# Updating Spatial Datasets after a Landscape Altering Event

National Park Service

## Mapping Vegetation and fuel load change after the Rocky Top Fire at Shenandoah National Park

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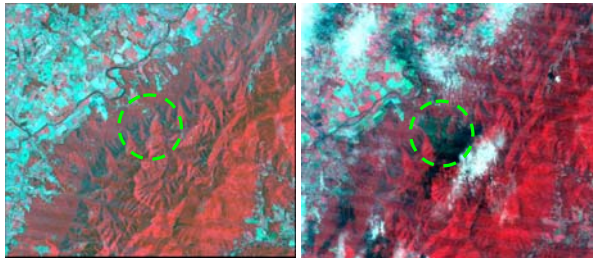
Introduction:
On the afternoon of June 21, 2002 a band of afternoon thunderstorms moved across the western facing slopes of Shenandoah National Park. That afternoon the Rocky Top Fire started from a lightning strike. Burning in a more remote section of the park but close to the park boundary, National Park Service personnel began what would be a month long effort to contain the Rocky Top Fire which would ultimately burn nearly 1500 acres of forest. Unlike most Eastern US wildland fires that burn slowly along the ground, a severe crown fire, fuel by a dense understory of Mountain Laurel occurred.

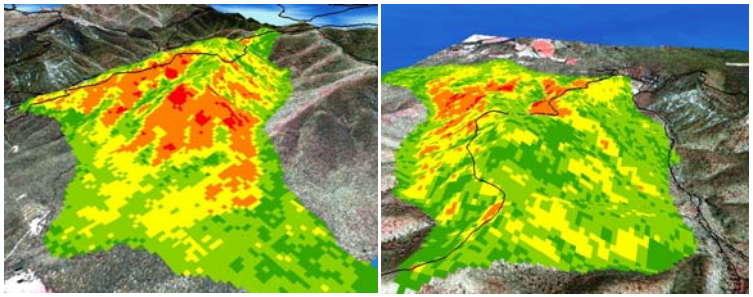


Landsat TM images, pre-fire June 30, 2001 and post-fire July 6, 2003.

Objectives:
To investigate several remote sensing techniques and determine the better suited at differentiating between areas of different burn severities.
Using the better suited technique, correlate those results with documented vegetation and fuel load return rates, to facilitate the creation of updated geospatial datasets.

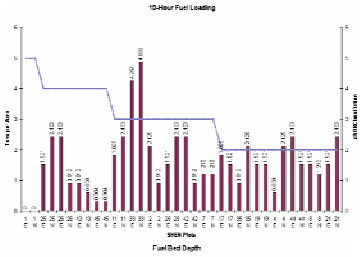
Research Methods:
Three remote sensing techniques were investigated; the NBR data transformation, the NDVI index and the Tasseled Cap data transformation. The NBR utilizing Landsat TM Bands 4 and 7 is an excellent indicator of not only burned areas, but at quantifying the burned areas as well, especially when compared to the NDVI and Tasseled Cap methods. Living vegetation is reflected by Landsat TM band 4, while band 7 is absorbed, as a result bands 4 and 7 generally have a profound spectral response after a wildland fire. Band 4 reflectance (near infrared: 0.76-0.90 microns) decreases after a fire, and Band 7 reflectance (mid-wave infrared: 2.08-2.35 microns) increases after a fire. The difference between band 4 and 7 exhibited the greatest variation of change when compared to other bands therefore providing a good measure of a fires effect.

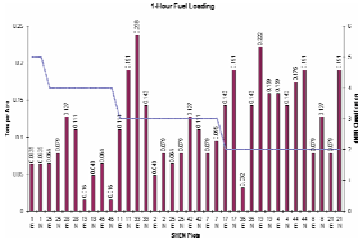
Field Work:
Field measurements were taken at 17 plots following the Brown's Transect's and Burgan-Rothermel Ocular Estimation guidelines. An inventory of, downed woody debris, leaf litter, duff, woody and non-woody vegetation as well as the percent coverage of tree, shrub, and grass species were taken for each plot. Due to time constraints and inaccessibility because of mountainous terrain, no field measurements were collected at plots located in areas classified as light surface burns or Class 1.

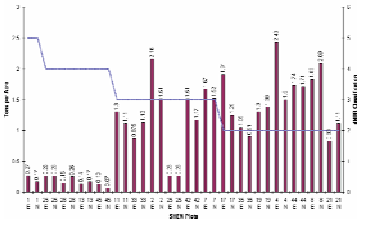


Using both a pre-fire and a post-fire Landsat TM image Band 4 was subtracted from Band 7 and divided by the sum of Band 4 and Band 7, then the two NBR images were subtracted from each other, and multiplied by 1000, with numbers scaled as outlined in the table below. Pixel values around zero represented unburned areas; a lower negative score represented areas of vegetation growth caused by a low intensity surface burn while the higher the positive pixel value, the more severe the burn event.

| dNBR Classification | | | |
|---|---|---|---|
| Enhanced Regrowth High | -500 to -251 | Low Severity | +100 to +269 |
| Enhanced Regrowth Low | -250 to -101 | Moderate-low Severity | +270 to +439 |
| Unburned | -100 to +99 | Moderate-high Severity | +440 to +659 |
| | | High Severity | +660 to +1300 |







Results:
Overall, the dNBR classification had an accuracy of 71% at indicating and quantifying the different burn severities that occurred at the Rocky Top Fire. Misclassification of burn severity occurred more in the unburned to lower severity classes, than the higher severity classifications. In all plots measured in dNBR class 3 severity, the post-fire vegetation documented was the same as the vegetation that existed before the fire. In plots measured in dNBR classes 4 and 5 severity, post-fire vegetation documented was dominated by pre-existing shrubs (Mountain Laurel) and early successional grasses. Furthermore, these plots had no measurable duff layer.

Pictures from plots in areas classified as NBR 4 (top) and 5 (bottom) .

Discussion:
The NBR technique shows promising results for use when correlating to updating fire fuel model spatial datasets. However, updating vegetation spatial datasets, using the NBR technique is less reliable because other environmental influences affect the rate of vegetation re-growth after a fire. Developed from Western US forest data does the existence (and removal) of the mid-story vegetation layer cause the NBR classification to exaggerate the effect of a wildland fire in the Eastern US? Does the removal of one type of vegetation by the fire, specifically Mountain Laurel, cause the NBR classification to exaggerate the fire's severity level because of Mountain Laurel's spectral reflectance values?

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