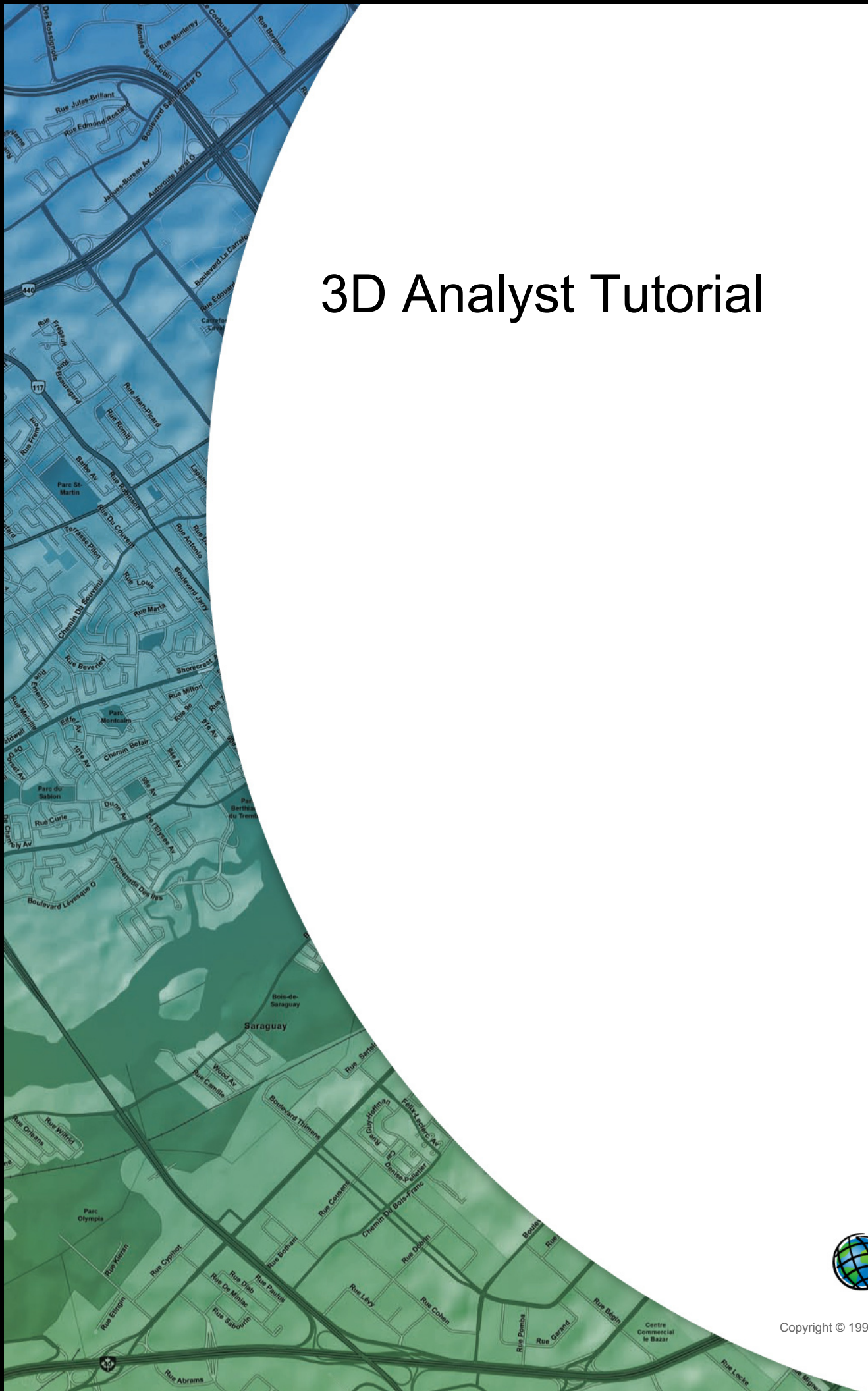


3D Analyst Tutorial

esri

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Introduction to the ArcGIS 3D Analyst tutorial

IN THIS TUTORIAL

- **Copying the tutorial data**
- **Exercise 1: Draping an image over a terrain surface**
- **Exercise 2: Visualizing contamination in an aquifer**
- **Exercise 3: Visualizing soil contamination and thyroid cancer rates**
- **Exercise 4: Building a TIN to represent terrain**
- **Exercise 5: Working with animations**
- **Exercise 6: ArcGlobe basics**
- **Exercise 7: ArcGlobe layer classification**
- **Exercise 8: Creating and using a terrain dataset**
- **Exercise 9: Creating a realistic 3D view**

The best way to learn ESRI ArcGIS 3D Analyst is to use it. In the exercises in this tutorial, you will do the following:

- Use ArcCatalog to find and preview 3D data.
- Add data to ArcScene.
- Set 3D properties for viewing data.
- Create new 3D feature data from 2D features and surfaces.
- Create new raster surface data from point data.
- Build a TIN surface from existing feature data.
- Make animations.
- Learn how to use ArcGlobe and manage its data content.

To use this tutorial, you need to have the 3D Analyst extension and ArcGIS installed and have the tutorial data installed on a local or shared network drive on your system. Ask your system administrator for the correct path to the tutorial data if you do not find it at the default installation path specified in the tutorial.

DATA CREDITS

Exercise 1: Death Valley image data courtesy of National Aeronautics and Space Administration (NASA)/Jet Propulsion Laboratory (JPL)/Caltech.

Exercise 2: San Gabriel Basin data courtesy of the San Gabriel Basin Water Quality Authority.

Exercise 3: Belarus CS137 soil contamination and thyroid cancer data courtesy of the International Sakharov Environmental University.

Exercise 4: Hidden River Cave data courtesy of the American Cave Conservation Association.

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Exercise 5: Elevation and image data courtesy of MassGIS, Commonwealth of Massachusetts Executive Office of Environmental Affairs.

Exercise 6: Las Vegas Millennium Mosaic (Year 2000 Landsat) and QuickBird images data courtesy of DigitalGlobe.

Exercise 7: Ozone concentration raster derived from data courtesy of the California Air Resources Board, Southern California Millennium Mosaic (Year 2000 Landsat) image courtesy of DigitalGlobe, Angelus Oaks imagery courtesy of AirPhoto USA, Southwestern U.S. elevation data derived from U.S. National Elevation Data courtesy of the U.S. Geological Survey.

Exercise 8: Spot elevation points and breaklines are of the Napa River Watershed area. GIS data courtesy of the County of Napa.

Exercise 9: Quickbird imagery of London courtesy of DigitalGlobe. Multipatch buildings Copyright © 2008 Google. All rights reserved.

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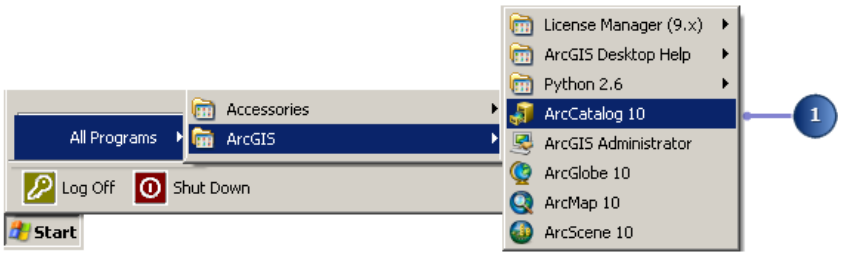
Copying the tutorial data

First, you will copy the tutorial data to a local drive. You will use ArcCatalog to browse to and copy the data.

Copying the tutorial data

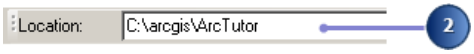
Steps:

1. Start ArcCatalog by clicking **Start** > **All Programs** > **ArcGIS** > **ArcCatalog 10.**



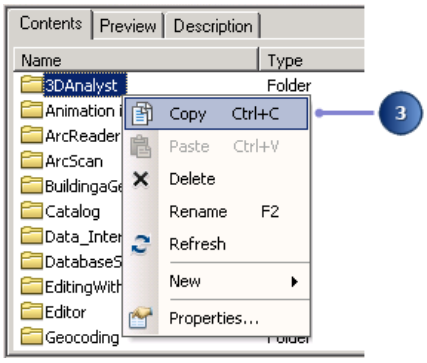
ArcCatalog lets you find and manage your data. The left side of the ArcCatalog window is called the Catalog Tree; it gives you a bird's-eye view of how your data is organized and provides a hierarchical view of the geographic data in your folders. The right side of ArcCatalog displays the contents of the selected branch of the Catalog tree.

2. Click in the **Location** combo box and type the path `C:\arcgis\ArcTutor`, which is where the tutorial data is installed and press ENTER.



The ArcTutor folder is now the selected branch of the Catalog Tree. You can see its contents in the **Contents** tab.

3. Right-click the 3DAnalyst folder and click **Copy**.

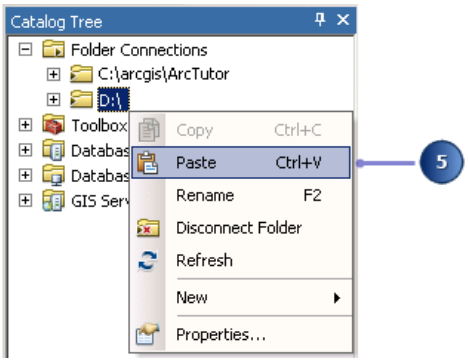


4. Click the **Connect to Folder** button, and choose the local drive where you want to place a copy of the tutorial data to work from, then click **OK**.



5. Right-click the local drive you just made in your Folder Connections list and click **Paste**.

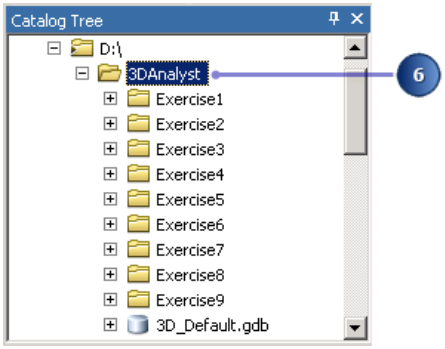
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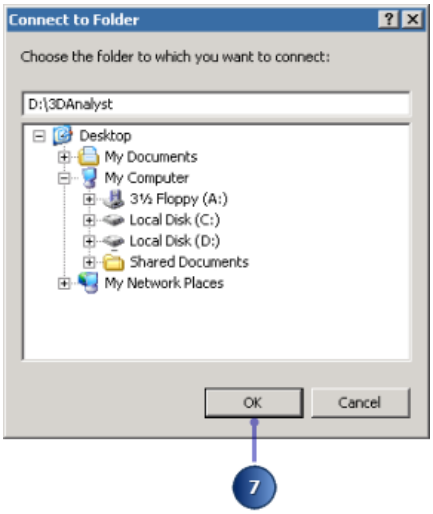
The tutorial data folder is copied to your local drive. Now you'll make a folder connection to the 3DAnalyst folder in the Catalog Tree. A folder connection acts like a bookmark or mapped drive to a path you frequently use.

6. Double-click the 3DAnalyst folder on your local drive and copy the path from the **Location** combo box.

   There should be nine exercise folders and one file geodatabase in your local drive.

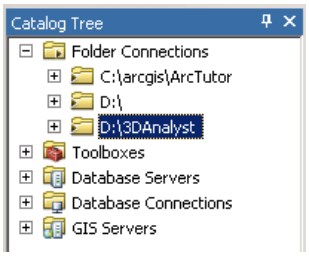


7. Click the **Connect to Folder** button and paste the path, then click **OK**.

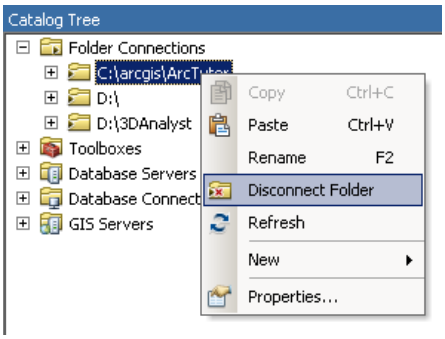


There is now a folder connection in the Catalog Tree for your local copy of the tutorial data.

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You can also disconnect the folder you do not need here. For example, right-click the folder C:\arcgis\ArcTutor and click **Disconnect Folder** .



Now the folder is no longer available in the Catalog tree.

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Exercise 1: Draping an image over a terrain surface

Complexity:
Beginner

Data Requirement:
Installed with software

Data Path:
See Copying the tutorial data

Goal:
Familiarize with the navigation tools to preview data, and setting layer properties to drape imagery.

Viewing a remotely sensed image draped over a terrain surface can often lead to greater understanding of the patterns in the image and how they relate to the shape of the earth's surface.

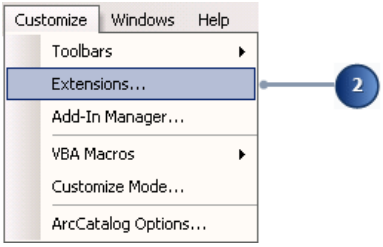
Imagine that you're a geologist studying Death Valley, California. You have collected a TIN that shows the terrain and a satellite radar image that shows the roughness of the land surface. The image is highly informative, but you can add a dimension to your understanding by draping the image over the terrain surface. Death Valley image data was supplied courtesy of NASA/ JPL/Caltech.

Turning on the 3D Analyst extension

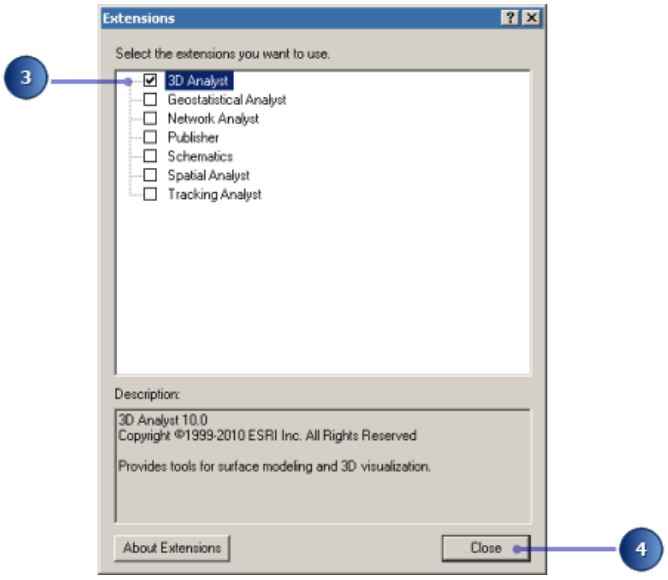
First, you'll need to enable the 3D Analyst extension.

Steps:

1. Start ArcCatalog by clicking **Start** > **All Programs** > **ArcGIS** > **ArcCatalog 10.**
2. Click **Customize** and click **Extensions**.



3. Check **3D Analyst**.
4. Click **Close**.



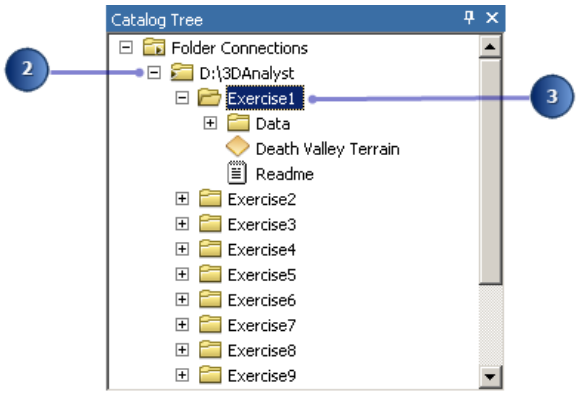
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Previewing 3D data in ArcCatalog

Before you drape the image, you'll browse to the terrain data and preview it in ArcCatalog.

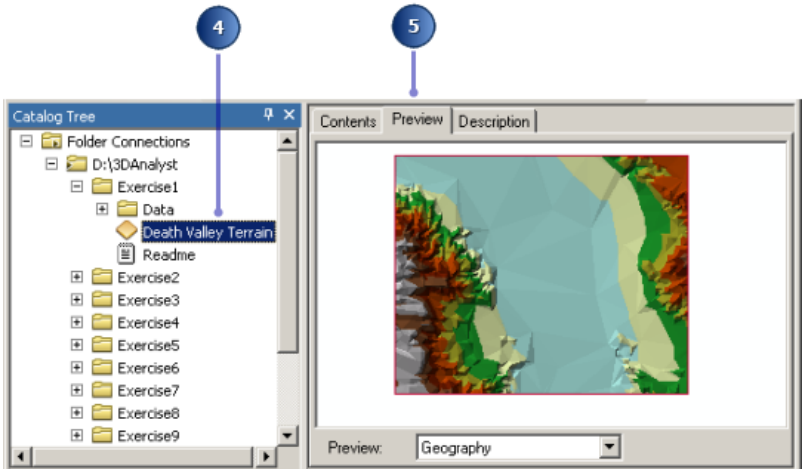
Steps:

1. Navigate to the **3DAnalyst** folder connection in the ***Catalog Tree***.
2. Double-click **3DAnalyst**.
3. Double-click **Exercise1**.

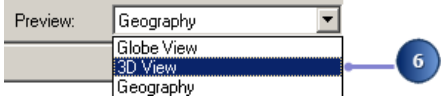


You see a folder called Data and a TIN layer called Death Valley Terrain.
A layer is a shortcut to geographic data. It also stores information about how the geographic data should be drawn on a map or in a 3D view.

4. Click Death Valley Terrain.

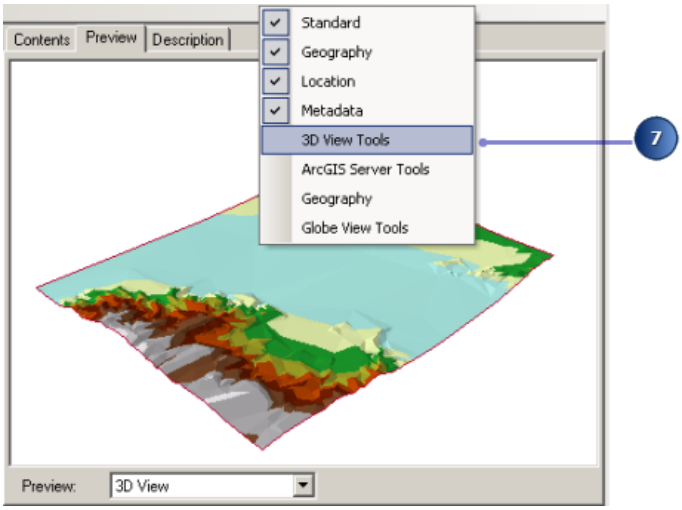


5. Click the **Preview** tab. You can preview your GIS data in ArcCatalog. With 3D Analyst installed, you can also preview some data in three dimensions.
6. Click the **Preview** drop-down arrow and click **3D View**.

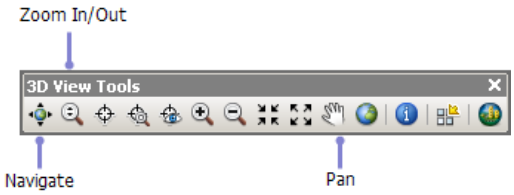


7. Right-click above the preview window and click **3D View Tools**.

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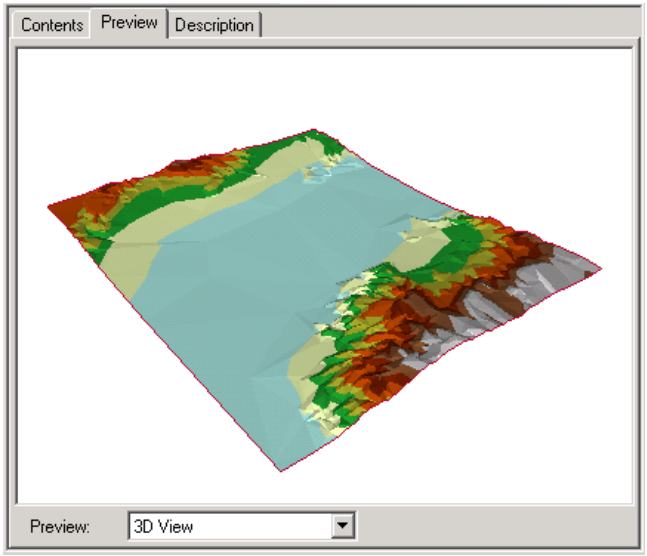
The preview becomes a 3D preview, and a new set of tools appears on the ***3D View Tools*** toolbar.



The **Navigate** tool is active when you first preview data in 3D. You can see the names of tools by hovering the pointer over the tool.

The **Navigate** tool allows you to rotate 3D data and change the apparent viewer height by clicking and dragging left and right and up and down, respectively, in 3D preview.

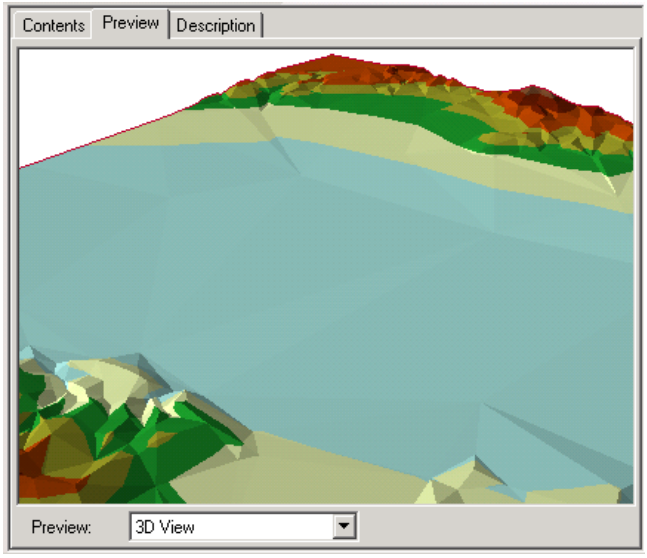
8. Click inside the 3D preview and drag to the right.



The data rotates around its center. The **Navigate** tool also allows you to zoom in and out and pan across the data, depending on the mouse button that you click while dragging in the 3D preview.

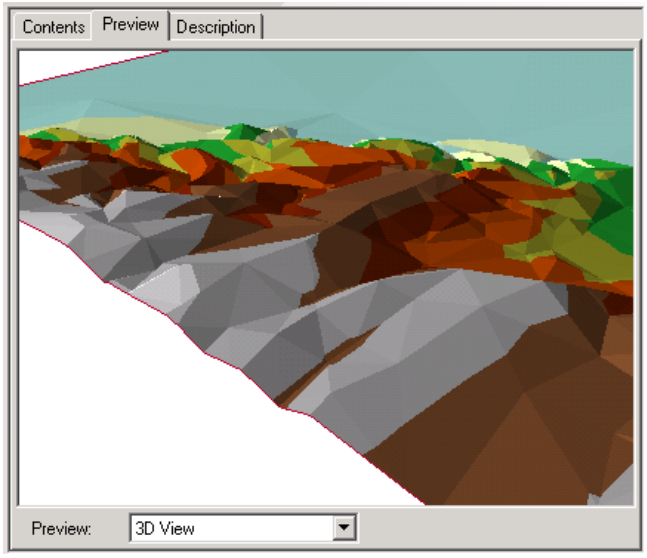
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9. Right-click the 3D preview and drag down.



The pointer changes to the **Zoom In/Out** pointer, and the view zooms in to the data.

10. Click the middle button—or both the right and left buttons if you have a two-button mouse—and drag to the right.



The pointer changes to the **Pan** pointer, and the view pans across the data.

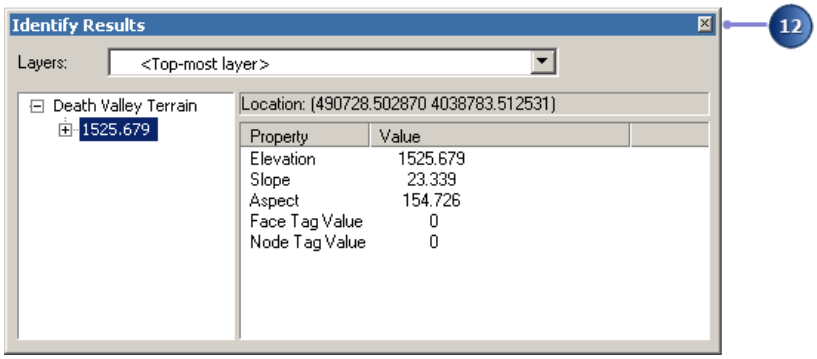
11. Click the Identify button and click on the TIN.



The ***Identify Results*** window that appears shows you the elevation, slope, and aspect of the surface at the point you clicked.

12. Close the ***Identify Results*** window by clicking the top right x.

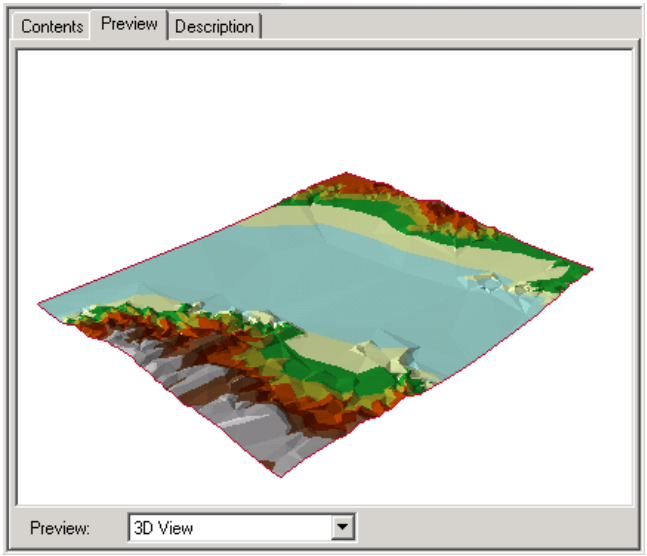
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13. Click the **Full Extent** button.



The view returns to the full extent of the data.



Now you've examined the surface data and begun to learn how to navigate in 3D. The next step is to start ArcScene and add your radar image to a new scene.

Starting ArcScene and adding data

ArcScene is one of two 3D visualization environments for 3D Analyst (ArcGlobe is introduced in Exercises 5 and 6). Although you can preview 3D data in ArcCatalog, ArcScene allows you to build up complex scenes with multiple sources of data.

Steps:

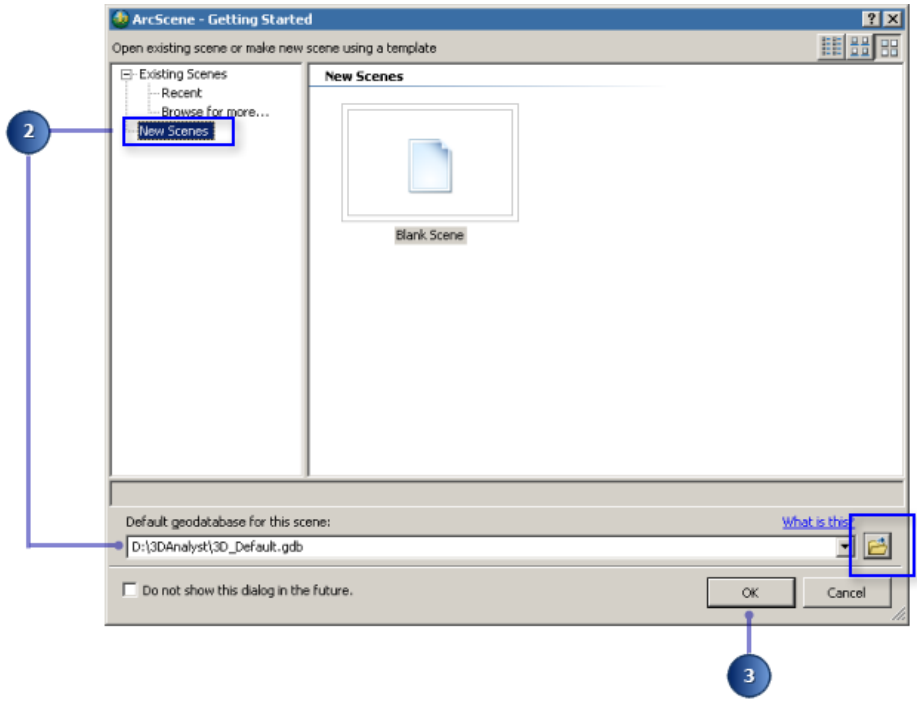
1. From ArcCatalog, click the **ArcScene** button on the ***3D View Tools*** toolbar to launch the application.



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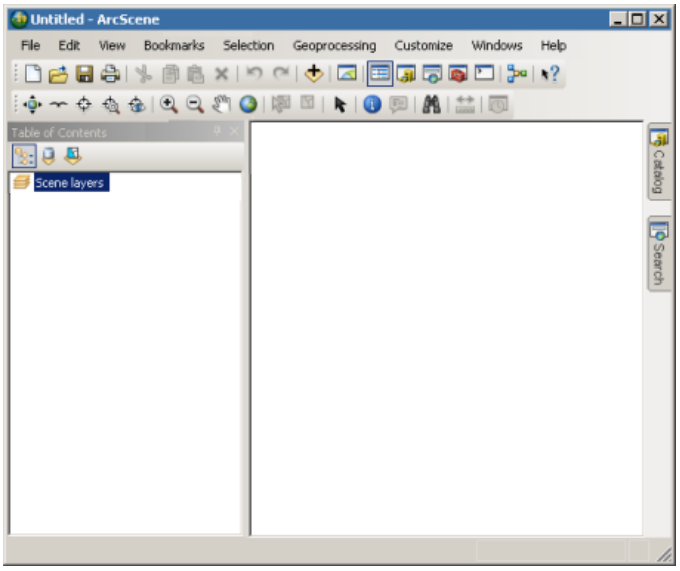
2. In the ***ArcScene - Getting Started*** dialog box, click **New Scenes** and click the **Browse** button to set the default geodatabase path to D:\3DAnalyst\3D_Default.gdb.

   This location will be used for output spatial data generated in the tutorial exercises.



3. Click **OK** to close the ***Getting Started*** dialog box.

   Note that many of the tools on the ArcScene ***Standard*** toolbar are the same as the 3D navigation tools that you see in ArcCatalog.

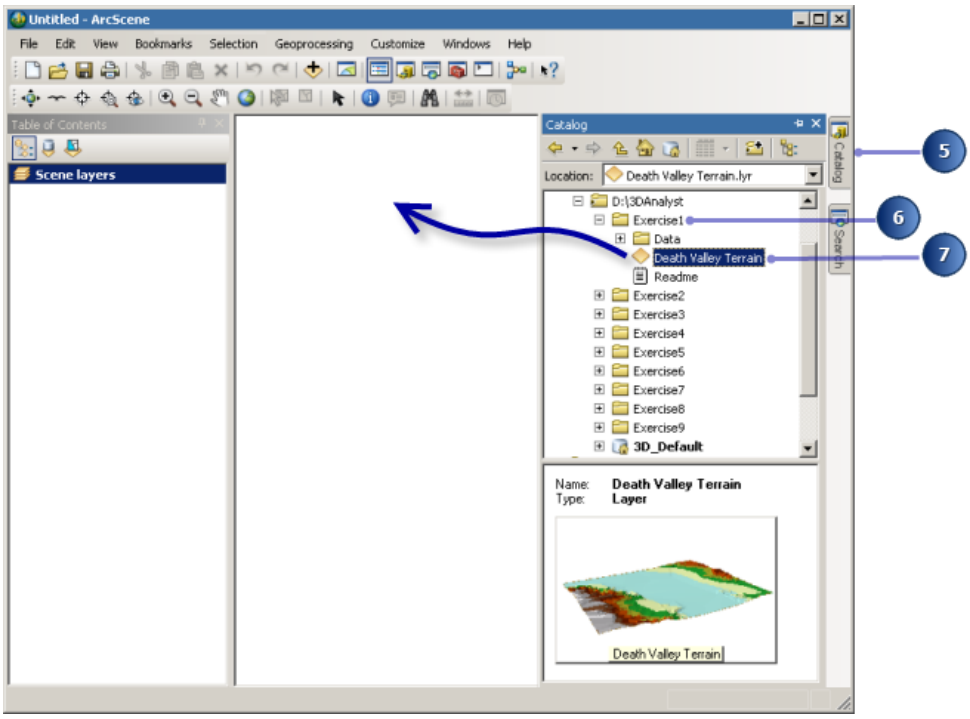


4. Close ArcCatalog.
5. On the right side of the ArcScene window, move your pointer over the ***Catalog*** tab or click the ***Catalog*** tab

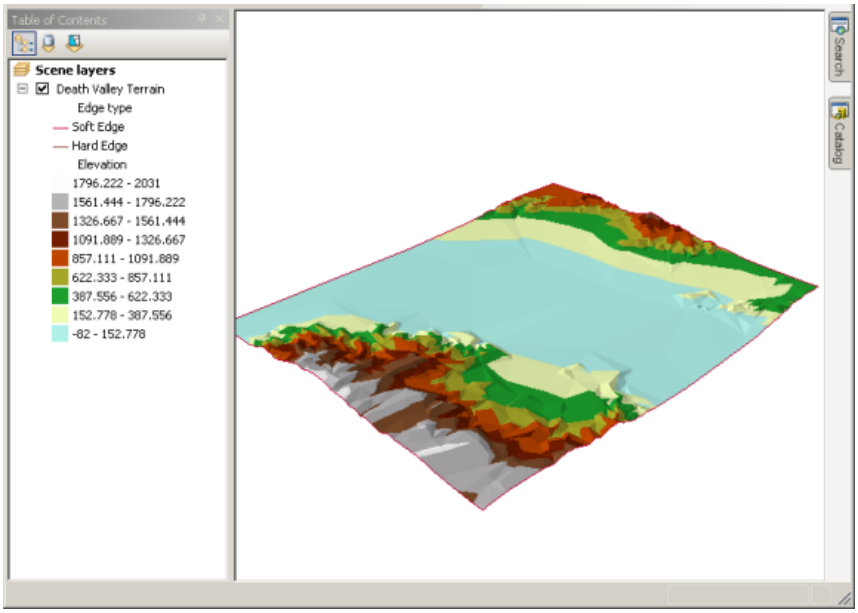
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The ***Catalog*** window slides into the view, ready for use.

6. Navigate to the **Exercise1** folder in the **Folder Connections** path where you locally saved the tutorial data.
7. Click the Death Valley Terrain layer and drag it into the 3D view area of ArcScene, then release the mouse button.



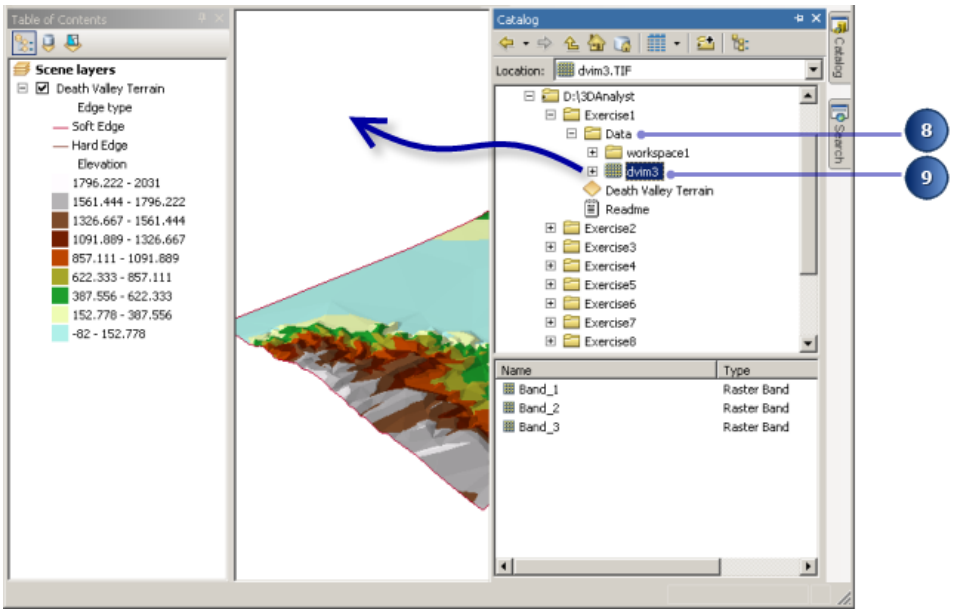
The TIN is drawn in the new scene, and the TIN layer is automatically added into the ***table of contents***.



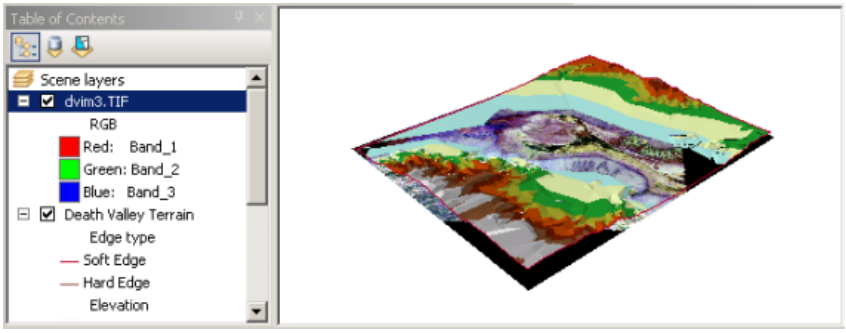
8. Navigate to the **Data** folder inside **Exercise1** from the **Catalog** window.

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9. Click the dvim3.TIF layer and drag it into the 3D view of ArcScene, then release the mouse button.

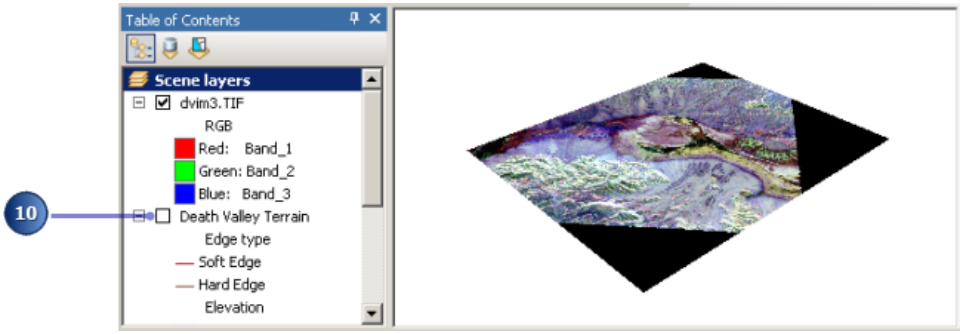


The image is added to the scene.



The image is drawn on a plane, with a base elevation value of zero. You can see it above the Death Valley terrain surface where the terrain is below 0 meters elevation (sea level); it is hidden by the terrain surface everywhere else.

10. Uncheck the Death Valley Terrain layer.



Now you can see the whole image. The black areas are parts of the image that contain no data and are a result of previous processing to fit the image to the terrain.

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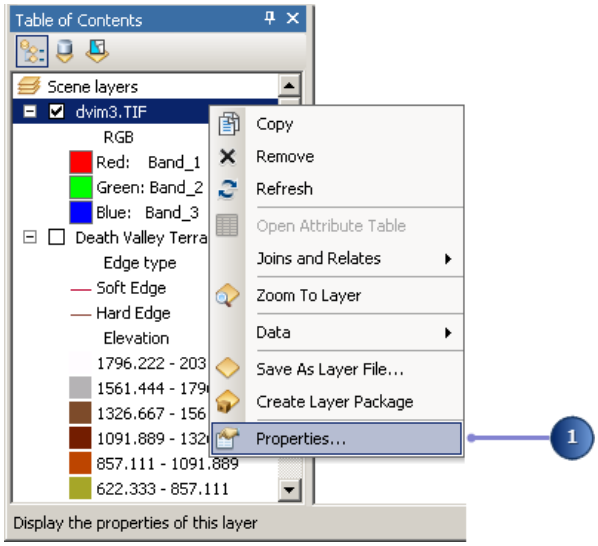
You have added the image to the scene. Now you will change the properties of the image layer so that the image will be draped over the terrain surface.

Draping the image

While the surface texture information shown in the image is a great source of information about the terrain, some relationships between the surface texture and the shape of the terrain will be apparent when you drape the image over the terrain surface. In ArcScene, you can drape a layer— containing a grid, image, or 2D features—over a surface (a grid or TIN) by assigning the base heights of the layer from the surface.

Steps:

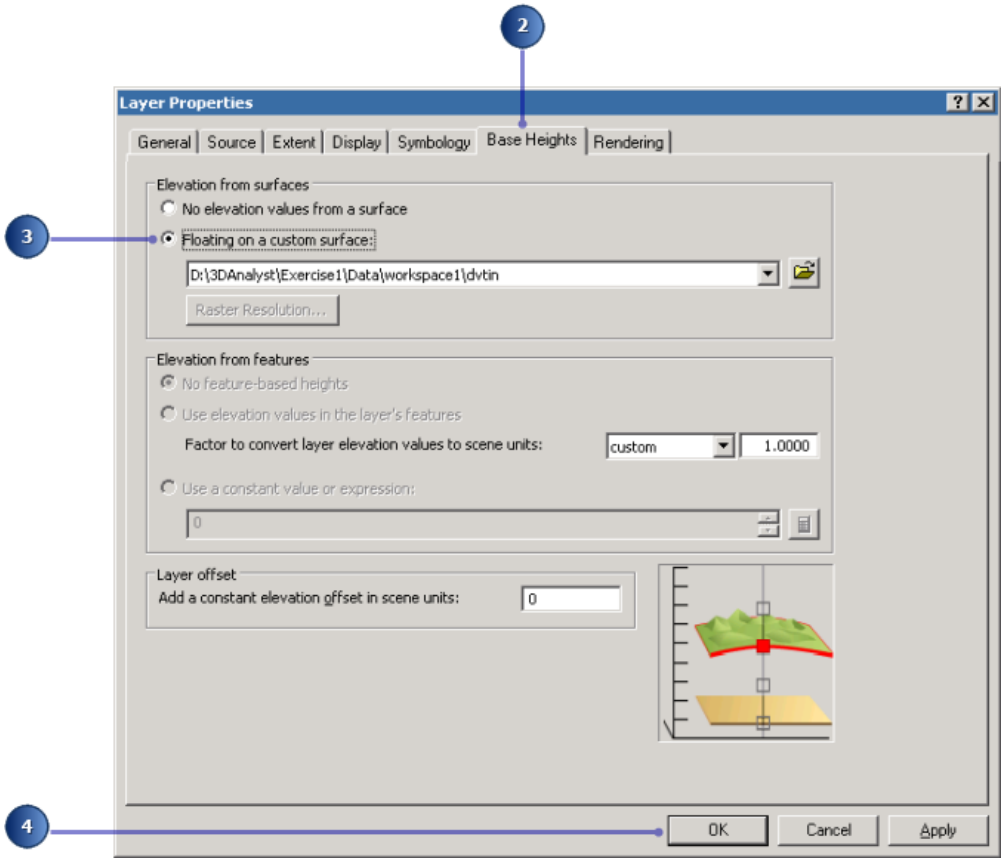
1. Right-click **dvim3.TIF** in the ArcScene table of contents and click **Properties.**



   The ***Layer Properties*** dialog box appears. You can change how a layer is drawn on a map or in a scene by setting its properties.

2. Click the ***Base Heights*** tab.

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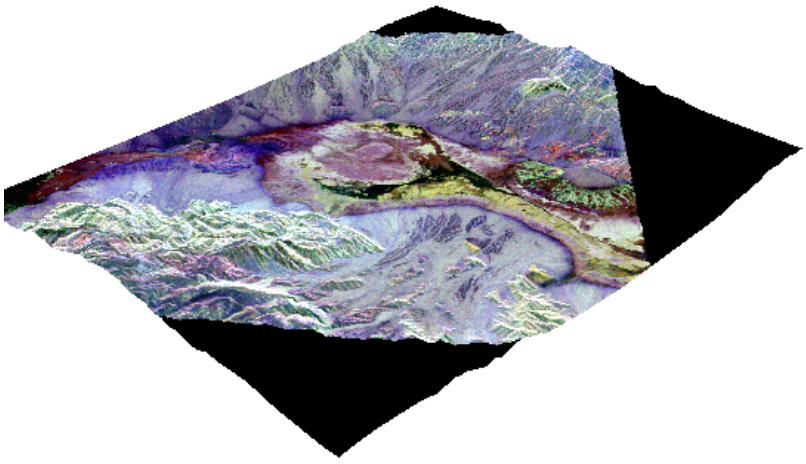


3. Click the option **Floating on a custom surface**.

   Because the TIN is the only surface model in the scene, it appears in the surface drop-down list.

4. Click **OK**.

   The image is draped over the terrain surface.



Now you will be able to navigate around the image and see the relationship between surface texture, as shown by the image colors, and the shape of the terrain.

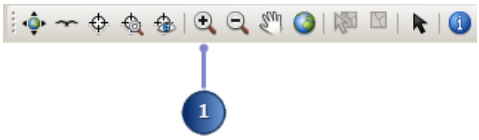
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Exploring the image

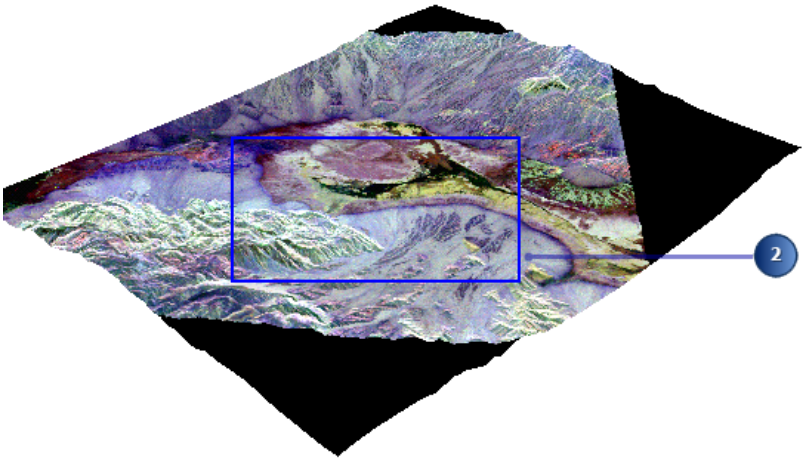
You will use the navigation tools on the ArcScene ***Tools*** toolbar to explore the draped image.

Steps:

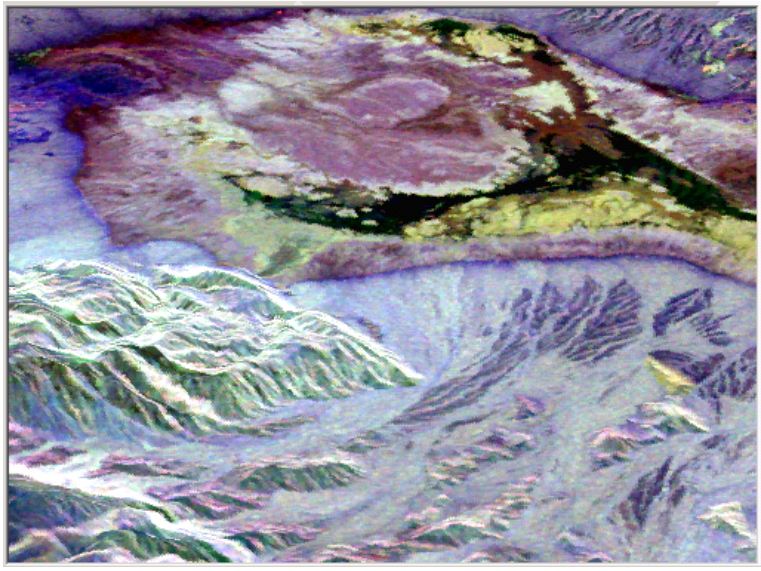
1. Click the **Zoom in** button.



2. Click and drag a rectangle around the middle of the image.



The scene zooms to the middle part of the image.

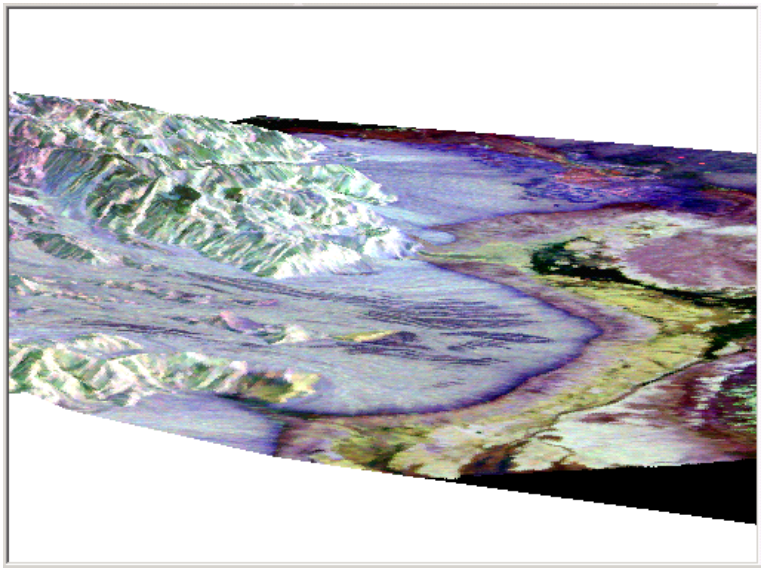


3. Click the **Navigate** button.

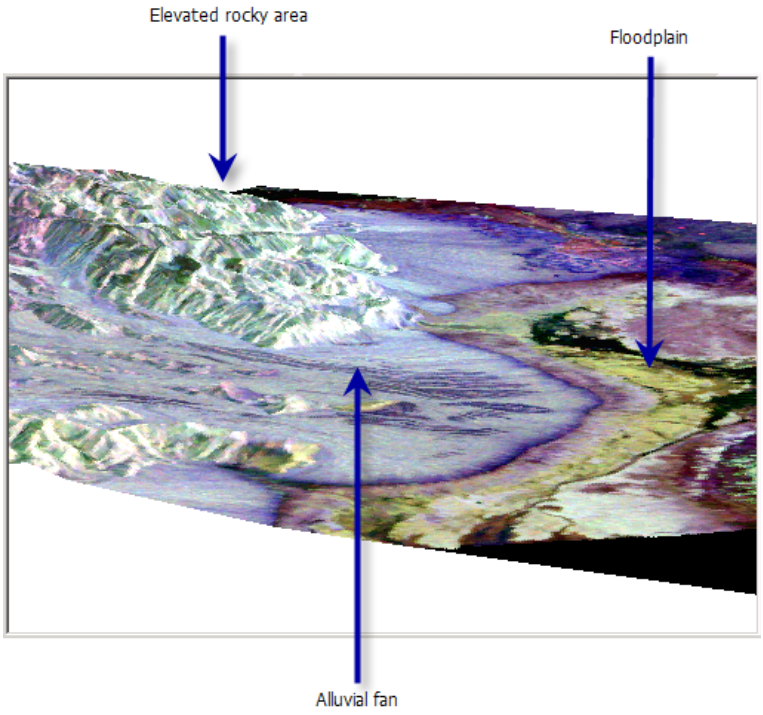
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4. Click and hold the scene with the mouse pointer and slowly drag up and to the left.



The scene rotates, and the view angle lowers, so it looks as though you are looking down the valley, past the higher land on the left side of the scene.



Draping the radar image over the terrain surface allows you to see the relationship between the general shape of the land surface and the texture of the rocks and sediment that make up the surface.

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Exaggerating the terrain

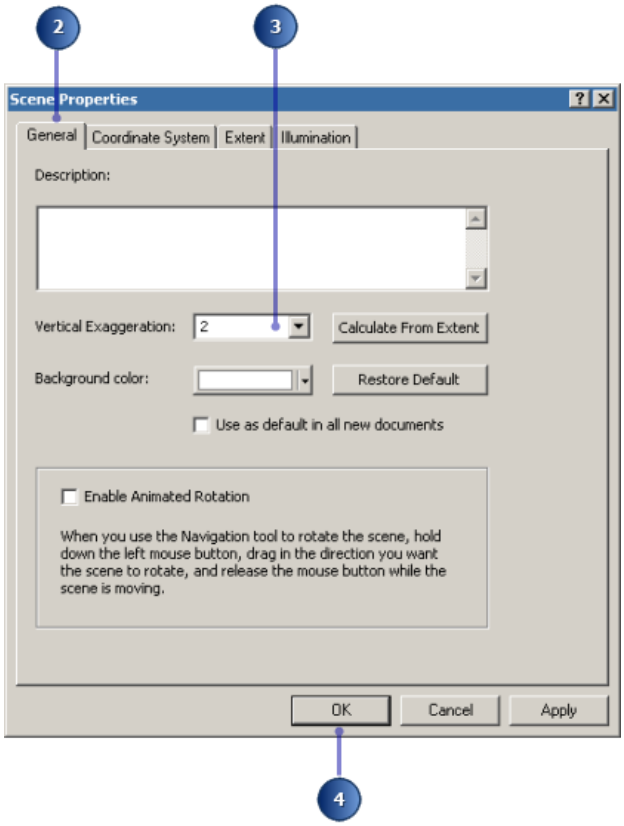
The valley is a broad area, relative to the height of the terrain, even though the mountains at the edge of the scene are more than 2,000 meters above the valley floor. In order to enhance the sense of depth in the scene, and to bring out subtle features in the terrain, you will exaggerate the height of the terrain.

Steps:

1. Right-click **Scene layers** in the table of contents and click **Scene Properties**.

   The ***Scene Properties*** dialog box lets you set properties that are shared by all the layers in the scene. These include the vertical exaggeration, the background color, the coordinate system and extent of the data, and the way that the scene is illuminated (the position of the light source relative to the surface).

2. Click the **General** tab.
3. Type 2 in the **Vertical Exaggeration** combo box.

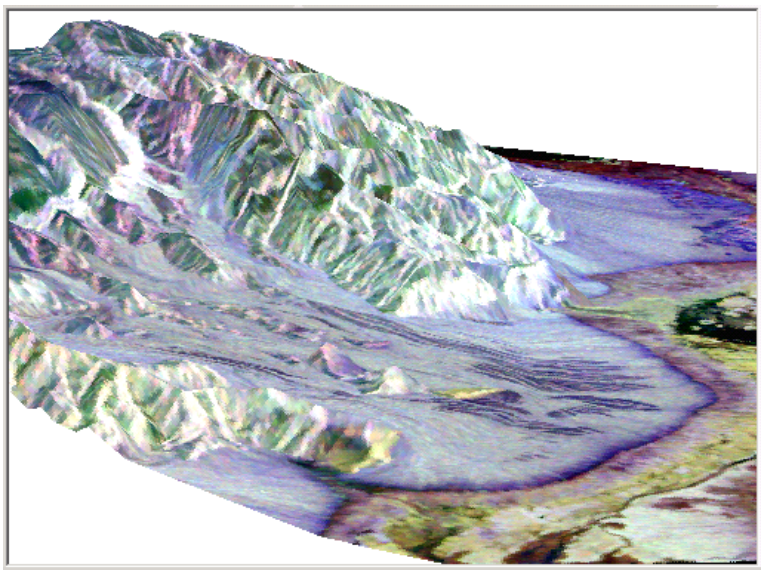


4. Click **OK**.

   The apparent height of the terrain is now doubled.

   You can now clearly see how the alluvial fan spreads out onto the valley floor, between the larger rocky area at the center of the scene and the smaller rocky area in the foreground at the left side of the scene.

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You have added depth to the radar image, explored the general relationship between the data in the image and the terrain data, and enhanced the scene so that you can perceive more subtle variations in the terrain.

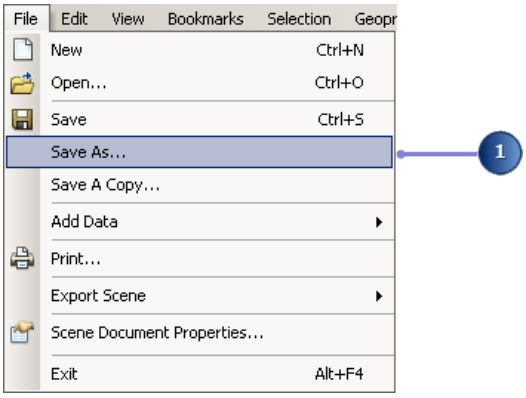
Now that you've built the scene, you will save it so that you can explore it later if you choose.

Saving the scene

Scenes, also called Scene Documents, are like maps in that they contain information about how the layers that are in the scene should be rendered and where the data is located.

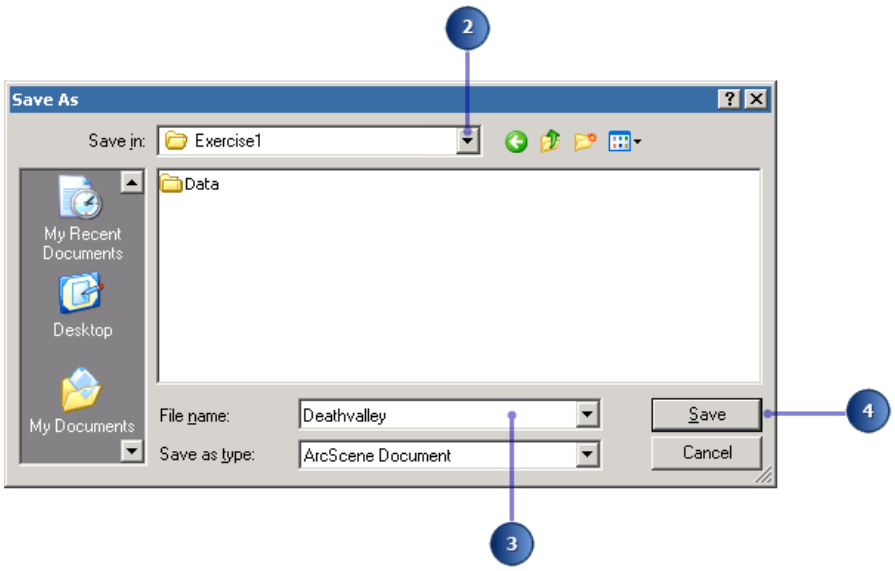
Steps:

1. Click **File** and click **Save As**.



2. Navigate to the Exercise 1 folder.
3. Type `Deathvalley` as the file name.

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4. Click **Save**.

   The scene will now be available for you to open later.

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Exercise 2: Visualizing contamination in an aquifer

Complexity:
Beginner

Data Requirement:
Installed with software

Data Path:
See Copying the tutorial data

Goal:
Use ArcScene to assess the impact of a groundwater contaminate in an aquifer

Imagine that you work for a water district. The district is aware of some areas where volatile organic compounds (VOCs) have leaked over the years. Scientists from your department have mapped some plumes of VOCs in the aquifer, and you want to create a 3D scene to help officials and the public visualize the extent of the problem.

Some of the data has already been assembled in the Groundwater ArcScene document. You will modify the scene to better communicate the problem.

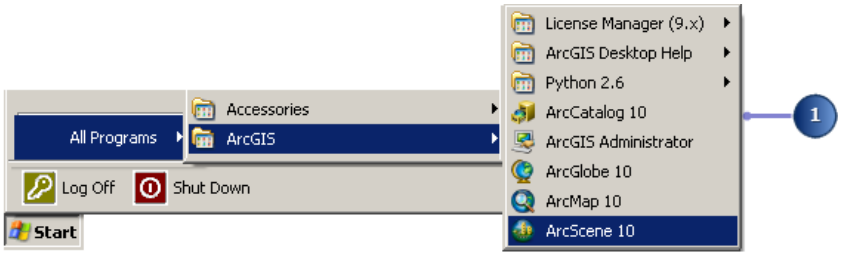
VOC data was supplied courtesy of the San Gabriel Basin Water Quality Authority.

Opening the Groundwater scene document

This scene document contains a TIN that shows the shape of the contaminant plume, a raster that shows the concentration of the contaminant, and two shapefiles that show the locations of parcels and wells. You will drape the concentration raster over the plume TIN, extrude the building features and change their color, and extrude the well features so that the wells most endangered by the contamination may be more easily recognized.

Steps:

1. Start ArcScene by clicking **Start** > **All Programs** > **ArcGIS** > **ArcScene 10**.

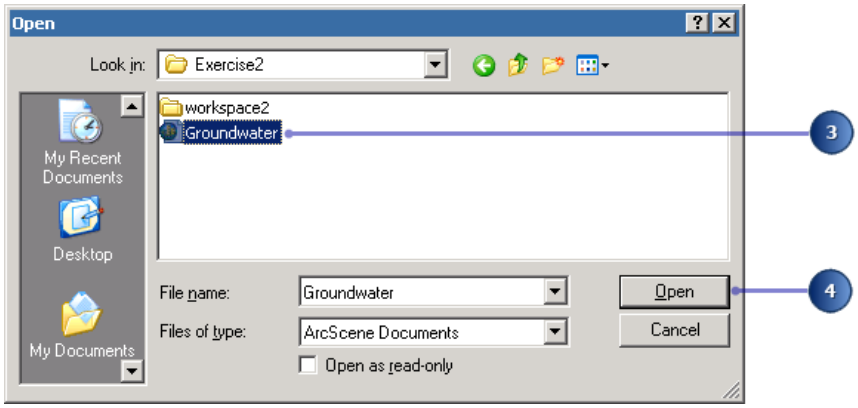


2. On the ArcScene - Getting Started dialog box, click **Existing Scenes** --> **Browse for more**.

   The ***Open*** dialog box appears.

3. Navigate to the **Exercise2** folder.

4. Click the **Groundwater** ArcScene document and click **Open**.



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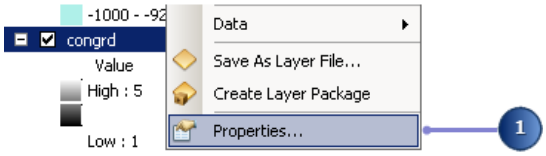
The Groundwater scene opens. You can see that four layers are already added to the table of contents.

Showing the volume and intensity of contamination

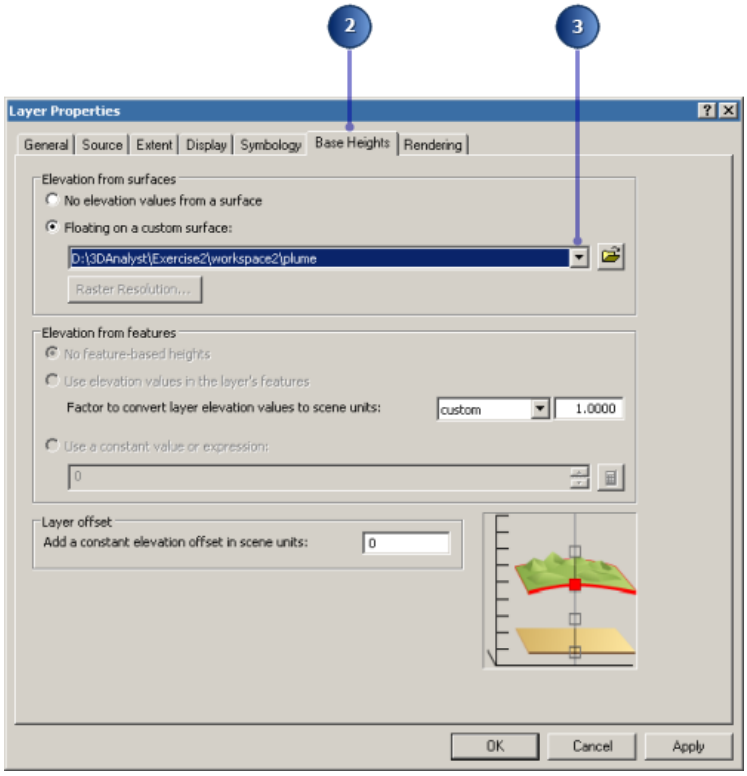
You'll drape the raster of VOC concentration over the TIN of the contaminant plume surface to show the volume and intensity of contamination in the aquifer.

Steps:

1. Right-click congrd in the table of contents and click **Properties**.



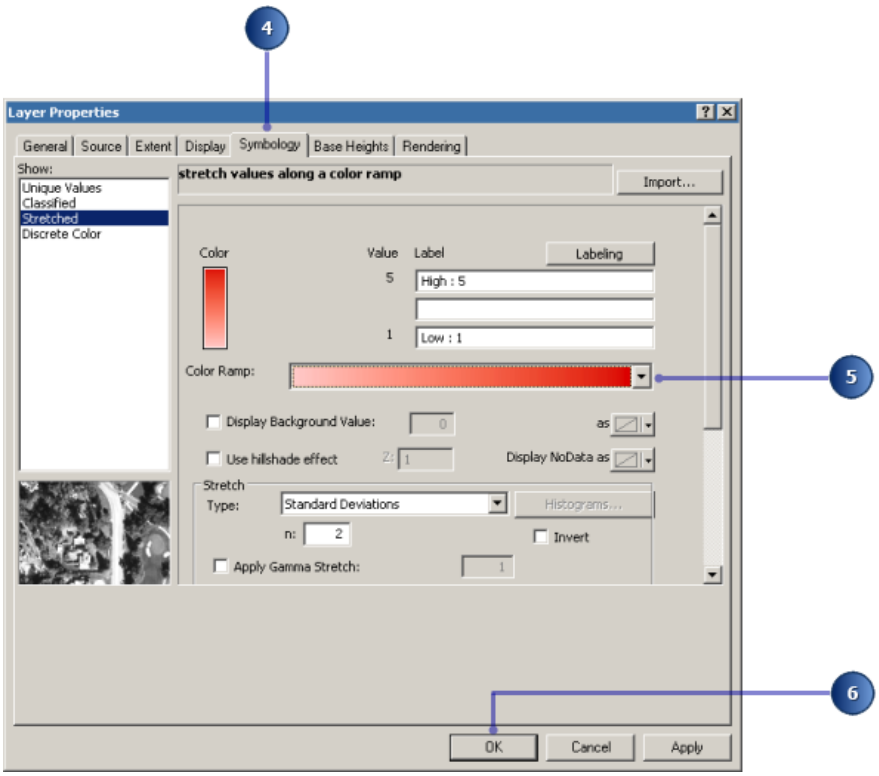
2. Click the **Base Heights** tab.
3. Click **Floating on a custom surface** and make sure the plume TIN is selected as the elevation surface to provide height values.



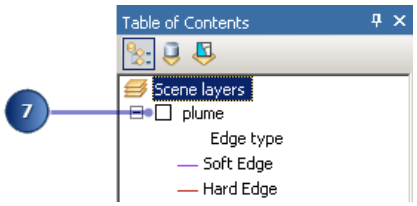
Now you will change the symbology of the raster to show the intensity of the contamination.

4. Click the **Symbology** tab.
5. Click the **Color Ramp** drop-down arrow and click a red color ramp for the raster.

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6. Click **OK**.
7. Uncheck plume in the table of contents.



Now it is possible to see the shape of the plume and its intensity in 3D.

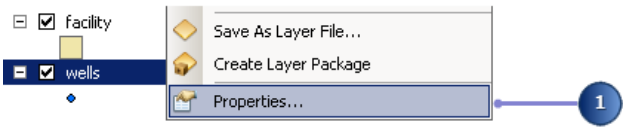
Showing the relationship of the plume to wells

You can see that some of the wells are within the area of the plume. However, it is difficult to see which wells are most seriously affected because the contamination is more widespread but less concentrated at greater depths.

You will extrude the well features based on their depth attribute in order to see which wells intersect the plume.

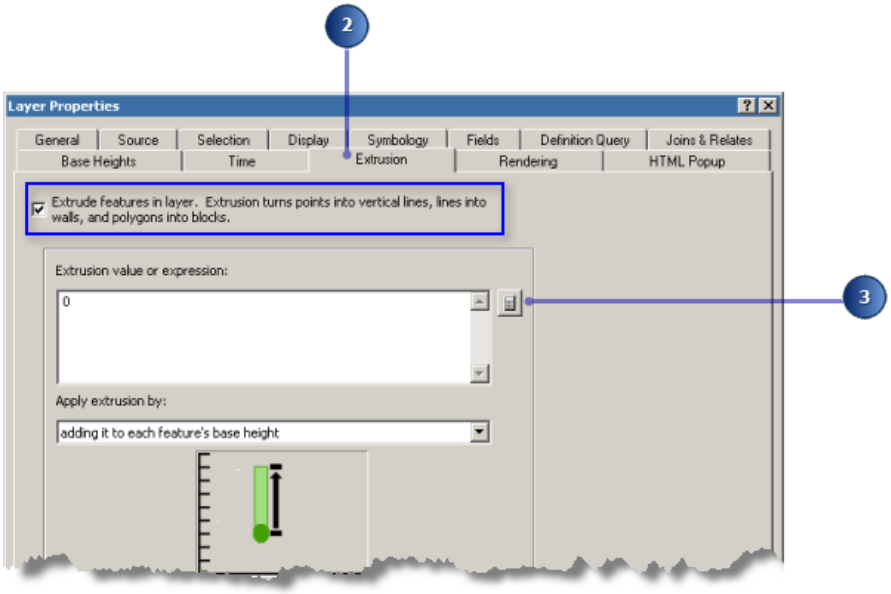
Steps:

1. Right-click wells and click **Properties**.



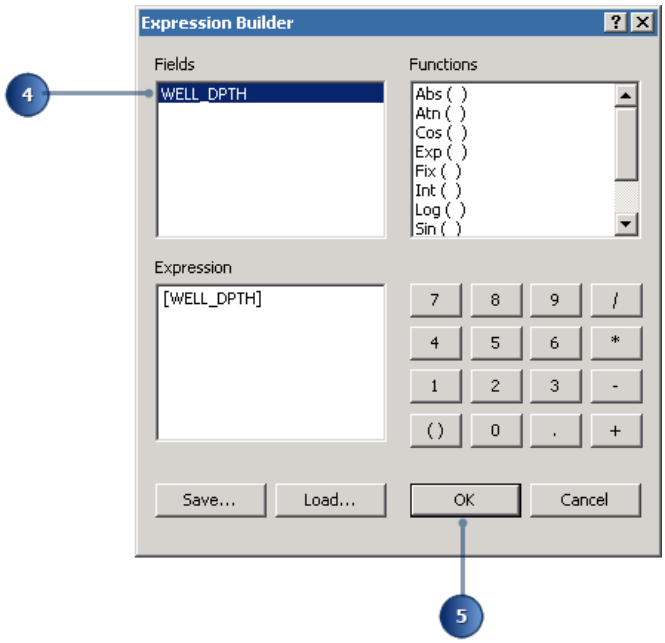
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2. Click the **Extrusion** tab.
3. Check to enable **Extrude features in layer** and click the **Calculate Extrusion Expression** button.



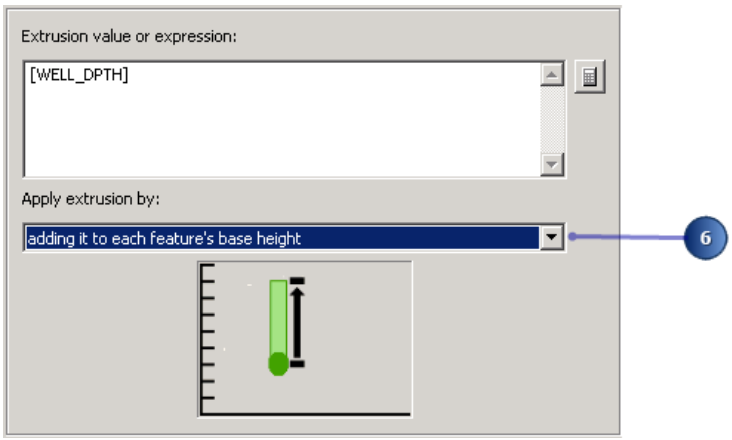
You will display the well points as vertical lines equal to the depth of the well. This information is stored in the WELL_DPTH field.

4. Click WELL_DPTH.
5. Click **OK**.



6. Click the drop-down arrow to apply the extrusion expression by adding it to each feature's base height. The well depths are expressed as negative values, so they will be extruded downward.

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7. Click **OK**.

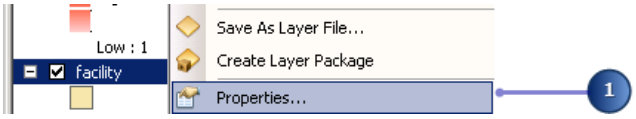
You can see the places where the wells intersect, or are close to, the plume. Now you will modify the scene to show the priority of various facilities that have been targeted for cleanup.

Showing the facilities with a high cleanup priority

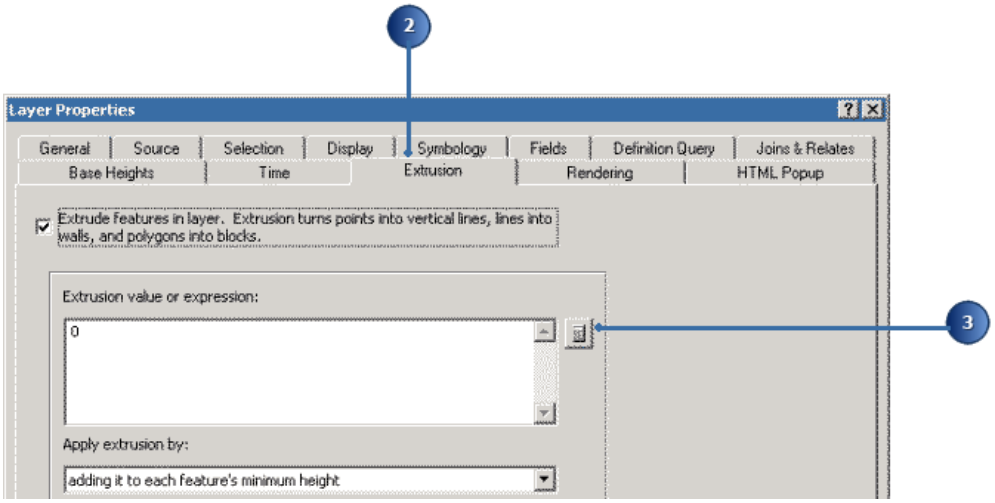
Analysts in your department have ranked the facilities according to the urgency of a cleanup at each location. You'll extrude the facilities into 3D columns and color code them to emphasize those with a higher priority for cleanup.

Steps:

1. Right-click facility and click **Properties**.



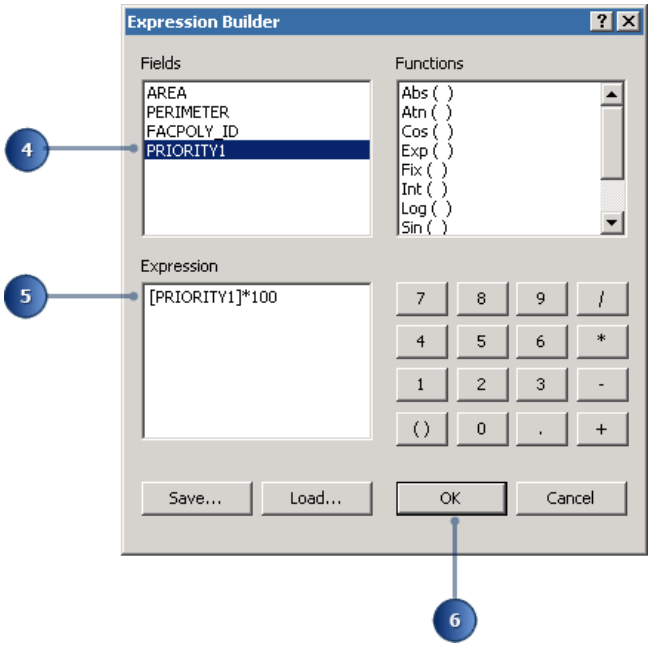
2. Click the **Extrusion** tab.
3. Check **Extrude features in layer** and click the **Calculate Extrusion Expression** button.



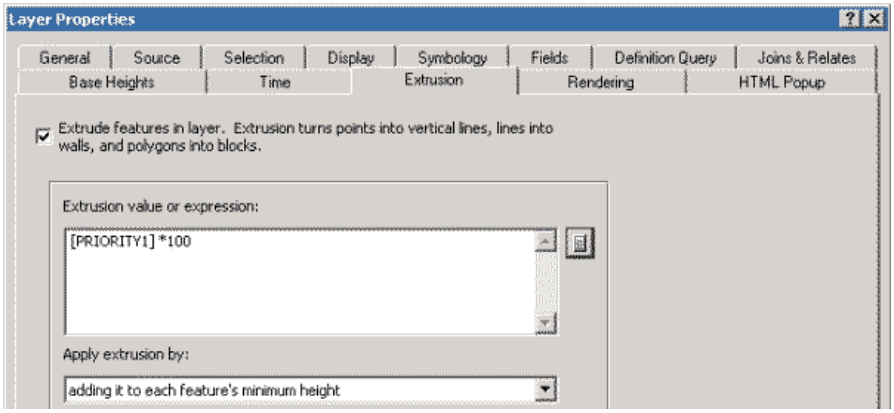
4. Click PRIORITY1.

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5. Type `*100`.
6. Click **OK**.

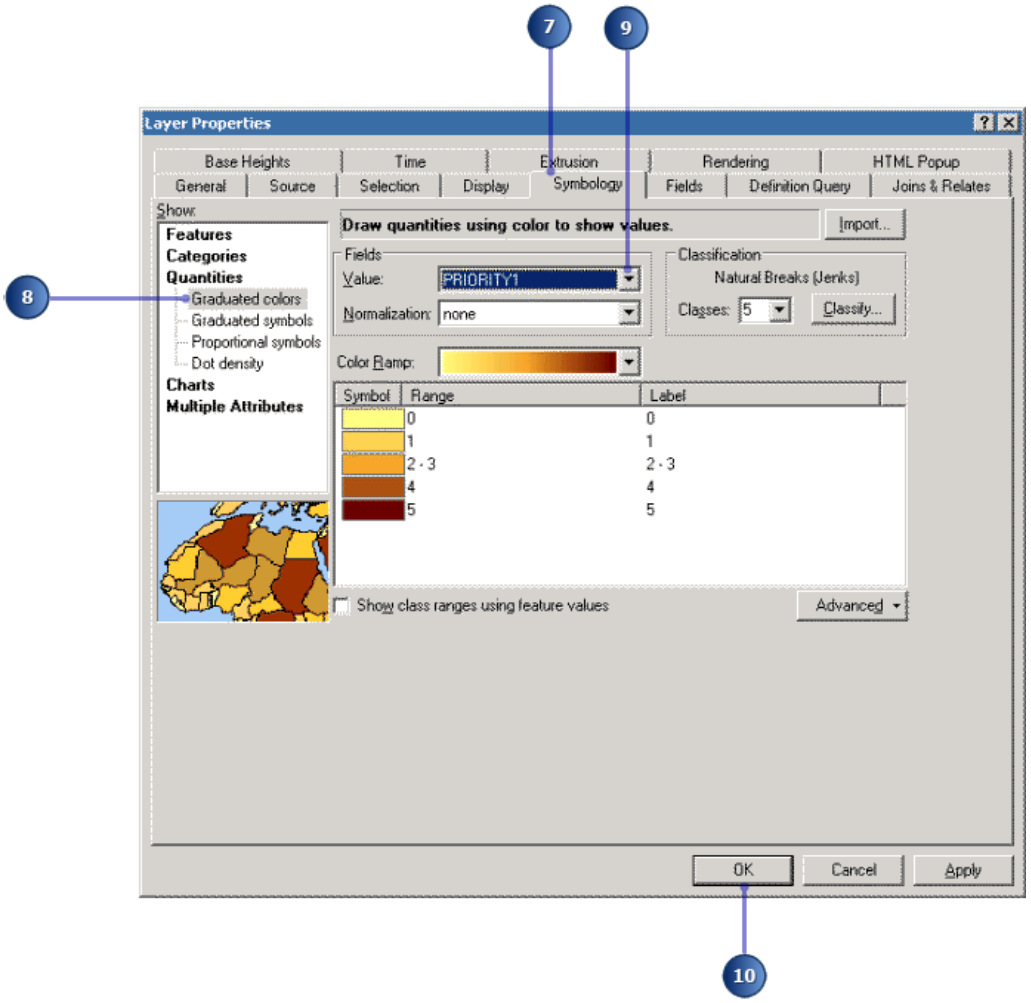


The expression you created appears in the Extrusion value or expression box.



7. Click the **Symbology** tab.
8. Click **Quantities**.
9. Click the **Value** drop-down list and click PRIORITY1.

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10. Click **OK** to close the ***Layer Properties*** dialog box and apply the extrusion and symbology settings.

    The facilities are now extruded in proportion to their priority score. The scene now shows the shape and intensity of the contamination, the wells in relationship to the plume, and the facilities that need to be cleaned up in order to prevent further pollution of the groundwater.

    Now you'll save your changes to the scene.

11. Click the **Save** button.

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Exercise 3: Visualizing soil contamination and thyroid cancer rates

Complexity:
Beginner

Data Requirement:
Installed with software

Data Path:
See Copying the tutorial data

Goal:
Use ArcScene and geoprocessing tools to compare two surface created from point data

In 1986, after the catastrophic accident at the Chernobyl nuclear power plant in Ukraine, a large amount of radioactive dust fell on Belarus. Since then, scientists have studied the aftermath of the accident. One tool for exploring the data is 3D visualization. In this exercise, you will create two surfaces from point data collected in Belarus. One set of points contains measurements of soil CS137 concentrations. CS137 is one of several radioactive isotopes released by the accident. The other set of points shows the rates of thyroid cancer, aggregated by district, with the sample point placed near the district centers.

The CS137 contamination and thyroid cancer data was supplied courtesy of the International Sakharov Environmental University.

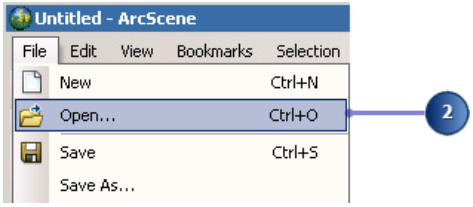
Viewing the point data

First, you will open the Chernobyl scene and view the point data.

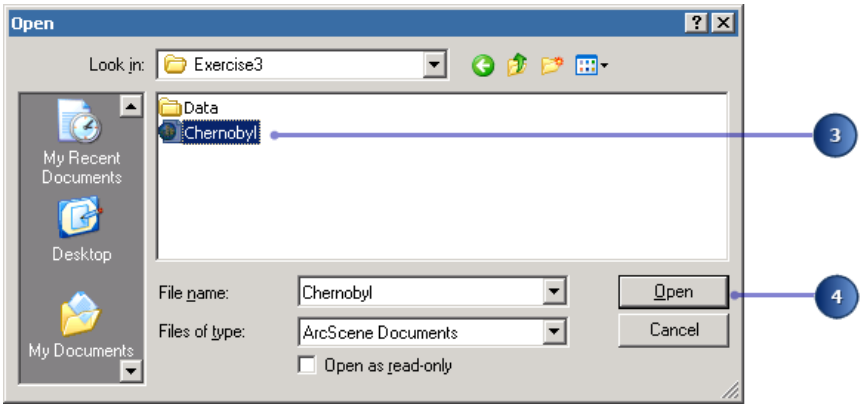
Steps:

1. Start ArcScene by clicking **Start** > **All Programs** > **ArcGIS** > **ArcScene 10**.
2. On the ArcScene - Getting Started dialog box, click **Existing Scenes** --> **Browse for more**.

   If you already have ArcScene open from the previous exercise, simply click **File** and click **Open**.



3. Navigate to Exercise3 and click the Chernobyl ArcScene document.



4. Click **Open**.

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The CS137 soil measurements are shown with small point symbols, using a graduated color ramp to show the intensity of the contamination. The districts' thyroid cancer rates are shown with larger symbols, using a different color ramp.

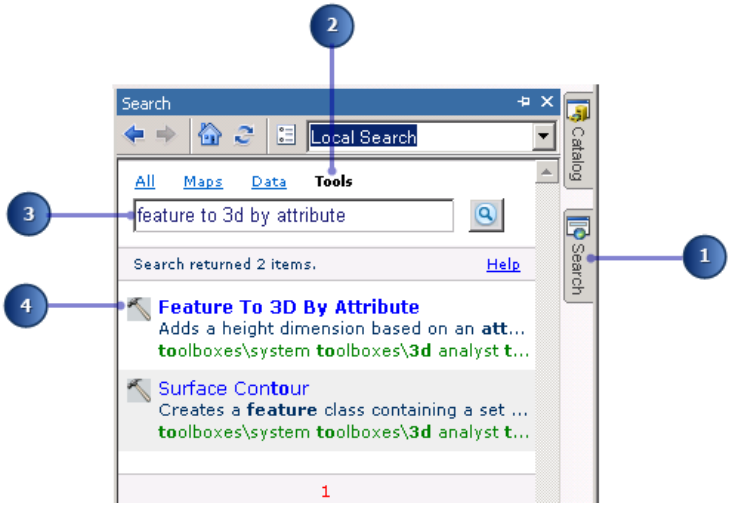
Creating 3D point features

The soil CS137 samples are 2D points with some attributes. One way to view 2D points in 3D is by setting an extrusion expression, or a base height. You can also incorporate a z-value into a feature's geometry to allow it to be directly viewed in 3D without the need to set a base height from a surface or an attribute.

This exercise requires the use of 3D Analyst geoprocessing tools, so make sure the 3D Analyst extension is enabled so that you can access the full suite of tools available. You will use the Search window to quickly search for individual tools by their name or by function keyword.

Steps:

1. On the right side of the ArcScene window, move your pointer over the **Search** tab or click the **Search** tab to bring it into view.
2. Click **Tools** to set the search filter on the ***Search*** window.
3. Click inside the Search combo box and type `feature to 3d by attribute` and press ENTER or click the Search tool.

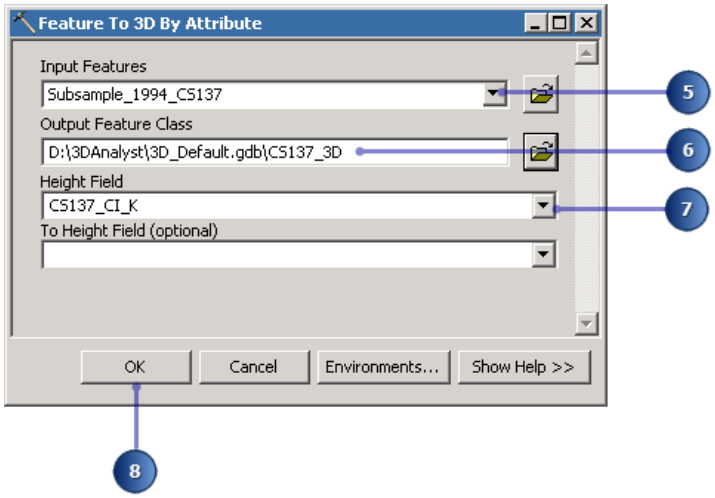


The search will return exact and relative keywords of tools. The hammer symbol left of the search results also indicates the item is a tool.

Using the tool search results, now you will create 3D point features from the soil CS137 points.

4. Click Feature To 3D By Attribute from the search results.
5. In the tool dialog box, click the **Input Features** drop-down list and click Subsample_1994_CS137.

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6. Click **Browse** and set the **Output Feature Class** location to the 3D_Default geodatabase for the 3D Analyst tutorial data. Then type the output feature name to **CS137_3D**.
7. Click the **Height Field** drop-down list and click CS137_CI_K
8. Click **OK**.

   You'll see a progress bar at the bottom of your document displaying the name of the currently executing tool. When the tool finishes executing, a pop-up notification will appear on the system tray. This is called background geoprocessing, which, by default, is turned on when the software is installed and opened. To disable background geoprocessing, use the ***Geoprocessing Options*** dialog box from the **Geoprocessing** main menu in ArcScene.

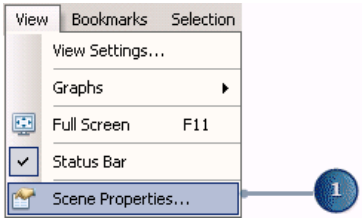
The features are converted to 3D point features; however, they still seem to be resting on a flat plane, because the CS137 concentration values range from 0 to 208.68, which is small relative to the horizontal extent of the data.

Increasing the vertical exaggeration

You will exaggerate the scene to show the new points with their height embedded in the feature geometry.

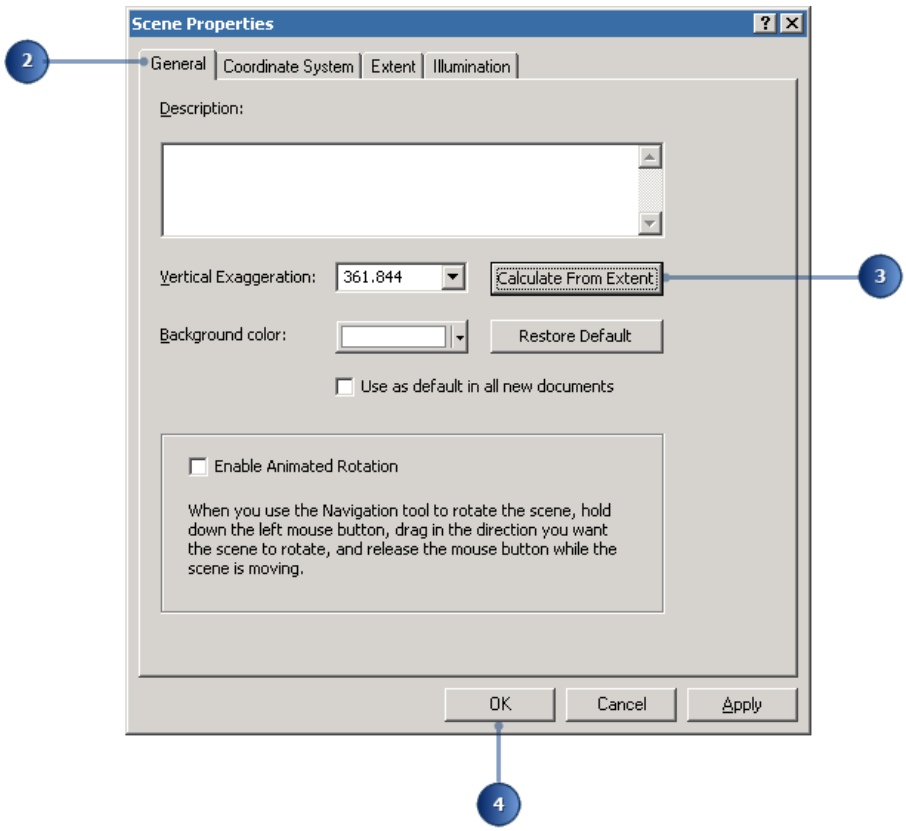
Steps:

1. Click **View** and click **Scene Properties**.



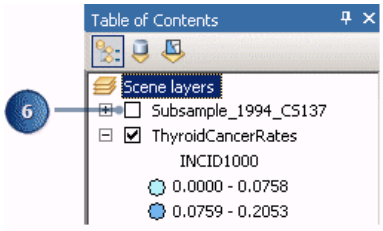
2. Click the **General** tab.
3. Click **Calculate From Extent**.

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4. Click **OK**.
5. Click the **Full Extent** button.

   Now that you can see the new 3D points in the scene, you can turn off the original CS137 sample point layer.
6. Uncheck the box in the table of contents beside Subsample_1994_CS137 and click the minus sign beside the box to hide the classification.



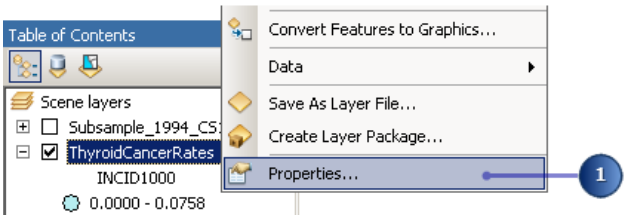
Extruding columns

Viewing points in 3D space is one way to investigate data. Another way is to extrude points into columns. You will extrude the thyroid cancer points into columns to compare them to the contamination data.

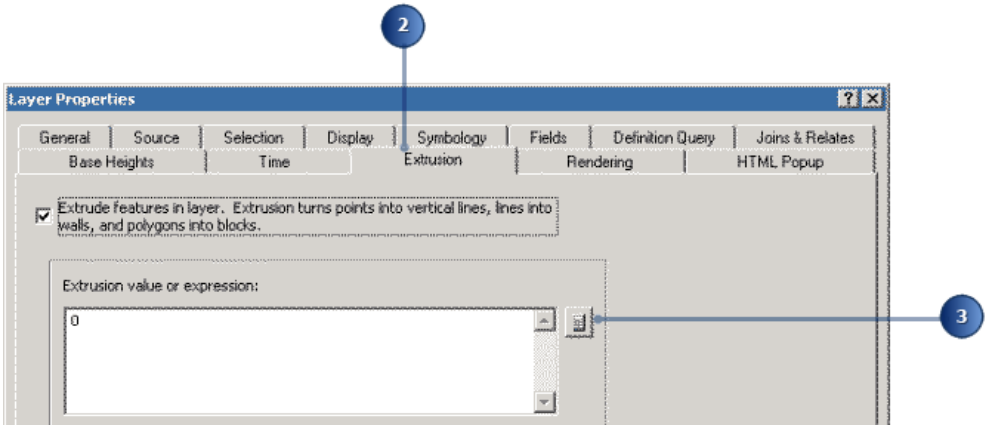
Steps:

1. Right-click **ThyroidCancerRates** and click **Properties**.

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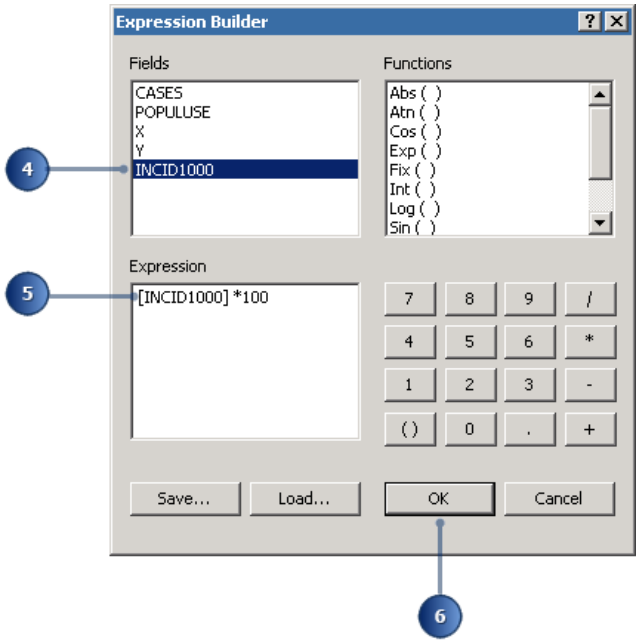
2. Click the **Extrusion** tab.
3. Check to enable **Extrude features in layer** and click the **Calculate Extrusion Expression** button.



4. Click INCID1000 (the rate of cases per 1,000 persons).

   Because the z-values of the phenomena that you are comparing have different ranges, you will multiply the cancer rate by 100 to bring the values into a range similar to that of the CS137 measurements.

5. Type `*100`.



6. Click **OK** on the ***Expression Builder*** dialog box.

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7. Click **OK** on the ***Layer Properties*** dialog box.

   Now the district centroid points are shown with columns proportionate to the thyroid cancer rates. If you navigate the scene, you will see that the areas with the highest contamination levels also tend to have high thyroid cancer rates, although there are areas with lower CS137 contamination levels that also have high cancer rates.

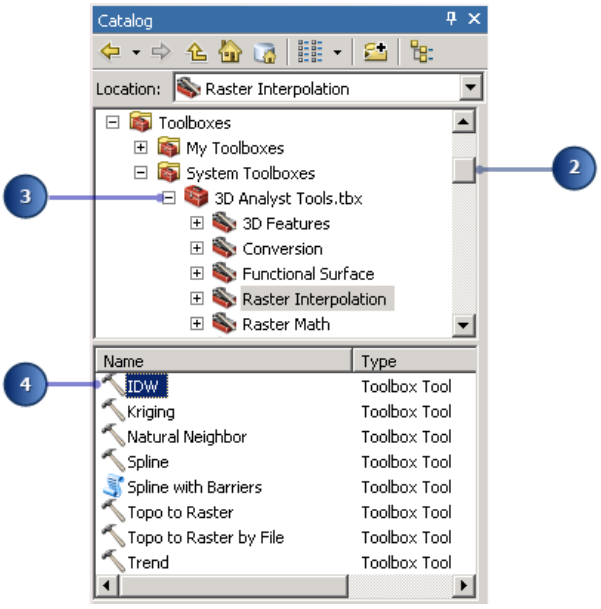
Creating a surface from point sample data

You know what the soil concentrations of CS137 are at the sample point locations, but you do not know what they are at the locations between sample points. One way to derive the information for locations between sample points is to interpolate a raster surface from the point data. There are many ways to interpolate such surfaces, which result in different models of varying accuracy. In this exercise, you will interpolate a surface from the samples using the Inverse Distance Weighted (IDW) interpolation technique. IDW interpolation calculates a value for each cell in the output raster from the values of the data points, with closer points given more influence and distant points less influence.

Steps:

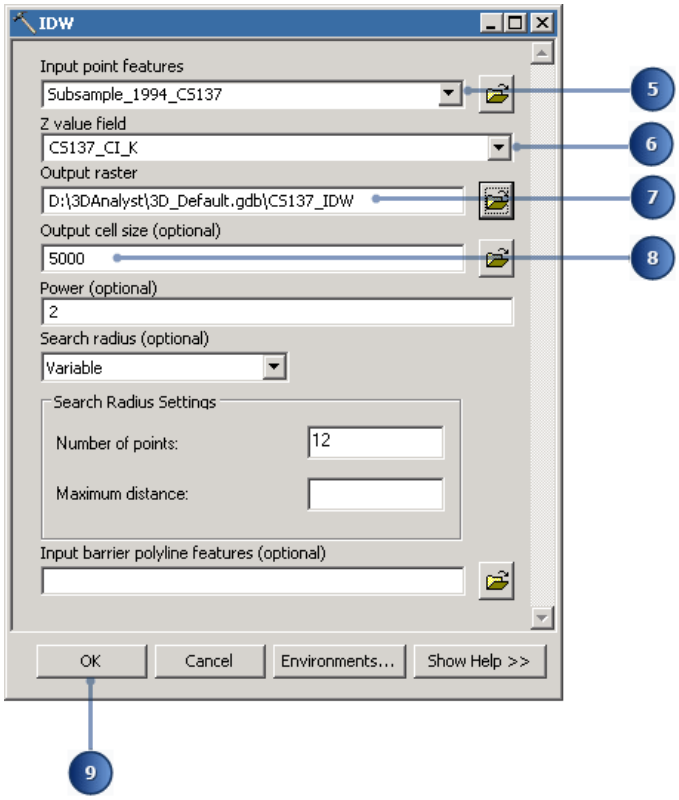
1. Click the **Catalog** tab to expand the ***Catalog*** window.
2. Scroll to find **Toolboxes**.

   This is another way of finding tools as an alternative to using the ***Search*** window. The ***Catalog*** window also maintains all the toolboxes.
3. Expand **Toolboxes**, click **System Toolboxes**, then expand the **3D Analyst Tools** toolbox.
4. Navigate to the **Raster Interpolation** toolset and double-click the IDW geoprocessing tool that appears in the lower window.



5. Click the **Input point features** drop-down list and click Subsample_1994_CS137.
6. Click the **Z value field** drop-down list and click CS137_CI_K.

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7. Verify that the **Output raster** location is set to the default geodatabase (3D_Default.gdb),then change the output raster name to CS137_IDW.

   Otherwise, click the **Browse** button to set the output raster location and click **Save**.

8. Click inside the **Output cell size** box and increase the value to 5000.
9. Click **OK**.
   ArcScene interpolates the surface and adds it to the scene.

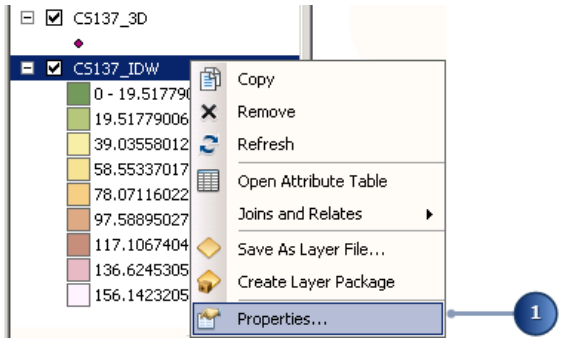
Viewing the interpolated surface

Now that the surface has been added to the scene, you can see that there are two areas with very high concentrations of CS137. You will view the surface in perspective, with a new color ramp, to better see its shape.

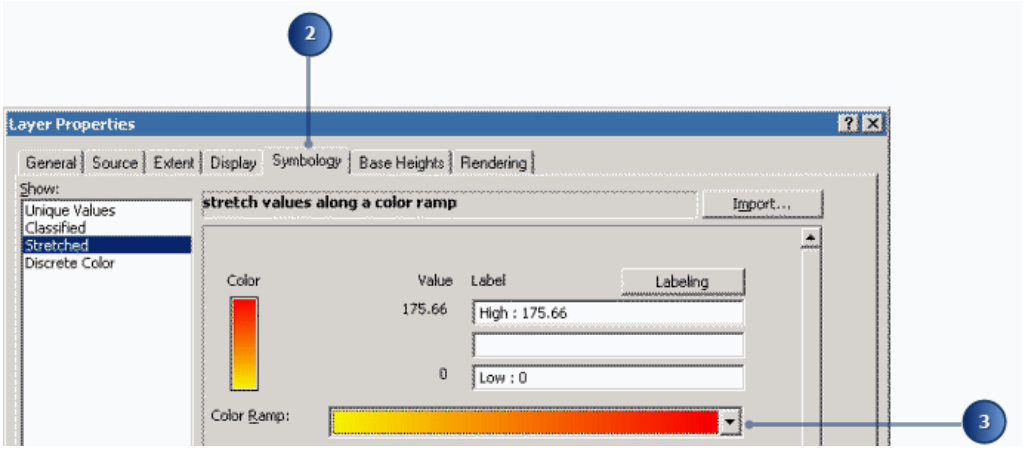
Steps:

1. Right-click CS137_IDW and click **Properties**.

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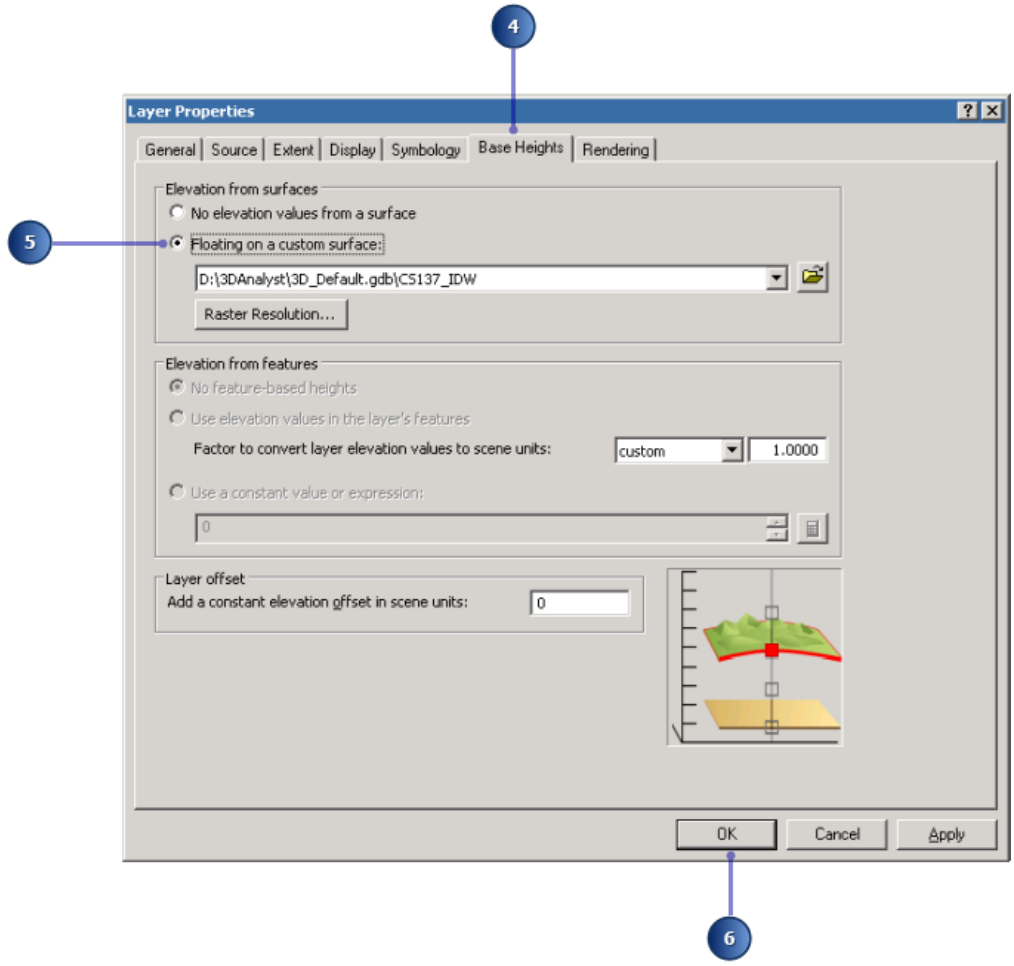
2. Click the **Symbology** tab and select **Stretched** from the **Show** category.
3. Click the **Color Ramp** drop-down arrow and click a new color ramp.



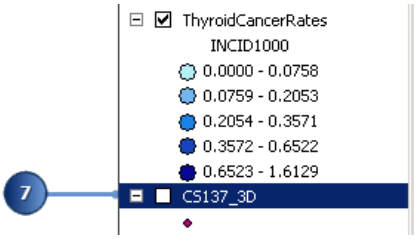
4. Click the **Base Heights** tab.
5. Click **Floating on a custom surface**.

   Confirm that the IDW surface is listed as the custom surface.

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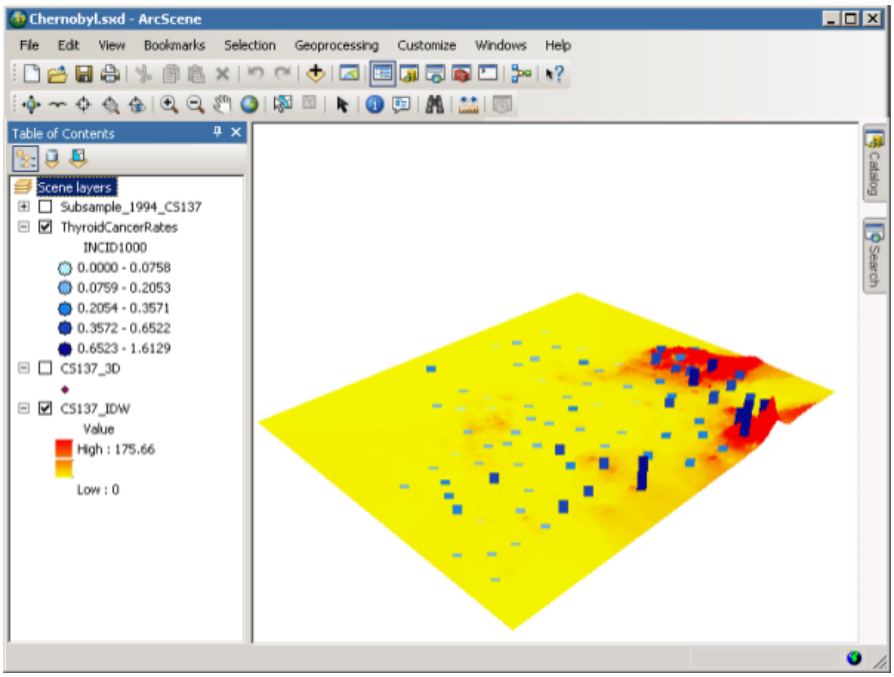


6. Click **OK**.
7. Uncheck CS137_3D in the table of contents.



Now you can see the interpolated surface of CS137 contamination, along with the thyroid cancer rate data.

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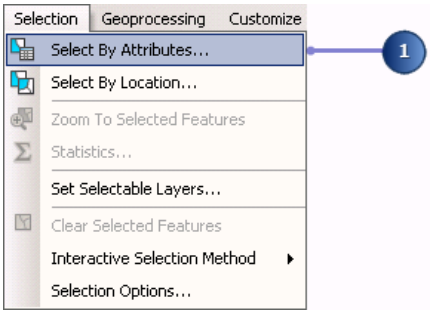
Next, you will select the province centers with the highest rates of thyroid cancer.

Selecting features by an attribute

Sometimes it is important to focus on a specific set of data or specific features. You can select features in a scene by their location, by their attributes, or by clicking them with the **Select Features** tool. You will select the province centers by attribute to find the locations with the highest rates.

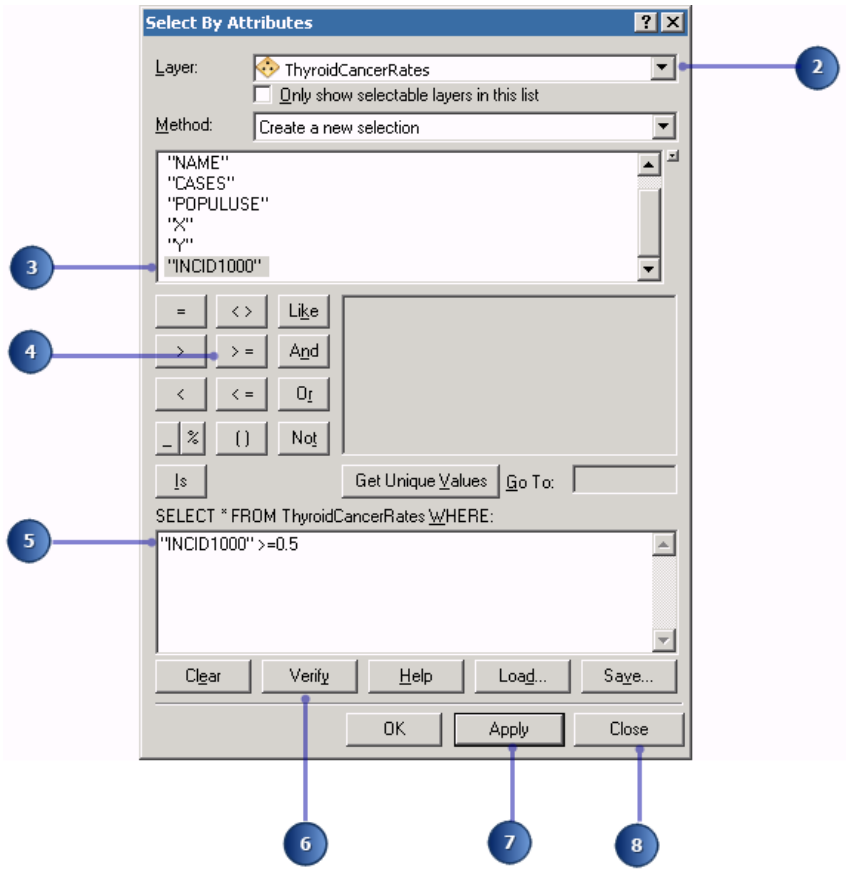
Steps:

1. Click **Selection** and click **Select By Attributes**.

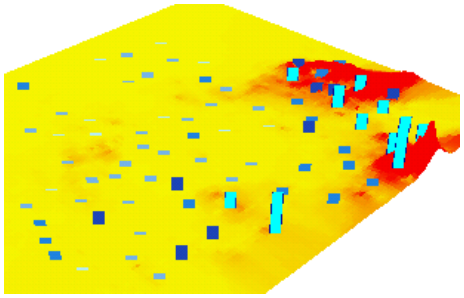


2. Click the **Layer** drop-down arrow and click **ThyroidCancerRates**.
3. Double-click **INCID1000** in the fields list.

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4. Click the **>=** button.
5. Type `0.5`.
6. Click **Verify** to check the selection expression you have built.
7. Click **Apply**.
8. Click **Close**.



The province centers with thyroid cancer rates greater than 0.5 cases per 1,000 are now selected in the scene. They are drawn in light blue to indicate that they are selected.

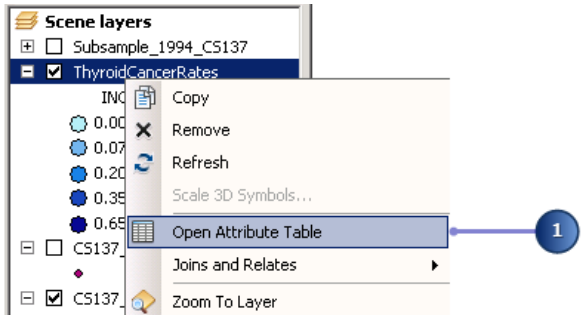
Viewing the attributes of features

You will investigate attributes of the selected locations and find out how many cases of thyroid cancer occurred in these districts.

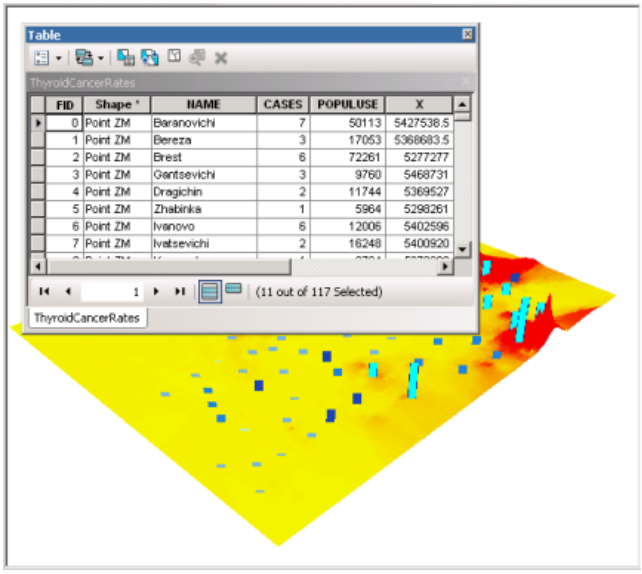
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Steps:

1. Right-click ThyroidCancerRates and click **Open Attribute Table**.



The ***Table*** window of the layer's attributes appears in the view.



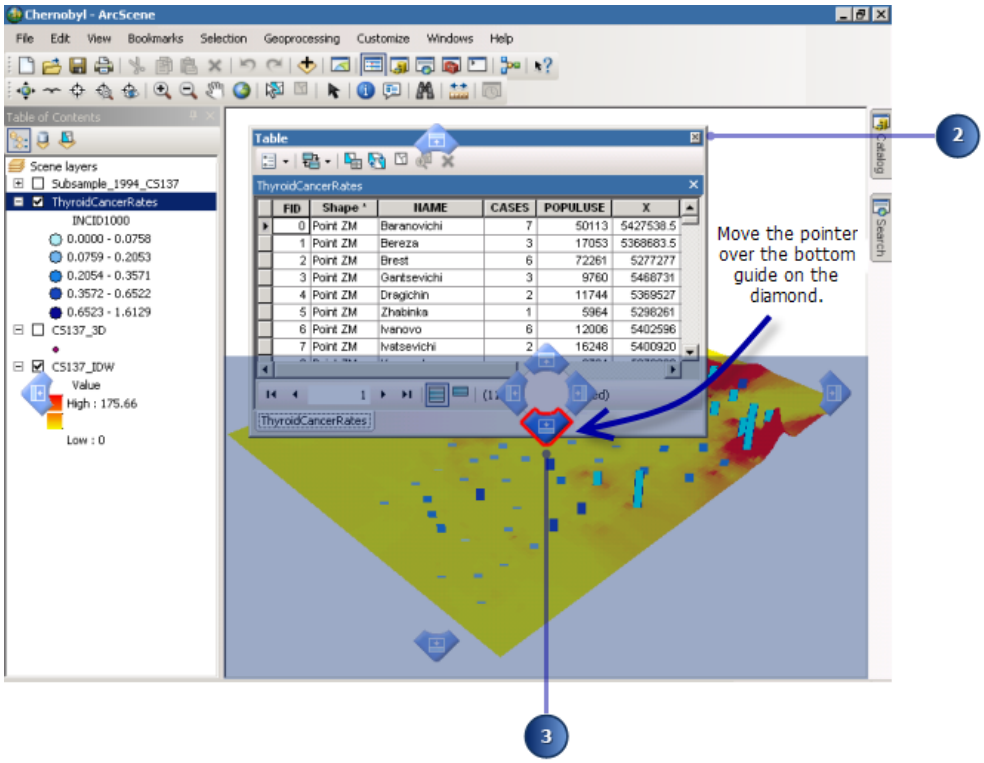
2. Click the title bar of the ***Table*** window and drag it from its current location toward the center of the 3D view.

   The guide diamond appears pointing towards the four edges of the 3D view where you can optionally dock the ***Table*** window.

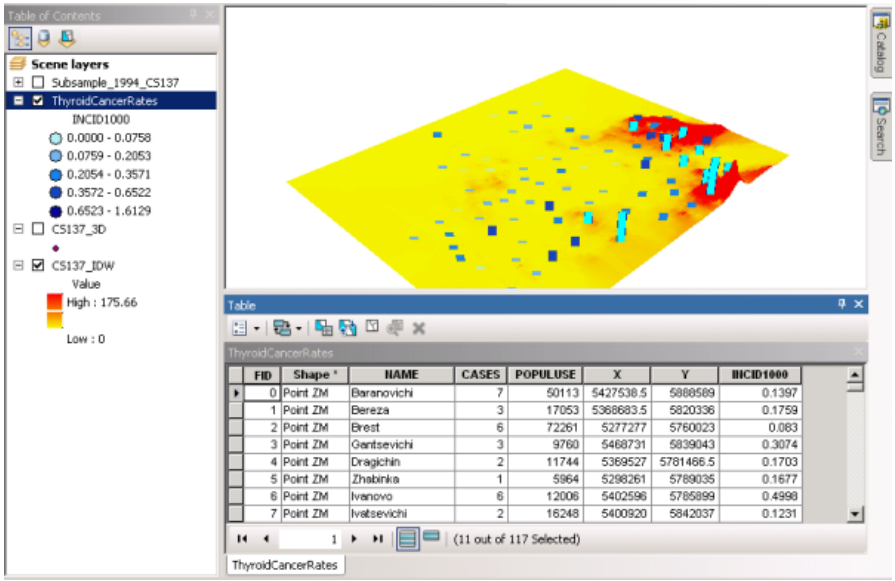
3. Move the pointer toward the bottom guide arrow until it darkens to indicate the selected docking location.

   A shaded outline of the window appears in the designated area.

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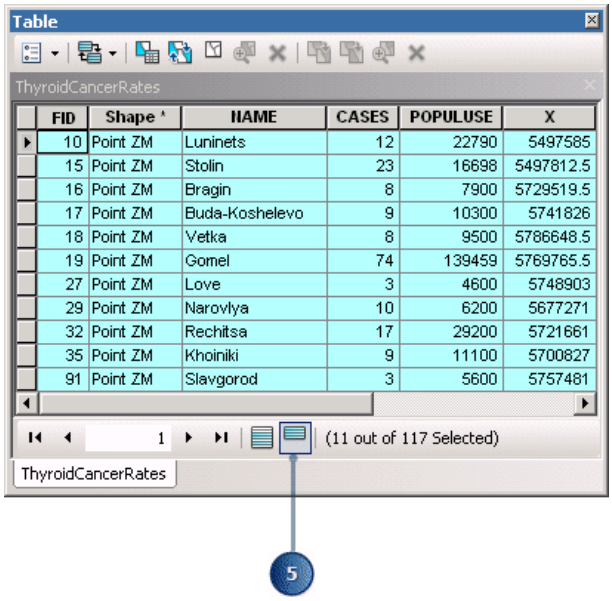
4. Release the mouse button to dock the ***Table*** window in the bottom of 3D view space.



You can play with other arrow location on the guide diamond to see which location suits your preferences. For this exercise, we will continue having the ***Table*** window docked at the bottom of the view.

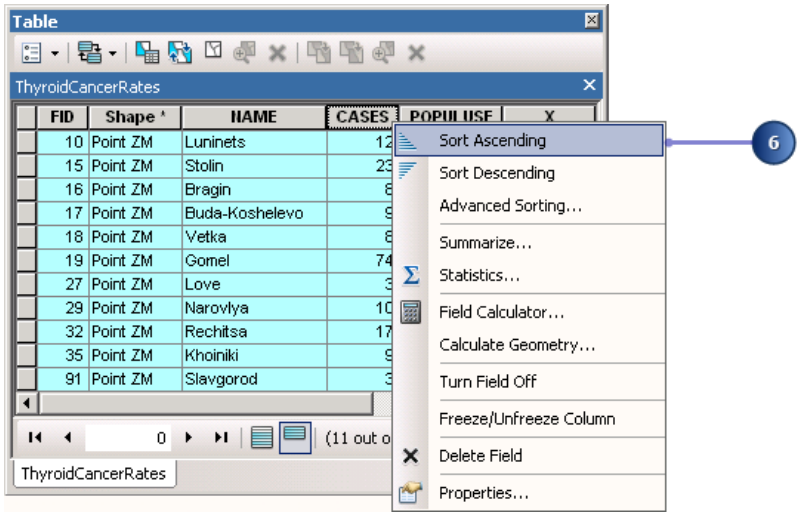
5. In the ***Table*** window, click the **Selected** button.

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The table now shows only those features that you selected.

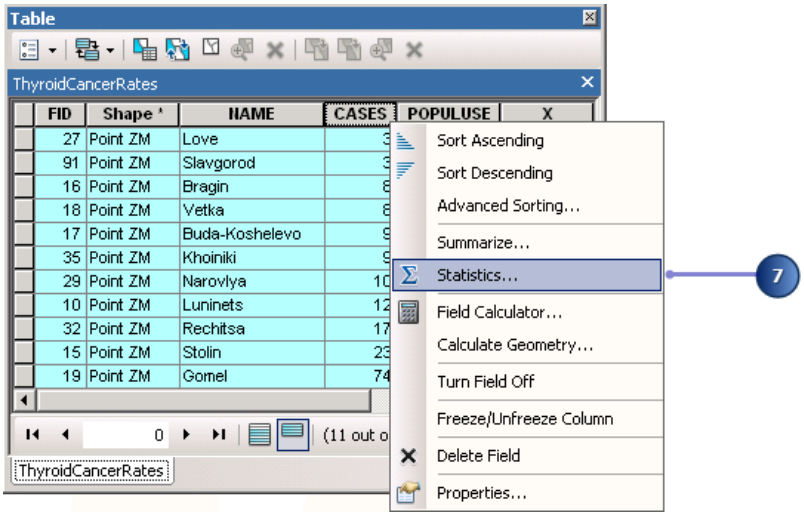
6. Right-click CASES and click **Sort Ascending**.



The selected province centers are sorted according to the number of cases.

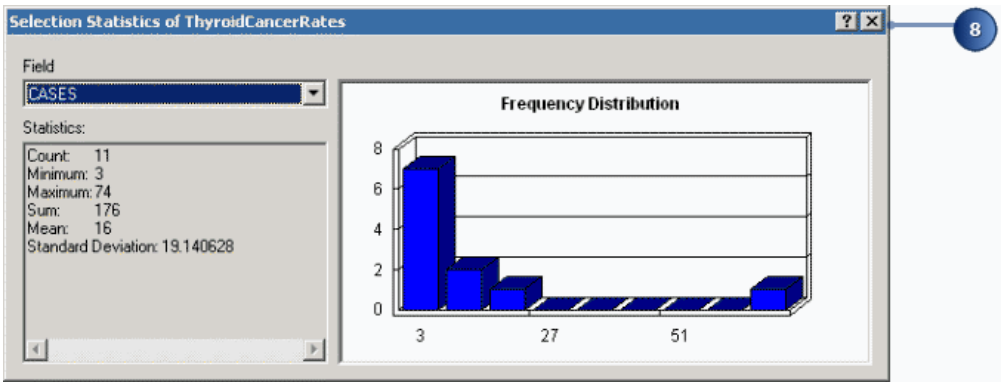
7. Right-click CASES and click **Statistics**.

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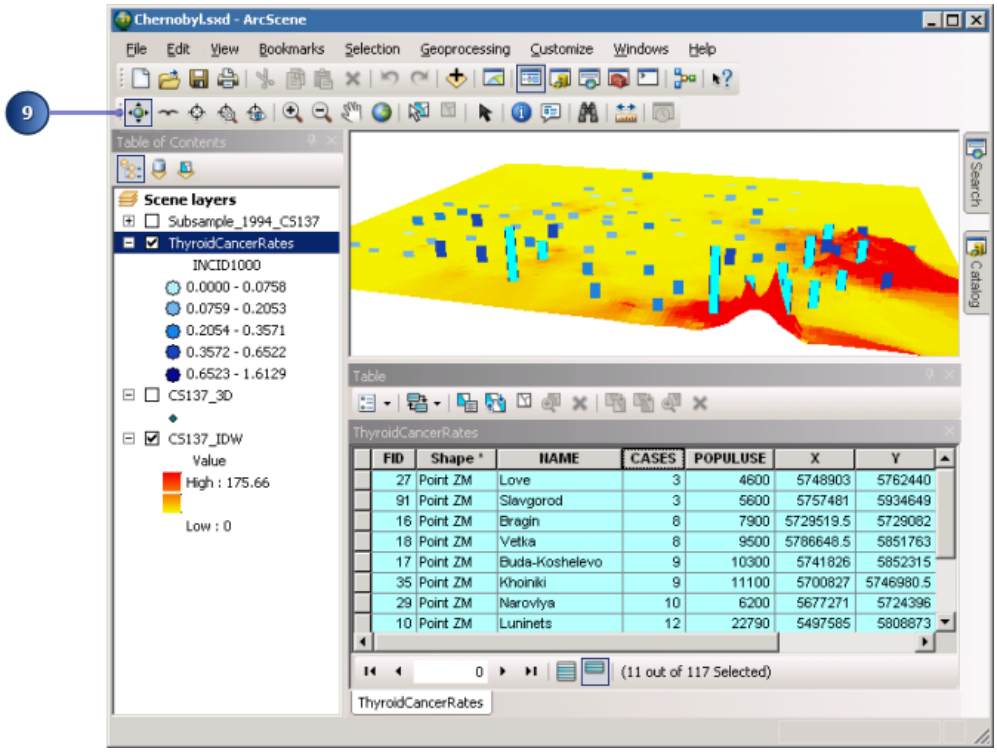
The total number of cases in the selected set of 11 province centers is 176.

8. Close the ***Selection Statistics*** dialog box.



9. Click the **Navigate** button and click on the scene.

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You can work in ArcScene while the Attribute Table is open.

10. Click the **Save** button.

In this exercise, you have created 3D features, extruded point features, and interpolated a raster surface from a set of data points. You've compared the extruded vector data to the surface data and explored the attributes of the vector data.

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Exercise 4: Building a TIN to represent terrain

Complexity:
Beginner

Data Requirement:
Installed with software

Data Path:
See Copying the tutorial data

Goal:
Use ArcScene and ArcMap to construct a TIN surface model, and geoprocessing tools to conduct surface analysis

The town of Horse Cave, Kentucky, is situated above a cave that once served as the source of drinking water and hydroelectric power for the town. Unfortunately, the groundwater that flows in the cave was polluted by household and industrial waste dumped on the surface and washed into sinkholes. Dye-tracing studies and a three-dimensional survey of the cave revealed the relationship between the cave passages and the town and demonstrated the connection between open surface dump sites and contamination of the groundwater in the cave below.

Thanks to the development in 1989 of a new regional sewage facility and the joint efforts of the Cave Research Foundation and the American Cave Conservation Association (ACCA), the groundwater is cleaner, and the cave has been restored. It is now operated as a tour cave and educational site by the ACCA.

Cave data was provided courtesy of the ACCA.

Viewing the cave and the landscape

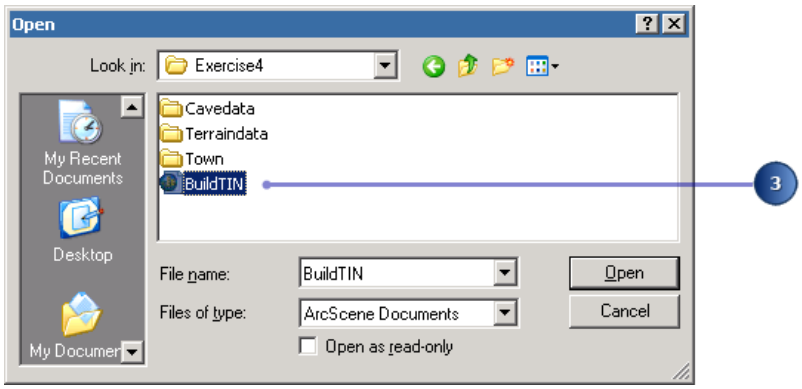
First, you will open the BuildTIN scene and view the cave survey and some terrain data layers. You'll use this terrain data to create a TIN and drape some other layers on it to visualize the relationship of the cave to the town.

Steps:

1. Start ArcScene by clicking **Start** > **All Programs** > **ArcGIS** > **ArcScene 10**.
2. On the ArcScene - Getting Started dialog box, click **Existing Scenes** --> **Browse for more**.

   If you already have ArcScene open from the previous exercise, simply click **File** and click **Open**.

   The ***Open*** dialog box appears.
3. Navigate to the **Exercise4** folder and double-click the **BuildTIN** ArcScene document.



   The scene opens, and you can see the location of roads and railroads, some sample elevation points, and a few significant contour lines. In the table of contents, you can see that some layers have been turned off.
4. Check the box to show the Cavesurvey layer.

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