Week 8 Cookbook: Review and Reflection

Week 8 Overview

1. Review and Reflection
2. Making Intelligent Maps: The Map Sheet as a Blank Canvas
3. Making Intelligent Maps: Base Layers and Analysis Layers
4. Making Intelligent Maps: Legends!
5. ArcGIS Online: Base Layers and Web Mapping
6. Mapping with Google: Map Maker, Building Maker, and Fusion Tables
7. Other Websites: ZeeMaps, free Geocoders, and Simple Mapper

After 8 weeks of learning GIS together...what have we learned?

Basic GIS, to me, is all about making meaningful and intelligent maps – we know how to do that. Now all we need are some GIS data (Weeks 9, 10), some analysis tools (Week 11) and we are ready for Projects 2 and 3 later on this semester.

This week we will slow-down a bit reviewing the material, catching-up with some of the assignments, and reflecting on the big-picture context of what we have accomplished so far.

But, there is also some cool new stuff this week: ArcGIS Online, some of the advanced Google mapping tools, and other mapping web sites.

Consider printing this cookbook for your convenience
8.1) Review and Reflection: Looking Back and Looking Ahead

It is useful to remind ourselves of the overarching learning goals for this class (from the course syllabus):

1) **Knowledge**
   Geospatial concepts and analysis using GIS tools (ArcGIS 9.3.1) and GIS data sources.

2) **Skills and Critical Thinking**
   Problem Solving: application of geospatial concepts, analysis, and GIS tools. Intellectual inquiry and effective communication.

3) **Perspective**
   Space, spatial patterns, and spatial relationships as global organizing concepts.

Course Organization

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**Weeks 1 to 7**
- What is GIS?
- How to use ArcGIS: Making meaningful choropleth maps

**Week 8**
- Review and Reflection

**Weeks 9, 10**
- GIS Data: online sources and digitizing

**Week 11**
- GIS Analysis

**Weeks 12 to 14**
- MassGIS Project: A Landuse Change Analysis

**Week 15**
- Final Project: Zoning in Westfield and Holyoke
8.2) Making Intelligent Maps: The Map Sheet as a Blank Canvas

To me, the map sheet starts as an empty canvas (or poster boards) on which you display the results of your GIS analysis. You can present these results in a variety of complementary ways, including maps (i.e. data frames), graphs, tables, text, and photographs. An intelligent map combines all of the above so that the GIS analysis is presented professionally, accurately, comprehensively, and visually-pleasing.

Map Sheet
That’s the actual piece of paper that the map is printed on. The size of the map obviously impacts the size and number of your data frames, graphs, tables, text, etc. Common sheet paper sizes are: 8.5 by 11 inches, 18 by 24 inches, and 24 by 36 inches. In addition, larger color printers print using rolls of paper, typically 3 feet wide.

Data Frames
Your map sheet will typically show a series of data frames – each showing a map consisting of a series of map layers containing your GIS analysis. One data frame may be show an overview/location map, whereas other data frames show the actual data analysis.

Graphs
Often, it is easier and better to illustrate the relationship between variables as graphs, for example line graphs, scatter plots, bar graphs, pie charts, etc. It is usually best to create these graphs in MS Excel and copy them into your map. This is especially useful if you are showing and quantifying the correlation between two variables.

Tables
Often, it is useful to summarize your data or results as a table (= data arranged as rows and columns). It is usually best to create the table in MS Excel and copy it into your map. In some cases you may include the actual data mapped in the data frames as a table.

Text
Don’t forget to use text to convey information. An intelligent map typically includes a few sentences or paragraphs of text to explain your GIS analysis.

Photographs
Photographs can be very useful to illustrate an important aspect of your GIS analysis.

All these items can be arranged on your map sheet (using the guidelines) to create a final map that presents your GIS analysis professionally, accurately, comprehensively, and visually-pleasing. We will practice this approach in the two remaining projects this semester (MassGIS Project and Zoning Project).

Example: 2003 Residential Energy Consumption of the U.S.

This map (shown below) contains four data frames showing choropleth maps. The table in the center of the map sheet lists the underlying data for each state and the graph compares energy consumption with CO2 emissions (per state). The text describes the overall GIS analysis, the methodology, and the results.

- Note: This map is not ‘perfect’ (no map ever is) – but illustrates how you can combine the various techniques to convey information in an intelligent map.
8.3) Making Intelligent Maps: Base Layers and Analysis Layers

Very frequently, a data frame contains one (or more) analysis layers shown on top of one (or more) base layers.

Analysis Layers(s)
- ‘Active’ data layers that show your GIS analysis, for example your choropleth map.

Base Layer(s)
- Static background data that provides spatial context without distracting from the GIS analysis shown in the analysis layers.
- Here we are often using satellite images, aerial photographs, roads, town lines, etc.

In other words: Your analysis layers show your creativity and intelligence in GIS analysis, whereas the base layers are only supposed to look good and show where the analysis layers are located in space.
Example 1: Stanley Park Trail Map

The map sheet in 18 by 24 inches and contains just one data frame. This is a simple trail map, so we did not include any graphs or tables. Text is included to provide some information about Stanley Park and the trail network. We also did not include photographs to give us as much room as possible on the map sheet for the data frame.

- The main analysis layer is the colored lines showing the trails that we mapped using GPS. This is essentially a choropleth map where the color of each line represents a trail characteristic, here its name. There is also a second analysis point layer showing important points.

- The base layer is an aerial photograph from 2005 – without it we would just see a bunch of colored lines printed on white paper. But, the aerial photograph is ‘static’ – I just downloaded it from a website – I did not perform any GIS analysis with it.

This map is intelligent and meaningful because it combines analysis layers with base layers.

Example 2: Pittsburgh Schools (Week 6)

Here you had one analysis layer in each data frame: the schools shown as circles, with the size of the circles as a function of student enrollment. That analysis layer was shown superimposed on a base layer showing the neighborhoods in Pittsburgh. That neighborhood layer did not show any GIS analysis – it just
provided the spatial context for the analysis layer (see example below) – without it all you would have seen is a bunch of colored circles printed on white space.

The base layer was static: the neighborhood lines in Pittsburgh do not really change. The analysis layer was dynamic: here you conveyed meaningful information as a choropleth map.

This is an example of the Pittsburgh school map – a classic point choropleth map where the size of the symbols (here: circles) is a function of the characteristic of the feature.

1 map sheet (size 8.5 by 11 inches) with 3 data frames.

1 analysis layer = the point layer showing the schools as a function of student enrollment.

1 base layer = the neighborhood lines.

Without the base layer…the analysis layer would just be a bunch of points floating in space.

Without the analysis layer…the base layer is just a boring wire frame map without any real content.

Together: they make an intelligent and meaningful map.

8.4) Making Intelligent Maps: Legends!

Good legends are the key to a good map…In other words: Bad legend = bad map.
A few general comments:

1. In ArcGIS the legends are dynamically-linked to the map. What does that mean? It means that your legend changes automatically when you change your map. In the example above, if you were to change the circle color from yellow to red, or change the classification – those changes would automatically change the legend.

2. The Legend Wizard in ArcGIS does a reasonable job creating useful legends, but you should always fine-tune your legends afterwards. Things to consider:

   Layout: vertical or horizontal layout, title, border, background, etc.
   Content: all layers? selected layers? units? labels?

3. If you use physical data in your map (for example elevation, temperature, etc.) then your legend has to include the units of measurement (feet, meters, °F, etc.).

There is a multi-part Jing in the Week 8 folder that shows you a few more ways to make better legends. Just follow along in ArcMap as you watch the Jings.

8.5) ArcGIS Online: Base Layers and Web Mapping

ArcGIS Online is a service provided by ESRI. ArcGIS Online is not ‘free’ – rather included in the purchase price for ArcGIS 9.3.1

ArcGIS Online has essentially two parts:

1. ArcGIS Online is a web mapping application where anyone can create and share maps (requires a free account).

2. ArcGIS Online provides great base layer data that you can embed into your own maps via the Internet. In this case you do not download a huge file to your computer. Instead, the base layer data resides on a GIS server and is linked to your map. This requires you to have (and use) ArcGIS 9.3.1.
8.5.1) Using Base Layers from ArcGIS Online

This is a great way to get base layer data – just embed the data directly from ArcGIS Online. This saves space on your computer. But, you are dependent on a fast internet connection for your maps.

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<tr>
<td>1.</td>
<td>Create a week8 folder on your flash drive.</td>
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<tr>
<td>2.</td>
<td>Start ArcCatalog and ArcMap.</td>
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<tr>
<td>3.</td>
<td>Create a folder connection to your week8 folder creates in Step 1.</td>
</tr>
<tr>
<td>4.</td>
<td>Save your blank map into your week8 folder after you have confirmed that relative pathnames is checked.</td>
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That’s the prep work that you need to do each time you create a new GIS map!

5. Select File – Add Data From ArcGIS Online. This opens the ArcGIS Online website in a web browser.

Now you have a lot of choices – currently nine base layers are available, but that number may increase in the future. For each base layer you can select Open and Details. Open adds the base layer to your map in ArcGIS 9.3.1 on your computer. Details provides some useful information about the data layer.

6. Click on Open below the Imagery map service.

   A dialog box appears and you can either Open or Save the layer file.  
   Select Open and the file is opened immediately in ArcMap on your computer.  
   Select Save to download the layer file that you need to open manually.  
   If Open does not work…try the Save option!

7. Select Open and the World Imagery is added to your map as a map layer.

This is very high-quality imagery, so try zooming into Westfield State University. Note that you can also activate data layers such as boundaries or transportation. **One note of caution:** The data are transferred to your computer via the Internet, so you need to be patient at times. Do not open more than a few base layers at a time!

8. Spend some time exploring the different base layer options, both for the U.S and also for the rest of the world. The Streets base layer and the USA Topo Maps base layer are great, but so are the world-wide base layers.
9. Remove all base layers, except for World Street Map and zoom-into Pittsburgh.

10. Add the Schools.shp shapefile that you used for the Pittsburgh Schools assignment.

   Read the Geographic Coordinate System Warning and hit Close.
   Make the size of the circles a function of enrollment.

11. Switch to Layout View and add all the required map elements.

12. Export as JPG image and save your map into the week8 folder.

Now you have a choropleth map of schools in Pittsburgh (= the analysis layer), displayed on top of a road map that also shows shaded relief (= the base layer). The analysis layer is located on your computer, but the base layer is served via the Internet from ArcGIS Online.

**8.5.2) Web Mapping with ArcGIS Online**

ArcGIS Online includes a very sophisticated web mapping application with many high-quality data layers. Anyone can make a web map, but you need a free ESRI account to save your map and share it with others.

Here you have two options:

- Make a map using the Map Viewer. You can choose different base layers and save/share your map with others.
- Make a map using ArcGIS Online Explorer. Now you can content, features, etc. and create a real presentation using a series of maps.

**8.6) Mapping with Google: Map Maker, Building Maker, and Fusion Tables**

Here are three exciting web mapping tools from Google: Map Maker, Building Maker, and Fusion Tables

**8.6.1) Google Map Maker: Citizens Cartography**

[http://www.google.com/mapmaker](http://www.google.com/mapmaker)

Google Map Maker allows you to create a map by adding or editing features such as roads, businesses, parks, schools and more. You can visually mark locations and add detailed information about them. Once you have submitted content, this information may be edited by other users or moderators. Your mapping contributions on Map Maker are eventually also made available on Google Maps (this update process is not immediate).

Great Tutorials and Help:

- [http://sites.google.com/site/mapmakeruserhelp/](http://sites.google.com/site/mapmakeruserhelp/)
- [http://maps.google.com/support/bin/answer.py?answer=155417&cbid=-bdvy1cadj3ok&src=cb&lev=answer](http://maps.google.com/support/bin/answer.py?answer=155417&cbid=-bdvy1cadj3ok&src=cb&lev=answer)
8.6.2) Google Building Maker: Citizens Architecture

http://sketchup.google.com/3dwh/buildingmaker.html

Building Maker is a 3D modeling tool for adding buildings to Google Earth. It's fun to use, and an easy way to get on the 3D map.

This is essentially the online version of Google SketchUp: http://sketchup.google.com/index.html

Great Tutorials and Help:

- http://sketchup.google.com/support/bin/answer.py?hl=en&answer=154082

8.6.3) Google Fusion Tables


This is in my opinion the most exciting tool available from Google: more-or-less a real GIS! You can upload data tables (for example MS Excel spreadsheets) and create real choropleth maps. All you need in your data tables is some type of geographic information or location data.

Great Tutorials and Help:

- http://www.google.com/support/fusiontables/bin/answer.py?hl=en&answer=184641

8.7) Other Websites: ZeeMaps, free Geocoders, and Simple Mapper

8.7.1) ZeeMaps

http://www.zeemaps.com/

ZeeMaps is very similar to Google My Maps and Google Fusion Tables: you can make your own maps and create maps from your own data tables.
8.7.2) Free Geocoders

http://tinygeocoder.com/
http://geocoder.us/
http://www.travelgis.com/geocode/

What is geocoding? You enter a street address and geocoding returns the geographic coordinates for that address. There is also reverse geocoding where you enter the geographic coordinates and the street address is returned.

Geocoding is the technology behind the Search and Directions functions of Google Maps, Mapquest, etc and represents one of the core functionalities of a GIS.

Example: You own a flower shop and you have a list with the street addresses of your 792 customers in a MS Excel spreadsheet. Now you want a map showing these addresses as 792 small circles so you can see where your customers live.

This means that all your 792 addresses need to be geocoded = converted from street addresses to latitude and longitude. You have a few options to do that:

1. Use one of the free geocoders listed above. But, that means that you have to enter each address manually.
2. Use Google Fusion Tables or ZeeMaps and simply upload your MS Excel spreadsheet.
3. Wait until GARP 0344 Advanced GIS and learn how to geocode in ArcGIS.

8.7.3) Simple Mapper

http://simplemapper.org/

Concept Maps, Network Diagrams, and workflows – maps do not always have to be traditionally geographic! This is a great site for maps that show relationships and interactions between concepts, ideas, people, processes, etc.

Try it out – great fun!