زانکۆی پۆلیتەکنیکی هەولێر
ERBIL POLYTECHNIC UNIVERSITY

Kurdistan Region Government
Ministry of Higher Education
and Scientific Research
Erbil Polytechnic University

وەزارەتی خوێندنی باڵا و توێژینەوەی زانستی

# Introduction to GIS

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# Course Outline

- What is Geographic Information System (GIS)?
- GIS Components
- What can GIS Do?
- What are the types of GIS data?
- Vector VS Raster.
- What are GIS Functions?

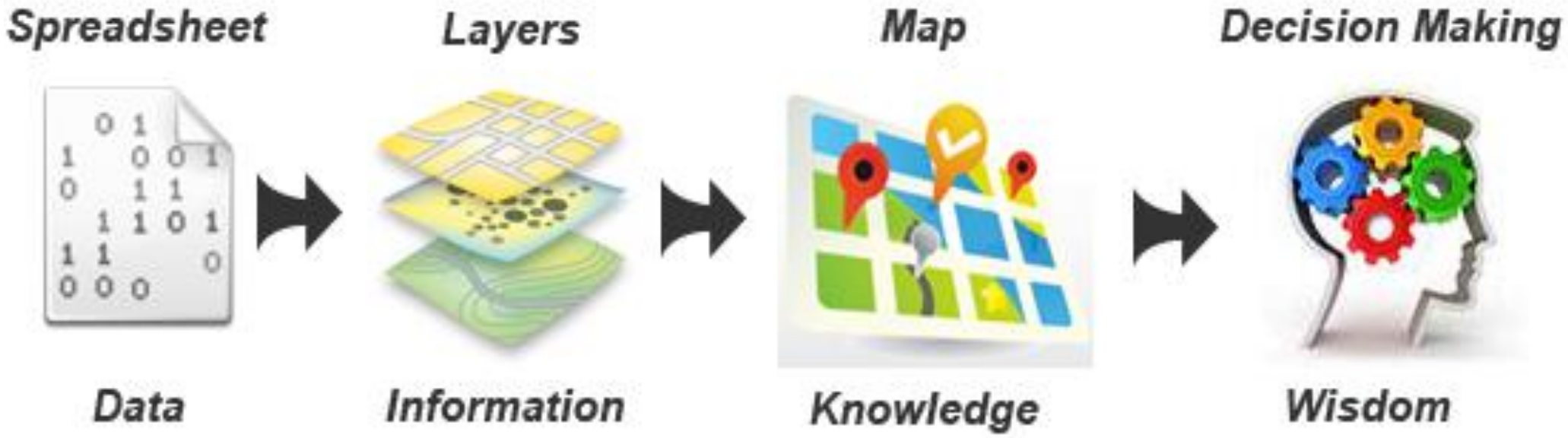
# What is GIS?

# What is Geographic Information System (GIS)?

**GIS**: Is a system designed to Capture, Store, Analyze, Manage, and present all types of data that are spatially referenced on the Earth.

**GIS can be applied** in Emergency Management, Risk Assessment, land Survey, Infrastructure damage assessment, Utility Management, Natural Resource Management, Urban Planning, Navigation …etc.

GIS can be used for problem solving and decision making and development planning.




Sources:www.google.com

# Phenomena ,Objects, Features

- Real-world can be represented as Shapes in Map

Agricultural

Sources:www.google.com

# Natural phenomena

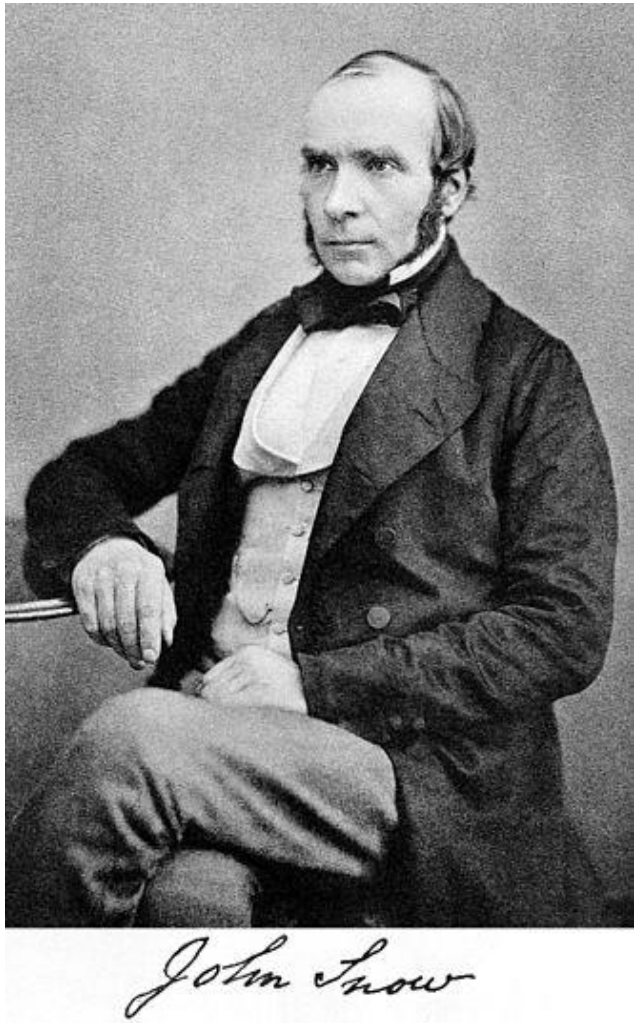
Sources:www.google.com

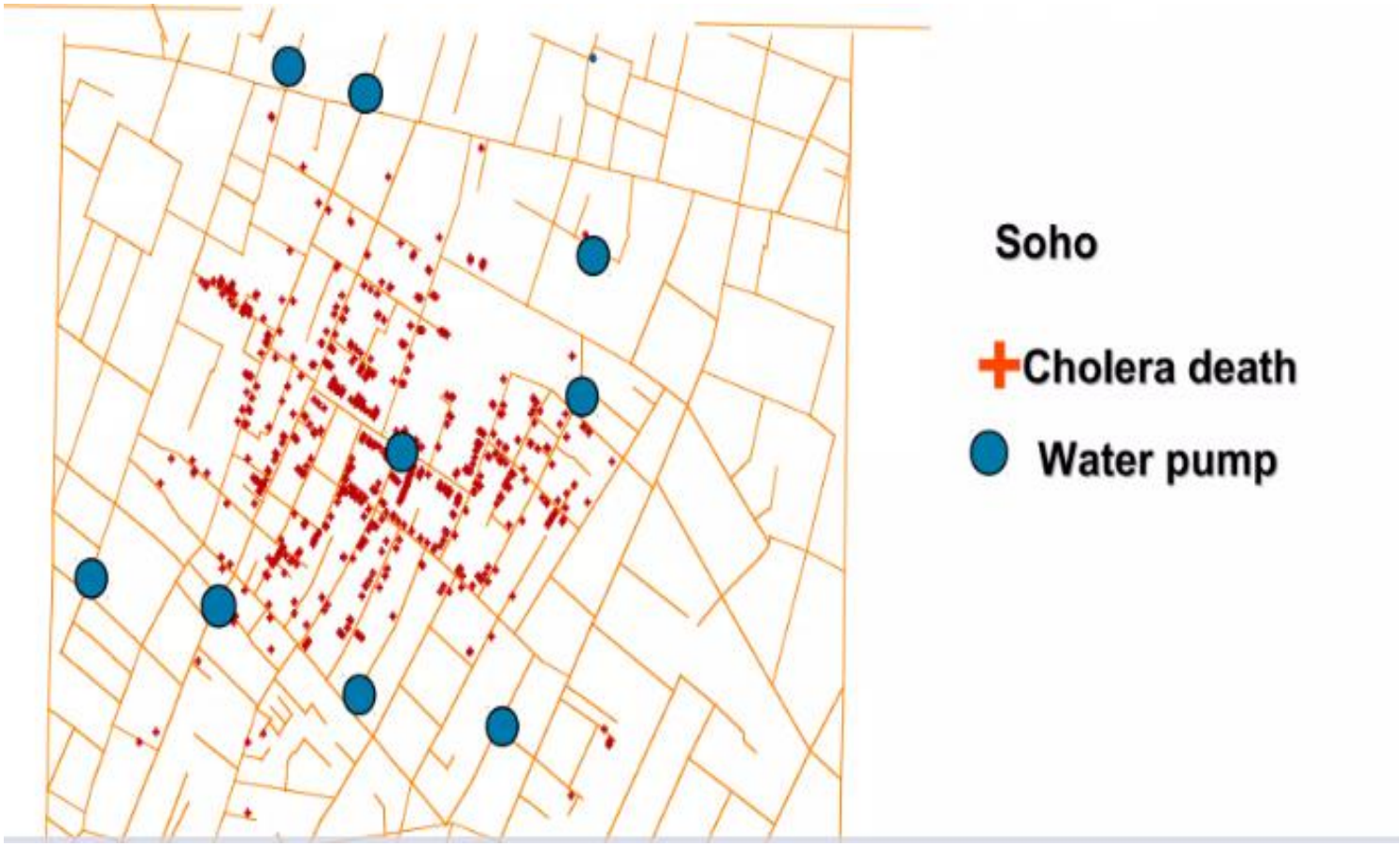
# Man-made phenomena


Sources:www.google.com

# A brief history

In the London Cholera epidemic of 1854 Dr. John Snow was able to locate the source of a cholera outbreak by plotting the locations of fatal cases in relationship to nearby wells.



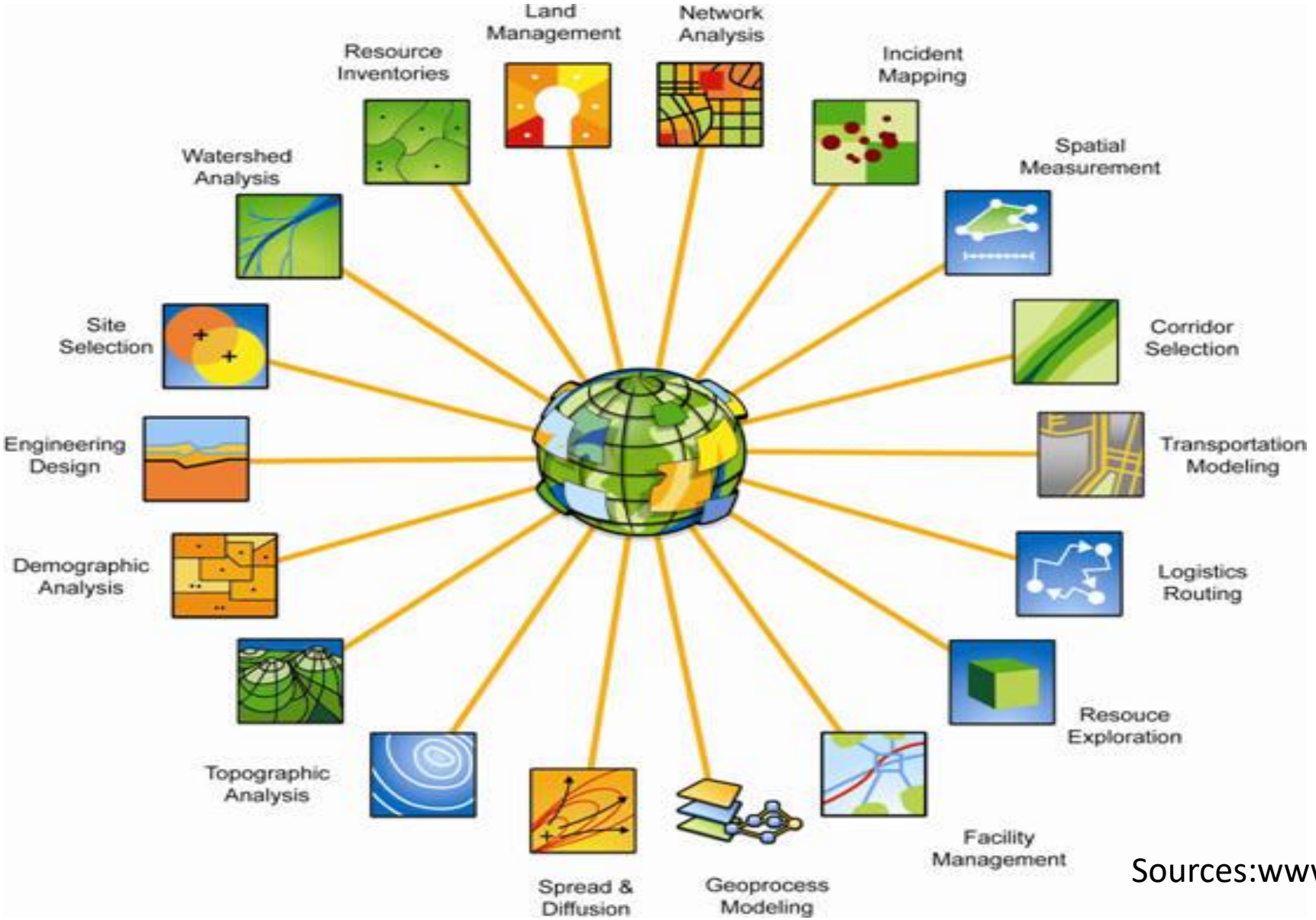




Sources:www.google.com

# GIS components


Sources:www.google.com

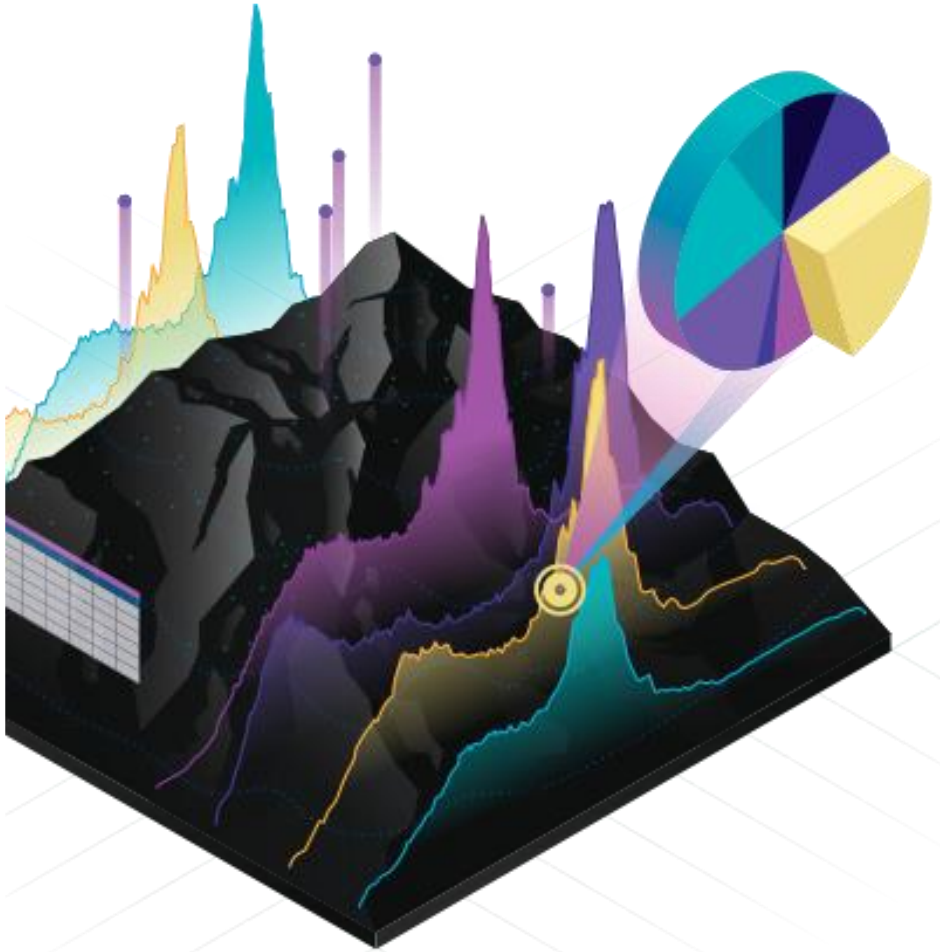
# What can GIS Do?




Sources:www.google.com

# What can we do with GIS?

- Mapping where things are.
- Mapping quantities.
- Mapping densities.
- Finding what is nearby..
- Maps can be used to compile data.

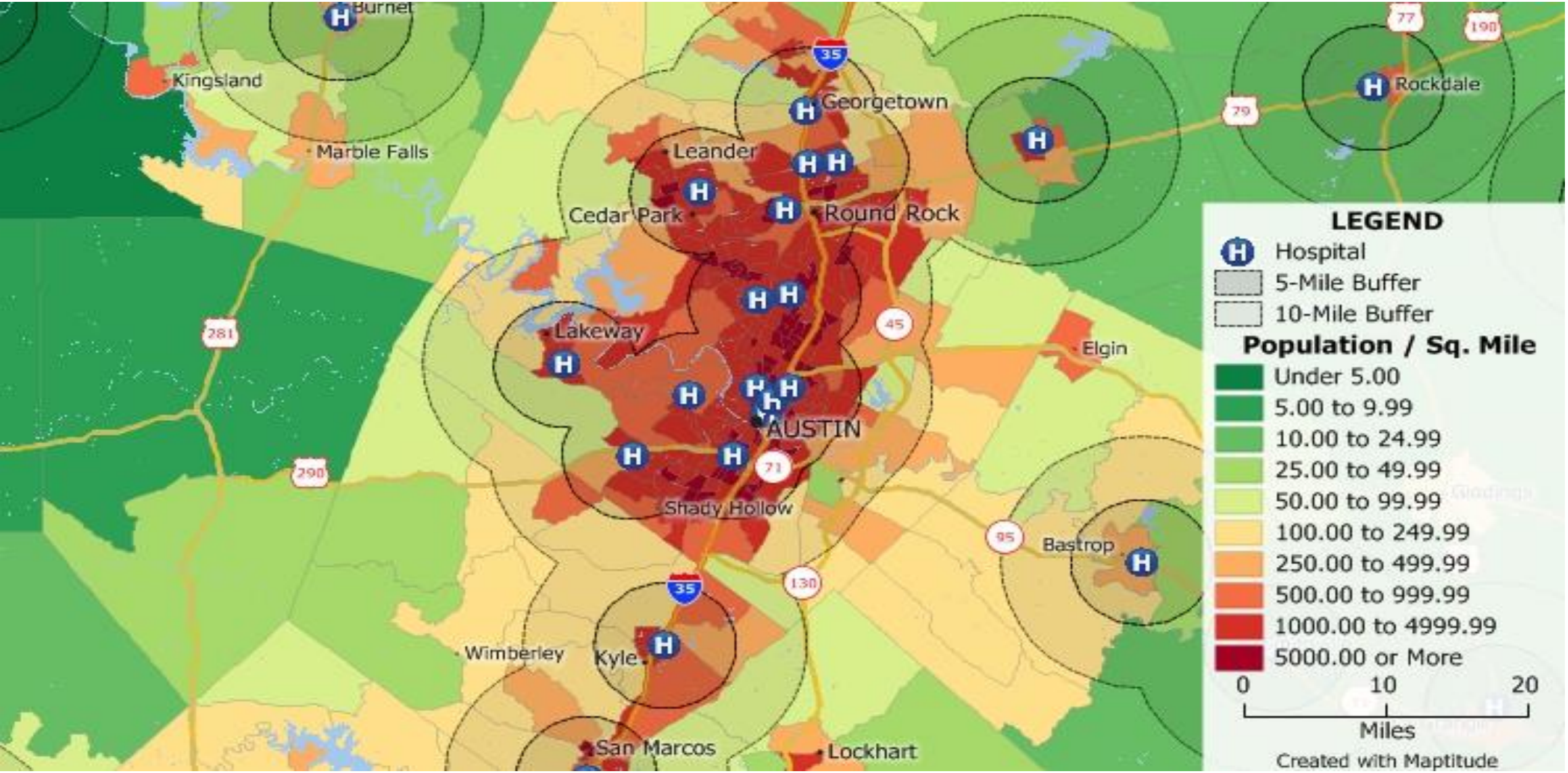


Sources:www.google.com

# The questions that GIS is required to answer

- What is going on.....? (An operational inquiry; what exists at a specific area)
- where it is? (Conditional inquiry; which locations meet particular criteria)
- What exactly how  has changed.....? (A trending question that detects geographical incidence.
- What data are related.....? (Relational question: investigates the spatial link between geographical features.)


Sources:www.google.com



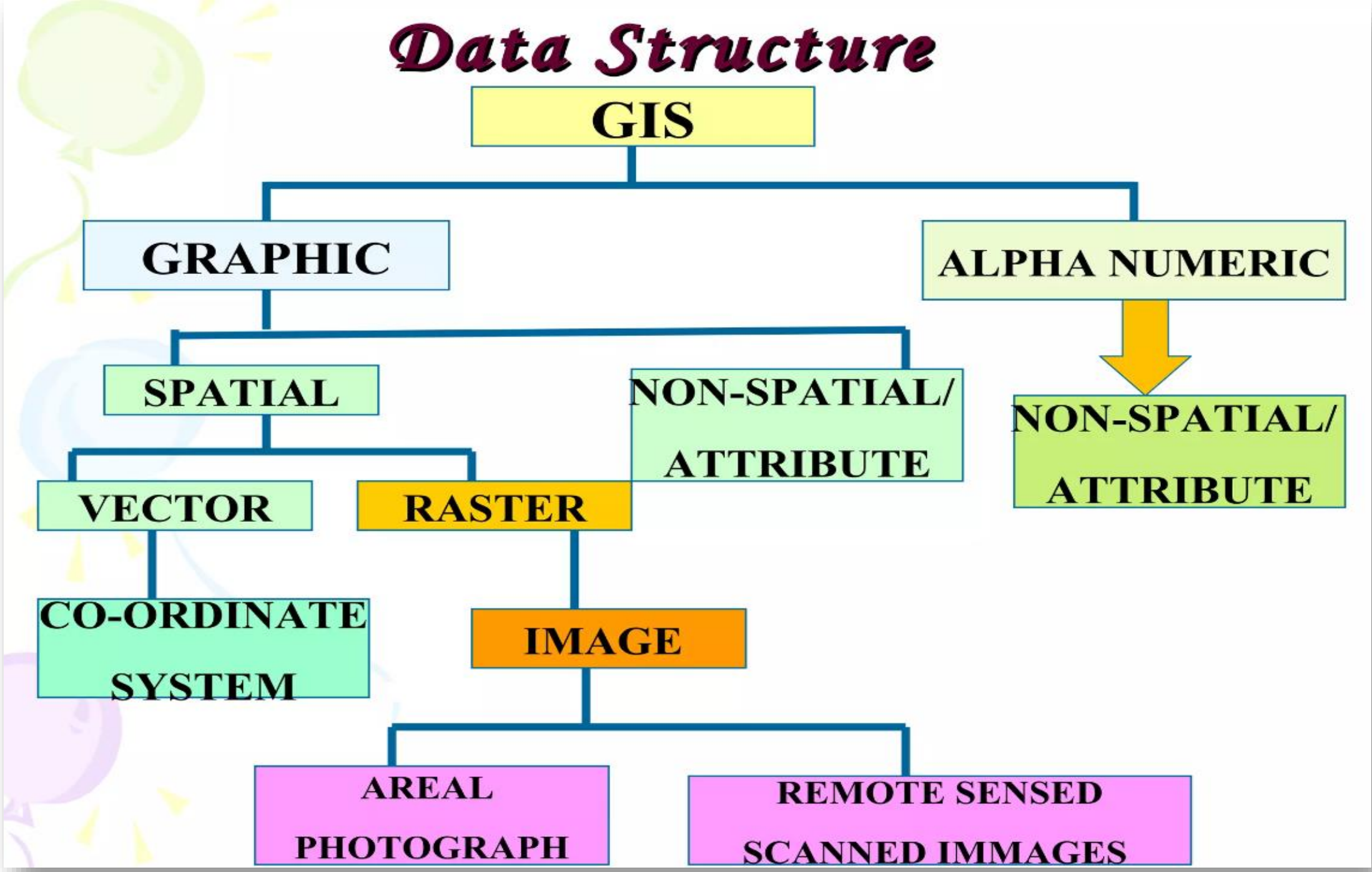

Sources:www.google.com

# Types of GIS Data

**Vector Data:**
A coordinate-based data model
Represents geographic features as points, lines, and polygons.
Each point feature is represented as a single coordinate pair
Line and Polygon features are represented as ordered lists of vertices.
Attributes are associated with each vector feature.

**Raster Data:**
Consists of a matrix of cells (or pixels) organized into rows and columns (or a grid).
Each cell contains a value representing information, such as temperature.
Raster's are digital aerial photographs, imagery from satellites, digital pictures, or even scanned maps.

# Data Structure



# Types of GIS Data

## Vector data

- Points
- Lines
- Polygons

VS

## Raster data

- Grids of rows and column
- Pixels
- Imagery

# Types of GIS Data

## Vector Data

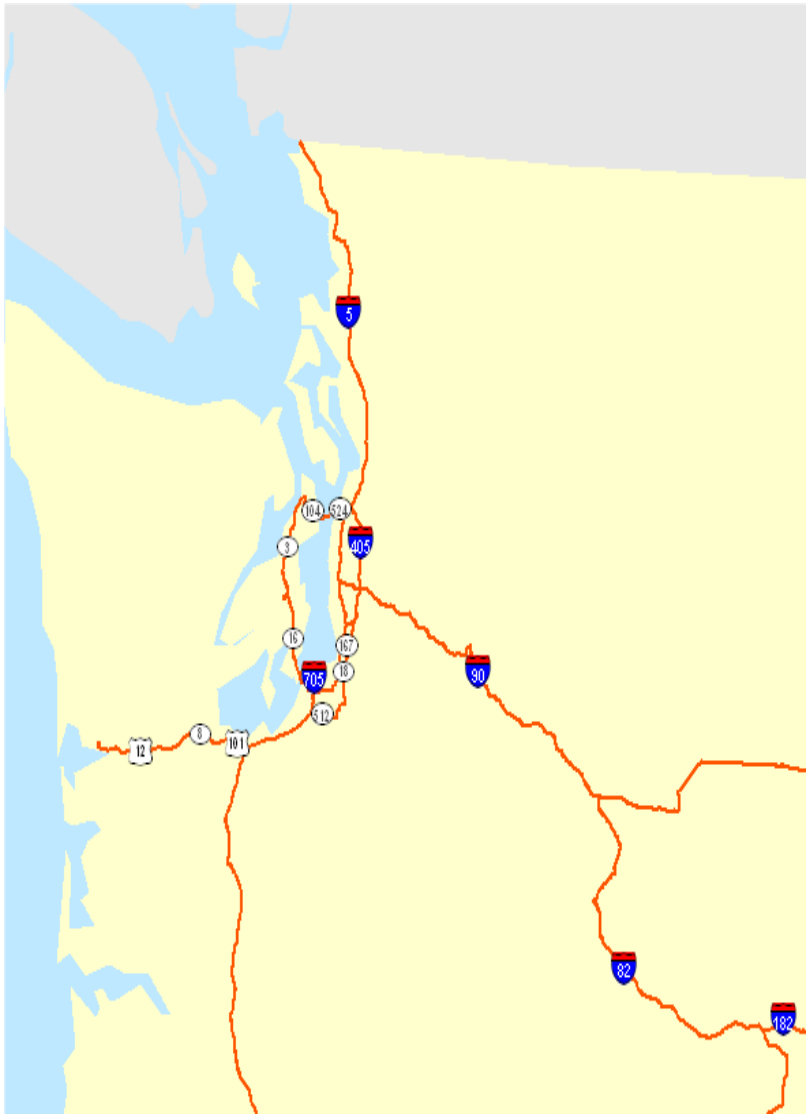
**Points** define discrete locations of geographic features too small to be depicted as lines or areas, such as well locations, telephone poles, and stream gauges. Points can also represent address locations, GPS coordinates, or mountain peaks.

**Lines** represent the shape and location of geographic objects too narrow to depict as areas (such as street centerlines and streams). Lines are also used to represent features that have length but no area, such as contour lines and administrative boundaries. (Contours are interesting, as you'll read later on, because they provide one of a number of alternatives for representing continuous surfaces.)

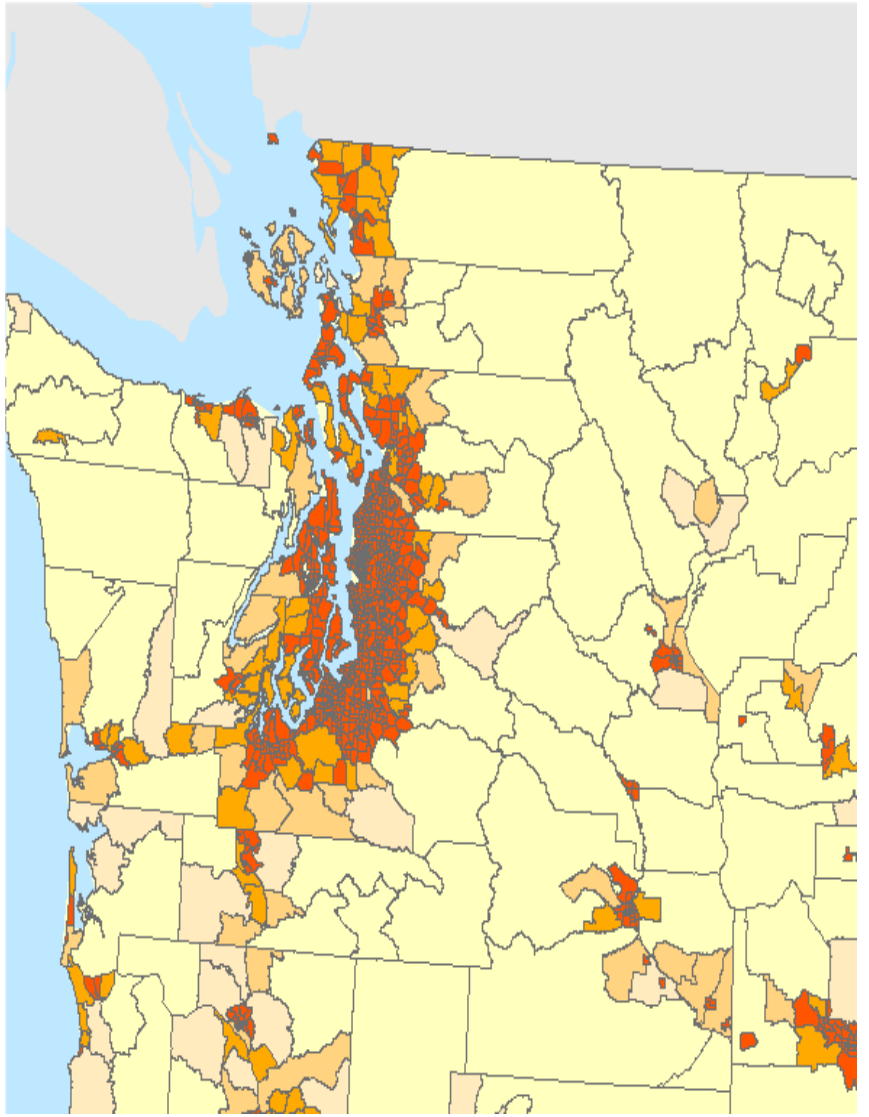
**Polygons** are enclosed areas (many-sided figures) that represent the shape and location of homogeneous features such as states, counties, parcels, soil types, and land-use zones. In the example below, the polygons represent land parcels.

# Types of GIS Data


Points




Lines



Polygons

Sources:www.google.com

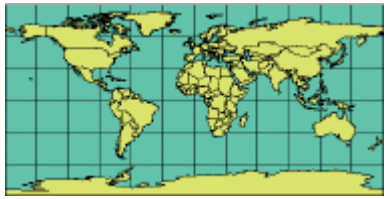
# Coordinates Systems

Reference system used to represent locations of geographic features on the Earth's surface

**Two main types of coordinate systems:**

1. Geographic coordinate systems: reference locations using angular measurements

1. Projected coordinate systems: reference locations using linear measurements



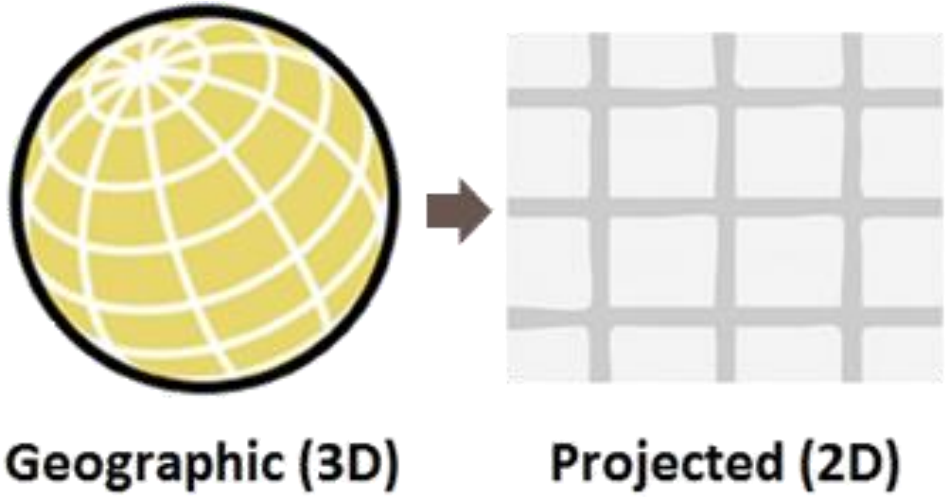
Sources:www.google.com

# Coordinates Systems

## Projected Coordinate Systems

Based on a geographic coordinate system

Defined on a flat 2D surface




https://www.youtube.com/watch?v=LcVlx4Gur7I&ab_channel=GIS%26GPSTipsandTechniques

Sources:www.google.com

# Most common Coordinates Systems used

**Latitude – Longitude:**

36.196780, 43.970977  Decimal Degree
36°11'48.4"N 43°58'15.5"E  Degree, minute, second

**Universal Transverse Mercator - UTM**
Divides the globe into 60 zones.
Each zone has its own projection parameters for maximizing the accuracy -

**Military Grid Reference System- MGRS**
Grid reference, derived from the Universal Transverse Mercator (UTM)

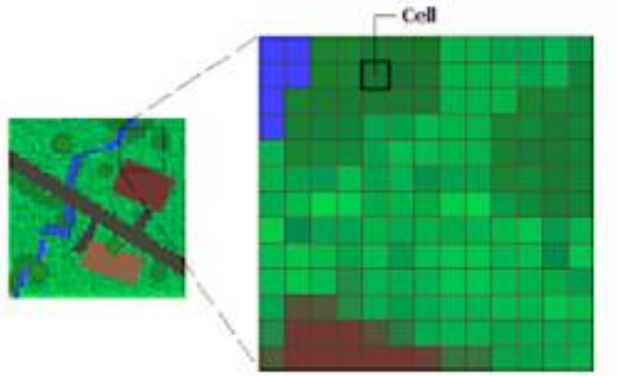
# Data Format

## Vector Data

SHP
GDB
KML

## Raster Data format

Standard Raster Format
Tagged Image File Format (TIFF)
Geo-TIFF
Graphics Interchange Format (GIF)
Joint Photograph Experts Group (JPEG)



# Shapefiles

Defines the **geometry** and **attributes of geographically referenced features** in three or more files with specific file extensions that should be stored in the same project workspace.

They are:

.shp—The main file that stores the feature geometry; required.

.shx—The index file that stores the index of the feature geometry; required.

.dbf—The dBASE table that stores the attribute information of features; required.

There is a one-to-one relationship between geometry and attributes, which is based on record number.

# File formats

**CSV - Comma Separated Value**: It isn’t exclusively a mapping format but it is often used in mapping.
Simplicity: they can be read by almost any program including the Excel or Google Docs.
When used in mapping, two extra columns are added to hold the x and y, or lat and long.

**Geodatabase:** a file with a collection of files in a folder on disk that can store, query, and manage both spatial and nonspatial data.
Popular format amongst advanced GIS users.

**KML**: The default file format of Google Earth.
KML does more than just store geometry and attribute data, it also contains lots of configuration options for Google Earth maps.