Quest GIS

An ISO 9001:2015 and MSME certified organisation

Getting started with QGIS

by

Quest GIS

(https://questgis.co.in/)

Lecture 1

Introduction to the "**Basics of GIS**"

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PhD. In Geology (Kumaun University, Nainital)

What is GIS ?

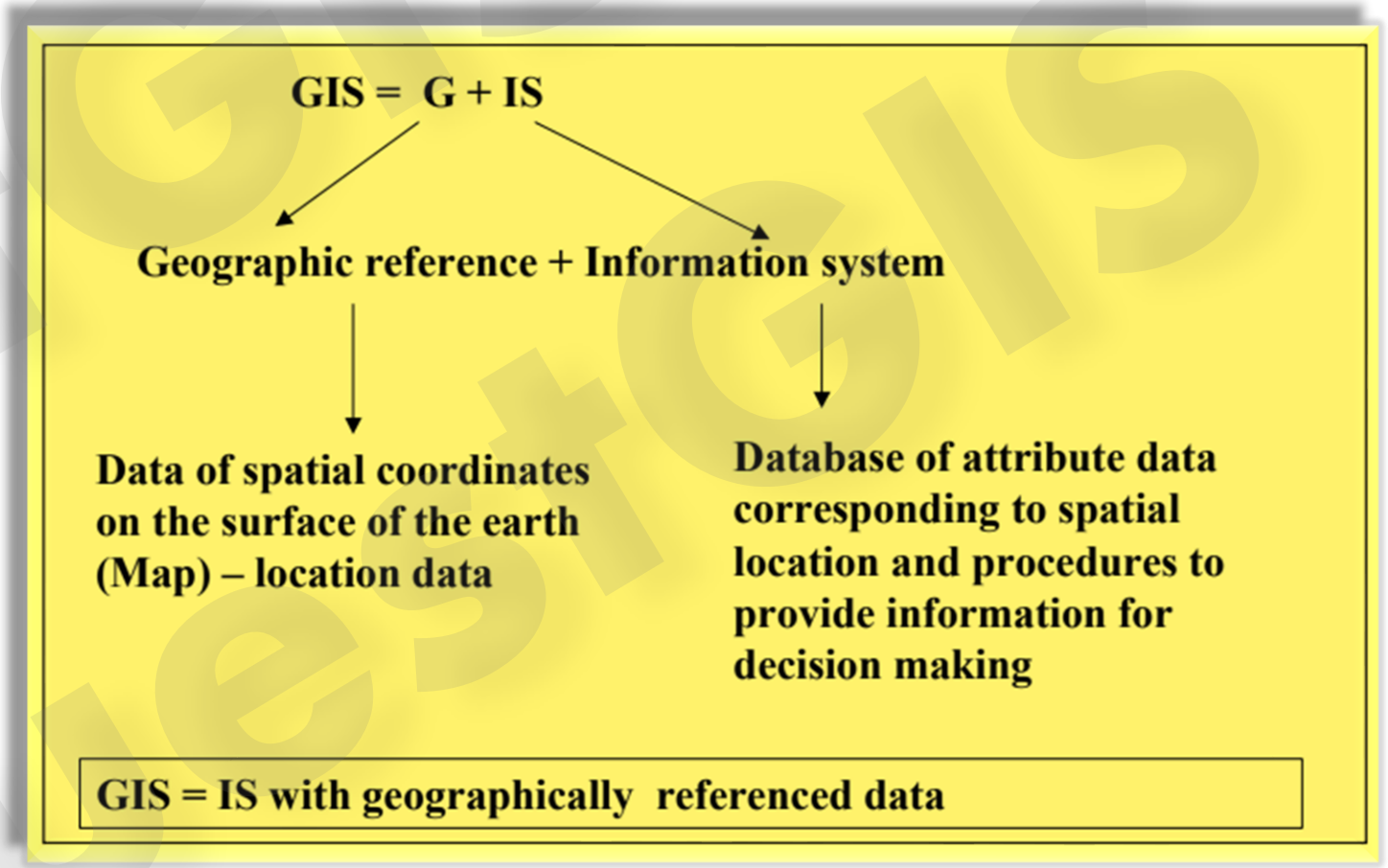
Basics of GIS

What is GIS ?

Basics of GIS

- Geography is the study of Earth's features and patterns of their variations in spatial location and time.
- In a GIS user connect data with geography.
- GIS is a generic term implying the use of computers to create and display digital maps.
- Traditional method of presenting geographical information in two dimensions is in the form of maps.

If I give you a bunch of latitude longitude locations in excel sheet, will it be possible for you to visualise it??



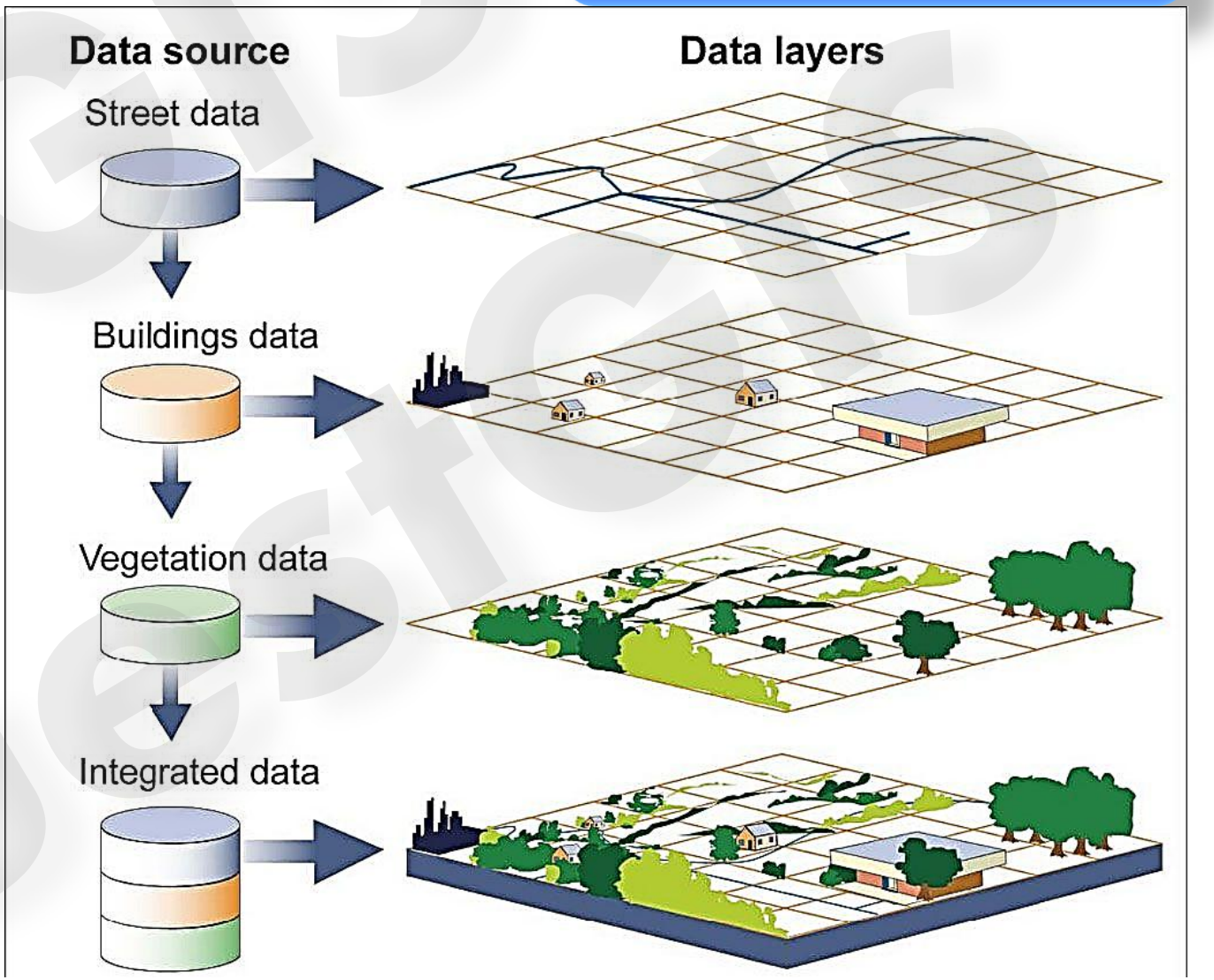
Basics of GIS

What is GIS ?

- GIS allows mapping, modelling, querying, analyzing and displaying large quantities of such diverse data, all held together within a single database.

- The attribute data which describe the various features presented in maps may relate to physical, chemical, biological, environmental, social, economic or other earth surface properties.

- GIS is a combination of four points
  - ✓ Create (geographical data)
  - ✓ Manage (geographical data)
  - ✓ Analyze (geographical data) and
  - ✓ Display (geographical data).



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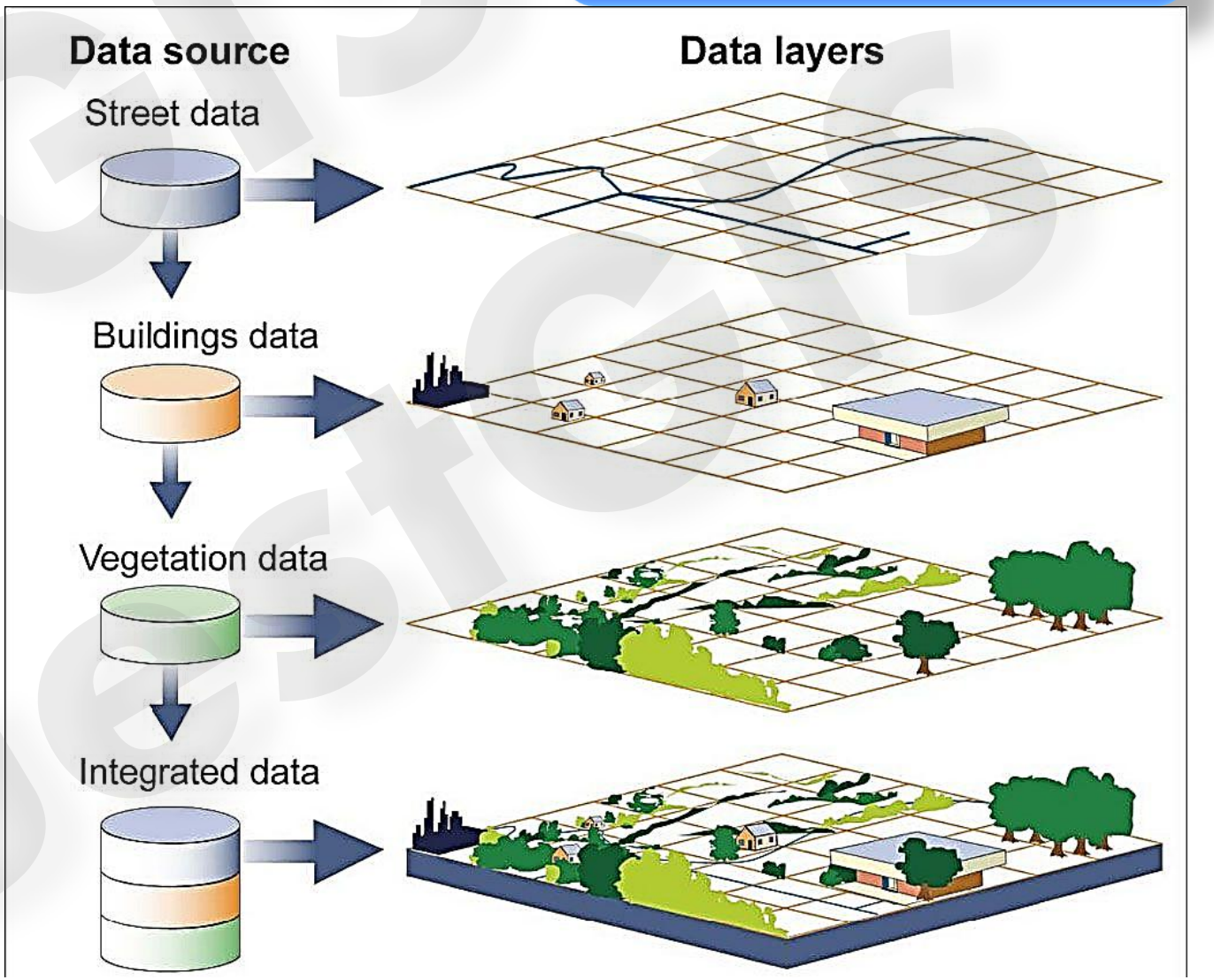
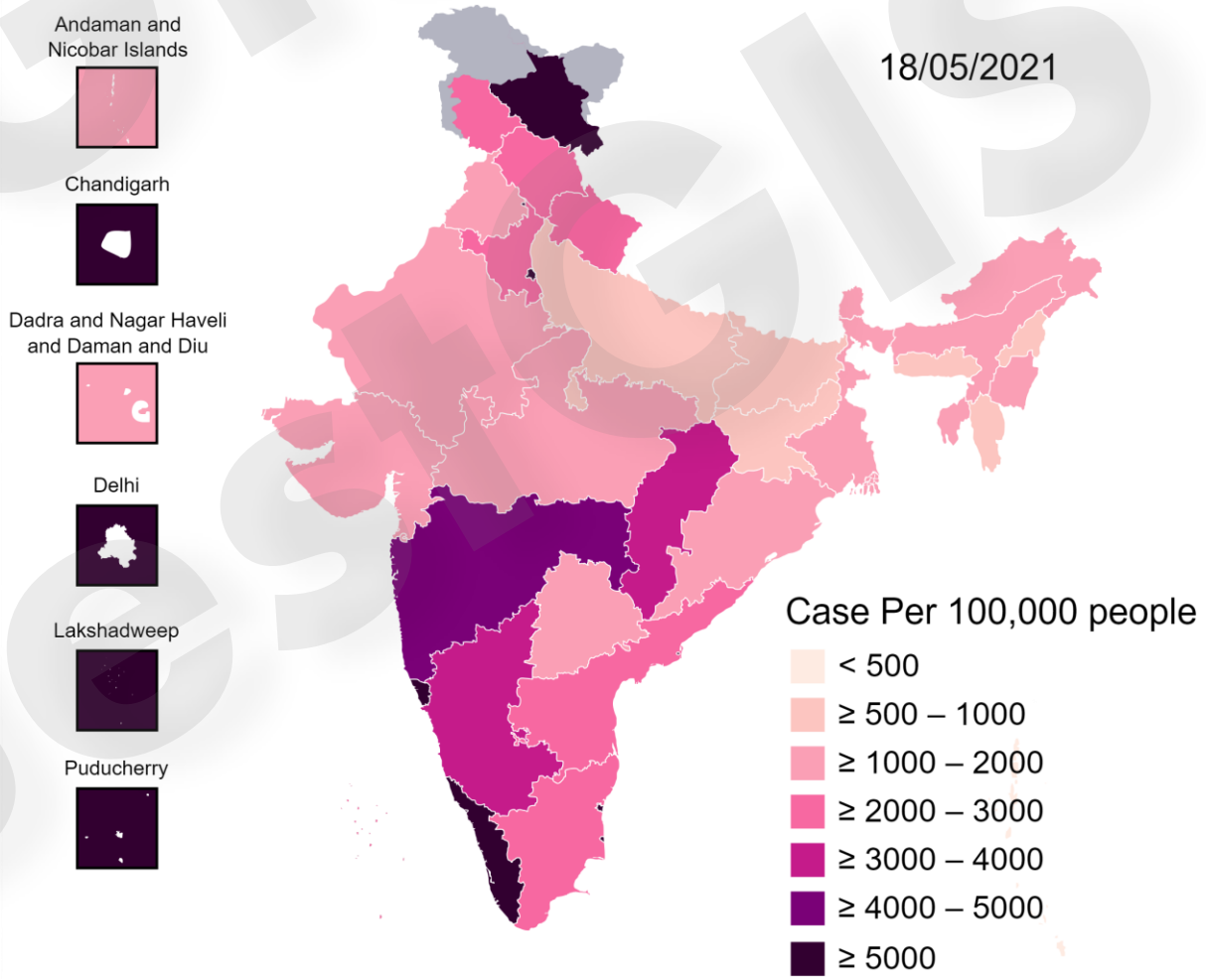


Capabilities of GIS

Basics of GIS

- What exists at a particular location?
- Where can specific features be found?
- Trends or What has changed over time?
- What spatial patterns exist?
- Modelling or What if ...?



Applications of GIS

Basics of GIS

- Urban Planning:
  - Land use analysis and zoning.
  - Transportation network optimization.
  - Infrastructure management.
- Environmental Management:
  - Conservation and natural resource planning.
  - Environmental impact assessment.
  - Watershed modeling and management.
- Agriculture:
  - Precision farming and crop management.
  - Soil analysis and mapping.
  - Pest and disease monitoring.
- Disaster Management:
  - Emergency response and evacuation planning.
  - Risk assessment and mitigation.
  - Post-disaster damage assessment.
- Public Health:
  - Disease tracking and epidemiology.
  - Health resource allocation.
  - Environmental health analysis.

Applications of GIS

Basics of GIS

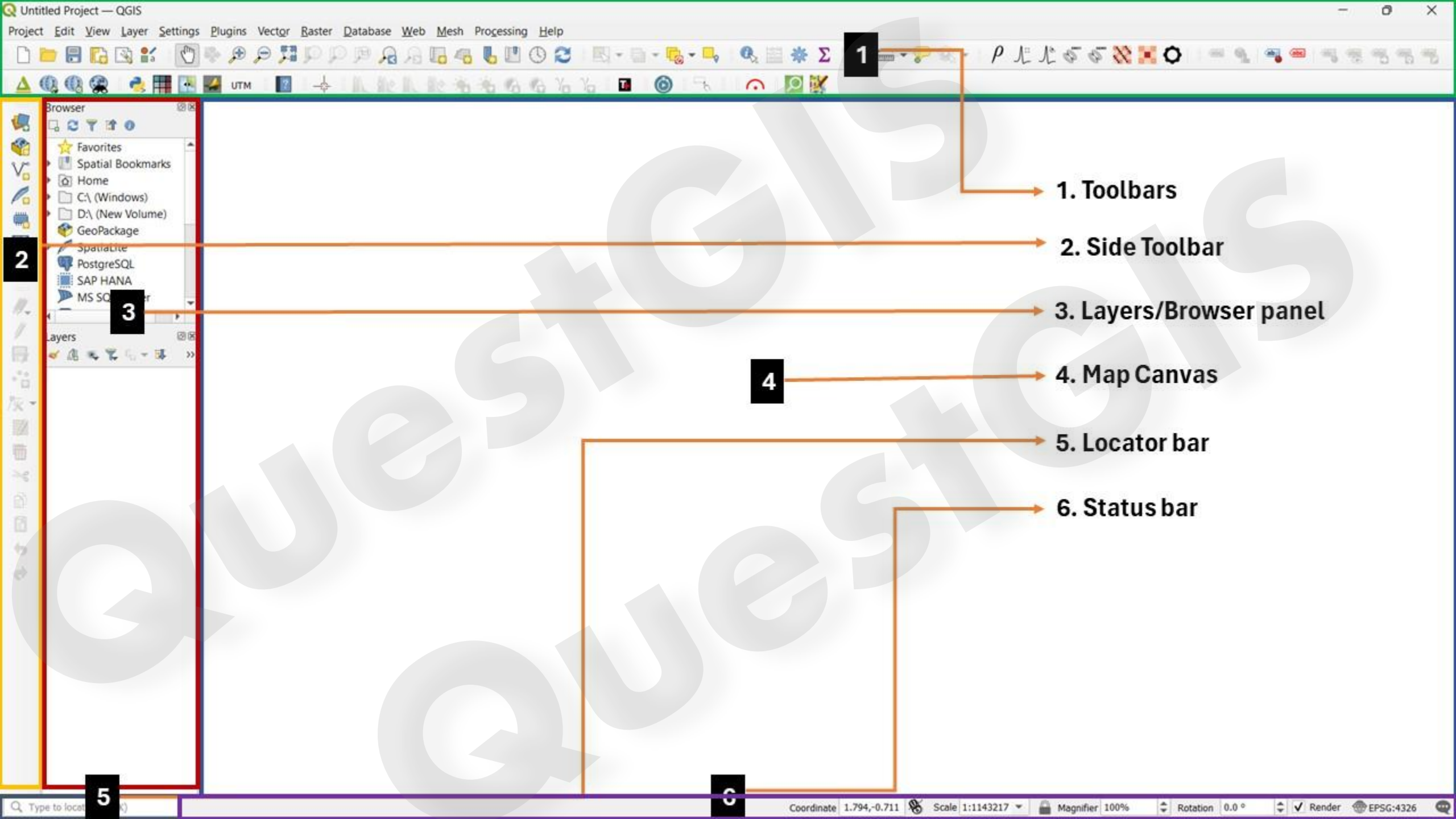
- Forestry and Natural Resources:
  - Timber harvesting and forest management.
  - Biodiversity conservation.
  - Habitat mapping.
- Archaeology and Cultural Heritage:
  - Cultural site preservation.
  - Archaeological site management.
  - Historical reconstruction.
- Geology and Mining:
  - Geological mapping and mineral exploration.
  - Mine site planning and management.
  - Geohazard assessment.
- Utilities Management:
  - Utility infrastructure mapping (water, electricity, gas).
  - Asset management and maintenance scheduling.
  - Service area analysis.
- Climate Change and Environmental Monitoring:
  - Climate modeling and analysis.
  - Monitoring and reporting greenhouse gas emissions.
  - Sea-level rise and flood risk assessment.

Components of GIS

Softwares available

- Commercial:
  - ArcGIS for Desktop (ESRI)
  - Geomedia (Hexagon)
  - Mapinfo (Pitney Bowes)
  - Elyx GIS (1st Spatial)
  - AutoCAD Map 3D (Autodesk)
  - IDRISI GIS (Clark Labs)
  - OCAD (OCAD Inc.)
- Open Source:
  - qGIS
  - GRASS GIS
  - gvSIG
  - uDIG

Why QGIS?


Untitled Project — QGIS
Project Edit View Layer Settings Plugins Vector Raster Database Web Mesh Processing Help
Browser
Favorites
Spatial Bookmarks
Home
C:\ (Windows)
D:\ (New Volume)
GeoPackage
SpatiaLite
PostgreSQL
SAP HANA
Layers
1
2
3
4
5
6
1. Toolbars
2. Side Toolbar
3. Layers/Browser panel
4. Map Canvas
5. Locator bar
6. Status bar
Coordinate 1.794,-0.711
Scale 1:1143217
Magnifier 100%
Rotation 0.0 °
Render
EPSG:4326

Spatial data

Basics of GIS

What is Spatial Data?

Spatial data is like a map in a computer. It shows information about places and where things are located.

Location Information:

Spatial data tells us about where things are in the world. It can be about cities, mountains, or even your favorite park.

Map Layers:

Think of spatial data like layers on a cake. Each layer can show different things like roads, buildings, or rivers.

Coordinates:

Spatial data uses special numbers called coordinates to pinpoint a place on Earth. It's like a secret code for locations.

GPS:

GPS on your phone uses spatial data to tell you where you are and how to get to your destination.

What GIS Does:

GIS helps people make smart decisions using maps. It can be used for finding the best place for a new school or tracking animal migrations.

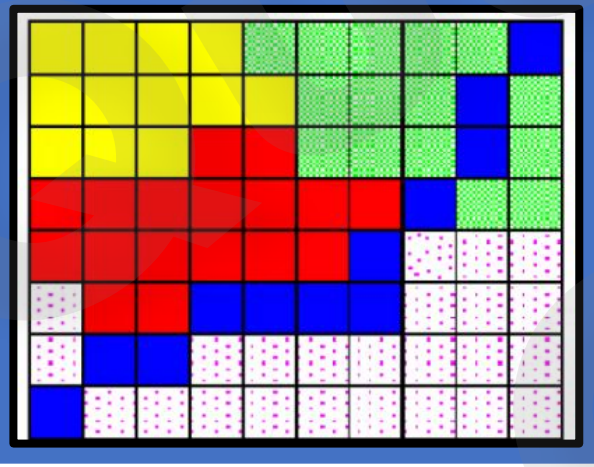
Everyday Uses:

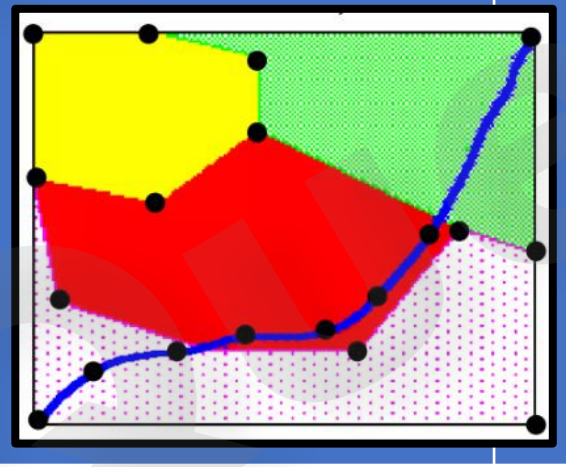
We use spatial data when we look at weather maps, use navigation apps, or even order food for delivery.

Type of Spatial data

Raster data

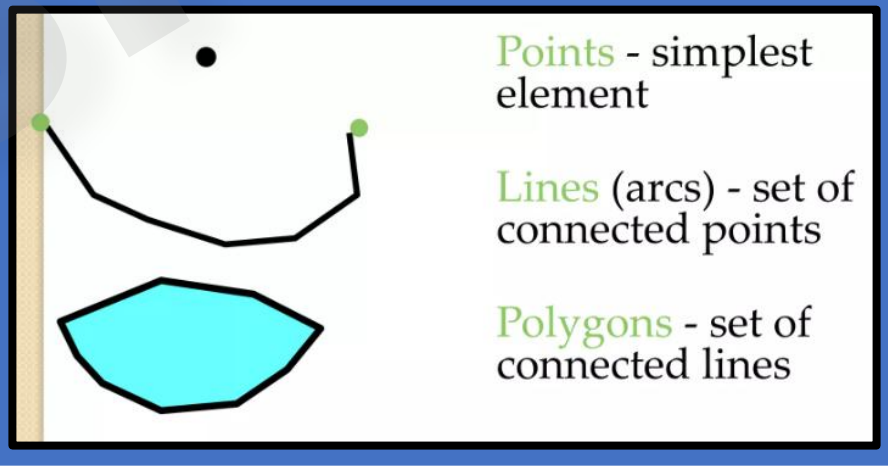
- It is in the form of images such as aerial photographs or imported scans of old maps.
- It stores the location and color value of each pixel that forms the image.
- Made up of grid or pixels

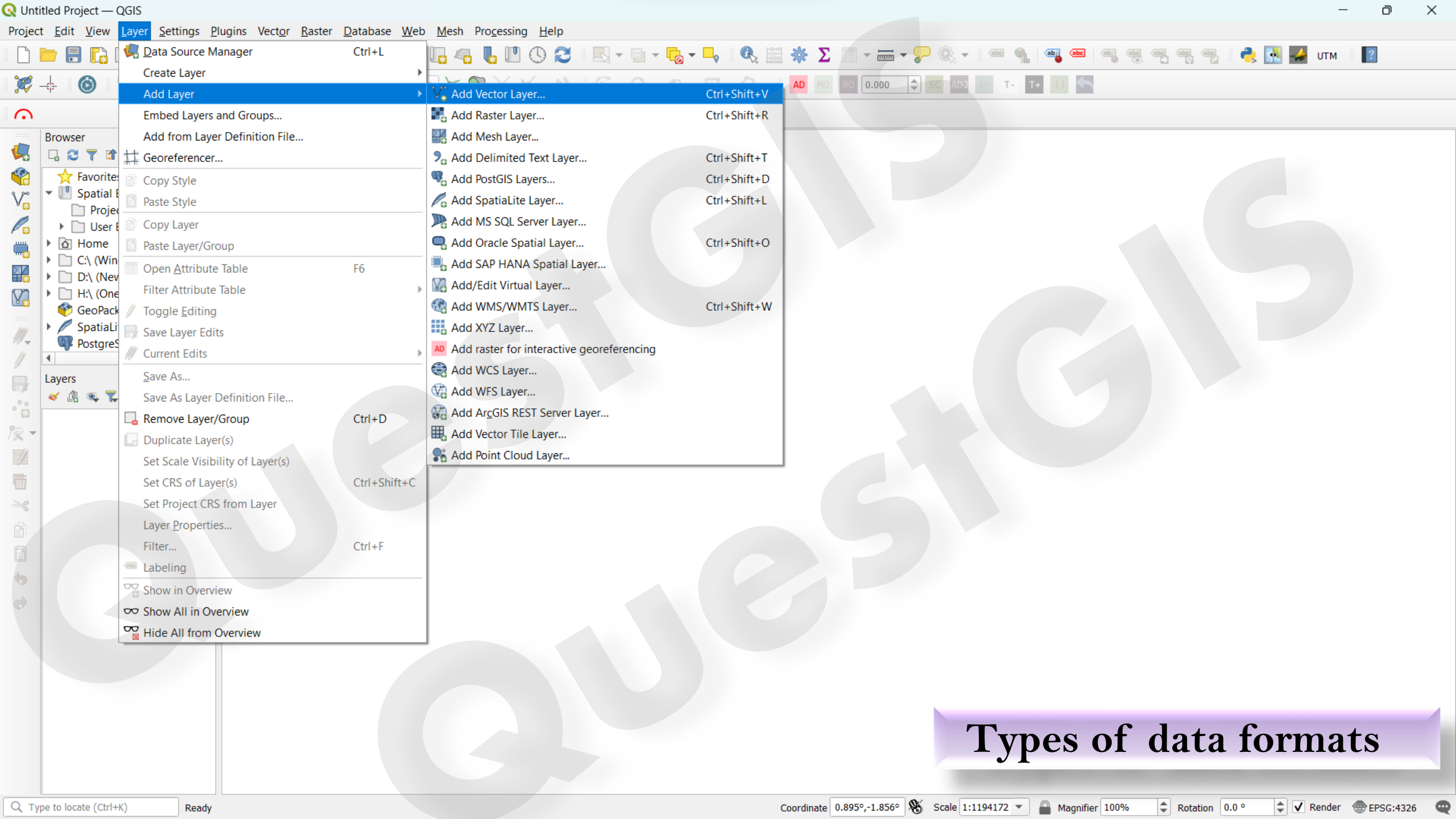




Vector data

- The information is stored using a combination of location specific point, lines or arcs (XY coordinates).
- Made of vertices and paths.
- Symbol types are points, lines and polygons (area)




Untitled Project — QGIS
Project Edit View Layer Settings Plugins Vector Raster Database Web Mesh Processing Help
Data Source Manager Ctrl+L
Create Layer
Add Layer
Embed Layers and Groups...
Add from Layer Definition File...
Georeferencer...
Copy Style
Paste Style
Copy Layer
Paste Layer/Group
Open Attribute Table F6
Filter Attribute Table
Toggle Editing
Save Layer Edits
Current Edits
Save As...
Save As Layer Definition File...
Remove Layer/Group Ctrl+D
Duplicate Layer(s)
Set Scale Visibility of Layer(s)
Set CRS of Layer(s) Ctrl+Shift+C
Set Project CRS from Layer
Layer Properties...
Filter... Ctrl+F
Labeling
Show in Overview
Show All in Overview
Hide All from Overview
Add Vector Layer... Ctrl+Shift+V
Add Raster Layer... Ctrl+Shift+R
Add Mesh Layer...
Add Delimited Text Layer... Ctrl+Shift+T
Add PostGIS Layers... Ctrl+Shift+D
Add SpatiaLite Layer... Ctrl+Shift+L
Add MS SQL Server Layer...
Add Oracle Spatial Layer... Ctrl+Shift+O
Add SAP HANA Spatial Layer...
Add/Edit Virtual Layer...
Add WMS/WMTS Layer... Ctrl+Shift+W
Add XYZ Layer...
Add raster for interactive georeferencing
Add WCS Layer...
Add WFS Layer...
Add ArcGIS REST Server Layer...
Add Vector Tile Layer...
Add Point Cloud Layer...
Browser
Layers
Types of data formats
Type to locate (Ctrl+K)
Ready
Coordinate 0.895°,-1.856°
Scale 1:1194172
Magnifier 100%
Rotation 0.0 °
Render
EPSG:4326

Georeferencing

Basics of GIS

- **What is Georeferencing?**
  - Georeferencing is like giving a location to an image or map. It helps the computer understand where things are in the real world.
  - Georeferencing or geo-registration means that the internal coordinate system of a digital map or aerial photo can be related to a ground system of geographic coordinates.
  - Geo-referencing refers to the process of assigning real-world coordinates to pixels of the scanned map.

- **Why Georeference?**

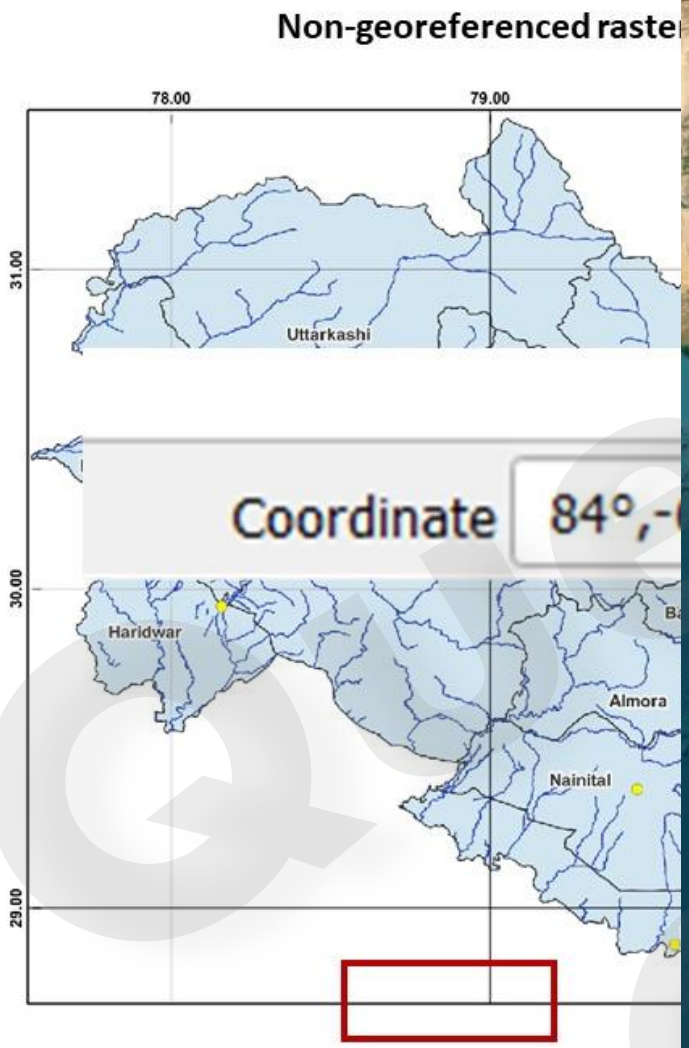
  We use georeferencing to overlay maps, images, or old paper maps onto modern maps. This helps us compare and analyse them.

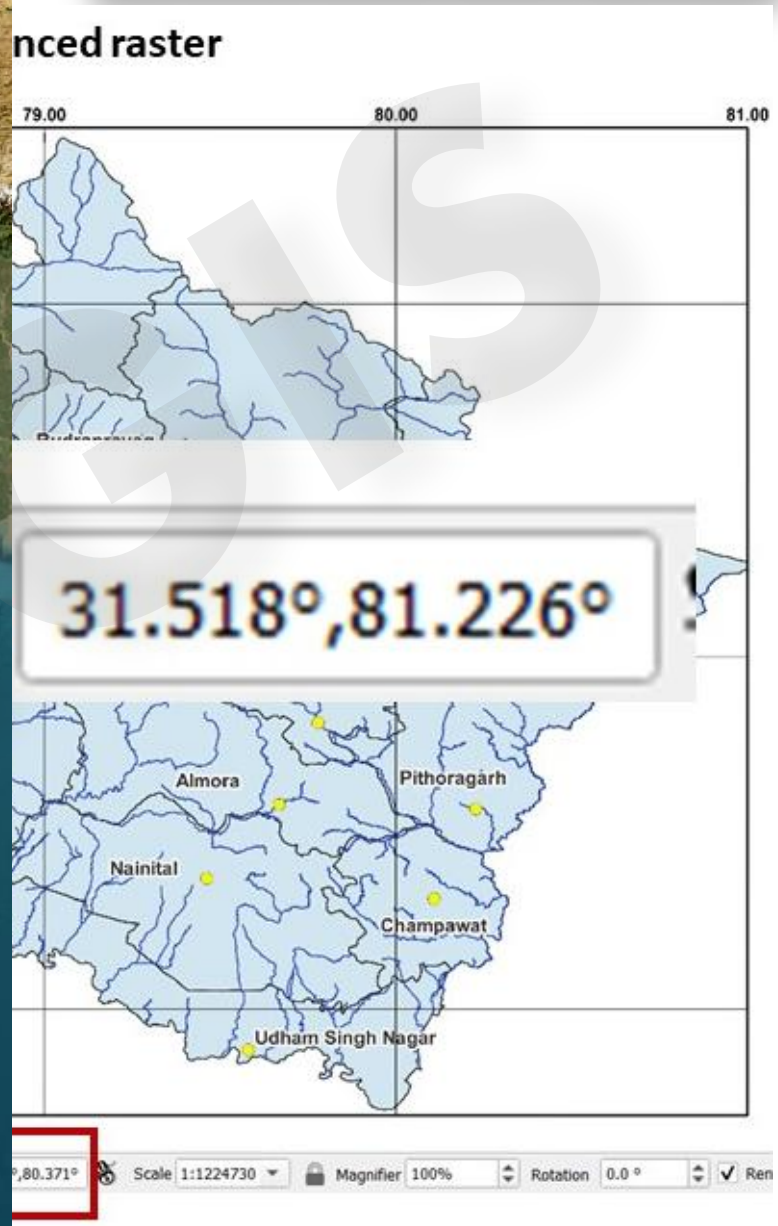
- **Points of Reference**

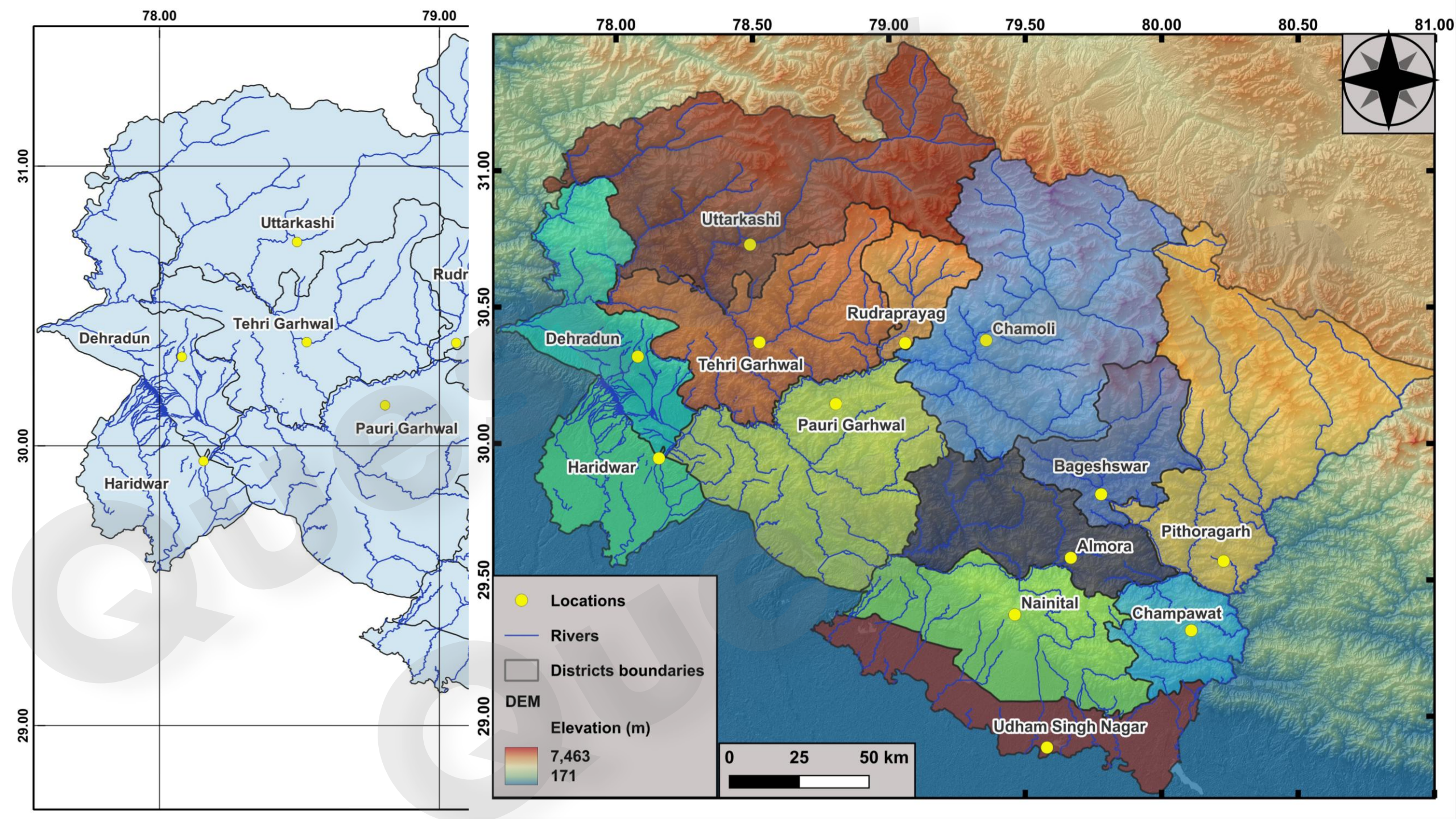
  You pick some points on your image and tell QGIS where they are on a real map. This helps QGIS figure out the rest.

Georeferencing

Basics of GIS

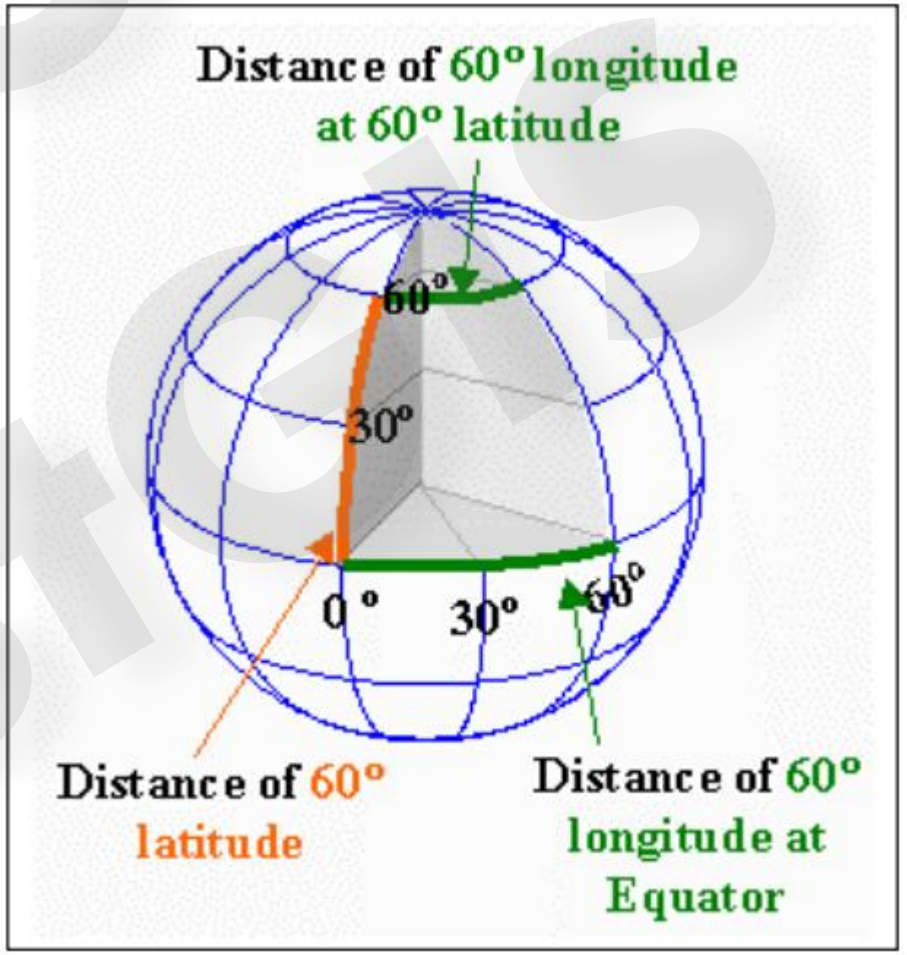





78.00
79.00
31.00
30.00
29.00
Uttarkashi
Tehri Garhwal
Dehradun
Pauri Garhwal
Haridwar
78.00
78.50
79.00
79.50
80.00
80.50
81.00
Uttarkashi
Rudraprayag
Chamoli
Dehradun
Tehri Garhwal
Pauri Garhwal
Haridwar
Bageshswar
Pithoragarh
Almora
Nainital
Champawat
Udham Singh Nagar
Locations
Rivers
Districts boundaries
DEM
Elevation (m)
7,463
171
0
25
50 km

Coordinate Reference System (CRS)

- Locations on the earth's surface are measures in angular units from the centre of the earth relative to two planes:
  - Plane defined by the equator (latitude value)
  - Plane defined by the prime meridian (longitude value)
- CRS is a reference system for identifying locations on the curved surface of the earth.
- This is the traditional way of representing locations on the surface of the earth is in the 3- dimensional coordinate system is by its latitude and longitude.

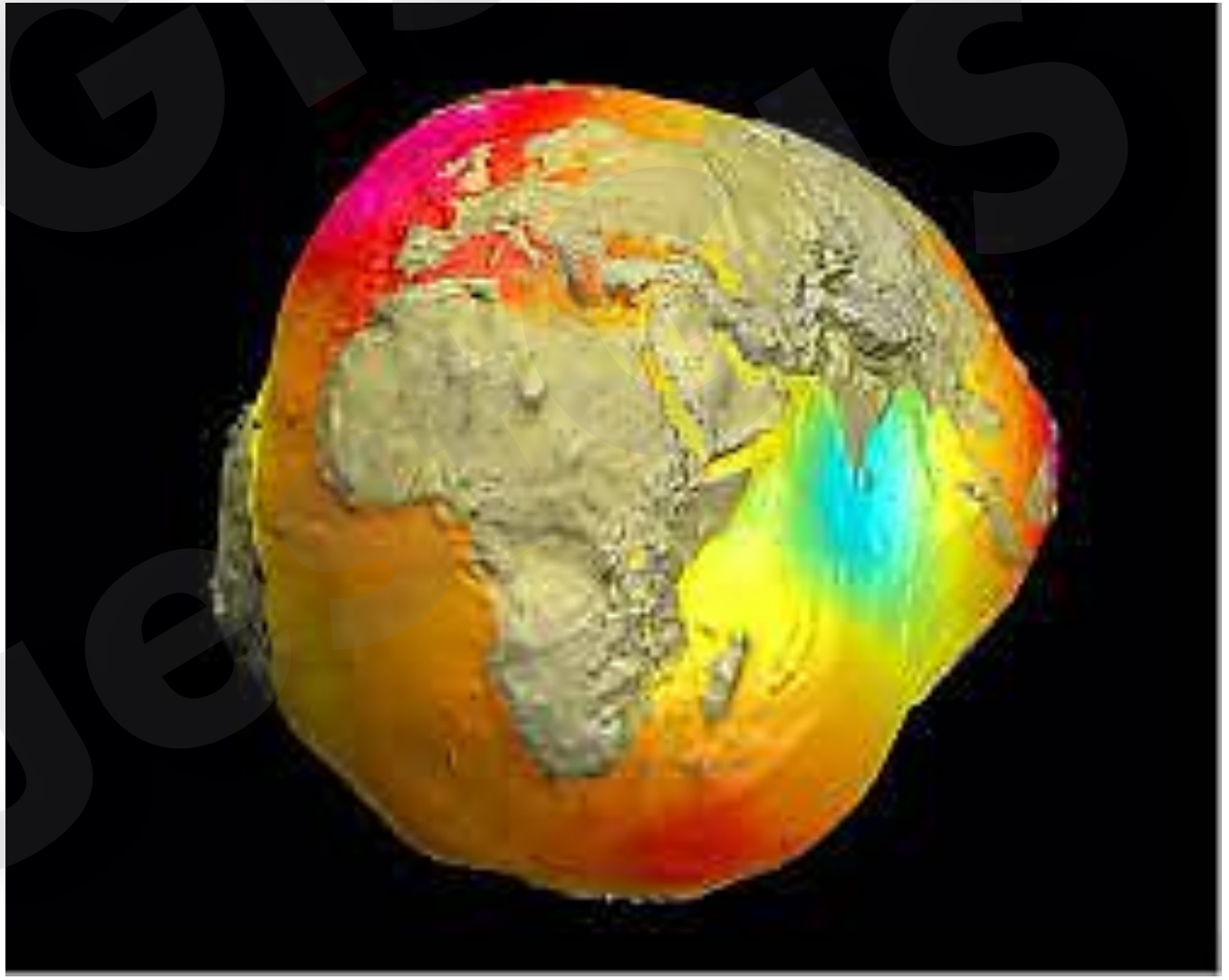


Source: ESRI

Coordinate Reference System (CRS)

Basics of GIS

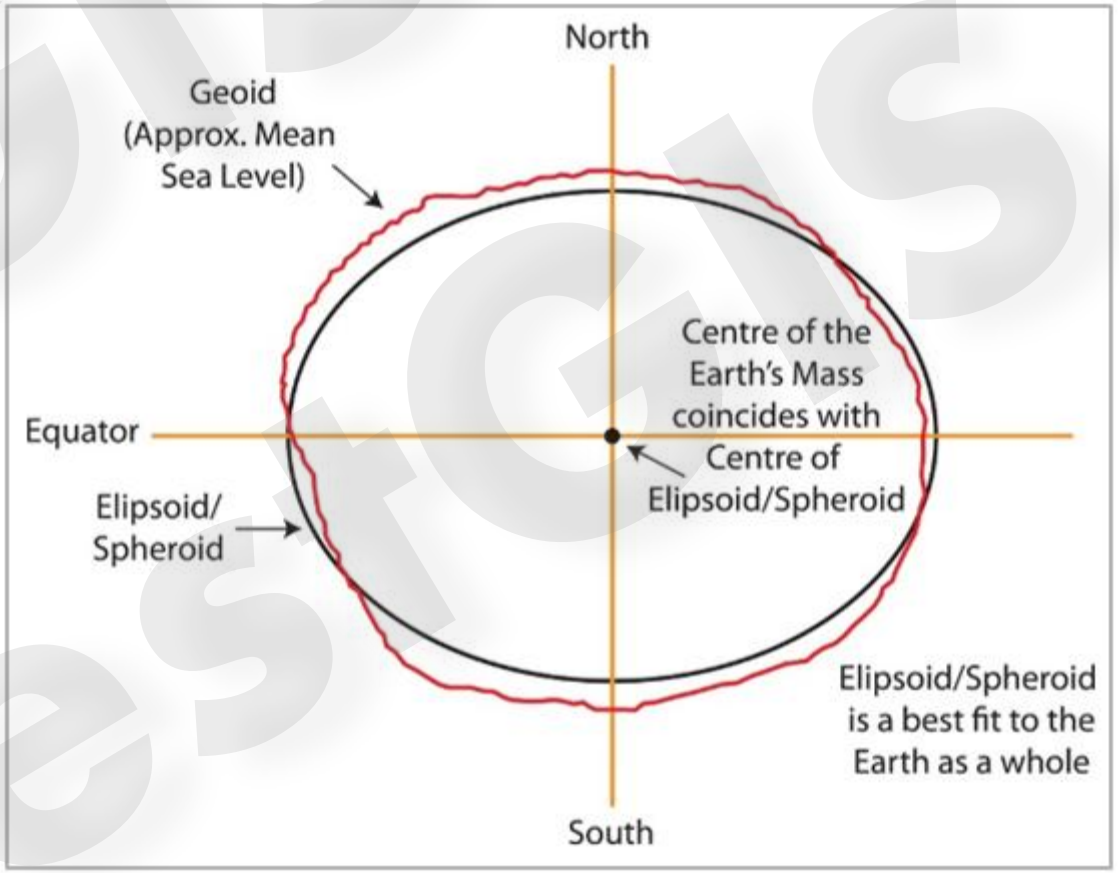
Real shape of the earth?



Datum

- A datum is like a reference point or a starting location on the Earth's surface that helps us measure and locate other places accurately.

- Since the Earth is not perfectly round, we need a standard point to measure from.



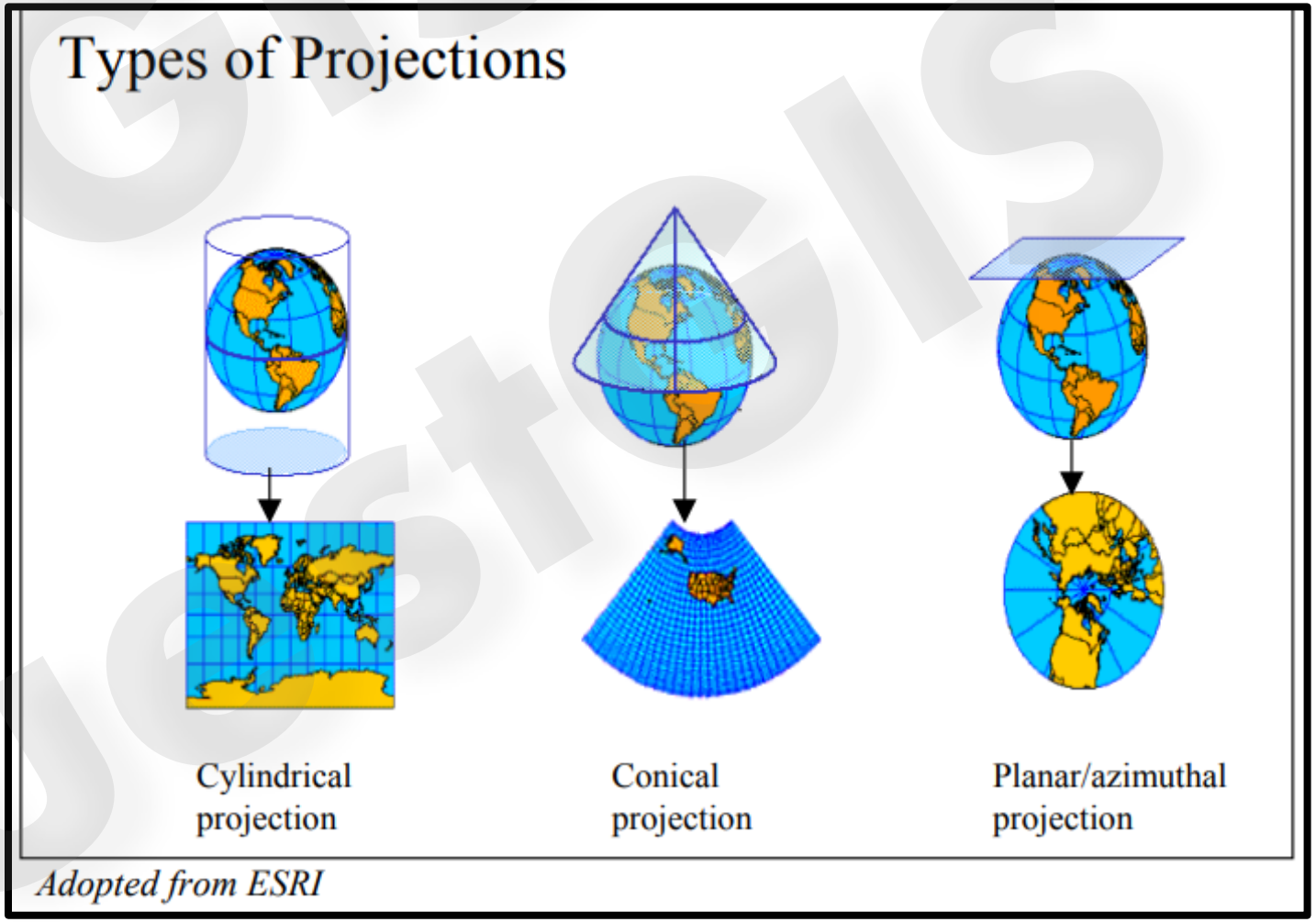
Source: https://www.e-education.psu.edu/geog486/node/538

Projection system

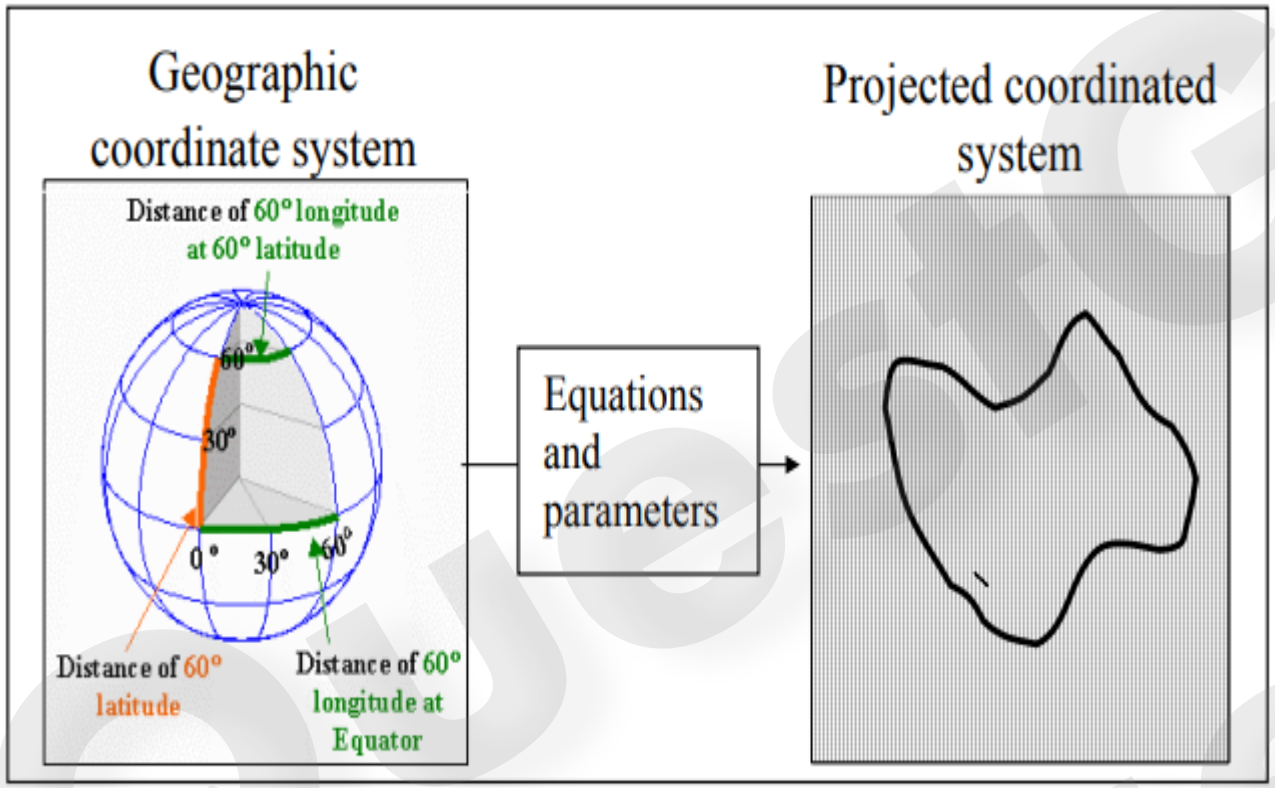
- A map projection transforms the geographic coordinates on an ellipsoid into locations on a plane.

- The process of projection transforms the earth's surface to a plane, and the outcome is a map projection ready to be used for a projected coordinate system.

- There are three types of map projections which are
  - ✓ Cylindrical
  - ✓ Conic
  - ✓ Azimuthal



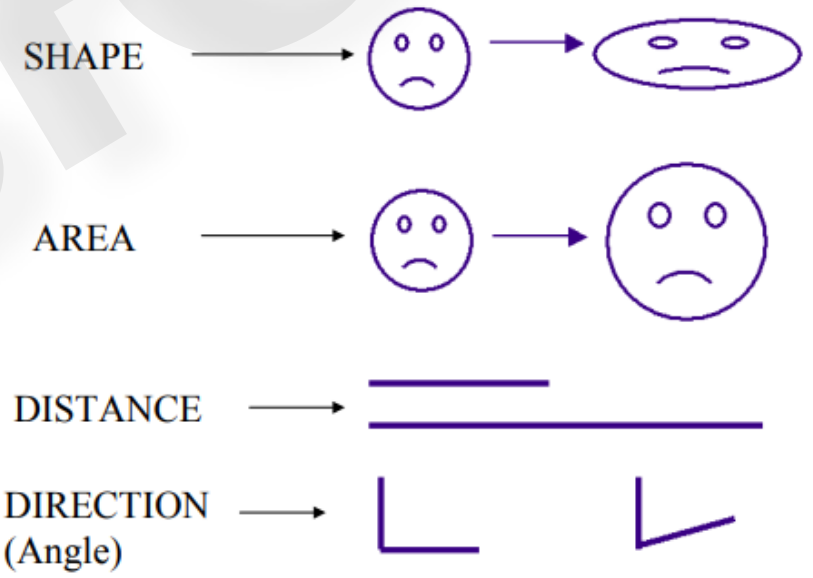
Projection system



Adopted from ESRI

MAP PROJECTIONS LEAD TO DISTORTIONS … ..

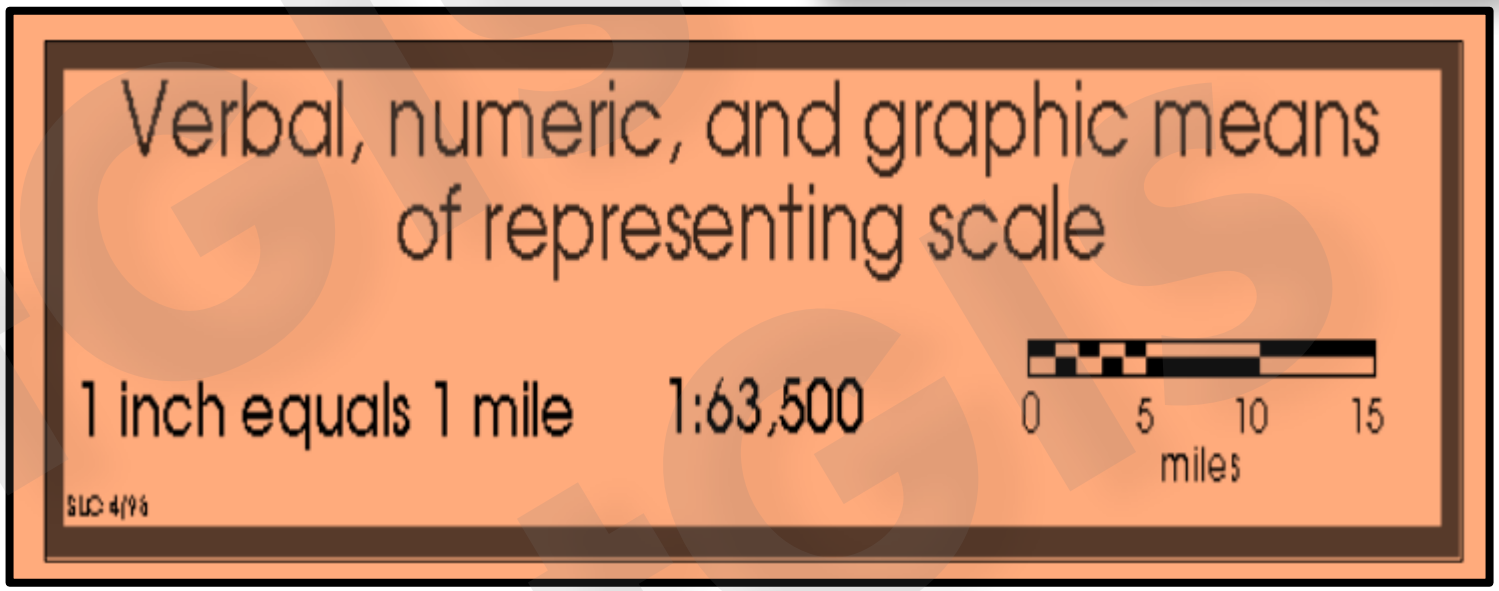
Choice of Projections depends on allowable distortions in:



Adopted from ESRI

Map scale

- Map Scale is the ratio of distances on map to distances to on the surface of the earth
- The standard map scales are: 1:1000,000 Country level or State level 1: 250, 000 State or District level 1: 50,000 District level 1: 12,500 Micro level
- A graphical scale should be present on all maps that are used in GIS as it ensures that any changes in scale in photocopying, etc. are accounted for.



Thank You