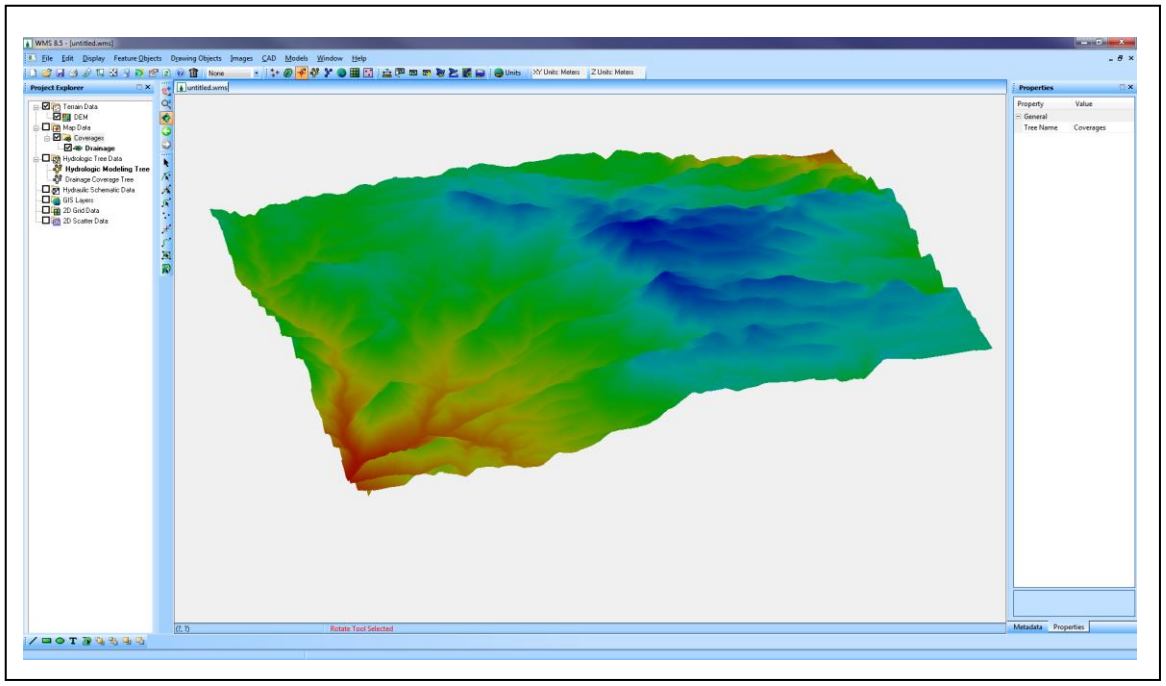
WMS

v. 10.1

*WMS 10.1 Tutorial*

# *Editing Elevations – DEM Basics*

Import, view, and edit digital elevation models



## Objectives

Learn to import DEMs from an online database, set the display options for an imported DEM, and view and edit the DEM attributes.

## Prerequisite Tutorials

- None

## Required Components

- Data
- Map

## Time

- 20–30 minutes

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# 1 Introduction

Digital Elevation Models (DEMs) are the most commonly available digital elevation source and therefore an important part of using WMS for watershed characterization. A DEM is a rigid data structure that contains a two-dimensional array of elevations where the spacing between elevations is constant in the x and y directions. In the United States, DEMs are downloadable from the Internet at 10m, 30-meter (1:24000 map series) and 90-meter (1:250000 map series) resolutions. There are several free online data sources where such DEMs can be downloaded.

The Arc/Info ASCII grid format is common throughout the GIS world. WMS has an automated tool to download DEMs at different resolutions and different projection systems. The basics of downloading, importing, tiling, editing, and displaying DEMs will be demonstrated in this tutorial.

This tutorial requires an internet connection to achieve the best experience. If an internet connection is not available, sections 4 through 6 can be completed using the DEM files included within the tutorial files.

# 2 Getting Started

Starting WMS new at the beginning of each tutorial is recommended. This resets the data, display options, and other WMS settings to their defaults. To do this:

1. If necessary, launch WMS.
2. If WMS is already running, press *Ctrl-N* or select *File* | **New…** to ensure that the program settings are restored to their default state.
3. A dialog may appear asking to save changes. Click **No** to clear all data.

The graphics window of WMS should refresh to show an empty space.

# 3 Downloading DEMs

This section discusses and demonstrates the process of downloading DEM data using the **Get Data** tool in WMS.

 

## 3.1 Using Virtual Earth Map Locator

In order to locate the site, WMS uses the *Virtual Earth Map Locator* plugin.

1. Click **Get Data from Map** to open the *Virtual Earth Map Locator* dialog.
2. To the right of the Map location section, turn on *Locator tool* to bring up a small dialog containing *What* and *Where* fields. This is the **Locator Tool**.
3. Enter "Provo" in the *Where* field and click **Find**

The map will zoom in to Provo, Utah in the United States (Figure 1).

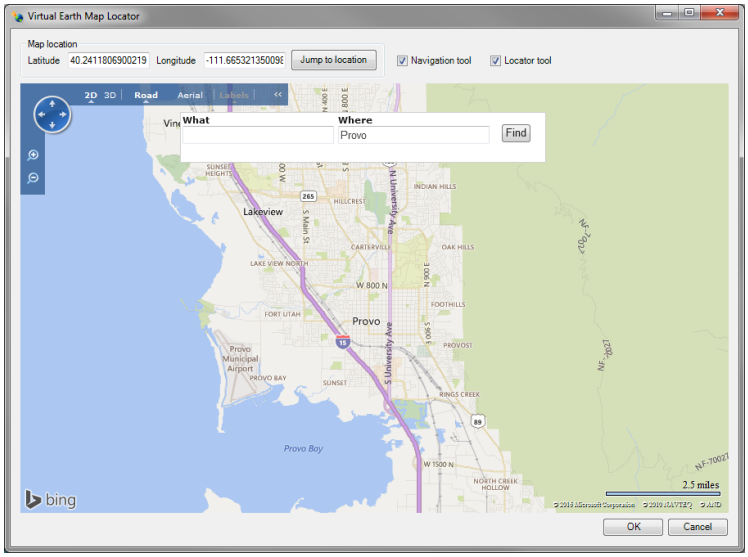


*Figure 1 Virtual Earth Map Locator showing Provo, Utah*

Just above the Provo Municipal Airport is a green area. This is Utah Lake State Park.

4. Zoom in on the state park using your mouse scroll wheel.

The map can be centered by clicking and dragging it until it appears as in Figure 2.

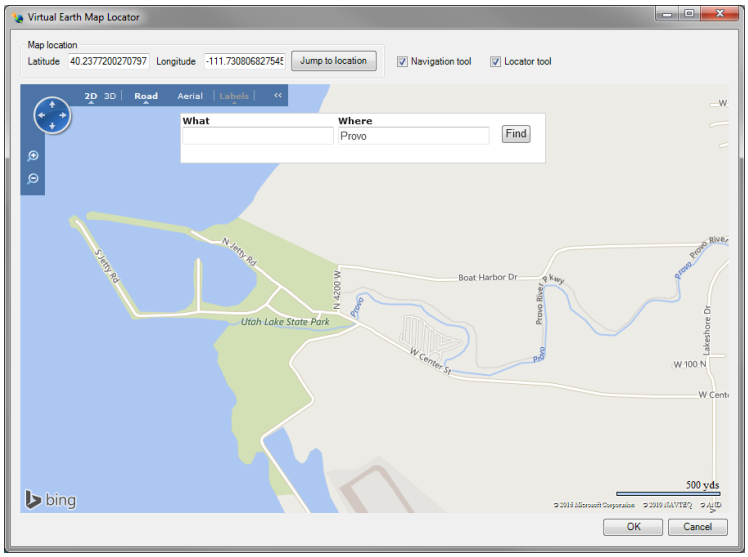


*Figure 2 Virtual Earth Map Locator zoomed to Utah Lake State Park*

5. Resize the window or zoom in/out to get the proper extent of the data. WMS will use the extents of this window to download the DEM data.
6. Click **OK** to close the *Virtual Earth Map Locator* dialog and open the *Data Service Options* dialog.
7. Select *United States Elevation Data (NED) (10m Resolution)* (Figure 3) and click **OK** to close the *Data Service Options* dialog open the *Save Web Services Data File(s)* dialog.

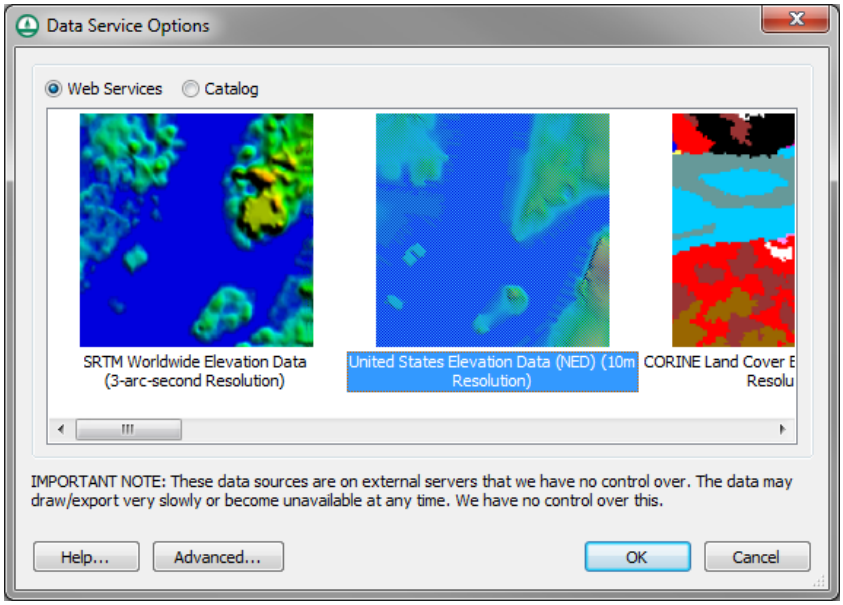


*Figure 3 Data Service Options dialog*

8. Browse to the *dembasics\dembasics* folder.
9. Select "Web Services Files (*.web)" from the *Save as type* drop-down.
10. Enter "UtahLakeSP.web" as the *File name*.
11. Click **Save** to close the *Save Web Services Data File(s)* dialog.
12. Click **Yes** when asked to confirm creation of the file and bring up the *Elevation Cell Size* dialog.
13. Click **OK** to accept the default DEM cell size and close the *Elevation Cell Size* dialog.

WMS will download the DEM data for the selected area. A dialog showing the progress of the download will appear. The download time will vary depending on the speed of the internet connection. As soon as the data download is complete, the progress dialog will close and WMS will plot the elevation contours for the DEM (Figure 4).

Notice that data was only downloaded for the area defined in the virtual earth map locator window. The data was projected into the UTM projection during the download process.

 

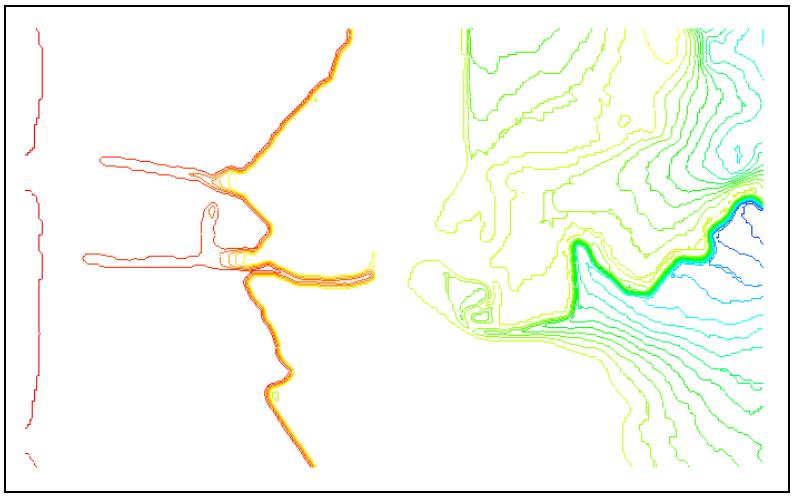

*Figure 4 DEM contours of Utah Lake State Park and surrounding area*

# 4 Merging DEMs

It is sometimes necessary to merge multiple DEM data files in order to facilitate studying an area that overlaps multiple DEM data quads. WMS can do this through the following steps:

1. Select *File* | **New** .
2. Click **No** if asked to save changes.
3. Click **Open** to bring up the *Open* dialog.
4. Select "USGS DEM File (*.dem;*.ddf)" from the *Files of type* drop-down.
5. Select "josephpeak.dem", "marysvalecanyon.dem", "redridge.dem", and "trailmountain.dem" by holding down *Ctrl* and selecting each of them.

By selecting multiple DEMs, it is possible to import in all the quads needed at the same time. WMS is able to read in an unlimited number of DEMs at a time (based on the amount of RAM installed in the computer being used).

Multiple DEMs can be imported in the standard USGS format (from the WebGIS site), the SDTS format, or Arc/Info ASCII grid format. However, multiple formats cannot be used simultaneously in WMS. It is possible to export any DEM in the Arc/Info ASCII grid format in order to get them all to a common format).

Note that DEMs from the NED site are seamless, so it is unnecessary to tile them.

6. Click **Open** to exit the *Open* dialog and open the *Importing USGS DEMs* dialog (Figure 5).

If a specific DEM is selected in the *Files* section, a colored field will appear in the gray box in the *DEM Coverage* section of the dialog. The highlighted area in the colored field indicates the location of the selected DEM in relation to the other DEMs. The boundaries of the DEM area appear in the four edit boxes around the center box.

7. Click **OK** to close the *Importing USGS DEMs* dialog.

 

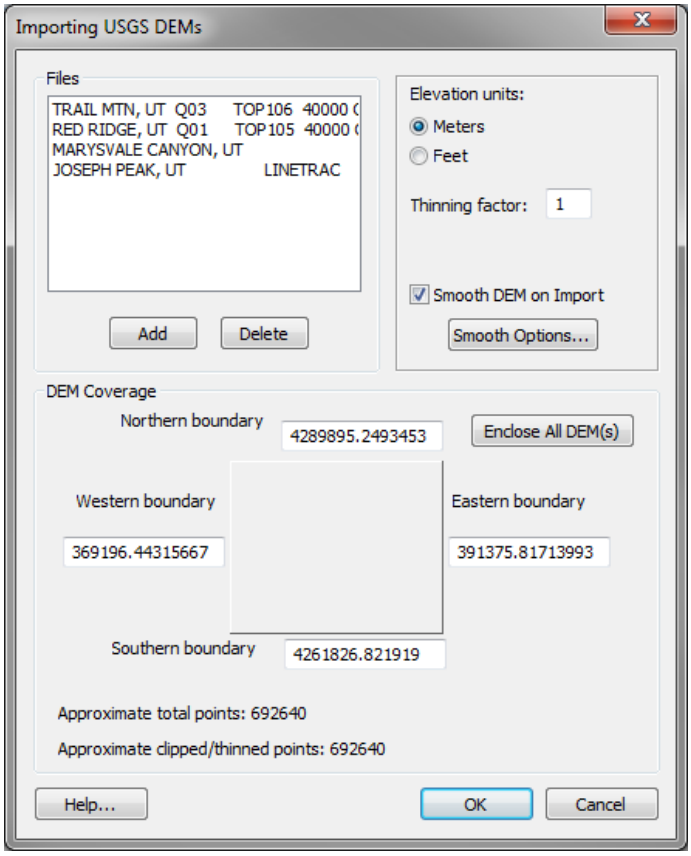


*Figure 5 Importing USGS DEMs dialog*

# 5 Trimming DEMs

WMS allows selecting the portion of the DEM needed and eliminating all of the surrounding elevation points. This can be done by creating a trimming polygon interactively.

## 5.1 Trimming DEMs

1. Switch to the **Terrain Data** module.
2. Under the "Terrain Data" folder, right-click on "trailmountain, redridge, marysvalecanyon, josephpeak" and select *Trim* | **Polygon…** to bring up the *Polygon Selection Options* dialog.
3. Select "Enter a polygon interactively" from the drop-down and click **OK** to close the *Polygon Selection Options* dialog.
4. Create a rectangular shaped polygon similar to the one in Figure 6 by clicking on the first three corners, then double-clicking on the last corner to finish the polygon and trim the DEM.

 

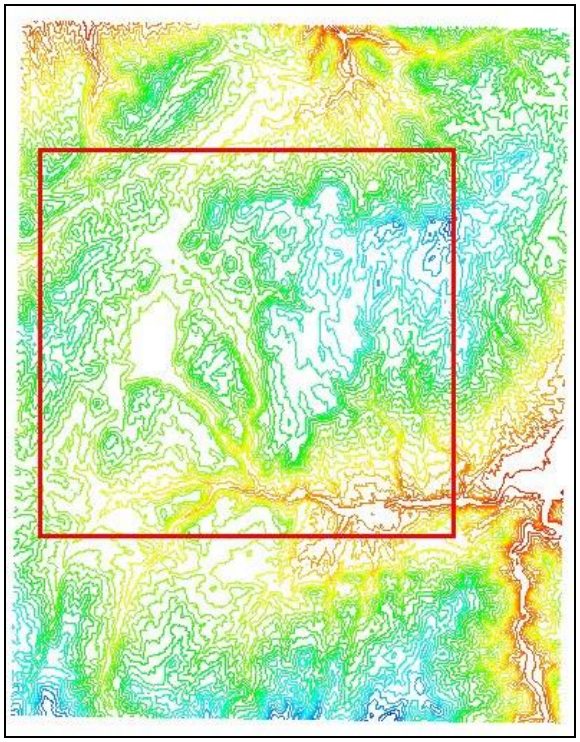

*Figure 6 DEM trim area*

A trimmed DEM should appear (Figure 7). Notice that both the original DEM and the trimmed DEM are listed under the "Terrain Data" folder in the Project Explorer.

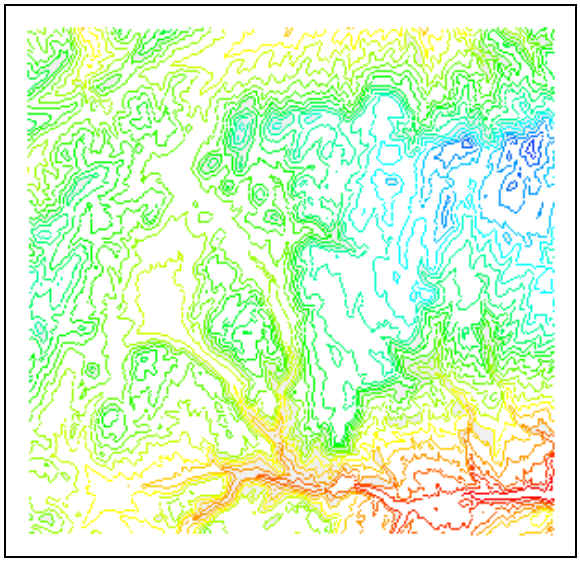

*Figure 7 The trimmed DEM*

# 6 Displaying DEMs

## 6.1 Contour Options

WMS has several contour display options for DEMs.

1. Right-click on "trailmountain, redridge, marysvalecanyon, josephpeak (Trimmed)" and select **Contour Options…** to bring up the *trailmountain, redridge, marysvalecanyon, josephpeak (Trimmed) Contour Options* dialog.
2. In the *Contour Interval* section, select "Number of Contours" from the drop-down and enter "10" in the field to the right of that.
3. Click **OK** to close the *trailmountain, redridge, marysvalecanyon, josephpeak (Trimmed) Contour Options* dialog.

Notice that there are fewer contours and they are spread farther apart.

4. Right-click on "trailmountain, redridge, marysvalecanyon, josephpeak (Trimmed)" and select **Contour Options…** to bring up the *trailmountain, redridge, marysvalecanyon, josephpeak (Trimmed) Contour Options* dialog.
5. In the *Contour Method* section, select "Color Fill" from the first drop-down.

This option fills the contours instead of using separated lines, making them smoother.

6. Near the bottom of the dialog, click **Legend…** to bring up the *Contour Legend Options* dialog.
7. In the *Legend Specifications* section, turn on *Display Legend*.
8. Click **OK** to close the *Contour Legend Options* dialog.
9. Click **OK** to close the *trailmountain, redridge, marysvalecanyon, josephpeak (Trimmed) Contour Options* dialog.

The Graphics Window should appear similar to Figure 8. Feel free to explore the various options in the *Contour Options* dialog.

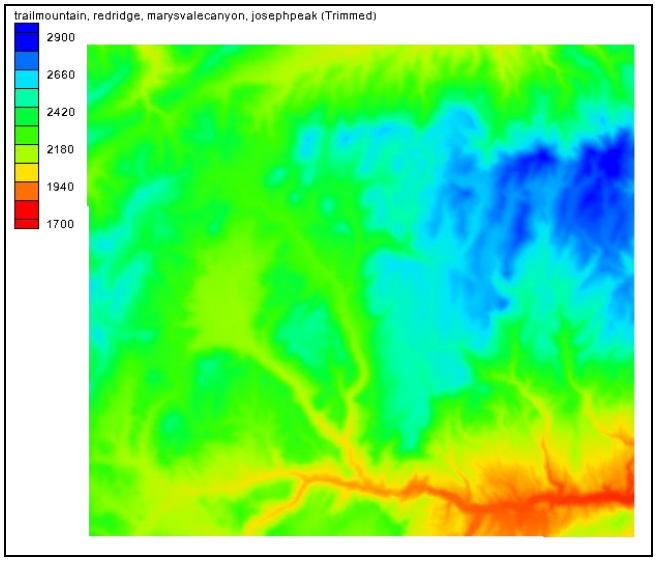


*Figure 8 Color filled contour map and legend*

## 6.2 Point Display Step

Now explore the point display step option:

1. Right-click on "  trailmountain, redridge, marysvalecanyon, josephpeak (Trimmed)" and select **Display Options…** to open the *Display Options* dialog.
2. Select "DEM Data" from the list on the left.
3. On the *DEM* tab, enter "4" as the *Point Display Step*.
4. Click **OK** to close the *Display Options* dialog.

Notice that the resolution has been reduced.

5. Right-click on "  trailmountain, redridge, marysvalecanyon, josephpeak (Trimmed)" and select **Display Options…** to open the *Display Options* dialog.
6. Select "DEM Data" from the list on the left.
7. On the *DEM* tab, enter "12" as the *Point Display Step*.
8. Click **OK** to close the *Display Options* dialog.

Notice that the resolution has been reduced further.

9. Right-click on "  trailmountain, redridge, marysvalecanyon, josephpeak (Trimmed)" and select **Display Options…** to open the *Display Options* dialog.
10. Select "DEM Data" from the list on the left.
11. On the *DEM* tab, enter "2" as the *Point Display Step*.
12. Click **OK** to close the *Display Options* dialog.

Raising the point display step allows the DEM display to refresh faster, especially on slower computers. Although WMS is not drawing every DEM point, each point that was imported is still there, so changing the point display step does not change the accuracy.

## 6.3 Shading Options

Now explore the shading options:

1. Select *Display* | **Display Options…** to bring up the *Display Options* dialog.
2. Select "Lighting Options" from the list on the left.
3. On the *Lighting Options* tab, turn on *Use light source*.
4. Click on the globe to move the light source (the direction of the light)
5. Adjust the slide bar to change the amount of ambient light.
6. Click **OK** to close the *Display Options* dialog.

Changing the position of the light source and the amount of ambient light alters the display of the DEM, giving it a more 3D appearance. Experiment with these options to accentuate the elevations that are most important to see.

 

## 6.4 Views

Plan view is the default view in WMS. The DEM elevations may be easier to see from a different viewpoint.

1. Select *Display* | *View* | **Oblique View** (or click the **Perspective View** macro).

It is now much easier to see the changes in elevation on the DEM. If the elevation relief cannot be clearly seen, change the Z-magnification to accentuate it.

2. Click **Display Options** to bring up the *Display Options* dialog.
3. Below the list on the left, turn off *Auto z-mag*.
4. Enter "3" as the *Z magnification*.
5. Click **OK** to close the *Display Options* dialog.

The image will redraw on its own, showing a clearer elevation relief (Figure 9).

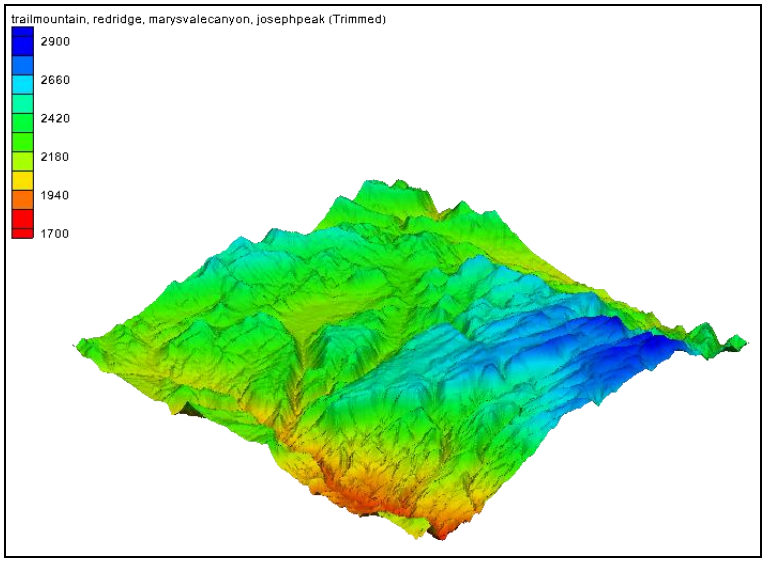


*Figure 9 Oblique view with lighting enabled*

# 7 Conclusion

This concludes the "Editing Elevations – DEM Basics" tutorial. DEM data for the United States is found in several places on the Internet. Data is available for most areas of the US and some parts of other countries. DEM data is very useful for delineating watersheds in WMS.

In this exercise, the following was discussed and demonstrated:

- Importing USGS DEMs in different formats
- Tiling multiple DEMs together
- Editing DEM elevations
- Setting DEM display options

 