Raster analysis

Adapted from presentation prepared by
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African Population and Health Research Center

ITC UNIVERSITY OF TWENTE.

ULB

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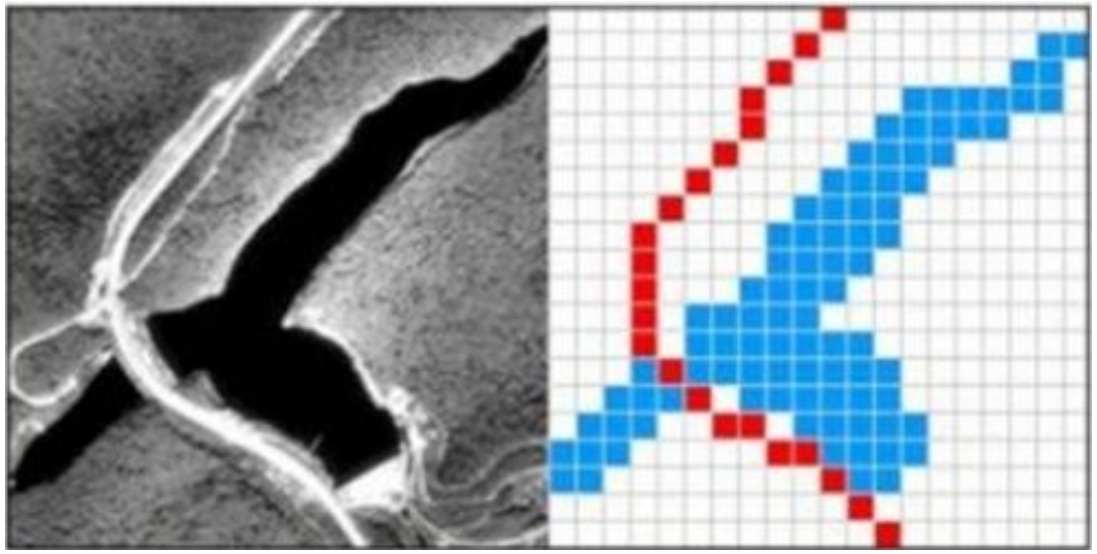
Overview

Program of the day

- About raster Data
- Raster Overlay
- Neighborhood Functions



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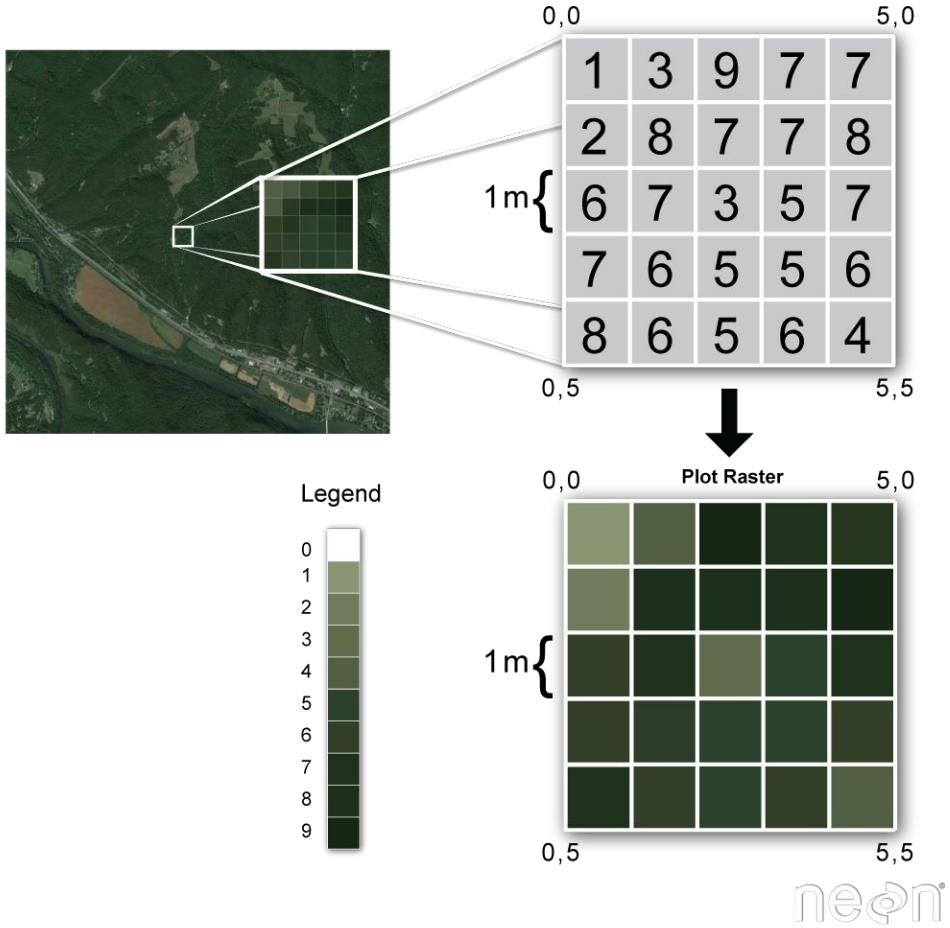
Raster Data

- Raster consists of matrix of cells (pixels) organized into rows and columns (grid) where each cell contains a value representing information, such as temperature, elevations, population



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Raster analysis

Analytical operations

- Reclassifying
- Raster Overlay
- Neighborhood functions

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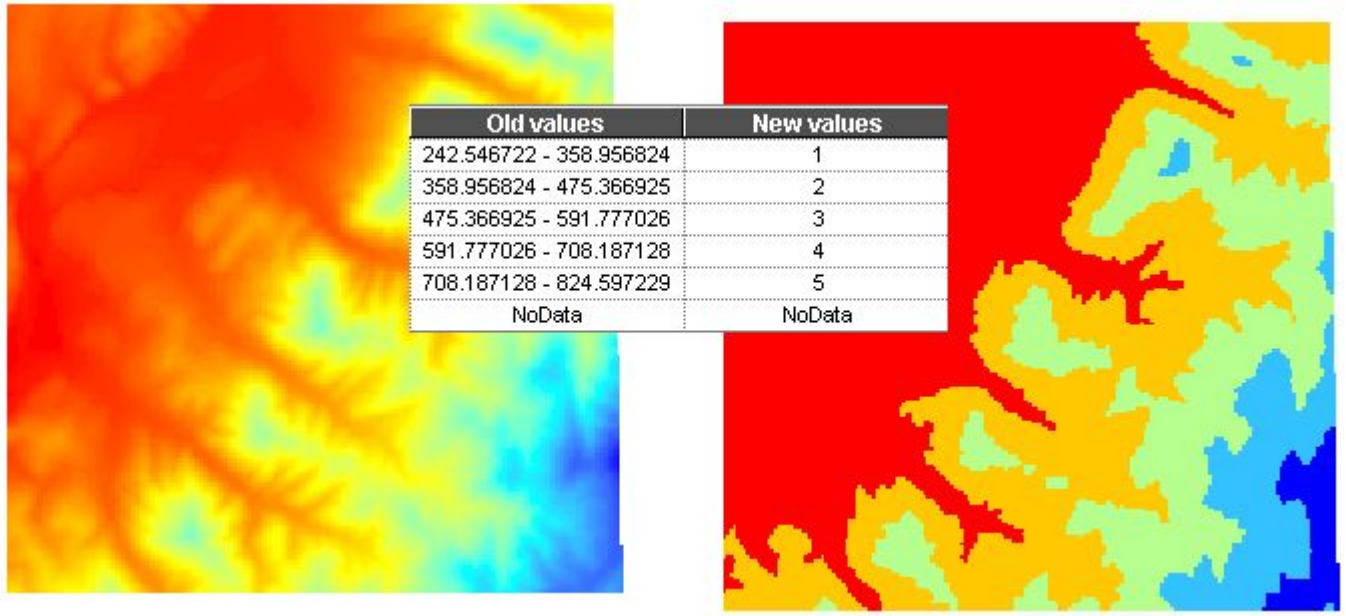
Reclassification

- is the process of reassigning one or more values in a raster dataset to new output values



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Reclassification rationale

- Remove details to reveal patterns
- Produce a new output dataset
- If input = classification → reclassification
- User controlled classification - Classification table
- Automatic classification

  - Equal interval technique
  - Equal frequency technique

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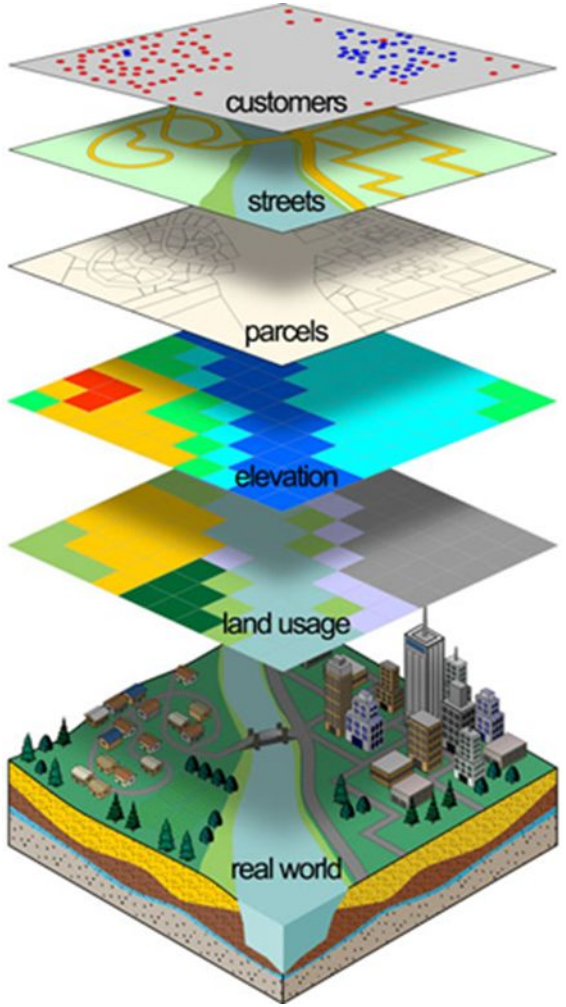
Raster overlay

It is known as **cell by cell combination or operation**. It is computationally less demanding. Overlay in raster datasets include two or more different sets of data that derive from a common grid. Each separate sets of data are usually specified numerical values



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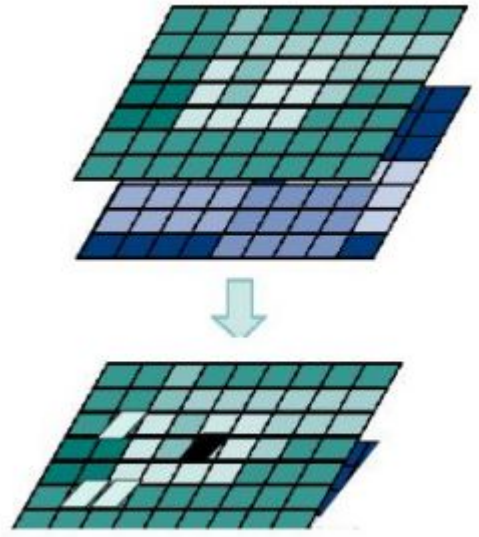
Raster overlay

Functions and operators:

- Arithmetic overlay operators
- Comparison and logical operators
- Conditional expressions
- Decision table



Output_raster_name := Raster_calculus_expression

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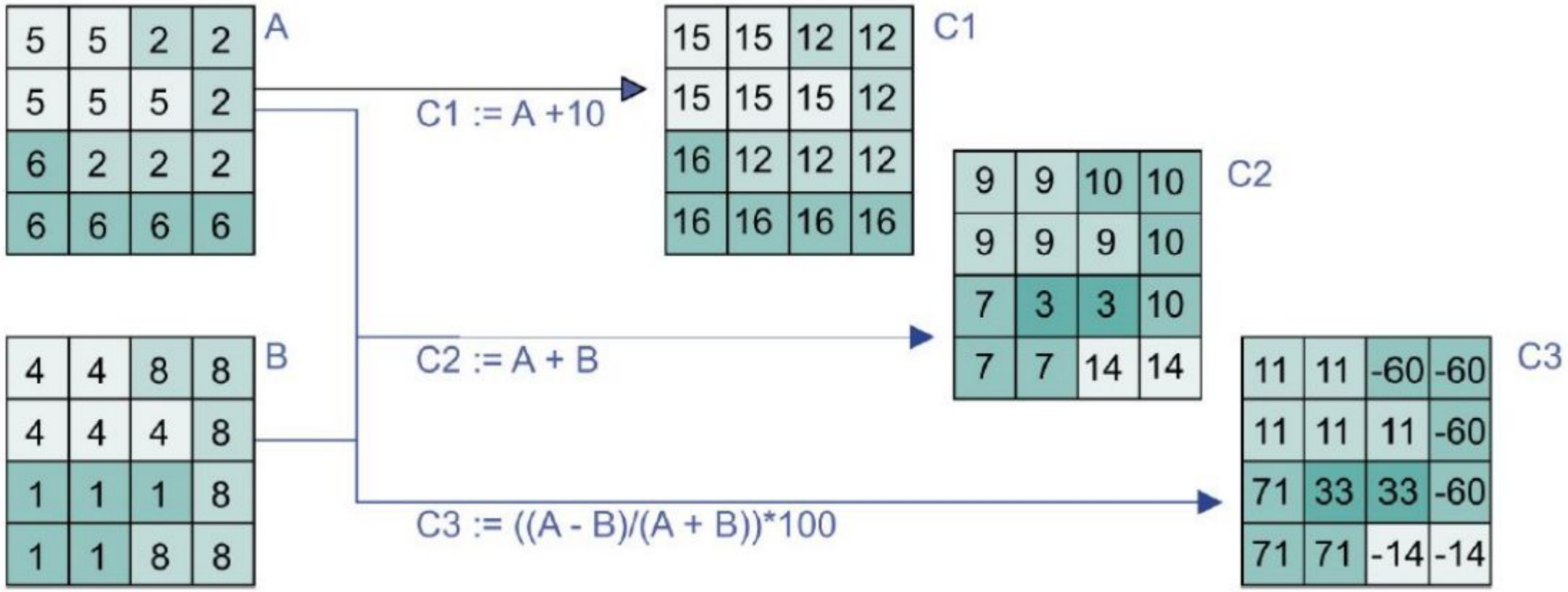
Raster Overlay
Arithmetic Operators



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Raster Overlay
Comparison Operators

Comparison Operators <, <=, =, >=, >, <>

- test whether one expression is larger, smaller, equal, etc. than another expression
- can be used in combination with logical operators or conditional functions

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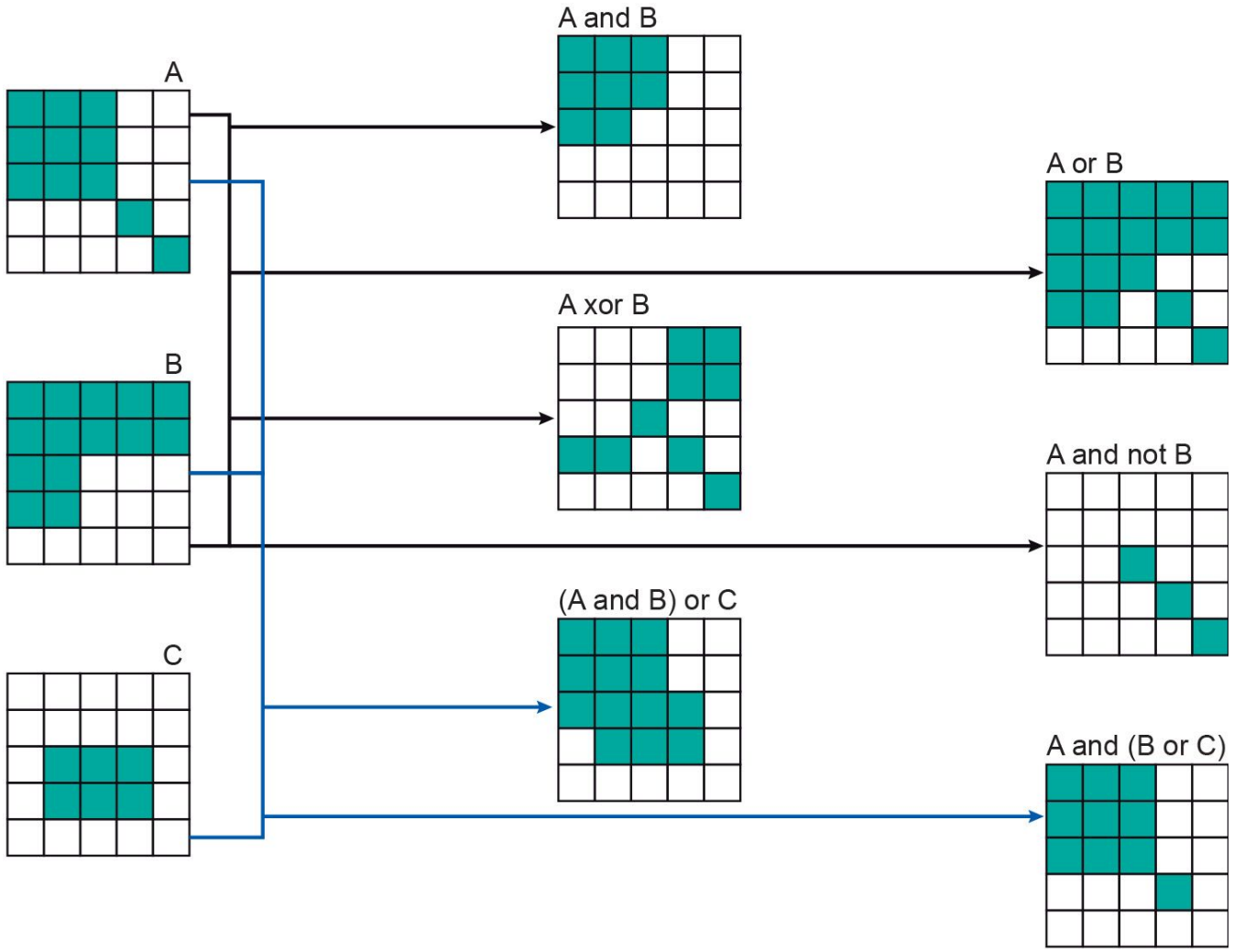
Raster Overlay
Comparison Operators



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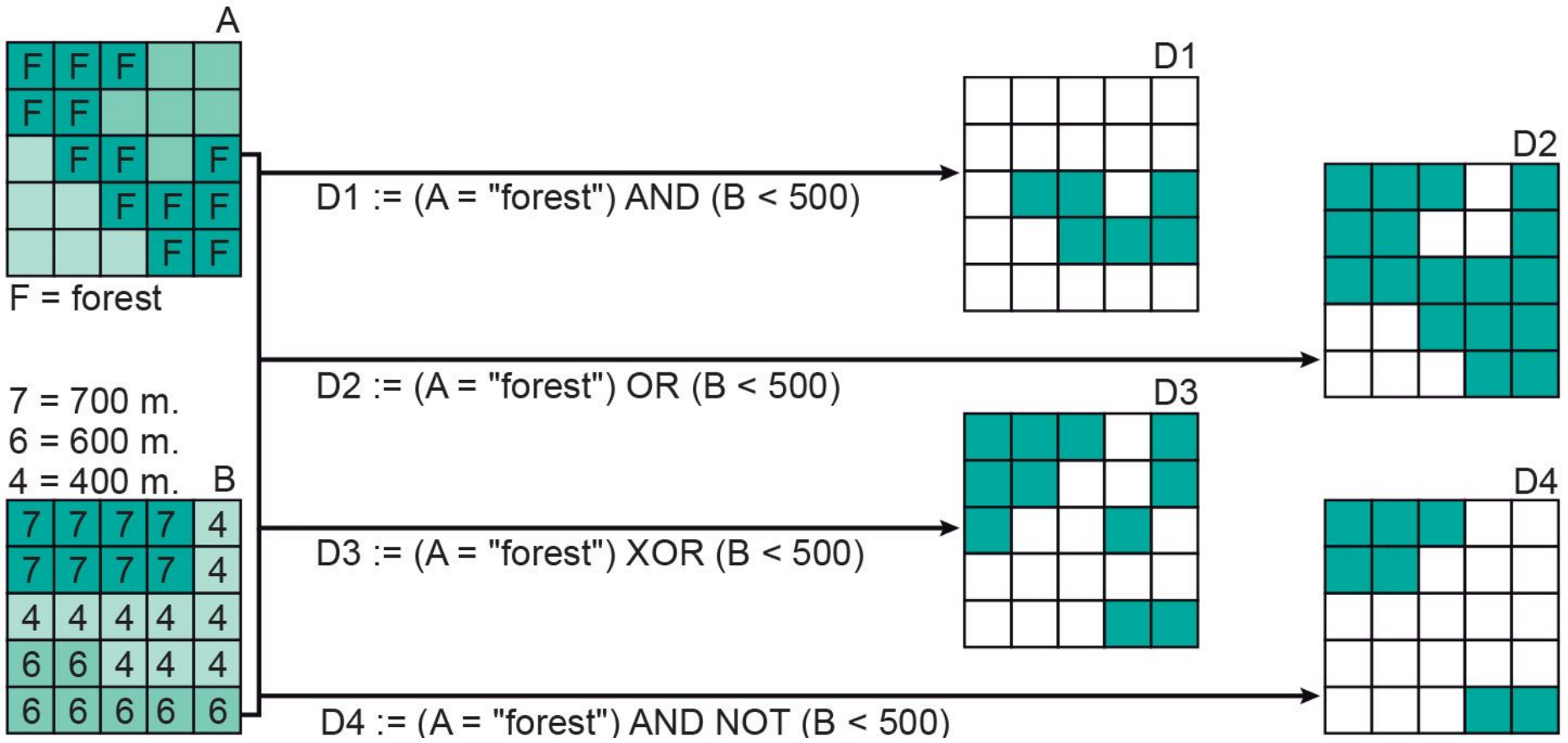
Logical excretions

Logical Operators AND, OR, XOR



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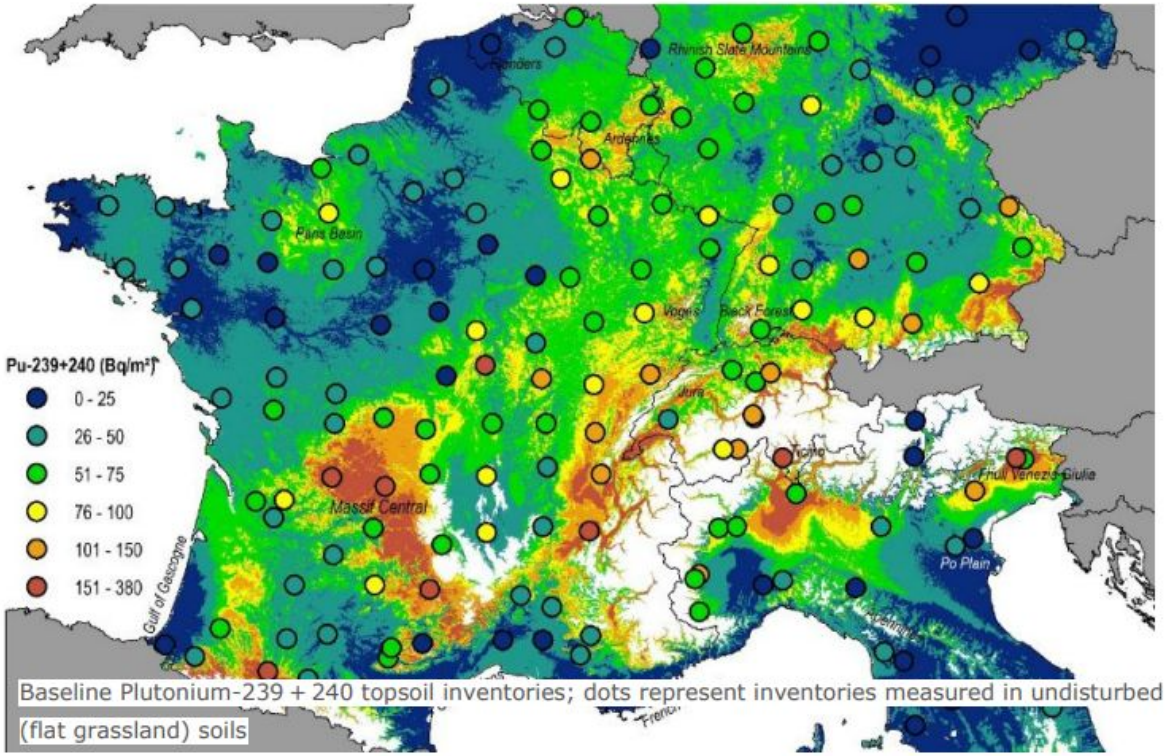
Neighborhood Functions

- Neighborhood functions **evaluate the characteristics of an area surrounding a feature's location**.
- A neighborhood function “scans” the neighborhood of the given feature(s), and performs a computation on it



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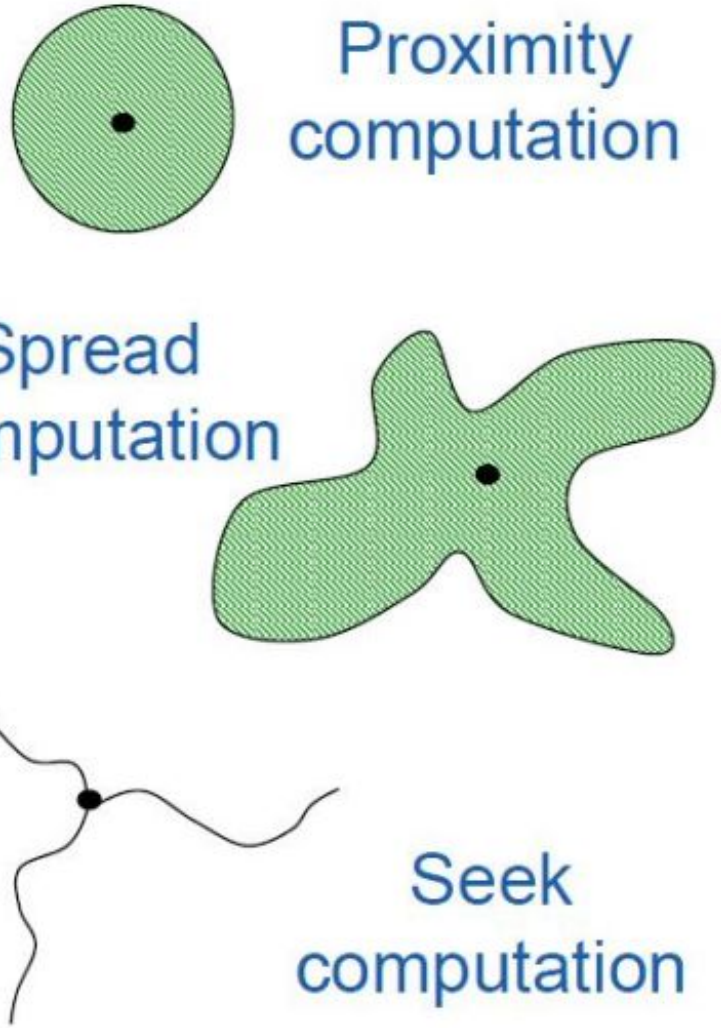
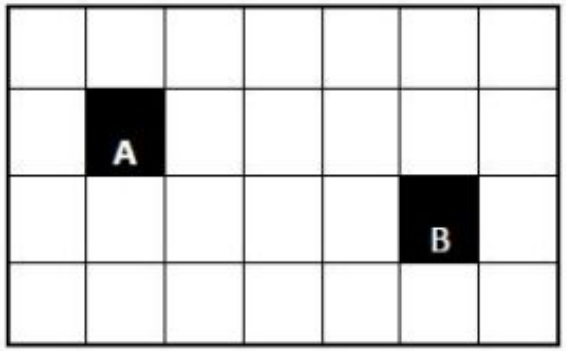
Neighborhood Functions type

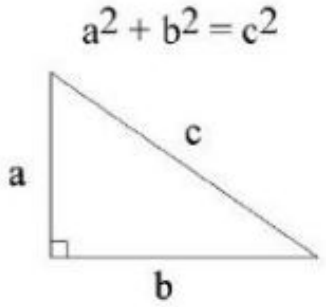
- **Proximity computation** makes use of the geometric distance function
- **Spread computation** assumes that the phenomenon spreads in all directions, but not necessarily equally easily in all direction
- In **Seek computation** the phenomenon will choose a least-resistance path



Raster analysis
Measuring Distance

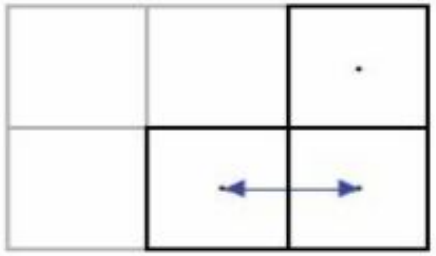
- The Euclidean distance between two cells is the distance between their mid-points



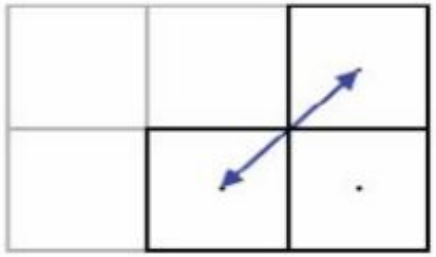


$$\sqrt{(2-6)^2 + (2-3)^2} * \text{cell size}$$

Cell size = 30 m x 30 m



Distance 30 m

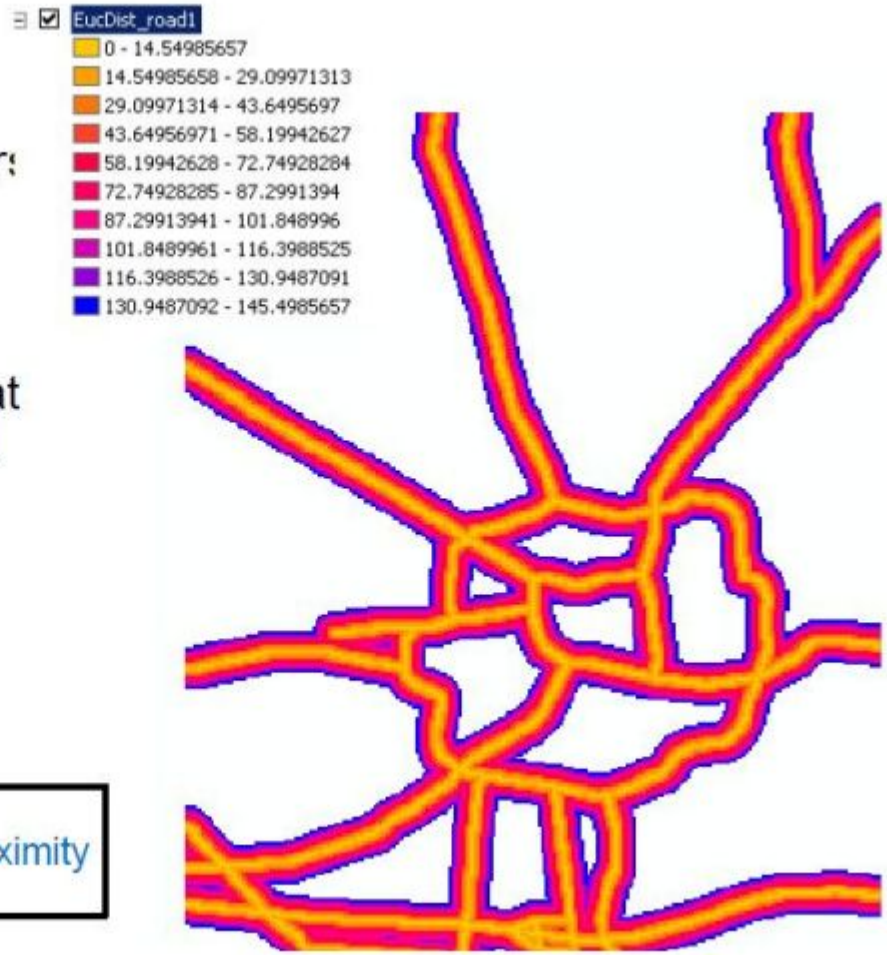


Distance 30* √2

Neighborhood Functions
Proximity

- Need target cell(s)
- Distance between the cell centers

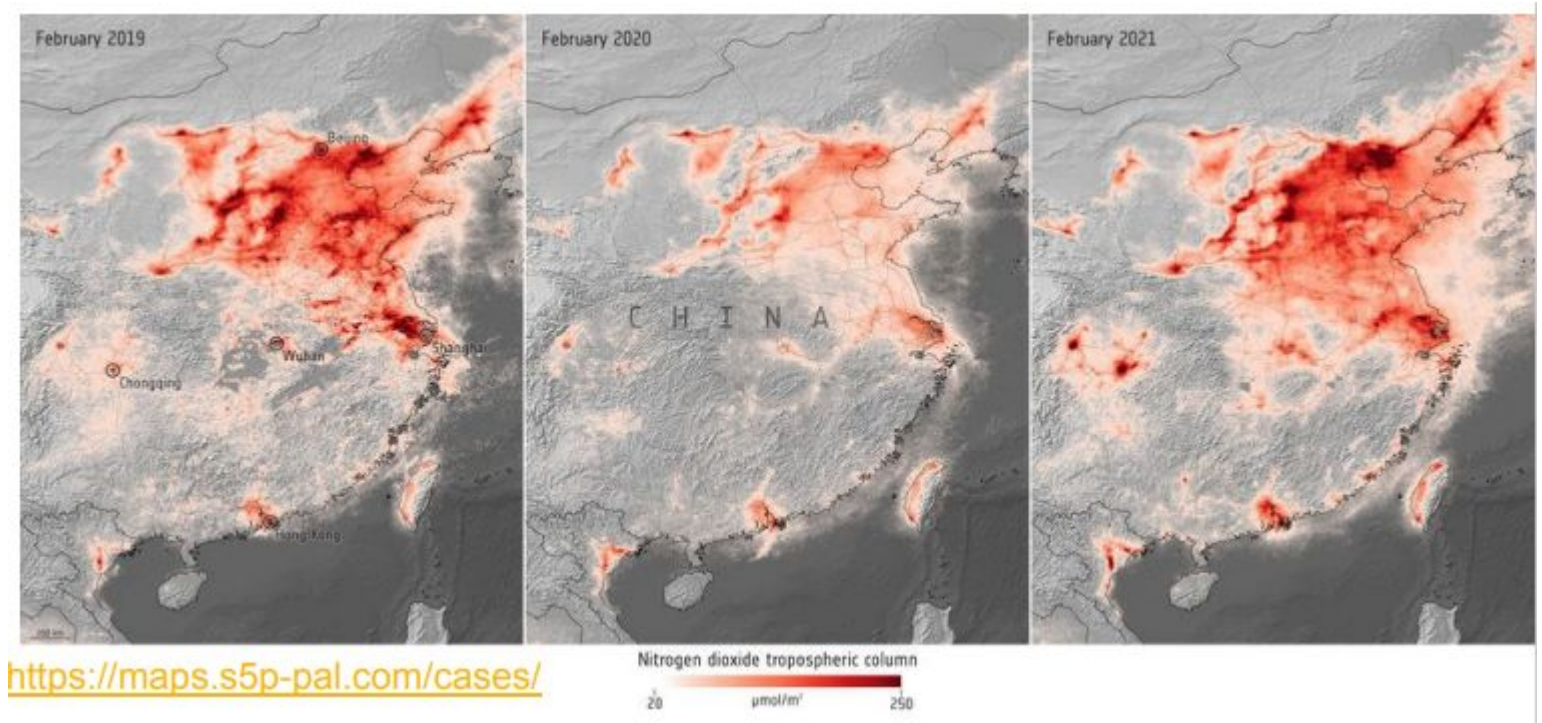
- The distance from a non-target cell to the target is the minimal distance one can find between that non-target cell and any target cell.



Living Textbook Raster proximity

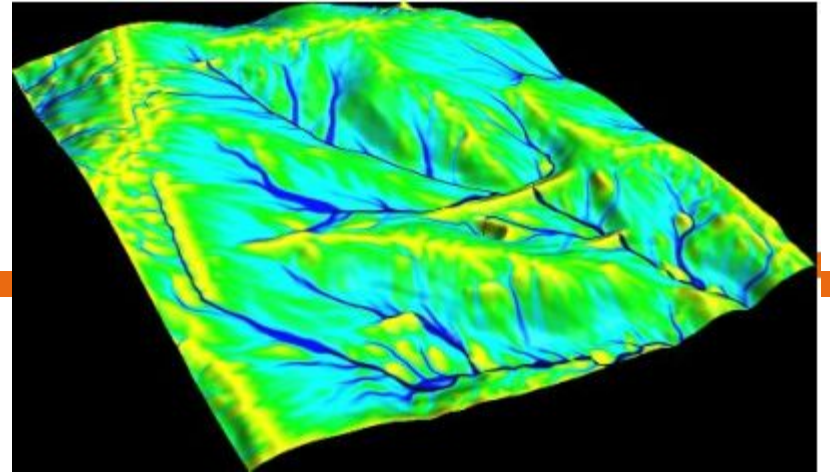
Neighborhood Functions
Spread Computation

- The neighborhood of a target location not only depends on distance but also on direction and differences in the terrain in different directions
- Target locations contain a “source material” that spreads over time.
  - Water and soil contaminants
  - Air (temperature, humidity)
  - People



https://maps.s5p-pal.com/cases/

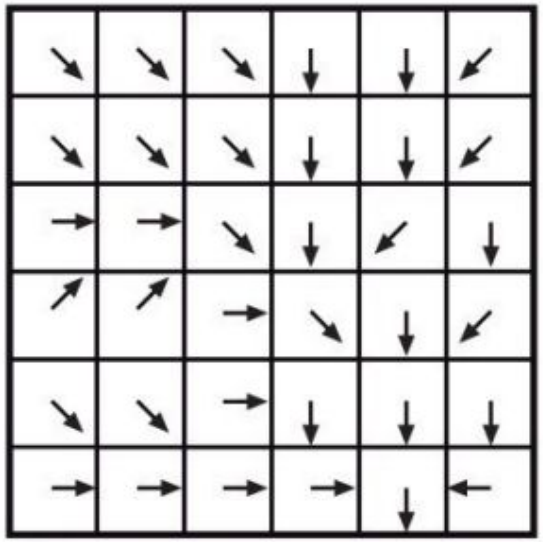
Neighborhood Functions
Flow Computation



- Also called seek computation
- Applies when a phenomenon does not spread in all directions but chooses a least-cost path.
- Typical example: Determination of drainage patterns in a catchment

156	144	138	142	116	98
148	134	112	98	92	100
138	106	88	74	76	96
128	116	110	44	62	48
136	122	94	42	32	38
148	106	68	24	22	24

a



b

0	0	0	0	0	0
0	1	1	2	2	0
0	3	7	5	4	0
0	0	0	20	0	1
0	0	0	1	24	0
0	2	4	1	35	1

c

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Multi-criteria analysis (MCA)

Multi-criteria analysis (MCA) is a technique used to consider many different criteria when making a decision. MCA gives a logical, well-structured process to follow so different factors can be clearly identified and prioritized. It allows the alternative solutions being considered to be ranked in order of suitability.

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Multi-criteria analysis (MCA

In GIS two types of criteria will be reflected:

- **Constraints or restrictive criteria**

  constraints or restrictive criteria will make it possible to reduce the area of study by discarding those areas that prevent the implementation of renewable energy plants. These criteria will be obtained from the legislation (planning regulations, protected areas , road networks railways, waterways, mountains, etc).

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Multi-criteria analysis (MCA

- **weighting criteria or factors.**

Weighting criteria or factors will be those which, according to the objective to be reached, influence the ability to solve a concrete alternative. The choice of such criteria is marked by the influence presented to the overall goal in this case they will be location, geomorphological, environmental and climatic criteria.

Questions?

Selftest

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Reading topics

1) Reclassification:

https://ltb.itc.utwente.nl/page/481/concept/78748Links to an external site.

2) Raster Overlay :

https://ltb.itc.utwente.nl/page/481/concept/78747Links to an external site.

3) Raster Measurements:

https://ltb.itc.utwente.nl/page/481/concept/78746Links to an external site.

4) Raster Surface Analysis:

https://ltb.itc.utwente.nl/page/481/concept/78579Links to an external site.

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Link to Exercise

https://www.qgistutorials.com/en/docs/3/multi_criteria_overlay.html