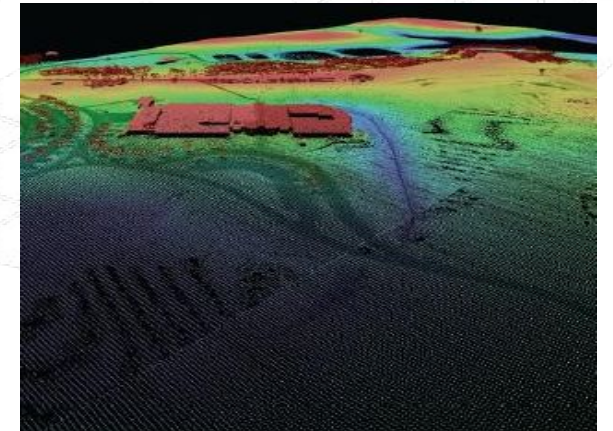
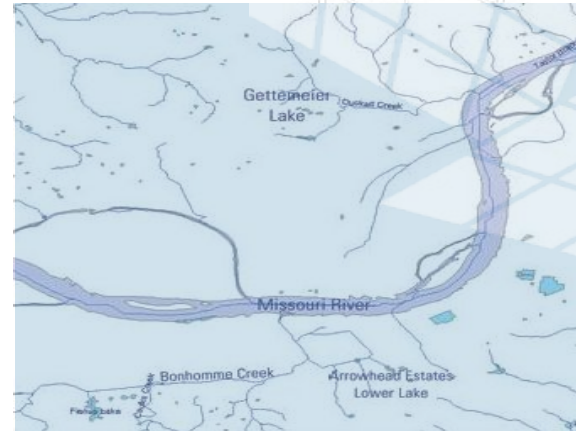
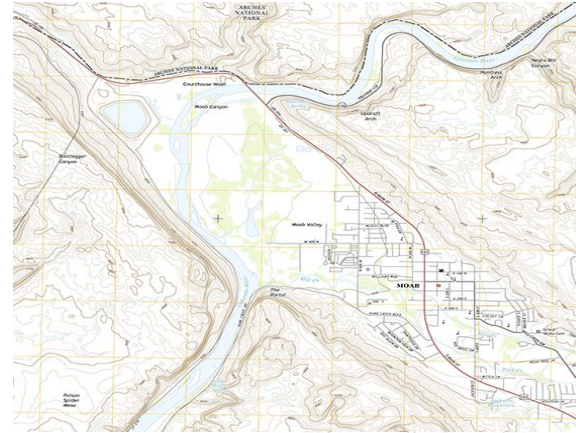




Our Future in 3D: The 3D National Topography Model and the 3D Hydrography Program



Stephen S. Aichele, Ph.D.

Geographer

U.S. Geological Survey, National Geospatial Program

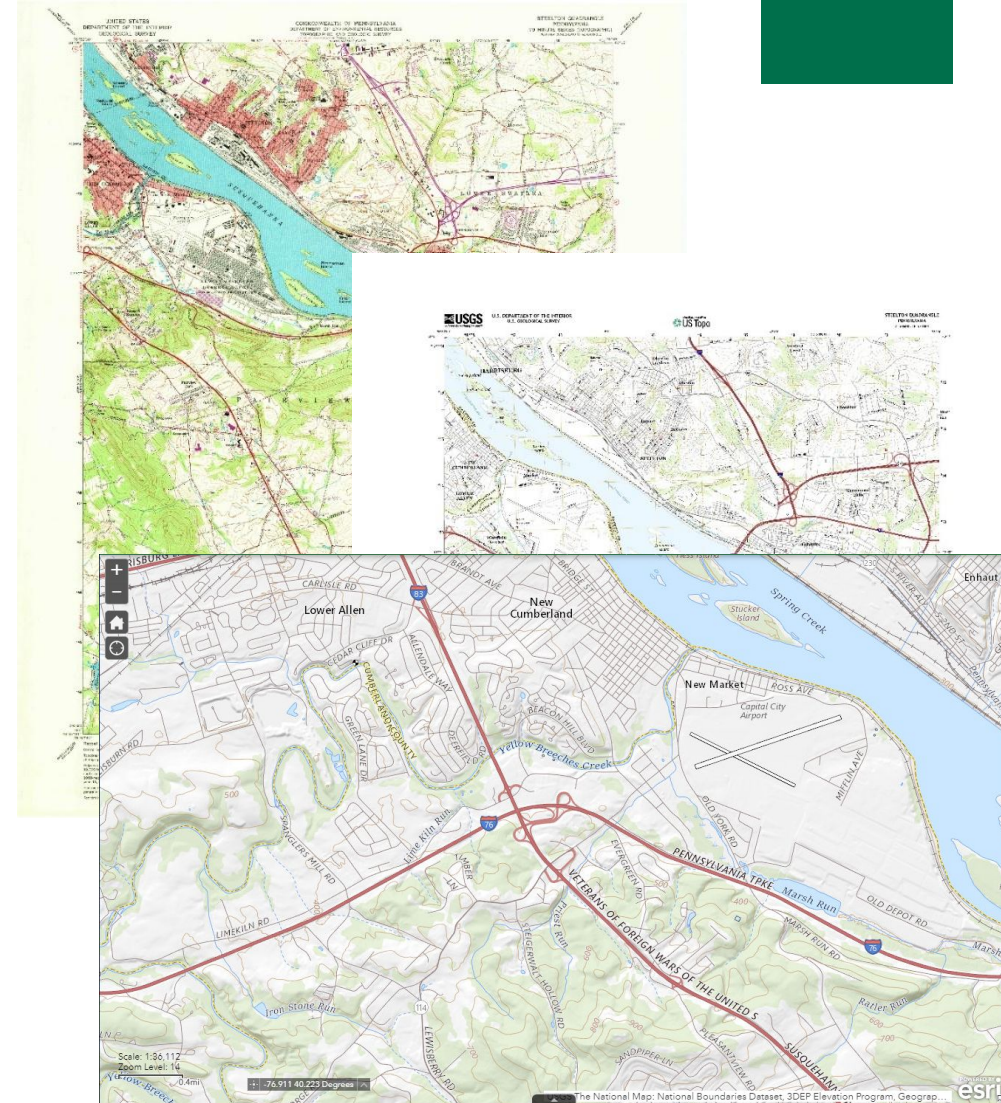
April 5, 2022

135 Years of topographic mapping



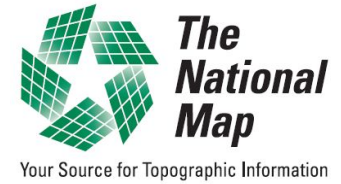
John Wesley Powell
Testimony to Congress
on December 5, 1884

“A Government cannot do any scientific work of more value to the people at large, than by causing the construction of proper topographic maps of the country”



3D National Topography Model (3DNTM)

Topography is defined by elevation and hydrography; elevation shapes hydrography, and hydrography shapes elevation. To support a broad range of applications, the **3D National Topography Model** integrates U.S. Geological Survey (USGS) elevation and hydrography datasets to model the Nation's topography in 3D.



3

3D Nation vision of a continuous data surface from the depths of the oceans to the peaks of the mountains

Supports sharing of water information as the geospatial foundation for the Internet of Water

Provides foundational data to critical initiatives

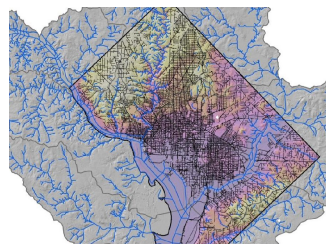
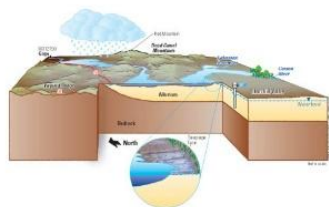
- Federal Emergency Management Agency Future of Flood Risk Data and Risk Rating 2.0
- The National Water Model
- The Clean Water Act
- National Landslides Preparedness Act

Enables new and emerging applications

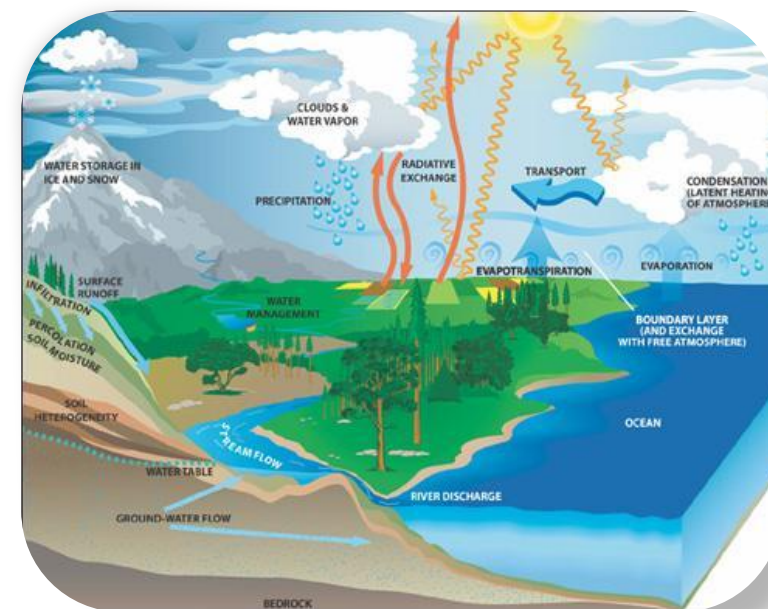
- Multiple vintages enable change detection
- Water-related applications move from the neighborhood to the street-level in accuracy

Underpins a broad range of applications including flood risk management, hazards response and mitigation, infrastructure management, climate change science, and more

3D Hydrography Program Data Enhancements



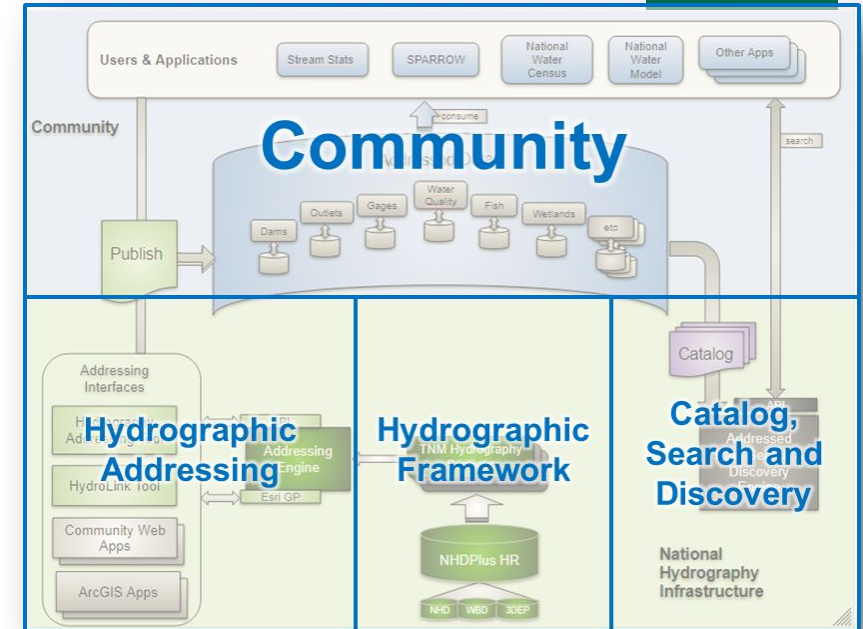
- More detailed and precise data
- Adding connections to groundwater
- Align with and National Wetlands Inventory
 - Working with FWS to understand how to improve mapping across these data sets
- Including engineered hydrologic systems
 - Storm water systems in midsized to larger cities
 - Need more research into the appropriate level of storm system mapping
- Estimated to provide more than \$1 billion in benefits every year when fully implemented (Hydrography Requirements and Benefits Study, 2016)



+ 3DHP supports the Internet of Water

5

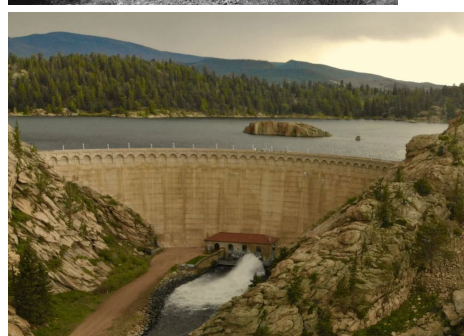
- While there is an abundance of water-related data collected, the Nation lacks a systematic way to organize, search, and discover it
- USGS and Federal partners are developing the 3DHP Infostructure, a geospatial information infrastructure for *federated* sharing and discovering of water information in the context of the stream network
- Will include tools to reference data to the stream network, and to search and discover the data of others
- 3DHP provides the geospatial underpinning for the Internet of Water



+ Introducing HydroAdd Tool

Create and maintain addressed data online

6



My Profile

Edit History

Search/Select

Edit Queues

Make New Queue

WA dams

Minn StrStats

Batch QC

Make New Point

Make New Line

Download Schema

HydroAdd Schema

Admin

USER GUIDE

SOURCE ID

HUCS

REA

Service Layer

MN StreamStats test

Search Source ID

DRAW EXTENT

CLEAR EXTENT

Show approved

Show unapproved

05288470 Minn StrStats

05288480 Minn StrStats

05288487 Minn StrStats

05288490 Minn StrStats

05288500 Minn StrStats

05288705 Minn StrStats

05288840 Minn StrStats

Rows per page: 2000

1-19 of 19

Hydrography Addressing Tool

Zoom: 9

XY -93.813761°, 44.503258°

World Hillshade

US Topo

US Imagery

US Topo Hillshade

Light Gray Canvas

NHDAREA (4)		NHDFLOWLINE (189)		NHDFLOWLINE_DIRECTION (189)		NHDFLOWLINE_REACHCODE_LABEL (189)		NHDLINE (0)		NHDPOINT	
objectid	permanent_identifier	fdate	resolution	gnis_id	gnis_name	lengthkm					
23407258	45714404	Mon, Apr 2, 2012 11:06 AM	2	00654181	Willow Creek	1.159					
27947885	45714332	Mon, Apr 2, 2012 11:06 AM	2	00654181	Willow Creek	5.561					
82404	45352052	Mon, Apr 2, 2012 11:20 AM	2	00648637	North Fork Crow River	3.559					

Rows per page: 25

1-25 of 189

DOI Privacy Policy

Legal

Accessibility

Site Map

Contact USGS

U.S. Department of the Interior

DOI Inspector General

White House

E-gov

Open Government

No Fear Act

FOIA

Last Modified: 12/03/2021

Version 1.0.0.11 BETA

What is Landsat?

The world's longest continuously operated land remote sensing satellite series, and most widely used and cited land remote sensing data set, helping us understand and manage natural and human-induced landscape change via a multitude of land, water, and natural resource management applications.



Common Uses of Landsat data by Federal Agencies, States, and the private sector:

- Agriculture and Forestry
- Regional Land Use Planning
- Land Use/Land Cover
- Fire/Disaster Management
- Energy and Mineral Mapping
- Water Quality and Resources
- Flood Management
- Drought Monitoring/Famine Early Warning
- Climate Change Research
- National Security
- Carbon Assessment
- Transportation Planning
- Calibration/Validation of other satellites

Multi-spectral coverage in VNIR-SWIR-TIR

-> to map surface composition & temperature

15 / 30 / 100 meter spatial resolution

-> to resolve human-scale land dynamics

16-day revisit frequency (8-days w/ two satellites)

-> global, seasonal coverage

Broad area collection => 12,000+ square miles per image

-> 1500 images/day = 22 million square miles/day

Highly calibrated “science quality” data

-> to resolve long-term trends & retrieve biophysical variables

Free and Open Data policy since 2008

-> 30 million products distributed by USGS last year



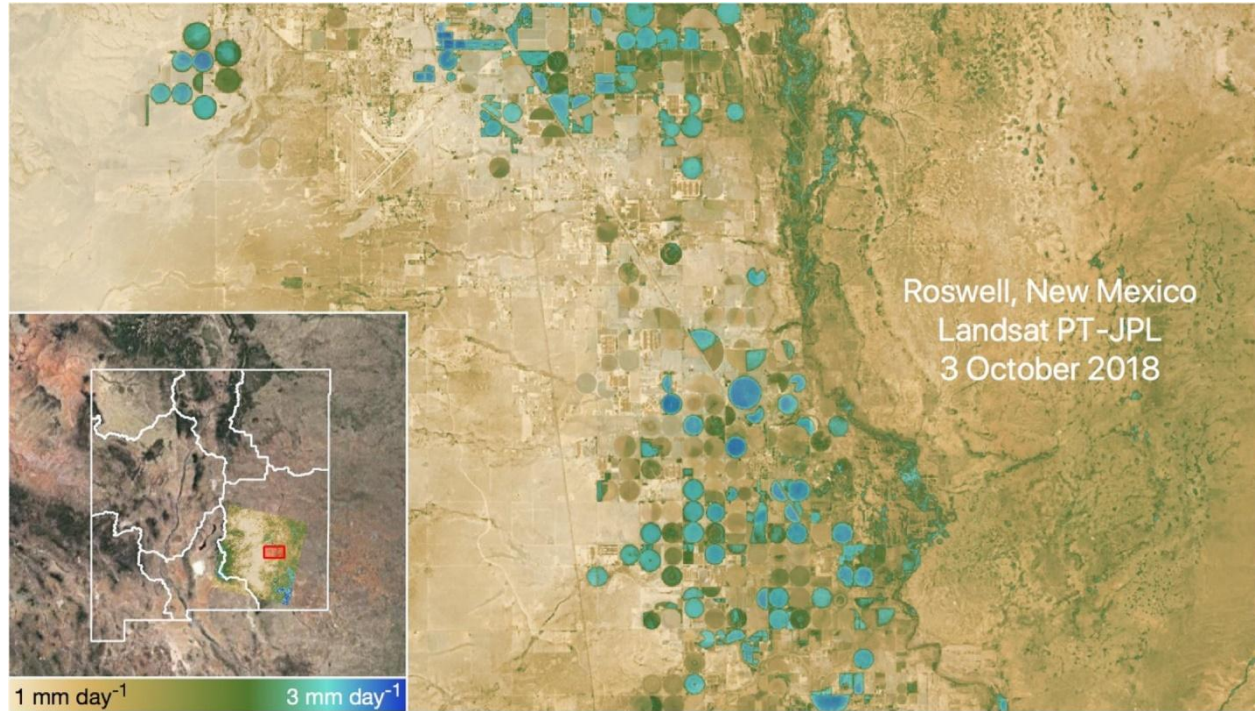
VNIR: Visible Near-Infrared SWIR: Shortwave Infrared TIR: Thermal Infrared



Landsat and Water Monitoring

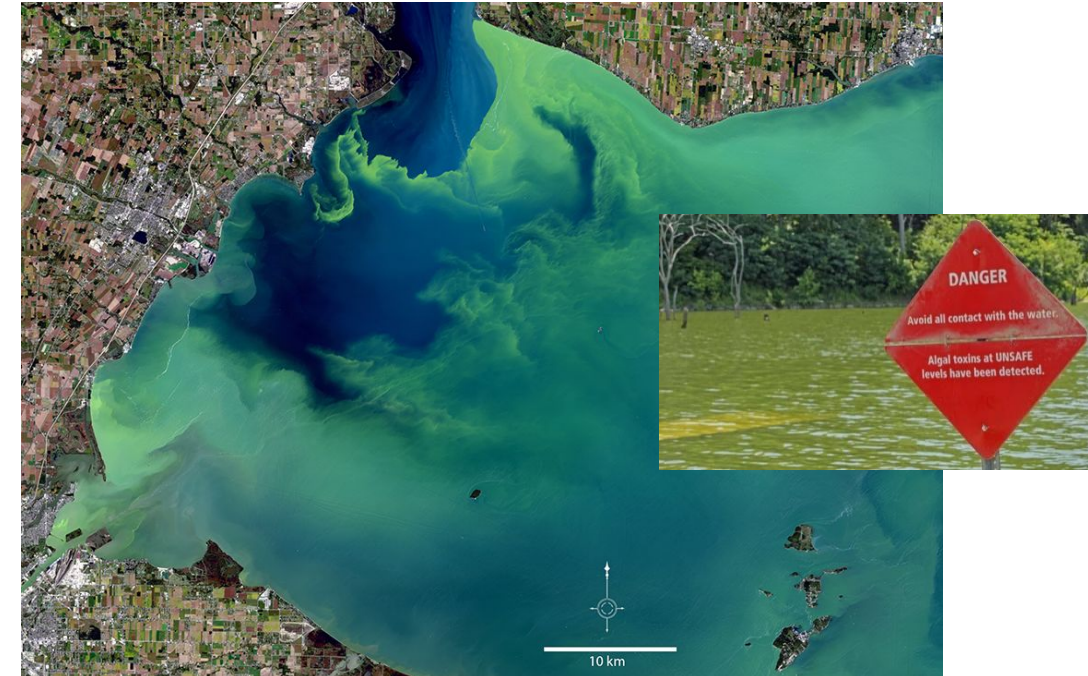
8

Every Western State uses Landsat's unique thermal capability for managing consumptive water use and facilitating water rights transfers and agreements



Landsat-derived map of water use by center pivot irrigation fields in Roswell, New Mexico on October 3, 2018. Image credit: Fisher et al. NASA, AGU19

Landsat is used to detect and address harmful algal blooms in lakes and coastal waters

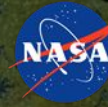


A hazardous algal bloom containing the toxin *microcystis* covered large portions of western Lake Erie in September 2017. Swirls of algae can be seen south of the Detroit River's mouth in this natural-color Landsat 8 image. Credit: USGS EROS

Idaho's Mapping Evapotranspiration application is a former winner of the Harvard University John F. Kennedy School of Government's Innovations in American Government Award



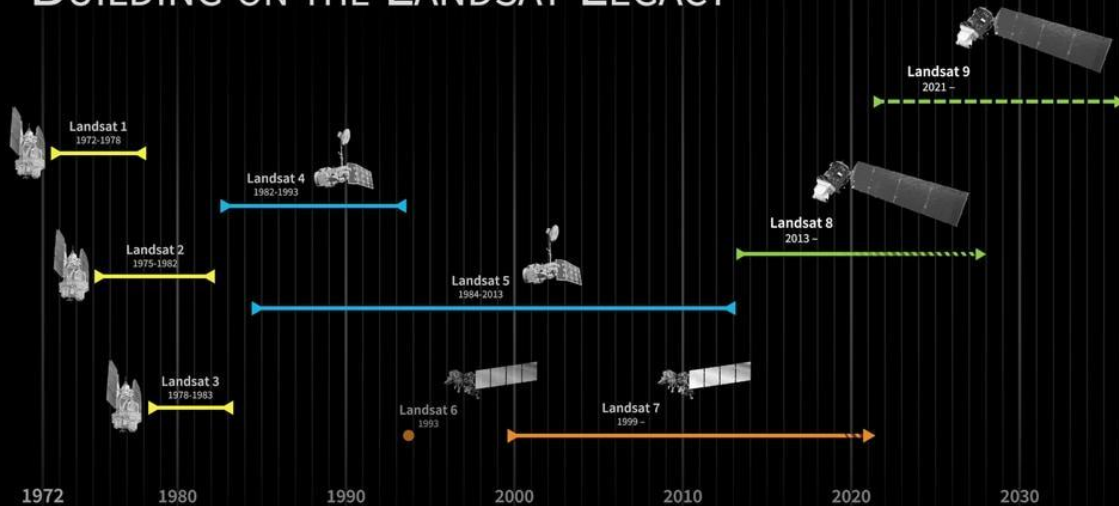
Sustainable Land Imaging (SLI)



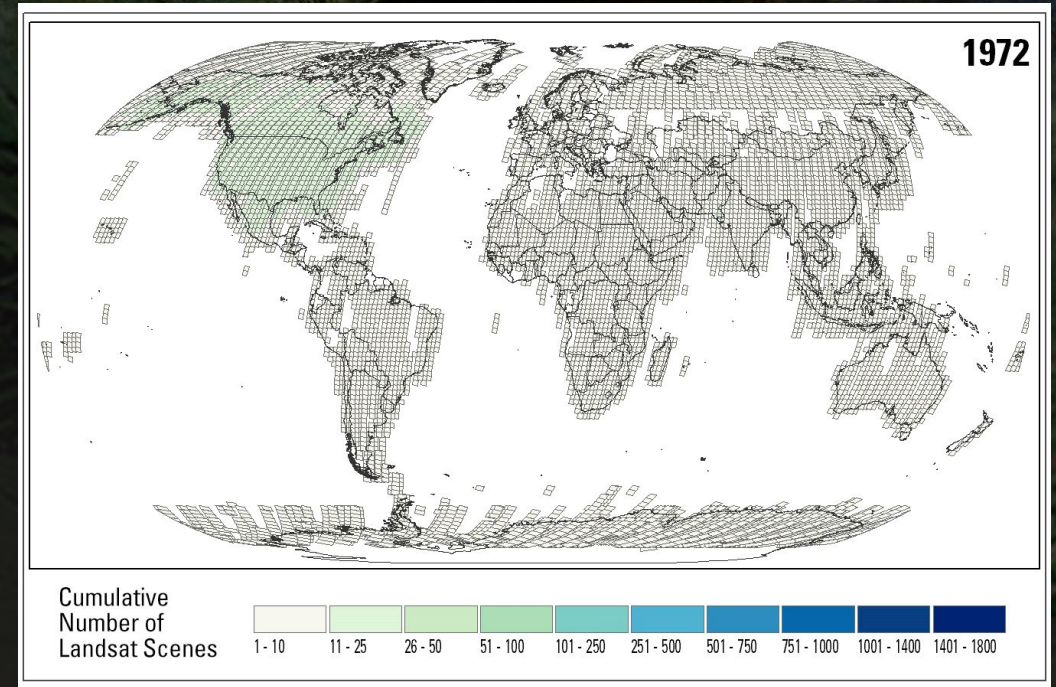
A partnership between DOI/USGS and NASA to ensure sustained access to high-quality, global, land-imaging measurements compatible with the existing 49-year Landsat record for research and operational users

- NASA responsible for developing the space segment, launch and on-orbit check-out
- DOI/USGS responsible for developing the ground segment, flight and ground system operations

BUILDING ON THE LANDSAT LEGACY



- Nearly five-decade record of land cover, land use, and vegetation condition
- Large area coverage for global, continental and regional land cover studies



- Archive contains 300 billion km²
- Adds 40 million km² per day



Questions

Steve Aichele

USGS National Geospatial Program

saichele@usgs.gov

usgs.gov/NHD