Week 11: *Maps*

EMSE 4572: Exploratory Data Analysis

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November 09, 2022

Today's data

```
milk_production <- read_csv(here::here('data', 'milk_production.csv'))
us_coffee_shops <- read_csv(here::here('data', 'us_coffee_shops.csv'))
```

New packages:

```
install.packages('maps')
install.packages('mapproj')
install.packages('sf')
install.packages('rgeos')
install.packages('rnaturalearth')
devtools::install_github("ropensci/rnaturalearthhires")
devtools::install_github("ropensci/rnaturalearthdata")
```

Week 11: *Maps*

1. Plotting maps

2. Adding data to maps

BREAK

3. Projections

Week 11: *Maps*

1. Plotting maps

2. Adding data to maps

BREAK

3. Projections

How to make a map

Step 1: Load a shape file

a. Use a library

b. Read in a shape file

Step 2: Plot the shape file

a. Polygon data: `geom_polygon()`

b. Simple Features data: `geom_sf()`

Polygon maps

Get the "World" shape file

```r
library(ggplot2)

world <- map_data("world")
head(world)
```

```
#>          long      lat group order region subregion
#> 1 -69.89912 12.45200     1     1  Aruba      <NA>
#> 2 -69.89571 12.42300     1     2  Aruba      <NA>
#> 3 -69.94219 12.43853     1     3  Aruba      <NA>
#> 4 -70.00415 12.50049     1     4  Aruba      <NA>
#> 5 -70.06612 12.54697     1     5  Aruba      <NA>
#> 6 -70.05088 12.59707     1     6  Aruba      <NA>
```

Polygon maps

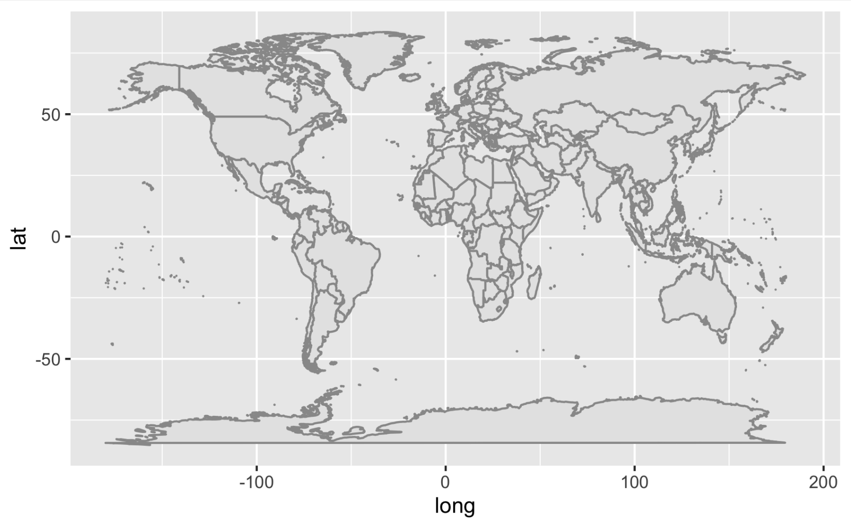
Get the "World" shape file

```
library(ggplot2)

world <- map_data("world")
```

Make the plot with `geom_polygon()`

```
ggplot(world) +
    geom_polygon(aes(x = long, y = lat, group = group),
                 fill = "grey90", color = "grey60")
```



Polygon maps

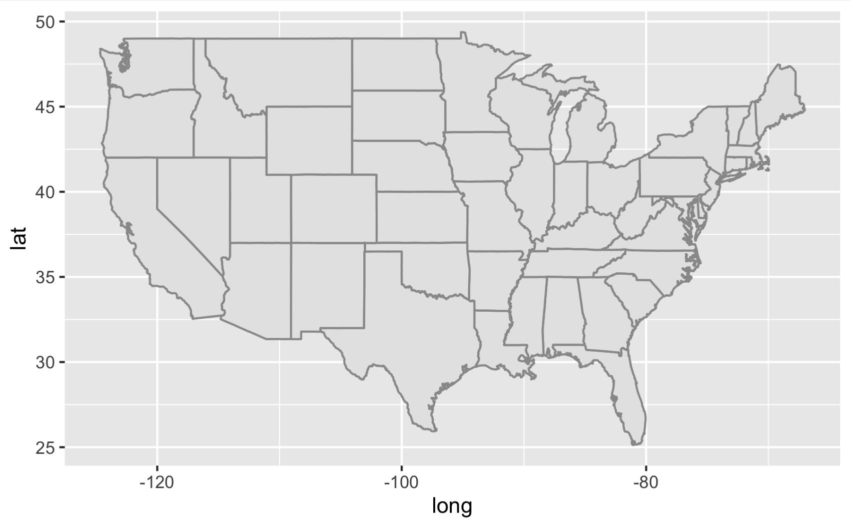
Get the "US States" shape file

```
library(ggplot2)

us_states <- map_data("state")
```

Make the plot with `geom_polygon()`

```
ggplot(us_states) +
    geom_polygon(aes(x = long, y = lat, group = group),
                 fill = "grey90", color = "grey60")
```



Simple Features (sf) maps

Library data from Natural Earth

```
library(rnaturalearth)
library(rnaturalearthdata)

world <- ne_countries(
  scale = "medium",
  returnclass = "sf")

world %>%
    select(name, geometry) %>%
    head()
```

```
#> Simple feature collection with 6 features and 1 field
#> Geometry type: MULTIPOLYGON
#> Dimension:     XY
#> Bounding box:  xmin: -73.36621 ymin: -22.40205 xmax: 1
#> CRS:           +proj=longlat +datum=WGS84 +no_defs +el
#>        name                       geometry
#> 0  Zimbabwe MULTIPOLYGON (((31.28789 -2...
#> 1    Zambia MULTIPOLYGON (((30.39609 -1...
#> 2     Yemen MULTIPOLYGON (((53.08564 16...
#> 3   Vietnam MULTIPOLYGON (((104.064 10....
#> 4 Venezuela MULTIPOLYGON (((-60.82119 9...
#> 5   Vatican MULTIPOLYGON (((12.43916 41...
```

Simple Features (sf) maps

Get the "World" shape file

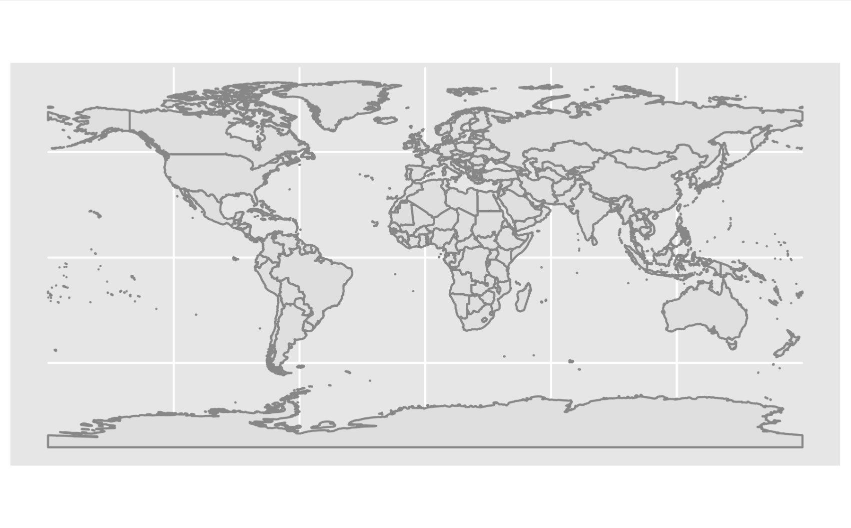
```r
library(rnaturalearth)
library(rnaturalearthdata)

world <- ne_countries(
  scale = "medium",
  returnclass = "sf")
```

Make the plot with `geom_sf()`

```r
library(sf)

ggplot(data = world) +
    geom_sf(fill = "grey90", color = "grey60")
```



Simple Features (sf) maps

Get the "US States" shape file

```r
library(rnaturalearth)
library(rnaturalearthdata)

us_states <- ne_states(
    country = 'united states of america',
    returnclass = 'sf')
```

Simple Features (sf) maps

Get the "US States" shape file

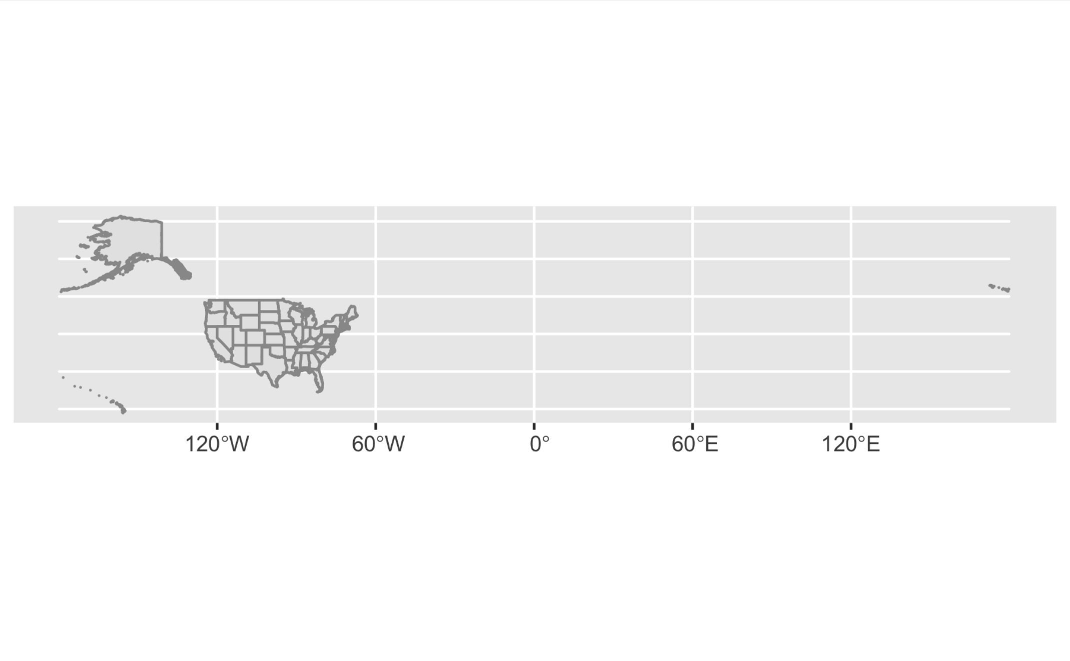
```r
library(rnaturalearth)
library(rnaturalearthdata)

us_states <- ne_states(
    country = 'united states of america',
    returnclass = 'sf')
```

Make the plot with `geom_sf()`

```r
library(sf)

ggplot(data = us_states) +
    geom_sf(fill = "grey90", color = "grey60")
```

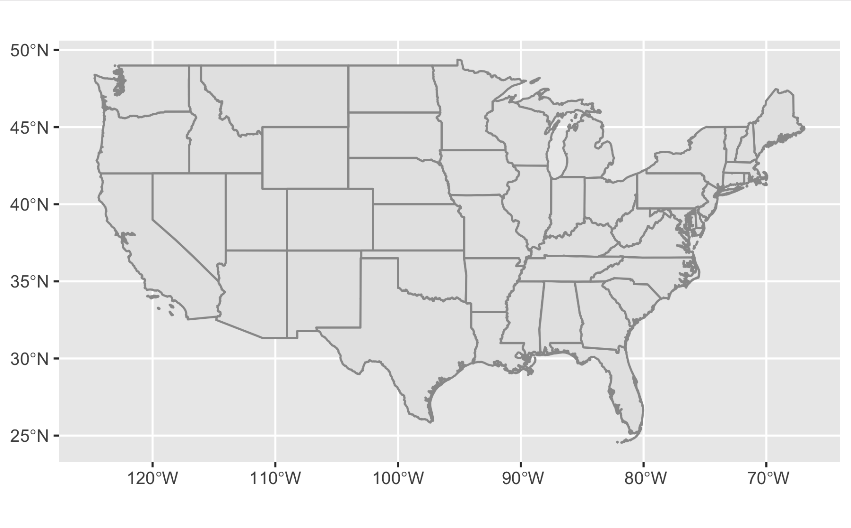


Simple Features (sf) maps

Get the **Continental** "US States" shape file

```
library(rnaturalearth)
library(rnaturalearthdata)

us_states_cont <- ne_states(
    country = 'united states of america',
    returnclass = 'sf') %>%
    filter(! name %in% c('Alaska', 'Hawaii'))
```



Make the plot with `geom_sf()`

```
library(sf)

ggplot(data = us_states_cont) +
    geom_sf(fill = "grey90", color = "grey60")
```

The maps package

Includes data on:

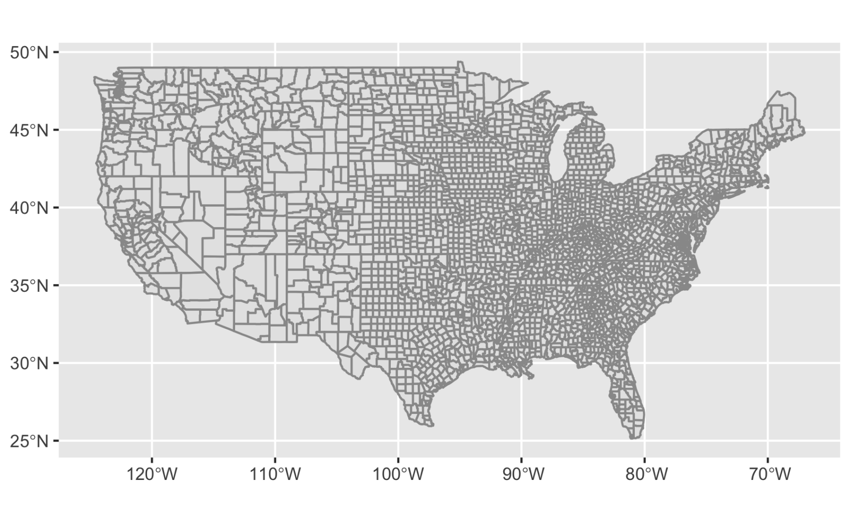
- World: world, world.cities, lakes
- US: states, county, state, usa
- France: france
- Italy: italy
- New zealand: nz

Example:

```r
library(maps)

us_counties <- st_as_sf(
    map("county", plot = FALSE, fill = TRUE))

ggplot(data = us_counties) +
    geom_sf(fill = 'grey90', color = 'grey60')
```



Simple Features (sf) maps: `st_read()`

Read in the "World" shape file from Natural Earth

```r
library(sf)

world <- st_read(here::here(
    'data', 'natural_earth_countries',
    'ne_50m_admin_0_countries.shp')) %>%
    clean_names()
```

```
#> Reading layer `ne_50m_admin_0_countries' from data sou
#> Simple feature collection with 241 features and 94 fie
#> Geometry type: MULTIPOLYGON
#> Dimension:     XY
#> Bounding box:  xmin: -180 ymin: -89.99893 xmax: 180 y
#> Geodetic CRS:  WGS 84
```

Simple Features (sf) maps: `st_read()`

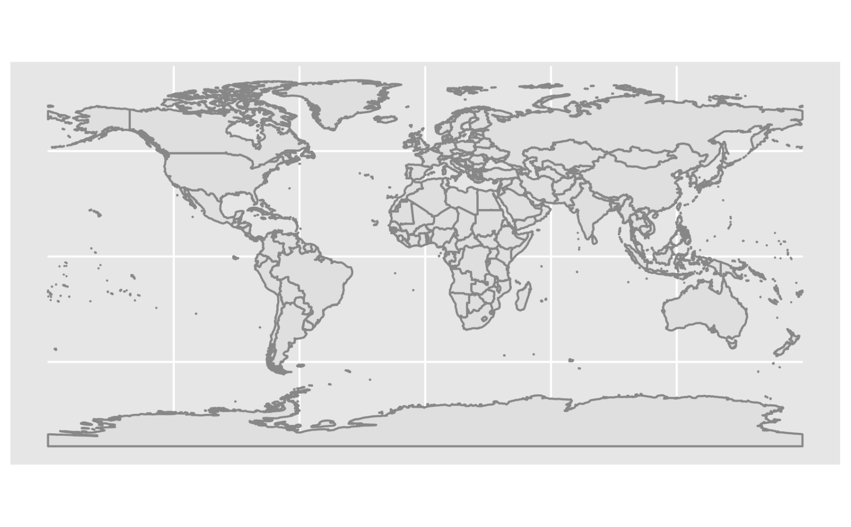
Read in the "World" shape file

```r
library(sf)

world <- st_read(here::here(
    'data', 'natural_earth_countries',
    'ne_50m_admin_0_countries.shp')) %>%
    clean_names()
```

```
#> Reading layer `ne_50m_admin_0_countries' from data sou
#> Simple feature collection with 241 features and 94 fie
#> Geometry type: MULTIPOLYGON
#> Dimension:     XY
#> Bounding box:  xmin: -180 ymin: -89.99893 xmax: 180 yr
#> Geodetic CRS:  WGS 84
```

```r
ggplot(data = world) +
    geom_sf(fill = "grey90", color = "grey60")
```



Simple Features (sf) maps: `st_read()`

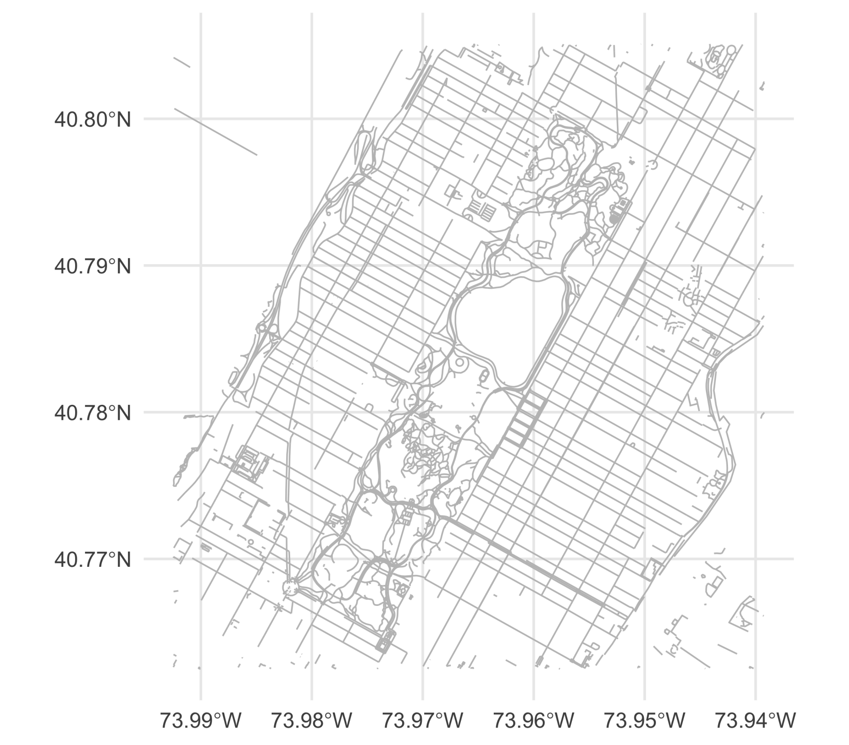
Read in the "Central Park" shape file [source]

```r
library(sf)

central_park <- st_read(here::here(
    'data', 'central_park', 'CentralPark.shp'))
```

```
#> Reading layer `CentralPark' from data source `/Users/j
#> Simple feature collection with 2550 features and 6 fie
#> Geometry type: LINESTRING
#> Dimension:     XY
#> Bounding box:  xmin: -73.99249 ymin: 40.7625 xmax: -73
#> Geodetic CRS:  WGS 84
```

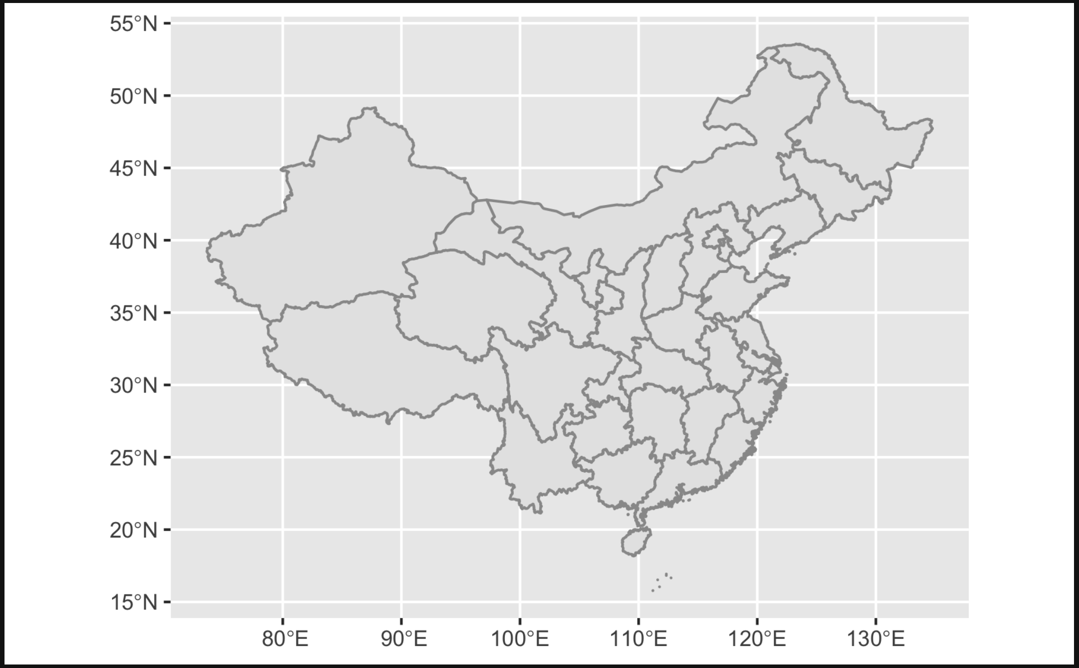
```r
ggplot(data = central_park) +
    geom_sf(color = 'grey75')
```

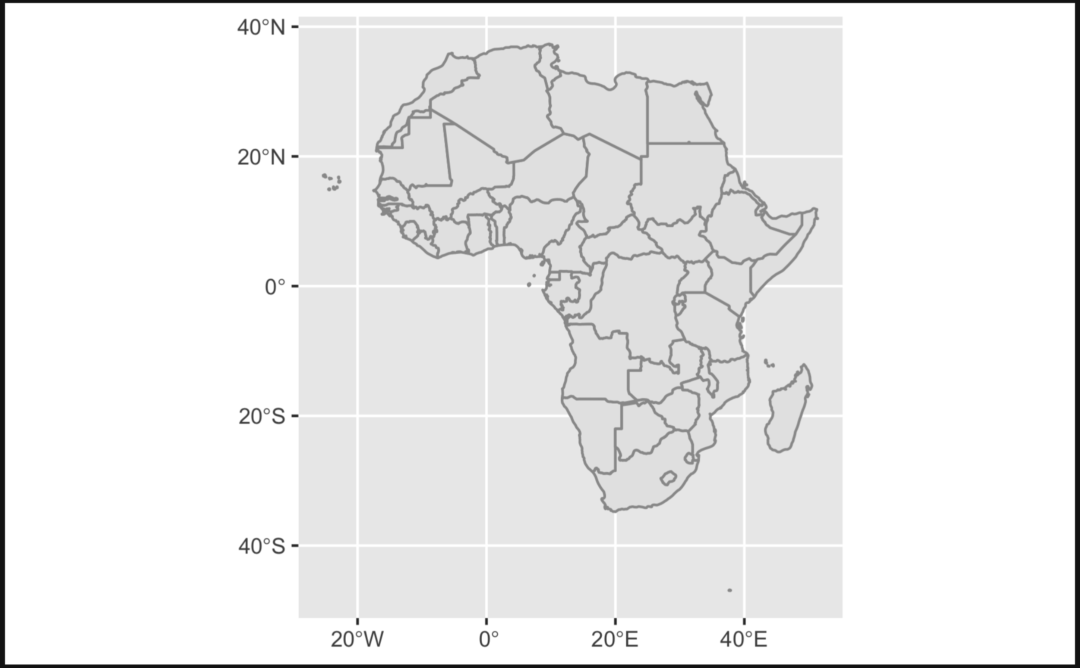


Your turn

10:00

Use the **rnaturalearth** library to extract and plot the shape files for China and Africa:





Week 11: *Maps*

1. Plotting maps

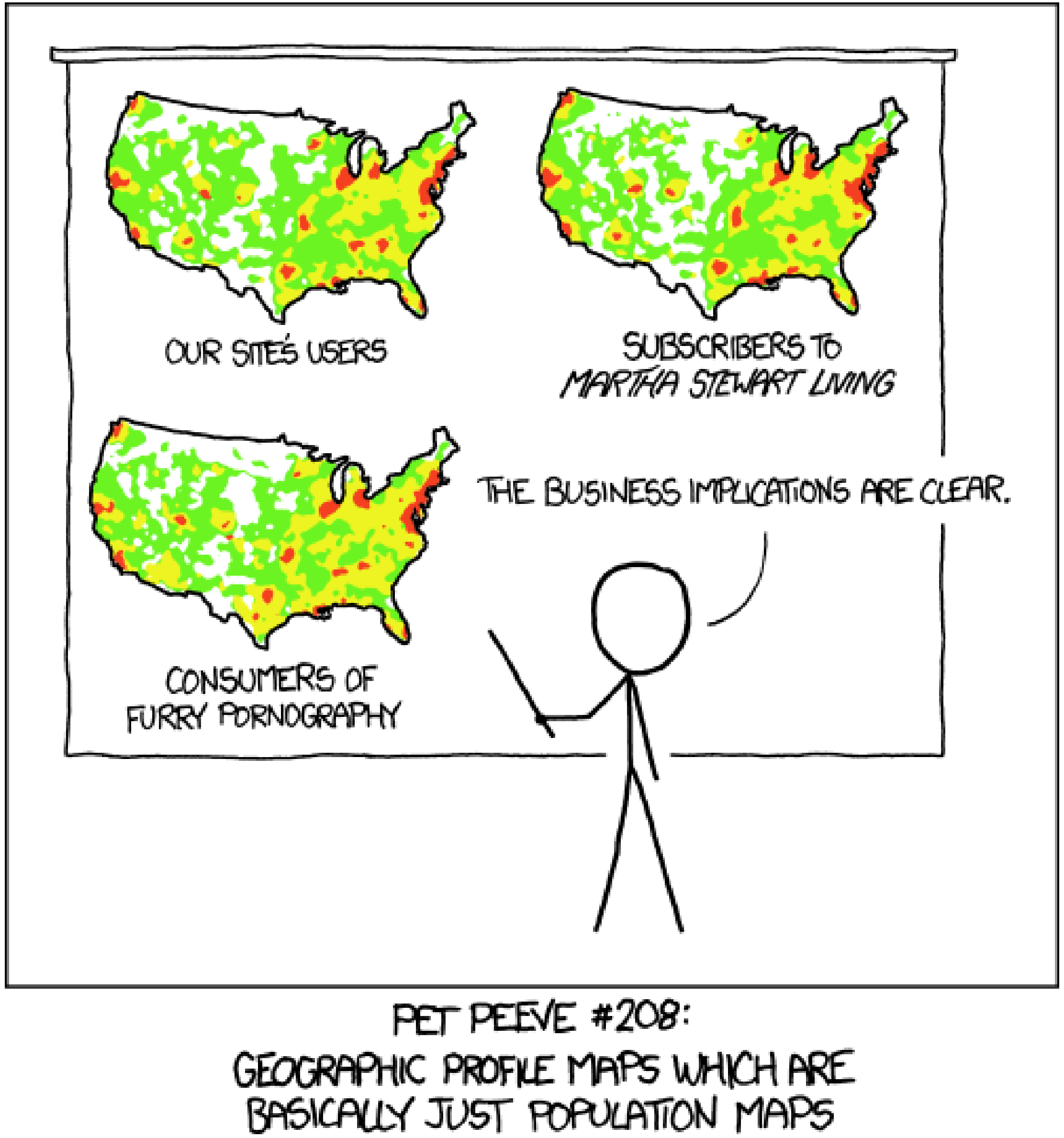
2. Adding data to maps

BREAK

3. Projections

First rule of adding data to maps:

Do you need to make a map?

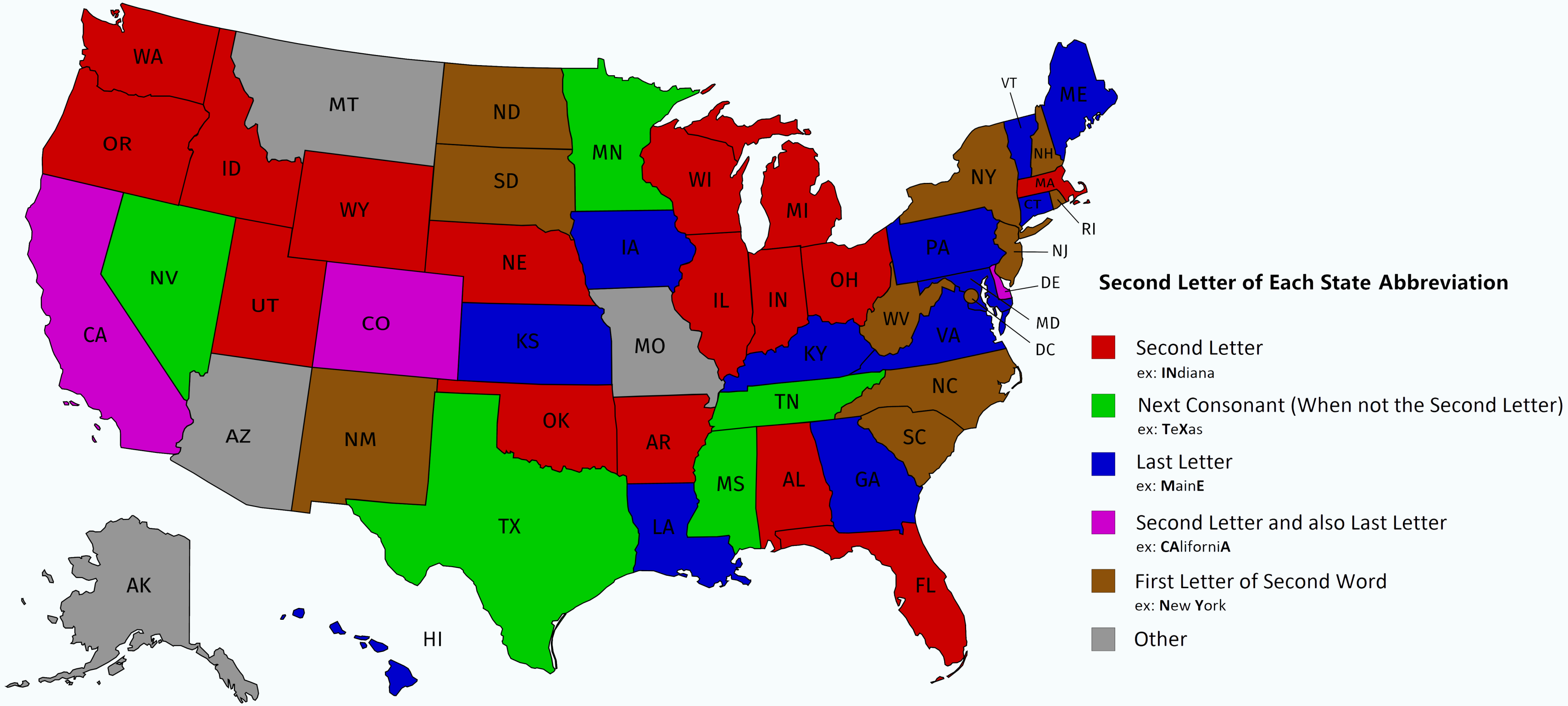

OUR SITE'S USERS
SUBSCRIBERS TO MARTHA STEWART LIVING
CONSUMERS OF FURRY PORNOGRAPHY
THE BUSINESS IMPLICATIONS ARE CLEAR.
PET PEEVE #208:
GEOGRAPHIC PROFILE MAPS WHICH ARE BASICALLY JUST POPULATION MAPS

https://xkcd.com/1138/

1. Choropleth maps
2. Point maps

Choropleth - from Greek:

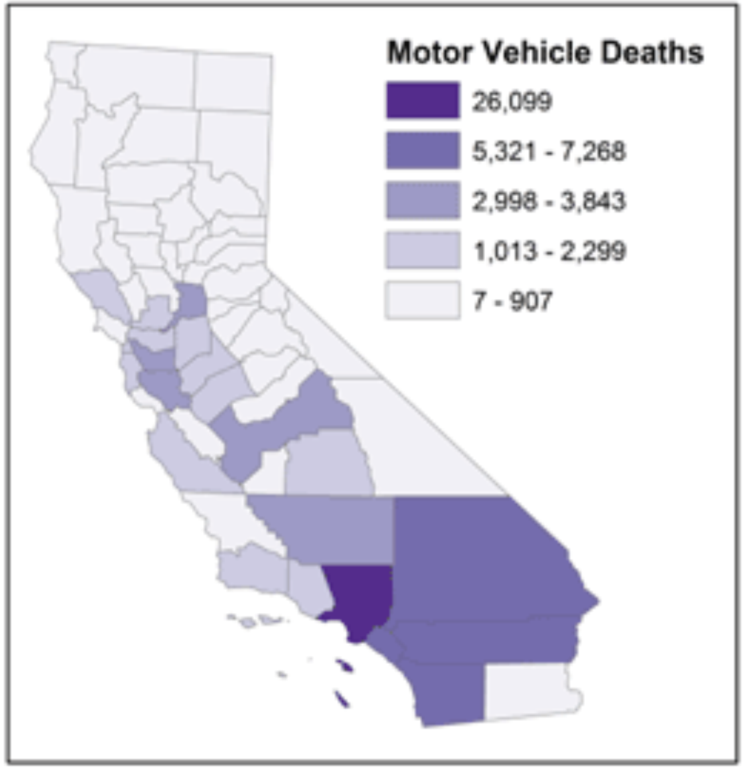
- χῶρος "choros" (area/region)
- πλῆθος "plethos" (multitude)

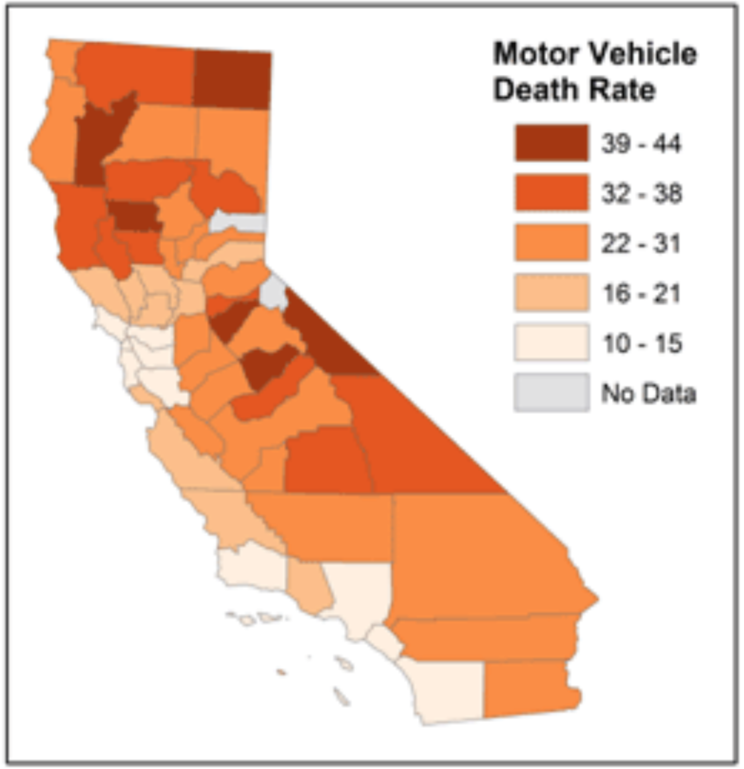


From reddit: r/dataisbeautiful by u/GaudyAudi

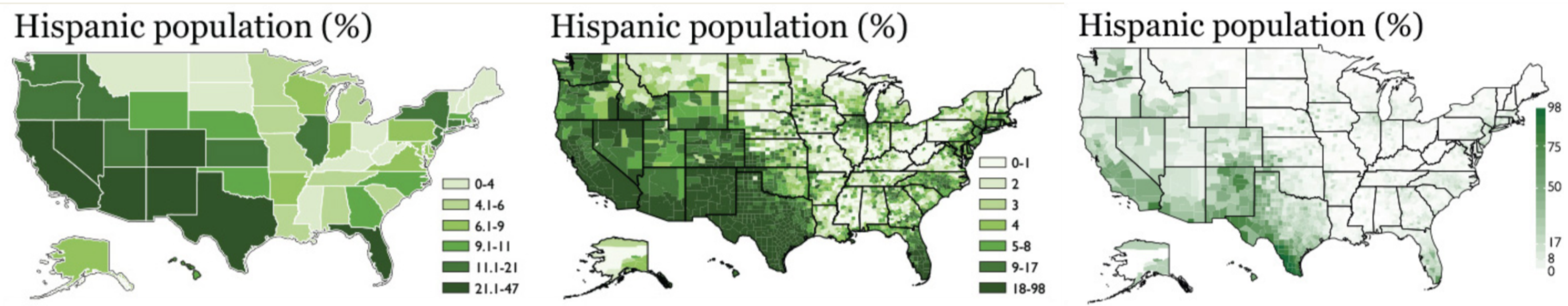
Choropleth maps are easily misleading

Number of events != Number of events **per capita**

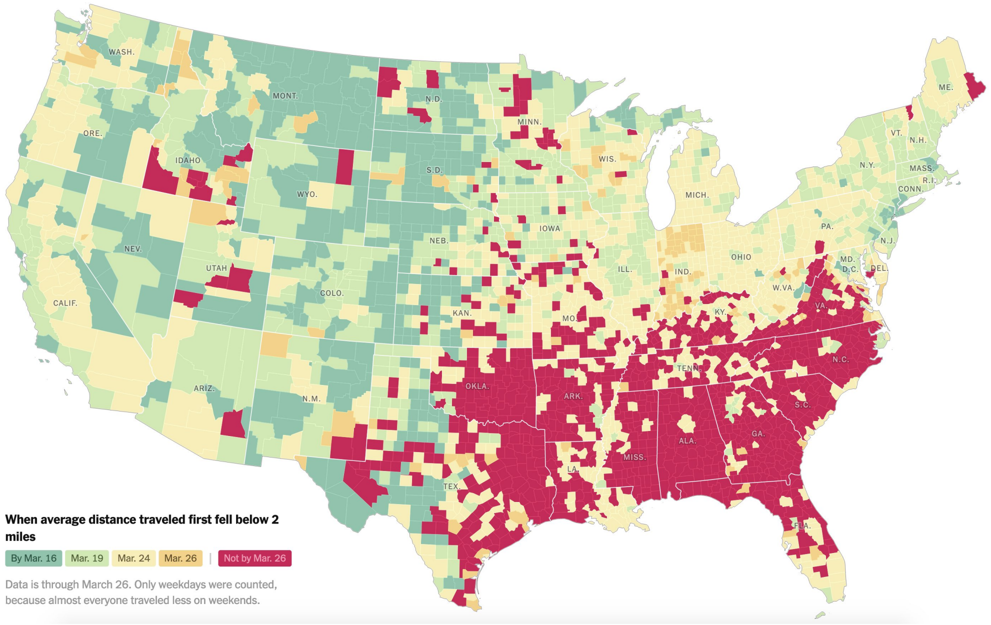




Manipulating fill scale produces wildly different maps

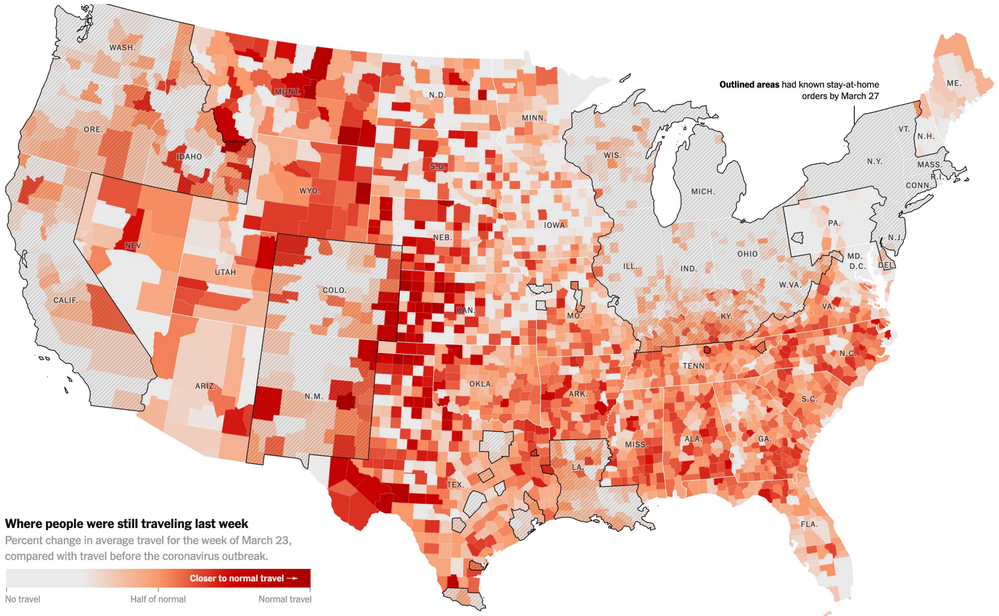


Manipulating fill scale produces wildly different maps



When average distance traveled first fell below 2 miles

Data is through March 26. Only weekdays were counted, because almost everyone traveled less on weekends.



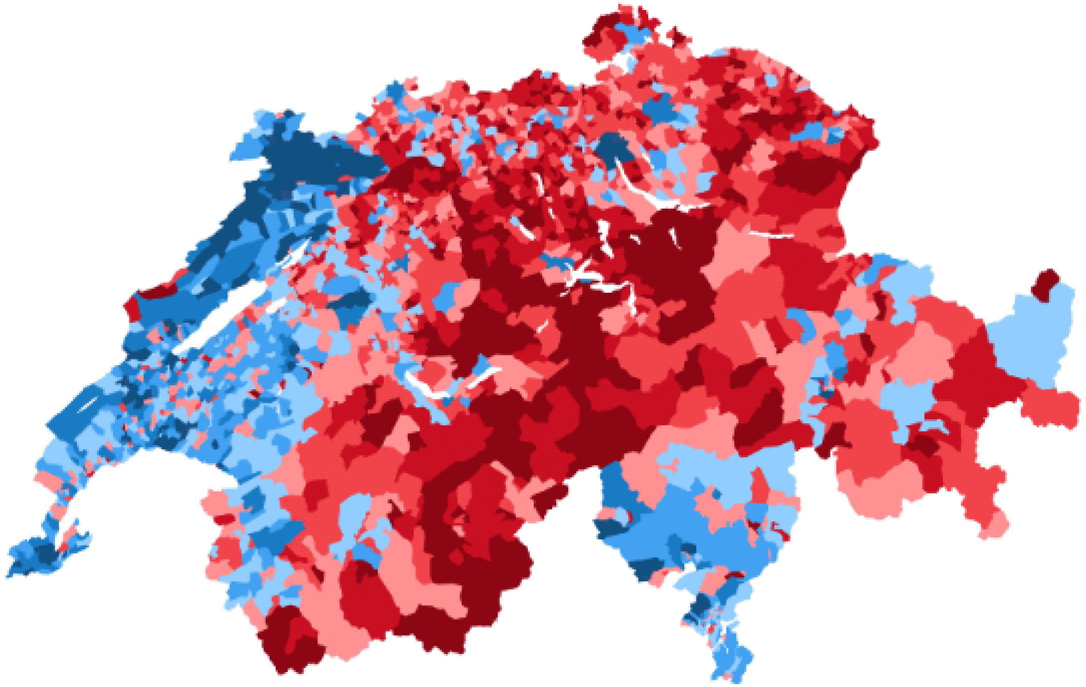
Where people were still traveling last week

Percent change in average travel for the week of March 23, compared with travel before the coronavirus outbreak.

Outlined areas had known stay-at-home orders by March 27

Source: New York Times

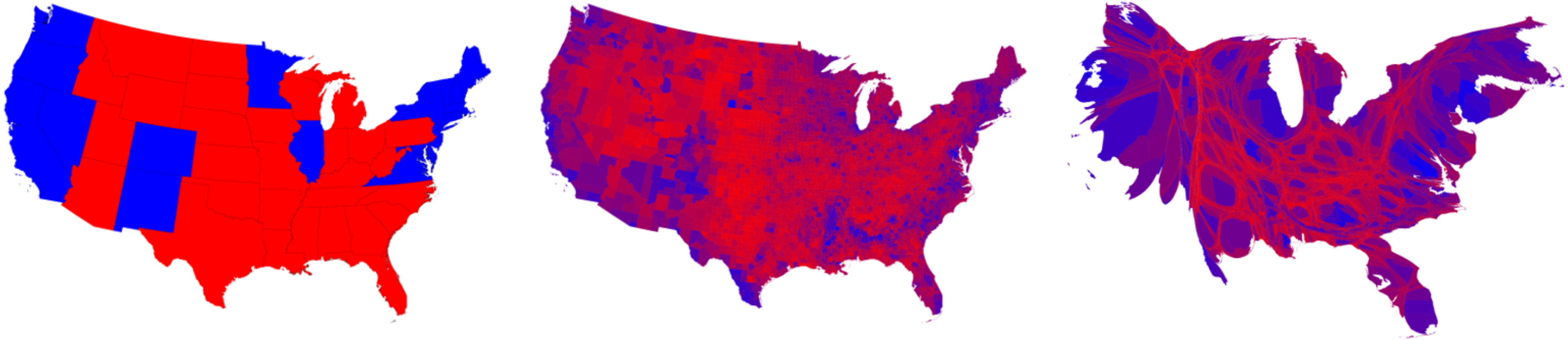
Land doesn't vote - people vote

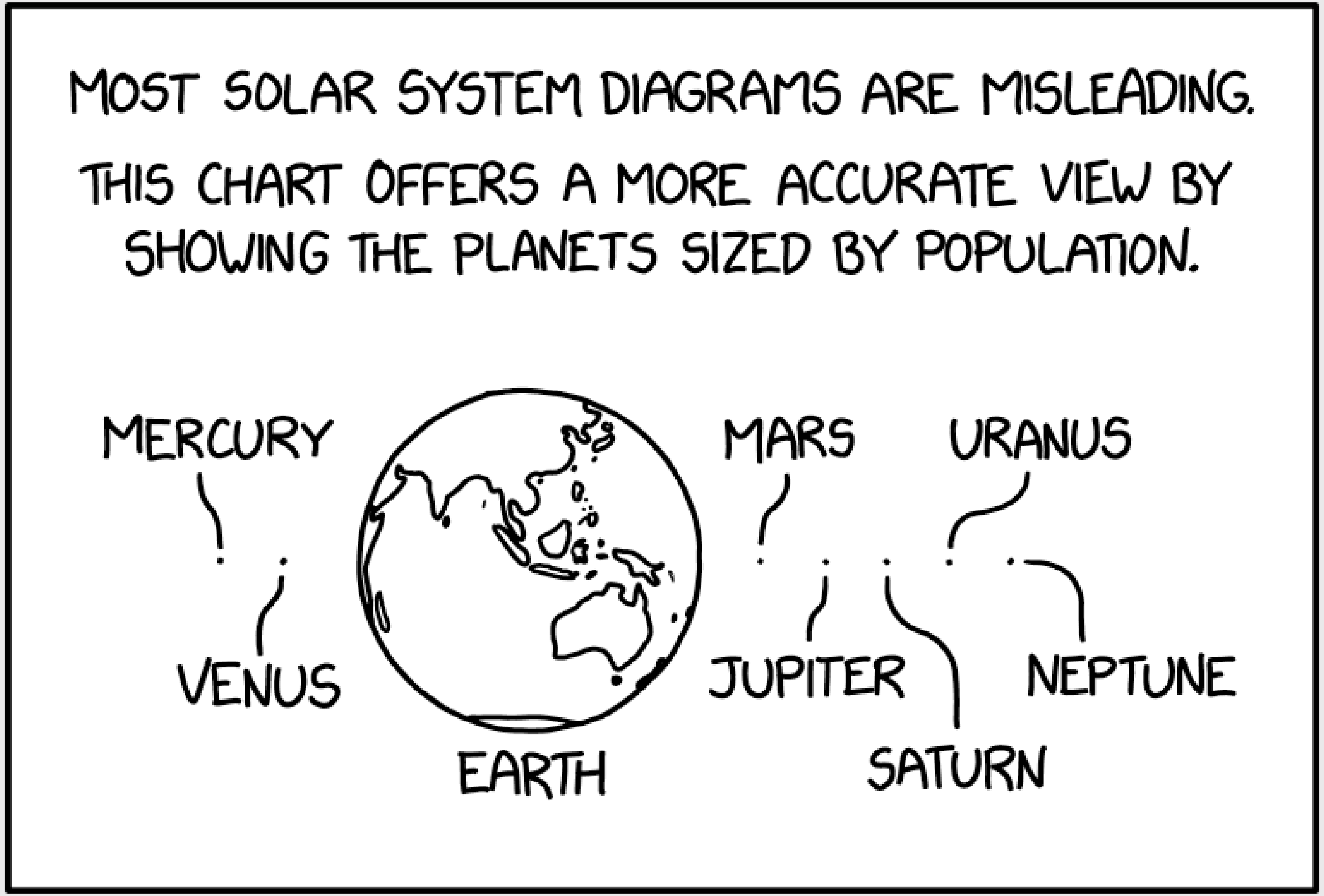


By David Zumbach

Land doesn't vote - people vote

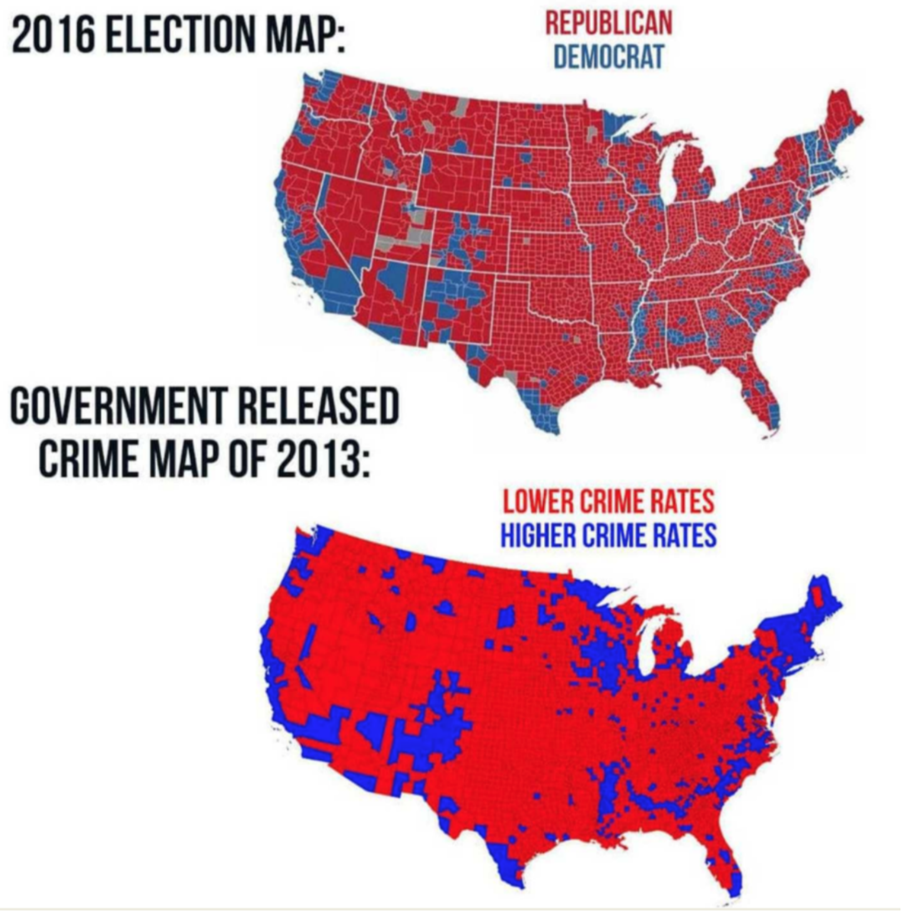
Election maps from: http://www-personal.umich.edu/~mejn/election/2016/




MOST SOLAR SYSTEM DIAGRAMS ARE MISLEADING.
THIS CHART OFFERS A MORE ACCURATE VIEW BY SHOWING THE PLANETS SIZED BY POPULATION.
MERCURY
VENUS
EARTH
MARS
JUPITER
SATURN
URANUS
NEPTUNE

https://xkcd.com/2439/

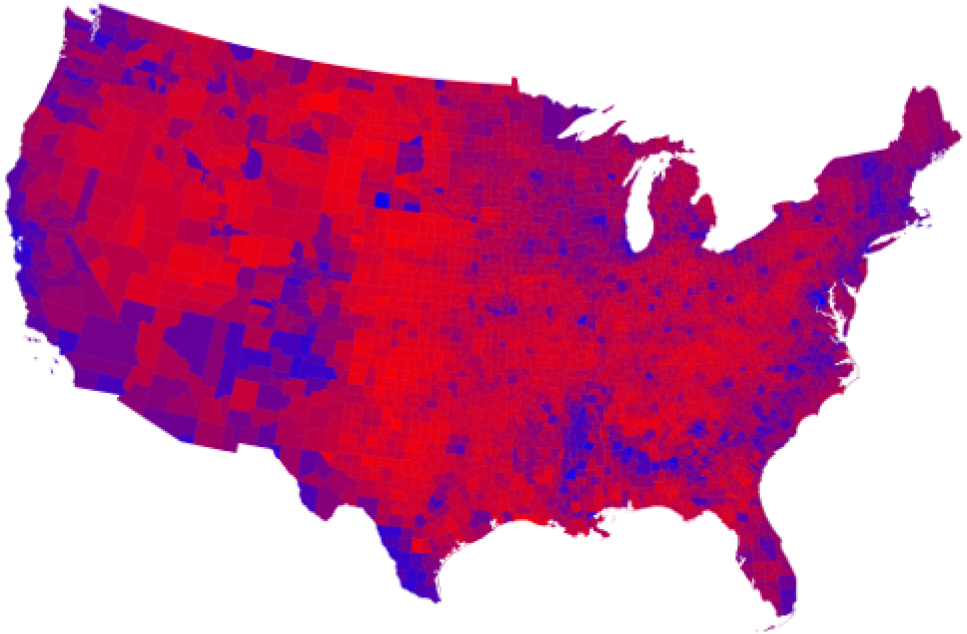
Easy to lie with fake news



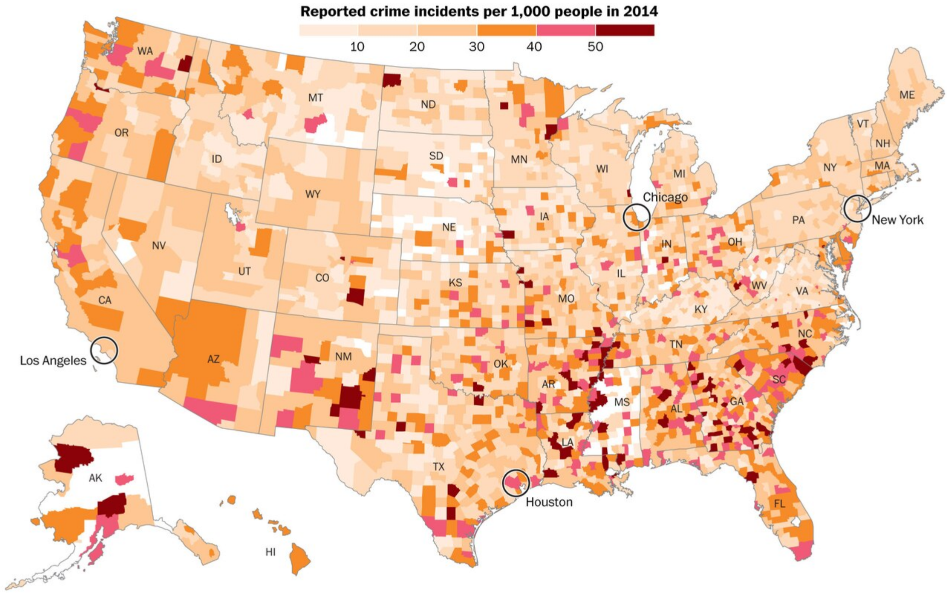
Bottom map is actually this map of the 2012 election

(here is what actual crime rates look like)

2016 Election map [source]

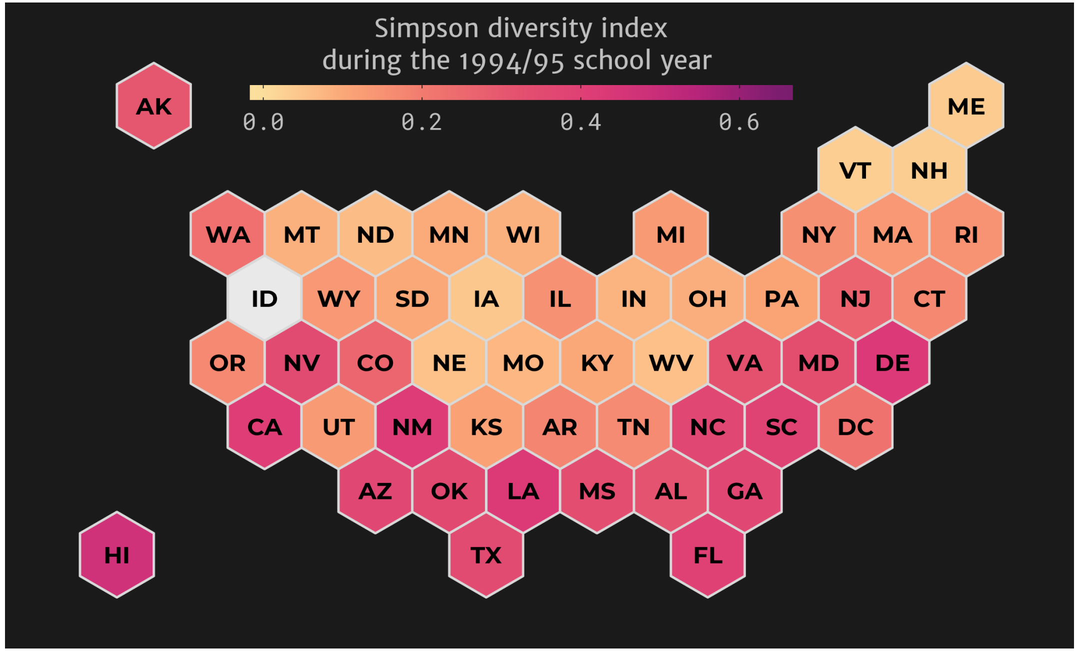


2014 Crime map [source]



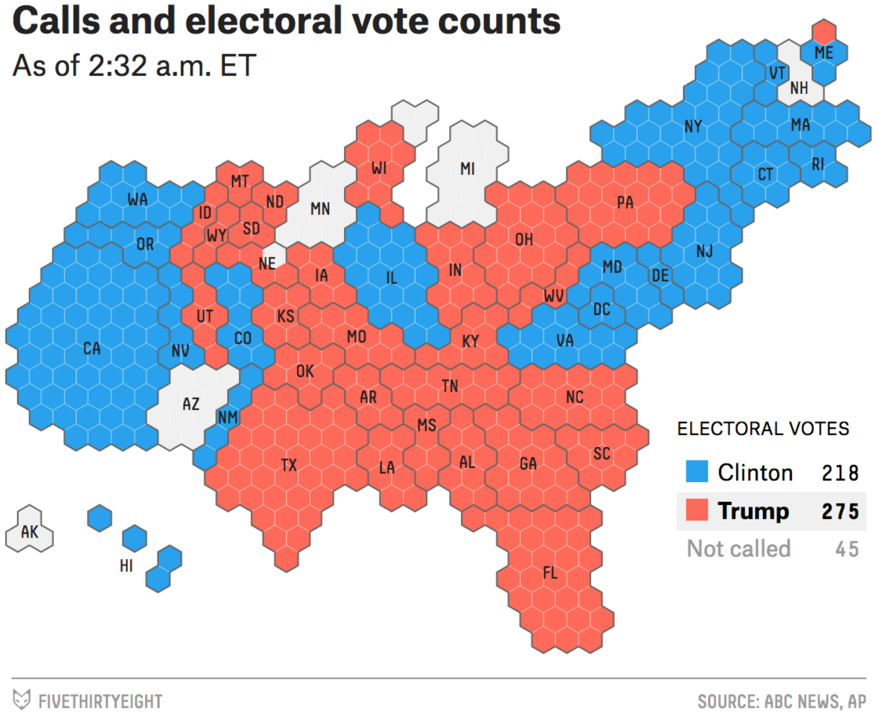
A choropleth alternative: hex maps

1994 Simpson Diversity Index in US Schools


Simpson diversity index
during the 1994/95 school year

https://github.com/malcolmbarrett/designing_ggplots

2016 Electoral College


Calls and electoral vote counts

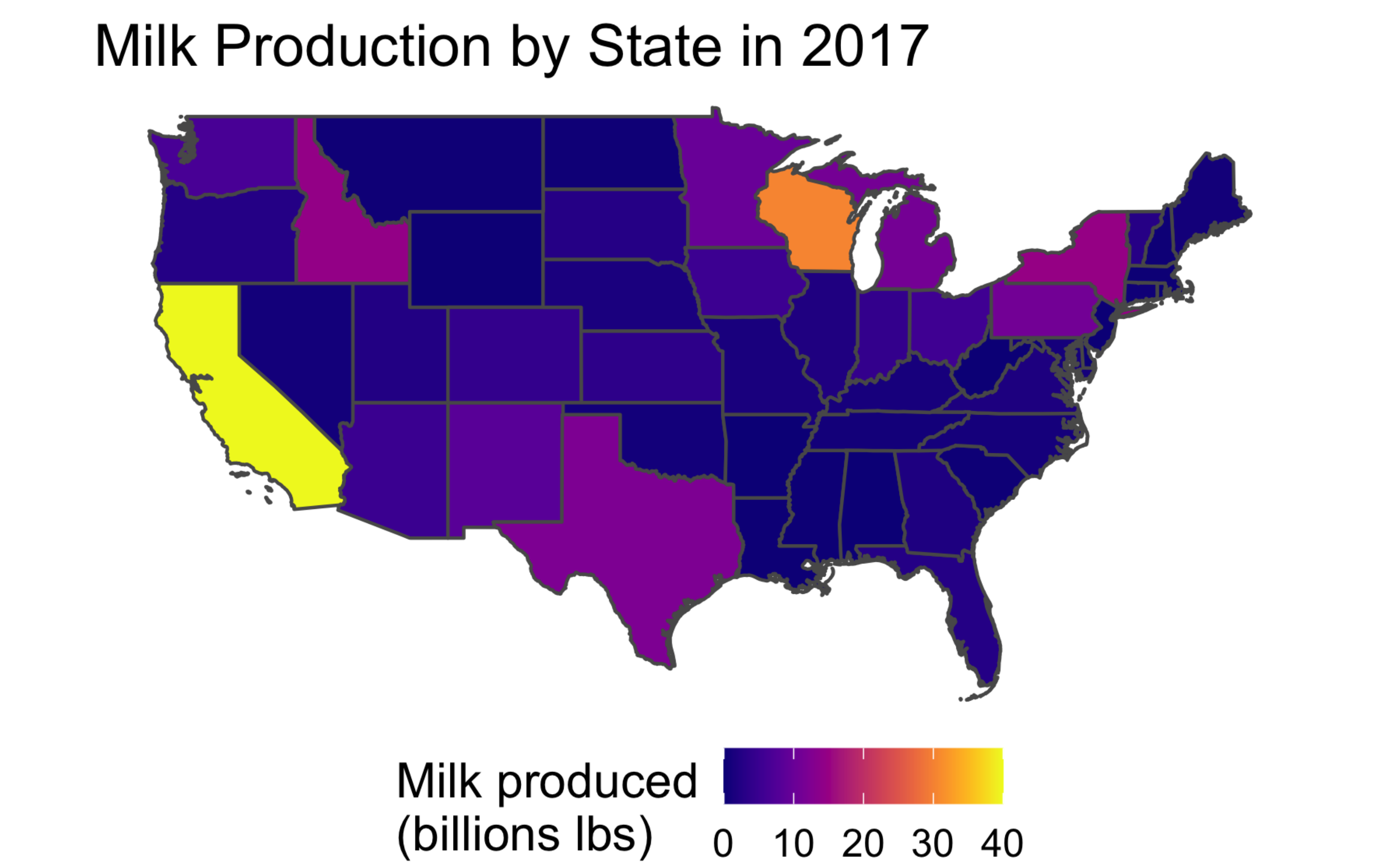
As of 2:32 a.m. ET

FIVETHIRTYEIGHT

SOURCE: ABC NEWS, AP

https://fivethirtyeight.com/

How to make a choropleth map



How to make a choropleth map

Get the "fill" data

```
milk_2017 <- milk_production %>%
    filter(year == 2017) %>%
    select(name = state, milk_produced) %>%
    mutate(milk_produced = milk_produced / 10^9)
```

Get the "map" data

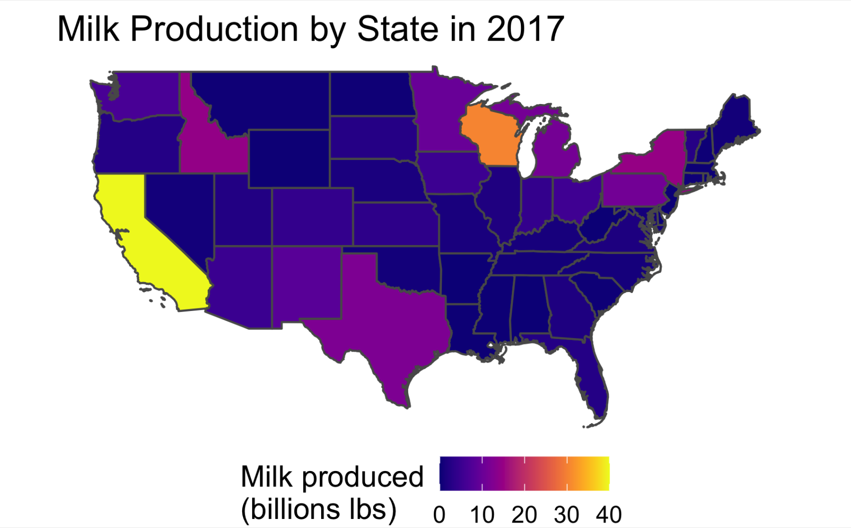
```
us_states <- ne_states(
    country = 'united states of america',
    returnclass = 'sf') %>%
    filter(! name %in% c('Alaska', 'Hawaii')) %>%
    left_join(milk_2017, by = 'name')
```

```
us_states %>%
    select(name, milk_produced) %>%
    head()
```

```
#> Simple feature collection with 6
#> Geometry type: MULTIPOLYGON
#> Dimension:     XY
#> Bounding box:  xmin: -124.7346 y
#> CRS:           +proj=longlat +da
#>           name milk_produced
#> 1    Minnesota         9.864 MUL
#> 2   Washington         6.526 MUL
#> 3        Idaho        14.627 MUL
#> 4      Montana         0.288 MUL
#> 5 North Dakota         0.345 MUL
#> 6     Michigan        11.231 MUL
```

How to make a choropleth map

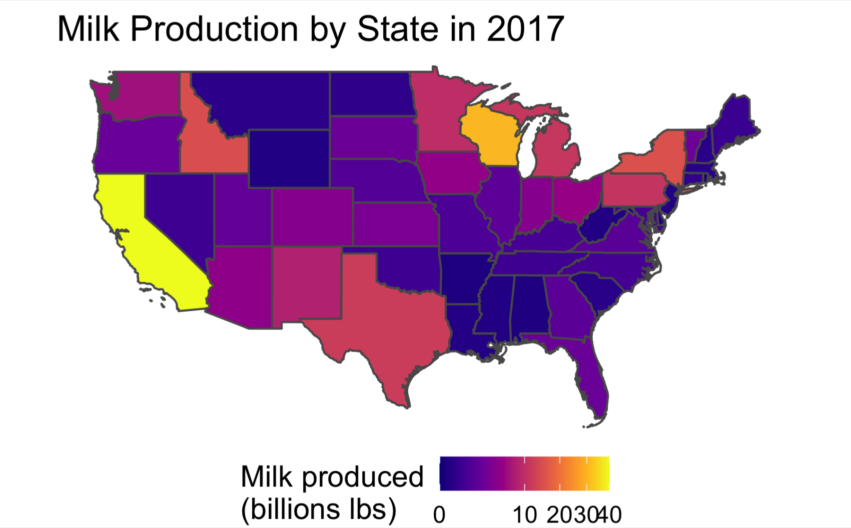
```
ggplot(us_states) +
  geom_sf(aes(fill = milk_produced)) +
  scale_fill_viridis(
    option = "plasma",
    limits = c(0, 40)) +
  theme_void(base_size = 15) +
  theme(legend.position = 'bottom') +
  labs(fill = 'Milk produced\n(billions lbs)',
       title = 'Milk Production by State in 2017')
```



How to make a choropleth map

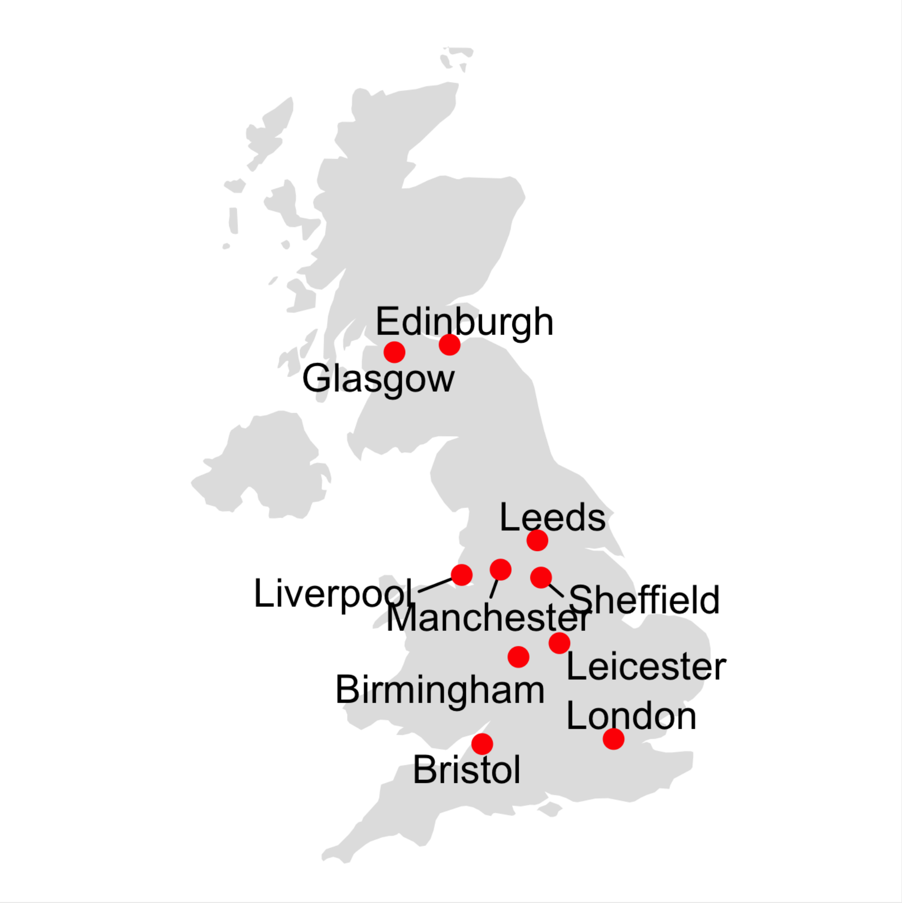
```
ggplot(us_states) +
  geom_sf(aes(fill = milk_produced)) +
  scale_fill_viridis(
    trans = 'sqrt',
    option = "plasma",
    limits = c(0, 40)) +
  theme_void(base_size = 15) +
  theme(legend.position = 'bottom') +
  labs(fill = 'Milk produced\n(billions lbs)',
       title = 'Milk Production by State in 2017')
```

Non-linear scale:

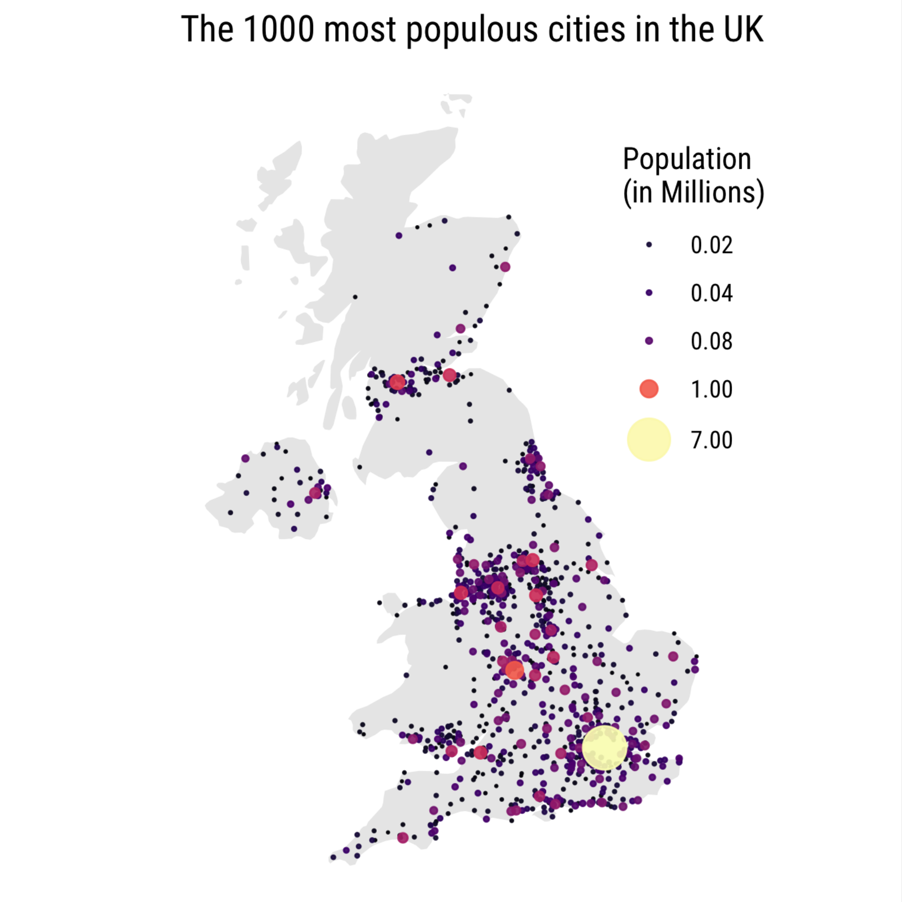


1. Choropleth maps
2. Point maps

Points as locations



Points encoding a variable

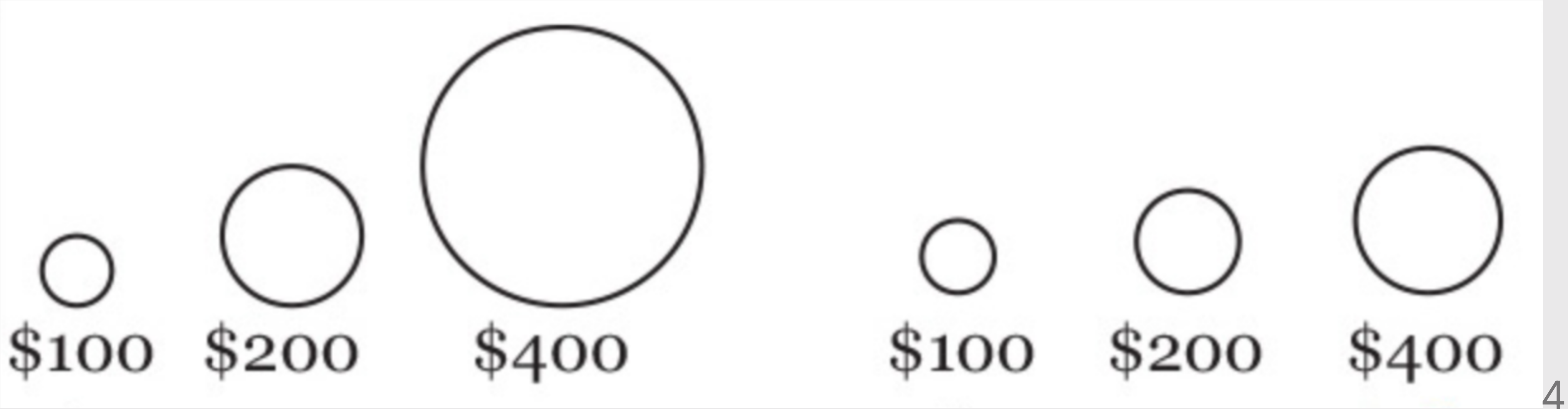


For point size, use **area**, not radius

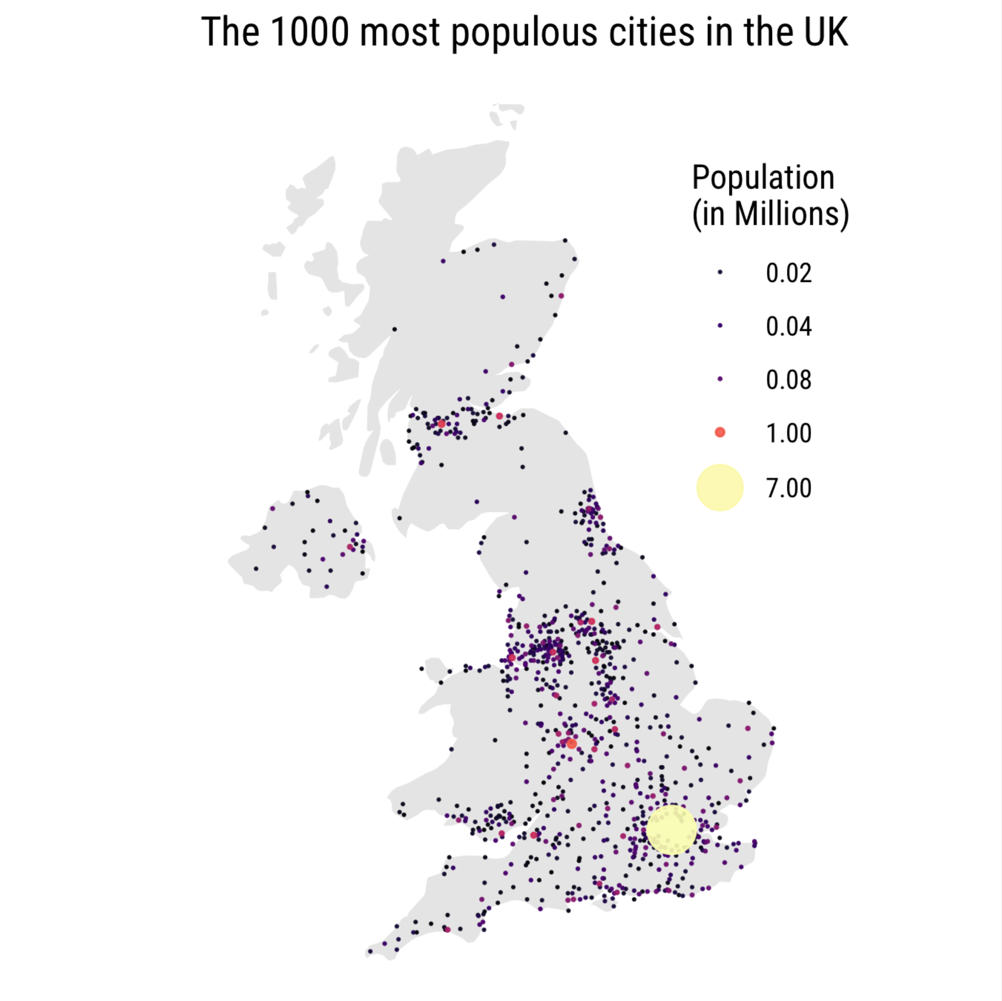
$$Area = \pi r^2$$

Radius

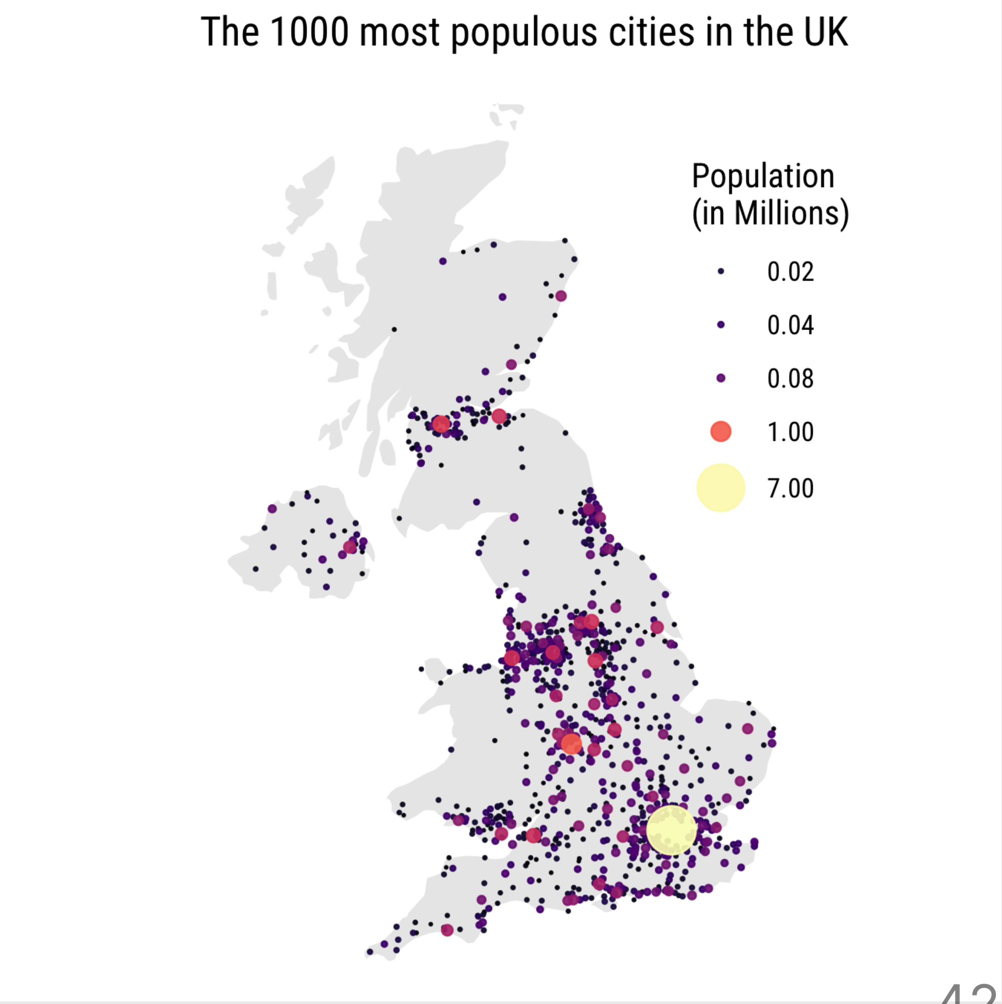
Area



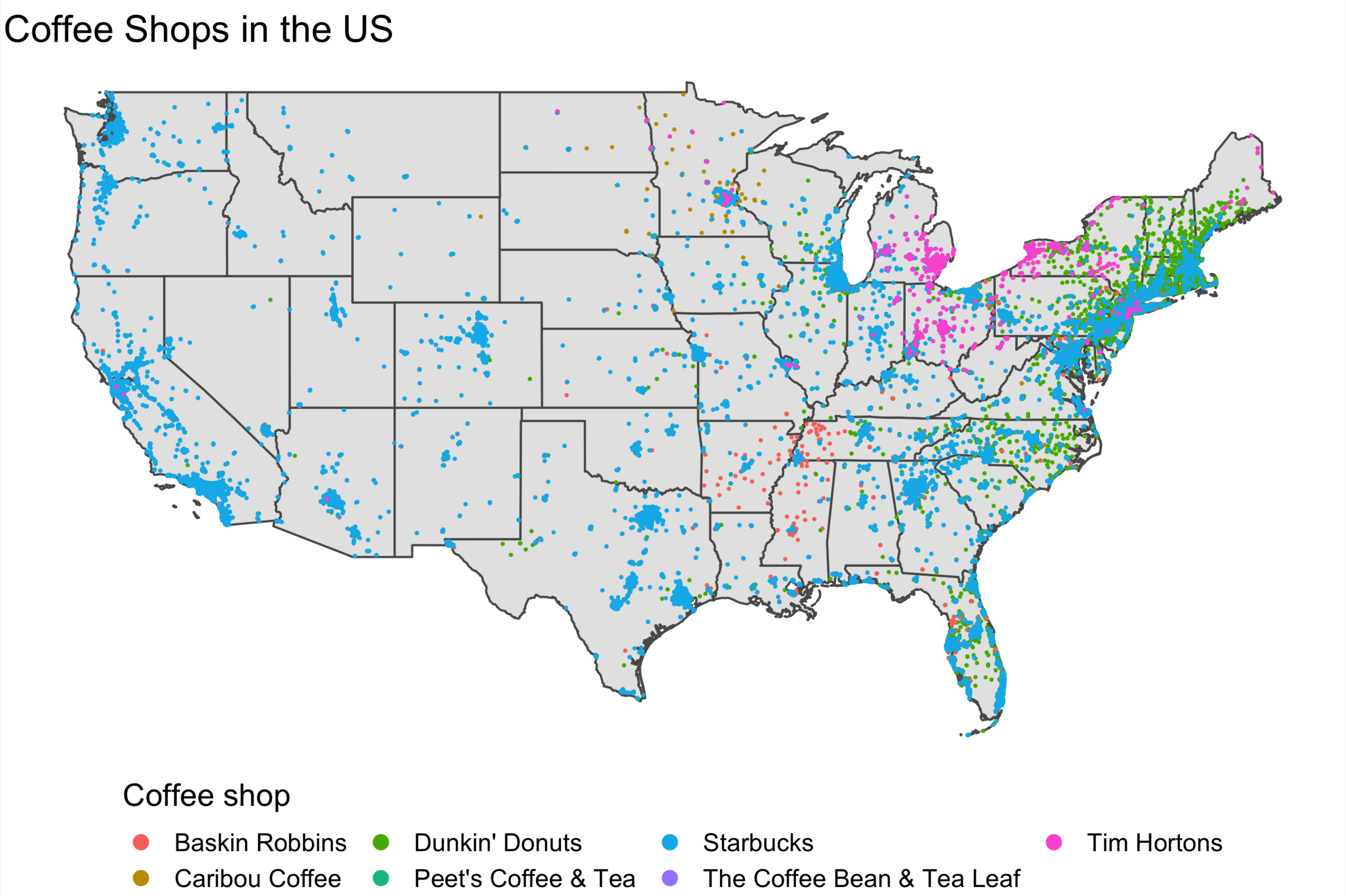
Radius


The 1000 most populous cities in the UK
Population
(in Millions)
0.02
0.04
0.08
1.00
7.00

Area


The 1000 most populous cities in the UK
Population
(in Millions)
0.02
0.04
0.08
1.00
7.00

How to add points to a map



How to add points to a map

Load the continental US shape file

```
us_states_cont <- ne_states(
    country = 'united states of america',
    returnclass = 'sf') %>%
    filter(! name %in% c('Alaska', 'Hawaii'))
```

Read in the coffee shop data

```
us_coffee_shops  <- read_csv(here::here(
    'data', 'us_coffee_shops.csv'))

# Only keep data in continental US
us_coffee_shops <- us_coffee_shops %>%
    filter(lat > 22,     lat < 50,
           long > -150, long < -66)
```

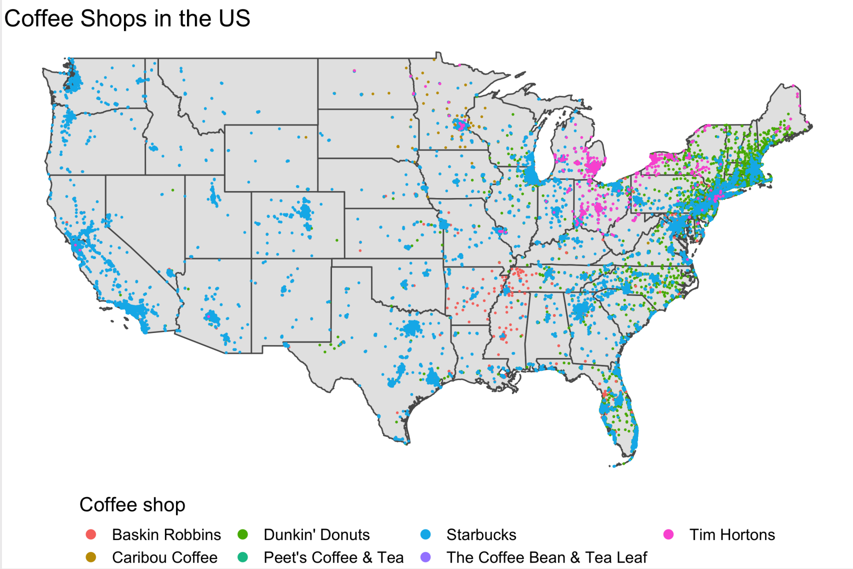
```
head(us_coffee_shops)
```

```
#> # A tibble: 6 × 8
#>   name              lat  long unique_id ci
#>   <chr>           <dbl> <dbl>     <dbl> <c
#> 1 Baskin Robbins   40.8 -73.4   3304448 Hu
#> 2 Baskin Robbins   42.1 -88.0  11342048 Ro
#> 3 Baskin Robbins   34.0 -84.5   3304169 Ma
#> 4 Baskin Robbins   29.8 -95.6   3304006 Ho
#> 5 Baskin Robbins   36.4 -89.5   3303959 Ti
#> 6 Baskin Robbins   40.7 -73.6   3304507 Me
```

How to add points to a map

Plot coffee shop locations over map

```
ggplot() +
  geom_sf(data = us_states_cont) +
  geom_point(
    data = us_coffee_shops,
    aes(x = long, y = lat, color = name),
    size = 0.3) +
  theme_void(base_size = 15) +
  theme(legend.position = 'bottom') +
  guides(color = guide_legend(
    # Move legend title to top
    title.position = "top",
    # Increase legend point size
    override.aes = list(size = 3))) +
  labs(color = 'Coffee shop',
       title = 'Coffee Shops in the US')
```



Your turn

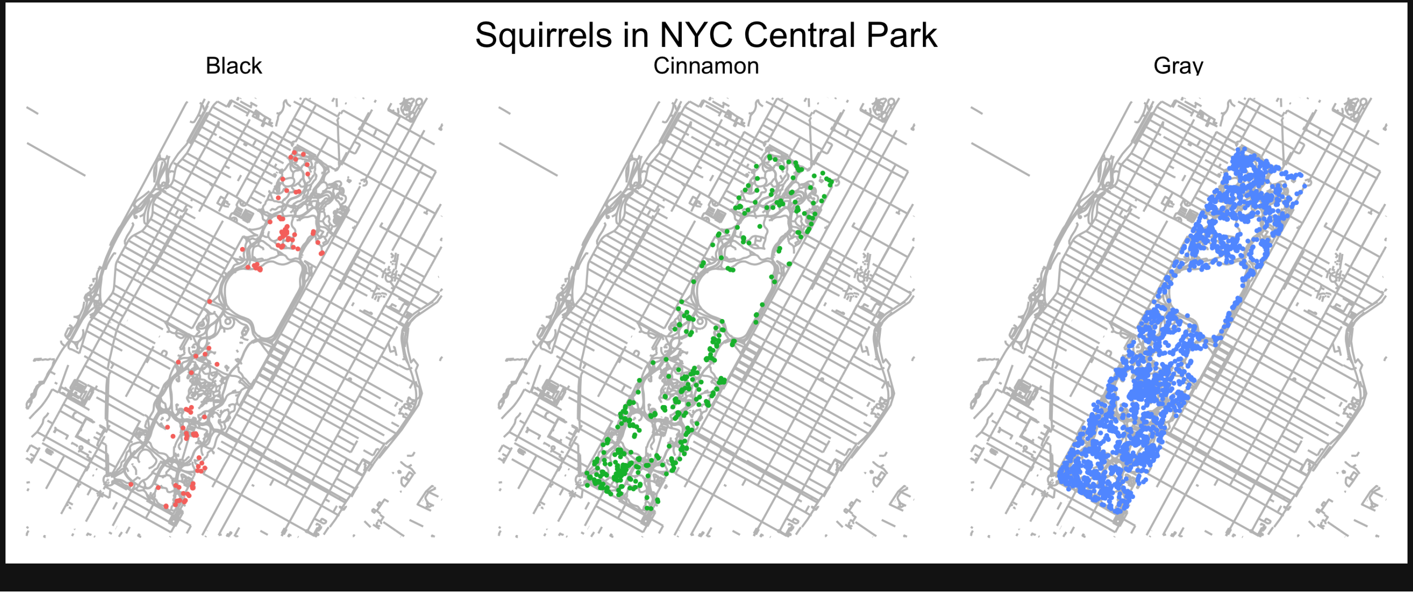
15:00

Create this map of squirrels in NYC's Central Park using this data from the Squirrel Census:

- The `CentralPark.shp` file in the `data/central_park` folder.
- The `nyc_squirrels.csv` file in the `data` folder.

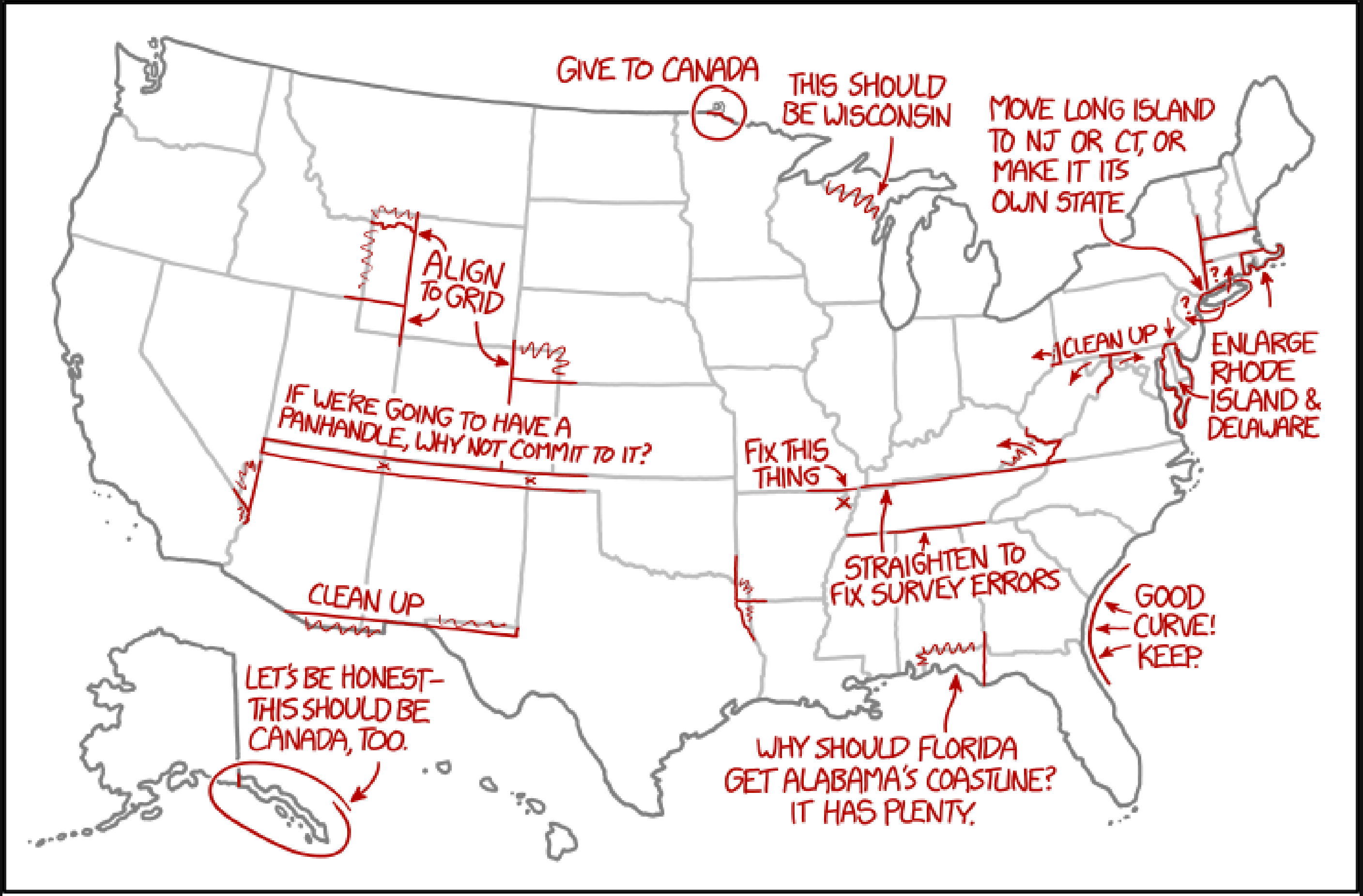
Hint: The color is mapped to the `primary_fur_color` variable

(More about the Squirrel Census here)



Intermission

05:00

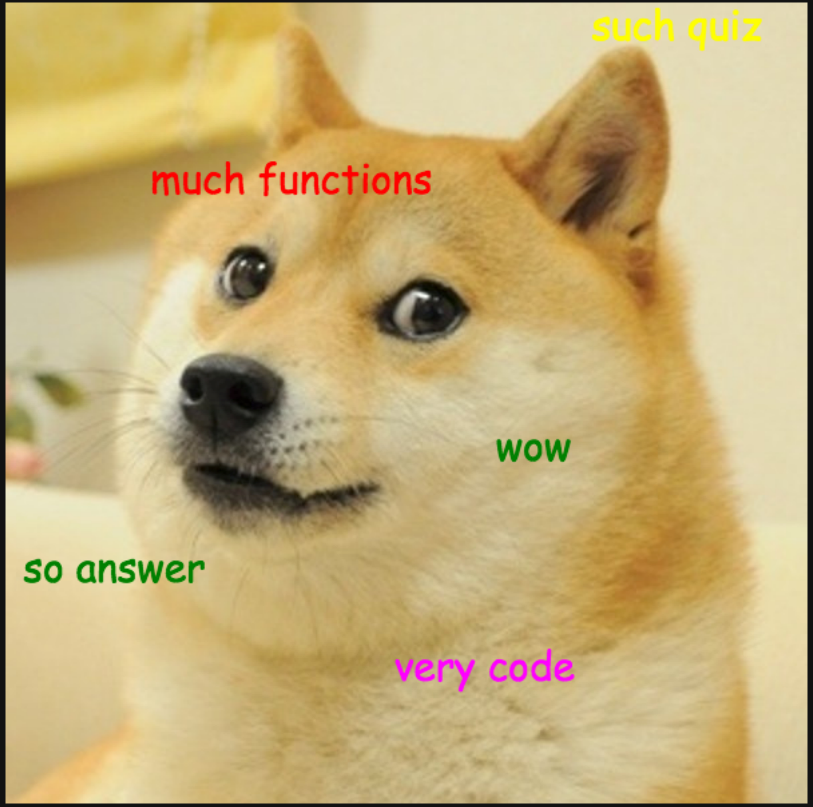

GIVE TO CANADA
THIS SHOULD BE WISCONSIN
MOVE LONG ISLAND TO NJ OR CT, OR MAKE IT ITS OWN STATE
ALIGN TO GRID
CLEAN UP
ENLARGE RHODE ISLAND & DELAWARE
IF WE'RE GOING TO HAVE A PANHANDLE, WHY NOT COMMIT TO IT?
FIX THIS THING
STRAIGHTEN TO FIX SURVEY ERRORS
CLEAN UP
GOOD CURVE! KEEP.
LET'S BE HONEST- THIS SHOULD BE CANADA, TOO.
WHY SHOULD FLORIDA GET ALABAMA'S COASTLINE? IT HAS PLENTY.
?
?

IT WAS SCARY WHEN THE GRAPHIC DESIGNERS SEIZED CONTROL OF THE COUNTRY, BUT IT TURNED OUT THEY JUST WANTED TO FIX SOME THINGS ABOUT THE STATE BORDERS THAT HAD ALWAYS BOTHERED THEM.

Quiz 4

Link is in the #class channel

10:00



Week 11: *Maps*

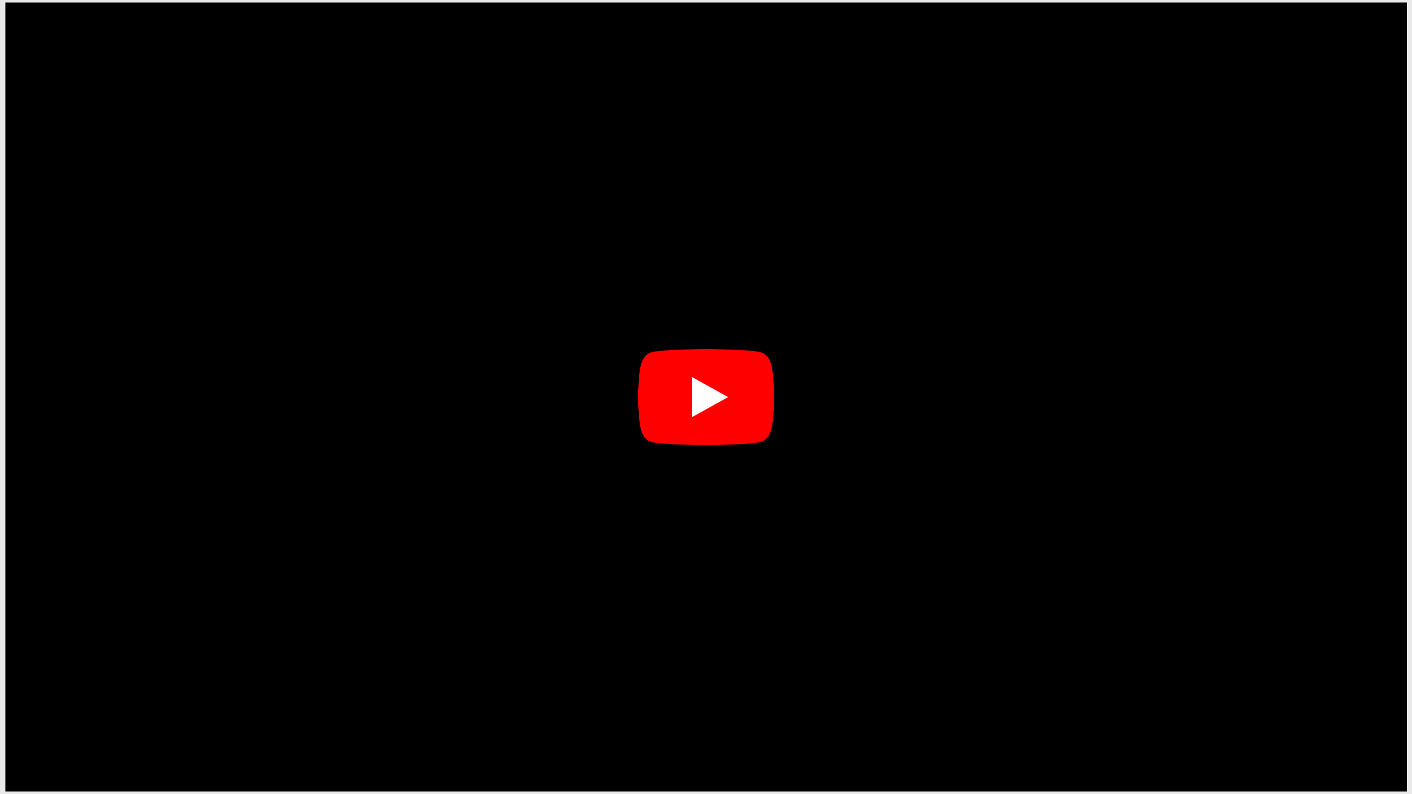
1. Plotting maps

2. Adding data to maps

BREAK

3. Projections

What's a map projection?



What is the best projection?...it depends

1. Compare projections

2. Compare country sizes

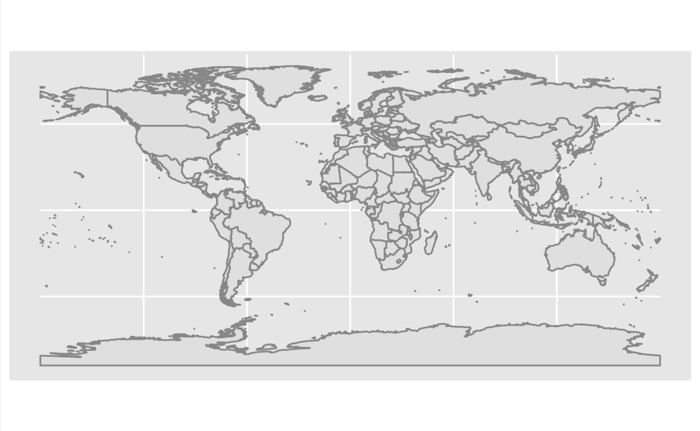
Using projections

To modify the projection of a map, use `coord_sf(crs = st_crs(XXXX))`

```
world <- ne_countries(scale = "medium", returnclass = "sf")
```

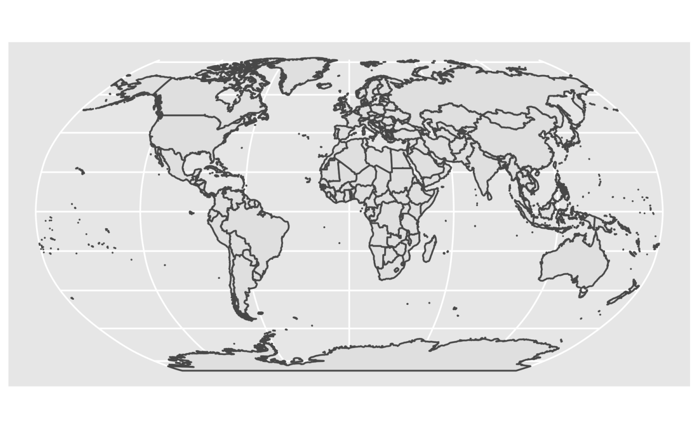
Default (long-lat)

```
ggplot(data = world) +
    geom_sf()
```



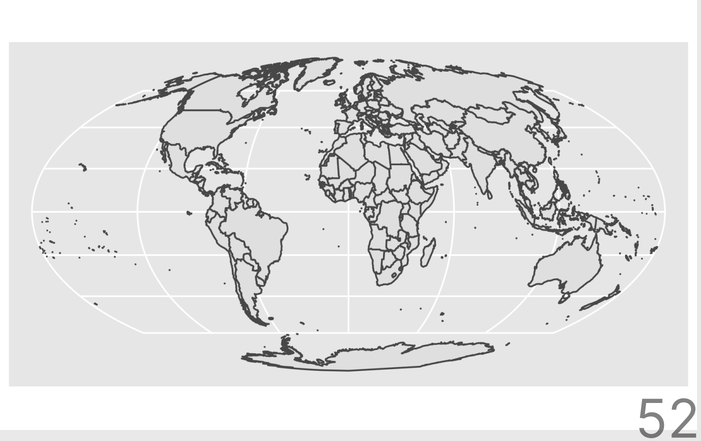
Robinson projection

```
ggplot(data = world) +
    geom_sf() +
    coord_sf(crs = "ESRI:54030")
```



Mollweide projection

```
ggplot(data = world) +
    geom_sf() +
    coord_sf(crs = "ESRI:54009")
```



Common Projections

ggplot layer:

```
coord_sf(crs = "ESRI:XXXX")
```

World

Code	Projection
"ESRI:54030"	**Robinson**
"ESRI:54002"	Equidistant cylindrical
"ESRI:54004"	Mercator
"ESRI:54008"	Sinusoidal
"ESRI:54009"	Mollweide

United States

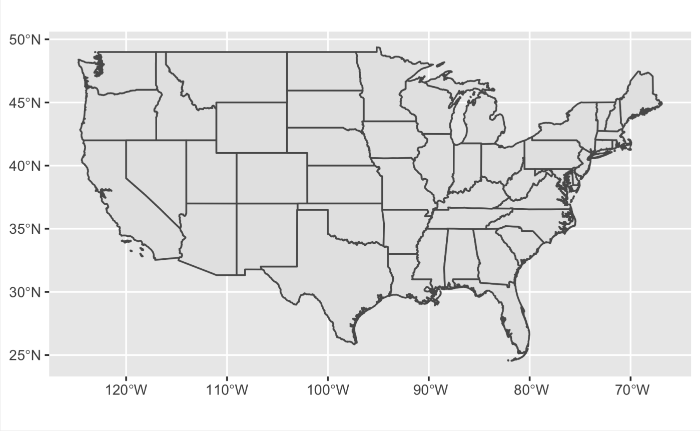
Code	Projection
"ESRI:102003"	**Albers**
"ESRI:102004"	Lambert Conformal Conic
4269	NAD 83

US projections

```
us_states_cont <- ne_states(country = 'united states of america',
    returnclass = 'sf') %>%
    filter(! name %in% c('Alaska', 'Hawaii'))
```

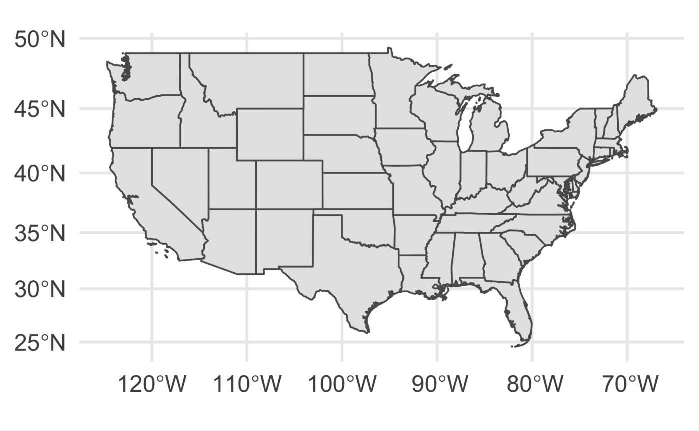
NAD 83 projection

```
ggplot(data = world) +
    geom_sf() +
    coord_sf(crs = 4269)
```



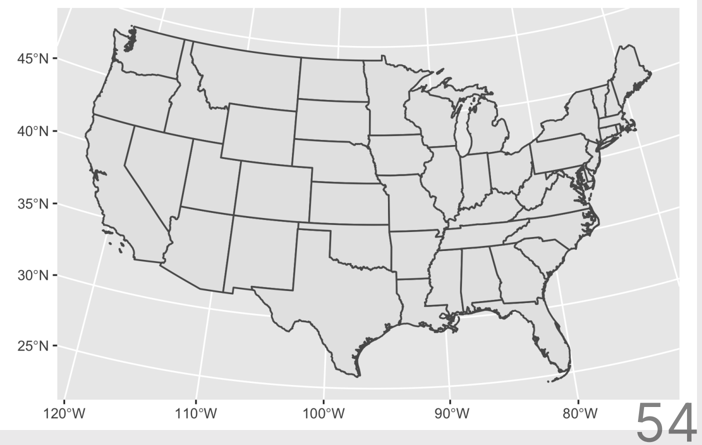
Mercator

```
ggplot(data = world) +
    geom_sf() +
    coord_sf(crs = "ESRI:54004
```



Albers

```
ggplot(data = us_states_cont)
    geom_sf() +
    coord_sf(crs = "ESRI:10200
```

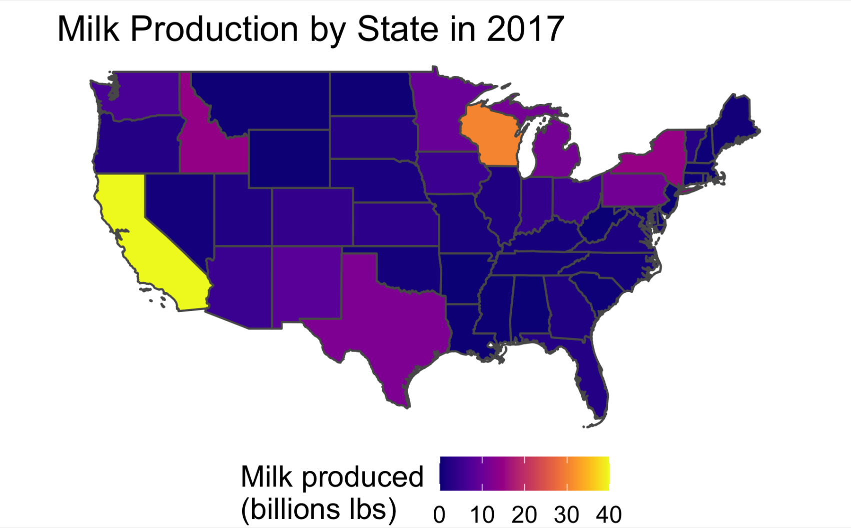


Mapping data to projections - choropleth map

```
milk_2017 <- milk_production %>%
  filter(year == 2017) %>%
  select(name = state, milk_produced) %>%
  mutate(milk_produced = milk_produced / 10^9)

us_states <- ne_states(
  country = 'united states of america',
  returnclass = 'sf') %>%
  filter(! name %in% c('Alaska', 'Hawaii')) %>%
  left_join(milk_2017, by = 'name')

ggplot(us_states) +
  geom_sf(aes(fill = milk_produced)) +
  scale_fill_viridis(
    option = "plasma",
    limits = c(0, 40)) +
  theme_void(base_size = 15) +
  theme(legend.position = 'bottom') +
  labs(fill = 'Milk produced\n(billions lbs)',
       title = 'Milk Production by State in 2017')
```



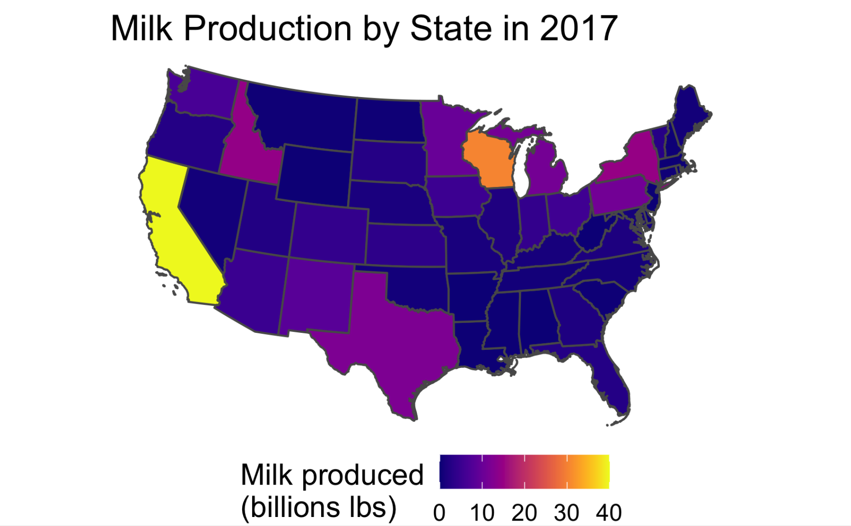
Mapping data to projections - choropleth map

```r
milk_2017 <- milk_production %>%
  filter(year == 2017) %>%
  select(name = state, milk_produced) %>%
  mutate(milk_produced = milk_produced / 10^9)

us_states <- ne_states(
  country = 'united states of america',
  returnclass = 'sf') %>%
  filter(! name %in% c('Alaska', 'Hawaii')) %>%
  left_join(milk_2017, by = 'name')

ggplot(us_states) +
  geom_sf(aes(fill = milk_produced)) +
  scale_fill_viridis(
    option = "plasma",
    limits = c(0, 40)) +
  theme_void(base_size = 15) +
  theme(legend.position = 'bottom') +
  labs(fill = 'Milk produced\n(billions lbs)',
       title = 'Milk Production by State in 2017') +
  coord_sf(crs = "ESRI:102003")
```

Albers Projection

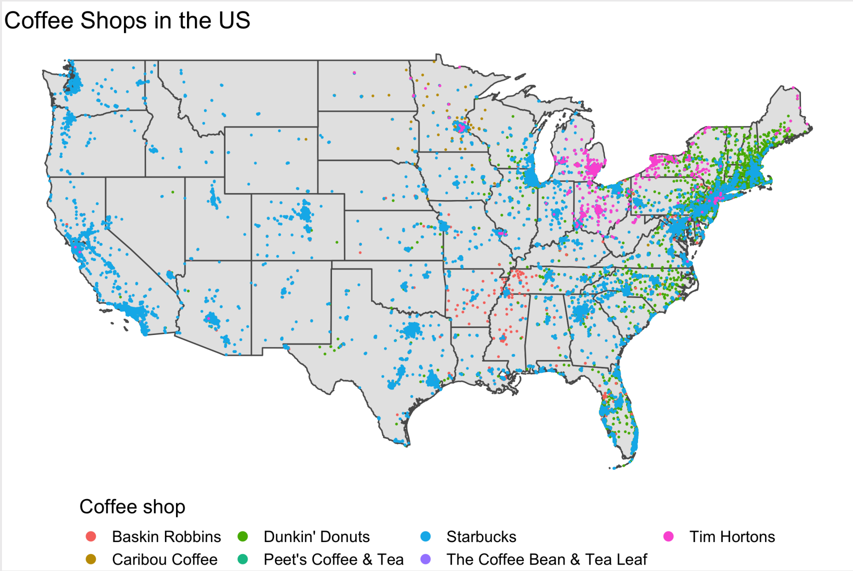


Mapping data to projections - points

```r
us_states_cont <- ne_states(
  country = 'united states of america',
  returnclass = 'sf') %>%
  filter(! name %in% c('Alaska', 'Hawaii'))

us_coffee_shops <- us_coffee_shops %>%
  filter(lat > 22,    lat < 50,
         long > -150, long < -66)

ggplot() +
  geom_sf(data = us_states_cont) +
  geom_point(
    data = us_coffee_shops,
    aes(x = long, y = lat, color = name),
    size = 0.3) +
  theme_void(base_size = 15) +
  theme(legend.position = 'bottom') +
  guides(color = guide_legend(
    # Move legend title to top
    title.position = "top",
    # Increase legend point size
    override.aes = list(size = 3))) +
  labs(color = 'Coffee shop',
       title = 'Coffee Shops in the US')
```



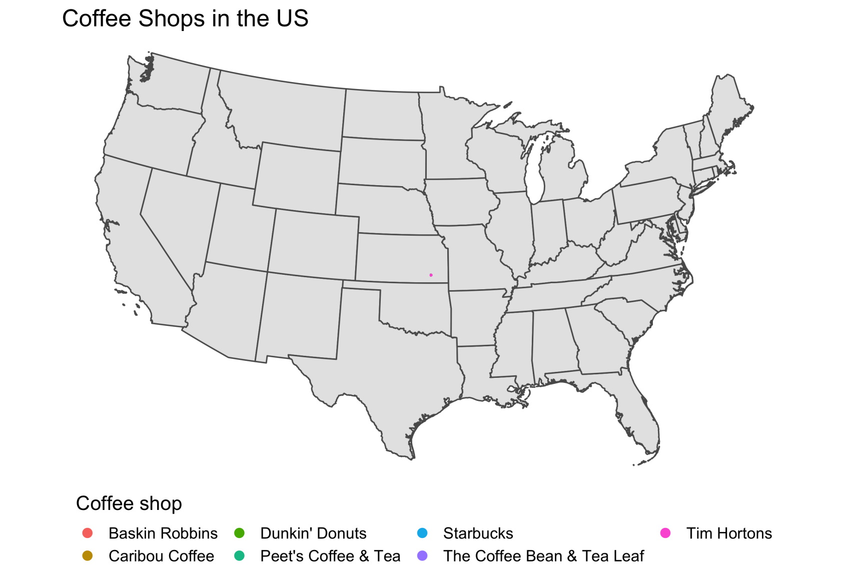
Mapping data to projections - points

```r
us_states_cont <- ne_states(
  country = 'united states of america',
  returnclass = 'sf') %>%
  filter(! name %in% c('Alaska', 'Hawaii'))

us_coffee_shops <- us_coffee_shops %>%
  filter(lat > 22,    lat < 50,
         long > -150, long < -66)

ggplot() +
  geom_sf(data = us_states_cont) +
  geom_point(
    data = us_coffee_shops,
    aes(x = long, y = lat, color = name),
    size = 0.3) +
  theme_void(base_size = 15) +
  theme(legend.position = 'bottom') +
  guides(color = guide_legend(
    # Move legend title to top
    title.position = "top",
    # Increase legend point size
    override.aes = list(size = 3))) +
  labs(color = 'Coffee shop',
       title = 'Coffee Shops in the US') +
  coord_sf(crs = "ESRI:102003")
```

Fail!



Mapping data to projections - points

First match `us_coffee_shops` crs to `us_states_cont`

```r
us_states_cont <- ne_states(
    country = 'united states of america',
    returnclass = 'sf') %>%
    filter(! name %in% c('Alaska', 'Hawaii'))

us_coffee_shops <- us_coffee_shops %>%
    filter(lat > 22,     lat < 50,
           long > -150, long < -66)

us_coffee_shops_sf <- st_as_sf(us_coffee_shops,
    coords = c("long", "lat"),
    crs = st_crs(us_states_cont))
```

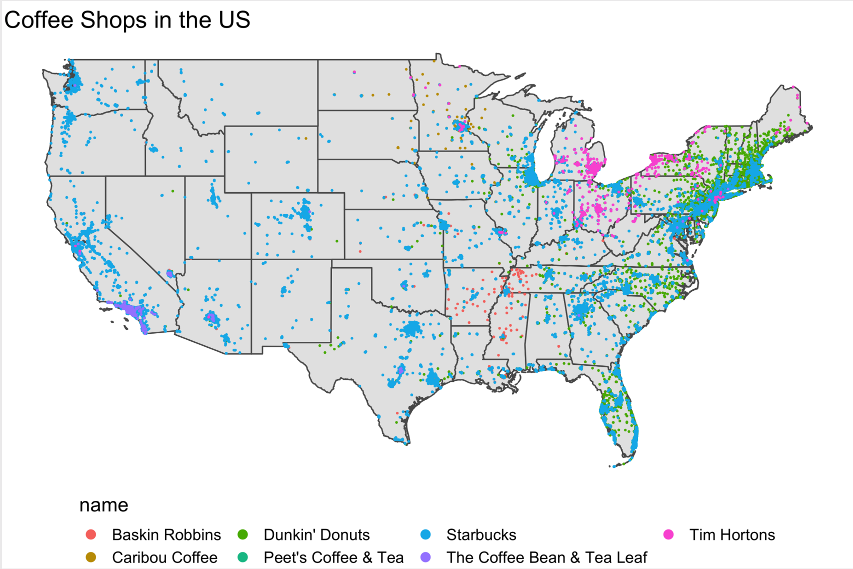
```r
head(us_coffee_shops_sf)
```

```
#> Simple feature collection with 6
#> Geometry type: POINT
#> Dimension:     XY
#> Bounding box:  xmin: -95.60337 y
#> CRS:           +proj=longlat +da
#> # A tibble: 6 × 7
#>   name            unique_id city
#>   <chr>               <dbl> <chr>
#> 1 Baskin Robbins   3304448 Hunti
#> 2 Baskin Robbins  11342048 Rolli
#> 3 Baskin Robbins   3304169 Marie
#> 4 Baskin Robbins   3304006 Houst
#> 5 Baskin Robbins   3303959 Tipto
#> 6 Baskin Robbins   3304507 Merri
```

Mapping data to projections - points

Plot coffee shop locations over map with `geom_sf()`

```r
ggplot() +
  geom_sf(data = us_states_cont) +
  geom_sf(
    data = us_coffee_shops_sf,
    aes(color = name),
    size = 0.3) +
  theme_void(base_size = 15) +
  theme(legend.position = 'bottom') +
  guides(color = guide_legend(
    # Move legend title to top
    title.position = "top",
    # Increase legend point size
    override.aes = list(size = 3))) +
  labs(fill = 'Coffee shop',
       title = 'Coffee Shops in the US')
```

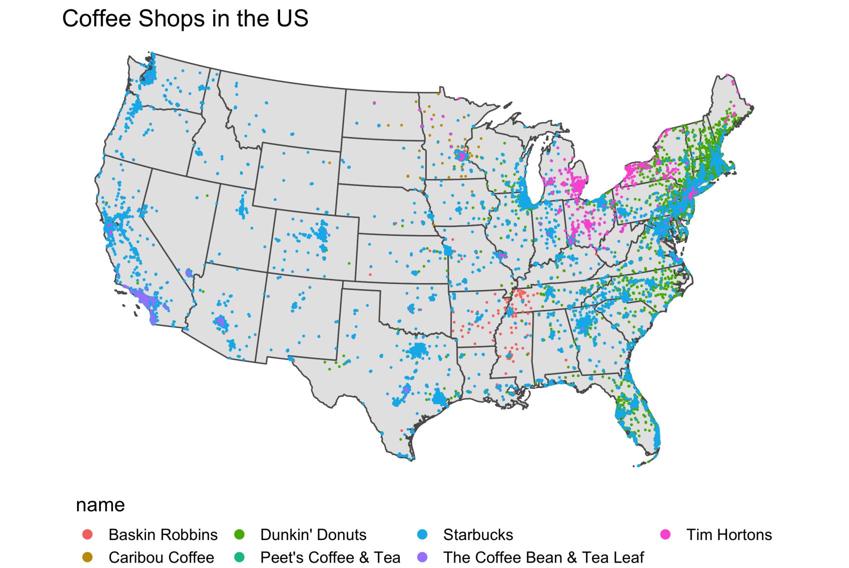


Mapping data to projections - points

Plot coffee shop locations over map with `geom_sf()`

```r
ggplot() +
  geom_sf(data = us_states_cont) +
  geom_sf(
    data = us_coffee_shops_sf,
    aes(color = name),
    size = 0.3) +
  theme_void(base_size = 15) +
  theme(legend.position = 'bottom') +
  guides(color = guide_legend(
    # Move legend title to top
    title.position = "top",
    # Increase legend point size
    override.aes = list(size = 3))) +
  labs(fill = 'Coffee shop',
       title = 'Coffee Shops in the US') +
  coord_sf(crs = "ESRI:102003")
```

Albers Projection

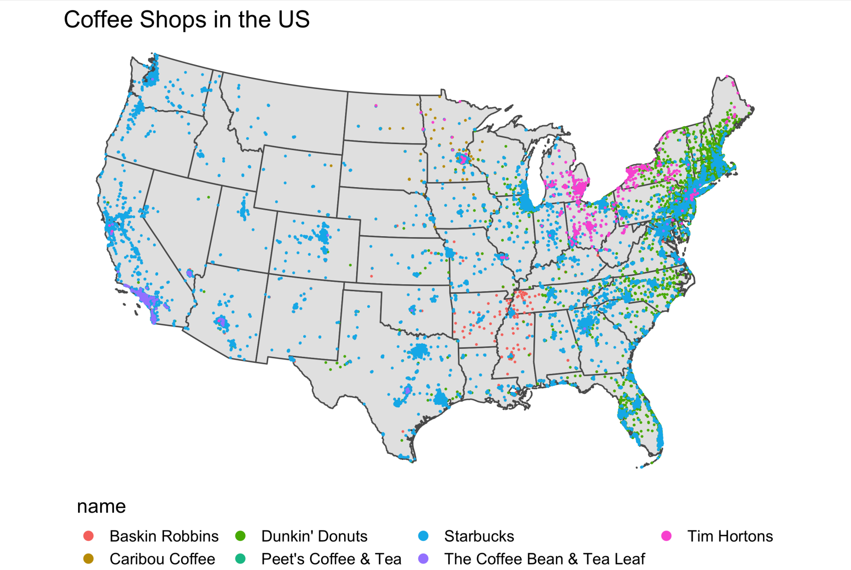


Mapping data to projections - points

Plot coffee shop locations over map with `geom_sf()`

```r
ggplot() +
  geom_sf(data = us_states_cont) +
  geom_sf(
    data = us_coffee_shops_sf,
    aes(color = name),
    size = 0.3) +
  theme_void(base_size = 15) +
  theme(legend.position = 'bottom') +
  guides(color = guide_legend(
    # Move legend title to top
    title.position = "top",
    # Increase legend point size
    override.aes = list(size = 3))) +
  labs(fill = 'Coffee shop',
       title = 'Coffee Shops in the US') +
  coord_sf(crs = "ESRI:102004")
```

LCC Projection



20:00

Your turn

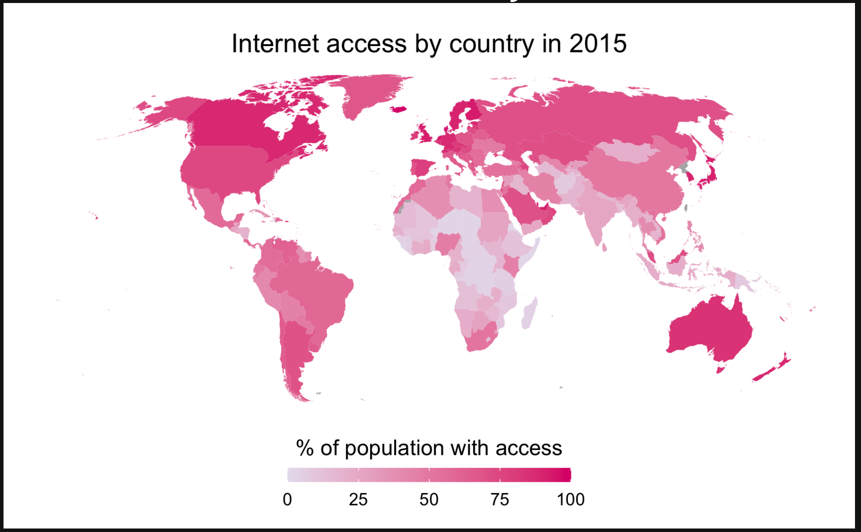
Use the `internet_users_country.csv` data and the `world` data frame from the **rnaturalearth** library to create these two versions of internet access by country in 2015.

Hints:

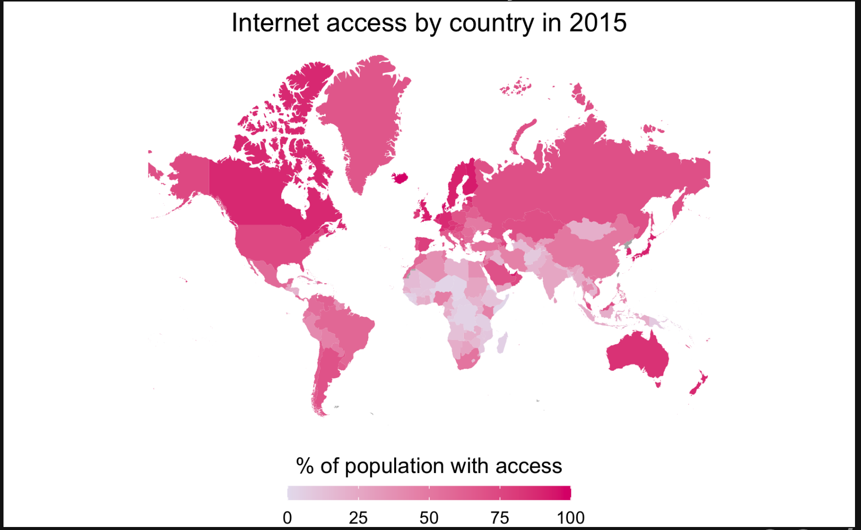
- The `iso_a3` variable in the `worlds` data frame corresponds with the `code` variable in the `internet_users_country.csv` data frame (use this for joining).
- Use `scale_fill_gradient()` to fill the color:

```
scale_fill_gradient(
    low = "#e7e1ef",
    high = "#dd1c77",
    na.value = "grey70",
    limits = c(0, 100))
```

Robinson Projection


Internet access by country in 2015
% of population with access
0
25
50
75
100

Mercator Projection

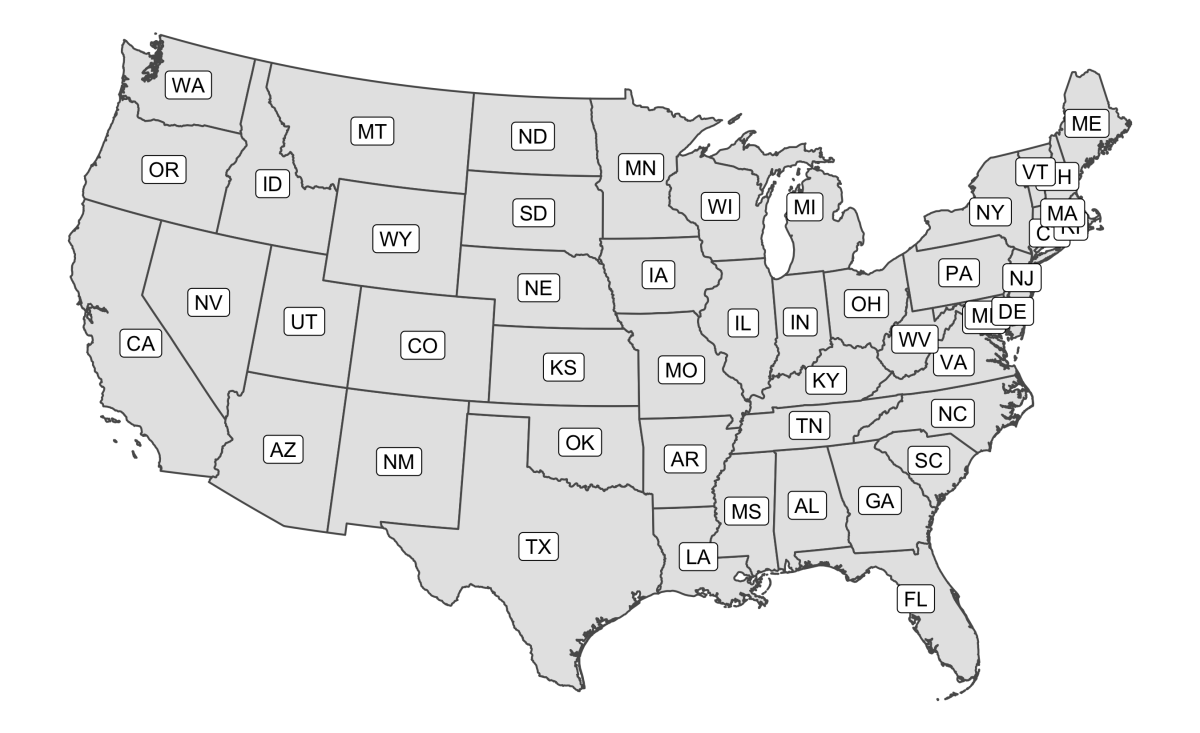

Internet access by country in 2015
% of population with access
0
25
50
75
100

Extra practice

Your turn

15:00

Use the us_states_cont data frame and the state_abbs data frame to create a labeled map of the U.S.:


WA
MT
ND
MN
ME
OR
ID
SD
WI
MI
VT
H
NY
MA
C
RI
WY
NE
IA
PA
NJ
NV
UT
CO
IL
IN
OH
M
DE
CA
KS
MO
WV
VA
KY
TN
NC
OK
AZ
NM
AR
SC
MS
AL
GA
TX
LA
FL