ABoVE Burn Severity Product User's Guide

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Abbreviations and Acronyms

ABoVE – Arctic – Boreal Vulnerability Experiment
AICC – Alaskan Interagency Coordination Center
BID – Burn ID
dNBR – Normalized Burned Ratio differencing
HNL – High Northern Latitudes
MTBS – Monitoring Trends in Burn Severity
NRC – Natural Resources Canada
PID – Landsat Image Pair ID

1.0 Introduction

This user guide provides information on the moderate resolution burn severity dataset. It is intended to provide the end user with detailed information about this dataset, including description of the data sources, methodological approach, caveats and known problems.

2.0 Product Description

The moderate resolution (30-m) burn severity product (1984 – 2015) is derived from pre- and post-burn Landsat scenes over the fire perimeters obtained from the Alaskan Interagency Coordination Center (AICC; https://fire.ak.blm.gov/) and the Natural Resources Canada (NRC; https://www.nrcan.gc.ca/) data sets. Only burns within the core ABoVE domain and whose areas are larger than 200 ha are processed in this dataset. The burn severity product is derived from calculating the Normalized Burn Ratio differencing (dNBR) within a 5-km buffered area surrounding each burn scar using Landsat LEDAPS (Masek et al., 2006) surface reflection image pairs.

$$dNBR = NBR_{pre\text{-}burn} - NBR_{post\text{-}burn}$$

$$\text{where, } NBR = (NIR - SWIR_{2.1}) / (NIR + SWIR_{2.1})$$

The pre- and post-burn images were selected based on the following criteria:

1) Images must contain a minimal amount of clouds and cloud shadows within the burn scars.
2) The following combinations of the pre- and post-image pairs are allowed: OLI-OLI, TM-TM, ETM+-ETM+, TM-ETM+, ETM+-TM. The combination of OLI and non-OLI images is excluded because of the differences in band ranges between the OLI and prior sensors.
3) The preferred acquisition date for the pre- (post-) burn images was chosen based on the following strategy:
    - Mid-May to late-June of the year before (after) fire > early-July to mid-September (before snow onset) of the year before (after) fire > snow-free image from the year of fire before (after) fire occurs.

The Monitoring Trends in Burn Severity (MTBS; https://www.mtbs.gov/) image pairs over Alaska were used as a basis for the chosen Landsat pairs over the Alaskan burn scars; however, any MTBS image pairs that did not meet our criteria were dropped and new image pairs were chosen.

3.0 Burn Severity Product

The product is available as sets of three-band GEOTIFF images depicting burns from a given fire year. The images are in the Canada Albers Equal Area Projection and gridded to the ABoVE 30-m reference grid B (Loboda et al., 2017). Only tiles that incorporate burn scars are produced for each year.

The naming convention of each tile follows:

ABoVE.dNBR.2015.Bh11v11.001.2017275170658.tif

where:

ABoVE – refers to the campaign
dNBR – refers to the product type
2015 – refers to the year of burn
Bh11v11 – refers to the grid B tile ID (see ABOVE grid and projection document – Loboda et al. 2017)
001 – refers to the version of the product
2017275170658 – refers to the production date and time (YYYYDDDHHMMSS)

Each gridded dNBR image contains three bands (Table 1). The first band represents the dNBR values calculated for each burn scar and a 5-km buffer. The dNBR values were set to -2500 for those pixels that were affected by invalid land observations (i.e. cloud, cloud shadow, ice/snow and water) according to the QA bands associated with LEDAPS surface reflectance data. The second band contains the Landsat image pair ID (PID) indicating the original Landsat image pair that was used to calculate the dNBR at each pixel in each fire year. The third band stores the perimeters of the fire scars represented by burn IDs (BID) in each fire year. Each BID is a unique 4-digit number assigned to an individual burn scar in the form of XYYY:

where:

X: 1 or 2, representing burn scars from AICC or NRC, respectively
YYY: a three-digit ID unique identifier for a given burn scar within a fire year

Since the dNBR images incorporate buffer zones surrounding each burn scar, for those scars that are in close proximity of each other, their dNBR images may overlap. In such cases, the dNBR of the overlapping regions were set to the highest value at each pixel. The source image pairs of the dNBR values are recorded by the supplementary PID layer.

Table 1: Layer parameters for the delivered GeoTIFF files

	Band1	**Band2**	**Band 3**
Parameter	dNBR	PID	BID
Data Type	16-bit signed integer	16-bit signed integer	16-bit signed integer

Valid Range	-2999 - 2999	0 - 1000	1000 - 3000
Scaling factor	0.001	none	none
Fill Value	-3000	0	0
Unclassified	-2500	0	0

All dNBR data tiles from the same year are associated with two auxiliary tables, which serve as index files containing the detailed information about each PID and BID (including the path/row, acquisition time of the pre- and post-burn images), respectively.

4.0 Caveats and Known Problems

For a small amount of fires, the dNBR was unable to be calculated for a portion of or the entirety of the fire perimeters due to a lack of valid data inputs.

5.0 References

Loboda, T.V., Hoy, E.E, & Carroll, M.L. (2017). ABoVE: Study Domain and Standard Reference Grids. ORNL DAAC, Oak Ridge, Tennessee, USA. https://doi.org/10.3334/ORNLDAAC/1367

Masek, J.G., Vermote, E.F., Saleous, N.E., Wolfe, R., Hall, F.G., Huemmrich, K.F., Feng, G., Kutler, J., & Teng-Kui, L. (2006). A Landsat surface reflectance dataset for North America, 1990-2000. *Geoscience and Remote Sensing Letters, IEEE, 3*, 68-72