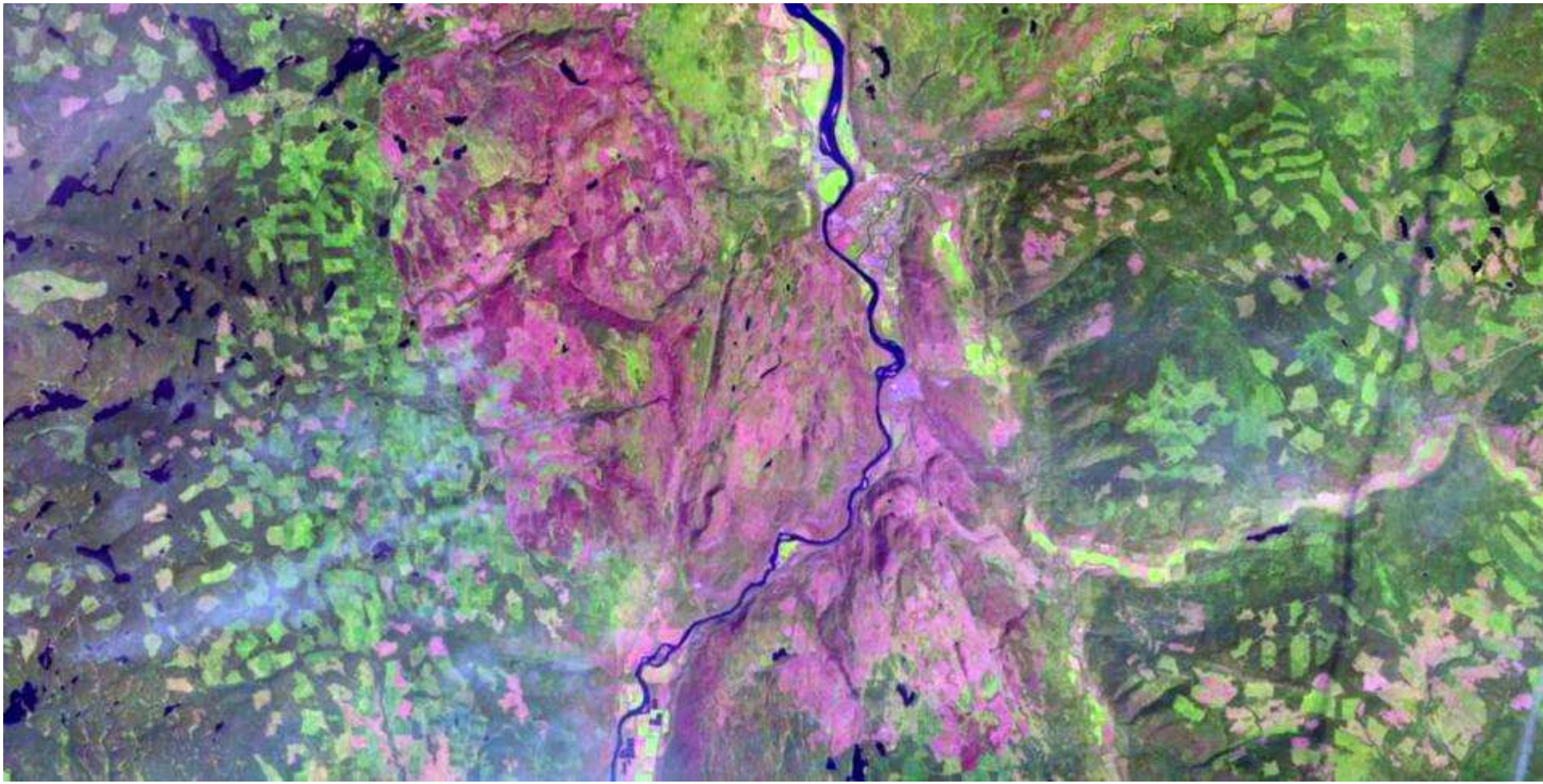
Barriere, BC Pre- and Post-2003 Forest Fire



10 July, 2001



01 August, 2003 – DOH!, Landsat 7



Clue is in the very bottom right

26 July, 2004 – hey, what's that black line?

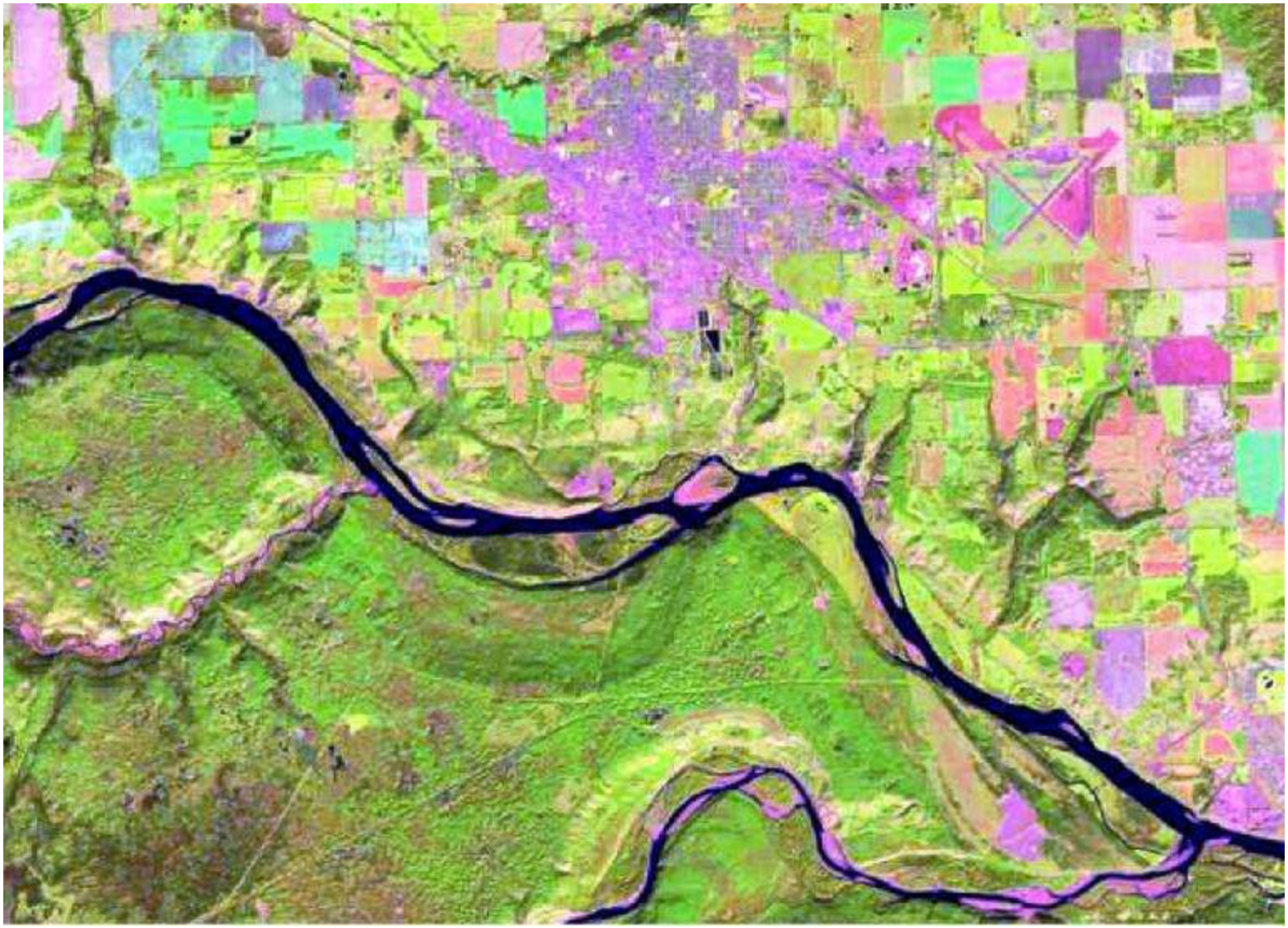
Three Gorges Dam, China

Dam location: 30°49’ North 111°00’ East

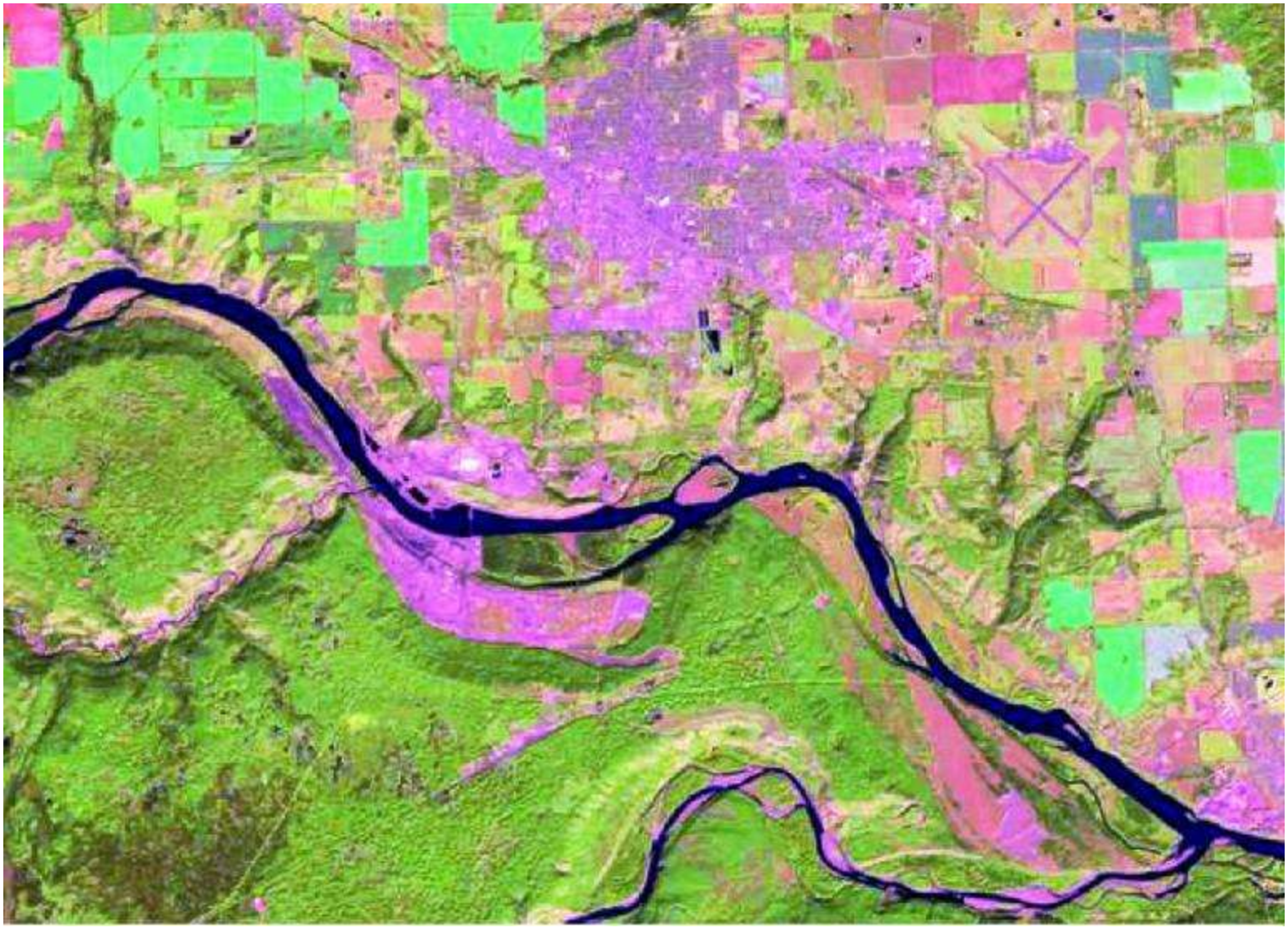
http://www.businessinsider.com/chinas-enormous-three-gorges-dam-is-turning-out-to-be-a-huge-mistake-2012-4

Environmental Change

Site C dam and Fort St. John August 2013



Site C dam and Fort St. John August 2017



Environmental change assignment (10%)
Summary of deliverables

powerpoint slides (best to avoid backgrounds)

1. Intro slide: general location, describe the event / change – could include a ground photo (or bing / google map)

2. Before image with date/year

3. After image with date/year – include a scale bar

x. Possible extra image as needed

Some themes: forest cover, glaciers, urban development, volcanic eruptions