

5. Zonal Analysis

5.1 Definition of a zone

5.2 Zonal statistics

5.3 Zonal statistics as table

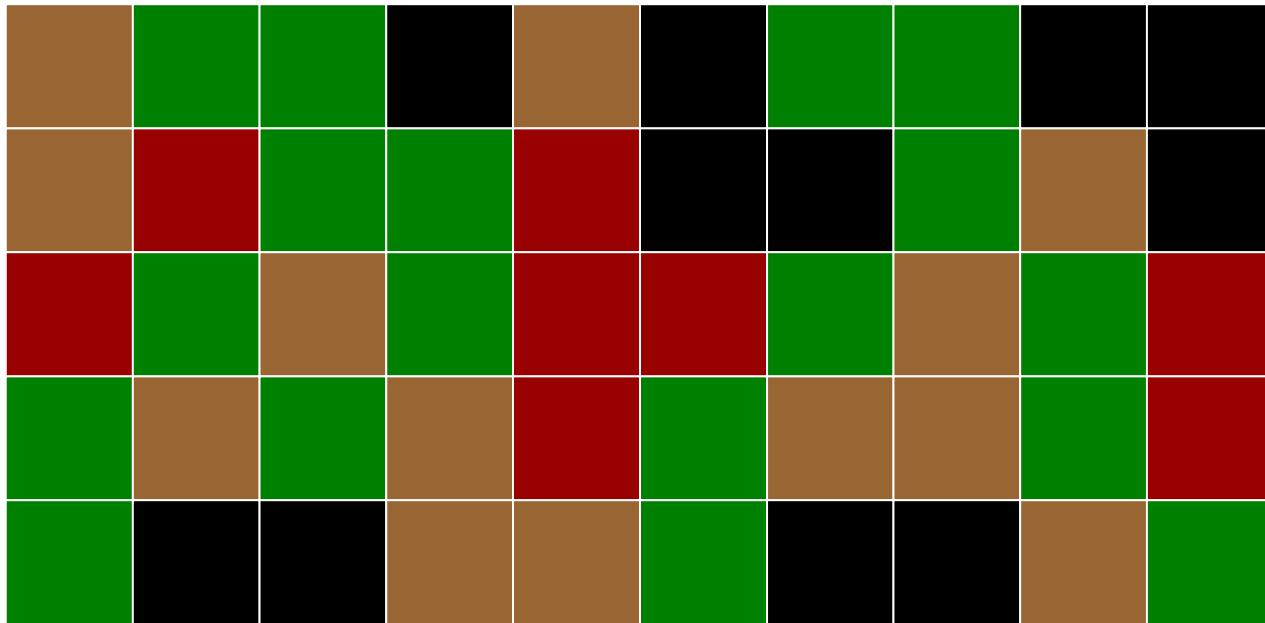
5.4 Zonal geometry

5.5 Zonal geometry as table

5.6 Zonal histogram

5.1 Definition of a zone

A zone is all the cells in a raster that have the same value, regardless of whether or not they are contiguous.

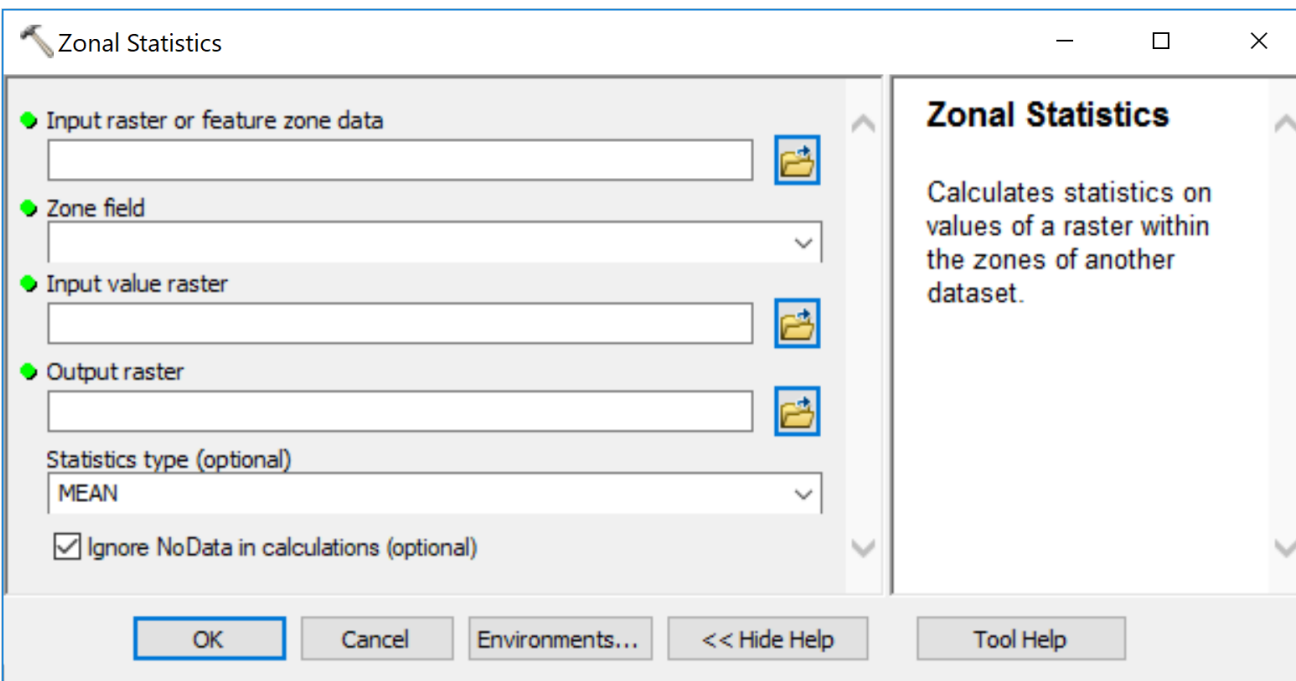


Four zones in a raster

5.2 Zonal statistics

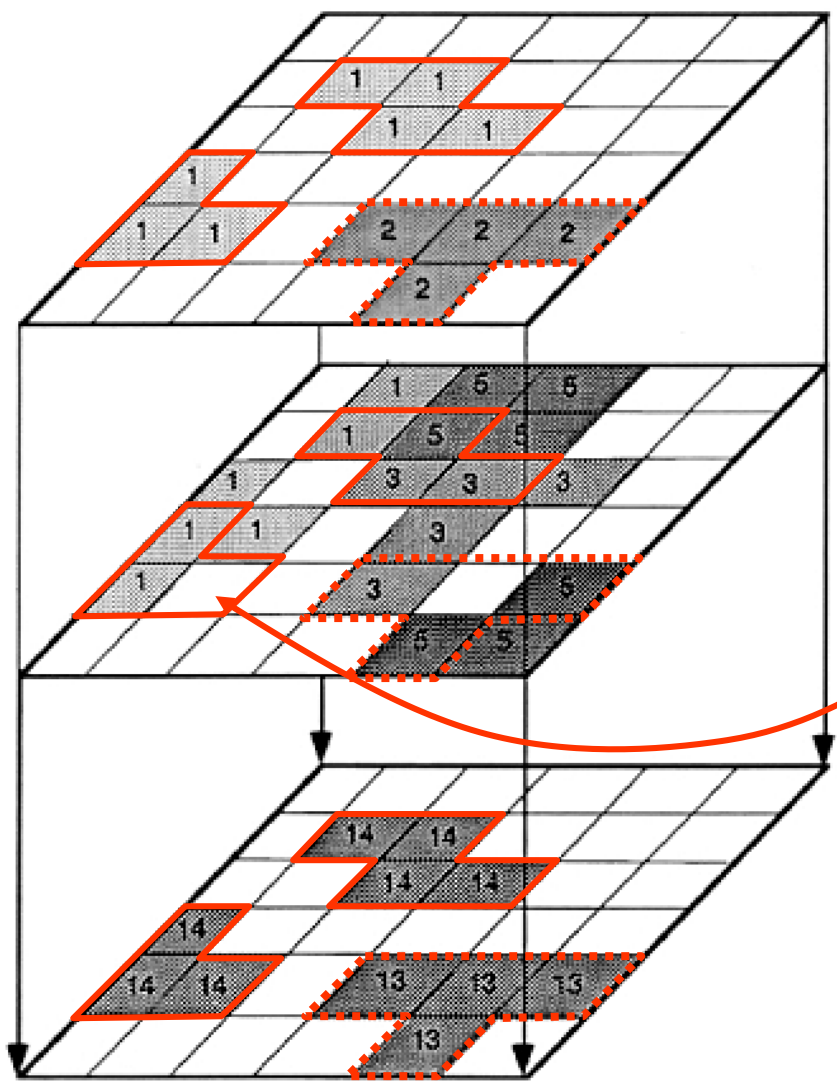
ArcToolbox → Spatial Analyst Tools → Zonal

Zonal statistical functions perform statistics on a per-zone basis; a single output value is computed for every zone in the input zone dataset.



- Majority
- Maximum
- Mean
- Median
- Minimum
- Minority
- Range
- Standard Deviation
- Sum
- Variety

5.3 Zonal statistics (cont.)



Zone Data Layer
(can be a raster or feature dataset)

Value Raster

Ignore NoData in calculations (optional)

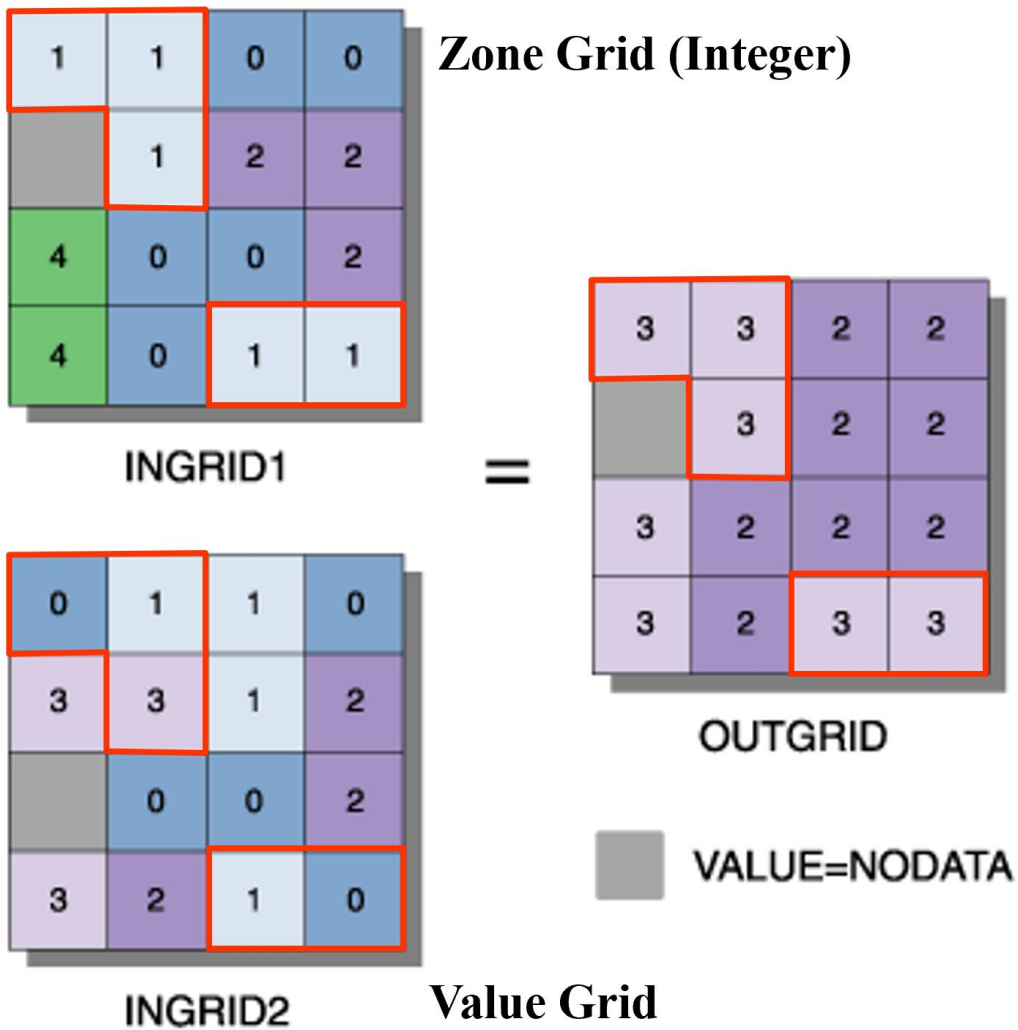
Output Raster (Zonal Sum)

Zone 1: $1+5+3+3+1+1 = 14$

Zone 2: $3+5+5 = 13$

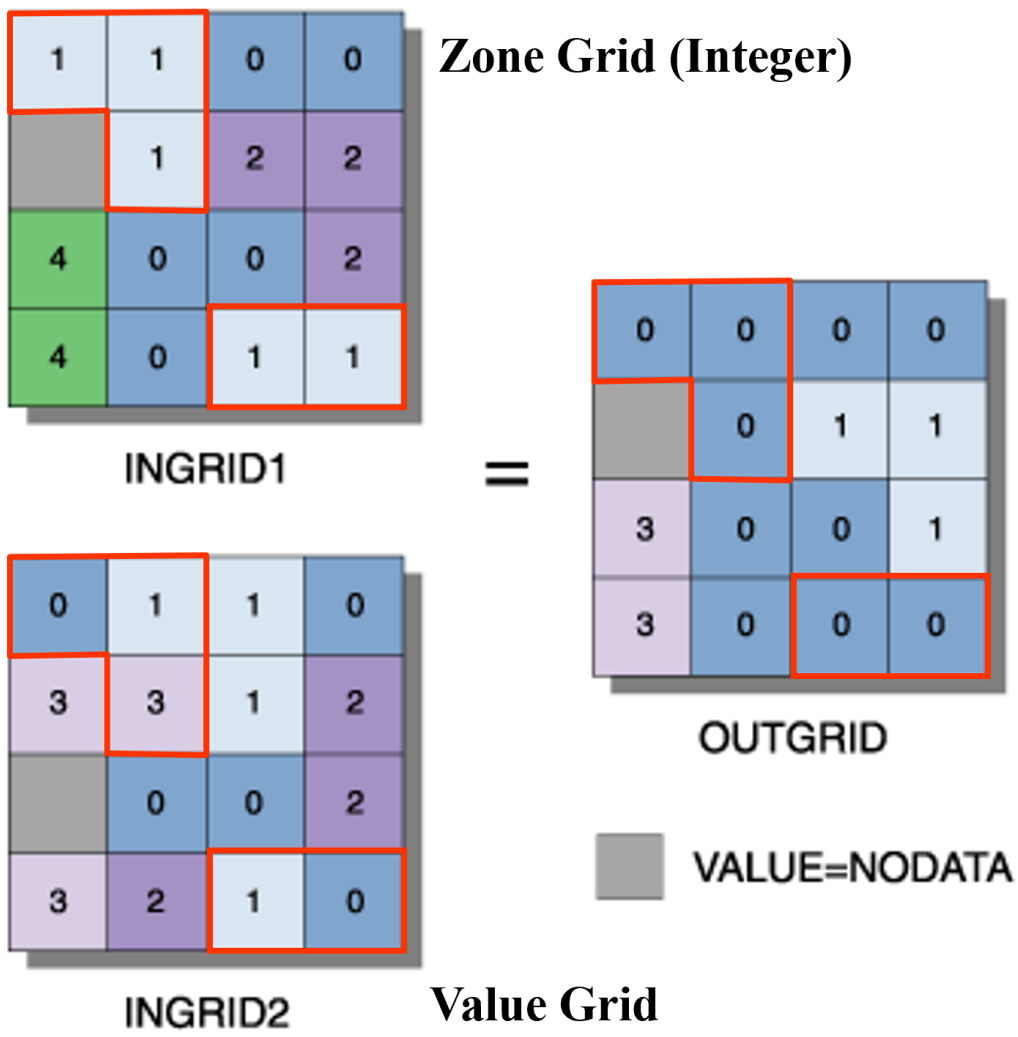
5.3 Zonal statistics (cont.)

Zonal Max



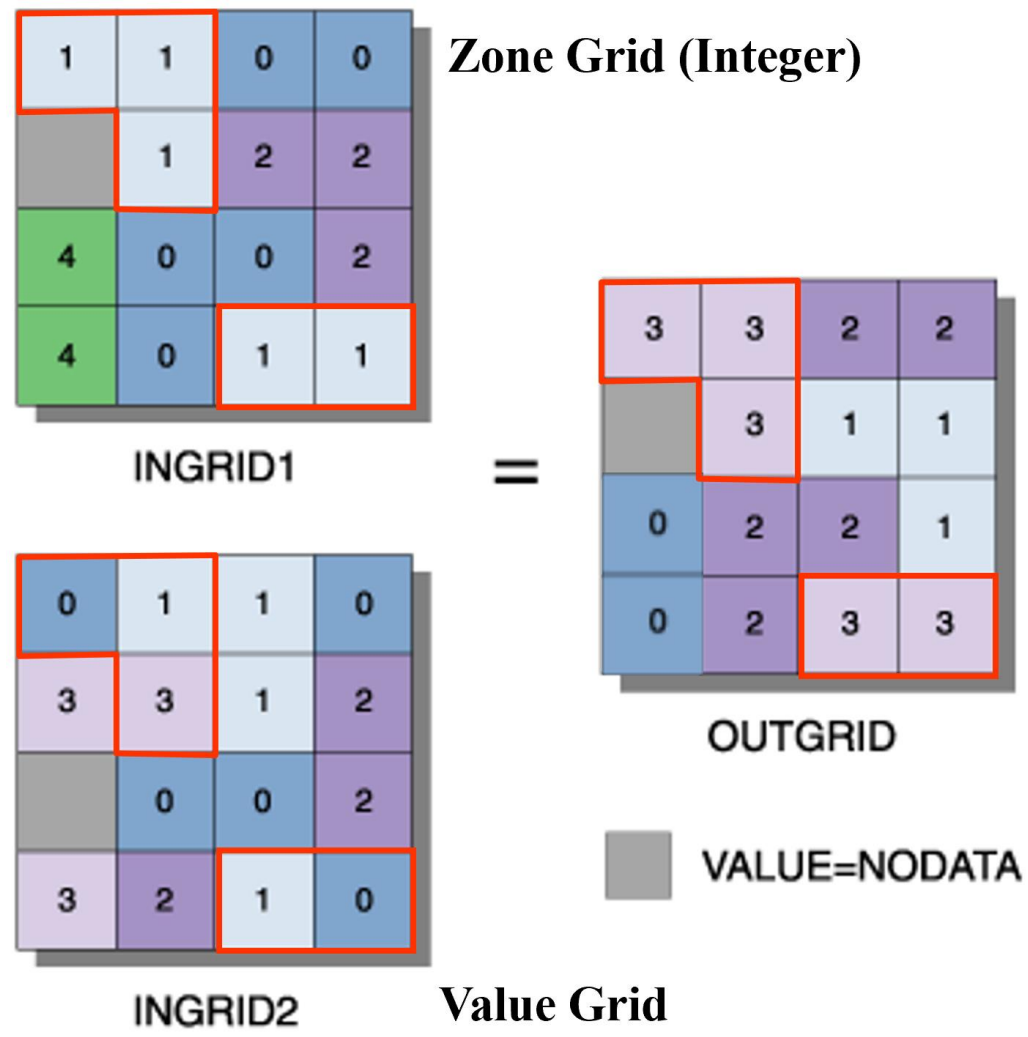
5.3 Zonal statistics (cont.)

Zonal Min



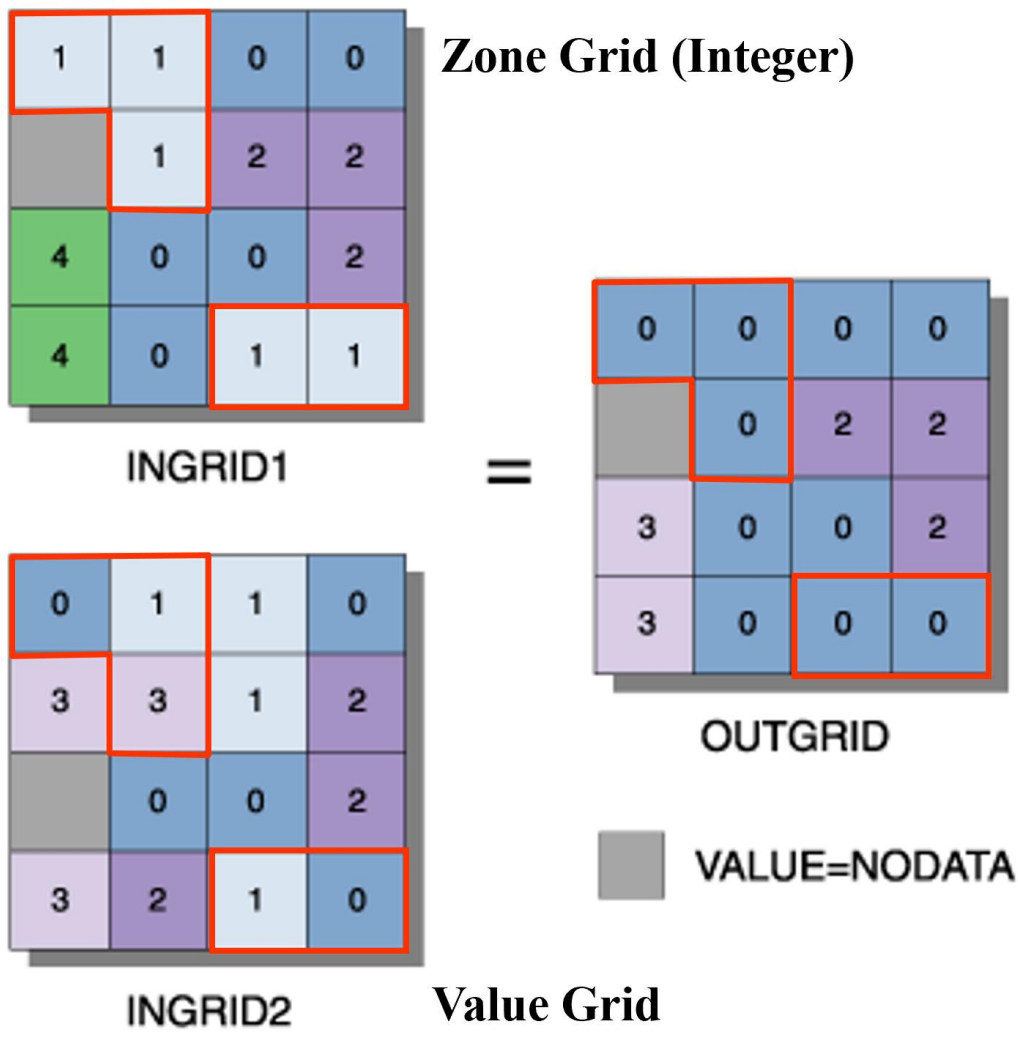
5.3 Zonal statistics (cont.)

Zonal Range



5.3 Zonal statistics (cont.)

Zonal Majority



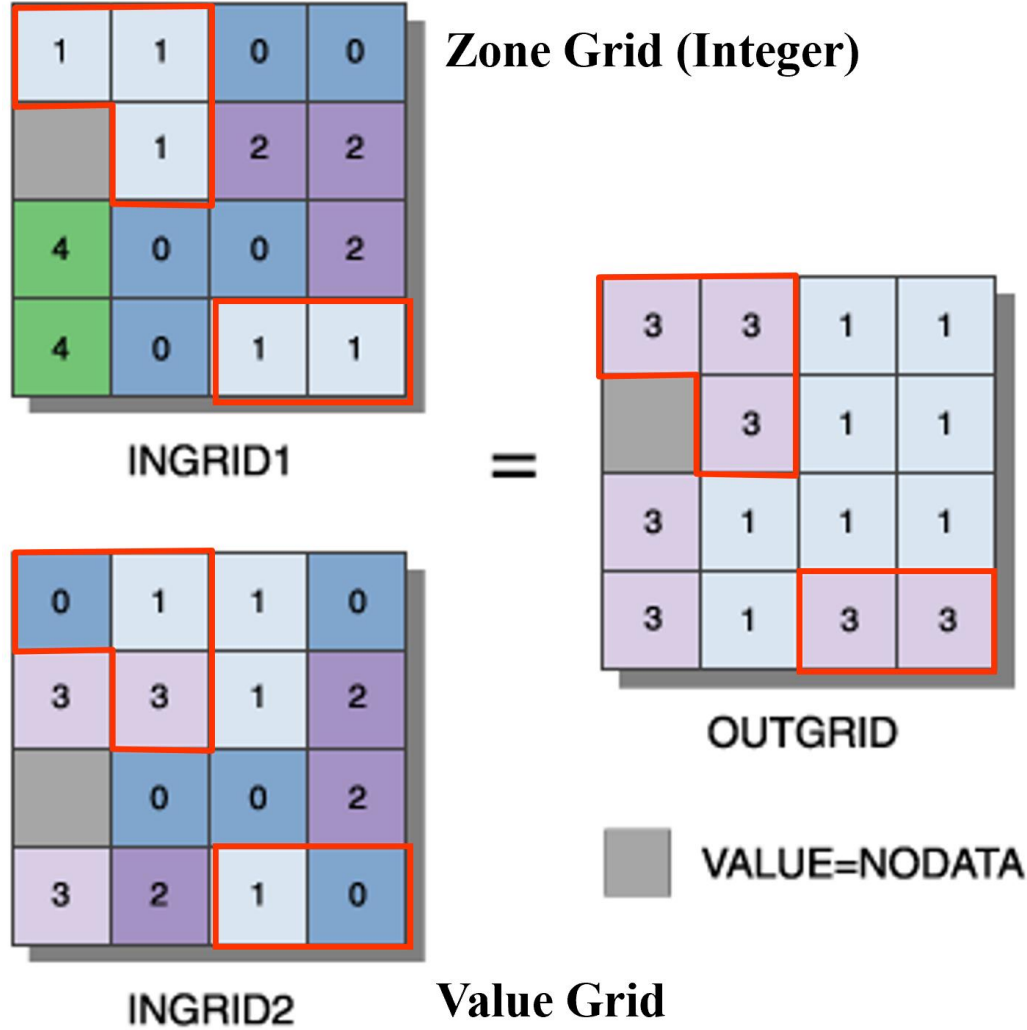
Zone Grid (Integer)

OUTGRID

Value Grid

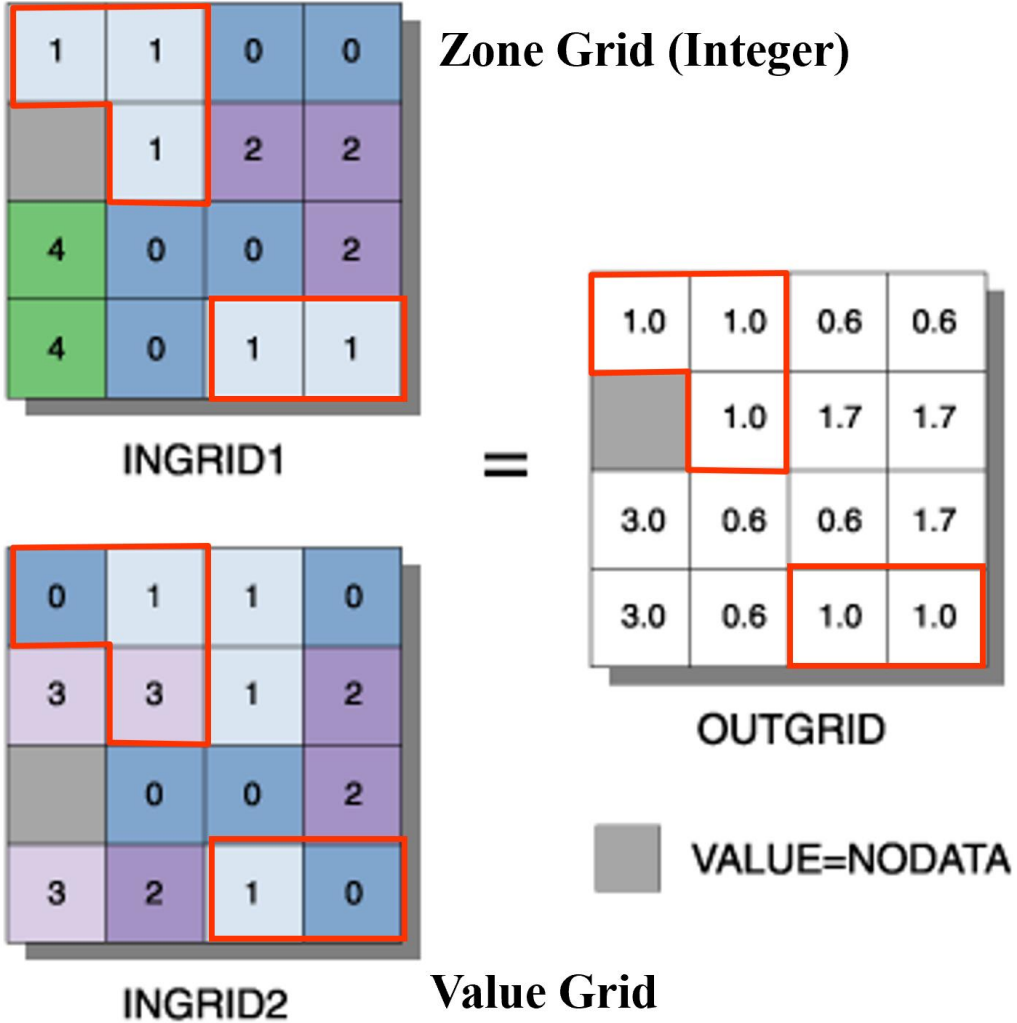
5.3 Zonal statistics (cont.)

Zonal Minority



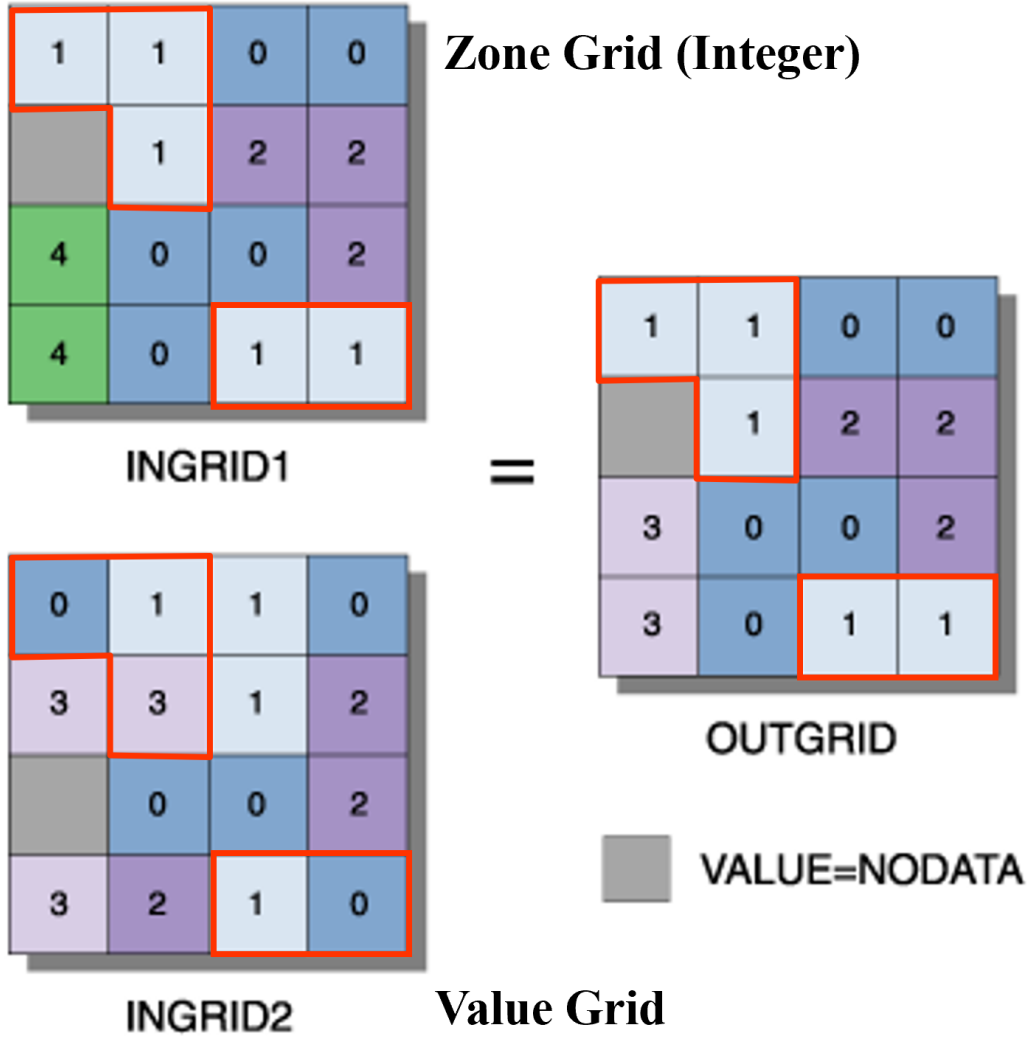
5.3 Zonal statistics (cont.)

Zonal Mean



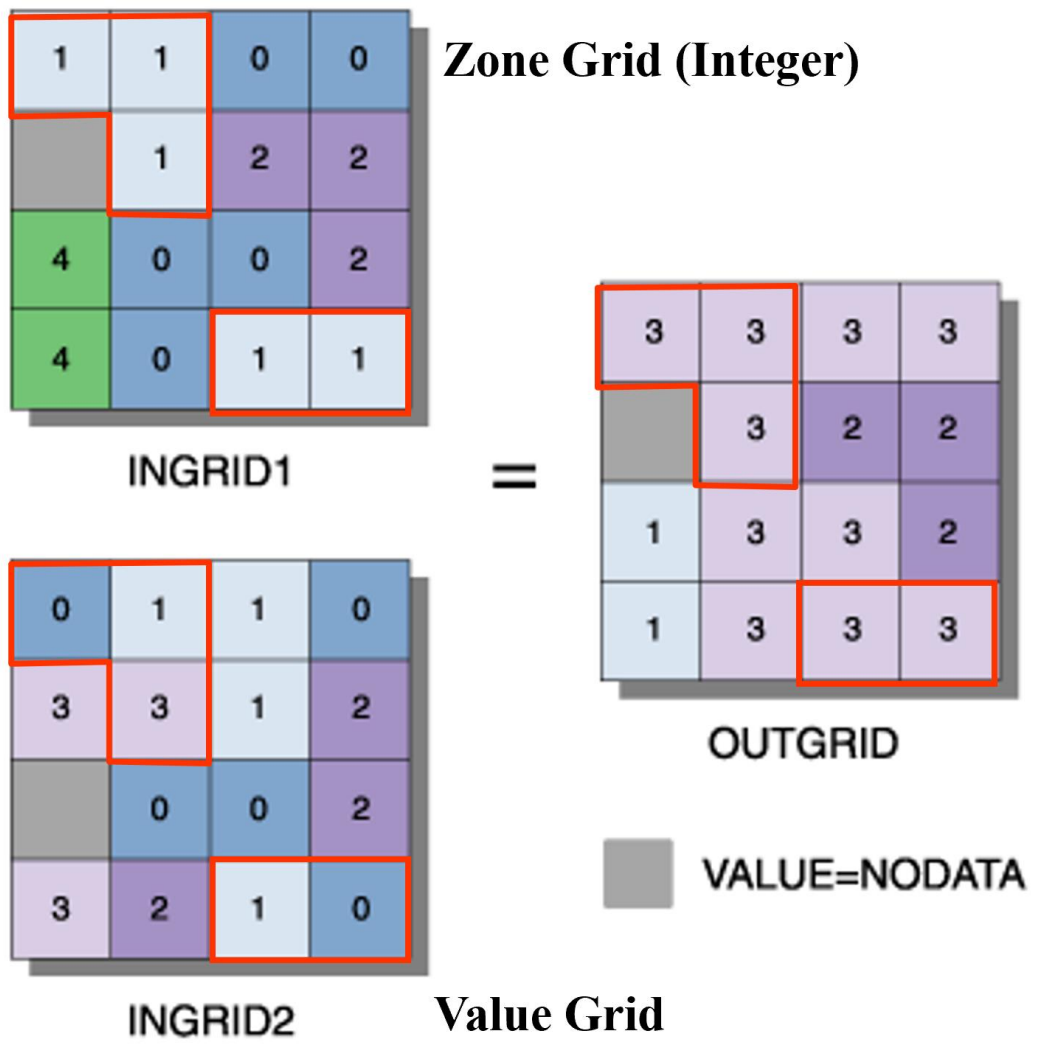
5.3 Zonal statistics (cont.)

Zonal Median



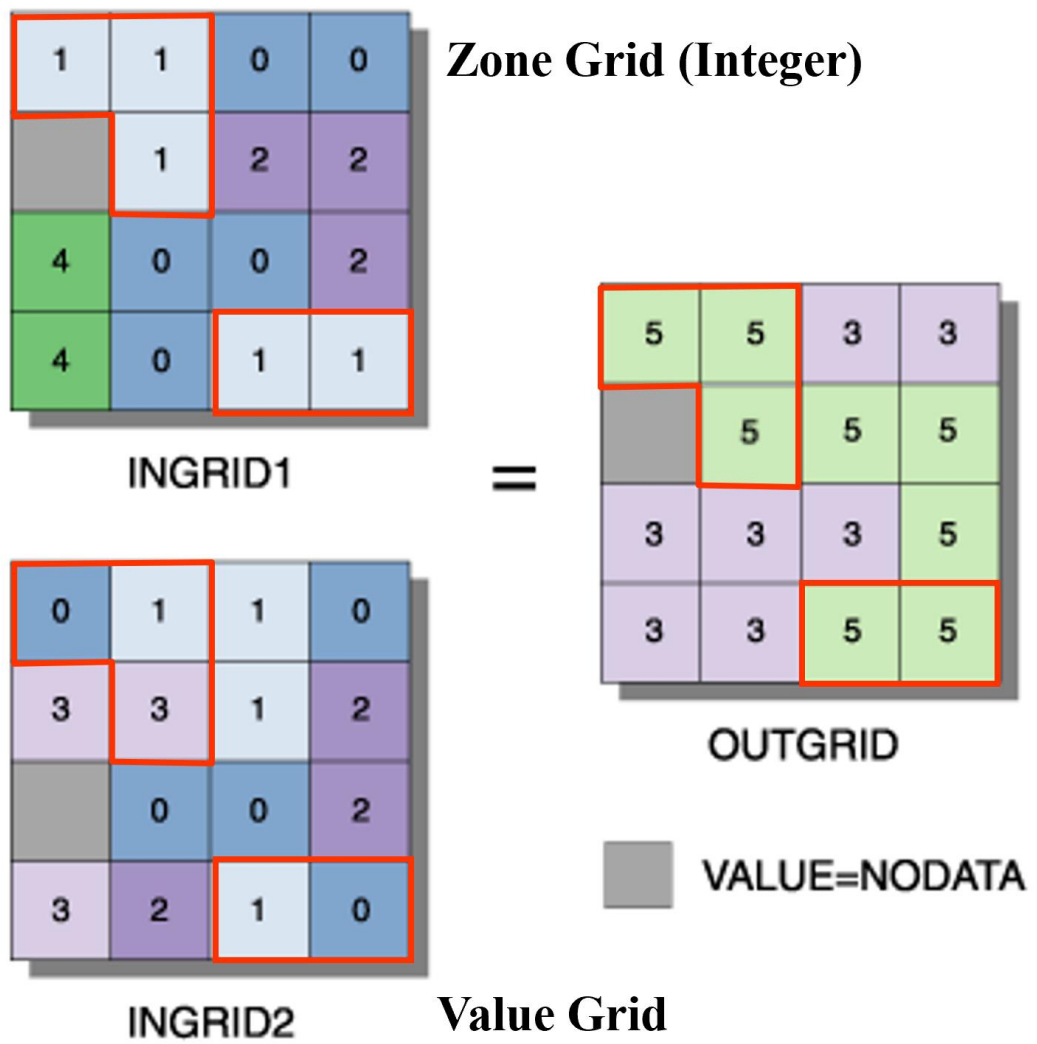
5.3 Zonal statistics (cont.)

Zonal Variety



5.3 Zonal statistics (cont.)

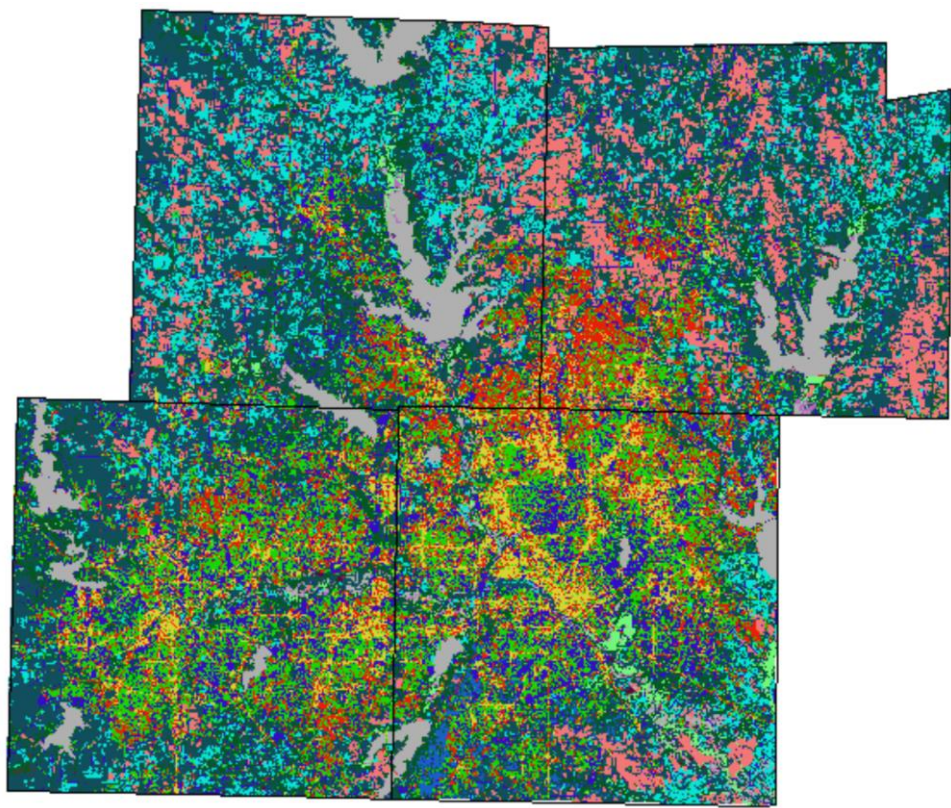
Zonal Sum



5.3 Zonal statistics (cont.)

Example 1: Zonal statistics of land cover types in Collin, Dallas, Denton, and Tarrant

- Use county polygons as zones, and NLCD data as raster data;
- **Discussion:** What statistics can be used?



11	Open Water
12	Perennial Ice/ Snow
21	Developed, Open Space
22	Developed, Low Intensity
23	Developed, Medium Intensity
24	Developed, High Intensity
31	Barren Land (Rock/Sand/Clay)
41	Deciduous Forest
42	Evergreen Forest
43	Mixed Forest
51	Dwarf Scrub*
52	Shrub/Scrub
71	Grassland/Herbaceous
72	Sedge/Herbaceous*
73	Lichens*
74	Moss*
81	Pasture/Hay
82	Cultivated Crops
90	Woody Wetlands
95	Emergent Herbaceous Wetlands

5.3 Zonal statistics as table

Zonal Statistics as Table

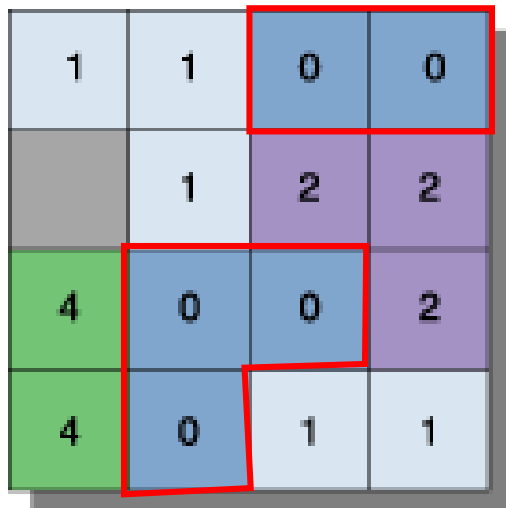
- Input raster or feature zone data
- Zone field
- Input value raster
- Output table
- Ignore NoData in calculations (optional)
- Statistics type (optional): ALL

Zonal Statistics as Table

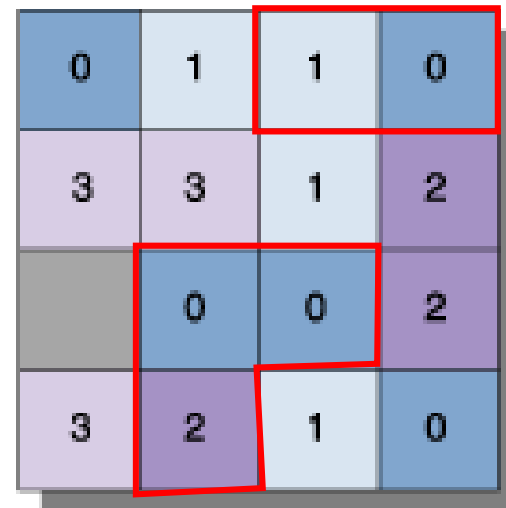
Summarizes the values of a raster within the zones of another dataset and reports the results to a table.

OK Cancel Environments... << Hide Help Tool Help

5.3 Zonal statistics as table (cont.)



INGRID1
Zone Grid



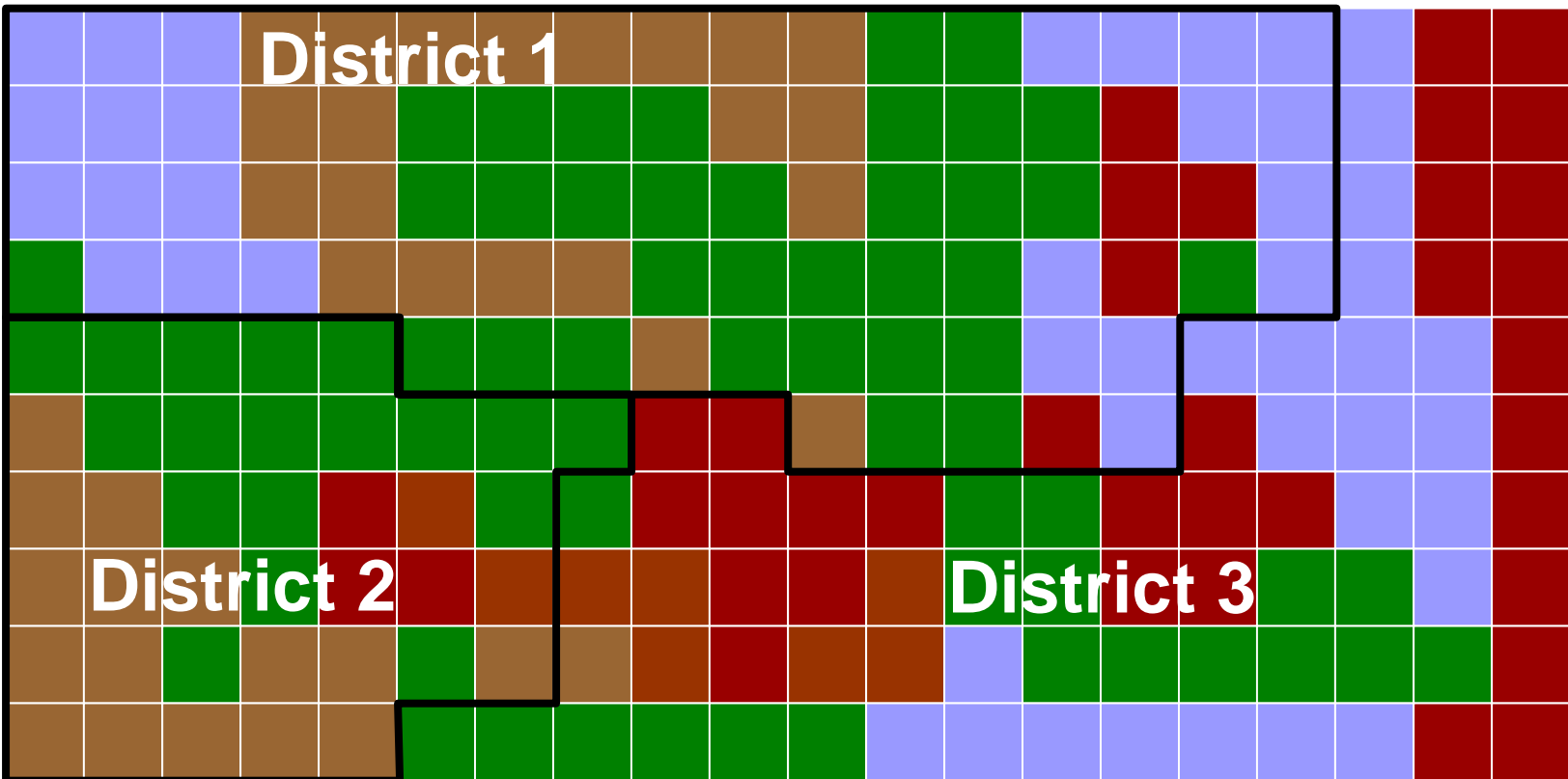
INGRID2
Value Grid

Output INFO table:

VALUE	COUNT	AREA	MEAN	MIN	MAX	...
0	5	125.0000	0.6	0.0	2.0	...
1	5	125.0000	1.0	0.0	3.0	...
2	3	75.0000	1.667	1.0	2.0	...
4	2	50.0000	3.0	3.0	3.0	...

5.3 Zonal statistics as table (cont.)

Example 2: Neighborhood Housing Density



1	2	3	4
---	---	---	---

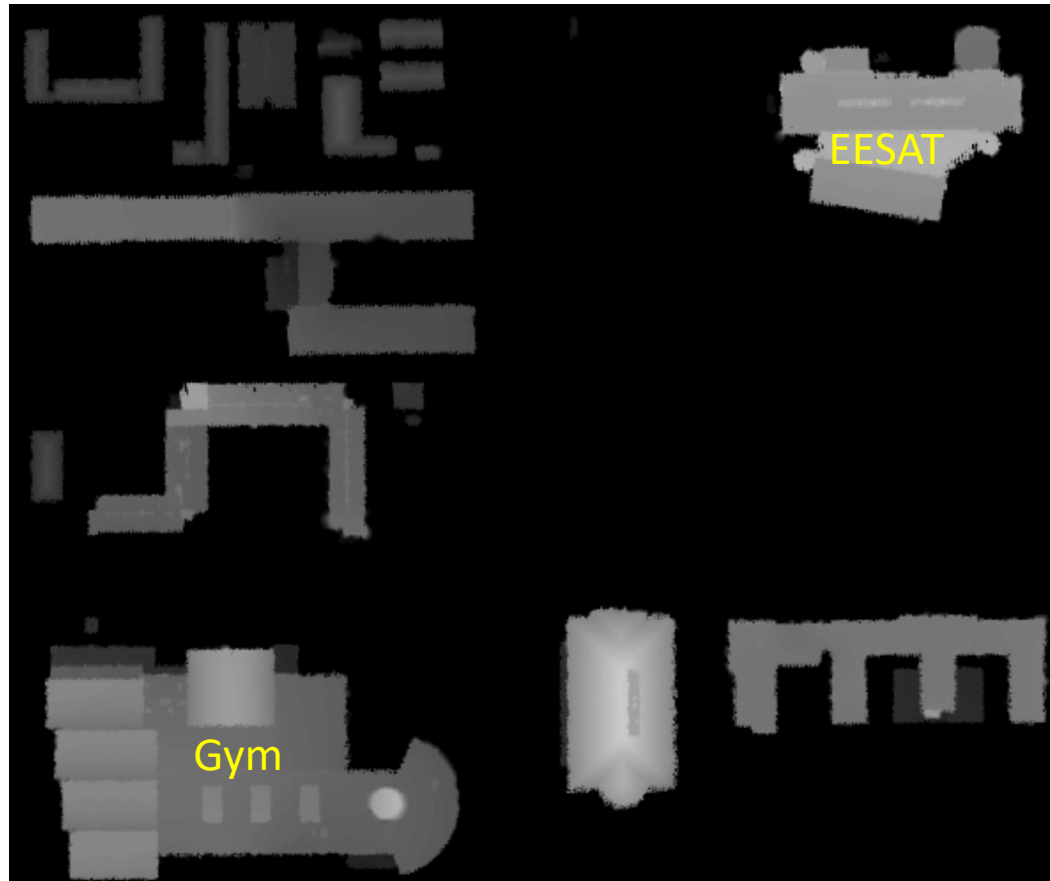
(Number of houses per acre)

	Majority	Minority	Variety ...
District 1	4	3	...
District 2	4	3	...
District 3	3	2	...

5.3 Zonal statistics as table (cont.)

Example 3: Calculating building volume using LiDAR-derived digital height models (DHM) – 0's for ground surface, other cells for building heights.

Discussion: How?



5.4 Zonal geometry

- Area
- Perimeter
- Thickness
- Centroid

Zonal Geometry

Input raster or feature zone data

Zone field

Output raster

Geometry type (optional)
AREA

Output cell size (optional)

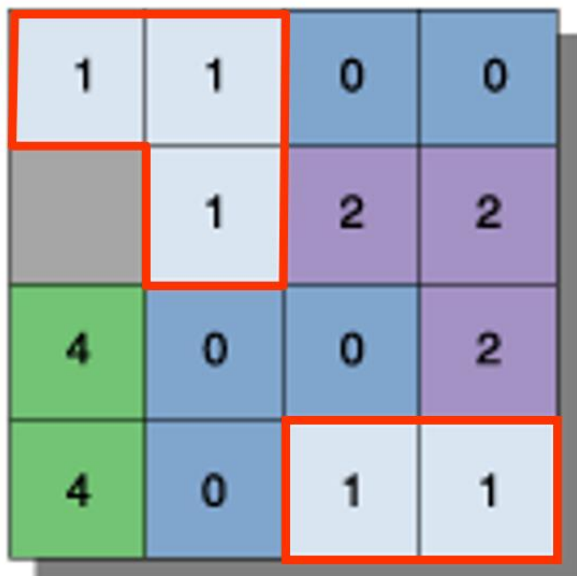
Zonal Geometry

Calculates the specified geometry measure (area, perimeter, thickness, or the characteristics of ellipse) for each zone in a dataset.

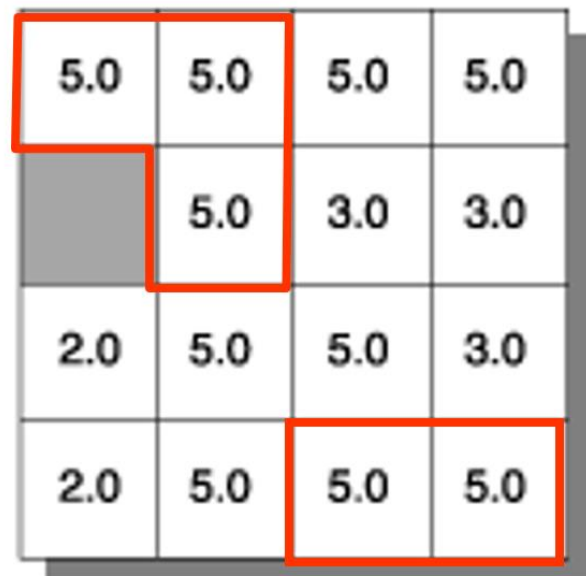
OK Cancel Environments... << Hide Help Tool Help

5.4 Zonal geometry (cont.)

Area



=



INGRID1

OUTGRID

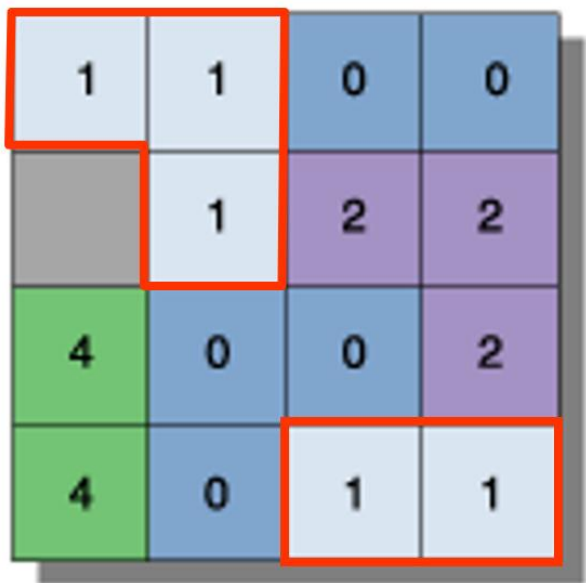
VALUE=NODATA

(Esri)

Cell size = 1

5.4 Zonal geometry (cont.)

Perimeter



INGRID1

=



OUTGRID



VALUE=NODATA

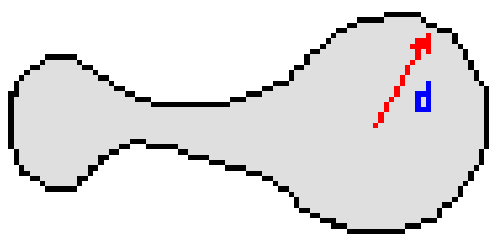
(Esri)

Cell size = 1

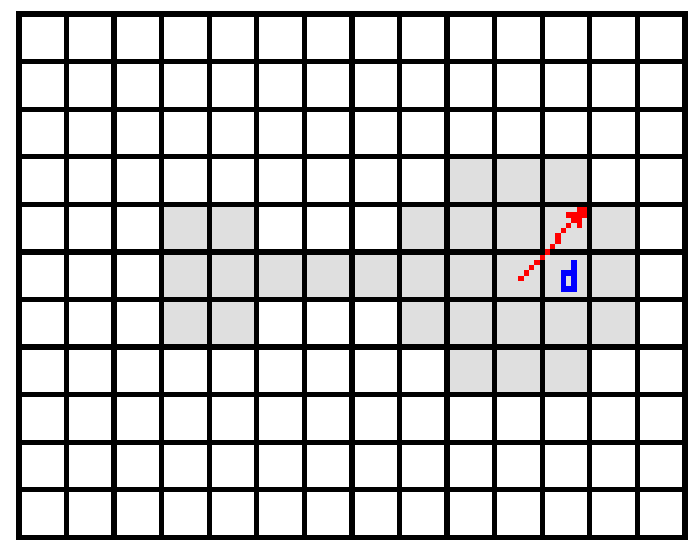
5.4 Zonal geometry (cont.)

Thickness

The radius (in cells) of the largest circle that can be drawn within each zone without including any cells outside the zone.



Forest polygon

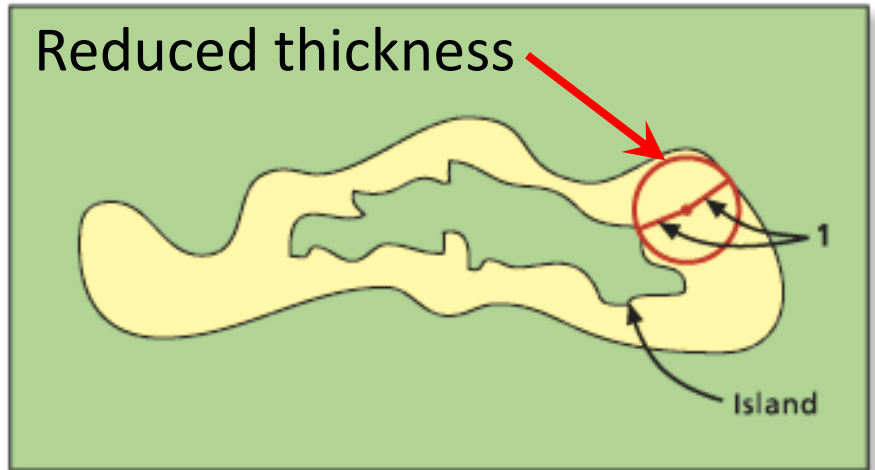
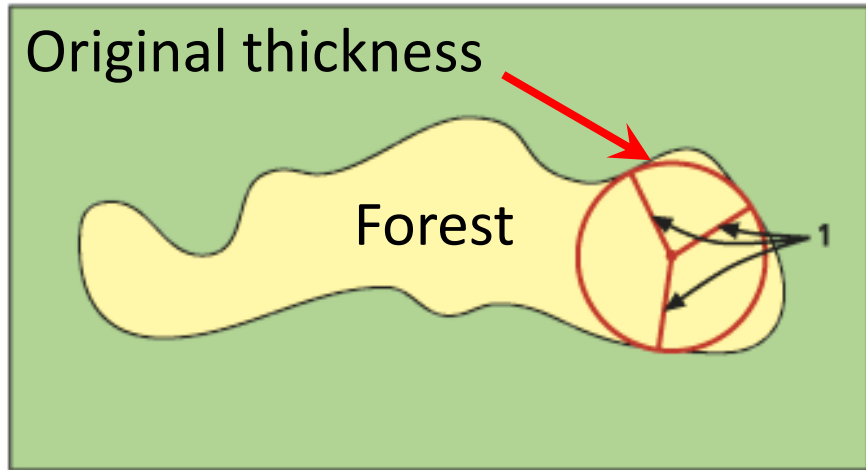


ZONALTHICKNESS on forest zone

(Esri)

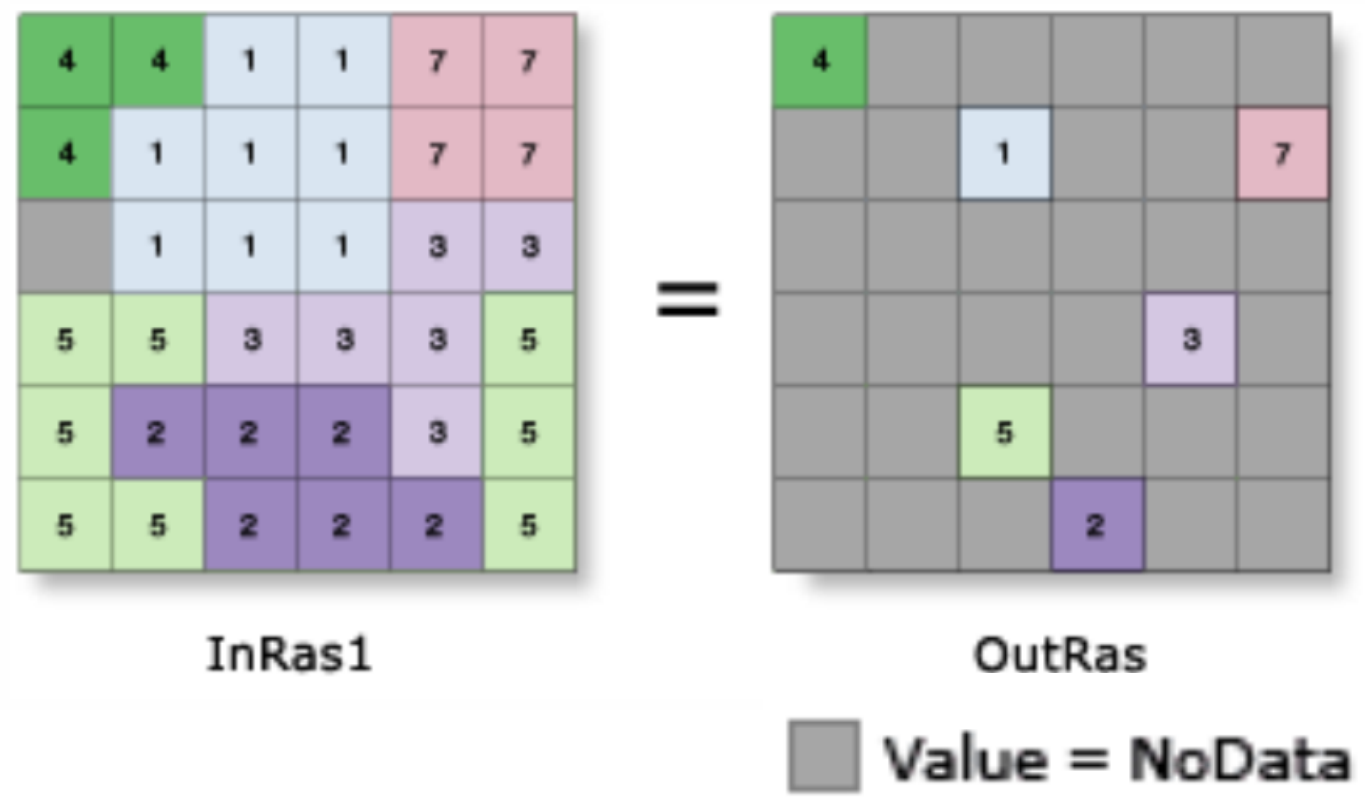
5.4 Zonal geometry (cont.)

Thickness



5.4 Zonal geometry (cont.)

Centroid



5.5 Zonal geometry as table

Zonal Geometry as Table

- Input raster or feature zone data
- Zone field
- Output table
- Processing cell size (optional)

Zonal Geometry as Table

Calculates the geometry measures (area, perimeter, thickness, and the characteristics of ellipse) for each zone in a dataset and reports the results as a table.

OK Cancel Environments... << Hide Help Tool Help

5.5 Zonal geometry as table (cont.)



InRas

VALUE	AREA	PERIMETER	THICKNESS	XCENTROID	YCENTROID	MAJORAXIS	MINORAXIS	ORIENTATION
0	5.0	14.0	0.5	2.300	2.100	2.338	0.681	60.714
1	5.0	14.0	0.5	1.900	2.100	2.668	0.596	126.061
2	3.0	8.0	0.5	3.167	2.167	1.286	0.743	135.000
4	2.0	6.0	0.5	0.500	1.000	1.128	0.564	90.000

(Esri)

5.6 Zonal histogram

Zonal Histogram

Input raster or feature zone data
DentonCounty

Zone field
FID

Input value raster
denton2001

Output table
C:\Temp\dentonhist2001

Output graph name (optional)
dentonhist2001

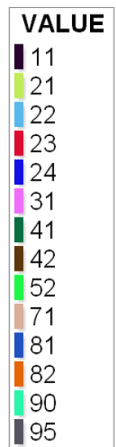
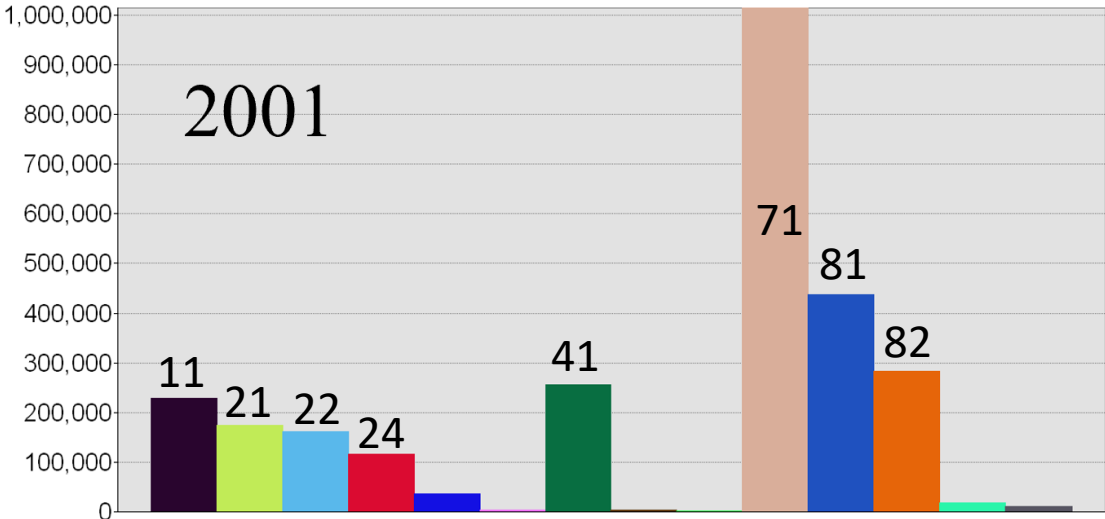
Zonal Histogram

Creates a table and a histogram graph that show the frequency distribution of cell values on the Value input for each unique Zone.

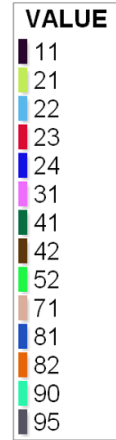
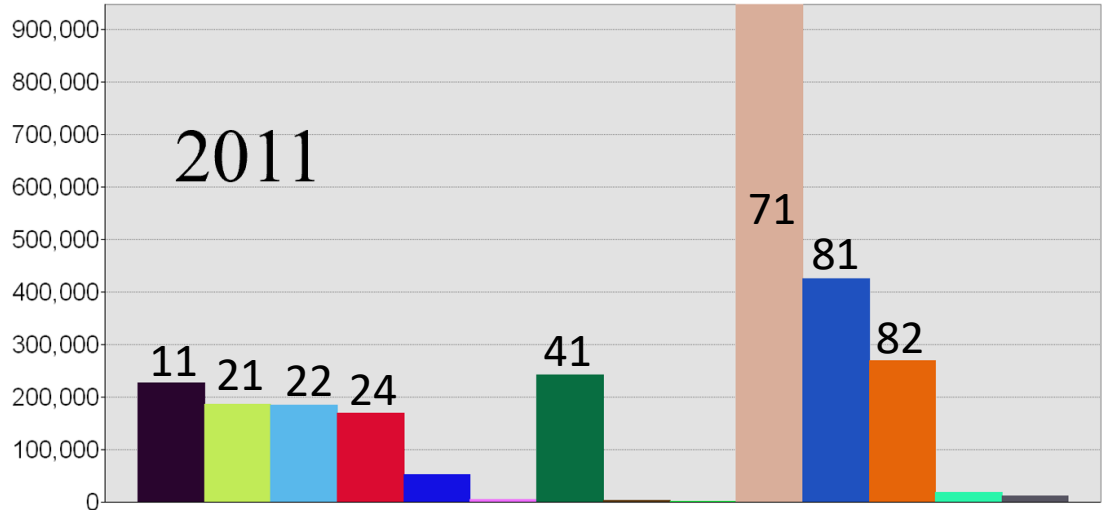
OK Cancel Environments... << Hide Help Tool Help

5.6 Zonal histogram

Example 4: Denton NLCD histograms for 2001 and 2011



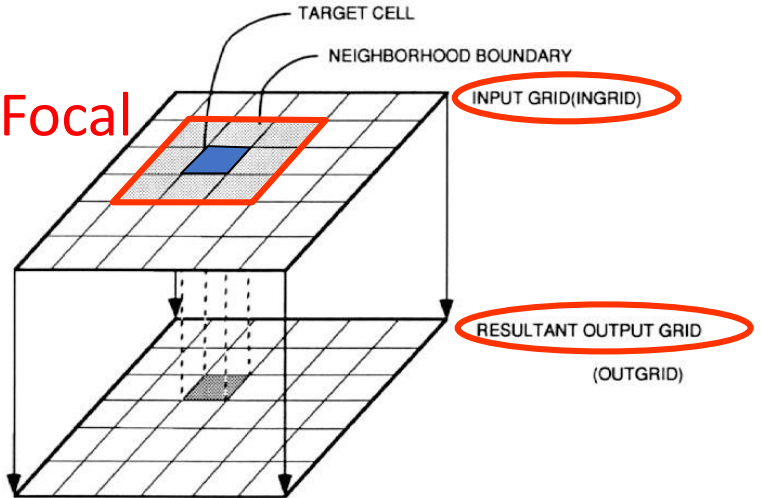
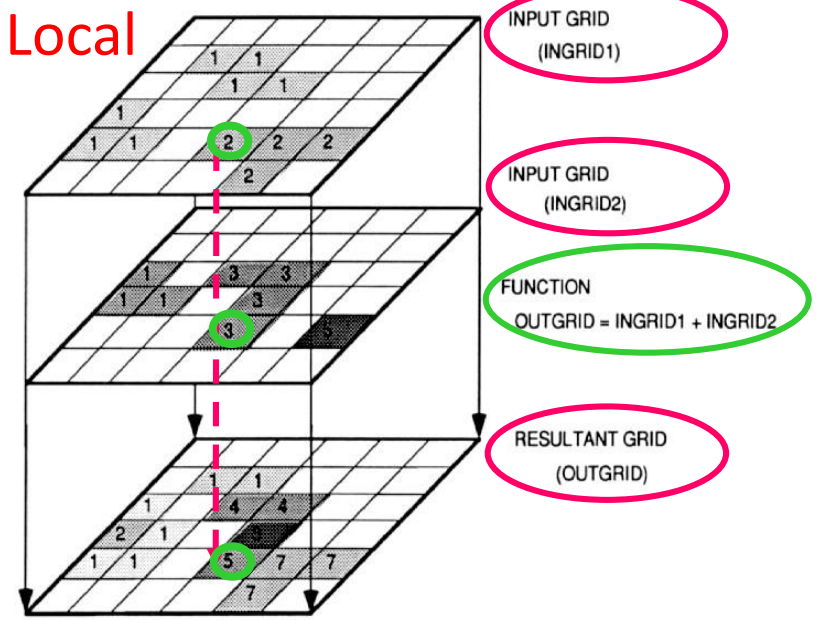
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- 12 Perennial Ice/ Snow
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- 43 Mixed Forest
- 51 Dwarf Scrub*
- 52 Shrub/Scrub
- 71 Grassland/Herbaceous
- 72 Sedge/Herbaceous*
- 73 Lichens*
- 74 Moss*
- 81 Pasture/Hay
- 82 Cultivated Crops
- 90 Woody Wetlands
- 95 Emergent Herbaceous Wetlands



Summary

- Zonal Statistics
 - Majority
 - Maximum
 - Mean
 - Median
 - Minimum
 - Minority
 - Range
 - Standard Deviation
 - Sum
 - Variety
- Zonal Geometry
 - Area
 - Centroid (balancing point or center of mass)
 - Perimeter
 - Thickness
- Zonal Histogram

Local, Focal, and Zonal Analyses: A Comparison

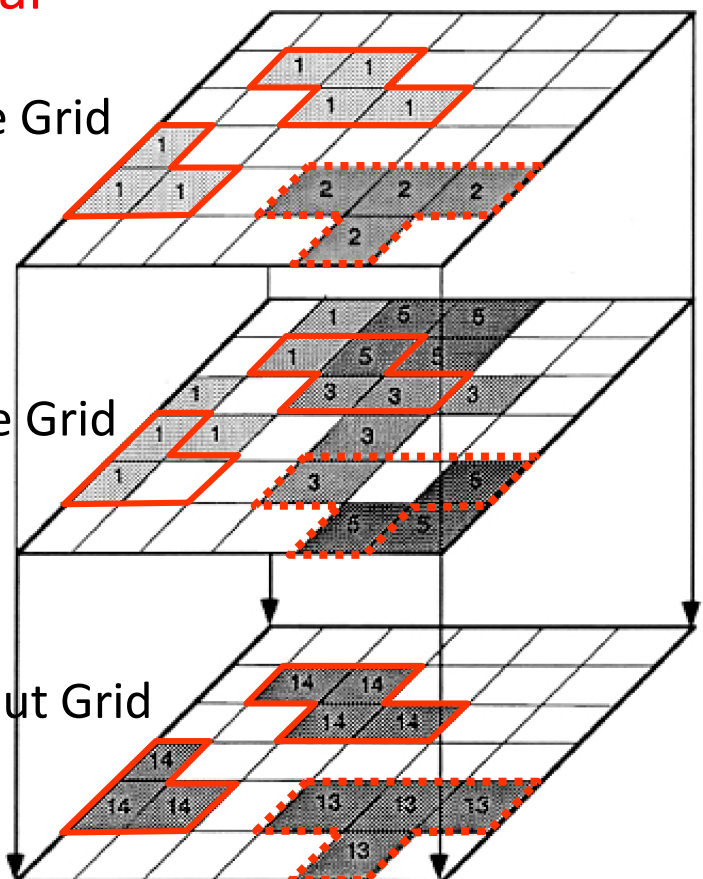


Zonal

Zone Grid

Value Grid

Output Grid



Review

5.1 Definition of a zone

5.2 Zonal statistics

5.3 Zonal statistics as table

5.4 Zonal geometry

5.5 Zonal geometry as table

5.6 Zonal histogram