Lab 6: Environmental Change assignment (10%)
Due: Wednesday 25 October

A. Pick your area from personal knowledge/interests / google maps, earth time lapse etc..
B. Don't start downloading before you find two good images for the before/after change
 …Finding/selecting the before/after scenes may take the most time in the assignment

1. General notes:

Cloud cover: The two images should ideally be cloud-free; these are easier to find in drier locations. I suggest searching for 0-5% (max) - remote cloudy places e.g. Iceland, Greenland, and equatorial regions have fewer options

Years: you are looking for change – could be long-term, but it doesn't have to cover the entire 1984-2023 period; it's better to have a good contrast than a long period.

Dates: The ideal is the same general time of year. A smaller year span but with closer date / season is likely to show better. Images should usually be free of seasonal snow.

In Canada, a date range might be June 1-September 30 (July 30-Sept 15 in mountains); adjust for different areas – winter images in Canada and most places are not useful.

Area relative to scene edges: Some areas will be nicely placed in the middle of an image, while others may be on the edge, and may not fit your screen as well. Technically if it's in Canada, there is >50% side scene overlap, so it could be on the edge of one scene, and the middle of another, in an E-W direction. Scenes are 'cut' along a N-S swath, so some places may be tough to get images simply because they are always near a 'join' or scene top/bottom edge. In such a case, you might be better to pick another area.

2. EARTHEXPLORER: image view/download

https://earthexplorer.usgs.gov/

Note: Firefox may block pop-up windows which are essential here, so either use Chrome or watch for pop-up signs;
and check 'settings' to ensure it always asks you where to save downloads ..

You will need to fill in location, search criteria, and Data sets – I pick Datasets first:
Data sets: Landsat -> Collection level 2 → level 1

It seems you can check all L8/9, L7 and L5 but you should only pick one for each search, as it will only search for the first one checked
Change the months from 'All' to better suite your area – e.g. summer (July-September)
You could do all years with Landsat 5 if 1984-2011; or Landsat 8/9 2013-23 if your before/after are within one of those time ranges, but you may wish to be more selective.

Search criteria

Location
Enter feature placename (after picking US or World), click on feature if it shows up -
Only 'major features' will show up e.g. Quesnel, but maybe not Hixon - then 'show' .. it
should show up with location; zoom in as much as possible to your area as needed
click on 'use map' = map area will turn red (it will search for anywhere covered by this)
Or draw a polygon around the area you want, click, click and end with double-click to
close the polygon, or a circle – define centre and radius

Data Range
Search from: insert your start date (day/month/year) and end date – no need for
example if you want the whole range of Landsat 8/9 (2013-2023) or L5 (1984-2011).
Search months: Change to summer months as needed (except for tropical areas)

Cloud cover – move slider from 100% to 5%

Click results – brings up the search results – hopefully 5-50 but maybe more
click on scene image thumbnails on left for zoom view .. and again on the new enlarged
image (we've found this does not always work with some recent Landsat 9 images). You
need this expanded view to check for clouds and quality

Check the path and row for your images, and click on the first icon (show footprint) – this
checks that your chosen site is covered
It will be ideal to pick two images from the same path/row
You will need to do all this twice for your 'before' and 'after' images
when you have the best choices (see below) - You will need to login to download

You may want to change your browser options/preferences if it goes straight to the
'downloads' folder. Settings -> downloads. Scroll down to Downloads and check the
button for 'Always asks you where to save files'.

3. Scene download

After selecting the scene download option (5th icon):
This brings up a new window asking for a user name and password, if you didn't login. –
you could also login when you first start the webpage
The class group username is: **geog357**
The password is**: unbc4thenorth**

Select the download icon and then the GeoTIFF (Natural Color), the first listed download option after the level 1 product bundle data at the top which is ~ 100 times bigger in size. **do NOT download the Product bundle** dataset (although you will choose this option for your project). The JPEG options are inadequate as they are not georeferenced.
The 'natural colour' is a SWIR-NIR-Red composite scaled to 8-bit display layers.
Save the download to your folder. Also download/save the Thermal GEOTIFF as this is relevant to tomorrow's lecture topic – and we may use it in the 5% quiz later in the term.

4. Viewing/subsetting in Catalyst

Start **Catalyst** and open your two colour TIF files: one for before and one after the event. The geographic features should perfectly align – though maybe not the scene edges.
You could also load your two thermal images for comparison with the colour images.
Change your display area to be ~ 3 x 2 ratio 'landscape' image ... zoom as needed, but not so much that you can see individual pixels

Zoom/pan to an area of interest that should fit on a screen without having to pan; as a rule the dimensions could be 1000 x 1500 or max 1200 x 1800 for a 'landscape' format which will best fit the final powerpoint frame; don't zoom in so much you can see the pixels
… enhance as needed, and so the two images match. Include a 'marker feature' if there is one e.g. lake, river, town for context, and when satisfied, Choose:

Tools-> Clipping/subsetting .. check the rasters box in the new window, and enter a new name for the clip file .. it should be .pix format
On the right panel, change definition method dropdown to **Use Current View**
The red inset below should now show your chosen area, and click on Clip to make it so

Repeat for the second image, ensure it's for the same area / current view - don't move around – and clip that one using the same current view or you can be doubly sure to match the clip by choosing 'select a file' for definition method and browse to select your first clip as the file.

Load to view and do the same clip for your two thermal images – view them for interest

New project – using only your clipped images

Start a new project again, and load ONLY your two clipped colour images
enhance as needed so they match as closely as possible (except for the changed areas !)

file-> export map to save each image as JPG (change 'save as type' dropdown)
Select JPG format, and display resolution to 150dpi
For each one, make sure you have the file you intend to be exported. To be sure, turn the other off and highlight the intended file when you export.

Double-check your two exported jpg files are what you intended – open in a graphics viewer by double-clicking on their icons in windows file manager.

You can also export your 2 thermal images to .jpg files – we'll use them later.

5. Adding to powerpoint

Open a new powerpoint presentation with 2-4 blank slides
You don't need the thermal images in this exercise

Insert (picture) - each colour image into a blank slide; insert only, don't move them around or adjust, or you'll never get them to realign …

Note: it usually fills the slide; but if they are either too big or small, then use:
 - right-click on an image -> size and position option to modify size - use EXACTLY the same parameters for each of the two slides

Add feature location / date / year on each slide (insert-text box), and a rough scale bar on one image – in power point, you can use a straight line and add suitable distance by text

Create an extra introductory slide to describe what we are seeing in the change

The goal at the end of the lab is to have your pair of images 'ready to go' in the ppt file. You can add the text and explanation for submission by October 25, and for the class presentation on October 26.