

Identification\_Information:

Citation:

Citation\_Information:

Originator: U.S. Geological Survey and the U.S. Forest Service

Publication Date: 20080819

Title: Monitoring Trends in Burn Severity assessment of Fire Information: Fire Information

Geospatial\_Data\_Presentation\_Form: Raster digital data for satellite imagery and derived products Vector data for fire perimeters

Publication\_Information: Publication\_Place: Sioux Falls, South Dakota or Salt Lake City, Utah

Publisher: U.S. Geological Survey and U.S. Forest Service

Online\_Linkage: <http://edc.usgs.gov> or <http://www.fs.fed.us/eng/rsac/>

Description:

Abstract:

Monitoring Trends in Burn Severity (MTBS) is a multi-year project conducted through a partnership between the USGS EROS and the USDA Forest Service Remote Sensing Applications Center (RSAC). It is designed to consistently map the burn severity and perimeters of fires across all lands of the United States for the period spanning 1984 through 2010. MTBS is based on image processing and analysis methods currently utilized by the USGS and USFS for existing post-fire burn severity mapping efforts. The USGS Landsat Thematic Mapper image archive will provide a consistent and continuous source of 30 meter resolution data going back to 1984 for mapping burn severity of all fires greater than 1000 acres in the west and 500 acres in the east (east of 97W longitude).

Purpose:

The data generated by MTBS will be used to identify national trends in burn severity, providing information necessary to monitor the effectiveness of the National Fire Plan and Healthy Forests Restoration Act. MTBS is sponsored by the Wildland Fire Leadership Council (WFLC), a multi-agency oversight group responsible for implementing and coordinating the National Fire Plan and Federal Wildland Fire Management Policies. The MTBS project objective is to provide consistent, 30 meter resolution burn severity data and fire perimeters that will serve four primary user groups: 1. National policies and policy makers such as the National Fire Plan and WFLC which require information about long-term trends in burn severity and recent burn severity impacts within vegetation types, fuel models, condition classes, and land management activities. 2. Field management units that benefit from mid to broad scale GIS-ready maps and data for pre- and post-fire assessment and monitoring. Field units that require finer scale burn severity data will also benefit from increased efficiency, reduced costs, and data consistency by starting with MTBS data. 3. Existing databases from other comparably scaled programs, such as Fire Regime and Condition Class (FRCC) within LANDFIRE, that will benefit from MTBS data for validation and updating of geospatial data sets. 4. Academic and agency research entities interested in fire severity data over significant geographic and temporal extents.

Supplemental\_Information:

The MTBS Fire-ID is generated by combining several attributes taken from Federal or State agency fire records. The first field is the Federal Agency or State identification, next is a code related to the sub unit of the reporting agency (i.e. specific forest, park, refuge, etc.), next is the agency code given to the individual fire, and lastly is the start date of the fire in the format: year month day. NOTES: some of the fields were not recorded for some fires. Records from different agencies contain different formats or incomplete information for the date of the fire. Multiple agencies report the same fire, preferentially; a Federal agency record was used to identify a fire and duplicate MTBS fire IDs are also noted below. Fires that were discovered with no corresponding fire

record and met the fire size criteria were mapped and given an ?unknown?,  
?state? or ?agency? Fire-ID if it can be determined and a latitude, longitude  
and estimated start date: Unk-ddmmss-dddmmss-yyyymmddThe first ddmss field  
refers to the north latitude of the fire centroid.The second dddmmss field  
refers to the west longitude of the fire centroid.The date field is the best  
estimate of the fire start date.NOTE: An unknown fire may, in fact, have a  
corresponding fire record, but the fire record contains the wrong location  
and/or year of occurrence and could not be matched with the fire found on the  
Landsat imagery.

#### Supplemental Fire Metadata

##### Fire Information

MTBS Fire ID: FS-0403-014-20070711  
Duplicate MTBS Fire IDs: WY-BTF-014-20070711  
Fire Name (if known): SALT LICK  
Date of Fire: July 11, 2007  
State: Wyoming  
Agency: USFS  
MTBS Mapping Zone: North Central  
Geographic Area: Eastern Great Basin  
HUC4 Catalog Unit: 14040101  
Type of Assessment: Extended  
Acres within Fire Perimeter: 2526.8

Required spatial adjustment for co-registration of pre-fire NBR to post-fire NBR  
X-shift adjustment: 0 meters (relative to post-fire NBR)  
Y-shift adjustment: 0 meters (relative to post-fire NBR)

##### Landsat Path and Row: 38/30

Pre-Fire Landsat Date/Scene ID: Landsat 5 TM; June 25, 2007 / 5038030000717650  
Post-Fire Landsat Date/Scene ID: Landsat 5 TM; July 29, 2008 / 5038030000821150

##### Output Dataset Projection Albers Equal Area

Units: Meters  
Datum: NAD83  
Spheroid: GRS80  
1st Standard Parallel: 29 30 00  
2nd Standard Parallel: 45 30 00  
Central Meridian: -96 00 00  
Latitude of Origin: 23 00 00  
False Northing: 0  
False Easting: 0

##### Image Subset Corner Coordinates (center of pixel, projected meters)

ULX: -1127400  
ULY: 2336250  
LRX: -1116060  
LRY: 2326440  
Rows: 328  
Columns: 379  
Pixel size: 30 meters

##### Bounding Box

North Latitude: 43.25422 (43 15 15.2097228486)  
South Latitude: 43.21781 (43 13 04.13391137773)

East Longitude: -109.89834 (-109 53 54.0269178648)  
West Longitude: -109.96153 (-109 57 41.4999791388)

Latitude and Longitude within Fire Perimeter  
Latitude: 43.236889 (43 14 12.8004)  
Longitude: -109.931953 (-109 55 55.0308)

Fire Perimeter Generation Method: Manual

dNBR offset value used to calculate RdNBR: -28

Burn severity thresholds  
No Data Threshold: -970  
Increased Greenness: -150  
Low Threshold: 65  
Moderate Threshold: 251  
High Threshold: 475

Product List:

FS-0403-014-20070711\_pre\_refl.tif

Subset of Landsat scene used for pre-fire image (Bands 1-5, 7; Unsigned 8-bit GeoTIFF)

FS-0403-014-20070711\_post\_refl.tif

Subset of Landsat scene used for post-fire image (Bands 1-5, 7; Unsigned 8-bit GeoTIFF)

FS-0403-014-20070711\_d.tif

dNBR used for burn severity analysis and mapping; subset to the fire area (Signed 16-bit GeoTIFF)

FS-0403-014-20070711\_dt.tif

Thematic dNBR; Derived by thresholding dNBR subset (8-bit GeoTIFF)

FS-0403-014-20070711\_rd.tif

Relative dNBR; subset to the fire area (Signed 16-bit GeoTIFF)

FS-0403-014-20070711.shp

Perimeter of detectable fire area derived from satellite imagery (ESRI shapefile)

FS-0403-014-20070711\_cldshdw.shp

Mask for clouds, shadow, snow or anomalies intersecting fire area (ESRI shapefile)

d3830\_20070625\_3830\_20080729.tif

dNBR for full Landsat scene (path/row: 38/30)

Processing Comments:

Burn severity thematic categories

- 0 - outside fire perimeter
- 1 - unburned to low severity
- 2 - low severity
- 3 - moderate severity
- 4 - high severity

5 - increased greenness  
6 - nodata/non-processing mask

Time\_Period\_of\_Content:  
Time\_Period\_Information:  
Multiple\_Dates/Times:  
Currentness\_Reference: ground condition  
Status:  
Progress: Complete  
Maintenance\_and\_Update\_Frequency: As needed  
Spatial\_Domain:  
Bounding\_Coordinates:  
West\_Bounding\_Coordinate: 43.21781  
East\_Bounding\_Coordinate: 43.25422  
North\_Bounding\_Coordinate:  
South\_Bounding\_Coordinate:

Keywords:

Theme:

Theme\_Keyword\_Thesaurus: None  
Theme\_Keyword: Raster digital data  
Theme\_Keyword: U.S. Geological Survey  
Theme\_Keyword: USGS  
Theme\_Keyword: Monitoring Trends in Burn Severity  
Theme\_Keyword: MTBS  
Theme\_Keyword: Burn Mapping  
Theme\_Keyword: Imagery  
Theme\_Keyword: Fire  
Theme\_Keyword: Landsat

Theme:

Theme\_Keyword\_Thesaurus: ISO 19115 Category  
Theme\_Keyword: imageryBaseMapsEarthCover

Place:

Place\_Keyword\_Thesaurus: U.S. Department of Commerce, 1995, Countries, dependencies, areas of special sovereignty, and their principal administrative divisions, Federal Information Processing Standard 10-4,): Washington, D.C., National Institute of Standards and Technology

Place\_Keyword: United States

Place\_Keyword: U.S.

Place\_Keyword:US

Place\_Keyword:July 11, 2007

Place:

Place\_Keyword\_Thesaurus: U.S. Department of Commerce, 1987, Codes for the identification of the States, the District of Columbia and the outlying areas of the United States, and associated areas (Federal Information Processing Standard 5-2): Washington, D.C., National Institute of Standards and Technology

Place\_Keyword: NOT FOUND

Temporal:

Temporal\_Keyword\_Thesaurus: None

Temporal\_Keyword: 1999-present

Access\_Constraints: FTP data sets are available to any user.

Use\_Constraints: There are no restrictions on use, except for reasonable and proper acknowledgement of information sources.

Point\_of\_Contact:

Contact\_Information:

Contact\_Organization\_Primary:

Contact\_Organization: U.S.Geological Survey  
Contact\_Position: Customer Service Representative  
Contact\_Address:  
Address\_Type: mailing and physical address  
Address: 47914 252nd Street  
Address: USGS EROS  
City: Sioux Falls  
State\_or\_Province: SD  
Postal\_Code: 57198-0001  
Country: USA  
Contact\_Voice\_Telephone: 605/594-6151  
Contact\_Voice\_Telephone: 800/252-4547  
Contact\_TDD/TTY\_Telephone: 605/594-6933  
Contact\_Facsimile\_Telephone: 605/594-6589  
Contact\_Electronic\_Mail\_Address: custserv@usgs.gov  
Contact\_Electronic\_Mail\_Address: fsedc@usgs.gov  
Hours\_of\_Service: 0800 - 1600 CT, M-F, -6 h GMT  
Contact\_Instructions: <http://mtbs.gov/contactus.html>  
Data\_Set\_Credit: USGS and NASA  
Native\_Data\_Set\_Environment: Oracle, ERDAS Imagine, & ArcInfo  
Data\_Quality\_Information:  
Attribute\_Accuracy: Attribute\_Accuracy\_Report: MTBS geospatial data (both vector and raster) are generated using consistent methods and procedures. The differenced Normalized Burn Ratio (dNBR) image datasets are examined on a fire by fire basis to develop a thresholded, or categorical, burn severity dataset.  
Quantitative\_Attribute\_Accuracy\_Assessment:  
Attribute\_Accuracy\_Explanation: MTBS analysts examine the differenced Normalized Burn Ratio (dNBR) image for each fire in the context of remote sensing spectral data and any ancillary information available to the analyst. dNBR image data for each fire are thresholded into classes representing unburned areas; areas of low, moderate, high burn severities; and areas of increased vegetation response. Analysts follow guidelines established by subject matter experts in order to maintain consistency in discerning burn severity thresholds from fire to fire and minimize subjectivity.  
Logical\_Consistency\_Report: These Landsat data are collected from a nominal altitude of 705 kilometers in a near-polar, near-circular, sun-synchronous orbit at an inclination of 98.2 degrees, imaging the same 183-km swath of Earth's surface every 16 days. The pixels representing the bands for the image are in the data set only once.  
Completeness\_Report: Fire Perimeter Generation Method: Manual (from metadata)  
Positional\_Accuracy:  
Horizontal\_Positional\_Accuracy:  
Horizontal\_Positional\_Accuracy\_Report: Each Landsat Thematic Mapper image used to create the burn severity assessment was precision terrain-corrected using 3-arc-second digital terrain elevation data (DTED), and georegistered using ground control points. This resulted in a root mean square registration error of less than 1 pixel (30 meters).Lineage:  
Process\_Step:  
Process\_Description: These data products are derived from Landsat Thematic Mapper data. A pre-fire scene and a post-fire scene are analyzed to create a Differenced Normalized Burn Ratio (dNBR) image. The dNBR image portrays the variations of burn severity within the fire.

The Landsat images are terrain corrected and geometrically rectified to an Albers Conical Equal Area map projection using the National Landsat Archive Production System (NLAPS). The images are further processed to convert bands 1-5 and 7 to

at-satellite-reflectance. The Normalized Burn Ratio (NBR) is computed for each date of imagery using the following formula:

$$((\text{Band 4} - \text{Band 7}) / (\text{Band 4} + \text{Band 7})) \times 1000 = \text{NBR}$$

The differenced NBR is computed by subtracting the post-fire NBR from the pre-fire NBR:

$$\text{PreNBR} - \text{PostNBR} = \text{dNBR}$$

Further processing is required to generate the 'Relativized' dNBR (RdNBR). The RdNBR takes into account pre fire conditions related to the amount of vegetation cover vs. bare soil. In one sense, an area of 25% vegetation cover that burns completely should be considered 'high severity' as would an area of 100% cover that burned completely. The dNBR does not allow that distinction. To calculate the RdNBR, the analyst must determine the 'dNBR offset value': the average dNBR value of a nearby area of unburned vegetation (similar to the vegetation that did burn). The RdNBR is calculated as follows:

$$(\text{dNBR} - \text{dNBROffset}) / (\text{Square Root of } (\text{PreNBR}/1000)) = \text{RdNBR}$$

Higher dNBR and RdNBR values are correlated with more severe burns. The dNBR image is evaluated to determine the threshold value between burned and unburned areas. The perimeter of the fire is delineated using the dNBR and/or post-fire reflectance image. The dNBR image, the pre-fire and post-fire TM images, and a fire perimeter vector file are provided in digital format.

Source\_Used\_Citation\_Abbreviation: TM  
Process\_Date: Unknown  
Process\_Contact:  
Contact\_Information:  
Contact\_Organization\_Primary:  
Contact\_Organization: U.S.Geological Survey  
Contact\_Position: Customer Service Representative  
Contact\_Address:  
Address\_Type: mailing and physical address  
Address: 47914 252nd Street  
Address: USGS EROS  
City: Sioux Falls  
State\_or\_Province: SD  
Postal\_Code: 57198-0001  
Country: USA  
Contact\_Voice\_Telephone: 605/594-6151  
Contact\_TDD/TTY\_Telephone: 605/594-6933  
Contact\_Facsimile\_Telephone: 605/594-6589  
Contact\_Electronic\_Mail\_Address: custserv@usgs.gov  
Contact\_Electronic\_Mail\_Address: fsedc@usgs.gov  
Hours\_of\_Service: 0800 - 1600 CT, M-F, -6 h GMT  
Distribution\_Information:  
Distributor:  
Contact\_Information:  
Contact\_Organization\_Primary:  
Contact\_Organization: U.S. Geological Survey  
Contact\_Position: Principal Scientist, Land Cover Applications  
Contact\_Address:  
Address\_Type: mailing and physical address  
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Contact\_Electronic\_Mail\_Address: custserv@usgs.gov  
Contact\_Electronic\_Mail\_Address: fsedc@usgs.gov  
Hours\_of\_Service: 0800 - 1600 CT, M-F, -6 h GMT  
Contact\_Instructions: <http://mtbs.gov/contactus.html>  
Resource\_Description: Downloadable Data  
Distribution\_Liability: No warranty expressed or implied is made by the USGS regarding the use of the data, nor does the act of distribution constitute any such warranty.  
Standard\_Order\_Process:  
Digital\_Form:  
Digital\_Transfer\_Information:  
Format\_Name: Geo-TIFF  
Format\_Version\_Number: 1  
Digital\_Transfer\_Option:  
Online\_Option:  
Computer\_Contact\_Information:  
Network\_Address:  
Network\_Resource\_Name: <http://mbts.cr.usgs.gov/viewer>  
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Online\_Option:  
Computer\_Contact\_Information:  
Network\_Address:  
Network\_Resource\_Name: <http://mbts.cr.usgs.gov/viewer>  
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Format\_Version\_Number: 1  
Digital\_Transfer\_Option:  
Online\_Option:  
Computer\_Contact\_Information:  
Network\_Address:  
Network\_Resource\_Name: <http://mbts.cr.usgs.gov/viewer>  
Fees: None  
Turnaround: Same day  
Metadata\_Reference\_Information:  
Metadata\_Date: 20080819  
Metadata\_Contact:  
Contact\_Information:  
  
Contact\_Organization\_Primary:  
Contact\_Organization:  
U.S Geological Survey  
Contact\_Position: Science & Applications Branch  
Contact\_Address:  
Address\_Type: mailing and physical address  
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Contact\_TDD/TTY\_Telephone: 605/594-6933  
Contact\_Facsimile\_Telephone: 605/594-6589  
Contact\_Electronic\_Mail\_Address: custserv@usgs.gov  
Contact\_Electronic\_Mail\_Address: fsedc@usgs.gov  
Hours\_of\_Service: 0800 - 1600 CT, M-F, -6 h GMT  
Metadata\_Standard\_Name: FGDC Content Standards for Digital Geospatial Metadata  
Metadata\_Standard\_Version: FGDC-STD-001-1998  
Metadata\_Time\_Convention: local time  
Metadata\_Access\_Constraints: None  
Metadata\_Use\_Constraints: None  
Metadata\_Security\_Information:  
Metadata\_Security\_Classification\_System: None  
Metadata\_Security\_Classification: Unclassified  
Metadata\_Security\_Handling\_Description: None  
Metadata\_Extensions:  
Online\_Linkage: <http://www.esri.com/metadata/esriprof80.html>  
Profile\_Name: ESRI Metadata Profile