

# Early Childhood Education

## *Distribution of pre-K facilities and children under five years old*

— by Deden Rukmana

## Introduction

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### Problem

Early childhood education plays an important role in the long-term success of children. Early childhood education, particularly prekindergarten (pre-K), is designed to ensure that children are prepared to enter first grade with the skills they need to succeed academically and socially. Children learn a variety of lessons that promote social and emotional development, language development, cognitive development, and motor development.

Given the importance of early childhood education to the long-term success of children and their families, it would be crucial for parents to have access to affordable and quality early childhood education facilities including pre-K. The best locations for pre-K facilities are very close to homes with easy geographical access.

How well located are pre-K facilities in Chatham County, Georgia? Are the locations of pre-K facilities close to the residences of parents with children under five years old? Do parents with children under five years old have easy geographic access to pre-K facilities?

### Location

Chatham County, Georgia

### Time to complete the lab

Three to four hours

*Keywords: pre-K facility, neighborhood, census tract, geocoding, spatial distribution, US Census data, and children under 5 years old*

## Prerequisites

- Familiarity with ArcGIS 10
- Familiarity with Microsoft Excel

## Data used in this lab

- Locations and capacity of pre-K facilities in Chatham County from the Georgia Department of Early Care and Learning and the phone surveys.
- 2010 US Census data

# Student activity

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Given the importance of early childhood education to the long-term success of children and their families, it would be crucial for parents to have easy geographic access to affordable and quality pre-K facilities. The best locations for pre-K facilities are very close to the residences of families with children under five years old.

In this lab, you will attempt to address the following analytic questions:

1. Do the locations of pre-K facilities correspond with the population distribution of children under five years old?
2. Which neighborhoods or census tracts need pre-K facilities?

## RETRIEVE SPATIAL DATA FROM THE US CENSUS

You will begin by retrieving two spatial datasets from the US Census Bureau, including the 2010 census tracts of Chatham County, Georgia, from the Census Bureau's TIGER website and the number of children under five years old by census tract in Chatham County from the Census Bureau's American FactFinder website.

- 1 Use your web browser to go to the 2010 TIGER/Line Shapefiles at <http://www.census.gov/cgi-bin/geo/shapefiles2010/main>.
- 2 Click the *Select a layer type* drop-down list and click *Census Tracts* and then *submit*.
- 3 Click the *Census Tract (2010)* list and click *Georgia* and then *submit*.

- 4 Click the *county* list and click *Chatham County* and then *Download*.
- 5 Save all five downloaded files to your working folder.

You have retrieved the spatial data of census tracts of Chatham County, Georgia; it is in a shapefile format called *tl\_2010\_13051\_tract10*. The next step is to retrieve the number of children under five years old by census tract in Chatham County. The number of children under five years old will be an attribute for the downloaded census tracts of Chatham County.

- 6 Use your web browser to go to [factfinder2.census.gov](http://factfinder2.census.gov).
- 7 Click *Geographies* in the left panel.
- 8 Click the *geographic type* list and click *Census Tract*.
- 9 Click the *state* list and click *Georgia*.
- 10 Click the *county* list and click *Chatham*.
- 11 Click *All Census Tracts within Chatham County, Georgia*. Your view should look similar to the image below.

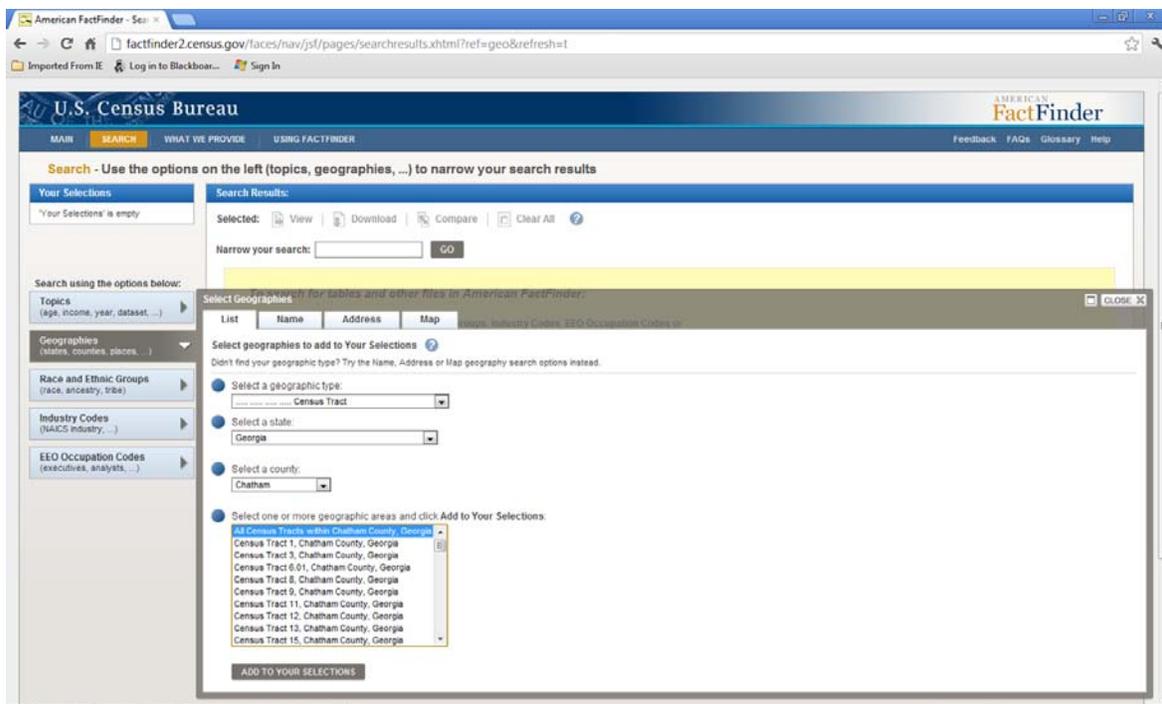


Figure 1. American FactFinder geographic selection.

- 12 Click **ADD TO YOUR SELECTIONS**.

Ensure that you do not have any selections before you click **ADD TO YOUR SELECTIONS**. Here you start a new search.

13 Click *Topics* in the left panel.

14 Click *Dataset* and click *2010 SF-1 100% Data*. This data is from the US 2010 Census.

The screenshot shows the American FactFinder interface. The search results table is as follows:

ID	Table, File or Document Title	Dataset	About
<input checked="" type="checkbox"/>	DP-1 Profile of General Population and Housing Characteristics: 2010	2010 SF1 100% Data	<a href="#">?</a>
<input checked="" type="checkbox"/>	QT-H1 General Housing Characteristics: 2010	2010 SF1 100% Data	<a href="#">?</a>
<input checked="" type="checkbox"/>	QT-H2 Tenure, Household Size, and Age of Householder: 2010	2010 SF1 100% Data	<a href="#">?</a>
<input checked="" type="checkbox"/>	QT-H3 Household Population and Household Type by Tenure: 2010	2010 SF1 100% Data	<a href="#">?</a>
<input checked="" type="checkbox"/>	QT-P1 Age Groups and Sex: 2010	2010 SF1 100% Data	<a href="#">?</a>
<input checked="" type="checkbox"/>	QT-P10 Hispanic or Latino by Type: 2010	2010 SF1 100% Data	<a href="#">?</a>
<input checked="" type="checkbox"/>	QT-P11 Households and Families: 2010	2010 SF1 100% Data	<a href="#">?</a>
<input checked="" type="checkbox"/>	QT-P12 Household Relationship and Group Quarters Population: 2010	2010 SF1 100% Data	<a href="#">?</a>
<input checked="" type="checkbox"/>	QT-P13 Group Quarters Population by Sex, Age, and Type of Group Quarters: 2010	2010 SF1 100% Data	<a href="#">?</a>
<input checked="" type="checkbox"/>	QT-P2 Single Years of Age and Sex: 2010	2010 SF1 100% Data	<a href="#">?</a>
<input checked="" type="checkbox"/>	QT-P2 Race and Hispanic or Latino Origin: 2010	2010 SF1 100% Data	<a href="#">?</a>

Figure 2. American FactFinder data download.

15 Click *Profile of General Population and Housing Characteristics: 2010*.

16 Click *Download*.

17 Ensure that *Data and annotations in a single file* is checked and click *OK*.

You do not select a download format in Microsoft Excel because you will download not only the data of census tract 1 but of all the census tracts in Chatham County.

18 Save all four downloaded files to your working folder.

**Question 1:** How many children under five years old are in census tract 6.01?

**Question 2:** Which census tract in Chatham County, Georgia, has the highest number of children under five years old?

## ADD A FIELD TO A SHAPEFILE ATTRIBUTE TABLE

- 1 Start ArcMap with a new map.
- 2 If the Catalog tab is missing on the right side of the ArcMap application, click the *Windows* menu and click *Catalog*.
- 3 Click the *Connect to Folder* icon.
- 4 Open your working folder.

Your view should look similar to the image below.

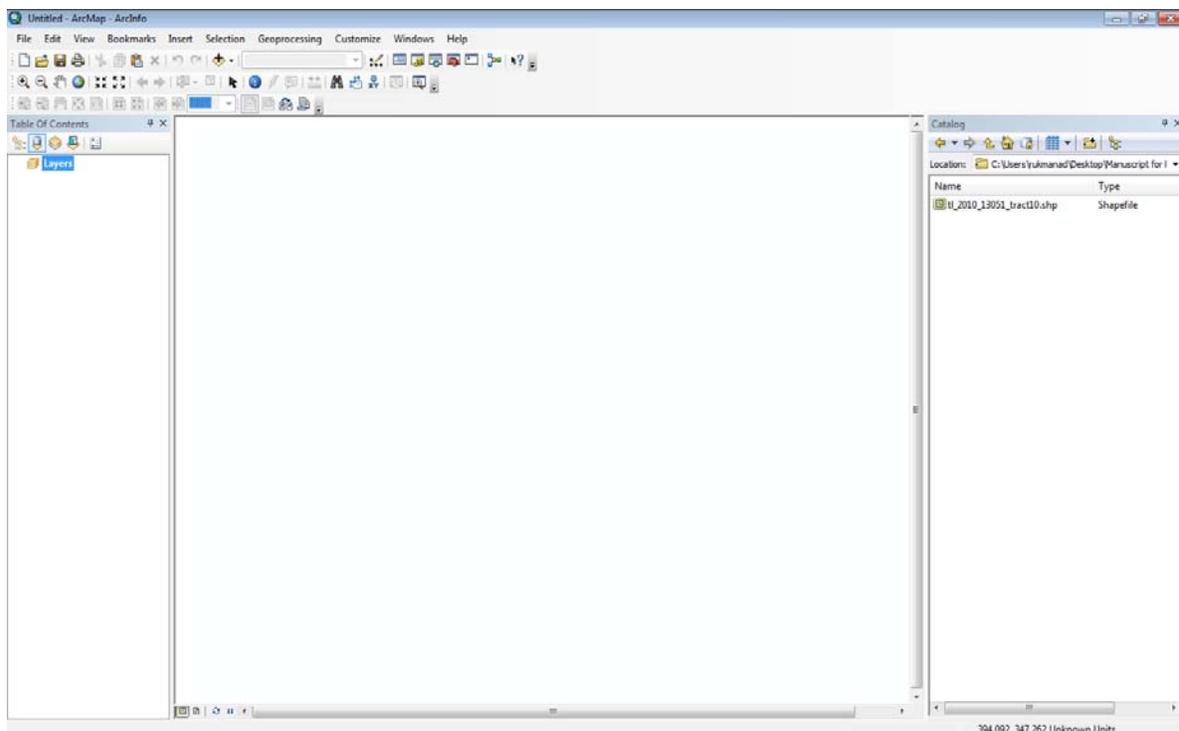


Figure 3. Catalog window.

- 5 Rename *tl\_2010\_13051\_tract10.shp* to ***Children under 5 years old.shp***.

- 6 Add the *Children under 5 years old* shapefile as a layer to ArcMap.

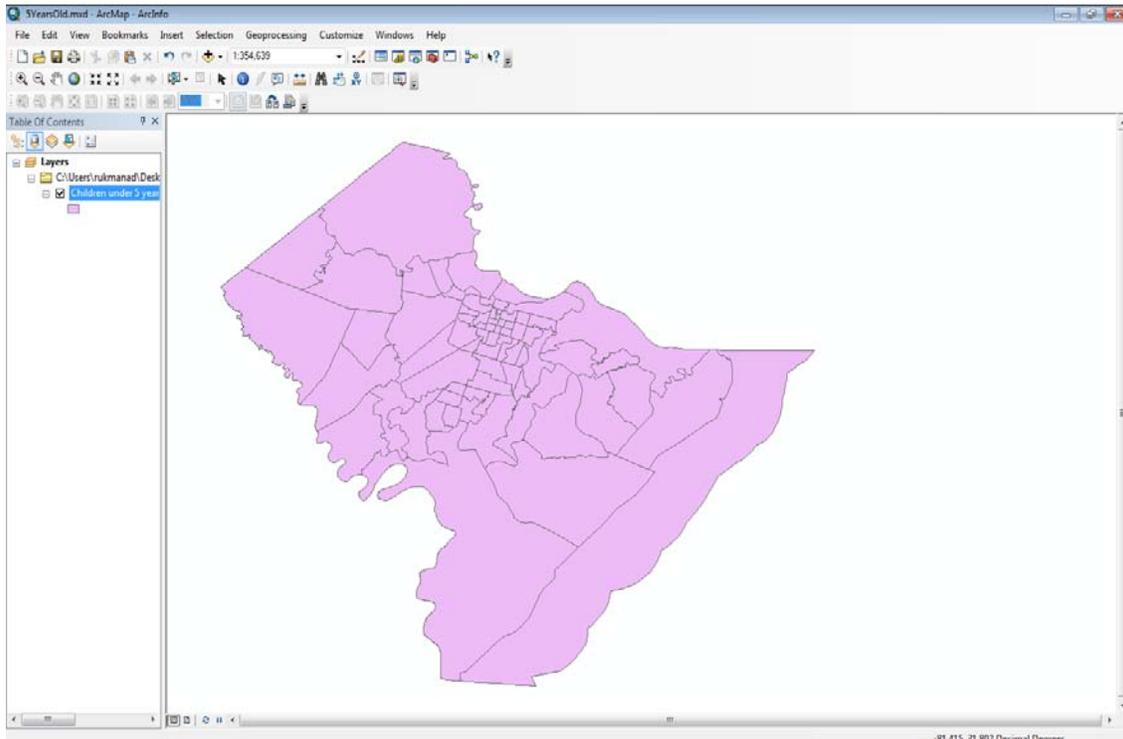


Figure 4. Census tracts in Chatham County, Georgia.

- 7 In the *Table of Contents*, right-click the *Children under 5 years old* layer and click *Open Attribute Table*. The *Children under 5 years old* attribute table appears.

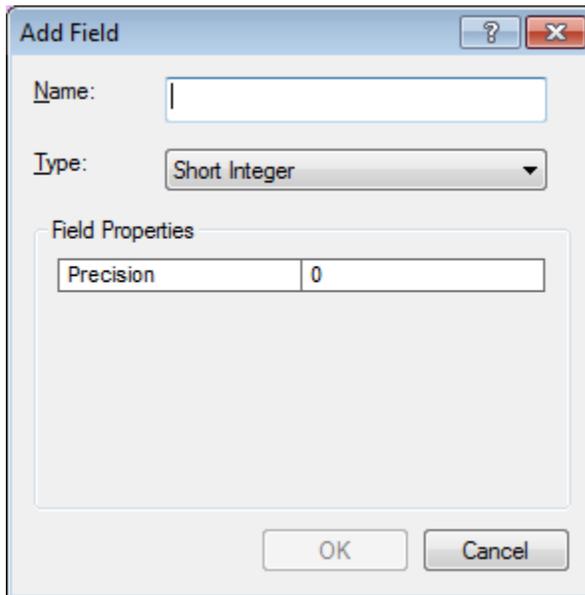
The screenshot shows the 'Table' window in ArcMap, displaying the attribute table for the 'Children under 5 years old' layer. The table has the following columns: FID, Shape, STATEFP10, COUNTYFP10, TRACTCE10, and GEOID10. The data is as follows:

FID	Shape *	STATEFP10	COUNTYFP10	TRACTCE10	GEOID10
0	Polygon	13	051	011003	130510110
1	Polygon	13	051	004100	130510041
2	Polygon	13	051	011005	130510110
3	Polygon	13	051	011006	130510110
4	Polygon	13	051	011107	130510111
5	Polygon	13	051	011106	130510111
6	Polygon	13	051	010809	130510108
7	Polygon	13	051	010808	130510108

The table window also shows navigation controls and a status bar indicating '(0 out of 72 Selected)'.

Figure 5. *Children under 5 years old* attribute table.

- Click the *Table Options* button in the table frame and click *Add Field*. The *Add Field* dialog box appears.



The image shows a standard Windows-style dialog box titled "Add Field". It has a title bar with a question mark icon and a close button (X). The main area contains three input fields: a text box for "Name:", a dropdown menu for "Type:" currently showing "Short Integer", and a "Field Properties" section containing a text box for "Precision" with the value "0". At the bottom of the dialog are two buttons: "OK" and "Cancel".

Figure 6. *Add Field* dialog box.

- In the *Name* box, type ***Child5yrs***.
- In the *Type* box, select *Short Integer*.
- In the *Precision* box, enter ***5***.
- Click *OK* to close the *Add Field* box.

A new field, *Child5yrs*, has been added to the attribute table of *Children under 5 years old*, but all values are still 0. You can see the values of 0 from the attribute table of *Children under 5 years old*.

The next step is to update the values of this new *Child5yrs* field.

- 13 On the ArcMap main menu, click the *Editor toolbar* button. The *Editor toolbar* appears.

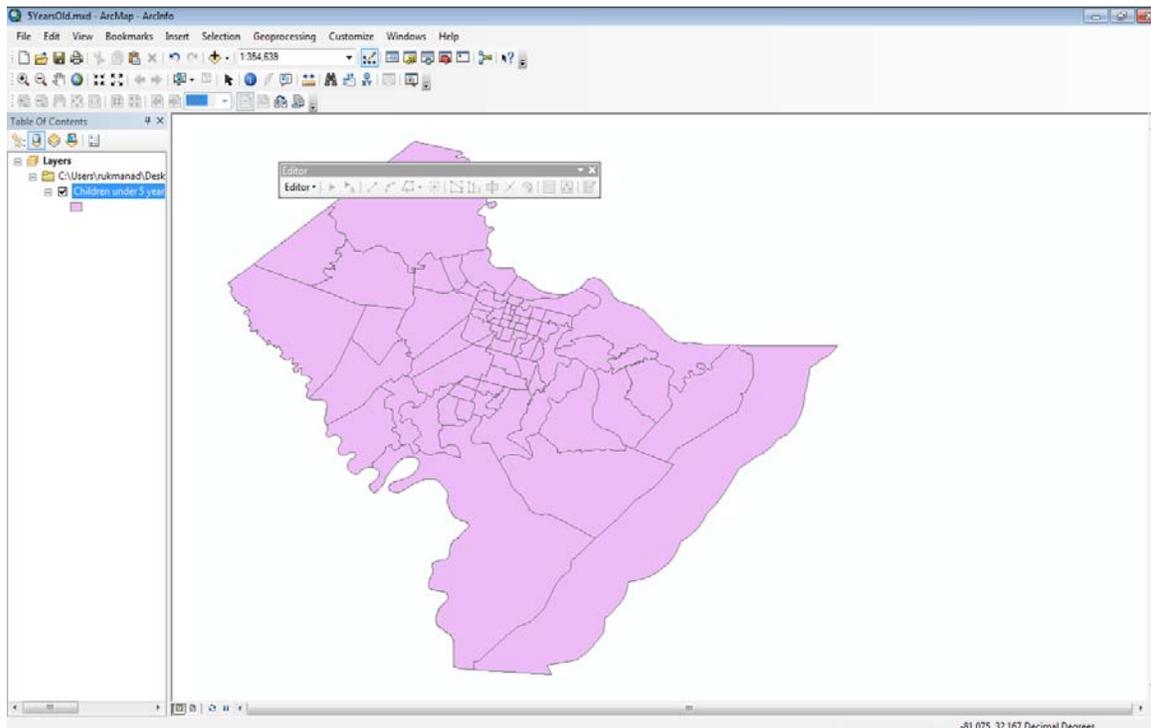


Figure 7. Editor toolbar.

- 14 On the *Editor toolbar*, click *Editor*, and then click *Start Editing*.
- 15 Open the attribute table of *Children under 5 years old*.
- 16 Enter the number of children under five years old by census tract under the new field of *Child5yrs*.

In this step, you will enter the number of children under five years old for each census tract. You will enter 72 numbers, one at a time. Ensure that you enter the number of children under five years old for their corresponding census tracts. You can expedite your data entry by sorting census tracts in ascending or descending order.

- 17 After you complete the data entry, click *Editor* on the *Editor toolbar*, and then click *Save Edit* and *Stop Editing*.
- 18 Save your map as ***Under5YearsOld.mxd***.

**Question 3:** Referring to *Under5YearsOld.mxd*, which parts of Chatham County have a high number of children under five years old?

## GEOCODE THE ADDRESSES OF PRE-K FACILITIES

Geocoding is the process of converting addresses, places, and similar information into map features or geographic coordinates. Now, you will geocode the addresses of pre-K facilities in Chatham County, Georgia. According to the Georgia Department of Early Care and Learning, 58 pre-K facilities are registered in Chatham County. These pre-K facilities include public and private facilities.

- 1 Open *Under5YearsOld.mxd*.
- 2 Add the *Chatham Roads* shapefile to your map.

You will get a message “Unknown spatial reference”. You can ignore this message and proceed with the next steps. This message appears because the *Chatham County* shapefile does not have the coordinate system or projection defined. You can define the coordinate system for this shapefile using (1) *ArcToolbox » Data Management Tools » Projections and Transformation* or (2) the Shapefile Properties page in ArcCatalog.

- 3 Add the *Chatham PreK\$* sheet from the *PreK Chatham* spreadsheet. The addresses of pre-K facilities that you will be geocoding are on this sheet.
- 4 Click the *Catalog window* icon (or from the Start menu, click *Windows* and then *Catalog*).

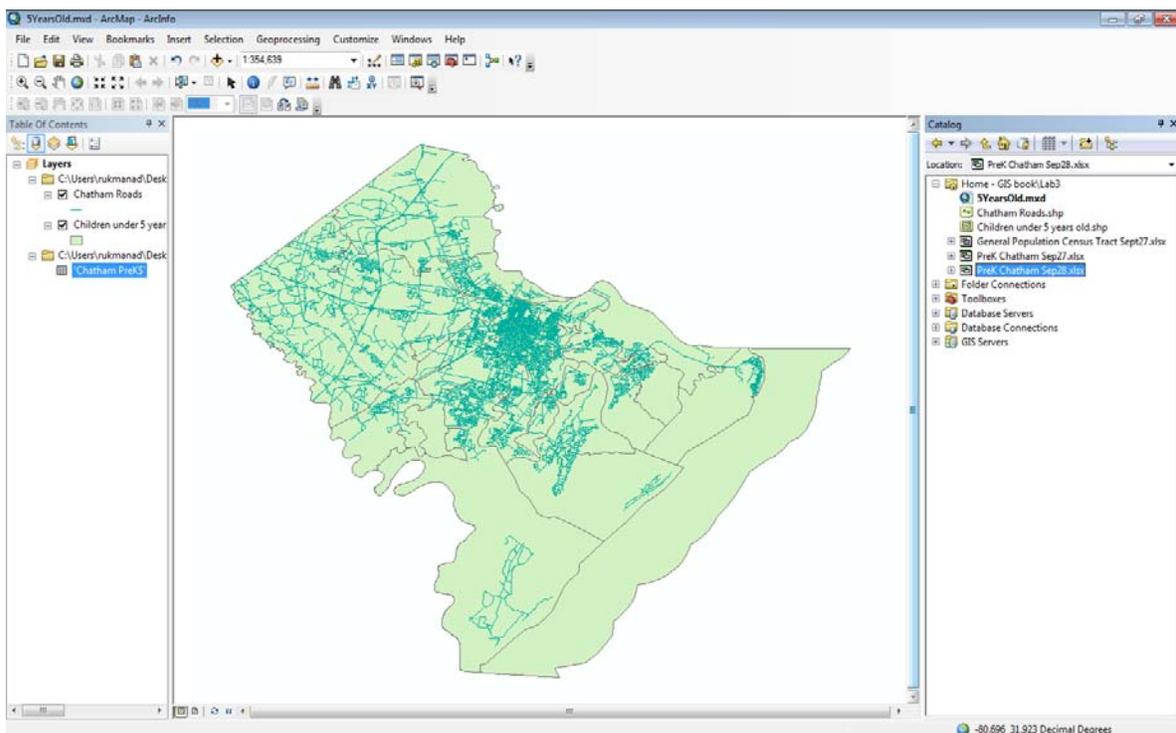


Figure 8. Basemap for geocoding.

- 5 In the *Catalog window*, right-click your working folder and click *New* and *Address Locator*.
- 6 A *Create Address Locator* dialog box appears.

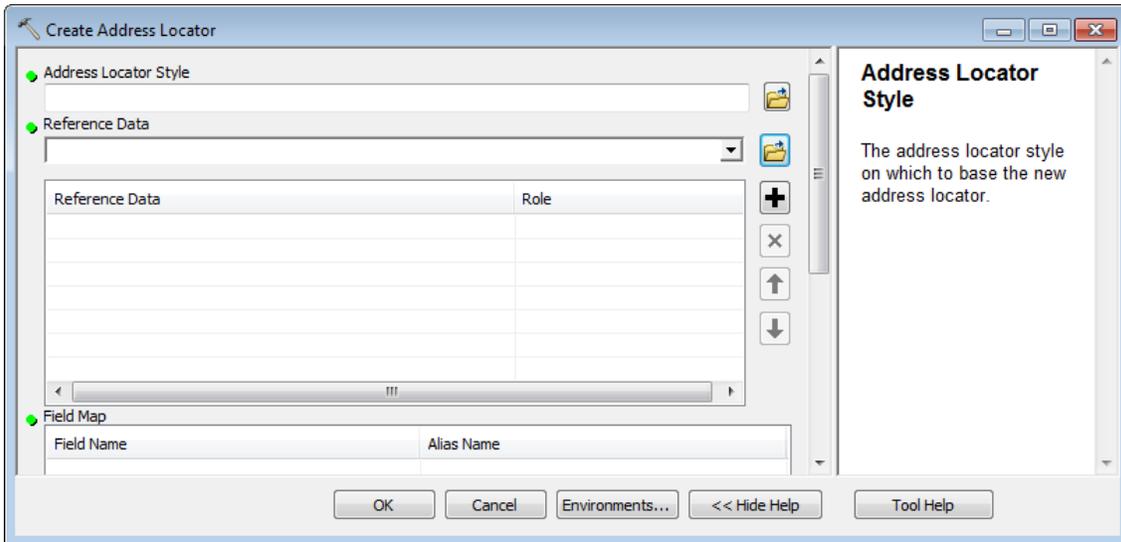


Figure 9. *Create Address Locator* dialog box.

- 7 Click the *Browse* button for *Address Locator Style*, and a *Select Address Locator Style* dialog box appears.

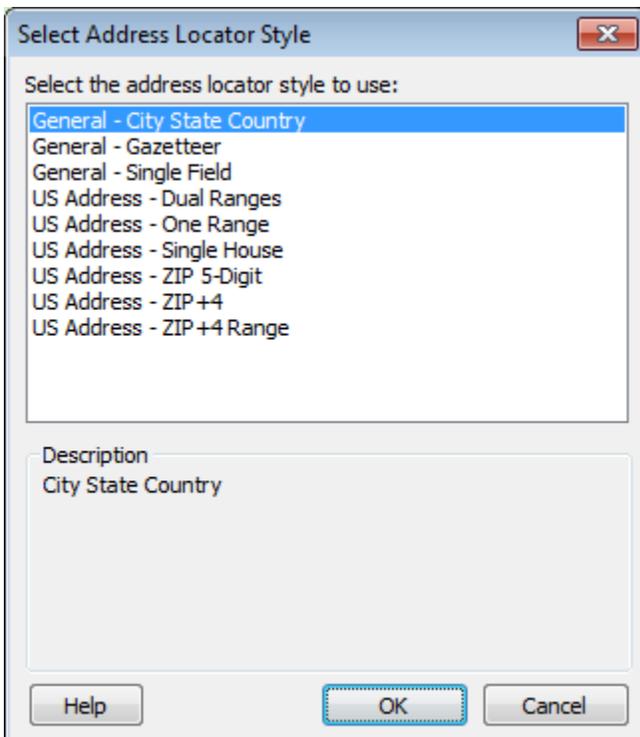


Figure 10. *Select Address Locator Style* dialog box.

- 8 Click *US Address - Dual Ranges*. Click *OK* (you can ignore the warning icon and message).
- 9 For *Reference Data*, select *Chatham Roads*.
- 10 Click the *Browse* button for *Output Address Locator*. Double-click your working folder, type ***PreKAddresses*** for *Name*, and click *Save*.
- 11 Click *OK* to create the address locator.

You have created an address locator named *PreKAddresses*. Look at your working folder and see that the address locator is there. The next step is to geocode the addresses of pre-K facilities to Chatham County streets.

- 12 On the main menu, click *Customize » Toolbars*, and then click *Geocoding*. The *Geocoding* toolbar appears.
- 13 On the *Geocoding* toolbar, click the *Geocode Addresses* button,
- 14 Click *Add* and select *PreKAddresses* (located in your working folder).
- 15 Click *Add*, and then click *OK*. A *Geocode Addresses* dialog box appears.
- 16 For *Address table*, select *Chatham PreK\$*.
- 17 For *Street or Intersection*, select *Address*.
- 18 For *City or Placename*, select *City*.
- 19 For *ZIP Code*, select *ZIP*.

Your dialog box should match the one on the following page.

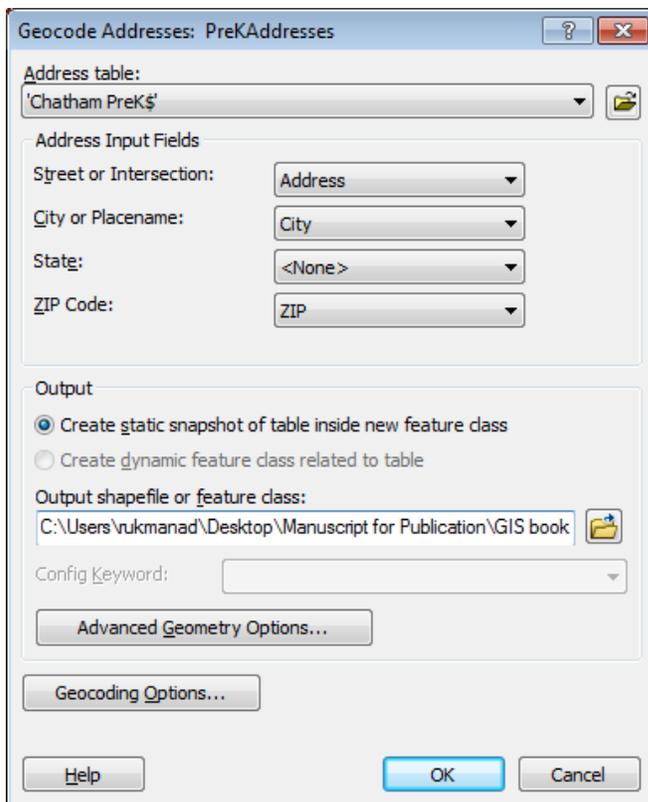


Figure 11. Geocode Addresses dialog box.

- 20 Click the browser icon for *Output Shapefile or feature class* and type **PreK Chatham Geocoded Addresses** for *Name*. Change the *Save as type* to *Shapefile*. Click *Save*.
- 21 Click *OK* to start the geocoding procedure. A window appears looking similar to the image below.

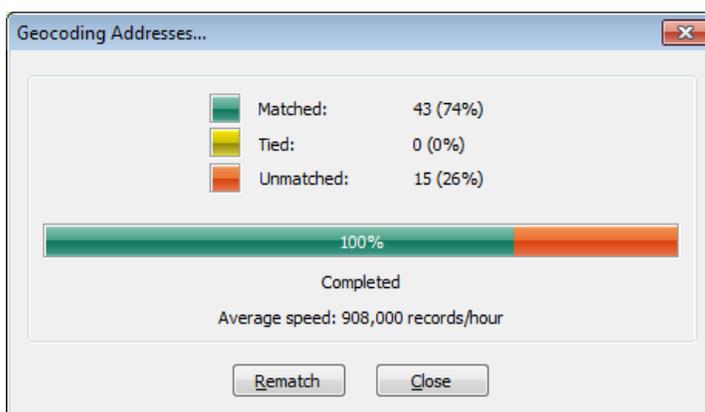


Figure 12. The aggregate results of geocoding procedure.

- 22 Click *Close*.

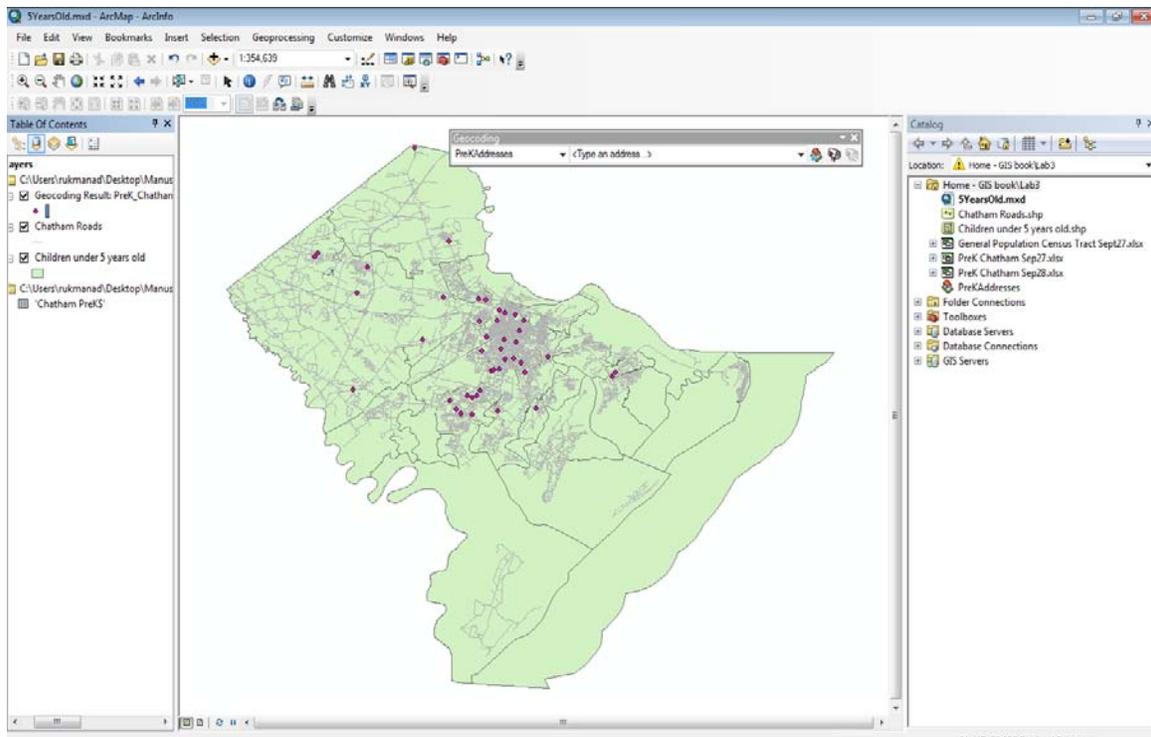


Figure 13. First results of geocoding procedure.

The software matches only 43 of 58 addresses of pre-K facilities in Chatham County. Fifteen addresses of pre-K facilities as listed in the *Chatham PreK* sheet were not matched with the streets in Chatham County as listed in the *Chatham Roads* shapefile. The next step is to geocode the 15 unmatched pre-K addresses.

- 23 In the *Table of Contents*, click *Geocoding Result: PreK Chatham Geocoded Addresses*.
- 24 On the *Geocoding* toolbar, click the *Review/Rematch Addresses* button.
- 25 In the Interactive Rematch window in the *Show results* field, select *Unmatched Addresses*.
- 26 For example, select the record with the school name *Pooler Elementary*, and you will find several candidates for this unmatched address.
- 27 Click the first candidate with the highest score and click *Match*.

The unmatched address is 308 Holly, and the first candidate address for this unmatched address is 308 Holly Ave. This shows that the unmatched address is an incomplete address because it omits "Ave."

- 28 Continue matching the other unmatched addresses of pre-K facilities in Chatham County and select the candidates with the highest scores.

You will be able to match eight unmatched addresses of pre-K facilities because candidates for the addresses exist in the Chatham Roads shapefile. However, you will also find seven unmatched addresses of pre-K facilities for which there are no candidates. Make a note about these seven unmatched addresses when you conclude this lab exercise.

**29** Save your map as *PreKAddresses.mxd*.

**Question 4:** Which pre-K facilities in Chatham County do not have any candidates for addresses in the Chatham Roads shapefile?

## CREATE A THEMATIC MAP OF THE SPATIAL DISTRIBUTION OF PRE-K FACILITIES AND NUMBER OF CHILDREN UNDER FIVE YEARS OLD

Now you are ready to create a map that shows the spatial distribution of pre-K facilities and the number of children under five years old in Chatham County, Georgia. You have all the features of pre-K facilities and the number of children under five years old from the previous tasks. You need to display all features in such a way that can address the following question:

- Does the distribution of pre-K facilities in Chatham County correspond with the population distribution of children under five years old?

**1** Open *PreKAddresses.mxd*.

- 2 In the *Table of Contents*, right-click *Children under 5 years old* and click *Properties*.

Ensure that the *Symbology* tab is active.

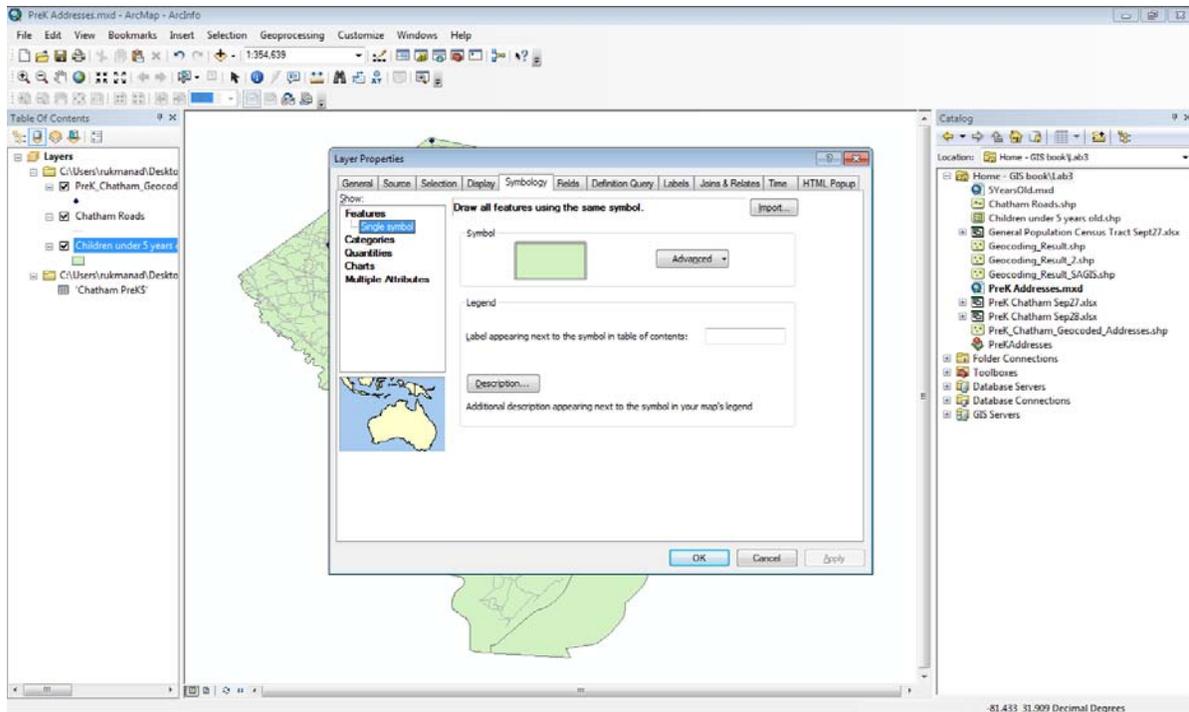


Figure 14. *Layer Properties—Symbology* tab.

- 3 In the *Show* panel, click *Quantities* » *Graduated colors*.

- 4 In the *Fields* panel for *Value*, select *Child5yrs*. The variable *Child5yrs* is the number of children under five years old in each census tract in Chatham County, according to the US 2010 Census.

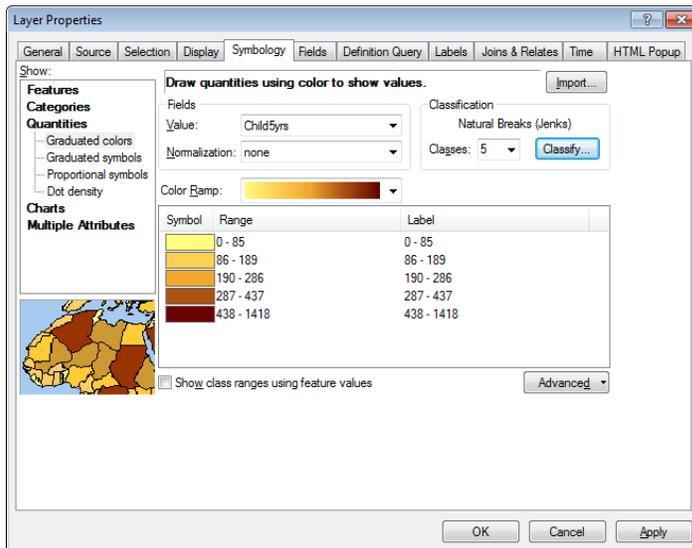


Figure 15. *Layer Properties*–*Fields* selection window.

- 5 Click *Apply*, and then click *OK* to close the *Layer Properties* dialog box.
- 6 In the *Table of Contents*, right-click *PreK Chatham Geocoded Addresses* and click *Properties*. Ensure that the *Symbology* tab is active.
- 7 In the *Show* panel, click *Quantities* » *Graduated symbols*.
- 8 In the *Fields* panel for *Value*, select *Capacity*. The variable *Capacity* is the total capacity of pre-K facilities according to the data from the Georgia Department of Early Care and Learning and the phone surveys.

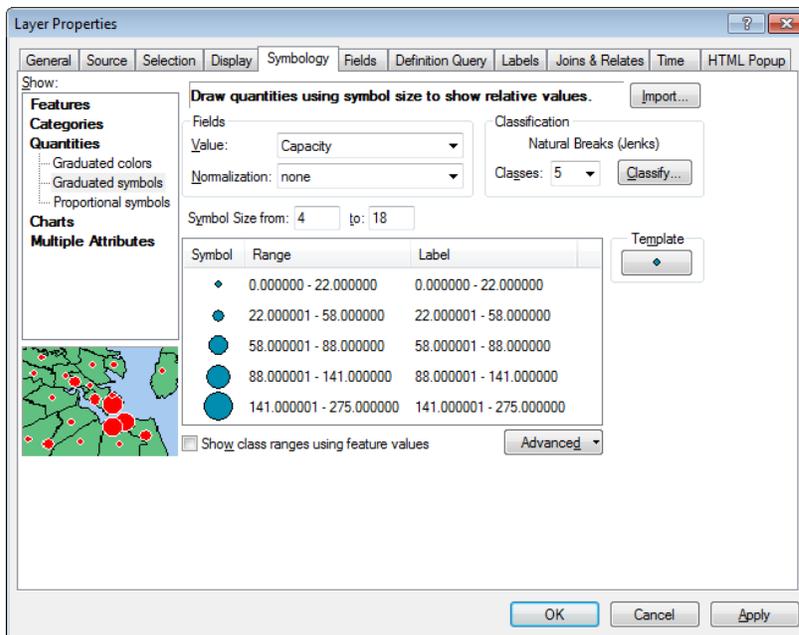


Figure 16. Layer Properties—Fields selection window.

If you want to change the number of decimal places of *Capacity*, follow these steps:

- (1) In the *Table of Contents*, right-click *PreK Chatham Geocoded Address* and click *Properties*.
- (2) Click the *Fields* tab and click *Capacity*.
- (3) On the *Number Format* tab, select the *Numeric* check box.
- (4) A *Number Format* window appears. Select *Numeric*.
- (5) Change *Number of decimal places* from 6 to **0** and click *OK*.

9 Click *Apply*, and then click *OK* to close the *Layer Properties* dialog box.

10 Save your map as ***PreKand5YearsPopulation.mxd***.

You have completed a map that shows the geographic distribution of pre-K facilities with their respective capacity and the total number of children under five years old for each census tract in Chatham County, Georgia.

**Question 5:** *Does the distribution of pre-K facilities in Chatham County correspond with the population distribution of children under five years old?*

**Question 6:** *What do you notice about daily commutes for parents dropping off and picking up their children at pre-K facilities in Chatham County? Which neighborhoods have long-distance commutes to get to a pre-K facility?*

## IDENTIFY NUMBER OF PRE-K FACILITIES IN EACH CENSUS TRACT

- 1 Open *PreKAddresses.mxd*.
- 2 Click *ArcToolbox* and click *Analysis Tools*.
- 3 Double-click *Overlay*.
- 4 Double-click *Spatial Join*.

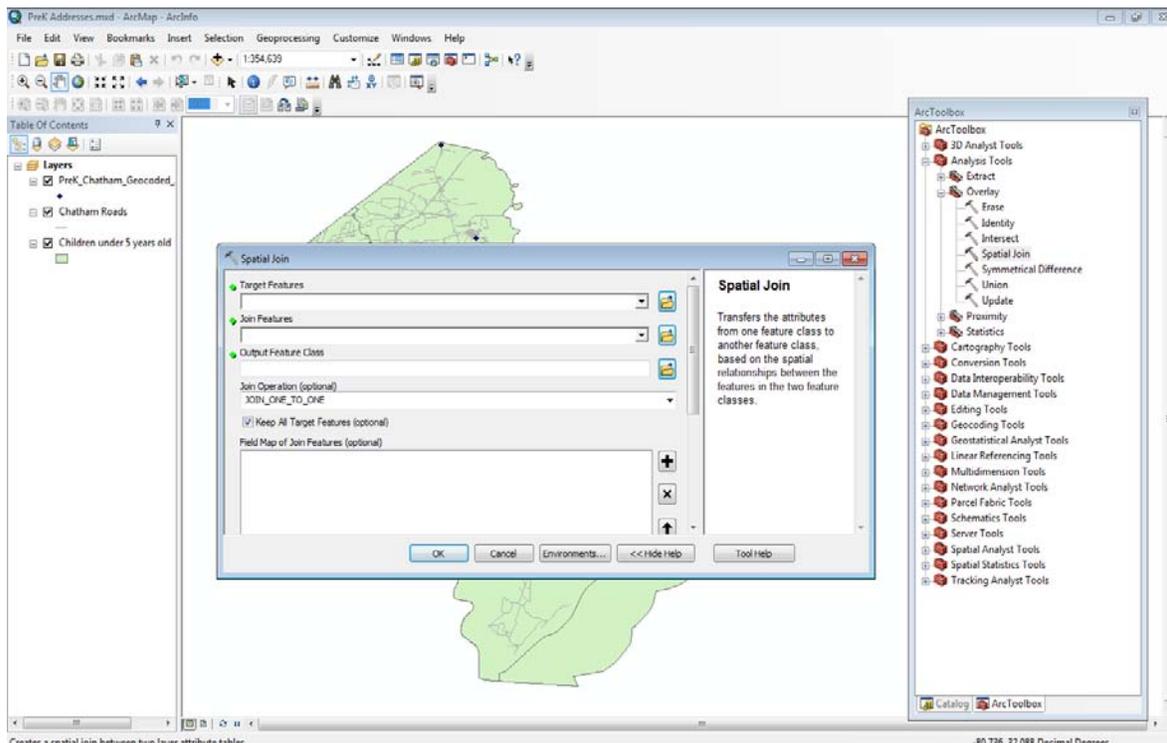


Figure 17: *Spatial Join* dialog box.

- 5 For *Target features*, select the *Children under 5 years old* layer.
- 6 For *Join Features*, select the *PreK Chatham Geocoded Addresses* layer.
- 7 For *Output Feature Class*, select the output (e.g., *CountPreK* shapefile) in your working folder.
- 8 Click *OK*.
- 9 Save the map as *CountPreK.mxd*.

**10** In the *Table of Contents*, right-click *CountPreK* and click *Open Attribute Table* to find the answers to the following questions:

**Question 7:** *Which census tract has the highest number of pre-K facilities in Chatham County?*

**Question 8:** *How many census tracts in Chatham County do not have any pre-K facilities?*

**Question 9:** *According to the map of the geographic distribution of pre-K facilities with their respective capacity and the total number of children under five years old, where would you build a new pre-K facility?*

## Submit your work

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Submit the following to your instructor:

- Under5YearsOld.mxd
- PreKAddresses.mxd
- PreKand5YearsPopulation.mxd
- CountPreK.mxd
- Answers to questions 1 through 9
- Brief essays explaining each of the following:
  - How well do the locations of pre-K facilities correspond with the population distribution of children under five years old?
  - Which neighborhoods or census tracts most need pre-K facilities?

## Credits

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### Sources of supplied data

PreK Chatham.xlsx, courtesy of the Georgia Department of Early Care and Learning.  
Chatham Roads.shp, courtesy of the Georgia GIS Clearinghouse.

## Instructor resources

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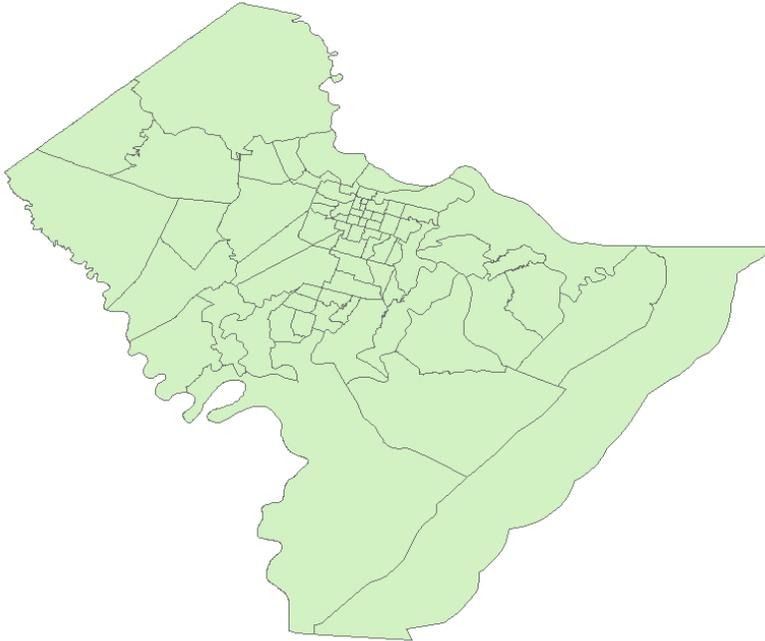
In this lab exercise, one demographic dataset is used from the US 2010 Census: the number of children under 5 years old by census tract in Chatham County, Georgia. This data is retrieved from the US Census Bureau's American FactFinder website. This data is used as an attribute table for the shapefile of Chatham County's census tracts. The Census Bureau's American FactFinder website provides the data of the US population by age group, including under 5 years old, 5–9 years old, 10–14 years old, and so on. The Census Bureau does not provide the US population data by age—i.e., there is no available data of the number of population age five.

The data of pre-K facilities, including the addresses and capacity of the facilities, is retrieved from the Georgia Department of Early Care and Learning at <http://decal.ga.gov/ProviderSearch/SiteSearch.aspx>. Phone surveys were also conducted to complete some missing data for pre-K facilities. According to the Georgia Department of Early Care and Learning, there are 58 registered pre-K facilities in Chatham County. These pre-K facilities include public and private facilities.

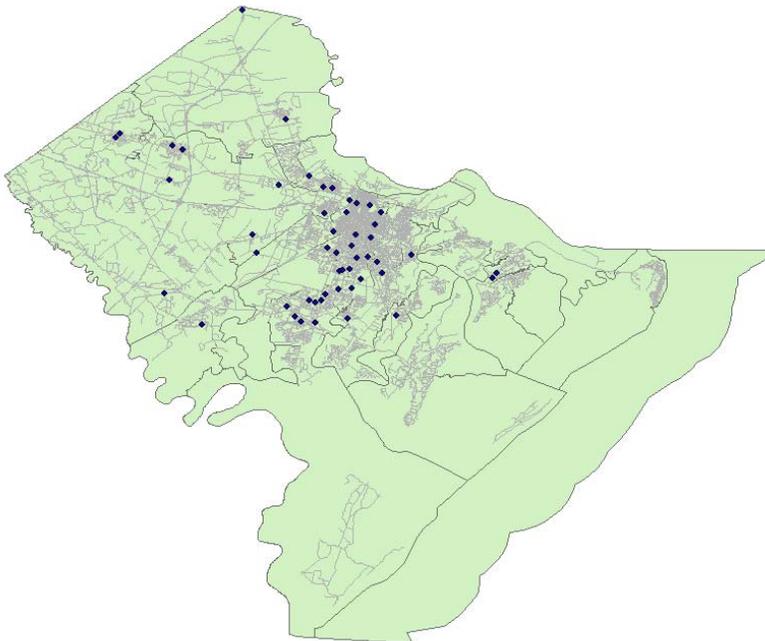
The results of this lab exercise show that the pre-K facilities are highly concentrated in the center parts of Chatham County. There are many neighborhoods or census tracts in the suburbs of Chatham County with a high number of children under five years old that do not have any pre-K facilities. Such a result indicates that the locations of pre-K facilities are close to workplaces, but not to the residences of parents with children under five years old.

## Map results

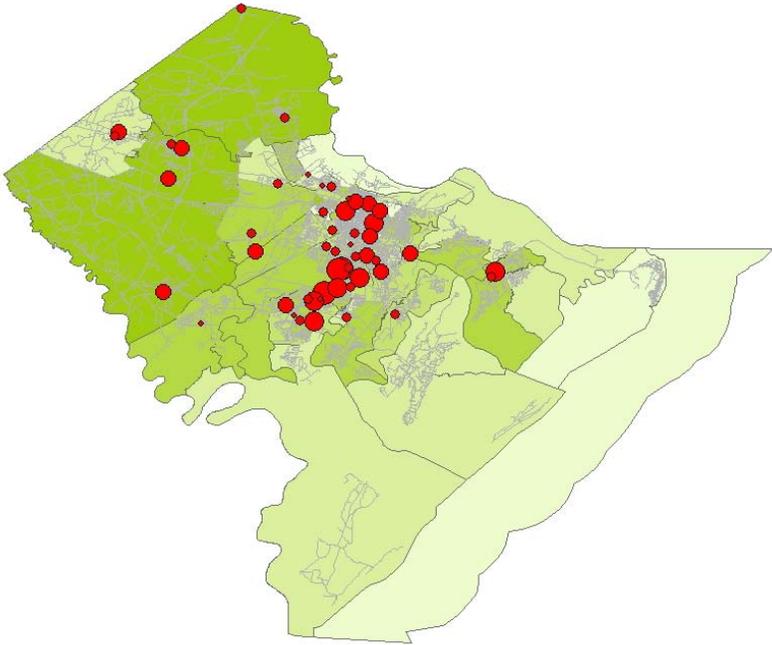
Use the following images as references when evaluating student results.



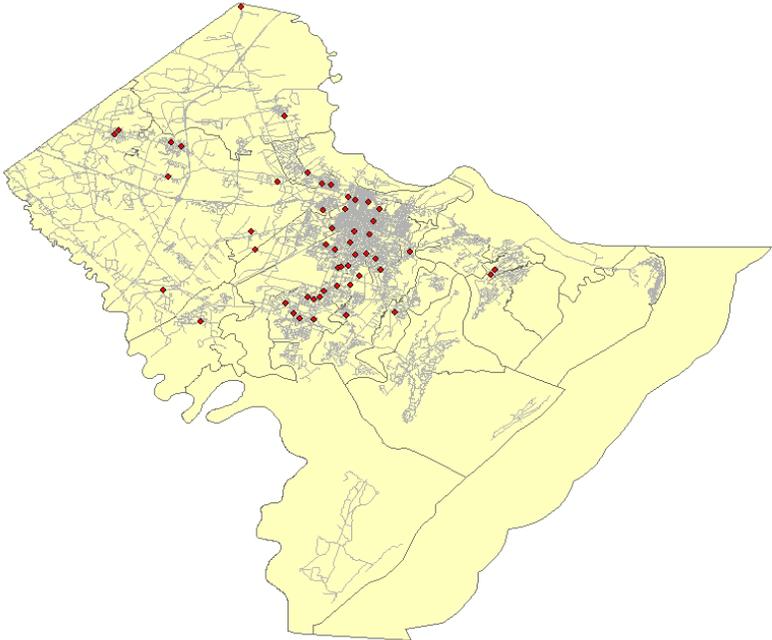
Under5YearsOld.mxd.



PreKAddresses.mxd.



PreKand5YearsPopulation.mxd.



CountPreK.mxd.

## Answers to questions

**Question 1:** *How many children under five years old are in census tract 6.01?*

**Answer:** 235 children.

**Question 2:** *Which census tract in Chatham County, Georgia, has the highest number of children under five years old?*

**Answer:** Census tract 107.

**Question 3:** *Referring to Under5YearsOld.mxd, which parts of Chatham County have a high number of children under five years old?*

**Answer:** The west parts of Chatham County.

**Question 4:** *Which pre-K facilities in Chatham County do not have any candidates for addresses in the shapefile of Chatham Roads?*

**Answer:**

- West Chatham YMCA Child Learning
- Terry's Childcare and Learning Center
- Shuman Elementary
- Hunter Army Airfield Child Development
- Marshpoint Elementary
- In His Arms Educational Center
- Pulaski Elementary

**Question 5:** *Does the distribution of pre-K facilities in Chatham County correspond with the population distribution of children under five years old?*

**Answer:** No. Most pre-K facilities in Chatham County are located in the center of Chatham County with a low number of children under five years old. Meanwhile, the areas with a high number of children under five years old are located in the west parts of Chatham County.

**Question 6:** *What do you notice about daily commutes for parents dropping off and picking up their children at pre-K facilities in Chatham County? Which neighborhoods have long-distance commutes to get to a pre-K facility?*

**Answer:** The locations of most pre-K facilities are not close to the residences of parents with children under five years old but are close to workplaces in the center of Chatham County. Most parents with children under five years old commute daily to pre-K facilities that are closer to their workplaces than to their residences. Neighborhoods in the suburbs of Chatham County have long-distance commutes to get to a pre-K facility.

**Question 7:** *Which census tract has the highest number of pre-K facilities in Chatham County?*

**Answer:** Census tract 40.1. This census tract has four pre-K facilities.

**Question 8:** *How many census tracts in Chatham County do not have any pre-K facilities?*

**Answer:** Thirty seven census tracts are without a pre-K facility. They are 3, 9, 15, 20, 21, 22, 23, 26, 28, 33.01, 36.01, 36.02, 37, 38, 42.09, 43, 101.01, 102, 106.01, 106.05, 108.02, 108.06, 108.09, 109.01, 110.03, 110.05, 110.06, 111.03, 111.06, 111.07, 111.08, 111.09, 113, 114, 115, 9800, and 9900.

**Question 9:** *According to the map of the geographic distribution of pre-K facilities with their respective capacity and the total number of children under five years old, where would you build a new pre-K facility?*

**Answer:** A new pre-K facility should be built in a census tract that has a high number of children under five years old but without any pre-K facilities. The census tract without a pre-K facility but with the highest number of children under five years old is census tract 33.01 with 1,270 children under five years old. However, this census tract is relatively close to many pre-K facilities. Another census tract that needs a new pre-K facility is census tract 108.09, with 814 children under five years old. This census tract is located in the suburbs of Chatham County.

**Essay:** *How well do the locations of pre-K facilities correspond with the population distribution of children under five years old? Which neighborhoods or census tracts most need pre-K facilities?*

**Answer:** The locations of pre-K facilities in Chatham County do not correspond well with the population distribution of children under five years old. There is spatial mismatch between the locations of pre-K facilities and the residences of parents with children under five years old. The locations of most pre-K facilities are not close to the residences of parents with children under five years old but are close to workplaces in the center of Chatham County.

There are several census tracts in the suburbs of Chatham County without a pre-K facility. The parents with children under five years old in such census tracts have long-distance commutes to get to the nearest pre-K facility. Two census tracts in the suburbs of Chatham County that most need pre-K facilities are census tracts 108.09 and 108.02, with 814 and 702 children under five years old respectively.