
Introduction

-This project is designed to familiarize you with the techniques of graduated symbolization mapping, working with data in Microsoft Excel, and joining tables in ArcMap.

-**This lab is due on Tuesday (Oct. 16) by 1159 PM.**

-You have been contracted by the Wine Institute – the voice for California Wine to create a map showing wine production in Europe for 2009, the most recent year that you have data. California wines are world class, but you can't neglect your competition. You will be using ArcMap and Microsoft Excel to complete this lab.

-The data you will use is provided by the **Wine Institute** (<http://www.wineinstitute.org/>) and you should cite this as your data source.

-The wine production data you will need is in a file named **2009_Wine_Production.csv**. CSV files are the preferred file format for Excel data when they are going to be joined to a layer in ArcMap due to their simplicity in storing and displaying data.

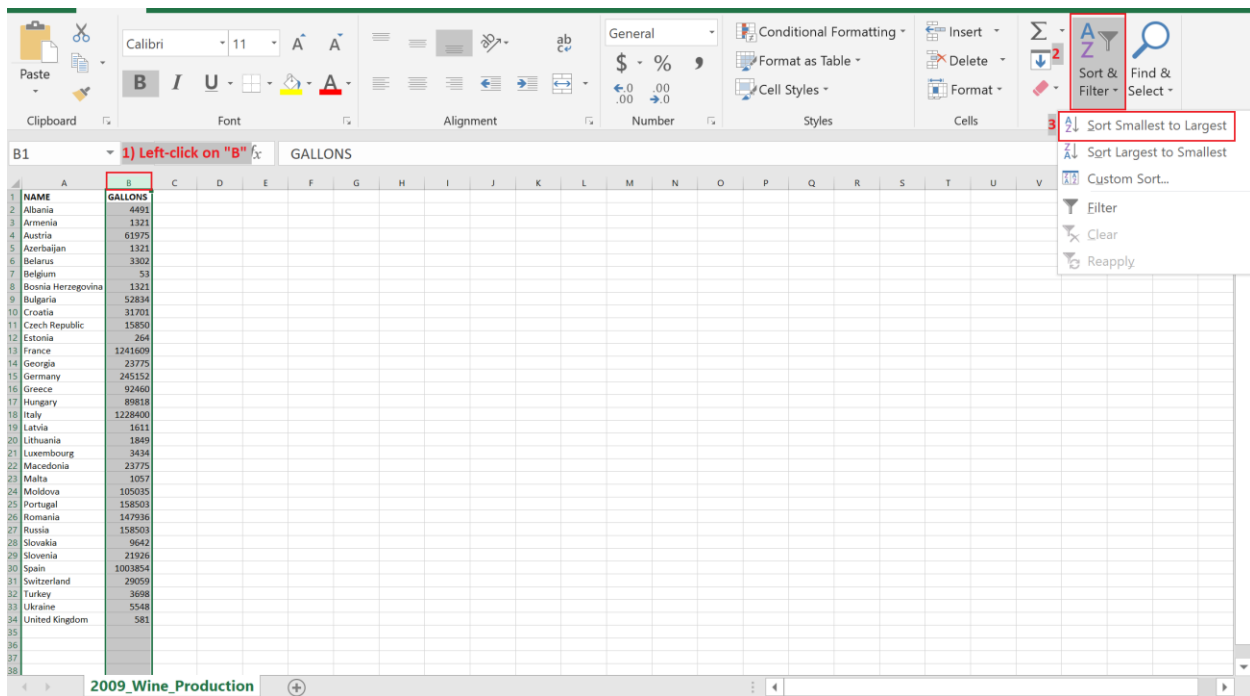
-The ArcMap document you will use to create your map is a file named **European_Wine_Production.mxd**.

-You will be creating one map to display the magnitude of wine production through using graduated circles. **It is up to you to determine the size of the circles.** In making the map you are to use proper cartographic design practices. This includes good balance of elements and establishing a visual hierarchy. **The map will be black and white to reduce costs (you may use shades of grey too).**

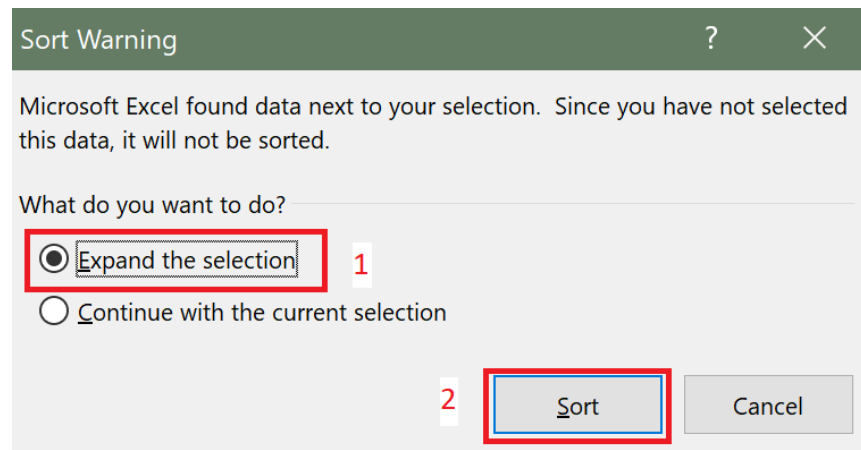
Instructions

Establishing classes in Excel

-Before creating our map in ArcMap we need to look at each country's wine production and establish classes (lowest to highest production) which will be utilized in your legend. Open **2009_Wine_Production.csv** in Excel. You will see **Column A** has country names (33 countries total) and **Column B** has the amount of wine produced per country (in *thousands of gallons*, so 1,000 thousand gallons = 1,000,000 gallons). In **Column C**, we will establish our classes representing different ranges of wine production.



-You will see the data are sorted alphabetically by the “NAME” column, we need to sort the data by the “GALLONS” column for us to create our ranks. Select Column B by left-clicking on “B”, then use Excel’s “**Sort and Filter**” command (see figure above). Sort the data in your “GALLONS” column from **smallest to largest**. A **Sort Warning** box will appear (see figure below), it will warn you that other data exists in the table that is not selected, we want to **Expand the Selection** so the values in the same row will stay together, or else only the data in Column B will get resorted. Click **Sort**.



2 Save Frequently!

A	B
NAME	GALLONS
Belgium	53
Estonia	264
United Kingdom	581
Malta	1057
Armenia	1321
Azerbaijan	1321
Bosnia Herzegovina	1321
Latvia	1611
Lithuania	1849
Belarus	3302
Luxembourg	3434
Turkey	3698
Albania	4491
Ukraine	5548
Slovakia	9642
Czech Republic	15850
Slovenia	21926
Georgia	23775
Macedonia	23775
Switzerland	29059
Croatia	31701
Bulgaria	52834
Austria	61975
Hungary	89818
Greece	92460
Moldova	105035
Romania	147936
Portugal	158503
Russia	158503
Germany	245152
Spain	1003854
Italy	1228400
France	1241609

-Your “**GALLONS**” column should now be sorted from smallest to largest value and your table should look like the above figure. Now in **Column C** in cell **C1** name it “***Classes***”. You need to choose between 5-7 classes. It is up to you how you want to separate your classes. The key is to look at the values in **Column B** and find an ideal upper limit that is an easy number to comprehend in your legend. See the figure below for an example:

A	B	C
NAME	GALLONS	Classes
Belgium	53	1
Estonia	264	1
United Kingdom	581	1
Malta	1057	2
Armenia	1321	2
Azerbaijan	1321	2
Bosnia Herzegovina	1321	2
Latvia	1611	2
Lithuania	1849	2
Belarus	3302	2
Luxembourg	3434	2
Turkey	3698	2
Albania	4491	2
Ukraine	5548	2
Slovakia	9642	2
Czech Republic	15850	3
Slovenia	21926	3
Georgia	23775	3
Macedonia	23775	3
Switzerland	29059	3
Croatia	31701	3
Bulgaria	52834	3
Austria	61975	3
Hungary	89818	3
Greece	92460	3
Moldova	105035	4
Romania	147936	4
Portugal	158503	4
Russia	158503	4
Germany	245152	4
Spain	1003854	4
Italy	1228400	4
France	1241609	4

In the figure above, the 33 wine producing countries were divided into 4 classes (you have to choose between 5-7 classes). The “**Classes**” column shows which class each country belongs to. As you can see, all the countries in class 1 (green box), produce less than 1,000 thousand gallons (or 1,000,000 gallons). Class 2 (orange box) has countries that produce between 1,000 - 14,999 thousand gallons, and so forth. The upper limits of each class were chosen to be round whole numbers that are easy to visualize and interpret. Here’s the complete breakdown:

Class 1: < 1,000 thousand gallons

Class 2: 1,000 - 14,999 thousand gallons

Class 3: 15,000 -99,999 thousand gallons

Class 4: >100,000 thousand gallons

***You will have different ranges based on how many classes you have and personal preference.**

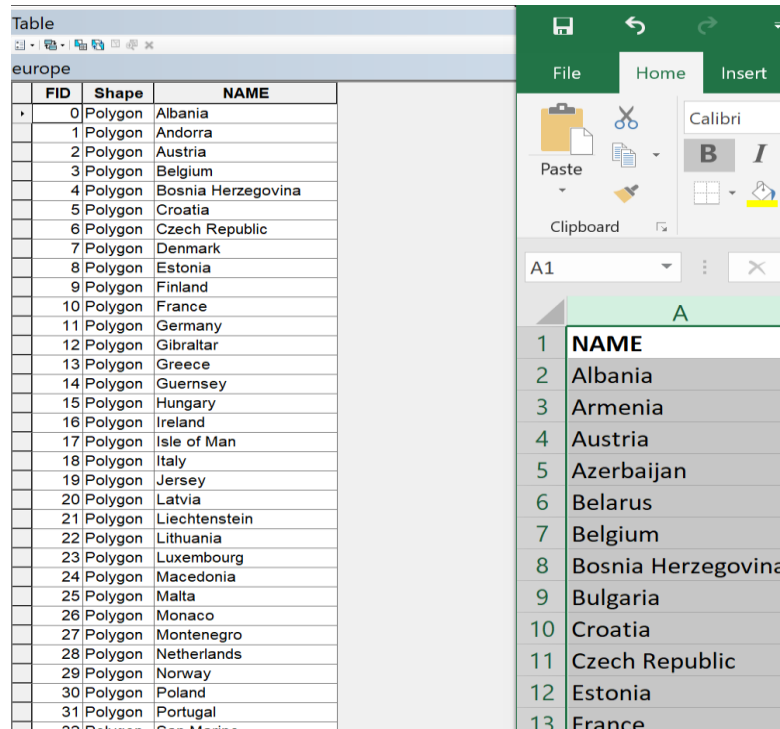
After you define your classes, write down range of each class since you’ll need them later. Save your CSV file by clicking the **Floppy Disk icon** in the upper left-hand corner and click **Yes** and close Excel.

Joining the CSV file in ArcMap

1) With **Excel** closed open the *European_Wine_Production.mxd* file which will open ArcMap. This ArcMap document includes these shapefiles: *no_wine_countries.shp* (European countries that do not produce wine), *europe.shp* (all European countries), *countries.shp* (all countries of the world), and *water.shp* (represents areas that are oceans and other water features). Make sure the layers are in this order from top to bottom. Stay in **Data View** for this section!

2) Click the **Add Data button**, then click the **Connect To Folder icon** then navigate to where you saved the CSV file and add it to the **Table of Contents**. The listing order of the **Table of Contents** will change from *List by Drawing Order* to *List by Source* after adding the CSV file, this is normal.

3) Now it's time to **Join** the CSV file to the *europe.shp* layer. We want to join the CSV to this layer because *europe.shp* has the countries we are interested in and the CSV table has the wine production values and square root values that are needed to create the circles. **When joining two tables, both need to have a common “field” or column. It is best practice to name and format the joining column's title the same in both tables, but is not required** (this eliminates the column's title being the culprit if the join fails). **It is most important that values in the joining column of the two tables are spelled and formatted the same(see figure below)!** If a value is formatted differently between tables, that value will not match when joining the tables and a “**NULL**” value will appear in its place after the join and its attributes will not carry over.



The image shows two side-by-side tables. The left table is from ArcMap's Data View, titled 'Table', and the right table is from Microsoft Excel.

FID	Shape	NAME
0	Polygon	Albania
1	Polygon	Andorra
2	Polygon	Austria
3	Polygon	Belgium
4	Polygon	Bosnia Herzegovina
5	Polygon	Croatia
6	Polygon	Czech Republic
7	Polygon	Denmark
8	Polygon	Estonia
9	Polygon	Finland
10	Polygon	France
11	Polygon	Germany
12	Polygon	Gibraltar
13	Polygon	Greece
14	Polygon	Guernsey
15	Polygon	Hungary
16	Polygon	Ireland
17	Polygon	Isle of Man
18	Polygon	Italy
19	Polygon	Jersey
20	Polygon	Latvia
21	Polygon	Liechtenstein
22	Polygon	Lithuania
23	Polygon	Luxembourg
24	Polygon	Macedonia
25	Polygon	Malta
26	Polygon	Monaco
27	Polygon	Montenegro
28	Polygon	Netherlands
29	Polygon	Norway
30	Polygon	Poland
31	Polygon	Portugal
32	Polygon	San Marino

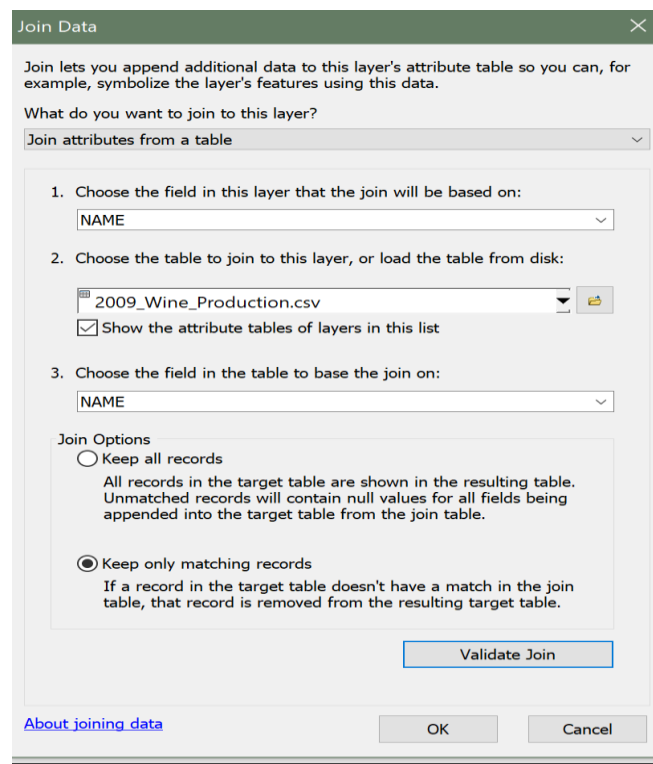
	NAME
1	NAME
2	Albania
3	Armenia
4	Austria
5	Azerbaijan
6	Belarus
7	Belgium
8	Bosnia Herzegovina
9	Bulgaria
10	Croatia
11	Czech Republic
12	Estonia
13	France

In the figure above, the table on the left is for *europe.shp* and the table on the right is the *2009_Wine_production.csv* file. We are going to join these two tables by their “**NAME**” columns,

notice how “**NAME**” is in caps in both tables and how each country’s first letter is capitalized and spaces between words are just spaces and not underscores. **Always before joining data, check the values in the column you are basing the join on in both tables and make sure the values are spelled and formatted the same!**

Let’s say for example that the country **Bosnia Herzegovina** is formatted like this in *europe.shp*’s “**NAME**” column, but it is formatted as **bosnia_herzegovina** in *2009_Wine_Production.csv*’s “**NAME**” column. When we join the tables, these values won’t match and join due their format differing. **Only use the join feature in ArcMap when you have ONE-ONE (both tables have only one matching record) or MANY-ONE (one table has several matches with one feature from the other table). In our case, we have a ONE-ONE relationship.**

4) Right-click on the *europe.shp* layer and go to **Join and Relates**, then **Join**. The **Join Data** box will appear. This is where you specify which table you want to join to *europe.shp*’s attribute table, which column the join will be based on, and if you want only matching records or all records visible after the join. See the screenshot below:



Since we opened the **Join Data** box under the *europe.shp* layer, ArcMap sets this as the **destination table** and the CSV file as the **source table**, after we join the tables, the columns and values from the *2009_Wine_Production.csv* will appear in *europe.shp*’s attribute table, thus allowing us to create our symbols. Let’s break down the steps in the **Join Data** box:

-At the top, we want to join the attributes from the wine production csv table.

- Step 1** asks us which column in the **europa.shp's** attribute table the join will be based on.
- Step 2** is where we choose the other table we want to join to **europa.shp's** attribute table.
- Step 3** asks us which column in **2009_Wine_Production.csv** we want to join with **europa.shp's** attribute table. Remember the values in the **NAME** column in both tables are spelled and formatted the same.
- Under **Join Options**, we can specify whether we want **all records** (regardless if they match or not, if this is selected you will have 54 features after the join in **europa.shp's** attribute table, with many cells in the second **NAME** column having **NULL**) or just show **matching records** (if this is selected, you will have 33 feature after the join in **europa.shp's** attribute table).

5) Before clicking **OK**, always press **Validate Join**, this will compare the columns you specified above and tell you if there any errors and how many records were matched. If you have 33 records matched, you can press OK. If you have fewer, then go back into your CSV file in Excel and check to see if your accidentally misspelled or formatted a value in the “**NAME**” column. If so, delete the CSV file from Arcmap, re-save the csv file and close it, then open it again in ArcMap and try joining again.

6) Once you click **OK**, open **europa.shp's** attribute table. You should see that the attribute table now displays the three columns from the **2009_Wine_Production.csv** table. See the screenshot below:

Table					
europe					
FID	Shape	NAME	NAME	GALLONS	Classes
3	Polygon	Belgium	Belgium	53	1
8	Polygon	Estonia	Estonia	264	1
39	Polygon	United Kingdom	United Kingdom	581	1
25	Polygon	Malta	Malta	1057	2
4	Polygon	Bosnia Herzegovina	Bosnia Herzegovina	1321	2
40	Polygon	Armenia	Armenia	1321	2
41	Polygon	Azerbaijan	Azerbaijan	1321	2
20	Polygon	Latvia	Latvia	1611	2
22	Polygon	Lithuania	Lithuania	1849	2
42	Polygon	Belarus	Belarus	3302	2
23	Polygon	Luxembourg	Luxembourg	3434	2
51	Polygon	Turkey	Turkey	3698	2
0	Polygon	Albania	Albania	4491	2
52	Polygon	Ukraine	Ukraine	5548	2
34	Polygon	Slovakia	Slovakia	9642	2
6	Polygon	Czech Republic	Czech Republic	15850	3
35	Polygon	Slovenia	Slovenia	21926	3
24	Polygon	Macedonia	Macedonia	23775	3
45	Polygon	Georgia	Georgia	23775	3
38	Polygon	Switzerland	Switzerland	29059	3
5	Polygon	Croatia	Croatia	31701	3
43	Polygon	Bulgaria	Bulgaria	52834	3
2	Polygon	Austria	Austria	61975	3
15	Polygon	Hungary	Hungary	89818	3
13	Polygon	Greece	Greece	92460	3
48	Polygon	Moldova	Moldova	105035	4
49	Polygon	Romania	Romania	147936	4
31	Polygon	Portugal	Portugal	158503	4
53	Polygon	Russia	Russia	158503	4
11	Polygon	Germany	Germany	245152	4
36	Polygon	Spain	Spain	1003854	4
18	Polygon	Italy	Italy	1228400	4
10	Polygon	France	France	1241609	4

0 (0 out of 33 Selected)

europe

The columns in the red rectangle are the ‘joined’ columns from the *2009_Wine_Production.csv* table. Again, looking at the two “NAME” columns, notice how the each of the 33 countries are spelled and formatted the same.

*Note: **This join is not permanent**, you can unjoin the tables by going back to **Join and Relates > Remove Joins** and selecting *2009_Wine_Production.csv*. To make the join permanent you have to export the table and make it it’s own file.

*For more information on joining data, go to this link:

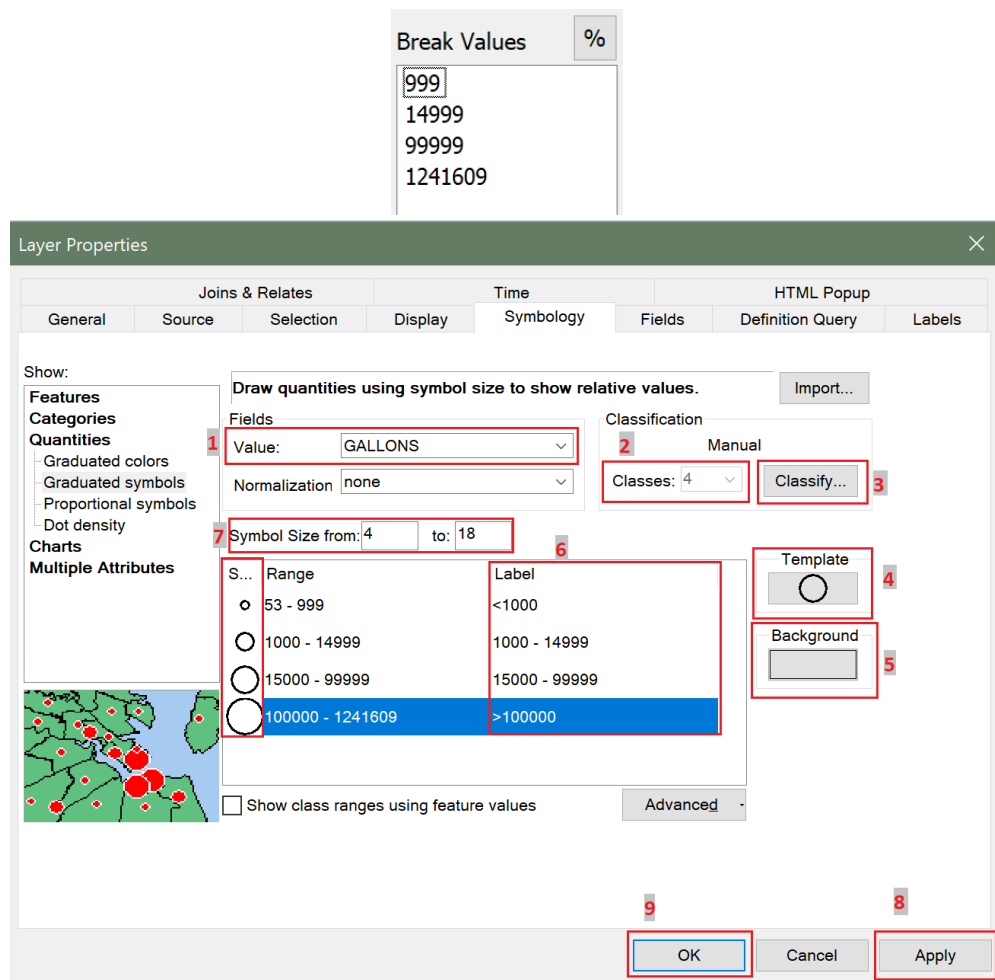
<http://desktop.arcgis.com/en/arcmap/10.3/manage-data/tables/essentials-of-joining-tables.htm>

7) If your *europe.shp*’s attribute table looks like the figure above, you can move on to creating your symbols. Double-click on *europe.shp* in the Table of Contents, go to the **Symbology** tab. In the **Show** box go to **Quantities > Graduated Symbols**. Do the following:

-Set the **Value** to the **GALLONS** column. Leave **Normalization** as **none**.

- Set the **number of classes** to the number you defined in the CSV file.
- Click on the **Classify box**, adjust the **Break Values** to your upper limit values of each class you wrote down earlier at the step at the bottom of page 4. Leave the last class as the default maximum value.
- Set the **Template** of the circles to **HOLLOW**.
- Set the **Background** to a shade of grey with a black outline of **0.40**.
- In the **Label column**, reword labels if need be.
- Set the **Symbol Size from:** somewhere between **4 - 20**. Play around adjusting the sizes, try to keep the circles within their country's borders and visible. You can also individually size a circle by double-clicking on one in the left-most column or in the **Table of Contents**.
- After completing these, click **Apply** to see your legend values and circle sizes update. When you think the circle sizes are suitable, click **OK**.

*See figures below for an example using the four classes from page 4.



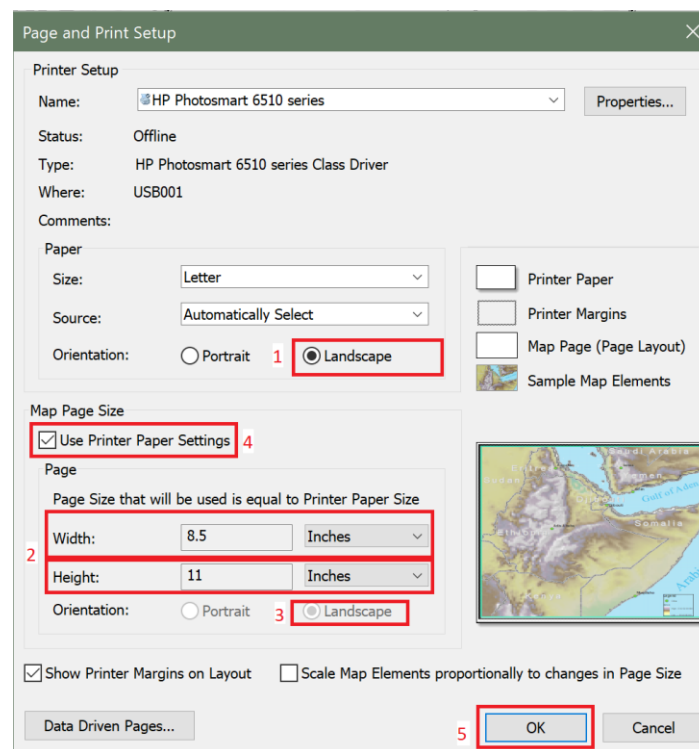
8). You may notice your circles for certain countries may overlap onto other countries, or be closer to one side of a country than the other, or barely visible, this is normal. **Make sure most of your**

circles fit within their borders and do not overlap any other circles (it's okay if the circles for your higher classes extending outside their country's borders a bit).

Creating the Basemap

1) Now that your symbols are created, it's time to create your final map! First, select a proper **Projected Coordinate System** for the data frame. Then **change the colors for *no_wine_countries.shp*, *countries.shp*, and *water.shp*** so they all fit within the color specifications of the lab, but make sure there's enough contrast between them! **We already chose our color for *europa.shp* when we changed it's *Template* color on the last page.**

2) Go to **Layout View** your map should be in Landscape orientation with the dimensions of a standard sheet of paper. To be sure, go to **File > Page and Print Setup...** your settings should be identical to what's in the red boxes in the figure below. If it's not, set the orientation to **Landscape**, the **width to 8.5 inches** and the **height to 11 inches**. Lastly, check the box "**Use Printer and Paper Settings**" and click **OK**.

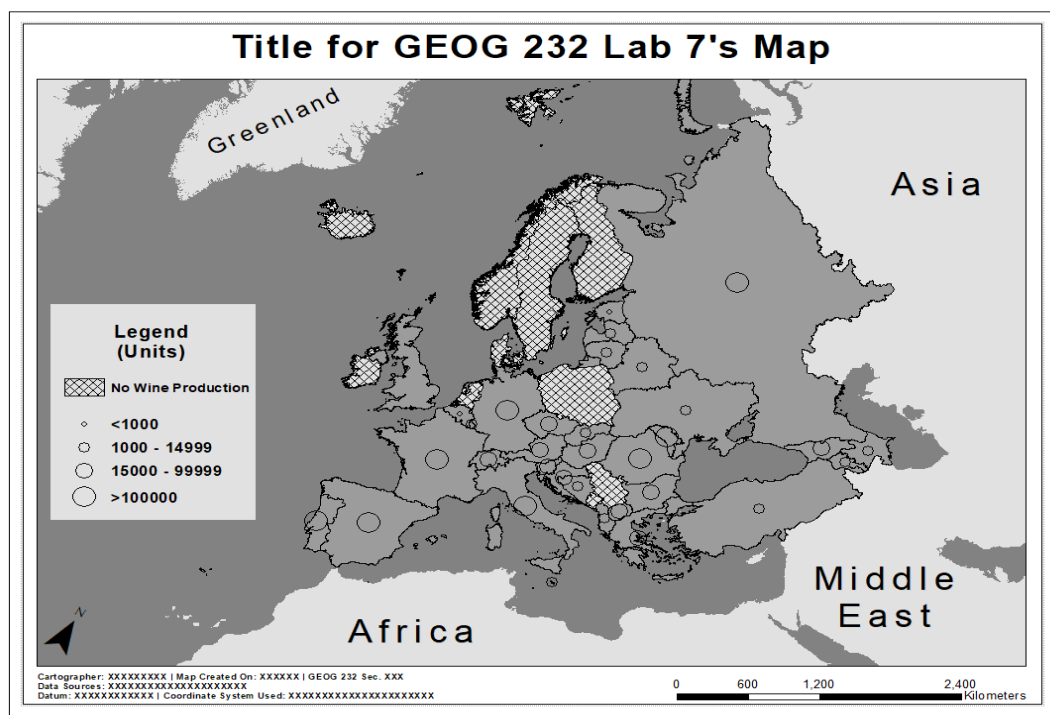


3) In **Layout View**, adjust the size of the data frame window and the data extent until you feel you have reached a suitable size and extent. Add the following elements:

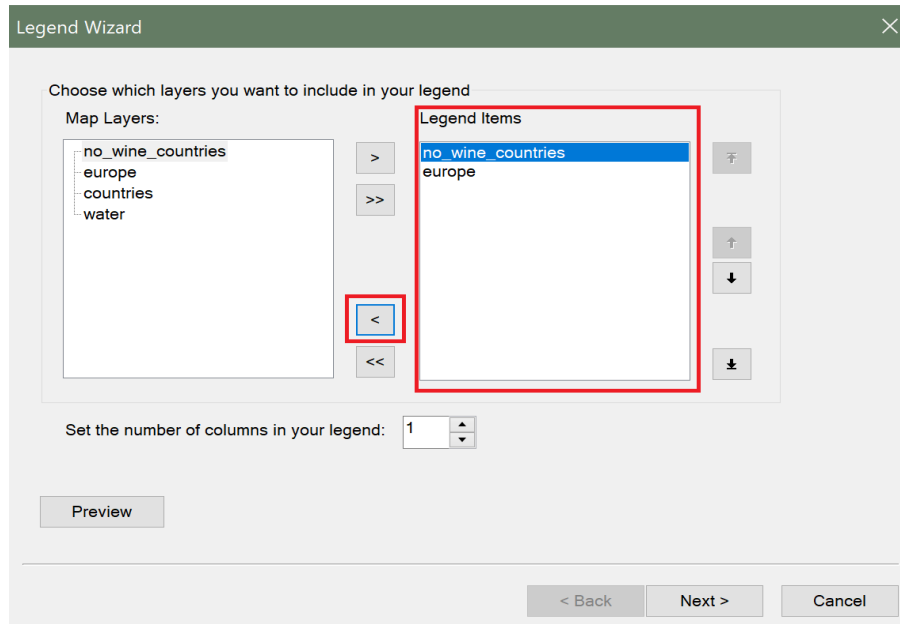
-Title

- Legend** (Make sure your legend title refers to what the values are and what units they're in).
- Neatline** (Up to you to decide on the dimensions, keep in mind that all elements have to be within it).
- Scale bar** (in km).
- North Arrow** (make sure it's oriented correctly)
- Data source credits**
- Information on the Datum and Coordinate System used.**
- Name, Date map was created on, Class and Lab section.**
- Any supplemental information you think is needed to help your audience understand the data you are trying to present.**

*Refer to the screenshot below for inspiration on how to design the layout of your map:



4) Before making your legend, consider how you will display the *no_wine_countries.shp* features in the data frame and the legend. You want to be able to distinguish them from the wine producing countries. In the **Legend Wizard**, make sure you have only *europa.shp* and *no_wine_countries.shp* layers in the **Legend Items box**, select any other layers and use the arrows to remove them. You can choose to add a background color (white or shade of grey), but leave everything else default in the wizard. See figure below:

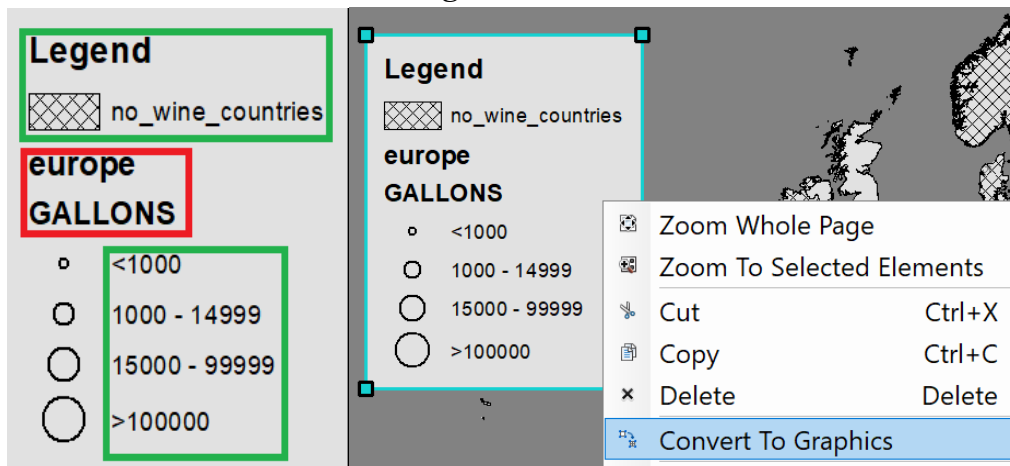


6) To remove text and edit the size/position of elements in the legend: **select the legend, right-click on it, go to Convert to Graphics, right-click on the legend again, go to Ungroup.** To separate a symbol from its text, simply select the symbol/text you want to ungroup, right-click on it and go to **Ungroup**.

-To regroup elements, simply select the elements by left clicking and holding the Shift key. When done, right-click on one of the selected elements and go to **Group**.

***Note: After you convert your legend to a graphic, your legend's circles and labels will not update if you choose to resize your circles. You will have to delete your legend and make a new one. Always create the legend last when you're certain the data is how you want!**

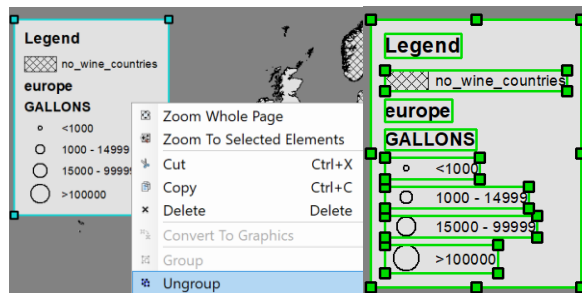
***See figures below for illustration:**



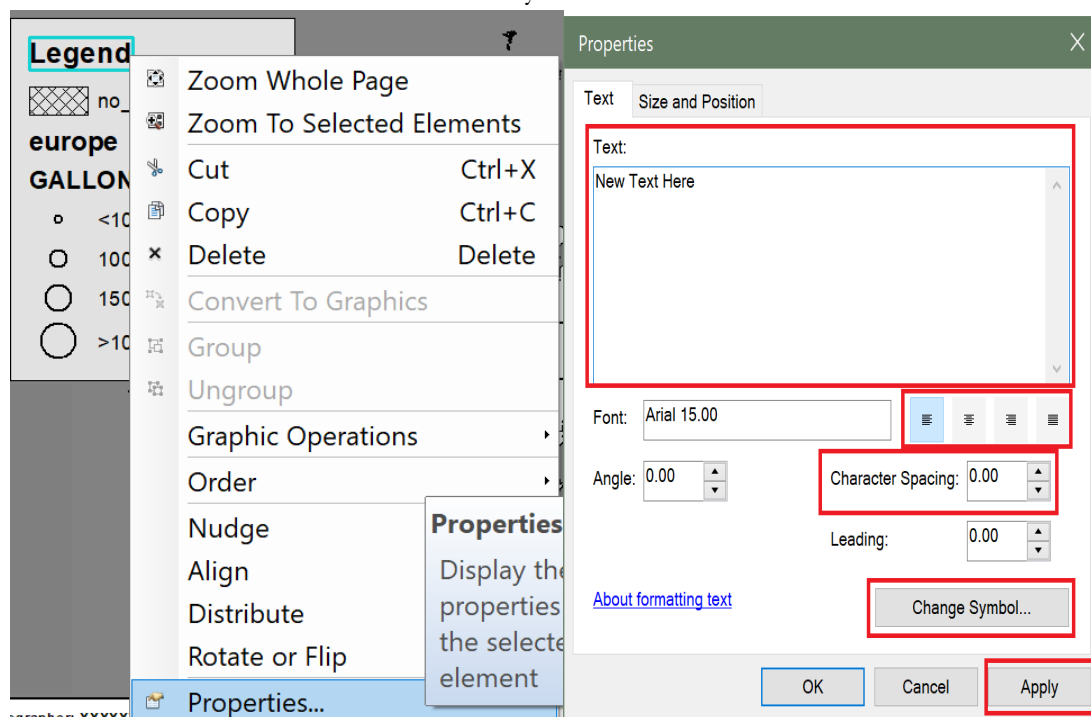
The legend on the left is the legend created in the wizard. The items in red are features that can be deleted whereas the items in green are ones that need editing. The right figure shows

converting the legend to a graphic, this allows the ability to **Group/Ungroup** elements so we can modify them further.

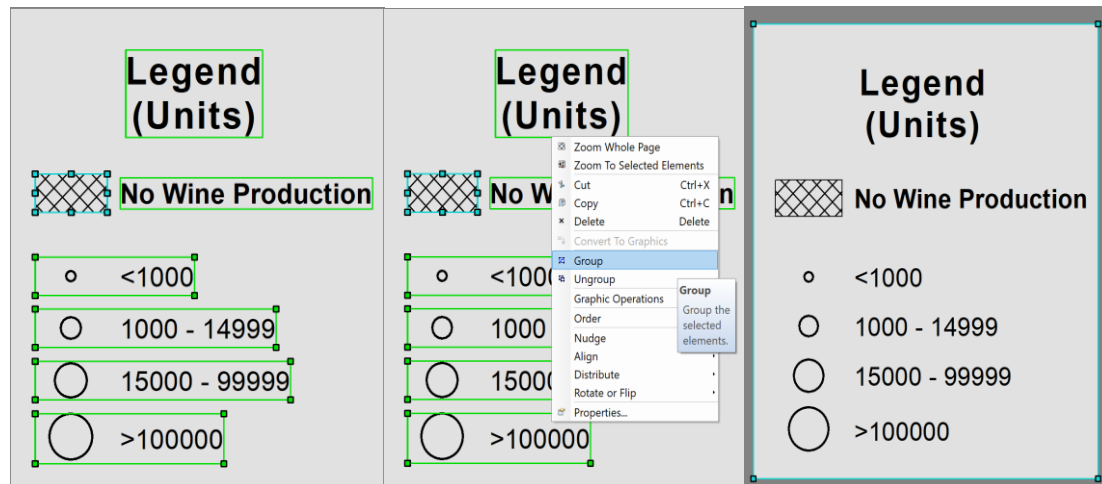
The figure below/left shows how to ungroup the elements in the legend. The bottom/right figure shows all of the main legend elements ungrouped (green highlighted rectangles).



To select a single element, click in the whitespace off the page to make the green rectangles disappear. Then **left-click to select the element** you want to modify, once it's selected right-click on it and go to **Properties** (left figure below). For text elements, you can type new text in, change its alignment, and angle. Go to **Change Symbol** to change **font size/family/color/style**. Always click **Apply** to see your changes. If the changes are good, then click **OK**. For symbol elements, you can adjust the color and size. To delete an element, select it and press the **Delete** button on your keyboard.



When you are finished editing your legend, select all the elements you want to group together. The bottom/left figure shows several selected elements (blue and green rectangles). When you have all of the elements selected, right-click on one of them and select **Group** (bottom/center figure). The bottom/right figure shows all the selected elements grouped into one new element.



5) Make sure you spend some time playing around with the placement of elements in **Layout View** since that is what Cartography is! After you have your map designed, go to **File > Print Preview** to see if any parts of the map or any elements are cut off or not aligned. If everything looks ok, **save your MXD file** (click the **Floppy Disk icon**) and export your map (**File > Export Map**) as a **JPEG (.jpg)** file with a **resolution of at least 300 dpi**. **BUT WAIT...THERE'S MORE!!!!**

Extra Credit (Up to 10 additional points!)

-Feeling ambitious? **Want to raise your lab grade?** If you remember earlier on page 10, it was mentioned that the some circles are not positioned in the most ideal location in their country. In order to take your map the extra mile and look professional you need to do the final placement of your circles and colorize the map in Inkscape.

-If you're up to the challenge, export your MXD file as a **Scalable Vector Graphics (.svg)** file **with a minimum dpi of 300**, and open it in Inkscape. Ungroup all of the elements until all of the map elements are their own individual elements in Inkscape.

1) Reposition the circles so they are in the most optimal location in their representative country.

2) Change the appearance of all map elements (circles, countries, ocean, etc.) using different colors to help make the map look more professional. Be sure to think about cartographic principles when designing the map - i.e. Do the colors you've chosen appropriately represent their objects and are pleasing to the eye? Are the fonts you've chosen appropriate for the map? By looking at the map, is the message of the data clear (from a first glance would you understand this is a map showing the amount of gallons countries produce)?

Turn in

-Submit your black and white (and color map if you do extra credit) map as a JPEG (.jpg) file to your TA via your TAMU email on **Tuesday (Oct. 16) by 1159 PM.**

-The email subject line should be: **Lab#_LastName_FirstName_GEOG232_Section#.**

-Be sure to open your JPEG file on your computer to see if it displays correctly before sending it! You can also email the image to yourself and see if it opens correctly on your email! If it does not display correctly, open the file in the software you created it in, and take a screenshot of it, save the screenshot as a JPEG and email that to your TA.

Rubric

Your completed map(s) will be graded based on the following criteria.

Overall Composition: -Does the map achieve good consistency among all map elements? -Are all elements appropriately sized? -Is map in black and white? -Is map in proper file format?	10 pts.
Circles: -Are the circles appropriately sized? -Are the circles legible? -Has interposition been used appropriately?	10 pts.
Map Projection: -Is the selected map projection appropriate for the intended use?	5 pts.
Other Elements: -Are all appropriate elements included on the map? -Are they rendered in such a way that they are in harmony with the other elements on the Map? -Is map in proper format?	10 pts.
Book Questions: -Are book questions correct? -Are book questions answered in complete sentences?	10 pts. (Ch. 8 and 9)
Extra Credit: -Are circles appropriately repositioned? -Does map elements achieve good consistency? -Are the colors of map elements appropriate?	10 pts.

If you have any problems do not hesitate to contact your TA.