Today

• HW1 solution
• Neighborhood & zonal functions
• Pause
• HW questions?
• 3 binary rasters (Red, Green, Blue):
• Elev: (raster, int or float), Elevation > 1400
• Veg: (vector, cat.): 
  TREE_SZ96 = 'O' OR TREE_SZ96 = 'L'
• Soil: (vector, cat.)
  NAME = "Madison Limestone"
• SnailHab_1 = Elev * Veg * Soil
  or: Elev AND Veg AND Soil
• Min: 0 * 0 * 0 = 0, Max: 1 * 1 * 1 = 1
• Area: 16886 cells, each cell is 50 m x 50 m, 
  16886 * 2500 = 42.2 Mio m²
• more levels of “happiness”
• SnailHab_1 = Elev + Veg + Soil
• Min: 0, Max: 3, Range: 4
• Very simple suitability analysis (equal weight given to all three factors)
• Good colors?
• % for each level?
• 100 % is raster width x raster height - provided there are no NoData areas
• 410 x 540 cells or ~540 Mio. m²
• 0: 40%, 1: 30%, 2: 26%, 3: 5%
Global raster functions - Expression evaluation

**Raster calculator: [A] + [B]**

1. Define an empty output raster based on the analysis environment (Spatial Analyst - Options)
2. Position to the next output cell (start at row 0, column 0)
3. Find cell values corresponding to row/column
4. Evaluate the expression (raster calculator) and write the result to the output cell
5. Repeat steps 2—4 for all output cells (0/0, 0/1, ...4/4)

**Same functions as in Tools:** SLOPE([A]) / 10.0
The CON function

IF-THEN-ELSE function for Map Algebra

\[
\text{CON(<condition>, <true_expression>, {false_expression})}
\]

IF \ \text{TEST} \ \text{THEN} (\text{TEST}= 1) \ \text{ELSE} (\text{TEST}= 0)

May be a simple IF-THEN-ELSE

\[
\text{CON(Slope <20, 1, 0)}
\]

Or nest CONs for an ELSE-IF

\[
\text{CON(Slope < 20, 1,}
\text{CON(Slope < 40, 2,}
\text{CON(Slope < 90, 3, 5)
}\}
\]
Neighborhood functions

- got through all cells (locations) of output raster
- for each cell calculate value (SUM) from *many* cells “around” it (in input grid)
- shape of “stamp”: kernel
- typical: 3 x 3 square
- other shapes
- ArgMap menu, Toolbox and raster calculator
Focal Neighborhoods

FOCALSUM (Elev)
FOCALSUM (Elev, Rectangle, 5, 3)
FOCALSUM (Elev, Circle, 2)
FOCALSUM (Elev, Annulus, 2, 3)
FOCALSUM (Elev, wedge, 4, 300, 330)

Kernel.txt

5 3
1 1 0 1 0
1 0 0 1 1
0 1 1 1 0
• Ex: 5 x 5 Majority of Slope > 10 deg

• Effect of 2. pass?

• Majority: needs int or categorical raster!

• Gotcha for Majority for 3 or more possible values: tie results in NoData!
The Neighborhood Function on an Individual Neighborhood

INGRID1

OUTGRID

VALUE=NODATA

The Neighborhood Function on a Grid

Expression: FOCALVARIETY(INGRID1, RECTANGLE, 3, 3)

INGRID1

OUTGRID

The Neighborhood Function on an Individual Neighborhood

INGRID1

OUTGRID

VALUE=NODATA

The Neighborhood Function on a Grid

Expression: FOCALMEAN(INGRID1, RECTANGLE, 3, 3)

INGRID1

OUTGRID
Block Functions:

• Similar to focal but fill area with **same** value
Zonal functions

• Needs 2 inputs:
  • a zone layer:
    non-float raster or polygon
  • a value raster

• Zones don’t need to be continuous!
  (see: regions)
Zonal functions

ZonalSum(District, Population)
Zonal functions

• for each zone do:
  • get stat for value raster cells that are inside the zone

• Creates many types of stats per zone “id”

• creates a standalone table and a chart

• Table can be joined to zone layer

• example: get
  • mean (min, max, etc.)
  • elevation

• for each watershed
• more zone related functions in Toolbox and Raster Calculator

• for later: make regions (REGIONGROUP function)

• ex_15b.mxd:
  • zonal layer - watershed
  • (convert to raster)
  • value raster: slope

• join result to watershed polygons
  • (can also use points, lines as zones!)
<table>
<thead>
<tr>
<th>Type</th>
<th>Map</th>
<th>Attribute Table</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polygon</td>
<td><img src="image1.png" alt="Polygon Map" /></td>
<td>ID Type</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 Sage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 Aspen</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 Aspen</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 Aspen</td>
</tr>
<tr>
<td>GRID (zone)</td>
<td><img src="image2.png" alt="GRID Zone Map" /></td>
<td>Value Type</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 Sage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 Aspen</td>
</tr>
<tr>
<td>GRID (after region grouping)</td>
<td><img src="image3.png" alt="GRID Group Map" /></td>
<td>Value Type</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 Sage</td>
</tr>
<tr>
<td></td>
<td></td>
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<tr>
<td></td>
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</table>