

Lesson 5:

Label Features Using GNIS Data

Lesson Goal: Use GNIS label data to enhance the Bright Angel model created in Lessons 3 and 4. GNIS data will be reprojected so that it will align properly with the model.

What You Will Need: A Pentium class PC with 32 MB of RAM (minimum) and 100 MB of free hard drive space, ArcView GIS 3.1 or higher, and the ArcView 3D Analyst extension.

Data and/or Utilities: The project and data from Lesson 3, corrected GNIS data for this area, and the Projector! extension from the *ArcUser Online* Web site.



GNIS data will be reprojected and used to label the model of the Grand Canyon created in previous lessons.

USGS Geographic Names Information System (GNIS) point data from the EROS Web site can be used to label the Bright Angel model created in the previous lesson. GNIS data, stored in a geographic coordinate (decimal latitude-longitude) system, must be reprojected into Universal Transverse Mercator North American Datum for 1927 (UTM NAD27) so it can be used to label the topographic and cultural features of the model constructed in the previous lessons.

Label point sets are quite large and rather complex. The sample data set used in this tutorial will give you a “jump start” and help you to learn difficult concepts and procedures. Several GNIS data sets as well as the converted DXF files for the Bright Angel model are included in the sample set.

What Is GNIS?

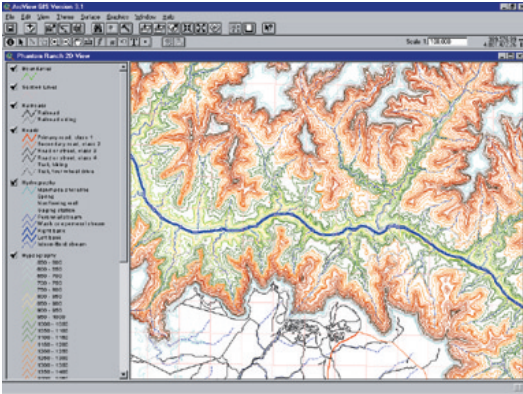
GNIS is a compilation of labeled points designed by the USGS and the U.S. Board on Geographic Names that contains name and location information for nearly two million physical and cultural features throughout the United States and its territories. GNIS data may be downloaded from the Internet or may be purchased on CD-ROM.

The CD-ROM, which includes National Geographic Names Data Base (NGNDB) for all states, also contains the Antarctica Geographic Names Data Base (AGNDB), Topographic Map Names Data Base (TMNDB), and Reference Data Base (RDB), may be purchased over the Internet. The data used for the Bright Angel model will be downloaded from an Arizona subset of the NGNDB.

Download and Edit GNIS Files

At the USGS GNIS site you will find summary information about GNIS and GNIS data sets that are available via FTP. Visit the GNIS page to download files and learn more about this data. Two types of compressed files are available. Files named with the U.S. Postal Service abbreviation followed by _DECI (e.g., AZ_DECI) contain decimal latitude and longitude. Commas separate fields and single quotes enclose text strings. Files named with the entire state name (e.g., arizona) include only degree, minute, and second coordinates, and the fields are separated by column position.

1. Select the file named AZ_DECI and download it. The files, compressed using GZ technology, require an appropriate decompression utility such as WinZip. The compressed AZ decimal file (AZ_DECI.GZ) is more than 1.3 MB and may require several minutes to download. Store the GZ file in the same directory as the Grand Canyon project and then unzip the file. The unzipped file will default to the name arizona. Add a .txt extension to the file during or following decompression.



The previous lesson modeled CAD format data in two dimensions.

2. The extracted file, arizona.txt, should be 9.4 MB and should contain 39,139 records. GNIS metadata, the GNIS data description, and additional information about structure and completion status is available from the GNIS home page at the USGS Web site.

3. Load the arizona.txt file into a text editor such as the Windows WordPad or a word processor in text mode to inspect the file. Notice that each record (line) contains many fields, all separated by commas.

4. Text within most fields is surrounded (delimited) by a single quote. Note that the first arizona.txt field does not have a leading delimiter and that the last field does not have a trailing delimiter. This is a major problem and must be repaired before the data set can be used. Also note that empty fields are correctly represented with quotation marks (“”). The data structure for the Arizona GNIS decimal data includes 16 fields. Table 1 shown here summarizes suggested field names, field types, and minimum field sizes for each field in the GNIS decimal data.

Reprojecting GNIS Points

To speed up the process of developing this model, we will use the corrected GNIS data for this project downloaded for the “Terrain Modeling with ArcView GIS” page. The corrected data in the dBASE file GC4GN108.DBF consists of 192 GNIS records for the 1:100,000 map GC4 Tile 08 model that includes Grand Canyon Village, Bright Angel Creek, and Phantom Ranch. Data

Table 1: Database Structure of GNIS Decimal Data

Field	Field Name	Field Type	Suggested Size
1	Names	Alphanumeric	100 characters
2	Type	Alphanumeric	9 characters
3	County	Alphanumeric	35 characters
4	State_FIPS	Alphanumeric	2 characters
5	Cnty_FIPS	Alphanumeric	3 characters
6	Lat_DMS_1	Alphanumeric	7 characters
7	Lon_DMS_1	Alphanumeric	8 characters
8	Lat_Dec_1	Numeric	single precision floating point
9	Lon_Dec_1	Numeric	single precision floating point
10	Lat_DMS_2	Alphanumeric	7 characters
11	Lon_DMS_2	Alphanumeric	8 characters
12	Lat_Dec_2	Numeric	single precision floating point
13	Lon_Dec_2	Numeric	single precision floating point
14	Elevation	Numeric	single precision floating point
15	Population	Numeric	single precision floating point
16	Quad_2400	Aphanumeric	54 characters

inconsistencies in arizona.txt are repaired and the table is ready to load into ArcView GIS.

The GNIS points included in GC4GN108.DBF are referenced in a geographic or decimal latitude-longitude coordinate system. The Grand Canyon model was created from DLG data in a UTM projection using the NAD27 datum. To use the GNIS points in the Grand Canyon model they must be reprojected to UTM NAD 27. This can be done by using Projector!, an extension that comes with ArcView GIS. A copy of Projector! is also available with data for this tutorial.



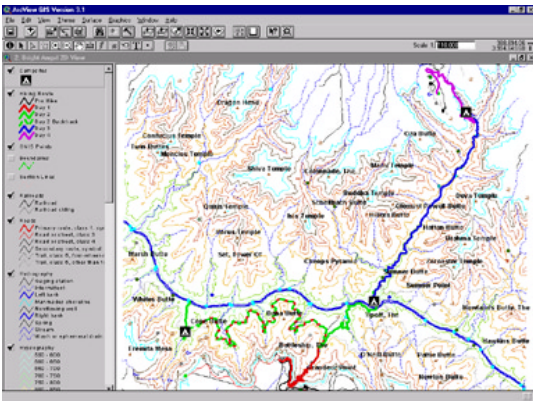
The Projector! extension adds a button with an arrow to the View GUI.

1. Open the ArcView GIS project used to create the Bright Angel model. Choose View > Properties from the menu to rename the view “2. Bright Angel 2D,” and verify that map units are set as meters. Next, create a new view to receive the GNIS data, set the map units to decimal degrees, and name this view “1. Lat Long Data.” Using a leading numeral will order the views in the project window.
2. In the project window choose Table then click the Add button to incorporate the GC4GN108.DBF into the model. Open the table and verify that all 16 fields are properly named and populated. Carefully study the fields Lat_Dec_1 and Lon_Dec_1. These fields will be used to register the data. Some records have a second coordinate pair in the fields Lat_Dec_2 and Lon_Dec_2. These points label long features such as rivers and streams.
3. Next make 1. Lat Long Data the current view. From the menu, select View, then Add Event Theme, and specify the table GC4GN108.DBF. Set the field Lon_Dec_1 as the x Field and Lat_Dec_1 as the y Field. Select GC4GN108.DBF as the active theme and make it visible to display the 192 points in this table. Check the names and latitude and longitude before reprojecting this geographic data to UTM NAD27.
4. Use Windows Explorer or another file manager to locate the Projector! extension (prjctor.avx) in the \ARCVIEWEXT32 subdirectory. If it is not in the EXT32 subdirectory, locate it in the \ARCVIEWSAMPLES\EXT subdirectory or download Projector! now. Make a **copy** of prjctor.avx and place the **copy** in the EXT32 directory. Return to the main project window to load the Projector! extension by choosing File then Extensions from the menu.
5. Return to the 1. Lat Long Data view. A new button with an arrow icon appears on the right end of the toolbar. This button runs the Projector! extension. Before running it, make certain that the view’s map units are set to decimal degrees. Projector! requires that view map units are specified. With view 1. Lat Long Data active and GC4GN108.DBF selected, click on the Projector! button. Specify meters as the output units.
6. Since the input data is already in a geographic projection,

ArcView GIS asks questions about the desired output projection. Select UTM-1972 as the category and specify Zone 12 as the type. UTM zones are divided into longitude zones six degrees wide. The central meridian of Zone 12 is -111° . Since this process reprojects point data, it is not necessary to recalculate area, perimeter, and length, so click No when prompted for items. Answer Yes when asked about adding the reprojected shapefile to an existing view and specify the 2. Bright Angel 2D view. Name the new theme GC4GN208 or other name that you devise. Save the project.

In the naming convention used for this project, GC4 is the quad designator, GN represents Geographic Names, 2 identifies a second projection, and 08 specifies Tile 08. Keep careful notes describing the names of reprojected shapefiles.

The Projector! extension loads the reprojected points into the specified view and places the theme at the bottom of the theme stack. Locate the points theme named GC4GN208, move it to the top of the stack, and make it active and visible. Use the Identify tool to check the names of several points. Check the relationship between map elements and points with types including summits, cliffs, streams, valleys, and more. Give the GC4GN208 theme a more meaningful name such as GNIS Points.



Set the text label properties for the GNIS Points Theme.

Labeling Topographic and Cultural Features

1. Make certain that the GNIS Points theme is loaded, visible, and above all the other themes in the 2. Bright Angel 2D view.
2. From the menu, select Theme, then Properties. In the Theme Properties dialog select Text Labels and specify Name as the label field. Position the text to the upper right of the label point.
3. Check the Scale Labels box and select OK to close the dialog box. These label defaults will be available each time you wish to label these points. A sample thematic legend for GNIS points is included with the sample data. GNISTYP1.AVL uses the Type field to classify GNIS points. Apply this legend to Type and study the results.
4. Choose the label font and size by selecting Window then Show Symbol Window from the View menu. Click on the button with the ABC icon to open the font palette. Select Arial as the font, 10 as the size, and bold as the style, then close the font palette.
5. Center the model in the view. Adjust the scale to 1:50,000 by typing 50,000 in the Scale box at the upper right corner of the interface. You should see the Colorado River flowing from east to west across the bottom of the view and more than 50 GNIS points should be visible.
6. To label all GNIS points in the model, make certain the GNIS Points theme is active and visible. Select Theme, then Auto-label from the menu. In the dialog, select Names from the drop-down box as the Label Field and click the Use Theme's Text Label Placement Property radio button. Check the Scale Labels box. Click on OK and watch your labels appear.

ArcView GIS Tip

To list views, tables, and other objects in a preferred order in a project window, place a leading sequential number to the left of the object name.

ArcView GIS Tip

You can create separate directories for different projections of the same data. Reprojected vector data can use the same file name if you store the files in separate, carefully named directories. Remember to be systematic and organized. Keep good notes!

7. Zoom in and then out. Observe how the font expands and contracts as the scale changes. Many labels overlap when using the scale and font parameters suggested above.
8. Experiment with another labeling procedure by again zooming to 1:50,000. Remove all labels by selecting Theme, then Remove Labels from the menu. Again, select Theme, then Auto-label from the menu. After specifying Name as the label field, select Find Best Label Placement and Allow Overlapping Labels. This time most labels are centered above the GNIS point, and overlapping labels are green.
9. Turning the GNIS Points theme off removes these symbols and graphics from the view. Turn the GNIS theme on and save the project now. All the labels will be saved with the point theme.

Summary

GNIS data, once properly edited to include delimiters and saved as a comma-separated text file or dBASE file, can be registered in a geographic projection. The ArcView GIS Projector! extension reprojects the geographic data into UTM NAD27 for use with the Bright Angel model. The reprojected GNIS data now labels geographic and cultural features in the model. The Type field can also be used to symbolize many different point types.

This lesson is based on an article written by Mike Price of ESRI that originally appeared in the April–June 1999 issue of *ArcUser* magazine.