

## **NPS-USGS NATIONAL BURN SEVERITY MAPPING PROJECT WORKING GROUP**

Summary of Working Group Meeting Results (February 9 – 13, 2004)

USGS EROS Data Center; Sioux Falls, SD

<http://burnseverity.cr.usgs.gov/>

### **Attending:**

Nate Benson – NPS

Carl Key – USGS BRD

Don Ohlen – USGS

Stephen Howard – USGS

Brian Sorbel – NPS

Zhi-Liang Zhu – USGS

Randy McKinley - USGS

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### **Reviewed and Updated National Burn Severity Mapping Project Mission Statement** (changes to mission statement highlighted in blue)

Using *satellite and field data to understand fire's effect on the landscape:*

- Develop, test, and implement new remote sensing and field validation methodologies [for monitoring short and long-term fire effects](#).
- Generate, distribute, and archive burn severity information.
- Investigate and validate useful applications of burn severity information.
- Educate land managers and scientists on the use of  $\Delta$ NBR, field validation methods, and applications of burn severity information.

### **Requesting Burn Severity Assessments in 2004**

Requests for burn severity initial and extended assessments will be completed through the National Burn Severity Mapping website using a web-base burn severity mapping user request form. Nate will provide instructions on how to initiate this process in a few weeks.

### **Updating Fuels Layers with Burn Severity Data**

A few parks already have or are beginning to update their fuels layers using burn severity data. Work has been done or is being done in Grand Canyon, Glacier and Yellowstone. Many of us have started to at least think about the need for this. If you have any documentation on ideas or processes to update fuels layers using burn severity data, please send those to Brian Sorbel and he will have them posted in a soon-to-be-created 'Resources' directory on the Burn Severity Mapping Project website.

### **Changes / Additions to Burn Severity Mapping Project Website**

The following changes will be made to the NPS-USGS Burn Severity Mapping Project website by summer:

- A new alias was created for the website: <http://burnseverity.cr.usgs.gov/> The website is still accessible via [http://edc2.usgs.gov/fsp/severity/fire\\_main.asp](http://edc2.usgs.gov/fsp/severity/fire_main.asp)
- Incorporation of a Web-base burn severity mapping user request form
- Capability to sort fires by NPS Region will be added
- Links between the burn severity project website and the NPS GIS Clearinghouse (with Anchor Tags) are being developed

- Burn Severity Summary statistics for NPS fires
- A 'Resources' link will be added that will connect to documents dealing with the project.
- Simplified URL; new web address will likely be: burnseverity.usgs.gov

### **Burn Severity Assessment Applications**

The dNBR working group will focus their attention this year on developing applications for burn severity assessments. The ranking of applications below reflect order of priority with 1 being the highest priority:

- 1) Develop application for updating vegetation and fuels layer
- 2) Measuring fuels reduction and effectiveness of treatment
- 3) Planning applications (refining prescriptions, risk maps, barriers to fire spread)

#### Secondary Priorities

- Erosion
- Invasive species
- T&E Species conservation

### **LANDFIRE**

The latest plan is that the western US LANDFIRE vegetation and fuels layers will be developed first. After finishing the two prototype areas (northern Utah and the Montana/Idaho Northern Rockies) the focus will be to complete the rest of the Western U.S. There will be an Eastern U.S. prototype this year. There will also likely be a pilot study in a small area of Alaska starting this year or next year. The target is to complete the entire U.S. in 5-6 years. In addition, the LANDFIRE project is tasked with demonstrating repeatability every 5 years. We are working with Zhi-Liang Zhu to see how burn severity assessments can be used to update LANDFIRE fuels and vegetation data layers.

### **Joint Fire Science Study**

In 2001, we received funding from Joint Fire Science to evaluate sensitivities of burn-severity mapping algorithms for different ecosystems and fire histories in the United States. We will try to complete this study this year. The focal areas of the study are:

- dNBR comparison between different ecological regions
  - Compare at a minimum 6 different vegetation type, growing season, fire regimes, climate,
    - Deciduous forests
    - Sage and Pinyon juniper
    - chaparral/ Sierra Nevada mixed conifer forest
    - Northern Rockies coniferous forest
    - tundra
    - Alaskan boreal
    - Southern Rockies/Black Hills Ponderosa pine
    - grasslands
  - Complete analysis of strata data
  - Compare seasonality and timing of assessment
- Complete comparison of dNDVI, dNBR, and Tassel Cap on four different fires

- Possible fires: 1) Jasper or Grand Canyon, 2) one from Glacier or Tetons, 3) Bear-Sanford UT or McNally CA, 4) Yukon Charlie, 5) Green Mt TN.
- Develop clear recommendations of what managers should be aware of when using any of the three methods
- Evaluate dNBR as a means to measure change from time since burn. Use fires from Glacier, Grand Canyon and/or Alaska. This we will do if we have time and we will not start on this project until 2005

### Updating of CBI Methods

Carl and Nate will complete update of CBI methods by April. Most of the changes are minor. Here are some of proposed changes:

- Problems with shrubs foliage altered, %green, living resprouting
  - Eliminate %green from shrubs and add explanation that when looking at %living/resprouting add to definition that you should look at potential mortality 2-3 years out (e.g., conifer sapling that is 70% brown and will die in two years)
  - Change %foliage altered: 2=60-90%; 3=significant branching loss (put significant in the definition)
- No change to low shrubs/herbs
- Stumps – general rule of thumb is to include them in to whatever fuel class you want or ignore them
- Can use two decimals to define quarters/thirds
- Include heights on field form for saplings/tall shrubs (1-5m), height for low shrub/herbs (<1m)
- Keep understory plot size at 20m, but if individuals want to use 30m plot they can. Make note in methods
- Clarify in our definition when green understory plants cover exposed soil how soil should be estimated. For example, pre-fire exposed soil and newly exposed soil perceive low herbaceous and shrubby vegetation less than 20 cm as covering the soil
- People have a hard time with mental gymnastics of subtracting or adding area burned or unburned to generate score. So, for all understory ratings(substrate, herb/low shrubs, tall shrubs/sapling) have them relative to pre-fire conditions. Make sure pre-fire unburnable areas (soil/rock) and canopy cover info is captured and can be used to calibrate scores later.
- Change density of trees to number of trees on plot form
- Include on field form under pre-fire substrate estimates % sign (e.g. %per-fire cover, pre-fire depth inches)
- Provide instructions for data entry
  - instructions on what to do with unburned plots
  - making sure right unit of measurement is used
  - Where to enter zeros, where to use n/a or n/r for missing or blank data fields
- For 3.0 on Litter/light fuels change to consumed. Make 2.5 90% loss of light fuels.
- Include Paul's idea in methods as how one can use the comment field in the field form to collect info for other folks

- Maybe change headings to herb, shrubs and trees <1m and shrubs and trees 1-8m. Things vary enough from region to region, so may be just keep it as is.
- Work with Andi Thod to standardize terminology between cbi and her severity methodology
- Should hire an editor and publish as an NPS publication? Maybe 2005

#### **Possible CBI Training Sessions/Field Work in 2004**

- FIREMON (top priority- most likely before june)
- North Cascades (next priority – August/September)
- Buffalo River ? (May-Sept)
- BICY/EVER (winter 2004/5)
- Gila and or Salmon/Chalis (Randy will organize, June/July)
- Glacier (June - September)

#### **Other Items**

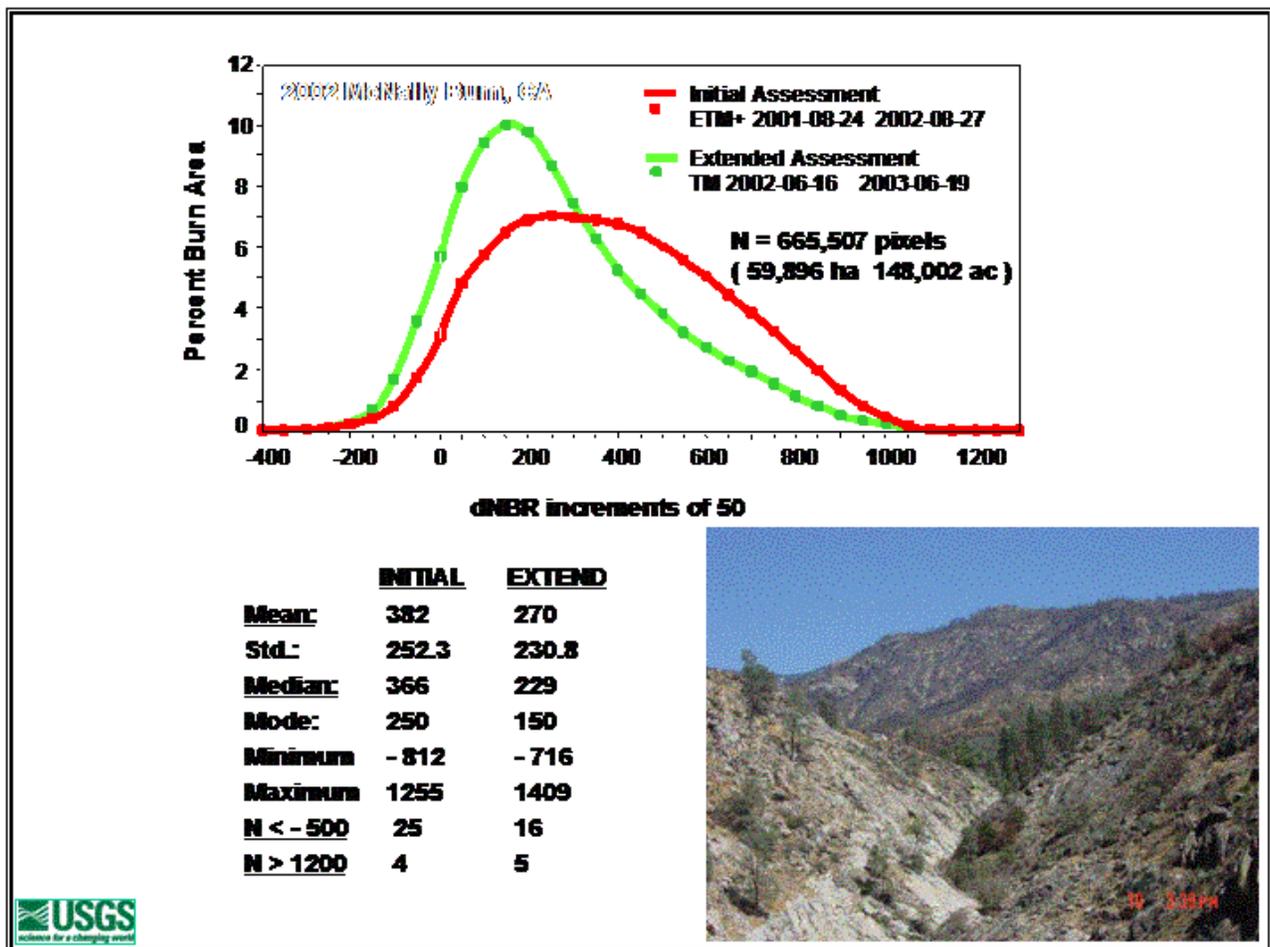
- Host a dNBR Technical Methods Workshop at EROS Data Center for remote sensing specialists and researchers this fall. The objective of the workshop is to share information on burn severity assessments.
- For 2005 develop a workshop on applications of burn severity assessments. The target audience for this workshop will be GIS specialists, resource managers, fire managers, and fire ecologists
- Assess the feasibility and costs of developing a centralized database accessible via the web for CBI data, including photos. Currently there are approximately 2000 field plots in 23 different sites.
- Include CBI protocols in FEAT
- Discussed selection criteria and prioritization of burns. Nate will complete write to assist in prioritization of burns
  - With grasslands, lightly shrub areas select scenes on what is ecologically relevant and/or meets management needs. Keep in mind regrowth potential of the area for selecting IA and EA
  - With deciduous forests try to do an IA and then determine whether an EA is needed. Remember to select scenes on what is ecologically relevant and/or meets management needs. Keep in mind regrowth potential of the area for selecting IA and EA
  - All fires will be evaluated based on whether it appears on landsat image
- Develop CBI field validation photo series. This year Brian Sorbel will investigate possible pilot project in AK.

## Burn Severity Descriptive Statistics

The EROS Data Center and Carl Key are going to experiment with the development of a standard set of burn severity summary statistics. Burn severity summary statistics would be generated for each fire by first clipping the dNBR grid using a final fire perimeter, and then summarizing the burn severity data within the final fire perimeter. The intent is to use the data to quantitatively describe not just how much area was burned by a particular fire, but also, how that area burned. A standard set of burn severity statistics can also be used to compare fires. Sample statistics to be captured include:

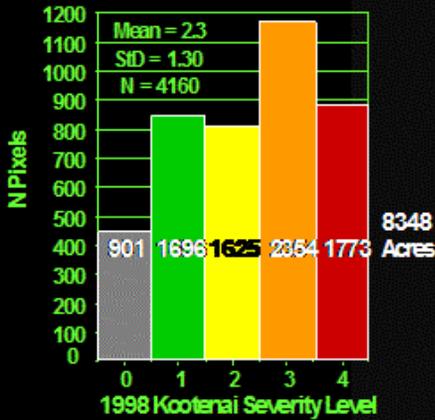
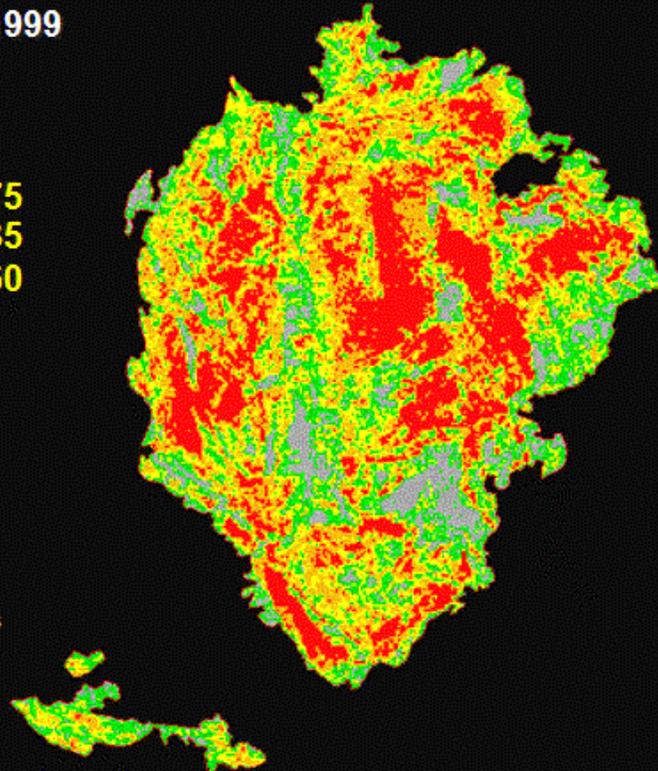
- Maximum and Minimum dNBR values
- Mean, Median dNBR values and standard deviations
- Tables and histograms showing the acreage breakdown within different severity levels

The following slides (from Carl Key) show examples of possible summary of products.

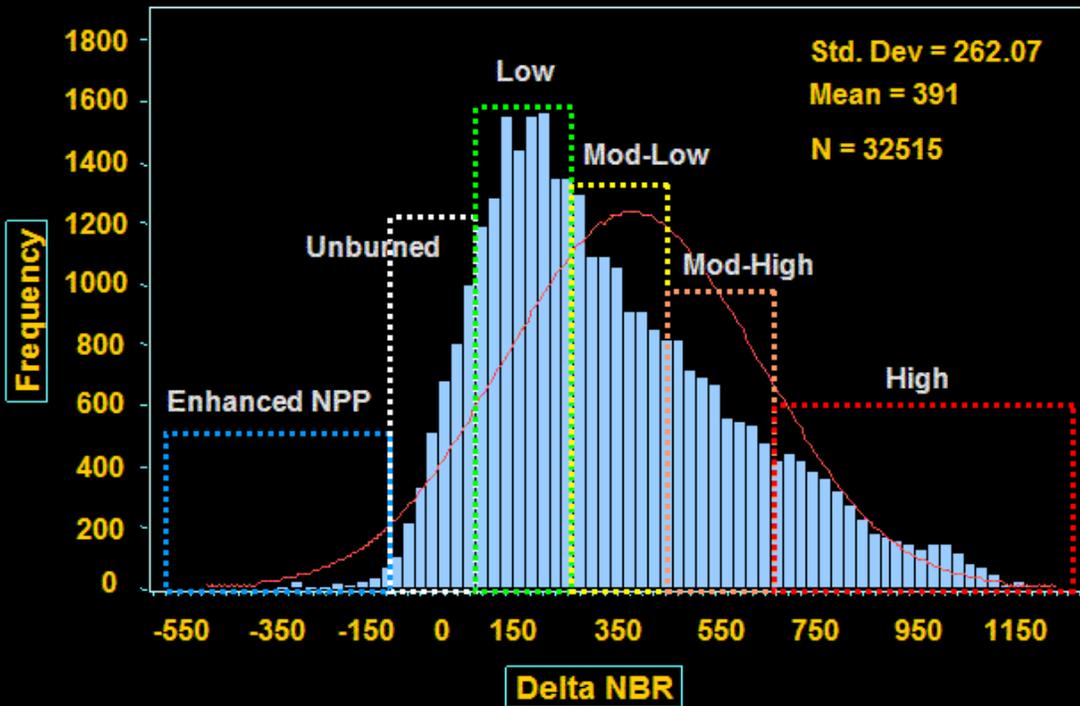


**Extended Assessment  
1998 Kootenai Complex  
dNBR 8/8/1998 - 9/12/1999**

<u>Severity Level</u>	<u>dNBR</u>
Unburned	<100
Low	100-275
Moderate low	276-435
Moderate high	436-660
High	>660



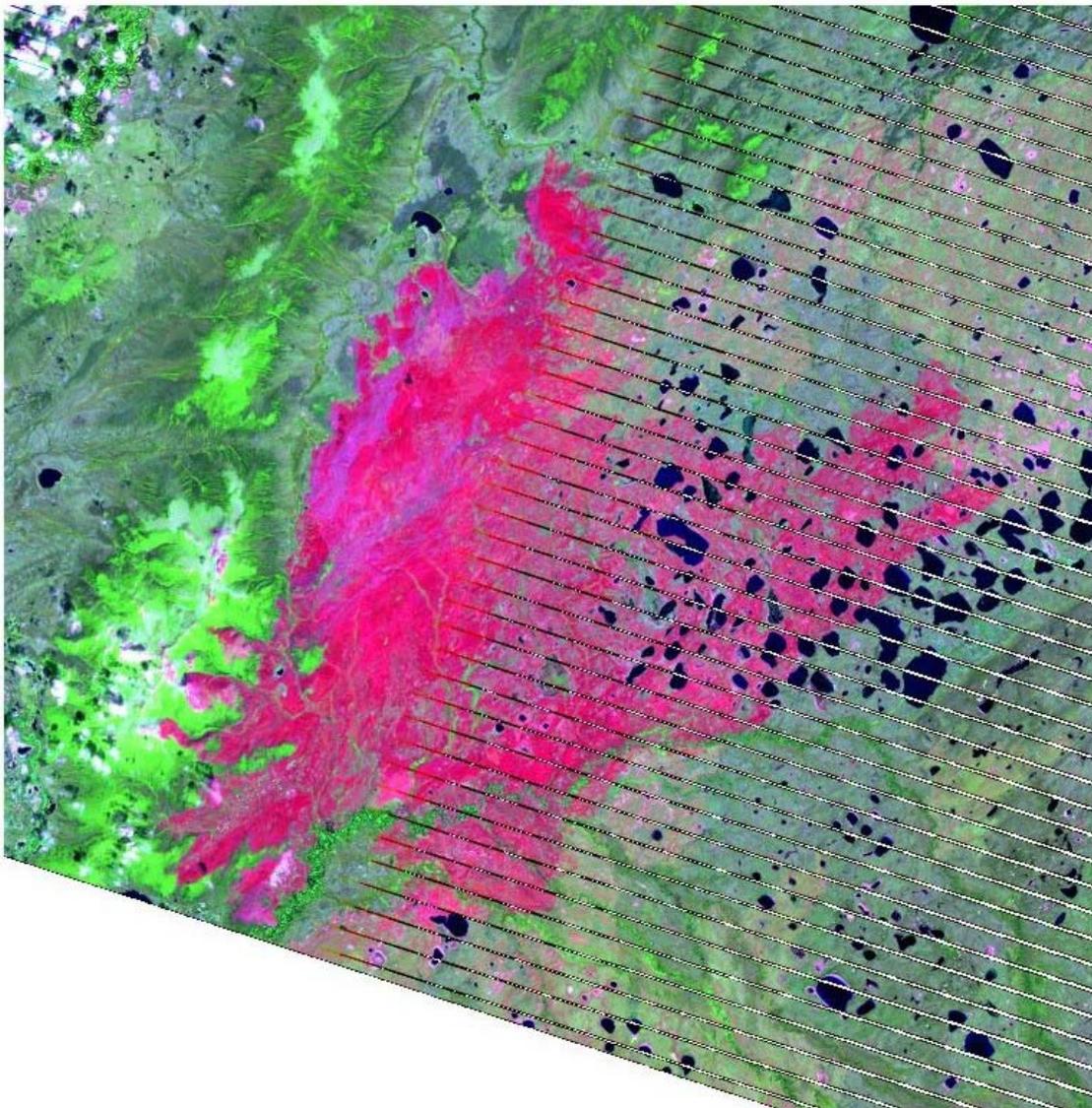
**Within Perimeter, 1994 Starvation Burn**



## Landsat 7 Update

Beginning in late May 2003, an anomaly in the Scan Line Corrector on Landsat-7 resulted in zebra like striping patterns across all Landsat-7 imagery. After several tests and attempts by the US Geological Survey and NASA, a mechanical fix or solution to the problem does not appear likely. The EROS Data Center has since begun to process and distribute SLC-off (Scan Line Corrector – off) imagery from Landsat-7. These images are available for browse at: <http://glovis.usgs.gov> (switch sensor to 'L7 ETM+ SLC-off'). The effects of the anomaly are minimal in the middle third of the scene but increase dramatically on the edges of scenes. On the extreme edges of the scene approximately 10-15 pixels (300-450 meters) are dropped in each pass. An example of SLC-off data for the 2002 Moose Lake fire in Denali National Park and Preserve is shown in Figure 1.

Figure 1



The EROS Data Center is trying to develop analytical methods to fix the gaps. These include gap-fill techniques based on interpolation using the nearest unaffected pixels as well as developing composite images from multiple SLC-off Landsat-7 scenes.

For the most part, SLC-off Landsat-7 imagery is not being used for NPS burn severity mapping in the lower 48. In most cases, Landsat-5 is filling the void left by Landsat-7. Landsat-5 is now the workhorse for lower-48 burn severity mapping for both the NPS burn severity project as well as BAER team assessments. Since Landsat-5 does not collect data over Alaska it is not an option for Alaskan fires.

Other satellite options do exist. For now, the satellite most similar to Landsat is ASTER, a Japanese sensor onboard the Terra satellite (<http://asterweb.jpl.nasa.gov/>). The ASTER sensor has bands that are roughly equivalent to Landsat bands 4 and 7 (those used for burn severity mapping). The EROS Data Center is currently developing methods to terrain rectify ASTER imagery and is analyzing which of ASTER's bands best match Landsat bands 4 and 7. The ASTER sensor has a 15-meter resolution in the near-IR and 30-meter resolution in the mid-IR. The ASTER sensor does not collect data continuously (as does Landsat) so requests are required for image acquisition. For now, ASTER is only being used for burn mapping on a limited basis when Landsat-5 data is not available. The use of ASTER for burn mapping may increase though in areas where Landsat-5 data is unavailable (Alaska).

### **Final Fire Perimeters**

Raster burn severity data and vector fire perimeters are created for the National Park Service by the EROS Data Center as part of the NPS-USGS Burn Severity Mapping Project. All GIS data deliverables are available for download on the project website at [http://edc2.usgs.gov/fsp/severity/fire\\_main.asp](http://edc2.usgs.gov/fsp/severity/fire_main.asp).

Perimeters derived through the application of the Normalized Burn Ratio to Landsat imagery have the potential to be very accurate and very detailed in most fuel types. In some cases, these perimeters may be superior to the final perimeter collected from the fire itself by incident management staff and should be the perimeter used in parkwide fire history polygon coverages. In certain vegetation types, or in instances of extremely low severity, perimeters generated on-site from the incident may be more accurate than satellite-derived perimeters. In some cases, a combination of incident and satellite sources may produce the most accurate and detailed final fire perimeter.

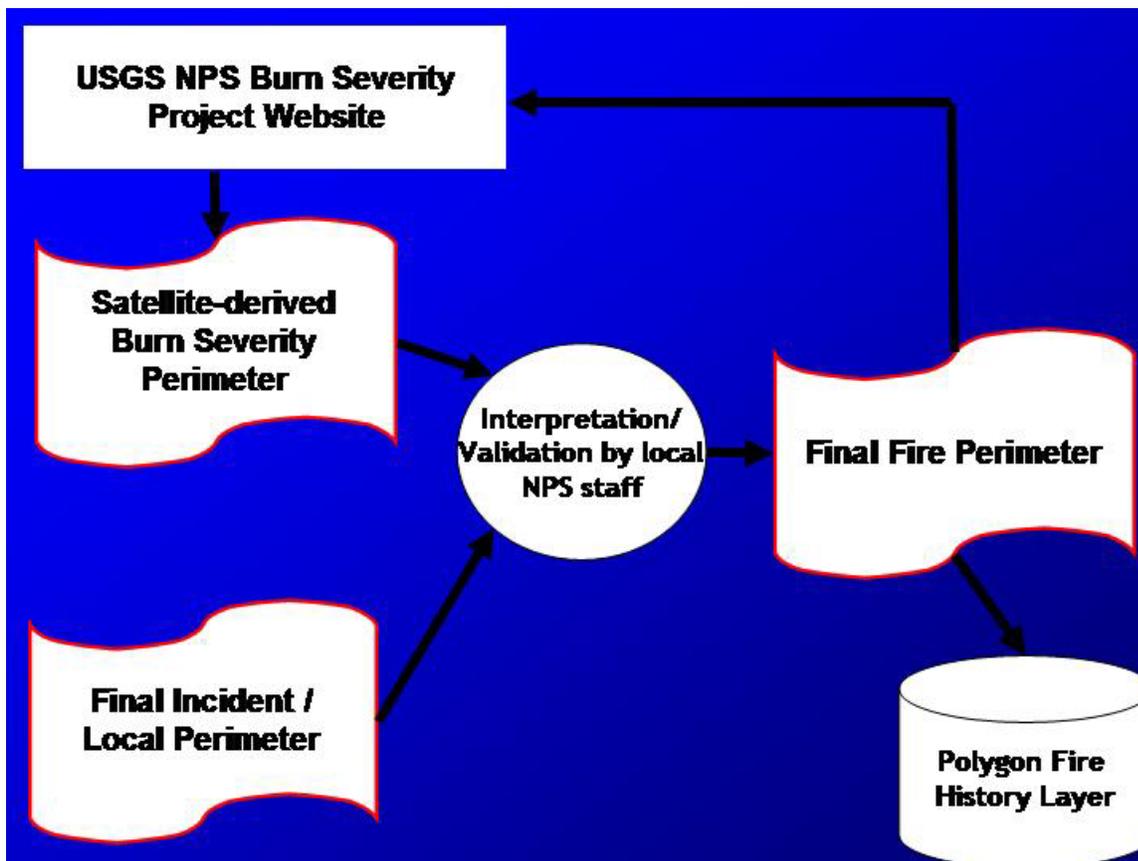
At the Spatial Odyssey Conference in December 2003 Brian Sorbel presented the following slides during a burn severity mapping session:

## Satellite-derived Burn Severity Perimeters

- Satellite derived burn severity perimeters for NPS fires are posted on the NPS USGS Burn Severity Project website.
- There may be a discrepancy between perimeters generated by an incident and perimeters generated through the burn severity mapping project using satellite imagery.
- In some cases, the incident perimeter is more accurate; In some cases the burn severity perimeter is more accurate; In other cases a combination of the two is the most accurate

## Satellite-derived Burn Severity Perimeters

- For every large NPS fire, there should be one final fire perimeter that is as accurate as possible when referenced to available sources
- NPS Fire GIS Specialists should cross reference Burn Severity perimeters with local / incident perimeters to arrive at a FINAL perimeter.
- The FINAL fire perimeter should be used within park fire history layers and should be sent back to the EDC (Steve Howard or Don Ohlen) for posting on the Burn Severity Project Website.



The Burn Severity Mapping Project website is the only place where fire perimeters for all large NPS fires since 2000 are accessible over the internet. It's in our interest to have what is being called the final perimeter up on this site. In addition, as we begin to develop standard summary statistics for each fire, those statistics will be most accurate and relevant if the final fire perimeter is used to clip out the burn severity data. Stephen Howard at the EROS Data Center will gladly receive your final corrected fire perimeters (smhoward@usgs.gov).