Working with Rasters

A raster is a matrix of identically sized square cells. Each cell in a raster stores a value.

NED - The National Elevation Dataset (NED) is the primary elevation data product of the USGS. NED data are distributed in geographic coordinates in units of decimal degrees, and in conformance with the North American Datum of 1983 (NAD 83). NED data are available nationally (except for Alaska) at resolutions of 1 arc-second (about 30 meters) and 1/3 arc-second (about 10 meters), and in limited areas at 1/9 arc-second (about 3 meters).

Although one can store a raster in a GCS, this practice is not common because the inherent distortion gives an unsatisfactory view of the data. Therefore, raster data are normally stored in whatever projected coordinates system gives the best and most undistorted view of the data. The main exception occurs for data providers, such as the USGS, which provide topographic or other data in GCS format. Such data should be projected before it is used.

Processing NED datasets

- Unzip your NED datasets
- Add the DEMs to your project
- Build pyramids

Mosaic DEMs

A mosaic is a combination or merge of two or more images. In ArcGIS, you can create a single raster dataset from multiple raster datasets by mosaicking them together. In many cases, there will be some overlap of the raster datasets. These can be handled in several ways; you can choose to only keep raster data from the first or last dataset, you can blend the overlapping cell values you can take the mean, or you can take the minimum or maximum value.

- Open ArcToolbox
- Data Management Tools > Raster > Raster Dataset > Mosaic to New Raster
Create a raster mask

- Create a new shape file
- Digitize and irregular polygon
- Open ArcToolbox
- Conversion Tools > To Raster > Feature to Raster tool
- Click the Environments button
- In the Environment Settings window, click Processing Extent, click the list arrow for Extent, click Same as “New Layer” > OK
- Turn off “New Layer”
- Open symbology for new mask

TIP: Grids have stricter naming conventions than other ArcGIS files. Grid names must have no more than 13 characters and should contain only letters, numbers, or the underscore character.

TIP: Grids should NOT be stored in folders that have pathnames containing spaces because some functions will not work.

- Number of Bands - 1

While raster maps are rectangular, there is a way to display them as an irregular boundary. This can be accomplished by creating and using a mask. A mask is a raster map layer, and thus rectangular in shape, but it has the value “No Data” for cells outside your irregular boundary, which can display using no color.
- Change No Data values to a color

**Extract by using a mask**
- Open ArcToolbox
- Spatial Analyst tools > extract > Extract by Mask

**Clip raster by polygon**
- Open ArcToolbox
- Data Management Tools > Raster > Raster Processing > Clip
- Clip raster using Output Extent of “New Layer”
- Compare results to previous results

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**Surface Analysis**
Surface analysis included a set of functions for calculation properties of a surface, such as slope and aspect. Commonly applied to elevation data, these functions can be used on any type of continuous grid.

- A surface map from contouring the grid
- A slope map showing the steepness of the terrain
- An aspect map, showing the compass direction of the slope
- A hillshade map, representing the surface as though an illumination source where shining on it
- A viewshed analysis to determine what part of the surface can be seen.

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**Understanding Hillshade**
- Shadows drawn on a map to simulate the effect of the sun’s rays over the varied terrain of the land
- The hypothetical illumination of a surface according to a specified azimuth and altitude for the sun
- Creates a three-dimensional effect that provides a sense of visual relief for cartography, and a relative measure of incident light for analysis
- It can greatly enhance the visualization of a surface for analysis or graphical display

**Create a hillshade**
- Open ArcToolbox
- Spatial Analyst Tools > Surface > Hillshade or 3D Analyst Tools > Raster Surface > Hillshade
- Use the default values
- How does it look?
- Run it again using the new Z-factor parameter
- Now how does it look?
- Try changing to Azimuth and Altitude to see if the change will bring out the structures that you are interested in.

**NOTE:** There is a problem when generating hillshades, the problem is in the Z units. They should be the same as the X, Y units. In the NED dataset the X, Y are in decimal degree units and the Z is in meters. With Arc GIS hillshade there is a Z-factor parameter which needs to be set to 0.00001 to scale the meters to decimal degrees.