

Assignment 1 – GGS416 Satellite Image Analysis (SAI)**Due February 8th 2026**

Using the same Landsat workflow demonstrated in Week 2, you will compute and map multiple spectral indices for a chosen area. This will help you understand how heterogeneous band combinations highlight varied land surface properties (e.g., vegetation, water, built-up areas, moisture, etc.).

This assignment aims to reinforce the core ideas from this week's class, to do the following:

- Retrieving and working with satellite imagery using the Microsoft Planetary Computer and STAC-based workflows
- Understanding Landsat band combinations and their relationship to land surface properties
- Applying mathematical band ratios to generate spectral indices
- Interpreting NDWI, NDBI, NDMI, and NBR as indicators of vegetation, water, built-up areas, moisture, and burn severity
- Visualizing and labeling geospatial raster data for analysis and presentation
- Exporting processed satellite imagery for use in reports and publications
- Developing reproducible geospatial analysis workflows in Python using Jupyter/Colab

1. Loading and inspecting your data (10%)

For a new location of your choosing, utilize the Microsoft Planetary Computer code from Week 2 to retrieve a cloud-free Landsat image. You must use `pystac-client`, `odc-stac`, and the other packages we covered, but you will need to update the date range and bounding box. Adequately label your map, open it in your Jupyter Notebook so it is clearly viewable for grading, and then write code to export it to a .png.

2. Spectral indices (60%)

As you have already learnt how to create the NDVI by re-arranging the selected bands, you must now create three more spectral indices maps for the following list:

- Normalized Difference Water Index (NDWI)
- Normalized Difference Built-up Index (NDBI)
- Normalized Difference Moisture Index (NDMI)

Explain what each index highlights (1 paragraph for each).

3. Wildfire detection (30%)

Similar to above, research a major wildfire location for a specific date. Download a suitable Landsat image, and apply the Normalized Burn Ratio (NBR). Suitably label your plot, show it in your notebook, and export to a .png file.

Explain what the index highlights (1 paragraph).

Submission format

Please write your analysis in a Google Colab notebook and then use the print function to save it to a .pdf file for submission on Canvas. Without submitting your files like this, you will receive a 50-point penalty

to your overall grade (as you need to provide both the code and the answers/maps). Please make sure your printed code outputs and maps are clearly visible for grading.

Grading rubric

Component	Points
Part 1: Data loading & inspection	10
Part 2: Spectral indices	60
Part 3: Wildfire detection	30

The Mason Honor code applies. Please also remember to follow Mason AI Use Policy.