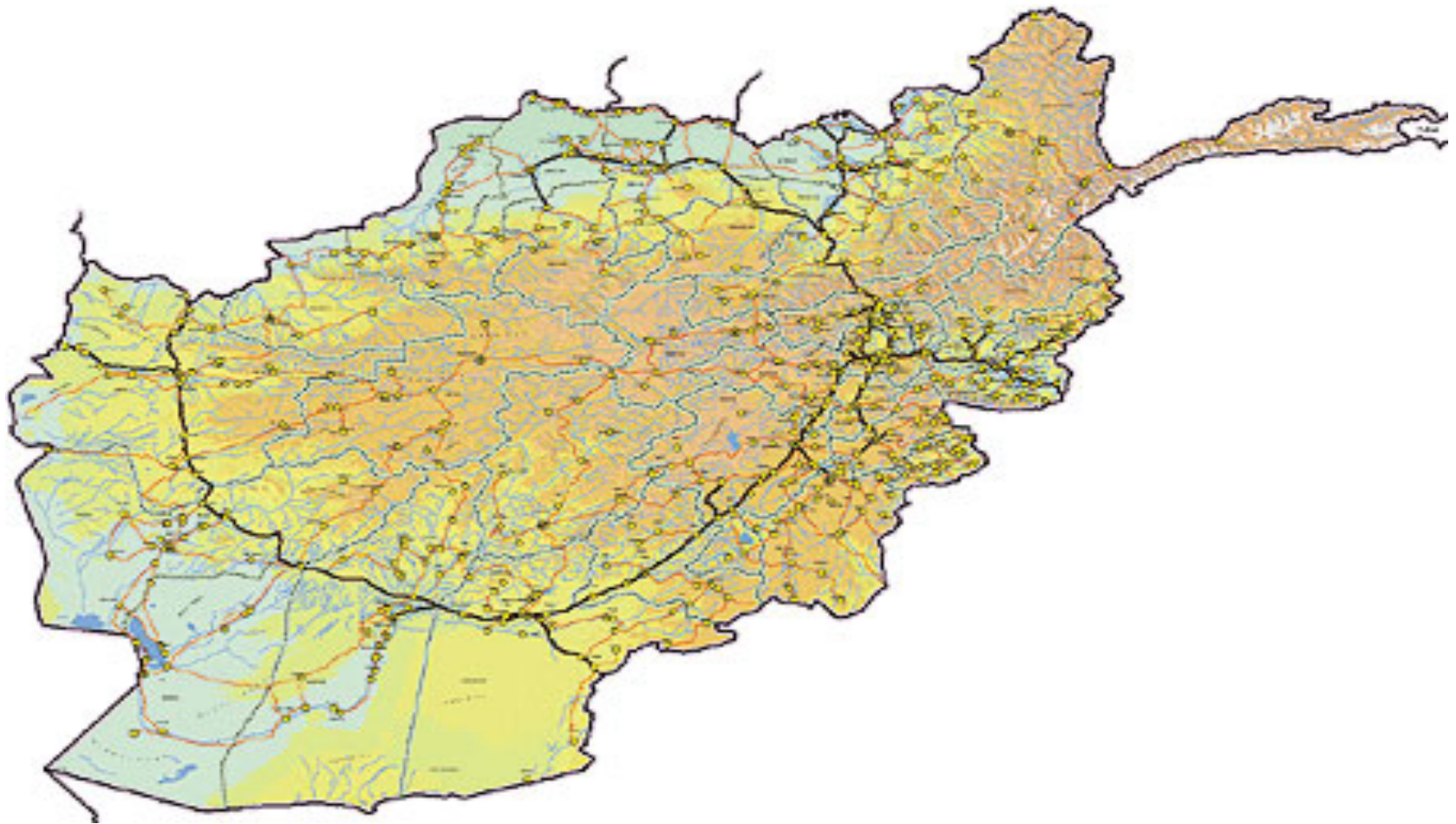


# Introduction to GIS

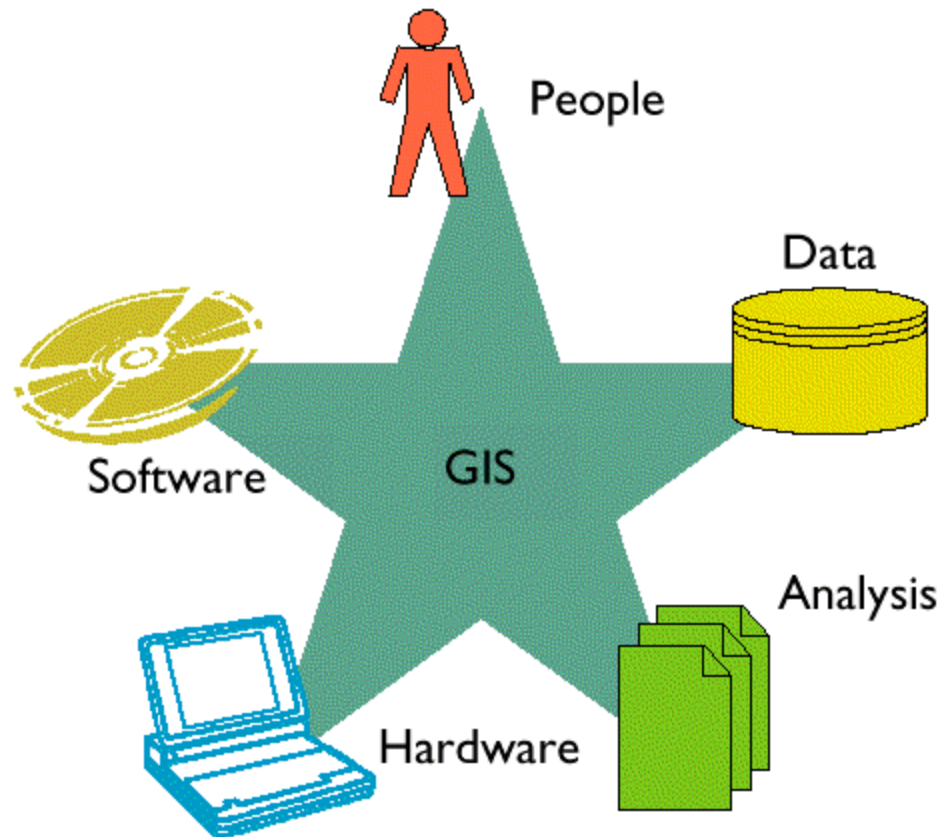
## **Concepts and Principles**

# Afghanistan Geographic Map



# What is a GIS?

- An integration of five basic components



# GIS Functions

**Capture**

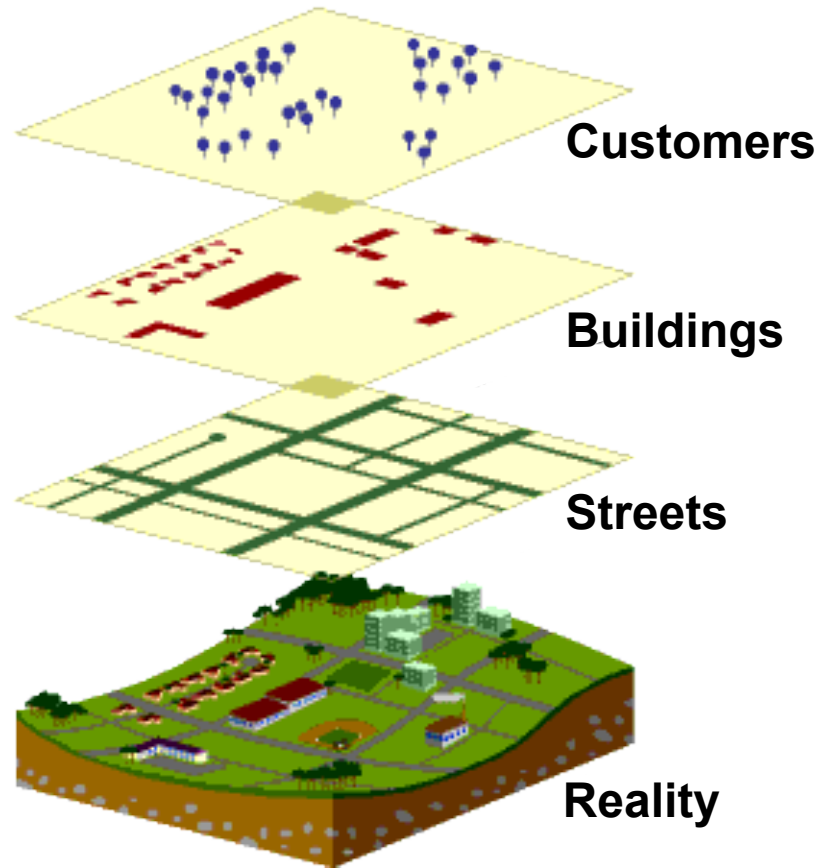
**Store**

**Query**

**Analyze**

**Display**

**Output**



# Data for GIS Applications

Digitized and Scanned Maps

- purchased, donated, free (Internet)

- created by user

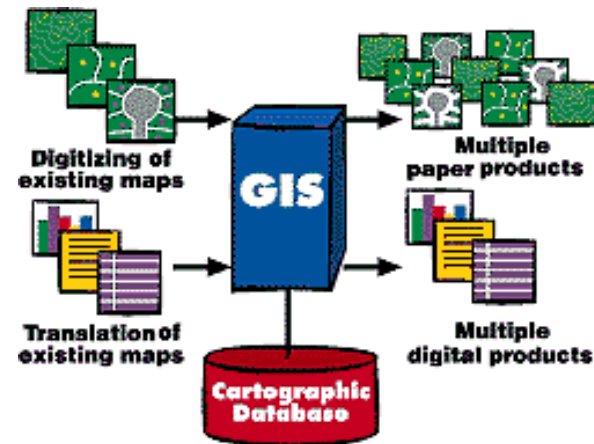
- Data Bases – Tables of data
- GPS – Global Positioning System

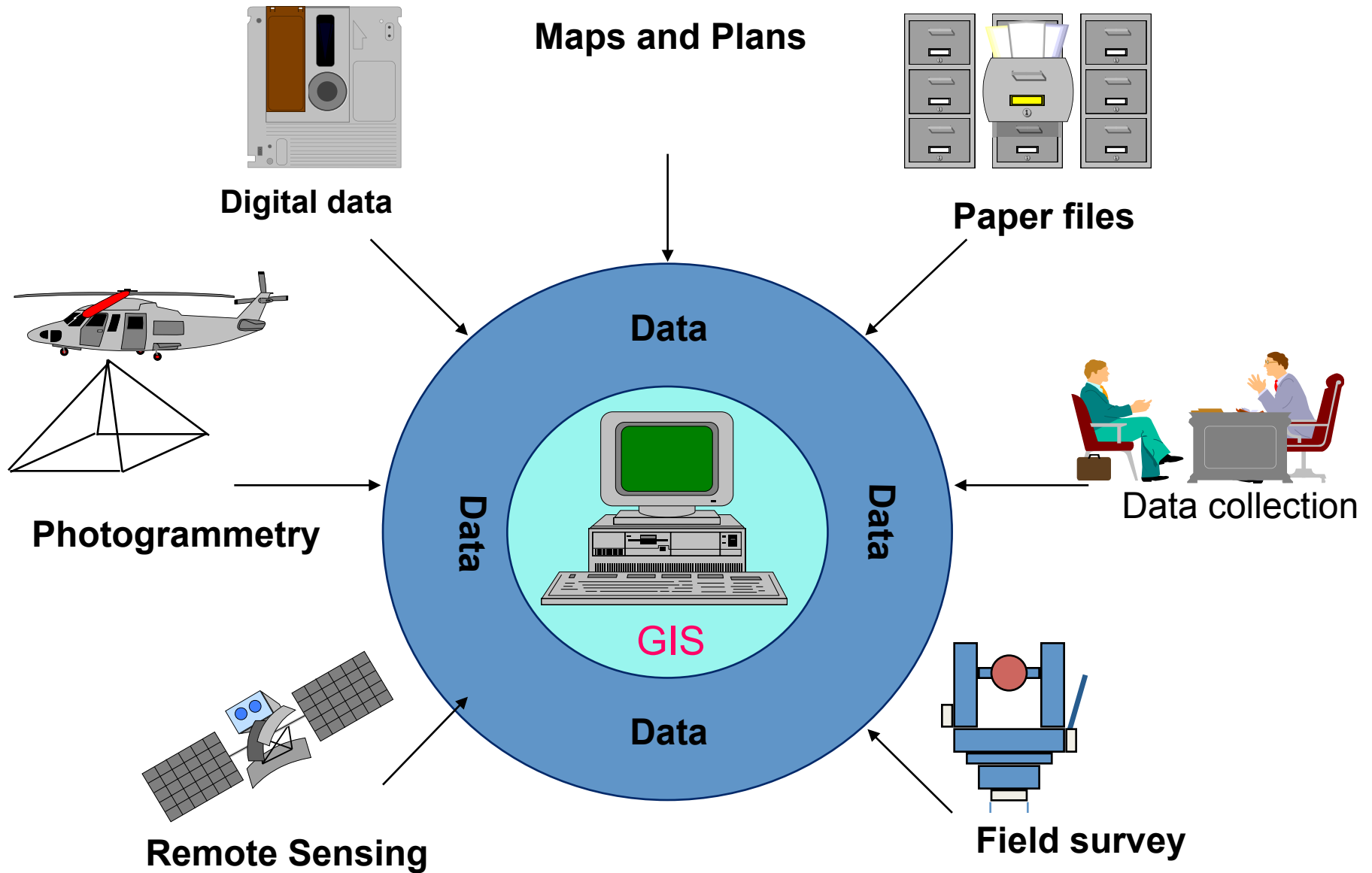
- accurate locations

- Field Sampling of Attributes
- Remote Sensing

Satellite Images

Aerial photography



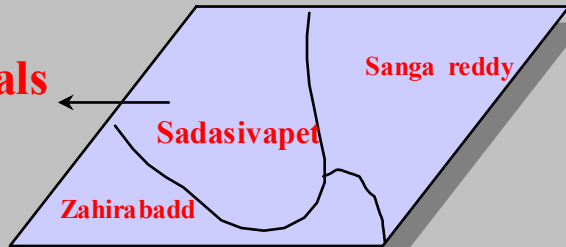


## GIS Data Sources

# Query

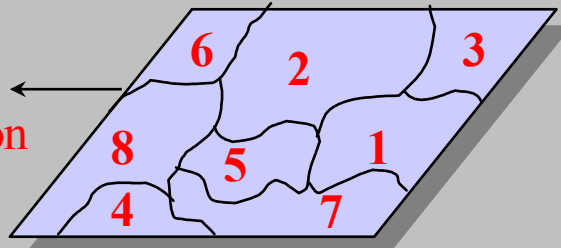
## Data

**Mandals**

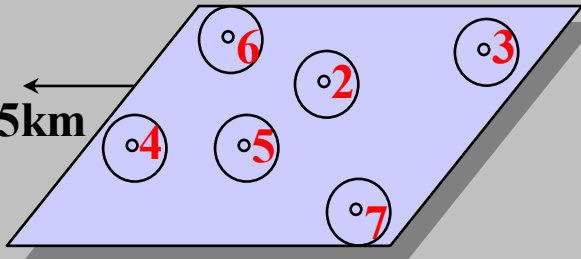


**Villages**

**Population**



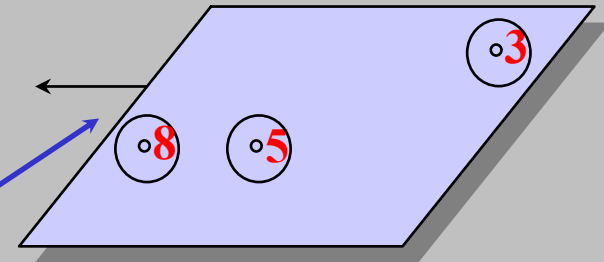
**Village  
Buffer 5km**



## Query

Identify villages  
where population  
is  $> 1000$  but  
no school with In  
5 Km

## Output

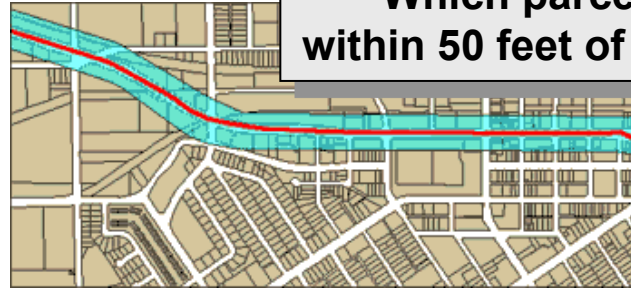


**Report**

3 villages of numbers  
8, 5 and 3 are having  
population more than 1000  
and without a school.

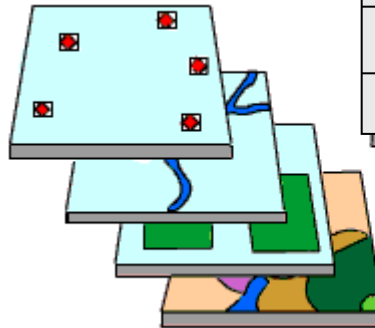
# Analysis

## Proximity



Which parcels are within 50 feet of the road?

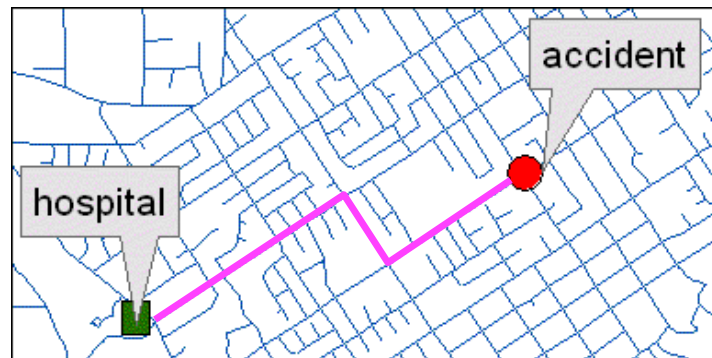
## Overlay



|                |         |
|----------------|---------|
| Well type      | Drilled |
| Building owner | Smith   |
| Soil type      | Sandy   |

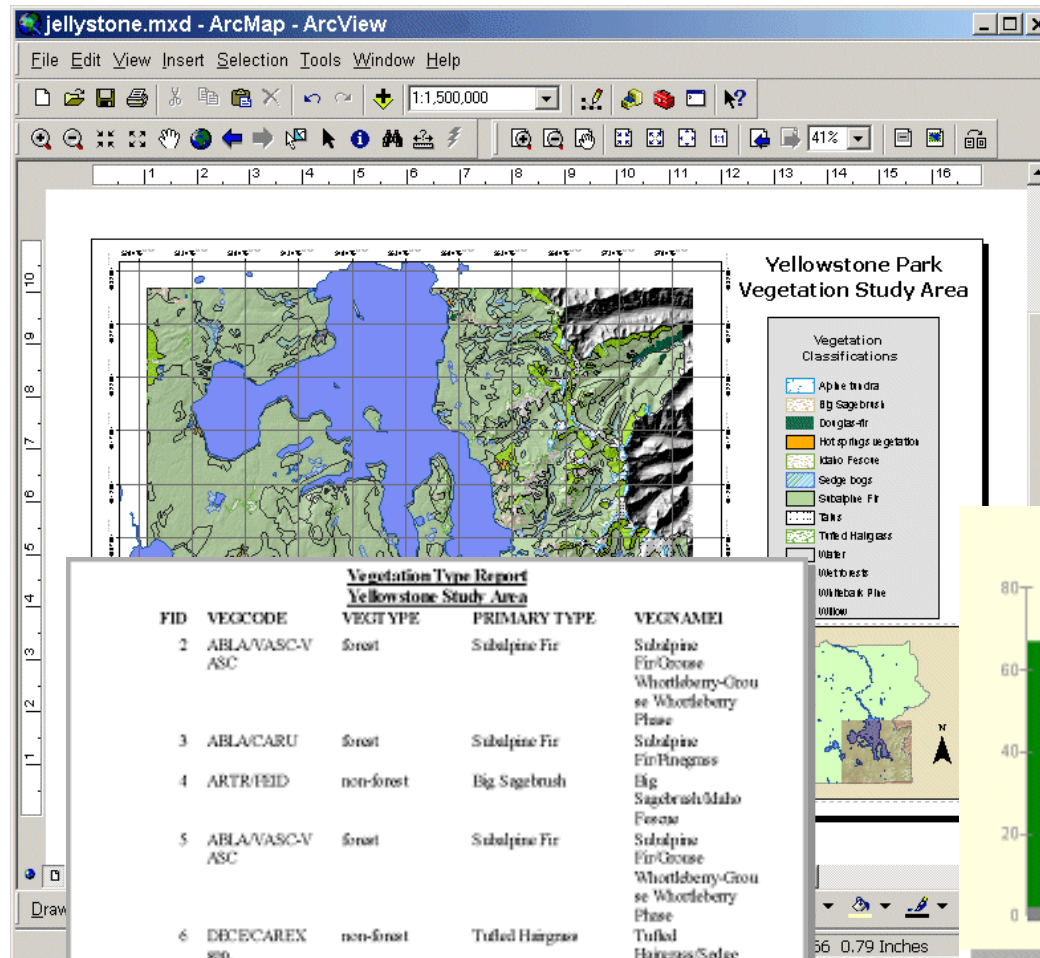


## Network



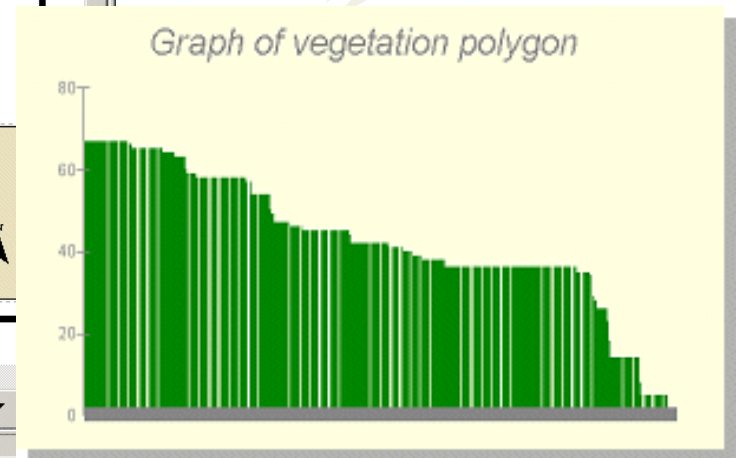


# Display



Maps

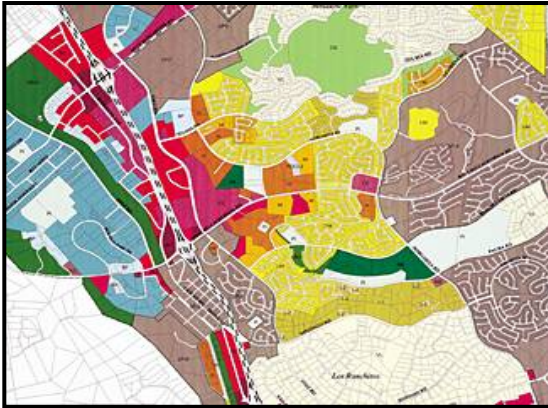
Graphs



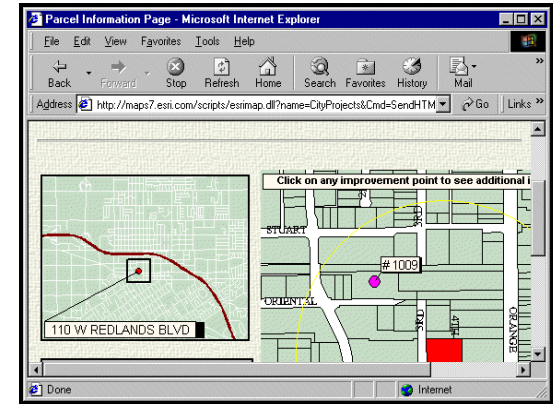
Reports

# Output

**Paper map**



**Internet**



**GIS Data**

**Image**



**Florida.jpg**

**Document**



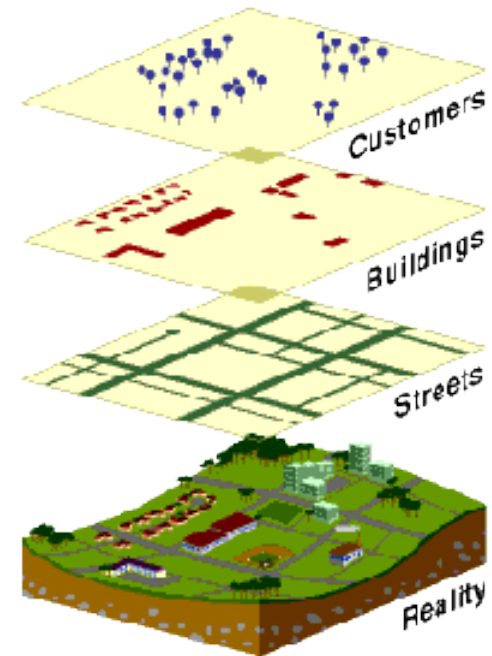
**Florida.mxd**

# A definition of GIS

- **GIS is a System of computer software, hardware and data, and personnel to help manipulate, analyze and present information that is tied to a spatial location –**

# A definition of GIS (Continued)

- ✚ ***GIS—The Language of Geography***
- ✚ ***Geography and GIS—Serving Our World***
- ✚ ***Geography and GIS—Sustaining Our World***
- ✚ ***Geography—Creating Communities***



# Why Use GIS

- ✚ Improve Organizational Integration.
- ✚ Make Better Decisions.
- ✚ Make Maps



# GIS Usage

- Emergency Services
- Transportation
- Business
- Industry
- Government
- Education

**Fire & Police**

**Motorpol**

**Site Location,**

**Delivery Systems**

**Communication, Mining,  
Pipelines, Healthcare**

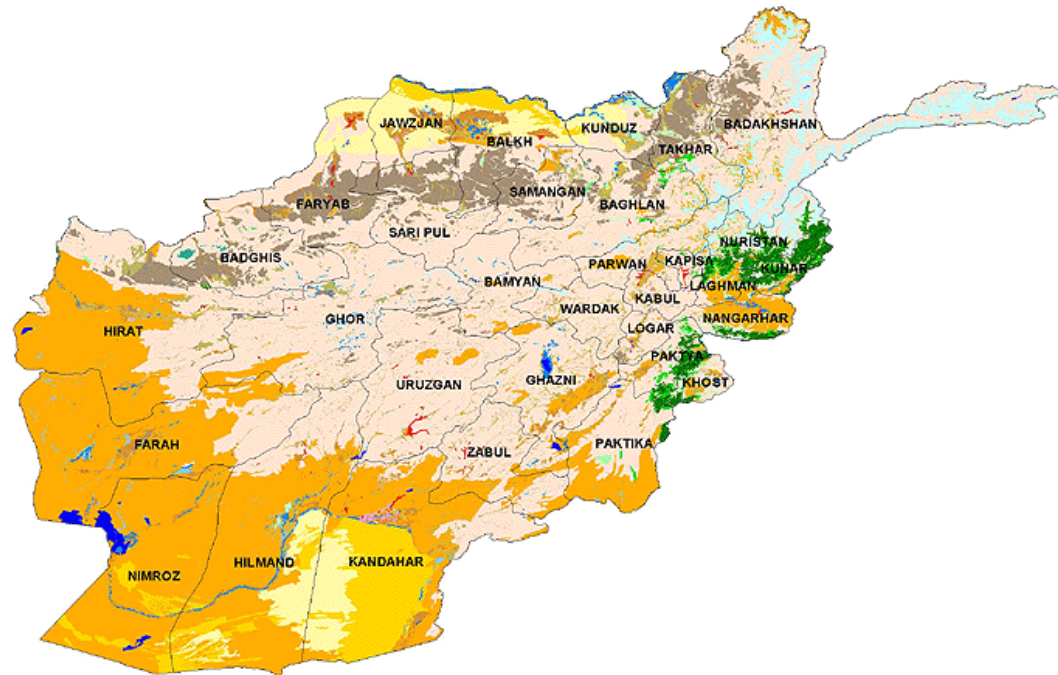
**Local ,Military**

**Research, Teaching Tool,  
Administration**

*Wherever Spatial Data Analysis is Needed*

# What is a Map

A graphic representation of features on the earth's surface or other geographically distributed phenomena is called a map.



# What is a Map

**Maps provide two types of information:**

Location information is graphically represented as points, lines and areas.

Spatial relationships are derived through interpretation by the map user.

**Maps contain POINT features, LINE features and AREA features**

|              |                |               |
|--------------|----------------|---------------|
| -wells       | -forest areas  | -roads        |
| -urban areas | -fire stations | contour lines |
| -hydro lines | -water bodies  | -rural area   |
| -rivers      | -hospitals     | -schools      |

-



# Map Projection

## Map Projection

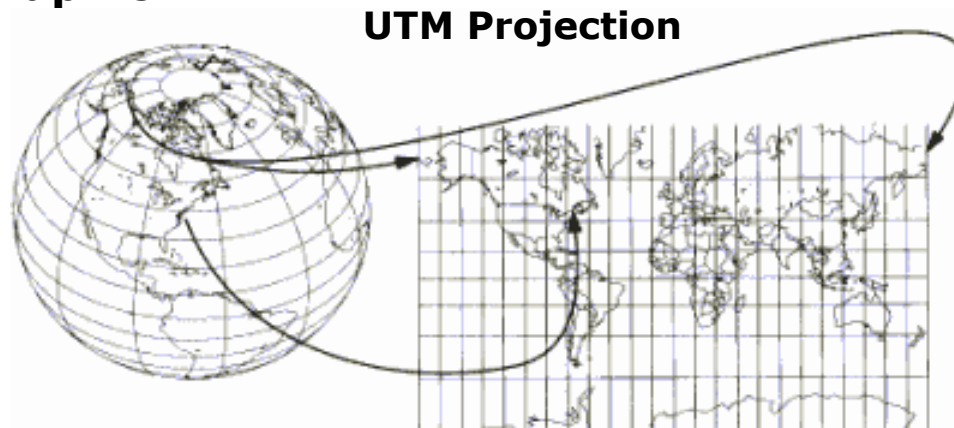
The process of transferring/relocating of latitude and longitudes from the globe onto a flat surface

(map) is called Projection.

There are several types of projections. In Afghanistan we use two type of projections.

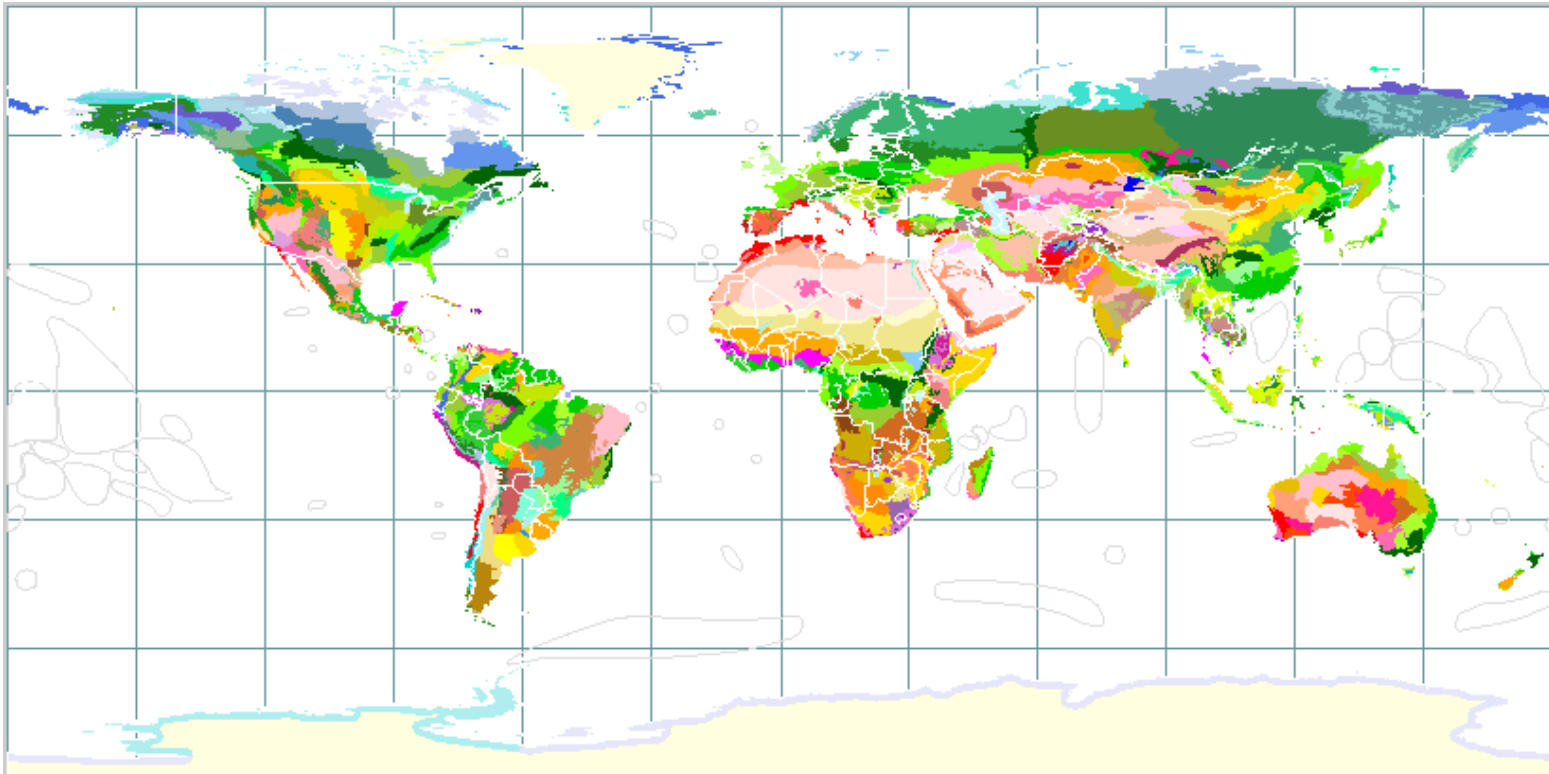
**1. Universal Transverse Mercator (UTM)**

**2. Geographic**



# Map Projection (Continued)

## Geographic Projection

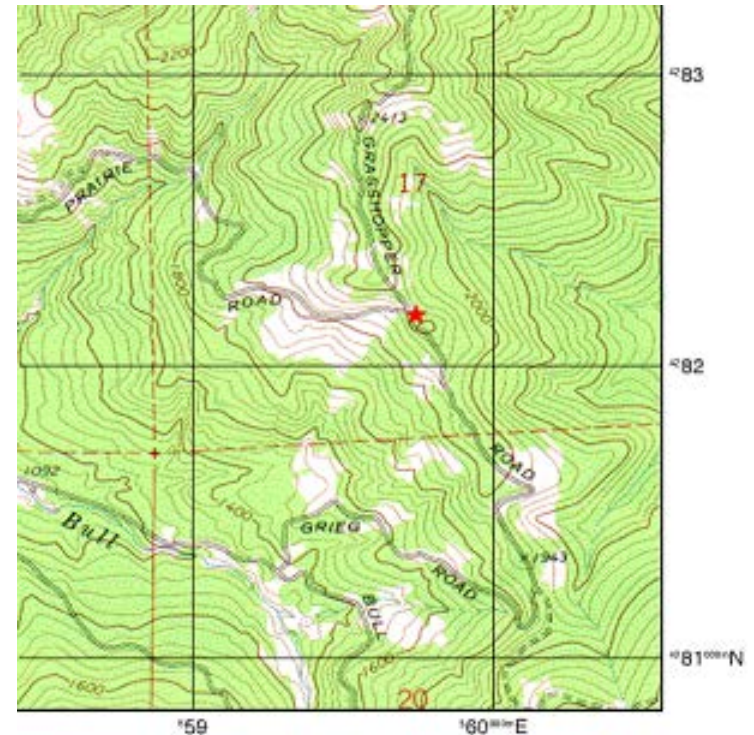


# Coordinate System

A coordinate system specifies the units used to locate features in two-dimensional space and the origin point of those units. Latitude and longitude is a coordinate system (often called the "geographic" coordinate system).

Types of **Coordinate Systems** we use in Afghanistan

1. **DD (Decimal Degree)**
2. **DMS (Degree Minute Seconds)**



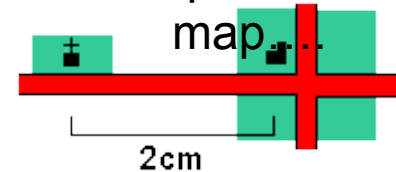
# Map Scale

Scale represents the ratio of a distance on the map to the actual distance on the ground.  
Maps are made to **scale**.

Most Popular way to define maps are:

- ✓ Small Scale Maps
- ✓ Large Scale Maps

For example, If 2cm on a map...



Represents 1km on the ground...



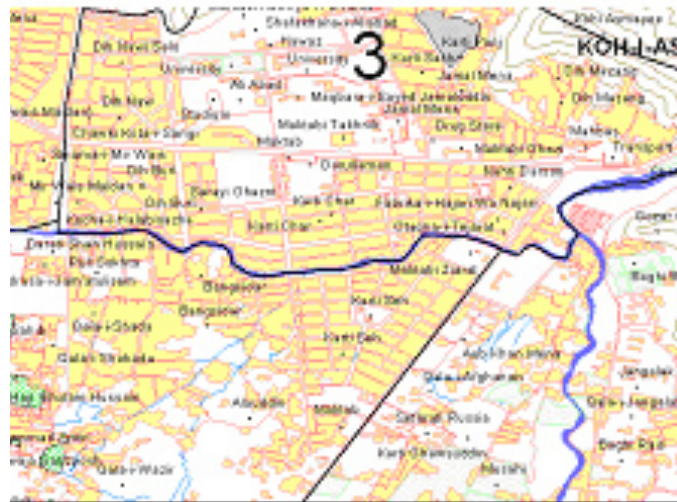
the scale would be 2cm  
= 1km, or...

$$\begin{aligned}\frac{\text{Distance on the Map}}{\text{Distance on the Ground}} &= \frac{2 \text{ cm}}{1 \text{ km}} = \frac{2 \text{ cm}}{100\,000 \text{ cm}} \\ &= \frac{1}{50\,000} \\ &= \text{1/50 000 Scale}\end{aligned}$$

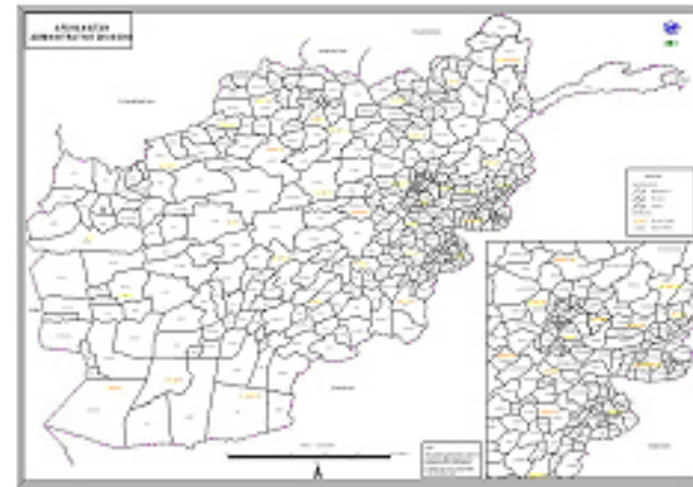
# Map Scale (Continued)

## Examples of Map Scales

Large Scale Map



Small Scale Map



# Theme, Feature and Vertex

## **Feature:**

It is made of vertex or vertexes. (Records in the table).

## **Vertex:**

The intersection of latitude and longitude.

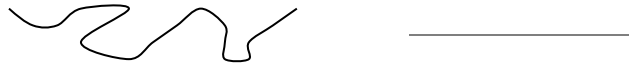
# Feature Types

## Feature Types

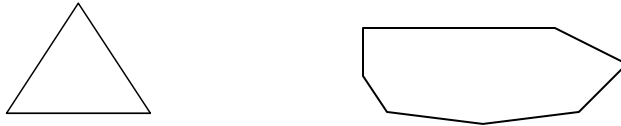
- **Point** (Which does not have length and width, with only one vertex)



- **Line** (Which has length, with at least two vertexes)

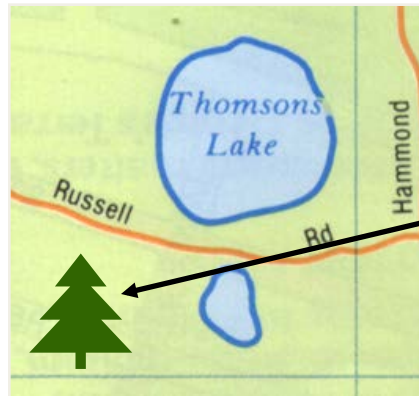


- **Polygon** (Which has both length, width and area, with at least three vertexes)



# Point Features

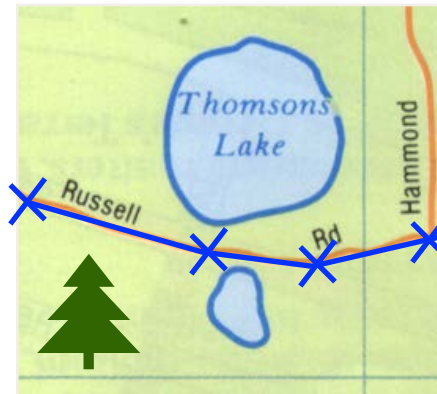
- **Tree**
- **Traffic accident**
- **Lamp post**





# Line Features

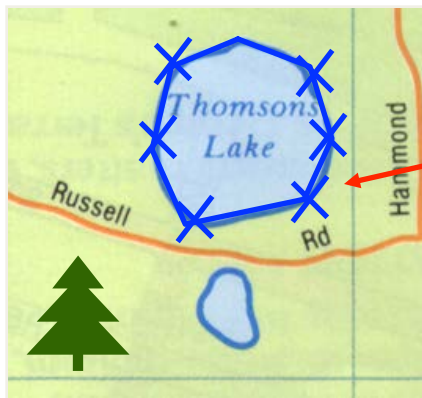
- Lines are a series of geographic coordinates joined to form a line such as:
  - Road
  - Stream
  - Railway



# Area Features

Areas (Polygons) are a series of geographic coordinates joined together to form a boundary such as:

- Lake
- Soil types



# Thematic layers contain features

Points



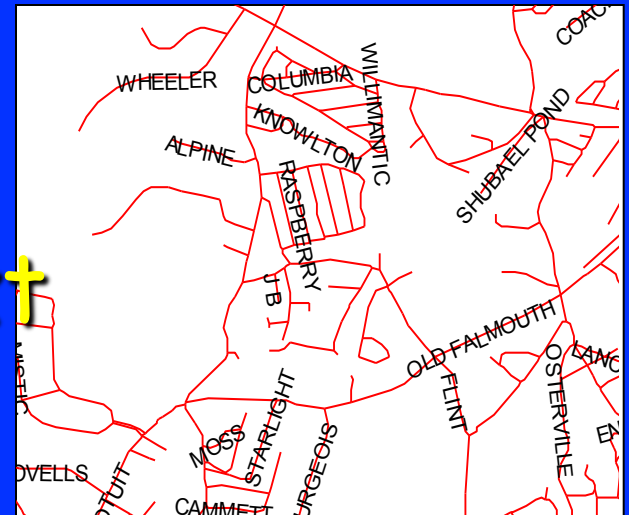
Lines



Areas



Text



# Data-Data-Data We All 'Got Data'

- **Scale of Data**

- Local to Global

- **Data Presentation**

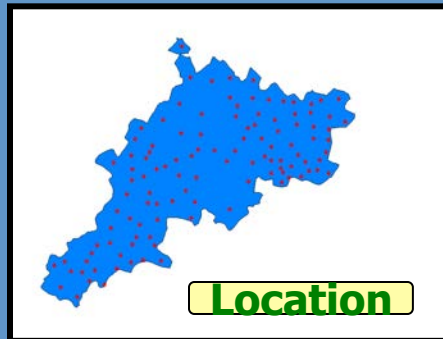
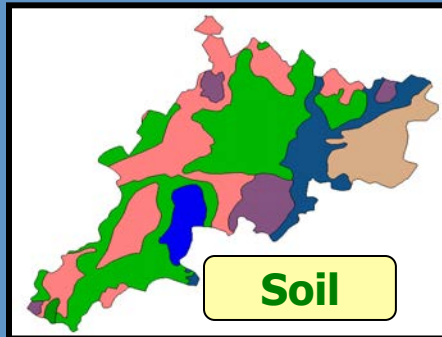
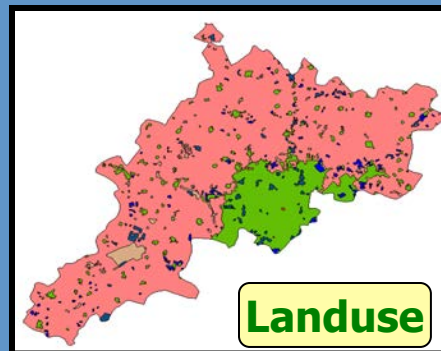
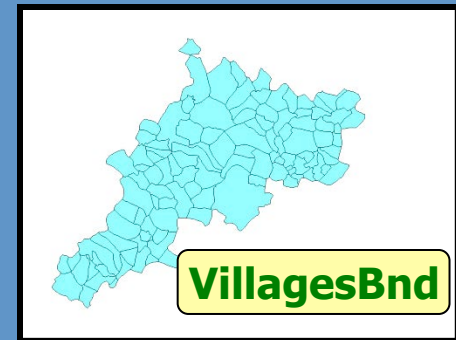
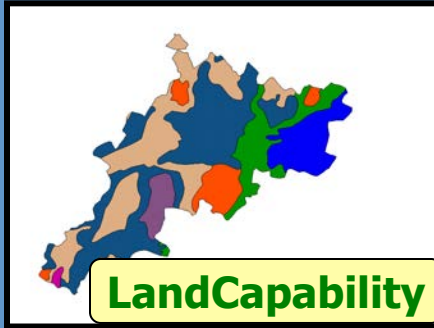
- Words, Charts/Graphs, Tables, or Maps

# Data, Information and Knowledge

Exploring **Data** using **GIS** turns it into **Information** and then into **Knowledge**

- Data:** Raw facts, especially organized for storage and analysis.
- Information:** A collection of facts or data that has been processed for use in making decisions.
- Knowledge:** Collection of information to enhance understanding.

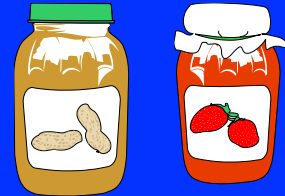
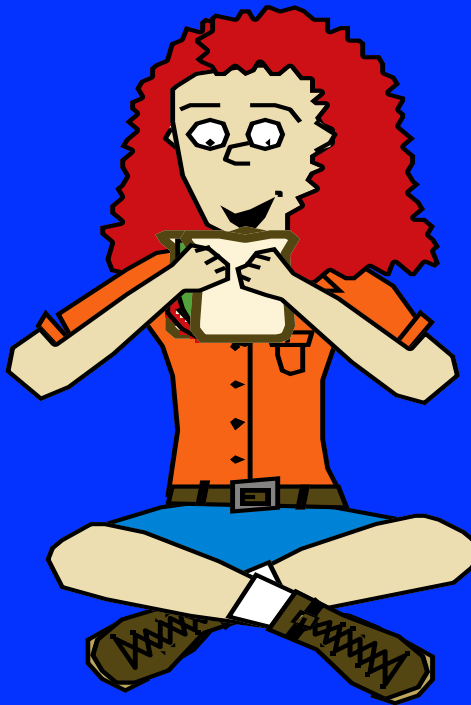
# Spatial Data Layers



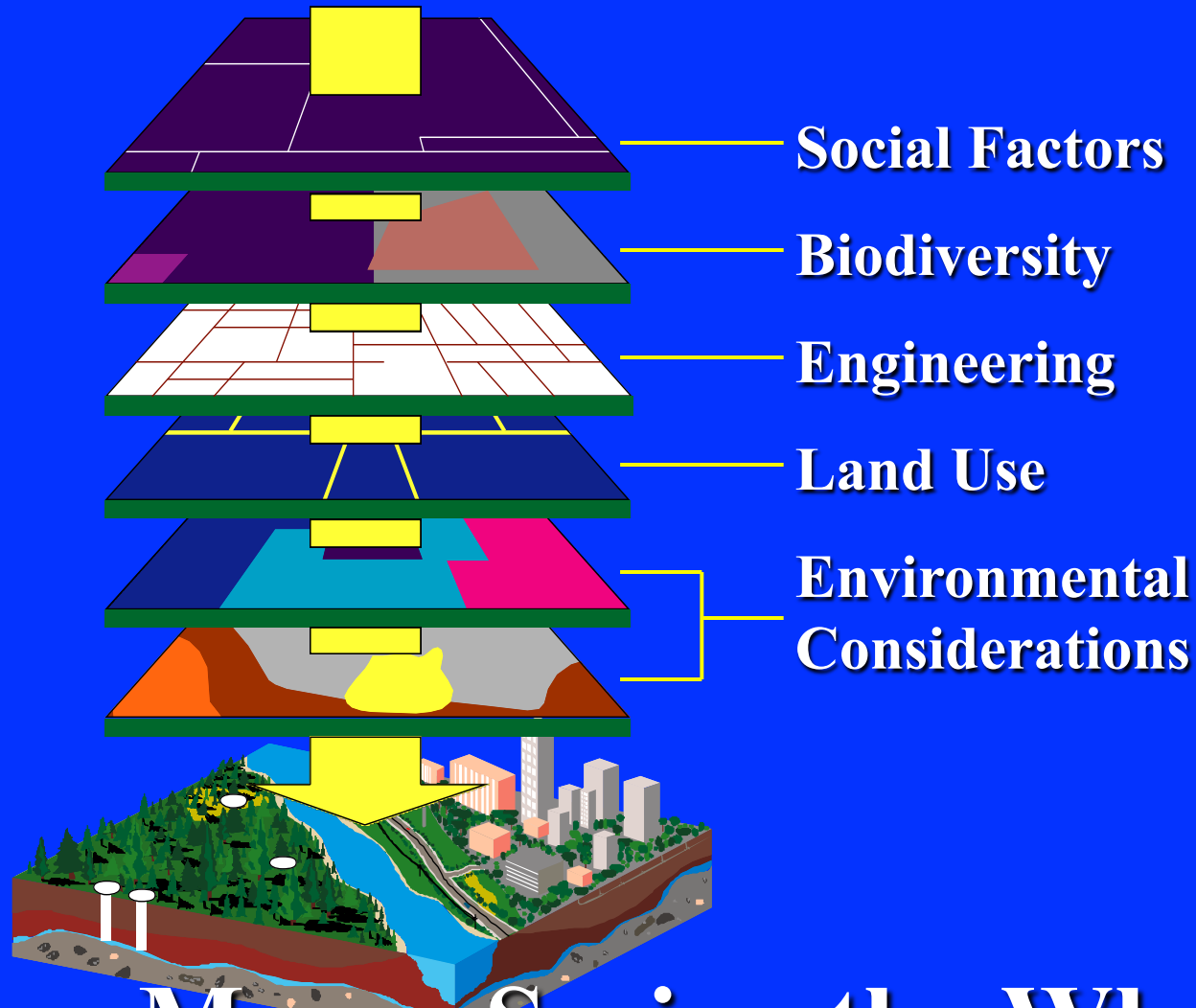
# The GIS sandwich

**Integration of Multilayer Data**

**Fusion Concept**



# Measuring and Integrating the Parts...



...Means Seeing the Whole