Intro to GIS!

Maptime September 2017

What we're about:

Teaching and Learning Together

Free and Open Source Geo

Fun and Networking

Follow us:

Meetup: meetup.com/MaptimeSEA

Twitter: @MaptimeSEA

Website: maptimesea.github.io

<u>Let us know if you want to:</u>

Learn something

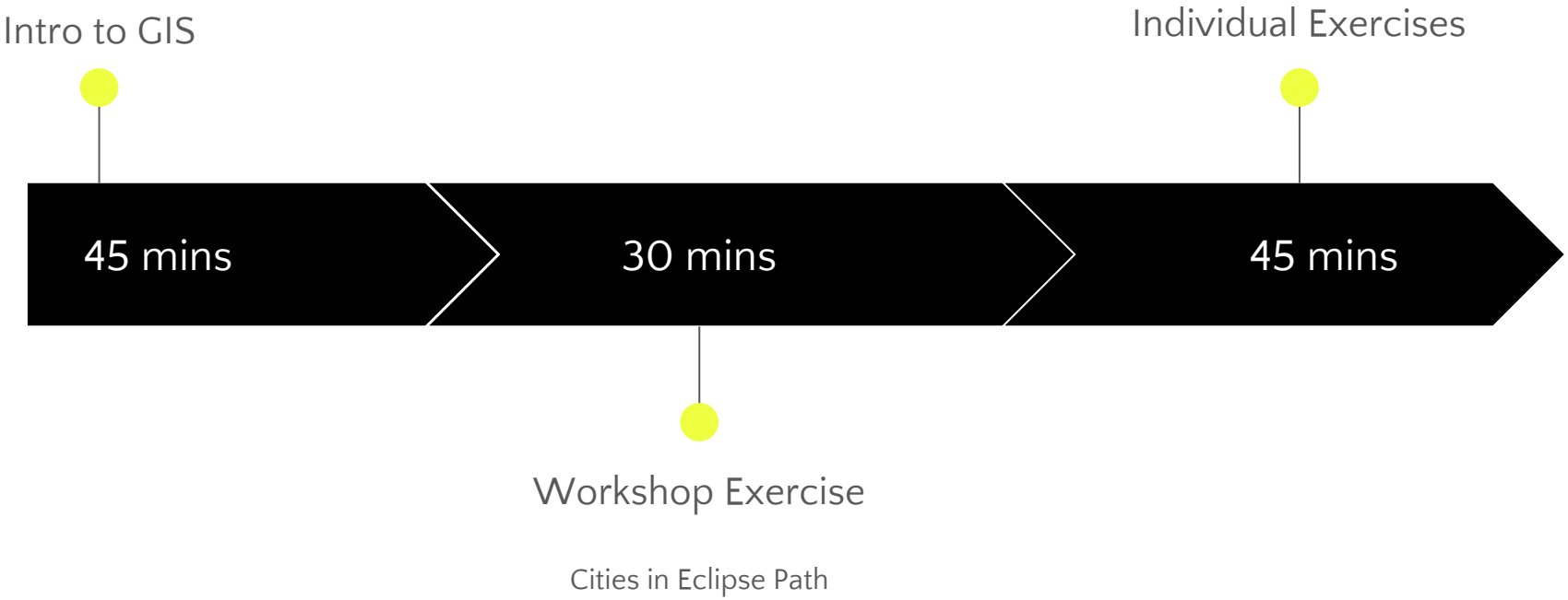
Teach something

Sponsor us somehow

Workshop Objectives

- Intro to Maps, GIS, and more!
- Learn basics of how to import, visualize, and manipulate vector data to achieve your analysis goals
- Go through a workflow together

Workshop Timeline

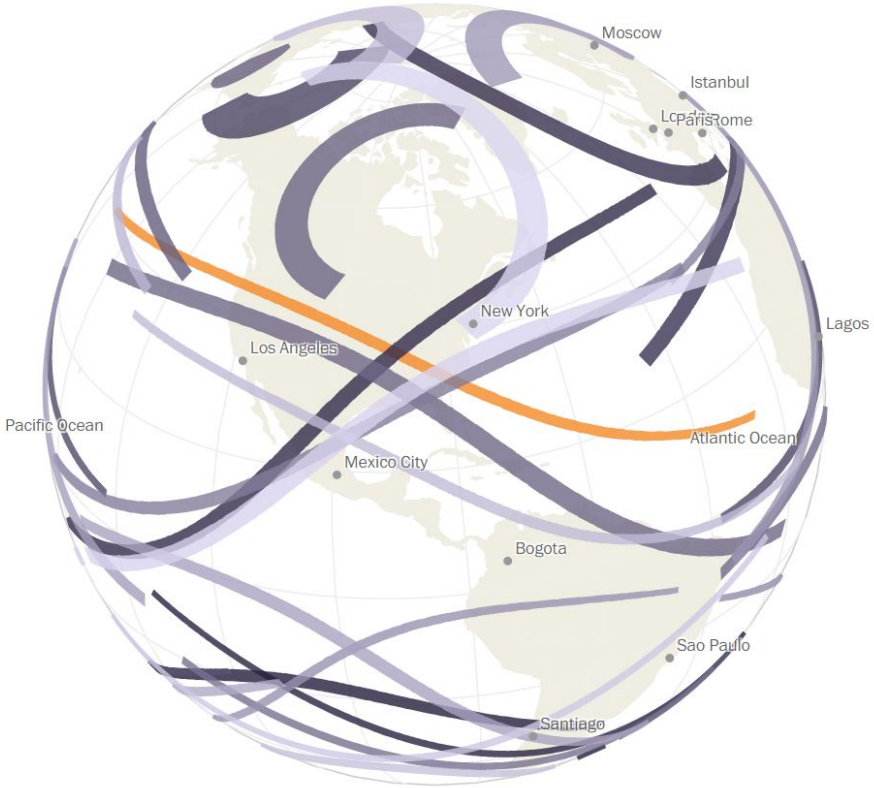


Let’s Talk About Maps

Maps are Useful

https://washington-org.s3.amazonaws.com/s3fs-public/styles/editorial_wide/public/wmata-metro-map.jpg

Maps are Cool

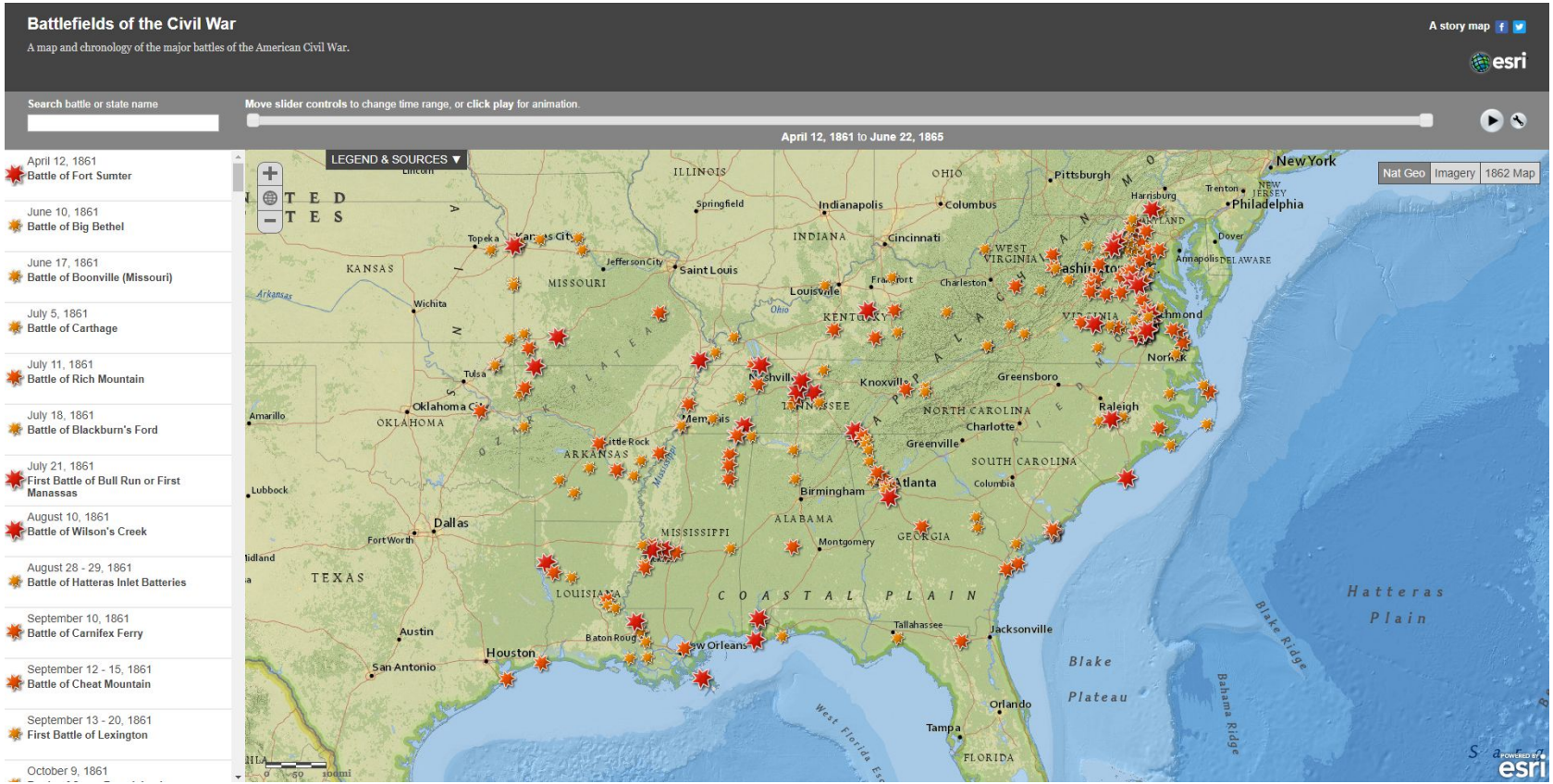


https://www.washingtonpost.com/graphics/national/eclipse/?utm_term=.d2cc157c8de0

Maps are Beautiful

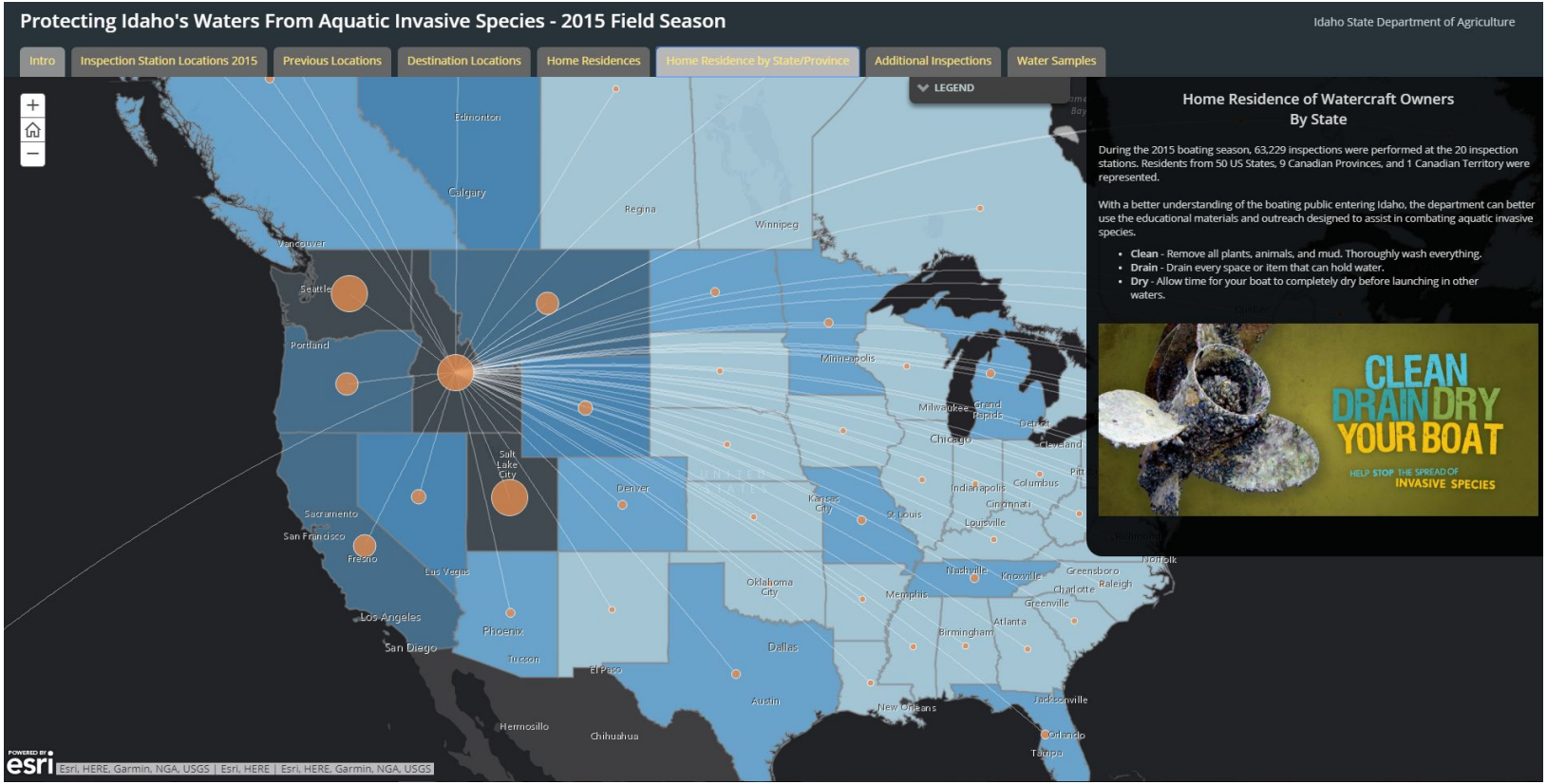
http://1.bp.blogspot.com/-zgKh_iUR1lI/UNJRIdDbZaI/AAAAAAAAIlY/GfBxUOZ3Rd0/s1600/Matthew-Cusick_trendland_2-600x436.jpg

Maps Tell a Story



http://storymaps.esri.com/stories/civilwar

Maps Tell a Story



http://idaho.maps.arcgis.com/apps/MapSeries/index.html?appid=17e491a6685f4ad09b20f4ec9763e2f7

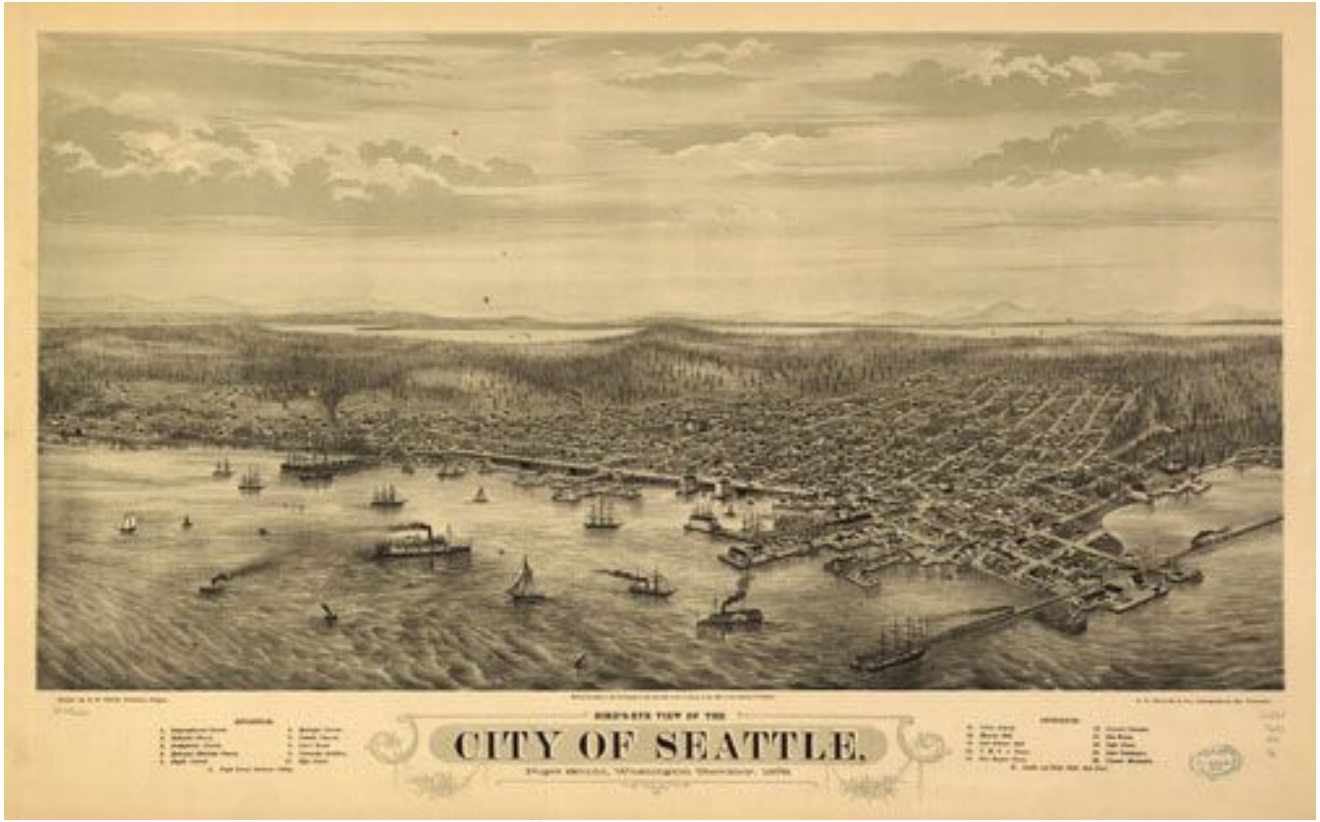
Maps Tell a Story

https://marinesanctuary.maps.arcgis.com/apps/Cascade/index.html?appid=44fde11b2c474fc49799c430e7a4445b

We Use Maps All The Time

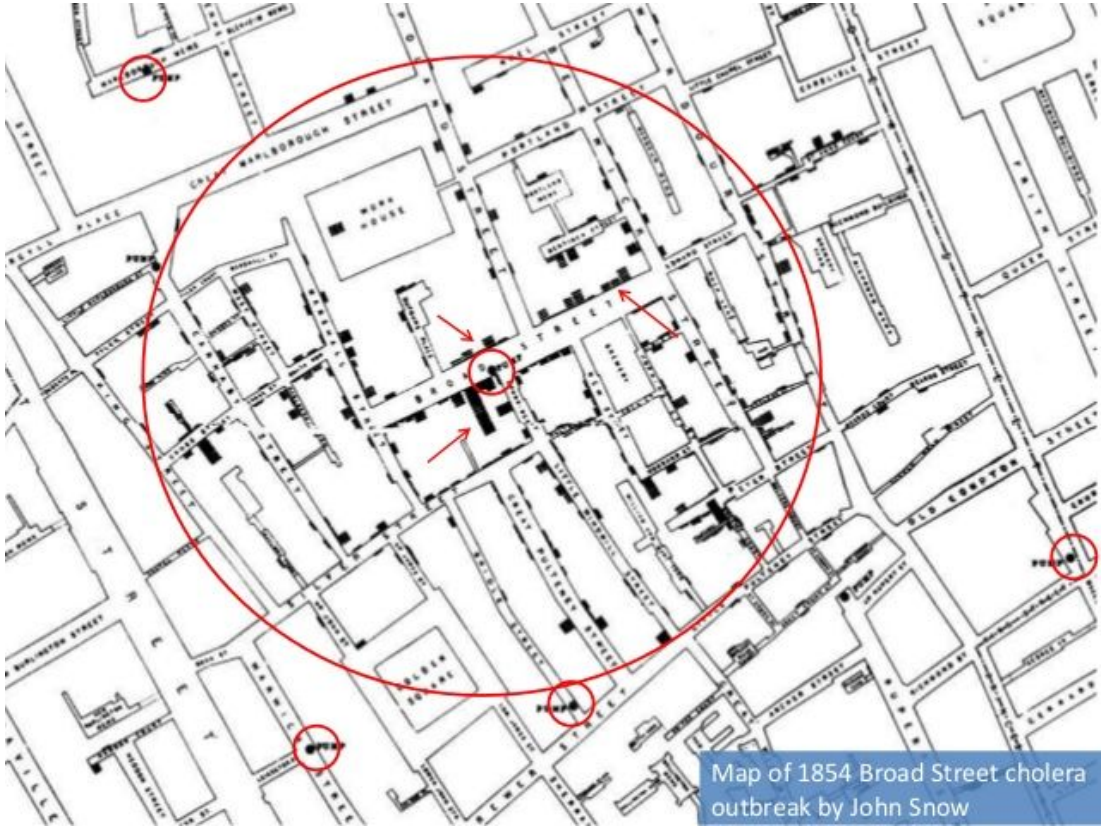
http://cdn-media-1.lifehack.org/wp-content/files/2014/12/Les-multiples-services-de-Waze.png

Maps Have Been Around a While



https://www.worldmapsonline.com/images/1whistoricmaps/1w-wa-se-1878.jpg

Mapping for Problem Solving



Map of 1854 Broad Street cholera outbreak by John Snow

https://image.slidesharecdn.com/130409-financial-networkscrc-130411091407-phpapp02/95/financial-networks-and-cartography-2-638.jpg?cb=1365671703

“Hasn’t Everything Already Been Mapped?”

“Hasn’t Everything Already Been Mapped?”

Not possible

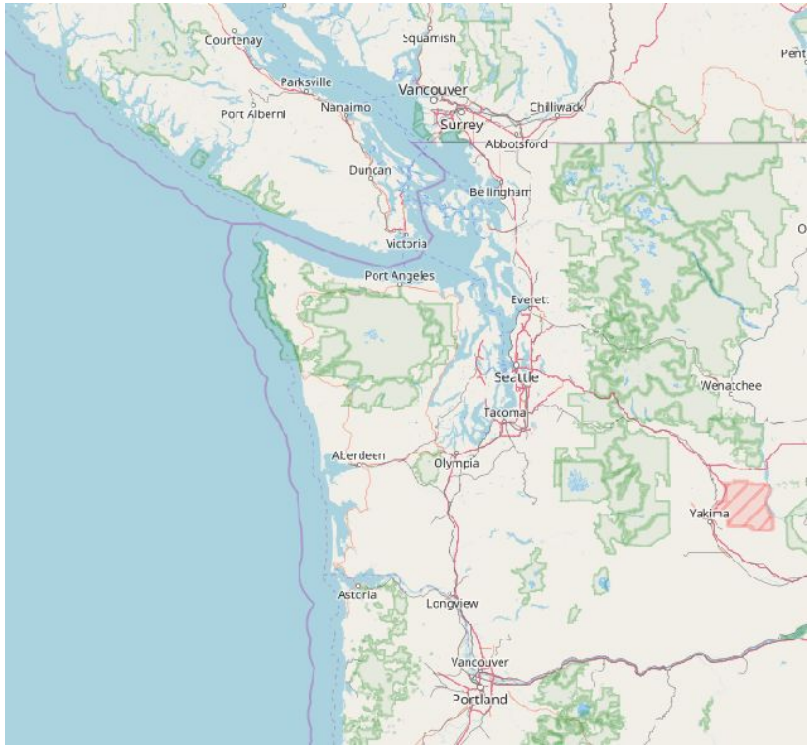
Let's Make a Distinction

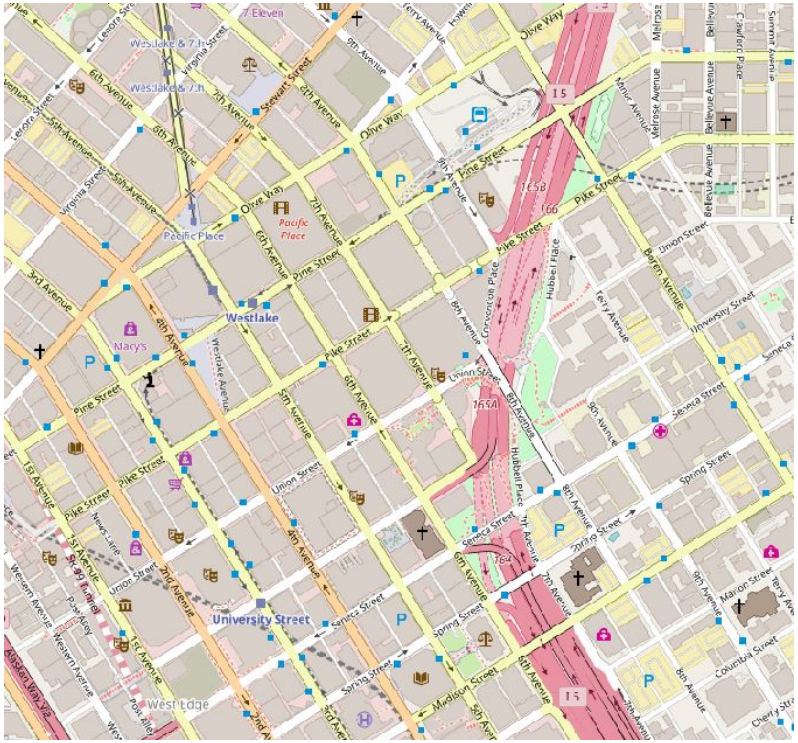
- Base maps - used for reference
- Thematic maps - have a theme

Base Maps

https://www.planet.com/products/basemap

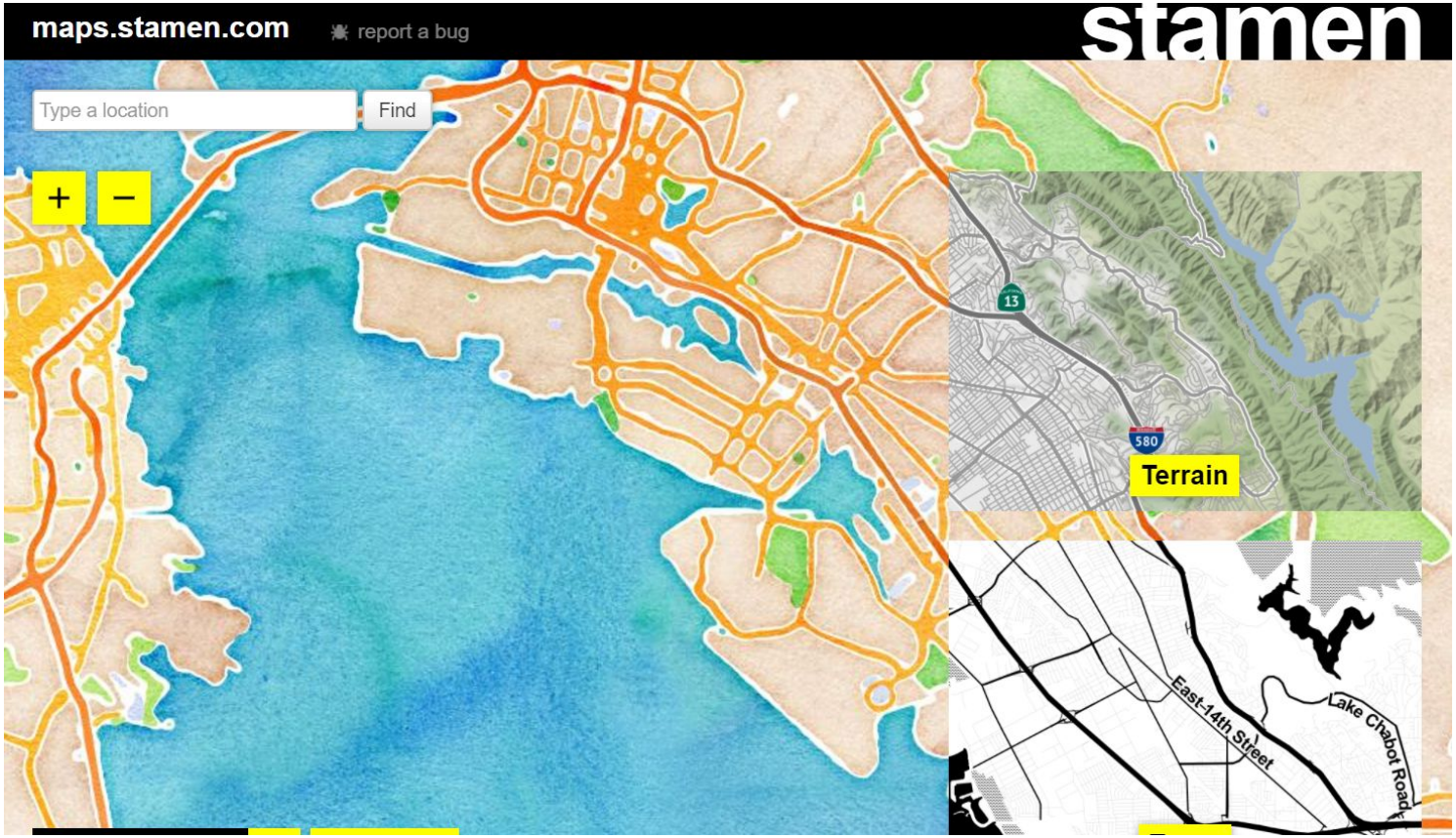
Base Maps





OpenStreetMap + Contributors

Base Maps



http://maps.stamen.com/#watercolor/12/37.7523/-122.2464

Base Maps

- Changes in landscapes and infrastructure

Base Maps

- Changes in landscapes and infrastructure
- Different colors

Base Maps

- Changes in landscapes and infrastructure
- Different colors
- Different scales

Base Maps

- Changes in landscapes and infrastructure
- Different colors
- Different scales
- Different features

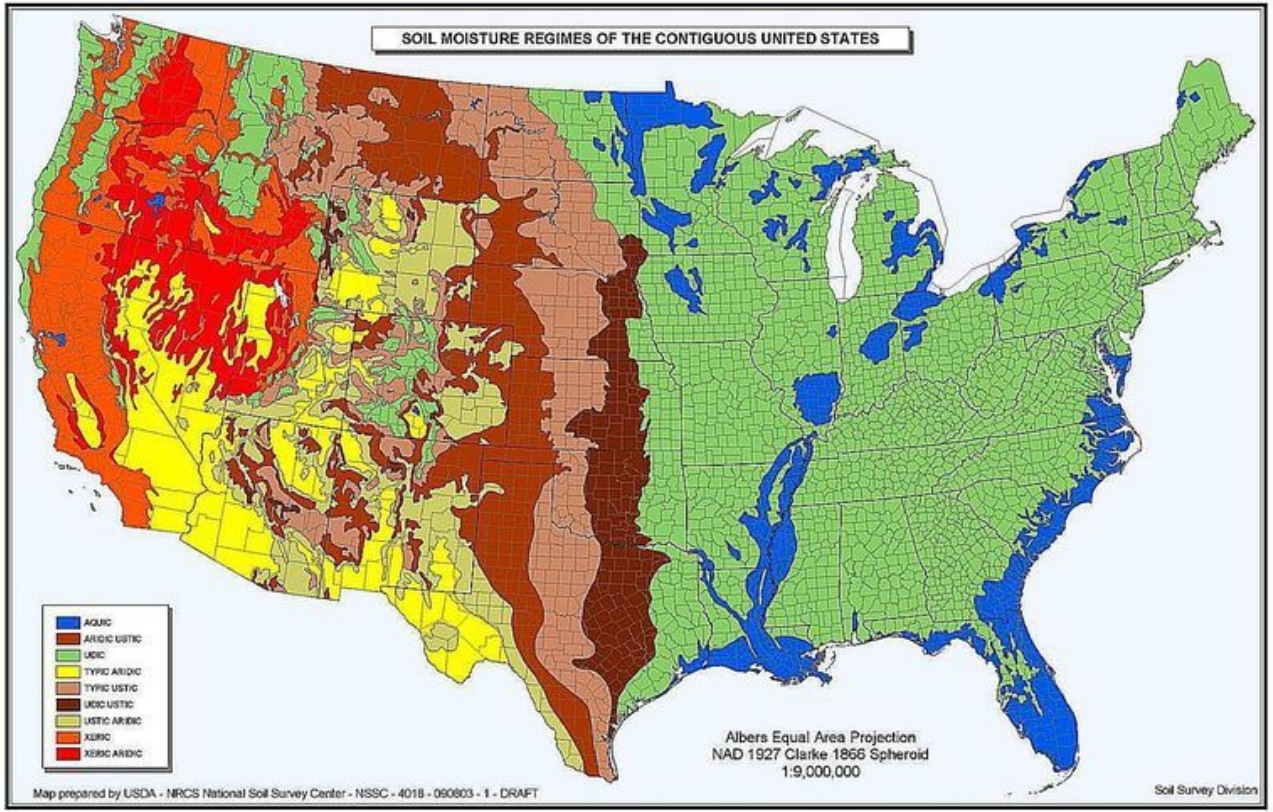
Thematic Maps

- A map with a theme

Thematic Maps

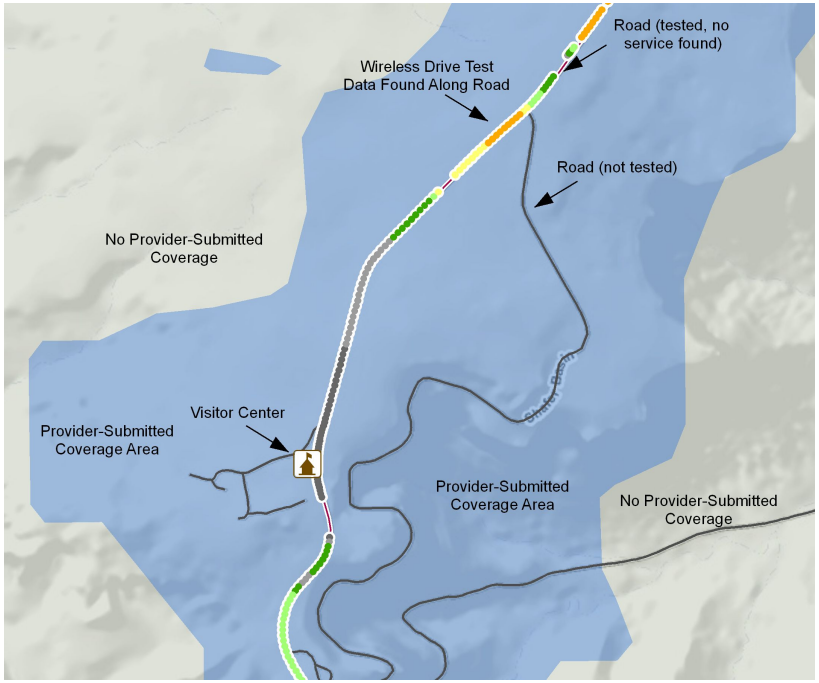
- A map with a theme
- The theme is *there*, but would not be seen from above

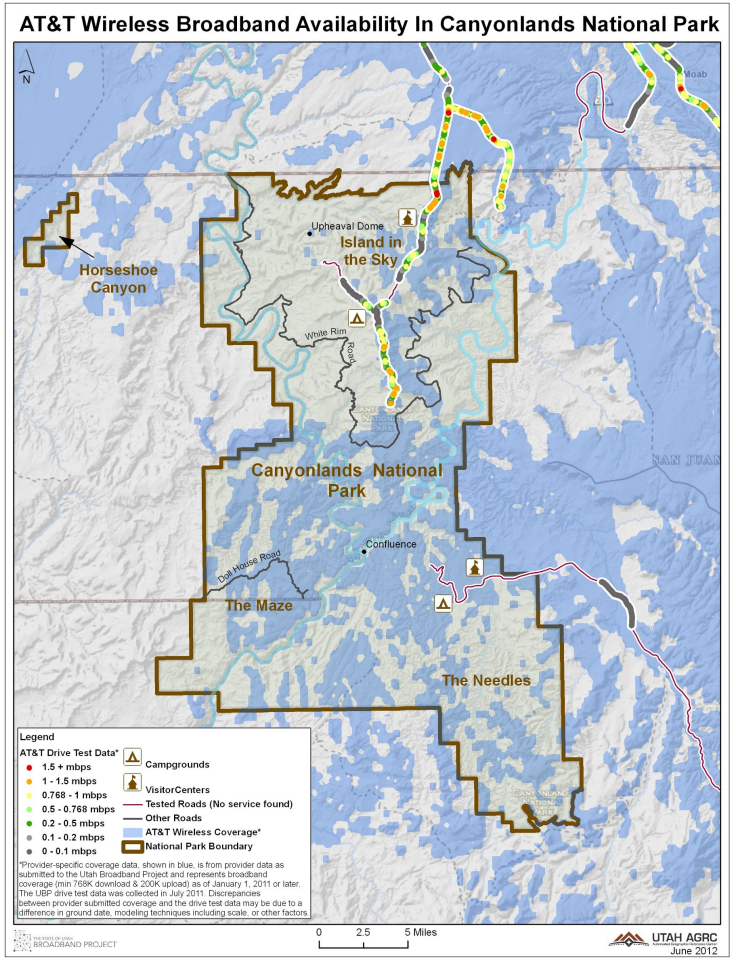
Thematic Maps



https://www.thoughtco.com/thematic-maps-overview-1435692

Thematic Maps





https://broadband.utah.gov/wp-content/uploads/2013/02/zion1.pdf

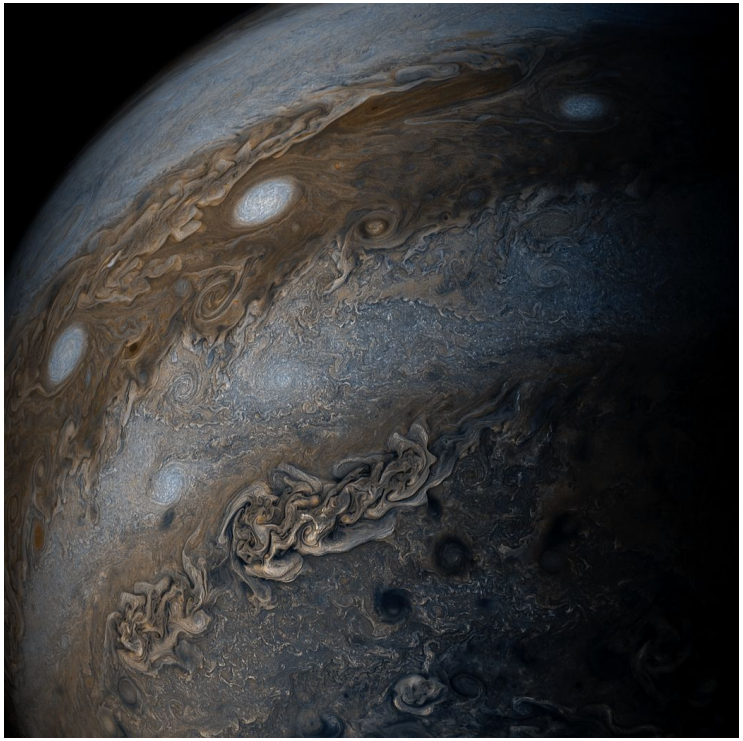
Thematic Maps

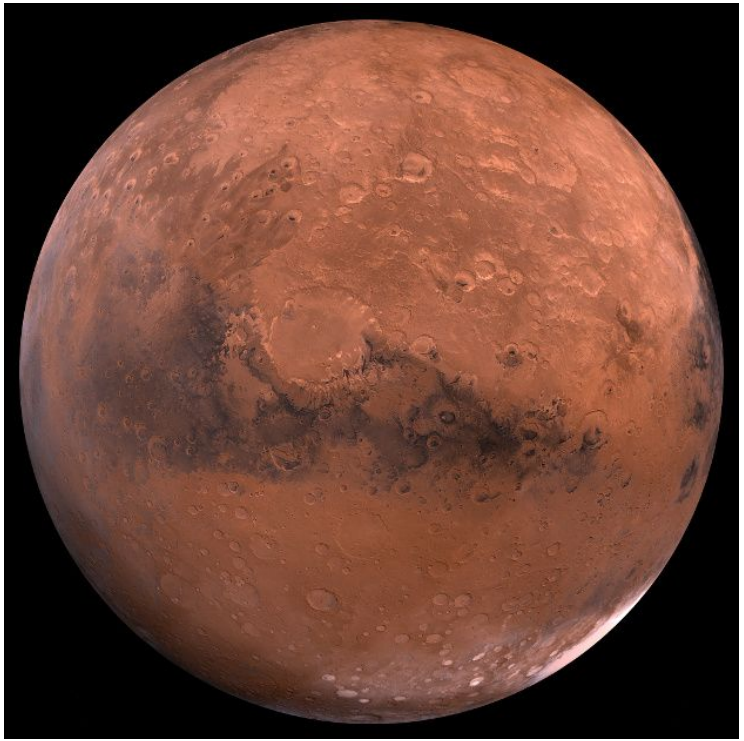
- Infinite themes to be mapped and spatial questions to ask

Thematic Maps

- Infinite themes to be mapped and spatial questions to ask
- We make maps with GIS

Non-Earth Maps





https://www.nasa.gov/image-feature/jpl/pia21334/saturnian-dawn
http://space-facts.com/wp-content/uploads/mars.jpg

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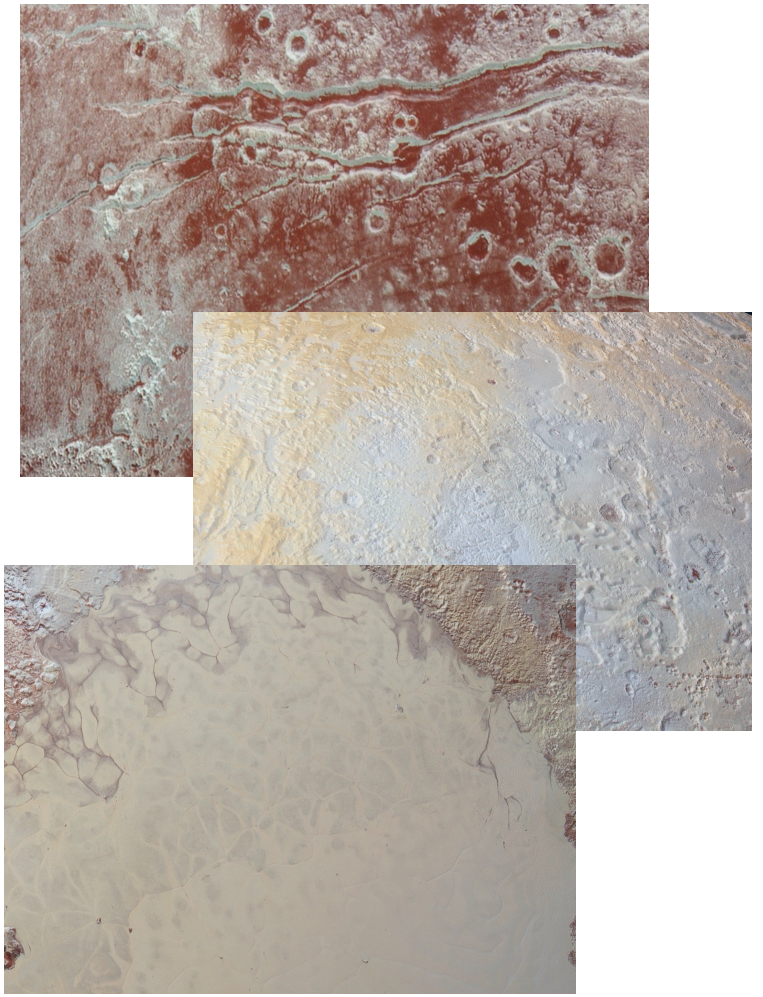

https://www.nasa.gov/image-feature/jpl/pia21334/saturnian-dawn
http://space-facts.com/wp-content/uploads/mars.jpg

Non-Earth Maps

http://ksassets.timeincuk.net/wp/uploads/sites/55/2017/07/Game-of-Thrones-opening-sequence-Winterfell-920x584.jpg
https://www.polygon.com/2016/7/4/12093570/game-of-thrones-map-westeros

Non-Earth Maps

https://vignette3.wikia.nocookie.net/lotr/images/7/72/Middleearthmap.jpg/revision/latest?cb=20100402045252

What is GIS?

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- A system that allows you to visualize, question, analyze, and interpret data to understand spatial relationships, patterns, and trends.

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- GIS is widely used in organizations of all sizes and in almost every industry.
- A mix of data, science, analysis, and maps.

We Use GIS to Answer Where Questions

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- Where is the zoo and how do we get there?

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- ...

What Makes Up a GIS?

G

I

S

What Makes Up a GIS?

Geographic

Information

System

What Makes Up a GIS?

Geographic - Spatial

Information

System

What Makes Up a GIS?

Geographic - Spatial

Information - Attributes

System

What Makes Up a GIS?

Geographic - Spatial

Information - Attributes

System - All the moving parts

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Geographic - Spatial

Information - Attributes

System - All the moving parts

A system that allows you to store, process, and visualize information with a spatial component.

What Makes Up a GIS?

- People
- Methods
- Data
- Software
- Hardware

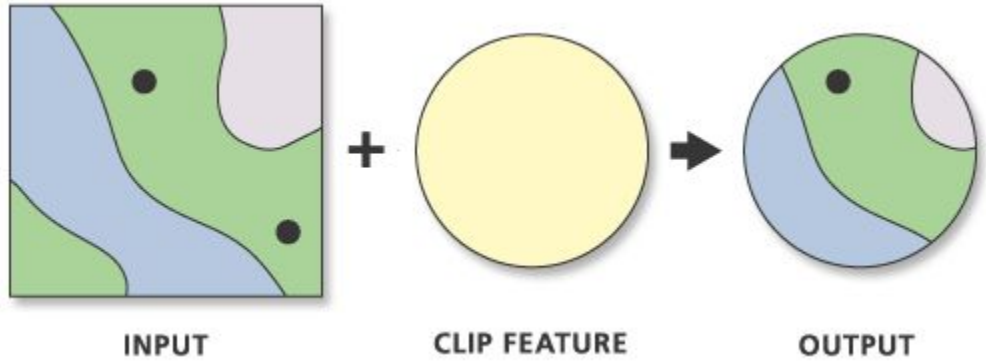
https://previews.123rf.com/images/naschy/naschy1611/naschy161100009/67318622-Vector-Illustration-of-GIS-Spatial-Data-Layers-Concept-for-Business-Analysis-Geographic-Information--Stock-Vector.jpg

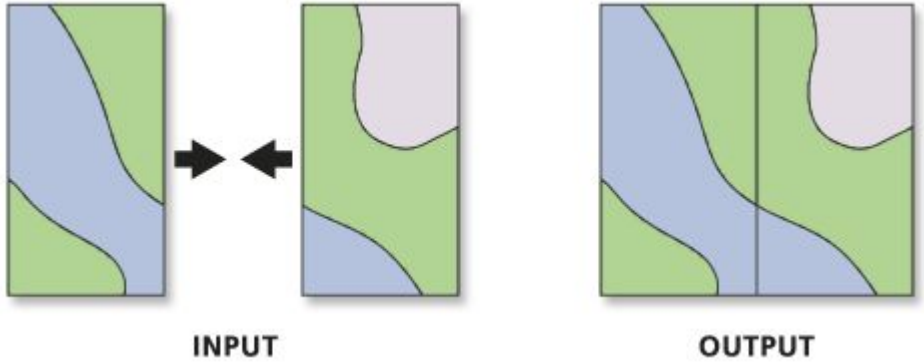
5. People

- Users and creators of the GIS
- Asking questions
- Designing methods
- Making maps
- Sharing/Deploying maps and mapping applications

4. Analysis/Methods

- Buffer
- Clip
- Transform

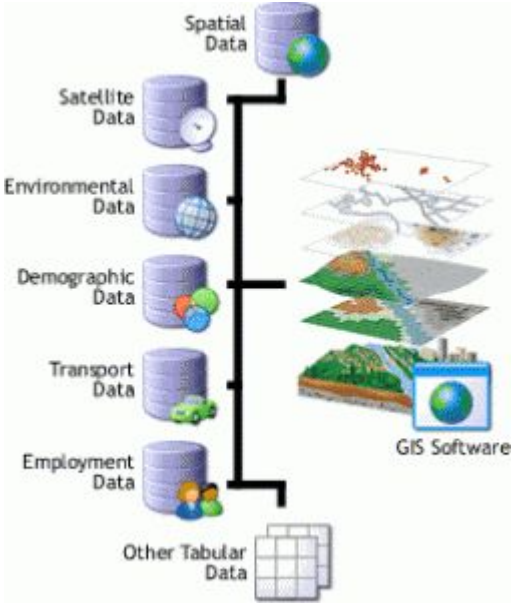




http://pro.arcgis.com/en/pro-app/tool-reference/data-management/GUID-AF3DF698-56D0-4BE3-946D-0089F91EC1A3-web.png

3. Data

- Files/Database
- Spatial characteristics
- Multiple sources



http://www.whatisgis.com/wp-content/uploads/2012/06/gis_dbSoftware-253x300.gif

2. Software

- Operating System
- Mapping application

MapInfo

THE INFORMATION DISCOVERY COMPANY

ESRI ArcGIS

QGIS Trademark

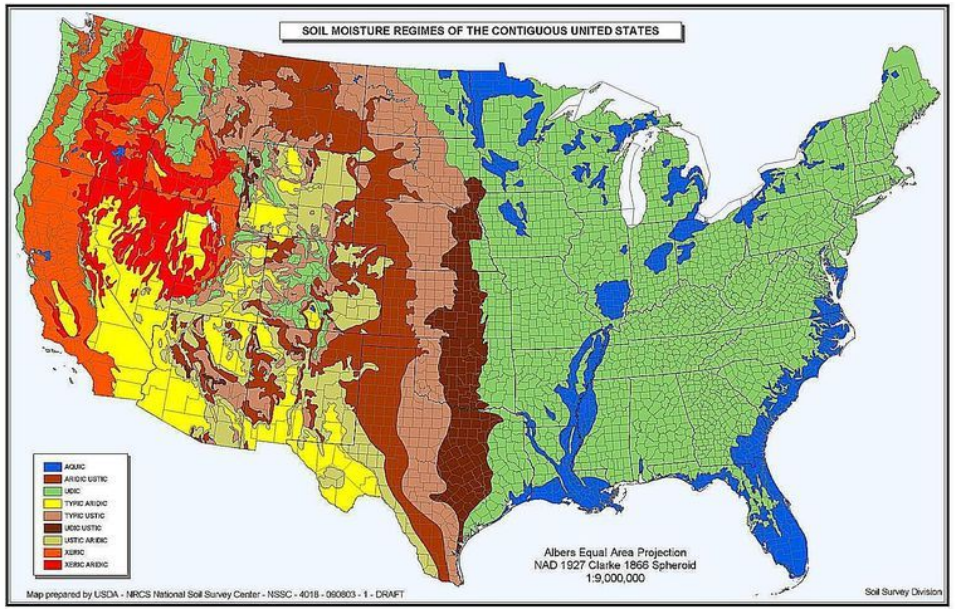
1. Hardware

- Computers/Servers
- Scanner
- Plotter
- GPS unit

https://mind42.com/public/7281a3b5-0cc5-462c-bc92-5d53439e6b57

Maps

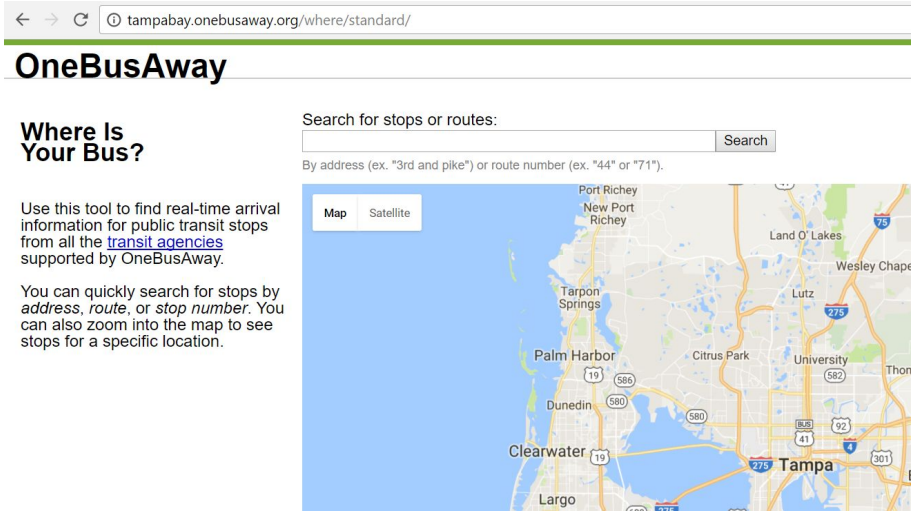
- The way we display GIS data



https://www.thoughtco.com/thematic-maps-overview-1435692

The Web

- More and more web mapping apps
- Primarily how GIS data and maps are distributed



http://tampabay.onebusaway.org/where/standard

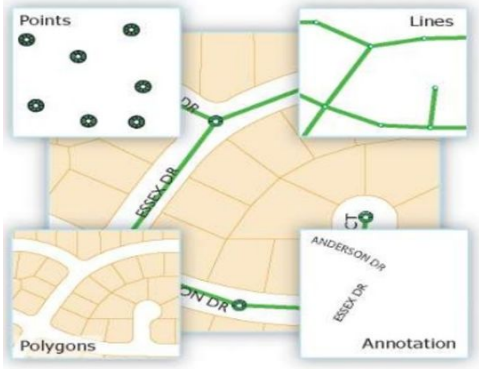
What Makes GIS Data Different?

- Things to Consider

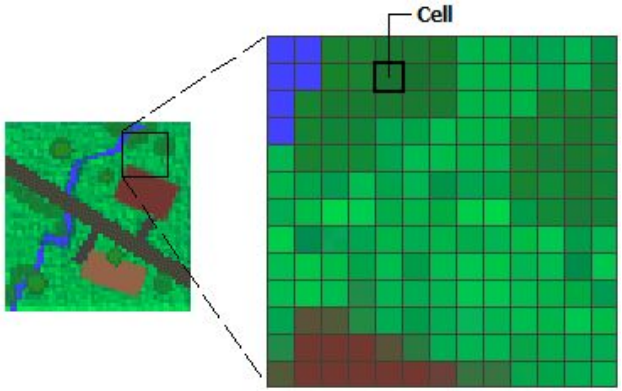
http://www.pngall.com/wp-content/uploads/2016/06/Earth-PNG-Pic.png

Vector/Raster

- Vector - discrete entities: points, lines, and polygons



- Raster - images consisting of regularly sized and spaced cells where every cell has a value



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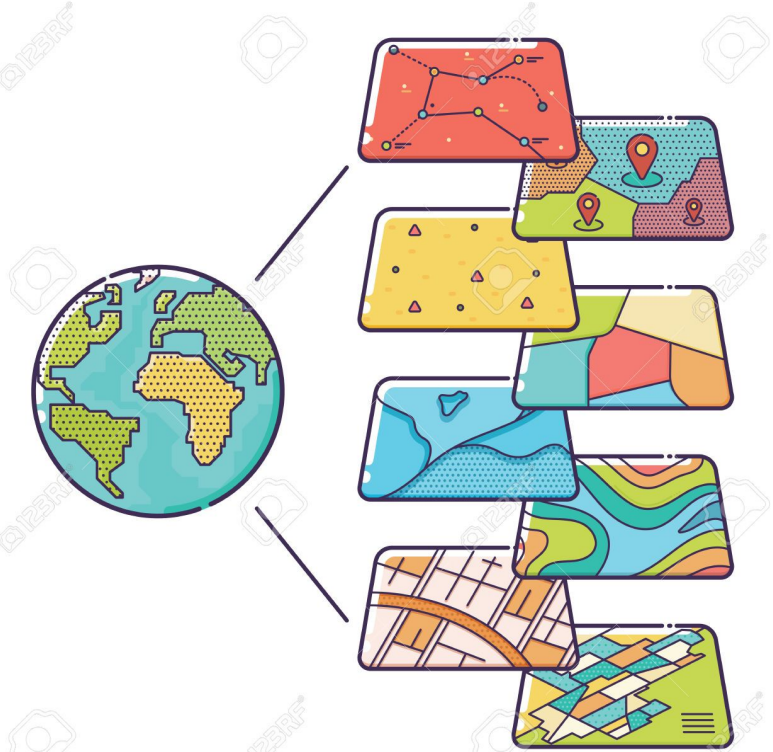
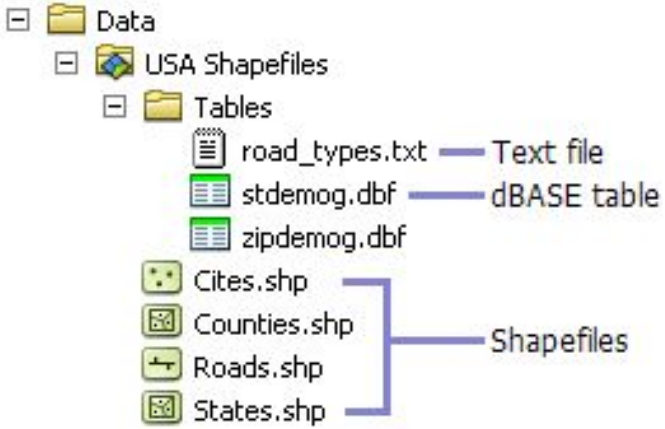
http://desktop.arcgis.com/en/arcmap/10.3/manage-data/raster-and-images/GUID-6754AF39-CDE9-4F9D-8C3A-D59D93059BDD-web.png

Vector





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http://desktop.arcgis.com/en/arcmap/10.3/manage-data/shapefiles/GUID-AFEE52B3-BBE8-4F33-A55B-5CFD5106B80C-web.png

Vector

states :: Features total: 51, filtered: 51, selected: 1

	ATE_NAI	DRAWSEQ	STATE_FIPS	SUB_REGION	STATE_ABBR
46	Vermont	10	50	New England	VT
47	Virginia	35	51	South Atla...	VA
48	Washington	2	53	Pacific	WA
49	West Virginia	30	54	South Atla...	WV
50	Wisconsin	8	55	East North ...	WI
51	Wyoming	7	56	Mountain	WY

Show All Features

Raster

- Digital Elevation Model
- One elevation value per cell

http://igic.org/news/media/5/elevation.jpg

Raster

- National Landcover Database
- One land cover designation per cell

https://www.mrlc.gov/nlcd06_data.php

Raster

Water

11 Open Water
12 Perennial Ice/Snow

Developed

21 Low Intensity Residential
22 High Intensity Residential
23 Commercial/Industrial/Transportation

Barren

31 Bare Rock/Sand/Clay
32 Quarries/Strip Mines/Gravel Pits
33 Transitional

Forested Upland

41 Deciduous Forest
42 Evergreen Forest
43 Mixed Forest

Shrubland

51 Shrubland

Non-Natural Woody

61 Orchards/Vineyards/Other

Herbaceous Upland Natural/Semi-natural Vegetation

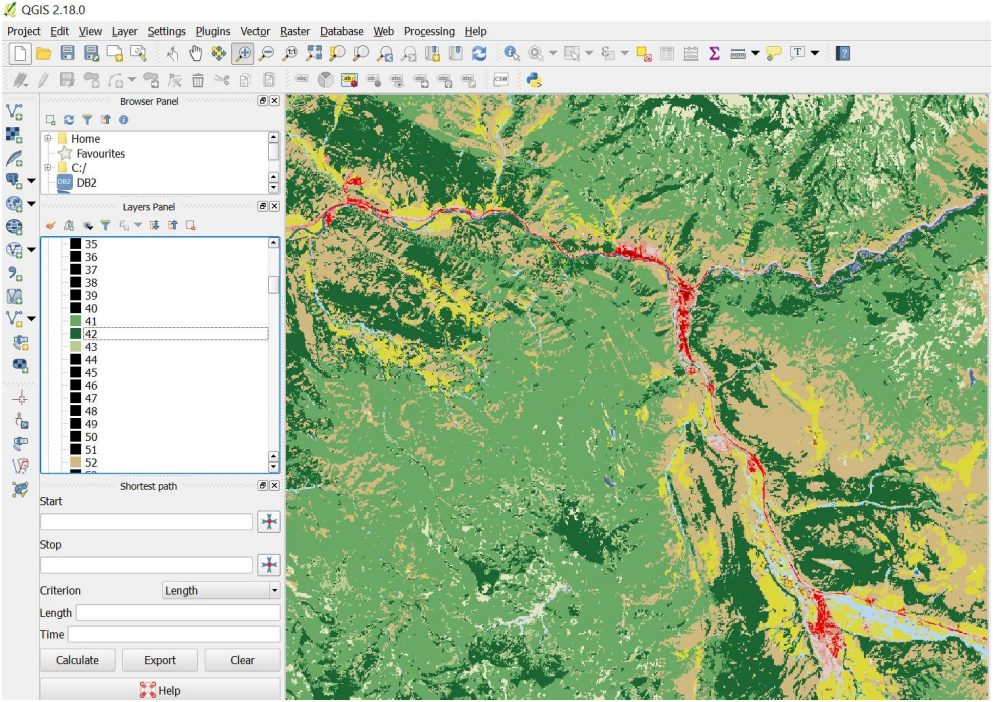
71 Grasslands/Herbaceous

Herbaceous Planted/Cultivated

81 Pasture/Hay
82 Row Crops
83 Small Grains
84 Fallow
85 Urban/Recreational Grasses

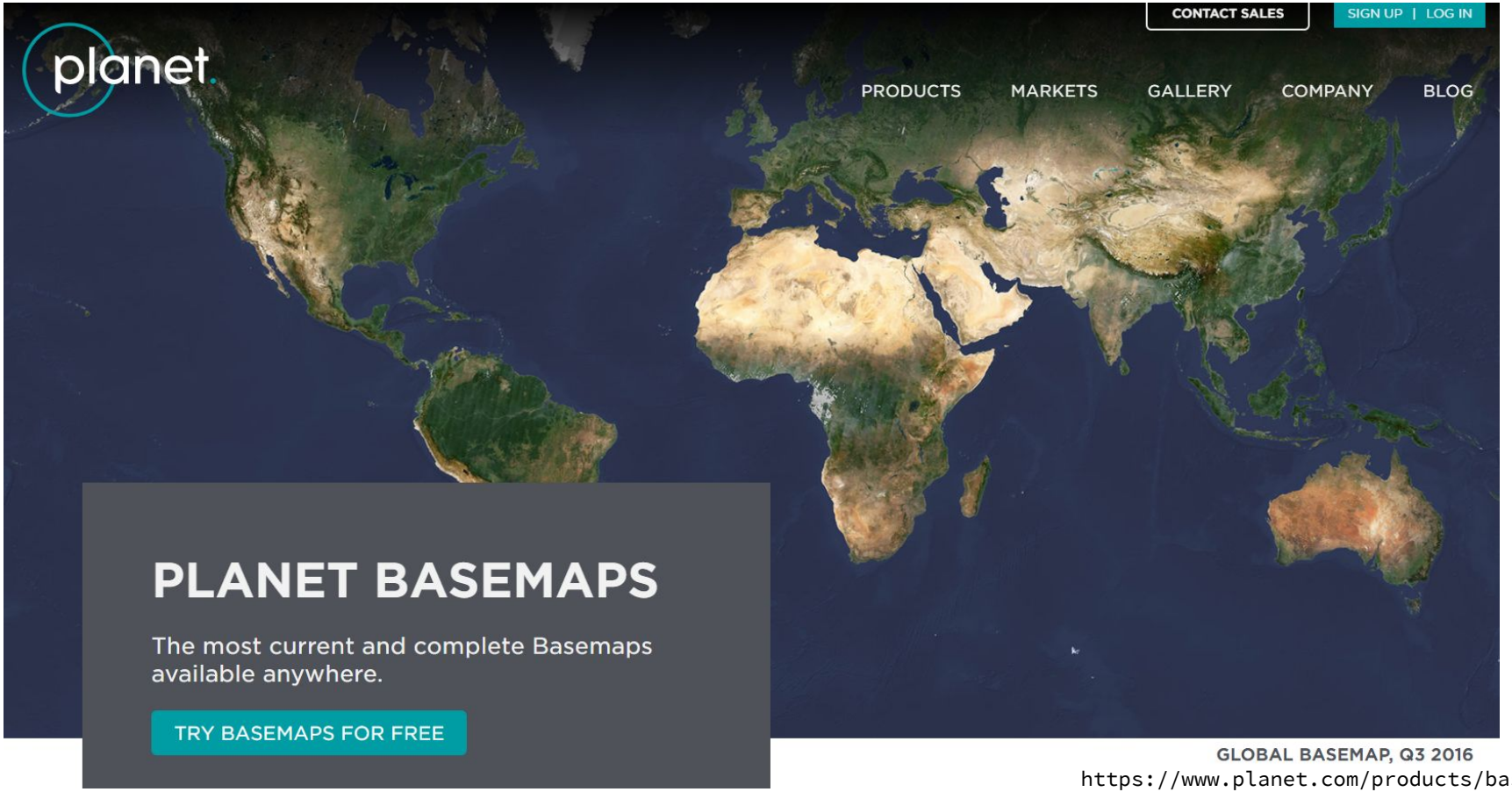
Wetlands

91 Woody Wetlands
92 Emergent Herbaceous Wetlands



https://landcover.usgs.gov/classes.php

Aerial Imagery



Data Acquisition

- Not all data exists
- May be costly or difficult
- Lots of data is available

OpenStreetMap

USGS

United States™ Census Bureau

bing

Common Data Sources

- Government
- Census
- Crowd sourced

OpenStreetMap

USGS

United States™ Census Bureau

bing

Data Quality

- Know your source
- Trust your source
- Cite your source

OpenStreetMap

USGS

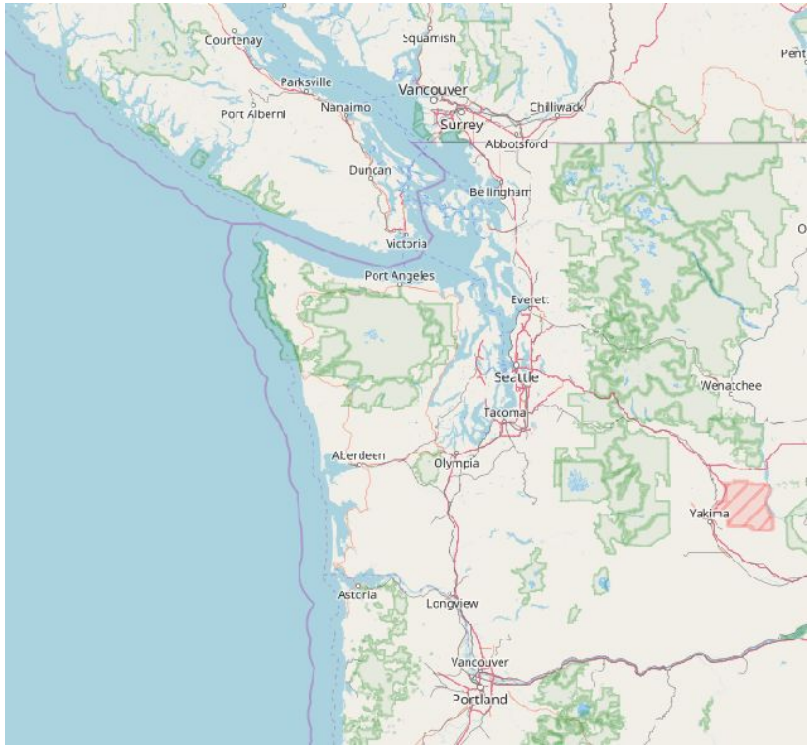
United States™ Census Bureau

bing

Scale

- How many inches represent 1 mile?
- How much information do you show?
- At what scales?

Remember Base Maps



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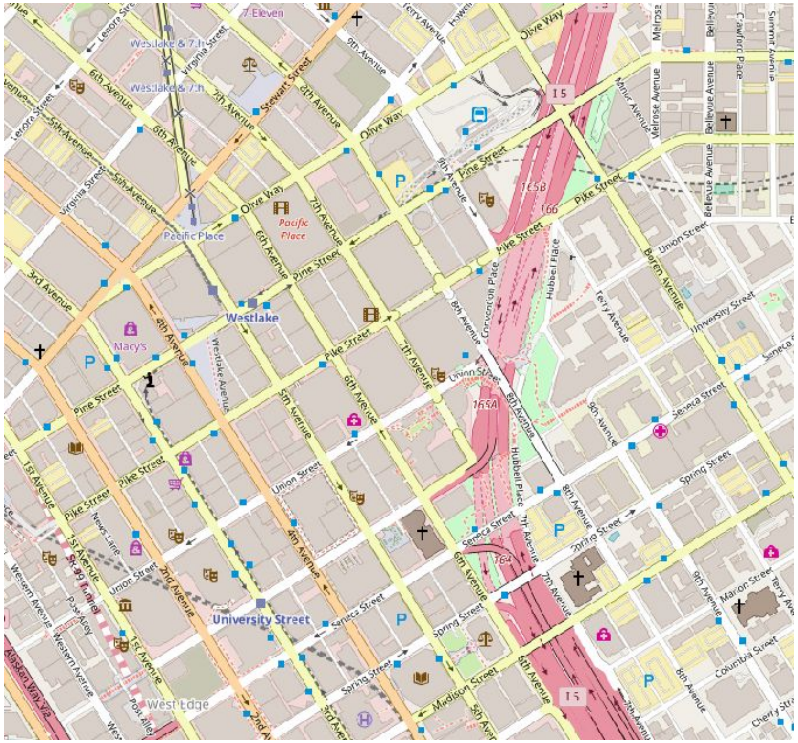


1:15,000

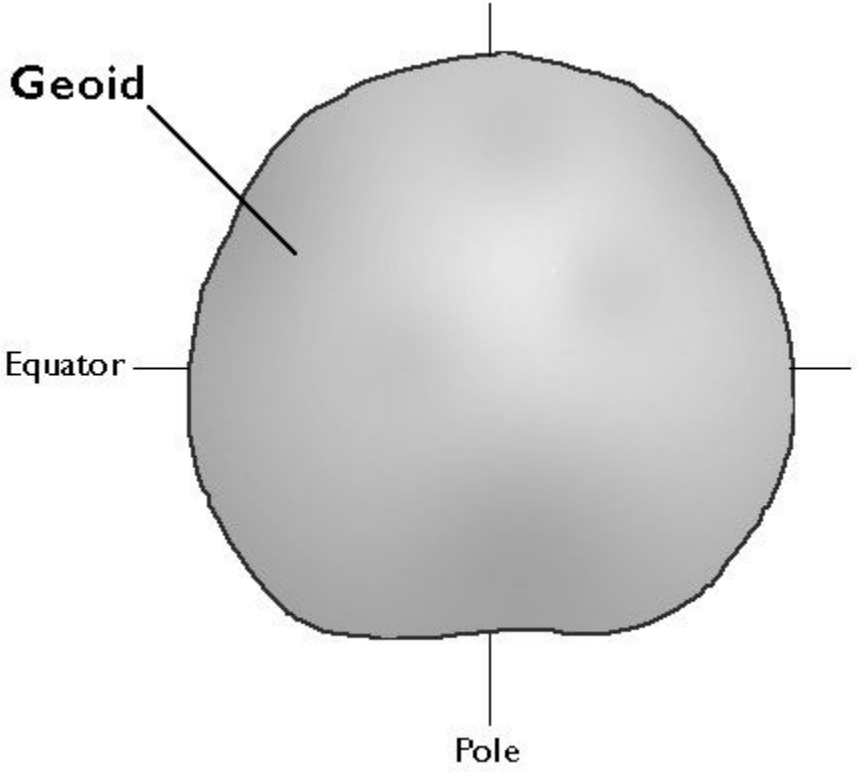
Data Collection and GPS

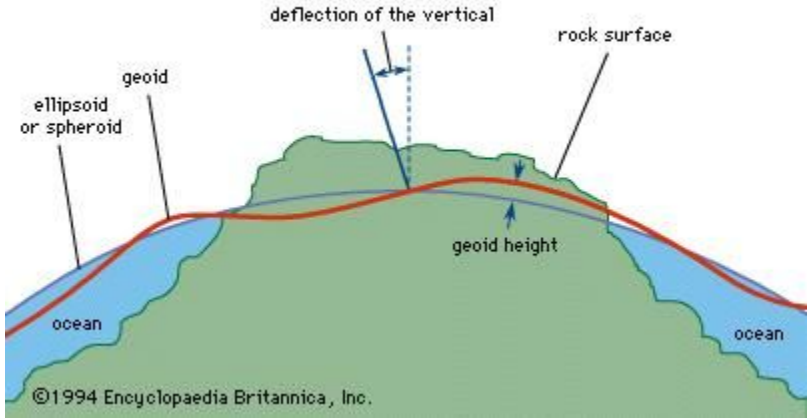
http://www.figonet.com/wp-content/uploads/2013/12/science-of-gps.jpg

The Earth is Not Flat

http://www.pngall.com/wp-content/uploads/2016/06/Earth-PNG-Pic.png

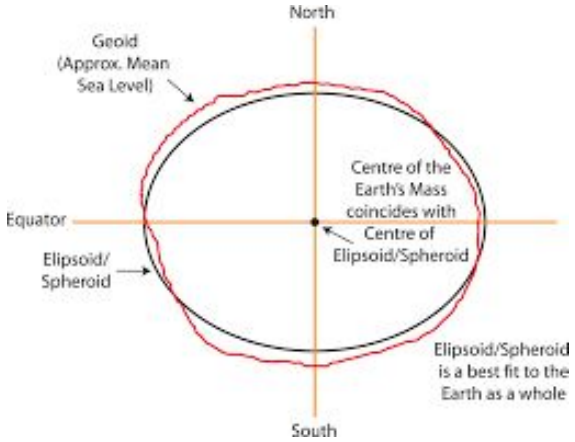
Geoid





https://www.e-education.psu.edu/natureofgeoinfo/sites/www.e-education.psu.edu.natureofgeoinfo/files/image/geoid_diagram.jpg
https://media1.britannica.com/eb-media/67/467-004-E3A4C9EC.jpg

Ellipsoid



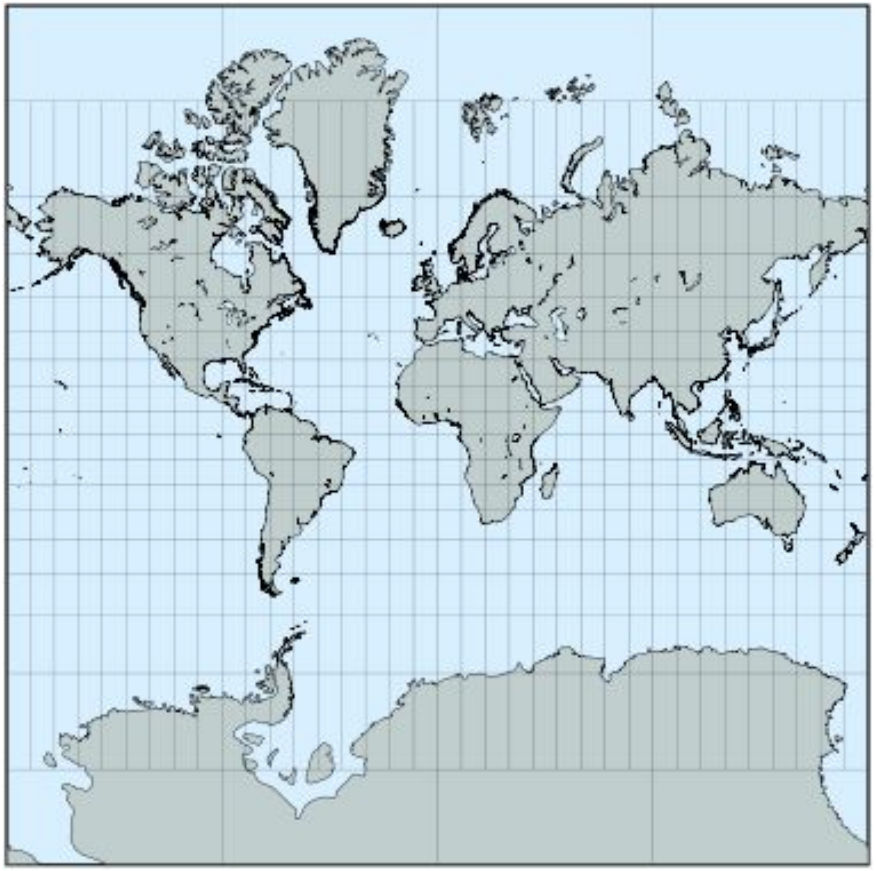
http://www.icsm.gov.au/mapping/datums1.html

Projections

http://www.statcan.gc.ca/pub/92-195-x/2011001/other-autre/mapproj-projcarte/images/m-c.jpg

The Mercator Projection

- Straight lines across oceans made for sea navigation
- Used in web maps
- Distorted at the poles



http://www.progonos.com/furuti/MapProj/Normal/ProjNav/Img/mp_Mercator-s60.png

The Gall–Peters Projection

- Equal area
- In the news for being less Eurocentric than the Mercator projection

Boston public schools map switch aims to amend 500 years of distortion

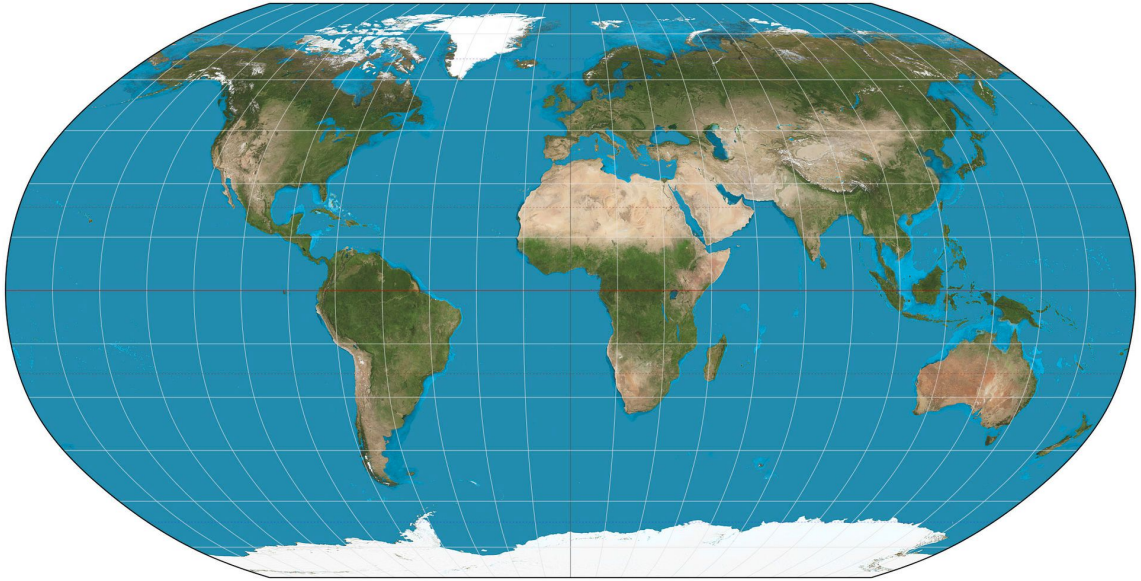
A district will drop the Mercator projection, which physically diminished Africa and South America, for the Peters, which cut the developed world down to size

The Gall-Peters projection, which shows land masses in their correct proportions by area, puts the relative sizes of Africa and North America in perspective. Photograph: Alamy Stock Photo

https://www.theguardian.com/education/2017/mar/19/boston-public-schools-world-map-mercator-peters-projection

The Robinson Projection

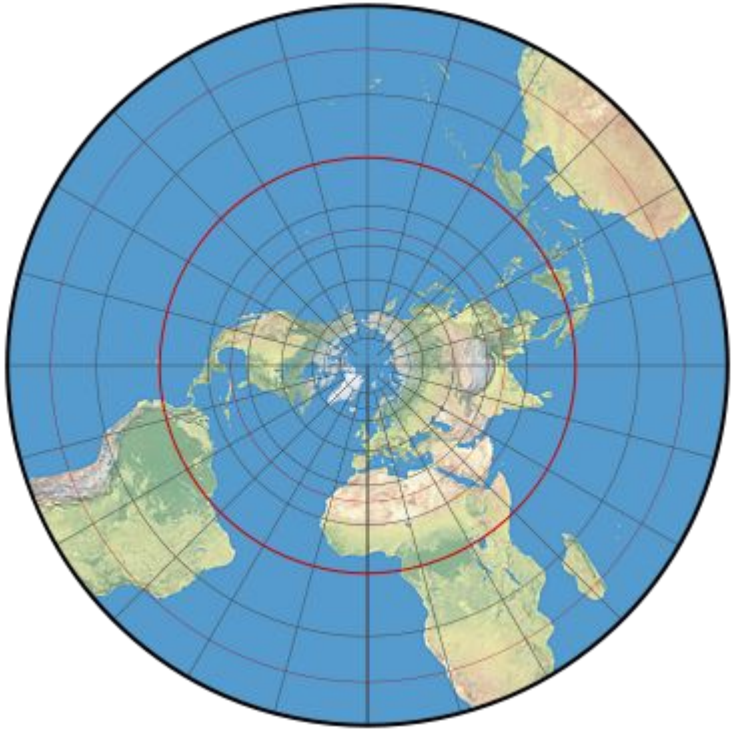
- Compromise between shape and size



https://upload.wikimedia.org/wikipedia/commons/9/96/Robinson_projection_SW.jpg

The Polar Stereographic Projection

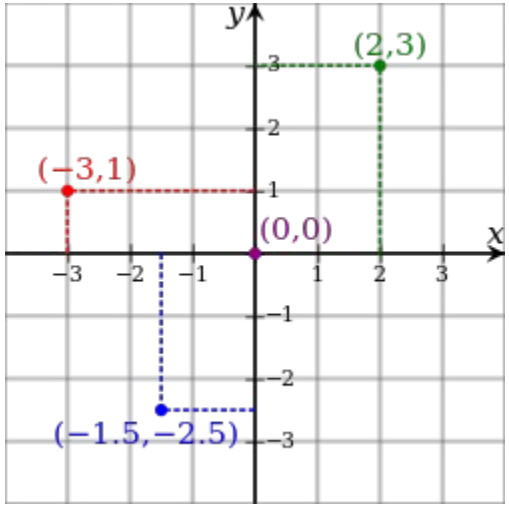
- Only the center is true to scale



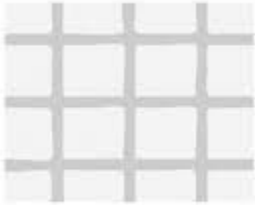
https://www.mapthematics.com/ProjectionsList/Projectioninfo/stereographic-map.png

Coordinate Systems

- How we define a location
- Geographic/Unprojected
- Projected



Geographic (3D)



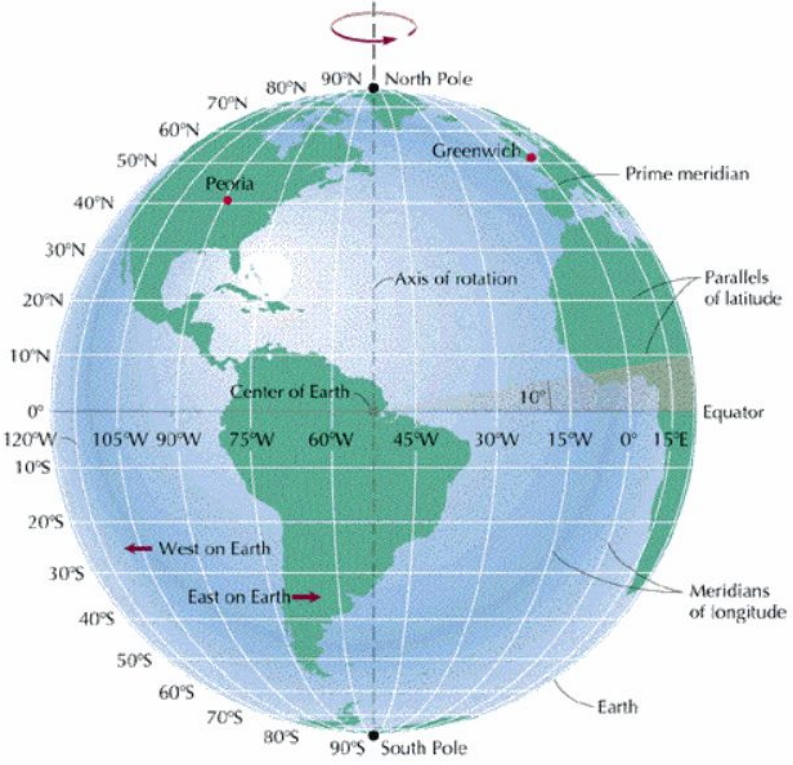
Projected (2D)

https://upload.wikimedia.org/wikipedia/commons/thumb/0/0e/Cartesian-coordinate-system.svg/250px-Cartesian-coordinate-system.svg.png
https://static1.squarespace.com/static/55bb8935e4b046642e9d3fa7/55bb8e8ee4b03fcc125a74c0/55bb8e91e4b03fcc125a7a66/1326905027513/1000w/coordinate_systems.jpg

Geographic/Unprojected Coordinate System

- Latitude, Longitude

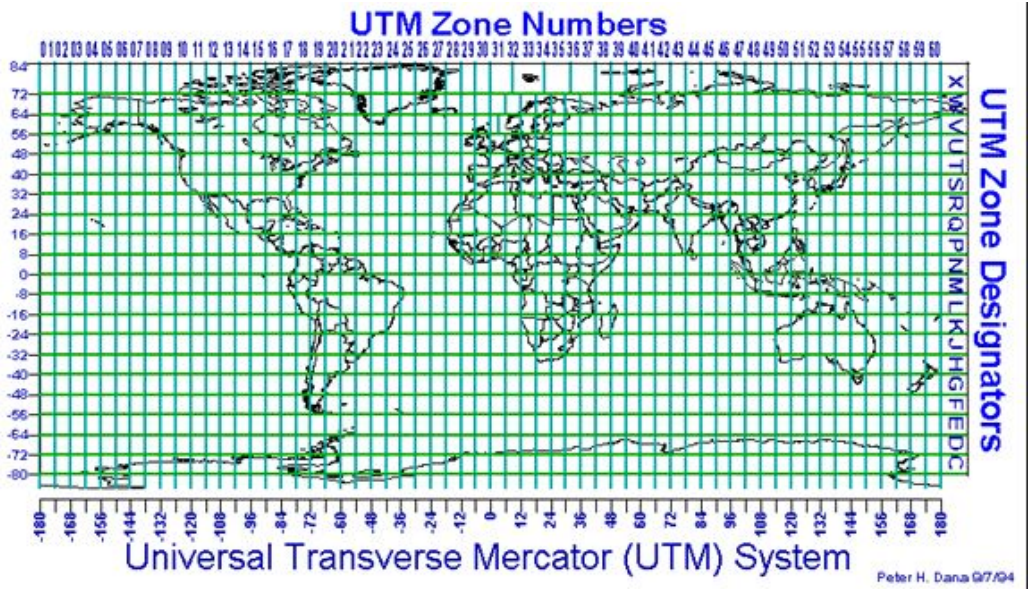
  Seattle, WA
  47.6062° N,
  122.3321° W



http://www.mymanatee.org/.imaging/stk/mcg-mymanatee/zoom/dms/departments/information-services/gis/gis-stage-images/EarthLatLong/document/EarthLatLong.gif

The Universal Transverse Mercator Coordinate System

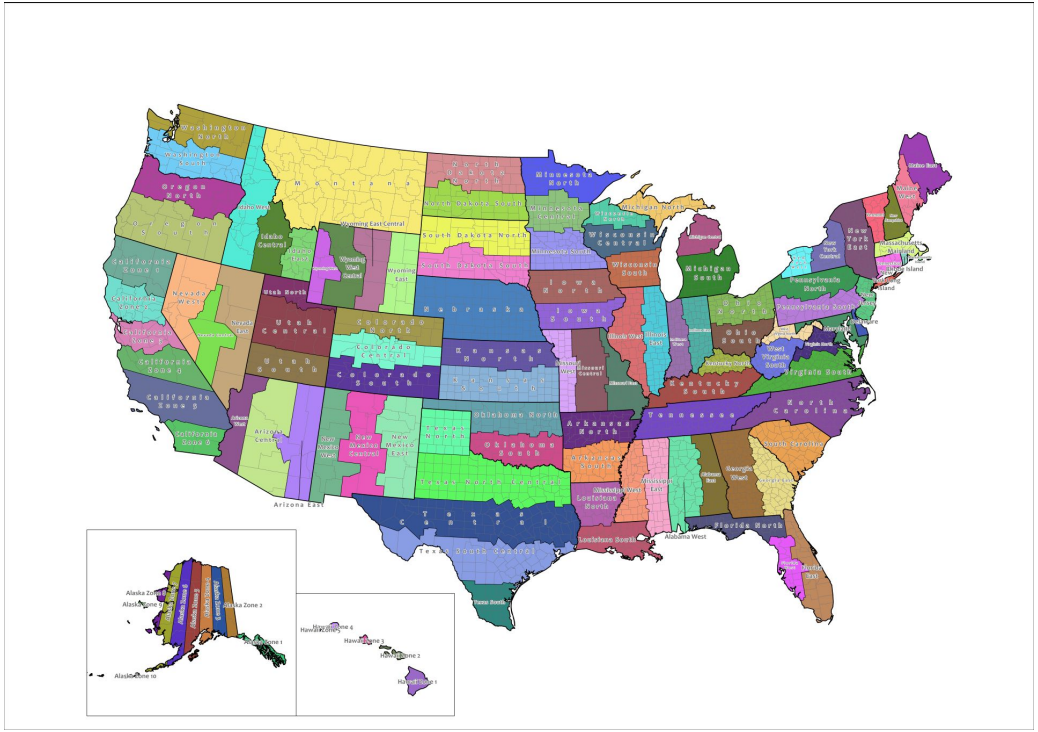
- Separated into 60 zones
- Uses a transverse mercator projection



http://gis.depaul.edu/shwang/teaching/geo381/LN4_files/image039.gif

The State Plane Coordinate System

- Optimized for states and zones
- Projections vary

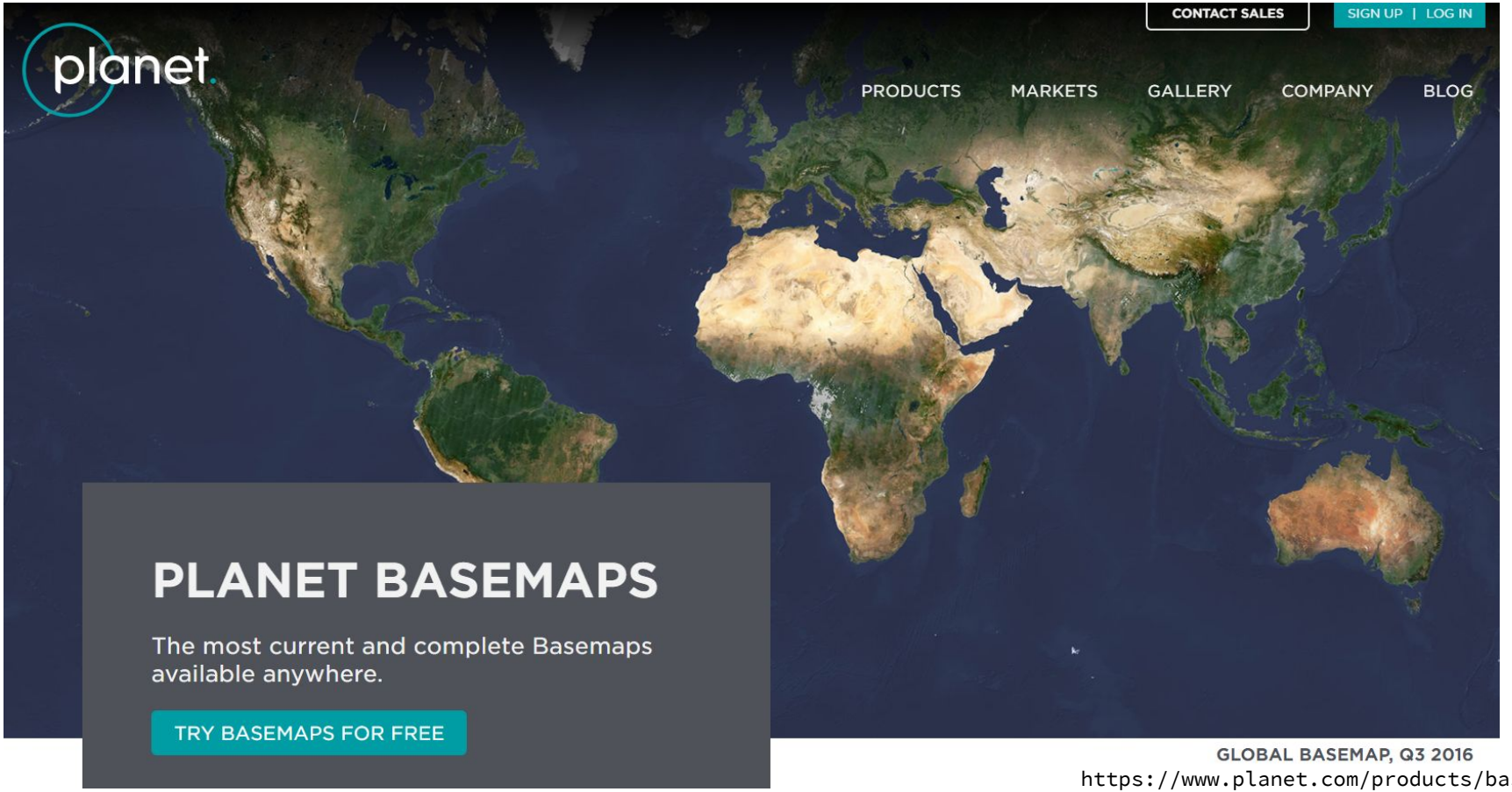


http://www.edc.uri.edu/nrs/classes/nrs409509/Lectures/4MapBasics/SPZones.png

Maps are Models

- And all models are wrong
- Depending on the projection:
  - Sizes are not consistent
  - Lines are not straight lines
- But you can make your maps less wrong
- Even a very good model is a simplification

This is Not How the World Looks



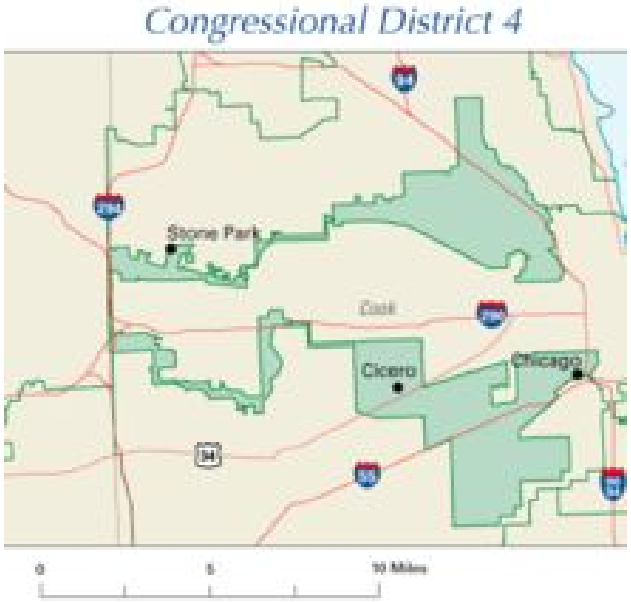
GLOBAL BASEMAP, Q3 2016

https://www.planet.com/products/basemap

Maps Can Be Used to Mislead

Monkey Cage • Analysis

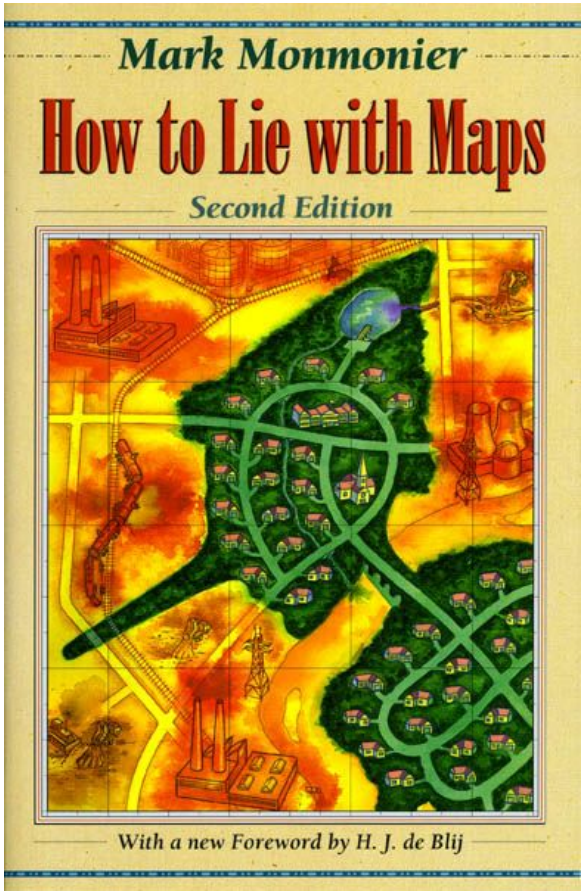
The Supreme Court will examine partisan gerrymandering in 2017. That could change the voting map.



https://www.washingtonpost.com/news/monkey-cage/wp/2017/01/31/the-supreme-court-will-examine-partisan-gerrymandering-in-2017-that-could-change-the-voting-map/?utm_term=.6455d75cd19f
https://upload.wikimedia.org/wikipedia/commons/9/99/Illinois_District_4_2004.png

Maps Can Be Used to Mislead

"How to Lie with Maps"



http://tmm.chicagodistributioncenter.com/IsbnImages/9780226534213.jpg

Maps Can Be Used to Mislead

Choice of colors, color classifications, data, and aggregation units can make maps tell different stories

Use GIS

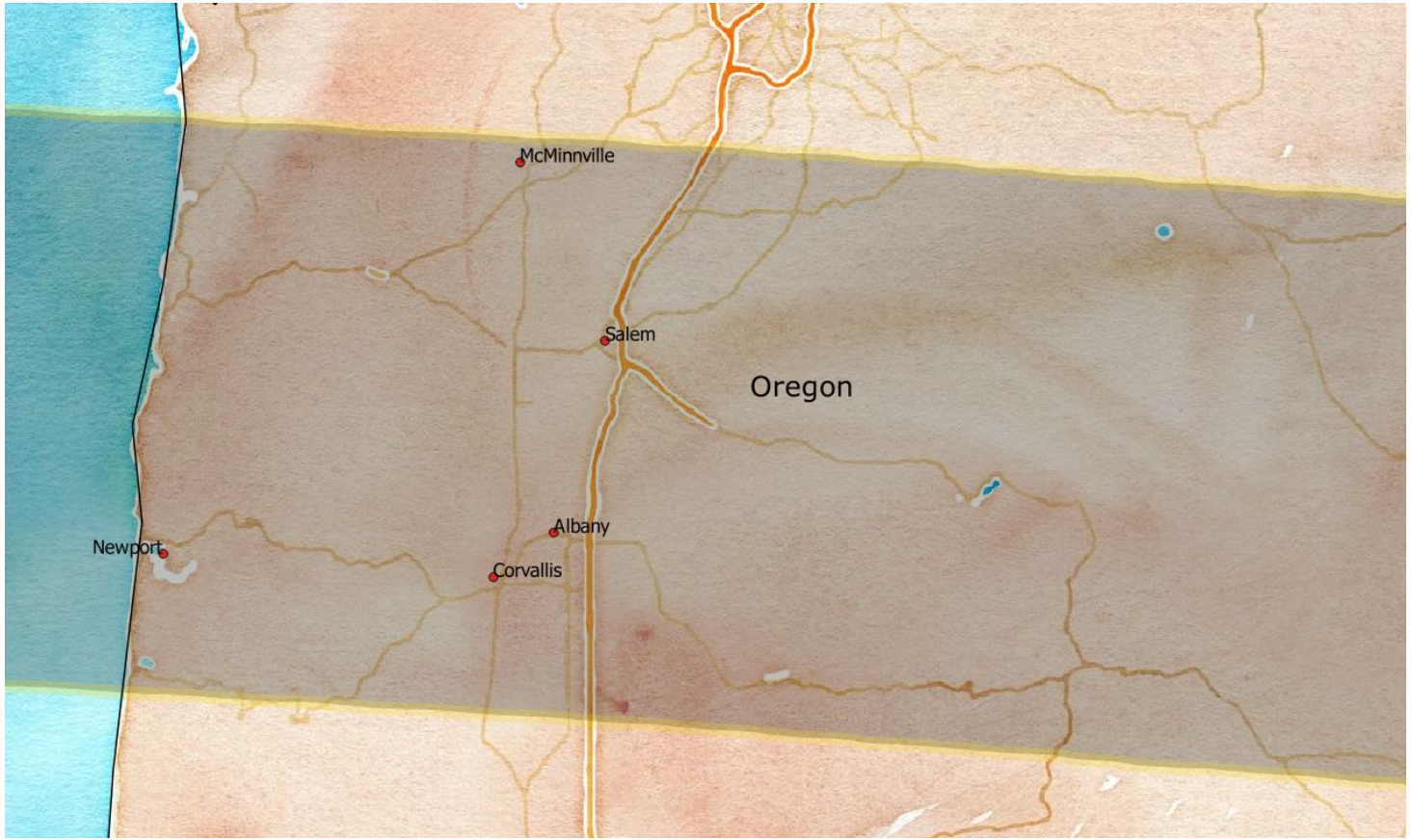
- Understand our world
- Answer spatial questions
- Make beautiful visualizations

https://www.greatamericaneclipse.com/best-places-to-view

Let's Use GIS to Find Out...

Which cities in Oregon experienced the totality of the eclipse on August 21, 2017?

Exercise Time



To Do:

- Get acquainted with QGIS, a free and open source mapping application!
- Locate GIS Data for US Cities and the eclipse path
- Load the data into QGIS
- Clip the cities to the eclipse path
- Make a pleasing and informative map

To Do:

- Get the data
- Data Sources:
  - Eclipse Path Nasa
  - Cities USGS via data.gov
  - State Boundaries Esri
  - Stamen Base Maps

Want More?

- Take your pic of these tutorials:

http://www.qgistutorials.com/en

To Sum Up...

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To Sum Up...

- Maps are great visualizations
- There’s a lot that goes into GIS
- Spatial data is different
- Think critically when using maps
- Use GIS to solve problems and make maps!

Questions?

Contact me:

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Twitter: @christytoes
Website: christyheaton.github.io

Upcoming Events:

September 14: Mappy Hour

October: QGIS

November: Vector Tiles

December: Hand Drawn Maps