Landsat 250th Portrait of America

Industry Week

Sustainable Land Imaging (SLI) Commercial Transition

U.S. Geological Survey

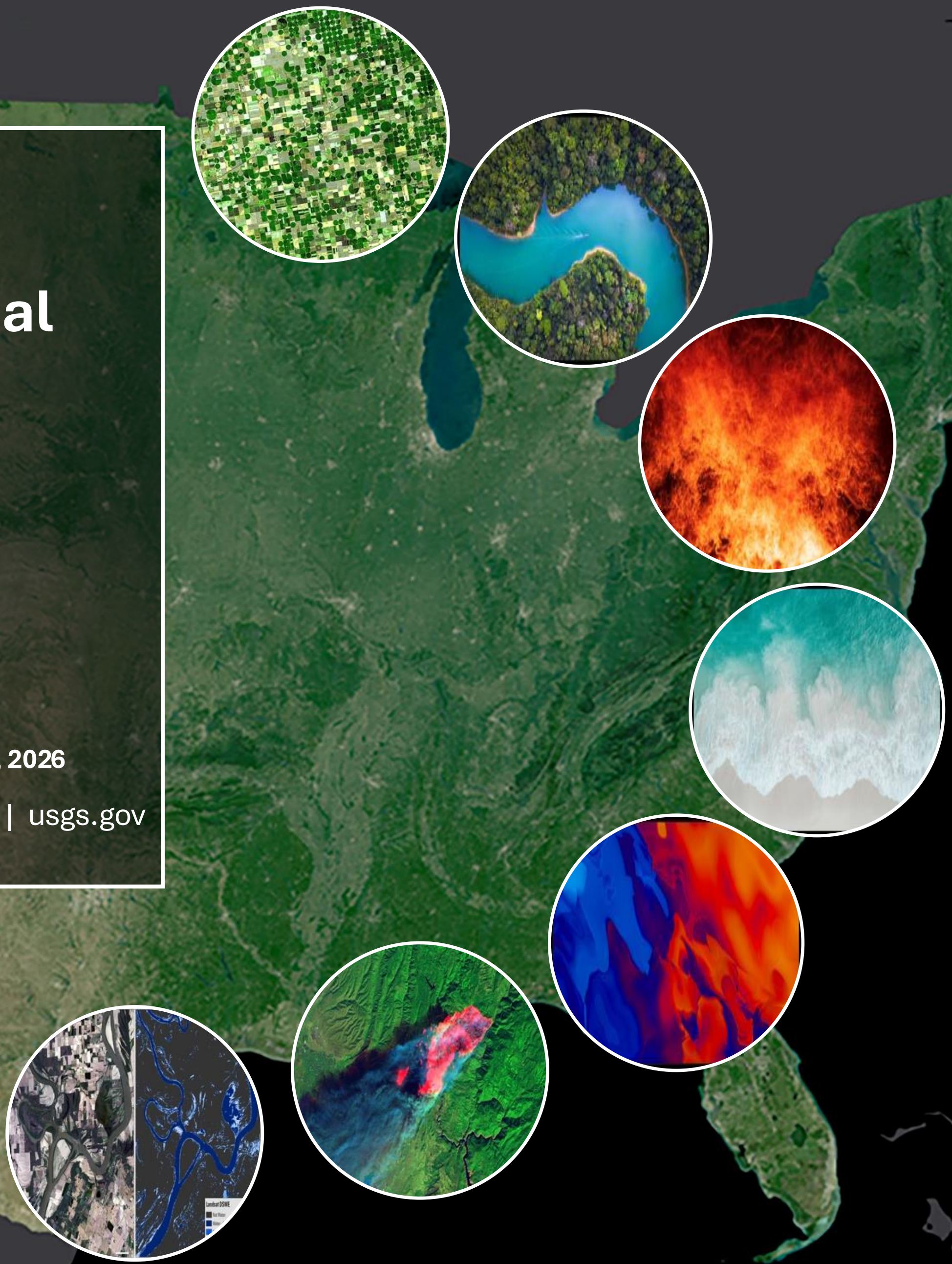
Department of the Interior

Earth Science Division, Science Mission Directorate

National Aeronautics and Aerospace Administration

August 31, 2026

nasa.gov | usgs.gov



U.S. Department of the Interior
U.S. Geological Survey

SLI Commercial Transition

Introduction and Welcome

Tim Newman
Program Coordinator
National Land Imaging
U.S. Geological Survey (USGS)

Scott Schwinger
Associate Director for Flight
Earth Science Division
NASA

Agenda

- **1:30 Welcome and Logistics**
  - Tim Newman
- **1:35 Leadership Remarks**
  - Ned Mamula
  - Karen St Germain
- **2:00 SLI Commercialization Strategy Summary**
  - Nima Pahlevan & Doug Daniels
- **2:20 SLI Strategy Q&A**
  - All
- **2:30 Break**
- **2:45 NASA and USGS Lines of Effort**
  - Brief Introduction
    - Nima Pahlevan
  - Product Summary
    - Terry Sohl
  - Technical Summary
    - Chris Neigh
  - Programmatic Summary
    - Dana Ostrenga & Doug Daniels
- **3:35 Next Steps and Conclusion**
  - Nima Pahlevan
- **3:45 General Q&A**
  - All

Opening Comments

Dr. Ned Mamula
Director
U.S. Geological Survey (USGS)

Dr. Karen St. Germain
Earth Science Division Director
NASA

Sustainable Land Imaging Commercial Transition

Strategy Summary

Douglas Daniels
Principal Engineer
USGS National Land Imaging
(The Aerospace Corporation)

Dr. Nima Pahlevan
SLI Program Scientist
Earth Science Division
NASA

SLI Commercialization Plan

- **Goal**
  - "As soon as feasible and no later than 2035, all or the majority of USGS Landsat products are produced using commercially-provided data, which is harmonizable with the historical archive, from a robust and competitive marketplace supported by a rolling federal procurement process that maintains the value of the Landsat data record."
- **For Level 1 data and Level 2 products, this strategy rests on three foundational pillars: continuing open science, preserving quality, and ensuring continuity.**
- **Approach**
  - NASA-USGS are pursuing a product-based strategy to allow the earliest and most effective use of commercial data through augmentation and then moving to replacement when appropriate.
  - The strategy will be executed in phases, with products selected based on their readiness for integration into the Landsat archive.
- **Phased approach with demonstration (FY27-28), initial capability and comprehensive assessment phases (FY29-31), followed by operational capability.**

A phased, product-based approach to support integrating commercial data into the Landsat record.

Product-Based Approach

Publish products requirements

Work with industry to demonstrate commercial data integration

Resolve technical issues and transfer responsibility

Validate product accuracy and stability

Promote product to sustainable operations

Iterative flow to integrate new sources

Start with augmenting existing products
Move to replacement

Begin with local & regional areas of interest -
Move to global scales

Progressively gain experience – Remove barriers to use of commercial data

- **Level 1 Data:** Top-of-atmosphere Radiance (**L1**)
- **Level 2 Products:** Surface Reflectance & Temperature (**L2**)
- **Level 2 Derived Products:** Bathymetry, Burned Area, etc. (**L2D**)

Strategic Phases

FY27-28

Demonstration Phase

- Multiple commercial data augmentation demonstrations, months in duration each focused on local and regional areas of interest
- Explore and identify feasible and sustainable business and cost models
- **Goals:** Demonstrate concept viability, resolve technical issues, & identify candidate products for operational workflow

FY29-31

Initial Capability Phase

- Promote select L2D products to sustainable operations that abide by the free and open access policy
- Continued demonstrations to move additional products into operational workflows, focused on local and regional areas of interest
- **Goals:** Demonstrate operational workflows, alongside sustainable business and cost models

FY31

Assessment Phase

- Assess technical progress for data and product harmonization
- Assess business and cost model(s) viability

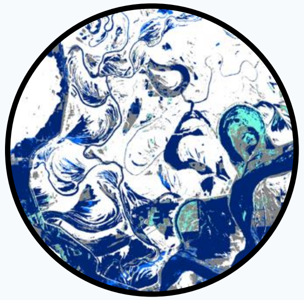
FY32+

Full Operational Capability Phase

- Move as many products as viable into operational workflows, free and open access for L1 data, both L2 products, and select L2D products
- Continued demonstrations to assess and move additional products into operations

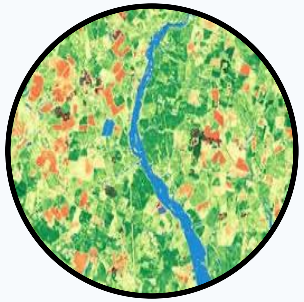
NASA and USGS will work directly with vendors during Demonstration and Initial Capability phases to achieve goals.

Lines of Effort



Product Line of Effort (USGS led)

- Identify candidate products and establish requirements
- Modify and create product algorithms
- Conduct product evaluation assessment, including user feedback, along with archive compatibility



Technical Line of Effort (NASA led)

- Conduct technical assessments
- Develop processing workflows, including continuous stability and accuracy evaluation, to harmonize products from various constellations
- Create and modify algorithms to harmonize multiple products spanning diverse viewing geometries
- Establish technology transfer program

Programmatic Line of Effort (Jointly led)

- Conduct and manage industry and user outreach
- Explore, generate, and identify sustainable business and cost models
- Execute contracts

Phased Roles & Responsibilities

FY27-28 Demonstration Phase

- **Industry**: Partners with the government, provides data and products, holds regular technical meetings, integrates workflows
- **USGS**: Evaluates L2D products, works with user communities
- **NASA**: Awards Demonstration contracts, develops evaluation/processing workflows, identifies validation and technology needs, onboards new vendors, analyzes business models

FY29-31 Initial Capability Phase

- **Industry:** Adopts workflow, generates L2 and L2D products, enhances technical and technological capabilities
- **USGS:** Awards operational contracts, establishes validation methods, operationalizes business and cost models, engage users and forms early-adopter cohorts
- **NASA:** Matures workflows, develops technology, onboards new vendors for demonstration and workflow adaptation

FY31 Assessment Phase

- **USGS & NASA:** Perform a comprehensive assessment of the feasibility and viability of the EO marketplace

FY32 and beyond Full Operational Capability Phase

- **Industry:** Contracted to produce L1 data, and L2 and select L2D products
- **USGS:** Moves most products into operational workflows with free and open access for L1 data, and L2 and select L2D products
- **NASA:** Continues to partner with new vendors, supports workflow improvements, validation, and harmonization

Key Challenges

How does government evaluate and ensure commercial data accuracy and stability over time?

- Develop rigorous calibration and validation standards, protocols, and methods
- Integrate continuous data and product quality assessments throughout all levels of the processing workflow
- Engage and collaborate with commercial vendors

How does government integrate multiple commercially sourced products into a single product?

- Account for differences in radiometric, geometric, and imaging geometry characteristics
- Produce pixel-level uncertainty quantification metrics
- Characterize and validate product accuracy and consistency for applications, including time series analysis

What business models best support productive partnerships between government and industry?

- Licensing standards and frameworks
- Source data transparency (provenance for science)
- Statutory archiving compliance
- Affordable, sustainable business models preserving free and open access for L1 data, L2 products, and select L2D products
- Contract durations & clauses to ensure long-term data availability
- Sustainable cost models

Strategy Summary Conclusion

- **Product-based strategy allows for immediate industry participation and path to operational workflow harmonization**
- **Demonstrations represent a great place to initiate commercial engagement**
  - Showcase commercial capabilities
  - Enhance current Landsat products (e.g., spatial, temporal, spectral)
  - Identify challenges early and work with industry to resolve
- **Partnerships are critical to the success of the SLI commercial transition strategy**
  - Grow commercial data use for high fidelity applications and decision making across public, private, state, and local sectors
  - Identify technology needs and facilitate transition

Commercial remote sensing sector is an increasingly important partner in meeting evolving SLI needs, filling capability gaps, and strengthening operational resilience.

SLI Commercial Transition

Strategy Questions & Answers Session

Break (15-Minutes)

SLI Commercial Transition

Introduction - NASA and USGS Lines of Effort

Dr. Nima Pahlevan
SLI Program Scientist
Earth Science Division
NASA

Lines of Effort

Product

- L2D product requirements, algorithm refinement
- Validation methods, workflow assessment
- User engagements, early-adopter activities

Technical

- Continuous L1 data evaluation
- Workflow development for L2 generation and harmonization
- Validation protocols and standards
- Technology demonstration and transfer, pre-launch calibration

Programmatic

- Awards and contracts
- Communications, events, and outreach

SLI Commercial Transition

Product Line of Effort Summary

Terry Sohl
Branch Chief - Integrated Science and Applications Branch (ISAB)
Co-Chair, Landsat Science Team
USGS Earth Resources Observation and Science (EROS) Center

Commercial Solutions – Product Types (L2D)

Low

Increasing Complexity

High

- **<u>Augmented Products (FY27-32+: Initial Demonstrations thru Operations)</u>:** Uses commercial products in tandem with existing Landsat products to enhance scientific value, generally at local or regional scales, via temporal, spatial, and spectral complementarity.

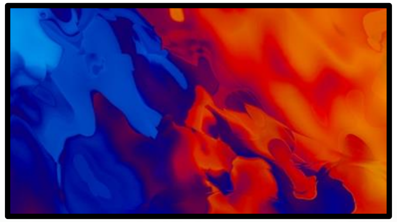
- **<u>New products (Market Expansion)</u>:** Takes advantage of commercial data to expand applications or add new geophysical variables beyond existing Landsat products. These new products could address high-value national needs that are not currently met by existing data and represent near-term, high-value opportunities for commercial data

- **<u>Replacement Products (FY32+: Operational Phase)</u>:** Those where commercial derived product quality and availability are sufficient to replace Landsat products, either regionally or globally. The highest complexity for industry providers but are the desired end state of the strategy

"Quick Win" Products

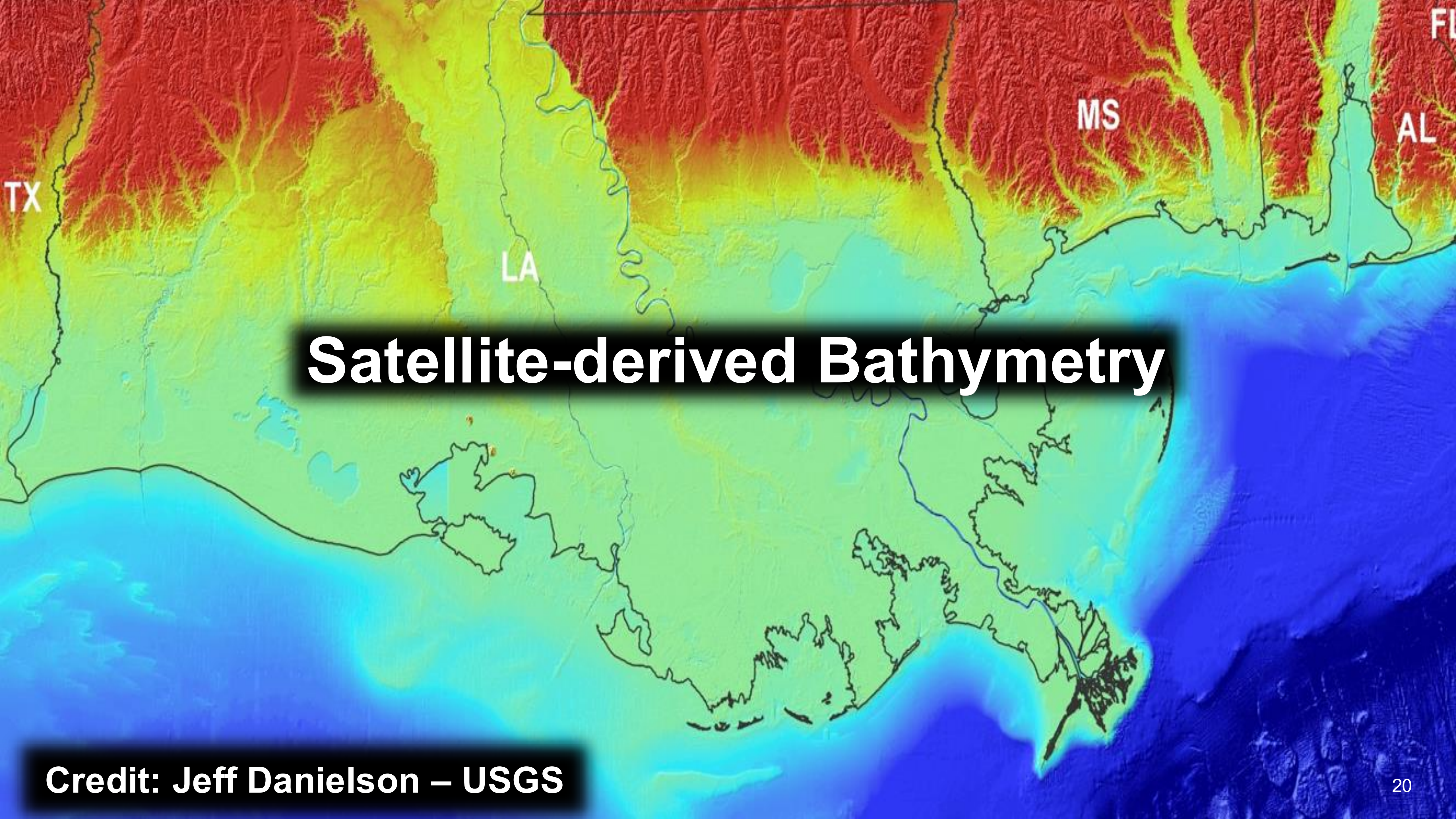
- **Satellite-derived Bathymetry** – Building from USGS algorithms on SDB to explore high-res, high-quality, targeted applications

- **Surface Water Extent** – Augmenting operational USGS/NASA products for higher temporal cadence, spatial resolution, low latency



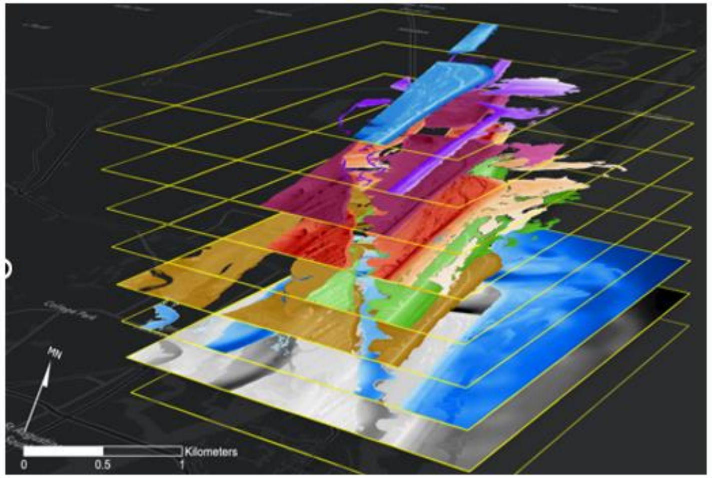
- **Burned Area** – Improving burned area mapping to reduce latency and observation density

- **Burn Severity** – Improving burn severity mapping to reduce latency and observation density

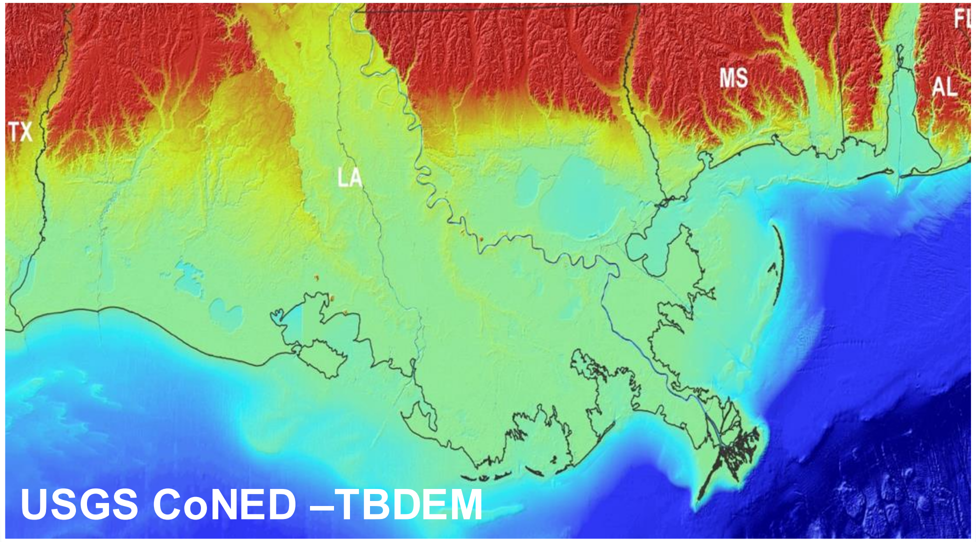

TX
LA
MS
AL
FL
Satellite-derived Bathymetry
Credit: Jeff Danielson – USGS

Why Satellite-Derived Bathymetry (SDB)?

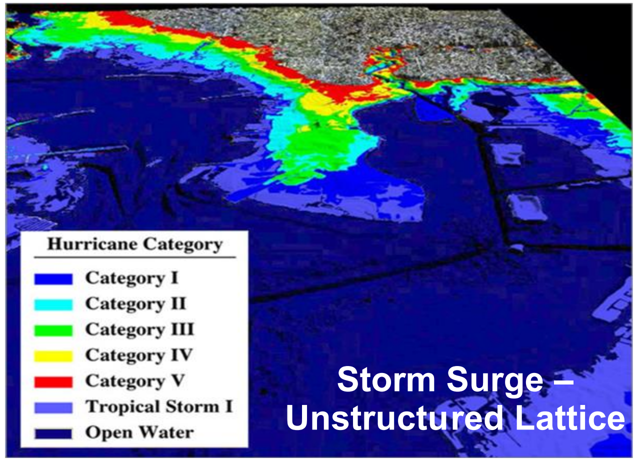
SDB supports coastal and marine spatial planning by creating comprehensive, high-resolution topobathymetric digital elevation models (TBDEMS) using disparate bathymetry sources.

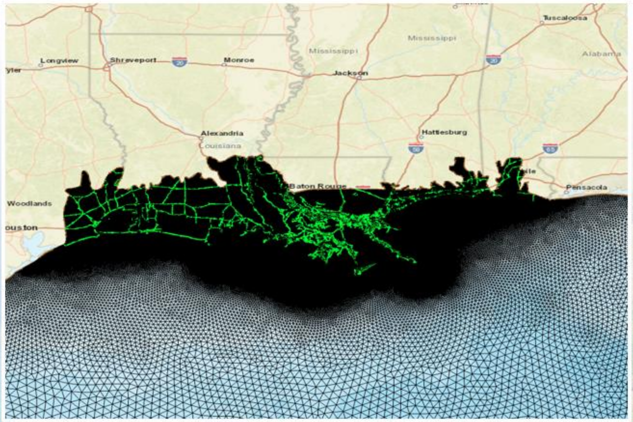


<u>Multisource data supporting applications:</u> Satellite-derived bathymetry integrated with disparate traditional sonar and lidar support sediment-transport, storm surge, and benthic habitat modeling



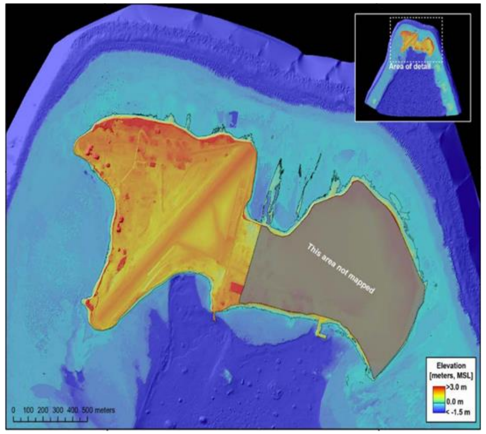
Key Advantage for SDB: Filling in nearshore data gaps where coverage is lacking due to navigational safety and general water clarity conditions.



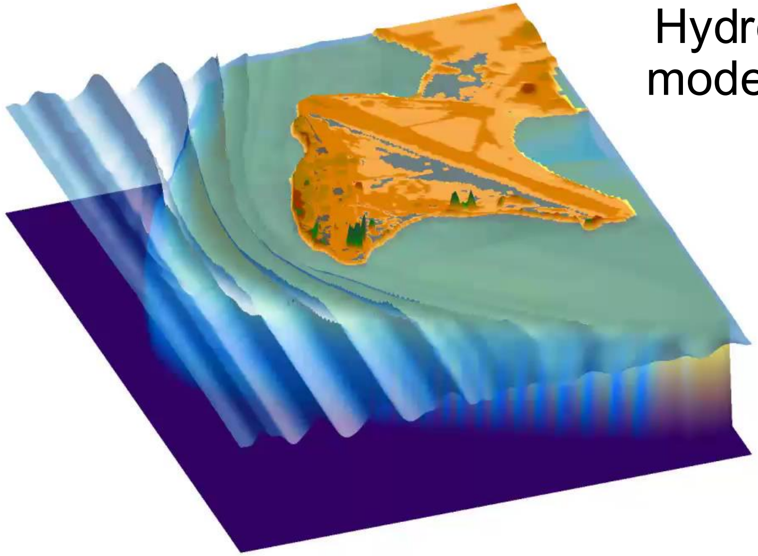


Why Satellite-Derived Bathymetry (SDB)?

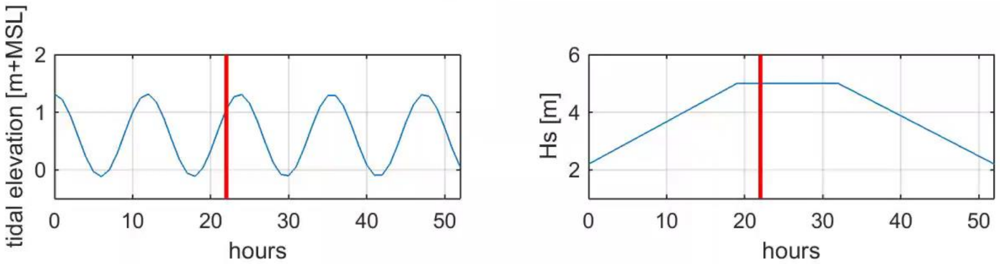
Flood inundation/hydrodynamic modeling example: Modeling wave-driven overwash of Pacific islands using SDB to support DOD base operations and critical infrastructure.



Satellite-derived bathymetry integrated with topographic lidar for accurate surface over which to model inundation flooding



Hydrodynamic modeling using SDB



Republic of the Marshall Islands, Kwajalein Atoll

Current Capabilities: USGS SDB Algorithms

Satellite-derived bathymetry estimates submerged topography (bathymetry) in optically shallow coastal or inland waters using satellite imagery based on remote sensing techniques instead of traditional sonar or lidar acquisition.

Feature / Aspect	Physics-Based SDB
Sensor Type	Multispectral
Core Algorithm	Physics-based inversion
Atmospheric Correction	Radiative transfer-based model
Water Optical Properties	Requires clear water, Derived from deep-water pixels and resolves optical properties such as CDOM, etc.
Bottom Reflectance	Uses bottom type lookup table
Depth Retrieval	Nonlinear optimization / inversion
Calibration Requirement	Not required, alignment optional to improve accuracy

Algorithm Access

Current Capabilities: USGS SDB Algorithms

Environmental Challenges

- Clouds (Nearshore / Shallow Water)
- Turbidity / Water Clarity
- Haze
- Sun Glint
- For Stereo – Convergence Angle / Overlap

Feature / Aspect	Physics-Based SDB
Depth Range	Up to 30 m (clear water)
Accuracy (RMSE)	1–3 meters
Spatial Coverage	Global/Coastal - Any multispectral imagery with 4 or more visible bands
Strengths	Flexible; sensor-agnostic
Limitations	Limited by number of bands for atmospheric correction, requires optically clear water, bottom type generalizations
Use Cases	Coastal mapping, hydrodynamic modeling

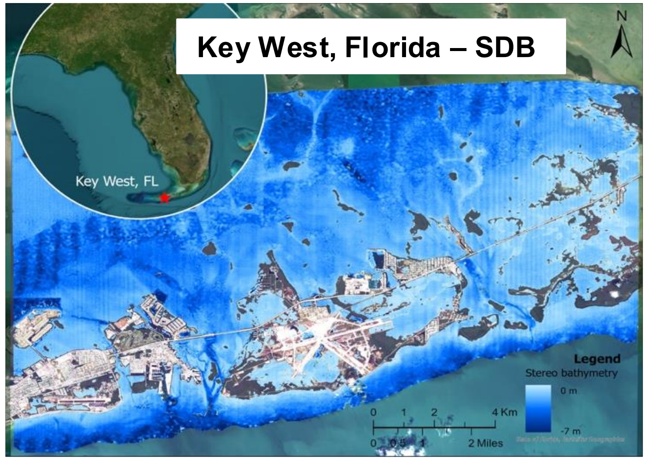
Algorithm Access

Commercial Solutions: Satellite Derived Bathymetry

Primary Objective: Submerged topography product based on USGS published SDB algorithm that uses physics-based algorithms based on multispectral imagery.

Targeted Pilot SDB Product Requirements

Product	Spatial Resolution	Revisit	Latency	Coverage	Format	Value
SDB	1-5 m	1 Month	1 Month	Global / Coastal	COG	Navigation, Flood Forecasting



Example Spectral bands for SDB

Bands (nm)
Coastal | 400–450
Blue | 450–510
Green | 510–580
Yellow | 585–625
Red | 630–690
Pan | 450 - 800

Pilot SDB Product Focus Areas:

Puerto Rico　Florida Keys　Guam

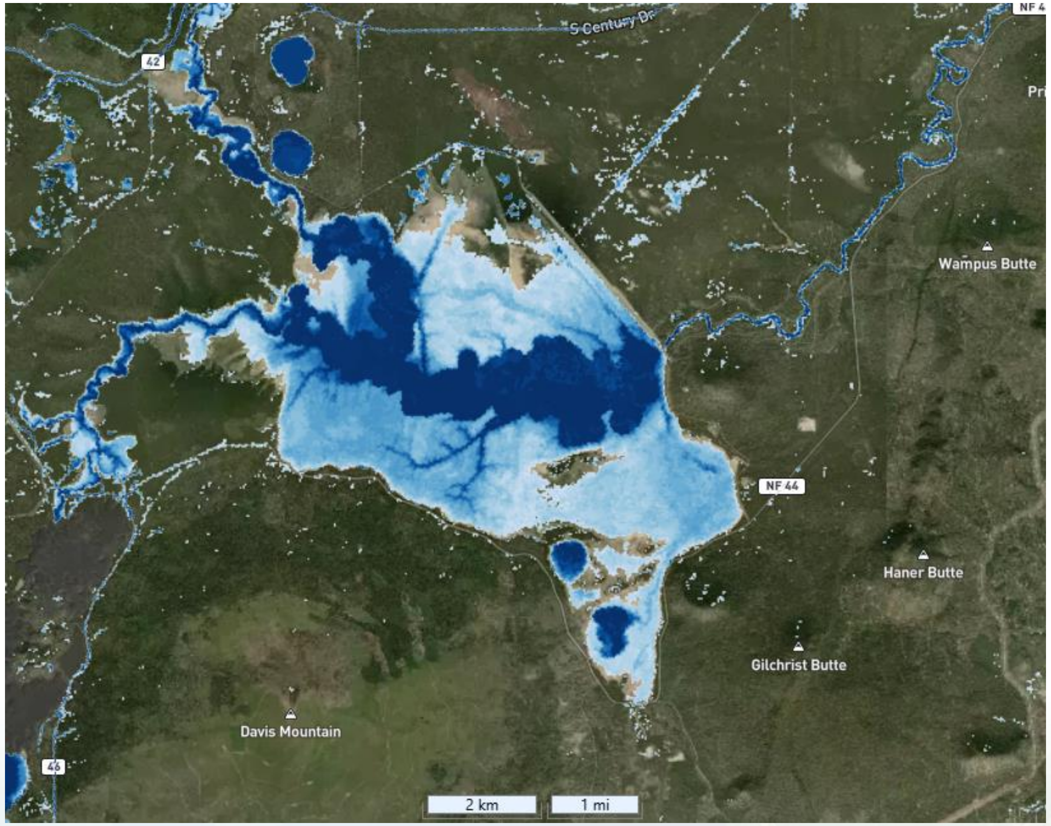
Surface Water Extent

Credit: John Jones - USGS

Why Dynamic Surface Water Extent (DSWE)?

Dynamic Surface Water Extent (DSWE) provides consistent maps of surface water over time, enabling users to monitor lakes, rivers, wetlands, reservoirs, and floodplains.

- **Applications**
  - Disaster mitigation and response
  - Water storage monitoring for agriculture and energy
  - Drought forecasting and monitoring
  - Habitat (e.g., duck) mapping, restoration, and monitoring
  - Military logistics, mobility, and tactics



Individual Landsat-DSWE/DSWx scenes are used for emergency response and other near-real time monitoring. Compilations of DSWE illustrate changes as water is gathered and released for energy, agriculture, recreation, and other uses. Here, per-pixel 2024 inundation frequencies for Wickiup Reservoir, OR are shown. [USGS WaterMAP - Interactive Satellite-Derived Hydrology Datasets]

Current Capabilities: Operational USGS / NASA Mapping

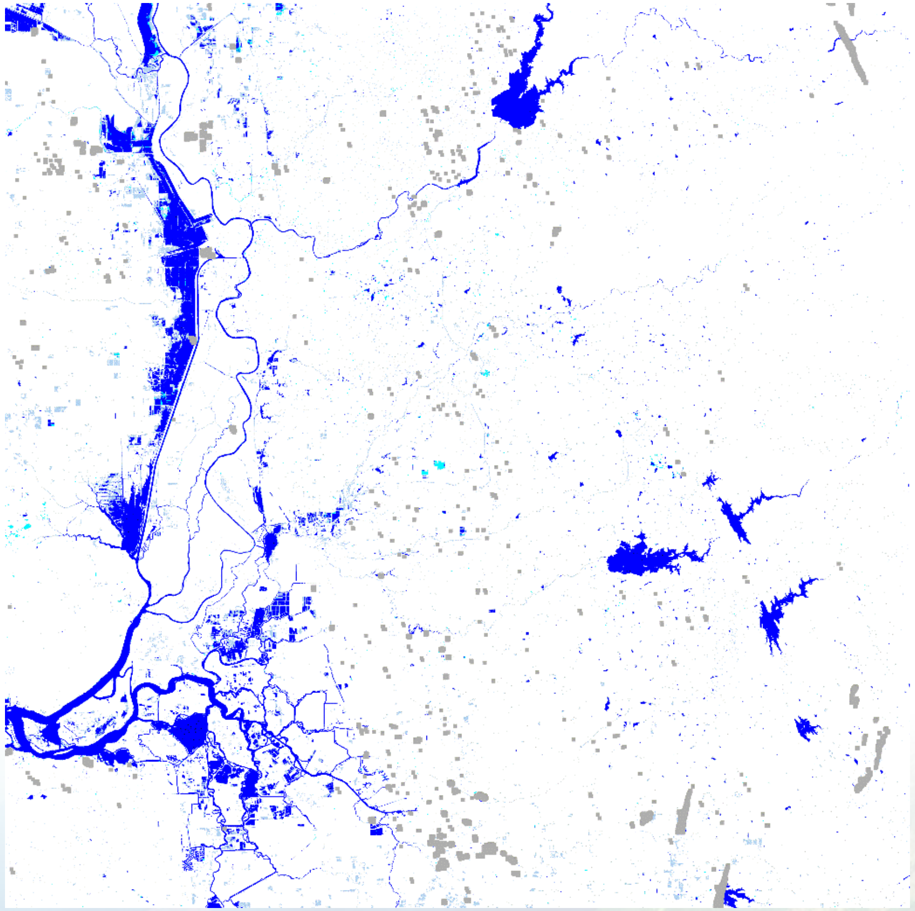
- **DSWE (Dynamic Surface Water Extent) (USGS):**
  - Landsat-based product providing a consistent 40+ year record at 30-meter resolution
  - US only, generated from Landsat L2 ARD
  - Produced for each new Landsat observation
  - Strengths – Long-term record, change analysis
- **DSWx (Dynamic Surface Water eXtent) (NASA):**
  - DSWx-HLS from Harmonized Landsat Sentinel-2 (HLS)
  - Near global coverage
  - Provides higher repeat frequency,
  - Temporal data availability limited

Calendar year 2024 inundation frequencies for New Orleans, LA calculated on a per-pixel basis from USGS DSWE. Colors from white to dark blue indicate increasing percent of clear observations that are declared inundated by the DSWE algorithm. Here, all DSWE open water and partial surface water (sub-pixel mixtures of water, soil, and vegetation) observations are combined as “Total Surface Water”. Separate class frequencies can be calculated/displayed. Analysis of these variables through uncover trends in drought, flooding, water availability, ground subsidence, restoration success, etc. Commercially sourced products can further improve observation frequency and detection limits.

Commercial Solutions: DSWE/DSWx Augmentation

- **DSWE/DSWx Mission**
  - Monitor open water extents with finest spatial and temporal resolutions possible

- **Augmentation Objectives**
  - Enable finer (smaller) stream, pond, and wetland monitoring
  - Improve observation frequency
  - Improve low-latency/event observation capabilities



March 9, 2026 Sentinel-2B based DSWx-HLS depicting flooded orchards and other agricultural land west of Sacramento, CA.

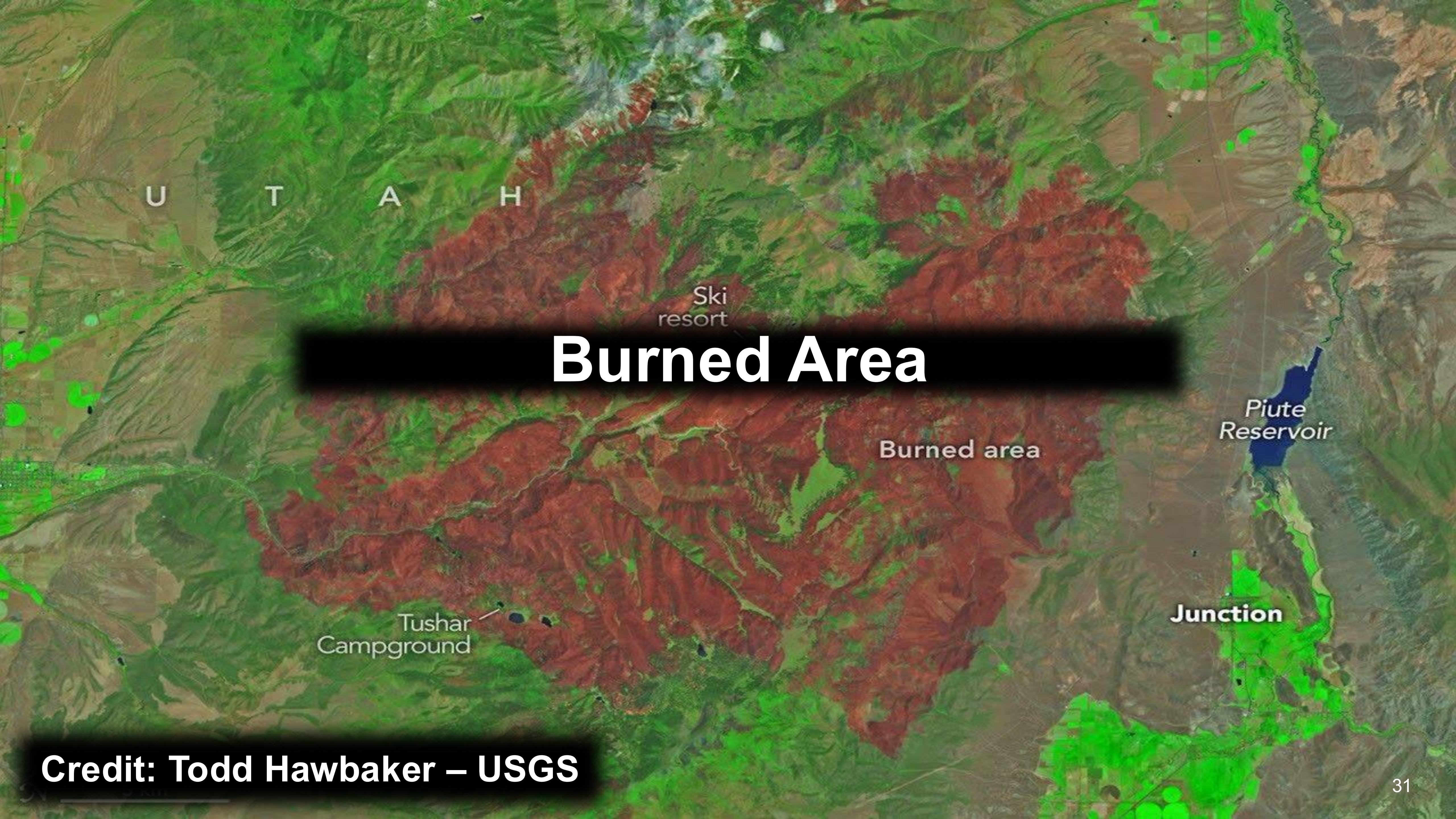
Commercial Solutions: DSWE/DSWx Augmentation

- **Technical approach**
  - Adapt DSWE electro-optical (EO)* for commercial satellite inputs.
- **Input requirements**
  - EO inputs must include similar SWIR region coverage to that provided by Landsat and Sentinel-2 for full, correct implementation of DSWE.
  - Adequate resolution, up-to-date digital surface and land cover data.
- **Challenges**
  - Shadows cast by clouds, terrain, and land cover.
  - Federal-commercial instrument differences

	DSWE
Primary Sensors	Landsat 4-9
Primary Data Inputs	VSWIR, Elevation, Land Cover
Key Spectral Bands	VNIR, SWIR1 (~1609 nm)
Key Requirement	SWIR band is essential for subpixel water and smoke, fog, and light cloud penetration

*Jones 2019; Jones et al 2024; Jung et al 2026

Burned Area



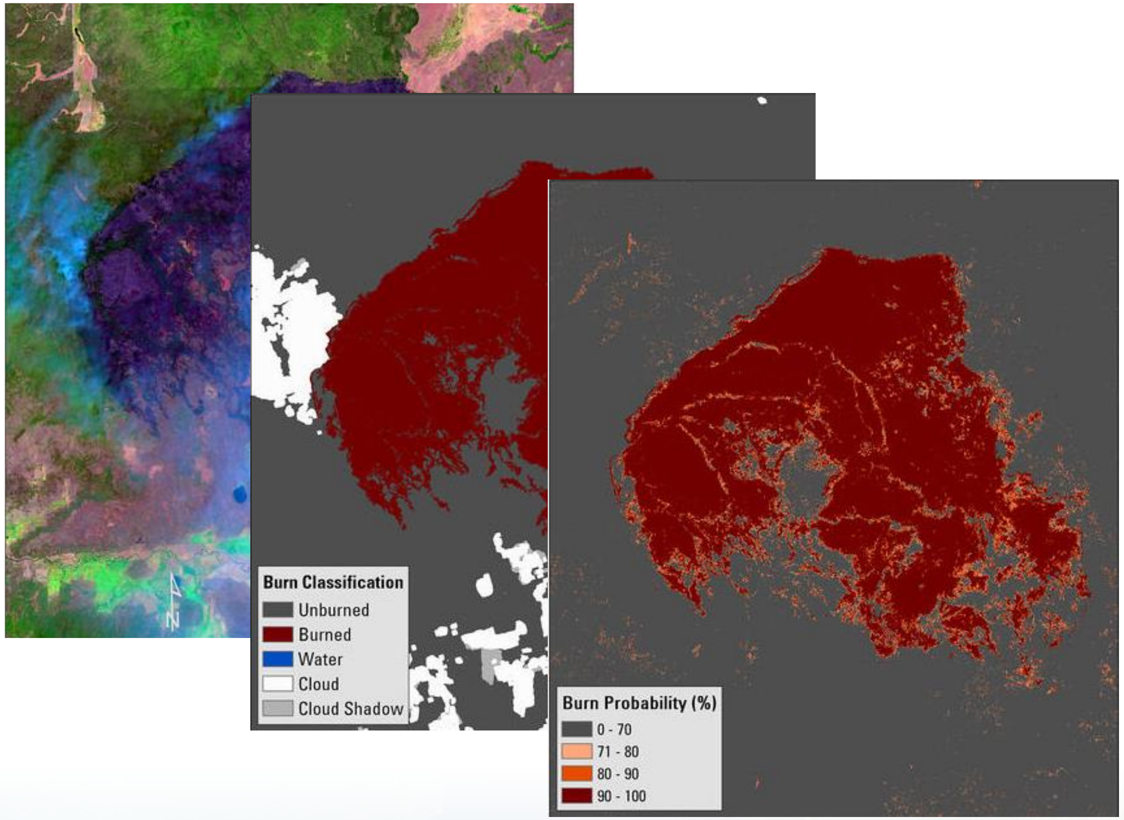
Credit: Todd Hawbaker – USGS

Why Burned Area Mapping?

USGS burned area mapping provides the spatial foundation for understanding where vegetation was consumed, how landscapes are changing, and how ecosystems recover.

Applications

- Emergency area stabilization
  - Burned Area Emergency Response teams (BAER)
- Flood and debris flow prediction
- Forest and fuel management
- Habitat assessment
- Insurance and risk modeling
- Carbon and greenhouse gas accounting
- Watershed management



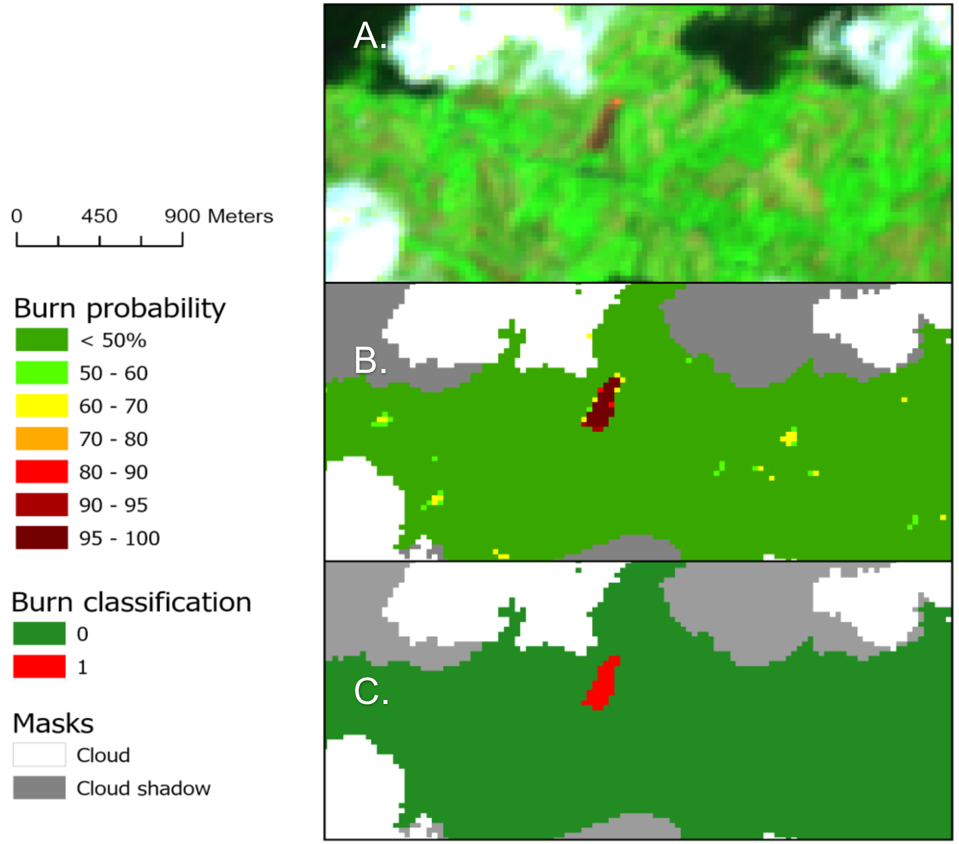
Example of the Landsat Collection 2 Burned Area Science Product showing the Bootleg Fire in Oregon on July 11, 2021 for tile h006V010.

- Left: Landsat Surface Reflectance image (Bands 6,5,4)
- Middle: Burn Classification (BC)
- Right: Burn Probability (BP)

Current Capabilities: Landsat Burned Area Products

- **Landsat Burned Area (BA) Algorithm**
  - Machine learning (gradient boosting decision tree), thresholding, and image segmentation applied to time series of Landsat ARD
  - Predictors: Scene-level spectral indices (NBRT1, VI6T, VI45, NDVI based on red, NIR, SWIR1, SWIR2, and thermal bands), 3-year lagged means, and change
  - Outputs: Per-scene burn probability (0–100%) and burn classification (burned/unburned)

- **Product Specifications**
  - Sensors: Landsat 4–9 (TM, ETM+, OLI, OLI-2)
  - Spatial resolution: 30 m
  - Temporal coverage: 1984–present
  - Coverage: Conterminous United States (CONUS)
  - Maps both wildfires and prescribed fires (>2 ha)

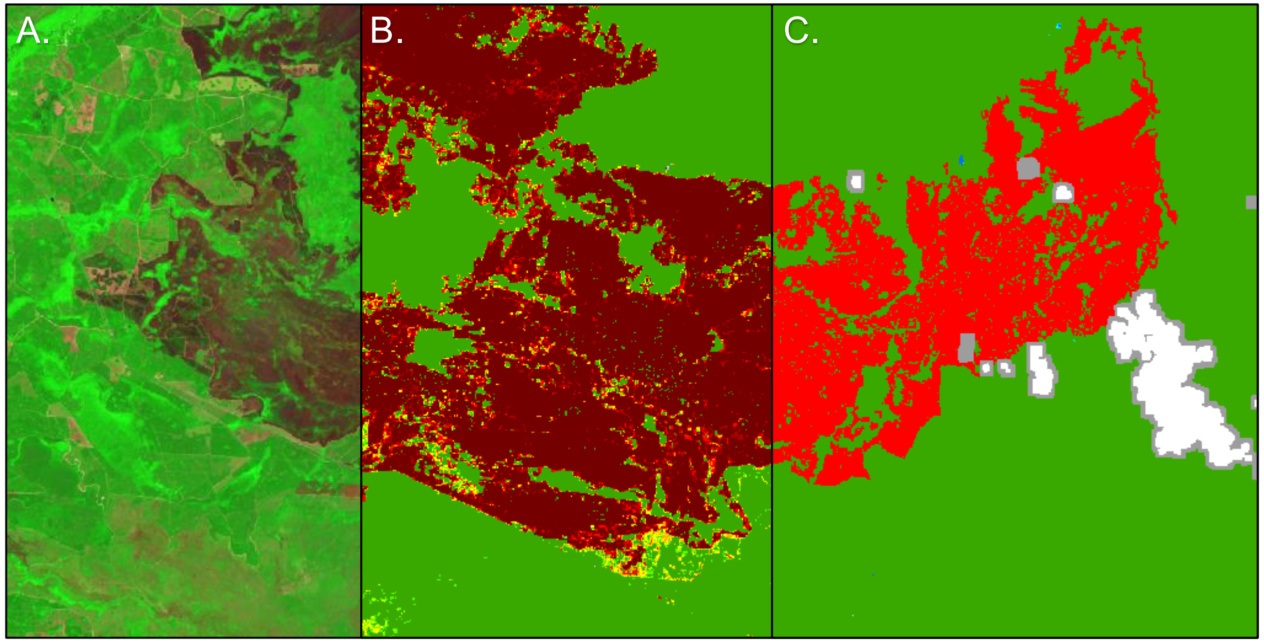


A. Landsat 7, 2000-04-03 (SWIR2/NIR/blue) with active fire and burned area.
B. Boosted decision tree burn probability.
C. Thresholded and segmented burn classification.

Commercial Solution: Landsat Burned Area Products

- **Technical Approach**
  - Adapt the Landsat Burned Area algorithm for 1–5 m commercial satellite platforms
  - Utilize per-acquisition predictors (e.g., NBR), lagged reference summaries, and change metrics (ΔNBR)
  - Add targeted search capabilities: identify burned area near reported ignition locations or active fire detections

- **Quick Win Product Requirements**
  - 1–5 m spatial resolution, daily revisit, 1–2-day latency
  - Coverage: USA to global; < 10% false positive and negative rates
  - Burned area (binary classification, data of burn detection, confidence/probability)

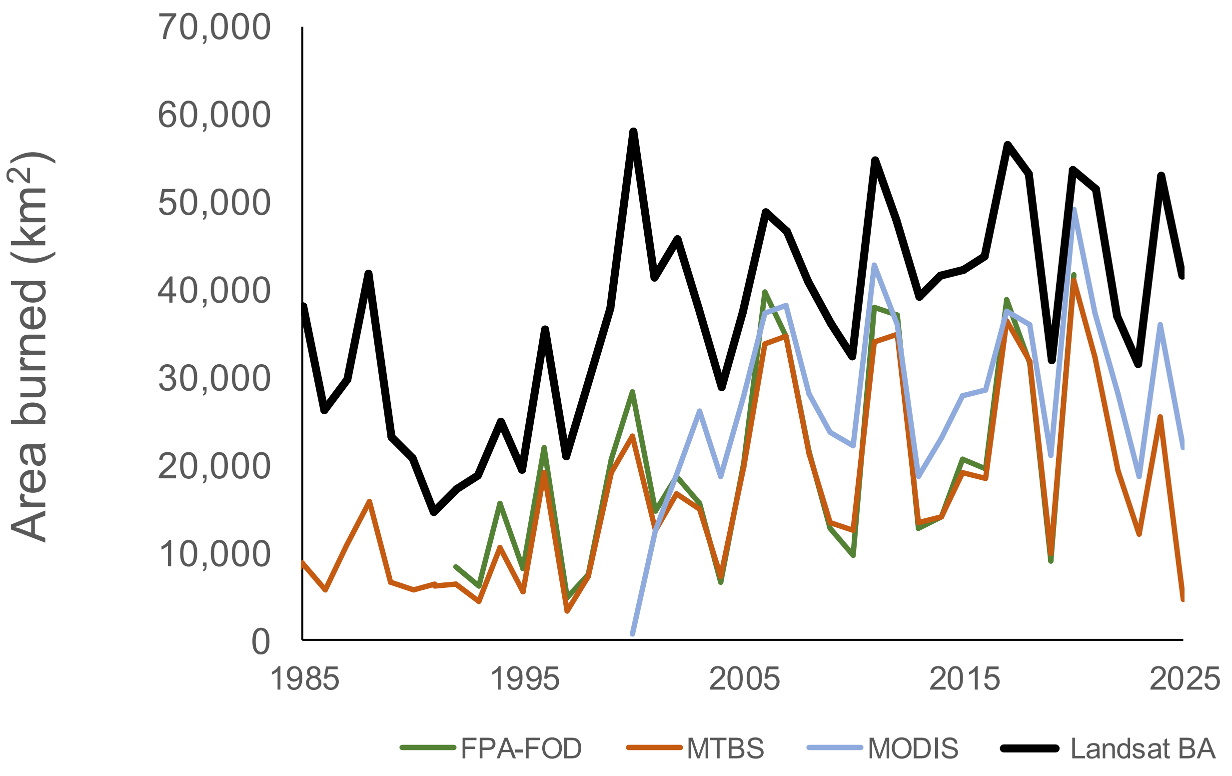


A. Landsat B. Burn probability C. Burn classification

Landsat imagery with burn probability and burn classification products for the MIMMS FIRE that burned Okefenokee Swamp and surrounding areas in 2017.

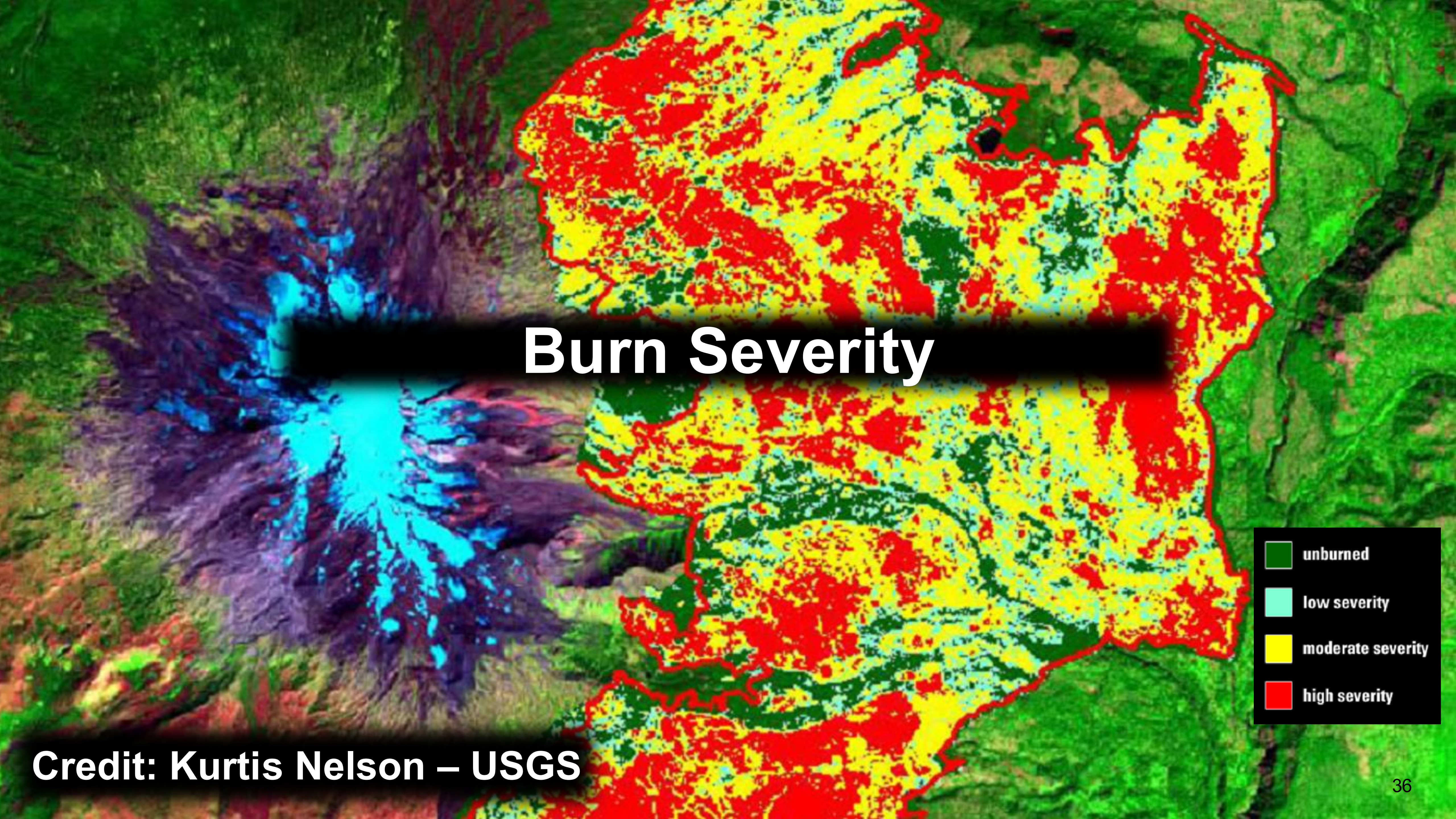
Commercial Solution: Landsat Burned Area Products

- **Key Challenges**
  - Spectral band availability: SWIR and thermal bands are used by the Landsat Burned Area algorithm
  - Consistent surface reflectance and accurate georeferencing are critical for change detection across acquisitions
  - Usable data masks (clouds, shadows, water, snow/ice) are essential
  - Higher spatial resolution increases data volume and processing demands substantially
  - Validation reference data at sub-5 m resolution are limited; training data may need to be revisited
  - Land-cover products can further reduce commission error (e.g., filtering agricultural false positives)



Annual burned area mapped by the Fire Program Analysis – Fire Occurrence Database (FPA-FOD; 1992-2020); Monitoring Trends in Burn Severity (MTBS; 1984-2025)); MODIS Burned area products (2000-2025), and Landsat Burned Area Products (1984-2025).

Burn Severity



Credit: Kurtis Nelson – USGS

Why Satellite-Derived Burn Severity Mapping?

The Monitoring Trends in Burn Severity thematic post-fire burn severity is a fundamental science product assessing the burn severity of fires ≥ 500 acres in the eastern and ≥ 1000 acres in the western U.S.

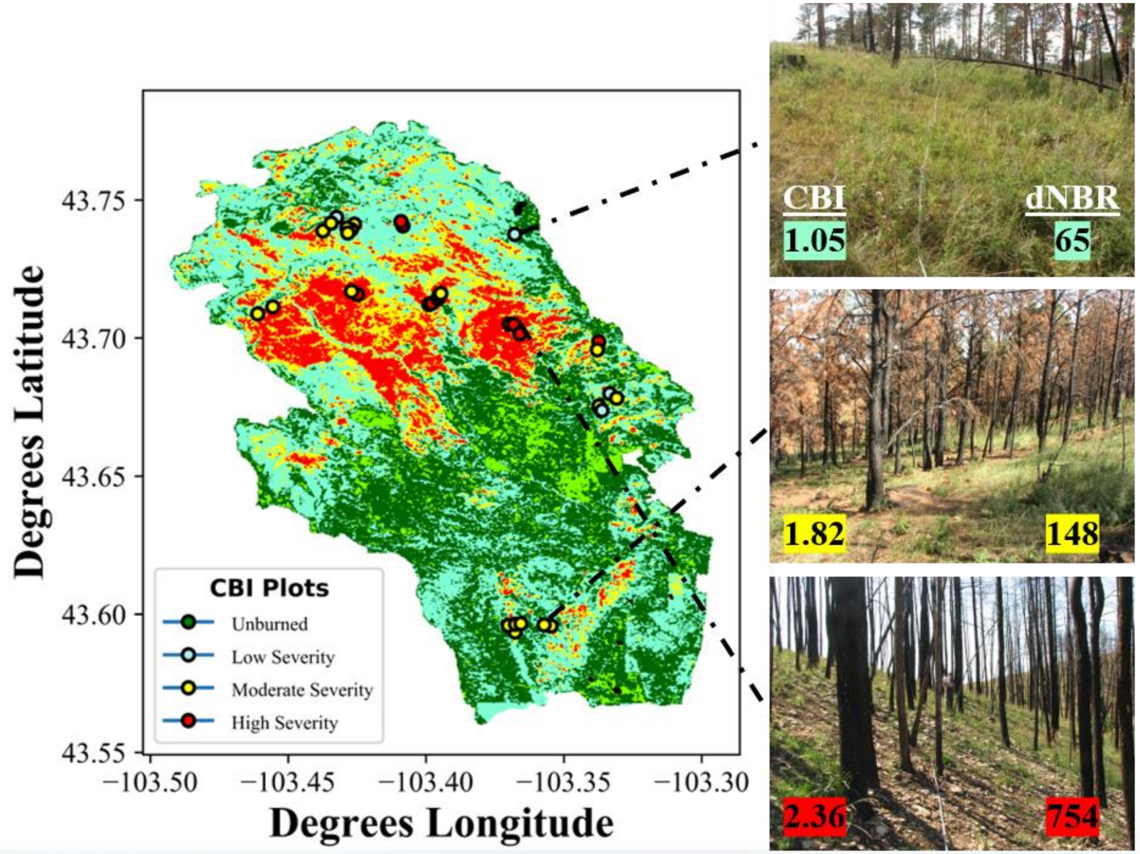
Current Capabilities: Thematic Burn Severity Mapping

Trees and Shrubs

1. Unburned-Low
   - No visible evidence of burning
2. Low
   - Up to 100% of litter and substrates
   - Low vegetation may be significantly scorched
   - Up to 25% mortality of subcanopy and canopy trees
   - Char height from ground flames < 3 meters.
3. Moderate
   - Transitional between low and high class burn severity
4. High
   - Substrates, herbaceous vegetation, litter, and duff consumed
   - Medium and heavy debris with deep char
   - 75% mortality of overstory trees
   - 100% crown char
   - Shrub branch loss
5. Mask
   - Clouds, shadows, and water

Herbaceous

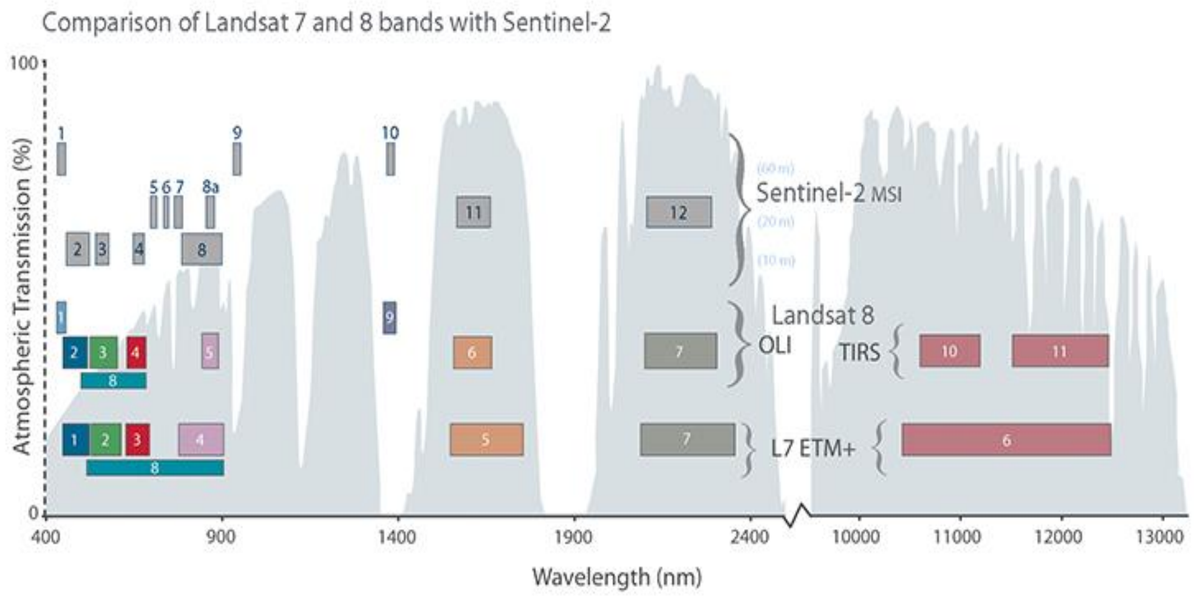
- Unburned-Low and Low severity classes only



Monitoring Trends in Burn Severity (MTBS) burn severity assessment image and Composite Burn Severity (CBI) plot locations for the December 11, 2017, Legion Lake Fire (near Custer, South Dakota). Associated CBI plot photos, CBI values, and differenced Normalized Burn Ratio (dNBR) values are provided to visually illustrate on the ground CBI versus remotely assessed dNBR values of burn severity.

Current Capabilities: Thematic Burn Severity Mapping

- **Current**
  - Primarily Landsat and Sentinel-2
  - 20-30 m spatial resolution
  - 2.7 days revisit (Jia et al. 2024)
  - U.S. Coverage
  - Bands
    - Near Infrared
    - Shortwave Infrared



https://www.usgs.gov/media/images/spectral-bandpasses-all-landsat-sensors

Jia, K., Hasan, U., Jiang, H., Qin, B., Chen, S., Li, D., Wang, C., Deng, Y. and Shen, J., 2024. How frequent the Landsat 8/9-Sentinel 2A/B virtual constellation observed the earth for continuous time series monitoring. *International Journal of Applied Earth Observation and Geoinformation*, *130*, p.103899.

Current Capabilities: Thematic Burn Severity Mapping

Methodology

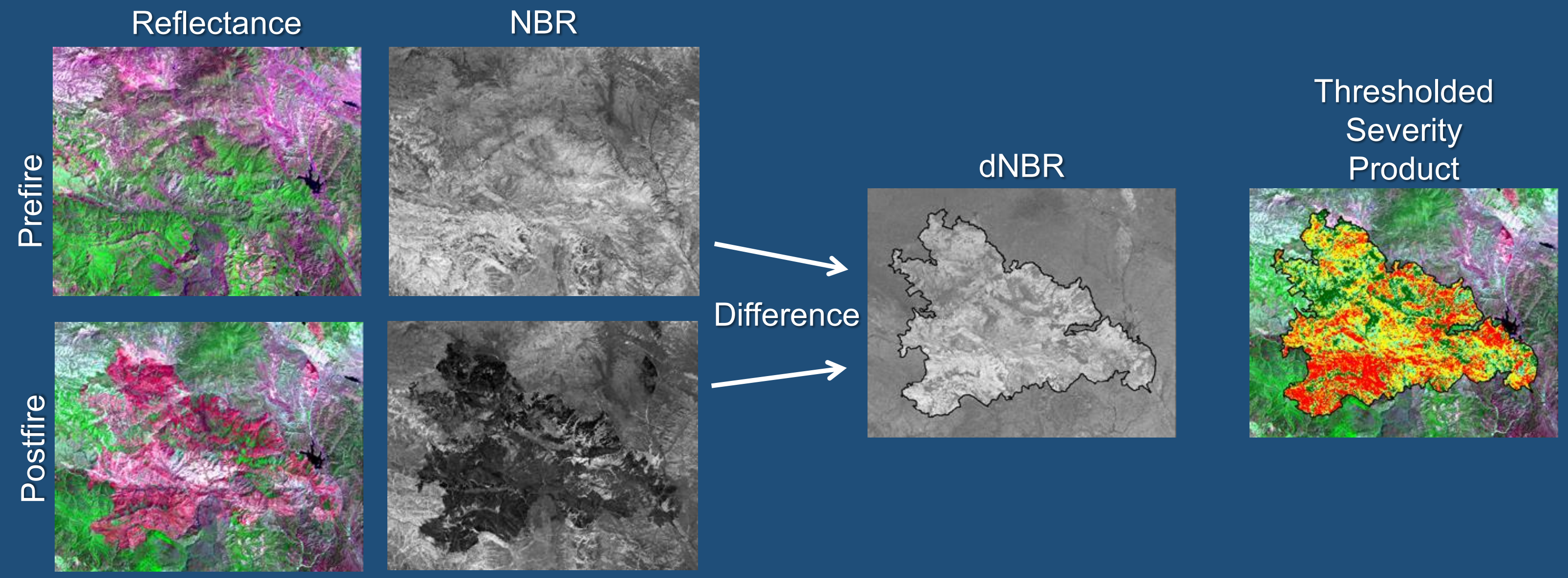
1) **Obtain pre- and post-fire imagery**
   - Phenologically and temporally consistent
   - Obstruction free
2) **Calculate NBR**
3) **Difference NBR to calculate dNBR**
4) **Threshold**

NBR

(Normalized Burn Ratio)

NBR = (NIR - SWIR) / (NIR + SWIR)

dNBR = Prefire NBR - Postfire NBR



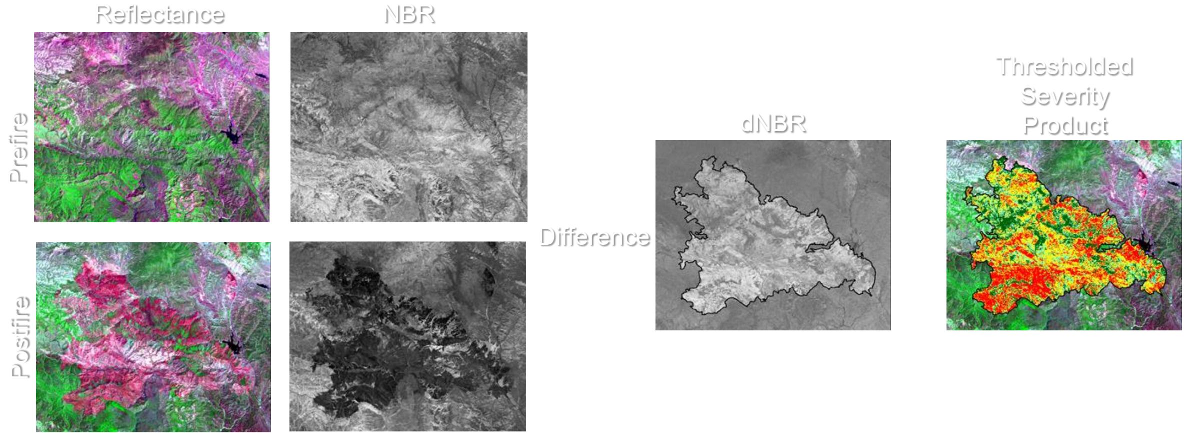
Commercial Solutions: Thematic Burn Severity Mapping

Classified Burn Severity (Increased Greenness, Unburned, Low, Moderate, and High)

Quick Wins product requirements (ideal):

- *Up to 1-5 m spatial resolution*
- *Daily Revisit*
- *USA Coverage*
- *5-class thematic product per MTBS definitions*

Band	Landsat (nm)	Commercial (nm)	Commercial (nm)
Near Infrared (NIR)	850 - 880	851.2 - 881.3	845 - 885
Shortwave Infrared (SWIR) 2	2,110 - 2,290	2111.7 - 2285.7	X



Challenges:

- Overlapping/nearby disturbances not directly related to fire
- Clouds, shadows, smoke, water, and snow/ice
- Rapid vegetation recovery of vegetation in areas of high biomass
- Data latency, rapid access, geometric stability for change detection, and useability

Product Requirements: Summary

Bathymetry

Requirement	Value / Attribute
Spatial	1–5 m
Spectral	Visible/Pan bands
Revisit	1 Month
Latency	1 Month
Accuracy	1– 3 m (vertical)
Coverage	Global / Coastal (Quick Wins Focus: FL. Keys, Guam, Puerto Rico)

Surface Water Extent

Requirement	Value / Attribute
Spatial	< 10 m (small streams, ponds, and wetlands)
Spectral	VNIR and SWIR1 (~1609 nm)
Revisit	High repeat frequency
Latency	Low-latency for event observation / rapid response
Accuracy	Input resolution, minimum mapping unit, and water class dependent
Coverage	Near-global coverage

Burned Area

Requirement	Value / Attribute
Spatial	Landsat-compatible (moderate to high resolution)
Spectral	VNIR and SWIR essential (SWIR needed to penetrate smoke/light clouds)
Revisit	Frequent revisit to track rapid landscape changes
Latency	Rapid access required for Emergency Area Stabilization
Accuracy	<20% commission and omission error
Coverage	Regional / targeted disaster areas

Burned Severity

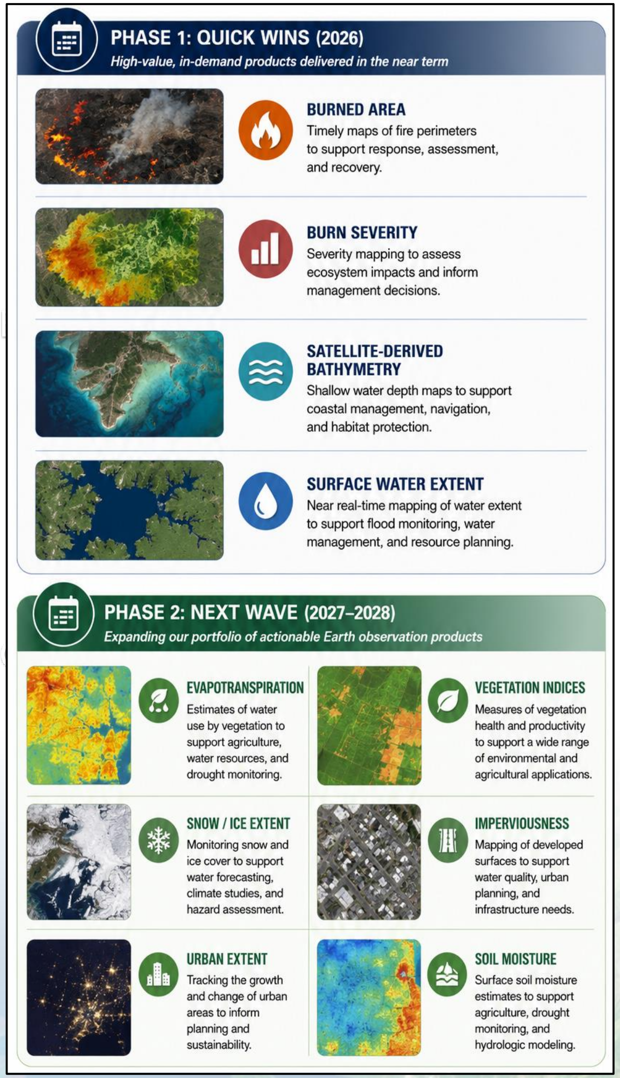
Requirement	Value / Attribute
Spatial	Up to 1–5 m
Spectral	NIR (845–885 nm) and SWIR2 (2110–2290 nm)
Revisit	Daily Revisit
Latency	Low data latency / rapid access for change detection
Accuracy	5-class thematic product per MTBS definitions
Coverage	USA Coverage

Demonstration Phase: Additional L2D Products

USGS and NASA will begin expanding the product portfolio in FY27 with additional product targets.

- Evapotranspiration (ET) has been identified as an early expansion product, reflecting strong and sustained operational demand from water resources, agricultural, and land management communities.

- Additional future target product areas under consideration include, but are not limited to:
  - Snow and ice extent and dynamics
  - Urban extent and impervious surface mapping
  - Soil moisture proxies and indicators
  - Non-Photosynthetic Vegetation

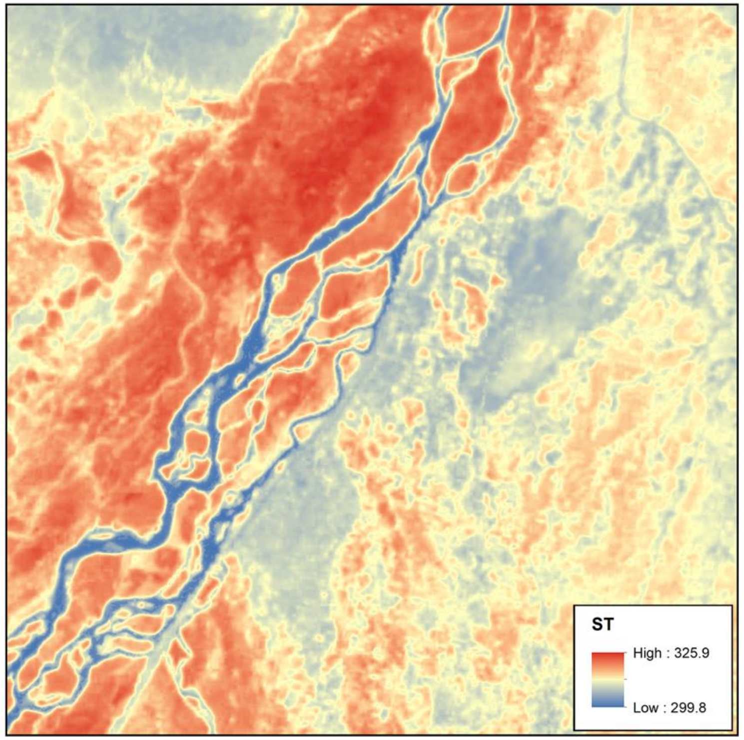


SLI Commercial Transition

Technical Line of Effort Summary

Dr. Chris Neigh
Project Scientist
Co-Chair, Landsat Science Team
Goddard Space Flight Center
NASA

Objectives: Harmonization of Landsat and Commercial Data



Landsat 8 Collection 2 L2 surface temperature product for an area over the Sapta Koshi River in Bairawa, Nepal (path 140 row 41) acquired on May 3, 2013.

- Enable creating Landsat-grade L2 products (*surface reflectance and temperature*) from disaggregated observations
- Develop universal workflows that ingest, calibrate, continuously evaluate, and process commercial data
- Validate L2 products with a range of trusted sources
- Develop intelligent harmonization capability by producing uncertainty metrics
- Identify technical issues and closely collaborate with industry to resolve technical pitfalls
- Perform Cal/Val needs assessment, demonstrate usability, develop methods and standards
- Develop technology demonstrations and transfer to industry

Technical Team will set up a process to calibrate and validate (ideally) every single ingested image and associated derived products.

Workstreams (1)

Workflow Architecture: Establish processing pipelines for VSWIR and TIR regions and separately for terrestrial and aquatic products.

- Adapt existing Landsat processing workflow
  - QC/QA, compliance check, cloud-masking
  - L1 radiometric and geometric calibration
  - Atmospheric correction
  - BRDF correction, spectral band harmonization
  - Pixel-level uncertainty metrics
- Workflows enable a continuous and frequent evaluation of data-quality compliance across all data/product levels (L1, L2, L2D products)
- Required ancillary input
  - Emissivity information, gaseous absorption, water vapor, surface pressure, etc.

Workstreams (2)

Technology: Develop hardware/software industry needs to meet product requirements.

- Identify and address technology gaps
- Demonstrate technology and transition to industry
- Assess pre-launch calibration and characterization needs

Validation: Ensure products are within acceptable uncertainties of Landsat equivalent products.

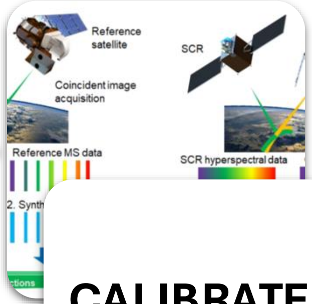
- Test and evaluate regional satellite-based cross-validation methods
- Study needs for ground-based L2 measurements
- Develop standards and protocols and demonstrate utility

Demonstration Phase: Workflow Architecture

Technical
Line of Effort

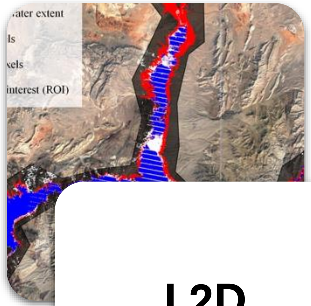
Product
Line of Effort

VENDOR L1 DATA

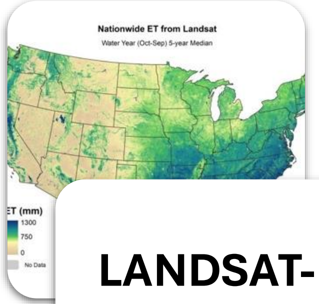


CALIBRATED L1 DATA

L2 PRODUCTS



L2D PRODUCTS



LANDSAT-CLASS PRODUCTS

DATA QUALITY COMPLIANCE
L1 CALIBRATION &
VALIDATION

ATMOSPHERIC/BRDF
CORRECTION
UNCERTAINITY METRICS

L2 VALIDATION
PRODUCT ALGORITHM
EXECUTION

PRODUCT VALIDATION

Industry (EO providers, analytics, Cal/Val) will work with the government teams throughout the workflow development.

Initial Capability (FY29-31)

- Transition workflow into vendor pipeline and support the Operational Capability phase
- Partner with new vendors and develop tailored workflows
- Establish a *multi-source Level-1 radiometric/geometric* calibration framework
- Construct *universal and adaptive* framework
- Mature L2 validation methodology
- Demonstrate and transfer technology to industry and establish/transition pre-launch instrument characterization capabilities
- Participate in the Assessment Phase

Technical Team will mature and advance processing workflows, facilitate their transition to industry, and invest in technology demonstrations and calibration.

Operational Capability (FY32+)

- Maintain and upgrade the workflow
- Establish cross-calibration procedure with Landsat-10
- Continue to demonstrate and transfer technology
- Support pre-launch calibration and characterization as needed

Technical Team will enable generating Landsat-grade L2D products using validated surface reflectance and temperature products.

SLI Commercial Transition

Programmatic Line of Effort

Douglas Daniels
Principal Engineer
USGS National Land Imaging
(The Aerospace Corporation)

Dana Ostrenga
Project Manager, Commercial Satellite Data Acquisition (CSDA)
Goddard Space Flight Center
NASA

PROGRAMMATIC LINE OF EFFORT

1 CONDUCT OUTREACH INDUSTRY

- Help refine commercialization strategy
- Publish product list with individual requirements
- Events:
  - Annual industry exchanges
  - Website

2 DEVELOP GOVT BUSINESS PRACTICE

- Commercial data pricing models
- Contract clauses for commercial operations
  - Contract types and duration
  - Operational availability requirements
  - Free and open data requirements

3 EXECUTE CONTRACTS

- Initial Demos through NASA
- Operational Capability through USGS

A coordinated approach to enable commercial data solutions that deliver value for science and applications.

Potential Future Opportunities

DEMONSTRATION PHASE FY27 - 28

- Contracting Office: NASA CSDA
- CSDA IDIQ or other vehicles, multiple awards
- < 24-month PoP
- Demonstrate commercial data product viability

INITIAL CAPABILITY PHASE PHASE: FY29 - 30

- Contracting Office: USGS
- Full and Open competition, multiple awards
- ~ 24-month PoP
- Execute operational delivery of select products

This presentation does not represent a guarantee by NASA or USGS to execute any contract or agreement. Any future efforts are subject to funding availability.

SLI Commercial Transition

Next Steps and Conclusion

Dr. Nima Pahlevan
SLI Program Scientist
Earth Science Division
NASA

Next Steps and Conclusion

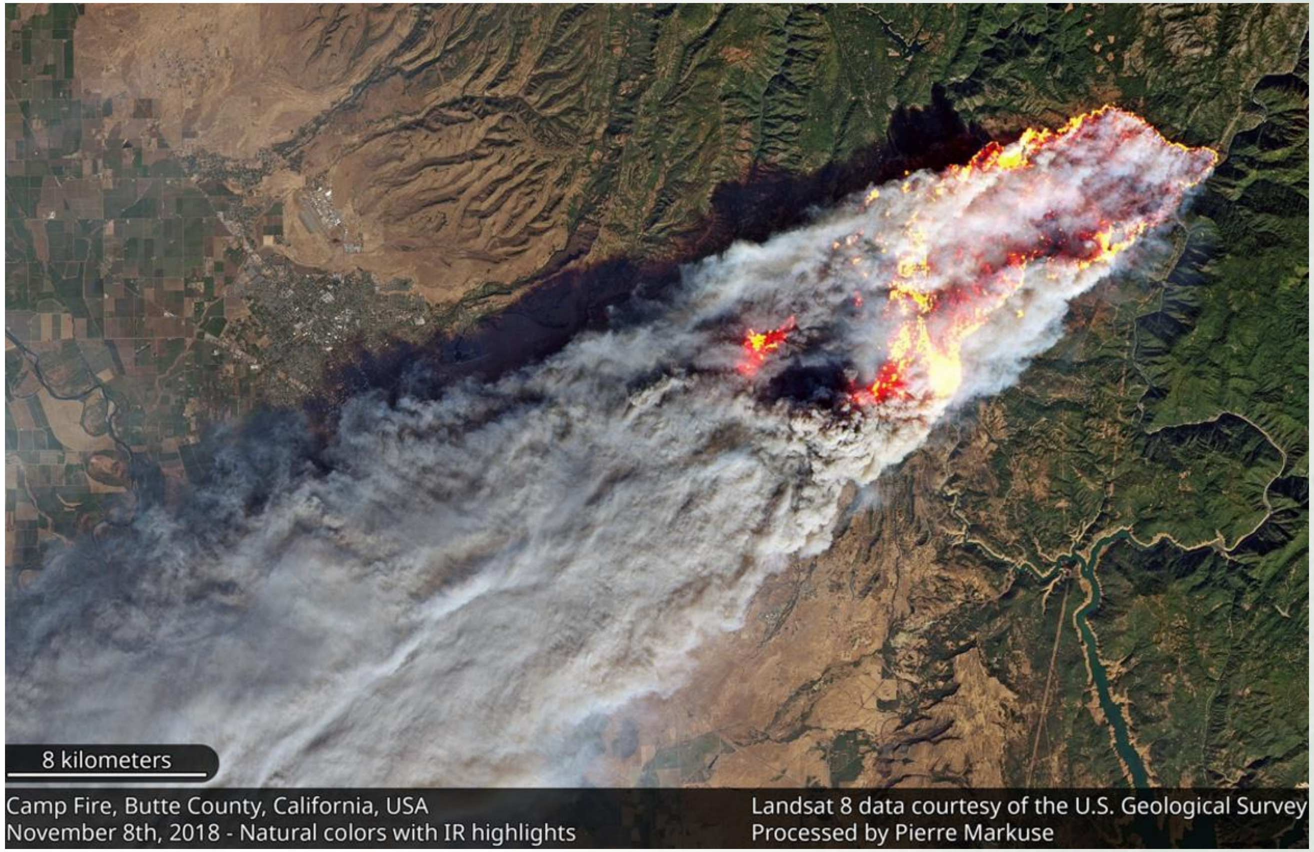
- **Notional Contracts: Prospective multiple awards during Demonstration Phase**
  - Priority: Vendors that meet product requirements
  - Regular technical exchange
  - Workflow integration
  - Cal/Val and technology needs assessment
  - Product evaluation
  - Cost assessment (procurement, processing, and distribution)

SLI Initiative Website

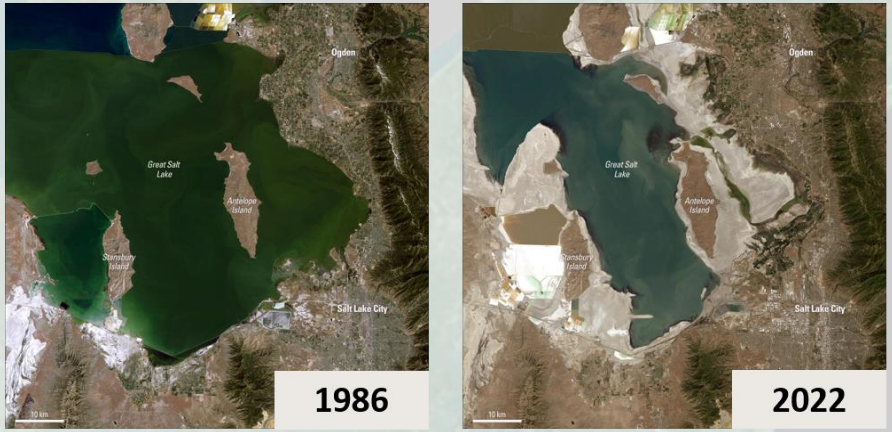
- **Products**
  - Publishing requirements
  - Additional high-value variables (e.g., ET, VIs, Crop Residue, etc.)

NASA and USGS recognize that the commercial EO sector is an increasingly important partner to help SLI ensure continuity and scientific integrity of the Landsat data record.

Thank You!



Landsat Case Study: Great Salt Lake 1986-2022



The Great Salt Lake has experienced dramatic shoreline retreat, exposing lakebed that threatens air quality, ecosystems, and regional water security. Landsat's high geometric accuracy and strict error tolerance ensures that changes in shoreline position are measured precisely, while its radiometric accuracy allows scientists to reliably track salinity, water extent, and the dust-prone exposed lakebed over time.