Hurricane Michael Impacts to Southern Forest Fuels

Tracking storm effects as they evolve

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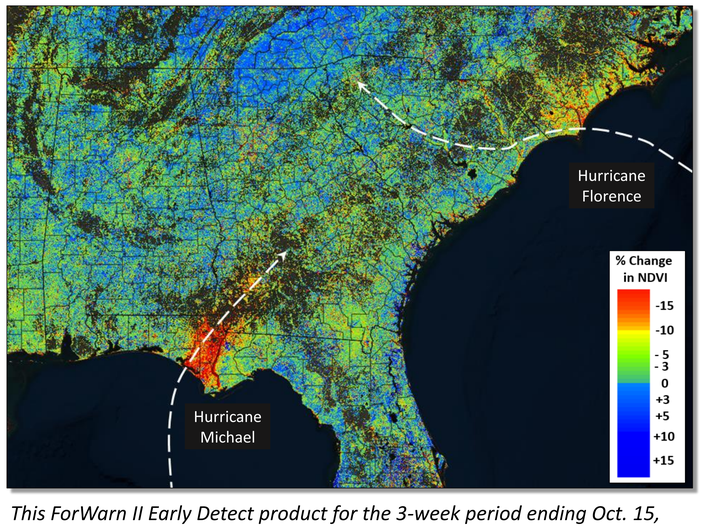
THE STORM EVENT

Hurricane Michael struck Florida's Panhandle on October 10, 2018 as a powerful Category 4 storm. Soon after its passage, Florida, Georgia and Alabama roughly estimated their timber damage to be near $2.3 Billion, with most on state and private land. The need for a refined knowledge of impacts extends to how fuels and wildfire hazards were altered by the storm. Increasingly high-resolution satellite data and technologies for processing "big data" provides us with an unprecedented capacity to efficiently characterize such impacts.

Alabama Forestry Commission

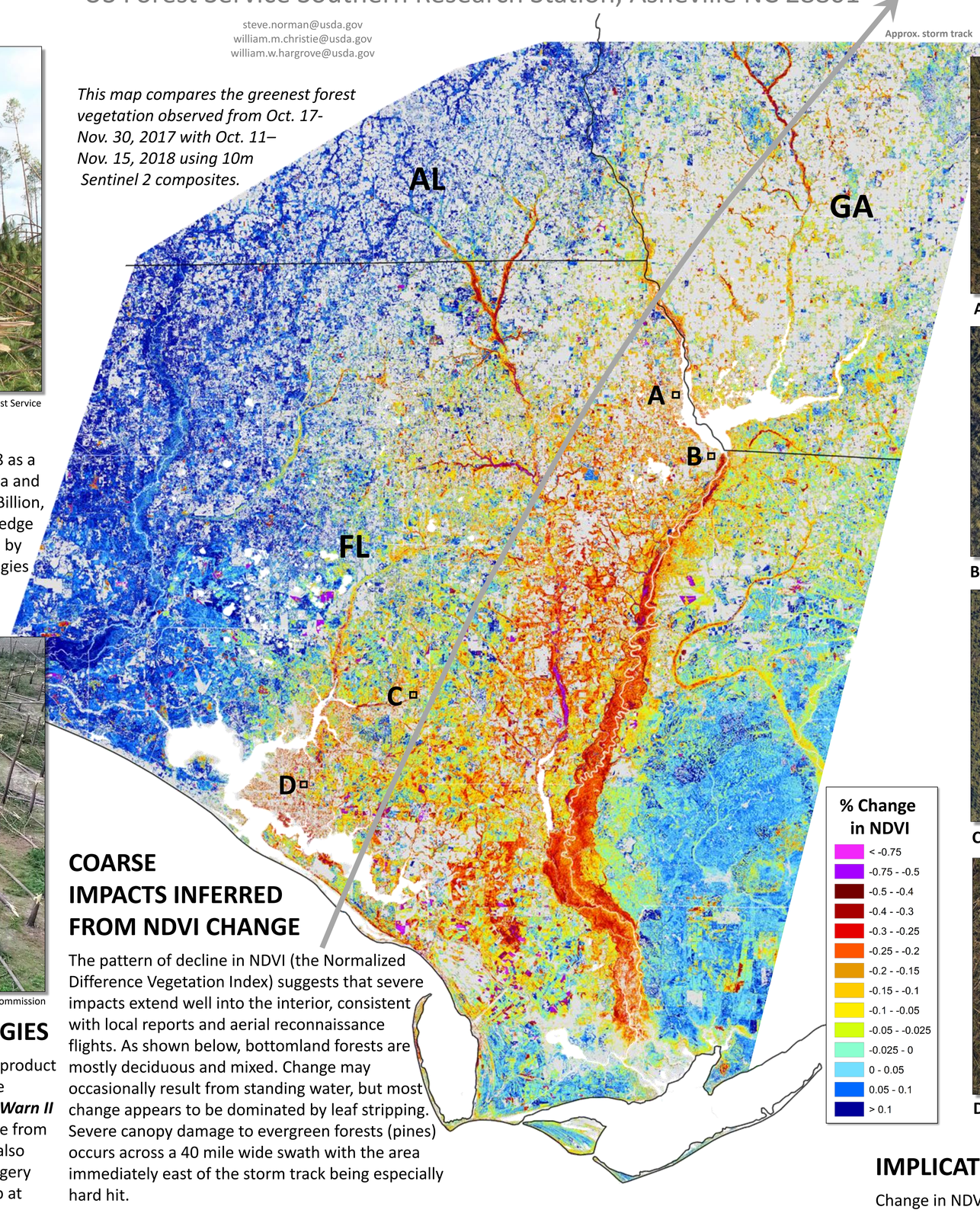
NEAR-REAL-TIME MONITORING TECHNOLOGIES

Just days after landfall, a standard ***ForWarn II*** Early Detect change product revealed the pattern of initial forest impacts as it had for Hurricane Florence that struck the Carolinas a few weeks earlier (below). ***ForWarn II*** uses the 250m daily MODIS satellite data stream and shows change from a range of baselines. See: https://forwarn.forestthreats.org/. We also generated a comparable 10m change product using Sentinel 2 imagery using cloud computing (Google Earth Engine). This is the large map at right, and it is masked to only show change in forest cover.



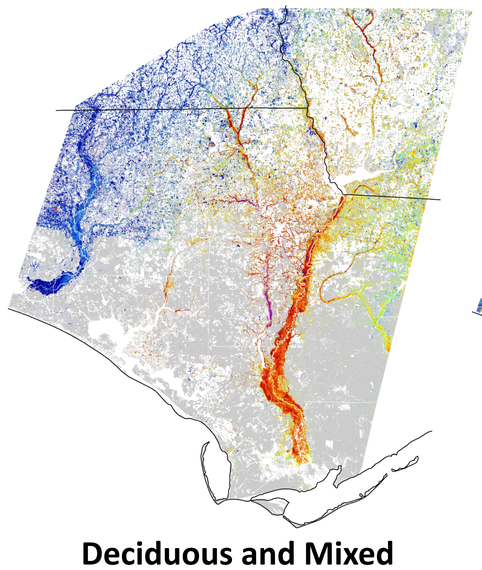
This ForWarn II Early Detect product for the 3-week period ending Oct. 15, 2018 shows change in NDVI (the vegetation-sensitive Normalized Difference Vegetation Index) compared to the same period in 2017.

This map compares the greenest forest vegetation observed from Oct. 17-Nov. 30, 2017 with Oct. 11–Nov. 15, 2018 using 10m Sentinel 2 composites.

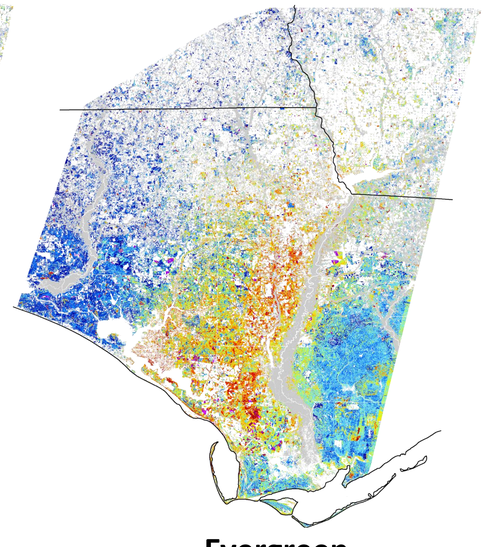


COARSE IMPACTS INFERRED FROM NDVI CHANGE

The pattern of decline in NDVI (the Normalized Difference Vegetation Index) suggests that severe impacts extend well into the interior, consistent with local reports and aerial reconnaissance flights. As shown below, bottomland forests are mostly deciduous and mixed. Change may occasionally result from standing water, but most change appears to be dominated by leaf stripping. Severe canopy damage to evergreen forests (pines) occurs across a 40 mile wide swath with the area immediately east of the storm track being especially hard hit.



Deciduous and Mixed Forest Change



Evergreen Forest Change

NOAA

A: West of Lake Seminole, FL

NOAA

B: West of Chattahoochee, FL

NOAA

C: Northeast of Nixon FL

NOAA

D: Northeast of Panama City, FL

IMPLICATIONS FOR FOREST FUELS

Change in NDVI, even at 10m resolution, does not correlate 1:1 to the number of trees killed or the volume of surface fuel produced. Actual fuel conditions require observations on the ground. Satellite-based monitoring does, however, provide inform the extent and pattern of storm impacts and their likely causes. Damage to pine plantations is conveyed through use of our innovative 2018 pre-storm forest mask that we produced with help of the same cloud computing technologies that we use to process NDVI change products.

In the coming seasons and years, as land managers respond with harvesting and to some degree prescribed fire, this technology can help track change in concert with management data. Conifer areas damaged by the storm, but left untreated, may pose special fuels hazards until they decay. Changes caused by leaf stripping are likely ephemeral.

About our forest mask: To have an up-to-date high resolution (20m) forest mask, we classified leaf off (winter 2018) and leaf on (summer 2018) Sentinel 2 imagery using the square of NDVI and the blue, green, red, near infrared and short wave infrared bands using clustering with 30 initial types generated. This unsupervised cross-seasonal classification let us isolate forest and non-forest types while further isolating deciduous from evergreen forest types which was critical for understanding the causes of change that likely occurred.