AN INTRODUCTION TO SPATIAL ANALYSES IN R: COMPARISONS TO ARCGIS

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What is R?

- Open source programming language
  - Statistical computing and graphics

- Stems from Bell Labs S language

- R created by Ross Ihaka and Robert Gentleman (New Zealand)
  - First released in 1993
  - Maintained by R Core Development Team
  - 32bit and 64bit versions available (use simultaneously)
    - Current release is 3.1.0
R-Studio Interface – 4 Panes

Source – Write Code Here

Console – Code ‘Executed’ Here

Workspace – Display of In-Memory Objects

Help, Plots & Packages
Data Frames = Tables in R

- `data.frame(matrix/vector)` … use `[ ]` to go to specific rows and/or columns
- Example of using a `data.frame` named ‘df’. Can represent each cell using:
  - Indexes – `df[row, col]` where `row` and `col` are index numbers beginning with 1
  - Character strings – `df["rowname1", "colname1"]`

<table>
<thead>
<tr>
<th>Obj= df</th>
<th>colname1</th>
<th>colname2</th>
<th>colname3</th>
</tr>
</thead>
<tbody>
<tr>
<td>rowname1</td>
<td>[1,1] = 4</td>
<td>[1,2] = 5</td>
<td>[1,3] = 6</td>
</tr>
</tbody>
</table>
Using R Studio (DEMO)
Spatial Analyses with R

- R can do many of the same functions as ArcGIS
- R requires certain ‘packages’, just like ArcGIS Extensions
  - Vector data packages: sp, rgeos, maptools, rgdal
  - Raster data packages: raster, rgdal
  - Projection package: rgdal
Polygon: polygons slot

Hypothetical situation where it requires two polygons to describe 1 feature

- poly@polygons : List of 1
  - poly@polygons[[1]]@Polygons: List of 2

Polygon 1: outer ring

Polygon 2: inner hole (erase the area)
Vector Demos

- **ArcGIS Tool**
  - Intersect (Analysis/Overlay)
  - Buffer (Analysis/Proximity)
  - Erase (Analysis/Overlay)
  - Near (Analysis/Proximity)

- **Program R Function**
  - gIntersection (rgeos)
  - gBuffer (rgeos)
  - gDifference (rgeos)
  - gDistance (rgeos)
Raster Demos

- **ArcGIS Tool**
  - Euclidean Distance (Spatial Analyst/Distance)
  - Extract by Mask (Spatial Analyst/Extraction)
  - Slope (Spatial Analyst/Surface)
  - Composite Bands (Data Management/Raster/Raster Processing)
  - Extract Values to Points (Spatial Analyst/Extraction)
  - Kernel Density (Spatial Analyst/Density)

- **Program R Function**
  - distance (raster)
  - crop or mask (raster)
  - terrain (raster)
  - stack (raster)
  - extract (raster)
  - kernel2d (splancs)