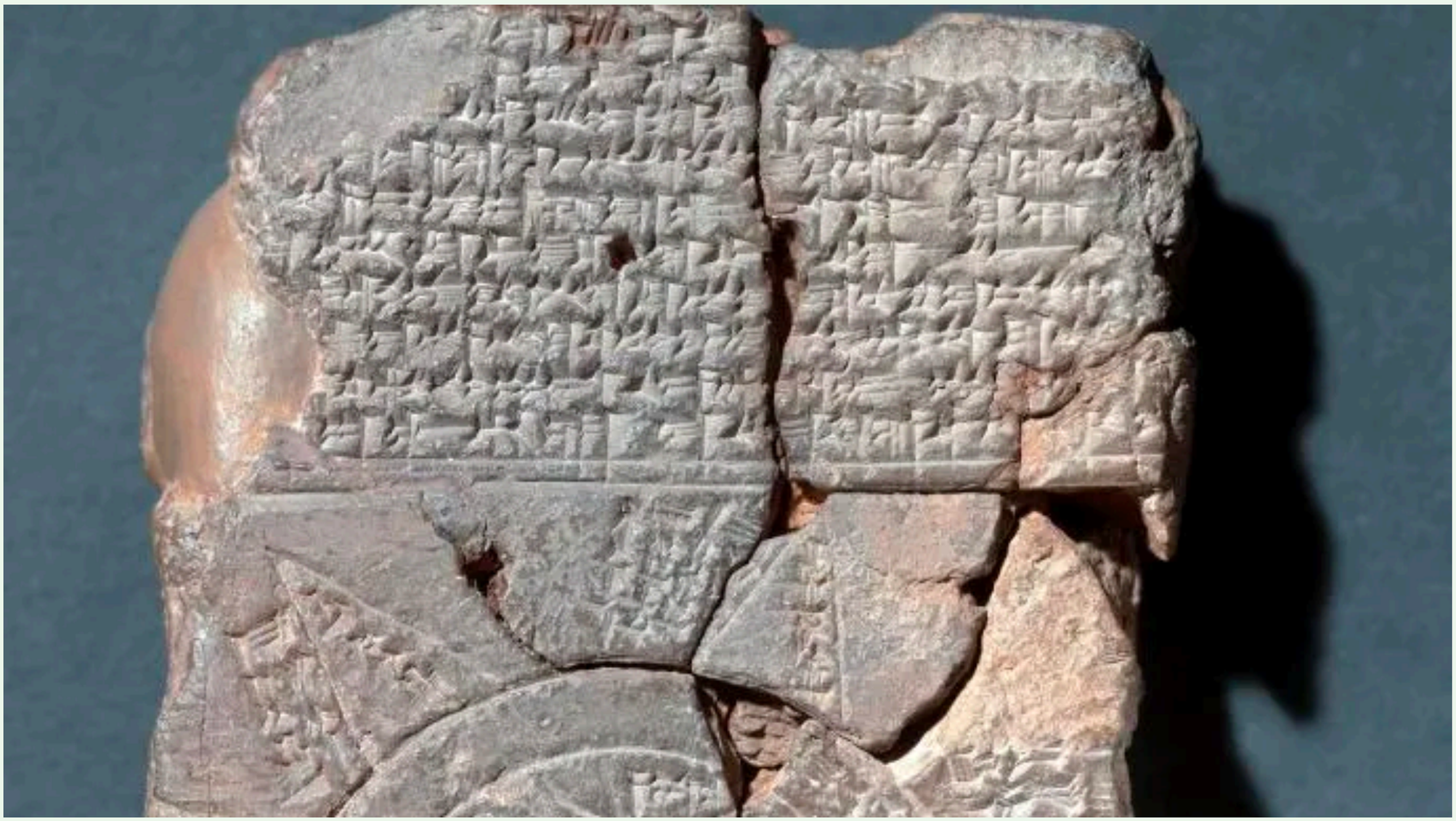
GEOG 358: Introduction to Geographic Information Systems

Maps & geovisualization

Maps, Cartography, GIS and Geovisualization

- Significance of maps
  - The language of geography
  - Existed before written languages

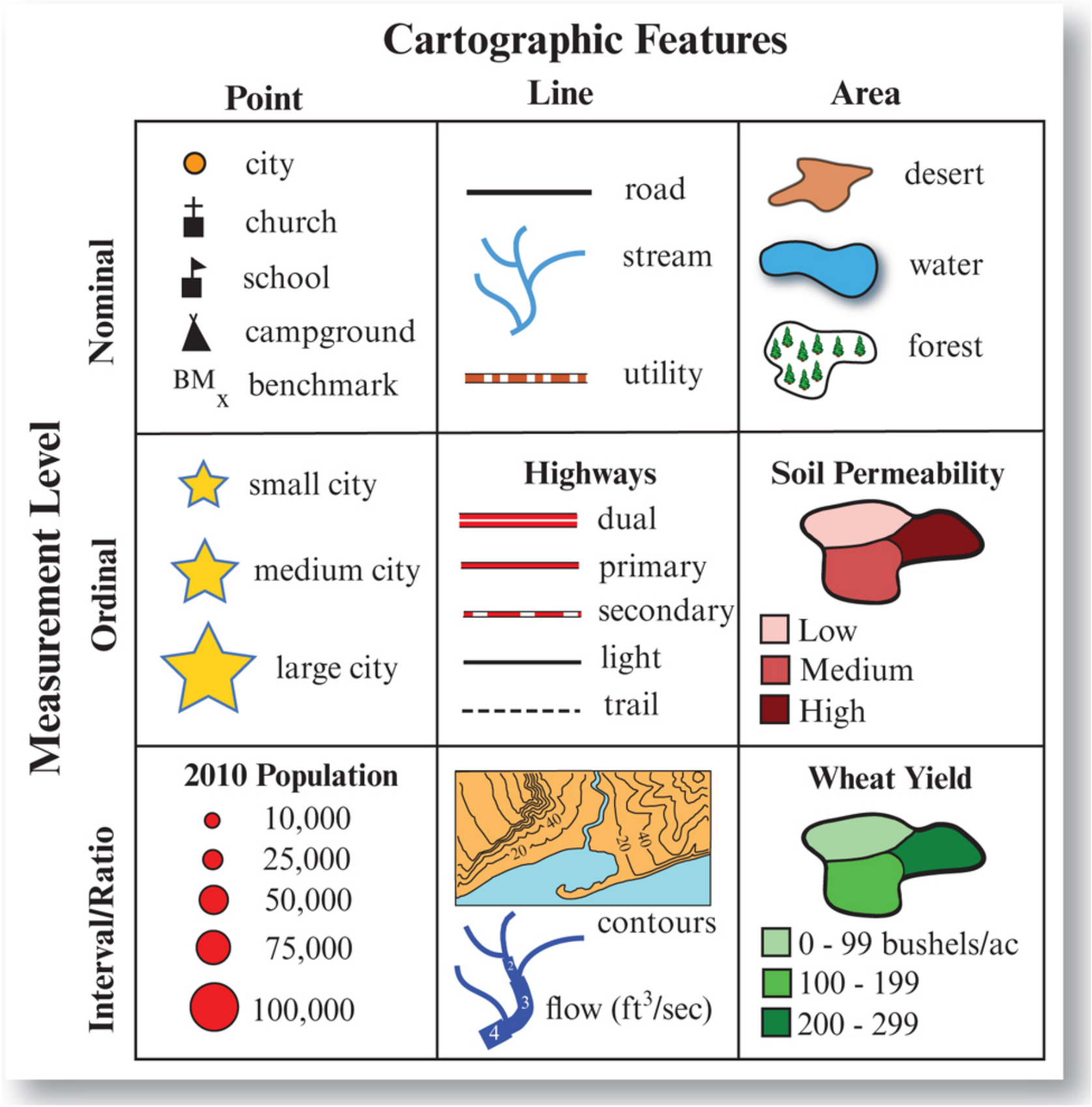


Purposes of Maps

- Map as a visual communication
  - For decision makers or the public
  - Make a point and communicate what we known
- Map as visual thinking
  - For spatial analysis
  - Prompt insight, reveal pattern, and highlight anomalies

Representing Geographic Features

- Represent where features are and what attribute(s) features have
- Symbol
  - A graphic or drawing representing certain characteristics of features
- Types of symbol
  - Point, line, and area symbols
- Properties of symbol
  - Location
  - Shape, size, and color (visual variables)



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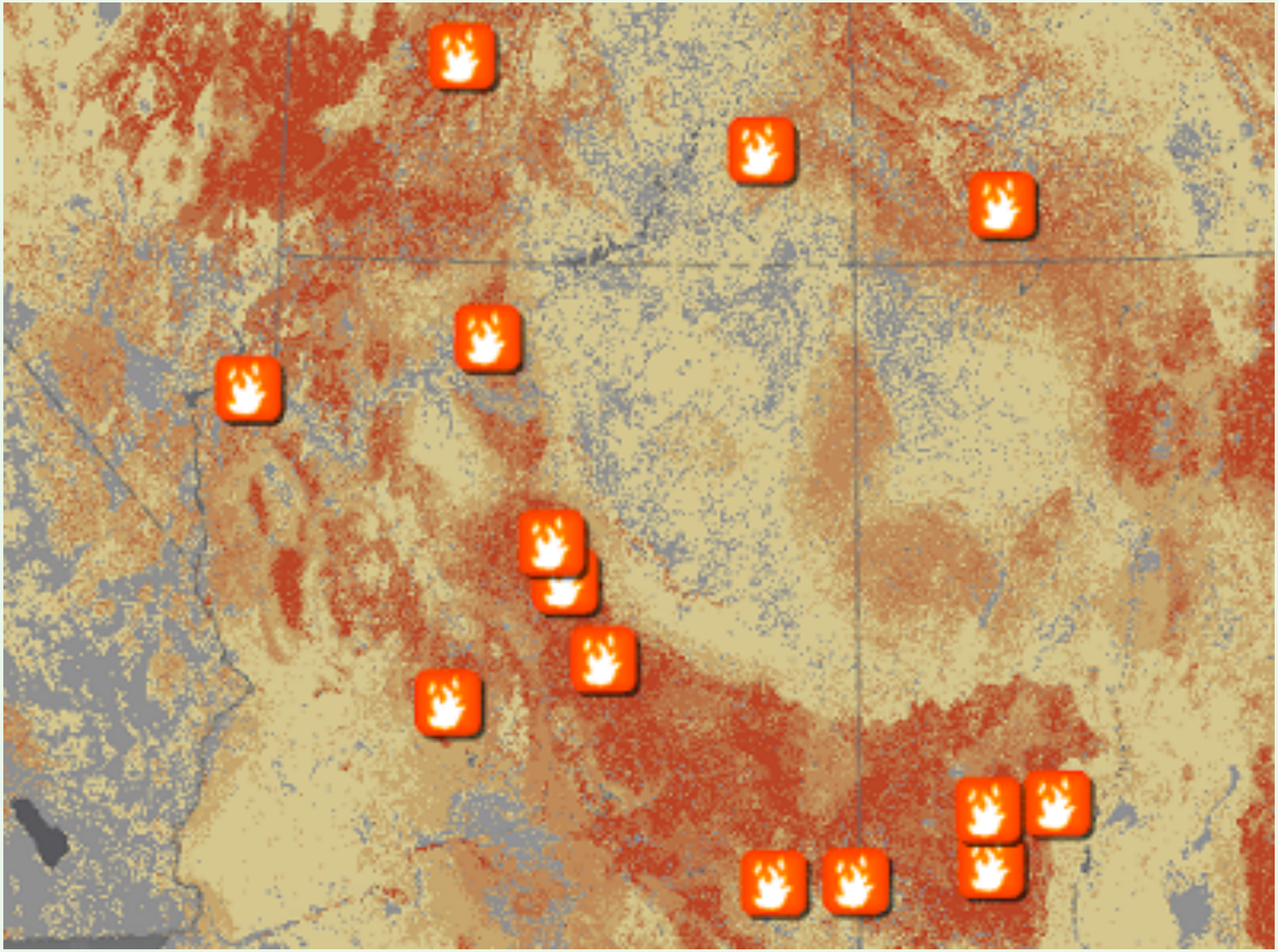
Single-symbol map



Standardized Point Symbols (USGS)

Control Data and Monuments

Boundary Monument	≥ 3rd order elevation & tablet	BM ⊡ 9134
	with number and elevation	67 ⊡ 4567
Horizontal Control	≥ 3rd order elev. & marker	BM △ 52
	with checked spot elevation	△1012
Vertical Control	≥ 3rd order elevation & tablet	BM × 5280
	spot elevation	×7523
River Mile Marker		+ Mile 69
Gauging Station		

a.

Selected Features

Building	
School; house of worship	
Athletic field	
Racetrack	
Airport, paved landing strip, runway, taxiway, or apron	
Tanks	
Picnic area	
Campground	
Cemetery	Cem †
Exposed wreck	
Quarry or open pit mine	

b.

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Figure

Standardized Linear Symbols (USGS)

Selected Transportation Features

Primary highway	
Secondary highway	
Light duty road	
Unimproved road	
Trail	
Highway or road with median strip	
Highway or road under construction	
Highway or road underpass; overpass	
Highway or road bridge; drawbridge	
Highway or road tunnel	
Standard guage railroad	
Railroad yard	

a.

Selected Hydrologic Features

Perennial stream	
Perennial river	
Intermittent stream	
Intermittent river	
Disappearing stream	
Falls, small	
Falls, large	
Rapids, small	
Rapids, large	
Masonry dam	

b.

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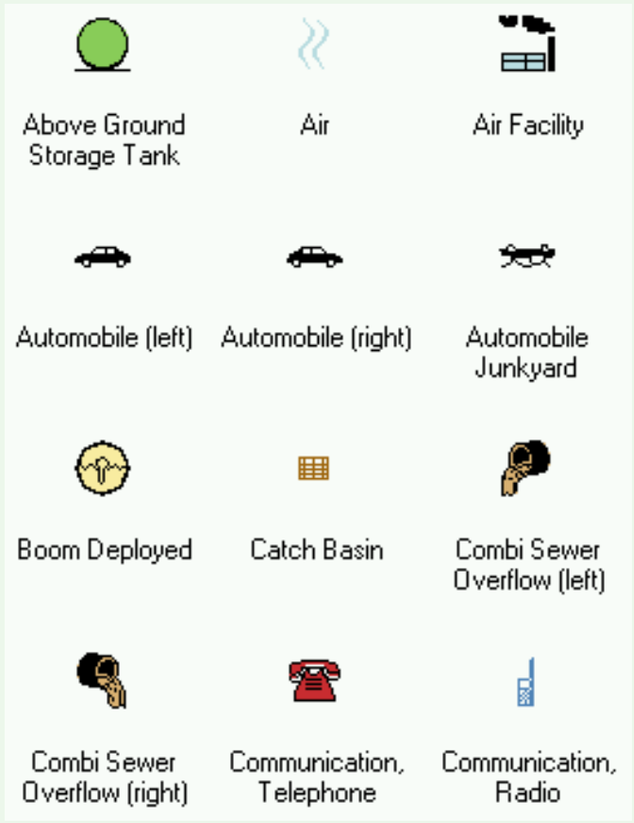
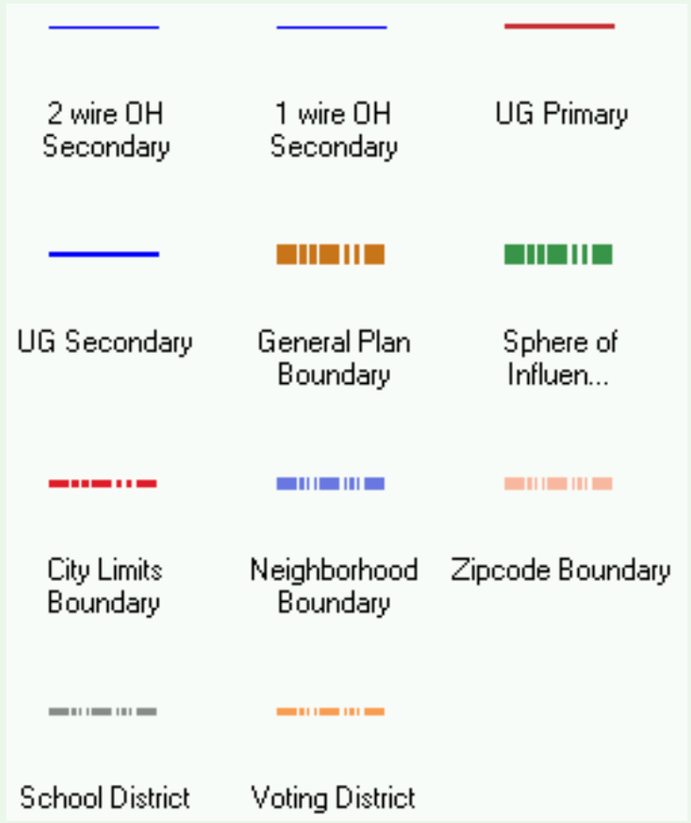
Styles

- A set of symbols used by an organization, community or a field





Visualize Feature Attributes

- Types of feature attributes
  - Numeric or categorical attributes (symbols)
  - Textual attributes (labels or annotation)
- Measurement levels of numeric attributes
  - Nominal, ordinal, and continuous
- The number of attributes
  - 0—single symbol maps (only location)
  - 1—unique value, graduated color, graduated symbol, and dot density maps
  - >1—multivariate and chart maps

Representing Nominal Attributes

- Unique value map—each unique value (representing a category) is represented by the color or shape of a symbol

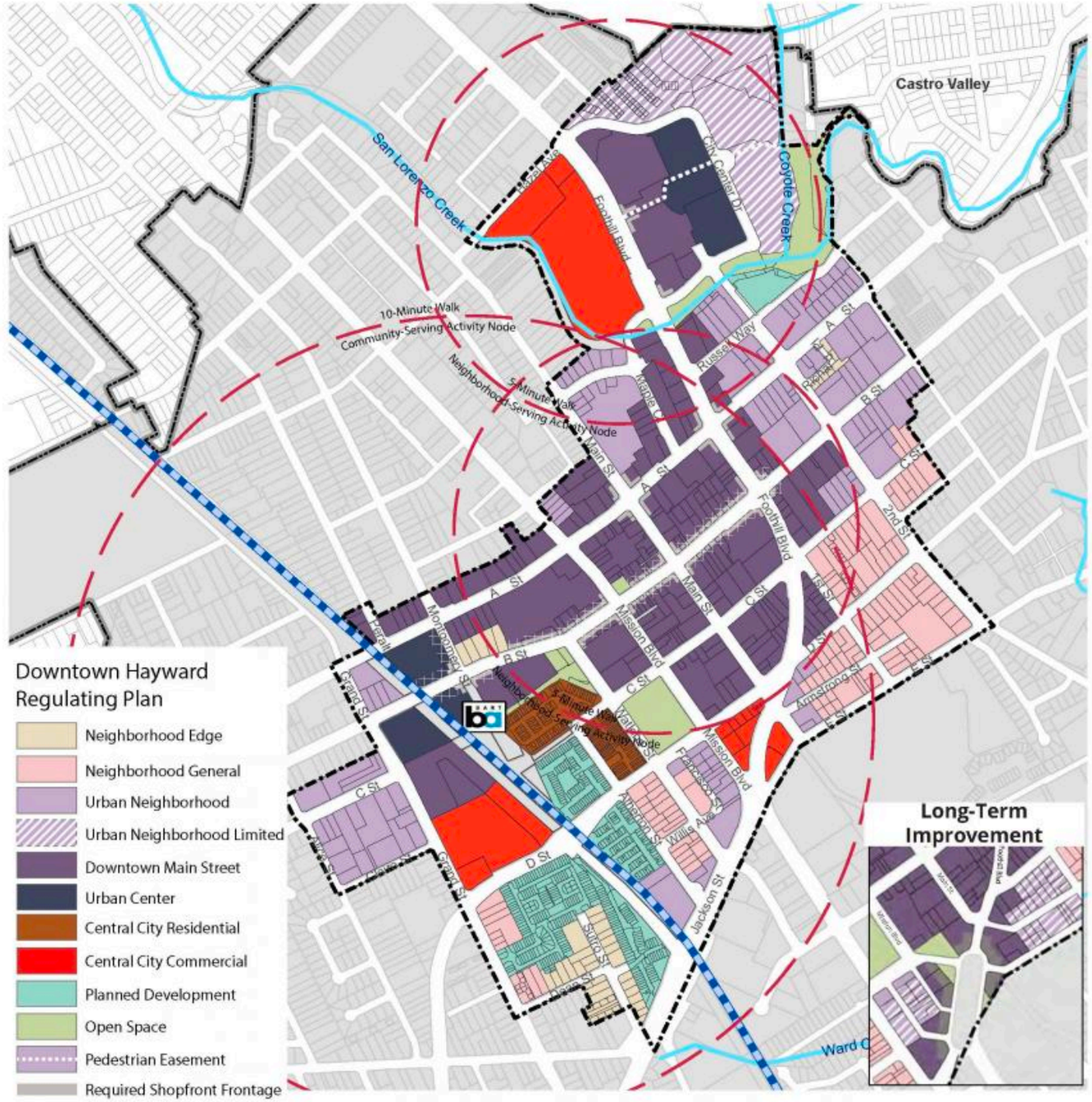


Figure 2.1.020.1 (Regulating Plan)

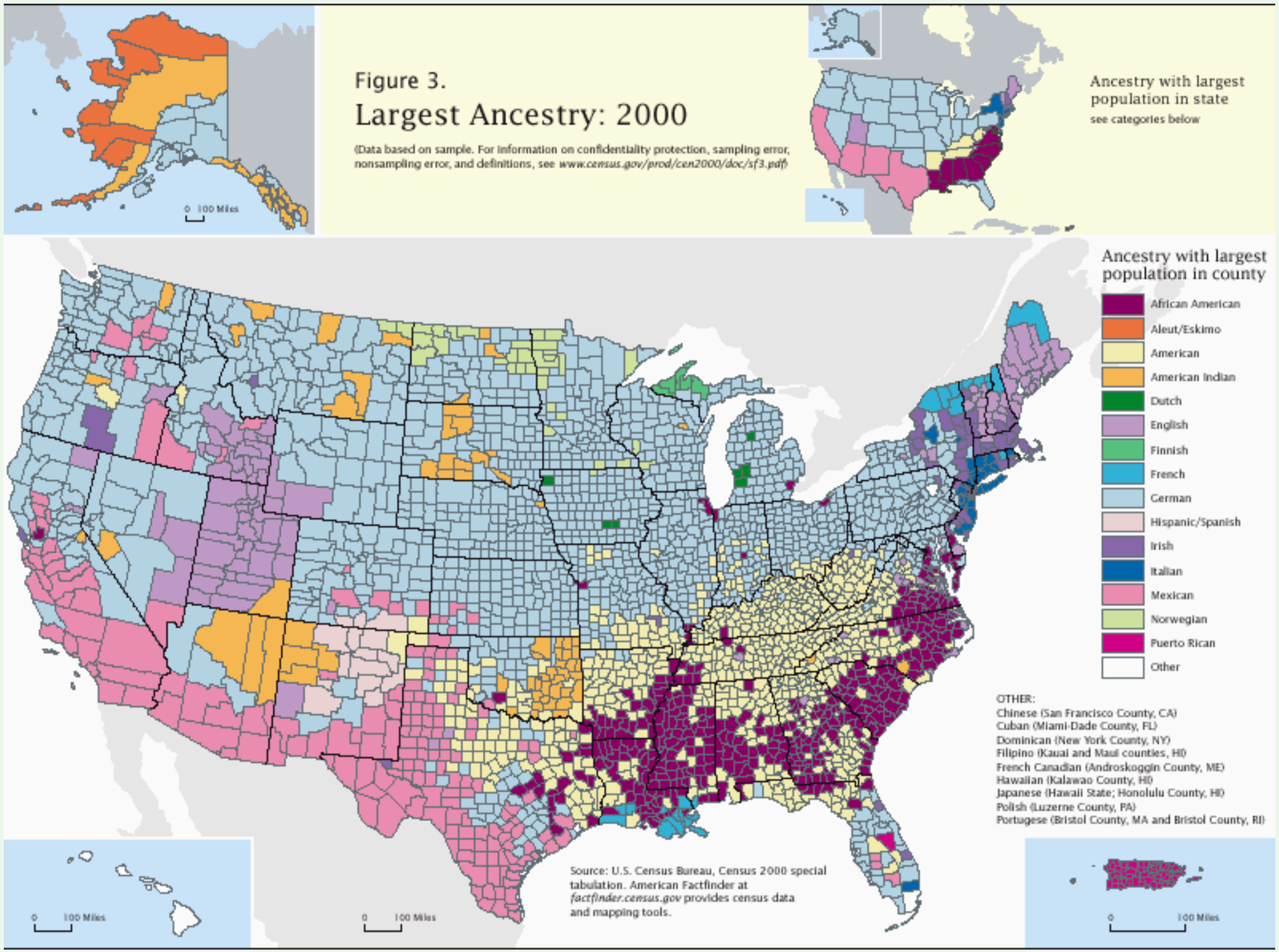
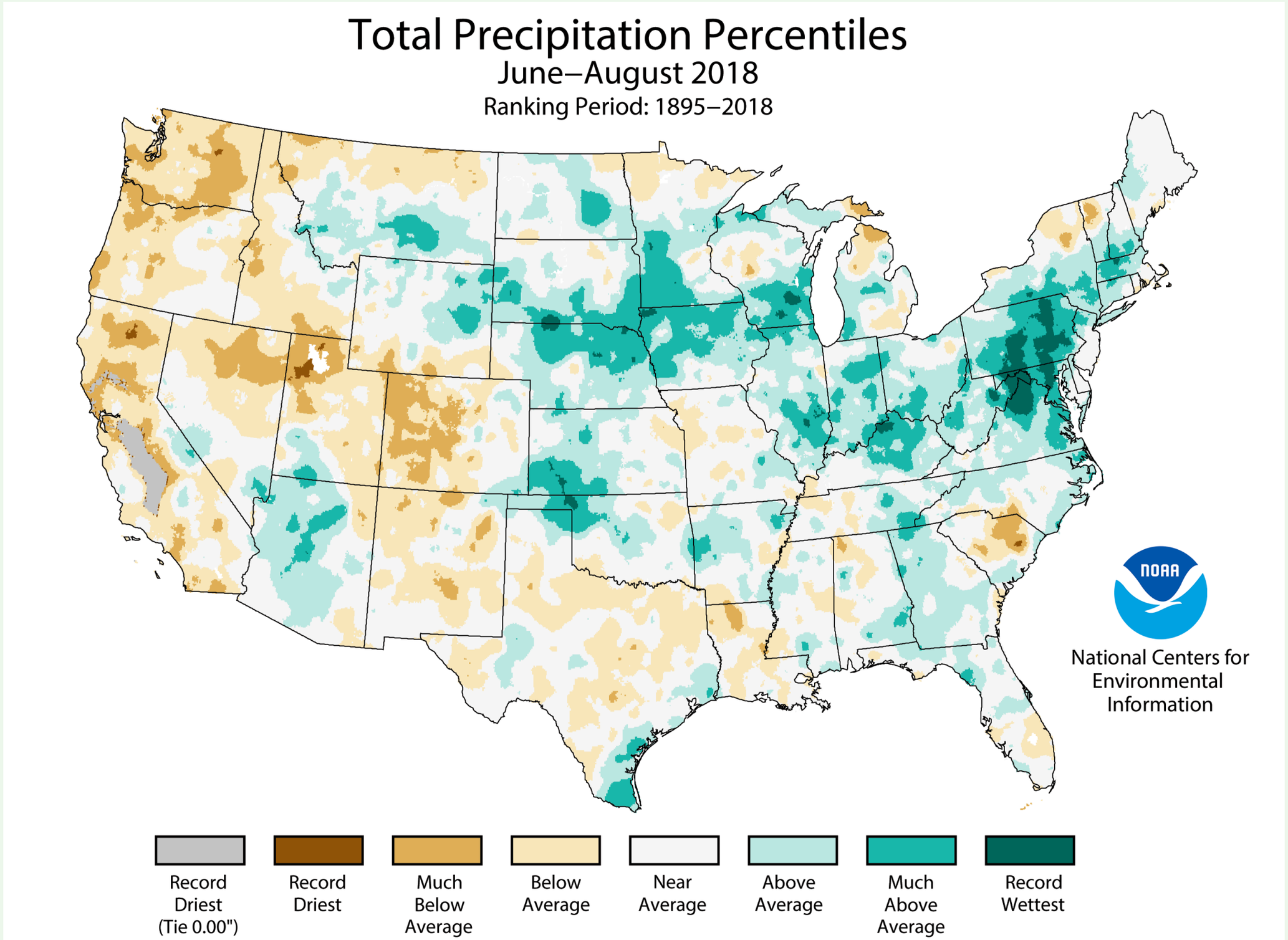
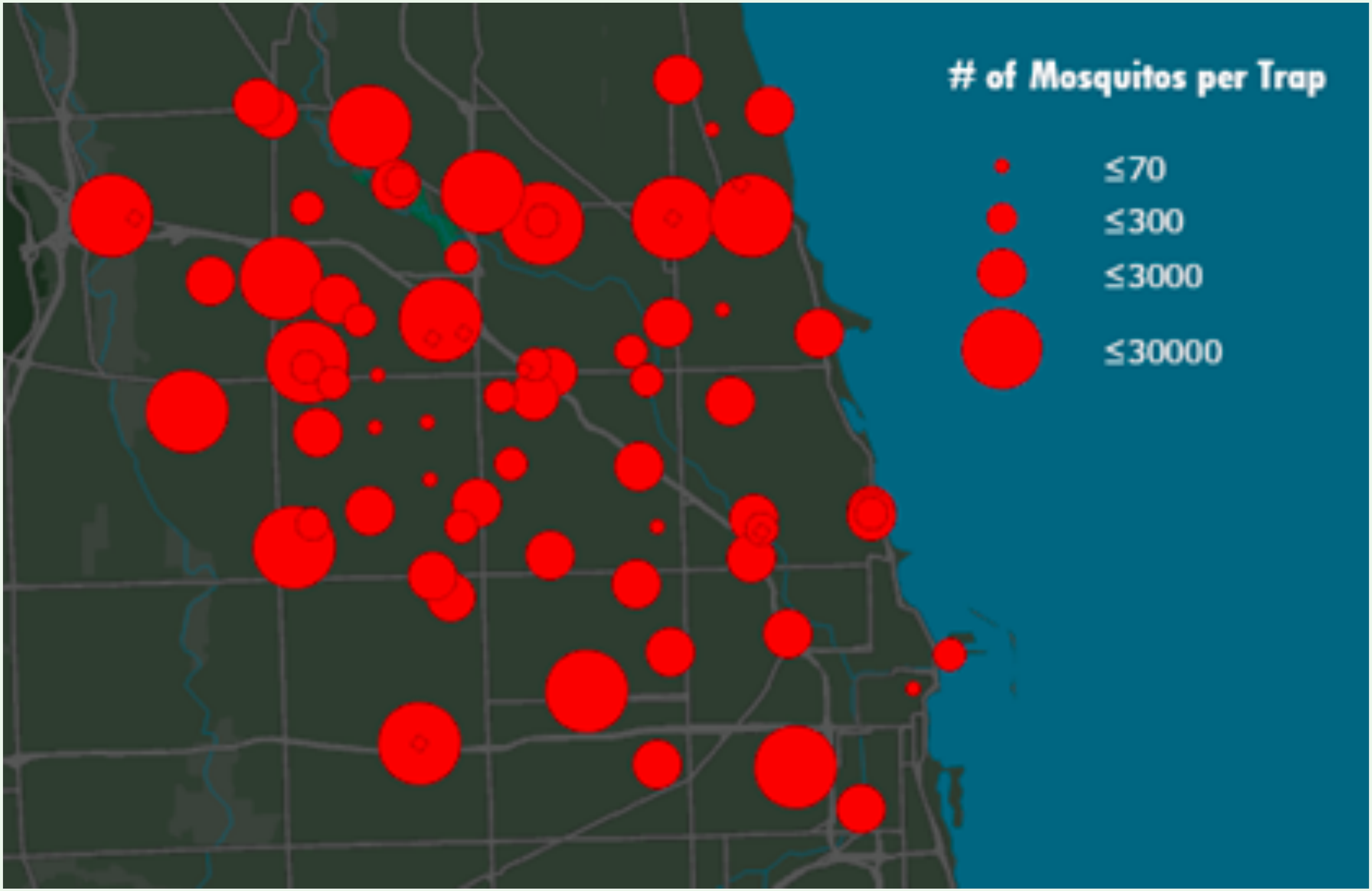


Figure 3.
Largest Ancestry: 2000
(Data based on sample. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see www.census.gov/prod/cen2000/doc/sf3.pdf)
Ancestry with largest population in state
see categories below
Ancestry with largest population in county
African American
Aleut/Eskimo
American
American Indian
Dutch
English
Finnish
French
German
Hispanic/Spanish
Irish
Italian
Mexican
Norwegian
Puerto Rican
Other
OTHER:
Chinese (San Francisco County, CA)
Cuban (Miami-Dade County, FL)
Dominican (New York County, NY)
Filipino (Kauai and Maui counties, HI)
French Canadian (Androskoggin County, ME)
Hawaiian (Kalawao County, HI)
Japanese (Hawaii State; Honolulu County, HI)
Polish (Luzerne County, PA)
Portugese (Bristol County, MA and Bristol County, RI)
Source: U.S. Census Bureau, Census 2000 special tabulation. American Factfinder at factfinder.census.gov provides census data and mapping tools.
0 100 Miles

Representing Ordinal Attributes

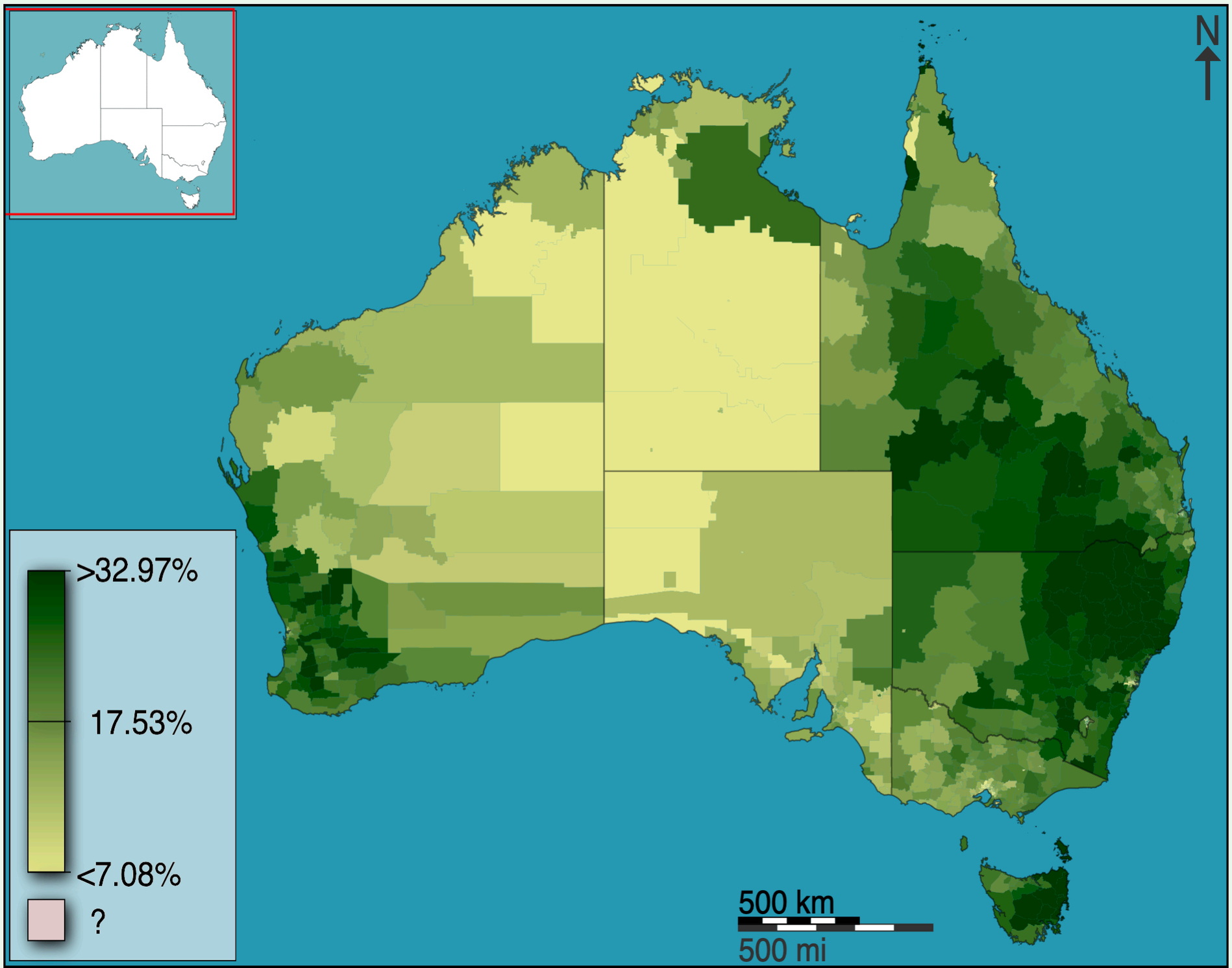
- Graduated symbol or color map—color, size

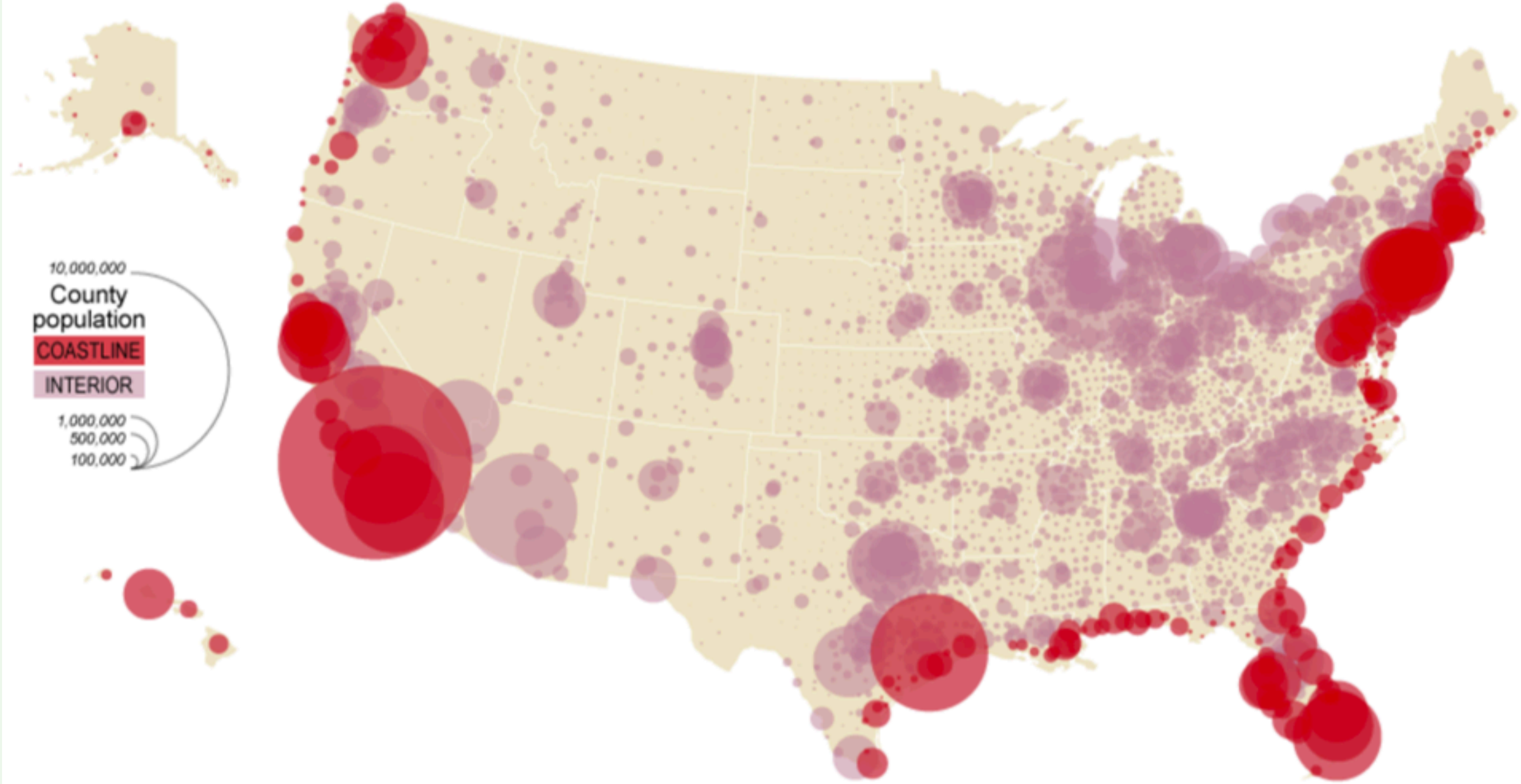



# of Mosquitos per Trap
≤70
≤300
≤3000
≤30000

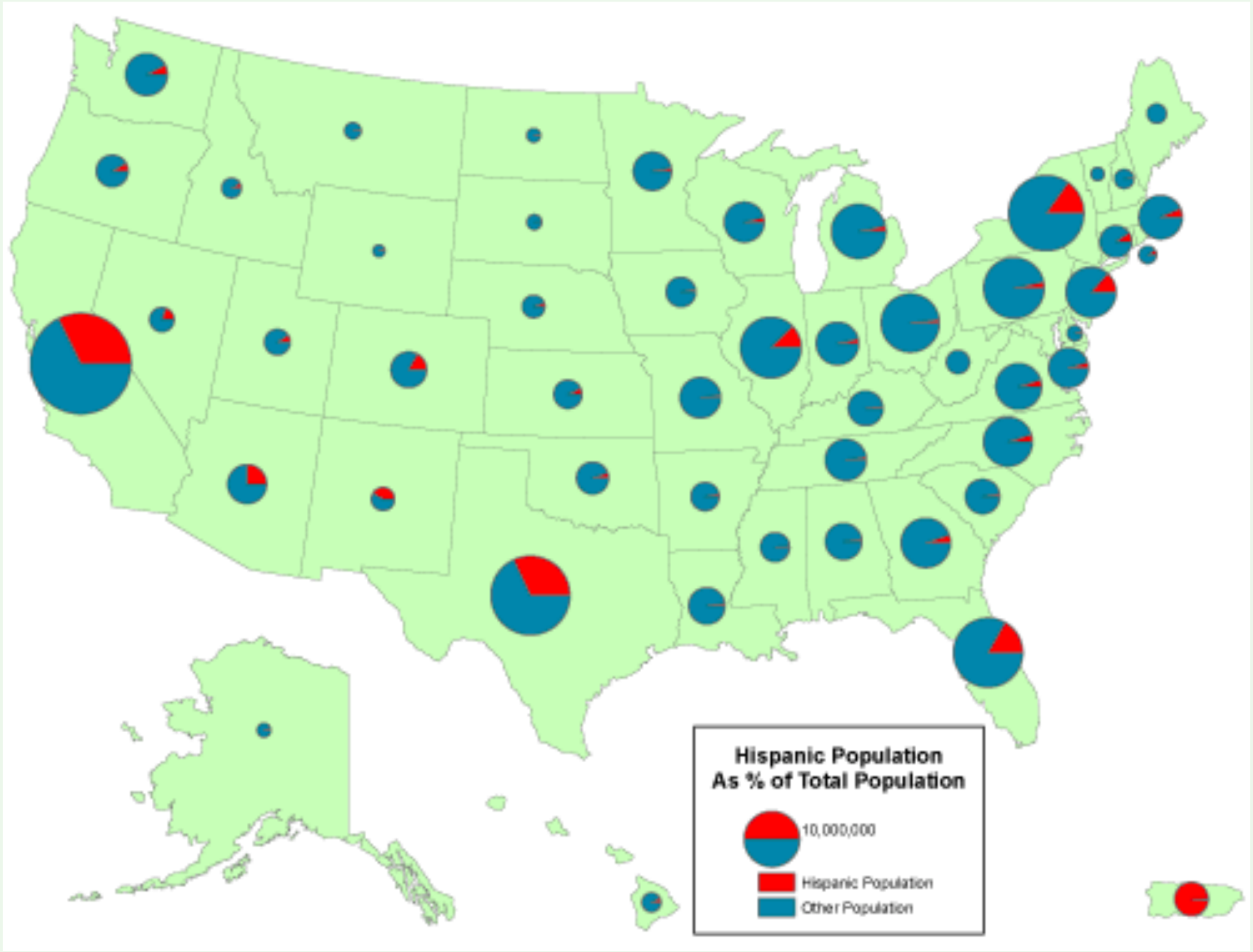
Representing Interval or Ratio Attributes

- Graduated symbol or color map—color, size




10,000,000
County population
COASTLINE
INTERIOR
1,000,000
500,000
100,000

Representing Multiple Attributes



Sequential and Diverging Colors

Three Sequential Color Schemes Extracted from ColorBrewer

	R	G	B
	241	238	246
	189	201	225
	116	169	207
	043	140	190
	004	090	141

a.

	R	G	B
	255	255	204
	194	230	153
	120	198	121
	049	163	084
	000	104	055

b.

	R	G	B
	255	255	212
	254	217	142
	254	153	041
	217	095	014
	153	052	004

c.

Three Diverging Color Schemes Extracted from ColorBrewer

	R	G	B
	166	097	026
	223	194	125
	245	245	245
	128	205	193
	001	133	113

d.

	R	G	B
	202	000	032
	244	165	130
	255	255	255
	186	186	186
	064	064	064

e.

	R	G	B
	215	025	028
	253	174	097
	255	255	191
	166	217	106
	026	150	065

f.

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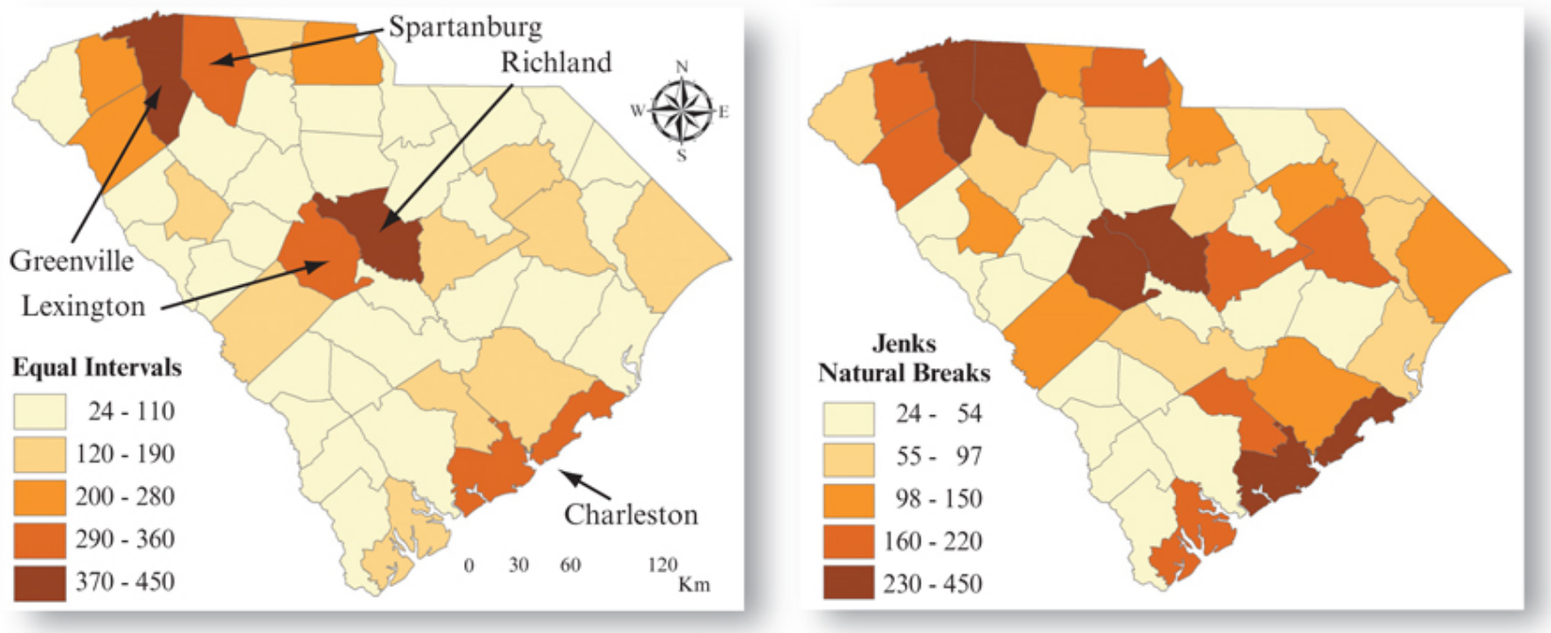
Feature Classification

- Aggregates features into a number of classes or groups
- Based on feature attributes
  - Degrading the attribute levels from interval/ratio to nominal or ordinal
- Show and find the general spatial pattern
- Classification methods:
  - Natural breaks
  - Quantile
  - Equal interval
  - Standard deviation

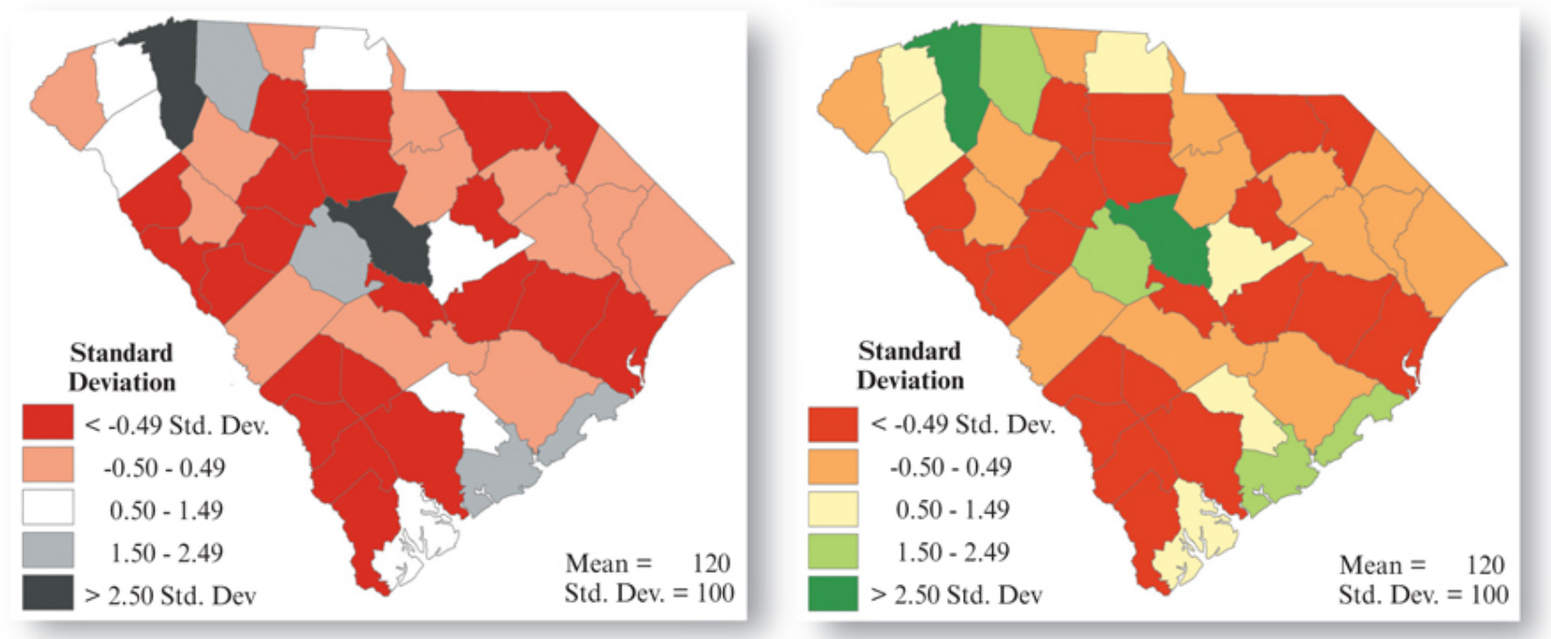
Figure

Sequential Color Scheme Choropleth Mapping of Population Density of South Carolina Counties in 2000 Persons per Square Mile



a,b. Equal area and Jenks natural breaks class intervals with the same sequential color classification scheme.

Diverging Color Scheme Choropleth Mapping of Population Density of South Carolina Counties in 2000 Persons per Square Mile



c,d. Standard deviation class intervals with two different diverging color classification schemes.

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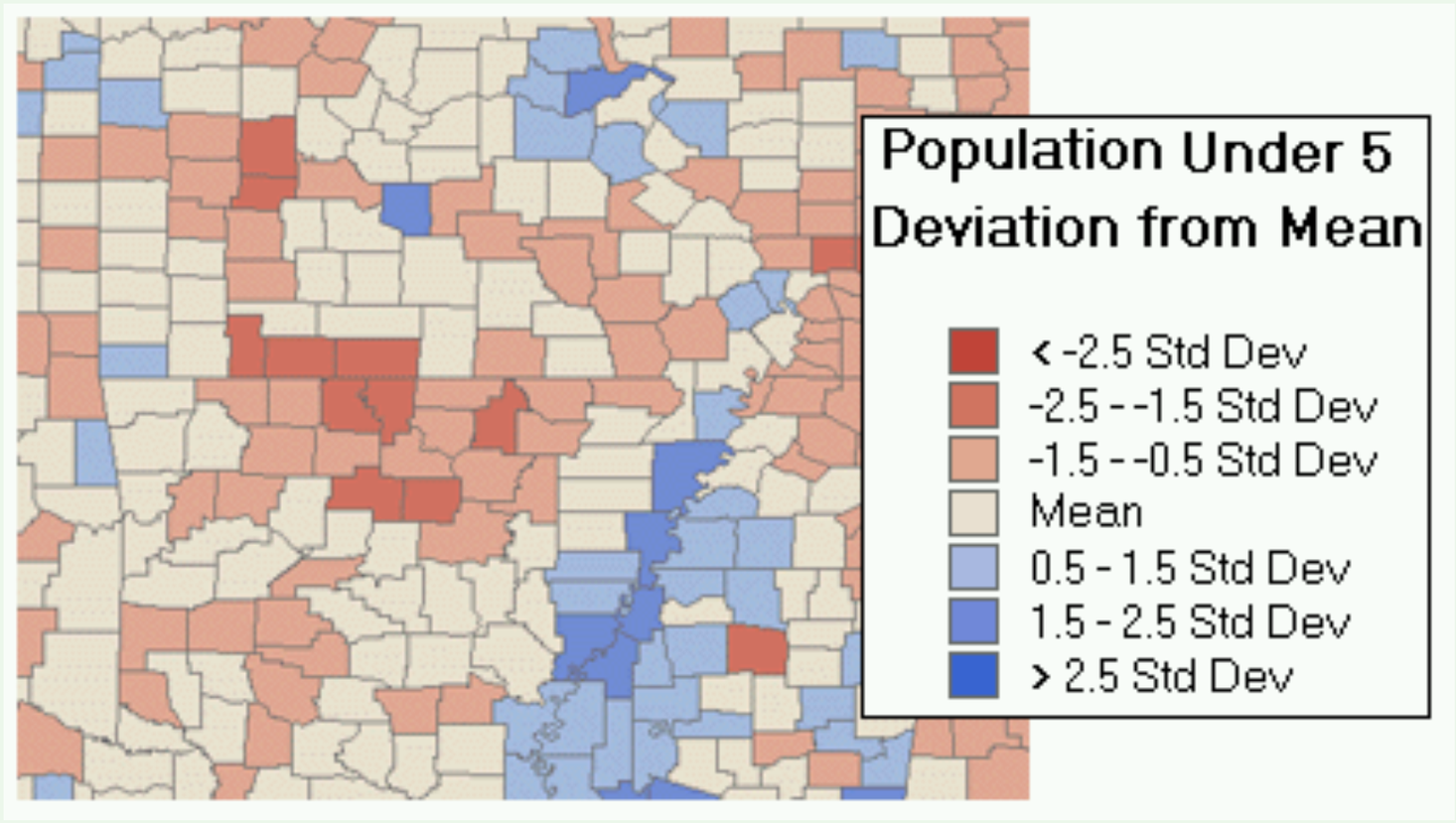
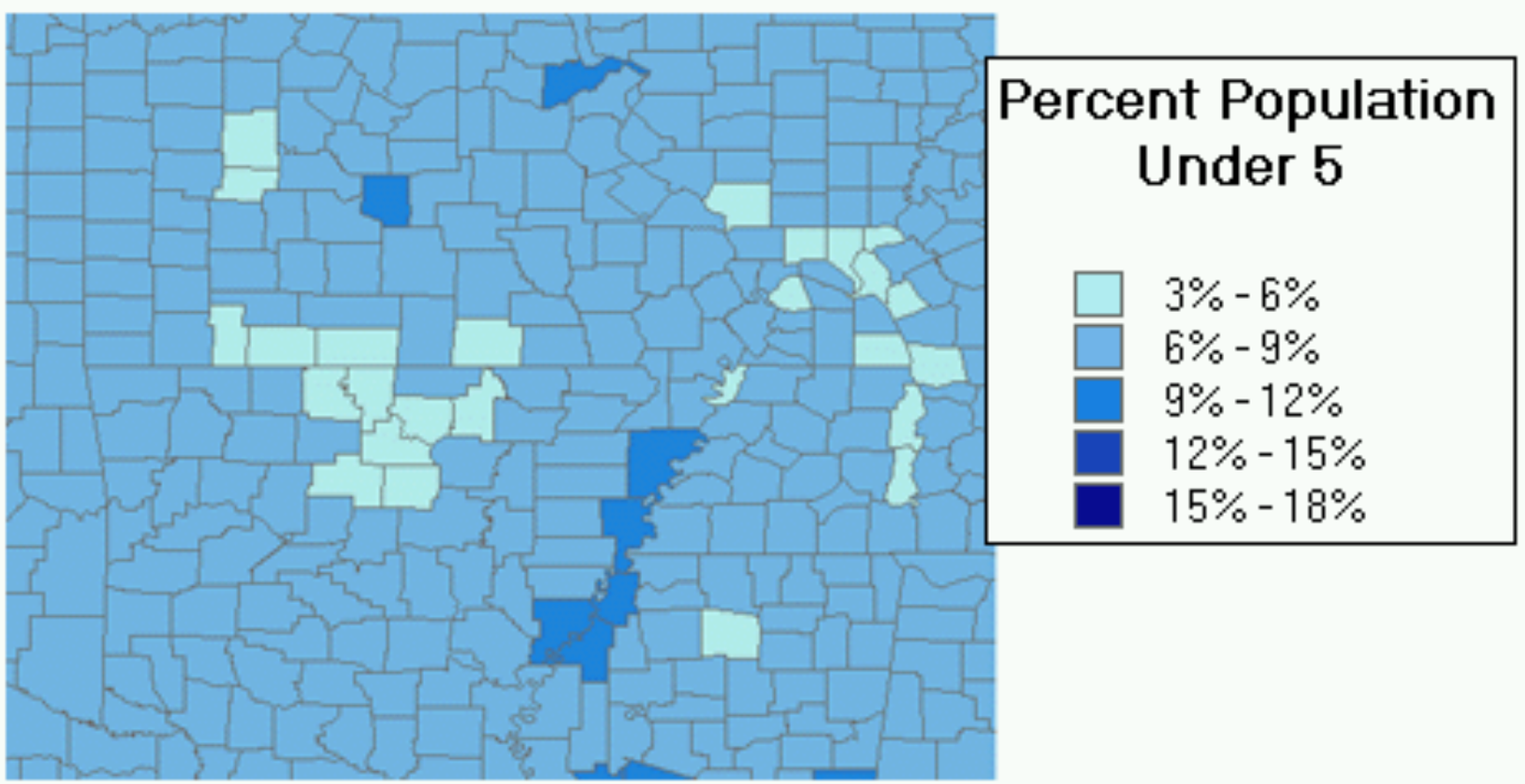
Standard Deviation Method

- Shows the amount a feature's attribute value varies from the mean.
- Classes generated by successively adding or subtracting the standard deviation from the mean.



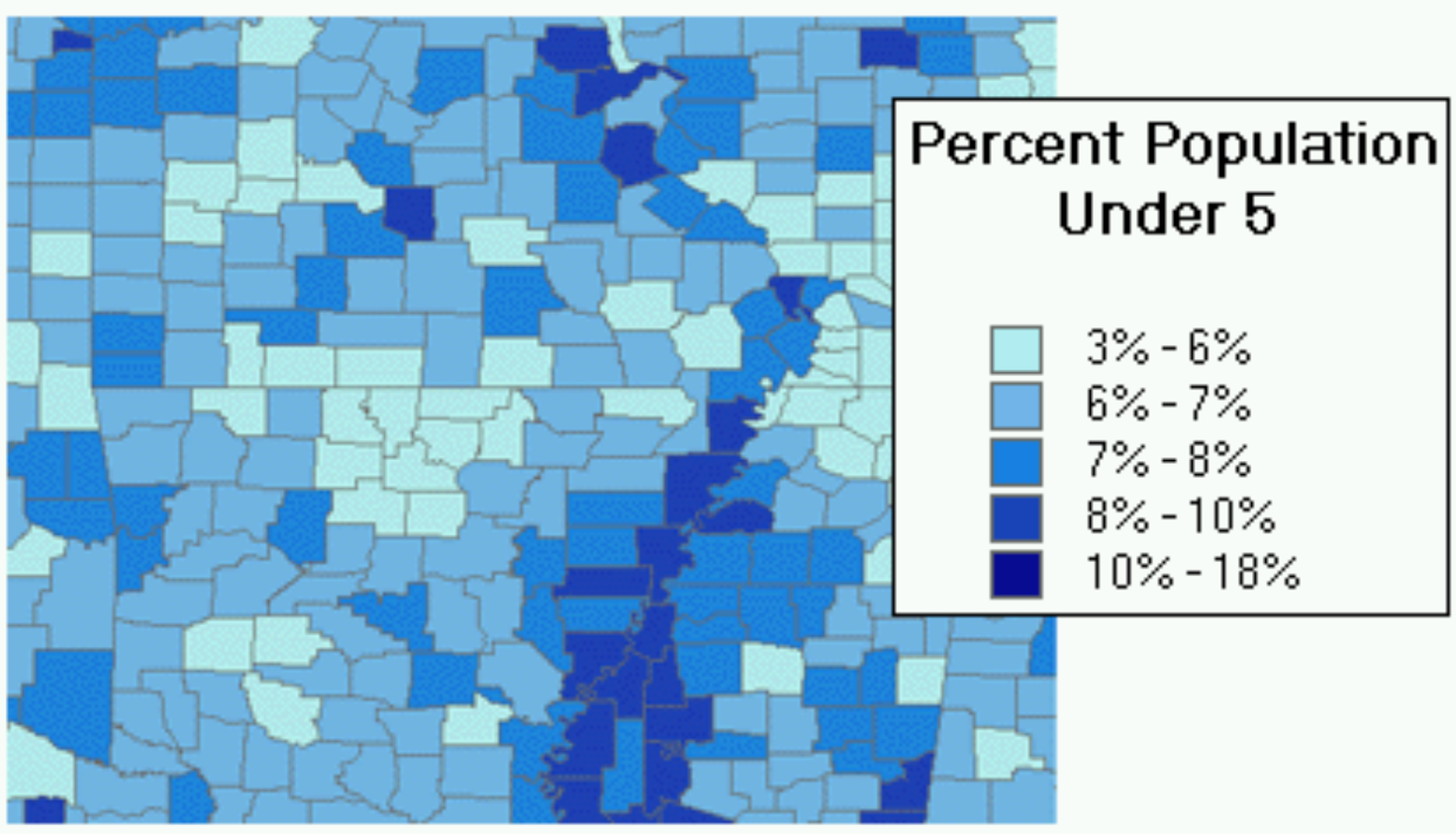
Equal Interval Method

- Divides the range of attribute values into equal-sized subranges.
  - attribute values ranging from 0 to 300 and you have three classes (0–100, 101–200, and 201–300).



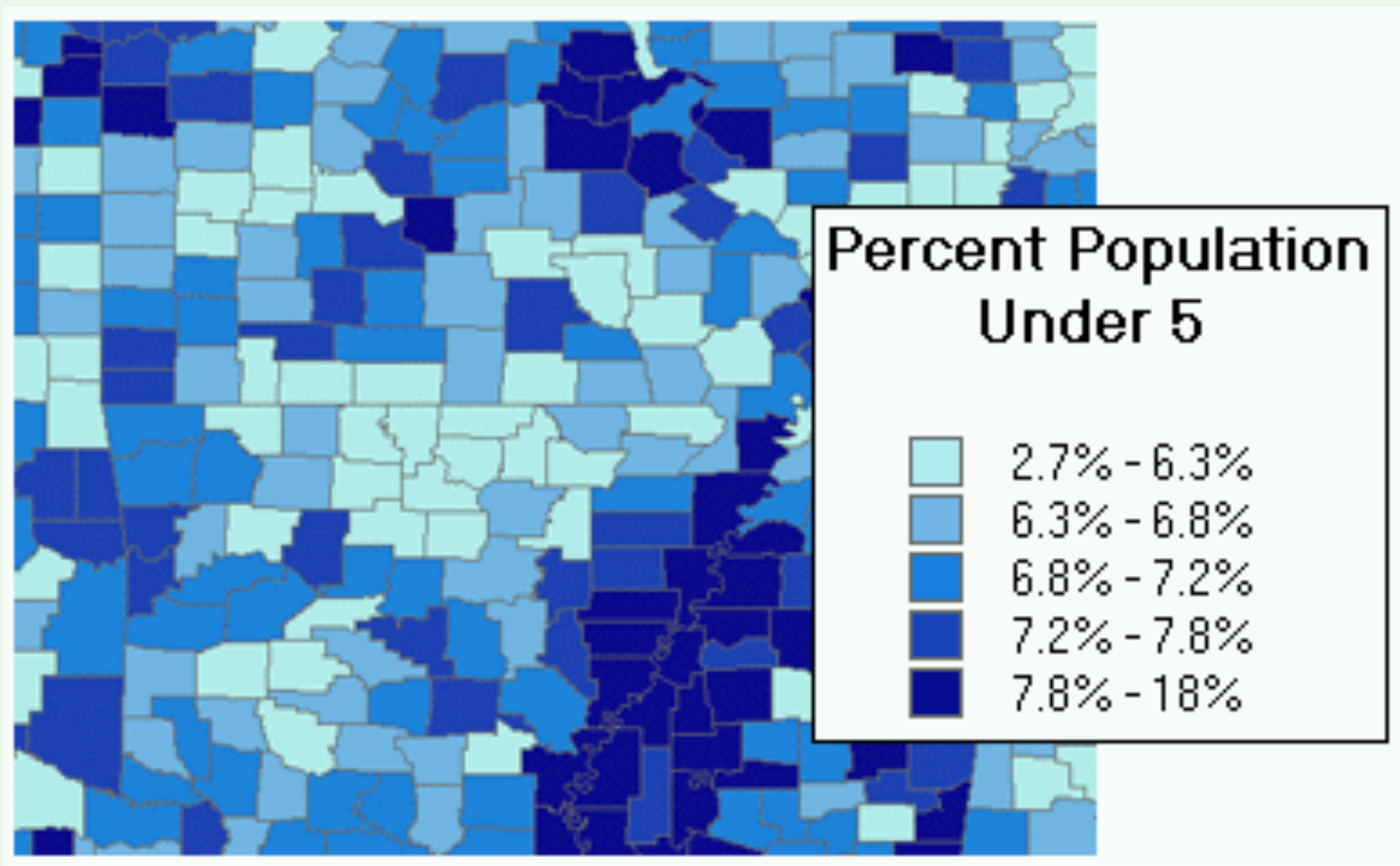
Natural Breaks Method

- Classes are based on groupings and patterns inherent (natural) in the data.
- The features are divided into classes whose boundaries are set where there are relatively big jumps in the data values.



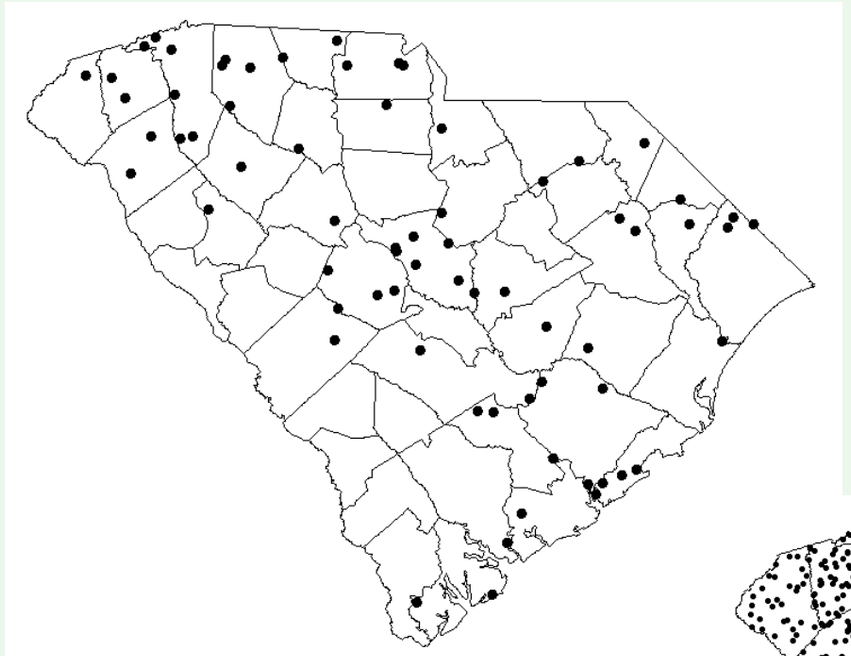
Quantile Method

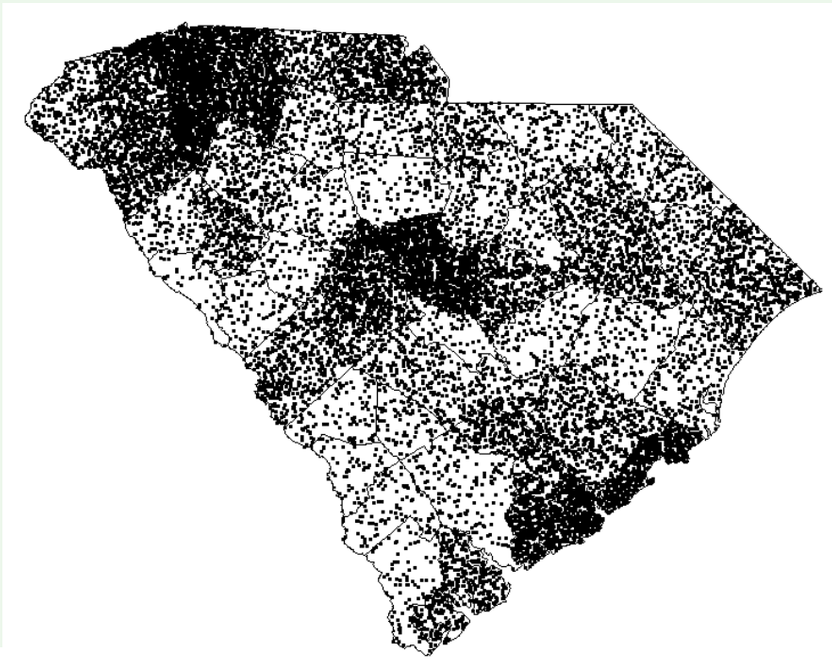
- Each class contains an equal number of features.
- Resulting map can be misleading.
  - Similar features can be placed in adjacent classes, or features with widely different values can be put in the same class.

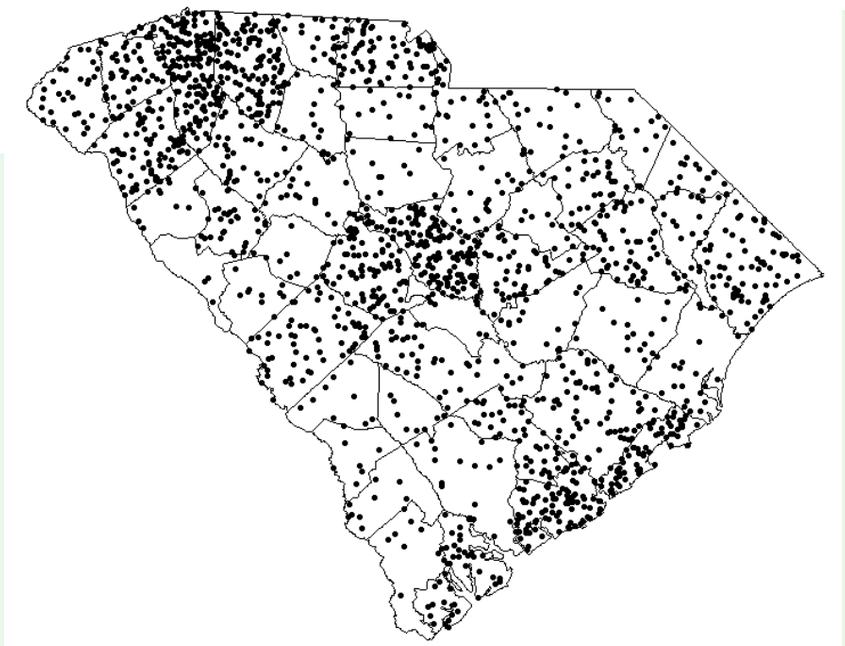


Representing Count Attributes

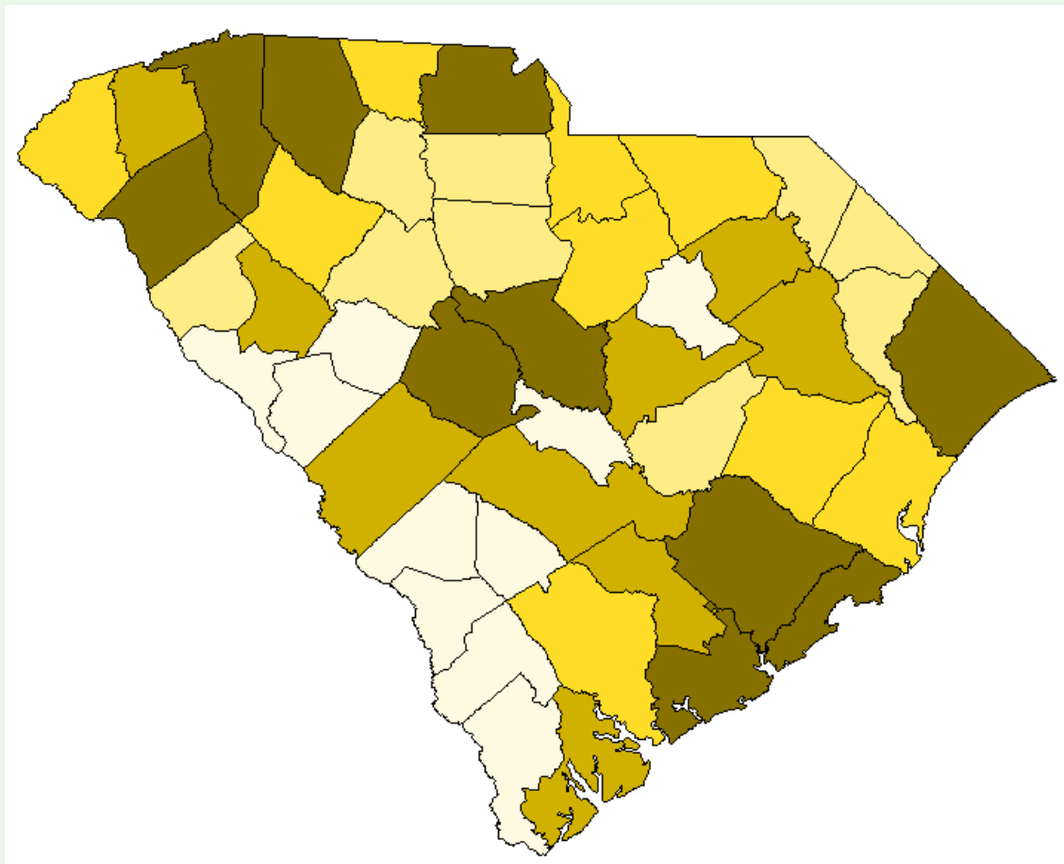
- Dot map



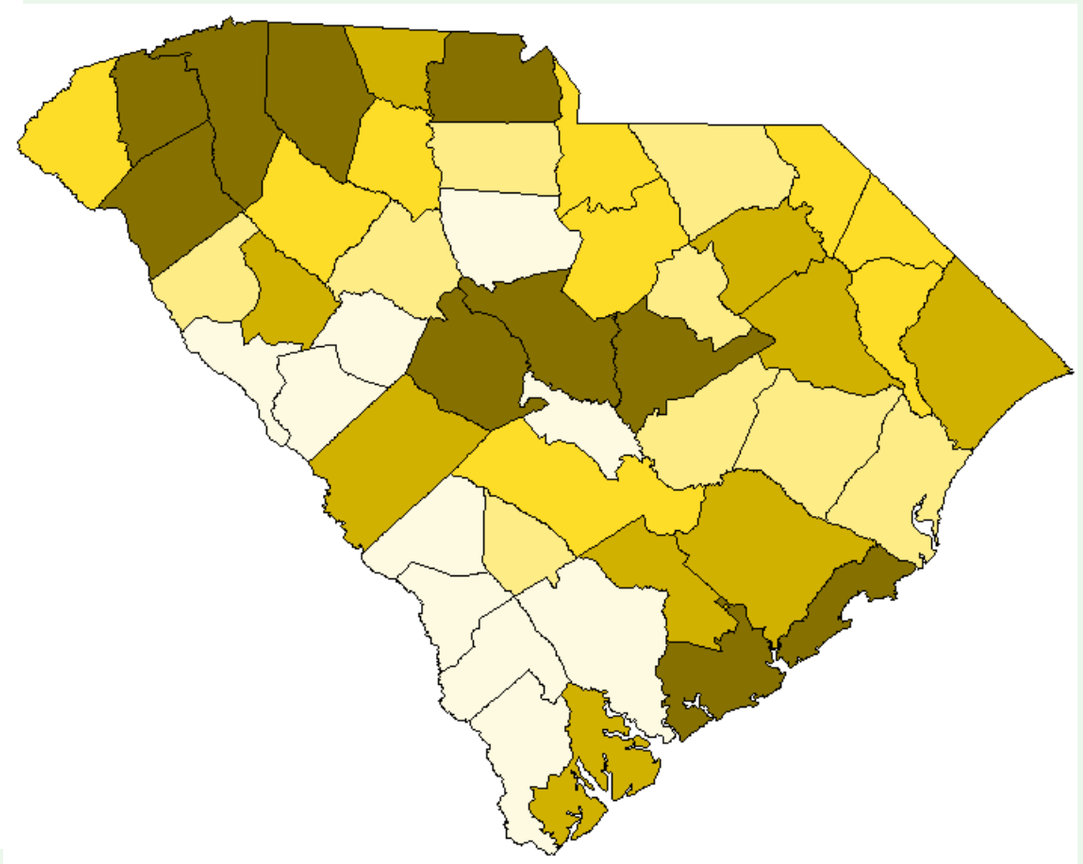




Representing Count Attributes



Population

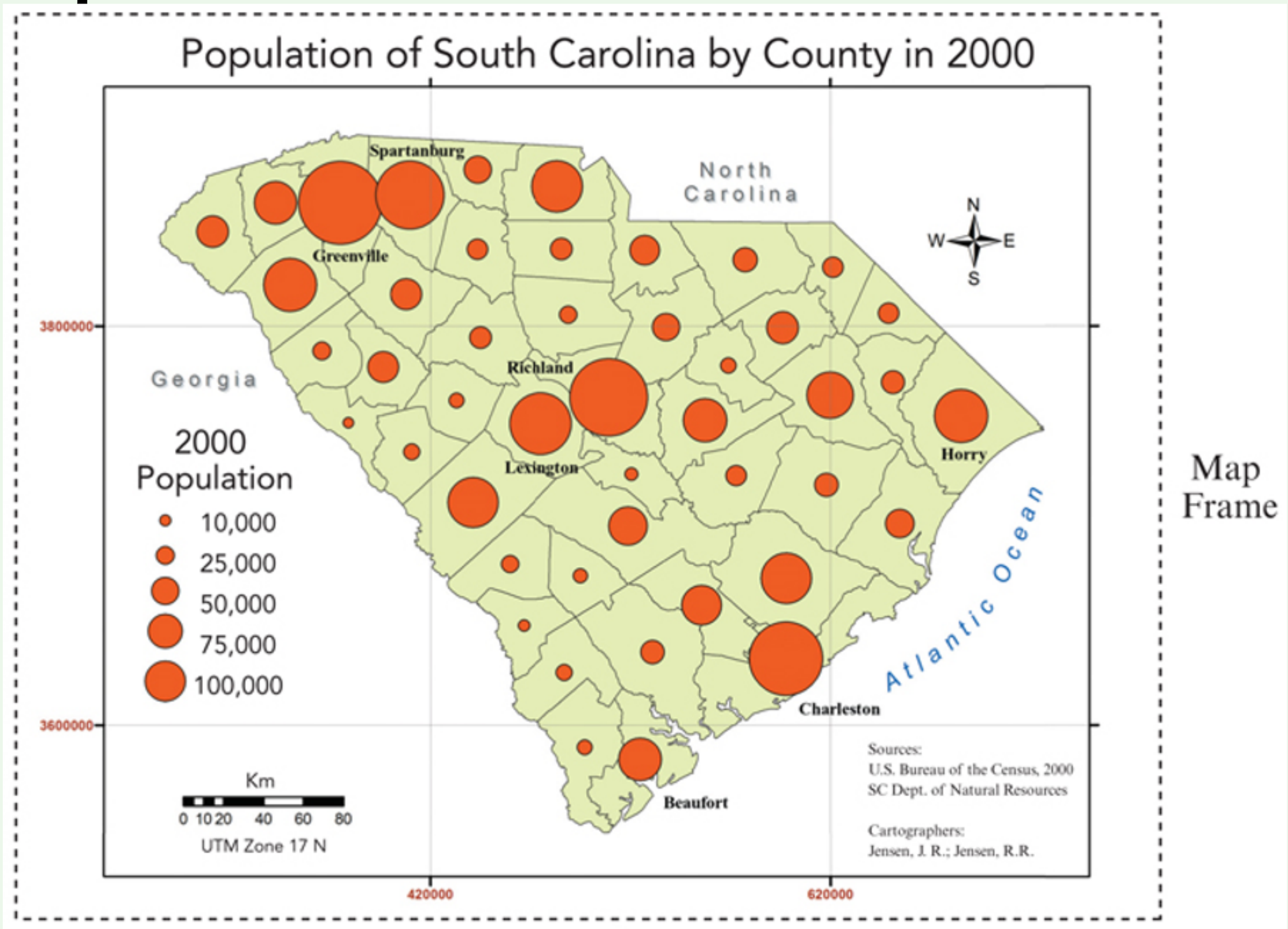


Population Density

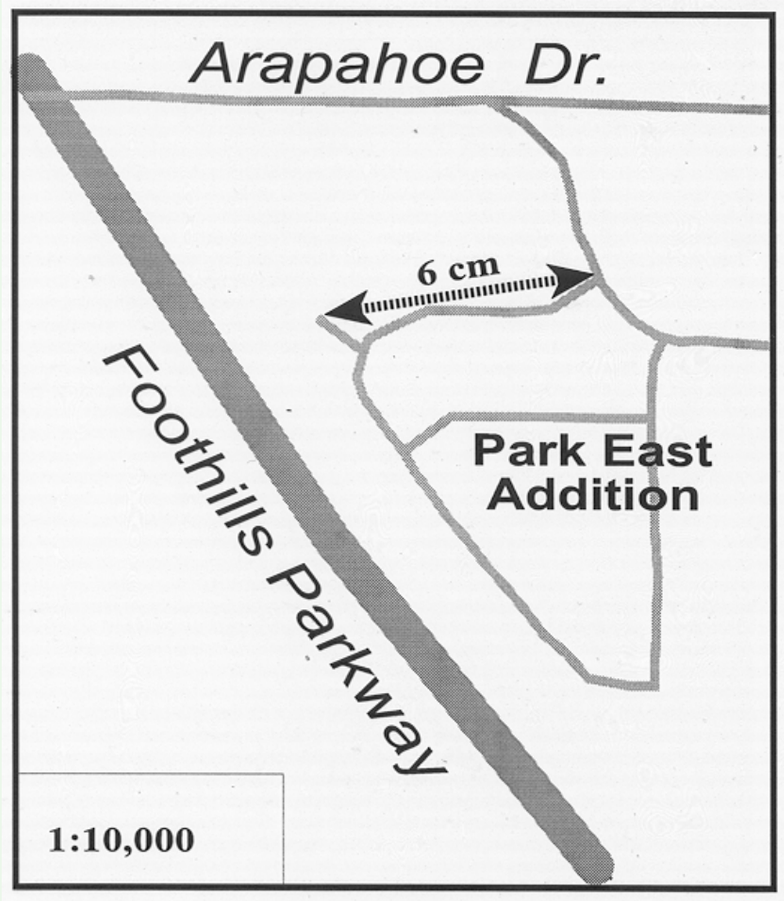
Create Maps

- Features
  - Location and attribute(s)
- Cartographic elements
  - Title, scale, legend, north arrow, cartographer, sources

Map Elements



Map Scale

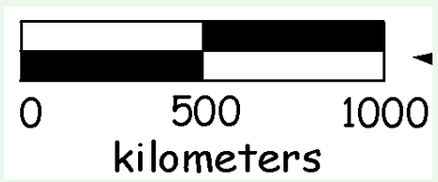


The ratio of a distance on a map to a distance on the ground

Commonly reported as a:

Unitless ratio : 6: 600,000 = 1:100,000

Scale bar:



Large and Small Map Scale

- Map scale is reported as a ratio, e.g., 1:100,000 scale. As a fraction this is 0.00001
  - A large scale map is one where the fraction is large.
  - This happens when the second number is small.
- Example:
  - 1 to 1 million map scale (1:1,000,000) expressed as a fraction is 0.000001;
  - a 1:200 map scale, expressed as a fraction, is 0.005.
  - Which is the larger scale, 0.000001, or 0.005?
- Larger scale maps cover less area, but show more detail.
  - People are often saying **"large scale" map when they mean "large area".**

Map Scale Example