

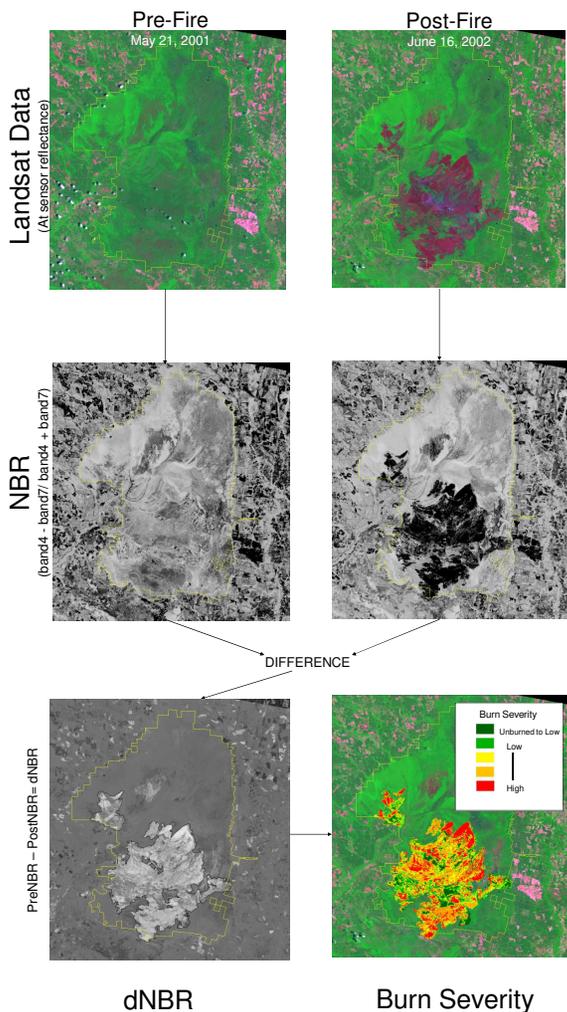
# Monitoring Trends in Burn Severity, part 1: Background

For the past several years, the USGS/EROS and USFS/RSAC have provided satellite-derived estimates of burn severity to land management agencies. Each center has developed production flows to quickly process Landsat satellite images to meet a variety of needs. "Rapid" assessments are used by burned area emergency response teams (BAER) to develop mitigation plans for erosion control. Initial assessments, compiled several months after the fire, are useful to map perimeters of grass fires that can quickly "fade away." Extended assessments are compiled a year later to evaluate vegetation response to the fire (i.e. delayed mortality or survival and re-growth).

Using a change detection process known as the differenced Normalized Burn Ratio (dNBR, Key and Benson, [www.fire.org/firemon](http://www.fire.org/firemon)), a post fire scene is compared to a pre fire scene. The extent of the change is related to the "severity" of the fire: the amount of vegetation lost. The satellite perspective easily shows the patterns of severity within the fire perimeter whereas in the past, these patterns were mapped with difficulty using field or aerial surveys. Understanding these patterns allows managers to more effectively plan erosion mitigation efforts or where to concentrate efforts for rehabilitation. The satellite-derived information is easily compatible with other map information such as vegetation maps or road and other infrastructure which enhances its value for other applications.

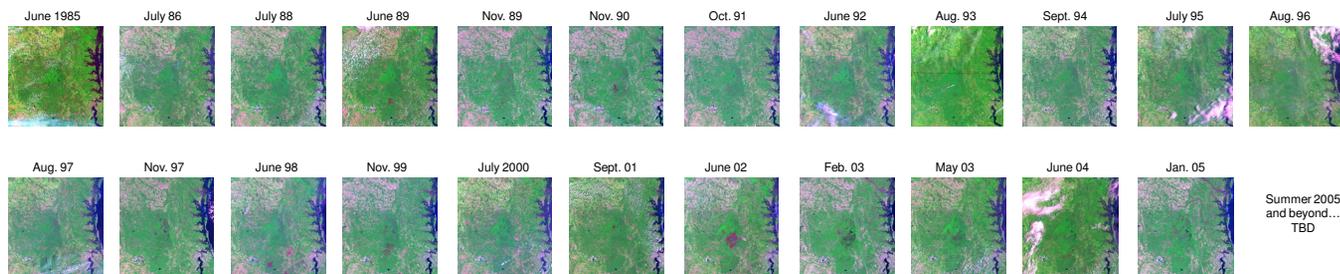
Combining the value of the dNBR with the historical archive of Landsat data led to the concept of a "fire atlas": a series of historical Landsat images to capture the history of fire over a particular location. That concept was implemented over several locations: Mesa Verde National Park, Okefenokee National Wildlife Refuge, Black Hills National Forest, Yosemite and Sequoia/Kings National Parks, just to name a few (see map). These fire atlases are valued as a way to capture and summarize the effects of large fires for land managers, agency and public officials and the general public. Following is a review of the dNBR process and an example of a fire atlas.

## Burn Severity Assessment Blackjack Fire 2002 Okefenokee Wildlife Refuge

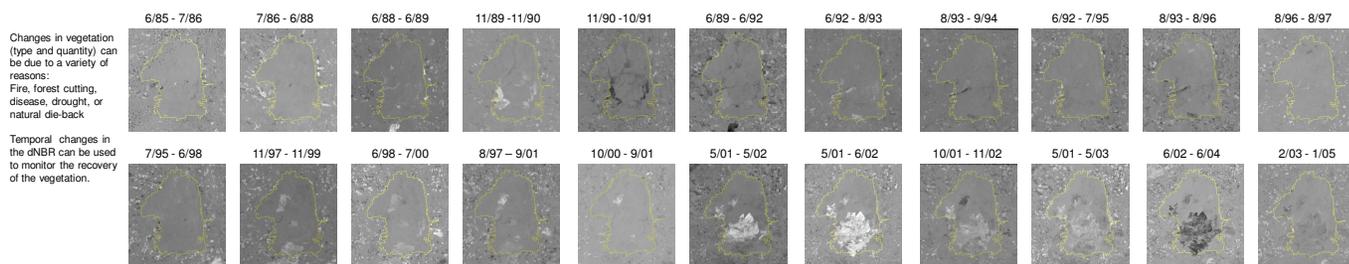


## Okefenokee Wildlife Refuge Fire Atlas 1985 – 2005

The following images represent the most current collection of Landsat Thematic Mapper images for the Okefenokee Wildlife Refuge. Earlier dates exist (1973, 1976, 1977, 1981 & 1982) but are from the Multispectral Scanner which is less suitable for fire mapping.



The following dNBR image subsets focus upon the refuge (yellow boundary). Except for clouds and shadows, bright areas show the loss of vegetation between the two dates and dark areas represent an increase of vegetation.

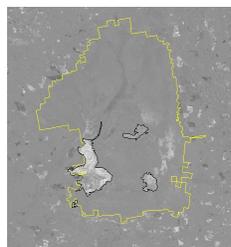


Changes in vegetation (type and quantity) can be due to a variety of reasons:  
Fire, forest cutting, disease, drought, or natural die-back

Temporal changes in the dNBR can be used to monitor the recovery of the vegetation.

This is the dNBR image 11/89 - 11/90, showing several large fires: the Shorts fire (largest), Mother's Day (northeast), and Mitchell Island (southeast) outlined by black perimeters.

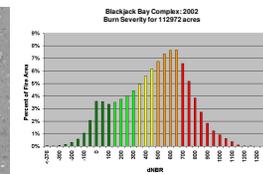
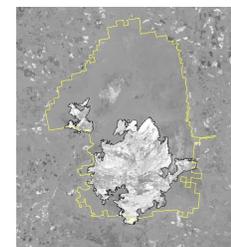
The other light dNBR values within the eastern refuge boundary appear to be the result of natural die-back as no fires were noted by refuge personnel.



This graph depicts the percent of the Shorts fire that burned at different severity levels. Typical dNBR values within a fire range from below 0 (unburned) to over 600 (for highest severity). This kind of information can be generated for each fire.

The dNBR image 05/01 - 06/02, shows the perimeters for the Bay Creek fire (northwest) and the Blackjack/Number One complex (largest). Previous fires from 2001 (light) and 1999 (dark) are also visible in this image.

The graph to the right shows the percentage of the fire at different severity levels and table shows the various vegetation types impacted at the different severity levels.

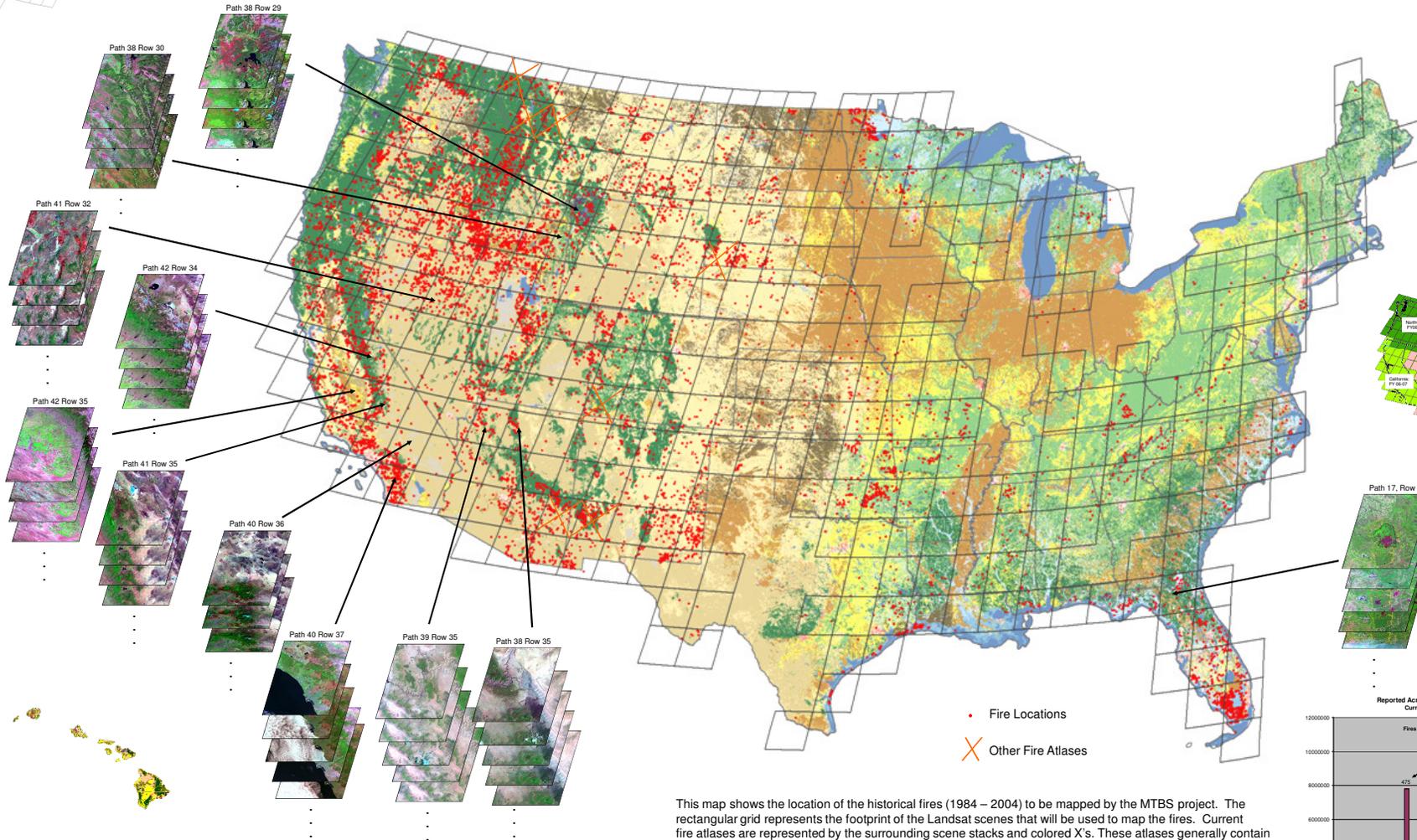
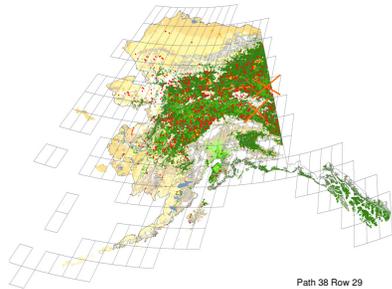


Vegetation Type	Unburned (0-1)		Low (2-4)		High (5-10)	
	Area (Acres)	Percent	Area (Acres)	Percent	Area (Acres)	Percent
Blackjack Bay Complex (2002)	112972	100%	0	0%	0	0%
Bay Creek (2001)	10000	100%	0	0%	0	0%
Number One (1999)	5000	100%	0	0%	0	0%
Shorts (1989)	21237	100%	0	0%	0	0%
Mother's Day (1989)	10000	100%	0	0%	0	0%
Mitchell Island (1989)	5000	100%	0	0%	0	0%
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# Monitoring Trends in Burn Severity, part 2: The Future

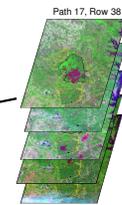
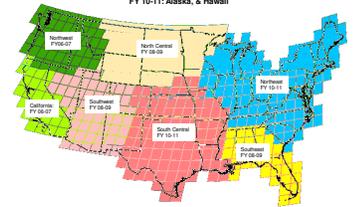
Recently, the Wildland Fire Leadership Council (WFLC), which implements and coordinates National Fire Plan (NFP) and Federal Wildland Fire Management Policies (National Fire Plan, 2004), adopted a strategy to monitor the effectiveness of the National Fire Plan and the Healthy Forests Restoration Act (HFRA). One component of this strategy is to assess the environmental impacts of large wildland fires and identify the trends in burn severity across the United States (WFLC 2004 Monitoring Proposal, Module 2.1). To that end, the WFLC has sponsored the USGS/EROS and USFS/RSAC to map and assess burn severity for all historical and current large fires using Landsat satellite imagery and the differenced Normalized Burn Ratio algorithm. EROS and RSAC will assess burn severity for all fires greater than 500 acres in the eastern United States, and greater than 1000 acres in the west that have occurred since 1984.

The number of historical fires that have occurred on federal and state lands meeting these criteria currently exceeds 10,000, with more (primarily fires occurring on state and private lands) likely to be identified. In addition to mapping historical fires, these two agencies will map all fires meeting the size criteria that occur through 2010. The MTBS project will generate burn severity data, maps and reports for use and the local, state and federal levels. This information will be used to assess trends in burn severity over the last 25 years and the effectiveness of land management decisions. All data (Landsat imagery, dNBRs, fire perimeters, etc.) and assessment results will be distributed to the public via an internet map service. Workshops and web-based training materials will be implemented to foster the understanding and application of satellite imagery and associated burn severity assessments.



### MTBS Schedule:

FY 06-11: New fires Nation-wide  
FY 10-11: Alaska, & Hawaii



• Fire Locations  
X Other Fire Atlases

This map shows the location of the historical fires (1984 – 2004) to be mapped by the MTBS project. The rectangular grid represents the footprint of the Landsat scenes that will be used to map the fires. Current fire atlases are represented by the surrounding scene stacks and colored X's. These atlases generally contain an almost continuous temporal record (all years) because of high fire activity. The MTBS project will only process scenes needed to cover the years of the fires (not necessarily a continuous record for each path row). For example, only two scenes (one pre-fire and one post-fire) will be processed for the single fire that shows in southern Texas.

Reported Acres Burned and Approximate Number of Large Fires: 1984 - 2004  
Currently Identified Fires on Federal Lands for the MTBS Project

