Raster Operations

Local, Neighborhood, and Zonal Approaches

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Raster Operations - Overview

- **Local**: Operations performed on a cell by cell basis
- **Neighborhood**: Operations performed using a moving group of cells
- **Zonal**: Operations performed using zones (groups of cells having the same value)

Local Operations - Overview

- Cell by cell operations
- Computes output cell values as a function of the input cell values
- Can be done using single or multiple rasters
- "No data" cells not included in calculations
- Common uses: reclassification and overlays

Local Operations – Reclassification (single raster)

One-to-one change – input raster cell value is replaced with new value in the output raster (integer rasters only)

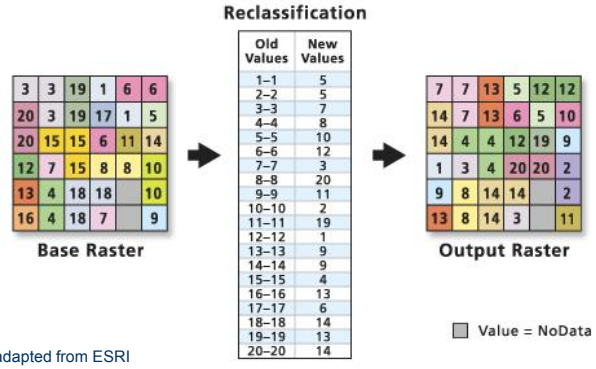


Diagram adapted from ESRI ArcGIS 9.3 Helpdesk

Local Operations – Reclassification (single raster)

Range of values – a new value is given to a range of values in the input raster (integer and floating point rasters)

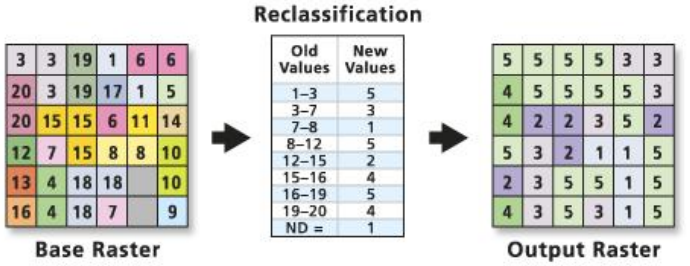


Diagram adapted from ESRI ArcGIS 9.3 Helpdesk

Reclassification Applications

- Simplification (creating groups for analysis)

- Replace values based on new information

- Create common scales for ranking data values (ex: creating suitability classes)

Local Operations – Multiple Rasters

Operation: add raster 1 and raster 2 cell values to produce an output raster with the summed cell values

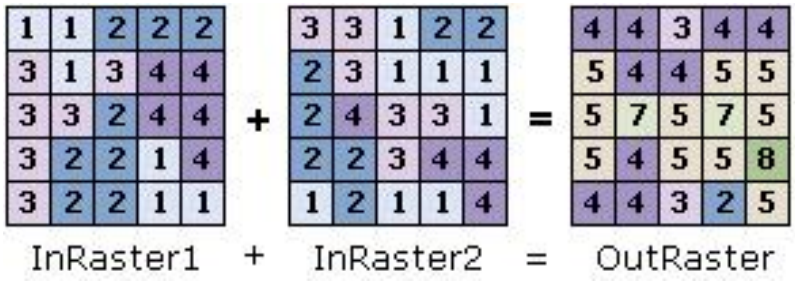


Diagram adapted from ESRI ArcGIS 9.3 Helpdesk

Local Operations – Multiple Rasters

Examples of operations that can be done using multiple rasters:

- mathematical functions
- summary statistics
- **Combine operation** (Combines rasters by assigning a unique output value to each *unique combination* of input values).

Applications: change detection studies; predicting habitats favorable for wildlife species

Neighborhood (focal) Operations

- Uses values for the cells within the neighborhood to calculate the value for the focal cell
- Focal cell moves from cell to cell
- Applies to single rasters
- Can produce summary statistics
- "No data" cells not included in analysis
- Common shapes used for neighborhood analysis:

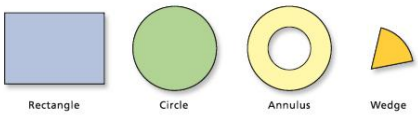


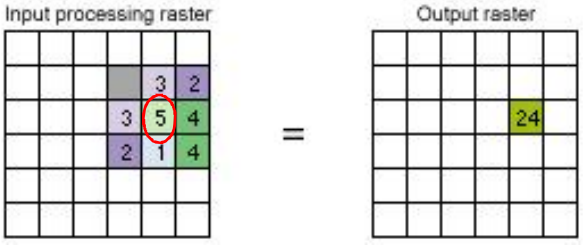
Diagram from ESRI ArcGIS 9.3 Help Desk

Neighborhood Operations

Operation: Summation (including value of focal cell)

Neighborhood size: 3 x 3 rectangle; red circle = focal cell

Gray square = no data for that cell's value



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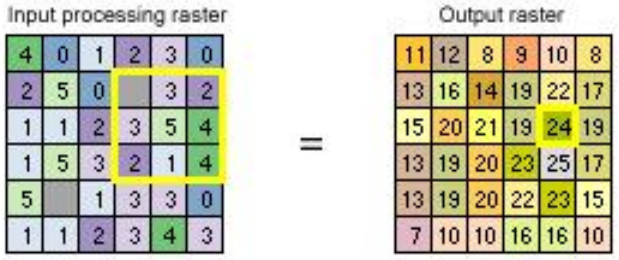


Diagram adapted from ESRI ArcGIS 9.3 Helpdesk

Neighborhood Operations - Common Applications

- Data simplification
- Terrain analysis
- Image processing
- Site selection

Zonal Operations

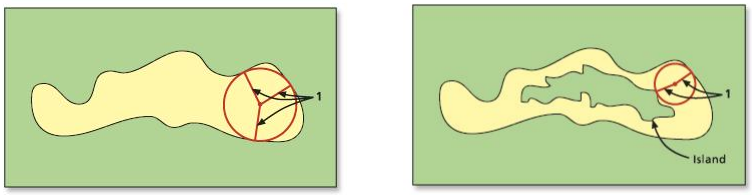
- Involves groups of cells with the same values or similar features (zones)
- Cells do not need to be contiguous to be in a zone
- Can be used with a single raster or with two rasters

Zonal Operations

- **Single raster zonal operations**
  - Measures the geometry of each zone (area, perimeter, centroid, thickness, etc.)
- **Two raster zonal operations**

  - Involves an input raster and a zonal raster to produce a new raster that summarizes cell values in the input raster by zone

Zonal Thickness – Single Raster Example

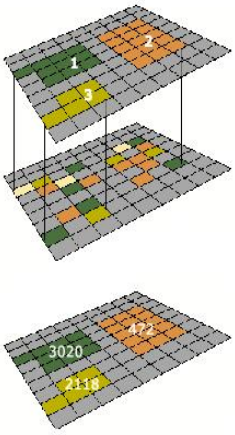


Answers the question:

”How far you can run into a forest at its deepest point before you are running out of it?”

(ESRI ArcGIS 9.3 Help Desk).

Zonal Operation – Two Raster Example



Zone layer:
Defines the zones (shape, values, and locations).

Value layer:
Contains the input values used in calculating the output for each zone.

The output table can be joined to the zone layer to display a stastic per zone.

Example application

Zone layer – soil type

Value layer – vegetation type

Output table – Number of vegetation types associated with each soil type

Diagram from ESRI ArcGIS 9.3 Helpdesk

Zonal Operations - Applications

* Landscape ecology analyses
* Comparisons of data sets using descriptive statistics

Raster Operations: Quiz Questions

1. List two reasons for doing reclassification and provide a real-world example of each.

2. Overlaying is another term for a ___ operation using multiple rasters.

3. True or False: Neighborhood operations are used to compare summary statistics from two or more rasters.

4. Fill in the blanks: ___ operations work with groups of cells of same values; ____ operations are cell-by-cell operations; and ___ operations involve moving groups of cells.

Raster Operations: References

Chang, K. 2009. Raster data analysis. In: Introduction to geographic information systems. McGraw-Hill. New York, NY. Pp. 248-267.

ESRI. 2002. Using ArcGIS spatial analysis. Redlands, CA. Pp. 164-189.

ESRI ArcGIS 9.3 Help Desk. http://webhelp.esri.com/arcgisdesktop/9.3/ (Accessed 10-23-09).