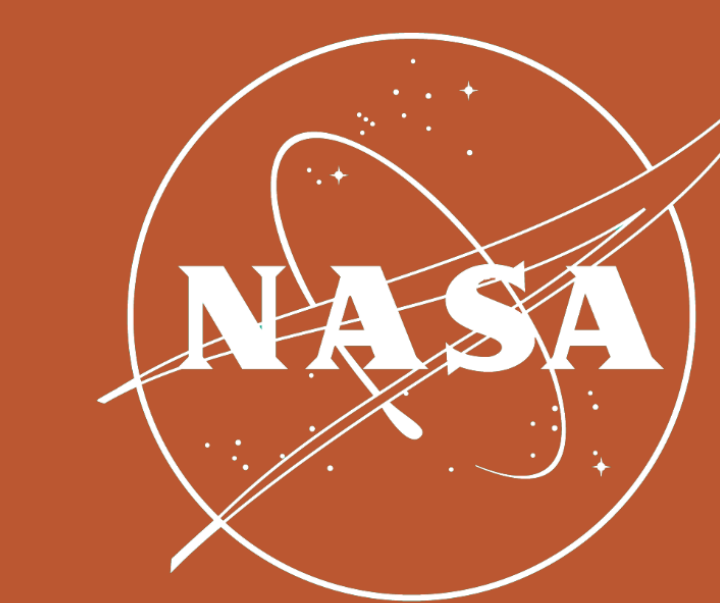# CALIFORNIA DISASTERS

Assessing the Effectiveness of Simulated HyspIRI Data in USDA Forest Service Post-Fire Vegetation Assessment and Decision Support

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NASA DEVELOP National Program, John C. Stennis Space Center

Objectives

- Demonstrate potential of HyspIRI's hyperspectral capabilities for wildfire damage assessments, e.g. Burned Area Reflectance Classification (BARC) maps generated from simulated HyspIRI data.

- Evaluate the additional usefulness of HyspIRI data versus Landsat data for USDA Forest Service's post-fire vegetation assessment.

- Provide insight into potentially useful vegetation assessment/monitoring tools that utilize simulated HyspIRI hyperspectral data to agencies such as the USDA Forest Service.
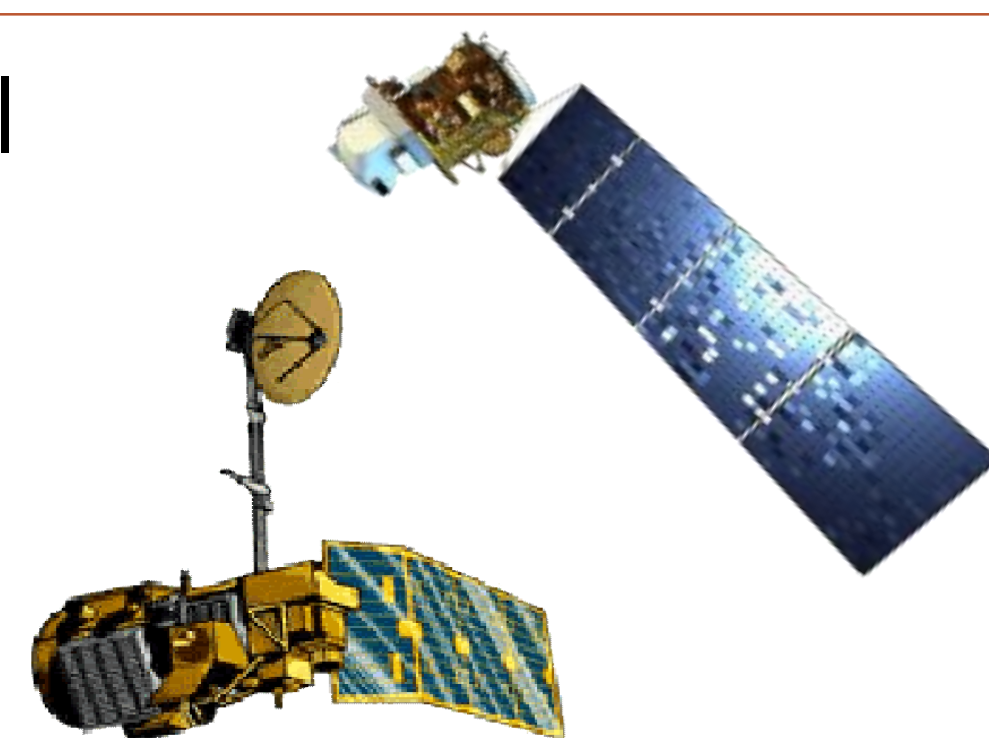
Abstract

Currently, the USDA Forest Service (USFS) has remote sensing programs in place to map and characterize vegetation and soil impacts due to major wildfires (e.g., the Burned Area Reflectance Classification (BARC) and the Rapid Assessment of Vegetation Condition (RAVG)). These programs use pre- and post-fire dates of Landsat-based burn severity indices to generate needed change products, including the differenced Normalized Burn Ratio (dNBR) and the Relative differenced Normalized Burn Ratio (RdNBR). When the Hyperspectral Infrared Imager (HyspIRI) is launched, its hyperspectral and thermal data will enable new tools for assessing natural disaster impacts to ecosystems, such as wildfire damage to forests. In response, this project was conducted to assess HyspIRI's potential for aiding wildfire damage assessments. In doing so, we calculated several burn severity products (i.e., dNBR) from simulated HyspIRI data collected over central California in 2013. Geographic coverage included the 2013 Rim Fire, the 3rd largest fire in California's history, as well as California's 2013 Aspen Fire. Results suggest HyspIRI can produce post-fire vegetation burn severity products similar to those currently being produced by the USFS with Landsat data. This study also explored HyspIRI's hyperspectral capabilities for generating alternative burn severity products and environmental monitoring indices that may enhance and augment needed information currently obtained from BARC and RAVG products. Additional work is planned to explore the potential of HyspIRI's thermal bands for aiding wildfire burn severity assessments.
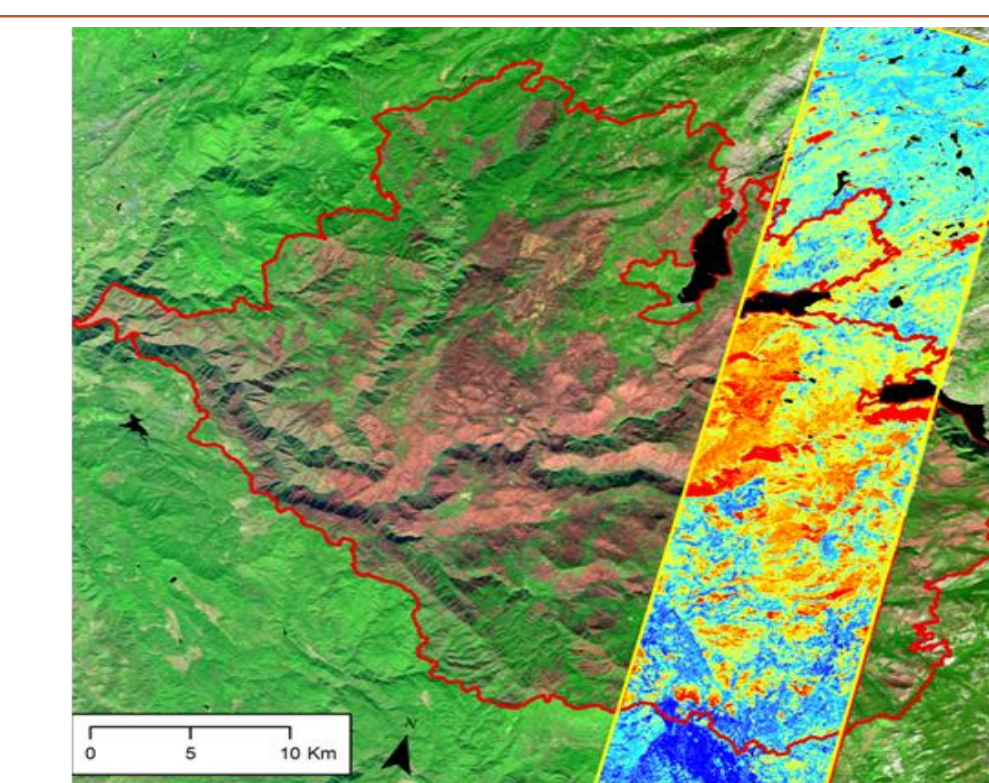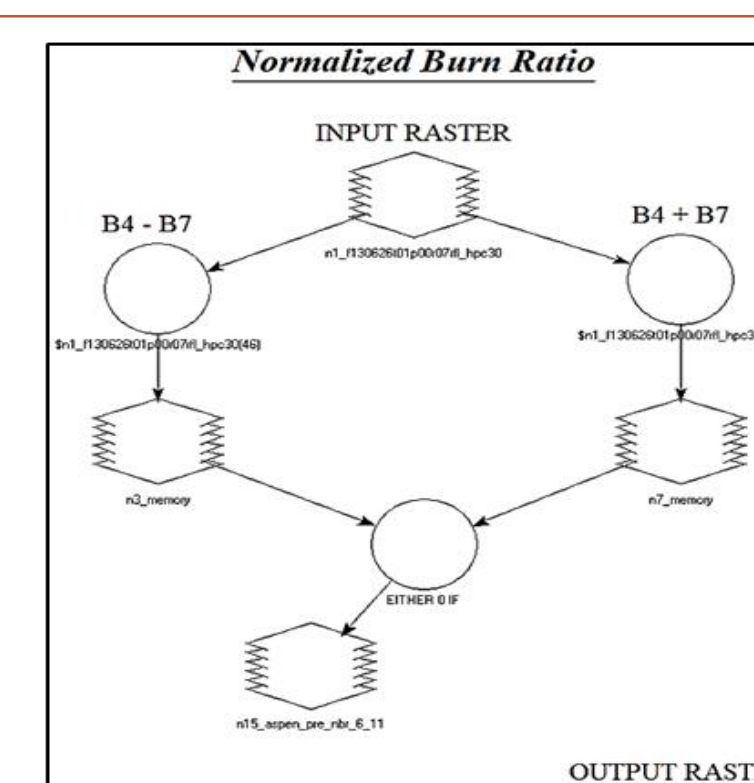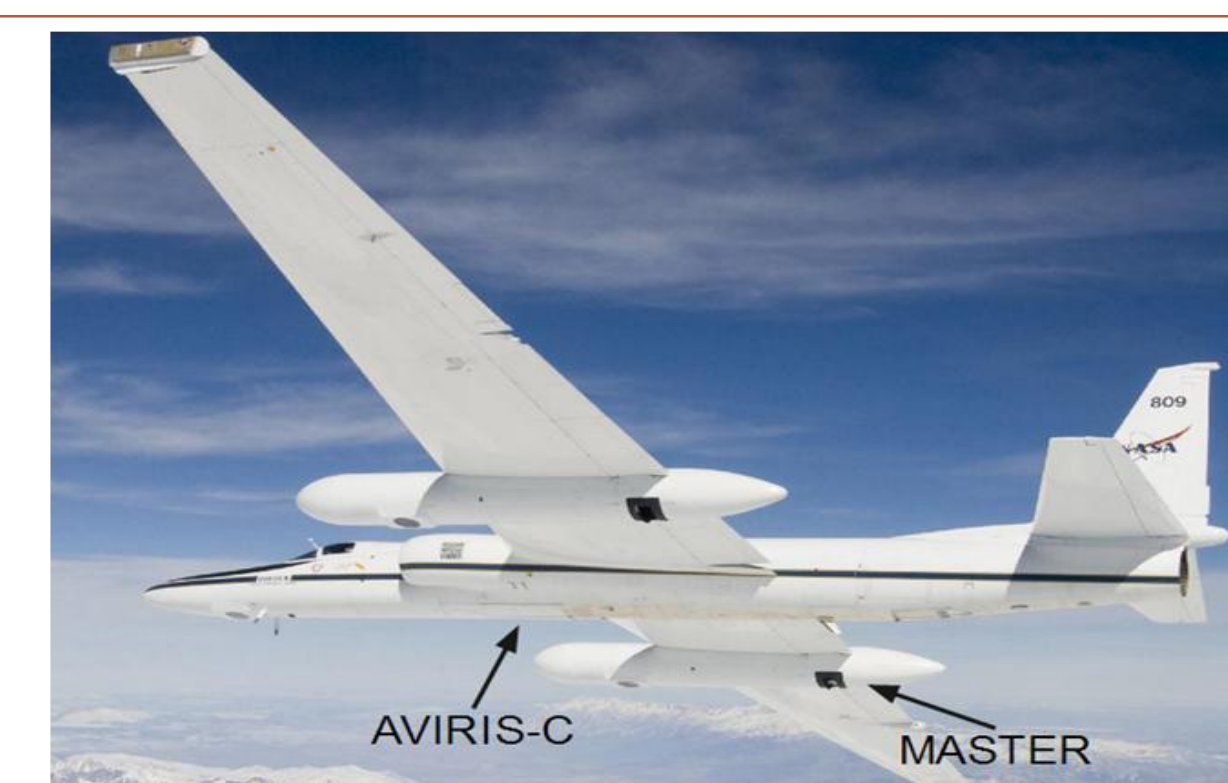
Study Area

▲ Rim Fire

◀ Aspen Fire

Earth Observations

- Simulated HyspIRI
- AVIRIS
- MASTER
- Landsat 5 TM
- Landsat 8 OLI

Project Partners

- **USDA Forest Service**
  - Remote Sensing Applications Center
  - Eastern Forest Environmental Threat Assessment Center

Methodology

Simulated HyspIRI and AVIRIS data were obtained from the Jet Propulsion Lab (JPL).

Burn severity indices were calculated using ENVI and ERDAS Imagine software.

Final map imagery was produced using ESRI ArcMap software.

$$\text{Shorter Red Edge Burn Index (SREBI)} = \frac{(SSWIR - Red\ Edge)}{(SSWIR + Red\ Edge)}$$

$$\text{Normalized Difference SWIR (NDSWIR)} = \frac{(NIR - SWIR)}{(NIR + SWIR)}$$

SSWIR = Shorter Shortwave InfraRed   *NIR* = Near Infrared   *SWIR* = Shortwave InfraRed

Team Members

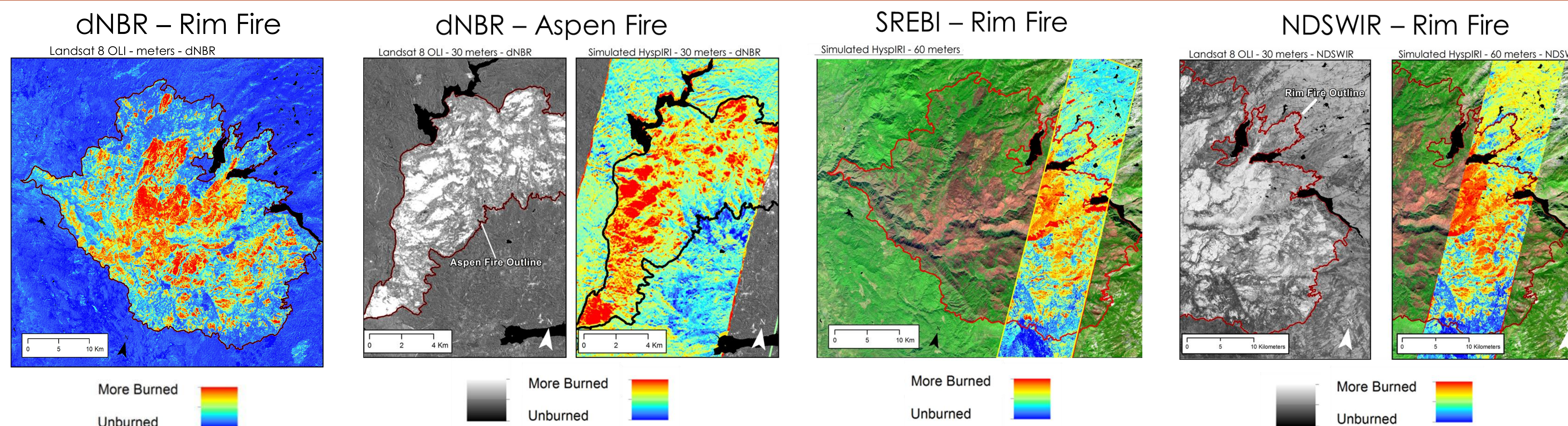L to R: Heather Nicholson, Eric Mack, Luke Wylie, Caitlin Ruby, & Tim Sutherlin

Acknowledgements

Results

dNBR – Rim Fire

Landsat 8 OLI - meters - dNBR

More Burned / Unburned

dNBR – Aspen Fire

Landsat 8 OLI - 30 meters - dNBR   Simulated HyspIRI - 30 meters - dNBR

Aspen Fire Outline

More Burned / Unburned

SREBI – Rim Fire

Simulated HyspIRI - 60 meters

More Burned / Unburned

NDSWIR – Rim Fire

Landsat 8 OLI - 30 meters - NDSWIR   Simulated HyspIRI - 60 meters - NDSWIR

Rim Fire Outline

More Burned / Unburned

Conclusions

- Differenced Normalized Burn Ratio (dNBR) products from simulated 60 meter HyspIRI data are visually comparable to those produced from Landsat.

- Alternative burn severity indices from single-date post-fire simulated HyspIRI imagery, such as the Normalized Difference Shortwave Infrared Index (NDSWIR) and the Shorter Shortwave Red Edge Index (SREBI), also show relative differences due to burn severity.

Suggested Future Work

- Research into use of simulated HYSPIRI thermal data for computing burn severity assessment products.

- Quantitative product evaluation, including comparisons to in-situ observations of burn severity.

- Research into potential of simulated HyspIRI data for detecting and monitoring other forest disturbances.