Raster Data Analysis

Raster Data Model

- Cells (Pixels)
- Cell value

- x, y cell sizes
- Geographic coordinates

Attributes
Raster to Vector / Vector to Raster

ArcGIS Spatial Analyst

- Mainly for raster data analysis
  - Arctoolbox: Spatial Analyst Tools
  - Spatial Analyst Toolbar
  - Raster Calculator
Raster Calculator

- Single-line map algebraic expression
- Multiple inputs in a single expression.
- Multiple Spatial Analyst tools in a single expression.

Raster Calculator Syntax

- Operators
  \[ \text{inraster1} + \text{inraster2} \]

- Tools & Functions (tool names are case sensitive!)
  \[ \text{Aspect("C:/Datat/inraster")} \]

- Tool parameters
  \[ \text{Slope("dem", "PERCENT_RISE")} \]
Spatial Analyst Option Menu (ArcGIS 9.x)

Geoprocessing Environment Setting (ArcGIS 10)
Mask & Extent

Raster Calculator Functions

- Arcinfo Workstation / Arcdoc
- > 200 functions
Raster Operations

Local operation (majority)  Focal operation (focalmajority)  Zonal operation (zonalmajority)

Global operation (costdistance)  Application functions

- Spatial Analyst Tools.tbx
  - Conditional
  - Density
  - Distance
  - Extraction
  - Generalization
  - Groundwater
  - Hydrology
  - Interpolation
  - Local
    - Cell Statistics
    - Combine
    - Equal To Frequency
    - Greater Than Frequency
    - Highest Position
    - Less Than Frequency
    - Lowest Position
    - Popularity
    - Rank
  - Map Algebra
  - Math
  - Multivariate
  - Neighborhood
    - Block Statistics
    - Filter
    - Focal Flow
    - Focal Statistics
    - Line Statistics
    - Point Statistics
  - Overlay
  - Raster Creation
  - Reclass
  - Solar Radiation
  - Surface

- Zonal
  - Tabulate Area
  - Zonal Fill
  - Zonal Geometry
  - Zonal Geometry as Table
  - Zonal Histogram
  - Zonal Statistics
  - Zonal Statistics as Table
Local Operator: Combine

\[
\begin{array}{c|c|c}
\text{Value} & \text{Count} & \text{Code} \\
0 & 1 & 2 \\
1 & 1 & 2 \\
2 & 0 & 2 \\
3 & 1 & 1 \\
\end{array}
\quad
\begin{array}{c|c|c}
\text{Value} & \text{Count} & \text{Type} \\
0 & 1 & \text{MIN} \\
1 & 4 & \text{MAX} \\
2 & 3 & \text{WMN} \\
3 & 3 & \text{SUM} \\
\end{array}
\quad
\begin{array}{c|c|c|c}
\text{Value} & \text{Count} & \text{InRas1} & \text{InRas2} \\
1 & 2 & 1 & 0 \\
2 & 1 & 1 & 0 \\
3 & 1 & 0 & 0 \\
4 & 1 & 0 & 0 \\
\end{array}
\]

\[\text{Value - NoData}\]
Working with Nodata in RC

- **ISNULL**: convert Nodata to a value
- **SETNULL**: set cell value to Nodata
- **CON**: conditional function

**Examples**

- Replace Nodata with 0 in a DEM
  \[
  \text{con(isnull([dem]), 0, [dem])}
  \]

- Set slope > 15 to Nodata on the DEM
  \[
  \text{setnull([slope] > 15, [dem])}
  \]
ISNULL() Function

returns "1" if the input value is NODATA, and "0" if it is not, on a cell-by-cell basis within the analysis window.

ISNULL(<grid>)

Argument

<grid> - an input integer or floating-point grid, or an expression resulting in a grid.

Notes

- Input values can be positive or negative.
- The output value types are always integer. The values are either 0 or 1.
- Valid expressions include:
  - outgrid = isnull(grid1)
  - outgrid = isnull(grid1 * 0.5)
  - outgrid = isnull(grid1 * ingrid1)
  - outgrid = isnull(grid1 + ingrid2)
  - outgrid = isnull(sin(ingrid1) * 4) + (focalsum(ingrid2))

SETNULL() Function

returns NODATA if the evaluation of the input condition is 'TRUE', if it is 'FALSE', returns the value specified by the grid, scalar or number on a cell-by-cell basis within the analysis window.

SETNULL(<condition>, <grid | scalar | number>)

Arguments

- <condition> - input condition to be tested for Boolean 'TRUE' or 'FALSE'. The condition can be a relational expression of a single grid, scalar, number, or expression resulting in a single grid, scalar or number.
- <grid | scalar | number> - defines what the output value will be if the evaluation of the condition is FALSE. If no argument is specified, the output will retain NODATA. Unless the desired result is a grid containing all NODATA, it is advisable to specify an output for this argument.
  - grid - an input integer or floating-point grid, or an expression resulting in a grid.
  - scalar - the current value of the specified scalar variable.
  - number - any integer or floating-point value, or an expression resulting in a number.
CON() Function

CON() Function
Available at: GRID

<table>
<thead>
<tr>
<th>Usage</th>
<th>Notes</th>
<th>Discussion</th>
<th>Related Topics</th>
</tr>
</thead>
</table>

performs one or more conditional if/else evaluations on a cell-by-cell basis within the analysis window.

CON(<condition>, <true_expression>,
    [<condition>, <true_expression>], ...,
    [<condition>, <true_expression>], <false_expression>)

Arguments
- **<condition>** - any valid Boolean or relational expression involving multiple grids, scalars, numbers, or expressions.
- **<true_expression>** - the value or expression that will be used to compute the output value if the evaluation of the **<condition>** is TRUE. The input argument can be a grid, scalar or number, or any valid map algebra expression involving operators and functions that results in a valid input. Another CON function is valid input.
- **<false_expression>** - the value or expression that will be used to compute the output value if none of the evaluations of the conditions is TRUE. The input argument can be a grid, scalar or number, or any valid map algebra expression involving operators and functions that results in a valid input. Another CON function is valid input.

Raster Clip Example

Output A

Output B

Output C
Raster Clip
Raster Buffering

Point Features to Raster

- `Con( isnull(pointg), 0, 1)`
Implementing Ordered Weighted Average in ArcGIS

- Raster Calculator
  
r1 = rank(1, [factor1], [factor2], [factor3])
  r2 = rank(2, [factor1], [factor2], [factor3])
  r3 = rank(3, [factor1], [factor2], [factor3])
  owavg = [r1] * 0.5 + [r2] * 0.3 + [r3] * 0.2