



USGS Update

National Academies of Sciences,
Engineering and Medicine

*Committee on Earth Science
and Applications from Space*

March 2026

Zhuoting Wu

*Earth Observation Applications Coordinator
National Land Imaging Program
U.S. Geological Survey*

USGS Mission and Vision

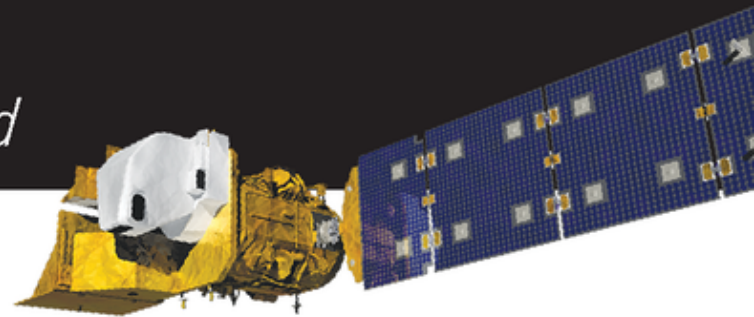
The USGS mission is to monitor, analyze and predict current and evolving dynamics of complex human and natural Earth system interactions and to deliver actionable information at scales and timeframes relevant to decision makers.

Vision Statement: Lead the Nation in 21st-century integrated research, assessments, and prediction of natural resources and processes to meet society's needs.



USGS by the Numbers

Science for a Changing World



PEOPLE

Our most valuable asset

8,410 Employees

1,436 Contractors

591 Emeriti

198 Volunteers

Data from December 2024

LOCATIONS

In all 50 states, Guam, and Puerto Rico

391 Total facilities

491 Laboratories

60 Science centers (7 regions)

22 Programs (5 mission areas)

SCIENCE AND MONITORING

170,000+ Publications since 1879

54,000 7.5-minute topographic quadrangles

480M Acres of DOI land supported by science for conservation and management

1000+ At-risk species studied

74 Invasive species and wildlife diseases addressed through early detection and rapid response

25 Active patents (85 since 1996)

~20,000 USGS-operated groundwater wells monitored for water level and water quality

11,800+ USGS-operated streamgages

~4,000 USGS-operated earthquake sensors in the U.S.

~70 U.S. volcanoes monitored (of 161 considered active)

14 Geomagnetic observatories

3 Satellites

1 Research reactor

201M Landsat data downloads

100% Interferometric Synthetic Aperture Radar (IfSAR) data collected in Alaska

98.3% National coverage of 3DEP high-resolution elevation data

56% U.S. coverage of geologic maps (detailed to intermediate scale)

171 Geologic provinces assessed for undiscovered oil and gas resources

~100 Minerals' supply, demand and trade tracked for 180 countries

PARTNERSHIPS

5,157 Contracts, cooperative agreements, and grants

4,300 Partners and cooperators

165 Tribal partnerships

10

Climate Adaptation Science Centers
(1 national - 9 regional)

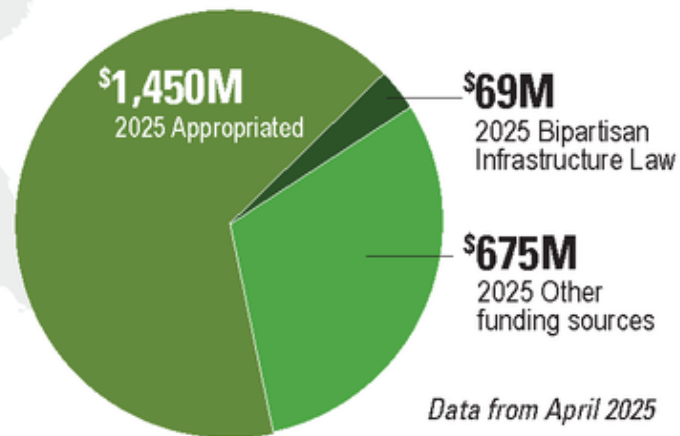
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Cooperative Research Units
(677 students supported)

54

Water Resources Research Institutes
(394 students supported)

FUNDING



Data from April 2025



USGS makes extensive use of Earth observation data

Terra, Aqua, Landsat, Sentinel-2, JPSS (VIIRS): Use in agriculture, coasts, ecosystems, conservation, wildland fire, land cover, hydrology, and disasters

ECOSTRESS: Use in agriculture, urban heat, water use, and mineral mapping

EnMAP, EMIT, PRISMA, AVIRIS: Use hyperspectral data in agriculture, vegetation, mineral mapping

Aura: Used in hydrology and volcano assessments

ICESat-2: Use in ecology, forestry, volcanos, coastal mapping

Sentinel-1: Use in hydrology, earthquakes, agriculture

Grace-FO: EarthMRI geophysical surveys

TSIS-1: Use in instrument calibration and validation activities

Planet, Vantor: High-resolution commercial imagery for agriculture, land cover mapping, forestry, wildland fires, hydrology, cryosphere, coastal evaluation, landslides, and glaciers

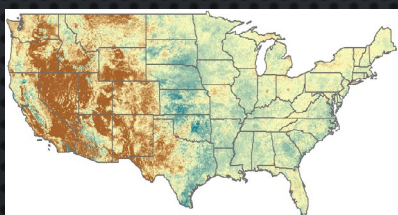
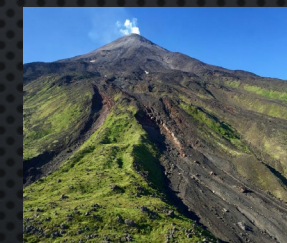
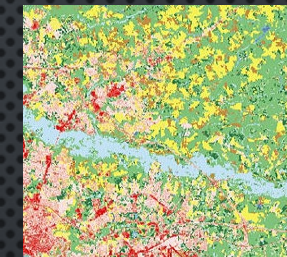
TerraSAR-X, RADARSat, COSMO-SkyMed SAR: High resolution synthetic aperture radar (SAR) imagery for volcano monitoring and surface water extent

ICEYE, Blacksky, Skysat, Capella – wildlife and volcano monitoring

PACE: Use in water quality and water resource assessment

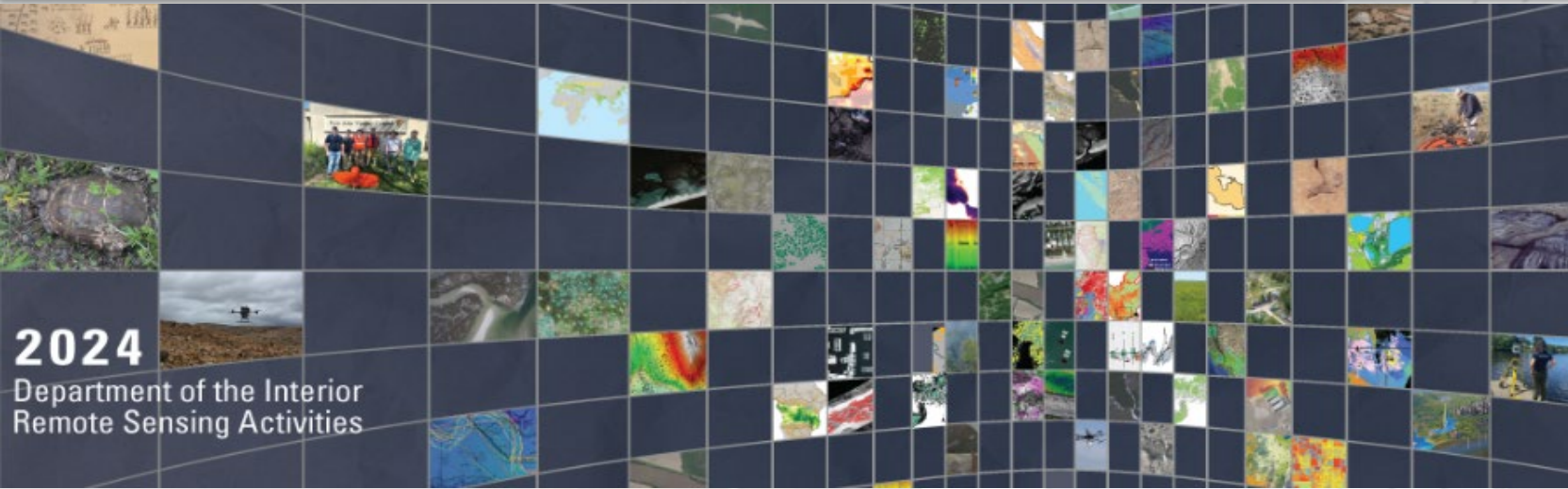
SWOT: Use in hydrology and National Flood Operations

NISAR: Use in mineral resource identification, vegetation, land cover, coastal mapping, and earthquake monitoring



**USGS is a user
and provider of
Earth
Observation data**

DOI Remote Sensing Report and the President's Report



Aeronautics and Space Report of the President

The annual "President's Report" is a summary of the Government's aerospace activities each year. Mandated by law. [Aeronautics and Space Report of the President - NASA](#)

The [DOI Remote Sensing Report](#) showcases remote sensing science across all DOI agencies.

Thanks to all DOI scientists, researchers, engineers, and others who submitted summaries of their critical work!



Fiscal Year 2024 Activities

The most recent President's Report highlights the Government's aeronautics and space activities for Fiscal Year 2024.

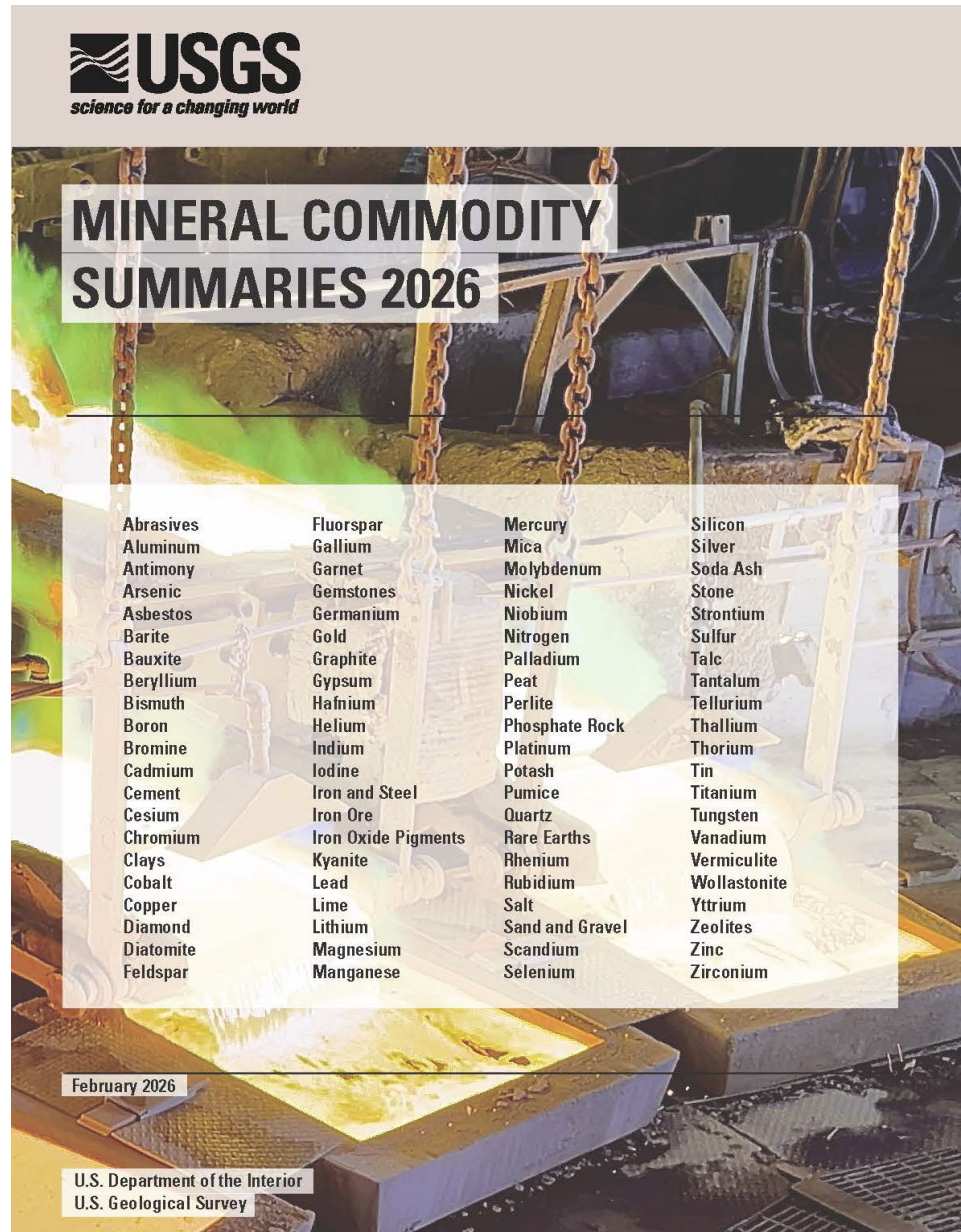
[Download the PDF](#)

MINERAL COMMODITY SUMMARIES

The USGS Mineral Commodity Summaries 2026 provide comprehensive data and analysis on the domestic industry structure, global mineral trends, and 5-year salient statistics for over **90 individual minerals and materials**.

- Drives decision making and investing by government and private industry.
- Information on events, trends, and issues for more than 90 individual minerals and materials.
- Production, consumption, trade, and reserve data and analysis.
- Includes U.S. net import reliance and other annual statistics.

U.S. Geological Survey, 2026, Mineral commodity summaries 2026: U.S. Geological Survey, 222 p., <https://doi.org/10.3133/mcs2026>.



THE NATION'S LIST OF CRITICAL MINERALS

2025 List of Critical Minerals

60 CRITICAL MINERALS

10 NEW CRITICAL MINERALS

15 RARE EARTH ELEMENTS*

USGS published the final 2025 List of Critical Minerals, outlining 60 minerals vital to the U.S. economy and national security that face potential risks from disrupted supply chains.

The final List adds 10 new minerals—**boron, copper, lead, metallurgical coal, phosphate, potash, rhenium, silicon, silver, and uranium**—based on new data, public and interagency feedback.

Critical minerals:

(i) are **essential** to the economic or national security of the United States; (ii) the **supply chain of which is vulnerable to disruption**; and serve an essential function in the manufacturing of a product, **the absence of which would have significant consequences** for the economic or national security of the United States.

ALUMINUM	HAFNIUM	RHODIUM
ANTIMONY	HOLMIUM*	RUBIDIUM
ARSENIC	INDIUM	RUTHENIUM
BARITE	IRIDIUM	SAMARIUM*
BERYLLIUM	LANTHANUM*	SCANDIUM
BISMUTH	LEAD	SILICON
BORON	LITHIUM	SILVER
CERIUM*	LUTETIUM*	TANTALUM
CESIUM	MAGNESIUM	TELLURIUM
CHROMIUM	MANGANESE	TERBIUM*
COBALT	METALLURGICAL COAL	THULIUM*
COPPER	NEODYMIUM*	TIN
DYSPROSIUM*	NICKEL	TITANIUM
ERBIUM*	NIObIUM	TUNGSTEN
EUROPIUM*	PALLADIUM	URANIUM
FLUORSPAR	PHOSPHATE	VANADIUM
GADOLINIUM*	PLATINUM	YTTERBIUM*
GALLIUM	POTASH	YTTRIUM*
GERMANIUM	PRASEODYMIUM*	ZINC
GRAPHITE	RHENIUM	ZIRCONIUM

Earth Mapping Resources Initiative (Earth MRI) Mapping the Nation's Geology and Resources

Current focuses

- Critical mineral resources
- Still in the ground
- Above ground in mine waste
- Construction resources (industrial minerals)
- Infrastructure hardening and disaster planning

Additional applications

- Infrastructure
- Energy and water resources
- Natural hazards
- Land use planning

Partners

- State and Federal agencies
- Tribes
- Industry
- Non-Governmental Organizations
- Universities

Funding

- \$10.8M in annual appropriations
- \$320M over 5 years through Bipartisan Infrastructure Law
- \$5M in Disaster Supplemental

Data

- All Earth MRI data are freely available to the public

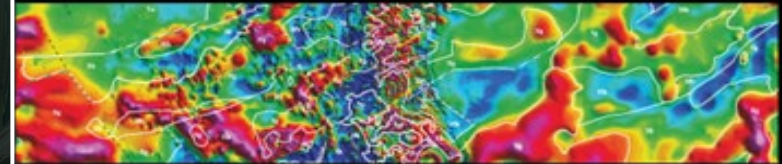
Topography— 3D elevation lidar data



Geology— USGS and State geological survey maps



Geophysics— Aeromagnetic, radiometric, and gravity data



Geochemistry— Rocks, soils, and stream sediments



Mineral deposit databases— USMIN, MRDS, ARDF



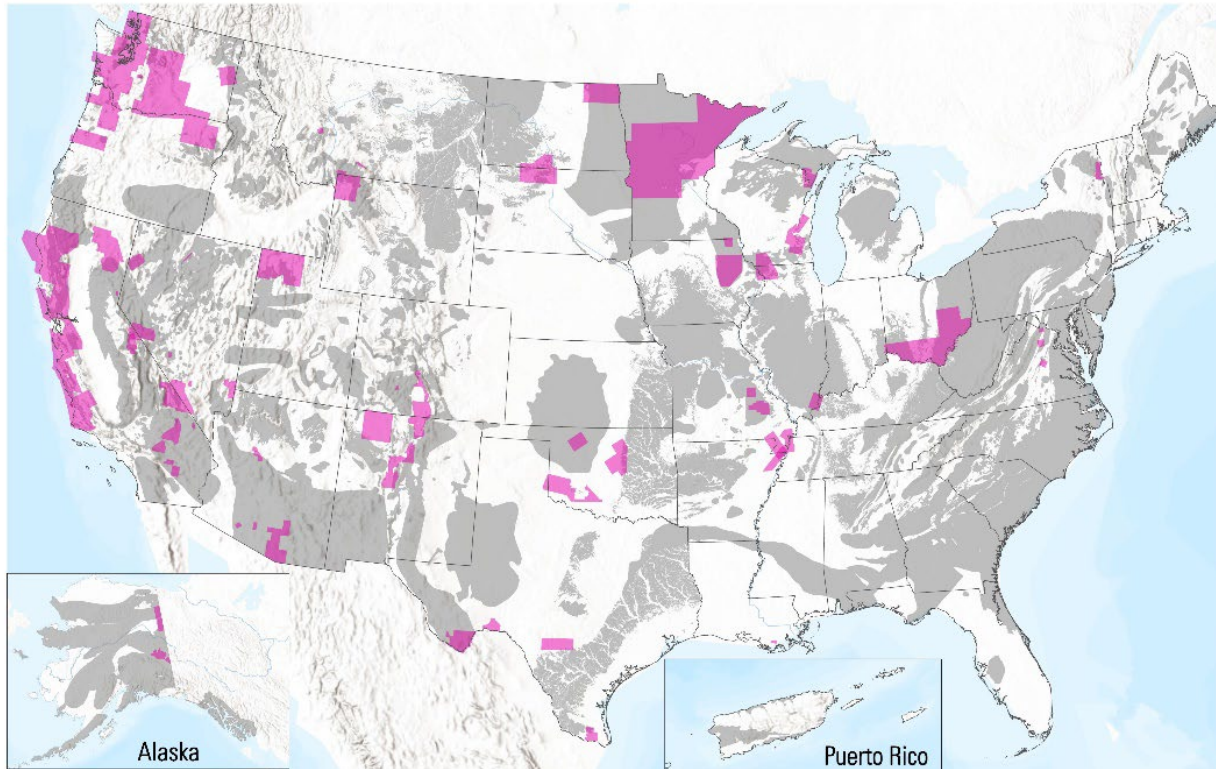
Coreholes— Geophysical logs and core samples



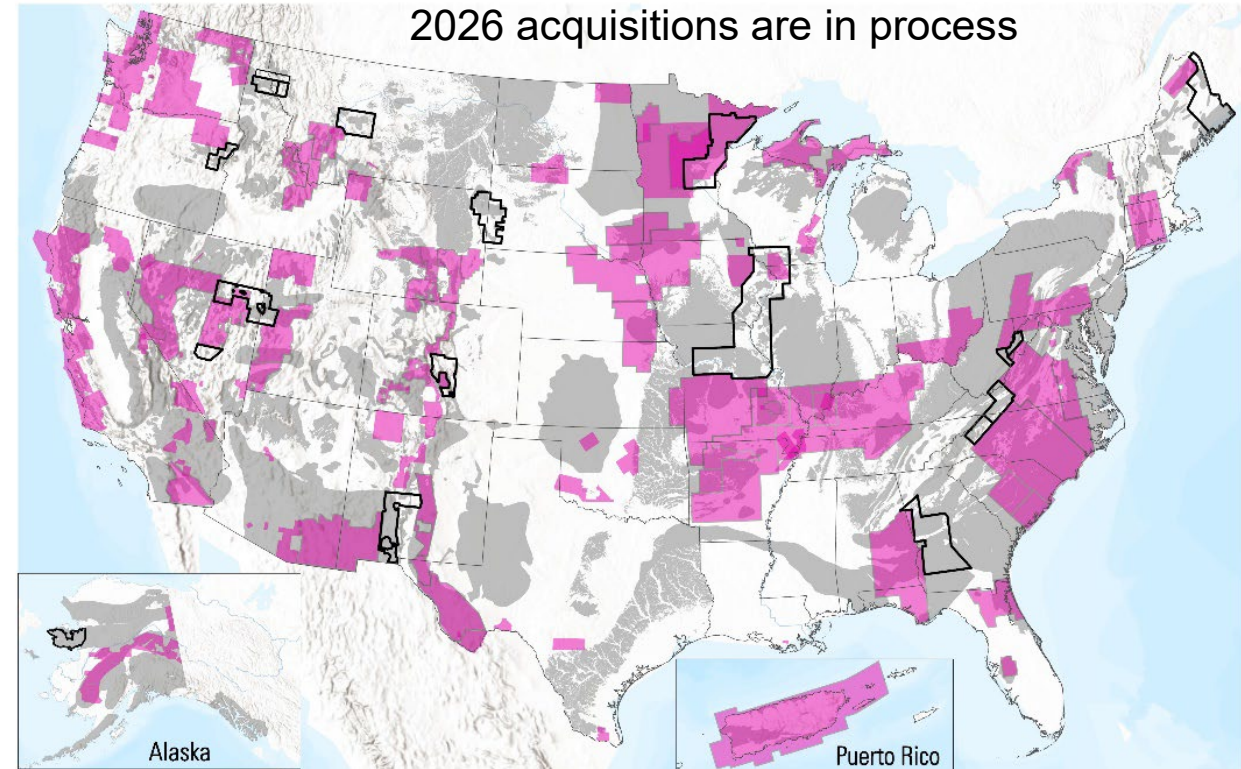
EARTH MRI AIRBORNE GEOPHYSICAL SURVEYS ARE MAKING DRAMATIC PROGRESS

Before Earth MRI (2019)

With Earth MRI (2024-2025)



7% national coverage, 9% of areas with critical mineral potential

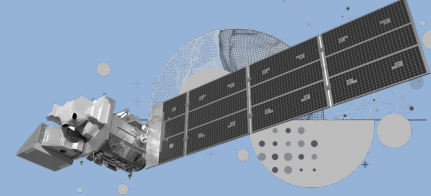


23% national coverage, 36% of areas with critical mineral potential

Earth MRI is providing essential data on areas of known and inferred critical mineral resources; new data will now support mineral mapping and other studies.

Landsat Updates – Landsat 8, 9 and Landsat 10

USGS Core Science Systems – National Land Imaging Program



Current Mission Updates:

- **Landsat 8:** Nominal operations. Collecting 750 new multispectral and thermal infrared scenes per day (with 11 distinct bands of data collected across over 10 million square miles of the Earth's land surface).
- **Landsat 9:** Nominal operations. Collecting 750 new scenes per day (more than 10 million square miles of new imagery).



Future Missions: Landsat 10 and beyond

- Raytheon is meeting all milestones in the Landsat Next Instrument Suite (LandIS) development (26 spectral bands, 10/20/60m resolution).
- NASA/USGS working closely on mission development



Earth Resources Observation and Science Center (EROS)

Landsat Archive Operations

Q1FY26 Statistics:

- 43 PB total Landsat data;
- 15 PB Landsat data publicly available;
- 10.5 PB Landsat data use;
- 87k unique users accessed Landsat data.



Landsat Science Team 2026-2030



SCIENCE PRODUCTS NEWS CONNECT ABOUT

NEWS

New Landsat Science Team Announced

The team brings together experts from universities, private industry, and federal and international agencies to advise the USGS and NASA ensure Landsat continues delivering trusted, publicly available data that supports disaster response, agricultural management, water resources, land stewardship, and national security.





USGS National Land Imaging Science portfolio

National Land Imaging Science portfolio conducts research and delivers information products to:

- **Improve understanding of rates, causes, and consequences of land change**
- **Anticipate future landscape changes**
- **Deliver landscape change information to natural resource managers and stakeholders**
- **Mitigate adverse effects of environmental change**



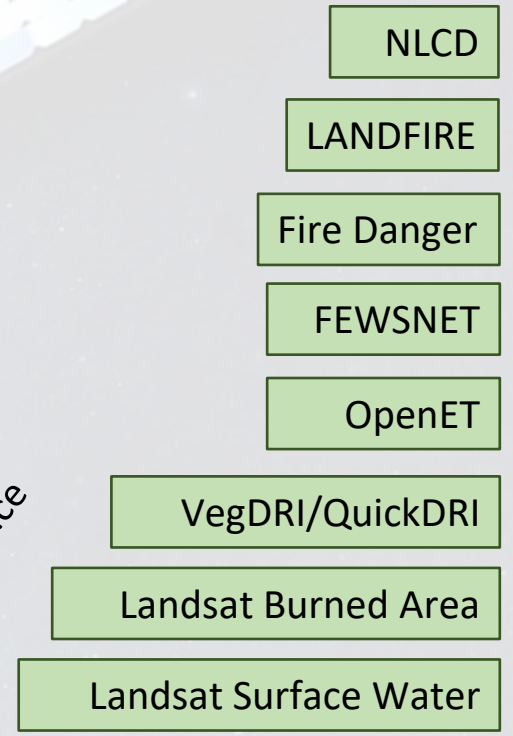
Science - Research to Operations

- Fundamental knowledge of Earth systems

- Local land management stakeholders
- Federal agency partners
- Local to global scale mapping

- National scale
- Routine production
- Wide user base
- Research for product improvement

Carbon and land use model integration
AK boreal forest change due to disturbance
3-Dimension fire fuel research
AK permafrost mapping
Forecasting wetland and watershed ecosystem services
Land Change Modeling and Projection
Buffelgrass mapping and prediction
Tribal land vegetation and prediction
Arid Land Water Harvest
Wildland-urban interface mapping
Agriculture conservation practices
Global irrigated cropland
ET and water balance



Research

Operations

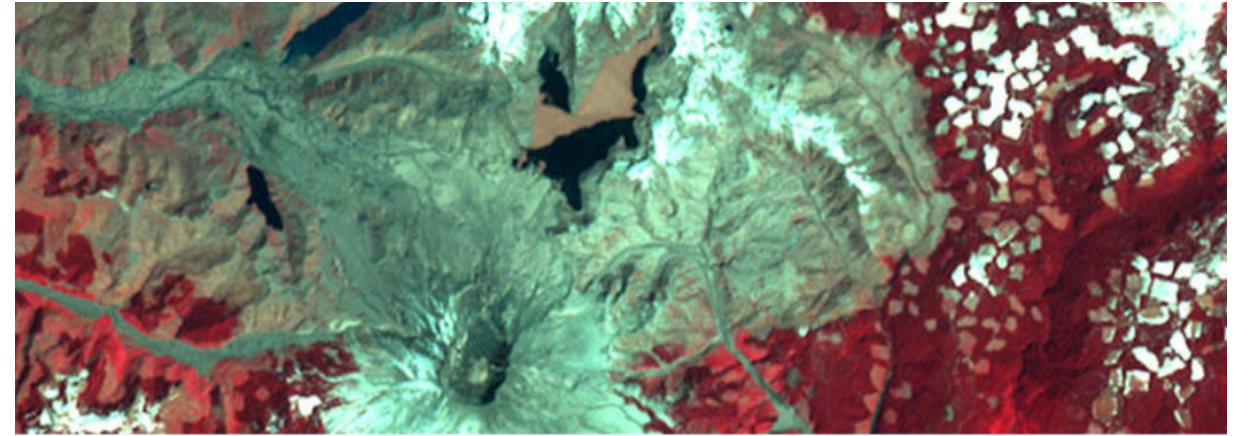


Science Focus Areas

Land Cover & Change: Historical land change and current land change. Assess where, how, and why the landscape is changing. Interactions with weather and climate, the carbon cycle, water resources, and ecosystem functioning.

Water & Drought: Surface water extent mapping, watershed modeling, evapotranspiration (ET), water use, water quantity and quality. Monitor drought impacts on vegetation, fire, water availability, land cover change, carbon storage, GHG, and ecosystem functions.

Fire Science: Wildland fuels mapping, fire risks monitoring, fire behavior modeling, fire danger forecasting, wildland-urban interface, post-fire assessment and recovery monitoring, for strategic and tactical fire management.



The USGS National Land Imaging Program supports science that tracks how land, fire, and water interact across the landscape — providing the data and research needed to understand change and inform decisions.

Land Cover and Change



USGS tracks changes in land cover over time to help inform land management decisions at local, regional, and national scales.

[View the Science](#)

Fire Science



USGS monitors fire patterns and behavior using remote sensing data to map fuels, forecast fire danger, and assess post-fire recovery, helping land managers protect ecosystems and communities.

[Learn more](#)

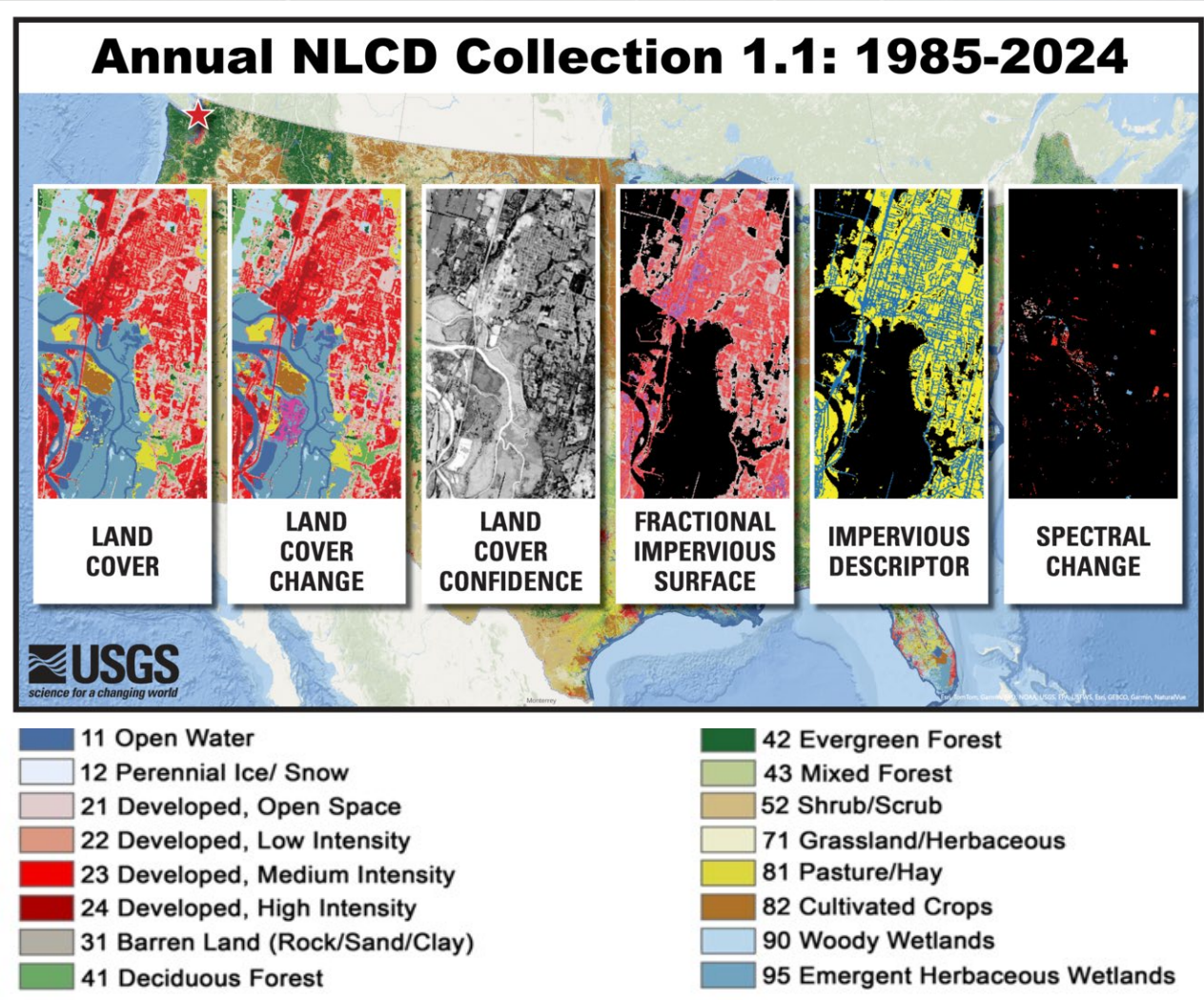
Water and Drought



USGS monitors water availability, drought impacts, and wetland extent using remote sensing and watershed modeling to help protect water resources across local, regional, and national scales.

[Read more](#)

Annual National Land Cover Database (NLCD) Release

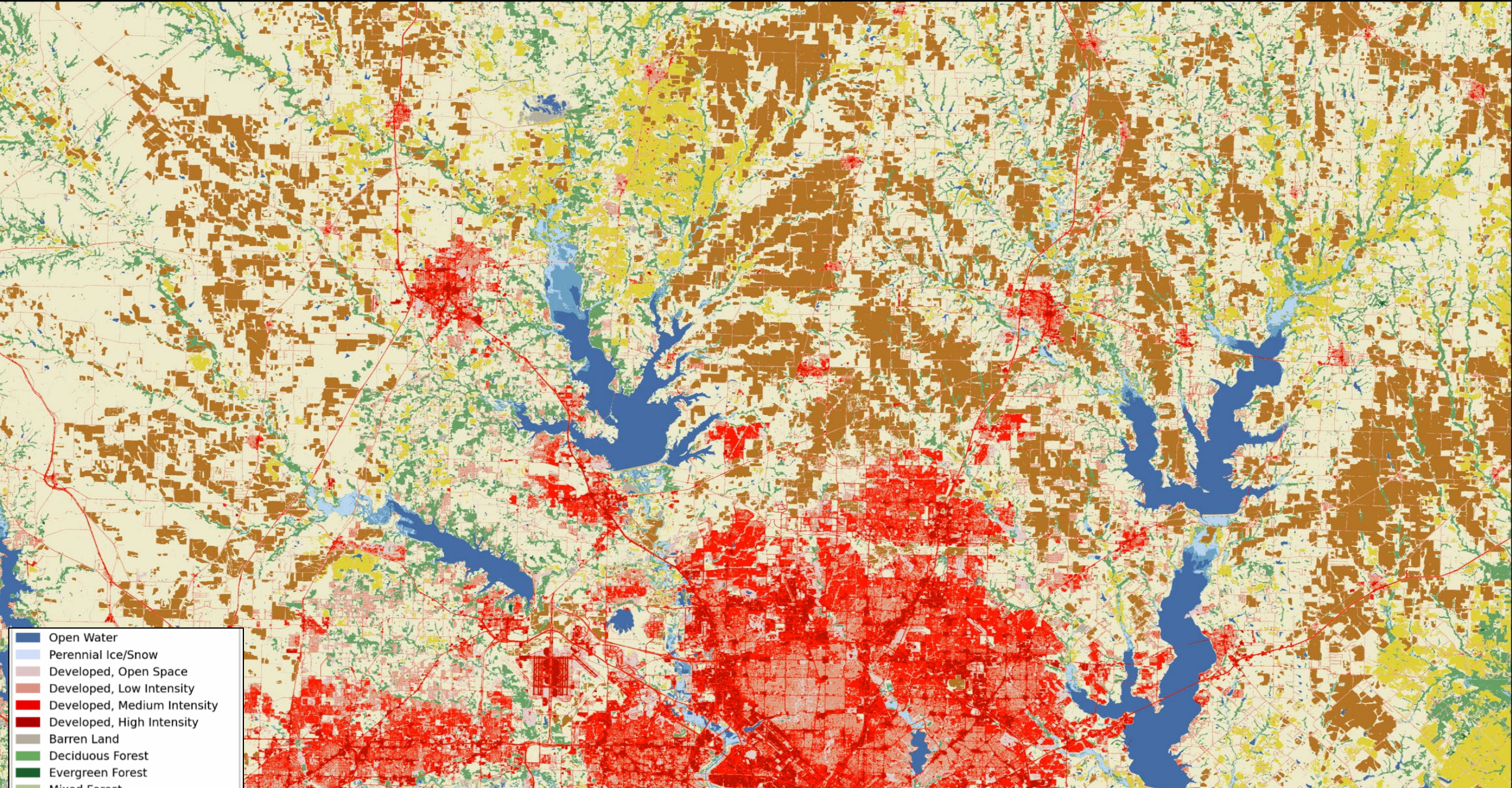


Annual NLCD Collection 1.1 (1985-2024)

- Released June 2025.
- 40 years of Landsat-based land cover and change product.
- Cover Conterminous United States (CONUS).
- Document how America's landscape changed over the past four decades.
- Map land cover, detect land change, characterize fractional impervious surface.
- Suite of 6 land cover and land cover change products for each year from 1985-2024 at 30-m spatial resolution.

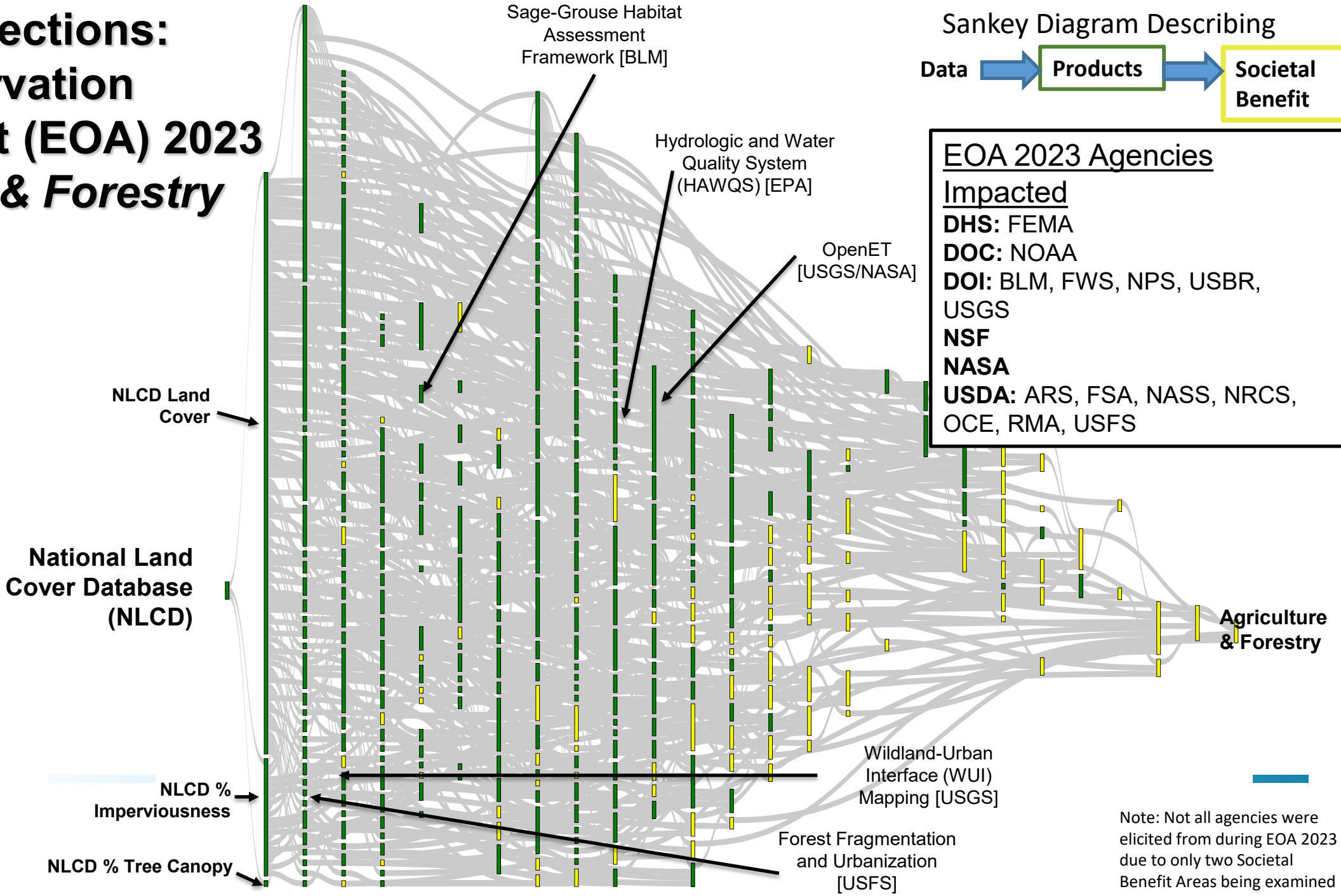
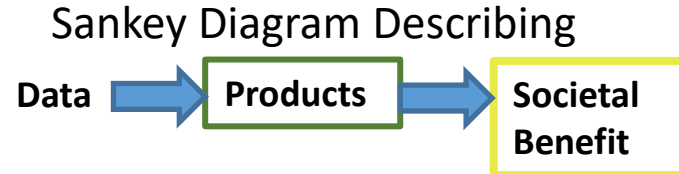
Annual National Land Cover Database (NLCD) – Dallas, TX

1985



- Open Water
- Perennial Ice/Snow
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Barren Land
- Deciduous Forest
- Evergreen Forest
- Mixed Forest

NLCD Connections: Earth Observation Assessment (EOA) 2023 Agriculture & Forestry

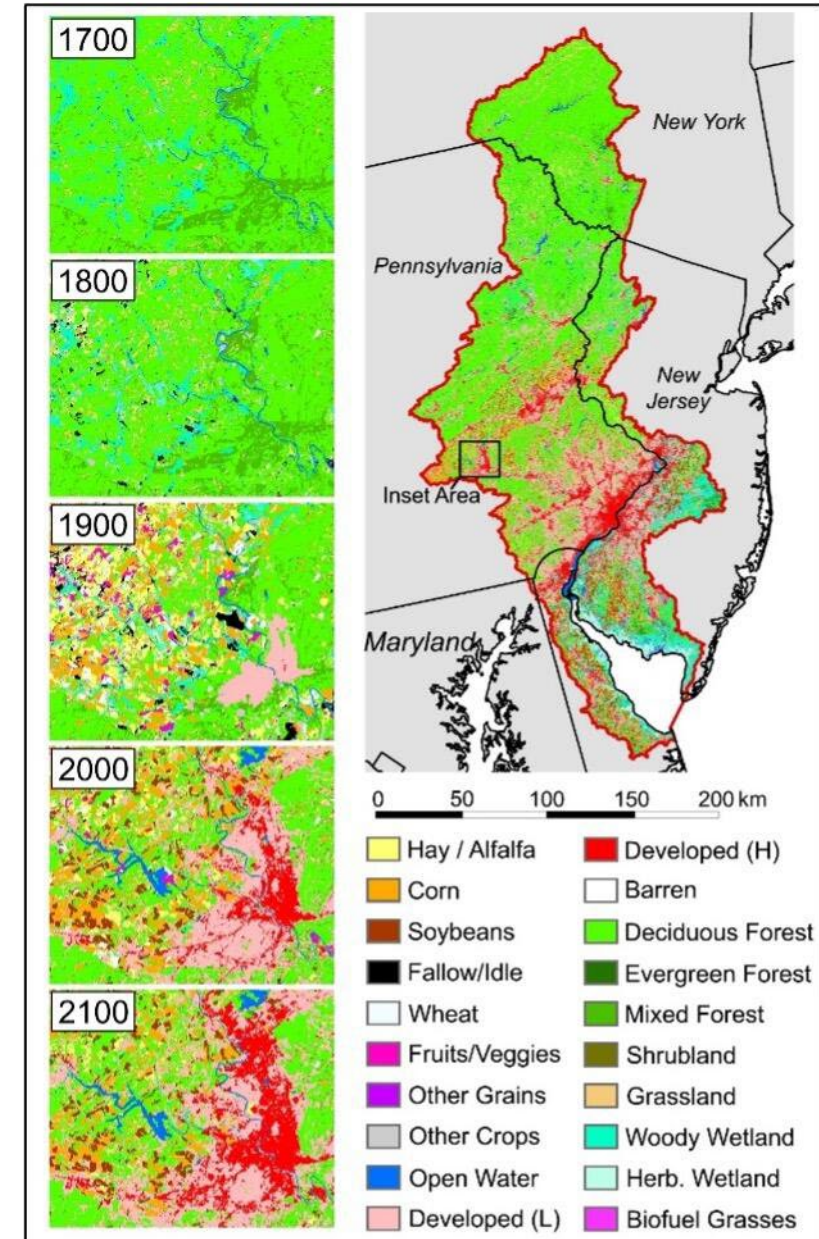
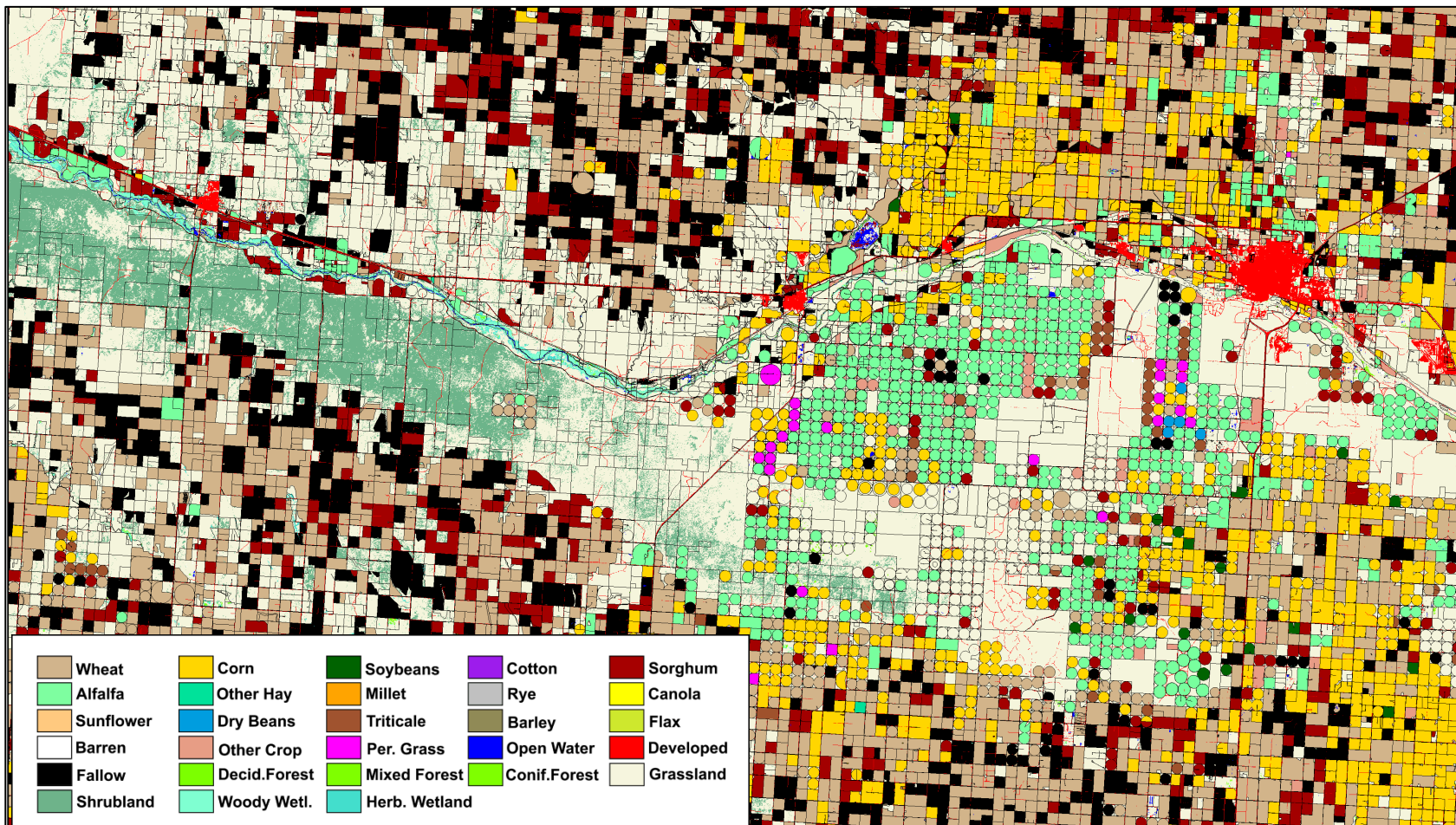


Note: Derived from 2023 OSTP-led assessment with broad civil agency participation. Not all network connections shown; reduced for presentation purposes.

Note: Not all agencies were elicited from during EOA 2023 due to only two Societal Benefit Areas being examined

Past, Present, Future: Long-term US Land Change

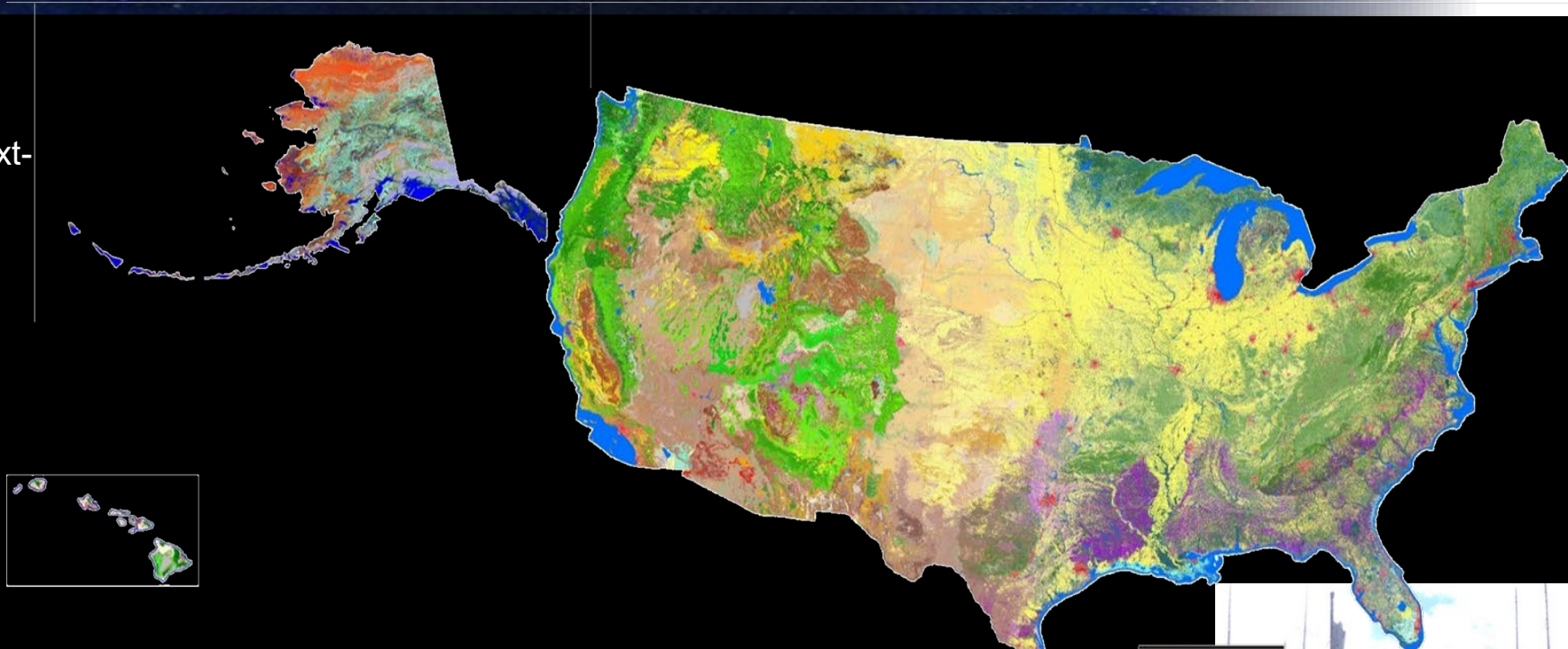
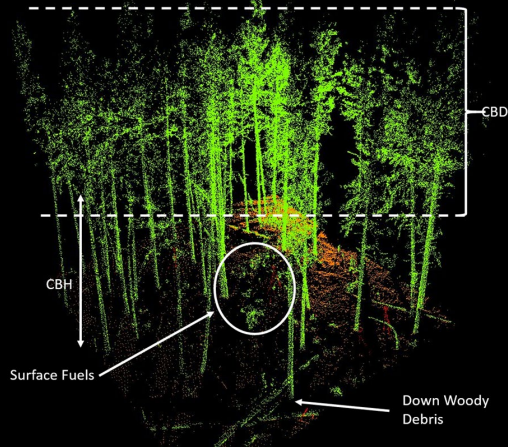
- USGS modeling past, present, and future landscapes
- Unique capabilities of both models are being merged to produce multi-scenario projections of land use for the Nation



Fire Science and LANDFIRE

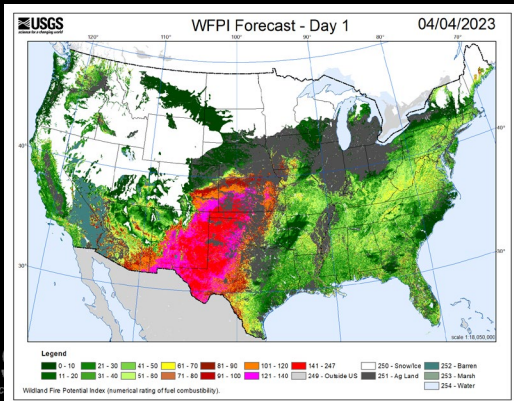
➤ 3D Fuels Research

- ❑ SAR+Lidar+Imagery integrated 3-D vegetation and fuel products using next-generation fire behavior models



➤ Fire Danger

- ❑ Provide 7-day forecast for fire potential, large fire, and fire spread probability



LANDFIRE uses Landsat to provide a common "all-lands" set of vegetation and wildland fire/fuels information, for strategic fire and resource management planning and analysis with 20+ national geospatial layers, databases, and eco-models



LANDFIRE team gathering field data in a remap prototype area of central Idaho

LANDFIRE – National Data Supporting Fire Management & Response

Existing Veg Cover (EVC)

Existing Veg Type (EVT)

Existing Veg Height (EVH)

Vegetation

- Existing Vegetation Type
- Biophysical Settings
- Environmental Site Potential
- Vegetation Cover, Height

Fire Fuels

- Fuel Vegetation type
- Fuel Vegetation Cover
- Fuel Vegetation Height
- Forest Canopy Cover, Height

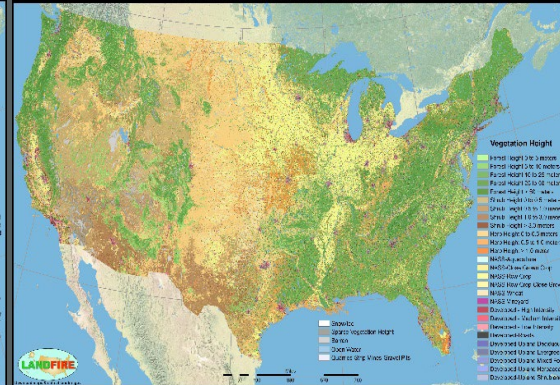
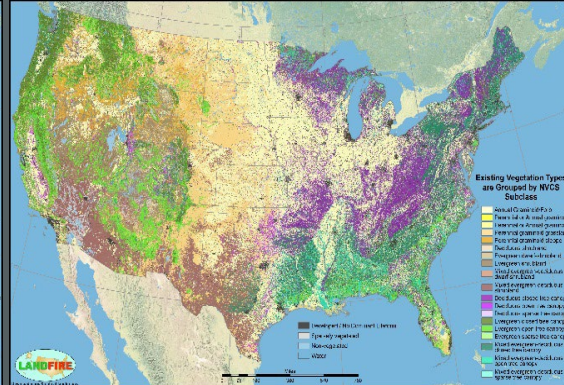
Fire Regime / Models

- Fire Regime Groups
- Fire Return Interval
- Vegetation Condition
- Fire Behavior Fuel Models

LANDFIRE: Existing Vegetation Cover

LANDFIRE: Existing Vegetation Type

LANDFIRE: Existing Vegetation Height



Disturbance

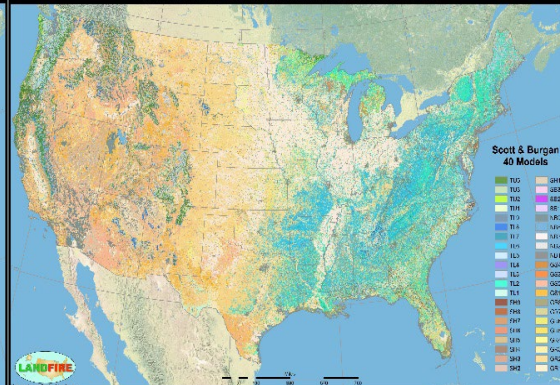
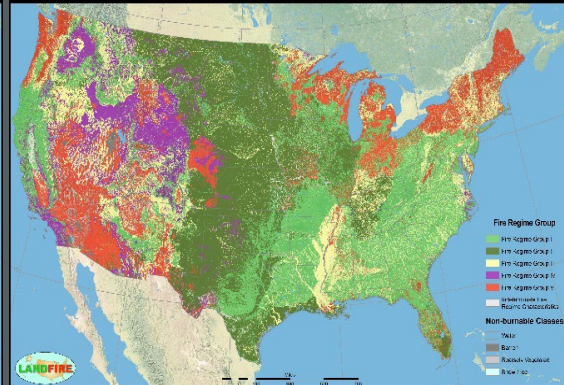
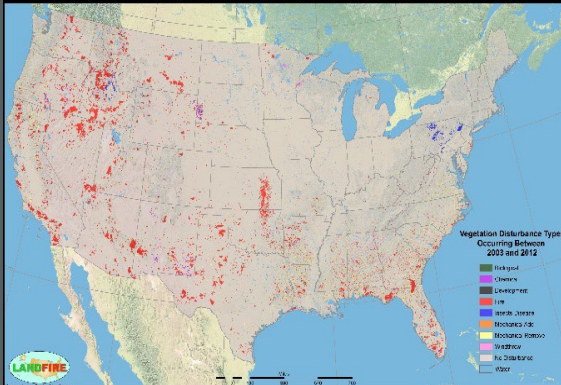
Fire Regime Groups

Fire Behavior Fuel Models (FBFM 40)

LANDFIRE: Vegetation Disturbances

LANDFIRE: Fire Regime Groups

LANDFIRE: Fire Behavior Fuel Models (FBFM40)



Landsat Burned Area

- Mapping fires across all lands and ecosystems from 1984 - present

- Uses machine learning and Landsat's long, consistent record to detect both wildfires and prescribed fires.
- Provides annual inputs to LANDFIRE's national fuels data updates.
- Expanding to global coverage and integrating Harmonized Landsat–Sentinel (HLS) imagery in collaboration with UW–Madison and the Army Corps of Engineers.

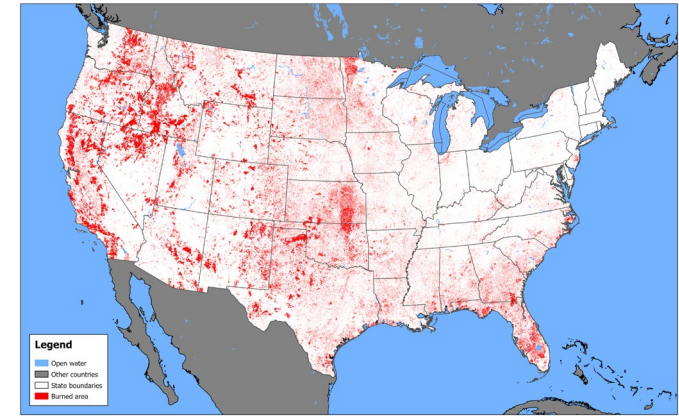


Figure 1. Landsat BA products from 1984 – 2025.

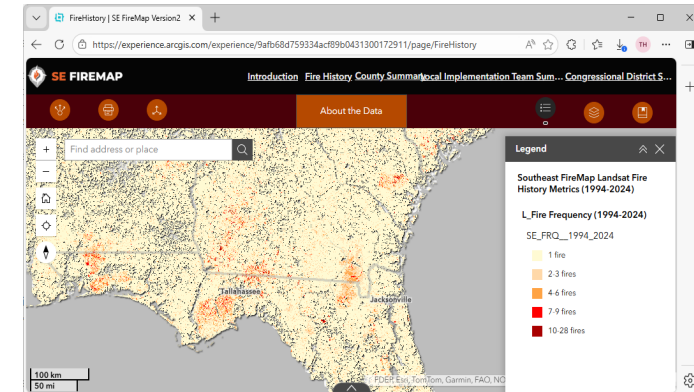


Figure 2. Southeast FireMap prototype data viewer, featuring the Landsat BA products and history metrics.

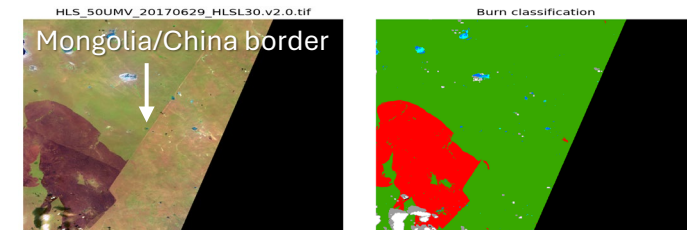
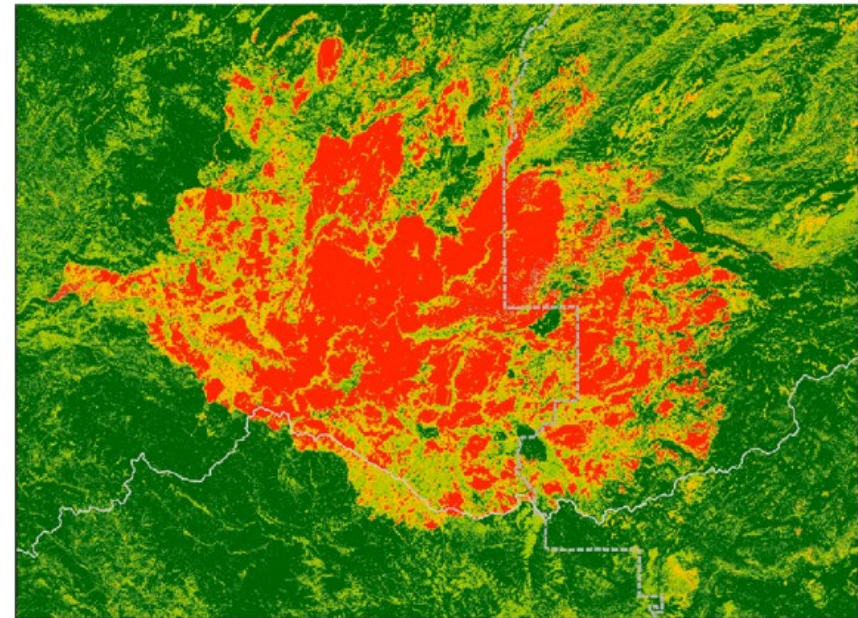


Figure 3. Wildfire burned area mapped using Landsat imagery (6/29/2027).

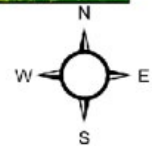
Monitoring Trends in Burn Severity (MTBS)



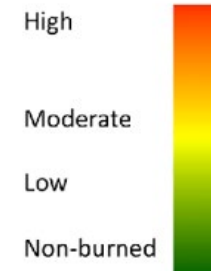
- Landsat imagery used to map and assess the burn severity for all large current and historical fires since 1984. The total number of fires mapped exceeds 30,000.
- Many uses include:
 - ◆ Wildfire Management & Recovery
 - ◆ Disaster risk and mitigation (e.g., landslides)
 - ◆ Insurance and Risk Assessment
 - ◆ Biodiversity and Habitat Studies



0 5 10 20 30 Kilometers

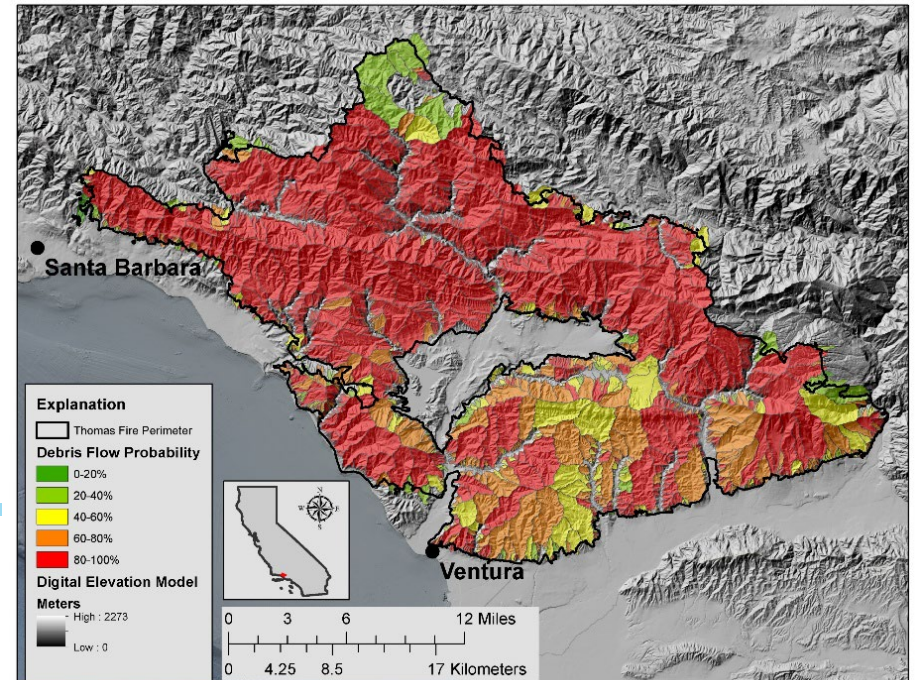
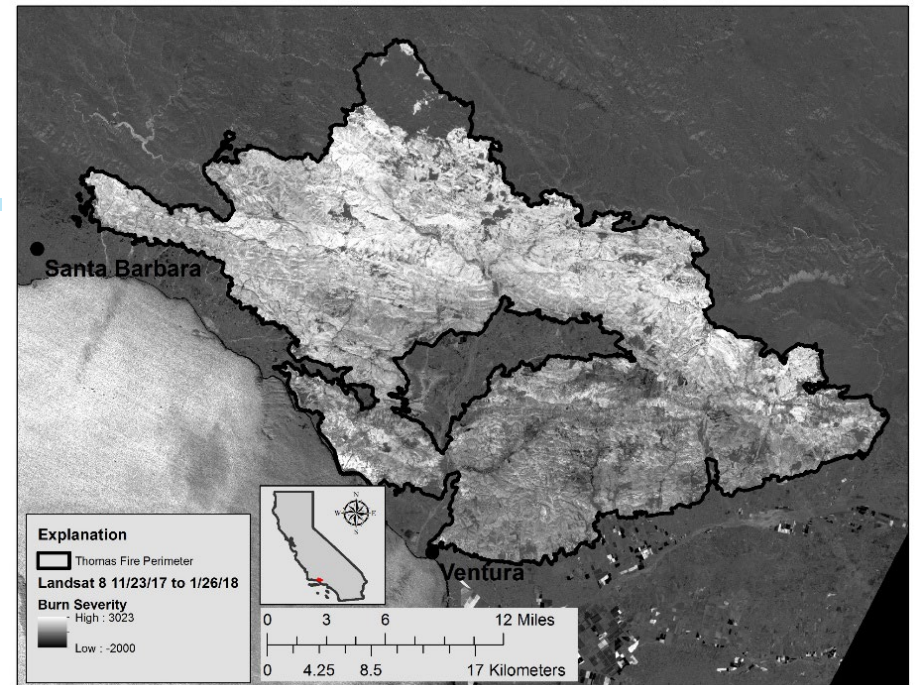


Burn Severity Classes



Burned Area Emergency Response (BAER)

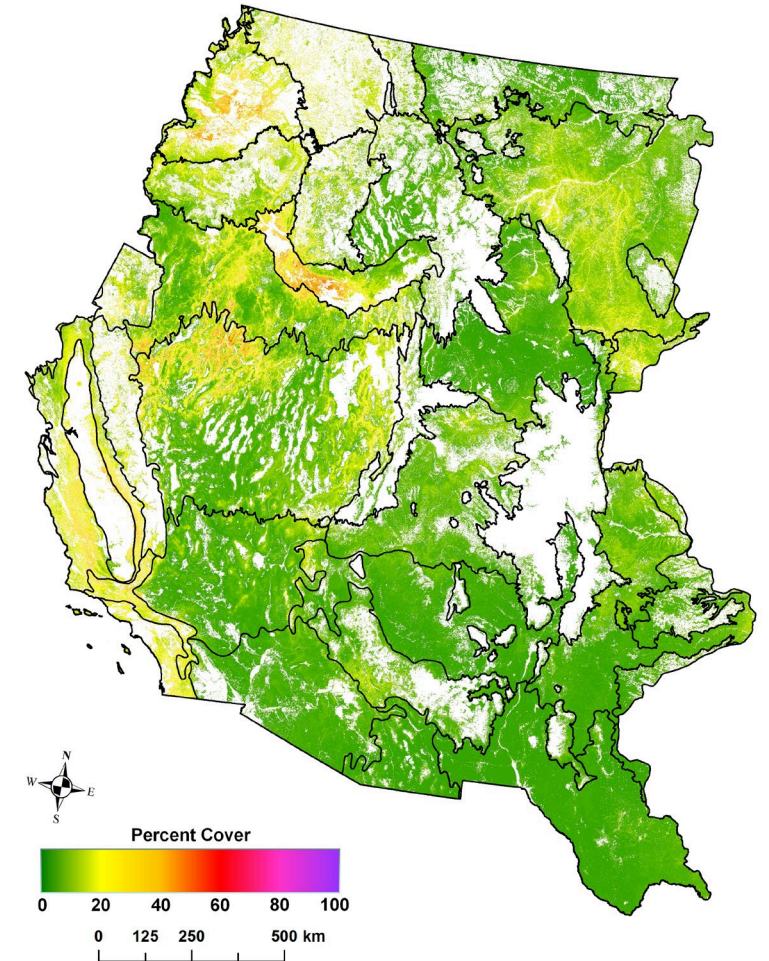
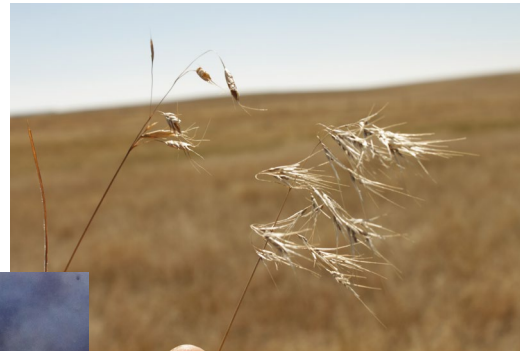
- DOI BAER teams require emergency response burn area maps immediately after large wildfire containment.
- USGS provides emergency response mapping support related to BAER team tasks to minimize post-fire hazards of downstream flooding, landslides, and soil erosion.



Top: dNBR imagery of 2018 Thomas Fire indicating burn severity
Bottom: USGS debris flow risk assessment using burn area data.

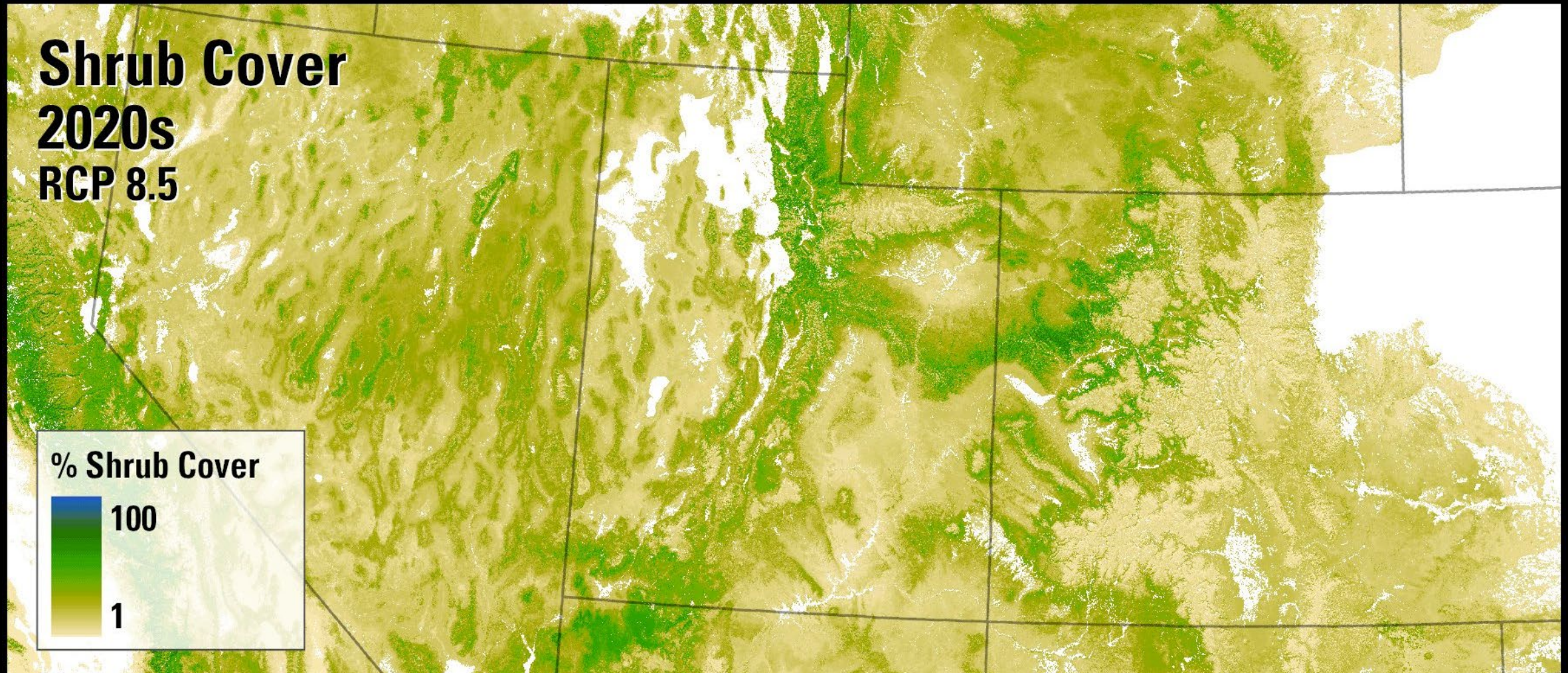
Invasive Grasses Mapping

- Invasive grasses such as cheatgrass contribute to ecosystem degradation and increased fire intensity in the Western United States.
- Landsat data, combined with Europe's Sentinel-2 data can provide 3x/week observation frequency for Western state land managers' early season potential fire fuel outlook and rapid response.
- Contributes to BLM Sagebrush Ecosystem Conservation and the Integrated Rangeland Fire Management Strategy Actionable Science Plan.



Expanding mapping effort to all Western U.S. using the USGS Denali Tallgrass High Performance Computing capability and the Landsat archive

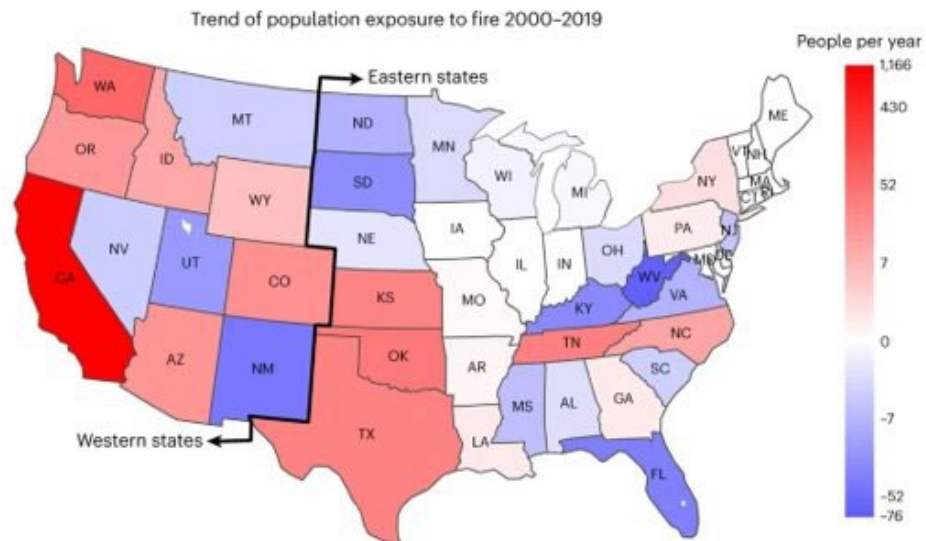
Rangeland Condition Monitoring, Assessment, and Projection (RCMAP)



- Fractional vegetation cover to capture gradual and abrupt change in US rangeland condition
- Improve LANDFIRE vegetation and fuel products
- Integrate invasive grasses mapping and RCAMP into comprehensive fractional cover mapping

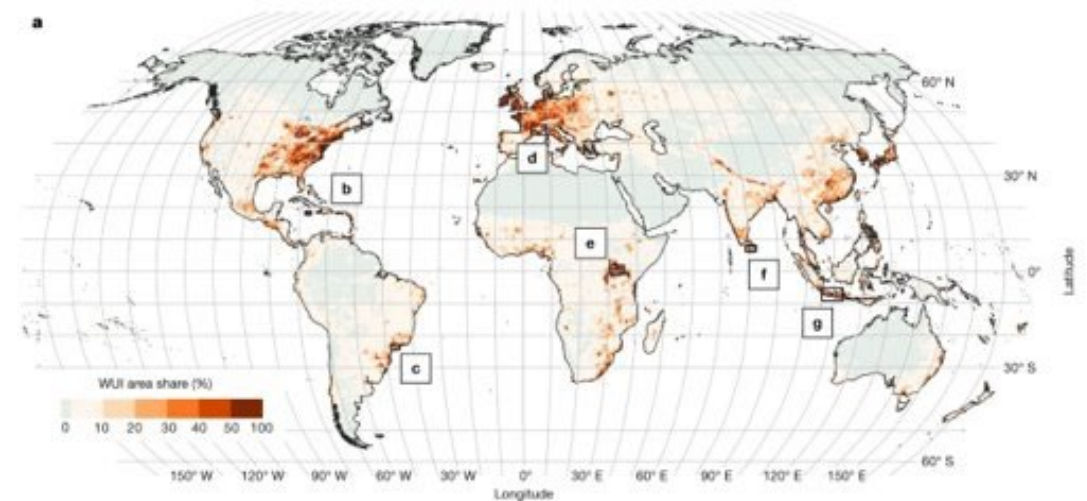
Fire Science Highlights

Human and infrastructure exposure to large wildfires in the United States



- Human exposure to large fires in the US from 2000-2019
- 82% occurred in the western US
- Increased wildfire extent drove increasing exposure trends

The global wildland-urban interface



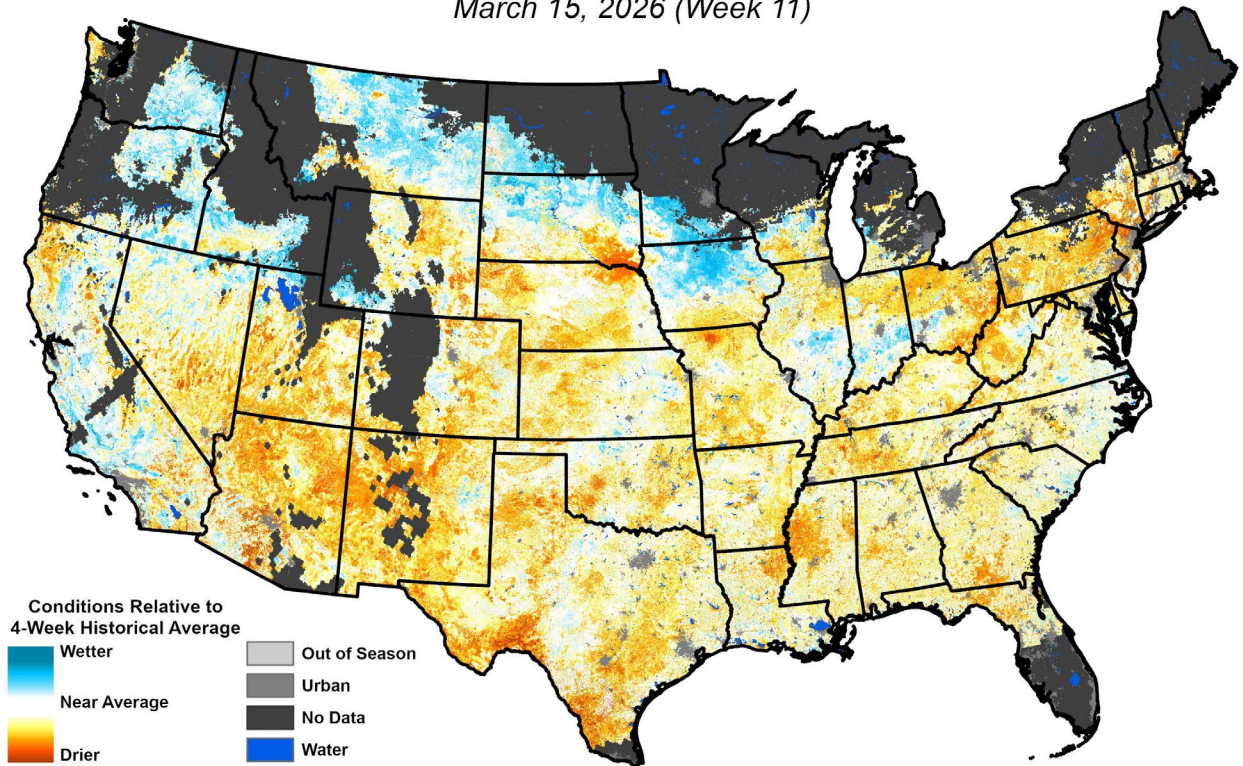
- First global Wildland –Urban Interface (WUI) map at 10-meter spatial resolution
- Uncovered many undocumented WUI hotspots
- WUI covers 4.7% of the global land surface, home to half of the world's population (3.5B)

Drought Monitoring

- USGS produces Vegetation Drought Response Index (VegDRI) and Quick Drought Response Index (QuickDRI) monitor weekly drought status
- VegDRI monitors long term drought; QuickDRI detects rapid drought onset
- Supports agriculture, water management, and wildfire risk assessment with real-time drought impact data
- Product enhancement – moving to 375m eVIIRS data nationwide, AI models, and modernizing input variables, reducing external dependencies

Quick Drought Response Index (QuickDRI)

March 15, 2026 (Week 11)

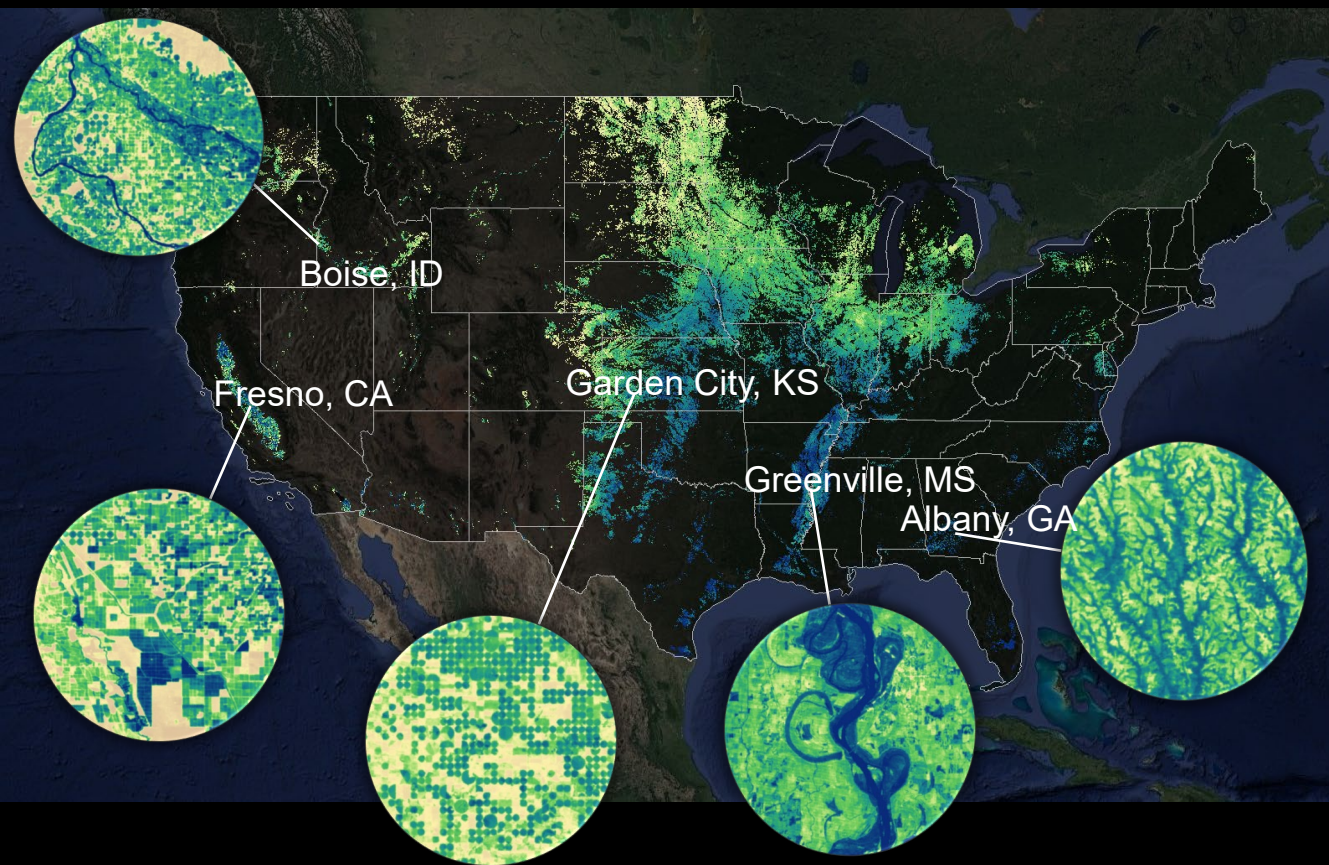




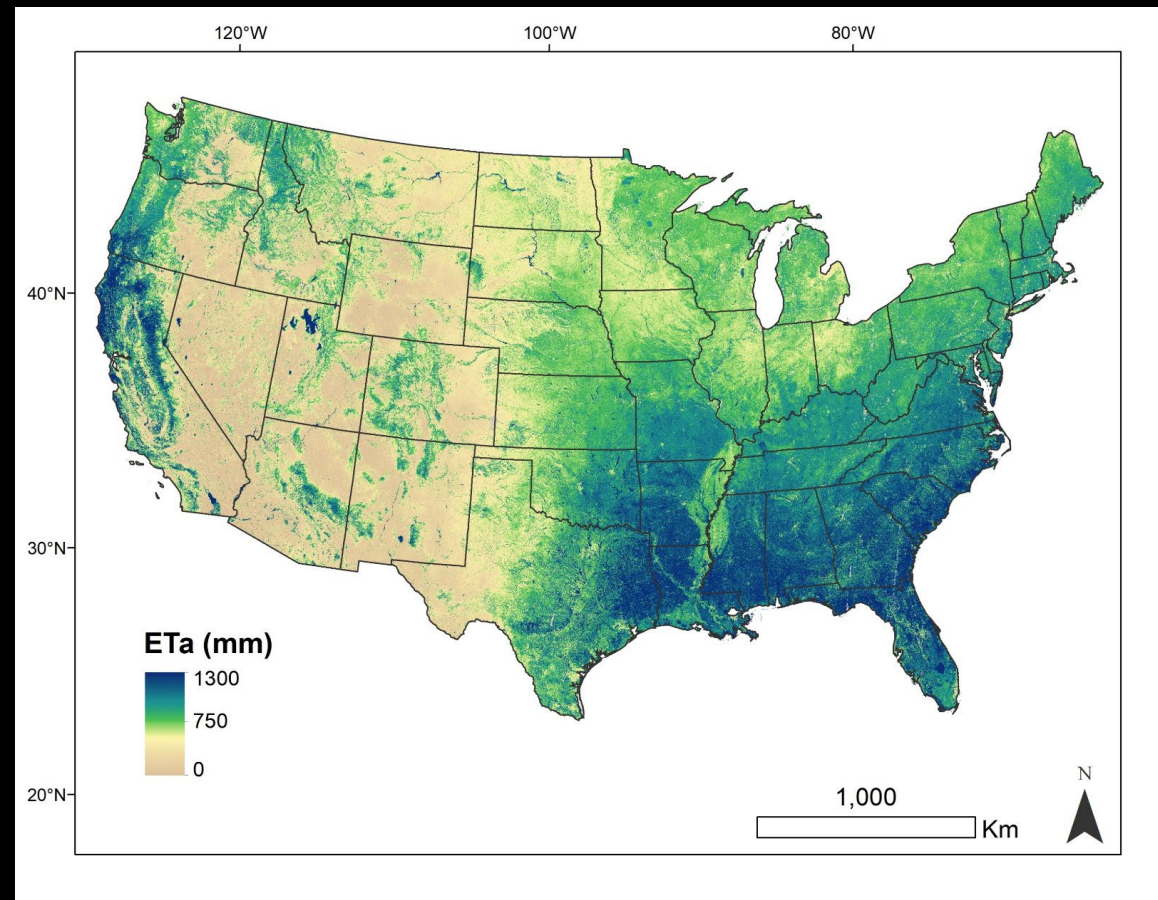
Water Use

➤ Evapotranspiration

- Landsat+ ET (Sentinel-2, VIIRS, etc.)



Annual Total ETa (mm)

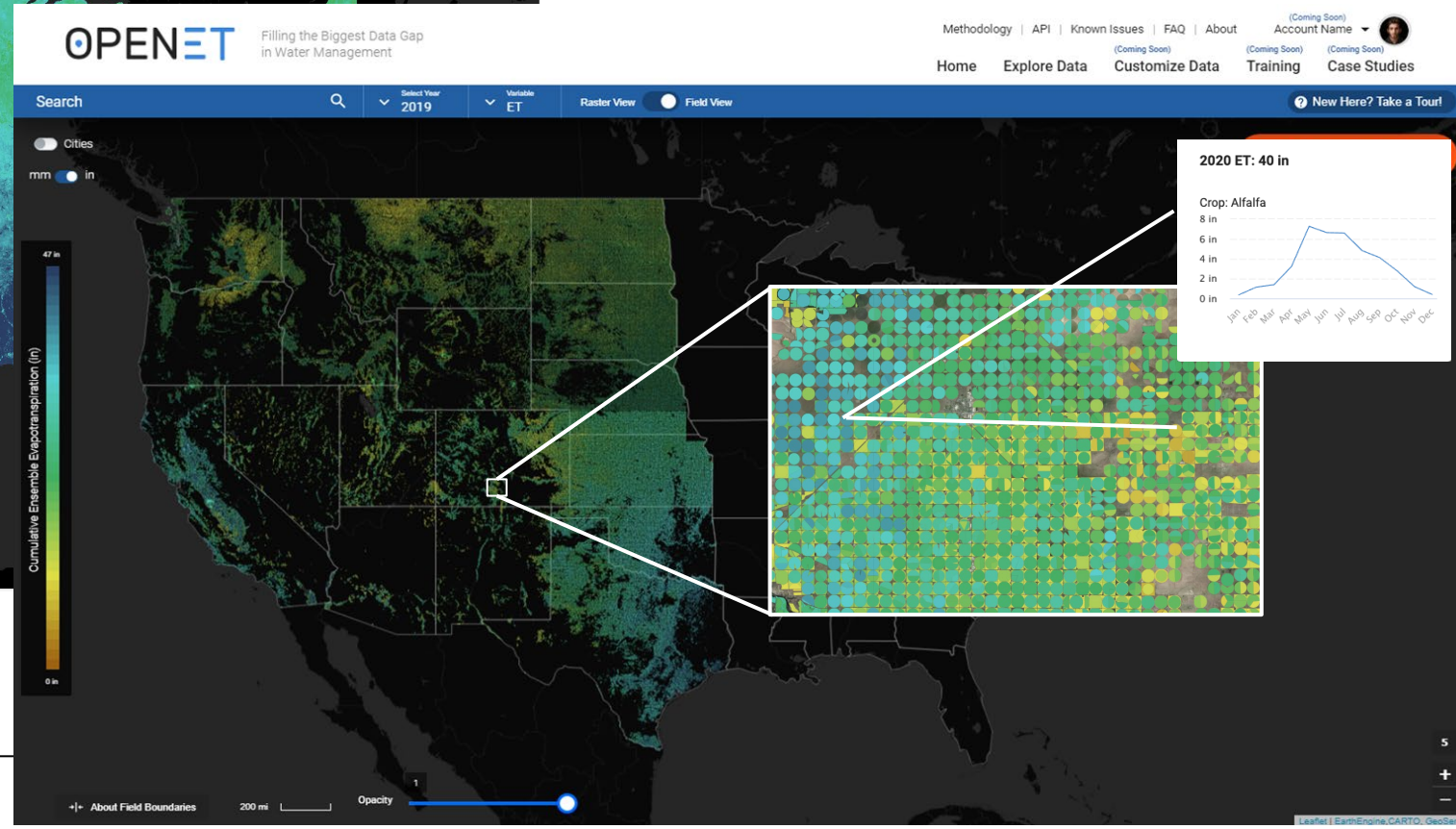
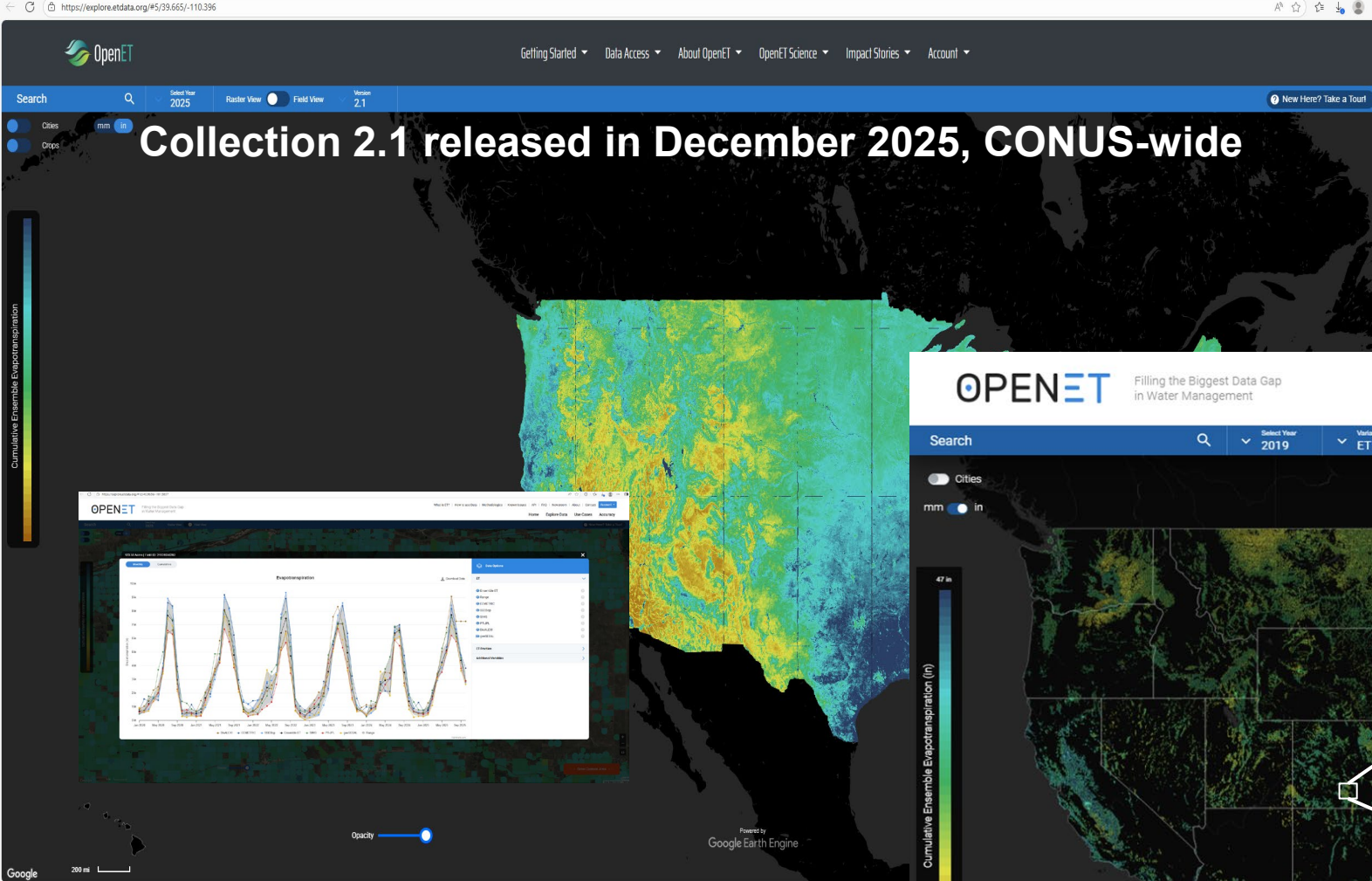


30-m CONUS Evapotranspiration

OpenET: Reliable, accurate water data



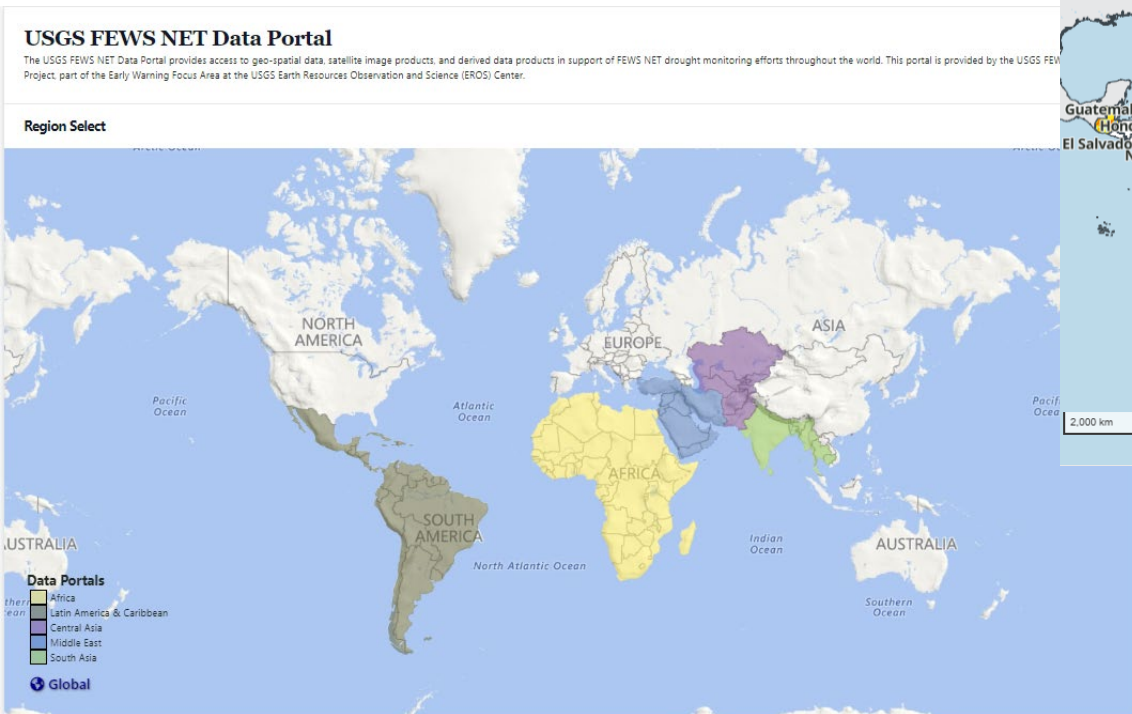
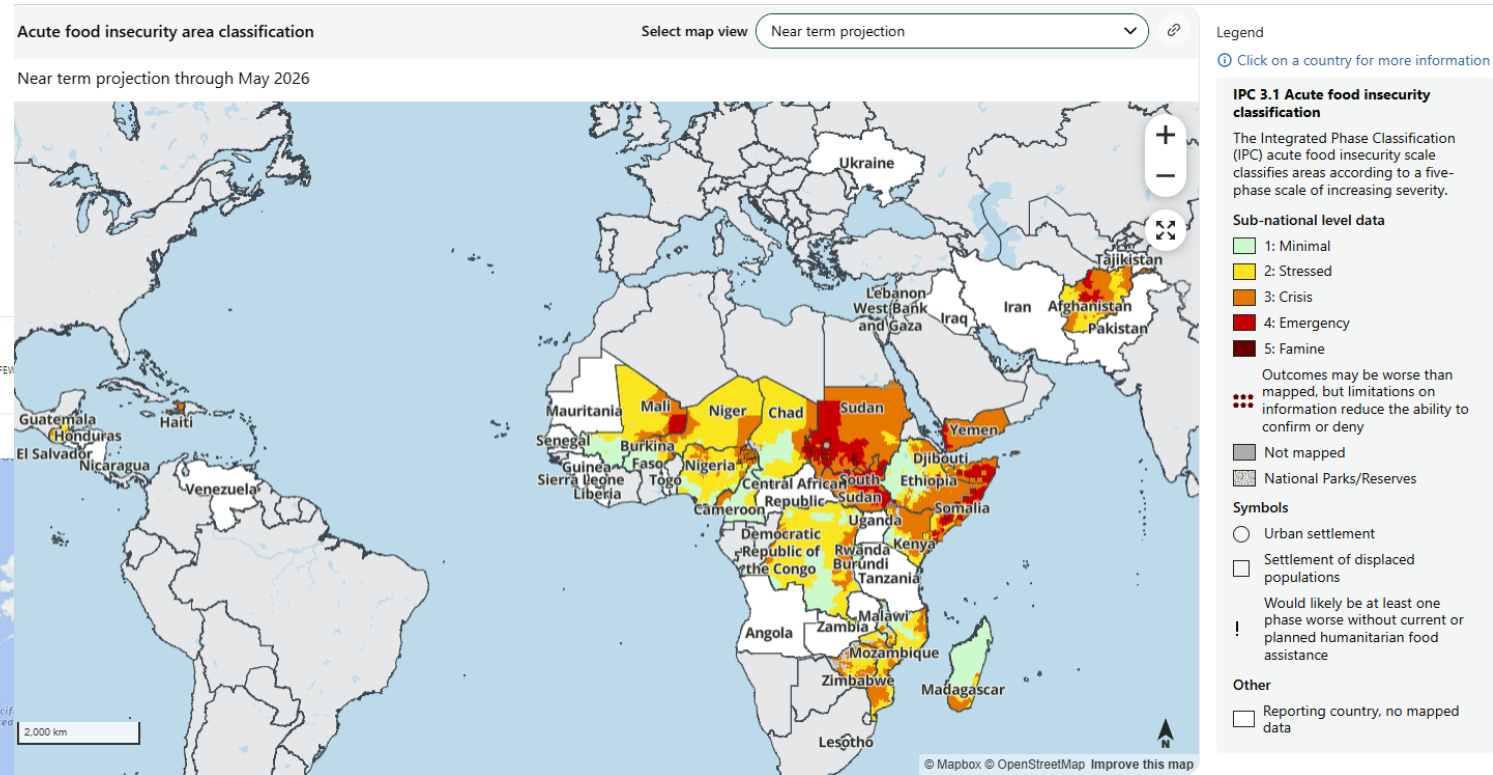
<https://etdata.org/openet-data-explorer/>



Melton et al., 2021. J. Hydro.

Famine Early Warning Systems Network (FEWS NET)

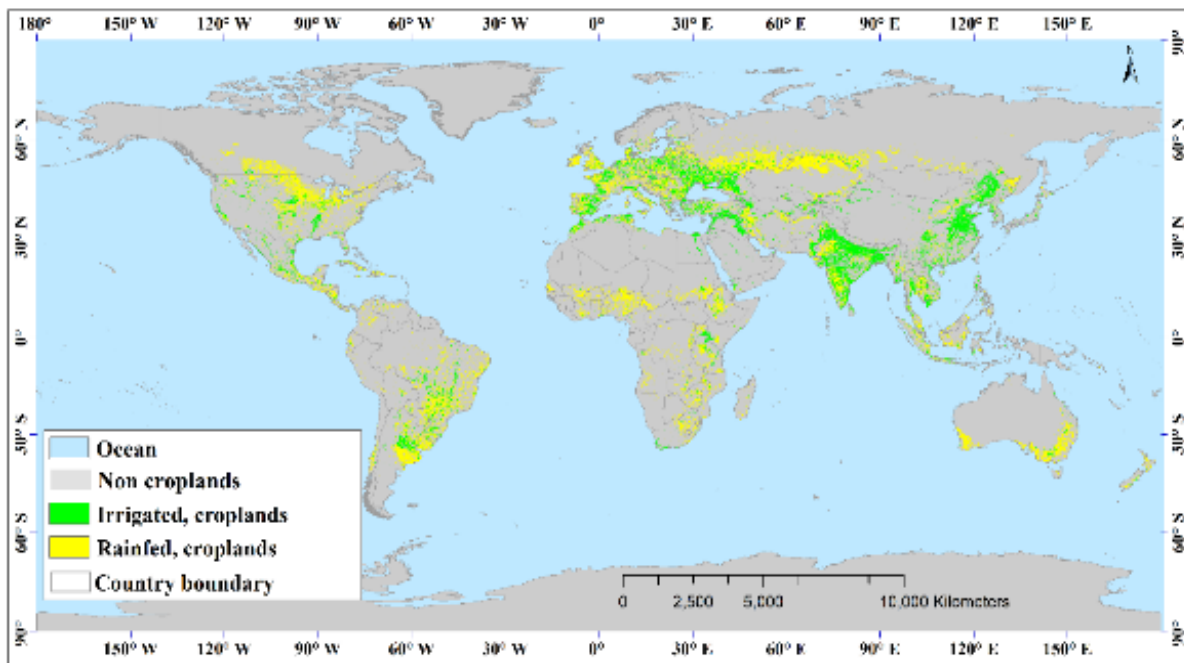
- FEWS NET, an activity of U.S. State Department, is a leading provider of early warning and analysis on [acute food insecurity](#) around the world.
- There are over 18 different product types, such as NDVI, ET, and precipitation, Water Point, available for 30 countries across the globe at temporal scales from daily to annual.





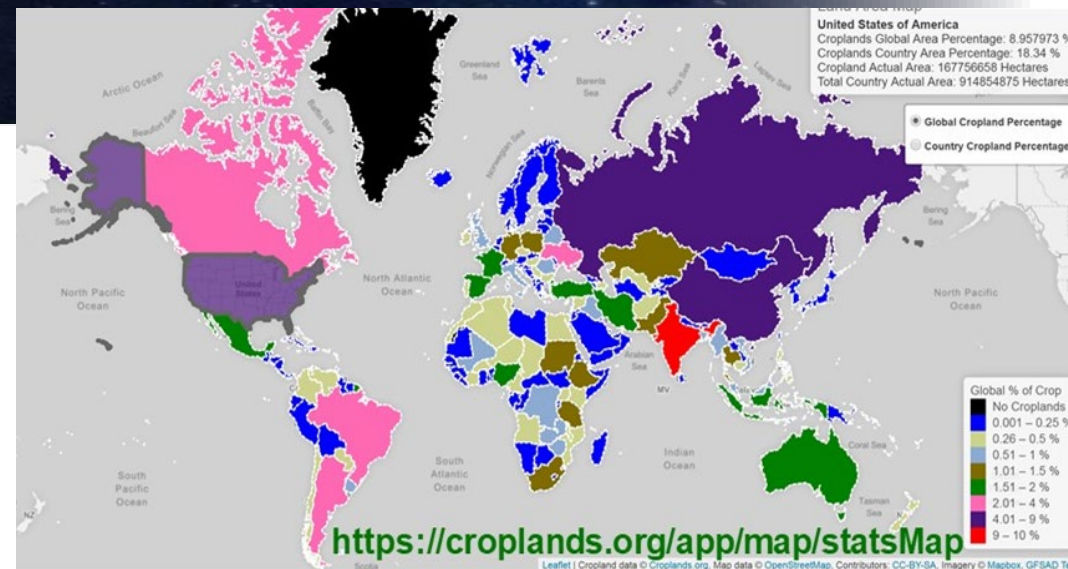
Global Food Security

- Global crop mapping, monitoring, assessments, and forecasting
- Leverage remote sensing data, AI/ML techniques and cloud computing to produce cropland extent and irrigated crop area.

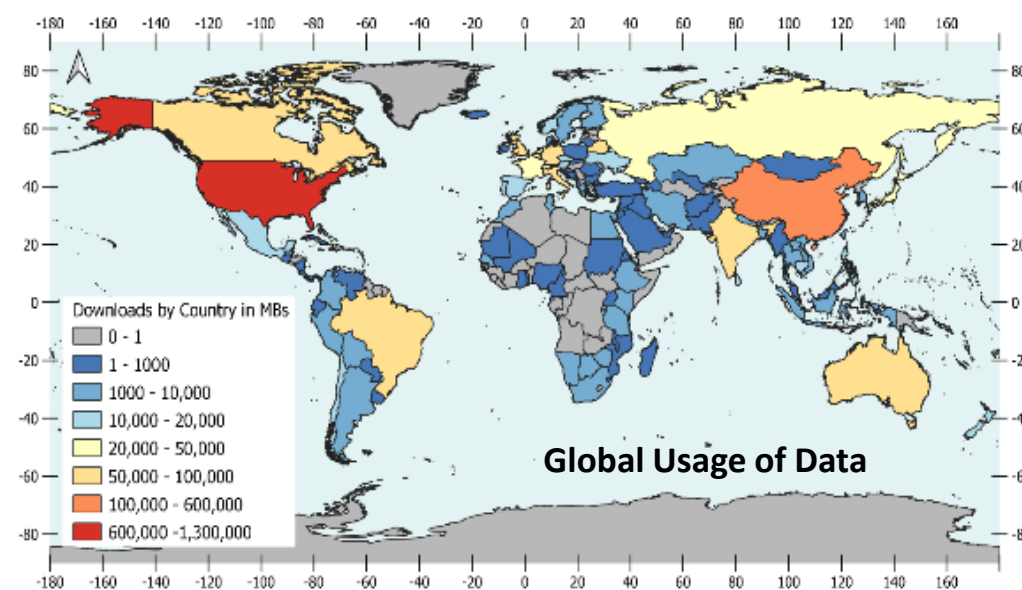


Global rainfed and irrigated-cropland product on LP DAAC

www.usgs.gov/wgsc/gfsad30; <https://www.usgs.gov/apps/croplands/app/map>
<https://pdaac.usgs.gov/news/release-of-lgrip30-data-product/>



Cropland as % of the Country Geographic Area



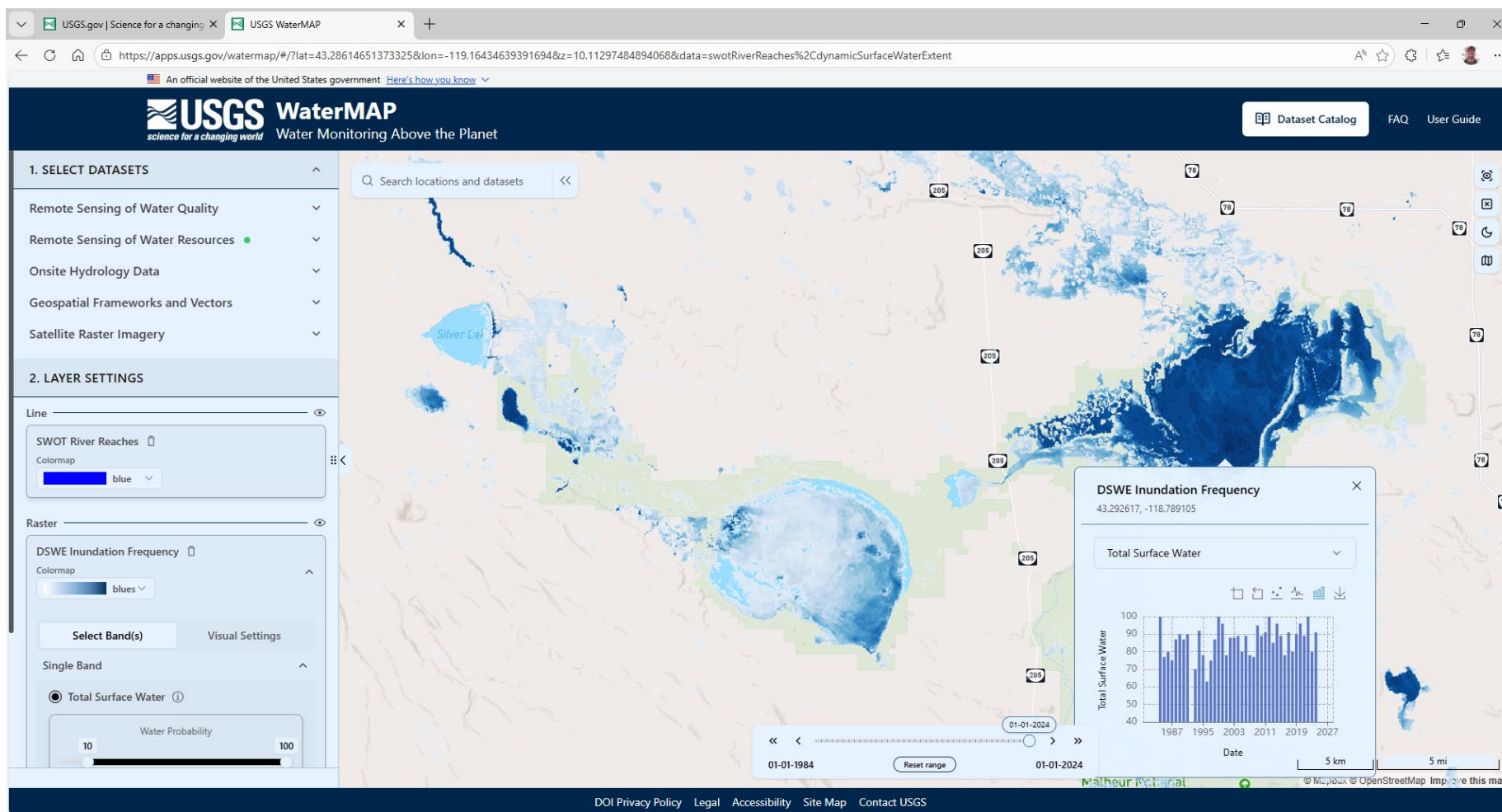
Global Usage of Data

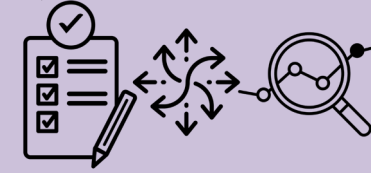
Surface Water Extent Mapping

Shown: 2024 Per-pixel Inundation Frequencies (Total Surface Water is Open + Partial Water) Malheur National Wildlife Refuge and surrounds.

Dynamic Surface Water Extent (DSWE): CONUS, AK, HI every Landsat image '84-Present

DSWx: Near-global every Landsat & Sentinel-2 image (2016-present), + Sentinel-1 (2024-Present), NISAR in development

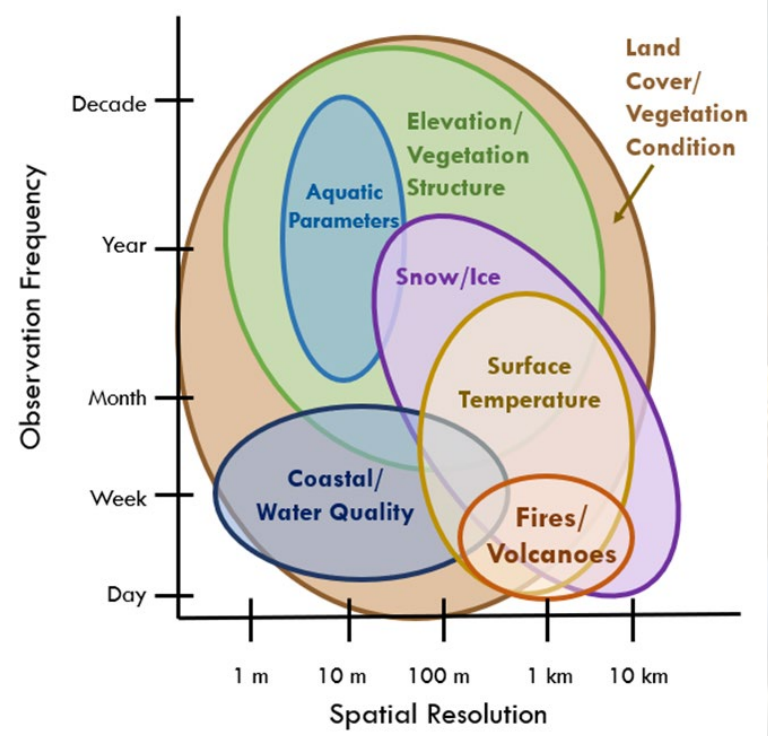




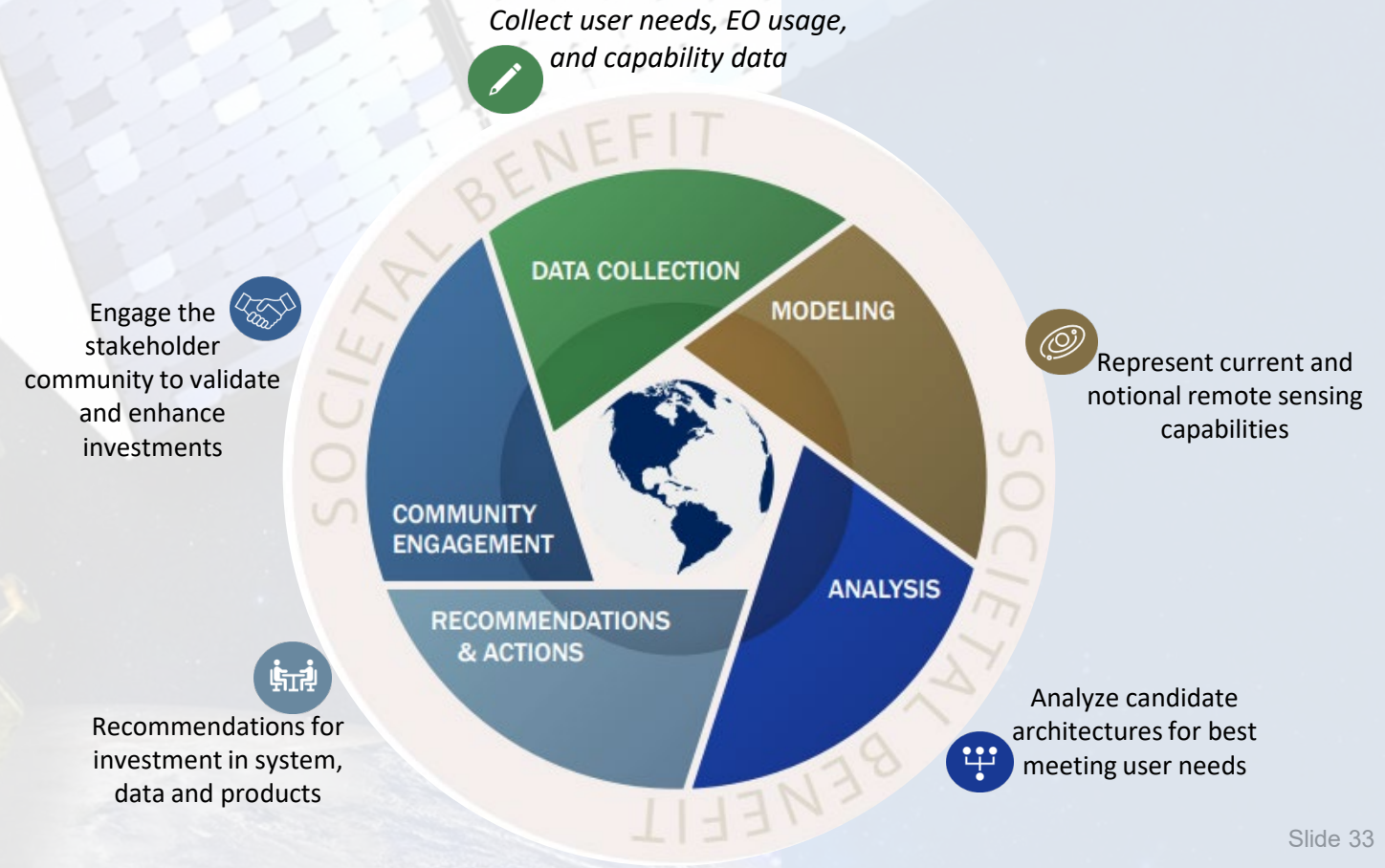
Requirements, Capabilities, and Analysis (RCA)

Core Science Systems – National Land Imaging Program

RCA documents user needs and assesses satellite capabilities to determine the most effective solutions to address broad civil agency and societal challenges.



User needs cover a breadth of land-imaging observation types, spatial scales, and frequencies. Sources/Usage: Public Domain.



RCA: User Needs to Earth Observation Solutions

RCA By the Numbers

Requirements

We host one of the largest & most comprehensive user needs database to support EO decision-making

2000+

User Needs

Our user needs represent the broad interests of the user community. We have over **11 years** of user needs data from **hundreds** of SMEs.

26

US Federal Agencies

31

Academic institutions, non-profits, etc.

15+

Application Areas

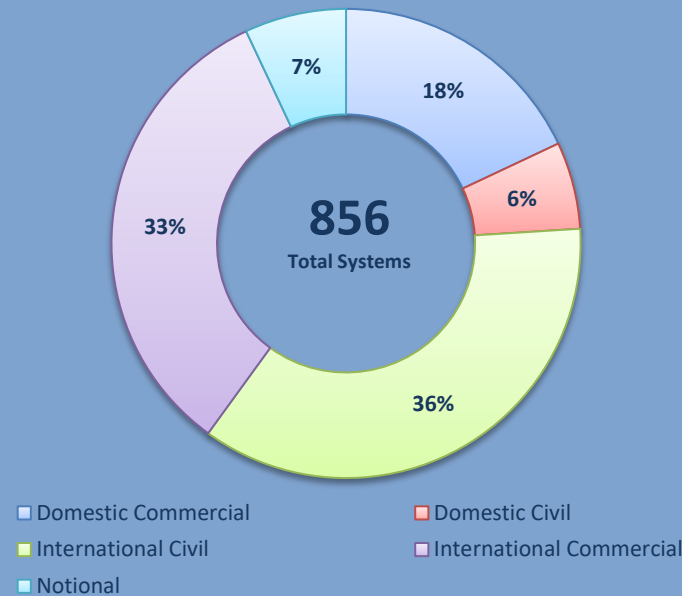
218

Geophysical Parameters

Capabilities

We document system capabilities to understand EO sector trends

EO System Capabilities



Analysis

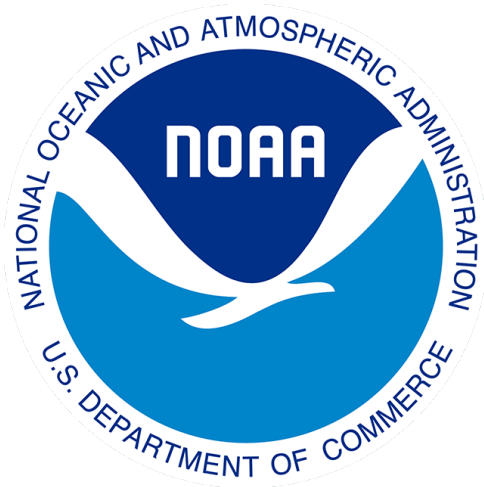
We analyze user need and system capability data to inform national studies

- 2019 Architecture Study Team
- 2021 National Land Imaging Study
- 2022 Wildland Fire EO Gap Study
- 2023 Earth Observation Assessment
- 2025 Mission Alternatives Assessment Team
- 2026 User Needs Gap Study

RCA: User Needs to Earth Observation Solutions

Collaboration with NOAA - EORES

Since 2014 RCA has collaborated with NOAA's Technology, Planning and Integration for Observations (TPIO) Office to jointly **develop, build, deploy, evolve, and maintain** the Earth Observation Requirements Evaluation System (**EORES**)



900+

Hours of software
scrum planning

12+

Years of
collaboration

130+

Software releases

8+

Strategic roadmaps
developed

65+

Conceptual data
model updates

5+

Technical Interchange
Meetings

RCA: User Needs to Earth Observation Solutions

High-Resolution User Needs Collection By the Numbers

Between 2020 and 2025 RCA submitted **224 high resolution user needs** to support the National System for Geospatial Intelligence (NSG) Commercial GEOINT Requirements Process through the Civil Applications Committee (CAC)



130+

Subject Matter Experts

150+

SAR-Specific User Needs

84

Elicitations

68

Geophysical Parameters

15+

Federal Agencies

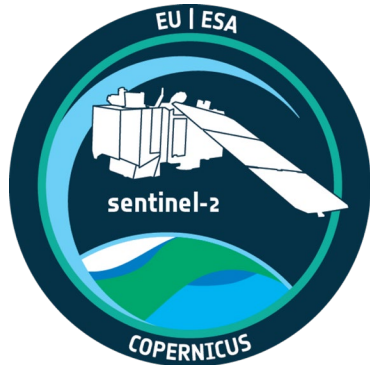
10+

Topical Applications

RCA: User Needs to Earth Observation Solutions

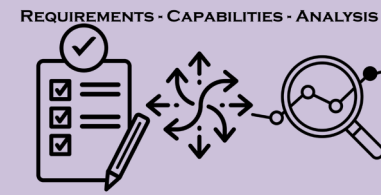
Near Real Time Data Collection

Future mission coordination and topical user needs data collection. RCA collected **19 near real time user needs** with the European Commission's Knowledge Center on Earth Observation (KCEO) to inform European Space Agency (ESA) decisions around Sentinel-2 Next Gen ground station development.



Requirements, Capabilities, and Analysis (RCA)

Core Science Systems – National Land Imaging Program



RCA guides program prioritization and investment in satellite mission formulation; engagement with U.S., international and commercial organizations; satellite needs and national Earth observation assessments.

Future Landsat mission concepts, products, and services

Commercial data augmentation

International satellite partnerships

National Earth observation Assessments

Prioritization of satellite data characterization studies

NASA Decadal Survey missions, and mission continuance

USGS science collaboration, needs, data accessibility



Thank you!

Zhuoting Wu
zwu@usgs.gov

*Earth Observation Applications Coordinator
National Land Imaging Program
U.S. Geological Survey*

