• Assignment: HW#3 (ArcGIS and Spatial Analyst exercise)
• HW#1 due today
• HW#2 is due 2/2
• Topic today
  • Basics of GIS
    • Thanks to Dr. Olivera, CVEN Dept., for many of the slides
ArcGIS

- GIS = Geographical Information Systems
- Creating and using maps
- Compiling geographic data
- Analyzing mapped information
- GIS integrates, stores, analyzes, shares, and displays geographic information
- GIS is a tool for interactive queries and to edit data in maps
ArcGIS

- ArcGIS for Desktop (three levels)
  - Basic (used to be known as ArcView)
    - Used to view spatial data
    - Create layered maps
    - Perform basic spatial analysis
  - Standard (used to be known as ArcEditor)
    - Has advanced tools for manipulation of shapefiles and geodatabases
  - Advanced (used to be known as ArcInfo)
    - Developer software
GIS Basics

- Map format combined with table data ➔ digital spatial dataset
- All data must be in a common coordinate system
  - This is very important!
- Data sets can be:
  - Feature datasets ➔ vector format
  - Grid datasets ➔ raster format
  - Images ➔ digital orthographic quadrangles (DOQs)
Feature Data Sets (Vector Format)

- Geographic Objects represented as:
  - points / lines / polygons
  - these are called map features in vector format

- **Point** = a single x, y coordinate

- **Line** = a pair of x, y coordinates

- **Polygon** = set of x, y coordinates that mark the vertexes of the polygon
Feature Datasets (vector format)

*Point* - a pair of $x$ and $y$ coordinates $(x_1, y_1)$

*Line* - an open sequence of points

*Polygon* - a closed sequence of points
Feature Data Sets

ArcGIS for Desktop

- Advanced: used to generate many line segments for each state
- Basic: used to view as one polygon for each state
- Standard: used for analysis of map info
Associated with each feature is an attribute table

- This table contains info about the map feature
- Each column in the table is a different attribute
  - For example, a map of Texas with a set of points representing the location of PET stations
    - Each point would be located in a separate row
    - Each column could contain:
      - Latitude / longitude / name / pan evap values / etc.
Feature Datasets

Polygons

One-to-one relation between features in the map and records in the table.
Feature Datasets

### Lines

A one-to-one relation between features in the map and records in the table.
Feature Datasets

Points

One-to-one relation between features in the map and records in the table.
GIS Basics (cont.)

- **Query utility**
  - Allows calculations using the table data
- **Statistics utility also available**
- **True power of ArcGIS**
  - Links attribute tables to pts, lines, polygons
  - Ability to store info for each feature
Example of Stream Gauging stations

- Click on point representing a station
- Lots of data instantly available
- Not just a map
- Link is dynamic
  - Table can be updated

HW#2
Themes

- Link features (pts / lines / polygons) to attribute tables
- Contains a set of related features
  - Each theme has a common set of attributes
  - Such as all roads or all streams or all boundaries, etc
- Themes can be over-laid each other if the projections are the same
Feature Datasets

- Polygons

Themes

One-to-one relation between features in the map and records in the table.
Feature Datasets

- Lines

Themes

One-to-one relation between features in the map and records in the table.
Feature Datasets

- Points
- Themes

One-to-one relation between features in the map and records in the table.
GIS Database

- All of the themes for a geographic area can be overlaid
- Can be used to solve problems
  - The focus is on hydrology problems in this class
- Can add / delete themes in a database
- Can separate / combine themes
Grid Datasets

- Stored in raster format
  - Cell-based representation of map feature
    - Each cell has a value
      - A group of cells with the same value represents a feature
    - Images and grids are stored in raster format
      - Topographic maps
      - Land use maps
      - Soil maps
Grid Data Sets

- Based on square cells of equal size
  - Cells are in rows and columns
  - Each cell has 1 attribute value
    - Elevation / land use type / soil type / etc
  - Cell size is based on resolution of data

- Small scale (10 m) resolution
  - More data

- Large scale (300 m) resolution
  - Less data
Grid Datasets

- Cellular-based data structure composed of *square cells of equal size* arranged in rows and columns.
- The grid cell size and by extension the number of rows and columns, as well as the value at each cell have to be stored as part of the grid definition.
Raster Datasets

**Point**
In raster format ➔ 1 cell

**Line**
In raster format ➔ 5 cells

**Polygon**
In raster format ➔ 17 cells

Note: Better definition with smaller cell size
Grid Datasets

- Grid datasets

Each cell has a curve number (CN) value
Images

Images are very limited

- No attribute tables associated with them
  - Therefore, no information embedded
- Digital orthographic quadrangles (DOQs) are just “pictures” with no information attached to them

Useful as a backdrop for orientation
Models typically require raster format
- Continuous surface is mapped
  - elevation / soil type / land use
- Can convert feature themes (vector format) to grid themes (raster format) in ArcGIS
- Spatial Analyst is required
  - Spatial analyst is an ArcGIS “extension”
Saving ArcGIS Datasets

- Stored as shape files
  - 3 to 5 files with extensions of .shp / .dbf / .shx / .sbx / .sbn
  - The .dbf file contains the attribute tables
    - dbf = DataBase File
    - not a standard .dbf file
    - Do not open with Excel!
    - Must export table 1’st

- Don’t use blanks or special characters in file name or path ➔ very important!!!
Class Wrap-up

- Assignment: HW#3
- HW#2 is due Feb 2