Spatial Analysis in Your Browser

Joseph Kerski
Education Manager
Esri
jkerski@esri.com
http://www.youtube.com/geographyuberalles
Twitter http://twitter.com/josephkerski
303-449-7779 x 18237
Goals

1. Understand what spatial analysis is.

2. Understand why spatial analysis is a unique characteristics of GIS and why it is powerful in education and in greater society.

3. Build skills in spatial analysis using ArcGIS Online.
What is GIS I?

1. Classical Definition: GIS is a tool that can access, integrate, and distribute layers of map information. The five parts of a GIS include hardware, software, data, procedures, and people.

2. A more Modern Definition (?): GIS lets us visualize, question, analyze, interpret, and understand data in new ways. This can reveal relationships, patterns, and trends.
What is spatial thinking and analysis?

My working definition of spatial thinking:

“Identifying, analyzing, and understanding the location, scale, patterns, and trends of the geographic and temporal relationships among data, phenomena, and issues.”

Esri Definition of Spatial Analysis: “The process of examining the locations, attributes, and relationships of features in spatial data through overlay and other analytical techniques in order to address a question or gain useful knowledge. Spatial analysis extracts or creates new information from spatial data.

Or: It is how we understand our world — mapping where things are, how they relate, what it all means, and what actions to take.
Components of Spatial Analysis

• Understanding where.
• Measuring size, shape, distribution
• Determining how places are related
• Finding the best locations and paths
• Detecting and quantifying patterns
• Making predictions

http://www.esri.com/products/technology-topics/spatial-analysis

Is this spatial analysis?

ChangeMatters Viewer

Pan and zoom around the maps to understand earth changes that have happened over time. Advanced change detection tools are also available by clicking any full screen button.

Instructions
You need data and tools to do spatial analysis!

Finding and Using Spatial Data

Old Paradigm

--Download data → Unzip → Format → Project → Tabular Manipulation → Use.

New Paradigm

--Access data in cloud → Use.

We are not *quite* to the point of fully using the new paradigm ... yet.
Thus, best practice today is still the hybrid model:

1. Start with ArcGIS Online to search for data.

2. Search local, state, national, international data depositories and portals.

Examples:

Local: Boulder County CO, Los Angeles County CA  
State: www.tnris.org (Texas), CASIL (California), RIGIS (RI)  
National: USGS, NASA, Census Bureau, NOAA, EPA, US DOT, USFWS, BLM, USFS, FAA, National Atlas, LINZ (New Zealand), IBGE (Brazil), OS (UK)  
International: WRI, WWF, UNEP, World Bank, Natural Earth Data
What kinds of data can you add to ArcGIS Online?

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Open in ArcGIS Online</th>
<th>Open in ArcGIS Desktop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Map Notes</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Tables (CSV)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Zipped Shapefiles</td>
<td>X</td>
<td>X Unzip first</td>
</tr>
<tr>
<td>Zipped other data</td>
<td>X after unzipping and serving</td>
<td>X after unzipping</td>
</tr>
<tr>
<td>Images (JPG, PNG, TIF)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Feature services</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Layer package, map package</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
Data Types and Sources

1) Vector: Shapefiles, geodatabases, feature services, other vector formats.
2) Raster: ArcGrids, GeoTiffs and other images, Tiled image services.
3) Tabular: Excel tables, CSVs, TXT files, other formats.
Data Sources and Issues (privacy, crowdsourcing, cloud vs. desktop, copyright, and how to use).


- [http://spatialreserves.wordpress.com](http://spatialreserves.wordpress.com)
10 Spatial Analysis Exercises in the Public Domain Data Book

Exercise 3: Siting a fire tower in the Loess Hills of Nebraska, USA

In Exercise 3, you determine the optimal site for a fire tower in the Loess Hills of Nebraska, USA, by examining elevation, slope, aspect, land cover, and distance to streams using data from the USGS and a data conversion program. The GIS Guide to Public Domain Data
Finding and using data on ArcGIS Online

--Often helpful to narrow the search, such as:
quotes “riparian zones”
--Keywords:
<search string> owner:jjkerski or tags: “bike lanes”
--Use Boolean operators:
“recent fires” OR fires
owner:esri AND tags:streets
--search in your specific map extent or in your organization

More tips on: Using Search – Fields:
/010q0000000n000000

❖ Accessing and using data portals
Access Boulder County GIS Portal
Save data sets locally, Add to ArcGIS Online via “My Content”
Using ArcGIS Online Analytical Tools

- ArcGIS Online is a cloud-based GIS, not just an online set of web maps. Hence, you can use it for conducting spatial analysis.

- The spatial analysis capabilities of ArcGIS Desktop still far exceed that of ArcGIS Online, given its 30 year head start, but more analytical capabilities are being added quarterly to ArcGIS Online.

- The spatial analytical tools in ArcGIS Online are easy to use. They are accessed from the arrows to the right of specific layers. Whether you see the analytical tools depends on (1) if you are using an ArcGIS Online organizational subscription, and (2) how the data are served in ArcGIS Online (i.e. ideally, as services)
Activity 1: Cholera Analysis, London 1854

- Using Analytical capabilities in ArcGIS Online

- Problem Statement: What percentage of the cholera outbreak cases are associated with the Broad Street and other pumps?

You will consider public water pumps, and locations with cholera cases in your assessment.
14 water pumps
322 data points
578 cholera cases
201 of 322 data points are within 500 feet of Broad Street pump
395 of 578 cases within 500’ of Broad Street pump.
117 cases within 500’ of Carnaby Street pump.
75 cases within 500’ of Rupert Street pump.
Activity 2: Boulder County Flood Analysis

♦ Using Analytical capabilities in ArcGIS Online

♦ Problem Statement: Because of recent devastating floods that occurred in September 2013, the Boulder County Office of Emergency Preparedness, hearing of your excellent GIS skills, has asked you to prepare an assessment of the most vulnerable lands in the county to future flooding and the people on those lands.

You will consider floodplains, geologic hazards, land cover, soils, and demographics in your assessment.
Analysis Workflow

1. Filter Floodplains layer to only consider the true floodplains. Filter geologic hazards layer to only consider Major Hazards.
2. Proximity ➔ Buffer floodplains by 200 meters.
3. Dissolve the buffer’s internal polygons.
4. Manage Data ➔ Overlay ➔ Intersect the dissolved floodplain buffers with Major Geologic Hazards.
5. Sort on Analysis Area and only consider the largest polygons.
6. Data Enrichment, with Group Quarters and % Wetlands.
Activity 3: A new road through the Serengeti?

- Using Analytical capabilities in ArcGIS Online

- Problem Statement: A new road is proposed through the Serengeti to link ports on the Indian Ocean with Lake Victoria. You will use spatial analysis to examine the route of two proposed roads, assessing the impact of each on wildlife migration and on the local ecoregions, and examining alternatives to the roads themselves.

You will consider the two routes proposed, wildlife migration, ecoregion, elevation, total length. Specifically: wildlife migration within 5 km from proposed roads, length of roads within each ecoregion.
A new road in the Serengeti?

UK Guardian article:
http://www.guardian.co.uk/world/2011/ma/highway-national-park
Instructional Considerations

- You can have students perform the analysis.

- Or -

- You can perform the analysis and have the students analyze the results (as I do often with the Serengeti lesson).

- Or –

- A combination of the two.

- Or –

- Teach with visual analysis of patterns, linkages, and trends, without the quantitative measures.
Next Steps

♦ Access these maps in ArcGIS Online. They are all public. Go through some of these analytical steps.


♦ Examine “How to teach with the ArcGIS Platform” documents, including video on spatial analysis tools:


♦ Review video tutorials: A Deeper Dive with ArcGIS Online: See playlist: http://www.youtube.com/geographyuberalles
Spatial Analysis in Your Browser

Joseph Kerski
Education Manager
Esri
jkerski@esri.com
http://www.youtube.com/geographyuberalles
Twitter http://twitter.com/josephkerski
303-449-7779 x 18237