

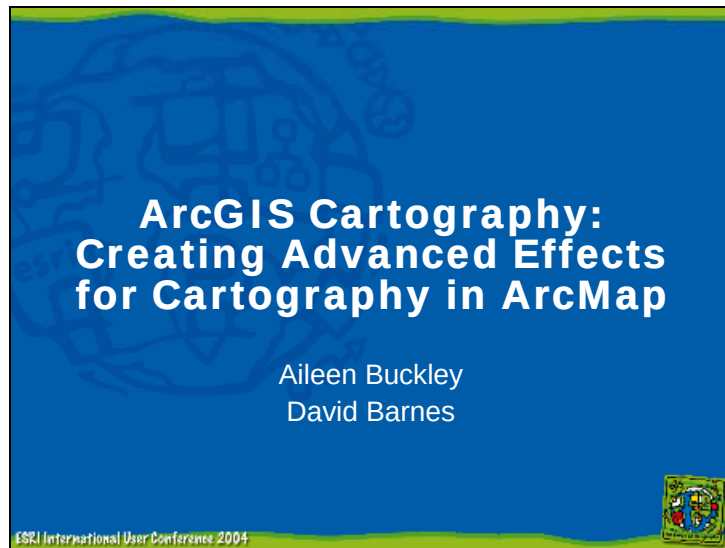
**ArcGIS Cartography:
Creating Advanced Effects
for Cartography in ArcMap**

Aileen Buckley
David Barnes

ESRI International User Conference 2004



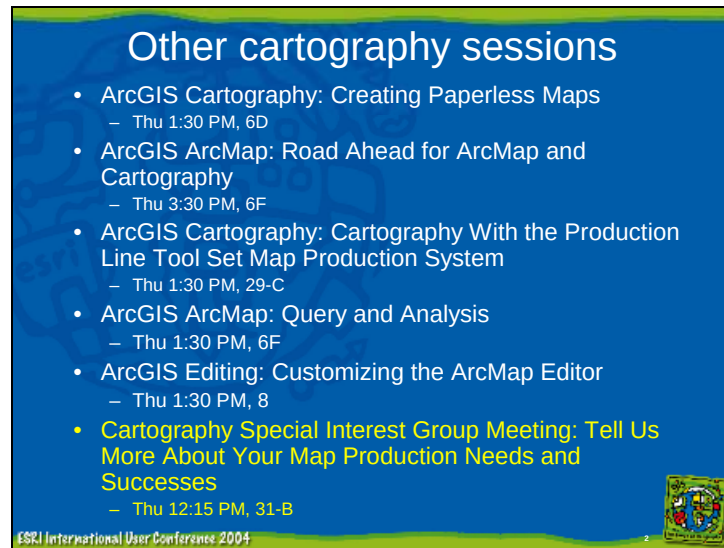
Slide 2



Welcome to our session on Creating Advanced Effects for Cartography in ArcMap! In the next hour and a half, we'll provide you with information about advanced display and finishing effects in ArcMap to produce high quality maps.

(DEMO: Have the USGS 24K map on the screen and have Spatial Analyst and Hillshade Toolboxes showing and make sure Maplex is on.)

Slide 3



Other cartography sessions

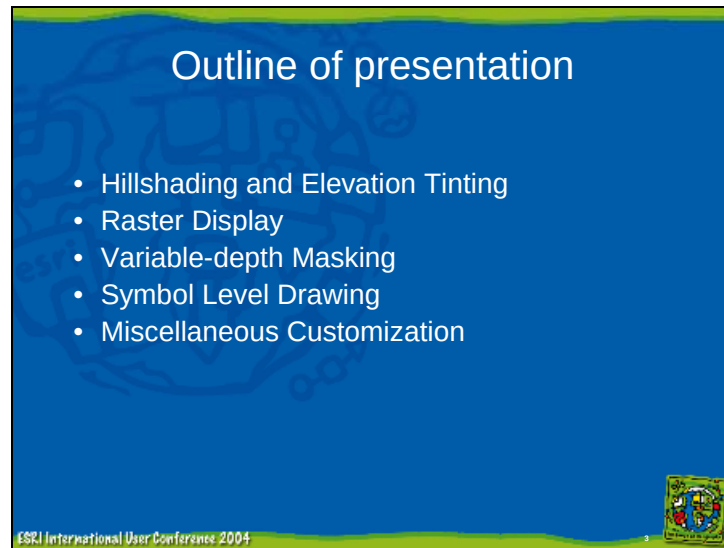
- ArcGIS Cartography: Creating Paperless Maps
 - Thu 1:30 PM, 6D
- ArcGIS ArcMap: Road Ahead for ArcMap and Cartography
 - Thu 3:30 PM, 6F
- ArcGIS Cartography: Cartography With the Production Line Tool Set Map Production System
 - Thu 1:30 PM, 29-C
- ArcGIS ArcMap: Query and Analysis
 - Thu 1:30 PM, 6F
- ArcGIS Editing: Customizing the ArcMap Editor
 - Thu 1:30 PM, 8
- **Cartography Special Interest Group Meeting: Tell Us More About Your Map Production Needs and Successes**
 - Thu 12:15 PM, 31-B

ESRI International User Conference 2004

Before we start, let me point out that there are a number of other cartography related sessions that you might want to visit. In fact, some of the maps we show you in our session will show up in other sessions as well – like those about creating and distributing paperless maps.

And there are other ArcMap sessions, too – these might be useful for working with the data that goes on the maps. For example, projections are incredibly important in mapping, so you can learn more about those if you want.

Slide 4



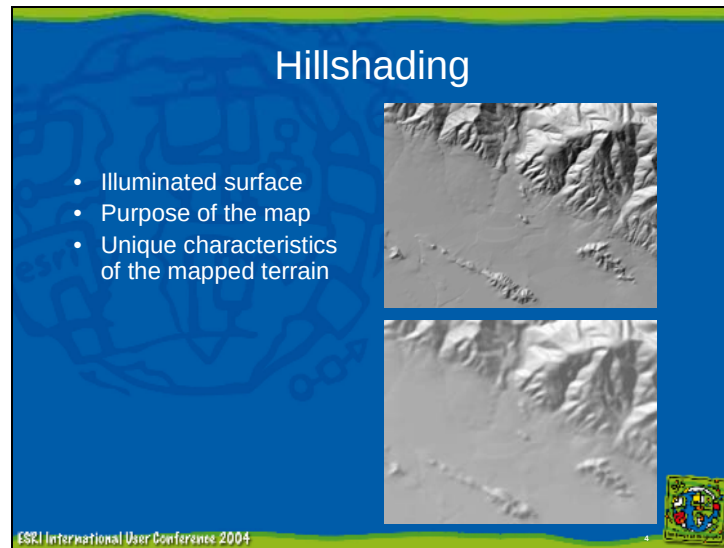
Now on to our talk. We want to show you a number of really neat things for high quality cartography:

Including how to create a background hillshaded surface and then drape it with colors to show elevation ranges.

We'll then show you some ways you can modify a raster display to soften or highlight features on the surface.

We'll also show you some of the ArcGIS functionality you can use to mask overlapping features and to set the drawing order of feature symbology.

And we'll finish up with a demonstration of some special methods to add a professional touch to your final map.



First, let's talk about creating a backdrop for our map.

DEMO: Let's turn off all the layers in our map except for the hillshade we made earlier.

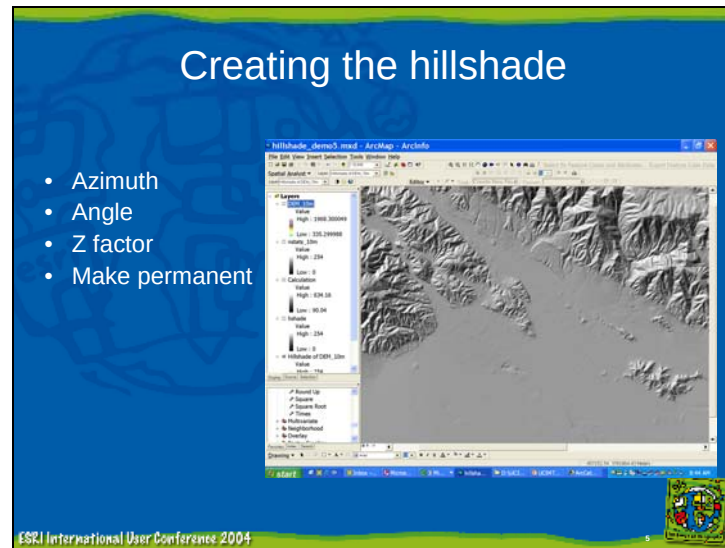
Often you'll see a hillshaded surface that provides an impression of the terrain illuminated from an external light source, like the sun.

When hillshading, the purpose of the map should be paramount. Sometimes the objective is to emphasize the terrain, in which case you want to use techniques that bring out details in the landscape. Other times you really want to use terrain as a backdrop to show other reference or thematic data. In this case, you want the hillshade to capture less of the visual attention of the map reader. And of course, the terrain representation should also take into consideration the unique characteristics of the area mapped like the relief and orientation of physiographic features.

DEMO: Now let's turn on the elevation tint.

Elevation tinting can be combined with hillshading to simulate vegetation, snow or other land cover.

Slide 6

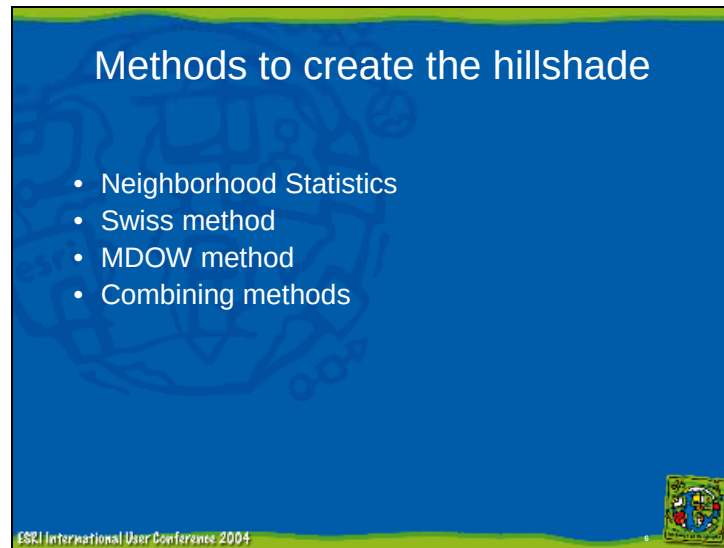


So how do you create a hillshade? It's really pretty straightforward if you have Spatial Analyst – or 3D Analyst. In order to demo this, we'll start by turning off all the layers except our DEM.

Let's switch to data view now. Using Spatial Analyst, under Surface Analysis, you'll find the Hillshade tool. Specify the digital elevation model that you want to use.

You can see that you can also change the angle or azimuth and height or altitude of the illumination source to further specify the way the shadows will be cast. And if you increase the Z factor, you'll essentially be creating a display that exaggerates the heights of the surface. You can either make a temporary hillshade for display only or you can make the output permanent for use in the future. We'll make our temporary and click OK to create the hillshade.

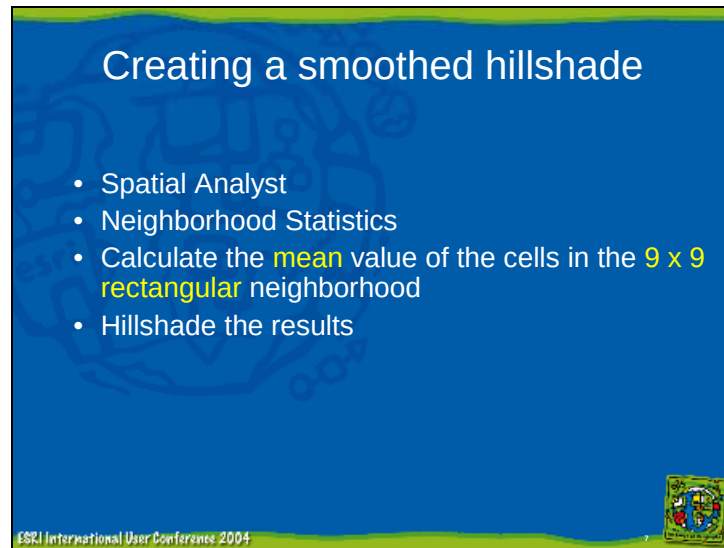
You can make some very simple to fairly complex modifications to this method to achieve some rather dramatic results. First we'll show you a very simple technique for smoothing the hillshade to create a more subtle effect. Then we'll show you some other methods that are a little more refined.



Now we want to show you how you can go beyond the defaults to add a professional touch to your hillshaded display.

The first method we'll show you reduces the amount of detail in the hillshade – smoothing it out for a more subtle look which you might want to use if you really want the hillshade to recede into the background a bit more. This method uses the Spatial Analyst Neighborhood Statistics tool.

Let's start with the simple smoothing method.



DEMO: Let's open Spatial Analyst and take a look at Neighborhood Statistics.

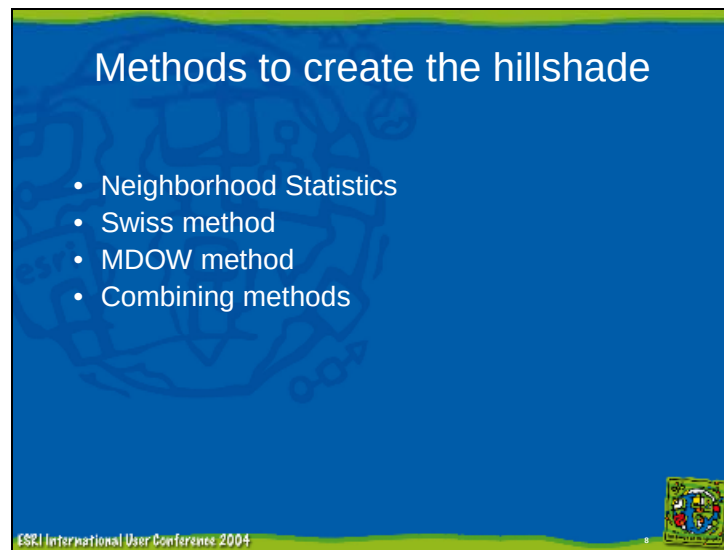
Use your DEM as the input grid, set the statistics to calculate the mean, use a rectangular neighborhood with a **9 by 9** cell size and click OK.

The output grid is a smoothed version of the DEM. You can then compute a hillshade from this generalized surface.

DEMO: So let's go back to the Hillshade tool and create a temporary hillshade of the neighborhood mean grid using the default settings.

The resulting surface reduces the amount of detail in the hillshade and provides a softened look that you can use as a background elevation display.

DEMO: When we turn the Neighborhood grid on and off so we can compare it to the default hillshade we can see the smoothing effect that the neighborhood mean creates. For example, look at the hill slopes in just west of the large wash in the center of the image – you should be able to see a smoothed representation of their character – can you see it?

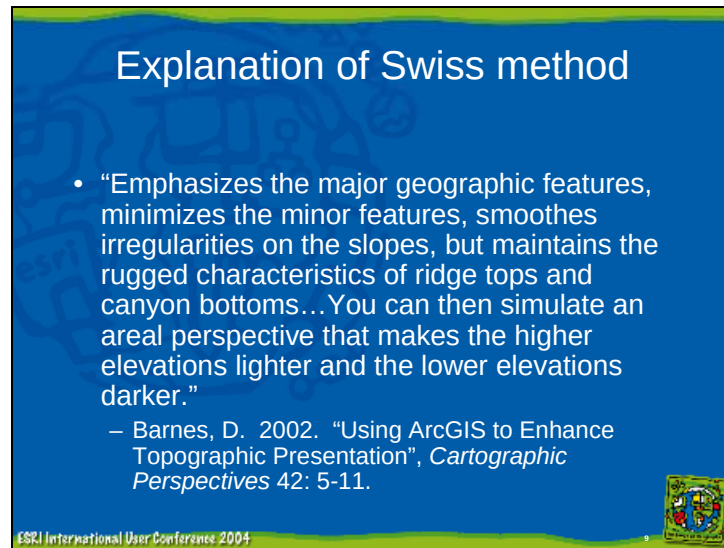


Now let's move on to two other methods for hillshading.

One was developed by the Swiss to help display the wonderful relief in their topographic maps.

The second was developed by the USGS to help bring out the relief of features that might be masked by a single source of illumination.

We'll start with the Swiss method.



What the Swiss method does is to create two new rasters from the input DEM. The DEM and the two new rasters are used together in the final display. It's a fairly simple process -- we'll work through it with you using Spatial Analyst.

To produce the Swiss effect, we need to use our original DEM and its default hillshade.

DEMO: Using Spatial Analyst's Raster Calculator, enter the formula $DEM / 5 + Hillshade$. Then click Evaluate.

This display simulates an areal perspective that makes the higher elevations lighter and the lower elevations darker.

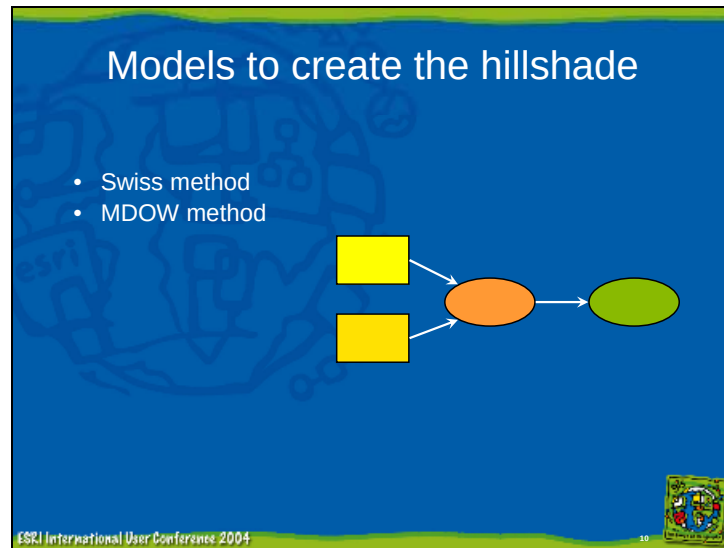
DEMO: Now let's make the second raster. Using the Neighborhood Statistics Tool in Spatial Analyst, use the default hillshade as the input raster, set the statistic type to mean, the neighborhood to circle and the radius to 4 cells and click OK.

The output grid generalizes the hillshaded terrain, emphasizing the major geographic features, minimizing the minor features, smoothing irregularities on the slopes, but maintaining the rugged characteristics of ridge tops and canyon bottoms. Now you can combine the grids in your display to get the final effect.

DEMO:

- Move the original DEM to the top and symbolize it with a color ramp to show elevation – we'll use a color ramp from the ESRI style that ranges from blue green to brown. Next, set the transparency to 55%.
- In the middle, display the neighborhood statistics grid with 35% transparency and use a single hue color ramp, like a black to white ramp.
- On the bottom, display the raster calculator grid with a black to white ramp and 35% transparency.

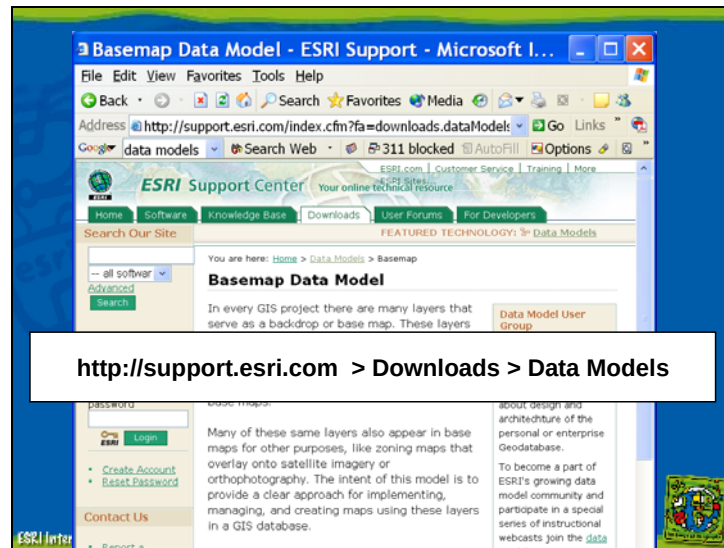
The final display produces an effect similar to the Swiss-style hillshade.



In Arc 9.0 you can actually make this even simpler by constructing a model using the Geoprocessing capabilities of ArcToolbox. We'll show you a model we created for this hillshade method – it's in a toolbox we made called Hillshade Tools. To see the model, we'll right-click the Swiss Hillshade Model and click edit.

The steps in the model are simply a combination of Spatial Analyst tools strung together. It also provides some documentation about the method like how to set the transparencies and order of your rasters in the output display.

Slide 12



This model will be posted on the Basemap Data Model Web Page which is being populated with models and scripts that you can download and customize. Here, you can also find other useful tools and hints for mapping and cartography, and look for more as they are developed!

Slide 13



And you should also be aware that there is a new (about one week old) web site for downloading other models – this is the Geoprocessing page that you can get to through the support.esri.com site.

We will also put a link to this model in the Base Map Data Model web page.

Explanation of Multi-directional Oblique Weighting (MDOW) method

- "Traditional computer-generated shaded-relief maps emphasize structures that happen to be obliquely illuminated, but wash out structures that are illuminated along the structural grain. This ... technique, which emphasizes oblique illumination on all surfaces, provides more detail in areas of an image that would otherwise be illuminated by direct light or left in darkness by a single source illumination."
 - This model was developed by Dr. Robert Mark, U.S. Geological Survey, Menlo Park, CA, 94025.

ESRI International User Conference 2004



Now let's look at a method that illuminates from multiple light sources. The MDOW method is a little more complex than the Swiss method, so to save a bit of time, we built a model to do our processing. Again, let's take a look at the model.

DEMO: This time we'll right click the MDOW Hillshade Model and click Edit.

I told you it was just a little more complex.

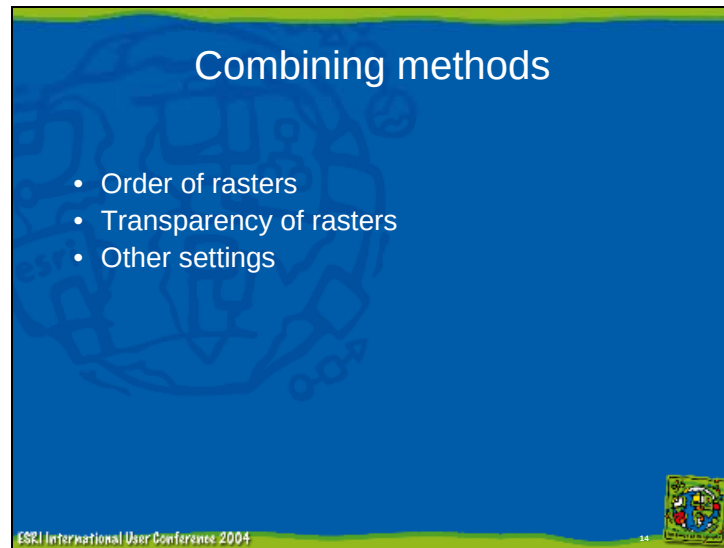
The methods we've seen so far use a default hillshade which highlight features that happen to be at or close to right angles to the angle of illumination. Structures that are illuminated in the same direction as the azimuth are washed out, though. The MDOW method creates an illuminated surface that uses four different azimuths, from 225 to 360 degrees.

We won't actually run this model at this time – if we did, it would take just over 2 minutes for three 10m quads of DEM data. Instead we'll show you the model parameters and the model results.

DEMO: First we'll close the Edit view; then just double click on the name of the model and we can see what parameters are required. The first thing we need is to fill in the name of the input

DEM. Then just fill in the name of the output DEM and you're all set to run the model. We'll close it and take a look at the results.

The output is a single raster that shows more detail in areas that would be illuminated by direct light or left in darkness by a single light source. And although some smoothing does take place, it is not emphasized as much as in the Swiss method, therefore the detail in the surface is more evident.



Now we want to show you how you can use both the Swiss and MDOW rasters together.

DEMO: First, let's turn on the three rasters required for the Swiss method. Now try placing the MDOW hillshade right under the DEM and set its transparency to 55%. Notice as we turn the MDOW layer on and off that we can see a combination of the smoothed Swiss hillshade along with the detail of the MDOW hillshade.

Don't be afraid to experiment with the various parameters of the display like the transparency settings and the order of the layers.

Speaking of transparency is a good lead in to our discussion of how to symbolize the hillshade you created.

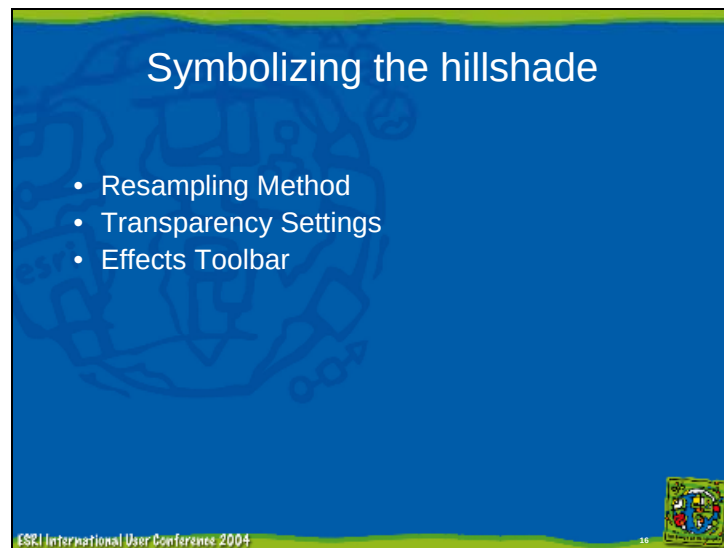


You can change the appearance of the hillshade by modifying the color ramp used in the display. Let's take a look at a color ramp that we're using in our map.

DEMO: To start, let's turn off all layers except the default hillshade so we can see things a little more clearly. Right click it to see its Properties and select the Symbology Tab. Then right click the color ramp and select Properties. Note that there is only one color listed but you're really using a ramp that ranges from black to white. Let's change the black to 40% Gray and then make sure that it still ranges to white.

DEMO: Once we've this modified color ramp, we may want to save it for use later in another map – right click the ramp again and select "Save to Style". Give it the name "Gray to White" and click save. When you look in your personal style, you'll find it there. See how the surface is now lighter on the map? This might be better if we want the hillshade to be a background image.

DEMO: Now let's see how we can use a ramp that we customized earlier. Right click the hillshade again and select the Symbology tab. We'll change the color ramp to a blue to yellow ramp to achieve another Swiss effect which simulates sunshine on surfaces toward the light and blue shadows in areas that are less illuminated. The color ramps used in today's presentation will be available on the Base Map Data Model Web Page.



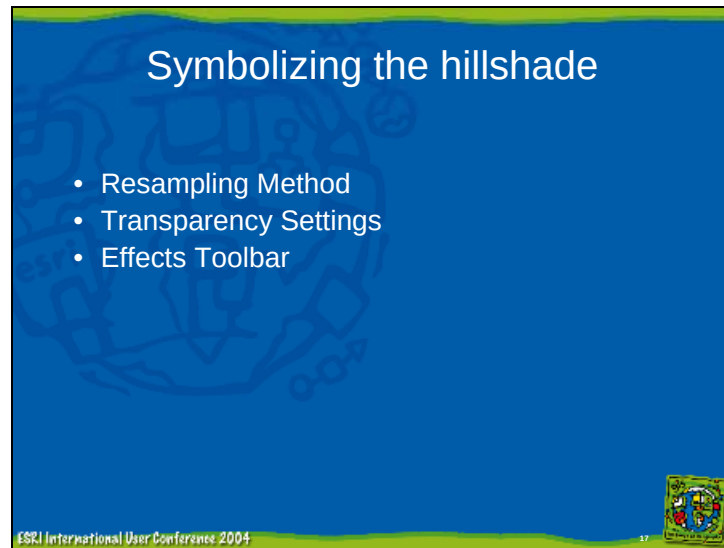
Now we want to show you some more tips and tricks for displaying your hillshade and other rasters. Some of them you saw briefly earlier -- we'll talk about them in more detail here. Two main settings are the Resampling Method and the Transparency settings.

DEMO: Right-click on the hillshade layer in the Table of Contents, and Select Properties. Then select the Display tab.

Here you can change the Resampling setting from the default Nearest Neighbor, which is best for discrete data, like categorical data – for example, land use classes from satellite imager. Bilinear Interpolation is better for continuous data, like our rasters. The third option, Cubic Convolution, is also good for continuous data but works better for imagery and photography since it doesn't smooth as much as Bilinear Interpolation.

While you're here, you can also set the transparency of the hillshade – this tones down the contrast between the brightly illuminated areas and the darker shadows. If you also check the option to “Allow interactive display for Effects Toolbar”, you can immediately see the results as you change some of the display settings with that tool.

DEMO: We'll turn that option on so you can see how the Effects Toolbar works. Click OK to save your settings.



DEMO: Let's pull the Effects Toolbar out in the display area where we can see it a little better. Let's set the raster to our hillshaded DEM.

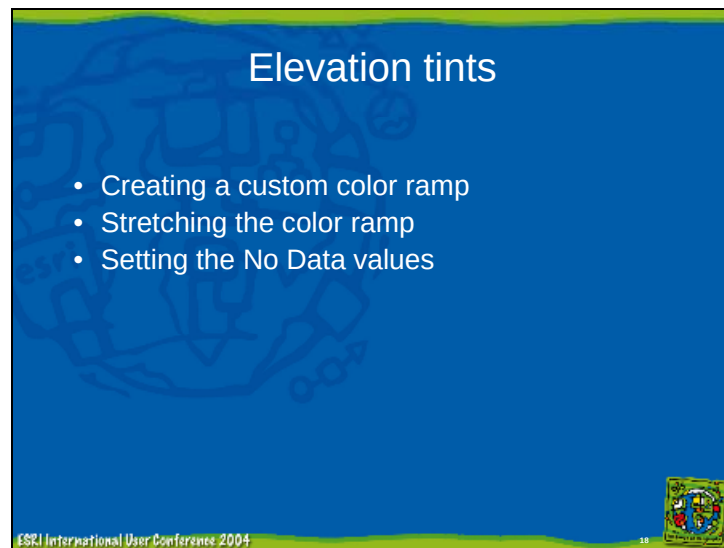
With the Effects toolbar, you can set the contrast and the brightness of your raster display, as well as the transparency. These enhancements are applied to the screen display, not to the original dataset.

- Contrast adjusts the difference between the darkest and lightest colors.
- Brightness increases the overall lightness of the image. This produces an effect similar to changing the color ramp from Black to White to Gray to White.
- Transparency lets you see other data layers underneath the raster layer. This is the same as the transparency setting in the Display tab of the Layer Properties.

With these tools and the others we showed you earlier, you can create a professional quality elevation display for your map.

Now we're going to work with a map of Western Europe to illustrate how hillshades and elevation tints are used together.

This map that showcases some of the work by David Barnes, a Product Specialist for ArcMap, and incidentally the person running our demos!



Elevation tints use bands of colors that display different elevation ranges. In this demo, we'll show you some additional ways to edit the elevation tint... and the hillshade... as well as a couple other data management techniques.

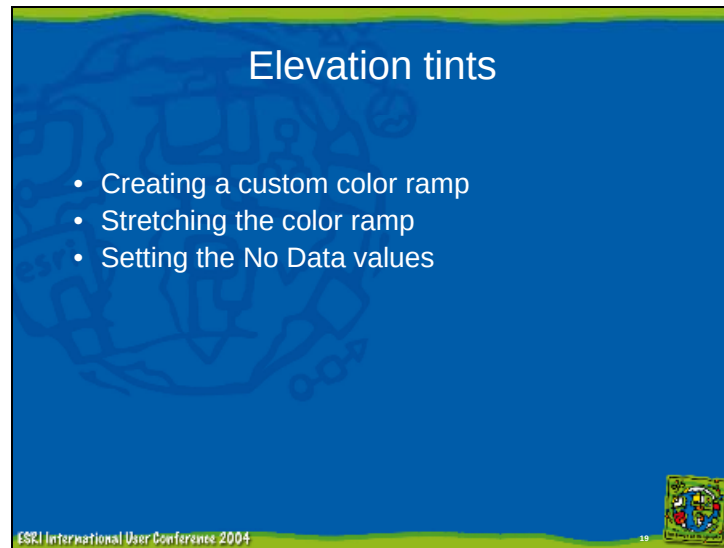
In the Europe map, notice that the mountains don't appear to be very high and the valleys appear as a somewhat muddy green.

DEMO: Now let's see how we can customize the color ramp used for elevation tinting with a user defined set of color values. We'll right click the elevation layer to see its Properties and click the Symbolology Tab. Again, let's look at the properties of the color ramp.

In this case, you can see that there are four algorithmic color ramps that together define the full range of colors used for layer tinting, from the lower elevations colors...in this case greens for valleys to higher elevation colors with white for snow capped peaks.

DEMO: Notice that our snow capped peaks are really gray, so click on the last ramp and then select properties and change the second color of the ramp to be white. Now when we display the ramped colors, the mountain peaks should appear to be snowy.

But they're not – YET – we need to fix this.



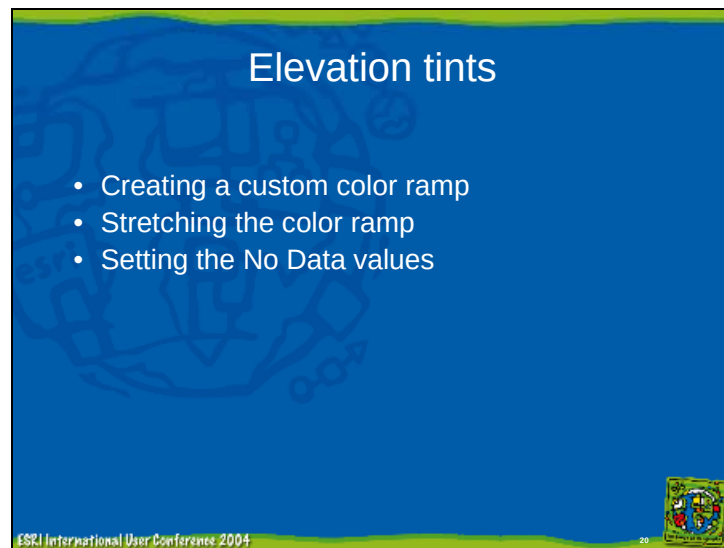
To do that, we'll edit the range of elevation values assigned to those colors by simply altering the high and low values – in effect stretching the elevations values to fit the color ramp.

DEMO: Under the Stretch Type, make sure to select the Minimum/Maximum option selected. Notice how we now have the ability to change the high and low values.

In this case, the elevation values for the entire DEM range from -16 (probably in the Netherlands!) to 4570 – but the high values are found outside our current area of display. So instead we want the color ramp to stretch from 0 to some lower elevation value.

DEMO: Here we can see the effects of setting the high value to 3000... we're getting a little more white on our peaks, now let's change it to 2000... that looks better, but let's try 1500. This is the value we want to keep as it highlights the higher elevations that fall within our area of interest.

We finally have our snow capped peaks! Now we want to clean up our muddy valleys.



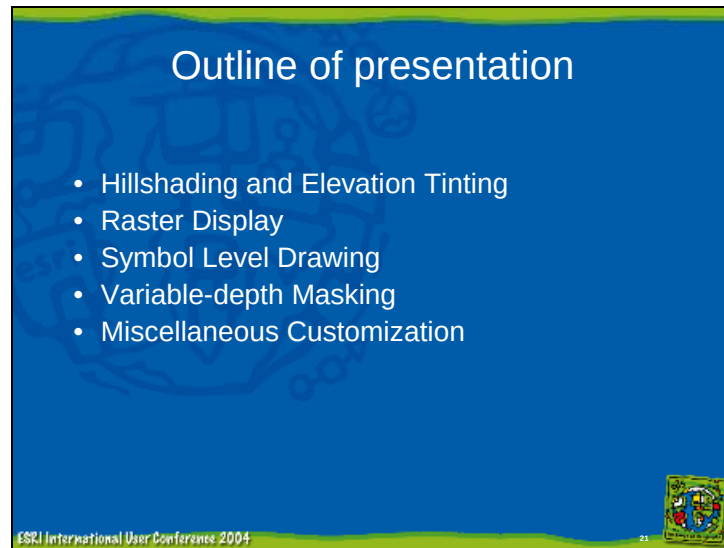
Before we do that, let's zoom in on the south of France around the area of Marseille to see a bit more detail. To fix the muddy valley look, we can manipulate the hillshade using the Layer Properties and under the Symbology Tab, we'll revisit the settings for the color ramp. Let's change it from the standard black to white colors to a green ramp.

Notice that it being displayed opposite of what we want – to get the higher values to be displayed with the lighter hues and the lower values displayed with the darker hues, simply click the Invert option in the small box in the lower right. Then click OK.

This new color ramp will compensate for the murky appearance created using the gray tones.

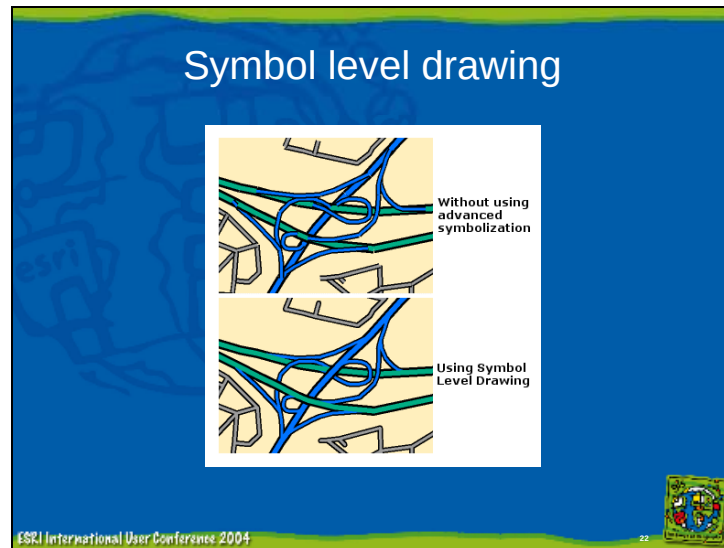
Finally, if we zoom in a little further to the Rhone Delta, we can see that the No Data pixels in our hillshade contrast with the surrounding pixels. We'll set the color used to display No Data pixels to Turquoise Dust to hide this problem.

Now let's take a look at the map at the full extent. We've got a beautiful map of western Europe with snowy mountains and green verdant valley – just the effect we were trying to achieve.



We're now about half way through the topics in our presentation and we're going to switch from displaying rasters such as hillshades and elevation tints to showing you some additional tricks and some new capabilities in ArcMap 9.0.

We'll use a map of Southern California to show you the next topic – Symbol Level Drawing.



Symbol level drawing gives you control over the drawing order of feature symbology. With symbol level drawing, you can set three different drawing parameters – how to join features with the same symbol, how to merge features with different symbols and how to order the symbols or parts of the symbols.

We'll use symbol level drawing to symbolize overlapping and intersecting line features with cased line symbols, blending the symbology for connectivity of roads and layering the symbology to clearly show overpasses and underpasses.

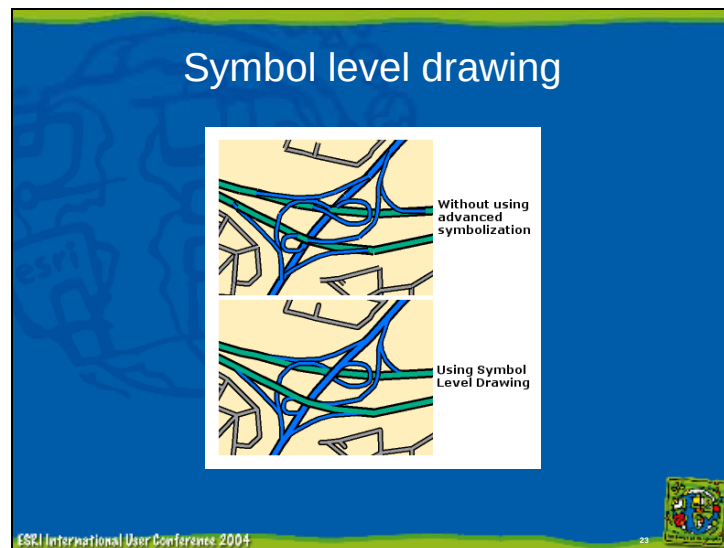
DEMO: To see some of the problems we can fix with Symbol Level Drawing, we'll first zoom to a ramp and highway interchange. If we use the Selection Tool, we can see that the ramps, which are a narrow orange line with black casing, should be connected to the highways, which are a wider orange line with a casing with centerline. Now if we zoom out a little, we can see that the segment of the ramp that connects to the secondary road, the gray line, is a separate feature. The secondary road is one feature that should actually go over and under the wrong features. The highways in each direction are each a single feature. Let's move over to see the white cased roads. These are a bunch of segments that should appear joined.

Let's see how Symbol Level Drawing can help us display these features more clearly.

DEMO: Right-click the layer you want to draw using Symbol Levels and click Properties. Click the Symbology tab. Click on the Advanced button near the lower right corner of the dialog box. Let's move the dialog box out of the way so we can see the changes we apply.

The first thing we want to do is to achieve a blending effect for all features drawn with the SAME symbol. This is done with Join.

DEMO: Let's turn on Join for the white cased roads and click OK then Apply. Notice how our roads are now symbolized. We want this effect for all our roads, so let's go back in and turn Join on for all the symbols.



The next thing we want to do is to fix how the ramp symbols intersect with the highway symbols.

To achieve a blending effect for features drawn with DIFFERENT symbols, we'll use Merge. The important thing to remember about Merge is that when you check the Merge box next to a symbol it is blended with the symbol directly above it in the symbol list. Since we want to merge ramps into the highways, let's move the highways up above the ramps and click the Merge box. When we click OK and Apply, we can see that the ramp symbols are now merged into the highway symbols.

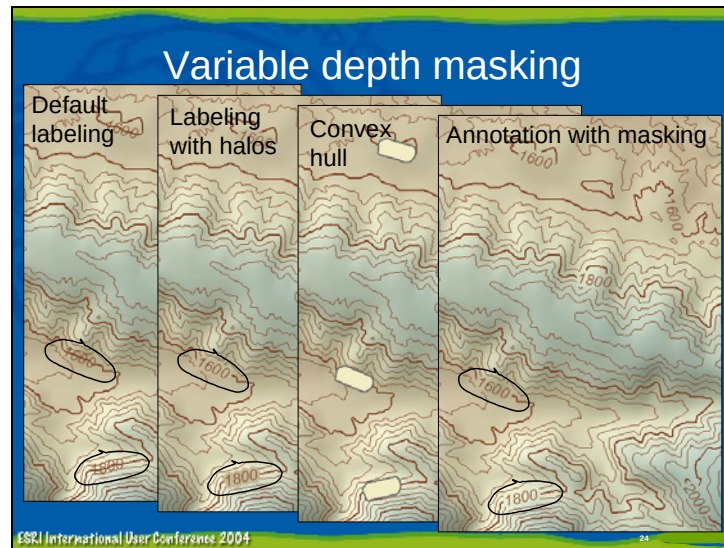
The last thing we need to do is change the drawing order of the features. This will ensure that the overpasses and underpasses are drawn correctly. David is now reordering the symbols so that the features will draw correctly on our map.

As a result, we could be able to see that our overpasses and underpasses are symbolized the way we want them to be.

You can also work with Symbol Levels in an advanced view. If you're working in Default view, you can click "Switch to Advanced View". Advanced view contains a matrix of symbols and their layers. You would use this view if you wanted to set the drawing order of each part of multilayer symbols. For example, our highway symbol is really a 3-layer symbol – the top or

first layer is the median line, the second layer is the orange fill and the third layer, which is just slightly larger than the red layer, creates the black casing effect. If you wanted to arrange the drawing order of each part of a symbol, you could do it here – specifying higher numbers for the layers you want to be displayed last. We don't need this for our map, so let's move on to the next topic...

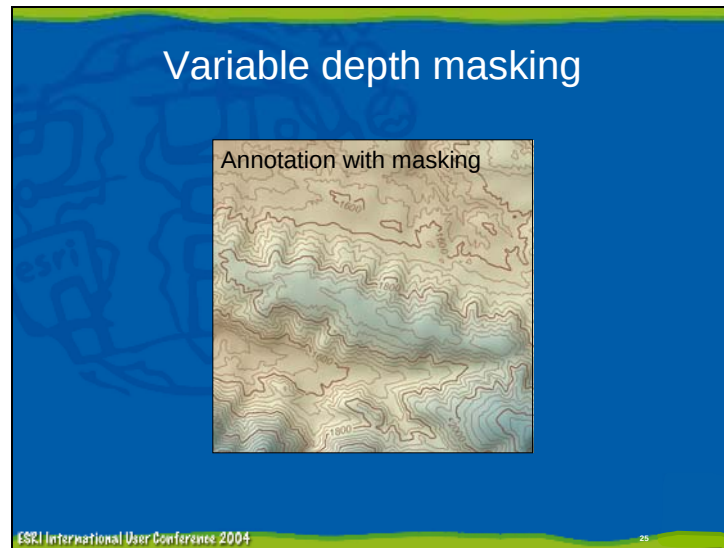
...Variable Depth Masking!



Variable-depth masking is a drawing technique for hiding parts of one or more layers. One common use for masking is to clarify the legibility of a map that is packed with text and features. To take care of this problem, you can create a polygon mask layer based on an annotation layer, and then mask out some feature symbology to make the map more readable. For example, we'll show you how to create masks for contour line annotation so that the lines are labeled more clearly.

In the contour map example shown here, the contour line labels and the contour lines run together. One approach to making the labels more legible might be to use text halos. But when we turn on the hillshade and the elevation tint, we can see that the colors vary across our map, so no one color will work for all the halos. Instead we need Variable Depth Masking.

With variable-depth masking, only some layers are hidden by the masks. So, for example, when using a mask for the text annotation, those sections of contour lines are hidden but elevation shading appearing behind those layers is still visible.

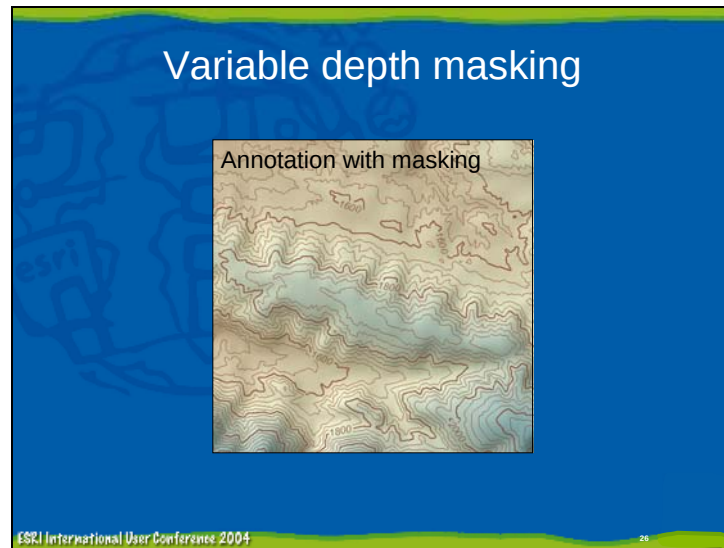


The first thing you need to do is create annotation from the labels. You can right click on the layer with the labels and select Convert Labels to Annotation. Variable Depth Masking requires geodatabase annotation so be sure to select the option to store the annotation in a database. We already did this so we'll move on to the next step.

DEMO: In ArcInfo 9.0, in ArcToolbox, there is a new Cartography Toolbox that contains the masking tools. To create masks for the annotation, we'll use the tool that creates mask polygons at a specified distance and shape around the features in the input layer. This is the Feature Outline Masks Tool.

Let's use to to create some masks for our demo. Click the Input Layer dropdown arrow and select the annotation layer we just created. Then type the name and location for the Output Feature Class. If you're using an annotation layer, the reference scale will be automatically set. Type a value in the Margin parameter – we'll use 1 point – and click the Mask kind dropdown arrow to select an outline method.

We'll use Convex Hull which represents the shape of the text, but not the internal holes. This is the recommended method. Now click OK.



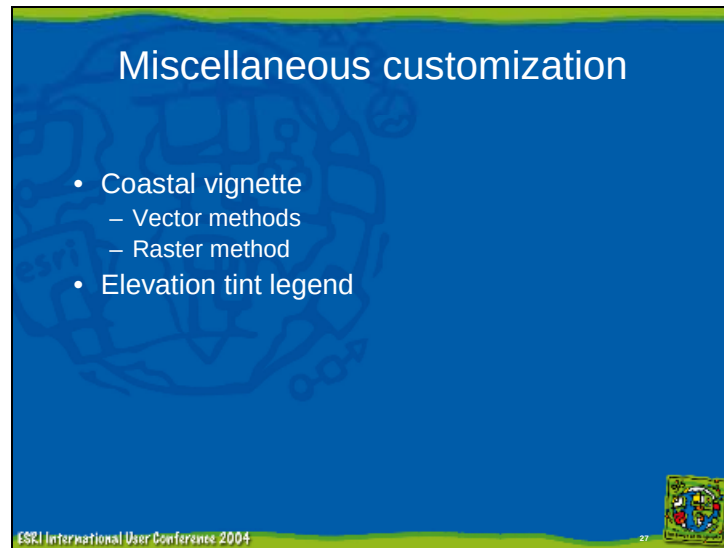
For Variable Depth Masking to work, the mask layer must be in the data frame.

DEMO: Right-click the data frame in the table of contents and click Advanced Drawing Options. Check “Draw using masking options specified below”. You would uncheck this if you wanted to turn masking off. Click the layer to use as a mask in the Masking Layers list – ours is the annotation mask layer we just created. Then check the layers you want affected by the mask – we’ll choose the Index and Intermediate Contours. Click OK.

DEMO: At this point turn off but don’t remove the mask layer.

And you can see that we’ve legible contour labels!

Now we’re going to use a map of the Western United States to show you how to add a professional quality to your maps by creating coastal vignettes.

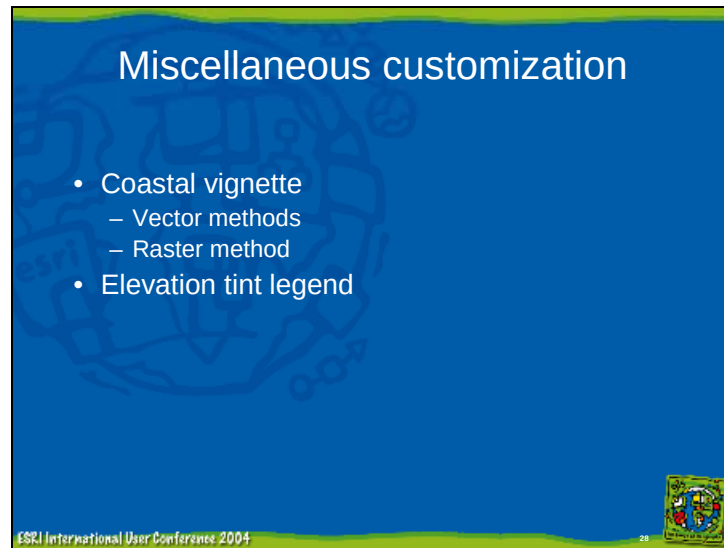


Coastal vignettes are a great way to symbolize water features to emphasize the land-water interface. We'll show you how to symbolize the water using two different methods. Because we're working in a large area, we won't actually run the tools, but we'll go through them with you!

You can create Buffers with the Arc 9.0 Geoprocessing tool. The geoprocessing tool allows you to make rings of different sizes, for example, to increase the width of the rings farther from the coast. Let's see how this works.

DEMO: In ArcToolbox under Analysis Tools there is a Proximity toolset with a Multiple Ring Buffer tool. Double click the tool and we'll take a look at the parameters. The main difference between this and the Buffer Wizard is that the Geoprocessing tool requires you to set the distance for each ring. Then you would run the tool.

What you see on the screen now are in fact 32 1 km. buffers. Now that we have the vector buffers, let's see how they are symbolized.



DEMO: In the Layer Properties dialog under the Symbology tab select Quantities and then graduated colors. Set the colors for the first class to blue and last class to white. Select the first and last classes together using the Control key, then right-click on the color and choose Ramp Colors. This applies a blue to white color ramp to the 32 vector buffers.

There are a number of advantages to using vector buffers for coastal vignettes, including the smaller file size and the fact that you don't need Spatial Analyst to create the rings.

But there are also some limitations. If you use fewer rings, you might get more obvious bands of colors. And you get less flexibility over symbolizing although it is easier to assign specific colors to any given band.

Miscellaneous customization

- Coastal vignette
 - Vector methods
 - Raster method
- Elevation tint legend

The diagram shows a 5x5 grid. The top-left cell is labeled 'Source cells' and contains a blue square. The bottom-right cell is labeled 'SOURCE LAND' and contains a blue square. A red line represents the 'True Euclidean Distance' from the source cells to the land. The distance is calculated as the square root of the sum of the squares of the horizontal and vertical distances. For example, the distance from the source cells to the land is $\sqrt{3^2 + 4^2} = 5$.

ESRI International User Conference 2004

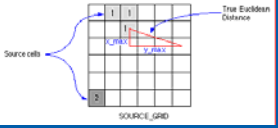
Now let's look at a way to make coastal vignettes using a raster method that involves a Euclidean Distance function. We'll create our Euclidean distance raster using another geoprocessing tool in ArcToolbox.

DEMO: To use the geoprocessing tool, from ArcToolbox Spatial Analyst Tools under Distance select Euclidean Distance. Double click the tool to start it and set the parameters. Here you would specify the input layer – this would be the land polygon –like our U.S. states. Then you specify the output raster. You can keep the rest of the defaults which are fine for making coastal vignettes. Then you would run the tool. Now we'll show you the result of this method.

DEMO: Once you have the Euclidean distance grid, you can symbolizing it using the Layer Properties dialog. Under the Symbology tab, select Stretched and select a color ramp. Then you can choose the Minimum-Maximum stretch type to edit the values to adjust the width of the vignette, as we did on our map.

Miscellaneous Customization

- Coastal vignette
 - Vector methods
 - Raster method
- Elevation tint legend



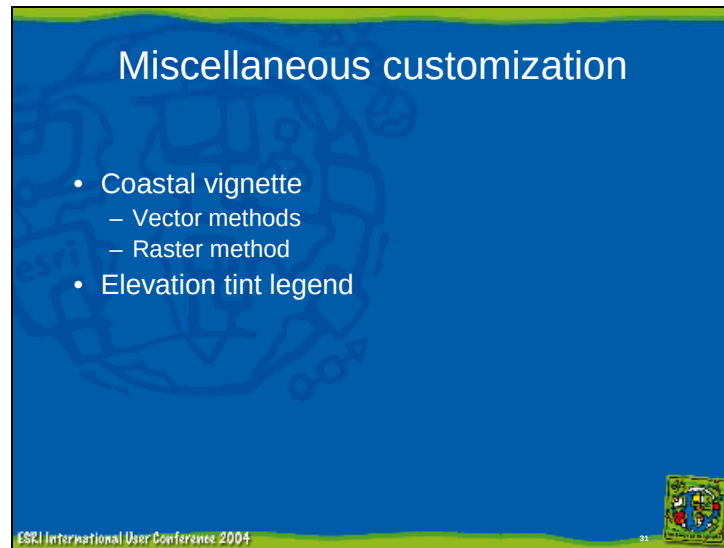
The diagram illustrates the raster method for coastal vignettes. It shows a grid with source cells (1, 2, 3) and a 'True Euclidean Distance' map. A 'SOURCE_GRID' is also shown.

ESRI International User Conference 2004

The advantages of using raster Euclidean distance for coastal vignettes include more flexibility over symbolization because you get to choose whether to use a classed renderer which would be like using the vector buffers, or you can use a stretched renderer which allows you to display more gradually varying colors.

There are a few limitations, too. For example, pixel edges will show up along the shoreline if the raster is too coarse for the map scale. Also, larger file sizes result from using raster layer – file sizes could be reduced if they are converted to a Mr. SID image or some other compressed format.

For our last demo, we'll use a map of Washington to show you how you can make an elevation tint legend.



On some maps you may want to create an Elevation Tint Legend which displays the elevation range colors on top of the black to white (or other) ramp that you used to display your hillshade.

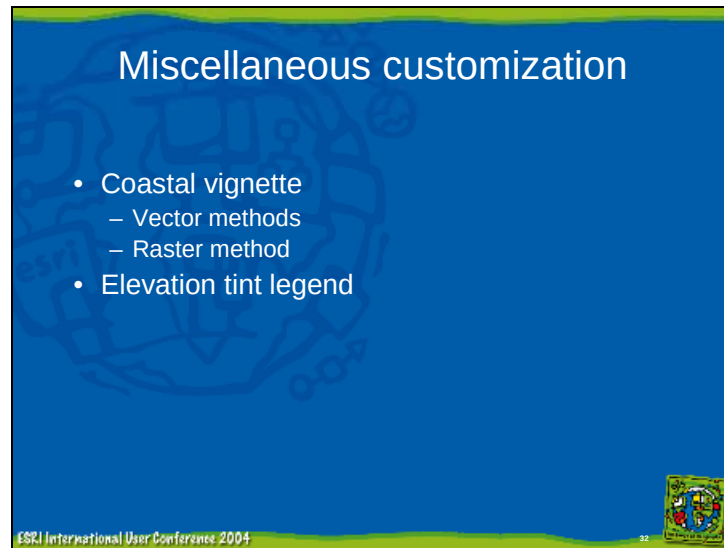
The objective is to create a legend that contains the same transparency and color ramp specifications as any of the layers used to create your hillshaded – elevation tinted surface. Say your map had a single hillshade overlaid with a single elevation tint that had a transparency. Then you would need to create a legend using two layers displayed in the same order and with the same settings as the hillshade and the elevation tint on the map.

Because of our time limitations, we'll describe how to do this, but we can't show you every step. Again, the instructions will be posted on the Base Map Data Model Web Site.

DEMO: First, you'll want to create a rectangle feature in an otherwise empty polygon dataset. The shape should be similar to how you want the final legend to look. We choose to make a long narrow horizontal rectangle.

DEMO: Next, you would add a data frame that contains two copies of this rectangle data layer. Then you would use gradient fills to symbolize the rectangles using the same color ramps as on our map. For the top rectangle, use a linear gradient fill with the elevation tint color ramp.

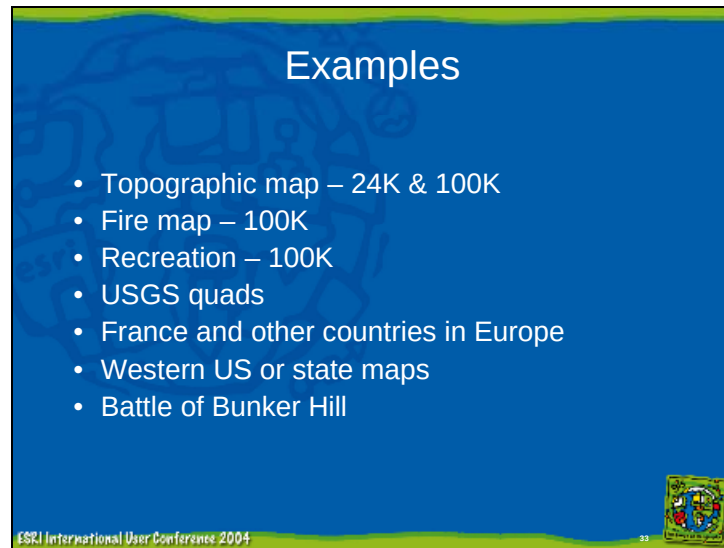
Remember to set the transparency to the value you used on your map. For the rectangle underneath, you would use the same black to white ramp used for the hillshade.



Because we're making a horizontal legend, we want the top of the legend to be lighter like the illuminated areas and the bottom of the legend to be darker like the areas in shadow. So we need to set the angle of this gradient fill to 90 degrees. One of the gradient fills should be set to a 90 degree angle. Which one you choose will depend on how you want to set up your legend.

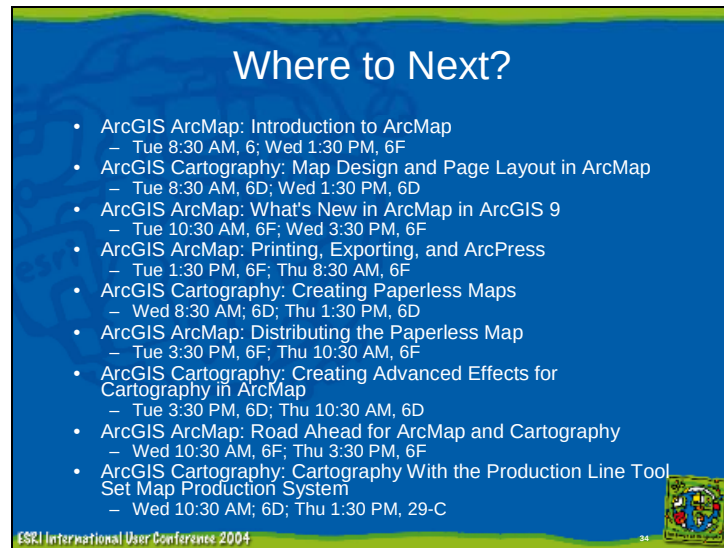
Finally, add text to the legend. Create graphic text to indicate elevation values and units at the high and low ends as well as any intermediate values desired. You can use Graphic tools to align and distribute the text.

That's it – an easy way to make a legend for your elevation tint and hillshade. And if you make a change on your map all you have to do is duplicate that in your legend, so it's very simple to update!



In our presentation, we've shown you a number of tools and tricks you can use to create high quality finished map products. During the course of the talk, we've shown you a few excerpts from some really nice looking maps -- we have copies of these on the walls.

We also have examples of other maps that also use the tools we introduced you to here. Take a look at some of the these to see more effects you can achieve using ArcMap! All of these highlight the functionality of ArcGIS to create high quality map products.



Where to Next?

- ArcGIS ArcMap: Introduction to ArcMap
 - Tue 8:30 AM, 6; Wed 1:30 PM, 6F
- ArcGIS Cartography: Map Design and Page Layout in ArcMap
 - Tue 8:30 AM, 6D; Wed 1:30 PM, 6D
- ArcGIS ArcMap: What's New in ArcMap in ArcGIS 9
 - Tue 10:30 AM, 6F; Wed 3:30 PM, 6F
- ArcGIS ArcMap: Printing, Exporting, and ArcPress
 - Tue 1:30 PM, 6F; Thu 8:30 AM, 6F
- ArcGIS Cartography: Creating Paperless Maps
 - Wed 8:30 AM, 6D; Thu 1:30 PM, 6D
- ArcGIS ArcMap: Distributing the Paperless Map
 - Tue 3:30 PM, 6F; Thu 10:30 AM, 6F
- ArcGIS Cartography: Creating Advanced Effects for Cartography in ArcMap
 - Tue 3:30 PM, 6D; Thu 10:30 AM, 6D
- ArcGIS ArcMap: Road Ahead for ArcMap and Cartography
 - Wed 10:30 AM, 6F; Thu 3:30 PM, 6F
- ArcGIS Cartography: Cartography With the Production Line Tool Set Map Production System
 - Wed 10:30 AM, 6D; Thu 1:30 PM, 29-C

ESRI International User Conference 2004

In conclusion, we encourage you to visit other ArcMap sessions to learn more about mapping capabilities in the software, and we want to point you in particular to some of the sessions that show you ways to create paper copies of these maps using the new graphics engine functionality in 9.0.

And you might also want to visit sessions related to making and distributing paperless versions of these maps for the Web. After all, once you have a great looking map, you want to people to see it!



Hopefully, you will have learned some new tricks to help you create better looking maps more efficiently. If you have any questions about anything we talked about here, we'll be happy to answer them.

And before you go, please take a minute to complete a survey form – we do use them to plan next year's sessions to better fit your needs.

Slide 37



And don't forget that you will be able to find everything we talked about here at the Base Map Data Model Web Page! Here's that web page one more time in case you want to jot down the URL!

Thanks!