

Introduction to GIS (Geographic Information Systems)

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clemsongis.com

The Importance of Maps



Importance of GIS



Geospatial Revolution

The **Location** of Anything
is Becoming **Everything**.

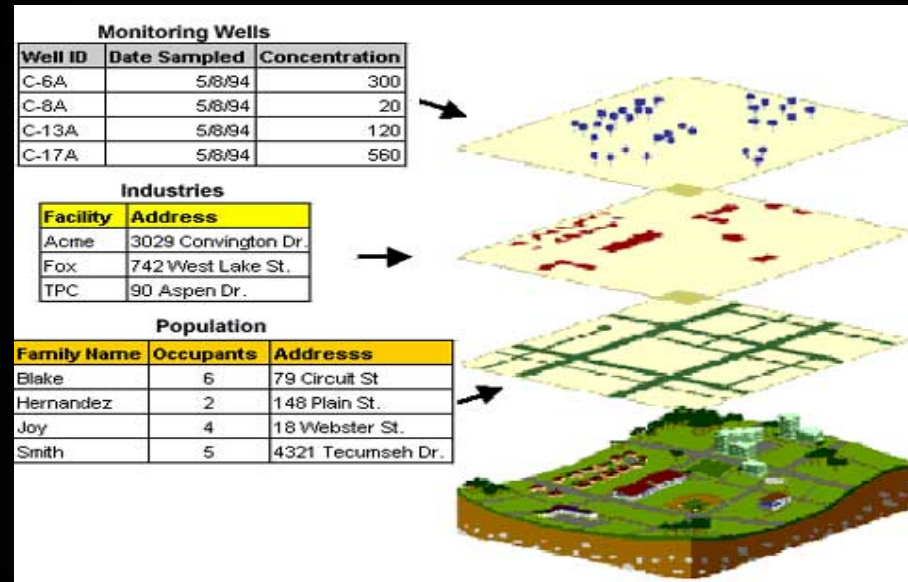
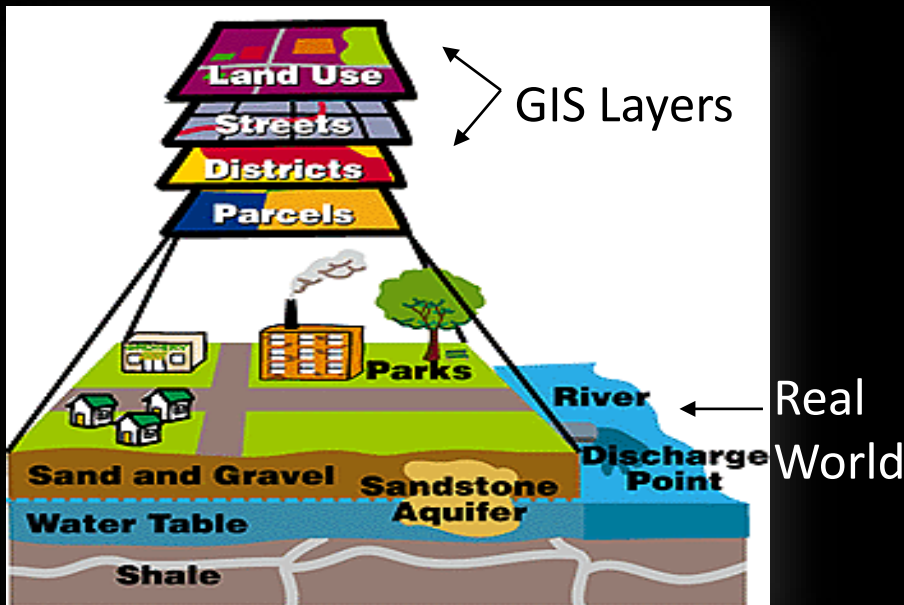
4:33 / 5:14

CC Settings YouTube

The image shows a YouTube video player interface. At the top left, the video title "Geospatial Revolution" is displayed. The main area of the player is a blurred image with the text "The Location of Anything is Becoming Everything." overlaid in white and red. The video progress bar is visible at the bottom, showing the video is at 4:33 out of 5:14. The YouTube logo and other interface elements are also present.

What is GIS?

A GIS is: "A system for capturing, storing, checking, integrating, manipulating, analyzing and displaying data which are *spatially referenced* to the Earth (Chorley, 1987)."



Tapestry Income Age Population Density

For ZIP Code

Top Tapestry™ Segments

22% Exurbanites

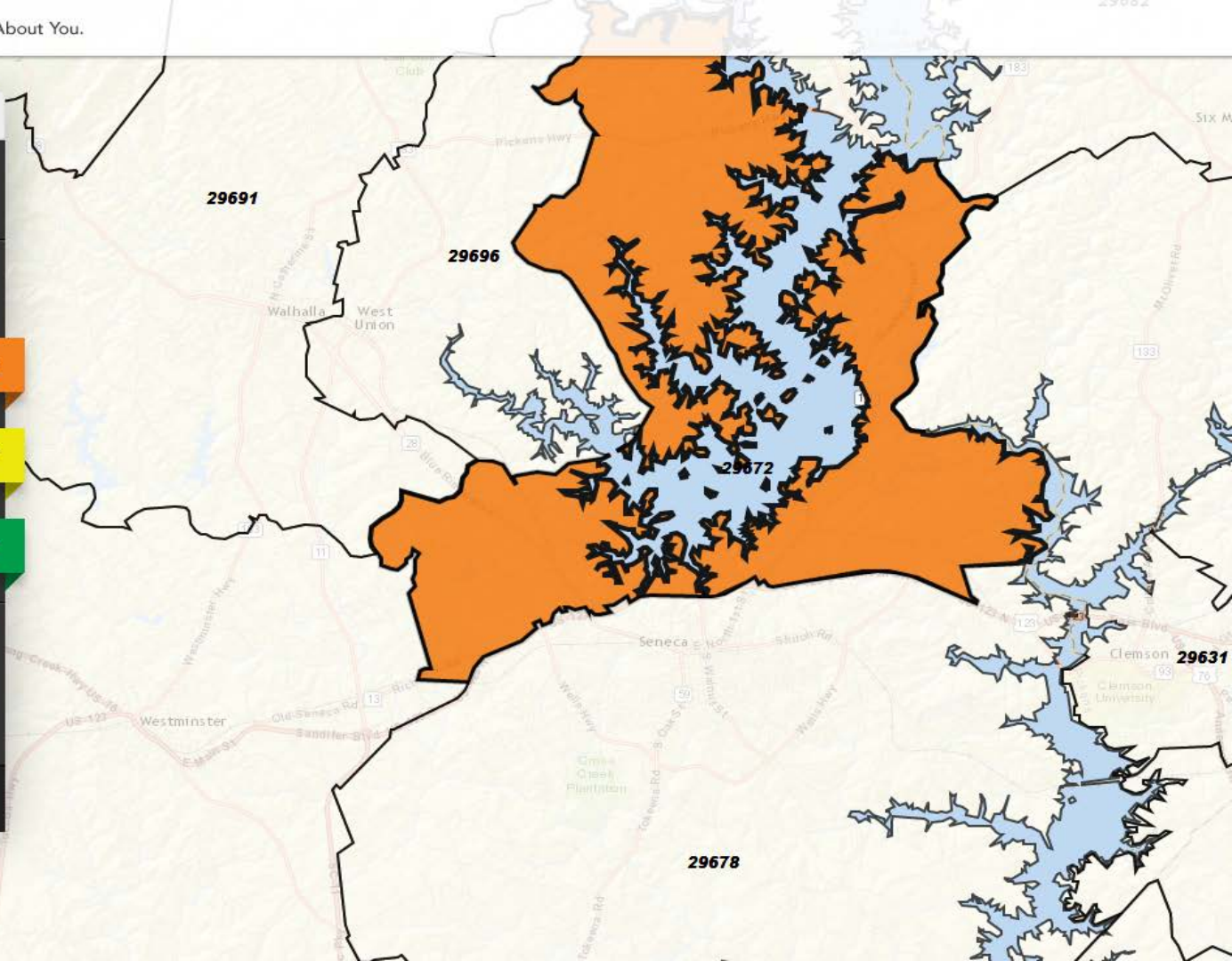
20% Midlife Constants

18% Rural Resort Dwellers

Want to know more? Esri's Tapestry™ Lifestyle Segmentation classifies the US population into 67 market segments and provides comprehensive lifestyle details.

[More about Tapestry](#)

[Contact Us](#)



Where are we?

12: Turn RIGHT onto E OCEAN BLVD. 2.2 mi

13: Turn RIGHT onto S TERMINO AVE. 0.1 mi


14: End at 4000 E Olympic Plz Long Beach, CA 90803-2828
Estimated Time: 2 0 hours 10 minutes Estimated Distance: 118.62 miles

B: 4000 E Olympic Plz, Long Beach, CA 90803-2828

Total Time: 2.0 hours 10 minutes Total Distance: 118.62 miles

Get help on the go! MapQuest directions now by phone with 1-800-FREE411 (1-800-373-3411).

Print map type: My View Show Entire Route on Map [Back to Map](#)



MAPQUEST

Los Padres Natl. For. Elizabeth Lake Leona Valley Palm
Wheeler Springs Santa Barbara Mira Monte Ojai Santa Paula Val Verde Park Santa Clarita Acton
Carpinteria Oak View Piru (23) (126) (126) (13) Vincent



Where are we? Real-time data

London

51.51 N, 0.13 W

Wed 30 Jan @ 09:28:41

Go to Map - Go to Grid - Change City



WEATHER STATIONS (MULTIPLE SOURCES) 4

STATION	WIND SPEED	WIND GUSTS	DIRECTION	TEMPERATURE	HUMIDITY	RAIN TODAY	PRESSURE	FORECAST
CASA Office: Bloomsbury W1	18.2 mph	13 mph	E ←	10.6 °C	57%	4.8 mm	1009.6 mbar	Clear Night
Hampstead NW3	18.7 mph	17.5 mph	E ←	9.6 °C	56%	5.7 mm	1009.0 mbar	Clear Night
Ben Cook: Bow E2	9.9 mph	8 mph	E ←	10.3 °C	62%	5.8 mm	1011.1 mbar	Clear Night

WEATHER (METAR) 895

London City Airport
Mostly clear
WSW at 25 mph **10 C**

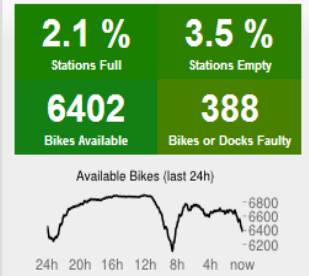
FORECAST (YAHOO! WTH) 1795

Wed	Thu
10 C	9 C
Light Rain/Wind Late	AM Showers/Wind

TUBE LINE STATUS (TfL) 25

Bakerloo	Good Service
Central	Good Service
Circle	Good Service
District	Good Service
H & C	Good Service
Jubilee	Good Service
Metropolitan	Good Service
Northern	Good Service
Piccadilly	Good Service
Victoria	Good Service
W & C	Good Service
Overground	Good Service
DLR	Good Service

BIKE SHARING (TfL) 85



ON THE STREETS NOW (TfL) 25

422 Underground trains

AIR POLLUTION (DEFRA) 1795

1 = Low 10 = V High

	Ozone	NO ₂	SO ₂	PM _{2.5}	PM ₁₀
Bloomsbury	2	1	1	1	1
Marylebone Rd	n/a	n/a	n/a	2	2
N Kensington	2	1	1	1	1

RADS (CASA) 0

CASA Office Desk
9 cpm (uncalibrated)

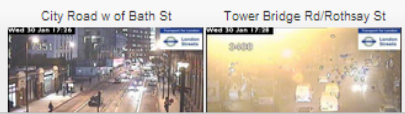
RIVER LEVEL (PLA) 295

Thames (Tower Pier)
5.81 metres

STOCKS (YAHOO) 10

FTSE 100 Index
6323.11
-16.08 (-0.25%)

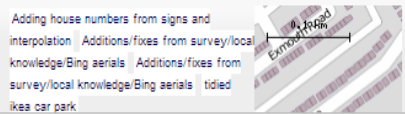
RANDOM TRAFFIC CAMERAS (TfL) 15



BBC LONDON NEWS (BBC) 95



OPENSTREETMAP UPDATES (OSM) 295



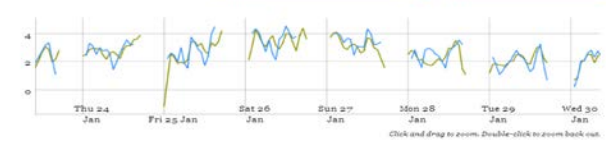
where are we happy?

These are the places where mappiness users have most recently reported feeling happy.



when are we happy?

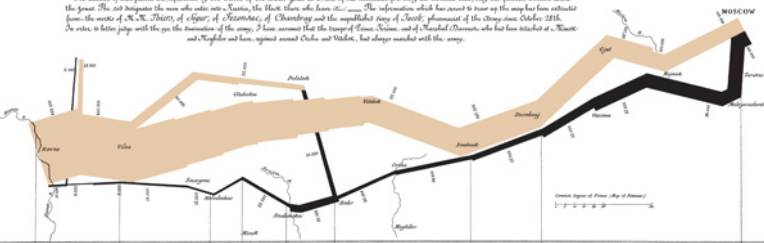
The hedonimeters on the right display mappiness users' happiness in real-time, compared against the all-time average. Below, happiness levels are charted hour by hour over the past week.



Figurative Map of the successive Lines in view of the French Army in the RUSSIAN Campaign 1812-1813.

Drawn up by G. N. KRAMER, Inspector General of Bridges and Roads in retirement. Paris, November 26, 1849.

The number of men present was represented by the width of the colored zones at a rate of one millimetre for every ten thousand men. They are further written across the zones. The red designates the men who enter into Russia, the blue those who leave it; and the information which has served to trace up the way has been extracted from the works of G. N. PLOTTZ, History of Affairs of Alexander, and the unpublished diary of Genl. Goussier of the Army from October 1812. In order to better judge with the eye the destination of the army, I have assumed that the troops of Genl. Suvorov, and of Marshal Olsouffiev, who had been detached at a "Rouss" and "Kouss" had been, against Orlow and Vukobrat, but always marched with the army.



GRAPHIC TABLE of the temperature in degrees of the Réaumur thermometer below zero.

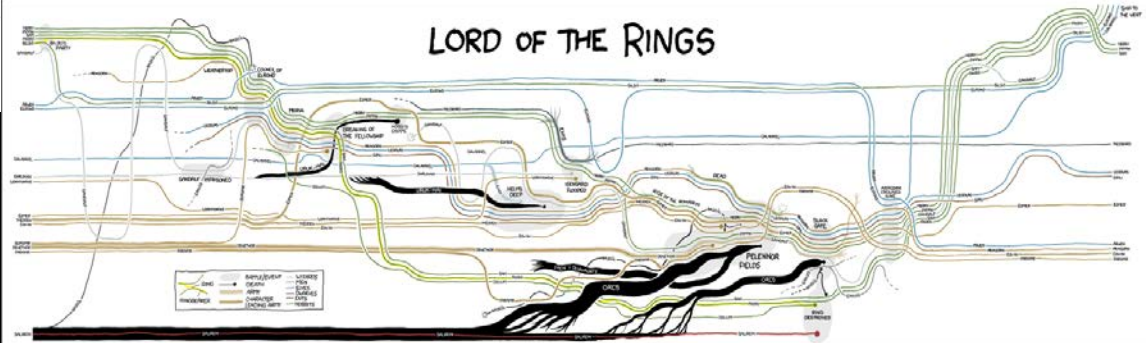
The distance from the French border to a village.



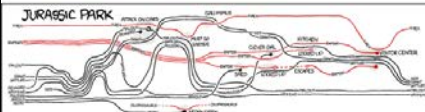
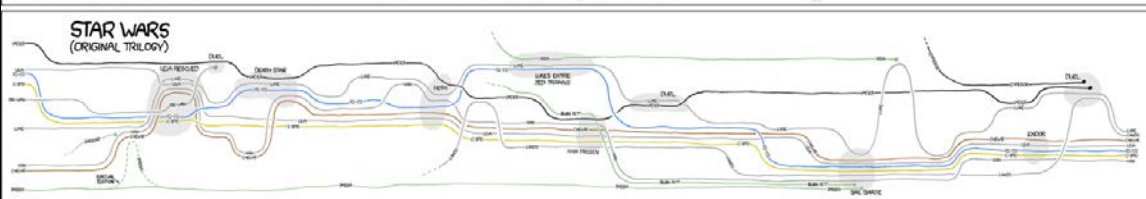
Traditional mapping?

THESE CHARTS SHOW MOVIE CHARACTER INTERACTIONS. THE HORIZONTAL AXIS IS TIME. THE VERTICAL GROUPING OF THE LINES INDICATES WHICH CHARACTERS ARE TOGETHER AT A GIVEN TIME.

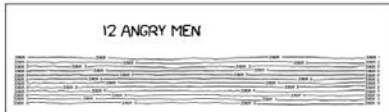
LORD OF THE RINGS



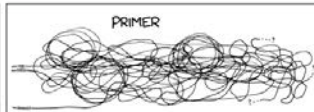
STAR WARS (ORIGINAL TRILOGY)



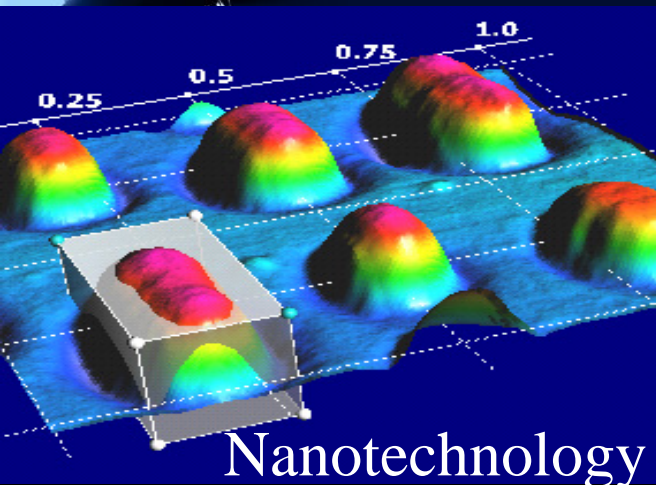
12 ANGRY MEN



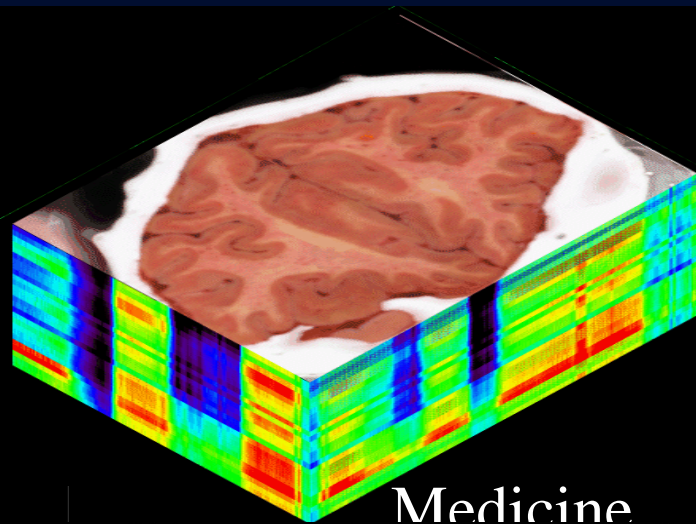
PRIMER



Spatial Analysis



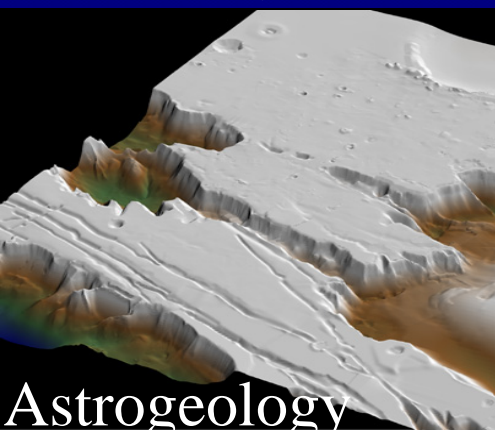
Nanotechnology



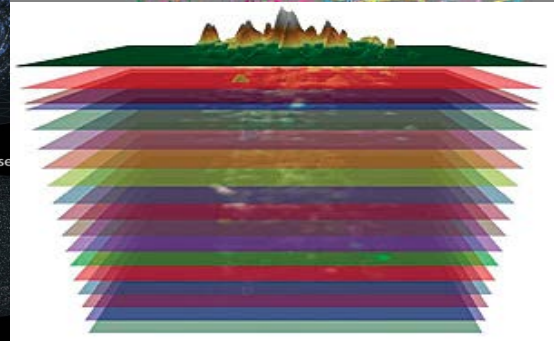
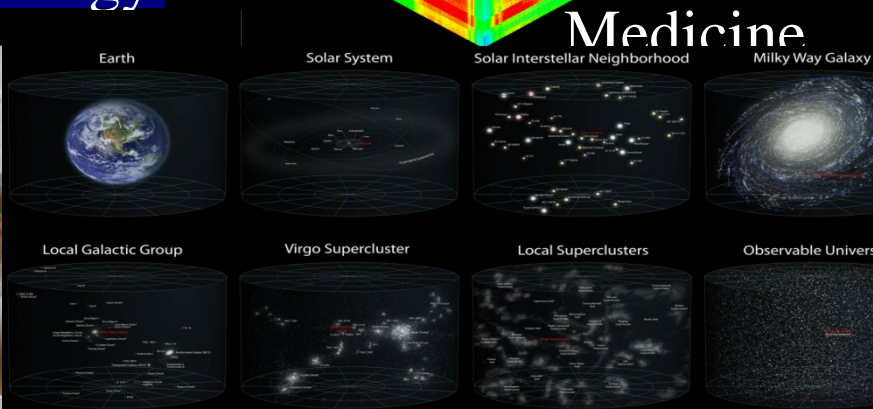
Medicine



Dance



Astrogeology



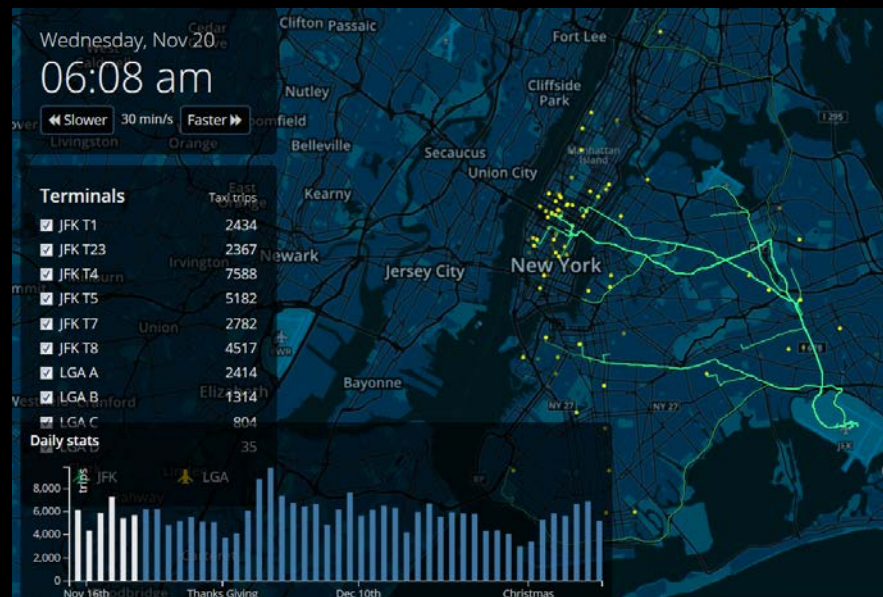
Mapping...Time

Live Cyber Attack Dashboar - Norse



<http://map.norsecorp.com/>

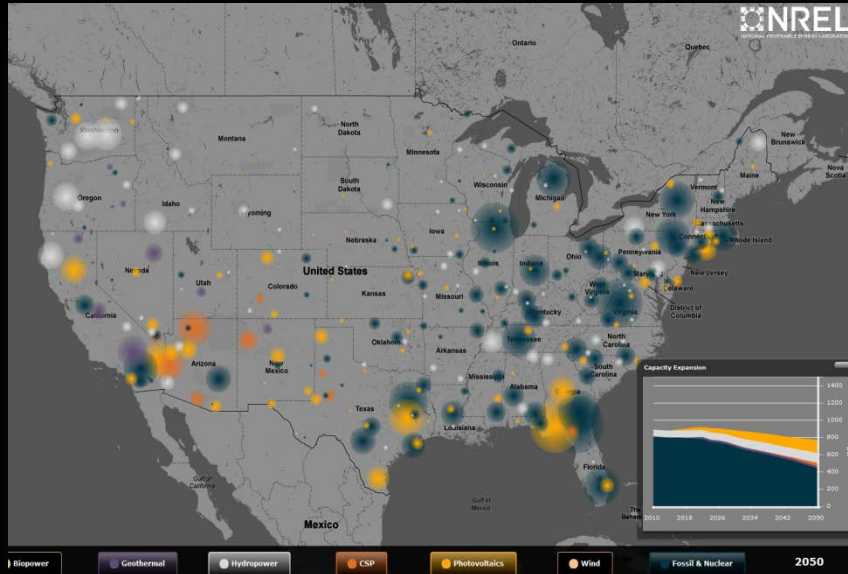
NYC Taxi Holiday Visualization



<http://taxi.imagework.com/>

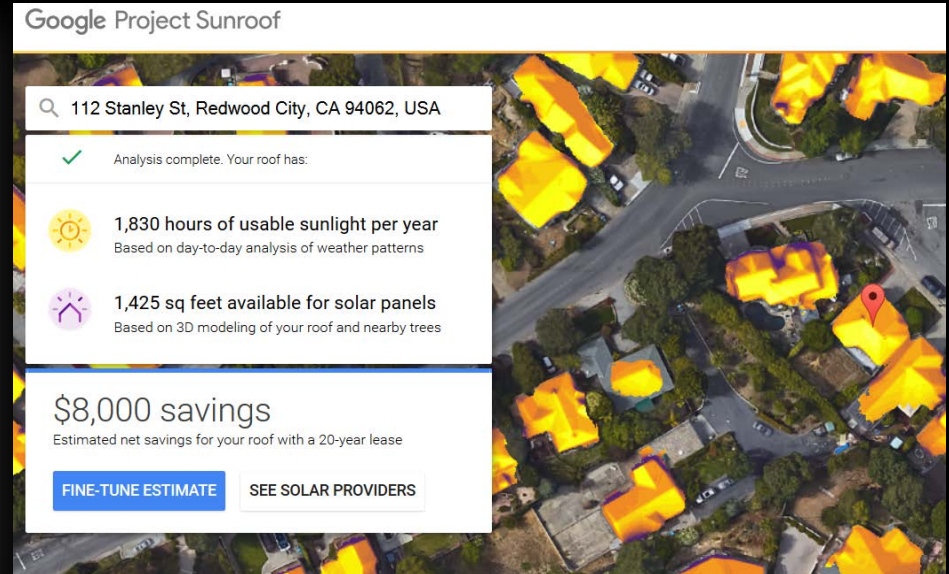
Mapping...Energy

Capacity Expansion by Technology - NREL



<http://rpm.nrel.gov/refhighre/expansion/expansion.html>

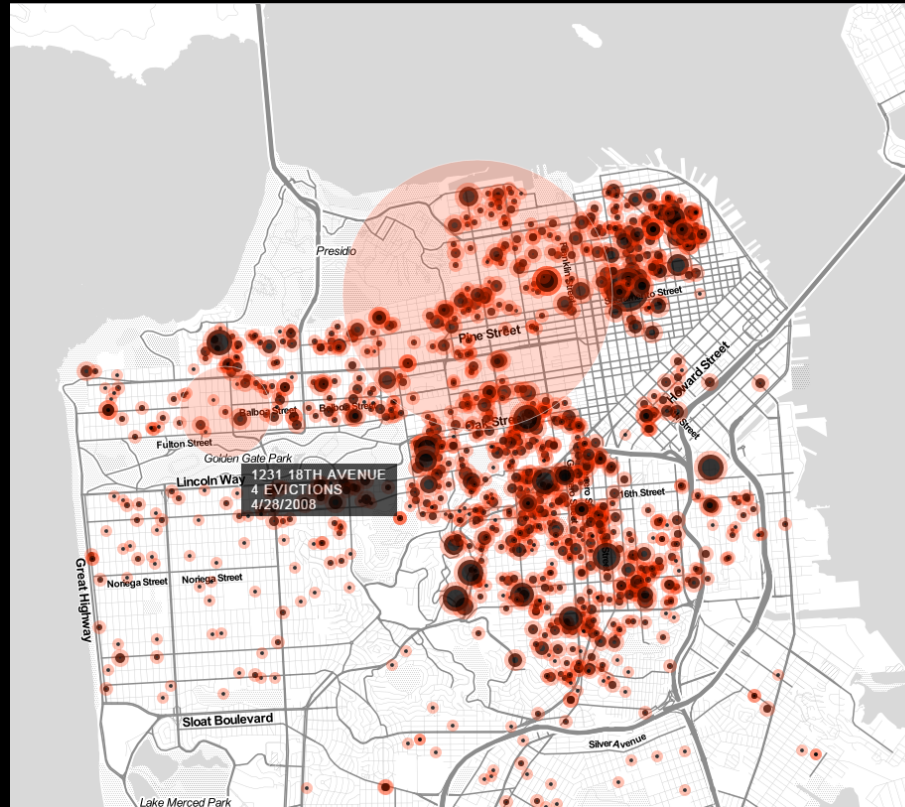
Google Project Sunroof



<https://www.google.com/get/sunroof>

Social Issues

Anti-eviction
Mapping
Project
<http://www.anti-eviction-map.com/>



THE ELLIS ACT 3115

SAN FRANCISCO FAMILIES FORCED OUT OF THEIR HOMES.

1/1/1997 - 8/13/2008



The Ellis Act is a state law which says that landlords have the right to evict tenants in order to "go out of business". All units in the building must be cleared of all tenants- no one can be singled out. Most often it is used to convert to condos or group-owned tenancy-in-common flats. Once a building becomes a condo it is exempt from Rent Control, regardless of the age of the building, and even if a unit owner subsequently rents to a long-term tenant.

There is no limit to the number of times a building owner can "go out of business". Rent Board data shows some owners buying and Ellis-ing multiple buildings over time. If these buyers do not want to be landlords, why are they buying buildings full of rental units? These Ellis-ed buildings - now "out of business"- are also showing up for rent as illegal vacation rentals on sites like AirBNB and VRBO.





With landlords looking for ways to avoid renting to long-term tenants, the housing crisis in San Francisco will only be exacerbated. See our [chart of no-fault evictions here](#).

If you have been evicted, please fill out our [survey](#) to add your story to a comprehensive map in the making!

You can submit your story to our crowdsourced [Map of Loss and Displacement here](#)

Also, please take our [pledge to boycott renting or buying from a landlord who has profited by displacing tenants here!](#) You can also look up an address to determine its [eviction history](#).

Public Health

A story map by Ben Martin and Da...    

Topography of Diabetes in the Carolinas

In this interactive Map Journal of North and South Carolina, we can observe the relationships between the potential factors of diabetes with its prevalence in a new and exciting way.

Did You Say Diabeetus?

Did you know diabetes is the 7th leading cause of death in the United States? How about that 9.3% of our population is diagnosed with this disease? That's *29.1 million* people. Well if that many people have it, can't be that serious, right?

Wrong. Diabetes doesn't have a cure. Therefore, only altering one's normal lifestyle plus a little medicinal aid can help those with diabetes live a fairly normal life. These maps are a visual aid in showing what factors may lead to or worsen diabetes. They specifically show the correlation between factors in the states of North and South Carolina.

CHN Diabetes Fact Facts

<http://www.cnp.com/2013/07/11/health/diabetes-fact-facts/index.html>



bit.ly/gishealth

Where are we?

Need Gas?

Scholars Organizing Culturally Innovative Opportunities

IMSOCIO
Franklin High School, Somersat, NJ
<http://www.imsocio.org>

Find a

Map Satellite Hybrid Terrain

DESCRIPTION

IMSOCIO Contact
<http://www.imsocio.org>
USDOE Call Center: 866-402-3775
E-mail: imsociofhs@gmail.com
Twitter: <http://www.twitter.com/imsocio2012>
Facebook: <http://www.facebook.com/groups/indgasstations>

Please send texts to: 732 993 8505

CATEGORY

- Open
- Sold Out
- Charging Station
- No Power
- No Power with GAS
- Unknown

Recent feedback from Google Crisis map

- open
- closed
- unknown

Credit: imsocio.org

Zoom to area

Legend

12-23 dBZ

64+ dBZ

Source: Weather.com
Last updated: 11:44 AM (25 minutes ago)

Pharmacies, restaurants, hotels

Gas stations

Mapper gas station status

Zoom to area

Legend

- Open
- Sold out
- Charging Station
- No power
- No power with gas
- Unknown

Crowd-sourced mapping of gas station status. Source: mapper.info and IMSOCIO

Hess fuel inventory

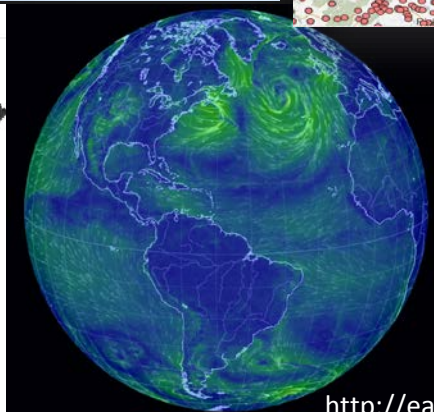
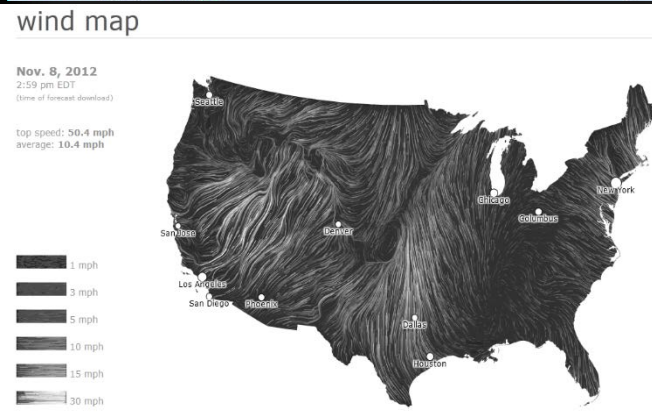
Zoom to area

Legend

- Stations reporting over 7,000 gallons
- Stations below 5,000 gallons (likely to run out within 2 hours)
- Stations near or below 2,000 gallons (almost out of stock)

IMPORTANT: It is not possible to predict the rate at which inventories change. Click a site to see more details.

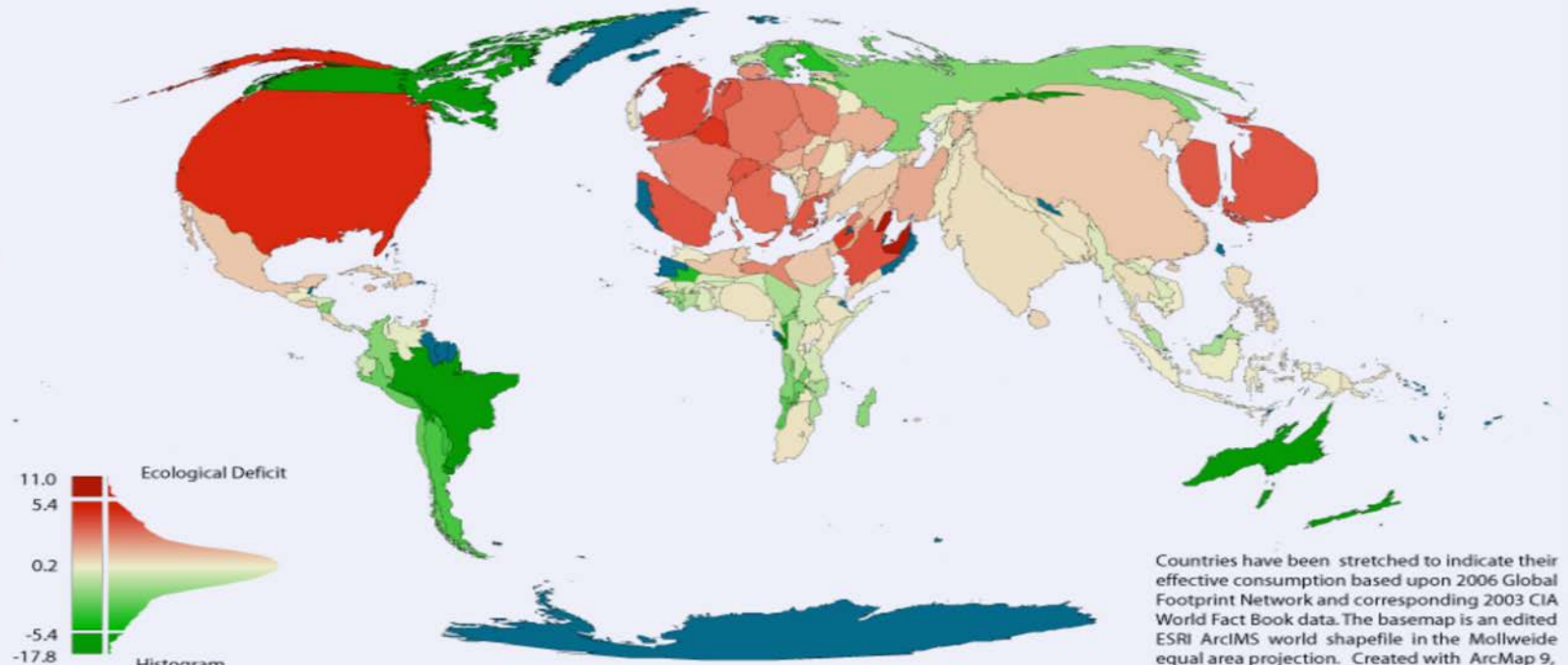
©2012 Google - Map data ©2012 Google - Terms of Use



MAP CROWD-SOURCING

<http://earth.nullschool.net/>

Cartograms – part II



2003 World Consumption Cartogram

<http://pthbb.org/natural/footprint/>

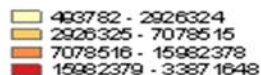
Countries have been stretched to indicate their effective consumption based upon 2006 Global Footprint Network and corresponding 2003 CIA World Fact Book data. The basemap is an edited ESRI ArcIMS world shapefile in the Mollweide equal area projection. Created with ArcMap 9, MAPress 1.3, OpenOffice 2.2 & Perl 5.8

© Jerrad Pierce 2007-11-19 <jpierce@cpan.org>

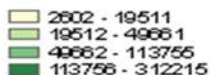
Cartograms – part III

US 2000 Ethnic Diversity Cartograms

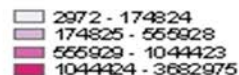
Total Population



Amer Indian or Alaskan



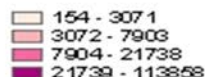
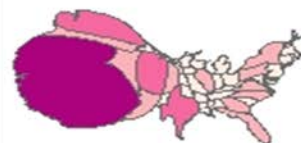
Asian



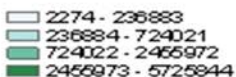
Black or African



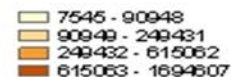
Hawaiian or Pacific Islander



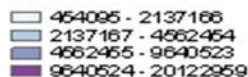
Other Race



Two or More Races



White

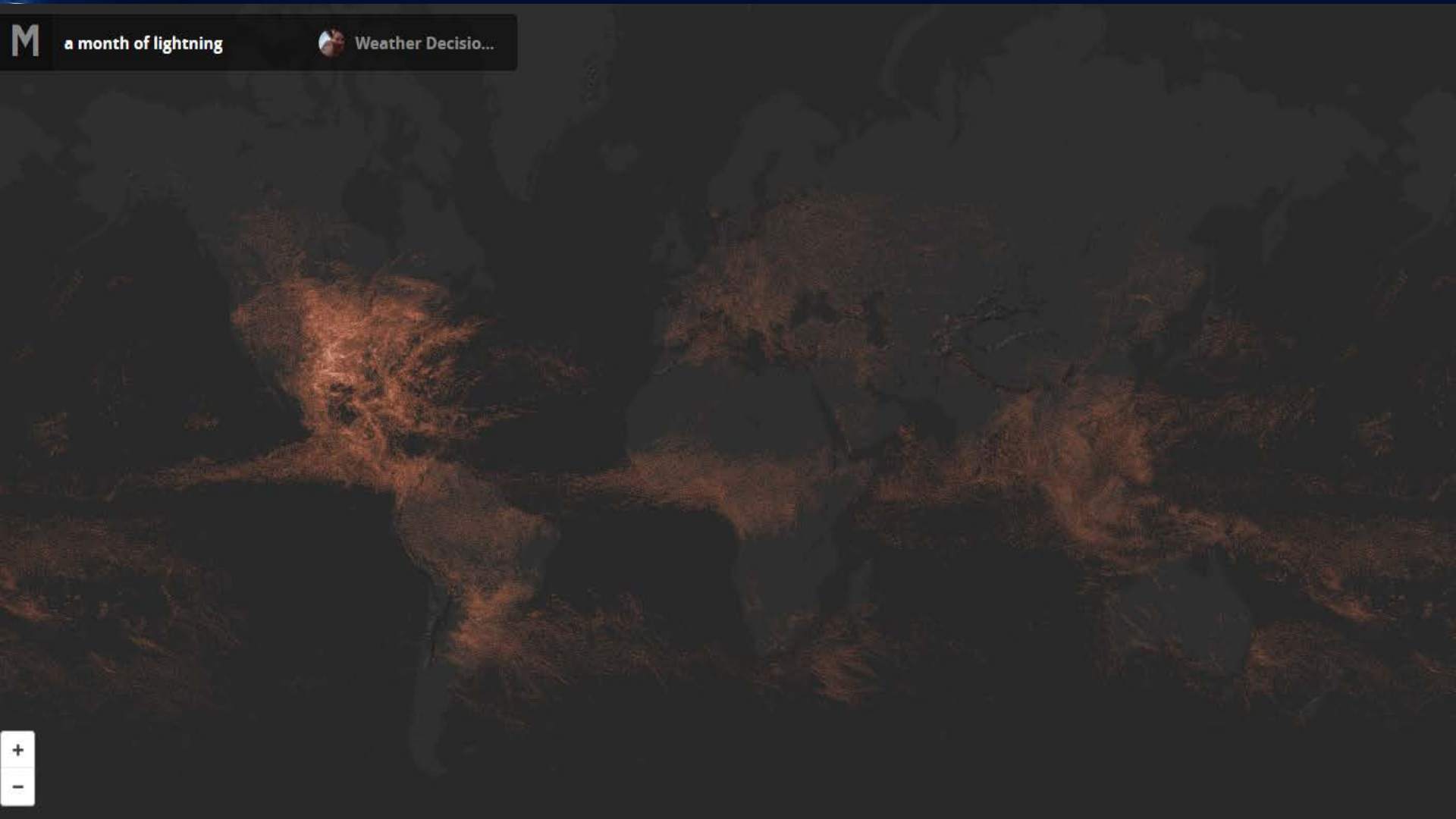




a month of lightning



Weather Decisio...

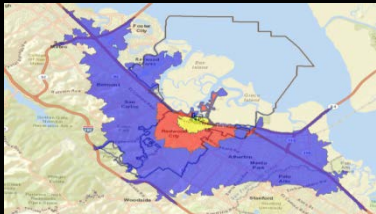


Spatial Statistics in GIS

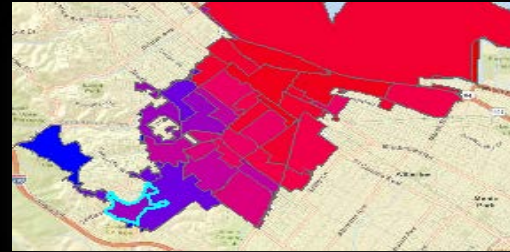
Spatial statistics:

“Spatial statistics is the collection of statistical methods in which spatial locations play an explicit role in the analysis of data (Ribeiro and Diggle, 2001)”

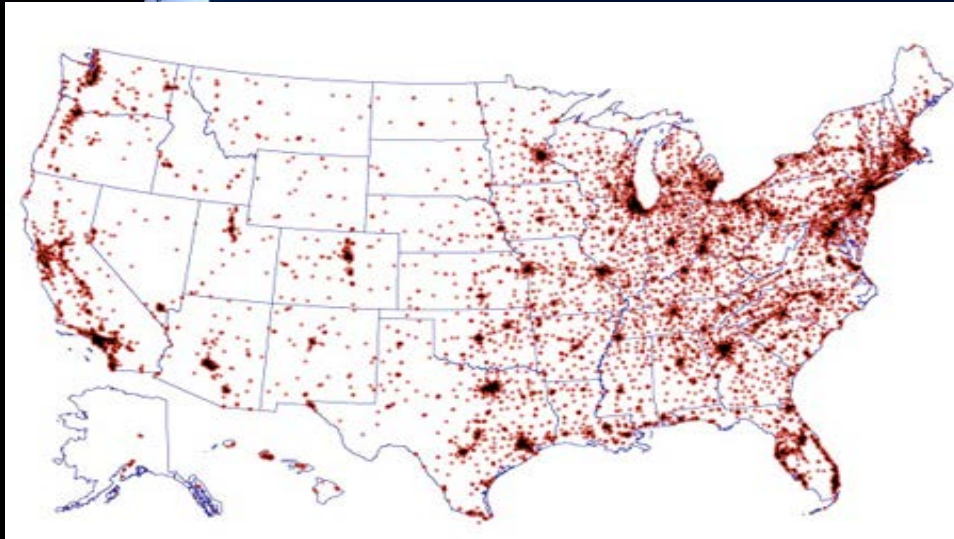
Incorporate space (area, length, proximity, orientation, and/or spatial relationships)
directly into their mathematics



Spatial statistics extend what the eyes and mind do naturally to assess spatial patterns, trends and relationships.



Why use spatial statistics?



How we present our results in a map:

- Colors
- Class Breaks
- Symbols Style & Size

Can either enhance or obscure communication

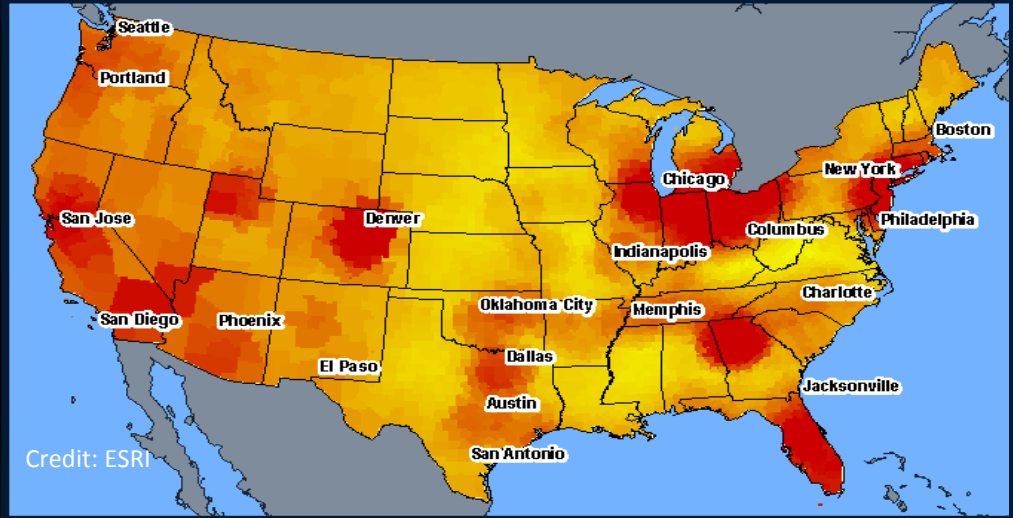
To Assess:

Patterns

Relationships

Trends

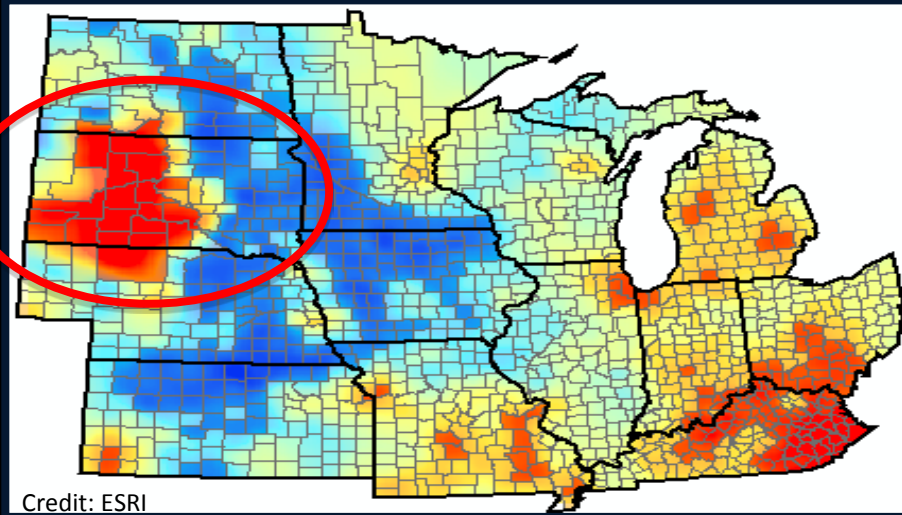
What kind of questions can you answer?



Where are gang territories overlapping in our city?

Where are hot spots of foreclosures in the U.S.?

What kind of questions can you answer?

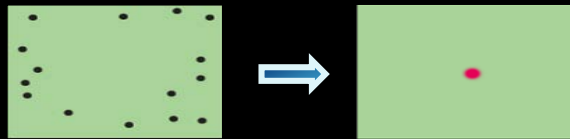


- Recognize **patterns** and **trends**
- Identify **outliers** and **anomalies**
- Visualize **relationships**, **proximity**, **connectivity**
- **Interpolate** and **extrapolate**

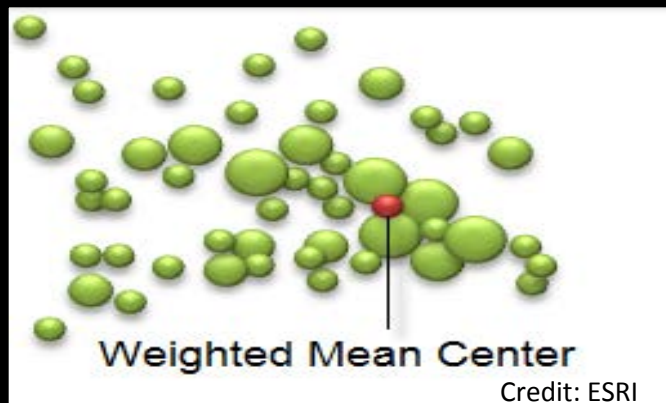
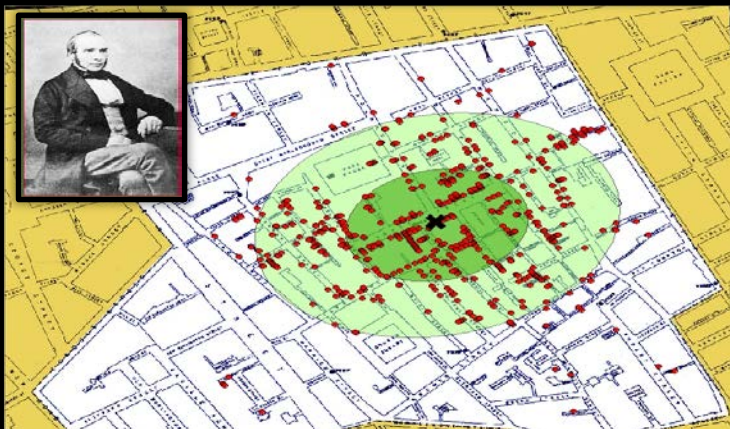
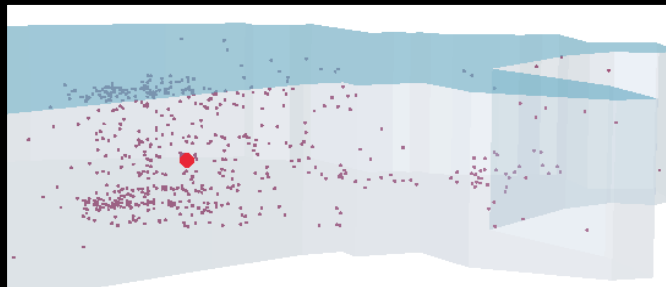
Why are people dying young in South Dakota?

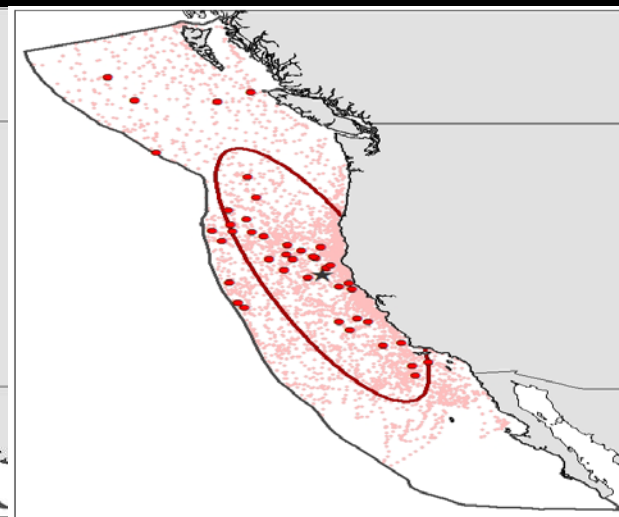
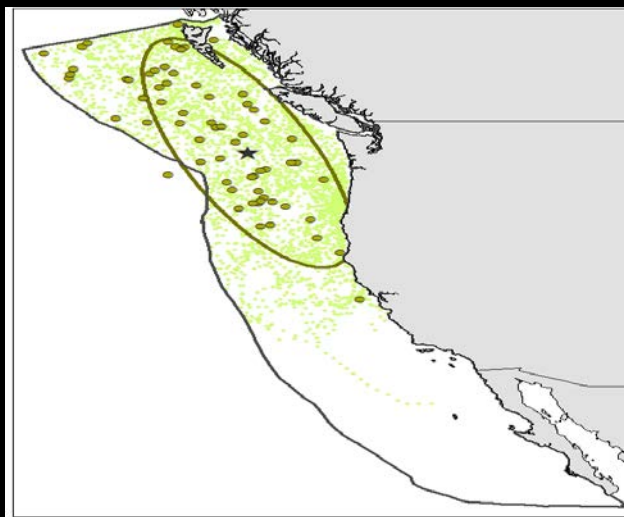
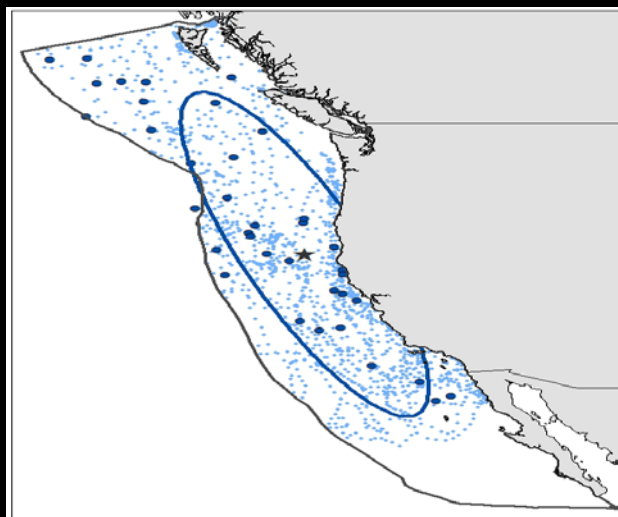
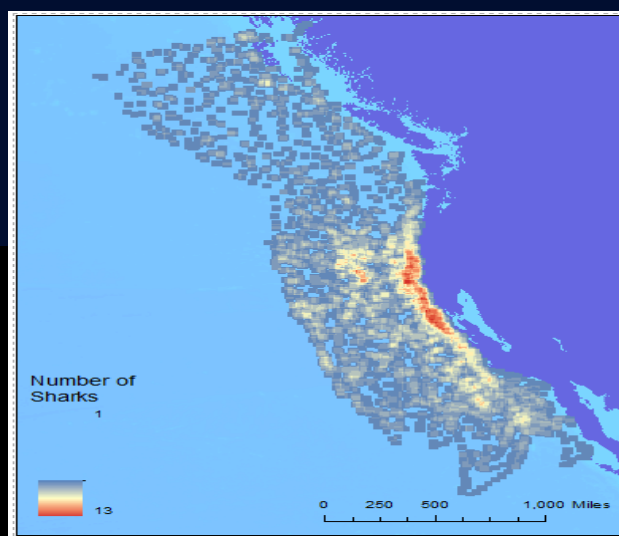
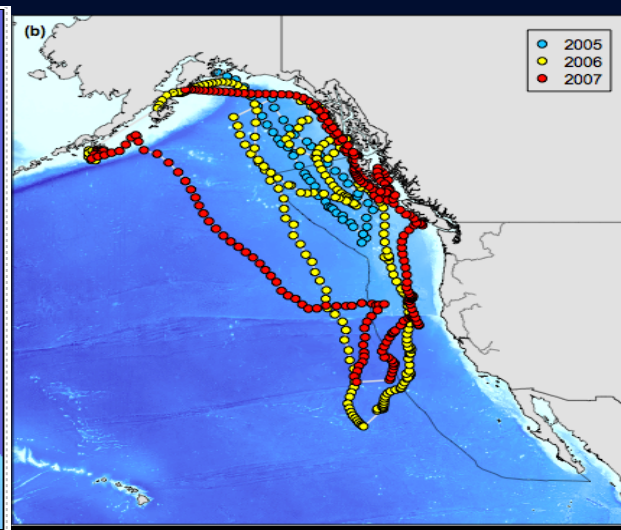
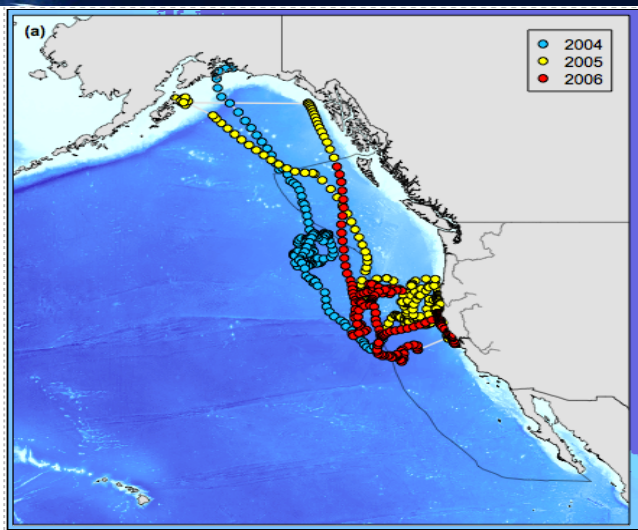
Measuring Geographic Distribution: Finding the Center

The **Mean Center** tool computes the average x and y coordinate, based on all features in the study area

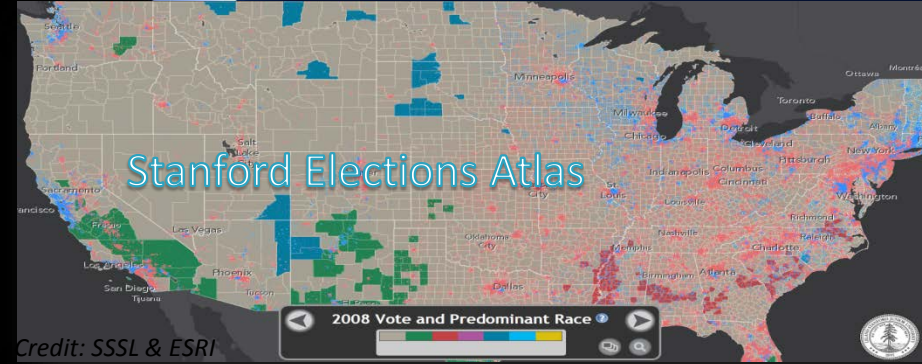


$$\bar{X} = \frac{\sum_{i=1}^n x_i}{n}, \quad \bar{Y} = \frac{\sum_{i=1}^n y_i}{n}$$

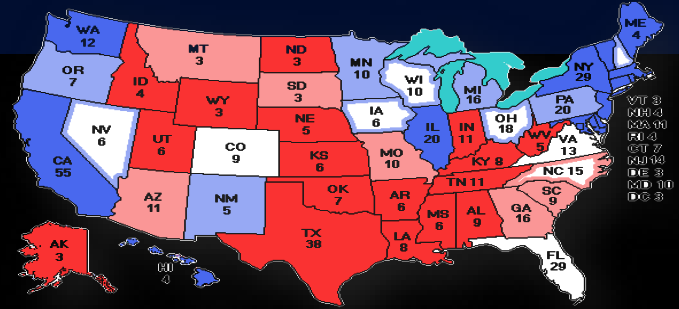




The Geography of the Elections



Mash up Version



NYT Infographics

Most of the nation shifted to the right in Tuesday's vote, but not far enough to secure a win for Mitt Romney.

In 2008, Barack Obama drew increased support from nearly every demographic category, and most of the nation shifted to the left.

Credit: New York Times

Thank you!

