School Redistricting Example

Maptitude Workshop — March 31, 2018

Background: Washington, DC has nine public high schools: Anacostia, Ballou, Cardozo, Coolidge, Dunbar, Eastern, Roosevelt, Wilson, and Woodson (more on DC Public Schools here). These schools have vastly differing demographics in terms of overall number of students, racial and ethnic background, and socioeconomic status, so determining equitable catchment areas is difficult. Not discussed here will be DC's charter school system (more here) or specialized schools like the Duke Ellington School of the Arts, since these schools do not use catchment areas to determine attendance.

Objective: Learn to use Maptitude's Territory Tool to redistrict DC public high school catchment areas and visualize corresponding changes in school demographics in real time.

Input Data: DCSchools.shp, an ESRI shapefile containing information about DC's 179 census tracts, including:

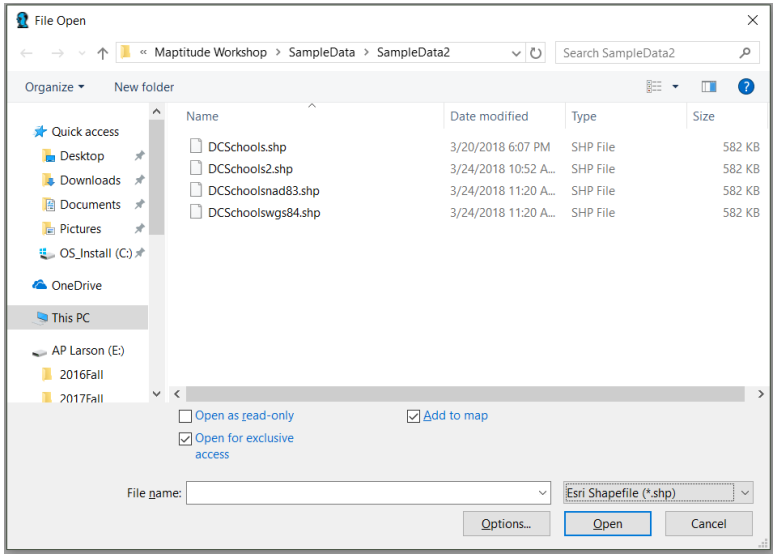
- SCHOOL, the DC public high school that students from that census tract attend;
- STUDENTS, the current number of students residing in the census tract;
- PROJ2, the projected number of students living in the census tract in 2020; and
- PROJ5, the projected number of students living in the census tract in 2023.

Contents:

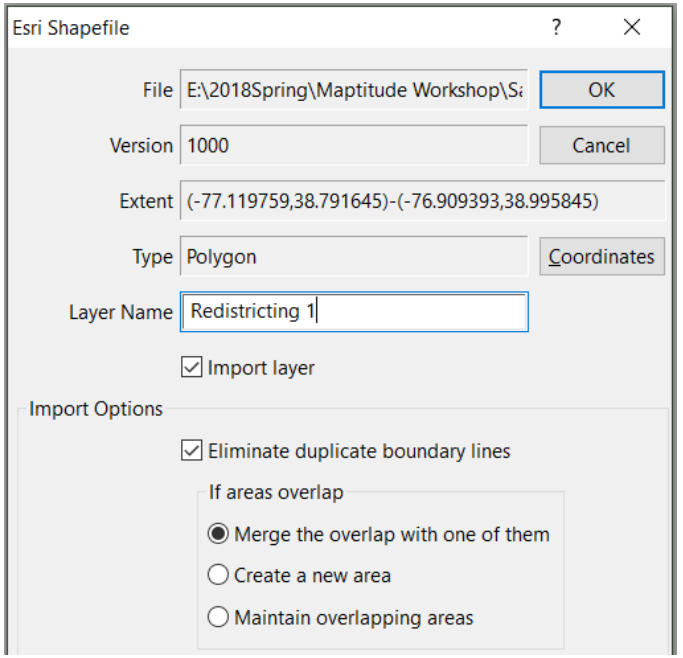
§1: Importing and Preparing an ESRI Shapefile for Analysis

Purpose: One of Maptitude's strengths is its ability to import files of several formats. This section outlines the procedure for importing an ESRI Shapefile into Maptitude and addresses changing input data types, one of the most common issues of data import.

1. Open Maptitude on your PC.
2. Click the folder  or File -> Open to open `DCSchools.shp`. Navigate to the directory where you saved the shapefile. When you have found your directory, select the file type *ESRI Shapefile (*.shp)* to view shapefiles in your directory. Select `DCSchools.shp` and click "Open."

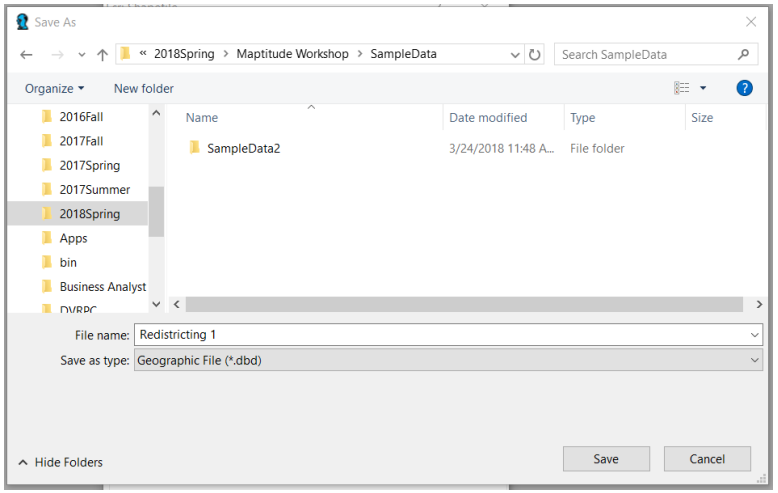


3. You will see a new window allowing you to adjust properties of your file as you import. Check the box for "Import Layer," and give your layer name an appropriate title.



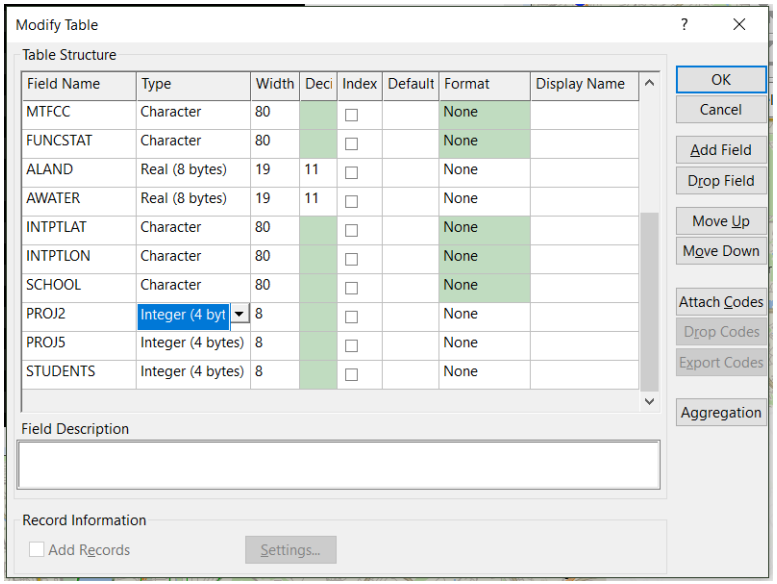
4. By selecting the "Import Layer" option, you can save your ESRI Shapefile in a Maptitude-compatible format. Save this file in your directory with the name of your choice. Click "Save."

   At this point, a map of Washington, DC should appear in Maptitude.



5. When importing the ESRI Shapefile, all fields — including the current and expected student populations — have been imported as text. These should be changed to an integer (numeric) format. Select Dataview -> New Dataview to view the data corresponding with each census tract. As you scroll rightward, you will see the fields SCHOOL, STUDENTS, PROJ2, and PROJ5.
6. Click the Modify Table button. This dialog allows you to change the data types of fields as necessary. Change STUDENTS, PROJ2, and PROJ5 to a numeric field by clicking the drop-down menu under "Type" and selecting "Integer (4 bytes)." Click "OK" to save changes.

   Now that the ESRI Shapefile has been successfully imported into Maptitude, it is time to visualize the current distribution of the student population.



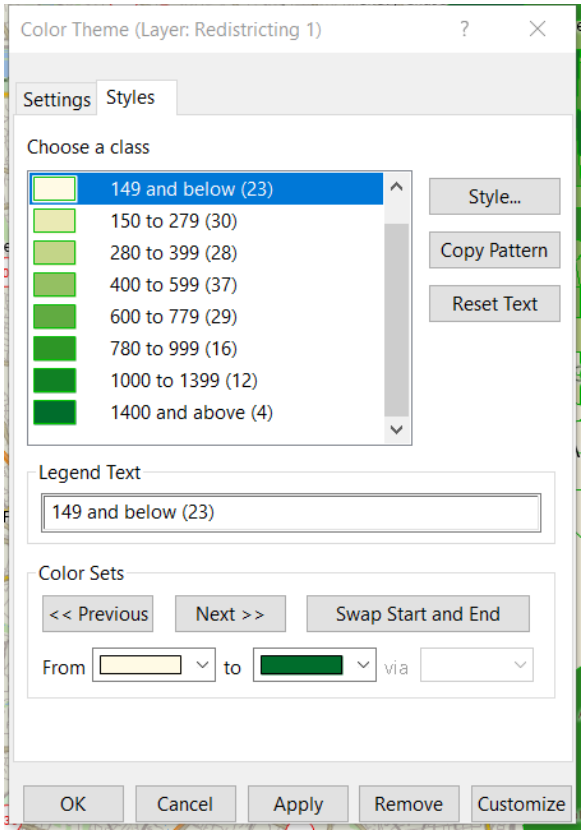
§2: Choropleth Mapping and Current Student Attendance

Purpose: Choropleth mapping is a fundamental skill in GIS. This choropleth map will allow the viewer to see and understand the spatial distribution of DC public high school students at a glance.

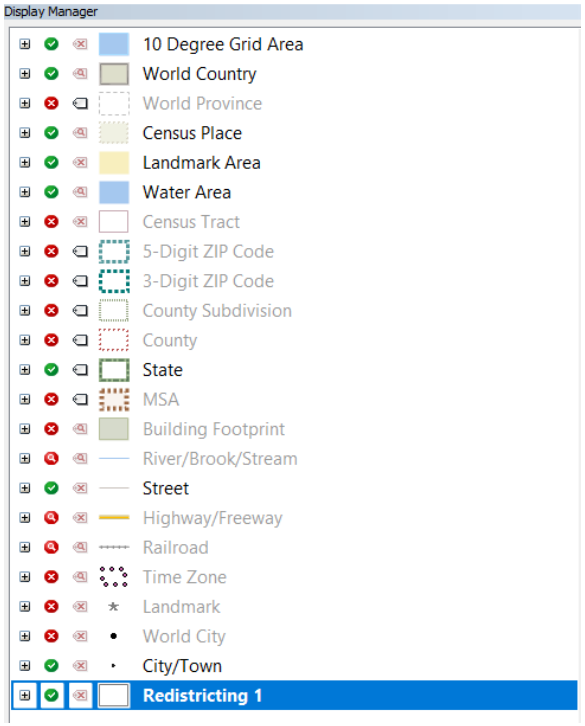
1. Create a choropleth map of current enrollment.
   Select the map icon and input the following information:
   a. Field: STUDENTS
   b. Method: Optimal Breaks. Feel free to try others.
   c. No. of Classes: 8.

   Click "OK" to view.

2. Change the default color scheme of the map. Select the map icon  , go to the "Styles" tab, and change the color options under "Color Sets." Click "Apply" to view the changes and "OK" to save.



3. Change the color of the default border between census tracts. Double-click the box to the left of DC Schools in the Display Manager. This will open a window allowing you to change the border color, style, and width.



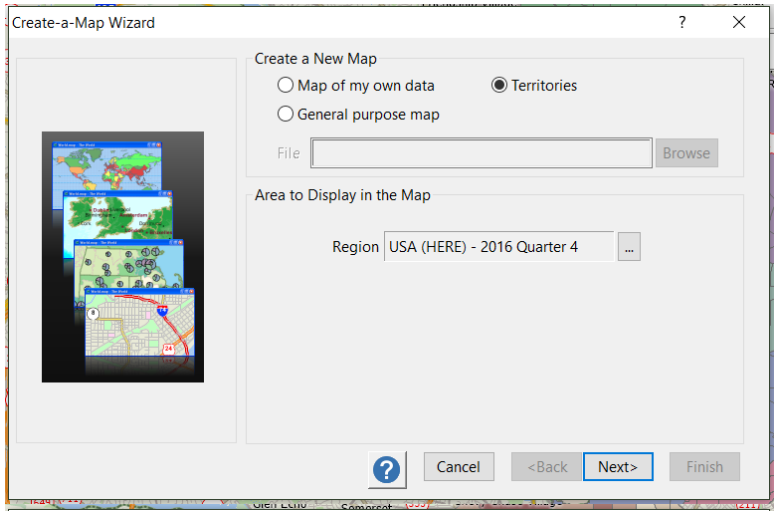
4. Create a map of current school catchment areas in DC. Select the map icon and input the following information:
    a. Field: SCHOOL
    b. Method: List of Values
    c. No. of Classes: 9.

§3: Introduction to Maptitude's Territory Tool

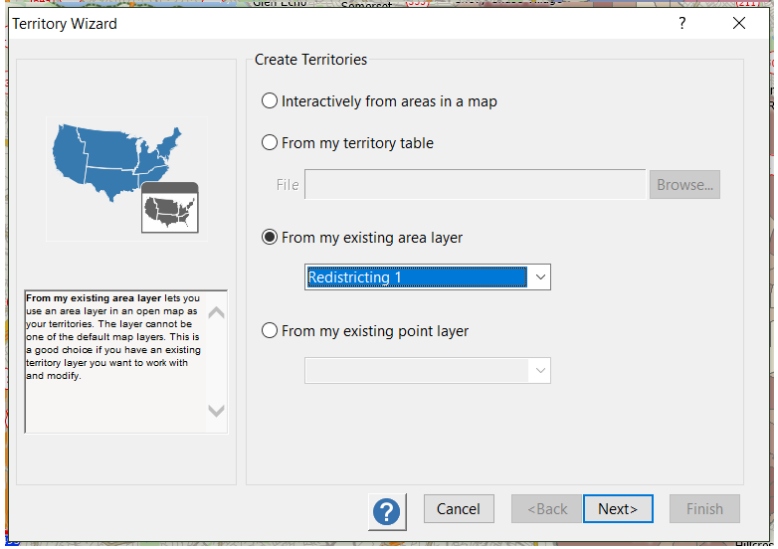
Purpose: Use Maptitude's Territory Tool to create school catchment areas with balanced sizes and learn basic functions within the Territory Manager.

§3.1 Starting the Territory Tool

1. Select the New Map button to open the Create-A-Map Wizard. Select "Territories" and click "Next."

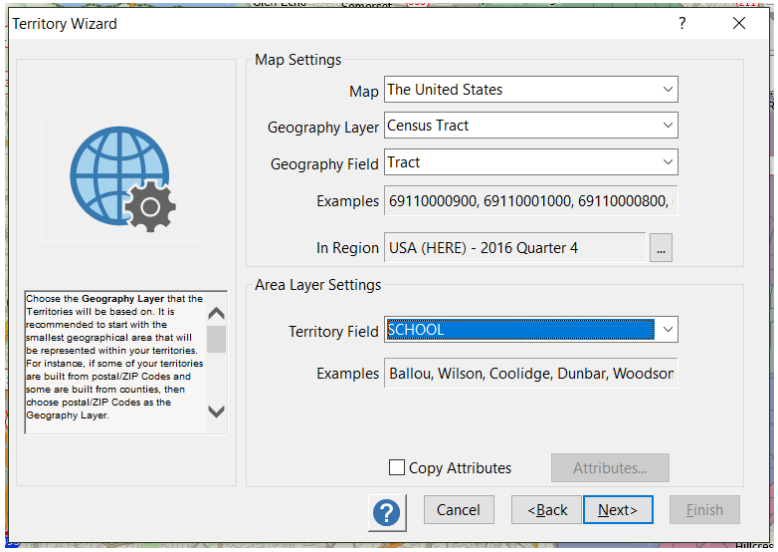


2. Select "From my existing area layer." Your file should be highlighted automatically. Click "Next."



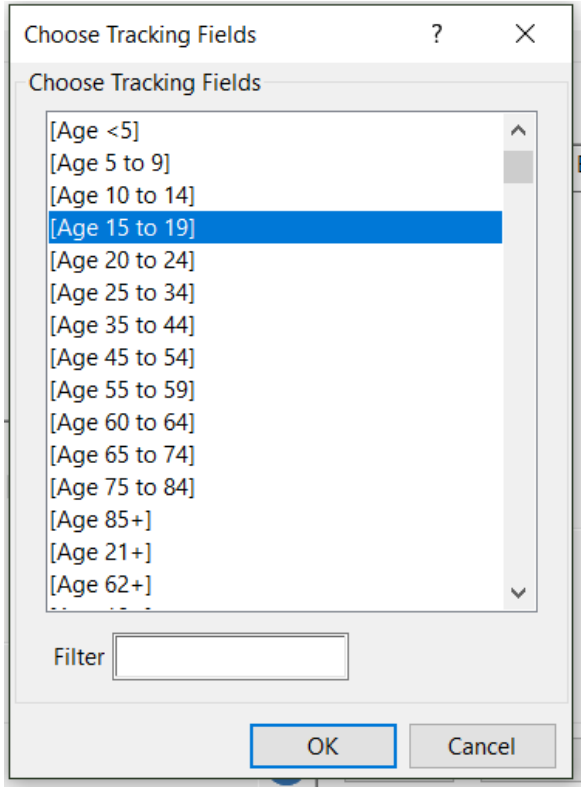
3. Since DC data is available at the census tract level, update the Territory Wizard with this information.
    a. Map: The United States
    b. Geography Layer: Census Tract
    c. Geography Field: Tract
    d. Territory Field: SCHOOL

    Click “Next.”

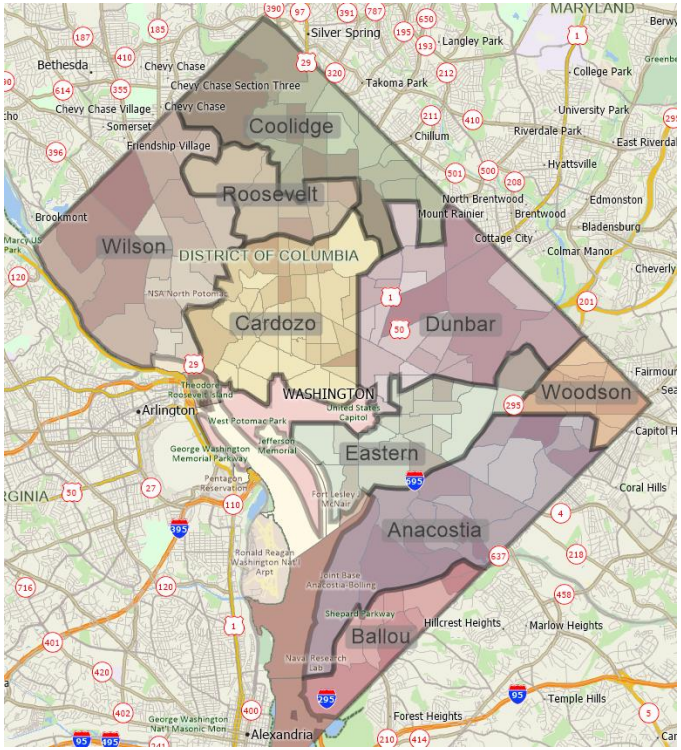


4. Then, select a Tracking Field. This can be filled with any of Maptitude's built-in datasets. To approximate the current high school attendance in DC, add the number of DC residents ages 15-19.

   Click the green plus (+) sign -> Tracking Fields -> Add Geography Layer Fields -> [Age 15 to 19]. Once [Age 15 to 19] is highlighted, click "OK."



5. A map showing DC and its corresponding high school catchment areas should appear.

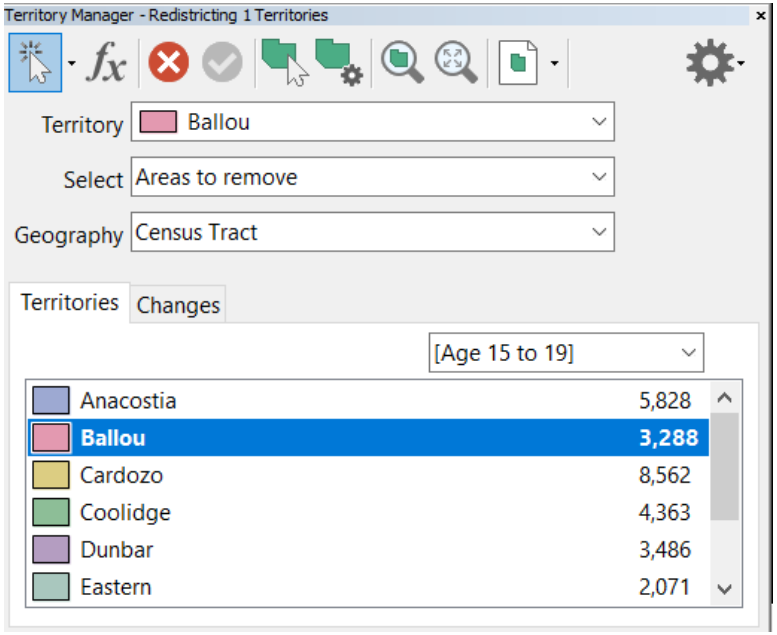


§3.2 Deleting Census Tracts from Territories

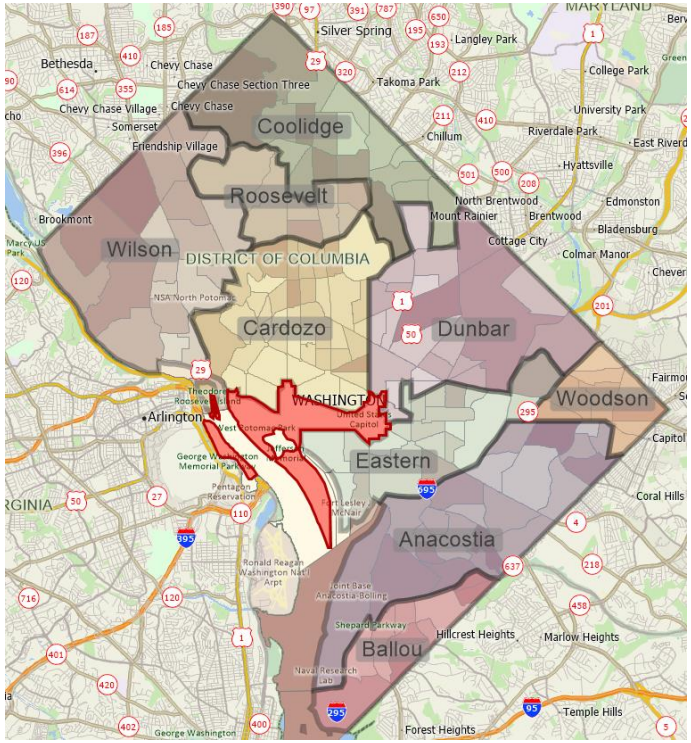
1. The area surrounding the U.S. Capitol is designated as a census tract in Ballou High School's catchment area, which is located at the southern end of DC. Technically, no students are recorded as living in the census tract that contains the U.S. Capitol and White House. Remove this census tract from Ballou's catchment area.

   View the Territory Manager window and select the following:

   a. Territory: Ballou
   b. Select: Areas to remove
   c. Geography: Census Tract



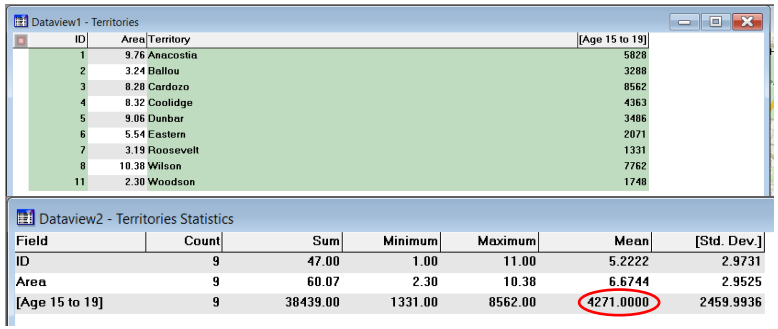
2. Click the "Select by Pointing" tool in the top left hand corner of the Territory Manager and select the census tract that contains the U.S. Capitol. Your screen should look like this:



3. After selecting the tract to delete, click the green check mark to remove the tract. Click the red X to undo any changes.

§3.3 Computing Statistics of All Territories

1. Because the ultimate objective is to balance student attendance across all nine DC public high school catchment areas, it would be useful to compute the grand mean of students across all 9 catchment areas. Maptitude makes this statistic simple.
2. Visit Dataview -> New Dataview to see the current balance of students.

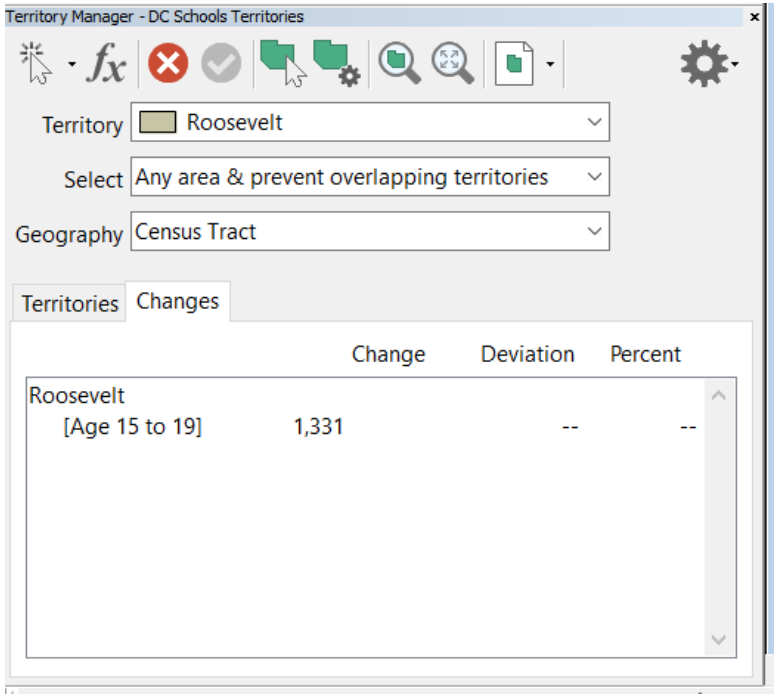


3. Calculate the mean number of students across all catchment areas by clicking the "Compute Statistics" button. This will display the grand mean.

§3.4 Transferring Students from One Territory to Another

1. A glance at the Territory Manager's Territories window reveals that Roosevelt High School has the fewest students. Use the Territory Manager to transfer additional students to its catchment area.
    a. Territories: Roosevelt
    b. Select: Any area & prevent overlapping territories

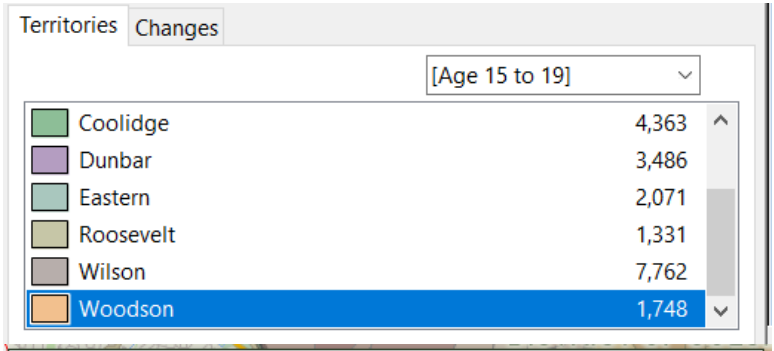
    Select the "Changes" tab to see how the student population changes with edits to the school catchment areas.



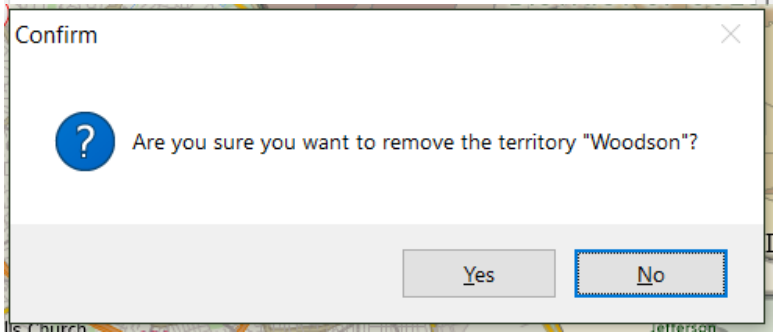
2. After adjusting the settings in the Territory Manager, use the "Select by Pointing" tool to attach additional census tracts to Roosevelt's catchment area. Click additional census tracts around the Roosevelt catchment area to add them to Roosevelt HS. The expected attendance of Roosevelt will increase as surrounding high schools decrease.
3. Once you are satisfied with the changes you made to Roosevelt's catchment area, click the green check mark to save changes. Click the red X to undo any changes.

§3.5 Removing Entire Territories

1. Say that you want to delete the Woodson catchment area in its entirety. Highlight Woodson in the Territory Manager by left-clicking its name, then right-click the record and select “Remove.”



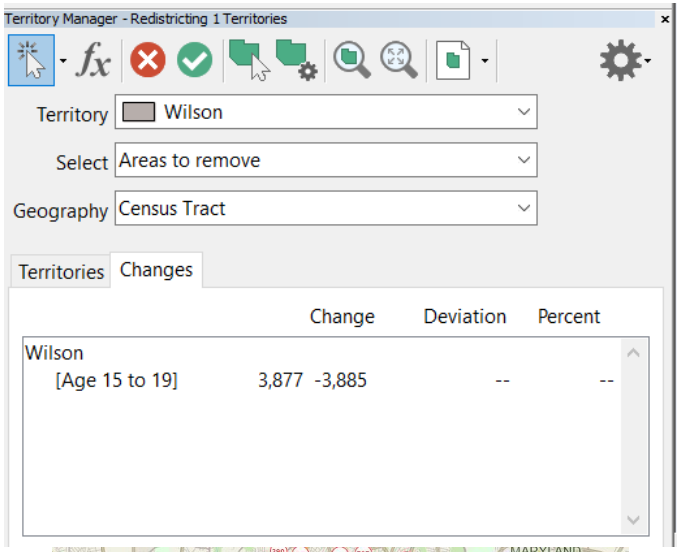
2. You will be given the option to remove the territory along with the following dialog. Select “Yes” to remove.

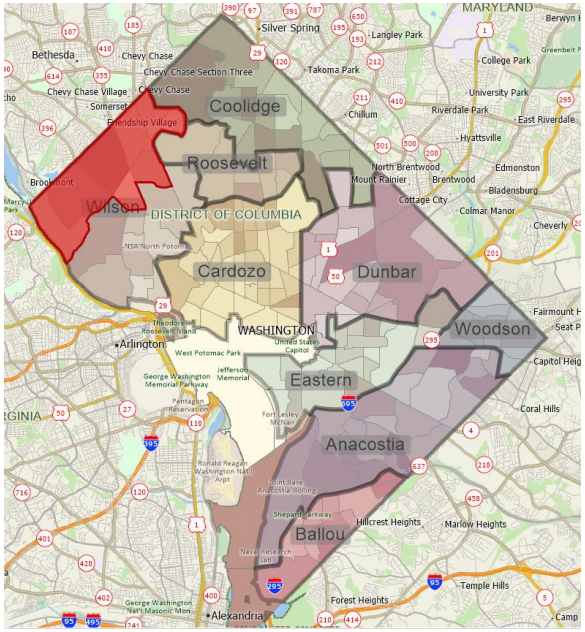


§3.6 Creating New Territories

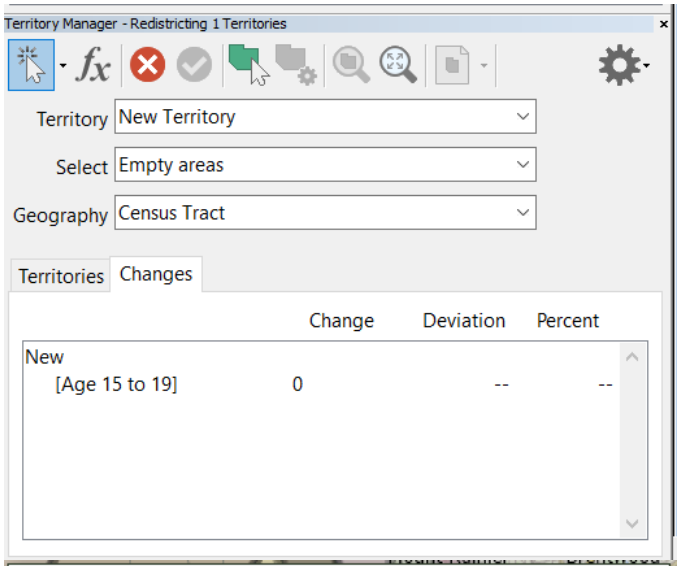
1. Say that you want to divide the Wilson school catchment area in half by adding another school. One way to do this would be to remove territory in the Wilson district that roughly equates half its student population. Visit the Territory Manager.
    a. Territory: Wilson
    b. Select: Areas to remove
    c. Geography: Census Tract

    Select the "Changes" tab to see how the student population changes with edits to Wilson's catchment area.

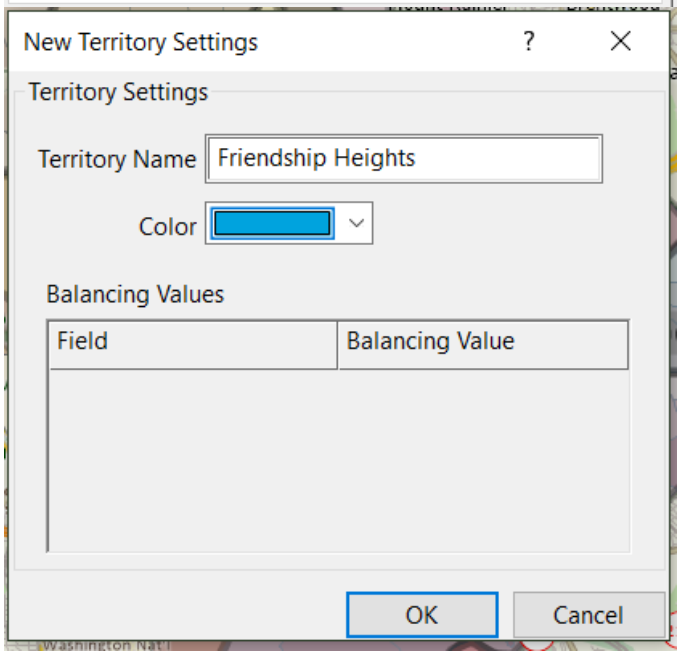




2. Then, allocate the removed areas to a new school. Visit the Territory Manager.
    a. Territory: New Territory
    b. Select: Empty areas
    c. Geography: Census Tract



3. Once you select all the census tracts within your new school catchment area, select the green check mark to save. Click the red X to undo any changes. You will be given the option to select a name and color for your new catchment area.



§4: Extensions

1. Make choropleth maps for PROJ2 and PROJ5, the projected number of high school students in each census tract in 2020 and 2023, respectively. Can you identify any areas of high student growth in Washington, DC?

2. The DC Office of the State Superintendent of Education has stated its intent to build a new high school in Washington, DC. Where would you place the school, and how would you propose to draw school catchment areas?

3. In planning for school catchment areas, it is important to anticipate future student growth. Would your catchment areas change when incorporating younger DC residents? (Hint: include younger residents in your calculation instead of residents ages 15-19).