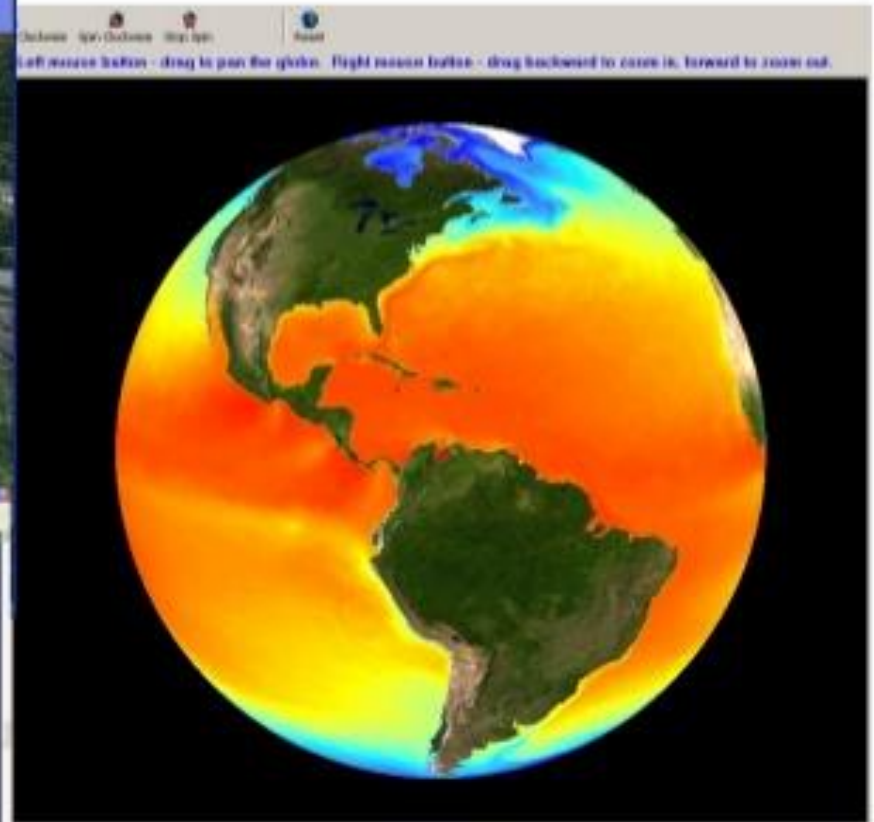# What is GIS?

What is GIS?

GIS = Geographic Information System

A GIS integrates hardware, software and data for **capturing**, **managing**, **analyzing**, and **displaying** all forms of geographically referenced information.

Capture → Manage → Analyze → Display

What is a GIS?

GEOGRAPHIC

implies that locations of the data items are known, or can be calculated, in terms of Geographic coordinates (Latitude, Longitude)

INFORMATION

implies that the data in a GIS are organized to yield useful knowledge, often as colored maps and images, but also as statistical graphics, tables, and various on-screen responses to interactive queries.

SYSTEM

implies that a GIS is made up from several inter-related and linked components with different functions. Thus, GIS have functional capabilities for data capture, input, manipulation, transformation, visualization, combinations, query, analysis, modelling and output.

Geographical Information System

o **A set of tools for**

- **Collecting**
- **Storing**
- **Manipulating**
- **Retrieving**
- **Transforming and Display of Spatial Data from the Real World**

GIS: a formal definition

"A system for capturing, storing, checking, integrating, manipulating, analysing and displaying data which are spatially referenced to the Earth. This is normally considered to involve a spatially referenced computer database and appropriate applications software"

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Components of GIS

- The major components of GIS is
  - Hardware,
  - Software,
  - Data,
 - People,
  - Procedure
  - Network

Six parts of a GIS

COMPONENTS OF GIS:

- 1.Computer system (hardware):
  - It includes – CPU , VDU , keyboard , mouse , plotter , printer , CD/DVD drive etc . – to store , process , and present spatial data

- 2.Software :
  - Includes software like – Arc GIS, Map info , Geometrica , Autodesk Map – to perform GIS operation

GIS

GIS

- 3. Data :
  - Geographical data in – form of - hard copy map , digital map ,aerial photos , satellite images , statistical tables , other documents - used for GIS operations

- 4. Procedure and Analysis:
  - To complete task – procedures are performed using – hardware and software

- 5. Expert and skilled personnel:
  - Experts with knowledge area required to apply GIS properly
  - Different types of users are using GIS at different level

Data Representation

- GIS data represents **real world objects** (e.g. roads, land use, elevation, trees, waterways, etc.)

- There are 2 broad methods used to store data in GIS
  1. **Vector** data model
  2. **Raster** data model
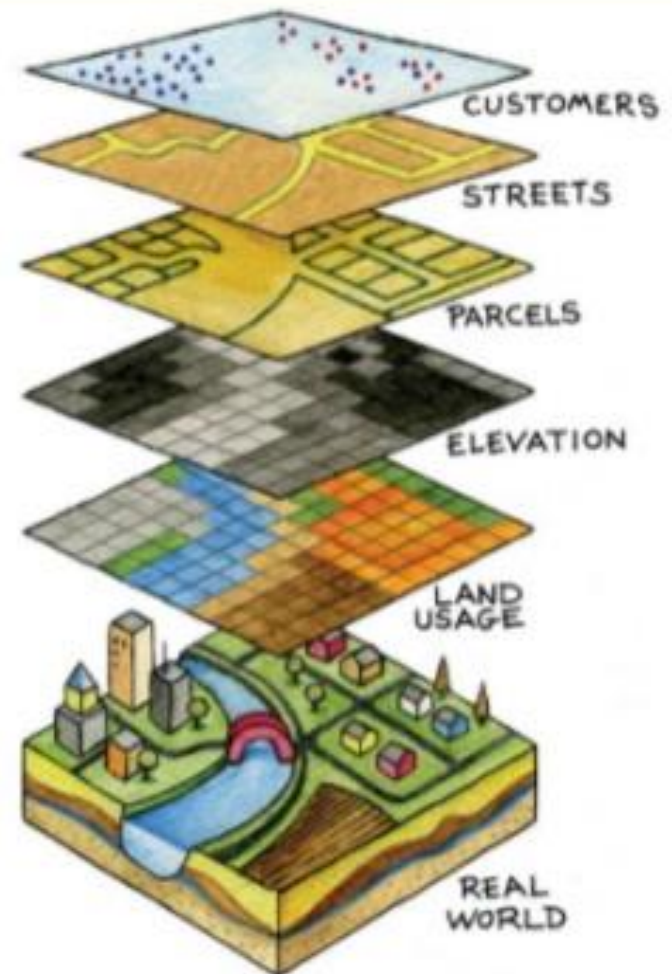
Data Representation (Vector)

A coordinate-based data model that represents geographic features as points, lines, and polygons.
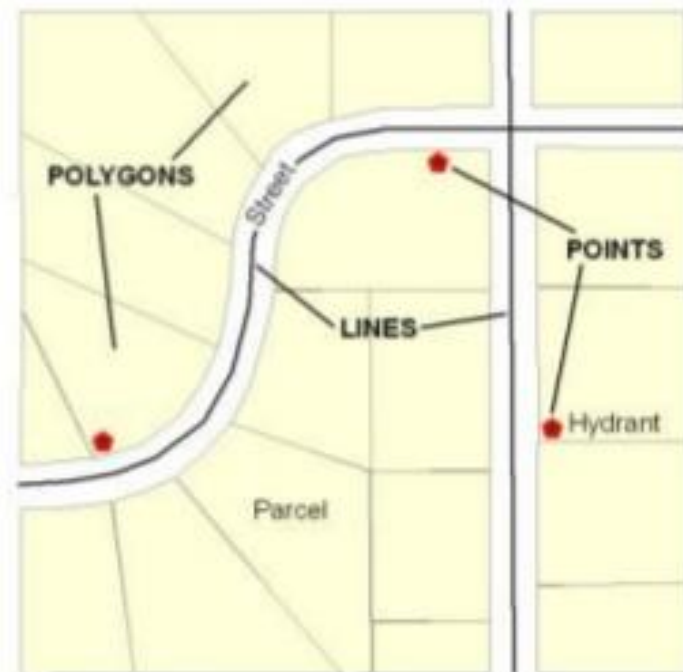
1. Points

Location of Wells, Schools, or Points of Interest

2. Lines / Polylines

Road Centerlines, Rivers, Trails, or Streets

3. Polygons

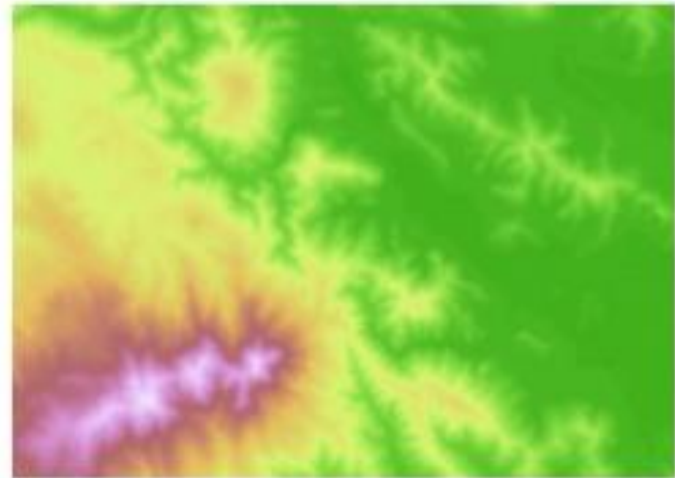Boundary of Cities, Lakes, or Forests

Data Representation (Raster)

A spatial data model that defines space as an **array of equally sized cells** arranged in rows and columns. Each cell contains an **attribute value** and **location coordinates**.

Raster as Satellite Imagery

Raster as Elevation Surface

Raster VS Vector

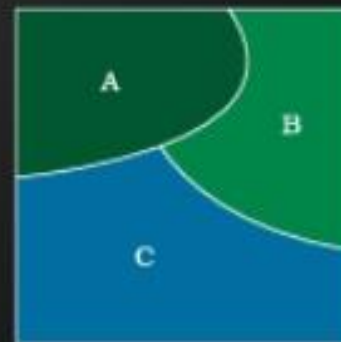Geographic Information Systems (GIS) Data Models:
Raster vs. Vector Models

Raster Data Model

	A	B	C	D	E
A	1	1	1	2	2
B	1	1	1	2	2
C	1	1	3	2	2
D	3	3	3	3	3
E	3	3	3	3	3

Vector Data Model

Graphical Coverage

Relational Database

ID	Variable 1
A	1
B	2
C	3

Raster models....

• represent continuous variation well
• represent discrete objects poorly
• have simple data structure
• require large file sizes

Vector models....

• represent continuous variation poorly
• represent discrete objects well
• have more complex data structures
• typically require smaller files sizes than raster
  models

Common GIS Data Format

Vector Data Model

- **Shapefile** (.shp, .shx & .dbf)
- Geography Markup Language **GML** (.gml)
- Personal Geodatabase (.mdb)
- **File Geodatabase** (.gdb)

Raster Data Model

- Enhanced Compressed Wavelet **ECW** (.ecw)
- **GeoTIFF** = TIFF file with GeoReference (.tif)
- MultiResolution Seamless Image Database **MrSID** (.sid)
- **JPEG2000** = JPEG file with GeoReference (.jpg)

GIS Areas

Geo Sciences

Civil Engineering

Transportation

Natural resources

Geology & Geophysics

Environment

Planning

Administration

Management

Business

Remote Sensing

Image processing

Urban & Rural Development

Floods , Disasters

Oil exploration

Mines

Surveys

Watershed management

Tourism

Communications

Application of GIS

- ## GIS used in multiple disciplines:

|	
Agriculture	
Archaeology	Geography
Architecture/Landscape Arch.	Geology
Business	Meteorology
Computer Science	Oceanography
Environmental Science	Law Enforcement
Engineering	Public Health
Journalism	History
Military Science	Sociology
Natural Resource Management	Urban/Regional Planning

Agriculture

- Farm management
- Pest/Disease tracking
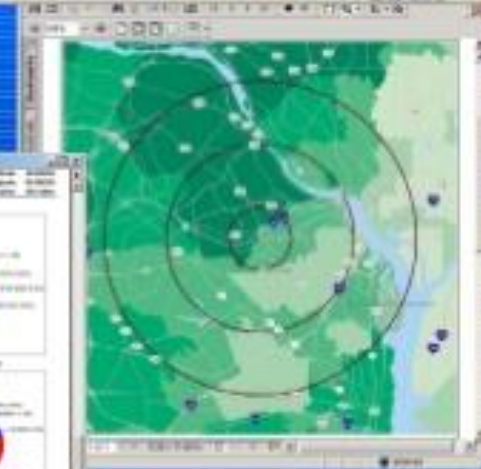- Crop monitoring
- Yield prediction
- Soil analysis
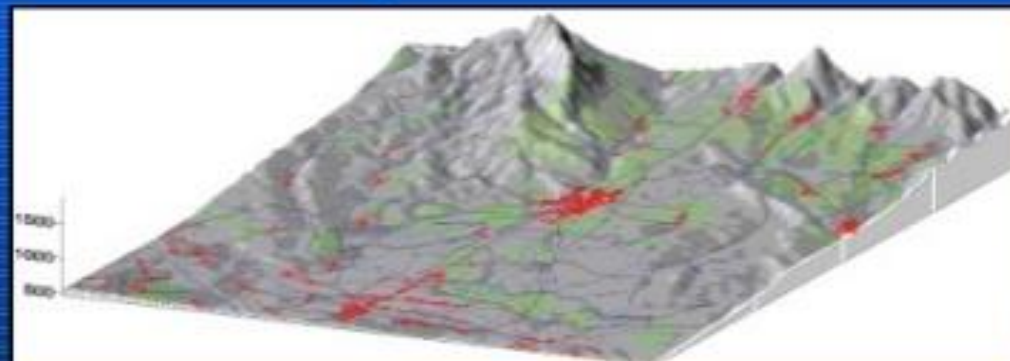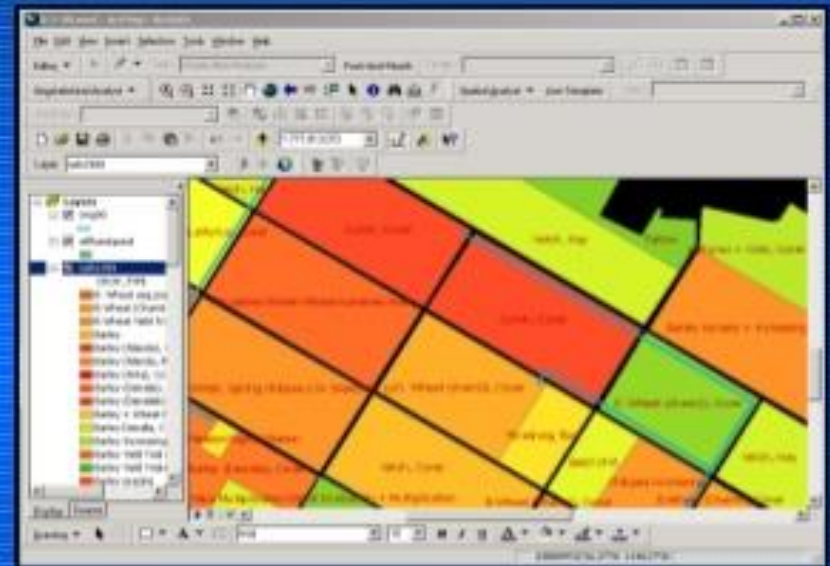
Natural Resource Management

- **Forestry**
- **Ecology**
- **Mining**
- **Petroleum**
- **Water Resources**
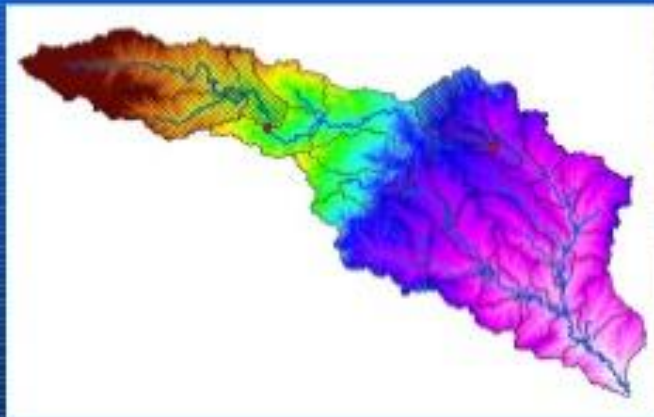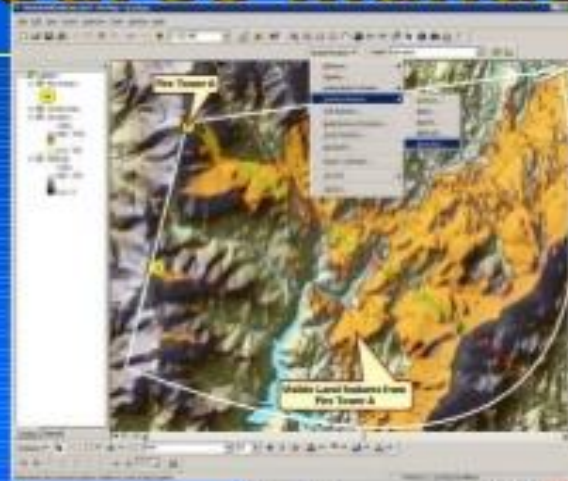
Planning and Economic Development

- Land Use/Zoning
- Emergency Preparedness
- Population Forecast
- Market Analysis
- Property Tax Assessment
- Transportation

Softwares

GIS

- ARC INFO
- ArcGIS
- MapInfo
- GRASS
- Geomedia
- Geoconcept
- WIN GIS
- Microstation
- AutoCAD

Digital Image Processing

- ERDAS Imagine
- ER Mapper
- ILWIS
- ENVI
- PCI Geomatica
- ArcView image analysis
- TNTMIPS
- Ecognition

Thank You