

Spatial Analysis

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Spatial Analysis

- Scope of GIS analysis varies greatly among different GIS users
- Most GIS programs include “generic” analysis and add additional specialist capabilities by plug-ins, e.g.
 - ArcGIS: Spatial Analyst, Business Analyst, Tracking Analyst (for real-time data)
 - QGIS: fTOOLS
- Spatial Analysis for Vector and Raster Data: partly similar, but also significant differences

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Simple spatial analysis

- Measuring (straight-line) distance
- Measuring area
- Query data(base)
 - Two ways: geographical feature → attribute data and attribute data → geographical feature

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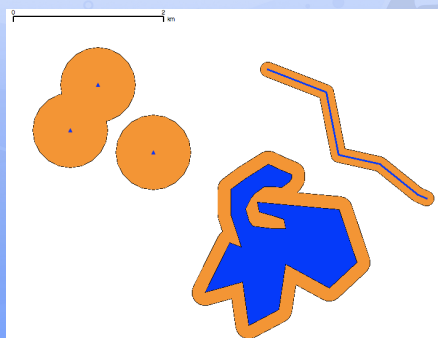
Elementary Vector Data Analysis

- Buffering
- Map overlay
 - union
 - intersect
 - identity
- Map manipulation
 - dissolve
 - merge
 - clip
 - select
 - eliminate
 - update
 - split

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Buffering

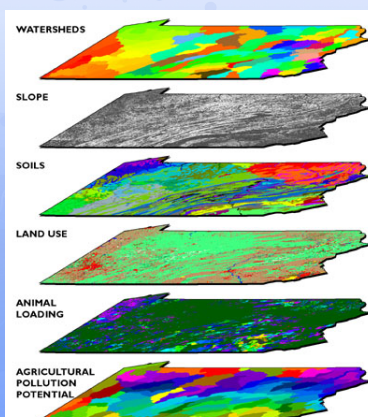
- Create buffer at specific distance from feature
- Buffer around points, lines and polygons
- Overlapping buffers can be merged



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Map Overlay (1)

- Essence of GIS is to overlay different layers of spatial information



Can be done with
raster and vector
data

Source: <https://www.e-education.psu.edu/natureofgeoinfo/>

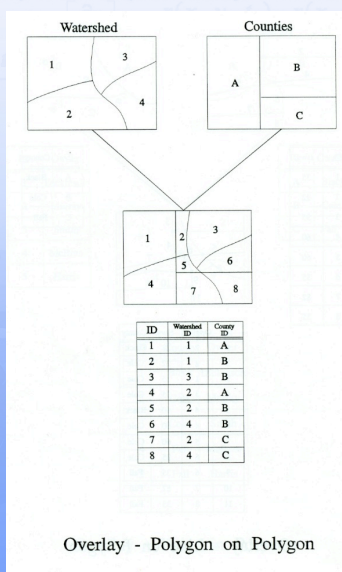
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Map Overlay (2)

- Map overlay combines geometries and attributes of two datasets in a new layer
- Layer can only contain one type of feature (point, line polygon), so three groups of operations can be distinguished:
 1. point-in-polygon
 2. line-in-polygon
 3. polygon-on-polygon

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Map Overlay (3)



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Map Overlay (4)

- Maps with different extent → three different methods:
 1. Union: keeps all areas of the input and overlay maps (Boolean [input map] OR [overlay map])
 2. Intersect: keeps the area common to the input and overlay map (Boolean [input map] AND [overlay map])
 3. Identity: keeps the area common to the input map (Boolean [input map] AND [overlay map] OR [input map]).

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Map Overlay (5)

1
2

input

A	B
---	---

overlay

1	1A	1B	1
2	2A	2B	2

identity

	A	B	
1	1A	1B	1
2	2A	2B	2
	A	B	

union

1A	1B
2A	2B

intersect

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Applications of map overlay

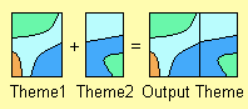
- Creation of map with vegetation types within 200 meter of a river
- Determination of possible sources of pollution for groundwater
- Allocation of groundwater wells to districts

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Map manipulations (1)

About Merge

This operation appends the features of two or more themes into a single theme. Attributes will be retained if they have the same name.

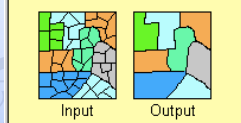


Theme1 Theme2 Output Theme

Dissolve: simplifying maps →

About Dissolve

This operation aggregates features that have the same value for an attribute that you specify.



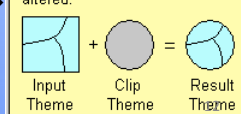
Input Output

← Merge: appending maps

Clip: selecting part of a map →

About Clip

This operation uses a clip theme like a cookie cutter on your input theme. The input theme's attributes are not altered.



Input Theme Clip Theme Result Theme

(Images from ArcView 3.2 help)

Map manipulations (2)

- Select: creating a new map with only the selected features
- Eliminate: removing selected features from a map
- Update: copy & paste
- Split: divide input map in two or more maps
- etc.

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Advanced Spatial Analysis

- Spatial interpolation
Going from point measurements to a surface (e.g. groundwater table) → many methods have been developed (simple, IDW, Kriging, etc.)
- Spatial regression analysis
- Spatial autocorrelation
- Optimisation (networks)
- Etc.

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