



Forest Service
U.S. DEPARTMENT OF AGRICULTURE

Introduction to Change Detection

Lecture 5: Data access + applications

Instructor: Lila Leatherman (they/them)

November 17-18, 2021

High Resolution Data Resources

- [FS EDW and Image Services](#)
 - NAIP Imagery
- [Google Earth Engine](#)
 - NAIP Imagery (and others)
- [Digital Globe](#)
 - WorldView-2 and WorldView-3 image search + view capabilities
- [USGS Earth Explorer](#)
 - Limited WorldView-2 and WorldView-3 imagery
- [Planet](#)
 - Basemaps available for select states, imagery starting April 2021
- [USGS CIDR request portal](#) (use in moderation)
 - Request archived high-resolution imagery
 - Request future acquisitions of high-resolution imagery
- [GTAC High Resolution Imagery access tutorial](#)
 - For identifying WorldView Imagery and requesting through Earth Explorer + CIDR

Moderate Resolution Imagery Resources

(10-30m resolution)

- USGS Earth Explorer
 - [Landsat - Analysis Ready Data \(ARD\)](#)
 - [Level-2 Data Products](#)
- [Copernicus](#)
 - Sentinel-2 data
- [Sentinel Hub EO Browser](#)
- Google Earth Engine (GEE)
 - Sentinel-2, Landsat, and many more
 - [Tutorial to get started, from GEE](#)
 - [GTAC GEE Training Repository with example code](#)
- [GTAC Sentinel-2 Imagery Acquisition tutorial](#)
 - For downloading via the Copernicus portal

More data resources

- WorldView data

- Digital Globe – [Discover to browse](#) , [G-EGD to download](#)
 - Requires authorization to create an account
- Submit [CIDR request](#) for specific new imagery acquisitions

Sign in Feedback | Help

Salt Lake City, UT, USA

Area of Interest Filters

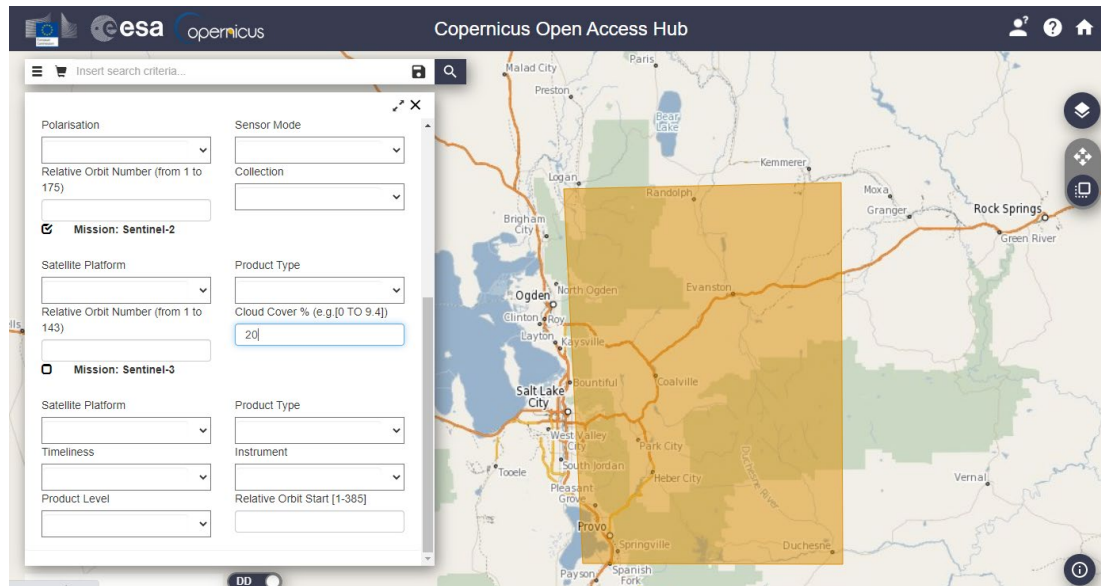
| Area Name | Selected | Coverage | | | |
|-------------------------------------|-----------|-------------|----------------|-------|---|
| AOI 1 | 10/296 | 99% | | | |
| Source | Collected | Area Clouds | Area Off Nadir | | |
| <input checked="" type="checkbox"/> | WV02 | 2020-10-31 | 0.0% | 29.5° | + |
| <input checked="" type="checkbox"/> | WV02 | 2020-10-31 | 0.0% | 27.7° | + |
| <input type="checkbox"/> | GE01 | 2020-10-29 | 0.0% | 15.8° | + |
| <input type="checkbox"/> | WV02 | 2020-10-26 | 0.0% | 24.4° | + |
| <input type="checkbox"/> | GE01 | 2020-10-21 | 0.0% | 14.4° | + |
| <input type="checkbox"/> | GE01 | 2020-10-21 | 0.0% | 4.3° | + |
| <input type="checkbox"/> | GE01 | 2020-10-21 | 0.0% | 16.3° | + |
| <input checked="" type="checkbox"/> | GE01 | 2020-10-10 | 0.0% | 19.5° | + |
| <input type="checkbox"/> | GE01 | 2020-10-10 | 0.0% | 7.6° | + |

DigitalGlobe

Solitude Brighton

More data resources

- Sentinel-2 Data
 - [Copernicus via the European Space Agency](#)



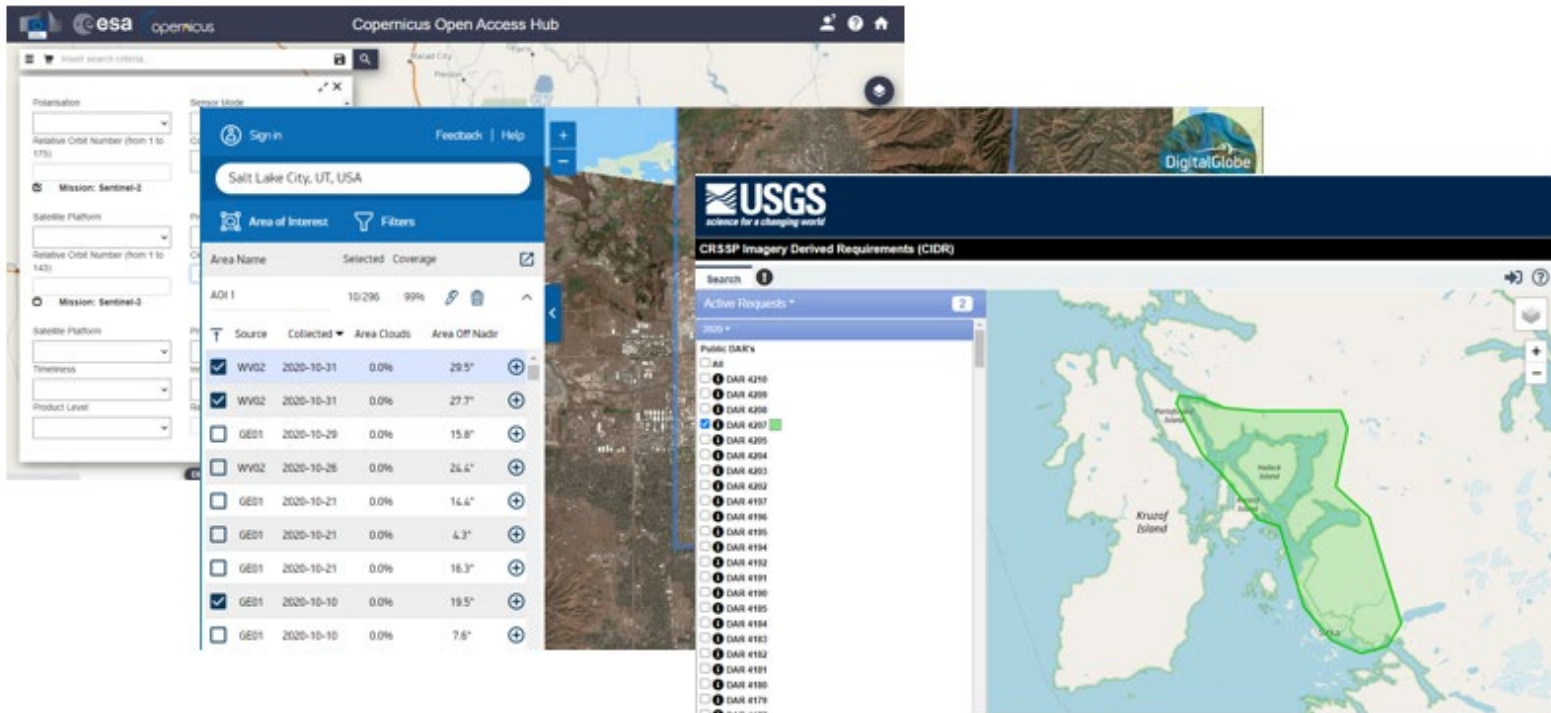
More data resources

- Google Earth Engine tutorials
 - [From GEE](#)
 - [From GTAC](#)

The screenshot displays the Google Earth Engine website interface. At the top, there is a search bar and a language dropdown set to 'English'. Below the navigation bar, the 'Community' tab is selected. The left sidebar shows a list of community tutorials, with 'Beginner's Cookbook' highlighted. The main content area features the title 'Beginner's Cookbook' by author TC25, published on Nov 11, 2019. A blue banner states: '★ Tutorials contributed by the Earth Engine developer community are not part of the official Earth Engine product documentation.' The text below introduces the tutorial's purpose: 'In this tutorial, we will introduce several types of geospatial data, and enumerate key Earth Engine functions for analyzing and visualizing them. This cookbook was originally created as a workshop during Yale-NUS Data 2.0 hackathon, and later updated for Yale GIS Day 2018 and 2019.' The 'Introduction' section defines GIS as the collection, visualization, and analysis of geographical or spatial data. The 'Vector data' section is partially visible at the bottom.

More data resources

- Tutorials on image access developed for FHP
- Obtaining Remotely Sensed Imagery [webinar](#) + [self-paced tutorial](#)

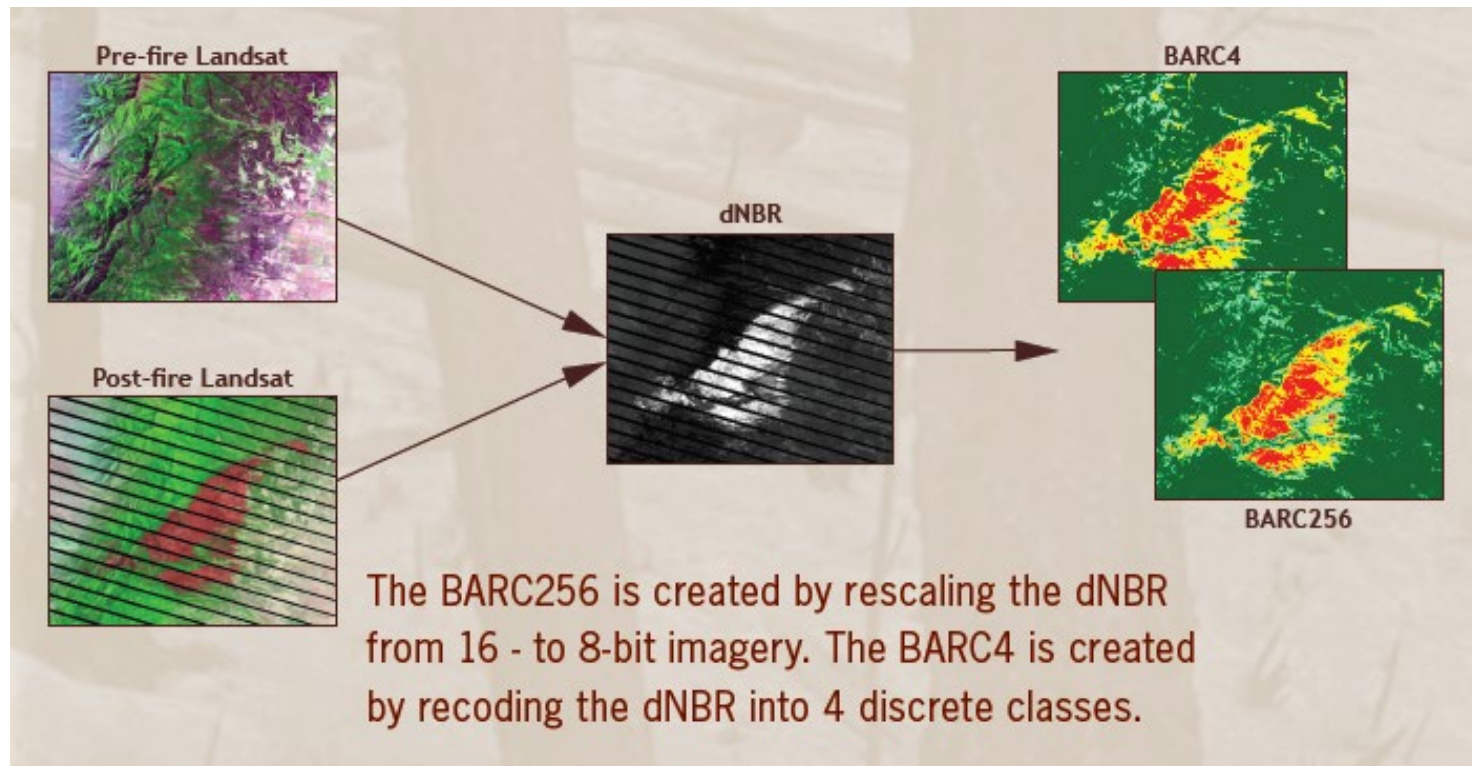


Data Resources - Disturbance Mapping Projects

- USFS/partner programs
 - Fire Mapping
 - **BAER** (Burned Area Emergency Response), **RAVG** (Rapid Assessment of Vegetation after wildfire), **MTBS** (Monitoring Trends in Burn Severity) and more...
 - Forest Health and Disturbance Monitoring
 - **FHAAS** (Forest Health Assessment and Applied Sciences Team)
- More programs and partnerships
 - USGS/NASA, research institutions, Google Earth Engine, etc.

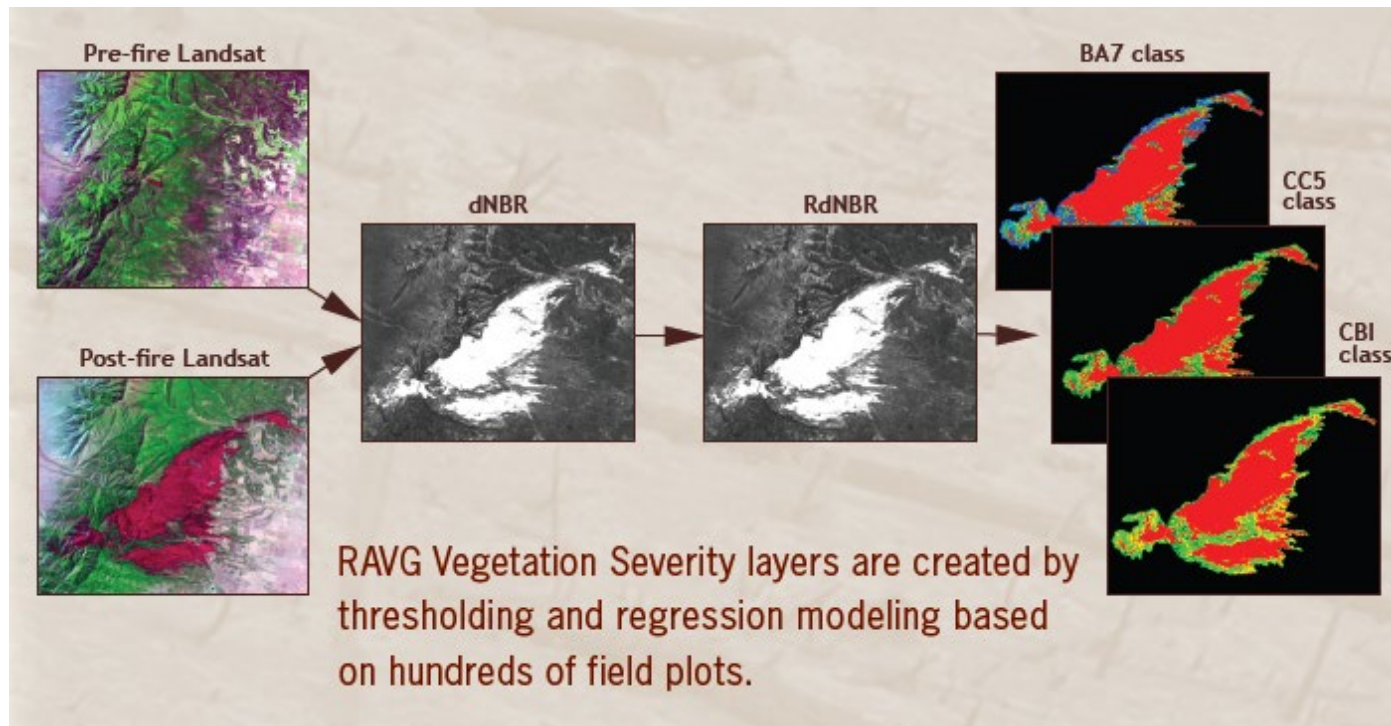
Fire Effects Data Products - BAER

- Burned Area Reflectance Classification (BARC)
 - 1-7 days post containment



Fire Effects Data Products - RAVG

- RAVG Severity layers and tables
 - 30-45 days post containment
 - All fires >1000 acres on USFS land



Fire Effects Data Products - MTBS

- Burn Severity layers from MTBS
 - Assessed 12-18 months post containment
 - All fires >1000 acres on USFS land

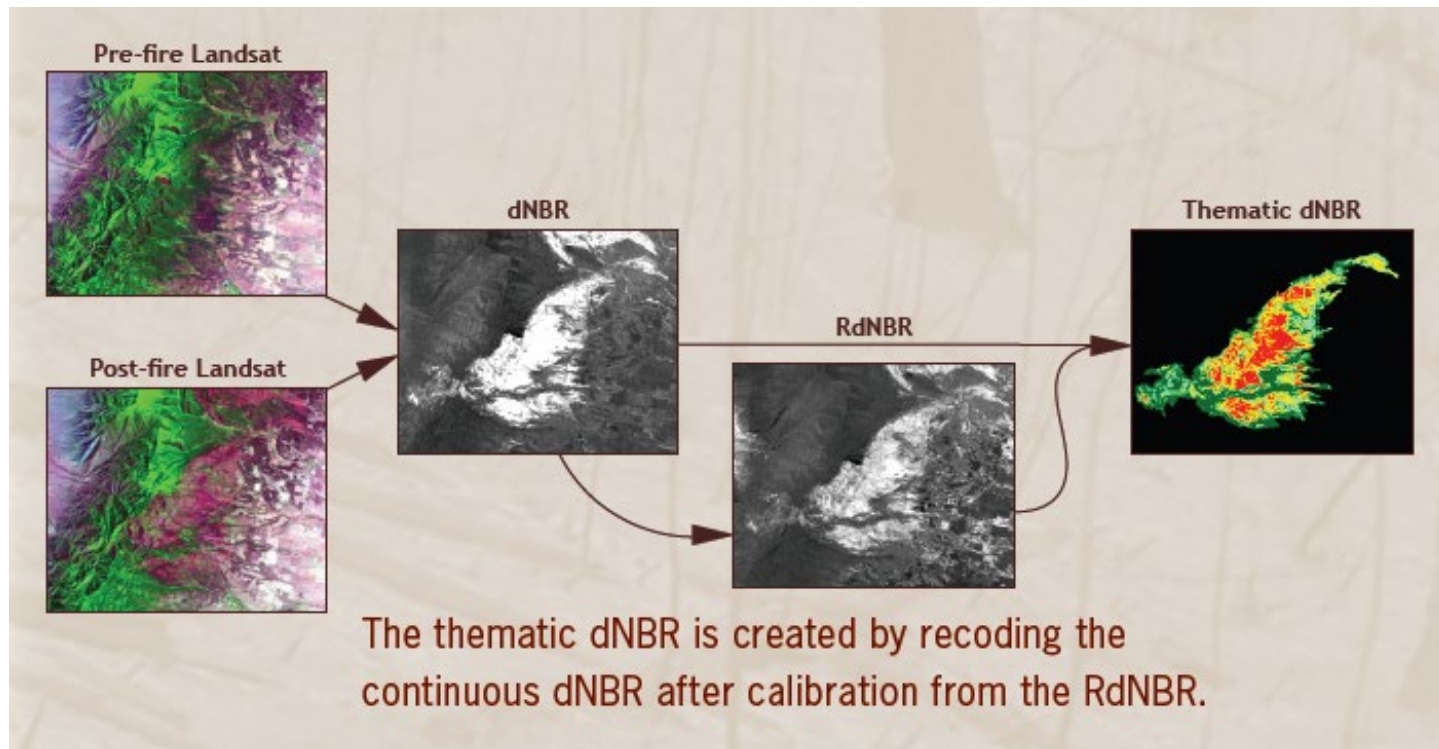


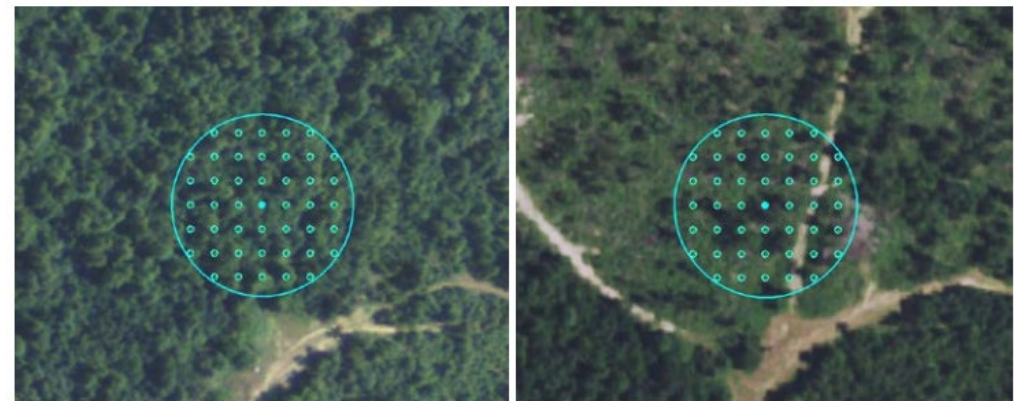
Image-Based Change Estimation (ICE)

- What is it?
 - Sampling approach using image-based interpretations to quickly estimate land cover and land use change
 - When **no change** present, 5 points
 - When **change** present, 45 points
 - All points attributed with LULC
 - Completed for all lower 48 states
 - Interpretation cycle follows NAIP's schedule

No change



Change



Change Detection Products Guide

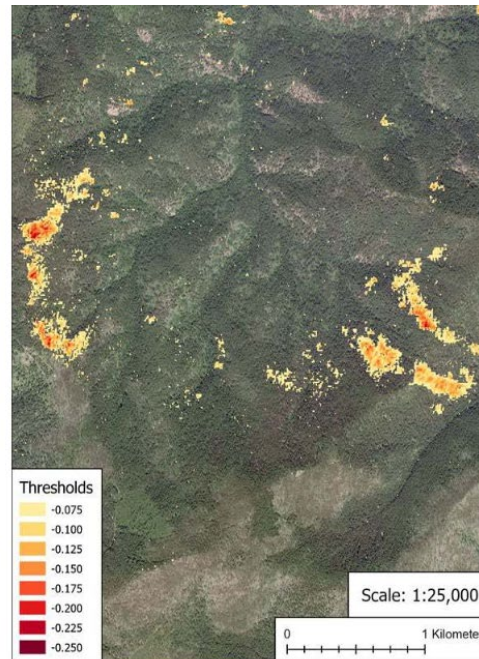
- Overview of operationally ready change detection methods for rapid, accurate, and repeatable estimates of tree mortality and defoliation events across large spatial extents
- [Link](#) to the Change Detection Products Guide

Products and Links

- Delta Viewer
- High-Resolution Forest Mapping System (HiForm)
- ForWarn II
- Landscape Automated Monitoring and Detection Algorithm (LAMDA)
- LandTrendr
- LCMS

Delta Viewer

- [Delta Viewer Hub Site](#)
- Near real-time, every 5 days
- Spatial Resolution: 20m
- Imagery: Sentinel 2
- Method: Two-date change Detection, uses multiple spectral Indices



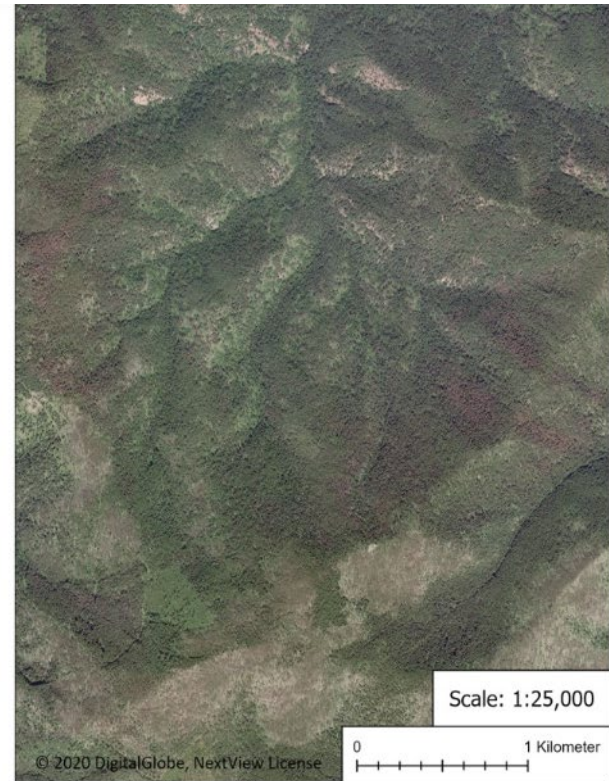
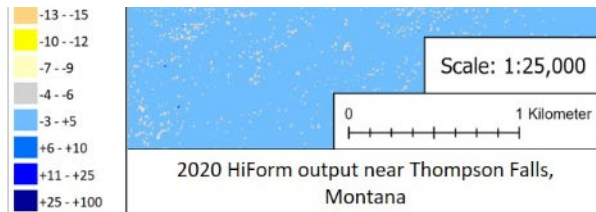
2020 DeltaViewer output near Thompson Falls, Montana



2020 WorldView Imagery of Thompson Falls, Montana

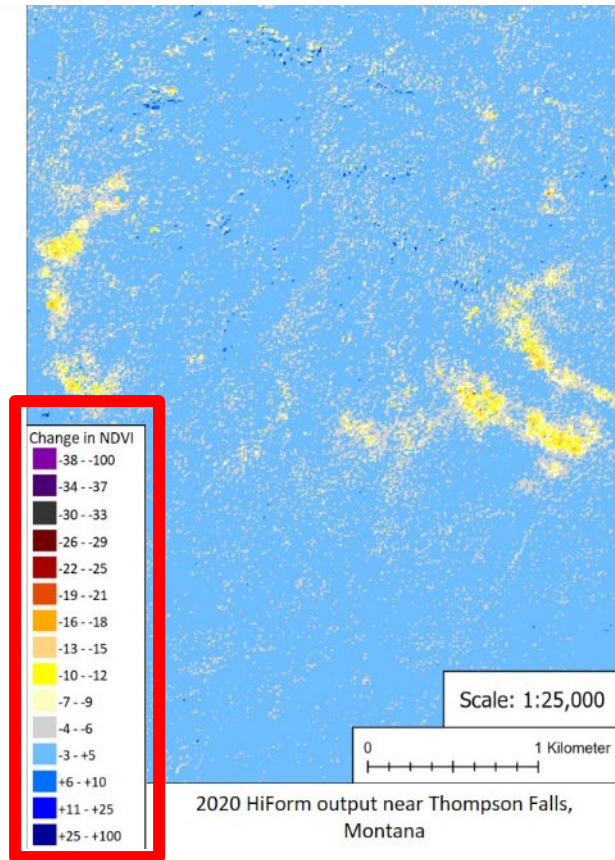
High Resolution Forest Mapping System (HiForm)

- [HiForm](#)
- Near real-time, every 5 days
- Spatial Resolution: 20m
- Imagery: Sentinel 2 and Landsat
- Method: Two-date change Detection of NDVI
- [Easy-to use GEE script](#)



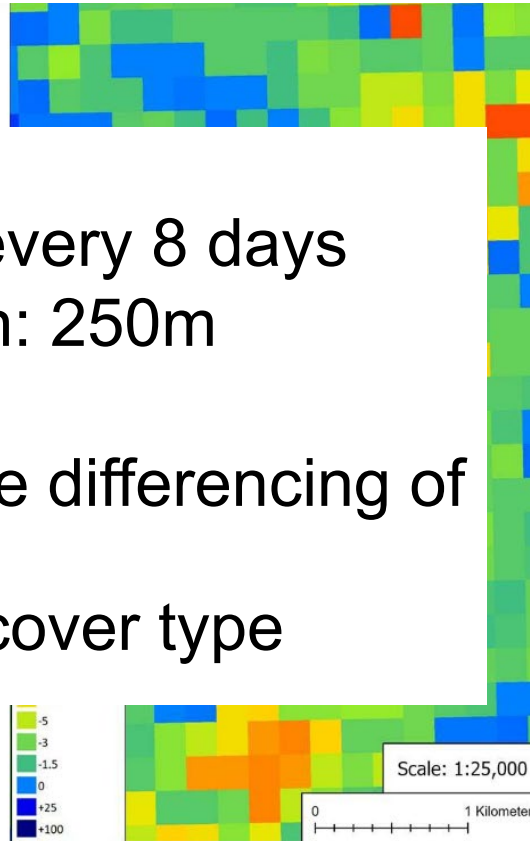
2020 WorldView Imagery of Thompson Falls, Montana

High Resolution Forest Mapping System (HiForm)

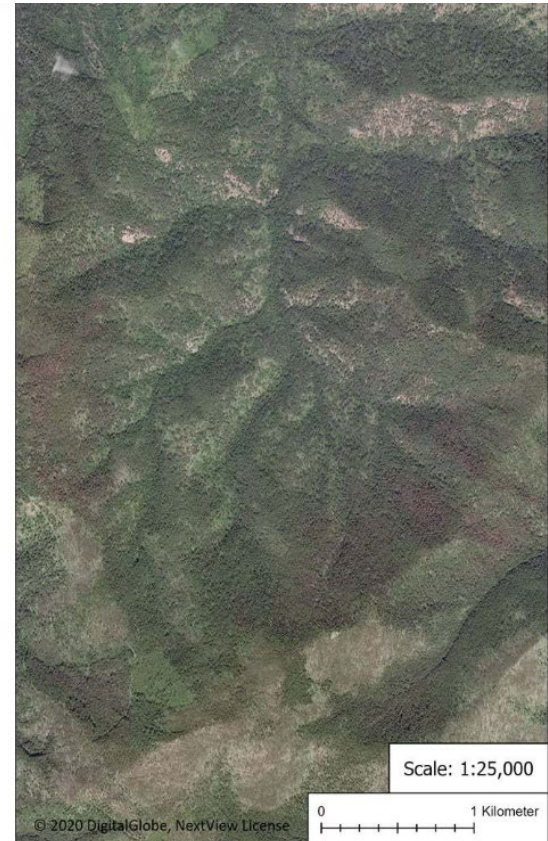


ForWarn II

- [ForWarn II](#)
- Near real time – every 8 days
- Spatial Resolution: 250m
- Imagery: MODIS
- Method: multi-date differencing of NDVI
- Can filter by landcover type

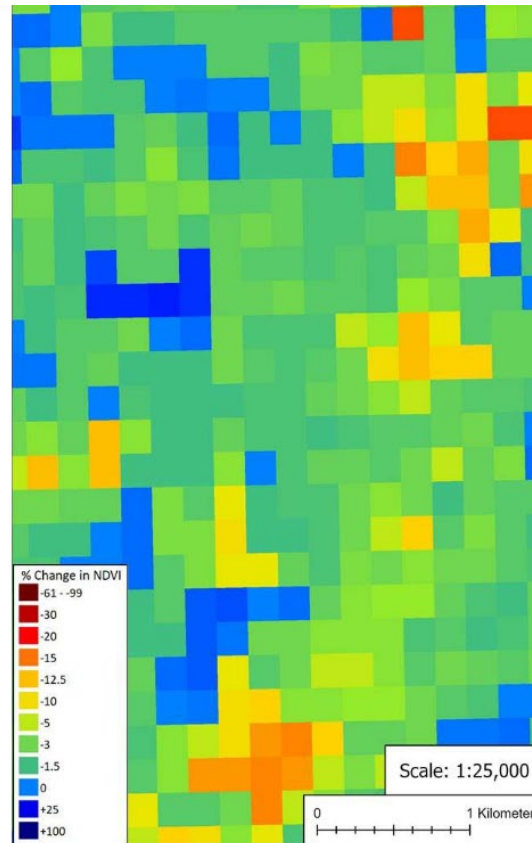


2020 ForWarn II output near Thompson Falls, Montana

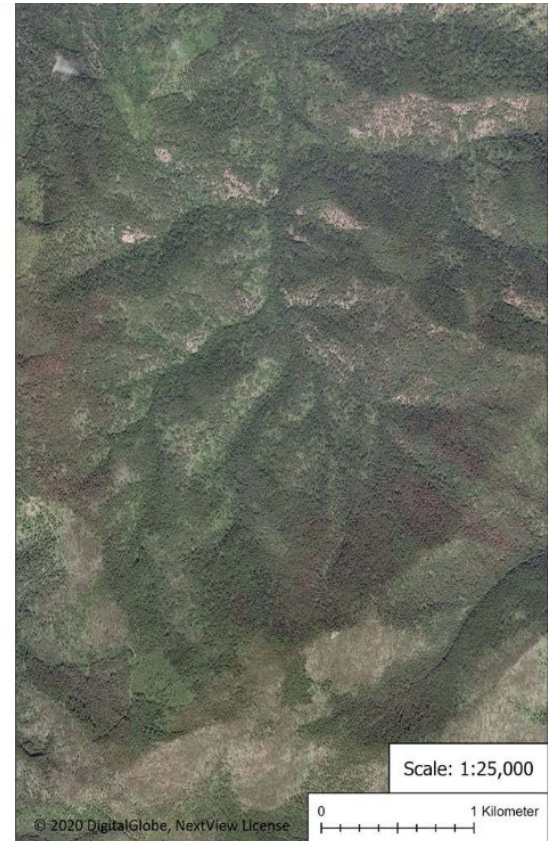


2020 WorldView Imagery of Thompson Falls, Montana

ForWarn II



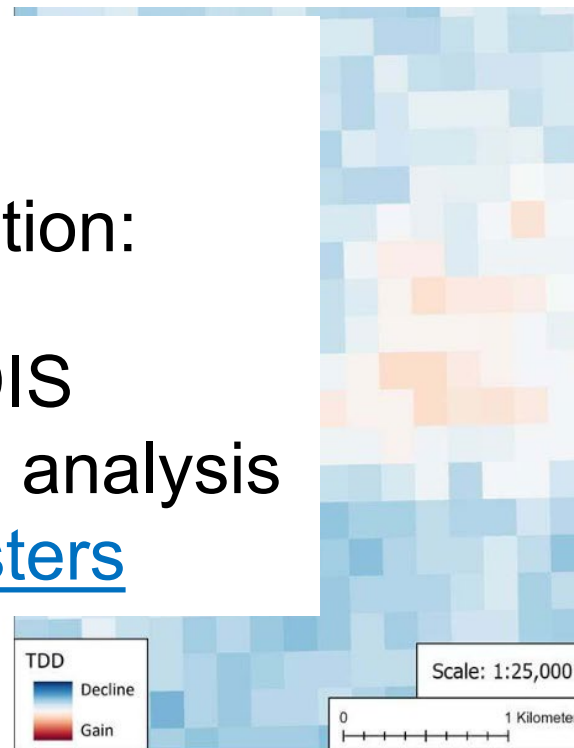
2020 ForWarn II output near Thompson Falls, Montana



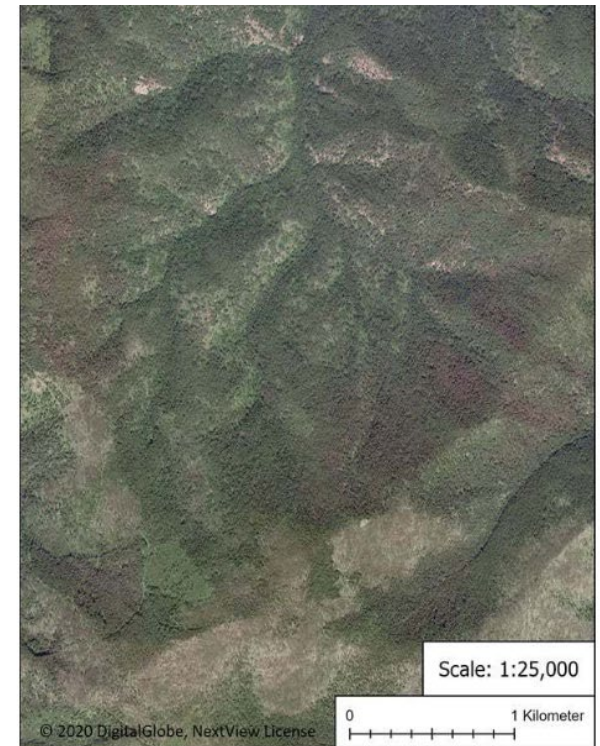
2020 WorldView Imagery of Thompson Falls, Montana

Landscape Automated Monitoring and Detection Algorithm (LAMDA)

- [LAMDA](#)
- Near real time
- Spatial Resolution: 250m
- Imagery: MODIS
- Method: Trend analysis
- [Download Rasters](#)

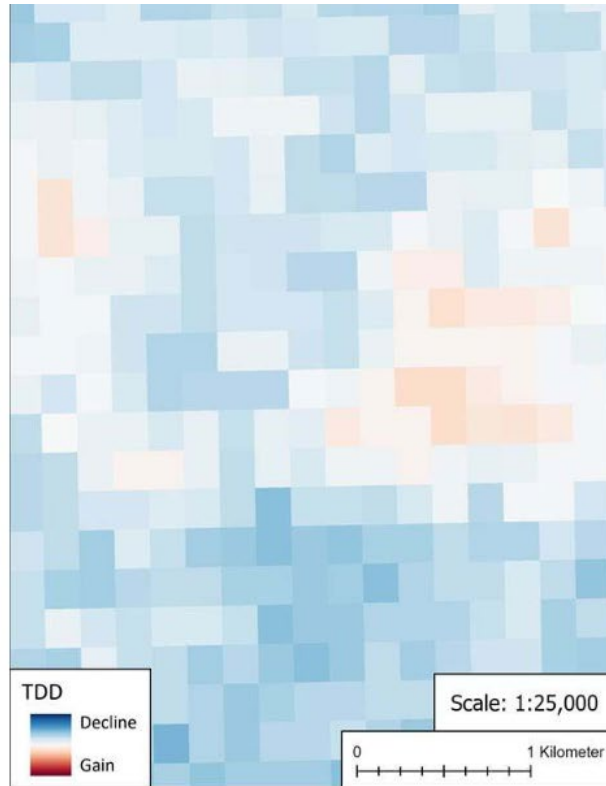


2020 LAMDA output near Thompson Falls, Montana

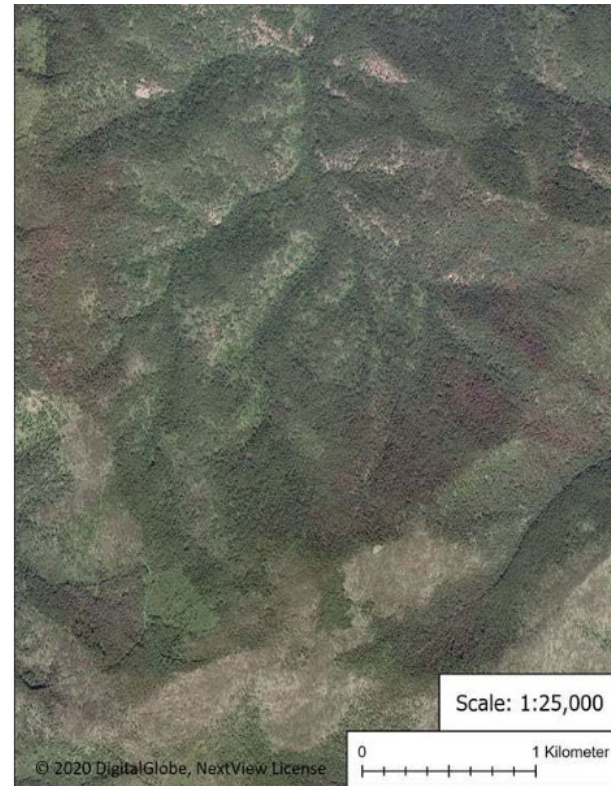


2020 WorldView Imagery of Thompson Falls, Montana

Landscape Automated Monitoring and Detection Algorithm (LAMDA)



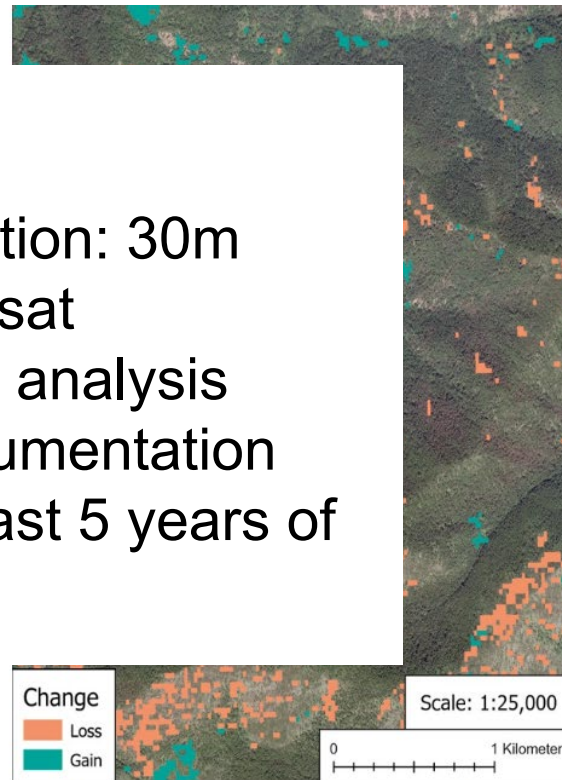
2020 LAMDA output near Thompson Falls, Montana



2020 WorldView Imagery of Thompson Falls, Montana

LandTrendr

- [LandTrendr](#)
- Annual
- Spatial Resolution: 30m
- Imagery: Landsat
- Method: Trend analysis
- Extensive documentation
- Requires at least 5 years of data input

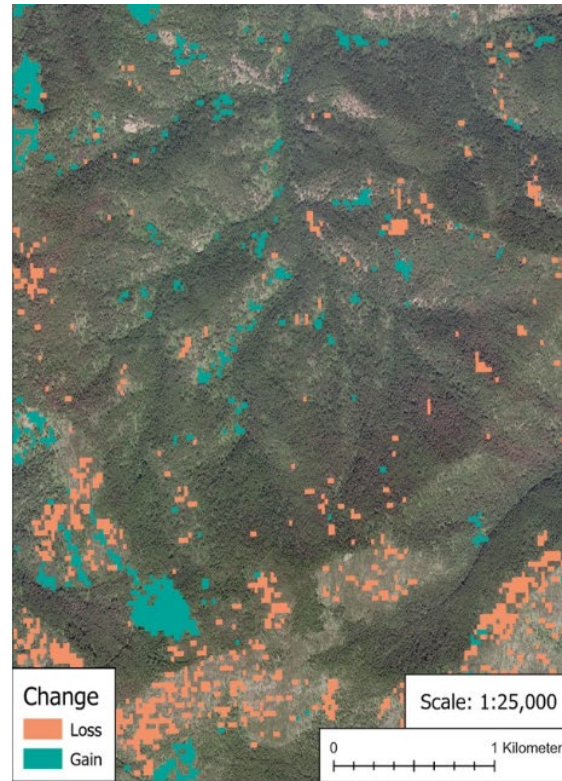


2020 LandTrendr output near Thompson Falls, Montana



2020 WorldView Imagery of Thompson Falls, Montana

LandTrendr



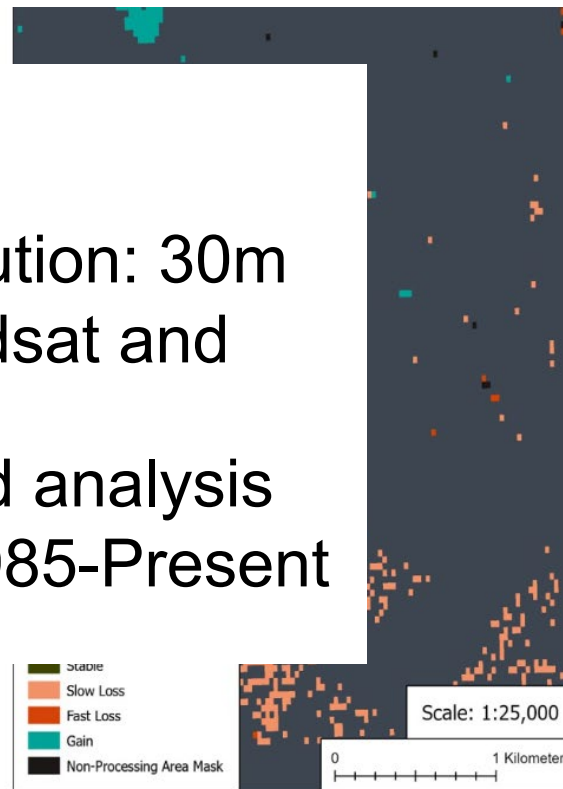
2020 LandTrendr output near Thompson Falls, Montana



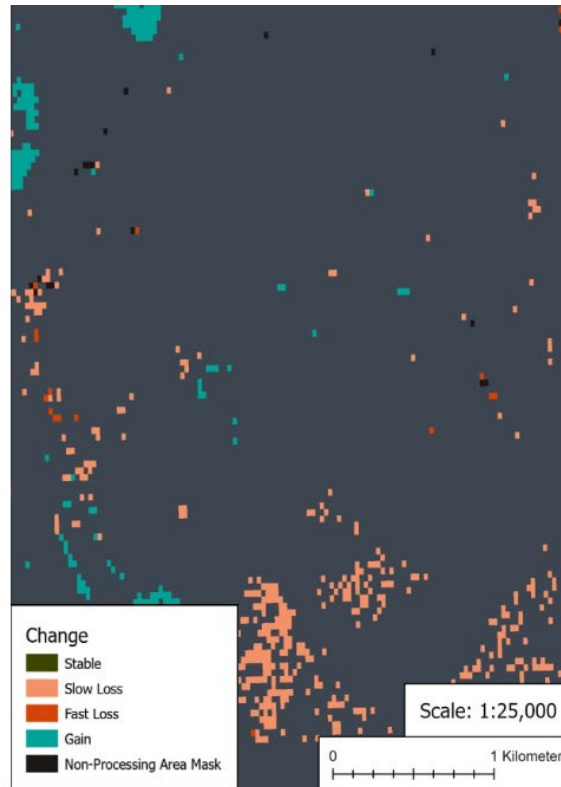
2020 WorldView Imagery of Thompson Falls, Montana

Landscape Change Monitoring System (LCMS)

- [LCMS](#)
- Annual
- Spatial Resolution: 30m
- Imagery: Landsat and Sentinel 2
- Method: Trend analysis
- Dates from 1985-Present



Landscape Change Monitoring System (LCMS)

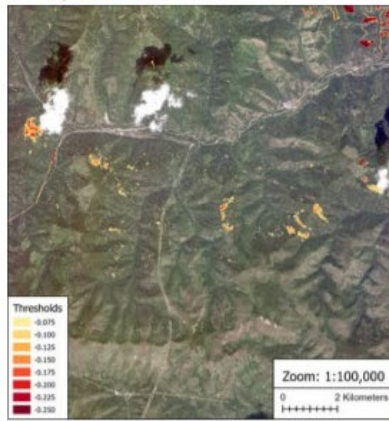


2020 LCMS output near Thompson Falls, Montana

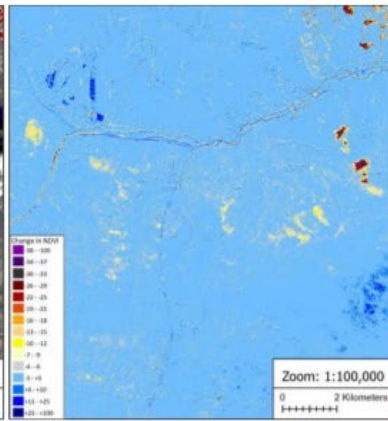


2020 WorldView Imagery of Thompson Falls, Montana

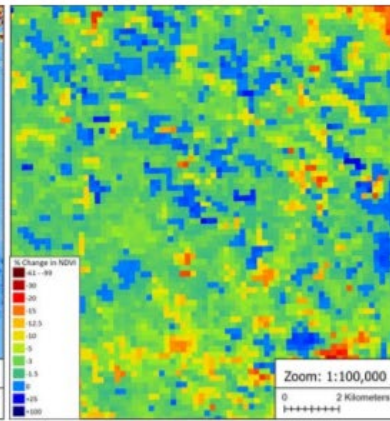
1:100,000 scale



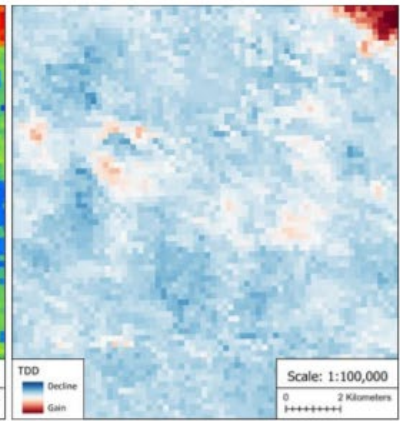
DeltaViewer



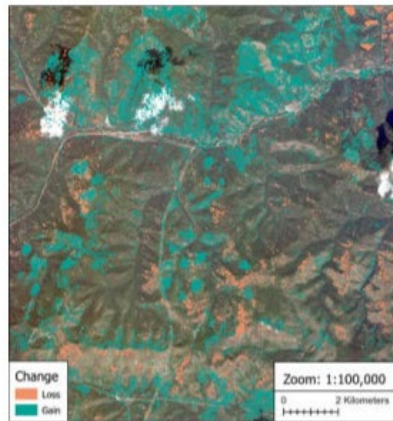
HiForm



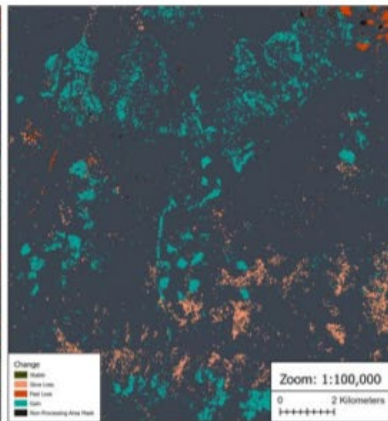
ForWarn II



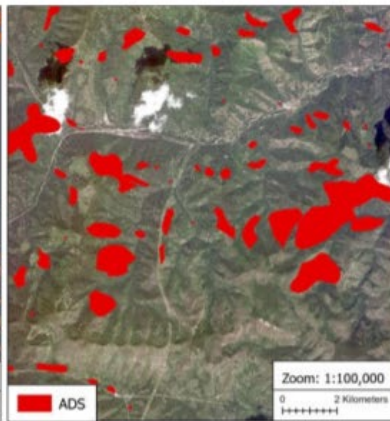
LAMDA



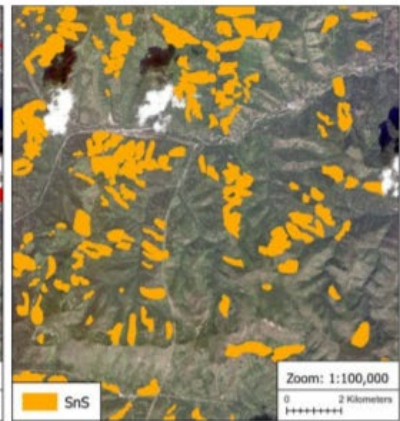
LandTrendr



LCMS

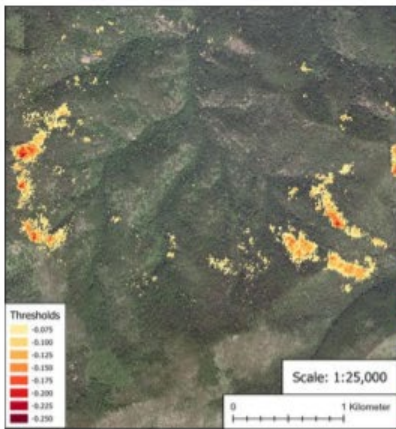


ADS

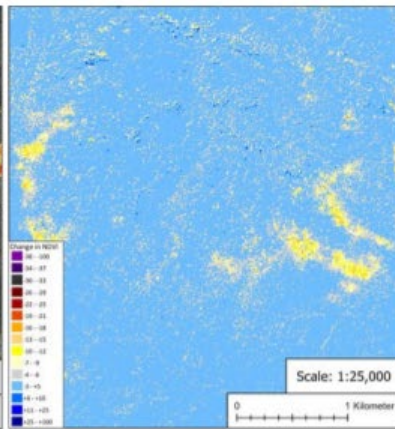


Scan and Sketch

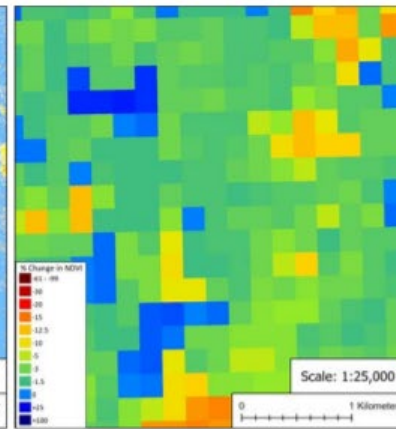
1:25,000 scale



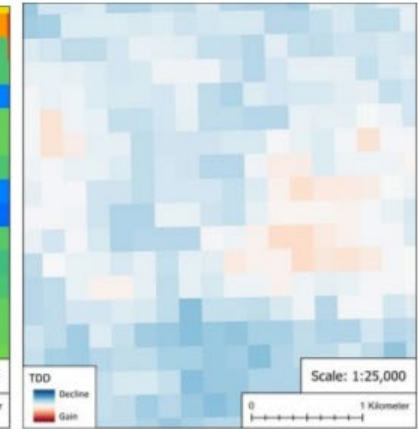
DeltaViewer



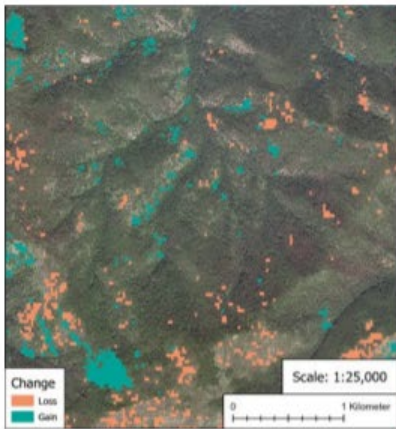
HiForm



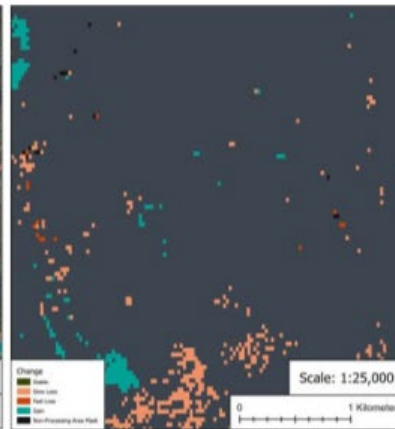
ForWarn II



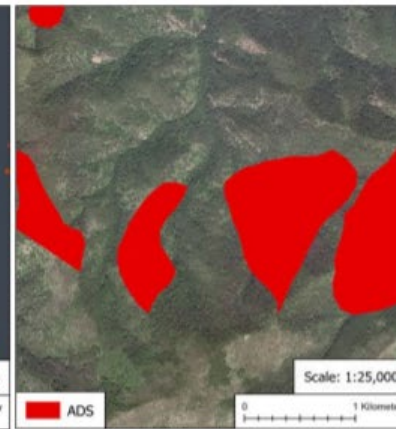
LAMDA



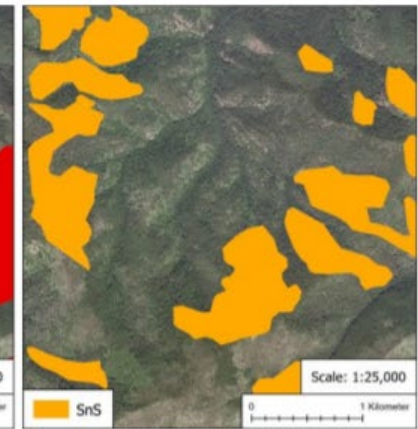
LandTrendr



LCMS



ADS



Scan and Sketch

GTAC Remote Sensing Contacts

| Point of Contact | Specialization | Email |
|------------------|--|--|
| Indigo Catton | Image interpretation, data portals, ArcGIS Pro, segmentation | indigo.catton@usda.gov |
| Kain Kutz | Object-based Image Analysis, Raster Geoprocessing, UAS | kain.kutz@usda.gov |
| Lila Leatherman | Change detection, Image classification, R & Earth Engine scripting, modeling | Lila.L Leatherman@usda.gov |
| Jeremy Webb | Aerial Photography, Photogrammetry, UAS | jeremy.webb@usda.gov |
| Mark Hammond | ERDAS and Data Services, Photogrammetry | mark.hammond@usda.gov |
| Shiona Howard | Lidar Acquisition, Analysis, and Support, Python scripting | Shiona.Howard@usda.gov |

[Geospatial Training and Awareness page](#)

GTAC Remote Sensing Contacts

| Areas of expertise | Name | Contact |
|---|------------------|----------------------------|
| Land cover classification, geospatial scripting in R and Google Earth Engine | Juliette Bateman | Juliette.bateman@usda.gov |
| Image interpretation, data portals, ArcGIS Pro, segmentation | Indigo Catton | Indigo.catton@usda.gov |
| Change detection, scripting in R and Google Earth Engine, machine learning, forest health | Jamie Chaitman | Jamieson.chaitman@usda.gov |
| Lidar data acquisition and analysis, python scripting | Shiona Howard | Shiona.howard@usda.gov |
| Change detection, scripting in R and Google Earth Engine, machine learning, forest health | Lila Leatherman | Lila.leatherman@usda.gov |
| eCognition, image segmentation, image classification | Wyatt McCurdy | Wyatt.mccurdy@usda.gov |
| Habitat suitability modeling, scripting in R and python, ArcGIS desktop | Marie Schleicher | Marie.schleicher@usda.gov |
| Aerial photography, photogrammetry, UAS | Jeremy Webb | Jeremy.webb@usda.gov |

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Questions?

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