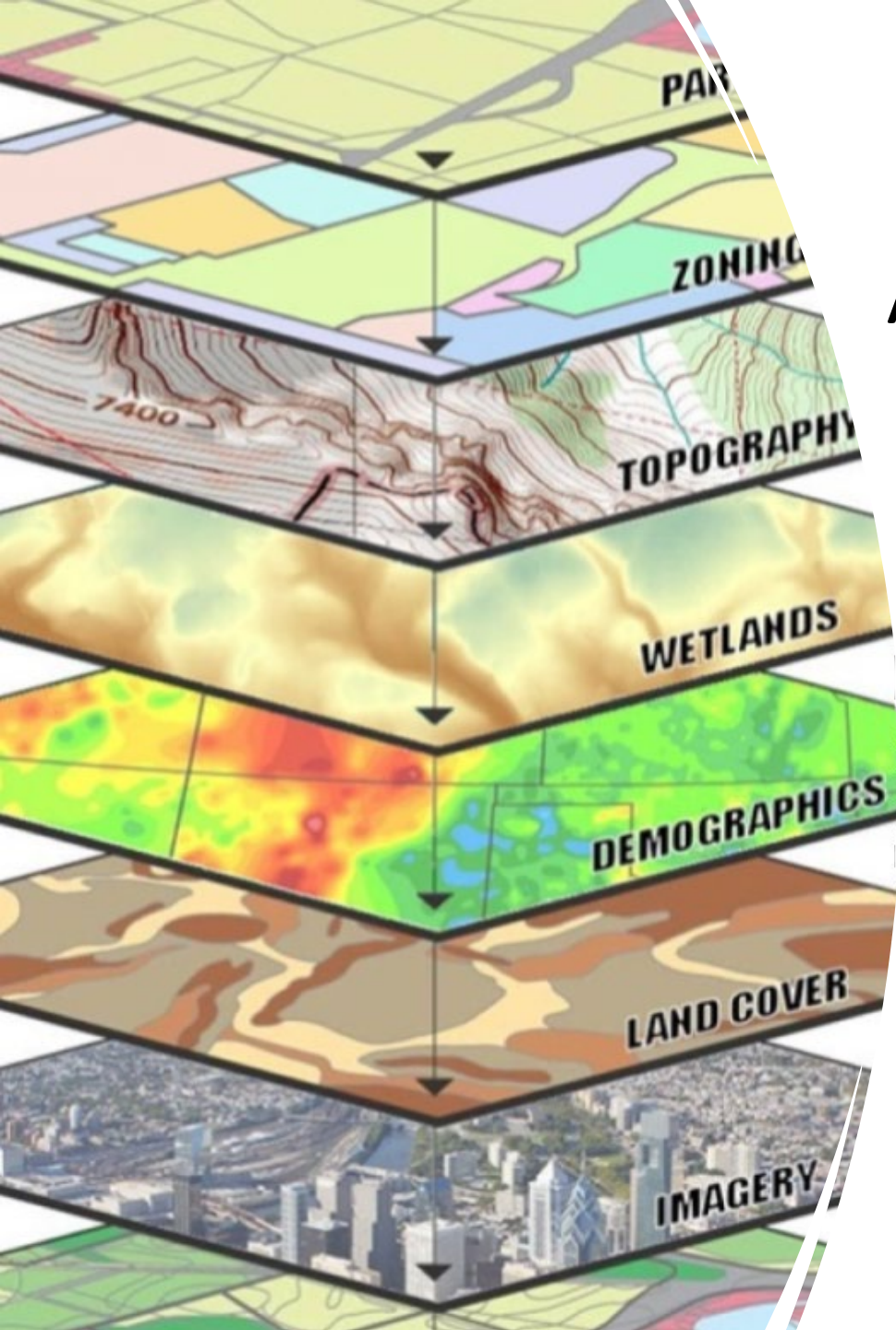


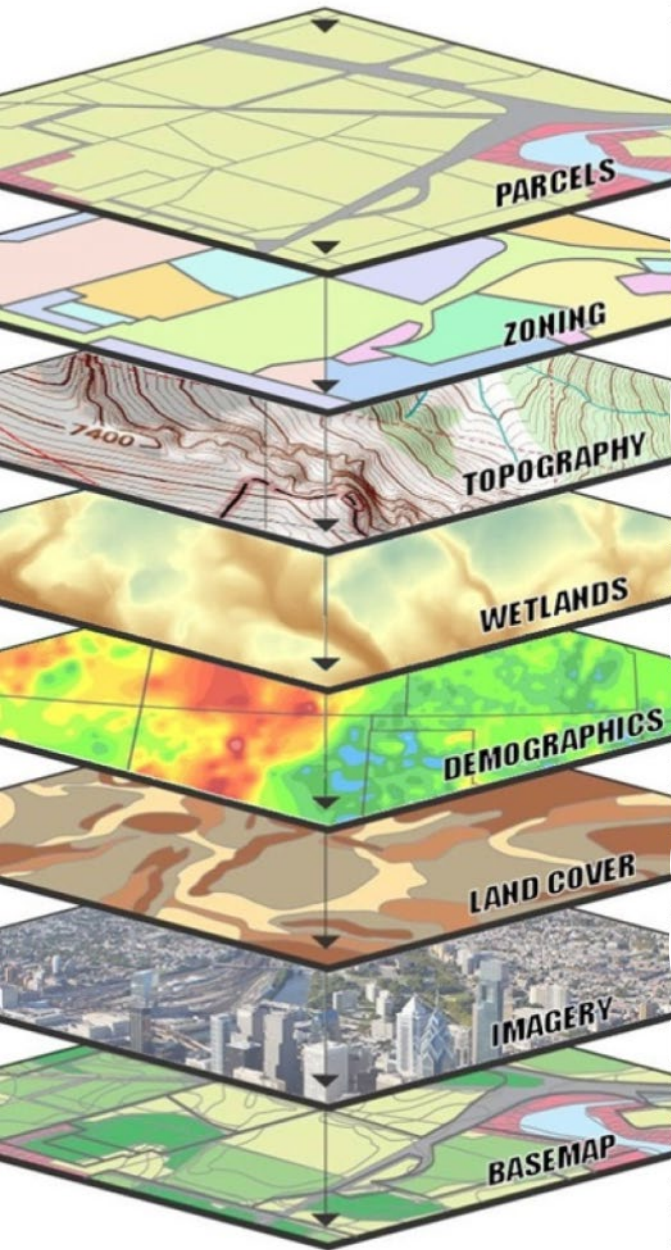


ACBA7005: Geographical Information Systems (GIS) and Habitat Management

Dr Alisdair Cunningham
Senior Lecturer

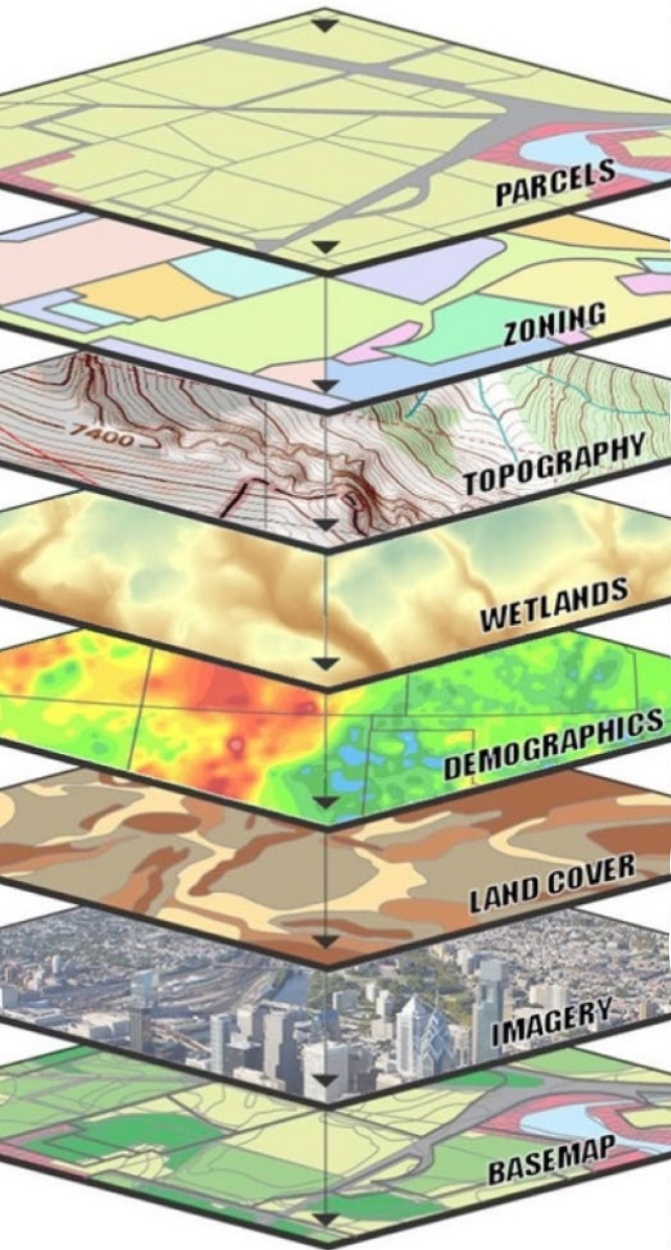
2024 / 2025

29/01/2025



This lecture will contain the following:

- Module Overview
- Module Assessment
- Understanding Maps and GIS Data
- Modelling the real world: Spatial Data Types
- Information: Attributes
- Practical:
GIS software for Data Visualisation

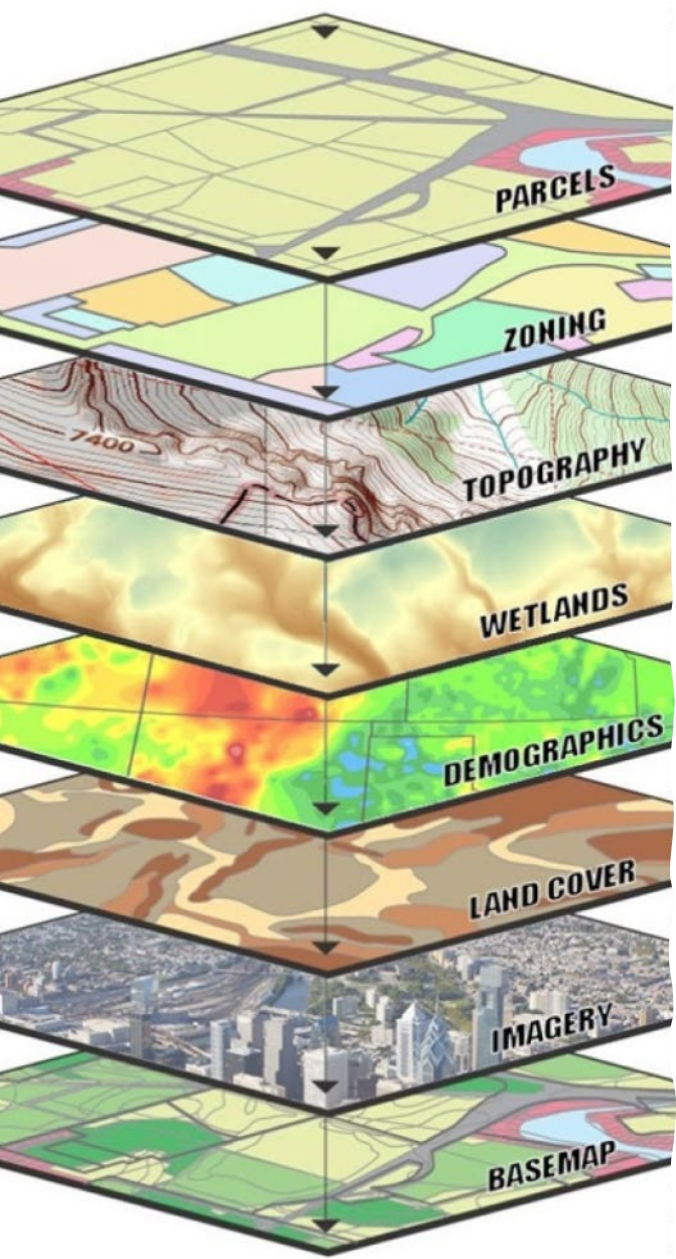


Module descriptor can be found on Moodle:

<https://moodle.uwtsd.ac.uk/course/view.php?id=6990>

“On successful completion of this module students will be able to:

- 1. Evaluate habitat management practices in terms of biodiversity and other factors.*
- 2. Critically evaluate different habitats and their management.”*



Assessment details can be found in the Module Descriptor, via Moodle:

<https://moodle.uwtsd.ac.uk/course/view.php?id=6990>

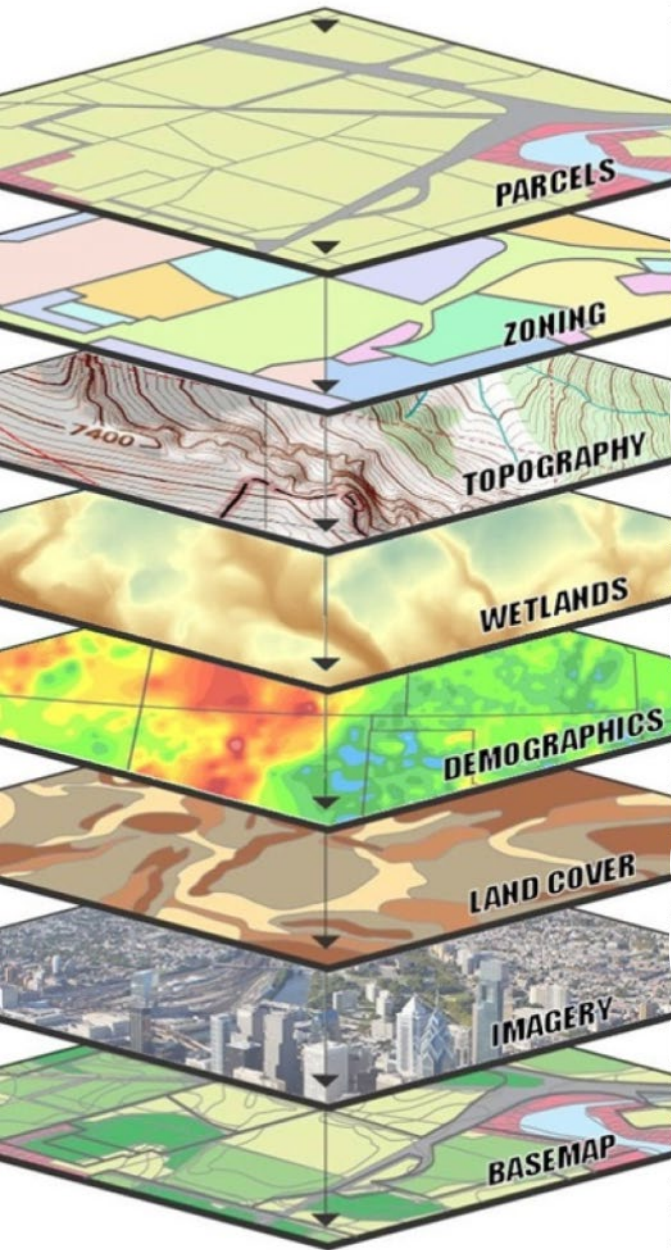
This module be assessed via coursework:

One assessment, composed of 1 element:

Report **100%**

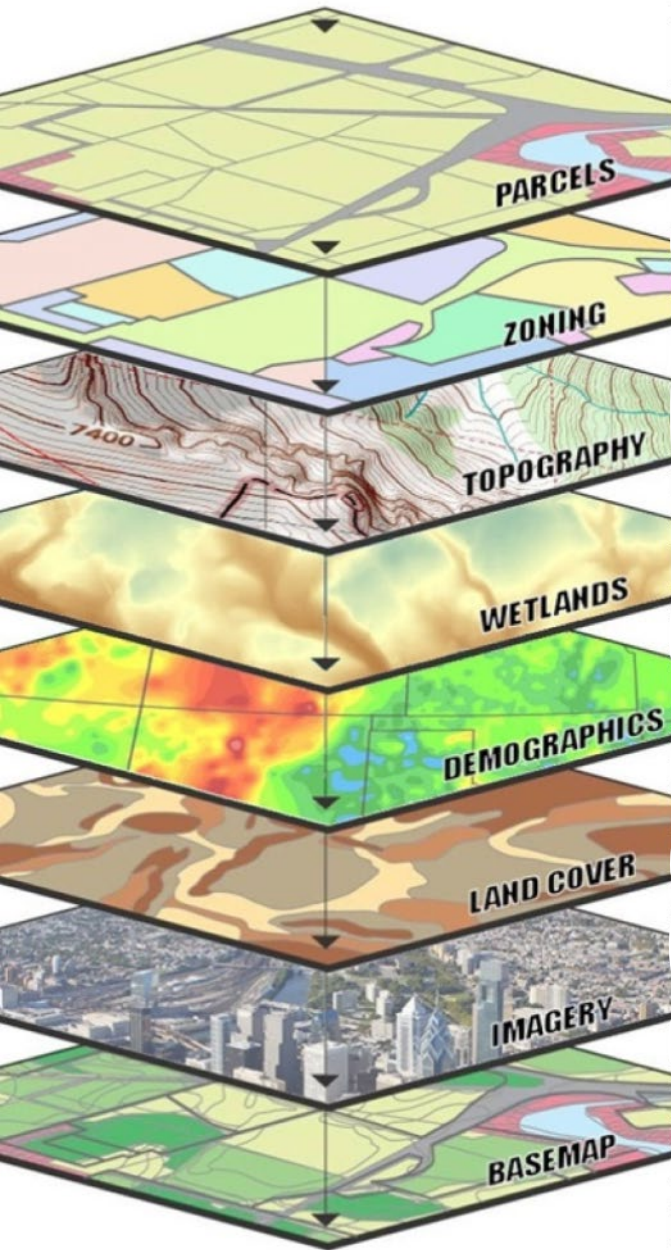
Assessment 1: Habitat Management Plan (Upland)

Mode of assessment	Volume	Weighting	Due Date
Report	6000 words	100%	7 th May 2025



This assessment will enable students to **produce a management plan for an upland habitat** (e.g. acid grassland, heathland, peatbog) for a **site of their choice**. You should select somewhere that has been prone to degradation. This does not have to be a rural location, but the **area must have an existing management plan for you to critique** and you must be able to access information about flora and fauna, as well as obtain aerial photographs. Please check with your tutor that your selection of site is appropriate. This could be a country park, national park, protected drinking water catchment, or private/ managed estate. Some sites will already be working towards achieving biodiversity targets or building resilience into their site management.

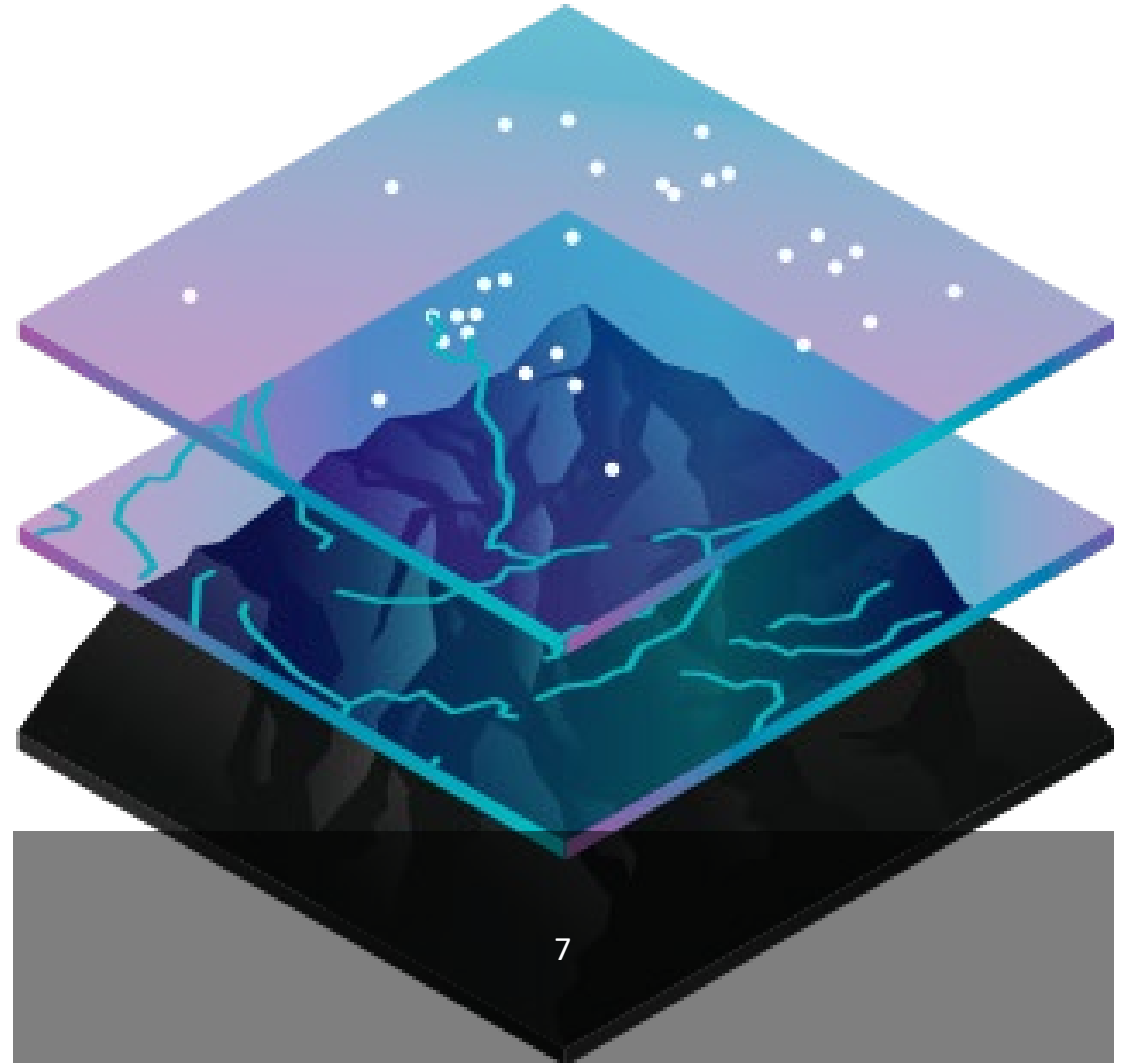
A professionally produced management plan should benefit the upland habitat in addition to adjacent land. **It should cover ecology, vegetation and catchment considerations. Habitat improvements are also vital** for the wellbeing and safety of local communities and for sustainable economic growth. Climate change pressures highlight the importance of building in resilience and allow our landscapes to function effectively in response.

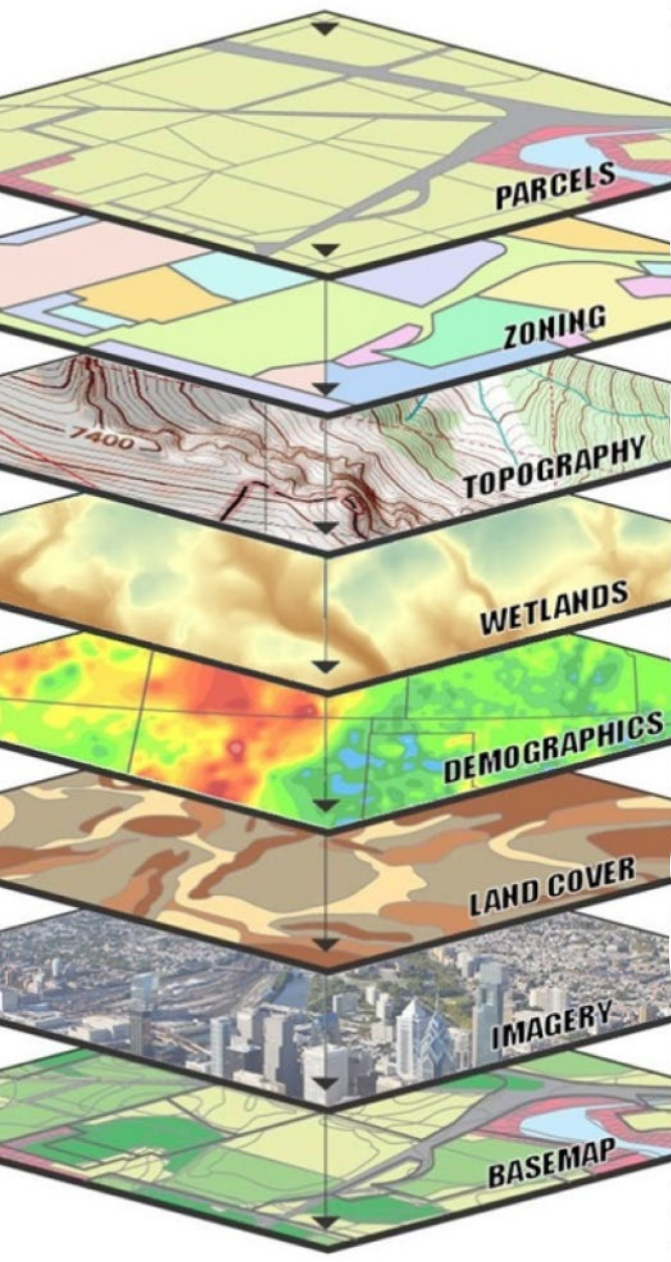


The assessment is as follows:

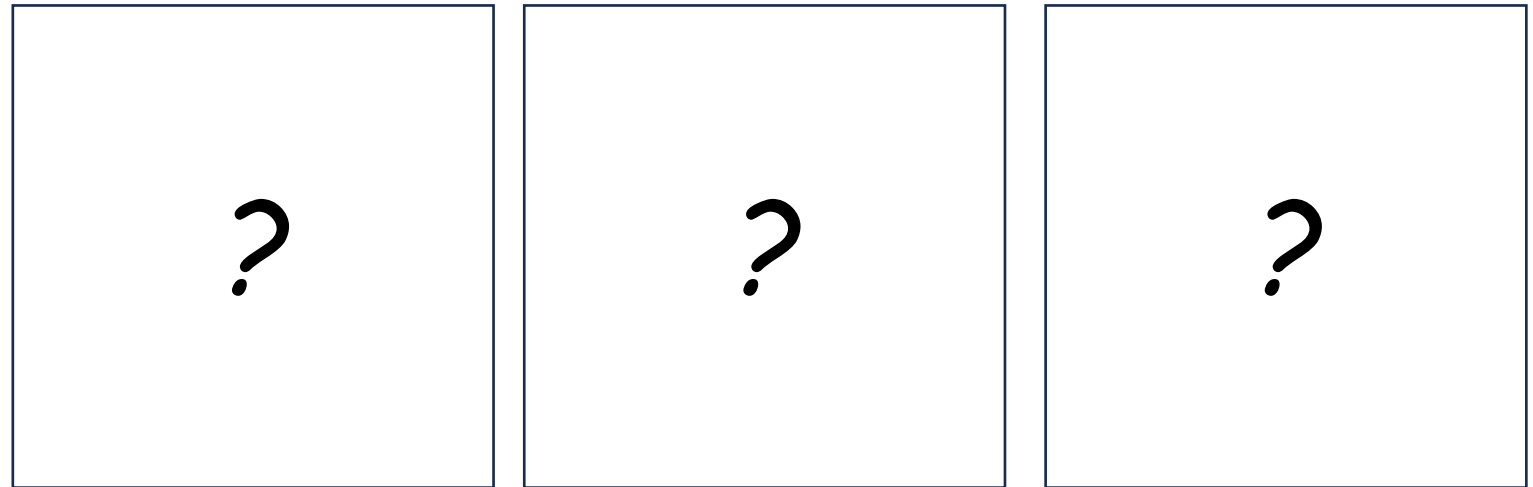
1. **Data will be mapped using GIS software.** Initially you will be introduced to the software and workshops will enable you to evaluate the raw data (provided by yourself or your tutor) which you must then manipulate within the software environment to build your GIS application of the site.
2. Combining the mapping and information gathered about the site, **you will construct an informed review of the current site management and a proposed 10-year plan for that site moving forward.** You should not simply regurgitate an old habitat management report, although this will prove a useful starting point. Along with the report, “your plan” will be delivered in an illustrated presentation lasting approximately 10 minutes, plus questions. The presentation will enable a snapshot of the priority suggestions featured.
3. As part of that presentation/crit, you will present the experimental maps that you have produced in your chosen GIS software development environment. Present relevant points to highlight your management plan findings.

Understanding Maps & GIS Data





QUESTION: Have you ever used a GIS system?



What is GIS? - Geographic Information System (GIS)

"A **system** for capturing, storing, checking, integrating, manipulating, analysing, and displaying **data** that are **spatially referenced to the earth**"
(Department of the Environment 1987: 132)

"A spatial **system** that creates, manages, analyzes, and maps all types of data. GIS connects data to a map, integrating **location data (where things are)** with all types of **descriptive information (what things are like there)**."
(ESRI, 2023)

<https://www.esri.com/en-us/what-is-gis/overview>

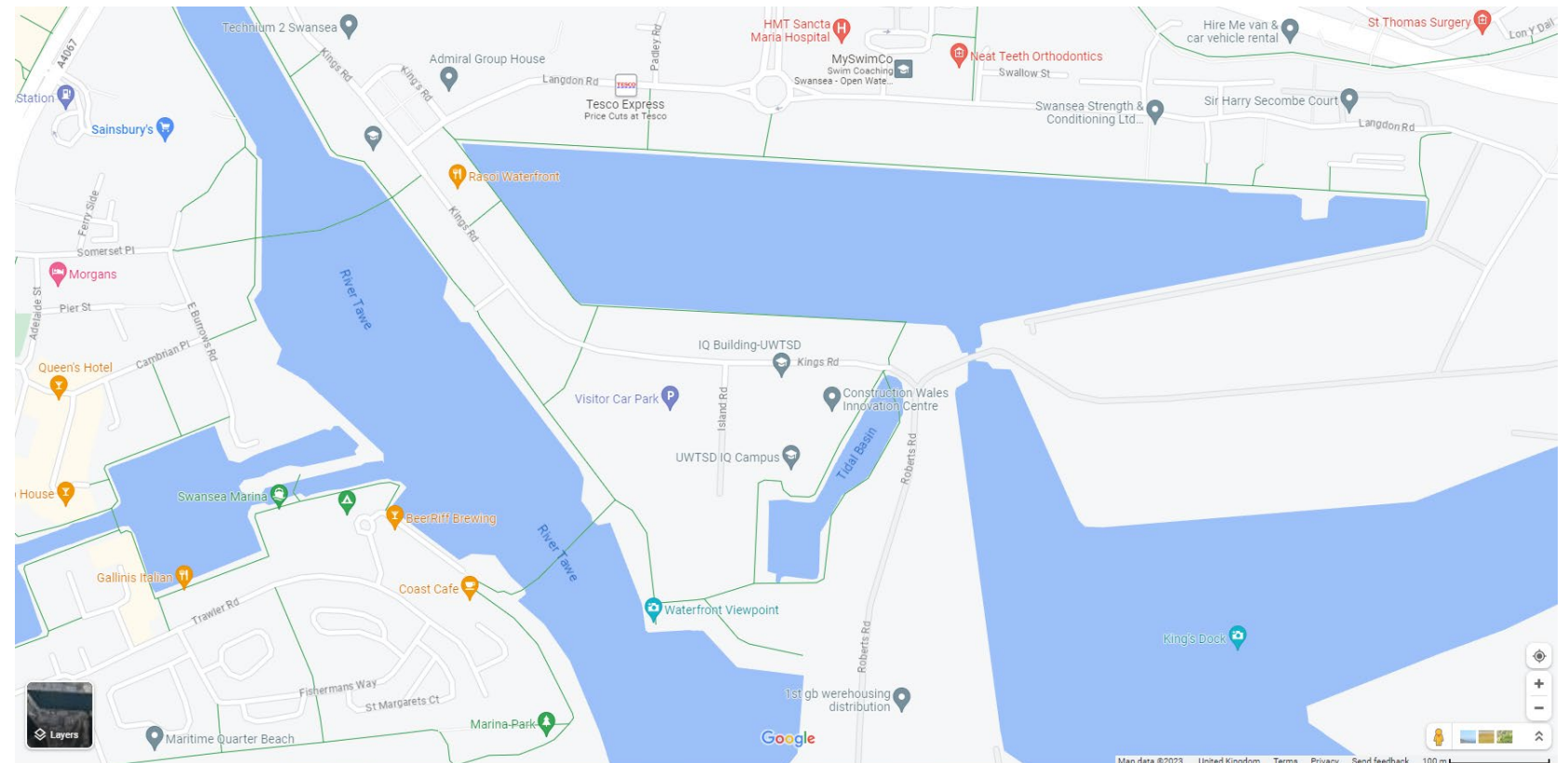
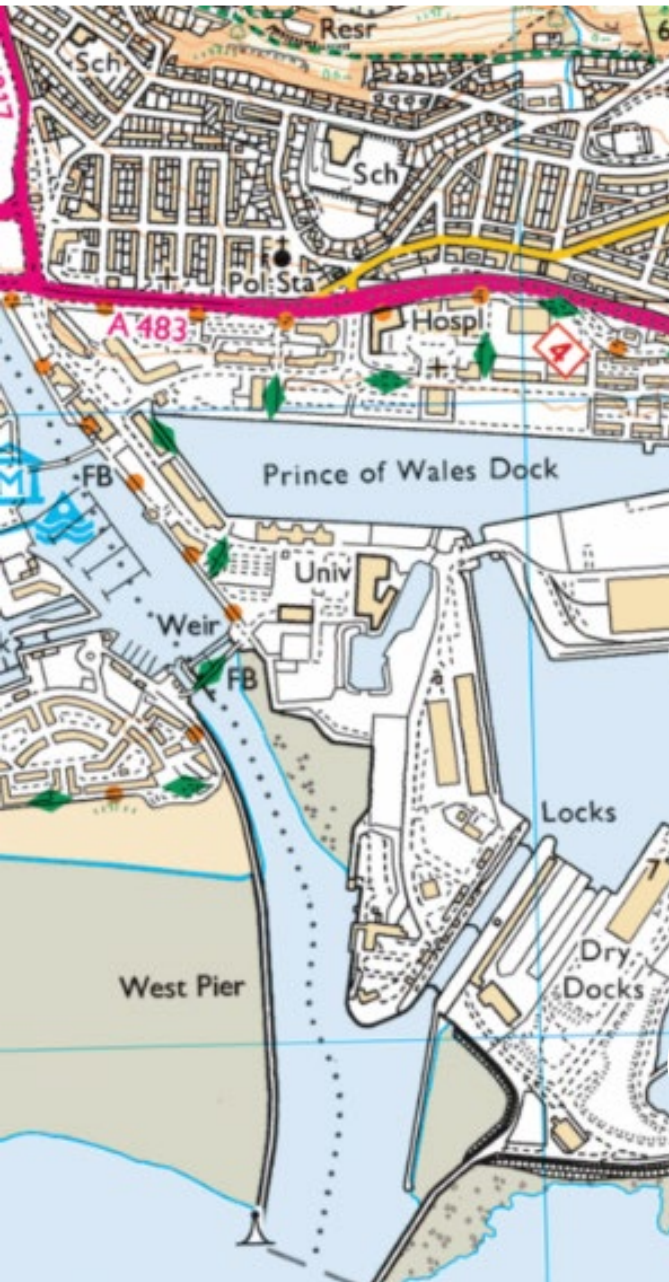
What is GIS?

Hundreds of thousands of organisations in virtually every field are using GIS to make maps that communicate, perform analysis, share information and solve complex problems around the world. This is changing the way the world works.

 Identify problems	 Monitor change
 Manage & respond to events	 Perform forecasting
 Set priorities	 Understand trends



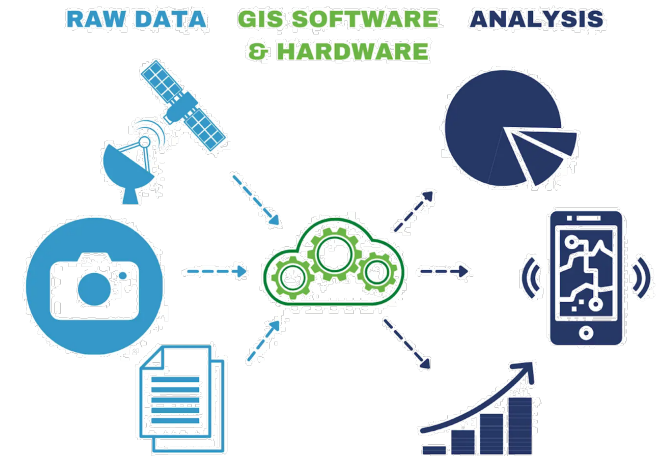
QUESTION: What is this difference between this screenshot below (Google Maps), and the same map within OS maps (left)?





‘System’ is used, and this is often described as the physical aspects:

- Hardware
- Software
- Analyst
- Data
- Methods

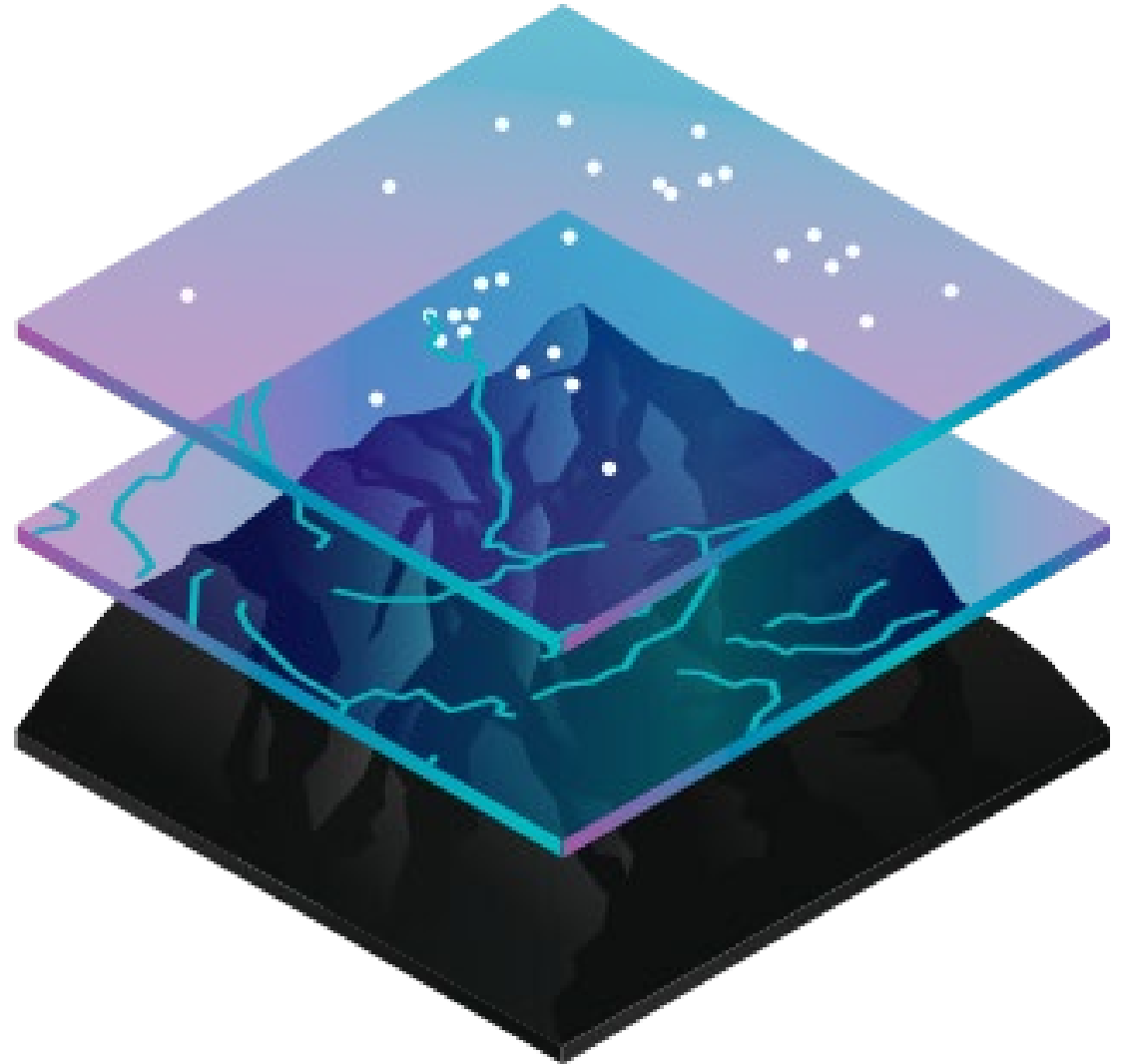


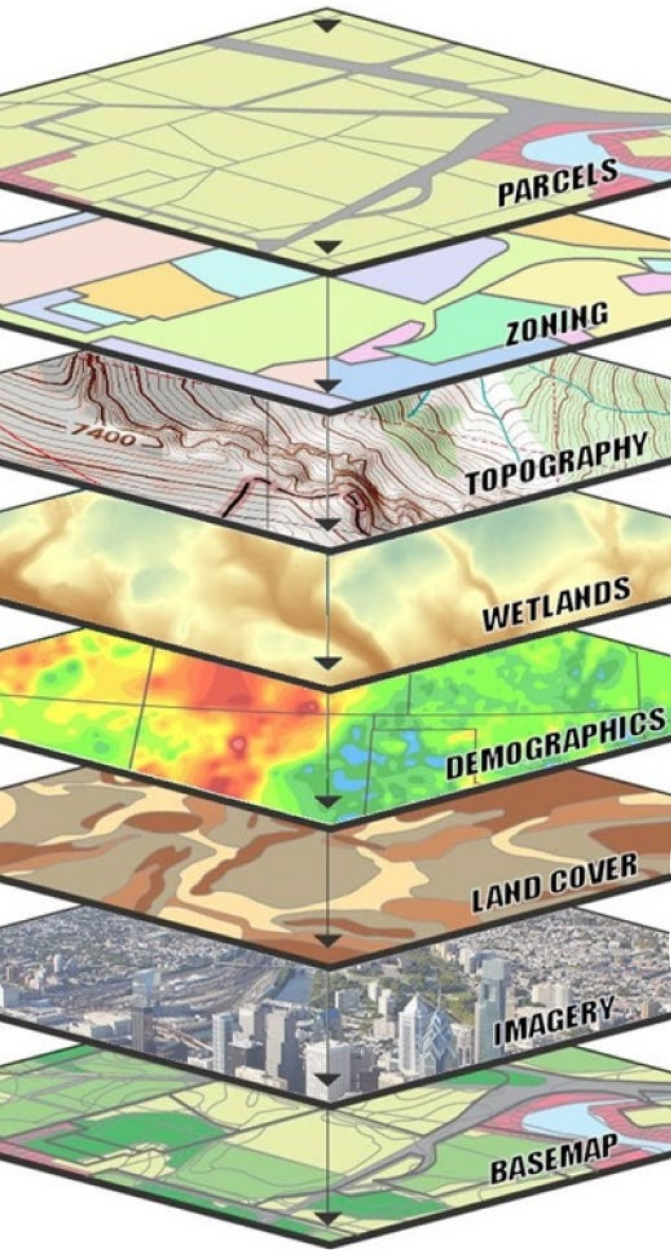
However, the origins and use of GIS are imbedded in Geographic Information Science (GIScience – not to be confused!) – (Schuurman, N., 2006)

- Explores the inter-relationships of spatial elements
- Explores the ‘How’ of a scientific question, whereas the GIS handles the ‘What’ and the ‘Where’

A tool for spatial problem-solving!

Modelling the real world: Spatial Data Types

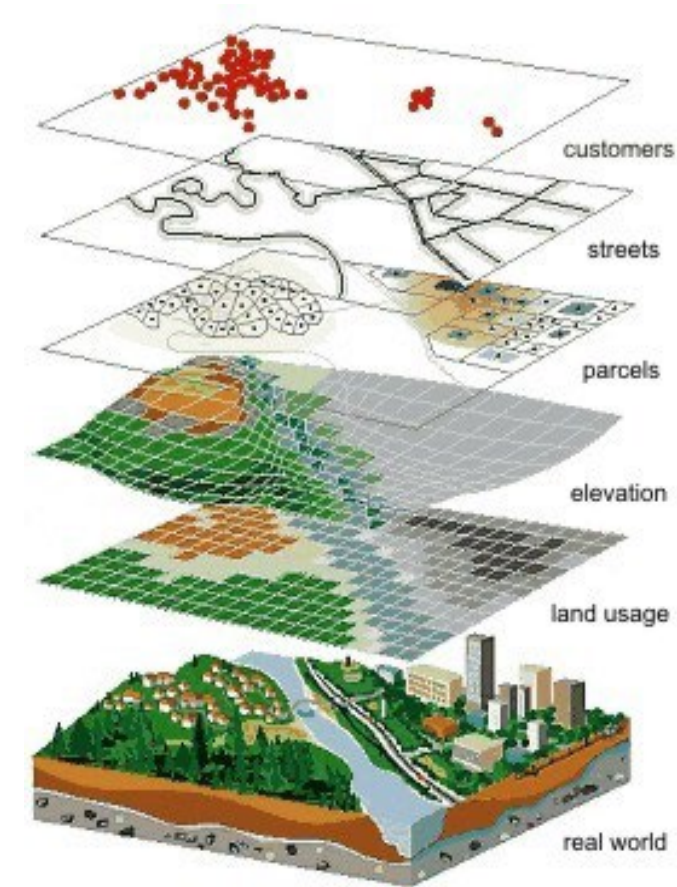




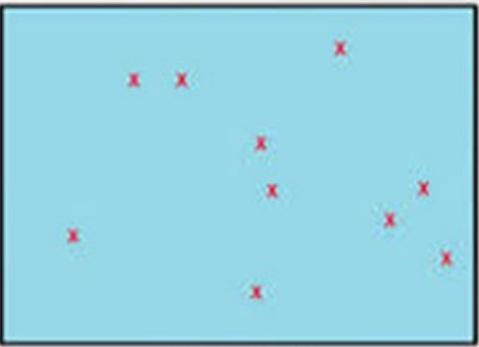
One of the key principles of GIS is to model the real world in a digital environment

- Represent the many complex elements in a single analytical environment
- The overlay method, brings together many discrete attributes so that data in corresponding locations can be analysed.
 - Some layers can be qualitative e.g. human defined areas such as county areas, or not visible at the surface, such as climate or soils / geology

GIS have specific data formats to allow for capturing these, **Vector** and **Raster**



Present day GIS example



Point features



Line features



Polygon features

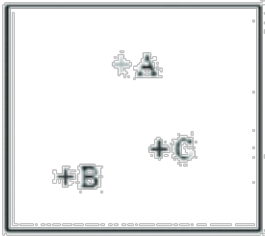
Vector point definition:
"indicates either the position or the location of any given point with respect to any arbitrary reference point"

Vectors are composed of either:

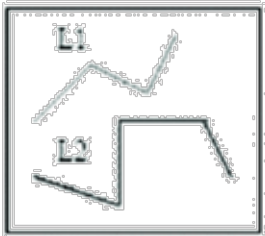
- Points: Single X,Y co-ordinates
- Lines: Linear feature composed of linked X,Y co-ordinates
- Polygons: Enclosed area features, delineated by X,Y co-ordinates

QUESTION: *Can you think of features that could be mapped as points, lines, or polygons?*

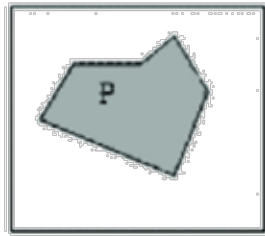
Vector



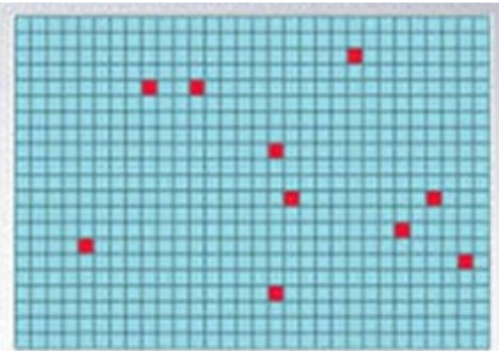
Points and their coordinates
A: (15, 7)
B: (9, 27)
C: (19, 21)



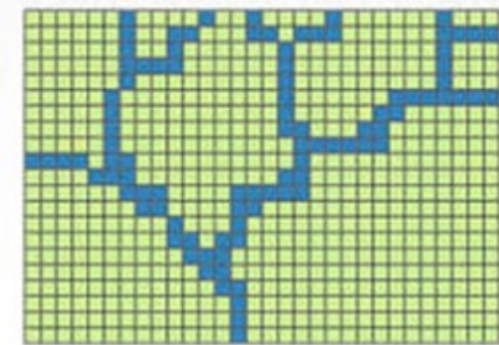
Lines and their coordinates
L1: (5,16) (10,8) (17,14) (25,3)
L2: (3,37) (13,40) (13,16) (30,16) (33,35)



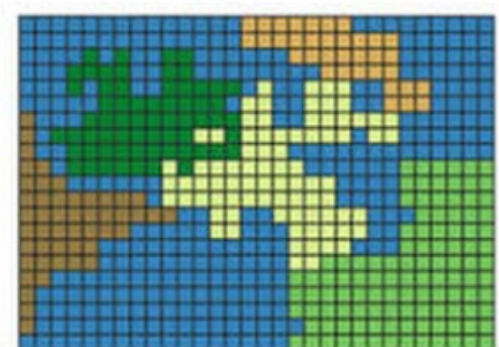
The polygon and its coordinates
P: (10,10) (20,10) (25,3) (30,13) (19,37) (3,17)



Raster point features



Raster line features



Raster polygon features

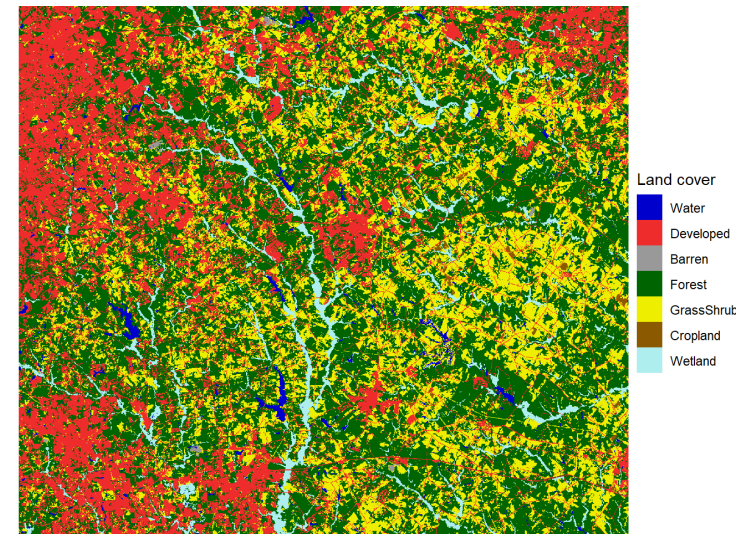
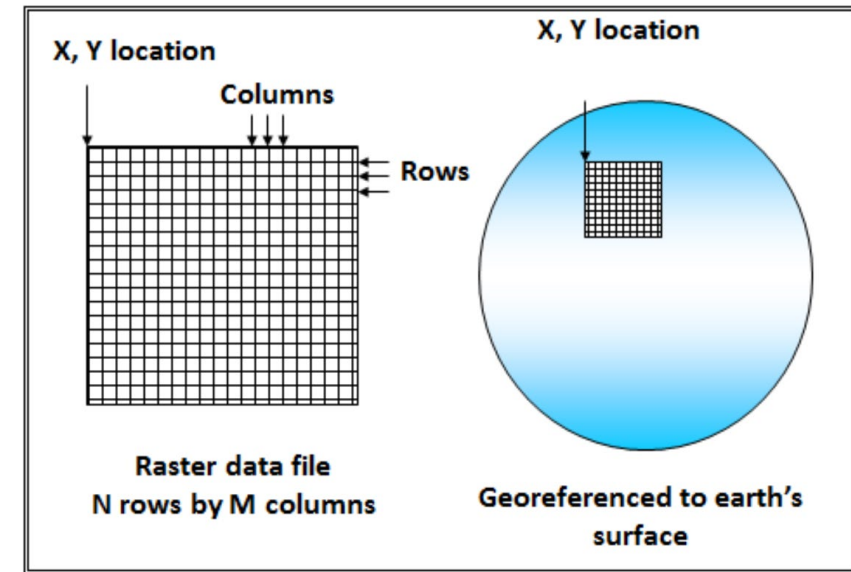
Raster definition:

“consists of a matrix of cells (or pixels) organized into rows and columns (or a grid) where each cell contains a value representing information, such as temperature”

(ESRI, What is raster data?, 2023)

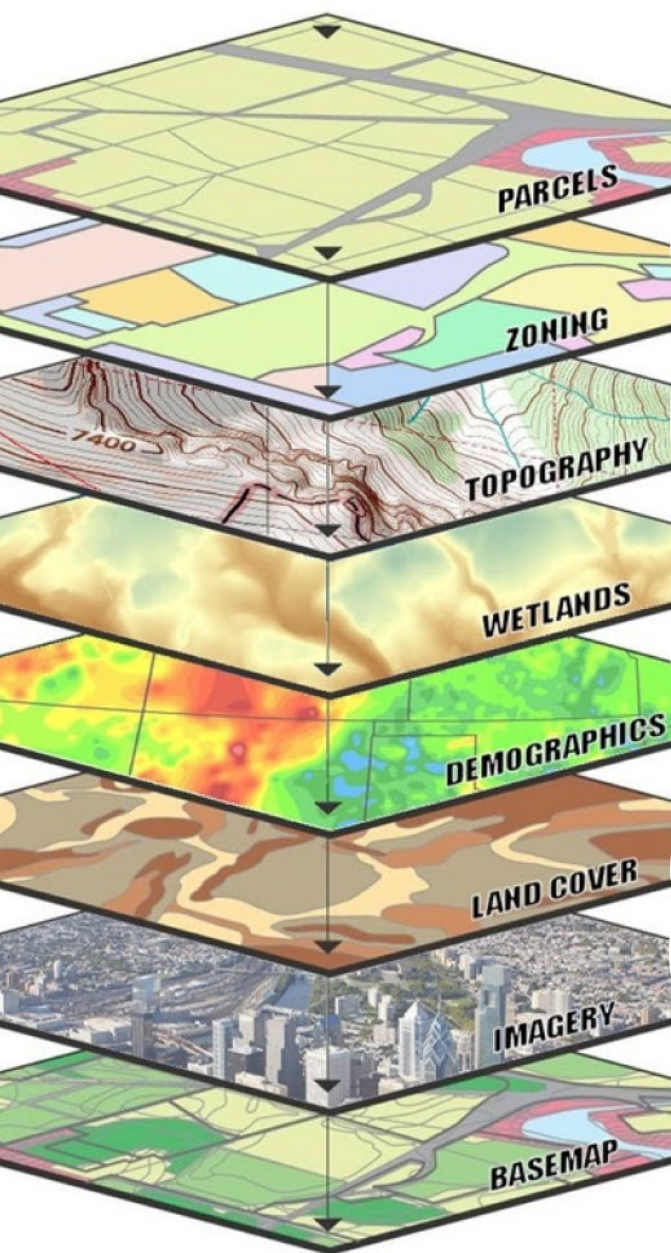
Rasters are composed of:

- Rows (and their height)
- Columns (and their width)
- Pixel Values e.g.:
 - Classification value
 - Elevation
 - Satellite imagery
 - Annual mean precipitation
- Origin location



Land cover

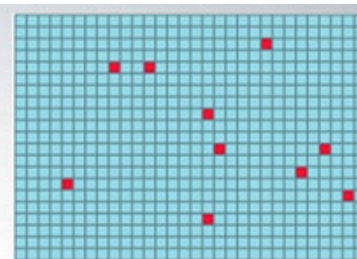
- Water
- Developed
- Barren
- Forest
- GrassShrub
- Cropland
- Wetland



QUESTION: What are the advantages or disadvantages to each data type when attempting to model / map real world features?
Consider : Coverage vs. Precision vs. Detail vs. Comparison



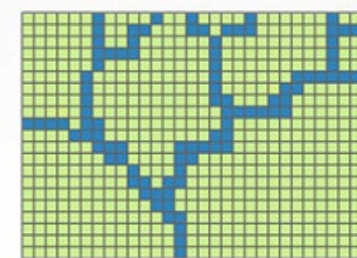
Point features



Raster point features



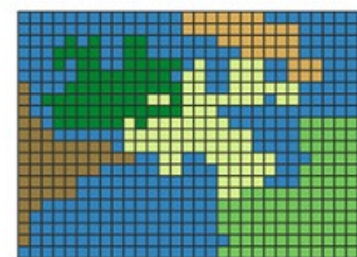
Line features



Raster line features



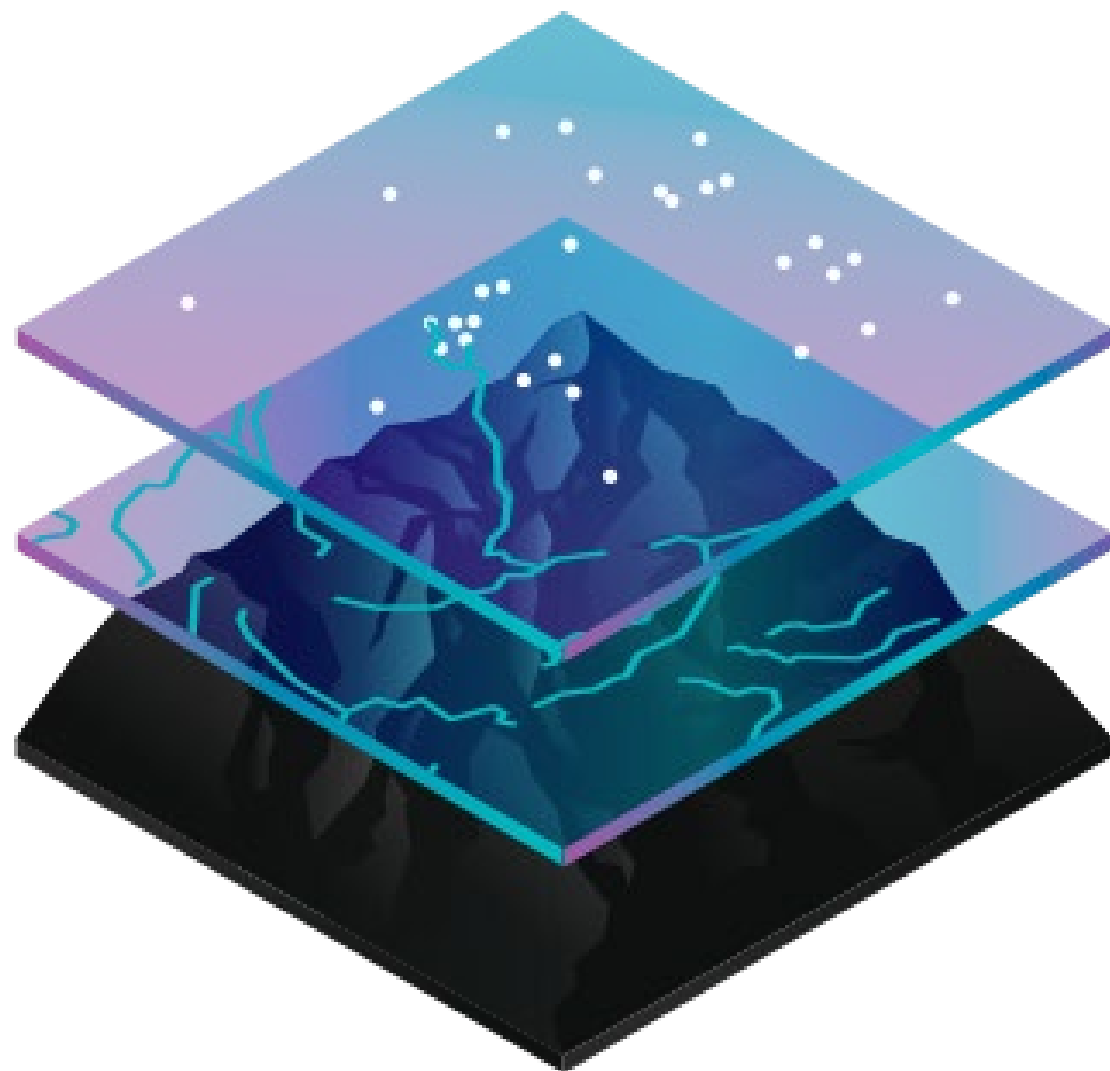
Polygon features

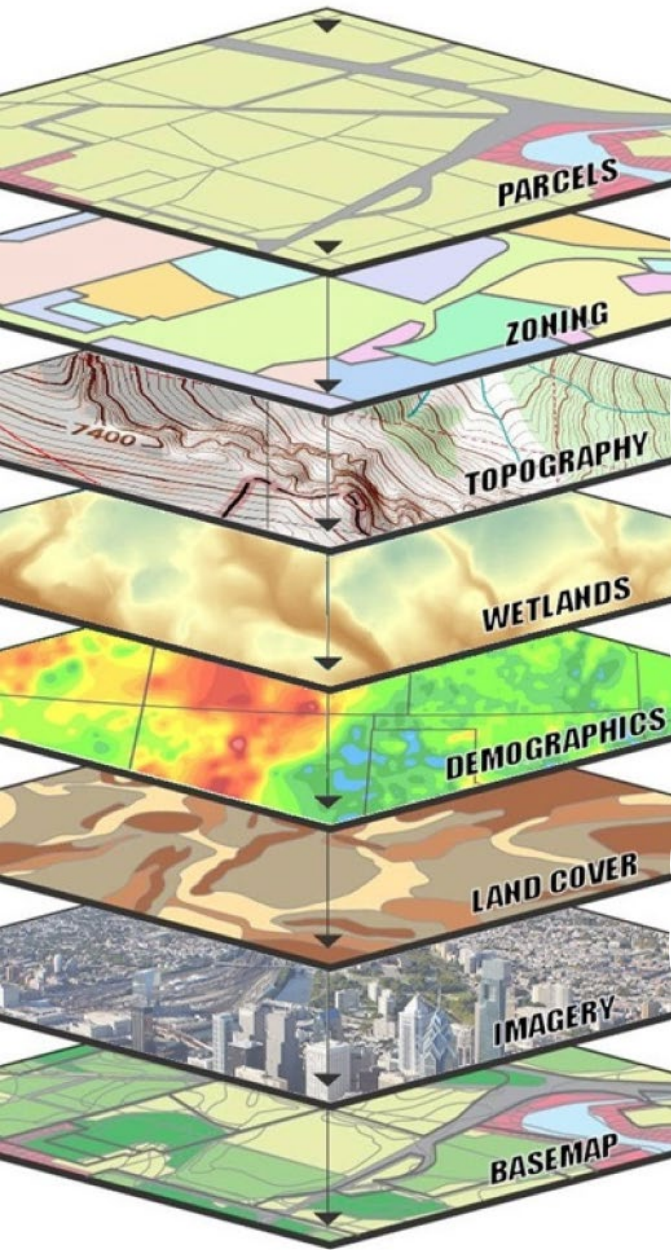


Raster polygon features

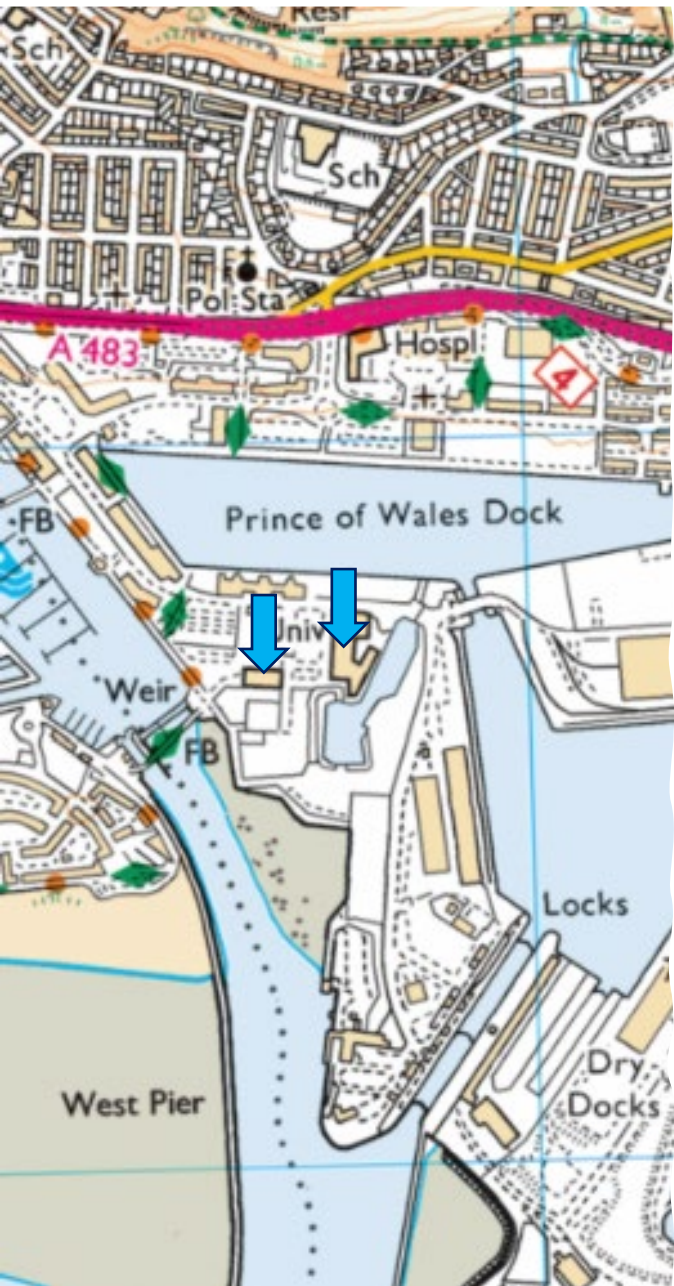


Information: Attributes





- Representing the location, or extent, of a spatial feature is only one element of GIS
- One of the greatest advantages is the ability to store **information** about a feature alongside the spatial element
- GIS uses 'Attribute' tables, and these are **typically linked to vector layers**
- These tables are **tabular**, with rows and columns, similar to tables you would see in Excel spreadsheets
- These data are the 'Information' of the GIS data



Geographic

“spatially referenced to the Earth’s surface” (DoE, 1987)

Co-ordinates:
Geographic - Lat / Long
Projected – X (Easting) / Y (Northing)

Lat	Long
51.618570	-3.930240
51.617045	-3.927679

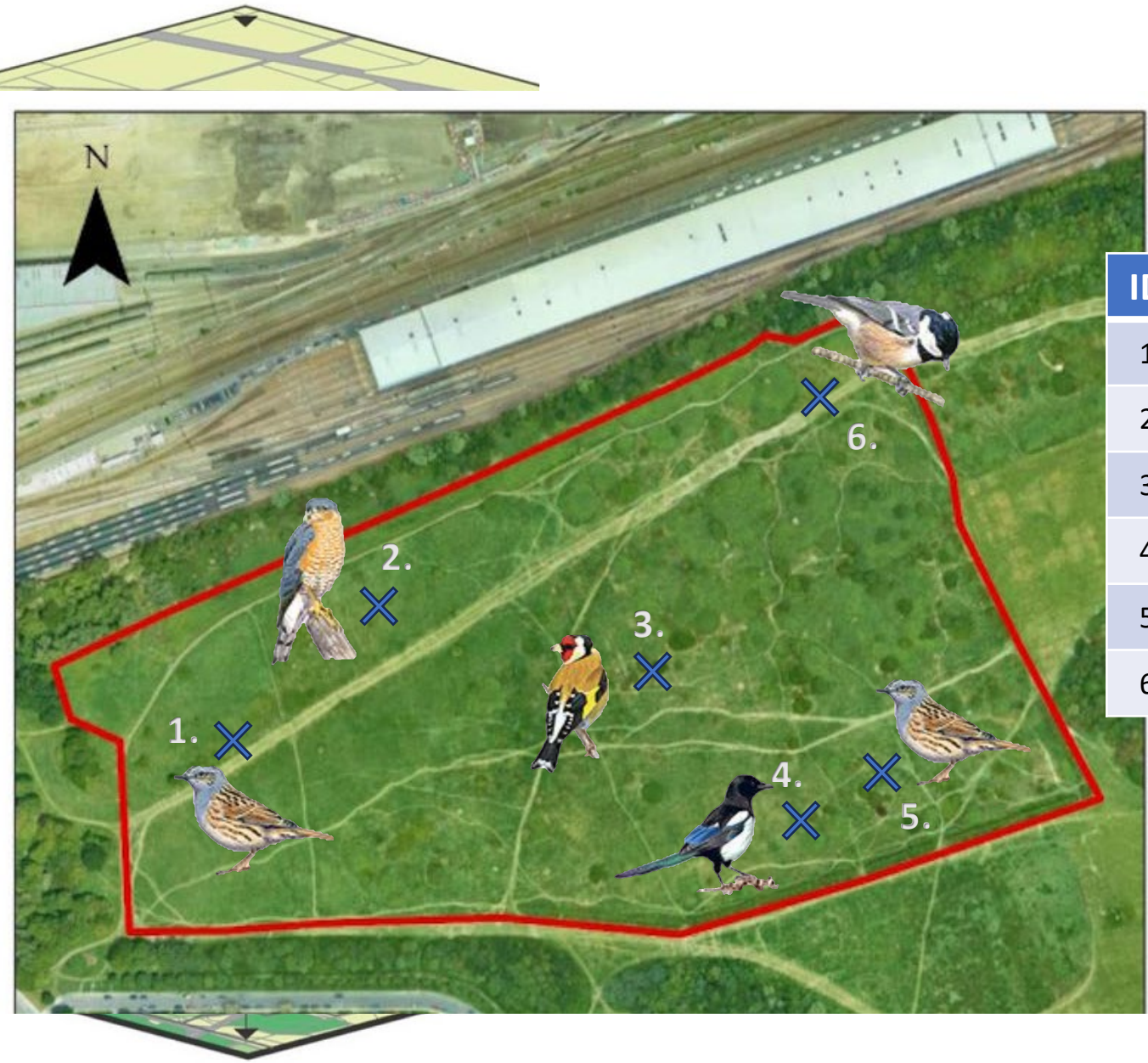
X	Y
266747	192700
266646	192676

Information

“descriptive information” (ESRI, 2023)

Attributes:
Qualitative or Quantitative,
Describe the geographic feature

Systems

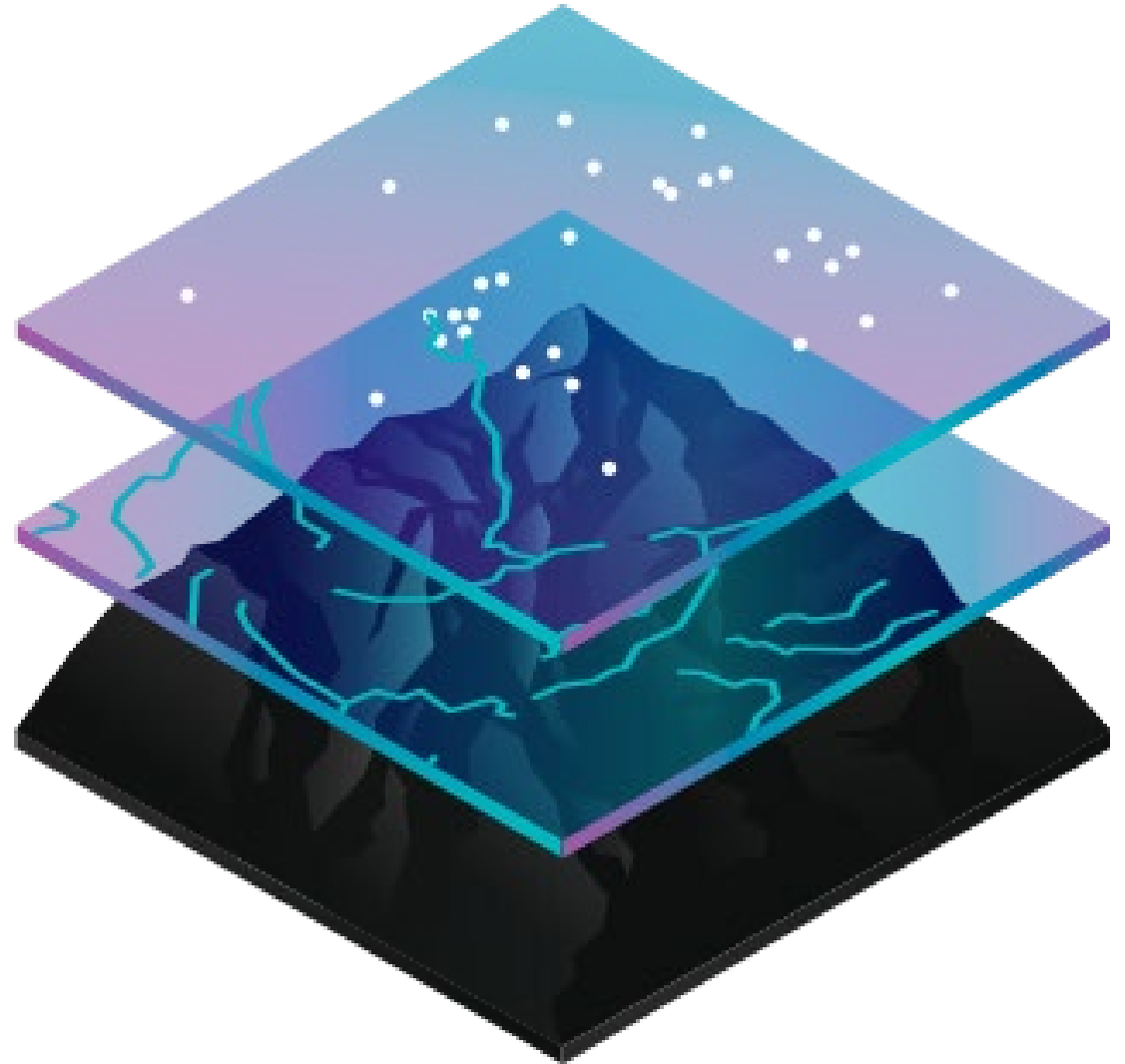


- Imagine the following bird survey is conducted, what information could you store alongside the location?

ID	X	Y	?	?	?	?	?	
1	52.16	-4.31						
2	52.30	-4.19						
3	53.14	-4.36						
4	52.96	-4.88						
5	52.07	-4.20						
6	52.55	-4.71						

- Consider a scenario where you discovered just the data, and you knew nothing about the survey, what data would need to be captured to make it useful?

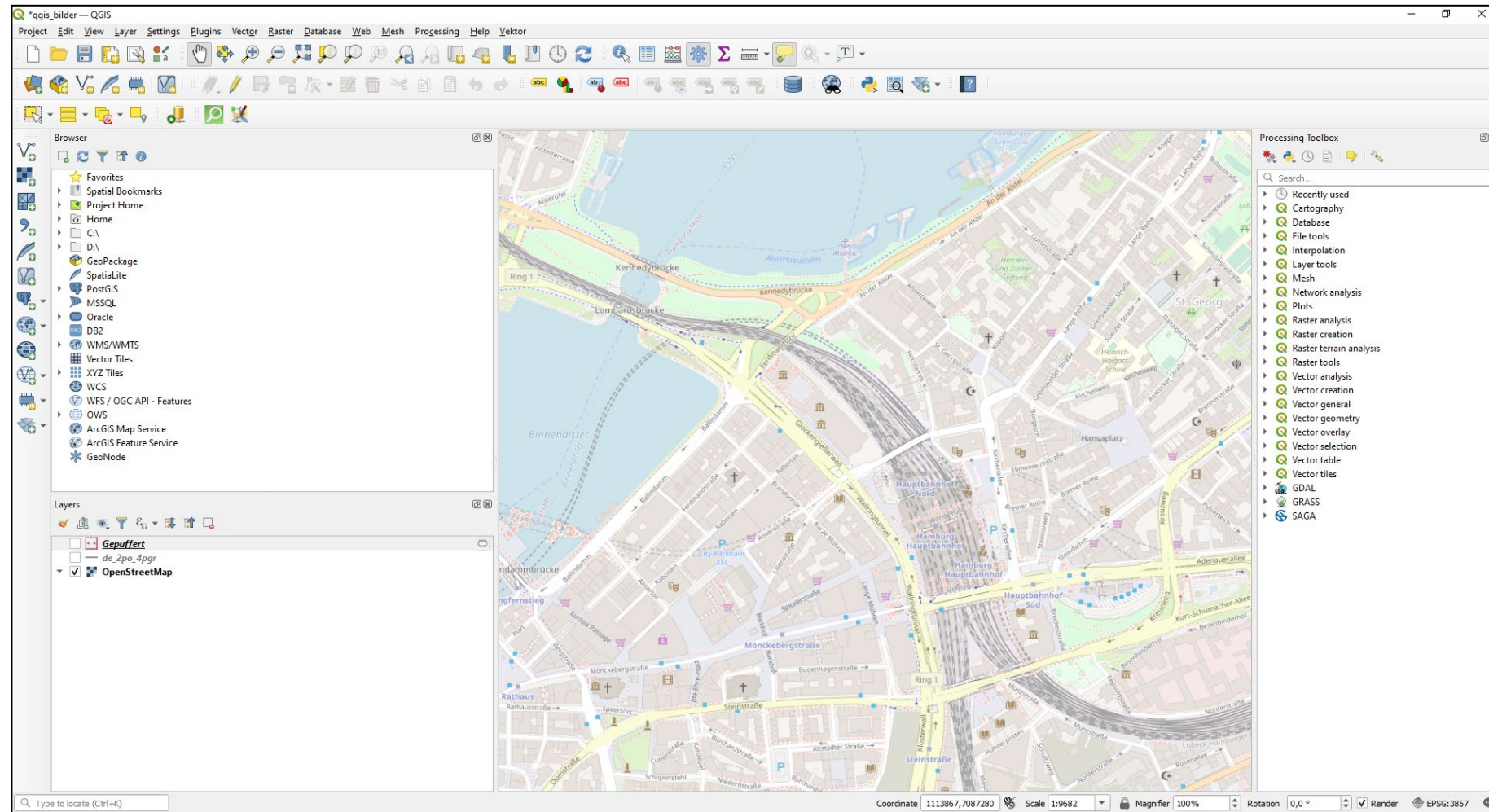
Practical: GIS software for Data Visualisation



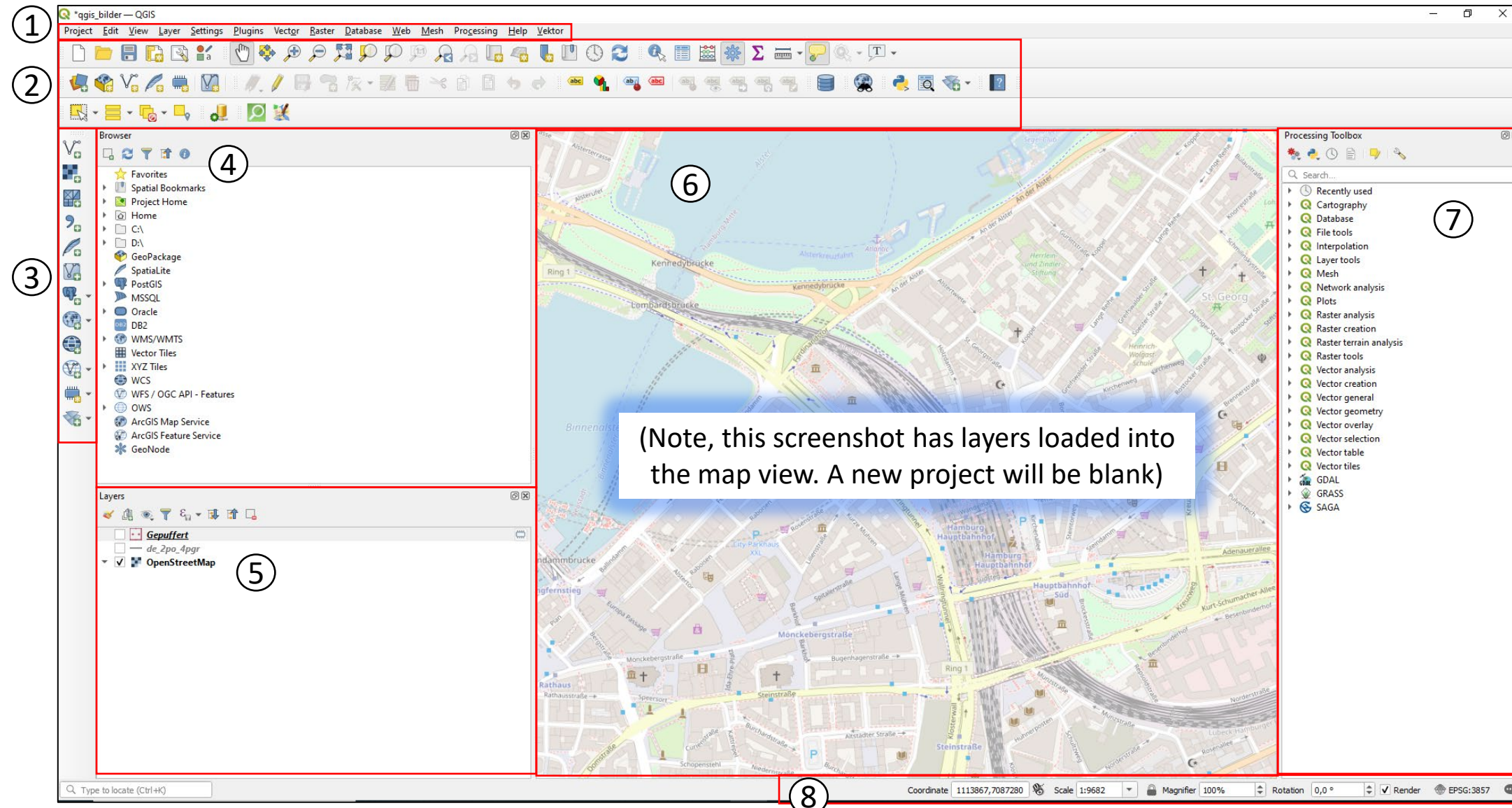
Quantum GIS (QGIS) is an open-source solutions which aim to provide comparable free software via volunteer projects.



- Volunteer project composed of different compiled functionalities (libraries)
- Similar functionality to other GIS (less specialised tools)
- Open-source software (not black box)
- Users / developer support
- Supports multiple file formats, including outputs from commercial GIS software



QGIS's Graphic User Interface (GUI) has the following features:



The first task of any project is to input data:

There are 4 options for importing data.

1. 'Layer' Drop down menu

- Add Layer
- Select data type you wish to import
- Navigate to file location in Windows directory

2. Data layer input icons

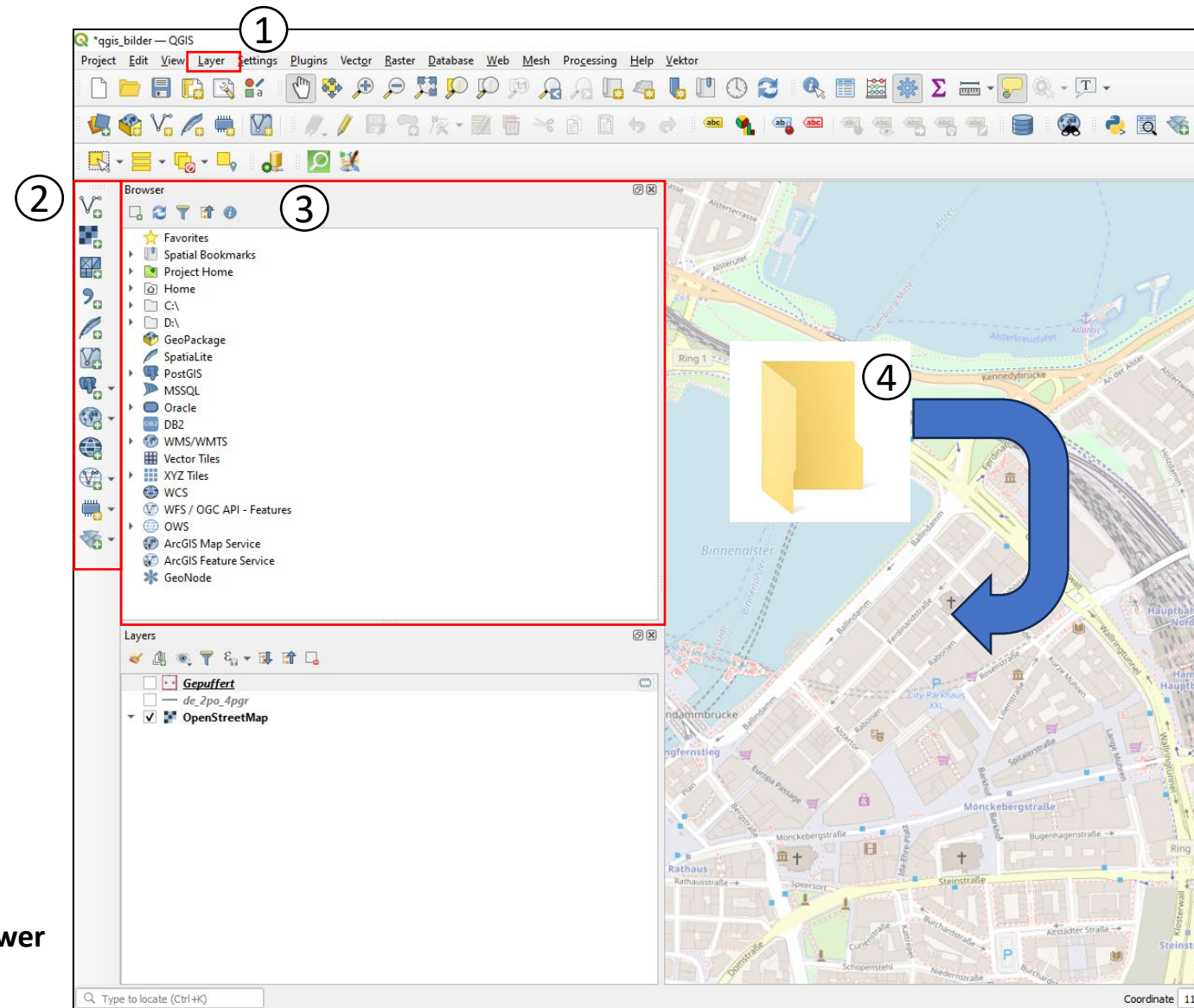
- Select data type you wish to import
- Navigate to file location in Windows directory

3. Browser panel

- Navigate to file location using file directory

4. Drag and drop

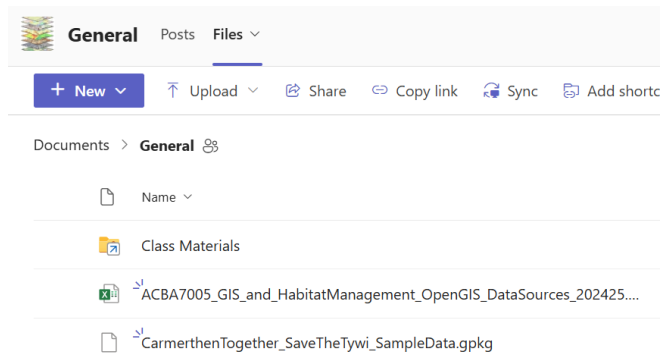
- Locate your file in Microsoft Documents window
- Click on the chosen file and drag it into the QGIS Map Viewer



'Carmarthen Together', a group formed to conduct a citizen science project ('Save the Tywi') after concerns about the River Towy's declining water Quality, have been collecting water samples at different locations within the catchment

ACTIVITY: Load and explore the Carmarthen Together citizen science water quality data samples (point sample vector data)

The dataset can be found on Teams:

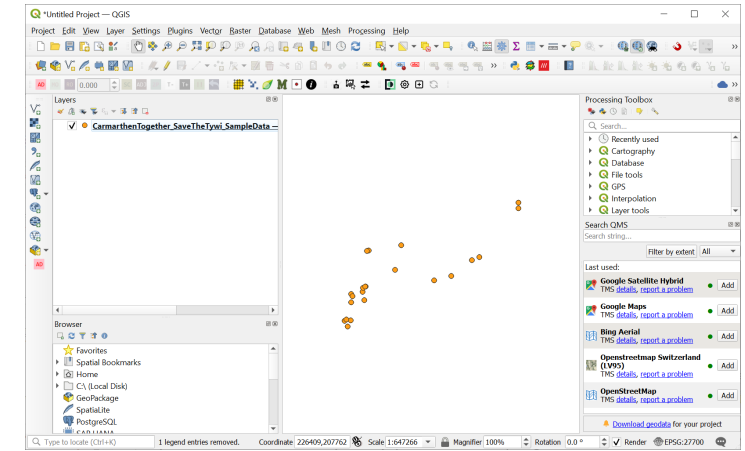


CarmarthenTogether_SaveTheTywi_SampleData.gpkg

Once the data is loaded, you will wish to explore it spatially

You can use a number of methods:

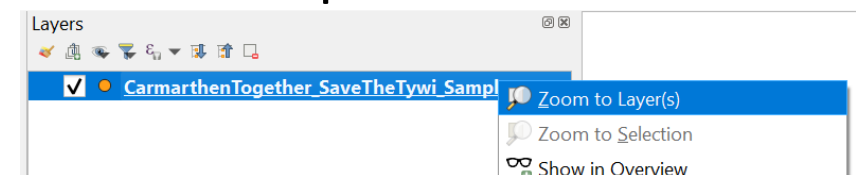
- Use the mouse to click and drag
- Use the keypad to move (pan) up, down, right, or left
- Scroll in and out with your mouse wheel to zoom in and out



There are also icons you can use to navigate:



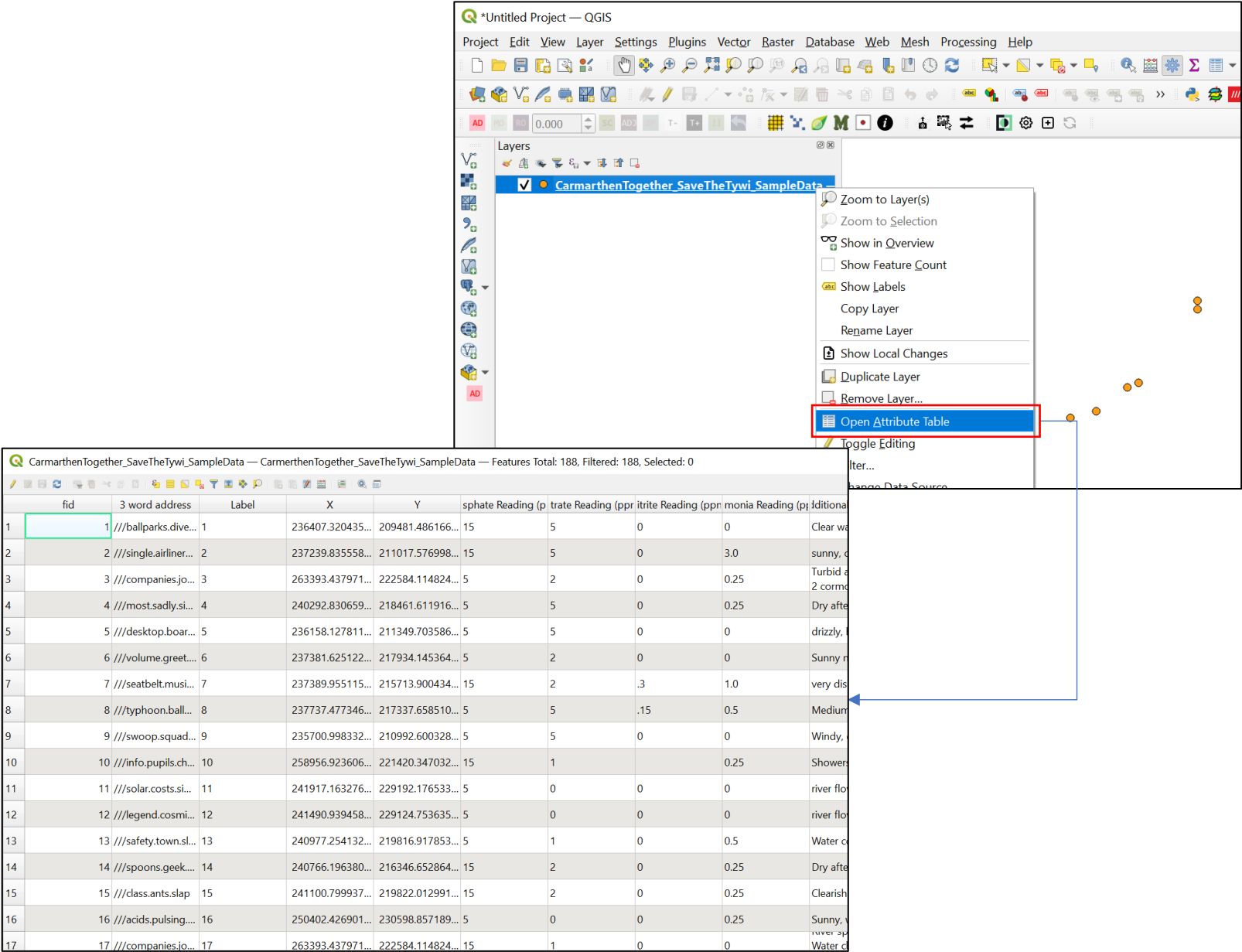
If you lose the data completely (cannot find it), right click on the filename in the 'Layers' panel, and click 'Zoom to Layer(s)' – this will return you to the full spatial extent of the layer.



While the map view shows the features spatially, the user can also explore the attribute table via the ‘Open Attribute Table’ option.

Right-click on the layer, and select the ‘Open Attribute Table’ option.

A new window will open with the complete attribute table. This can take a few minutes when there are a lot of features.

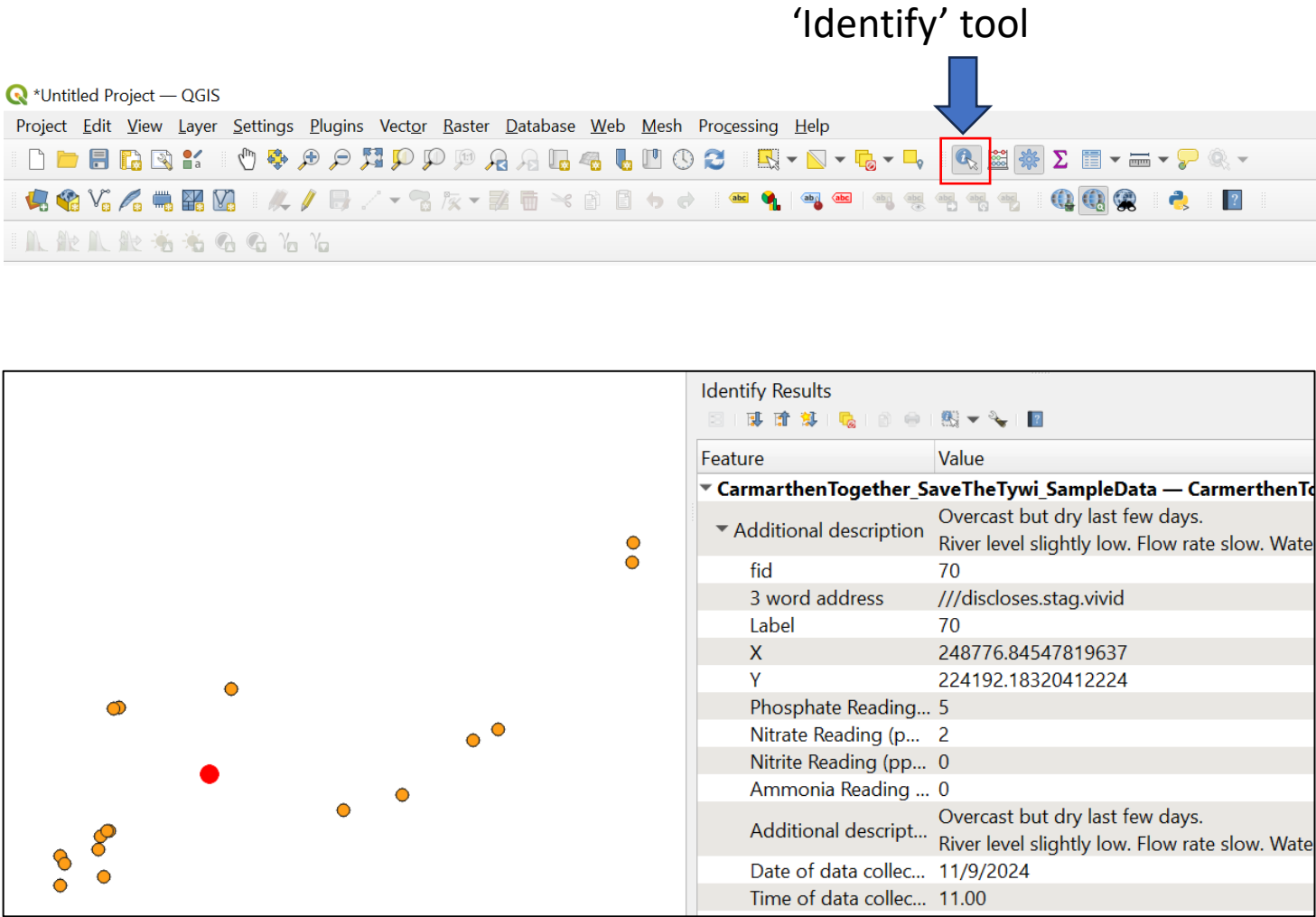


When presented with a number of features spatially in the map view, the user is unable to see the background data table of information / data, and may not wish to view the full attribute table to identify the attributes of one feature.

If the user wishes to identify these discrete features, they can use the ‘Identify’ tool

Then click on an item, which will then bring up the attributes associated with that feature

Try clicking on a point feature using the ‘Identify’ tool.



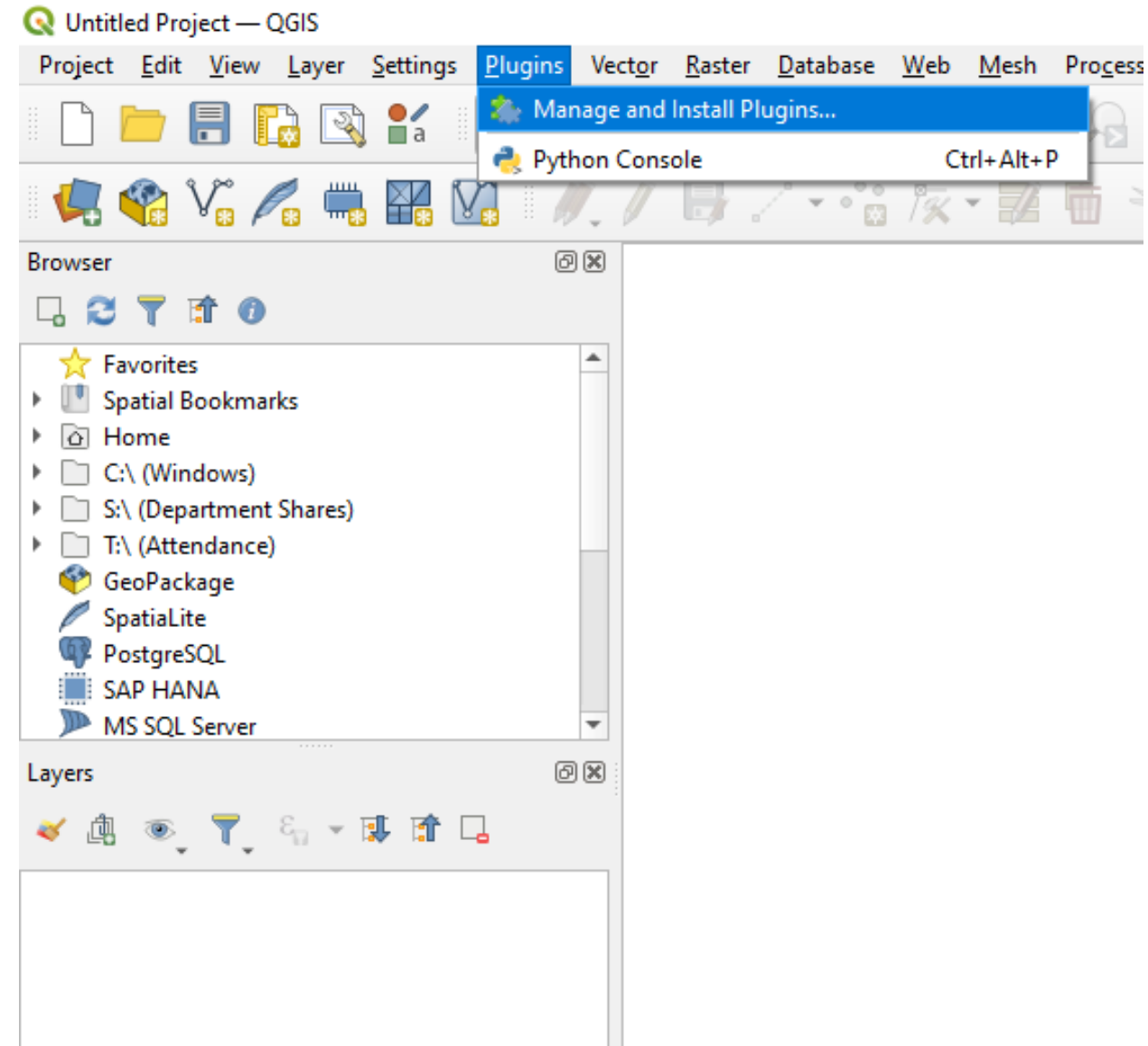
NOTE: The layer must first be selected in the Layers list, and the Identify Results window emerges in the lower right corner

In order to aid visual interpretation of the input data, it can be useful to add base maps.

Base maps can be spatial datasets that the user adds, or they can be third party datasets.

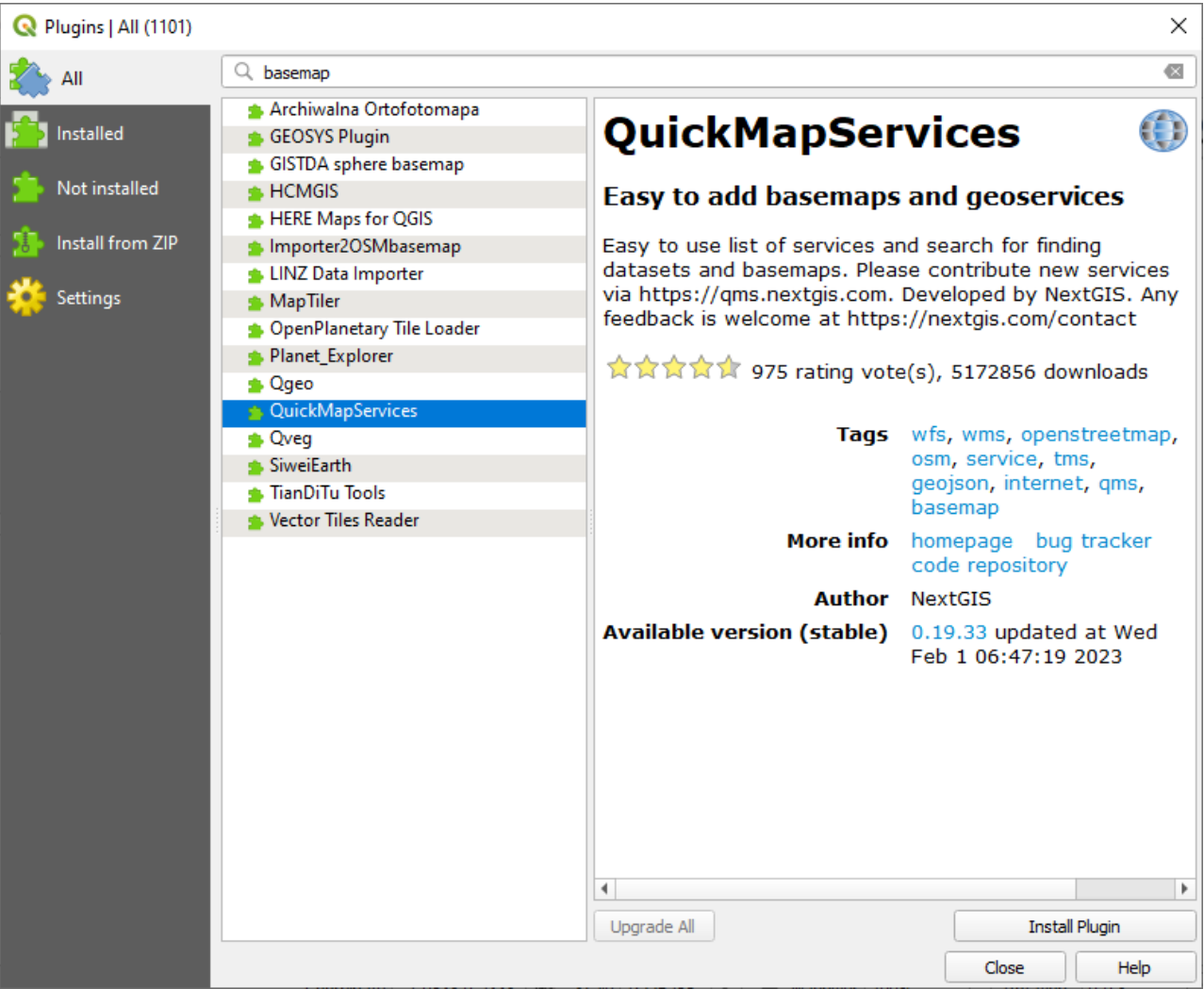
Typically, they are datasets with thematic contextual information e.g. streets, topography, physical landscape features

They allow the user to relate (spatially) they data they have imported into the GIS system to other features of reference within the vicinity.



Install the QuickMapServices plugin:

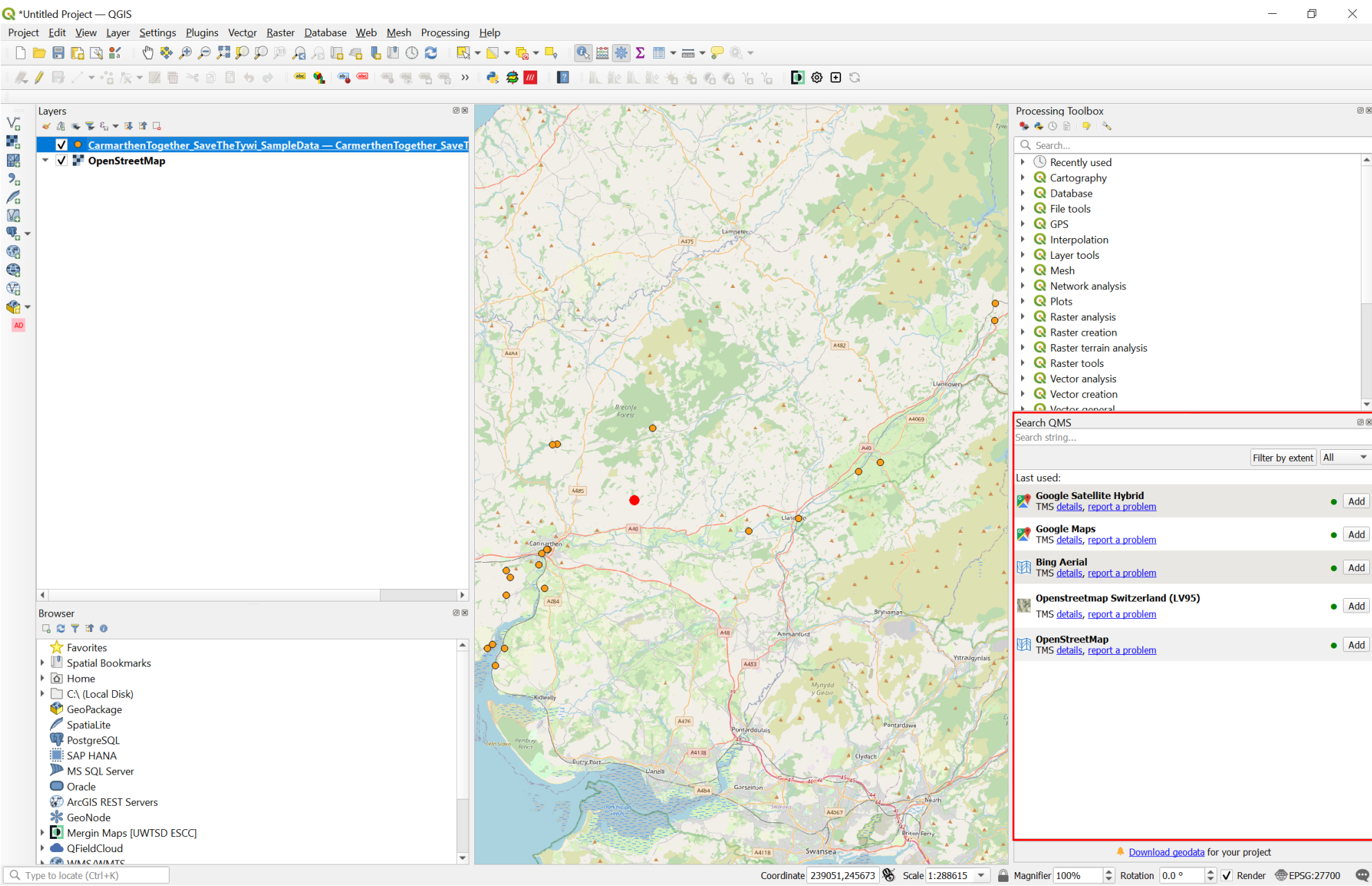
This plugin allows you access to visualise maps hosted online for public access, including:

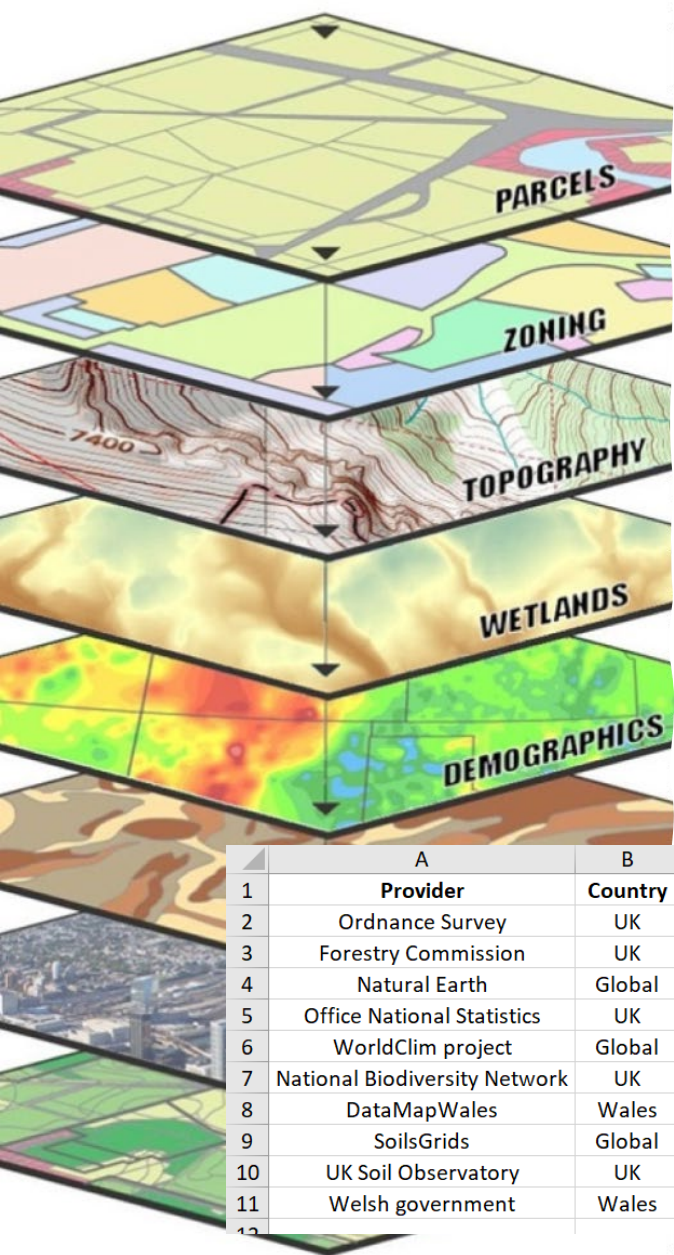


These are all examples of **Web Map Services (WMS)**

The user can now infer spatially related information:

- Absence / Presence
- Relative extent
- Distance (proximity)
- Density / sparsity

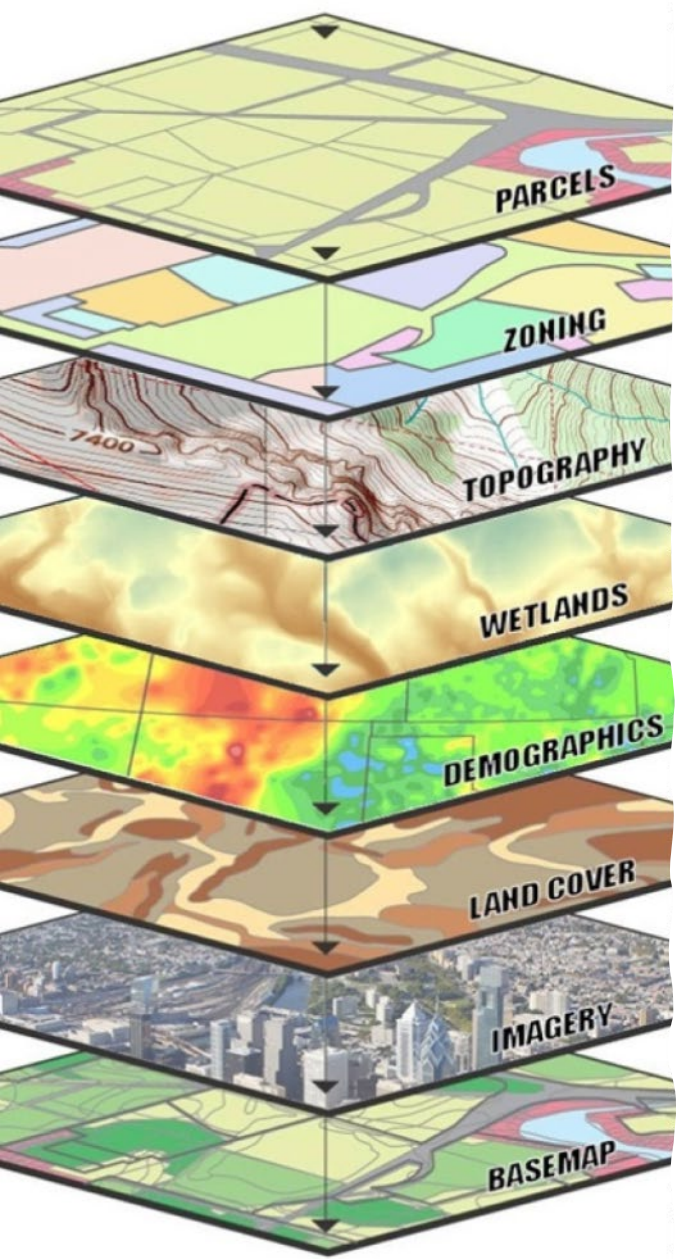




ACTIVITY:

- Find and open the database on Teams module channel with examples of open-source datasets:
ACBA7005_GIS_and_HabitatManagement_OpenGIS_DataSources_202425.xls
- Follow the ‘Source’ links and identify GIS datasets
- Download at least two datasets
- Copy this downloaded data into a new folder in your OneDrive account
- Open the layers in QGIS (using instructions on slide 21)
- Explore the data in QGIS (your tutor will guide you).

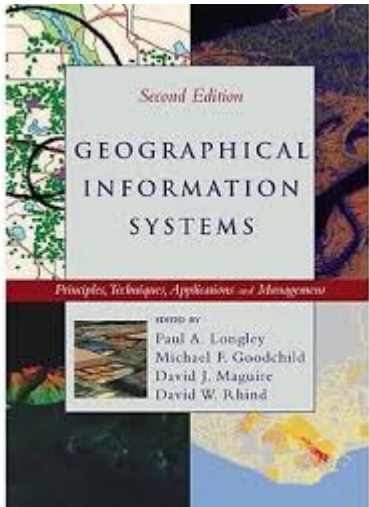
	A	B	C	D	E	F	G	H
	Provider	Country	Raster	Vector	Attribute	Data	Source	Access
1	Ordnance Survey	UK	x	x	x	Urban / land use mapping	https://osdatahub.os.uk/downloads/open	Open
2	Forestry Commission	UK		x	x	Forestry vector data	https://data-forestry.opendata.arcgis.com/	Open
3	Natural Earth	Global	x	x	x	Physical and cultural data	https://www.naturalearthdata.com/	Open
4	Office National Statistics	UK		x	x	ONS statistics data - population densities and boundaries	https://geoportal.statistics.gov.uk/	Open
5	WorldClim project	Global	x			Global climatic data	https://www.worldclim.org/data	Open
6	National Biodiversity Network	UK			x	Species observations records	https://records.nbnatlas.org/explore/your-area	Licence
7	DataMapWales	Wales		x	x	Repository / Catalogue for Wales specific natural / social data	https://datamap.gov.wales/	Varies
8	SoilsGrids	Global	x			Soils and geology data	https://soilgrids.org/	Open
9	UK Soil Observatory	UK		x		Soil and water data	https://mapapps2.bgs.ac.uk/ukso/home.html	Open
10	Welsh government	Wales	x	x		Various data	https://datamap.gov.wales/search/?limit=20&offset=0	Open
11								
12								



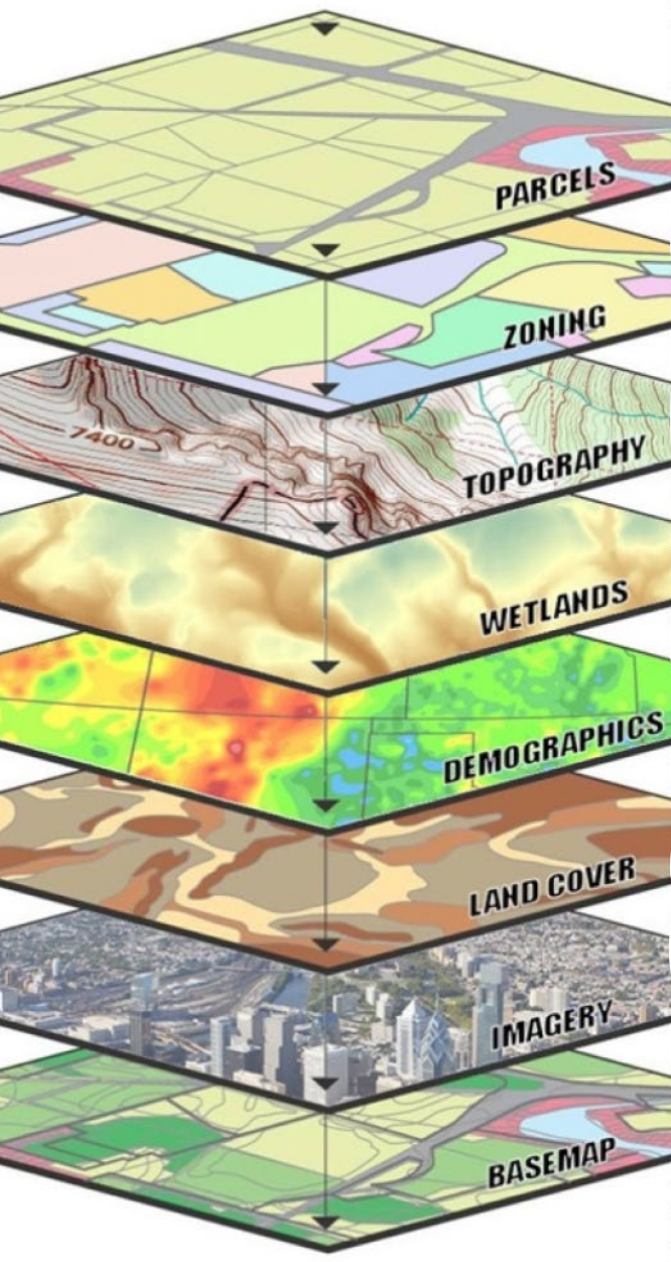
The next lecture will cover:

Phase 1 Habitat Surveys
and National Vegetation Classification
with Elanor Alun

Suggested reading:



Classification	Reading List entry	Electronic*
Essential	Longley, P, Goodchild, M, Maguire, D, Rhind, D (2015) <i>Geographical Information Systems and Science</i> , Hoboken, NJ: Wiley	☒
Essential	Alexander, M. (2013) <i>Management Planning for Nature Conservation: A Theoretical Basis & Practical Guide</i> , 2nd Edition, Springer. 536pp	☒
Further	Heywood, I., Cornelius, S. and Carver, S. (2011) <i>An Introduction to Geographical Information Systems</i> , 4 th ed. Essex: Pearson Education	☐
Further	Ausden, M. (2008). <i>Habitat Management for Conservation: A Handbook of Techniques (Techniques in Ecology & Conservation)</i> Oxford University Press, 430pp	☒



Any questions?

Please contact via:

Email:

a.cunningham@uwtsd.ac.uk

Teams:

"ACBA7005 GIS and Habitat Management 24/25_GRP"