

LANDSAT 'S 50TH ANNIVERSARY

LOOKING BACK & LOOKING AHEAD

THOMAS CECERE

CARTOGRAPHER,

UNITED STATES GEOLOGICAL SURVEY (USGS)

UN COPUOS STSC

FEBRUARY 11, 2022



Original Landsat Risk Takers - 1966



**DOI Secretary
Stewart Udall**

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**USGS Director
William Pecora**

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“The DOI’s (Department of the Interior’s) surprise declaration created a storm of political protest from NASA and Defense agencies...”*

“...Pecora was convinced that he would be fired as a result.”*

“Rumor has it that President Johnson was so angry over the stir that he never spoke with Secretary Udall again.”*



*Landsat Legacy Project Team, *Landsat’s Enduring Legacy*, ASPRS, 2017, (page 21).

CAMDEN, N. J.
COURIER-POST
SEP 21 1966

Eros Satellite Due To Map Resources Of Entire Planet

By EDMUND B. LAMBETH
Courier-Post Bureau

WASHINGTON—Interior Secretary Stewart Udall announced plans yesterday to build a satellite that by 1969 will begin monitoring the natural resources of the Earth.

Dubbed Project EROS (Earth Resources Observation Satellite), the new bird is the first model of a spacecraft that scientists hope will discover mineral deposits, predict volcanoes, spot fish, find underground water, assess crops and perhaps even count people.

The project represents the first significant civilian use of the military spy-in-the-sky sensors that have proven their value in critical reconnaissance missions such as the 1962 Cuban missile crisis.

Identify Crops

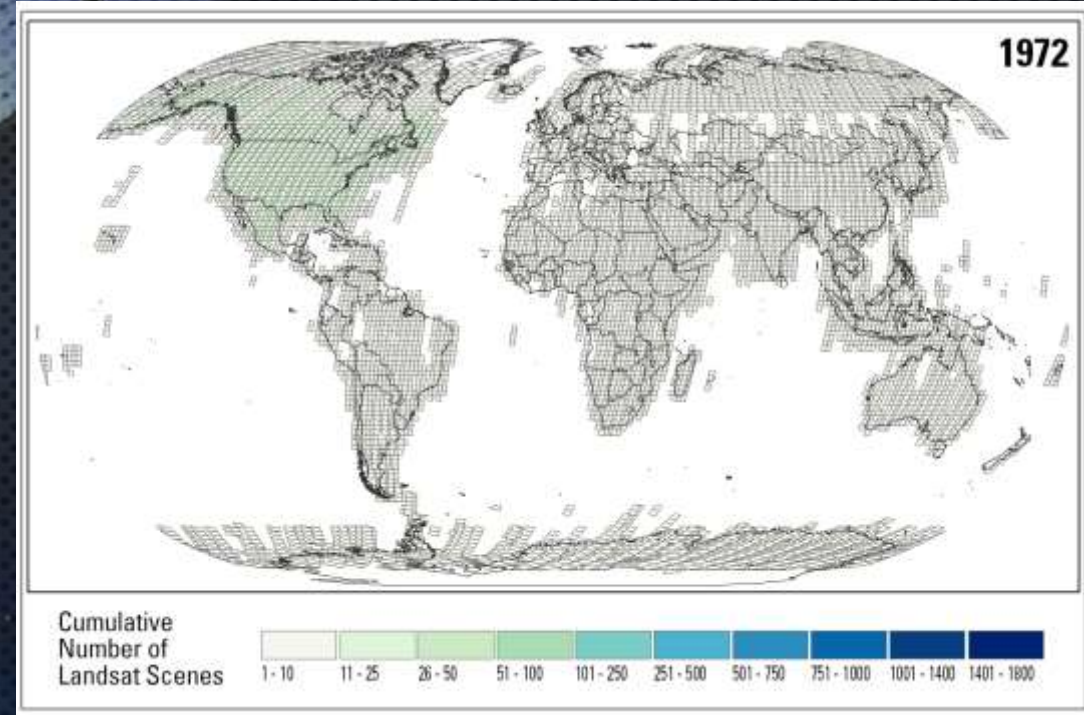
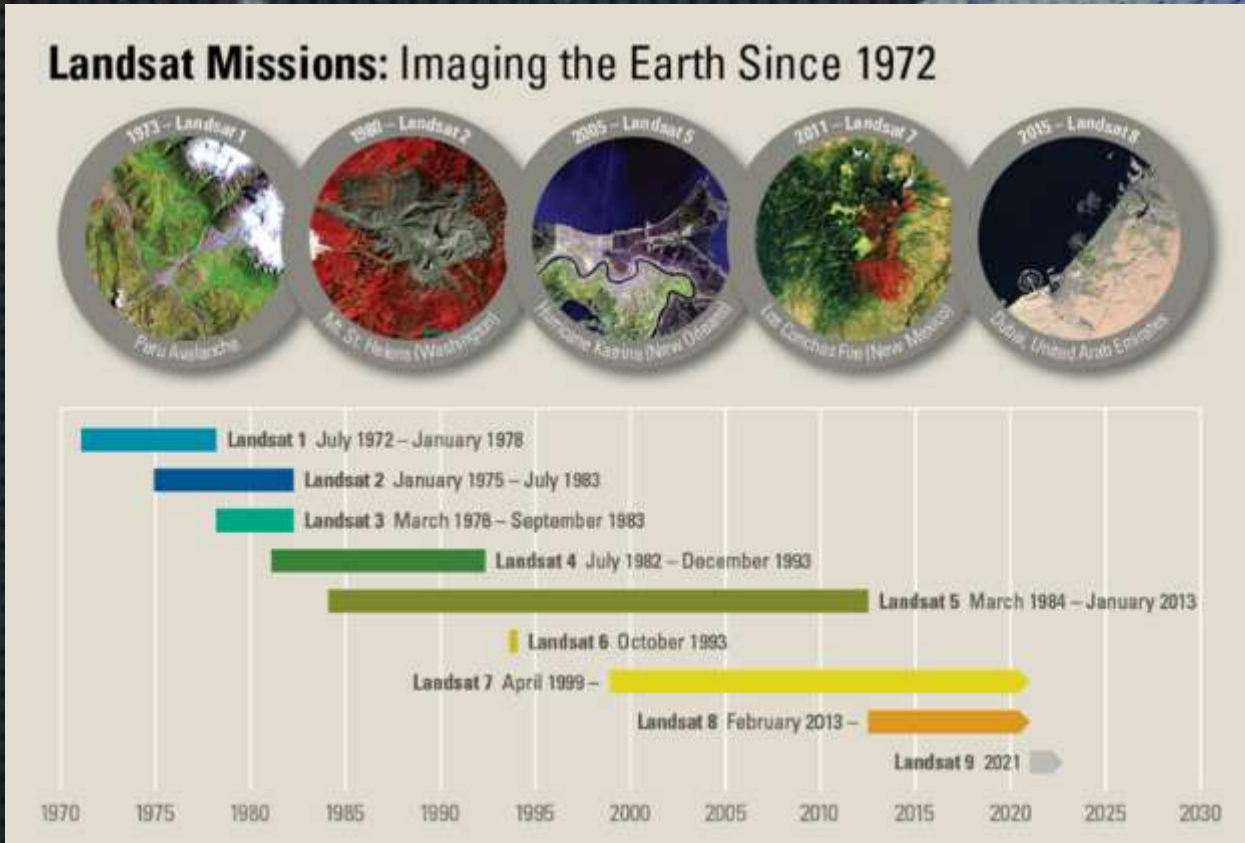
EROS' first assignment will be to map the Earth with television cameras, and identify and gauge the status of crops.

“Future sensing systems,” said William T. Pecora, director of the United States Geological Survey, “will employ heat-measuring devices to monitor the Earth’s volcanoes and search for sources of geo-thermal power, radar that will ‘see’ beneath the clouds, and eventually cameras with sufficient resolving power to permit timely updating of our national topographic map series.”

He estimated that it will cost 120 million to launch the spacecraft.

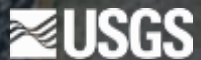
NASA – USGS Partnership

NASA Satellite Development & Launch
USGS Satellite Operations & Data Distribution



- ~5 DECADES OF LAND COVER, LAND USE, AND VEGETATION INFORMATION
- LARGE AREA COVERAGE FOR GLOBAL, CONTINENTAL AND REGIONAL STUDIES
- THE MOST CITED LAND-IMAGING SATELLITE IN PEER-REVIEWED SCIENTIFIC LITERATURE, AND THE CITATION RATE IS INCREASING

- DATA ARCHIVE CONTAINS 300 BILLION KM²
- ADDS 40 MILLION KM² PER DAY



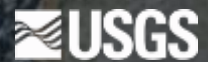
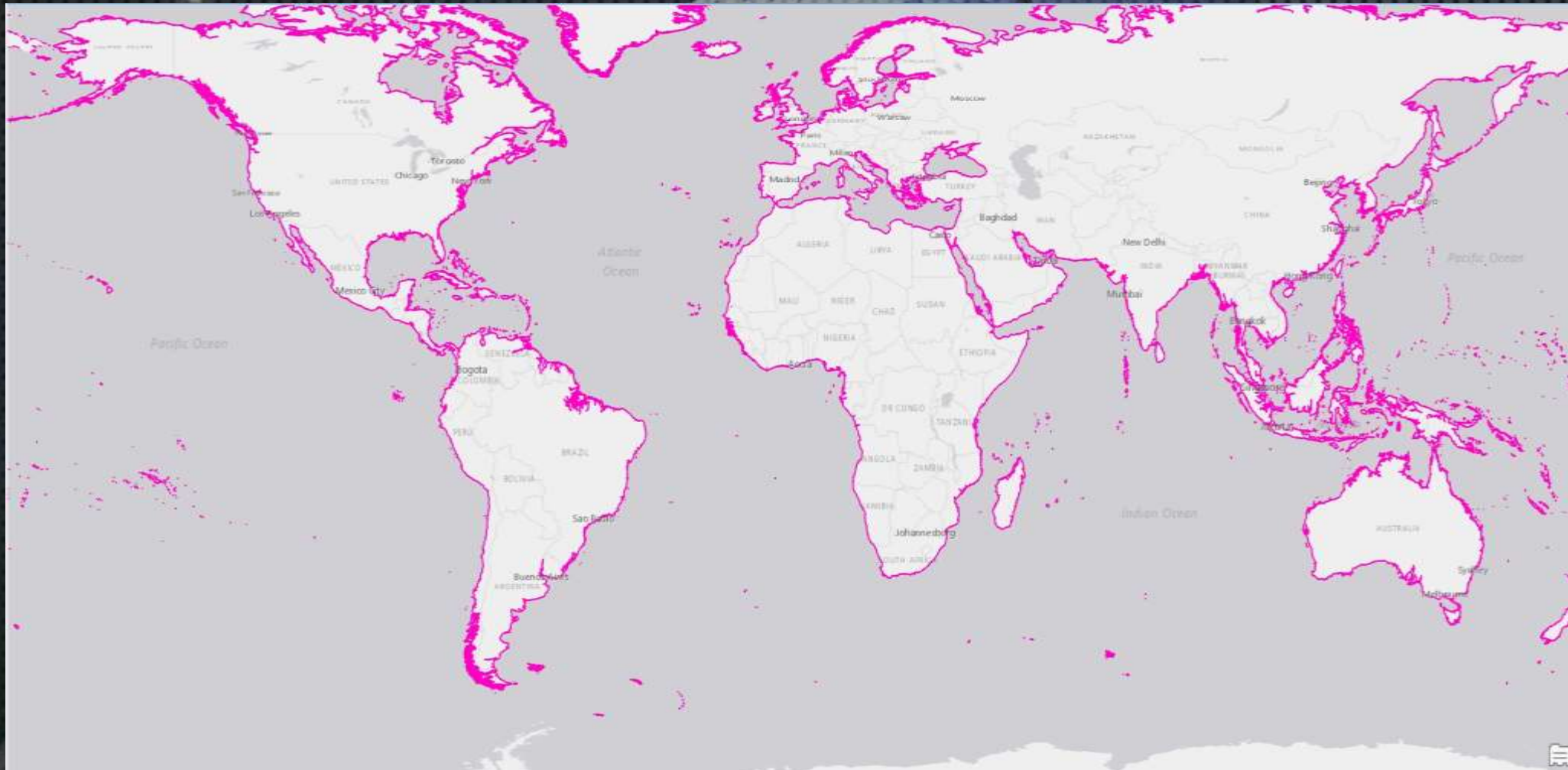
Current Landsat International Cooperator Network

11 Active L7 Stations / 16 Active L8 Stations



L7 = Landsat 7
L8 = Landsat 8
IGS = International Ground Station
LGN = Landsat Ground Network

Global Landsat Data Enables Global Coastline Depictions



Global Coastline Explorer Tool - <https://rmgsc.cr.usgs.gov/gce/>

Free and Open Data Access: USGS Web Tools



USGS SCIENCE PRODUCTS NEWS CONNECT ABOUT

Landsat Data Access

Landsat Commercial Cloud Data Access

Landsat Collection 2 Level-1 and Level-2 global scene-based data can be accessed from the Amazon Web Services (AWS) cloud platform. The Landsat products are located in an Amazon Simple Storage Service (S3) s3://usgs-landsat-publisher-usgs bucket within the Oregon us-west-2 region.

PLEASE NOTE: On December 23, 2020 the USGS identified an issue Temperature products using the Satellite (SAT) Application Programmer's Interface (API). The Collection 2 Surface Temperature products remain available to Machine to Machine (M2M), and direct access in the cloud. The engine issue and will provide an update when these Spatio-Temporal Asset Catalog (STAC) products are available.

Leveraging the storage and processing that cloud services can provide users. While this new capability does not change existing user data access the growing record of Landsat Earth Observations.

- USGS Press Release (March 2020)

Documentation and Additional Resources

Visit the links below to learn how to apply your workflows to Landsat data.

Documentation

- Landsat Commercial Cloud Data Access User Guide (pdf)

Tutorials

The following files are available to guide users while working with Landsat data in the cloud.

- Landsat Data in Motion to the Cloud
- Landsat in the Cloud - Supporting Current Workflows
- Cloud Processing - coming soon

Videos

These videos explain how using data in the cloud works.

- Landsat Data in Motion to the Cloud
- Landsat in the Cloud - Supporting Current Workflows
- Cloud Processing - coming soon

USGS science for a changing world

Earth Explorer

<https://earthexplorer.usgs.gov>

Search Criteria: Data Sets, Additional Criteria, Results

1. Enter Search Criteria

To narrow your search area, type in an address or place name, enter coordinates or click the map to define your search area (for advanced map tools, view the help documentation), and/or choose a date range.

Discover **RM (Shapefile Upload)**

Select a Geocoding Method
Feature (SRS)

Search Limits: The search result limit is 100 records; select a Country, Feature Class, and/or Feature Type to reduce your chances of exceeding this limit.

100 Features **Reset Features**

Feature Name

USGS science for a changing world

GloVis

<https://glovis.usgs.gov/>

Home | Table View | Release Notes | FAQ | Feedback | Login | Help

Page Expires In: 1:59:53

Interface Controls

Choose Your Data Set(s)

- DOQ #
- ED-1 All #
- ED-1 Hypack #
- Global Land Survey #
- IRS AWFS #
- IRS US-3 #

Metadata Filter

Date Range

Cloud Cover

Metadata

Global Land Survey

Current Scene Source

Time Scale (Year) (Month) (Day)

Timeline View

USGS science for a changing world

New LandsatLook

<https://landsatlook.usgs.gov>

Exciting Changes are Coming Soon to LandsatLook!

The LandsatLook viewer is undergoing a complete redesign in order to take full advantage of the opportunities that cloud access to Landsat data provides. For more information on this initiative, please visit the [USGS news release](#).

Collection 2

LandsatLook 2.0 will support Landsat Collection 2 data only.

Bookmark this page to view updates and the announcement for the release of the LandsatLook site.

Collection 1

LandsatLook will continue to support Landsat Collection 1.

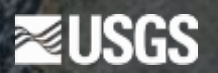
LandsatLook and SentinelLook viewers will remain available after the release in their current state.

Site Name	URL Live
LandsatLook (current)	https://landsatlook.usgs.gov
LandsatLook	https://landsatlook.usgs.gov/landsatlook
LandsatLook Viewer	https://landsatlook.usgs.gov/landsatlook/viewer.html
SentinelLook	https://landsatlook.usgs.gov/sentinellook
SentinelLook Viewer	https://landsatlook.usgs.gov/sentinellook/viewer.html
Web Mapping Services	https://landsatlook.usgs.gov/landsatlook/

Any questions on this update can be sent to User Services at customers@usgs.gov

DOI Privacy Policy | Legal | Accessibility | Site Map | Contact USGS

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GLOBAL SURVEY MISSION



30m VSWIR / 100m TIR
11 band MSI / 12 bit
705km sun synch orbit
185km swath

~1 TB / day

USGS



Landsat is Essential to Understanding Landscape Change

APPLICATIONS INCLUDE:

- **IMPACTS OF CLIMATE CHANGE**
- **QUANTIFYING GLOBAL FOREST CHANGE**
- **MANAGING WATER CONSUMPTION, MANAGEMENT & HUMAN HEALTH**
- **SUPPORTING DISASTER MITIGATION & RECOVERY EFFORTS**

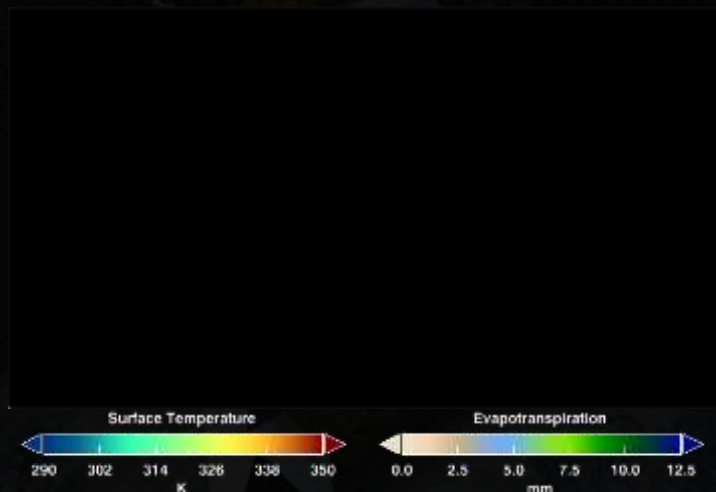
Harmful Algal Bloom - Lake Erie



Urban Heat Map - New York City



Irrigated Farm Lands - New Mexico



Tropical Forest Loss - South America



Disaster Recovery

Landsat – Monitoring Climate Change



Glacial Retreat Fills Alaska Lake



Summer Pools Appear in Antarctica



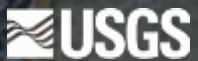
Antarctica's Newest Island



World of Change: Columbia Glacier Alaska



Landsat Analysis Ready Data (ARD)

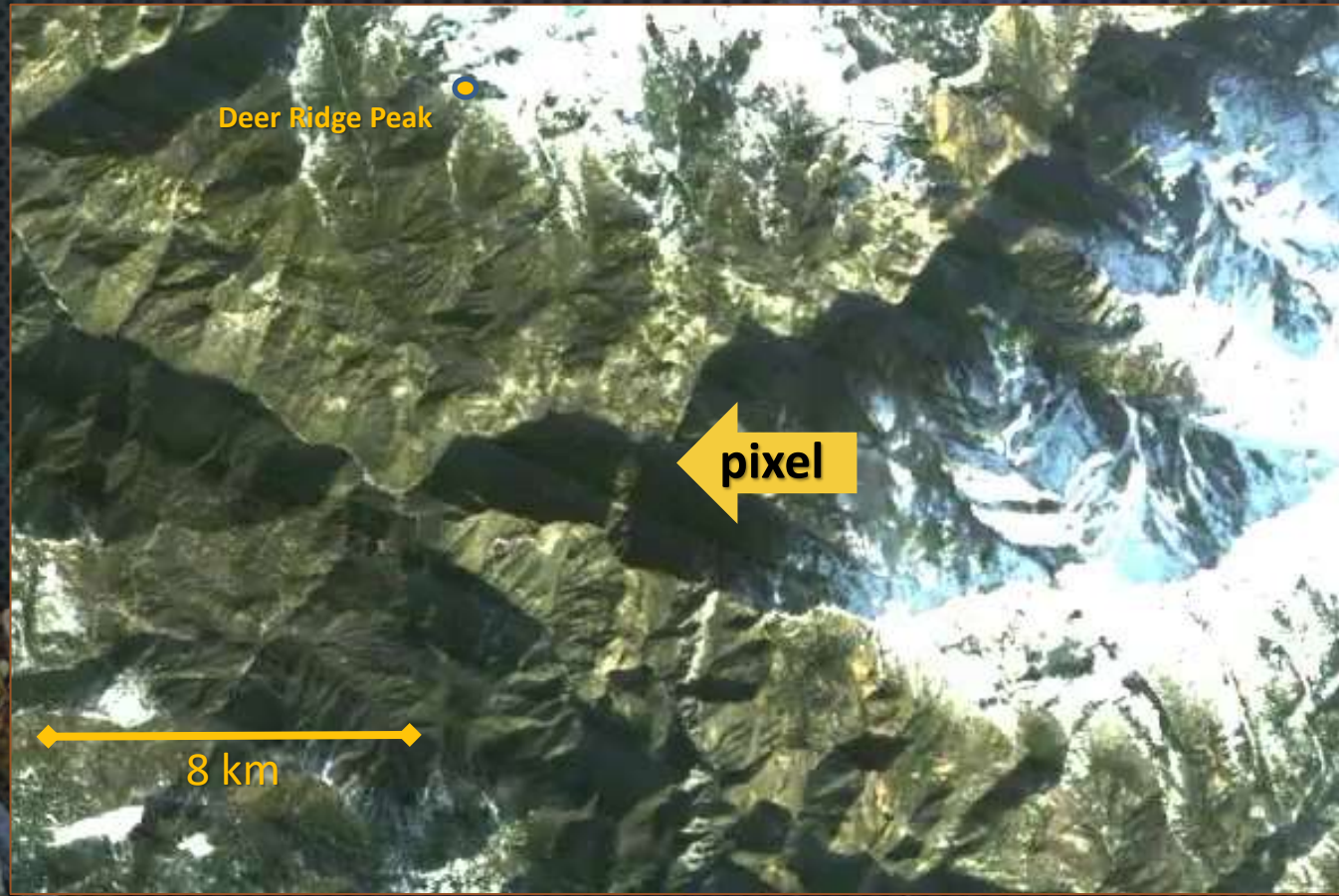


Dwyer, J., Roy, D., Sauer, B., et al.. Analysis Ready Data: Enabling Analysis of the Landsat Archive. *Remote Sens.* 10(9), 1363, 2018.

ARD used to characterize land change through time

Observation date
1983/01/18

Pixel trajectory



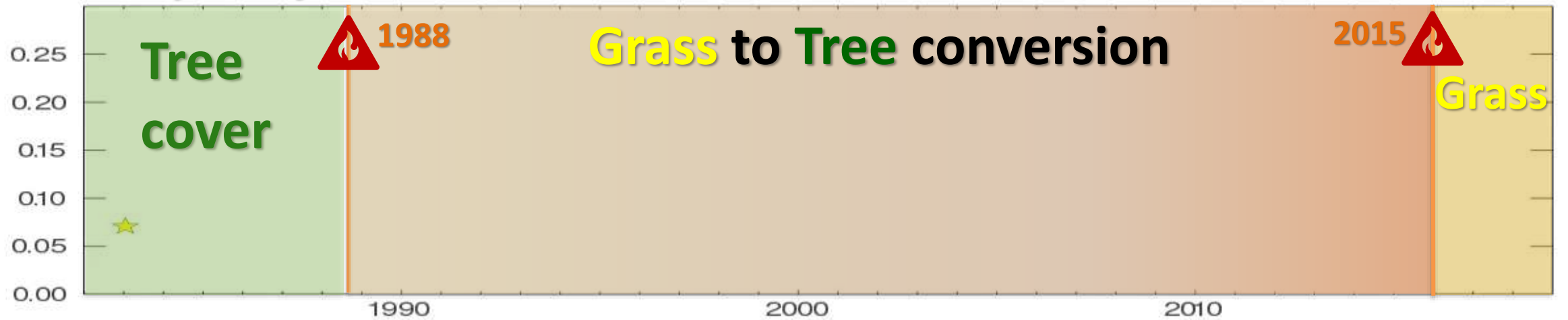
Sierra Mountains,
Central California

Landsat Images
(surface reflectance)

Acknowledgement:
H. Tollerud, EROS



Shortwave IR - 1



Land change monitoring a global scale



Earth Engine Apps Experimental

CCD TS controls

Select band: SWIR1

Start date: 2000-01-01

End date: 2020-01-01

Lambda: 0.002

Max iterations: 10000

Min observations: 6

Chi square prob: 0.99

Min years scaler: 1.33

Visualization params

Chart type: Time series

Num segments: 6

SWIR1: 0 to 0.6

NIR: 0 to 0.6

Create synthetic image

Date: 2001-01-01

RED band: RED

GREEN band: GREEN

BLUE band: BLUE

Stretch (Min): 0

Stretch (Max): 0.4

Create Image

Visualize coefficients

Date: 2001-01-01

Single coefficient?

Sele Sele 0 1

Sele Sele 0 1

Sele Sele 0 1

Map data ©2021 Imagery ©2021 NASA, TerraMetrics | 2000 km

CCDC TS, Latitude, Longitude: -18.4455, 25.7902

Observation fit 1 fit 2 fit 3 fit 4 fit 5 fit 6

Surface reflectance (SWIR1)

0.2

0.0

2002 2004 2006 2008 2010 2012 2014 2016 2018

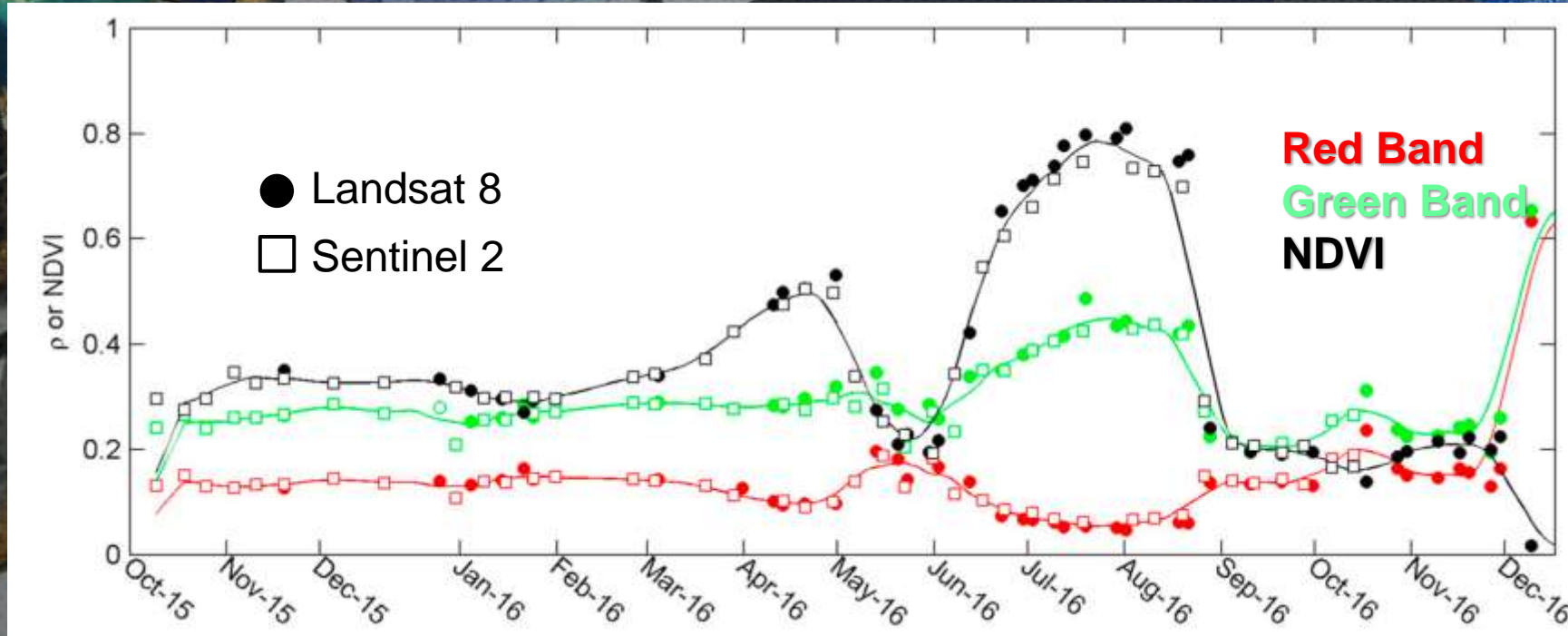
Cross-sensor *interoperability* of observations



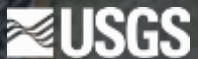
Harmonized Landsat/Sentinel (HLS)

Landsat 8 (USGS)

Sentinel 2 (ESA)



Claverie, M., Ju, J., Masek, J., Dungan, J., Vermote, E., et al. The Harmonized Landsat and Sentinel-2 surface reflectance data set. *Remote Sens. Environ.* 2018.



Sustainable Land Imaging (NASA - DOI/USGS)

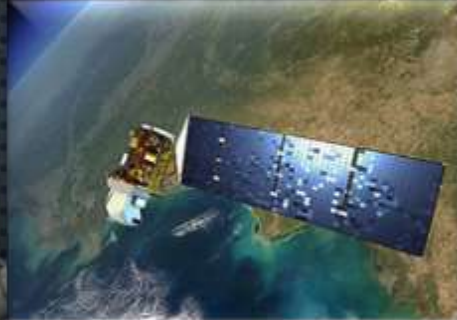


Landsat 7



1999 - present

Landsat 8



2013 - present

Landsat 9



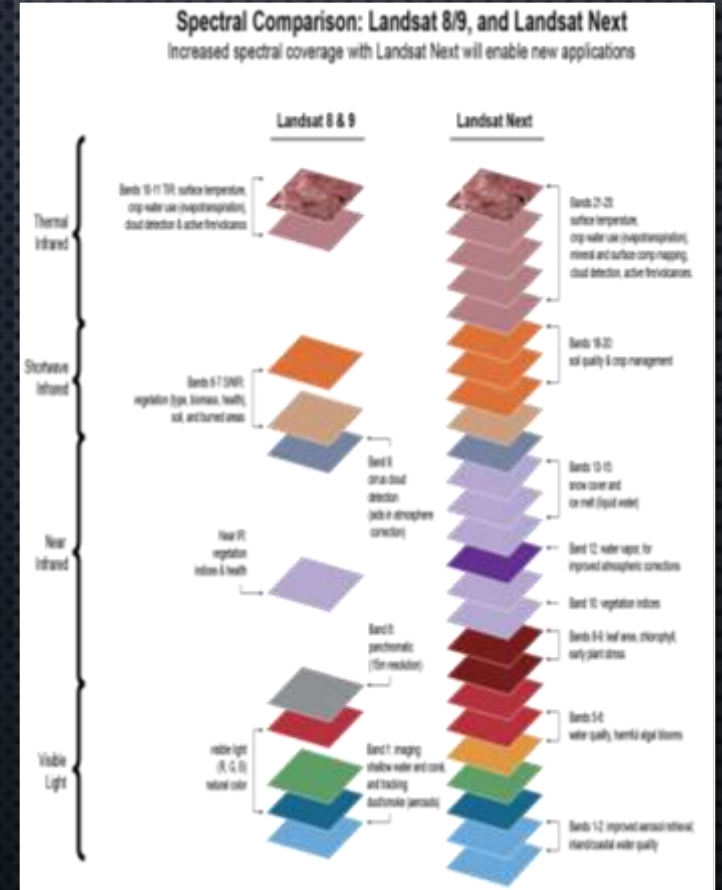
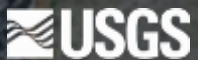
2022 -

Landsat Next

OSAM-1 (On-orbit Servicing, Assembly, and Manufacturing)



Mid-2020s



Late-2020s

