CSCI 491: Data Visualization

25- Visualizing Geospatial Data

Why visualizing the geospatial data?

- Data that contain information linked to locations in the physical world.

  - ✓ Spatial context
  - ✓ Immediate recognition
  - ✓ comparative analysis
  - ✓ Temporal changes
  - ✓ Enhanced engagement
  - ✓ data integration
  - ✓ Identifying correlation
  - ✓ Highlighting part of results

Reference Systems

- To uniquely specify a location on the earth, we need three pieces of information:

1- where we are located along the direction of the equator (the longitude)
2- how close we are to either pole when moving perpendicular to the equator (the latitude)
3- how far we are from the earth's center (the altitude).

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Reference Systems

- Longitude, latitude, and altitude are specified relative to a reference system called the datum. The datum specifies properties such as the shape and size of the earth, as well as the location of zero longitude, latitude, and altitude.
- One widely used datum is the World Geodetic System (WGS) 84, which is used by the Global Positioning System (GPS).

Reference Systems

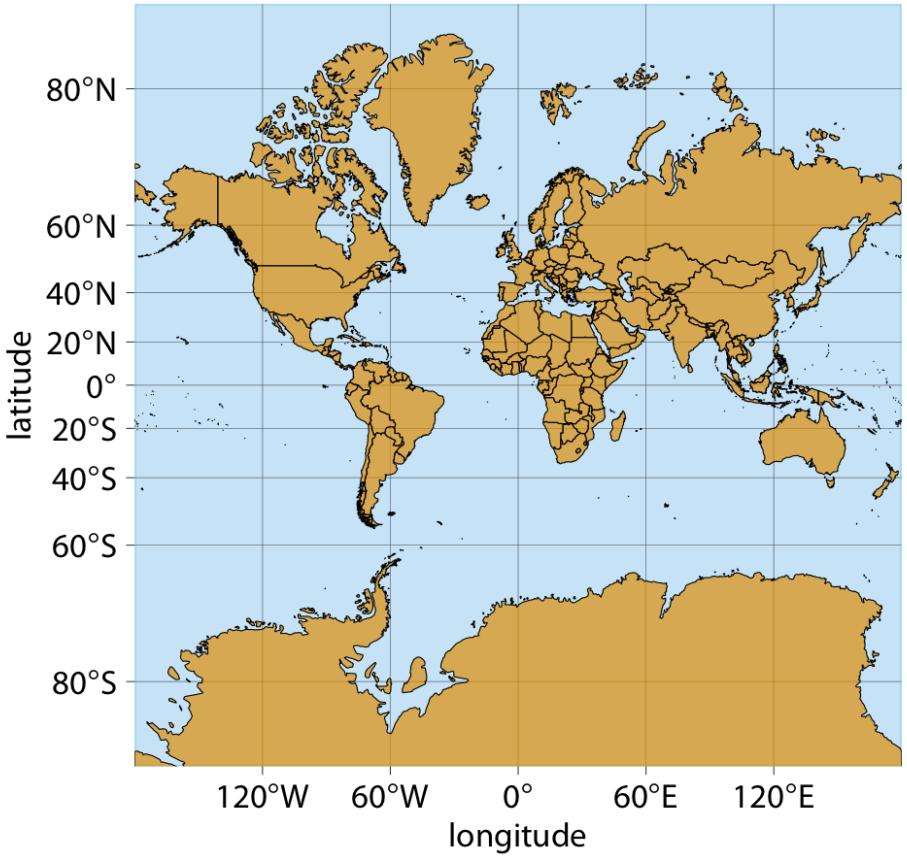
- Both longitude and latitude are angles, expressed in degrees. Degrees.
- Lines of equal longitude are referred to as meridians.
- The prime meridian, corresponding to 0° longitude
- Degrees longitude measure how far east or west a location lies.
- Degrees latitude measure how far north or south a location lies.
- Lines of equal latitude are referred to as parallels

Projections

- The challenge in map making is that we need to take the spherical surface of the earth and flatten it out so we can display it on a map. This process, called projection
- Projection necessarily introduces distortions, Why?
- Specifically, the projection can preserve either angles (conformal) or areas (equal-area) but not both.
- Some projections preserve neither or both but partially.

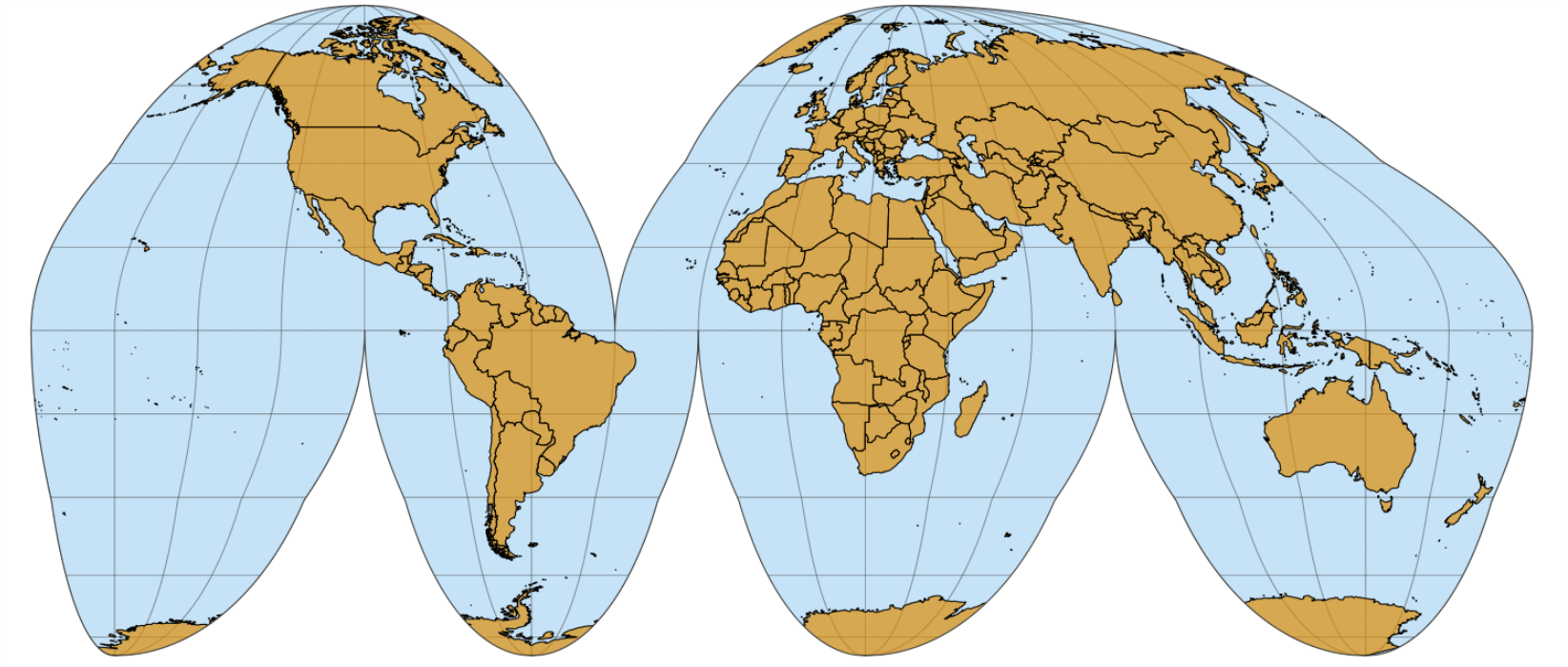
Mercator Projection

- Developed in the 16th century
- Conformal or equal-area?
- large-scale, small areas
- Web Mercator projection, by google



Interrupted Goode homolosine

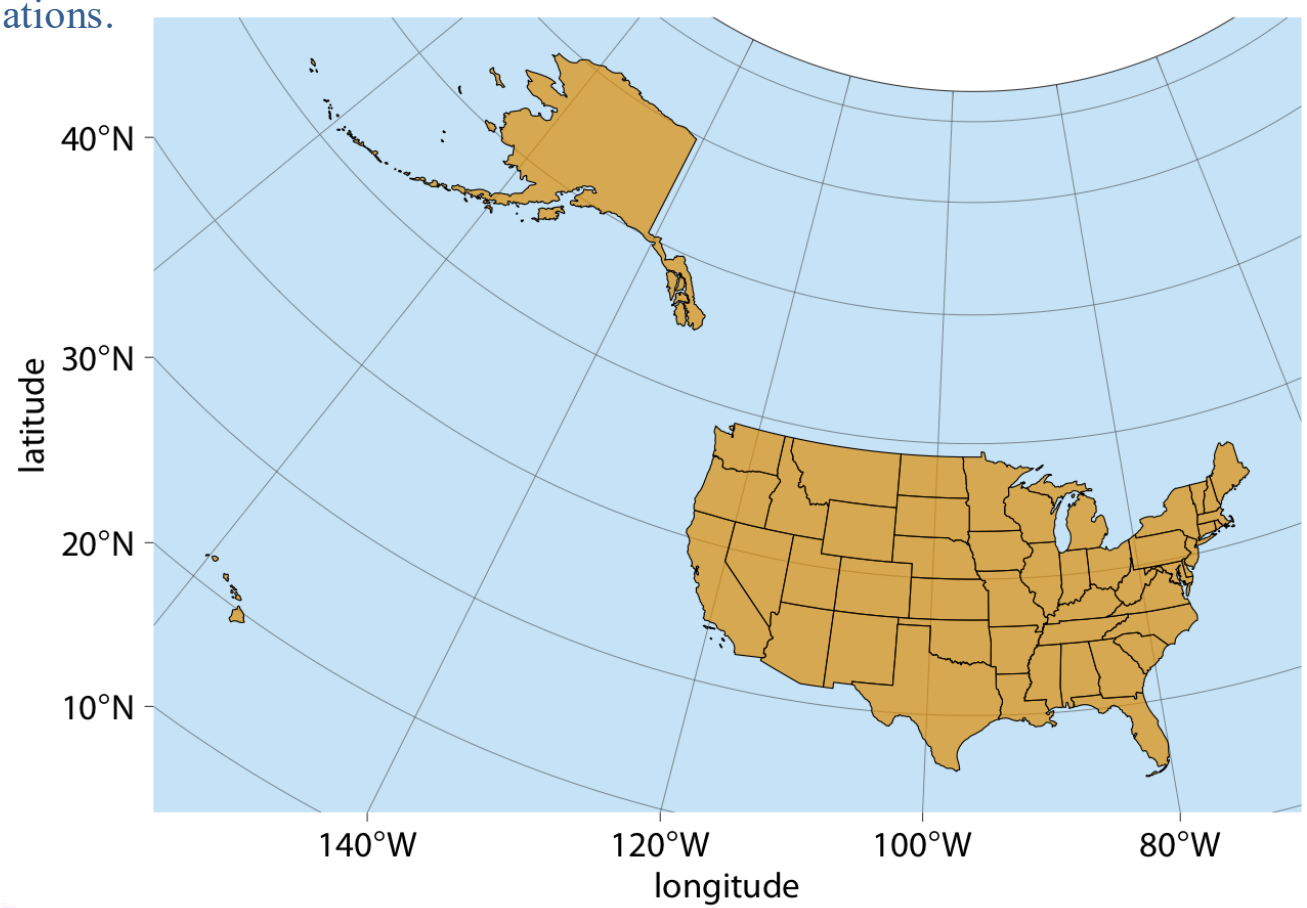
- Conformal or equal-area?



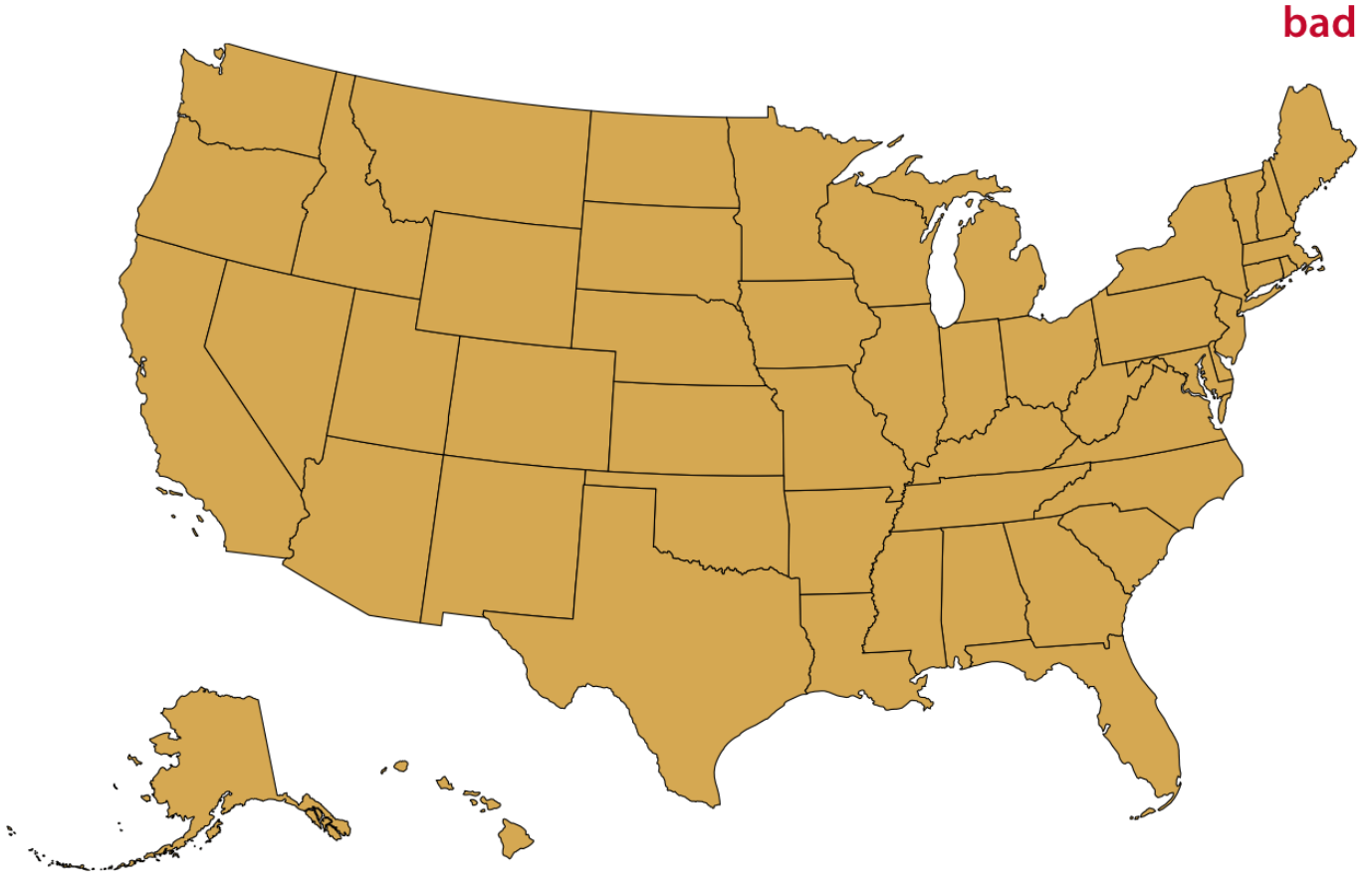
United States Map

United States Map

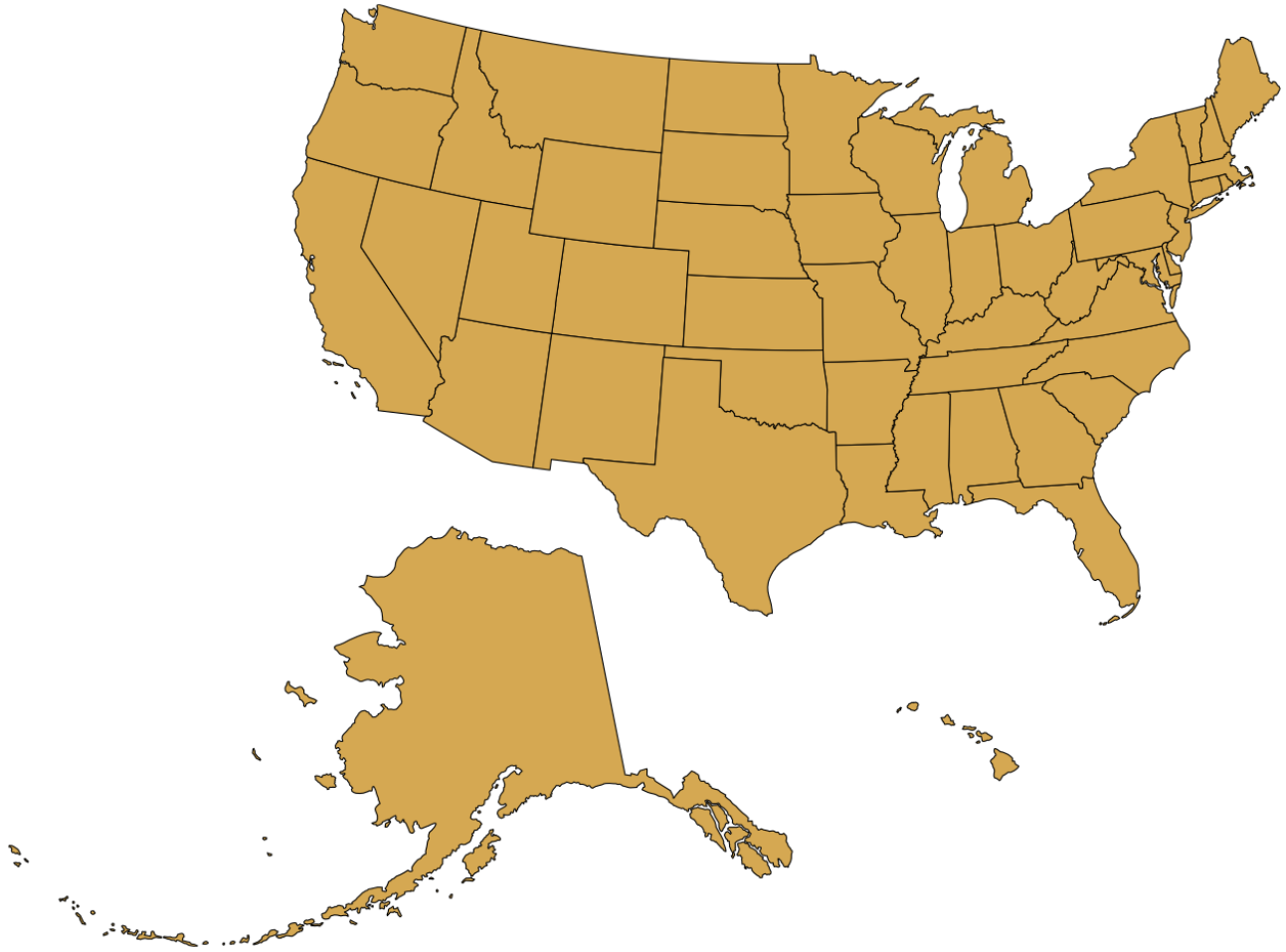
- Map of the United States of America, using an area-preserving Albers projection (ESRI:102003, commonly used to project the lower 48 states). Alaska and Hawaii are shown in their true locations.



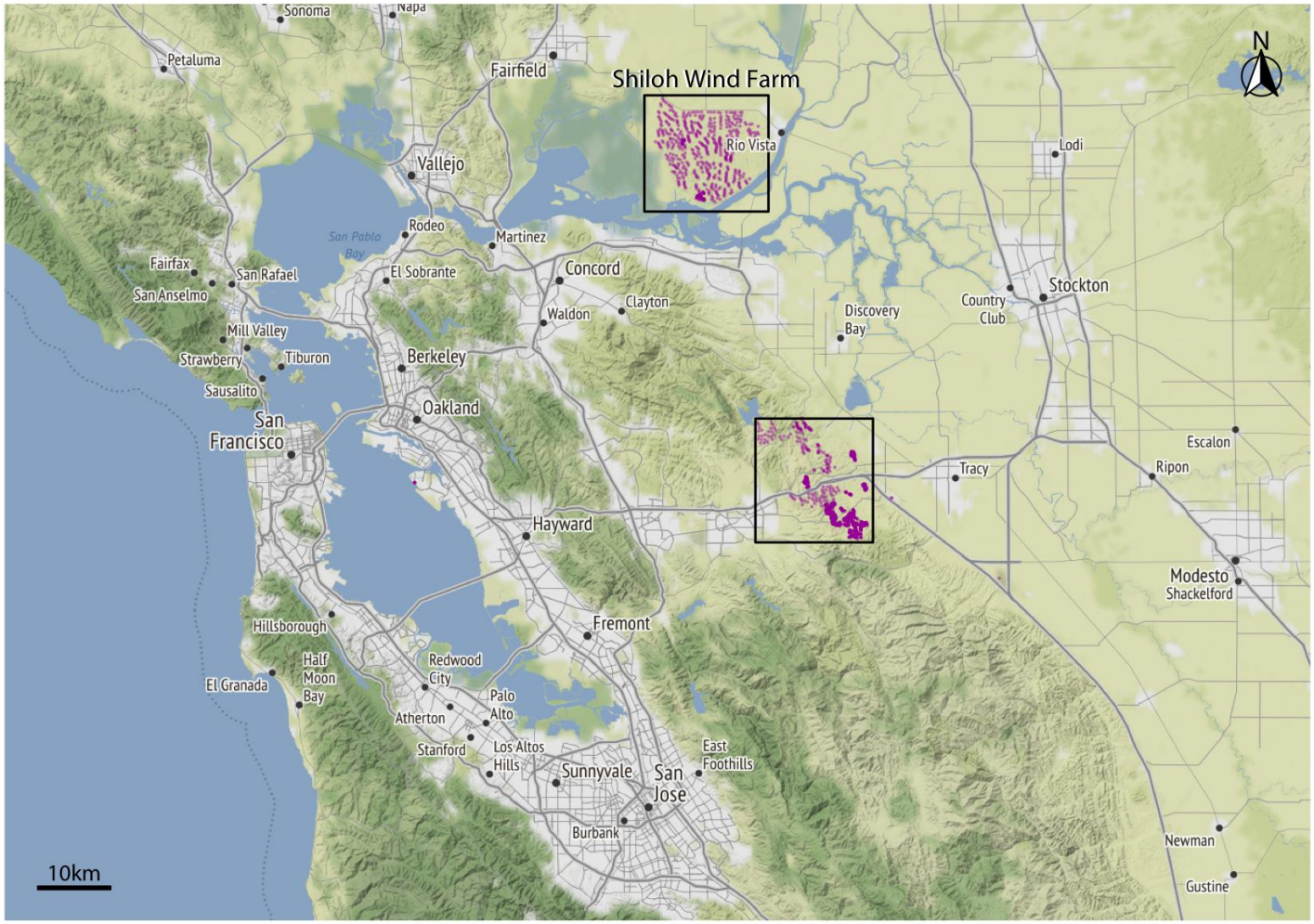
United States Map



United States Map



Layers

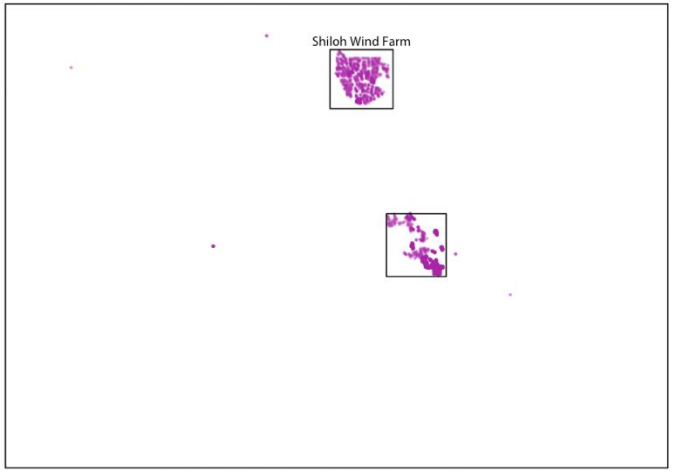

Shiloh Wind Farm
N
Sonoma
Napa
Petaluma
Fairfield
Rio Vista
Lodi
Vallejo
Rodeo
Martinez
San Pablo Bay
Fairfax
San Rafael
El Sobrante
Concord
San Anselmo
Clayton
Waldon
Discovery Bay
Country Club
Stockton
Mill Valley
Strawberry
Tiburon
Berkeley
Sausalito
Oakland
San Francisco
Escalon
Tracy
Ripon
Hayward
Modesto
Shackelford
Hillsborough
Fremont
Half Moon Bay
Redwood City
El Granada
Palo Alto
Atherton
Stanford
Los Altos Hills
Sunnyvale
East Foothills
San Jose
Burbank
Newman
Gustine
10km

Layers

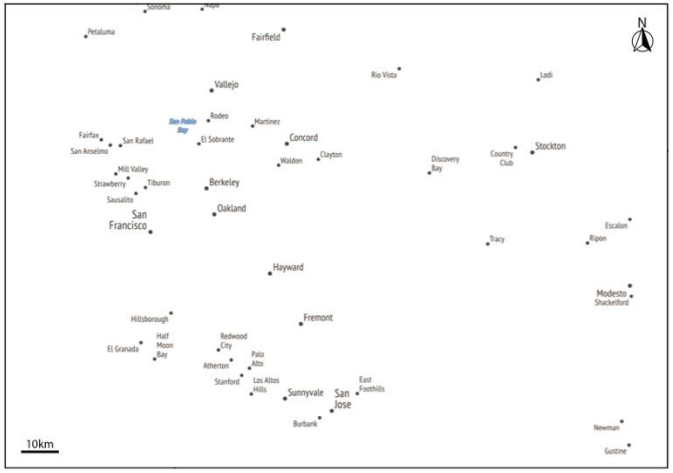
terrain

roads

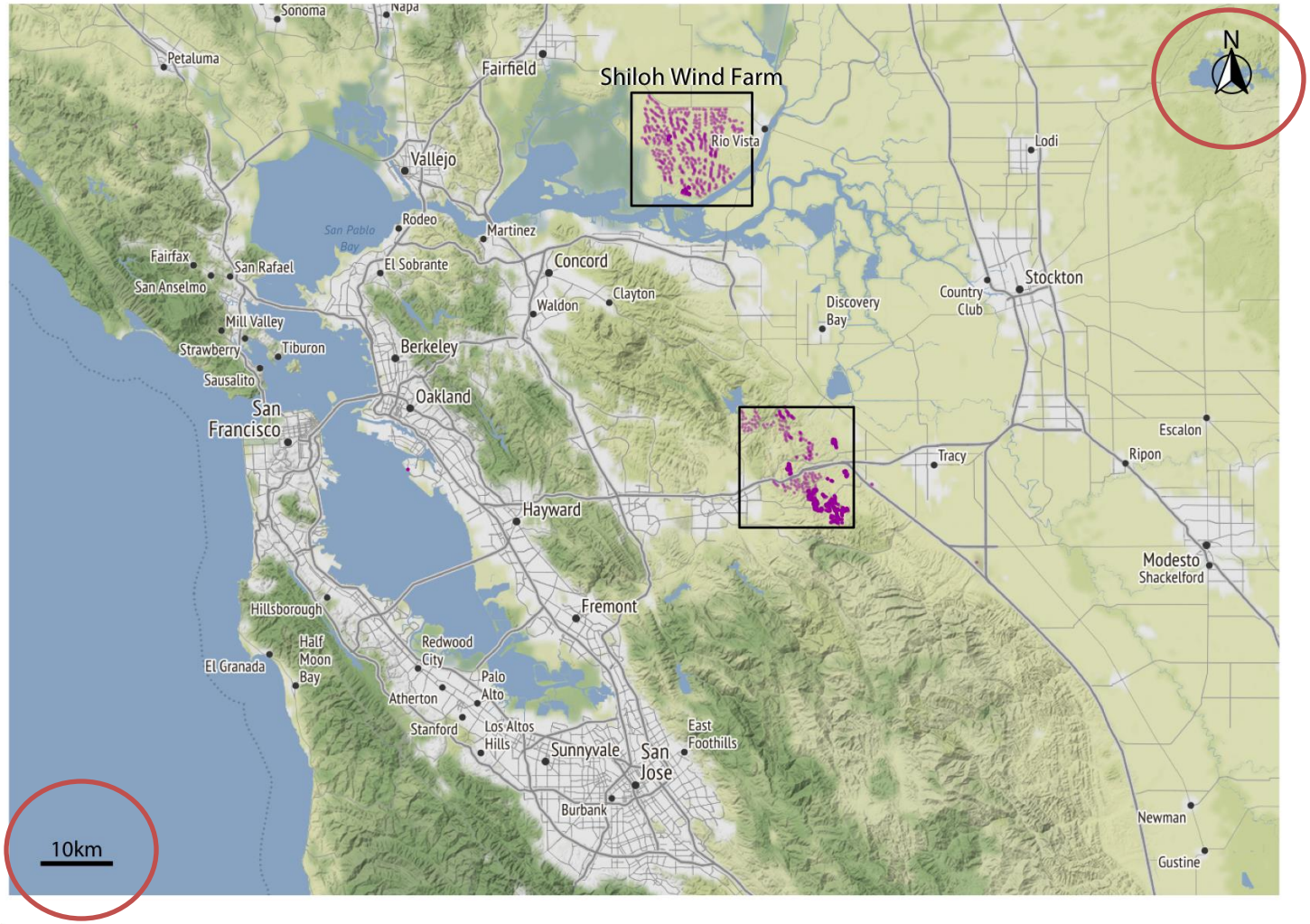
wind turbines



city labels, scale bar



Layers


Shiloh Wind Farm
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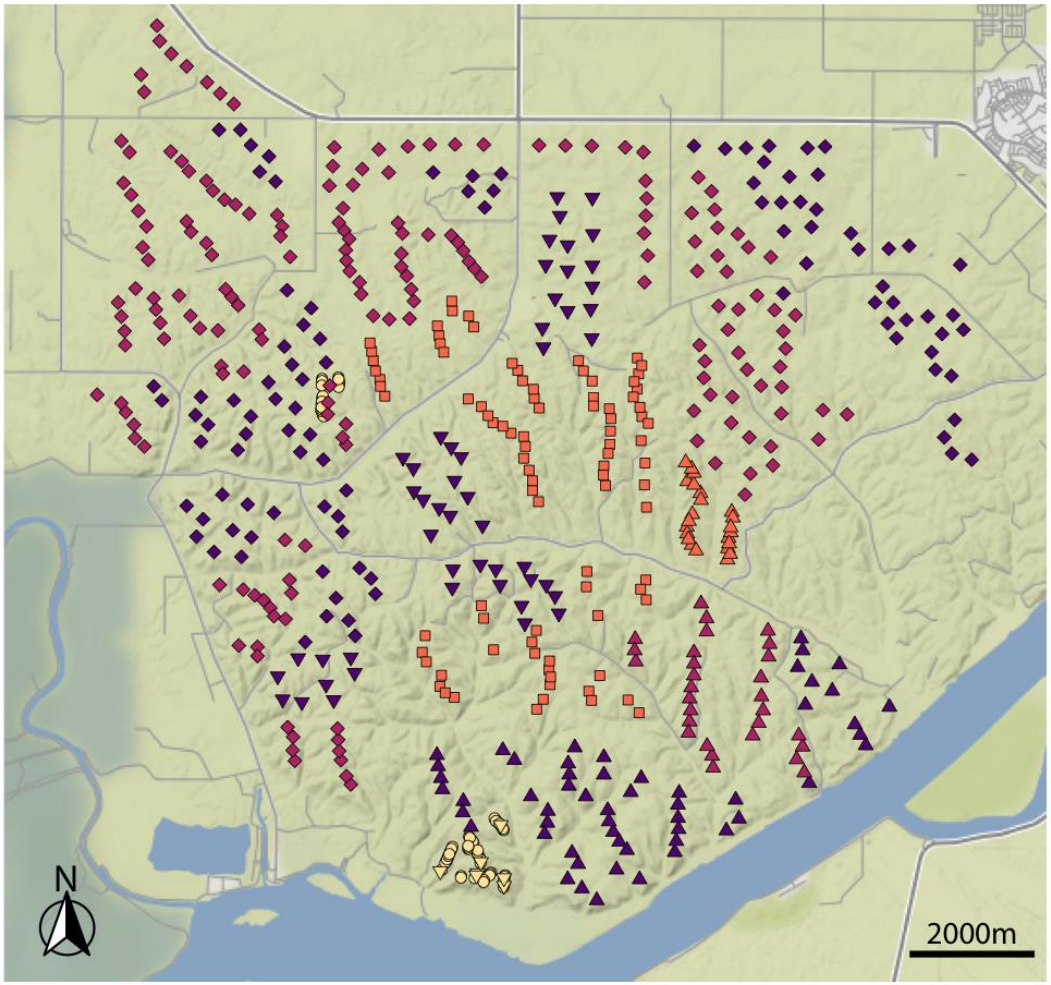
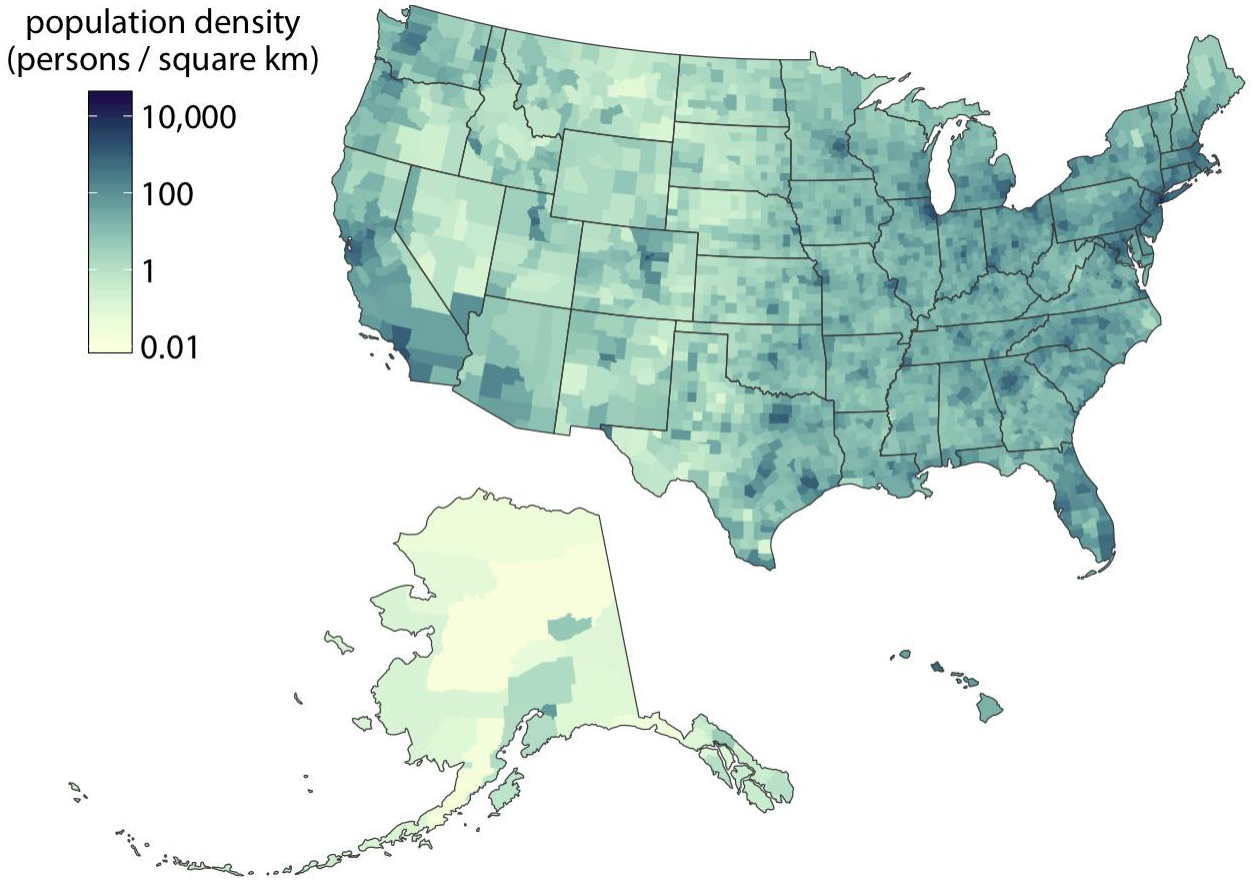
Berkeley
Sausalito
Oakland
San Francisco
Escalon
Tracy
Ripon
Hayward
Modesto
Shackelford
Hillsborough
Fremont
Half Moon Bay
El Granada
Redwood City
Palo Alto
Atherton
Stanford
Los Altos Hills
Sunnyvale
San Jose
East Foothills
Burbank
Newman
Gustine

Aesthetics on Maps for Categorical Vars



Choropleth Mapping for Quantitative Vars.

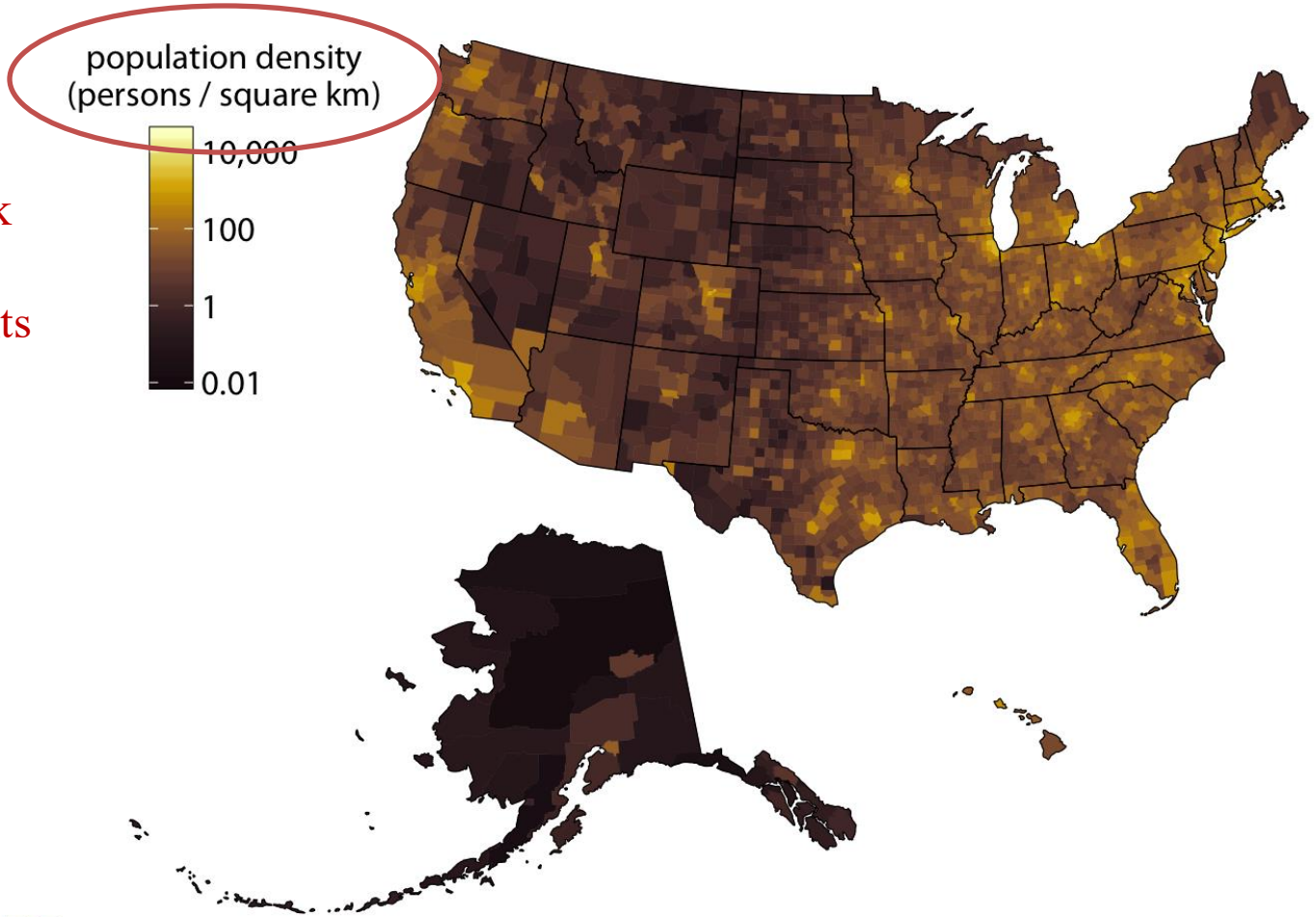
- We tend to associate darker colors with higher intensities when the background color of the figure is light.



Choropleth Mapping for Quantitative Vars.

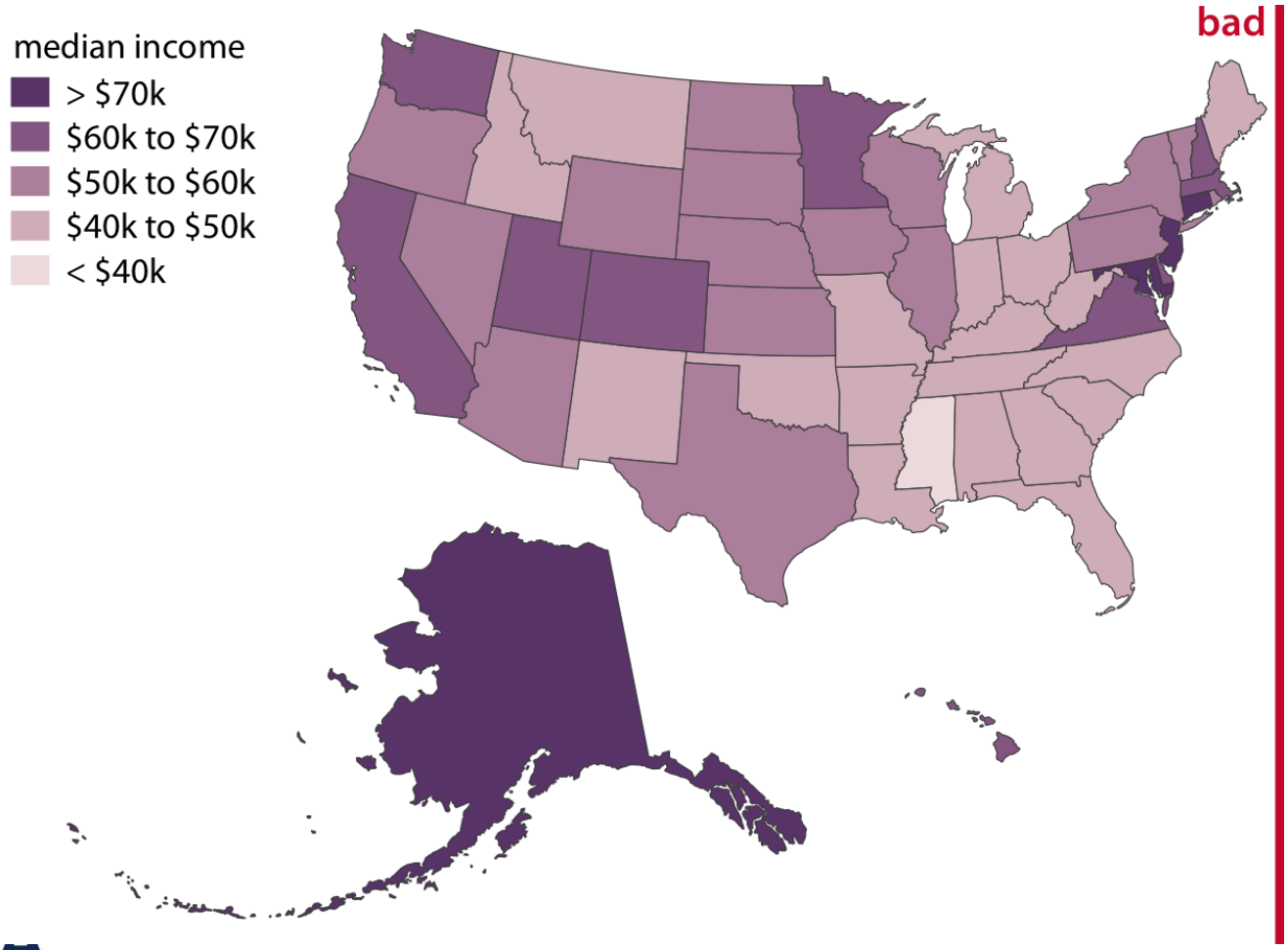
An alternative color map the high densities glow up on darker background

Choropleths work best when the coloring represents a density



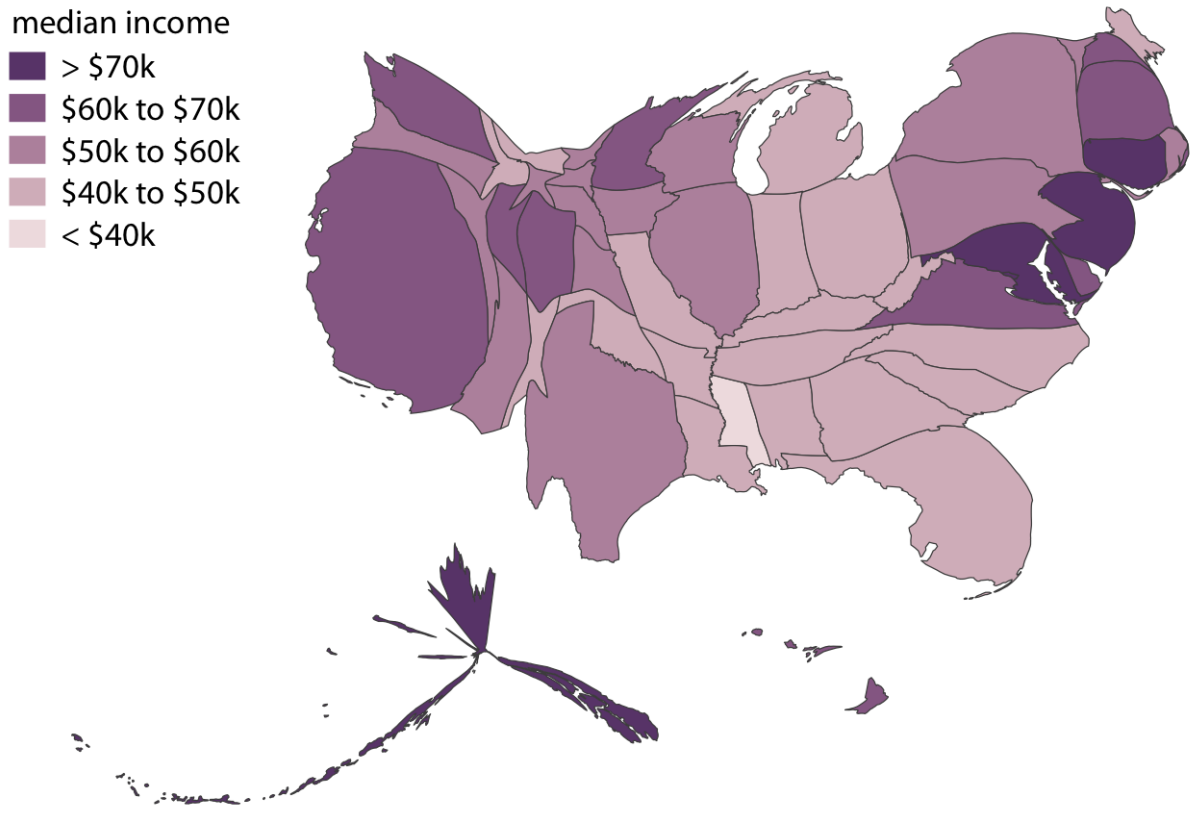
Choropleth Mapping for Quantitative Vars.

Large area of Alaska makes it appear very rich; remember, it's mostly empty

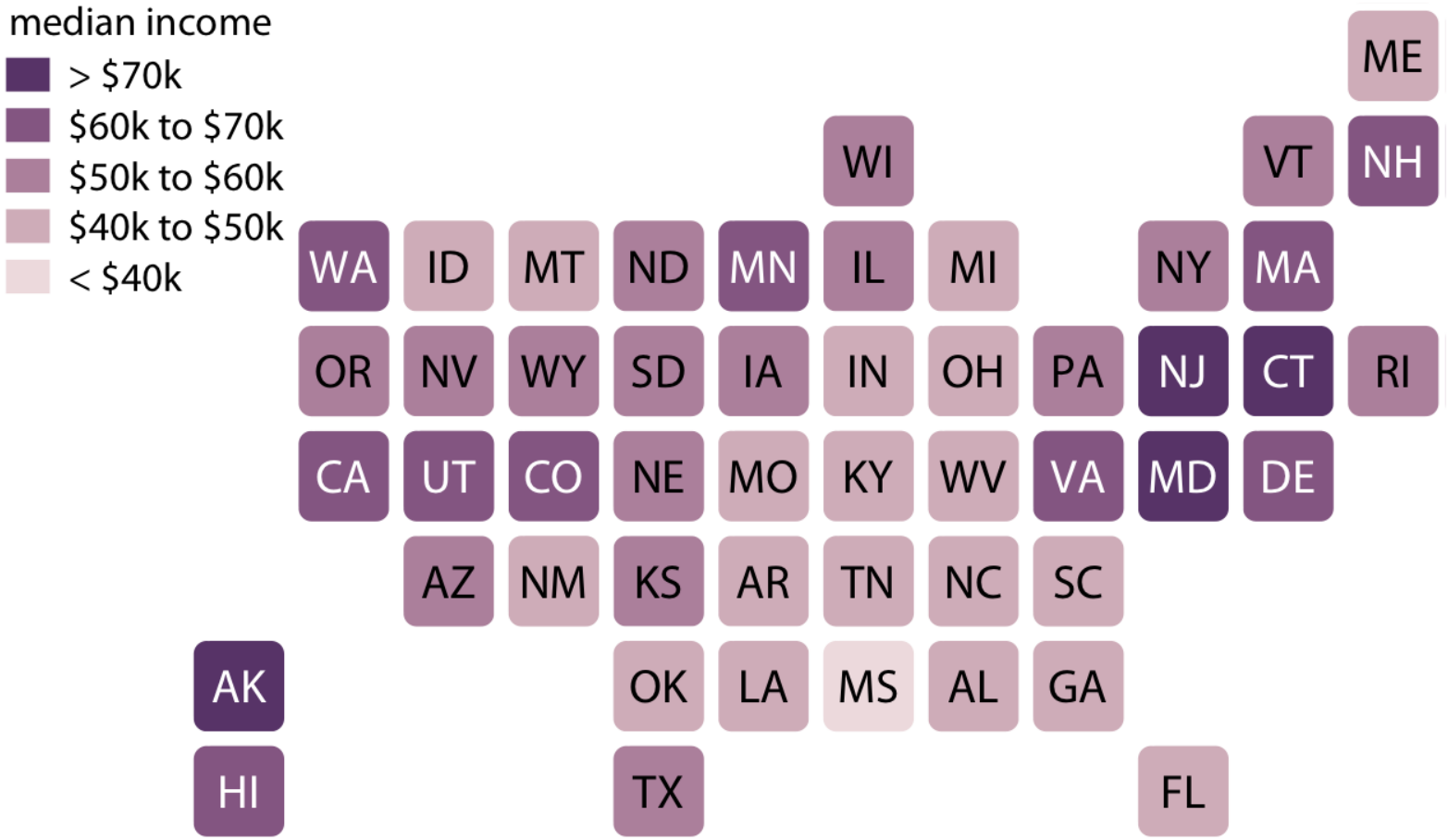


Cartograms

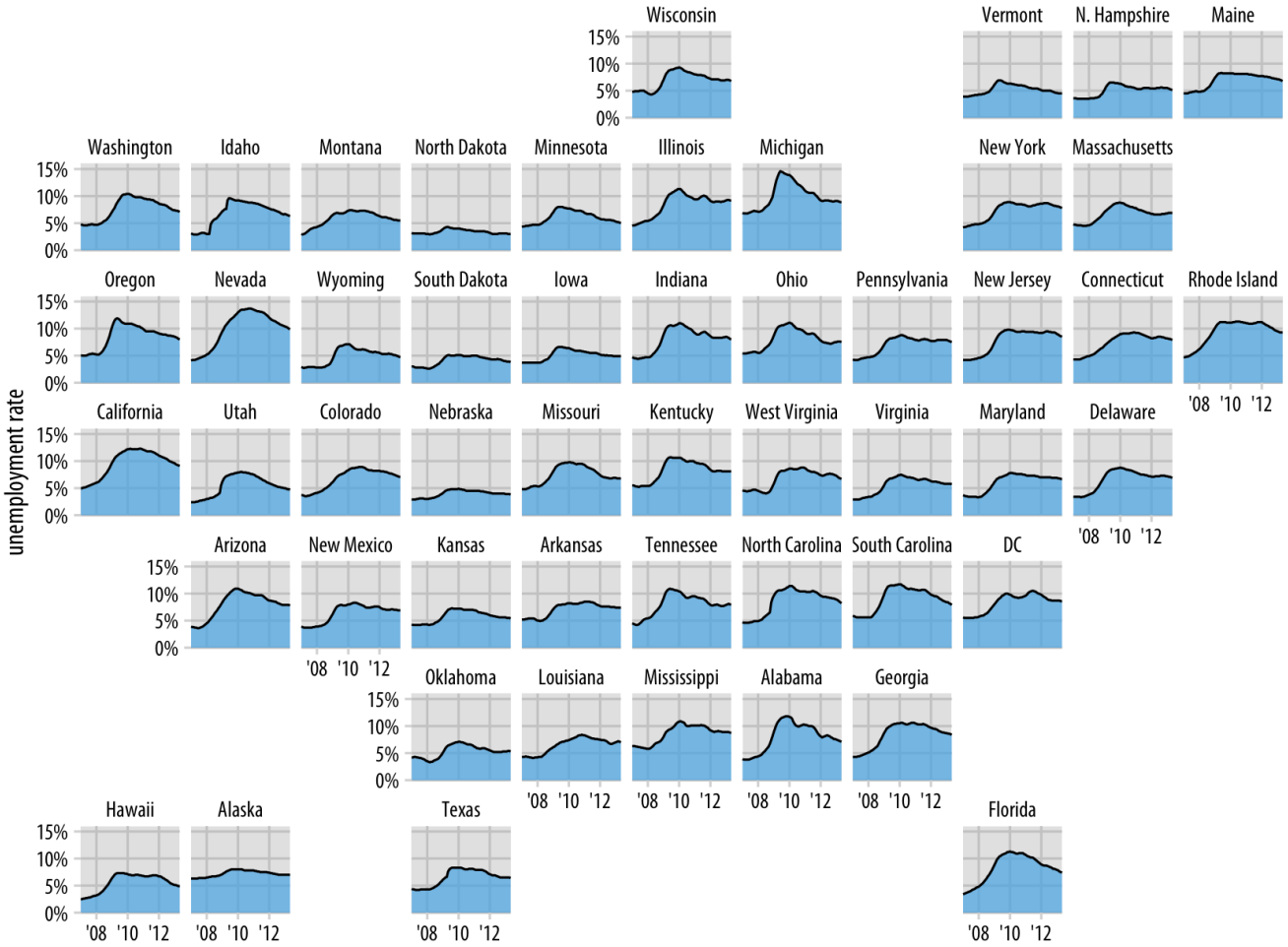
Not every map-like visualization has to be geographically accurate to be useful.



Cartograms


median income
> $70k
$60k to $70k
$50k to $60k
$40k to $50k
< $40k
ME
WI
VT
NH
WA
ID
MT
ND
MN
IL
MI
NY
MA
OR
NV
WY
SD
IA
IN
OH
PA
NJ
CT
RI
CA
UT
CO
NE
MO
KY
WV
VA
MD
DE
AZ
NM
KS
AR
TN
NC
SC
AK
OK
LA
MS
AL
GA
HI
TX
FL

Cartograms


unemployment rate
Wisconsin
Vermont
N. Hampshire
Maine
Washington
Idaho
Montana
North Dakota
Minnesota
Illinois
Michigan
New York
Massachusetts
Oregon
Nevada
Wyoming
South Dakota
Iowa
Indiana
Ohio
Pennsylvania
New Jersey
Connecticut
Rhode Island
California
Utah
Colorado
Nebraska
Missouri
Kentucky
West Virginia
Virginia
Maryland
Delaware
Arizona
New Mexico
Kansas
Arkansas
Tennessee
North Carolina
South Carolina
DC
Oklahoma
Louisiana
Mississippi
Alabama
Georgia
Hawaii
Alaska
Texas
Florida
15%
10%
5%
0%
'08
'10
'12