LECTURE 5-A

SPATIAL ANALYSIS AND GEOPROCESSING

CEEN 4800/6965 - Special Topics
Geographic Information Systems and Hydrologic & Hydraulic Modeling
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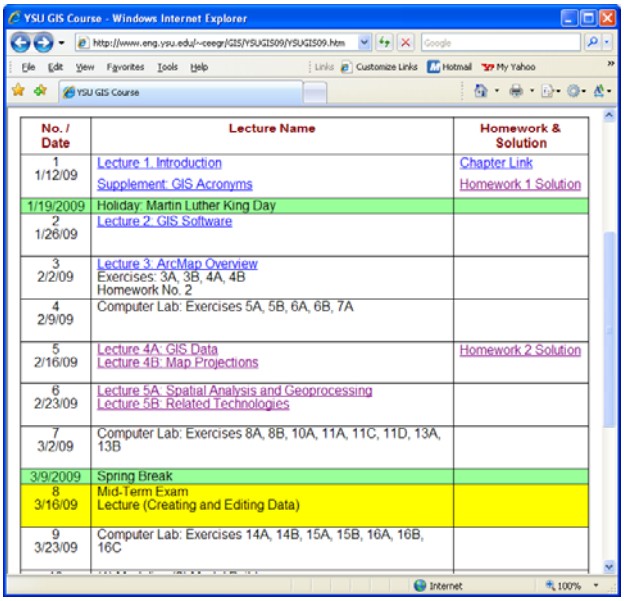
1

CURRENT SCHEDULE



No. / Date	Lecture Name	Homework & Solution
1 1/12/09	Lecture 1: Introduction Supplement: GIS Acronyms	Chapter Link Homework 1 Solution
1/19/2009	Holiday: Martin Luther King Day	
2 1/26/09	Lecture 2: GIS Software	
3 2/2/09	Lecture 3: ArcMap Overview Exercises: 3A, 3B, 4A, 4B Homework No. 2	
4 2/9/09	Computer Lab: Exercises 5A, 5B, 6A, 6B, 7A	
5 2/16/09	Lecture 4A: GIS Data Lecture 4B: Map Projections	Homework 2 Solution
6 2/23/09	Lecture 5A: Spatial Analysis and Geoprocessing Lecture 5B: Related Technologies	
7 3/2/09	Computer Lab: Exercises 8A, 8B, 10A, 11A, 11C, 11D, 13A, 13B	
3/9/2009	Spring Break	
8 3/16/09	Mid-Term Exam Lecture (Creating and Editing Data)	
9 3/23/09	Computer Lab: Exercises 14A, 14B, 15A, 15B, 16A, 16B, 16C	

2

MID TERM EXAM

- Date: 3/16/09
- Duration: 1 hour
- Will start after Lecture 6 (Creating and Editing Data)
- Content: All lectures and exercises covered up to the previous class (2/23/09)
- Type: Open book (you can use your book, handouts, notes, and computer)
- Format: 30 multiple choice questions
  - 2 minutes / question
  - Not enough time to search the answers; you should study and know where the answers are

3

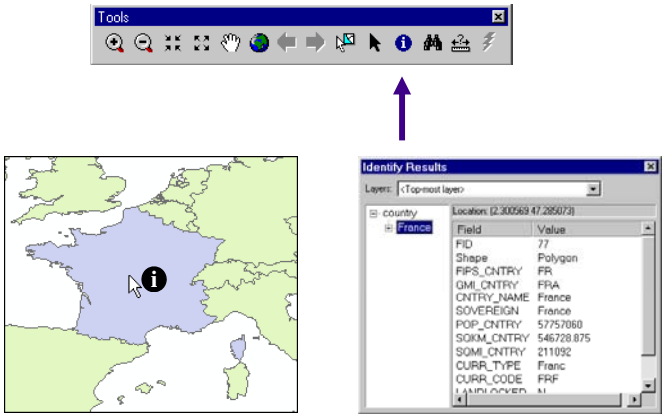
OUTLINE

- Section 4: Getting Information About Features
  - Chapter 8: Querying Data
    - Identify, Find, Measure, MapTips, hyperlinks
    - Selection methods and layers
    - Selecting features by attributes
    - Lab work
      - Exercise 8a: Identifying, selecting, finding, and hyperlinking features.
      - Exercise 8b: Selecting features by attributes
- Section 5: Analyzing Feature Relationships
  - Chapter 10: Analyzing Feature Relationships
    - Spatial selection
    - Calculating summary statistics
    - Lab work
      - Exercise 10a: Using location queries

5

IDENTIFYING

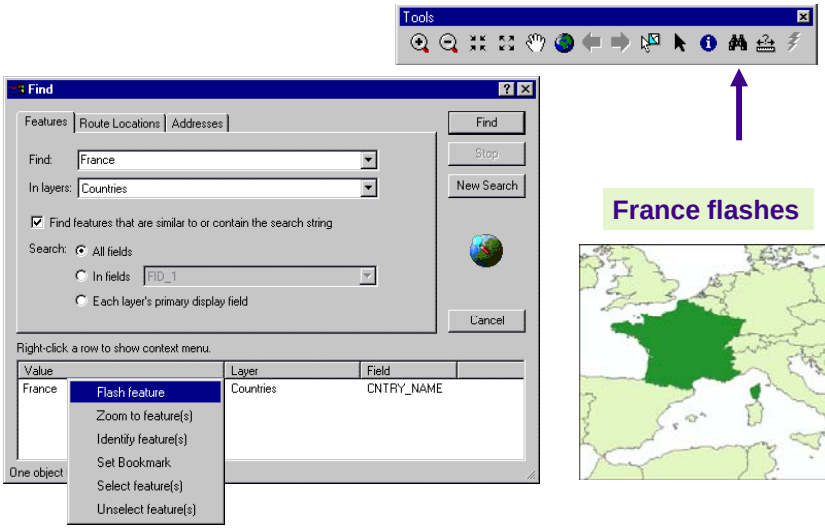
- Popup attributes for a specific feature



6

FINDING

- Locate a specific feature or attribute

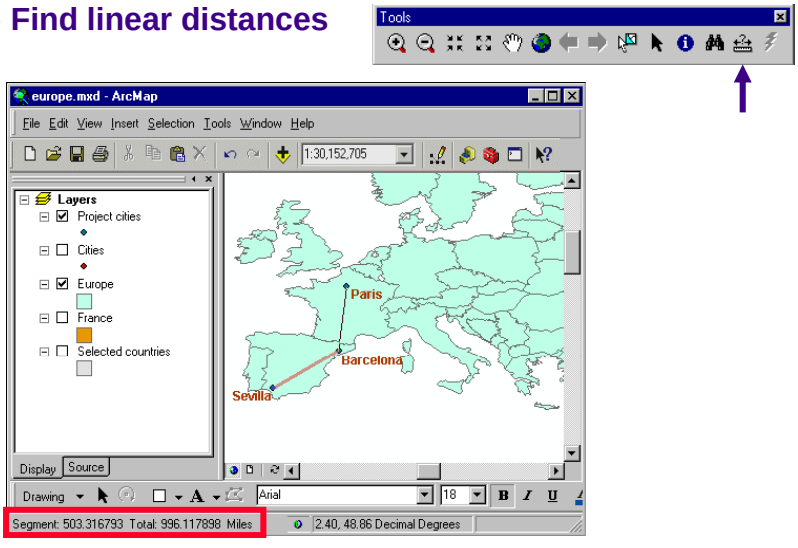


France flashes

7

MEASURING

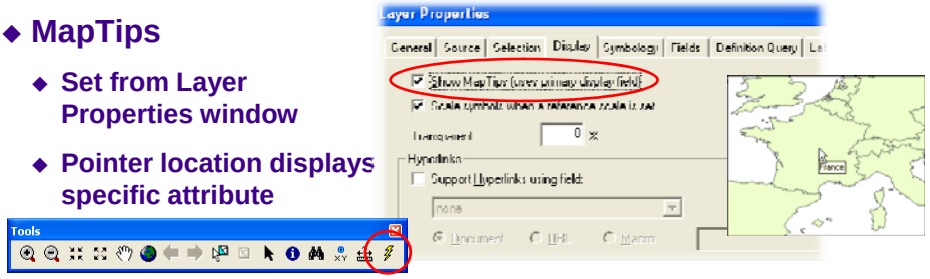
- Find linear distances



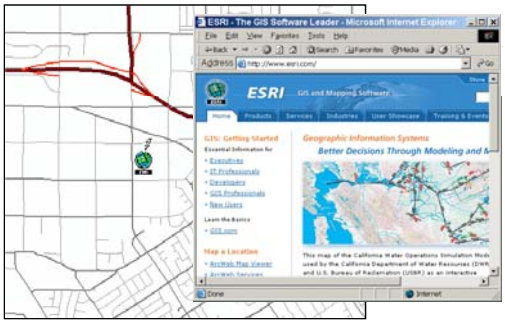
8

MAPTIPS AND HYPERLINKS

- MapTips
  - Set from Layer Properties window
  - Pointer location displays specific attribute



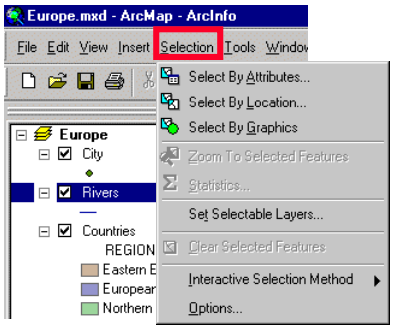
- Hyperlinks
  - Document
  - URL
  - Macro
  - Multiple links per feature

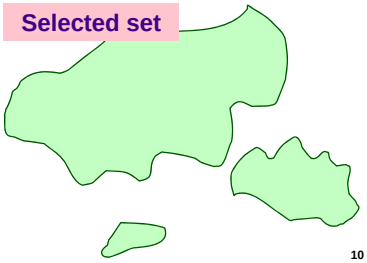


9

AVAILABLE SELECTION TOOLS

- Four selection methods:
  - Interactive (click on a feature or drag a box on the screen to select multiple features)
  - Attributes
  - Location
  - Graphics

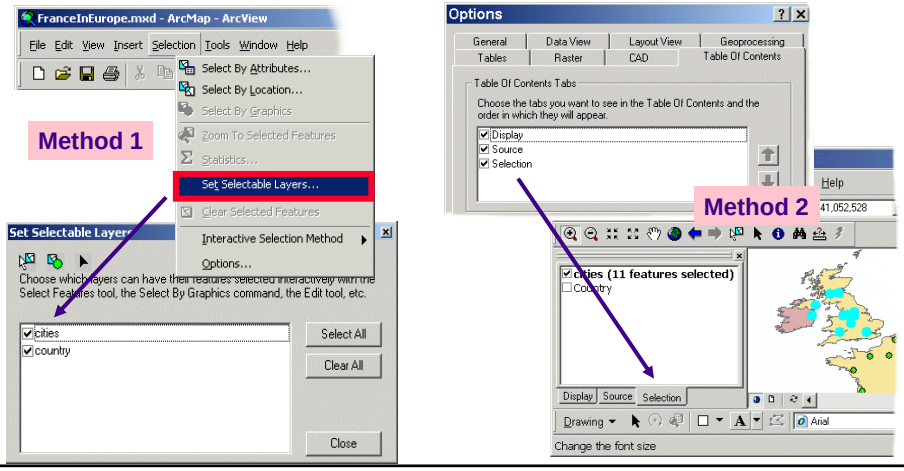




10

SELECTION LAYERS

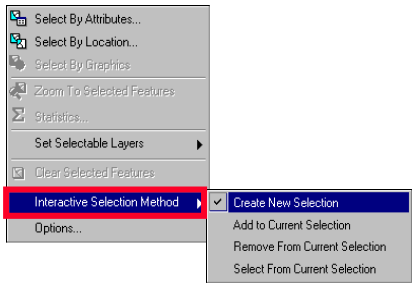
- Method 1: Specify from Selection menu or
- Method 2: Add tab to TOC
- Layers available when using interactive selection tool



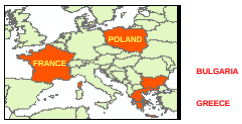
11

FOUR INTERACTIVE SELECTION METHODS

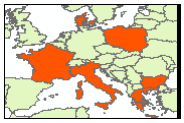
- Specify from Selection menu



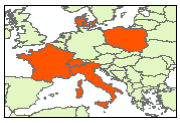
Create new selection (France, Poland, Bulgaria, Greece)



Add to the selection (Italy)



Remove from the selection (Bulgaria, Greece)

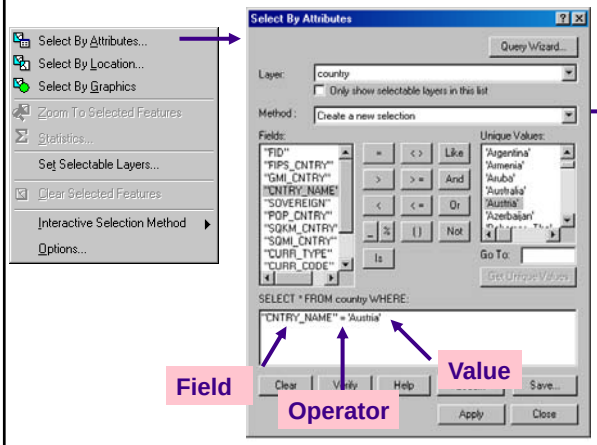


Select from selection (France)

12

SELECTING FEATURES BY ATTRIBUTES

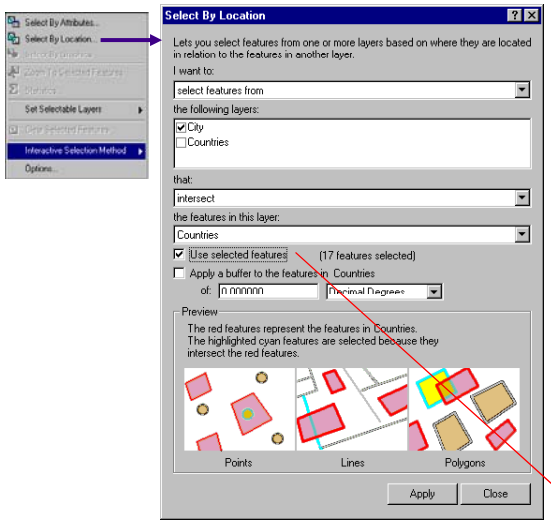
- Use a SQL (Structured Query Language) query to select features
- Save and reload selection expressions

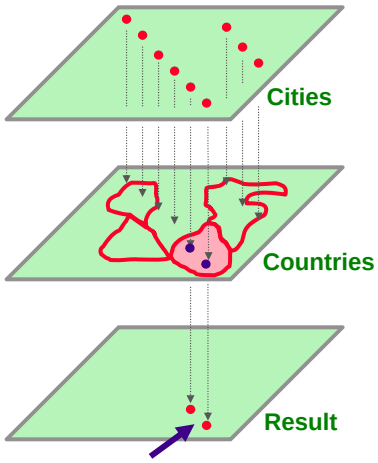


For current selection:
- **Add to**
- **Remove from**
- **Select from**

SELECT BY LOCATION (SPATIAL QUERY)

- Use features in one layer to select features in another
- Power of GIS !!!!



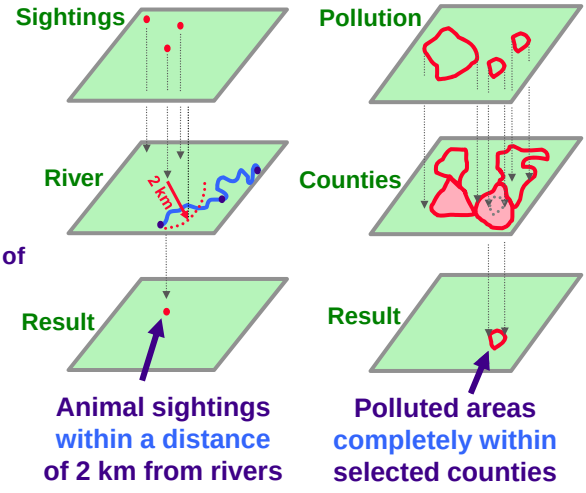


Cities intersected by selected countries

LOCATION SELECTION METHODS

Select by location offers 11 selection methods

1. Intersect
2. Are within a distance of
3. Completely contain
4. Are completely within
5. Have their centers in
6. Share a line segment with
7. Touch the boundary of
8. Are identical to
9. Are crossed by the outline of
10. Contain
11. Are contained by



Animal sightings within a distance of 2 km from rivers

Polluted areas completely within selected counties

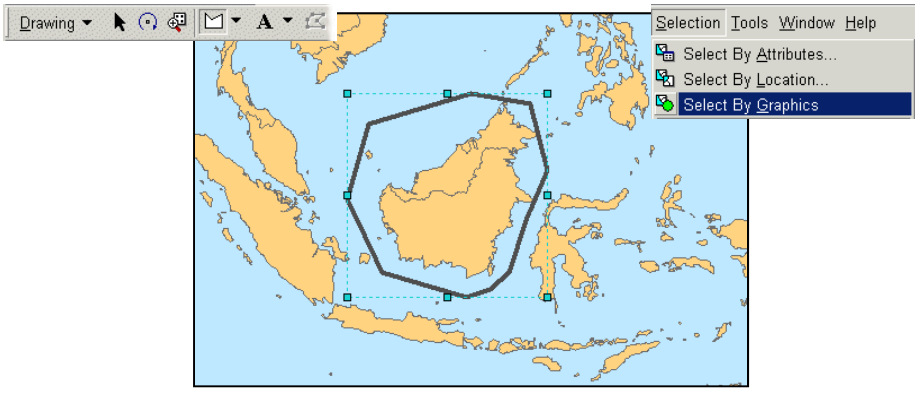
15

SELECT BY GRAPHICS

- Draw a graphic to select features
- Works with interactive selection methods

1) Draw graphic

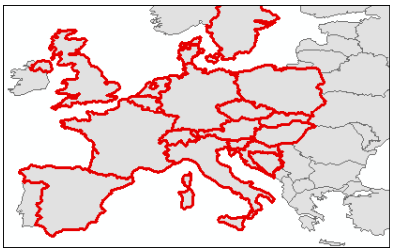
2) Select Method

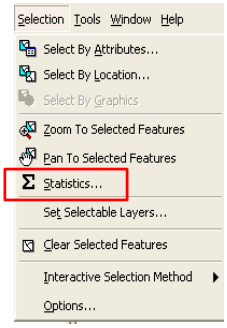


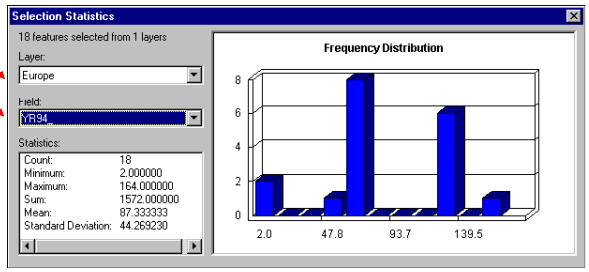
16

CALCULATING SUMMARY STATISTICS

- Choose Statistics from Selection menu
- Select
  - Features
  - Layer
  - Field







17

LAB EXERCISES

- **Exercise 8a:** Identifying, selecting, finding, and hyperlinking features
- **Exercise 8b:** Selecting features by attributes
- **Exercise 10a:** Using location queries

18

OUTLINE

- Section 5: Analyzing Feature Relationships
  - Chapter 11: Preparing Data for Analysis
    - Geoprocessing in ArcToolbox
    - Lab work
      - Exercise 11a: Dissolving features
      - Exercise 11c: Clipping layers
      - Exercise 11d: Exporting data
  - Chapter 12: Analyzing Spatial Data
    - Buffering, overlaying, Calculating attribute values
    - Lab work
      - Exercise 12a: Buffering features
      - Exercise 12b: Overlaying data
      - Exercise 12c: Calculating attribute values

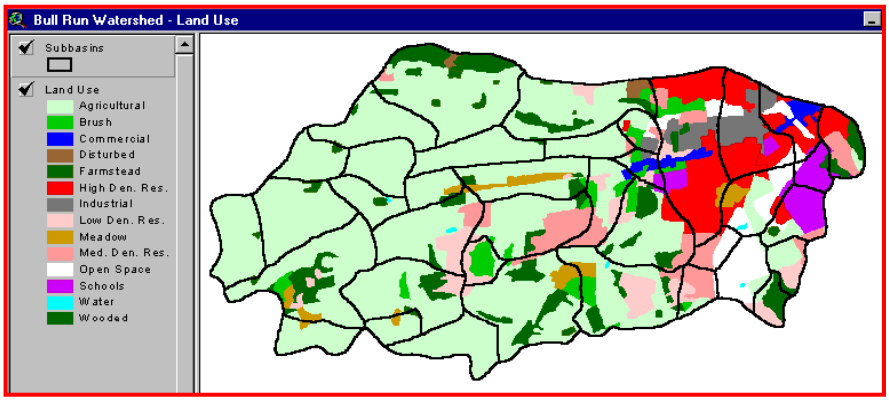
20

GEOPROCESSING

- Geoprocessing = spatial analysis
  - What's the population of a given sewershed?
    - Overlay of sewershed and census block layers
  - What's the runoff curve number of a given watershed?
    - Overlay of watershed, land use, and soil layers

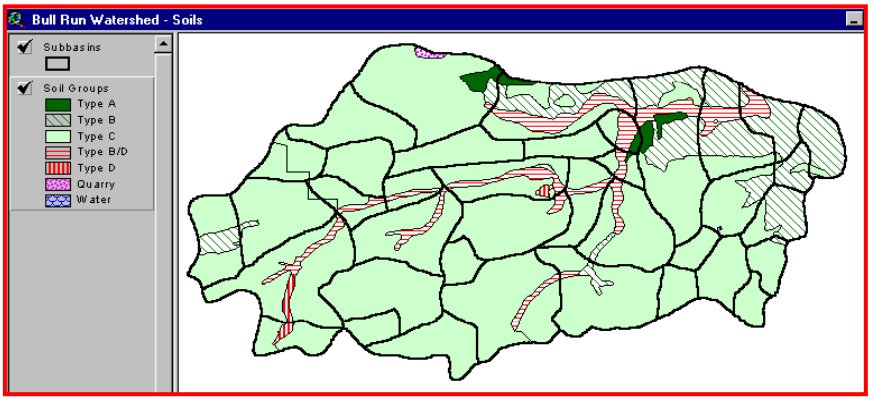
21

OVERLAY LAND USE AND SUBBASIN LAYERS



22

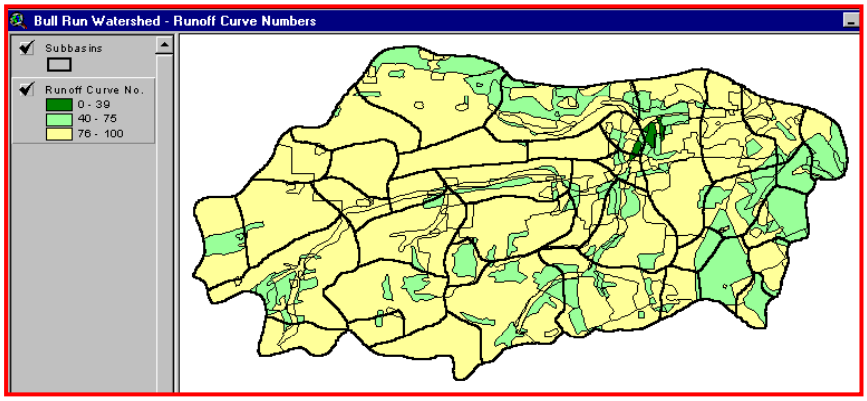
WITH SCS HYDROLOGIC SOILS GROUP LAYER



HSG attributes can be obtained from NRCS SSURGO data

23

TO ESTIMATE RUNOFF CURVE NUMBERS



subbasins + land use + HSG = RCN

Rows from NRCS runoff curve number table

Land Use	% Imp.	Runoff Curve Number for Hydrologic Soil			
		A	B	C	D
High density residential	51	69	80	87	90
Medium density residential	28	56	71	81	86
Low density residential	16	49	66	78	83

GEOPROCESSING TOOLS IN ARCTOOL BOX

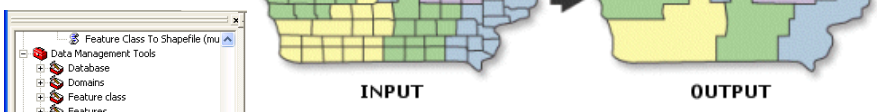
- Dissolve
- Merge
- Clip
- Buffers
- Union
- Intersect

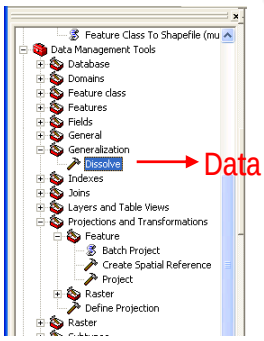
} OVERLAY OPERATIONS

25

DISSOLVE

- This tool combines like features based on a specified attribute or attributes.



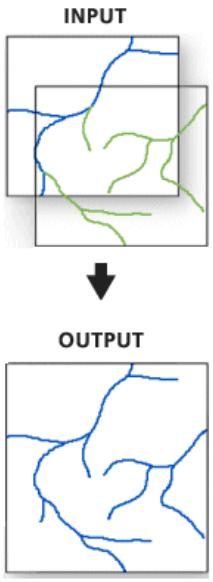


Data Management Tools> Generalization > Dissolve

26

MERGE

- Combines input features from multiple input sources (of the same data type) into a single, new, output feature class.
- The input data sources may be point, line, or polygon feature classes or tables.



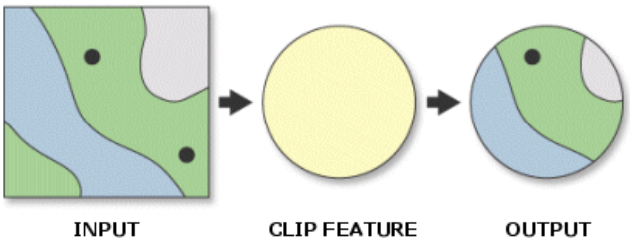
Data Management Tools> General > Merge

27

CLIP

- This tool uses a polygon boundary to cut features and their attributes from a feature class.

Works like a cookie cutter.

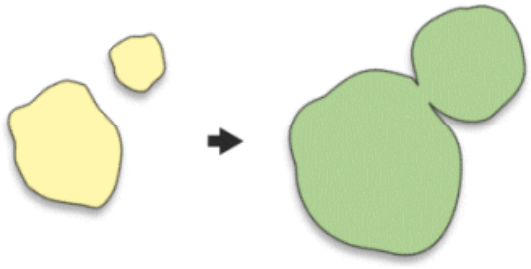


Analysis Tools> Extract > Clip

28

BUFFER

- A Buffer is an area drawn at a uniform distance around a feature.
- The Buffer tool creates a new feature class of buffer polygons around either polygon, line, or point features.

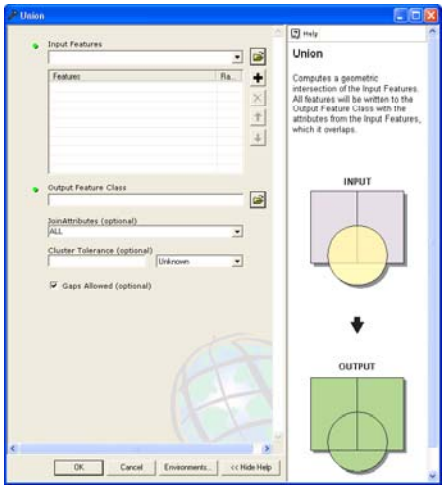


Analysis Tools> Proximity > Buffer

29

UNION

- Computes a geometric intersection of the Input Features. All features will be written to the Output Feature Class with the attributes from the Input Features, which it overlaps.

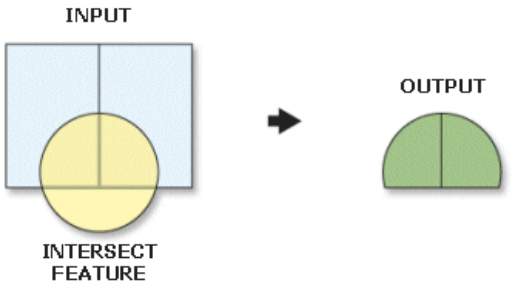


Analysis Tools> Overlay > Union

30

INTERSECT

- **This tool builds a new feature class from the intersecting features common in both feature classes. It retains the attributes of both feature classes.**

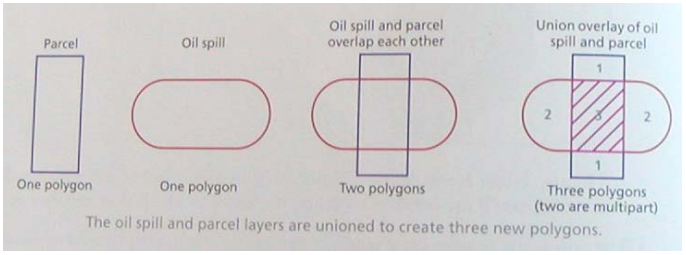


Analysis Tools> Overlay > Intersect

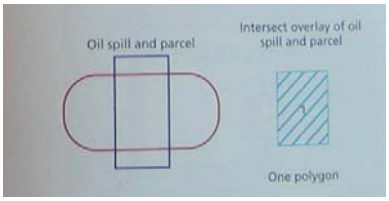
31

UNION VS. INTERSECT

- **Union: Output data set includes non-overlapping areas.**



- **Intersect: Output data set includes only overlapping areas.**



32

LAB EXERCISES

- **Exercise 11a:** Dissolving features
- **Exercise 11c:** Clipping layers
- **Exercise 11d:** Exporting data

33

HOMEWORK 3: SPATIAL ANALYSIS

- **Exercise 12a:** Buffering features
- **Exercise 12b:** Overlaying data
- **Exercise 12c:** Calculating attribute values
  - Repeat Exercise 12c with revised data
  - Calculate attribute values using field calculator
  - Submit updated results
- See next slide for details

34

HOMEWORK 3: SPATIAL ANALYSIS

- Complete Exercise 12a (Buffering features). Submit a screenshot or map shown on page 324
- Complete Exercise 12b (Overlaying data). Submit a screenshot or map shown on page 335
- Complete Exercise 12c (Calculating attribute values) and answer the following questions.

Question 1. Before completing Step 7: For harvestable area polygon with Object ID = 5, provide the following data:
Stand Value =
Value Per Meter =
Stand ID =

Question 2. After completing Step 9: For harvestable area polygon with Object ID = 8, provide the following data:
Stand Value =
Value Per Meter =
Stand ID =

Question 3. After completing Step 10: Suppose you underestimated stand unit cost (ValuePerMeter) by 10% in your calculations and would like to repeat your calculations to recalculate the correct bid price. To recalculate the bid price, repeat steps 7 to 10 but modify the expression entered in field calculator (Page 339) to increase the ValuePerMeter by 10% (i.e. multiply it by 1.1). Provide a screenshot of the revised Statistics window and answer the following question:
The original bid price =
The corrected bid price =
Percent difference in the original and corrected bid price =

35