

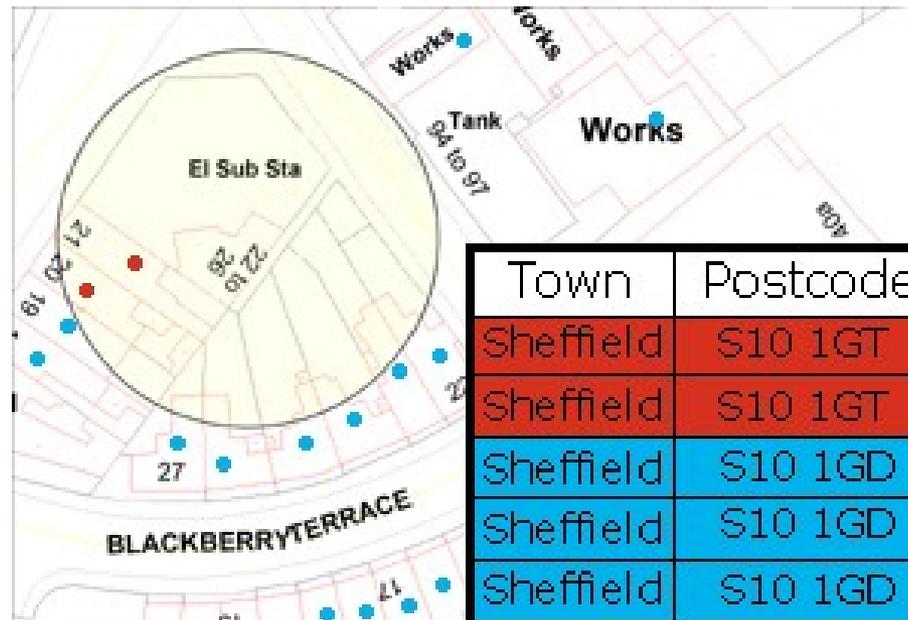
GIS Analýza

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

1. Průzkum

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

Retrieval: Selective Search



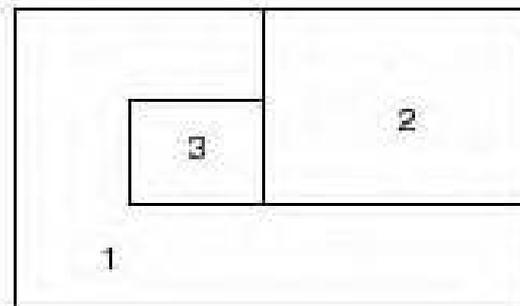
addresses selected because they fall within circle

Reclassification (Vector)

Dissolving to
aggregate
polygons

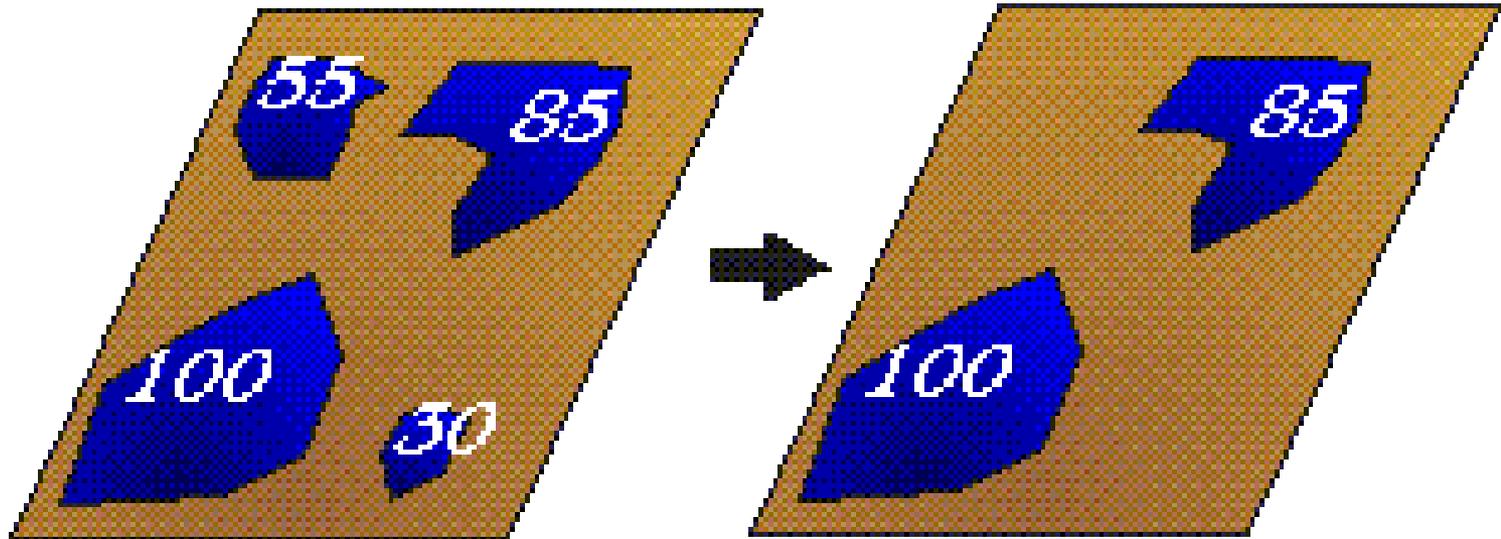
1	1	2	2	2
1	3	2	2	2
1		1		

Input layer



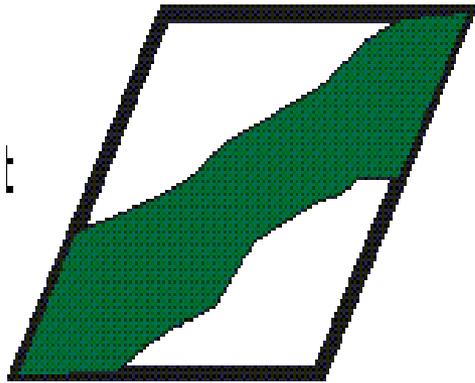
Output layer

Reclassify by Area Size

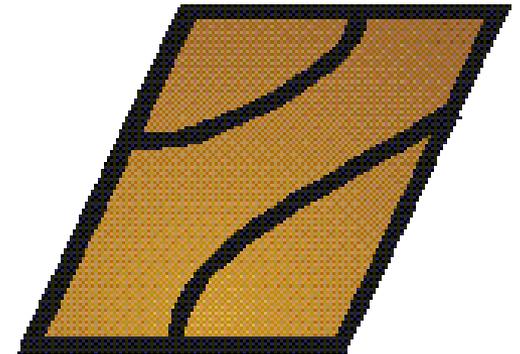
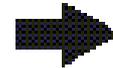
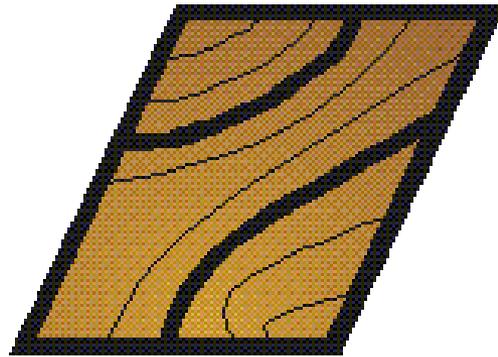


Work with areas > 80 acres

Reclassify values



Work with elevations
between 20 and 40 feet



Change feet to meters

Vector Distance Operation: Buffers & Setbacks

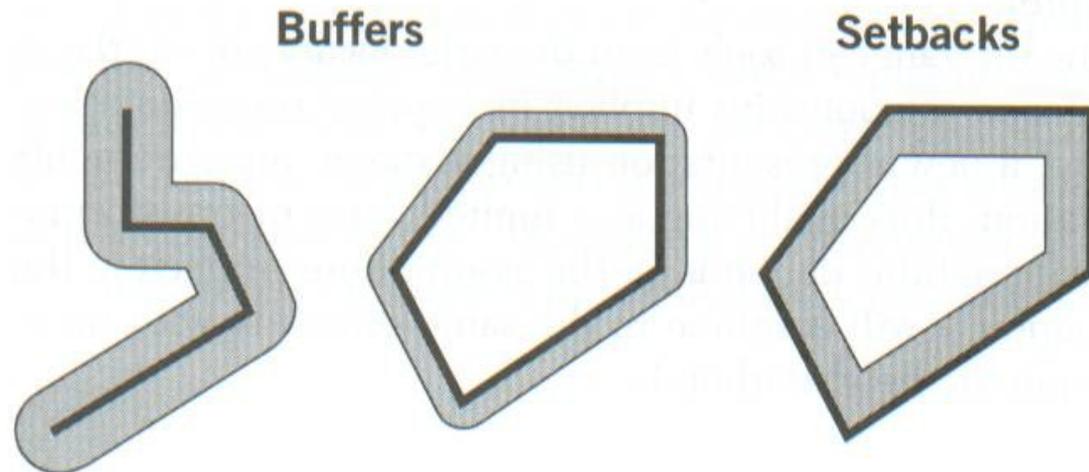


Diagram of simple buffers and a setback.

NOTE: buffers go outward from lines or areas; setbacks run inside of areas (not lines).

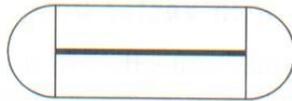
Buffer Creation: Illustrated

A Simple Buffer

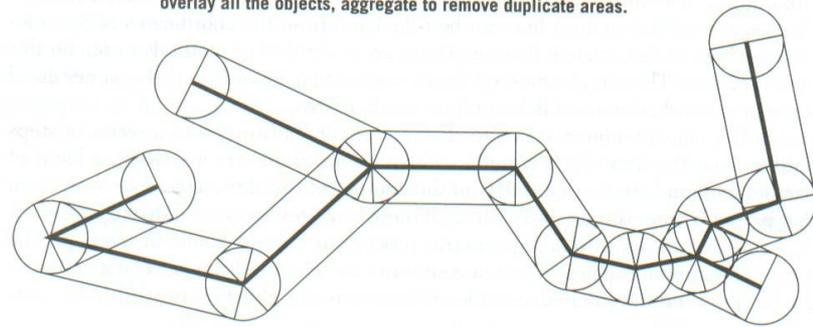


Method of construction:

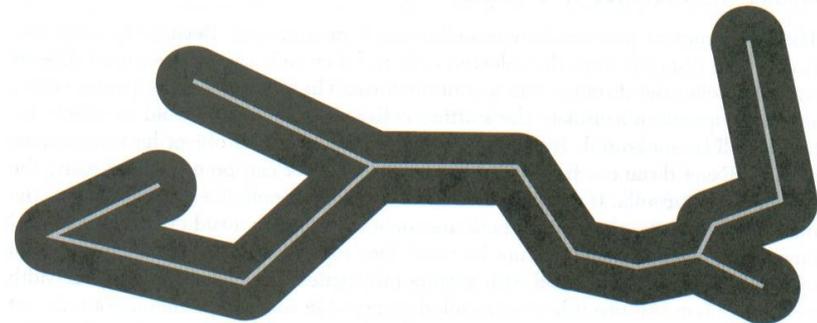
Each segment throws out a zone around it (two half circles and one rectangle.)



To generate a buffer, construct these objects around each segment, overlay all the objects, aggregate to remove duplicate areas.



Result of overlay



Buffer produced by aggregating all the objects.

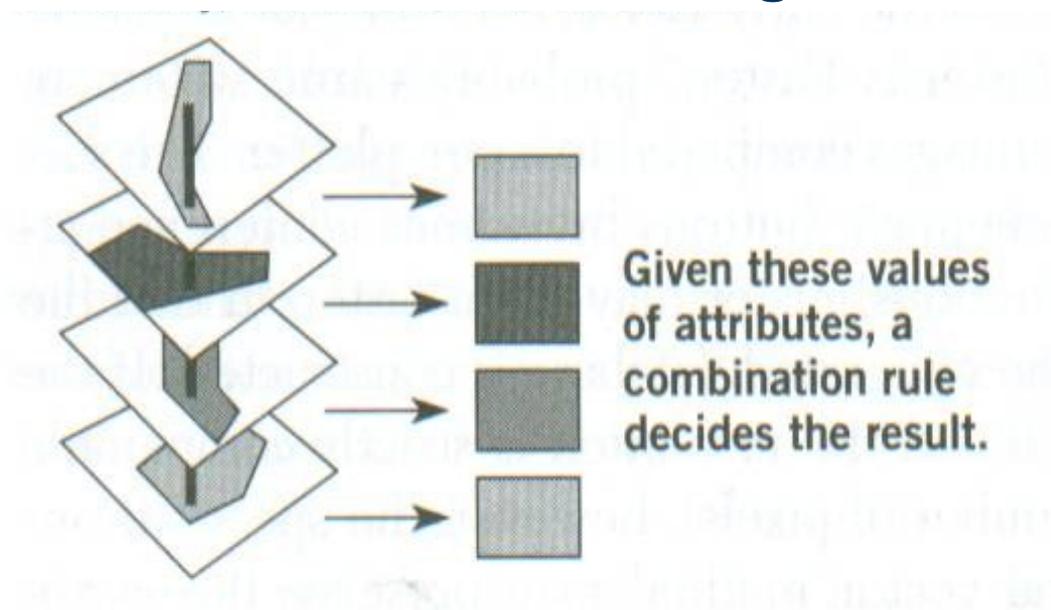
Figure 6-3 Construction method for buffers in a vector representation.

2. Overlay Functions

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

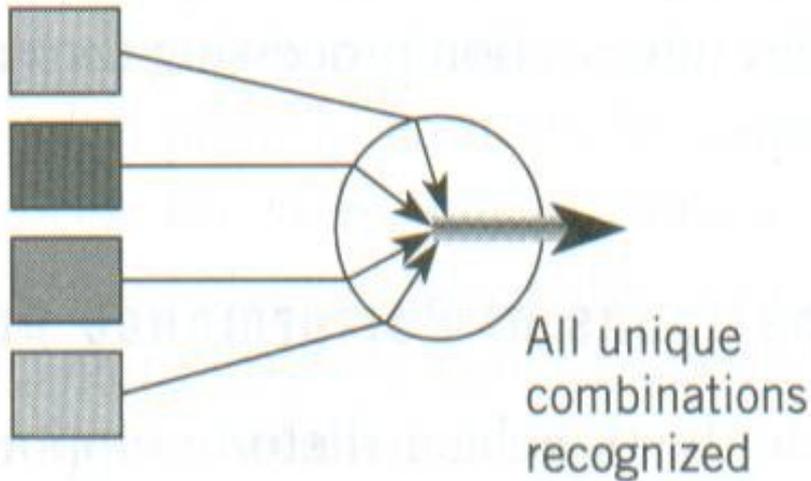
Overlay: Combining Attributes

Select attributes of interest for a given location

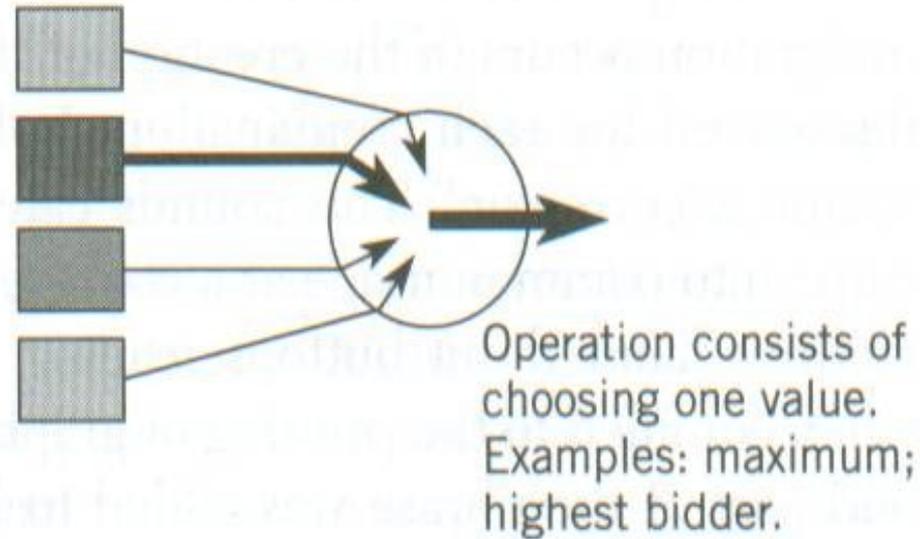


(Raster & vector methods do this differently, but the results are similar)

Overlay: 4 Basic Rules

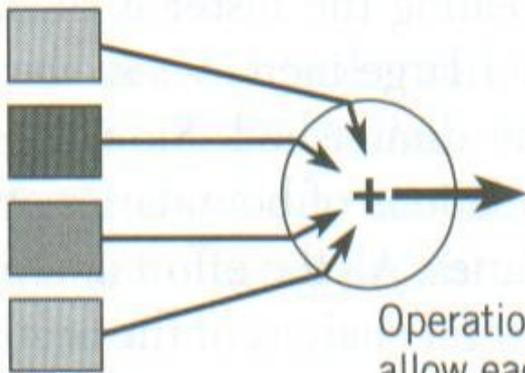


#1 Enumeration Rule: Each Attribute preserved in output



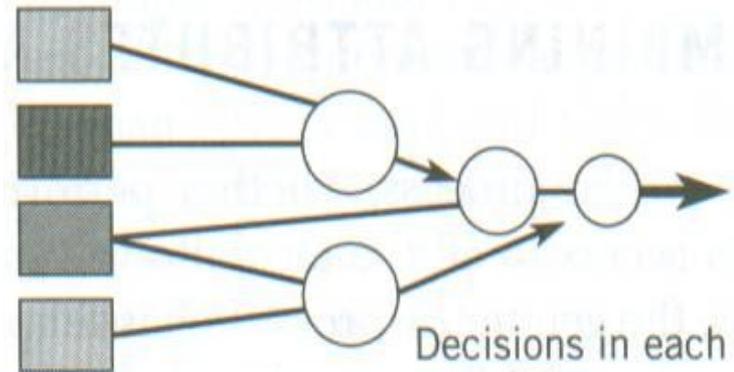
#2 Dominance Rule: One value wins

Overlay: 4 Basic Rules



Operations like addition allow each source to contribute to result.

#3 Contributory Rule: each attribute value contributes to result



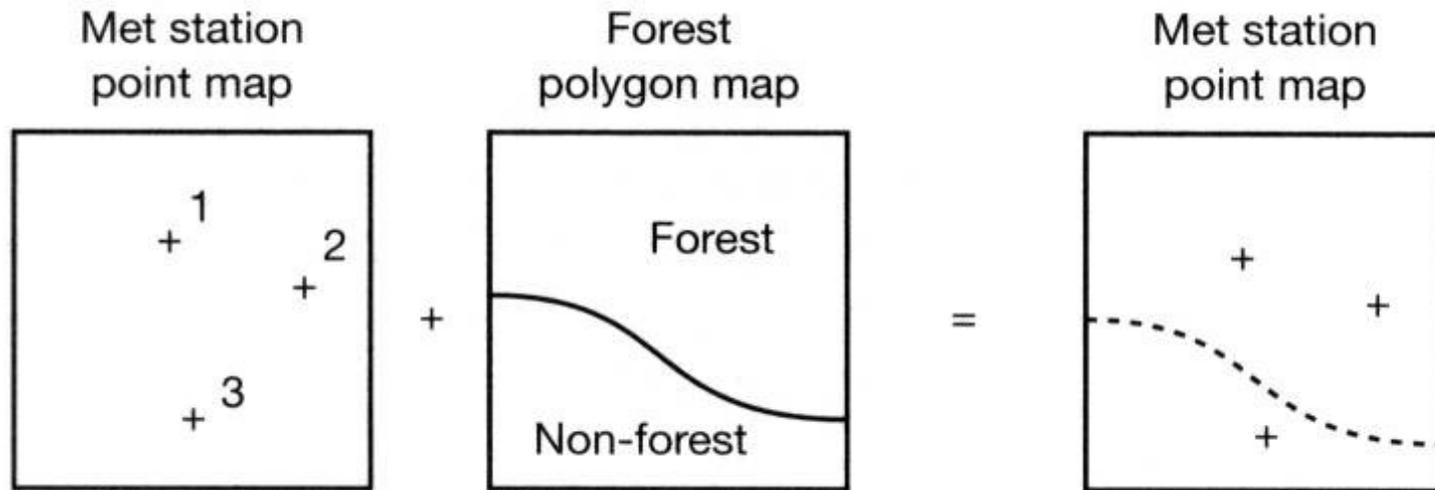
Decisions in each step may differ.

#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

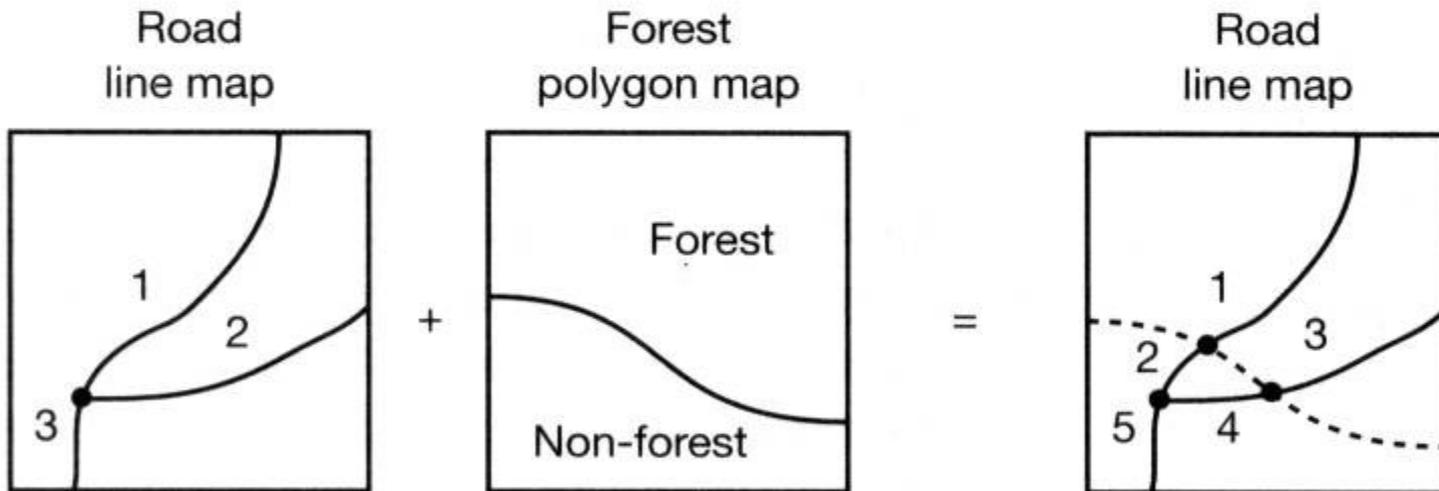


point-in-polygon example

Met station
attribute table

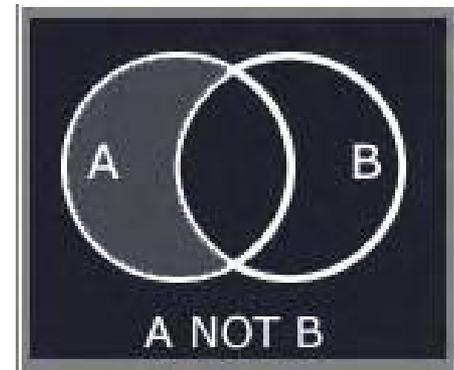
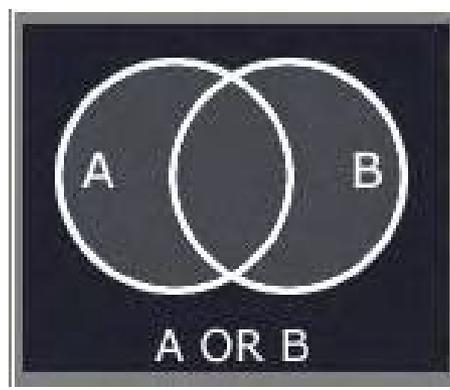
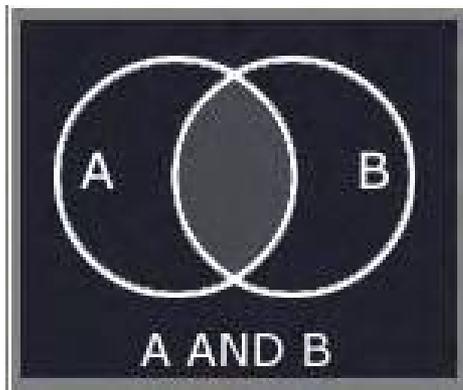
Point ID	Land use
1	Forest
2	Forest
3	Non-forest

Vector based overlay



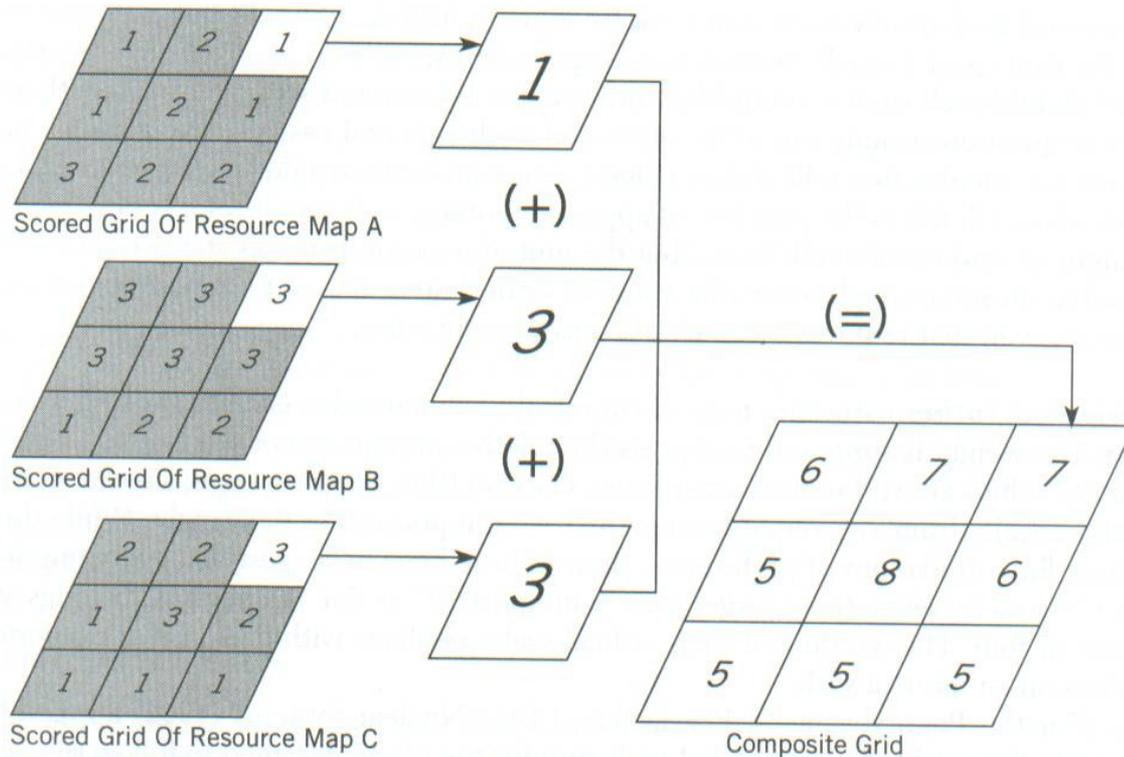
line-in-polygon example

Vector based overlay

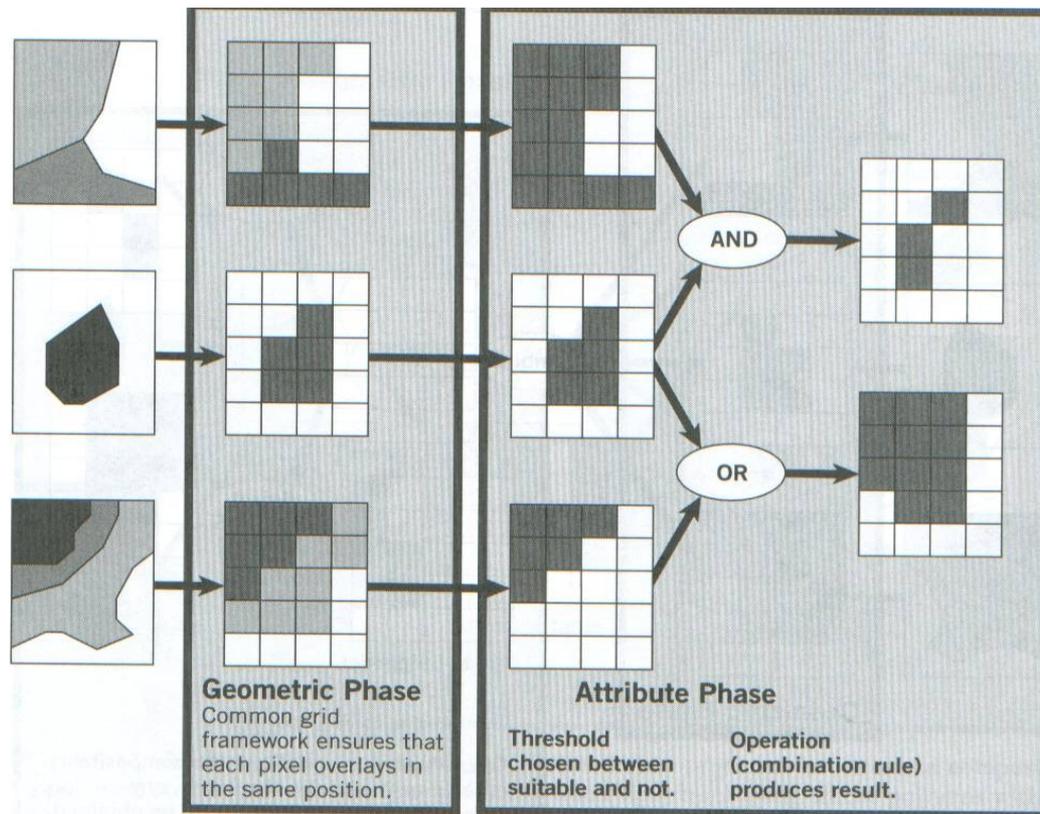


polygon-in-polygon example

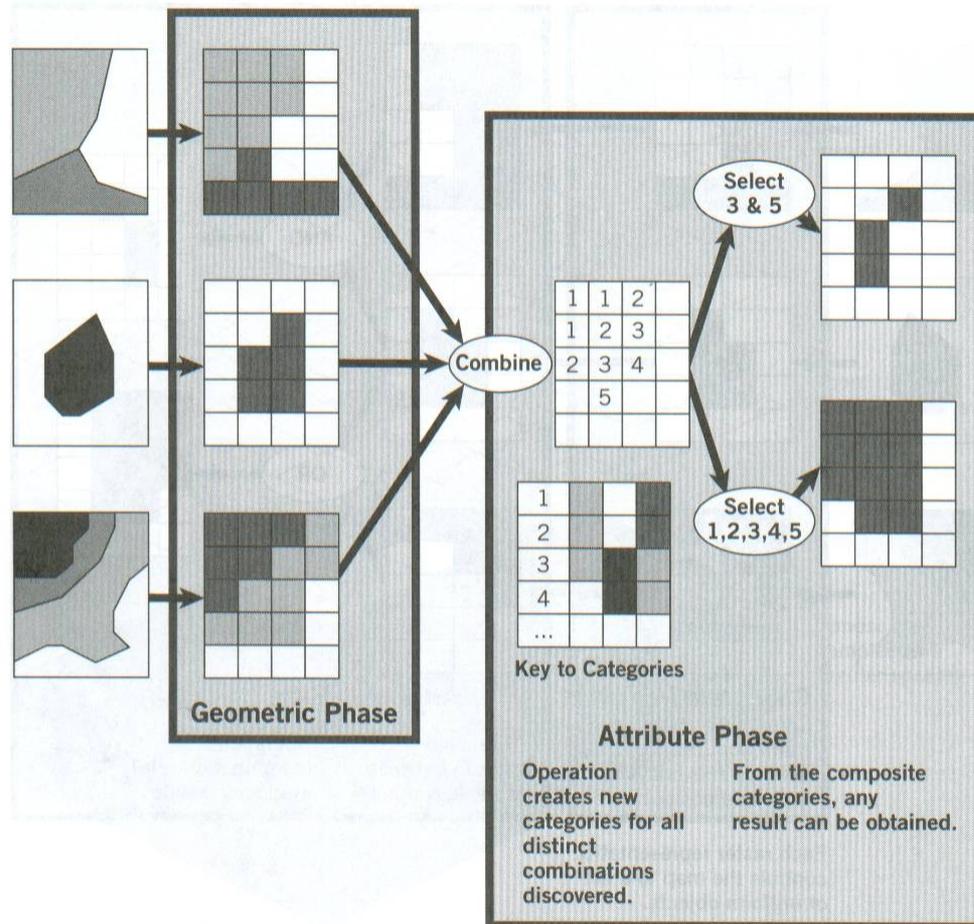
Raster Based Overlay: Simple Addition



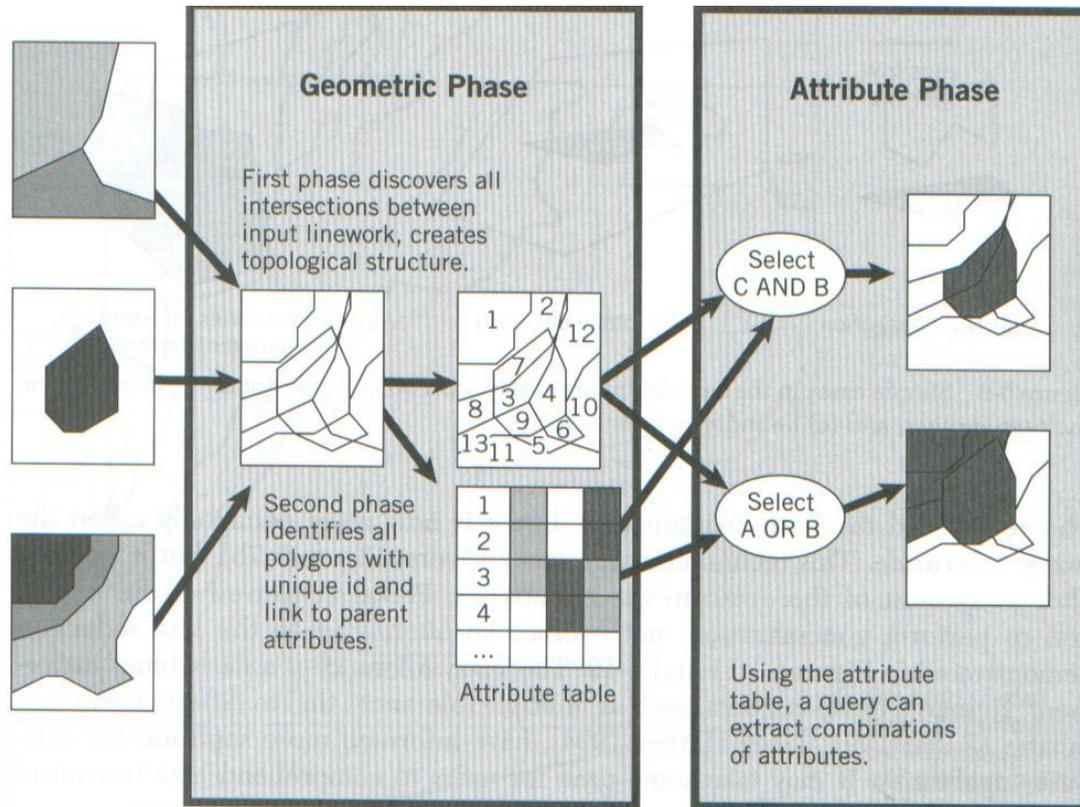
Raster Overlay: Boolean Combine



Raster Overlay: Composite Combine



Vector Overlay: Composite Structure



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

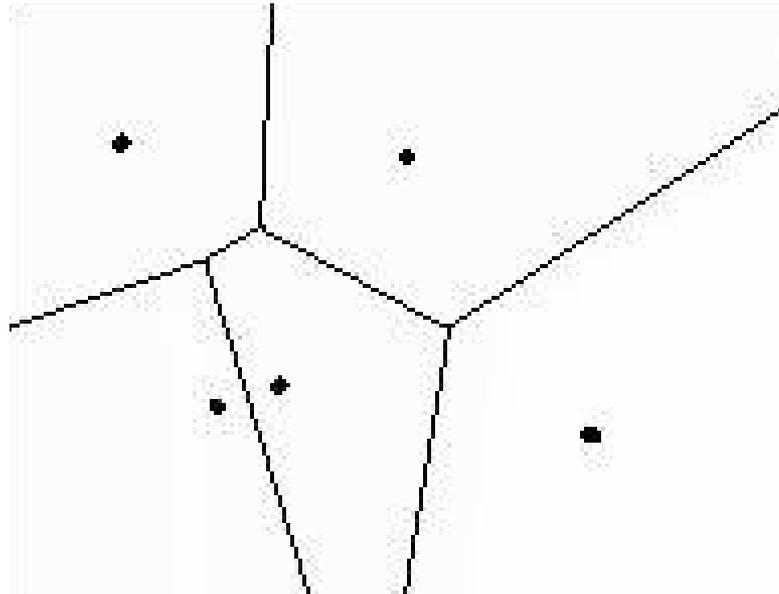
3. Neighborhood Function (cont)

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

3. Neighborhood Functions (cont)

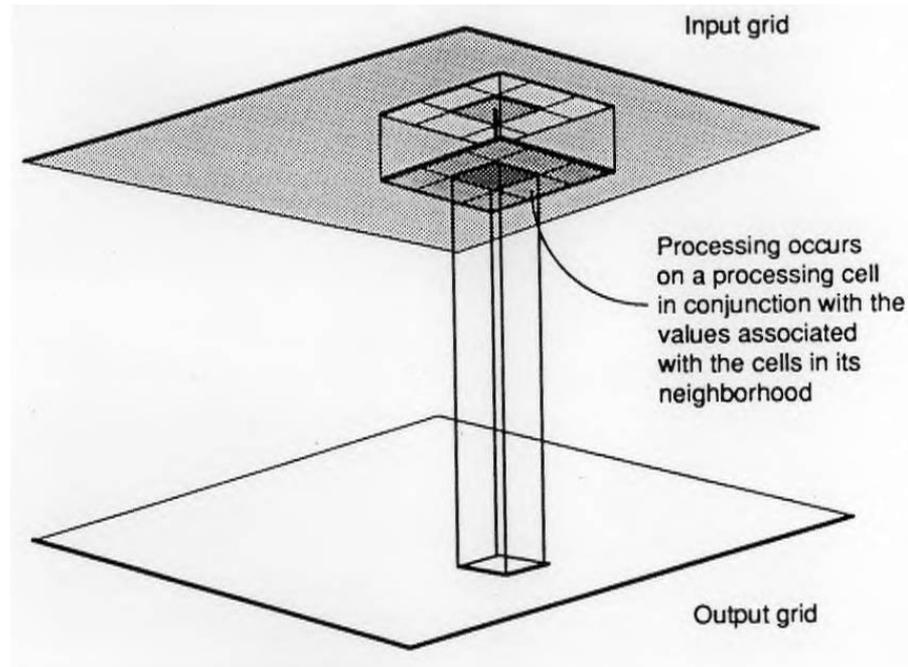
- Thiessen Polygons Operation
 - defines the individual area of influence around a point
 - used to predict values at surrounding points from a single point observation
 - can produce polygons with shapes unrelated to phenomenon being mapped

Example: Neighborhood Function



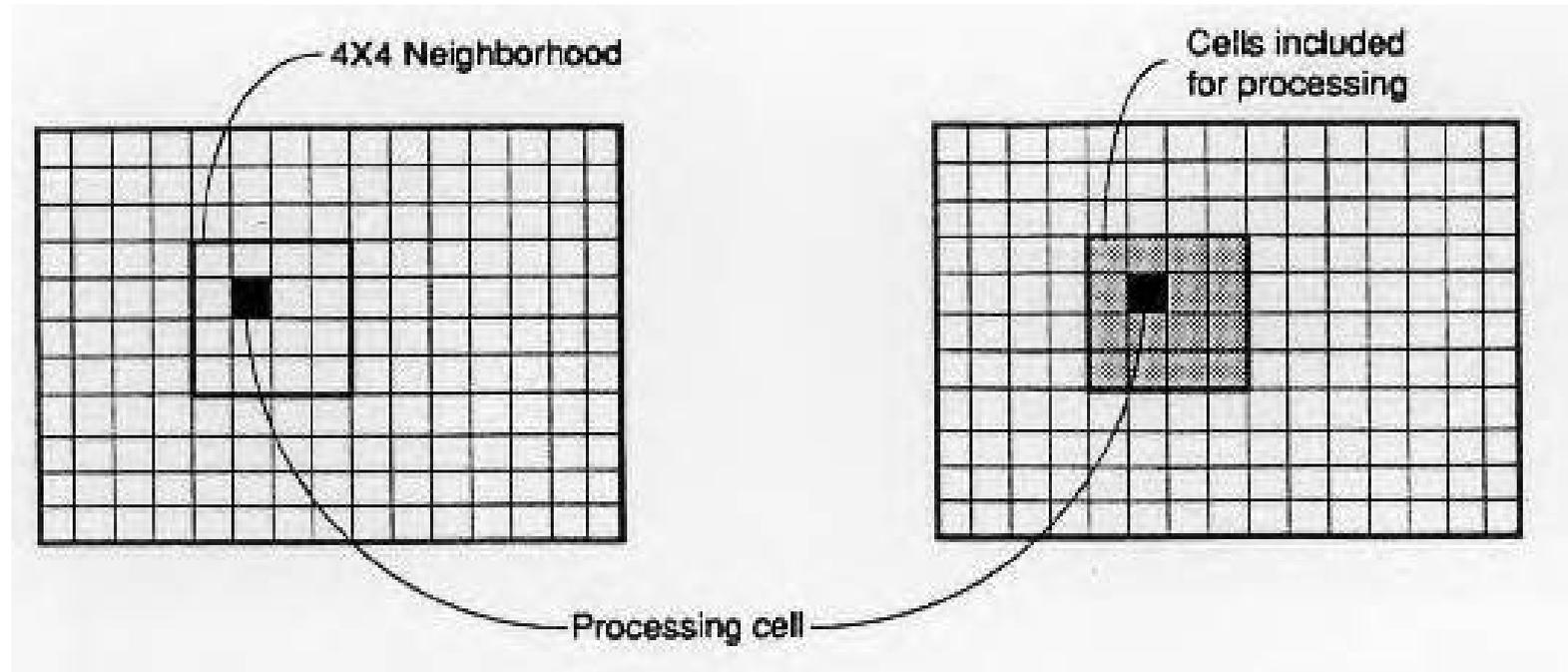
Thiessen Polygons

Neighborhood Functions: Implementing

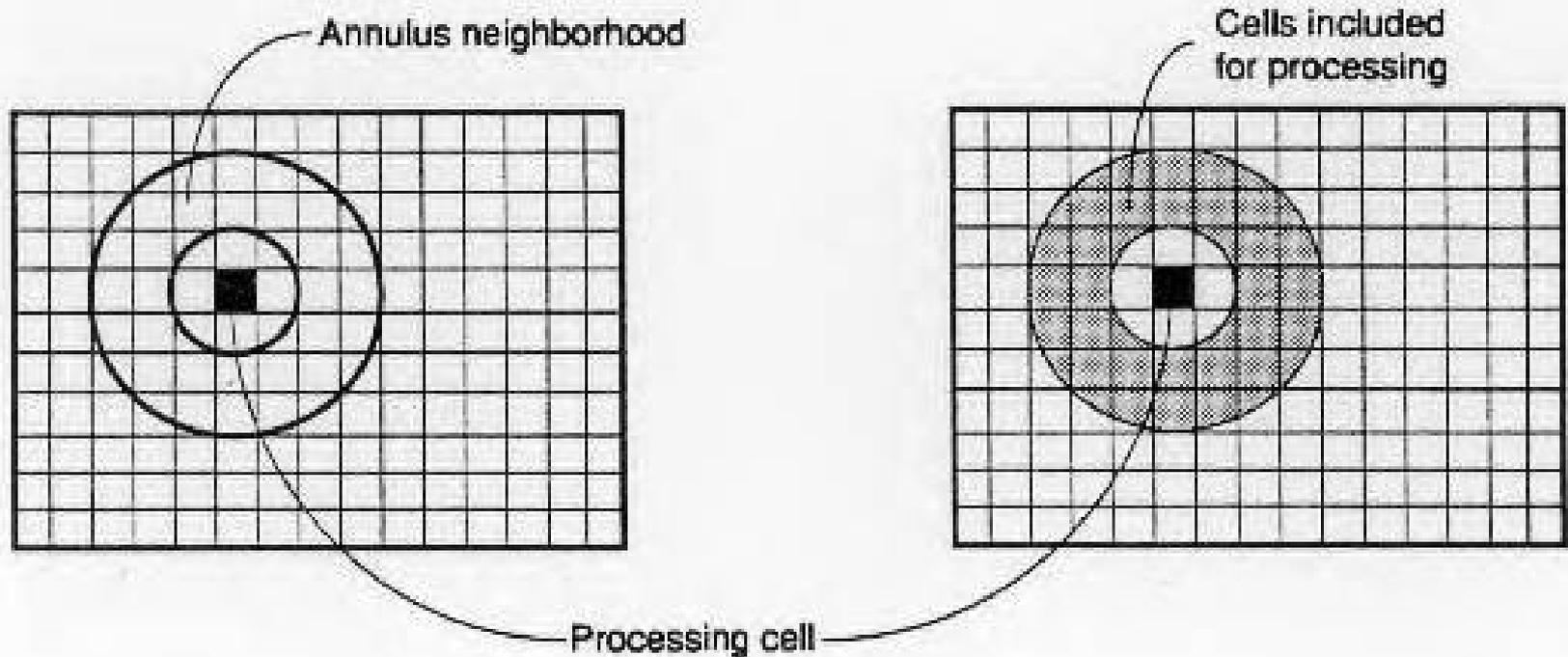


Used for calculating the mean, standard deviation, sum, or range of values within the immediate or extended neighborhoods.

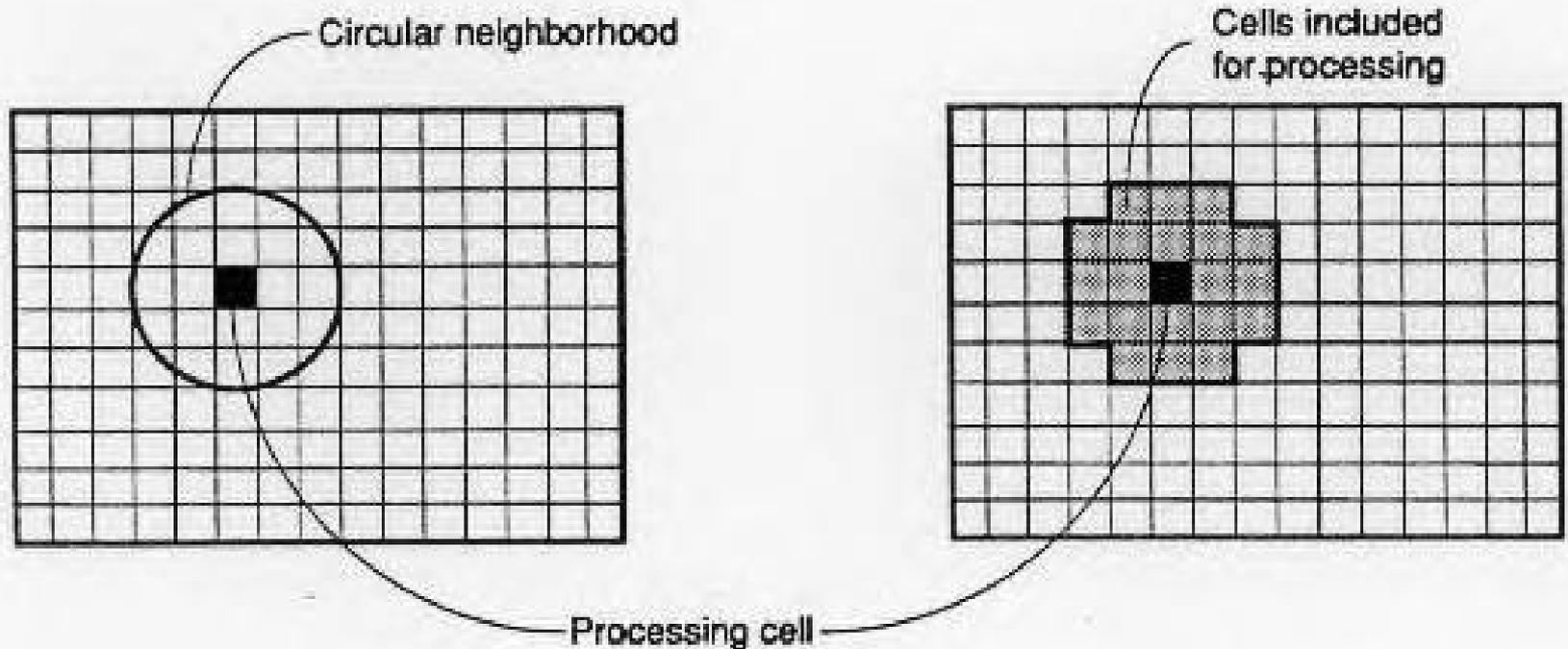
Neighborhood Functions: 4 x 4 Window Processing



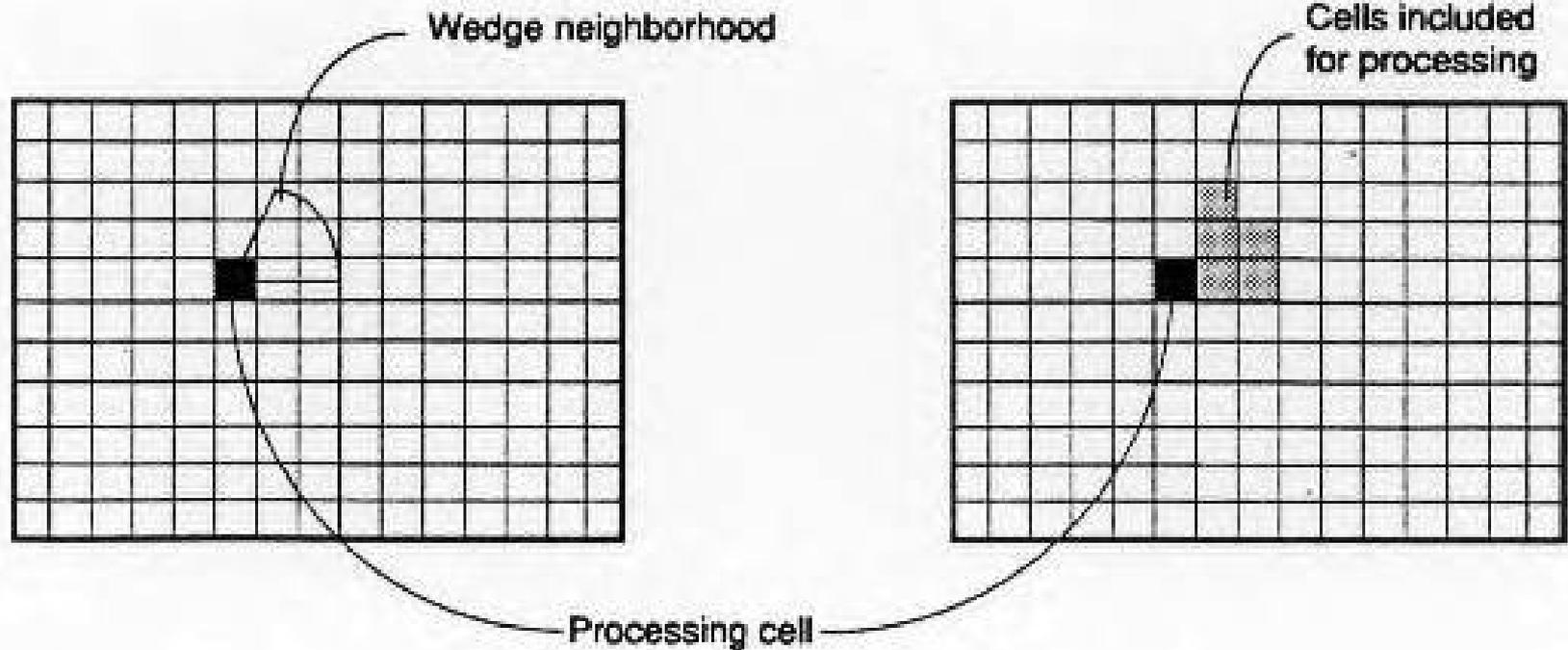
Neighborhood Functions: Annulus Neighborhood Processing



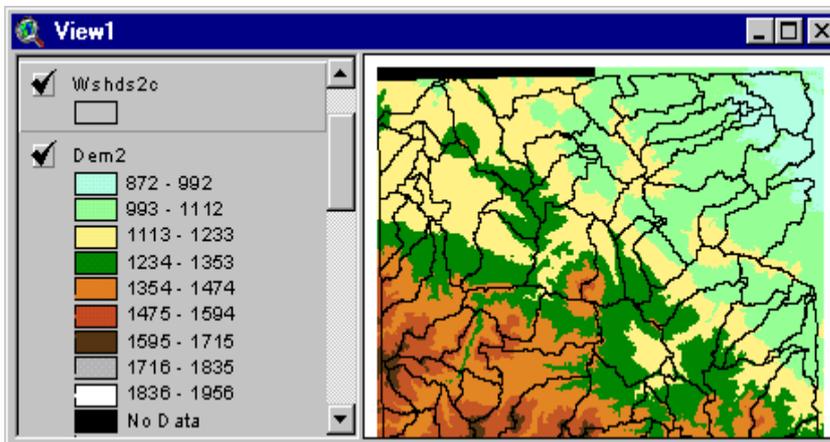
Neighborhood Functions: Circular Neighborhood Processing



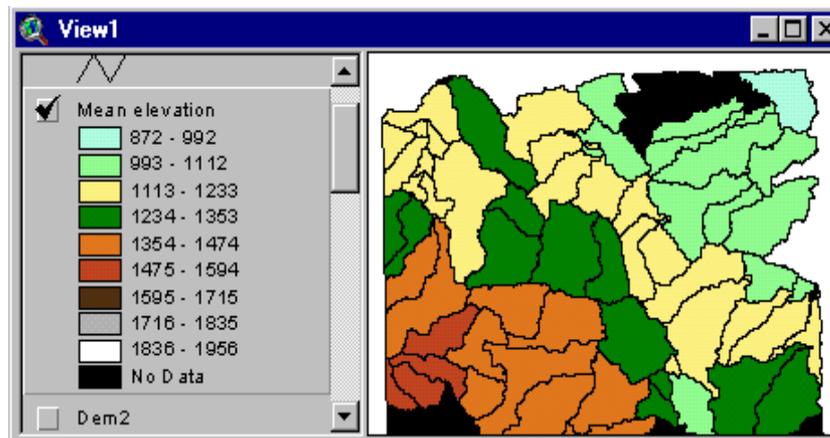
Neighborhood Functions: Wedge Neighborhood Processing



Neighborhood Functions: Example

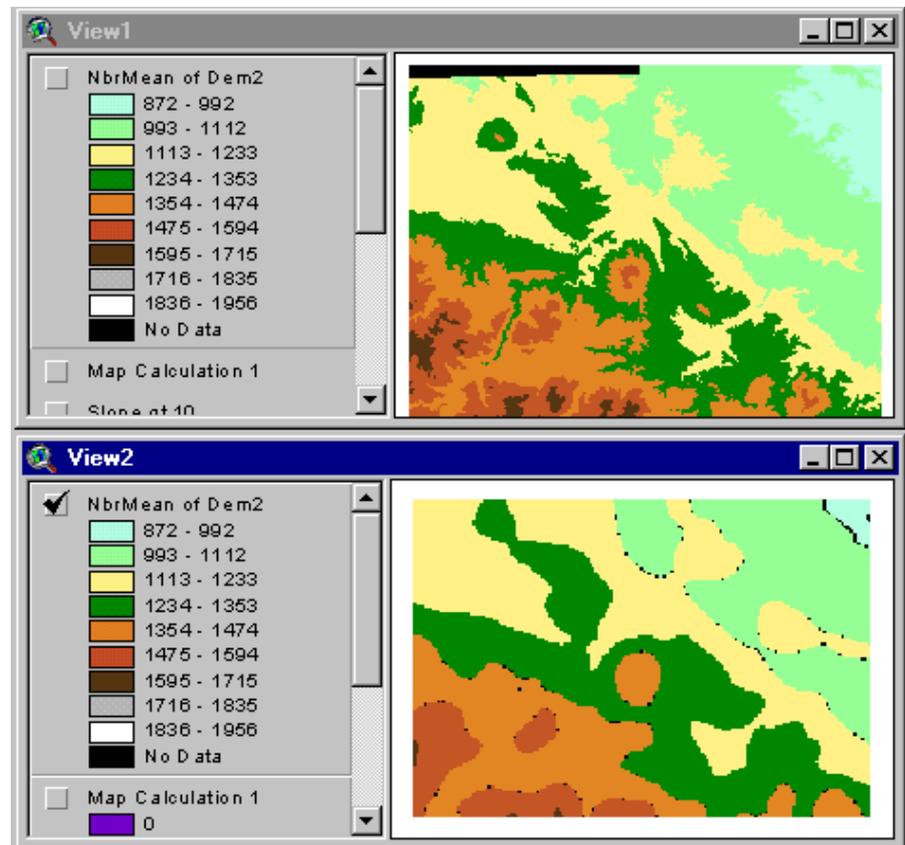
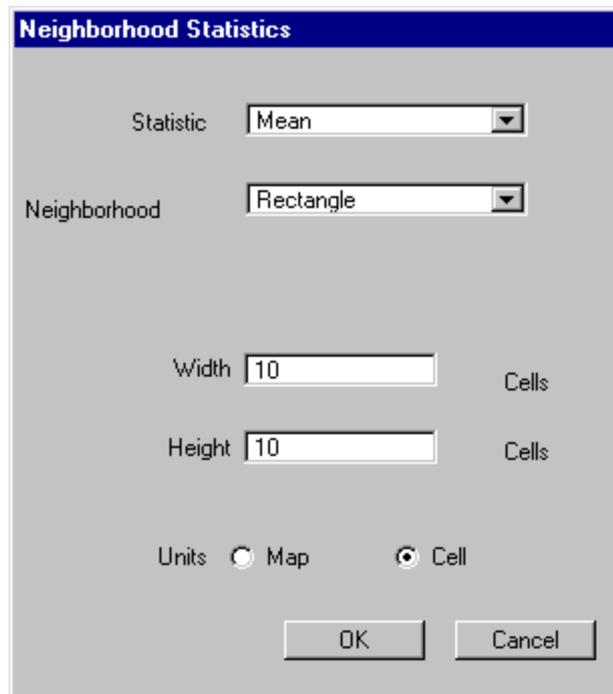


Zone theme: Watersheds
Value theme: Elevation
Statistic type: Mean



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)

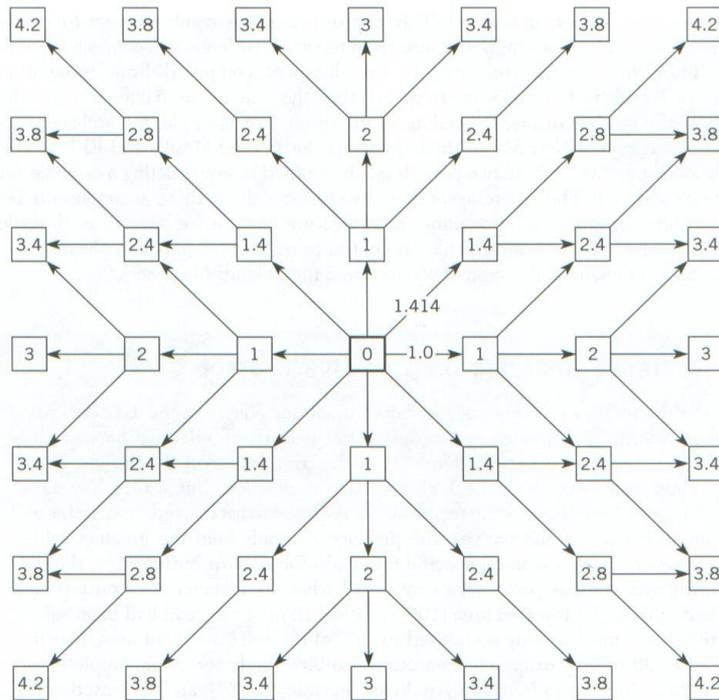
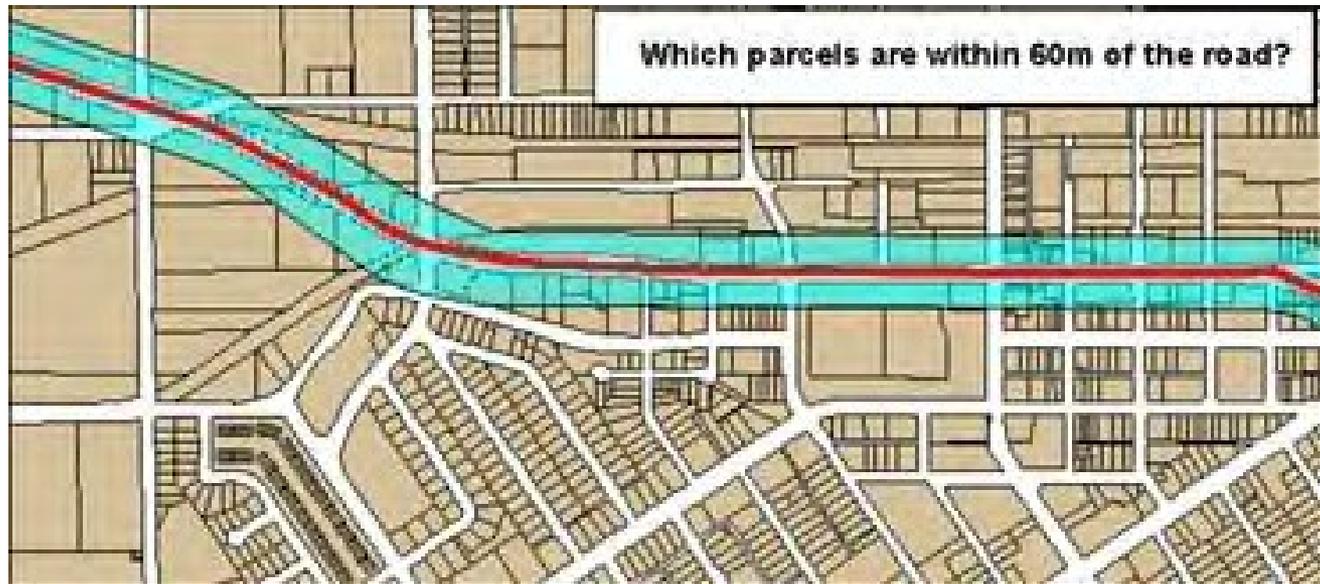


Figure 6-4 Measuring distances by adding distances to cell neighbors.

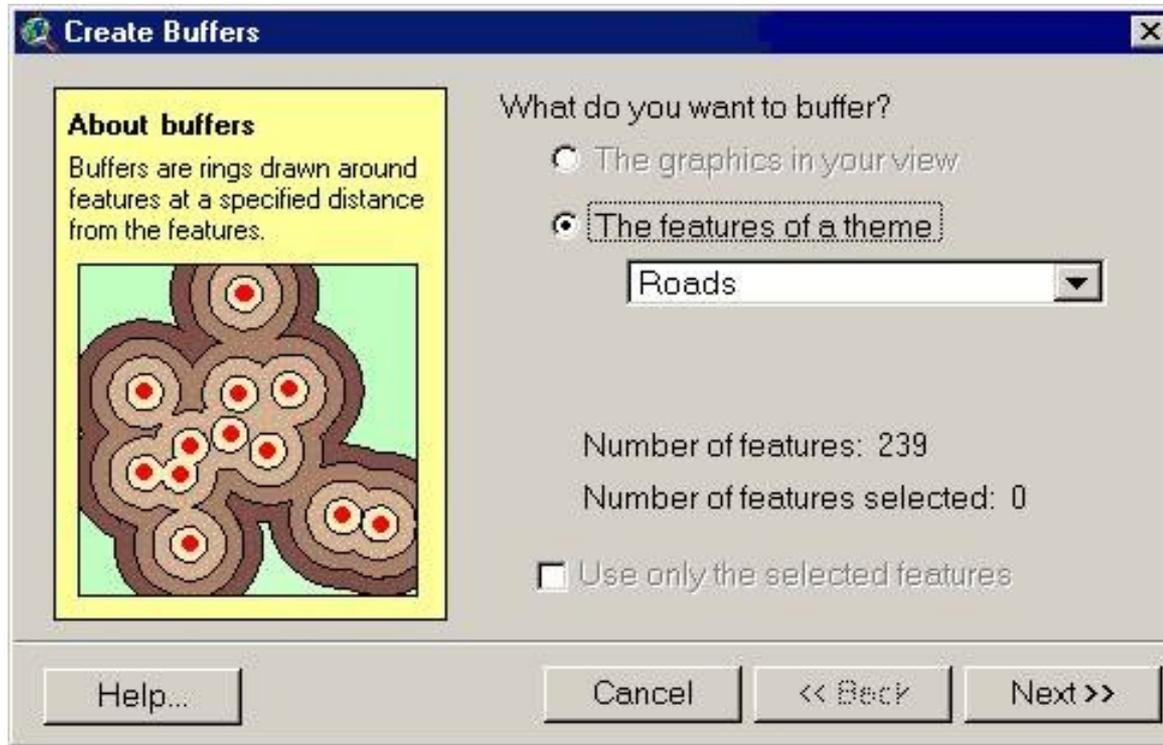
Proximity Operation: Distance From Neighbor

Example: Connectivity (Vector)



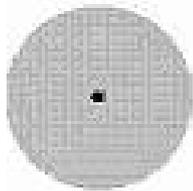
Proximity Operation: Road Buffer

Example: Connectivity (Vector)

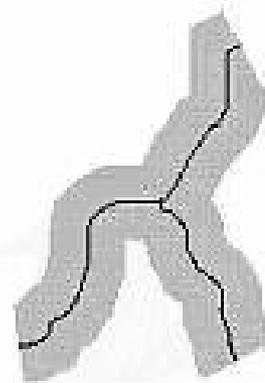
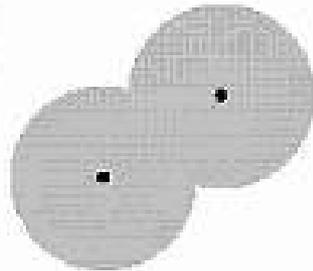


Proximity Operation: Buffer Generation

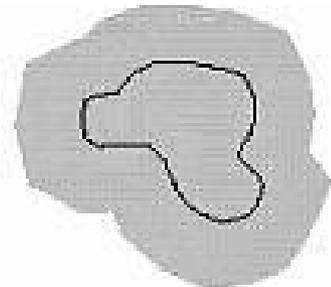
Example: Connectivity (Vector)



Points



Lines



Polygons

Proximity Operation: Buffer Types

Example: Connectivity (Vector)

Proximity Operation - Buffers & Setbacks

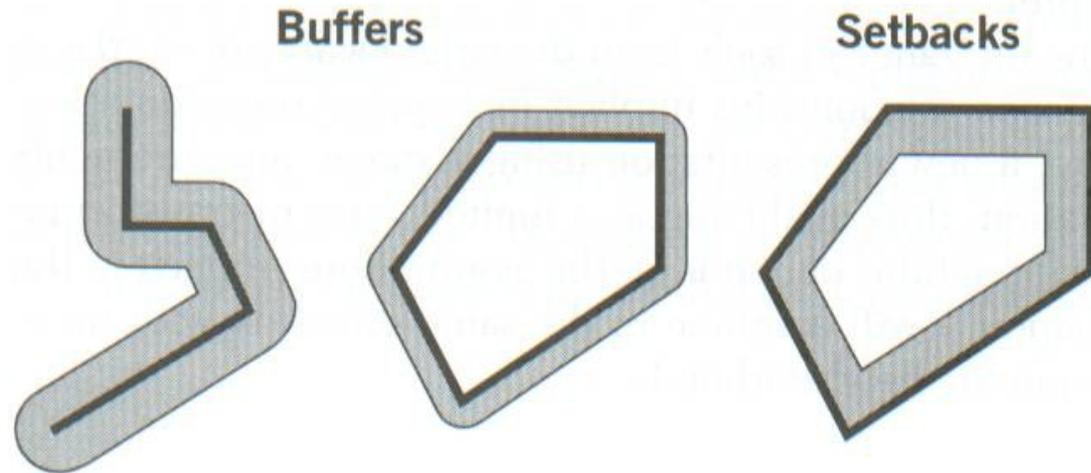


Diagram of simple buffers and a setback.

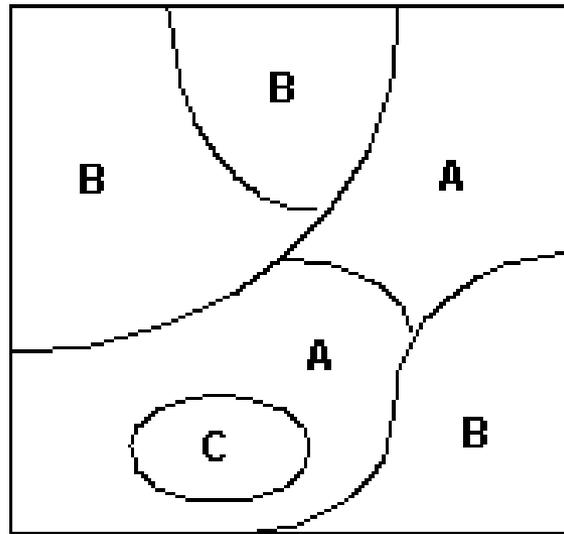
NOTE: buffers go outward from lines or areas; setbacks run inside of areas (not lines).

4. Connectivity Functions (cont).

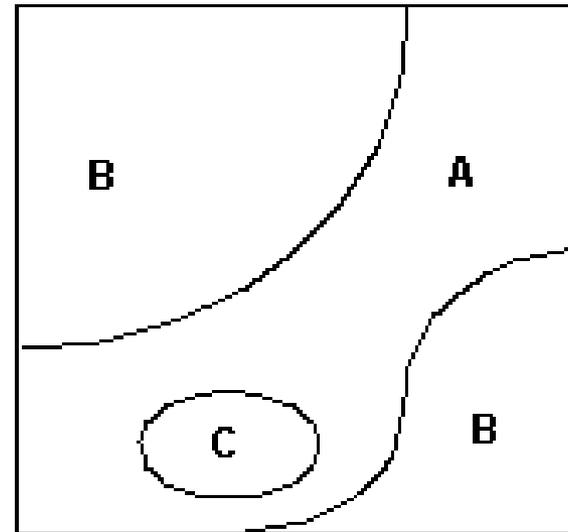
- Contiguity Operation
 - spatial units are connected - defines “unbroken area”
- Contiguity measures:
 - size of neighboring area(s)
 - shortest/longest straight line distance across adjacent area(s)
 - specific shape of neighboring area(s)

Contiguity Functions

Before DISSOLVE



After DISSOLVE

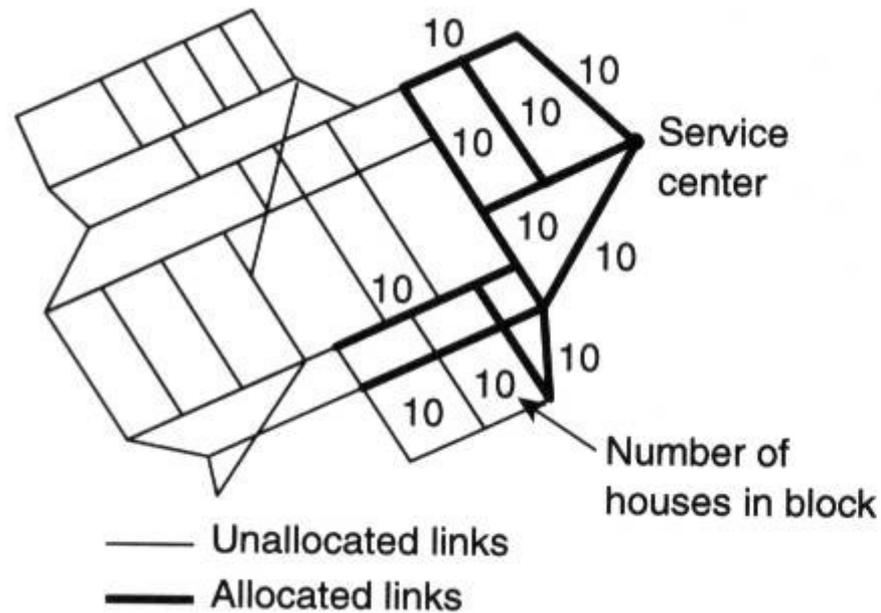


Combines adjacent units together when they share a common attribute

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 – Friction Surface

Friction Surface
Data Layer

2	2	2	1	1	1
2	2	2	1	1	1
2	2	2	1	1	1
2	2	2	1	1	1
2	2	2	1	1	1

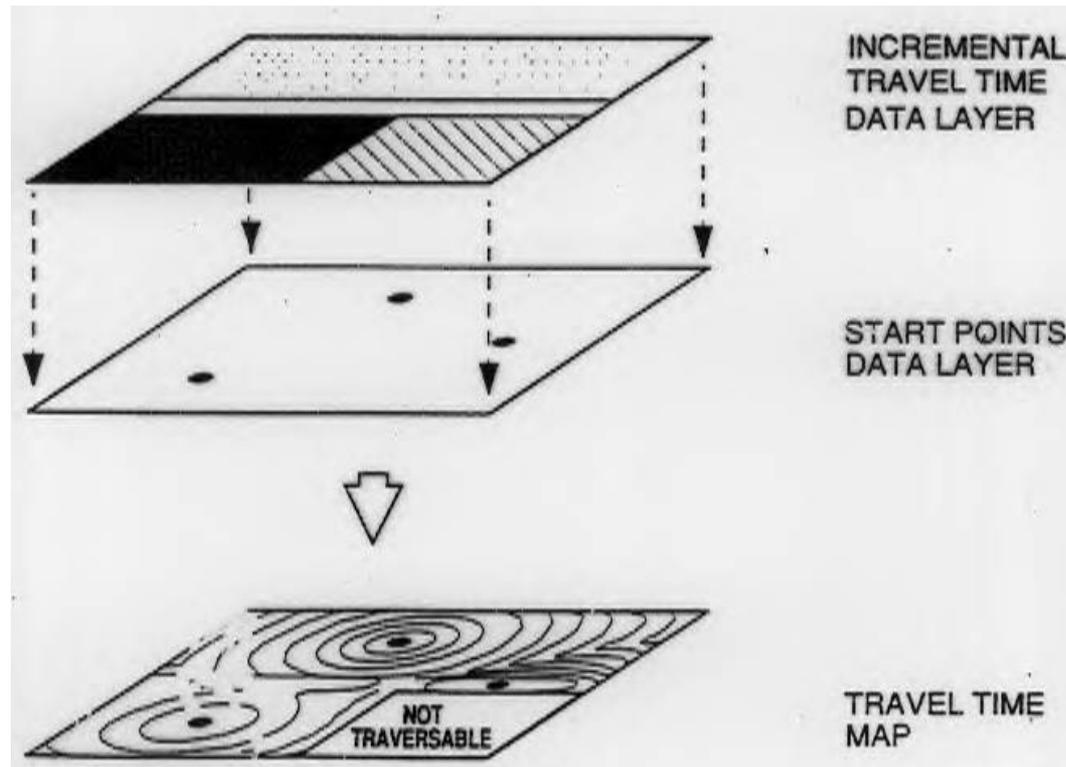
Start Point
Data Layer

⊕	.
---	---

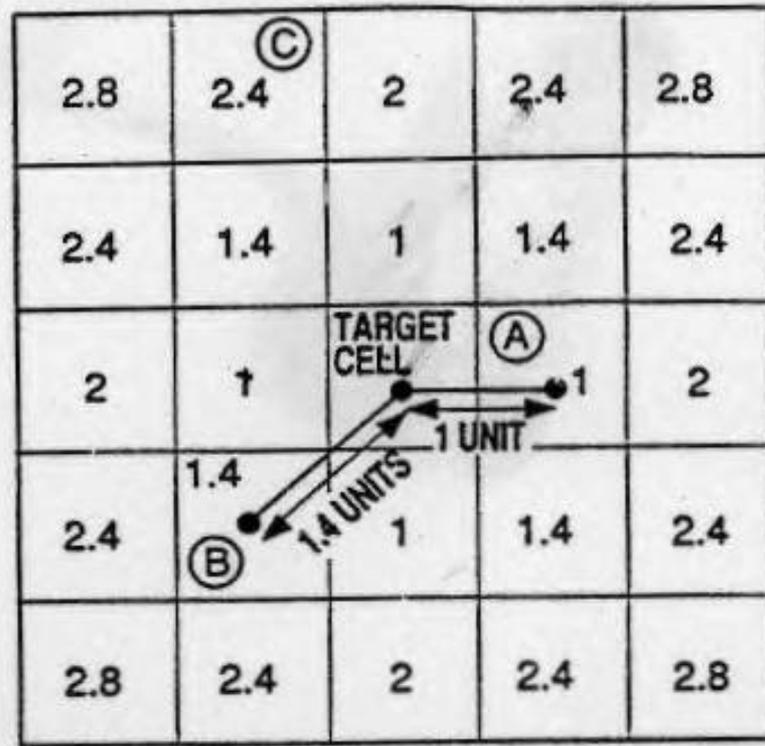
4.8	4	4.8	4.2	4.8	5.8
2.8	2	2.8	3.4	4.4	5.4
2	⊕	2	3	4	5
2.8	2	2.8	3.4	4.4	5.4
4.8	4	4.8	4.2	4.8	5.8

Cumulative
Travel Time
Data Layer

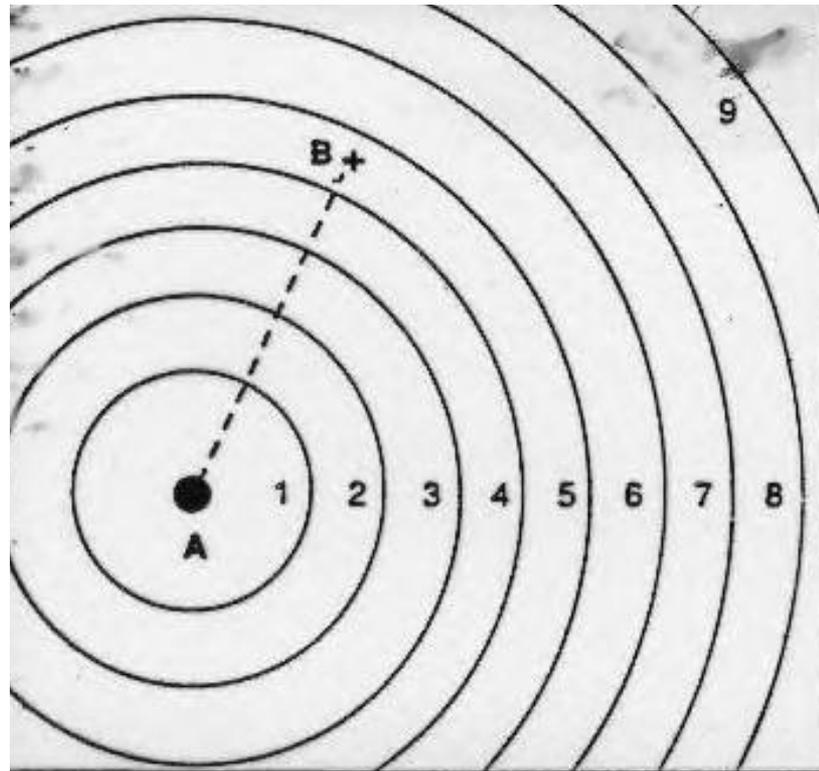
Spread Functions: Travel Time – Map



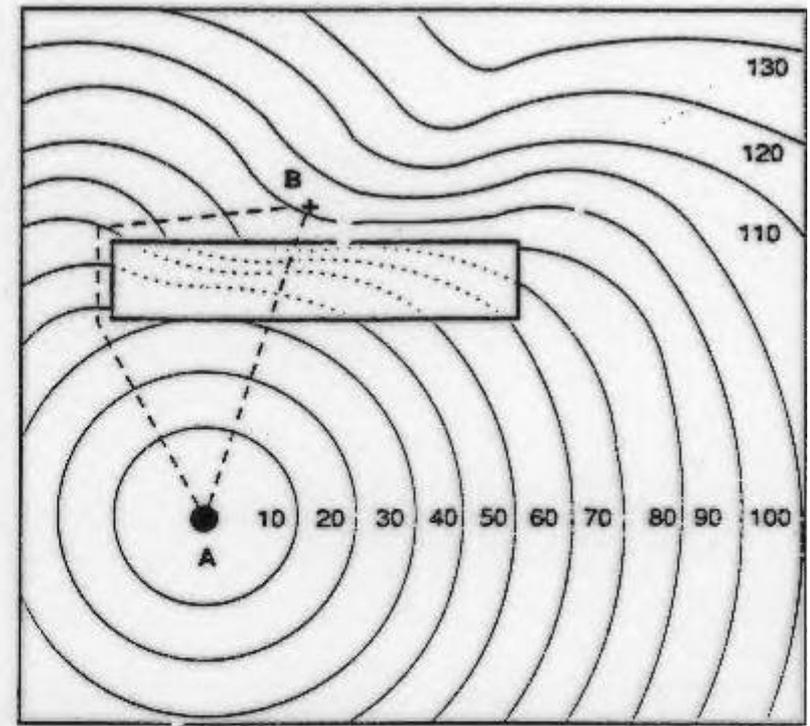
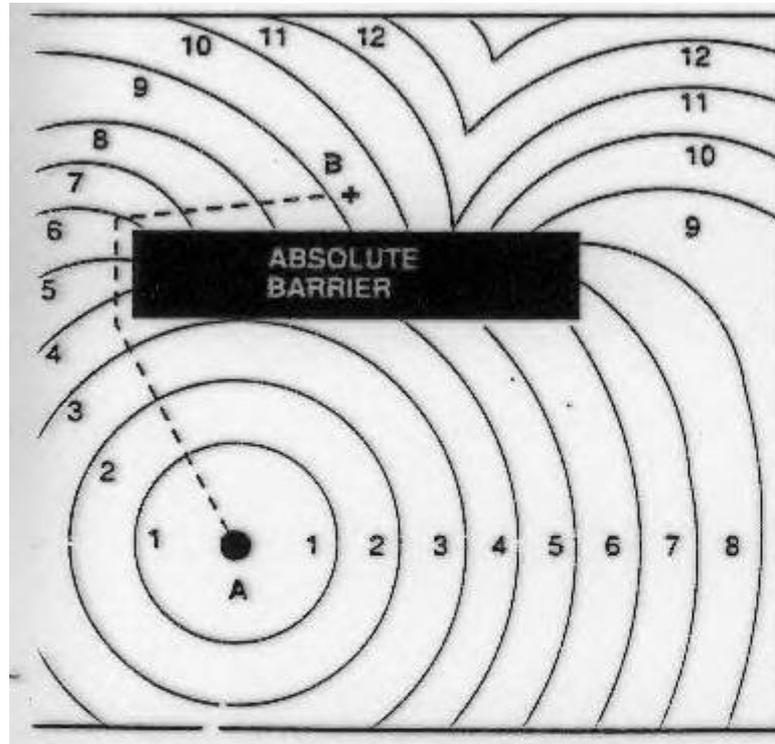
Spread Function: Calculation of Distance



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

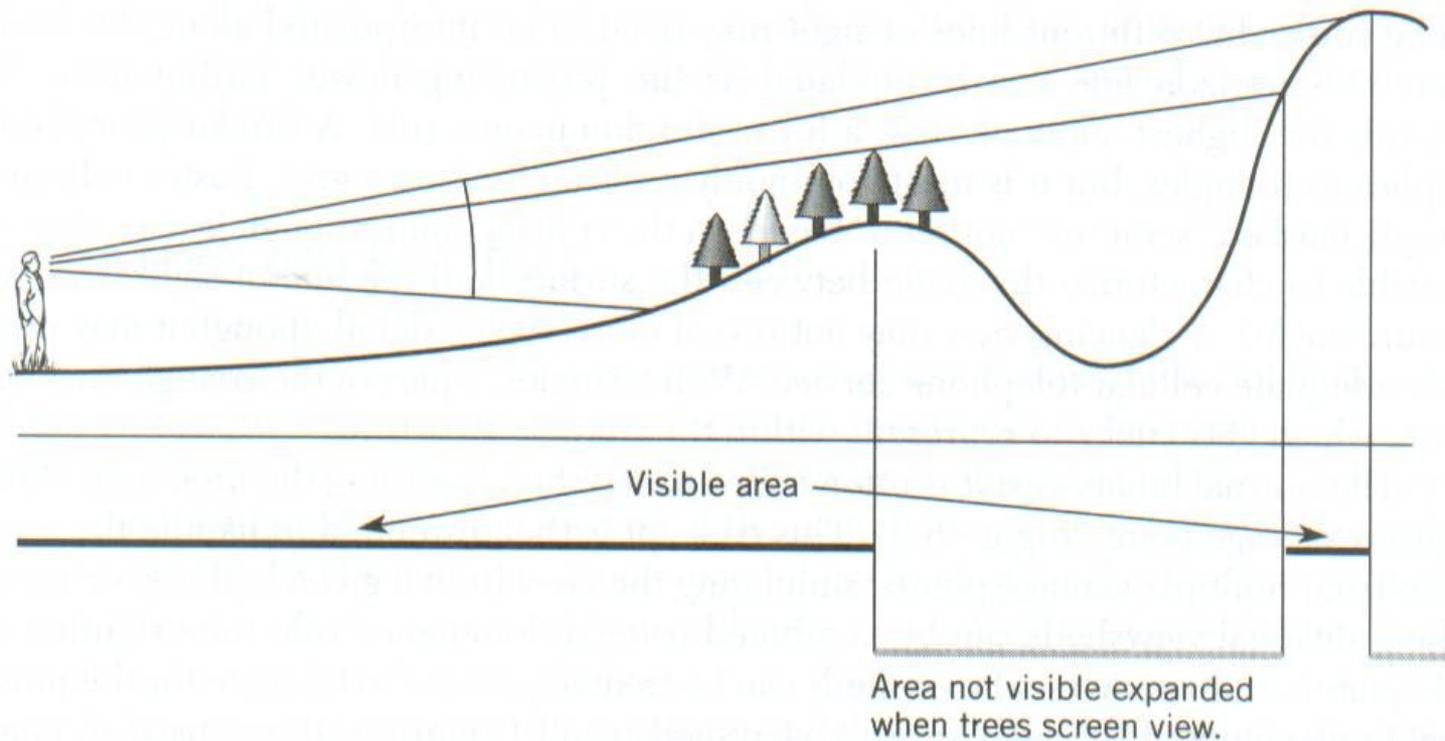
4. Connectivity Functions (cont).

- 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)?

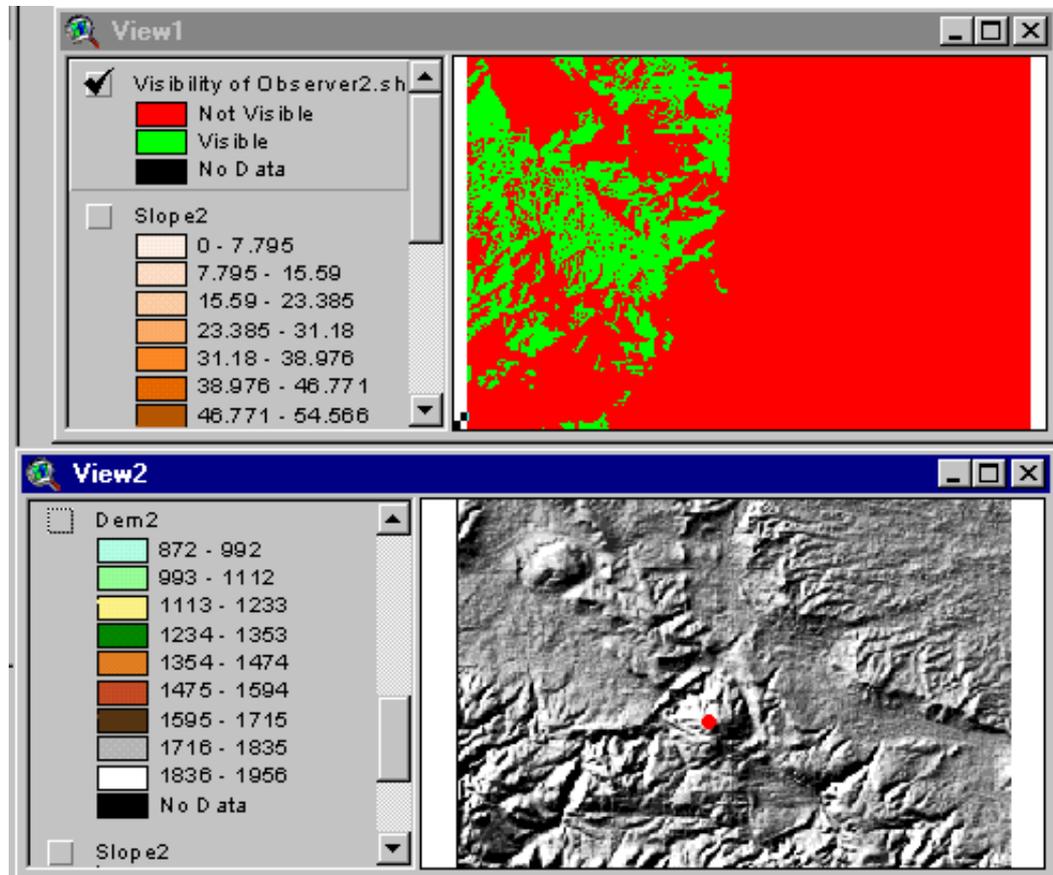
4. Connectivity Functions (cont).

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

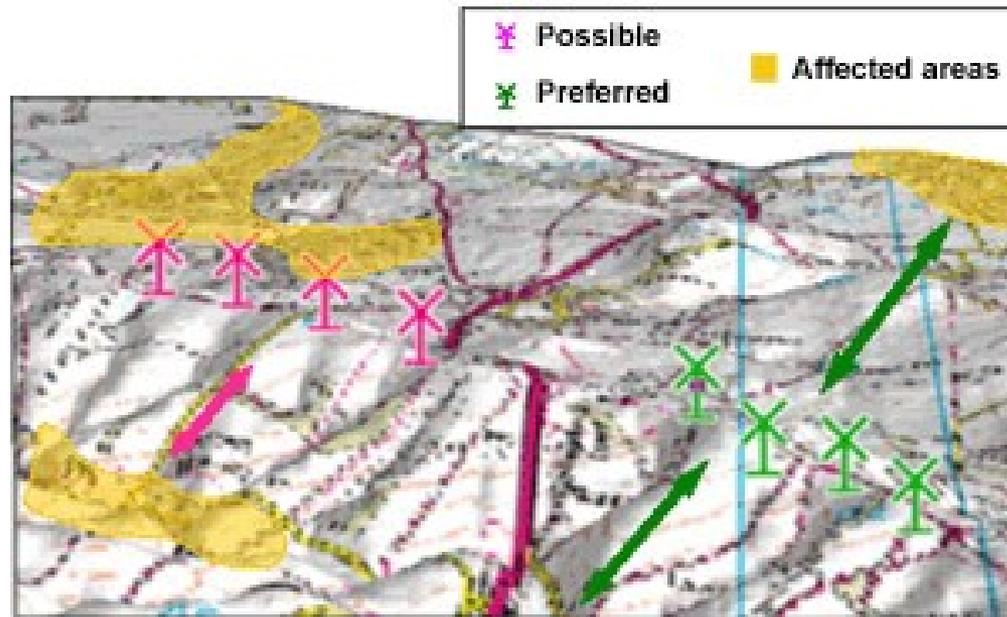
Connectivity Function Example: Viewshed Analysis



Viewshed aka Intervisibility



Environmental Impact Analysis



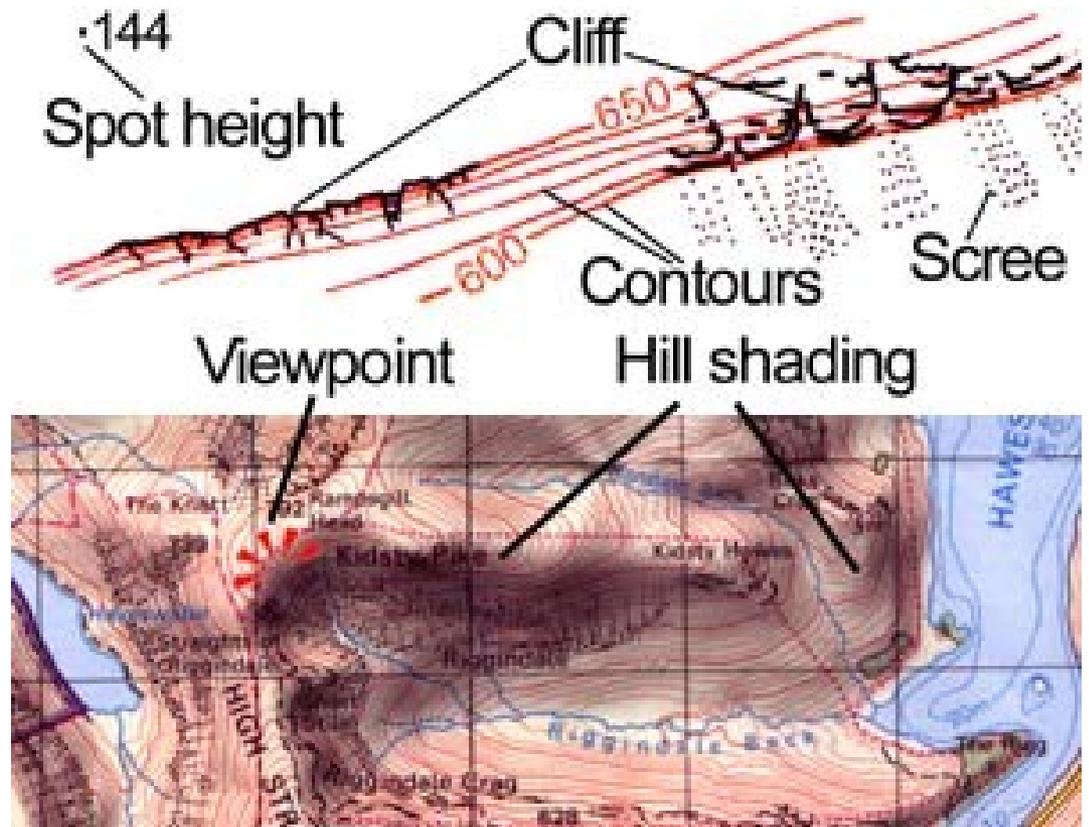
3D landscape model impact on natural beauty

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

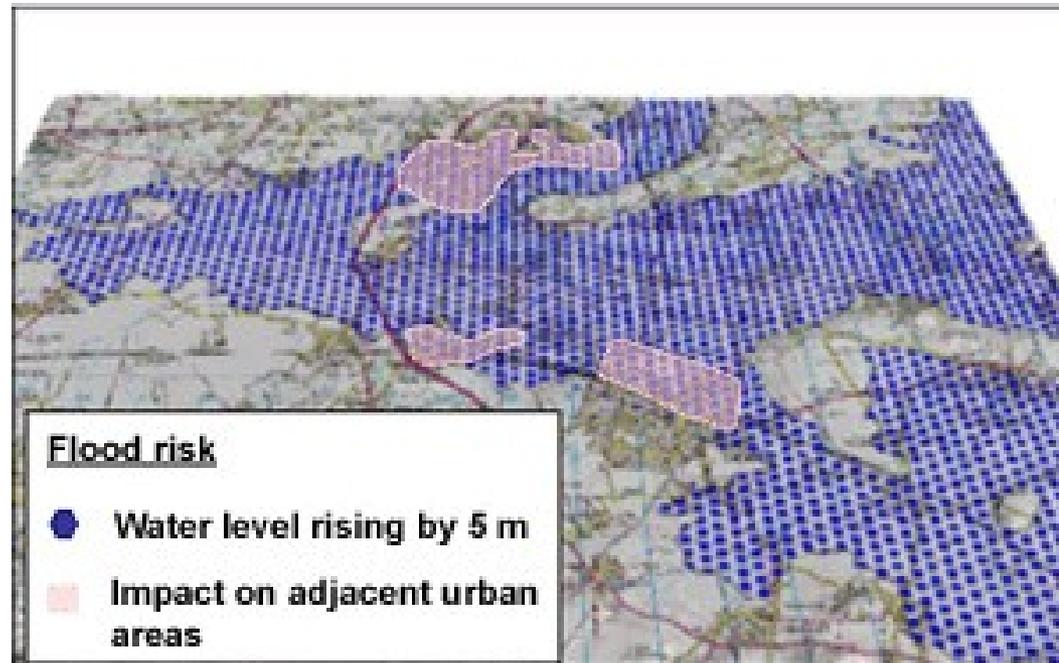
- Contours
- Hill shading
- Spot height symbols
- Cliff & slope symbols
- Viewpoint symbols



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

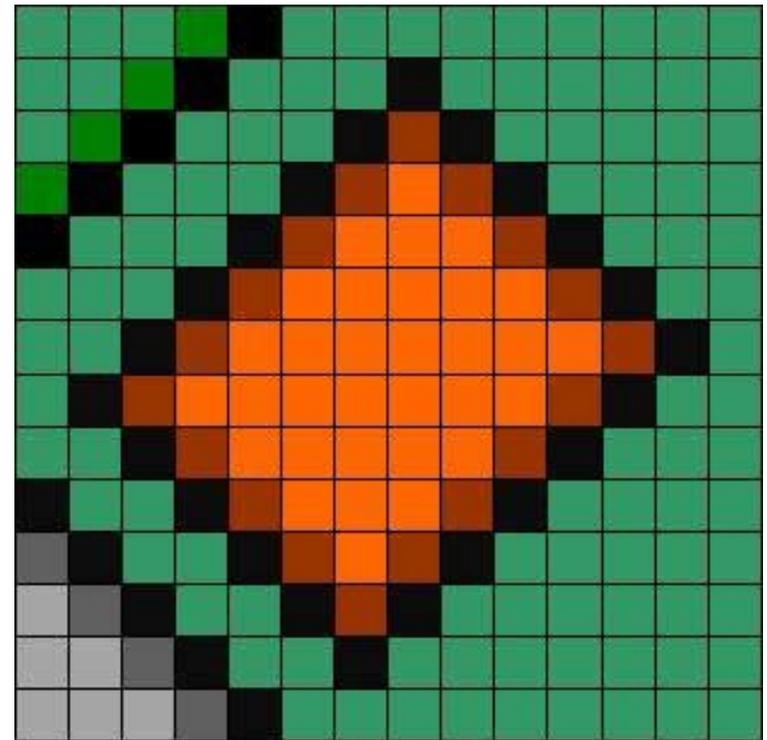


3D height data changing water levels-danger areas

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, demographics

Airport Noise Pollution



noise complaints mapped by address location