# Raster Data Analysis and data display

Module 5

# Topics to be covered

Chap: Raster data analysis

- Data analysis environment,
- Local operations,
- Neighborhood operations,
- Zonal operations,

Chap: Data Display

- Cartographic symbolization
- Types of maps
- Typography
- Map design

# Data analysis environment

- Because a raster operation may involve two or more raster, it is necessary to define the data analysis environment by specifying its area extent and output cell size.
- The area extent for analysis may correspond to a specific raster, or an area defined by its minimum and maximum x-, y-coordinates, or a combination of raster.
- Given a combination of raster with different area extents, the area extent for analysis can be based on the union or intersect of the raster.
- The union option uses an area extent that encompasses all input raster, whereas the intersect option uses an area extent that is common to all input raster.

- An analysis mask, either a feature layer or a raster, can also determine the area extent for analysis.
- An analysis mask limits analysis to its area coverage.

# Local operations

- Vector overlay operators are useful but geometrically complicated and this sometimes results in poor operator performance.
- Raster overlays do not suffer this disadvantage as most of calculations are cell based and are thus faster.
- When producing a new raster, we must provide a name for it, and define how it is computed. This is done in an assignment statement of following format:

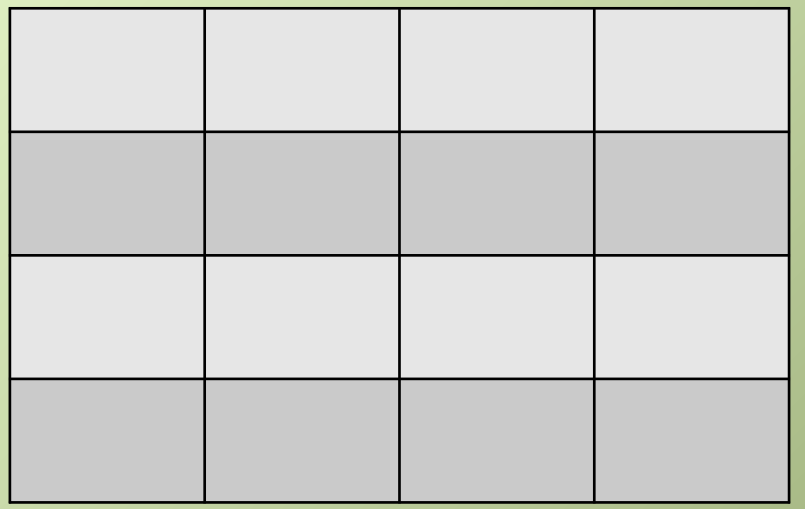
$$Output\_raster\_name := Map\_algebra\_expression.$$

Operators:

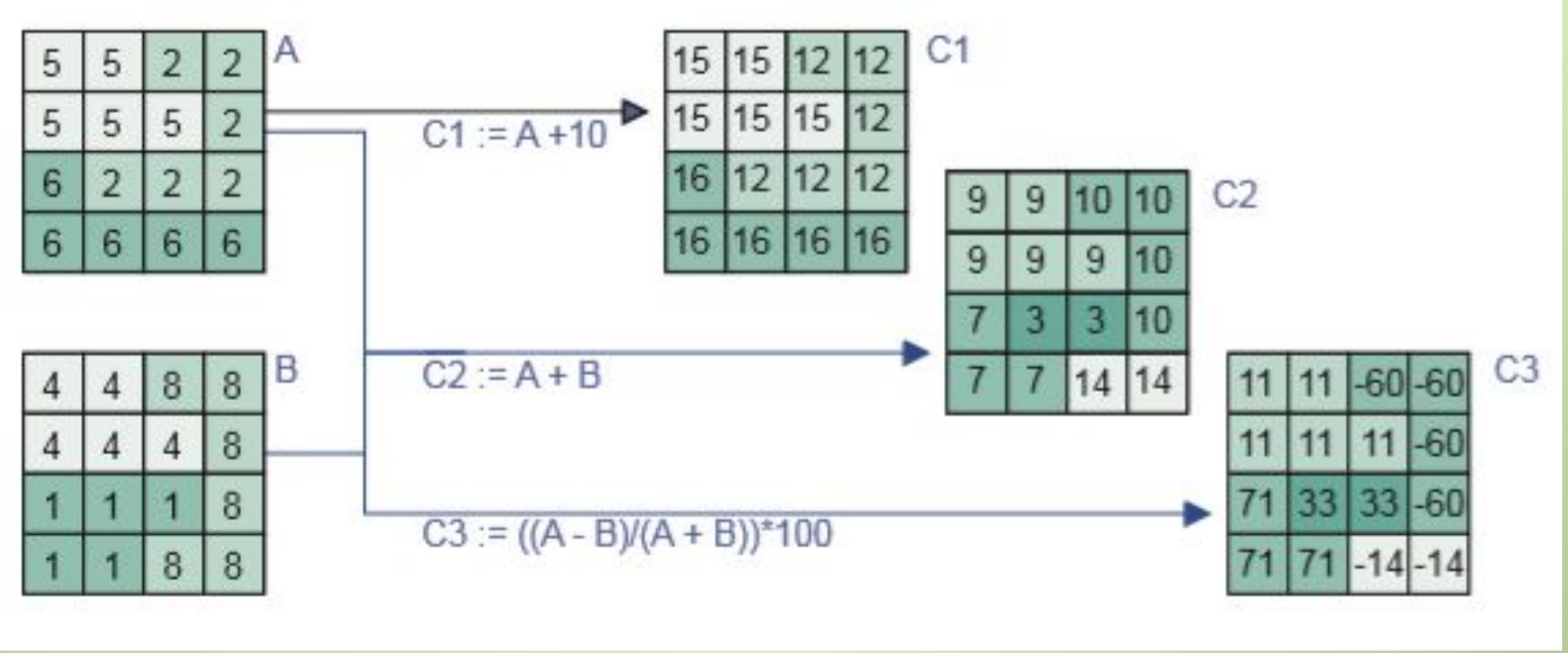
1. Arithmetic
2. Comparison and Logical
3. Conditional

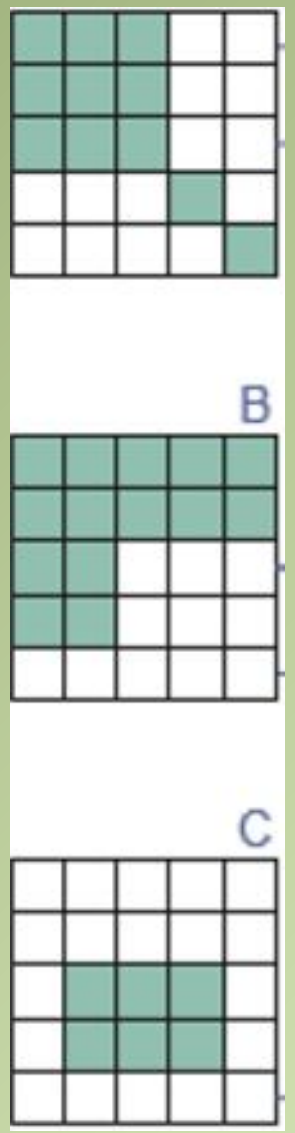
| | | | |
|---|---|---|---|
| 5 | 5 | 2 | 2 |
| 5 | 5 | 5 | 2 |
| 6 | 2 | 2 | 2 |
| 6 | 6 | 6 | 6 |

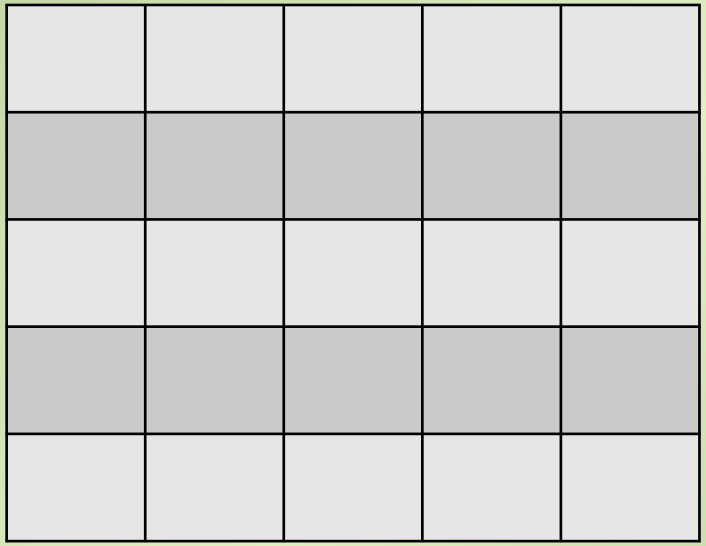
| | | | |
|---|---|---|---|
| 4 | 4 | 8 | 8 |
| 4 | 4 | 4 | 8 |
| 1 | 1 | 1 | 8 |
| 1 | 1 | 8 | 8 |

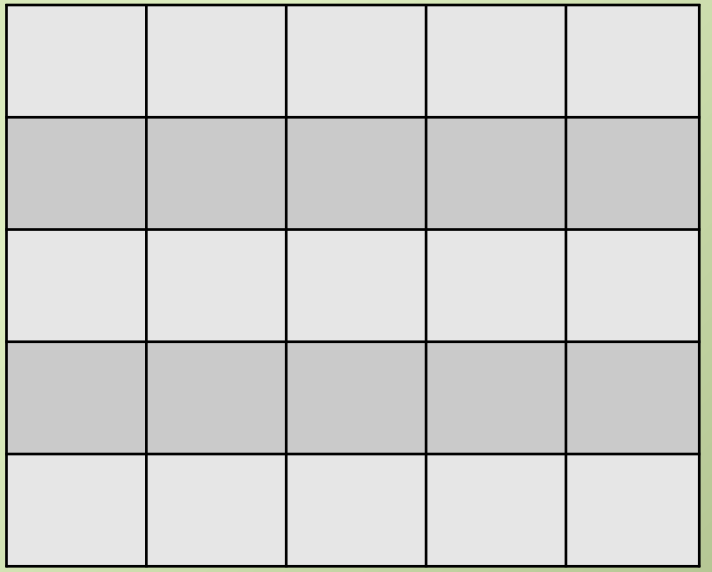


# ARITHMETIC OPERATORS




B
C





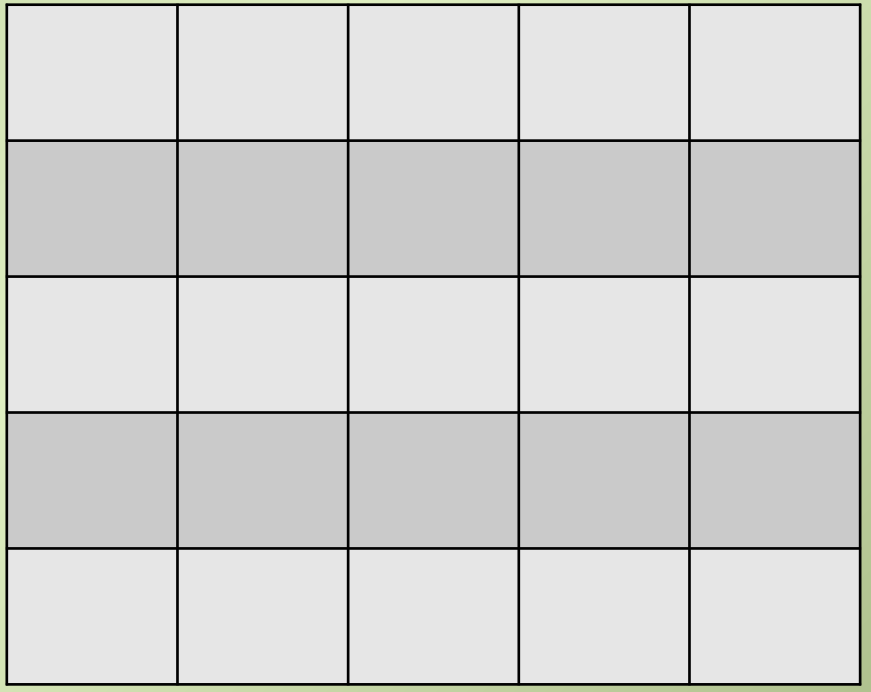
| | | | | |
|---|---|---|---|---|
| F | F | F | | |
| F | F | | | |
| | F | F | | F |
| | | F | F | F |
| | | | F | F |

F = forest

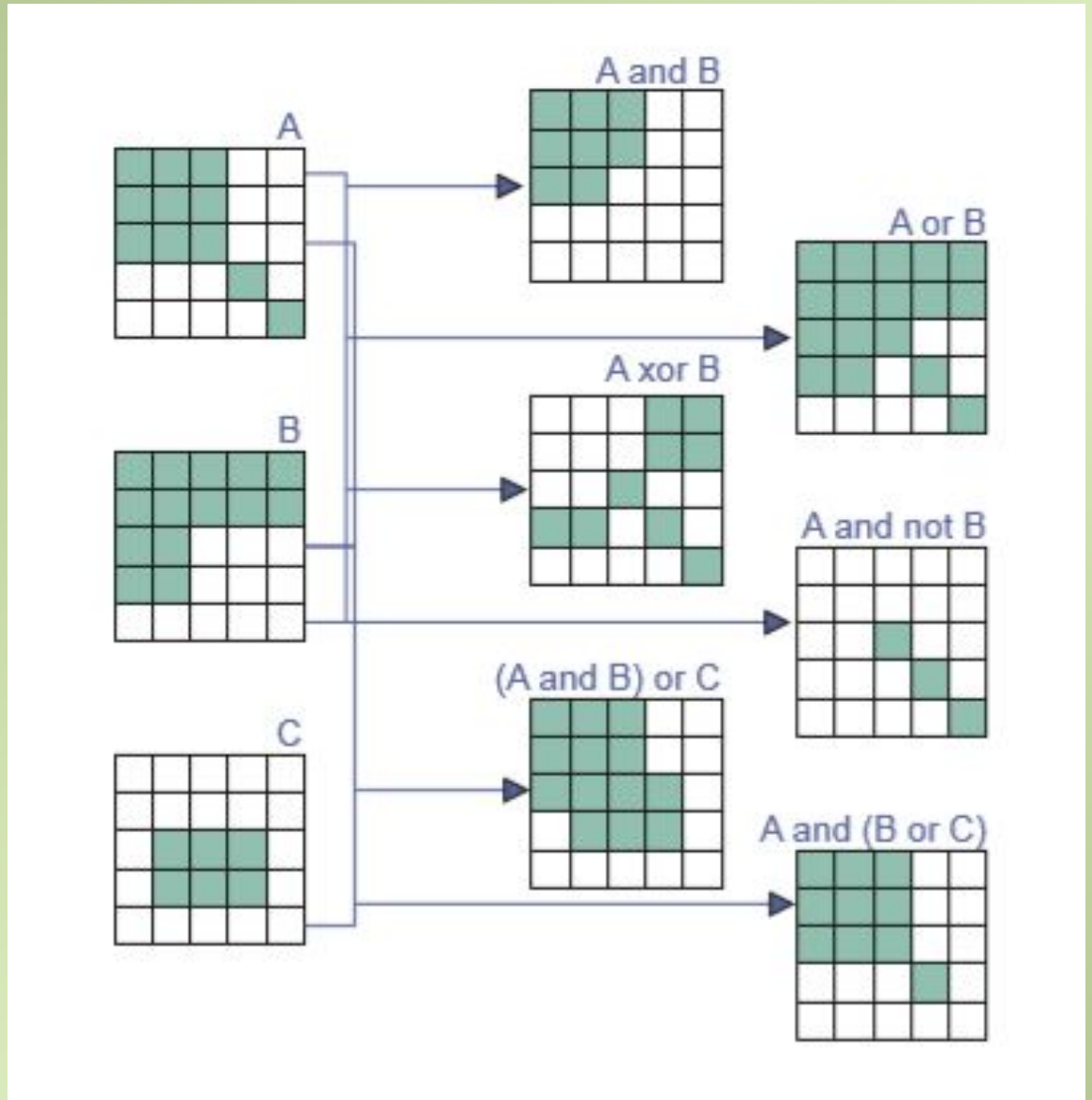
7 = 700 m.
6 = 600 m.
4 = 400 m.

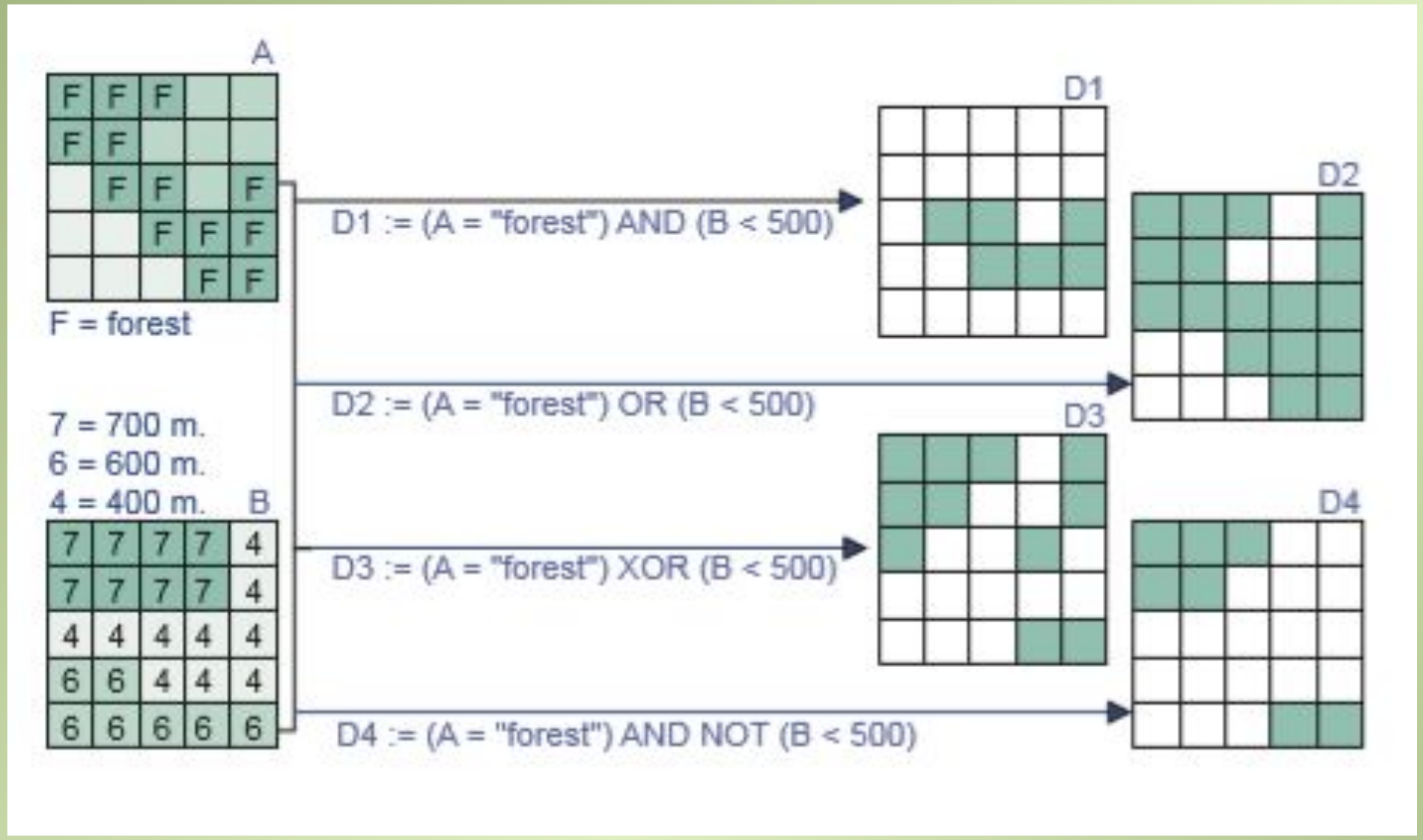
| | | | | B |
|---|---|---|---|---|
| 7 | 7 | 7 | 7 | 4 |
| 7 | 7 | 7 | 7 | 4 |
| 4 | 4 | 4 | 4 | 4 |
| 6 | 6 | 4 | 4 | 4 |
| 6 | 6 | 6 | 6 | 6 |

D1 := (A = "forest") AND (B < 500)



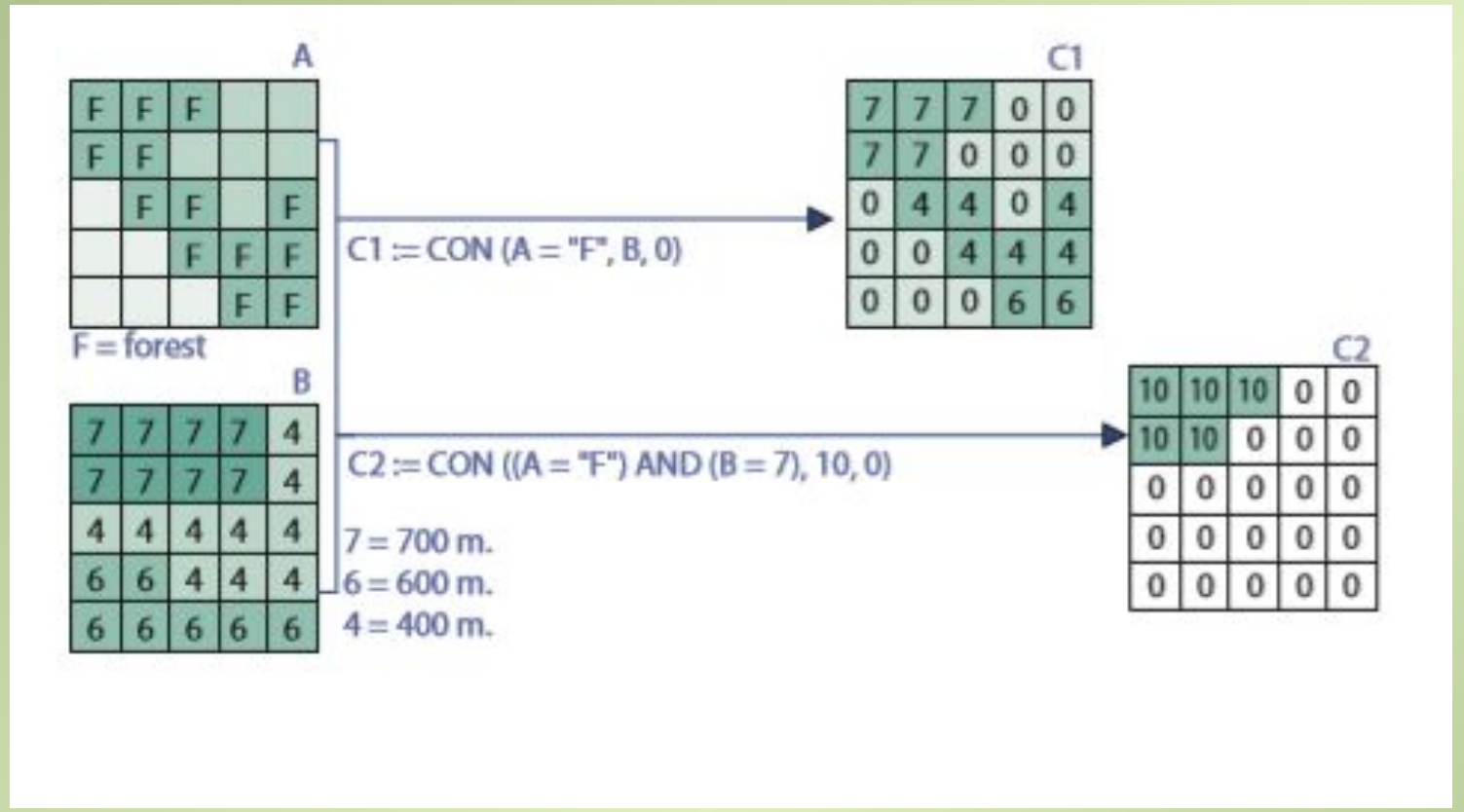
# COMPARISON AND LOGICAL OPERATORS




A
F F F
F F
F F F
F F F
F = forest
7 = 700 m.
6 = 600 m.
4 = 400 m.
B
7 7 7 7 4
7 7 7 7 4
4 4 4 4 4
6 6 4 4 4
6 6 6 6 6
D1 := (A = "forest") AND (B < 500)
D2 := (A = "forest") OR (B < 500)
D3 := (A = "forest") XOR (B < 500)
D4 := (A = "forest") AND NOT (B < 500)
D1
D2
D3
D4

# CONDITIONAL OPERATOR

$$Output\_raster := CON(condition, then\_expression, else\_expression).$$



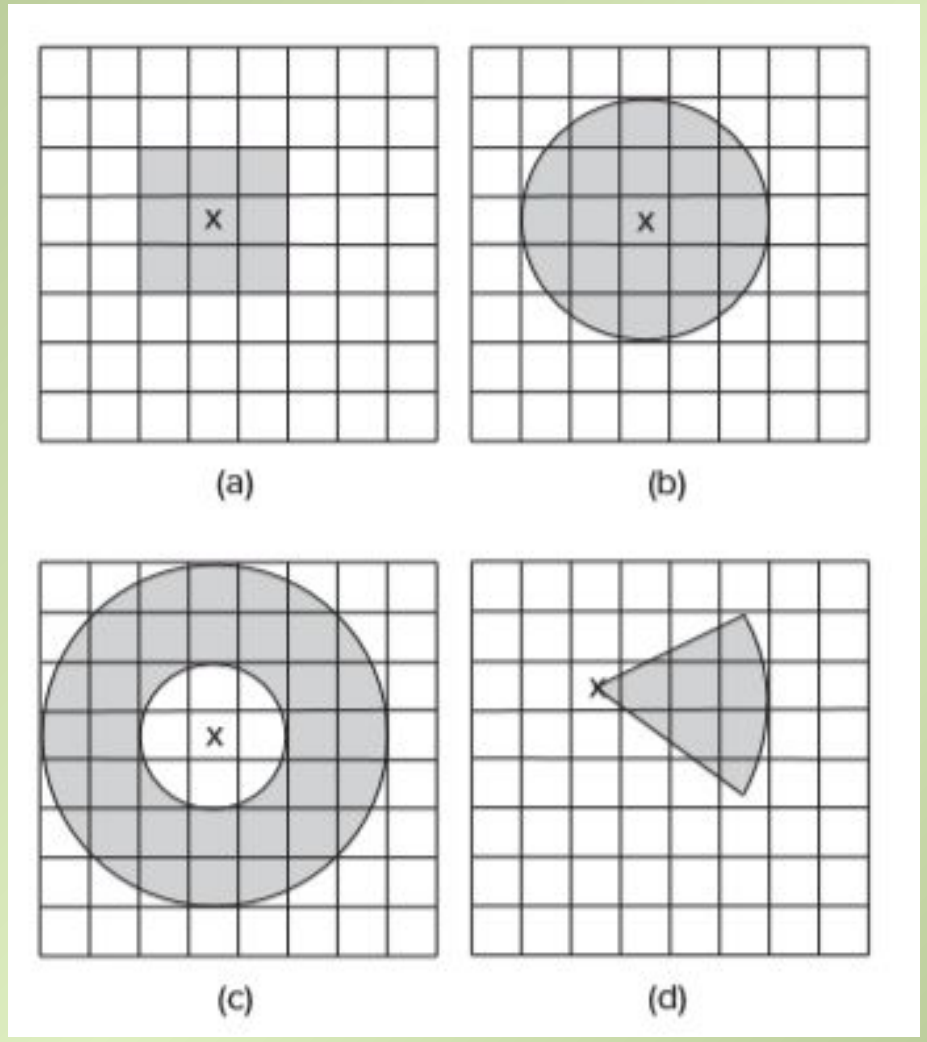
# Neighborhood operations

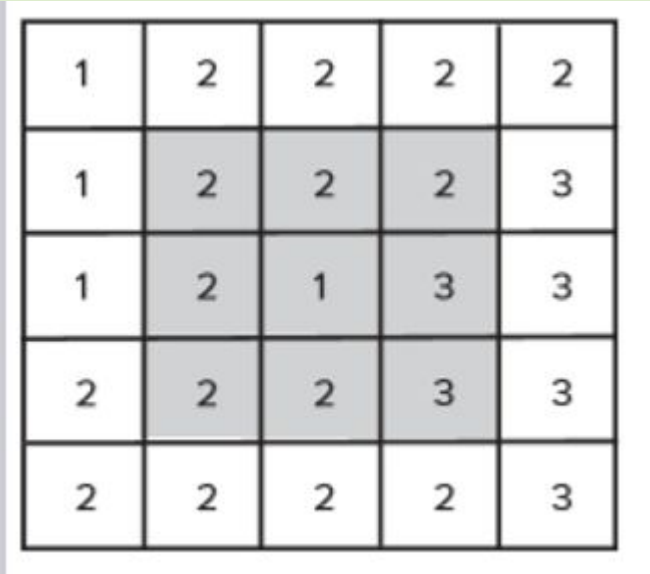
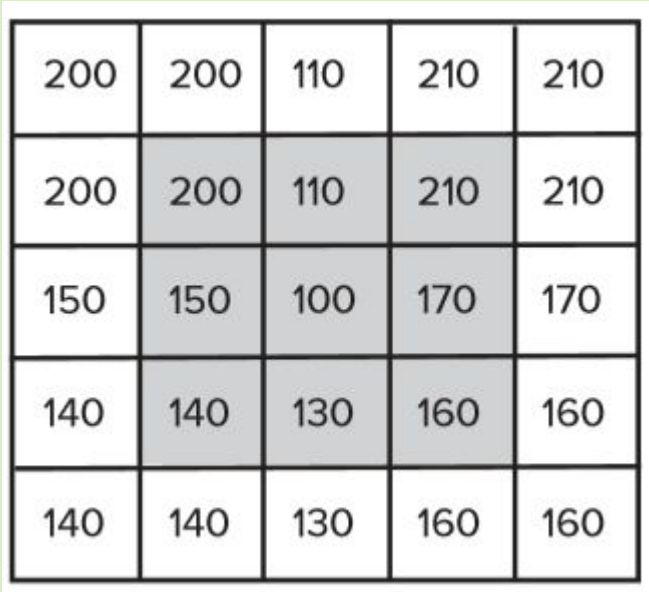
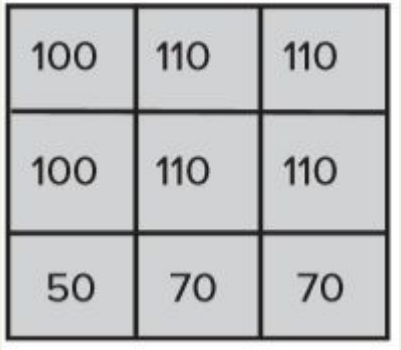
- The principle here is to find out the characteristics of the vicinity, here called as neighbourhood, of a location.
- Spatial analysis doesn't always consider what is "**at**" the location, but also what is "**nearby**" to the location.

To perform neighbourhood analysis, we must:

1. State which target locations are of interest to us, and define their spatial extent,
2. Define how to determine the neighbourhood for each target,
3. Define which characteristic(s) must be computed for each neighbourhood.

- Common neighborhoods include **rectangles, circles, annuluses, and wedge**



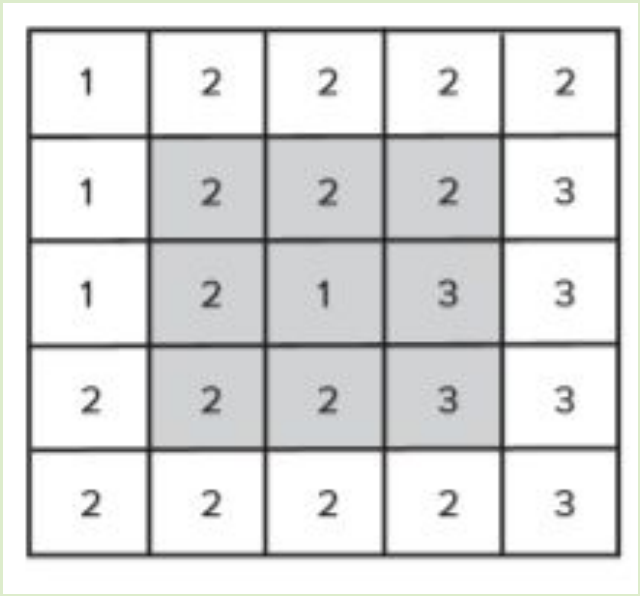
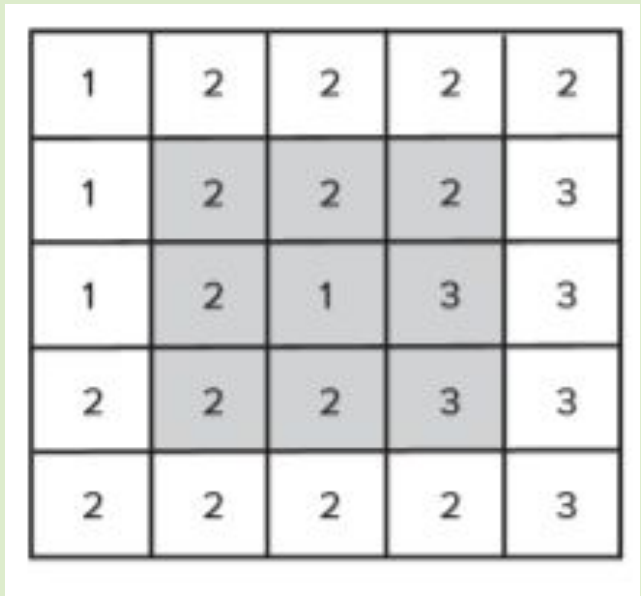
| NEIGHBORHOOD MEAN STATISTICS | NEIGHBORHOOD RANGE STATISTICS |
| --- | --- |
|  |  |
|  |  |

| | | |
| --- | --- | --- |
| 1 | 2 | 2 | 2 | 2 |
| 1 | 2 | 2 | 2 | 3 |
| 1 | 2 | 1 | 3 | 3 |
| 2 | 2 | 2 | 3 | 3 |
| 2 | 2 | 2 | 2 | 3 |

| | | |
| --- | --- | --- |
| 200 | 200 | 110 | 210 | 210 |
| 200 | 200 | 110 | 210 | 210 |
| 150 | 150 | 100 | 170 | 170 |
| 140 | 140 | 130 | 160 | 160 |
| 140 | 140 | 130 | 160 | 160 |

| | | |
| --- | --- | --- |
| 1.56 | 2.00 | 2.22 |
| 1.67 | 2.11 | 2.44 |
| 1.67 | 2.11 | 2.44 |

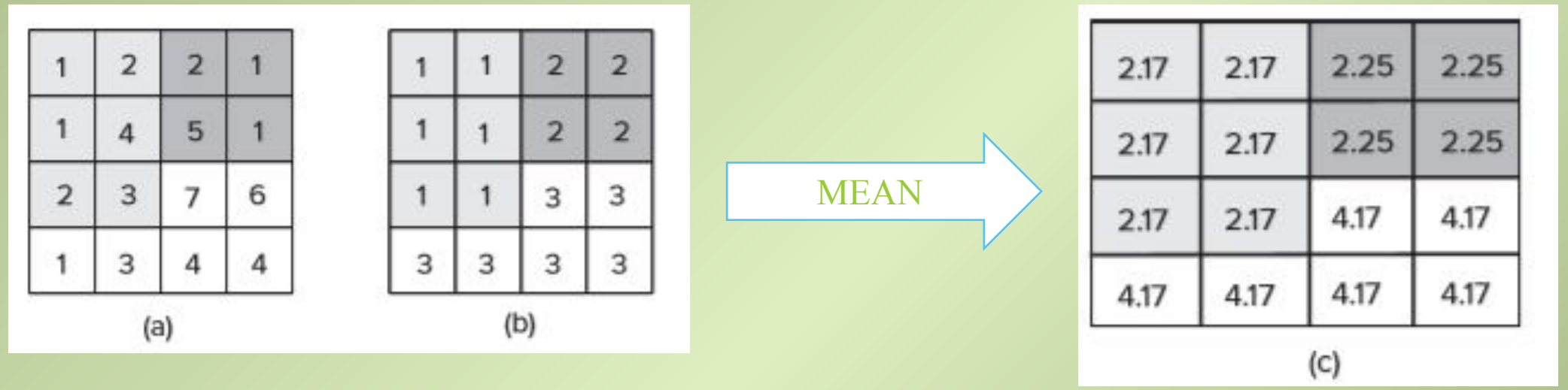
| | | |
| --- | --- | --- |
| 100 | 110 | 110 |
| 100 | 110 | 110 |
| 50 | 70 | 70 |

| NEIGHBORHOOD MAJORITY STATISTICS | NEIGHBORHOOD MEDIAN STATISTICS |
| --- | --- |
|  |  |
| | |

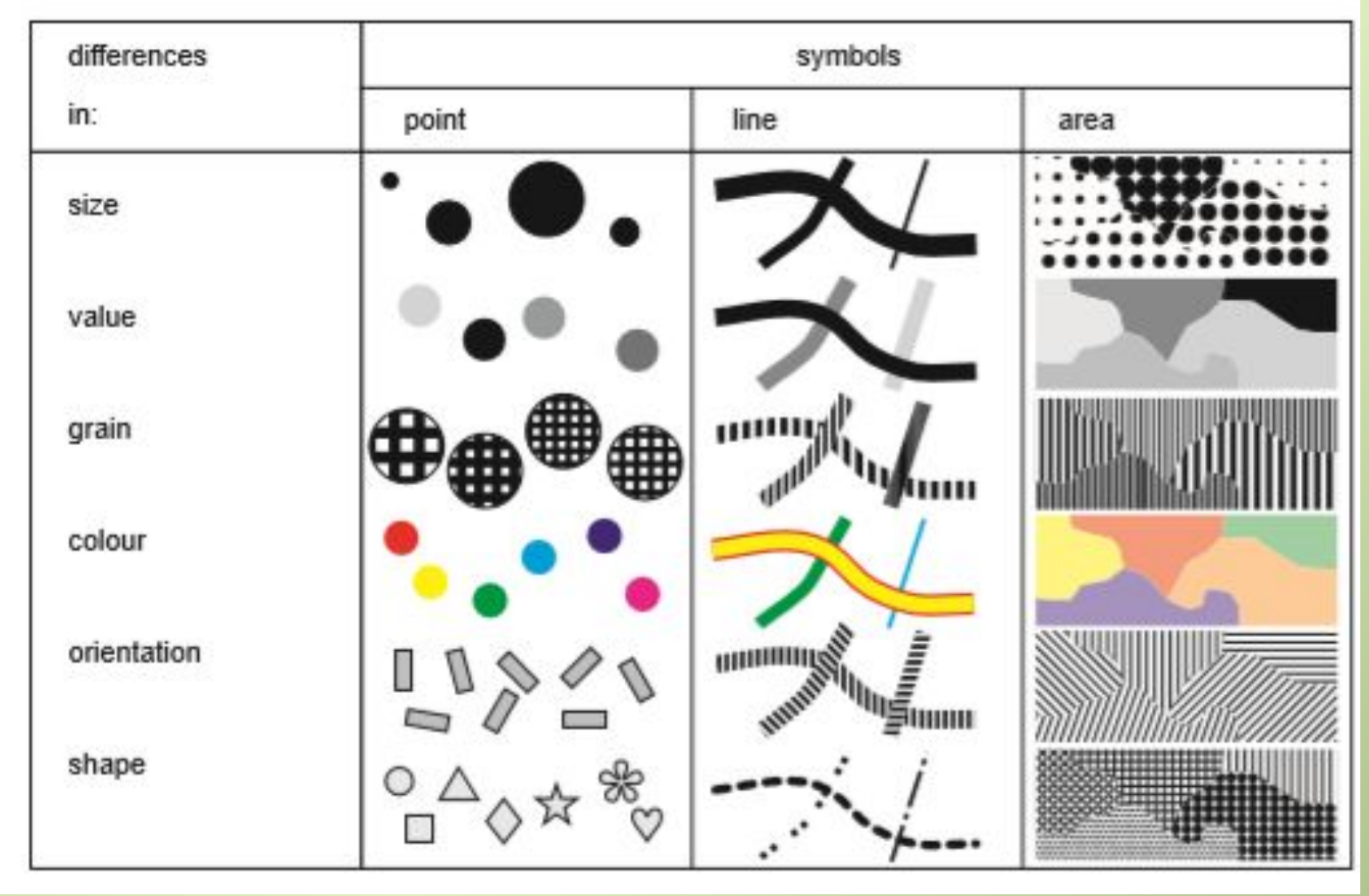
# Zonal operations

- A zonal operation works with groups of cells of same values or like features.
- These groups are called zones. Zones may be contiguous or noncontiguous.
- A contiguous zone includes cells that are spatially connected, whereas a noncontiguous zone includes separate regions of cells.
- A watershed raster is an example of a contiguous zone, in which cells that belong to the same watershed are spatially connected.
- A land use raster is an example of a noncontiguous zone, in which one type of land use may appear in different parts of the raster.

- A zonal operation may work with a single raster or two raster.
- Given a single input raster, zonal operations measure the geometry of each zone in the raster, such as area, perimeter, thickness, and centroid.

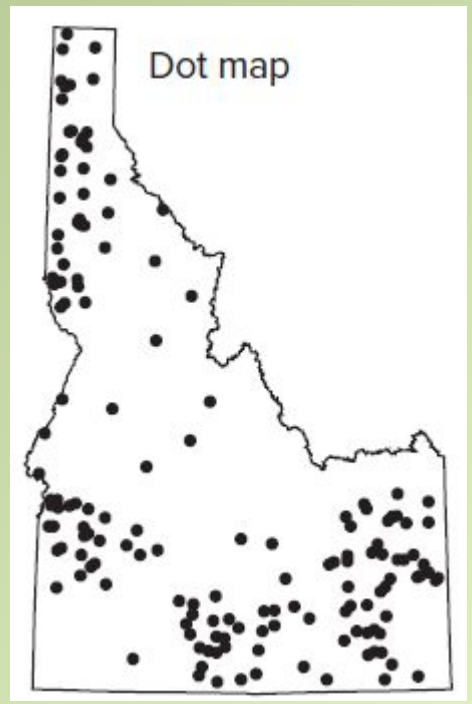


# Cartographic symbolization

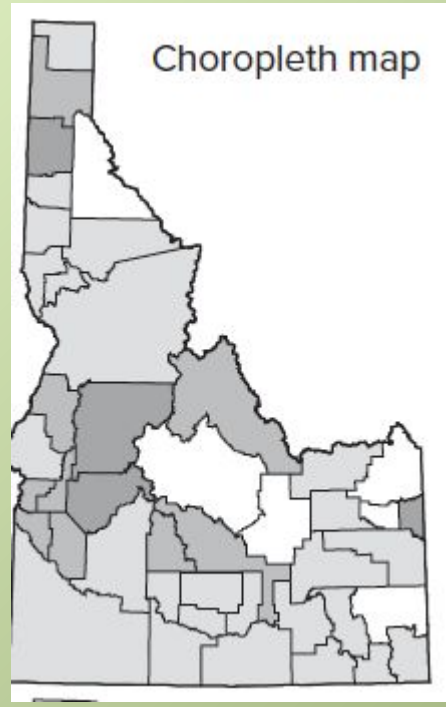


# Types of Maps

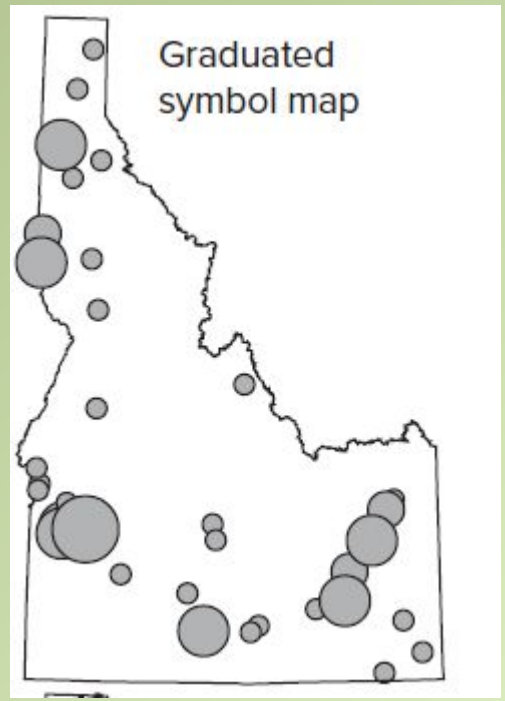
The **dot map** uses uniform point symbols to show geospatial data, with each symbol representing a unit value



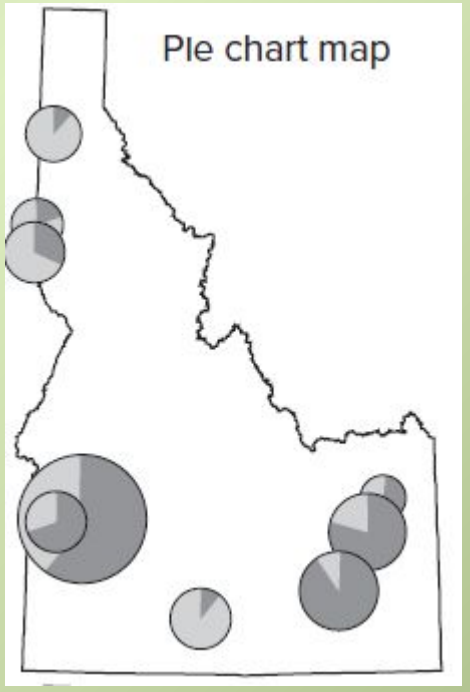

The **choropleth map** symbolizes, with shading, derived data based on administrative units



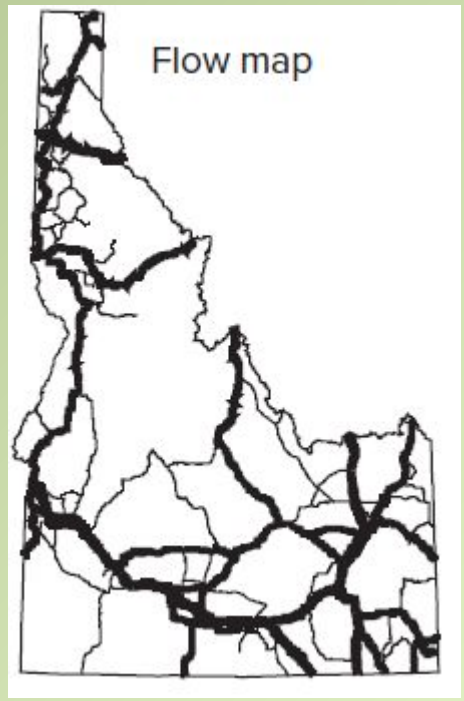
The **graduated symbol map** uses different-sized symbols such as circles, squares, or triangles to represent different ranges of values.




The **chart map** uses either pie charts or bar charts. A variation of the graduated circle, the pie chart can display two sets of quantitative data



The **flow map** displays flow or spatial interaction data such as stream flow, traffic, and migration data

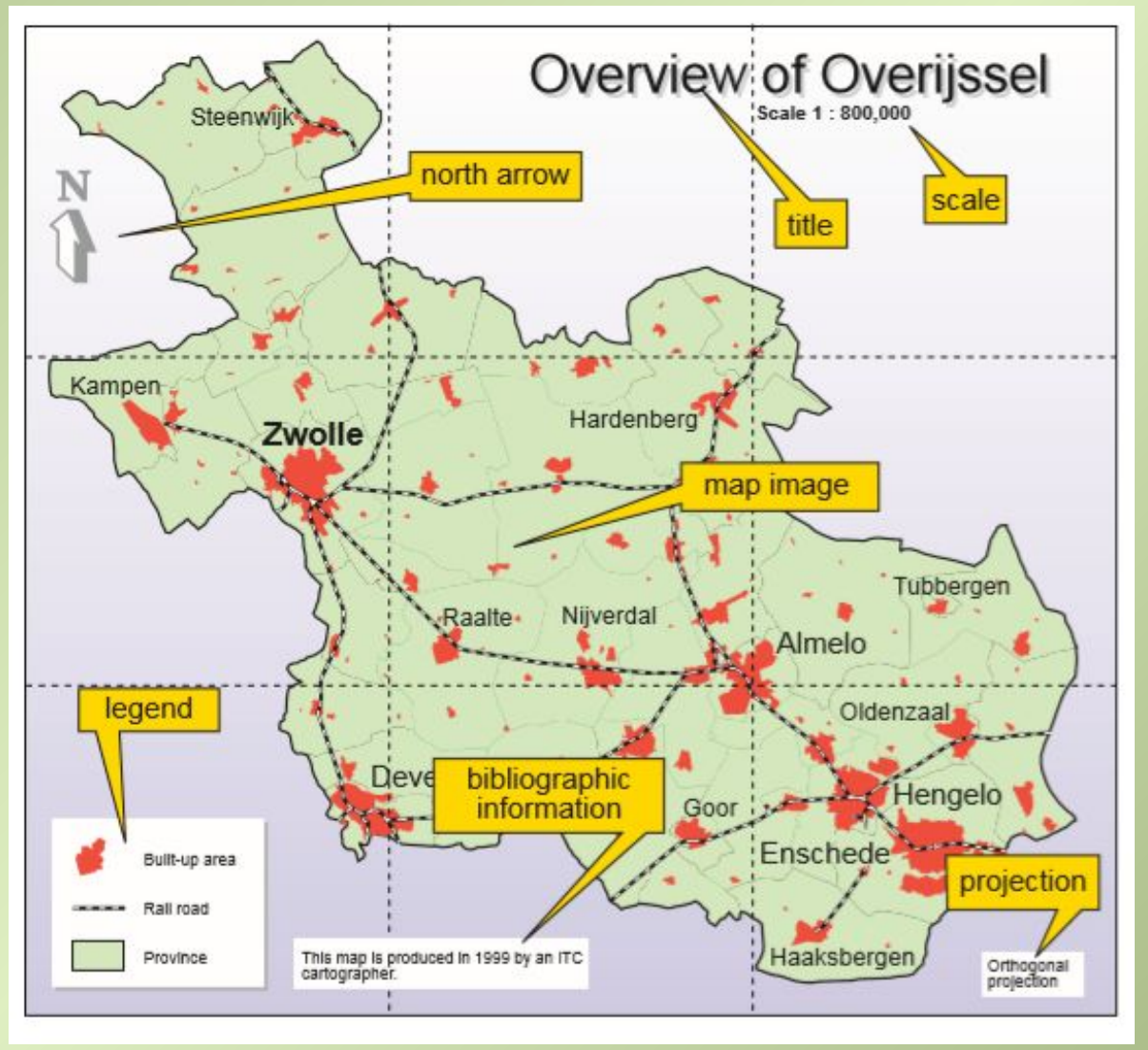



The **isarithmic map** uses a system of isolines to represent a surface. Each isoline connects points of equal value. GIS users often use the isarithmic map to display the terrain

# Typography

- A map cannot be understood without text on it.
- Text is needed for almost every map element.
- Mapmakers treat text as a map symbol because, like point, line, or area symbols, text can have many type variations.
- Using type variations to create a pleasing and coherent map is therefore part of the mapmaking process.

# Map design


Overview of Overijssel
Scale 1 : 800,000
north arrow
title
scale
map image
legend
bibliographic information
projection
Steenwijk
Kampen
Zwolle
Hardenberg
Raalte
Nijverdal
Tubbergen
Almelo
Oldenzaal
Goor
Hengelo
Enschede
Haaksbergen
Built-up area
Rail road
Province
This map is produced in 1999 by an ITC cartographer.
Orthogonal projection