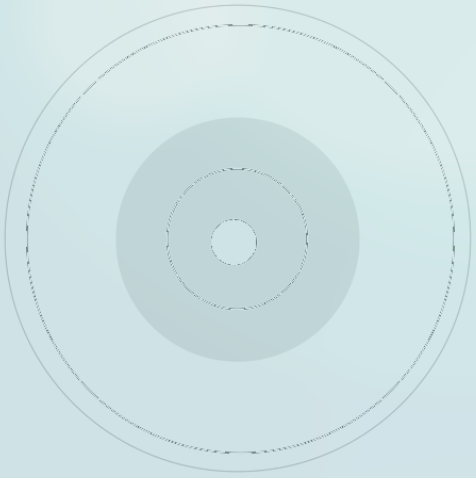
Elevation



Lesson Overview

Your computer and television screens are essentially rasters. If you zoomed in close enough to those screens, you would see equal-sized pixels—each cell being represented by a single value—creating images showing depth.

In this lesson, you'll create a raster layer from point data showing elevation in the Mexican state of Oaxaca. And like your television and computer, you'll add color to those pixels so your audience can distinguish between mountain peaks and valley floors.

Unlike vector maps, which use point data, raster maps lend themselves well to displaying continuous flow data, showing changes such as those involving rainfall, temperature, and soil. They are also well suited to showing elevation changes such as the ones you'll create in this exercise. Vector maps use x- and y-coordinates to display points, lines, and polygons. Vector maps are better equipped to show specific locations such as cities, roads, and rivers.

Builds Skills in These Areas

- Creating raster layers from point data
- Classifying data
- Changing basemaps

Software Requirements

- ArcGIS Online account (obtain a free ArcGIS Public Account or ArcGIS trial)

Estimated Time

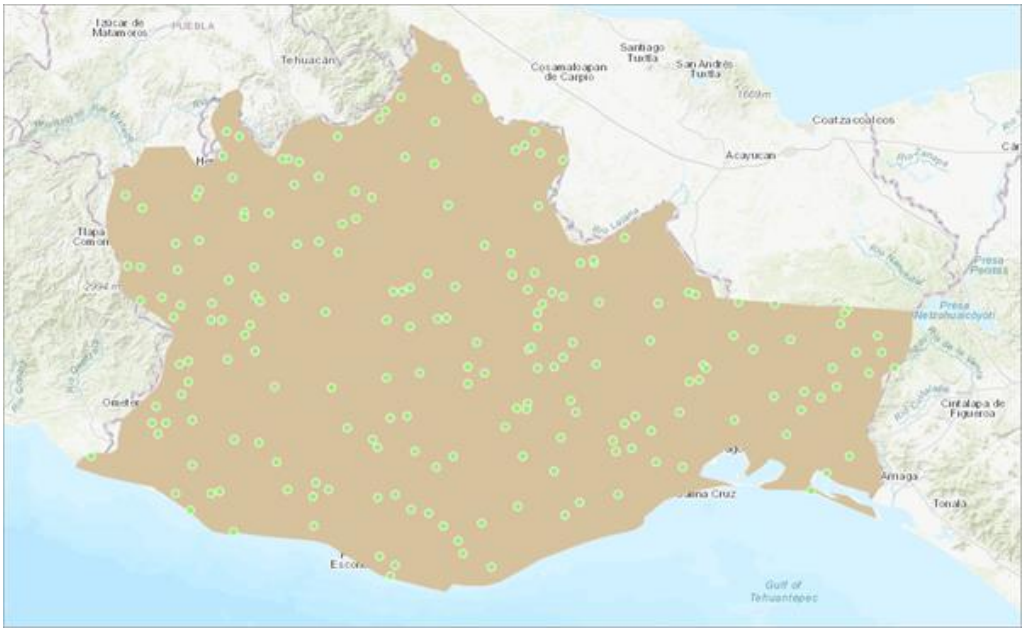
- 30 minutes – 1 hour

Exercise

Step 1: Open the map

You'll start with a map of Oaxaca, one of 31 states in Mexico.

1. Sign in to your ArcGIS organizational account.
2. Open the map of Oaxaca.



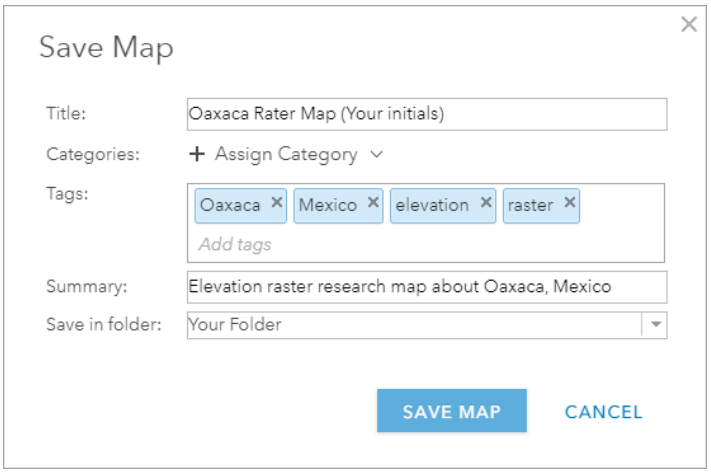
You'll save your map, with appropriate metadata, so you can open it later.

3. On the ribbon, click **Save** and **Save As**.
4. In the **Save Map** window, do the following:
    - For **Title**, type **Oaxaca Raster Map** (add your initials to ensure the map name is unique within your organization).

Note: New maps, as well as the results of geospatial tools, must have unique names within your organization; otherwise, the URLs from those layers would conflict. Once the layer has been created, you can rename it without your initial or name.

- For **Tags**, delete any current tags and type **Oaxaca**, **Mexico**, **elevation**, and **raster** (press ***Enter*** after each tag).

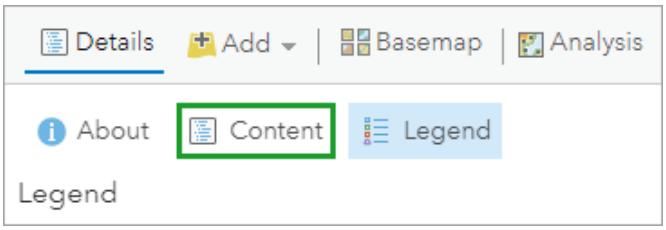
- For **Summary**, type **Elevation raster research map about Oaxaca, Mexico.**
- Save in your folder.



- Click **Save Map**.

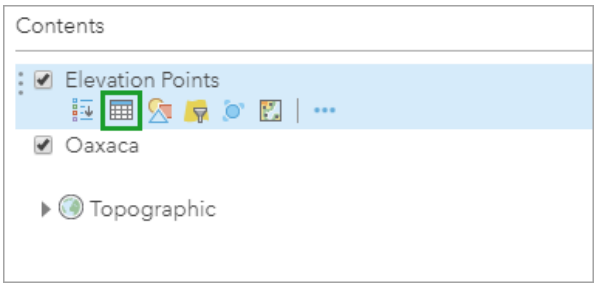
The map is saved to your My Content folder.

5. If necessary, click the **Content** button.



It's always worth your time to familiarize yourself with your data before starting. That way, you'll have the context needed to better understand the geospatial tool you'll be using.

6. In **Contents**, point to the **Elevation Points** layer and click the **Show Table** button.



7. Use the **Elevation Points** table to answer these questions:

Q1. How many elevation data points are in the Elevation Points layer?

A1. _____

Q2. What unit of measure is used for elevation?

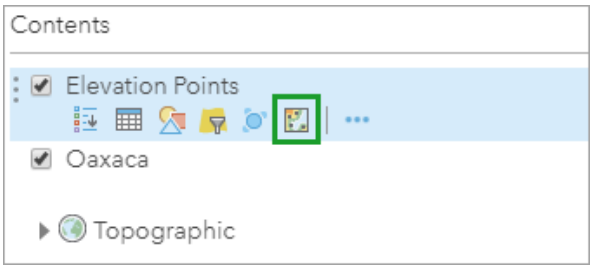
A2. _____

8. Click the **Show Table** button to close the **Elevation Points** table.

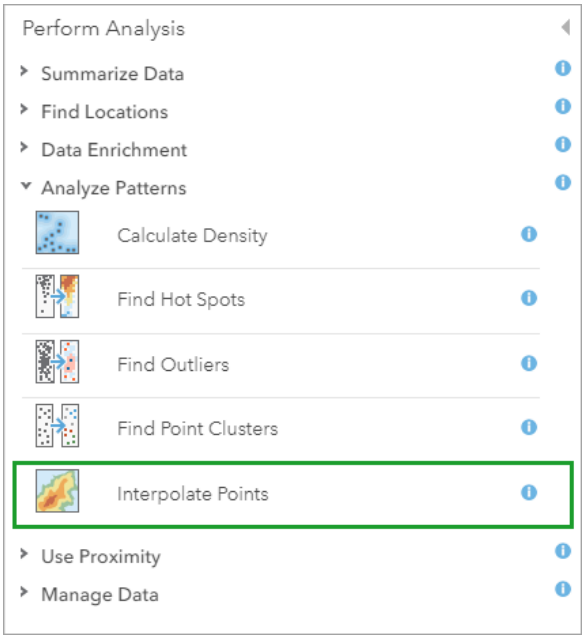
Step 2: Create a continuous surface map

Vector and raster are the two primary ways spatial data is displayed on maps. Vector maps can be converted to raster maps and vice versa. In general, when working with continuous data, raster maps are preferred because pixels are easier to work with than coordinate pairs.

1. In **Contents**, point to the **Elevation Points** layer and select **Perform Analysis**.



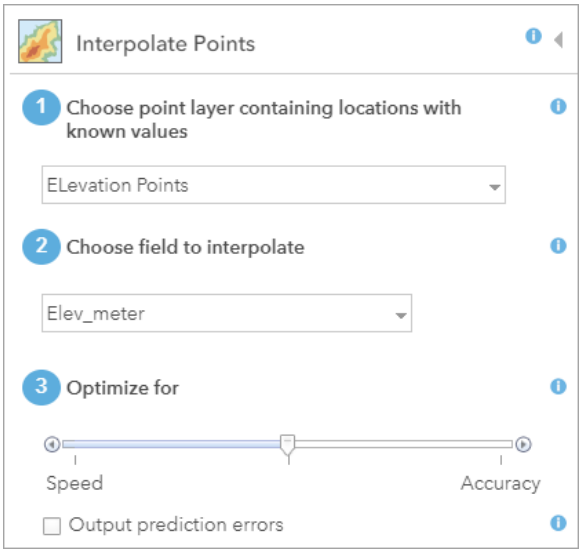
2. Click **Analyze Patterns** and select **Interpolate Points**.



Note: You can learn more about any geospatial tool by clicking the blue information icon.

The Interpolate Points geospatial tool uses the data points from your Oaxaca vector map to predict the data missing in nearby cells. By adding the missing data, the tool adds the values needed to complete a continuous surface layer.

3. In the Interpolate Points tool, do the following:
    - For **Choose point layer containing locations with known values**, verify that **Elevation Points** are selected.
    - For **Choose field to interpolate**, select **Elev_meter**.
    - For **Optimize for**, accept the default setting.



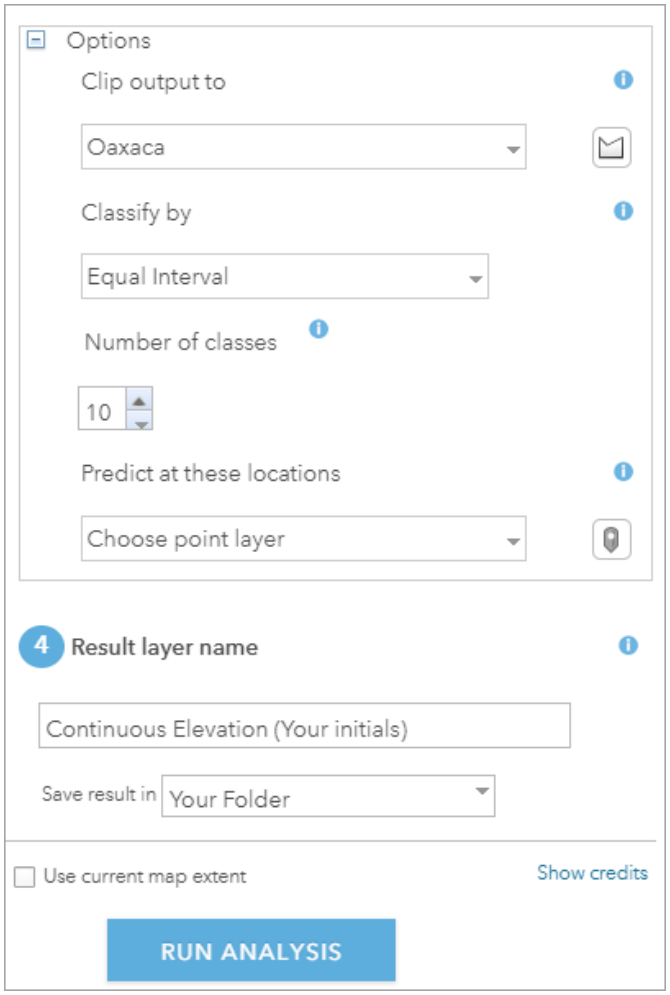
    - Expand **Options**.

Many parameters in the Options box are self-explanatory; however, some parameters could use some clarification. In this geospatial tool, you'll accept the 10 as the default number of classes because that number won't overwhelm the elevation ranges, as well as their accompanying colors, that will appear in your legend. If you have too few classes in your legend, the elevation ranges would be too vague to be of any value; if you have too many classes in your legend, your audience might be confused by an overwhelming number of colors and numbers. Also, selecting the **Predict at these locations** setting tells the tool which layer it should pick to create the information needed for interpolation.

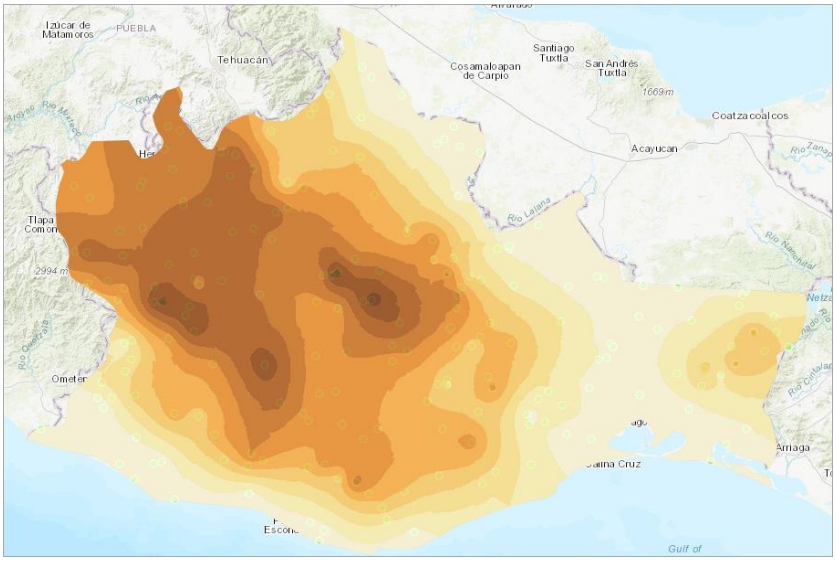
- In the expanded **Options** box, do the following:
    - For **Clip Output to**, select **Oaxaca**.
    - For **Classify by**, select **Equal Interval**.
    - For **Number of classes**, verify **10**.

- For **Predict at these locations**, accept the default **Choose point layer**.

- For **Result layer name**, delete the default name and type **Continuous Elevation** and add your initials.
- Save in your folder.
- Uncheck **Use current map extent**.



- Click **Run Analysis.**



The Interpolate Points tool converted 199 elevation data points into a raster, which created a continuous surface map. The darker the color, the higher the elevation.

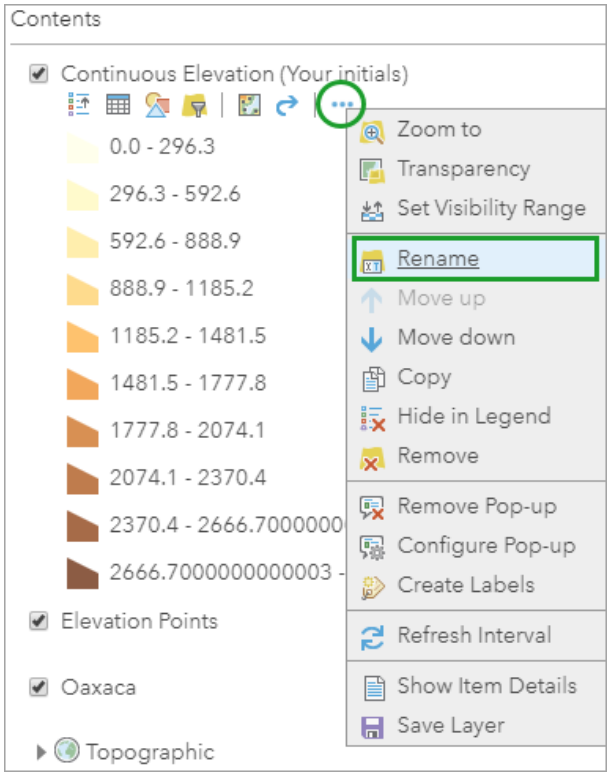
4. In **Contents**, point to the **Continuous Elevation** layer and click the **Show Legend** button.

The legend shows the elevation ranges for each color. On the map, you can click a color to see its elevation range. (You may need to click through the white arrows within the pop-ups to see the pop-up showing elevation.)

Q3. How did the Interpolate Points tool predict the values needed to complete the continuous flow? (Hint: Check the tool's icon)

A3. _____

5. On the **Continuous Elevation** layer, click the **More Options** button.



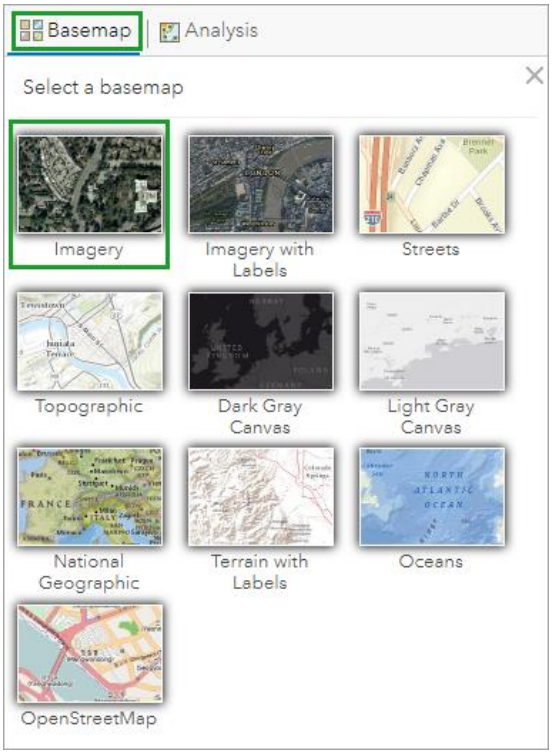
6. In the **Rename** window, delete your initials and press ***OK***.

Step 3: Symbolize the elevation map and set transparency

At this point, you have a map showing a continuous layer map imposed over Oaxaca. By adjusting the transparency level and changing the basemap, you'll make the map more meaningful.

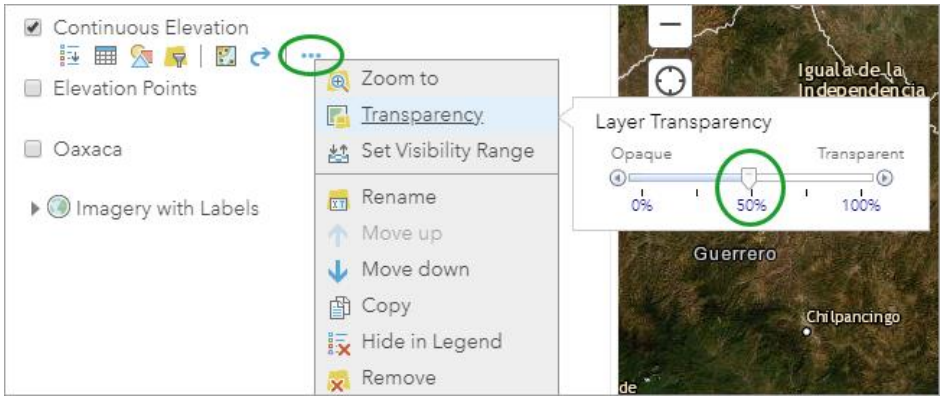
First, you'll declutter your map so you can focus your audience on what you want them to see.

1. Uncheck the layers for **Elevation Points** and **Oaxaca**.
2. On the ribbon, click **Basemap** and select **Imagery**.



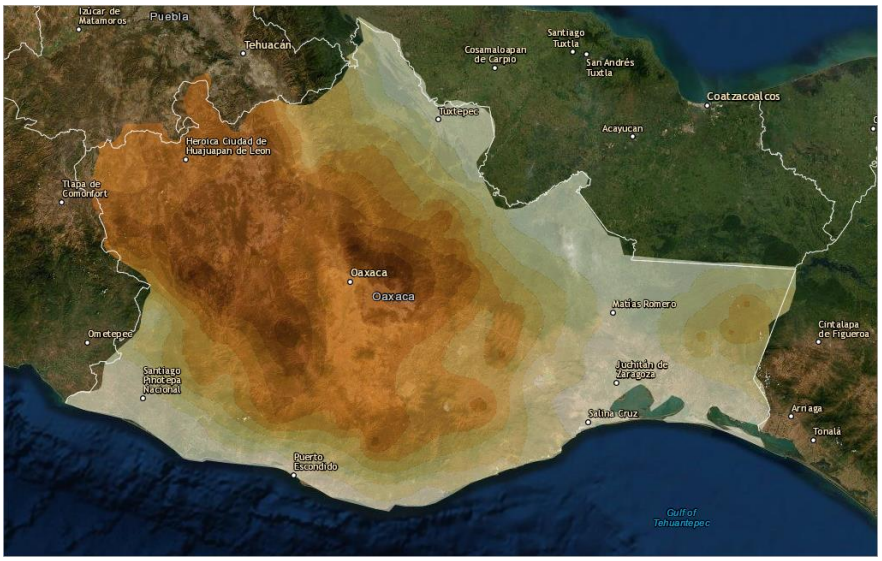
Your map now has imagery, but the opaqueness of the **Continuous Elevation** layer is obscuring it.

3. In **Contents**, point to the **Continuous Elevation** layer and click **More Options**.
4. Point to **Transparency**, and in the **Layer Transparency** window, slide the marker to **50%**.



By adjusting the transparency, your map now blends the **Continuous Elevation** layer with the imagery underneath to create a meaningful map showing Oaxaca's terrain. By changing the basemap again, you can add even more context to your map.

5. Click **Basemap** and select **Imagery with Labels**.
6. If necessary, click the **Show Legend** button on the **Continuous Elevation** layer.



The basemap now shows the cities and political boundaries of Oaxaca and surrounding states.

Q4. Your map contains 10 elevation ranges with 0 representing the lowest and 9 representing the highest. Click the darkest brown area near the city of Oaxaca. How many square miles are in the continuous elevation layer in the highest elevation class?

A4. _____

Q5. Your map now lists eight cities in Oaxaca. How many cities are located within the continuous elevation layer measuring between 0 meters in elevation and 296 meters in elevation?

A5. _____

In this exercise, you created a continuous surface image by interpolating point data using the variable of elevation. By using a geospatial tool and changing basemaps, you took the map's original vector data and created a continuous flow map with more context involving elevation and cities.

Exercise Answers

Q1. How many elevation data points are in the Elevation Points layer?

A1. 199

Q2. What unit of measure is used for elevation?

A2. Meters

Q3. How did the Interpolate Points tool predict the values needed to complete the continuous flow layer? (Hint: Check the tool's icon)

A3. As indicated in the Interpolate Points information icon, the tool predicted values of those new locations by basing them on measurements found in known collection points.

Q4. Your map contains 10 elevation ranges with 0 representing the lowest elevations and 9 representing the highest elevations. Click the darkest brown area near the city of Oaxaca. How many square miles are in the continuous elevation layer in the highest elevation class near the city?

A4. 23.15

Q5. Your map now lists eight cities. How many cities are located within the continuous elevation layer measuring between 0 meters in elevation and 296 meters in elevation?

A5. Six

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About the Author

Kathryn Keranen is an award-winning teacher and author. She serves as an instructor in geographic science at James Madison University and is the co-founder of the award-winning Geospatial Semester. With Bob Kolvoord, she is the co-author of the *Making Spatial Decisions* series from Esri Press.

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