Welcome to
Intro to Raster Data with *QGIS*

In 3 sentences or less, answer out loud or in the chat:

- What is your name?
- What program/department are you from?
- What brought you to the workshop today?
- What do you hope to get out the workshop?

2026

University of Victoria Libraries

Intro to Raster Data with *QGIS*

2026

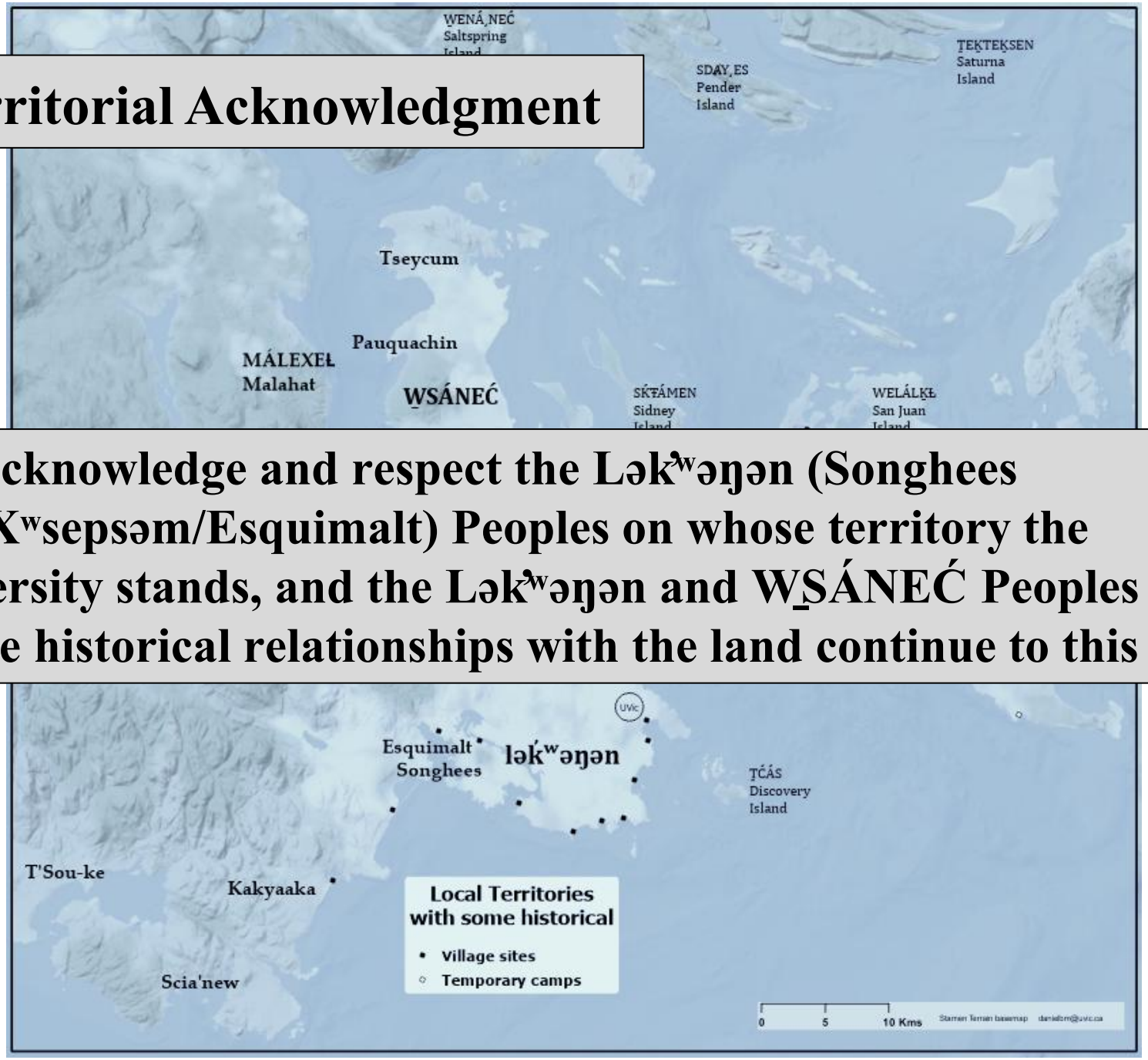
University of Victoria | Libraries

As per the instructions when you signed up:

QGIS downloaded on your computer?

If not, please come back to the workshop another time!

Territorial Acknowledgment



We acknowledge and respect the Lək̓ʷəŋən (Songhees and Xʷsepsəm/Esquimalt) Peoples on whose territory the university stands, and the Lək̓ʷəŋən and W̱SÁNEĆ Peoples whose historical relationships with the land continue to this day.

Learning Objectives

- **Distinguish** between GIS and other web map interfaces
- **Identify and navigate** key *QGIS* interface elements

  (Layers panel, Menu bar, Map view)
- **Define** the basics of **raster data**
- **Review**(?) basics of **vector point data**
- **Explore data layers** using tools such as identify feature

Outcomes

Using *QGIS*, participants will:

- **Load and display** NDVI raster data
- **Import locations.csv data** and add to it
- **Sample raster values** with location.csv

What is a Geospatial Tool?

- Software/hardware typically designed for specific tasks or functions such as mapping
- Web-based mapping tools, very limited spatial analysis

Not all geospatial tools are a GIS!

What is a Geographic Information System (GIS)?

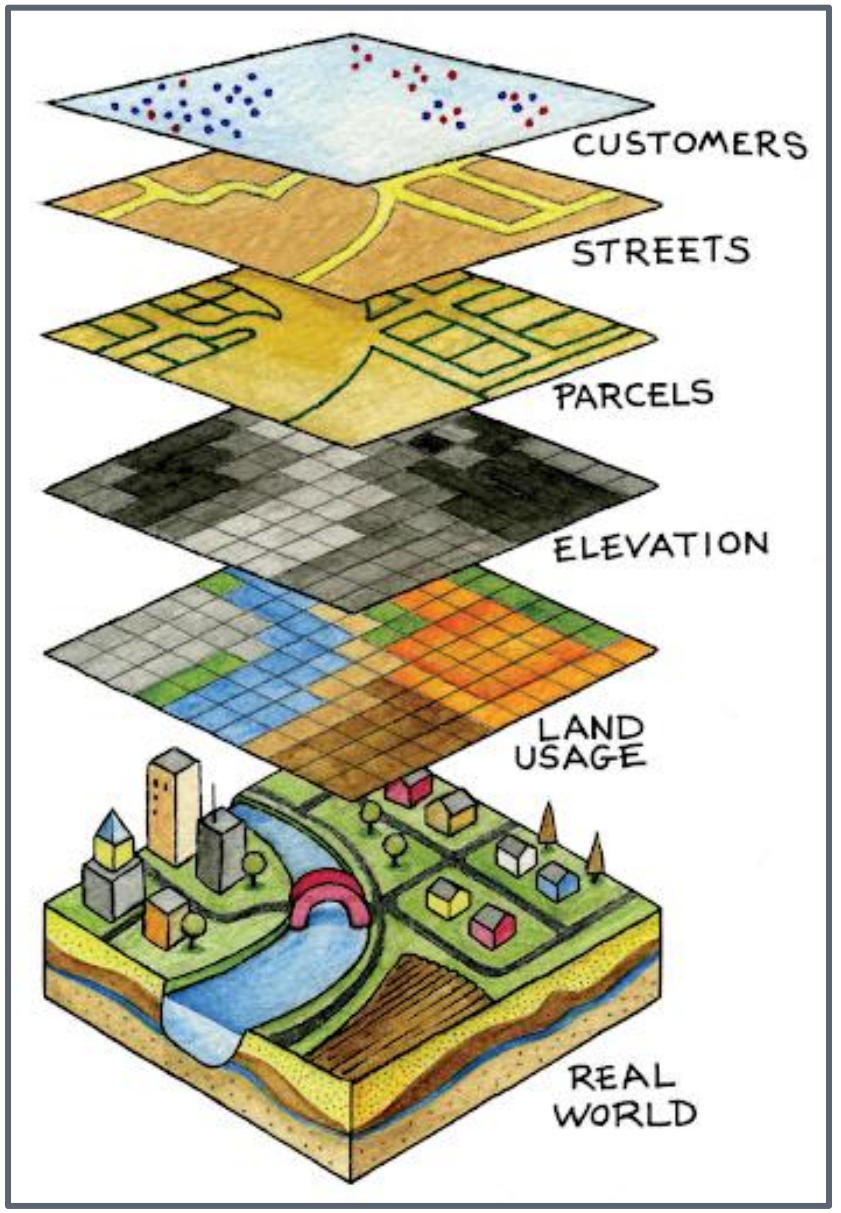
- A comprehensive system which encompasses a range of geospatial tools for spatial modelling and analysis

What is GIS?

GIS can:

- Create
- Edit (manipulate, sub-set, etc.)
- Query
- Manage
- Analyse
- Store

data



GIS and Mapping - Wyoming County, PA, USA

Maguire, D.J. (1991). An overview and definition of GIS. *Geographical information systems: Principles and applications.*

Chrisman, N.R. (1999). What does 'GIS' mean? *Transactions in GIS* 3(2)

Desktop GIS: *Proprietary*

Desktop GIS: *FOSS*
(Free and Open-Source Software)

GRASS GIS

OSGeo

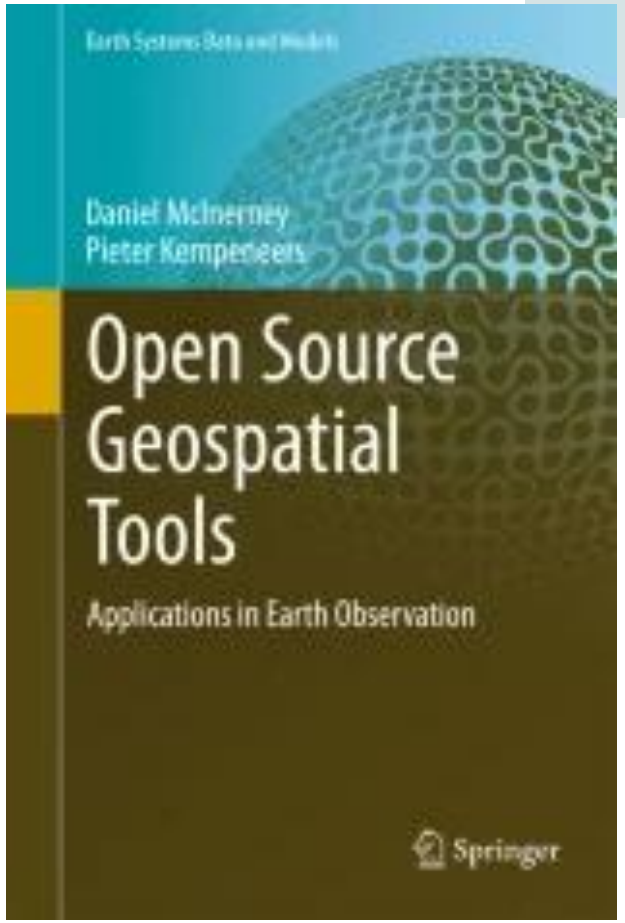
gvSIG

QGIS

QGIS

R

SAGA
System for Automated Geoscientific Analyses

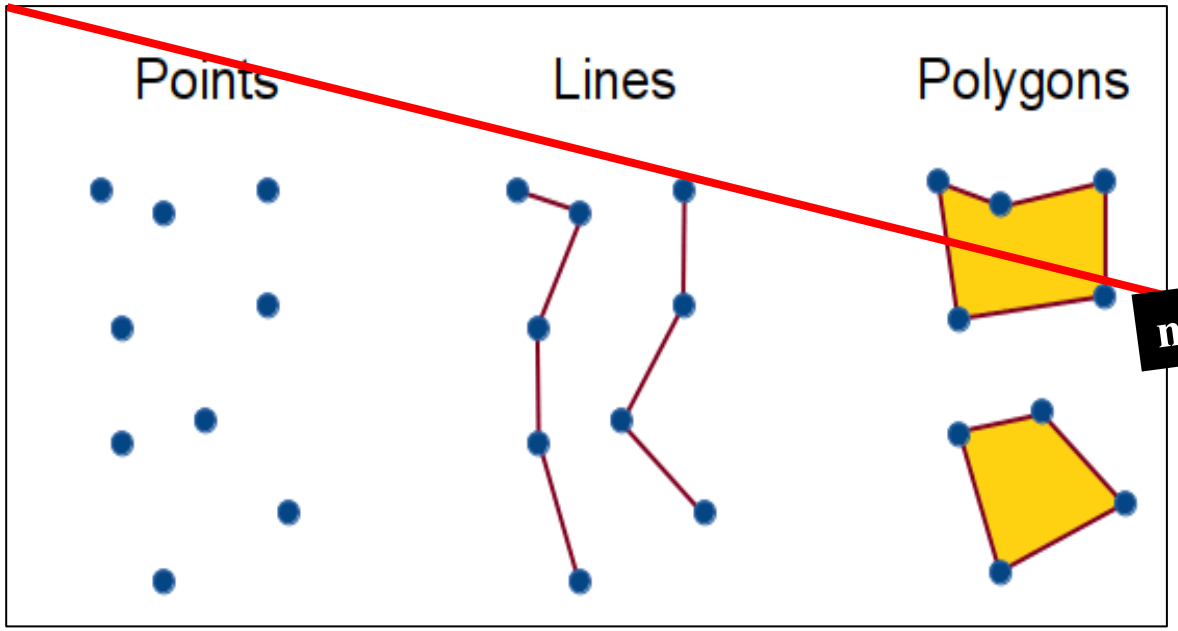


Questions?

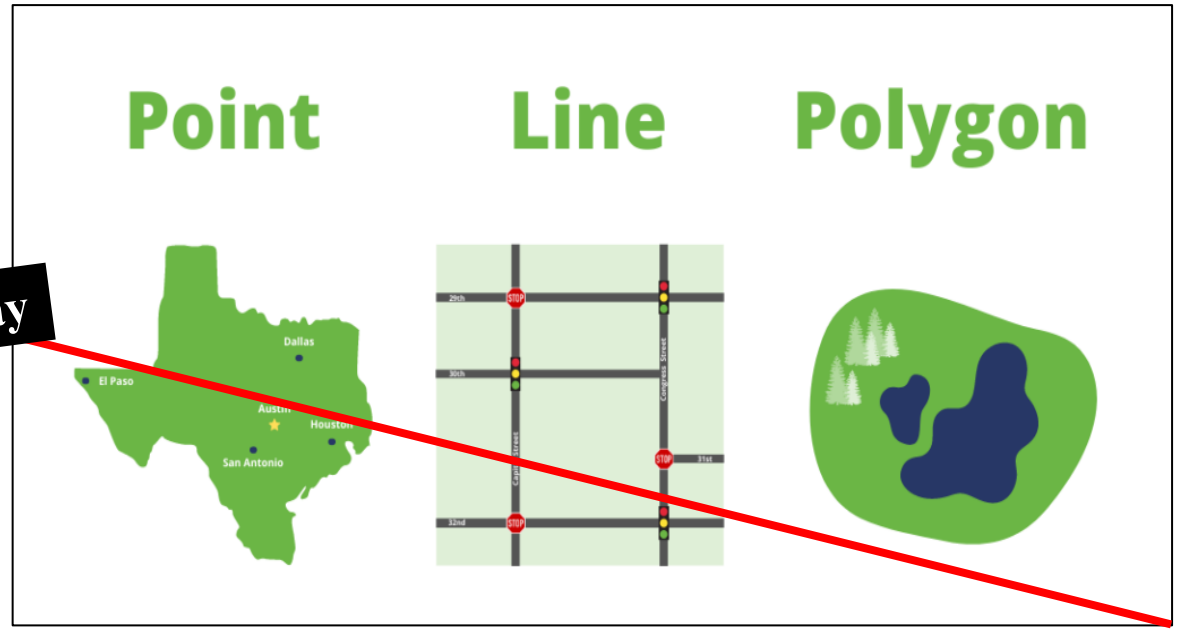
Geospatial Data: Two Types

Vector

- Sometimes no accompanying data values



not today



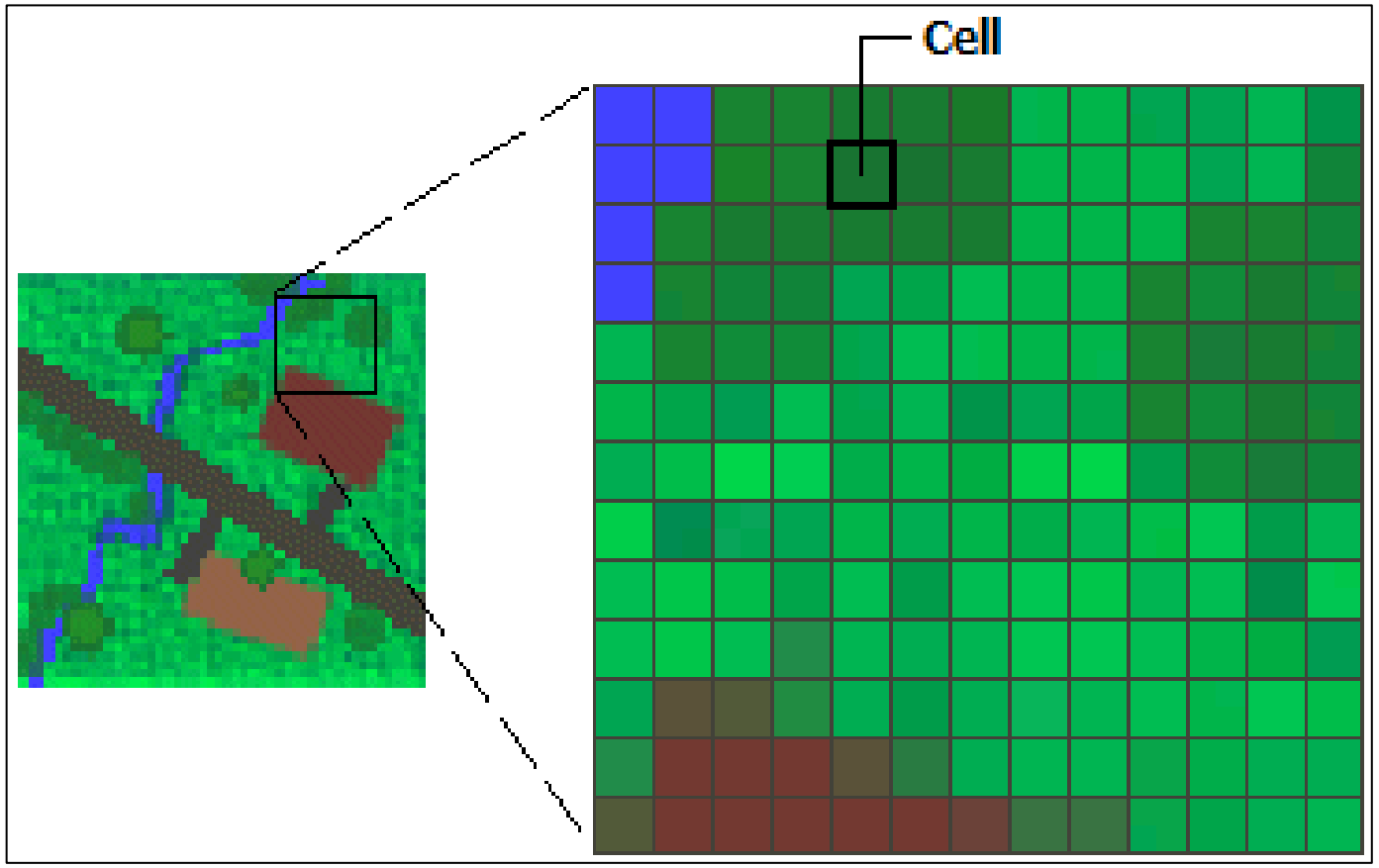
Visualizing Terrain in ArcGIS Pro

Spatial Data Models - Geographic Information Systems (GIS) - LibGuides at University of Connecticut

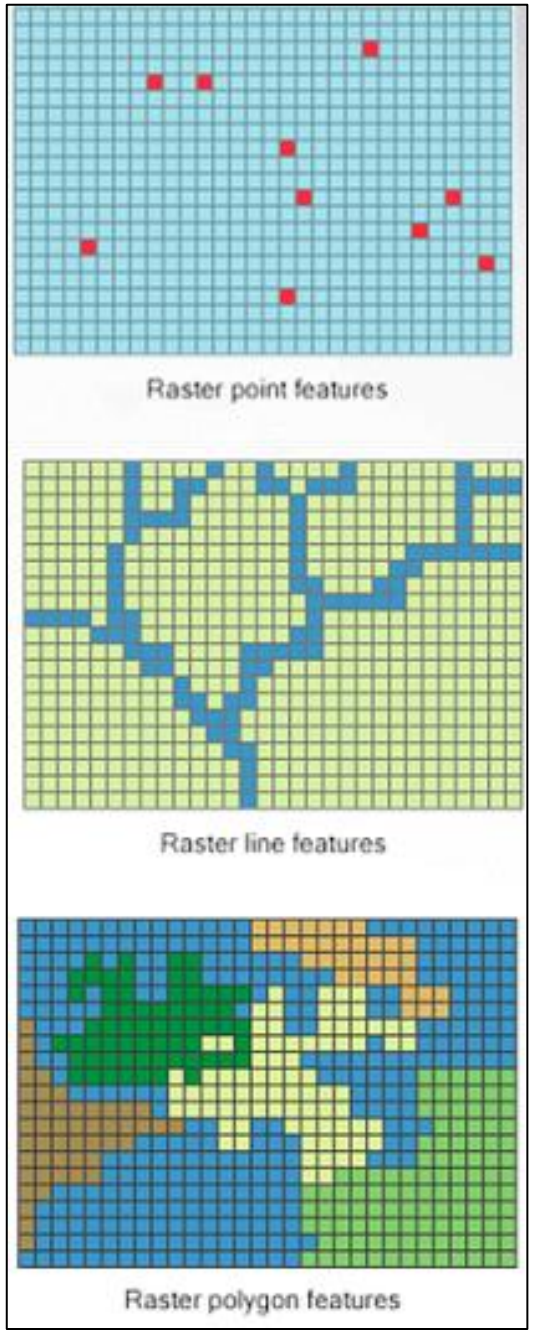
Geospatial Data: Two Types

Raster

- Represents Earth's surface as a grid of pixels or cells
- Each cell has numeric value(s)



https://desktop.arcgis.com/en/arcmap/latest/manage-data/raster-and-images/what-is-raster-data.htm



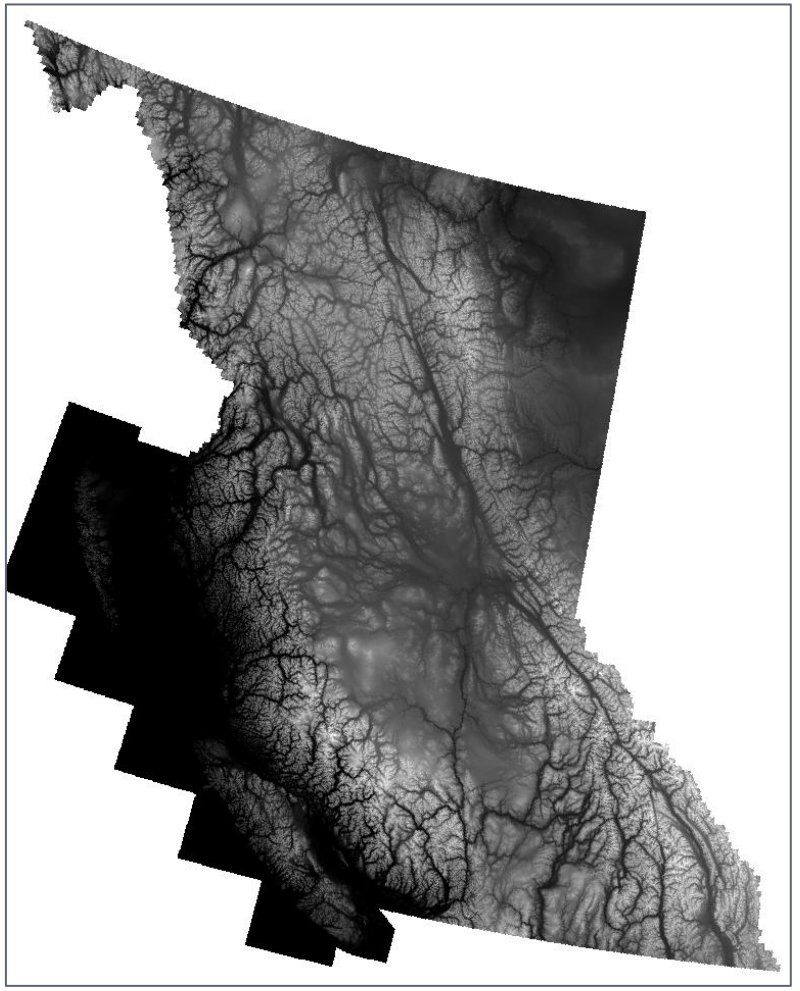
https://news.north.io/en/what-is-geospatial-data

Raster Data

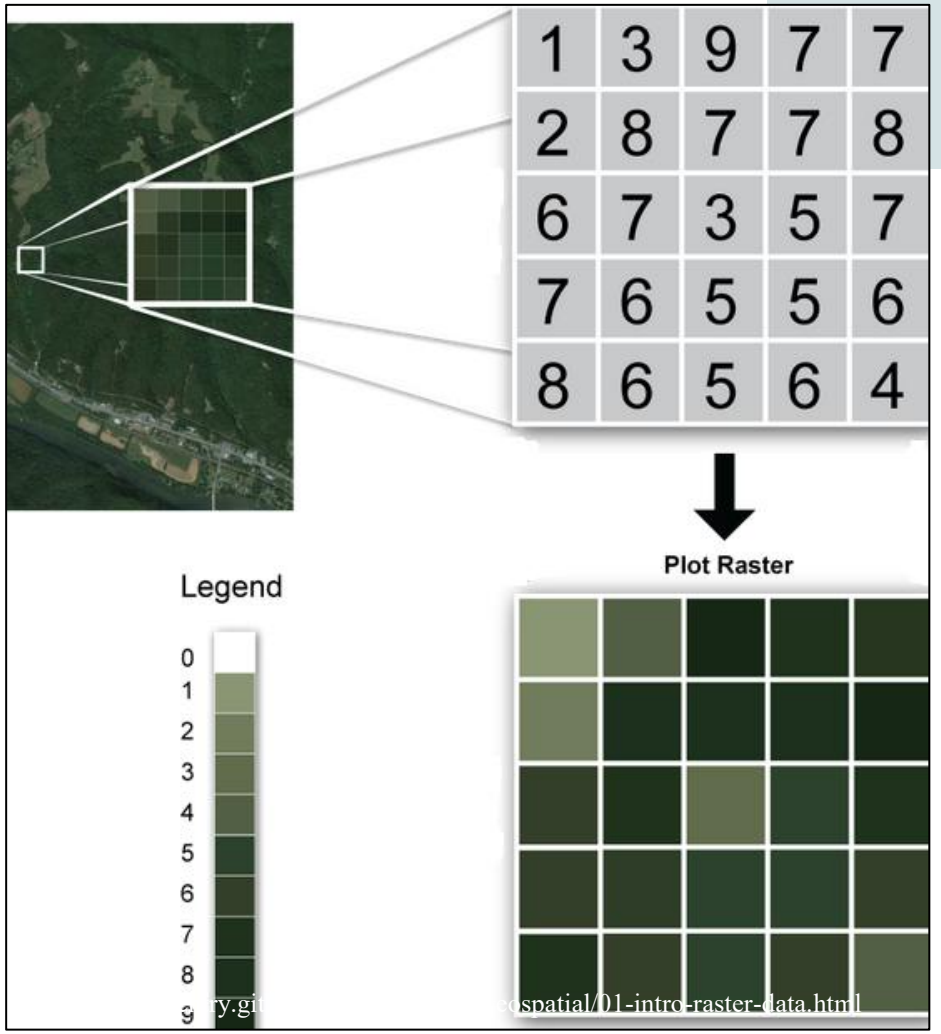
- Represents Earth's surface as a grid of pixels or cells
- Each cell has numeric value(s)
  - Elevation
  - Land use
  - Rainfall
  - Temperature
  - Reflectance, etc

Why is raster data useful?

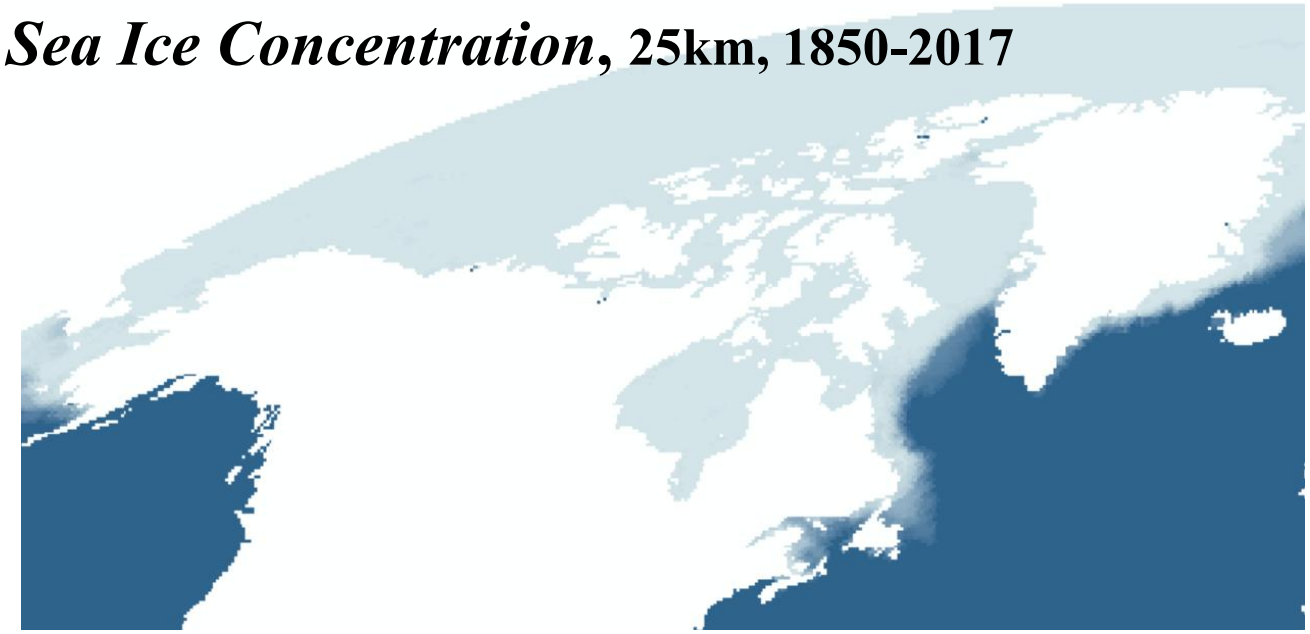
- Patterns & trends
- Calculations
- etc



Hectares BC: Elevation



Sea Ice Concentration, 25km, 1850-2017



PolarWatch ERDDAP
Easier access to scientific data

1850 (Jan15)

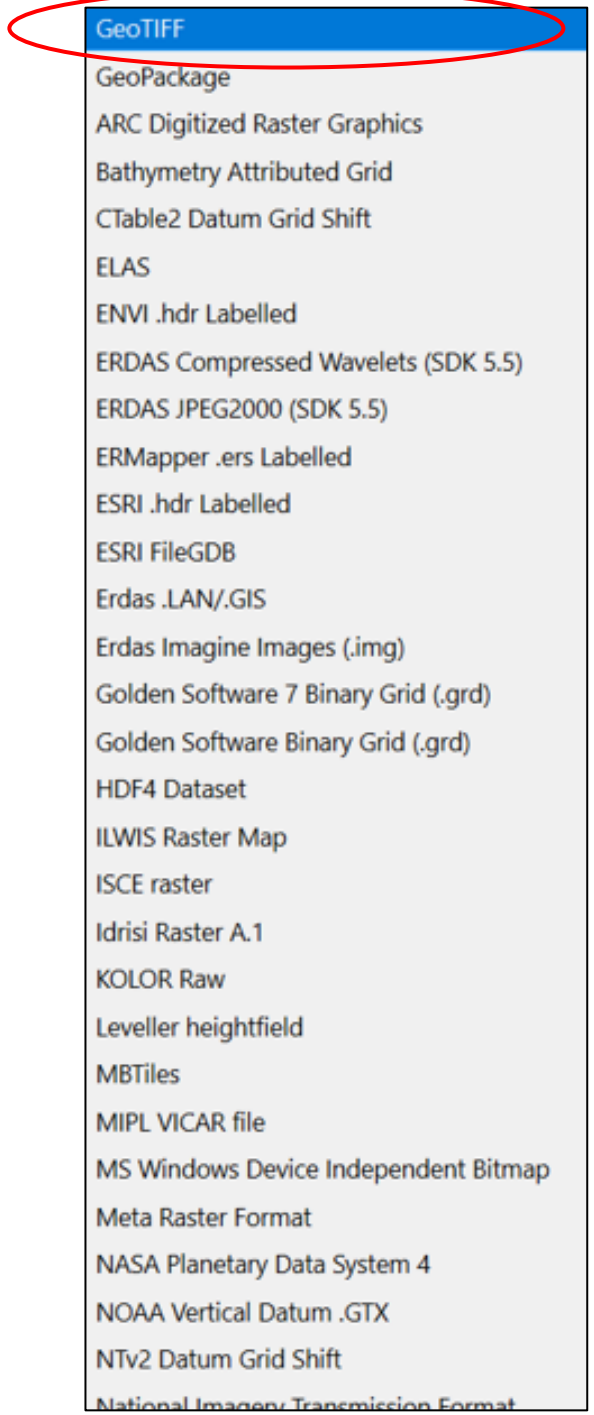
via ArcMap Loximuthal Sphere projection (EPSG 53023)

2017 (Jan15)

https://polarwatch.noaa.gov/erddap/griddap/nsidcSeaIceConc1850.html[15]

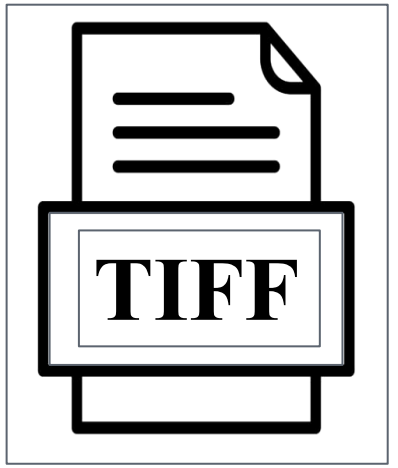
Raster Types

Many, many raster types…



Raster file type for this workshop - GeoTiff

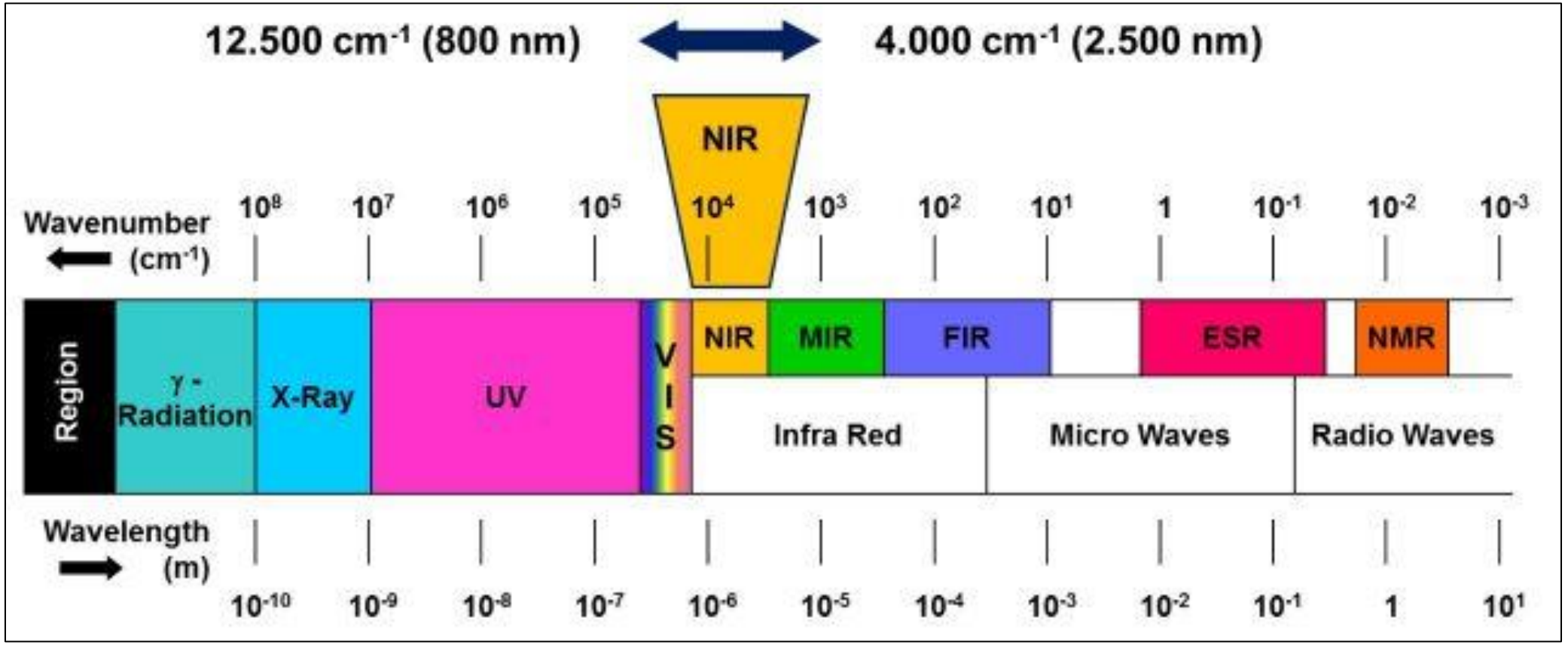
- **GeoTIFF** is an open-source file format for storing **raster data** with geospatial information (coordinates, projections)
- Combines **data values** and **location info** in a single file, allowing the file to be placed geographically accurate
- Commonly used in GIS for climate data, elevation, land use, ocean data, satellite imagery, etc



Questions?

Sentinel-2 satellite Raster Data

- Raster data for workshop is imagery from the European Space Agency satellite *Sentinel-2*
- *Sentinel-2* collects imagery in many spectral bands,
  and these bands can be used to gather information about Earth's surface

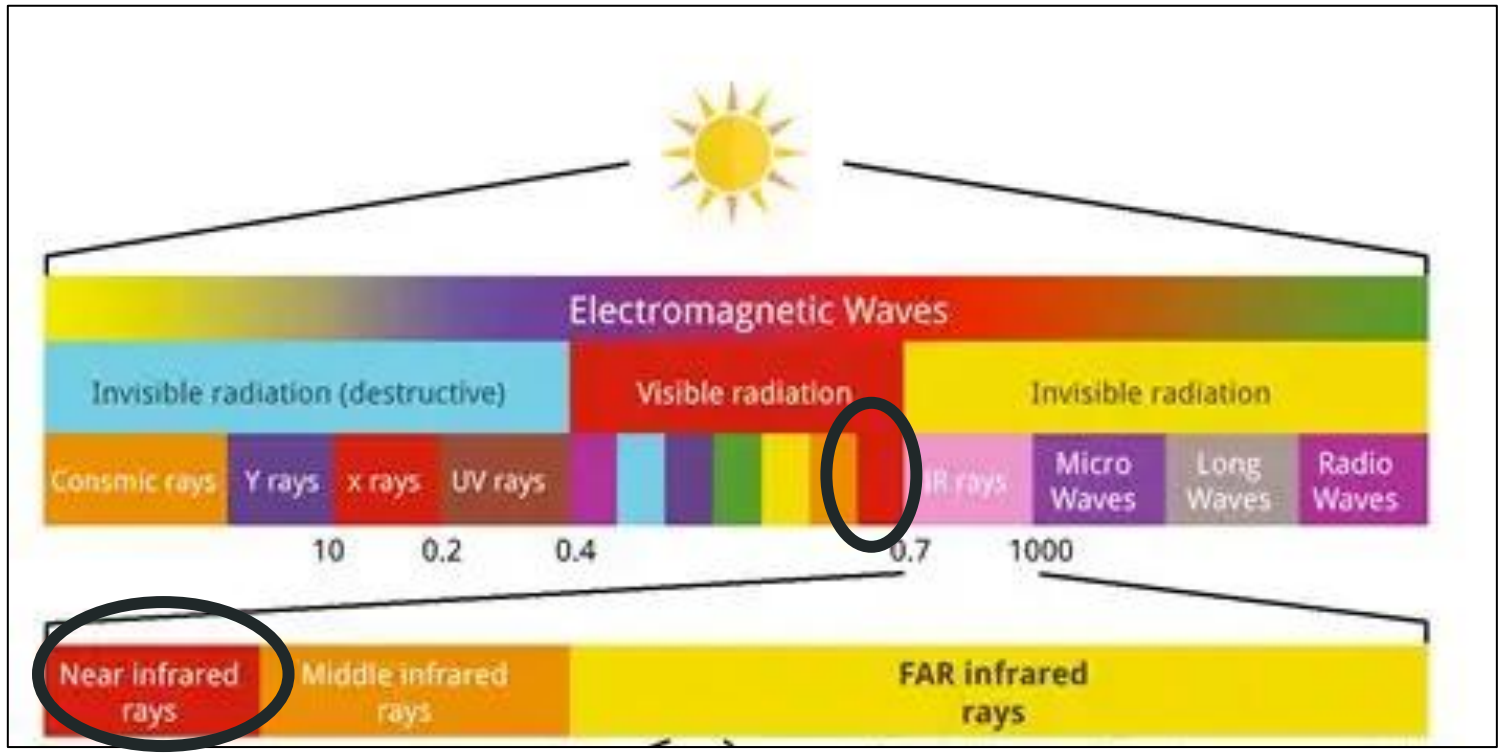


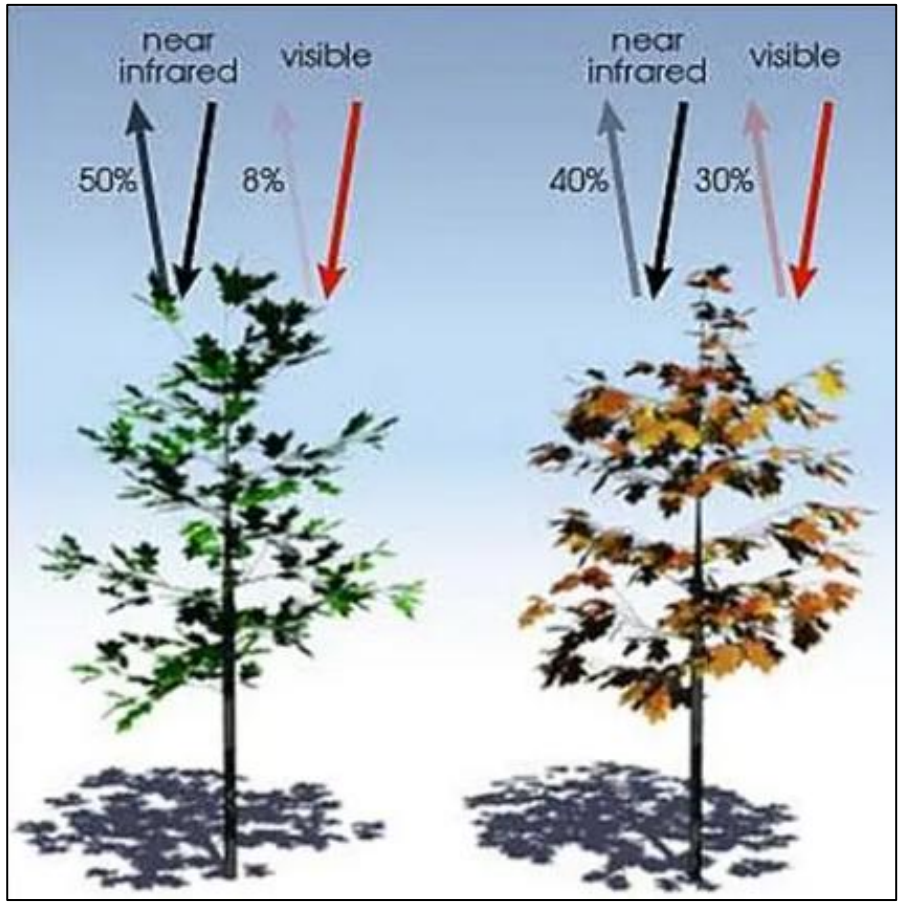
Why FT-NIR spectroscopy? | Bruker

Satellite Raster Data

Two *Sentinel-2* bands are **Red** and **Near Infrared (NIR)**

- Healthy vegetation reflects more **NIR** and less red light
- Unhealthy vegetation reflects less **NIR** light and more red light

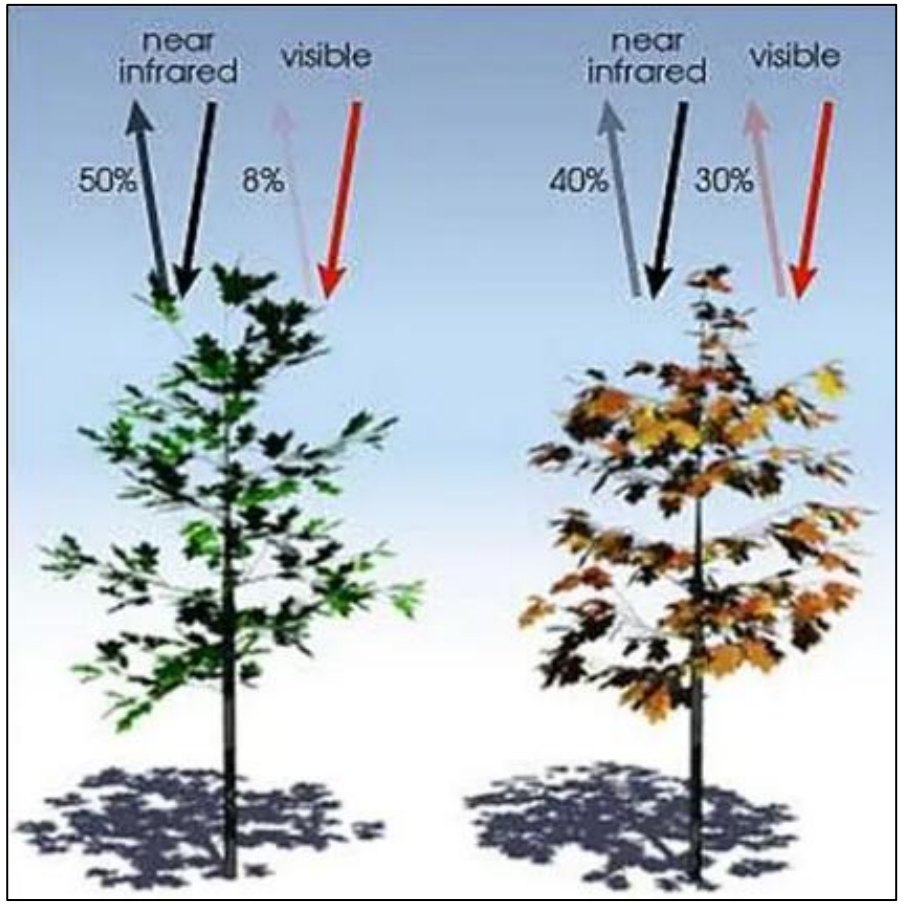




Normalized Difference Vegetation Index (NDVI)

- With difference between **Red** and **NIR** reflectance,
  Normalized Difference Vegetation Index (NDVI) is created
  - Values are between -1 and 1, where 1 is very healthy vegetation

$$NDVI = \frac{(NIR - Red)}{(NIR + Red)}$$

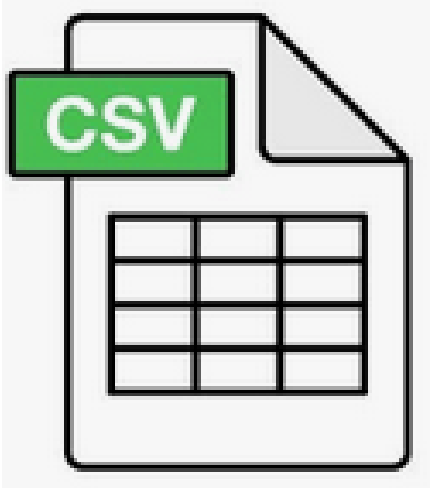


European Space Agency *(ESA)* via *Copernicus* provides **NDVI raster layer** (we could create the NDVI raster…but won't today…)

Questions?

.csv vector data (overview)

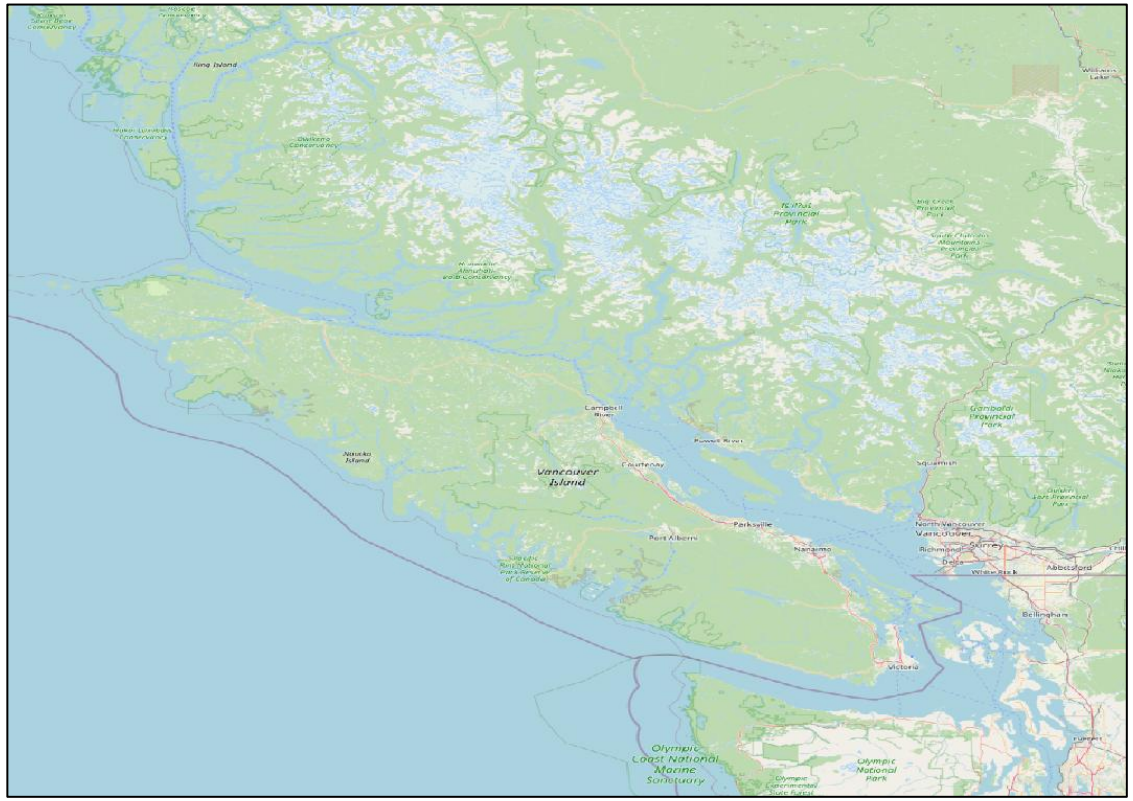
- (later) we will add **.csv** with Lat/Long to a map as (vector) points
  - **.csv** may or may not have geospatial Latitude/Longitude coordinates (could have other values)
  - Points do not have area
    - can be symbolized larger/smaller…but do **not** have area
- With *(Q)GIS* we can combine **raster** data with **vector** data (polygons, points, etc.) for analysis



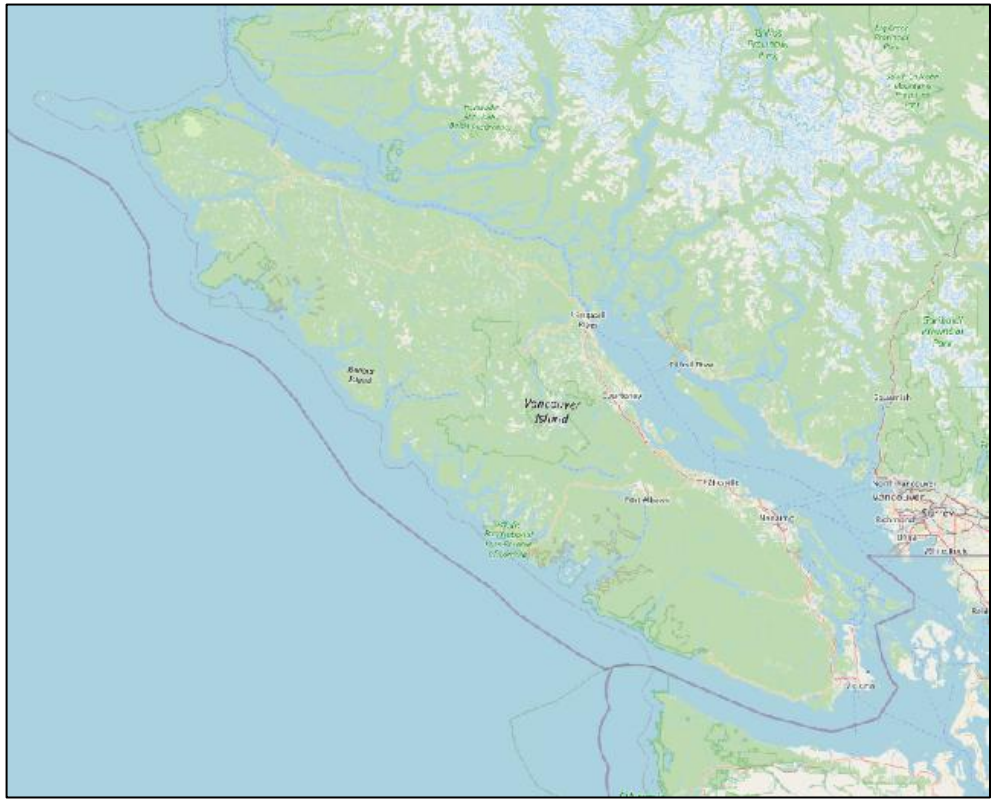
	A	B	C
1	Latitude	Longitude	Name
2	48.46352593	-123.3096322	UVic Library

Geographic Coordinate Systems

- default GCS for *QGIS* is **EPSG 4326**
- data downloaded for this workshop from *Copernicus Browser* also in **EPSG 4326**
- data changed to **EPSG 3157** for our study area (Victoria, BC)



Vancouver Island in **EPSG 4326**



Vancouver Island in **EPSG 3157**

Which looks "better"?

Geographic Coordinate Systems

- default GCS for *QGIS* is **EPSG 4326**
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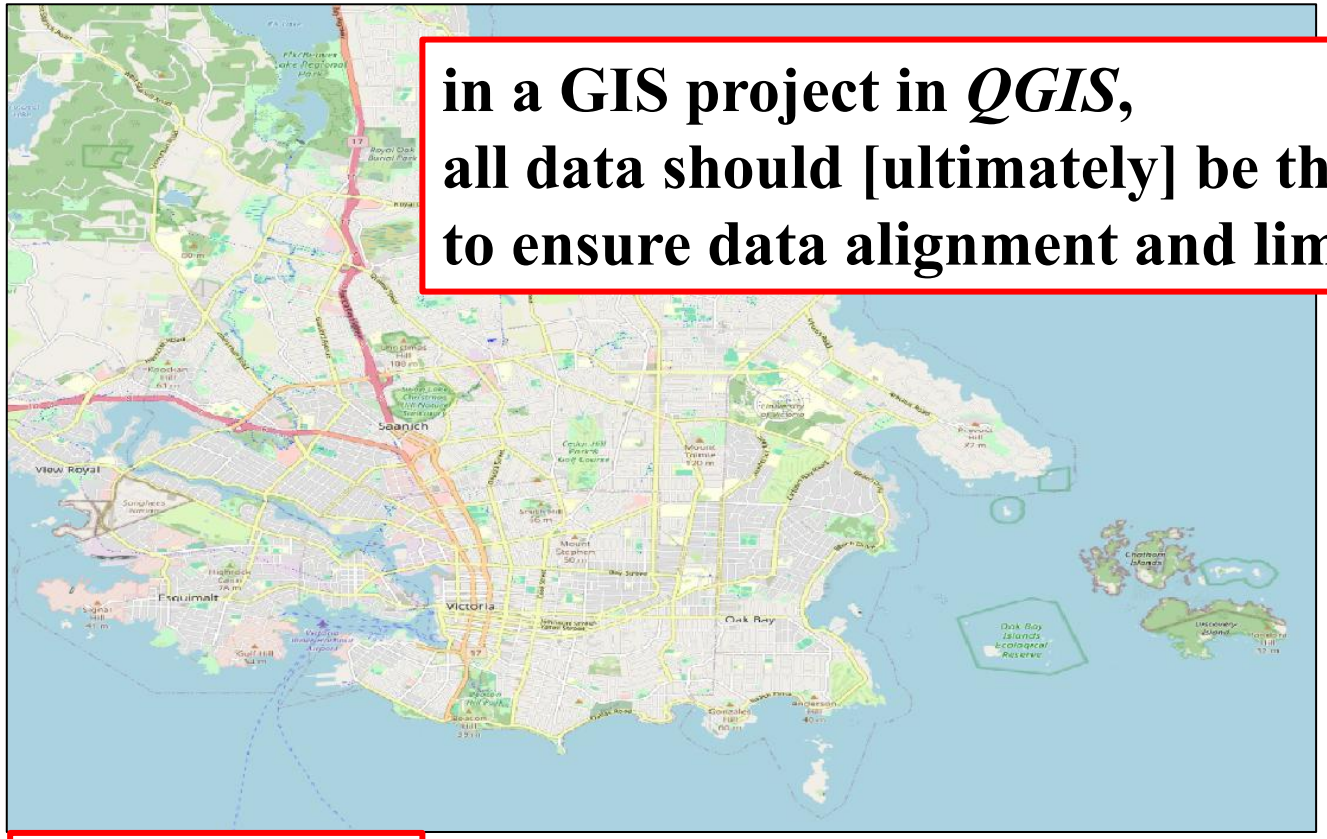
in a GIS project in *QGIS*,
all data should [ultimately] be the same GCS/PCS
to ensure data alignment and limited distortions



Victoria in **EPSG 4326**

Victoria in **EPSG 3157**

The GCS/PCS depends on the project…
location, purpose, scale, accuracy needs, etc

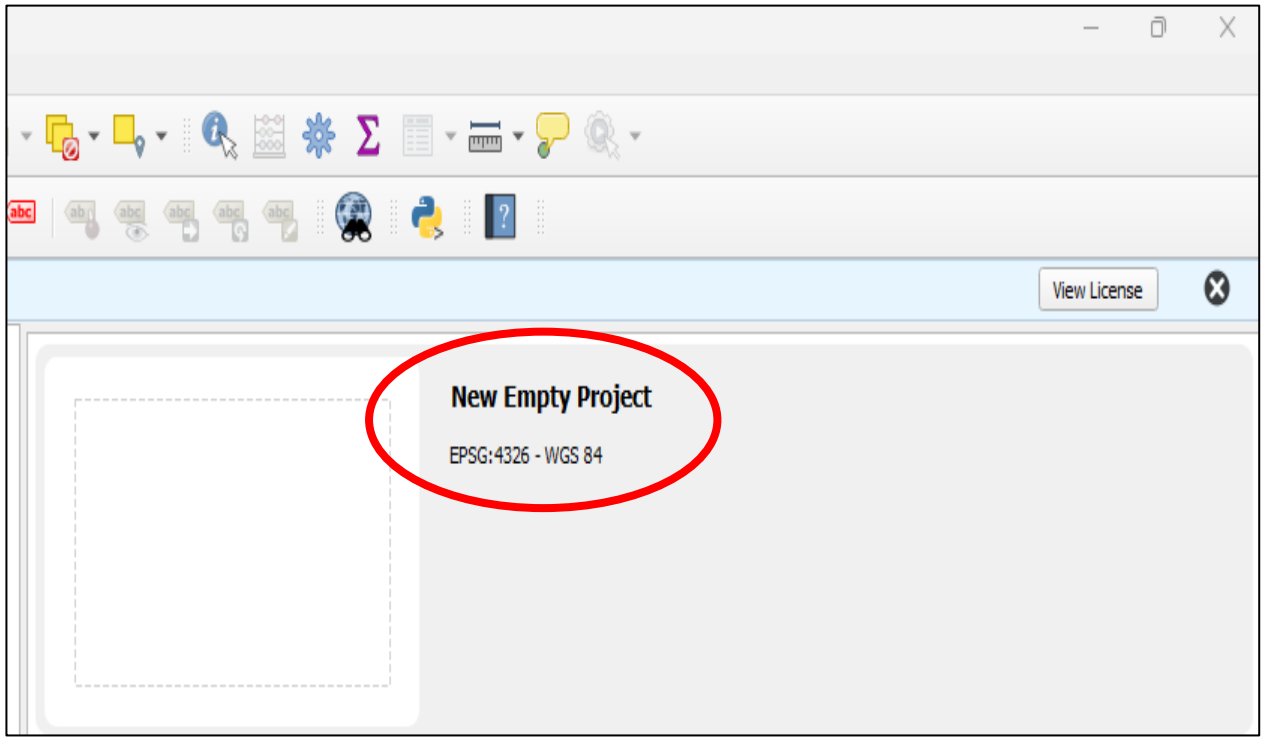
Start *QGIS*

Download workshop data

- Extract /unzip the .zip file
- Save it where you can find it…

Open QGIS (your version may be different)

- Double click on *New Empty Project*

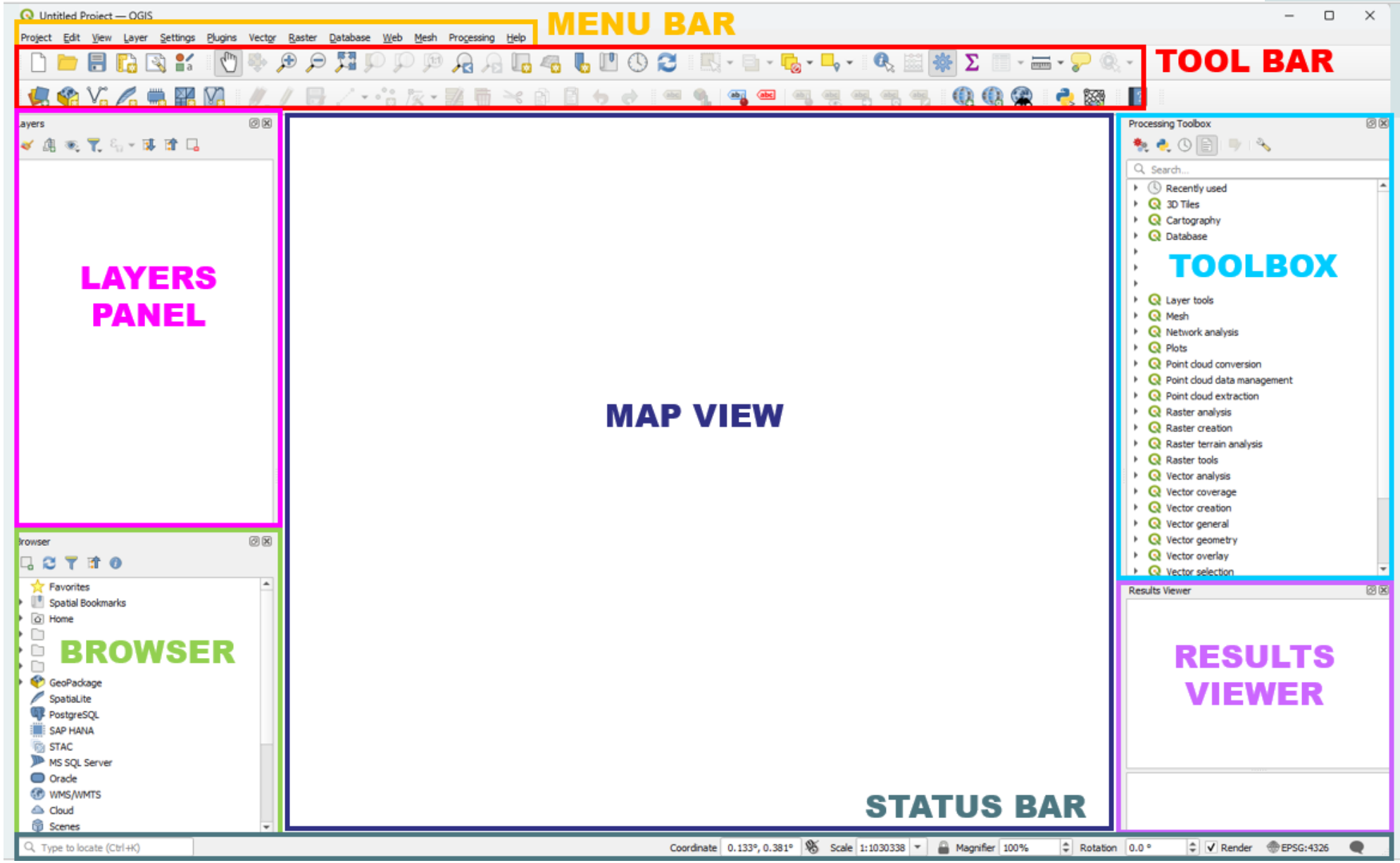


Note: New *QGIS* projects open with Geographic Coordinate System (GCS) **EPSG:4326**

Understand *QGIS* interface

*your interface may look different

- Menu Bar
- Toolbar
- Layers Panel
- Map view
- Browser
- Toolbox
- Status Bar
- Results Viewer



Understand *QGIS* interface

Menu Bar:

Horizontal bar at the top providing access to various functions and tools

(Project management, Edit, Plugins, Vector & Raster tools, etc.)

Toolbar:

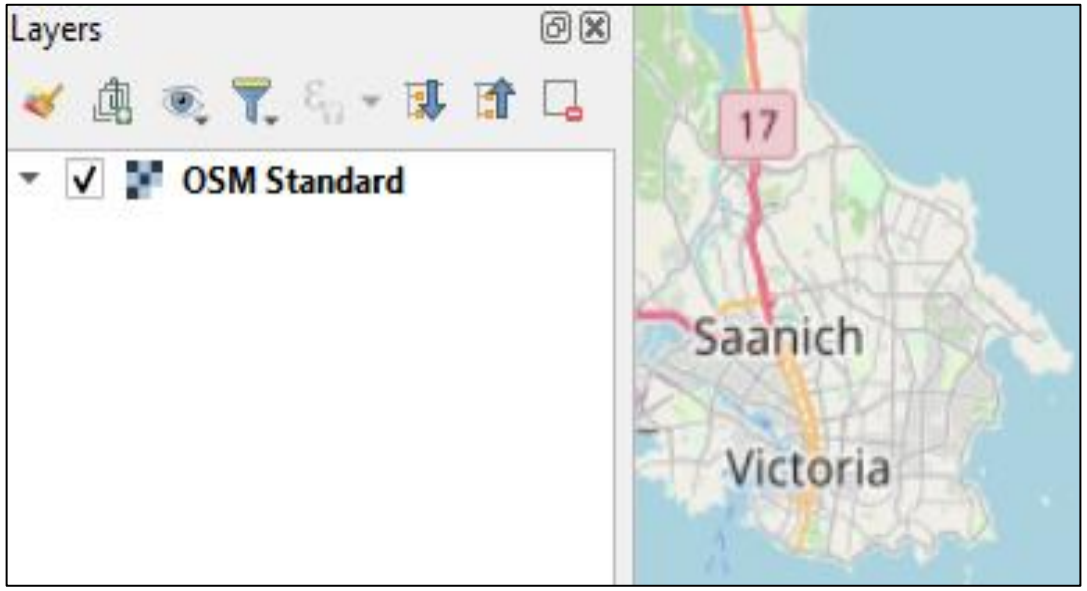
Contains icons for frequently used tools, such as Add Data, Pan, Zoom, Identify, etc.

Quick access to essential operations.

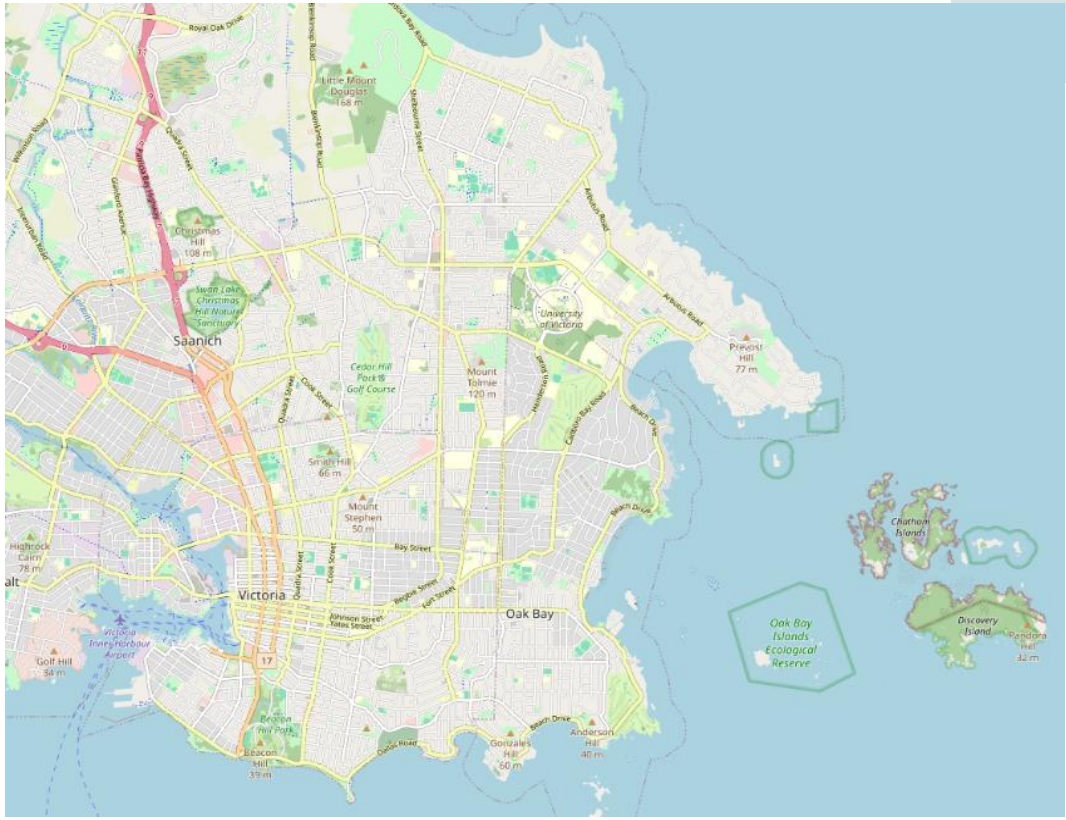
Layers Panel:

Displays all active **Layers** in the project.

Allows users to organize, manage visibility and access properties of layers



Understand *QGIS* interface

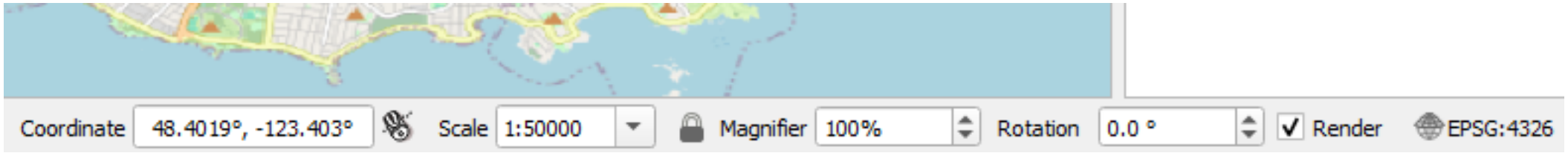


Map View:

The central area where spatial data is displayed.
Interact with the map, visualize layers
and analyze spatial relationships.

Status Bar:

Located at the bottom, it provides information about current project: coordinate display, scale and CRS settings.



Toolbar essentials

New project, open, and save

Pan

zoom

“**zoom full**”

Add data

Questions?

From this point onwards
everyone works at their own pace

There are **Check-In** slides to **ask** for help
(or **ask** sooner!)