Introduction to ArcGIS

For

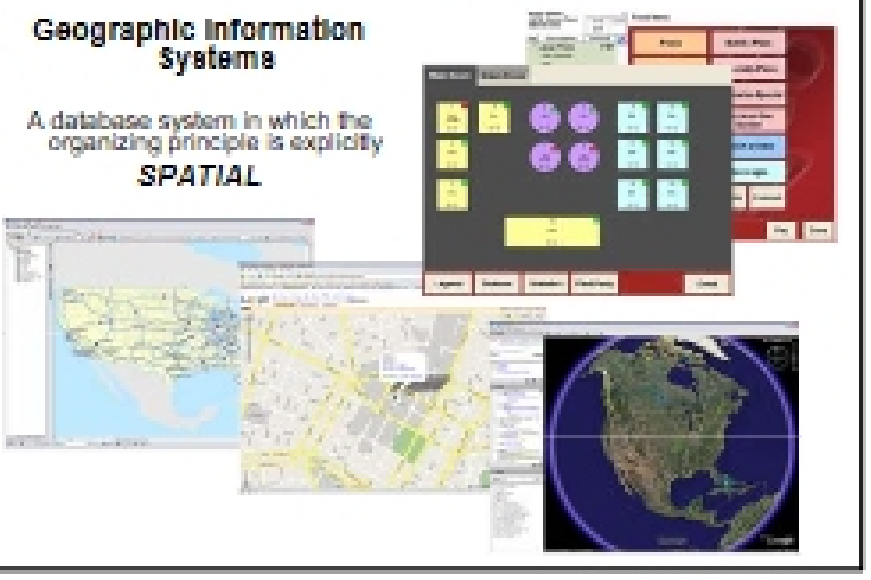
CPSC 178 Visualization: Data, Pixels, and Ideas.

What *is* GIS?

Geographic Information Systems

A database system in which the organizing principle is explicitly

SPATIAL



What Can You Do With GIS?

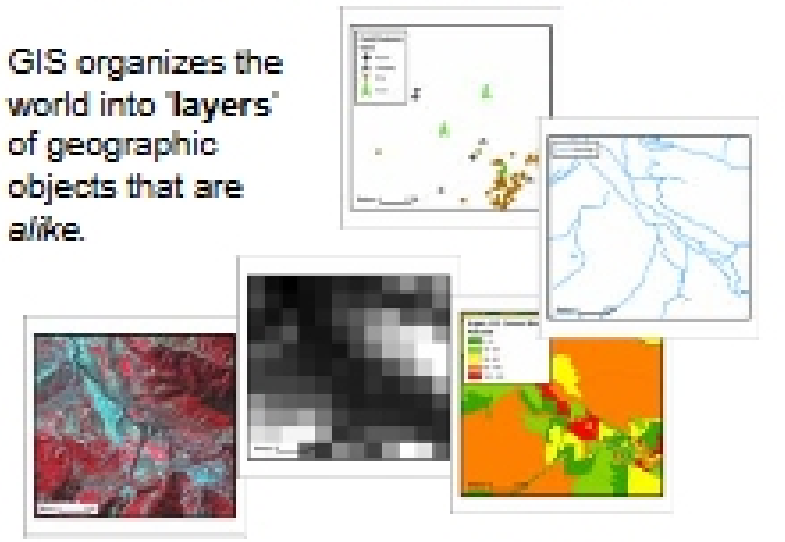
- With GIS, you can analyze

  EVERY POSSIBLE MAP!

- With the right data, you can examine…
  - Land
  - Elevation
  - Population density
  - Distance to public restrooms
  - Noise levels
- Anything you can associate with a location!

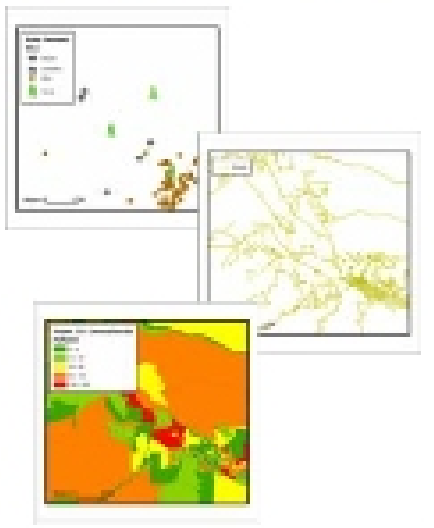
GIS Maps Contain ***Layers***

- GIS organizes the world into "layers" of geographic objects that are *alike*.

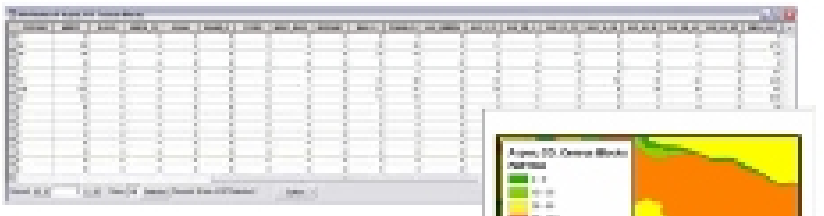


Layers Can Contain ***Features***

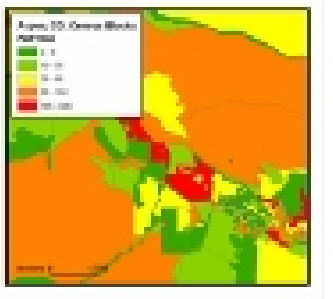
- **Features** are geographic objects that can have shape and dimension.
- Can be 'modeled' as **points, lines, or polygons**.
  - Mine Locations
  - Streets
  - Census Blocks
- This is referred to as the **Vector Data Model**



Features Can Have ***Attributes***

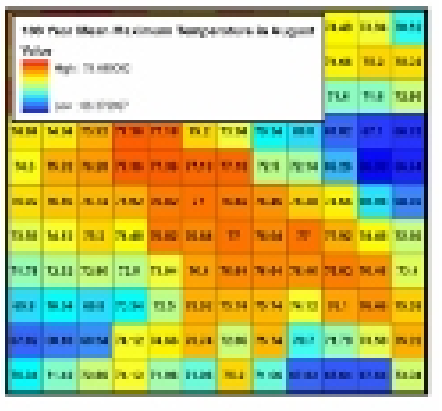


In this example, each Census Block feature is associated with dozens of **Demographic Attributes**



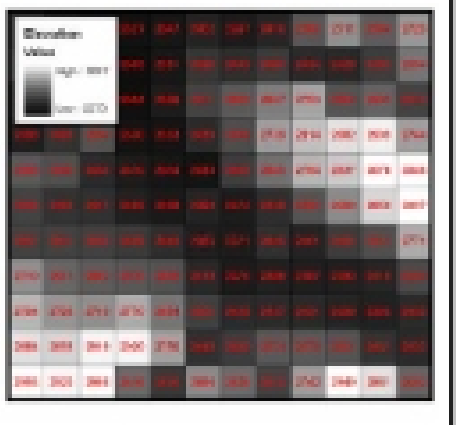
The Raster Data Model

- The Raster Data Model is used to model spatial phenomena that vary continuously over a **surface** and that do not have discrete dimension
  - Elevation
  - Temperature
  - Rainfall
  - Noise Levels



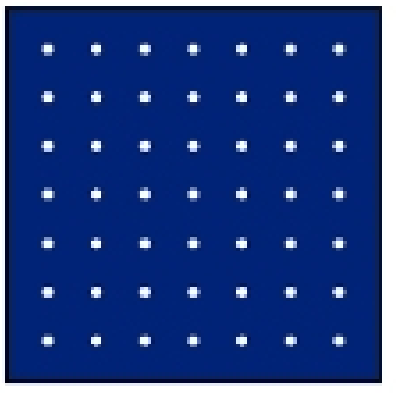
Surfaces Have ***Numeric Values***

- Things like elevation, temperature, slope and precipitation have measurable values for any particular location on the earth's surface.



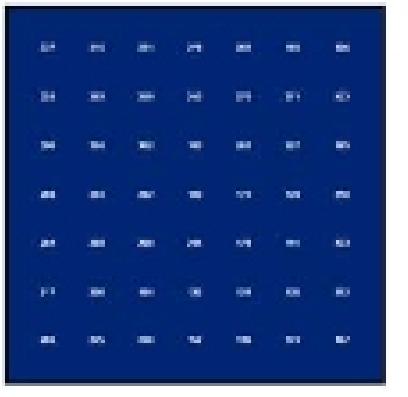
Surfaces Have ***Numeric Values***

- To model these phenomena, an area of interest is divided into an array of identically sized squares
- The centers of these squares then become the 'sample points'



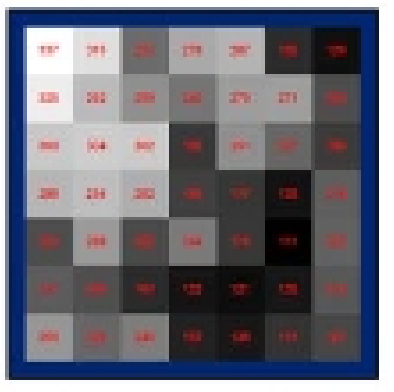
Surfaces Have ***Numeric Values***

- The values of the variable of interest are recorded, or estimated, at each of the sample points.



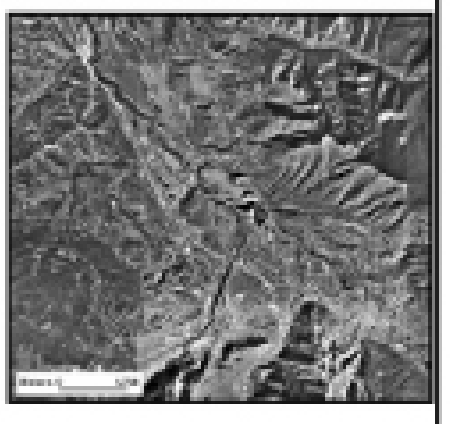
Surfaces Have ***Numeric Values***

- These values can then be assigned colors, or shades of gray, in order for them to be visualized

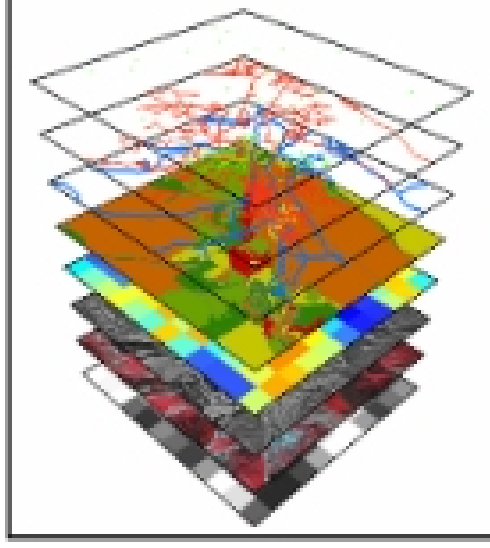


Digital Photos

- The most familiar type of Raster Data is the **digital photograph.**
- **Digital Photos** are raster datasets that record the relative amount of light being reflected off of a surface.



Putting It All Together – GIS Analysis

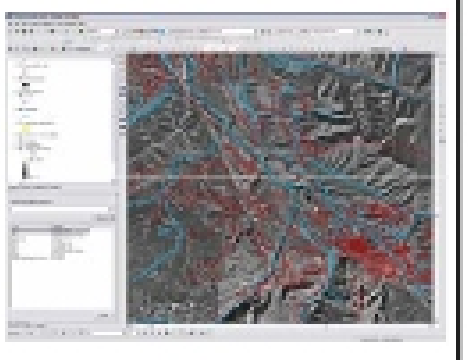


Because GIS Data is organized based upon location, *unlike* data can be 'overlaid' and analyzed based upon spatial relationships:

- Coincidence
- Proximity
- Containment
- Adjacency
- Intersection

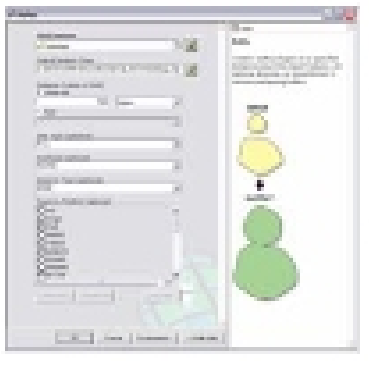
GIS Analysis – For Example…

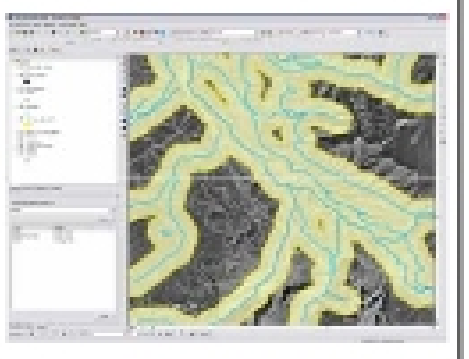
Suppose we are interested in the parts of streets that are within 500 meters of rivers & streams in a city…



GIS Analysis – For Example…

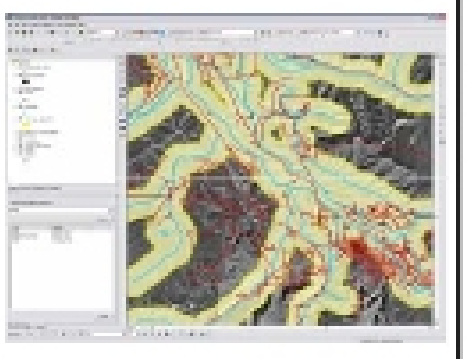
…using GIS Software, we can create a 500 meter 'buffer' around all rivers & streams in our area of interest…





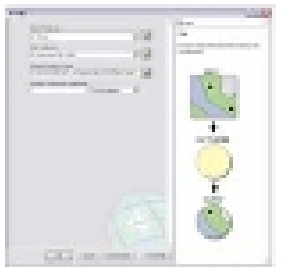
GIS Analysis – For Example…

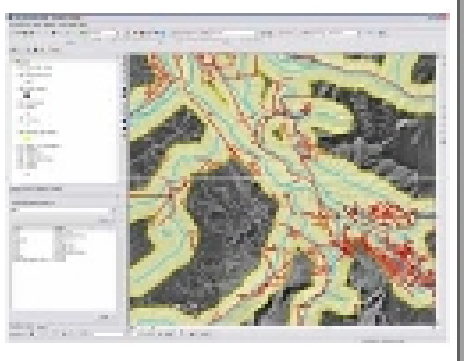
…then we can overlay our streets with this new 'buffer feature'



GIS Analysis – For Example…

…and finally, we can 'clip' the streets to extent of the buffer feature to end up with a layer that describes all streets within 500 meters of a river or stream!





GIS Analysis – For Example…

Or perhaps we would like to examine the statistical relationship between two variables.

For example, elevation and temperature…