

## Explore vector and raster data

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You are going hiking in Yellowstone National Park. You will hike the Fawn Pass trail from east to west, beginning at the trailhead in the Mammoth ranger district and ending at the cabin along the western district margin.

Before you begin, you will explore vector and raster data on a GIS map to determine the distance you will hike, the elevation of the trail, which areas might get rain, what type of plants and trees you will see, and what the terrain will be like.

After completing this exercise, you will be able to:

- Measure the length of a line feature.
- Use an elevation layer to assess the steepness of a trail.
- Use a precipitation layer to assess the amount of rainfall along a trail.
- Use a vegetation layer to identify the vegetation types along a trail.
- Use an aerial photograph to visualize the terrain along a trail.

Estimated time to complete: 30 minutes

### ***Before you begin***

The data for this exercise is contained in the following files:

- **StartGIS.exe** (Course data file)
- **Data.exe** (Module data file)

If you have not downloaded one of these files, you should [download the data now](#).

Need help? [Course data instructions](#)

### **Step 1 Start ArcMap and open a map document**

Start ArcMap and choose to start using ArcMap with an existing map.

Browse to your **VirtualCampus\StartGIS\Data** folder.

Click **Mammoth\_Trails.mxd**, then click Open.

You see a map of Yellowstone National Park with campgrounds, peaks, rivers, roads, lakes, and ranger districts.

#### **[VIEW RESULT](#)**

 [Can't find your data?](#)

### **Step 2 Display the Fawn Pass trail**

In this step, you will zoom in to the Mammoth ranger district, turn on the Fawn Pass trail, and zoom to it.

The Mammoth ranger district is in the northwestern quadrant of Yellowstone.

From the Tools menu, choose My Places.

In the My Places dialog box, click Mammoth, then click Zoom To.

**Note:** If your My Places dialog box is empty or you do not see Mammoth in the list of places, click Load and browse to your **VirtualCampus\StartGIS\Data** folder and double-click **myplaces.dat**.

The map zooms in to the Mammoth ranger district.

Move the My Places dialog box out of the way, if necessary, so you can see the map.

In the table of contents, click the plus sign next to the Fawn Pass layer to expand its legend.

Check the box next to the Fawn Pass layer to turn it on.

You see the Fawn Pass trail with its trailhead on the right where you will begin your hike, and a cabin on the left where you will end your hike.

[VIEW RESULT](#)

In the table of contents, right-click Fawn Pass and choose Zoom To Layer.

You are now zoomed in to the entire trail. You can see that it extends beyond the Mammoth ranger district into the neighboring Gallatin ranger district.

The Fawn Pass layer is vector data. Vector data is used to represent features that have well-defined shapes and distinct boundaries.

[VIEW RESULT](#)

[REVIEW CONCEPT](#)

### Step 3 Measure distance along the Fawn Pass trail

In this step, you will measure the length of the Fawn Pass trail that you plan to hike, from the trailhead to the cabin. First, you will zoom in for a closer look.

Use My Places again to zoom to Fawn Pass.

Now you should be zoomed in to the portion of the trail you will measure.

[VIEW RESULT](#)

Close the My Places dialog box.

On the Tools toolbar, click the Measure tool .

The Measure window opens.

At the top of the Measure window, click the down arrow button, point to Distance, and click Miles.

[VIEW RESULT](#)

To start measuring the trail, click the beginning of the red line on the right.



To measure the trail, move your mouse pointer along the red line to trace it in the direction of the cabin. Each time the trail changes direction, click.

Continue clicking along the trail to measure it. When you reach the cabin, double-click to end the line.



In the Measure window, look at the results for Length.

? Approximately how long is the Fawn Pass trail from the eastern trailhead to the cabin?

- 6 miles
- 8 miles
- 10 miles
- 12 miles

Close the Measure window.

#### Step 4 Measure elevation along the trail

In this step, you will examine the elevation values along the trail and determine whether you will be hiking uphill or down. The elevation data is a raster dataset.

Turn on the Elevation layer and expand its legend.

Each cell in this raster layer contains an elevation value.

Look at the Elevation legend.

? What is the range of elevation values?

▶ [Answer](#)

Look at the map.

The elevation raster covers most of the area between the trailhead and the cabin.

? Where is the highest elevation along the trail? Hint: Look at the colors in the legend.

- Near the beginning of the trail (eastern trailhead)
- Near the middle of the trail, half-way between the trailhead and the cabin
- Near the cabin
- The elevation doesn't change along the trail

Now you will determine the elevation along the Fawn Pass trail.

On the Tools toolbar, click the Identify button .

The Identify window opens.

In the drop-down list at the top of the Identify window, choose Elevation.

[VIEW RESULT](#)

Click the trail at the eastern (right) edge of the elevation map.

? What is the approximate elevation of the trail at this location? Hint: The elevation is stored in the Pixel value attribute.

- 7400 feet
- 7800 feet
- 8200 feet
- 8600 feet

Now click the trail at the western edge of the elevation map.

? What is the approximate elevation of the trail at this location?

- 7400 feet
- 7800 feet
- 8200 feet
- 8600 feet

? Will you be hiking uphill or downhill to reach the cabin?

▶ Answer

Close the Identify window.

Turn off the Elevation layer and collapse its legend.

### Step 5 Measure precipitation along the trail

In this step, you will examine a raster dataset that represents precipitation to determine where along the trail it is most likely to rain.

Turn on the Precipitation layer.

The precipitation raster covers a large area extending beyond the trail.

Expand the Precipitation legend.

Each cell in this raster layer contains a precipitation value.

In the table of contents, look at the legend for the Precipitation layer.

? What is the approximate range of precipitation values in this layer?


▶ Answer

Look at the map.

? Does rainfall increase or decrease as you move west along the trail?

▶ Answer

Now you will measure the precipitation along the trail.

If necessary, click the Identify button .

Click anywhere on the map to open the Identify window.

In the Identify window, click the down arrow and choose Precipitation from the drop-down list.

Click the beginning of the trail at the eastern trailhead.

? What is the approximate rainfall at this location?

- 15 inches
- 22 inches
- 31 inches
- 39 inches

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Now click the trail at the location of the cabin.

? What is the approximate rainfall at this location?

- 22 inches
- 32 inches
- 39 inches
- 50 inches

? Where is it most likely to rain along your route from the trailhead to the cabin?

- Near the eastern trailhead.
- Near the middle of the trail, half-way to the cabin.
- Near the cabin.
- Everywhere along the trail.

Close the Identify window.

Turn off the Precipitation layer and collapse its legend.

### Step 6 Describe the vegetation along the trail

In this step, you will see what types of plants and trees you are most likely to encounter along the trail.

Turn on the Cover types layer and expand its legend.

You see nine different types of cover or vegetation that occur in Yellowstone National Park.

Is Cover types a raster or a vector layer? Can you tell?

One way to find out is to zoom in until you can see if there are individual cells. Another way is to open the properties dialog box for the layer.

Right-click Cover types and choose Properties.

In the properties dialog box, click the Source tab.

? Cover types represents raster data.

- True
- False


The Raster Information area of the dialog box reports the number of columns and rows and the cell size, among other things. You have learned that raster data is organized into cells arranged in columns and rows.

[VIEW RESULT](#)

Click Cancel to close the properties dialog box.

Look at the Cover types legend and at the map.

Use the Identify tool to answer the question below.

 Which three cover types below will you see along the Fawn Pass trail between the eastern trailhead and the cabin?

- Nonforested
- Aspen
- Water
- Whitebark Pine
- Douglas Fir
- Englemann Spruce and Subalpine Fir

[Check my answers](#)

Close the Identify window.

Turn off the Cover types layer and collapse its legend.


### Step 7 Visualize the terrain

Now you know the elevation, precipitation, and cover types along the trail. In this step, you will look at an aerial photograph to help you visualize the terrain.

Turn on the Aerial Photo layer and expand its legend.

You see that this photo consists of three bands. Each band represents a portion of the light (color) spectrum; in this case, red, green and blue. Each cell in the photo has multiple values, one for each color band—a value for red, a value for green, and a value for blue. With so many possible color combinations, you can see a broad range of colors on the photo.

Maximize your ArcMap window, if it is not already.

 How would you describe the first one-third of the trail? Choose two answers below.

- Flat
- Forested

- Unforested
- Steep

[Check my answers](#)

Use the aerial photo to answer the following question.

? How would you describe the last two-thirds of the trail? Choose two answers below.

- Flat
- Forested
- Unforested
- Steep

[Check my answers](#)

### Step 8 Close the map document and exit ArcMap

From the File menu, choose Exit.

Click No when prompted to save changes to the map document.

### Conclusion

In this exercise, you explored vector and raster data for a portion of Yellowstone National Park. The trail data, which is vector, was useful for measuring length and visualizing the location and shape of the trail, which has clear boundaries.

The elevation, precipitation, and cover type layers are raster datasets that you used to get information about phenomena that do not have clear boundaries. The aerial photograph is a raster dataset that provides even more information about what this part of the world looks like.

Vector data and raster data are often used together on a GIS map to get a more accurate view of the real world than either can provide alone.

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