

# Geography 360

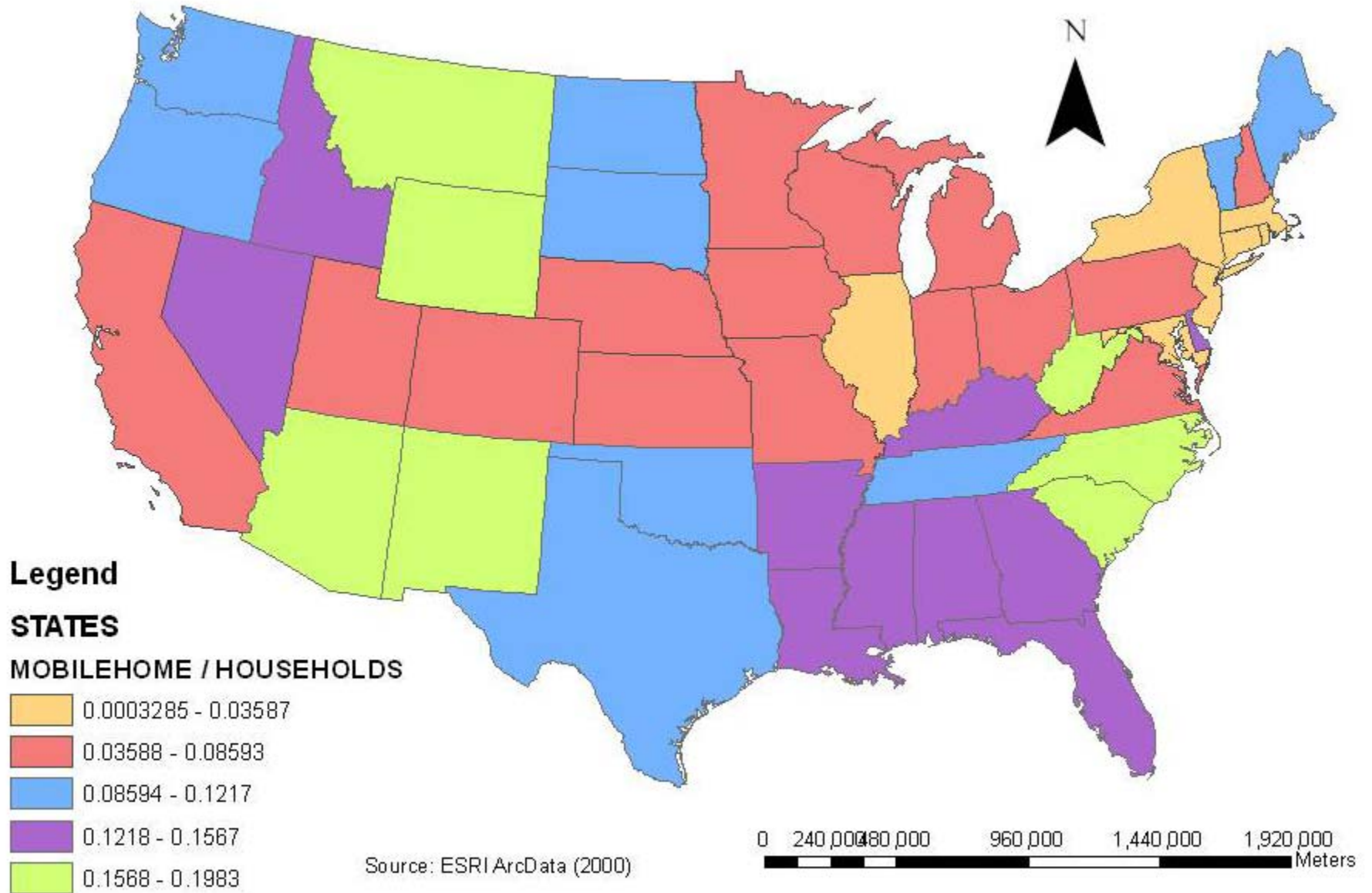
## Principles of Cartography

April 19, 2006

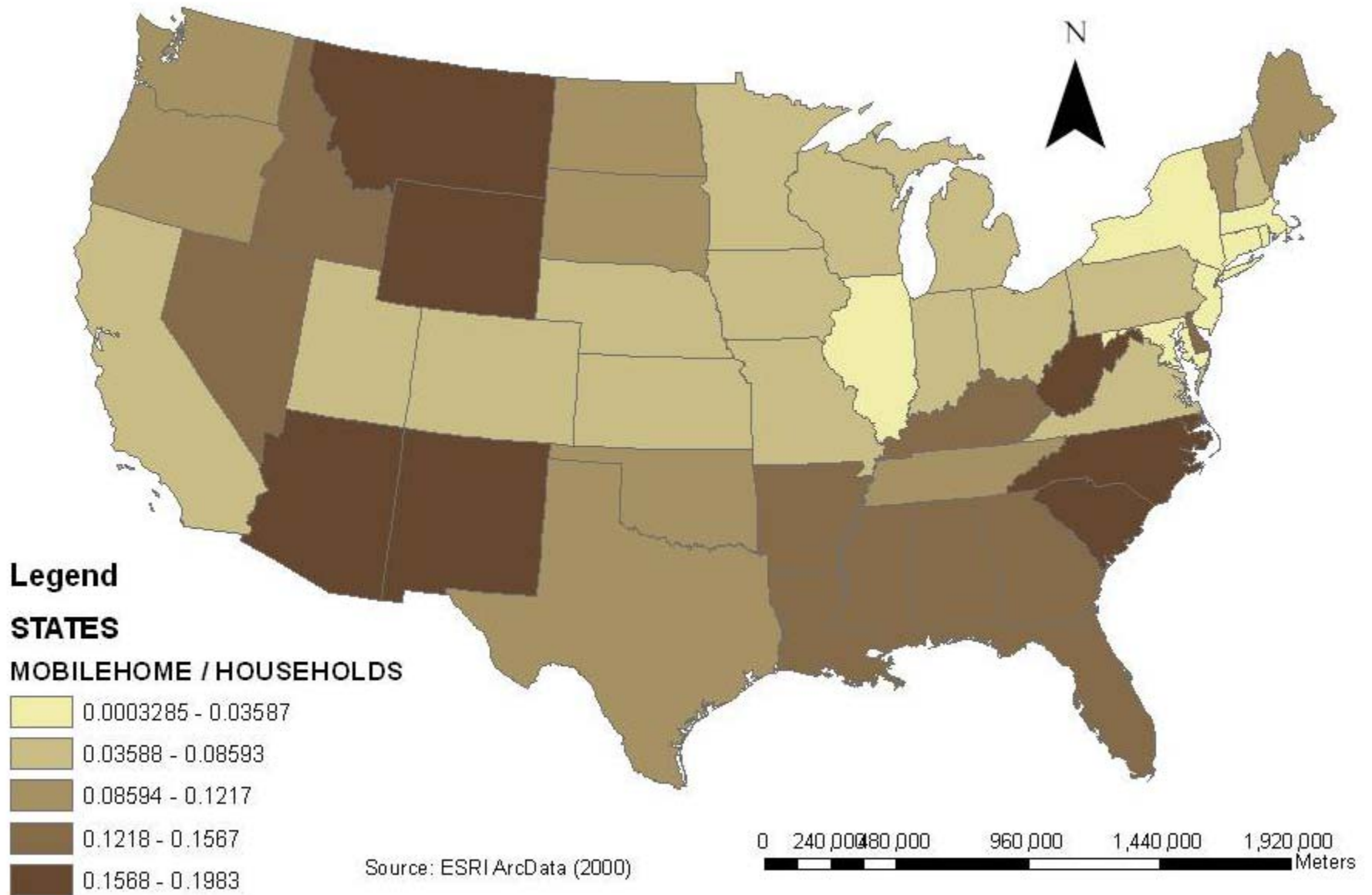
# Outlines

- Visual variables
- Principles of map symbolization
- Use of visual variables
- Comparisons of thematic maps

# Mobilehome per households by State



# Mobilehome per households by State



- Let us define “visual variables” as graphic primitives of map symbols (like color or lightness from the example)
  - a.k.a. Graphic variables
  - a.k.a. Graphic elements
- Particular visual variables has its inherent logic - suggesting order or not
- Visual variables intuitively suggest important characteristics of your data

# Visual variables

- Shape
- Size
- Color
  - Hue
  - Value
  - Saturation (chroma, intensity)
- Pattern
  - Arrangement
  - Orientation
  - Texture (spacing)

# Visual variables


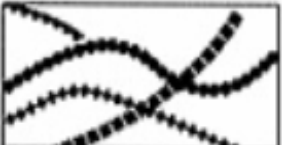
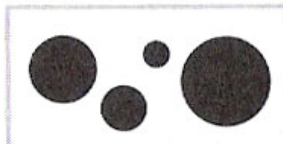
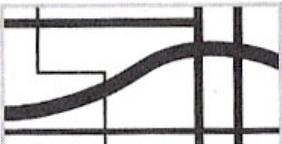

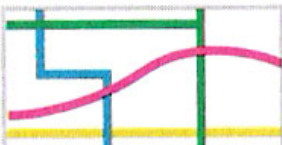






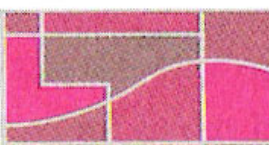
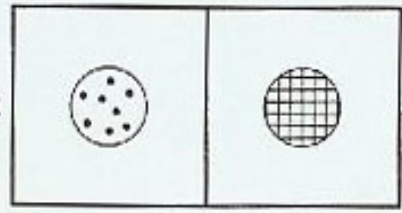
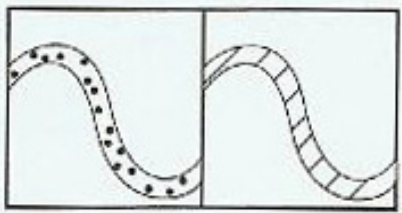
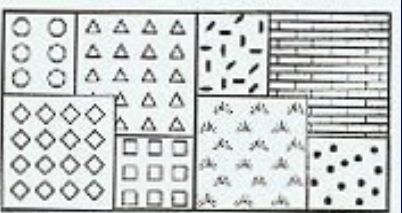
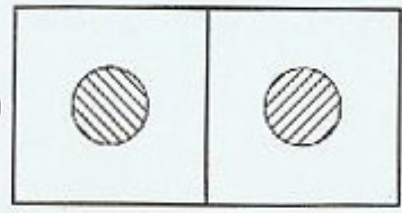
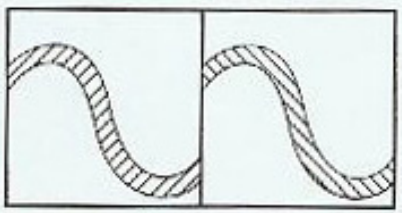
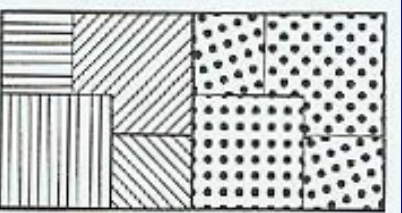
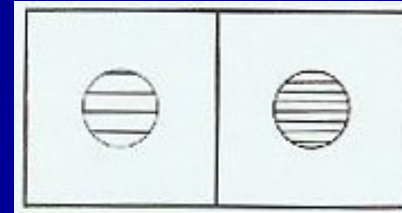
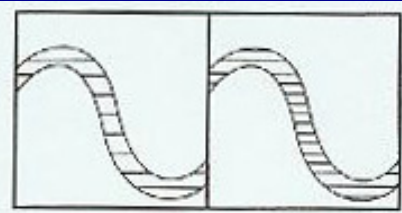

	<i>Points</i>	<i>Lines</i>	<i>Areas</i>
<i>Shape</i>			<i>cartogram</i>
<i>Size</i>			<i>cartogram</i>
<i>Color Hue</i>			
<i>Color Value</i>			
<i>Color Intensity</i>			

Image source: Krygier and Wood 2005 "Making Maps"

# Visual variables - pattern

	Point	Line	Area
Arrangement			
Orientation			
Texture (spacing)			



# Do visual variables suggest qualitative differences or quantitative differences?

	Qualitative	Quantitative
Shape		
Size		
Color		
Hue		
Value		
Saturation		
Pattern		
Arrangement		
Orientation		
Texture		

Row: visual variables; Column: levels of measurement

# Do visual variables suggest qualitative differences or quantitative differences?

	Qualitative	Quantitative
Shape	x	
Size		x
Color		
Hue	x	
Value		x
Saturation		x
Pattern		
Arrangement	x	
Orientation	x	
Texture		x

Row: visual variables; Column: levels of measurement

# Principles of map symbolization

- If your data are qualitative, choose a visual variable which suggests qualitative differences (shape, color hue)
- If your data are quantitative, choose a visual variable which suggests quantitative differences (size, color value)
- In sum, match visual variables to measurement scale of the theme mapped

# Visual variables for different spatial data type

	Point	Line	Area
Shape			
Size			
Color			
Pattern			

Row: visual variables; Column: spatial data type

# Visual variables for different spatial data type

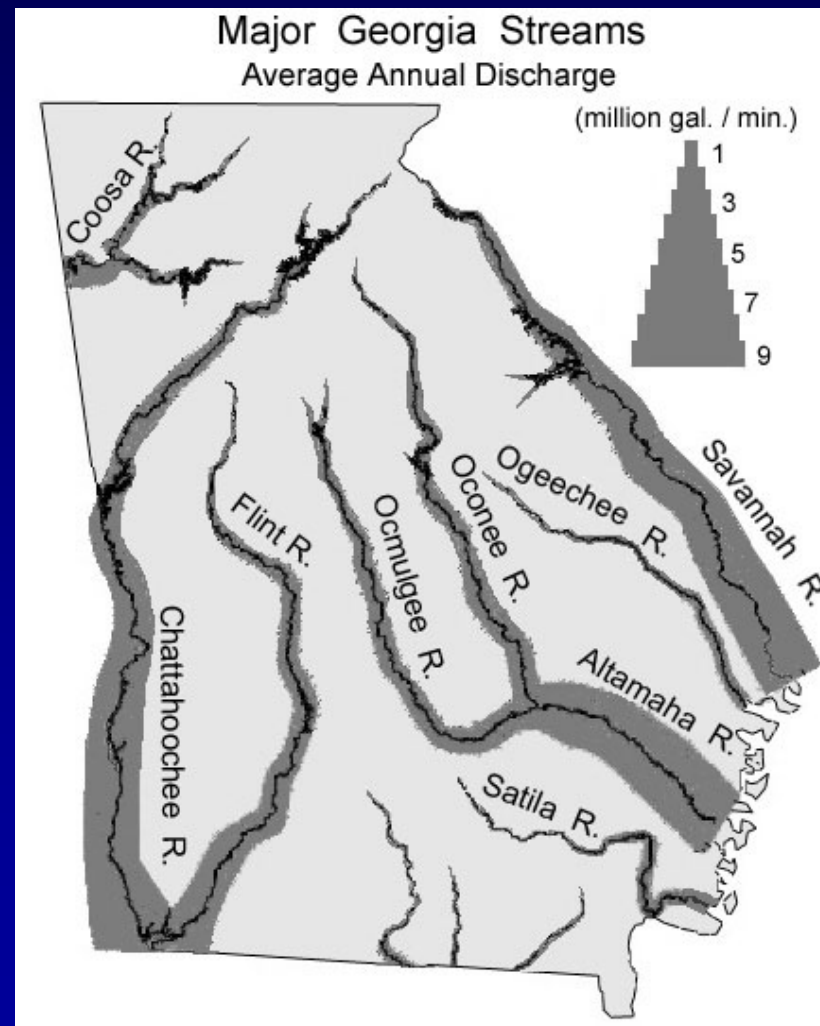
	Point	Line	Area
Shape	X	X	
Size	X	X	
Color	X	X	X
Pattern			X

Row: visual variables; Column: spatial data type

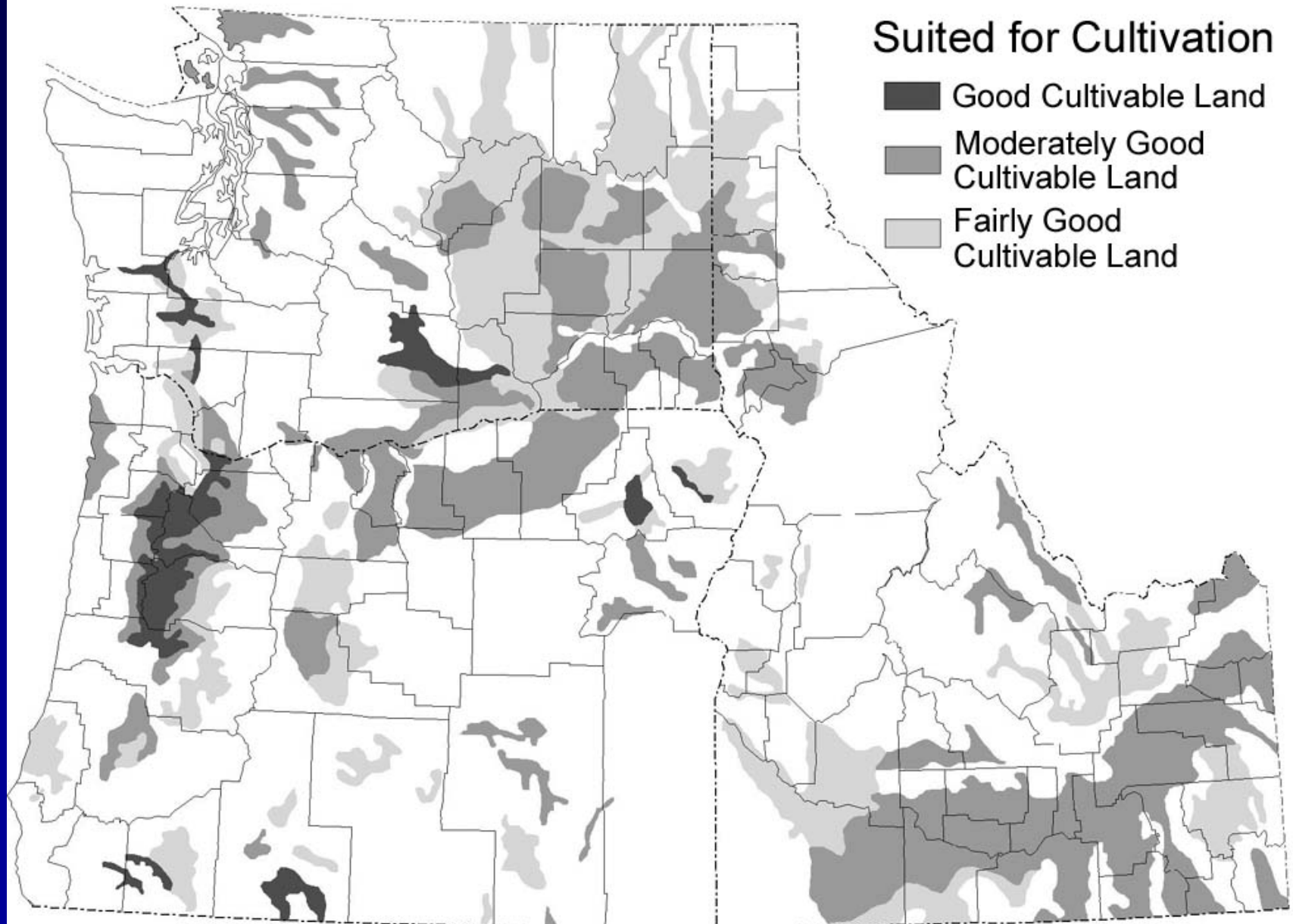
# Visual variables useful in quantitative mapping

Feature Type	Graphic Element			
	Size	Pattern Texture	Color Lightness	Color Saturation
Point	<p>Small ○ Low</p> <p>↓</p> <p>Large ○ High</p>	<p>Coarse [grid] Low</p> <p>↓</p> <p>Fine [grid] High</p>	<p>Light [light gray] Low</p> <p>↓</p> <p>Dark [dark gray] High</p>	<p>Pale Red [light red] Low</p> <p>↓</p> <p>Intense Red [dark red] High</p>
Line	<p>Medium</p> <p>Low [thin] High [thick]</p>	<p>Medium</p> <p>Low [thin] High [thick]</p>	<p>Medium</p> <p>Low [light] High [dark]</p>	<p>Medium</p> <p>Low [light] High [dark]</p>
Area	<p>High [tall] Medium [medium] Low [short]</p>	<p>Medium</p> <p>High [coarse] Low [fine]</p>	<p>Medium</p> <p>High [dark] Low [light]</p>	<p>Medium</p> <p>High [dark] Low [light]</p>

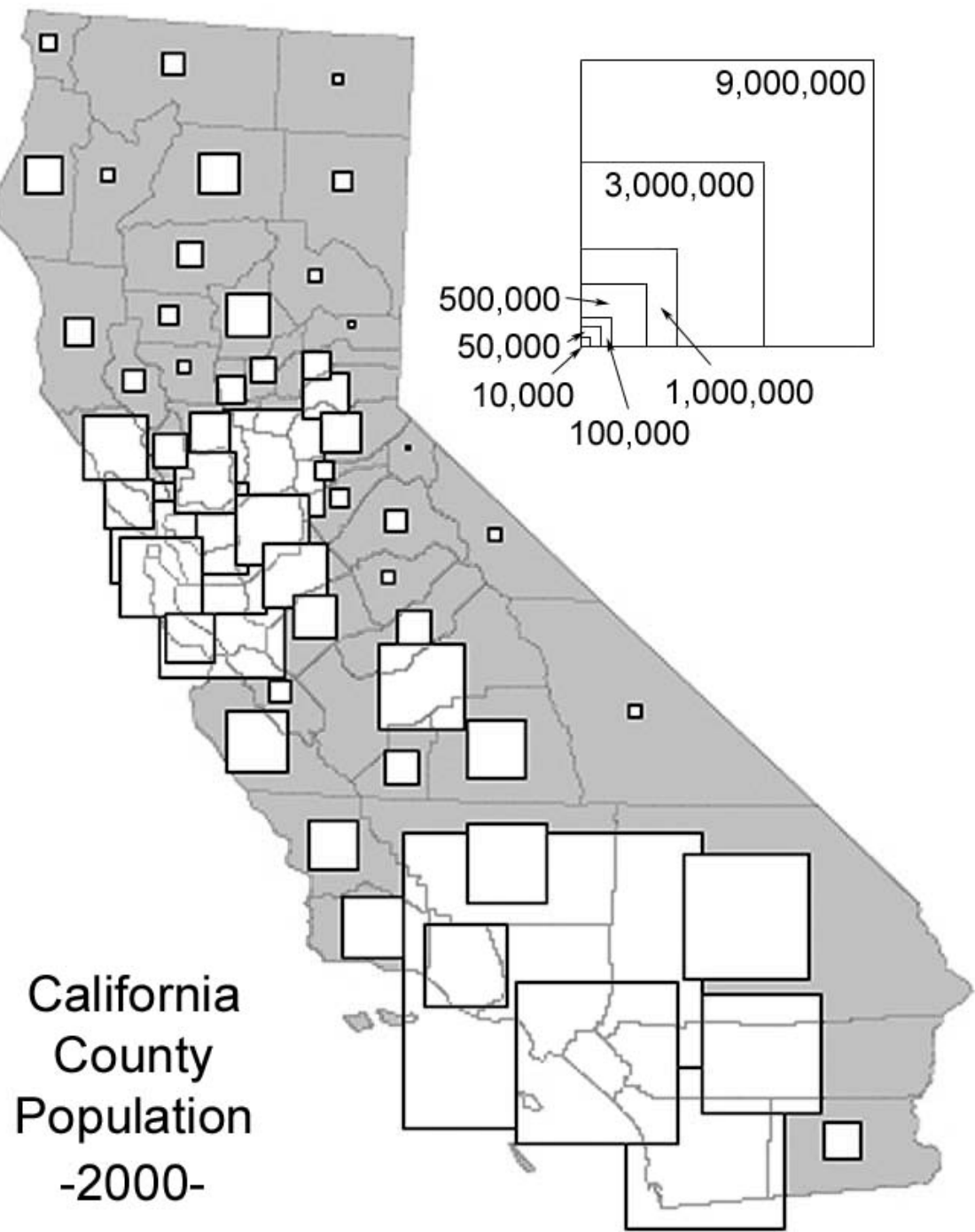
# Measurement scale & visual variable?



# Land Capability Classes

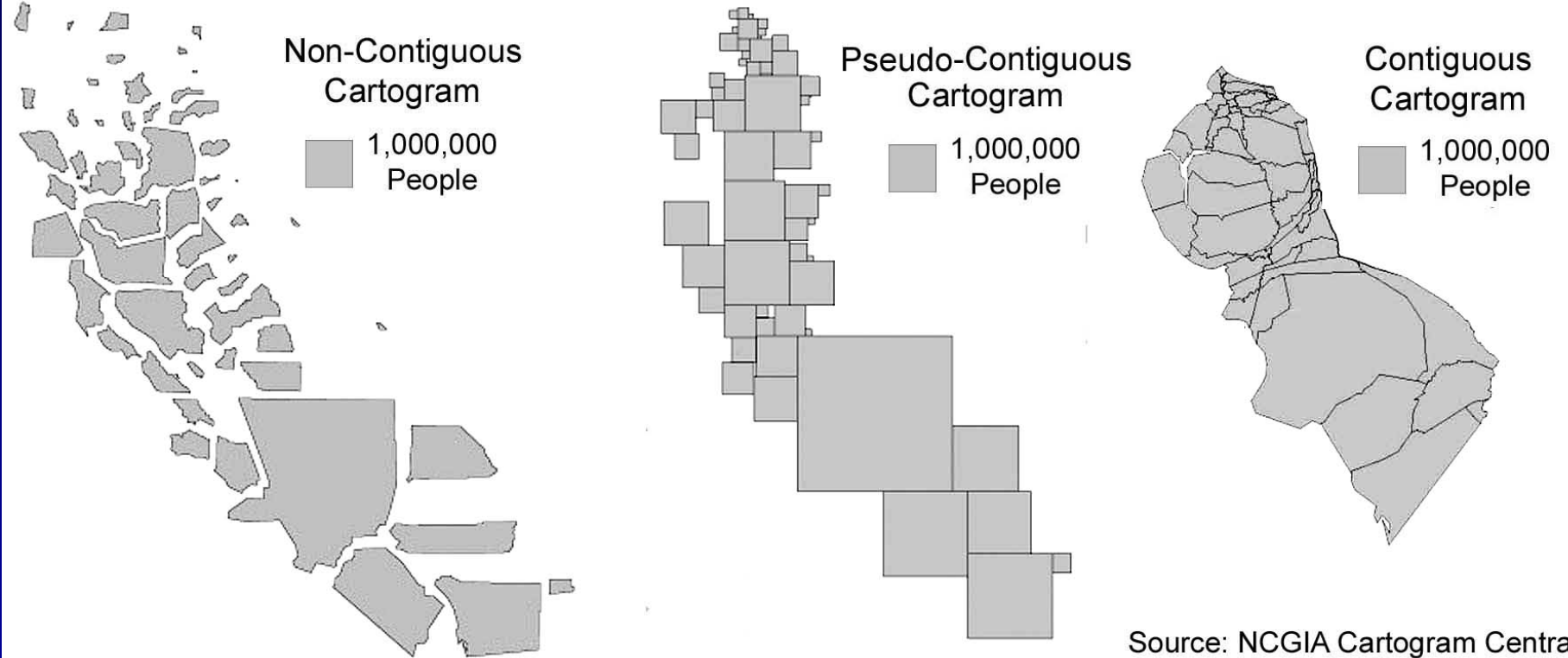






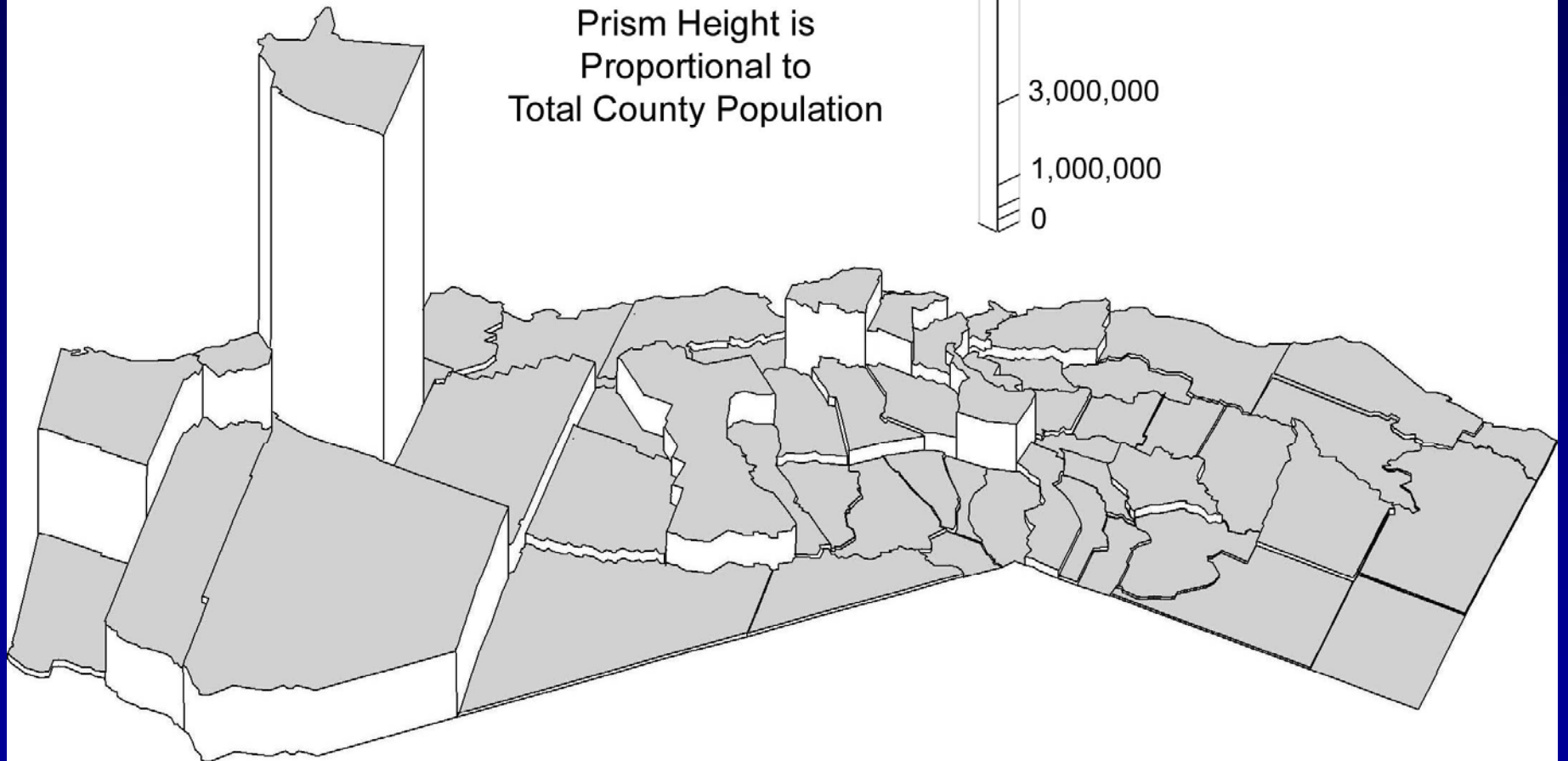
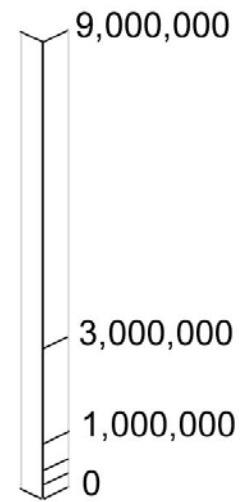
California  
County  
Population  
-2000-

## California County Population Cartograms From 2000 Census Data



# California County Population -- 2000

Prism Height is Proportional to Total County Population



# California City Safety

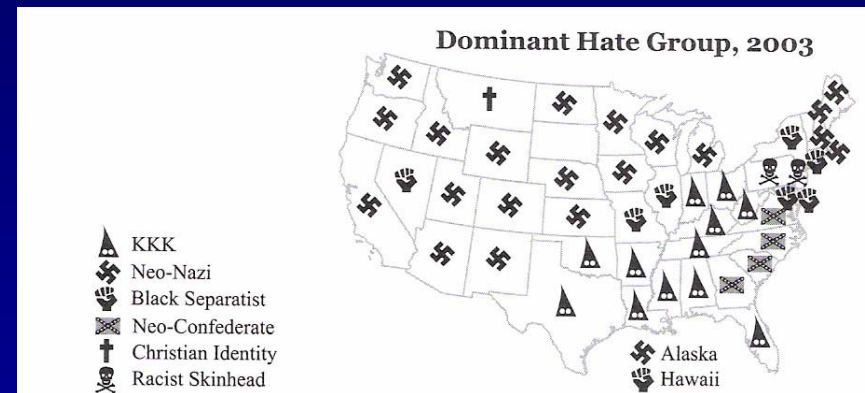
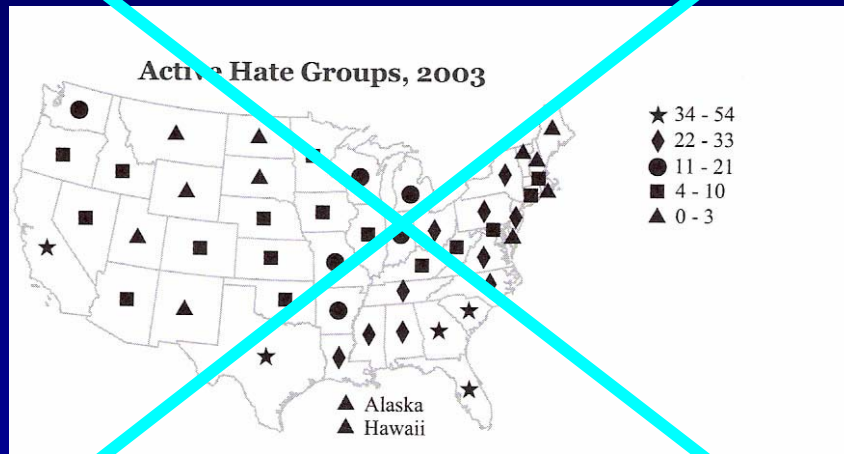
-cities over 75,000-

- Safest
- Less Safe
- ◐ Safe
- Least Safe



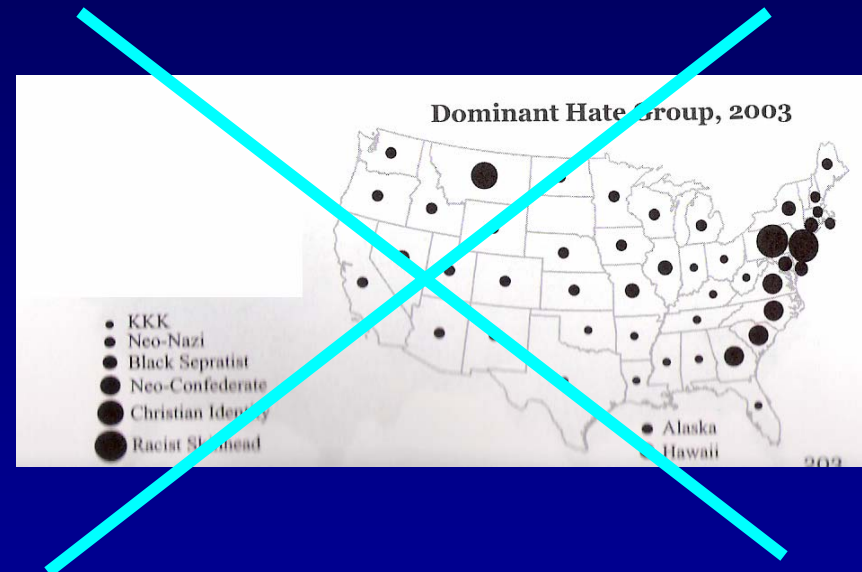
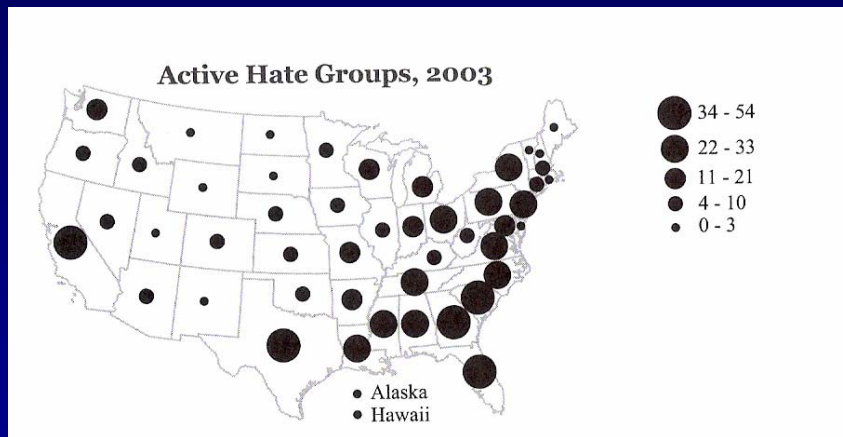
# Use of visual variables – shape

which figure uses shape poorly?



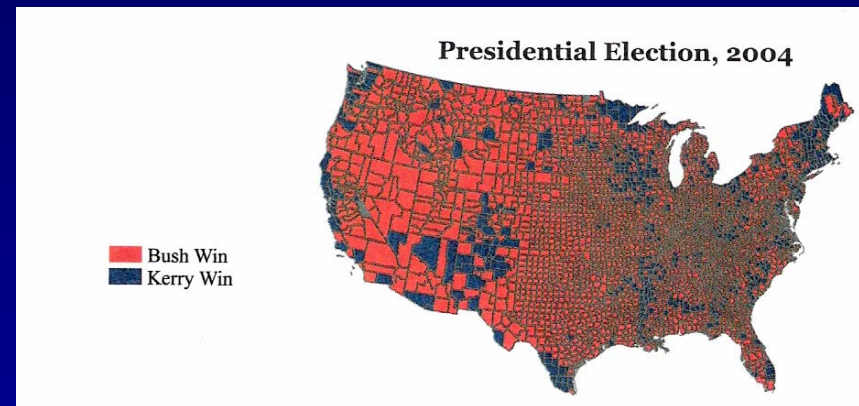
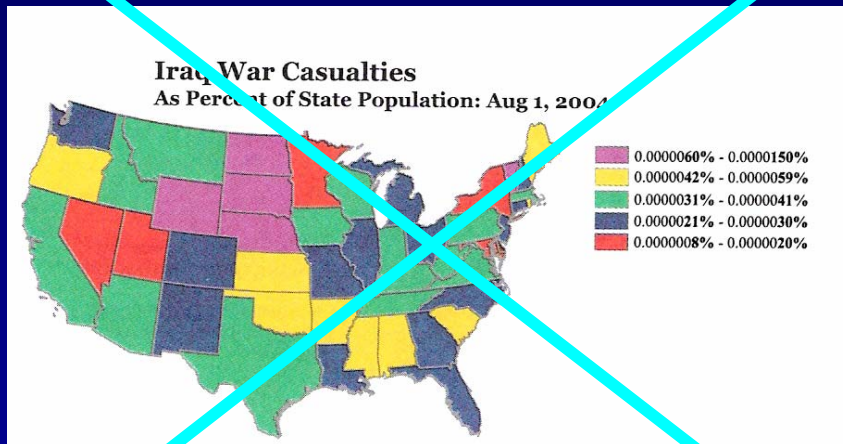
# Use of visual variables – size

which figure uses size poorly?

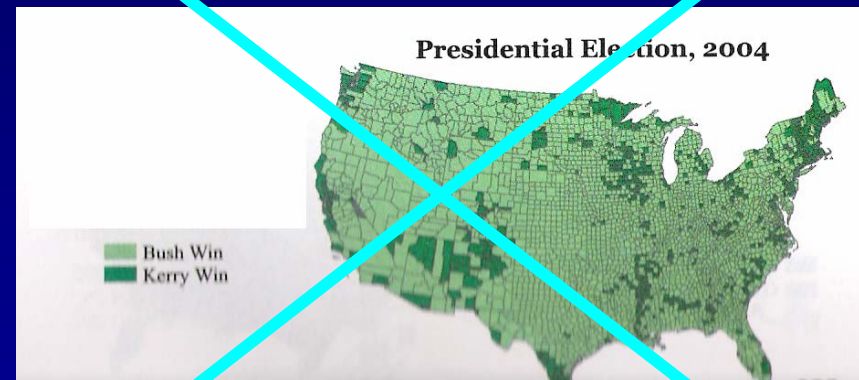
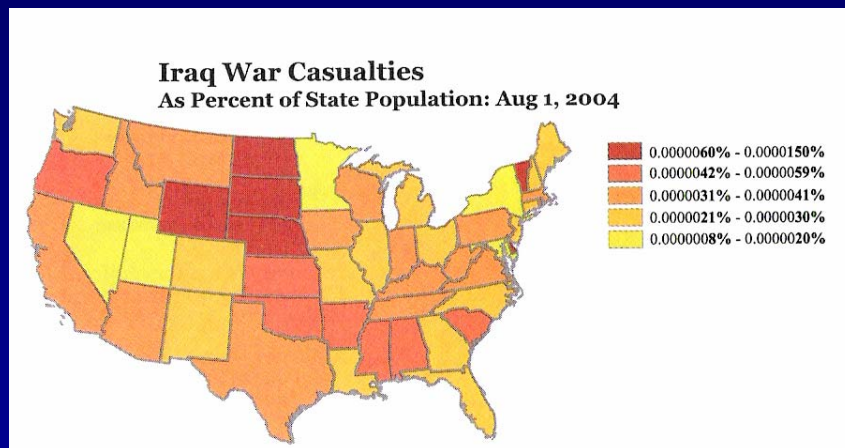


# Use of visual variables – color hue

which figure uses hue poorly?



# Use of visual variables – color value which figure uses value poorly?





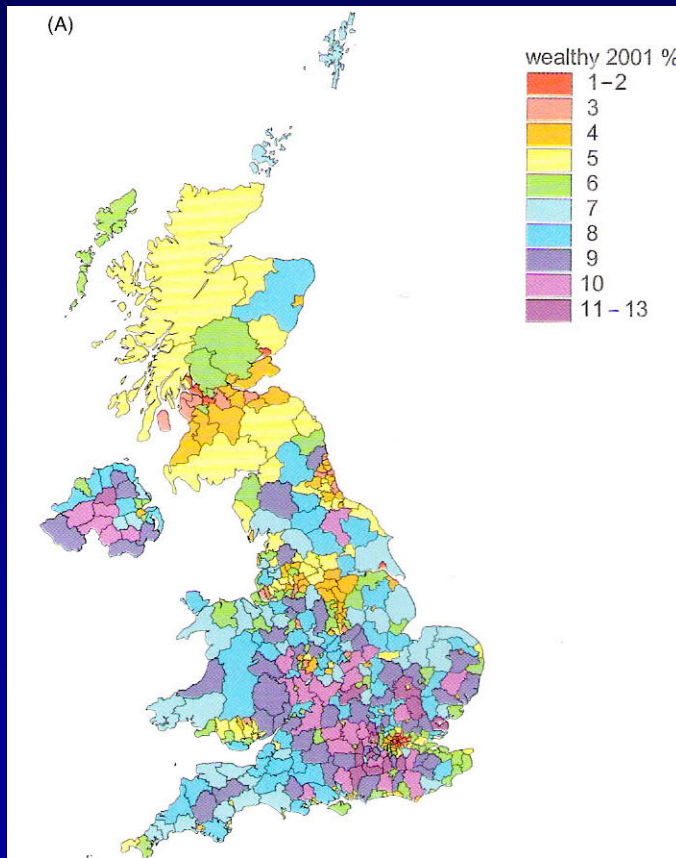
# Comparison of thematic maps - visual variables -

- Dot map
  - Numerosity of dots represents data value magnitudes
- Choropleth map
  - Lightness (color value or pattern texture) represents data value magnitudes
- Proportional symbol map
  - Size of symbol represents data value magnitudes

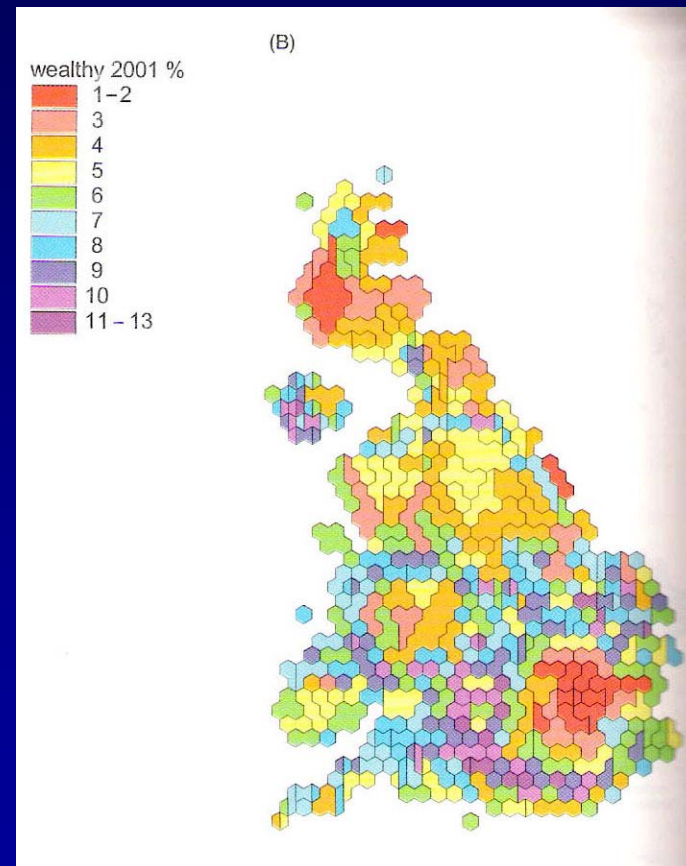
# Comparison of thematic maps - limitations -

- See four maps in Figure 4.9, and discuss limitations of each mapping technique
- So what would you suggest as important criteria in selecting the appropriate map?

# The effect of varying areal size on map interpretation

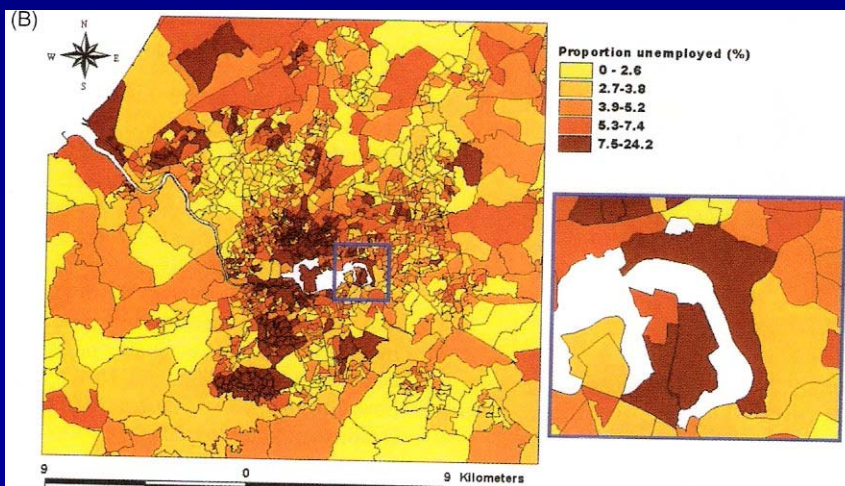
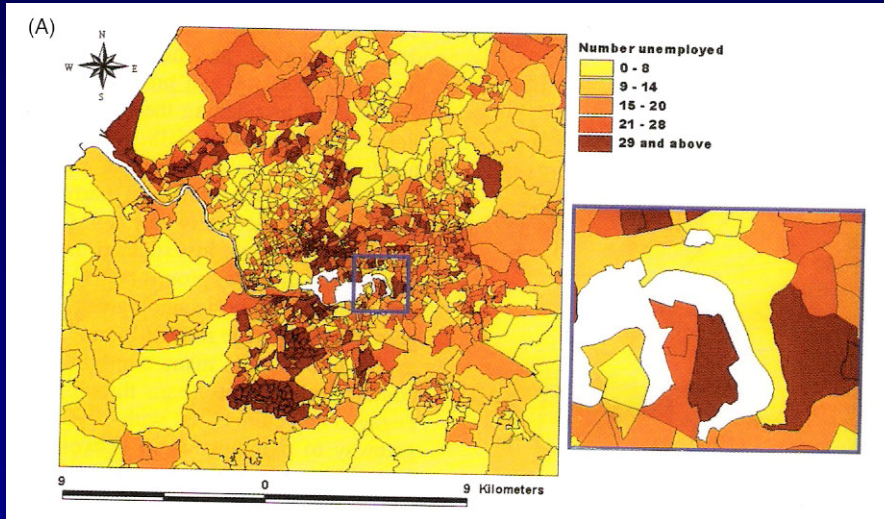


Choropleth map



Cartogram

# Using standardized value is not without a problem



# Selecting an appropriate map

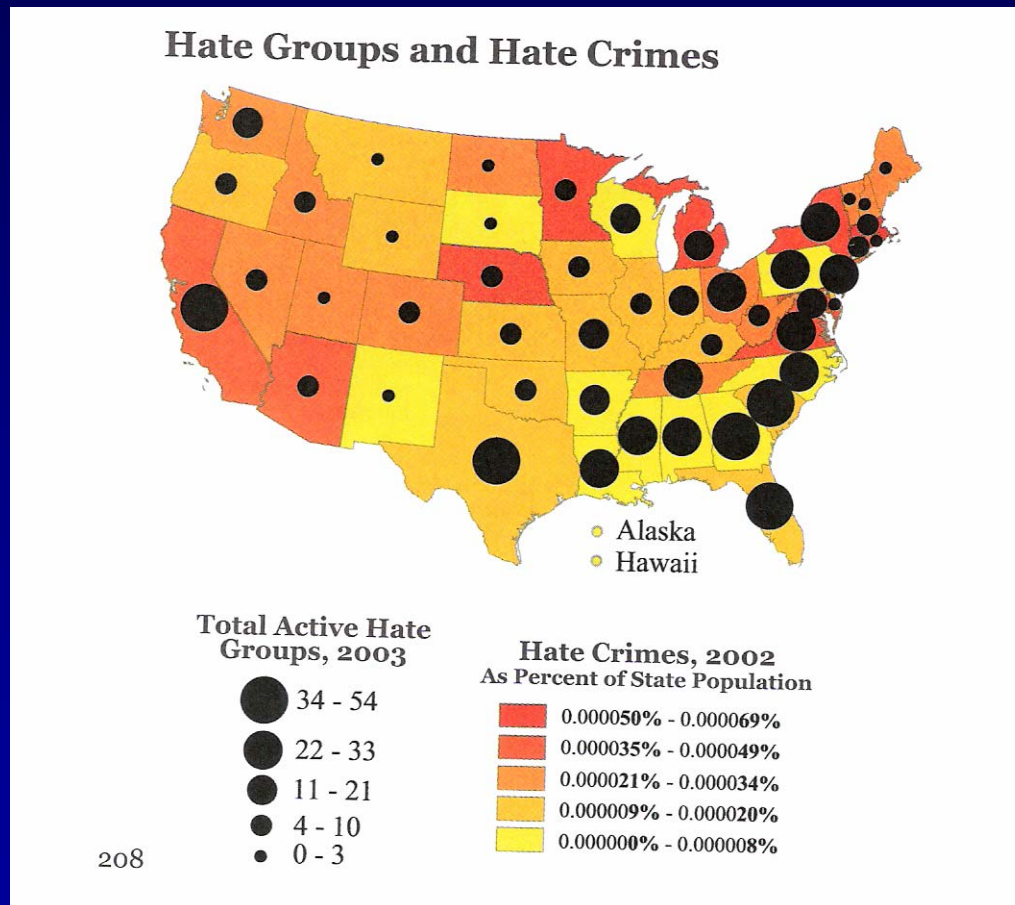
- Depends on
  - The nature of the underlying phenomenon
  - The purpose for making the map

	Abrupt	Smooth
Discrete	Proportional symbol	Dot
Continuous	Choropleth	Isarithmic

Government agency may be interested in comparing values between enumeration units, then choropleth map will be fine

Demographic analysts may be interested in overall pattern of demographics, then isarithmic map will be fine

# Bivariate mapping



Where color value is used to represent standardized value with choropleth map, and size is used to represent total counts with proportional symbol map

# Cookbook approach to mapping sustainability indicators

- Find out
  - measurement scale
  - spatial data type
  - nature of geographic phenomenon
- Apply the knowledge:
  - models of geographic phenomenon
  - principles of map symbolization
- Given other factors – map purpose, intended audience and constraints
- Also note design considerations for effective map presentation

# Exercises:

Given measurement scale, spatial data type, and nature of phenomenon, choose map type and symbolization

- Social: Floor area per person by country
- Economic: Vehicle Miles Traveled by city on the U.S. map
- Environmental: Emission of greenhouse gases around the globe

Indicators of sustainable development

[http://www.un.org/esa/sustdev/natlinfo/indicators/isdms2001/table\\_4.htm](http://www.un.org/esa/sustdev/natlinfo/indicators/isdms2001/table_4.htm)



# ICD3: Map Symbolization

Time	Activities
9:55-10:00	Three persons form one group
10:00-10:05	Write essay on the question
10:05-10:10	“Written comment”
10:10-10:15	“Verbal comment”
10:15-10:20	Wrap-up