GEOGRAPHIC INFORMATION SYSTEMS
Lecture 17: Geoprocessing and Spatial Analysis

Geoprocessing

Geoprocessing tools are commonly used tools that we normally use to prepare data for further analysis. In ArcMap, the most commonly used tools appear in the Geoprocessing pulldown menu. These tools can begin to give you an idea of the power of GIS and what types of spatial analysis are possible.

1) Buffer
   - the Buffer tool creates polygon buffers around point, line or polygon features using a specified distance. Typically the buffer is used to select features in other layers. Buffers are used to ask a spatial question of what features are within a certain distance of other features. This is a type of proximity analysis. Buffers help answer questions like: what pipelines are within 100 feet of oil wells. To answer this question you first buffer the oil wells by 100 feet, and then use the buffer to select the pipelines.

2) Clip
   - the Clip tool clips features (either points, lines or polygons) in one layer using the extent of a polygon in another layer. Clip is an important tool to help simplify data. Clip helps extract only the features needed within a study area to create a smaller, more manageable dataset.
   - note that we used this tool to clip the MergedContours layer using the StudyArea layer in the Caprock Canyons Project.

3) Dissolve
   - the Dissolve tool is used to aggregate (combine) features in a single layer based on common attribute values. Dissolve works on polygons and line features.

4) Intersect
   - the Intersect tool calculates a set of new features based on the overlap between two or more layers
   - the new output layer contains all of the features present only in the overlap of the input layers
   - the input features can be point, line or polygon, but the output will contain features with the lowest dimension (ex. intersect lines & polygons will output lines).

5) Union
   - the Union tool calculates a set of new polygons based on the combination of two or more layers
   - the new output layer contains all of the polygons present in the overlap of the input layers, plus the polygons that exist where there is no overlap
   - Union answers the most basic question in geography: What is on top of what? Ex. what vegetation is on top of what type of soils. So you can get an idea of vegetation productivity with different soil types.

6) Merge
   - the Merge tool is used to combine two or more layers that do not overlap into one layer
   - used to combine either two or more point layers, two or more line layers or two or more polygon layers
   - note that we used this tool to merge the two contour (hypsography) layers in the Caprock project

7) Select by Location
   - the Select by Location tool selects feature in one layer based on a spatial relationship to features in another layer. There can be several different types of spatial relationships between layers. These relationships include selecting features that are completely within, or selecting features that intersect, as well as other types of spatial relationship.

Spatial Analysis in GIS

- the basic types of analysis that can be accomplished with a GIS are outlined in The Esri Guide to GIS Analysis

To be continued next lecture….
What is Geoprocessing?

A GIS operation or process used to manipulate GIS data

- Geoprocessing is used to
  - Perform operations on data
  - Get results from those operations
  - Work with data and tools
  - Solve problems
  - Get answers by performing some type of spatial analysis
What is Geoprocessing?

A GIS operation or process used to manipulate GIS data

- Geoprocessing is used to

Geoprocessing

1) Buffer

the Buffer tool creates polygon buffers around point, line or polygon features using a specified distance
Geoprocessing

2) Clip
- the Clip tool extracts input features in one layer by using features in another layer. Input features can be points, lines or polygons.
- the clip features do not have to be a polygon! Can be points or lines

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Geoprocessing

3) Dissolve
Simplifies data by dissolving boundaries that have a common attribute

Geographic Information Systems
Geoprocessing

4) Intersect  Outputs only overlapping features between layers and outputs attributes from tables of both layers

- Output overlapping areas
- Output lines that overlap polygons
- Output overlapping points

Geoprocessing

5) Union  Outputs all areas from input layers and outputs all attributes from both layers

Geographic Information Systems
Geoprocessing

6) Merge

Combines datasets of the same type (points, lines, polygons) into a new one

Geoprocessing

7) Select by Location

Selects features in a layer based on a spatial relationship to features in another layer
**Geoprocessing**

7) **Select by Location**

Selects features in a layer based on a spatial relationship to features in another layer.

- **Select Interstates that are completely within Texas**
- **Select Interstates that Intersect Texas**

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**Spatial Analysis in GIS**

For more information: Esri Guide to GIS Analysis

- Volume 1: Analyzing Geographic Patterns and Relationships
- Volume 2: Spatial Measurements and Statistics

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