

Mapping fire effects at 10m using Sentinel 2 seasonal composites



Photo credit: Kenny Frick FHP
Tellico Fire 7/20/2017



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US Forest Service Southern Research Station
Asheville, NC

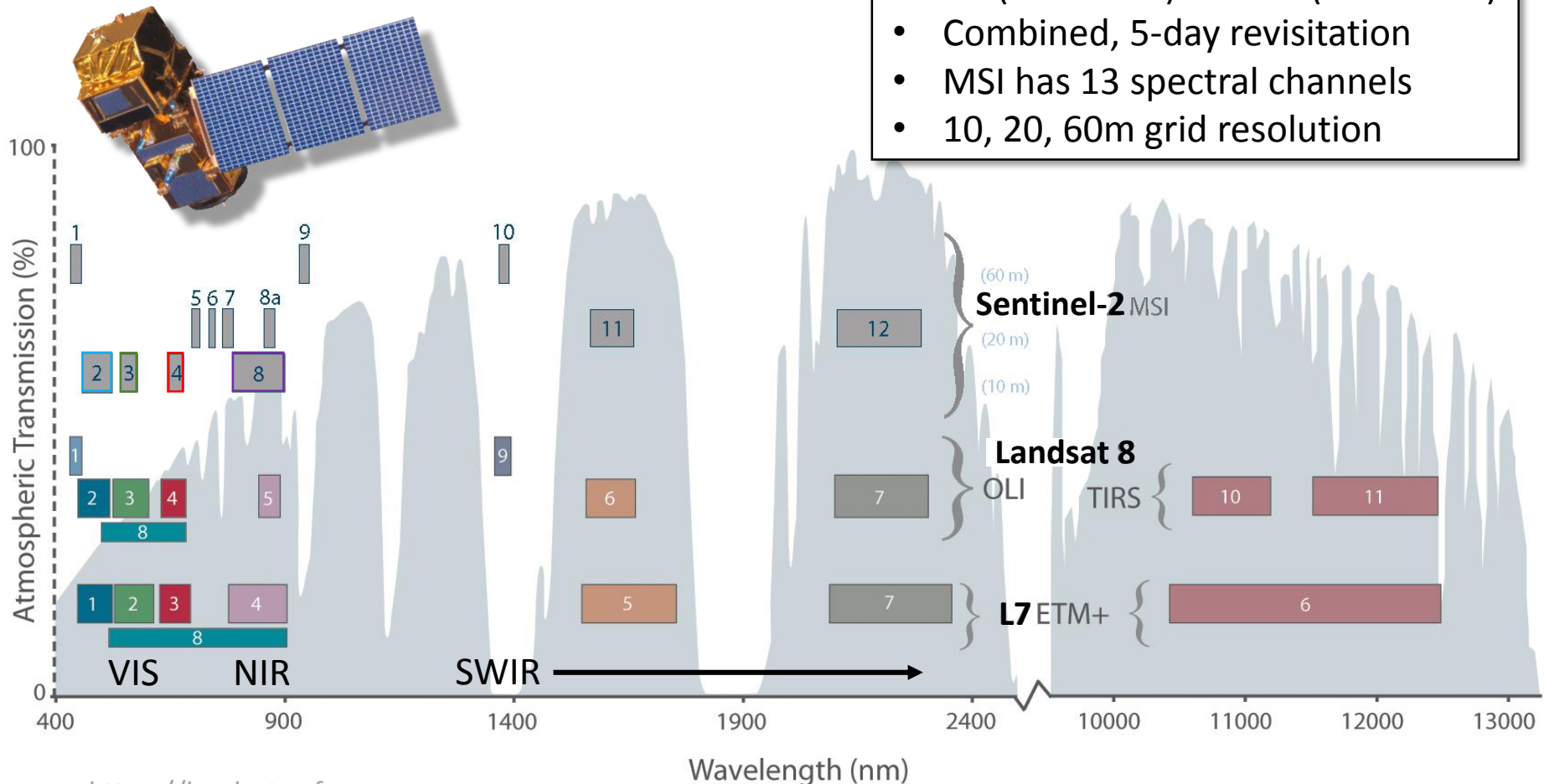
(stevenorman@fs.fed.us)

Mountain Regional
GIS Alliance (MRGAC)
Sep. 15, 2017
Asheville, NC

Why Sentinel 2?

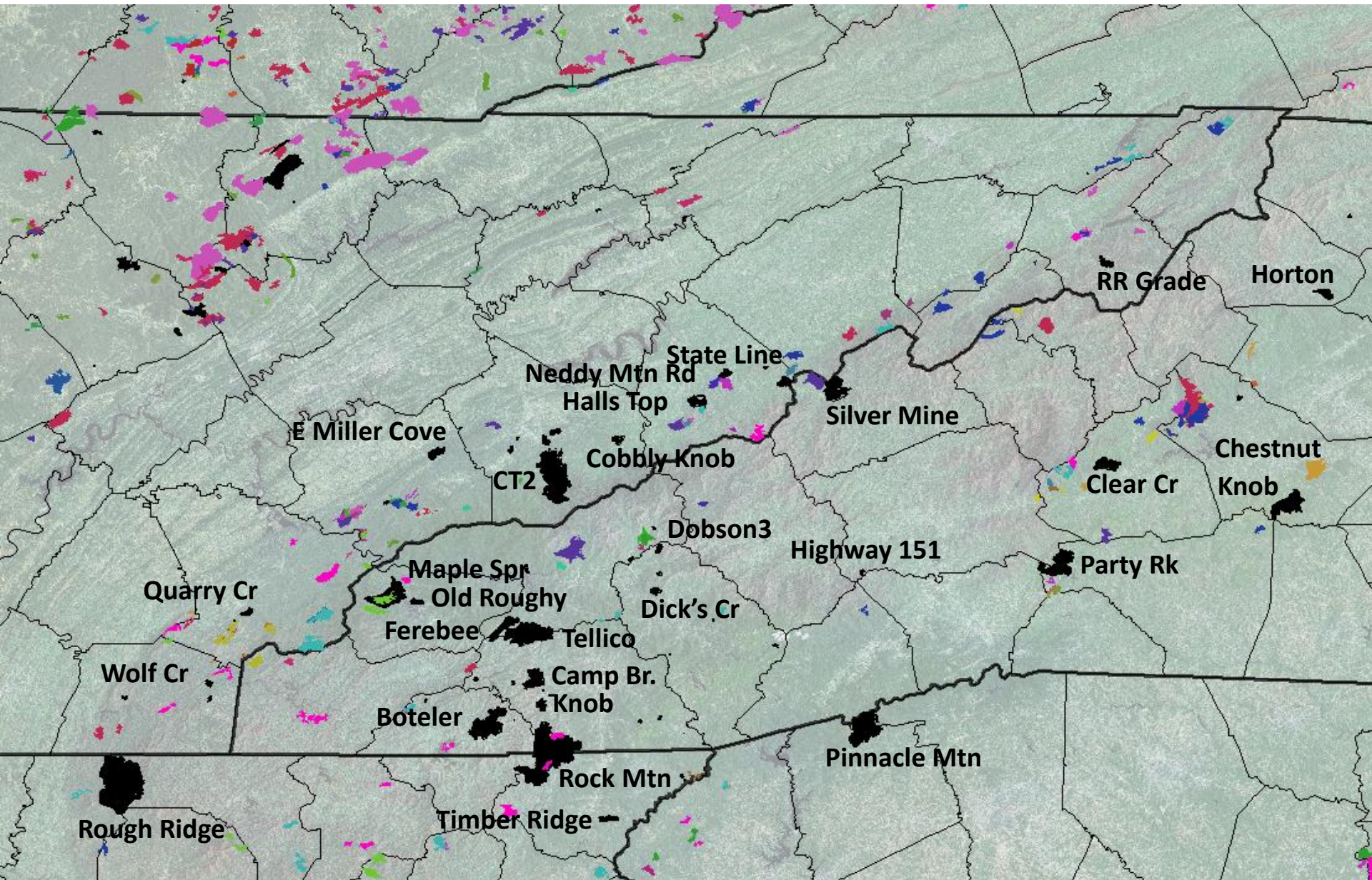
- Targeted dynamics occur close to 10m resolution
- Relatively high frequency
- Standardized product for landscape analysis

- European Space Agency
- Global coverage
- Free and open data policy
- **2A** (Jun. 2015) and **2B** (Mar. 2017)
- Combined, 5-day revisitation
- MSI has 13 spectral channels
- 10, 20, 60m grid resolution



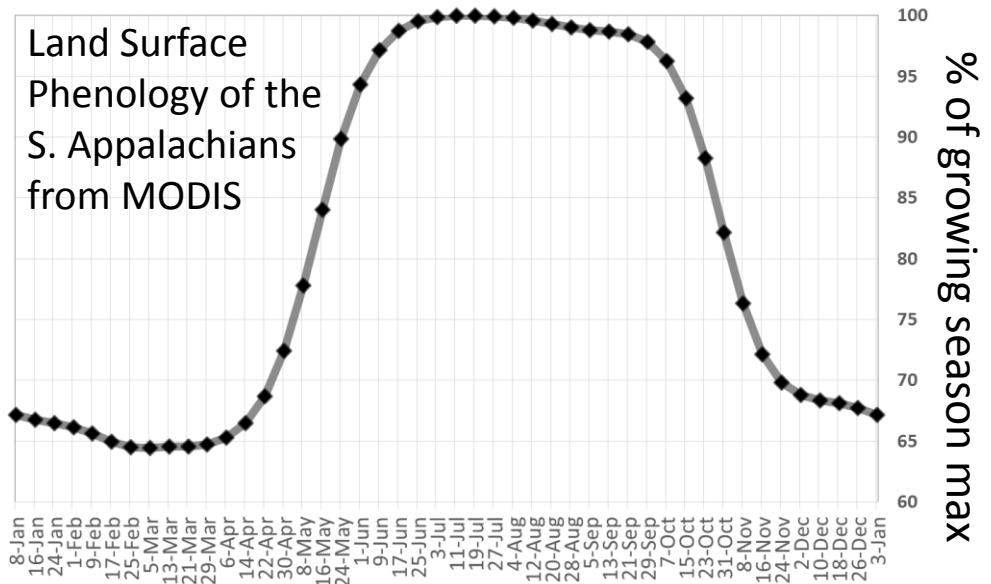
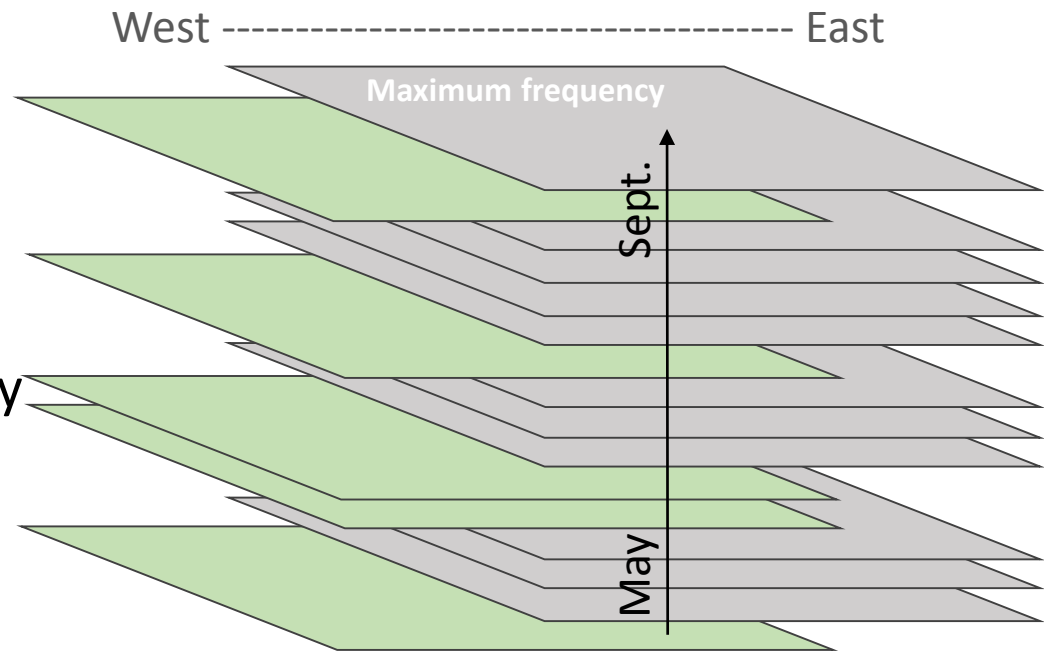
Southern Appalachian Wildfires

2016 fires are labeled and in black; other colors are fires since 1984

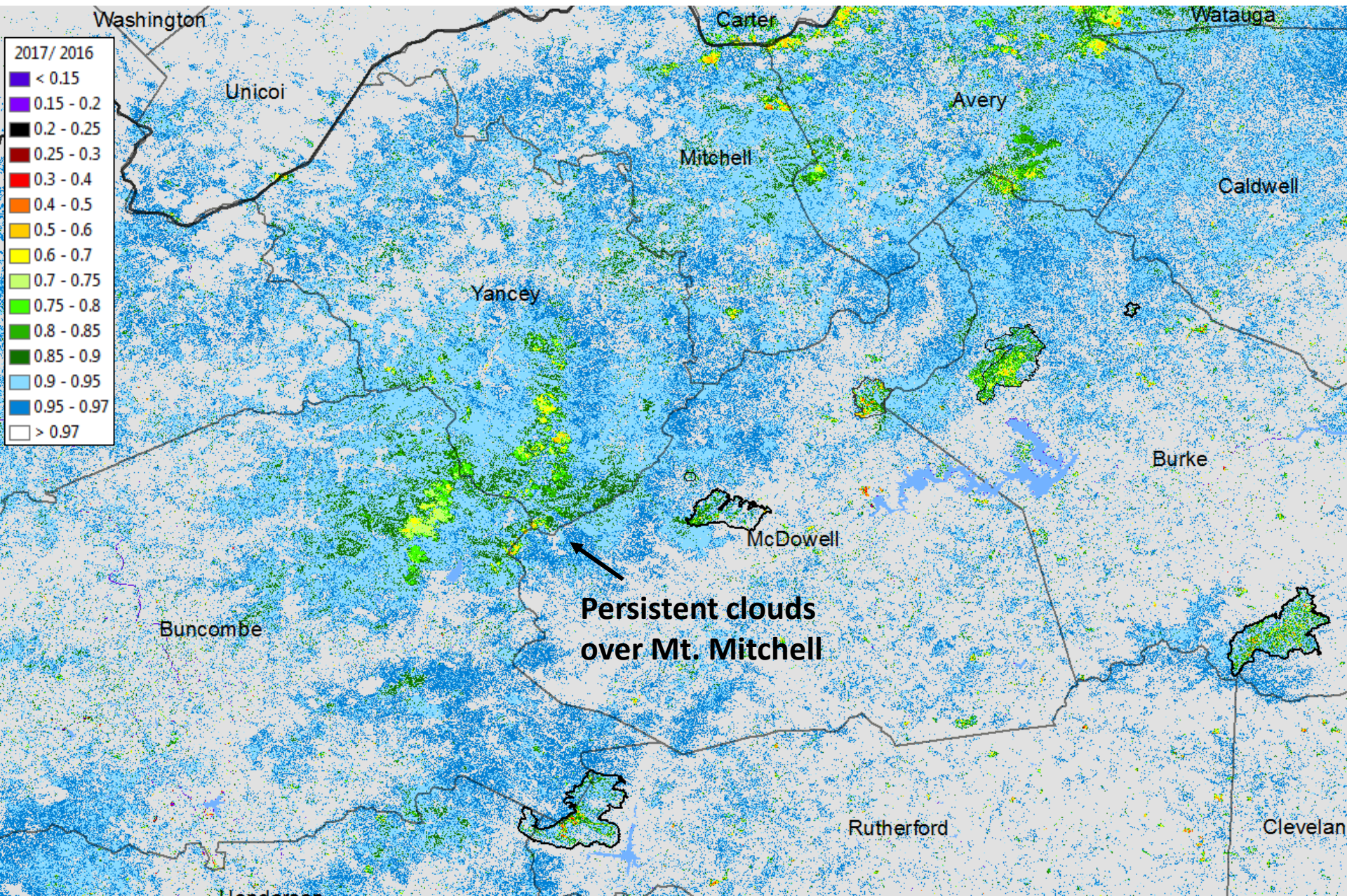


Methodology

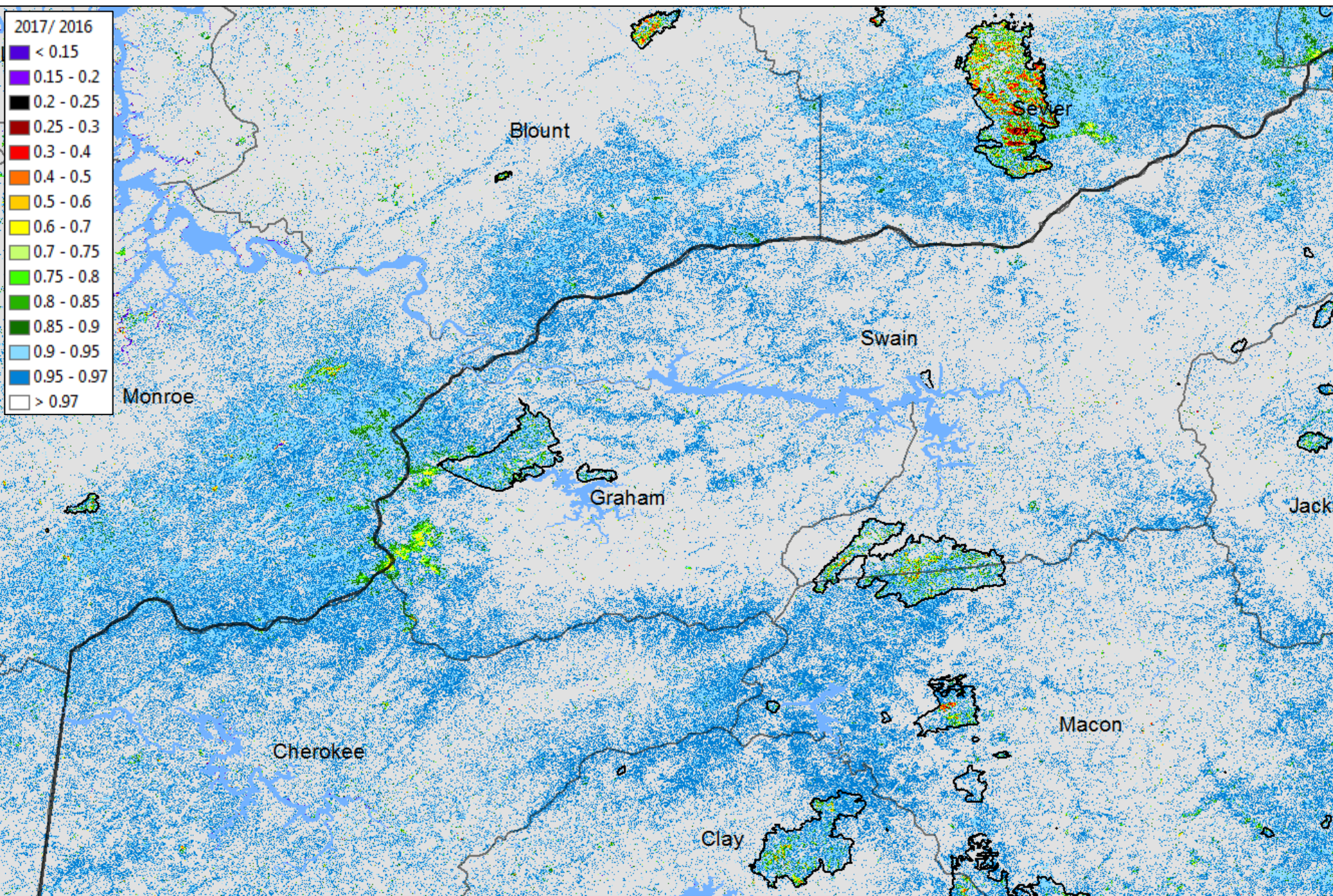
- Calculated NDVI at 10m for each date
- Removed major clouds to identify areas with “no data” (SWIR B12)
- Calculated the 2016 and 2017 growing season maximum NDVI values
- Generated annual change products from growing season composites
- Generated spring progress products vs composited 2016 baseline (“percent greenup”)



Results: Eastern S. Appalachians 2017/2016

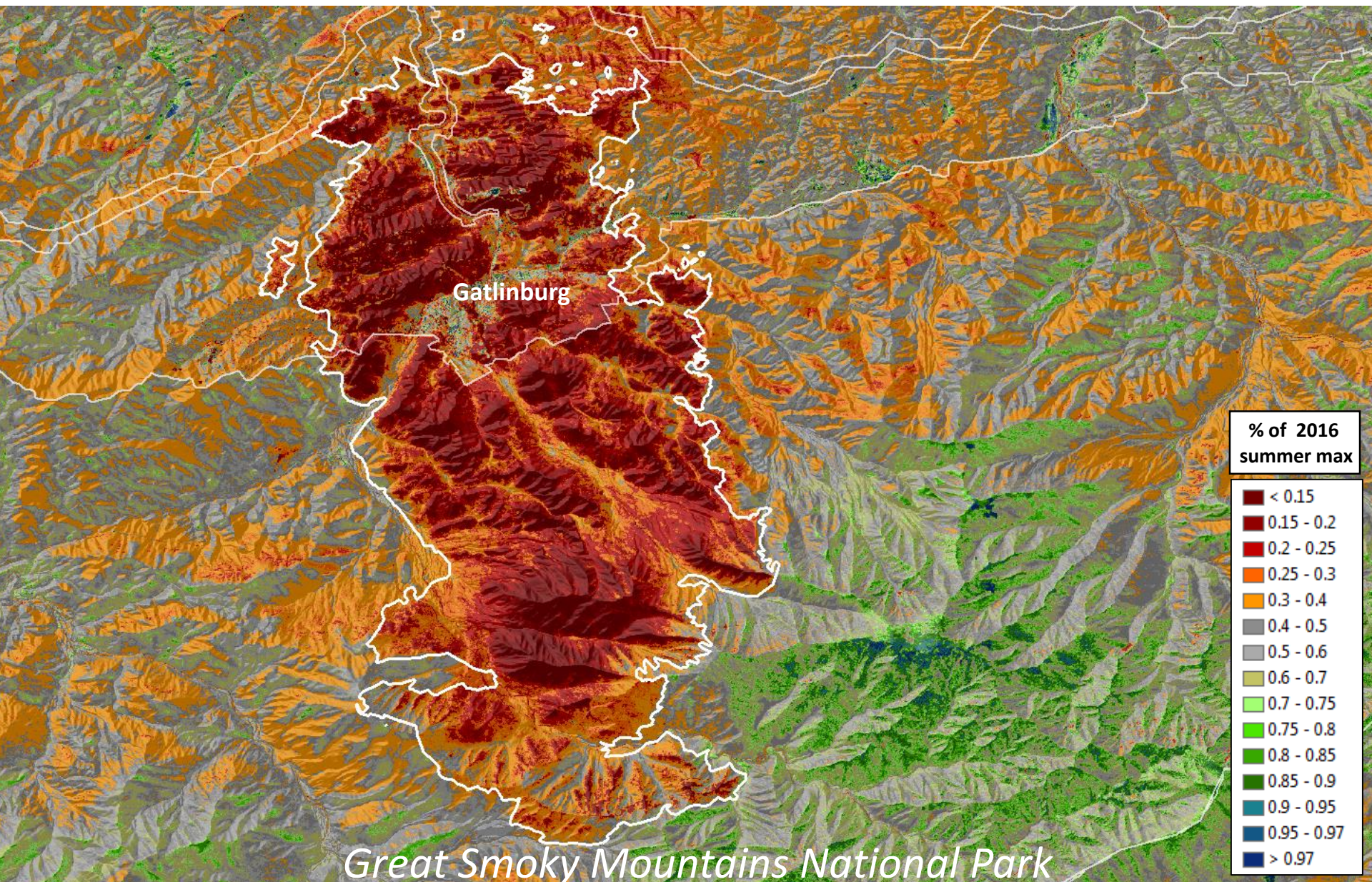


Results: Western S. Appalachians 2017/2016



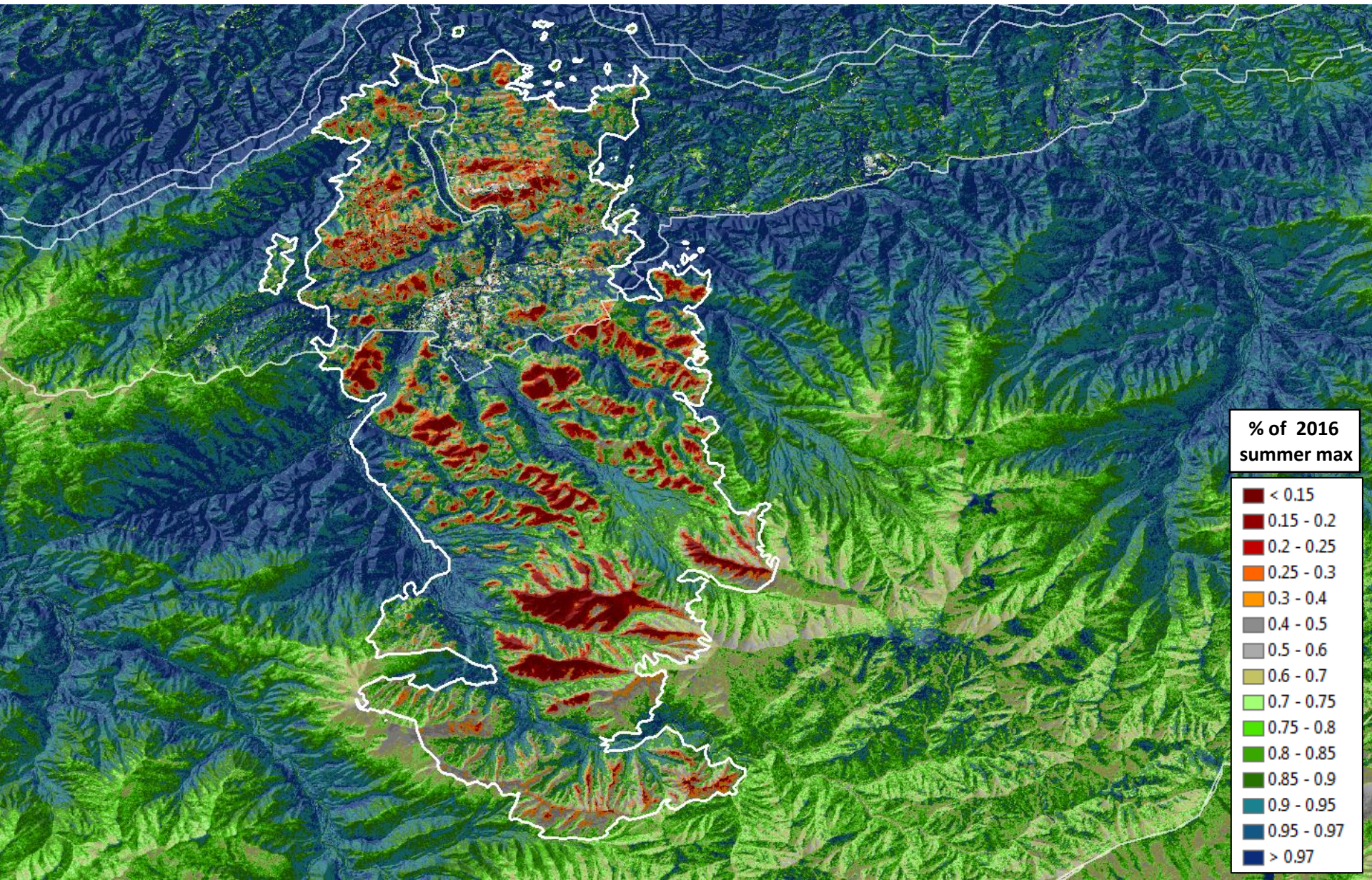
Results: Percent Greenup as of 3/23/2017

Based on 2016 Sentinel composted max. growing season NDVI



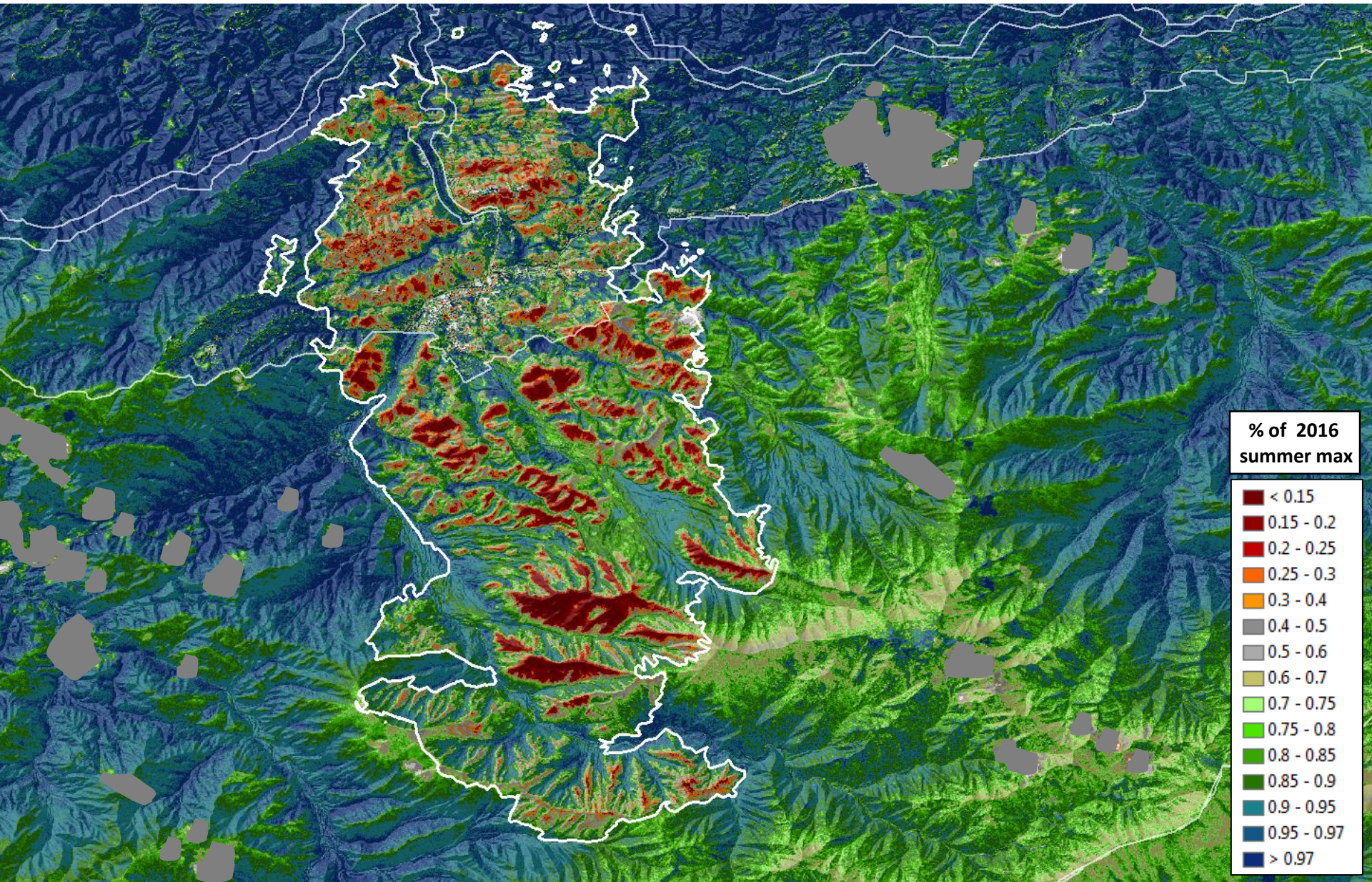
Results: Percent Greenup as of 5/2/2017

Based on 2016 Sentinel composited max. growing season NDVI



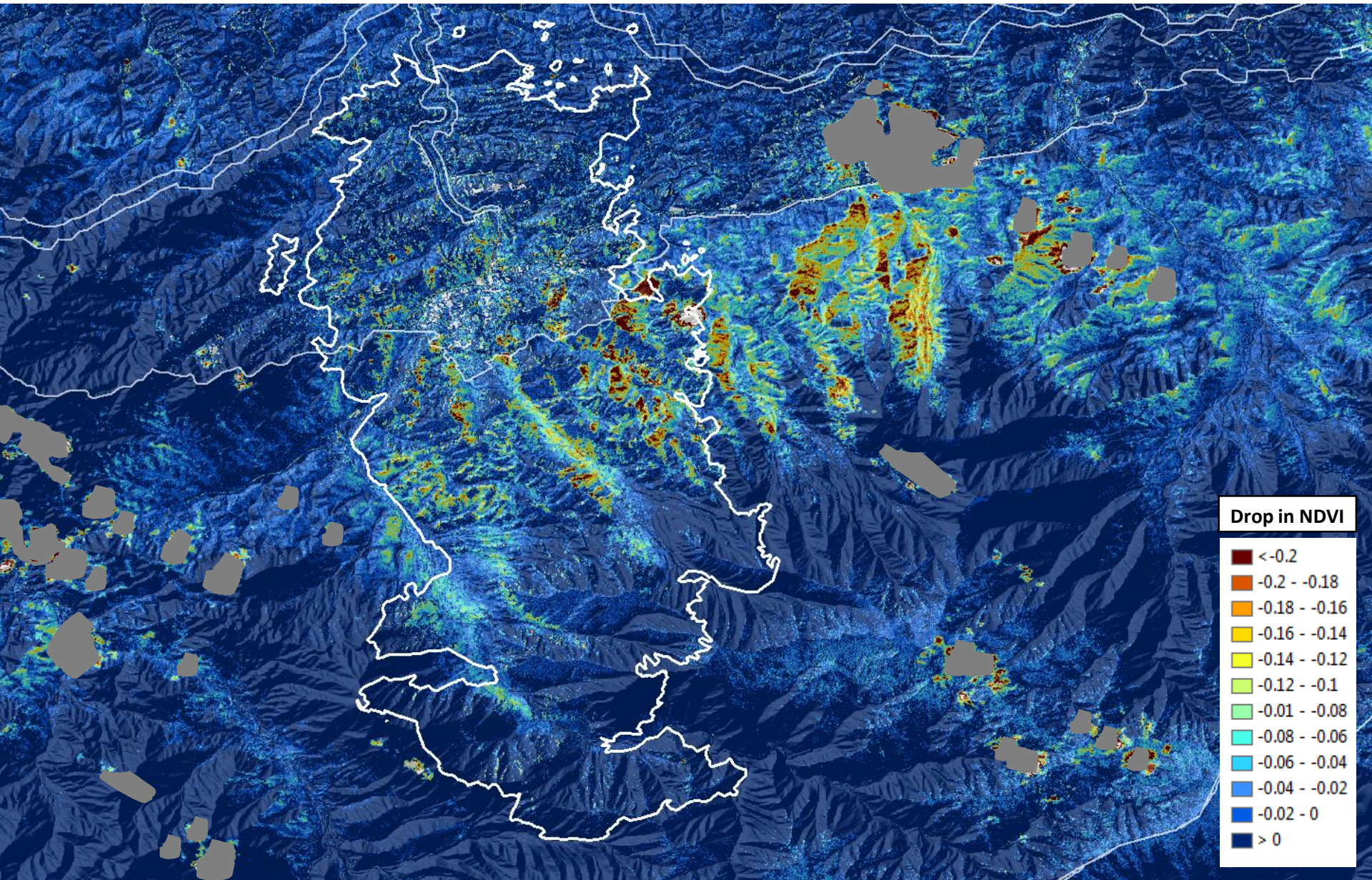
Results: Percent Greenup as of 5/15/2017

Based on 2016 Sentinel composted max. growing season NDVI



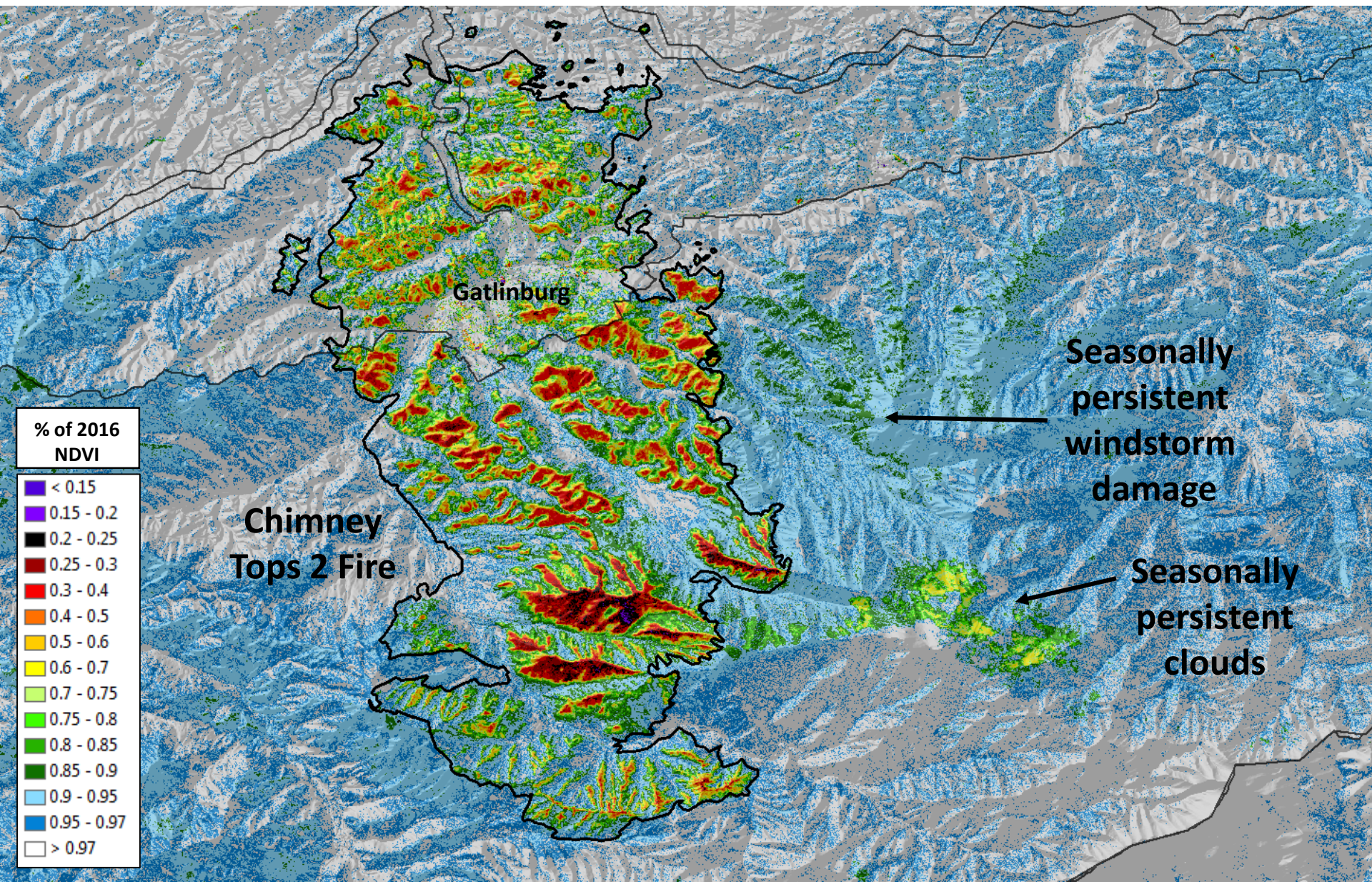
Results: Unexpected Spring Phenological Reversal

Between 5/2 and 5/15 caused by a 5/4/2017 mountain wave wind event

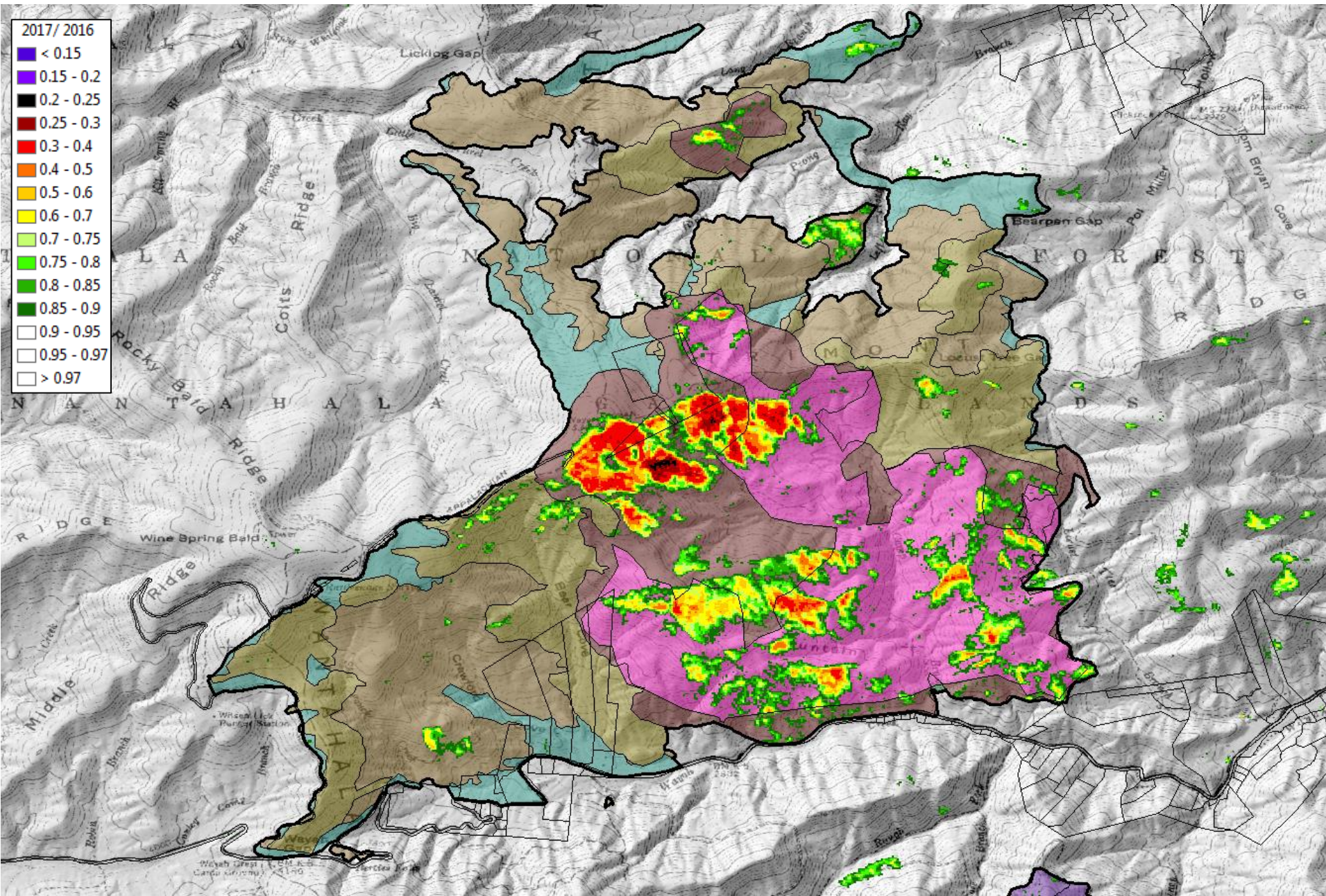


Results: Change in Growing Season NDVI

Based on Sentinel Composites, 2017/2016, showing the fire's canopy impact



Camp Branch Parcels, Progression and Impacts




Camp Branch Oblique Photograph – 7/20/2017



Photo credit: Kenny Frick FHP

Planet.com imagery for 9/4/2017



[Upgrade plan](#)
[Terms](#)

No date ranges defined

Save search

Daily Imagery - Aggregate of image captures

Cloud cover
0 - 25 %


Area coverage
10 - 100 %

Source
2 sources

All filters >

All (253) >


Most recent



September 9, 2017
Upgrade plan

4-band PlanetScope Scene (3 m)
100 % area coverage


2 images



September 8, 2017
Upgrade plan

4-band PlanetScope Scene (3 m)
100 % area coverage


2 images



September 8, 2017
Upgrade plan

4-band PlanetScope Scene (3 m)
100 % area coverage


2 images



September 4, 2017
Upgrade plan

4-band PlanetScope Scene (3 m)
69 % area coverage


2 images



September 4, 2017
Upgrade plan

4-band PlanetScope Scene (3 m)
100 % area coverage


2 images



August 29, 2017
Upgrade plan

4-band PlanetScope Scene (3 m)
14 % area coverage


1 image



August 22, 2017
Upgrade plan

4-band PlanetScope Scene (3 m)
100 % area coverage


3 images



August 20, 2017
Upgrade plan

4-band PlanetScope Scene (3 m)
100 % area coverage

2 images



200 m

1 Month

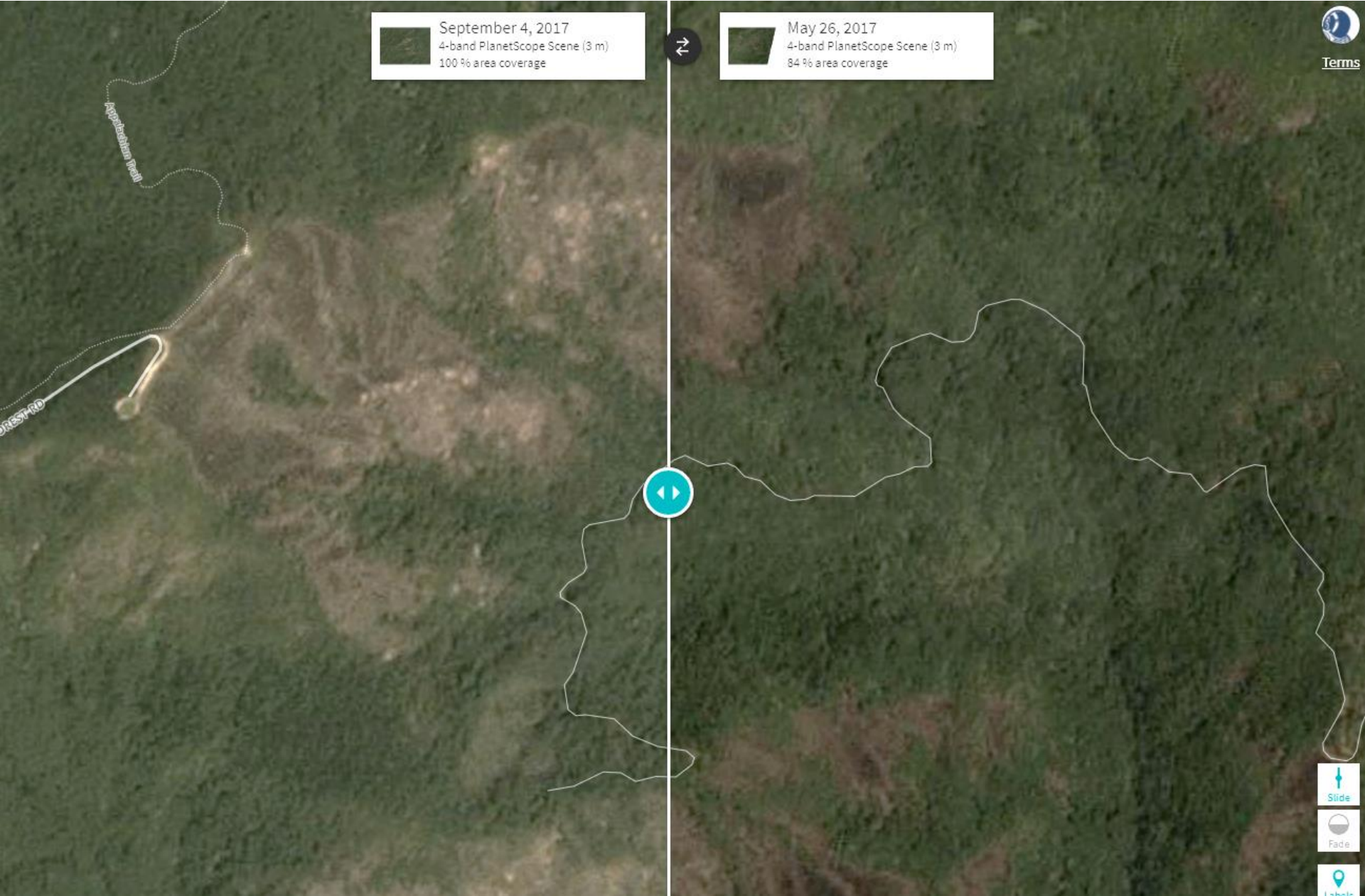
Daily Imagery

API { : }

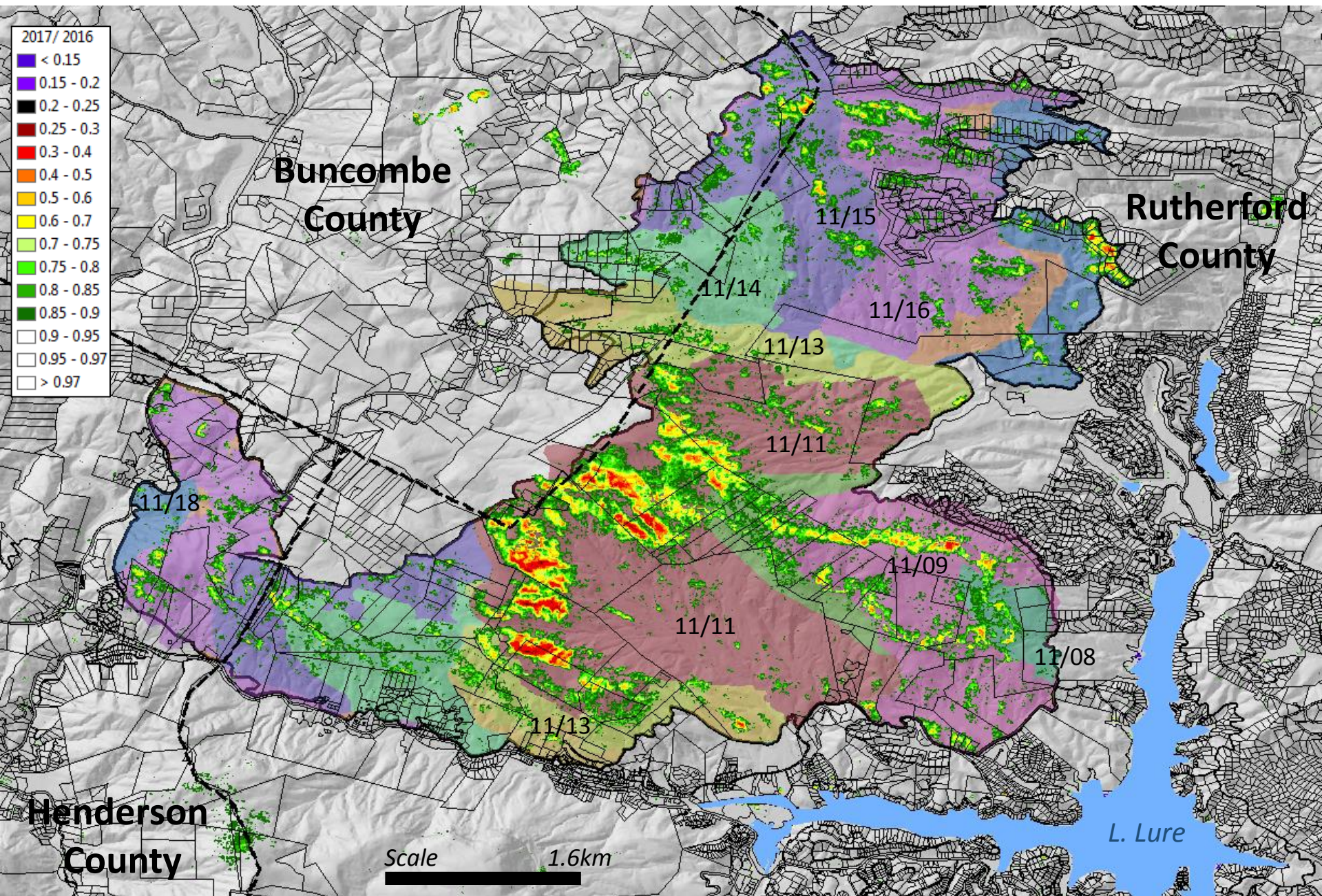
Compare days

Order items (0)

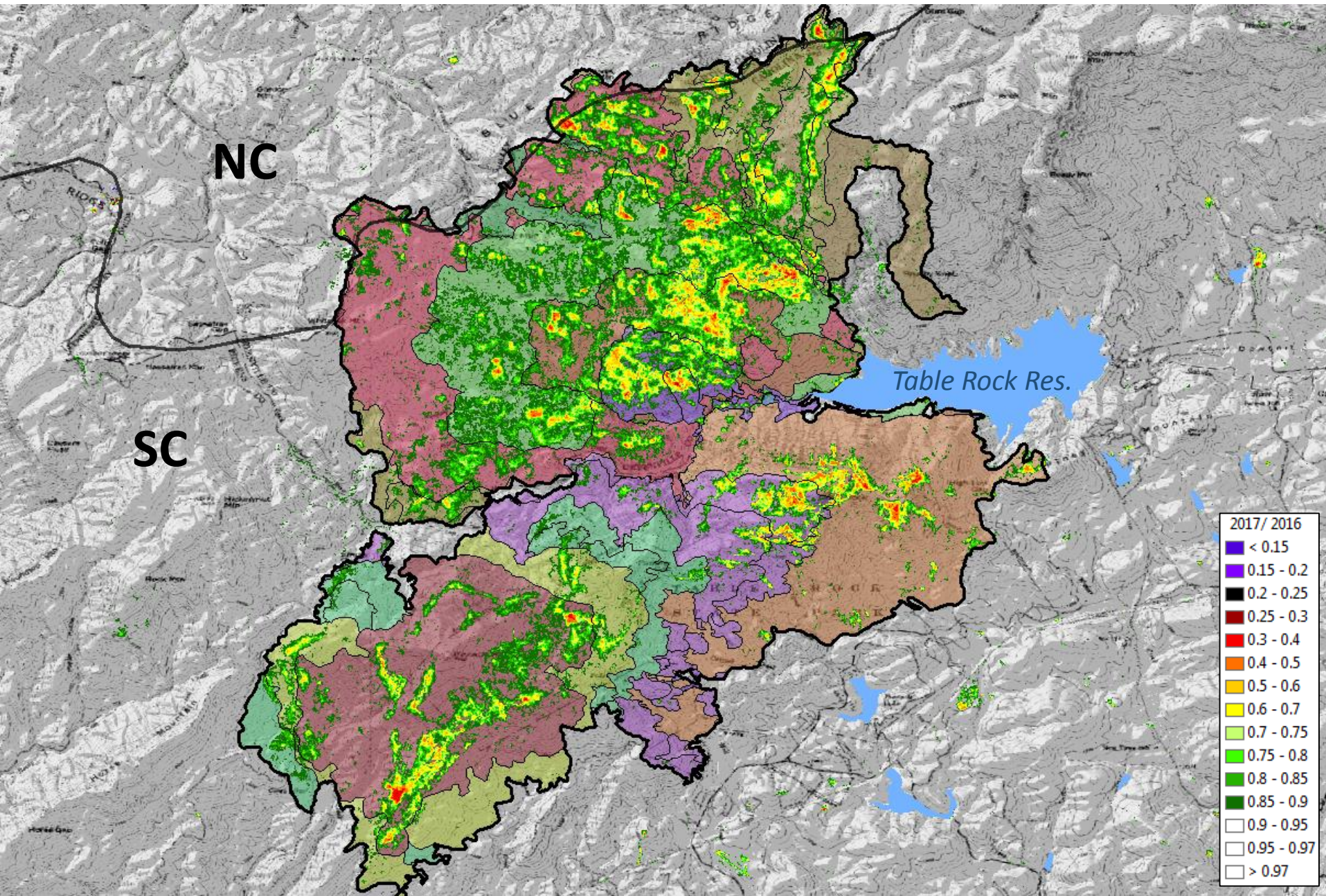
Planet.com imagery for 9/4 vs 5/26/2017



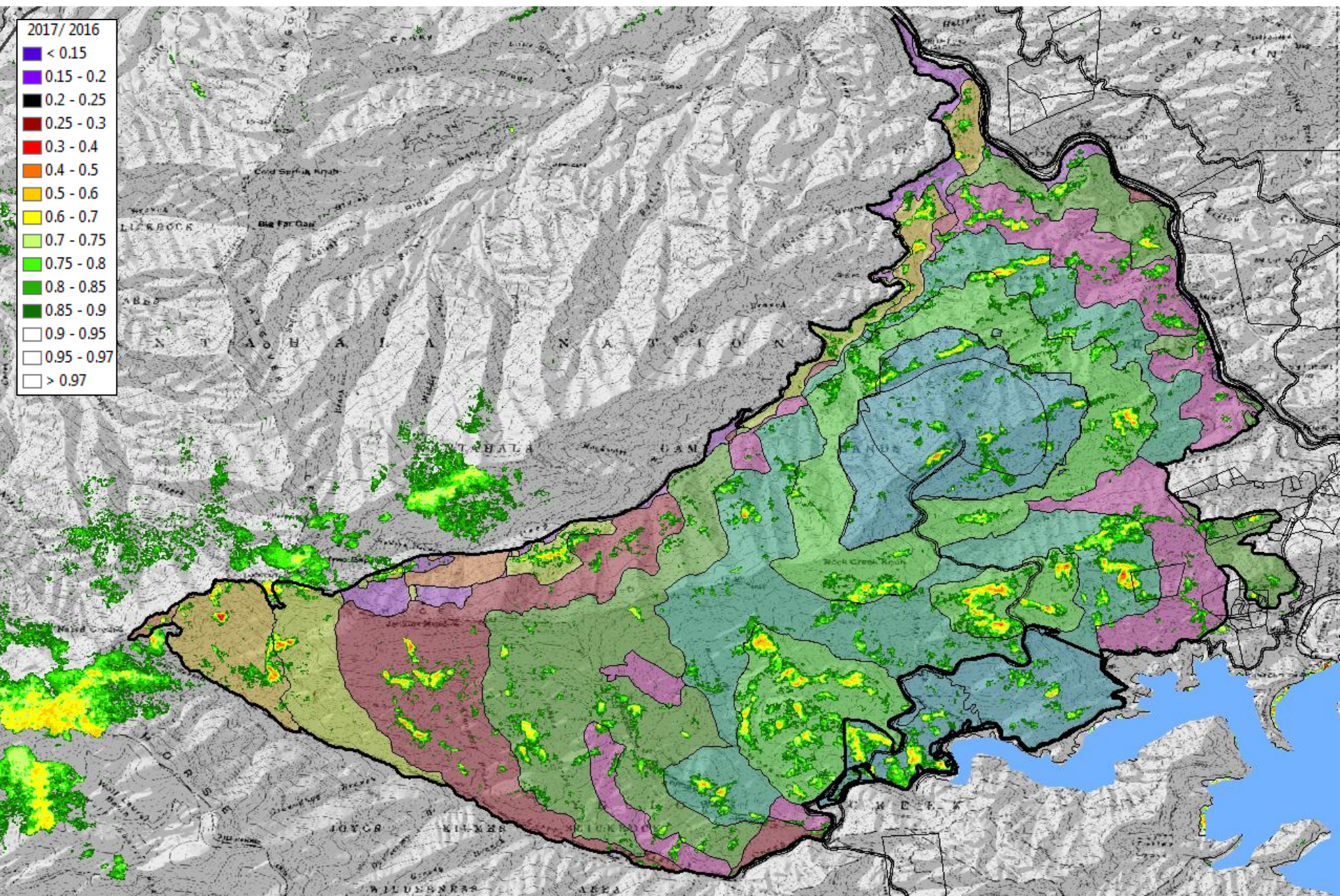
Party Rock Parcels, Progression and NDVI change



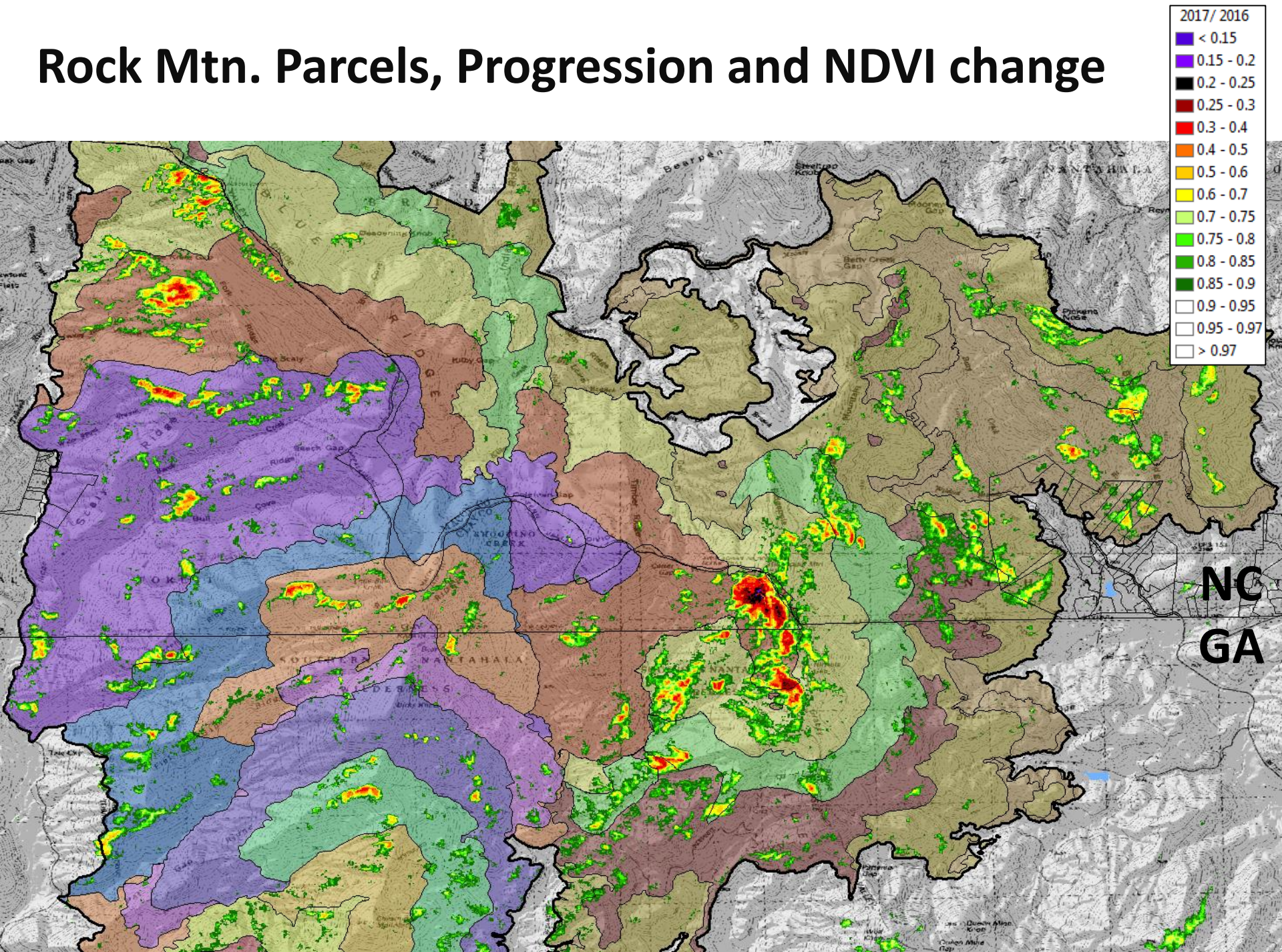
Pinnacle Mtn Fire Progression and NDVI change



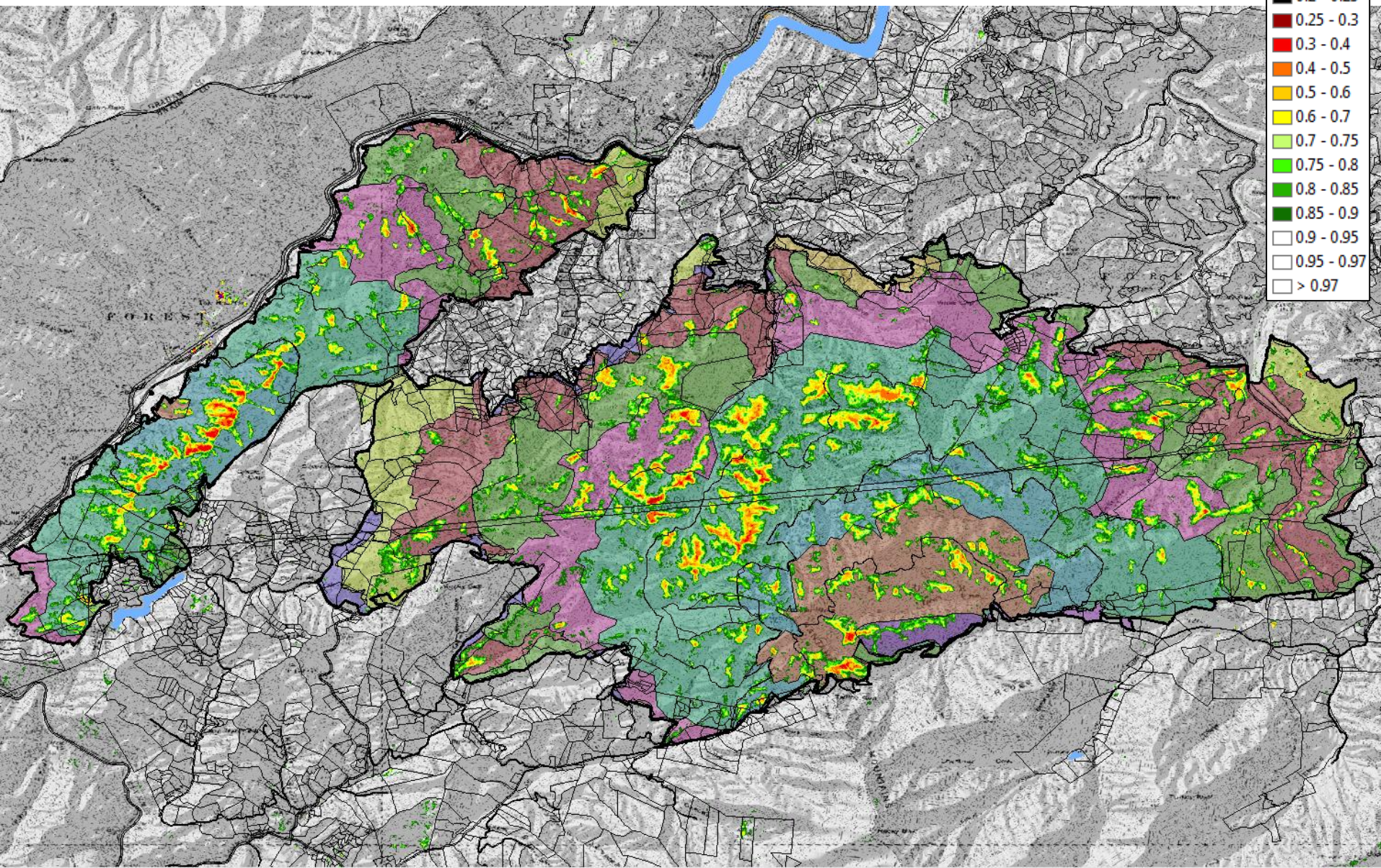
Maple Spr. Parcels, Progression and NDVI change



Rock Mtn. Parcels, Progression and NDVI change



Tellico Fire Parcels, Progression and NDVI change

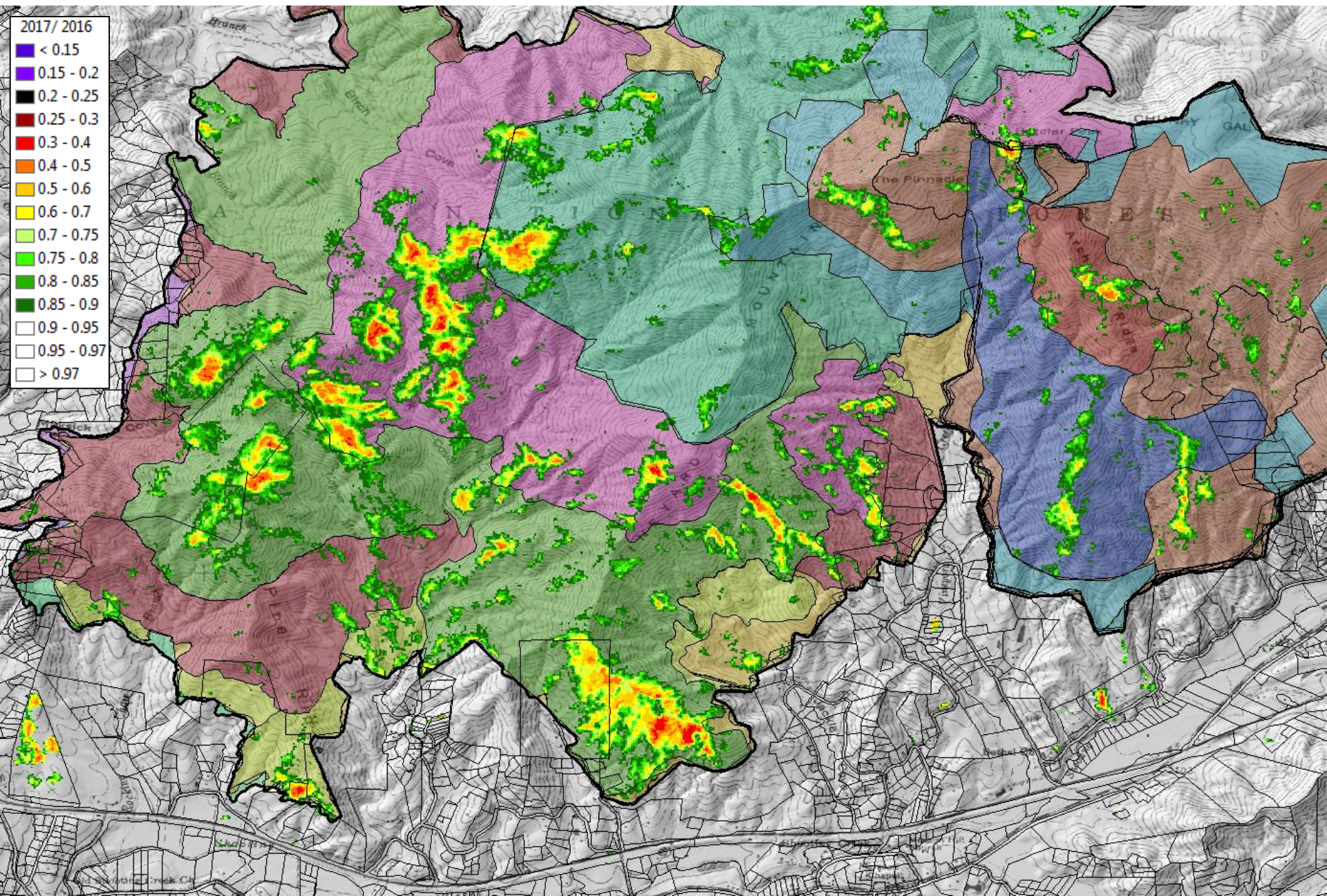


Fire-triggered invasive species establishment

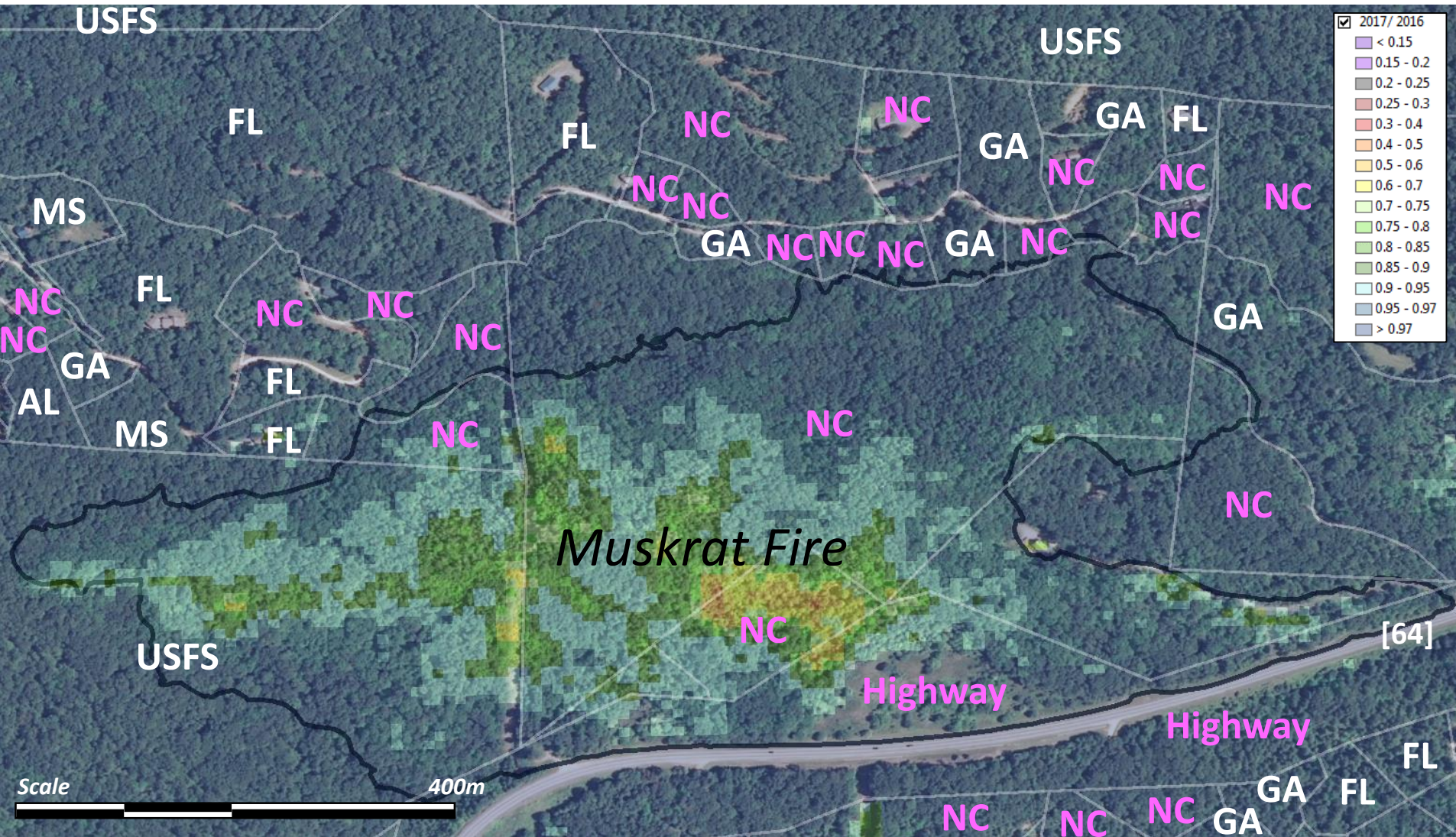
Non-native, invasive Paulownia (princess tree) after the Boteler Fire



Boteler Fire Parcels, Progression and NDVI change



Muskrat Fire Parcels and NDVI change

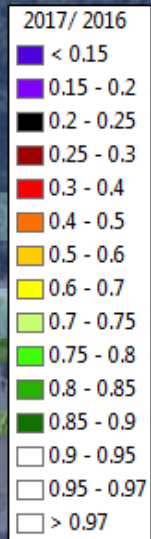


Last fall, a typical large wildfire spread at an average maximum rate of 750m/day, excluding extreme spotting events.

State codes show private parcel ownership
Muskrat Fire: 11/12/2016, 42ha. (104ac.)

Urban forest applications

UNC
Asheville



W. T. Weaver Blvd.

SRS



Broadway

Summary and closing thoughts

- Compared to Landsat, Sentinel 2 provides gridded data at higher frequency and with 9x the detail, but we need time to develop robust historical baselines for certain applications.
- At “large tree canopy resolution”, Sentinel 2 is well suited for understanding many wildland and urban forest processes, such as tree stress and mortality in gaps and patches.
- Seasonal compositing provides a solution for many (but not all) cloud and atmospheric problems that have long plagued remote sensing efforts.
- Near-real-time applications include understanding spring and fall progression and disturbance events that can be updated as conditions change.