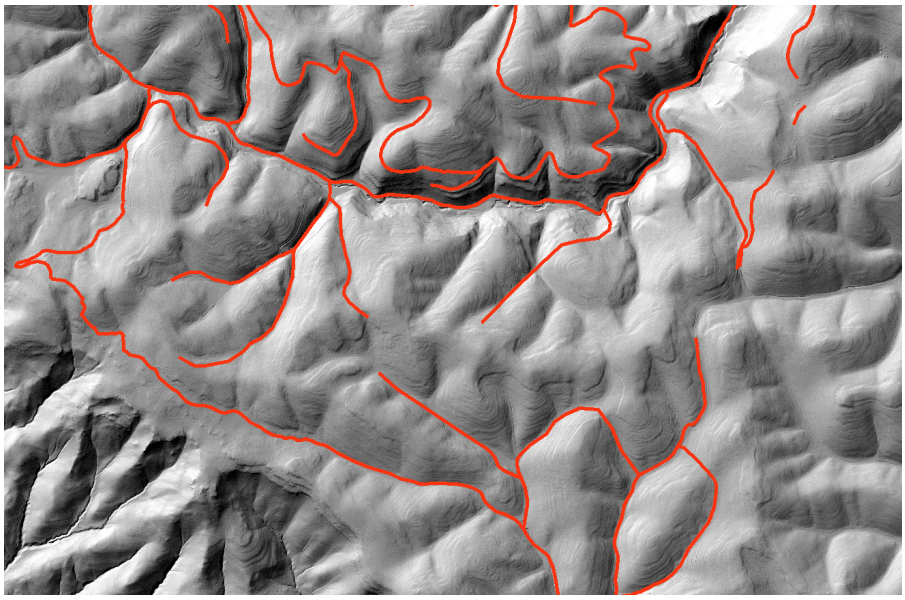
Last Updated: February 2022
Version: ArcMap 10.7

Exercise 2a
Identifying and Digitizing Roads



Introduction

Lidar derived DEM products can be used as background images for heads-up digitization to produce more accurate and complete road networks than what can be achieved with just aerial photos. This is because lidar has the unique capability to penetrate forest canopies and thus provide a more accurate depiction of the ground in forested areas. Accurate road databases are critical for planning future roads, analyzing stream-road interactions, watershed management, and other management applications. This exercise will teach you how to heads-up digitize roads by using DEM products and aerial imagery.

Objectives

- Identify roads using a variety of geospatial data layers
- Create a shapefile and use it to digitize and attribute roads

Required Data

- **Lincolnnf_dem_south.tif**
- **Lincoln_NF_NAIP2020_5M.tif**
- **South_roads.shp** – reference layer of digitized roads

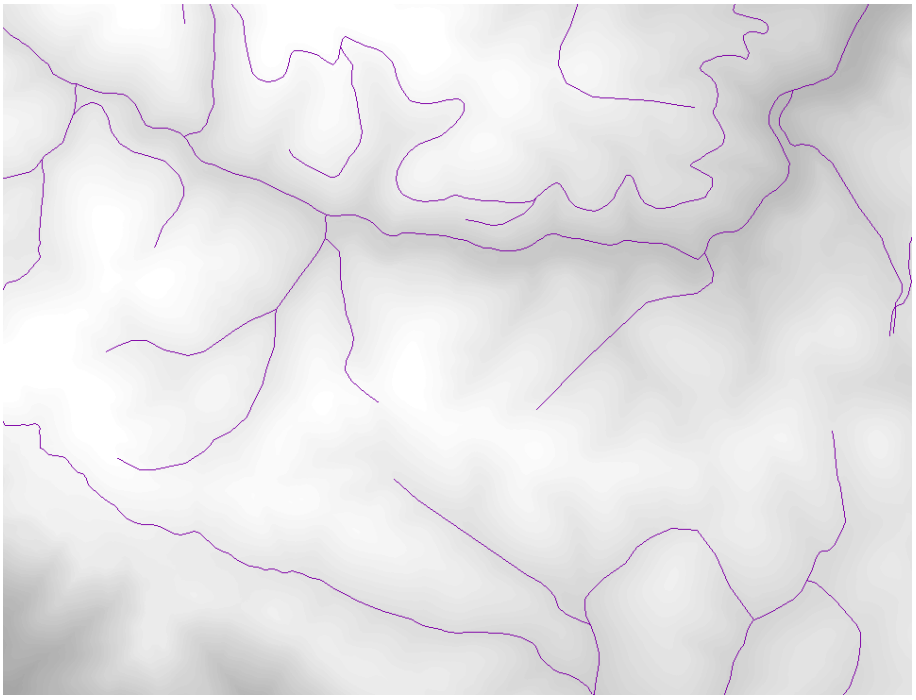
Prerequisites

- ESRI ArcMap installed on computer
- Basic understanding of how to use ArcMap**.**

Table of Contents

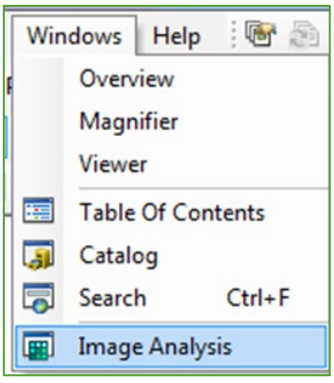
Part 1: Load Data Layers into ArcMap

1. Launch ArcMap from the start menu by clicking **Start, Programs, ArcGIS, ArcMap 10.7**.
2. Click the **Add Data** button and navigate to the South_Data\DEM folder within your course data folder.
3. Add the **Lincolnnf_dem_south.tif** layer.
4. Add the **South_roads.shp** layer from the South_Data\Vector folder and make sure it is above the DEM in the table of contents.
5. Notice that the roads in the shapefile aren't visible or apparent on the DEM.



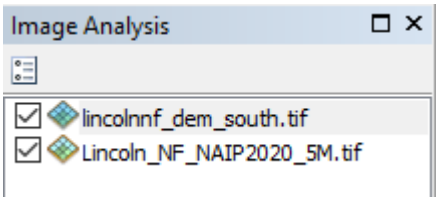
Part 2: Create Hillshade Layers

1. On the ArcMap main menu, click **Windows**, then **Image Analysis** to turn on the Image Analysis tool (see following graphic).



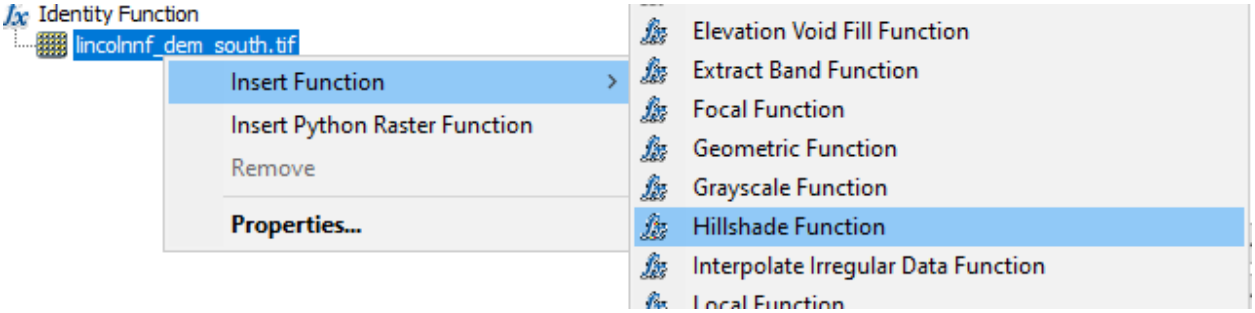
*Note: The **Image Analysis Window** is a powerful tool that allows users to explore their raster based images in a quick and convenient manner. The functionality built into this window are available elsewhere within ArcMap but the Image Analysis Window generates all products within RAM which enables the quick display and creation of the most commonly used raster products.*

2. The Image Analysis tool will open. Dock it if desired; you may need to click and drag the bottom of the window down to view the entire tool. Most of the tools will be greyed out.
3. In the top window, click on the **lincolnnf_dem_south.tif** layer. Notice that when you do, most of the tools within the Image Analysis Window will now be available.

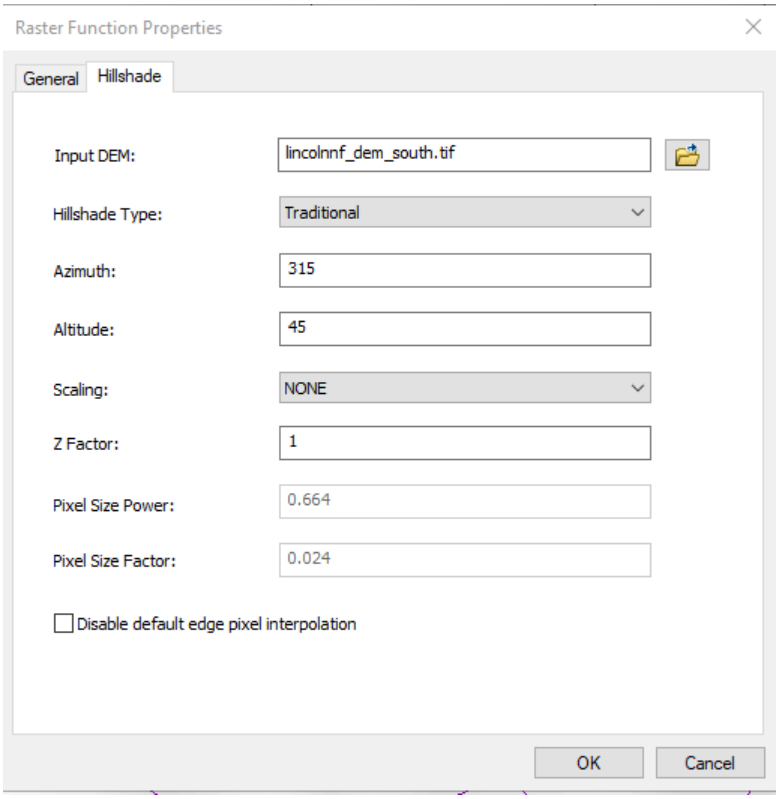


4. In the Processing section click on the **Add Functions** button.

5. In the **Function Template Editor** dialog, right-click on the DEM image at the bottom of the Function Chain, click on **Insert Function**, and select the **Hillshade Function** (see below).

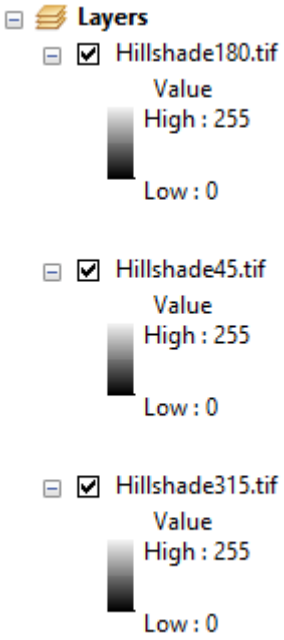


6. In the Raster Function Properties dialog, make sure the **Azimuth** field value is **315**. An azimuth of 315 means the hillshade will be illuminated from 315 degrees (northwest). You may leave the other settings at their default.
7. Click **OK** (see below).



8. Click **OK** in the **Function Template Editor.** You should now see the hillshade layer in the table of contents.
9. In the table of contents, double-click the hillshade layer to open Layer Properties. Under the General tab, change the Layer Name to **Hillshade315.tif** (see below).
   i. Alternatively, select the layer in the table of contents, then click it one more time to edit the name without opening the Layer Properties window.

10. Repeat steps 4 – 8 to create two more hillshades with azimuths set to **45** and **180**.
11. You should now have three hillshade images with azimuths of 315, 180, and 45 (see below).

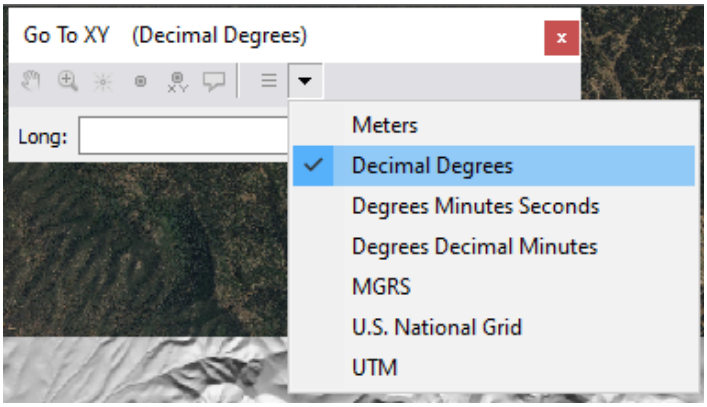


Part 3: Compare Image Layers

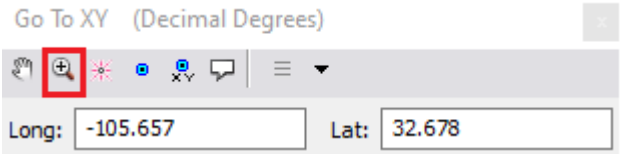
Next you will compare the data layers based on how visible the roads are on them. You will first add NAIP imagery and then use given coordinates to explore three areas.

1. Click the Add Data button, then navigate to your NAIP folder and add **Lincoln_NF_NAIP2020_5M.tif.**
2. On the **Tools** toolbar, click the **Go To XY** button (see below).

3. On the Go To XY tool, click the **Units** button then select **Decimal Degrees** (see below).



4. In the **Long:** field enter -**105.657** and in the **Lat:** field enter **32.684.**
5. Click the **Zoom To** button (see below).



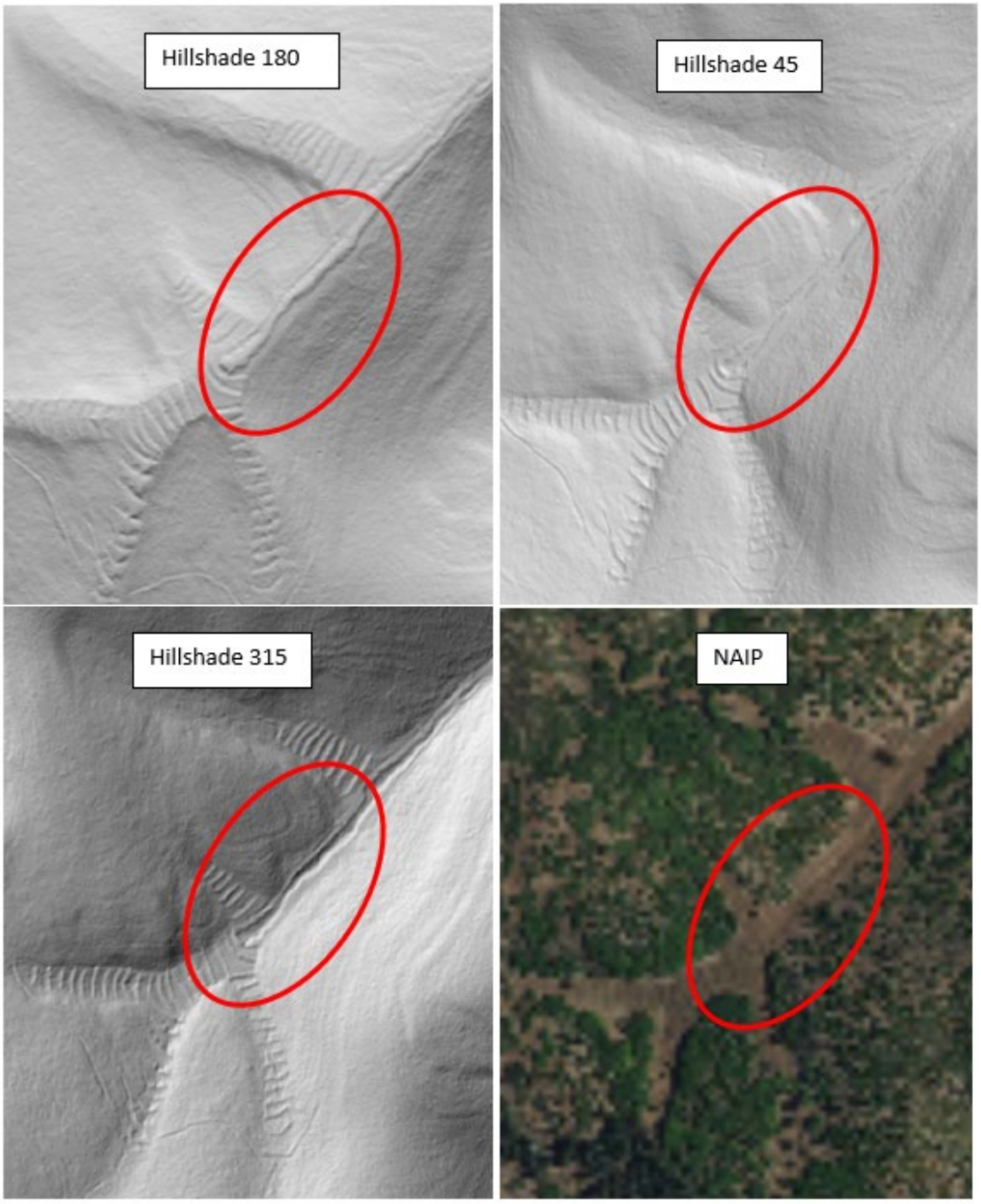
6. Notice the road in the middle of the scene at the bottom of the drainage. Click on the **South_roads.shp** layer to see exactly where this road is.

i. Turn off all layers except the **NAIP** imagery (click the check box next to the layer in the table of contents) and notice how the road is somewhat difficult to see.

ii. Look at the road on the **Hillshade 180** layer. It's a little easier to see than in the NAIP.

iii. Look at the road on the **Hillshade 45** layer.

iv. Look at the road on the **Hillshade 315** layer. Notice how much better the road shows up on this layer than all the others (see below).



7. Open the **Go to XY** tool again and enter the following coordinates:
   i. Long: -**105.726**
   ii. Lat: **32.690**
8. Click the **Zoom To** button and study the roads layer in this area and compare how visible the roads are in the NAIP and hillshade images.
   i. Can you find sections of road that are more visible in the NAIP than the hillshades?
9. In the **Go to XY** tool enter the following coordinates and click the **Zoom To** button:

i. Lont: -**105.636**

ii. Lat: **32.672**

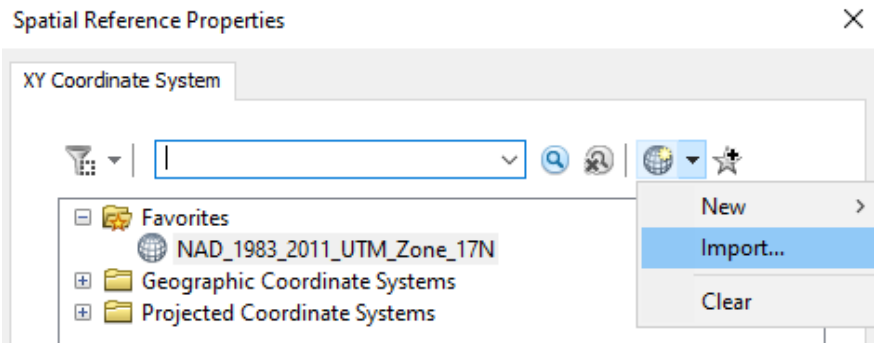
10. Which hillshade layer provides the best visualization of roads in this area?

Part 4: Create New Shapefile

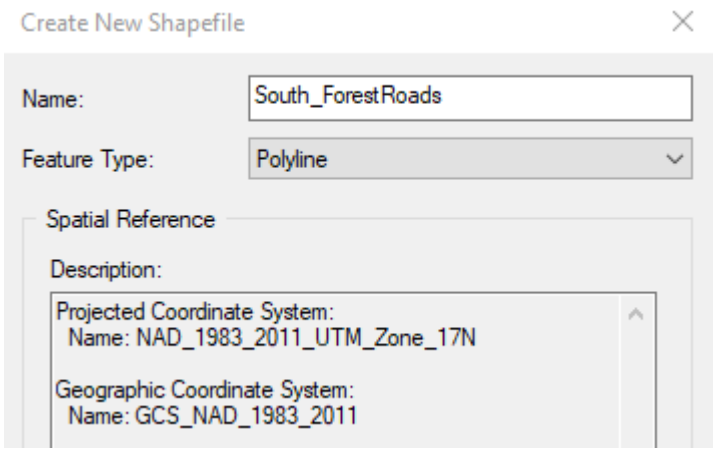
Before you can start digitizing roads you must create a shapefile.

1. Open the ArcCatalog window that is available within ArcMap. It may be docked to the side of your ArcMap session. If you don't see it, click the ArcCatalog button at the top of your ArcMap (see below), then dock it to the side of your window.

2. In the **ArcCatalog** pane, navigate to your course data folder (South_Data\Vector).
3. Right-click the folder, click **New**, then select **Shapefile…**
4. In the **Name** field, type a name like **Forest Roads.**
5. Next to **Feature Type**, select **Polyline**.
6. Click on **Edit** below the **Spatial Reference** section.
7. Click the **Add Coordinate System** button then click **Import** (see below).



8. Navigate to your course data folder and add the **South_roads.shp** or **lincolnnf_dem_south.tif** layer. This applies the spatial reference of the file you chose to the new shapefile.
9. Click **OK.**
10. Your **Create New Shapefile** dialog should look similar to the graphic below.

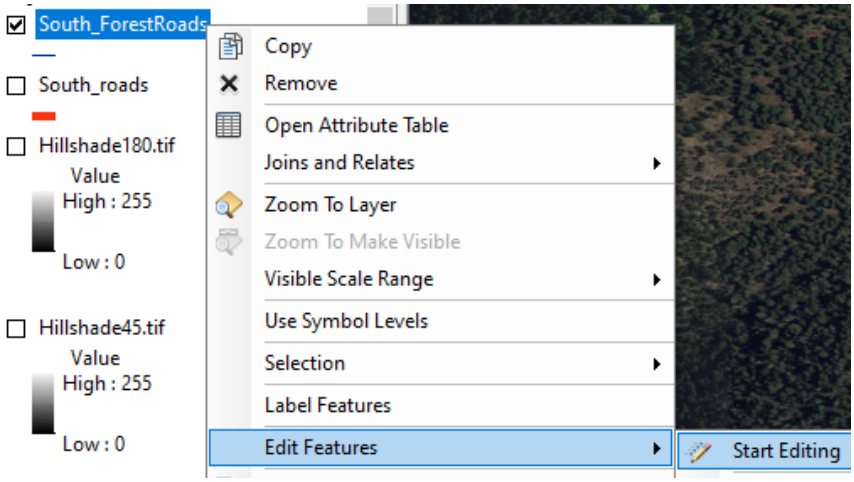


11. Click on **OK**.
12. The shapefile should be added to ArcMap automatically. If not, add it to the map.

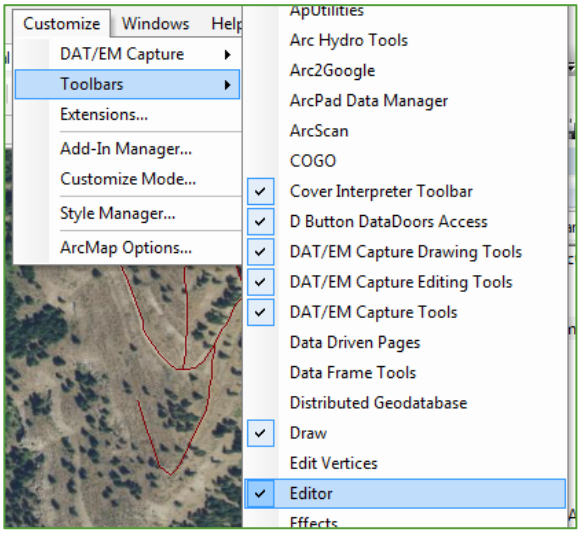
Part 5: Digitize Roads

Now you have the images and shapefile ready to digitize roads.

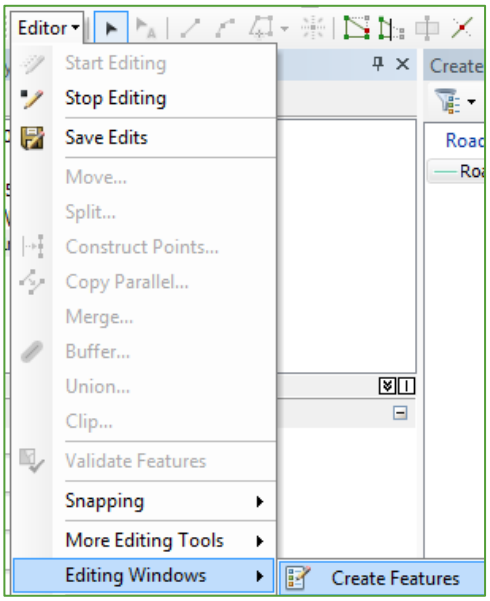
1. Use the NAIP and all three hillshade layers to find roads to digitize.
2. In the Table of Contents, right-click on the shapefile you just created then click **Edit Features | Start Editing** (see below).



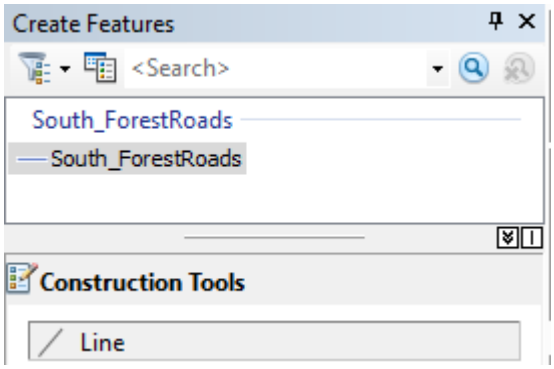
3. Open your **Editor toolbar** by going to **Customize | Toolbars** and then place a check next to **Editor.**



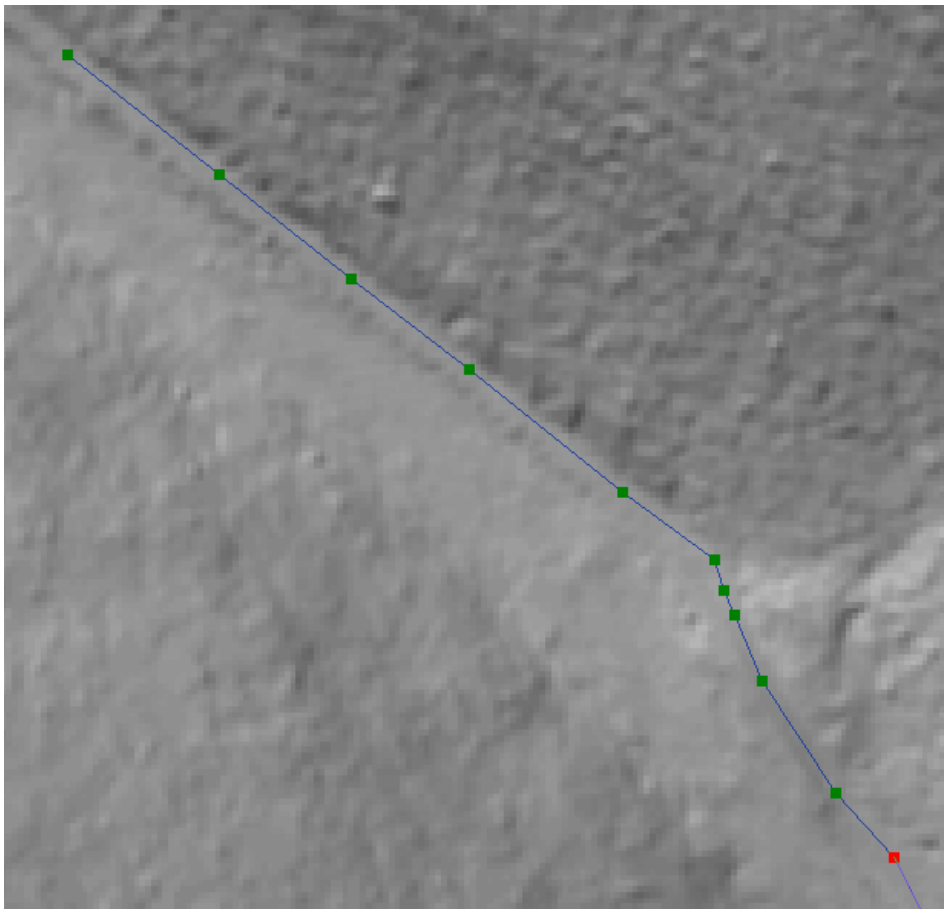
4. Click the Editor drop-down menu, then go to **Editing Windows** and click **Create Features** to open the Create Features window.



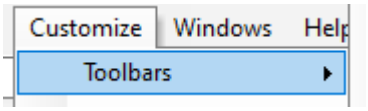
5. In the Create Featuers window, click on your road shapefile, then in the **Construction Tools** window below click **Line** (see below).



6. Your cursor should now be a cross and you can start digitizing a road by left-clicking. A higher zoom level is often desireable for digitizing features.
   i. Keep left-clicking to create vertices in the polyline (see below).



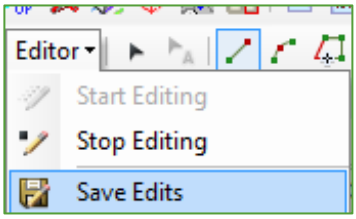
7. Double left-click to finish your edit.
8. If you continue digitizing more roads that connect to other segments you have created, make sure to turn on your snapping. You can do this by going to “Cutomize”, “Toolbars”, “Snapping”.



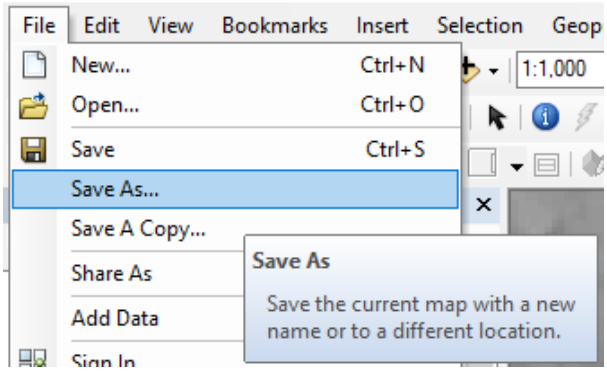
i. Make sure to set your snapping to be "End Snapping", "Vertex Snapping", and "Edge Snapping".

IMPORTANT: *It is essential to properly attribute your newly digitized roads so that they can be included in Forest Service's infrastructure database (a.k.a. "Infra"). Review the Travel Routes National Data Dictionary & National Business Rules for Roads, updated May 2021, and for support see NRM Roads Support.*

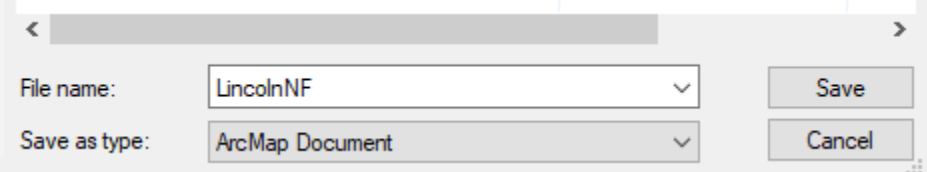
9. It's a good idea to save your edits every 10 minutes or so in case ArcMap crashes. Click the Editor toolbar dropdown menu then **Save Edits** (see below).



10. If desired, you can save your map as a .mxd file so that all of the settings and data layer paths of the map are saved.
    i. On the main menu, click **File | Save As** (see below).



    ii. In the **Save As** dialog, enter a map name and make sure the **Save as type** field is set to **ArcMap Document (*.mxd)**. See below.



Congratulations! You have completed this exercise, which has taught you the tools you need to create hillshades from a DEM to identify features on a landscape.