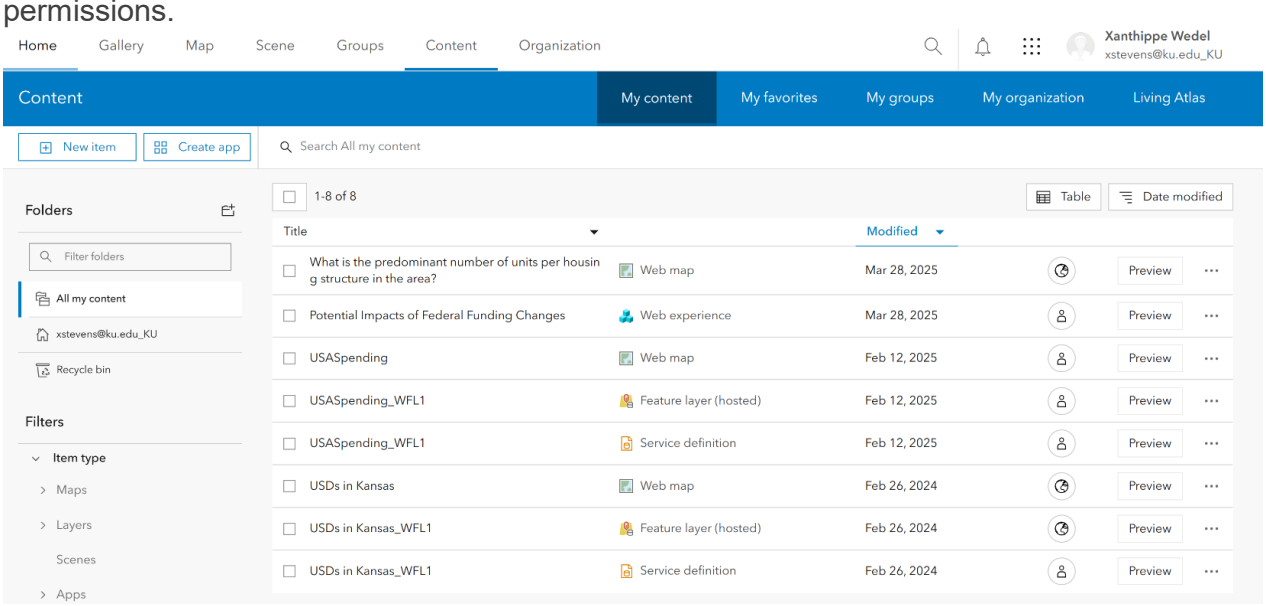
Applied GIS

Step 1: Getting Started

1. Visit: https://www.arcgis.com/ and login. Although you can make a map without signing in, you must be signed in to save your work.

The Content tab will display all of your maps and map layers.

The content table lists all of your map items and contains the type of content, date last modified, and permissions.



2. On the ribbon, click the **Map** tab.

   A default web map appears.

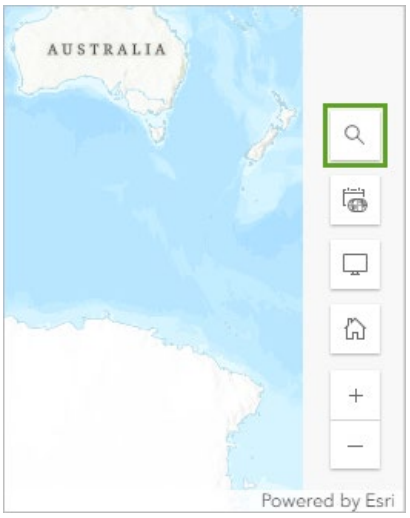
Your map's appearance varies based on your account or organizational settings and your browser window size. It may show the United States, the world (such as in the example image), or another extent.

The only layer on the map is the basemap, which provides geographic context such as water bodies and political boundaries. The default basemap is **Topographic**, but your map may have a different basemap depending on your organization's settings.

On either side of the map are the toolbars. The **Contents** (dark) toolbar allows you to manage and view the map contents and work with the map. The **Settings** (light) toolbar allows you to access tools and options for configuring and interacting with map layers and other map components. The **Layers** pane is also open. The data you add to the map will be listed here.

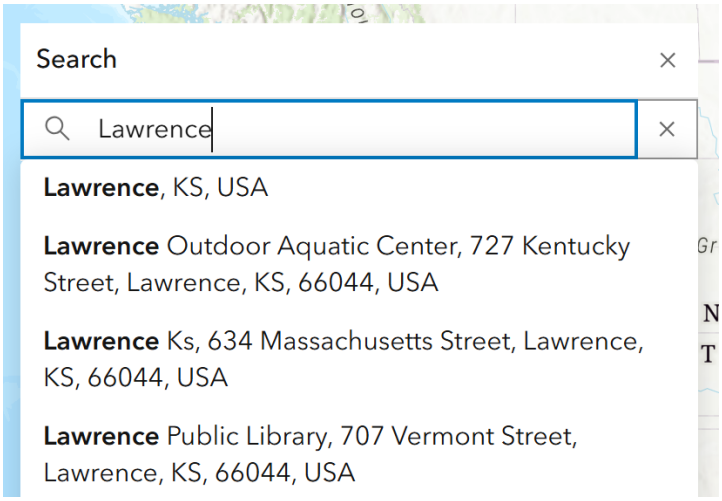
Next, you'll navigate to your area of interest.

3. On the map, at the bottom corner, click the **Search** button.

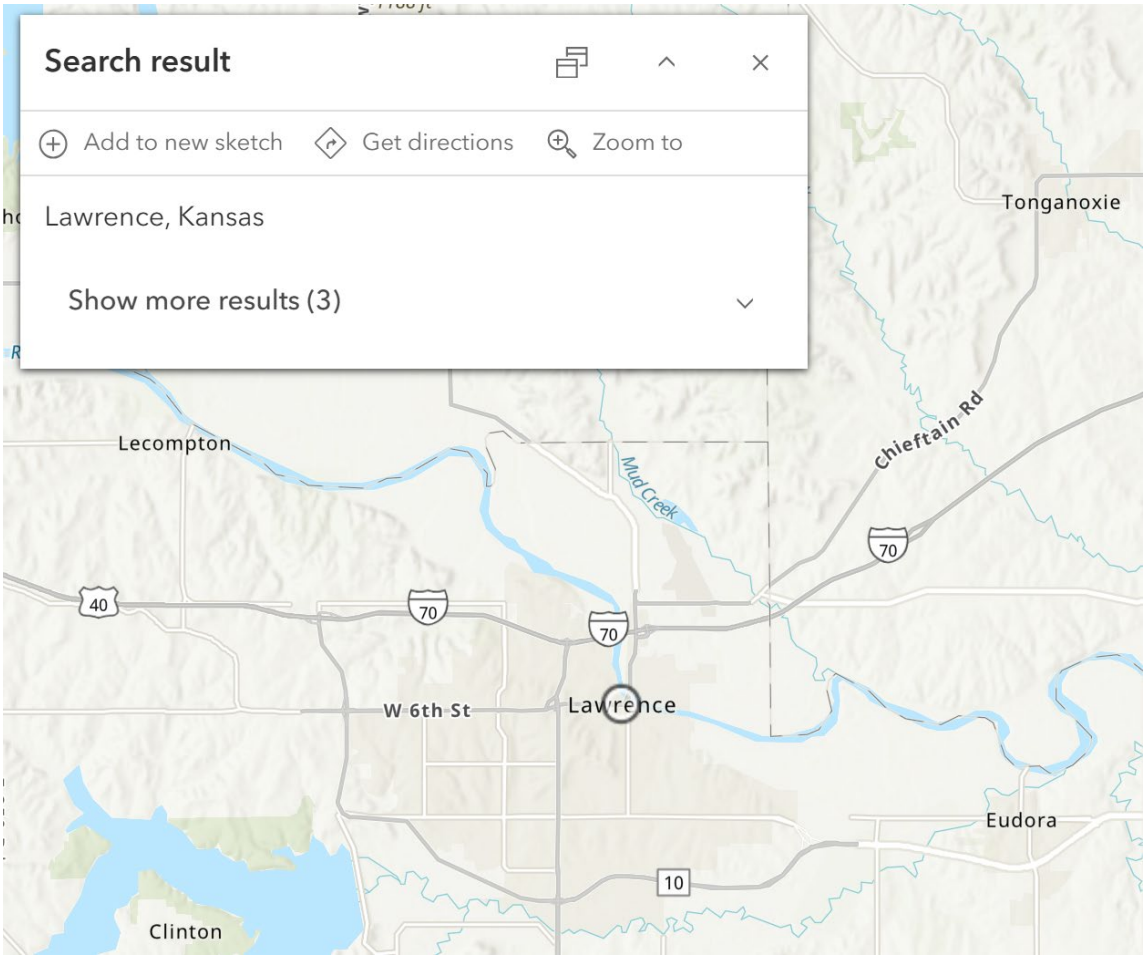


   A search box appears at the top of the map window.

4. In the search box, type **`Lawrence`** and choose **Lawrence, KS, USA** from the list of suggested locations.



The map zooms to Lawrence. The **Search result** window confirms the location.

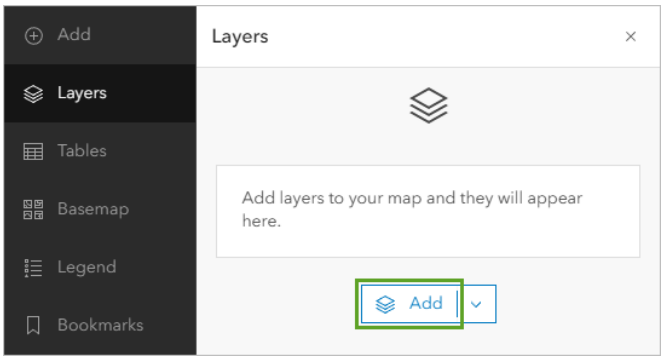


5. Close the **Search result** window.

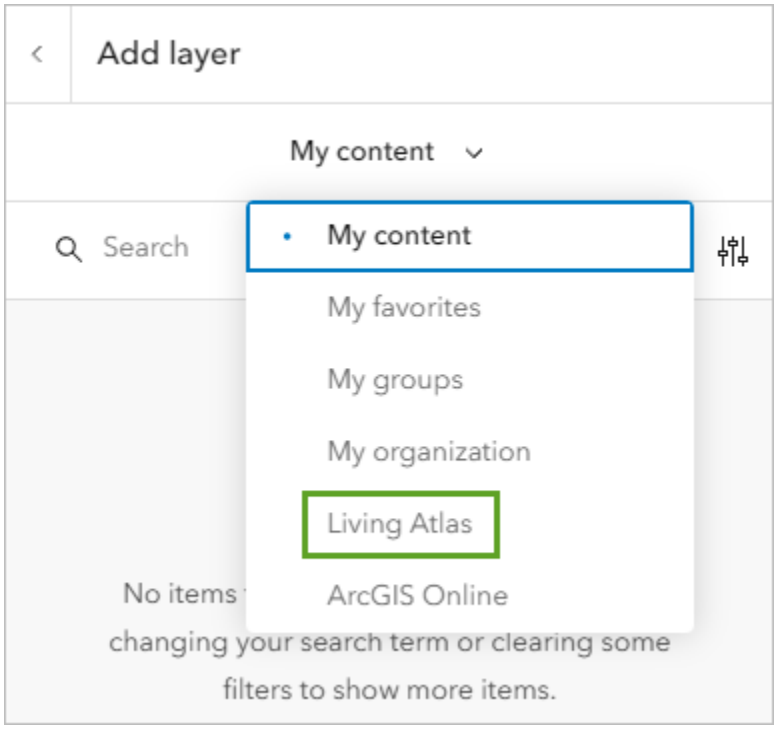
Step 2. Add a layer

Layers contain geographic data that can be displayed on your map. United States census tracts divide counties into smaller geographic areas, which are useful for revealing spatial patterns. When creating maps, you can add your own data or search for existing data that organizations have shared. In this tutorial, you'll add existing data.

1. In the **Layers** pane, click **Add**.



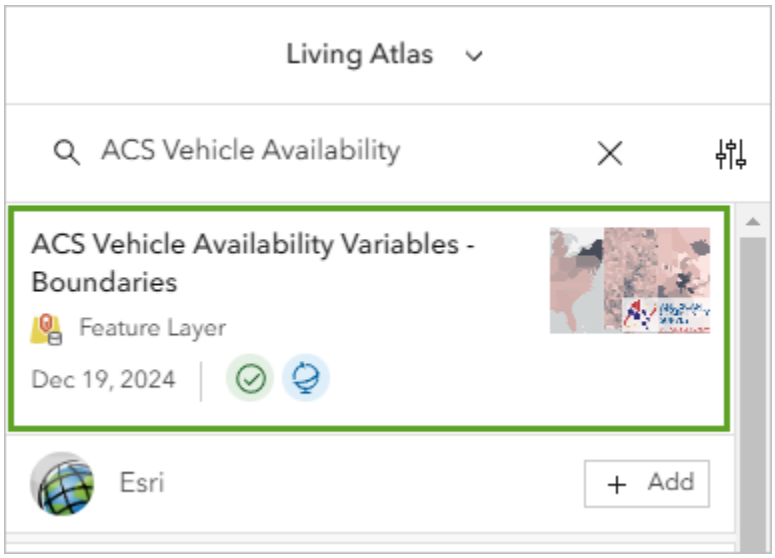
2. In the **Add layer** pane, click **My content** and choose **Living Atlas**.



ArcGIS Living Atlas of the World is a collection of authoritative geographic data shared by a variety of organizations.

3. In the search box, type or paste `ACS Vehicle Availability`.

4. Click the **ACS Vehicle Availability Variables - Boundaries** result.



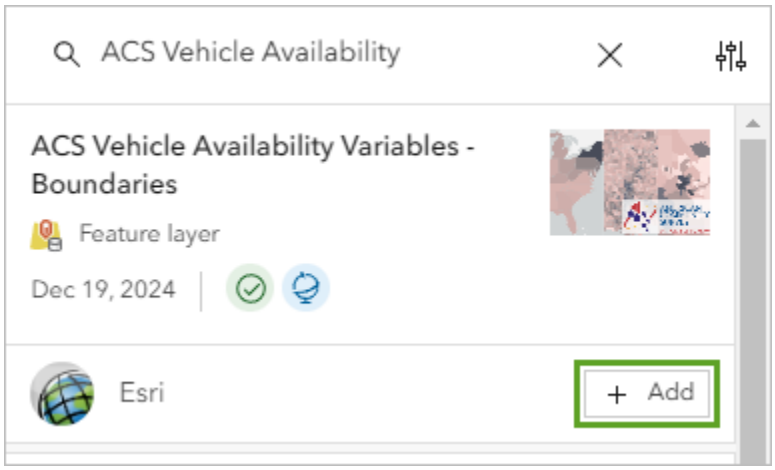
The item pane appears. It shows details about the layer, including a summary and description of what the layer contains.

5. The item pane appears. It shows details about the layer, including a summary and description of what the layer contains.

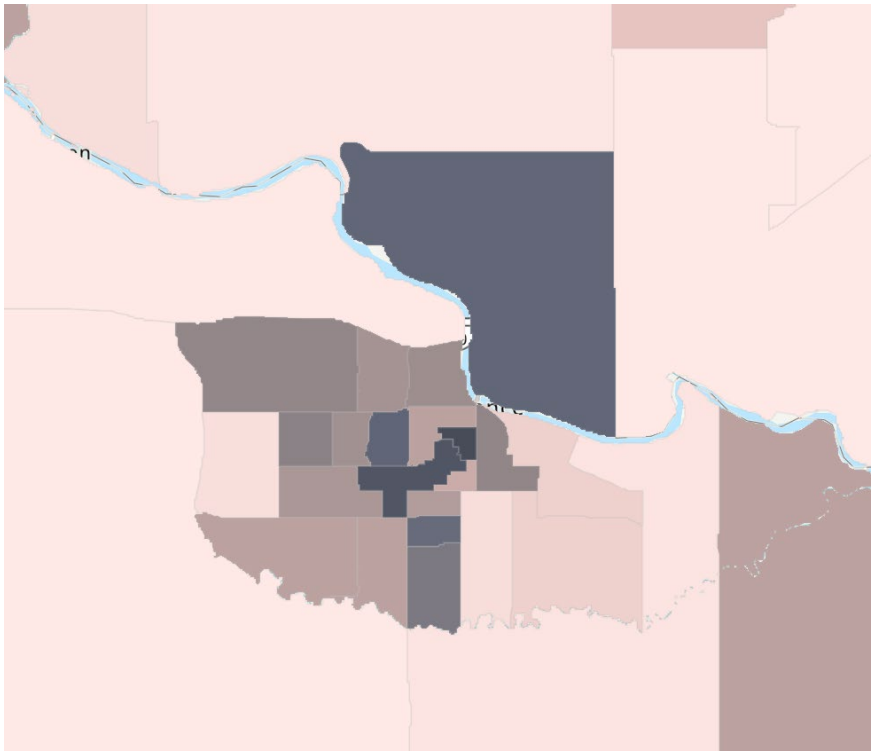
   This layer contains data collected by the United States Census Bureau about the number of vehicles available to households.

6. Close the item pane.

7. For the **ACS Vehicle Availability Variables - Boundaries** layer, click **Add**.



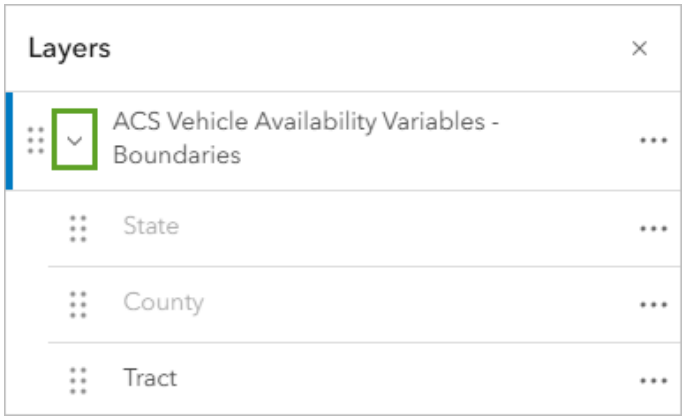
The layer is added to the map. It's styled to show the percentage of households with no vehicle available in each census tract. Darker gray tracts have a higher percentage of households without a vehicle available. Lighter pink tracts have a lower percentage.



8. At the top of the **Add layer** pane, click the **Back** button.

You return to the **Layers** pane, where the new layer is now listed. This is a group layer, meaning that there are multiple related layers that have been added and can be managed together.

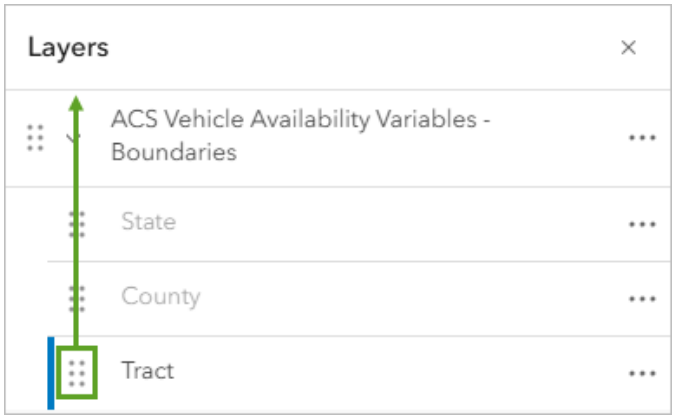
9. In the **Layers** pane, expand the **ACS Vehicle Availability Variables - Boundaries** group.



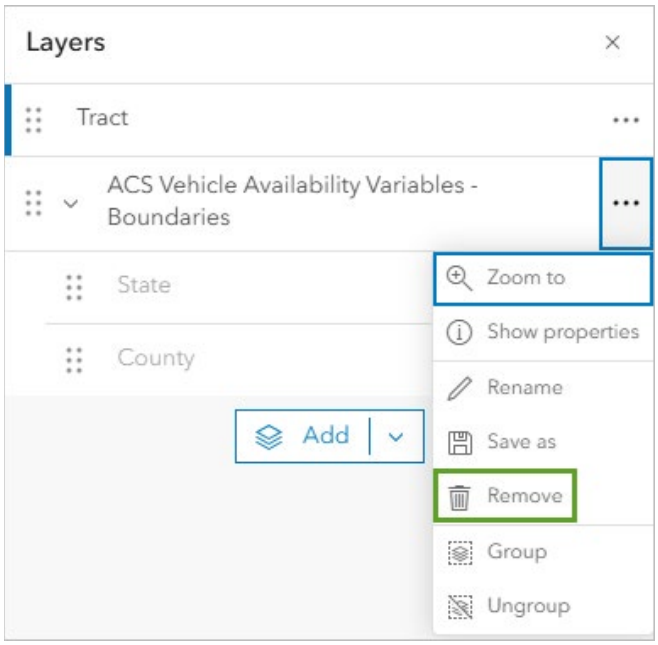
The group contains three layers. Each layer shows the percentage of households with no vehicle available aggregated within a different geographic boundary and at a different scale. For example, if you wanted to compare the availability of vehicles across the state of Kansas, you could zoom out to see the **County** layer. To compare the availability of vehicles across multiple states, you could zoom out to see the **State** layer.

If you were making a map in which it was helpful for you to make these kinds of comparisons, you could leave all of the layers on the map. Because you want to focus on the area of Lawrence specifically, you'll separate out the **Tract** layer and remove the additional layers.

10. In the **Layers** pane, drag the **Tract** layer above the **ACS Vehicle Availability Variables – Boundaries** group.



11. For the **ACS Vehicle Availability Variables - Boundaries** group, click the **Options** button and choose **Remove**.



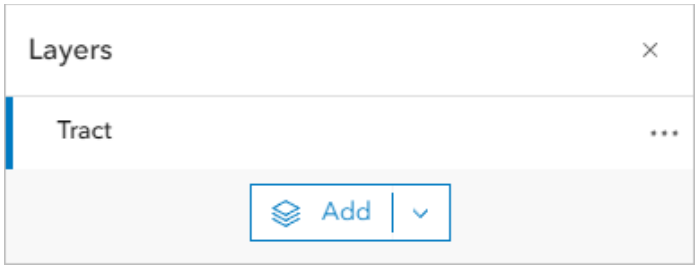
The group is removed from the map. There is one layer listed in the **Layers** pane now, **Tract**.

Step 3. Style demographic data

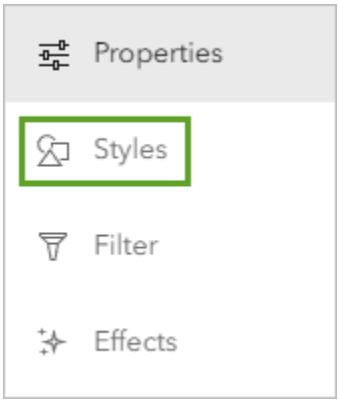
Next, you'll change the layer's appearance. The layer is already styled based on the percentage of households with no vehicle available, which is what you want to show. You'll choose a different color scheme to emphasize tracts with high percentages of households without a vehicle.

1. If necessary, in the **Layers** pane, click the **Tract** layer to select it.

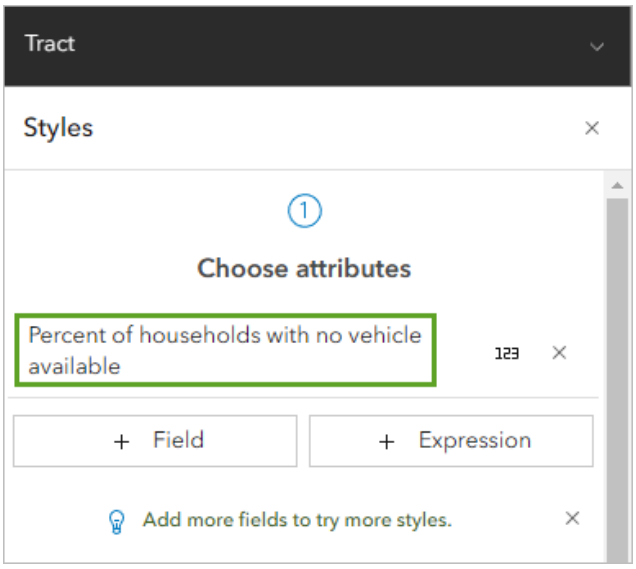
A blue bar to the left of the layer name shows whether it is selected. Selecting a layer allows you to work with it.



2. On the **Settings** toolbar on the right, click the **Styles** button.

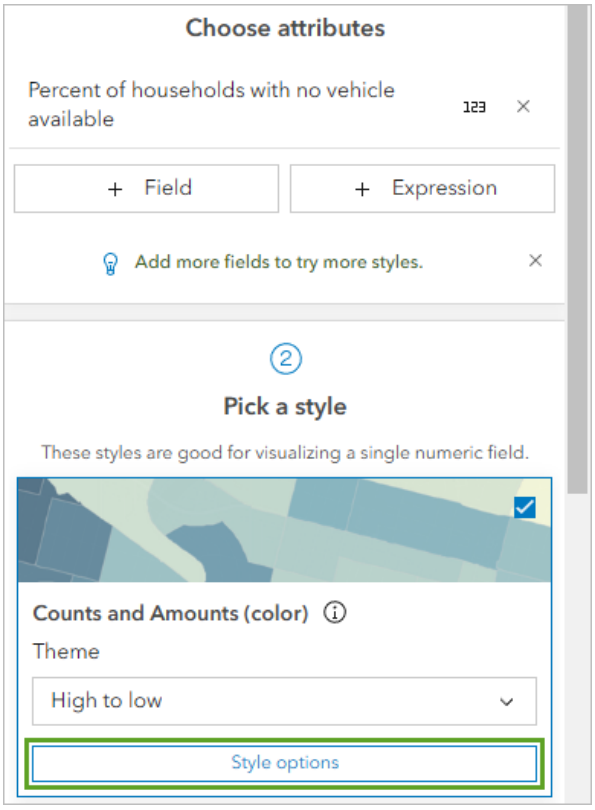


3. In the **Styles** pane, for **Choose attributes**, make sure **Percent of households with no vehicle available** is selected.

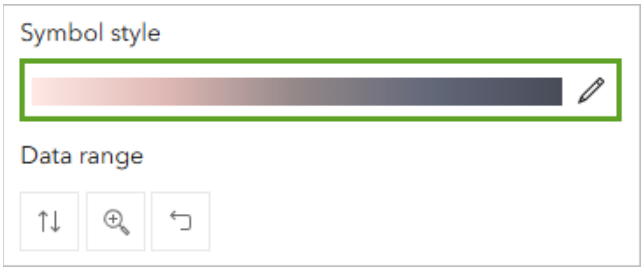


The list of available styles is determined by the data type. In this case, the options are for numeric data. The map shows the **Counts and Amounts (color)** style. The colors are based on the **High to low** theme. This style symbolizes each census tract with a different color based on the percentage of households without a vehicle. Census tracts with the lowest values have a light color, while those with the highest values have a dark color.

4. For **Pick a style**, on the **Counts and Amounts (color)** card, click **Style options**.



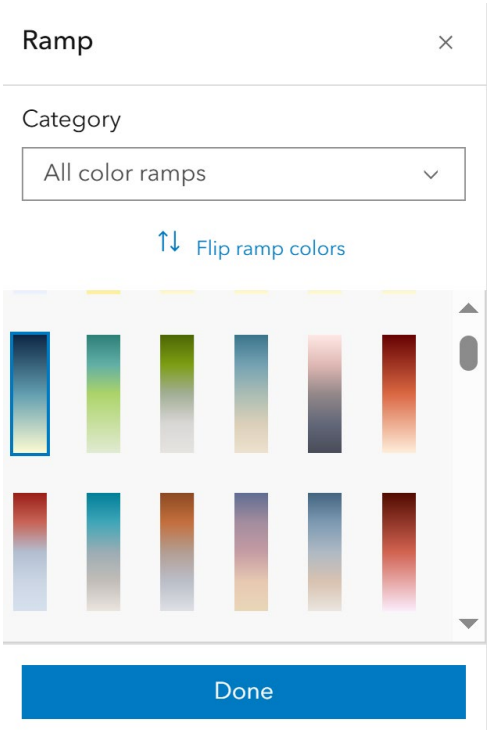
5. For **Symbol style**, click the color ramp.



The **Symbol style** window appears. It includes options to change the fill color and outline of the symbols on the map. You'll choose a color ramp that emphasizes tracts with high percentages of households with no vehicle available.

6. In the **Symbol style** window, for **Colors**, click the color ramp.

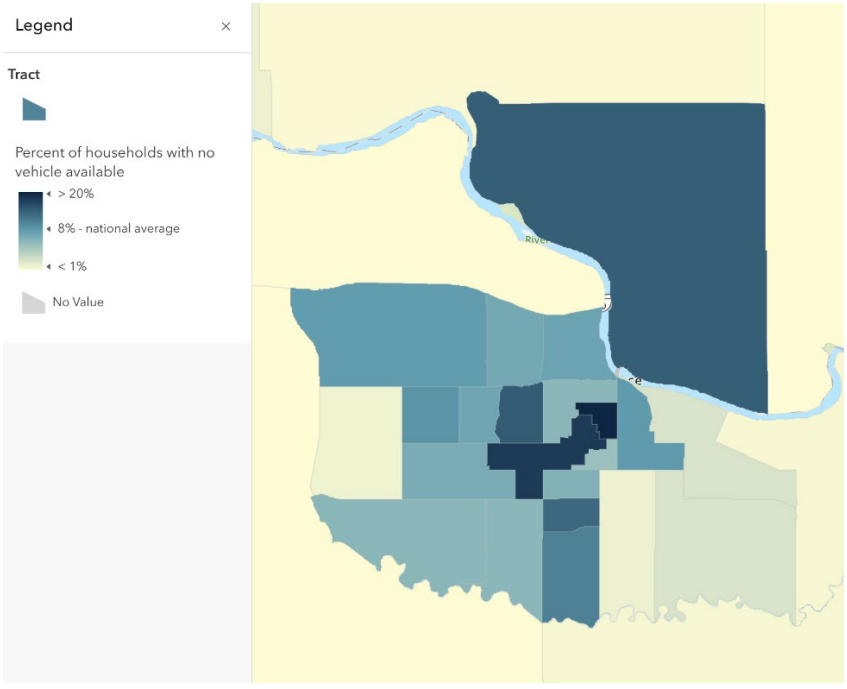
7. In the **Ramp** window, choose **Blue 2**.



8. In the **Ramp** window, click **Done**. Close the **Symbol style** window.

9. In the **Style options** pane, click **Done**. Click **Done** again.

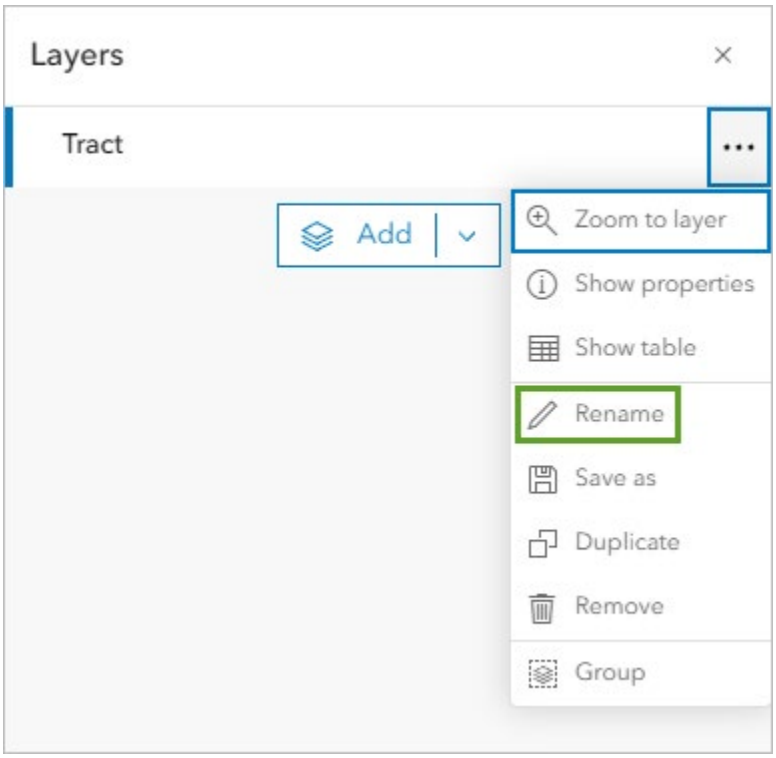
   The new color ramp is applied to the map. Census tracts with high percentages are displayed in dark blue while low percentages are pale yellow.



Now the census tracts with a higher-than-average percentage of households without a vehicle are more noticeable on the map. Based on the legend, the average percentage is about 8 percent. A clear pattern of limited access to vehicles is seen in and around campus. These census tracts would likely benefit the most from access to public transportation.

Next, you'll give the layer a more descriptive name.

10. In the **Layers** pane, for the **Tract** layer, click the **Options** button and choose **Rename**.



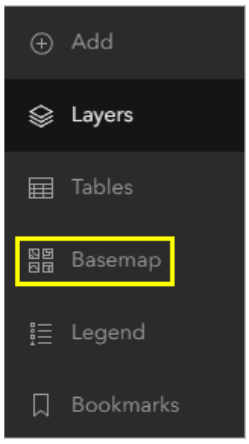
11. For **Title**, type `Percent of Households with No Vehicle Access`. Click **OK**.

The layer name updates in the **Layers** pane.

Step 4. Change the basemap

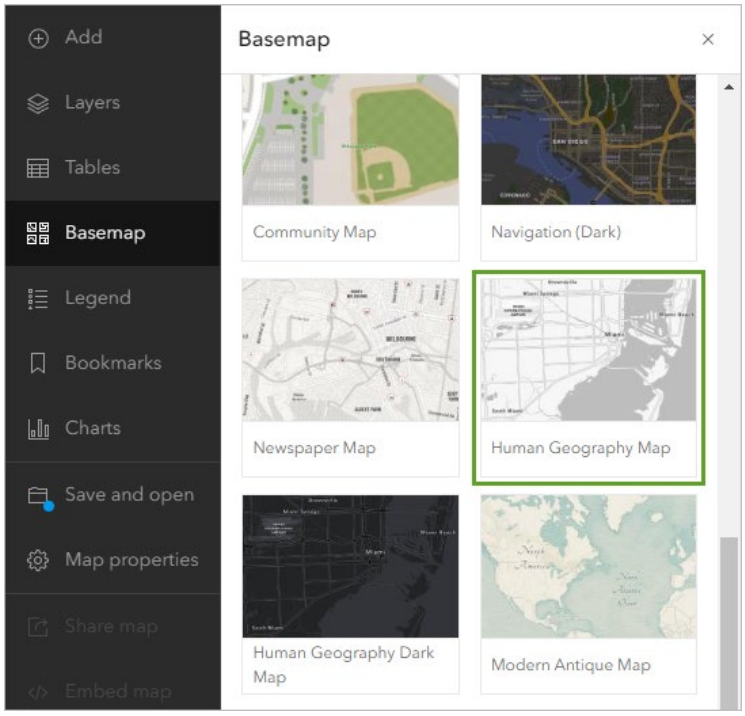
On the map, the basemap's labels are hidden by the census tracts. In some cases, this is desirable, such as when you want to add your own labels to the map. In this case, labels will help you identify areas across the city, so you don't want them to be hidden. You'll change the basemap to one that shows labels over features.

1. On the **Contents** toolbar, click **Basemap**.



The **Basemap** pane appears. It lists basemaps that you can choose to add to your map. *Take a minute to explore basemap options.*

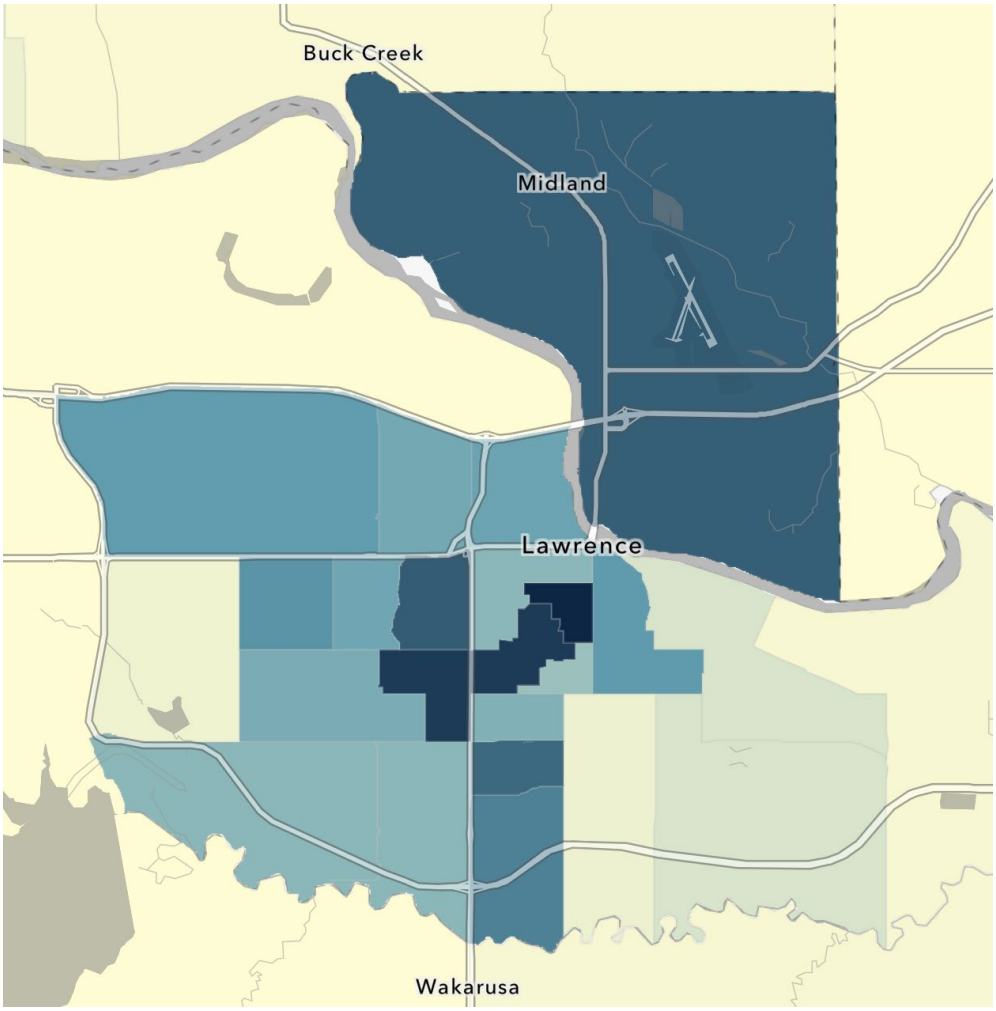
2. In the **Basemap** pane, find and choose **Human Geography Map**.



Note:

Some ArcGIS organizations have different default basemaps. If you don't see the **Human Geography Map** basemap, scroll to the end of the list and click **Living Atlas**.

On the map, the basemap changes.

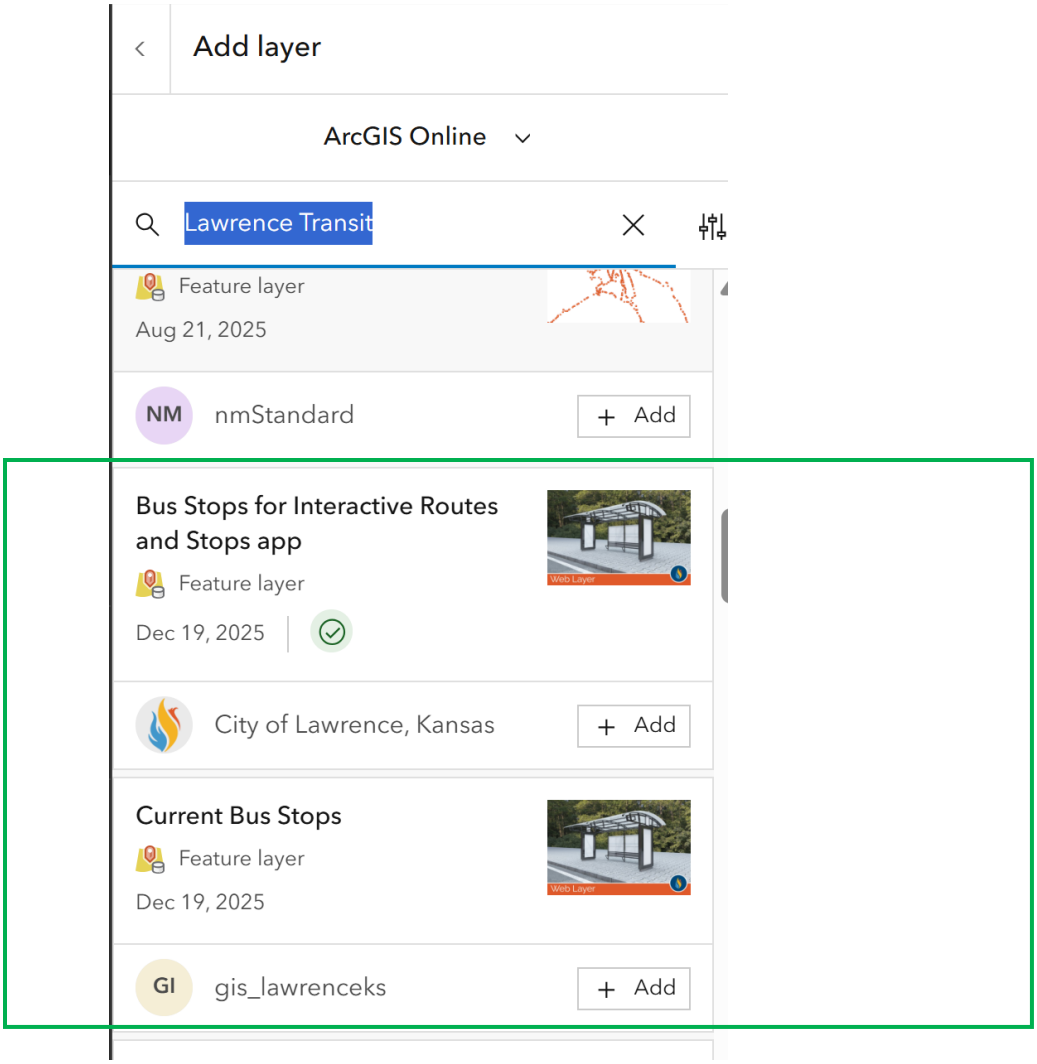


Labels and other contextual information like major roads and water bodies now show on top of the census tracts. Zoom in and out. Notice how the basemap changes.

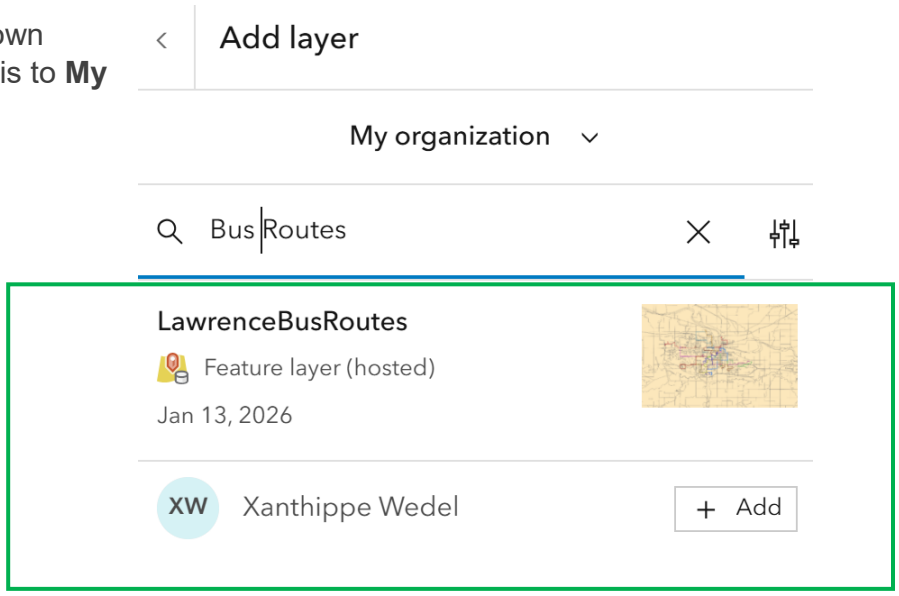
Step 5. Add Related Layers

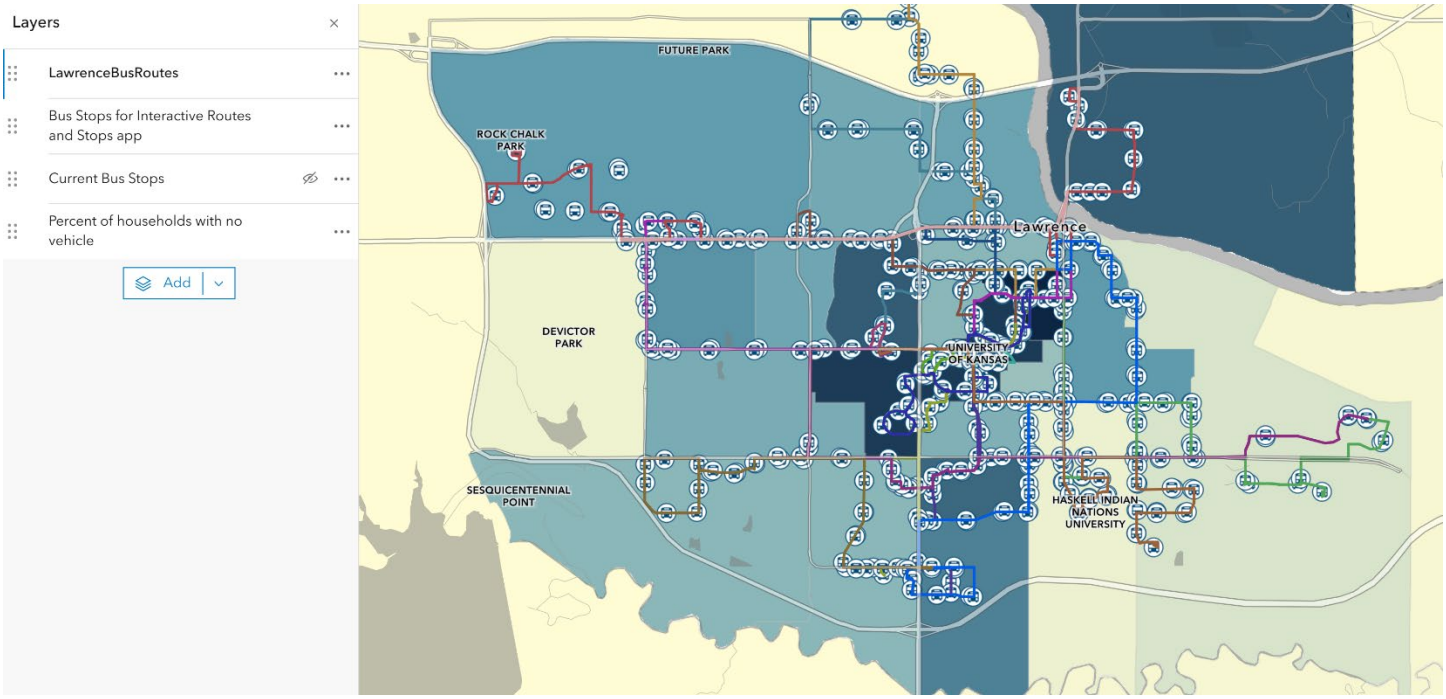
The true strength of GIS lies in its ability to integrate and analyze multiple data layers. For this workshop, let's explore public transportation and polling locations.

1. In the **Layers** pane, click **Add**.
2. Select **ArcGIS Online**.
3. Search for "**Lawrence Transit**"



4. Add **Bus Stops for Interactive Routes and Stops app.**
5. Add **Current Bus Stops**.
6. Click the ArcGIS Online dropdown below Add layer and change this to **My organization**.
7. Search for **Bus Routes**.
8. Add **LawrenceBusRoutes**.





Our map now contains points representing the bus stops, lines representing the bus routes, and a layer with the percent of households with no vehicle. Click the eye symbol next to each layer to turn it off/on. There are two layers with bus stops that appear to have the same content.

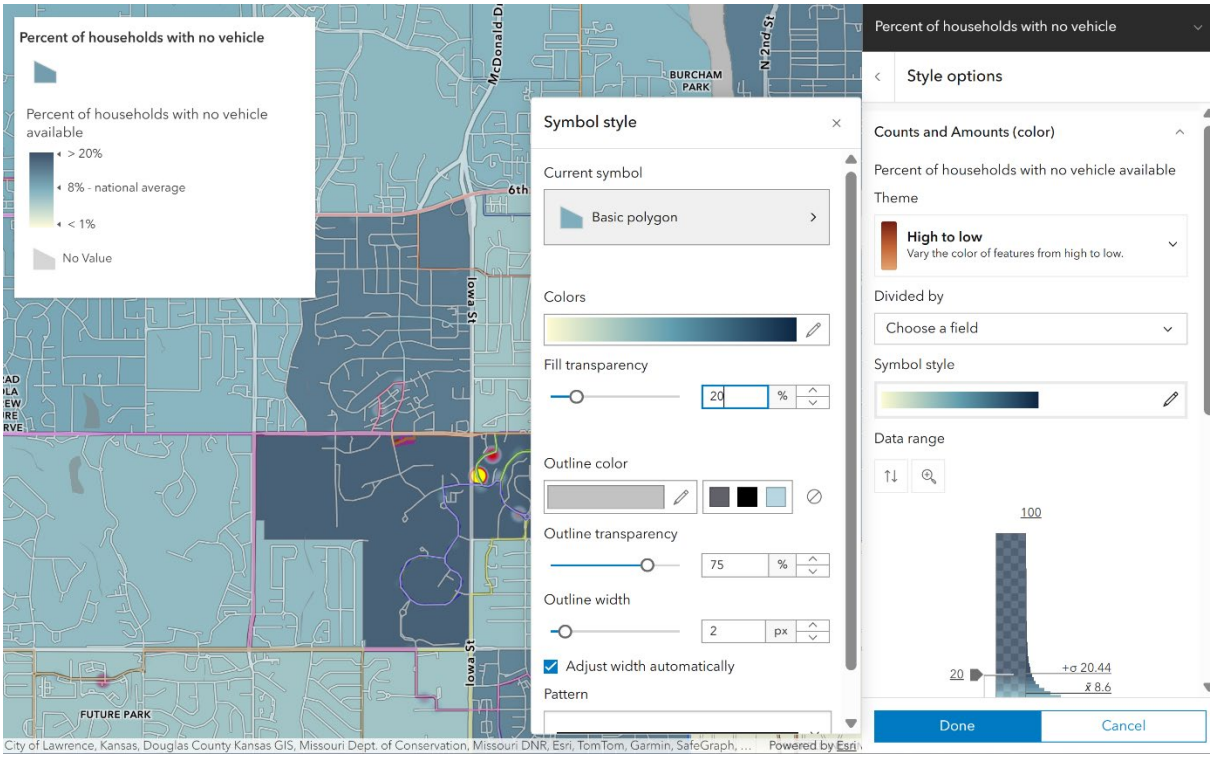
Step 6. Refine Map Appearance

Refining how layers appear in a map is an important step to making a useful map. In this step, we will explore different methods for displaying data in a map.

1. Click **Layers** on the left menu and add click the three dots **…** on **Current Bus Stops**.
2. Select **Show table**.
3. Browse the data available in this layer.
4. Close the table.
5. Click **Current Bus Stops** in the Layers pane.
6. Click the **Styles** icon on the right menu.
7. Under **Choose attributes**, click the **Field** button.
8. Check the box next to **Average Weekday Passenger Count** and click **Add**.
9. Scroll down and select the **Heat Map** style.
10. Click **Done**.

11. In the **Layers** pane, drag the **LawrenceBusRoutes** layer below the **Bus Stops for Interactive Routes and Stops app** layer and above the **Current Bus Stops** layer.

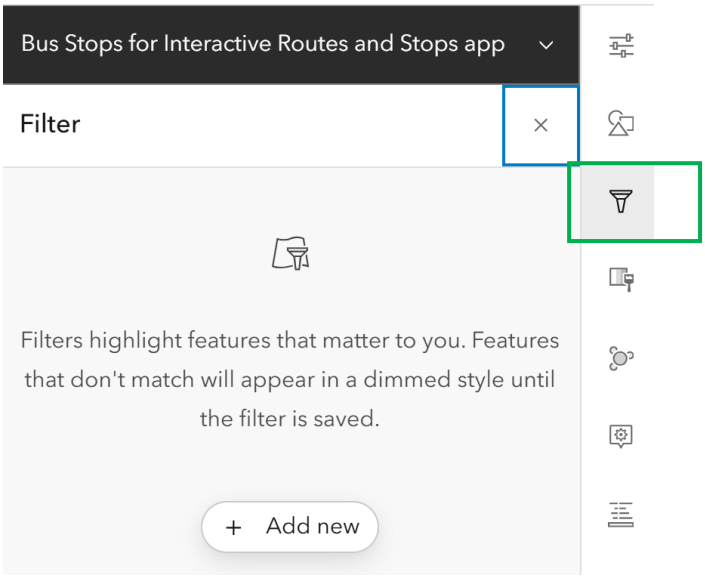
12. Set transparency on a layer
    a. Select the **Percent of Households with No Vehicle Access** layer.
    b. In the **Styles** menu, select **Style Options**.
    c. Click **Symbol Style**.
    d. Adjust the **Fill transparency** by sliding the bar. The map will dynamically change.



In this case, transparency isn't terribly effective. **Set transparency back to 0 and click Done**.

13. Filter data

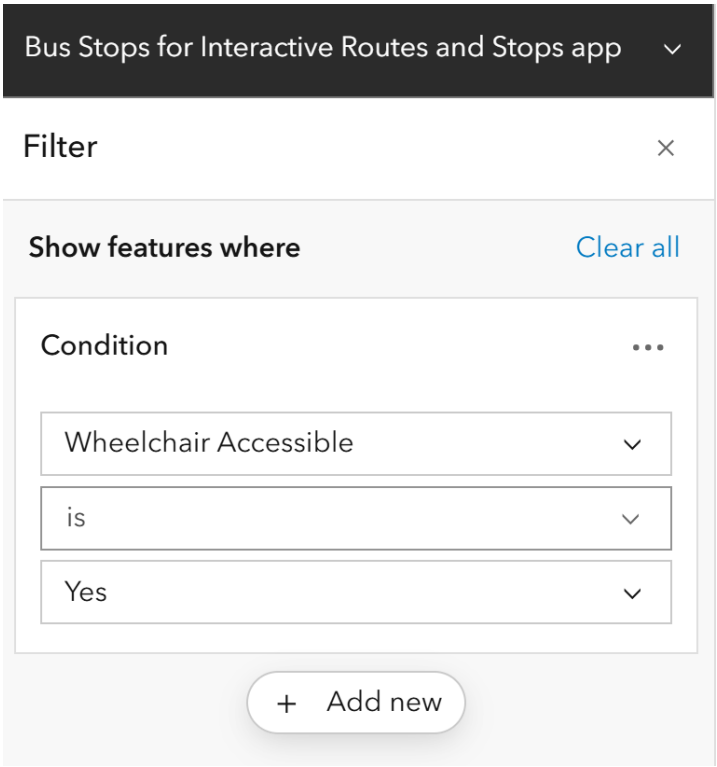
    a. Select the **Bus Stops for Interactive Routes and Stops app**, click **Filter** on the right.



b. On the Filter panel, click **+ Add New**

Now you can set a parameter based on the data in the layer.

c. While the layer illustrates all bus stops, it may be important for planning and evaluation purposes to view the bus stops with specific characteristics.

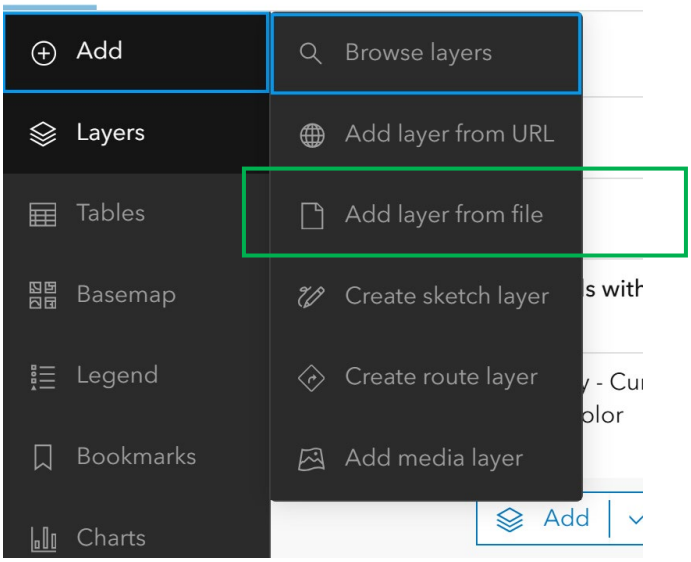


d. Select a condition of your choosing and then click **Save**.

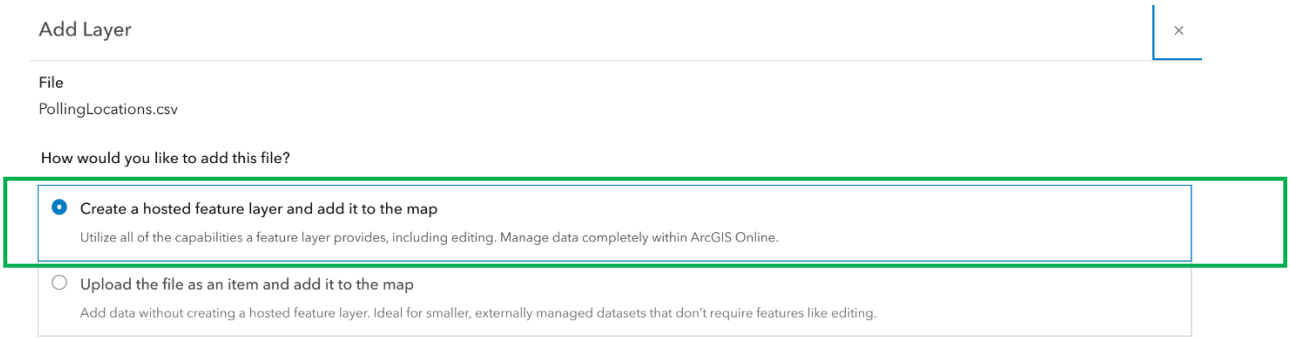
Step 7. Add your own data

Living Atlas, the ArcGIS Online community, and your organization have lots of information available in GIS formats. However, there may be time when you need to add your own data.

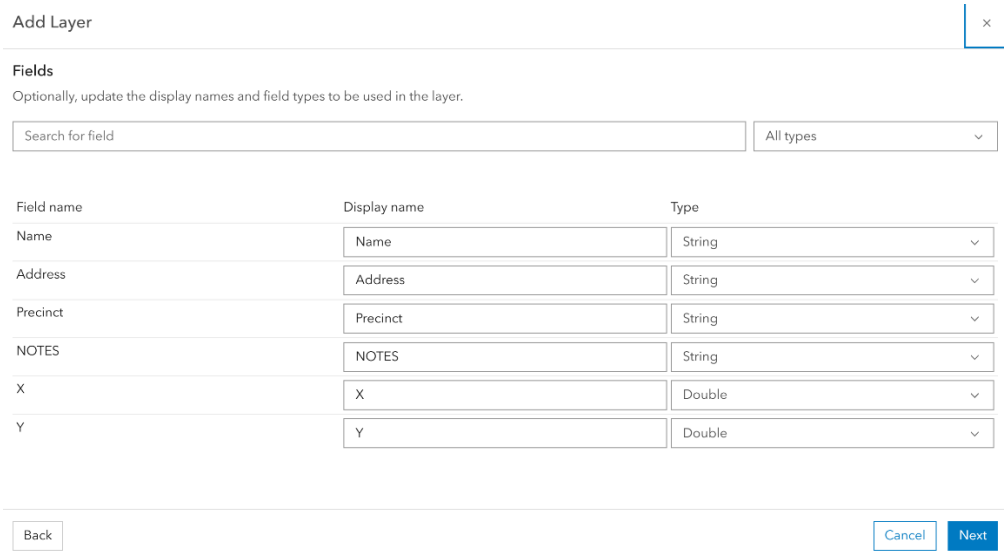
1. **Download** sample data – visit https://ksdata.ku.edu/temp and download the sample data set (PollingLocations.csv).
2. Click Add then **Add layer from file**.



3. Drag and drop or navigate to the sample data file.
4. Upload the file as a hosted feature layer. This will allow us to edit the layer, if needed.

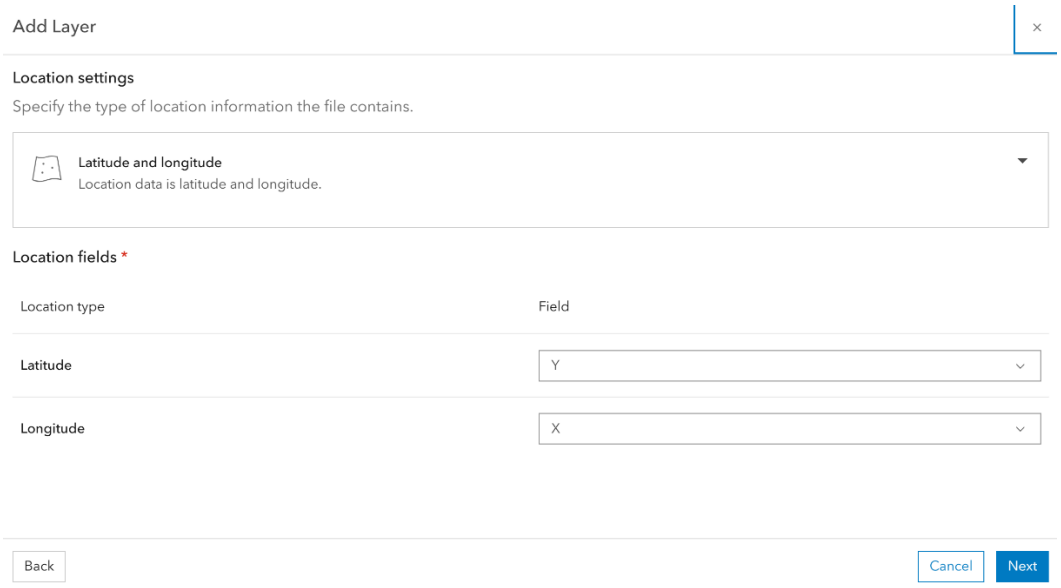


ArcGIS will "read" your data. Confirm that your data is properly interpreted.

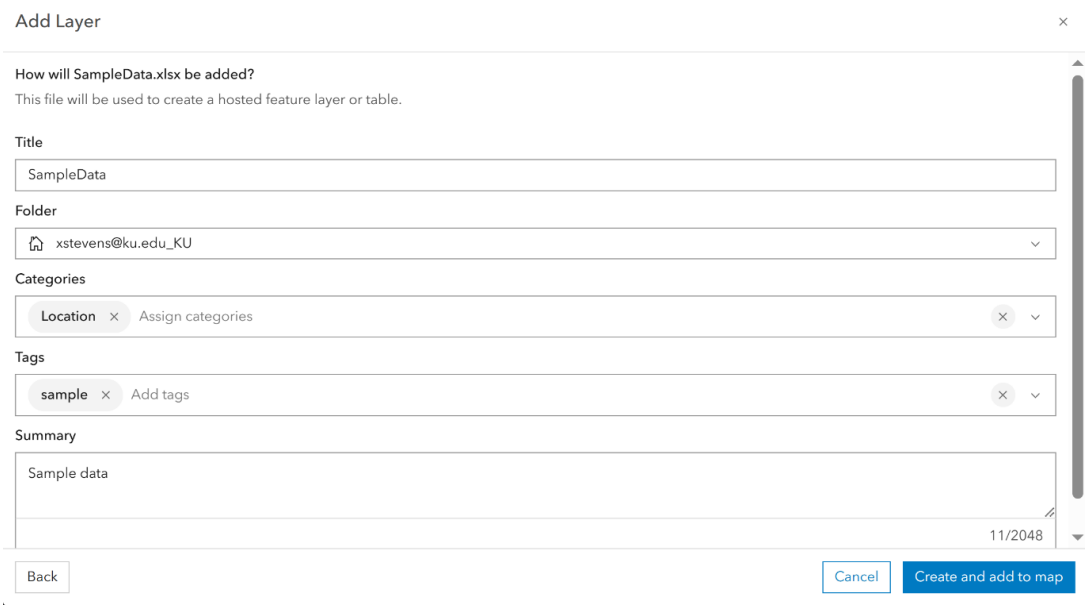


5. Click **Next**

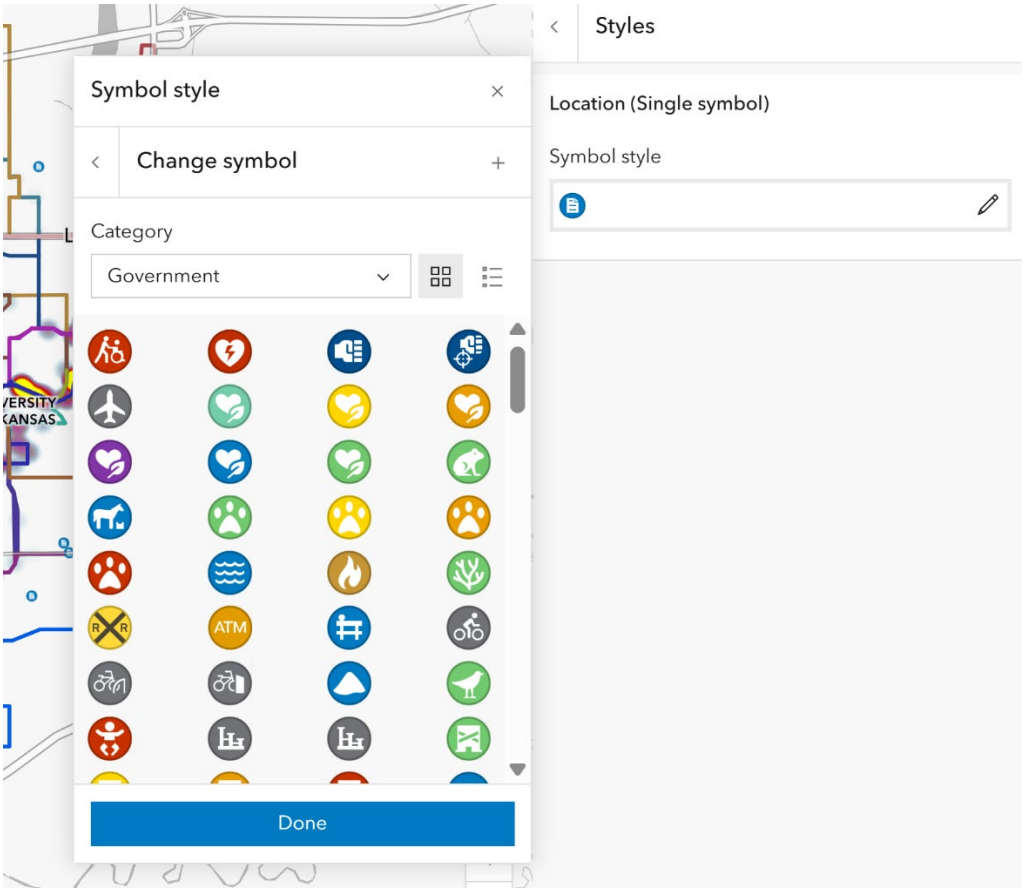
   ArcGIS recognizes that the columns X and Y contain coordinates.



6. Click **Next**.
7. Lastly, you need to confirm a name and location for your layer and enter information about your data then click **Create and add to map**.



8. The points are shown with default settings. Explore and **pick a symbol**.

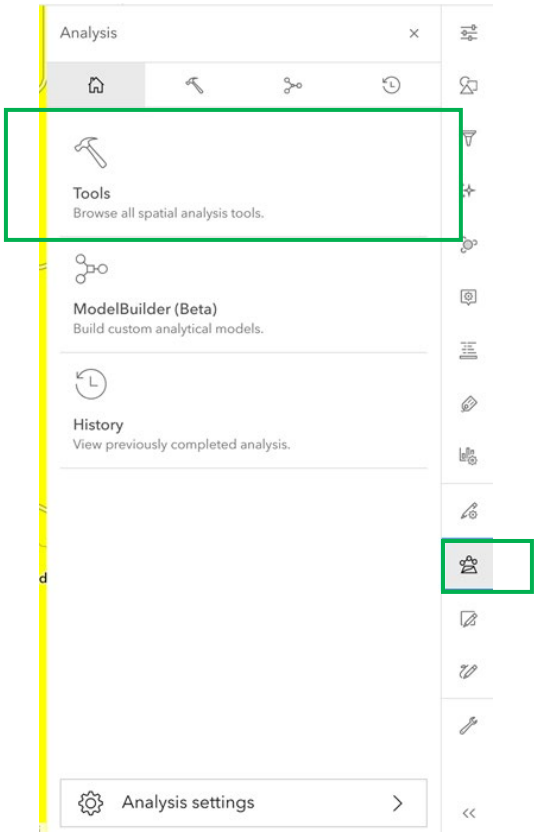


Step 8. Spatial Tools – *Analysis tools are only available for paid subscribers.*

Spatial tools allow us to analyze the data in and across layers and their locations. For this workshop, we are only interested in the polling locations in Lawrence. Previously, we used a filter to show select features. However, the data associated with this layer doesn't make this possible.

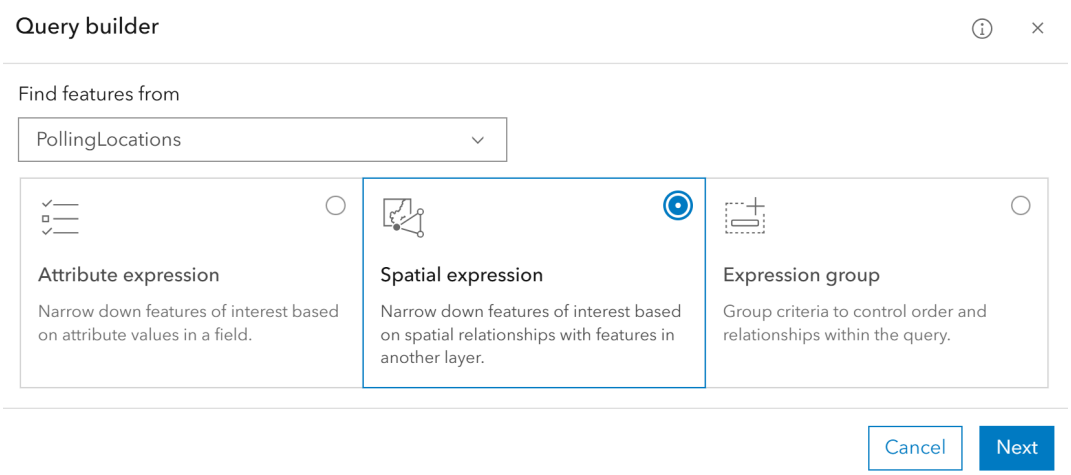
1. Click the **Layers** tab on the left. Add the layer called **City Limit Boundary for Lawrence Kansas** published on ArcGIS Online by the City of Lawrence.

2. Click **Analysis** on the right menu then click **Tools**.



3. Search for "**Find**". Select **Find by Attributes and Location**.

4. On the Find by Attributes and Location panel:
    a. Click **Build new query**.
    b. In the Query builder, select the **Polling Locations** as the source layer and select Spatial expression. Click **Next**.



c. In the Where panel, find features from PollingLocations that **intersect** the City Limit Boundary for Lawrence Kansas.

d. Click **Add**.

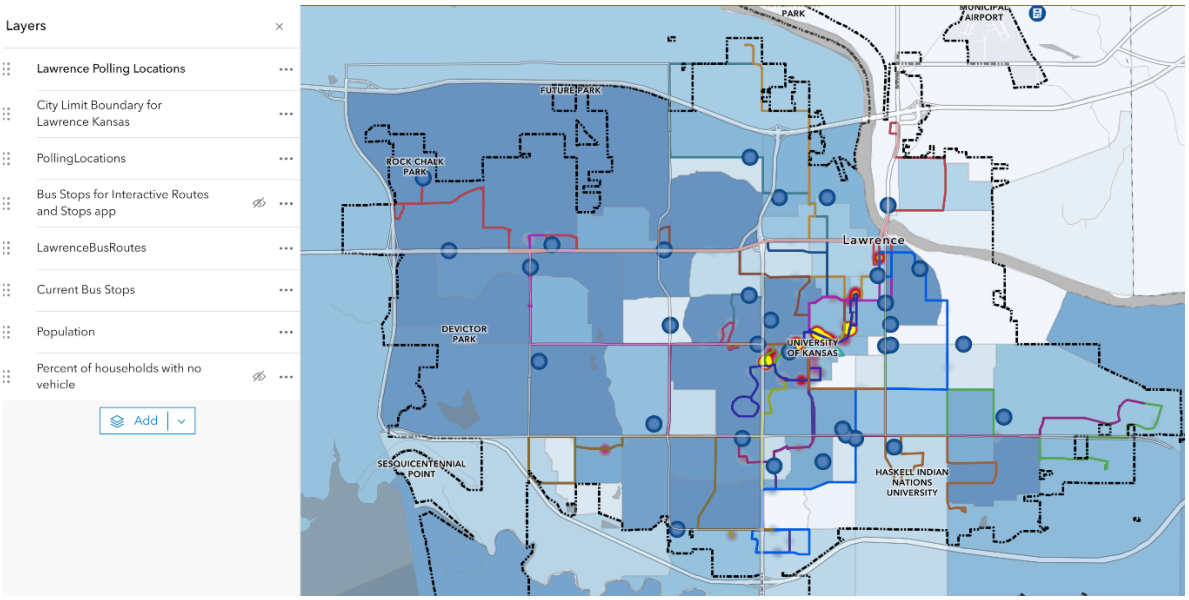
e. **Name** the new layer.

CREDITS:

Some tasks in ArcGIS Online require credits. If you are on an organizational account, your organization may have a ***limited number of credits***. Click Estimate credits to see how many credits will be consumed.

f. Click **Run**.

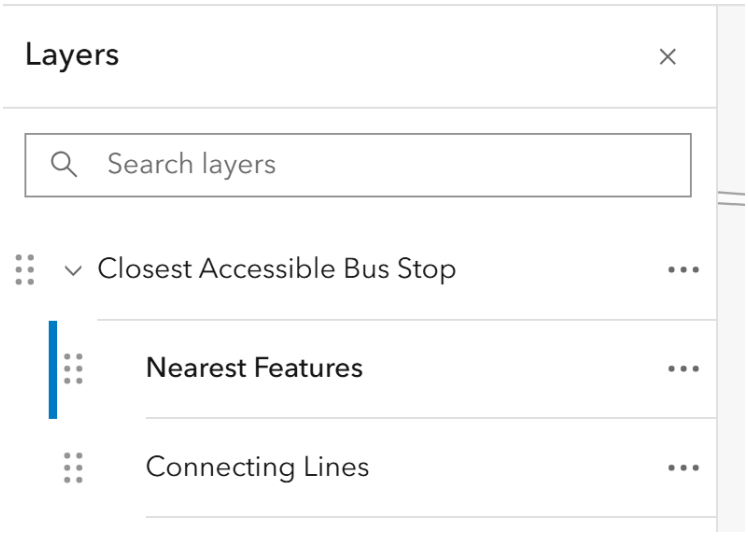
g. **Close** the Find panel then the Tools panel.



5. Turn off the **PollingLocations** layer and **symbolize** the new Lawrence Polling Locations as you like.

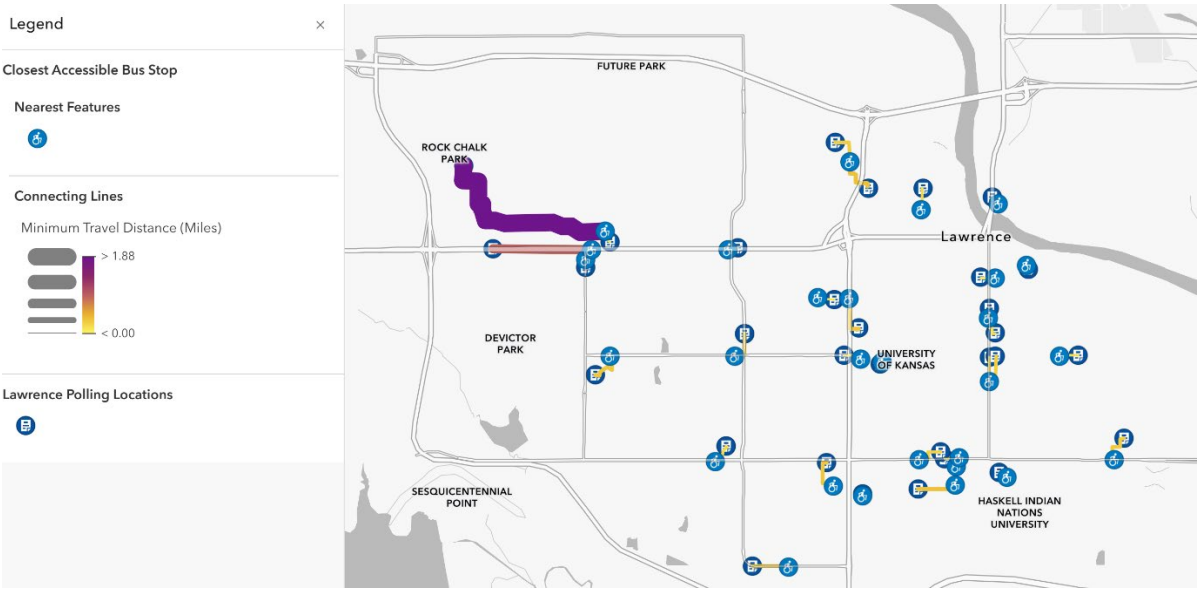
Now we are ready to calculate the distance between each polling location in the City to the nearest wheelchair accessible bus stop.

1. Click **Analysis** on the right.
2. Search and select the **Find Closest** tool.
3. Select **Lawrence Polling Locations** as the Input layer.
4. Select **Bus Stops for Interactive Routes and Stops app** as the near layer.
5. Under measurement type, click the drop down and select **Walking Distance**.
6. Enter **2** as the Max search range. Units should already be in miles, but this can be changed as needed. This will restrict the search radius and shorten processing time.
7. Enter a name for the Output layer.
8. Again, this will consume credits. Click the **Estimate Credits**. ***The previous tool took a fraction of a credit where this tool will take 17 credits.***
9. **Close** any analysis panes and **expand** the new layer. The Find Closest tool created two layers one with the Nearest Features and another with the Connecting Lines.



10. Click the three dots to the right on Connecting Lines and select **Show table**.

11. Scroll to the right until you locate the columns labeled **Minimum Travel Distance (miles)** and **Travel Time (Minutes)**. Which polling location is farthest from a wheelchair accessible bus stop? How many polling locations are more than a 5 minute walk from an accessible bus stop?
12. Play with the symbology until you have a meaningful map.

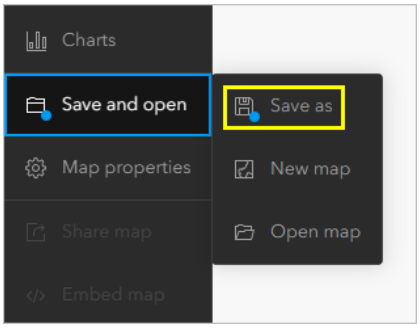


Step 9. Save and share the map

Finally, you'll save your map and give it a title, tags, and a summary so you can find and access it later. Then, you'll share the map to make it accessible to others.

1. On the **Contents** toolbar, click **Save and open** and choose **Save as**.

   Note: The blue dot next to **Save and open** indicates that the map has unsaved changes.



2. In the **Save map** window, for **Title**, type `Workshop Map`.

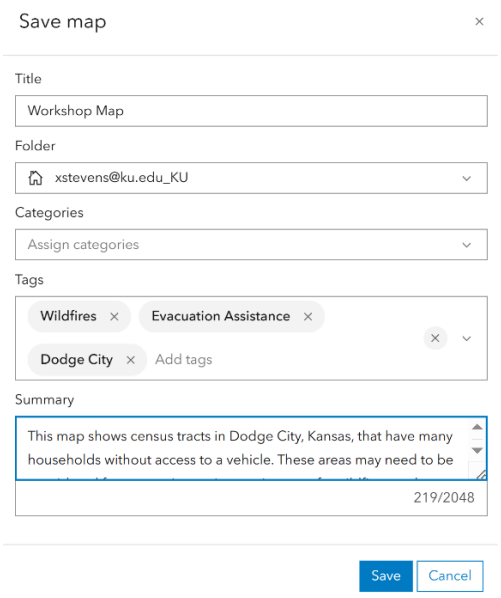
   Next, you'll add tags. Tags are terms that allow users to search for your map in ArcGIS Online.

Note:
For **Folder**, you can leave the default or choose a folder of your choice. Similarly, for **Categories**, you can add or select a category of your choice from the drop-down menu.

3. For **Tags**, type each of the following tags, pressing Enter after each one:
    - Polling Locations
    - Bus Stops
    - Lawrence Kansas

    Finally, you'll add a summary. The summary appears on your map's details page and should provide information about the map so that users better understand its purpose.

4. For **Summary**, type `This map shows bus routes & stops, polling locations, and households without access to a vehicle in Lawrence, Kansas. Analysis of these data might improve accessibility of polling locations.`

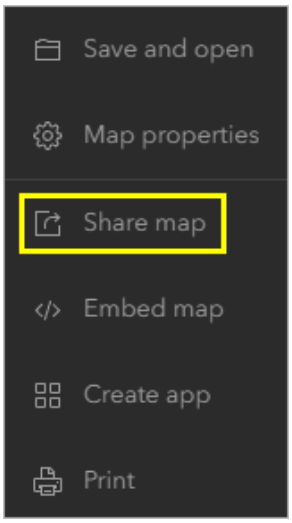


5. Click **Save**.

The map is saved. It now appears in your account's content. You can access your content by clicking the options button next to the map's name and choosing **Content**. For now, you'll set the sharing permissions.

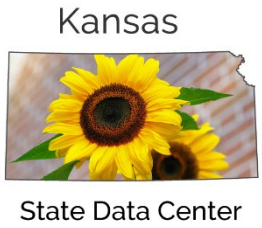
By default, your content is private and only visible to you and your organization's administrator. You can share content to different groups of viewers depending on the level of privacy you want to maintain and the content's audience and purpose. For example, if you choose to share it with your organization, only users with accounts in the same organization as you can access your content. For this tutorial, you've created a public information map and you want it to be available to everyone, so you'll share it publicly.

6. On the **Contents** toolbar, click **Share map**.



7. In the **Share** window, choose **Everyone (public)** and click **Save**.

Questions?



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- Esri Online Tutorials – this workshop was adapted from Esri's Get Started with ArcGIS Online tutorial
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- Bus stops – City of Lawrence.
- Bus routes – Lawrence Transit, https://lawrencetransit.org/data/.
- Polling locations – Douglas County Clerk, https://www.dgcoks.gov/locations/polling-places.
- Topographic map sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, OpenStreetMap contributors, and the GIS User Community.
- Human Geography Map sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, OpenStreetMap contributors, and the GIS User Community.