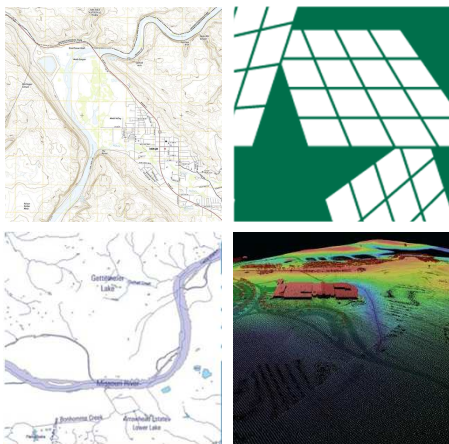




+

## Natural Resources Management Underpinned by Geospatial Information

### United States



Mike Tischler, Ph.D  
 Director, National Geospatial Program  
 U.S. Geological Survey  
 Email: mtischler@usgs.gov

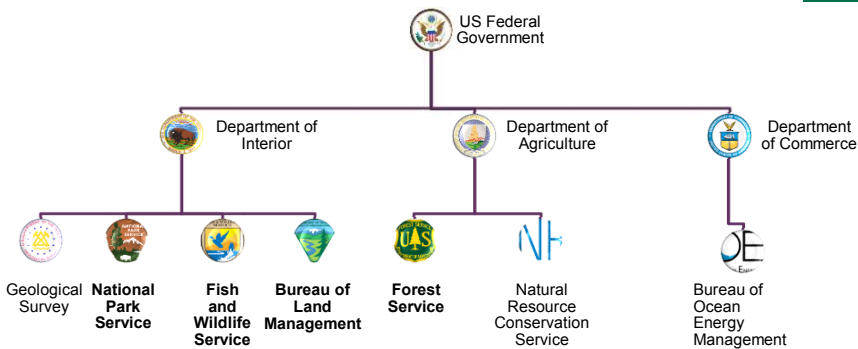
UN-World Geospatial Information Congress  
 November 2018

+

## Natural Resource Management in the U.S.


Multi-agency approach


2



```

            graph TD
            US[US Federal Government] --> DOI[Department of Interior]
            US --> DAg[Department of Agriculture]
            US --> DOC[Department of Commerce]
            DOI --> GS[Geological Survey]
            DOI --> NPS[National Park Service]
            DOI --> FWS[Fish and Wildlife Service]
            DOI --> BLM[Bureau of Land Management]
            DAg --> FS[Forest Service]
            DAg --> NRC[Natural Resource Conservation Service]
            DOC --> BOM[Bureau of Ocean Energy Management]
            
```





## + U.S. Geological Survey



3

### Mission

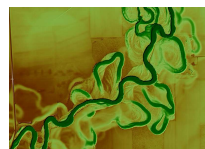
- Provides reliable scientific information to describe and understand the Earth to
  - Minimize loss of life and property from natural disasters
  - Manage water, biological, energy, and mineral resources
  - Enhance and protect our quality of life

### Scope

- Collects, monitors, analyzes, and provides science about natural resource conditions, issues, and problems
- Carry out large-scale, multidisciplinary investigations and provide impartial scientific information



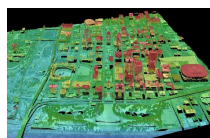
## + U.S. Geological Survey 3D Elevation Program (3DEP) Documented Business Uses



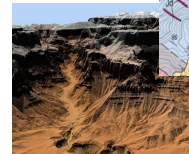
4

Flood Risk Management

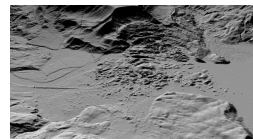
Rank	Business Use	Annual Benefits	
		Conservative	Potential
1	Flood Risk Management	\$295M	\$502M
2	Infrastructure and Construction Management	\$206M	\$942M
3	Natural Resources Conservation	\$159M	\$335M
4	Agriculture and Precision Farming	\$122M	\$2,011M
5	Water Supply and Quality	\$85M	\$156M
6	Wildfire Management, Planning and Response	\$76M	\$159M
7	Geologic Resource Assessment and Hazard Mitigation	\$52M	\$1,067M
8	Forest Resources Management	\$44M	\$62M
9	River and Stream Resource Management	\$38M	\$87M
10	Aviation Navigation and Safety	\$35M	\$56M
:			
20	Land Navigation and Safety	\$0.2M	\$7,125M
Total for all Business Uses (1 – 27)		\$1.2B	\$13B



Infrastructure



Critical Minerals



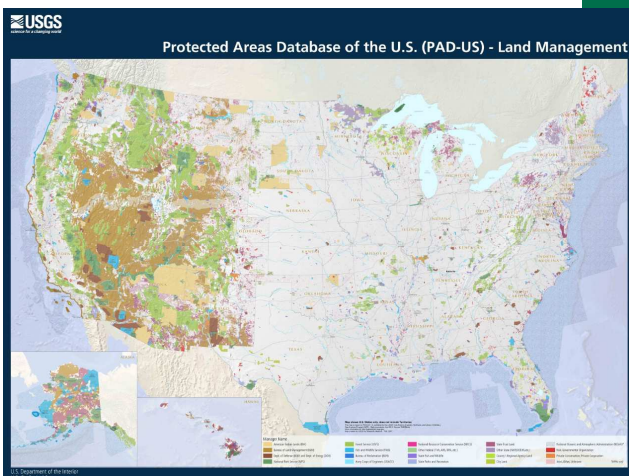
Landslides



## + U.S. Geological Survey

### Protected Areas Database of the United States (PAD-US)

Official inventory of public parks and other protected areas in all U.S. states and territories



The PAD-US Map Viewer displays a variety of map layers from Manager Name to Public Access



Source: <https://gapanalysis.usgs.gov/padus/>



5

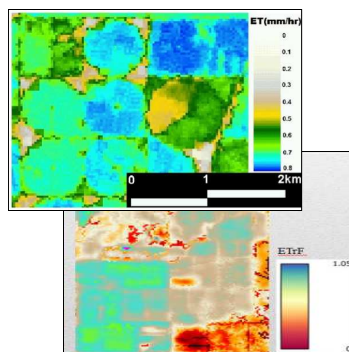
## + U.S. Geological Survey

### LANDSAT: Field-scale monitoring of water management in near-real time

**In the western United States, government agencies and private parties use Landsat data to monitor water demand and consumption in near-real time to allow for more efficient use of limited water resources and adjudicate water rights:**

*“Evapotranspiration Maps derived from Landsat thermal imagery are used operationally by water managers to monitor and manage agricultural and urban water use, administer water rights, evaluate market transfers, negotiate and monitor interstate compacts, estimate water use by invasive species, and assess and monitor water and food security and sustainability. Landsat is the only operational satellite that combines thermal data with short-wave data at the spatial resolution needed to administer water use and water rights, which is often at the level of the individual agricultural field.”*

-- Western States Water Council



Upper: Evapotranspiration from fields irrigated via center-pivot irrigation systems (Oakley, Idaho, United States)  
Lower: Evapotranspiration in vineyards (Lodi, California, United States)



From: Serbina and Miller, 2014. Landsat and Water—Case Studies of the Uses and Benefits of Landsat Imagery in Water Resources.



6

## + National Park Service



7

### Mission

- “...To conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.”  
(NPS Organic Act, 1916)

### Scope

- Covers more than 85 million acres with 418 sites with at least 19 designations including 129 historical parks or sites, 88 national monuments, 60 national parks, 25 battlefields or military parks, 19 preserves, 18 recreation areas, 10 seashores, four parkways, four lakeshores, and two reserves



## + National Park Service



8

### Adding Depth to Lakes



Most maps show the water as flat and blue, but there is much more below the surface. Collecting multi-beam sonar data along with lidar data helped map the lake bottom of all five national parks and lakeshores on Lakes Michigan and Superior.



Basic Google Map (left) and NPS/USACE Bathymetry Map (right) of Munising Bay, Pictured Rocks National Lakeshore, Michigan



- **Fisheries Management** providing critical information about lake trout populations
- **Coastal Restoration** revealing lake bottom features to plan future restoration projects such as Park headquarters
- **Mussels, Algae, and Botulism** mapping dead zones to help avoid waterfowl deaths
- **Cultural Resources** identifying unique stories such as ships running aground and dumping iron ore to free it



## + National Park Service

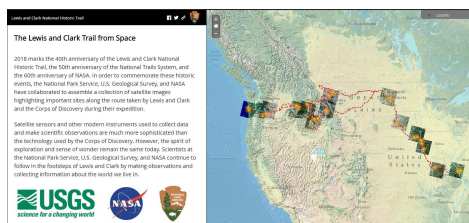
### National Trails System



Using GIS through online interactive maps, story maps, and cartographic maps communicate the value of the national scenic, historic, and recreational trails that provide economic, historical, and environmental benefits for communities and natural resources across the country.



9



NPS, USGS, and NASA have assembled a collection of satellite images and topographic maps to highlight important sites along the Lewis and Clark National Historic Trail drawing parallels between scientific observations made then and information collected about Earth's resources and utilized now by NASA, USGS, and NPS scientists.

Garfield Peak Trail, Crater Lake National Park

The National Map  
Your Source for Topographic Information

## + Fish and Wildlife Service

### Mission

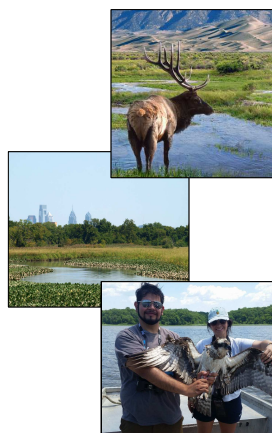
- Work with others to conserve, protect and enhance fish, wildlife and plants and their habitats for the continuing benefit of the American people

### Scope

- Enforce federal wildlife laws
- Protect endangered species
- Manage migratory birds
- Restore nationally significant fisheries
- Conserve and restore wildlife habitat such as wetlands
- Help foreign governments with their international conservation efforts



10




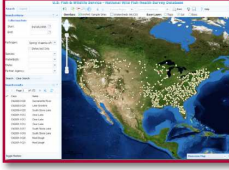
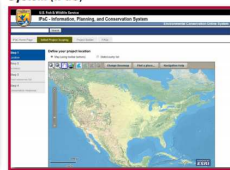

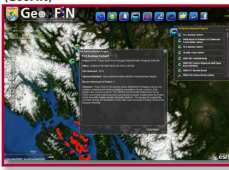

USGS science for a changing world The National Map Your Source for Topographic Information

## + Fish and Wildlife Service

### Geospatial Applications



11

<p><b>National Wetlands Inventory (NWI)</b></p>  <p>Provides information to the public on the extent and status of the Nation's wetlands</p>	<p><b>National Wild Fish Health Survey Database</b></p>  <p>Provides national fish health information to Service partners and the public</p>	<p><b>Information, Planning and Conservation System (IPaC)</b></p>  <p>The IPaC system assists people in Planning their activities within the context of natural resource Conservation</p>
<p><b>Critical Habitat Portal</b></p>  <p>Serves information regarding Threatened and Endangered Species and Critical Habitat designation across the US</p>	<p><b>Geospatial Fisheries Information Network (GeoFIN)</b></p>  <p>The GeoFIN Mapper is an assemblage of data, showing an inventory of potential barriers to fish passage</p>	<p><b>Waterfowl Production Area</b></p>  <p>The Waterfowl Production Area Mapper presents a visualization of Waterfowl Production Areas in the Upper Midwest of the United States</p>



Source: <http://www.fws.gov/GIS/applications>

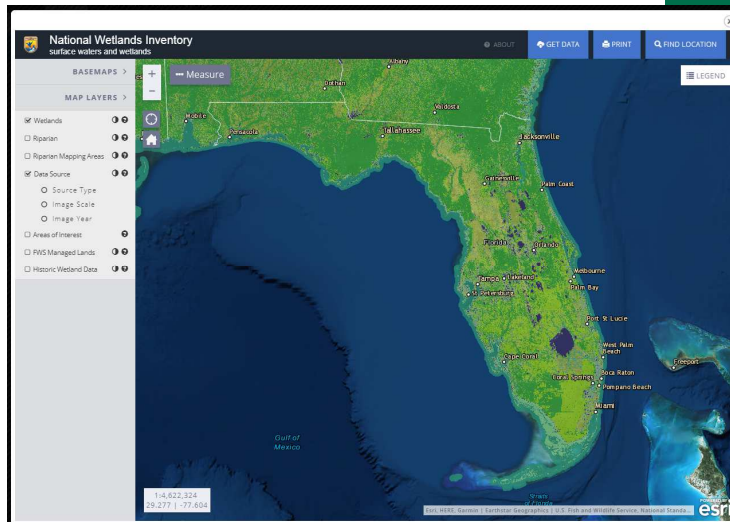
## + Fish and Wildlife Service

### National Wetlands Inventory



12

Provides information to the public on the extent and status of the Nation's wetlands

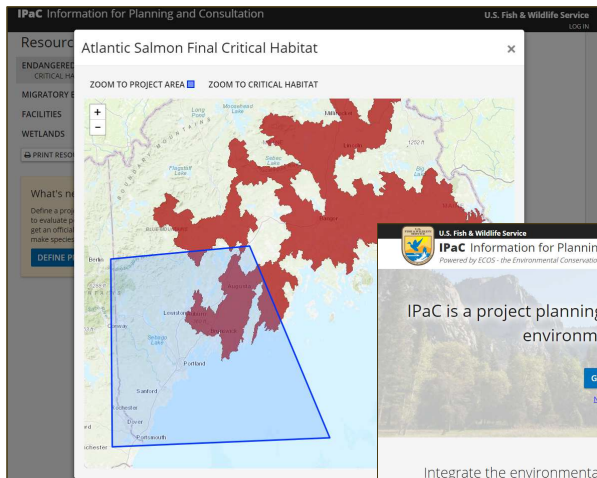



Source: <https://www.fws.gov/wetlands/data/Mapper.html>

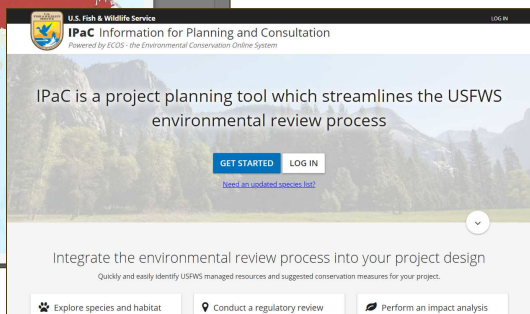
## + Fish and Wildlife Service Information for Planning and Consultation



13



A tool to assist in determining how activities may impact sensitive natural resources and obtain suggestions for ways to address these impacts



Source: <https://ecos.fws.gov/ipac/>

## + Bureau of Land Management



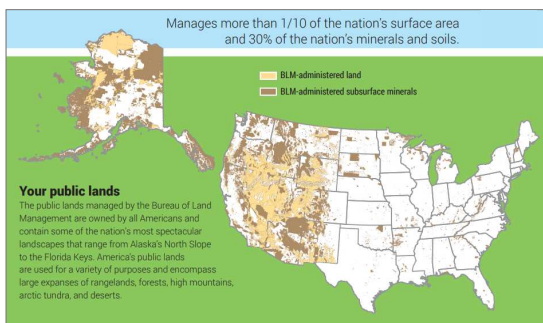
14

### Mission

- To sustain the health, diversity, and productivity of public lands for the use and enjoyment of present and future generations

### Mandate from Congress

- Energy development
- Livestock grazing
- Recreation
- Timber harvesting
- Ensuring natural, cultural, and historic resources are maintained



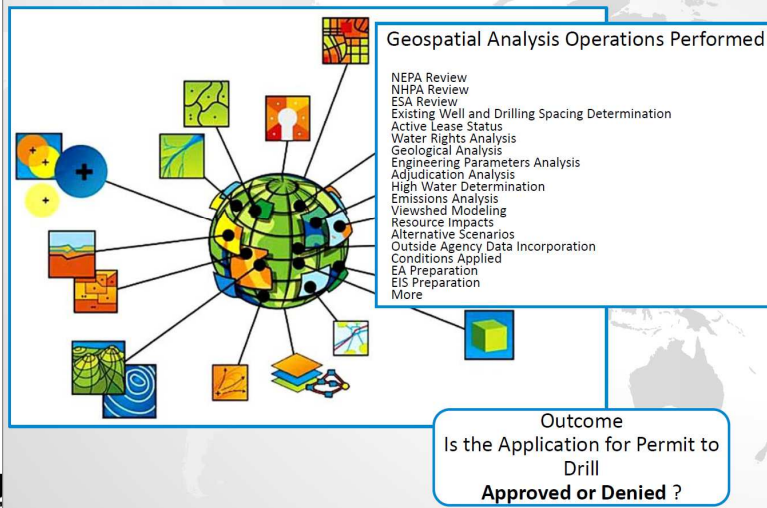
+ Bureau of Land Management



15

BLM GEOSPATIAL ANALYSIS

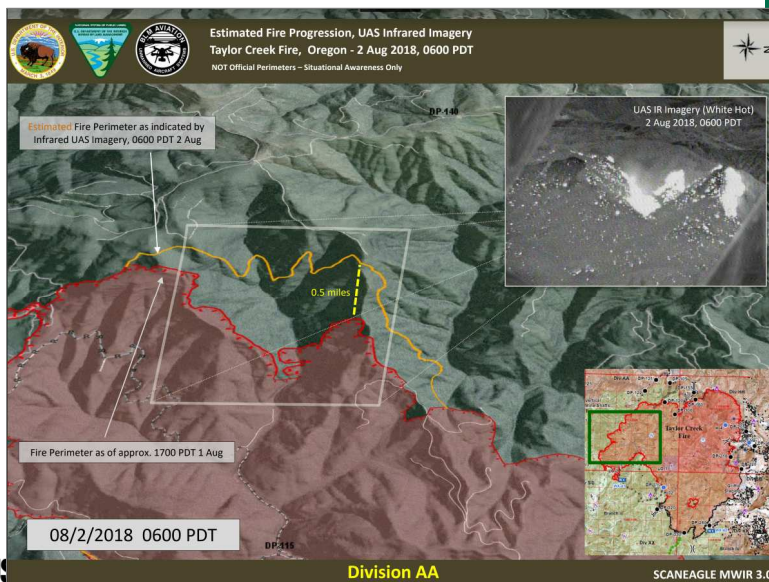
Application for Permit to Drill Example



+ Bureau of Land Management



16





# + Bureau of Ocean Energy Management

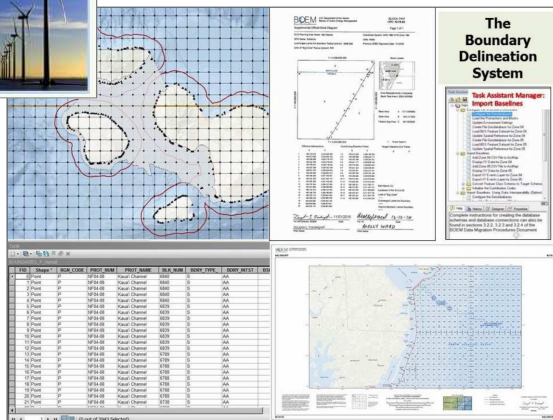


17



MISSION

Responsible for overseeing the safe and environmentally responsible development of energy and mineral resources on the Outer Continental Shelf

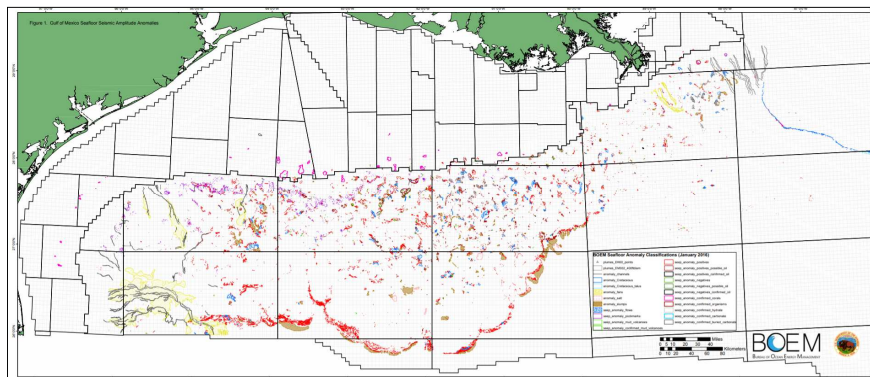


# + Bureau of Ocean Energy Management



18

## Seismic Water Bottom Anomalies



Used by the BEOM's Office of Environmental Biology



Source: <https://www.boem.gov/Seismic-Water-Bottom-Anomalies-Map-Gallery/>

## + Marine Cadastre

19

## + U.S. Forest Service



20

### Mission

- Sustain the health, diversity, and productivity of the Nation's forests and grasslands to meet the needs of present and future generations

### Scope

- Achieve quality land management under the sustainable multiple-use management concept to meet the diverse needs of people




Motto: Caring for the Land and Serving People



**+ U.S. Forest Service**

**Forest Inventory Modeling**



21

**Collect Data**

Lidar Plot Metrics

Field Plot Measurements

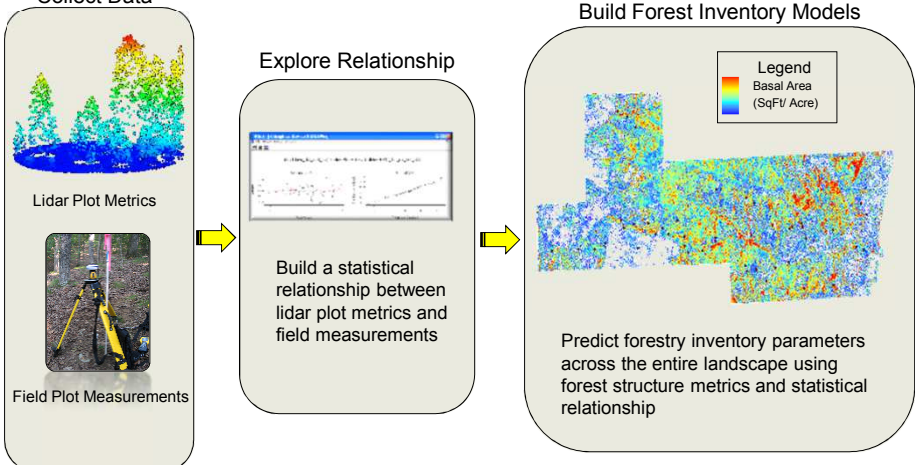
**Explore Relationship**

Build a statistical relationship between lidar plot metrics and field measurements

**Build Forest Inventory Models**

Legend  
Basal Area  
(SqFt/ Acre)

Predict forestry inventory parameters across the entire landscape using forest structure metrics and statistical relationship



**USGS** **The National Map**  
Your Source for Topographic Information

**+ U.S. Forest Service**

**National Land Cover Dataset (NLCD) Tree Canopy Cover**



22

- Tree canopy cover is an important spatial input
  - Fire behavior models
  - Insect and disease risk models
  - Forest fragmentation analyses
  - Wildlife habitat analyses

The National Land Cover Database (NLCD) 2011 Percent Tree Canopy Cover



NAIIP TCC

National Agricultural Imagery Program aerial photography as the input and the Tree Canopy Cover as the output example

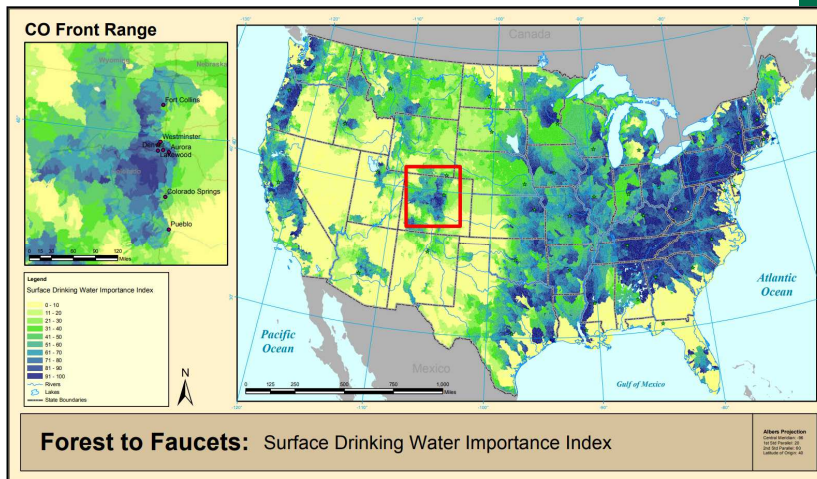
**USGS** **The National Map**  
Your Source for Topographic Information

## + U.S. Forest Service: Forests to Faucets



23

Modeling and mapping land areas most important to surface drinking water



## + Natural Resources Conservation Services



24



Provide resources to farmers and landowners to aid them with conservation

Ensuring productive lands in harmony with a healthy environment

Helping People Help the Land

# + Natural Resources Conservation Services



25

## Many Resource Issues

Soil Quality

Irrigation Water Management

Water Quality

Rangeland Management

Wildlife Habitat

Forest Management

Soil Erosion

Nutrient Management

reference for a changing world Your Source for Topographic Information

# + Natural Resources Conservation Services



26

5m DTM from LIDAR or IFSAR Terrain

Soil Survey Hydric Rating Soils

Wet Year Ortho Imagery (Fall 1997) Spectral

Ortho Rectified Radar Image (IFSAR) or Intensity Image (LIDAR)

Model for Potential Wetlands

Composite Hydric Rating

Highest Probability

Trimble GeoXT

LIDAR Hydric Landscape Analysis - Northeastern South Dakota

Guide Field Work

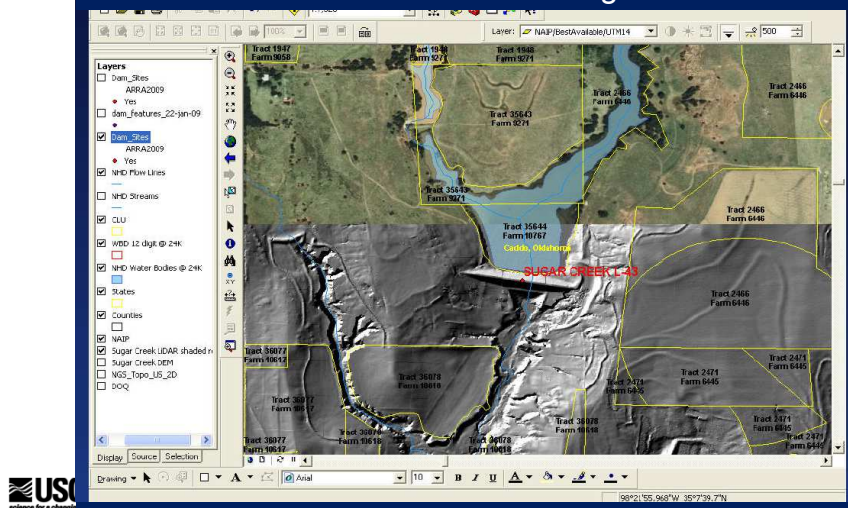
reference for a changing world Your Source for Topographic Information

# + Natural Resources Conservation Services



27

## NRCS Watershed Rehabilitation Program



# + LANDFIRE

## Landscape Fire and Resource Management Planning Tools



28

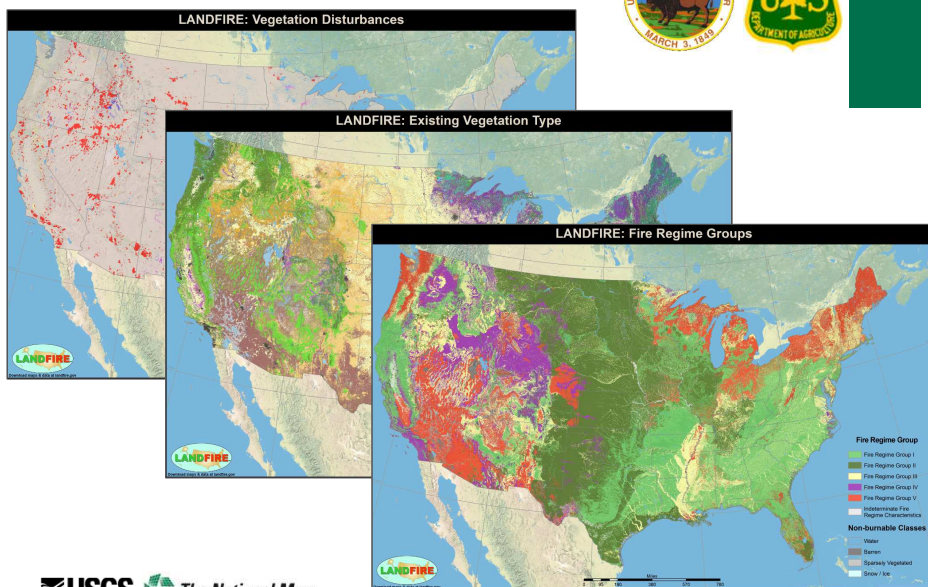
- Shared program between the wildland fire management programs of the U.S. Department of Agriculture Forest Service and U.S. Department of the Interior
- Provides landscape scale geo-spatial products to support cross-boundary planning, management, and operations

Source: <https://www.landfire.gov/>

# + LANDFIRE



29



Source: <https://www.landfire.gov/>

**THANK YOU!**

Mike Tischler, Ph.D.  
Director, National Geospatial Program  
U.S. Geological Survey  
Email: [mtischler@usgs.gov](mailto:mtischler@usgs.gov)