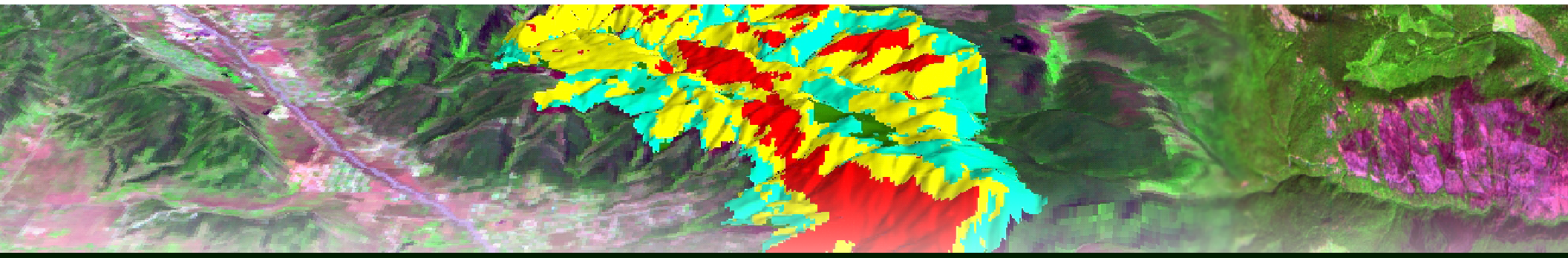

The Monitoring Trends in Burn Severity Project

Establishing a Nationwide Baseline of Historical Burn Severity Data to Support Monitoring of Wildfire Effects and National Fire Policies

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MTBS Background

- Sponsored by the Wildland Fire Leadership Council (WFLC)
  - One element of a strategy monitoring the effectiveness of NFP and HFRA
    - WFLC 2004 Monitoring Proposal, Module 2.1
  - Requires a consistent information base to synoptically assess environmental impacts and trends
  - Required for all lands in conterminous US, AK, and HI
- GAO recommendation that land management agencies develop and implement comprehensive burn severity assessments
- Jointly implemented by USGS EROS and USFS RSAC

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MTBS Objectives

- Primary objective: Provide information for a national analysis of trends in burn severity for the NFP
- Secondary objective: Provide consistent and comprehensive data characterizing wildfire effects to land managers and the scientific community

MTBS Project Definition of Burn Severity

- National Wildfire Coordination Group (NWCG)
  - **Fire Severity**

    Degree to which a site has been altered or disrupted by fire; loosely, a product of fire intensity and residence time.
    see also: Burn Severity

MTBS Project Definition of Burn Severity

- Additional Characteristics
  - Composite of 1st/2nd order fire effects on biomass
  - Occurs on a gradient or scale (ordinal)
  - Characterized w/n a fire perimeter
  - Occurs within strata
  - Longer term effects are complicated by multiple variables that MTBS is not characterizing
  - Map-able
  - Remote sensing provides a measurement framework

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MTBS Products

- Burn severity data on all fires >1000 ac west of the 97th meridian and >500 ac east (1984-2011)
  - 16 bit continuous
  - 5 class thematic (unburned/undetectable, low, moderate, high, increased response)
- Fire perimeters
  - Shape files
- Tabular data summarizing burn severity acres by class
  - Additional stratification by vegetation type, treatment zones, condition classes, etc.
- Metadata
- 'normalized' historical fire history database
- Greatly expanded Landsat data archive

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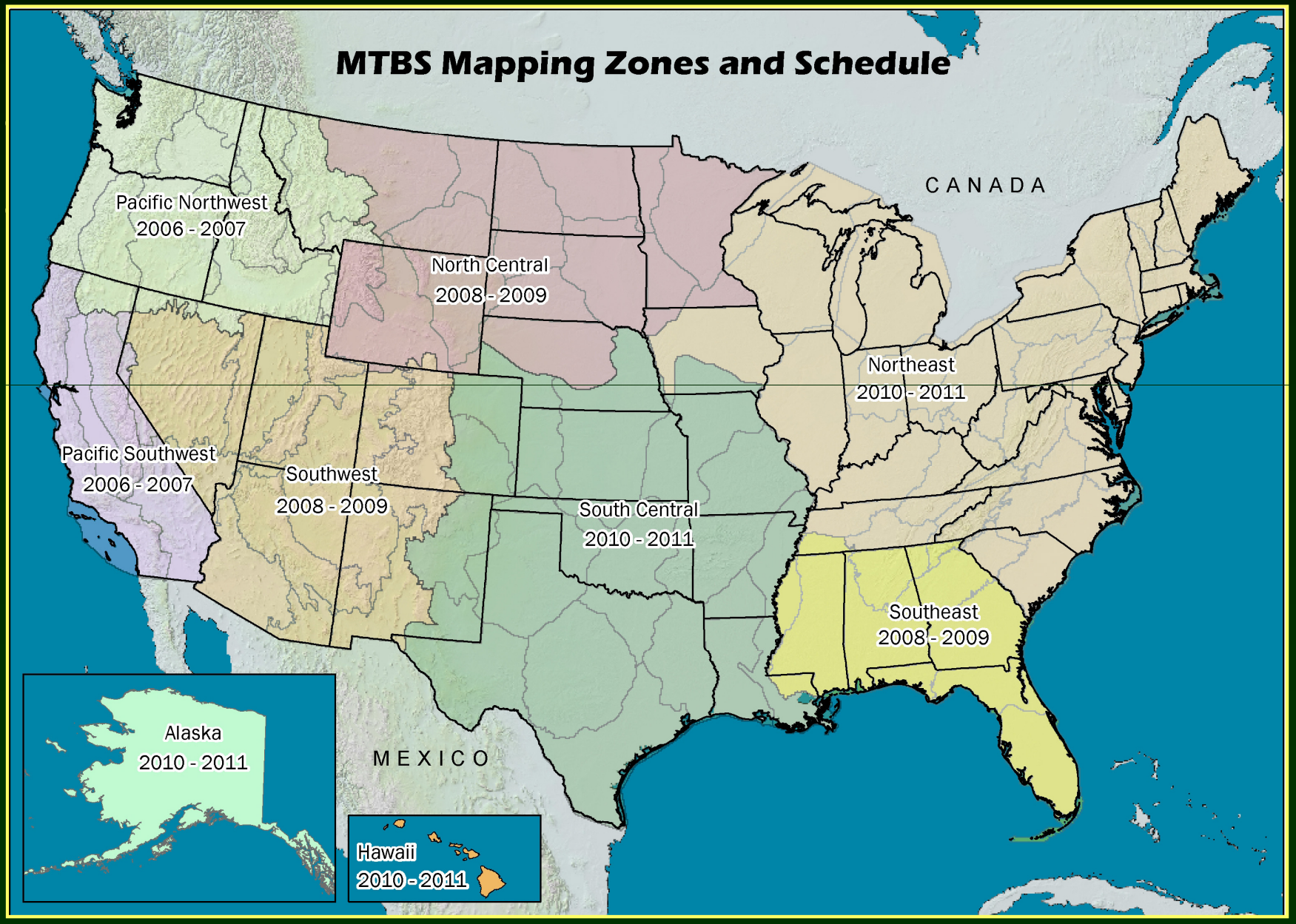
MTBS Schedule



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MTBS Methods

Burn severity products are based on Landsat data and the differenced Normalized Burn Ratio (dNBR) approach

NBR = (NIR – Mid IR) / (NIR + Mid IR)
dNBR = pre NBR – post NBR

- Mature science established in the literature
  - Lopez-Garcia and Caselles, 1991; Brewer et al., 2005; Cocke et al., 2005; others
- Operational precedent
  - Implemented by Key and Benson for development of NPS fire atlases
- Landsat data record
  - Consistent data record spanning ecologically and possibly climatically significant time frame
- Resolution synergy
  - Spatial and spectral resolutions comparable to other national scale data

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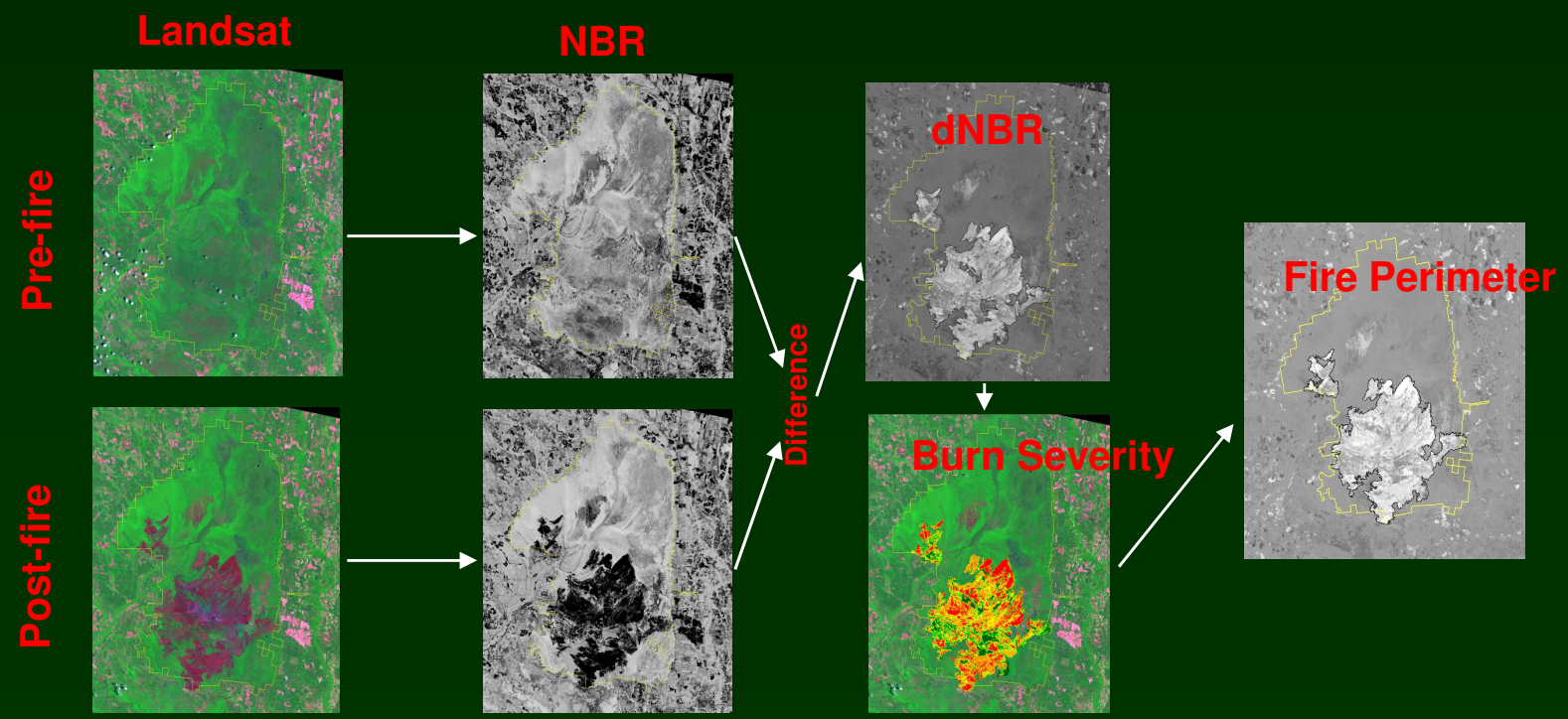
MTBS Method Outline

1. Compile a single MTBS fire occurrence database from existing sources
2. Based on fire occurrence database, select pre and post-fire Landsat scenes
3. Data processed at EROS-terrain correction through NBR calculations
4. EROS and RSAC analysts perform differencing, threshold dNBR images into burn severity classes, and delineate perimeters
5. Data summary trend analysis, and reporting



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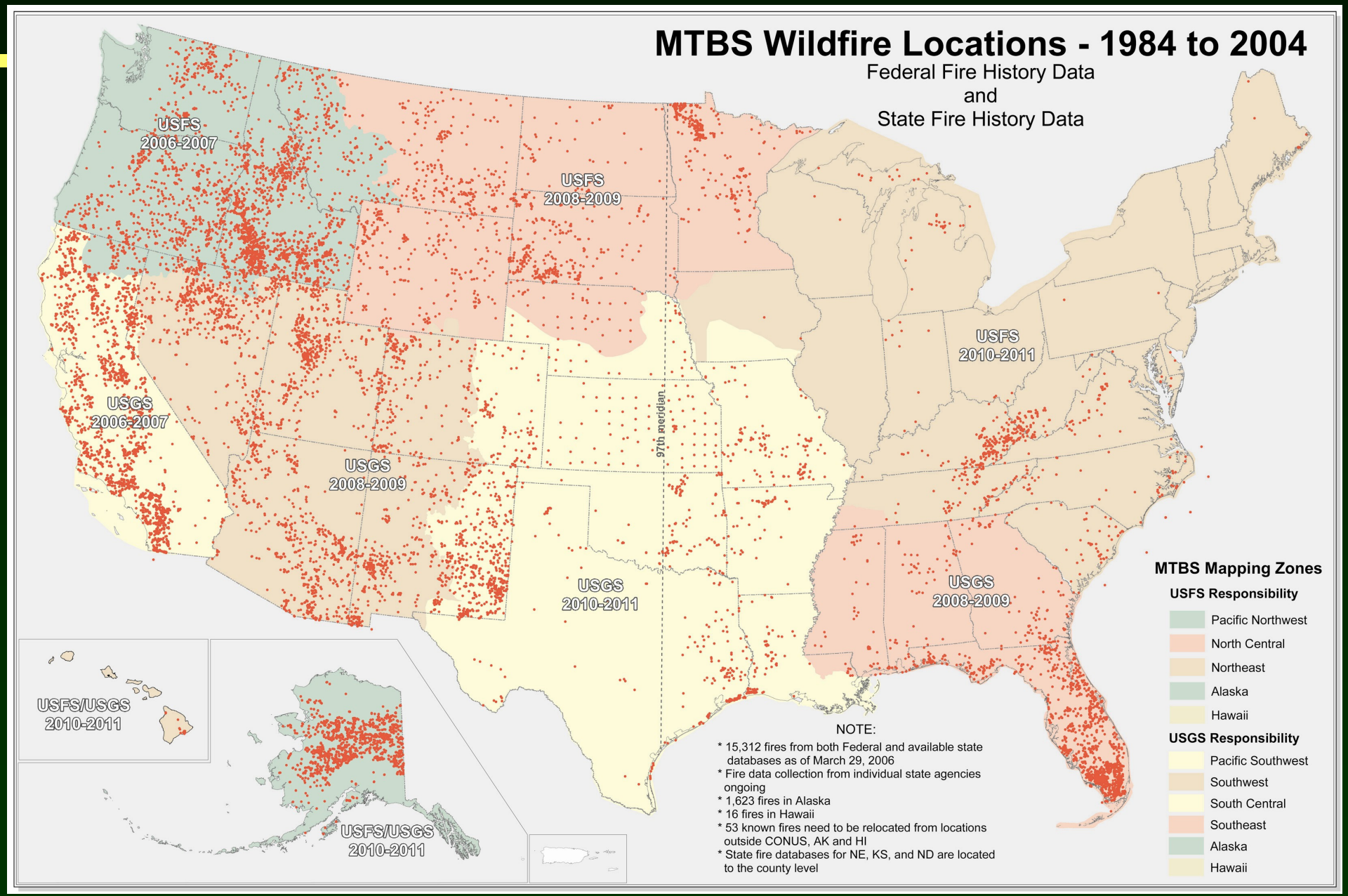
MTBS Method-Fire History DB

- Existing federal and state fire occurrence databases have been compiled
  - Federal fire history database (GTG)
    - Compiled from ICS209 database
  - Most state databases
- Standardized to address format and content variability
  - Core fire data harvested (fire name, database id, start data, containment date, fire size)
  - Unique MTBS id assigned that links to database of origin
- 15000+ records
  - Numerous duplicates and spatial anomalies



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MTBS Method-Scene Selection

- Scene selection based on fire location/date, cloud-free availability, and optimal seasonality
  - Extended assessments on forest and shrublands
  - Grassland burn severity and perimeters based on immediate post-fire assessment
- USGS Global Visualization Browser (GLOVIS)
  - MTBS driven enhancements include input of user supplied shape files and dynamic NDVI graph popups

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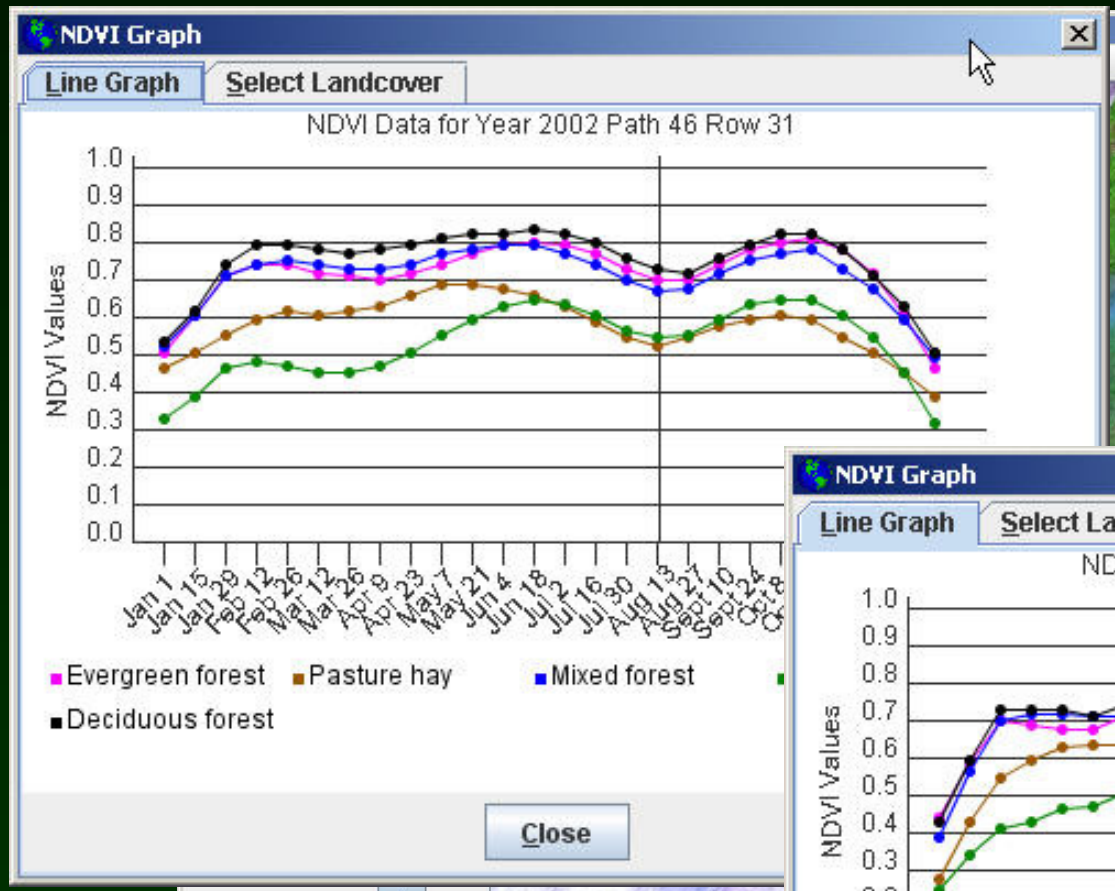
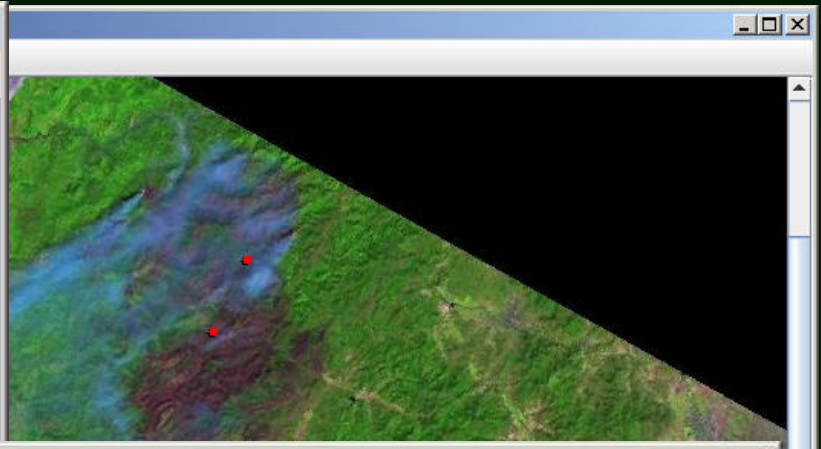
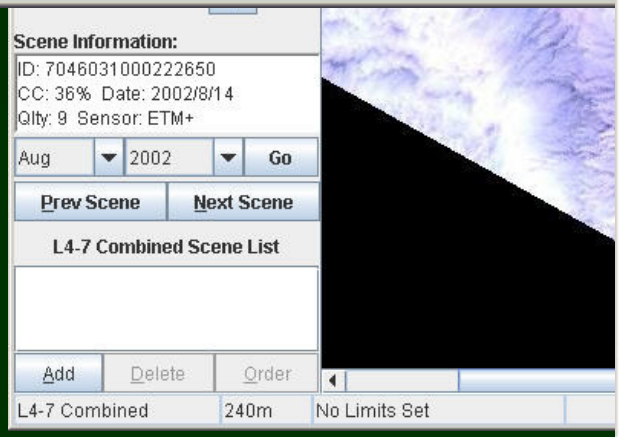
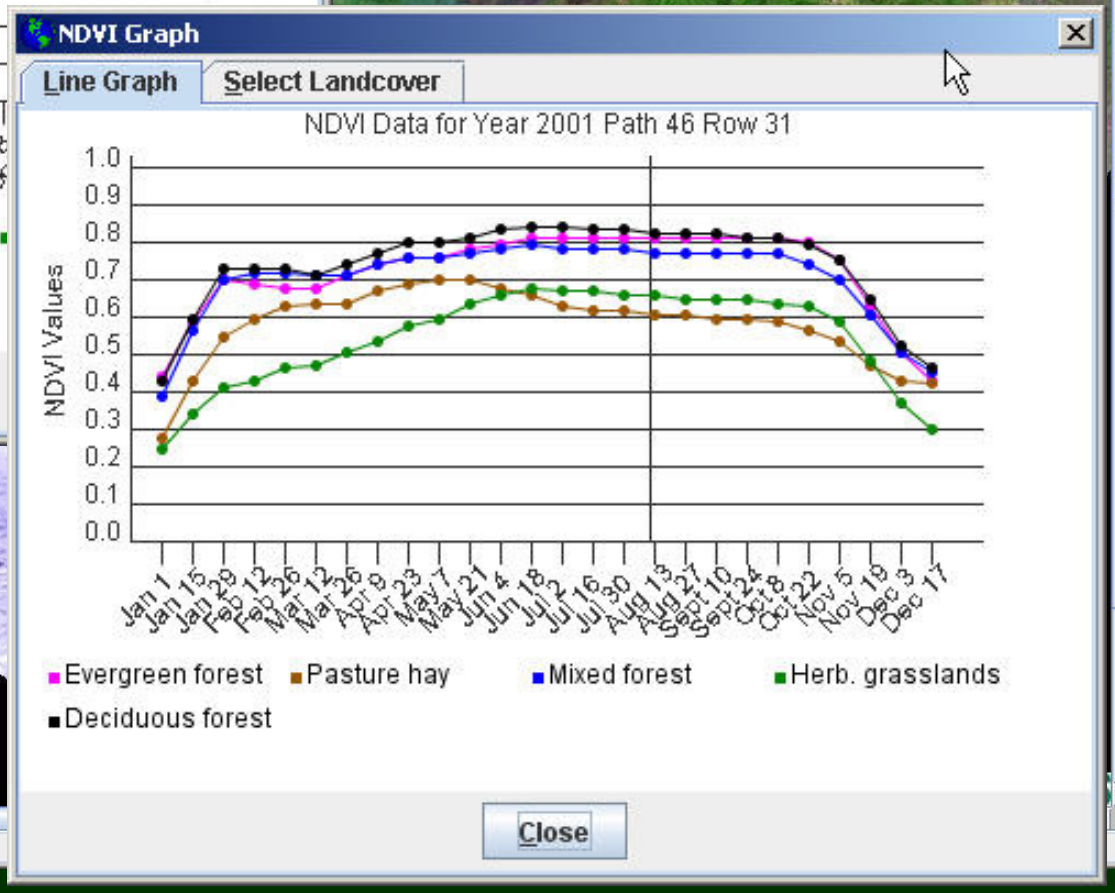
GLOVIS Scene Selection









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MTBS Methods - Data processing

MTBS Analysts submit data orders to EROS

↓

Data are terrain corrected using National Land Archive Production System (NLAPS)

↓

NLAPS images calibrated to At-Satellite reflectance

↓

NBR images derived from reflectance images

↓

Data are delivered to MTBS analysts for mapping, analysis, and reporting

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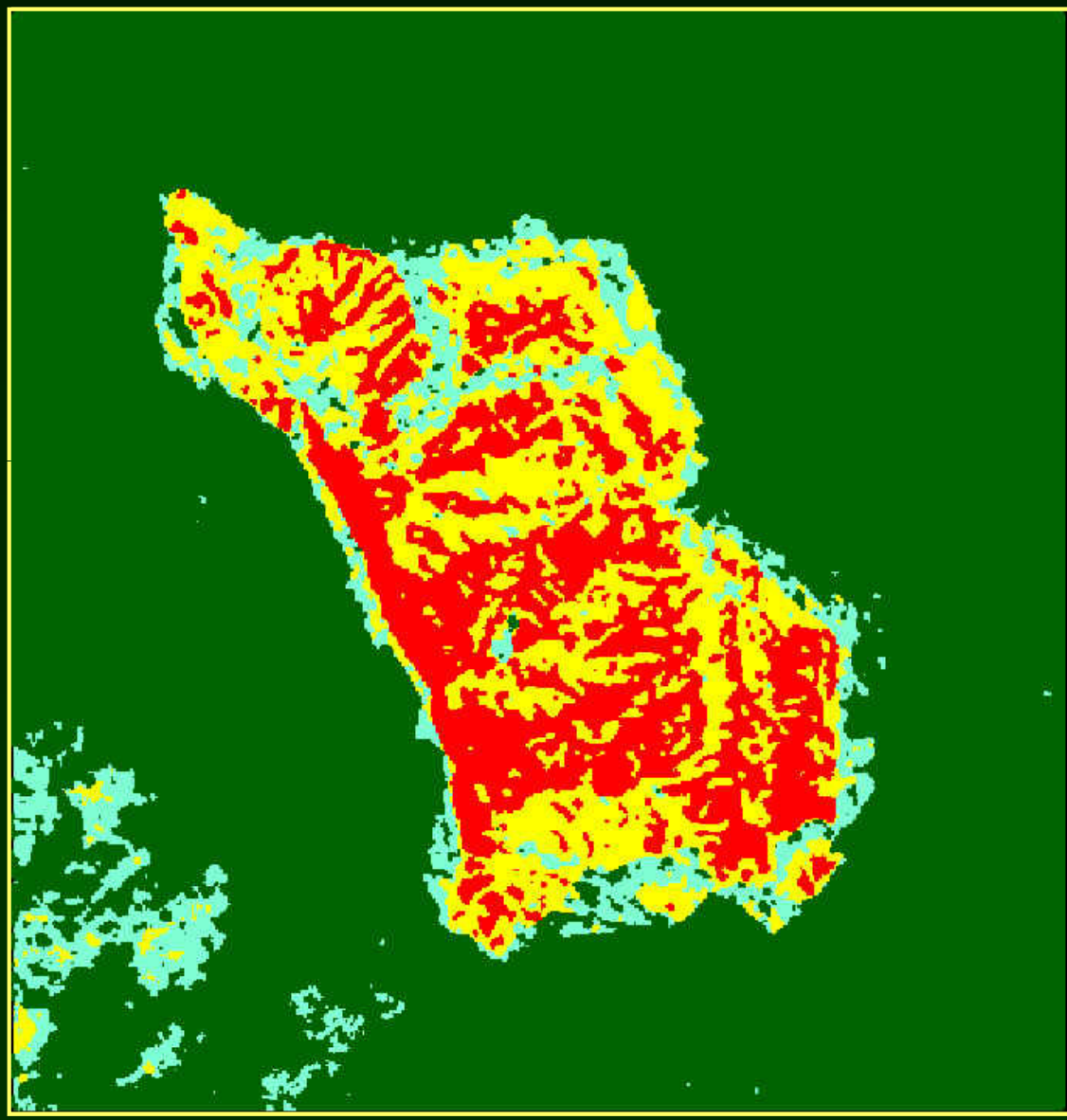
MTBS Methods - Burn Severity Map Development

- Differenced NBR images are interpreted to derive severity classes
- Analysts use existing Composite Burn Index (CBI) thresholds (Key, 2001) as guidance for choosing severity thresholds



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MTBS Methods - dNBR Thresholding

Two approaches

- Thresholds based on ecological interpretation and use of existing ancillary data, e.g. CBI plots
  - Can be intuitive
  - Most subjective and dependent on familiarity with site ecology
  - Relevance of interpretations/thresholds is dependent on analysis and management objectives
- Arithmetic partitioning
  - Has no intended relevance to a specific management objective
  - Offers greatest flexibility for trend analysis
  - Offers greatest flexibility for consistent analysis of historic data

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MTBS Methods - Perimeter Delineation

- Perimeters digitized around dNBR
- Incident perimeters do not directly affect delineation
- Goal is to utilize a consistent method and data to derive perimeters
- Perimeter confidence levels included as feature level metadata

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MTBS Trend Analysis

Trend and Pattern Analysis Process

- Trends and patterns characterized across:
  - Time
  - Space
  - Policy
- MTBS analysis will focus on pattern characterization, summarization, and reporting
- Explanatory analysis and causation are longer term activities best handled by the research and specialized user communities

MTBS Technology Transfer, Training, and Feedback Opportunities

- Multi-faceted approach
  - Web availability of documents and powerpoints beginning in 06
  - Workshops to enhance understanding of burn severity maps and appropriate applications
  - Web-based modules to describe data and applications
  - Findings from analysis of national trends documented and published in peer-reviewed journals
  - Web and workshop environments in addition to ad hoc opportunities will be used as feedback mechanism to project team

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MTBS Challenges and Limitations

- Continued availability of LANDSAT data
- Ability of dNBR to characterize fire effects across a wide range of ecological conditions
- Assessment timing relative to severity characterization and perimeter delineation
- Reporting unit sensitivity-minimum logical reporting unit?
- Accuracy assessment
- Large project responsiveness
- …

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MTBS Potential applications

- Event specific fire effects analysis…?
- Land management impact assessment
  - Fuels and silvicultural treatments
  - Grazing
  - Prescribed and wildland use fires
- Post-fire habitat impact assessment
- Fire safety risk assessments
- Fire related change data for targeted updates of similar scale landcover and fuels layers
- On and on…

Example Application

Using historical trends in burn severity, and existing fuel and landscape attributes, the Salmon-Challis NF is identifying some of the most dangerous wildland firefighting risks in the Western United States: crown fire and extreme fire behavior.

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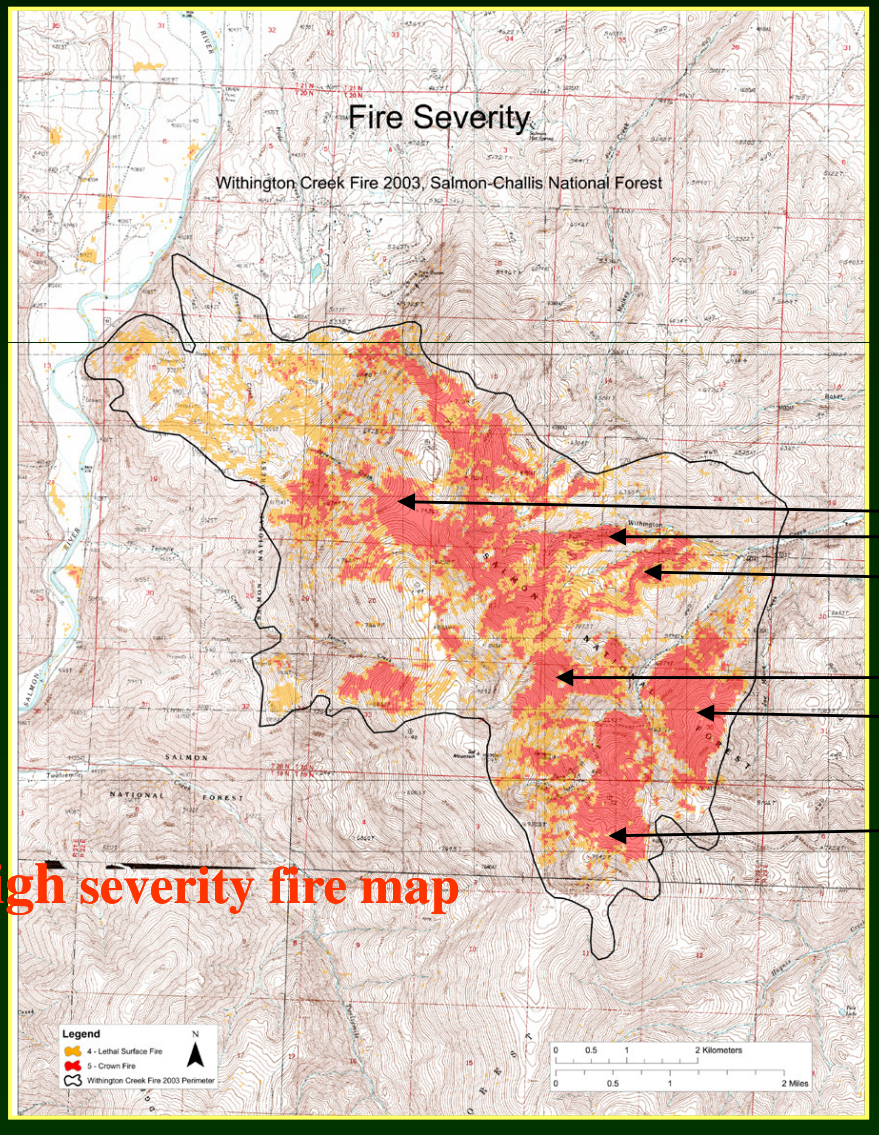
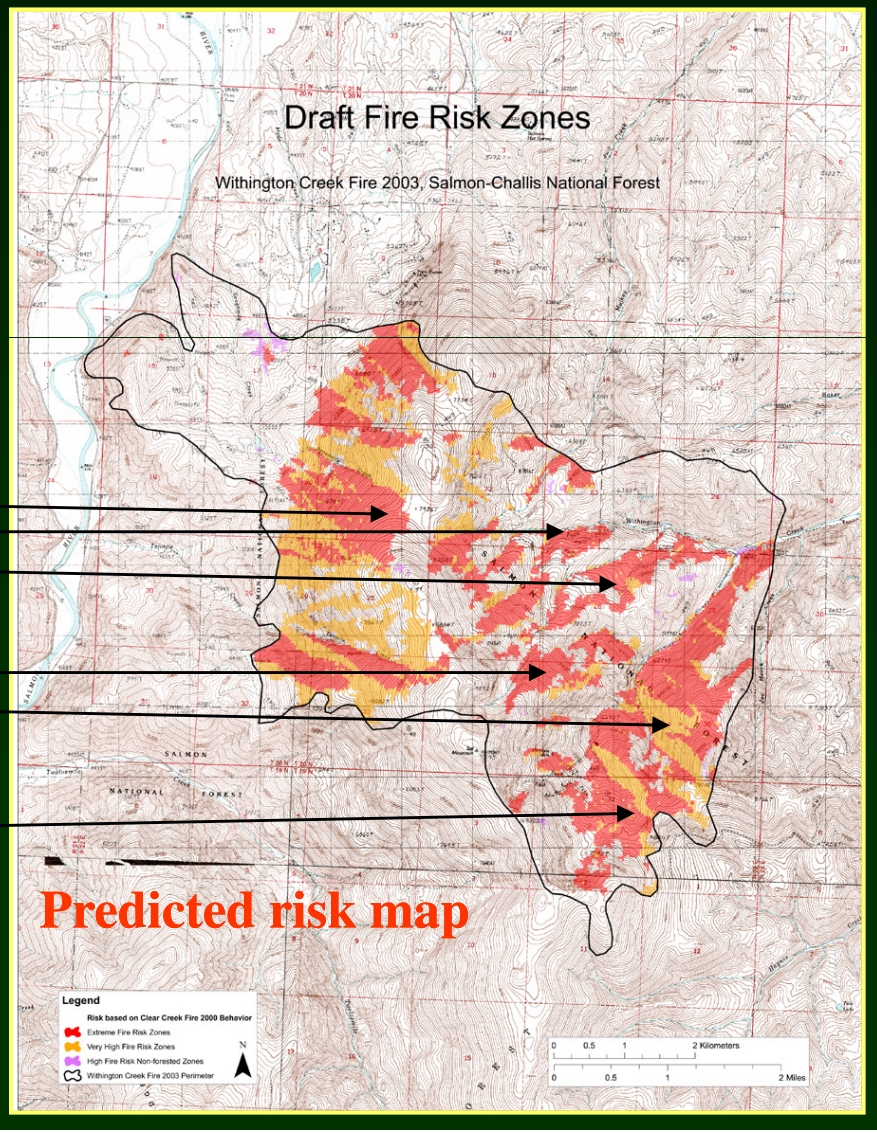
Example Application

Withington Fire 2003: Very strong correlation of the predicted Extreme/High Risk Zones to actual lethal and crown fire occurrence.



High severity fire map



Predicted risk map

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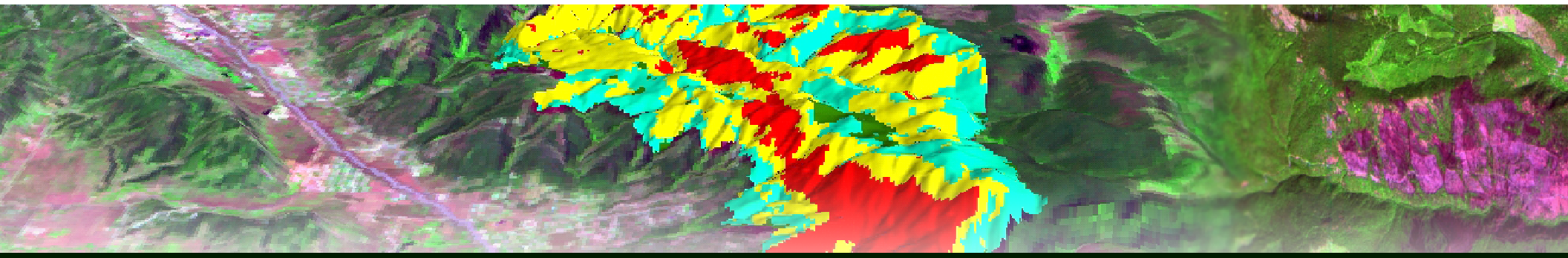

MTBS Contact Information

Project Leads

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Science Leads

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Web presence coming soon...
http://www.fs.fed.us/eng/rsac
http://edc.usgs.gov

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