Burned Area Emergency Response Image Support

In the immediate aftermath of a wildfire, a Forest Service Burned Area Emergency Response (BAER) team is dispatched to the site to do an initial assessment of burn severity and to estimate the likely future downstream impacts due to flooding, landslides, and soil erosion. One of the first tasks for this team is the creation of a burn severity map that highlights the areas of high, moderate, and low burn severity. BAER assessments must be completed within 5 days of fire containment.

This map then serves as a key component in the subsequent flood modeling and Geographic Information System (GIS) analysis. Traditionally, the BAER burn severity map was created by sketch mapping on a topographic map - or even a forest visitor map - from a helicopter or road accessible overlook. In 2001 the Remote Sensing Applications Center (RSAC) established a program to provide remotely sensed satellite imagery and derived products to assist Forest Service BAER efforts. RSAC can provide imagery and data from one of multiple sensor platforms according to the time frame and needs of the BAER teams.

BAER team members installing straw wattles to control postfire erosion.

Inspecting a clogged culvert.

Burn Severity Definition and Examples

Unburned

Unburned landscape on the Nuttall Fire in Arizona, showing the wide variety of potential fuels, from the low shrubs on the forest floor to the heavily wooded areas seen. In assessing burn severity, scientists consider the impact of fire on various vegetation types as one of many factors.

Moderate

A moderate-severity burned landscape at the site of Washington's Pot Peak Fire in the summer of 2004. Foliage on the trees is scorched, but not completely consumed. What remains provides for "needle-cast," in which the dead needles will drop, creating a layer of protective mulch on the forest floor.

Low

A low-severity burned landscape from the Pot Peak Fire in summer 2004. Light grass and scattered trees covered this area. Although some of the grass burned, it still has root mounds in place. The trees are still standing and only slightly scorched.

High

A landscape on the Pot Peak Fire in Washington showing a high-severity burn. Trees are blackened and all foliage has been burned from the trees. All understory vegetation has been consumed. (Photos courtesy of US Forest Service, RSAC)

This aerial view shows the differences between low, moderate, and high burn severity. Green trees are in low burn severity areas, brown trees with dead needles are located in moderately burned areas, and black, needleless trunks have been severely burned. (Photo courtesy of Annette Parsons, US Forest Service)

RSAC uses the best available imagery to create BARC (Burned Area Reflectance Classification) maps. Image sources include Landsat ETM+ & TM, ASTER, (Advanced Spaceborne Thermal Emission & Reflection Radiometer), ALI (Advanced Land Imager), and SPOT (Système pour l'Observation de la Terra).

References:

Clark, J.; Parsons, A.; Zajkowski, T.; Lannom, K. 2003. Remote sensing imagery support for Burned Area Emergency Response teams on 2003 Southern California wildfires. RSAC-2003-RPT1. Salt Lake City, UT: U.S. Department of Agriculture, Forest Service, Remote Sensing Applications Center. 25 pp.

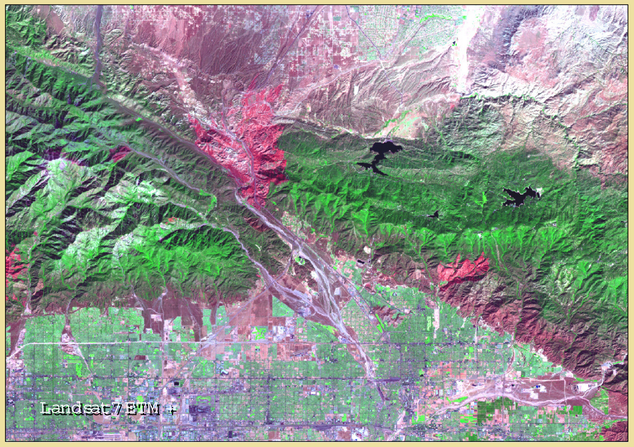
Earth Observatory NASA. 2002. Satellites Do It Faster, Cheaper. <http://earthobservatory.nasa.gov/cgi-bin/texis/webinator/printall7/Study/BAER/baer3.html>.

Parsons, A.; Jarvis, B.; Orlemann, A. 2002. Mapping post-wildfire severity using remote sensing and GIS. Proceedings of the Twenty-second Annual ESRI International User Conference, 8-12 July, 2002, San Diego, California. Unpaginated CD-ROM. Remote Sensing Applications Center, Salt Lake City, UT.

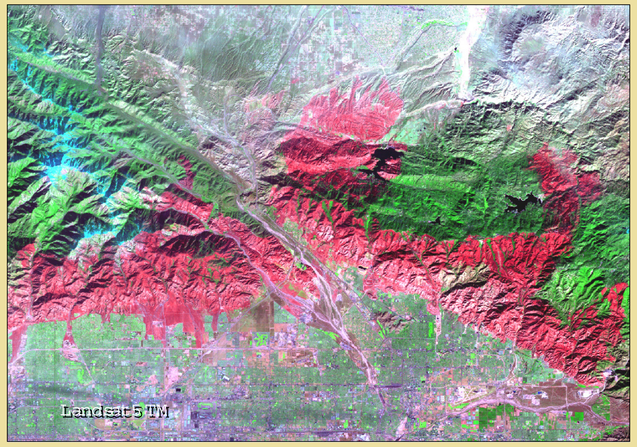
For more information about RSAC's BAER Image Support, visit our website: www.fs.fed.us/eng/rsac/baer

Burned Area Reflectance Classification (BARC)

Prefire Image - Acquired October 7, 2002



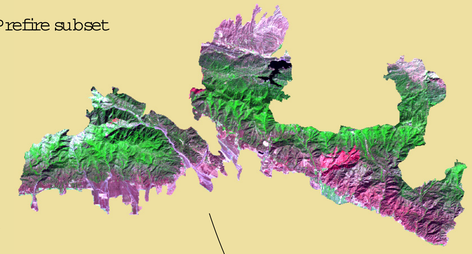
Postfire Image - Acquired November 19, 2003



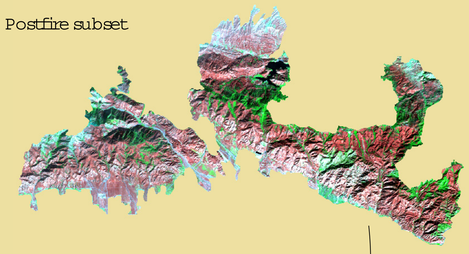
A Burned Area Reflectance Classification (BARC) is a satellite derived map of postfire condition. The BARC has four classes: high, moderate, low, and unburned.

BARC maps are made by comparing satellite near infrared reflectance values to shortwave infrared reflectance values.
–Near infrared light is largely reflected by healthy green vegetation.
–Shortwave infrared light is largely reflected by rock and bare soil.
–Satellite imagery collected over a forest in a pre-fire condition will have very high near infrared values and very low shortwave infrared values. Data collected over a forest after a fire will have very low near infrared values and very high shortwave infrared values.

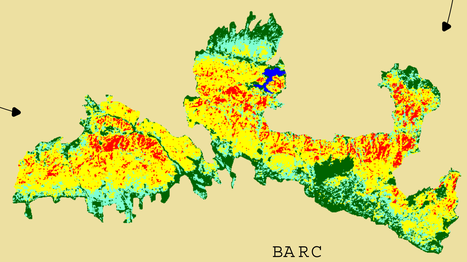
Prefire subset



Postfire subset



It is the relationship between the near infrared and shortwave infrared bands that BARC mapping attempts to exploit. The best way to do this is to measure the relationship between these bands prior to the fire and then measure them again after the fire. The areas where that relationship has changed the most are most likely to be severely burned, whereas those areas where that relationship has changed little are likely to be unburned or very lightly burned.

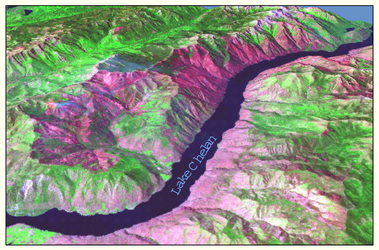


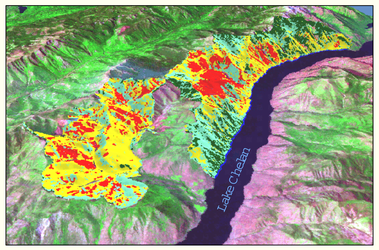
BARC

In addition to the 4-class BARC product, field teams are given an adjustable, 256-class version of the BARC. This dataset is intended to be adjusted according to field observations and validation.

Additional Map Products

3-D visualizations are produced by draping imagery over a digital elevation model (DEM). BAER team and media members find these images useful as a real-world perspective of the burned areas. In the examples shown here of the Pot Peak Complex in Washington, the ASTER imagery was draped over a 30-meter DEM. In the second picture (right), the 4-class BARC was draped over the imagery and DEM.





Post-Fire Assessment Using Remote Sensing Technologies