

# **Renewable Energy & Hydroelectric Works**

**8th semester, School of Civil Engineering**

**2nd semester, Master's Programme "Water Resources Science & Technology"**

## **QGIS: An introduction**

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# What are Geographic Information Systems (GIS)?

- A **GIS** captures, stores, analyses and visualizes data linked to locations on Earth.



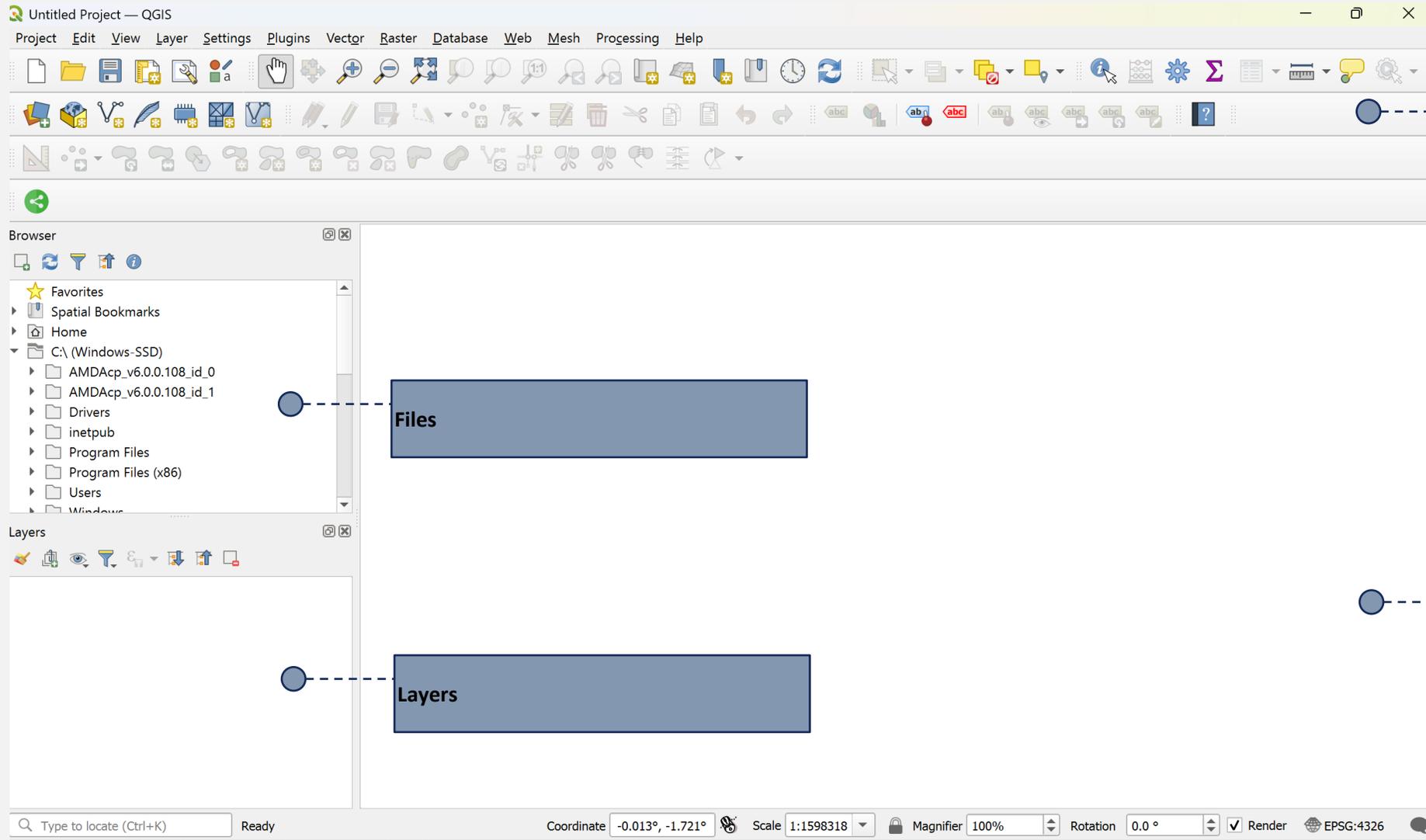
## ArcGIS (by Esri)

- 💰 Commercial — requires a paid licence
- 🏢 Industry standard in government & enterprise
- ☁️ Strong cloud & web GIS ecosystem (ArcGIS Online)
- 🎓 Widely taught in universities worldwide

## QGIS (Open Source)

- 🆓 100% free — no licence, no cost ever
- 🌐 Community-driven, constantly updated
- 🔌 Huge plugin library (Processing, GRASS, SAGA...)
- 👛 Used in research, NGOs, startups & public sector

# The QGIS Interface



Menu bar and Toolbars

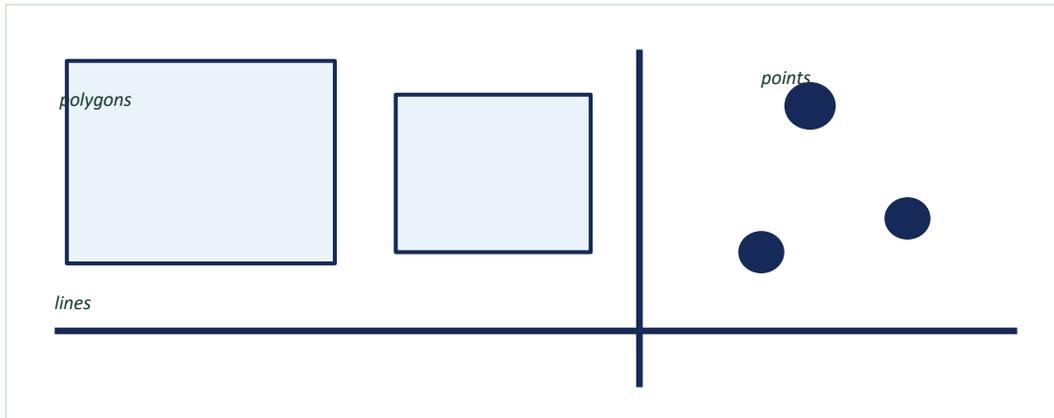
Files

Layers

Map  
Canvas

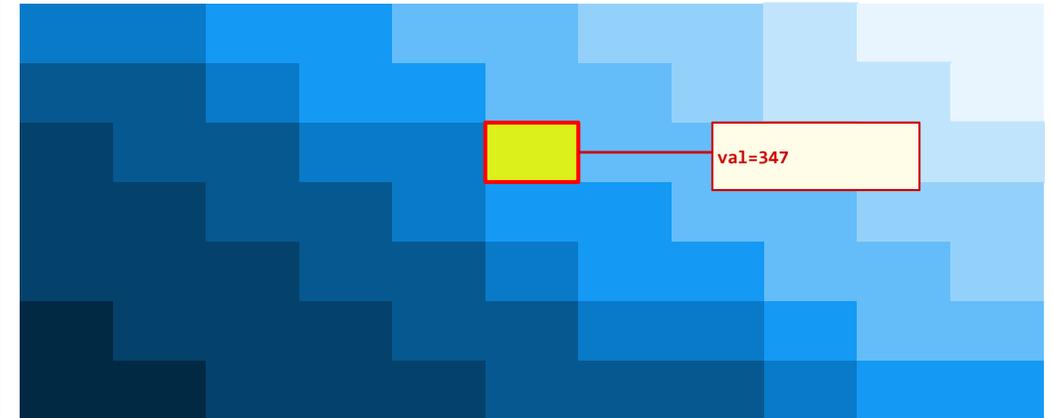
# Layers: Raster vs Vector

## VECTOR



- Made of geometric shapes: points, lines, polygons
- Each feature has attributes (name, type, value...)
- Scales without losing quality — no pixels!
- Examples: roads, buildings, country borders, GPS tracks

## RASTER

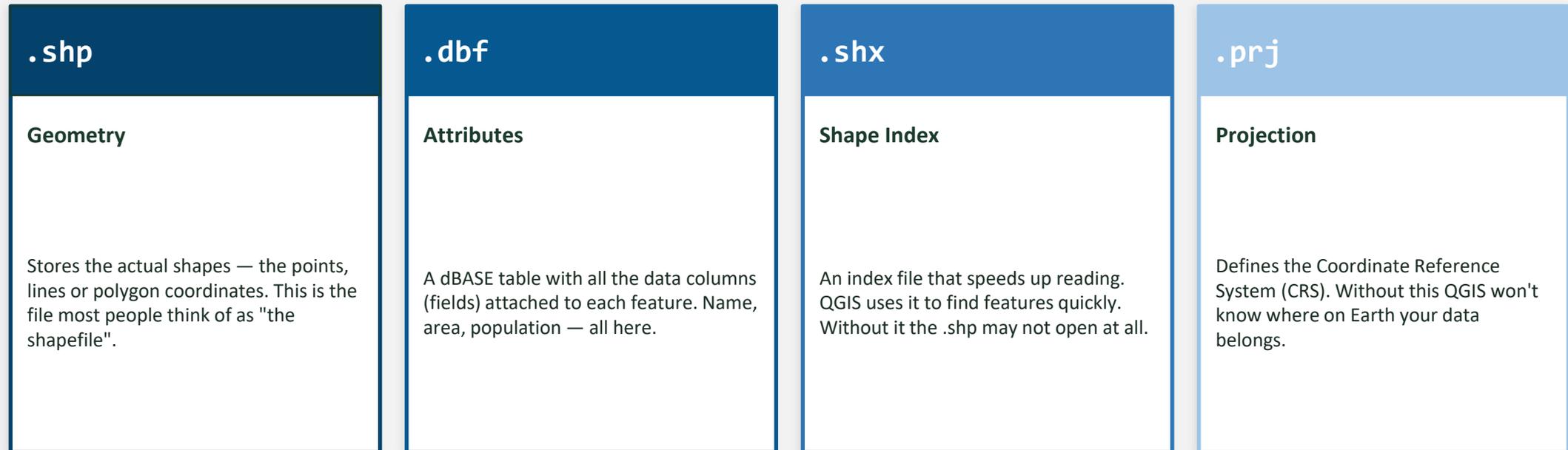


- A grid of cells (pixels), each holding a numeric value
- Resolution = cell size (e.g. 10m × 10m per pixel)
- Zooming in reveals individual pixels — quality is fixed
- Examples: satellite imagery, elevation (DEM), rainfall maps

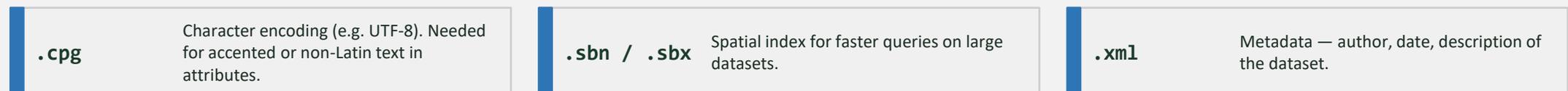
# Shapefile is not a single file

⚠ When you copy or share a shapefile, you must include ALL files — not just the .shp!

**MANDATORY** — all four must travel together:



**OPTIONAL** — may also be present:



# Import a shapefile

## What is a Shapefile?

A shapefile is a vector data format storing geometry (points, lines, polygons) + attributes. It comes as a bundle of files: .shp · .dbf · .shx · .prj

1

Layer → Add Layer → Add Vector Layer...

*Or drag & drop the .shp file onto the map canvas*

2

Source Type: File Browse to your .shp

*Make sure the .dbf and .shx are in the same folder*

3

Click Add then Close

*Your layer appears in the Layers panel on the left*

4

Right-click layer → Zoom to Layer

*Fit the map view to your new layer*

# Load a background

QGIS can load tiles

1 Open the Browser panel (View → Panels → Browser)

2 Expand XYZ Tiles in the Browser tree

3 Right-click XYZ Tiles → New Connection...

4 Paste the Google Maps URL (see right) → OK

5 Double-click the new connection to add it to your map

6 In Layers panel, drag it below your data layers

Google Satellite

```
http://mt0.google.com/vt/lyrs=s&hl=en&x={x}&y={y}&z={z}
```

# Create a new point or line layer

1

## New GeoPackage or Shapefile

Layer → Create Layer → New GeoPackage Layer (recommended) or New Shapefile Layer

2

## Set geometry type

Choose Point from the dropdown. Set the CRS to match your project.

3

## Add fields

Type a field name (e.g. "name"), pick Text data type, click Add to Fields List

4

## Save the file

Browse to a folder, give it a name, click OK. Layer appears in panel.

5

## Toggle Editing

Click the pencil  icon or press T. The layer enters edit mode.

6

## Add Point Feature

Click the Add Point Feature tool (or press A), then click on the map to place a point.

 Save edits frequently: Layer → Save Layer Edits (or Ctrl + S)

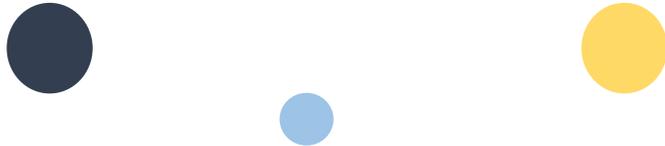
# Style your layers

## How to open Layer Properties

**1** Double-click the layer name in the Layers panel

**2** Right-click → Properties...

**3** Click the Symbology tab on the left



*You can change color, size, shape and add labels!*

### Single Symbol

One style for all features — quickest option for a new layer.

### Categorized

Different colors per category value (e.g. land use type).

### Graduated

Color ramp based on a numeric field (e.g. population count).

### Labels

Display field values on the map. Set in the Labels tab.

# Save your project

## Project → Save As... (Ctrl + Shift + S)

Saves a .qgz file that remembers all your layers, styles and map settings.

### The .qgz file is NOT your data

It stores references to your shapefiles / GeoPackages. Always keep your data files alongside the project.

### GeoPackage (.gpkg)

Consider saving all your layers into one GeoPackage — it bundles everything into a single portable file.

### Keep a tidy folder

Recommended structure: /project\_name/ → data/, styles/, output/, project.qgz

**Thank you**

***Testing leads to failure, and failure leads to understanding.  
- Burt Rutan***