Evaluating High Resolution Hyperspectral Images for Determining Postfire Burn Severity. 01C-2-1-02. Peter Robichaud, Paul A. Maus, and Michael Parenti.

Problem: Mapping burn severity after wildfire events has been the focus of burn rehabilitation crews for decades. Burn severity can vary depending upon the type of fuel present and the duration of the fire in a given location, and is typically mapped as high, moderate or low. While these designations have been useful for rehabilitation efforts, they have been difficult to accurately map. Recently, remote sensing in the form of multi-spectral satellite imagery has been used to map burn severity. Although these tools have been useful for delineating burn extent and vegetation condition after a fire, their link to soil burn severity is not direct. As new remote sensing tools become available, it is necessary to test their capabilities on the ground and remotely to determine how they can improve upon existing methods. Newer hyperspectral sensors, with higher spatial and spectral resolution than multi-spectral satellite imagery, show promise for improving our capabilities of collecting direct, meaningful measurements of burn severity.

Approach: The study was conducted immediately following the 55,000 ha Hayman Fire in 2002. Approximately sixty sample points were selected in each of the three burn severity classes (low, moderate, and high) as delineated by the BAER burn severity map for a total of 183 sample points. A burn severity assessment was completed to evaluate the accuracy of the BAER burn severity map and to determine which ground measures were most indicative of burn severity. Water repellency tests and organic matter determinations were completed. Hyperspectral imagery was acquired by an airborne sensor and the data were corrected to relative reflectance. A spectral library of image-derived endmembers considered meaningful for measuring burn severity was built. A partial spectral unmixing routine was used to identify the physical abundance soil, ash, scorched and green vegetation on the ground. The image results were then compared to the corresponding ground data.

Project Findings: The study provided a framework and method of analysis for hyperspectral data. However, due to the current complexity of airborne data acquisition and post-flight image processing, additional research is needed before these data can be used to improve the speed and accuracy of burn severity mapping. Here is a brief on the findings:

- BAER Burn Severity map for the Hayman Fire was approximately 70% accurate when compared to ground-truthed field plots.
- Four ground surface components (ash, soil, scorched and green vegetation) were determined to be most highly related to, and therefore, most useful for determining burn severity.
- The spectral signatures of these representative surface components were derived from the image and included in a library of spectral signatures that may or may not be useful after other fires. In other words, the spectral libraries were created, but additional research will be needed to determine the universality of these spectral signatures.
- Each hyperspectral data pixel can be ‘unmixed’ to characterize and quantify the various materials found in a corresponding ground location.

- A strong relationship was found between water repellent soil conditions and burn severity that will improve the detection of water repellent soils and modeling postfire hydrological responses.

Deliverables and Technology Transfer: Dissemination of results included presentations at remote sensing conferences and workshops. Project report, peer-reviewed journal articles and conference proceedings were instrumental in disseminating the science findings.

Reference:
Project information is available online at: http://jfsp.nifc.gov/JFSP_Project_Info_6.htm.