

# GIS at Skidmore

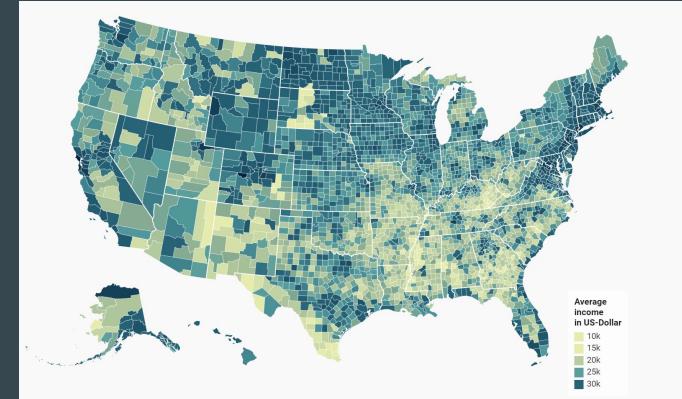
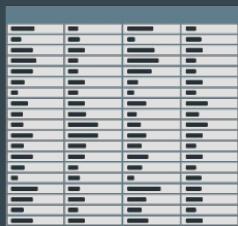
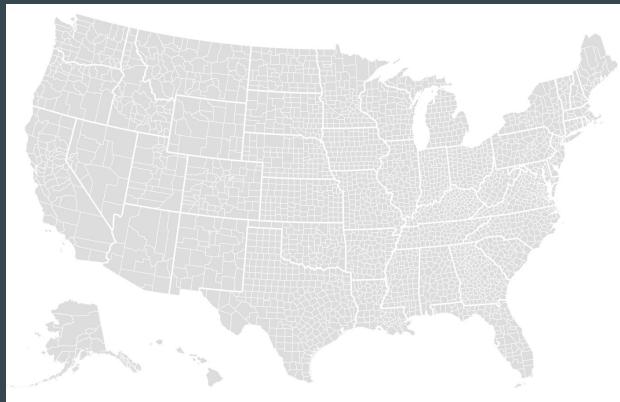
**Charlie Bettigole** - Director of the GIS  
*Center for Interdisciplinary Research*

# So....What is GIS?

*“A Geographic Information System is a computer-based tool that analyzes, stores, manipulates and visualizes geographic information, usually in a map.” -GIS Geography*

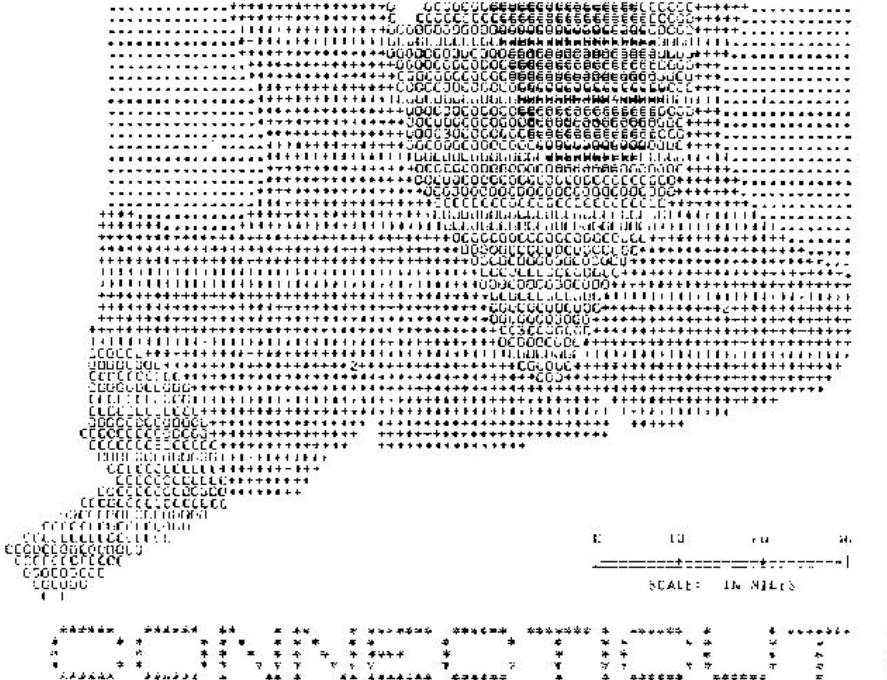
**Most data has a geographic component.**

# So....What is GIS?



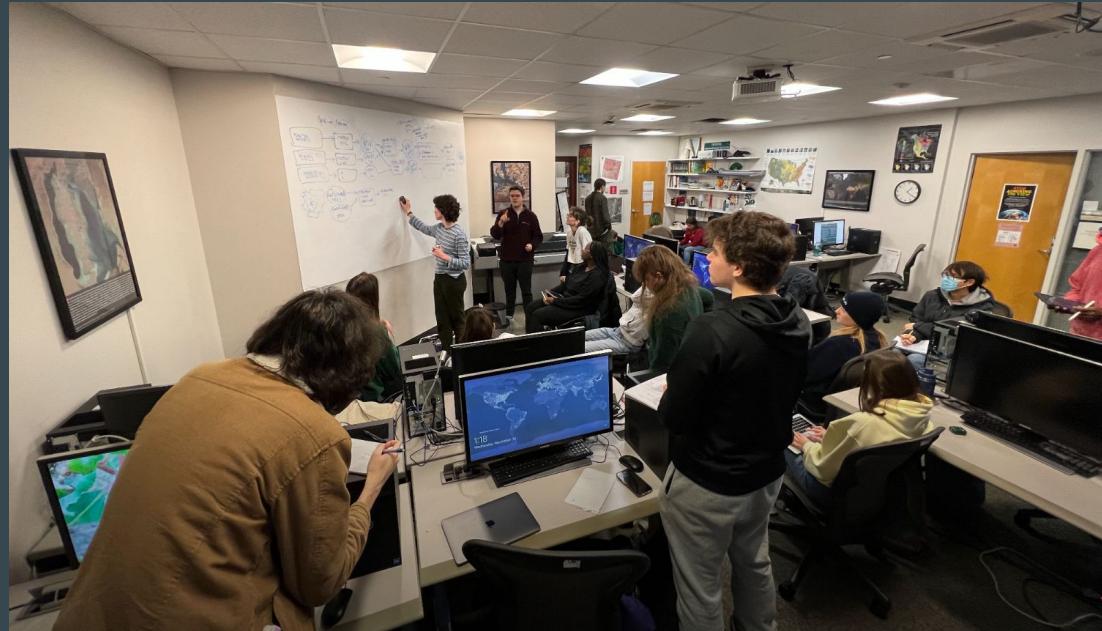
**“Maps + Data = GIS”**

*Source: Datawrapper*



This is one of the first computer maps ever produced. From the Graduate School of Design at Harvard.

Now we've got super-fast computers, with “intuitive” software platforms, and free, readily available data anywhere on the web



As a GIS professional and an academic I've made lots and lots of maps:

- Ranching and Farming
- Counting all the trees in the world
- Census and Ag Census
- Hydrology
- Wildlife Conservation
- Invasive Plant Species
- Social & Environmental Justice
- Renewable Energy
- Coral Reef Mapping
- Residential Planning
- Transportation Planning
- Art and Dance Collaborations
- Conflict Mapping
- Archeology
- Redistricting/Gerrymandering

# My GIS Background



# GIS at Skidmore

- Classes
  - Intro GIS (ID 210)
  - Advanced GIS (ID 351d)
  - Landscape Analysis with Drones (ID 351a)
- Research and Resources
  - GPS units, data, computers
  - Lab assistants
  - Summer research

# Some mapping projects we work on in Intro GIS

- Food justice
- Gerrymandering
- Climate change impacts
- Avalanche risk modeling
- Working with US Census data
- Trends in Social Media
- COVID-19 Mapping
- Much More!

# Some mapping projects we worked on for class in Advanced GIS (s24)

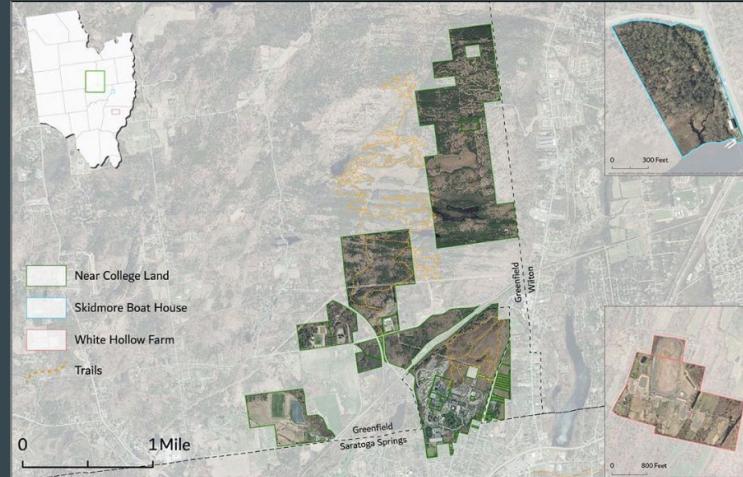
- Exploring redlining and current spatial inequalities
- Paleolithic human movement patterns
- Wildlife population modeling
- Land cover change
- Coding and map publication
- Civic engagement with local organizations

# Summer Research Over the Last 5 Years

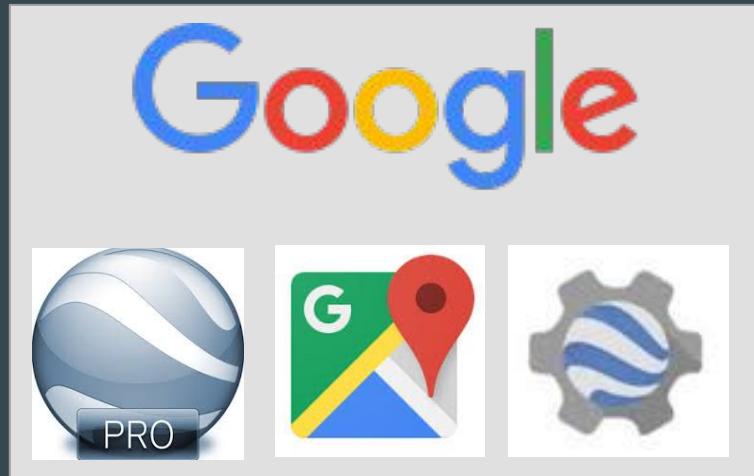
- Collaborations with ESS students (e.g. Dome Island)
- Spatial analysis at Al Gore's farm in TN
- New Visions Mapping Collaborative
- Hemlock Woolly Adelgid
- Spongy Moth
- Mapping Trail Potential on Skidmore Land

# GIS Center Lab Assistants

- Serve as hybrid teaching assistant / research assistants
- Get to work on cool projects internal to Skidmore and with community partners
- ***Here to help students, even if you're not in a GIS class!***



# The Software

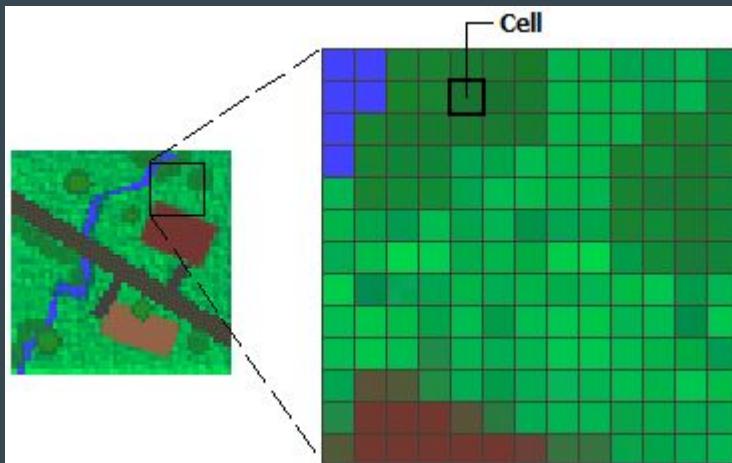


# Representing the world with data models:

## Raster

Vs.

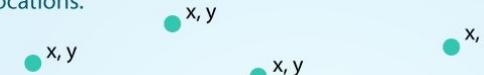
## Vector



Source: GRASS-Wiki

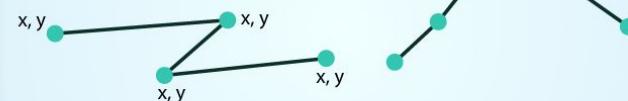
**POINTS:** Individual  $x, y$  locations.

ex: Center point of plot locations, tower locations, sampling locations.



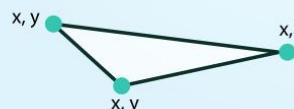
**LINES:** Composed of many (at least 2) vertices, or points, that are connected.

ex: Roads and streams.



**POLYGONS:** 3 or more vertices that are connected and **closed**.

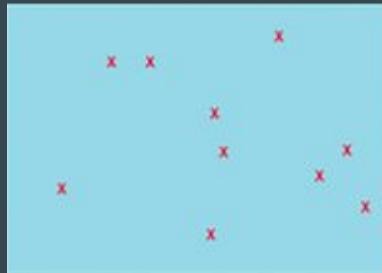
ex: Building boundaries and lakes.



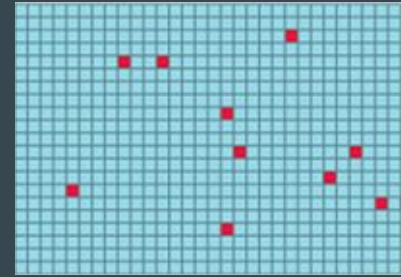
neon

Source: Data Carpentry

# Raster Vs. Vector



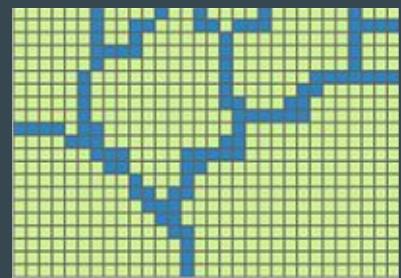
Point



Raster Point



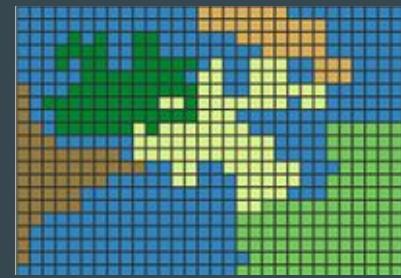
Line



Raster Line

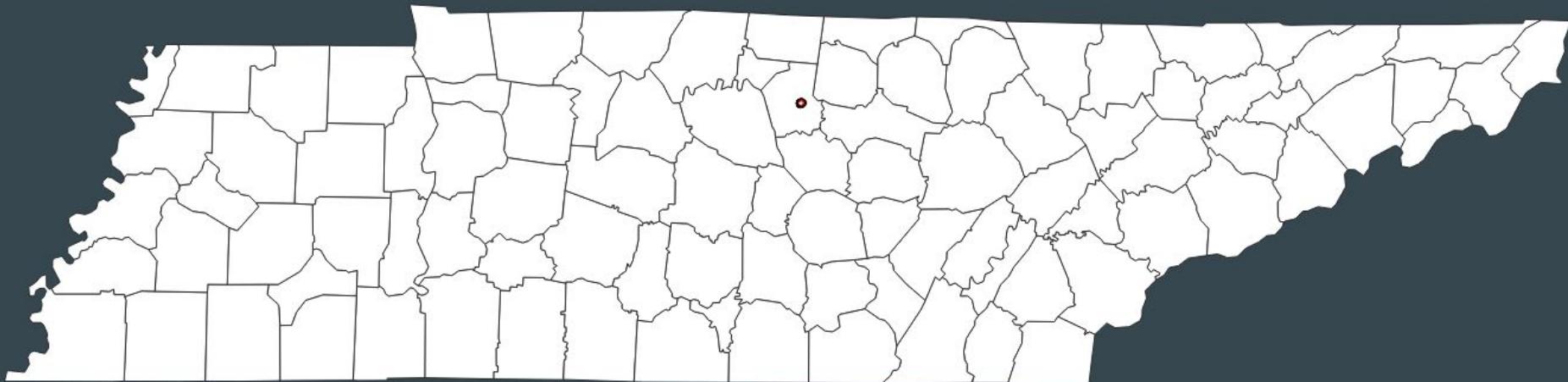


Polygon



Raster Polygon

# Raster or Vector?



# GIS Center for Interdisciplinary Research: Find GIS Data



[Home](#) | [GIS Software](#) | [Find GIS Data](#) | [Skidmore's GIS Network](#) | [Collect Data](#) | [Peer Help](#) | [Tutorials & Training](#) | [Other Resources](#)

## Library Databases

- [GeoRef](#)

GeoRef indexes journal articles, books, maps, conference papers, reports, and theses covering a variety of geosciences topics. Geology of North America is covered from 1785 to the present and geology of the world is covered from 1933 to the present.

- [Web of Science Core Collection](#)

Web of Science™ Core Collection provides researchers, administrators, faculty, and students with quick, powerful access to the world's leading citation databases.

Authoritative, multidisciplinary content covers over 12,000 of the highest impact journals worldwide—including open access journals—and over 160,000 conference proceedings. You'll find current and retrospective coverage in the sciences, social sciences, arts, and humanities, with coverage dating back to 1900. Focus on the essential data from across more than 250 disciplines.

- [Global Commodities](#)

This resource brings together manuscript, printed and visual primary source materials for the study of global commodities in world history. The commodities featured in this resource have been transported, exchanged and consumed around the world for hundreds of years. They helped transform societies, global trading operations, habits of consumption and social practices. Click on the "Data & Maps" tab to dig deeper.

- [ICPSR](#)

## General Data

- [ArcGIS Hub](#) ⓘ
- [Data.gov](#) ⓘ
- [DIVA-GIS](#) ⓘ
- [Earth Explorer](#) ⓘ
- [Geoplatform.gov](#) ⓘ
- [Natural Earth Data](#) ⓘ
- [USGS National Map](#) ⓘ
- [GIS Data Starting Points](#) ⓘ
- [ESRI Data & Maps](#) ⓘ
- [Wikipedia List of GIS data sources](#) ⓘ
- [Living Atlas of the World](#) ⓘ
- [Data Planet Statistical Data Sets](#) ⓘ
- [Data Planet LibGuides Subject Guide](#)
- [List of 1,400 GIS Data Servers by Joseph Elfelt-MappingSupport.com](#) ⓘ

## United States Socio-Economic Data

- [US Census Bureau Tools & Apps](#) ⓘ
- [US Census Bureau Fact Finder Search](#) ⓘ
- [US Census Bureau TIGER Products](#) ⓘ
- [National Historical GIS](#) ⓘ

## New York State & Local Data

- [NY State GIS Clearinghouse](#)
- [Capital District Regional Planning Commission \(CDRPC\) Census Data](#)
- [Cornell University Geospatial Information Repository \(CUGIR\)](#)
- [NY State data.gov](#)
- [NY State Health Data](#)
- [NY Department of Labor](#)
- [NY State Geological Survey](#)
- [NY State Orthoimagery](#)
- [NY Climate Change Science Clearinghouse](#)
- [Bytes of the Big Apple](#) ⓘ

## State Data

- [Data for the US \(by state\)](#)  
A variety of links to state GIS data from MIT Libraries.
- [List of 1,400 GIS Data Servers by Joseph Elfelt-MappingSupport.com](#) ⓘ
- [Data by State](#)  
List of state GIS portals from Northwestern University.

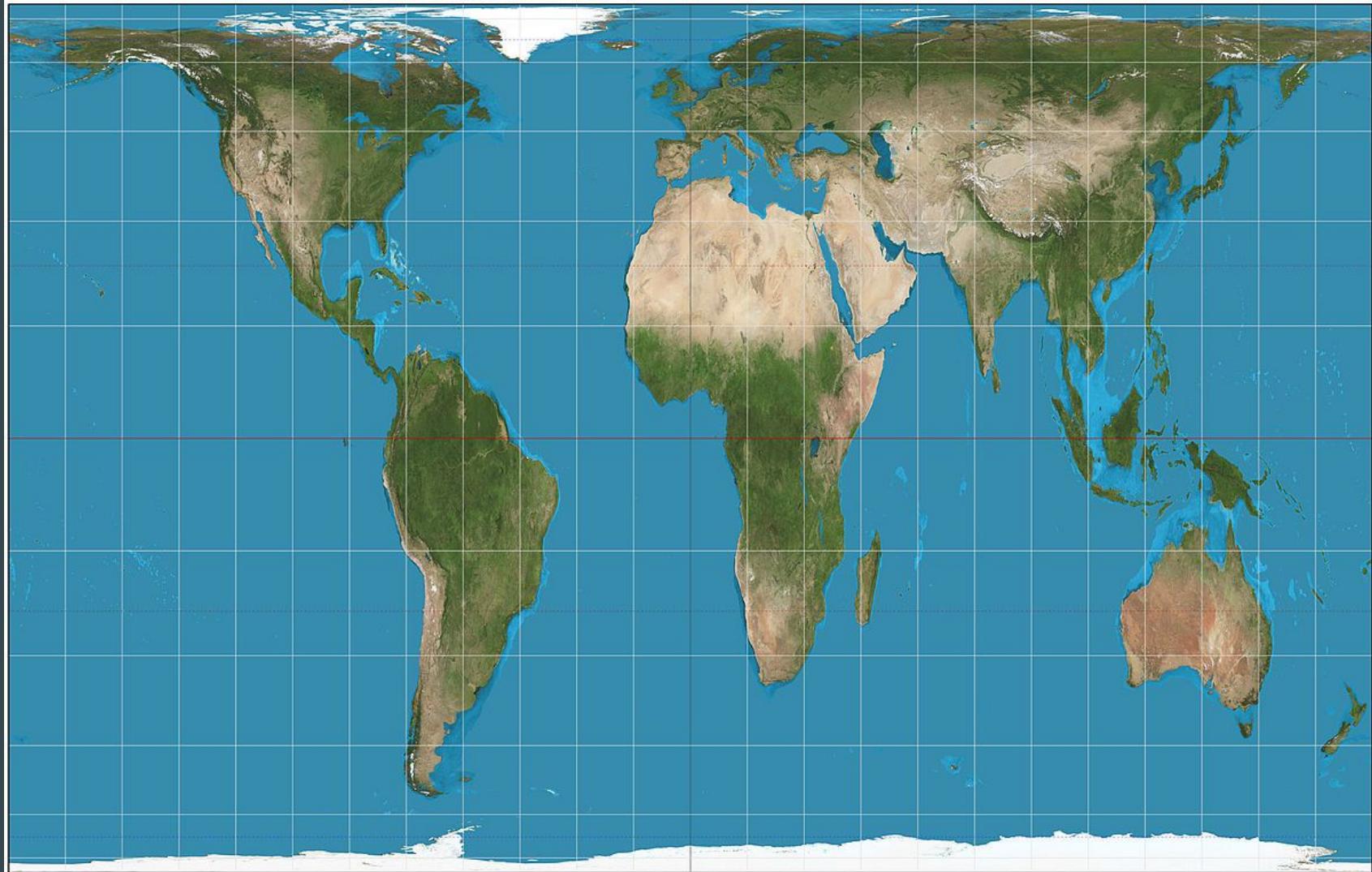
## International Data

What's the best way to represent our  
“round” earth on a map?



# What's the best way to represent our “round” earth on a map?





*thetruesize.com*

# *Data Visualization*

*“Graphical excellence is that which gives to the viewer the greatest number of ideas in the shortest time with the least ink in the smallest space.”*

-Edward Tufte

**Remove**  
to improve  
(the **data-ink** ratio)

**Overarching Principle:**

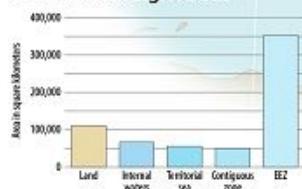
**DON'T ACCEPT THE DEFAULTS  
&  
BE CONSISTENT**

# Visual Hierarchy

## CUBA Maritime Zones and Limits



### Cuban Sovereign Areas



### Limits

- Maritime boundary
- Median line
- 200 nautical mile limit
- Contiguous zone
- Territorial sea
- Straight baseline

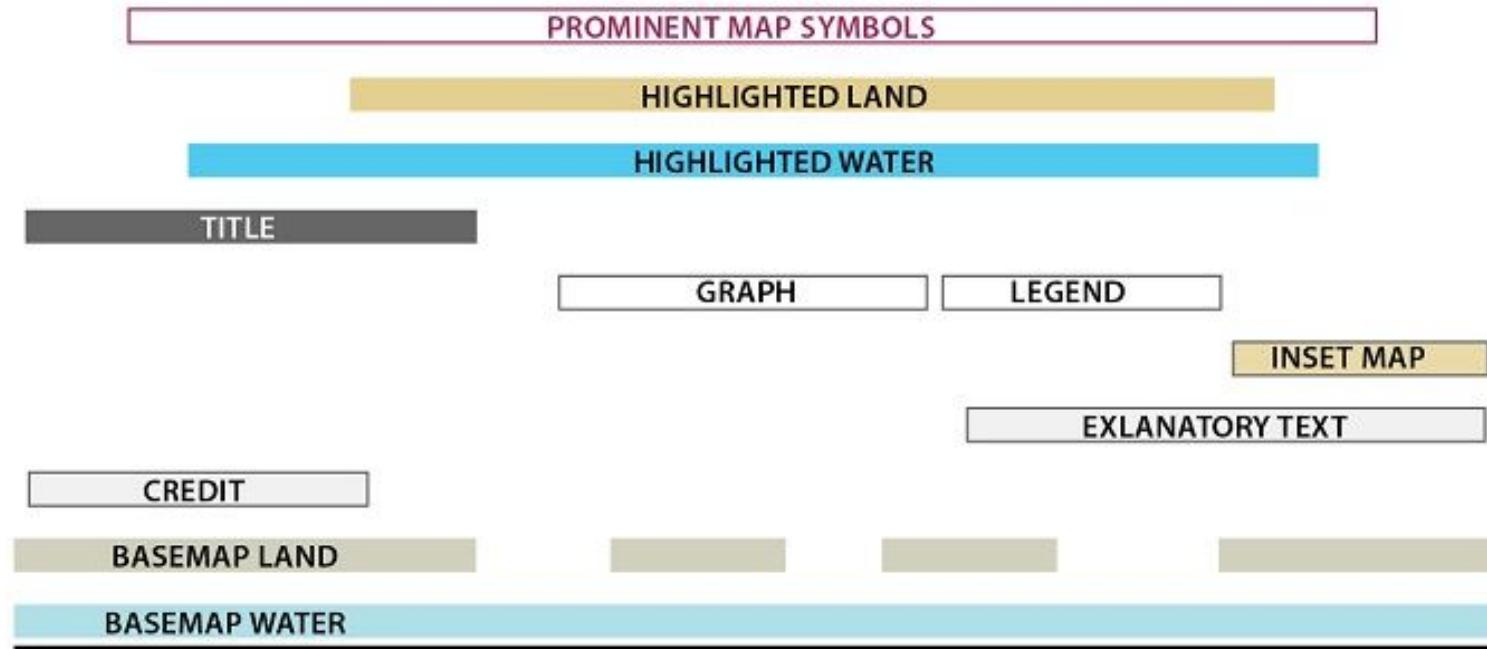
### Explanation

Lore ipsum dolor sit amet, consectetuer adipiscing elit, sed diam nonummy nibh euismod tincidunt ut laoreet dolore magna aliquam erat volutpat. Ut wisi enim ad minim veniam, quis nostrud exerci tation ullamcorper suscipit lobortis nisl ut laoreet dolore magna aliquam erat volutpat. Ut wisi enim ad minim veniam, quis nostrud exerci

# Visual Hierarchy

## Visual Hierarchy

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# OPINION

## Obama's Divided Nation

### Visual Contrast

Now Obama presides over a more divided country than at any time in 50 years. That was riven by racial lines gathered in 2008 to elect its first black president. That president has spent four years dividing the country on the basis of economy. The campaign revealed no evidence that Mr. Obama will close the chasm he has created between his voters and those he attacked and vilified.

It may be true that Mitt Romney failed to respond



Source: AP

drawn attention to what hap-

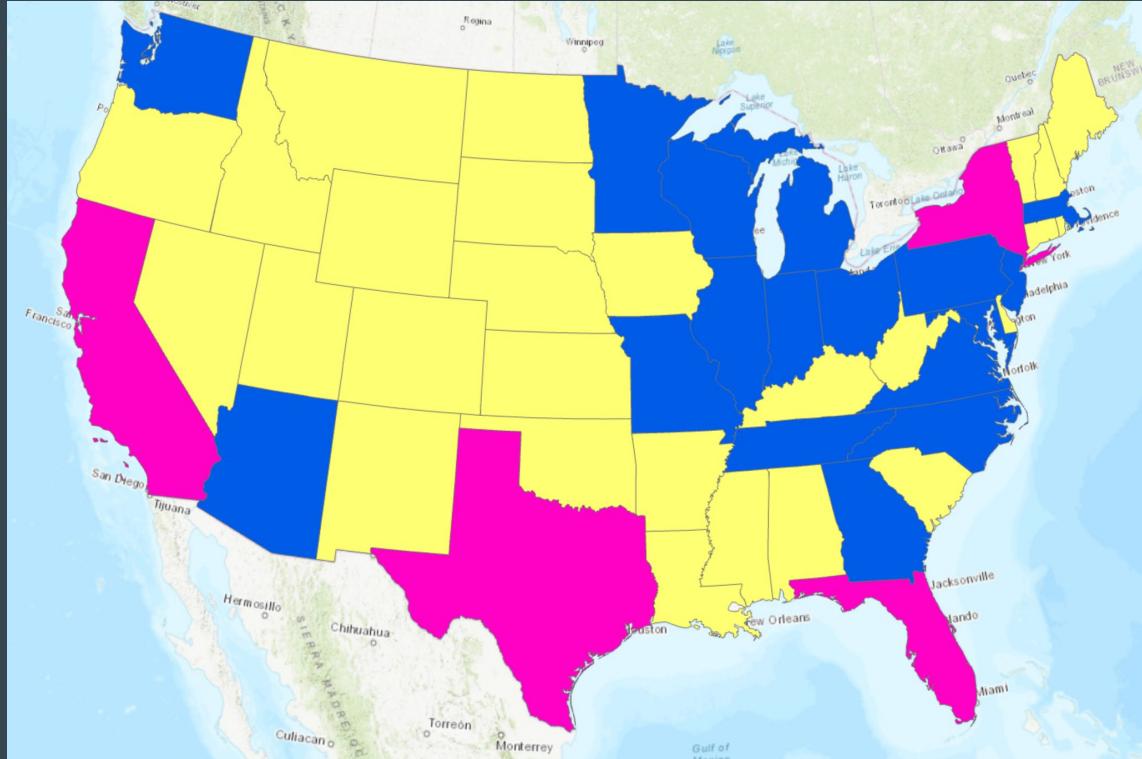
Obama spoke to *Stomum* replied: "It's right and you're wrong. It

problem with pols, especially when it comes to the economy, is that it's verbally facile as Mr. Obama is. But when it comes to that in crunch time, he reverts to No. 1. Exit polls show that 9% of the electorate who voted for just him did so because of Tuesday; and among them, 42% said Mr. Obama's Sandy response—tellingly, a photo op—was a factor. Of those, 58% voted for Mr. Obama. Mr. Christie is one of the few politicos who is not.

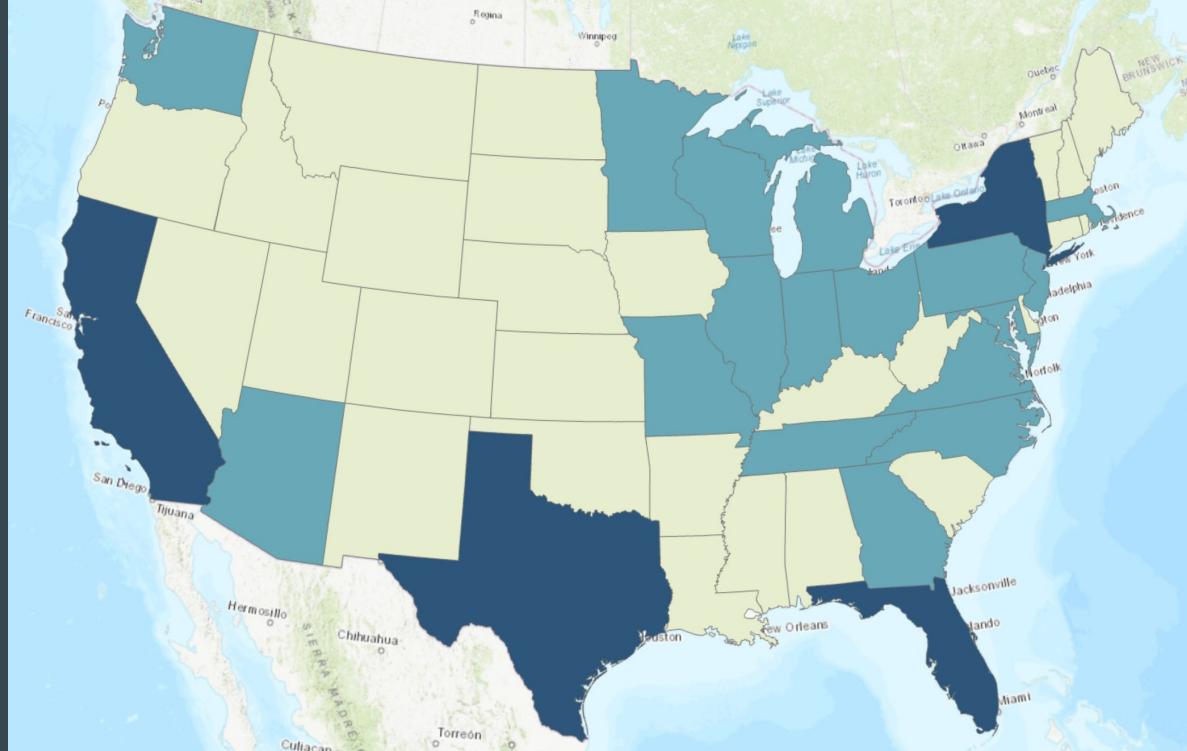
Yes, Republicans are divided across two presidents. But that there are divisions is not how crudely Obama has handled an issue like immigration reform. Blowing up the House of Representatives if you thought that was the day's results

VOX

**Yes, there's  
such a thing  
as too much  
Visual  
Contrast**

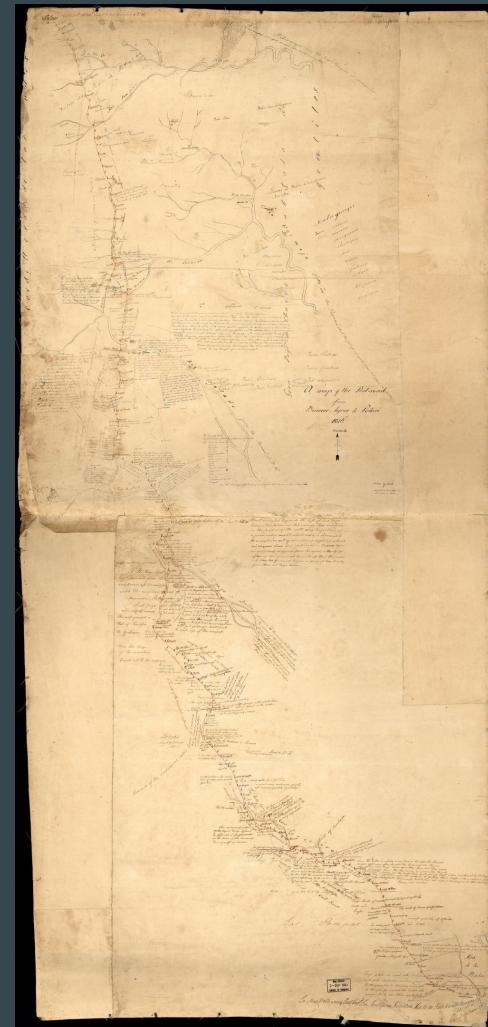
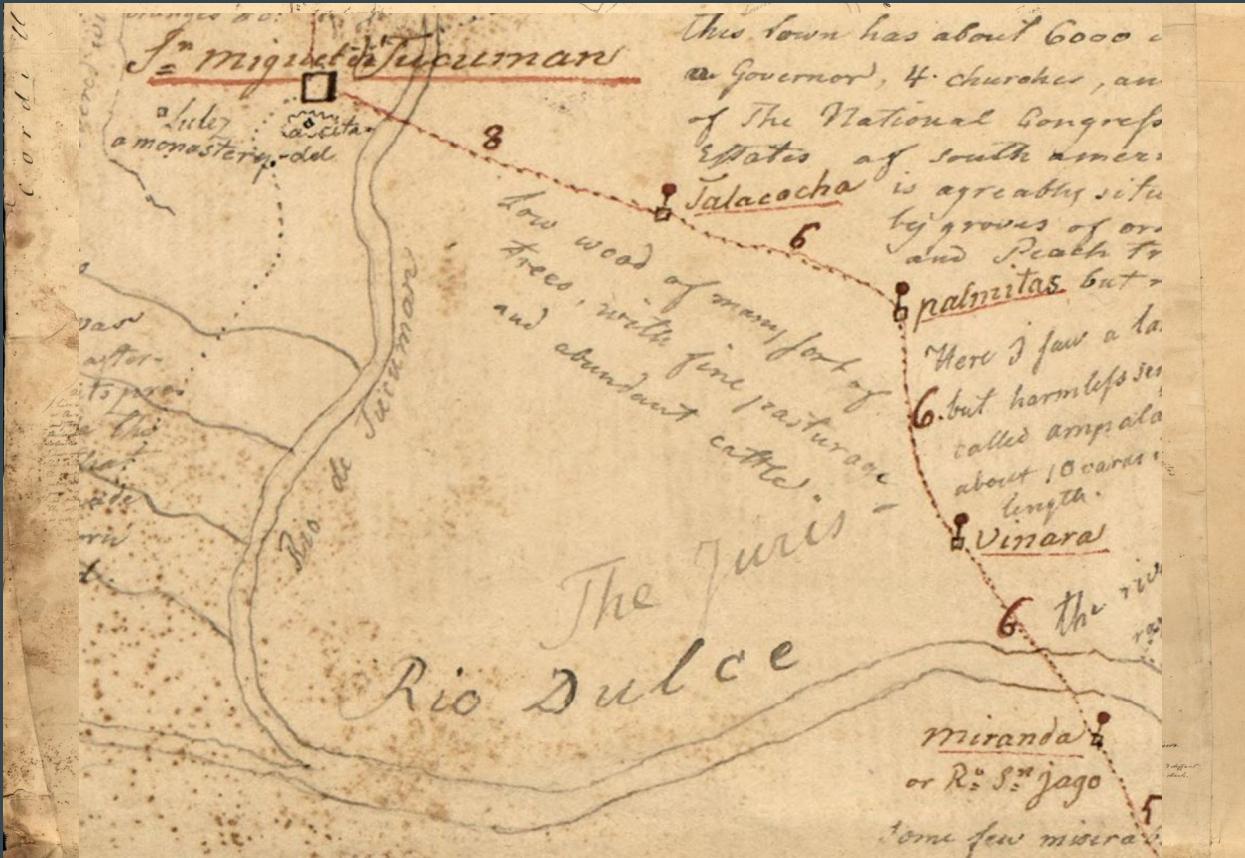


**Yes, there's  
such a thing  
as too much  
Visual  
Contrast**

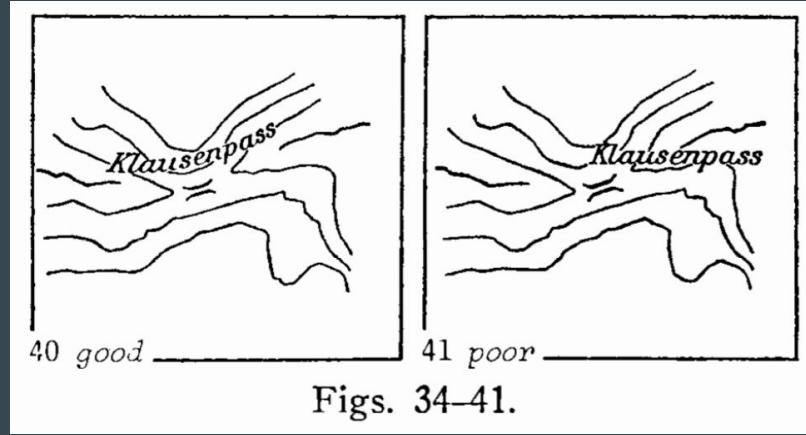
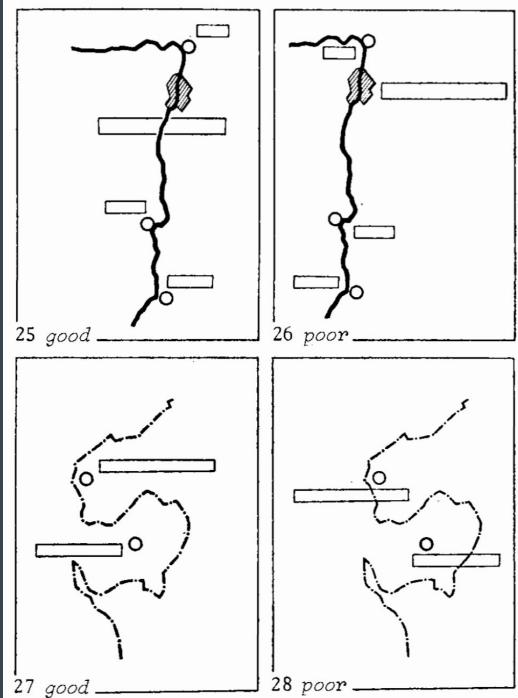


# Legibility

(scale matters)



# Legibility (scale matters)



Figs. 34–41.

*The names should, in spite of their incorporation into the dense graphics of the map, be easily read, easily discriminated, and easily and quickly located.*

**Legibility** depends not only on type form, type size, and type color but also on the position or arrangement of other names.

*Eduard Imhoff (1975)*

# How can you make your own maps without expensive GIS software?

- Datawrapper:
  - *app.datawrapper.de/create/map*
- Dave's Redistricting Tool
  - *Davesredistricting.org*
- Google Maps
- Google Earth
- QGIS

# OK, lets make a map with Datawrapper

- Download this data:
  - [bit.ly/lil00data](https://bit.ly/lil00data)
- Go to this Website
  - [www.datawrapper.de/maps](https://www.datawrapper.de/maps)

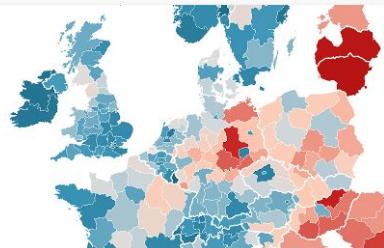
# Mapping with Datawrapper

Datawrapper

Create new ... Sign in

What kind of map do you want to create?

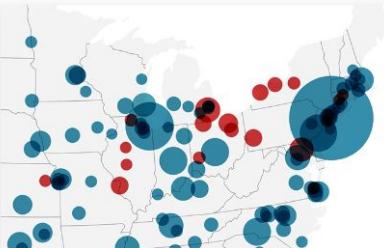
Choose the map type that fits your data:



**Choropleth map**

Color regions to show data like unemployment rates or election results on a map. Upload your own map or use any of our more than 3000 maps. The resulting map is responsive & interactive.

[Learn more about choropleth maps](#)



**Symbol map**

Create symbols sized and colored according to your data. Works great for specific locations (like cities). Upload your own map or use any of our more than 3000 maps. The resulting map is responsive & interactive.

[Learn more about symbol maps](#)



**Locator map**

Add markers to a map to show where something is located or happened, e.g. events within a city. Perfect for showing readers the places you mention in an article. The resulting map is responsive and static.

[Learn more about locator maps](#)

# Mapping with Datawrapper

Welcome to Datawrapper 😊! Learn how to create your first chart.

1 Select your map    2 Add your data    3 Visualize    4 Publish & Embed

 Choropleth map    Proceed →

What type of map do you want to create?

World  
 Africa  
 Europe  
 Latin America  
 Middle East  
 North America  
 Oceania  
 Asia  
 South America  
 Mediterranean Sea  
 Central America  
 West Africa  
 South-East Asia  
 USA » States

A red arrow points to the "USA » States" option in the list.



# Mapping with Datawrapper

Welcome to Datawrapper 😊! Learn how to create your first chart.

1 Select your map ✓      2 Add your data      3 Visualize      4 Publish & Embed

Now your map needs data!

We prefilled the table with Name keys.  
You can start adding your values or [upload your own file](#).

[Upload](#)   [Match](#)   [Check ✓](#)

[Upload a file \(CSV or Excel\)](#)  
You can also simply drop it here

[Upload file](#)

OR

[Copy & paste your data \(including header row/column\):](#) ?

Paste your data here or directly into the table →

First row as label

Search data table

	A	Name	B	Values	C
1	Name			More Niners	More Chiefs
2	California			71	29
3	Nevada			60	40
4	New Mexico			59	41
5	Hawaii			62	38
6	Iowa			39	61
7	Idaho			58	42
8	Michigan			51	49
9	Kansas			15	85
10	Utah			54	46
11	South Dakota			42	58
12	Arizona			51	49
13	Montana			50	50
14	Wisconsin			52	48
15	Oregon			61	39
16	Wyoming			46	54
17	Missouri			16	84
18	Texas			46	54
19	North Dakota			47	53
20	Nebraska			27	73
21	Alaska			52	48

# Mapping with Datawrapper

Refine Annotate Layout

**Colors**

Select column: More Niners

Select palette:

Type:  steps  continuous

Steps: 5 Rounded values

Custom range: MIN 15 MAX 71

**Legend**

Show color legend

Caption: Show caption

Proportion of google search

Labels: ruler  ranges  custom

Format: 1,000[.00]

Show advanced options

Where are people thinking about superbowl?

Proportion of google searchers for 49rs vs Chiefs in last 30 days

Proportion Range	States
< 20	None
20-30	None
30-40	None
40-50	None
50-60	None
60-70	None
≥ 70	None

Get the data • Created with Datawrapper

PREVIEW

Size (px): 600 auto

Colorblind check:

Dark Mode:

# Global Positioning System (GPS)





How far we've come:

*"In 1991, a project to create a miniature GPS receiver successfully ended, replacing the previous 16 kg (35 lb) military receivers with a 1.25 kg (2.8 lb) handheld receiver."*

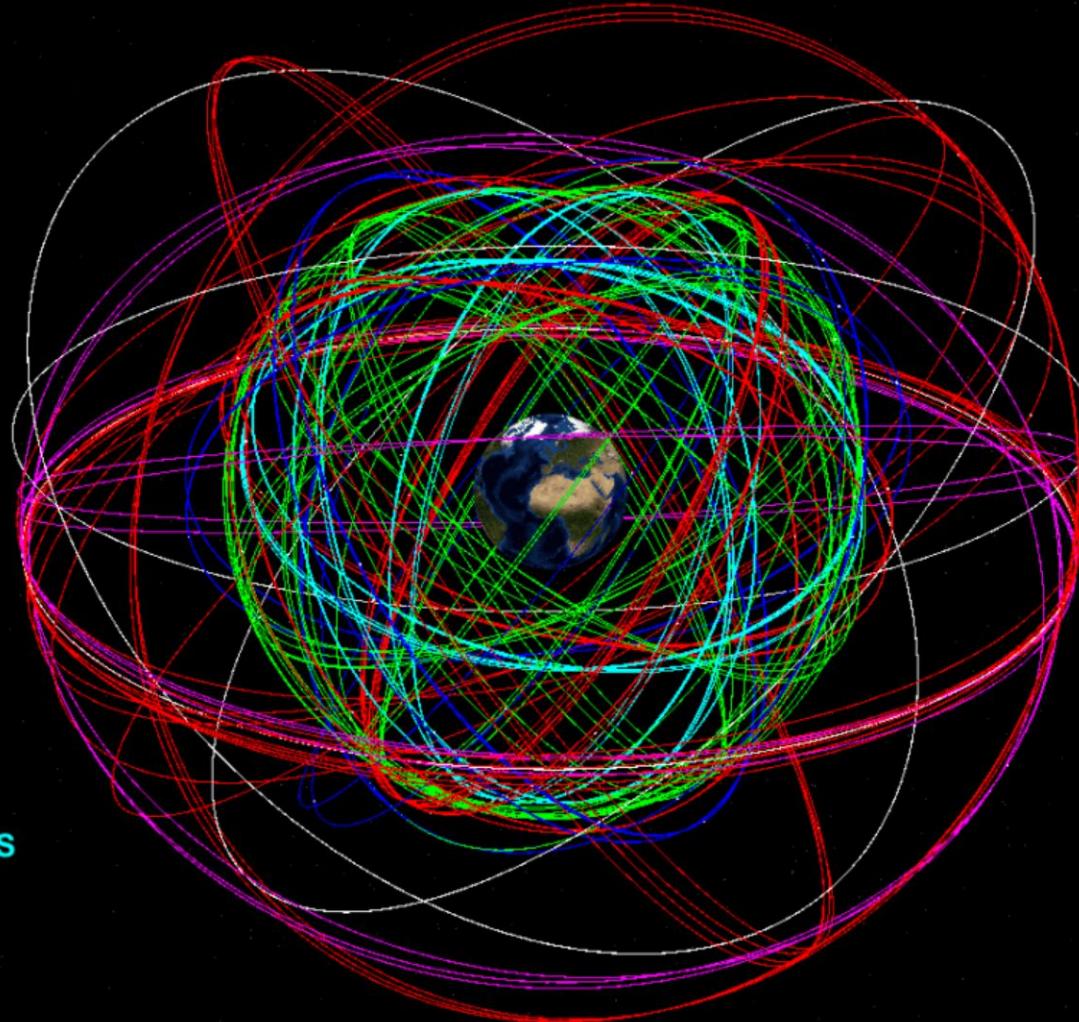


Thanks to Clinton and Gore, by year 2000, civilian receivers were able to receive non-degraded signals

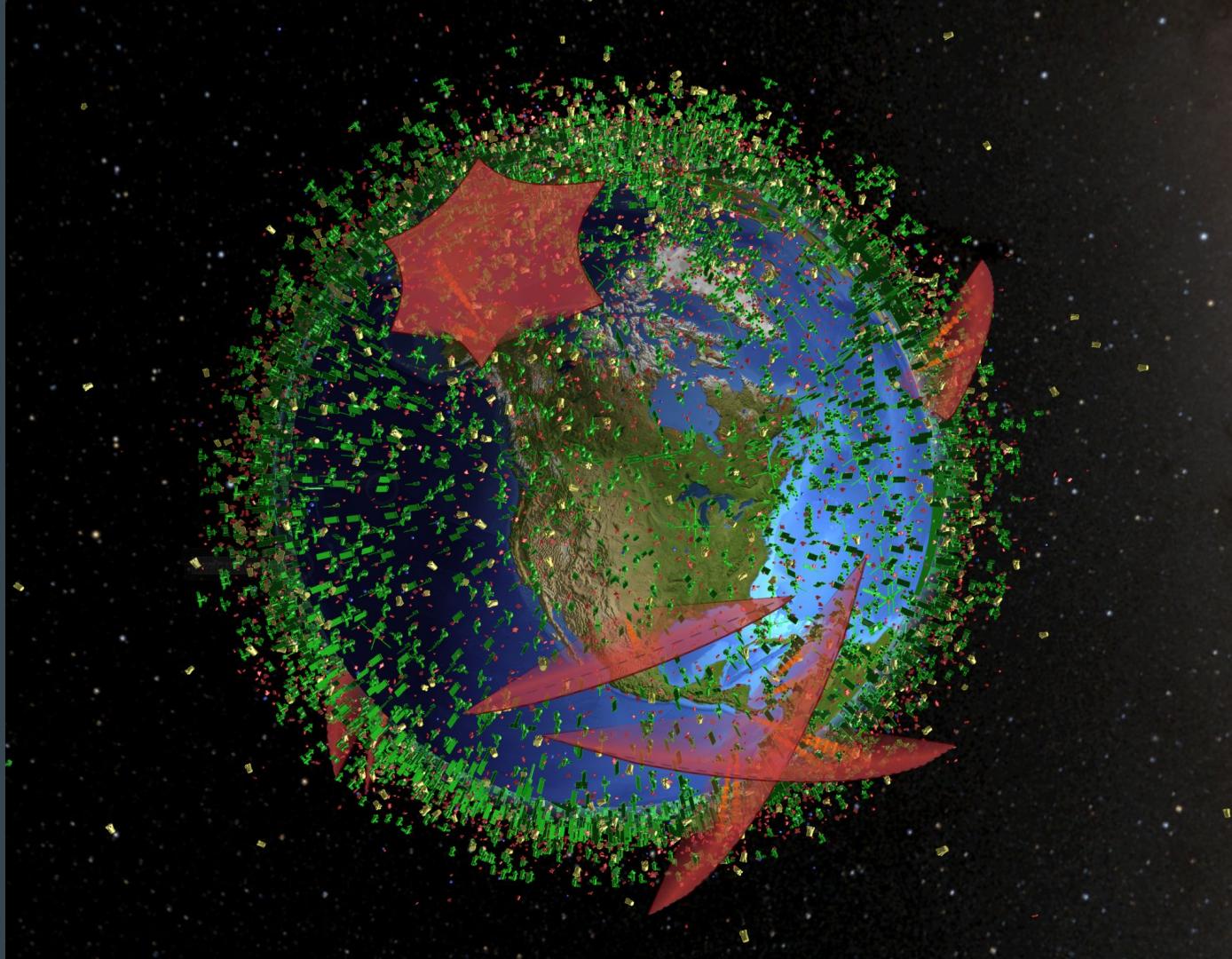


*Many phones these days can use all of these!*

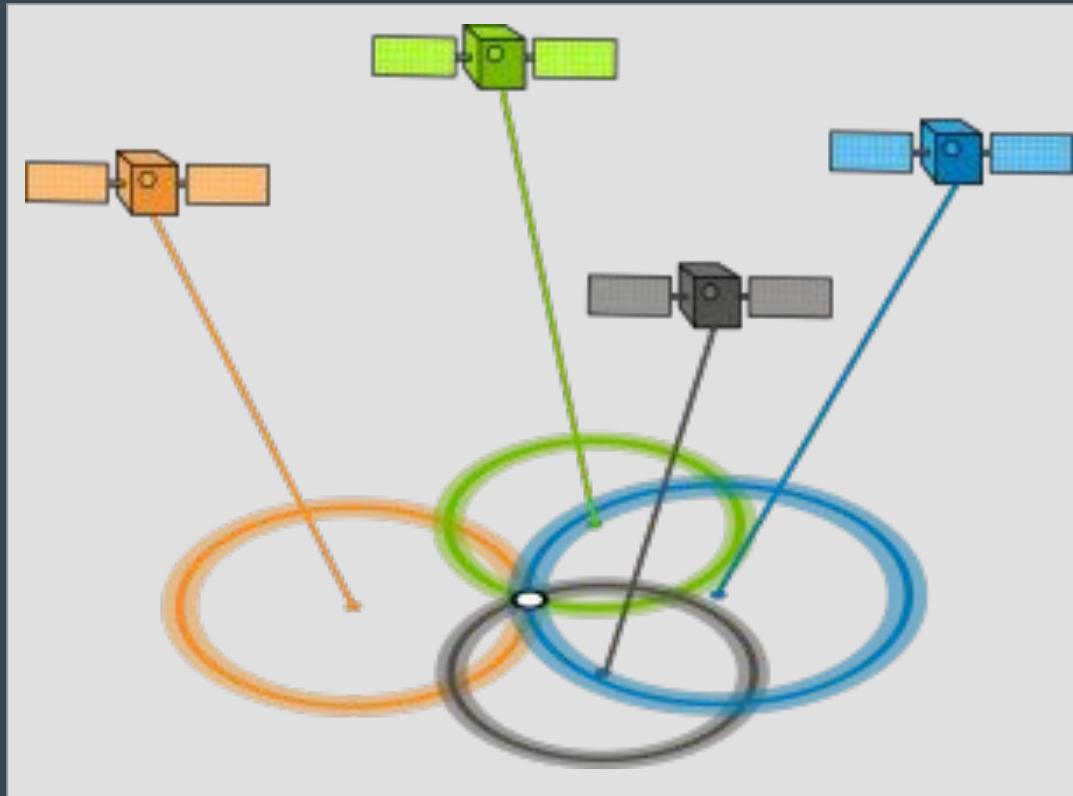
Source: wikipedia



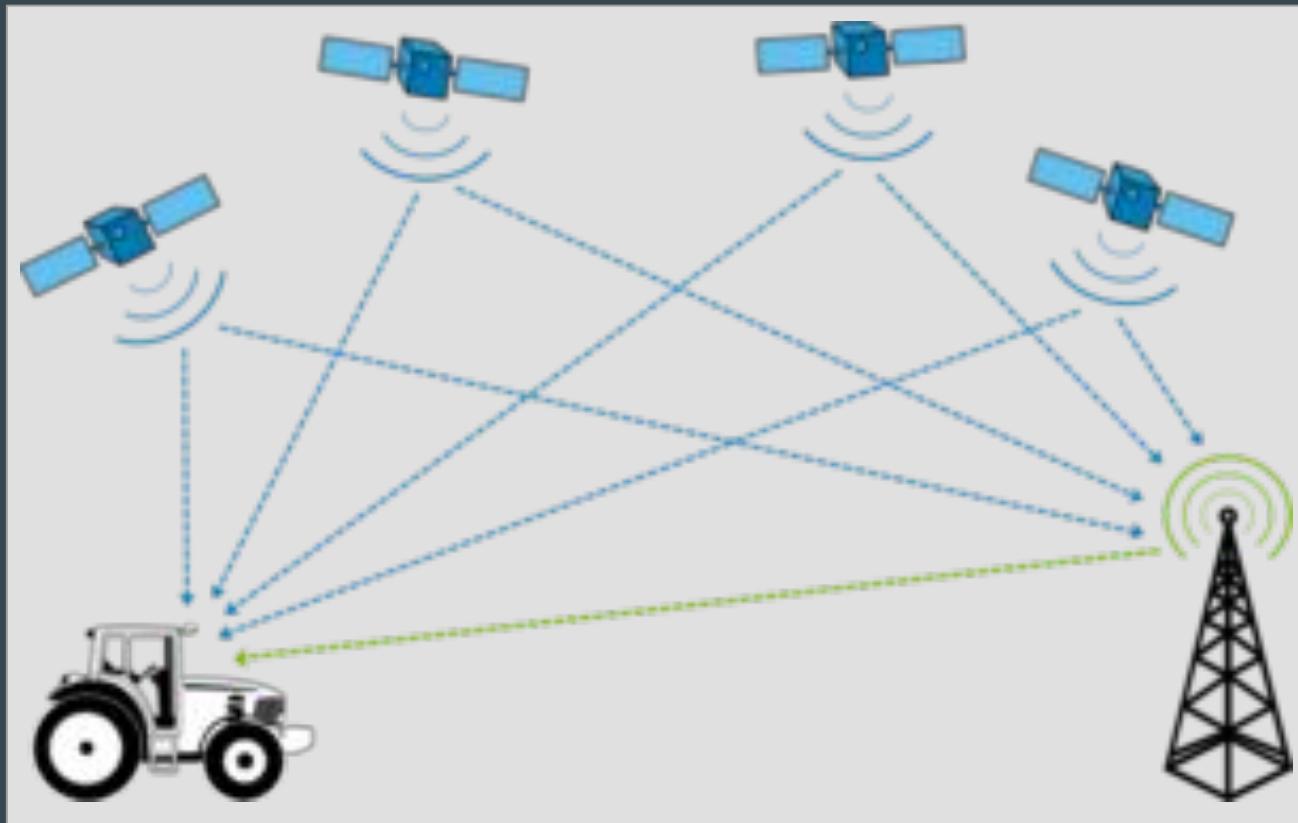
**GPS**  
**GLONASS**  
**Galileo**  
**BeiDou**  
**QZSS**  
**IRNSS**



# How Do They Work?



# Differential Correction





# GPS Accuracy



# GPS Accuracy

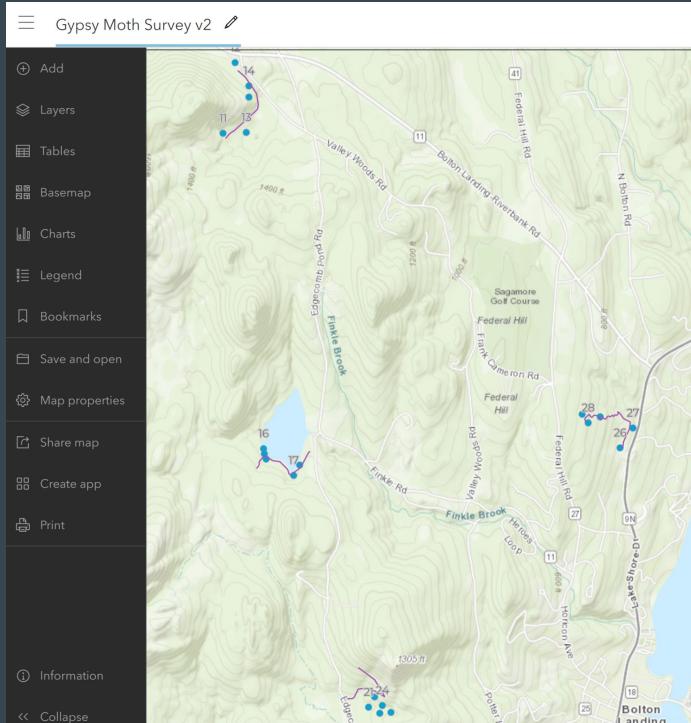


# **Putting it all together:**

## *ArcGIS Online and Field Maps!*



# How do we create new Field Maps?



Create a map with an  
editable layer

Gypsy Moth Presence	Gypsy_Moth_Siting	String
Stand Type	Tree_Type	String
Browsing Intensity	Browsing	String
Regrowth (Yes/No)	Regrowth	String
Complete	Complete	String
GlobalID	GlobalID	GlobalID
CreationDate	CreationDate	Date
Creator	Creator	String
EditDate	EditDate	Date
Editor	Editor	String

Create a data  
dictionary



Open in field maps!