# Data Mapping

01. Course Objectives

- Introduce GIS to include definition of a coordinate system, as well as comparing/contrast of geographic versus a projected coordinate system
- Explain different types of GIS data models to include raster and vector models, their properties
- Provide definition of GPS, its use and how it works
- Outline steps to using QGIS features
- Using shapefiles, and creating maps
- Conducting spatial analysis
- Using Map templates

What Is GIS?

- A Geographic Information System or geographical information system (GIS) is a system designed to capture, store, manipulate, analyze, manage, and present all types of spatial or geographical data.

- A GIS is a computer system capable of assembling, storing, manipulating, analyzing and displaying geographically referenced information, i.e., data identified according to their locations (Harvard University)

Line of latitude

Line of longitude

Equator

Prime meridian

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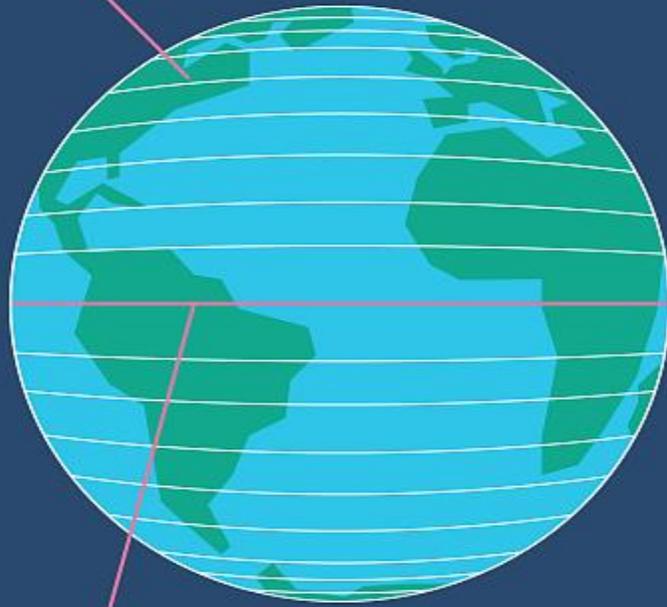
Geographic Coordinate System

- A geographic coordinate system (GCS) is a coordinate system that enables every location on earth to be specified by a set of numbers or letters, or symbols

- GCS uses 3-dimensional spherical surface to define locations on the earth

- The coordinates are often chosen such that one of the numbers represents vertical position, and two or three of the numbers represent horizontal position

- A common choice of coordinates is latitude, longitude and elevation

Projected Coordinate System

- A projected coordinate system (PCS) is defined on a flat, two-dimensional surface

- A PCS has constant lengths, angles, and areas across the two dimensions

- A PCS includes a map projection, a set of projection parameters that customize the map projection for a particular location, and a linear unit of measure.
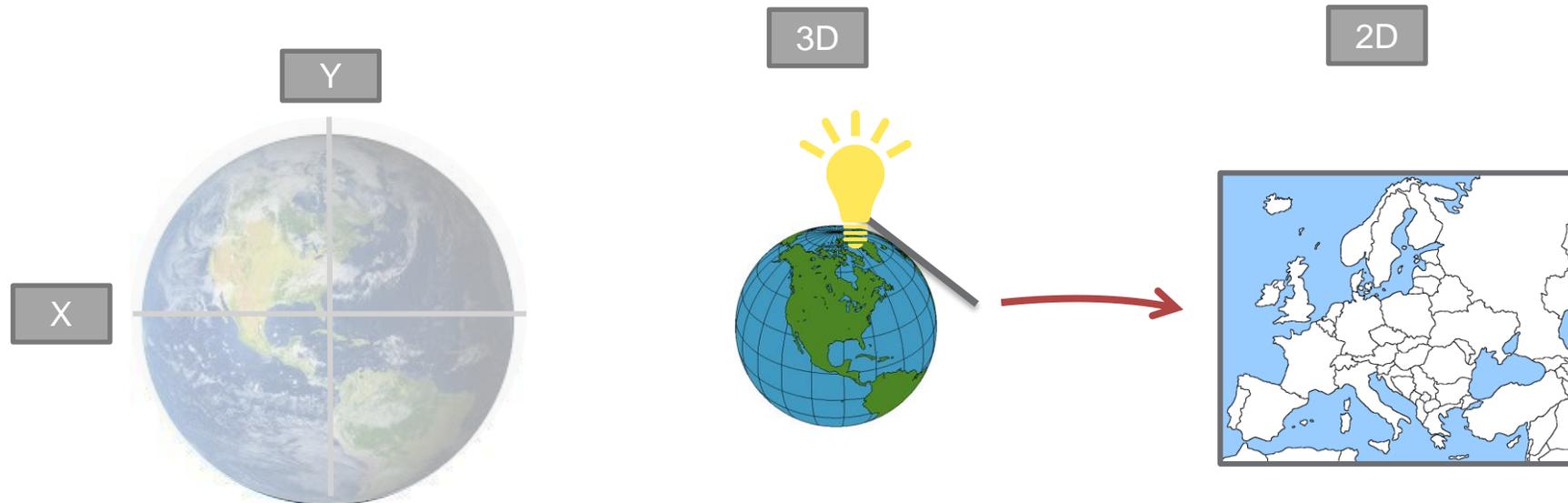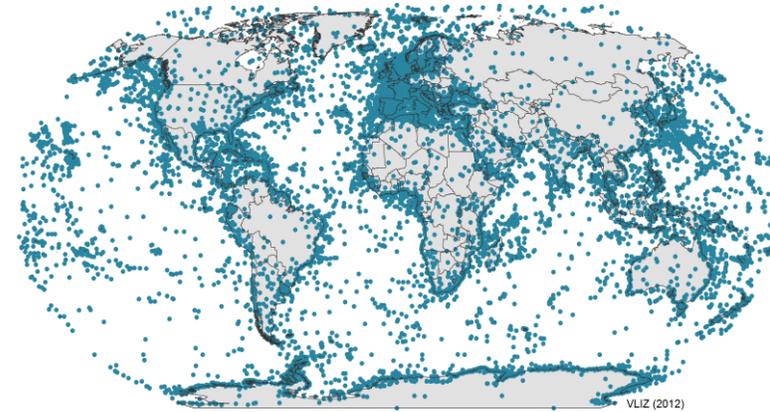
Data Models

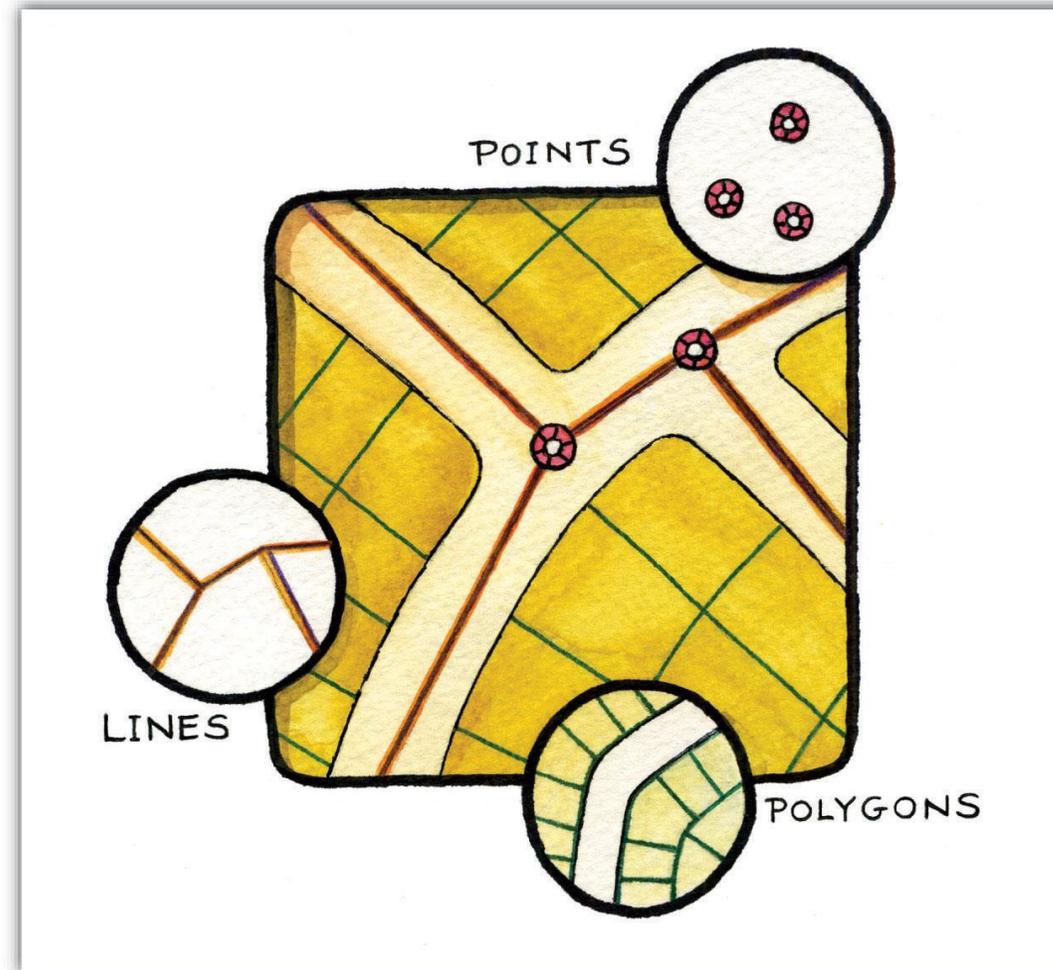A data model in GIS is a mathematical construct for representing geographic objects or surfaces as data
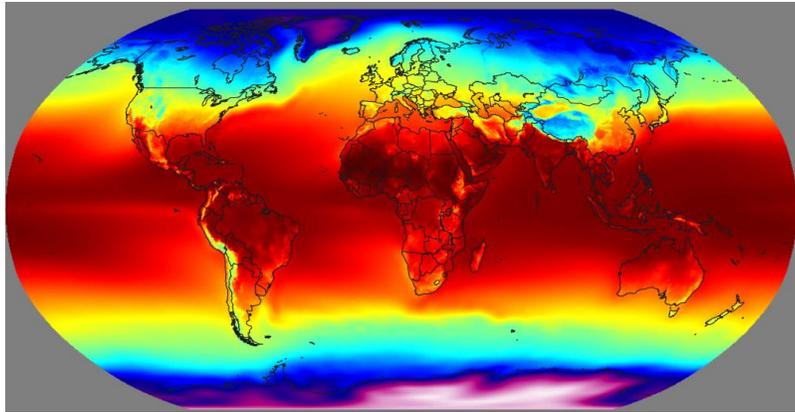

Raster: Continuous

Vector: Objects

# Vector Data Model

POINTS

LINES

POLYGONS

What Are Vectors?

- **Points** are zero-dimensional objects that contain only a single coordinate pair

    Points: Location of a mobile device, weather station, supermarket etc.

- **Lines** are one-dimensional features composed of multiple, explicitly connected points

    Lines: Street, River, track from a gps device

- **Polygons** are two-dimensional features created by multiple lines that loop back to create a "closed" feature

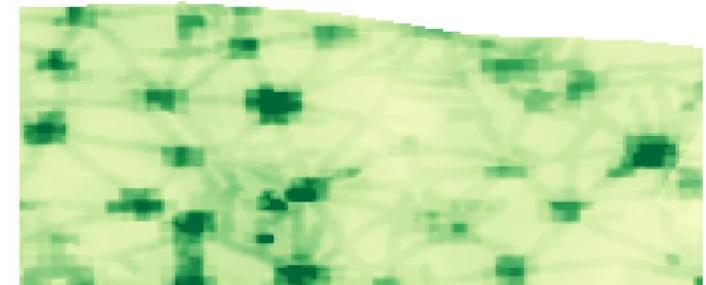   **Polygons**: country boundaries, lakes, buildings etc.
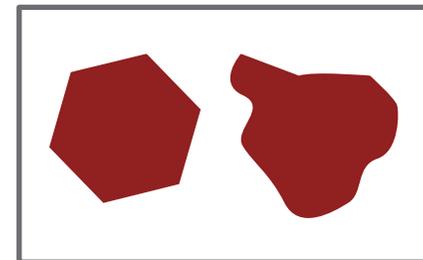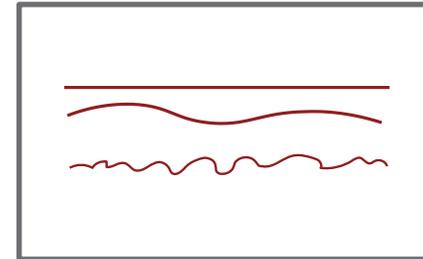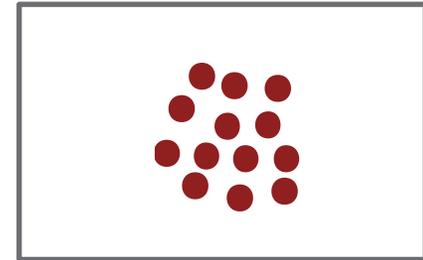
Raster Data Model

- Regular grid of cells
  - Cells represent an area on the ground
  - Resolution determined by the size of the cells

- All the cells looked at as a whole become a useful representation
- A value is assigned to each cell
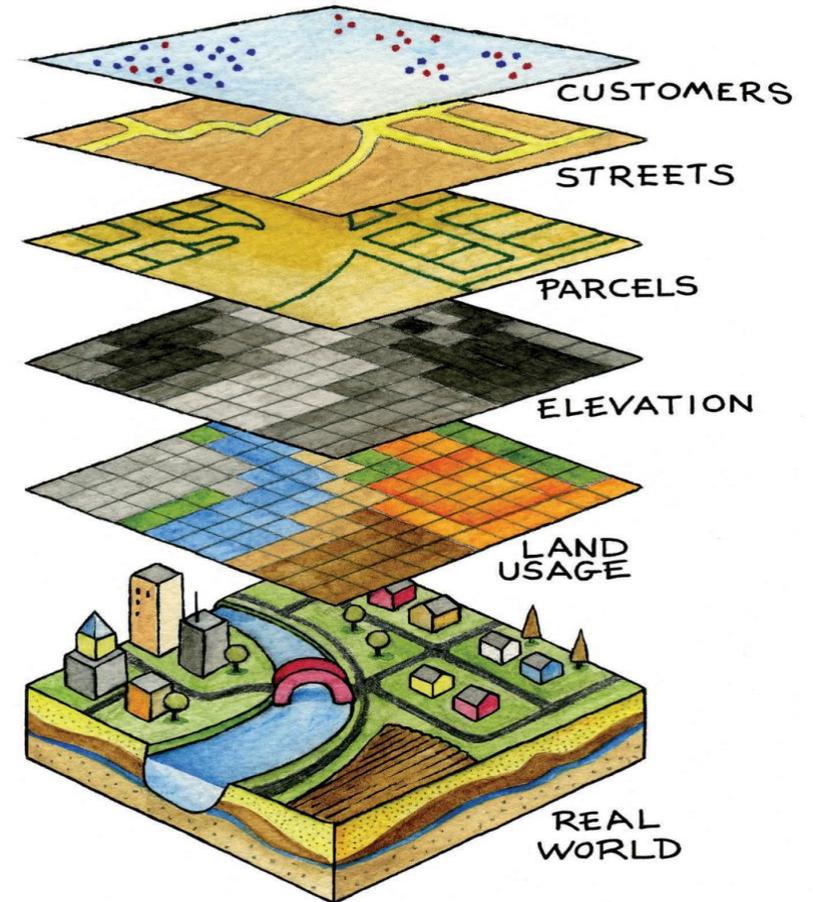- Satellite images is a type of raster
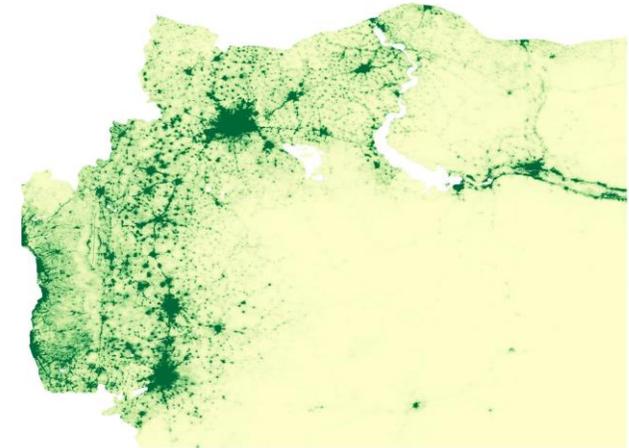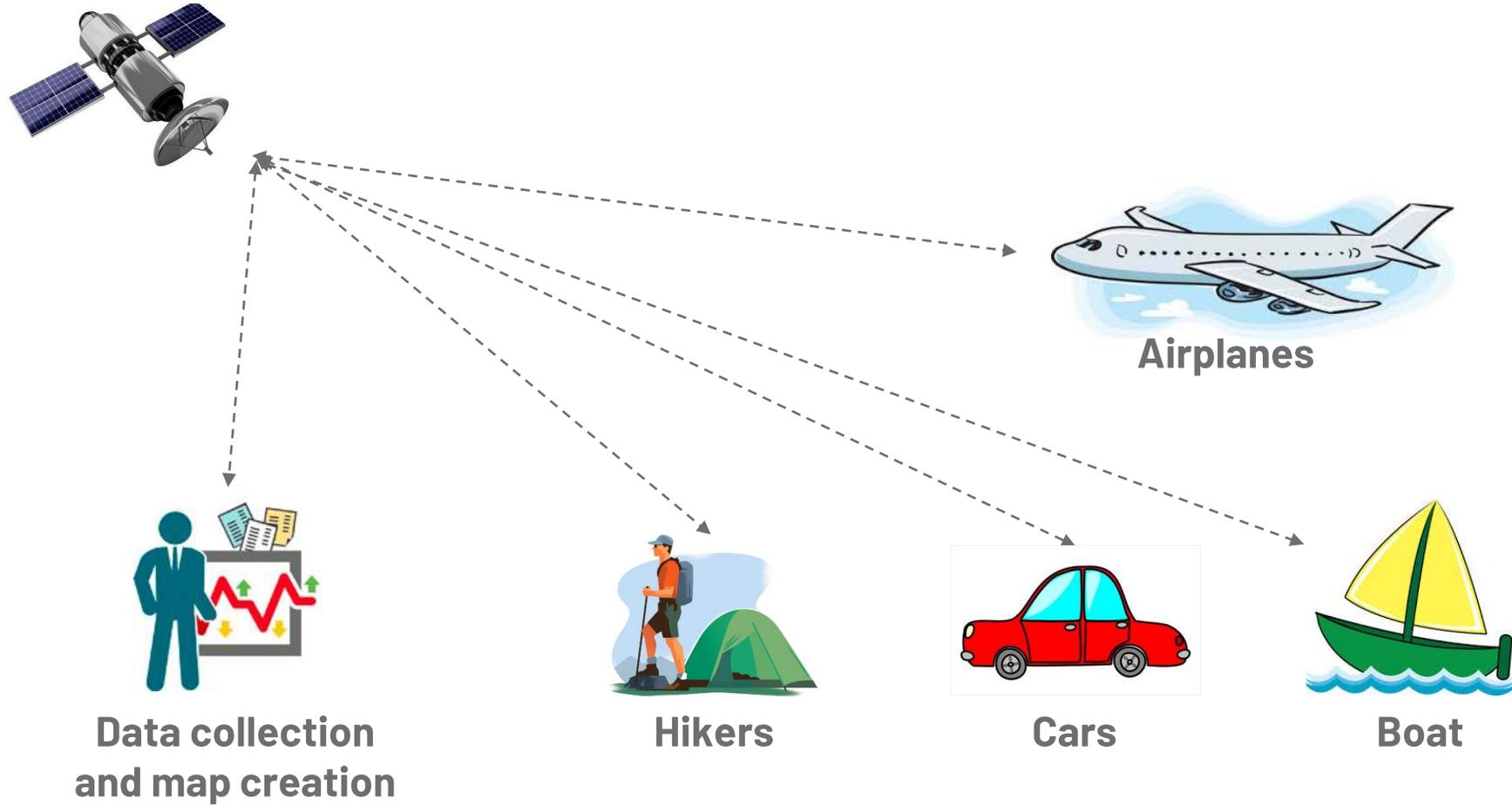
Zooming In

From The Real World to A Coordinate System

- Representations of reality

- Linking attributes to the representation

- Create spatial relationships between representations

GPS Usage

Airplanes

**Data collection
and map creation**

Hikers

Cars

Boat

The GPS System

visible sat = 12
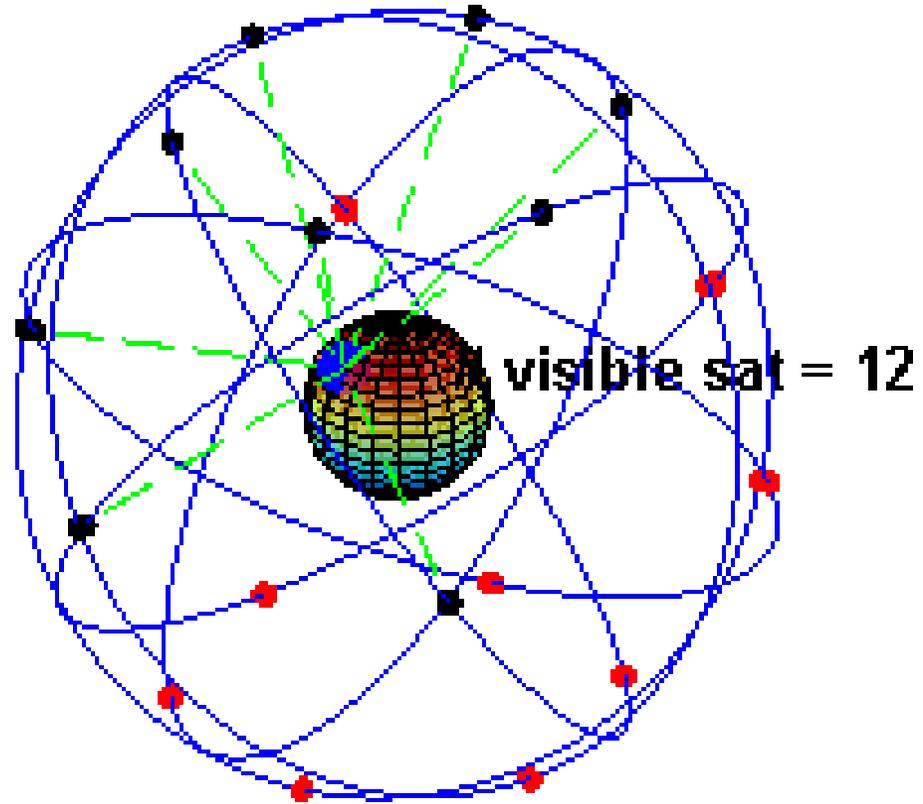
**Around 30 satellites are used to calculate
your position**

What GPS Needs To Work

Three or four satellites are "visible"

Correct time

Receiver
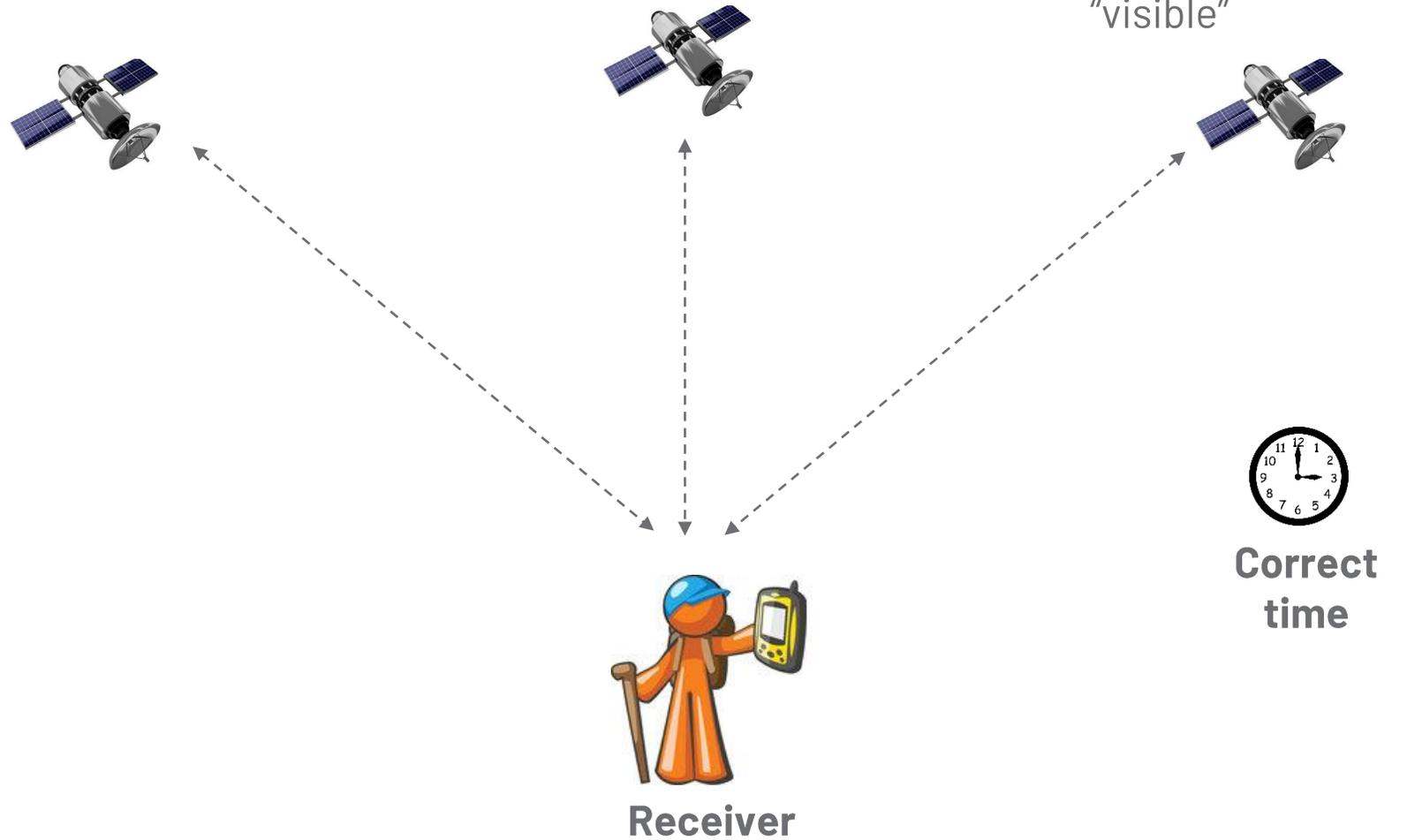
Basic GIS Functions

1 **Capture**

2 **Store**

3 **Edit**

4 **Analyze**

5 **Display**

#1 – Data Capture

#2 – Data Storage

- Database management system

- Linking attributes to spatial information

#3 – Data Editing

https://www.openstreetmap.org/search?query=Ethiopia#map=6/9.193/40.490&layers=H
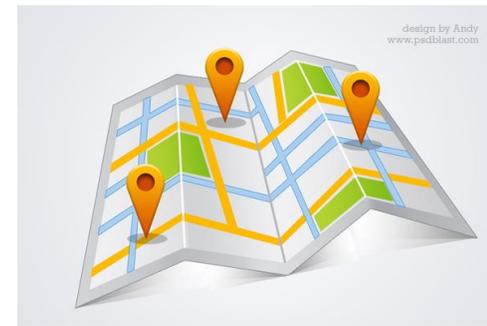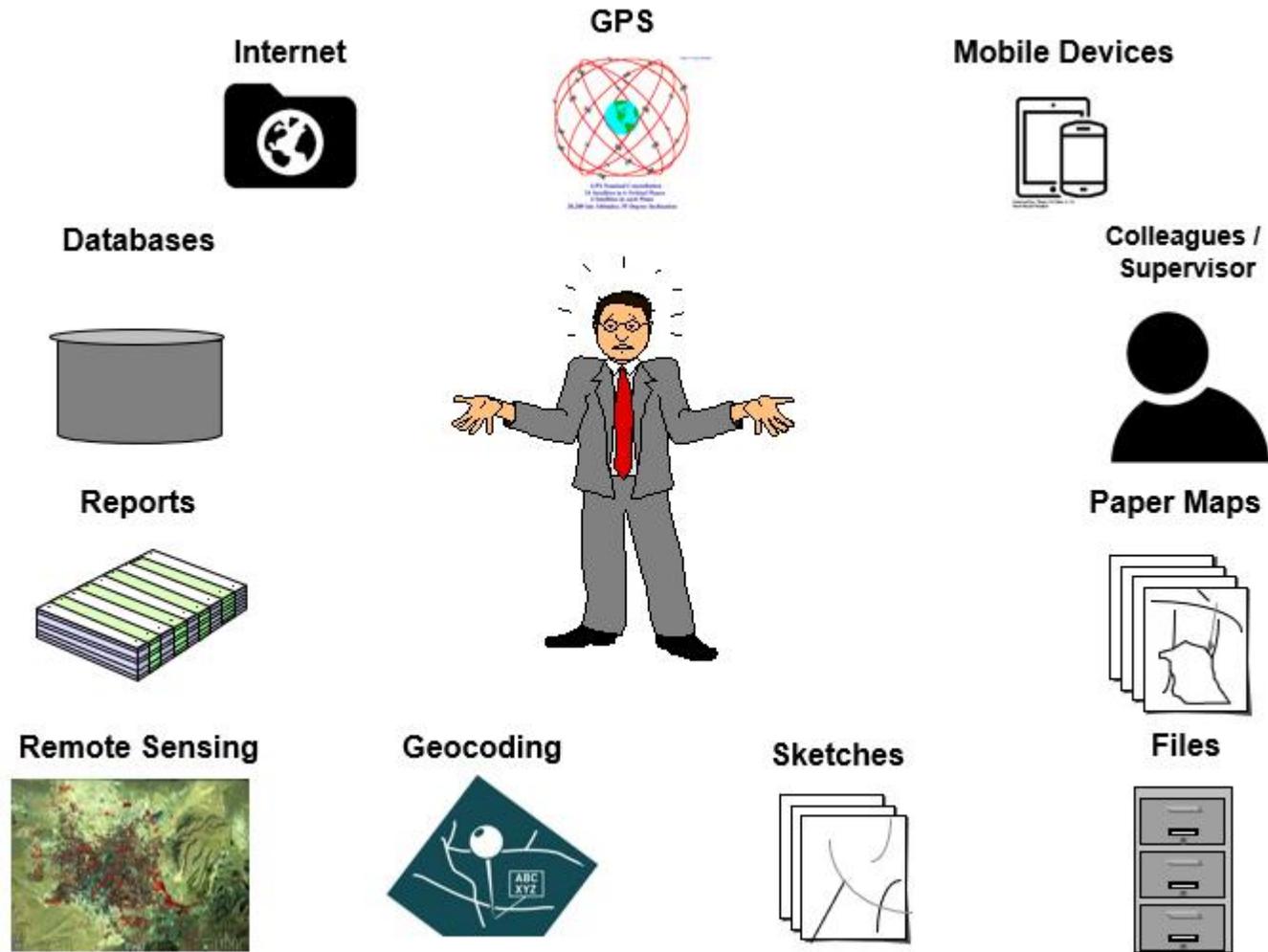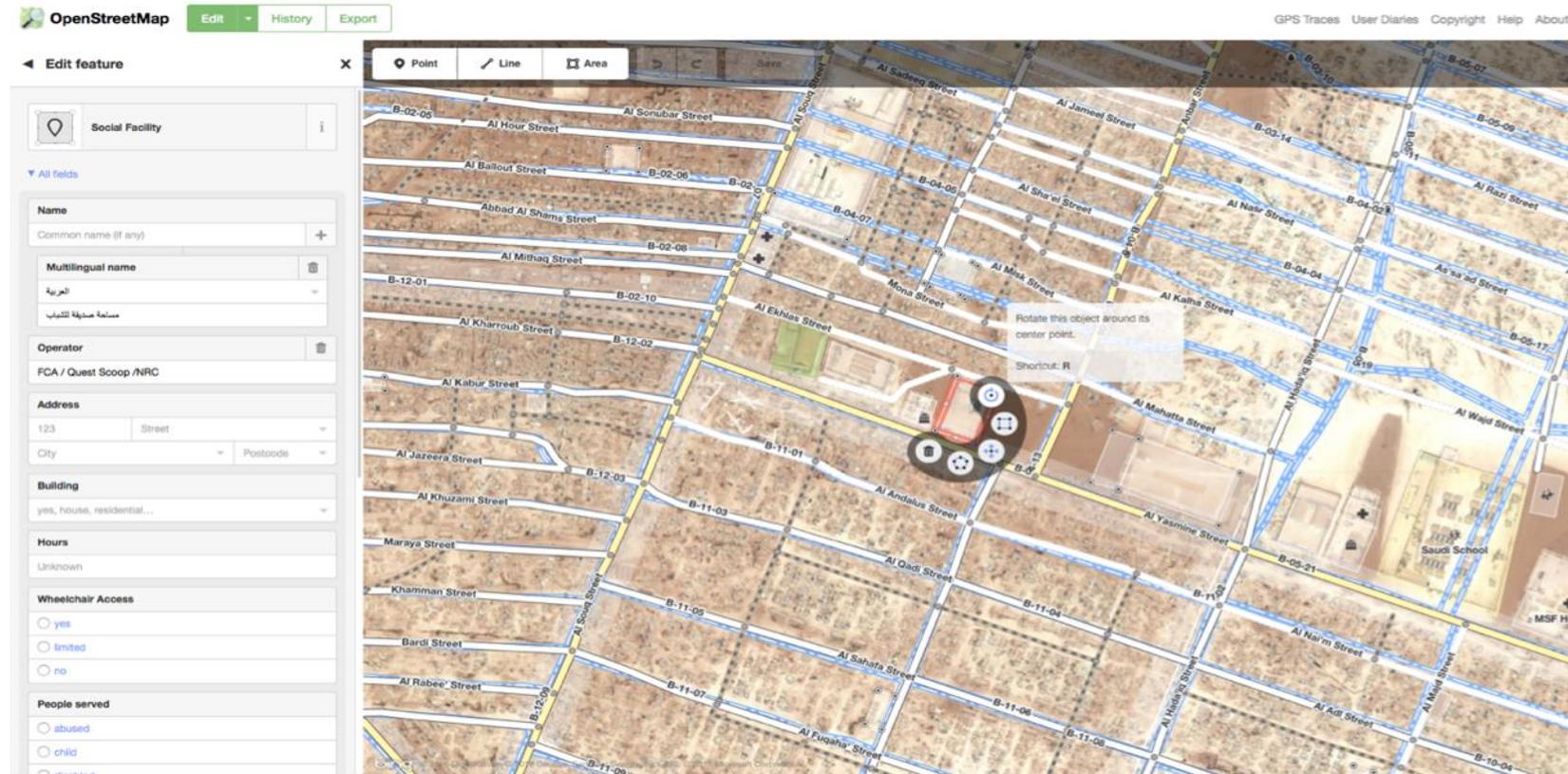
#4 –Data Analysis

GIS answers the following questions:

What is at a given location?

Where does it occur?

What is nearby?

What trends are occurring?
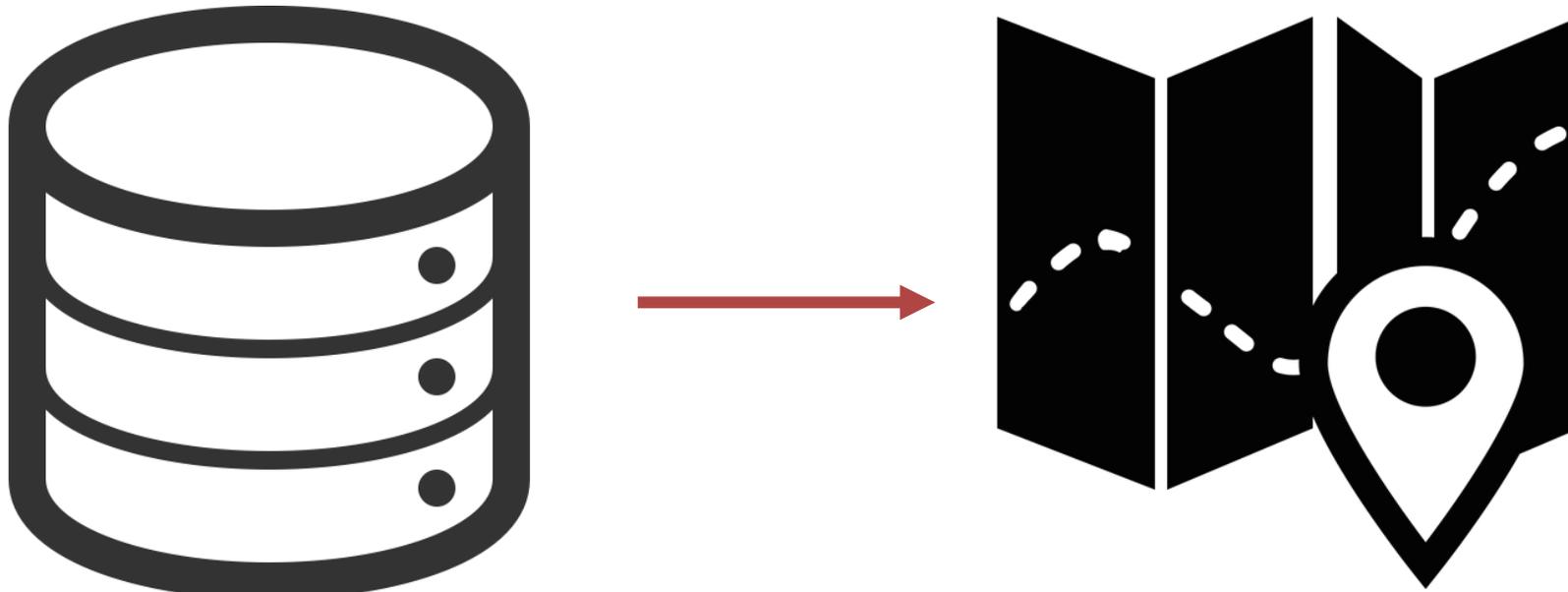
What happens "if"?

What relationships occur?

#5 – Display and Output

Combined layers to create a map

All kinds of maps can be created in various formats

Limitations Of GIS

- No data = no map!

- Bad data = bad map!

- Not everything displayed on a map is true

- Maps can present problems, but not solve them

- GIS software is quite complex and needs time to be learned

Administrative Boundaries

- P-code code is short for "Place Code"
- Unique identifiers to thousands of locations and administrative units in a humanitarian operation
- Provide a systematic means of linking data to an unambiguous location
- Information that is tagged with P-codes can be combined and analyzed with any other "p-coded" data
- Go to https://data.humdata.org
- Type "Ethiopia Administrative Boundaries" in the search box
- Download the shape files and the pcodes excel sheet

About QGIS

QGIS or Quantum GIS

- Free and Open Source GIS

- Cross-platform (works on Windows, Mac, Linux and Android, and and supports numerous vector, raster, and database formats and functionalities)

- Data viewing, editing and analyzing

- Available in 48 languages

Data Formats

Table formats
- Spreadsheets (.xls, .xlsx, …)
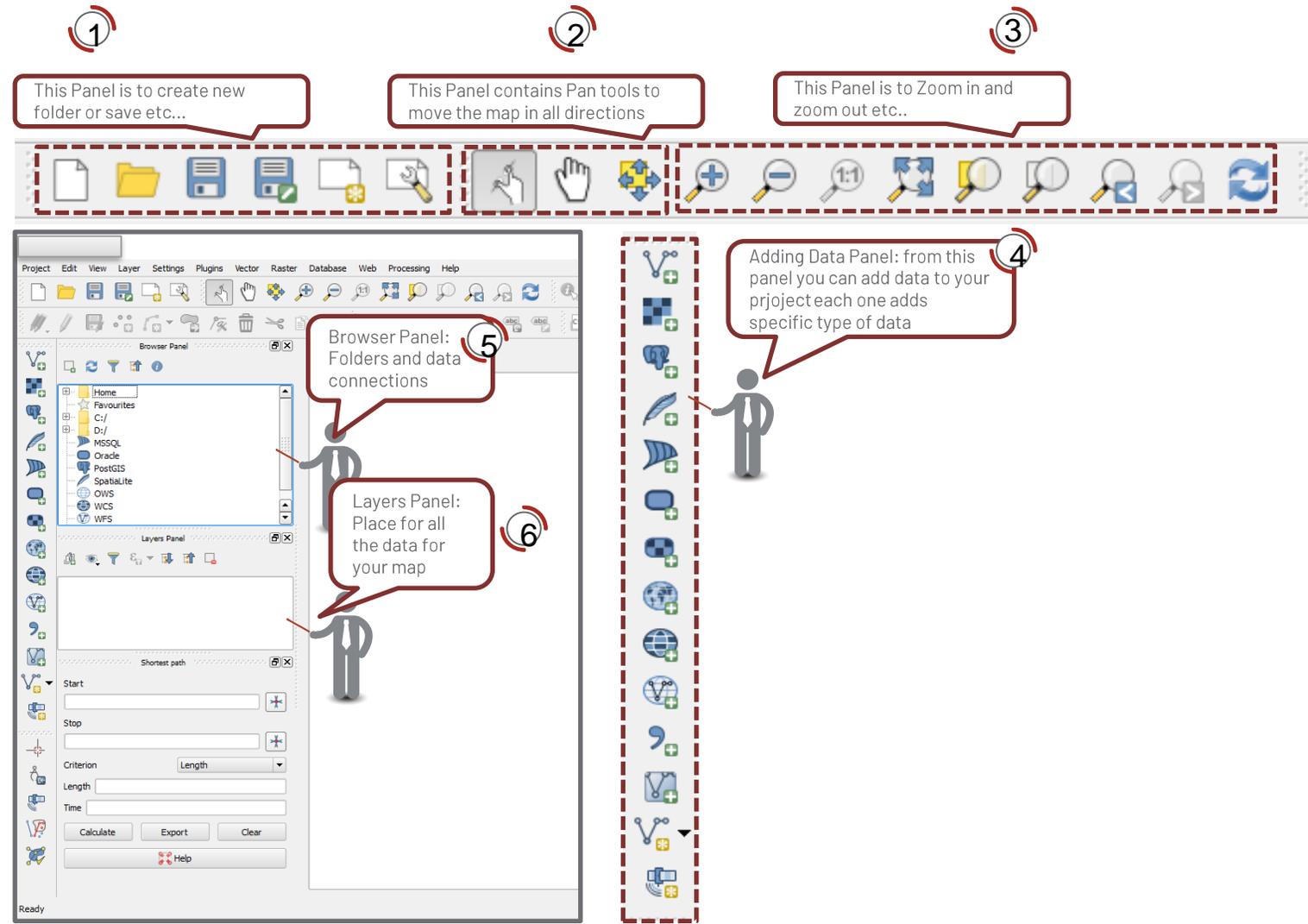- Text data (.csv, .txt, .tab, …)

GIS data
- ESRI shapefiles (.shp / .zip)
- Google Earth files (.kml / .kmz)
- Web services: Web Map Service (WMS), Web Coverage Service (WCS)
- Many more: GPX, GEOJSON, GMT, GML…)
- You can open (almost) all of them in QGIS!

Other formats
- Databases, API calls
- Word documents, PDFs, scans, paper

Tool Bars And Layout

- As the first time you open QGIS you will see much tools that you might be confused

- But it is not that confusing as you will learn in this course about all the tools you will need to create a map and adding data to analyze it

① This Panel is to create new folder or save etc...

② This Panel contains Pan tools to move the map in all directions

③ This Panel is to Zoom in and zoom out etc..

④ Adding Data Panel: from this panel you can add data to your prjoject each one adds specific type of data

⑤ Browser Panel: Folders and data connections

⑥ Layers Panel: Place for all the data for your map

Adding A Shape File.shp

- Click on Layer
- Choose Add Layer
- Choose Add Vector Layer
- Click on Browse and choose the file destination
- Click Open
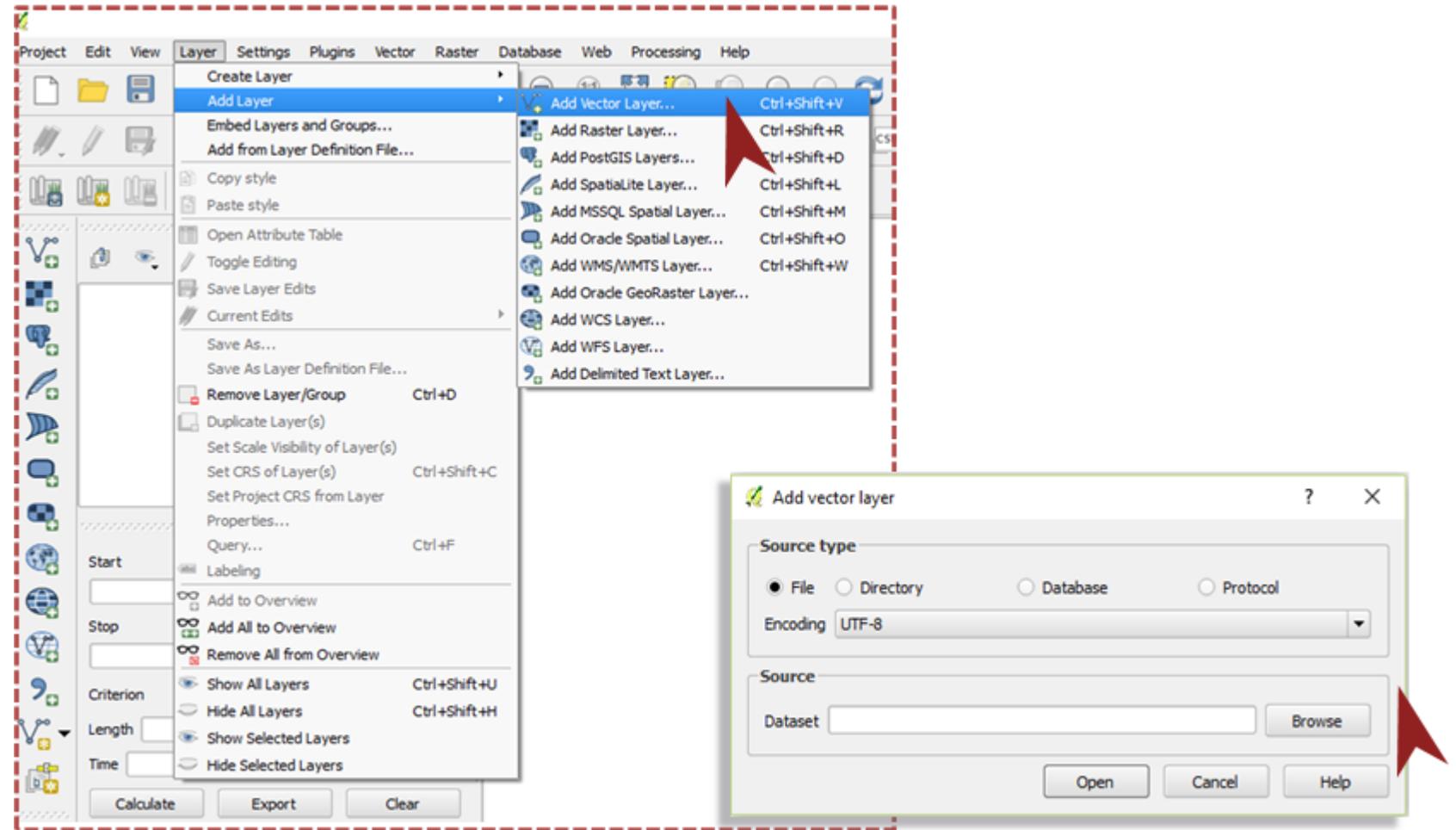
Adding A Text File .csv

- Click on Layer
- Choose Add Layer
- Choose Add Delimited Text Layer
- Click on Browse and choose the file destination
- Make sure all the options as shown below
- Click OK when done
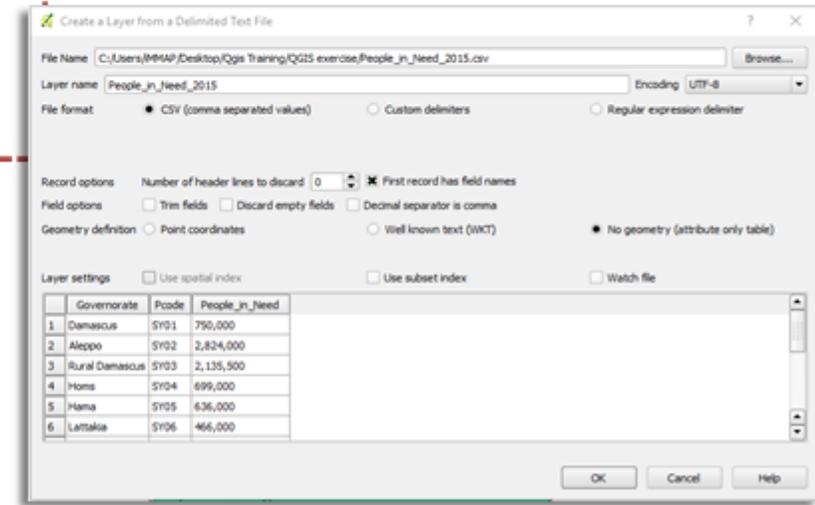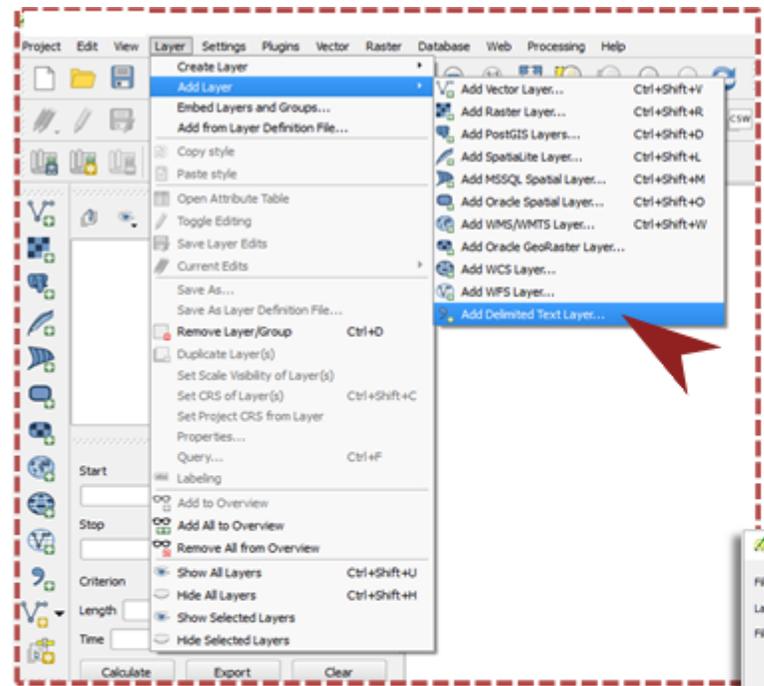
Attribute Table and P-Code

- Every map has its data and this data you can find it in the attribute table of that map or shape file
- To see this data right click on that layer file and choose open attribute table
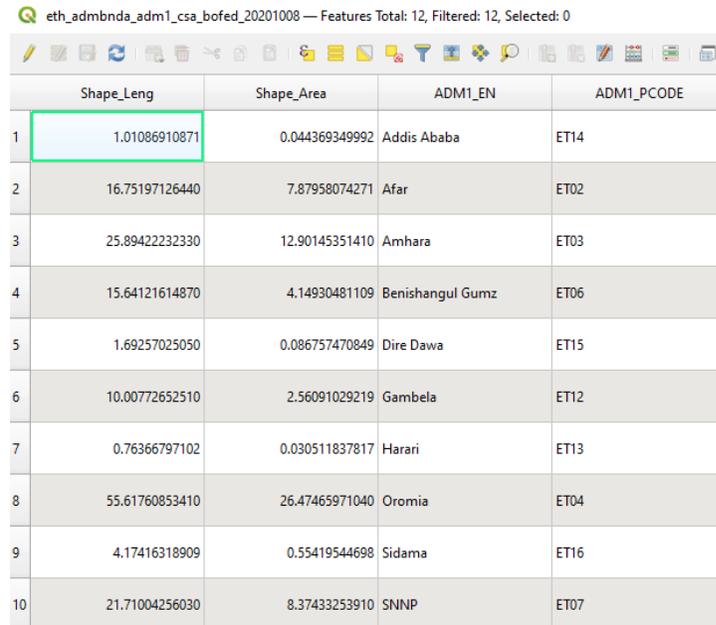
Q eth_admbnda_adm1_csa_bofed_20201008 — Features Total: 12, Filtered: 12, Selected: 0

	Shape_Leng	Shape_Area	ADM1_EN	ADM1_PCODE
1	1.01086910871	0.044369349992	Addis Ababa	ET14
2	16.75197126440	7.87958074271	Afar	ET02
3	25.89422232330	12.90145351410	Amhara	ET03
4	15.64121614870	4.14930481109	Benishangul Gumz	ET06
5	1.69257025050	0.086757470849	Dire Dawa	ET15
6	10.00772652510	2.56091029219	Gambela	ET12
7	0.76366797102	0.030511837817	Harari	ET13
8	55.61760853410	26.47465971040	Oromia	ET04
9	4.17416318909	0.55419544698	Sidama	ET16
10	21.71004256030	8.37433253910	SNNP	ET07

- Pcode is a code that is used in the data related to mapping, the pcode is used to create a link between the text data and the map to connect specific place data to the place itself in the map
- As you can see above this is the p-codes of all the governorates in Syria. Using this code you can connect any data to the attribute table of the map

Join Data

In the previous chapter we learned the link between the text file and a map and we are going to join the data to the shape file:

- Right click on the shape file layer and choose properties
- On the left panel you can see the join tab as shown in the image choose it
- Click on the green plus sign to start the join process
- In the Join layer Field choose People_in_Need_2015
- In the Join field and below it the Target field choose Pcode and Click OK
- Click OK again and open the attribute table of the layer
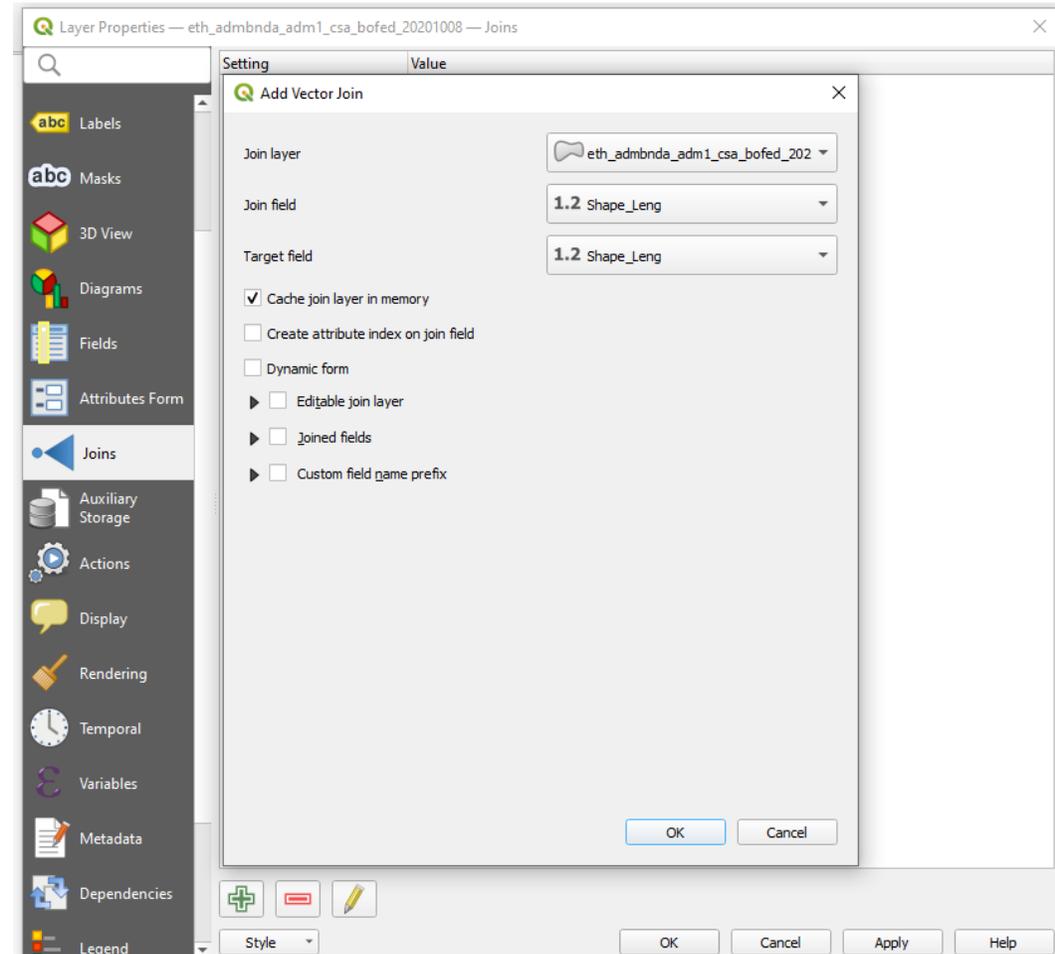
Stylizing Your Data

- Go to the properties of the map
- Choose the stylize tab
- Here you can stylize your map the why you want the dropdown arrow where you can see Single Symbol inside
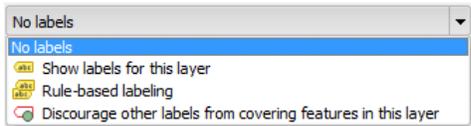
Style types
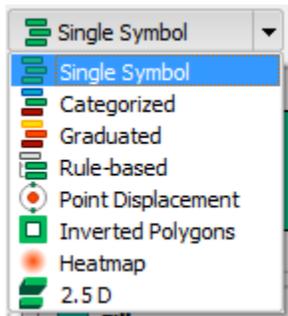
Each of these type has it uses please procced trying each of them to see what is the result you will get and what each one of them is used for
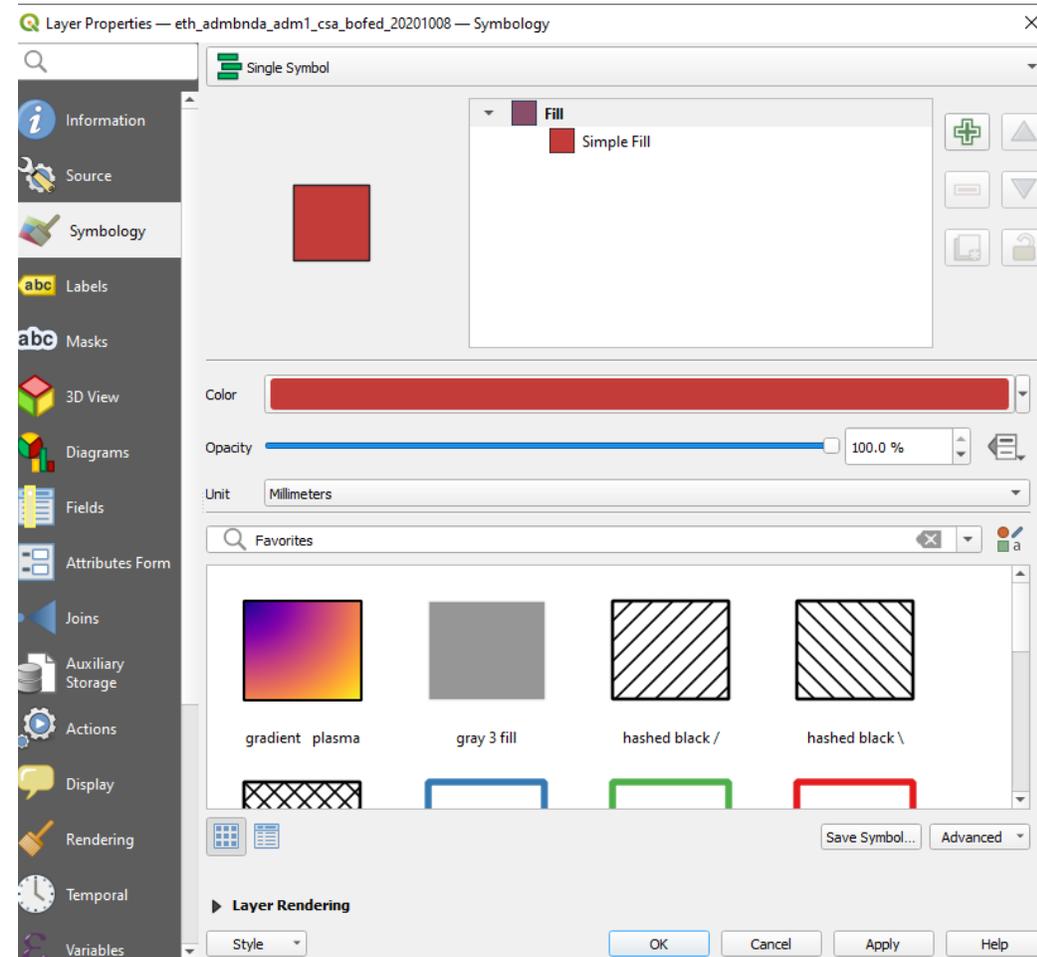
Stylizing Your Data

- Open map properties
- Choose labels
- Click on the dropdown arrow as shown below

- Choose show labels for this layer
- Click on the dropdown arrow (Label with)
- And choose the field that you want to show as a label for this map
- Edit the label as desired
- Click OK

Labels are used to show specific data on the map like the name of the areas or information about a specific point even street name so what is meant here that you can use table for points, lines and polygons
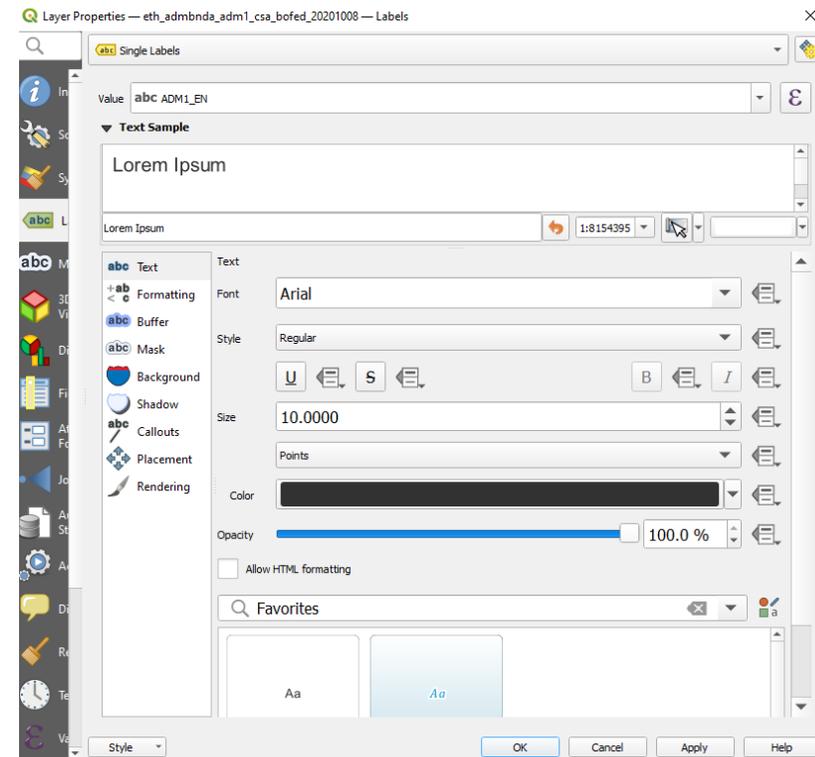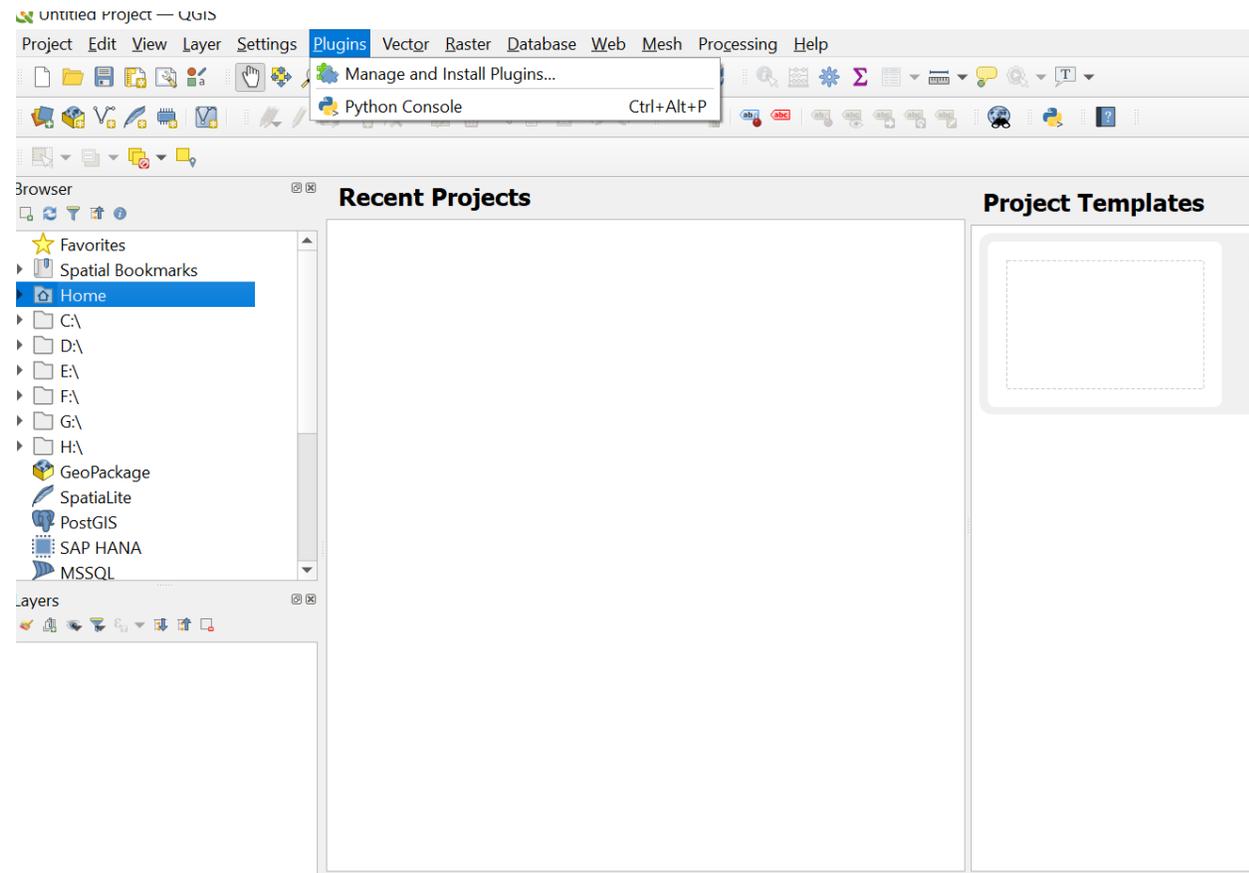
Adding Decorations

- Adding decorations is the easiest part of QGIS and it is very important part too, as you can see the characters are pointing to the decorations added to the map

- One the decorations section choose each one and click enable to make them appear in the map
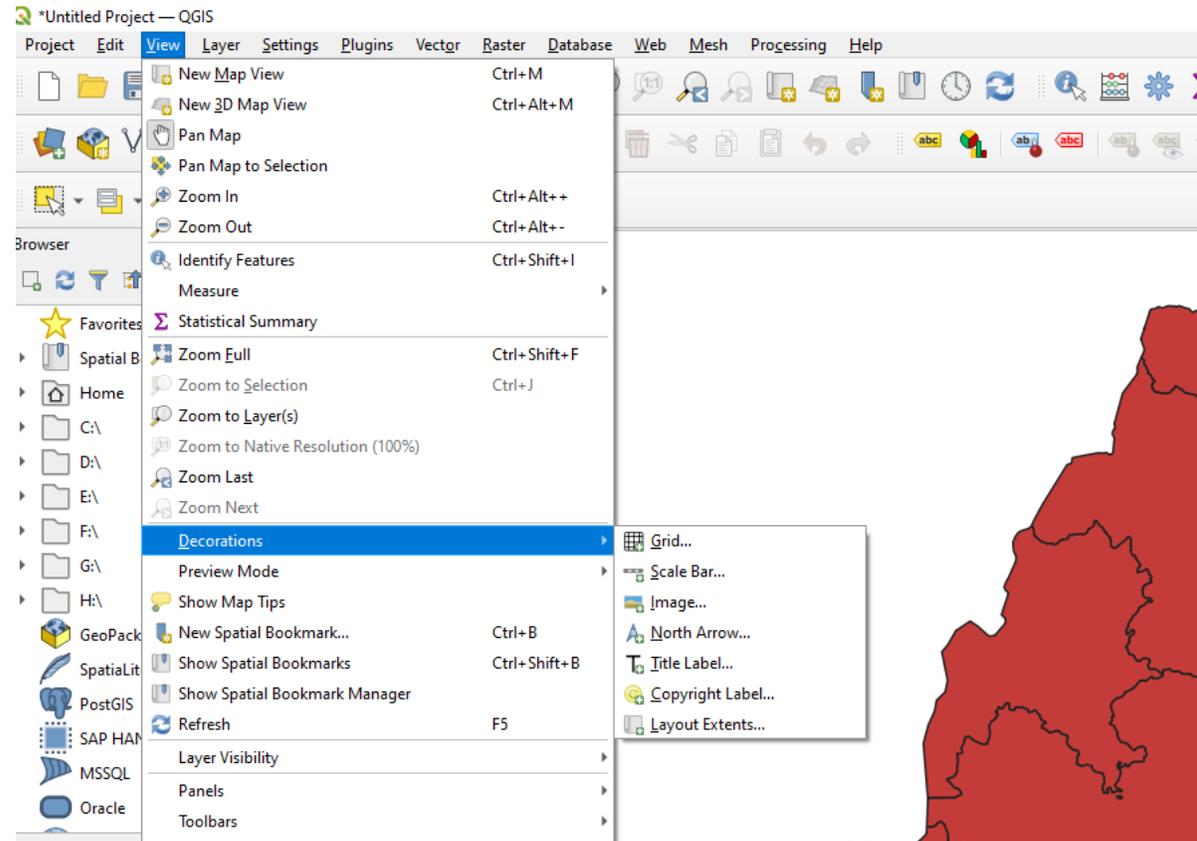
Installing Additional Plugins

Open QGIS. Click on Plugins ▸ Manage and Install Plugins.... to open the Plugin Manager dialog

Thank You