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# Geography & Mapping in R

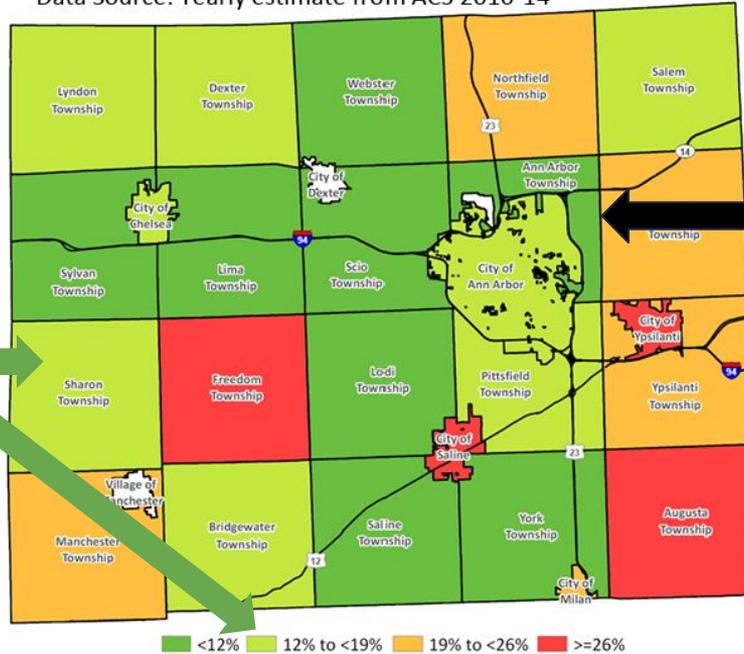
2026-03-13

# Making Maps Requires Two Types of Data

Percent of individuals 65+ yrs living below 200% of FPL  
Washtenaw County  
Data Source: Yearly estimate from ACS 2010-14

The **metric / data**  
you want  
to present

The physical  
**geography**  
outlines

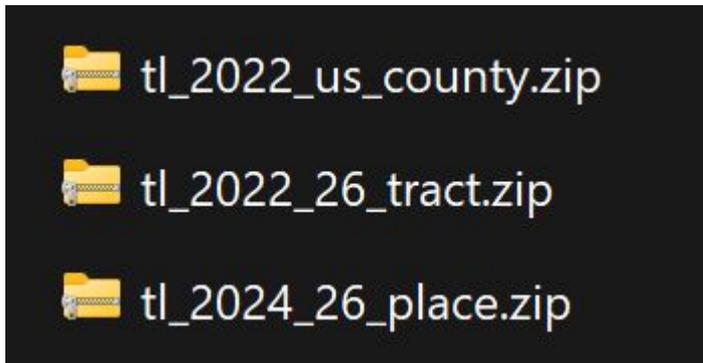


Note: Jurisdictions with no color had too few people for accurate ACS estimates.

# To make the geographic outlines, we need a “new” Data Type: Shape Files!

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Common to download as .zip file:



Name	Date Modified	Type	Size
tl_2022_26_tract.cpg	3/4/2025 4:09 PM	CPG File	1 KB
tl_2022_26_tract.dbf	3/4/2025 4:09 PM	DBF File	316 KB
tl_2022_26_tract.prj	3/4/2025 4:09 PM	PRJ File	1 KB
tl_2022_26_tract.shp	3/4/2025 4:09 PM	SHP File	9,101 KB
tl_2022_26_tract.shp.ea.iso.xml	3/4/2025 4:09 PM	Microsoft Edge HTM...	22 KB
tl_2022_26_tract.shp.iso.xml	3/4/2025 4:09 PM	Microsoft Edge HTM...	53 KB
tl_2022_26_tract.shx	3/4/2025 4:09 PM	SHX File	24 KB

But contain more than just a .shp file, and you need all the pieces together in a folder for R to “use” the .shp file



# A “new” Data Type: Shape Files!

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Generally, these files are very large, as they often encode a lot of information.

Common Sources:

- Census.gov:

<https://www.census.gov/geographies/mapping-files/time-series/geo/tiger-line-file.html>

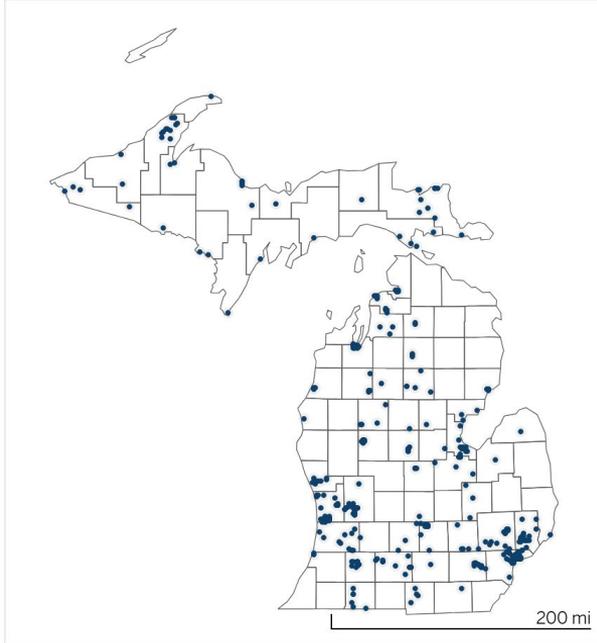
- Michigan GIS Open Data: <https://gis-michigan.opendata.arcgis.com/>

It's also possible to make your own using ArcGIS.

# Vocab - Types of Maps: Point Map

(or dot distribution map)

Michigan COVID-19 Wastewater Sampling Sites



Note: This map displays sampling sites that have ever participated in this wastewater monitoring effort in Michigan since 2020. Both active and inactive sites are included.

**Point maps are used to indicate exact locations (or central locations) for particular events.**

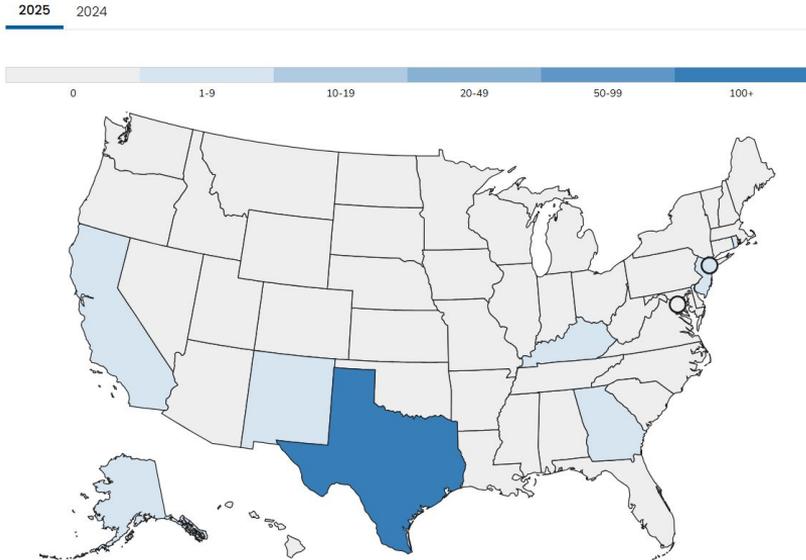
**They often serve as the base for network maps.**

<https://www.michigan.gov/coronavirus/stats/wastewater-surveillance/wastewater-surveillance-for-covid-19/dashboard>

# Vocab - Types of Maps: Choropleth

Map of measles cases in 2024 & 2025

as of February 27, 2025



Data Table

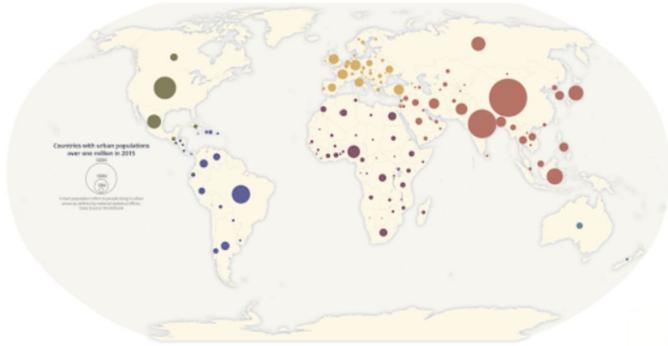


[Download Data \(CSV\)](#)

A type of map where geographic areas are outlined and filled with a color that represents an aggregate summary metric for the area.

<https://www.cdc.gov/measles/data-research/index.html>

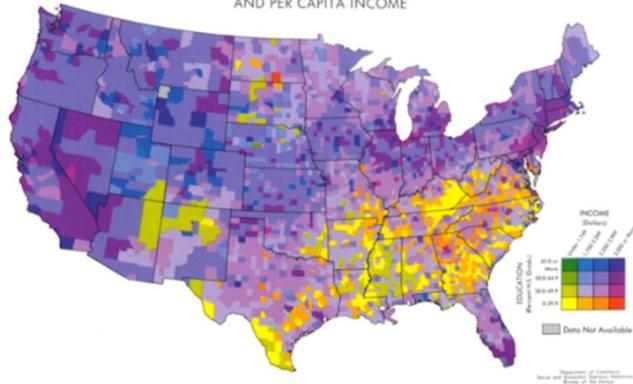
# Lots of Maps Types!



**Graduated  
Symbol Map**

## Bivariate Choropleth Map

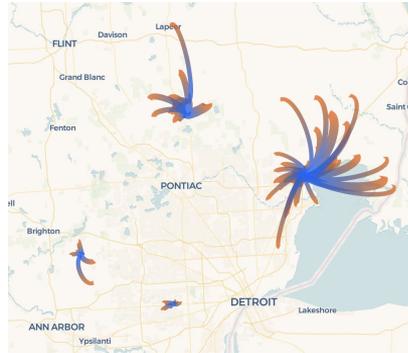
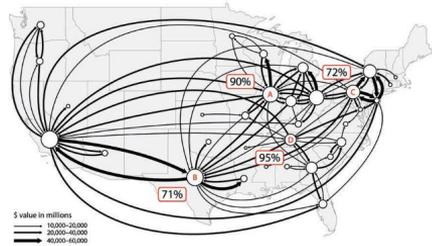
INTERRELATIONSHIP OF EDUCATIONAL ATTAINMENT  
AND PER CAPITA INCOME



**Heat Map**

# Lots of Maps Types!

Flow of Goods in U.S.A



Spatial flows and networks

## Cartograms

### US Presidential Election 2020

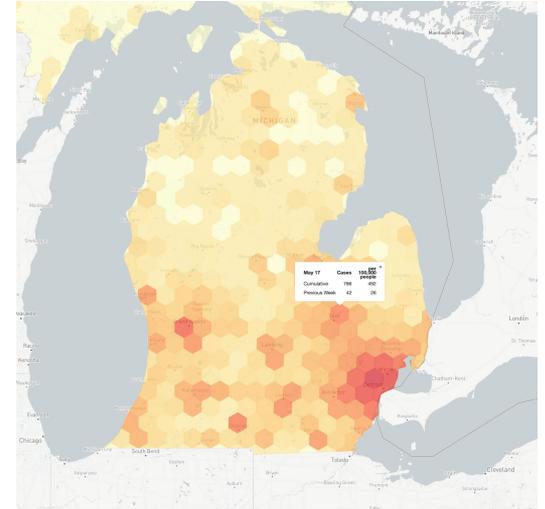
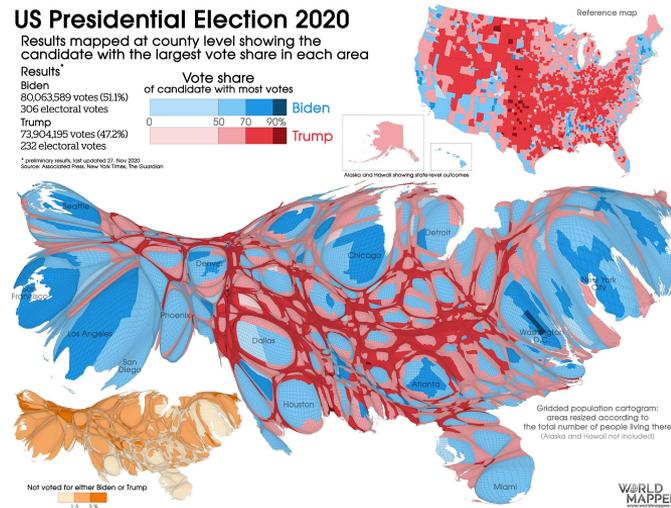
Results mapped at county level showing the candidate with the largest vote share in each area

Results

Biden  
80,063,589 votes (51.1%)  
306 electoral votes

Trump  
73,904,195 votes (47.2%)  
232 electoral votes

\* preliminary results last updated 07. Nov 2020  
Source: Associated Press, New York Times, The Guardian

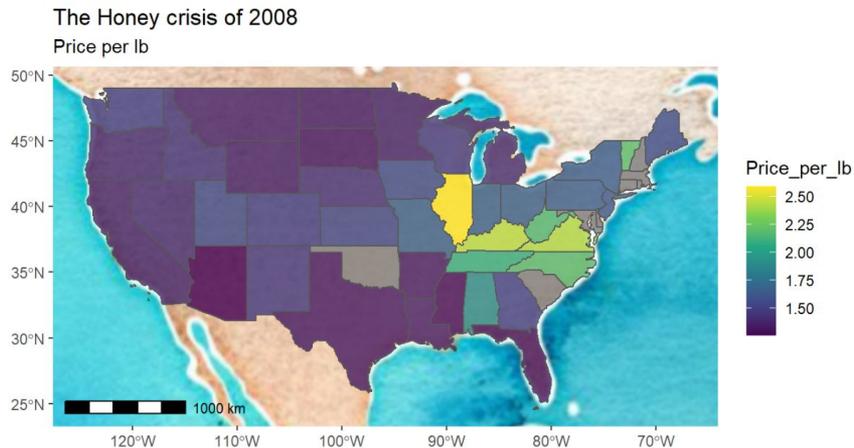


covidmapping.org

Hexbin Maps

# R Package For Mapping: ggplot

```
ggplot(data = honey2008) +  
  annotation_map_tile("stamenwatercolor") +  
  geom_sf(aes(fill = Price_per_lb), alpha = 0.8) +  
  annotation_scale() +  
  scale_fill_viridis_c() +  
  ggtitle(label = "The Honey crisis of 2008", subtitle = "Price per lb")
```



- Good for the basics!
- Static
- Same “layered” logic as tidyverse/general ggplot

[https://bookdown.org/nicohahn/making\\_maps\\_with\\_r5/docs/ggplot2.html](https://bookdown.org/nicohahn/making_maps_with_r5/docs/ggplot2.html)

# R Package For Mapping: leaflet

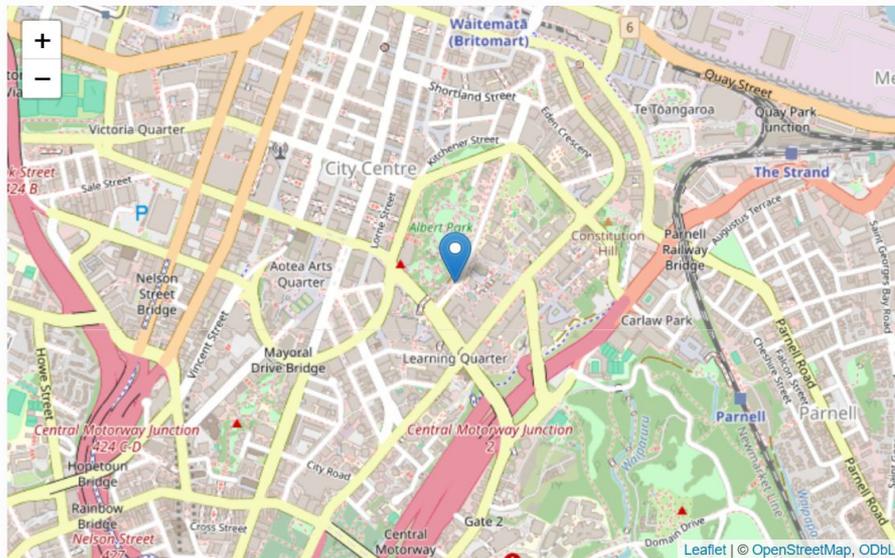
- More advanced/dynamic maps
- Can be interactive
- Still carries the same “layering” logic

<https://rstudio.github.io/leaflet/articles/leaflet.html>

**Warning! Leaflet is a Javascript system first - so you often have to specify “leaflet r” in any google searches for help!**

```
library(leaflet)
```

```
m <- leaflet() %>%  
  addTiles() %>% # Add default OpenStreetMap map tiles  
  addMarkers(lng=174.768, lat=-36.852, popup="The birthplace of R")  
m # Print the map
```



# Important! Geocoding Security

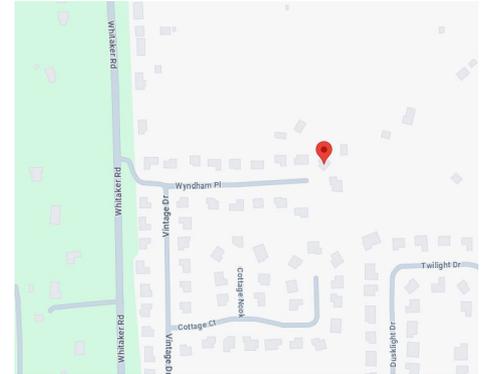
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**Geocoding: converting from address to lat-long  
(and sometimes need to do the reverse)**

**Usually requires sending the address to a service  
(google maps, whatever else)**

**This means sharing that data with an outside  
service, which can be complex from a  
identifying/security perspective (e.g. geocoding  
a list of cases)**

**1234 Street  
Town, State 56789**



**(42.785823, -83.772496)**

# Important! Geocoding Security

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Likely not a regular concern, but -

R library can turn addresses into lat/long coordinates:

- ex. tidygeocoder

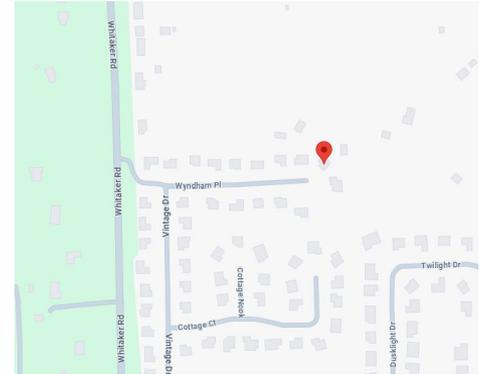
Default uses [Nominatum](#) service, others available - of note is the [Census](#)

None of these options are truly secure, though some are better than others

Local geocoding options exist but can be complicated

<https://cran.r-project.org/web/packages/tidygeocoder/readme/README.html>

1234 Street  
Town, State 56789



(42.785823, -83.772496)

# What We'll Learn to Do Today:

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## Shapefiles:

- Loading them in, what they look like

## ggplot:

- Make a choropleth map (map with areas shaded by a variable)
- Make a point map
- Save a map as a png file
- Legends & Legend Placement

## leaflet:

- Color Palettes & Base maps
- Make a more intricate choropleth map with points and pop-ups
- Legends (moving them too!)
- Saving a map

# What We'll Learn to Do Today:

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## ggplot:

- Understanding the plot, axes, aesthetics, scales, and themes
- Arranging data in plots with factors
- Understanding the structure of the syntax
- Some new geometries

## Shapefiles:

- Loading them in, what they look like
- Data cleaning (they're *almost* like any other dataset!)
- Make a choropleth map (map with areas shaded by a variable)

## leaflet:

- Make a quick, zoomable, scrollable map



# Extra Slides

# Instructions to download the shapefile set that we'll need if we don't have it up on the workshop site!

Visit

<https://gis-michigan.opendata.arcgis.com/datasets/counties-v17a/explore> and download the Counties (v17a) shapefile set, unzip the folder set, and place it in a folder ready for use during the workshop.

