

## FOOD SECURITY BIVARIATE CHOROPLETH MAP

Bivariate maps are powerful maps to show the relationship between two variables, especially in showing the correlation between the distribution of a phenomena and the underlying population

Tools: QGIS, AI, Photoshop

Location of Data: California Open Data

Output: Print

### DIRECTIONS

\*\*\*These direction detail how I made my map. With each process make sure you fiddle around with the parameters to make your map look how you like it. Sometimes a certain combinations of settings will work well for one map and look horrible on another based on things like underlying geography, distribution of points, color choice, scale, etc. Use these directions as a guideline but feel free to venture off in other directions. \*\*\*

First, download counties for California from California Open Data.

<https://data.ca.gov/dataset/ca-geographic-boundaries>

Open the attribute data and create a new column called security. Now manually enter the data from the food insecurity for the state of California column from Feeding America. Use decimal places rather than percentages.

[http://www.feedingamerica.org/research/map-the-meal-gap/2016/overall/CA\\_AllCounties\\_CDs\\_MMG\\_2016.pdf](http://www.feedingamerica.org/research/map-the-meal-gap/2016/overall/CA_AllCounties_CDs_MMG_2016.pdf)

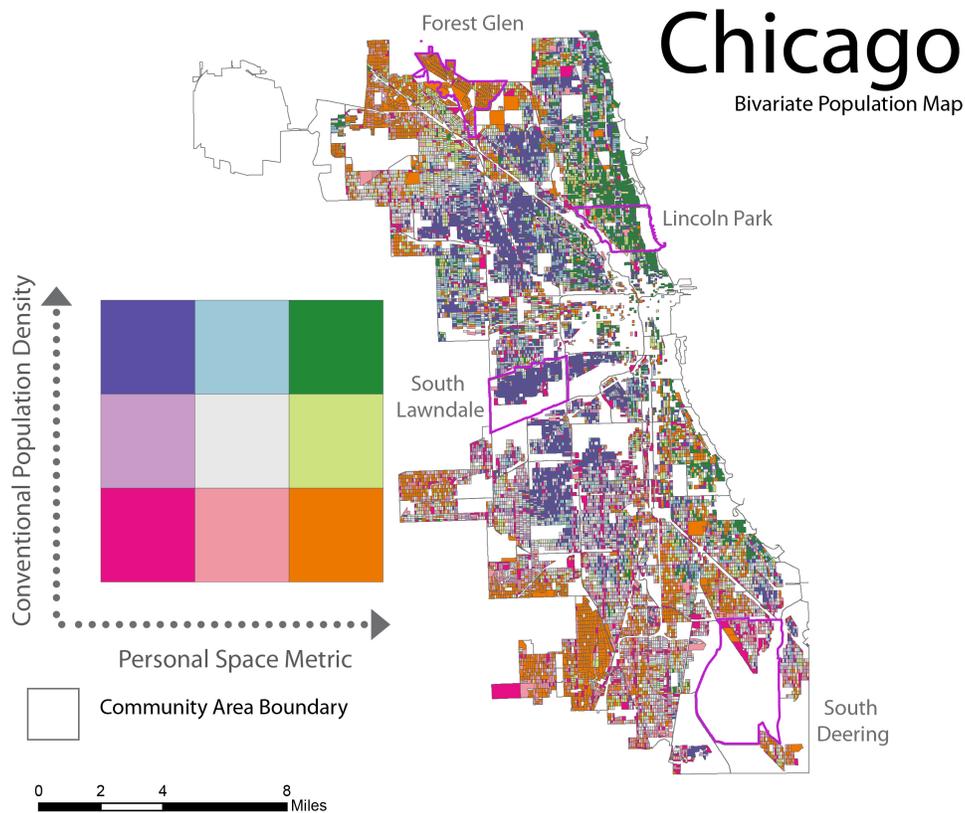
You should now have a shapefile with two columns that will be your variables in the bivariate map. One is the population of counties, the second is percentage of the population food insecure.

You will want your data to look like this. Each row has a value for the underlying population and a value for a second variable. Our map will compare the two variables.

Josh Stevens from NASA created the most straightforward guide to doing this. The following direction are based on his tutorial. Make sure you read carefully to understand why we are doing certain things.

<http://www.joshuastevens.net/cartography/make-a-bivariate-choropleth-map/>

The first thing we need to do is decide whether you want to have a sequential or diverging map. You are showing low, medium, and high for each axis. Do you want to emphasis the range in the data or the variation? This will determine how you make your grid. I suggest going two sequential scales for this project, it makes the legend easier to make. Here is an example of diverging I made for my master's thesis.



Next, create a 3x3 matrix in your notebook that looks like this

|    |    |    |    |
|----|----|----|----|
| 30 | 31 | 32 | 33 |
| 20 | 21 | 22 | 23 |
| 10 | 11 | 12 | 13 |
|    | 1  | 2  | 3  |

Next we will create three columns in the attribute table, **population rank, insecurity rank, and total**. Make these columns short integer with a precision of 2. This is the tricky part with bivariate maps. First we have to classify each dataset, rank them, and add them together. Let's do population rank first.

Visualize this data with graduated color, make the data classification method quantile and three classes. This will put 33% of the data in each class (high, medium, and low). Write down the break points. Now go into the attribute table and select by attribute. Select the

counties where the population is less than or equal to the first break point. This will highlight 1/3 of the counties. Right-click on the population rank attribute and select field calculator. Type 1 into the box to give all selected counties a 1 for population rank. Now select counties where the population rank is greater than the first break point. This will select the other 2/3 of the counties. In field calculator change type 2. Finally, select counties where the population rank is greater than your second break point. In field calculator change type 3. Now a third of your counties should be ranked 1, a third ranked 2, and a third ranked 3.

Do the same thing with the food insecurity data, except this time use the value 10, 20, and 30 in the field calculator.

Finally, let's add them up to make our bivariate legend. First, make sure no counties are selected. Open the field calculator for the attribute total. Add the population rank and food insecurity rank together. This will give you a column that matches the organization of the grid shown above.

Now visualize the counties using the category symbolization for the total field. Make sure you add all values. This will be a rainbow looking map, but will work for now. Write down the colors for each box of the grid. When ready export to AI.

Now that you are in AI, save the file as something else in case you need to go back to your original export. Let's carefully create a legend and change the values of your counties to match the corresponding classification. Go slow here, if you mess up it is really hard to fix it and you will have to go back to your original. First make your legend. It should be nice square boxes arranged like the grid above.

First question, do you want a light or dark background. If you want a dark background, your bottom left box (low/low) will be dark. If you want a light background, the bottom left will be light. Google image search bivariate map legend to get a sense of some options. See how the colors go light to dark in a couple different directions, through a couple different hues. Look at color brewer to get some color combinations. Play around with this for a bit until you get a nice combination. Use screen shots and the eyedropper tool to get it perfect.

Once you have your legend, change the counties to so they correspond with your color scheme. The easiest way to do this is to select one county, and then go to select->same->fill and stroke. This will select all the counties with a certain color. Group these together to organize your layers. Now you can change them with the eyedropper tool to the correct classification.

Finishing touches. Add a title, legend, description. Look at Josh's back on the first page and how he clarifies that legend for you.

\*\*\*QGIS->AI

Go to Project->New Print Composer to create a map document. In map composer select add new map and draw a box on the blank page where your map will be. Your layers should automatically load into this map.

Export as PDF. Open PDF in AI and remove clipping paths, save as AI file.\*\*\*

Below is an example of what your map may look like.

