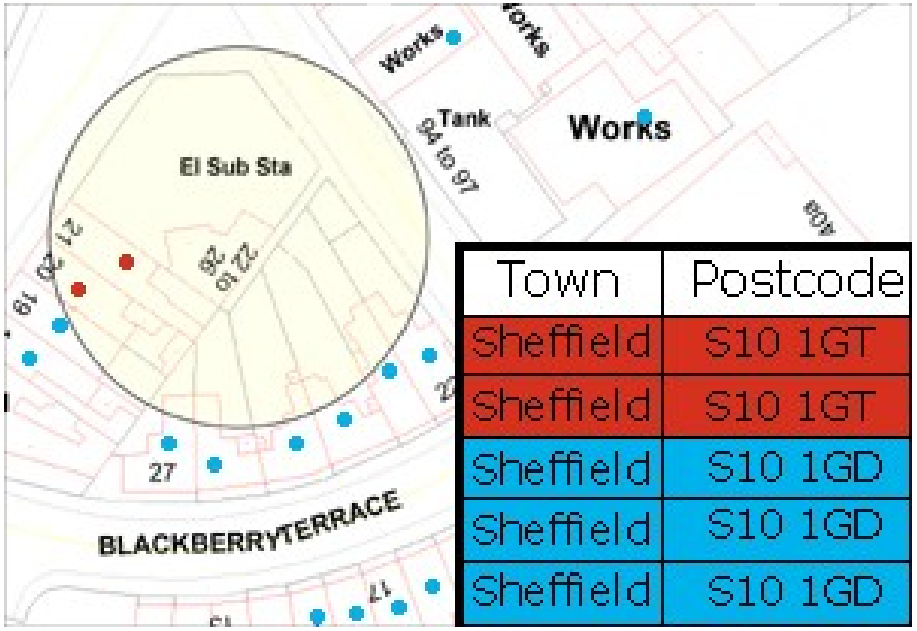
GIS Analýza

1. Vyvolání/klasifikace/měření
2. Překryt (koincidence)
3. Sousednost
4. Napojenost

1. Průzkum

- Vyvolání
  - Selekce dotazováním
- Klasifikace
  - seskupení
  - vzory
- Měření
  - Délky, plochy, vzdálenosti, hustoty

Retrieval: Selective Search

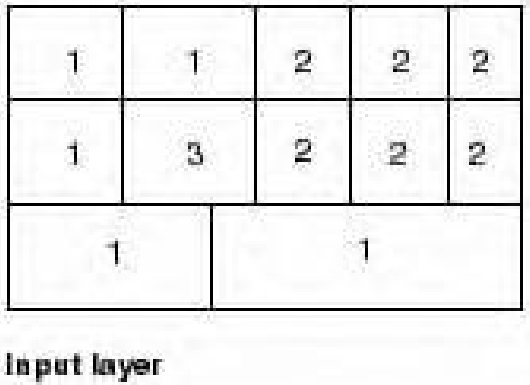


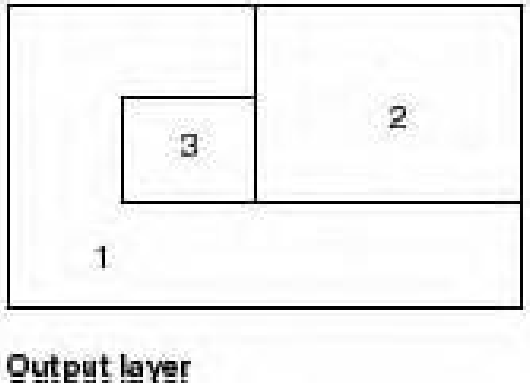
Town	Postcode
Sheffield	S10 1GT
Sheffield	S10 1GT
Sheffield	S10 1GD
Sheffield	S10 1GD
Sheffield	S10 1GD

addresses selected because they fall within circle

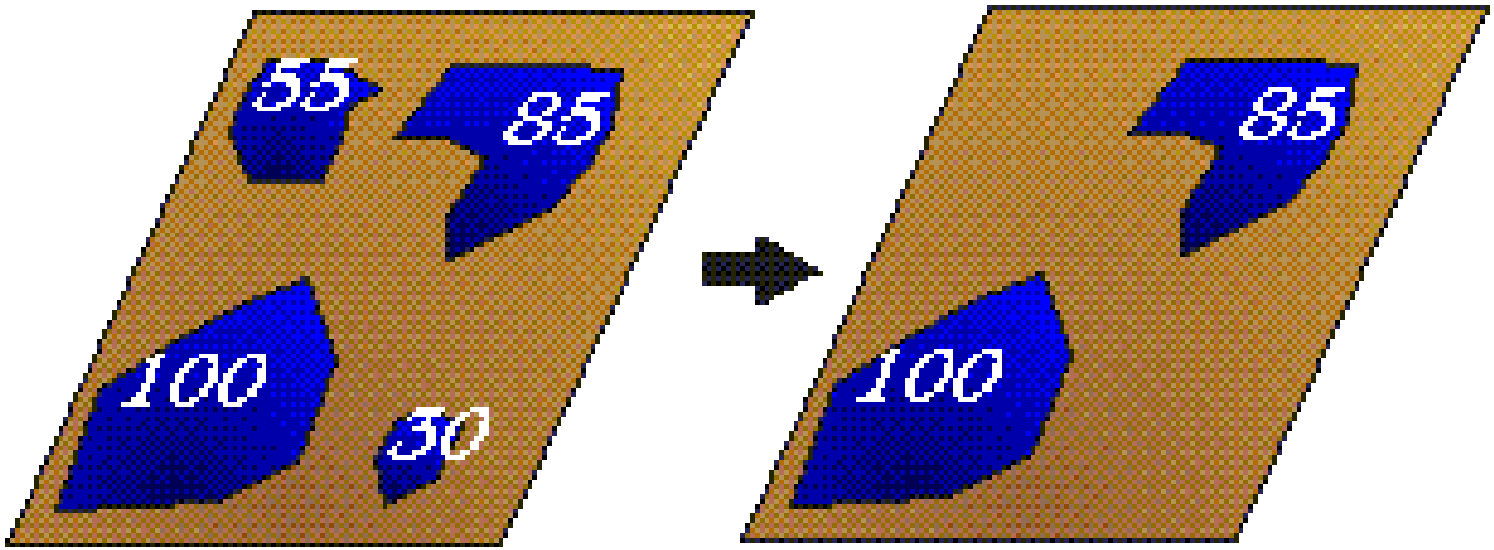
Reclassification (Vector)

Dissolving to aggregate polygons



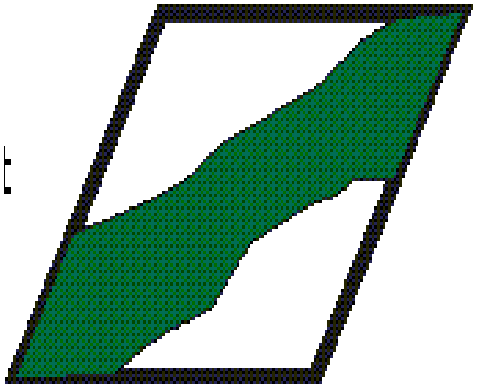


Reclassify by Area Size

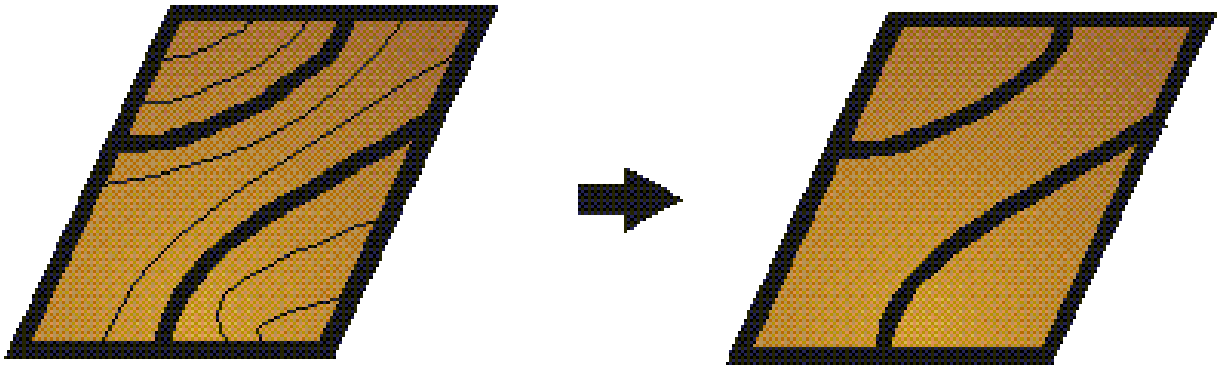


Work with areas > 80 acres

Reclassify values



Work with elevations between 20 and 40 feet



Change feet to meters

Vector Distance Operation: Buffers & Setbacks

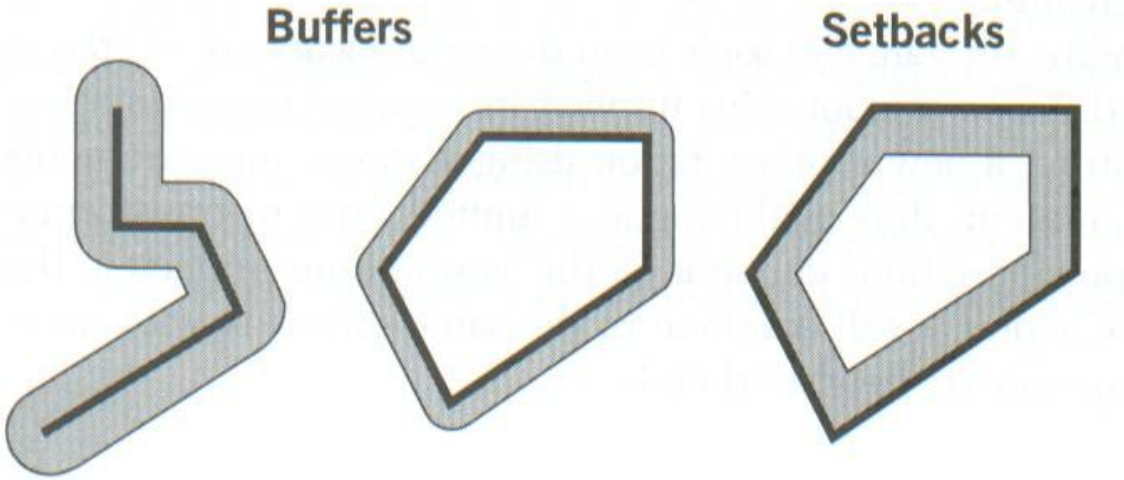


Diagram of simple buffers and a setback.
NOTE: buffers go outward from lines or areas; setbacks run inside of areas (not lines).

Image Source: Chrisman, Nicholas.(2002). 2nd Ed. *Exploring Geographic Information Systems*. p 154. fig. 6-1.

Buffer Creation: Illustrated

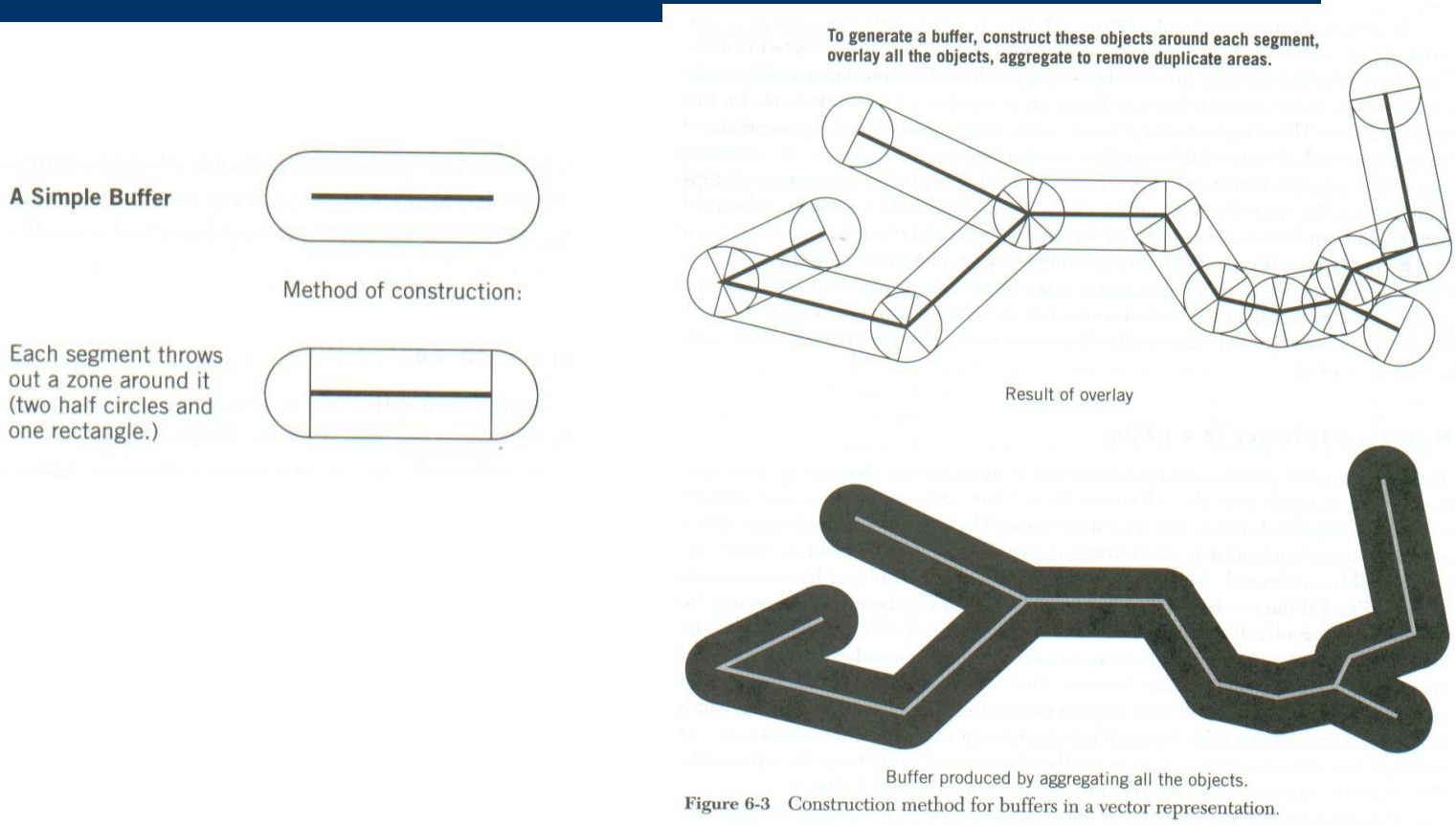


Figure 6-3 Construction method for buffers in a vector representation.

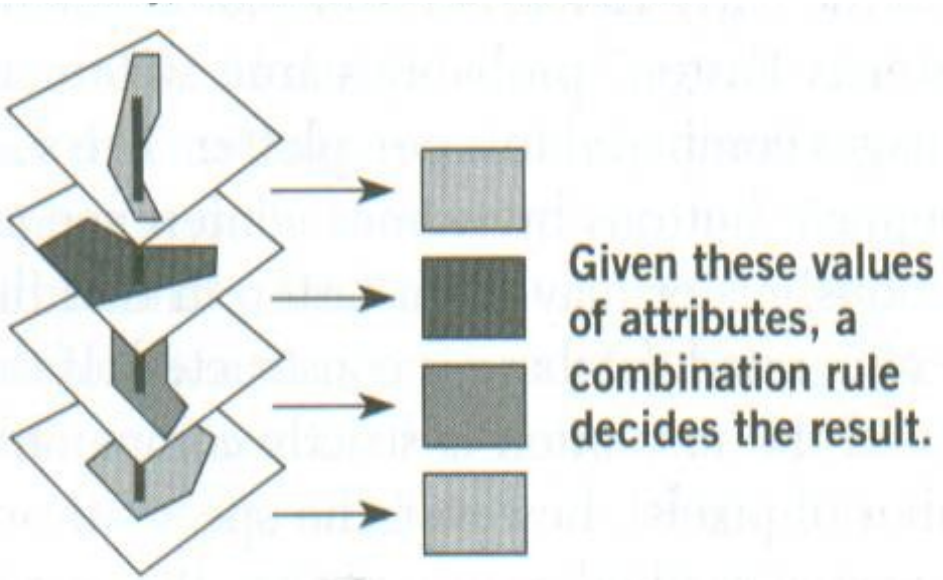
Image Source: Chrisman, Nicholas.(2002). 2nd Ed. *Exploring Geographic Information Systems*. p 60. fig. 6-3.

2. Overlay Functions

- Aritmetické
  - + - * / sin() etc.
- Logické
  - and, or, >, <, etc.
- Grid vs. Vektor
  - Vektor zachová více informací
  - Grid je jednodušší a flexibilnější

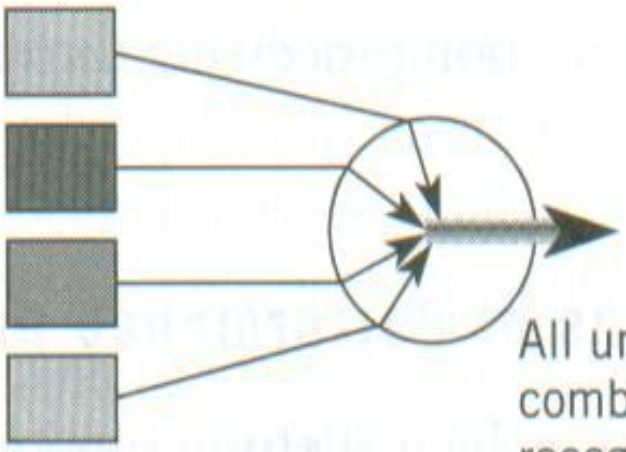
Overlay: Combining Attributes

Select attributes of interest for a given location

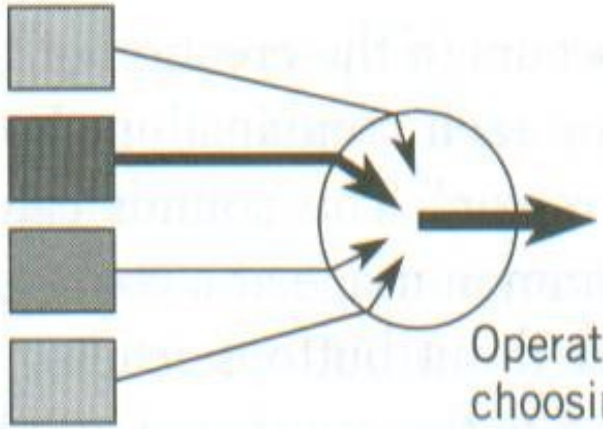


(Raster & vector methods do this differently, but the results are similar)

Overlay: 4 Basic Rules



All unique combinations recognized

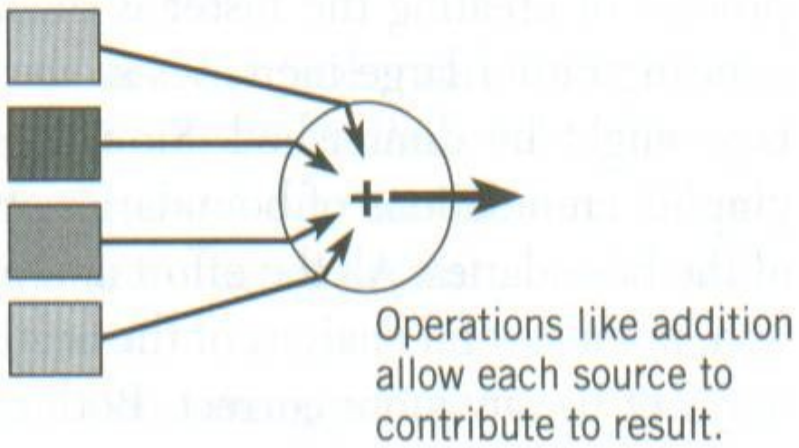


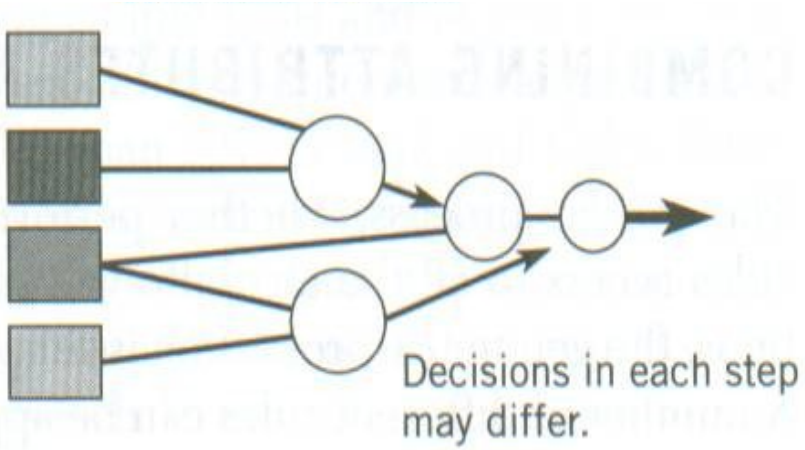
Operation consists of choosing one value. Examples: maximum; highest bidder.

#1 Enumeration Rule: Each Attribute preserved in output

#2 Dominance Rule: One value wins

Overlay: 4 Basic Rules





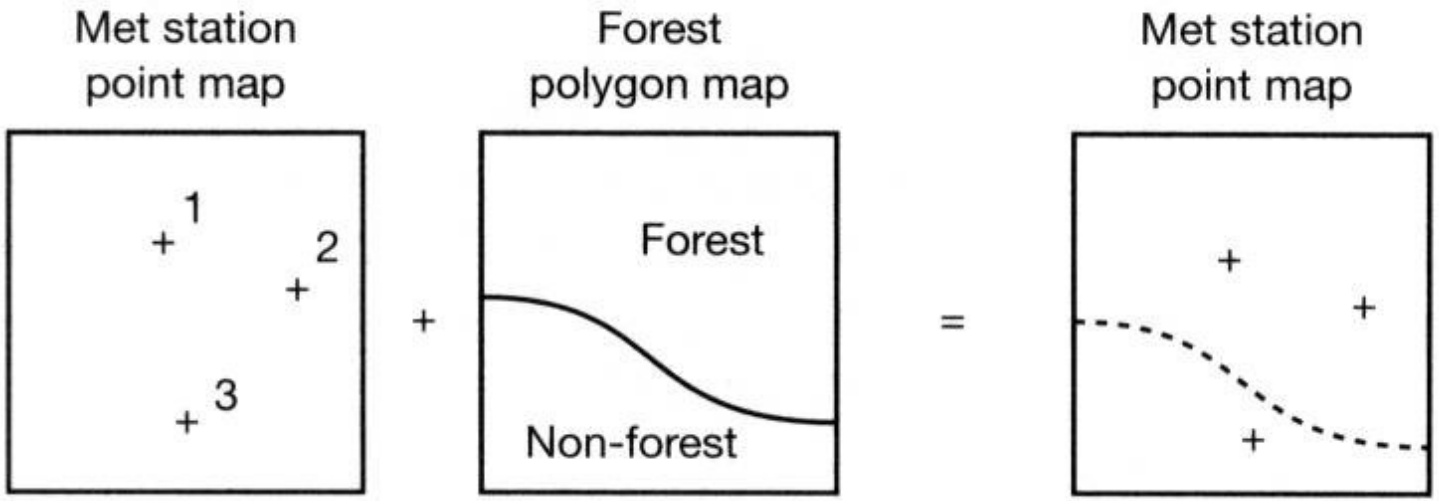
#3 Contributory Rule: each attribute value contributes to result

#4 Interaction Rule: pair of values contribute to result

Vector based Overlay

- 3 main types of vector overlay
  - point-in-polygon
  - line-in-polygon
  - polygon-on-polygon

Vector based overlay

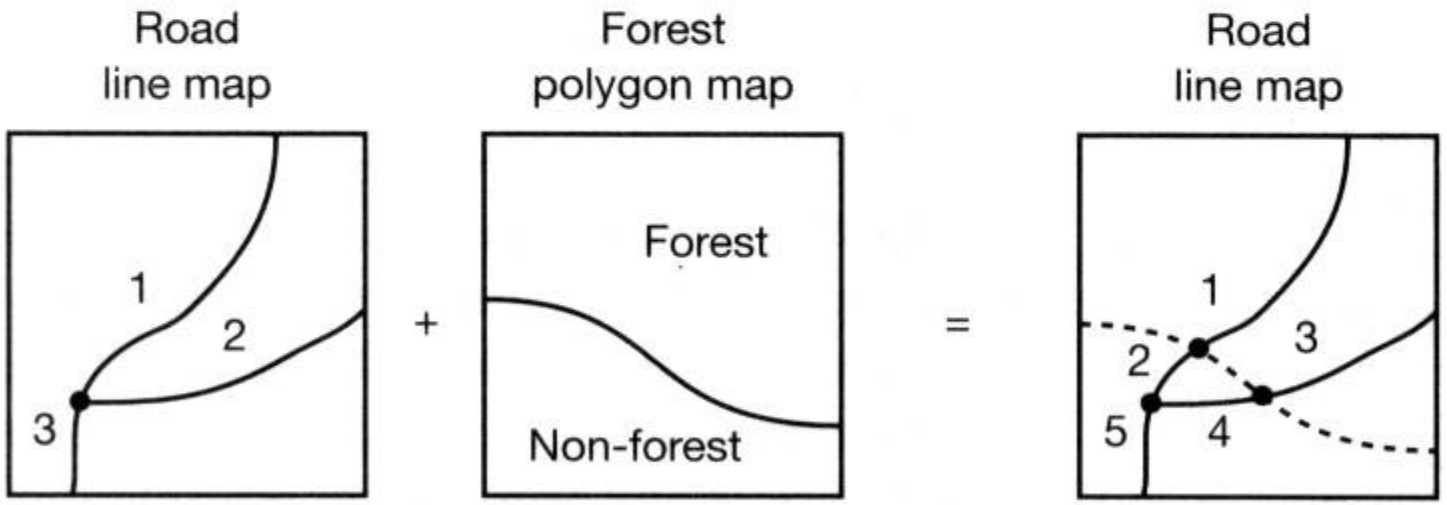


point-in-polygon example

Met station
attribute table

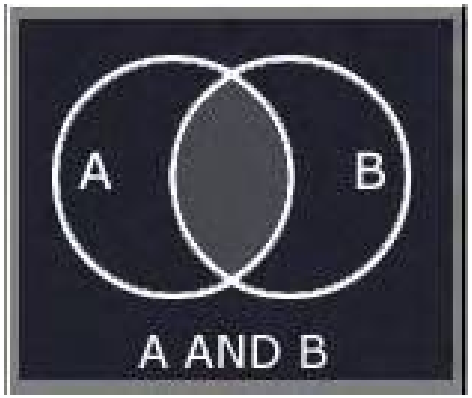
Point ID	Land use
1	Forest
2	Forest
3	Non-forest

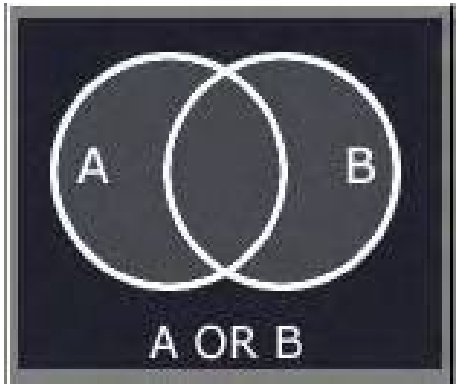
Vector based overlay

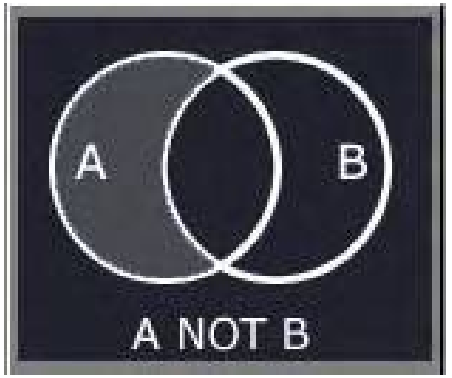


line-in-polygon example

Vector based overlay







polygon-in-polygon example

Raster Based Overlay: Simple Addition

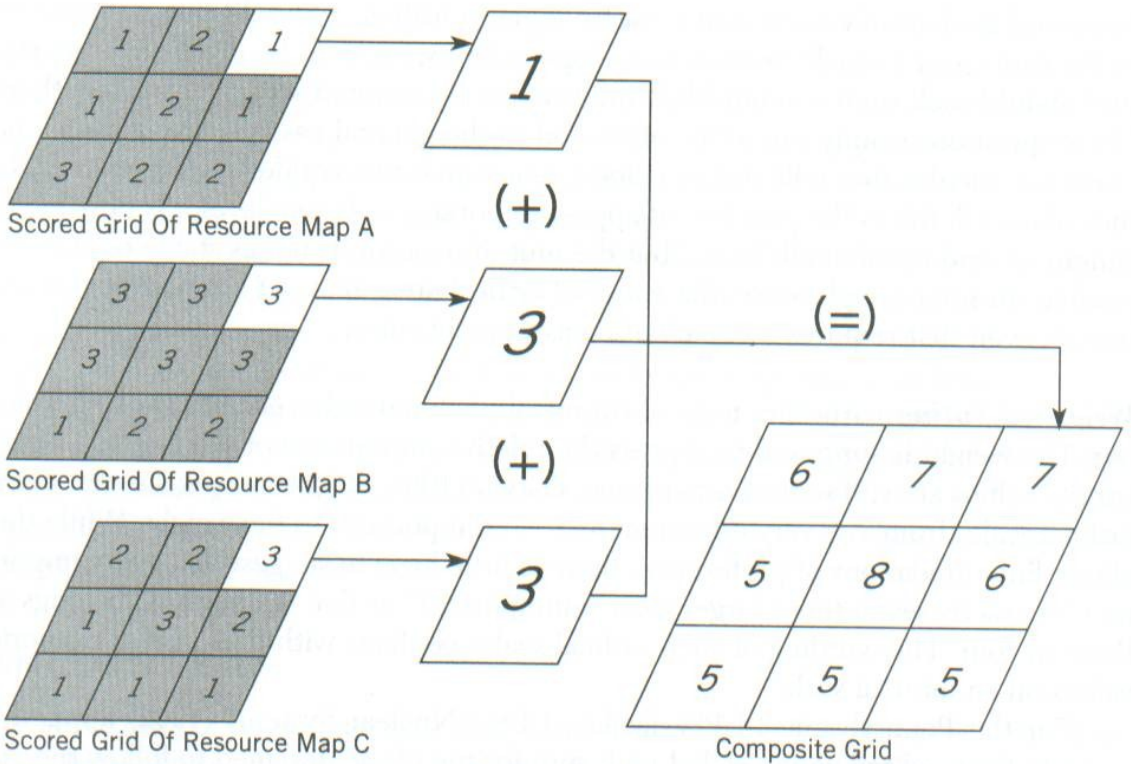


Image Source: Chrisman, Nicholas.(2002). 2nd Ed. *Exploring Geographic Information Systems*. p 144. fig. 5-12.

Raster Overlay: Boolean Combine

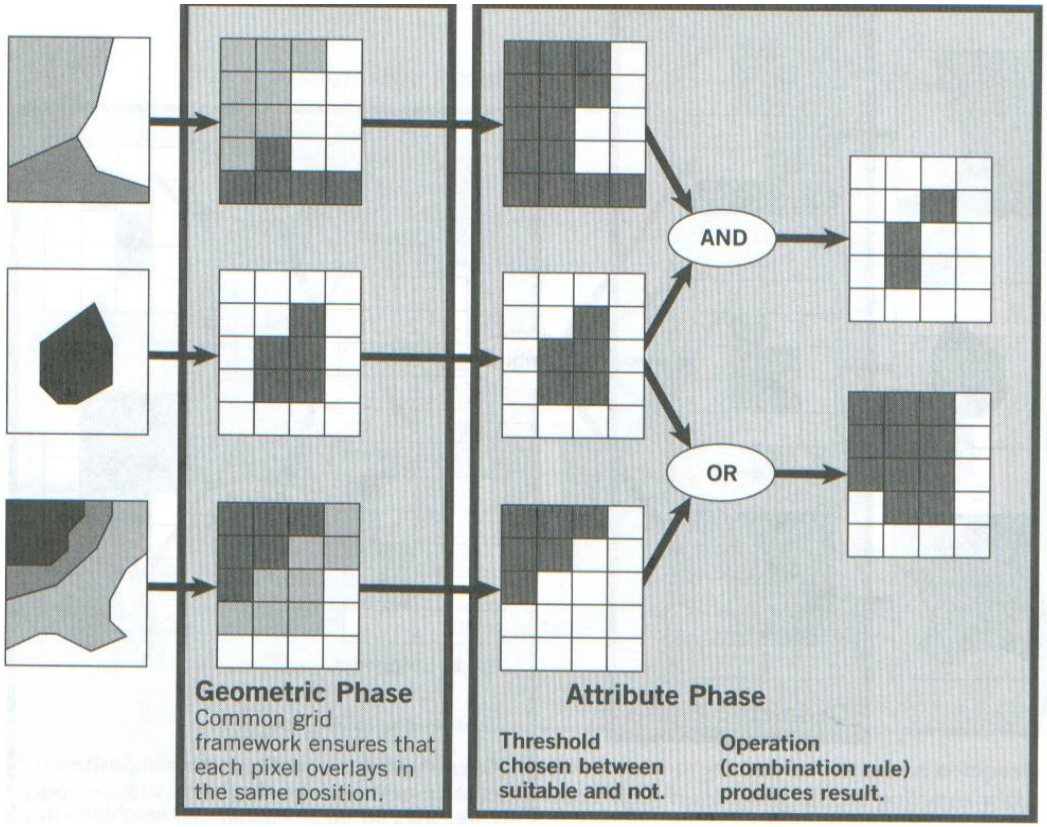
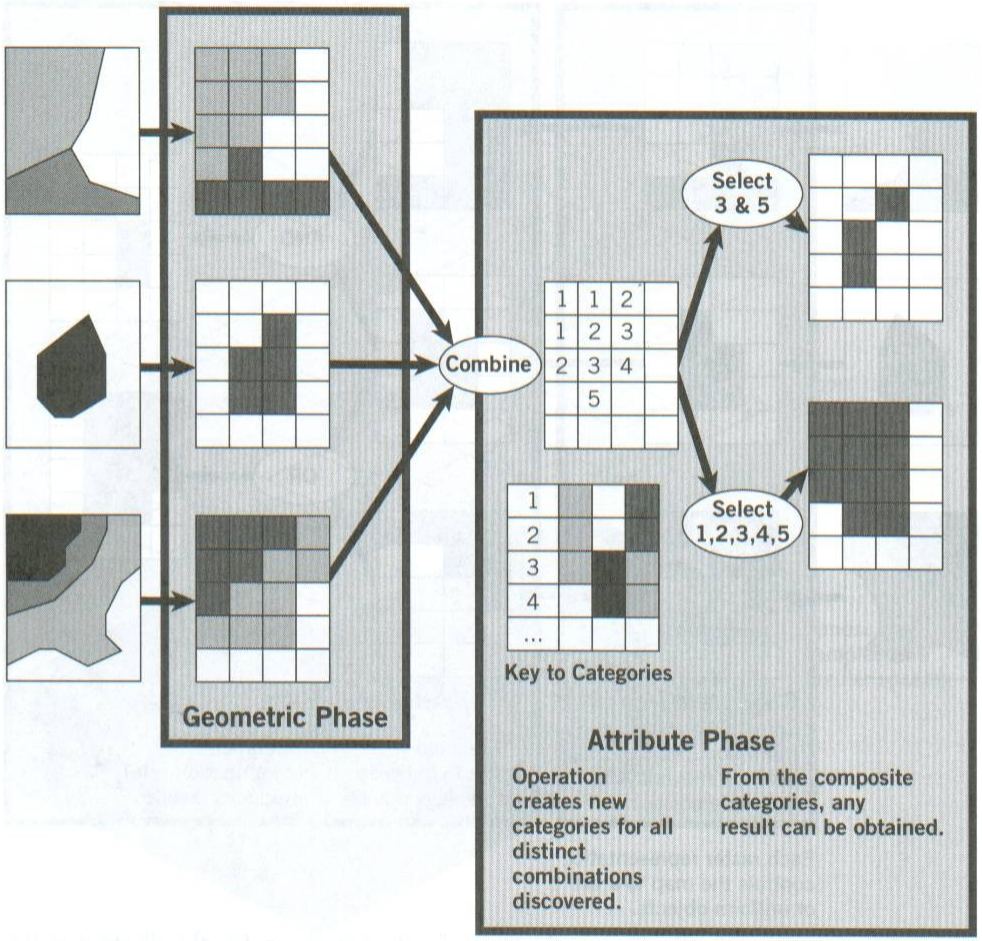


Image Source: Chrisman, Nicholas.(2002). 2nd Ed. *Exploring Geographic Information Systems*. p 125. fig. 5-3.

Raster Overlay: Composite Combine



Vector Overlay: Composite Structure

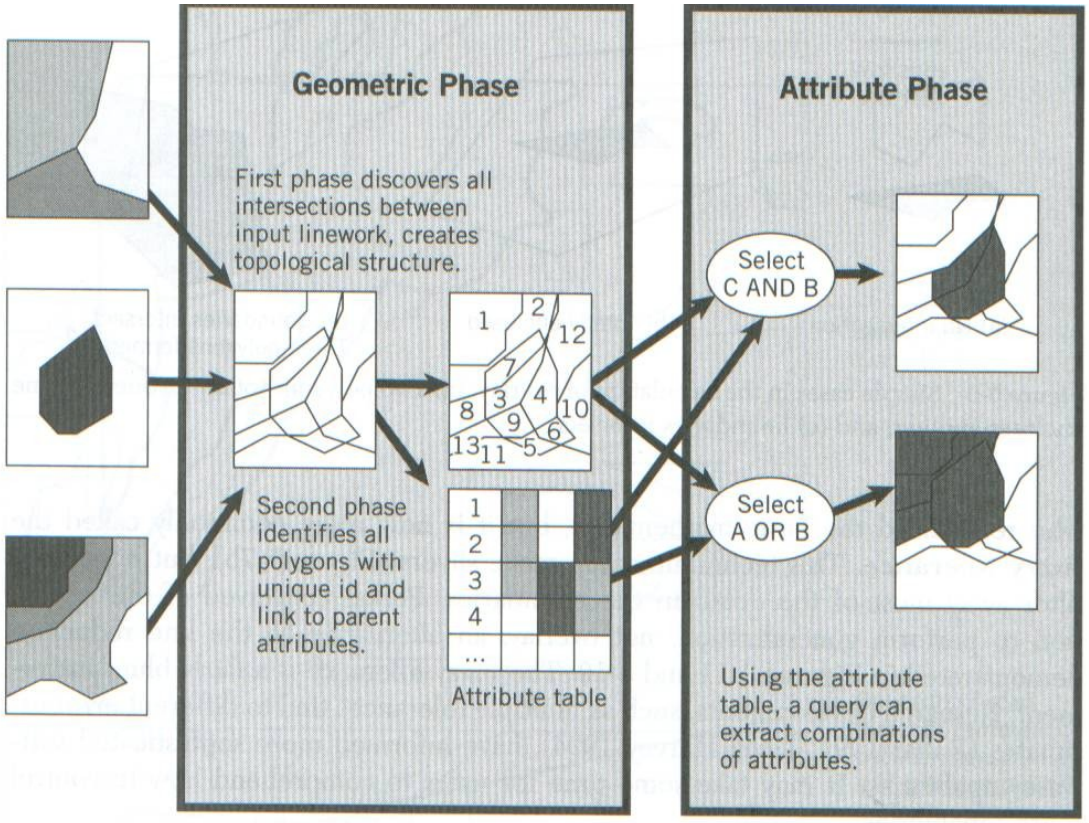


Image Source: Chrisman, Nicholas.(2002). 2nd Ed. *Exploring Geographic Information Systems*. p 127. fig. 5-5.

3. Neighborhood Functions

- Basic Functions
  - Average, diversity, majority, minimum/maximum, and total
- Parameters to define:
  - Target location(s)
  - Specification of neighborhood
  - Function to perform on neighborhood elements

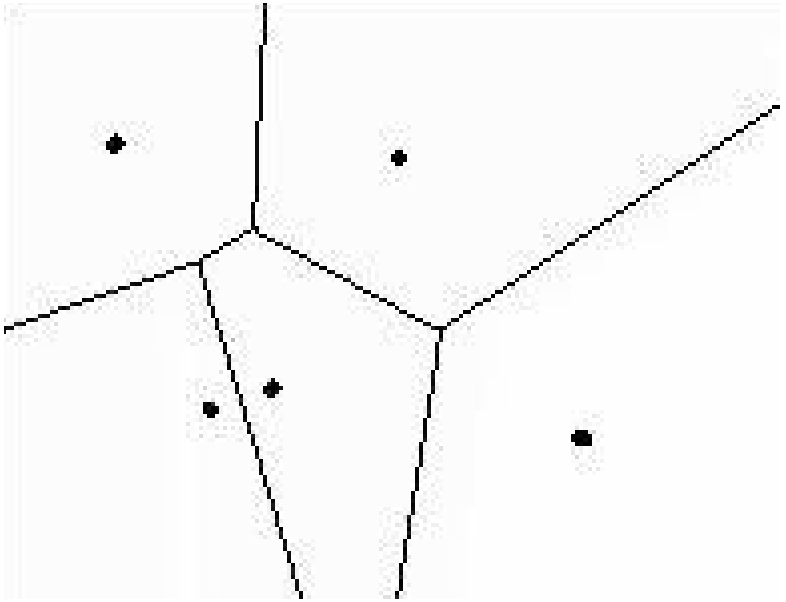
3. Neighborhood Function (cont)

- Search Operation
  - most common neighborhood operation
- Example
  - count the number of customers within 2 miles of the grocery store

3. Neighborhood Functions (cont)

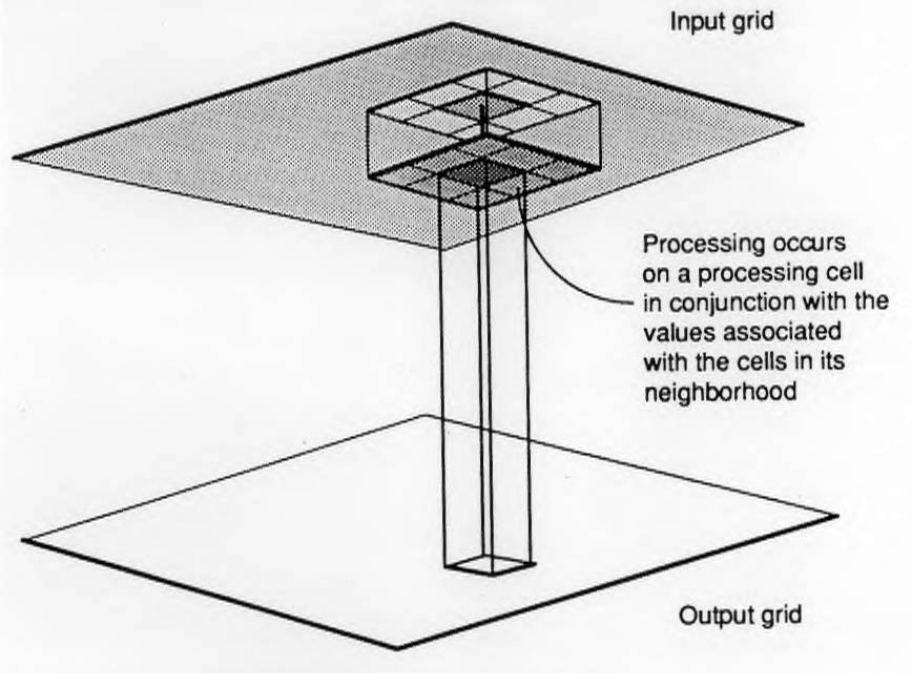
- Thiessen Polygons Operation
  - defines the individual area of influence around a point
  - used to predict values at surrounding points from a single point observation
  - can produce polygons with shapes unrelated to phenomenon being mapped

Example: Neighborhood Function



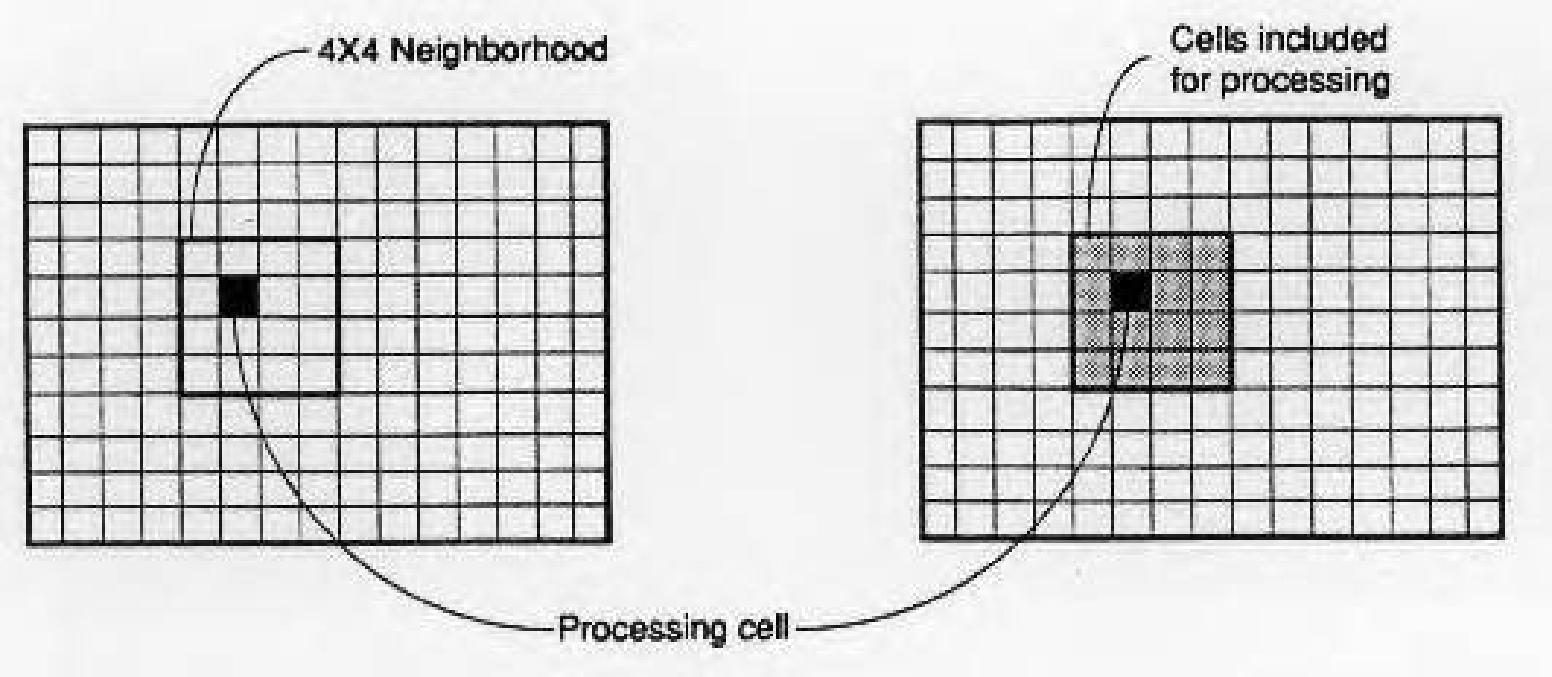
Thiessen Polygons

Neighborhood Functions: Implementing

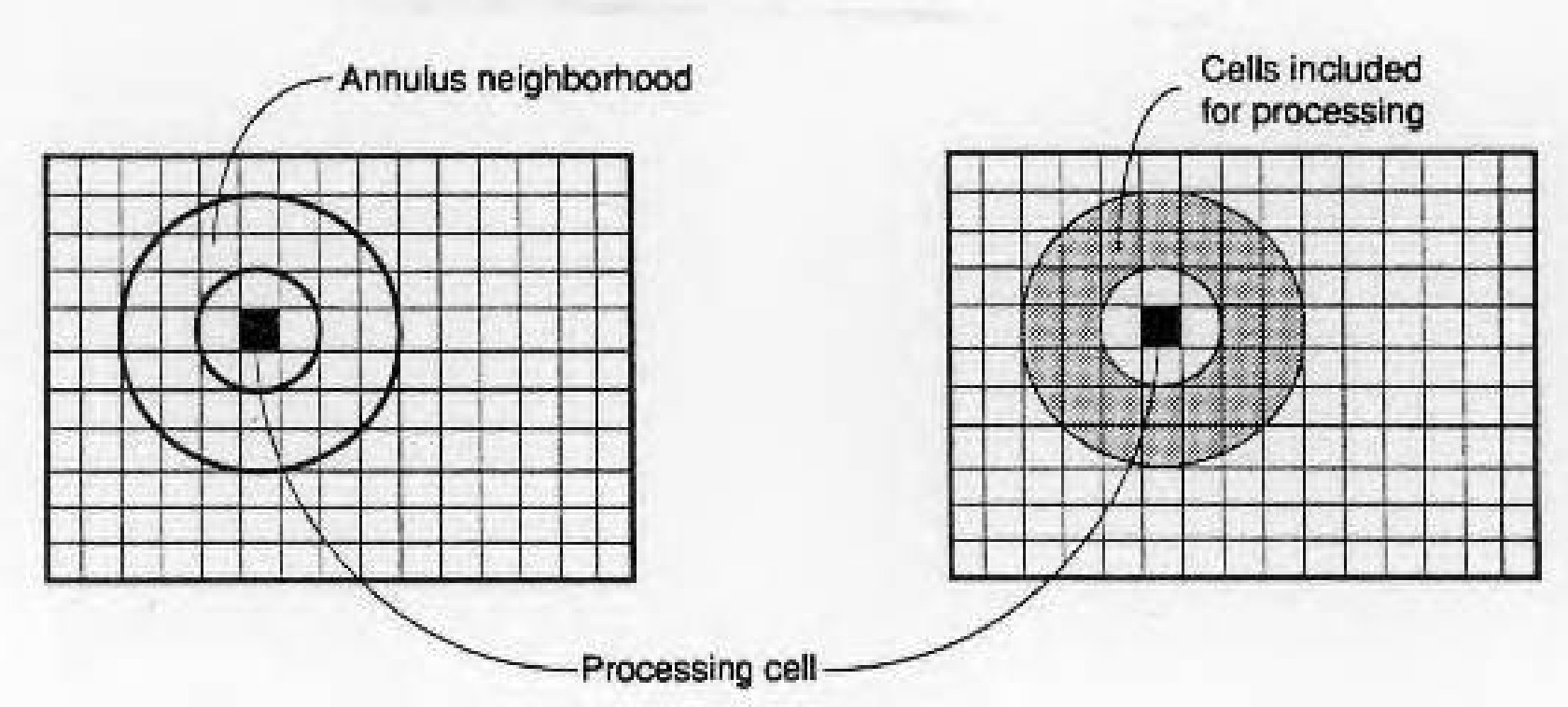


Used for calculating the mean, standard deviation, sum, or range of values within the immediate or extended neighborhoods.

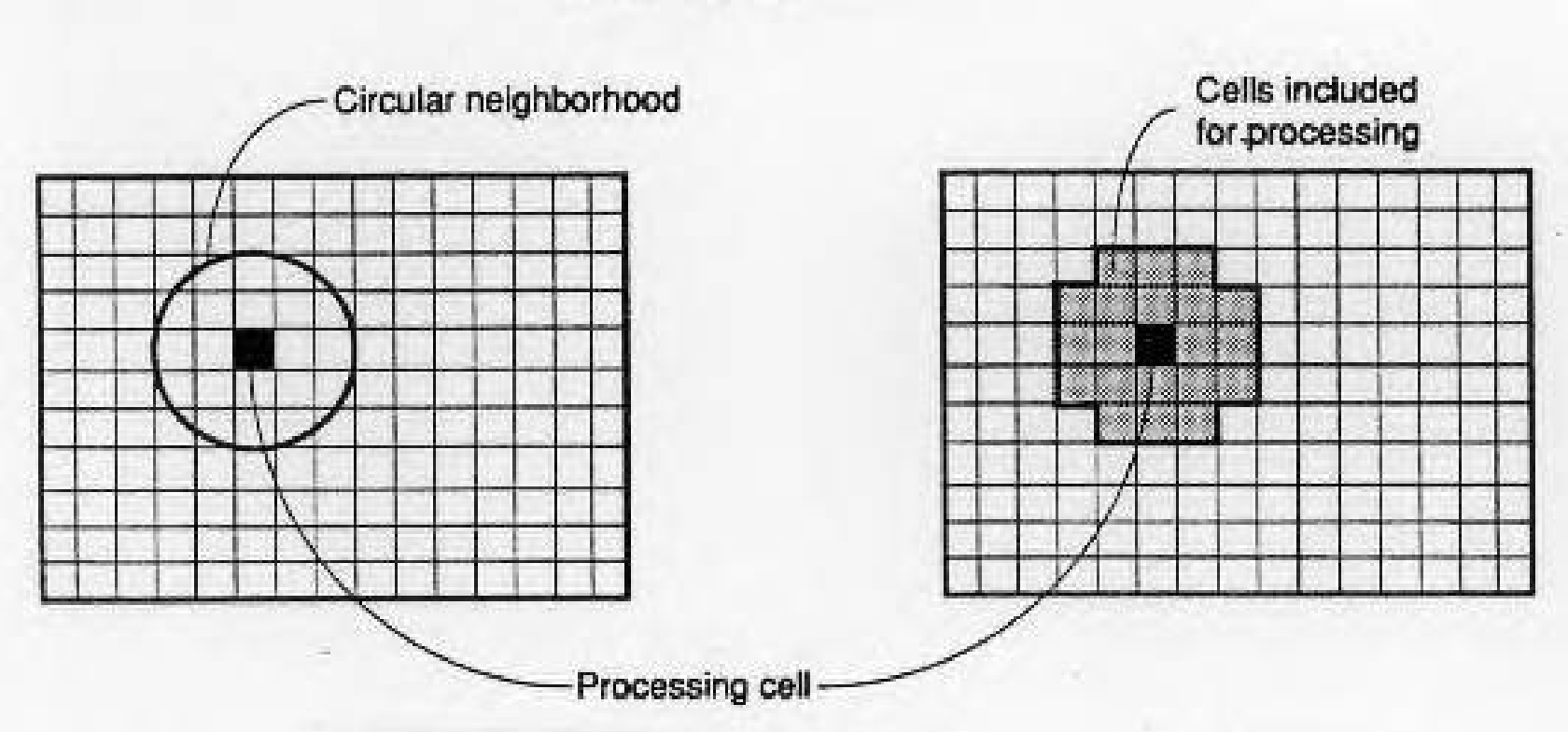
Neighborhood Functions: 4 x 4 Window Processing



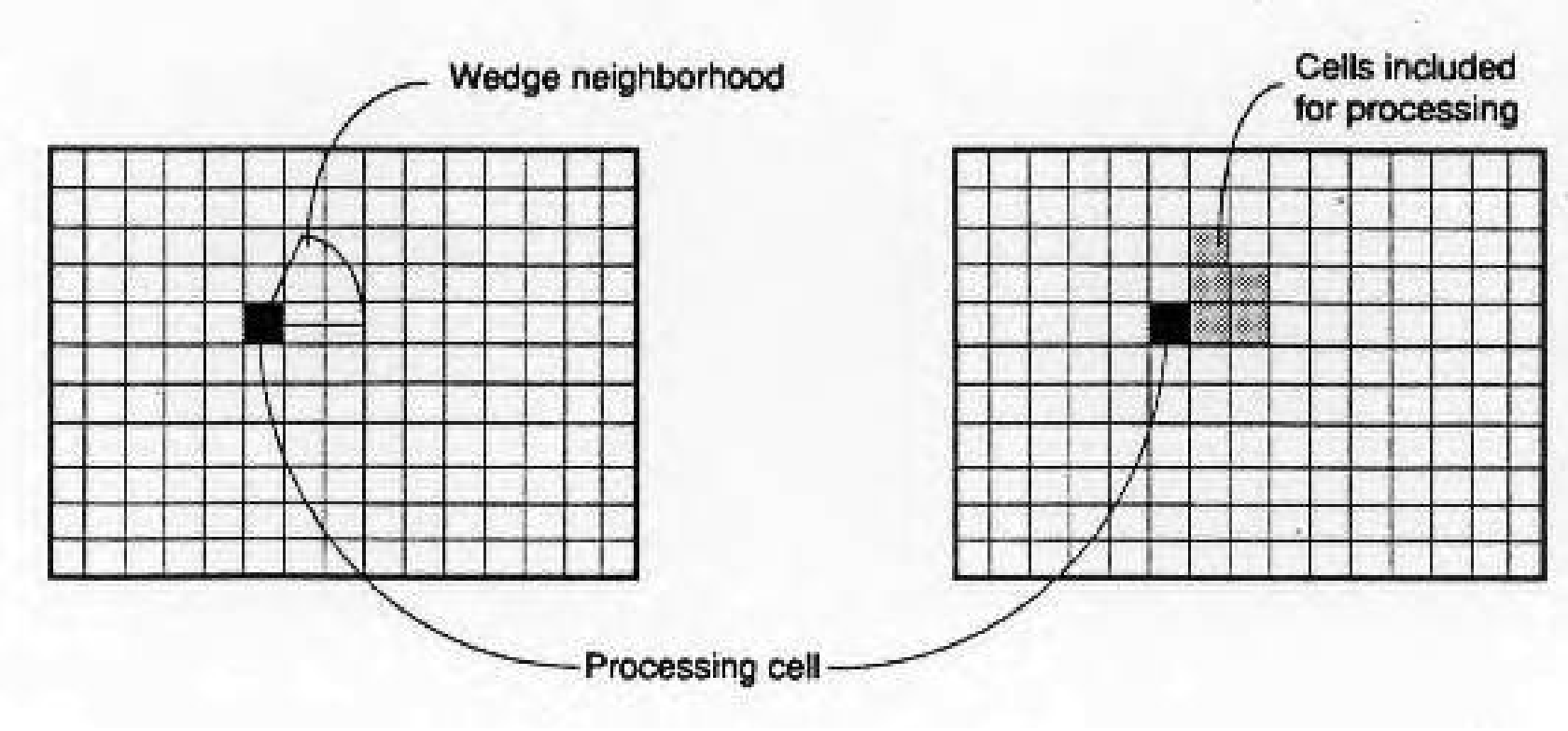
Neighborhood Functions: Annulus Neighborhood Processing



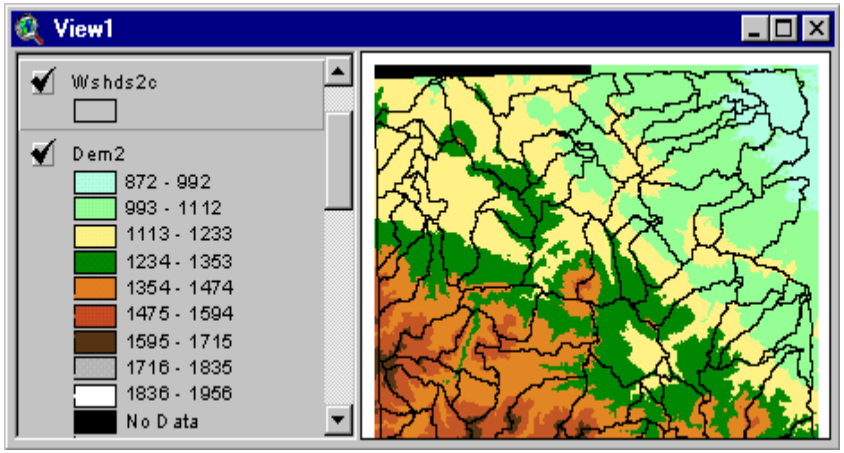
Neighborhood Functions: Circular Neighborhood Processing



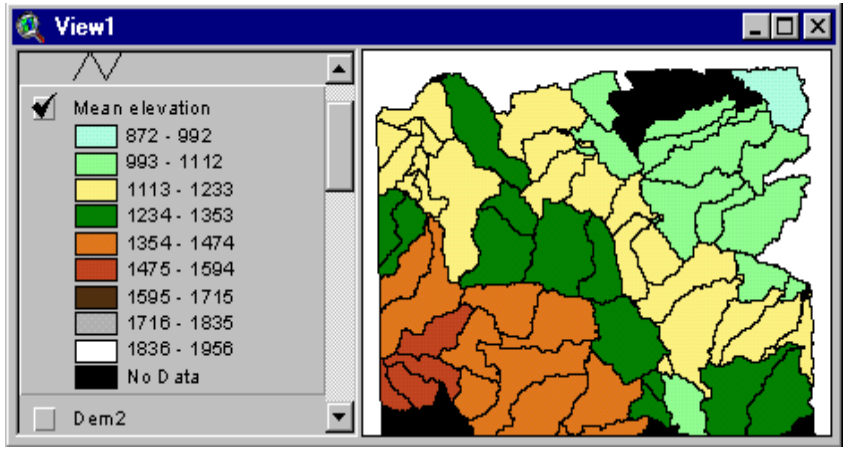
Neighborhood Functions: Wedge Neighborhood Processing



Neighborhood Functions: Example

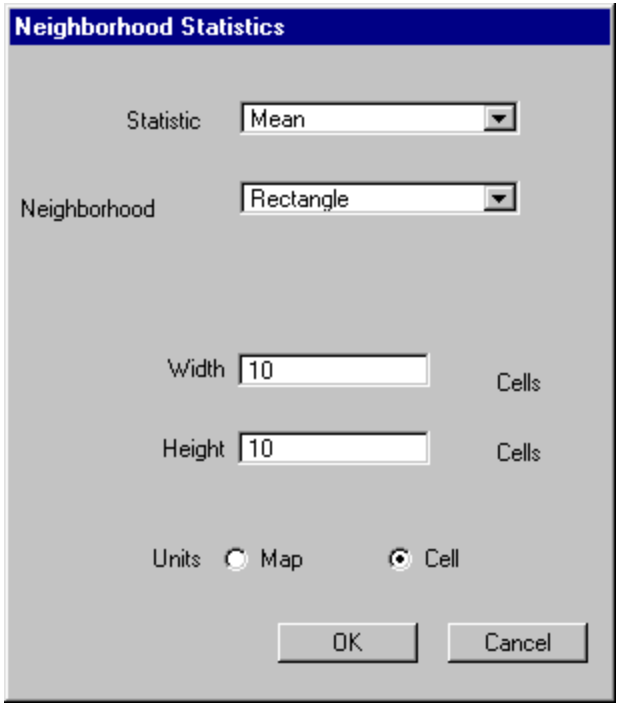


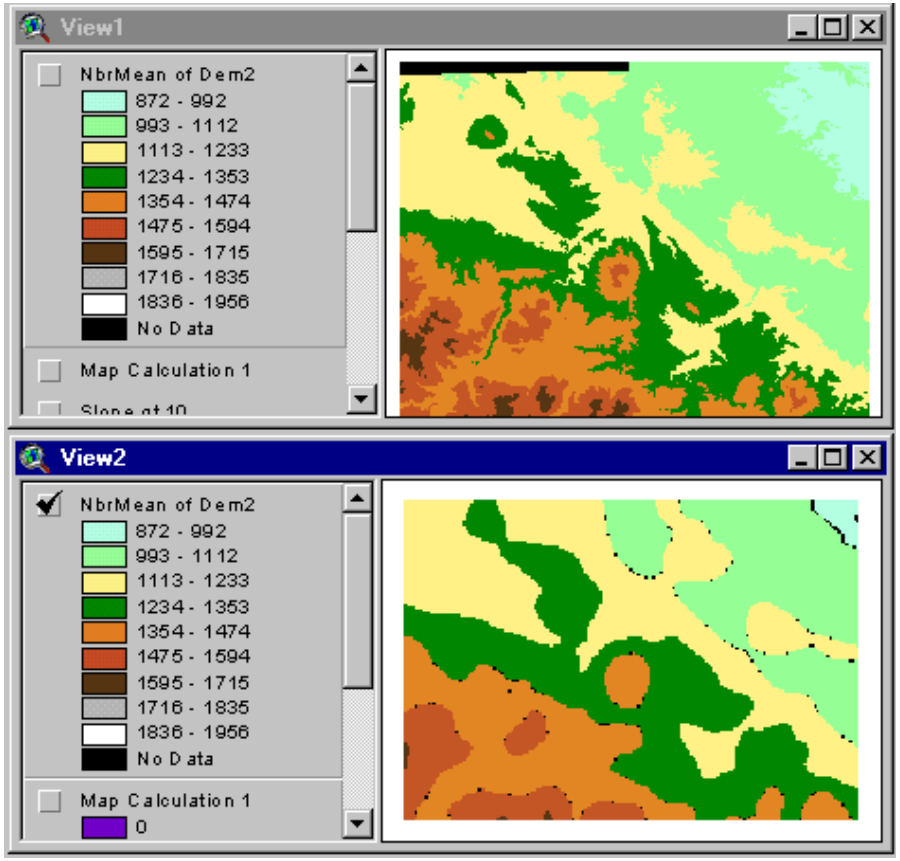
Zone theme: Watersheds
Value theme: Elevation
Statistic type: Mean



Output:
Mean elevation of each watershed

Neighborhood Functions: 10x10 averaging filter on a DEM





4. Connectivity Functions

- Used to accumulate values over an area being navigated
- Parameters to define:
  - specification of way spatial elements are connected
  - rules that specify allowed movement along interconnections
  - a unit of measurement

4. Connectivity Functions (cont).

- Proximity Operation
  - measure of the distance between features
  - not restricted to distance; can be noise, time, pollution, etc.
- Parameters to define:
  - target location
  - unit of measure
  - function to calculate proximity (distance/time/noise)
  - area to be analyzed

Example: Connectivity (Raster)

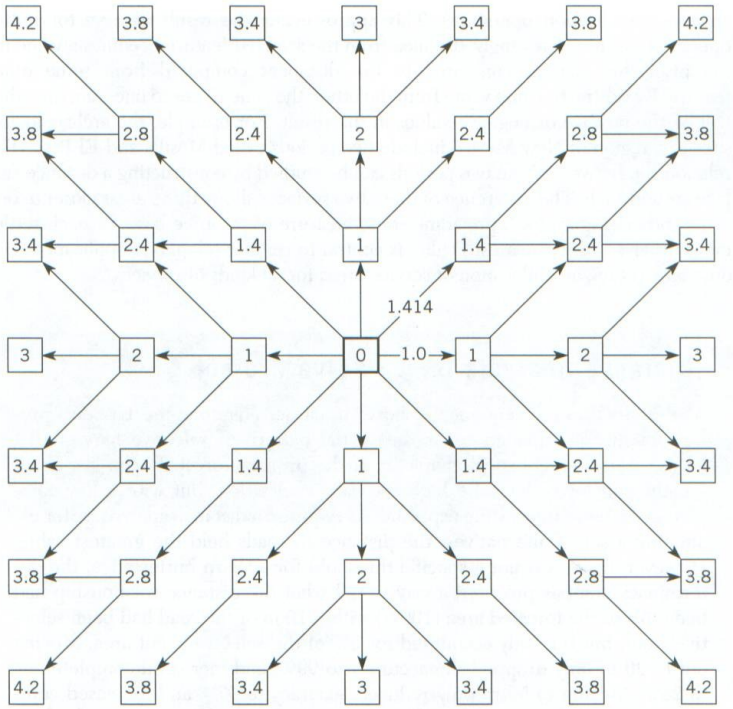
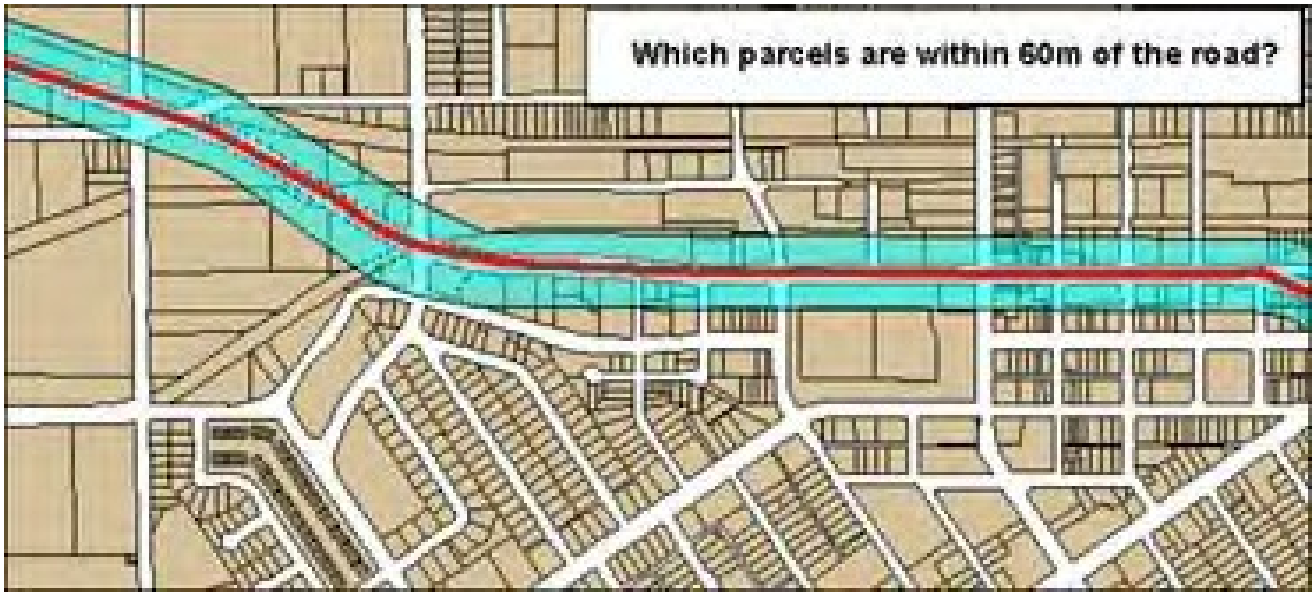


Figure 6-4 Measuring distances by adding distances to cell neighbors.

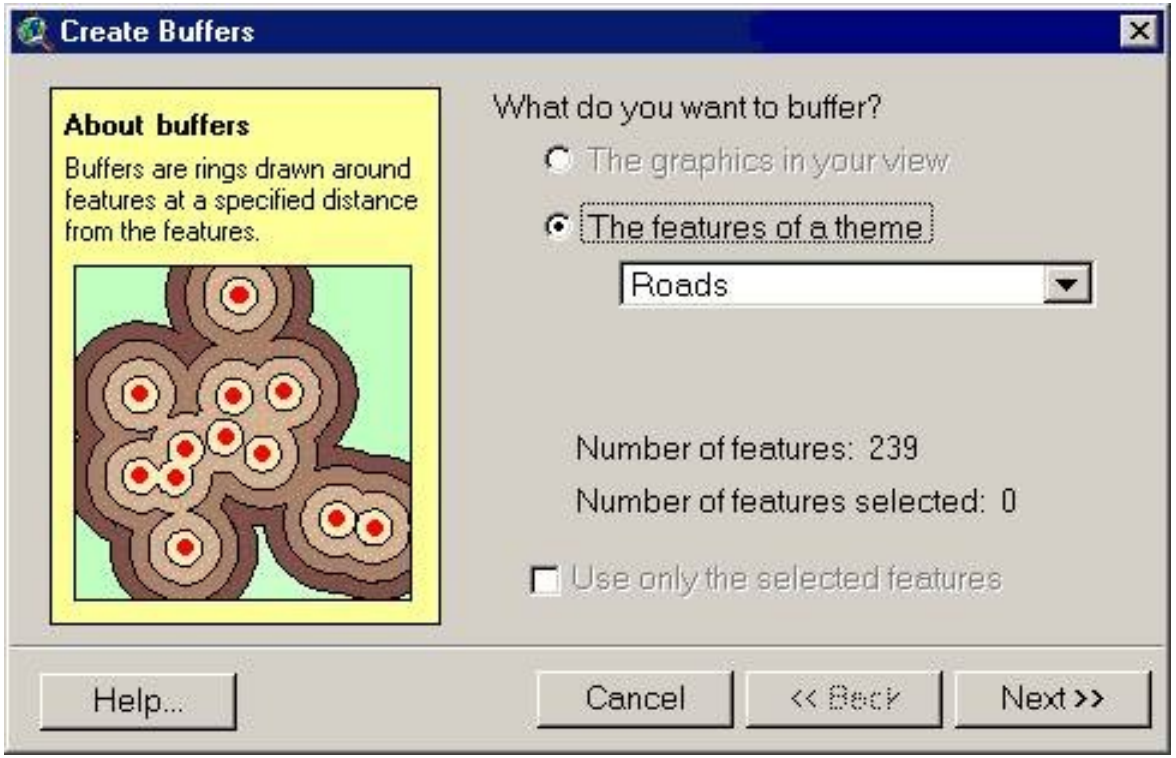
Proximity Operation: Distance From Neighbor

Example: Connectivity (Vector)



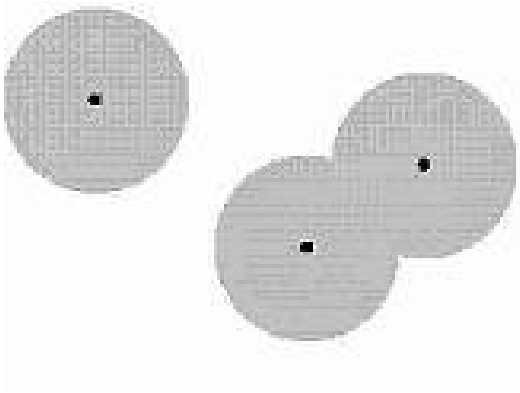
Proximity Operation: Road Buffer

Example: Connectivity (Vector)

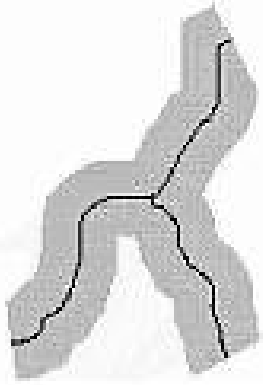


Proximity Operation: Buffer Generation

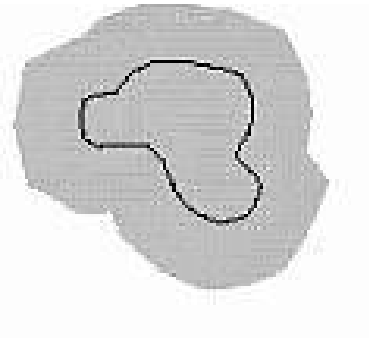
Example: Connectivity (Vector)



Points



Lines



Polygons

Proximity Operation: Buffer Types

Example: Connectivity (Vector)
Proximity Operation - Buffers & Setbacks

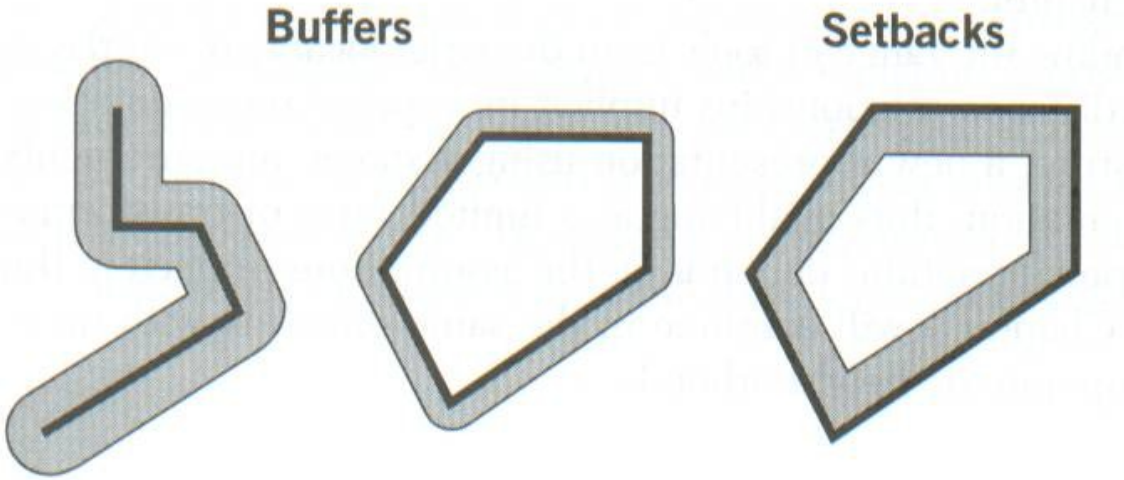


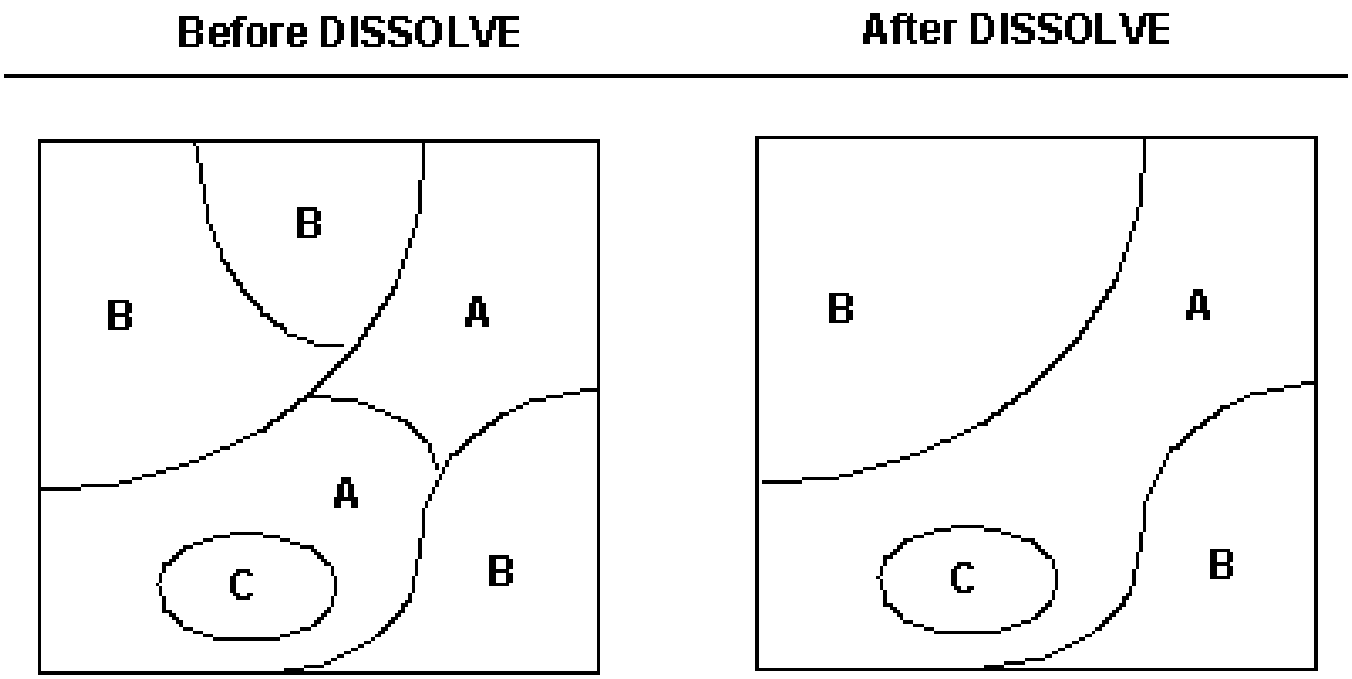
Diagram of simple buffers and a setback.
NOTE: buffers go outward from lines or areas; setbacks run inside of areas (not lines).

Image Source: Chrisman, Nicholas.(2002). 2nd Ed. *Exploring Geographic Information Systems*. p 154. fig. 6-1.

4. Connectivity Functions (cont).

- Contiguity Operation
  - spatial units are connected - defines “unbroken area”
- Contiguity measures:
  - size of neighboring area(s)
  - shortest/longest straight line distance across adjacent area(s)
  - specific shape of neighboring area(s)

Contiguity Functions

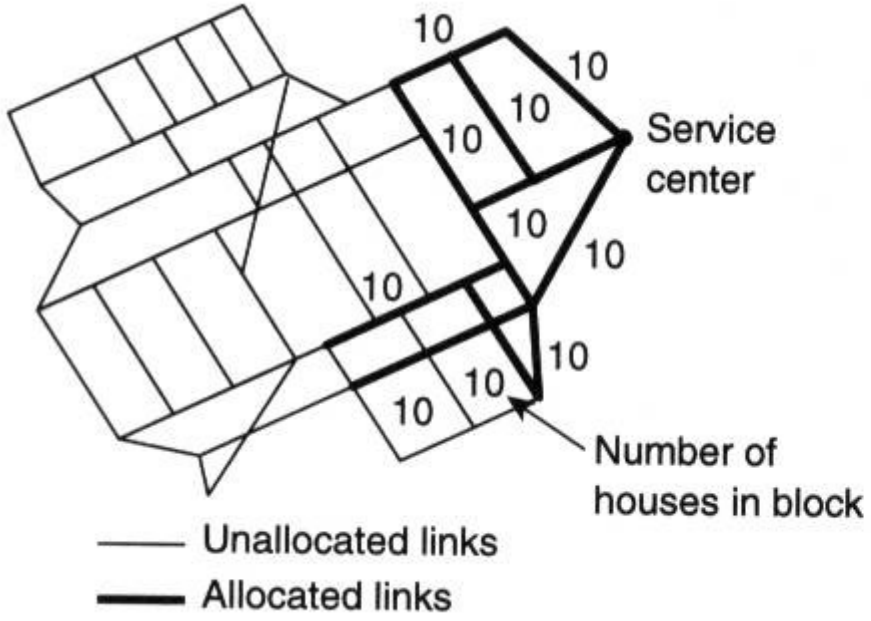


Combines adjacent units together when they share a common attribute

4. Connectivity Functions (cont).

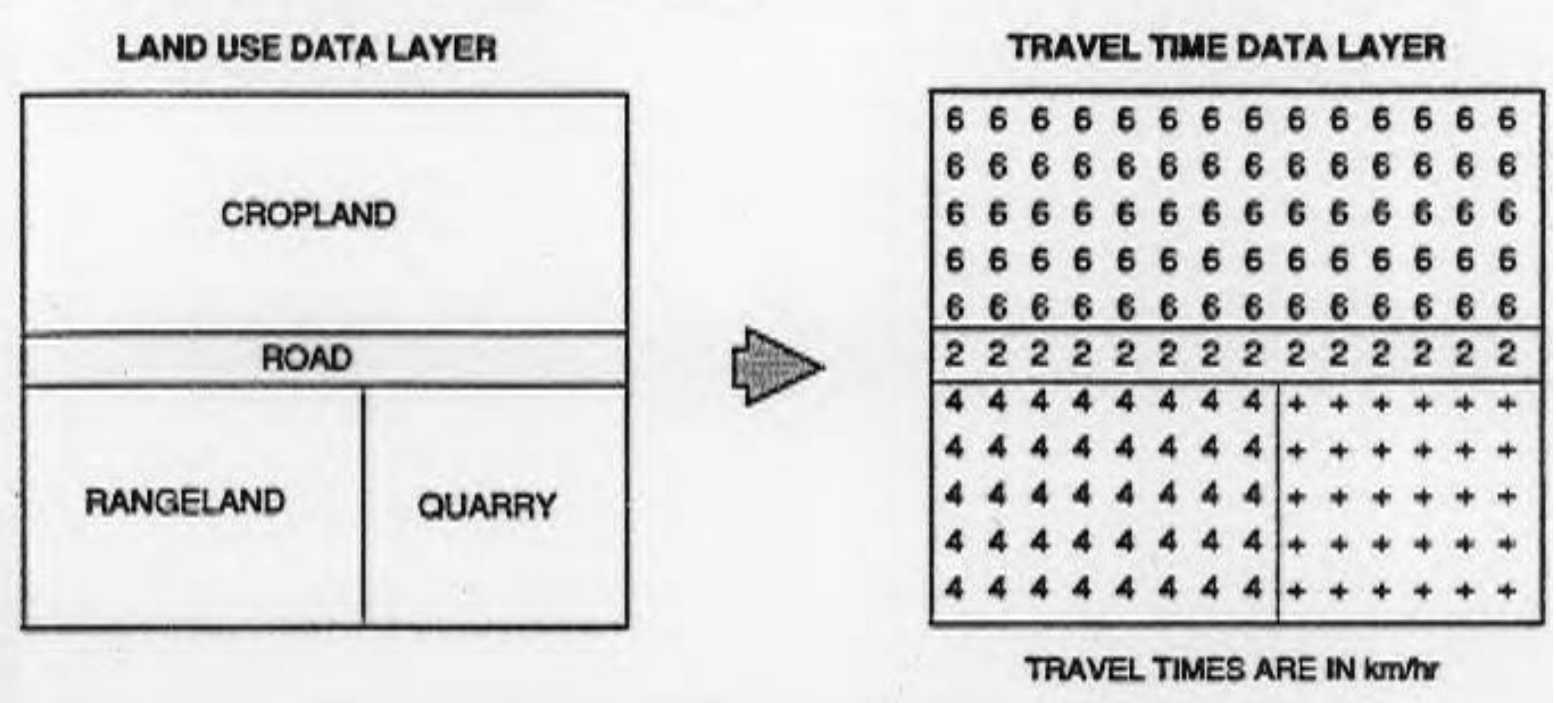
- Network Operations
  - set of interconnected lines that represent a set of features through which resources flow
- Common network functions
  - shortest path problem (route optimization)
  - location-allocation modeling (resource allocation)
  - traveling salesperson problem (route optimization)
  - route tracing (prediction of network loading)

Example: Connectivity (Vector)



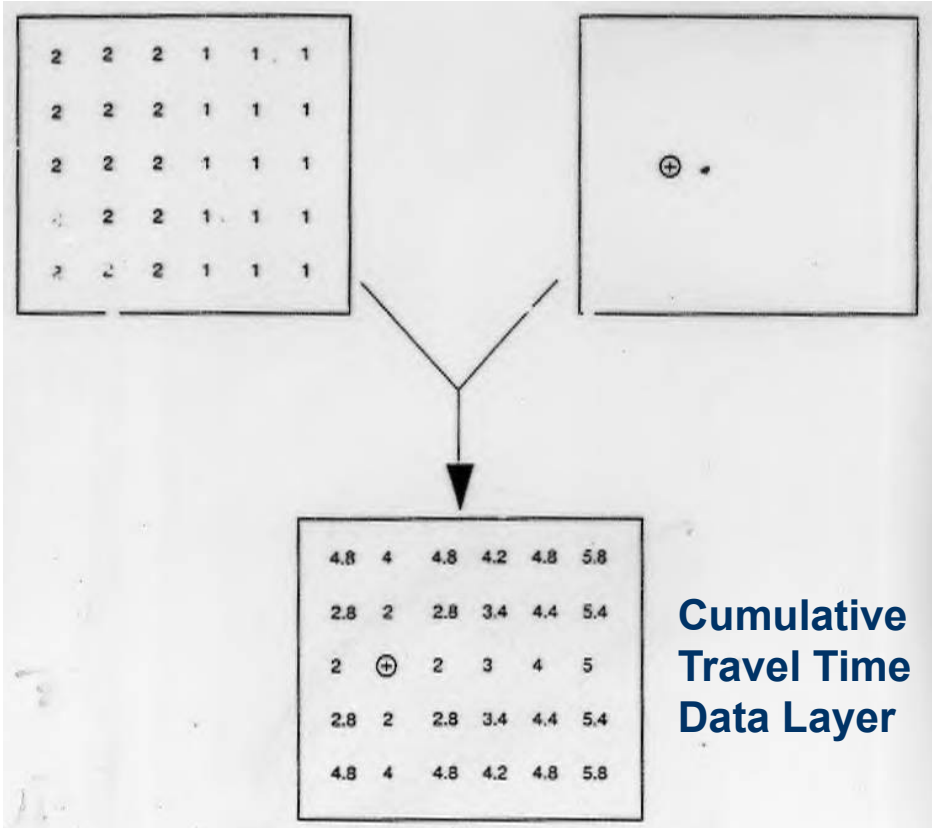
Network Function: Location-Allocation

Spread Functions:
Travel Time – Creating Friction Surface



Spread Functions: Travel Time – Friction Surface

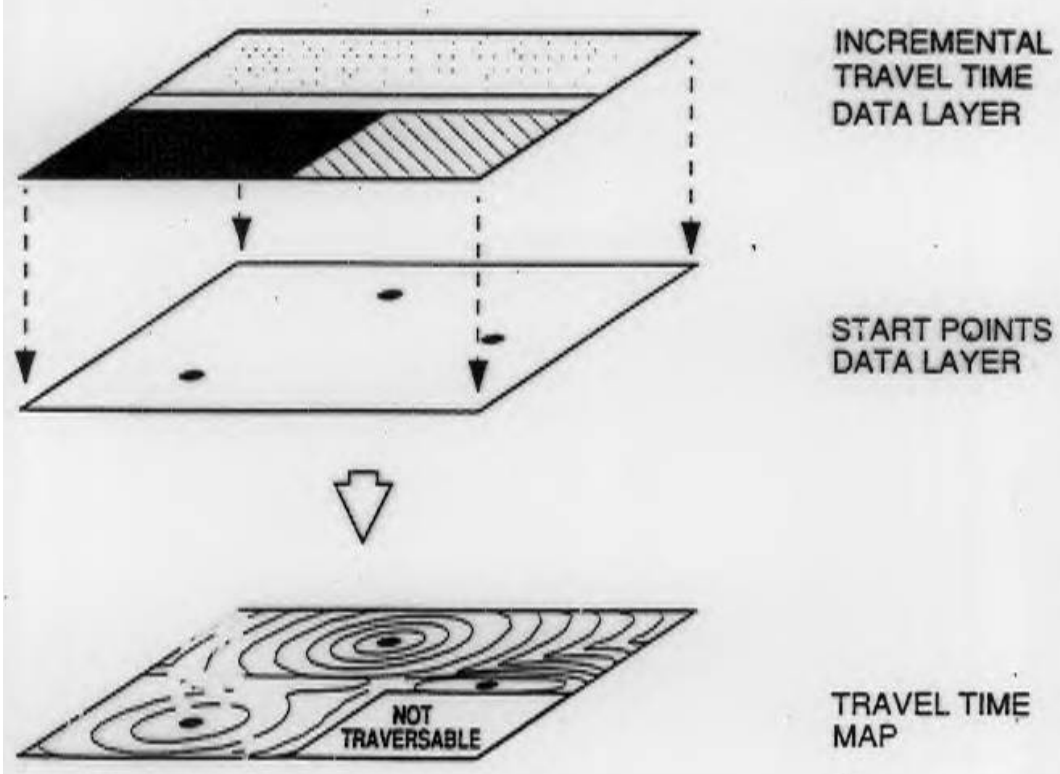
Friction Surface Data Layer



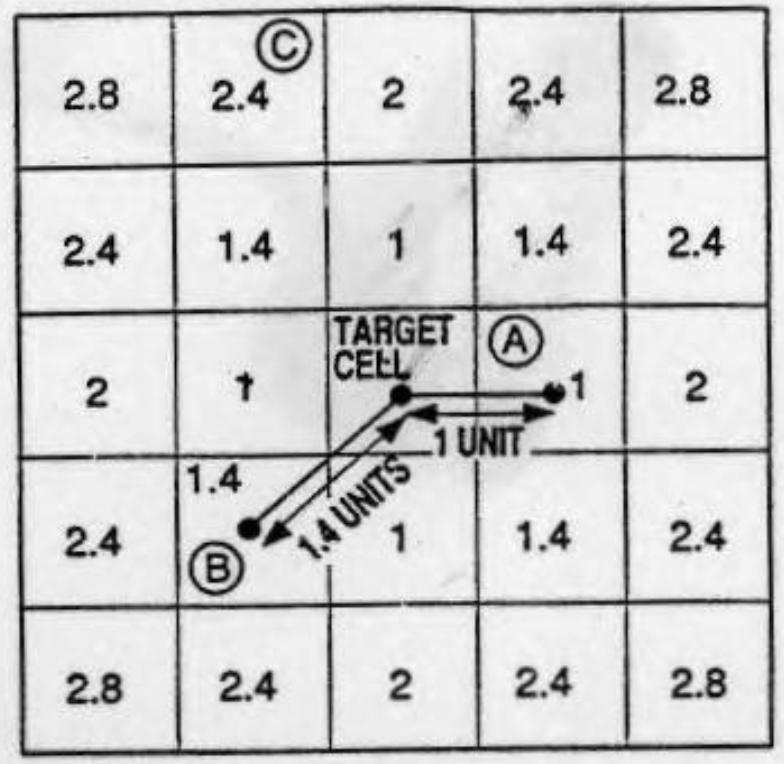
Start Point Data Layer

Cumulative Travel Time Data Layer

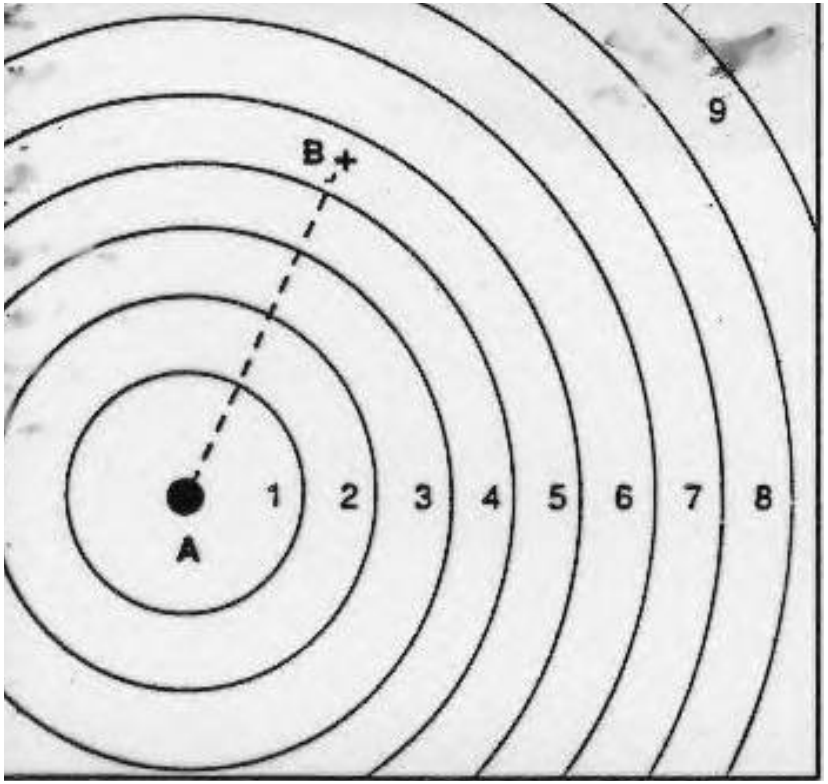
Spread Functions: Travel Time – Map



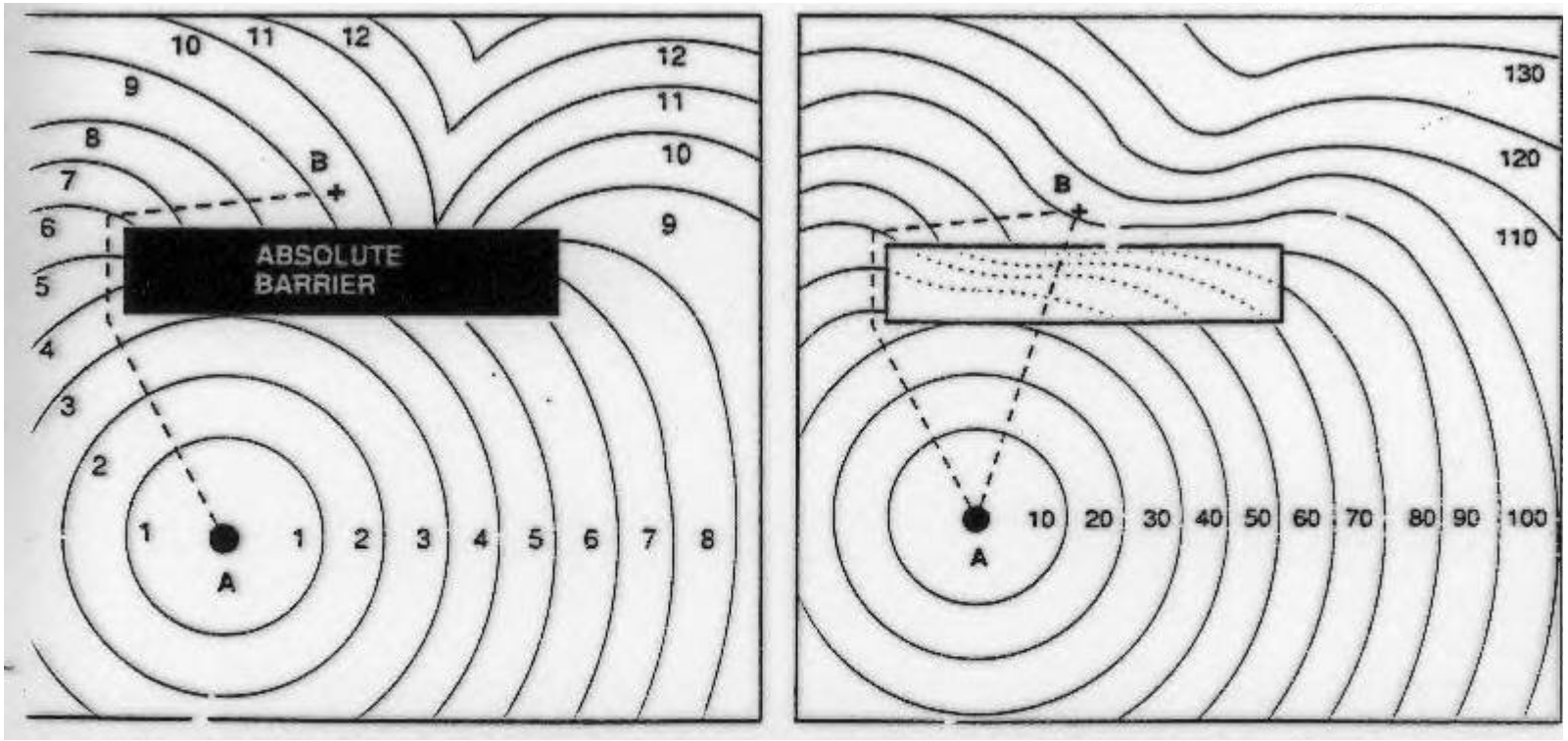
Spread Function: Calculation of Distance



Spread Function:
Equidistant Travel Zones from Target (A)



Spread Function:
Travel Zones-Absolute & Partial Barriers



Emergency Services

Real time tracking, route-finding, best to respond

4. Connectivity Functions (cont).

- Visibility Analysis Operations
  - identification of areas of terrain that can be seen from a particular point on the surface
- Viewshed Operation
  - uses digital elevation model data (DEMs) or.....
  - digital terrain model data (DTMs) or.....
  - triangulated irregular network data (TINs)?

4. Connectivity Functions (cont).

- Visibility Analysis Operations
  - identification of areas of terrain that can be seen from a particular point on the surface
- Viewshed Operation
  - uses digital elevation model data (DEMs) or.....
  - digital terrain model data (DTMs) or.....
  - triangulated irregular network data (TINs)

Connectivity Function Example: Viewshed Analysis

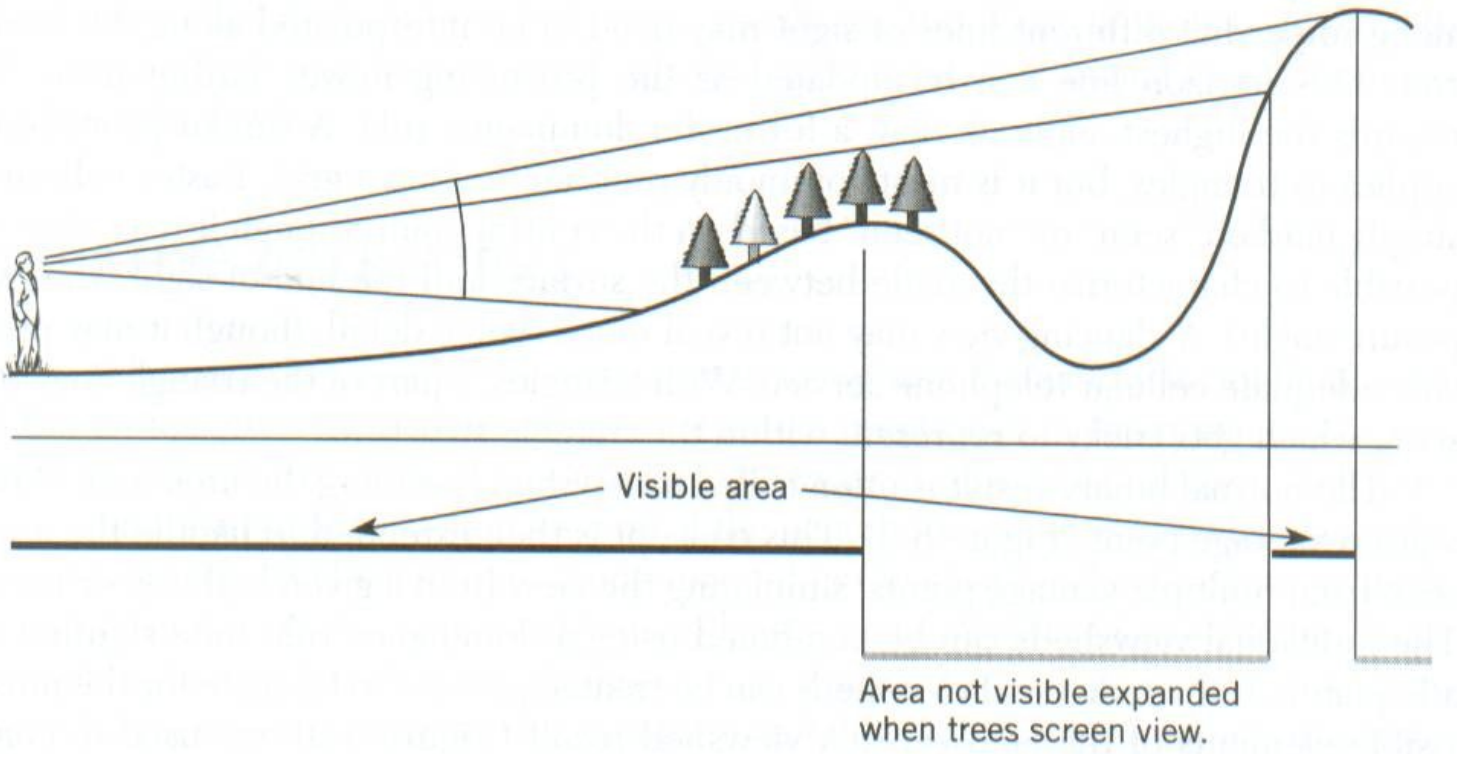
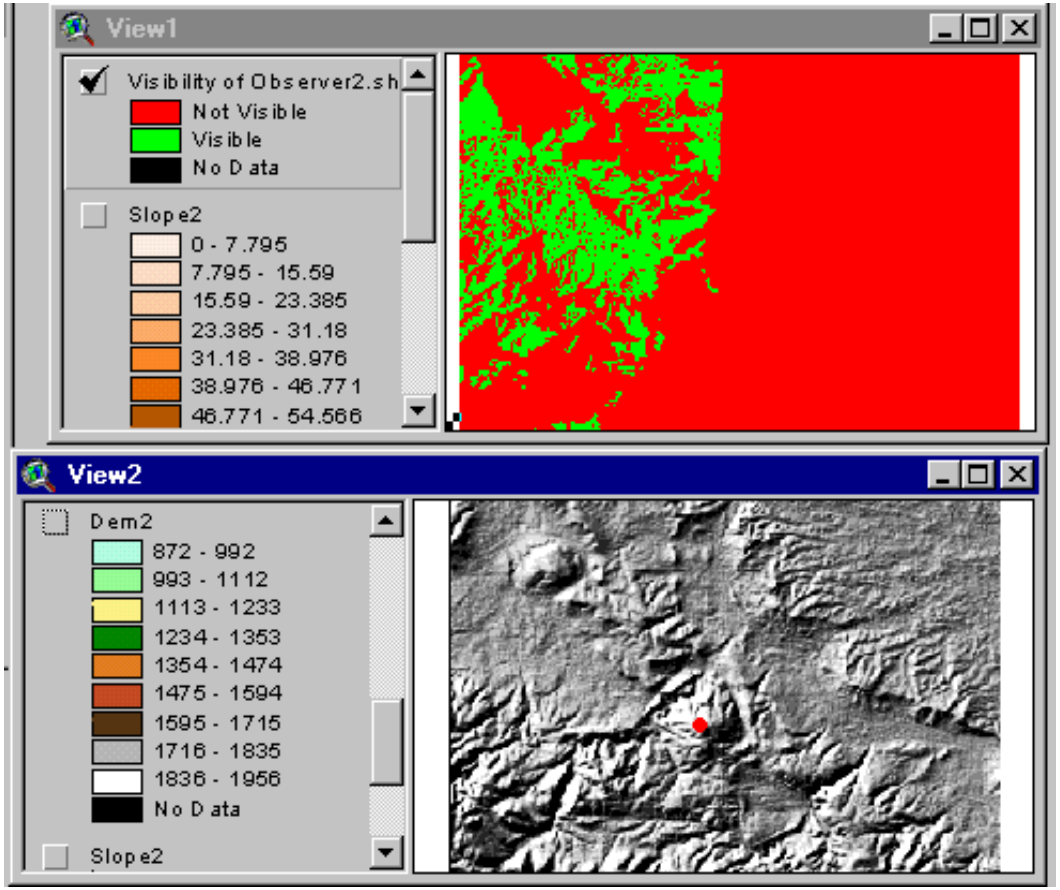
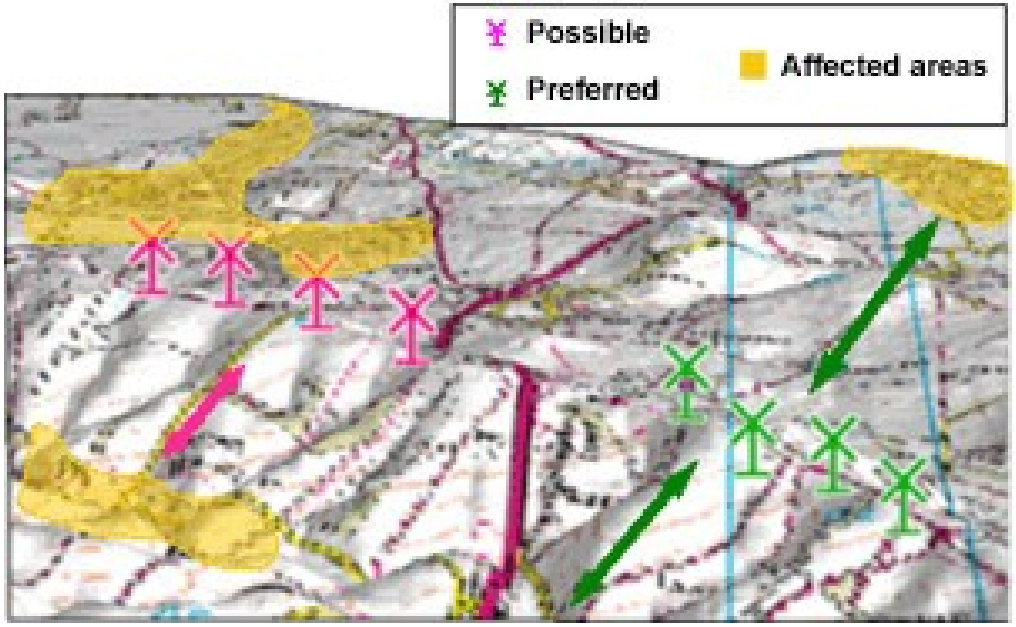


Image Source: Chrisman, Nicholas.(2002). 2nd Ed. *Exploring Geographic Information Systems.* p 198. fig. 8-14.

Viewshed aka Intervisibility



Environmental Impact Analysis



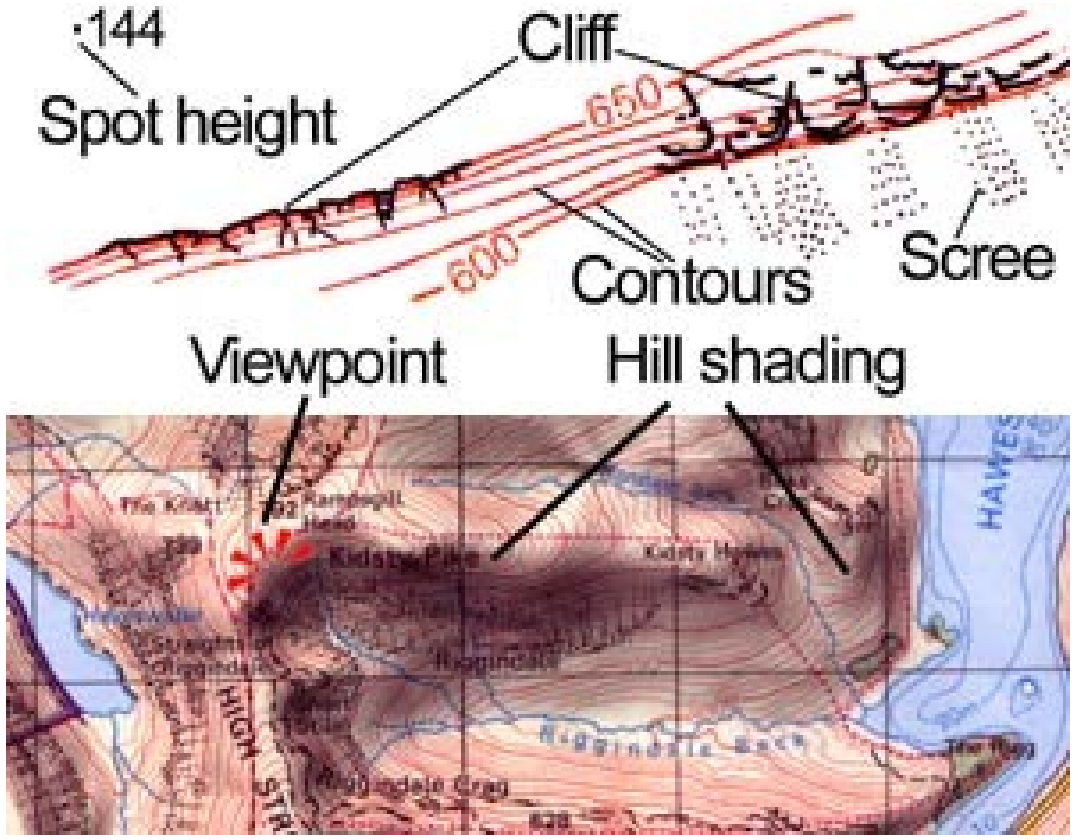
3D landscape model impact on natural beauty

Another term: Surface Analysis

- Surface functions
  - density, contour, interpolation functions
  - aspect, slope, hillshade, etc.
  - watershed analysis and modeling (flow direction, flow accumulation, flow length, watershed delineation, stream ordering)
  - visibility modeling/mapping
    - determine the area that can be "seen" from the target location

The 3rd Dimension: Height Analysis

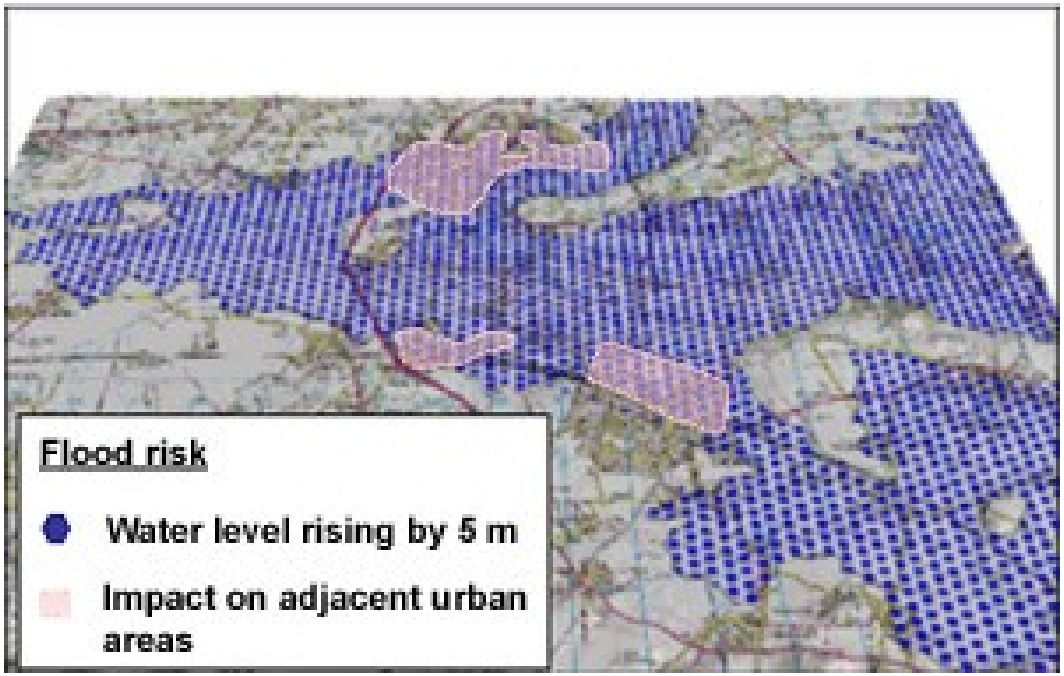
- Contours
- Hill shading
- Spot height symbols
- Cliff & slope symbols
- Viewpoint symbols



Analysis: Summation

- GIS does not always provide exact answers to problems, but by identifying trends based on geography, GIS can reveal patterns that can help us make *informed decisions*.
- A GIS can improve decision-making; it cannot make decisions for us.

Flood Risk

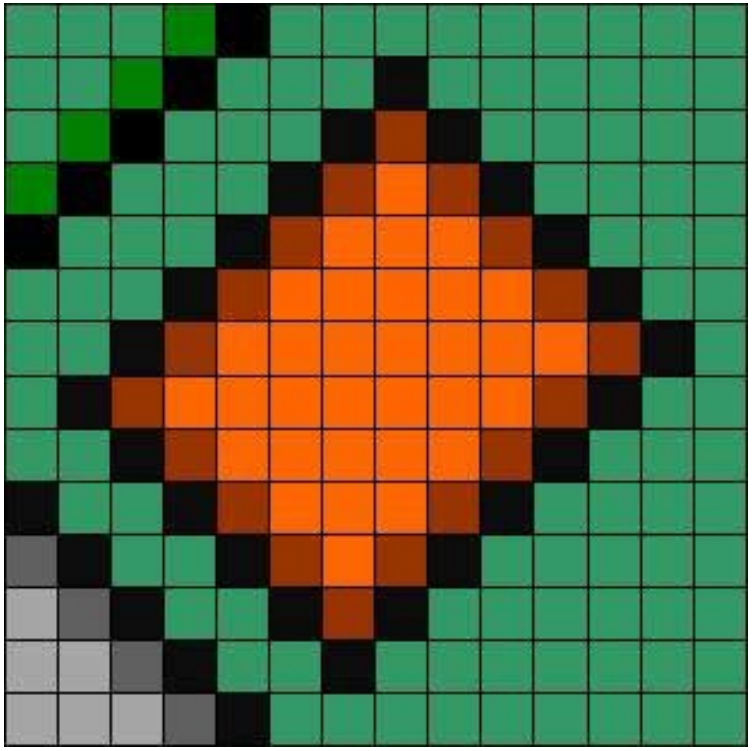


3D height data changing water levels-danger areas

Derived Mapping: Data from images

2	2	2	9	1	2	2	2	2	2	2	2	2	2
2	2	9	1	2	2	2	1	2	2	2	2	2	2
2	9	1	2	2	2	1	8	1	2	2	2	2	2
9	1	2	2	2	1	8	3	8	1	2	2	2	2
1	2	2	2	1	8	3	3	3	8	1	2	2	2
2	2	2	1	8	3	3	3	3	3	8	1	2	2
2	2	1	8	3	3	3	3	3	3	3	8	1	2
2	1	8	3	3	3	3	3	3	3	8	1	2	2
2	2	1	8	3	3	3	3	3	8	1	2	2	2
1	2	2	1	8	3	3	3	8	1	2	2	2	2
4	1	2	2	1	8	3	8	1	2	2	2	2	2
7	4	1	2	2	1	8	1	2	2	2	2	2	2
7	7	4	1	2	2	1	2	2	2	2	2	2	2
7	7	7	4	1	2	2	2	2	2	2	2	2	2

Numerical Values



Color Representation

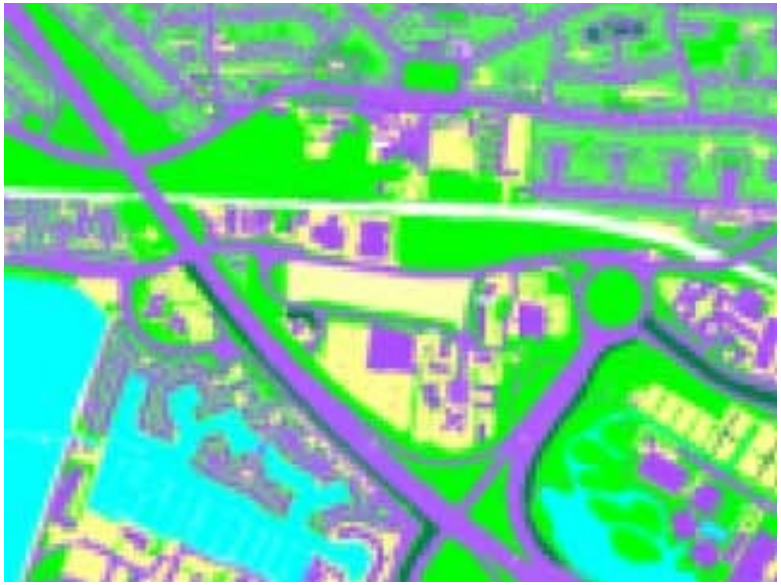
Derived Mapping: Data from images

Aerial Imagery

Digitized Buildings

Derived Mapping: Data from images

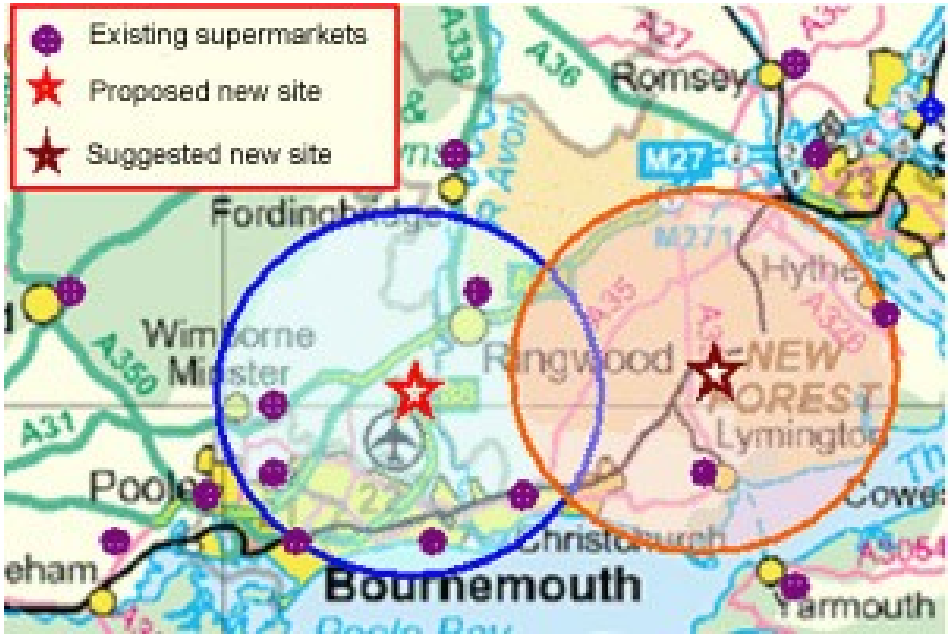
Satellite Imagery



Derived Area Map

This is a goal: Not there yet!

Retail: Site Selection



Existing stores, 15 min. drive time, demograhics

Airport Noise Pollution

noise complaints mapped by address location