

## Enhancing Fire Management with Earth Observations

### Pitch Team:

**Mary Ellen Miller, PhD**

**Nancy French, PhD**

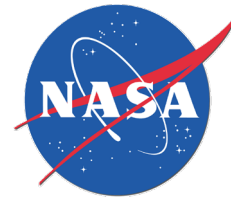
Michigan Tech Research Institute, Ann Arbor, MI

**Mathew Dickinson**

U.S. Forest Service, Northern Research Station, Delaware, OH

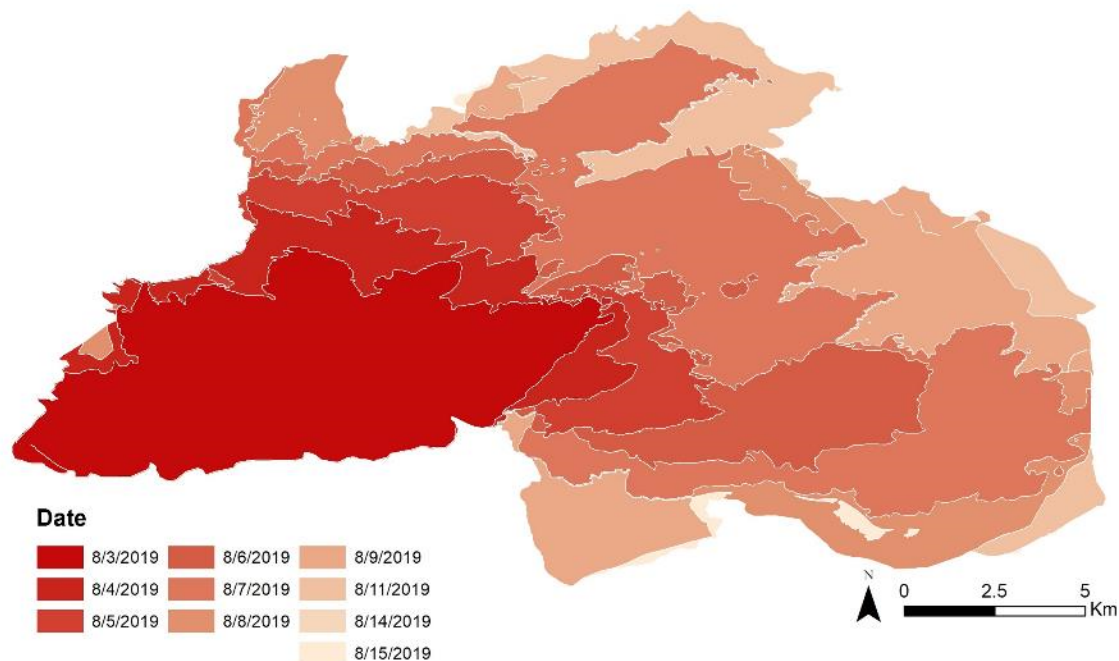
**Sam Batzli, PhD**

University of Wisconsin-Madison, Madison, WI

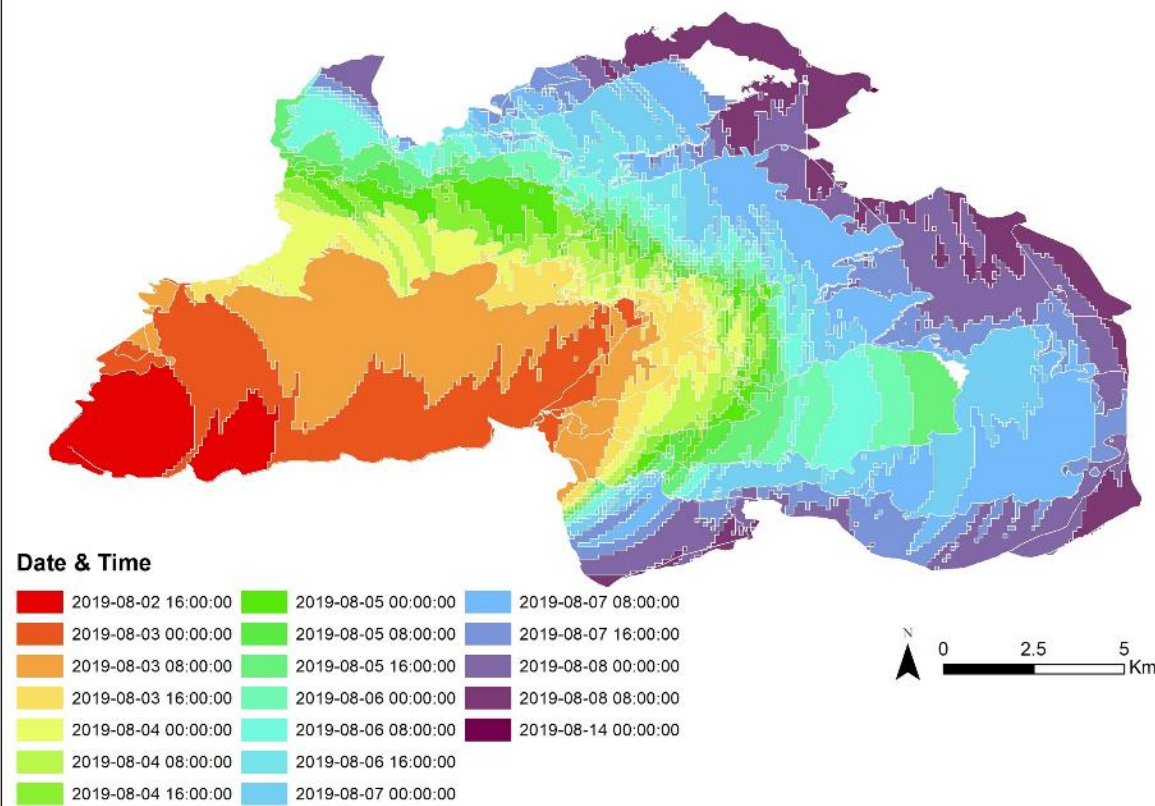


# Fusion of Thermal Imagery

GeoMAC Contiguous Progression



GeoMAC Contiguous Progression  
Interpolated with MODIS & VIIRS





# ***ECOSTRESS: ECOsystem Spaceborne Thermal Radiometer Experiment***

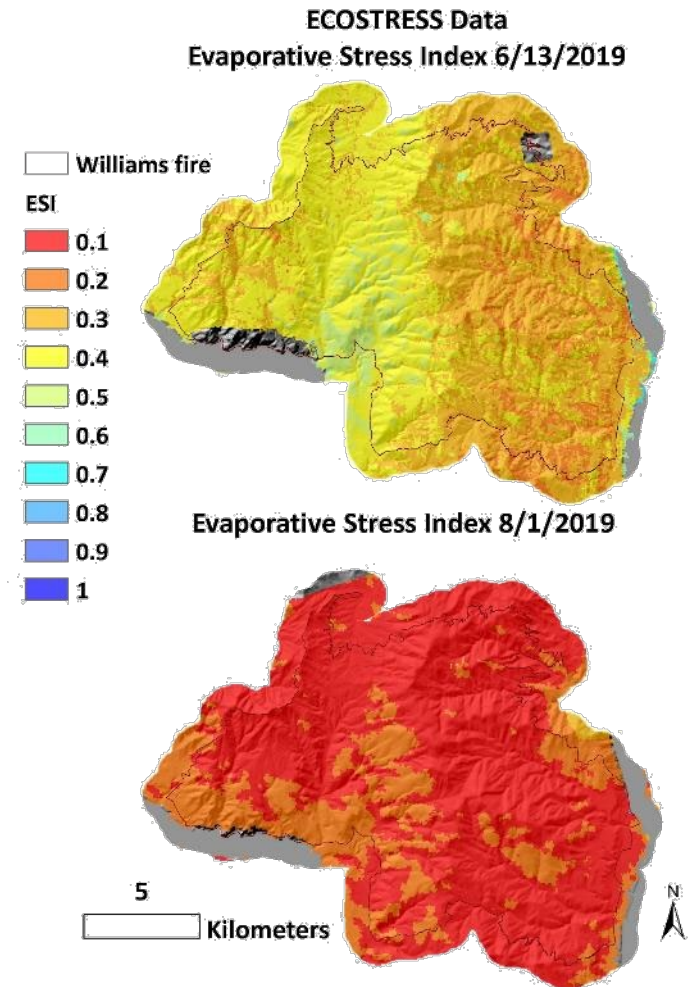
**Relies on multiple instruments, models and datasets to perform energy balance modeling in order to derive ET and Evaporative Stress Index.**

$$\text{ESI} = \text{ET} / \text{PET}$$

Potential evapotranspiration (PET) is the amount of water that would be transpired and evaporated occur with an ample water supply.

Evapotranspiration (ET) is the actual amount of water that is evaporated and transpired.

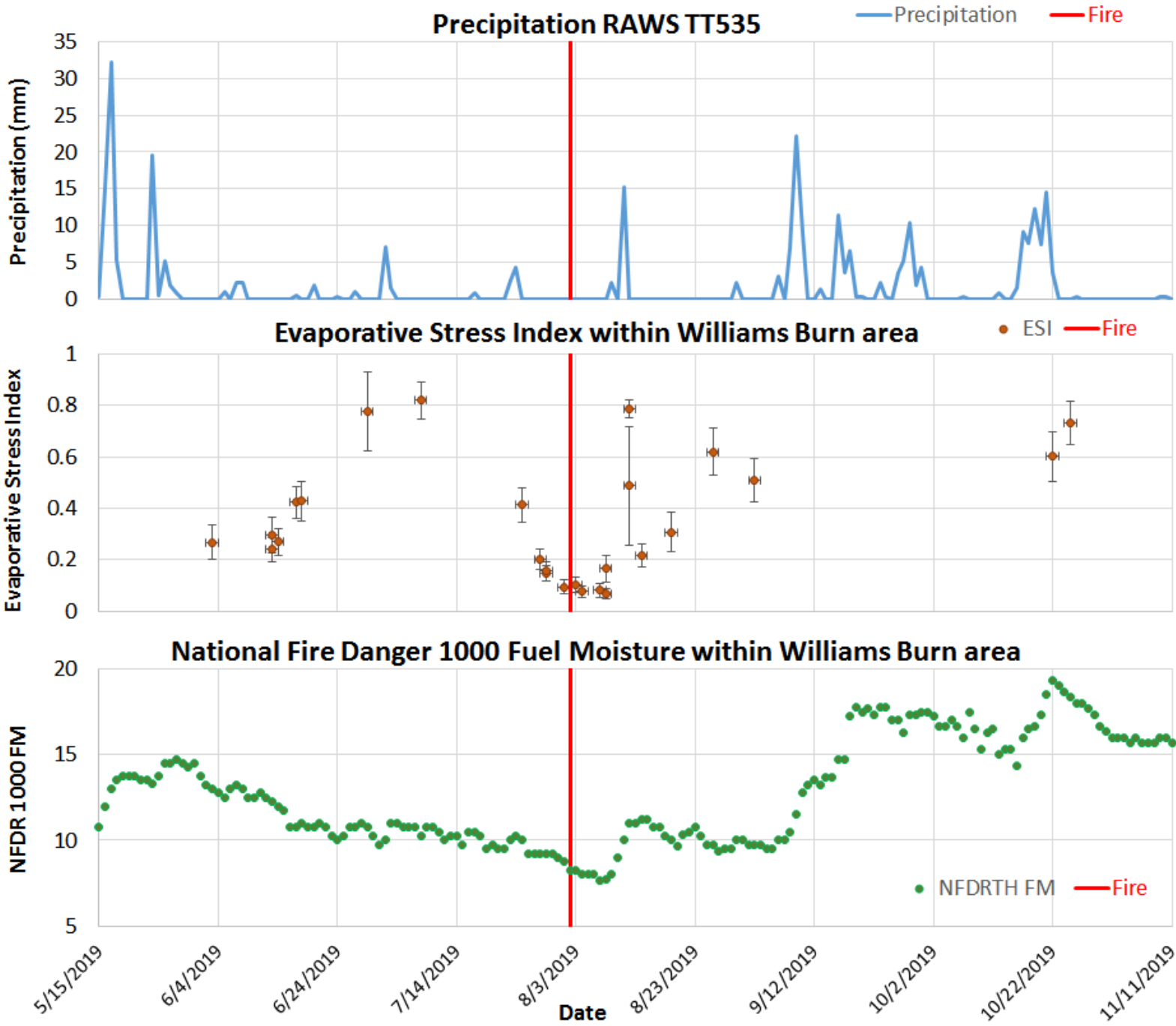
ESI is a unitless ratio of mm/hr ranging from 0 (very water stressed) to 1 (no water stress)





# Explore ECOSTRESS Fire Applications:

- Can ECOSTRESS help map Fire Danger?
- Improve live and dead estimates of fuel moisture?
- Can better estimates of fuel moisture improve estimates of emissions?
- Improve predictions of potential burn severity?







# Burn Severity Prediction Tool

<https://apps.mtri.org/burnsev/get>

BURN SEVERITY PREDICTOR

← → ↻ 🏠 🔒 <https://apps.mtri.org/burnsev/get> 🔍 ★ ⚙️ 📄 📱

## Burn Severity Predictor 5000

Michigan Tech Research Institute

Click on the square tool to draw a bounding box indicating download area. To redraw, click the tool again.

Selection area: -- km<sup>2</sup>

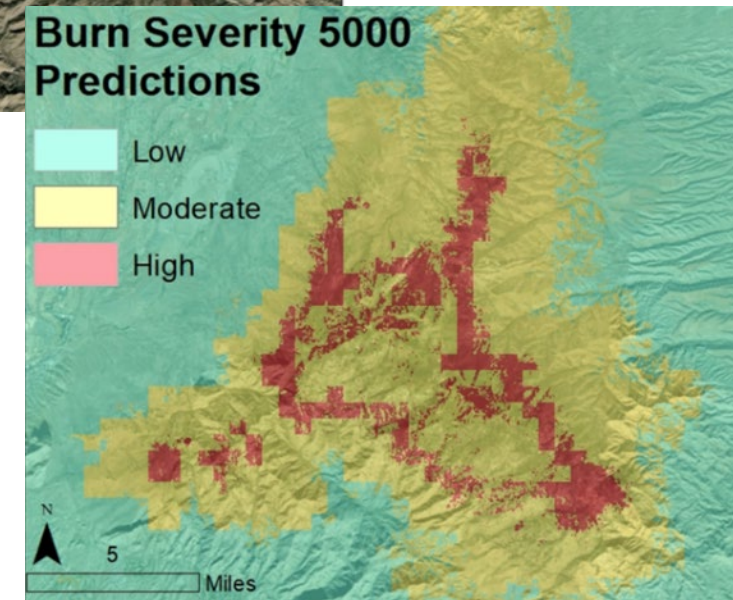
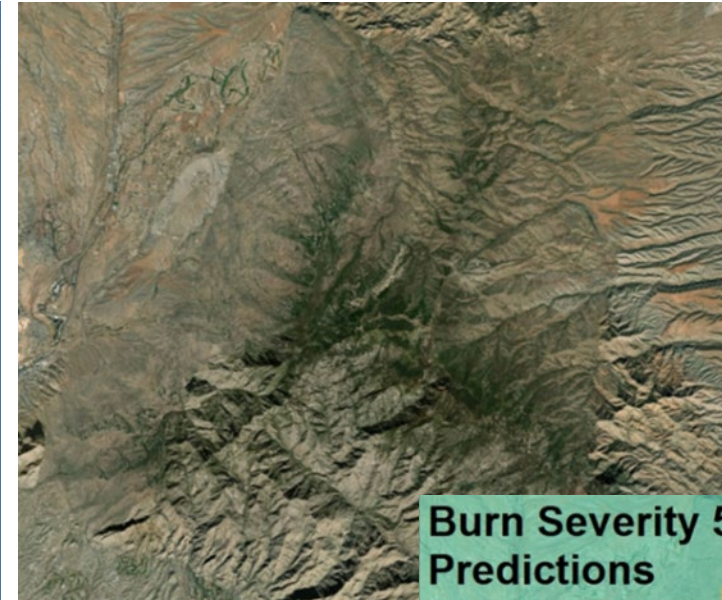
Email address:

For notification when model run completes.

**Select area to model!**

This app predicts burn severity by comparing properties of the drawn bounding box to nearby historic fires having known burn severity data (classified dNBR maps). In the table below, select the historic fires to use in your prediction:

| MTBS ID | MTBS NAME | DATE | 1K-HR FM | dNBR MEAN |
|---------|-----------|------|----------|-----------|
|---------|-----------|------|----------|-----------|







# Rapid Response Erosion Database

RRED <http://rred.mtri.org/rred/>



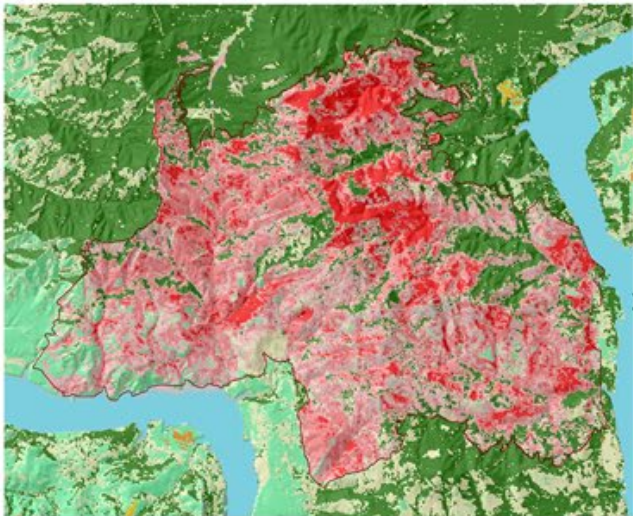
- The removal of protective cover from soil by wildfire can dramatically increase runoff and erosion.
- RRED combines earth observations of burn severity with model inputs to allow for rapid assessment of post-fire erosion hazards.

Williams fire

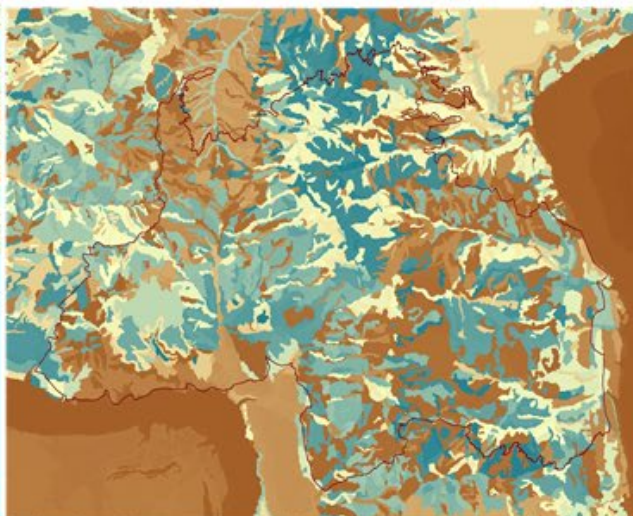
Land cover

- Water
- Developed
- Roads
- Barren
- Young Forest
- Forest
- Short grass
- Tall grass
- Shrub
- Pasture/Hay
- Crops
- Wetlands
- Low severity
- Mod severity
- High severity

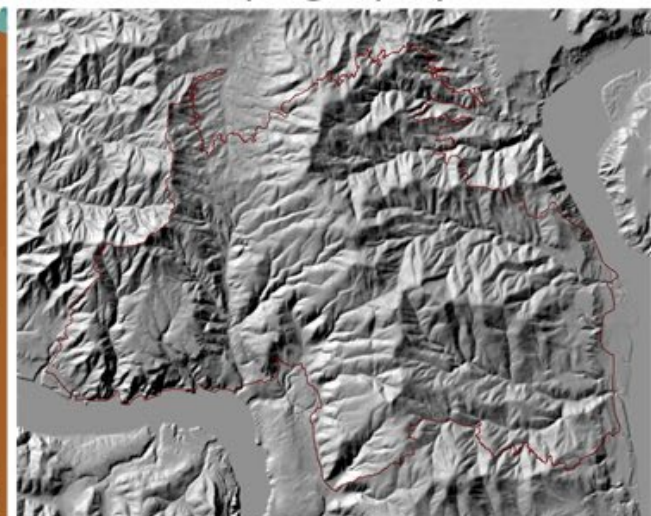
Land cover



Soils



Topography



# BRIDGE Map: Raster Math with NDVI



## Burn Intensity Delta Greenness Estimation (BRIDGE) Map:

To quantify change, we subtract NDVI values of the before-fire product from the values of the after-fire product.

|   |   |   |   |
|---|---|---|---|
| 1 | 1 | 0 | 0 |
|   | 1 | 2 | 2 |
| 4 | 0 | 0 | 2 |
| 4 | 0 | 1 | 1 |

InRas1

|   |   |   |   |
|---|---|---|---|
| 0 | 1 | 1 | 0 |
| 3 | 3 | 1 | 2 |
|   | 0 | 0 | 2 |
| 3 | 2 | 1 | 0 |

InRas2

=

|   |    |    |   |
|---|----|----|---|
| 1 | 0  | -1 | 0 |
|   | -2 | 1  | 0 |
|   | 0  | 0  | 0 |
| 1 | -2 | 0  | 1 |

OutRas

Value = NoData

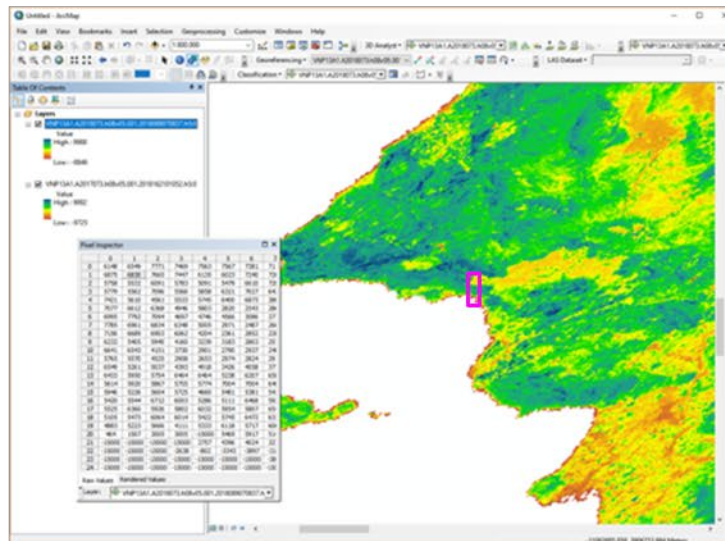
NDVI After

-

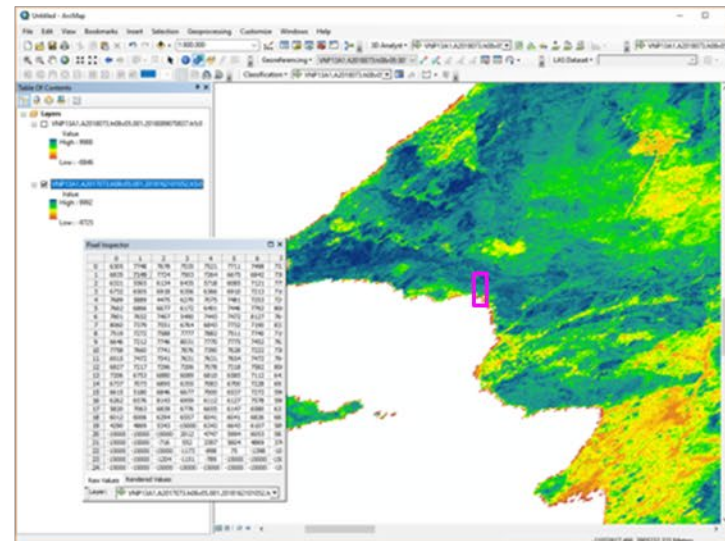
NDVI Before

=

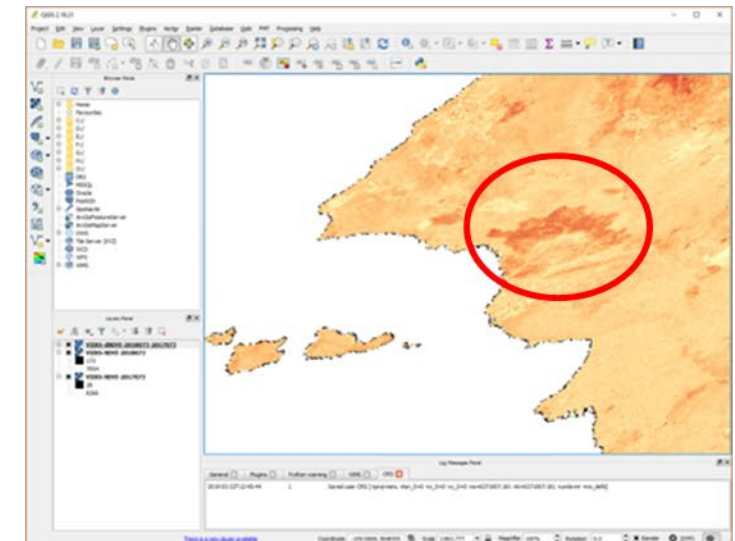
dNDVI (Change)



-



=





# RRED and new **BRIDGE** VIIRS early burn severity assessment maps

Can **RRED** and **BRIDGE** provide an even faster response?

**Yes!** – using **BRIDGE** data a new early assessment burn severity map derived from VIIRS NDVI data.

**BRIDGE** burn severity map was created without information from Landsat data.

