

FALL 2018



APPLIED ENGINEERING DATA ANALYSIS, OPTIMIZATION AND VISUALIZATION

Introduction to GIS w/ R

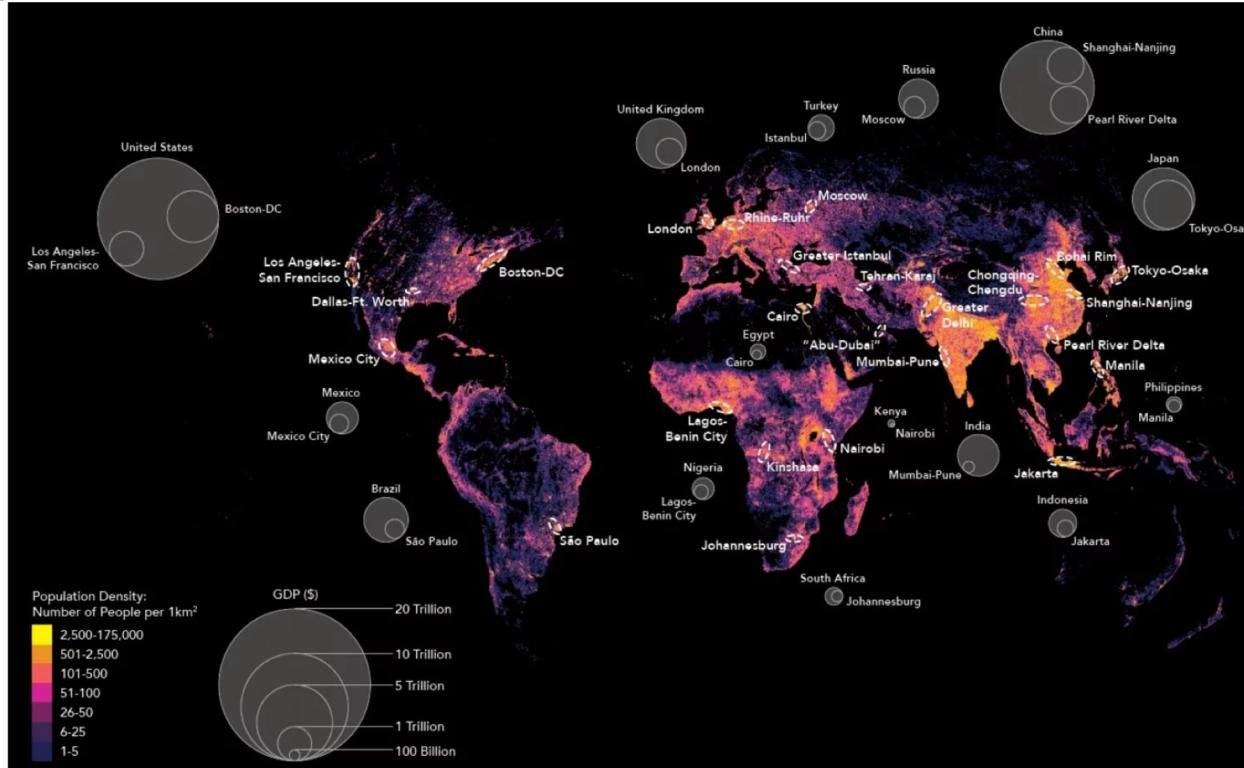
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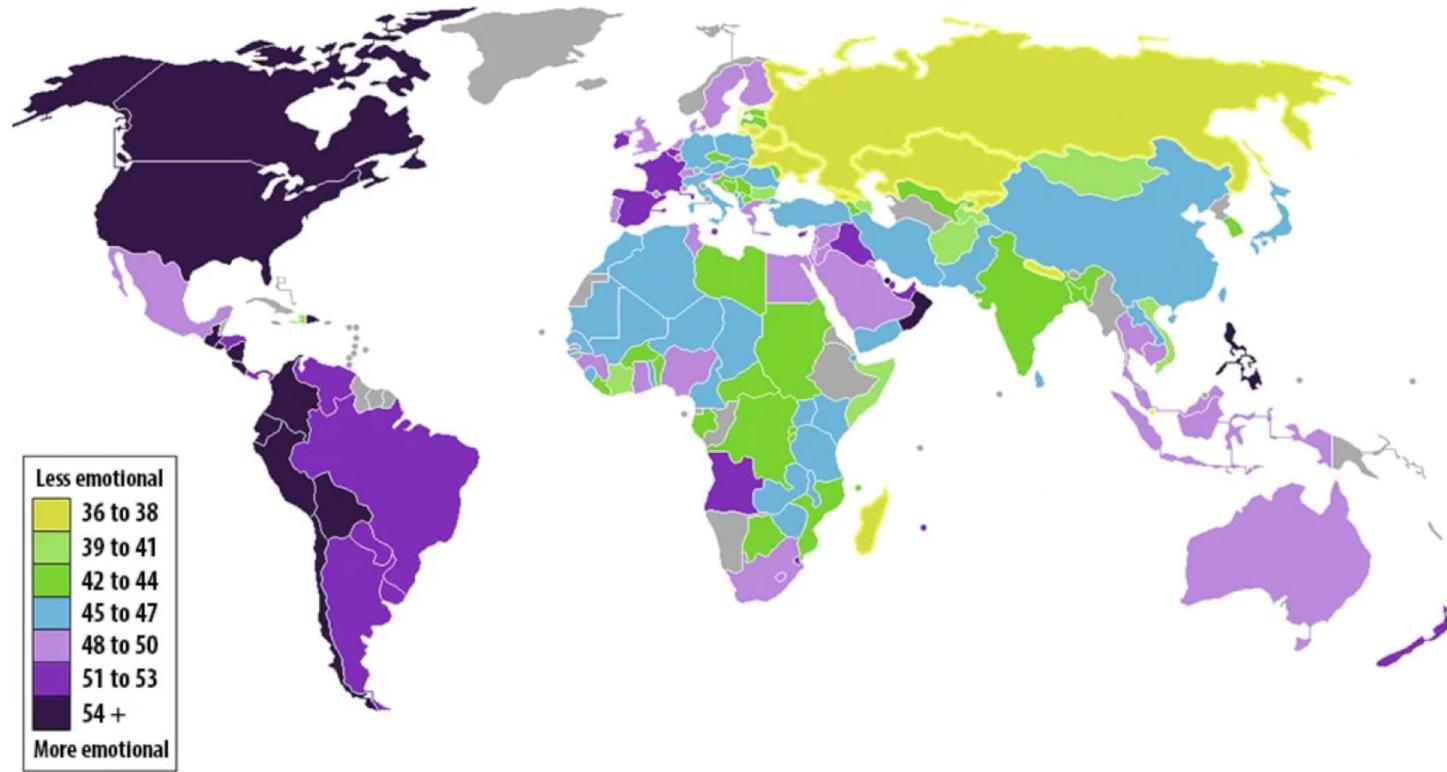
GIS: Geographic Information Systems

- More than just pretty maps
 - Although those are cool too
- There are lots of analyses with spatial components
 - This area of data analysis is growing very quickly!

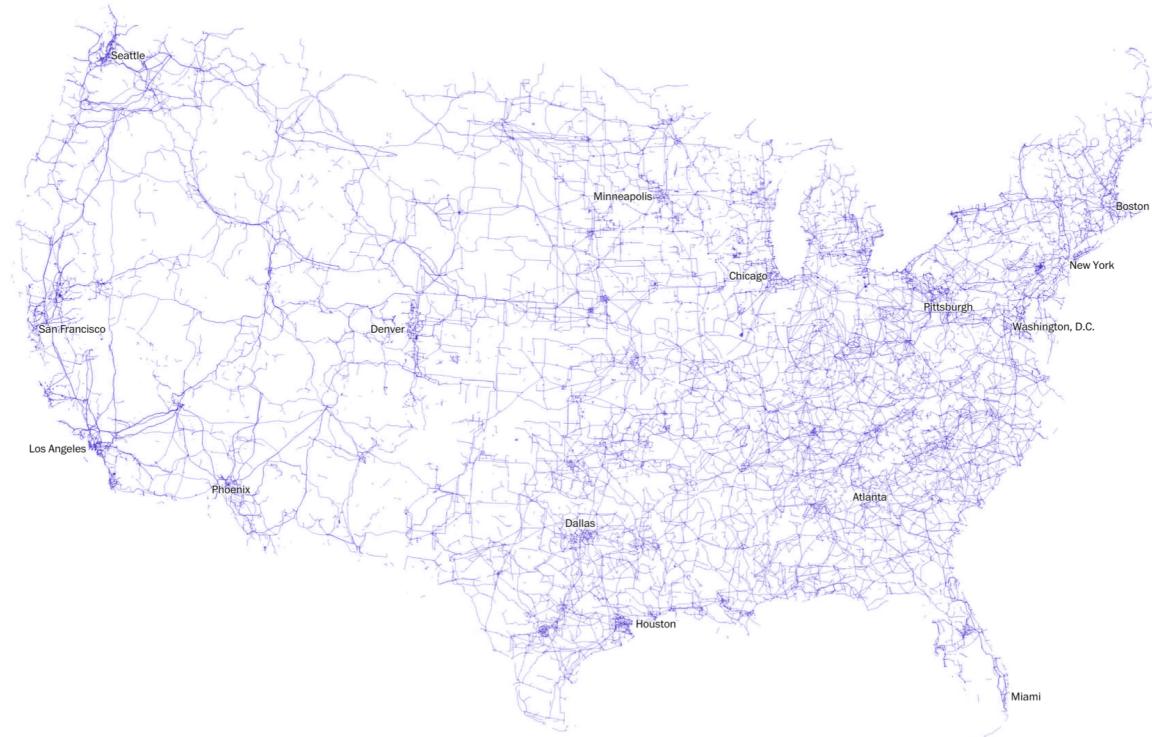
Everyone loves a good map



6. The countries where people are the most and least emotional



Maps tell stories





TEXAS
The University of Texas at Austin

WHAT STARTS HERE CHANGES THE WORLD

You are from somewhere on this map



There are lots of uses for GIS

- Conveying information
- Looking for bottlenecks in flows
- Finding optimal routes
- Finding interesting intersections
- This website list 1,000 uses:
 - <https://gisgeography.com/gis-applications-uses/>

ArcGIS is the industry standard GUI, but there are others



Google Earth



But of course we are not going to use them!

- R is also a powerful GIS tool
 - You already know how to handle data
 - You already know how to plot-ish
 - You are already there!
- Python also has GIS tools
 - GeoPandas – I have not used...

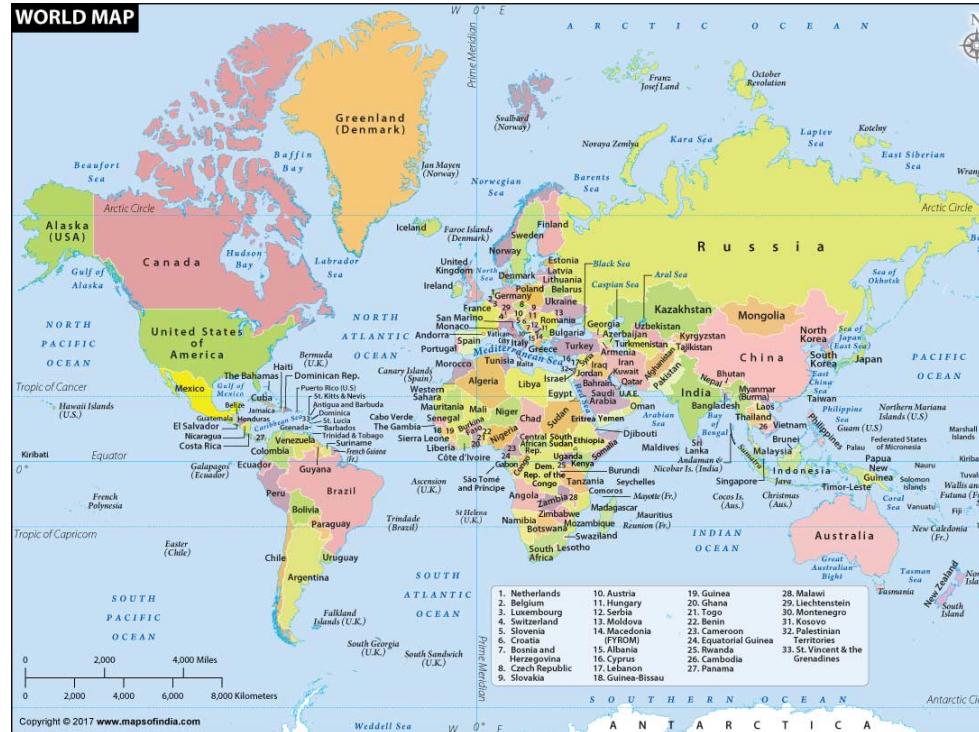
The data are similar, with some differences

- GIS data are spatial
 - They have a reference on the earth
 - We need to know what that reference point is
- Other data do too, but we don't have to worry about them

Reference systems

- If one wants to know which position of the Earth we refer to, coordinates of geospatial data require a reference system
 - geodesic/geographic coordinates need an order, a unit and a datum (a reference ellipsoid: WGS84, ETRS89, NAD27?)
- I am not an expert here, but I do know that one needs to be careful to be consistent

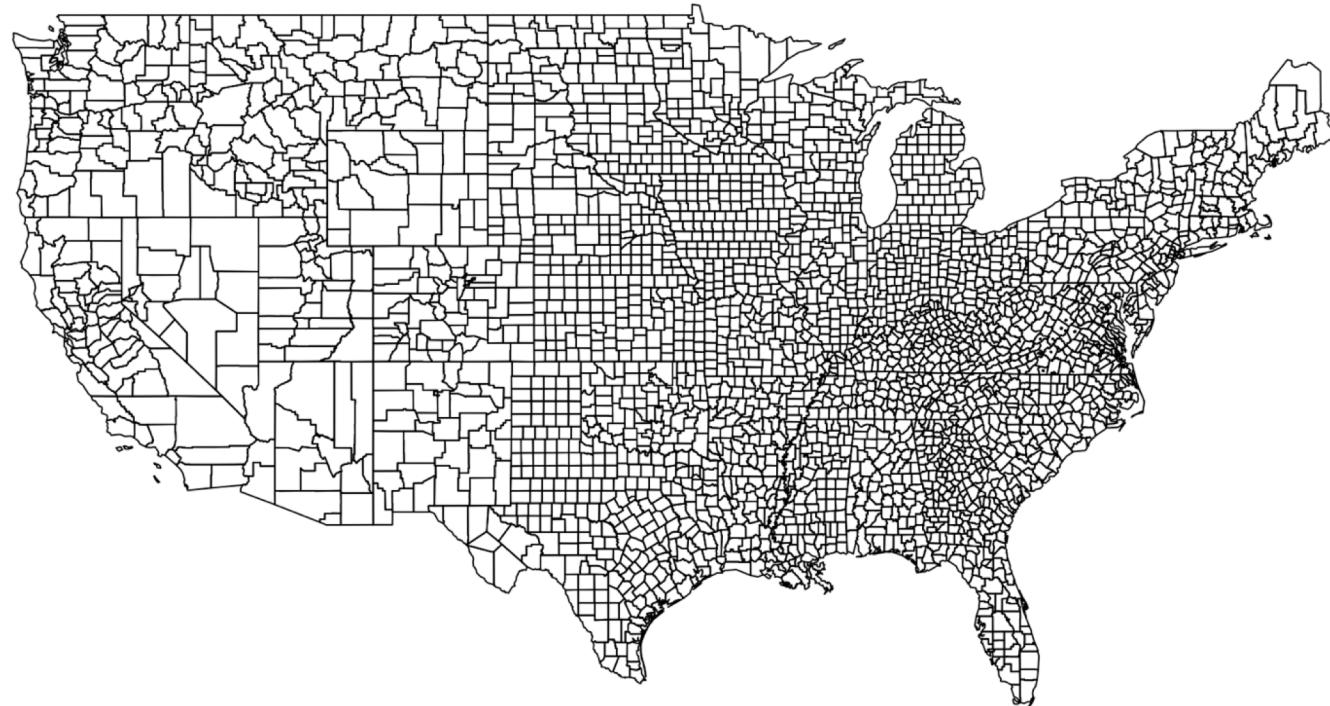
You have all see this map...



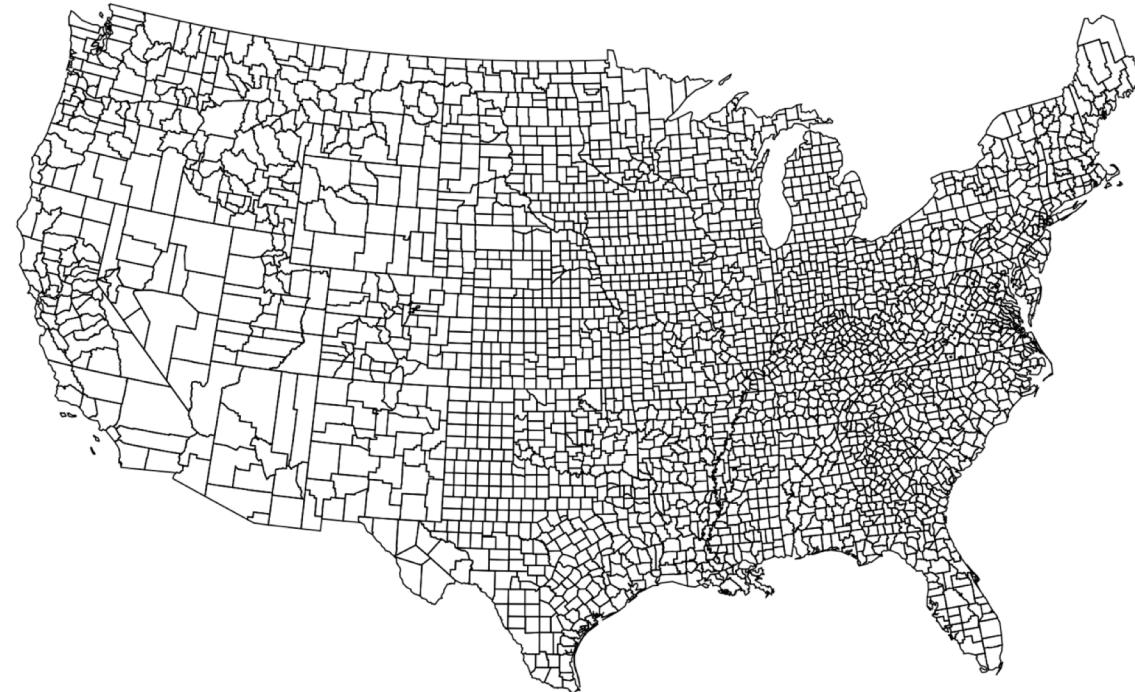
It literally is a matter of perspective...

- https://www.boredpanda.com/true-size-countries-mercator-map-projection-james-talmage-damon-maneice/?utm_source=google&utm_medium=organic&utm_campaign=organic

One way to look at the US



Another way to look at the US



There are lots of places to get spatial data

- <https://hifld-geoplatform.opendata.arcgis.com/>
- https://www.eia.gov/maps/layer_info-m.php
- <https://openei.org/search/?q=shapefile>

Common spatial data type: shapefile

- A shapefile is a simple, nontopological format for storing the geometric location and attribute information of geographic features.
- Geographic features in a shapefile can be represented by points, lines, or polygons (areas).
- The workspace containing shapefiles may also contain dBASE (.dbf) tables, which can store additional attributes that can be joined to a shapefile's features.

Let's try it out

Question for today:

Given that the latest CO₂ credits in the Federal Budget might make CCS economic, how much NGCC capacity in Texas is within 10km of CO₂ pipelines?