Southern California Disasters II

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The USDA Forest Service (USFS) has multiple programs in place which primarily utilize Landsat imagery to produce burn severity indices for aiding wildfire damage assessment and mitigation. These indices provide widely-used wildfire damage assessment tools to decision makers. When the Hyperspectral Infrared Imager (HyspIRI) is launched in 2022, the sensor's hyperspectral resolution will support new methods for assessing natural disaster impacts on ecosystems, including wildfire damage to forests. This project used simulated HyspIRI data to study three southern California fires: Aspen, French, and King. Burn severity indices were calculated from the data and the results were quantitatively compared to the comparable USFS products currently in use. The final results from this project illustrate how HyspIRI data may be used in the future to enhance assessment of fire-damaged areas and provide additional monitoring tools for decision support to the USFS and other land management agencies.

Introduction

There has been an increase in the number of wildfires in California due to drought and warmer weather. In 2014, approximately 5,500 wildfires burned more than 90,000 acres in California. An increase in wildfires can lead to soil erosion, expansion of invasive plant species, and loss of property and life. It is necessary to be able to quickly map the burn severity of a wildfire in order to mitigate its effects.

Objectives

- Use simulated HyspIRI data to produce wildfire burn severity and vegetation assessment products which are used to aid post wildfire remission and wild land restoration
- Quantitatively compare HyspIRI products to similar Landsat-based products generated by the USFS to assess and show how hyperspectral satellite data may help improve current capabilities.

NBR

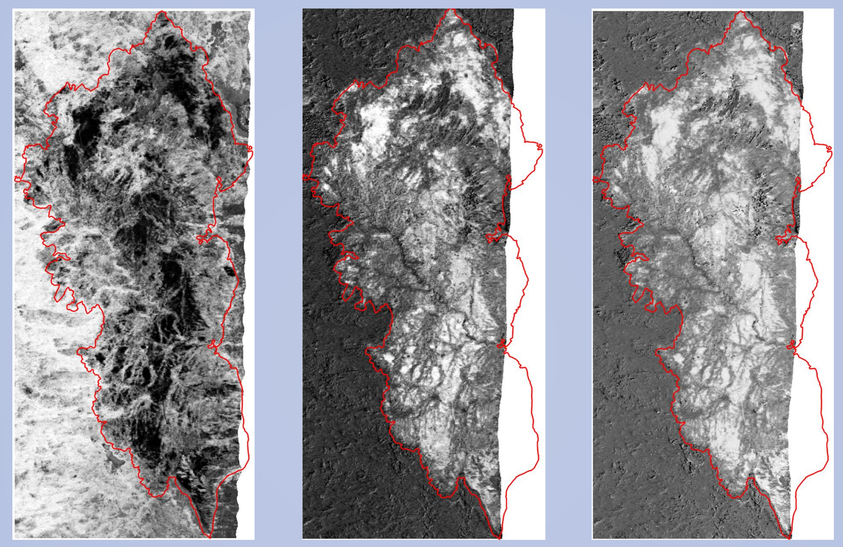
$$\frac{NIR - LSWIR}{NIR + LSWIR}$$

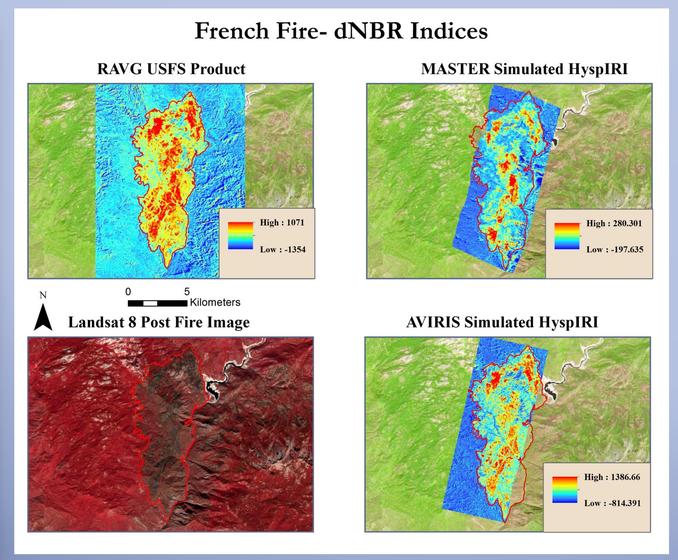
dNBR

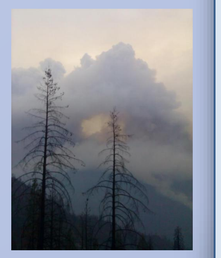
$$1000(NBR_{pre} - NBR_{post})$$

RdNBR

$$\frac{dNBR}{\sqrt{abs(NBR_{pre})}}$$







Field Images of French Fire
Images' Source: Inciweb

Outcomes

- Statistical analyses were performed in R. The indices were proved to have non normal distributions by Shapiro-Wilks tests.
- A Wilcoxon rank-sum test with continuity correction further suggested that there is a statistically significant difference between the indices.
- Spearman's rank correlation coefficient implied that all indices were strongly correlated to the ground truth data for the King Fire.

Spearman's Rank Correlation Coefficient Results for dNBR indices
Comparing index pixel values to ground-truthed GeoCBI data

Data set name for indices	P-value	Rho
RAVG dNBR King Fire	1.144e^-14	0.926
MASTER dNBR King Fire	1.344e^-11	0.880
AVIRIS dNBR King Fire	7.857e^-09	0.815

Summary

The results from this project suggest that future HyspIRI data will be a valuable data source for USFS post-fire decision support.

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