

What exactly is DATA ?

- We can collect all kinds of data about all kinds of things.
- The length of rainbow trout in a Colorado stream,
- The number of vegetarians in Alaska,
- The **diameter of mahogany tree trunks** in the Brazilian rainforest,
- Student scores on the last GIS midterm,
- The altitude of mountain peaks in Nepal,
- The depth of snow in the Austrian alps,
- The **number of people who use public transportation** to get to work in London .

- ✓ Data refer to facts, measurements, characteristics, or traits of an object of interest.
- Facts, measurements, and characteristics of something of interest.



> What exactly is INFORMATION ?

- Information simply refers to the knowledge of value obtained through the collection, interpretation, and/or analysis of data.
- Though a computer is not necessary to collect, record, manipulate, process, or visualize data, or to process it into information, information technology can be of great help.
- For instance, computers can automate repetitive tasks, store data efficiently in terms of space and cost, and provide a range of tools for analyzing data from spreadsheets to GISs, of course.

 Knowledge and insights that are acquired through the <u>analysis</u> of data.







> DATA vs INFORMATION ?



• Data is <u>RAW</u> !!

 Information is the <u>PROCESSED form of data</u> !!



Spatial Data

- Geographic or spatial data refer to geographic facts, measurements, or characteristics of an object that permit us to define its location on the surface of the earth.
- Such data include the latitude and longitude coordinates of points of interest, street addresses, postal codes, political boundaries, and even the names of places of interest.
- Geographic data are concerned with defining the location of an object of interest.
- Attribute data are concerned with its nongeographic traits and characteristics.

Data that describe the geographic and spatial aspects of phenomena.





- > Spatial Data
 - Geographic or spatial data
 - -1854 Broad Street cholera outbreak





Dr. John Snow









> Spatial Data

Attribute data





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> Types of GIS Data



Geospatial Data/ Types/



> Types of GIS Data



Geographic or Spatial Data

Lines

Areas



Raster





Geographic or Spatial Data





Geographic or Spatial Data



Geographic or Spatial Data

- 1. Raster Data Models
- The raster data model is **widely used** in applications ranging far beyond geographic information systems (GISs).
- Most likely, you are already very familiar with this data model if you have any experience with digital photographs.
- The ubiquitous JPEG, PNG, and TIFF file formats are based on the raster data model.
- Take a moment to view your favorite digital image. If **you zoom deeply into the image**, you will notice that it is composed of an array of tiny square pixels.
- Each of these uniquely colored pixels, when viewed as a whole, combines to form a coherent image.







- Geographic or Spatial Data
 - 1. Raster Data Models











- Geographic or Spatial Data
 - 1. Raster Data Models
 - The raster data model **consists of rows and columns of equally sized pixels** interconnected to form a planar surface.
 - These pixels are used as building blocks for creating points, lines, areas, networks, and surfaces.
 - Because of the reliance on a uniform series of square pixels, the raster data model is referred to as a grid-based system.





- Geographic or Spatial Data
 - 1. Raster Data Models







Geographic or Spatial Data

- 1. Raster Data Models
- Each cell in a raster carries a single value, which represents the characteristic of the spatial phenomenon at a location denoted by its row and column.
- The data type for that cell value can be either integer or floating-point.
- Alternatively, the raster graphic can reference a database management system wherein open-ended attribute tables can be used to associate multiple data values to each pixel.



List of cell values

[11112243112224361222546622254366225244662552544354452544444254]



- Geographic or Spatial Data
 - 1. Raster Data Models
 - The area covered by **each pixel determines the spatial resolution** of the raster model from which it is derived.

Spatial resolution:

• The smallest distance between two adjacent features that can be detected in an image.







- Geographic or Spatial Data
 - 1. Raster Data Models

Spatial Resolution

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a) Quickbird Sensor: b) Landsat c) MODIS 500 m \$00 m Deep Decreasing resolution **Resolution:** 2.4 m pixel 30 m pixel 250 m pixel Extent: Increasing extent 1000 km 50 km Monitoring Type: d) Local e) Regional f) Global

- Geographic or Spatial Data
 - 1. Raster Data Models
 - □ What is a digital elevation model (DEM)?
 - A Digital Elevation Model (DEM) is a representation of the bare ground (bare earth) topographic surface of the Earth excluding trees, buildings, and any other surface objects.











1. Raster Data Models







- Geographic or Spatial Data
 - 2. Vector Data Models
 - In this model, space is not quantized into discrete grid cells like the raster model.
 - Vector data models use points and their associated X, Y coordinate pairs to represent the vertices of spatial features, much as if they were being drawn on a map by hand.
 - The data attributes of these features are then stored in a separate database management system.
 - The spatial information and the attribute information for these models are **linked via a simple identification number** that is given to each feature in a map.





AND UNIVERSIT

Geographic or Spatial Data

2. Vector Data Models

 Three fundamental vector types exist in geographic information systems (GISs): points, lines, and polygons.

Points

- Points are zero-dimensional objects that contain only a single coordinate pair.
- Points are typically used to model singular, discrete features such as wells, power poles, sample locations, and so forth.
- Points have only the property of location.



Geographic or Spatial Data

2. Vector Data Models

Points

- Other types of point features include the **node** and the **vertex.**
- Specifically, a point is a stand-alone feature, while a node is a topological junction representing a common X, Y coordinate pair between intersecting lines and/or polygons.
- Vertices are defined as each bend along a line or polygon feature that is not the intersection of lines or polygons.
- Node: The intersection points where two or more arcs meet.
- ✓ Vertices: A corner or a point where lines meet.





Geographic or Spatial Data

2. Vector Data Models

Lines

- Lines are onedimensional features composed of multiple, explicitly connected points.
- Lines are used to represent linear features such as roads, streams, faults, boundaries, and so forth.
- Lines have the property of length.
- Lines that directly connect two nodes are sometimes referred to as chains, edges, segments, or arcs.



Toto

Geographic or Spatial Data

2. Vector Data Models

Polygons

- Polygons are two-dimensional features created by multiple lines that loop back to create a "closed" feature.
- In the case of polygons, <u>the first coordinate pair</u> (point) on the first line segment is the same as the last coordinate pair on <u>the last line segment.</u>
- Polygons are used to represent features such as city boundaries, geologic formations, lakes, soil associations, vegetation communities, and so forth.
- Polygons have the **properties of area and perimeter.**
- Polygons are also called areas.





> Geographic or Spatial Data

2. Vector Data Models





Geographic or Spatial Data

2. Vector Data Models





Raster





Polygon (area segment) 3 OR MORE VERTICES THAT ARE CONNECTED AND CLOSED

5 OR MORE VERTICES THAT ARE CONNECTED AND CLO

E.g., Land/water boundaries, buildings



- Geographic or Spatial Data
 - Raster vs Vector







Geographic or Spatial Data





(d) Digital colour aerial photograph



(e) Vector contours and roads



(a) Soil map display

(b) Reselection of specific soil types

(c) Simple soil erosion model predictions







(a) Raster digital elevation model

(b) Raster land cover data

(c) Satellite image



(f) Vector soil polygons



(g) Vector census polygon boundaries



(h) Vector land cover polygons



Geographic or Spatial Data

Raster vs Vector





(a) Points (e.g. buildings)

(b) Lines (e.g. roads)



(c) Polygons (e.g. forests)



(e) Topographic map





(d) Surface (e.g. terrain)



(f) Digital terrain model

Geographic or Spatial Data

Raster vs Vector

Raster Graphics	Vector Graphics
They are composed of pixels.	They are composed of paths.
In Raster Graphics, refresh process is independent of the complexity of the image.	Vector displays flicker when the number of primitives in the image become too large.
Graphic primitives are specified in terms of end points and must be scan converted into corresponding pixels.	Scan conversion is not required.
Raster graphics can draw mathematical curves, polygons and boundaries of curved primitives only by pixel approximation.	Vector graphics draw continuous and smooth lines.
Raster graphics cost less.	Vector graphics cost more as compared to raster graphics.
They occupy more space which depends on image quality.	They occupy less space.
File extensions: .BMP, .TIF, .GIF, .JPG	File Extensions: .SVG, .EPS, .PDF, .AI, .DXF





Attribute Data





Attribute Data



References



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