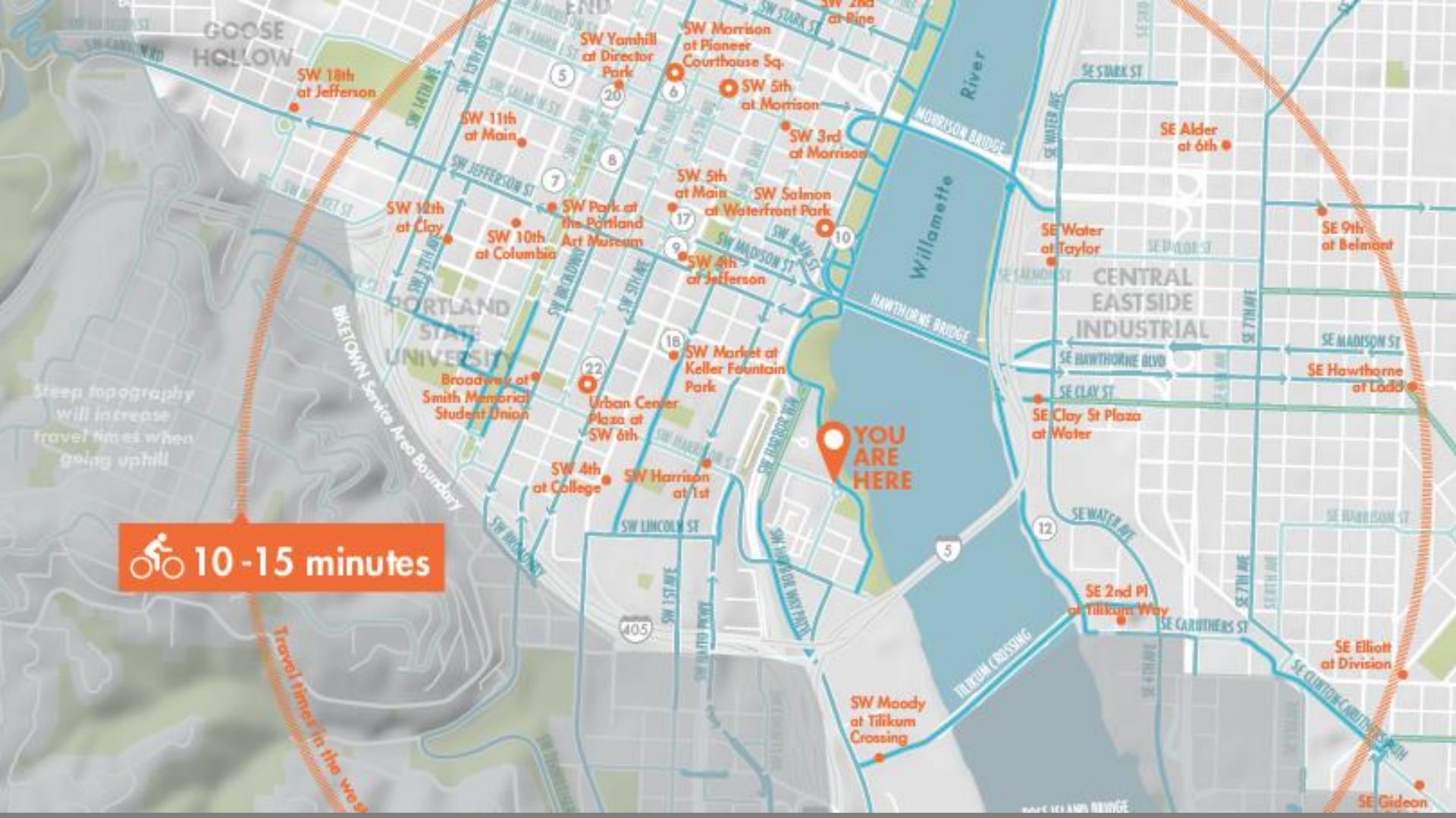


MAP SYMBOLS

Cartographic Design & Principles| Winter 2018

Cave
Small Muslim Shrine or Tomb
Patrol Route
Gantry Crane
Manholes along Sewer line
Oil Seepage
Thorny Scrub
Pigeon Roost
Demolished Building
Forest Ranger's House
Stone Mosque
Train Roundhouse and Track
Fishing Stakes
Shipwreck
Fenced Fuel Tanks
Dry Dock
Semaphore Signal
Essential Oil Plants
Fir Tree Landmark
Tank Trap
Common Grave
Fog Station
Whirlpool
Trigonometrical Point on Burial Mound
Gas Drip Manhole
Cairn
Corduroy Road
Stone or Brick Wall
Ruins
Bunker
Log Chute
Railroad Ferry
Moss and Grass
Pine or Cedar Landmark
Birch Grove
Winter Road
Casuarina
Marabout
Cattle Run
Wooden Windmill
Overland Oil Pipe & Station
Post Relay Center
Prospect Well
Radio Station
Forest Service Station
Kilometer Post
Narrow Gauge Railroad
Tent

Map Symbols – A way of thinking

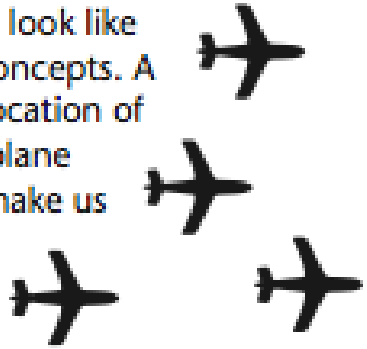
- Everything on a map is a symbol
  - Text or graphic or conceptual

Map Symbols | Resemblance

Symbols that look like a phenomenon

Resemblance

Some map symbols look like particular data or concepts. A map showing the location of airports uses an airplane symbol. Airplanes make us think of airports.



Maps in a war atlas use red explosion symbols to show the location of battles. The symbol looks like an explosion, and we think of danger or conflict.

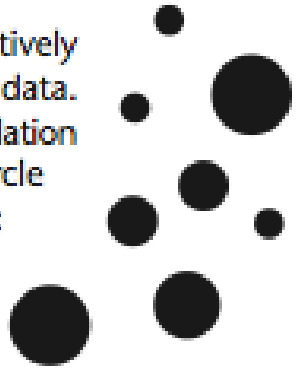
Map Symbols | Relationship

Quantitative data symbols can show changes in population, using different size circles

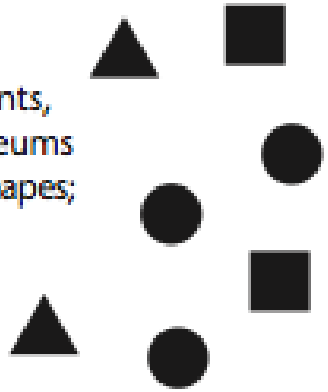
Qualitative data symbols can differentiate a variety of data with shapes

Relationship

Some map symbols intuitively suggest general kinds of data. A map showing the population of different cities uses circle sizes from small to large: sizes vary in amount, as do the data.



A map showing restaurants, antique stores, and museums in a town uses different shapes; shapes vary in kind, as do the data.

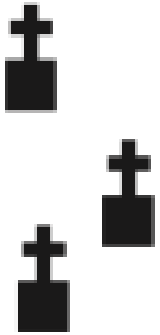


Map Symbols | Convention

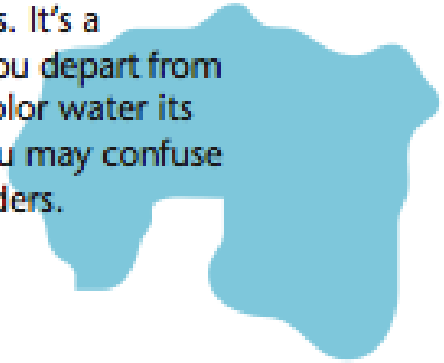
Water is blue; County boundaries are dashed or dot-dashed black lines over gray bar

Convention

Of course, all map symbols are symbols by convention. But this is particularly clear when symbols reveal cultural bias or don't resemble what they symbolize. The U.S. Geological Survey uses a Christian cross to symbolize all places of worship – church, mosque, synagogue. Fail!



Most maps use blue for water. But water is not usually blue. Except on maps. It's a convention. If you depart from conventions (color water its actual color) you may confuse your map's readers.



Map Symbols | Unconvention

Historic maps, artistic maps, modern maps – all use unconventional map symbols

Unconvention

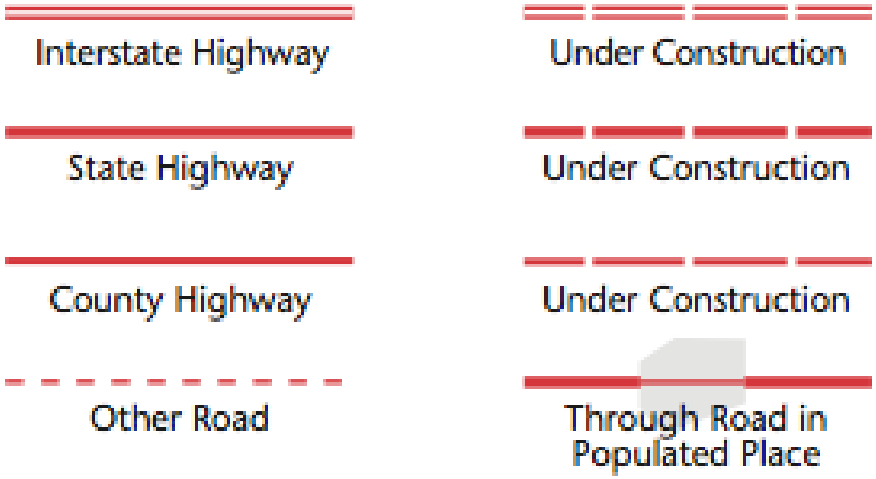
Old maps reveal startling, unconventional map symbols, often conventions of the past. This 17th-century Russian map contains very unconventional symbols for trees, rivers, and properties.

Map Symbols | Difference

Symbols can be used to create visual differentiation between features on a map

Difference

All symbols work by being different from other symbols. But some symbols can be developed from others by using a process of visual differentiation.



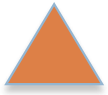
Map Symbols | Standardization

Reduce ambiguity through a shared set of common map symbols

Standardization

Isotype consists of a series of "universally communicable" symbols. Such standards aim to reduce ambiguity through a shared set of common map symbols.

Symbols| Graphics & Concepts

- Symbols are graphics on a map that represent a concept
  -  to represent a grocery store
- Symbols are concepts tied to a graphic on the map
  - How public funds are distributed throughout the US

Quantitative & Qualitative

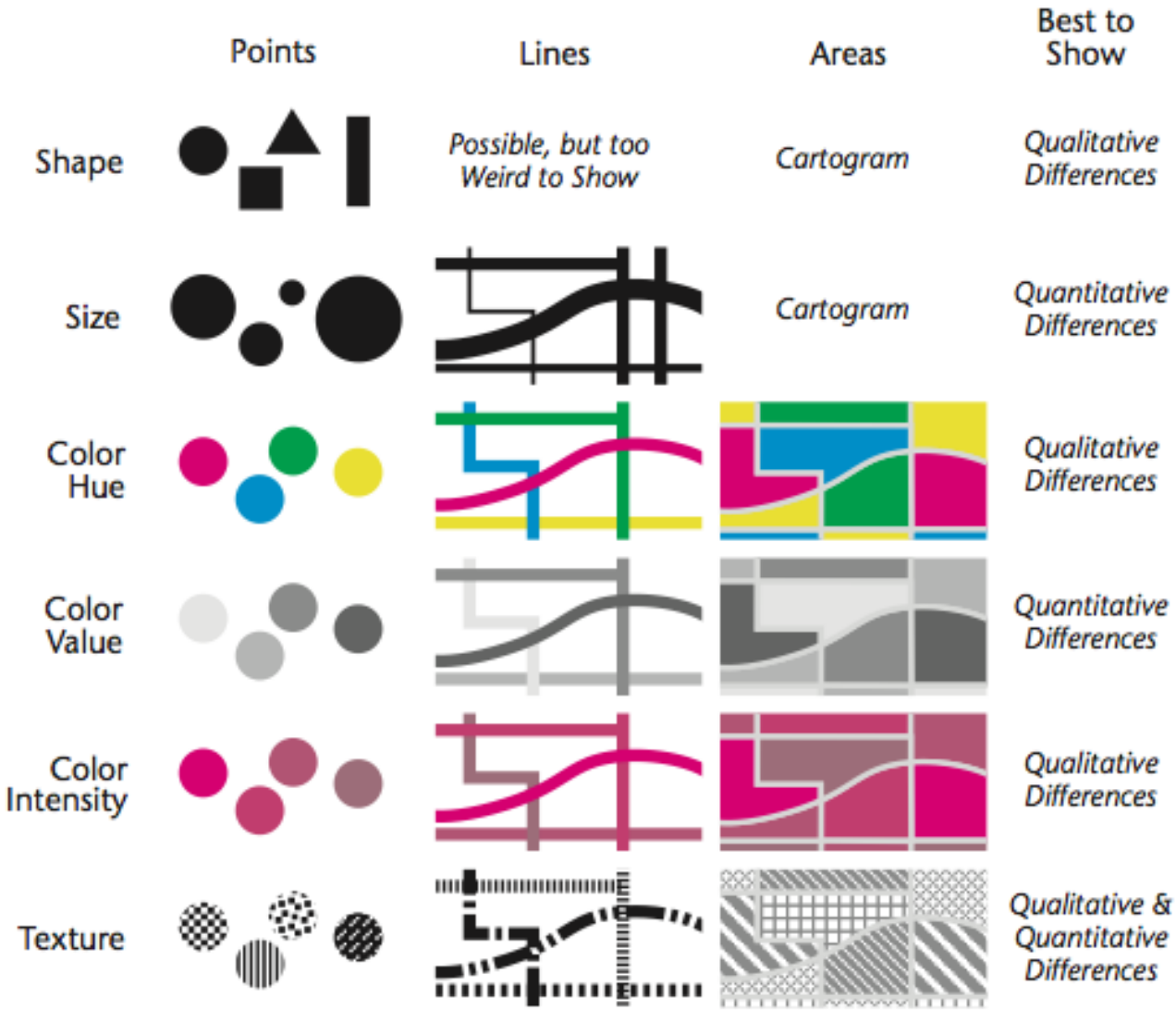
Qualitative v. Quantitative

- Land-use
- Population
- Religious affiliation
- Tree Height
- Animal or plant species
- Park types
- Murder rate
- Temperature

Qualitative v Quantitative

- Hue
- Shape
- Orientation
- Pattern arrangement
- Size
- Lightness / value
- Pattern spacing

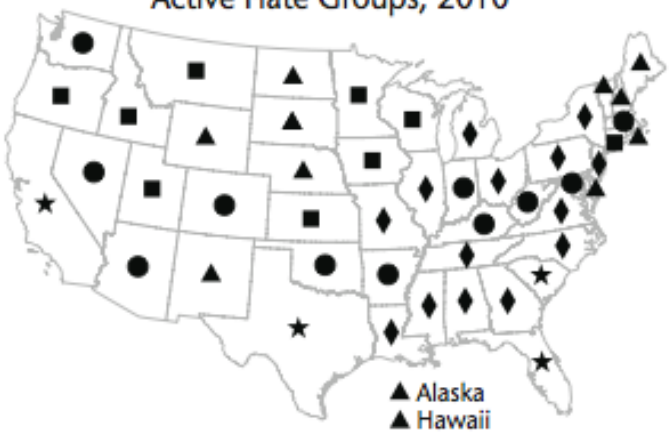
Qualitative v. Quantitative



Shape

☹ use of shape

Active Hate Groups, 2010



★ 41 – 84
♦ 21 – 40
● 11 – 20
■ 5 – 10
▲ 0 – 5

Shape is a poor choice for showing *quantitative* data. Using shape makes it hard to see the patterns on the map, as the symbols do not suggest the order (low to high) in the data.

☺ use of shape

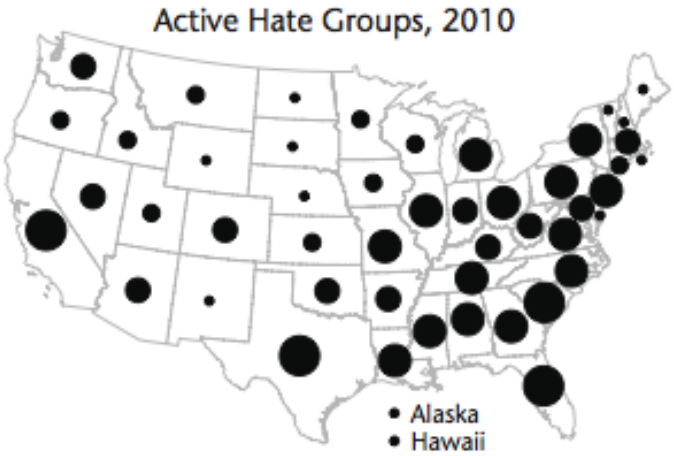
KKK
Neo-Nazi
Black Separatist
Neo-Confederate
Christian Identity
Racist Skinhead

Shape is a good choice for showing *qualitative* data. Different shapes suggest the qualitatively different groups.

Dominant Hate Group, 2010

Size

use of size



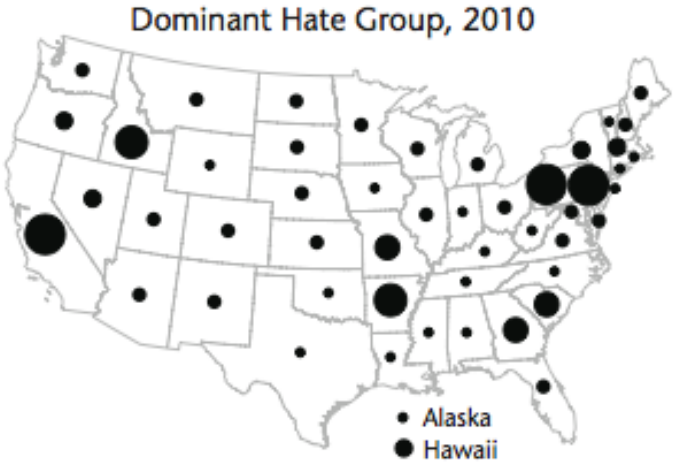
41 – 84
21 – 40
11 – 20
5 – 10
0 – 5

Size is a good choice for showing *quantitative* data. The use of one symbol varying in size parallels the order in the data.

use of size

- KKK
- Neo-Nazi
- Black Separatist
- Neo-Confederate
- Christian Identity
- Racist Skinhead

Size is a poor choice for showing *qualitative* data. Different sizes suggest order in the data rather than the qualitatively different groups.

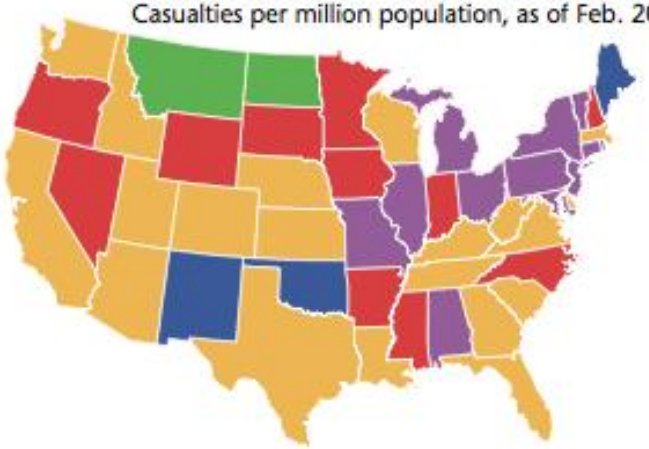


Color Hue

use of color hue

Total Iraq & Afghanistan War Casualties

Casualties per million population, as of Feb. 2010



- 80 – 230
- 42 – 79
- 26 – 41
- 13 – 25
- 16 – 12

Hue is a poor choice for showing *quantitative* data. Using hue makes it difficult to see the patterns on the map, as the colors do not suggest the order (low to high) in the data.

use of color hue

- McCain Win
- Obama Win

Color hue is a good choice for showing *qualitative* data. Qualitatively different hues parallel the qualitatively different data.

Presidential Election, 2008

Color Value

use of color value

Total Iraq & Afghanistan War Casualties

Casualties per million population, as of Feb. 2010

80 – 230
42 – 79
26 – 41
13 – 25
16 – 12

Value is a good choice for showing *quantitative* data. The use of one hue varying in value parallels the order in the data.

use of color value

McCain Win
Obama Win

Color value is a poor choice for showing *qualitative* data. Values suggest an ordered difference, which is not appropriate for these data.

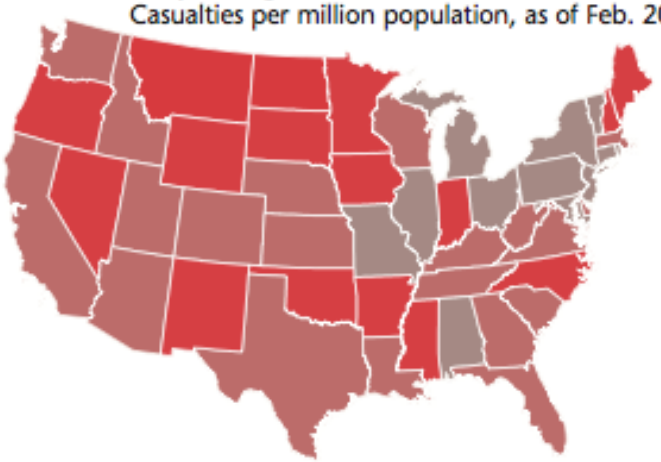
Presidential Election, 2008

Color Intensity

use of color intensity

Iraq & Afghanistan War Casualties

Casualties per million population, as of Feb. 2010



80 – 230
42 – 79
26 – 41
13 – 25
16 – 12

Intensity is a poor choice for showing *quantitative* data. Intensity may suggest order, but due to the lack of variation in value the sense of order is weak.

use of color intensity

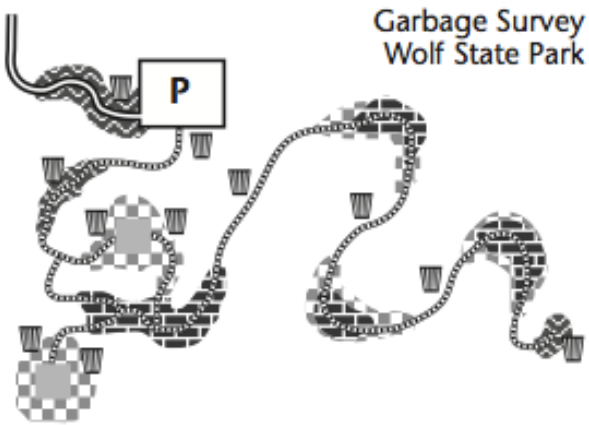
No African Americans
One or More African Americans

Intensity is a good choice for showing *binary* (yes/no) data. Intensity, like binary data, is neither qualitative nor quantitative.

African-American Absence, 2000

Texture

☹ use of texture



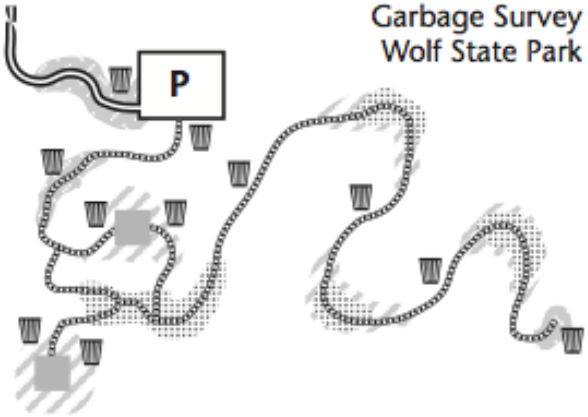
Cigarette Butts
Paper Debris
Glass & Cans

Textures can be visually noisy and imply ordered differences. Be careful with textures that look like something: glass and cans are shown with a brick pattern, which does not make sense.

☺ use of texture

Cigarette Butts
Paper Debris
Glass & Cans

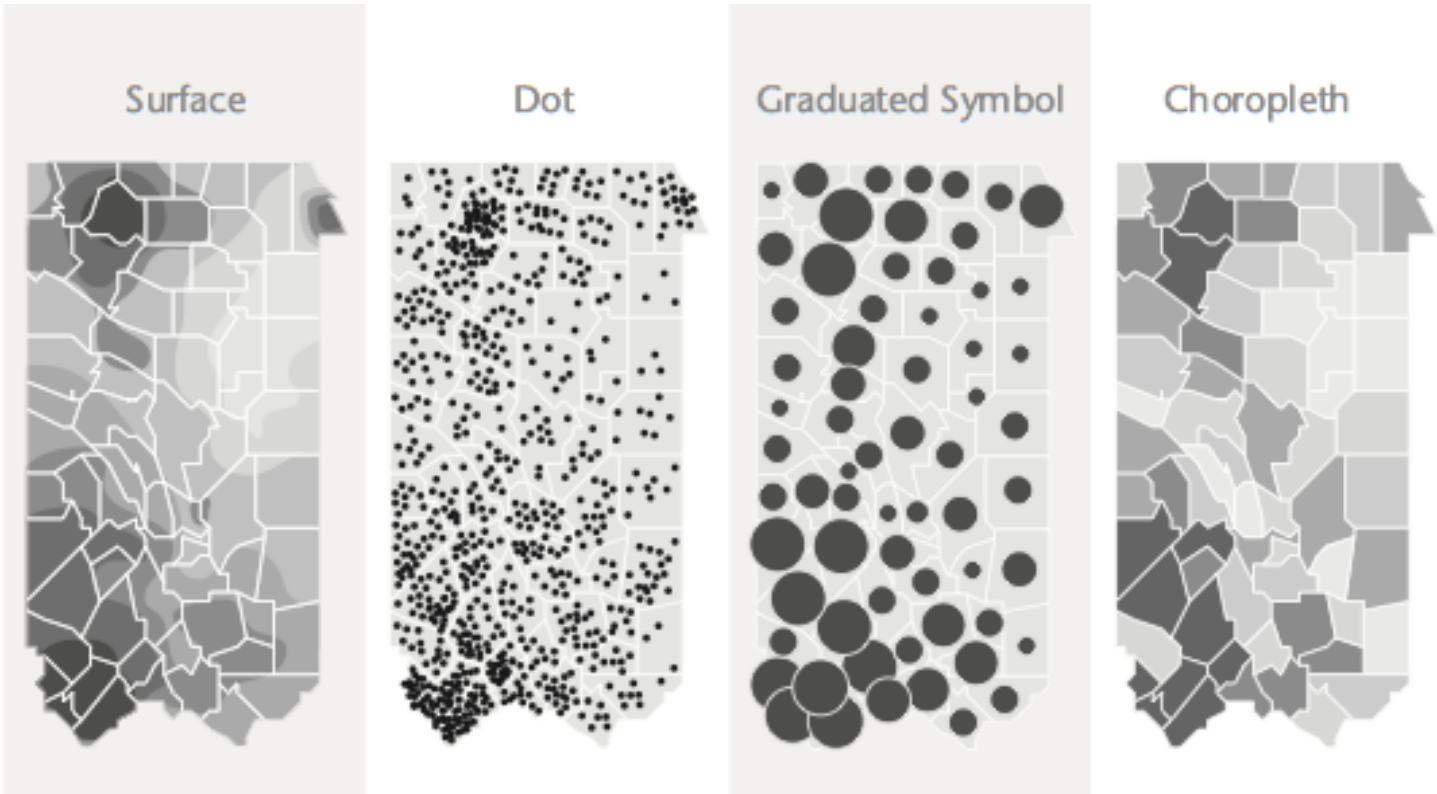
Texture can be good for showing qualitative data. Select textures that are not visually noisy and that suggest the qualitative differences in the data.



Symbolizing Quantitative Data

Aggregating data

- Typically, quantitative data is aggregated into geographic areas (counties, census tracts, states, etc)
- Methods for mapping aggregated data:
  - Choropleth
  - Graduated Symbol
  - Dot Density
  - Surface Density
  - Cartogram


Surface
Dot
Graduated Symbol
Choropleth

Choropleth

- Varies shading of each area based on a data value associated with that area
- Most common method of Quantitative thematic mapping
- Mapping raw data is not recommended when there is a large variation in the size of the geographic features (counties, cities, states, etc)
  - A larger state is likely to have more people

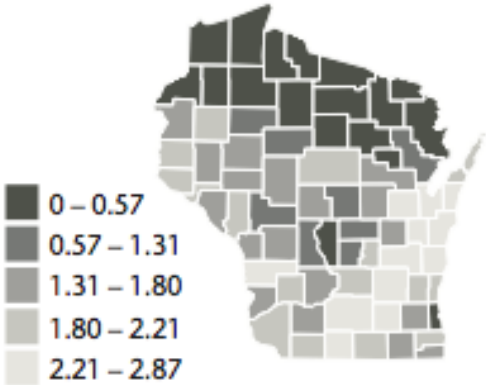
Choropleth

- Normalization is "the process of dividing one numeric attribute value by another to minimize differences in values based on the size of areas or the number of features in each area. For example, normalizing (dividing) total population by total area yields population per unit area, or density."

(GIS Dictionary)

☹ value and legend

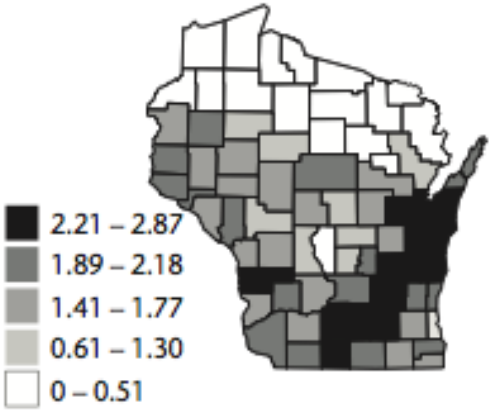
Wisconsin Farm Density



Dark means less is unconventional
Smaller values at legend top are unconventional
A continuous legend is used; there is no gap between class breaks, falsely suggesting that values span the full range of the class

☹ value and boundaries

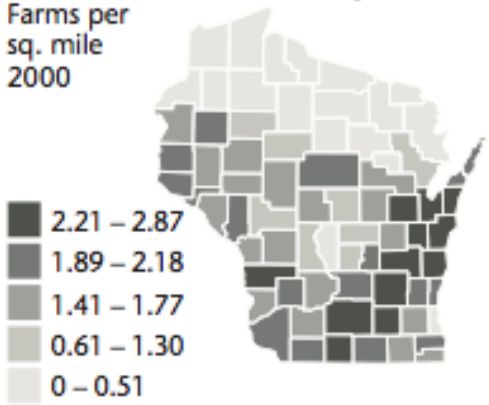
Wisconsin Farm Density



Black for top class blends with boundaries
White for bottom class suggests no data
Boundaries jump out too much

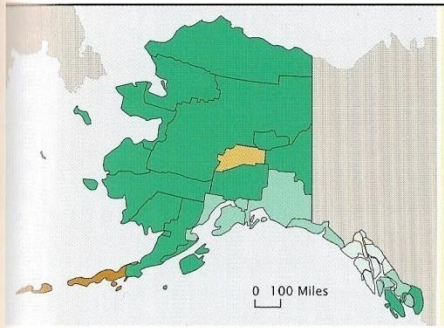
☺ value and legend and boundaries

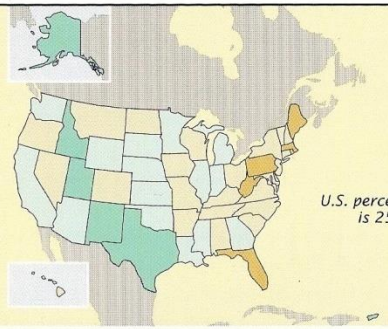
Wisconsin Farm Density
Farms per sq. mile
2000



Dark means more to most people
A noncontinuous legend provides an indication of the actual data variation in each class by showing the high and low value
Larger values at the legend top (high = more)
A title that explains the numbers in the legend
Overall smoother feel without black and white class shading, while removing the problems they cause
Boundaries less dominant but distinct

Percent Under Age 18, 2000





Percent of total population under age 18 by state

- 28.0 to 32.2
- 25.7 to 27.9
- U.S. percent is 25.7
- 24.0 to 25.6
- 20.1 to 23.9

Percent of total population under age 18 by county

- High proportion of young people: 30.0 to 46.6
- 28.0 to 29.9
- 25.7 to 27.9
- U.S. percent is 25.7
- 24.0 to 25.6
- 20.0 to 23.9
- Low proportion of young people: 2.0 to 19.9

0 100 Miles

0 100 Miles

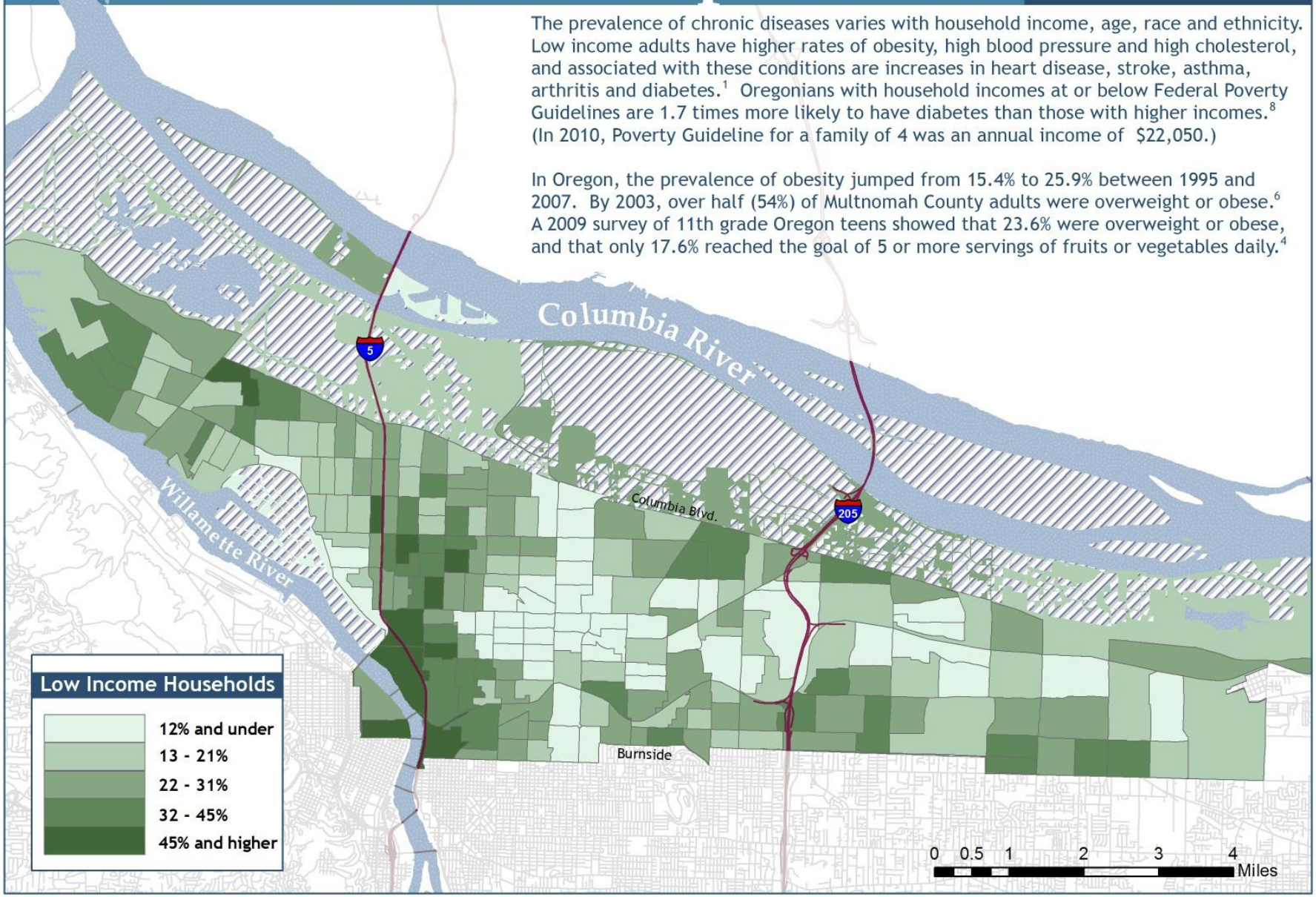
0 100 Miles

Data Source: U.S. Census Bureau, Census 2000 Redistricting Data (PL 94-171) Summary File.
Cartography: Population Division, U.S. Census Bureau.
American FactFinder at *factfinder.census.gov* provides census data and mapping tools.

Low-Income Population

The prevalence of chronic diseases varies with household income, age, race and ethnicity. Low income adults have higher rates of obesity, high blood pressure and high cholesterol, and associated with these conditions are increases in heart disease, stroke, asthma, arthritis and diabetes.[1] Oregonians with household incomes at or below Federal Poverty Guidelines are 1.7 times more likely to have diabetes than those with higher incomes.[8] (In 2010, Poverty Guideline for a family of 4 was an annual income of $22,050.)

In Oregon, the prevalence of obesity jumped from 15.4% to 25.9% between 1995 and 2007. By 2003, over half (54%) of Multnomah County adults were overweight or obese.[6] A 2009 survey of 11th grade Oregon teens showed that 23.6% were overweight or obese, and that only 17.6% reached the goal of 5 or more servings of fruits or vegetables daily.[4]



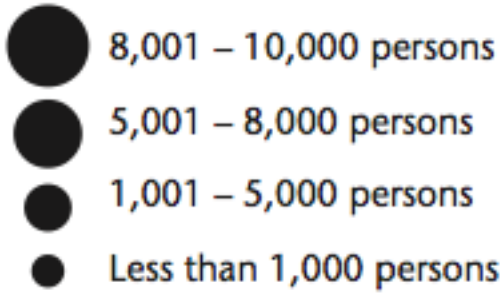
Demographic data from 2010 Census, and 2009 Census projections from Simply Map

Graduated Symbol

- Varies the size of a symbol centered on each area, for the data value associated with that area
- Mapping normalized (or derived) data is not recommended
  - Graduated symbols imply magnitude rather than density or rates

Graduated Symbol | Legend

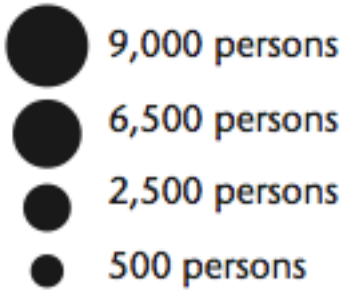
Classified Legend



Classified graduated symbol maps use standard classification schemes. Assign one symbol size for each class.

Less data detail
Easier to match particular symbol on map to legend
Easier to see distinct classes in data

Unclassified Legend



Unclassified graduated symbol maps scale each symbol to each value. Legend should include *representative* symbol sizes.

More data detail
Harder to match particular symbol on map to legend
Harder to see distinct classes in data

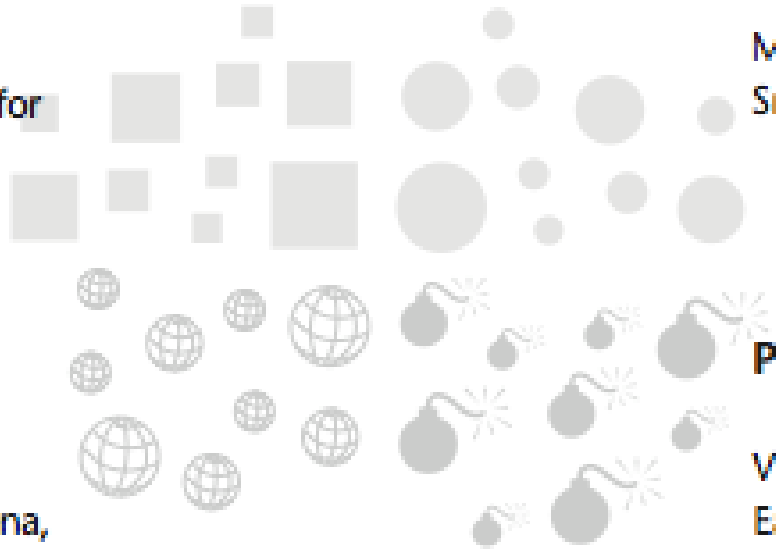
Graduated Symbols | Symbols

Squares, Triangles

Less compact symbol
Edgy visual impression good for edgy phenomena

Circles

More compact symbol
Smooth visual impression good for mellow phenomena



Volumetric Shapes

Visually attractive
Suggest volumetric phenomena, avoid these stinkers

Pictographic Shapes

Visually attractive
Easy to understand
Potentially cute and distracting

365 Obama
Electoral Votes
Projected Winner

0
undecided

173 McCain
Electoral Votes

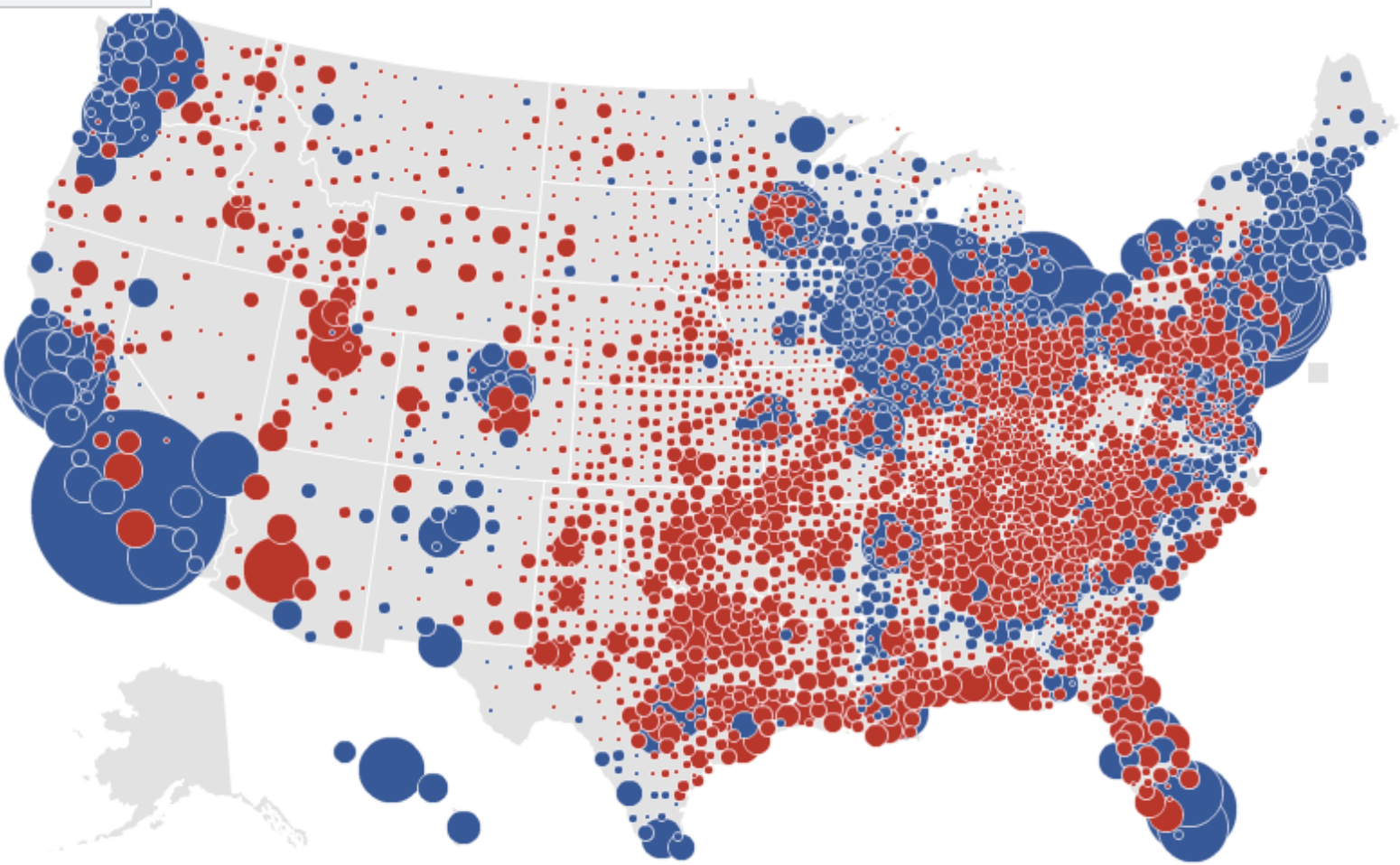
Popular vote: 66,862,039

270 needed to win

Popular vote: 58,319,442

- State winners
- **County bubbles**
- County leaders
- Voting shifts

ZOOM IN



Year

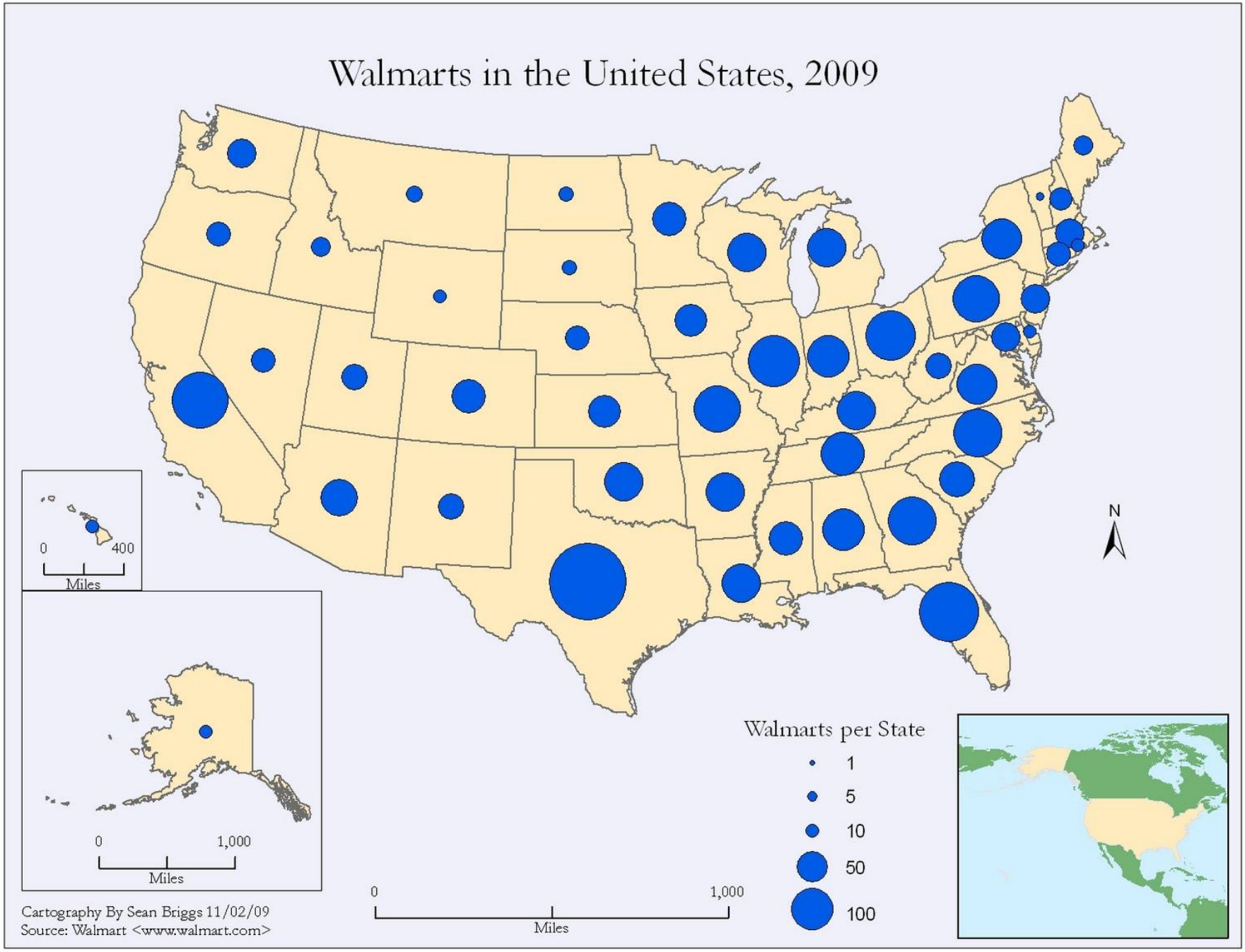
'08 '04 '00 '96 '92

Map key

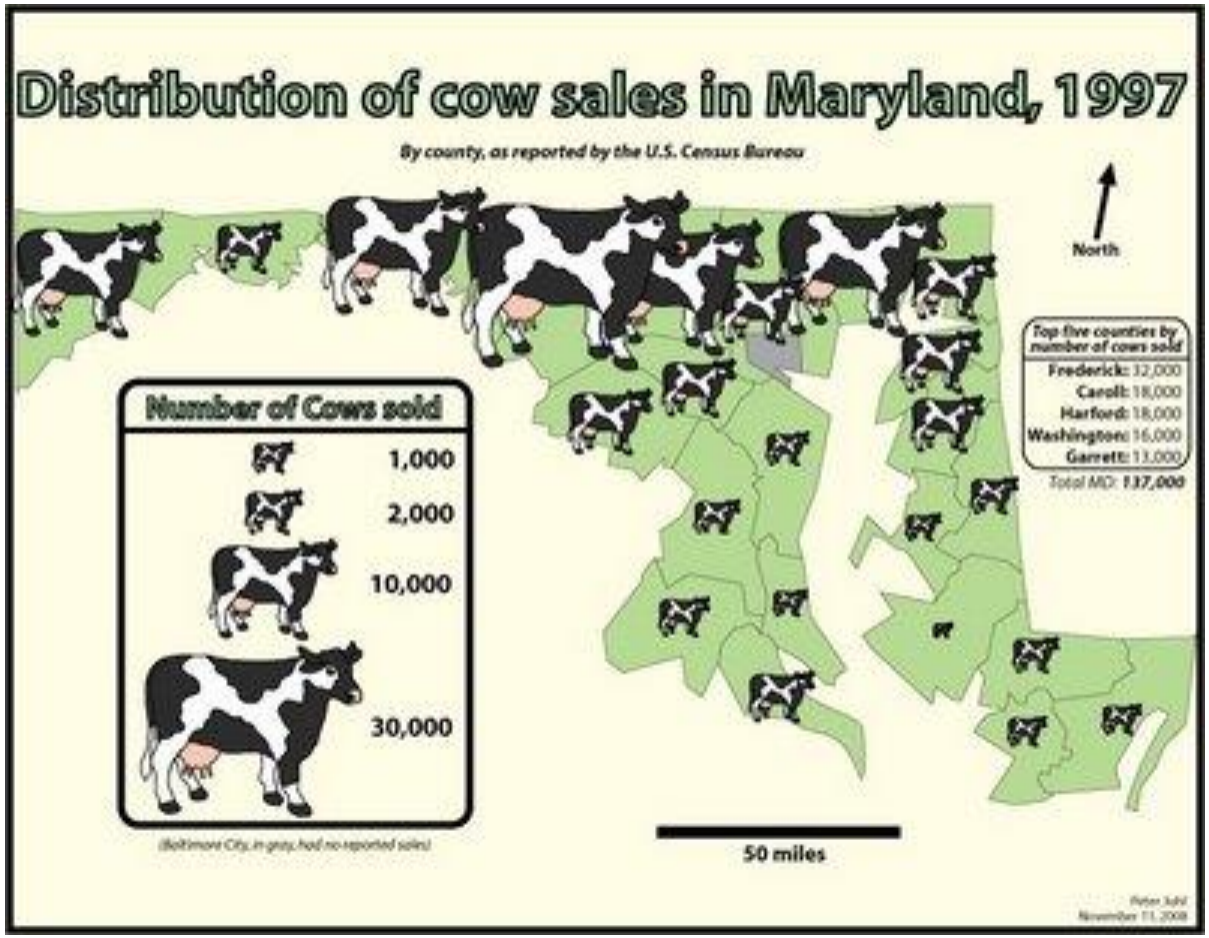
Circle size is proportional to the amount each county's leading candidate is ahead.

Larger Smaller

Walmarts in the United States, 2009

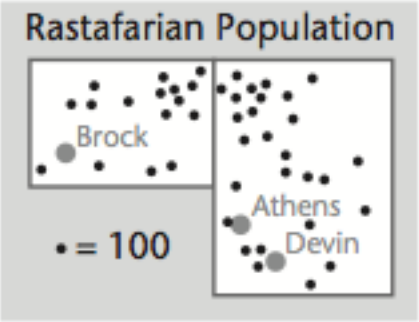


Cartography By Sean Briggs 11/02/09
Source: Walmart <www.walmart.com>

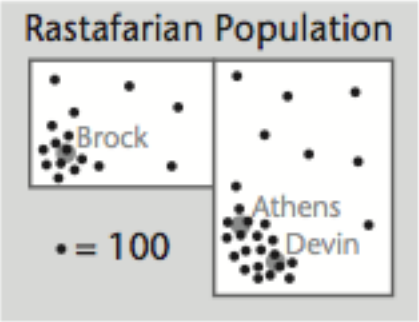

Distribution of cow sales in Maryland, 1997
By county, as reported by the U.S. Census Bureau
North
Number of Cows sold
1,000
2,000
10,000
30,000
(Baltimore City, in gray, had no reported sales)
50 miles
Top five counties by number of cows sold
Frederick: 32,000
Carroll: 18,000
Harford: 18,000
Washington: 16,000
Garrett: 13,000
Total MD: 137,000

Dot Density

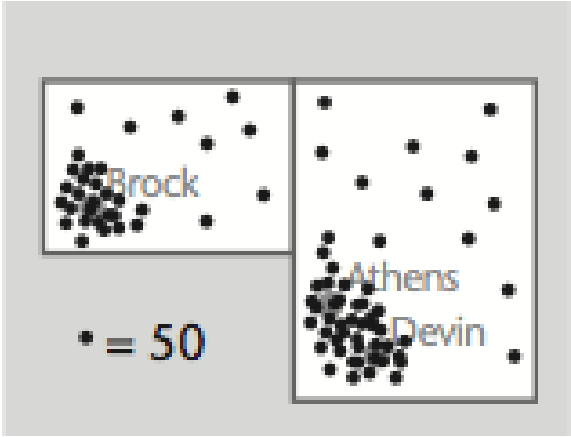
- Varies the number of dots in each area based on the data value associated with it
  - 1 dot = # of phenomenon
- By default, dots are placed randomly
- Mapping normalized or derived data is not recommended



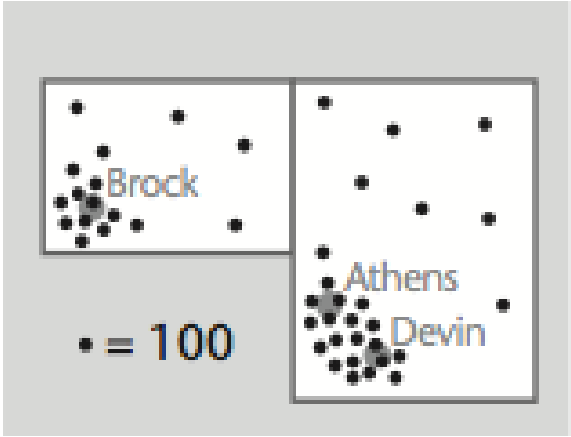
Dot placement should be guided by additional knowledge or filters in mapping software. Thus more of the dots are placed around urban areas than in rural areas.



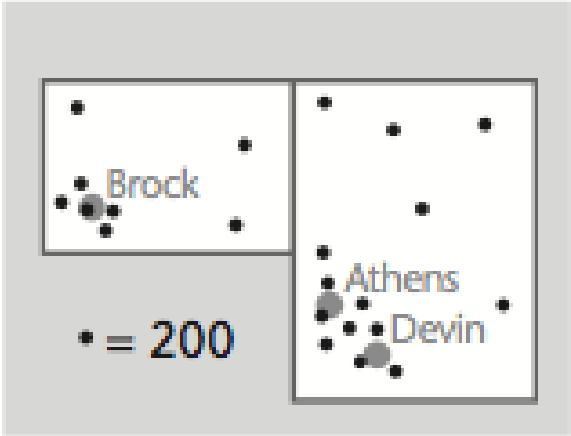
dot value (too dense)



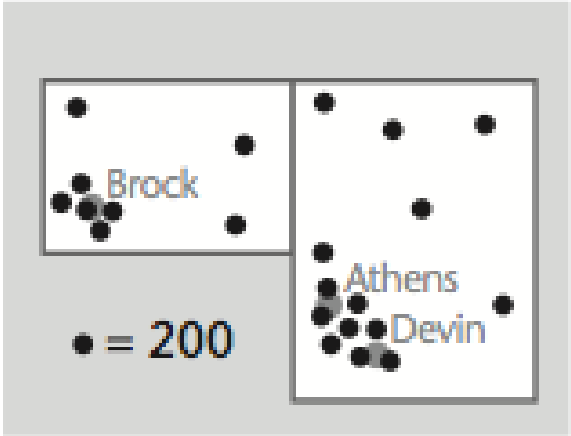
dot value (value changed)

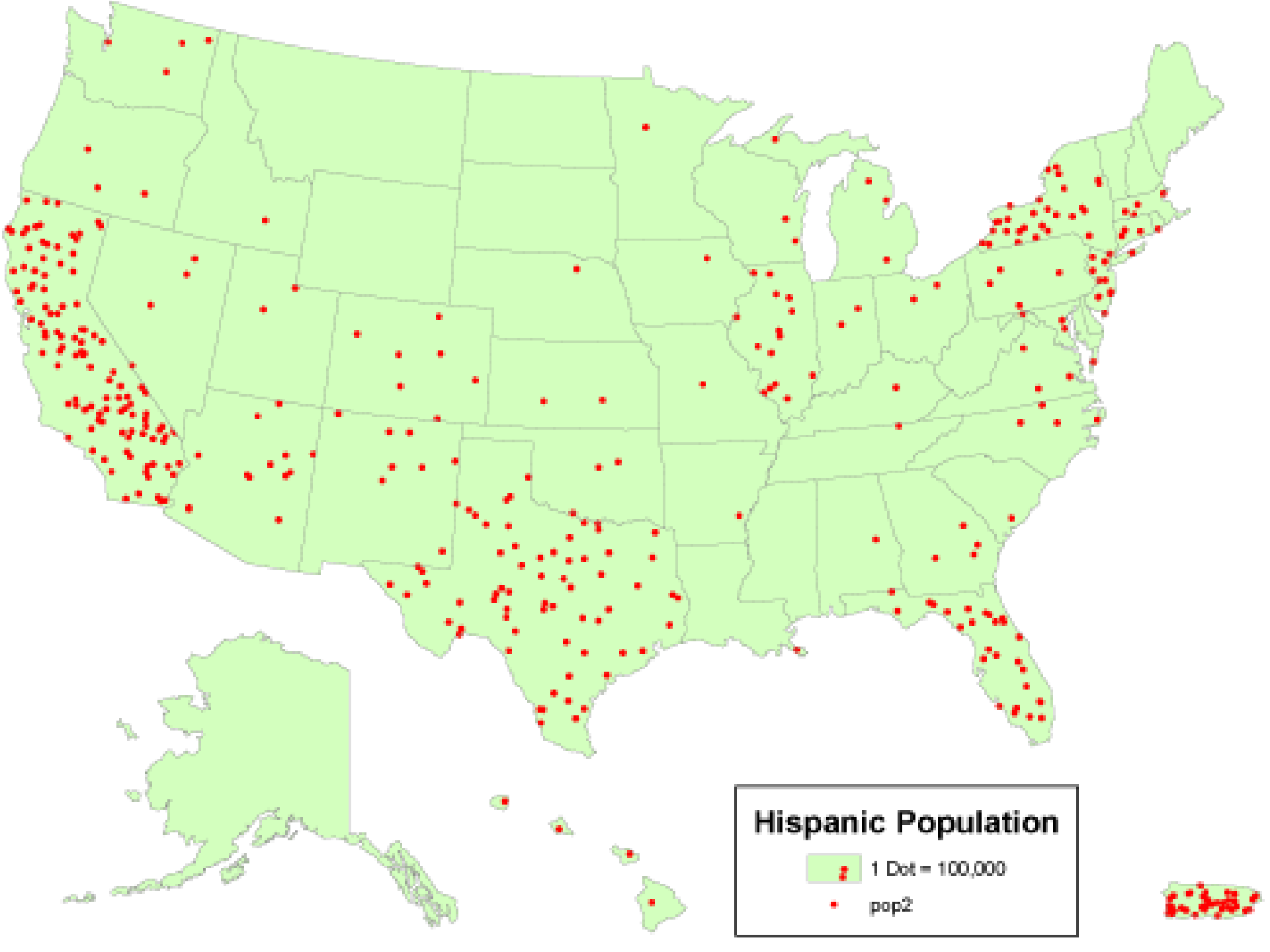


dot value (too sparse)



dot value (size change)

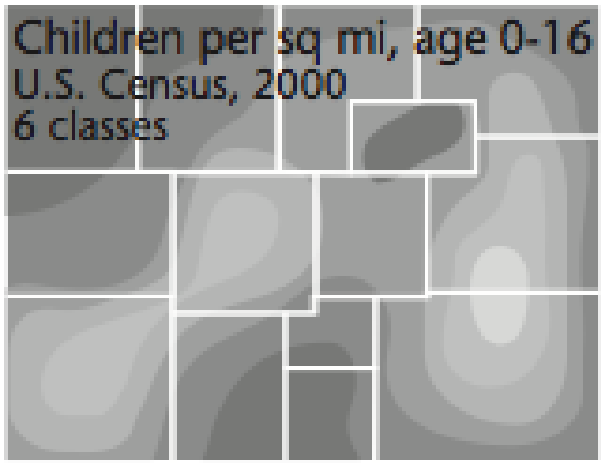



Hispanic Population
1 Dot = 100,000
pop2

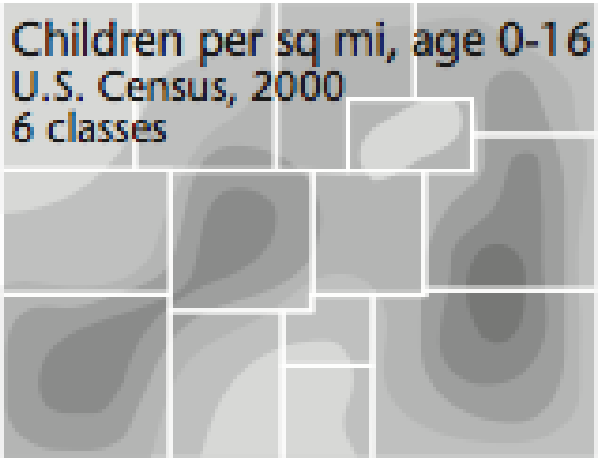
Density Surface

- Creates an abstract surface from the single data across the surface of your study area (also known as creating ‘hotspots’)
- Not recommended for mapping raw data

design (light = more)



design (dark = more)

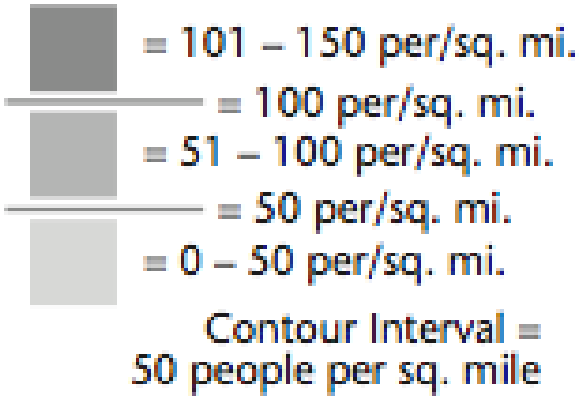


Surface Map: Legend

legend

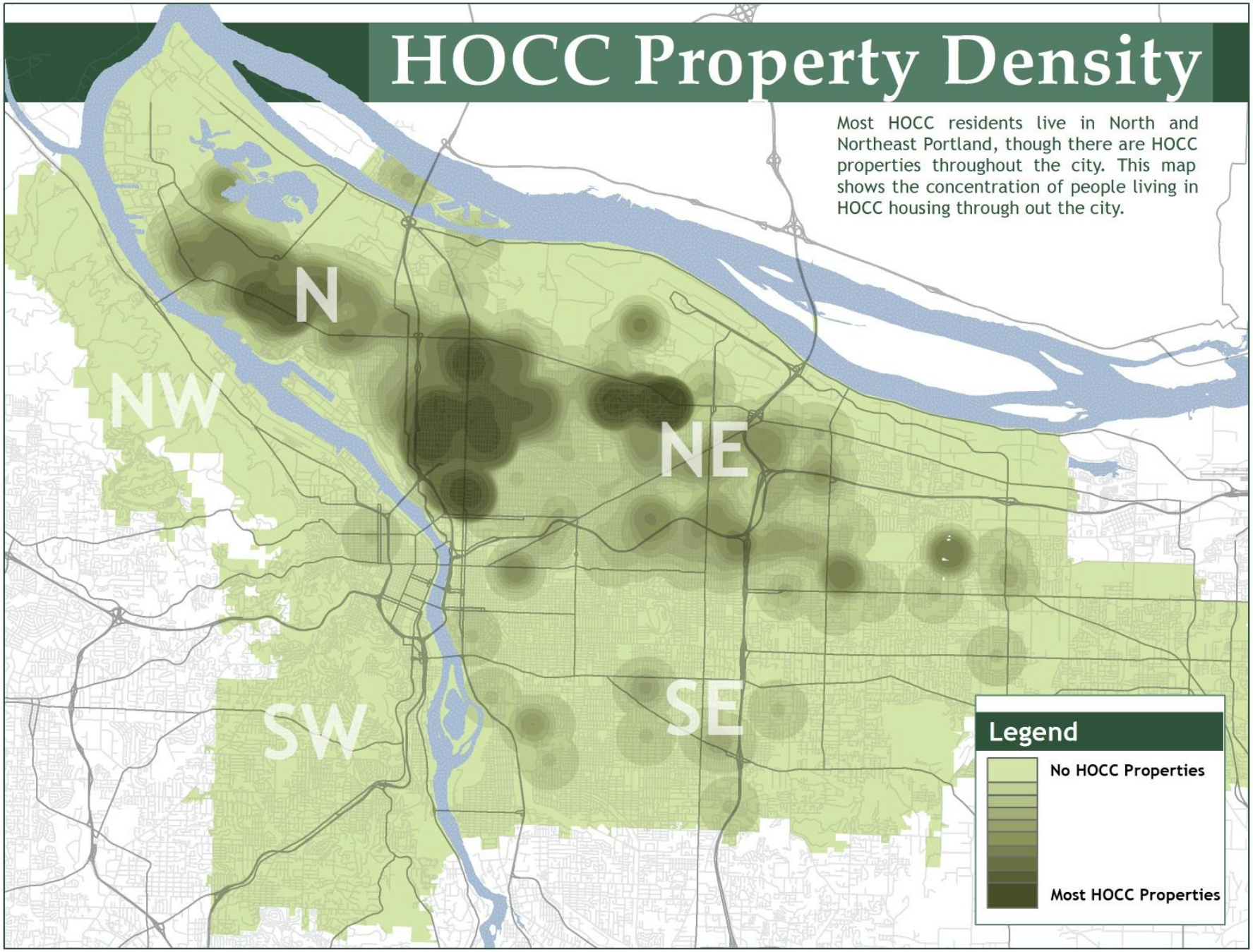
Contour Interval =
50 people per sq. mile

legend



HOCC Property Density

Most HOCC residents live in North and Northeast Portland, though there are HOCC properties throughout the city. This map shows the concentration of people living in HOCC housing through out the city.

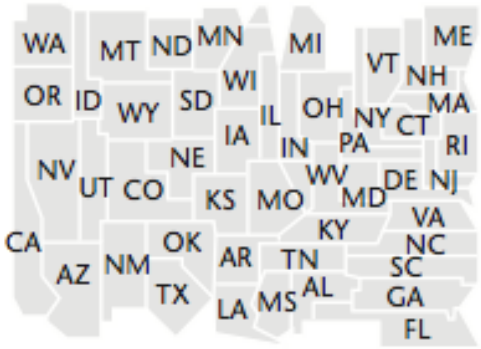


Cartogram

- Varies the size of the geographic area itself (not the symbol) based on the data value
- Not a good choice when map reader is not familiar with the geographic area

Appropriate Data: Totals and Derived Data (Densities, Rates)

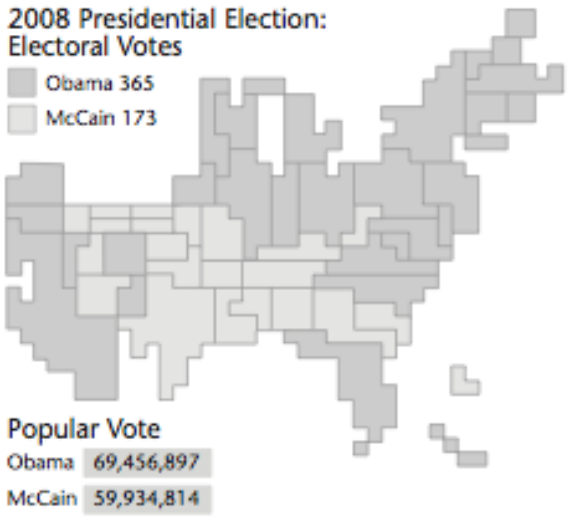
Derived Data: U.S. Suicide Rate



Cartograms of data with minimal variation from area to area can be interesting. Suicide rates don't vary much around the U.S., and thus all the states are about the same size.

Cartograms are not effective when the map reader is not familiar with the geographic areas being varied.

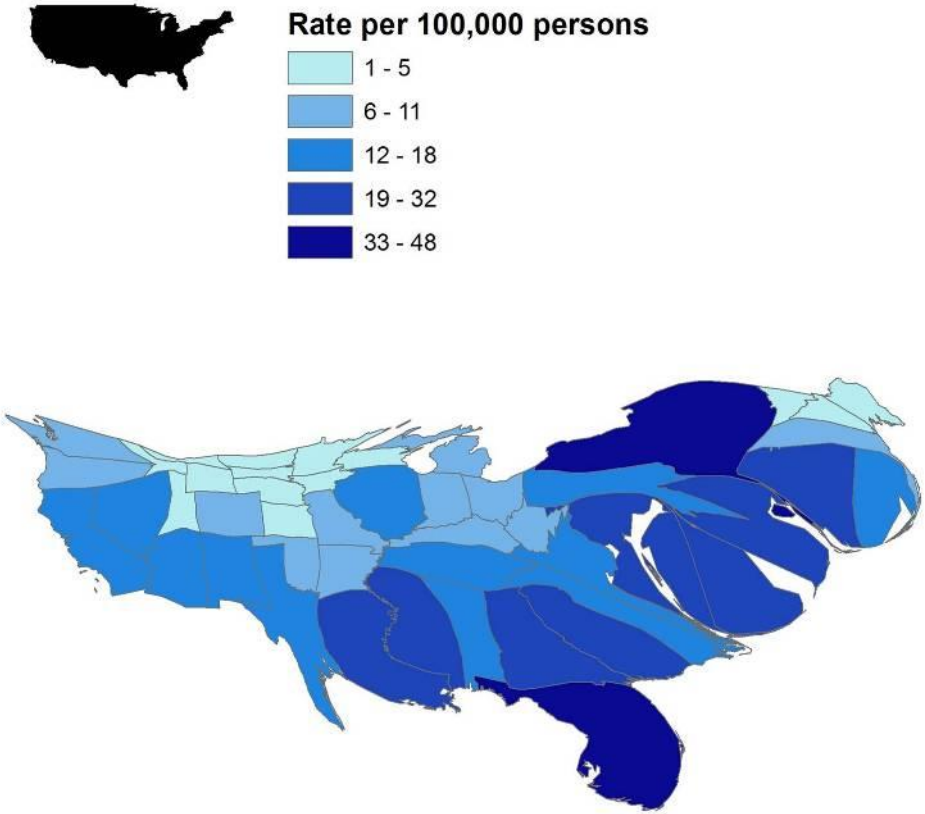
Total Data: 2008 U.S. Election



Cartograms are effective when data variation from area to area is significant. A cartogram scaled to electoral votes in each state in the U.S. removes the confusion introduced by state size.

Catherine Reeves's famed "equinational projection" – a world cartogram with each country the same size.

AIDS Incidence (2004)



*Data based on Table 14 of "Cases of HIV Infection and AIDS in the United States, 2004", CDC.
The District of Columbia is not shown.

In 2004, the Centers for Disease Control and Prevention (CDC) estimated 40,000 new HIV infections per year.

Done

Seven Billion : Population Cartograms

Touch to view

1960 Population

2011 Population

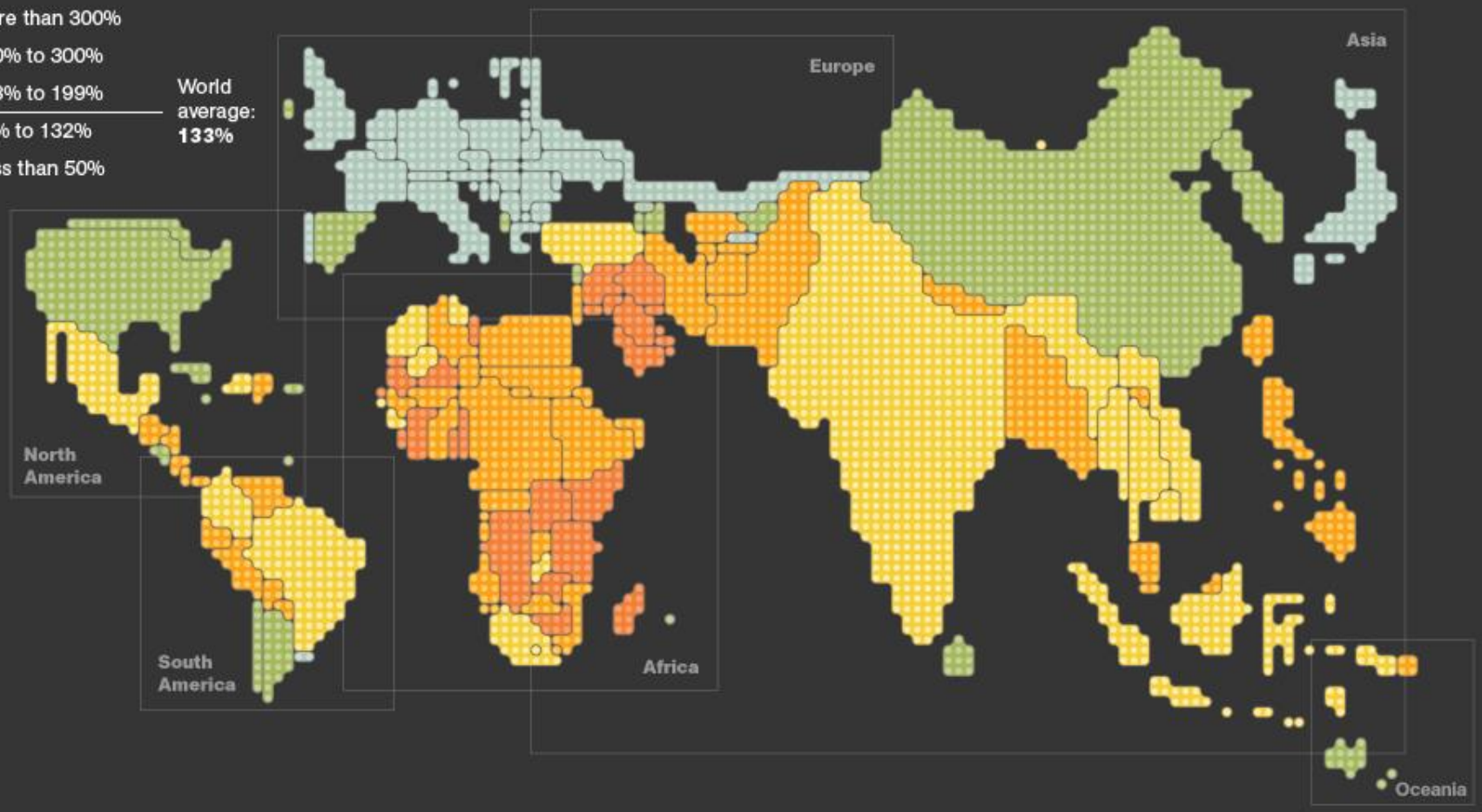
Color shows amount of growth from 1960 to 2011.

- More than 300%
- 200% to 300%
- 133% to 199%
- 50% to 132%
- Less than 50%

World average: **133%**

Each country is sized according to its projected population in 2011. Each dot represents two million people. Nations with populations under 1.5 million are not shown.

Tap map regions to view more

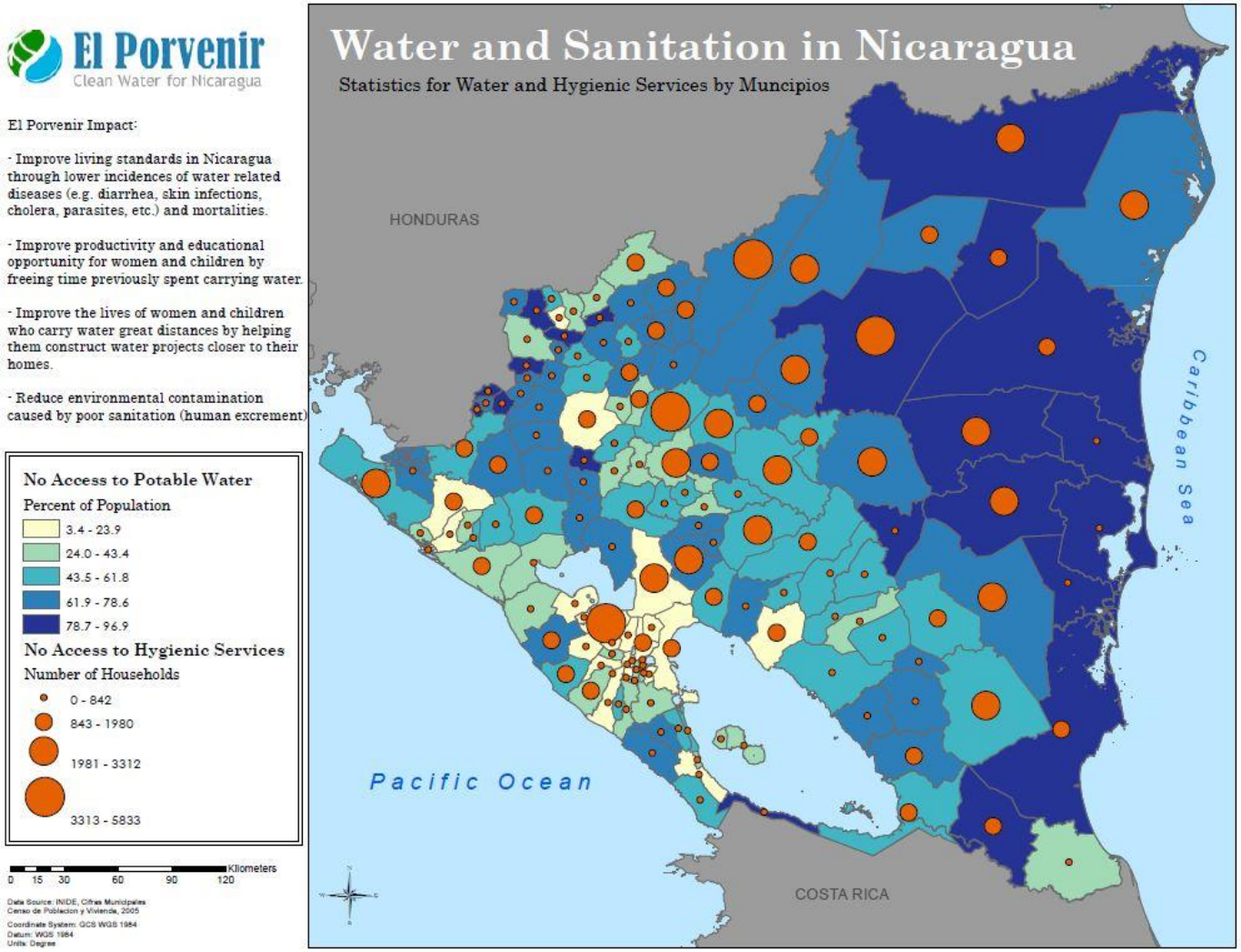


Population Cartogram | Population Charts | Consumption Cartogram | Consumption Charts | Credits

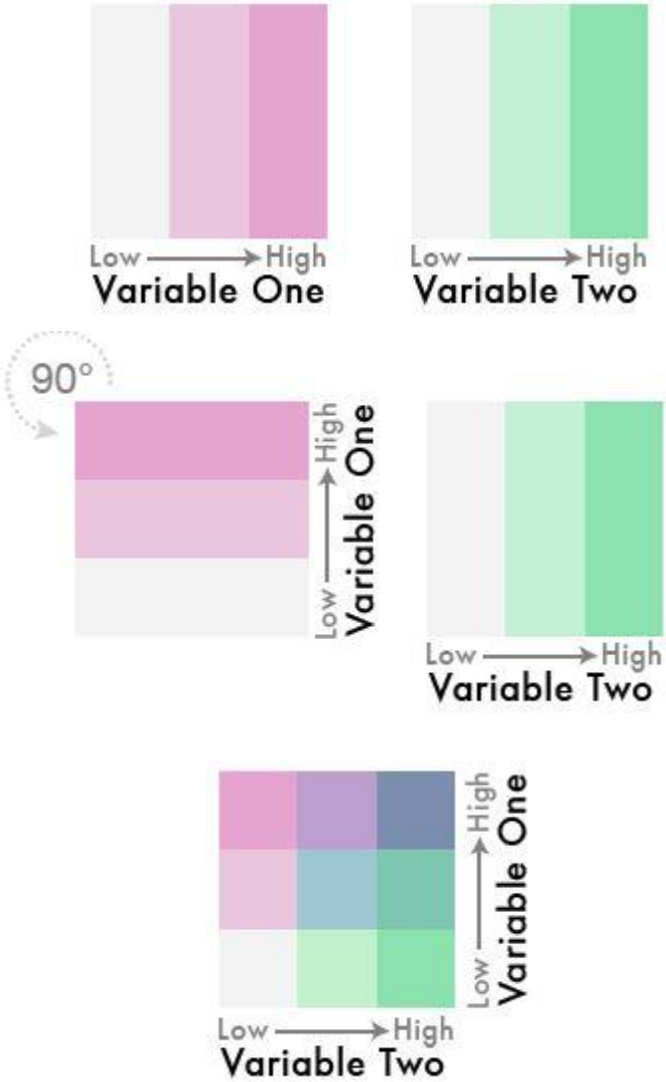
Multivariate maps

When visual variables are overlaid or combined into bivariate symbols

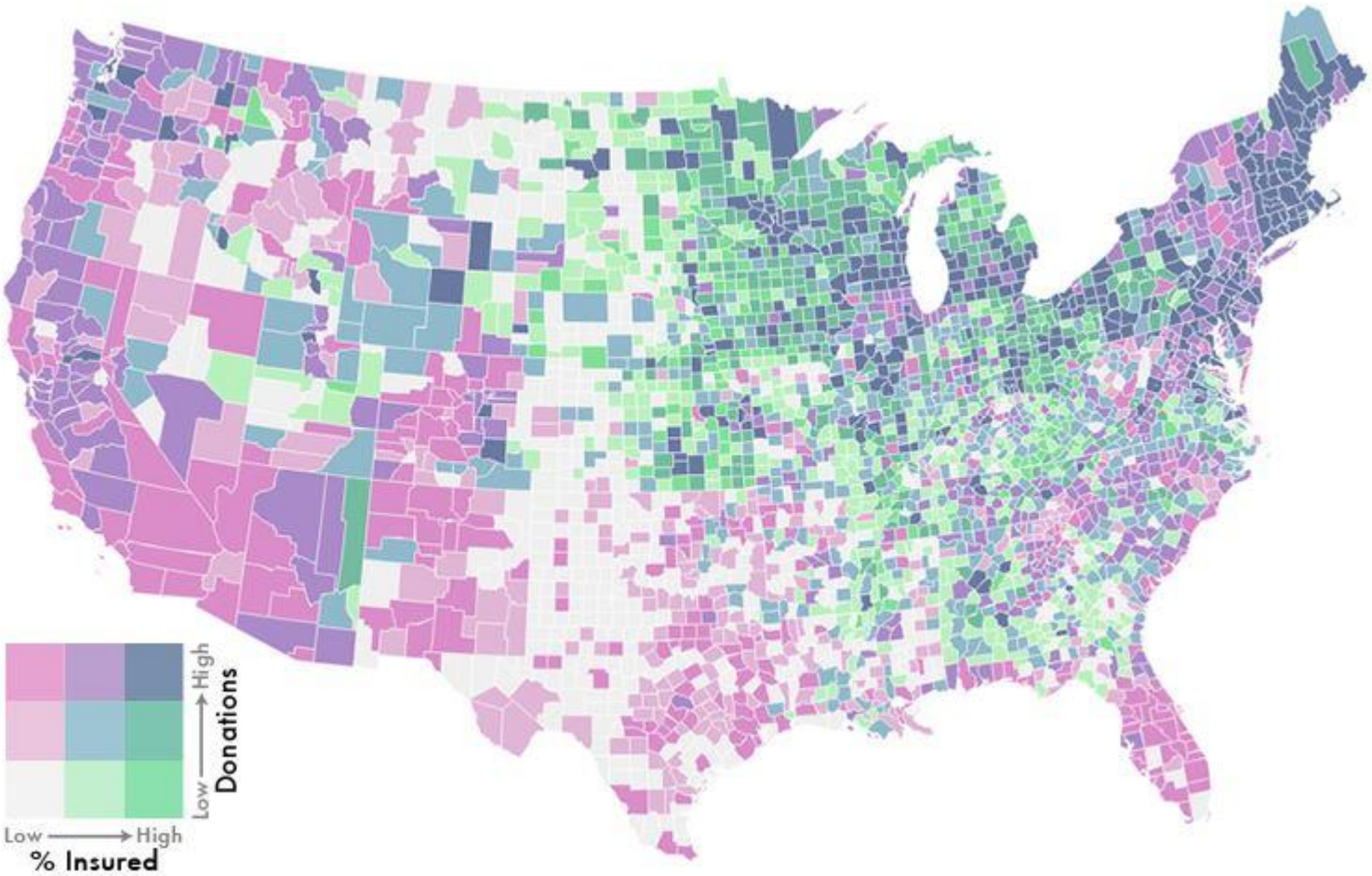
Overlaid symbols



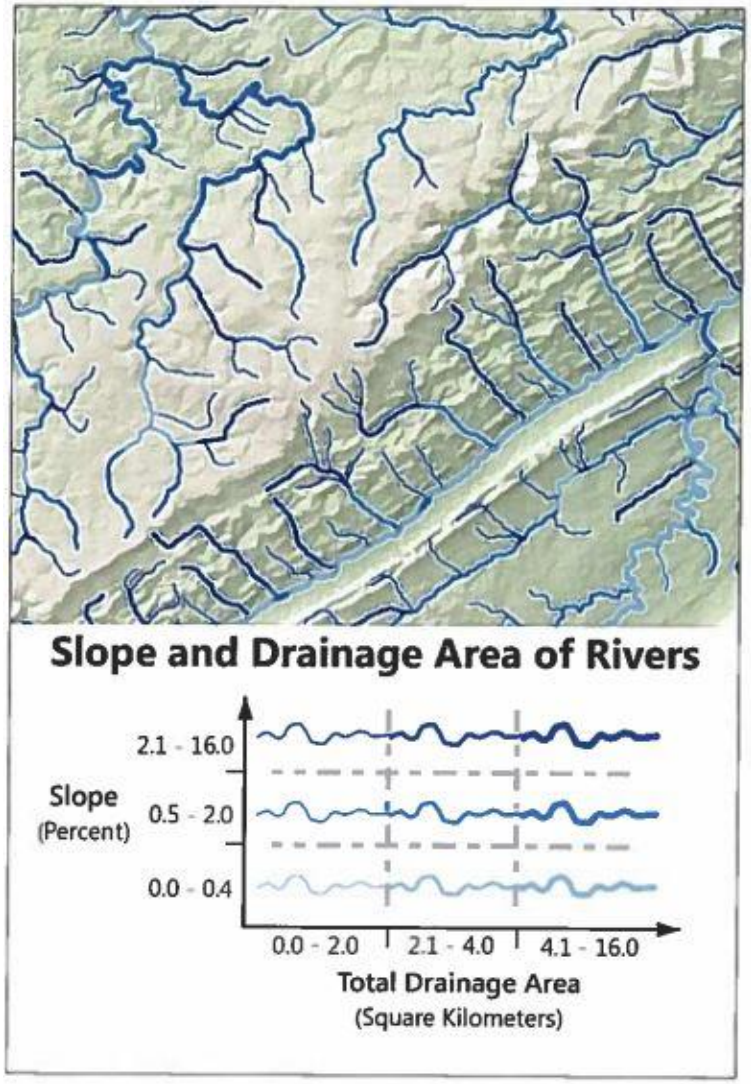
Bivariate symbols

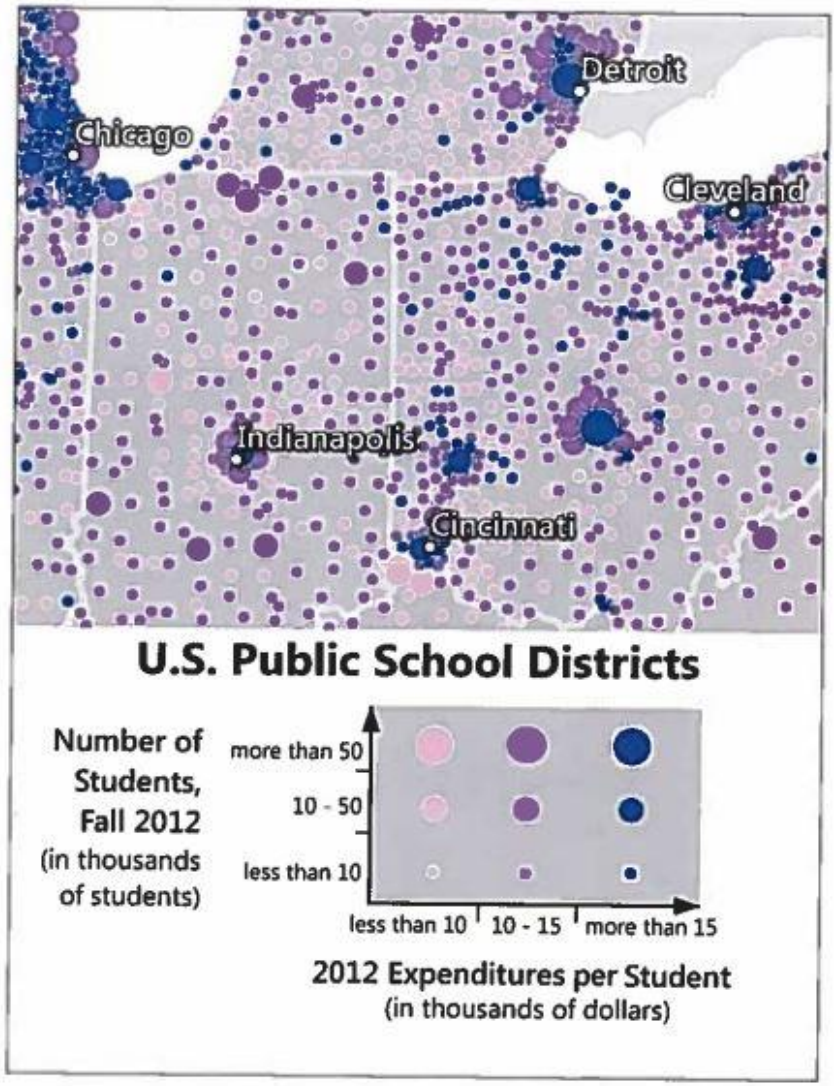


Bivariate symbols



Bivariate symbols





Bivariate palettes

These example palettes should get you off to a good start.