

UC Merced

UC Merced Previously Published Works

Title

Mapping Political Economies over Time, GIS Exercise 1: Urban Systems in 19th Century France

Permalink

<https://escholarship.org/uc/item/5gh6f7fb>

Authors

Ryavec, KE

Henderson, M

Publication Date

2023-12-11

Copyright Information

This work is made available under the terms of a Creative Commons Attribution-NonCommercial-ShareAlike License, available at <https://creativecommons.org/licenses/by-nc-sa/4.0/>

Peer reviewed

Mapping Political Economies over Time

A Primer of Regional Systems Theory and Methods for the Study of Historical Economies, Societies and Polities, and their Integration into the Modern World System

Exercise 1: Urban Systems in 19th Century France

Karl Ryavec University of California, Merced

Mark Henderson Mills College

First Edition, 2017

Creative Commons License ([CC BY-NC-SA 4.0](https://creativecommons.org/licenses/by-nc-sa/4.0/))

Exercise 1:

Urban Systems in 19th Century France

Learning Objectives

1. Create maps of the population size of urban centers, and population density based on the France Census of 1831 at the Commune level.
2. Identify the regional economies of 19th century France in relation to the urban hierarchy, and their core-periphery structures.

Files used in this exercise

Datasets referenced in this exercise may be downloaded from the Harvard Dataverse repository at <https://dataverse.harvard.edu/dataverse/mpe>. We suggest that instructors provide a shared directory for students to access these files on their local network. The basemap data layers are accessible through ESRI ArcGIS Online.

<u>File Name</u>	<u>Attribute</u>
1. dem	Elevation (grid value)
2. elev_contours.shp	Elevation (Low, Medium, High)
3. hydro.shp	Carto (river line hierarchies)
4. watersheds.shp	
5. systems.shp	Name (of each economic region)
6. City1831	P1831 (Total Persons in 1831)
7. Commune	P1831 (Total Persons in 1831)
8. MetroAll	Nom_Commune (Name of Commune)

Data sources

This exercise makes use of data developed by the Institut National de la statistique et des études économiques (INSEE)/ National Institute of Statistics and Economic Studies, the National Aeronautics and Space Administration (NASA), and by G. William Skinner and his research team at the University of California, Davis, now archived at the Harvard University Center for Geographic Analysis.

Claude Motte, Isabelle Séguy, and Christine Théré (2003). *Communes d’hier, communes d’aujourd’hui. Les communes de la France métropolitaine, 1801-2001. Dictionnaire d’histoire administrative*. Paris: Institut National d’Études Démographiques.

A. Jarvis, H.I. Reuter, A. Nelson, and E. Guevara (2008). *Hole-filled SRTM for the globe, Version 4*. Washington, DC: Consortium for Spatial Information. <http://srtm.csi.cgiar.org>.

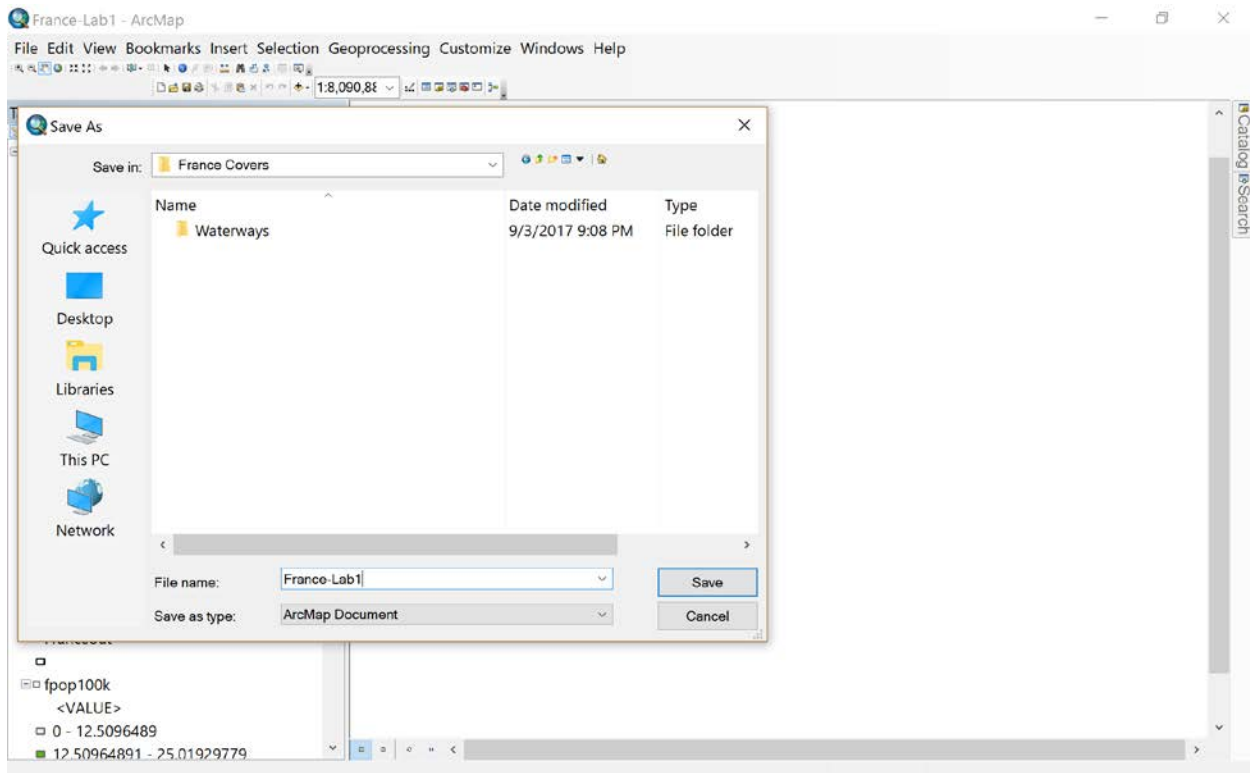
Mark Henderson and Merrick Lex Berman, ed.s (2016). *Skinner Regional Systems Analysis Dataverse*. Cambridge: Harvard University. <https://dataverse.harvard.edu/dataverse/hrs>.

Getting Started: Start ArcMap 10 and Save an ArcMap Project

This exercise shows examples from ArcMap version 10.5. If you're using a different version, or different GIS software, what you see on your screen may vary. We assume that you're familiar with the basic layout of your GIS software and are ready to try some new techniques.

To begin, start ArcMap and create a new ArcMap project. From the Menu Bar click on File / Save As, and name your ArcMap document **China-Lab3**.

Consult with your instructor to determine the best location to save your .mxd document file. Remember, the .mxd file is only an array of pointers to the actual GIS data files, which must also be present where you save your work for the file to correctly open again later.



I. Urban Primacy and Levels in the Urban Hierarchy

Regional systems function as the service areas of urban centers. Walter Christaller's classic Central Place Theory offers a method for identifying a hierarchy of urban centers within an urban system. Christaller wanted to explain the spatial arrangement of cities and towns of different sizes in southern Germany. He focused on the idea that cities and towns provide central services to their hinterlands: daily food markets might be found in every town, opera houses might be found only in cities of a certain size and draw clients from further away (but less frequently), and specialized merchants in the Metropolis might draw customers from an entire region.

According to Skinner, the first step of regional systems analysis is the assignment of central places to levels in the urban hierarchy. In the case of France, central functions for each city were compiled from two France-wide commercial directories published in 1856.

We will proceed with the analysis from the top down, by first determining which cities in the entire country served as central and regional metropolises. Although no list or GIS file of Skinner's Central Places of France compiled from the 1856 commercial directories have been found in his archival data, several hardcopy maps Skinner made survive depicting these Central Place Systems of France as of the mid-19th century according to five urban levels:

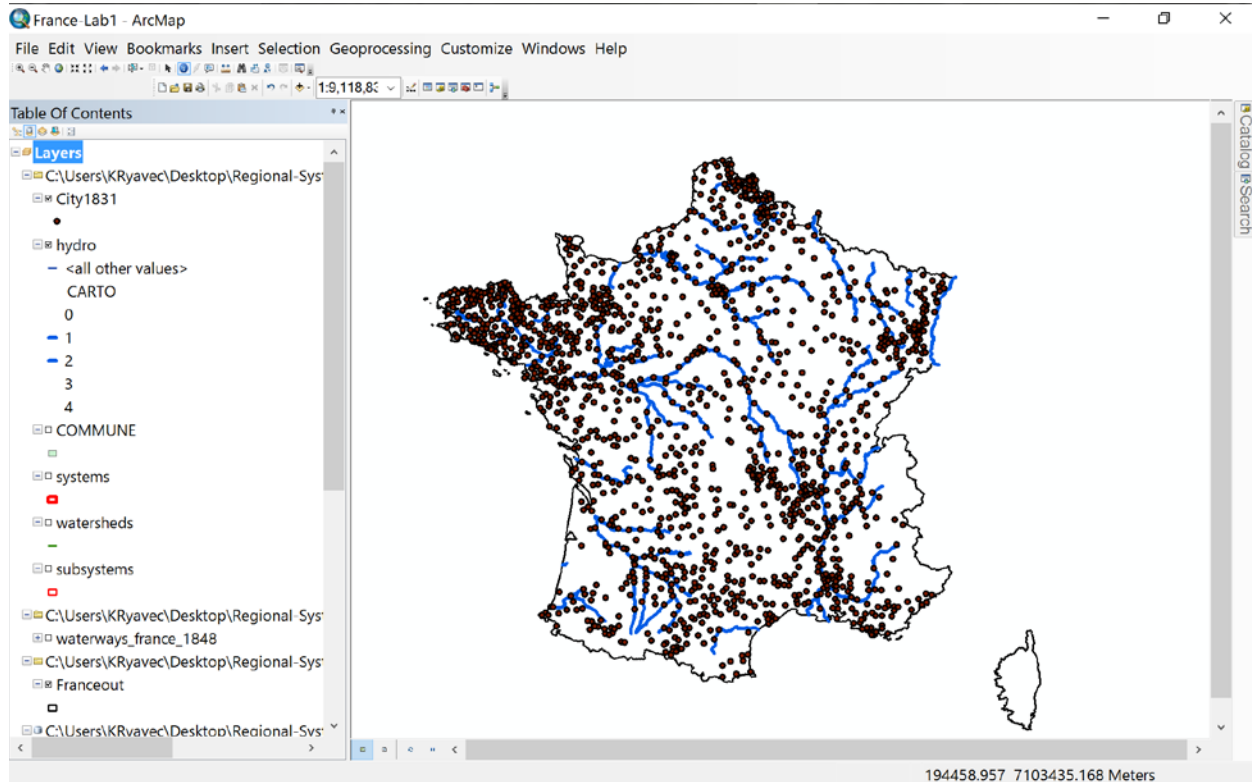
1. Metropolises
2. Regional Cities
3. Greater Cities
4. Local Cities
5. Country Towns

French administrative units: Communes

We are now ready to begin to identify the towns and cities that historically developed in France as a way to identify regional economies (or macroregions). The most detailed French population census data was reported by *commune*, an administrative area meant to cover each settlement from the smallest town to the largest city, every five years beginning in 1806. There are approximately 36,000 communes in France. First we'll need to add a point layer of communes representing only those communes with more than 2500 inhabitants in 1831. We will assume these represent all the towns and cities (i.e., urban centers) of France at this point in time.

Step 1. Open the 1831 Town/City points

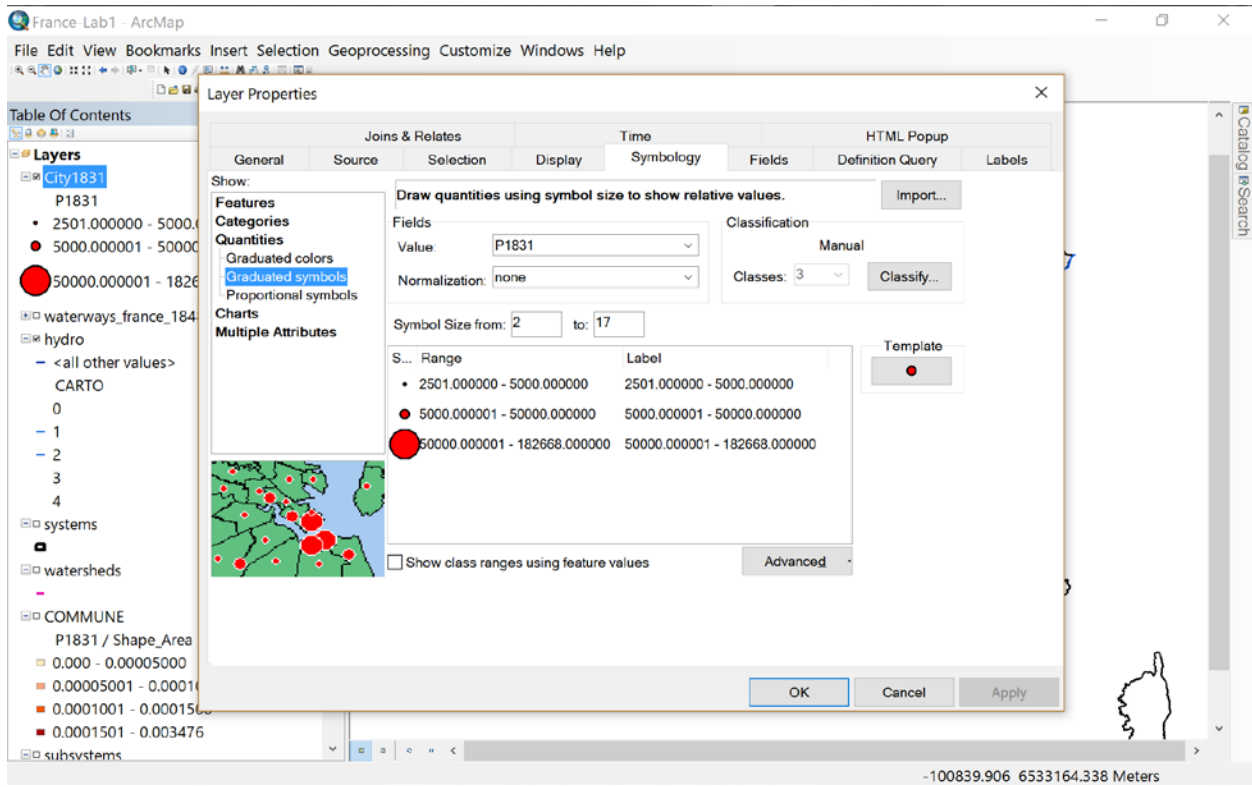
For the sake of clarity, turn off all previous layers except the hydro lines, then add the shapefile named City1831 from Data/France. You'll see 1475 points representing these towns and cities (and also the largest villages that were likely not true urban centers at this point in time).



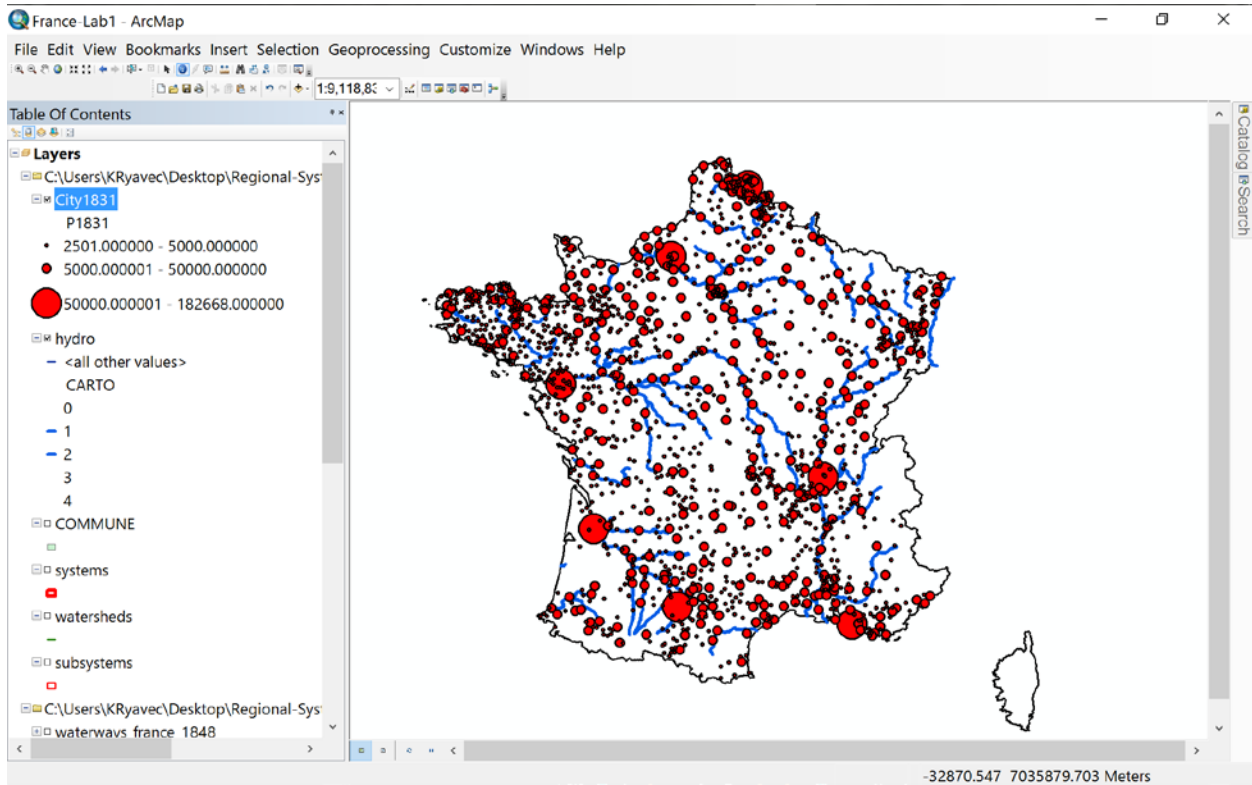
Step 2. Symbolize the 1831 Towns/Cities with Graduated Symbols

Next let's represent these towns and cities with 3 sizes of Graduated Symbols so the largest cities will be clearly distinguished from the numerous towns and large villages: Right-click on the City1831 layer in the Table of Contents, then choose Properties, and then the Symbology tab.

Under Quantities, choose Graduated Symbols. Next, choose 3 Classes, then click on Classify and set the first break level to 5,000, and the second break level to 50,000. Note that the third and highest break level is automatically listed at 182,668 (for the city of Lyon). Paris in 1831 had a population of 785,000, but in our available Commune point shape file Paris is represented in 20 Arrondissements (another form of administrative division used in France). Thus we cannot represent Paris as the largest circle on our map now.

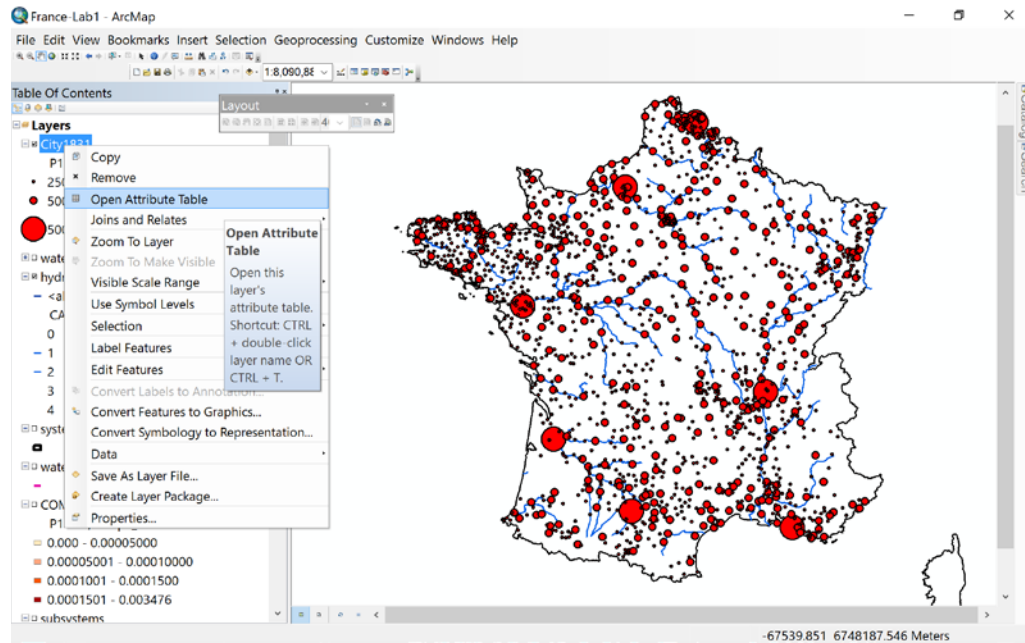


Now your map should look like this:



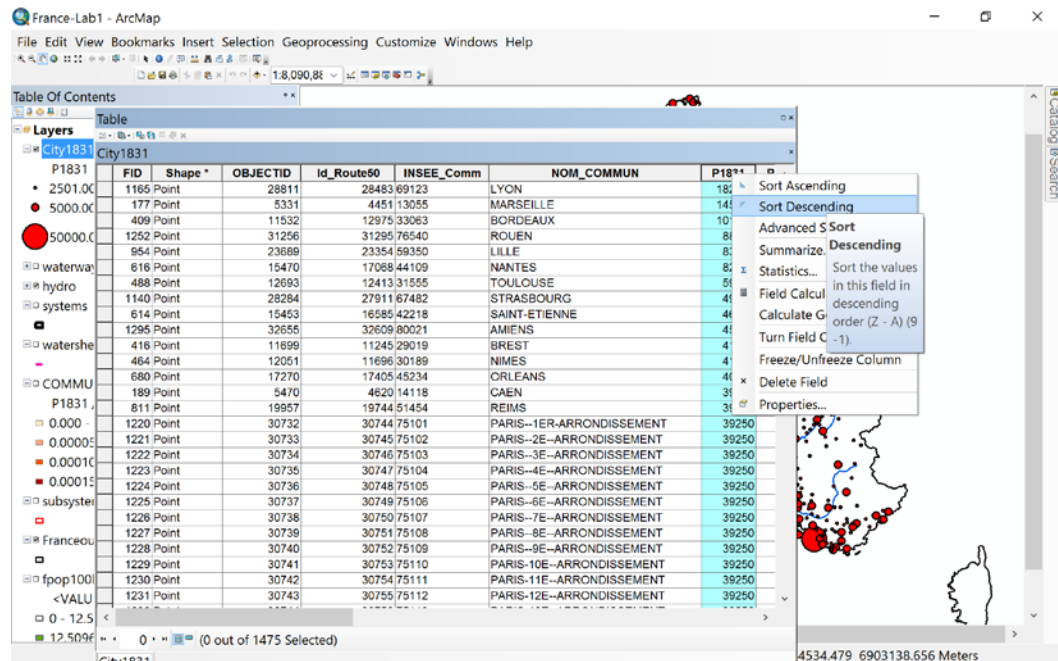
Step 3. Sort 1831 Cities by Population Size in the Attribute Table

Right click on City1831 in the Table of Contents, then left click on Open Attribute Table.



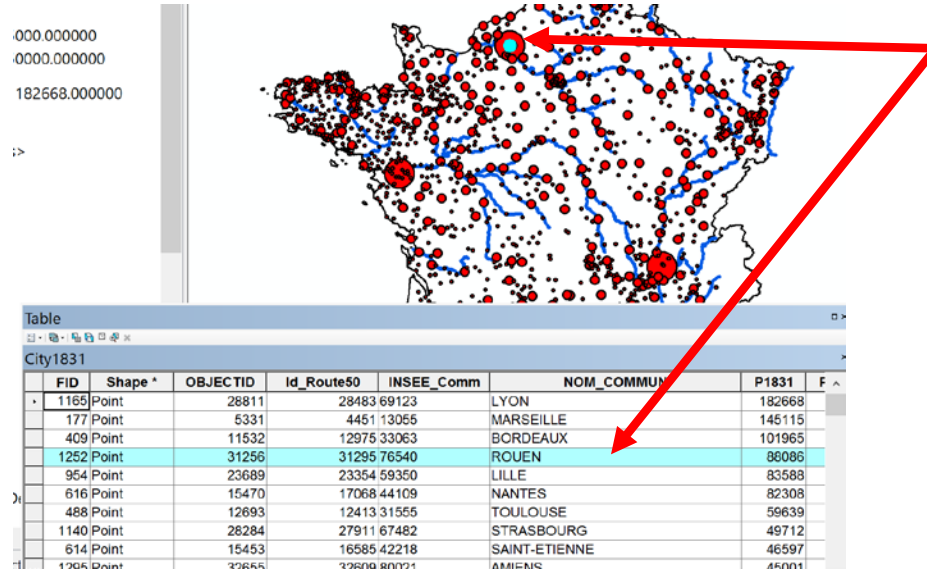
Next, make the Table wide enough to see both the Name of the Communes field (NOM_Comm) and the name of the 1831 population field (P1831). Then left click on the P1831 field (or column) header, right click and choose Sort Descending.

You should see Lyon listed as the most populous city (after Paris as mentioned above), then Marseille, Bordeaux, and Rouen.



Step 4. Identify and Highlight Individual Places between the Map and Attribute Table

Left-click on each metropolis's record (or row) in the Attribute Table. Notice how when you highlight the record, the feature on the map itself is also highlighted.



II. Visualizing the Landscape

Physiographic boundaries, defined by the watersheds of major rivers, offer one logical place to start to examine the extent of functional regions like premodern regional economies. Natural resource flows (through river systems) and social and economic exchanges (across the transport network, which is invariably more efficient based on water transport in lowlands than across mountain passes) have mutually reinforced the salience of these regions throughout human history.

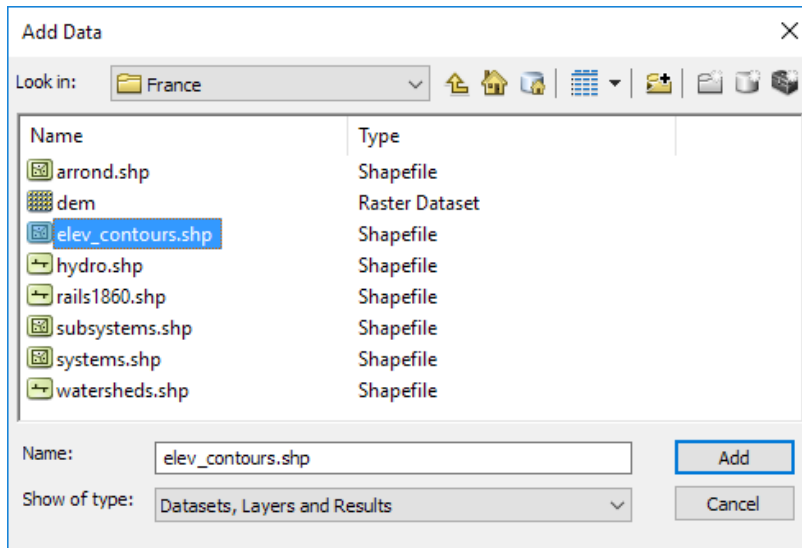
For our examination of the regional systems of France, we'll begin by mapping these physiographic features: the terrain itself, rivers, and major watersheds.

Elevation Contours and Digital Elevation Models

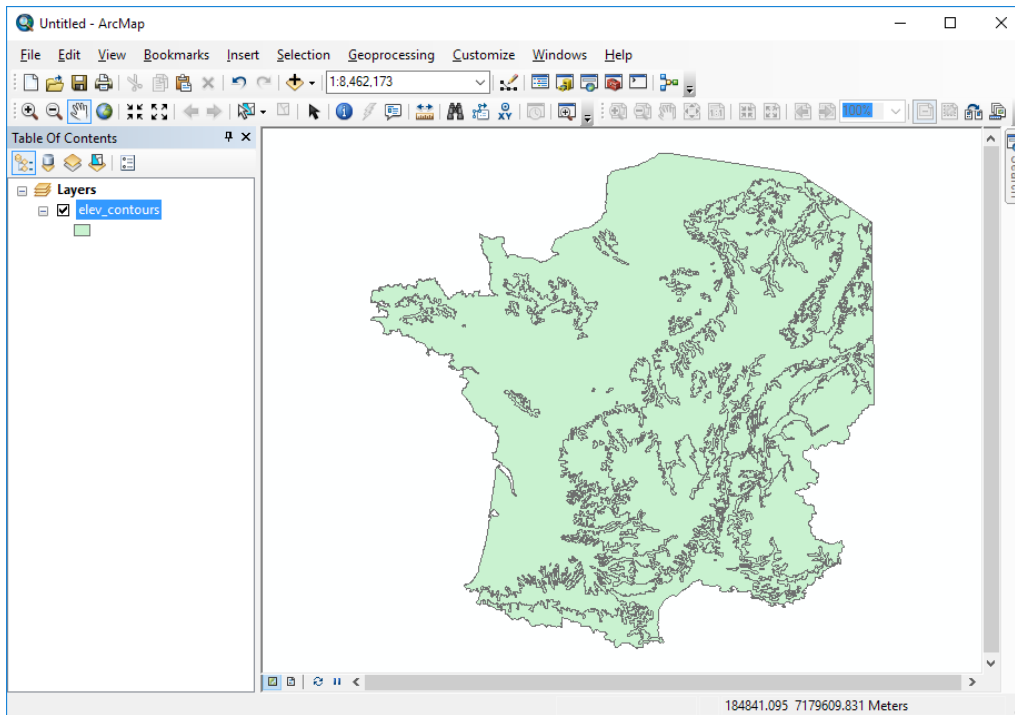
As we've seen, representing "the lay of the land" is a challenge for cartographers producing flat maps. Two common methods to represent elevations are the contour line based on the Vector Data Model, and the digital elevation model, or grid based on the Raster Data Model. With the former, a line on the map connects points of the same elevation, and the area between two contour lines falls between those elevations. With the latter, each cell in a grid is given a value representing the elevation inside the area of the cell (usually the mean elevation, but sometimes the maximum, so as to represent mountain peaks accurately). Let's take a look at both.

Step 5. Open the Elevation Contours of France.

Press the Add Data button and navigate to the Data / France folder to add the elev_contours shapefile.



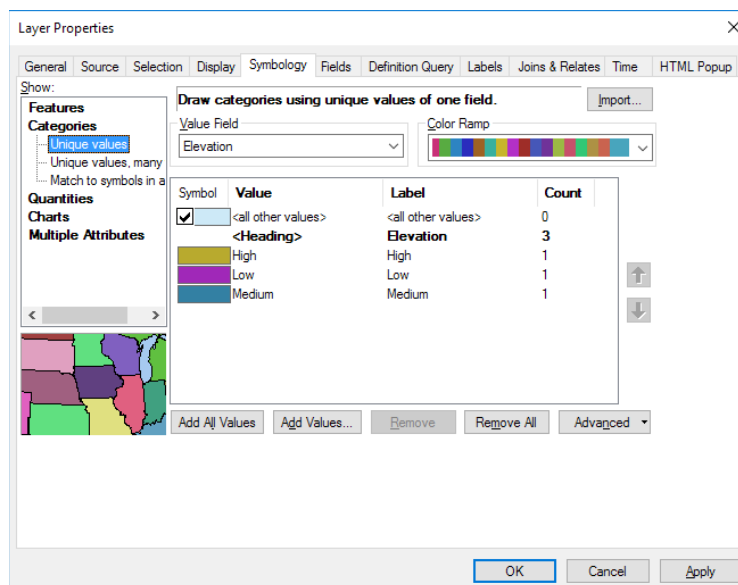
The elevation polygons will appear all in one color.



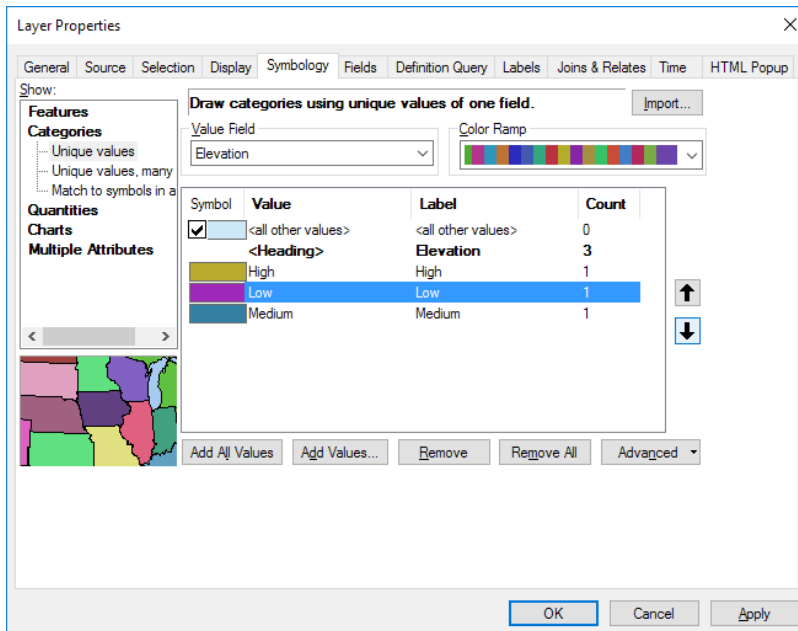
Step 6. Symbolize the Elevation Areas based on Contours

Let's change the symbols so that the low, medium, and high elevation polygons are displayed in different colors. Right-click on the layer name in the Table of Contents, then select Properties at the bottom of the pop-up menu to open the Layer Properties window.

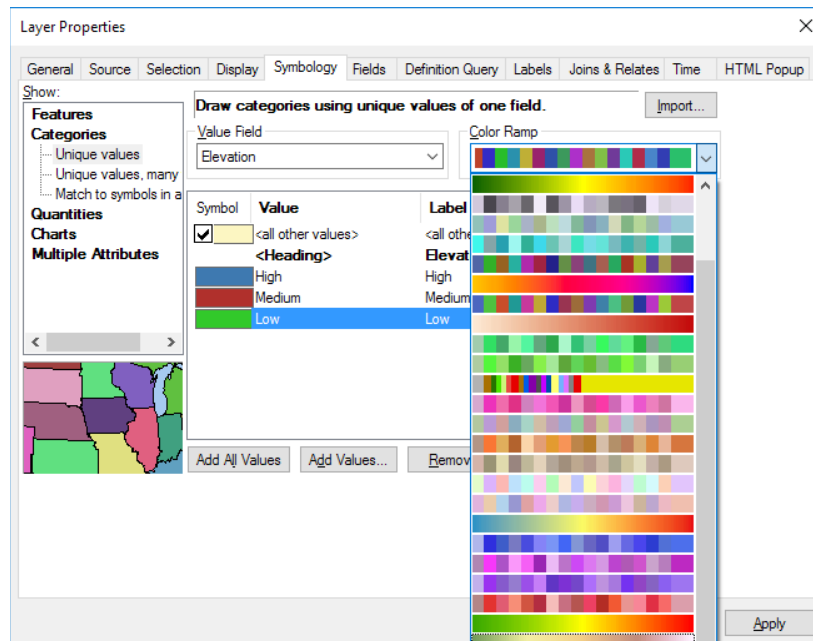
Choose the Symbology tab in the Layer Properties window, then select Categories / Unique Values from the choices at the left. For Value Field, choose Elevation, and then click Add All Values. ArcMap will assign random colors to the three possible values of the Elevation field, in alphabetical order.



Alphabetical order isn't the best order for elevation data! Let's rearrange these from High to Medium to Low. Click on the color patch for Low, then press the down arrow at the right side of the window.

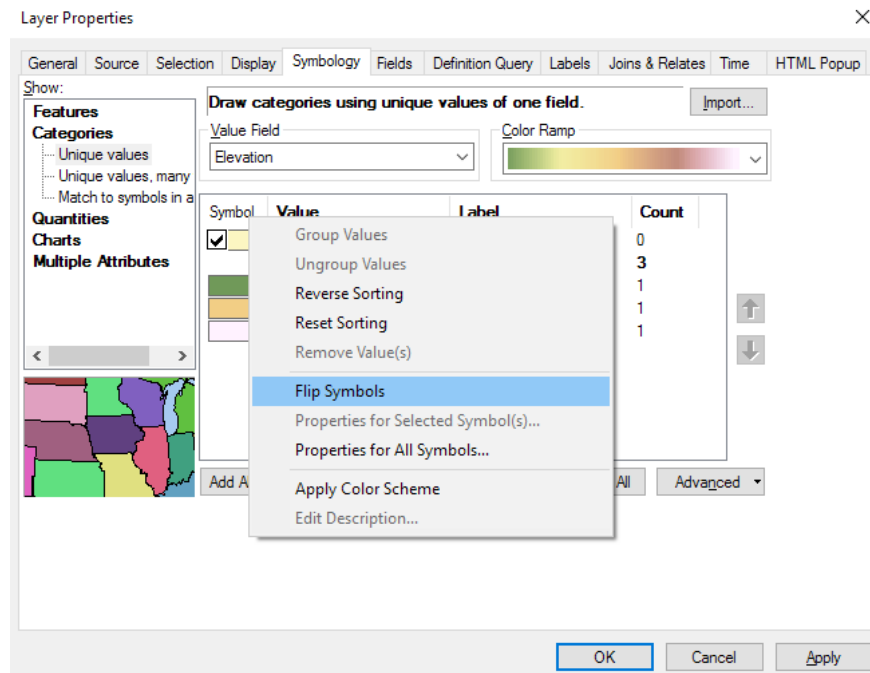


Now that the elevation values are listed in a logical order, we can use a Color Ramp to display them. Pull down the Color Ramp menu and choose a graduated set of colors that will represent elevation.

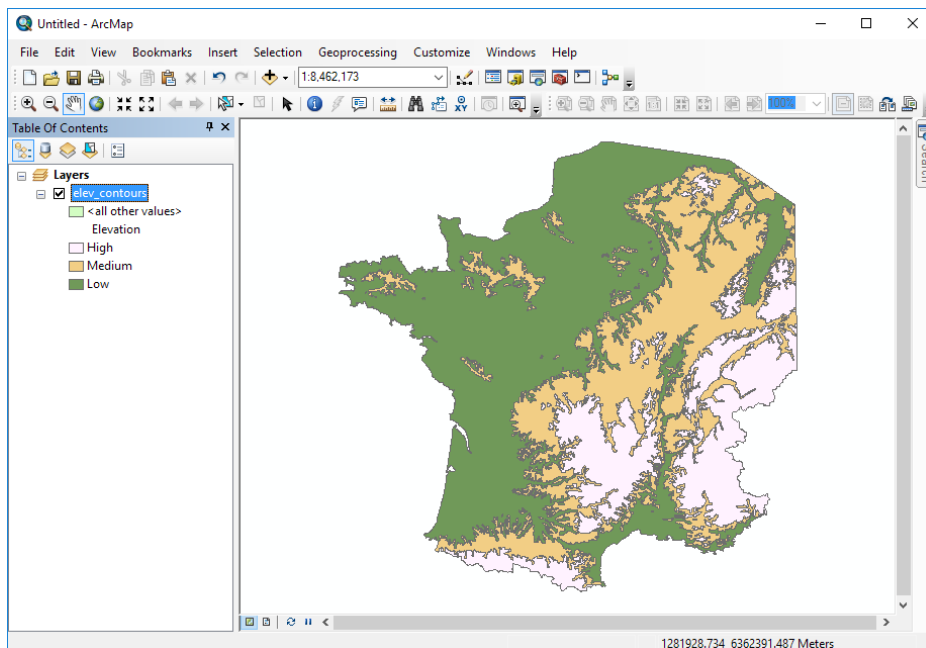


Tip: as an alternative, you can double-click on each color patch to choose individual colors.

Traditionally, cartographers use green shades for lower elevations, yellows for medium elevations, and brown and white for higher elevations. If the colors come out backwards, you can reverse them by right-clicking on the word Symbol and choosing Flip Symbols.



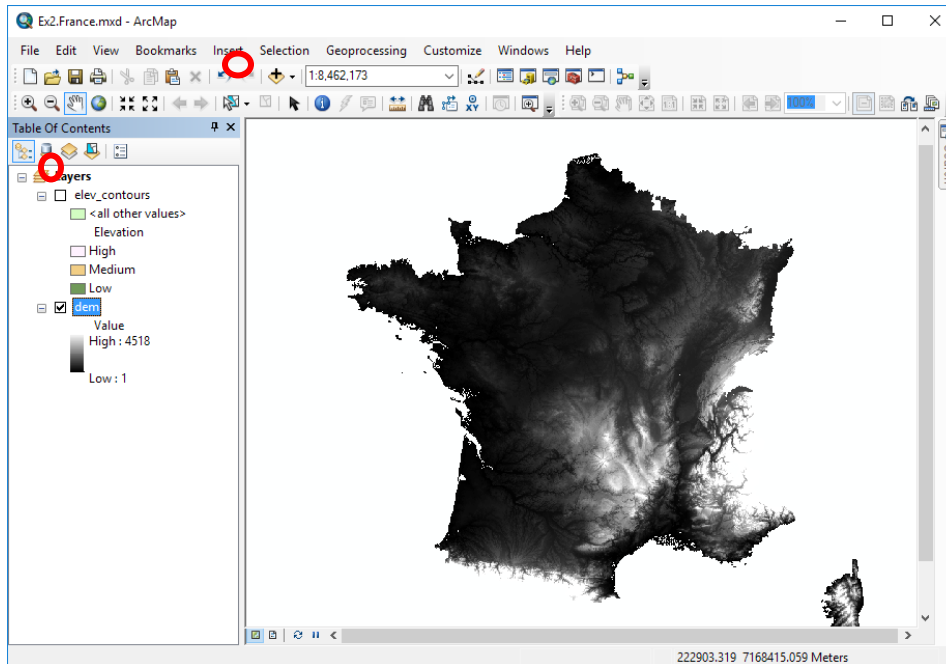
Your map should look something like this.



Tip: now would be a good time to save your map file.

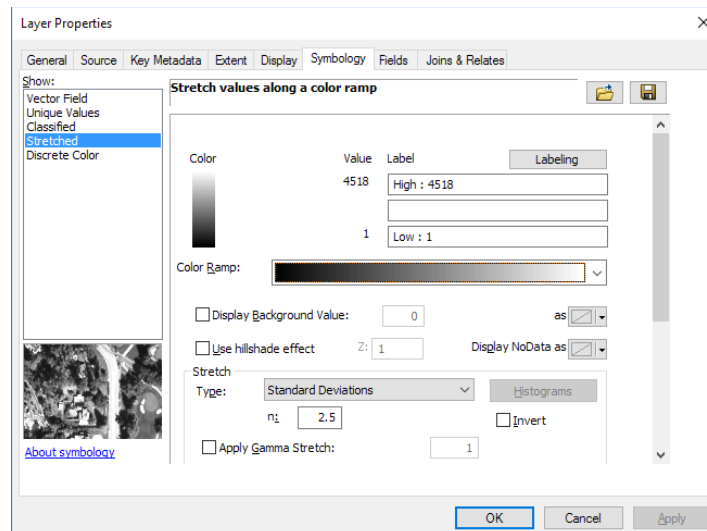
Step 7. Open the Digital Elevation Model (DEM) of France.

Now let's try displaying a digital elevation model. For now, turn off (uncheck) the elev_contours layer in the Table of Contents. Then use the Add Data button and add the raster layer in the Data/France directory named dem.

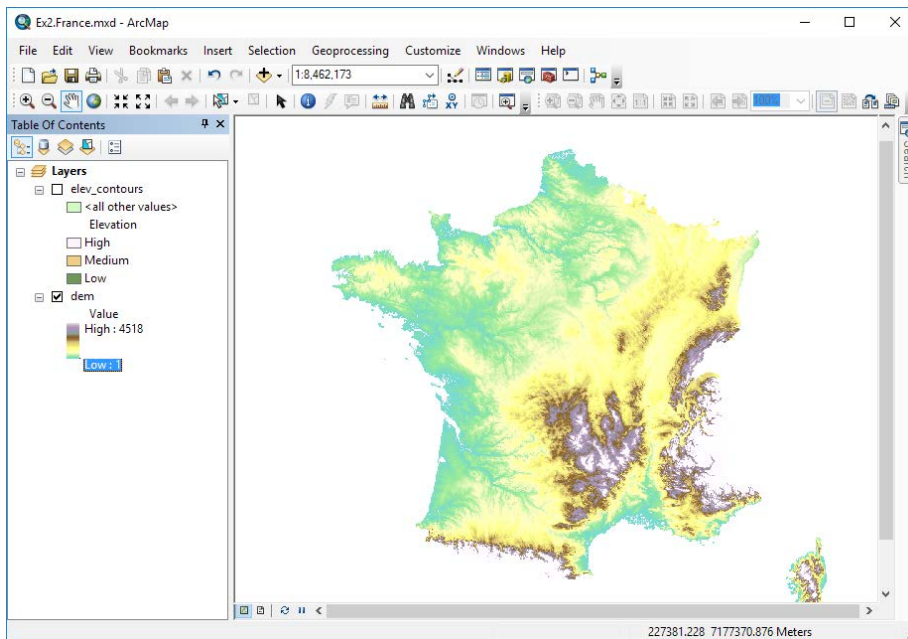


Step 8. Symbolize the Digital Elevation Model (DEM) of France.

Let's apply a better color scheme to symbolize elevations. Open the Layer Properties window for the dem layer (right-click on the layer name in the Table of Contents). You'll notice that the Symbology tab has different options for raster layers.



Choose a suitable color ramp. ArcMap will stretch all of the elevation values from low (1 meter) to high (4518 meters) across the colors in the color ramp. Click OK to return to your map.



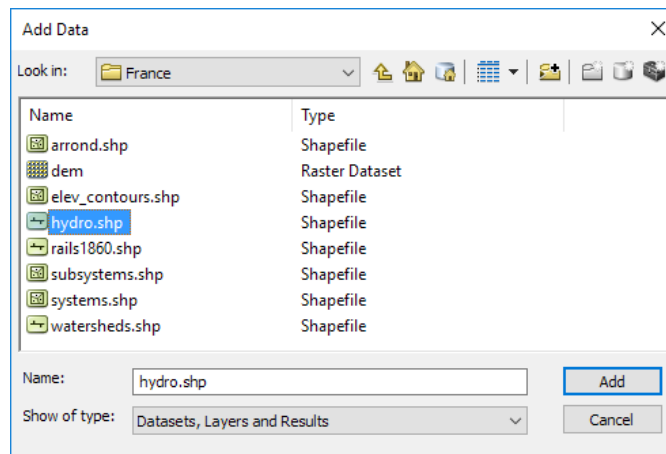
Tip: optionally, check the box to Use hillshade effect to instruct ArcMap to simulate shadows on the terrain.

Try turning the elev_contours layer on and off so that you can compare these two representations of the landscape. Discuss why you might choose vector (contour) or raster (DEM) methods for different purposes.

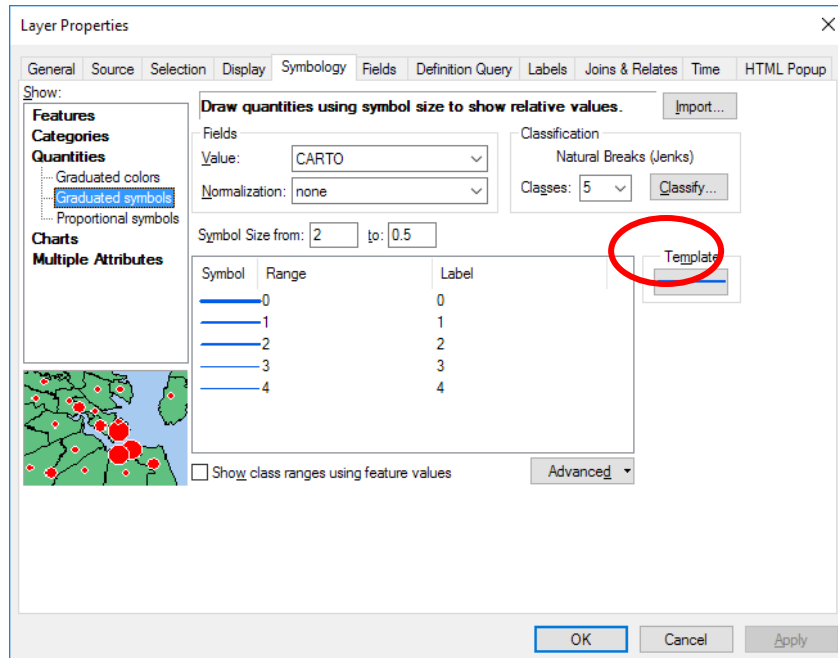
River systems

Step 9. Open and Symbolize the Rivers of France.

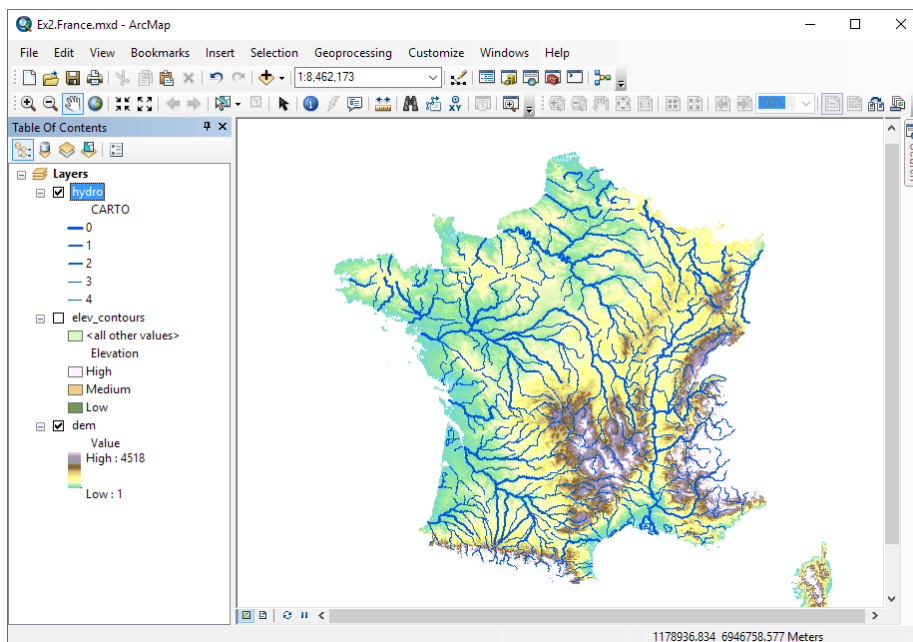
Water shapes the natural landscape, and the human landscape as well, serving both to divide and to connect. Let's add a layer showing hydrographic features next: use the Add Data button, navigate to Data/France, and select hydro:



ArcMap again chooses a random color to draw the layer you've just added. Let's change it to blue, and with more important rivers drawn with a thicker line. Open the Layer Properties window for the hydro layer. On the Symbology tab, choose Quantities / Graduated Symbols. Choose CARTO as the value field (this column contains the stream order, or relative importance for cartographic purposes). Change the Template symbol to a blue line (double-click on the line to change its color), and set the symbol sizes to run from 2 down to 0.5. Click OK to return to your map.



Your map should look something like this:

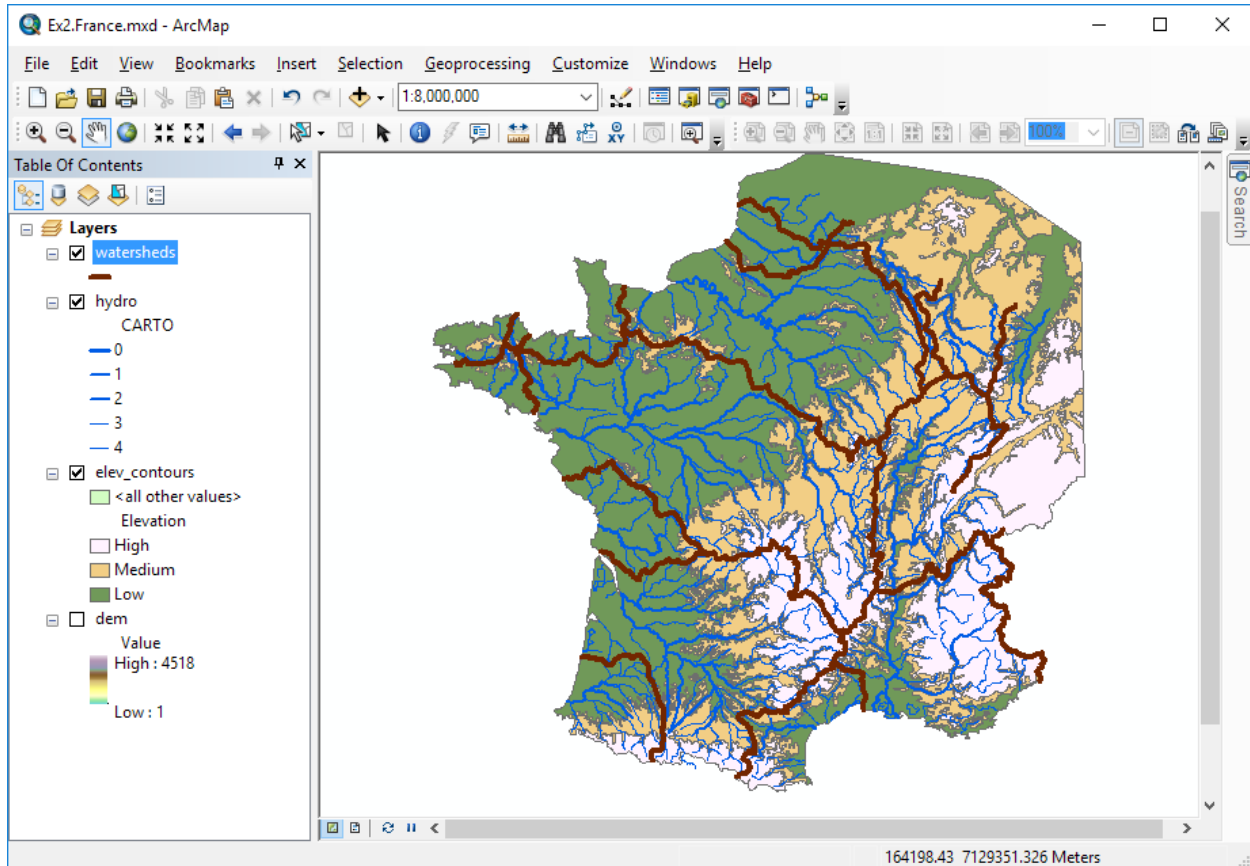


Step 10. Open the Watershed boundary lines of France.

Watersheds divide rivers between different drainage basins. Let's also add a layer showing the boundaries of the major river basins of France, the watershed shapefile in the LabData/France directory.

Tip: look back at the previous instructions to remind yourself how to add a new layer and change its symbology.

With the watersheds layer drawn in a thick brown line and the elev_contours layer turned on in place of the dem layer, your map should look something like this:

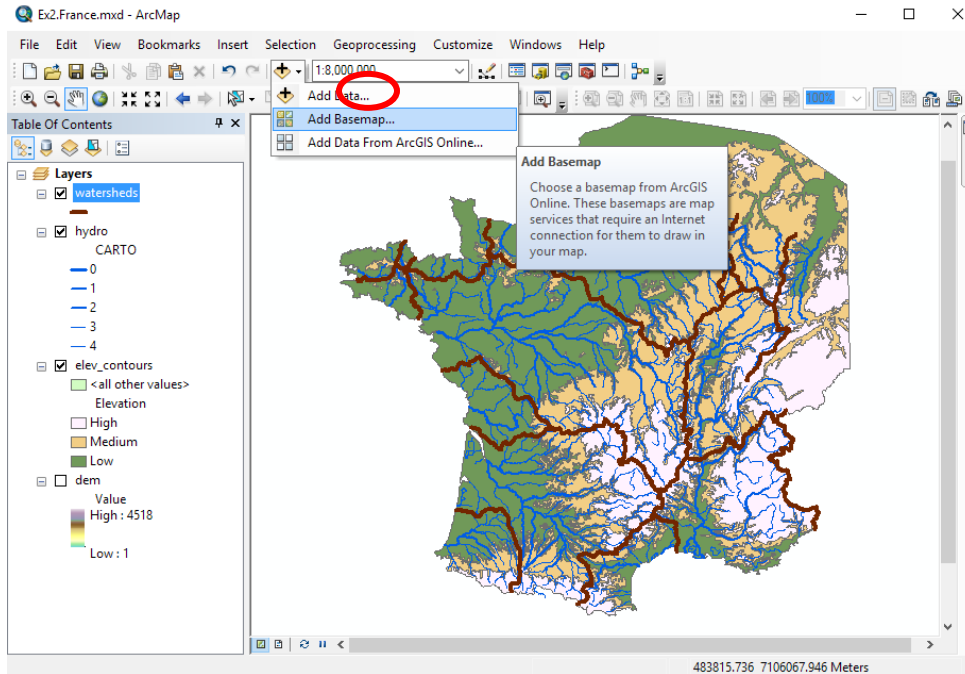


Note how you can follow each river within its basin from higher to lower elevations. Of course, it should be acknowledged that the selection of “major” basins is a subjective exercise.

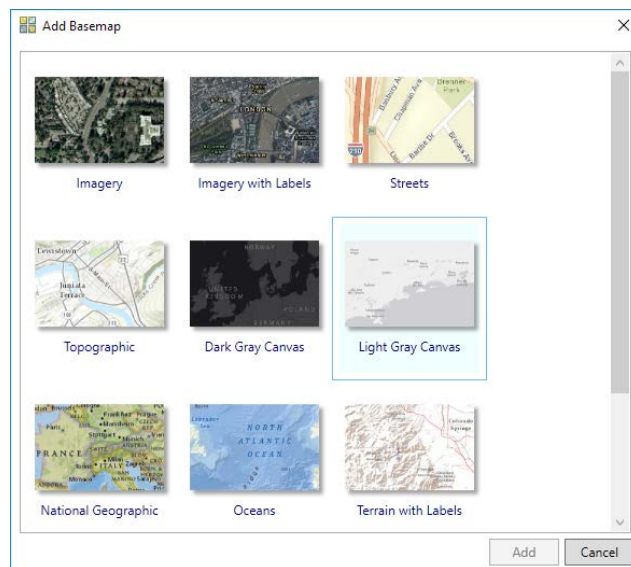
Basemaps and reference layers

Step 11. Open a Basemap

Besides adding GIS files that we have on our own computer, ArcMap offers a selection of basemaps that it can access over the Internet. If your computer is connected to the Internet now, try adding a basemap. Use the pull-down menu next to the Add Data button and choose Add Basemap.



For an unobtrusive basemap that provides the names of countries and major cities, choose the Light Gray Canvas basemap.



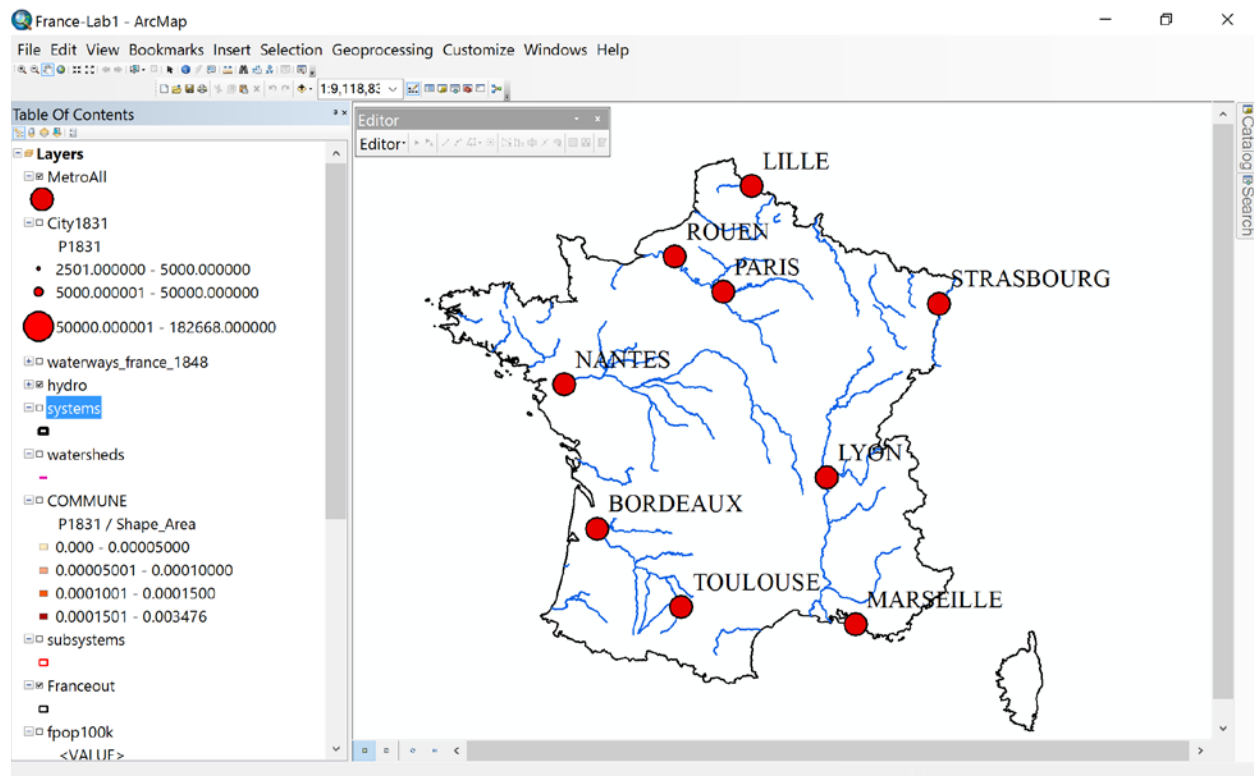
III. Regional Systems and their Core-Periphery Structures

According to Skinner, The metropolises that served as apex cities of Macroregional Economies were but the highest level of a more or less integrated hierarchy of central places that extended down to rural market towns.¹ The marketing systems centered on those towns, each typically encompassing 15-20 villages, constituted the basic building blocks of the economic hierarchy.² Macroregional economies such as that centered on the Seine Basin of northern France with Paris as a Central Metropolis may be seen as the culmination of this hierarchical structure of local and regional systems.

Question: Before overlaying the boundaries of the Macroregional Economies Skinner identified (which we will do in Step 12 below), can you estimate the likely outlines of such traditional agrarian systems based on the locations of the 5 Metropolises (Paris, Lyon, Marseille, Bordeaux, and Rouen), as well as several key Regional Cities, in relation to major rivers and watersheds? Draw on the map below (either by hand or just mentally).

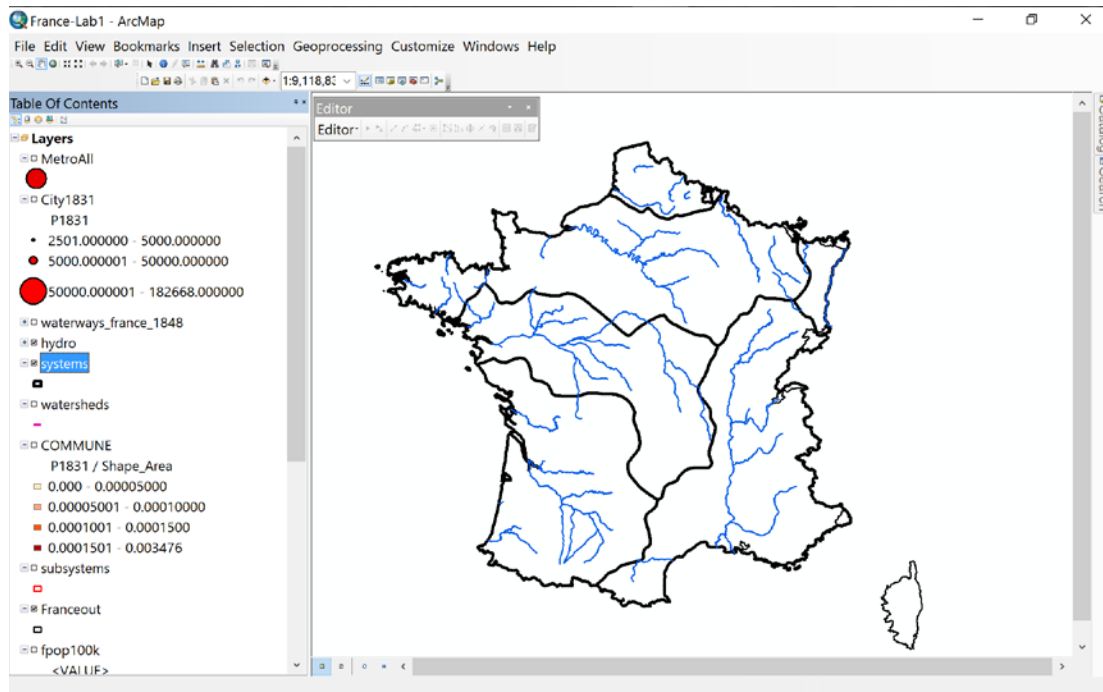
¹For the initial explication of the model, see pp. 275-286 in Skinner, “Cities and the hierarchy of local systems.” In *The City in Late Imperial China*, edited by G. W. Skinner. Stanford: Stanford University Press, 1977.

²For an example from China, see Skinner, “Marketing and social structure in rural China, Part I.” *Journal of Asian Studies* 24 (1964).



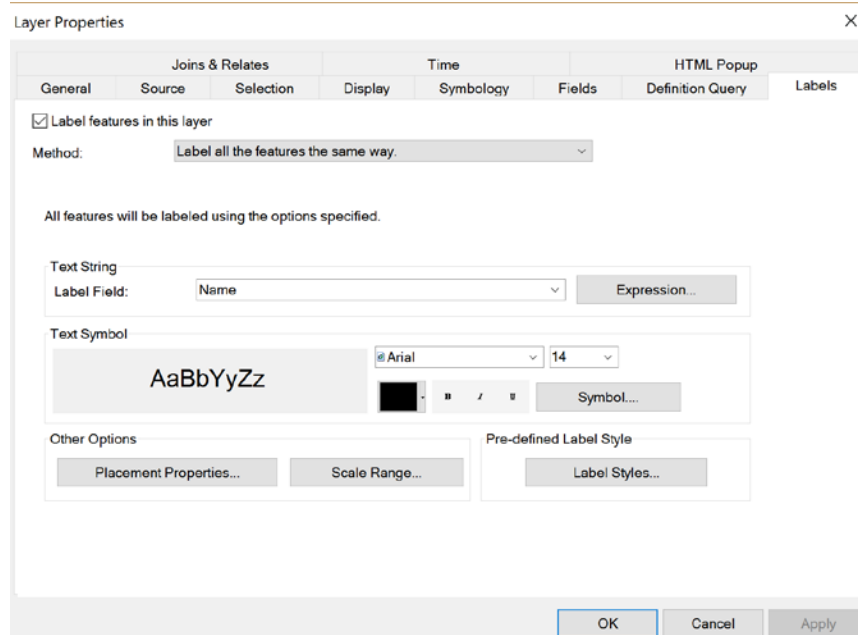
Step 12. Open the Economic Regions Boundaries

Click Add Data and open the systems shape file. How do these compare to your earlier conception?

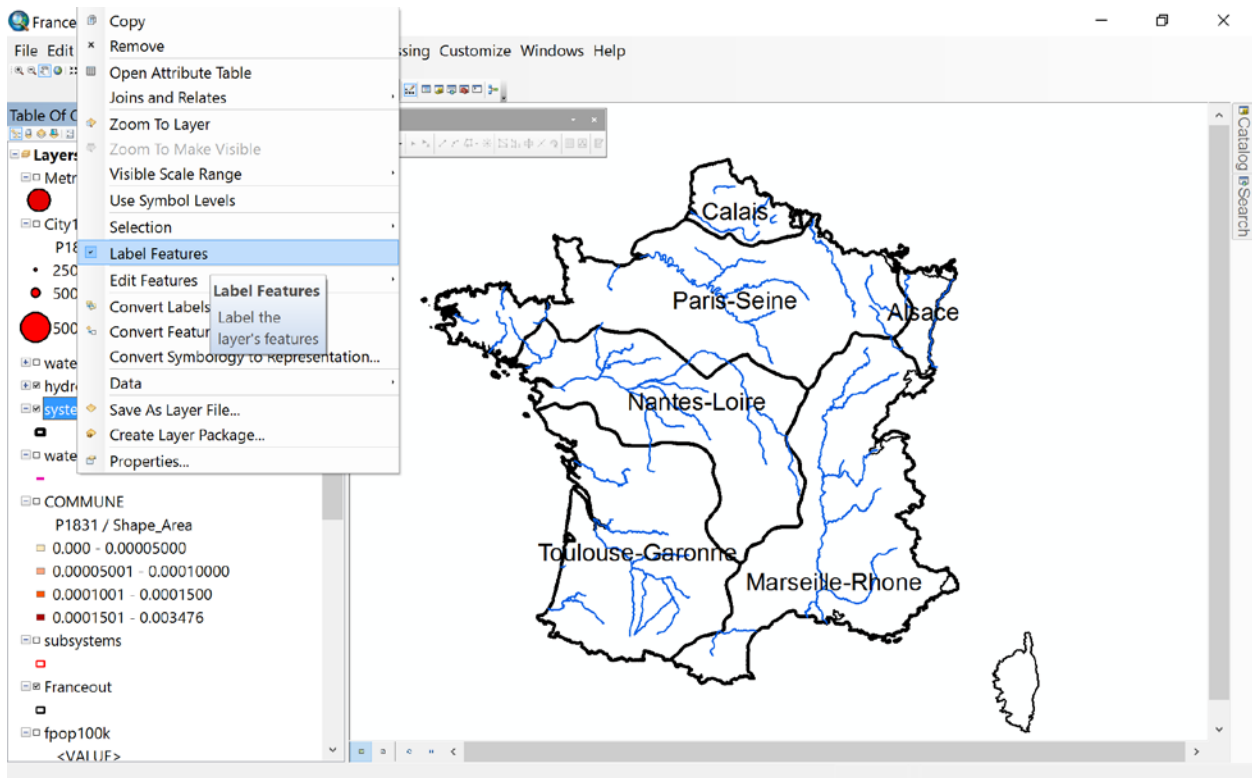


Step 13. Label the Economic Regions

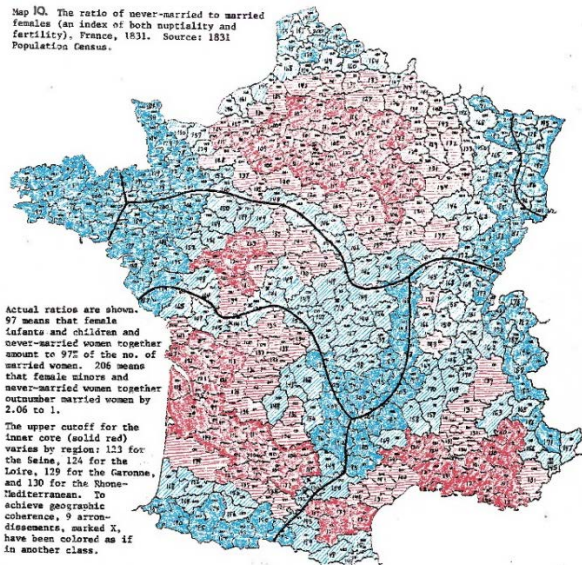
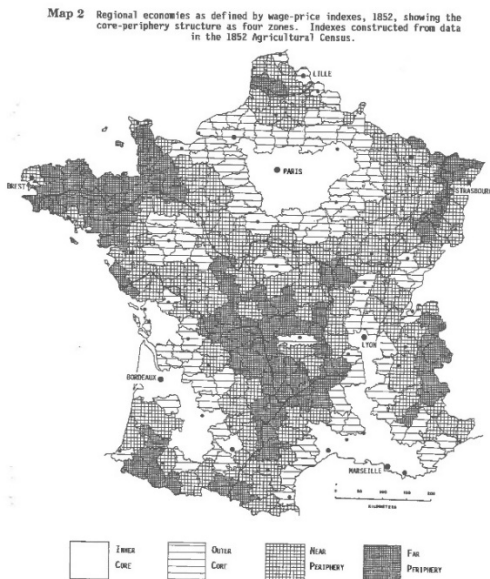
Right-click on the systems layer, and chose Layer Properties, then click on the Labels tab. Choose Name for the Label Field, and then select a suitable font and size. Click Apply, then OK



To see the Labels, right click on the systems layer in the Table of Contents and choose Label Features.

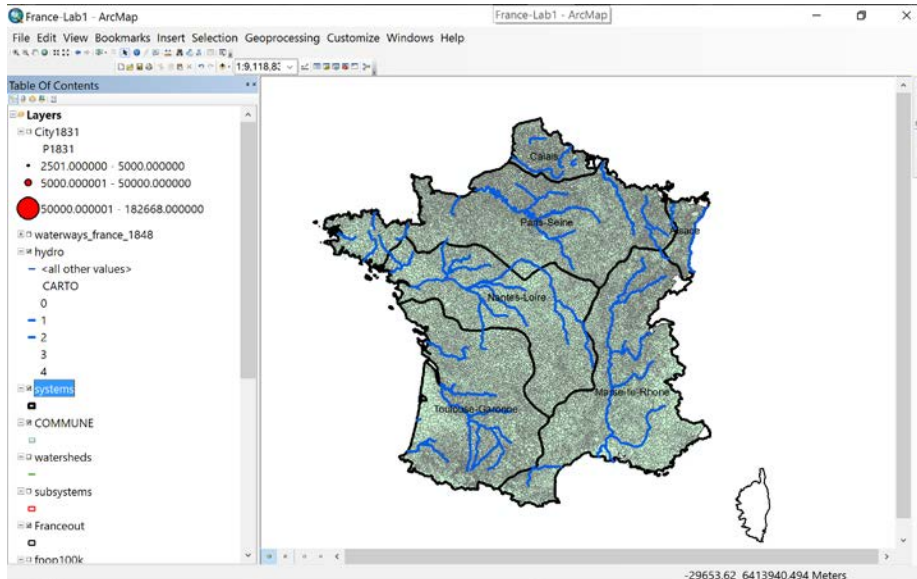


Note: Skinner compiled economic and demographic data for France in relation to the regional economies or macroregions he delineated. These archived data have not been fully cataloged and are not easily usable at present, but we can map the 1831 population density in 1831 as one key demographic variable, to test the relevance of these macroregions as of the mid-nineteenth century. The following illustrations by Skinner show his pre-GIS analyses.



Step 14. Open the Commune polygon shape file

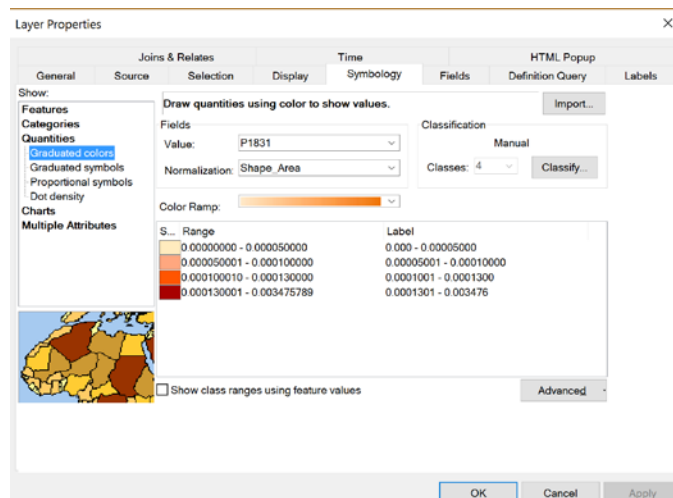
Click on Add Data and choose the Commune file.



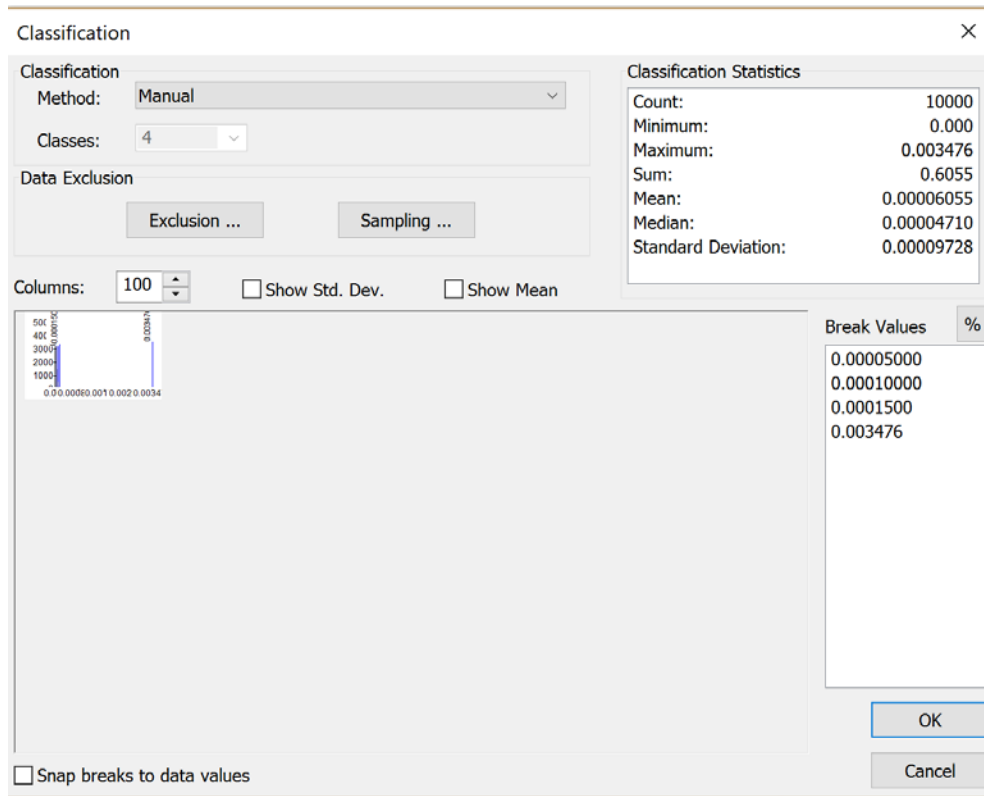
Step 15. Display Population Densities as Graduated Shades of Color

Another method for showing populations (or other data values) in polygons is to shade the polygons with graduated colors. But to avoid the Modifiable Areal Unit Problem, shaded values must be *ratios*, not raw numbers. Most commonly, we display populations as population densities—the number of people divided (or normalized) by the area of the polygon. Maps constructed this way are called choropleth maps.

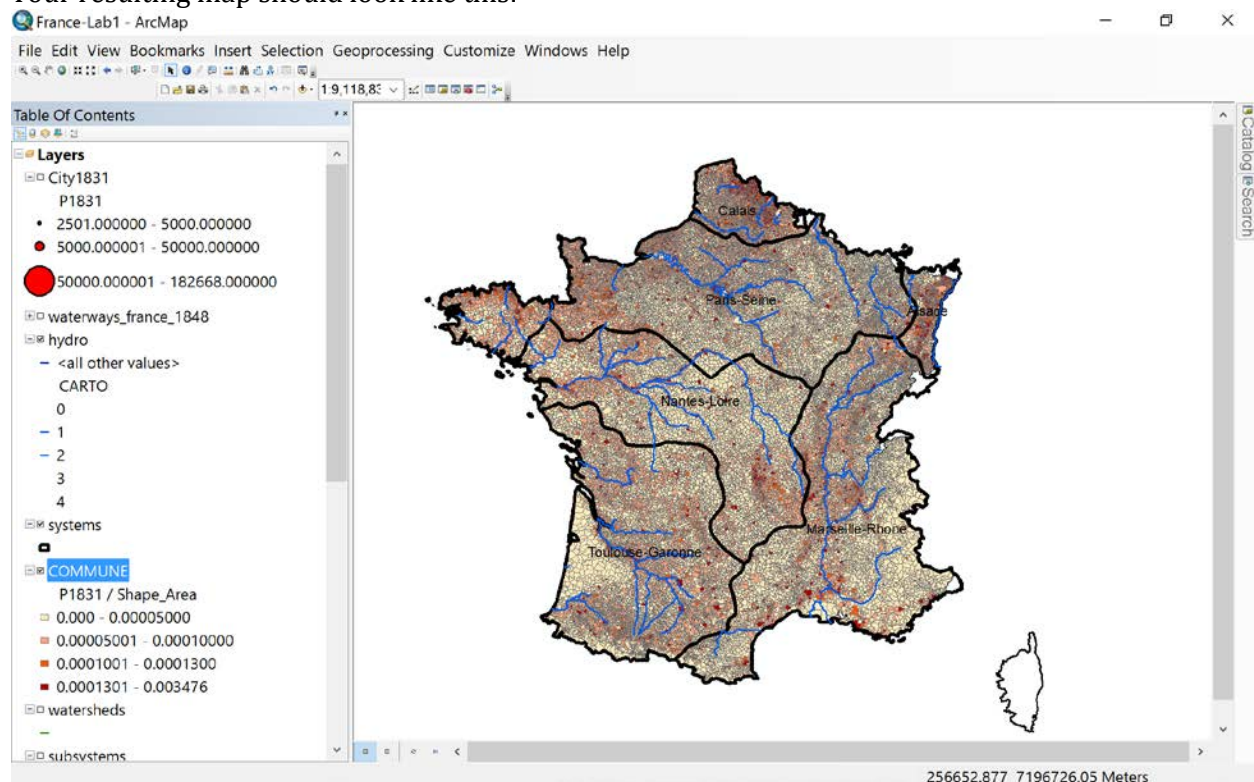
Return to the Layer Properties window for the Commune layer and, on the Symbology tab, change the settings to show Quantities / Graduated Colors. Keep P1831 for the Value Field and set Shape_Area (the polygon area in square kilometers) as the Normalization Field. Choose a color ramp that you like, or choose specific colors as shown. Then click the Classify button for more settings.



Make sure to choose Manual as the Classification Method, and select 4 Classes. Then in the Break Values, enter the values (in meters) as shown below:

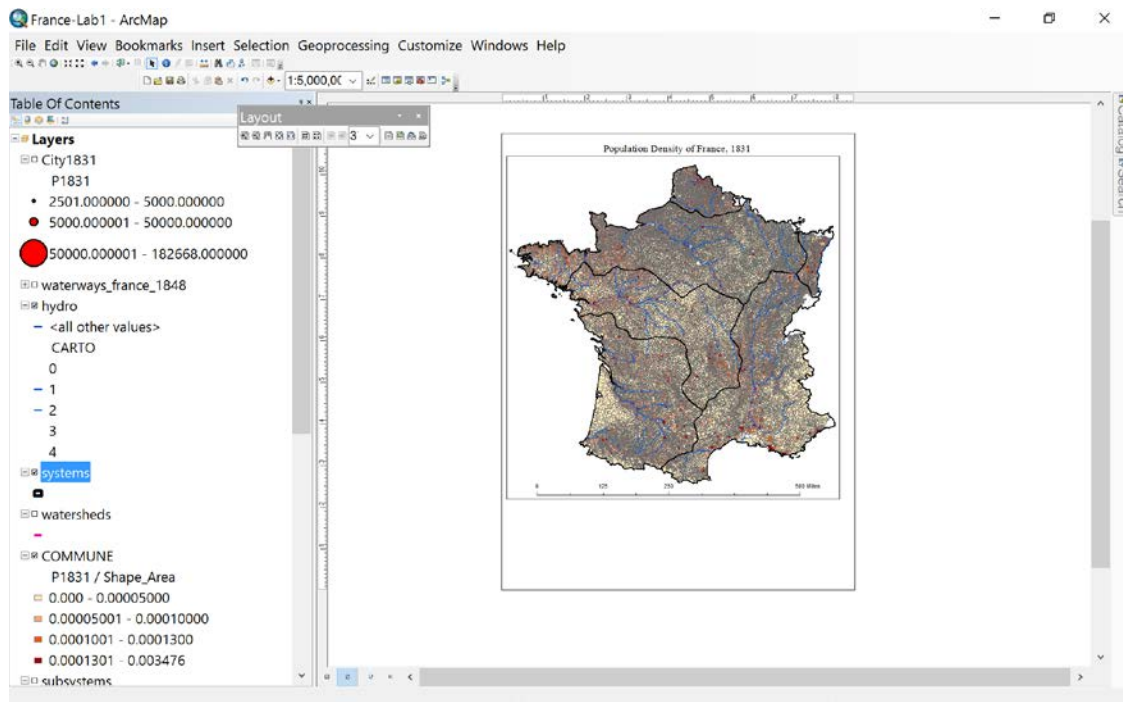


Your resulting map should look like this:

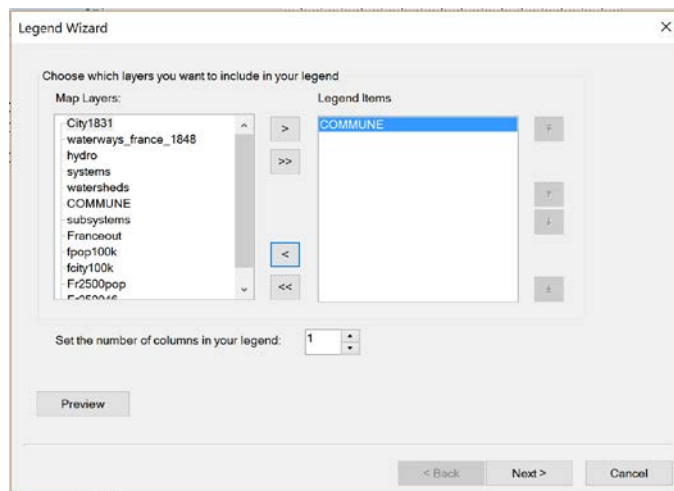


Step 16. Make a Map Layout and Legend

Under View, choose Layout View. Then under Insert, select a Title, then a Scale. You may need to change the zoom level (or Scale) of your map, and then use the Pan (hand) tool to center your map like this:

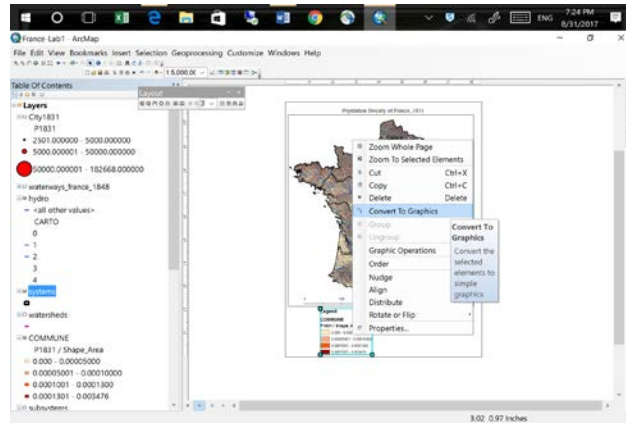


Next, under Insert select Legend and the Legend Wizard will open. Remove all layers except Commune from the Legend Items as shown below, then click Next (and keep clicking next until your legend is inserted on our map layout).

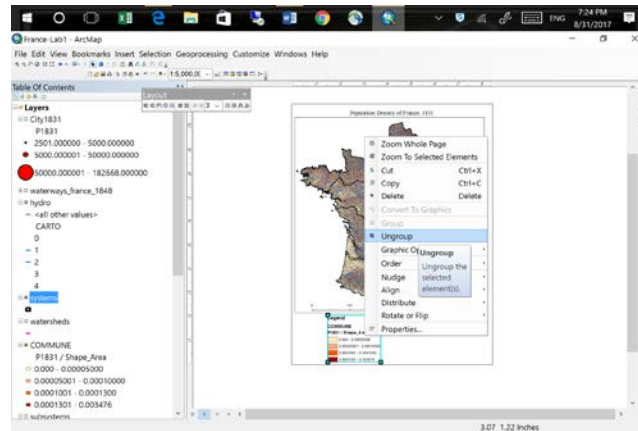


It is now necessary to convert the default legend to graphics, and ungroup each element, so we can give our legend a logical name instead of the default 'Legend' and subtitle derived from our GIS files names:

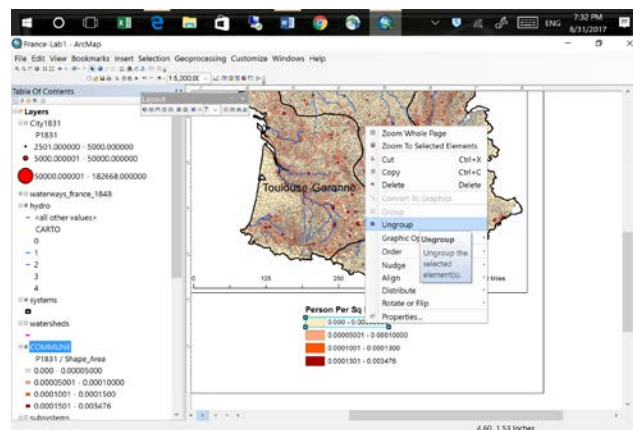
Right-Click on your Map Legend and choose Convert to Graphics.



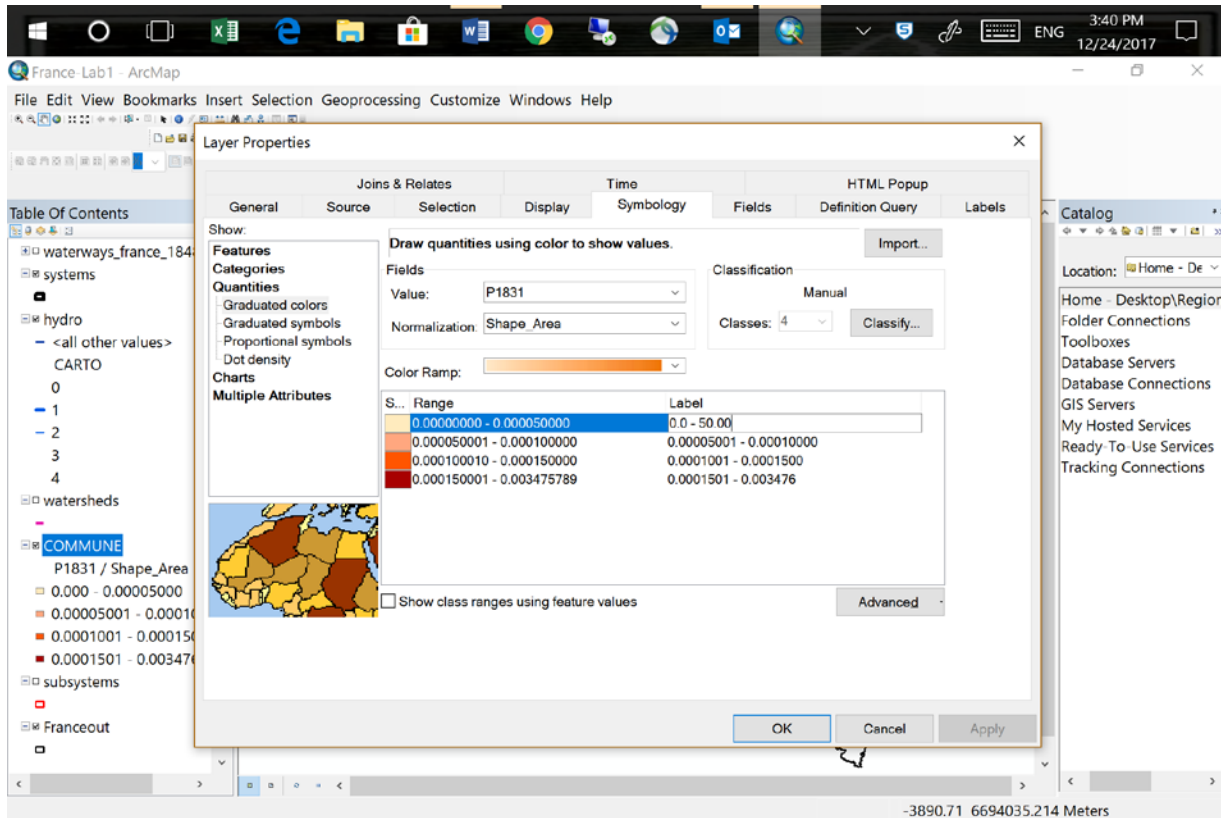
Next, Right-Click again and choose Ungroup.



Now you can select each individual Population Density level and Ungroup each of them.



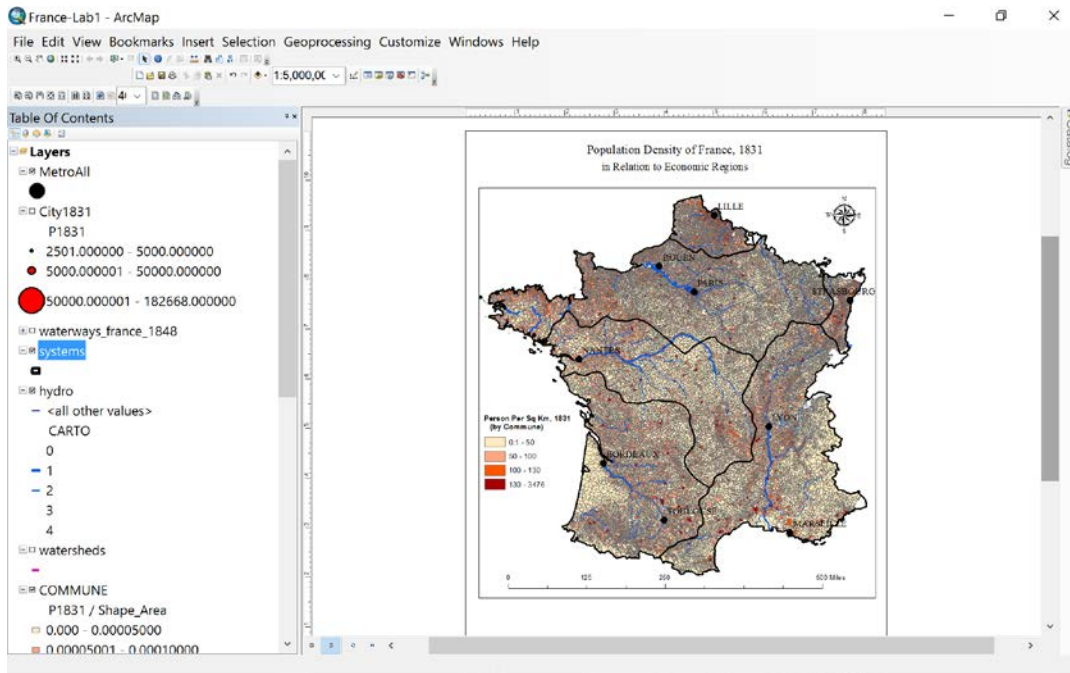
The map legend shows the Population Densities in persons per square meter, which makes for some very small numbers. To make this easier for others to understand, let's change the legend to show persons per square kilometer. In the Layer Properties window's Symbology Tab, edit the Labels for each class by shifting the decimal point six places to the right (because there are 1,000,000 square meters in 1 square kilometer).



Add a subtitle simply by selecting the title and copying and pasting it onto your map, then changing the wording and font size. Position the title and subtitle where you want them on the page.

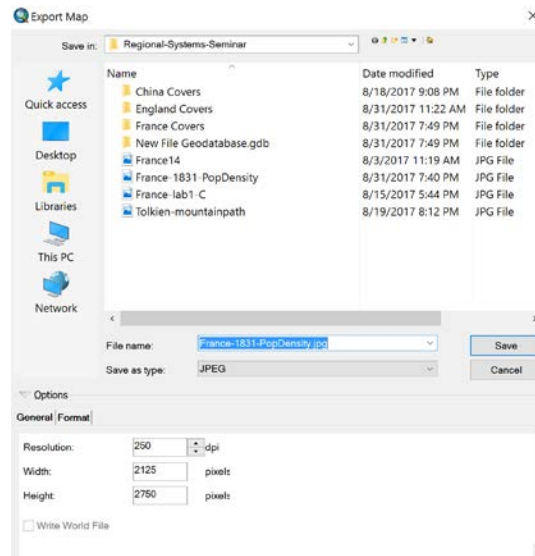
Add a North Arrow, choosing from among the many styles available.

Then add the MetroAll layer to show the major cities of each regional economy. Your map should look something like this:



Step 17. Export your Map

To incorporate your map into printed or online documents, it's useful to save it in a common image format. Under File, select Export Map, and save your map in your folder as a JPEG image with a resolution of 200 to 300 dpi. Give your map file a logical name such as shown below.



Population Density of France, 1831 in Relation to Economic Regions

