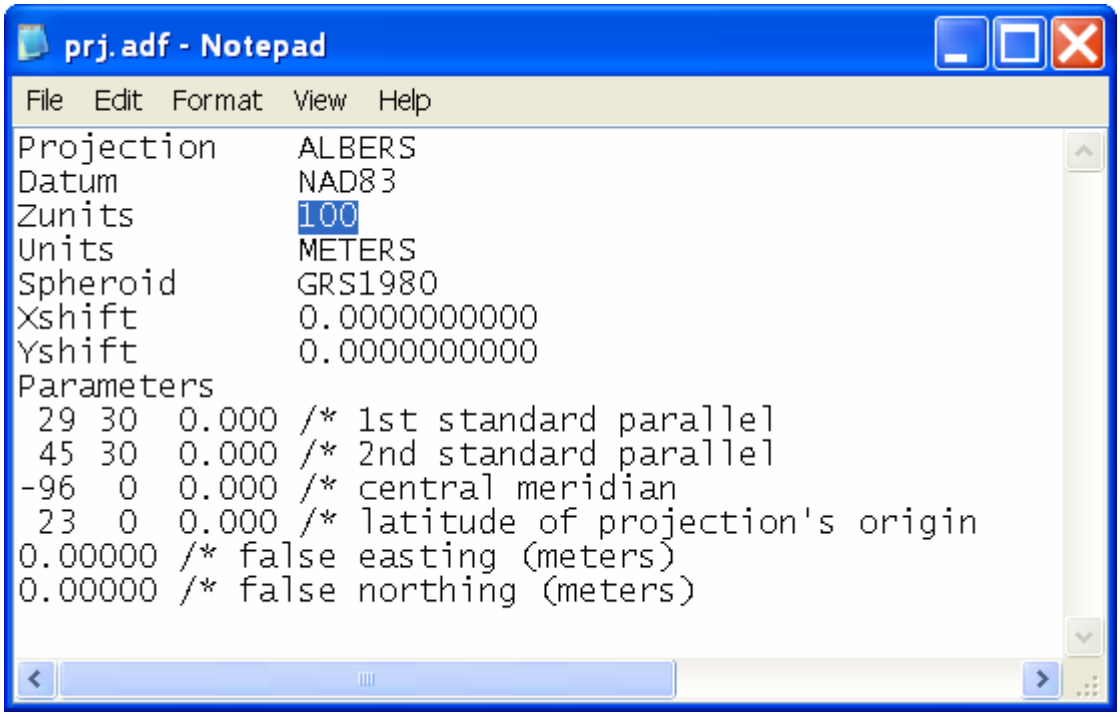
Exercise # 6: Using the NHDPlus Raster Data Sets – Last Updated 3/28/2006

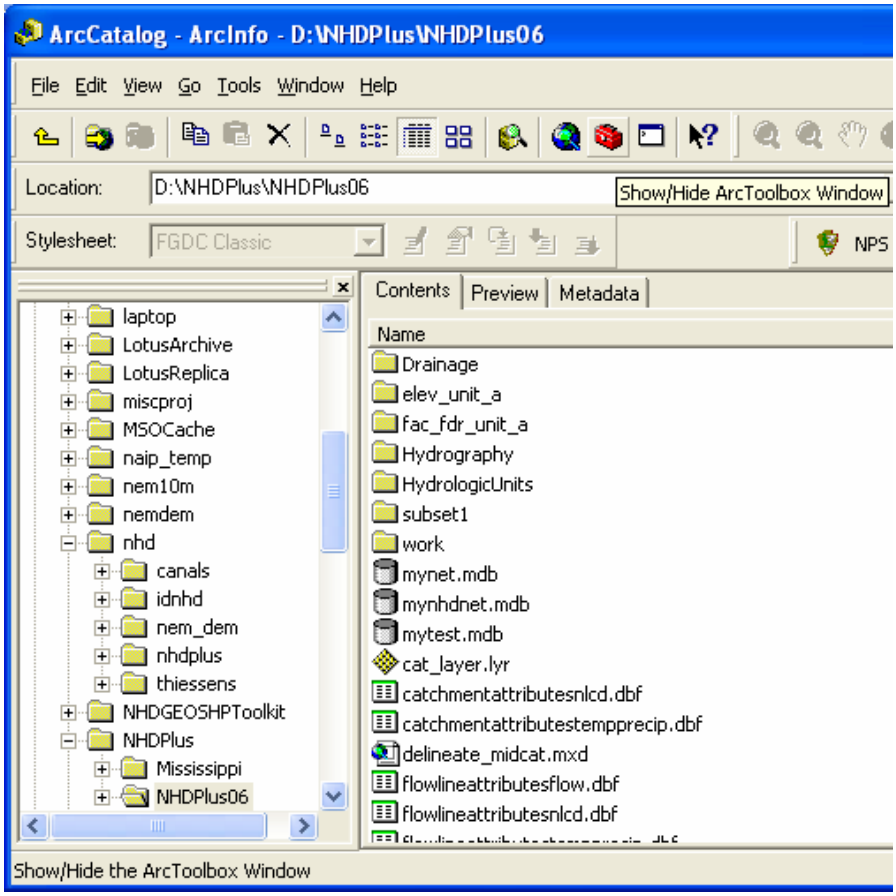
The NHDPlus includes several raster (grid) data sets. Several of these are primarily used in analytical processes that are beyond the scope of this exercise. Some, however, are useful for display purposes. This exercise will provide hints on efficient use of these raster data sets.

1. First, let's discuss the characteristics of each of the raster data sets in general
    a. The ***cat*** grid contains an unusually large number of unique grid values. By default ArcMap will only show the first 65,536 records in the value attribute table (***cat.vat***). The Region 06 ***cat*** grid is smaller, but the ***cat*** grid for most regions exceeds this maximum number of value attribute table records. Such a large grid also cannot be displayed showing unique symbols for each value. Note in ArcGIS 9.1 (but not in earlier versions) there is an Advanced ArcMap setting to allow more than 65,536 records to be displayed in the VAT for a grid. This should be used with caution, however. If a grid with a large numbers of values, like ***cat*** is symbolized to show unique values, display performance can be extremely SLOW! In most cases you don't really need to see the records in the ***cat.vat*** or to display it with unique symbols. All the same information is in the ***catchment.shp*** attribute table, and can be used much more readily in that form. The ***cat*** grid is primarily useful for gridded overlay analysis rather than for display purposes.
    b. The ***fdr*** (flow direction) contains only eight unique values, one for each possible flow direction. Although it is easy to display this grid, it is not particularly easy to interpret. This grid may sometimes be inspected closely in order to understand the flow in a very small area, but generally this grid is not displayed, and is used by automated procedures to derive flow paths or delineate watersheds.
    c. The ***fac*** grid contains a very skewed distribution of values. The vast majority of cells contain small numbers (fewer than 100), however the cells along major flow paths can have values into the hundreds of millions. The default display of such grids is very difficult to use. We will see later in this exercise how to display the ***fac*** grid in a more useful manner.
    d. The ***elev_cm*** grid contains integer values of elevation, using vertical units of centimeters. The original floating-point NED data were multiplied by 100 and converted to integer in order to allow automatic compression of the grids. This saves a large amount of disk space. In some of the early distributions of NHDPlus data, the Z units were specified incorrectly. In the processing unit elevation folder, (e.g. ***elev_unit_a***), open ***elev_cm\prj.adf*** using Notepad. Make sure it has "Zunits 100". If it has "Zunits NO", change it as shown below.

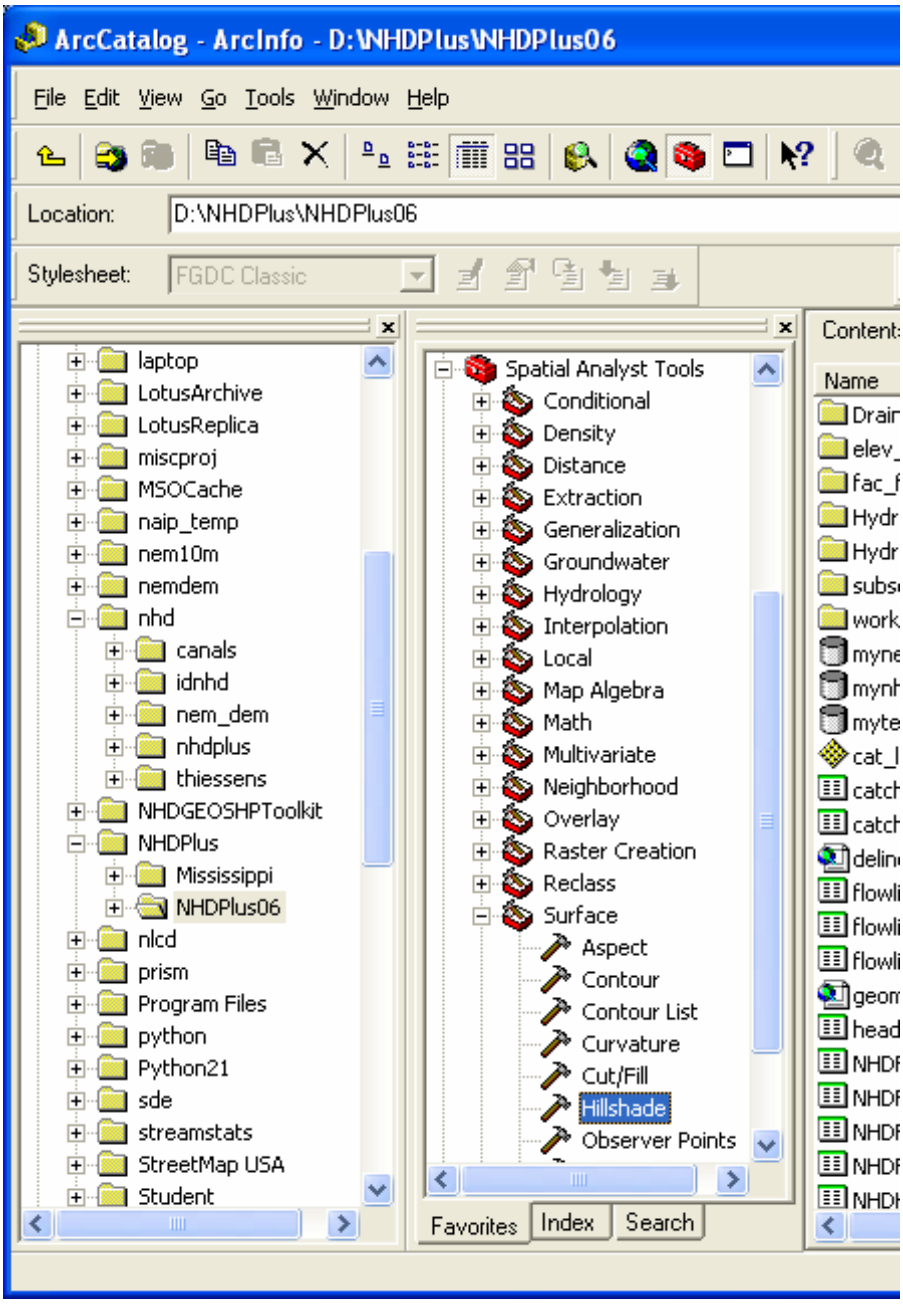


2. Now, let's create a shaded relief map*. Start ArcCatalog.
    a. Let's create a folder to work in. Use either Windows Explorer or ArcCatalog, and the File, New, New Folder choice to create a new folder under our NHDPlus06 folder, and name it "work".
    b. To create a shaded relief grid, use Show/Hide ArcToolbox Window to add the ArcToolbox to ArcCatalog.

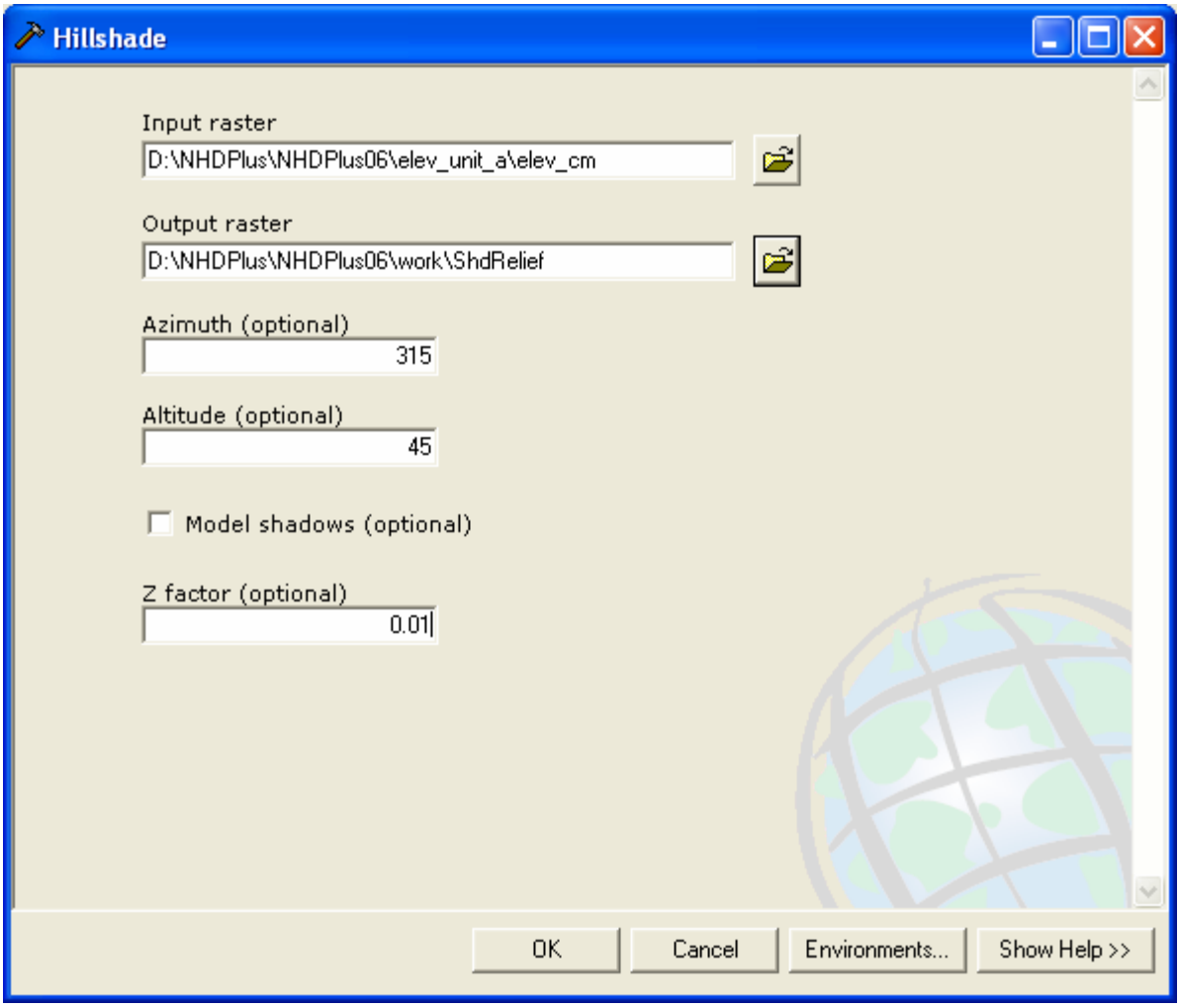
* Note that the ArcHydro Tools Batch Preprocessing tool, covered in Exercise 7, also creates a shaded relief grid. If you plan to do Exercise 7, you could skip this exercise and come back to it after doing Exercise 7.


ArcCatalog - ArcInfo - D:\NHDPlus\NHDPlus06
File Edit View Go Tools Window Help
Location: D:\NHDPlus\NHDPlus06
Show/Hide ArcToolbox Window
Stylesheet: FGDC Classic
NPS
laptop
LotusArchive
LotusReplica
miscproj
MSOCache
naip_temp
nem10m
nemdem
nhd
canals
idnhd
nem_dem
nhdplus
thiessens
NHDGEOSHPToolkit
NHDPlus
Mississippi
NHDPlus06
Contents
Preview
Metadata
Name
Drainage
elev_unit_a
fac_fdr_unit_a
Hydrography
HydrologicUnits
subset1
work
mynet.mdb
mynhdnet.mdb
mytest.mdb
cat_layer.lyr
catchmentattributesnlcd.dbf
catchmentattributestempprecip.dbf
delineate_midcat.mxd
flowlineattributesflow.dbf
flowlineattributesnlcd.dbf
Show/Hide the ArcToolbox Window

c. Expand the **Spatial Analyst Tools** list, then expand the **Surface** tools list, and double-click the **Hillshade** tool.



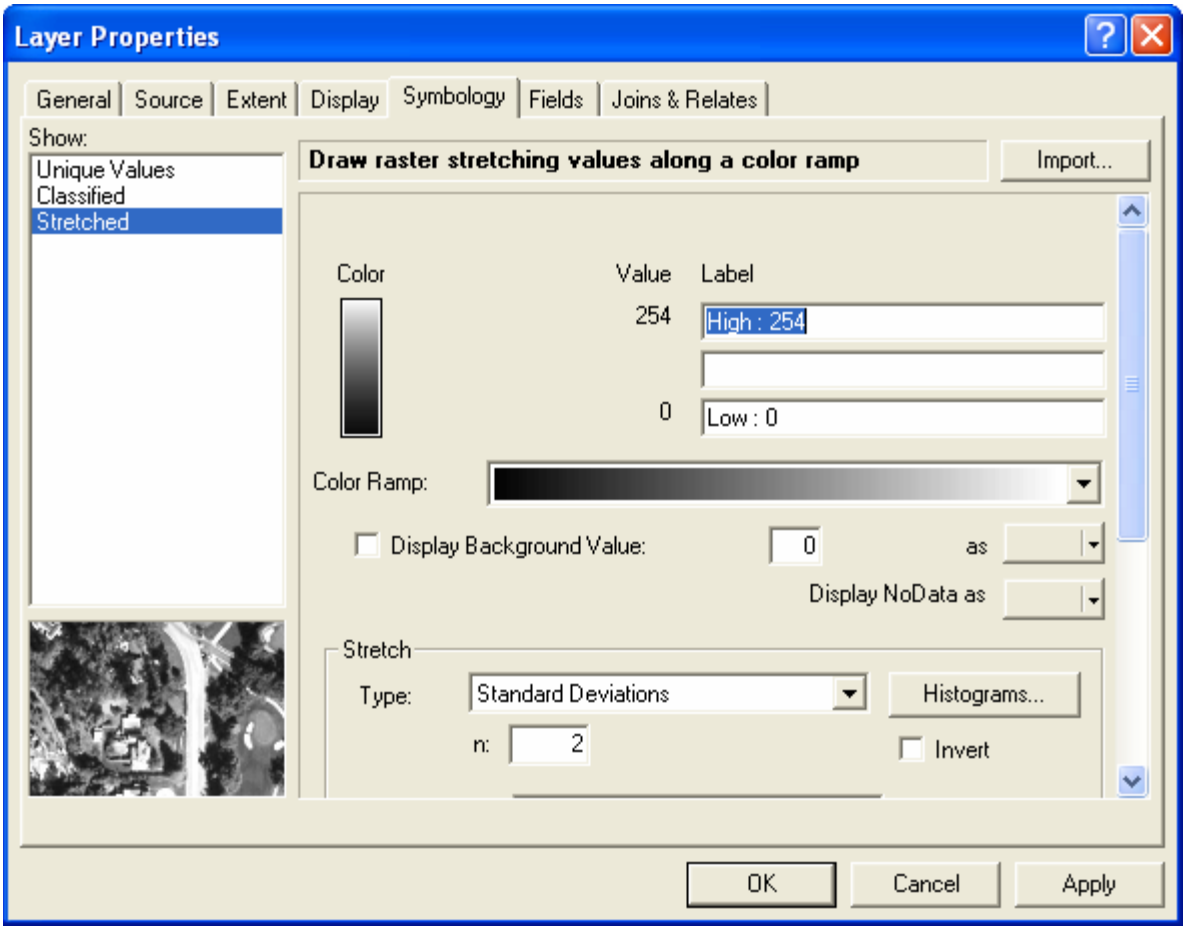
d. Fill in the Hillshade menu as shown below. Use a zfactor of 0.01, because the ***elev_cm*** grid has vertical units of centimeters and horizontal units of meters. Click OK. (This takes about 3 minutes.)



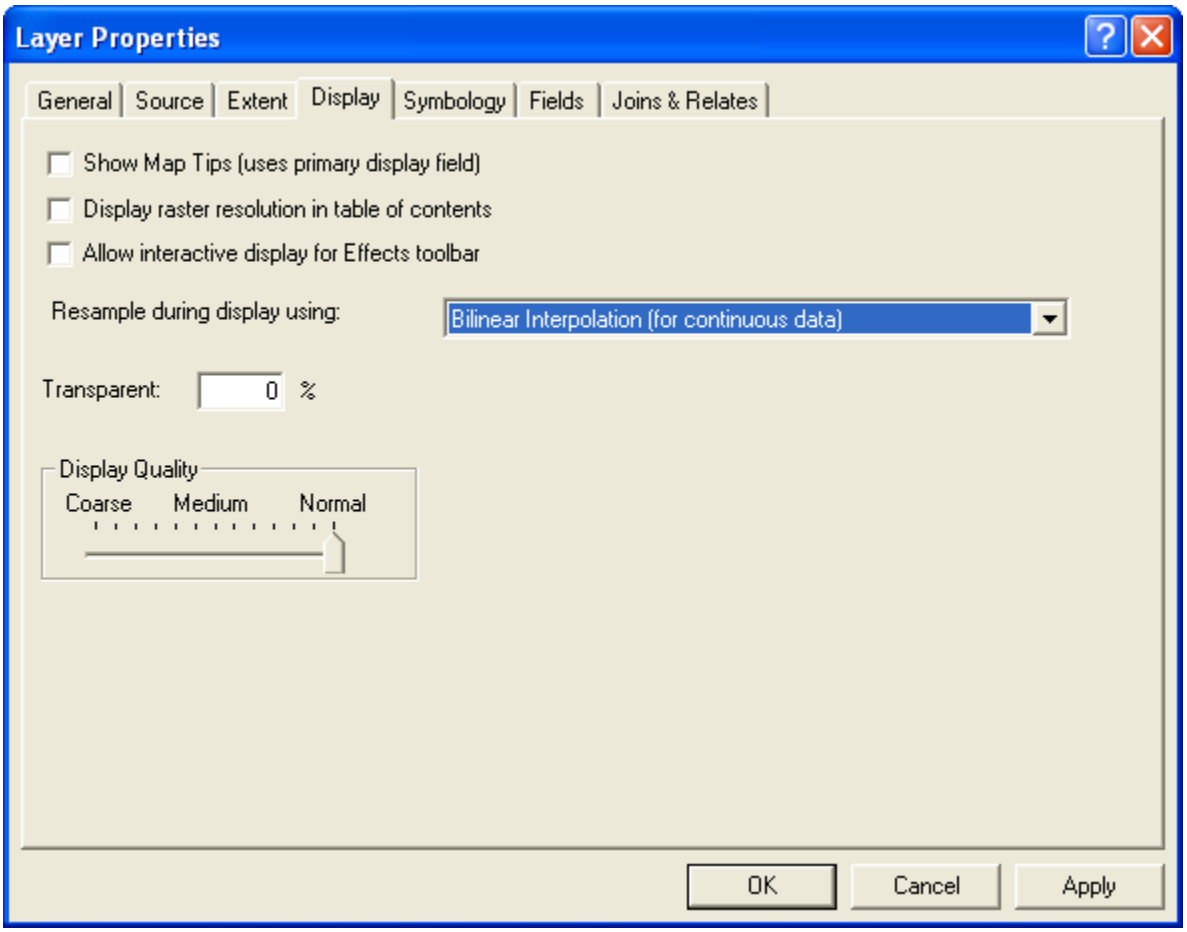
e. Build pyramids for the newly created ***ShdRelief*** grid by right-clicking on it in ArcCatalog and choosing Build Pyramids…, then clicking OK on the Build Pyramids menu.

3. Open ArcMap and close ArcCatalog.
   a. Add the ***ShdRelief*** grid to the map. Note that by adding a raster data set first, the map document takes on the NAD_1983_Albers coordinate system from the raster data set. When working with raster data, particularly when doing raster analysis, it is best to keep the map document in this projection. (Conversely, if doing vector analysis, particularly when using a geometric network, the GCS_North_American_1983 should be used.)

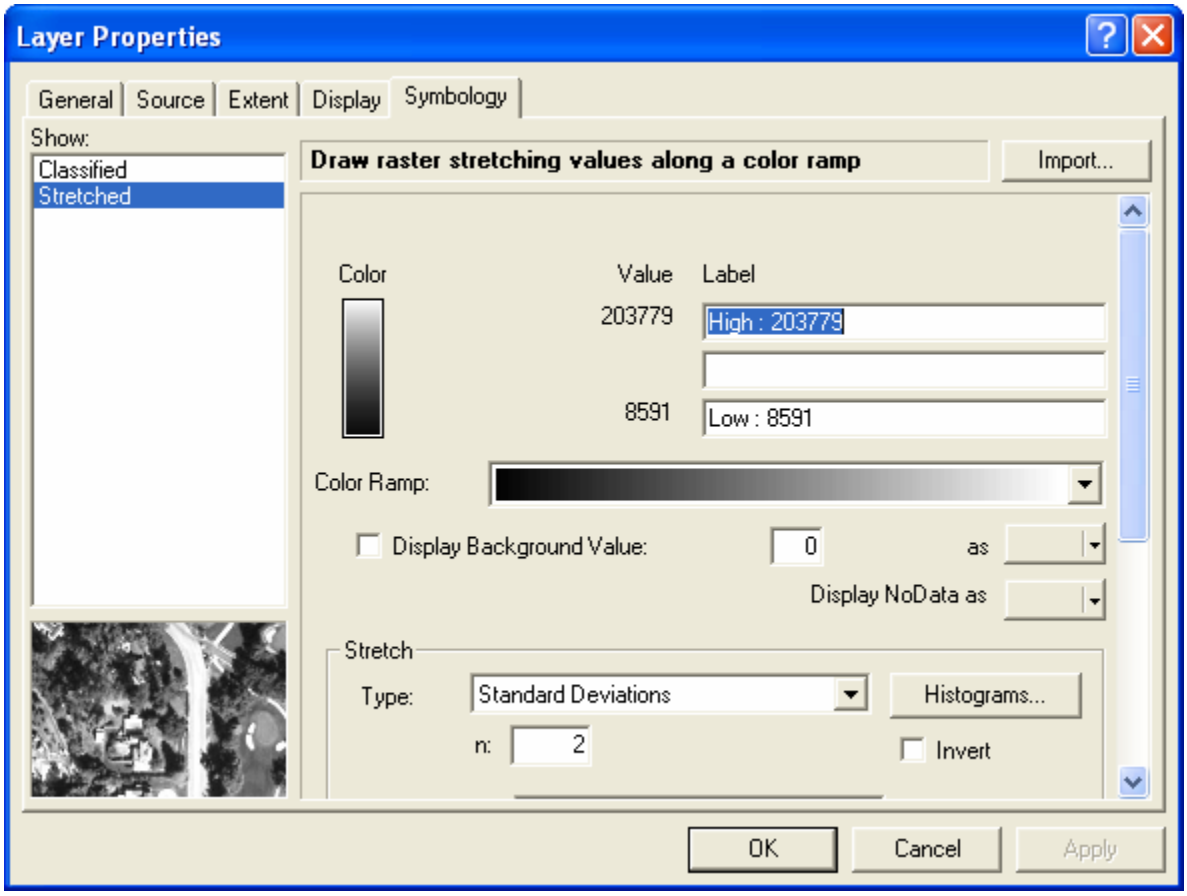
b. Right-click on the ***ShdRelief*** grid, and choose **Properties**. Select the **Symbology** tab. If the renderer is not Stretched, change it to Stretched as shown below, then click Apply.



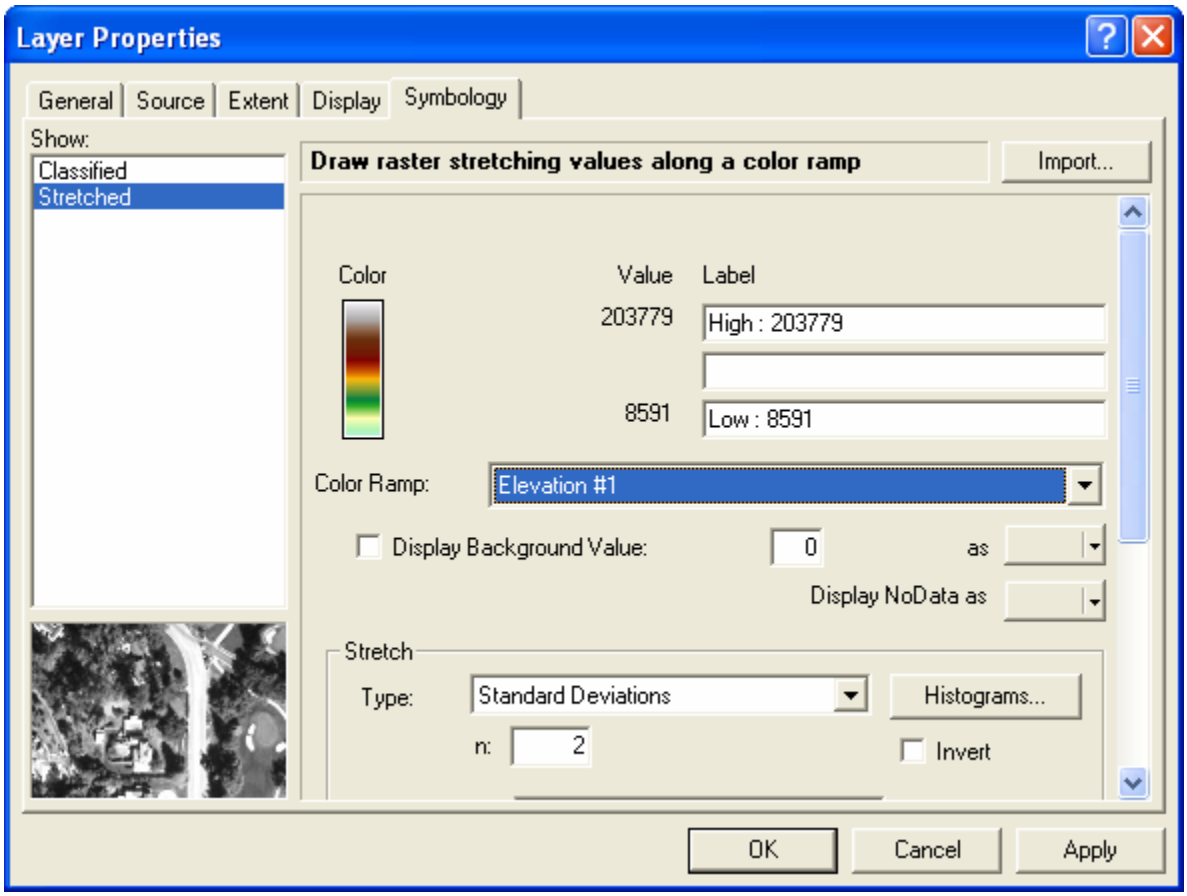
c. Select the **Display** tab and set Resample during display to Bilinear Interpolation for smoother display. Click OK.



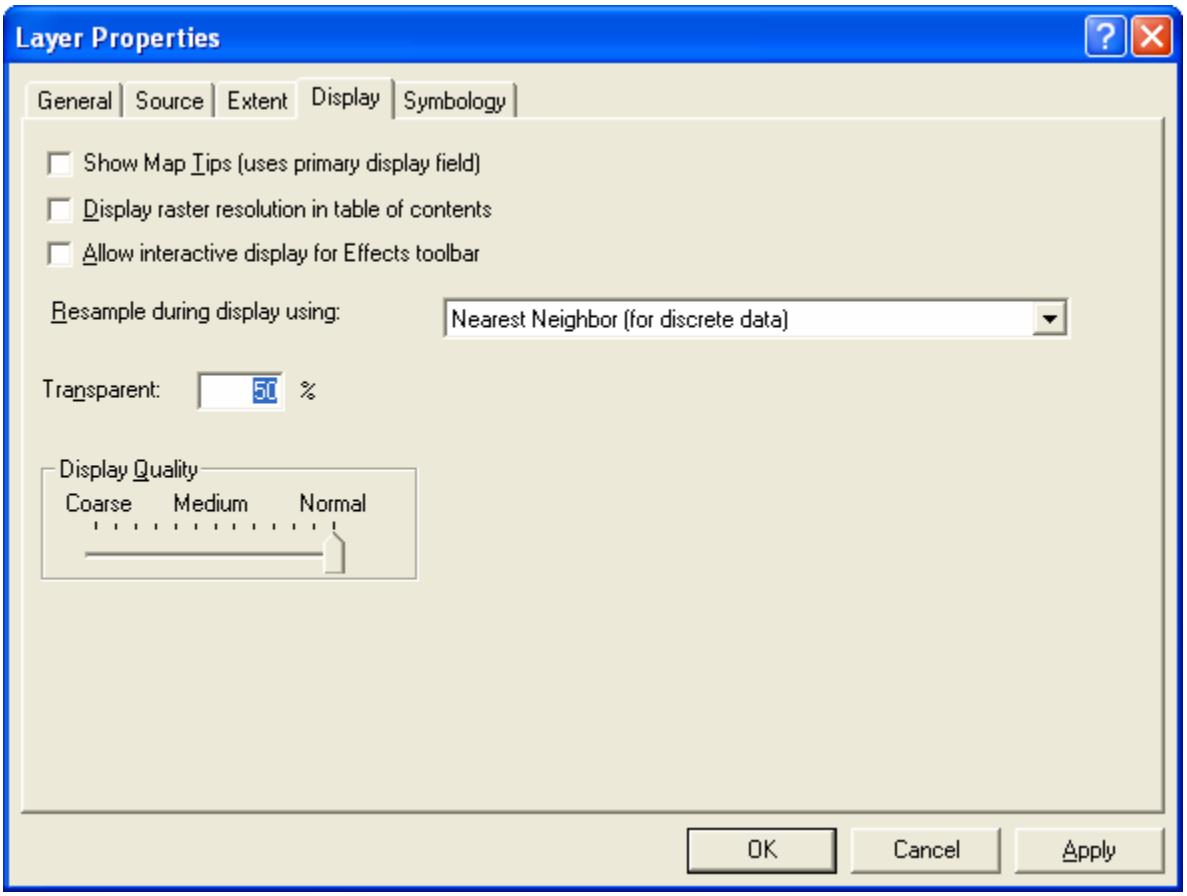
4. Now let's display elevation in a range of colors.
    a. Add the ***elev_cm***,grid to the map. Open its **Layer Properties Symbology** Tab as we did before with the ShdRelief grid. It should look like this:



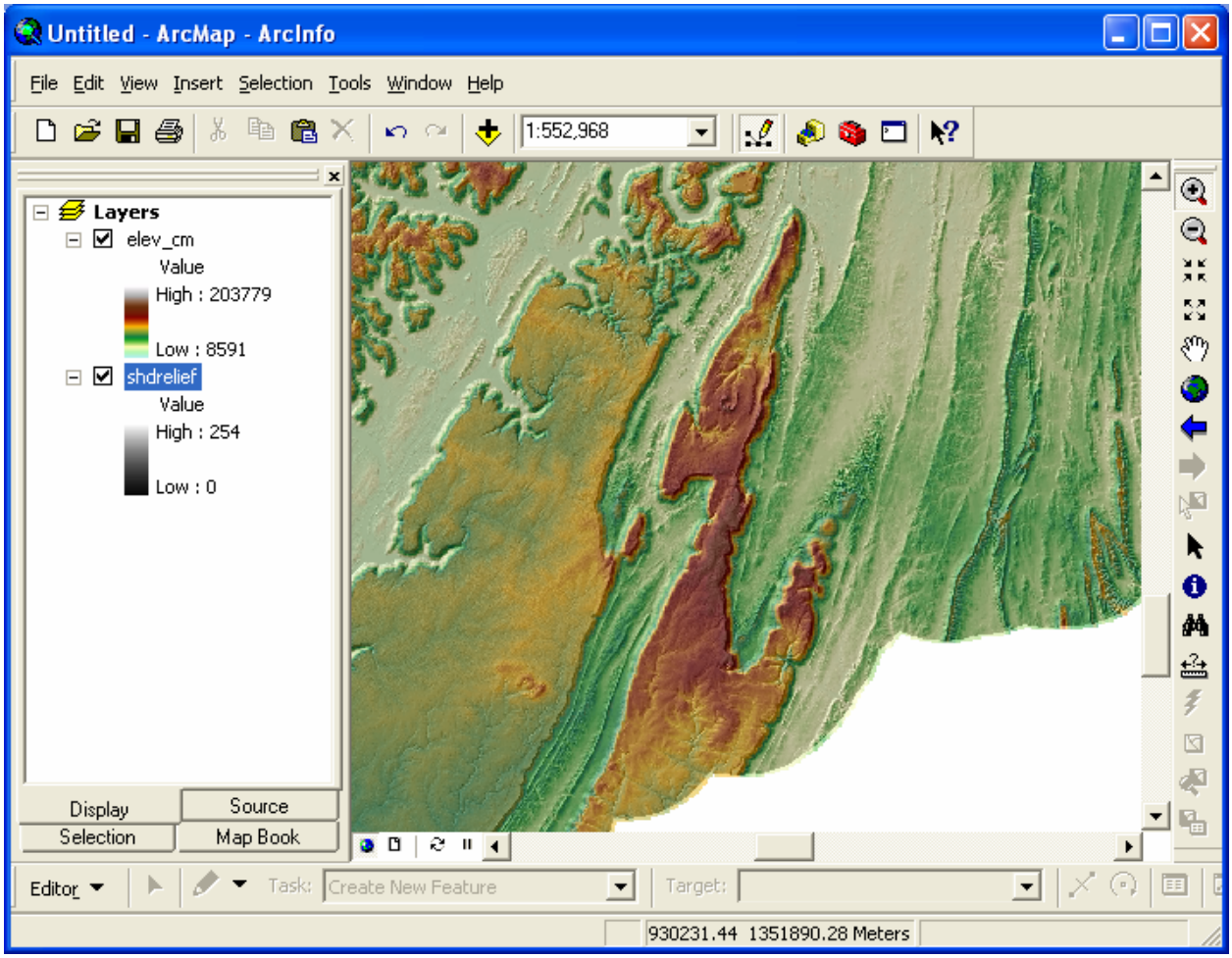
b. Right-click on the black to white shaded Color Ramp pulldown menu and choose **Graphic View**. The check mark beside it should disappear and the text descriptions of the Color Ramps should appear. Using the pulldown menu scroll down to find the Elevation #1 color ramp and select it. The menu should now look as below.



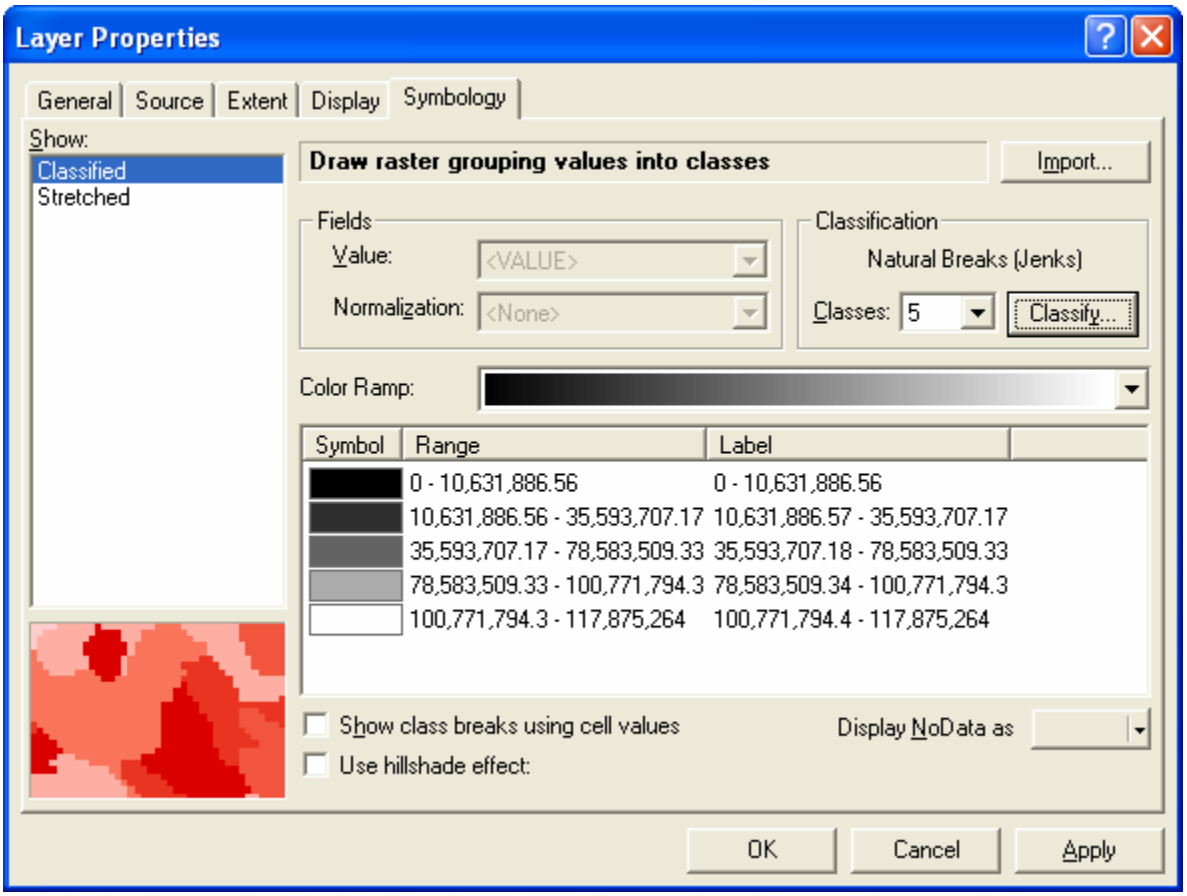
c. Select the **Display** tab, then set the transparency level to 50%. The menu should look like the one shown below. Click OK.



d. In the ArcMap table of contents, drag the elev_cm layer above the shdrelief layer and turn them both on. Zoom in somewhere to see a nice color shaded relief map.

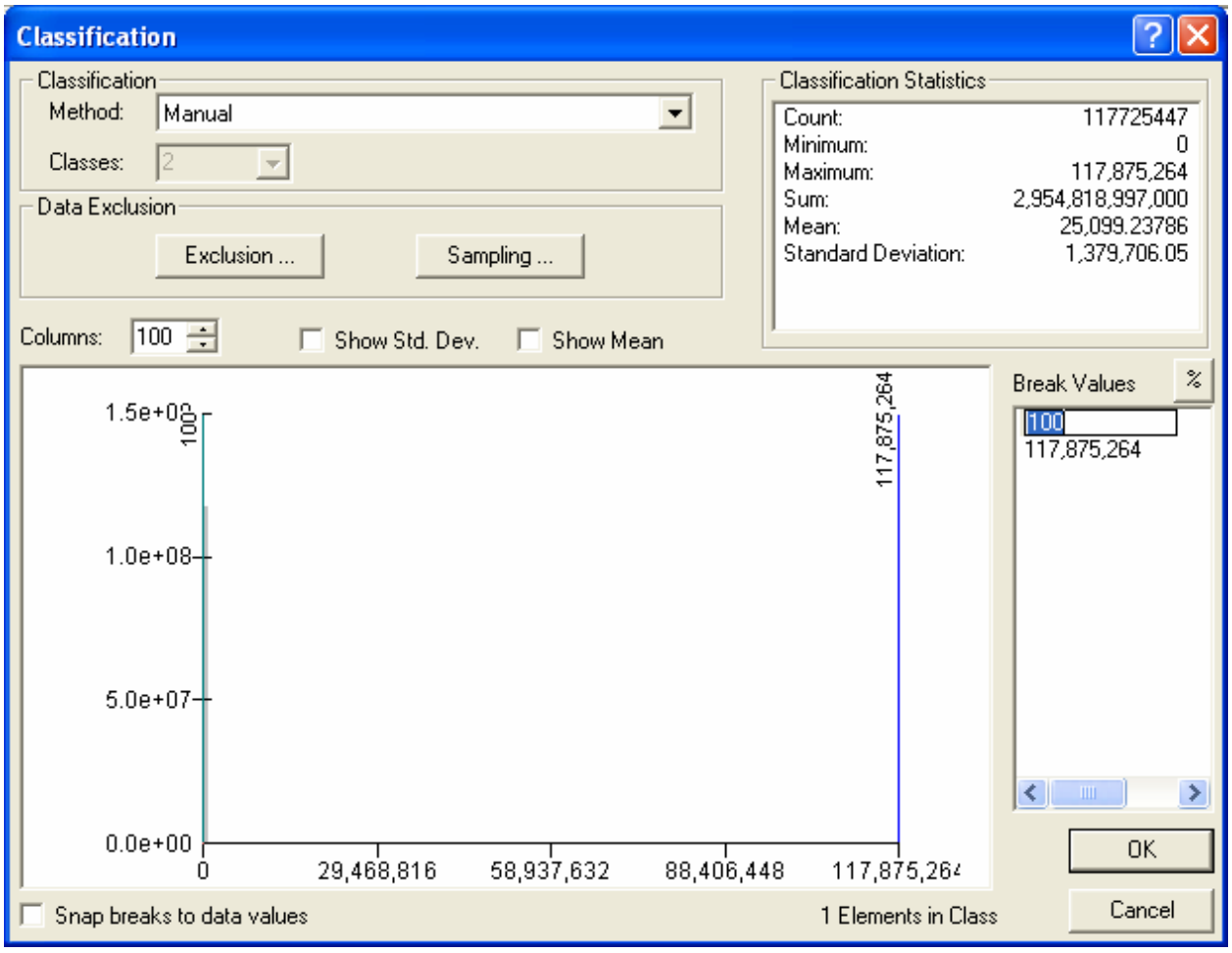


5. Now let's see how we can use the fac (flow accumulation grid) to see where stream channels are according to the HydroDEM.
    a. Add the ***fac*** grid to the map. Right-click on the ***fac*** grid, and choose **Properties**. Select the **Symbology** tab. Change the renderer from Stretched to Classified as shown below.

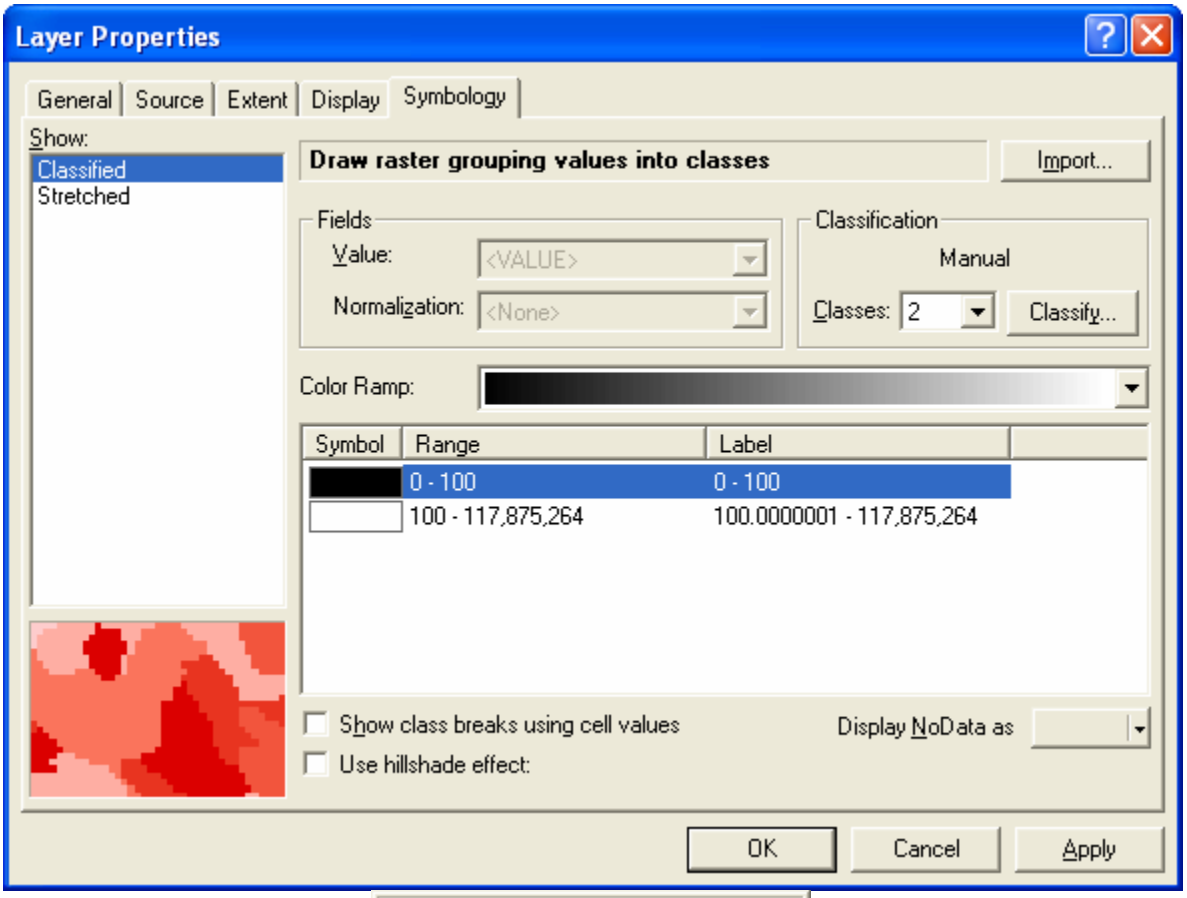


    b. Click the **Classify** button next to the number of classes.

c. On the Classification menu, change the number of classes to 2, then change the first Break Value to 100, as shown below. Click OK.



d. Now back on the **Layer Properties Symbology** menu, double-click on the black box under Symbol next to the 0 - 100 Range, then choose No Color on the color menu that pops up.



e. In a similar manner, change the color on the 100 - 117,875,264 range to a dark blue. Zoom in somewhere so you can see the dark blue ***fac*** grid cells. The ***fac*** cells that are dark blue are cells having 100 or more cells upstream, and indicate where drainage channels are on the HydroDEM. In general these

should follow the NHD Flowlines closely, since all networked NHD Flowlines were burned into the HydroDEM. The threshold of 100 is shown for illustrative purposes, but any threshold may be chosen. A threshold of around 3000 to 5000 has been found to result in a drainage density similar to the medium resolution NHD Flowlines, although this varies considerably throughout the NHD. Below is an example showing the 100-cell threshold fac grid in dark blue, with nhdflowline in orange, overlaid on the ShdRelief grid (which was produced in the Preprocessing step.)