Setup:

1. Go to: go.ncsu.edu/tdhi-may19
    a. Download 1861_RR_Depots.xlsx
        i. Note: this data is from http://railroads.unl.edu/resources/
    b. Download NC_1860.jpg from the Map of North and South Carolina folder.
2. Login to Mapwarper.net
3. Login in to Studio.Mapbox.com
4. Open Tableau Public (if you haven't downloaded it yet, download it from https://public.tableau.com)

Activity 1: Georeferencing your map with MapWarper.net

In this activity, you will upload a map and georeference it using the open source online tool Map Warper. The result will be a GeoTiff file that you can use in online mapping platforms like Tableau or ArcGIS Online, or with traditional GIS software, like QGIS or ArcGIS.

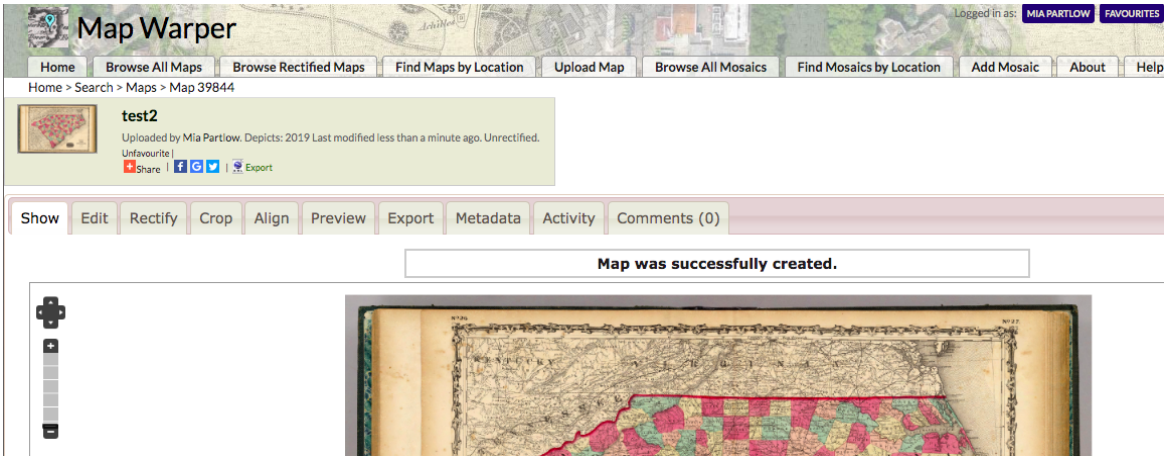
Set up Map Warper and upload your map:

1. Go to the NC_1860.jpg file you downloaded.
   Note: You will need to rename the file in order to upload it to Map Warper**.** Open the folder with NC_1860.jpg and rename it so it has a unique name, for example: NC_1860_**yourlastname**.jpg.
2. On the left hand side of the screen, click the green button to Upload Map

3. The next screen asks for descriptive information that will make the map easier to find (also known as metadata). Only the Title field is required.
    a. You can find the map's metadata in the NC_1860_metadata.txt file in the "Map of North and South Carolina" folder. (Download the file if you want to Copy & Paste data into Map Warper.)
4. Fill in some information from the metadata text file, such as author and date issued.
5. Click the Choose File button under "Upload an image file." Depending on your screen size, this will be either towards the bottom of the page, or in the rightmost column.
6. Navigate to the NC_1860_yourlastname.jpg map that you downloaded, Open, and then click **Create**.

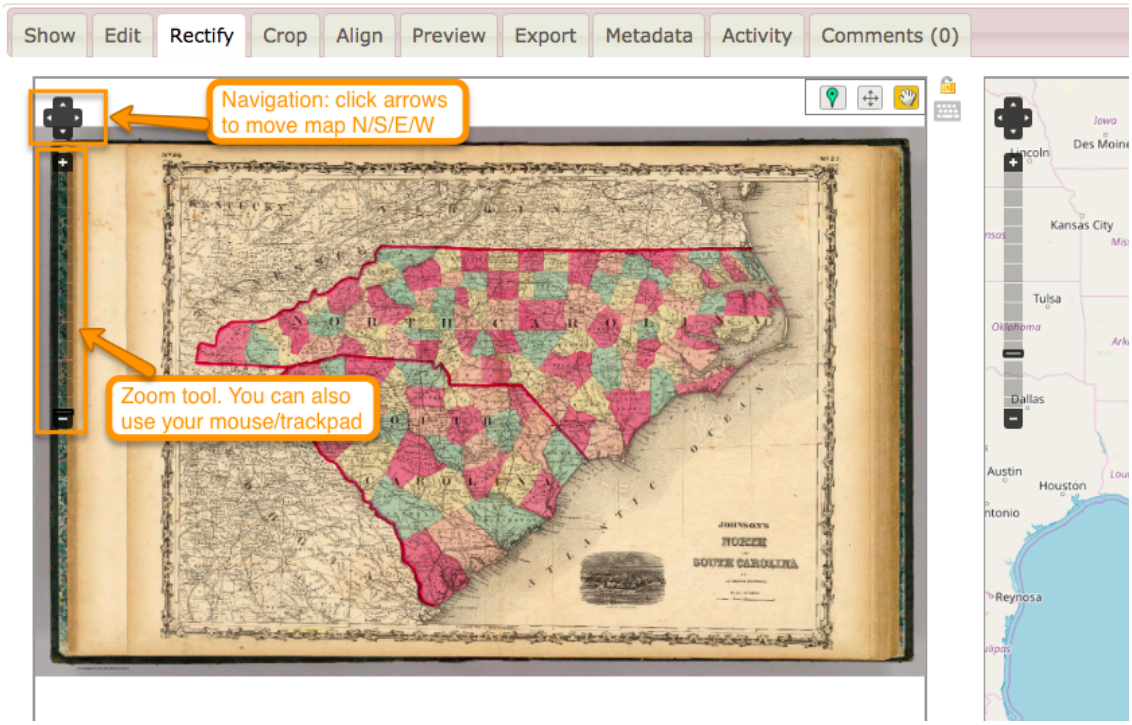
Georeference your map:

1. You now have your map loaded into Map Warper. The interface is organized into tabs.
    - **Show** displays only your uploaded map
    - **Edit** allows you to edit the descriptive text (metadata)
    - **Rectify** is the tab used for the georeferencing itself
    - **Align** is a useful tool if you are stitching together multiple maps
    - **Preview** shows your map on top of a modern basemap
    - **Export** gives you a variety of export options and formats



2. Click on the Rectify tab
3. Take a moment to move the world basemap on the right side to the North and South Carolina region.

- The arrows at the top of the screen move the map slightly to the North, South, East, and West and are useful when you need to make small adjustments to the map.
  You can zoom with the slider or with your trackpad/mouse.



4. To move around a map, click the hand icon. 

5. To add a control point, select the green location marker tool and click on the map where you want to place your marker. Click on a second location to move your marker.

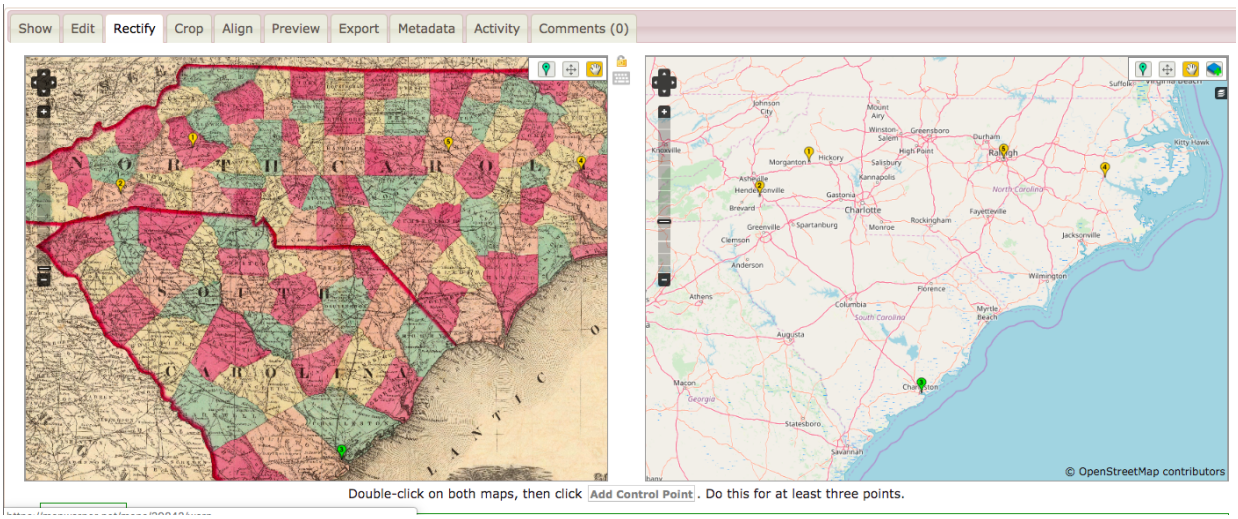
   Note: The control point will not be permanently selected until you click the Add Control Point button below the maps.

6. Once you feel comfortable moving around in the maps, select your first control point. Start from the historic map and choose a location--for example, a city--that will be relatively easy to find on the modern map.

7. Then, click the green marker on the modern map and find the same location.

8. Click the Add Control Point button.

9. You need at least 4 or 5 points. Spread them out across your historic map--focusing on borders and major cities is a good strategy for this type of map.



10. When you have enough points and think they are distributed well across your historic map, click Warp Image! towards the bottom of the page.

11. You will now see the map layered on top of the basemap. You can choose to view a satellite image basemap or the regular OpenStreetMap layer we've been using.

12. Click the Preview tab for a larger view of the georeferenced map. Changing the opacity can give you a sense of how accurate your georeferencing is.

13. Click the Export tab

14. Choose "Download Rectified GeoTiff"

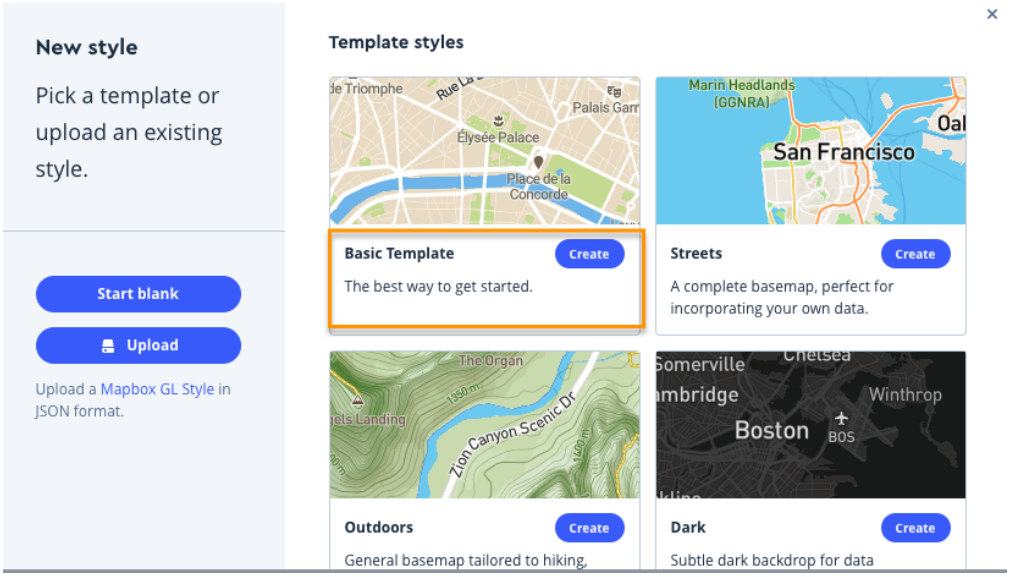
    - GeoTiffs are image files with geographic information embedded. You can use this GeoTiff to publish your map online, as we'll show you in the next activity, or you can upload it into GIS software programs such as QGIS or ArcGIS.

Activity 2: Loading a map into Mapbox.com

Next, we'll upload our georeferenced map onto Mapbox.com, which allows you to create custom web maps that can be used in a variety of online mapping applications.

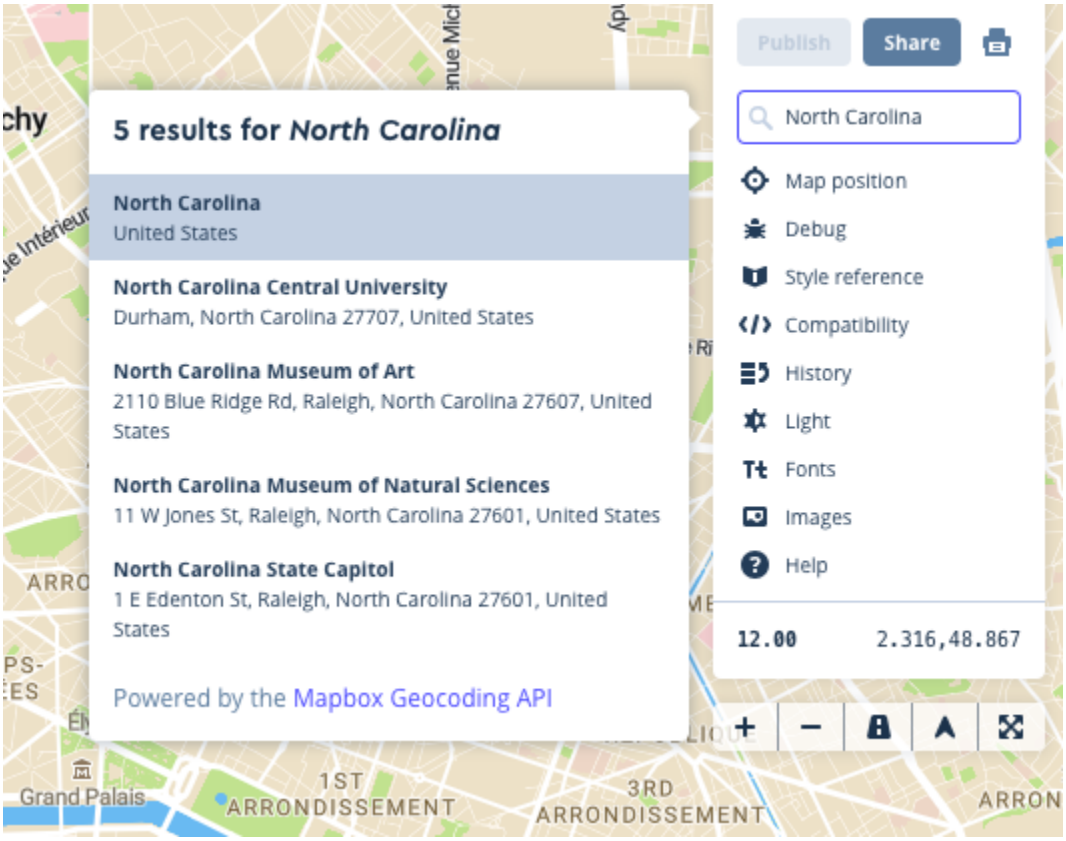
1. To load in your georeferenced map, you'll need the GeoTIff file you created in Map Warper.

2. Go to www.Mapbox.com. Click the Sign In button at the top right to login or create an account.
3. Once you are signed in, click on the Astronaut  and choose Studio at the top right.
4. Under Styles, click the New Style button, then next to “Basic Template,” click Create.

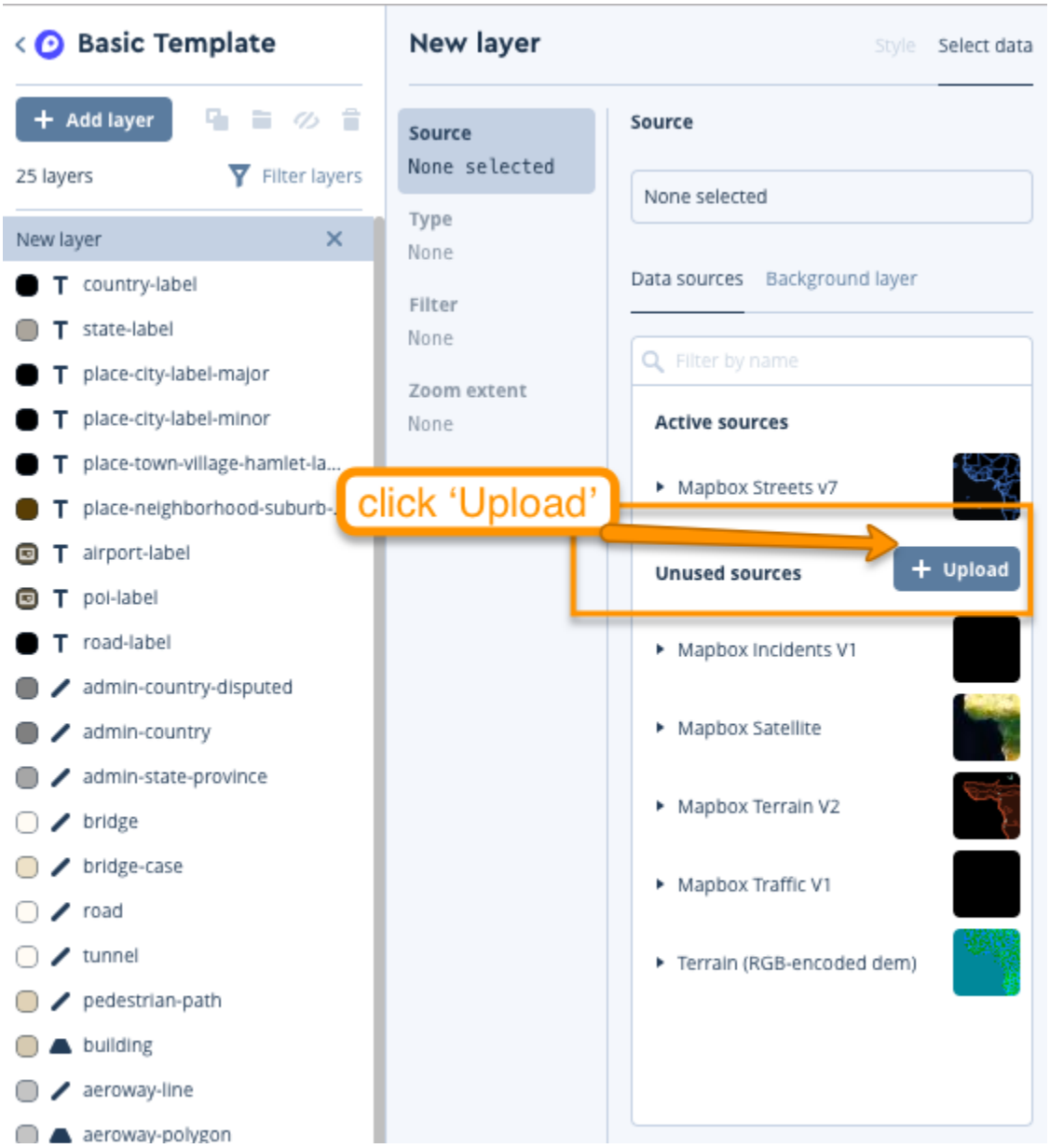


5. You have now loaded in a map that is customizable--you can change the colors, fonts, what features appear (highways, feature labels), and more.

6. In the search box, type “North Carolina,” so that it moves the map view to where our georeferenced map is.



7. Click on the Add Layer button. The “New layer” menu appears. Click the Upload button, seen here:



8. Select your georeferenced map file, Open it, and Confirm.

9. Once your map has finished loading, you’ll need to refresh the page and click on “Add layer” again.

10. In the Add Layer menu, under “Unused sources” you will see the map file that you uploaded. Click on the map title to expand it, and then click on the layer name that appears below it--it will have this icon next to it:

11. Your layer will now appear on the map.
12. To close the New layer menu, click the three bars next to the new layers name--it will be at the top of the list of layers. 

13. Next, in the top right corner click Publish, then Publish as New.
14. Then click Share, and choose ‘Public’

15. Click ‘Use’, then ‘Third Party’ from the menu on the left, and finally, click on ‘Tableau’ from the menu along the top.

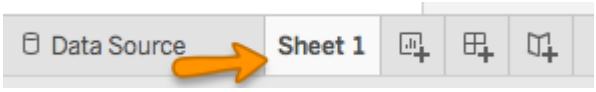
16. Copy the link in the **Integration URL** box by clicking on the blue clipboard next to the url box.
17. We are now going to use this link to load the map into Tableau. You can leave this window open while you open Tableau Public in case you need to copy the link again later.

Activity 2: Visualizing Spatial Data in Tableau

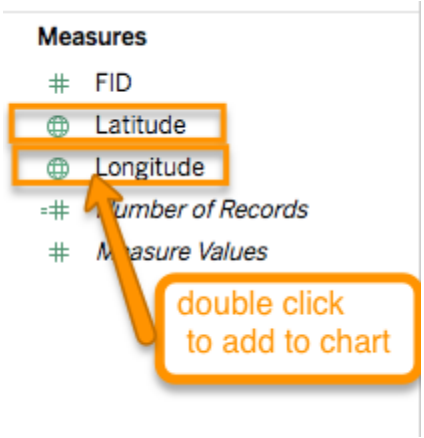
Note: Tableau Public allows you to perform your analysis and create visualizations, but you can only save to the online Tableau Public gallery. Students and Instructors can get a Tableau download for free by submitting a request to Tableau.

1. Open Tableau Public
2. In the Connect menu on the left, choose Microsoft Excel.
3. Browse to 1861_RR_Depots.xlsx on your computer (wherever you downloaded it) and click OK.

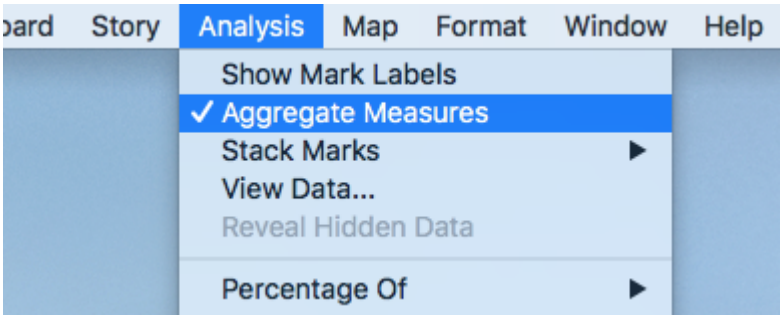
4. Click on Sheet 1 at the bottom of the screen



5. Double click on Latitude in the left sidebar. Then double click on Longitude. They will now appear in the Columns and Rows sections above the chart. Note: it's normal to see only one point on the map.

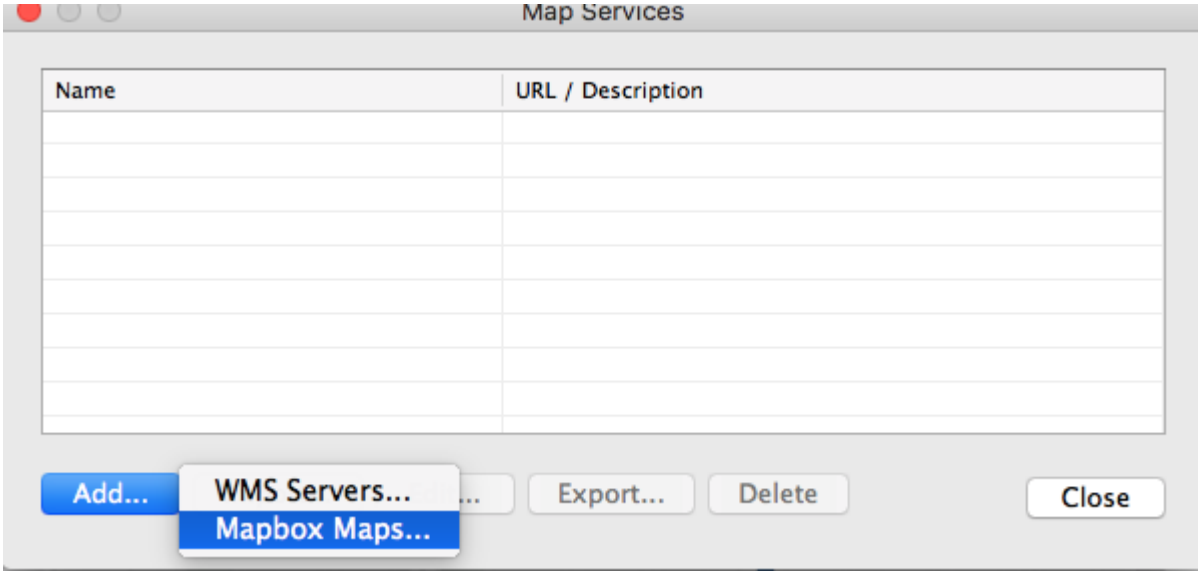


6. Next, from the Analysis menu (top menu bar on your screen), click Aggregate Measures to uncheck it. All of the railroad depots for North and South Carolina should now appear.

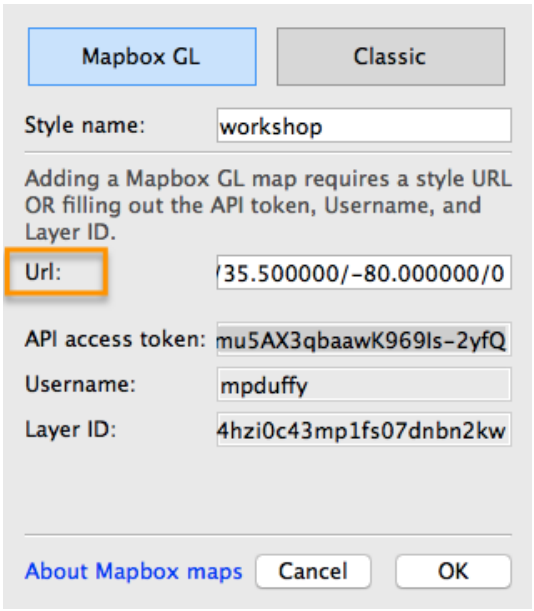


7. Next, we're going to bring in the historic map from Mapbox.
8. From the top menu, go to Map → Background Maps → Map Services

9. Click Add → Mapbox Maps



10. Give your style a name, e.g. “workshop.” In the URL field, paste in the “Integration URL” you copied from Mapbox. Press Tab, and the rest of the fields will autofill. Click OK. Close the Map Services window.



11. You now have 1861 railroad depots displayed on an 1860 map of North and South Carolina.
12. If you want to save your map, go to File → Save to Tableau Public, then sign in to Tableau Public (you may need to create an account).