Beyond TIGER Files:
Federal Government Geospatial Data Sources to Support GIS Research Needs

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DLC Meeting & FDL Conference
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Overview

- GIS Overview
- GIS Data Types
- Federal GIS Data Sources & Map Viewers
- Example State & Local Data Sources
- Esri + Government Data
- Citizen Science
- Questions & Answers

GIS Overview

Geospatial Data

- Geospatial data is data that is associated with a particular location.
- It has a spatial component – like an address, latitude & longitude, country, state, county, place, zip code, etc.

Geographic Information Systems

Definition

GIS refers to a system where geographic information is stored in layers and integrated with geographic software programs so that spatial information can be created, stored, manipulated, analyzed, and visualized (mapped).

Dempsey, C. (2014). What is the difference between GIS and geospatial? Retrieved from https://www.gislounge.com/difference-gis-geospatial/

Maps + Tabular Data + Analysis Capabilities

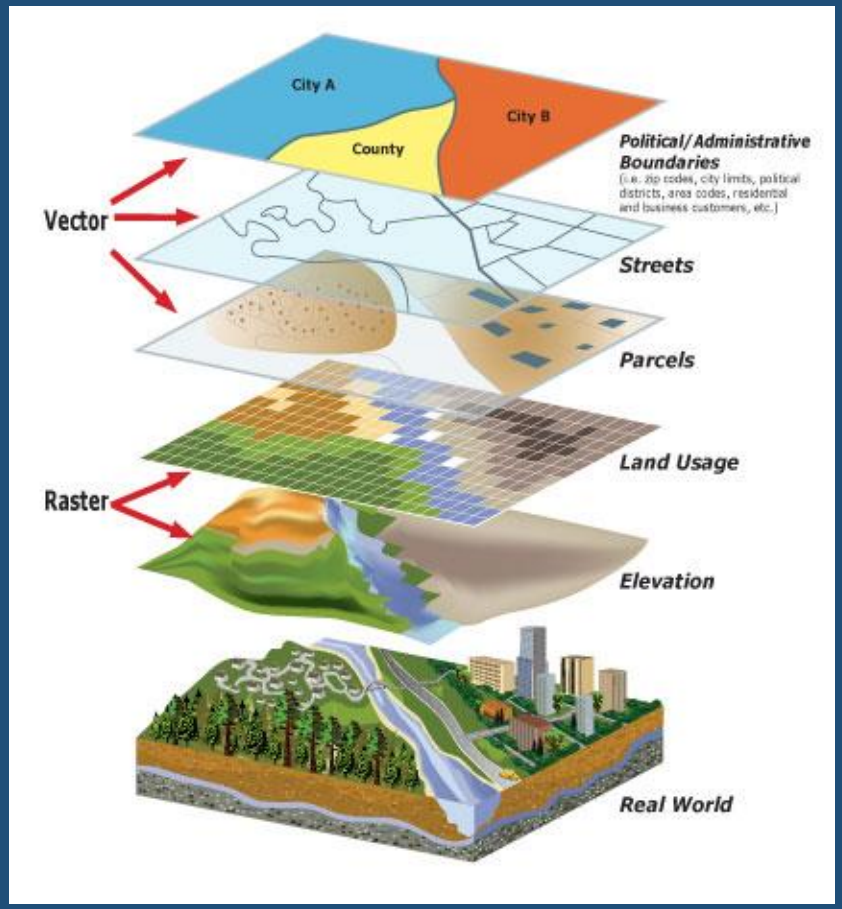
Image by The National Atlas.

Image by GNOME icon artists. CC BY-SA 3.0

Layers

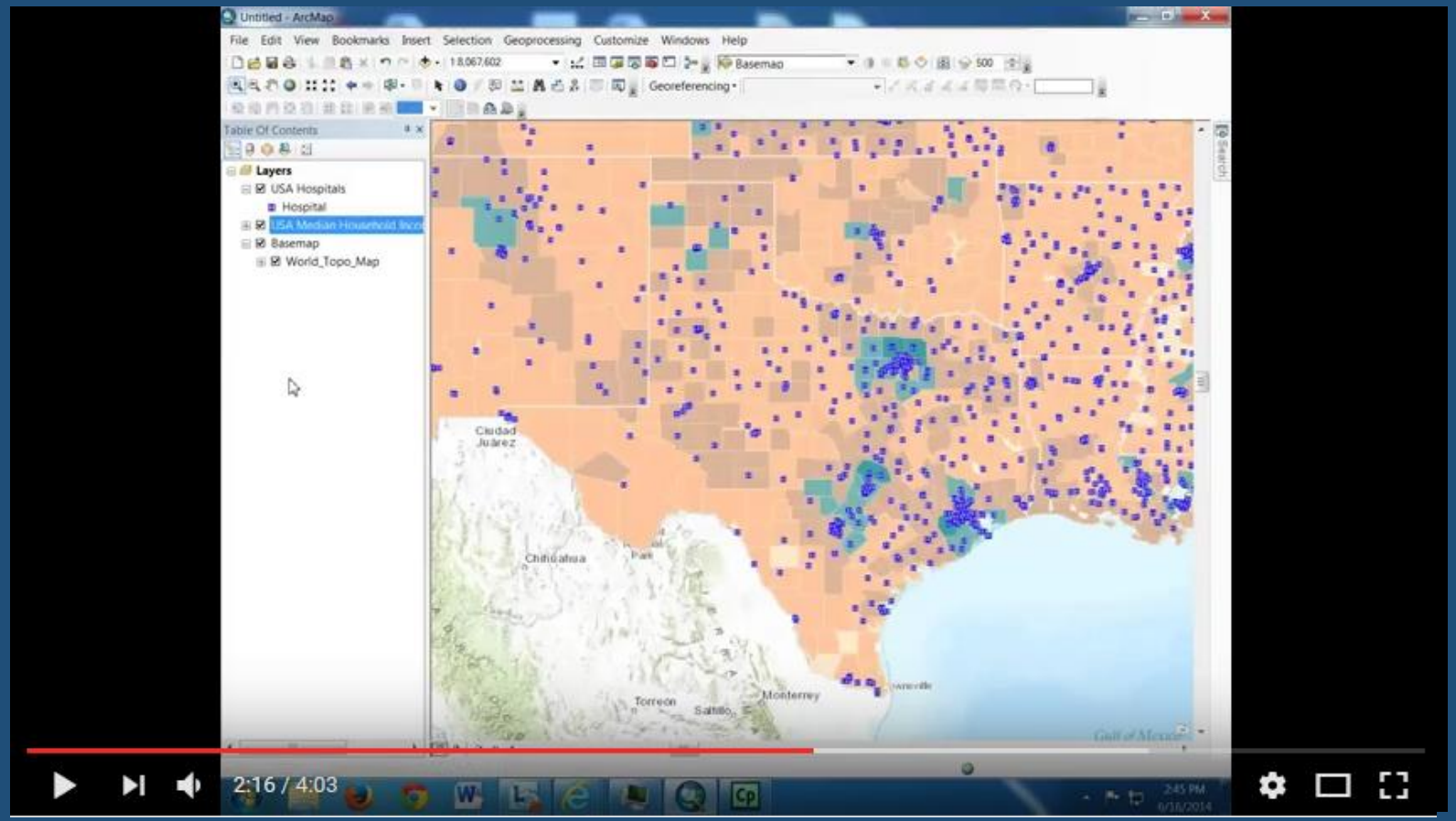
Geographic Information Systems allow data to be overlaid in layers.

This data can be analyzed – and relationships between the data can be investigated.



ArcGIS Informational Model https://doc.arcgis.com/en/arcgis-online/reference/geo-info.htm

ArcMap Demonstration



ArcMap demonstration by Rory Elliott https://www.youtube.com/watch?v=E-B5E4OCYYU

GIS & Government Information

- Government bodies produce an enormous amount of statistics & geographical information.
- If the data has a spatial component, it can be used in a GIS.
- GIS allows the library user to get more from the data we have historically provided.

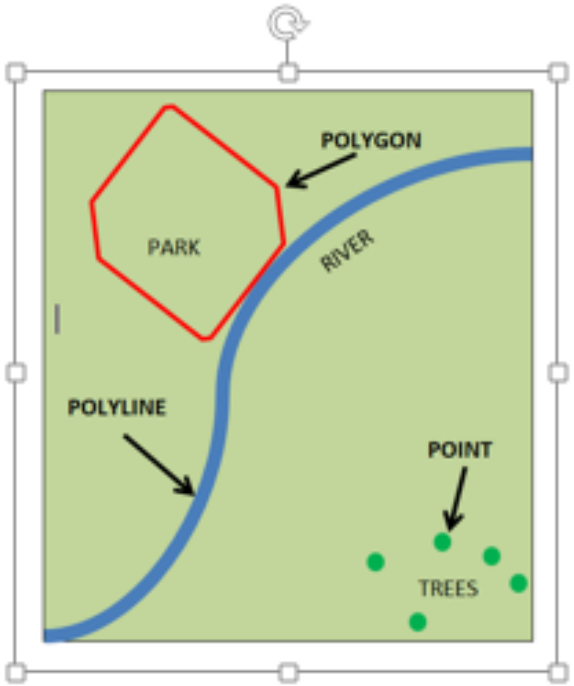
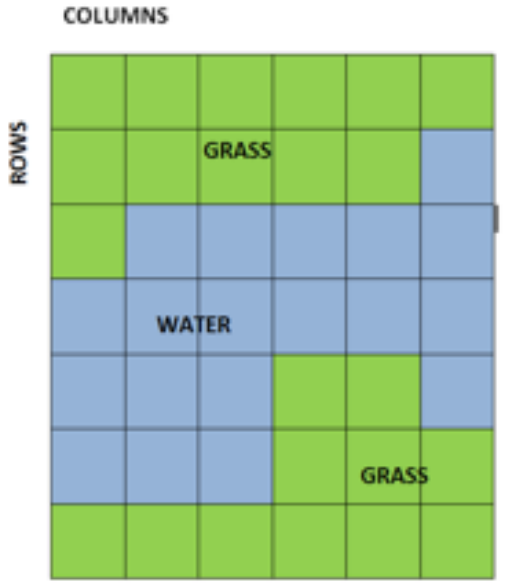
Types of GIS Data

GIS Data

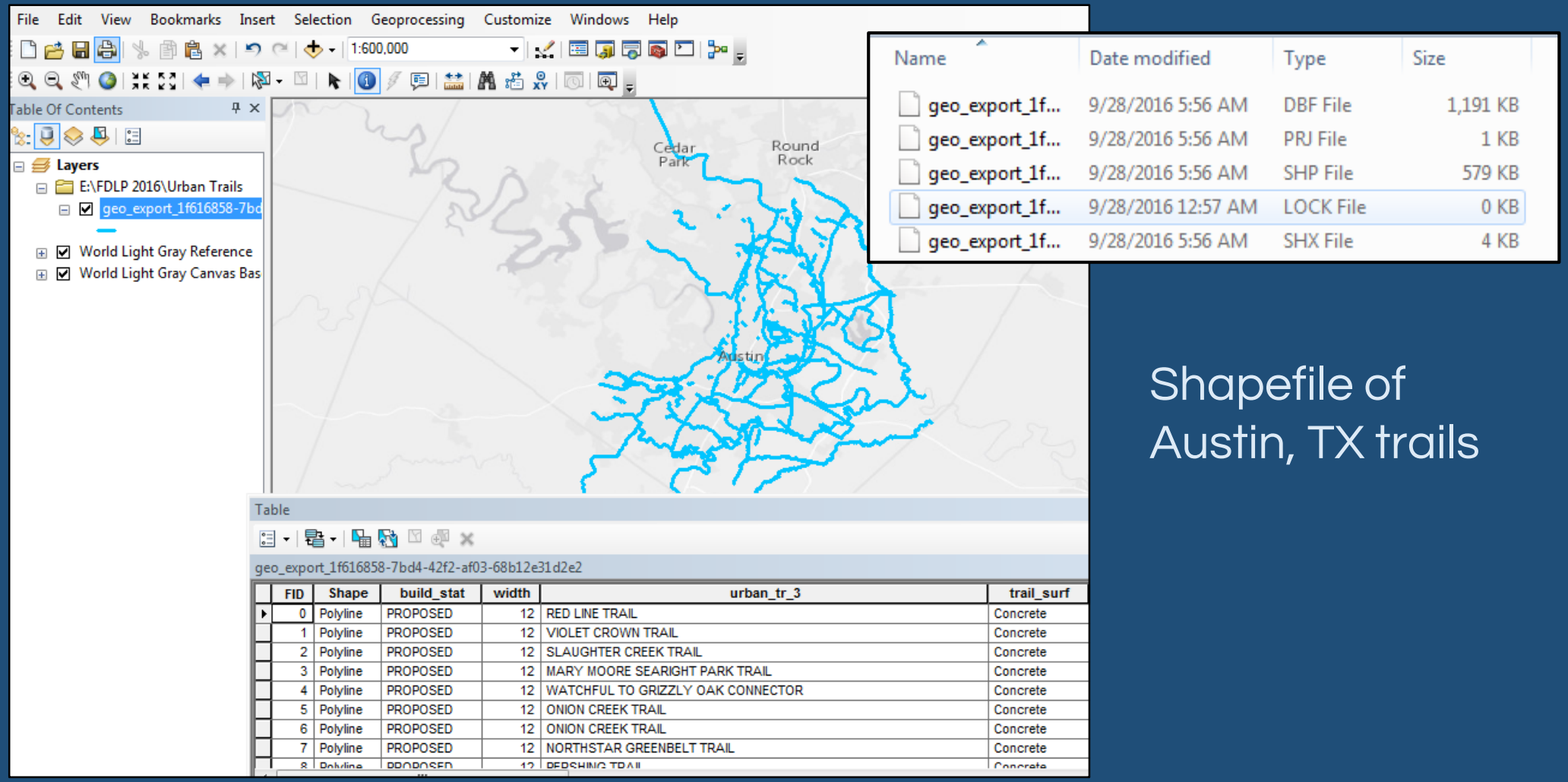
- **Spatial Data**: Identifies the geographic location of features. It includes coordinates and projection information. It is the 'Where"
  - Vector: Points, lines, polygons, Shapefiles, KML
  - Raster: Images

- **Attribute Data**: Describes and classifies the features. It is the 'What, Where, and Why'
  - Tabular: tables, Excel, CSV, txt

Spatial Data

Vector	Raster
Points, Polylines, and Polygons	Cells in a grid; Pixels in an image
Definite x,y coordinates	Georeferenced to a coordinate system.
File Types: Geodatabases, Shapefiles, KML	File Types: .JPG, .PNG, .TIFF
	

Vector Data

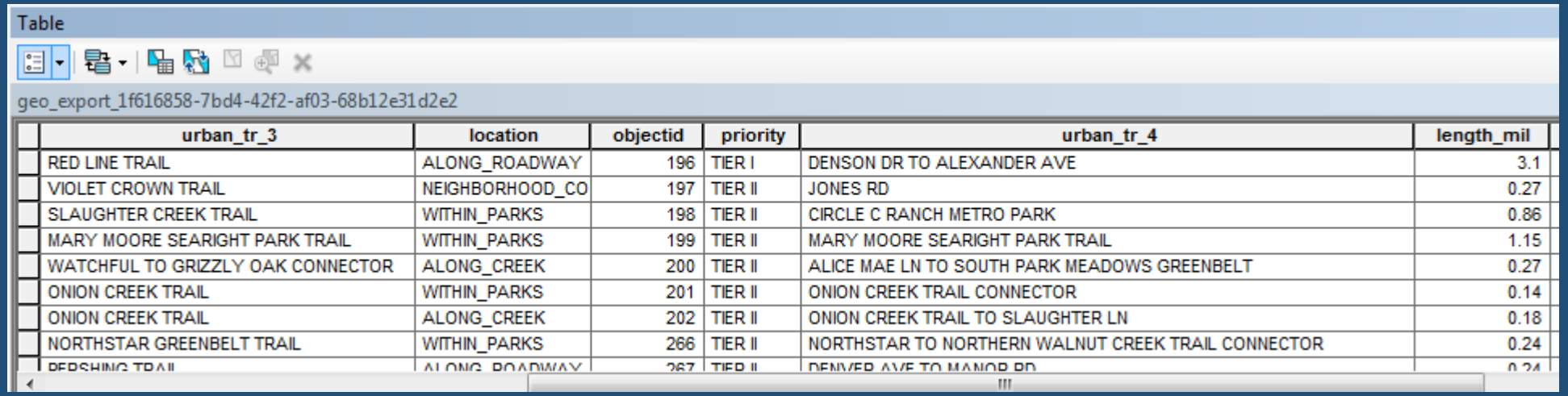


FID	Shape	build_stat	width	urban_tr_3	trail_surf
0	Polyline	PROPOSED	12	RED LINE TRAIL	Concrete
1	Polyline	PROPOSED	12	VIOLET CROWN TRAIL	Concrete
2	Polyline	PROPOSED	12	SLAUGHTER CREEK TRAIL	Concrete
3	Polyline	PROPOSED	12	MARY MOORE SEARIGHT PARK TRAIL	Concrete
4	Polyline	PROPOSED	12	WATCHFUL TO GRIZZLY OAK CONNECTOR	Concrete
5	Polyline	PROPOSED	12	ONION CREEK TRAIL	Concrete
6	Polyline	PROPOSED	12	ONION CREEK TRAIL	Concrete
7	Polyline	PROPOSED	12	NORTHSTAR GREENBELT TRAIL	Concrete

Shapefile of Austin, TX trails

Attribute Data

- Attribute data describes and classifies the features.
- It is the 'What, Where, and Why.'
- Attributes are often in the tabular formats.



Table

geo_export_1f616858-7bd4-42f2-af03-68b12e31d2e2

urban_tr_3	location	objectid	priority	urban_tr_4	length_mil
RED LINE TRAIL	ALONG_ROADWAY	196	TIER I	DENSON DR TO ALEXANDER AVE	3.1
VIOLET CROWN TRAIL	NEIGHBORHOOD_CO	197	TIER II	JONES RD	0.27
SLAUGHTER CREEK TRAIL	WITHIN_PARKS	198	TIER II	CIRCLE C RANCH METRO PARK	0.86
MARY MOORE SEARIGHT PARK TRAIL	WITHIN_PARKS	199	TIER II	MARY MOORE SEARIGHT PARK TRAIL	1.15
WATCHFUL TO GRIZZLY OAK CONNECTOR	ALONG_CREEK	200	TIER II	ALICE MAE LN TO SOUTH PARK MEADOWS GREENBELT	0.27
ONION CREEK TRAIL	WITHIN_PARKS	201	TIER II	ONION CREEK TRAIL CONNECTOR	0.14
ONION CREEK TRAIL	ALONG_CREEK	202	TIER II	ONION CREEK TRAIL TO SLAUGHTER LN	0.18
NORTHSTAR GREENBELT TRAIL	WITHIN_PARKS	266	TIER II	NORTHSTAR TO NORTHERN WALNUT CREEK TRAIL CONNECTOR	0.24
PERSHING TRAIL	ALONG_ROADWAY	267	TIER II	DENVER AVE TO MANOR RD	0.24

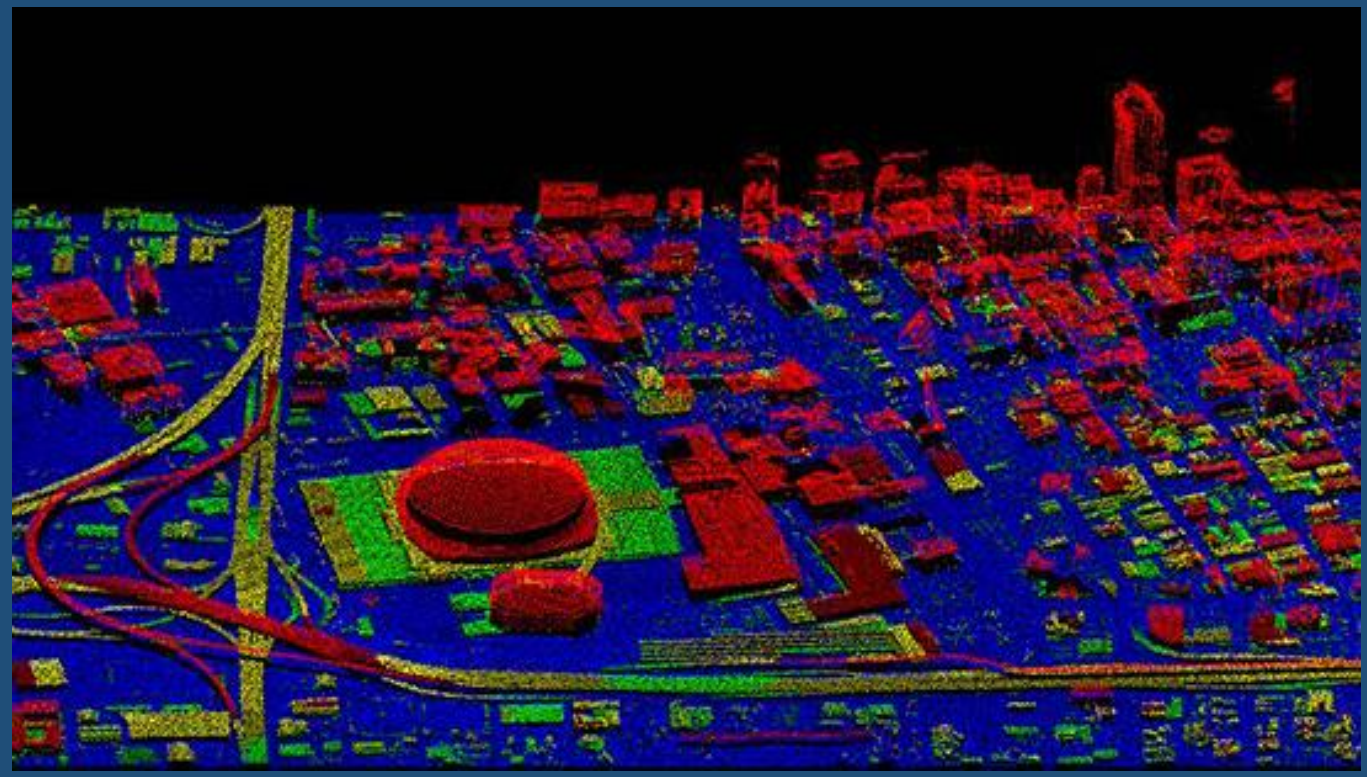
Point Cloud Data

- **LiDAR:**

  Light + Ra**dar** or

  Light **D**etection **A**nd **R**anging

- Uses green visible light, ultraviolet light, or near infrared light to collect x,y,z measurements.
- Creates accurate 3D models of surface and structures.



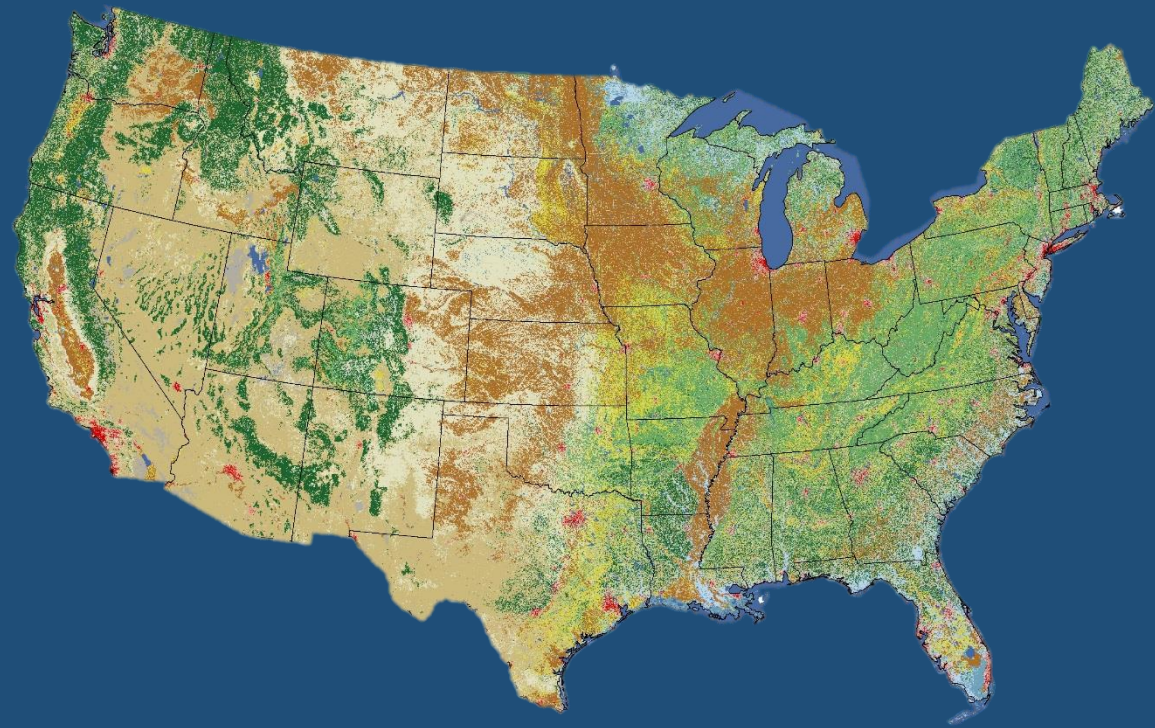
Source: Earth Resources Observation and Science (EROS)
http://eros.usgs.gov/topographic-research/structures

Raster Data

Can include thematic data, continuous data, & pictures.

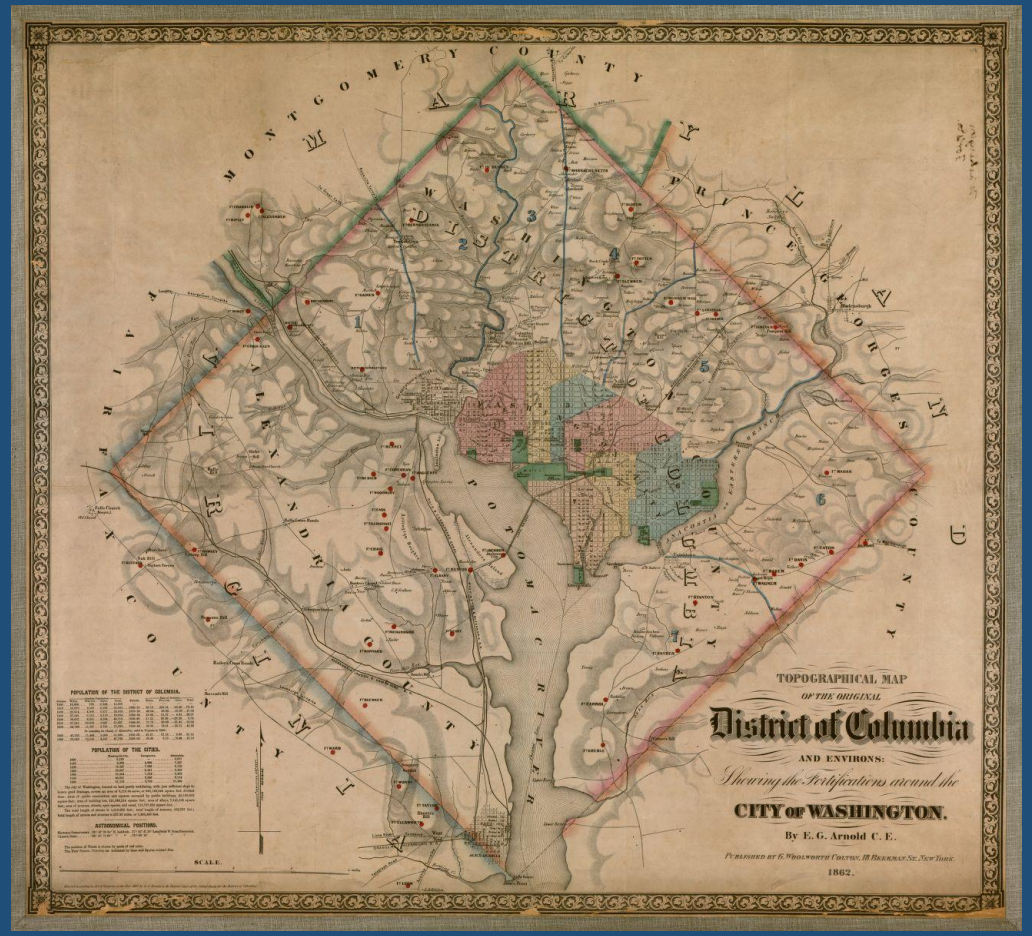
Common types of Raster Data:

- Orthoimages
- Multispectral Images
- Digital Elevation Models
- Scanned Maps



Scanned Maps

Scanned maps can be georeferenced to a particular location on Earth.



Arnold, E. G. & Colton, G. W. (1862) *Topographical map of the original District of Columbia and environs showing the fortifications around the city of Washington*. New York: G. Woolworth Colton. [Map] Retrieved from the Library of Congress, https://www.loc.gov/item/88690604/

Orthoimagery

Orthoimages: high resolution aerial images that combine the visual attributes of an aerial photograph with the spatial accuracy and reliability of a planimetric map.

Source: The National Map: http://nationalmap.gov/ortho.html

Orthoimagery from www.sciencebase.gov

Multispectral Imagery

Multispectral Imagery includes satellite imagery at various wavelengths of the electromagnetic spectrum captured by a multispectral scanning radiometer.

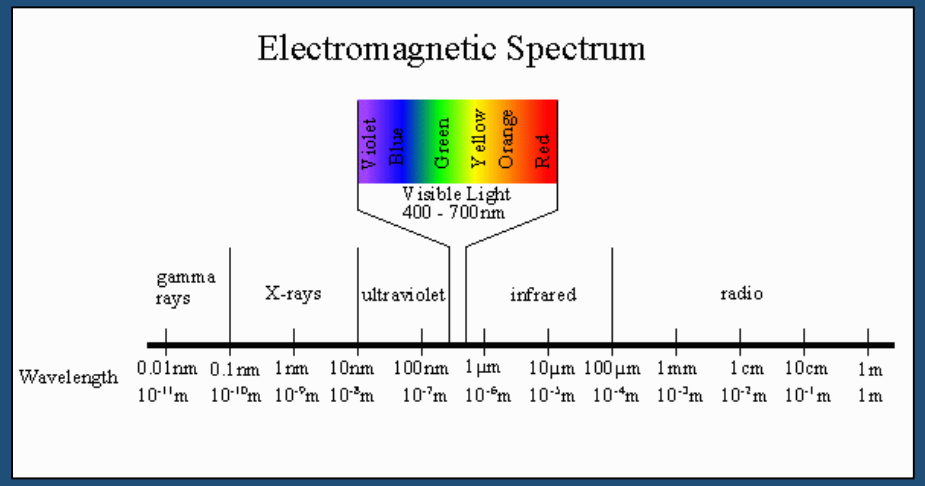
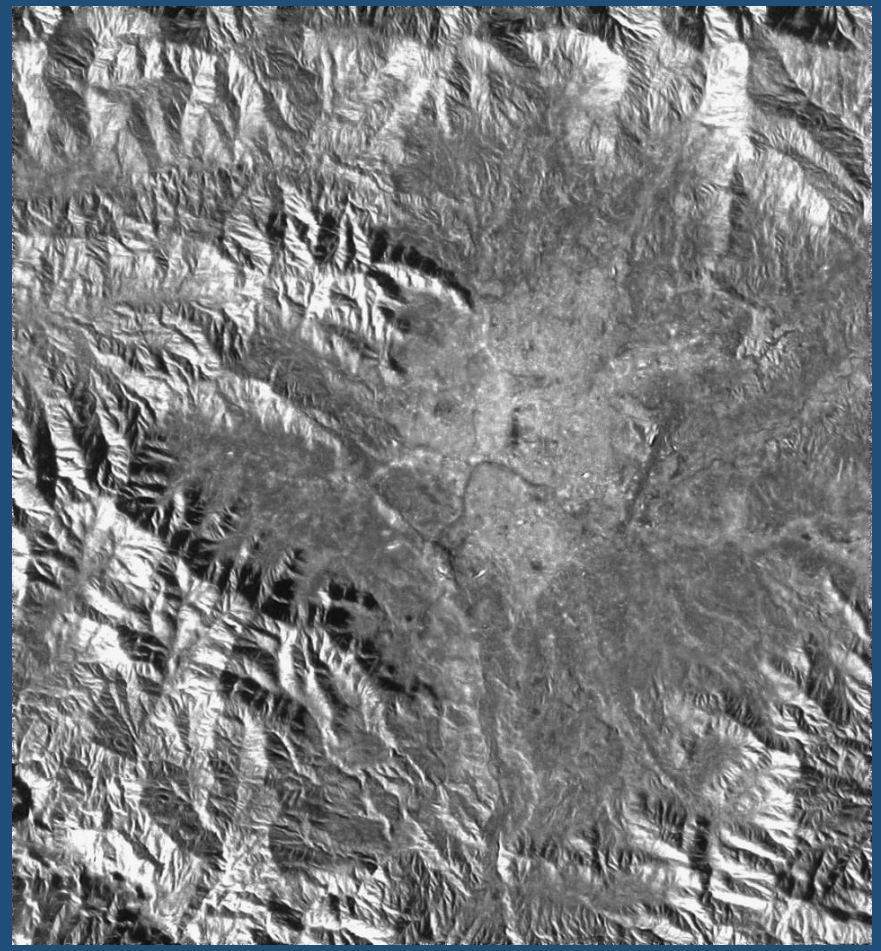


Image from NOAA's Solar Calculator Glossary

Landsat Infrared imagery of Mount Vernon. Source: Earthshots by USGS http://earthshots.usgs.gov/earthshots/about#ad-image-6

DEM – Digital Elevation Models

- Gridded arrays of elevation
- Mostly derived from LiDAR
- Each cell has elevation data
- Types of DEM include:
  - DSM – Digital Surface Models
  - DTM – Digital Terrain Models



Elevation Map of Kathmandu, Nepal. Source: Earth Observatory by NASA
http://earthobservatory.nasa.gov/IOTD/view.php?id=1872

Terrain Extraction & Segmentation

Video shows items being extracted from LiDAR.

What would be a Digital Surface Model will be transformed into a Digital Terrain Model.

Source: Terrain Extraction & Segmentation Demo by Geospatial Laser Applications & Measurements at Applied Research Laboratories. http://www.arlut.utexas.edu/glam/index.html

Spatial Data Gathering Technology

Global Positioning System Receivers (GPS)

Remote Sensing

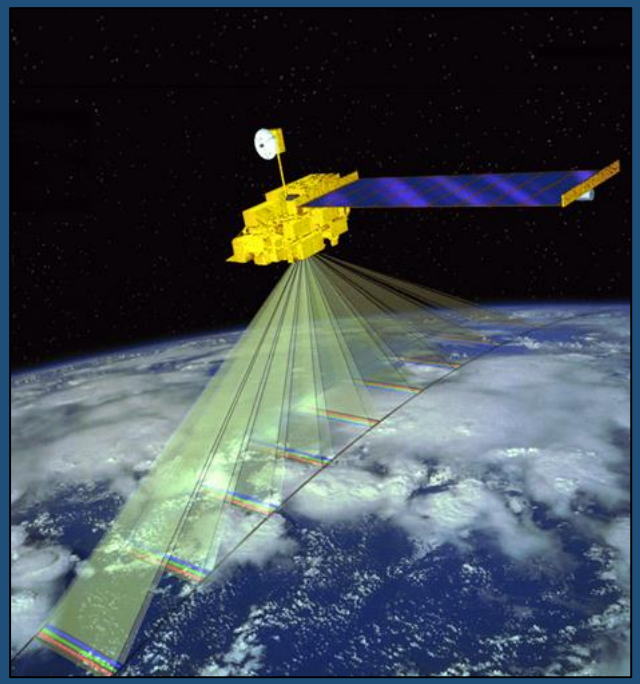
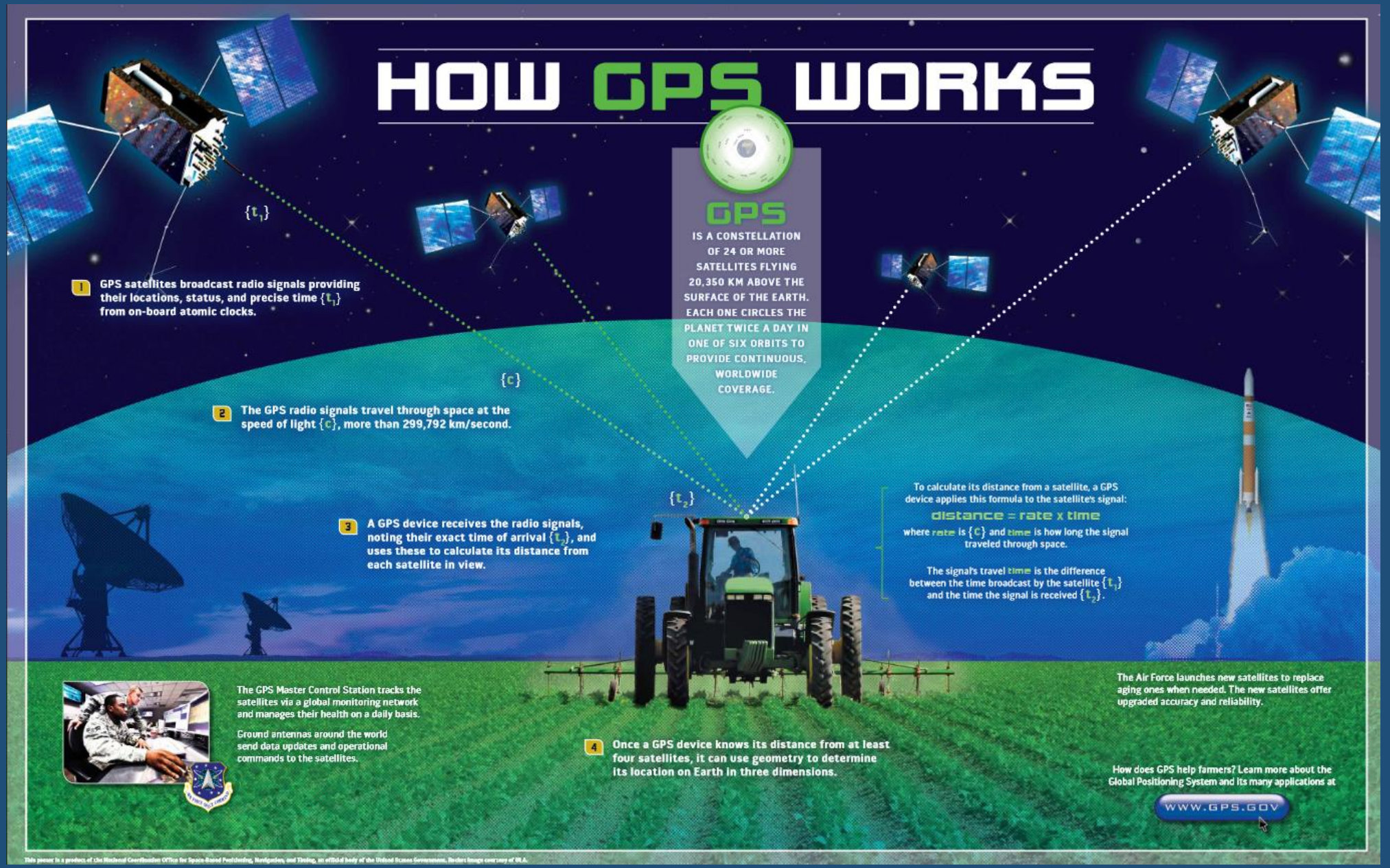


Image: TERRA Satellite from USGS EROS Virtual Tour

Global Positioning Systems (GPS)

- GPS receivers record coordinates, as well as collect attribute data (e.g. text, time stamps, images, etc.).
- There are GPS apps, but standalone GPS receivers are currently more powerful.
- GPS is operated and maintained by the U.S. Air Force.

Simple GIS Coordinate Display app for Android



Source: www.gps.gov

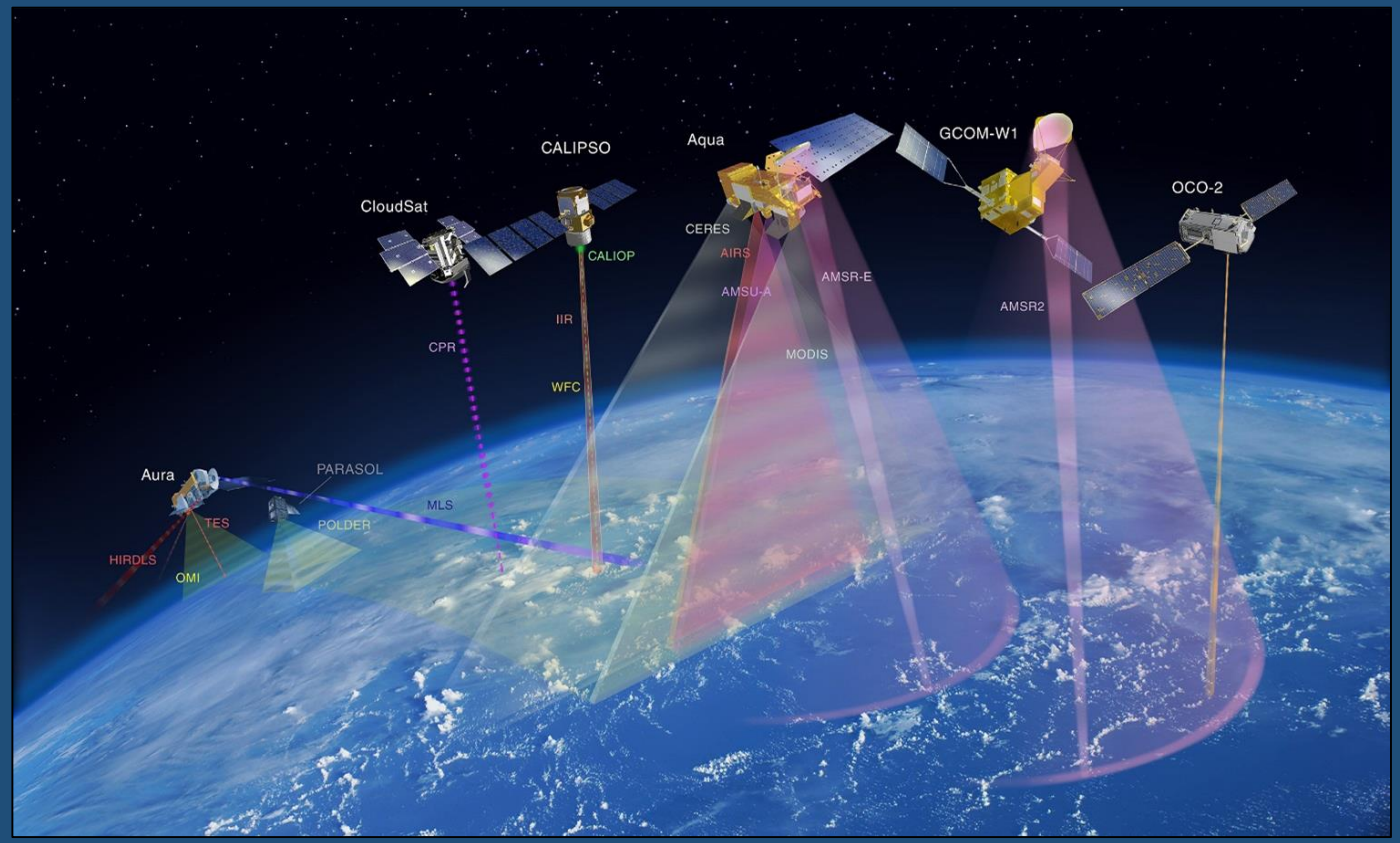
Remote Sensing

Remote Sensing: information is obtained from a distance

Planes or satellites gather information from the earth's surface, such as:

- Aerial Photographs
- Infrared
- RADAR
- LiDAR

"The Afternoon Constellation" of satellites



http://atrain.nasa.gov

Federal GIS Data Sources

Geospatial Data Powerhouses

- Census
- USGS
- NASA
- NOAA

TIGER Products by U.S. Census

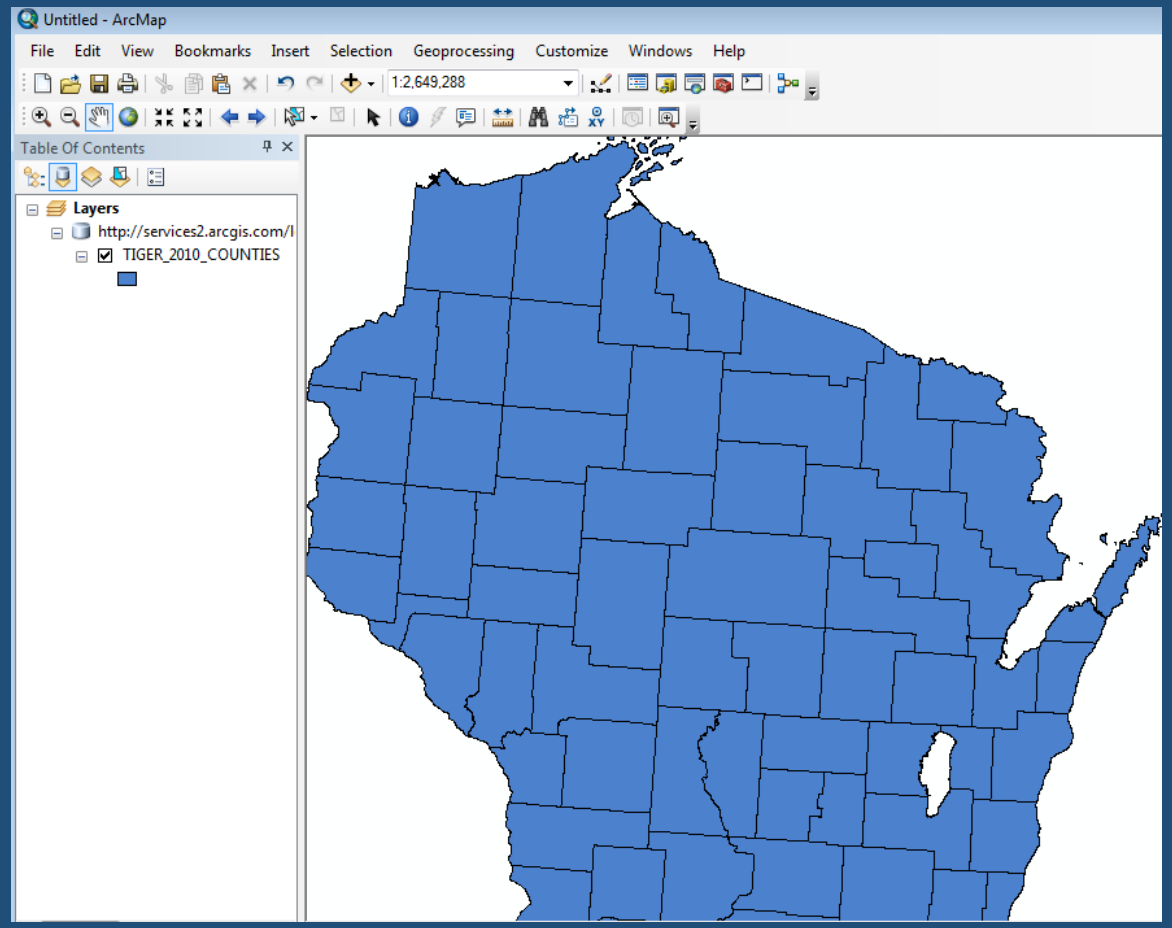
https://www.census.gov/geo/maps-data/data/tiger.html

- TIGER (Topologically Integrated Geographic Encoding and Referencing) products:

  vector files of features such as roads, railroads, hydrography, statistical boundaries (such as census tracts), government boundaries (such as counties), and administrative boundaries (such as school districts).

- These files are very helpful for creating thematic maps.
- GeoIDs in TIGER files can be used to link to the Census Bureau's demographic data found in American Factfinder

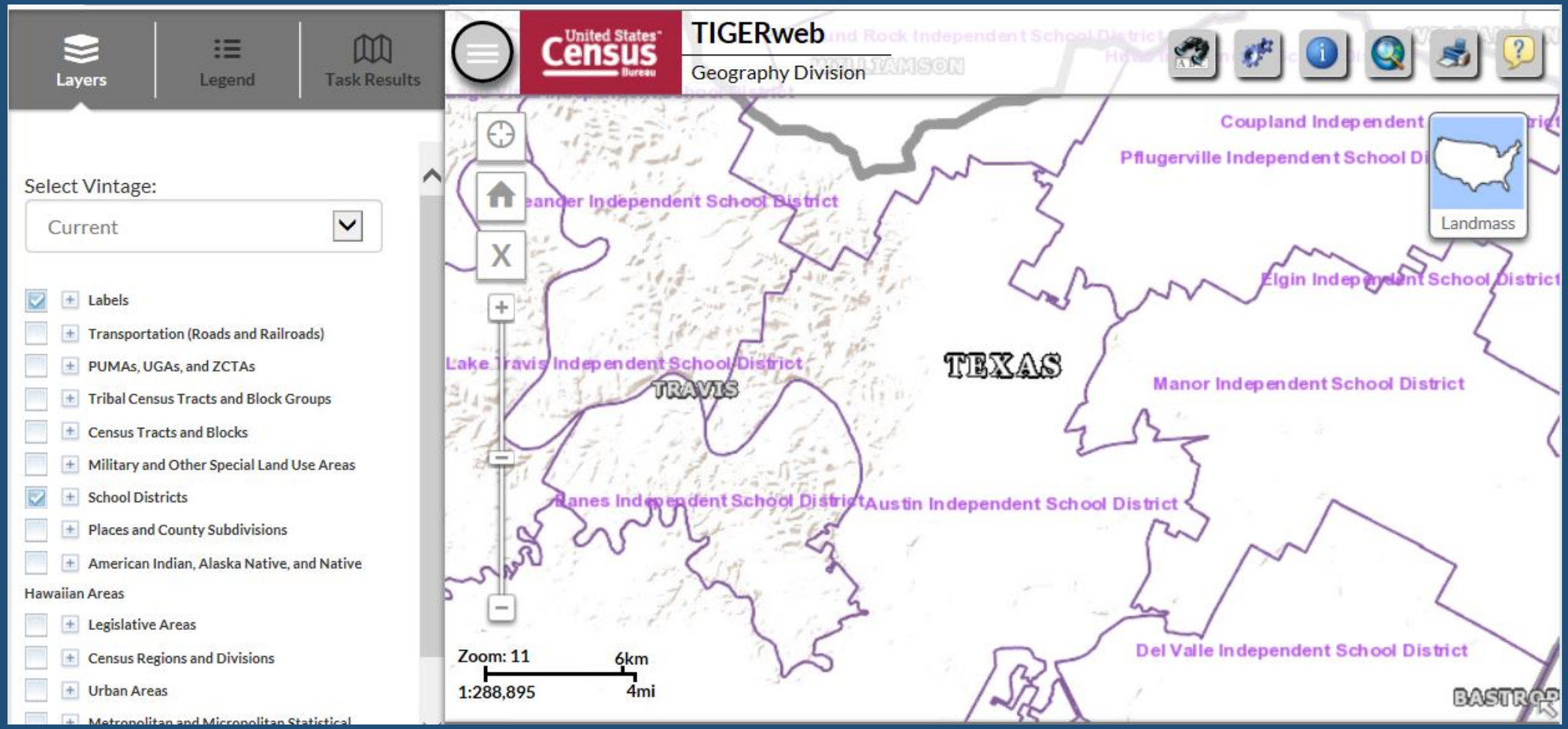
TIGER Shapefiles



Shapefile of the counties of Wisconsin

TIGERweb

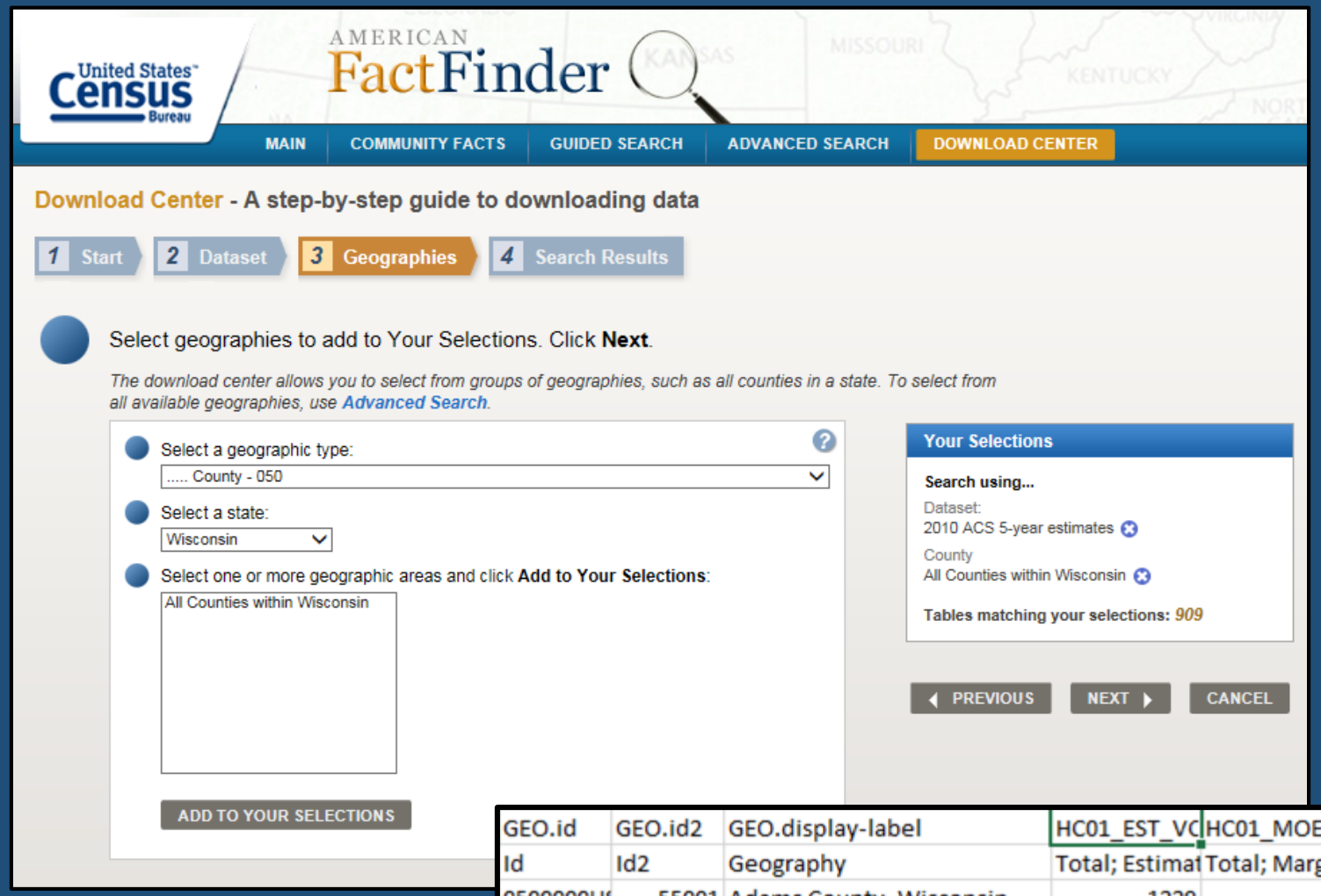
https://tigerweb.geo.census.gov/



American FactFinder by U.S. Census

https://factfinder.census.gov

- Find demographic, economic, and social characteristics of United States
- Data from various Census sources:
  - Decennial Census
  - American Community Survey
  - Puerto Rico Community Survey
  - Economic Census
  - Population Estimates Program
  - Annual Economic Surveys
- Has GeoIDs to easily join with spatial boundary files



GEO.id	GEO.id2	GEO.display-label	HC01_EST_VC	HC01_MOE_VC01	HC02_EST	HC02_MOE_VC	HC03_EST
Id	Id2	Geography	Total; Estimat	Total; Margin of Er	Male; Esti	Male; Margin c	Female; E
0500000US	55001	Adams County, Wisconsin	1229	49	683	38	546
0500000US	55003	Ashland County, Wisconsin	1646	78	846	52	800
0500000US	55005	Barron County, Wisconsin	3545	86	1876	51	1669
0500000US	55007	Bayfield County, Wisconsin	826	43	478	20	348
0500000US	55009	Brown County, Wisconsin	24820	170	12172	138	12648
0500000US	55011	Buffalo County, Wisconsin	997	18	528	8	469
0500000US	55013	Burnett County, Wisconsin	821	52	404	38	417

Geographic Identifiers (GEOIDs)

https://www.census.gov/geo/reference/geoidentifiers.html

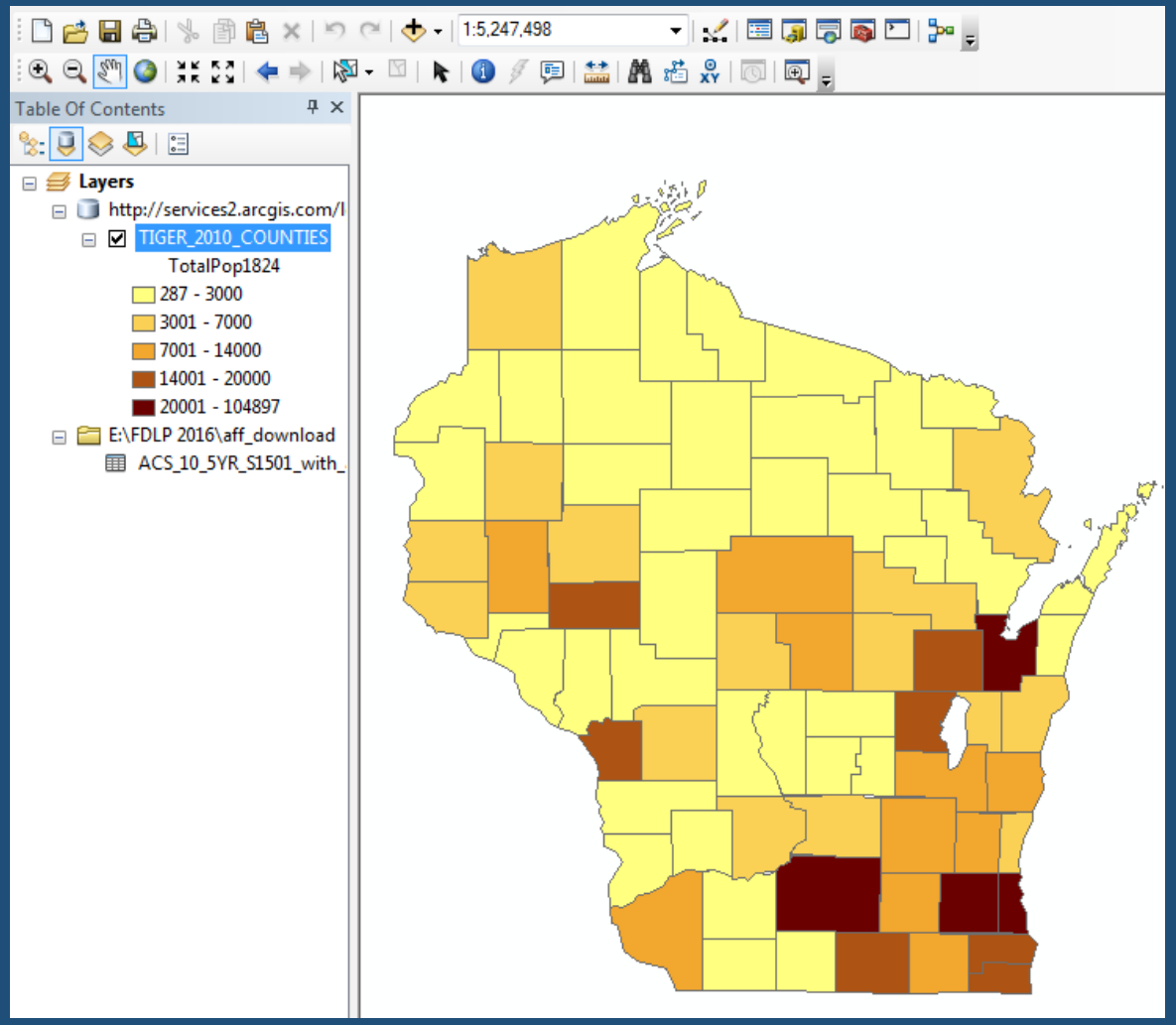
- **Federal Information Processing Series (FIPS)** codes

  "States, counties, core based statistical areas, places, county subdivisions, consolidated cities and all types of American Indian, Alaska Native, and Native Hawaiian (AIANNH) areas"

- **Geographic Names Information System (GNIS)** codes

  "Most types of physical and cultural geographic features, both current and historical. Does not include road and highway features."

Joined TIGER & AFF Data



Population of 18-24 year-olds in Wisconsin in 2010.

Inputting Tabular Data

- **Data with a spatial component can be input into a GIS!**
- Easier if has coordinates information or geographic identifiers (GEOIDs)
- May need to clean up the data – even from AFF.
  - Make sure only one column header.
  - Remove spaces between words in column header.
  - Remove special characters.
  - Check for missing data.
  - See “Importing Data from Excel Spreadsheets” for more info: http://www.esri.com/news/arcuser/0312/files/excelmagic.pdf

Geocoding

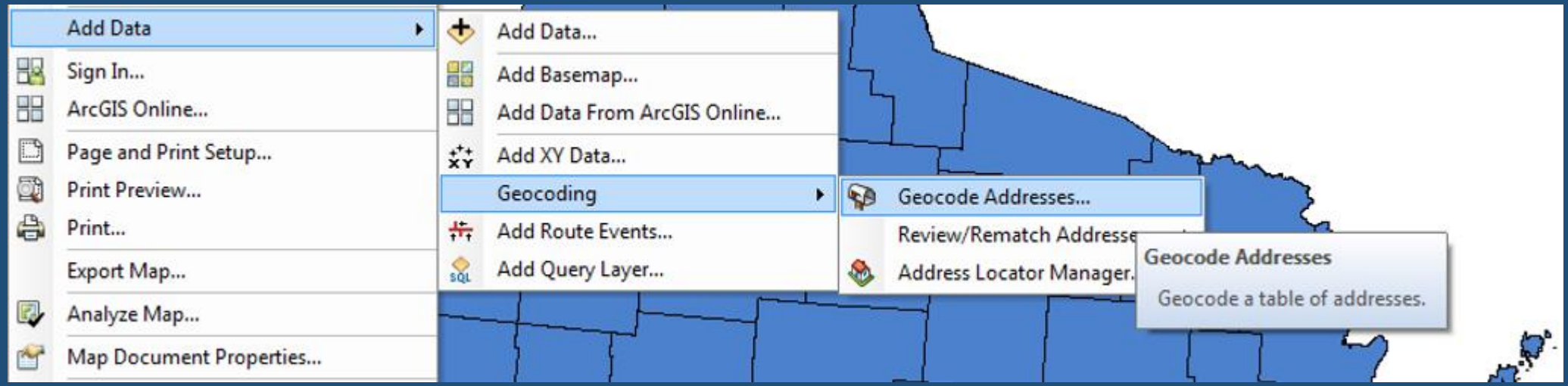
- Geocoding is converting addresses and other geographic data to geographic coordinates, such as latitude and longitude.

300 Army Navy Drive
Arlington, Virginia 22202-2891

38.863785, -77.052683

Geocoders

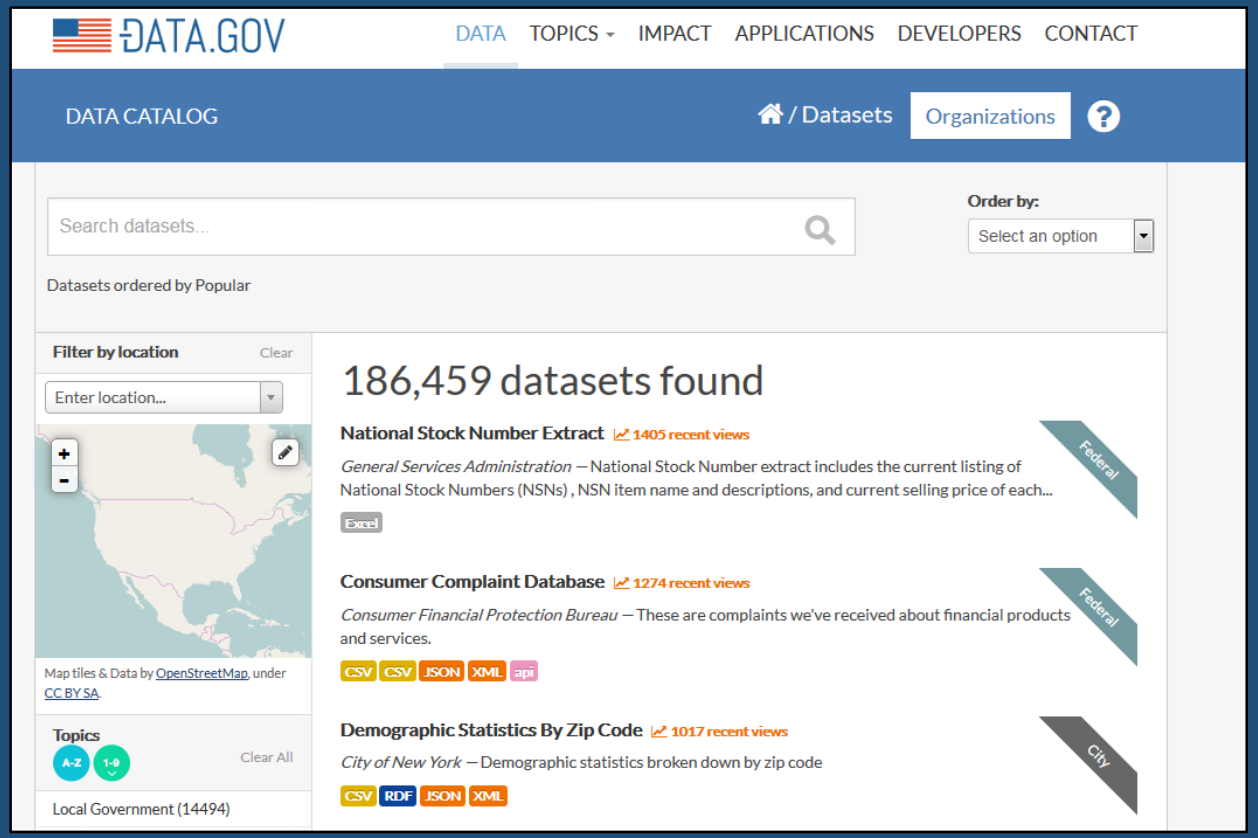
- ArcGIS Online Geocoding Service
- Census Geocoder
  http://geocoding.geo.census.gov/geocoder/
- Texas A&M's Geocoder List https://geoservices.tamu.edu/Services/Geocode/OtherGeocoders/



Data.Gov

https://www.data.gov/

- A repository of government data with >185,000 as of Sept. 2016
- Filter options include location, organization, topic, tags, file formats, & more.



Data.Gov File Formats

Formats

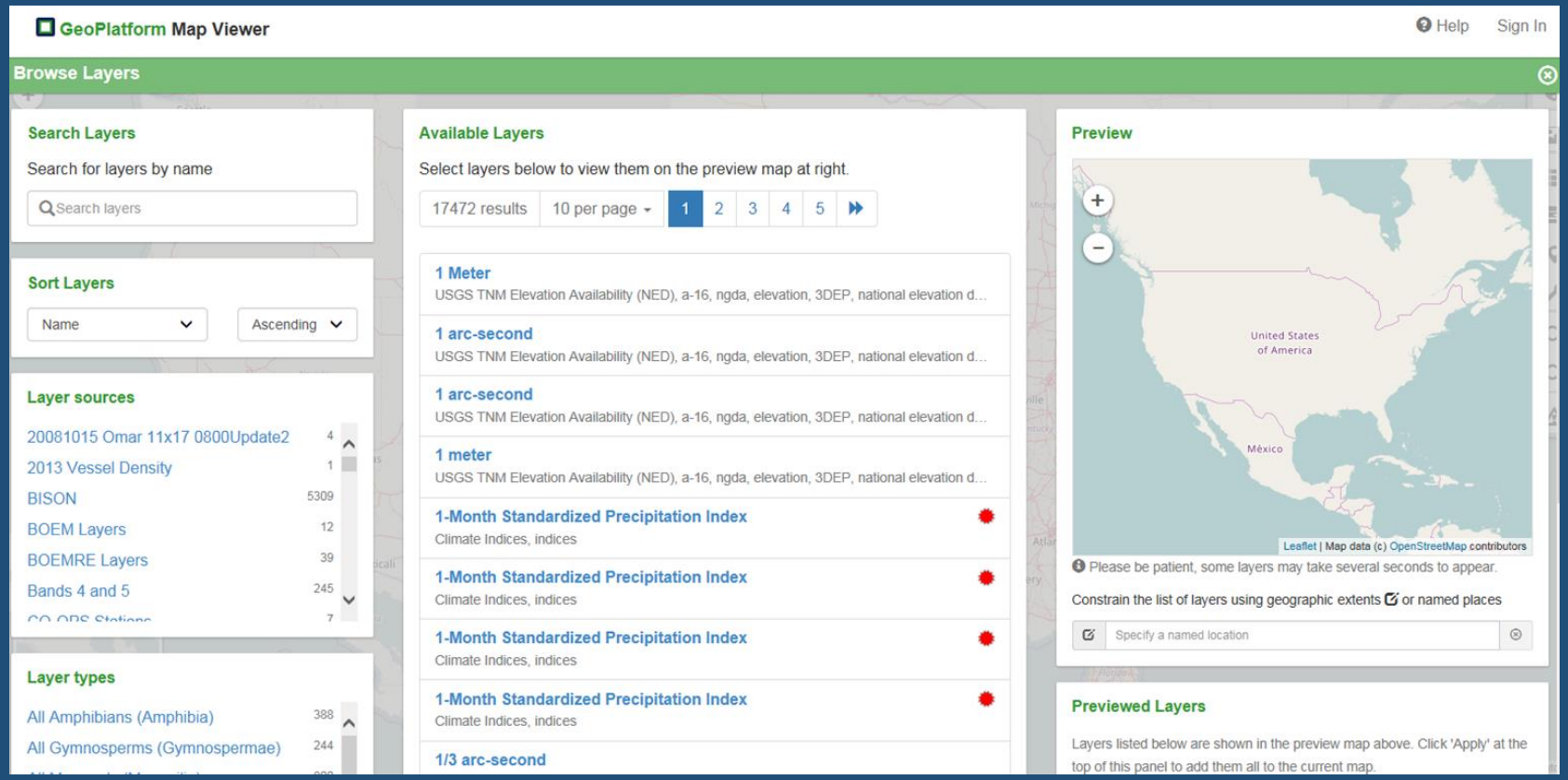
A-Z 1-9 Clear All

- HTML (76046)
- XML (43663)
- PDF (36501)
- originator data format (26105)
- ZIP (17791)
- TIFF (13662)
- CSV (13212)
- MrSID (12884)
- WMS (11716)
- JSON (11410)
- XYZ (7957)
- RDF (7935)
- WCS (5628)
- Esri REST (5591)
- JPG (5570)
- TXT (4832)
- NetCDF (4419)
- application/octet-s... (3740)
- iwxmm-us (3560)
- JPEG (3223)
- Excel (3168)
- application/vnd.lot... (3109)
- KML (2758)
- WFS (2710)
- gml (2402)
- tif (1907)
- hdf (1749)
- esri shapefile (1665)
- application/vnd.goo... (1012)
- fema-dcs-hydrology (960)
- opendap (954)
- application/vnd.goo... (951)
- fema-dcs-hydraulics (919)
- arce (911)
- TAR (841)
- fema-dcs-terrain (804)
- geotiff (800)
- XLS (738)
- ascii (679)
- api (509)
- xlsx (407)
- fema-dcs-survey (336)
- application/unknown (317)
- shapefile (314)
- web page (302)
- export (297)
- geojson (292)
- ngdc created iso me... (256)
- erdas compressed wa... (247)

Geoplatform.gov

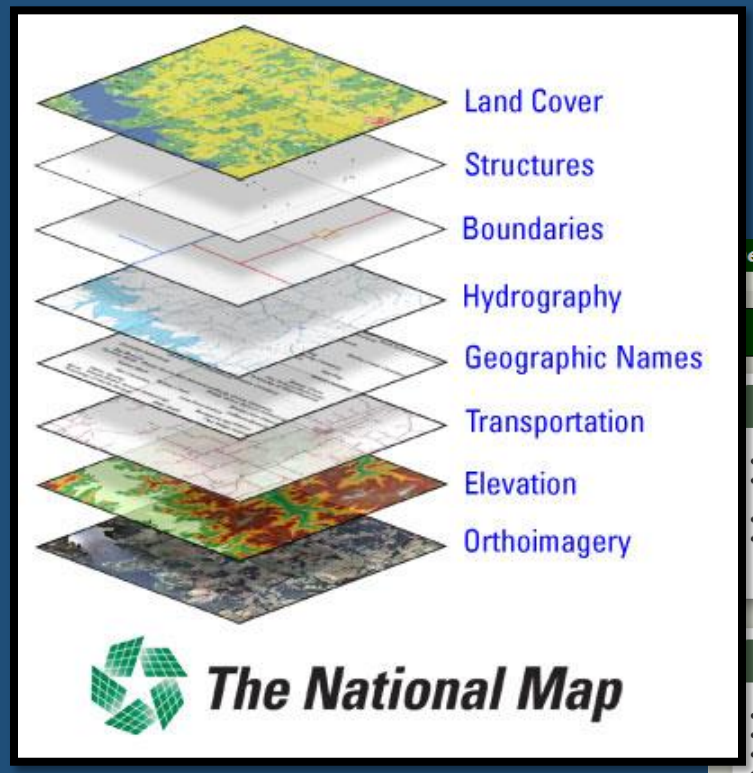
https://www.geoplatform.gov/

- Data maintained by Data.gov, but data coordinated by Federal Geographic Data Committee.

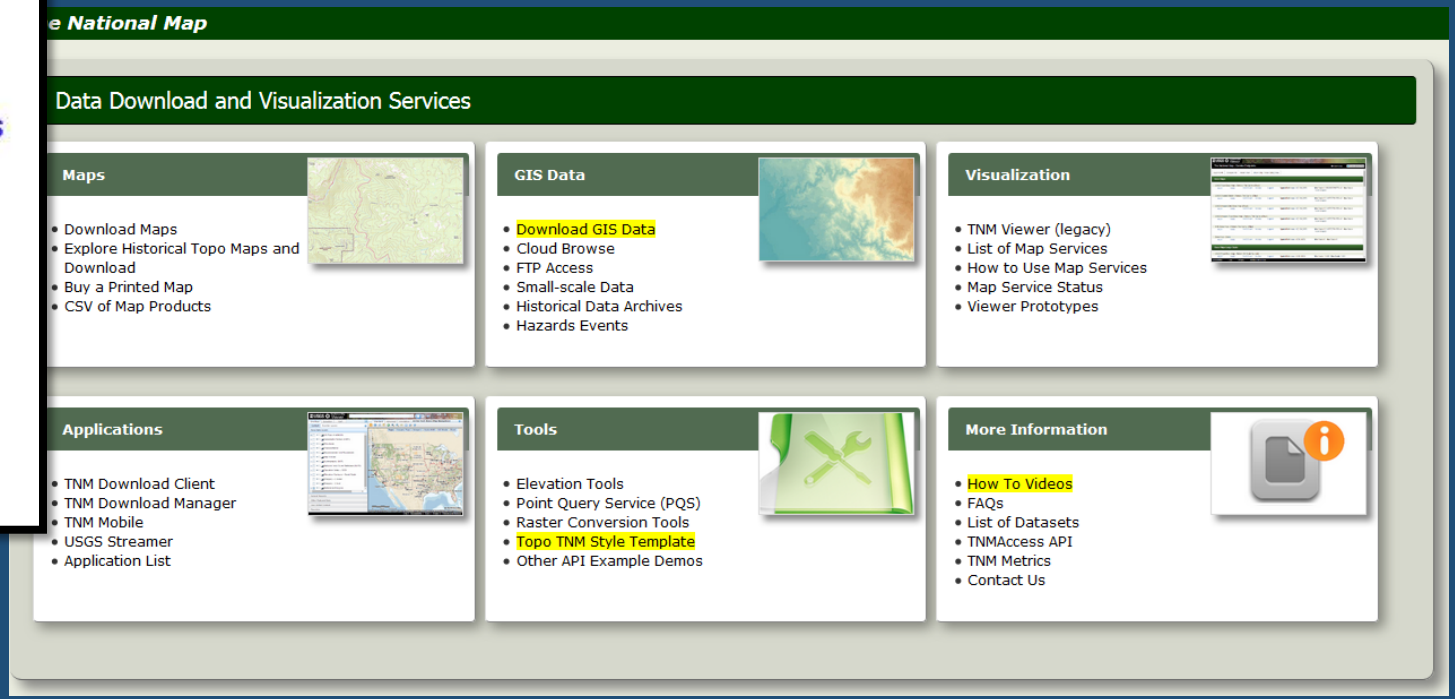


National Map by USGS

http://nationalmap.gov/



TNM Datasets

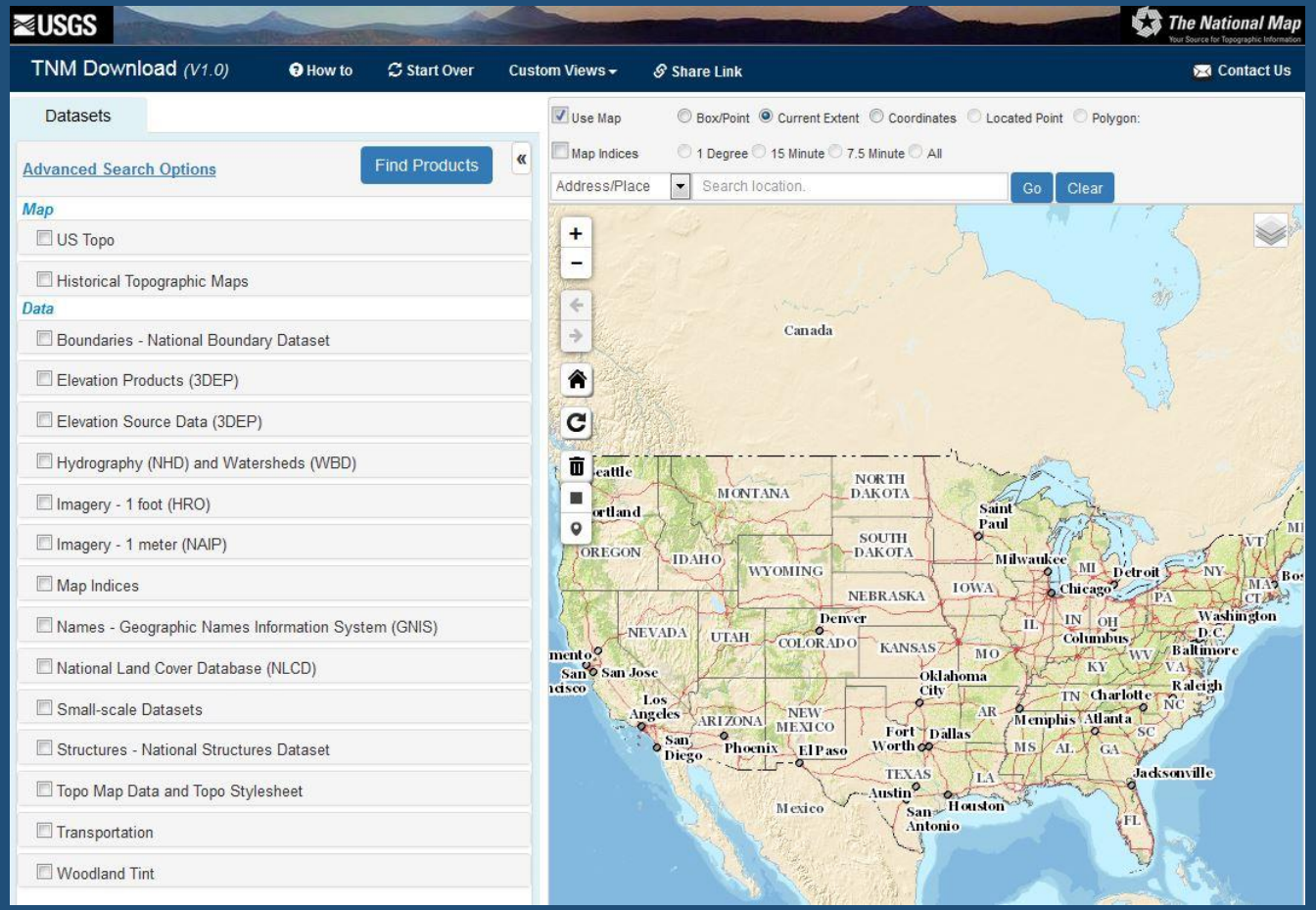


The National Map (TNM) Download by USGS

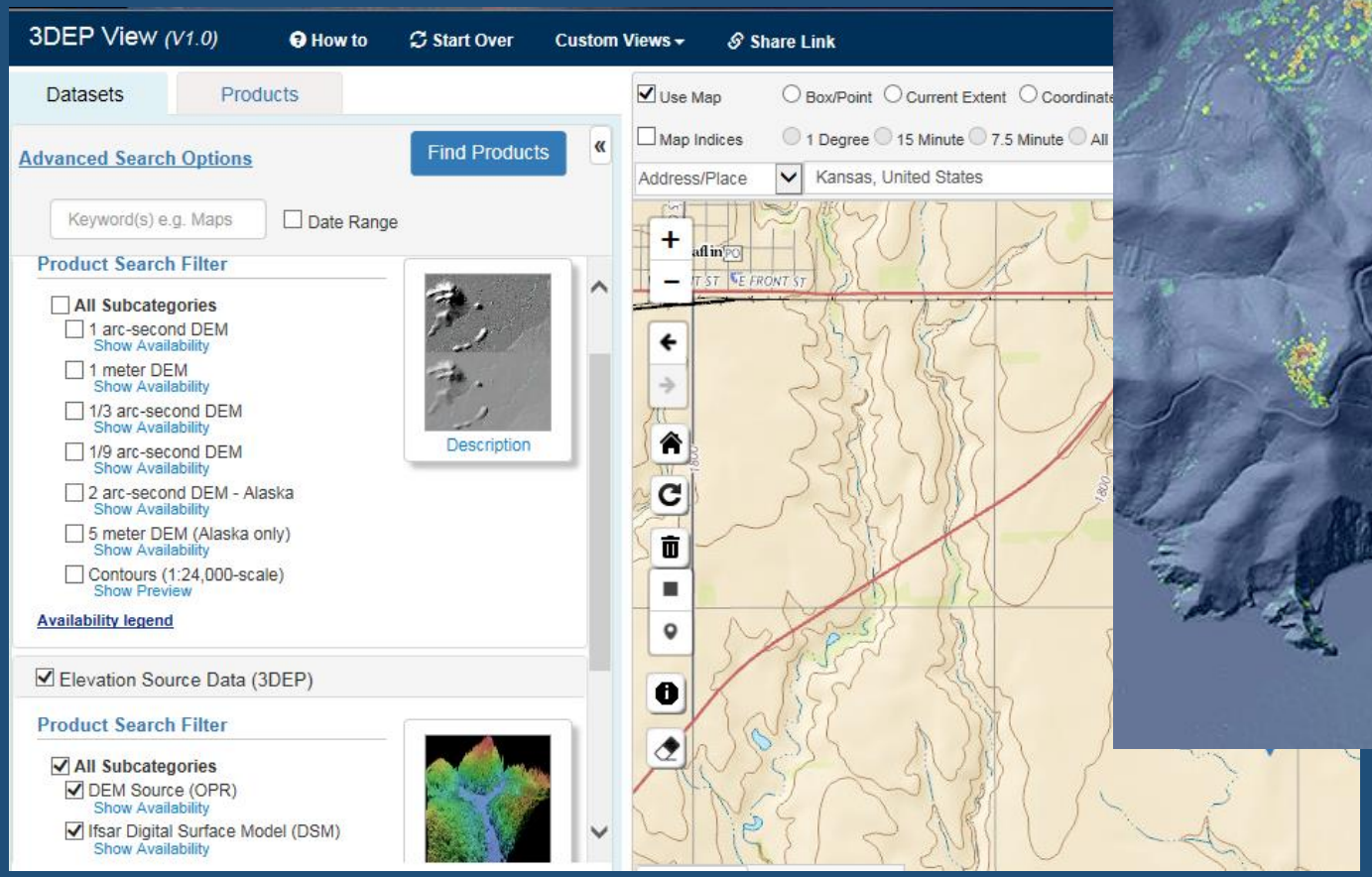
https://viewer.nationalmap.gov/basic/

View a variety of datasets in the interactive map viewer & easily download the data for import into a more robust GIS for further analysis.

Data includes elevation data from the new 3DEP incorporating NED (National Elevation Dataset).



3D Elevation Program (3DEP) by USGS



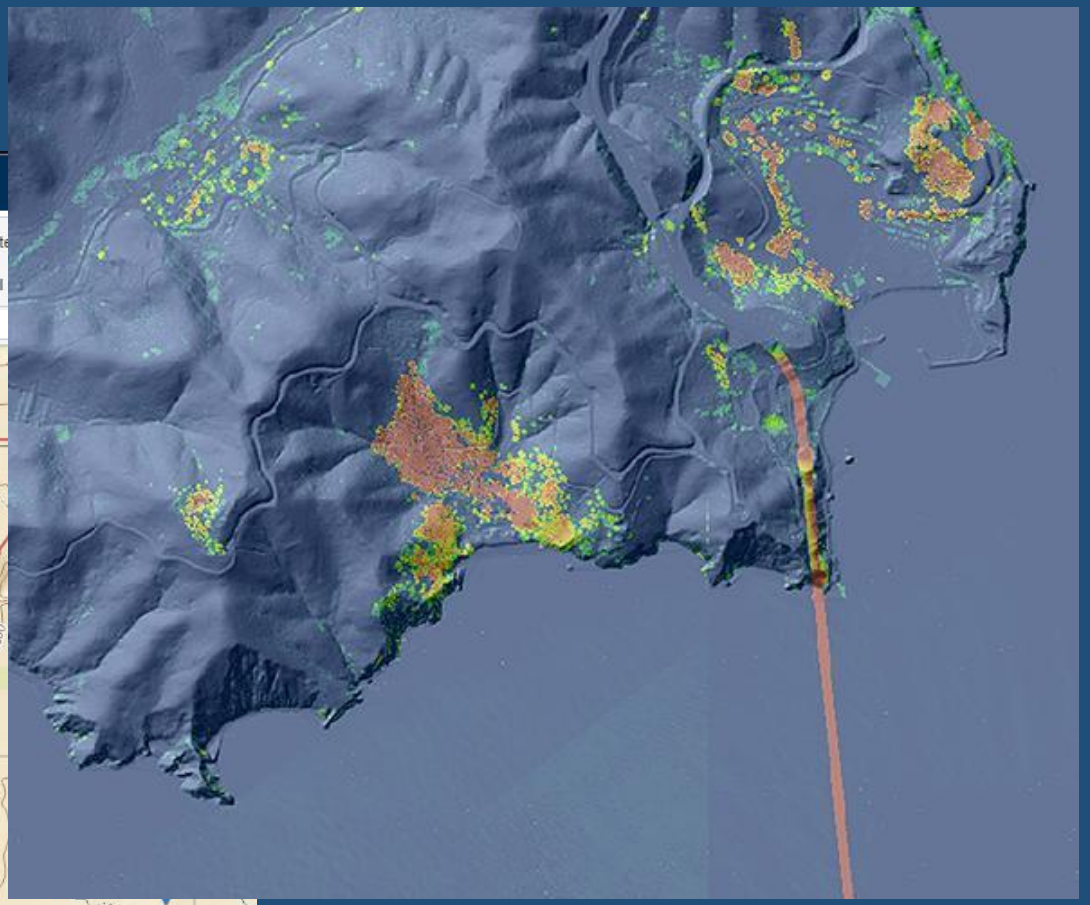


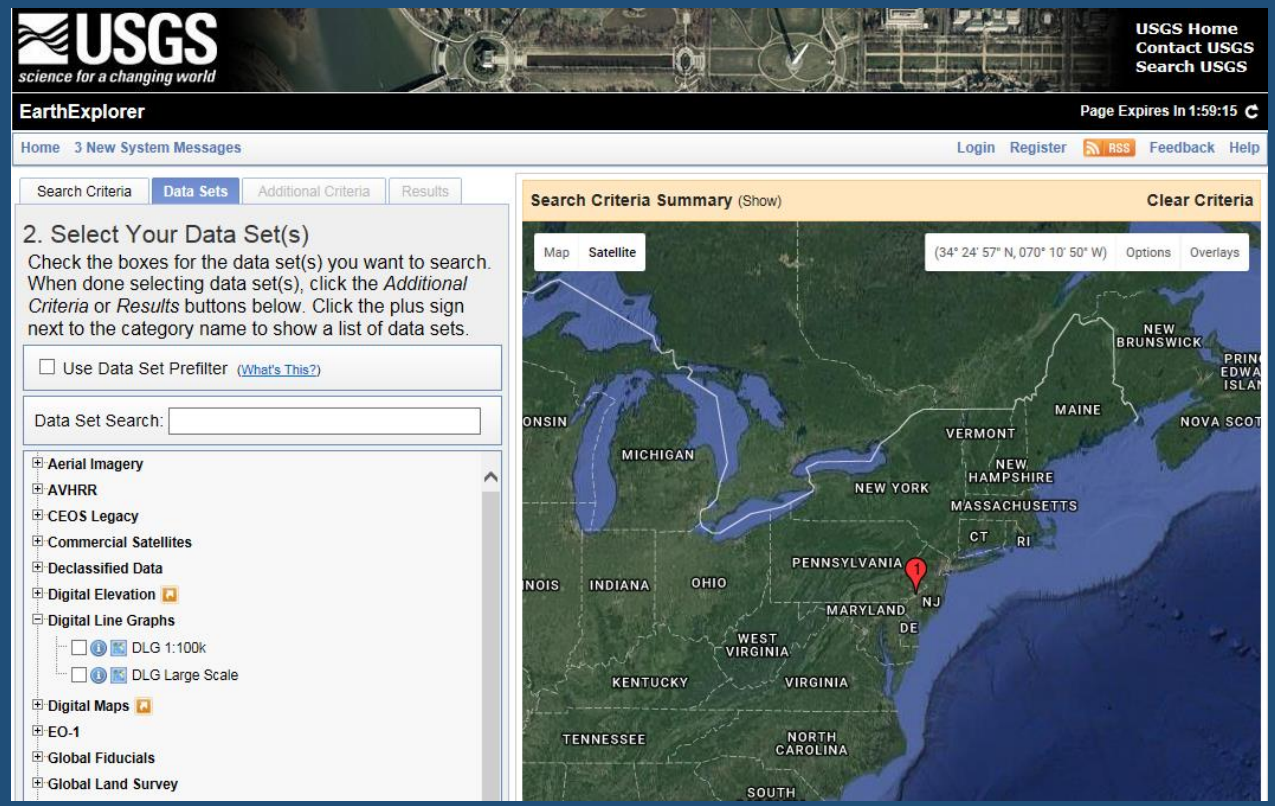
Image from 3DEP Transition webpage.

EarthExplorer by USGS

http://earthexplorer.usgs.gov/

Interactive map from USGS with an enormous selection of remote sensing data including:

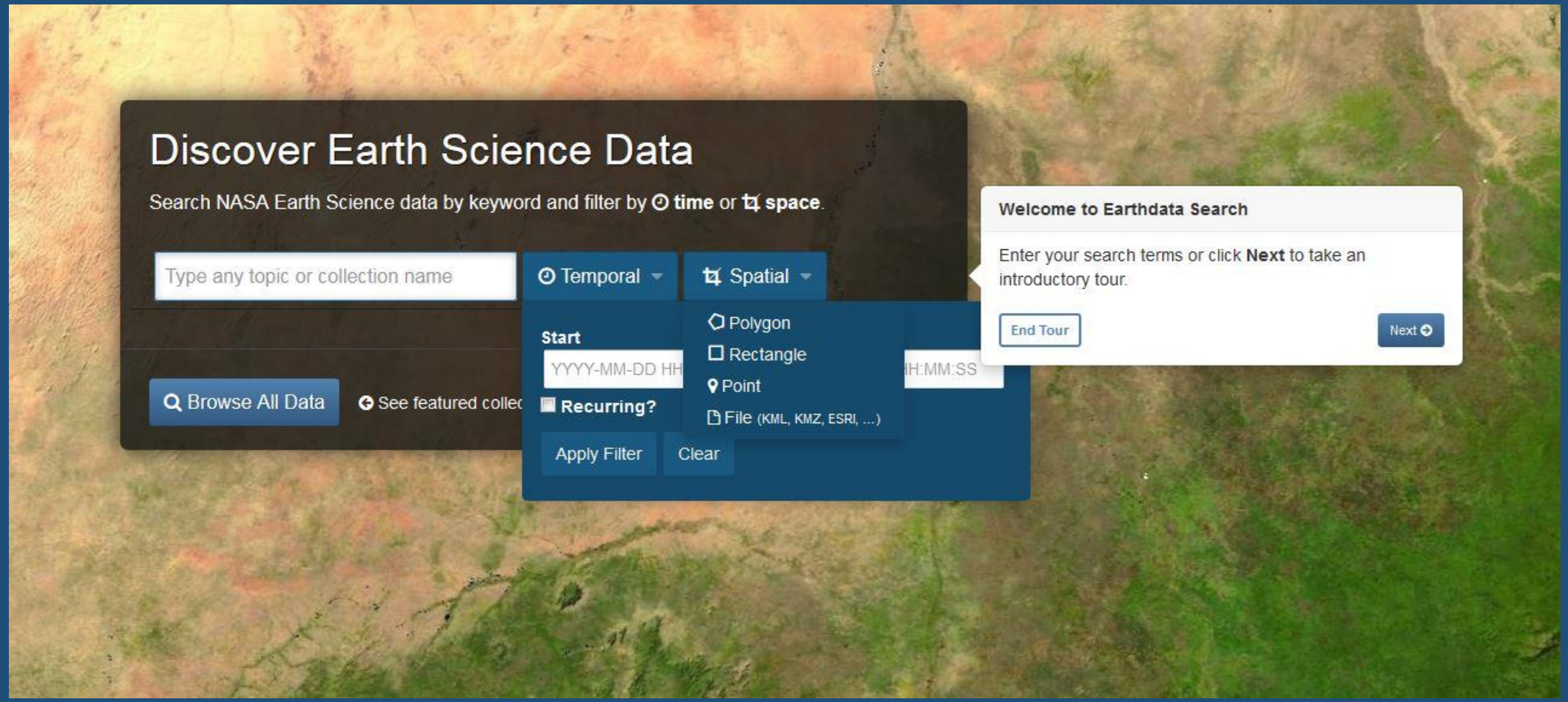
- **DEMs** (Digital Elevation Models)
- **NAIP** (National Agriculture Imagery Program)
- **Landsat**
- & more!



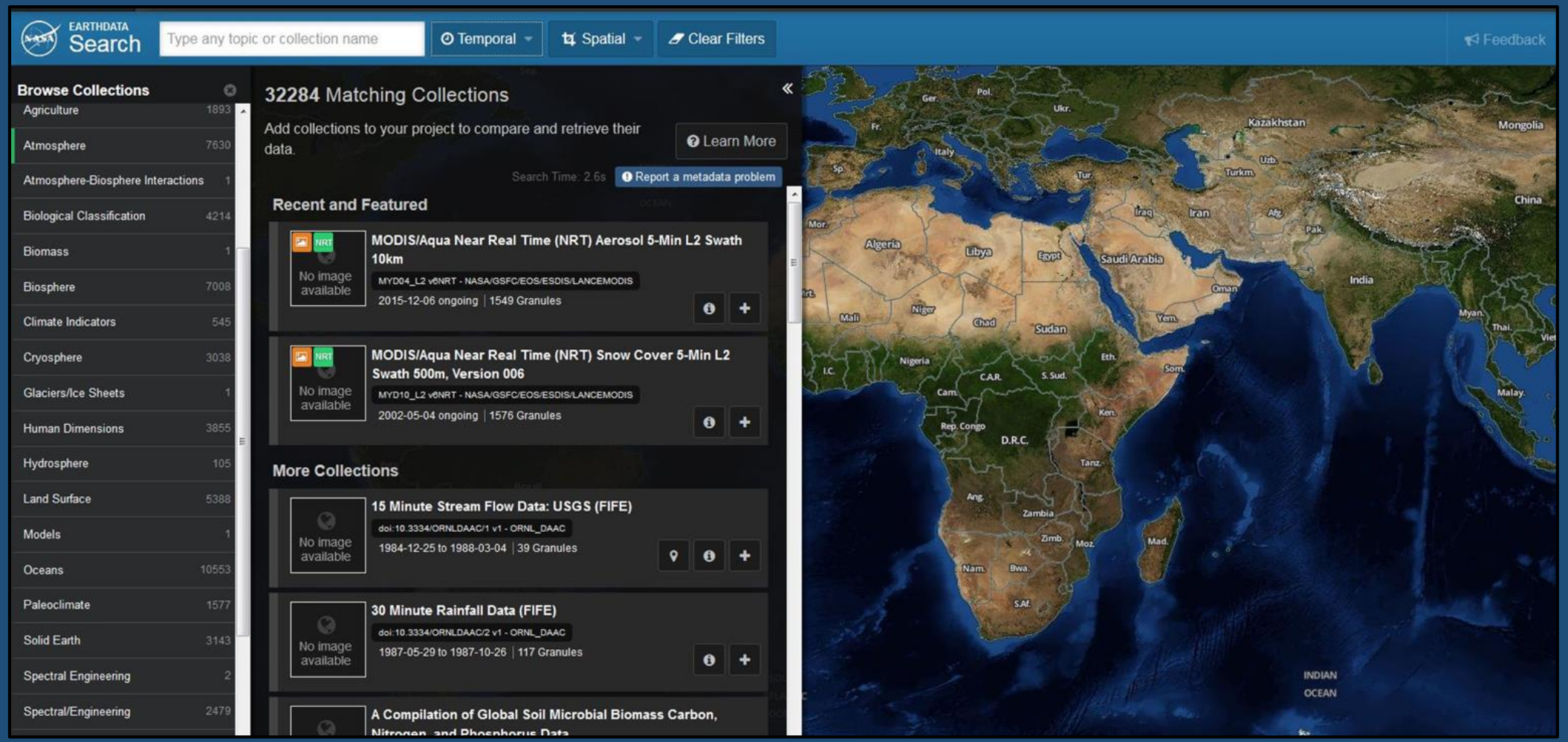
Including declassified reconnaissance images from Corona!

Earthdata by NASA

https://earthdata.nasa.gov/

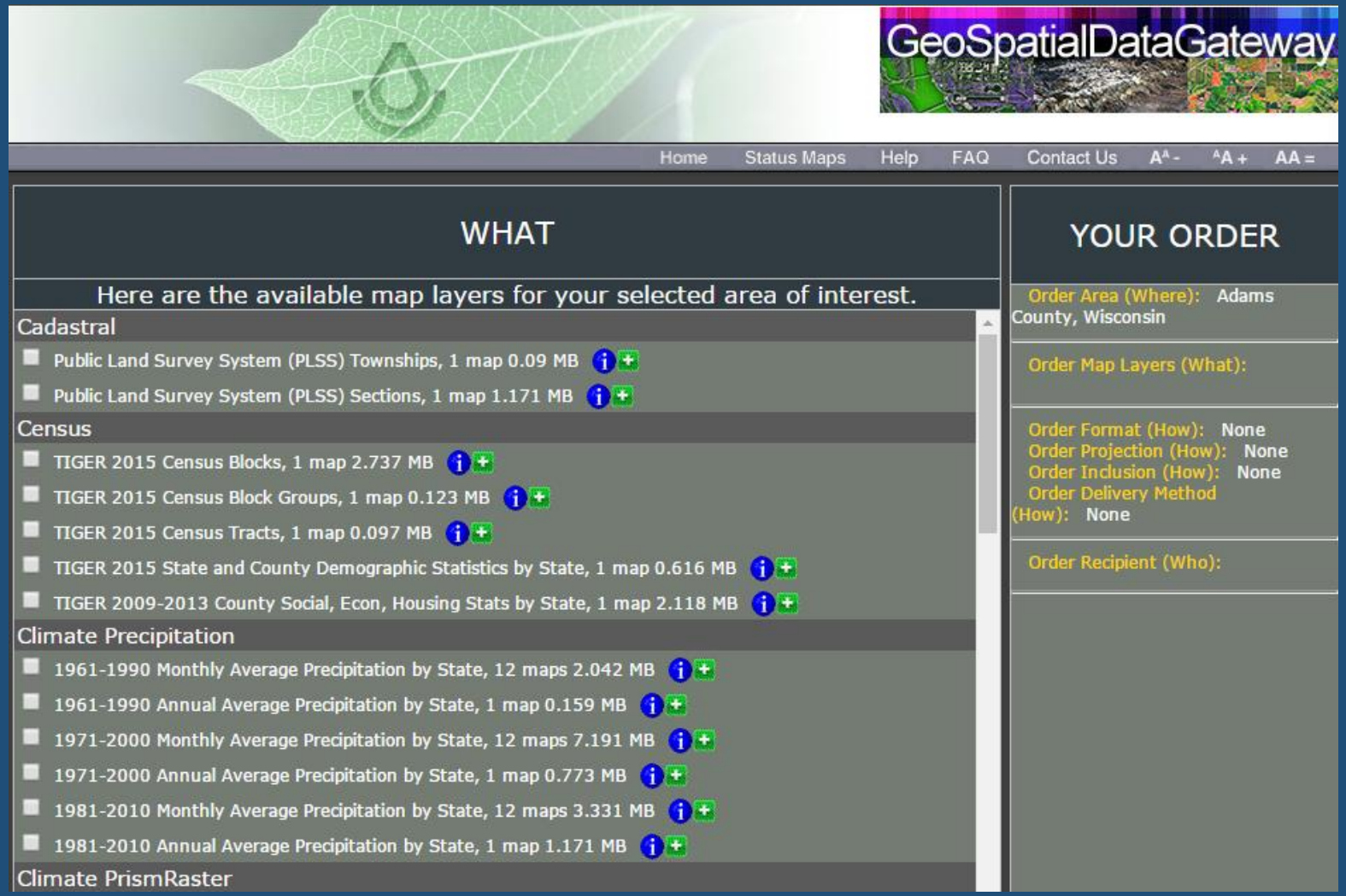


Earthdata Search



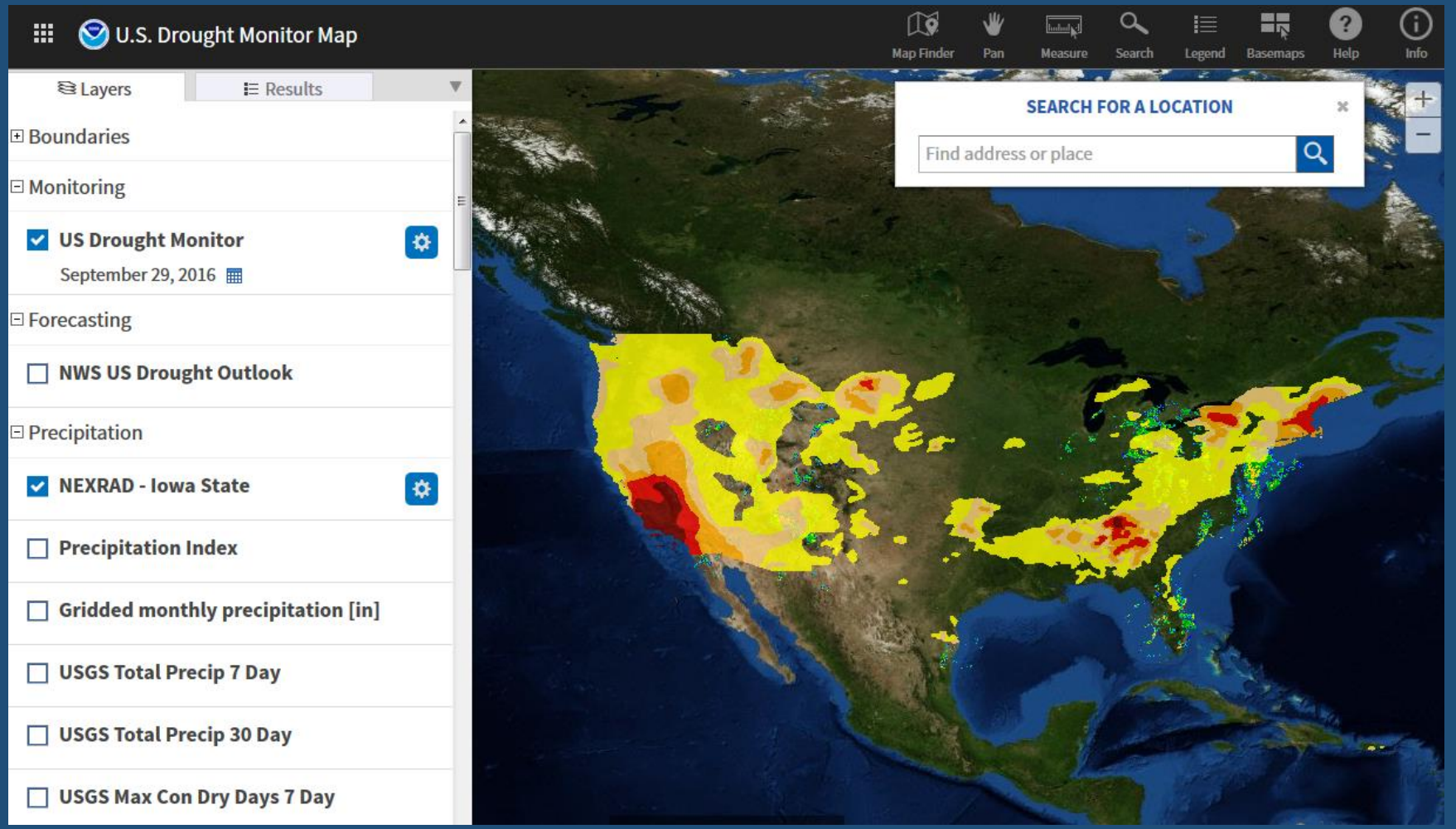
Geospatial Data Gateway by USDA

https://gdg.sc.egov.usda.gov/



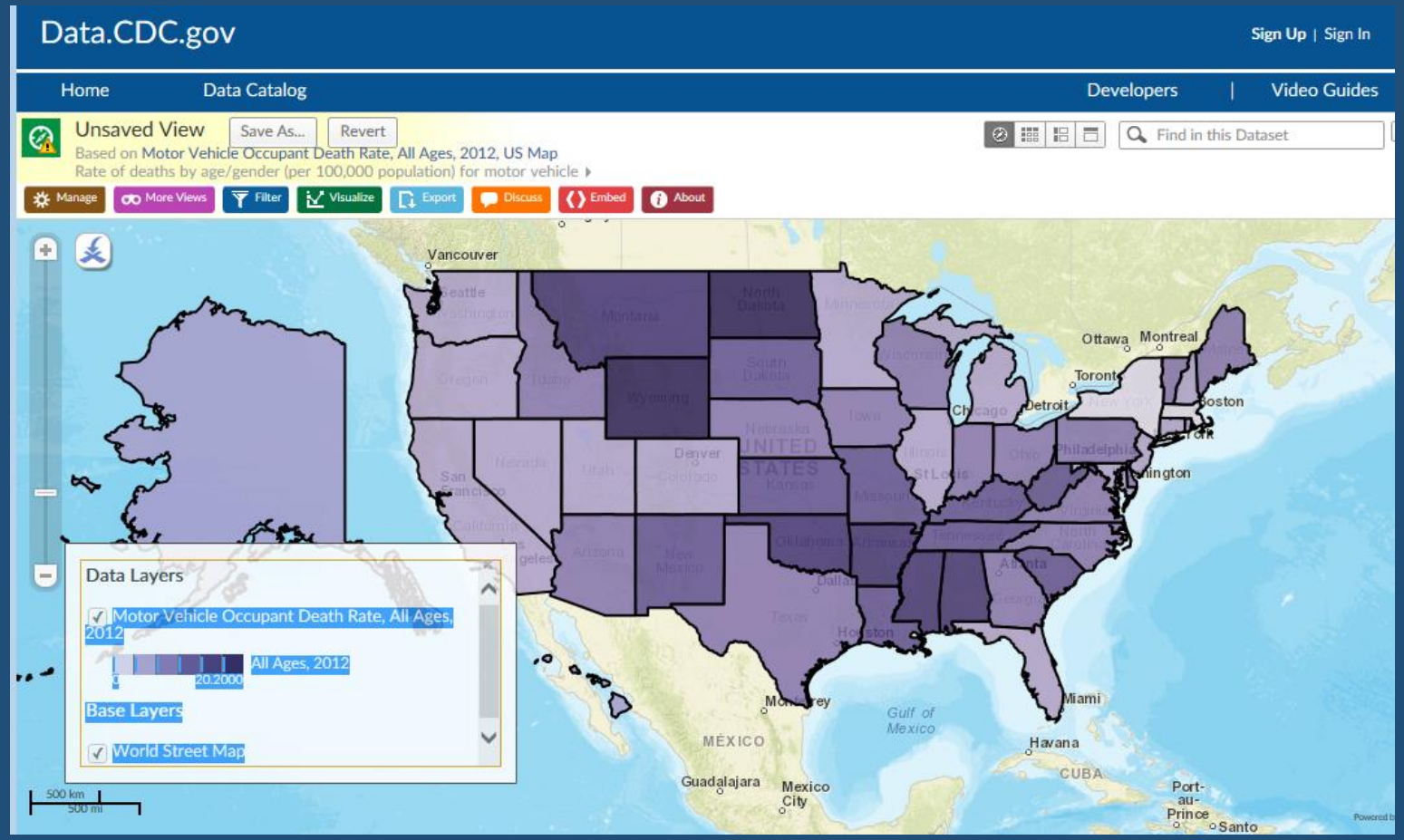
NCEI Map Viewer by NOAA

https://gis.ncdc.noaa.gov/maps/ncei/



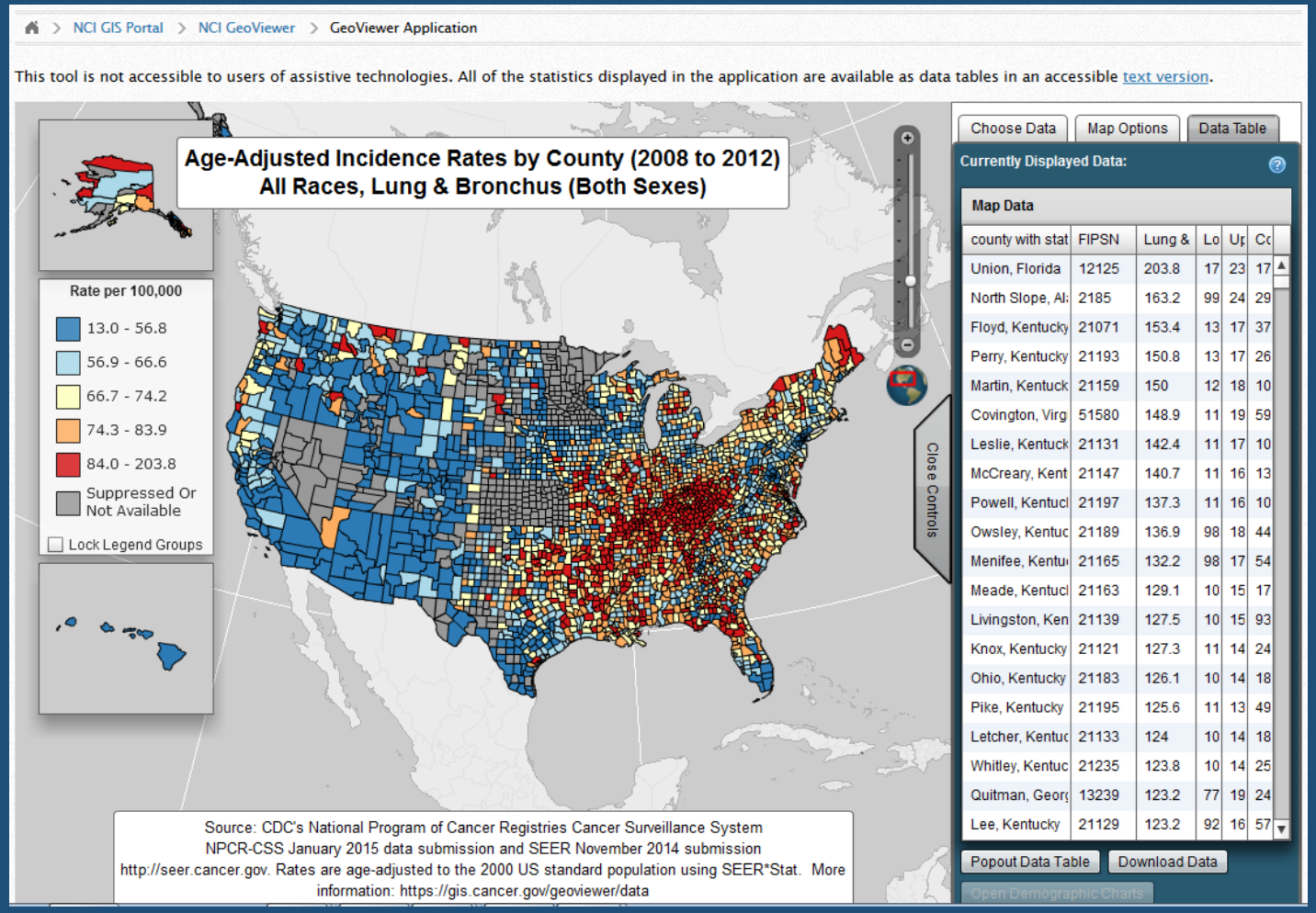
Data.CDC.Gov by Centers for Disease Control & Prevention

https://data.cdc.gov/



NCI Geoviewer by National Cancer Institute

https://gis.cancer.gov/geoviewer/app/

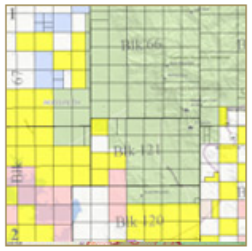


Example State & Local Government Geospatial Data Sources

Texas General Land Office

http://www.glo.texas.gov/land/land-management/gis/index.html

GIS MAP VIEWERS



GISWEB Viewer

The GISWEB, an interactive mapping application, provides access to vast collections of land and energy related data at the Texas General Land Office. The GISWEB display upland and submerged Original Texas Land Survey boundaries, Permanent School Fund land, upland and coastal leases, oil and gas well locations, and current imagery.

Launch GLO - GISWEB Viewer

Texas Beach Watch

The goal of the Texas Beach Watch program is to provide the public with information about water quality at selected recreational beaches along the Texas coast.

Launch Texas Beach Watch

Texas Coasts

Find Your Perfect Beach. From fishing and boat ramps, to camping and BBQ—the Texas Coast provides a wealth of resources to all visitors. The GLO is proud to offer this free resource to help you explore all that our shores have to offer.

Launch Texas Coasts

Texas Parks & Wildlife

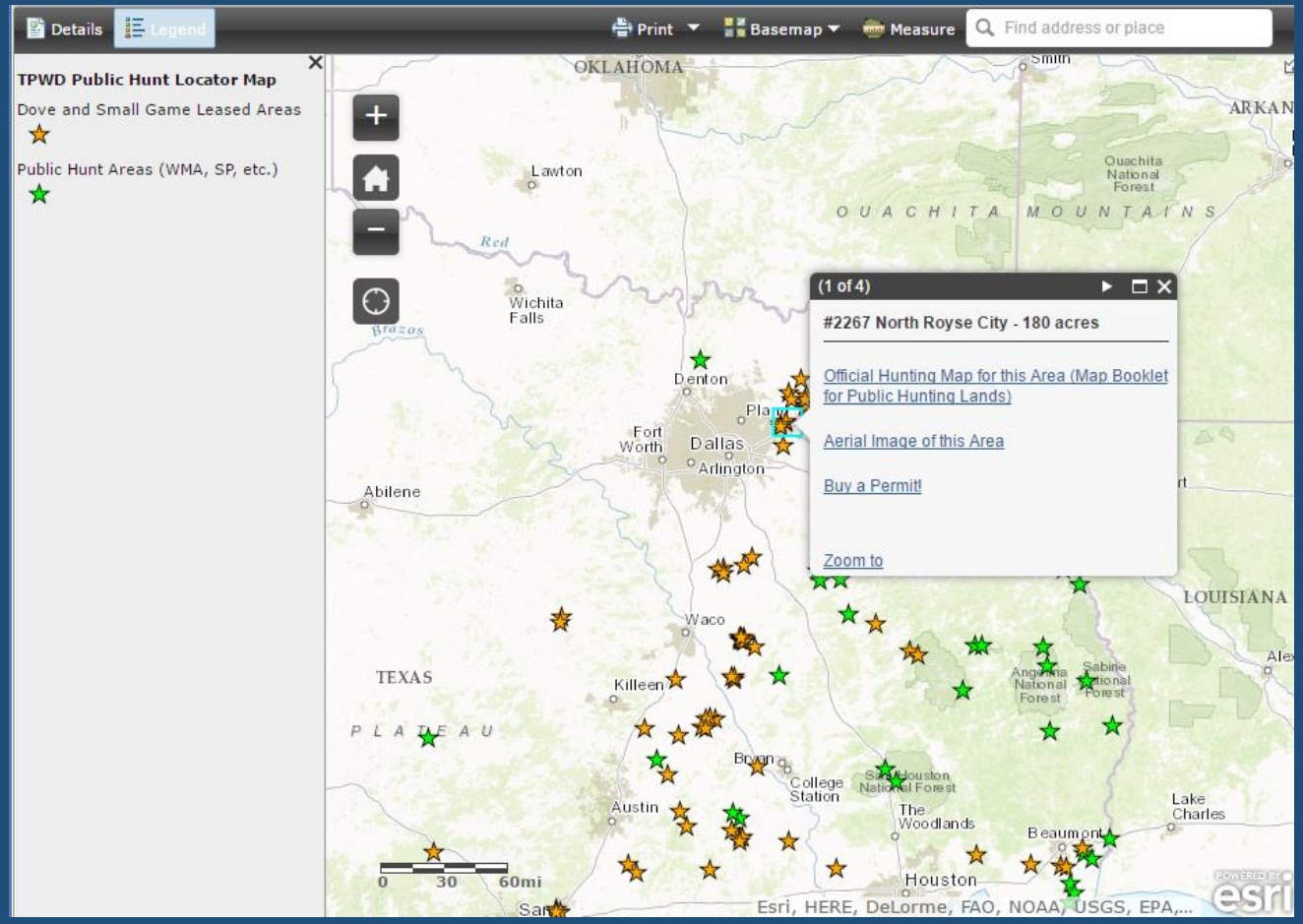
http://tpwd.texas.gov/gis/data/downloads

Boundaries

- Counties
- State Plane Zones
- Texas-Louisiana Boundary Line - 1976
- Texas-Louisiana Boundary Points - 1976
- Quads - 24K
- City Points
- Wildlife Management Areas
- State Park Boundaries

Ecological Mapping Systems of Texas

- Omernik Ecoregions Level III Map
- Texas Ecological Systems Data by Ecoregion
- Texas Ecological Mapping Systems Statewide (Raster)
- Supporting Documents



TNRIS: Texas Natural Resources Information System

https://tnris.org/

Data Catalog

Browse through the TNRIS datasets and map products to find out what is hosted online or available for order.

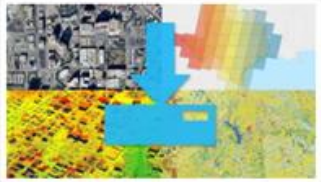
Browse the Catalog

Research & Distribution (RDC)

The RDC offers a variety of additional products, support and services from our in-house staff. We provide hands-on assistance and expertise.

Order Data

Data Download



The quickest way to search and download online TNRIS data.

Start Downloading

Online Mapping Services

Data sets optimized for access through Web Mapping Services (WMS).

View our services

Custom Map Creation

Our trained staff can help you create a custom map to your specifications using TNRIS data or other public sources.

More about Custom Maps

Data & Mapping Solutions

Applying design, communication, and technology to provide custom data solutions and cartographic products.

Learn More

TNRIS is a division of the Texas Water Development Board

City of Austin

ftp://ftp.ci.austin.tx.us/GIS-Data/Regional/coa_gis.html & https://data.austintexas.gov/

Description	Metadata	Feature Type	Updated
ABIA Planimetrics	metadata	Line	01/25/2013
Address Points	metadata	Point	Monthly
Aerial Photo Index Grid 2003 and 2006	metadata	Polygon	08/27/2007
Austin 200' City Grid	metadata	Polygon	06/11/1999
Austin Water Utility Service Area	metadata	Polygon	07/27/2015
Building Footprints 2003	metadata	Polygon	09/24/2007
Building Footprints 2013	metadata	Polygon	7/02/2014
Combining and Overlay Zoning Districts	metadata	Line/Polygon	11/18/2013
Community Registries	metadata	Polygon	Monthly
Core Transit Corridors	metadata	Line	09/06/2007
County Boundary	metadata	Polygon	12/15/1999
Creek Lines	metadata	Line	Monthly
Decks 2013	metadata	Polygon	7/02/2014
Edwards Aquifer Contributing Zones	metadata	Polygon	07/13/2015
Electric Service Area	metadata	Polygon	03/22/2012
Future Land Use Map	metadata	Polygon	Monthly
GPS Monuments	metadata	Point	12/05/2008
Imagine Austin Centers	metadata	Polygon	Monthly

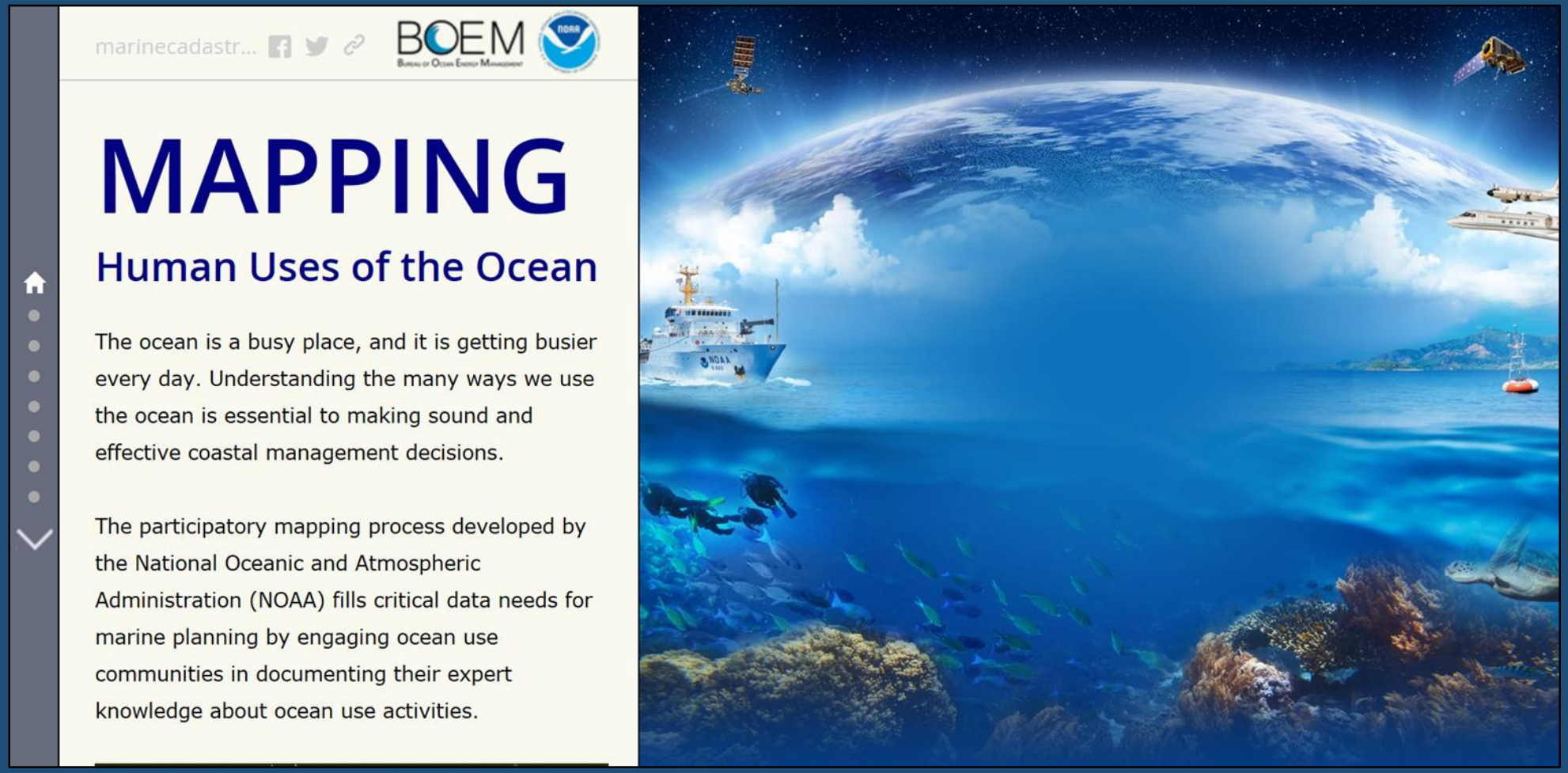
Esri + Government Data

Federal Data in ArcGIS Online

https://www.arcgis.com/home

Story Maps

http://storymaps.arcgis.com/en/gallery

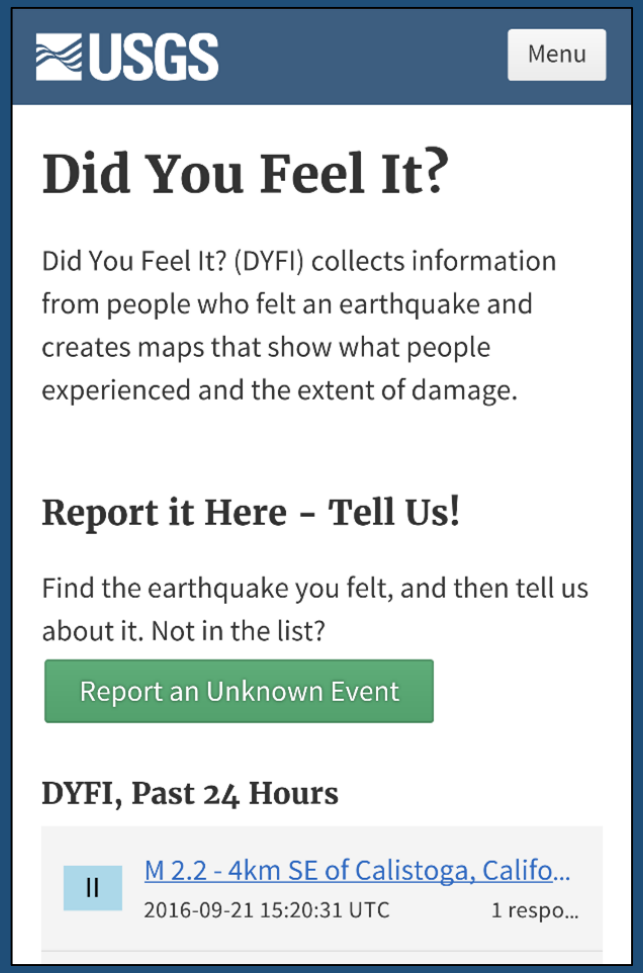


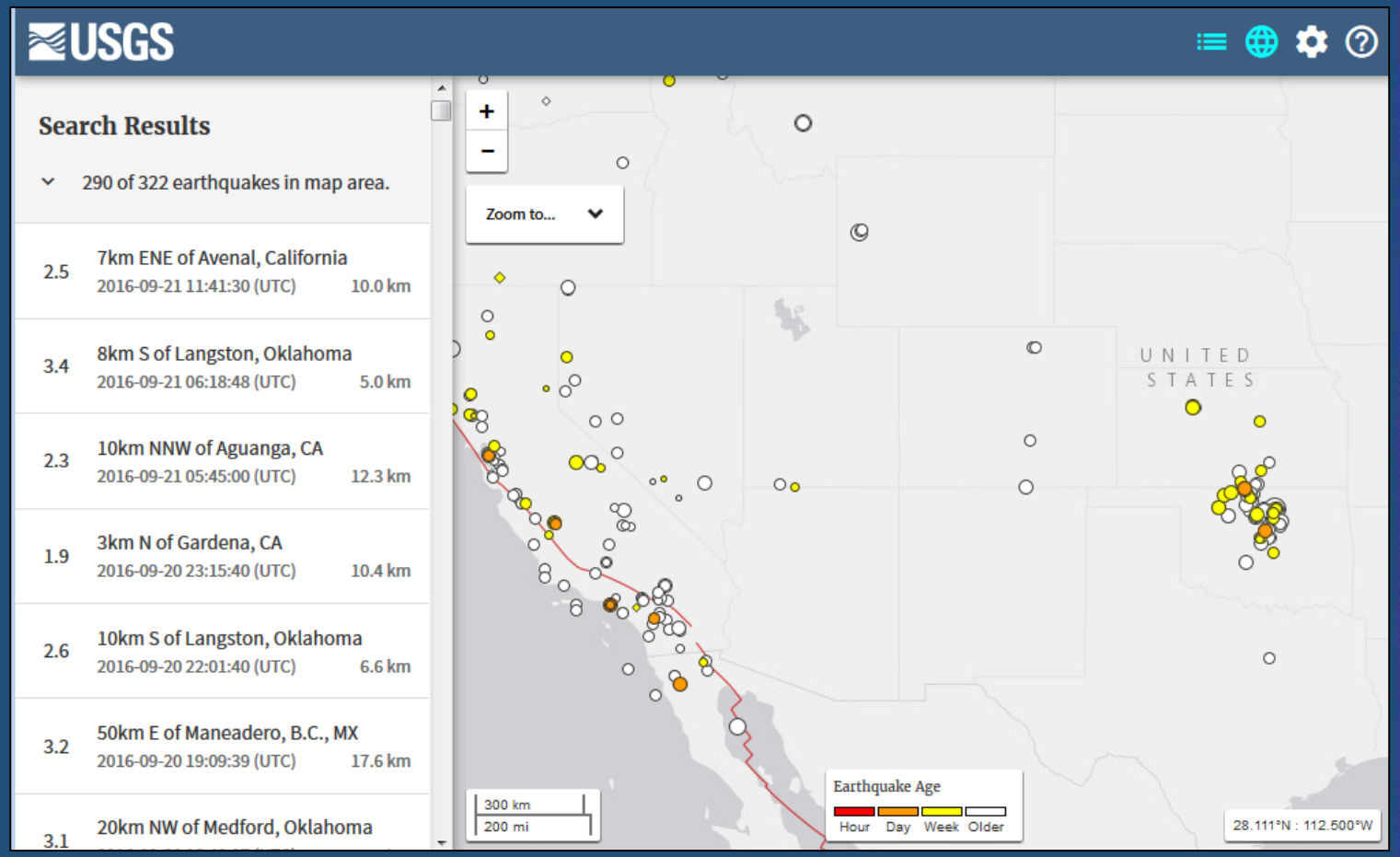
Mapping Human Uses of the Ocean by NOAA

Citizen Science

Did You Feel It? by USGS

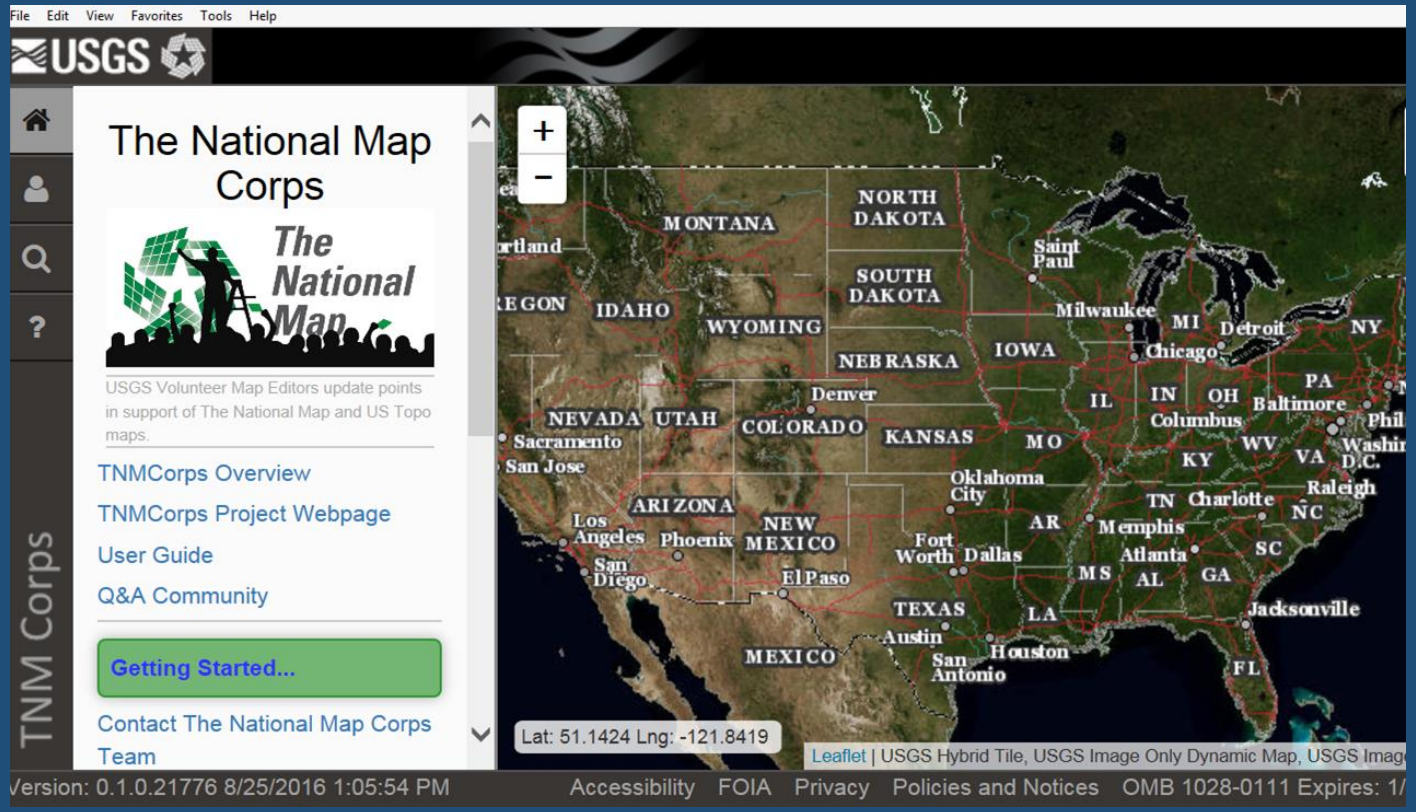
http://earthquake.usgs.gov/data/dyfi/





The National Map Corps Mapping Challenge by USGS

The National Map Corps is enlisting help from volunteers in confirming locations of structures such as schools, hospitals, post offices, police stations, and other important public buildings.



GLOBE Observer by NASA & NSF

http://www.globe.gov/

GLOBE Observer app allows people to gather cloud data and submit it. This data can be downloaded from the GLOBE website.

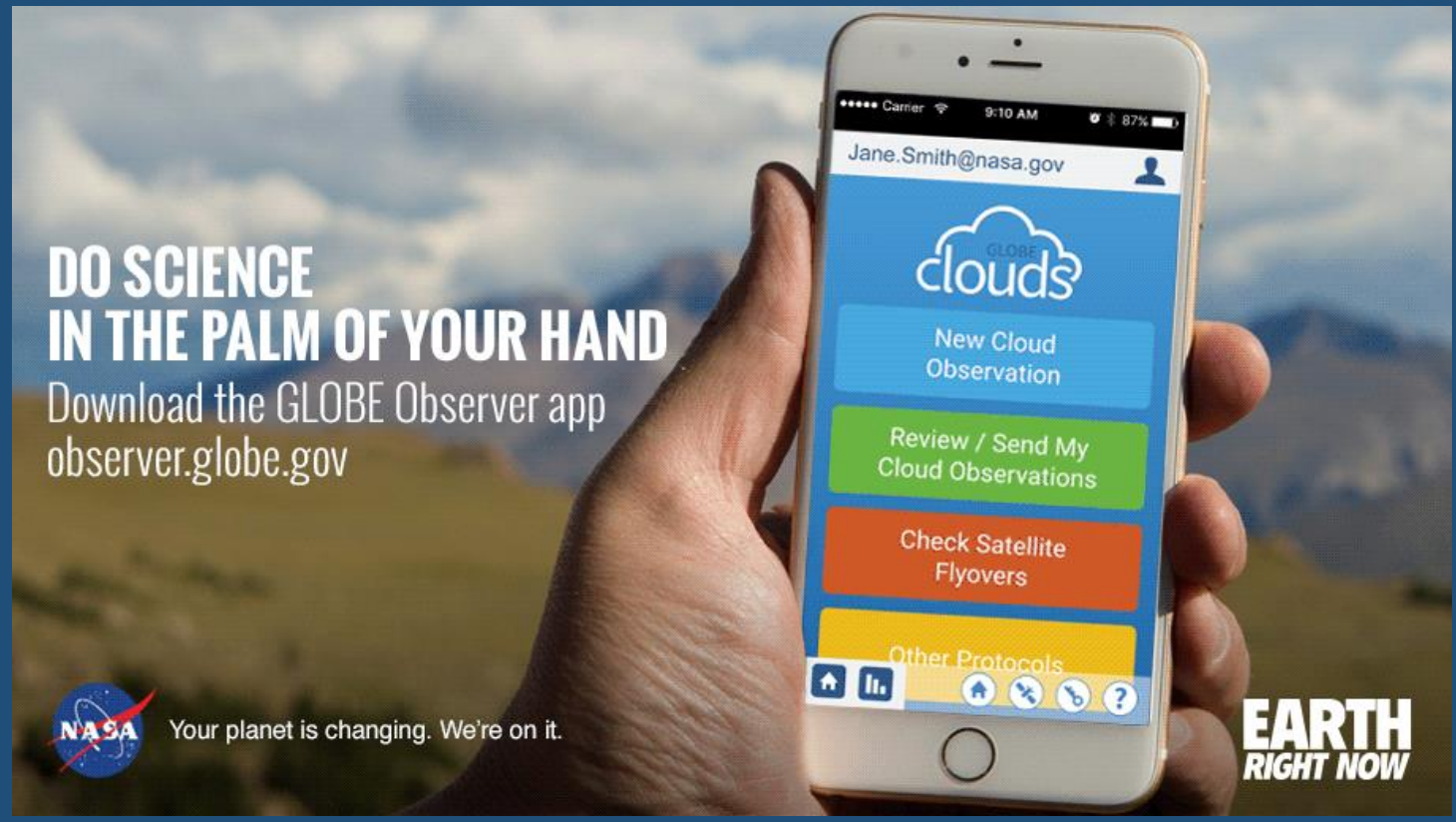


Image Source: http://www.jpl.nasa.gov/edu/news/2016/8/31/nasa-earth-science-app-wants-you/

Additional Resources

List of additional resources & references:

http://guides.library.txstate.edu/BeyondTIGERFiles

Questions?

Contact Information

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