Raster Data Analysis

Raster Data Model

- Cells (Pixels)
- Cell value
- x, y cell sizes
- Geographic coordinates

Attributes
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
  
  `inraster1 + inraster2`

- Tools & Functions (tool names are case sensitive!)
  
  `Aspect("C:/Datat/inraster")`

- Tool parameters
  
  `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

\[
\begin{array}{c|c|c}
\text{InRas1} & \text{InRas2} & \text{OutRas} \\
\hline
1 & 0 & 1 \\
1 & 1 & 2 \\
0 & 1 & 2 \\
0 & 0 & 2 \\
4 & 0 & 1 \\
\hline
\end{array}
\begin{array}{c|c|c}
\text{Value} & \text{Count} & \text{Code} \\
\hline
0 & 5 & 002 \\
1 & 5 & 004 \\
2 & 3 & 005 \\
4 & 2 & 008 \\
\hline
\end{array}
\begin{array}{c|c|c|c}
\text{Value} & \text{Count} & \text{Type} & \text{InRas1} \\
\hline
0 & 5 & \text{MIN} & 1 \\
1 & 4 & \text{MAX} & 1 \\
2 & 3 & \text{WIN} & 1 \\
3 & 3 & \text{SUM} & 1 \\
\hline
\end{array}
\begin{array}{c|c|c|c}
\text{Value} & \text{Count} & \text{InRas1} & \text{InRas2} \\
\hline
1 & 2 & 1 & 0 \\
2 & 2 & 1 & 1 \\
3 & 1 & 0 & 0 \\
4 & 1 & 1 & 0 \\
5 & 1 & 2 & 1 \\
6 & 1 & 2 & 2 \\
7 & 1 & 4 & 2 \\
8 & 1 & 0 & 2 \\
\hline
\end{array}
\]

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**

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 1 or 0.
- Valid expressions include:
  
  - outgrid = isnull(grid1)
  - outgrid = isnull(grid1 + grid2)
  - outgrid = isnull(sin(grid1) * 4) + (focalsum(grid2))

**SETNULL() Function**

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 receive 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() performs one or more conditional true/false 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