

**Massachusetts Institute of Technology
Department of Urban Studies and Planning**



**11.204: Planning, Communication & Digital Media
Fall 2004**

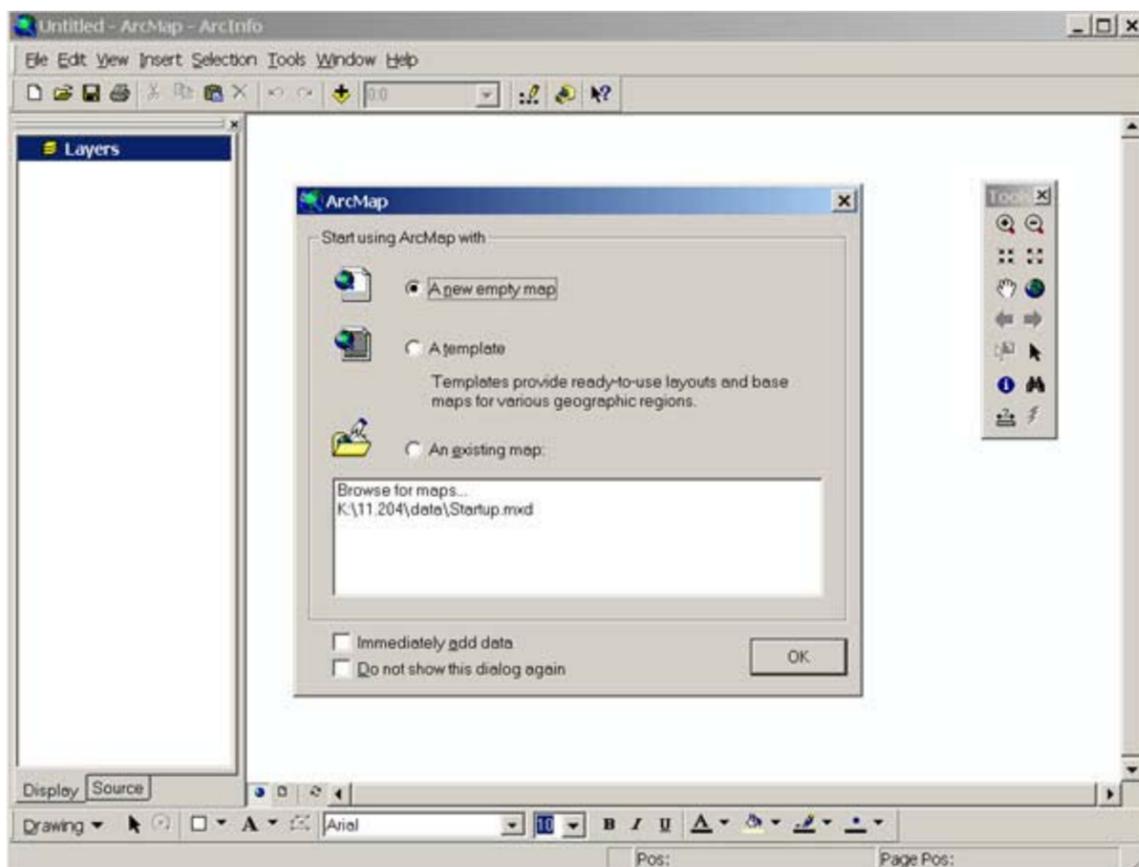
**Lab 4:
Using ArcGIS to Visualize Population Density
Help Section**

ArcMap interface and elements

Start ArcMap

ArcMap is a part of the ArcGIS package. This program lets you create thematic maps.

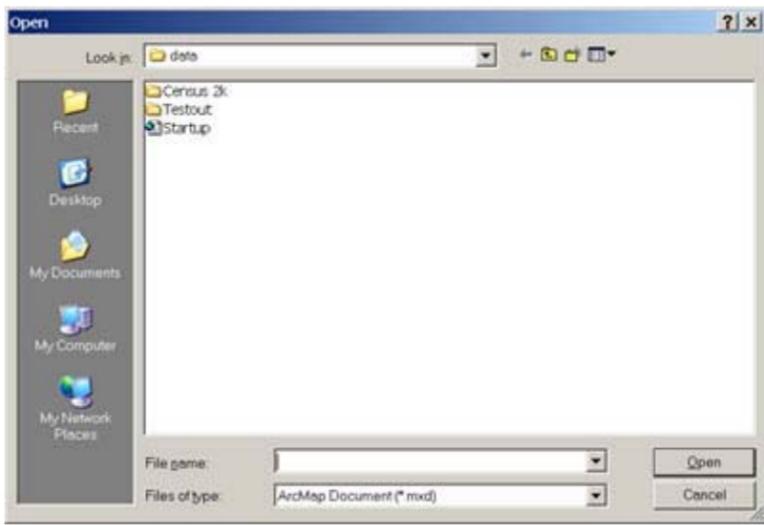
To launch ArcMap, from the Start Menu choose Start > Programs > ArcGIS> ArcMap. Wait a moment for it to launch.



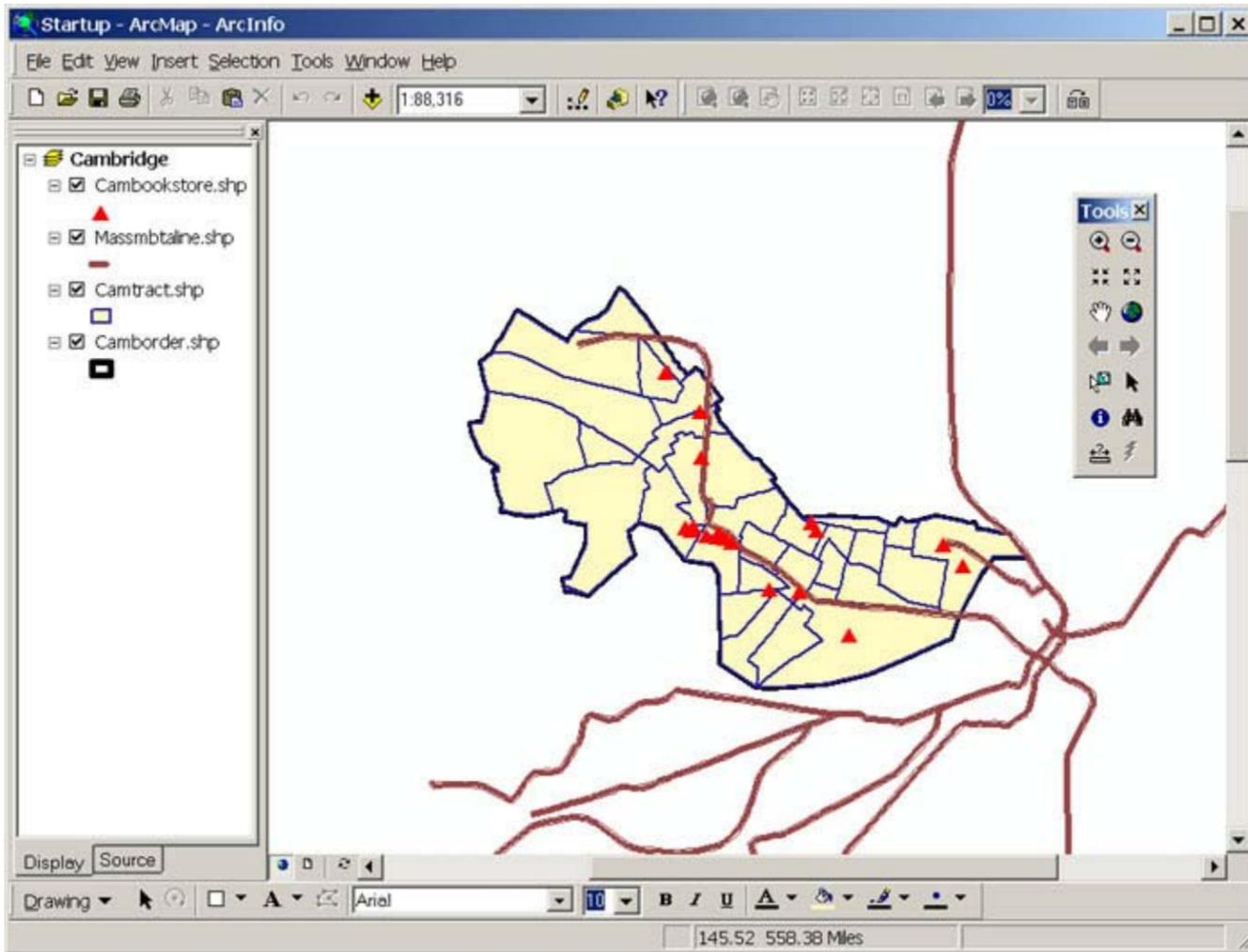
Open a ArcMap file

When ArcMap first launches, you should see a "ArcMap: Start using ArcMap with..." window that prompts you to create or open a new map document. Click the option button "An existing map." If the file you want to open appears in the list below, click it to select and then click OK. If not, choose "Browse for maps..." in the box and launch the Open dialogue box shown below.

In the Open dialog box, navigate to the MIT Server. Click OK.

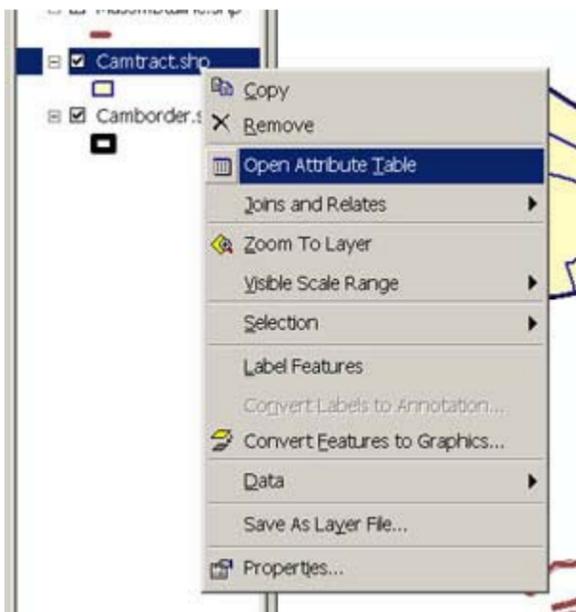


The window should look like the following.



Open an attribute table

Click on the layer (listed on the left) "Camtract.shp" to make it active. Then over the text, right click the mouse and in the pop-up menu, choose "Open Attribute Table."



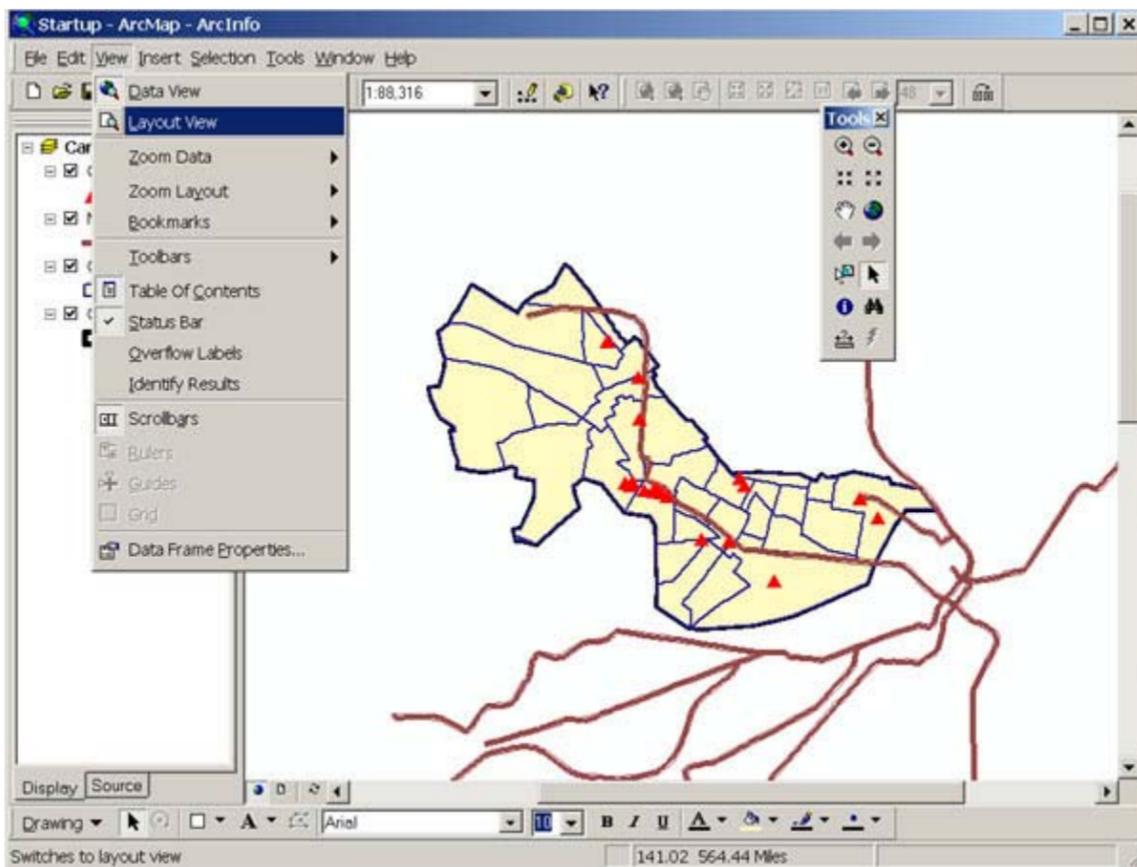
The attribute table for the "Camtract.shp" layer appears.

(Optional: If you activate a single tract using "Select Features" function available in the "Tools" bar, the highlighted records are corresponding to the Census tract selected in the view window.)

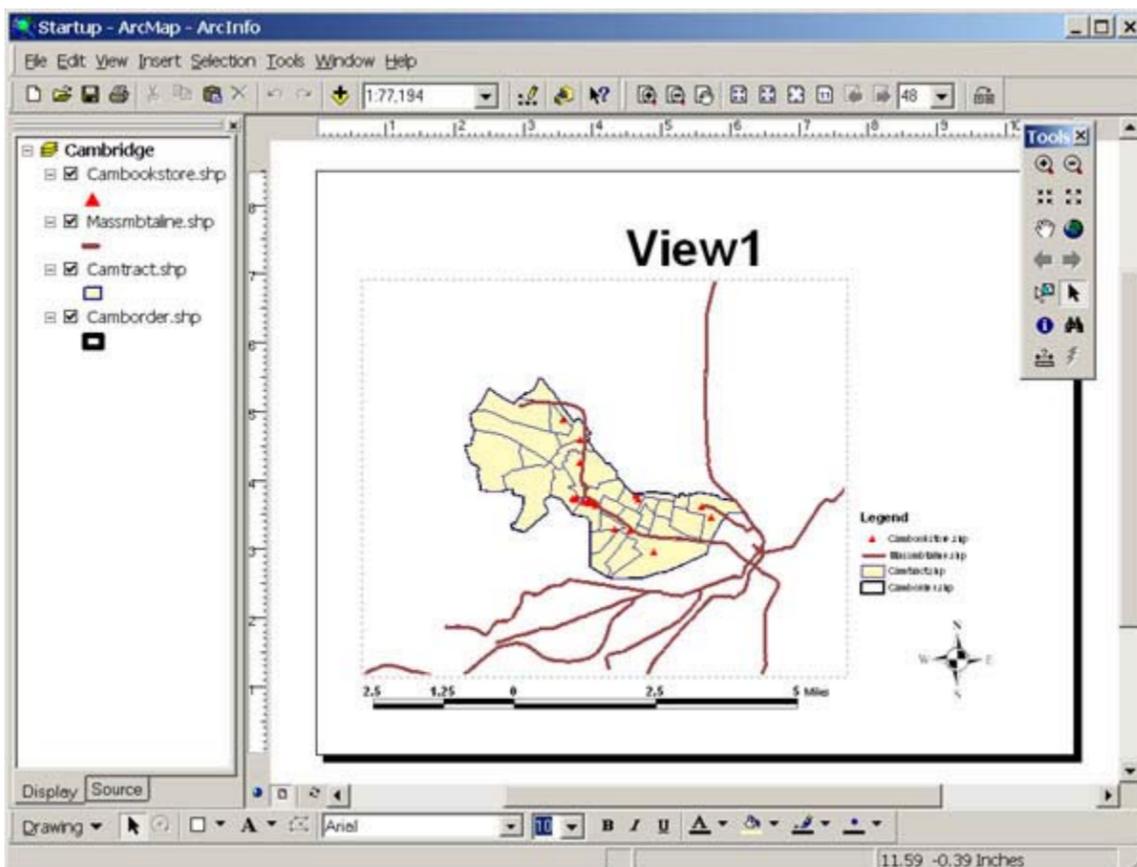
FID	Shape*	AREA	PERIMETER	MSA5 TR90	MSA5 TR901	STCNTYTR	CNTY
0	Polygon	482491.81312	4402.74376	331	330	25017355000	017
1	Polygon	1285551.80508	5768.48054	339	338	25017354900	017
2	Polygon	329889.67306	2599.62459	344	343	25017354800	017
3	Polygon	1507295.74136	6439.08698	348	347	25017354600	017
4	Polygon	352574.03569	2992.29107	356	355	25017354700	017
5	Polygon	1867883.63025	6069.57763	358	357	25017354300	017
6	Polygon	407952.66176	4088.98277	362	361	25017354500	017
7	Polygon	293304.48222	2491.44482	368	367	25017354400	017
8	Polygon	488519.0508	3916.51264	377	376	25017354000	017
9	Polygon	726866.67794	3610.61639	378	377	25017353600	017
10	Polygon	1625805.36198	6487.69136	381	380	25017354200	017
11	Polygon	625705.12558	4066.6027	385	384	25017354100	017
12	Polygon	552034.19767	3915.82092	396	395	25017353700	017
13	Polygon	287454.40502	2409.86394	403	402	25017352900	017
14	Polygon	153925.7415	2619.85262	410	409	25017352700	017
15	Polygon	1042324.3296	5258.27113	411	410	25017352100	017
16	Polygon	141962.65074	1641.45628	412	411	25017352200	017
17	Polygon	298396.52597	2532.68955	413	412	25017353800	017
18	Polygon	162164.77028	2211.17891	417	416	25017352800	017

Open a Layout

From the text menu on the top of the window, choose "Layout View" from the "View" menu. A layout view for finalizing your mapping work shows up. To go back to the work pane, choose "Data View" from the same menu.



Choose View -> Layout View



Layout View

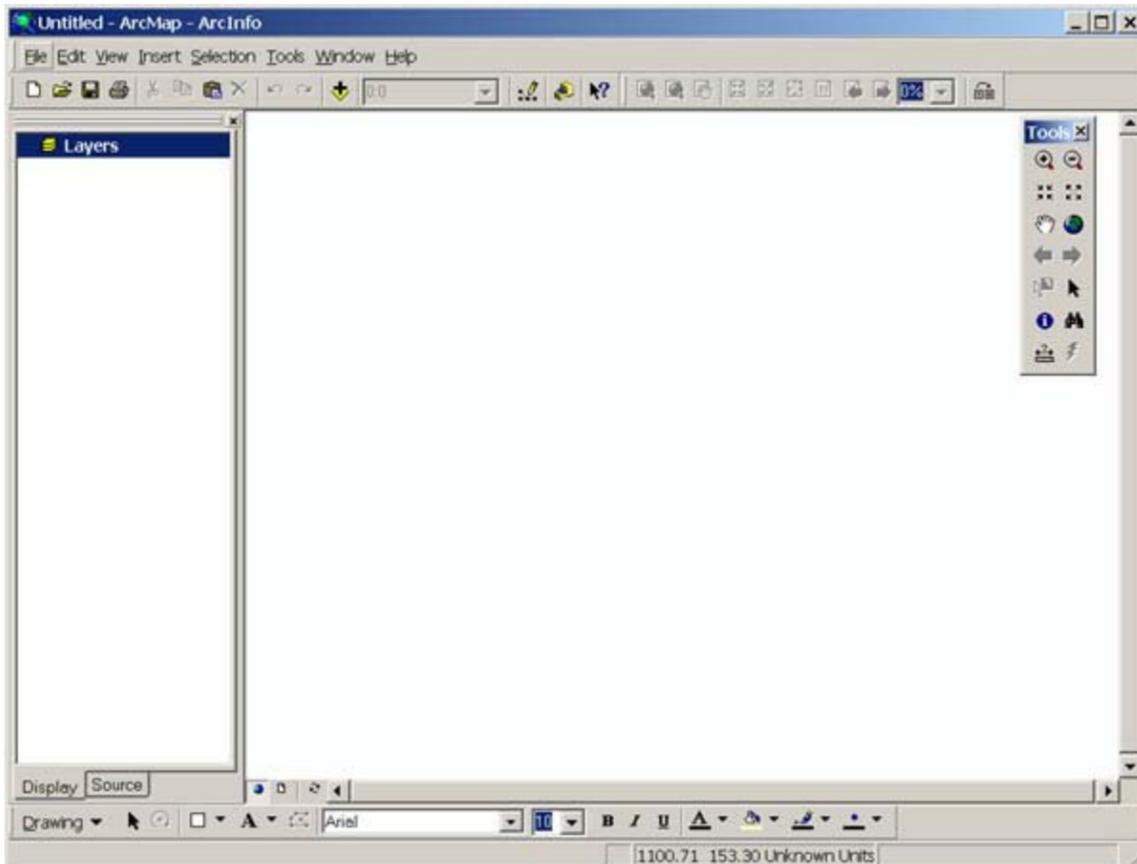
Close the document and ArcMap

From the text menu "File", choose "Exit." (or simply click [x] on the top right) You will be asked whether or not save changes to the file "startup.mxd," choose No.

Create your own map document

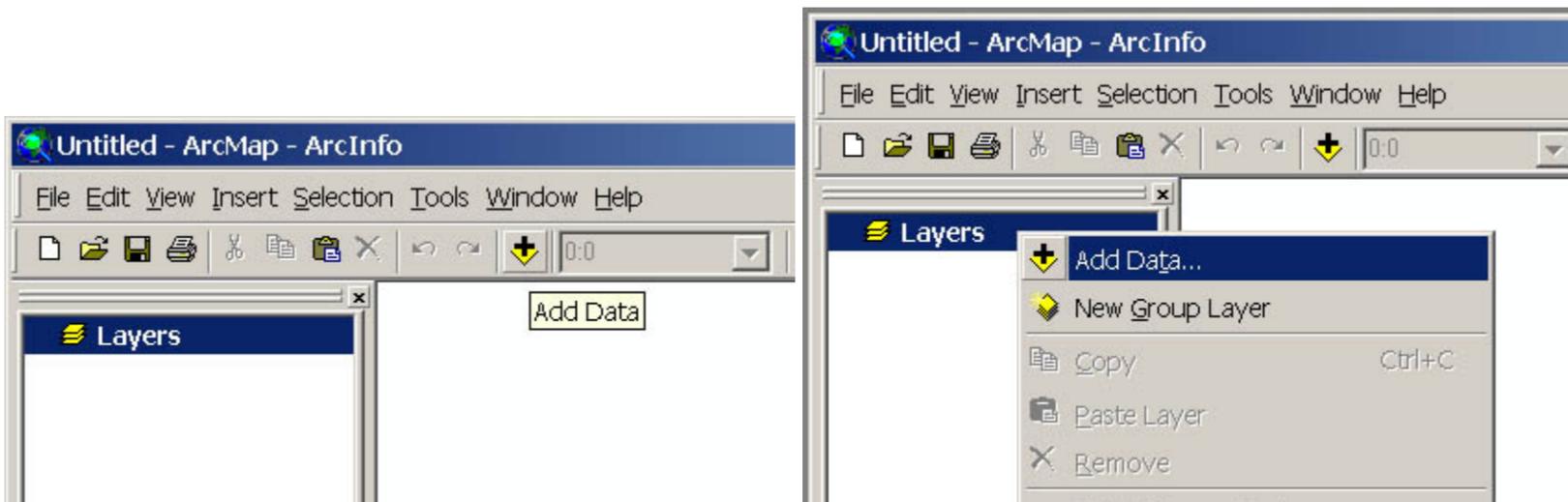
Create a new document

Start ArcMap by from the Start Menu choosing Start > Programs> ArcGIS> ArcMap. In the welcome window choose the option "A new empty map."
(If the welcome window is closed, click the New Map File icon [looks like a sheet of paper] on the top left. Use "blank document" as your template.)

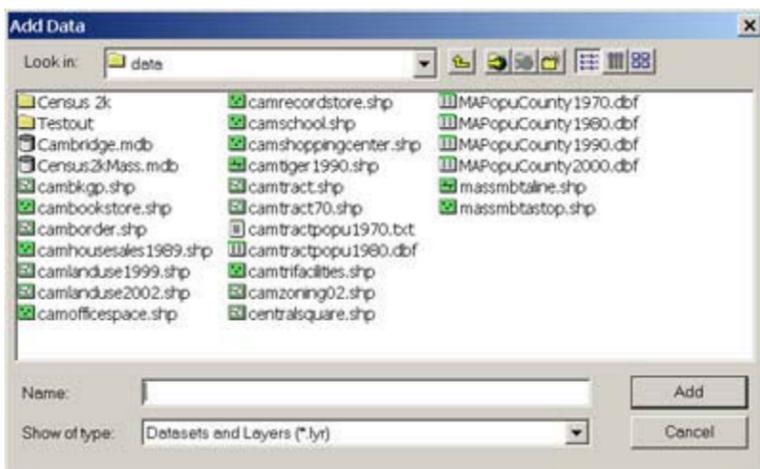


Add data (layers)

Click the "Add Data" icon, or right click on the "Layers" text and choose "Add Data" from the pop-up menu.



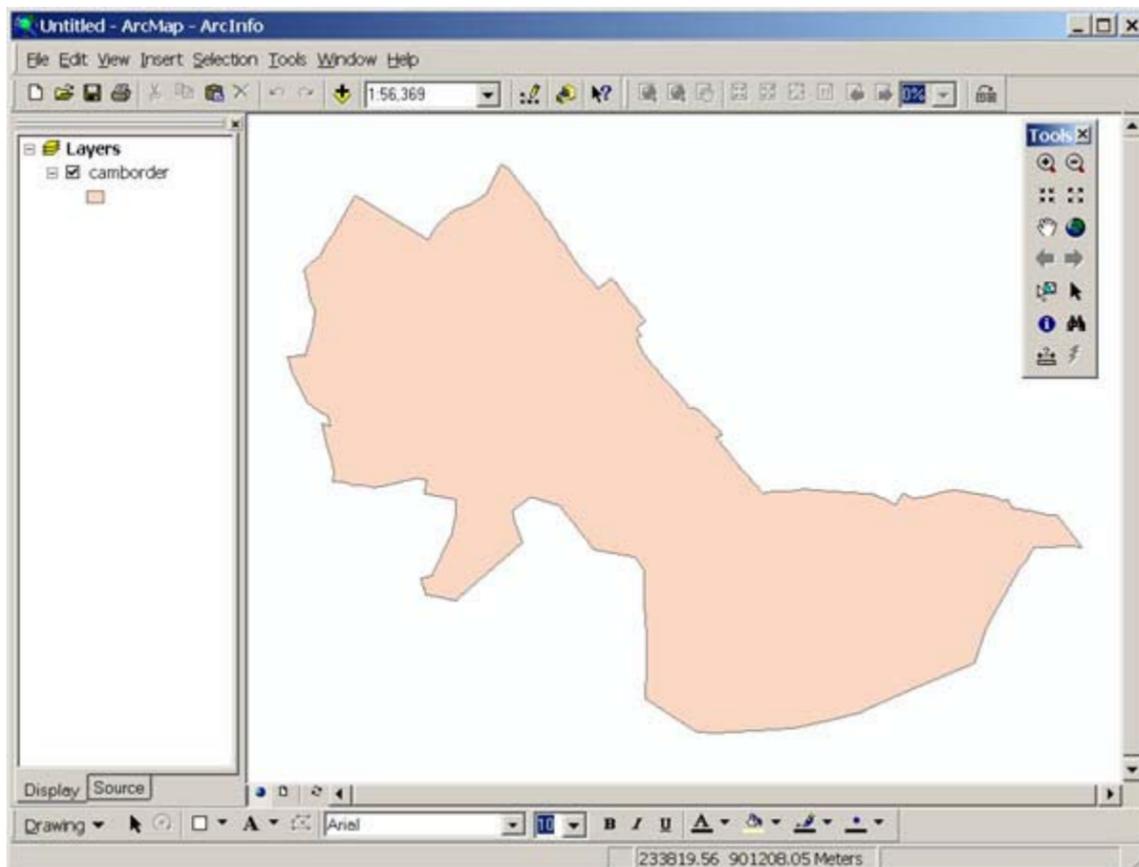
In the "Add Data" dialogue, choose the data file that will be used in the exercise.



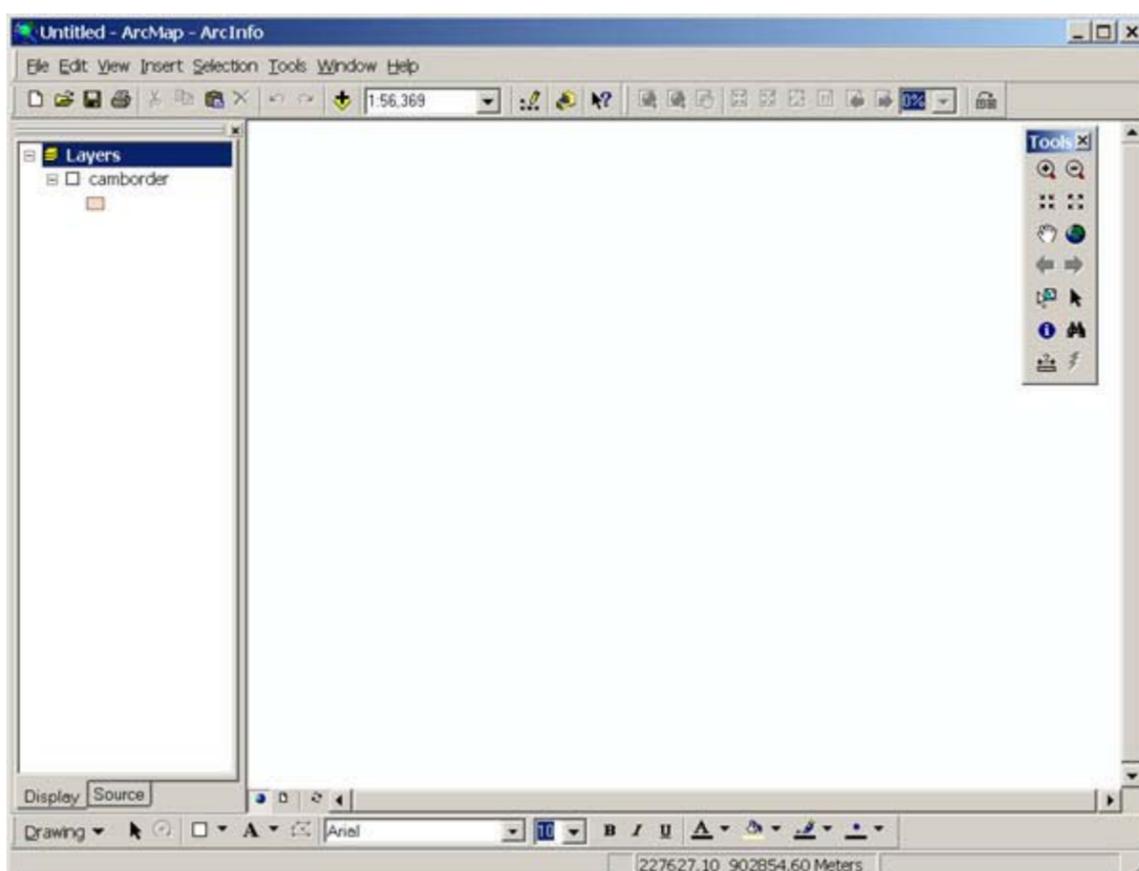
Browse to the MIT Server\Data, select "camborder.shp" and click OK. A new layer, "Camborder," will be added, and the geographic features are automatically displayed.

NOTE: If you don't find the MIT Server\Data in your "Add Data" window, you have to assign the folder in your catalogue of ArcGIS files. To do so, click this icon  in the Add Data window to open the "Connect to Folder" window, type

in the MIT Server\Data" in the box, or browse to the data folder, then click OK. This process can take some minutes.



Click on the square to the left to the layer name. The Cambridge border disappears. Click it again to make the box checked to show the polygon.

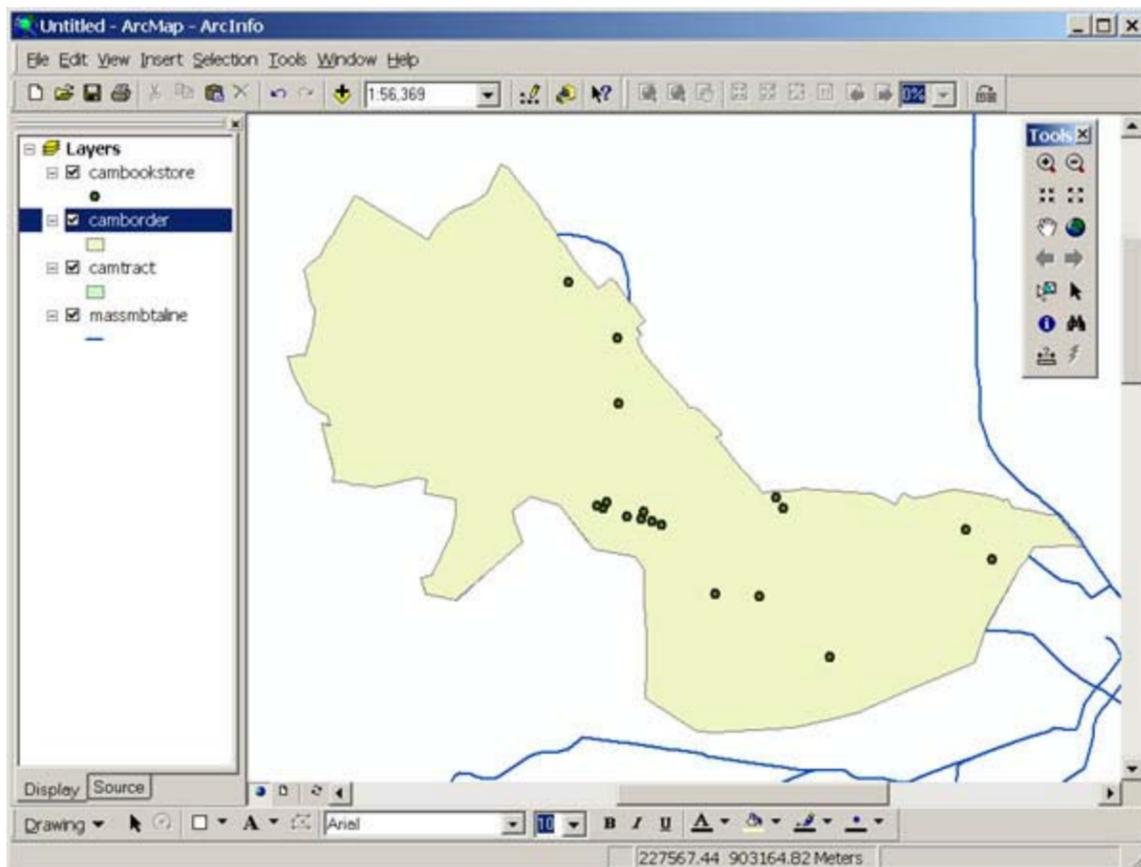


We need to add more layers. From "the MIT Server\Data\" add "cambookstore.shp," "massmbtline.shp," and "camtract.shp." We can select multiple layers in the adding layer window by pressing the "Control" key while clicking on files.

Turn layers on and off, change layer draw sequence, and making a layer active

We turn layers "on" and "off" (making them visible or invisible) by clicking the square to the left to the layer name. In order to make a layer active, we just need to click on the layer name in the left panel of the table of contents window.

All layers are overlaid in a sequence. The sequence of the layers are automatically determined by the software. We can change the display sequence by dragging and dropping layer objects. You should experiment with the ordering of layers, as it has a direct impact on how the image appears in the view.



This is an example of the result of switching the order of layers.

How to Zoom/Pan

Now take the opportunity to pan and zoom in the window. First, you may wish to enlarge both the main ArcMap window so that you can see more detail in the image (click [] box on the top right).

Try clicking the following buttons in the "Tools" bar, then clicking in the map window:
(If Tools bar is not there, go to "View"->"Toolbars"->"Tools" and turn the "Tools" bar on.)

 Zoom In - Click to zoom in on that location. Click and drag to zoom to a particular bounding box.

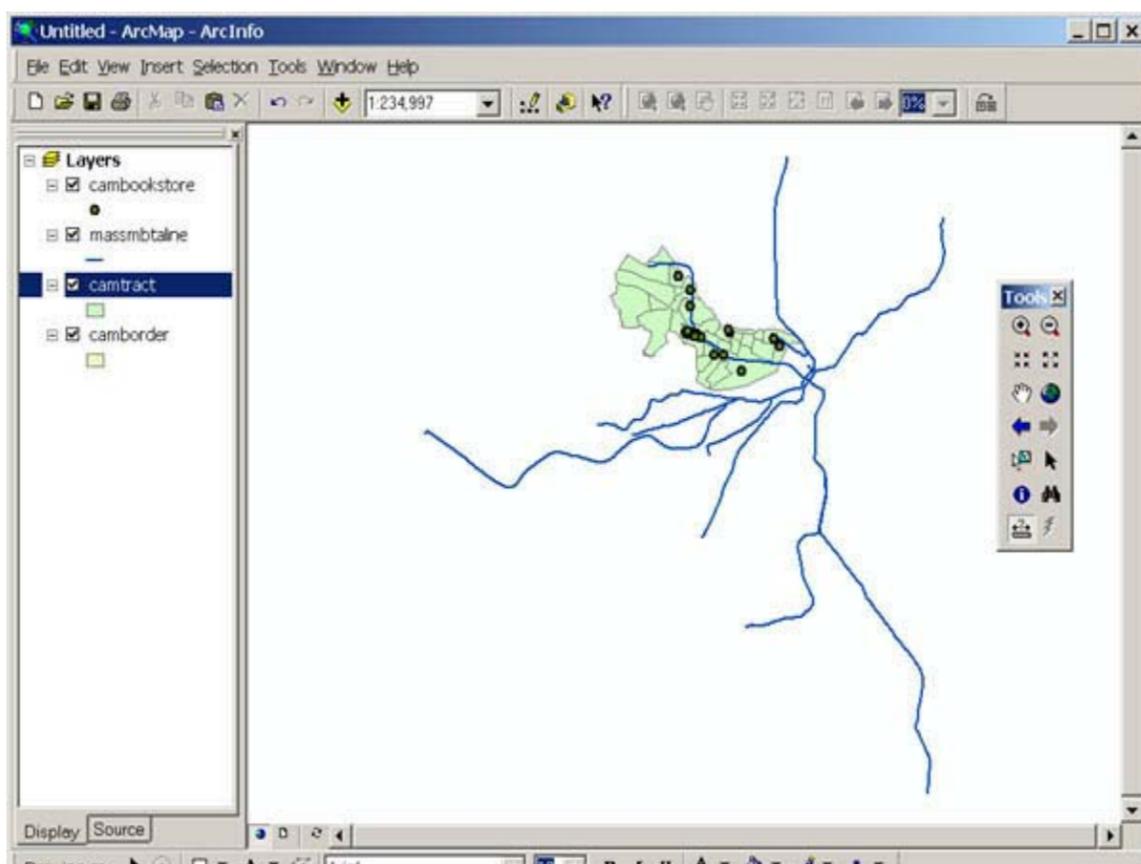
 Zoom Out - Click to zoom out centered on the location of the click.

 Fixed Zoom In - Click to zoom in without moving the map center

 Fixed Zoom Out - Click to zoom out without moving the map center

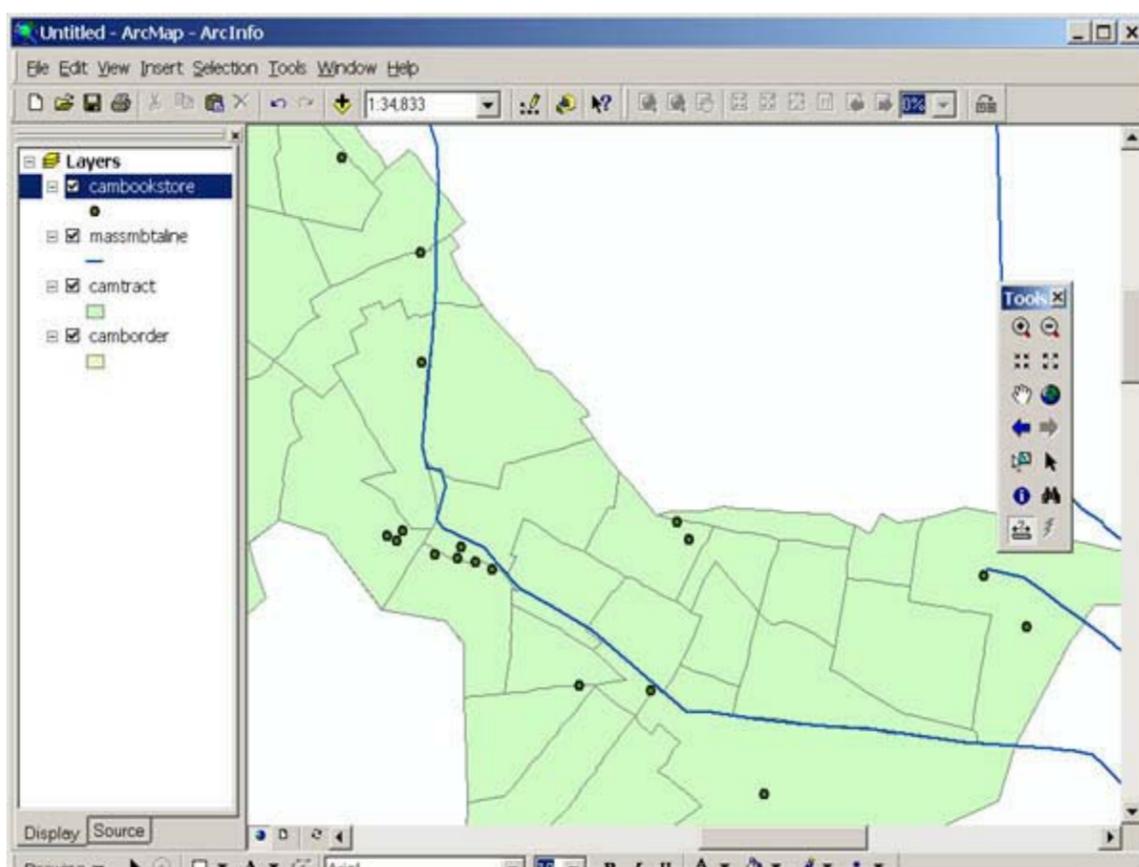
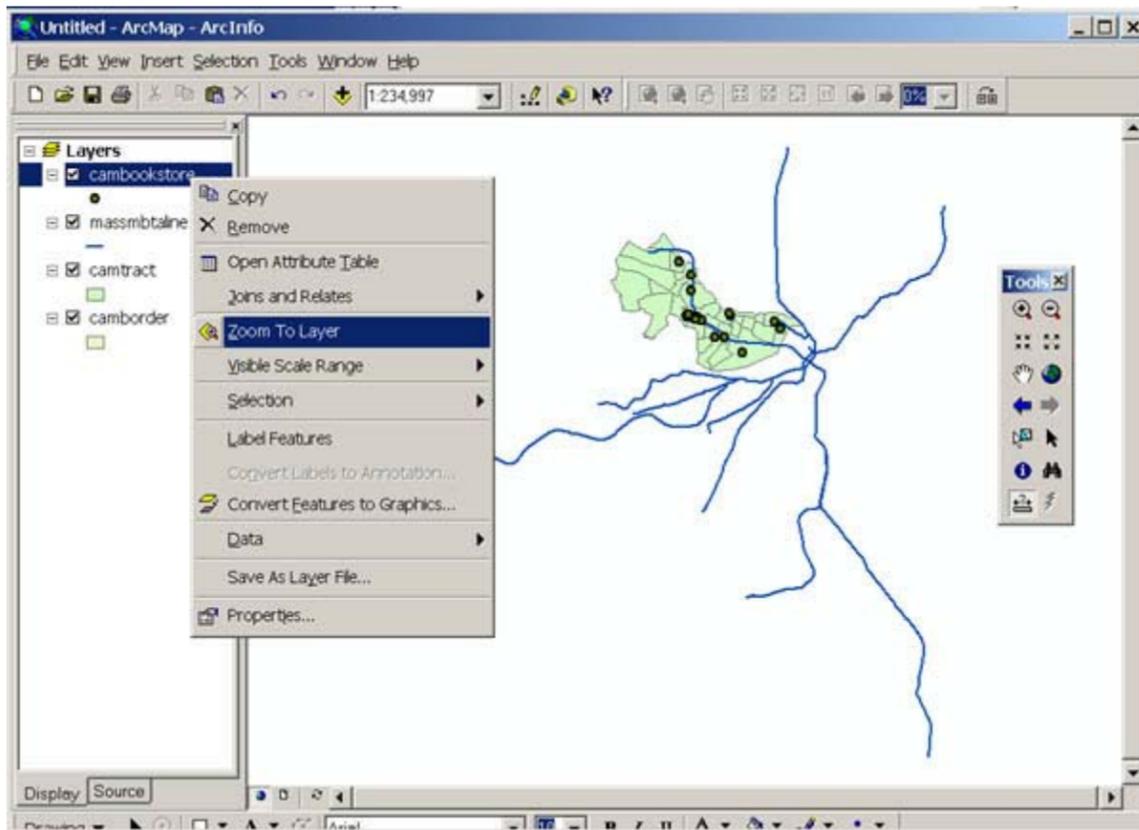
 Pan - Click and drag to pan around the map area.

 Zoom to Full Extent - Click and observe that ArcMap zooms to the full extent of the largest layer (i.e. massmbtaine).



Zoom to Active Layer

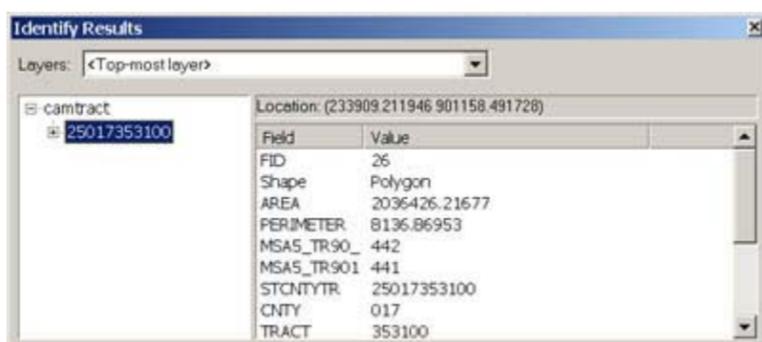
Right click the layer name and choose "Zoom To Layer" from the pop-up menu.
The view is zoomed to the extent of the chosen layer.



Zoomed to the extent of bookstore locations in Cambridge.

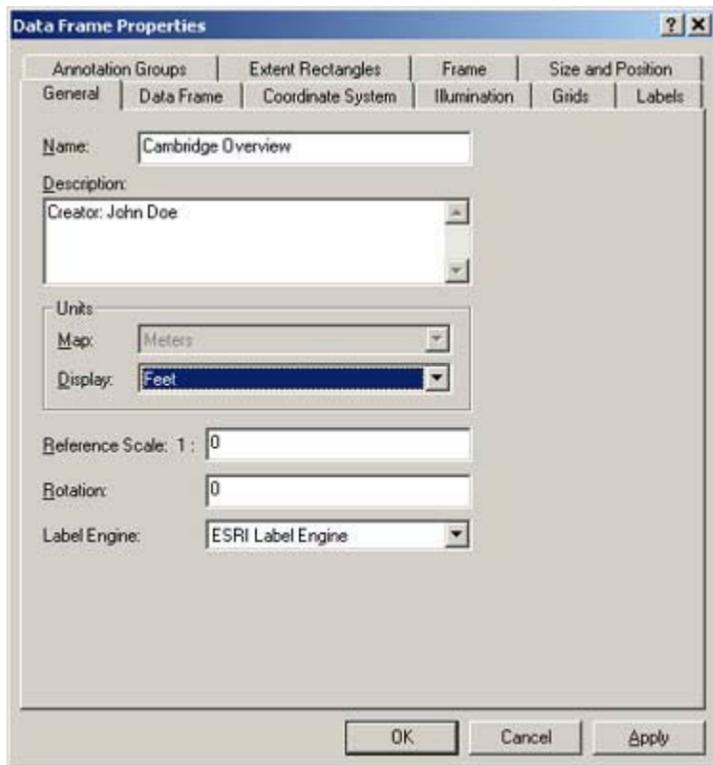
Examining Attribute Data

First activate the layer "camtract.shp," and click on the info ("i") tool  in the Tools menu. Move the mouse onto the map window and click on the tract where MIT resides. You can locate this tract based on where the MBTA line runs. The attributes associated with this tract appear in a popup window. In the column area, we can read out the area value for this Census tract.

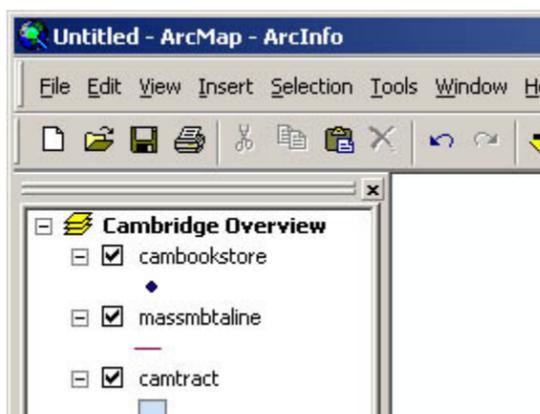


How to set data frame properties

At this point it is important to set a few properties for this data frame. From the View menu, select Data Frame Properties to change the name of the data frame from "Layers" to "Cambridge Overview", add in creation date and your name as creator in the pop-up window. Also in this dialog box you should set the "Display Units" to "Miles".

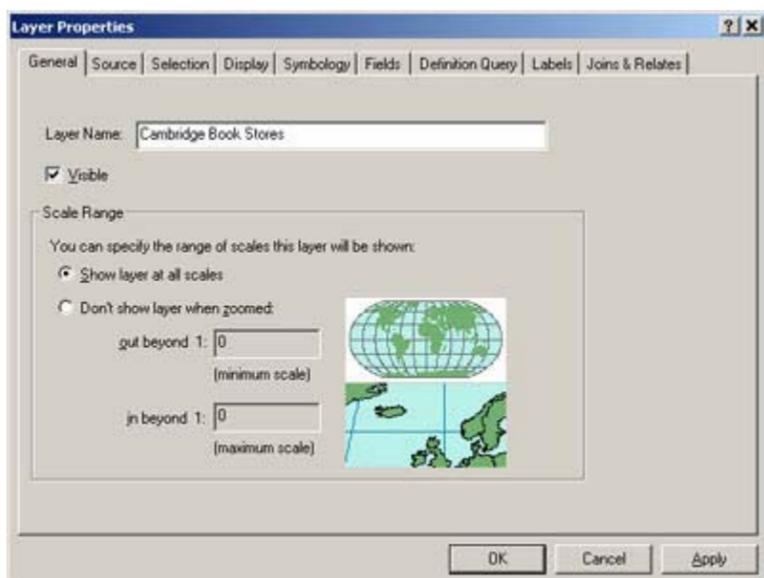


Once you close the Data Frame Properties window, you should see that the name of the layers changes to "Cambridge Overview," which is shown in the table of contents window.

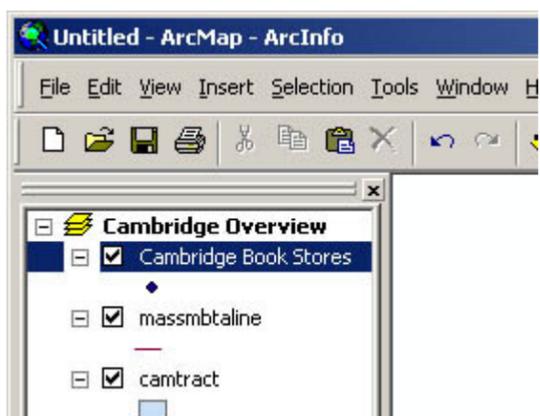


How to set layer properties

Activate the layer "cambookstore" then from the table of contents window, right click to open a pop-up menu, then select Properties to open a Layer Properties dialog box. Click the General tab, and change the name of the layer to "Cambridge Book Stores".

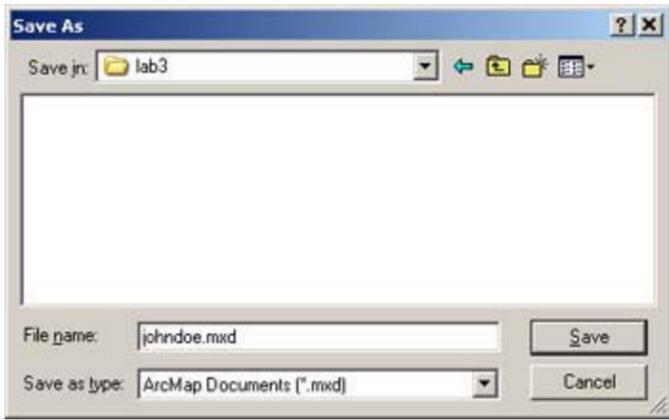


Change other layer names according to their contents. After this, we will find the new layer name shown in the table of contents (left side) .



How to save a map document?

Save your map document now. Go to the File menu and select Save. The "Save As" dialog box will appear.

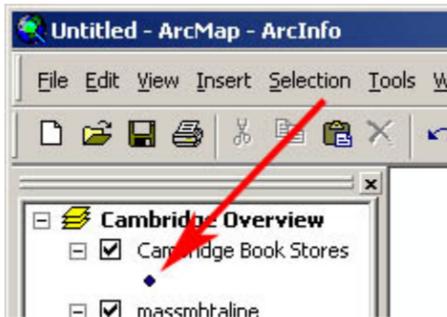


Browse to the H:\private\11.204\lab4, name the map document file as johndoe.mxd. (Replace johndoe with your username.)

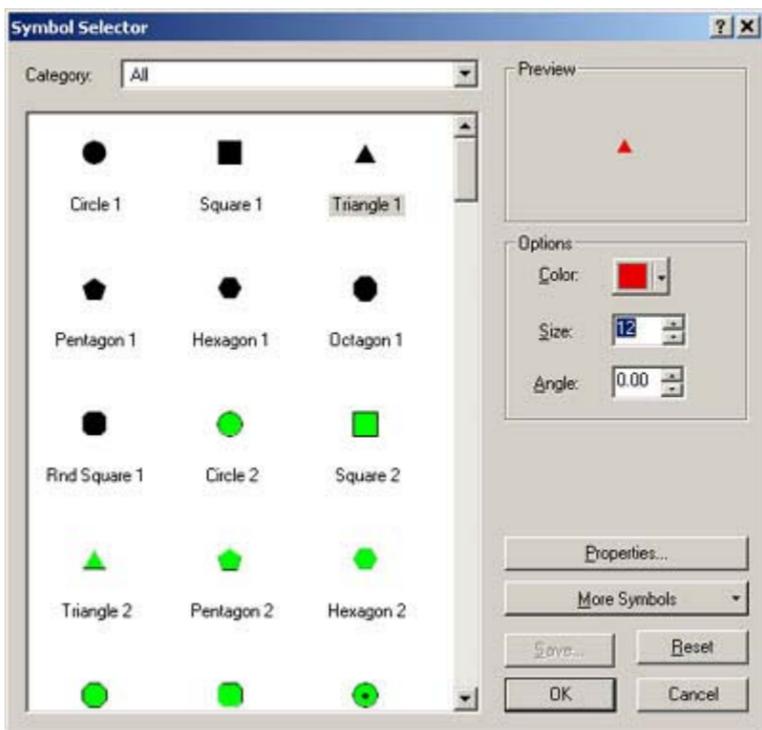
Symbolization & classification

How to change the default symbols for points

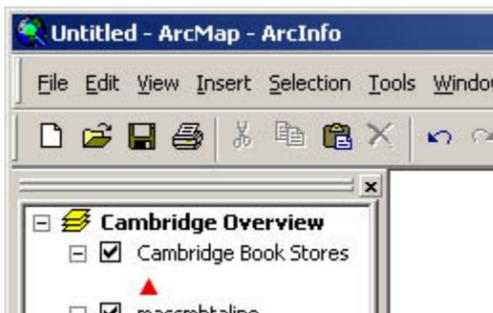
In the table of contents (left side) of the window, double-click on the small symbol below the layer name.



Symbol Selector opens. Click on Triangle 1 to select the triangle shape. Click on the color box to open a color selector and choose red (or similar). Change the size to 12. Click OK to apply.

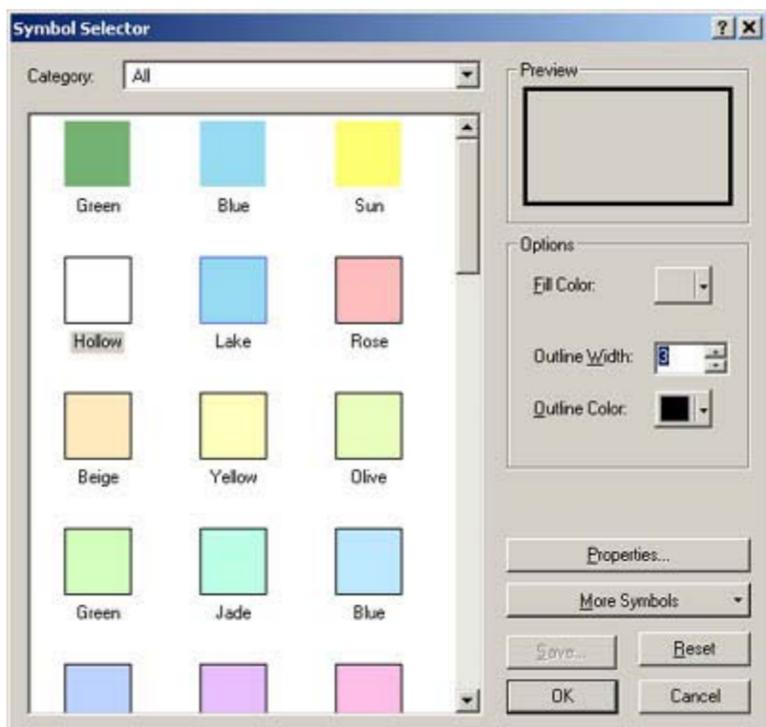


Observe the view window to see the symbolization change for the Cambridge book stores.



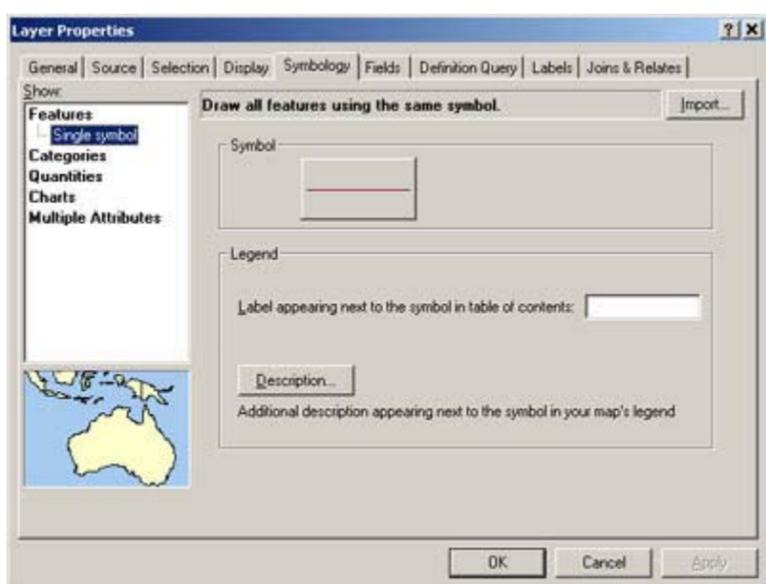
How to change the default symbols for lines

In the table of contents (left side) of the window, double-click the box below the text "Cambridge Census Tract." Symbol selector opens. Choose Hollow and change Outline Width to 3.

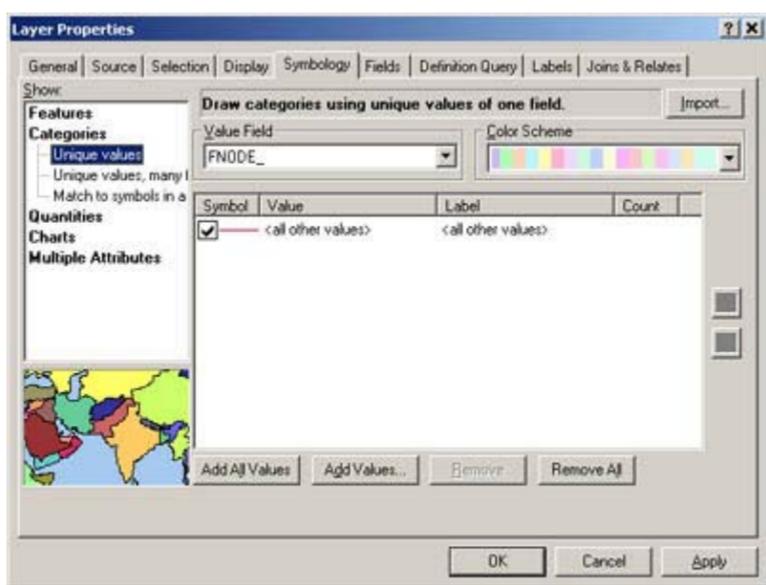


How to render the lines in different colors according to their name.

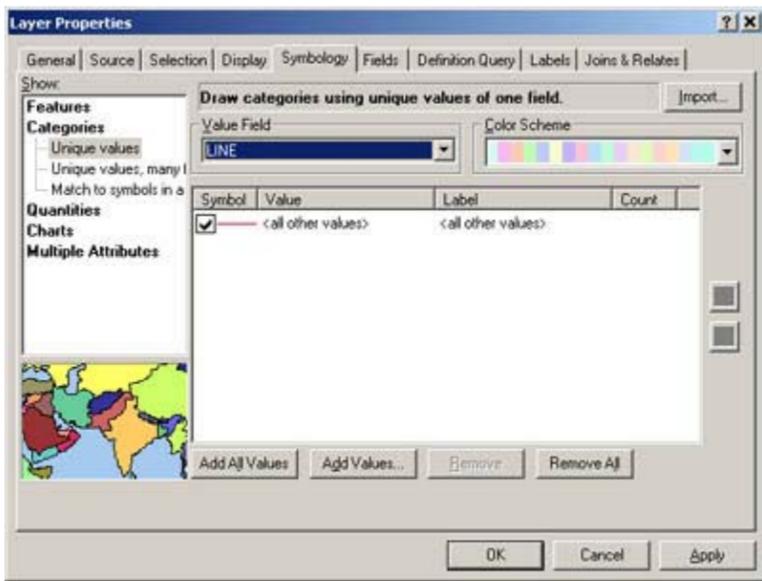
In the table of contents (left side) of the window, double-click on layer name "MBTA Subway" (or right-click to open the pop-up, then choose Properties). Now you see the Layer Properties window. Click on the Symbology tab.



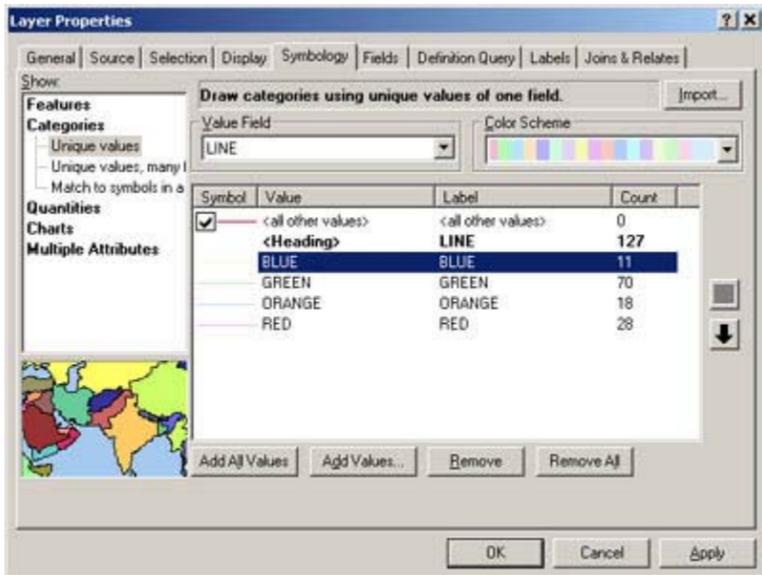
Choose "Categories" -> "Unique Values" in the Show box on the left.



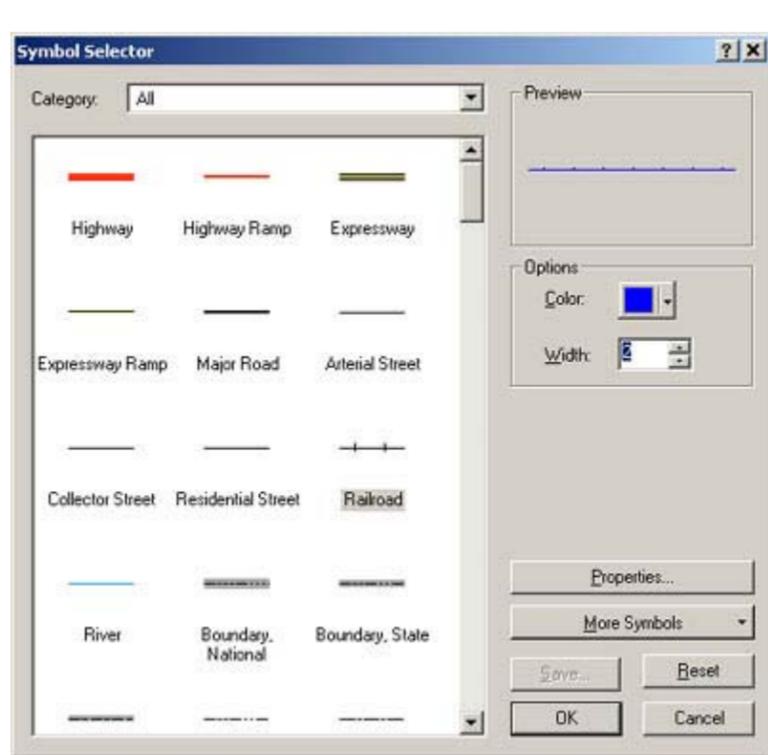
Choose "LINE" in the Value Field select box.



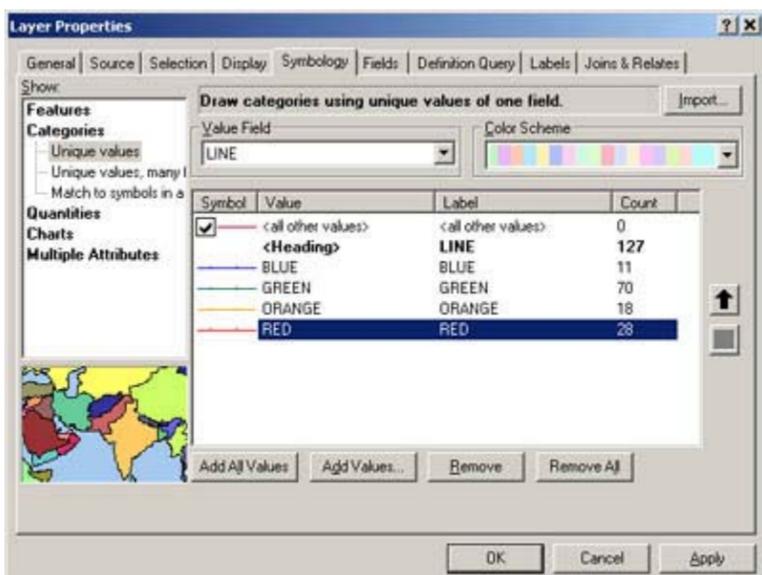
Click on the "Add All Values" button to add four attributes of the MBTA Subway layer.



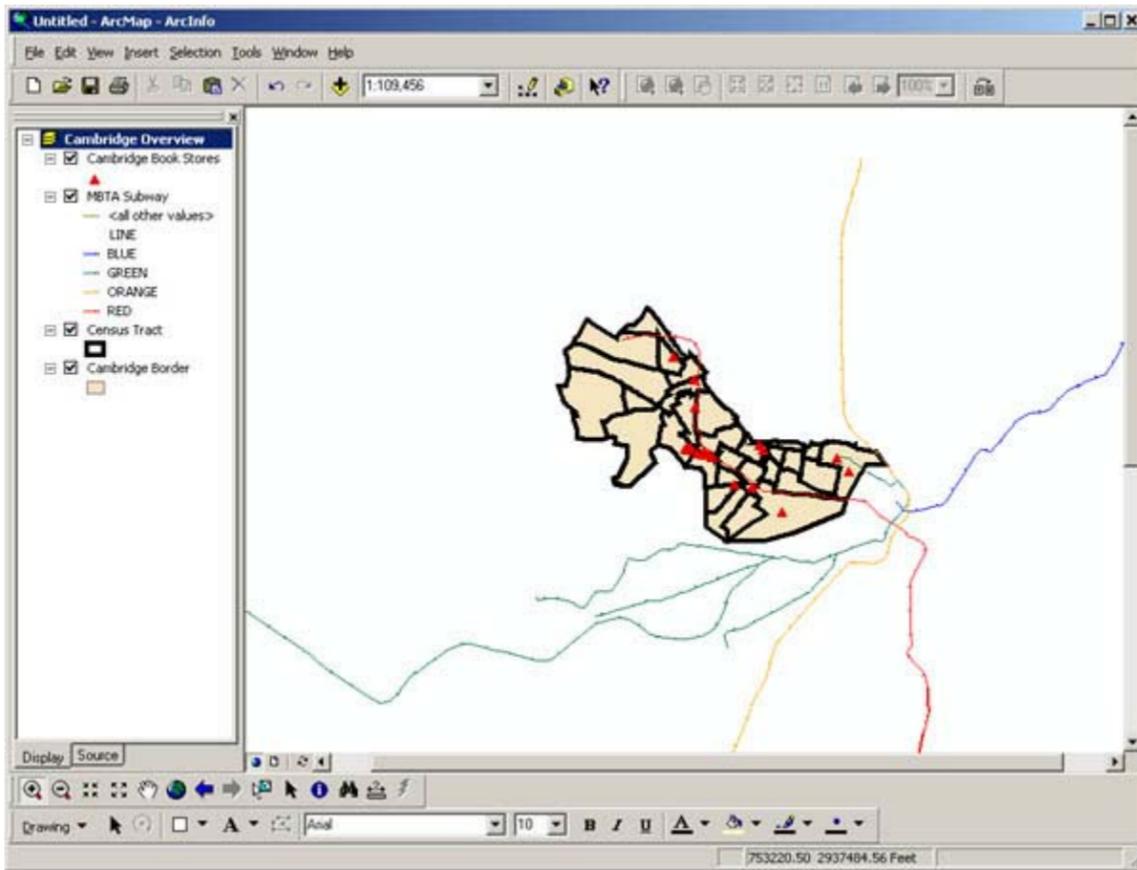
To change the line style/color for the BLUE line, double click on the text "BLUE" to open the Symbol Selector.



Do the same thing for all other three subway lines. Change their color according to their names. The Layer Properties now looks like this.



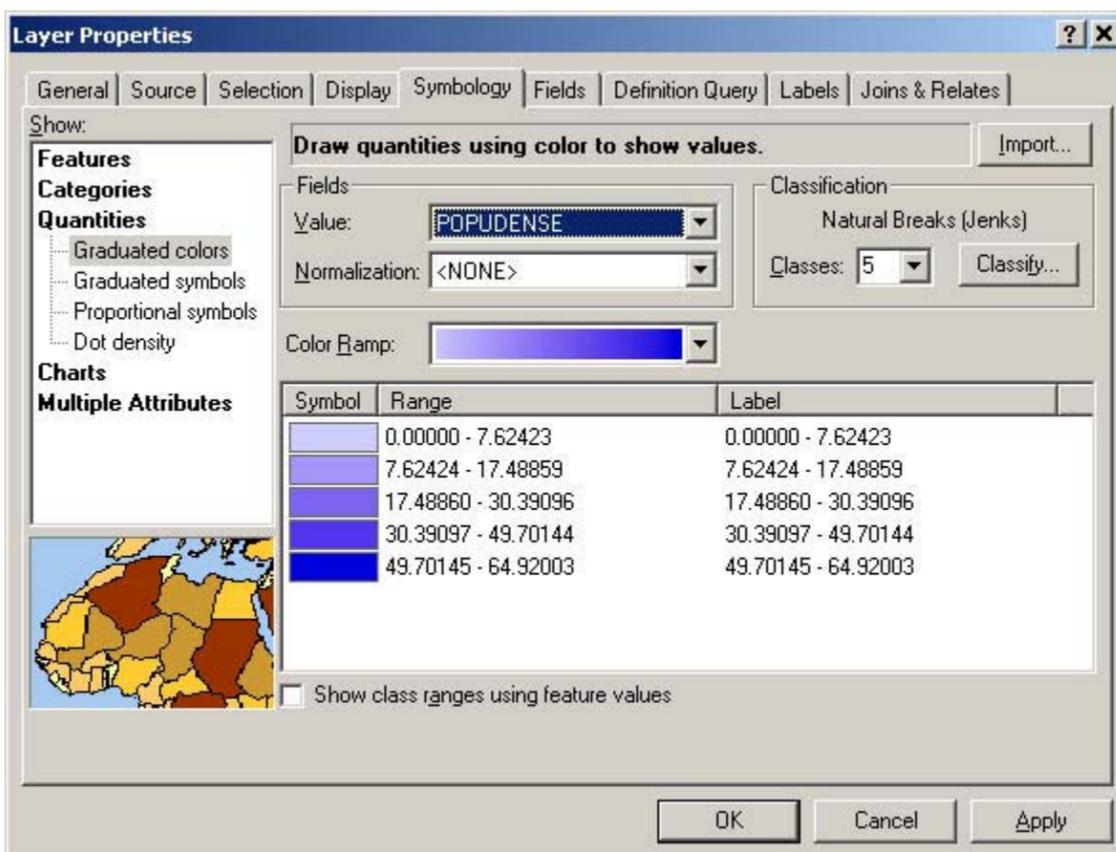
Click OK to see the effect in the window.



How to classify the features.

In the table of contents (left side) of the window, double-click on layer name "Census Tract" (or right-click to open the pop-up, then choose Properties). Now you see the Layer Properties window. Click on the Symbology tab. This is same as what we did for the subway lines.

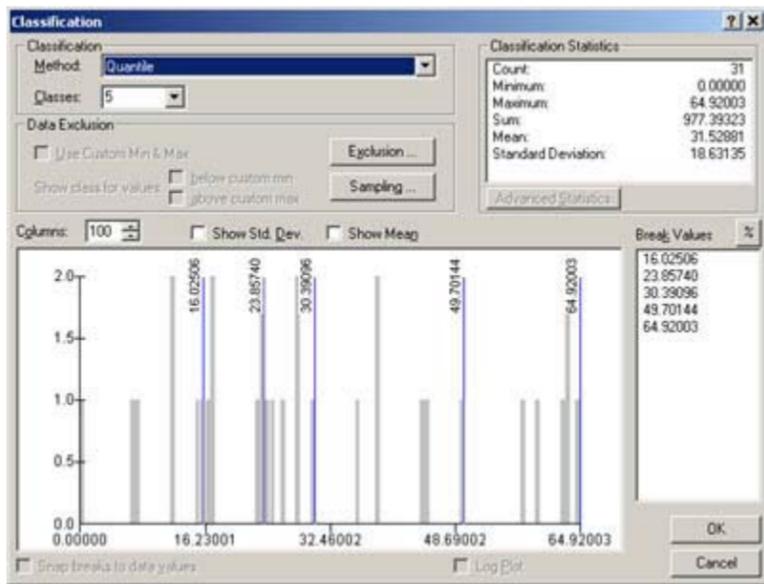
Choose "Quantities" -> "Graduated colors" under "Show:" Under "Fields">"Value" select "POPUDENSE" (population density in the unit of persons per acre).



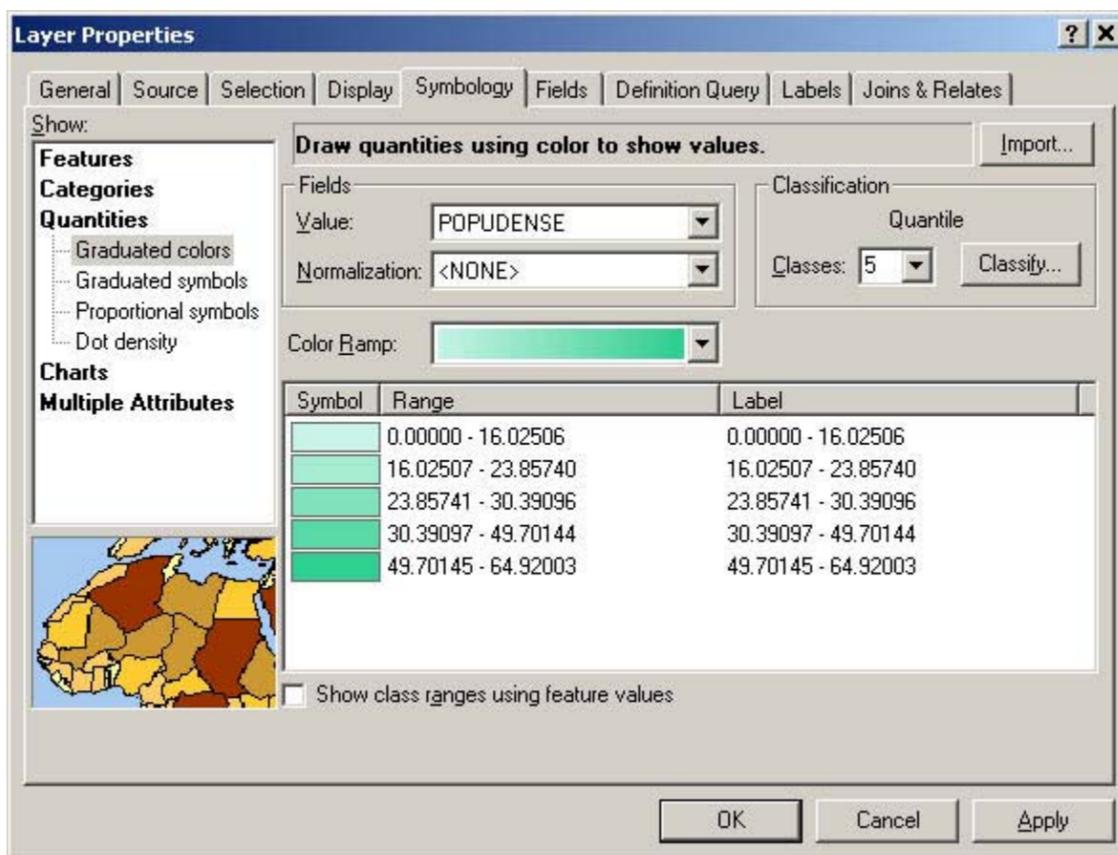
Notice that ArcGIS automatically divides the population density data into five ranges and assigns a color to each. The default color ramp is Blue monochromatic. Change to Light Green monochromatic (the one shown below).

Note: Population density is equal to the number of people per acre. This was calculated by taking the area of each tract (in square meters) and dividing by 4,046.9 (which is the number of square meters per acre). Then we divided the total population for the tract by the number of acres.

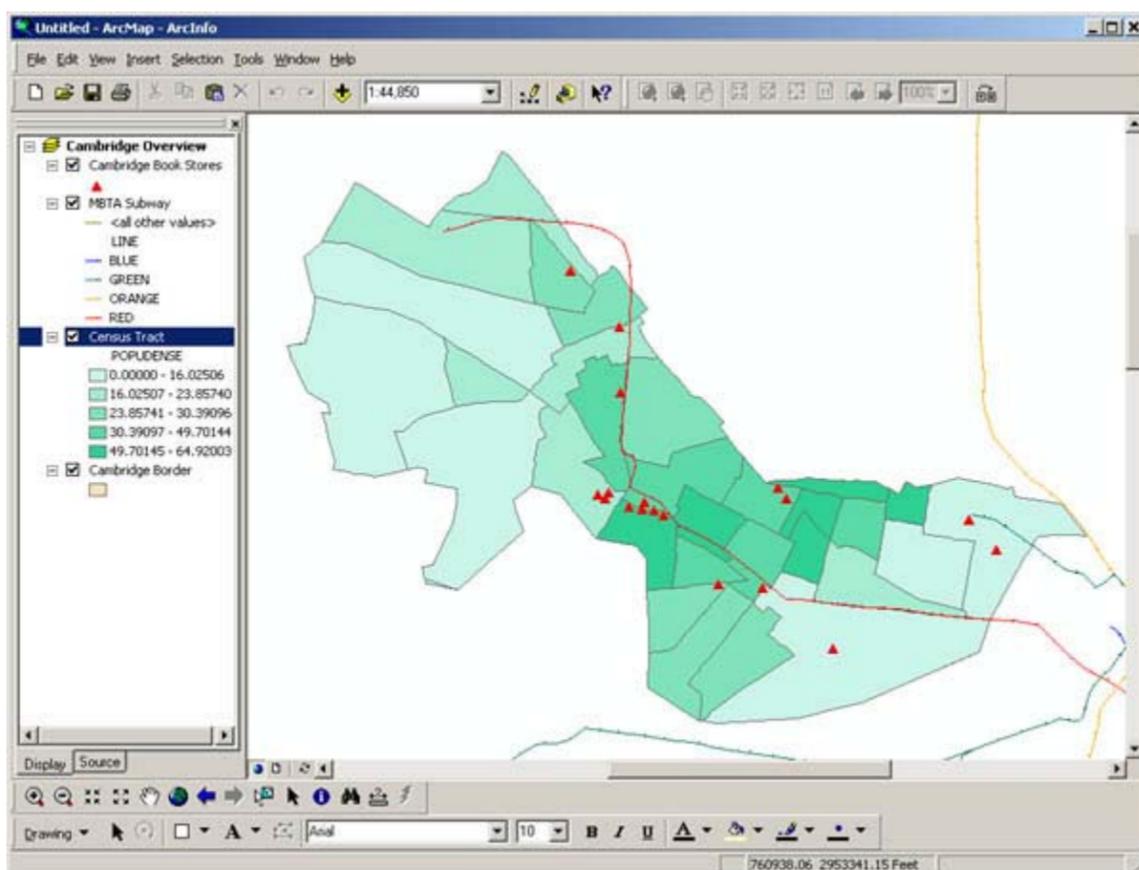
Often we will want to make some adjustments to the way these ranges are created. To do so, click on the Classify button. The Classification window will appear. Under "Method:" select "Quantile", keep the number of classes at 5 then click OK. The quantile classification method divides your data into so that, in this case, an equal number of tracts fall within each of the five ranges.



Back in the Legend Editor notice that the ranges have changed to reflect the new classification scheme. Now click OK to make this new scheme take effect in the map.



You've made your first thematic map, with population density divided into 5 categories, each consisting of 20% of the tracts. The darker color highlights the tracts with a denser population in 2000.

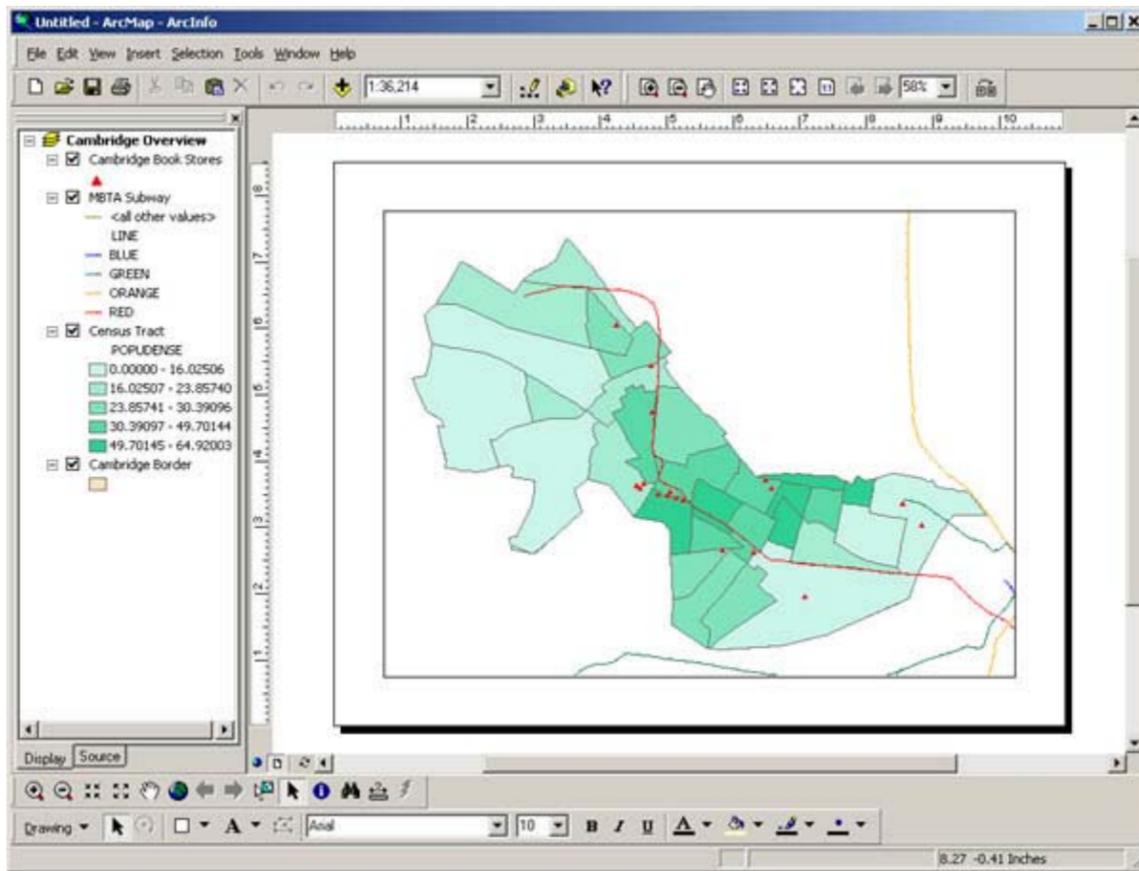


Save your map document by pressing Ctrl-s (the short-cut for save map document).

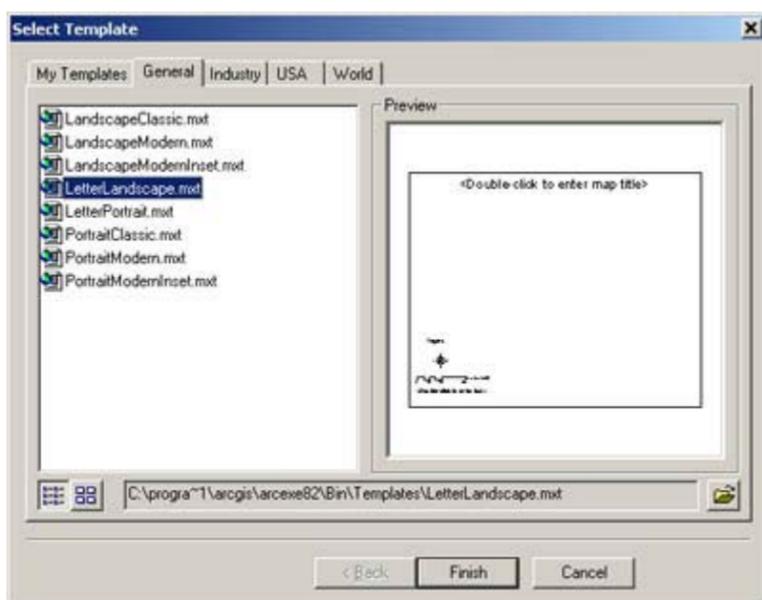
Layout/export

How to turn to the Layout mode (view).

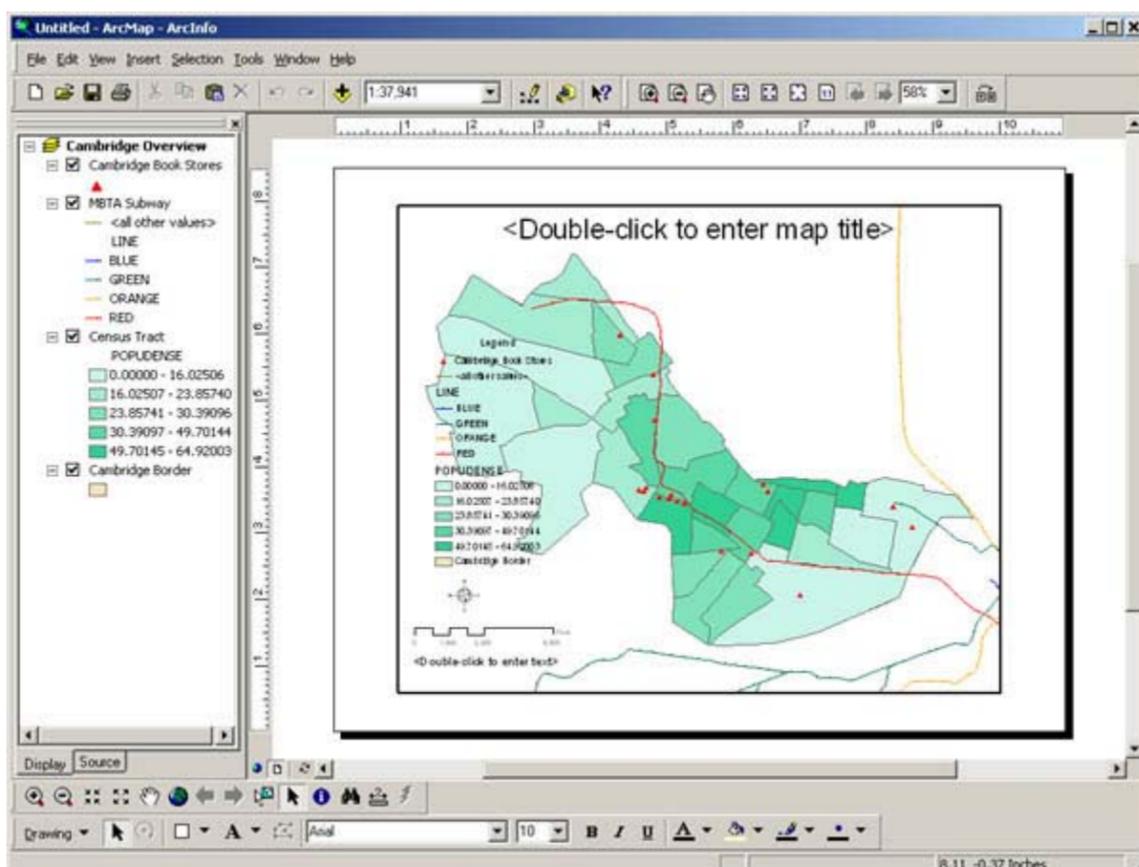
Now you are ready to create your final layout which will include a legend, title, scale bar, and north arrow. Zoom in/out to a reasonable scale because the extent that your map shows here will be the extent that will be displayed in your final layout.. Under the View menu select Layout View.



The main window will change to a layout mode without design works. Now, you need to apply a template to add map elements. Right click the map to open a pop-up menu and choose "Change Layout." (You might have to right click the map outside the green rectangular frame or without any selections, otherwise you get a different set of menu options, which does not include "Change Layout".)



Select Template window will appear. Choose "General"->"LetterLandscape.mxt" for this Lab work.

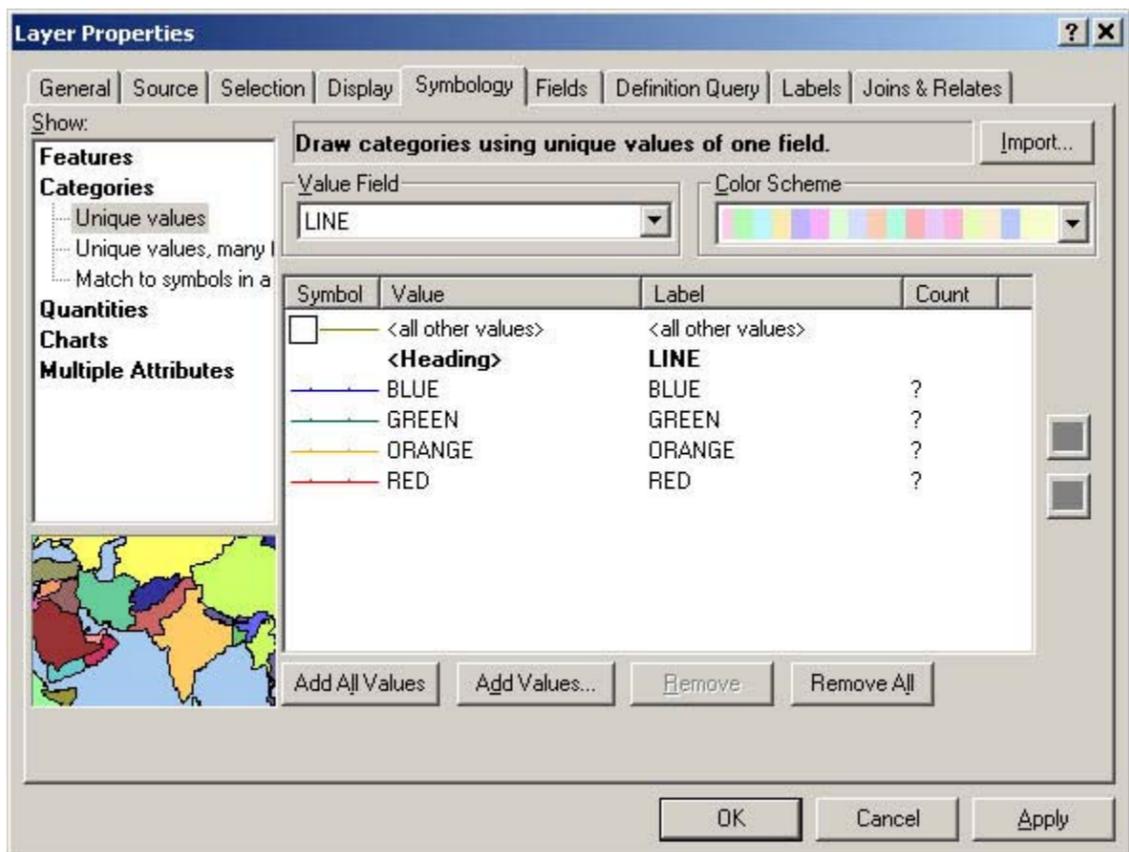


You should now see a page with a map, title, legend, scale bar and north arrow already placed on it. These are the most basic components of a map. If you think that your map should cover greater area on the paper, go back to the Data view using the View menu and zoom in/out a bit more. Then come back to the Layout view and you will see that it is automatically refreshed. In this way you can adjust the size of the map on the page as it suits you.

How to arrange Legend

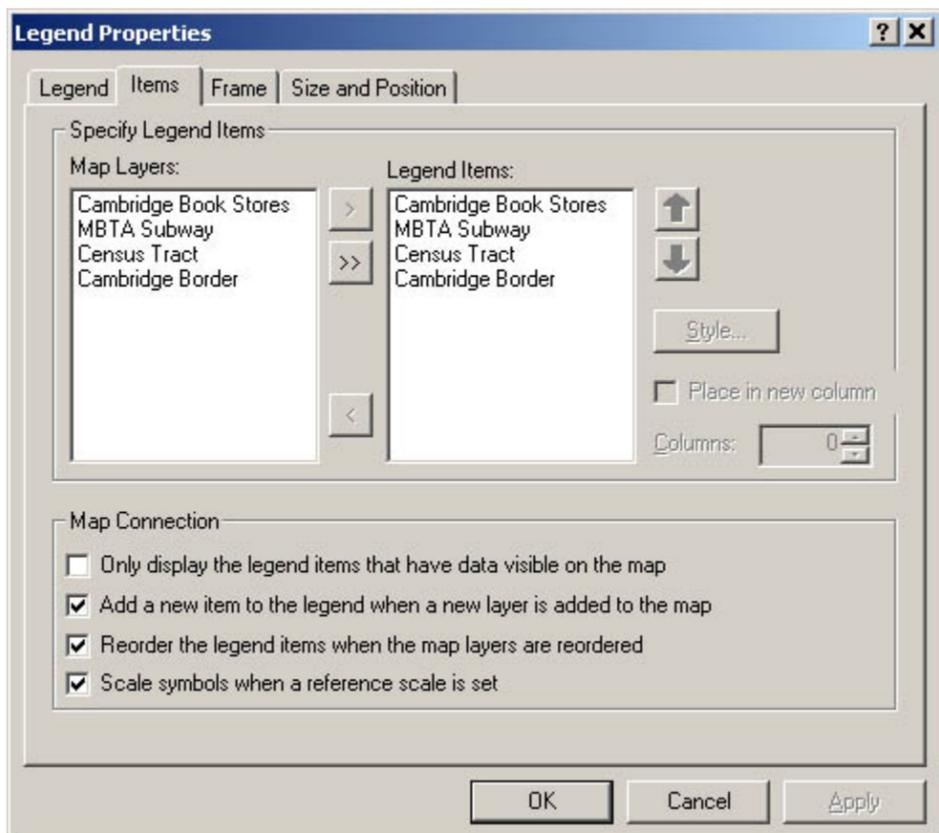
We need to work on the legend to make it legible. First, you need to remove <all other values> in the MBTA subway category. This stands for those line elements without attribute data in the LINE property. Because such polygons do not exist in our data set, you can remove the category.

In the table of contents (left side), double click over "MBTA Subway" or right click to open a pop-up menu to choose "Properties."

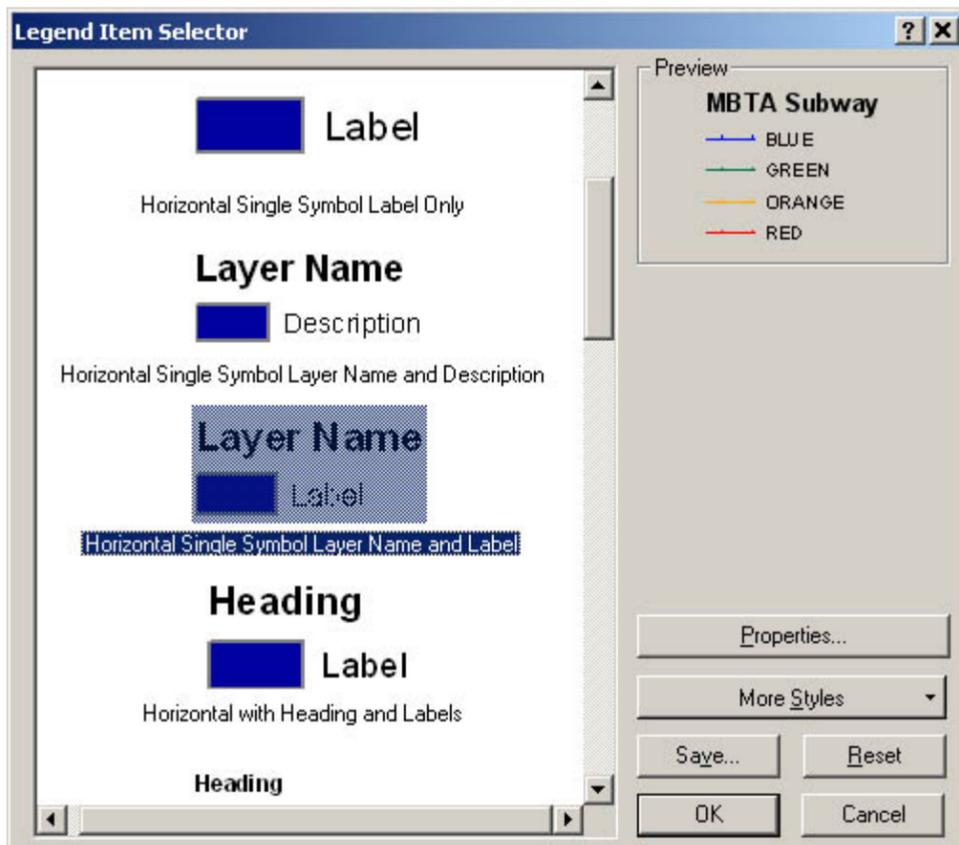


In the Symbology tab, uncheck the checkbox next to <all other values>, and click OK. This action hides the line elements without attribute data in the LINE property.

Still, the legend is not sensible. Double click over the legend on the map. Legend Properties will show up.

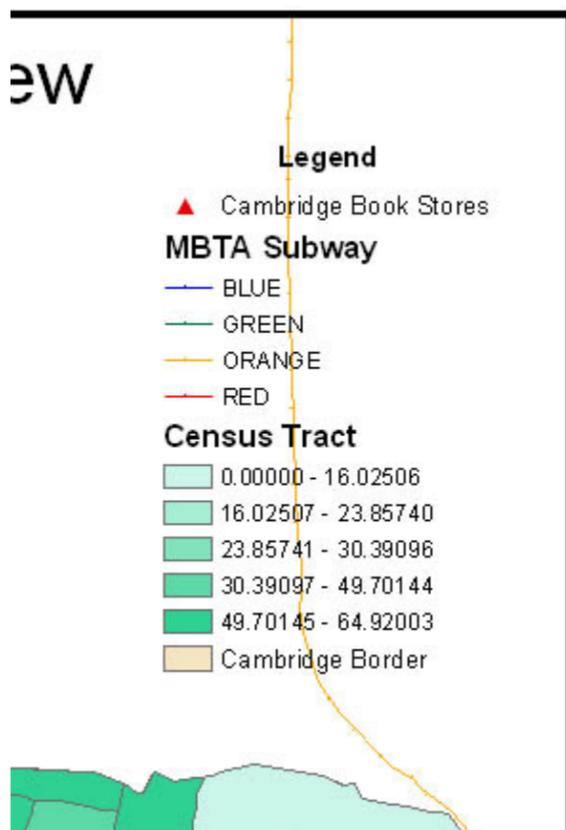


In the "Items" tab, choose "MBTA Subway" in the Legend Items box (not Map Layers on the left). Then click Style... box on its right. Legend Item Selector will show up.

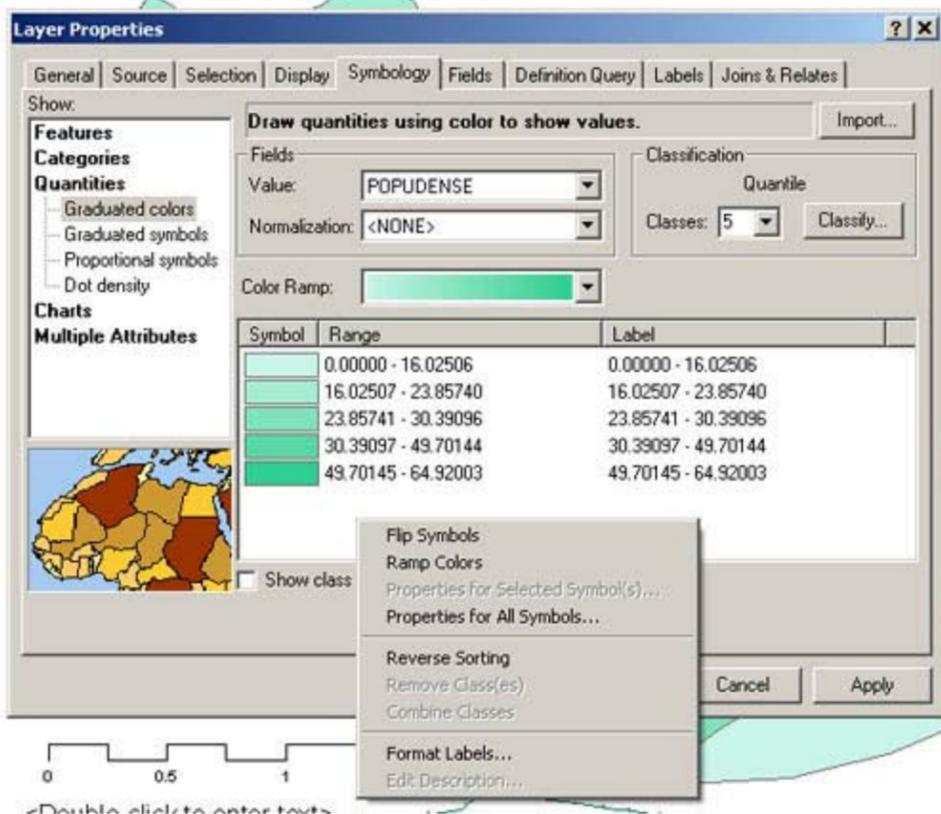


Choose "Horizontal Single Symbol Layer Name and Label" for the subway lines. Click OK to close this window. Then Click OK again to close Legend Properties to see how the change is reflected in the map.

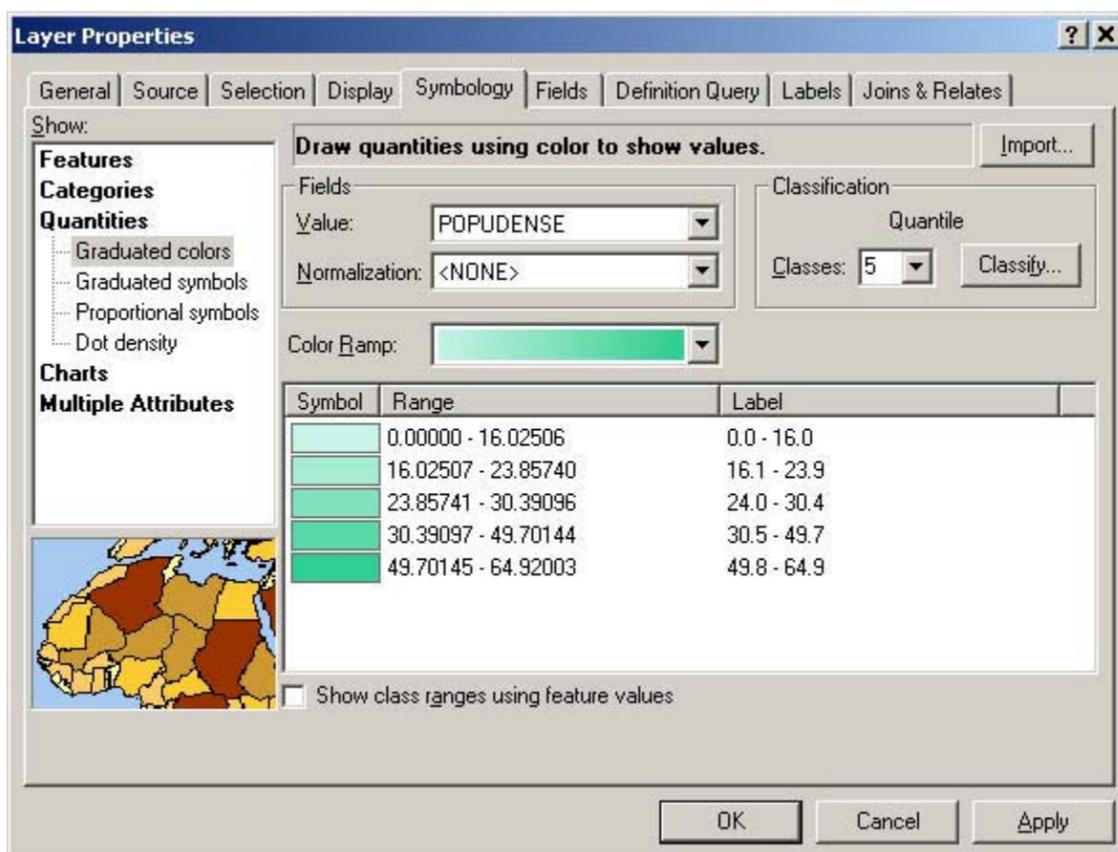
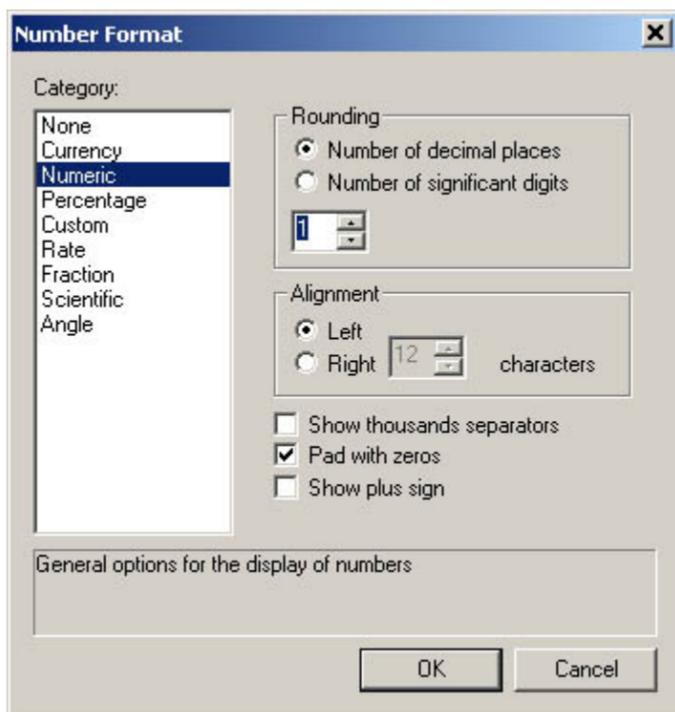
We will do the same change for the Census Tract. Choose "Horizontal Single Symbol Layer Name and Label" for this layer, too. Now, the legend should look like this.



We need to reformat the labels (numbers) for the Census Tract. The digits are too long. Double click the text "Census Tract" on the left side of the window to open Layer Properties, then go to the Symbology tab (You should have opened this window before to create the thematic map). Right-click in the Symbol-Range-Label box to open a pop-up menu shown below. Choose "Format Labels."



Number Format window will show up. Reduce Rounding to 1. Click OK to apply.



Now you see the decimal point reduced to 1, and it is reflected in the Layout View.

We need to add a few more elements to the map:

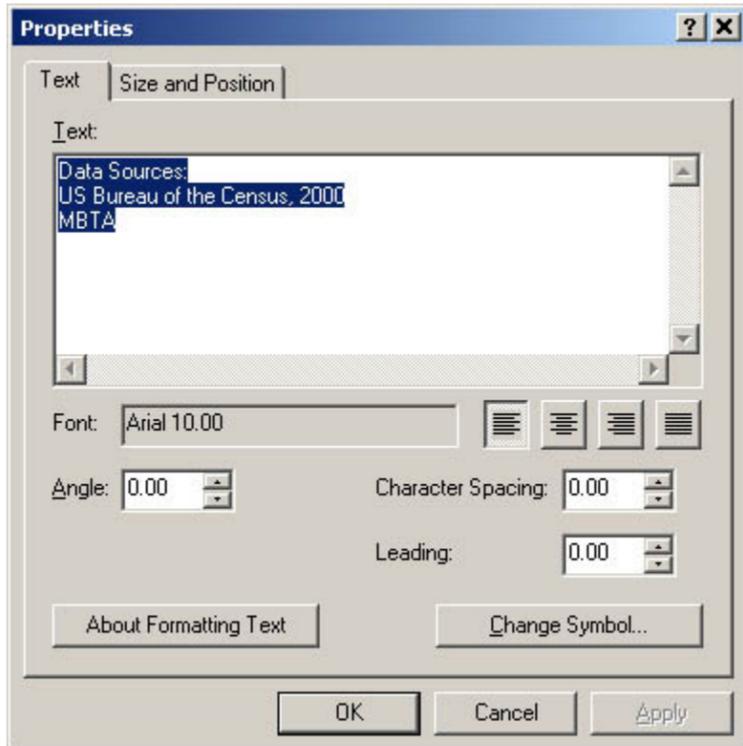
- Data sources
- Subtitles
- Author's Name

- Date

Let's add the data source first. Click once on the Text ("T") button , or choose "Insert"->"Text" menu, then click once on the Layout view. A text box appears, and type as follows:

Data Sources:
 US Bureau of the Census, 2000
 MBTA

If you want to correct, double click the text box to open a Properties window to change it. You can also change font style and size in this window.



Note that you can use the Enter key to insert line breaks in the text. Once you click OK, the text is placed wherever you clicked in the layout window.

(When you applied the template, a text box is already prepared on the left bottom. You can also use this ready-made text box to add texts.)

You can move this text by selecting the arrow pointer tool  (far left), then dragging the text to a new position. To change the type size, select the arrow pointer tool from the toolbar, then click once on the text. Small squares surrounding the text should appear. Then double click on it. Once again we see the Symbol Window, but this time the text tools are displayed.

Choose a font, a font size, and a font style. This time changes are automatically applied.

In the same way, add your username as the author and the current date.

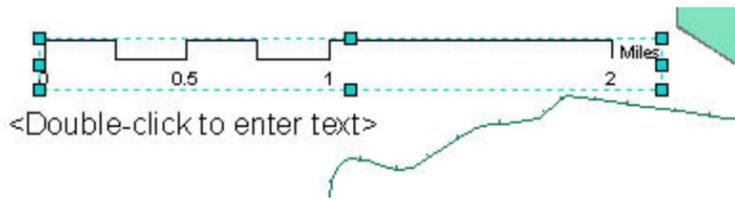
Arrange map elements (North Arrow, Legend, Scale, Title, Comments) and modify the size and style to create an attractive layout.

To change the properties for the scale, double click the scale bar. Stepped Scale Line Properties window will open.

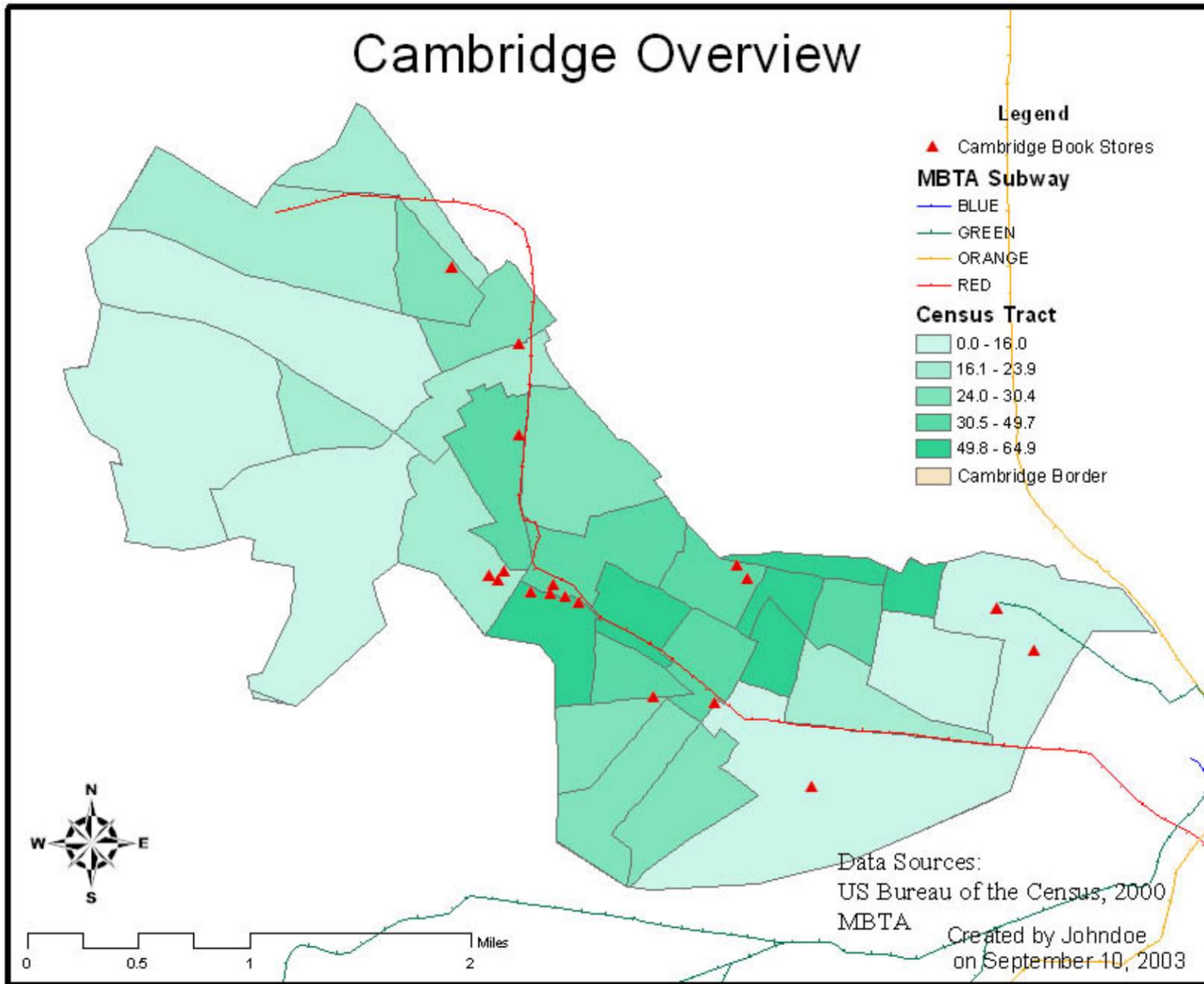


Change Division Units to "Miles"

In the Layout View, adjust the size of the scale to make it look suitable to the map.

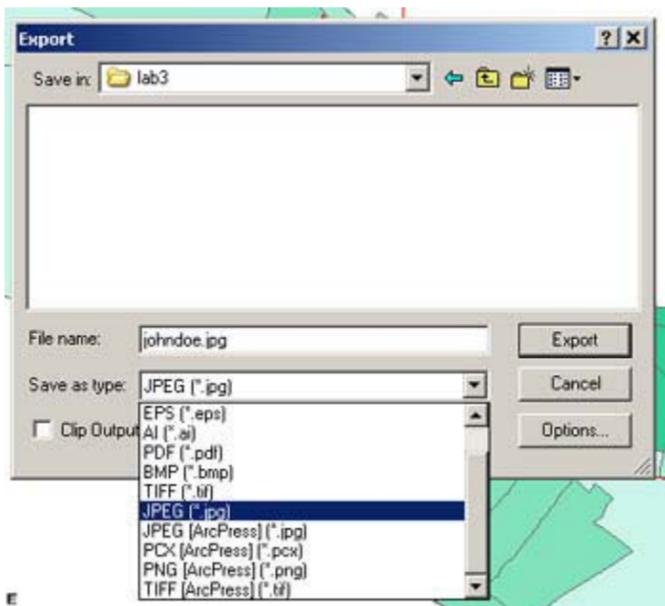


Below is **an example** of the final arrangement. However, it contains several flaws. For example, does it seem reasonable that one of the subway lines cuts across the legend? Is the title, "Cambridge Overview" helpful or descriptive? Does the heading "Census Tract" make sense? Your map should be better than this.

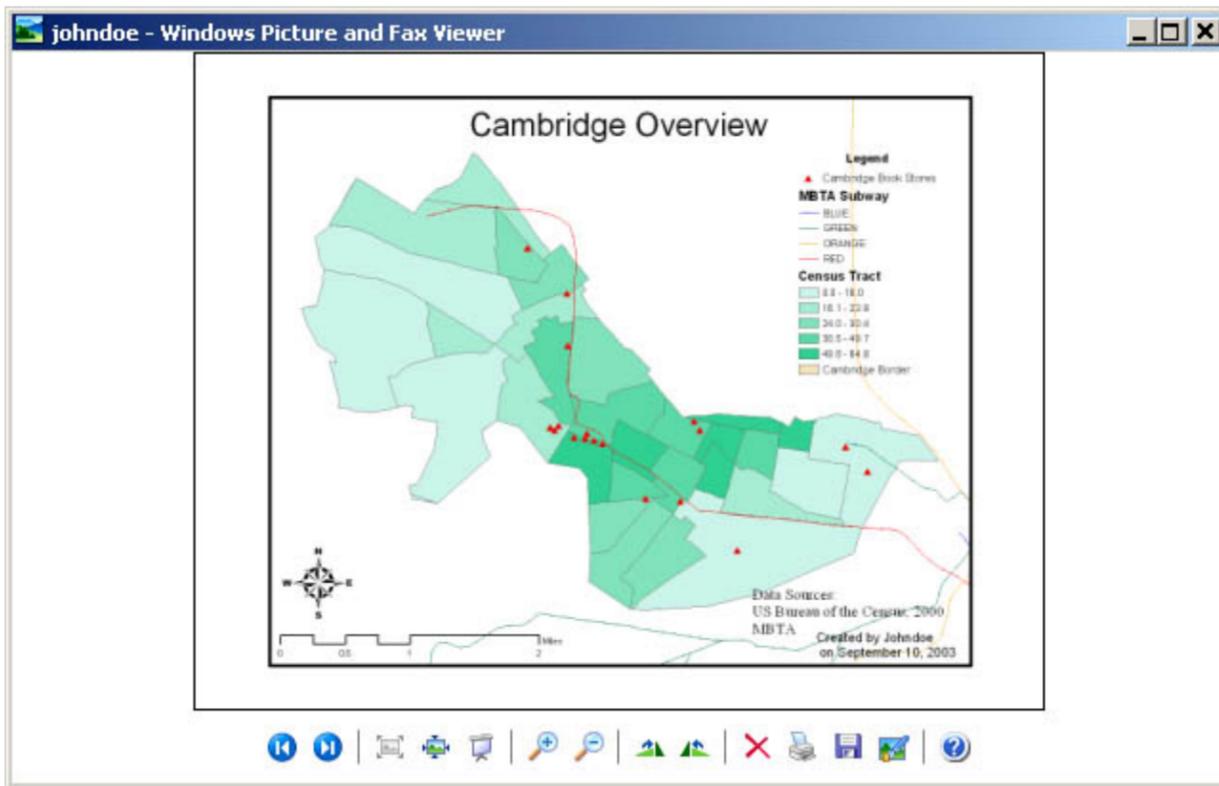


How to export maps into ".bmp" or ".jpg" pictures.

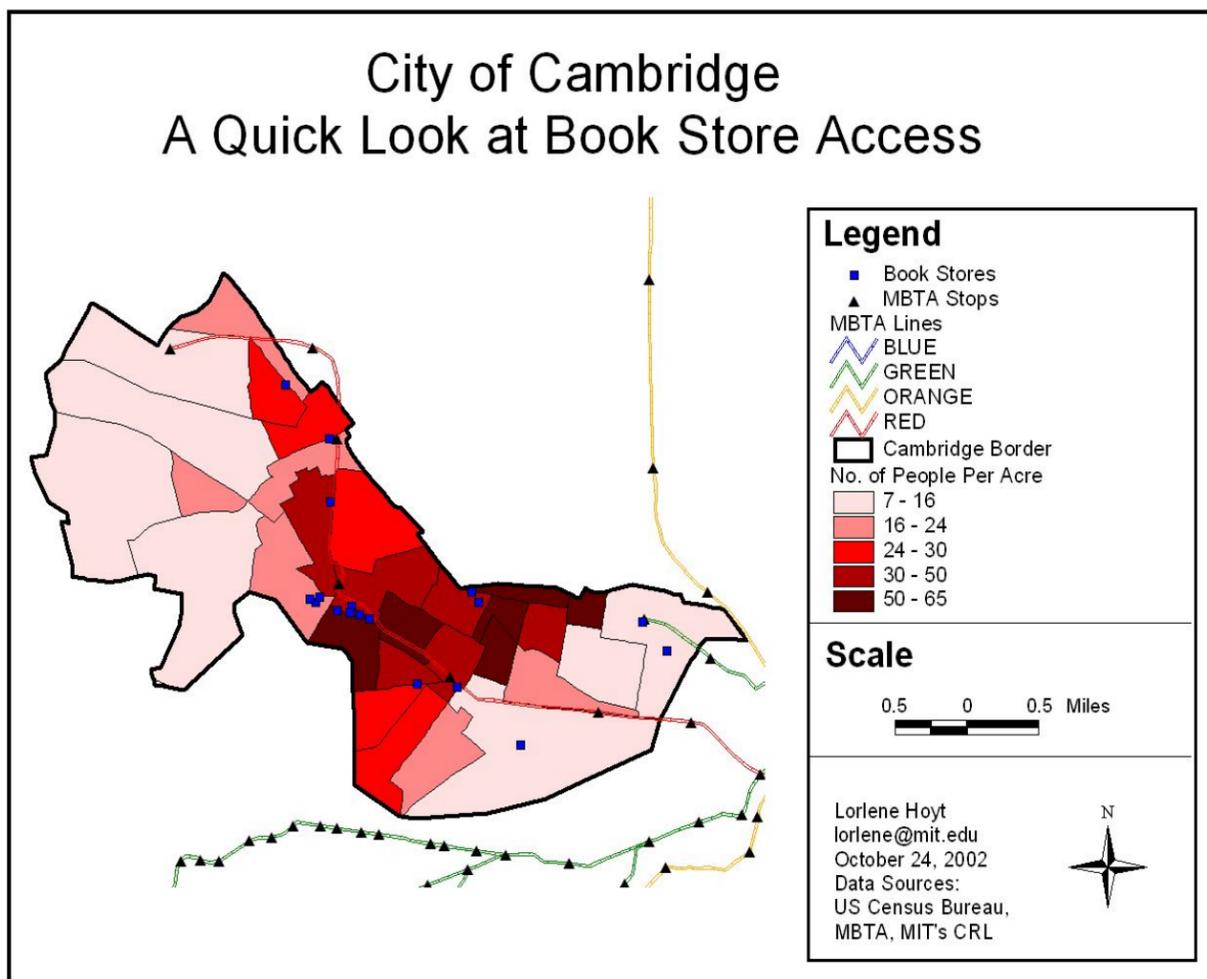
After you are satisfied with the layout design, you can export the map into a picture file. For this exercise, use JPEG (Joint Photographic Experts Group) format. Highlight the layout window, under File Menu, and choose "Export Map..."



In the Export window, choose "JPEG" as the File Type (do not use JPEG [ArcPress]), browse to H:\private\11.204\lab4, name is as johndoe.jpg (replace johndoe by your username) and click OK. After seconds, the image file is exported and you can view the image in viewing software or upload the image to your web site.



Take the time to improve the presentation. Add a descriptive title and neat lines. Remember, you are trying to convey an idea without the benefit of an oral presentation.



Save the map document and exit ArcGIS.