Lesson 4: Types of Maps

## INTRODUCTION

This lesson covers various types of maps and their features. Many types of maps exist so that cartographers can visualize spatial phenomenon in the most advantageous way. It is important that you be aware of all the different map types available to you so that you can visualize your data in the format that will be most appropriate for the content of your map and your map user. This lesson covers three map types: choropleth maps, proportional symbol maps, and dot density maps.

## LESSON OBJECTIVES

By the end of this lesson, you will be able to:

1. Identify map elements and design principles.

2. Employ appropriate map elements and design principles for different types of maps and audiences.

## LEARNING SEQUENCE

|  |  |
| --- | --- |
|  | |
| Required Reading | Read the following:  Types of Maps   * Choropleth Maps * Proportional Symbol Maps * Dot Density Maps |
| Assignments | Complete the following assignments:   * Quiz: Types of Maps * Lab: Making a Thematic Map Using United States Census Data |

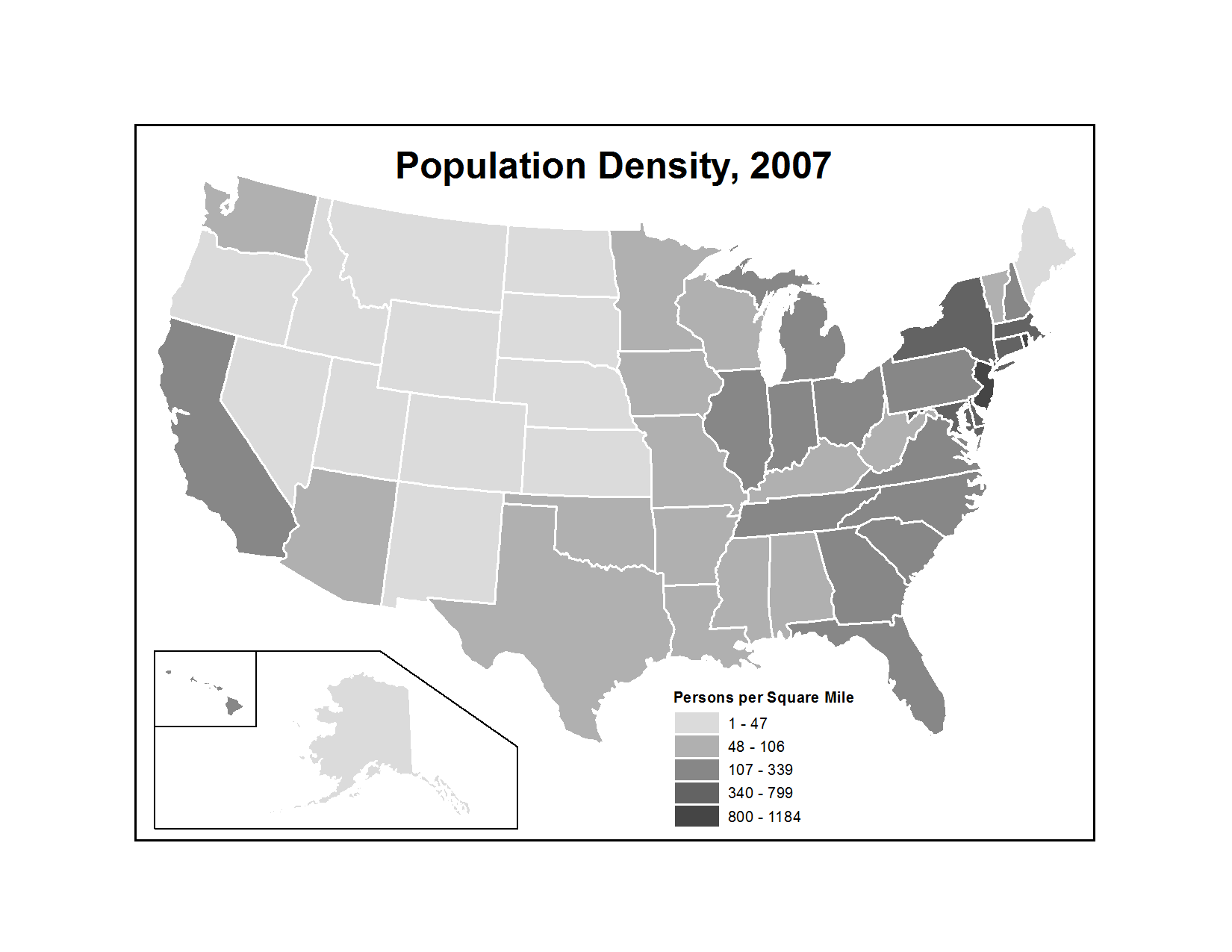
## INSTRUCTION

# Types of Maps

## Choropleth Maps

### What is a Choropleth Map?

A choropleth map is a map where colored or shaded areas represent the magnitude of an attribute. For example this map shows the population density in the year 2007 for the United States of America. For each state the number of persons per square mile has been calculated. The states with a lower population density are shaded with a lighter gray color. The states of a higher population density are shaded with a dark gray color. The states with population densities between the two extremes are shaded on a continuum from the lightest gray to the darkest gray. Based on the five different shades of gray, the map visually represents in an intuitive manner where the most densely populated states are in the United States.



### Why Create a Choropleth Map?

There are many reasons why you would want to create a choropleth map. Choropleth maps is relatively easy to create and easy to interpret by map readers. A choropleth map excels at displaying variables overall geographic pattern. As each color or shade is assigned a value or range of values the map reader can ascertain the values displayed on the map easily. Choropleth maps are also excellent for comparing multiple choropleth maps with one another to see how the spatial distribution of a variable changes. We refer to multiple small maps on the same page as small multiples. A small multiple is when you have multiple small choropleth maps made with similar structure and context.

### Appropriate Data

It is important that the only data represented on the choropleth map is data that can be linked to an enumeration area. An enumeration area is an area where data is collected and combined. Common enumeration areas in the United States are states, counties, and regions. It is important that the data be normalized against enumeration areas or a total population true blue area or size bias. What is meant by area or size bias is that larger areas might tend to have more population simply because there is more area for people to live. Smaller areas will naturally have less population because there is less area to live in.

By normalizing data against the enumeration area and taking size out of the equation you can do apples to apples comparisons between areas that have different sizes. Examples of normalized data are population per square mile which gives us population density, and percent unemployed which is the number of unemployed people divided by the total number of people eligible for work. In a choropleth map the boundaries of areas do not have a related value. In other words, the outline of an area is in no way related to the value of the area. Only the different color or shaded the area is related to the value.

### Inappropriate Data

## There are several types of inappropriate data for choropleth mapping. Continuous data is not appropriate for inclusion on the choropleth map as continuous data is not controlled by an enumeration unit. For example, air temperature is not confined on County outlines nor is it logical to assume so.

## Another type of inappropriate data is any map ratio not involving an area. That means if a value can be assigned to a very specific point and it is not logical to aggregate that data value to a larger area, it should not be used for choropleth map. Total values should not be used on a choropleth map. Variables where the values vary too much should also not be used for choropleth maps. If you still wish to use variables with a large value range you may want to consider choosing a smaller enumeration unit so that there is smaller variation in each enumeration unit.

### Data Classification

## In order to display vast majority of data on a choropleth map, you must employ some data classification schemes. We classify to simplify generalized the data for display on the map. In general four to seven classes are preferred. If you need to exceed seven classes you need to keep in mind that humans cannot effectively use more than eleven classes at once.

## Now consider the five types of classification methods to determine when to use each one on a choropleth map. The equal area data classification method is useful for layouts including multiple maps. The equal frequency data classification method is useful if you are performing statistical test between classes. The arithmetic and geometric data classification methods are useful for the data shows a normal distribution. The nested means data classification method is useful for non-normal distributions. And finally, the natural breaks data classification method maximizes homogeneity within classes and is typically going to be your best general choice for displaying data on a choropleth map.

### Projection

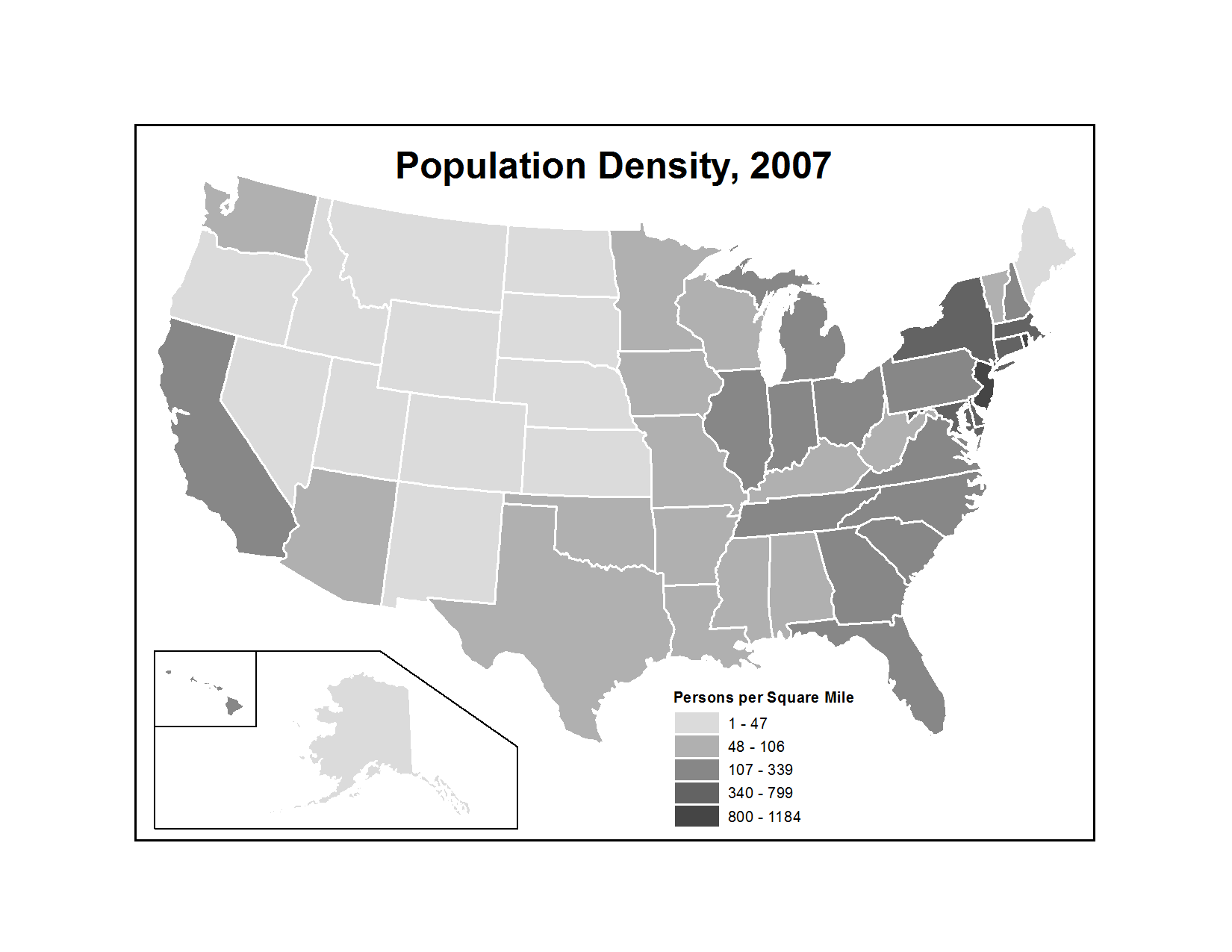
In most cases for choropleth maps the equivalent, or equal area, projection are the most appropriate. The reason why the equal area map projections are the most appropriate is that since we typically normalize data based on area, relative size is important to maintain when comparing the values of the underlying enumeration.

### Symbolization

Consider the symbolization choices for choropleth maps. If you are producing your choropleth map using black and white colors only, then the black color should represent larger values in the light grey color should represent smaller values. The color white should be generally reserved for the background of the map or outlines. Additionally, you should use caution with pure black and white fills as they may obscure boundary lines. You may use pattern, dot, line, or Hatcher patterns, instead of shades of gray, but this is considered to be the “old style” of choropleth mapping.

#### Black and White

Here is the population density choropleth map of the United States for the year 2007. In this black and white map the color white is used for the background and state outlines. The light gray color represents lower values and the dark gray color represents higher values.

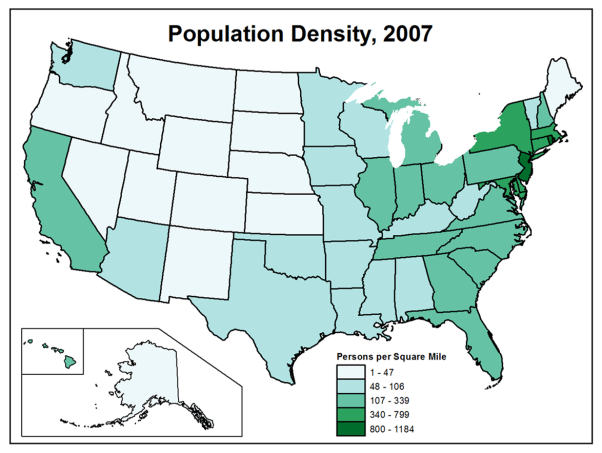


#### Color

If you are producing your choropleth mapping color you should consider these points. Darker or more saturated colors represent larger values. Lighter or less saturated colors represent smaller values. Make sure you can easily differentiate between colors of different classes, that is, make sure that no two adjacent colors are too similar.

You should avoid qualitative color schemes on a quantitative choropleth map. That means, if you only have one variable on your map, such as population, you should choose a single color, or hue to represent that you are only showing different values of a single kind of thing. To represent the different quantities of that single thing, vary the saturation or value of the chosen color. On a color map, white suggests ‘light gray’ can effectively represent “no data”. Black or white is an effective boundary color on a color choropleth map.

On this color choropleth map that deals with a single variable of population, a single hue of green was chosen. The green hue is varied in saturation so that the lighter color green represents lower population density in the darker color green represents a higher population density. The color black was chosen as the state outlines as it provides great contrast against the green hue.



### Color Schemes

In general there are three color schemes that should be used on a color choropleth map based on the type of data being displayed. If your data is considered unipolar data, which means that there is no natural dividing point, you should use a sequential color scheme. An example of unipolar data is population density.

If you have bipolar data, which means that has a natural dividing point such as 0, or mean, then you should use diverging color scheme. Examples of bipolar data are population gains and losses. If you have balanced data, this means you have two complementary phenomena. In this case a diverging color scheme is appropriate. An example of this would be the ratio of males to females.

### Reference Features

Thematic maps should be simple by design by focusing on the featured variable. When creating them you should avoid placing reference features on the map and less they are important in explaining the pattern of the variable being mapped.

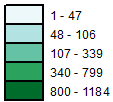
### Legend Design

To wrap up our discussion of choropleth maps this section will focus on legend design.

#### Legend Boxes

Choropleth maps typically use legend boxes. The legend boxes are typically square or rectangular and are large enough to provide a visual anchor but not too large to distract the eye from the main map body. The symbols in the legend should be identical to the symbols on the map in both color and line weight.

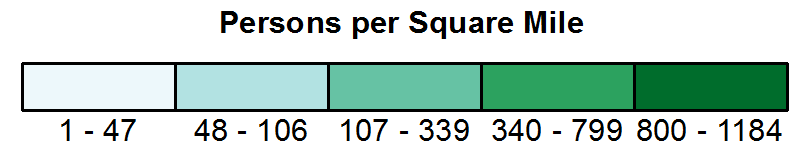
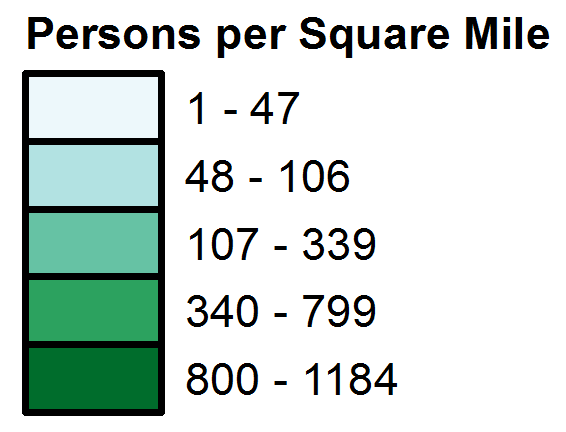
If the enumeration units on the map are reasonably small then the size of the symbol on the legend should be about the average size of the enumeration unit on the map. If the enumeration units on the map are very large then you may consider making the boxes ½ to 1/3 the average size of the enumeration unit on the map.



#### Legend Layout

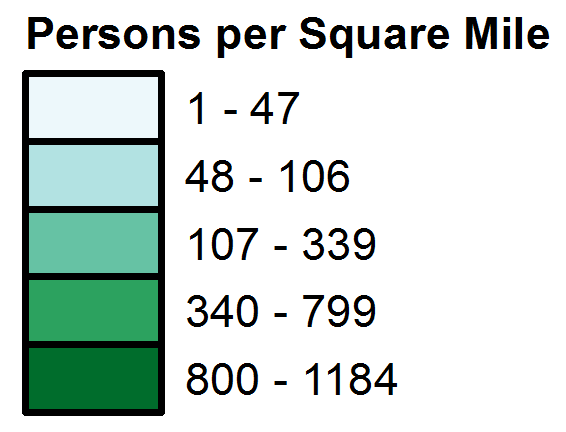
The legend should be laid out into orientations: horizontally or vertically. With the horizontal orientation the lowest value should be on the left and the highest value should be on the right. The value numbers should be located below the boxes. In a vertical layout you can either have the lowest or highest value on the top and the lowest or highest value on the bottom as neither layout is considered standard. The numbers representing the value should be to the right of the boxes.

**Horizontal Vertical**

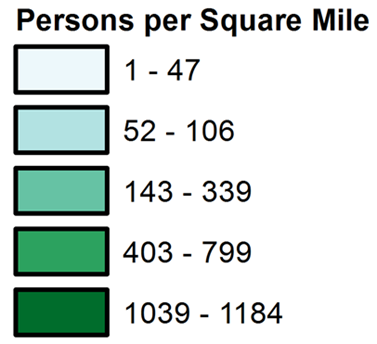
 

#### Continuous Classes

In the case where the values on your map represent continuous data, which means that the maximum value in one class is slightly less than the minimum value of the next class, you should follow these guidelines. Your legend should emphasize degradation of values and show that the values on the map exhaust the data. Additionally the legend should reinforce the fact that there is no data that falls between the cracks. By having a continuous legend it allows the same legend to be applied to multiple maps. In our example, to reinforce the fact that the data is exhaustive and there are no cracks, the boxes of but each other and look like a single continuum.



#### Non-Continuous Classes

If you have non-continuous classes on your map then your legend should show the actual extreme values in each class. You would want to do this to narrow the reader’s estimate of the actual values in each class. A non-continuous legend is best with a single map displaying non-continuous data. For example, our legend shows each box separated from the other boxes to reinforce the fact the classes are not exhaustive and on a single continuum.

#### Formatting Conventions

Use either “to” or “-“ between class ranges. If there are more than four numbers a value, use a comma after every third number left of the decimal value. If you choose to have a legend title, the legend title should match the topic of the map and should not use abbreviations including symbols.

You should place any ancillary text below the legend of the information will not fit into a concise legend title. If you are creating an animated map which shows the change of the variable throughout time, you should use a single continuous legend that encompasses the global maximum and global minimum over the entire series of the maps included in the animation.

## **Proportional Symbol Maps**

### What is a Proportional Symbol Map?

On a proportional symbol map, a symbol’s size is buried in proportion to the quantity it represents. The most common symbol used in a proportional symbol map is a circle. On this example proportional symbol map it shows the total population per state in the year 2007 for the United States of America. The circles vary in size as the total population it represents increases. On this map, map readers can quickly and easily determine which states have the largest population in relation to other states.

## C:\GST 104\Proportional Symbol Map.png

### Why Create Proportional Maps?

So why should you create a proportional symbol map? A proportional symbol map is easy for map reader to understand. Multiple variables can be displayed simultaneously on a proportional symbol map. For example, the symbols size, symbols color, and symbols a shape can all represent different variables.

Additionally, you can overlay a proportional symbol onto another type of thematic map such as a choropleth map. Finally, a main reason to create a proportional symbol map is when you want to display a quantitative distribution of a variable throughout space.

### Why not Create Proportional Maps?

Here is why you should not create a proportional symbol map. In general, map readers tend to underestimate the relative size of the symbols on the map this leads to over or under estimation of values. Also, symbols can easily overlap too much a dense locations in the user will not be able to see enough of the symbols to determine the values in the map will look cluttered.

### Appropriate Data

Appropriate data for a proportional symbol map is either total values, percentage values, or rate values. Additionally the data should occur at a point or the data should be aggregated to an enumeration unit such as accounting. If the data is aggregated to a point within an area the dot is typically placed in the center of the area.

### Inappropriate Data

An appropriate data for a proportional symbol map is interval data. As the size of a symbol can be reduced to 0, which is a natural 0 state for the symbol, the data to should have a natural 0 point. This would exclude data that does not have a natural 0 point such as temperature. Another type of inappropriate data for proportional symbol map is data with small ranges in the values. Data with small ranges of values will make for an interesting map as the size of the symbols will not very too greatly. There is also density data. Density data is not appropriate for proportional symbol map and you should consider making a choropleth map instead.

### Projections

The equivalent, or equal area projections are the most appropriate map projections for proportional symbol map. Since relative size is important to maintain and comparing values within enumeration units you should choose a map projection that maintains the relative sizes of the areas.

### Proportional Symbols

Now consider the proportional symbols themselves. Various shapes can be used for proportional symbol although the circle is the most common. There are two categories of point symbols that we can use: geometric symbols, and pictographic symbols.

A geometric symbol can be either two-dimensional or three-dimensional and it should not look like the image or area that is being mapped.

### Two-Dimensional symbols

Examples of 2-D geometric symbols are a circle, triangle, and a star. A pictographic symbol looks like the thing being mapped.

First focus on the two-dimensional geometric symbol as this will probably be the most common symbol you will use of a proportional symbol map. For the 2-D geometric symbol, the area of the symbol is scale to represent the magnitude difference of the value of represents. The circle is the most widely used symbol of proportional symbol map.

Advantages for using a circle are that its geometric form is compact and the circles are visually stable since the eye does not wander across the circle too much. If circle symbols overlap they can still be effective in indicating magnitude. And finally, circles can easily, lend to a second variable by changing its color or texture. Squares are also popular choices as their main advantage is that the proportional areas are nearly perfectly perceived whereas they will be over or underestimated for circles and most other two-dimensional geometric symbols.

A Disadvantage of using squares is that it adds “squareness” to the map which may not be desirable. It can also be confused for other common symbols like houses.

### Three Dimensional symbols

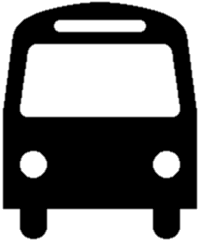
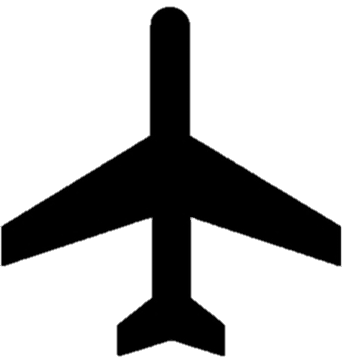
Three-dimensional geometric symbols can also be used as proportional symbols. Examples of three-dimensional geometric symbols are a sphere, prism, or pyramid. Advantages of three-dimensional geometric symbols are that they are visually attractive and they allow for less crowding of the map because they add the third dimension which allows it to be slightly more compact.

Disadvantages of three-dimensional geometric symbols are that readers cannot accurately judge scaling differences because the readers now have to judge changes in volume. Range grading the symbols is recommended for three-dimensional symbols to combat scaling issues. You will learn about range grading in a few slides. Complicated three-dimensional geometric symbols can also be hard to understand on a map.

### Pictographic

Pictorial symbols are sometimes good choices for proportional symbols. Advantages of pictorial symbols are they are visually attractive and attention grabbing. Disadvantages for pictorial symbols are the more regular the shape of the control symbol, the harder will be to perceive the magnitude differences. Additionally mapping a second variable is difficult except for simple hue changes.

Three examples of pictographic symbols are the front of a bus, and outline of an airplane, and a taco.

### Proportional Symbol Color

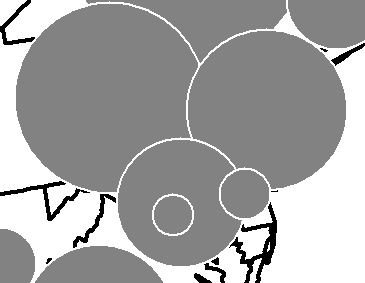
Now consider proportional symbol color. Different colors apparently do not affect the estimation of symbol size differences. Symbols that are too darkly tinted command a lot of attention so you should avoid extremely dark symbols unless you wish them to command a significant amount of attention on the map.

Symbols with little contrast from its surroundings may be lost and are not popular choices. You should consider using appropriate strategies for contrast. Symbols that are black or gray colors are the most popular with map readers for a proportional symbol map. And finally, changing the color of the symbol can be used for a second variable.

### Overlap

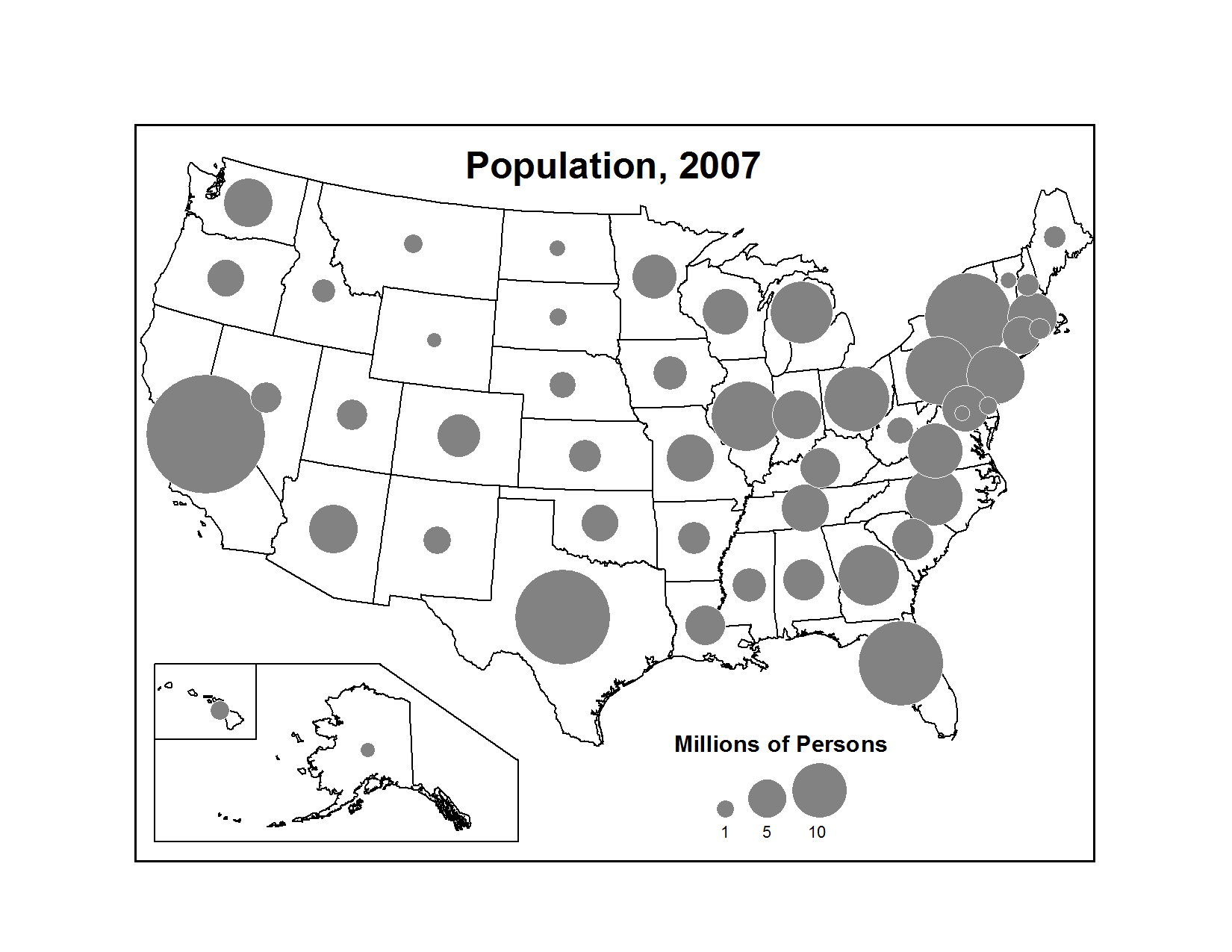
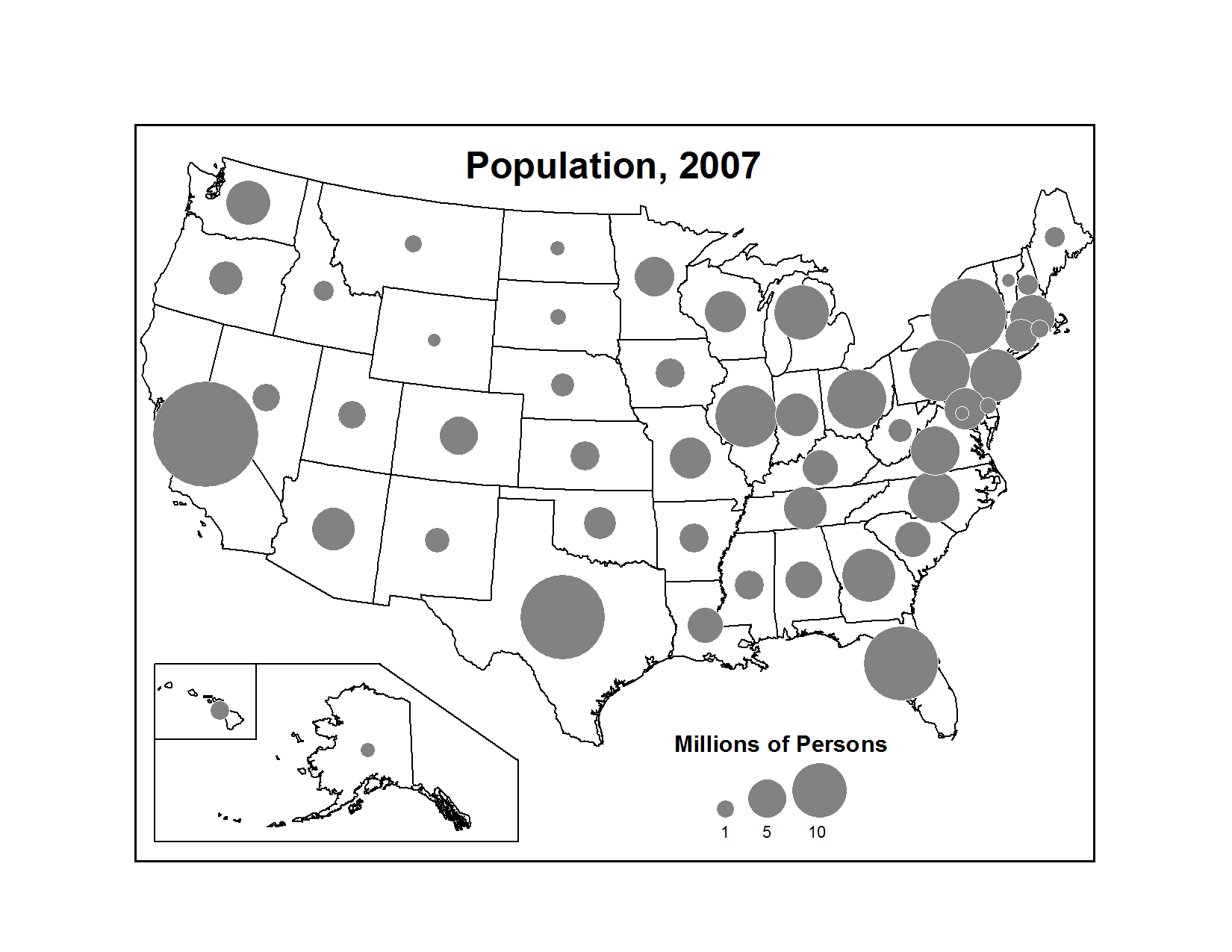
Sometimes on proportional symbol map symbols will overlap. Overlapping symbols express a sense of visual cohesiveness and may make the map more memorable to the user as it will make a strong visual imprint in their mind. The downside to symbol overlap is that it may make it harder for the map reader to estimate the individual symbol sizes as they will be partially obscured.

To combat this try not to overlap symbols more than 25% to 33%. Additionally, when symbols overlap, smaller symbols must cover the larger symbols as shown in the example. If you cannot avoid significant symbol overlap another option is to make the circles transparent, or semitransparent to help users perceive of overlapping symbols.



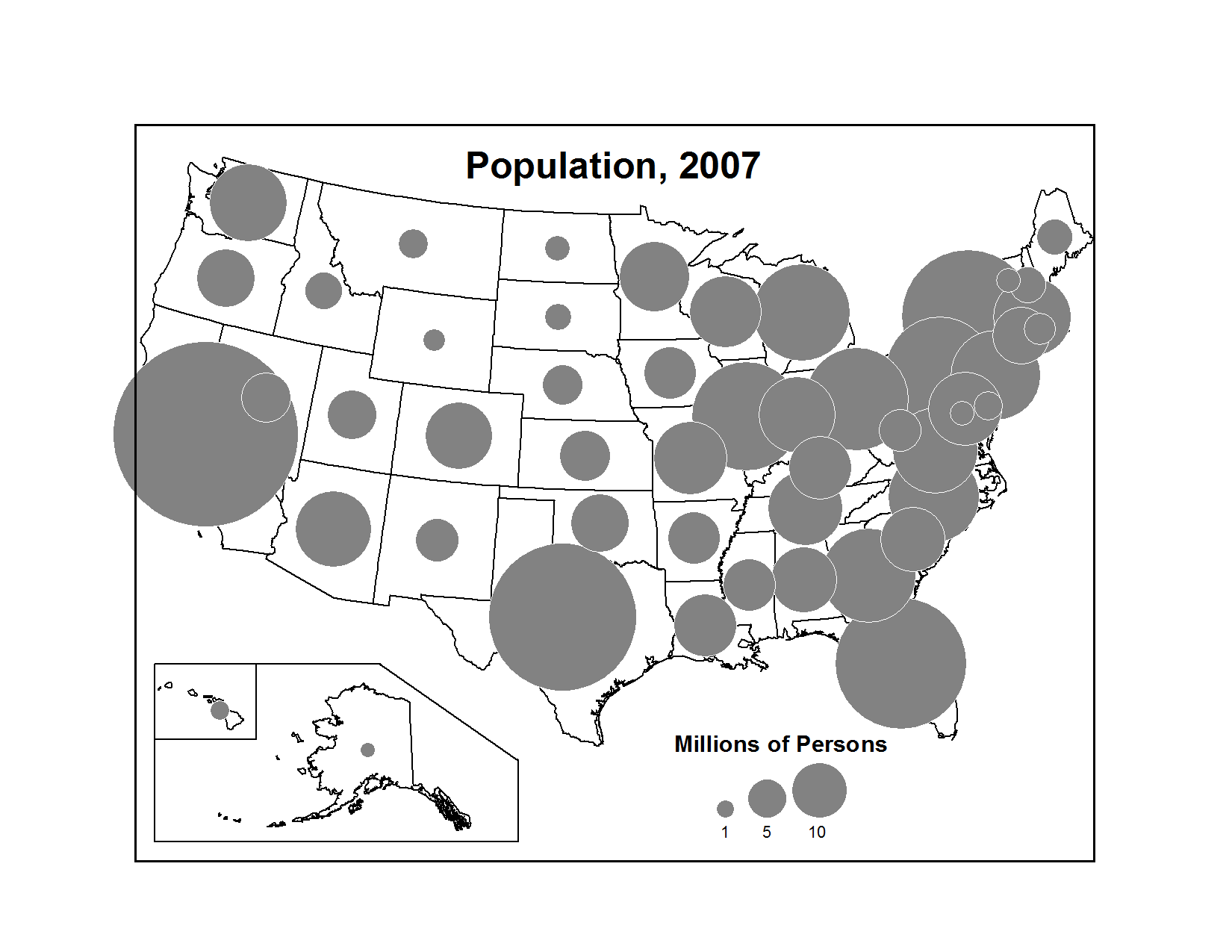
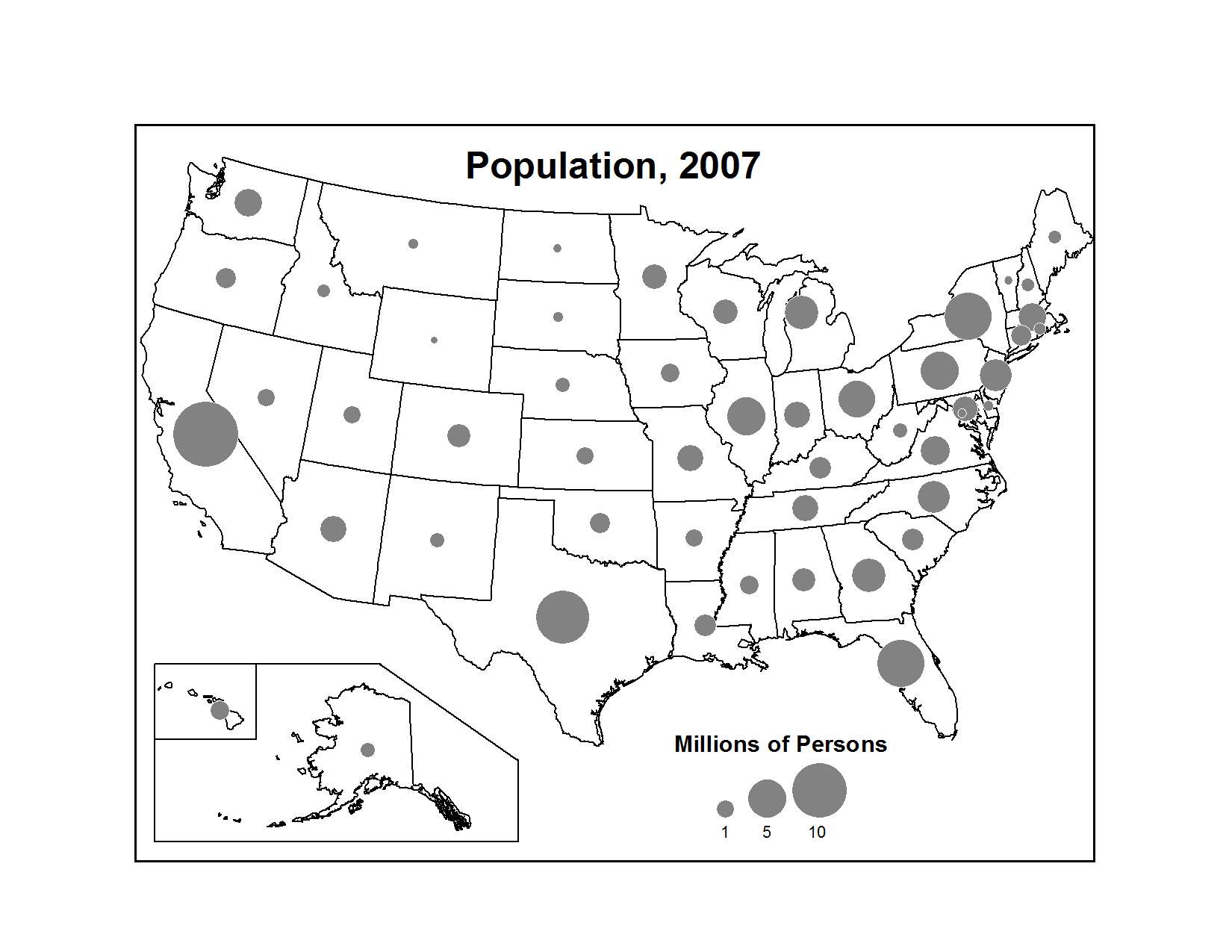
### Appropriate Overlap

Here are two examples of maps using appropriate symbol overlap. In both maps the symbols overlap state outlines and other proportional symbols but not so significantly that you cannot estimate the size of the circles that are being obscured. Additionally, with this amount of symbol overlap, the map has a cohesive feel to it in the large amount of overlap in the northeast part of the United States makes the data memorable.

### Inappropriate Overlap

There are two examples of inappropriate amounts of symbol overlap. In the map on the left there is too little overlap which makes it seem empty and uninteresting. On the map on the right there is too much overlap of the circles which causes circles to be obscured. Also, the proportional symbol for California exceeds the neat line of the map which looks very messy.

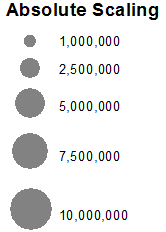
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Too Little Overlap, Empty, Uninteresting Too Much Overlap

### Scaling Methods

There are three primary methods of scaling proportional symbols: absolute, apparent magnitude, which is also known as perceptual, and range grading.

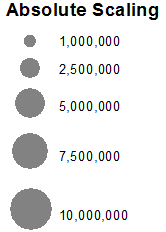
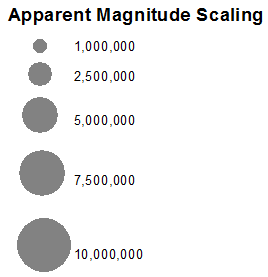
#### Absolute Scaling

In absolute scaling symbols scale proportionally to their data values and to each other. Absolute scaling is great if you want each symbol to be unique in size and to give a true visualization of the relative values. Negative aspect of absolute scaling is that it can be difficult for the map user to interpret because the map user can only differentiate a given number of symbol sizes effectively.

#### Apparent Magnitude Scaling

In apparent magnitude scaling it applies factors to compensate for the users underestimation of area and volume of the symbols. Typically this factor is used to increase the size of the circles faster than in absolute scaling. Apparent magnitude scaling is also known as Flannery, perceptual, or psychological scaling.

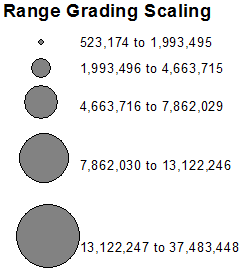
Looking at the two example legends, there are five proportional circles in each legend, with the same value, however, the circle sizes and the apparent magnitude scaling legend are a bit larger to compensate for the map user’s tendency to underestimate relative areas of the circles.

#### Range Grading Scaling

Another type of scaling is range grading scaling. In range grading scaling each symbol size represents a range of data values and not a single data value. Range grading is similar to choropleth mapping as you employ data classification methods to determine class breaks. The main advantage to range grading scaling is that readers can easily discriminate symbol sizes and match them to the legend symbols.

For instance, if there are five circles on the legend of different sizes and there will only be circles of five different sizes on the map it should be easy for the map reader to match the symbols from the map to the legend thereby getting the range of values for that location. Range grading is recommended for three-dimensional geometric or pectoral symbols as users tend to have difficulty in estimating sizes properly for the symbols.

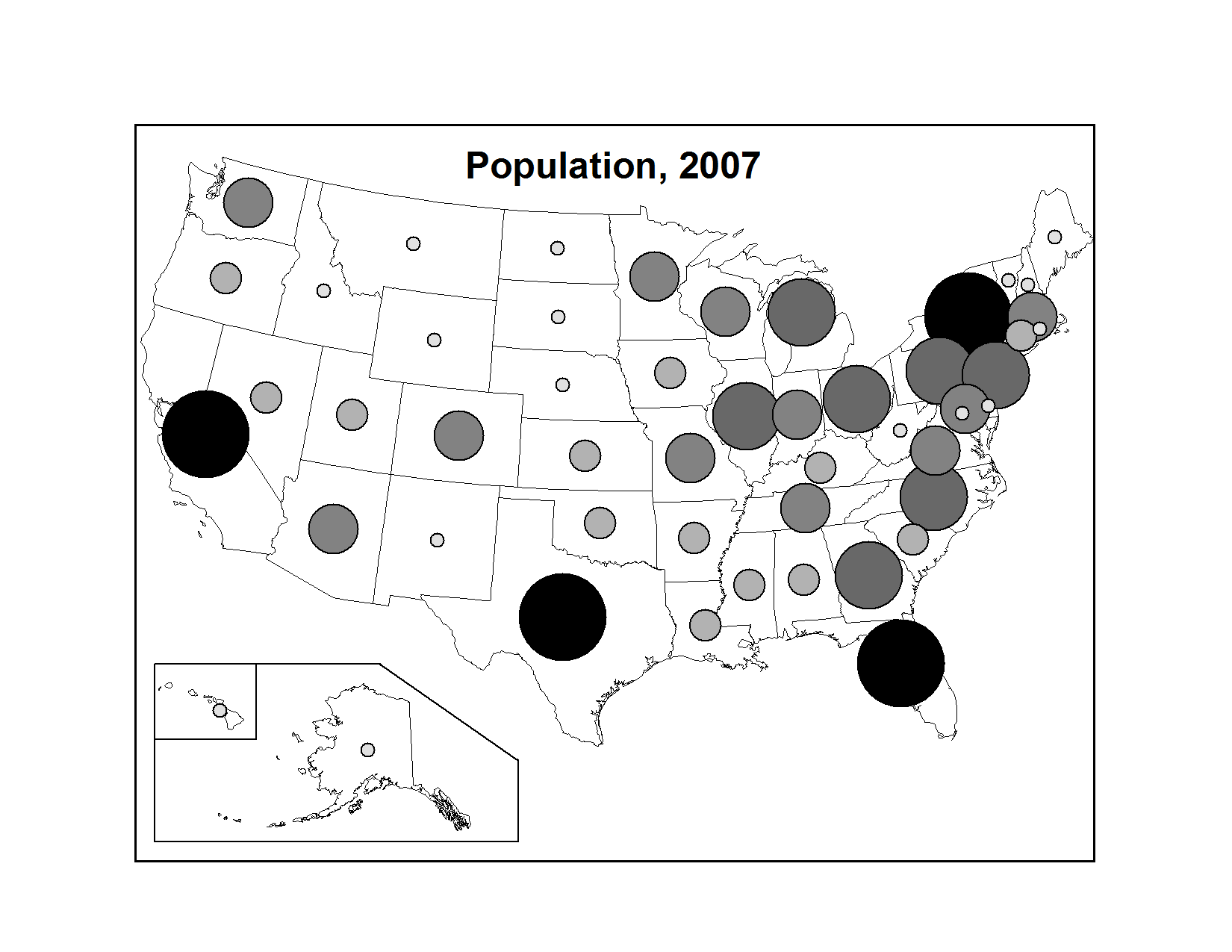


### Redundant Coding

One option available to you when creating a proportional symbol map is the idea of redundant coding. Redundant coding is the use of more than one visual variable to differentiate the symbols from each other. For example, as the value of the attribute increases, we can increase the size of the symbol and darken the color of the symbol. By using more than one visual variable to differentiate the symbols, this reinforces the idea of increasing or decreasing magnitude.

The most common way in which redundant coding is used on a proportional symbol map is through varying the lightness and hue in concert with the size of the symbol. In this case, lighter colors should represent lower values and darker colors should represent higher values. If the circles represent one kind of thing, and it is recommended that you choose a single color and simply vary the lightness and darkness.

Here is an example map that employs redundant coding. The smaller circles are colored with lighter colors and represent smaller values. The higher values used darker colors to represent higher values. Using redundant coding can add a nice visual impact to the map.

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### Reference Features

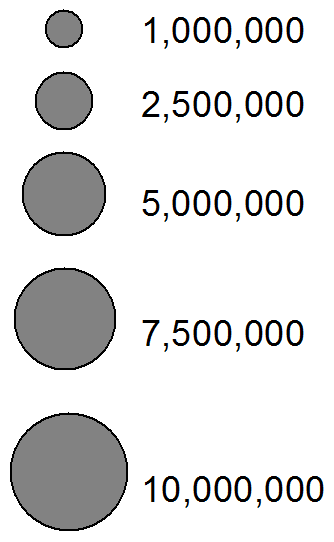
Now you can consider the use of reference features on a proportional symbol map. Again, thematic maps should be simple by design so that the map user can focus on the proportional symbols and the data they represent. You should avoid placing reference features unless they are important in explaining the pattern of the variable being mapped.

### Legend Design

On a proportional symbol map the legend serves as a visual anchor for interpreting symbol sizes. There are four common legend layouts which are: vertical, horizontal, nested symbols, and nested semi-symbols. In these different legend layouts numbers or data values are placed to the right of the symbols with the vertical or nested legend layout and below the symbols if it is a horizontal layout.

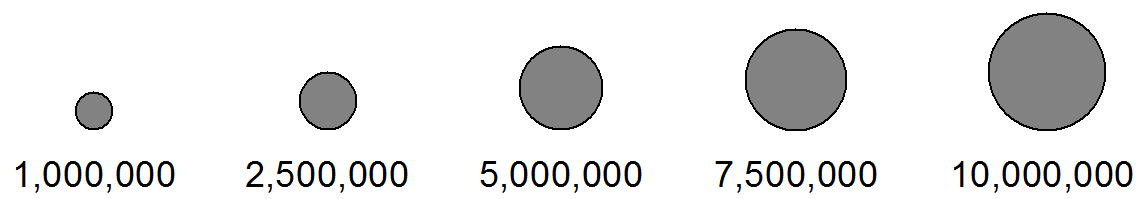
#### Vertical Layout

For the vertical legend layout the values are displayed to the right of the symbol. Also, small values are at the top and large values are at the bottom.



#### Horizontal Layout

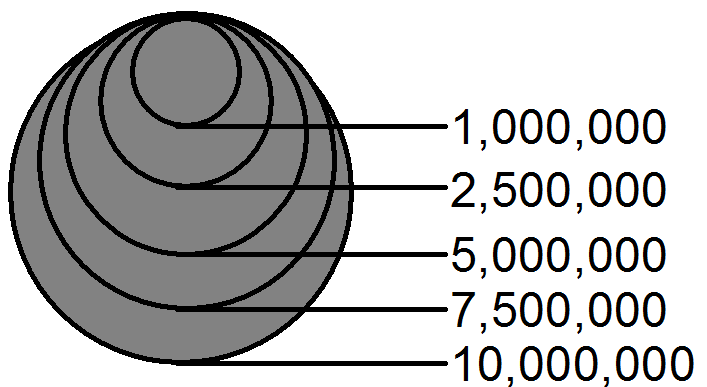
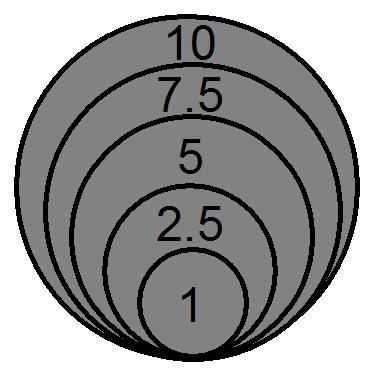
For the horizontal legend layout values are below the symbols and small values are on the left and large values are on the right.



#### Nested Symbols Layout

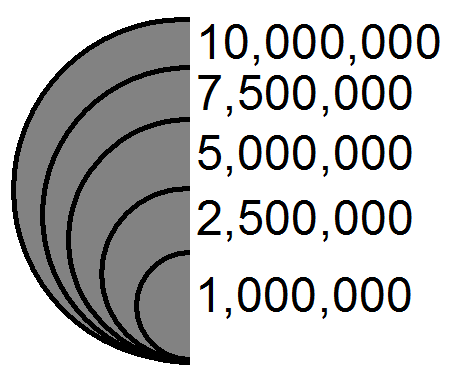
In the nested symbols legend layout the symbols are placed on top of each other with the smallest symbol on top of the largest symbol on bottom. The symbols are also a line along their tops, or bottoms.

The main reason to use a nested symbols legend layout is that it requires less space on the map layout and the vertical or horizontal legend layout. To save even more space you can place the values inside the symbols if there is space available, otherwise the value should be to the right of the nested symbols with a leader line connecting the values to the symbols.

#### Nested Semi-Symbol Layout

The nested semi-symbols legend layout requires the least amount of space on a map. This is essentially the nested symbols legend but with half of the symbol missing and replaced with the values. You may also have leader lines from the top of the symbols to values as well.



### Proportional Symbol Map: Legend Design

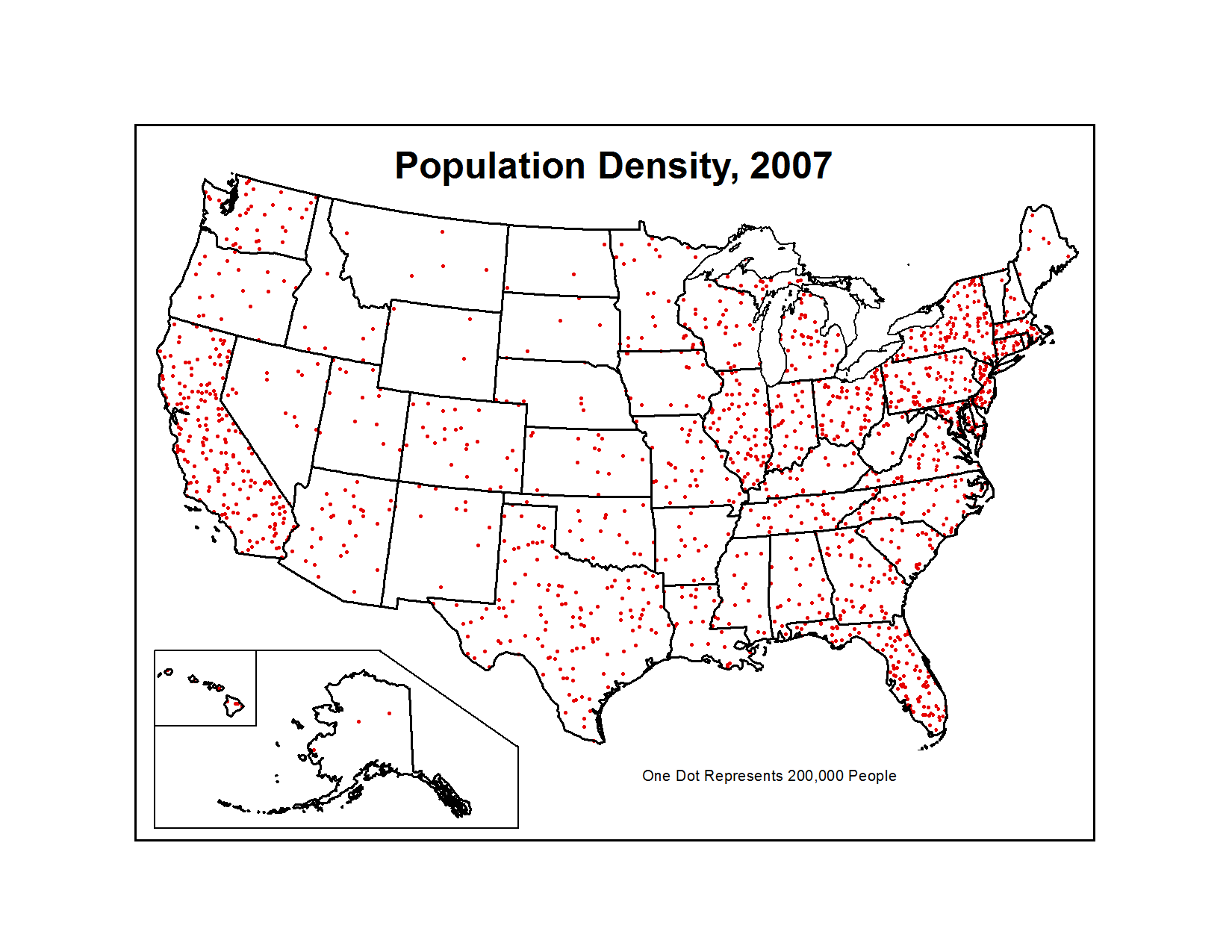
With respect to legend designed for proportional symbol maps there are a few special cases to consider. If a single, or if your values are significantly larger or smaller than all the other values, we may consider these outliers. In the case of outliers we can label the symbol on the map with its name and value to bring attention to it. We can also label the symbol on the legend with each unique name and value or change the color of the outlier to bring attention to it to show that it is different in some way than the other symbols. If there is not much congestion on the map it is okay to label the proportional symbols on the map itself with their values.

## Dot Density Maps

### What is a Dot Density Map?

A dot density map is a map showing total values represented by randomly placed dots within an enumeration area to represent density and spatial distribution. This example map shows population density for the year 2007 for the United States of America.

On this map, 1 dot represents 200,000 people. Each dot is randomly placed within its enumeration unit, which in this case, is the county. Where the dots are denser on the map the user will interpret this area as having more value. Where there are less dots on the map, the user will interpret this is having less value.



#### Why Create a Dot Density Map?

A dot density map is easy to create and easy to interpret. It excels at displaying a variable’s overall geographic pattern and density. Counting the number of dots in an area will allow the map user to ascertain total values with some rounding error. Dot density maps can reflect distributions more accurately than other thematic map types.

#### Why Not Create a Dot Density Map?

So why should you not create a dot density map? First, map readers do not perceive dot densities linearly; they may overestimate or underestimate the densities of the dots as density increases in an area. Second the dots may not be automatically placed close to the phenomenon they represent since the dots are randomly placed.

Third the large ranges of data values make it hard to choose a single dot value. Fourth it may be hard for the map users to recover original totals when dots are place close together making it hard to pick out individual dots. Fifth and finally dots may appear where they cannot possibly exist. For example a dot representing cattle may show up in a lake when that does not make sense for the dot to be there.

### Appropriate Data

Total values are the types of data that are appropriate for a dot density map. The data should be represented and aggregated to an enumeration area. You should strive for the smallest enumeration units possible to maximize the likelihood that the dot will be placed close to the location of the phenomenon. Generally the enumeration units themselves should not be shown on the map.

If you wish to show the enumeration units on the map, either deemphasize enumeration units or keep the enumeration units off the map and shows the next level up of an enumeration unit. For example, if our data’s enumeration unit is counties, then we could not show counties of a map, but instead, show state boundaries. Data sets that do not have large or small ranges are also appropriate for dot density map. If the data set has a small range of values it will lead to a uniformed look on the map. If the data set has a large range of values it will be hard to choose a good size.

### Inappropriate Data

Inappropriate data for a dot density map is continuous data that is not controlled by an enumeration unit. Data sets with small or large ranges are not appropriate. Derived data such as persons per square mile is not appropriate for dot density map.

### Map Projections

The best map projection for dot density map is the equivalent, or equal area map projection. As relative size is important to maintain when comparing values within enumeration units, you should choose a map projection that maintains relative size.

### About the Dots

It is important that on all dot density maps each dot represents more than one item. If the dot represents exactly one item then the dot should be placed exactly where the item it represents is located. If this is the case then what you are creating is a general reference map, not a dot density map.

Dots should be large enough to stand out but small enough to not be totally dominant on their own. Generalization of the dot values occurs at one half of the dot value. That means a dot that has the value 100,000 can be considered to represent all values between 50,000 and 149,999. Each dot is a spatial proxy which means that the dots are placed around the center of gravity of the geographic phenomenon.

#### Random Placement

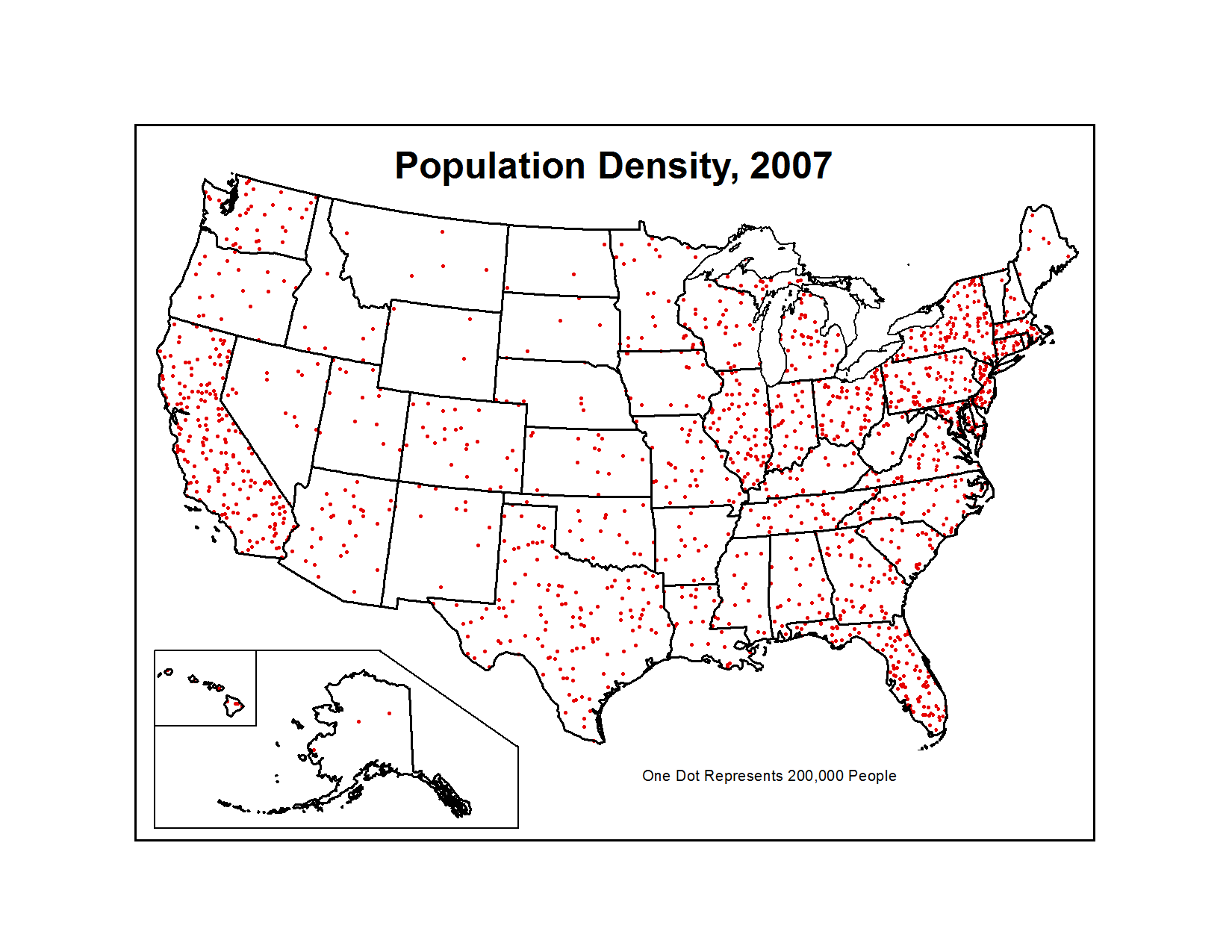
Each dot is randomly placed inside the enumeration unit. The dots are randomly placed to avoid giving the impression that the dots are precisely placed and to avoid regular placement of the dots having large values. You can use ancillary data to restrict the placement of dots. For example, you could tell the software to not place the dots within lakes if it does not make sense for the dots to appear within the lake.

#### General Dot Guidelines

Here are some general dot size guidelines. Enumeration units with the smallest value should have about two to three dots inside of it. Dots should just begin to coalesce in the most dense enumeration area. Dot values should be easy to understand and to count with. For example 500 and 1000 are good dot values.

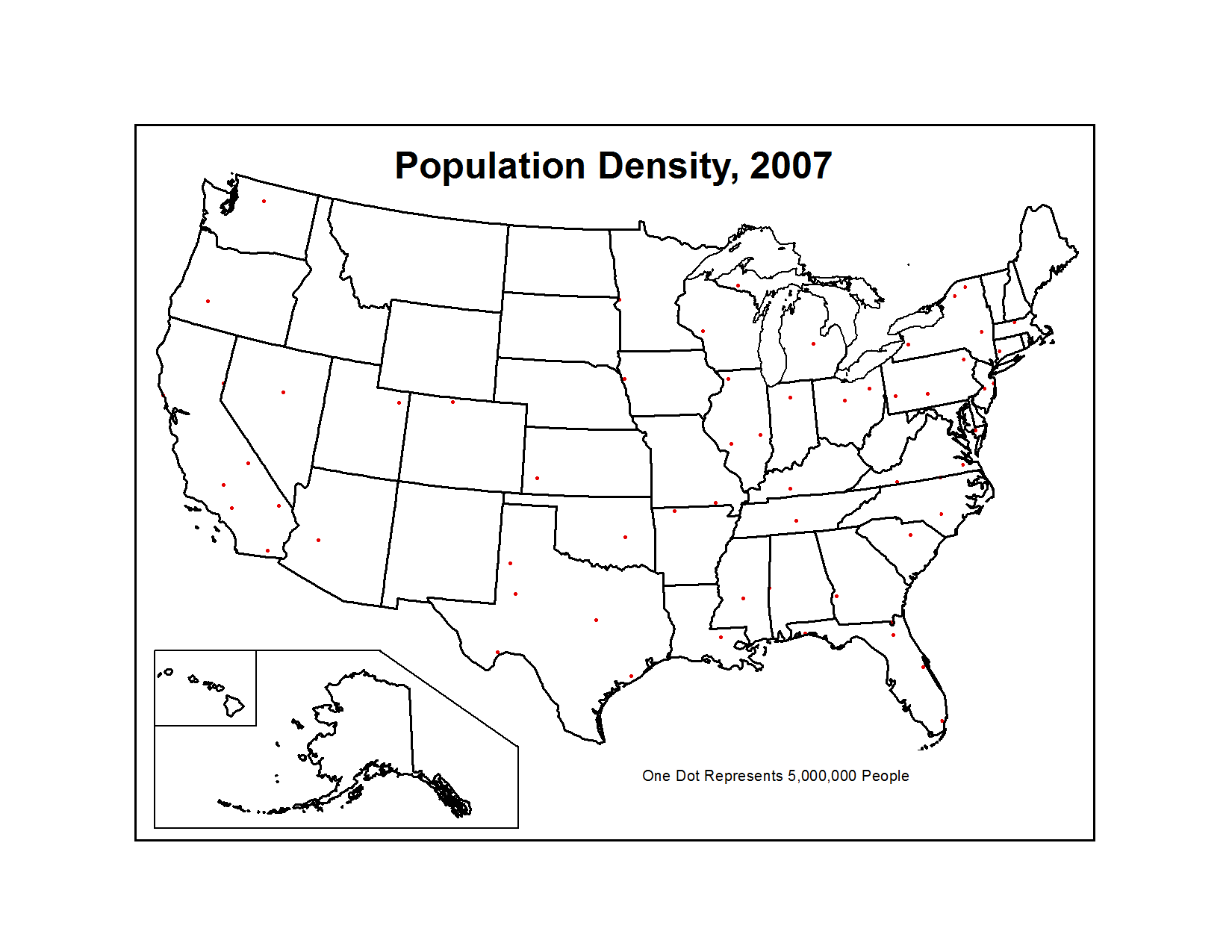
#### Good Dot Size and Value

On this map, the dots are of a good size and of good value. In the densest area of the maps the dots just begin to coalesce; you can still generally pick out each individual dot.



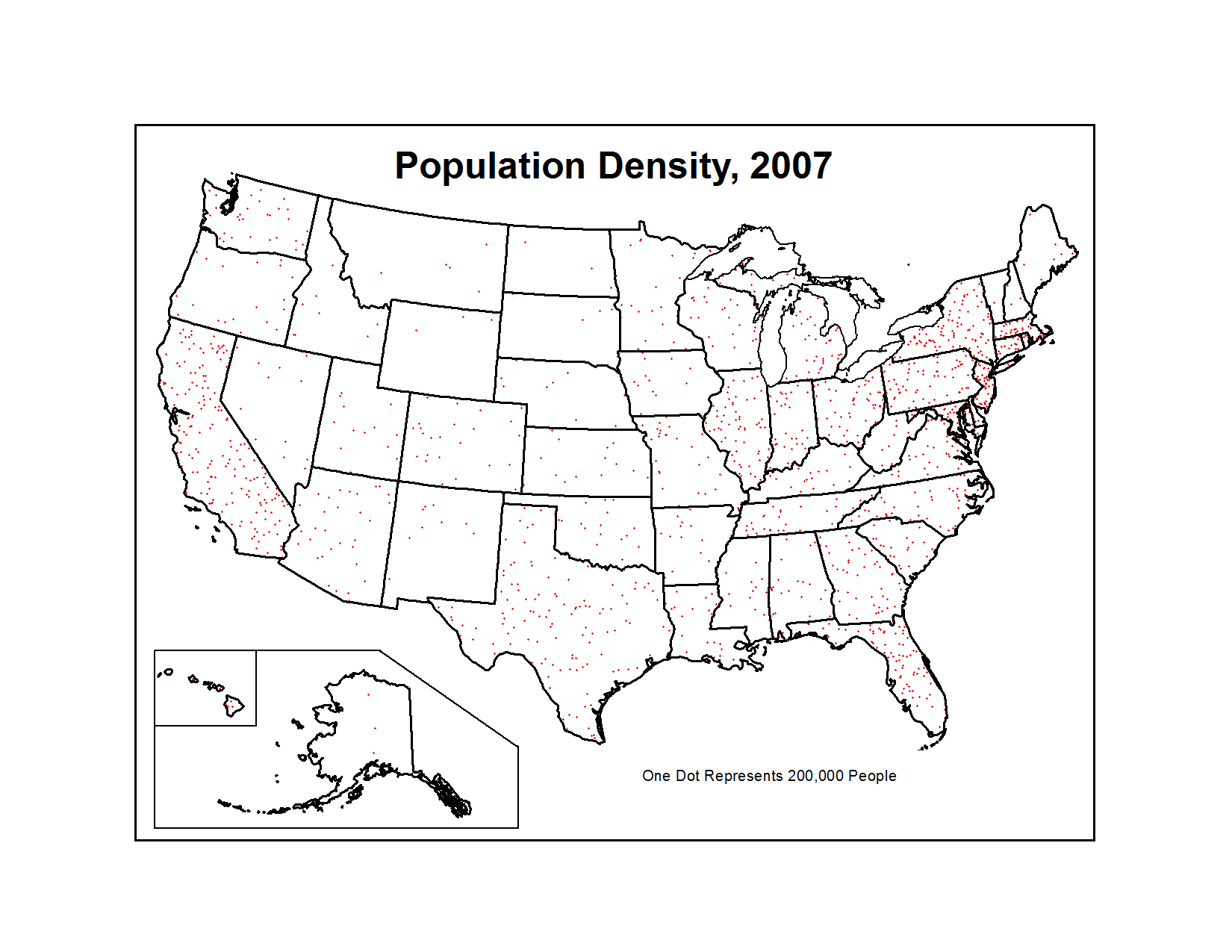
#### Good Dot Size, Poor Value

On this map the dots are of a good size; however, the dot value was chosen poorly and is too large. Because the dot value is so large most of the map looks sparse and the densest areas do not give a good feeling of high density.



#### Poor Dot Size, Good Value

On this map the dots are of a poor size but the dot value is good. As the dot size is so small it still leaves the map looking sparse. The dot size should be increased so that the dots are easier to see and the map looks more filled in.



### Other Symbols

It is possible to use other symbols than dots. You can use geometric shapes which are familiar to map readers and are simple and easily recognizable at multiple sizes. Another option is to use pictorial shapes which may add to the theme and memorability of the map. The negative aspect of pectoral shapes is that if the pectoral shapes are too complex they may not scale well to multiple sizes.

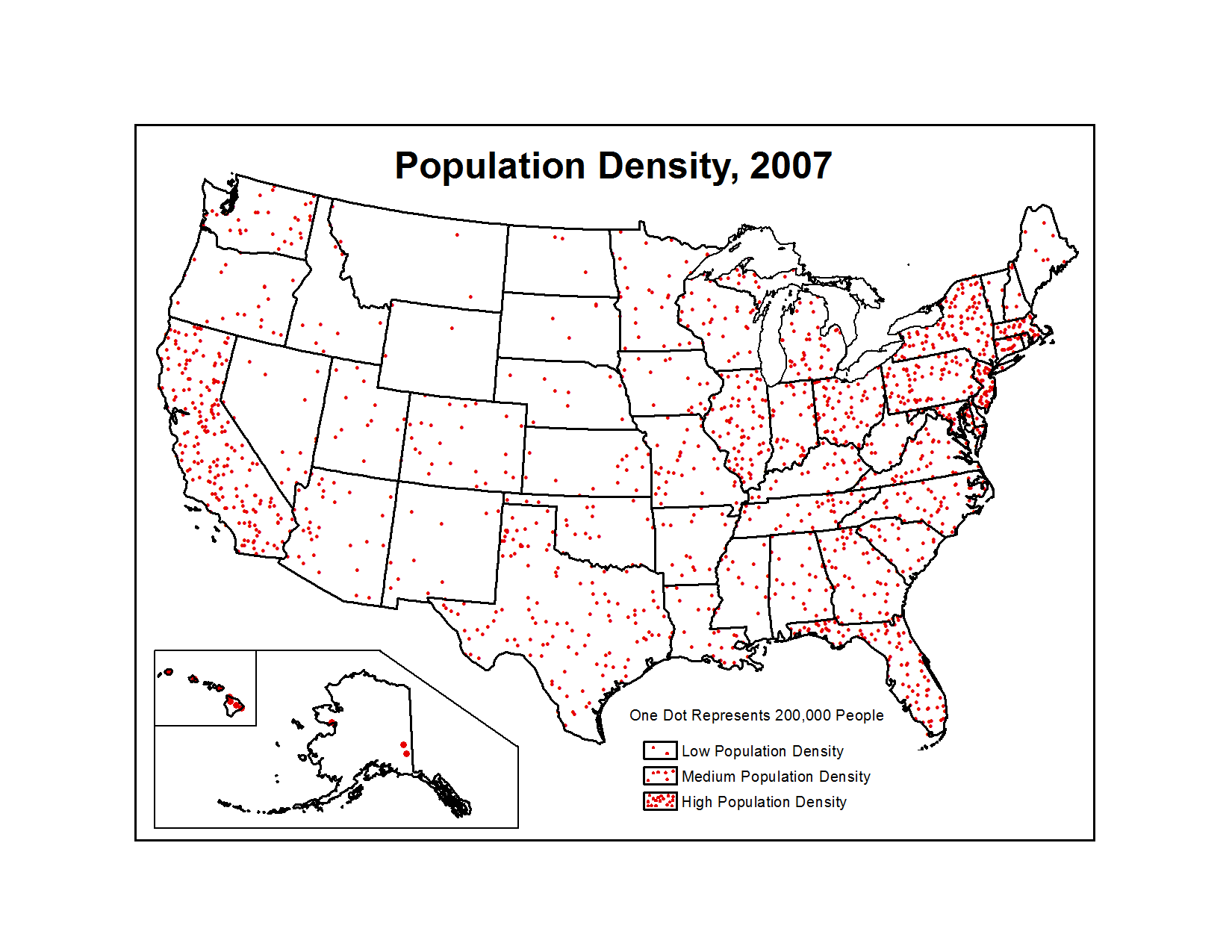
### Reference Features

With respect to reference features on a dot density map, like other thematic maps, it too should be kept simple by design. You should avoid placing reference features unless they are important in explaining the pattern of the variable being mapped.

### Dot Density Map: Legend Designs

Designing legends for dot density map is fairly straightforward. On the legend you should have a representative symbol and a statement about the value of that symbol. Rarely are legend headings required for a dot density map legend. You can include additional information in the legend if necessary, such as the total of all values of a map, or representation of what a low, medium, and high density looks like on the map.







## SUMMARY

This lesson covered various types of maps and their features. Choropleth, Dot Density, and Proportional Symbol Maps were exhibited and explained. You learned about appropriate and inappropriate data as well as data classifications and symbolization for each map type. Map legends and the elements that should be considered when using this feature were also covered.

## ASSIGNMENTS

1. Quiz: Types of Maps
2. Lab: Making a Thematic Map Using United States Census Data