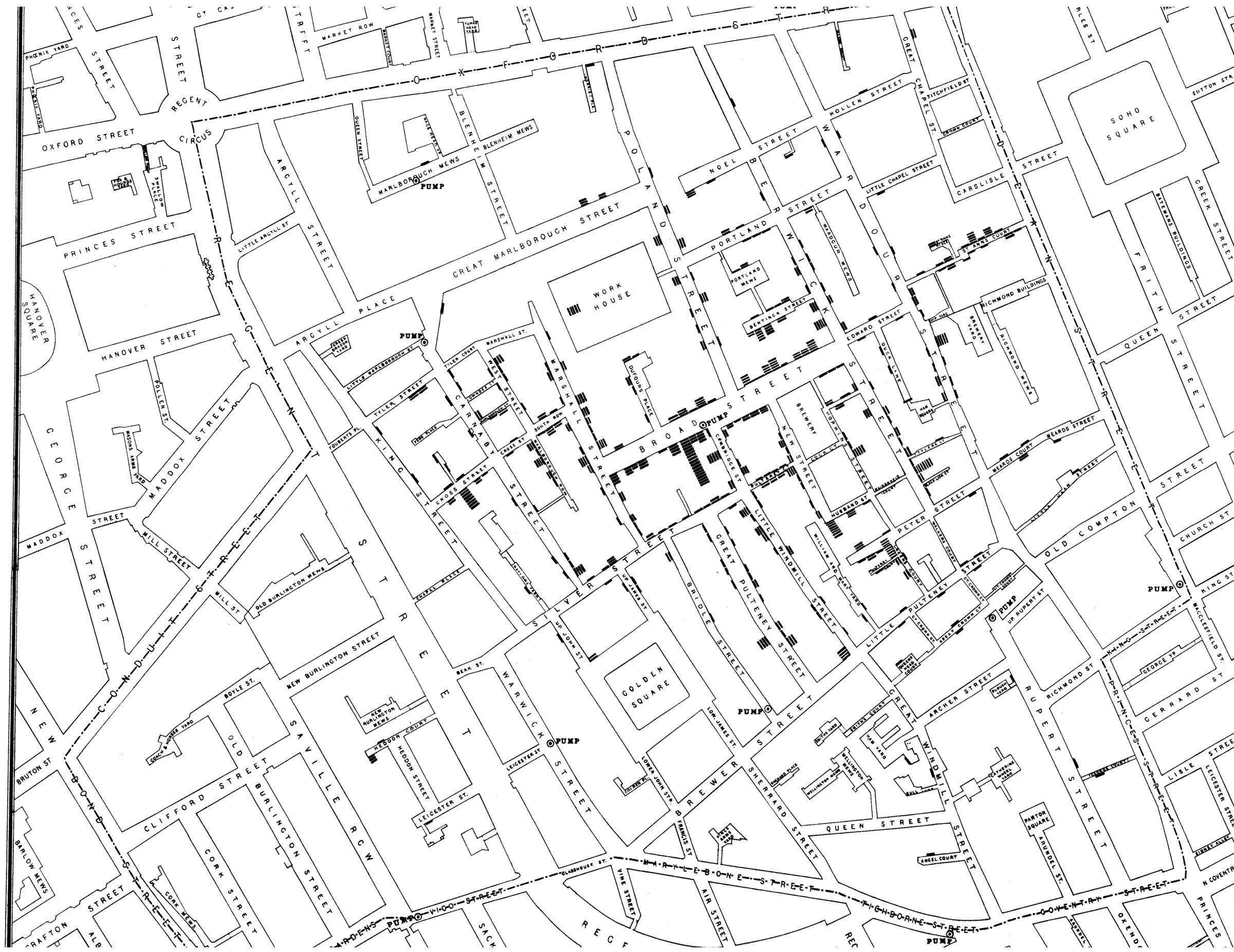


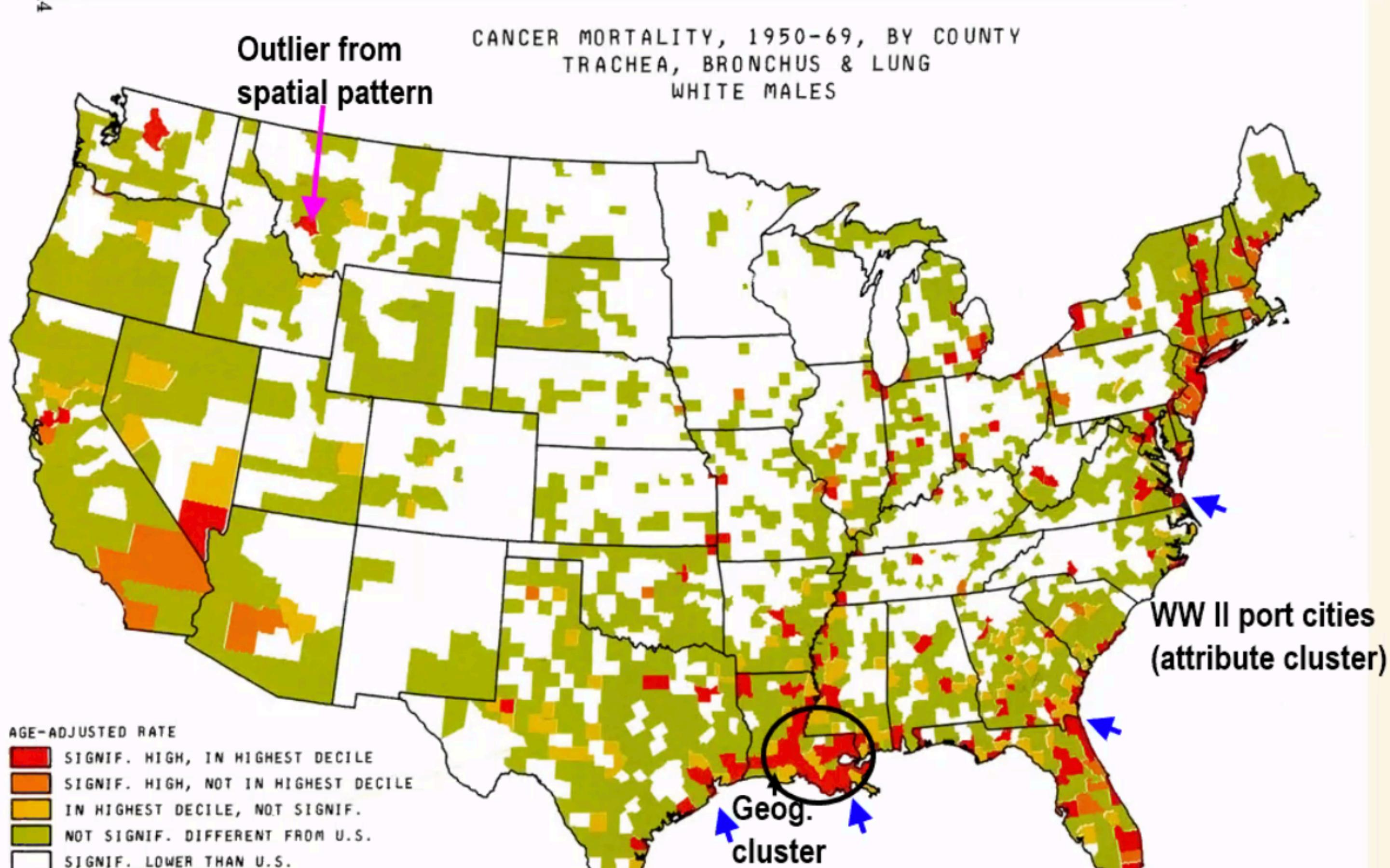
# Spatial data

Best case for mapping spatial data:  
when geography matters

# John Snow, Cholera Map 1854



# Findings from 1st NCI Cancer Atlas, 1975 Lung cancer among white males, 1950-69



source: Linda Pickle

# Locations of printer failures

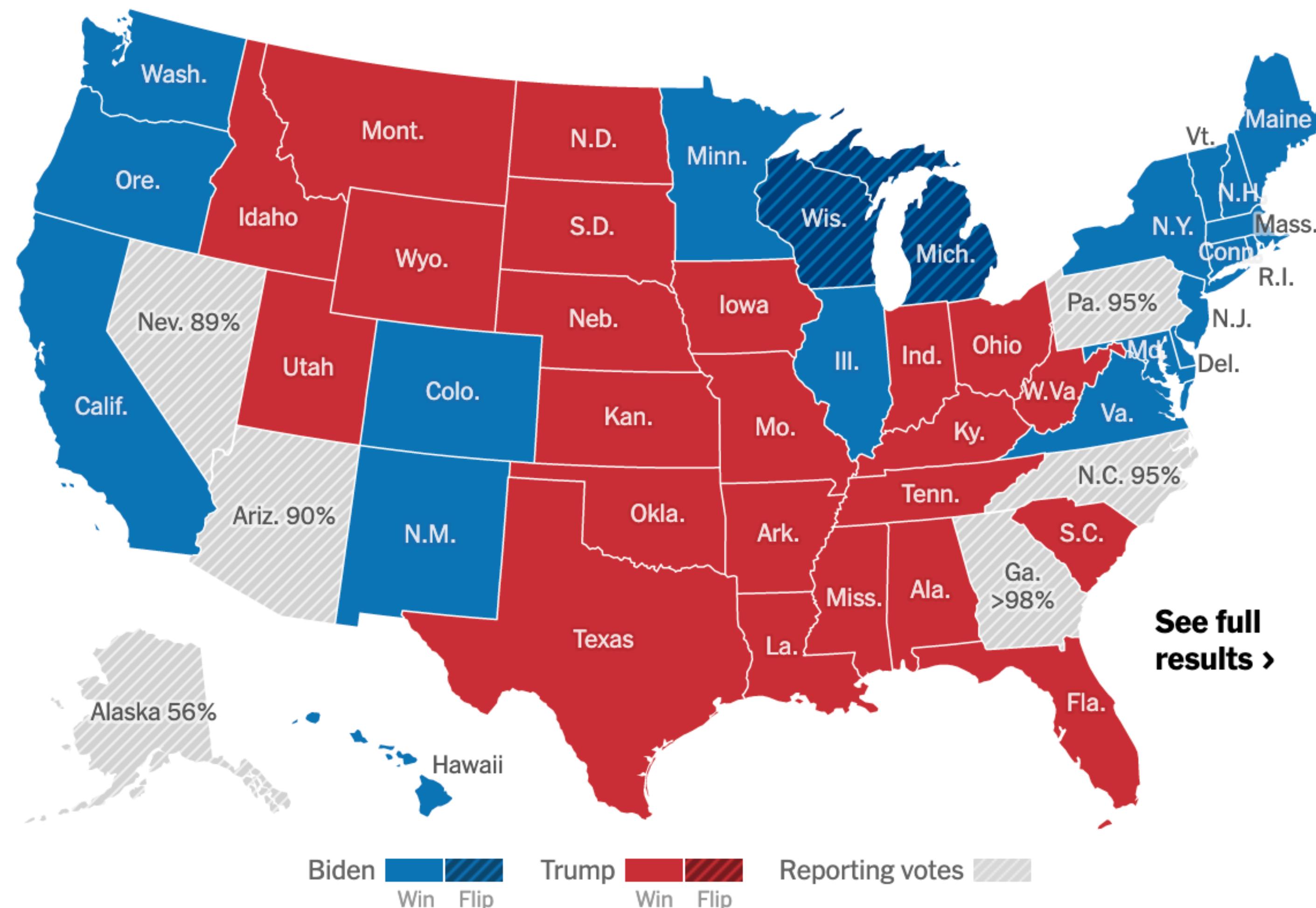


source: Dick DeVeaux

# Does geography matter?

NFL standings										
GAMES	NEWS	STANDINGS					PLAYERS			
American Football Conference										
AFC East		W	L	T	Pct	PF	PA	Home	Away	Strk
 Patriots		5	2	0	.714	214	179	4-0-0	1-2-0	W4
 Dolphins		4	3	0	.571	151	177	3-1-0	1-2-0	L1
 Jets		3	4	0	.429	182	176	2-2-0	1-2-0	L1
 Bills		2	5	0	.286	81	175	1-1-0	1-4-0	L2

# Does geography matter?



Source: Vote totals from N.E.P./Edison Research

<https://www.nytimes.com>, Nov. 6, 2020

## The winding path to victory

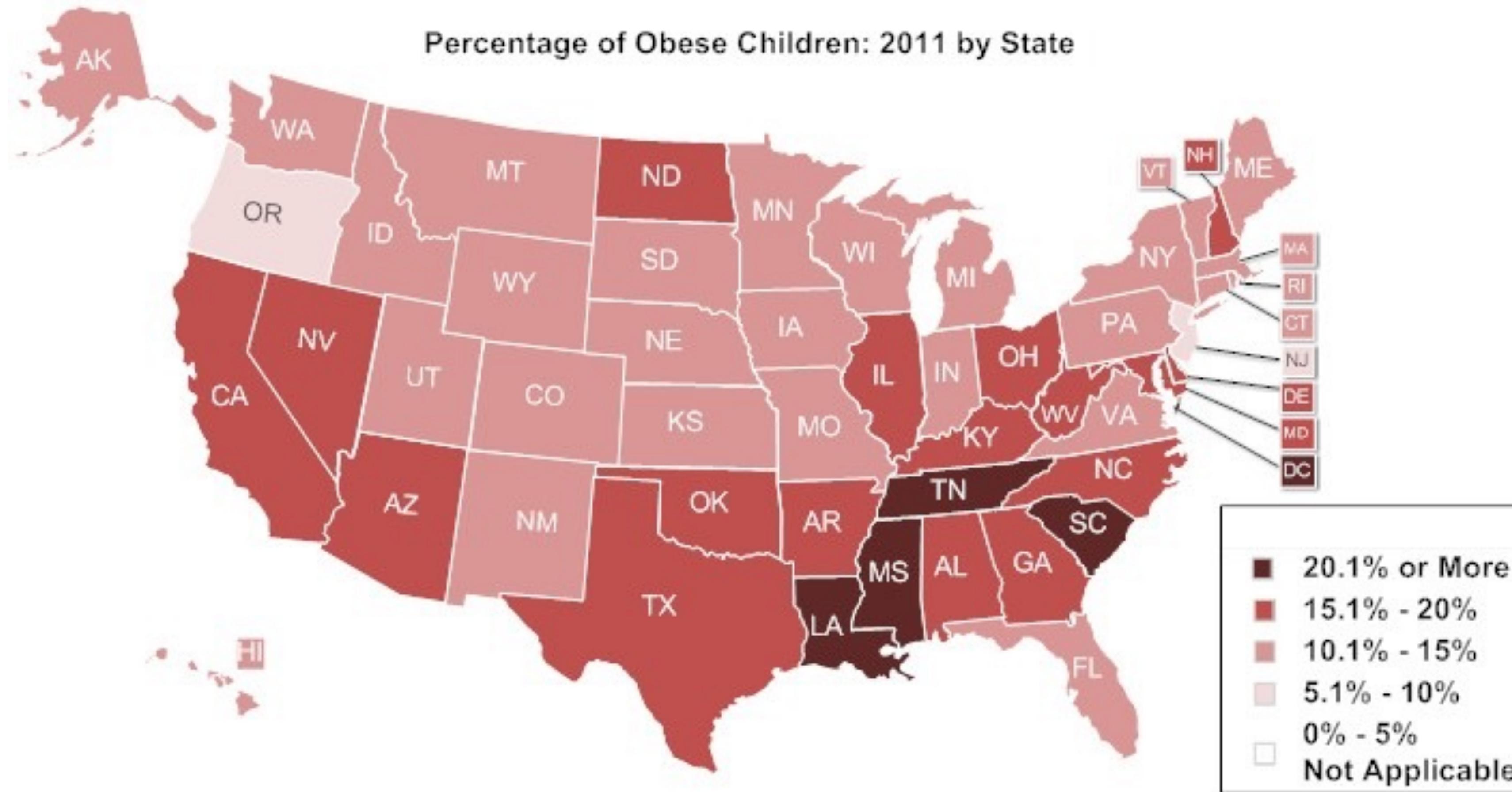
States that are forecasted to vote for one candidate by a big margin are at the ends of the path, while tighter races are in the middle. Bigger segments mean more Electoral College votes. Trace the path from either end to see which state could put one candidate over the top.



<https://projects.fivethirtyeight.com/2020-election-forecast/>

# Political Boundaries

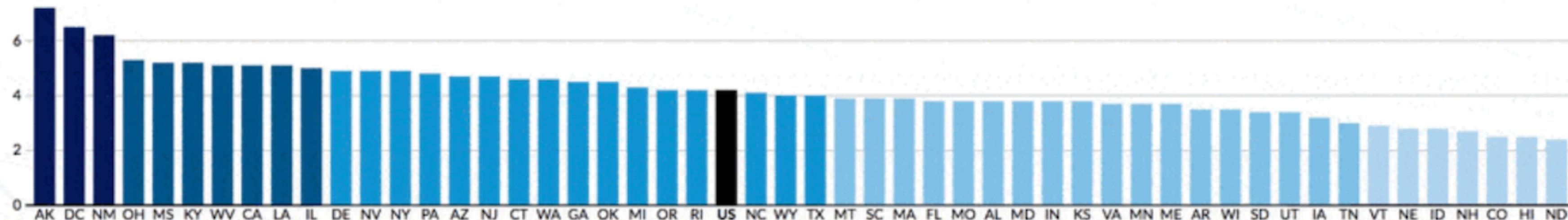
# Choropleth



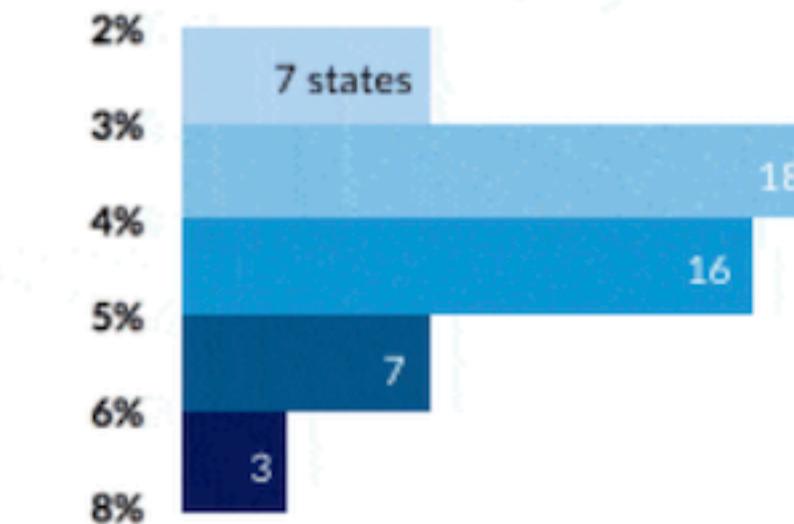
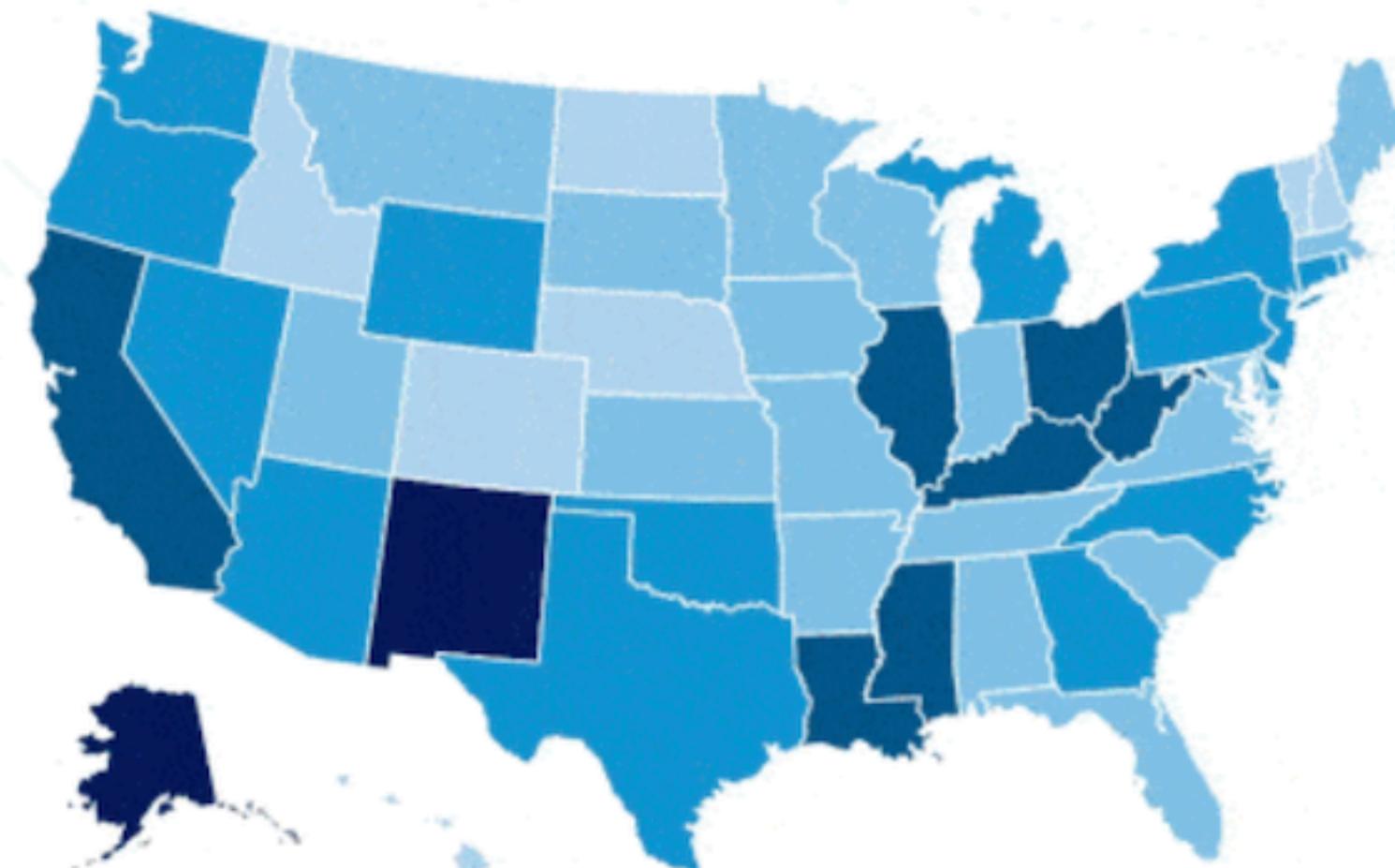
# Choropleth

**Unemployment Rate** (percent, seasonally adjusted)

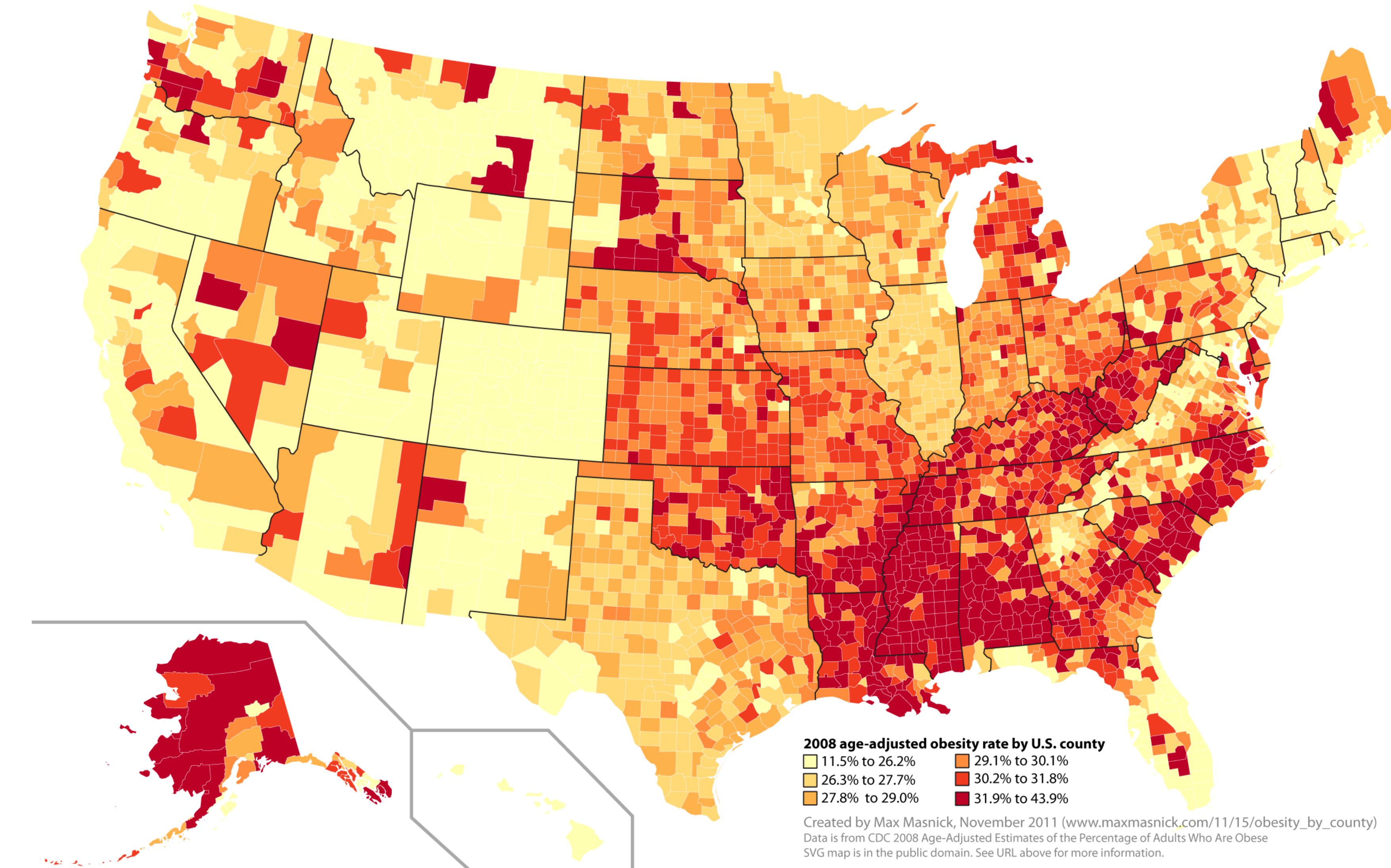
*The national unemployment rate was 4.2 percent as of September 2017.*



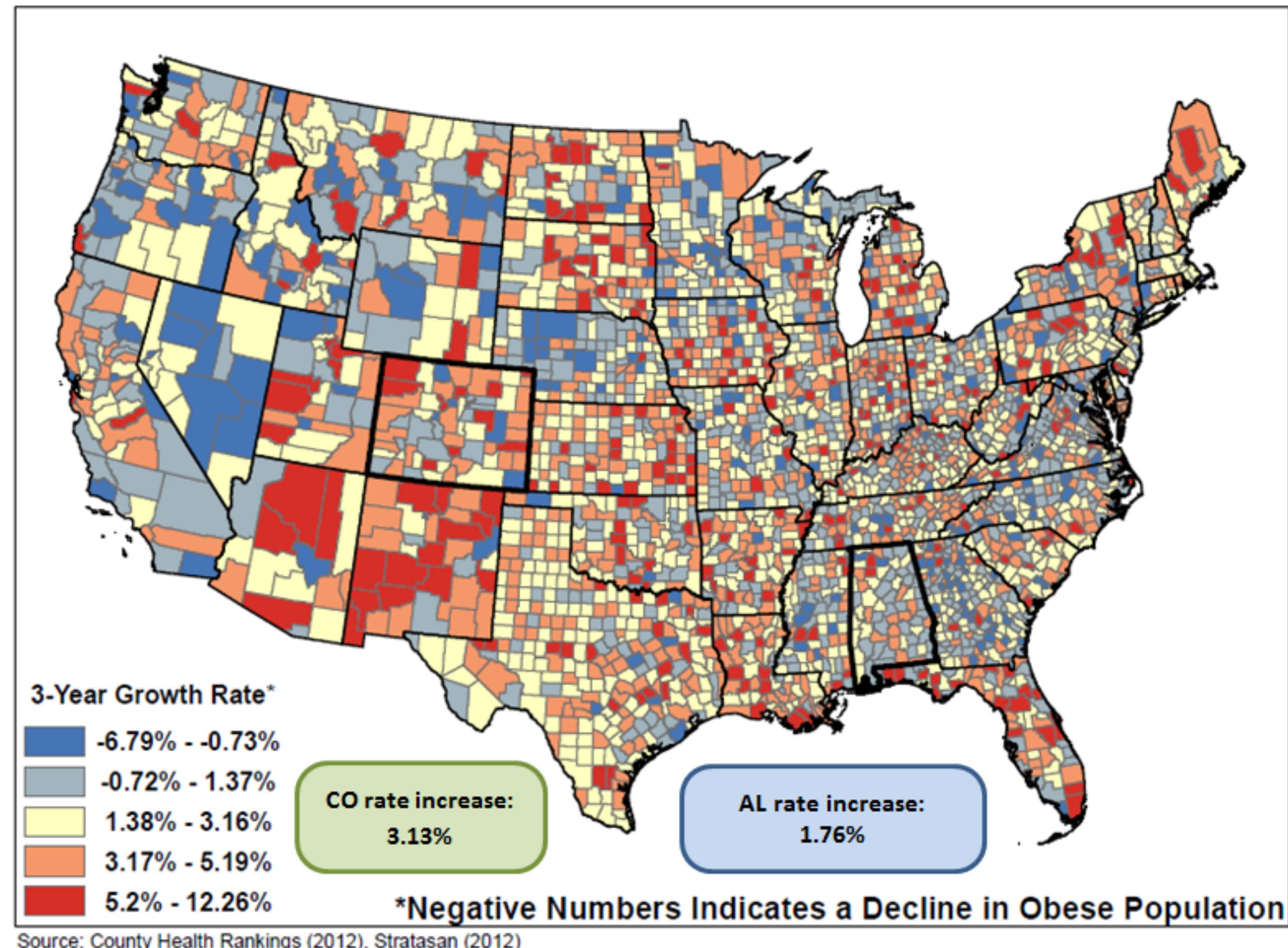
REGION/STATE  
**Colorado** RATE  
2.5% MONTH  
September YEAR  
2017  
US average: 4.2%



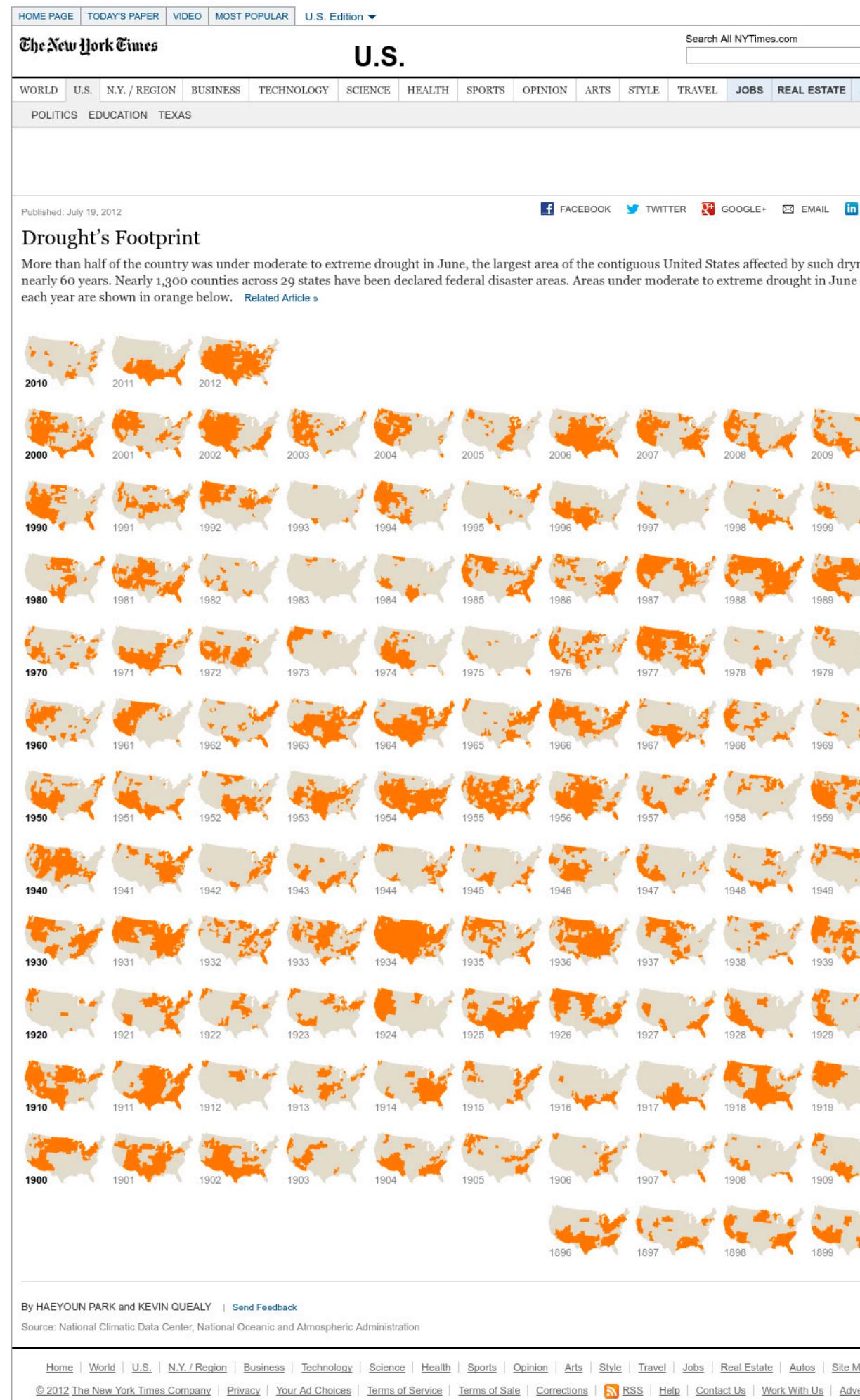
Source: Bureau of Labor Statistics.



# Obesity Trends by County 2010-2012

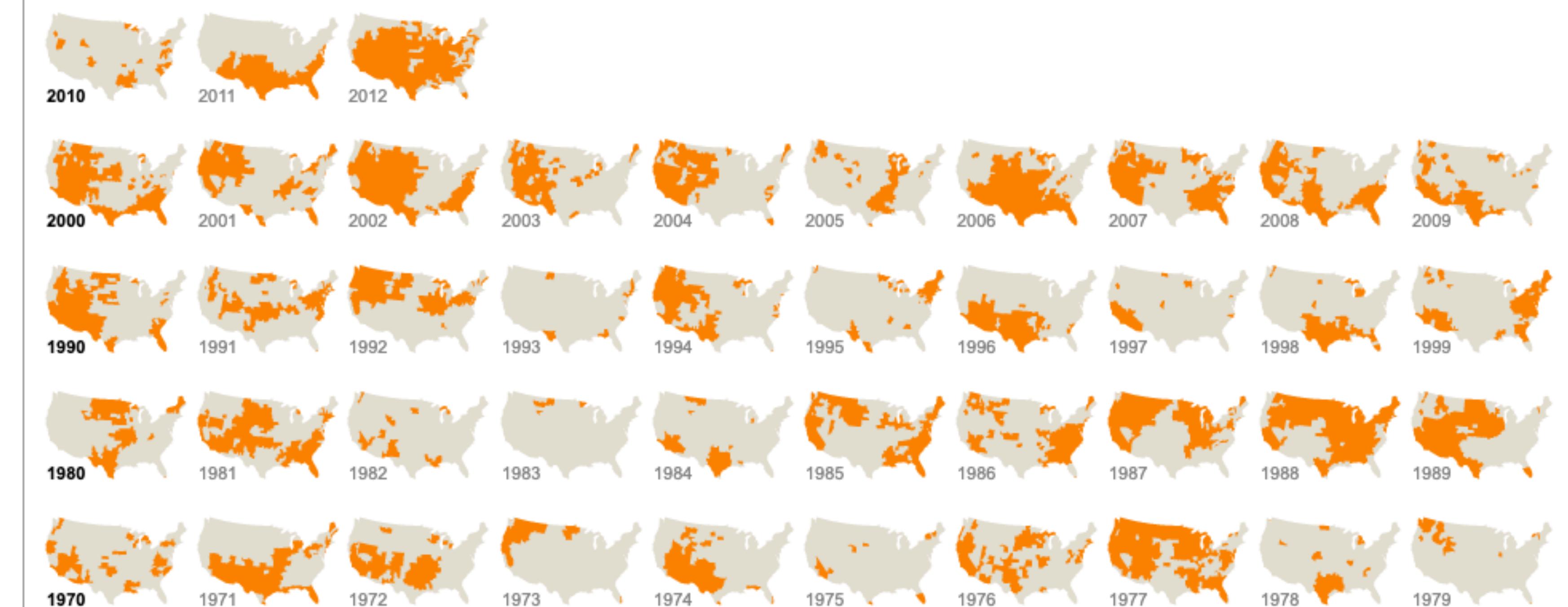


# Change over time: small multiples

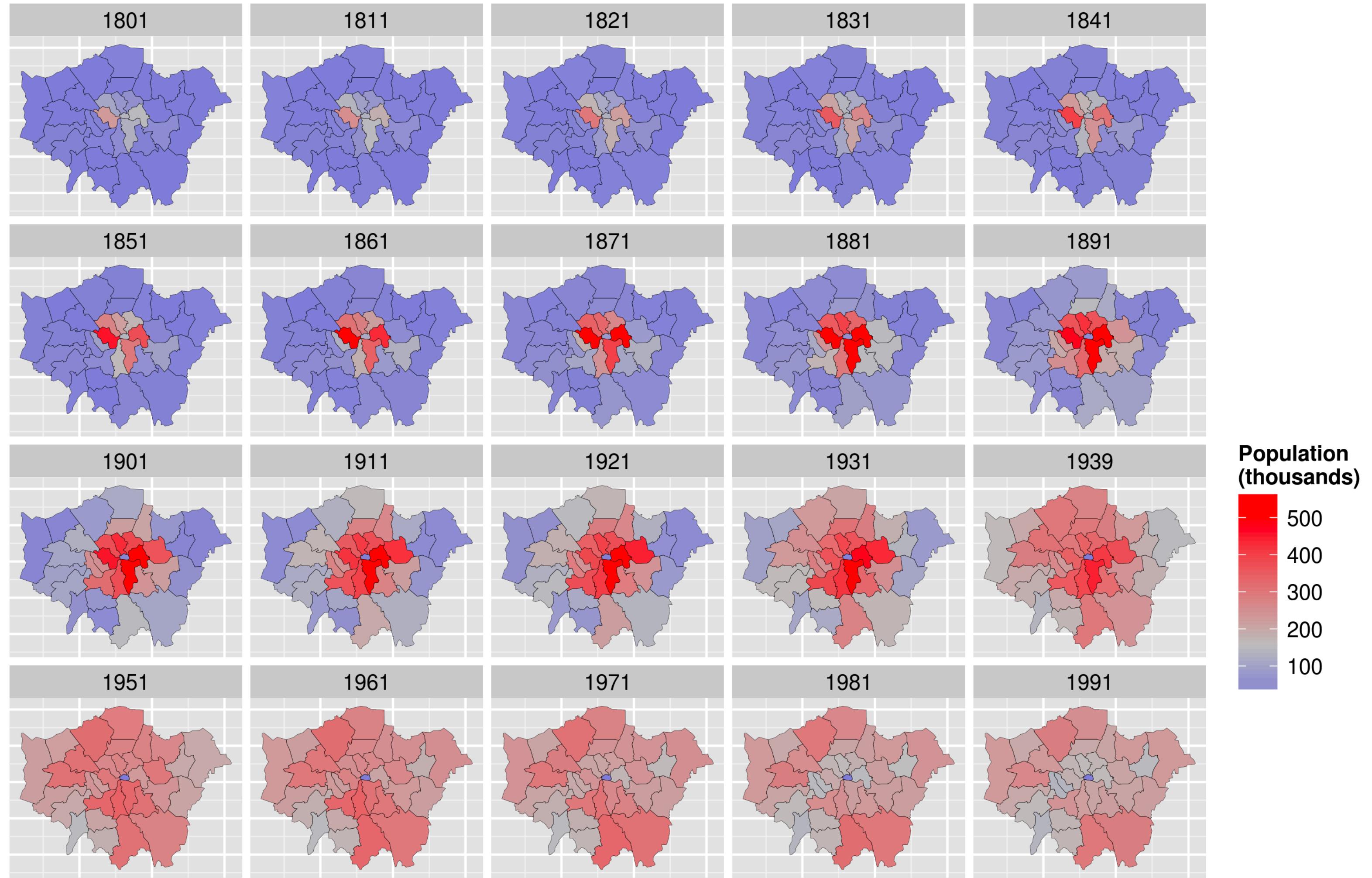


## Drought's Footprint

More than half of the country was under moderate to extreme drought in June, the largest area of the contiguous United States affected by such dryness in nearly 60 years. Nearly 1,300 counties across 29 states have been declared federal disaster areas. Areas under moderate to extreme drought in June of each year are shown in orange below. [Related Article »](#)

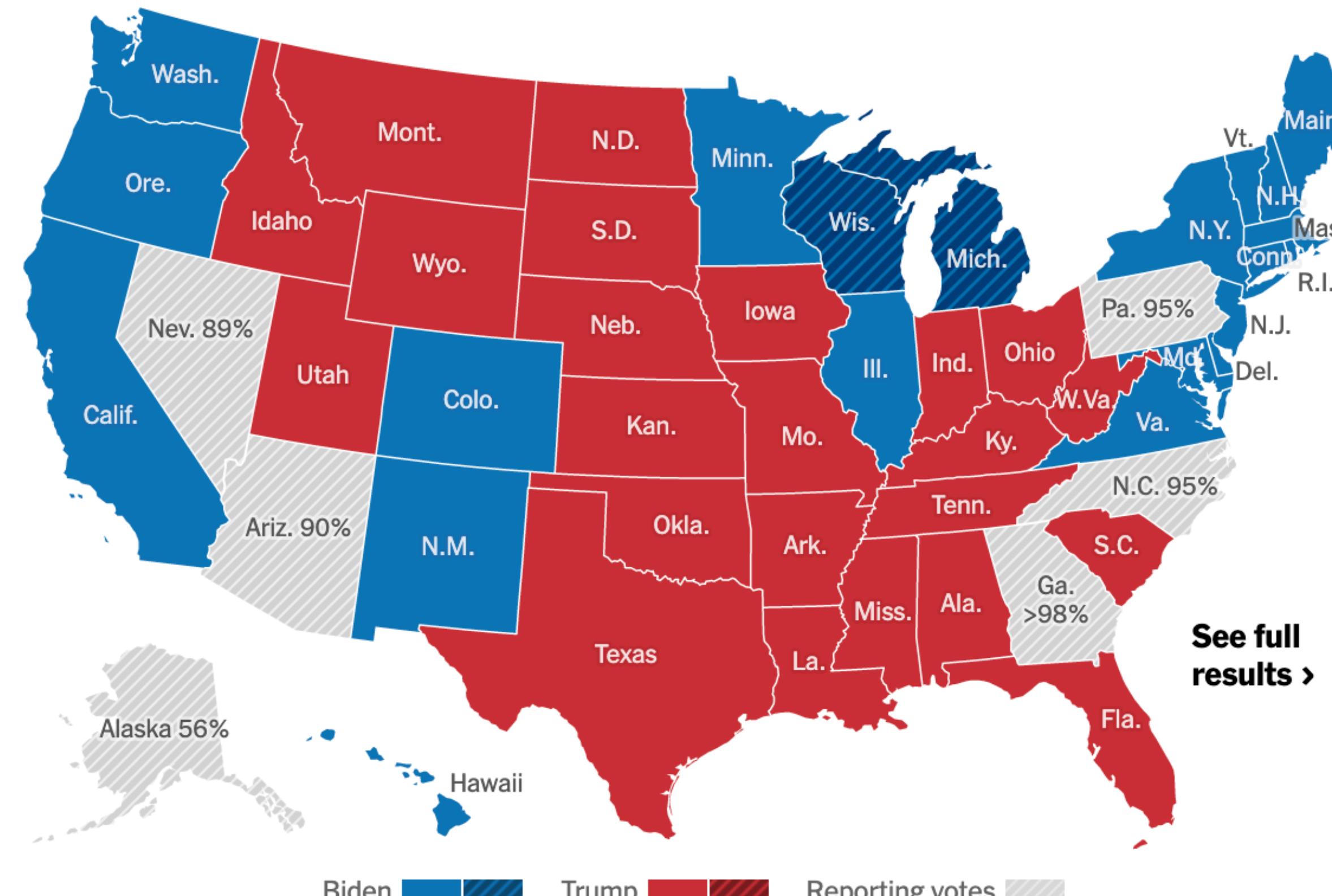


# geom\_polygon



# Land area problem

President Senate House Photos



Percentages are estimates of how much vote has been counted.

Source: Vote totals from N.E.P./Edison Research

# Cartogram

## US Presidential Election 2016

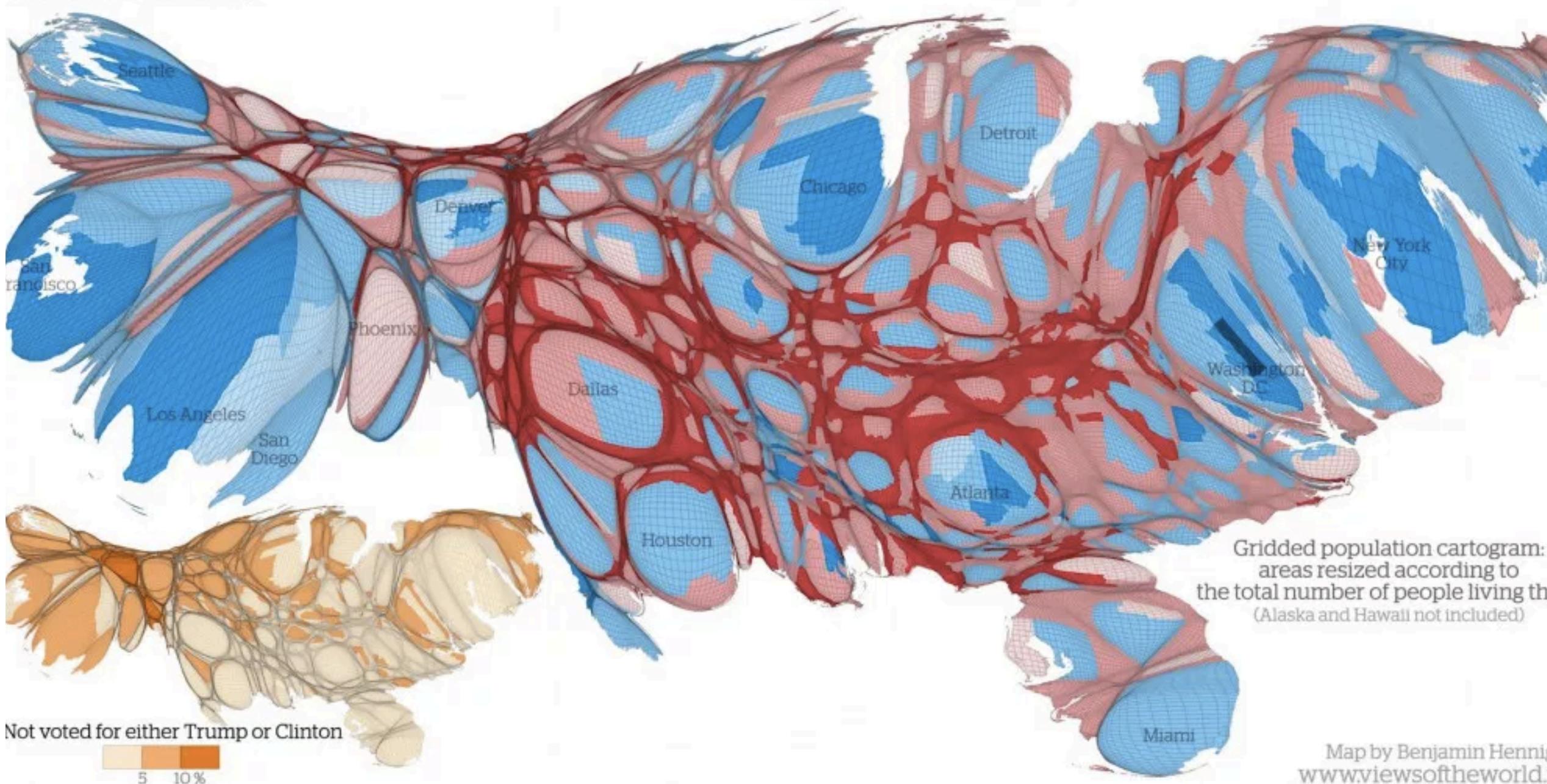
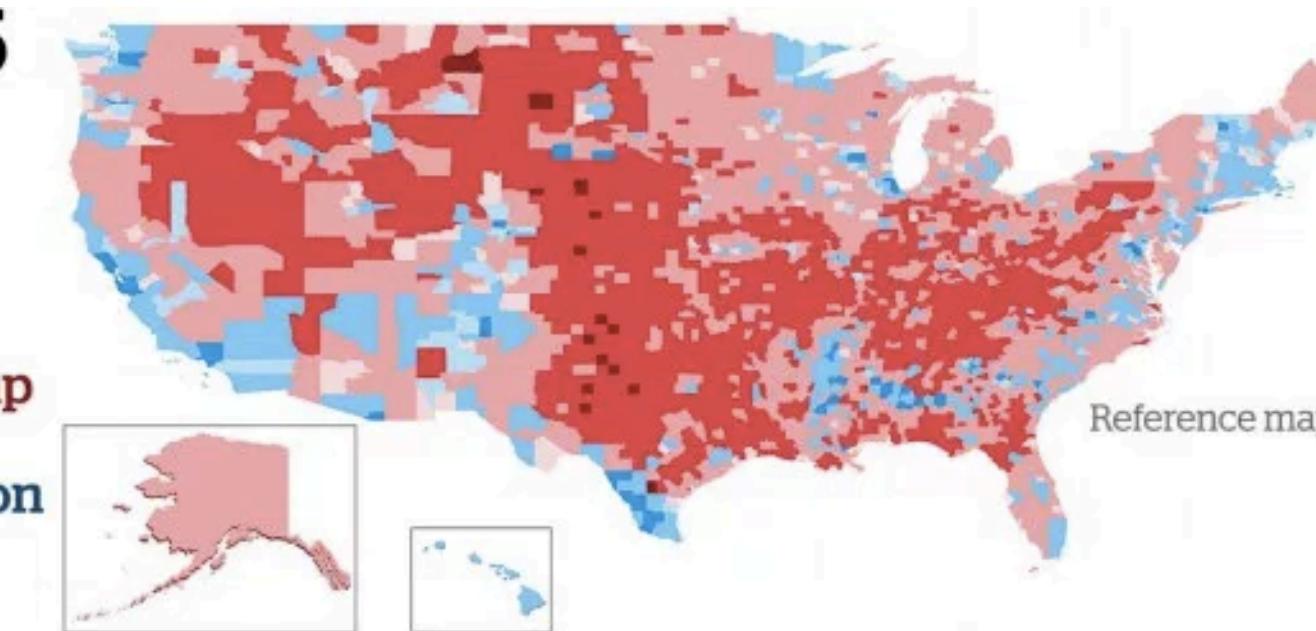
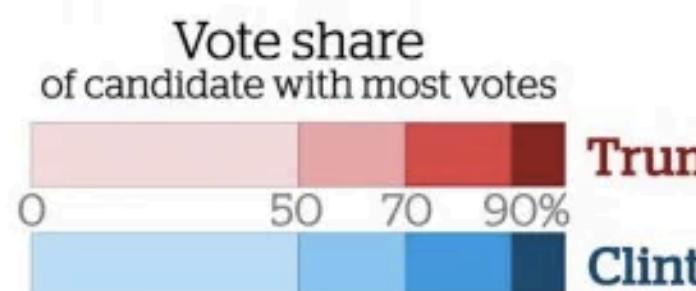
Results mapped at county level showing the candidate with the largest vote share in each area

### Overall result:

**Trump**  
60,265,858 votes (47.3%)  
290 electoral votes

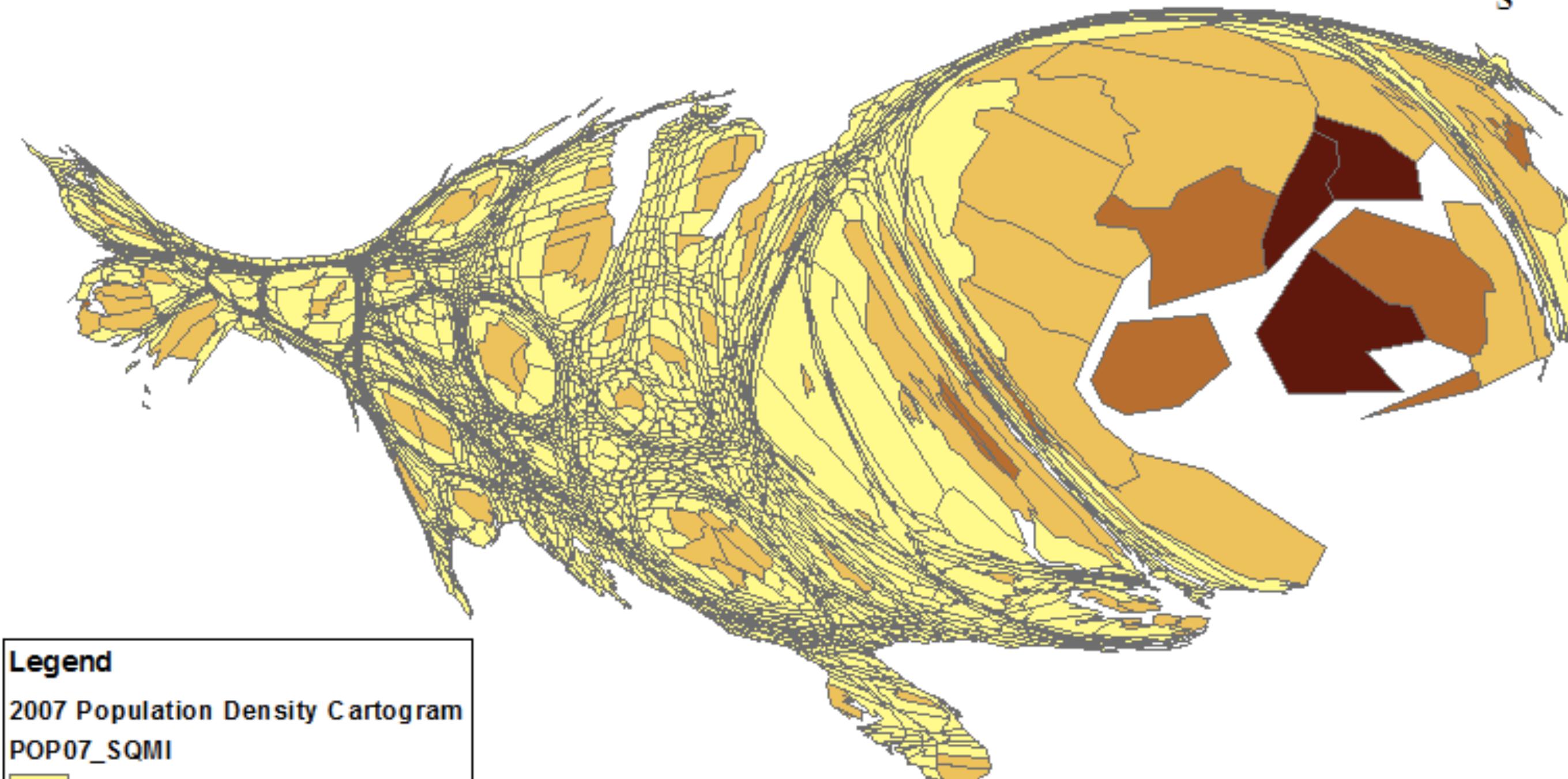
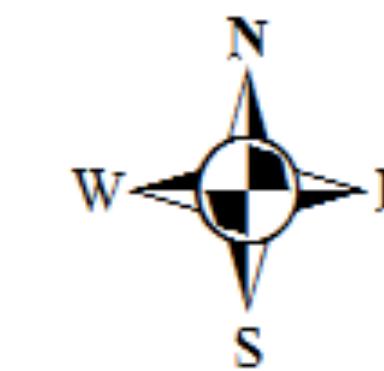
**Clinton**  
60,839,922 votes (47.8%)  
228 electoral votes

**Other candidates**  
6,226,950 votes (4.9%)



# Cartogram

2007 Population Density Cartogram

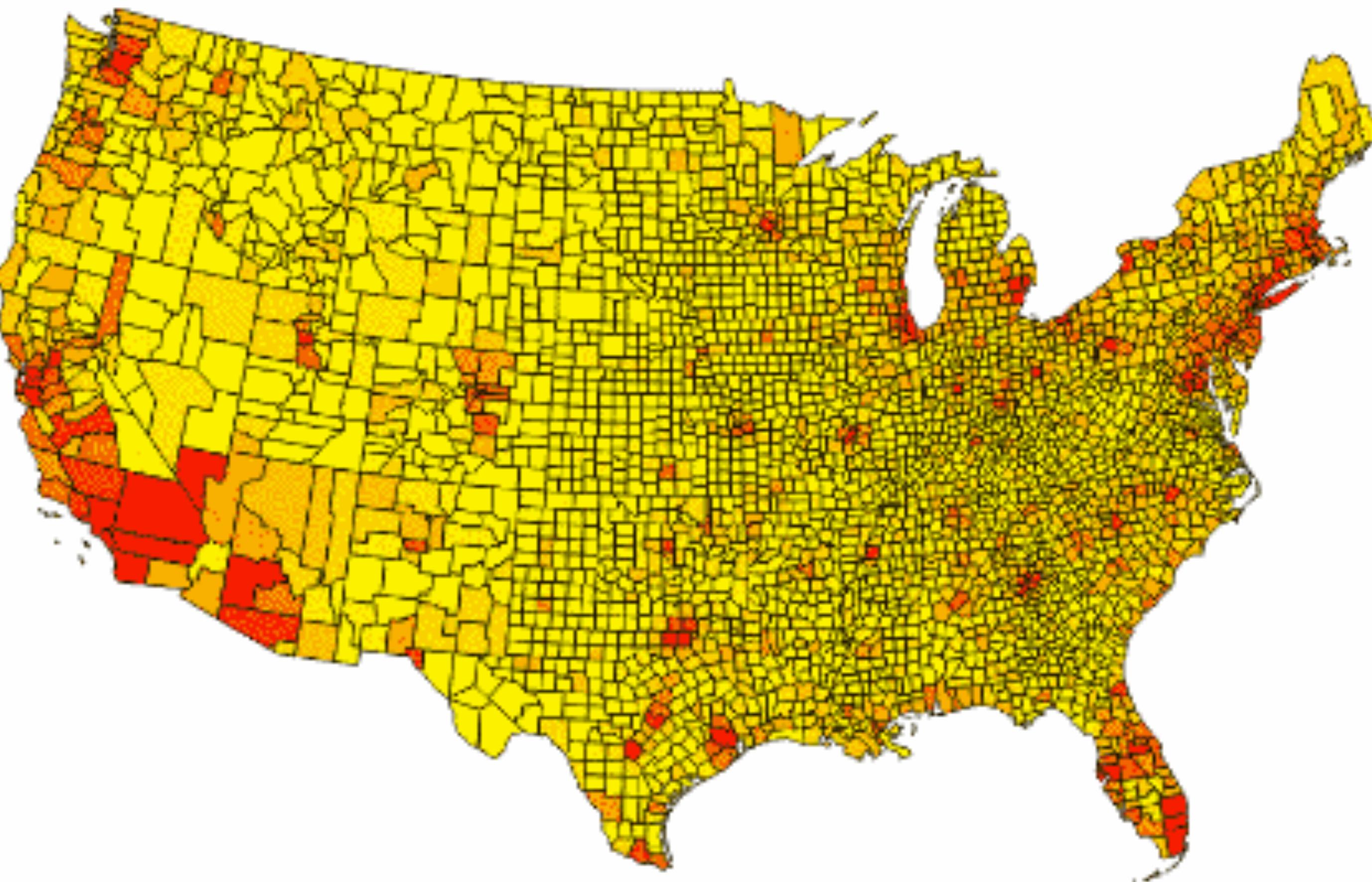


**Legend**

2007 Population Density Cartogram	
POP07_SQMI	
<span style="background-color: #ffffcc; border: 1px solid black; padding: 2px 5px;"></span>	0 - 1217
<span style="background-color: #ffcc99; border: 1px solid black; padding: 2px 5px;"></span>	1218 - 6314
<span style="background-color: #cc9966; border: 1px solid black; padding: 2px 5px;"></span>	6315 - 21167
<span style="background-color: #663333; border: 1px solid black; padding: 2px 5px;"></span>	21168 - 58458

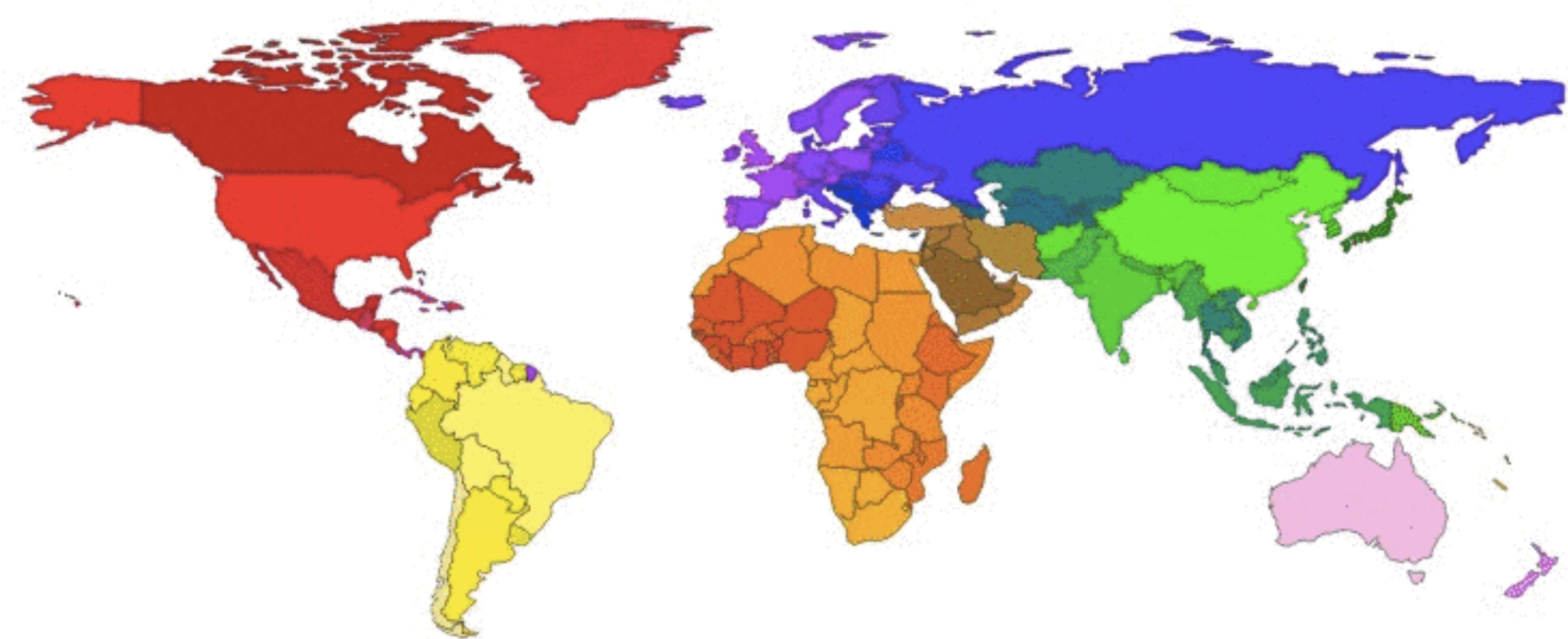
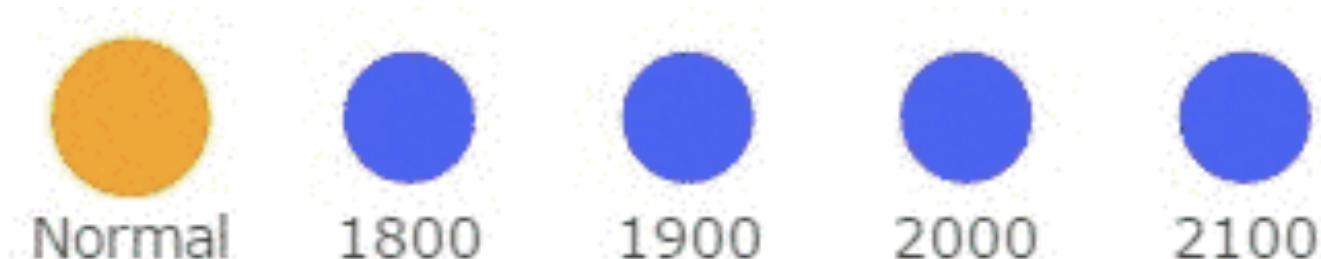
0 250 500 1,000 1,500 2,000 Miles

# Animated cartogram

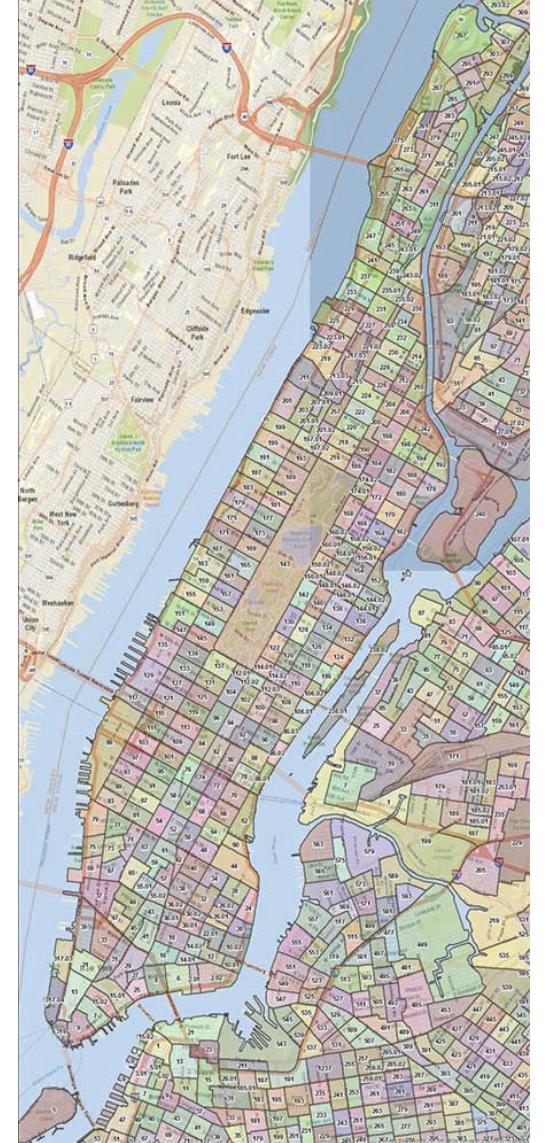


# Animated cartograms

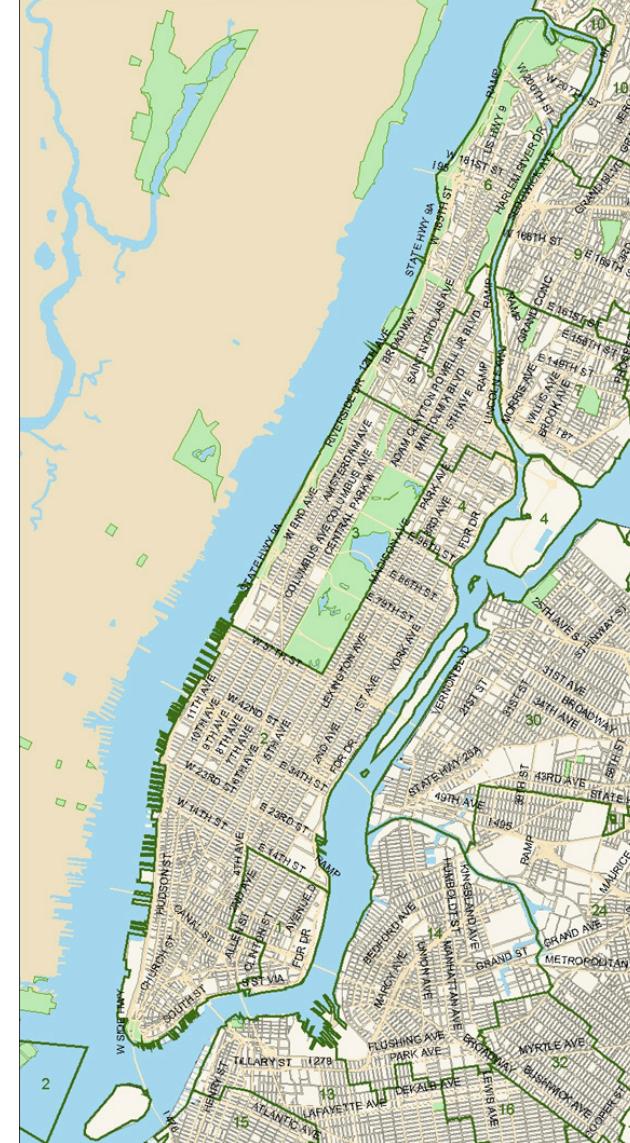
Select a year



# Which political boundaries?



census  
tracts



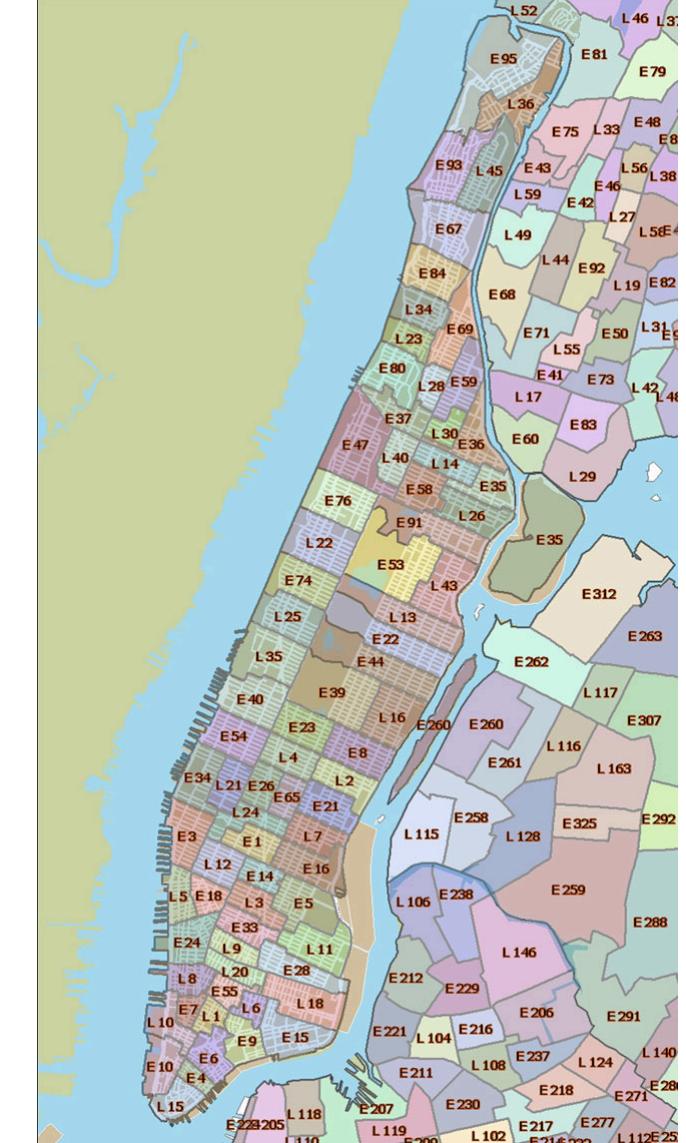
school  
districts



zip  
codes



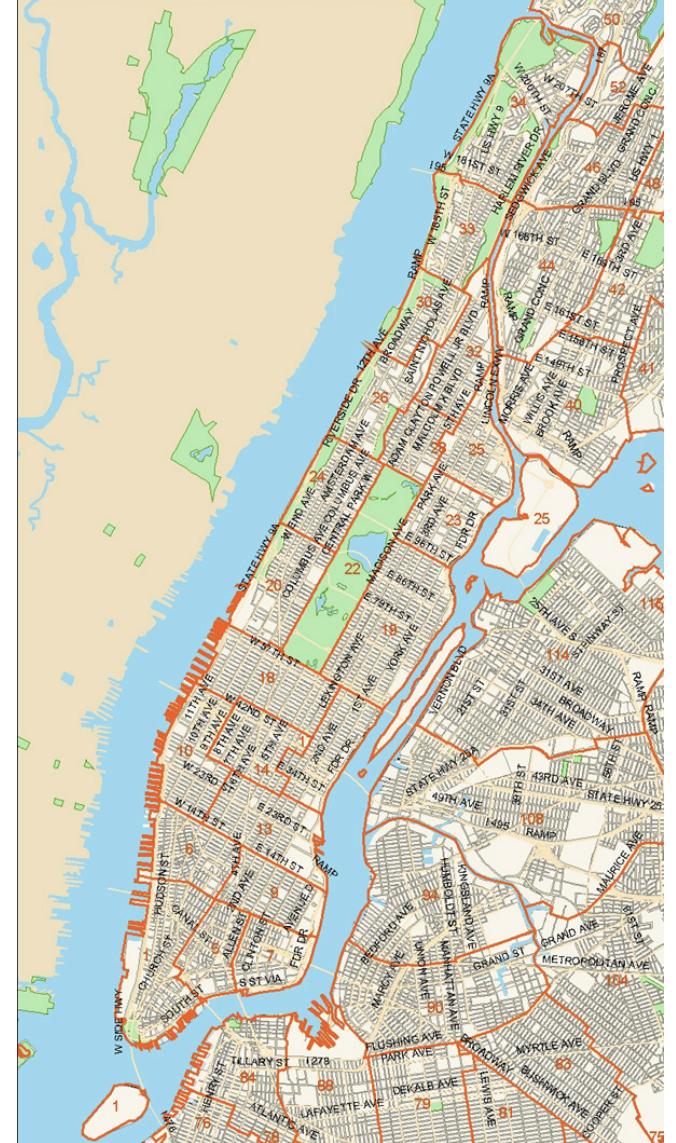
community  
districts



fire  
companies



congressional  
districts

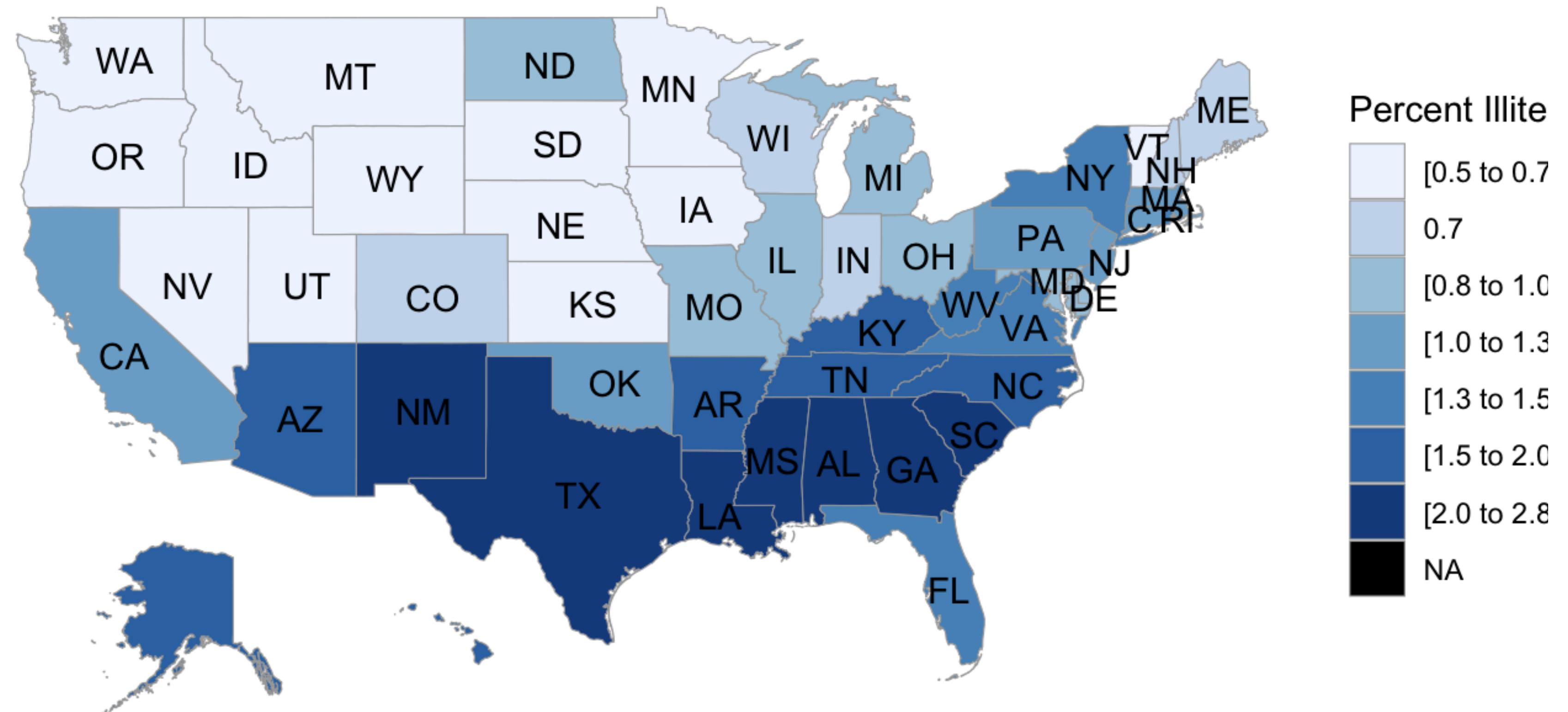


police  
precincts

Source: <http://crg.unhp.org/>

# choroplethr package

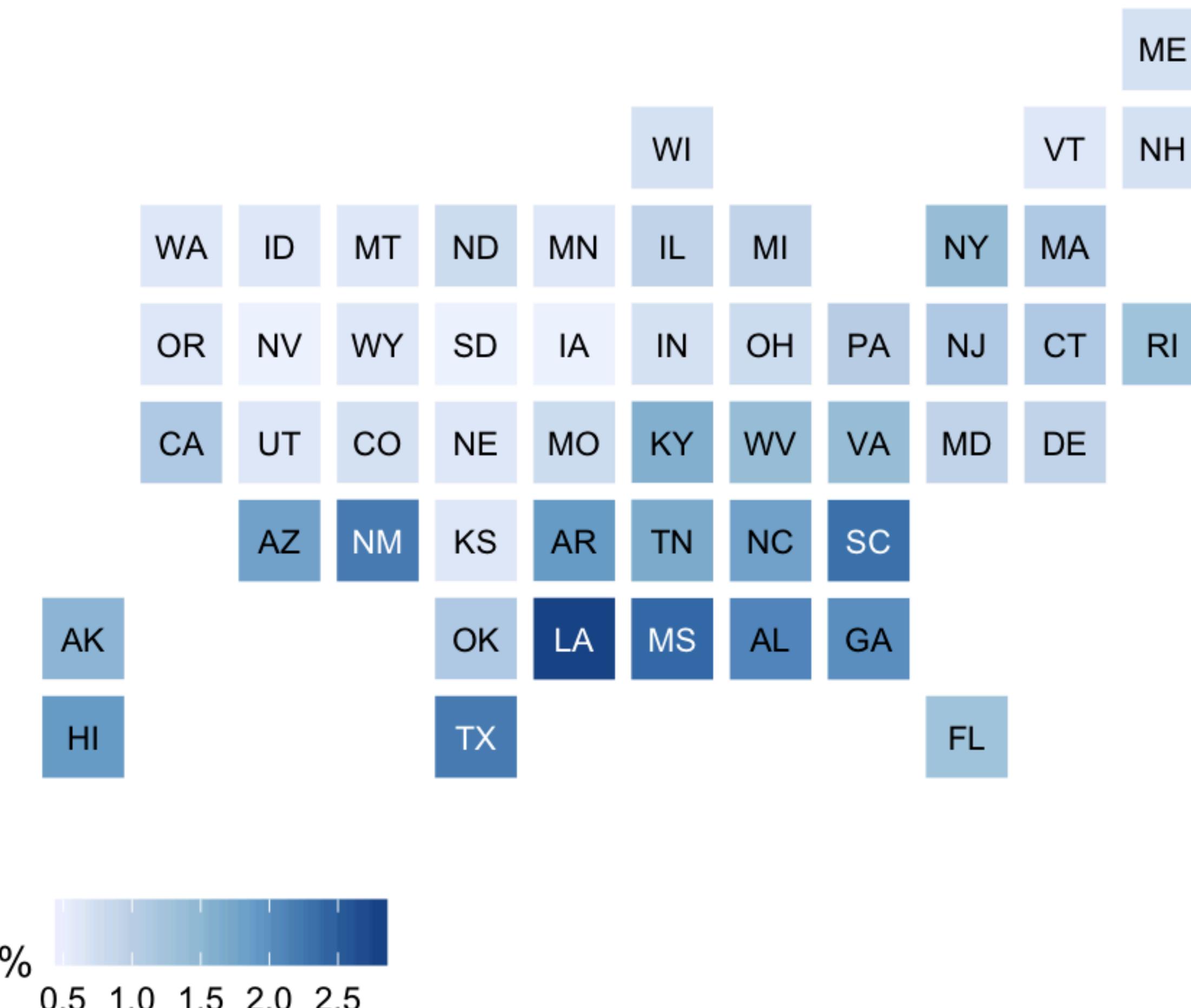
State Illiteracy Rates, 1977



code: <https://edav.info/maps.html>

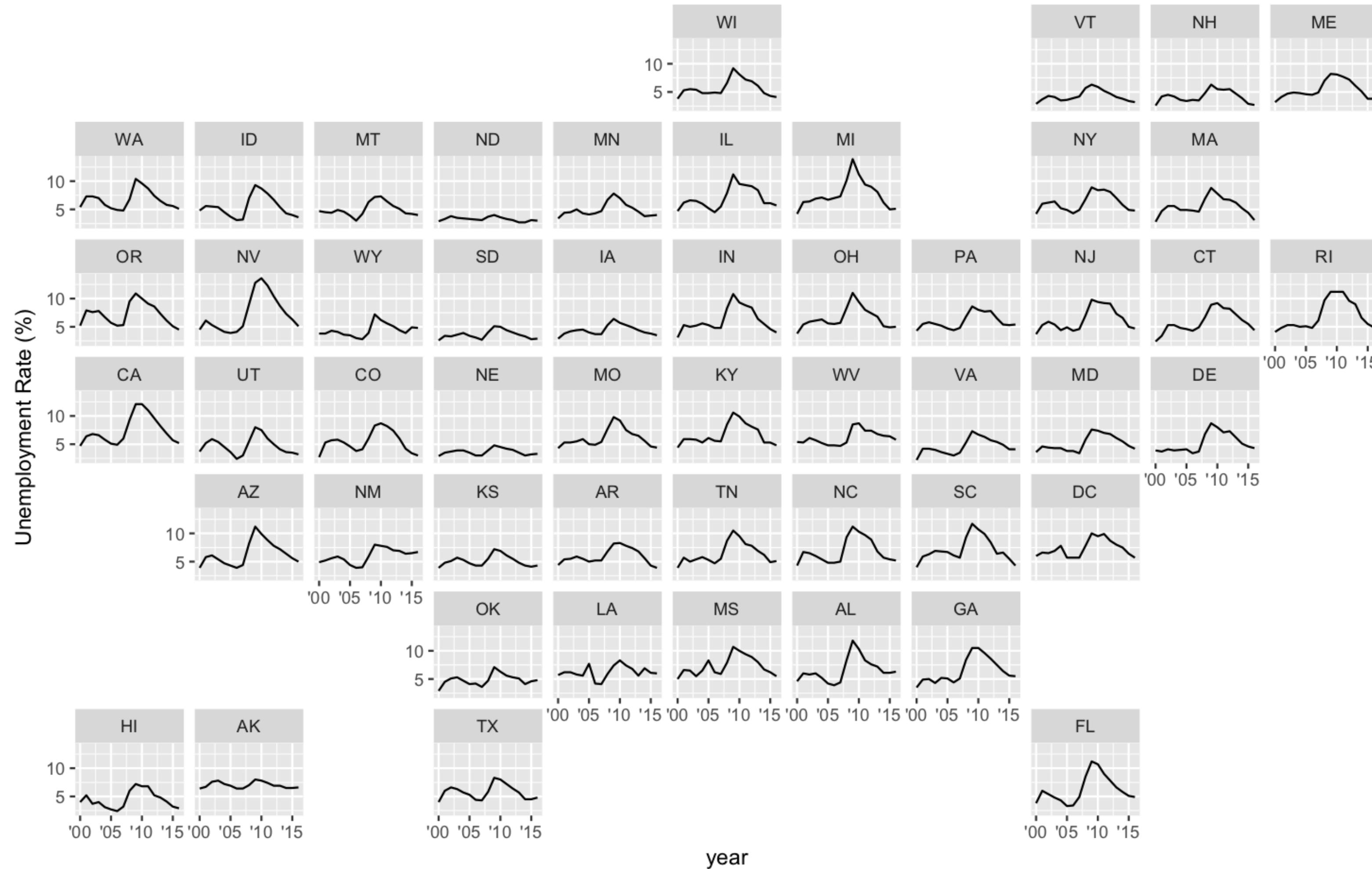
# statebins package

State Illiteracy Rates, 1977



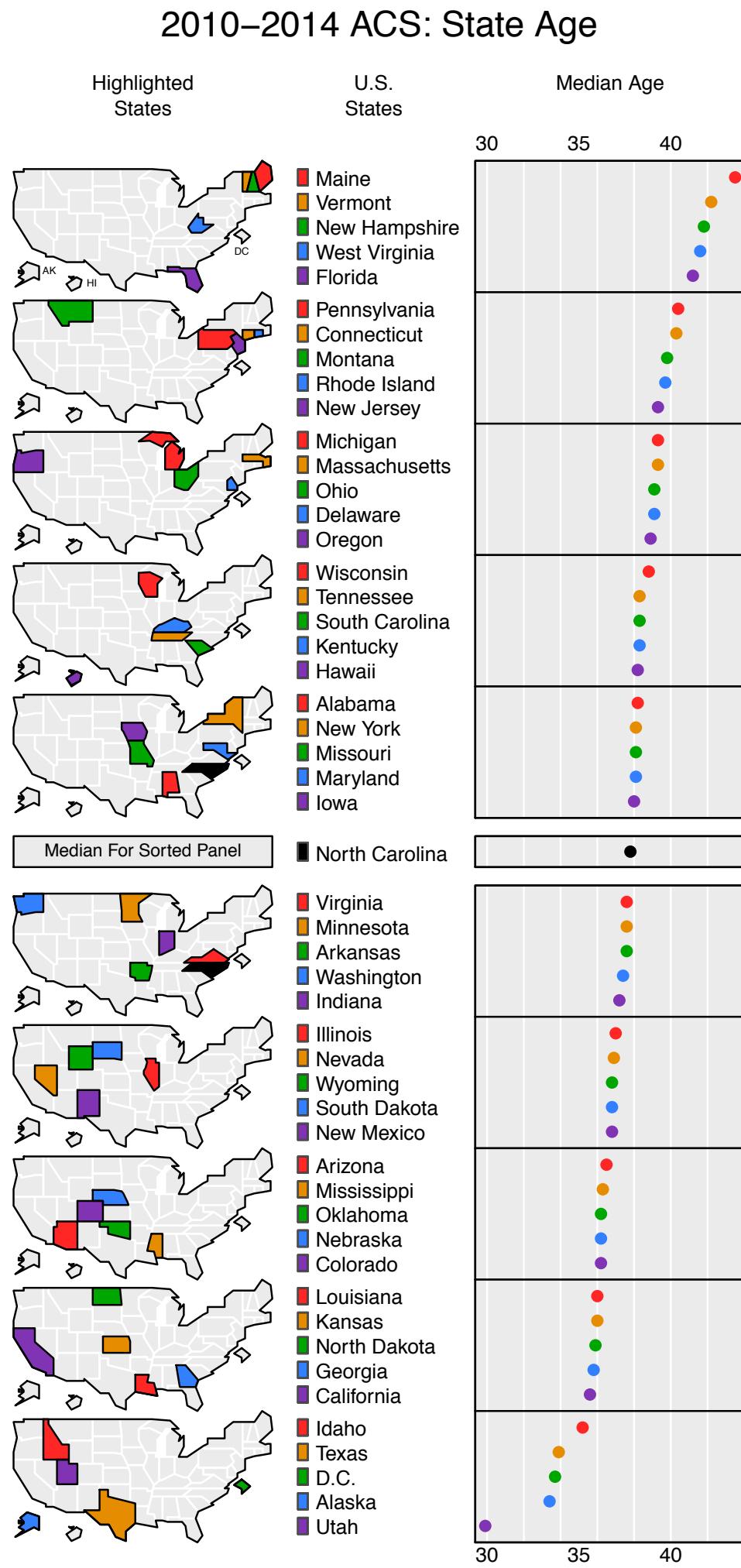
code: <https://edav.info/maps.html>

# geofacet

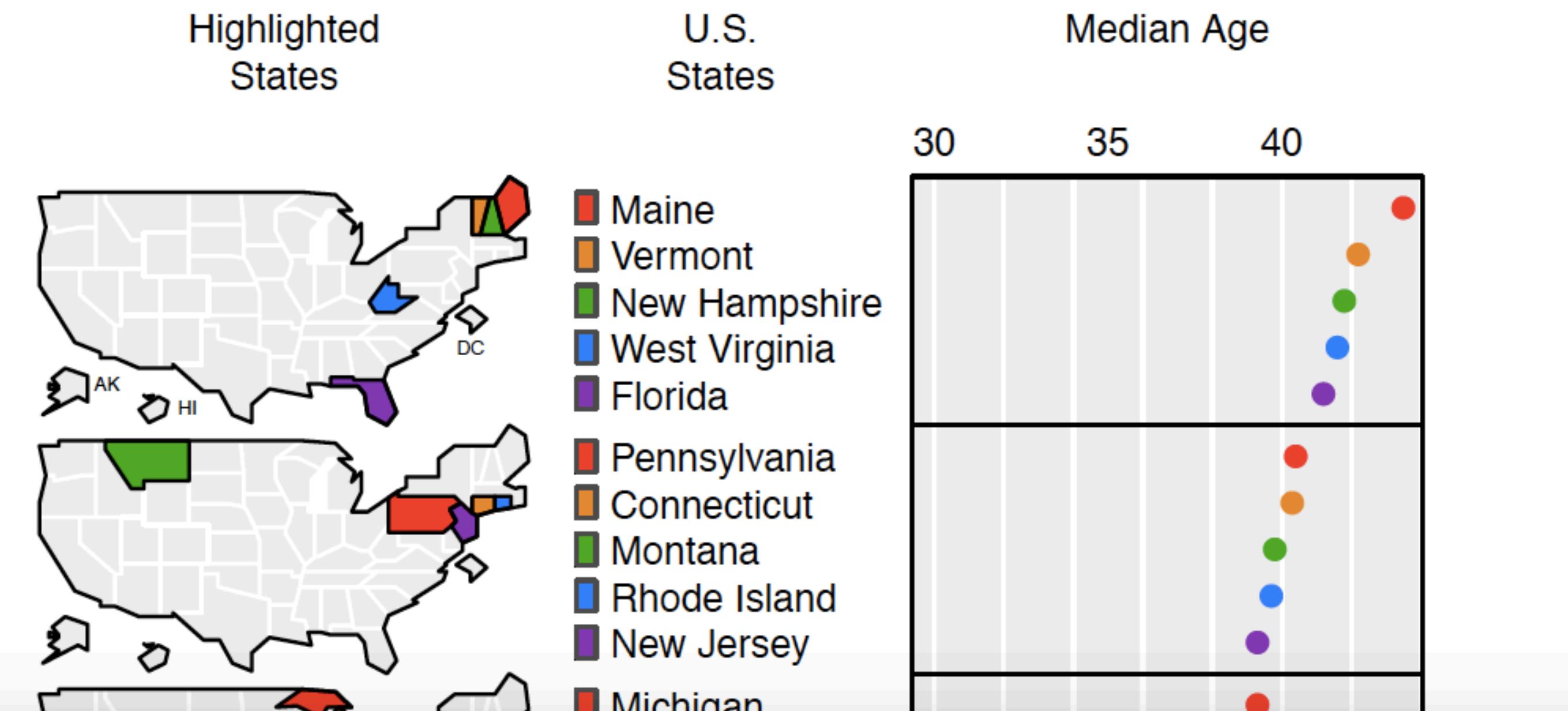


<https://ryanhafen.com/blog/geofacet/>

# Linked micromaps

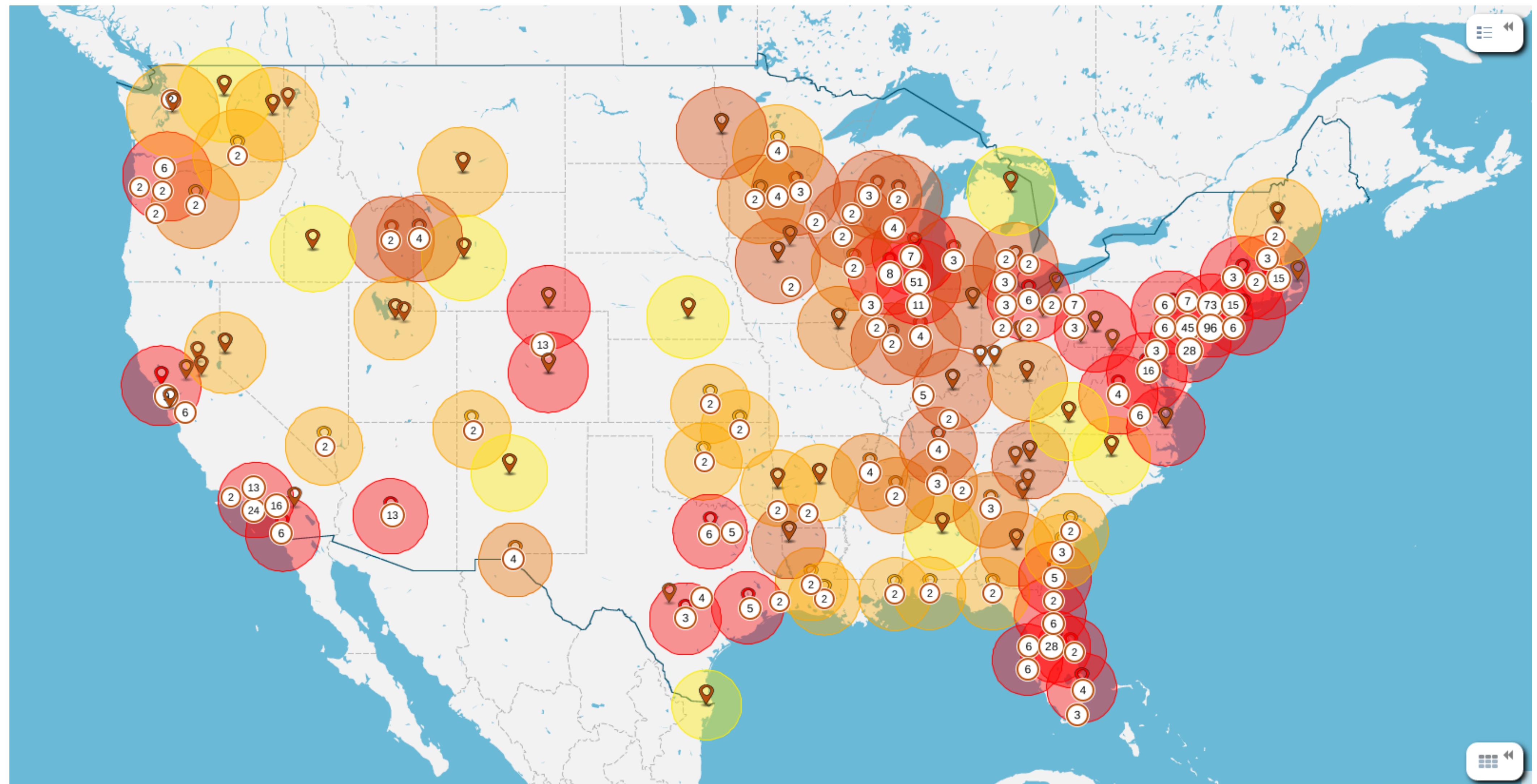


2010–2014 ACS: State Age

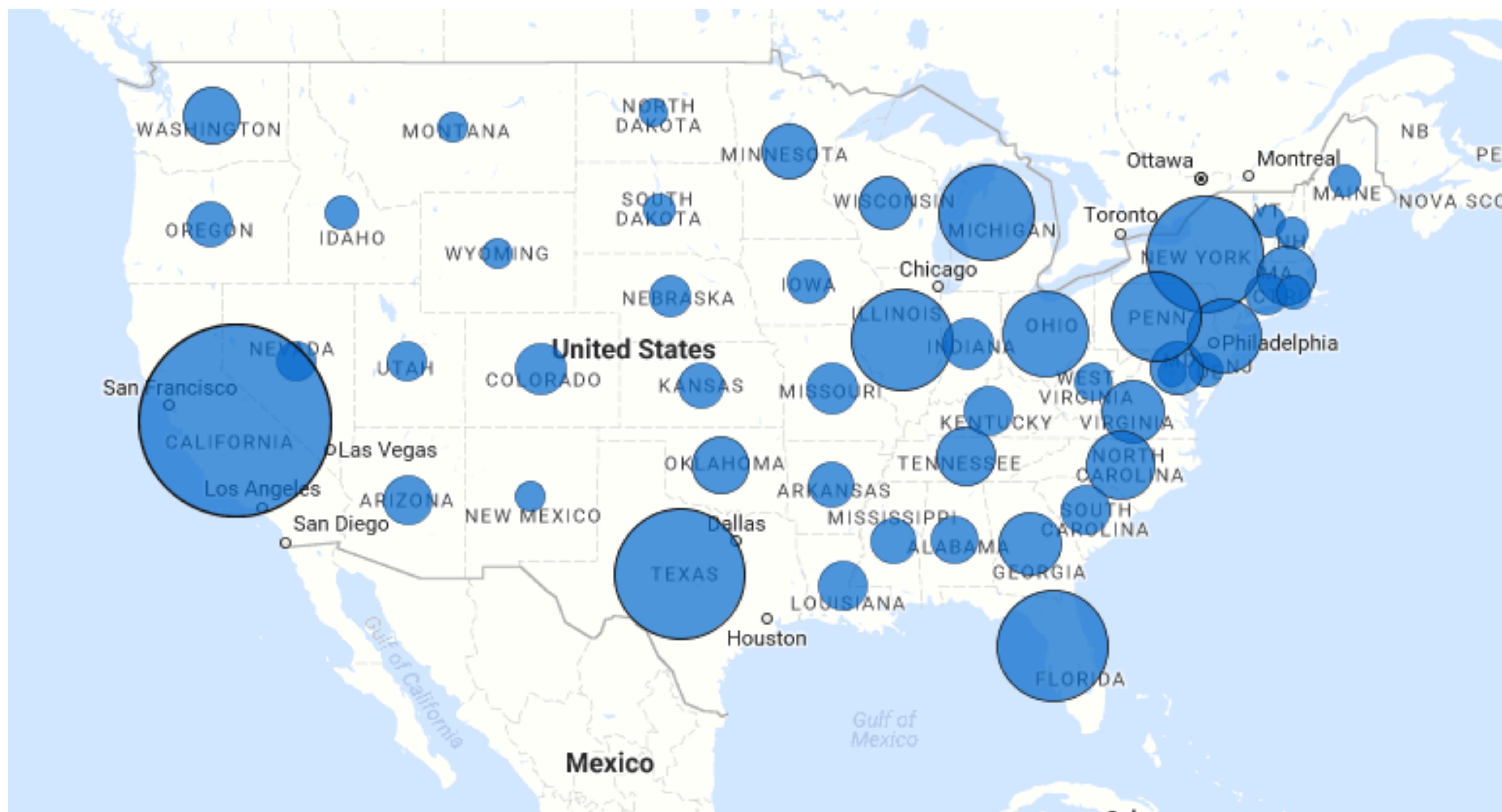


micromapST package

# Latitude & Longitude



# Radius map





# Push Pin Map



# Record Summer Temperatures, By The Numbers

Published: July 21st, 2012, Last Updated: July 20th, 2012



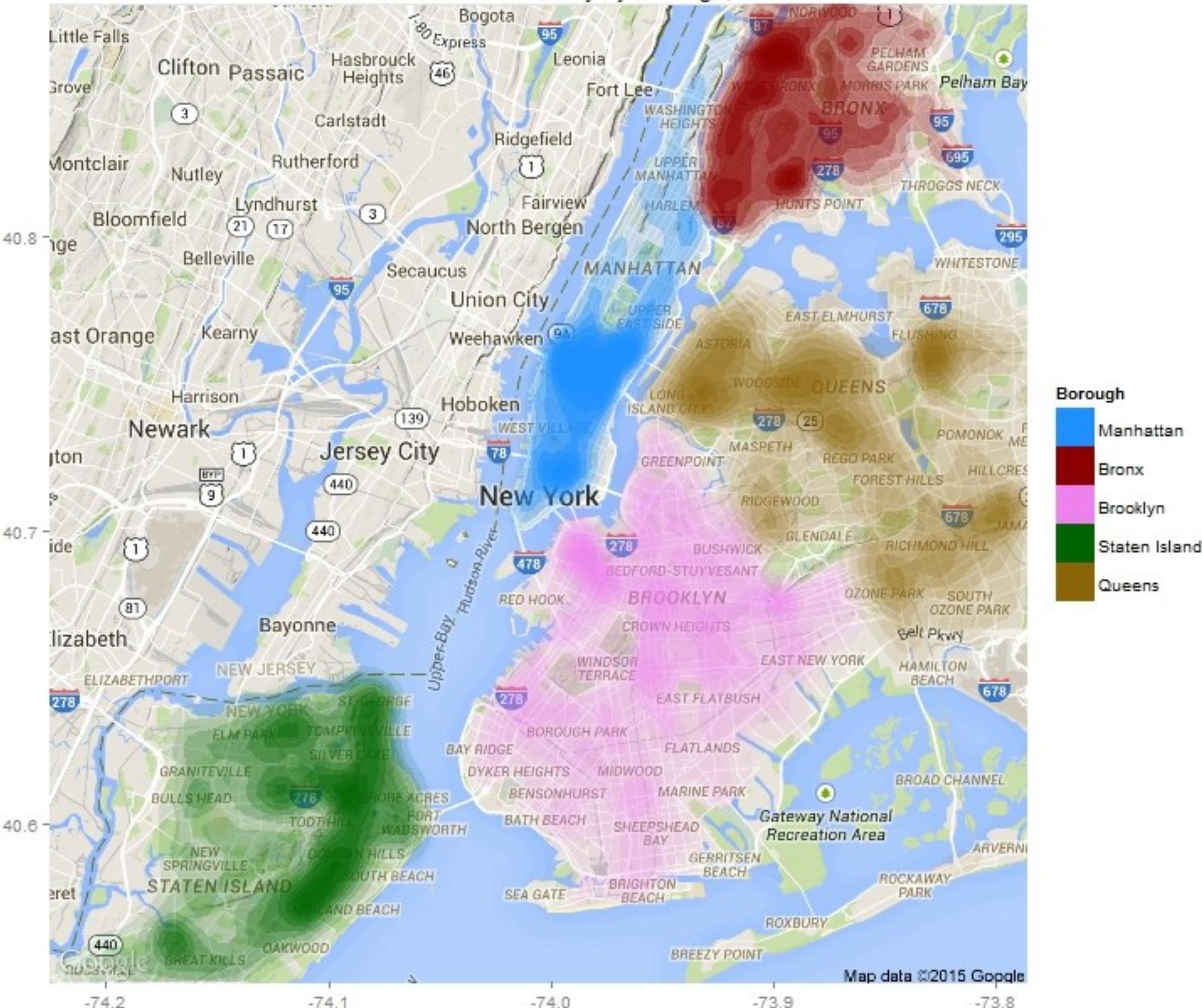
The weather this summer has been so extreme that it has rivaled the most destructive and unbearable summers in U.S. history, years that are infamous in weather lore. Those years include 1934 and 1936, which were in the middle of the Dust Bowl era, as well as 1954 and 1988, which was the year that Yellowstone National Park burned and NASA scientist James Hansen first warned the U.S. Senate about the consequences of manmade global warming.



*Each dot on this map represents a temperature record set during June of 2012. Click on the image for a larger version. Credit: Climate Central.*

As a reporter and analyst on the extreme weather and climate change beat, I've found this summer to be dizzying, with too many extreme events and broken records to count, let alone write about. First it was the heat, then the wildfires, and now the ever-expanding drought that seems intent on swallowing the entire country and kicking off a global food crisis. Oh, and there has been more extreme heat. On Friday, in fact, several states in the High Plains were under heat watches and warnings, but they're used to that by now. After all, this is the summer of sweat. It's also a summer that offers a vivid and disturbing preview of what's to come as a result of manmade global warming.

### NYC Vehicle Accident Density by Borough, 2010



<https://i1.wp.com/stablemarkets.files.wordpress.com/2015/03/densitybyborough.jpeg?ssl=1>

# See a heatmap of NYC's live music venues



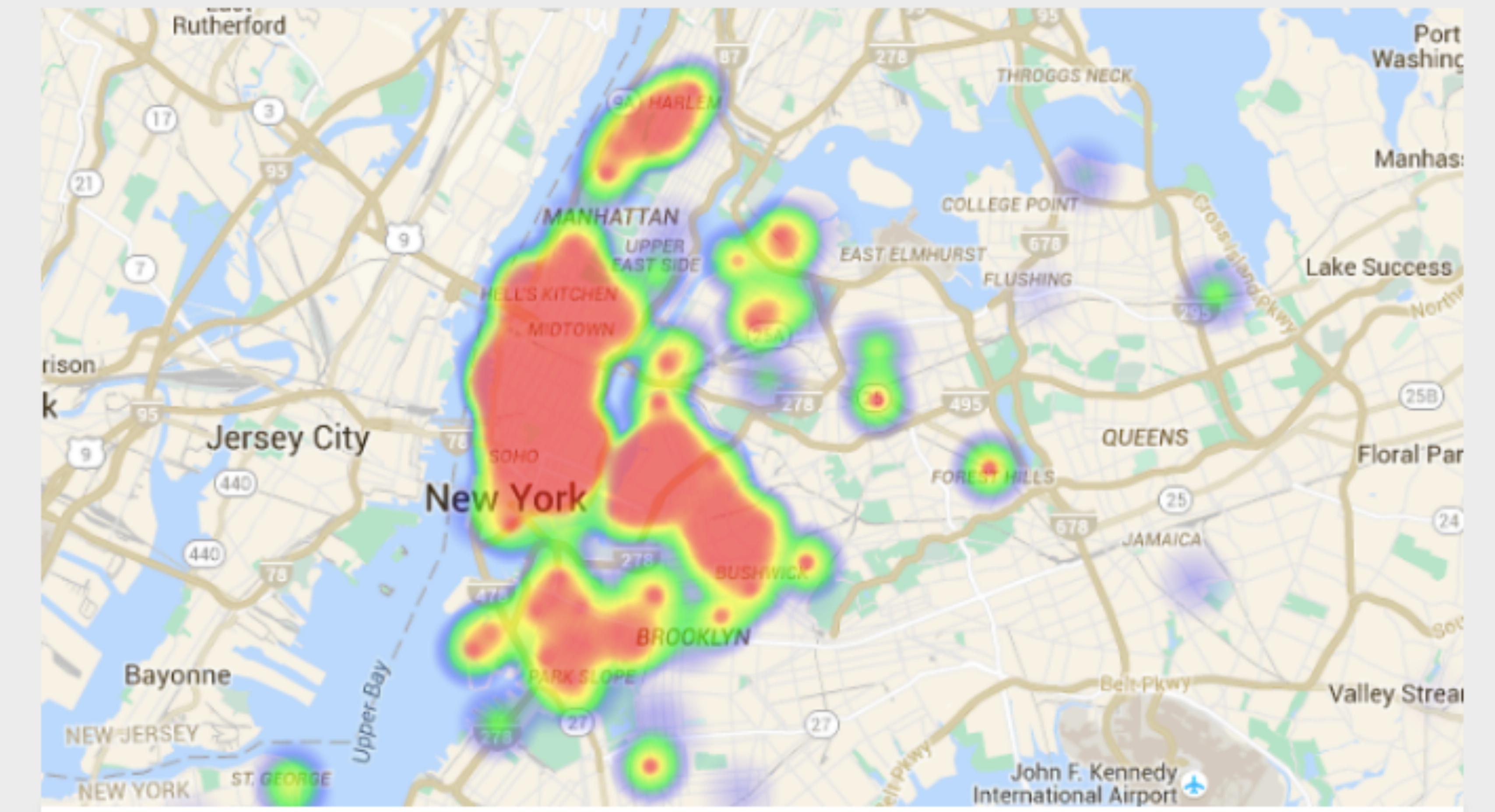
f Share



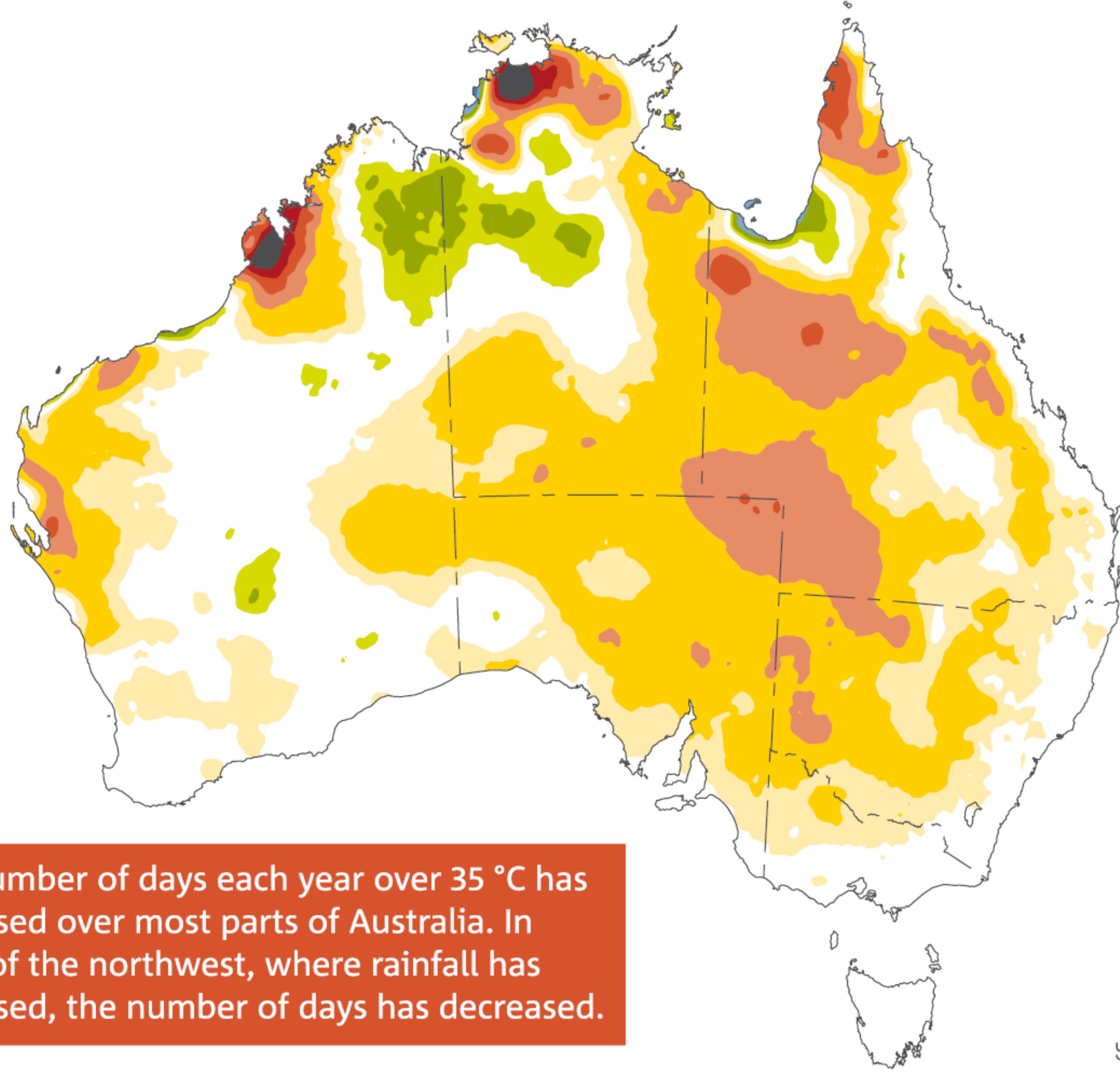
Tweet



Got a tip? Send it to [tips@timeout.com](mailto:tips@timeout.com)

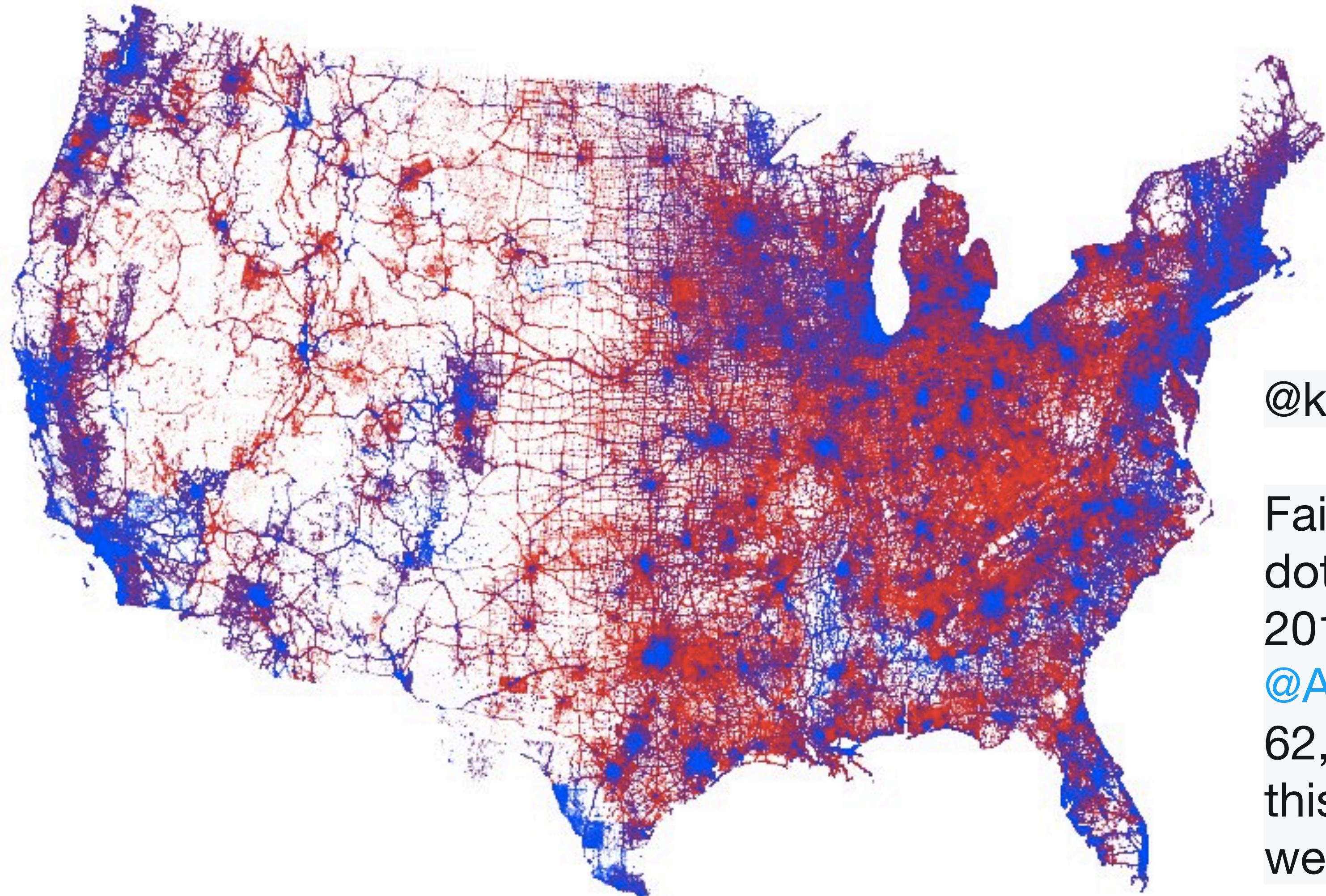


## Trend in days/year



The number of days each year over 35 °C has increased over most parts of Australia. In parts of the northwest, where rainfall has increased, the number of days has decreased.

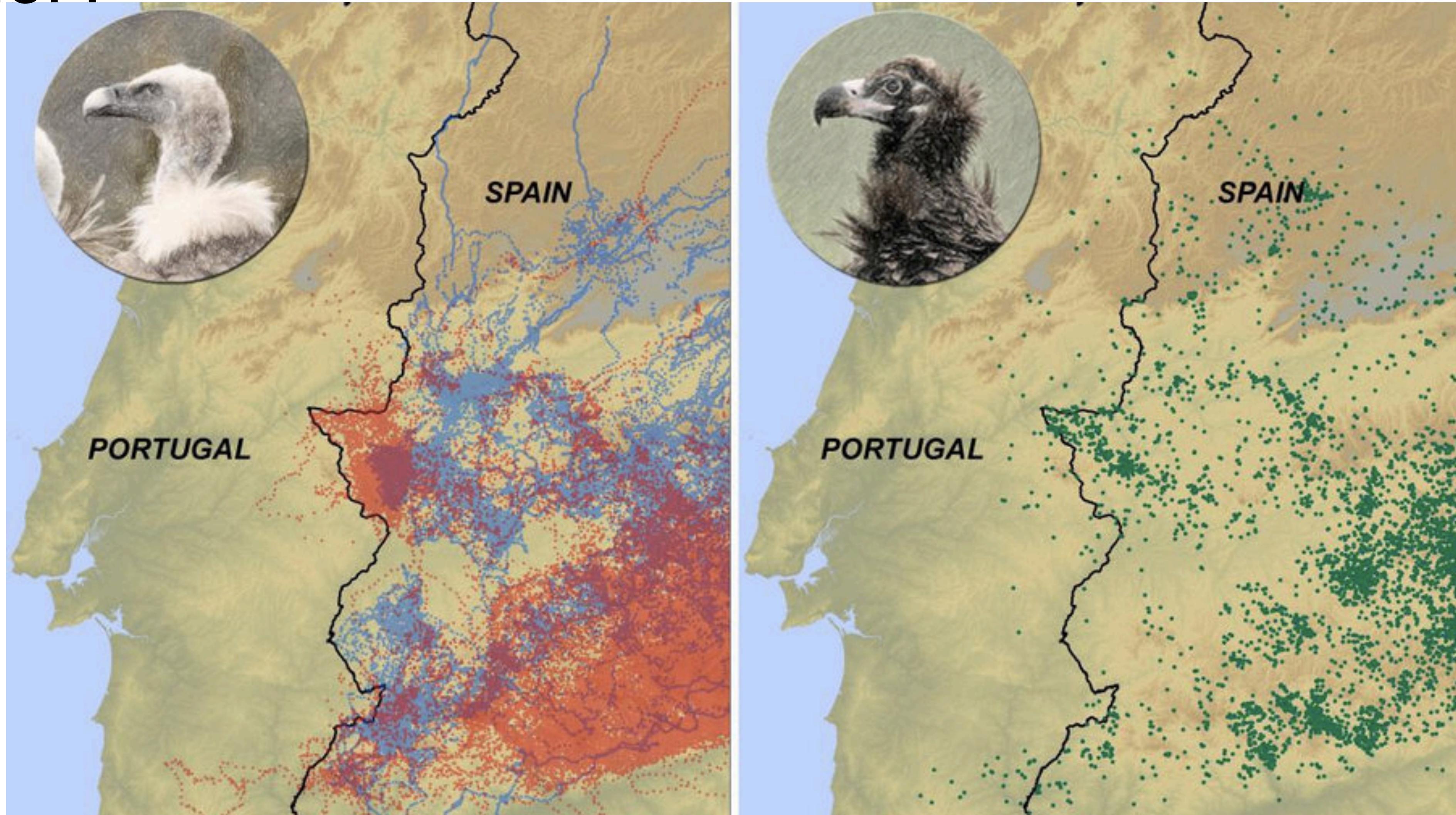
Source: Bureau of Meteorology



@kennethfield:

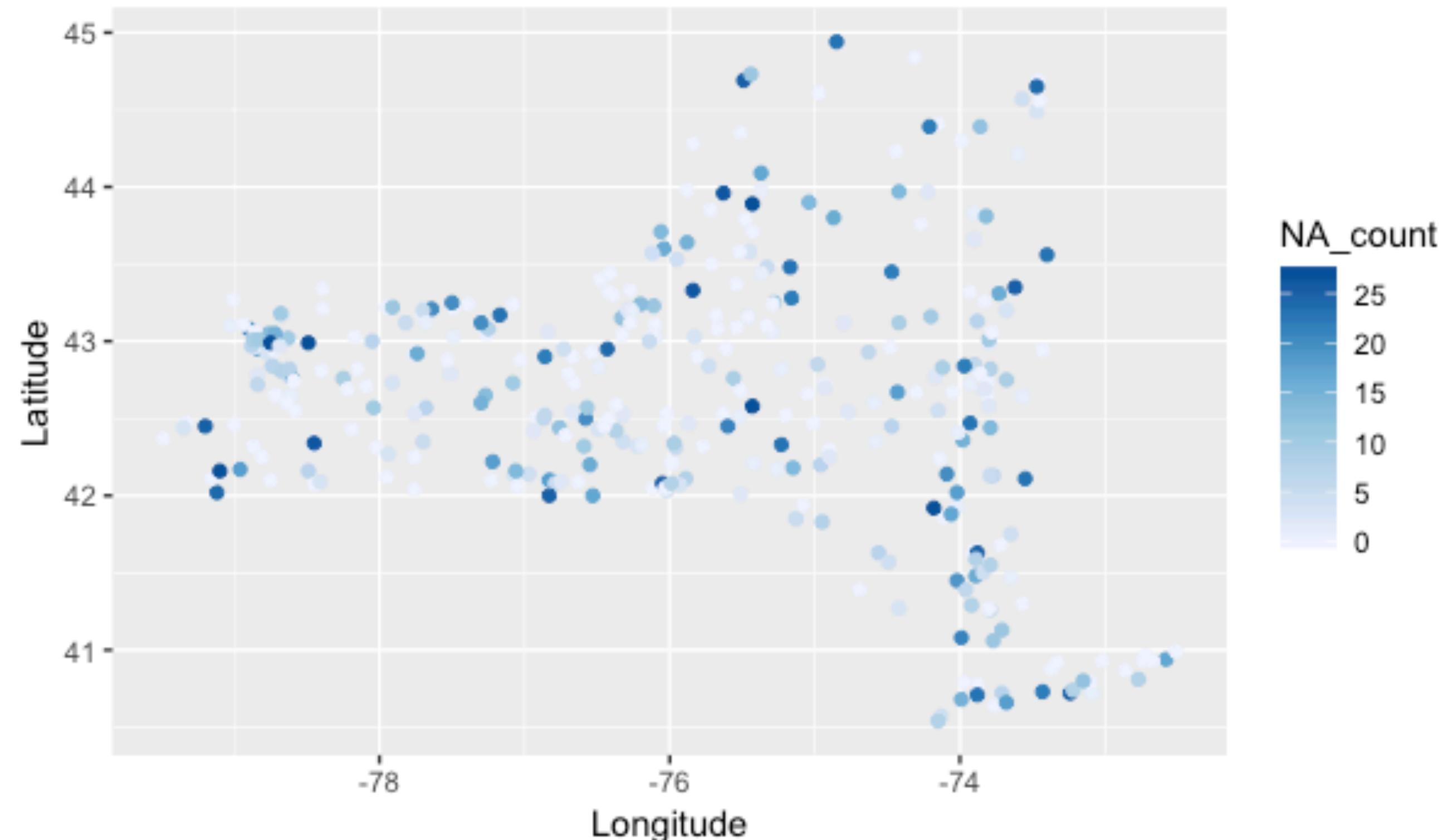
Fair bit of data wrangling but finally...a 1  
dot = 1 vote dasymetric dot density  
2016 Presidential election map from  
[@ArcGISPro](#). 65,844,61 blue dots.  
62,979,636 red dots. Count 'em! (note:  
this is just a rough screengrab, will  
webify & make pretty)

# Why do vultures care about the Spanish Portuguese border?

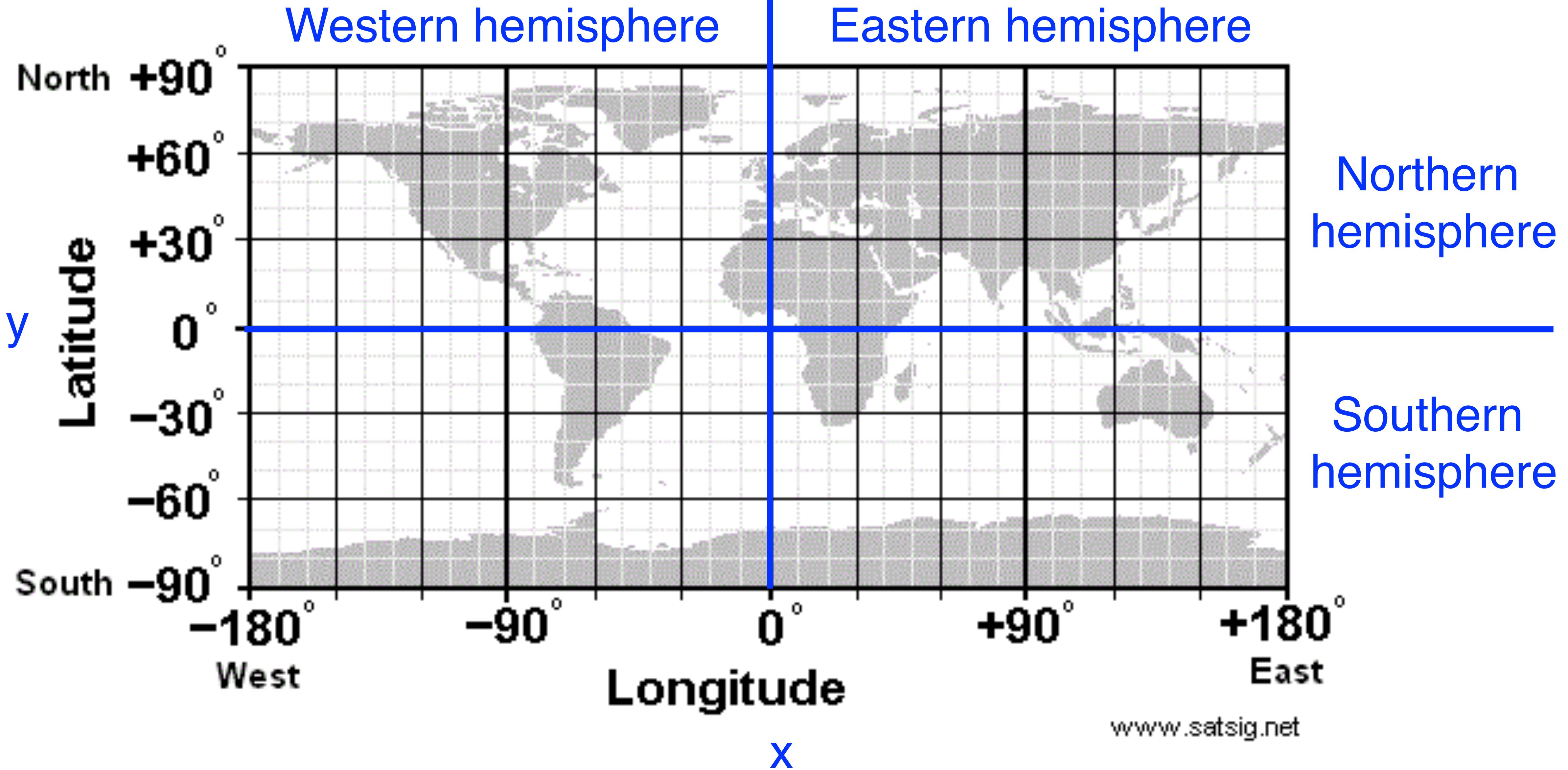


# Latitude & Longitude

```
ggplot(missing, aes(Longitude, Latitude,  
color = NA_count)) + geom_point() +  
scale_color_distiller(direction = 1) +  
theme_bw()
```



# Latitude & Longitude



Latitude

y

Longitude

x

Columbia University



Western hemisphere

Eastern hemisphere

Northern hemisphere

Southern hemisphere

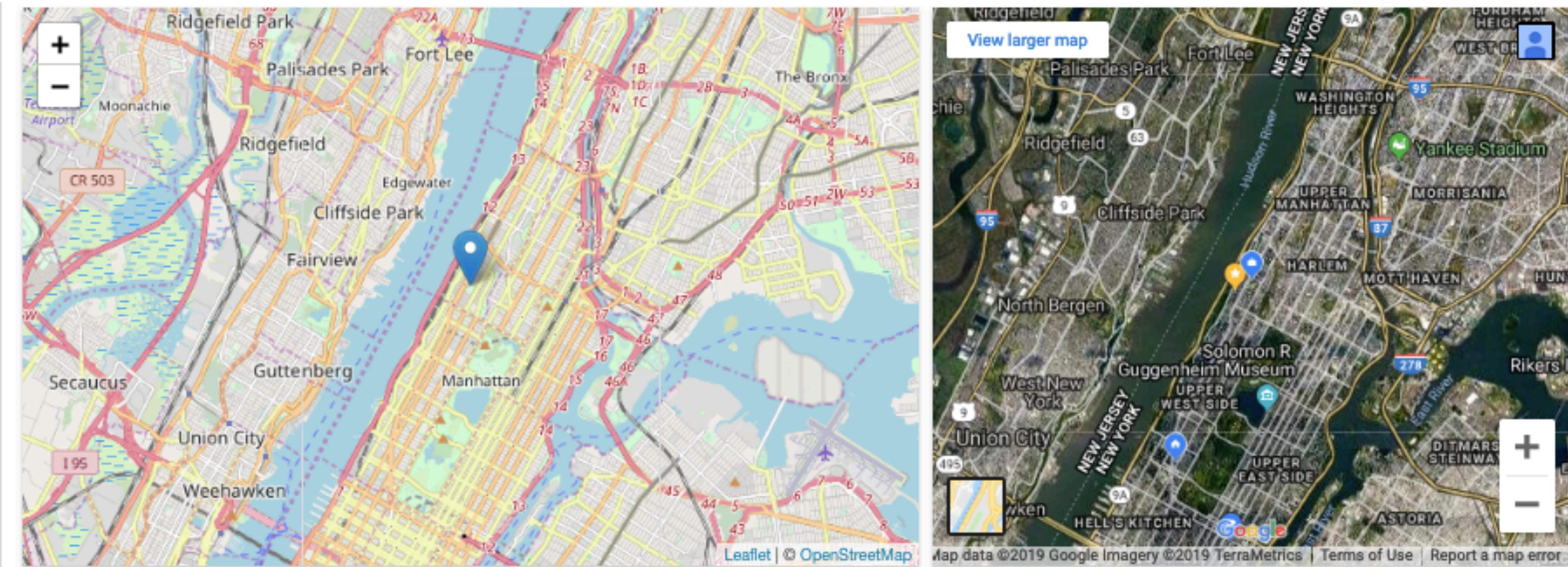


## Lat Long

(40.807537, -73.962570)

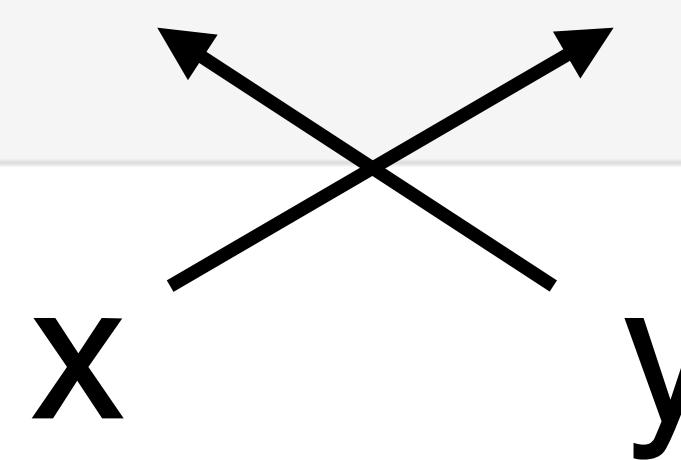
## GPS Coordinates

40° 48' 27.1332" N  
73° 57' 45.252" W



## Lat Long

(40.807537, -73.962570)



## GPS Coordinates

40° 48' 27.1332" N  
73° 57' 45.252" W

# Latitude & Longitude

----- Forwarded Message -----

**Subject:**Daily U.S. Snowfall and Snow Depth

**Date:**Fri, 2 Mar 2018 19:50:24 -0500

**From:**Jingbo Wu [jw2531@columbia.edu](mailto:jw2531@columbia.edu)

**To:**[ncei.orders@noaa.gov](mailto:ncei.orders@noaa.gov)

Dear Concerned,

I am a data science student here at columbia. I am also an atmospheric scientist at GISS/NASA. We are downloading some US snowfall data particularly a data file of daily snowfall of NY state counties for February 2017. We are using it in our exploratory data visualization and analysis class. But it seems the latitude and longitude in the data file was wrong. They should be switched around: the latitude seemed to be the actual longitude while the longitude data seemed to be latitude data. Would you please check why this is happening? Attached please find the screen shot of the data.

Thanks for your attention!

Jingbo Wu

# Latitude & Longitude

On Mon, Mar 5, 2018 at 9:50 AM, Scott Stephens - NOAA Federal <[scott.stephens@noaa.gov](mailto:scott.stephens@noaa.gov)> wrote:

Hey guys,

Please see below. It looks like the headers are reversed from the data presentation (header says order is Latitude, Longitude, while data is actually displayed as Longitude, Latitude.

thanks,

Scott

----- Forwarded message -----

From: NCEI Orders <[ncei.orders@noaa.gov](mailto:ncei.orders@noaa.gov)>

Date: Mon, Mar 5, 2018 at 9:22 AM

Subject: ss\*Fwd: Daily U.S. Snowfall and Snow Depth

To: Scott Stephens <[Scott.Stephens@noaa.gov](mailto:Scott.Stephens@noaa.gov)>, NCEI Orders - NOAA Service Account <[ncei.orders@noaa.gov](mailto:ncei.orders@noaa.gov)>

# Latitude & Longitude

----- Forwarded message -----

From: Jesse Enloe - NOAA Federal <[jesse.enloe@noaa.gov](mailto:jesse.enloe@noaa.gov)>

Date: Mon, Mar 5, 2018 at 9:56 AM

Subject: Re: ss\*Fwd: Daily U.S. Snowfall and Snow Depth

To: Jingbo Wu <[jw2531@columbia.edu](mailto:jw2531@columbia.edu)>

Cc: "NCEI Monitoring.Info - NOAA Service Account" <[ncei.monitoring.info@noaa.gov](mailto:ncei.monitoring.info@noaa.gov)>, Scott Stephens - NOAA Federal <[scott.stephens@noaa.gov](mailto:scott.stephens@noaa.gov)>

Thank you for contacting us about this issue! You are indeed correct that the lat/lon was switched in the CSV data. The correction has been made and submitted for deployment. I will let you know as soon as the correction makes it online. In the meantime, the XML and JSON formatted data are correct, if you wish to use those. Please let me know if you need any further assistance.

Thank you,

Jesse

# Geocomputation with R

Geocomputation with R

Welcome

How to contribute?

Reproducibility

Supporting the project

Foreword

Preface

1 Introduction

I Foundations

2 Geographic data in R

3 Attribute data operations

4 Spatial data operations

5 Geometry operations

6 Reprojecting geographic data

7 Geographic data I/O

II Extensions

8 Making maps with R

9 Bridges to GIS software

10 Scripts, algorithms and functions

11 Statistical learning

III Applications

12 Transportation

Geocomputation with R

Robin Lovelace, Jakub Nowosad, Jannes Muenchow

2021-02-23

## Welcome

This is the online home of *Geocomputation with R*, a book on geographic data analysis, visualization and modeling.

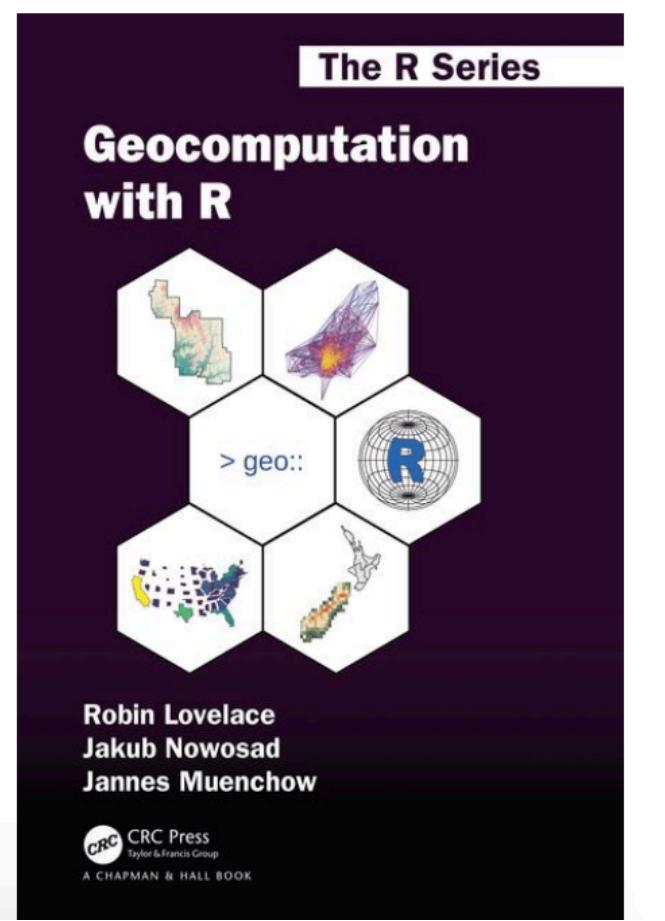
**Note:** This book has now been published by CRC Press in the [R Series](#). You can buy the book from [CRC Press](#), [Wordery](#), or [Amazon](#).

Inspired by [bookdown](#) and the Free and Open Source Software for Geospatial ([FOSS4G](#)) movement, this book is open source. This ensures its contents are reproducible and publicly accessible for people worldwide.

The online version of the book is hosted at [geocompr.robinlovelace.net](https://geocompr.robinlovelace.net) and kept up-to-date by [GitHub Actions](#), which provides information on its ‘build status’ as follows:

Render-Book-from-master | passing

CRC Press



# *New York Times*

[https://www.nytimes.com/interactive/2017/10/05/upshot/gun-ownership-partisan-  
divide.html](https://www.nytimes.com/interactive/2017/10/05/upshot/gun-ownership-partisan-divide.html)

[https://www.nytimes.com/interactive/2017/08/29/upshot/harvey-rainfall-where-you-  
live.html](https://www.nytimes.com/interactive/2017/08/29/upshot/harvey-rainfall-where-you-live.html)

[https://www.nytimes.com/interactive/2017/06/30/upshot/the-best-and-worst-new-  
york-neighborhoods.html](https://www.nytimes.com/interactive/2017/06/30/upshot/the-best-and-worst-new-york-neighborhoods.html)