

Title: Geodatabase and Reference Map Construction

Critical Resources: an internet connected computer; a computer with ArcMap, Geodatabase and Reference Map Construction data sets zip file, Geodatabase and Reference Map Construction support video.

Other resources: Chapter 1 from *Designing Better Maps: A Guide for GIS Users* by C. Brewer. It is recommended you read this chapter to get some good ideas on effective map design.

The following short article is also a useful resource for understanding map design:

<http://www.esri.com/news/arcuser/0911/making-a-map-meaningful.html>

Purpose:

The purpose of this lab will be for you gain experience in cartographic design by constructing a reference map using ArcMap.

Learning Objectives – After completing the lab, you will know:

- How to build and import datasets into a File Geodatabase
- How to create an event theme in ArcMap.
- How to apply a definition query to a layer in ArcMap.
- How to use the layout tools of ArcMap to build maps than can be exported from ArcMap.
- How to apply cartographic concepts to map production.

Deliverables:

- 1- A zip file containing a fully functioning .mxd and corresponding data inside a single File Geodatabase that can display your map. For example, no red exclamation points for data layers appear when the .mxd is loaded.
- 2- a PDF of the map you create

**** Note:** The file

Geodatabase_and_Reference_Map_Construction_final_example.zip contains a working example of the .mxd, file geodatabase and final PDF map that are your deliverables for this lab. Use these assets to guide you in this lab.

Instructions:

For this part of the assignment, you will build a reference map based on data you find. Your map must include: (a) a raster backdrop showing elevation, (2) two (or more) vector layers stylized appropriately, (3) a place names layer based on an event theme to show point features. Source data for the event theme is provided for you and is discussed further in these instructions.

Before you begin, create a new .mxd with a relative path to a data folder¹.

1. Define your study area – this must be within the limits of a single USGS 1:24000 quad boundary in NYS². For a reference on NYS quad boundaries, refer to this webpage:

<http://gis.ny.gov/gisdata/quads/drg24/index.htm>

Ideas on picking a study area:

- Select where you grew up, it might be interesting to do a GIS project on a familiar area
- If you are interested in the outdoors, select an area in the Adirondacks or Catskills
- If you are interested in urban space, select a city area like Buffalo or Rochester (NYC might be a little overwhelming)
- If you can't think of anything, let me know, and an area will be assigned to you
- Use an area you might want to use for your final project

2. Download a Digital Elevation Model (DEM) for your study area³

Once you have selected your study area, download the DEM for your study area from CUGIR - <https://cugir.library.cornell.edu/catalog/cugir-008186>

3. Download two (or more) vector reference layers for your study area.

From either CUGIR or NYS GIS Clearinghouse, download two vector layers from your study area that are good reference layers. For example, for Transportation features, you would download a roads layer. For Hydrography you would download a streams layer.

4. For this part of the assignment, you will create a file geodatabase and import the data layers you downloaded in steps 2 and 3 into feature datasets. You will then use the data in the File Geodatabase for building your map deliverable. Create a File Geodatabase with two feature datasets related to the datasets you downloaded in step 3⁴. Use the metadata from the datasets you downloaded in step 3 to determine what the coordinate system should be for the feature datasets you create⁵

For example you might create these feature datasets:

Transportation

Hydrography

¹ See: <https://www.youtube.com/watch?v=MjVw2plCDpE> at 22:28 for a reference on doing this task

² Note: If you would like to use any area outside the USA, please contact me to discuss.

³ Note: If you would like to use any area outside the USA, please contact me to discuss. ETOPO/GTOPO

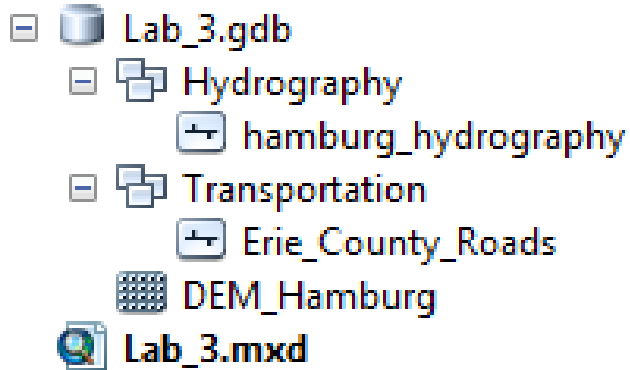
⁴ See <https://www.youtube.com/watch?v=06E15oM04Ek> at time 7:52 for a reference on this step

⁵ See <https://www.youtube.com/watch?v=331QYllHZuM> at time 5:15 for a reference on this step

Import the vector layers you downloaded in step 3 into their respective feature datasets created as per the instructions in step 4.

5. Import the DEM into your Geodatabase created in step 4 using the DEM to Raster tool located in the ArcToolbox Conversion toolset.

Your Geodatabase should similar to the figure below if all the steps so far have been followed correctly:

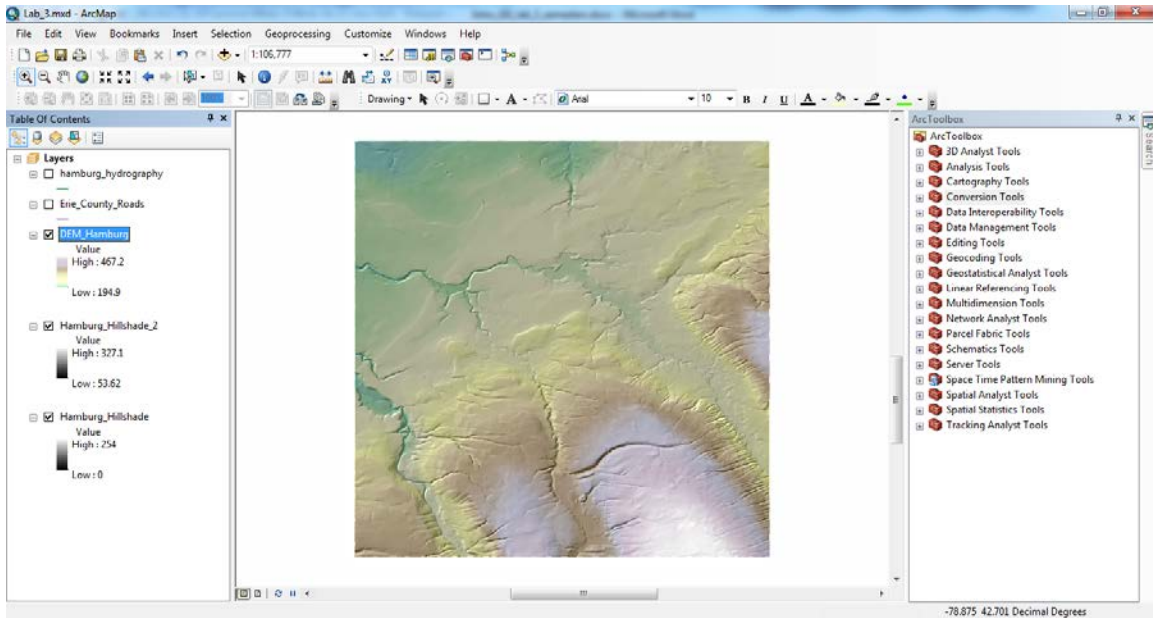


6. Styling your name

Create a 2 ½ D raster backdrop from the DEM using the Swiss Hillshade method⁶.

Using the techniques discussed in class, create a 2 ½ D raster backdrop of your DEM. If everything worked correctly, your 2 ½ D raster backdrop should look similar to the image below:

⁶ Tip: If you store your hillshade output in your file geodatabase, it could break the links with the other datasets as evidenced by red exclamation points. If this happens, simply re-set the data sources for the red exclamation point layers using the layer's data source properties.



7. Add the event theme to supply place name point data for your map

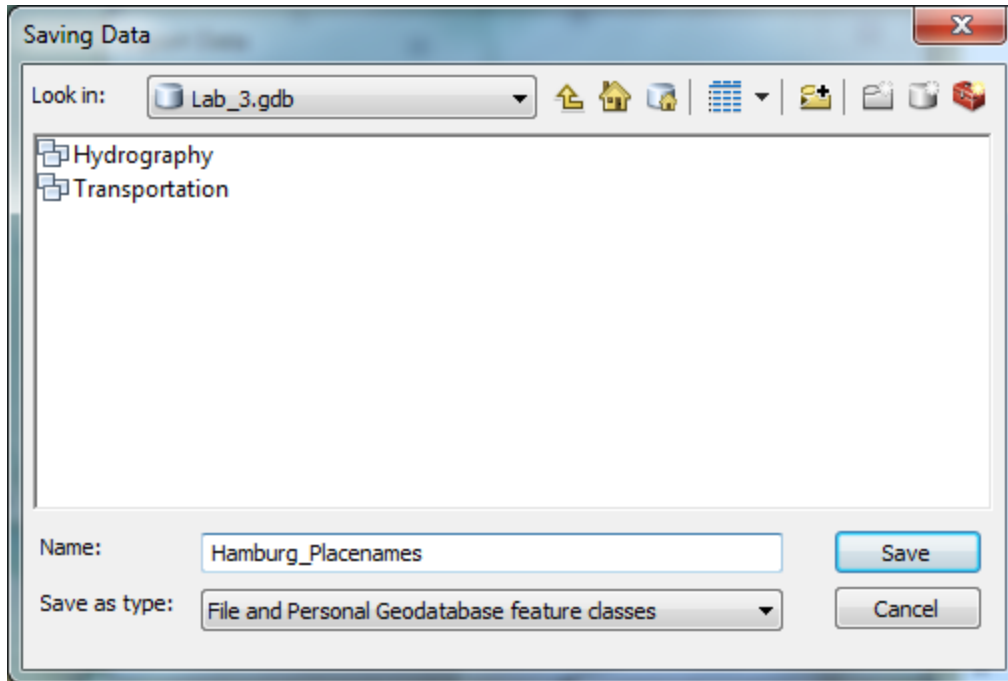
Follow these steps to incorporate event data into your map⁷

- a. Add the file NY_Features_20090203_tab.txt from the reference_map_data folder of the lab 3 datasets to your map using the Add Data button or ArcCatalog⁸.
- b. Convert the text file into an event theme using these steps:
 - Right click on NY_Features_20090203_tab.txt and select DisplayXY data
 - Select PRIM_LONG_DEC as the X field
 - Select PRIM_LAT_DEC as the Y field
 - Click the OK button
 - You should then see a large number of points on NYS draw on the map

After importing the points, export them into your geodatabase using the Data > Export data feature available by right clicking on a layer in the table of contents. Select the “this layers source data” as the coordinate system option and File and Personal Geodatabase feature classes option in the Saving Data dialog. You can export the data as a layer called place_names into the root of your geodatabase like seen in the screen shot below:

⁷ Also see: <https://www.youtube.com/watch?v=gDBaDCKdFJK> at time 26:11 for a technical reference on these steps

⁸ Again, if using an area outside of the USA, please contact me. For example, you could use points from Geonames (<http://www.geonames.org/>)



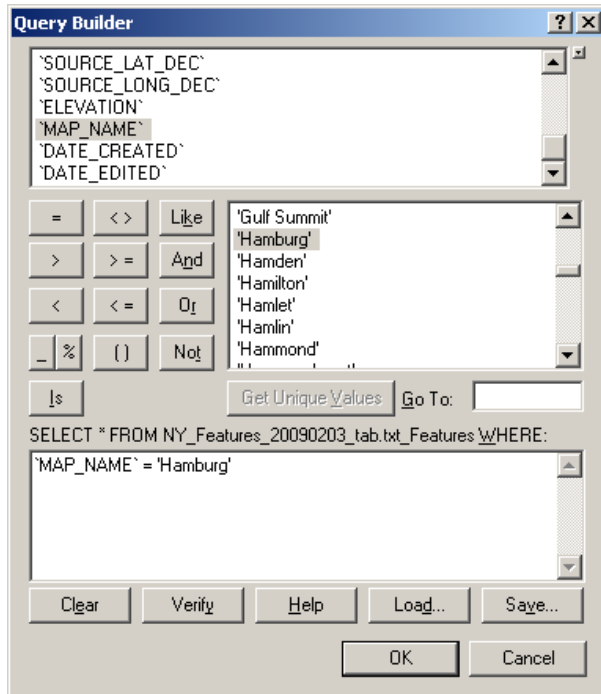
8. Filter your place name data so only points from your quad map are showing.

For this step, you need to know the name of the quad map that defines your study area⁹.

To filter out points:

- Right click on the layer you just exported (it should be automatically added to ArcMap) and select properties
- Select the definition query tab and click the query builder tab
- In the query builder, double click 'MAP_NAME' from the fields list on the top. You should start to see a query build below.
- Enter an equal sign after 'MAP_NAME' in the formula box
- To select your quad name, click the Get Unique values button in the middle, you should see a list of values appear
- Find your map name and double click it. The name should automatically be added to the query. Your query should look similar to the screen shot below where the Hamburg map has been selected:

⁹ Also see: <https://www.youtube.com/watch?v=MjVw2plCDpE&t=1348s> at time 33:16 to see how a definition query works.



Click the OK button

- when you are back on the Definition query tab, click apply. You should see the layer filtered to just show points within your quad.

9. Symbolize your points

Now that you have your point layer filtered, symbolize the points using appropriate symbols.

A good way to do this is to symbolize the points by unique values on the FEATURE_CLASS field.

Once you see all the values, choose appropriate symbols based on the feature class.

10. Add and symbolize your two vector layers

For this step, add your two vector layers into the map.

Symbolize these layers accordingly. For example, if you have a road layer, symbolize it by the type of road (interstate, county, local etc.). To find out what fields and their values mean, look at the metadata for your layers or see: <http://support.esri.com/technical-article/000001496> for roads.

Label features accordingly following labeling best practice guidelines. Use Label Manager SQL statements to potentially remove extraneous labels.

If one of your datasets goes outside the area of your map, use masking to eliminate overflow.

Use a reference scale of 1:24000 and annotation classes to fine tune label placement¹⁰.

10. Build a layout

In this step, you will now build your final map. Use these steps as guidelines:

- Arrange your layers in a logical manner for final display.

Create a D size page layout – Using the layout tools of ArcMap, create a D-size page layout. The general specifications for this are as follows:

Page size – 22” x 34” (also known as ANSI D); portrait

Page Scale: 1:24000

Main view frame – width: 23.5”; Height: 23.5”

At a minimum the map must include:

- Metric and English graphical scale bars
- Textual scale (i.e 1:24000)
- Legend
- Title
- North Arrow
- Projection Information (projection, datums)

Extra items (not required, but will make it look good and may score you extra points)

- Magnetic Declination indicator (instead of a standard north arrow)
- map location in NYS
- adjoining quads indicator
- UTM or Lat/Long coordinate tics or grid lines
- whatever your creative, imaginative mind can come up with

See the example map included with the lab materials to get a general sense of what your final product for this task should be. Be creative though and try and come up with your own ideas and design.

**** Note: Review your map closely for the common rookie map maker mistakes as seen in the video [Cartography and GIS](#).**

When you are done, export your map as a PDF using these steps in ArcMap
File → Export map → Save as type PDF

Rename your PDF using this convention:

{your last name}_refmap_lab3.pdf

¹⁰ See: <https://www.youtube.com/watch?v=MjVw2plCDpE&t=1348s> at time 59:00 for a reference

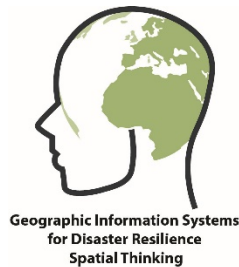
For example, tomaszewski_refmap_lab3.pdf

When you are done, place your .mxd and File Geodatabase datasets along with your final PDF map into a single .zip file and post this single .zip file in the lab 3 dropbox on myCourses.

General Grading Criteria:

- All data layers referenced from the .mxd submitted display correctly (i.e., no red exclamations marks are found when the .mxd is done)
- Map produced is well designed – no strange font sizes, unclear legend item, tasteful color and symbol choices, all rookie map maker mistakes are avoided.
- All data used in the map is contained inside the File Geodatabase. Do not send the instructor all the data you downloaded. I am looking for evidence that you can handle working with digital datasets cleanly and efficiently, I am not interested in looking at a big disorganized data mess.

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