RECOVER PROTOCOL: Creating a differenced Normalized Burn Ratio (dNBR) Layer

Purpose:

Prepare a differenced Normalized Burn Ratio (dNBR) to support fire managers.

Software Needed:

- IDRISI Terrset (or other version with "Landsat Archive Import" tool)
- ArcMap

Fire Data and Information:

- Fire start date _____

- Fire end date _____

- Pre- and Post-fire multispectral imagery

- Fire Perimeter or Area of interest GIS data layer

STEPS

I. **Acquire Imagery:**

Using USGS Earth Explorer download Landsat 8 imagery of the fire area. You must obtain two Landsat images, 1) a Pre-ignition image and 2) a post-fire image. Selecting image dates as close to the actual fire dates as possible produces the best results.

- Pre-Fire Imagery date _____

- Post-Fire imagery date _____

II. **Pre-Process Imagery in IDRISI:**

To calculate dNBR (or any other spectral index) you must first atmospherically correct the imagery. This can be done using IDRISI TerrSet's "Landsat Archive Import" tool along with Landsat 7 or 8 imagery, for which you have the imagery metadata file (.MTL). To do so:

1. Make sure you are using Landsat 8 imagery in order to use the Landsat Archive Import tool

2. Select "File" on the top toolbar and expand to and select Import> Government / Data Provider Formats > Landsat data Archive. This will open the Landsat Archive Import Tool

3. From the Landsat archive import tool dialogue, click the ellipses ( ) , then click "Browse…" and navigate to and select the desired Landsat metadata (.MTL) file.

4. Once the individual bands have loaded click "Yes/No" beneath the "Include" field to select the bands that you want to import and atmospherically correct (for landsat 8, include bands 5 and 7). Note: Only including the bands you need to process dNBR will make the tool execute more quickly.

5. In the "Multispectral bands" section, select "Convert to reflectance".

6. In the "Reflectance Correction" section, select Cos(t) model.

7. Click "ok"

8. After processing, the imported and corrected band images will display and be available in the TerrSet Explorer pane.

III.   Process NBRs

Using IDRISI run the Image Calculator to calculate NBR for Pre-Fire and Post-Fire Imagery using each image's respective bands.

NBR = (NIR-SWIR)/(NIR+SWIR)
- Landsat 8: **NBR = (B5-B7)/(B5+B7)**

IV.   Export NBR images
You should now have two NBR images. 1) A NBR image of the area of interest before the fire start date, and 2) a NBR image of the same area of interest after the the fire's end date.

Once you have the Pre-fire NBR and Post-Fire NBR images complete, export each to GeoTIFF format for use in ArcGIS.

- File>Export>Software-Specific Formats>GeoTIFF/TIFF

V.   Create dNBR in ArcMap

1. Open ArcMap and add the Pre-Fire and Post-Fire NBR TIF images as well as the fire perimeter or Area of Interest polygon to the table of contents. Select yes to build pyramids and calculate statistics for the raster data if prompted.

2. Make sure all data is projected in:
**USA_Contiguous_Albers_Equal_Area_Conic_USGS_version
WKID: 102039**

3. Using "Raster Calculator" create dNBR
   - **dNBR = Prefire_NBR – Postfire_NBR**

VI.   Clip dNBR to the fire Perimeter.
Use the Clip tool in the Raster Processing Toolbox. Clip to specific Fire Perimeter.

 If you are creating a "Fire Affected Vegetation (dNBR)" layer for a RECOVER web client.

If you want to create a "Fire Severity" Continue on through the following steps.

VII.   Scale dNBR by 10^3

Using Raster Calculator multiply the dNBR layer by 1000, using the following equation (INT(dnbr) * 1000)). This will create a practical data range of approximately -500 to +1300.

VIII.   Reclassify dNBR
Using Reclassify in the Reclass toolbox of the Spatial Analysis Tools, reclassify the dNBR into severity levels of:

Severity Level	dNBR Range	Value
Unburned	-148 – 100	1
Low Severity	101 - 305	2
Moderate Severity	306 - 550	3
High Severity	551 - 1115	4
Increased Greenness	-LOW - -150	5

These value ranges are flexible and Scene-Pair dependent. Shifts in thresholds +/- 100 are possible. dNBR values less than about -550, or greater than about +1350 may occur, but usually are not considered burned. Rather they are anomalies caused by miss-registration, clouds or other factors not related to real land cover differences. *This information was provided by the USGS.*

IX.   Edit dNBR attribute tables to include class names
Open the attribute table for the classified imagery and create a new field called "Fire_sever". Add the Severity Level class names to the corresponding value. (e.g., 1 = Unburned, 2 = Low Severity)