Creating Slope-Enhanced Shaded-Relief Using Global Mapper

Kent D. Brown Utah Geological Survey

Introduction

The purpose of this document is to demonstrate that slope-enhanced hillshade, or shaded-relief maps, are superior to those created by traditional software methods using a simple sun angle and azimuth to show shadow detail in physical terrain models. The results shown here were achieved using Global Mapper software.

Methods

Import your elevation data and map boundary polygon into Global Mapper.

Use the **Tools** \rightarrow **Configuration** \rightarrow **Vertical Options** menu, or click on the **Configuration** icon, and choose the **Daylight Shader** and check the **Enable Hill Shading** box.

Configuration X				
General Vector Display Area Styles Line Styles Point Styles Vertical Options Shader Options Projection				
Daylight Shader				
Elevation Display/Export Units © Native Overlay Units © Metric © Statute (ft)				
Light Direction Altitude 60 🔹 Azimuth 360 🛫				
Ambient Lighting (0.00) Dim Bright				
Vertical Exaggeration (0.8) Flat				
Hill Shading Shadow Darkness (36) Dark —Light				
Water Display Show Water on Elevation Data Water Color				
Water Level: 933 Meters				
Water Transparency (117) Clear Opaque				
OK Cancel Apply Help				

Set the **Light Direction** altitude and azimuth to your preferences. This will likely vary according to the physical geography of the map area. An altitude of 60° seems to work best, but the azimuth is the setting to experiment with the most!

The recommended Ambient Lighting is 0, Vertical Exaggeration, 0.8, and Hill Shading Shadow Darkness, 36.

Now use the **Tools** \rightarrow **Configuration** \rightarrow **Control Center** menu, or click on the **Control Center** icon, click on your elevation layer and then click the options button, which will open the **Elevation Options** dialog box. From the pulldown list, set the display shader option to **Daylight Shader** and check the box for

Anti-Alias Pixels; that will make your hillshade look nice and smooth!

Elevation Options			
Display Alter Elevation Values Feathering Projection			
Color Intensity (0)			
Lighter Darker			
Default			
Translucency (Can You See Through It?) (100.0%)			
Transparent Opaque			
Transparency			
Transparent Set Transparent Color			
Make Very Similar Colors Transparent as Well			
Blend Mode No Blend			
✓ Anti-Alias Pixels (Interpolate)			
Shader: Daylight Shader			
OK Cancel Apply Help			

Now click on the **Feature Info Tool** icon and then click on the map area to select the boundary

polygon, which allows you to clip the hillshade to the map boundary. Export your hillshade with the **File** \rightarrow **Export Raster and Elevation Data** menu, and choose one of the many raster file types.

This will open a dialog box to select your output options. In this example the export file is GeoTIFF. Set the file type to **8-bit Palette Image** and select **Grayscale Palette** from the palette options pull-down.

GeoTIFF Export Options	×			
GeoTIFF Options Gridding Export Bounds				
File Type File T				
Palette				
Grayscale Palette				
Vertical Units				
Meters				
Sample Spacing				
X-axis: 9.24397395869238 meters				
Y-axis: 9.24392467960974 meters				
☑ Always Generate Square Pixels				
If you wish to change the ground units that the spacing is specified in, you need to change the current projection by going to Config-Projection.				
Click Here to Calculate Spacing in Other Units				
DPL/shue To Source in Image (0 for Name)				
DPI Value To Save in Image (0 for None) 0				
Save Scale/Elevation Legend/Grid if Displayed Save Vector Data if Displayed				
Generate TFW File				
Interpolate to Fill Small Gaps in Data				
Use LZW Compression Generate PBJ File				
Make Background (Void) Pixels Transparent				
OK Cancel Apply Help				

The **Export Bounds** tab offers a choice to crop the output to a selected area feature, click it.

When you are finished with choosing export options you will be prompted for a filename and destination for the output; save your raster file. Import your new hillshade as another layer in Global Mapper.



Your hillshade will look similar to this one, a traditional result.

Configuration 🔀				
General Vector Display Area Styles Line Styles Point Styles Vertical Options Shader Options Projection				
Daylight Shader Gradient Shader Surface Color Low Color Slope Shader				
Minimum Slope Slope Value Color				
Maximum Slope Slope Value Color				
Coloring Between Min and Max Slope Values Smooth Gradient C Custom Color <u>Select</u>				
Slope Direction Shader				
West Color West Color South Color East Color				
HSV Shader				
Low Color Start:				
Value:				
Range:				
Custom Shaders New Edit Delete				
Reverse Colors of Selected Shader				
OK Cancel Apply Help				

Next, you'll create a slope map from your elevation data layer, so you need to set new options for it. Once again, click on the **Configuration** icon and on the **Shader Options** tab, set the **Slope Shader Minimum Slope** value to 0, and set the color to white. Now set the **Maximum Slope** value to 5, and set the color to black. Click on the **Smooth Gradient** option so all slope values will display in shades of gray instead of just black or white.

These settings will turn all slopes of 0° white, and any slope over 5° , black; anything in between as various shades of gray.

Now to see the result you'll need to change the display options for the elevation data. Once again, from the **Control Center**, click on your elevation layer and then click the options button to change the display shader to **Slope Shader**. After accepting the changes your elevation data layer should display a slope map similar to this one.



Differently from ArcMap, Global Mapper draws the overlay layers from the bottom up; so in the **Control Center** set the position of the elevation data layer to the top of the list and the hillshade just under that. Change the display options on the hillshade layer so the **Blend Mode** is set to **Screen** and then check the option for **Anti-Alias Pixels**. Make sure both the elevation data and hillshade overlays are turned on. When these options are set, the display should look like this.



Here you can see how adding the slope map has modified the hillshade to display a better representation of the physical terrain, and the very low angle slopes are now devoid of any shading. Now you can save a new slopeenhanced hillshade from this combined effect, clipping it to the map boundary.

Taking further advantage of the Global Mapper display blending modes, a very nice shadedrelief base map can be created using this slopeenhanced hillshade and a topographic base map image.

Perhaps the most useful of all of the available blending modes is the **Multiple** mode. The multiple mode allows you to blend any layer into another so the features of both can be seen clearly without the need to set layer transparency to any of them; an outstanding feature for map creation. These "mashups" can be used to create any number of thematic map variations and maintain excellent graphic quality.

The next page shows an example of a shadedrelief and topographic base map mash-up created using Global Mapper.



High-quality mashup created using a topograghic basemap and slope-enhanced shaded relief.

Global Mapper Mash-ups

Create high-quality mash-ups from scanned topographic maps, slope-enhanced shaded-relief maps, and high-resolution images of geologic map unit colors and patterns.

Global Mapper Stack Order	Transparency %	Blend Mode
DRG or Scanned Topo Map	30	None
Slope-enhanced Shaded Relief	40	Multiple
Raster Image of Map Colors and	100	Multiple
Patterns		



The above shows the elements and settings used in Global Mapper to create a high-quality mash-up used in the publication of the Geologic Map of the St. George and east part of the Clover Mountains 30'x60' Quadrangles, Washington and Iron Counties, Utah. Note the blend modes used. Since ArcMap cannot blend layers together, this is the only way that the topographic base, the shaded-relief, and the polygon colors can be combined without using a transparency on the polygons; which diminishes the original polygon colors to undesirable colors.

Following is a screenshot of a portion of this published geologic map.



Kent D. Brown, Utah Geological Survey 20100324