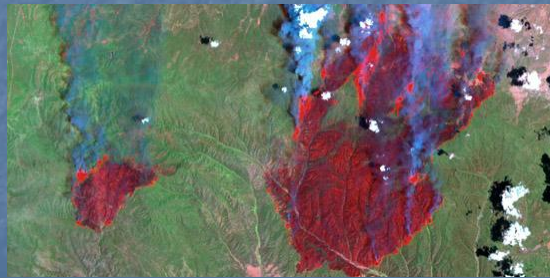# A discussion of USFS Burn Severity Calculations Using Remotely Sensed Data

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USFS Remote Sensing Applications Center (RSAC)

- Along with the Geospatial Services and Technology Center (GSTC), the RSAC provides national assistance to agency field units in applying geospatial technologies in monitoring and mapping natural resources.

- A major component is the assistance of Burned Area Emergency Rehabilitation (BAER) teams. These teams, often interagency coordinated, are tasked with the initial response to a post wildfire incident. The importance of accurate assessment of post fire effect (PFE) is critical in establishing a rehabilitation regime for a given area.

Burned Area Reflectance Classification (BARC)

- BAER teams primary focus is on areas most severely impacted by wildfire events. Due to this they often prefer maps indicative of soil burn severity.

- Due to influences of both photosynthetic and non-photosynthetic vegetation on spectral properties of post fire images a combined method approach is used to produce BARC maps. Due to differences in regional vegetation, etc. different correalation matrices are utilized to produce BARC maps. All include either a NBR or dNBR calculation in combination with dNBRT1/2, dEVI, or NDVI.

BARC Maps
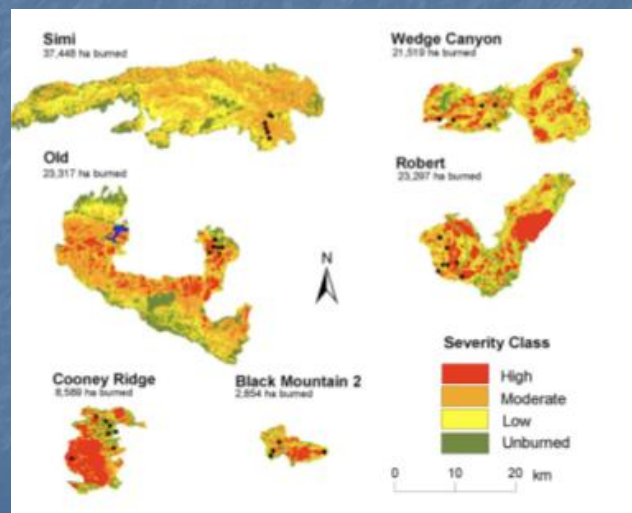
PFE vs. BSI

- PFE field measures:
    - Overstory cover (%)
    - Understory cover (%)
    - Surface
        - Ash (%)
        - Charred organic (%)
        - Charred inorganic (%)
        - Etc
    - Subsurface
        - Duff depth
        - Duff moisture (%)
        - H20 penetration time

- RS Burn Severity Indices (BSI)
    - Normalized Burn Ratio
    $(NBR)=(B4-B7)/(B4=B7)$
        - dNBR, RdNBR
    - NDVI
    $(B4-B3)/(B4+B3)$
    dNVI
    - EVI Enhanced Vegetation Index
    $2.5* (B4-B3)/(B4+6*B3-7.5*B1+1)$
    dEVI

Field Methods vs Remote Sensing

- Accurate severity indices are dependant upon a combination of remotely sensed data and ground truthing. This is due to certain weaknesses inherent in RS data.
    - I.e. Burned grassland are often missclassified as areas of "high" burn severity. However, grasslands rarely burn severely enough to cause extensive damage to soil substrates .

- While the above example is easily corrected using the NLCD to remove any areas of grassland classified as "high" and reclassify them as "low", not all biasing errors are correctable using GIS and require field observations

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Methods Con't

- Calculated spectral indices are divided into NBR, dNBR,NDVI, NBR derived, etc
- Correalations between field and image variables are generated

- NBR is considered to correlate better to field attributes when post fire image capture occurs immediately post fire. Conversely dNBR is considered to produce better correealations when several weeks have passed after burning.
- RSAC products generally rely on Jenks Natural Breaks logic to establish breakpoints. However these do not accurately represent breakpoints between severity classes and are meant to provide field users with an easier starting point for classification

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- Hudak A, P. Morgan, C. Stone, P. Robichaud (2004). The relationship of field burn severity measures to satellite-derived Burned Area Reflectance Classification (BARC) maps. *International Archives of Photogrammetry and Remote Sensing.*

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