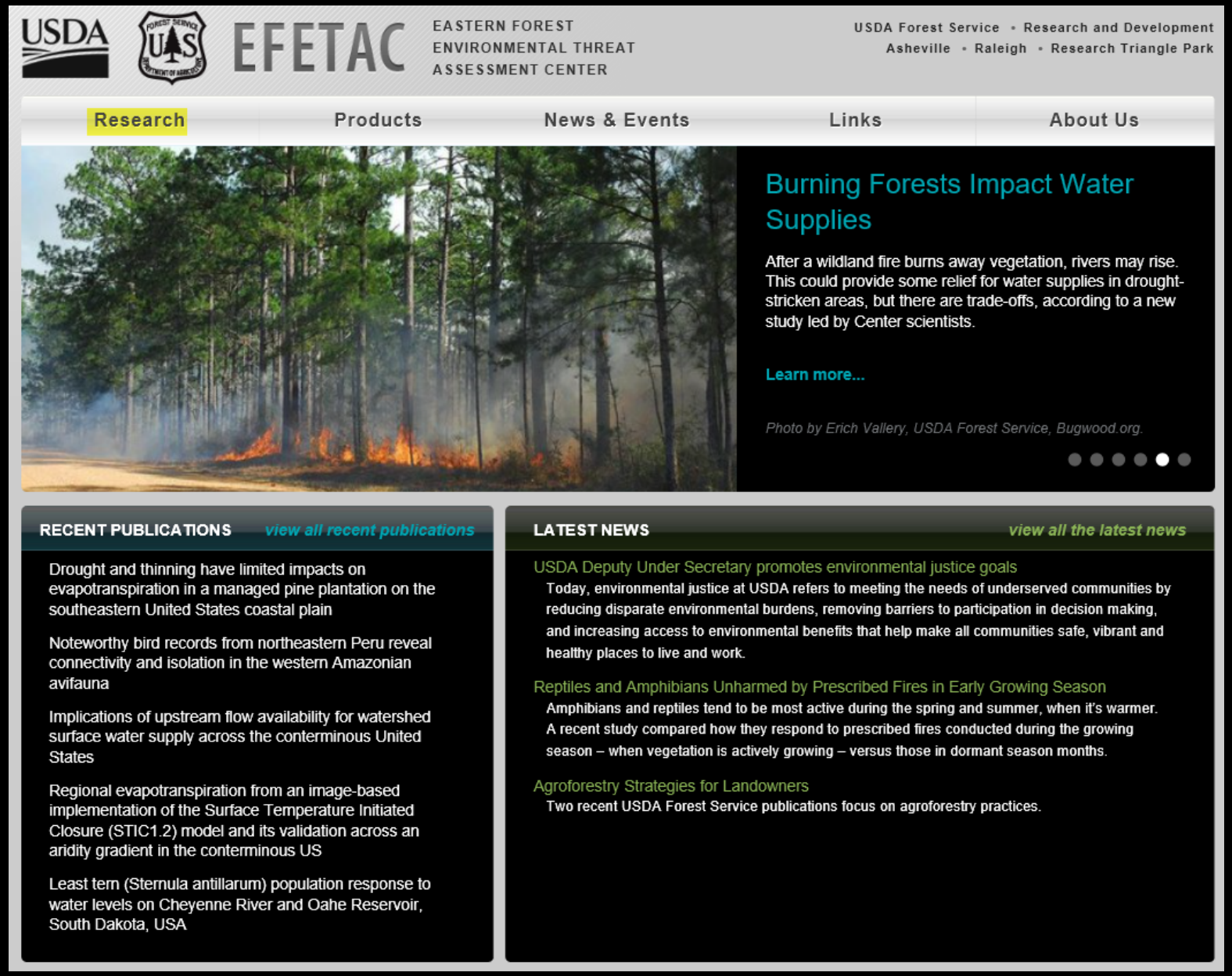
https://forestthreats.org



Data & Tools

Comparative Risk Assessment Framework and Tools (CRAFT)

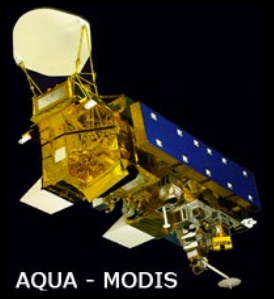
Forecasts of Climate-Associated Shifts in Tree Species (ForeCASTS)

ForWarn II

Landscape Dynamics Assessment Tool (LanDAT)

Template for Assessing Climate Change Impacts and Management Options (TACCIMO)

Water Supply Stress Index (WaSSI)



"Praemonitus Praemunitus"

ForWarn II

Satellite-Based Change Recognition and Tracking

- A **national-scale near real-time** satellite-based recognition and tracking system for all land cover disturbances
- "Officially" rolled-out in 2012, but has actually been operating since January 2010
- ***ForWarn*** covers the entire lower 48 United States
- Generates new potential **disturbance maps every 8 days**, even throughout the winter
- Detects most types of regional and local land cover disturbances
    - insects, diseases, wildfires, ice and frost damage, tornadoes, hurricanes, blowdowns, harvest, urbanization, seasonal timing and drought. and landslides
- 231 meter native resolution map cells (13-acre minimum mapping unit)
    - It is not necessary for an entire forested pixel to be disturbed for disturbance to be detected

ForWarn's Context

ForWarn II

- Strategic – The *ForWarn II* system routinely monitors wide areas at coarse resolution, repeated frequently – it produces alerts or warnings that forest vegetation at particular locations may be affected by forest threats

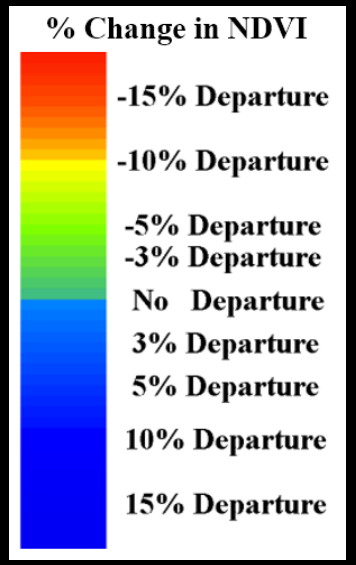
  Tier 1 can be used to optimally direct the labor-intensive efforts of Tier 2, which are limited in coverage and frequency

Insect and Disease Surveys

- Tactical – Airborne overflights and ground inspections of areas of potential interest are visited to determine if such warnings are confirmed and become alarms

The two tiers are complementary and support each other

How Does *ForWarn* Work?



- Based on a simple comparison between current greenness vs. historical greenness (NDVI)
- We develop this historical greenness from the 16-year historical MODIS satellite record
- The comparison is both spatially and temporally explicit – compares during the same 24-day window and for the same MODIS pixel location
- If the current NDVI value is **less than 100% of the baseline** used =

  Potential Disturbances shown as **Greens**, **Yellows**, **and Reds**
- If the current NDVI value is **greater than 100% of baseline** used =

  Vegetation Regrowth, Recovery or Normalcy shown as **Blues**
- Only shows a Disturbance if it affects the plants - and to the degree that it affects the plants
- When first opening the 'Forest Change Assessment Viewer', only forested areas are shown by default, but ***ForWarn*** detects disturbances in all NLCD-based land use and land cover classes, including agricultural crops and rangeland forage (see the new "Masking" tool)

ForWarn II Products

(6) annually-based disturbance maps every 8 days (emphasizing **age and magnitude**)

(4) intra-annual disturbance products during the growing season (emphasizing **persistence**)

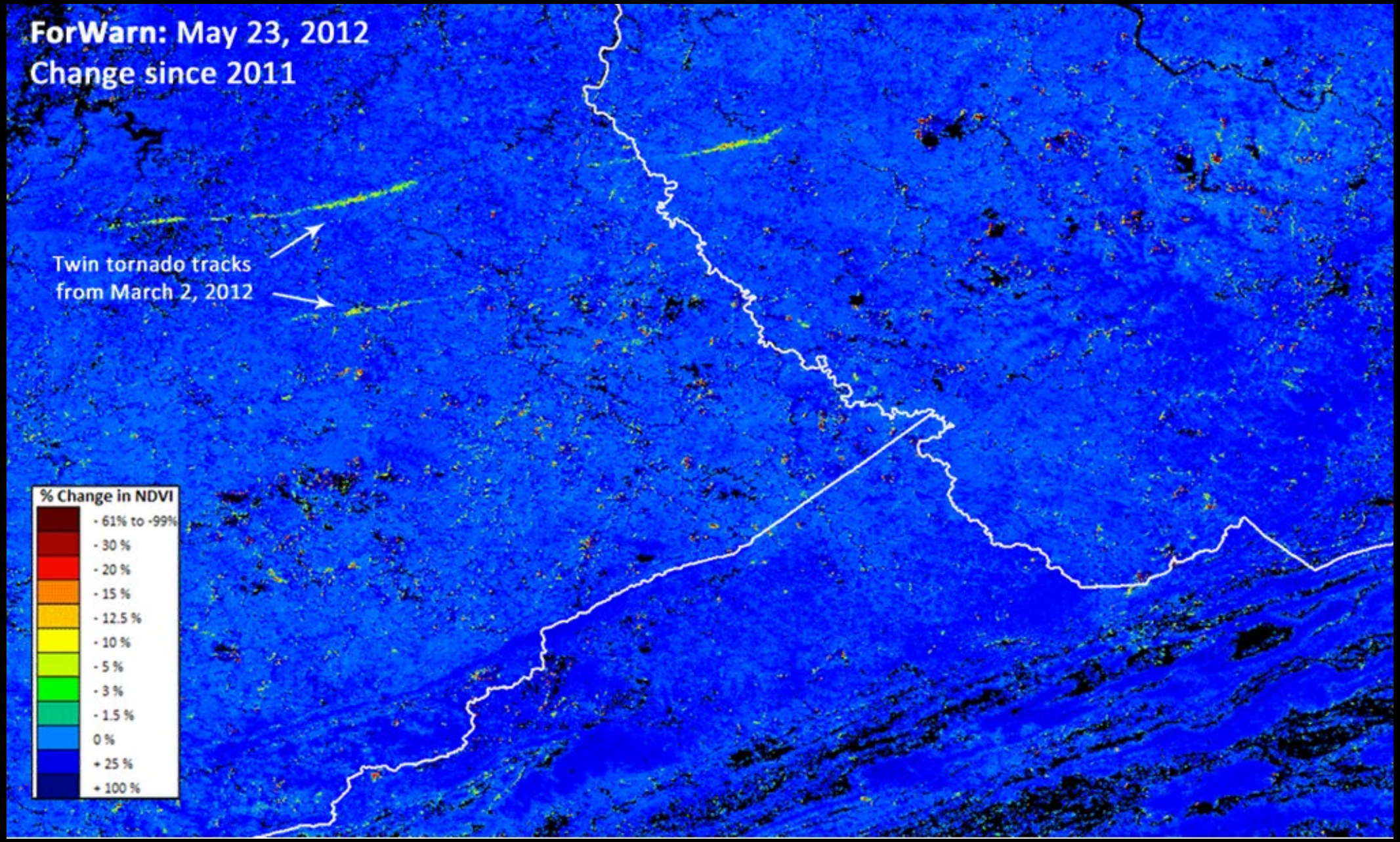
Annually-based Products

1. 1yr baseline '*Early Detect*' (NDVI max, 8 day composite)
2. 1yr baseline (NDVI max, 24 day composite)
3. 3yr baseline (NDVI max , 24 day composite)
4. 5yr baseline (90th percentile , 24 day composite)
5. 10yr baseline (90th percentile , 24 day composite)
6. All-year baseline (NDVI median , 24 day composite)

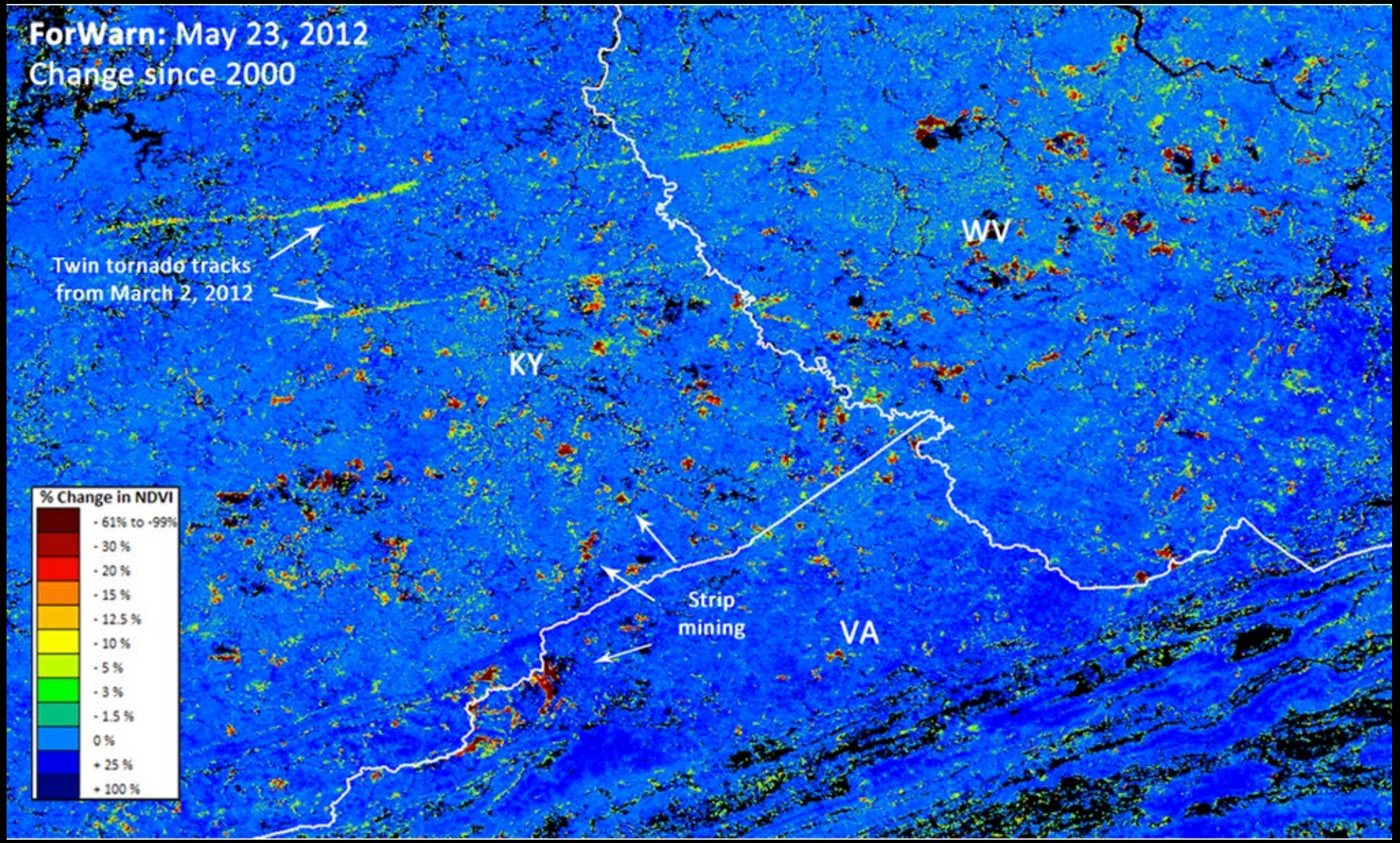
Intra-Annual Duration

1. 6-period Duration, May 8 – June 17 (for western U.S.)
2. 6-period Duration, June 24 – Aug 4
3. 6-period Duration, Aug 12 – Sept 21
4. 12-period Duration, June 24 – Sept 21

ForWarn 1yr baseline vs. All-year baseline

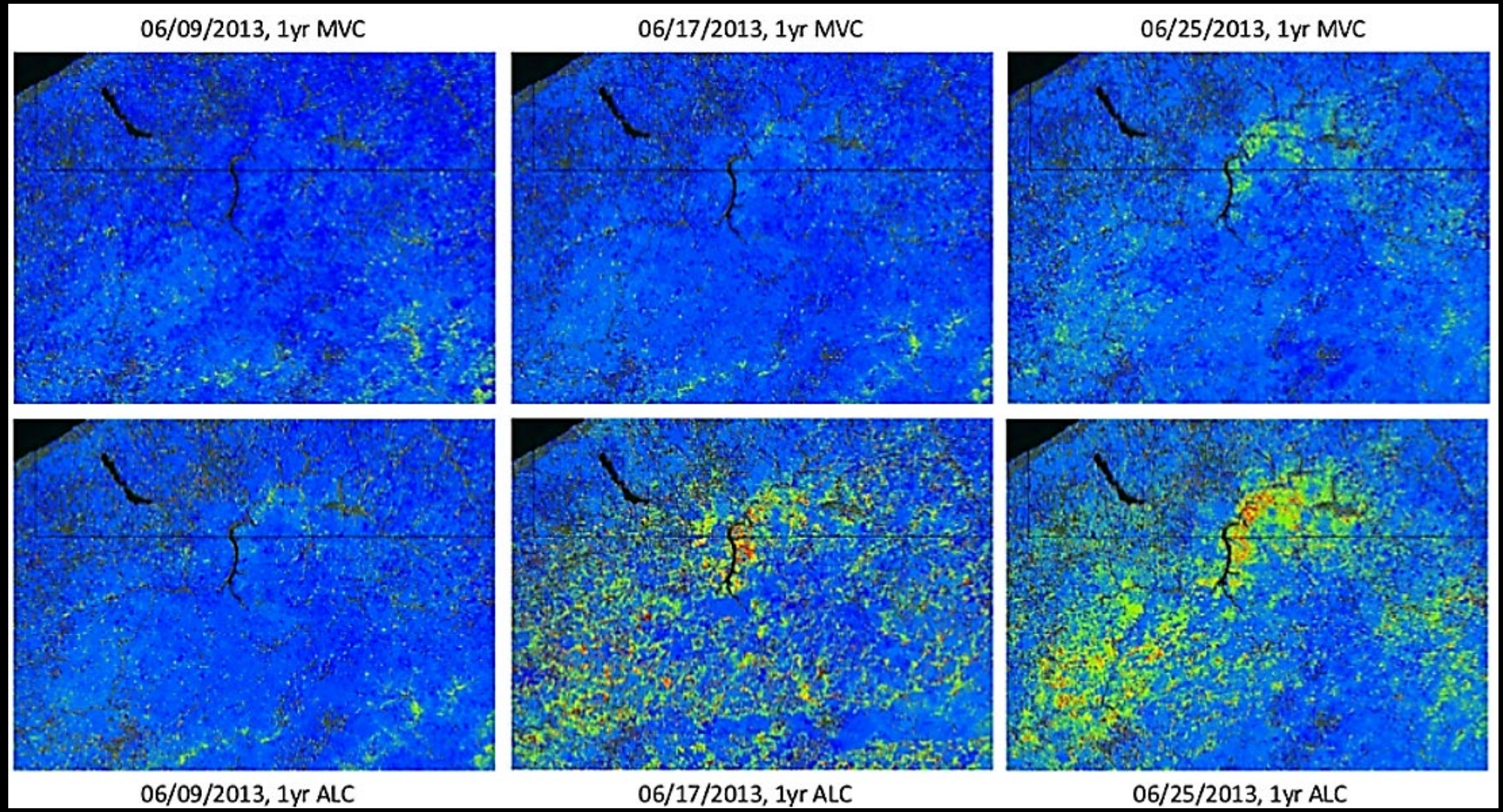


ForWarn 1yr baseline vs. All-year baseline



ForWarn 1yr Baseline 'Standard' Product vs. 1yr Baseline 'Early Detect' Product

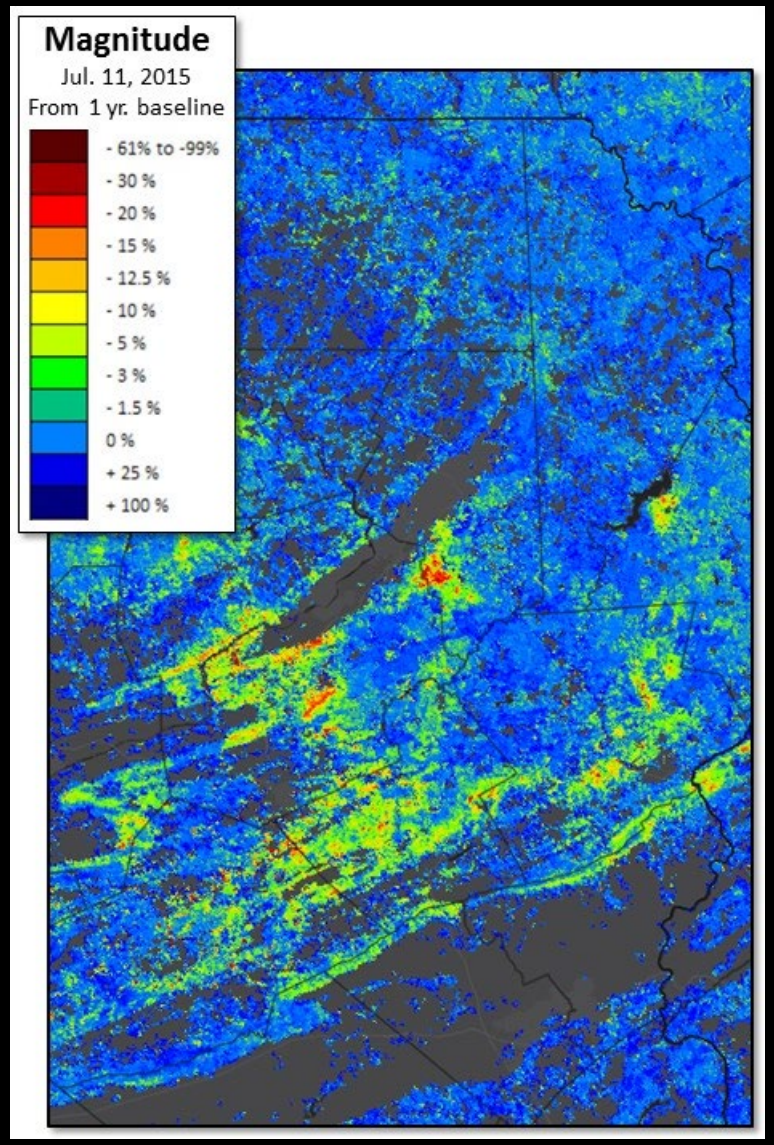
2013 Gypsy Moth Defoliation, Allegheny NF, PA-NY

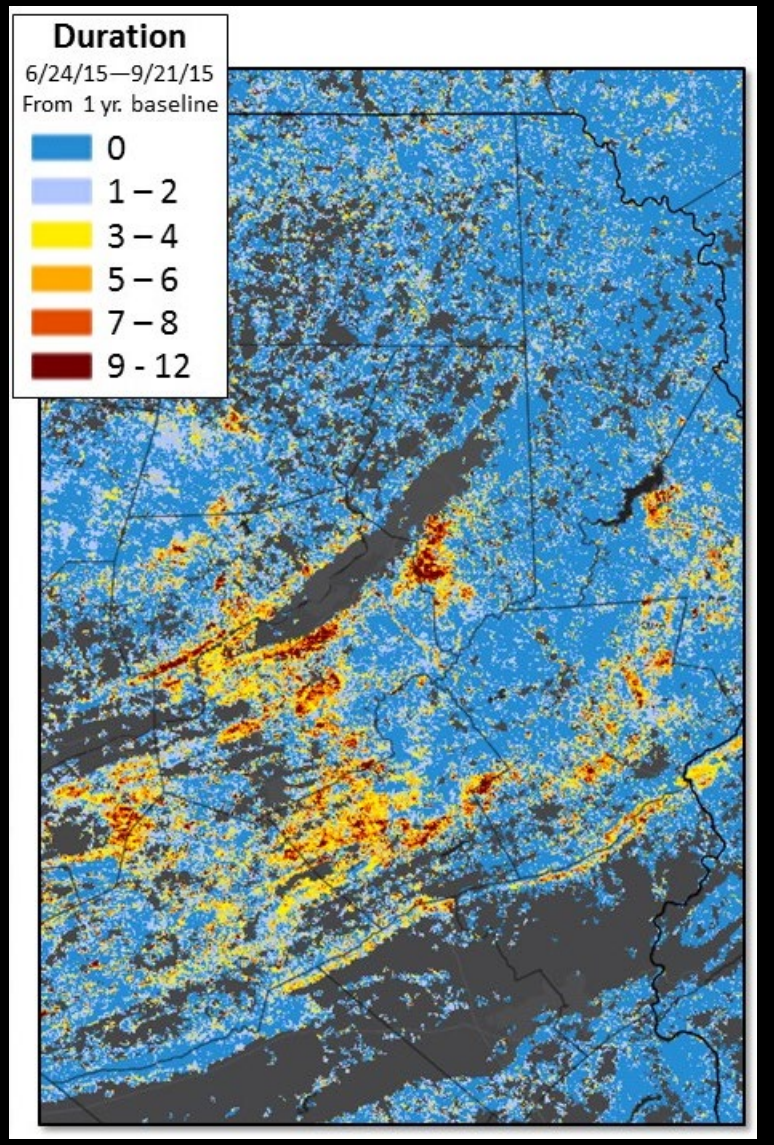


*The 'Early Detect' product dramatically reduces **ForWarn** detection speeds, allowing the detection of disturbances in as few as one 8-day period*

Tracking Gypsy Moth emergence and severity with magnitude and duration (PA, 2016)

Static images produced every 8-days





(6) or (12) Consecutive image dates are summarized within the growing season for these timeframes:

6-period Duration
May 8 – June 17

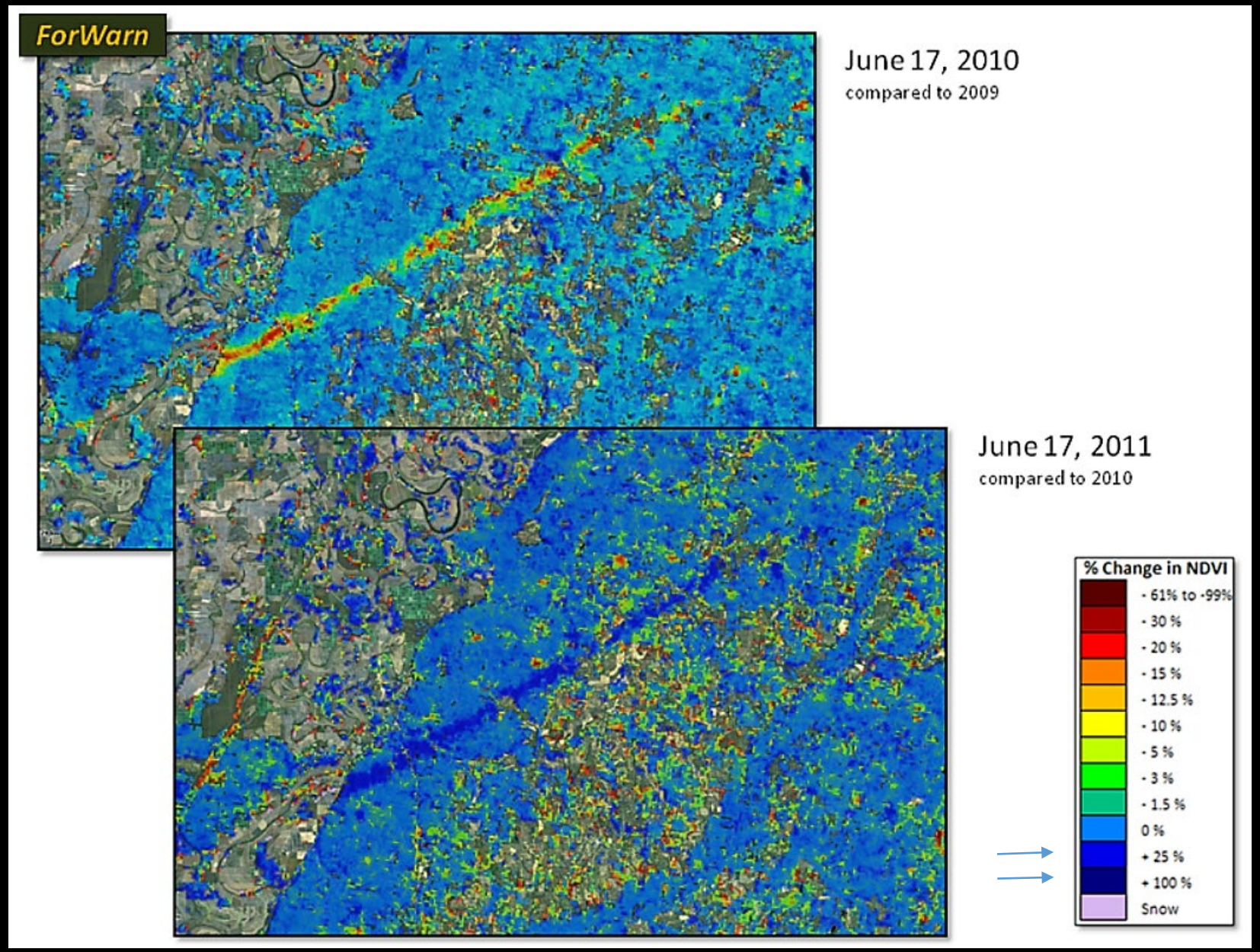
6-period Duration
June 24 – Aug 4

6-period Duration
Aug 12 – Sept 21

12-period Duration
June 24 – Sept 21

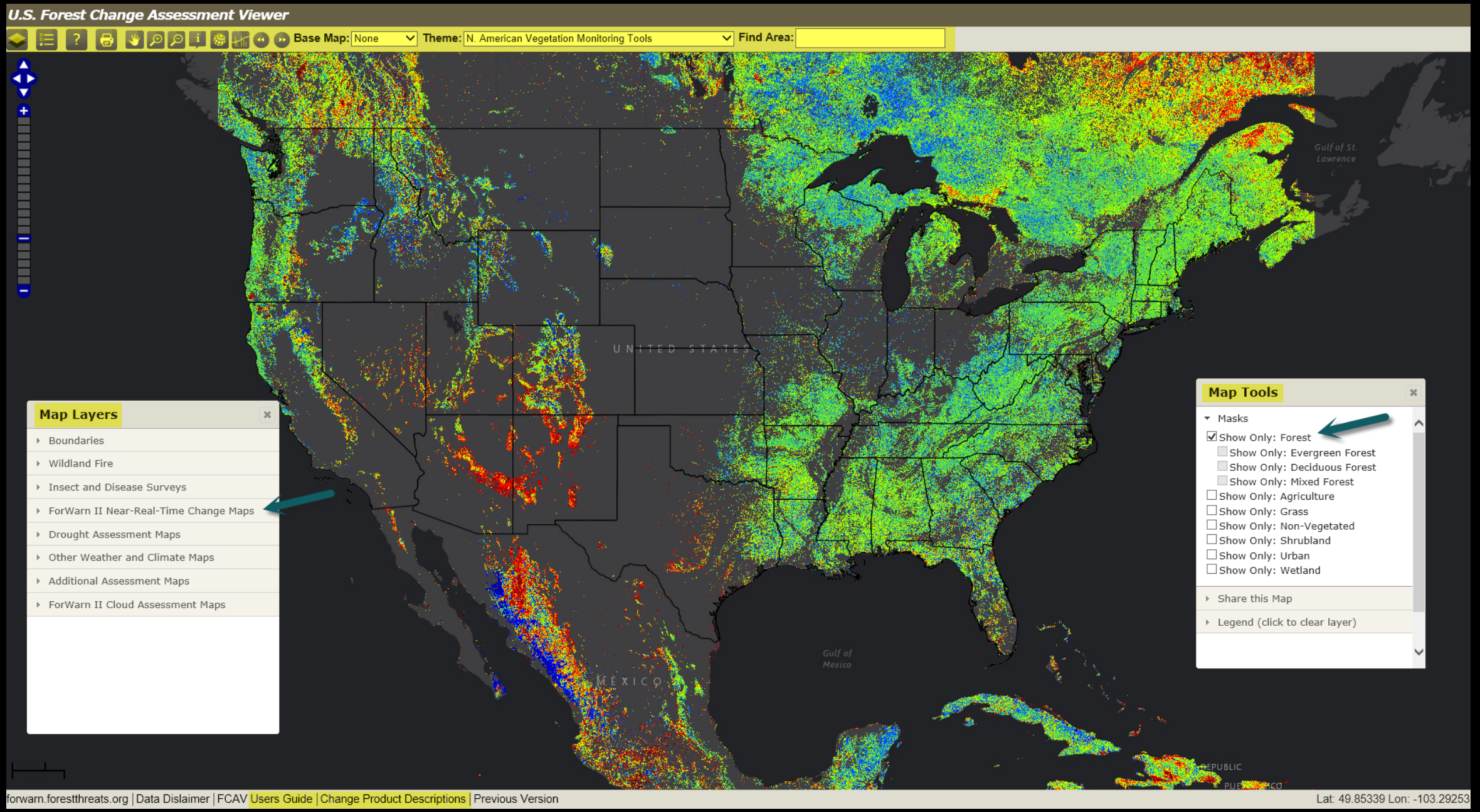
ForWarn's Seasonal Duration products help discriminate ephemeral from persistent impacts

Positive NDVI Departure = Vegetative Recovery / Re-Growth

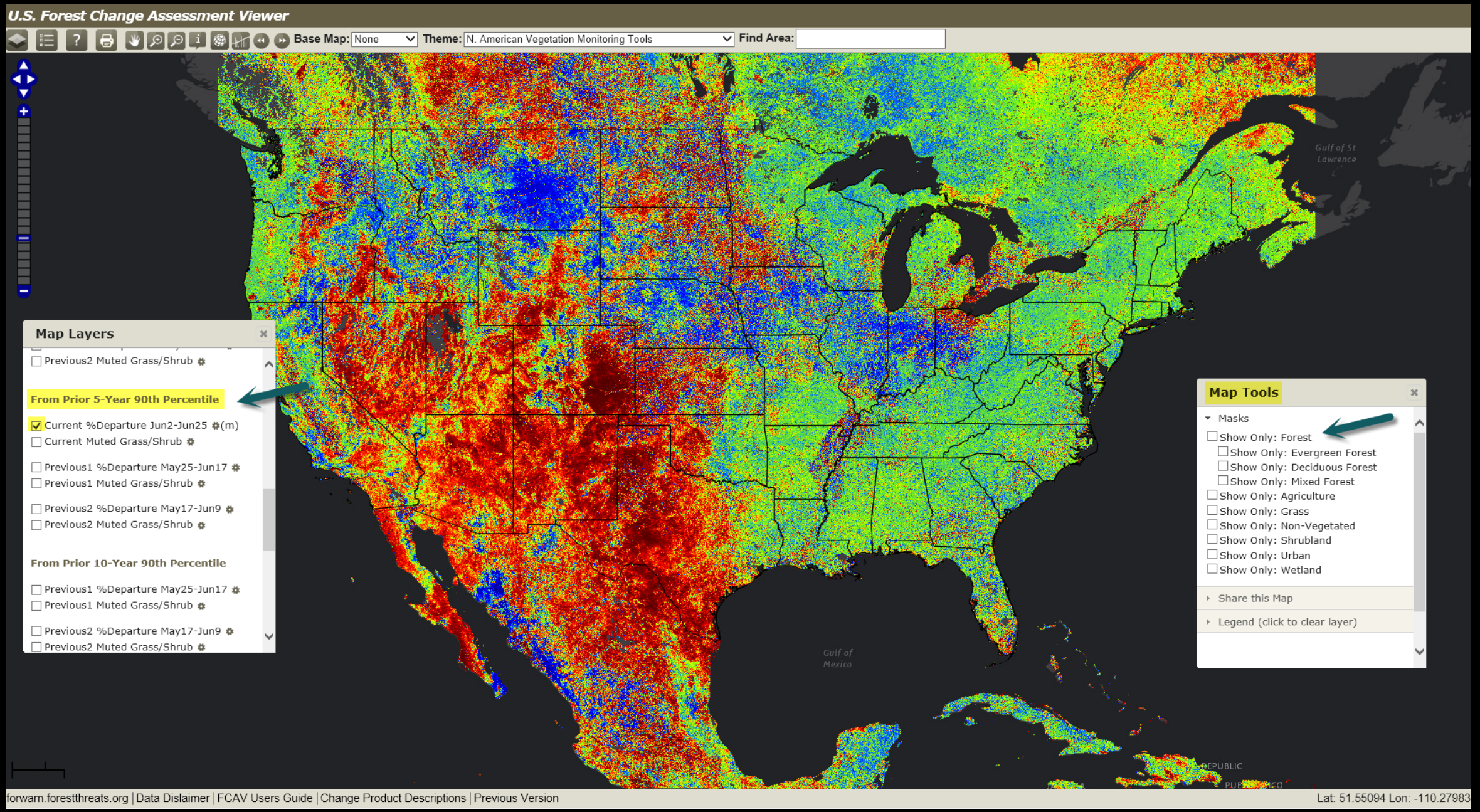


Relative to a 1-year baseline, forest vegetation is re-growing within the Yazoo, MS tornado track. ***ForWarn*** can easily track such recovery, and the variability in the rate of recovery.

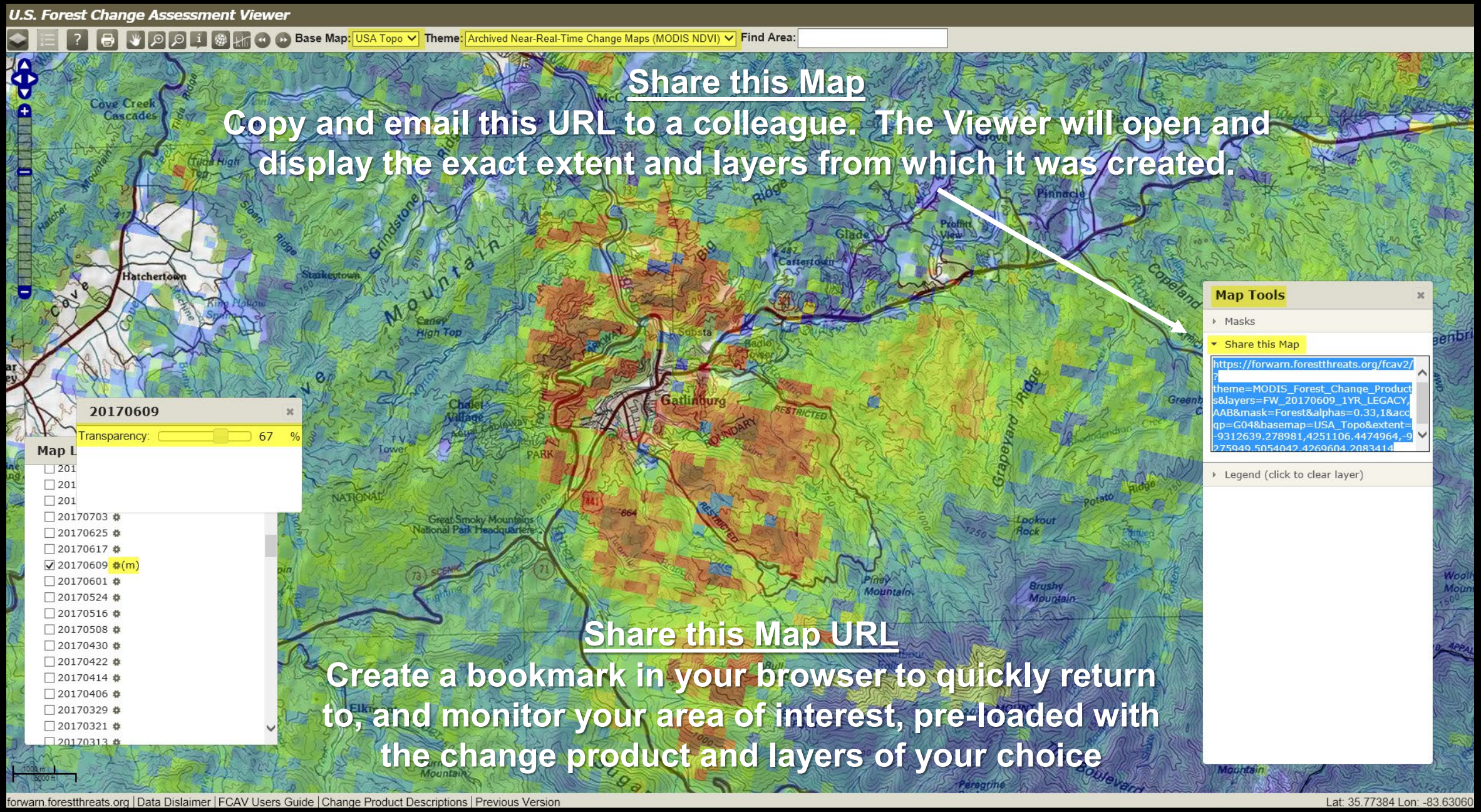
ForWarn's Forest Change Assessment Viewer (forwarn.forestthreats.org/fcav2)



Forest Change Assessment Viewer (FCAV): **5yr '90th percentile'** *(unmasked)*

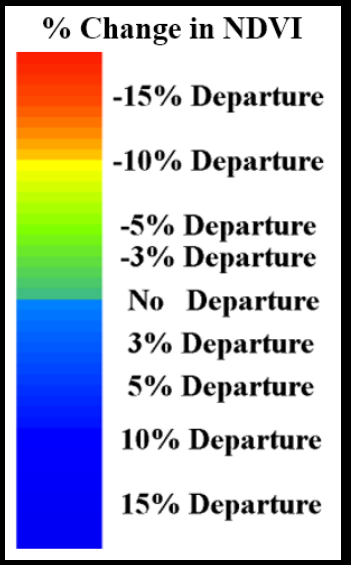


FCAV Feature: **"Share this Map"** *(share potential disturbances with your colleagues)*



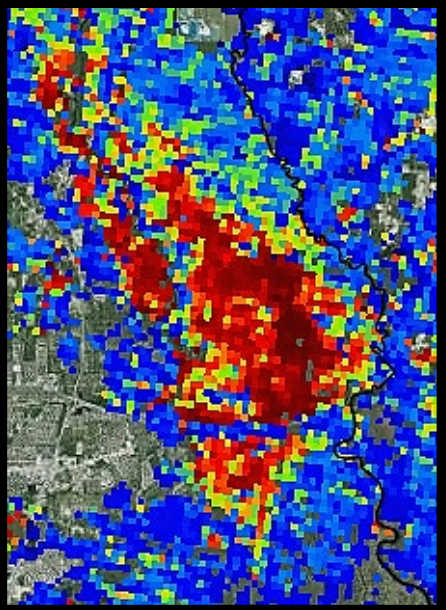
Identifying and Interpreting NDVI Change

locate – characterize – assess



- ***Site** and **situation**?*
  - **Land Use / Land Cover type** (image base map, masks, veg maps)
  - **Topographic position** (elevation, slope, aspect, wet/dry, amount of **LULC** mix)

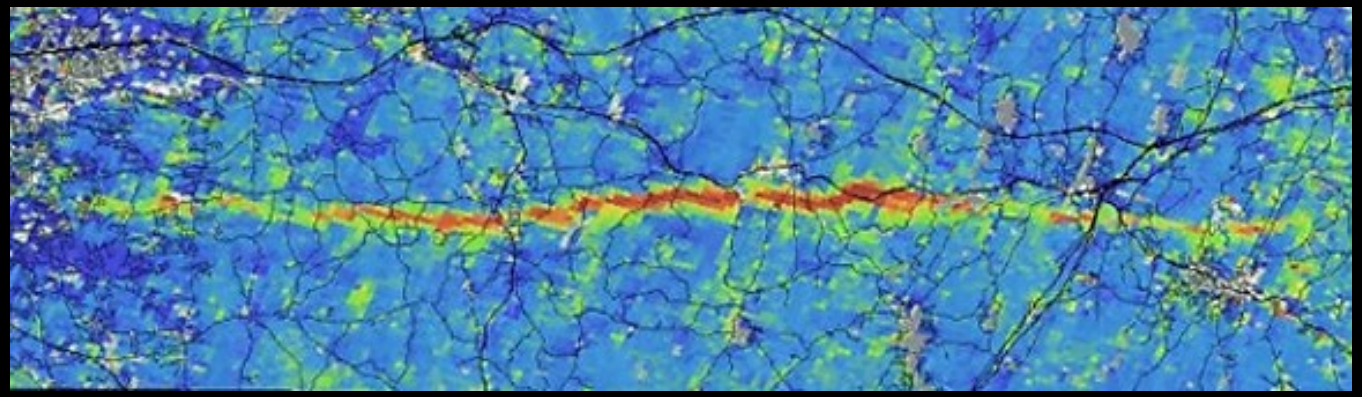
- *What is the **character** of the NDVI departure?*
  - **Progression speed** (toggle 3 most recent, fast/slow, on/off = clouds)
  - **Severity and Duration** (pos/neg, high/low, persistence – long/short)
  - **Spatial extent** (regional, large area or localized)
  - **Pattern and shape** (scattered, contiguous, target-like, linearity)
  - **Edges** (well defined or bulls-eye – trails-off showing less departure)
  - **Seasonality** (spring, fall, snow, frost effects)



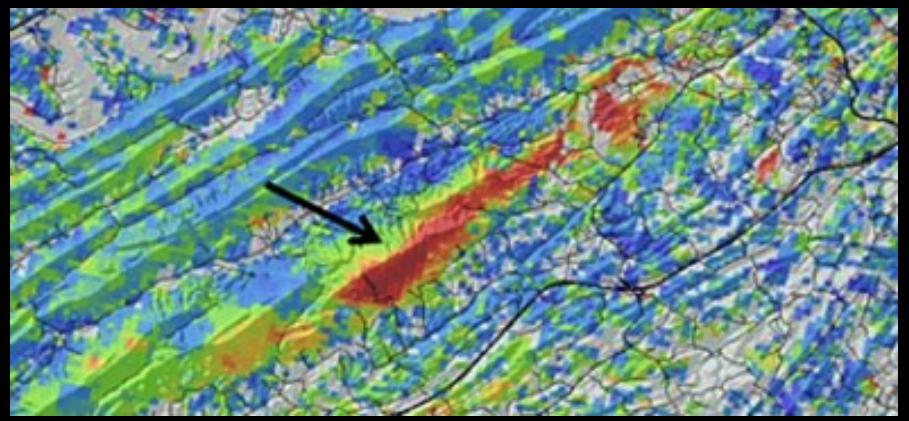
Examples of forest disturbance, or recovery, seen in the *ForWarn* forest change images

Natural Disturbance

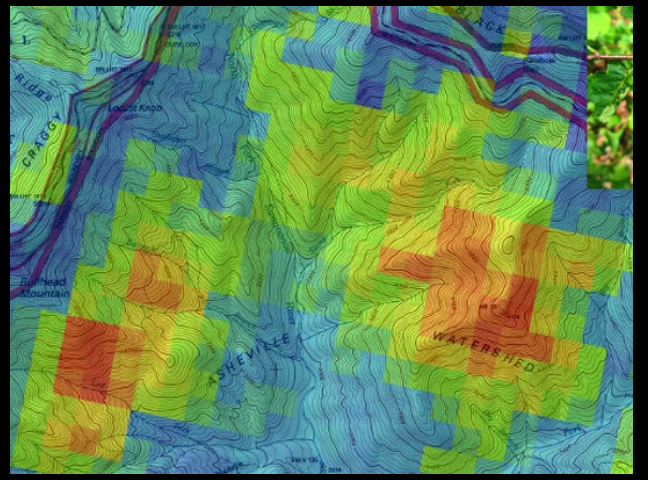
Severe weather (tornadoes, wind, hail, ice)
Drought and flood events
Insects and disease outbreaks
Early/late – spring/fall timing
Snow
Wildfire events



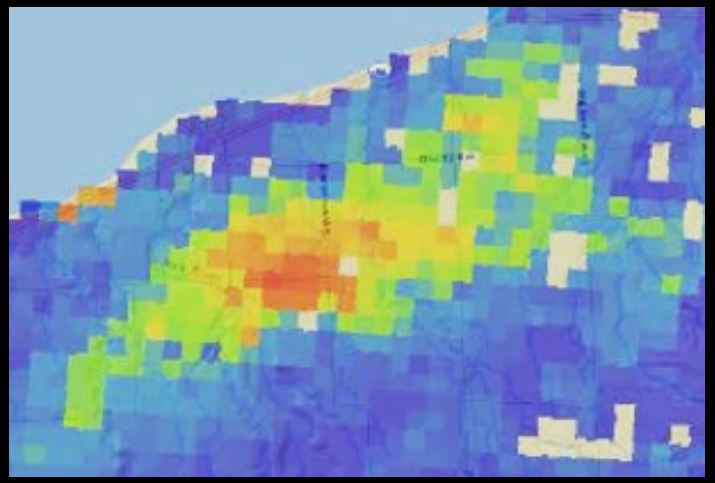
Tornado (MA)



Severe Wind, Leaf Stripping (TN)



Hail Damage (NC)



Severe Weather (MI)

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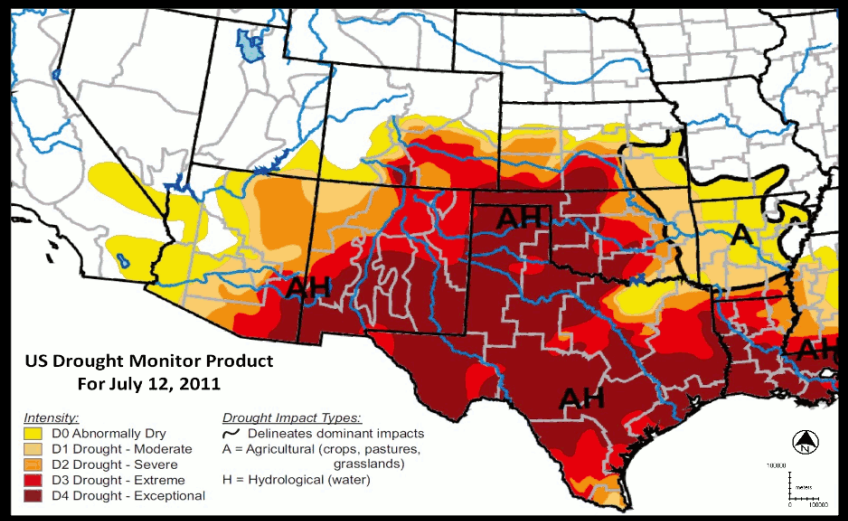
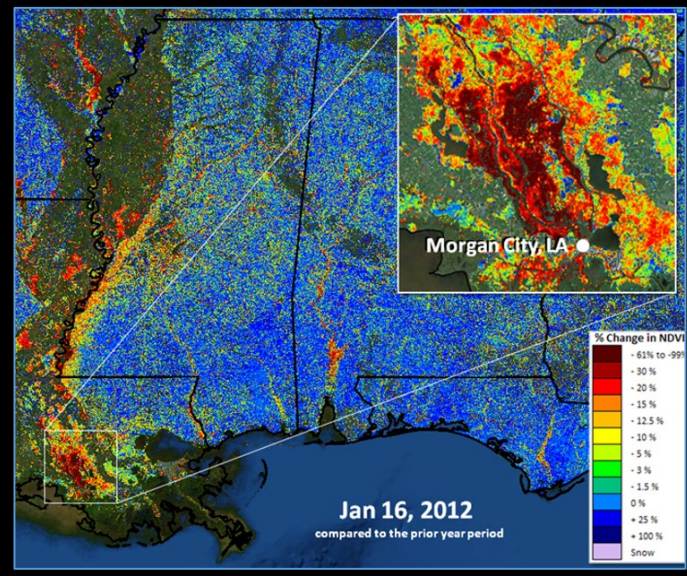
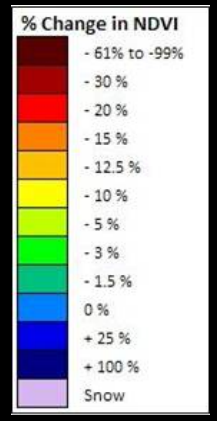


Texas Drought Monitor Comparison, 2011

Bottomland Hardwood Flooding (SC)



Flooding (Atchafalaya Basin, LA)



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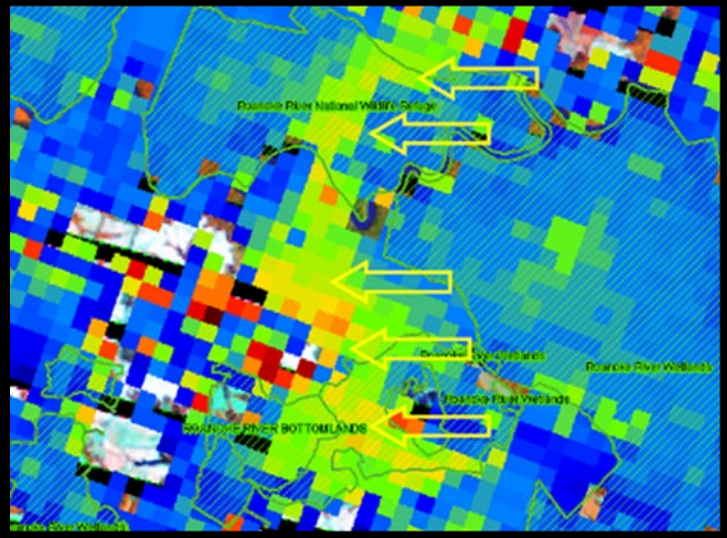
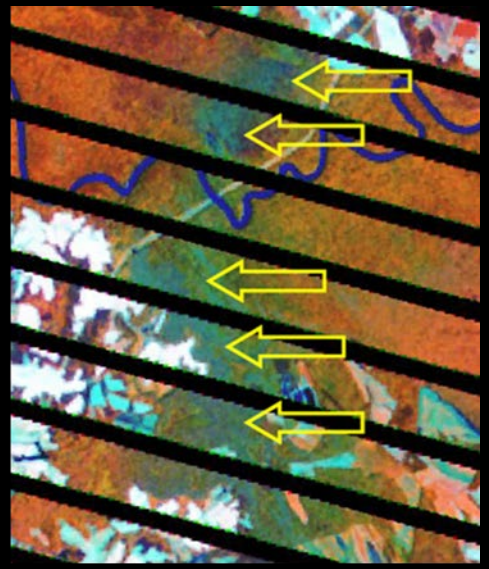
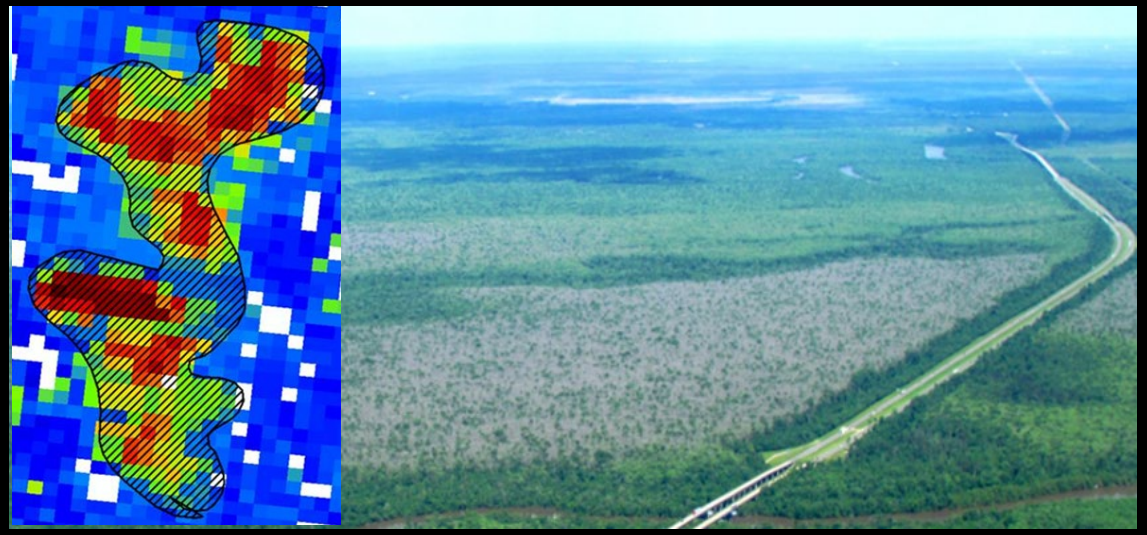


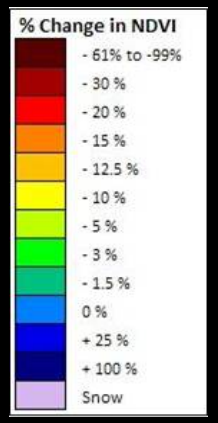
Forest Tent Caterpillar (NC)

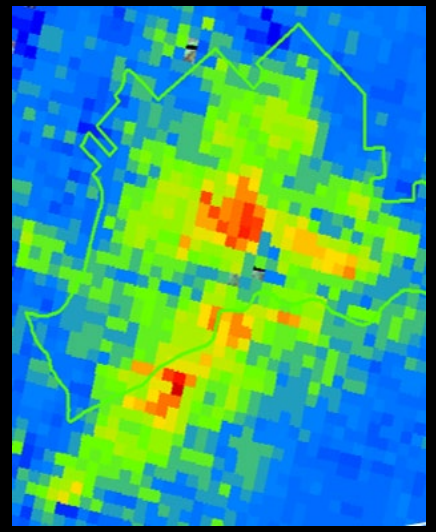


Landsat

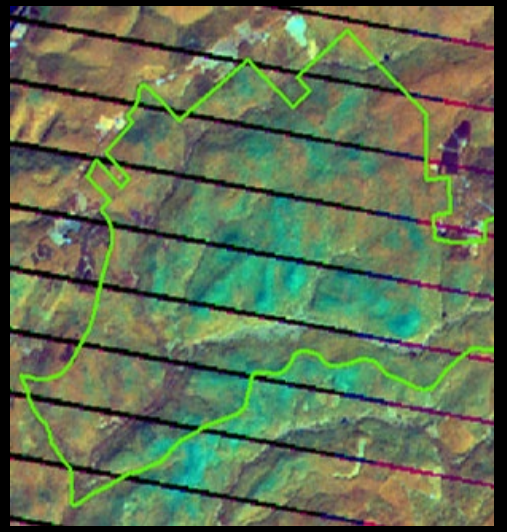


Forest Tent Caterpillar (LA/MS)





Fall Webworm (PA)

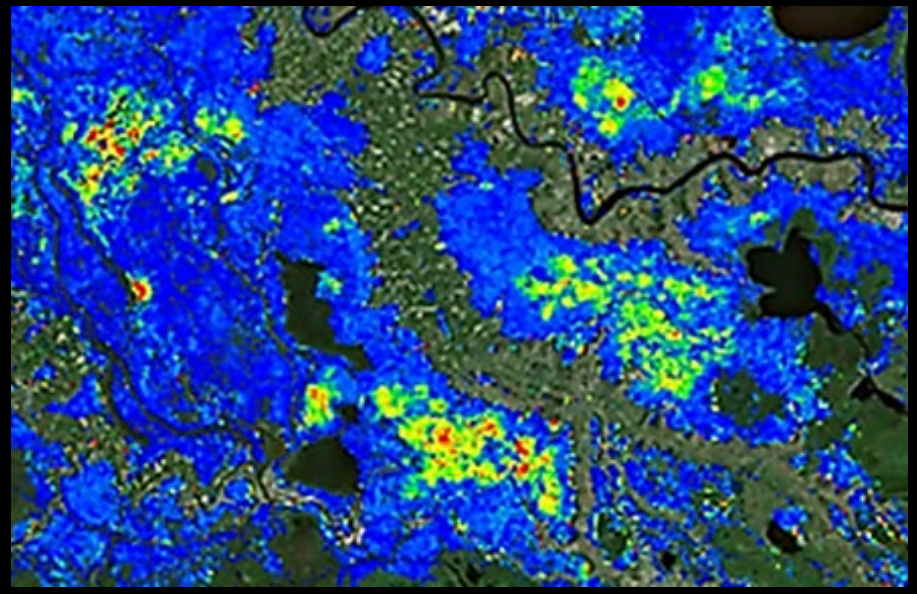


Landsat

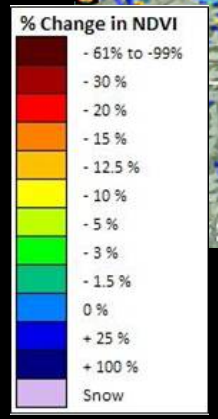
Examples of forest disturbance, or recovery, seen in the *ForWarn* forest change images

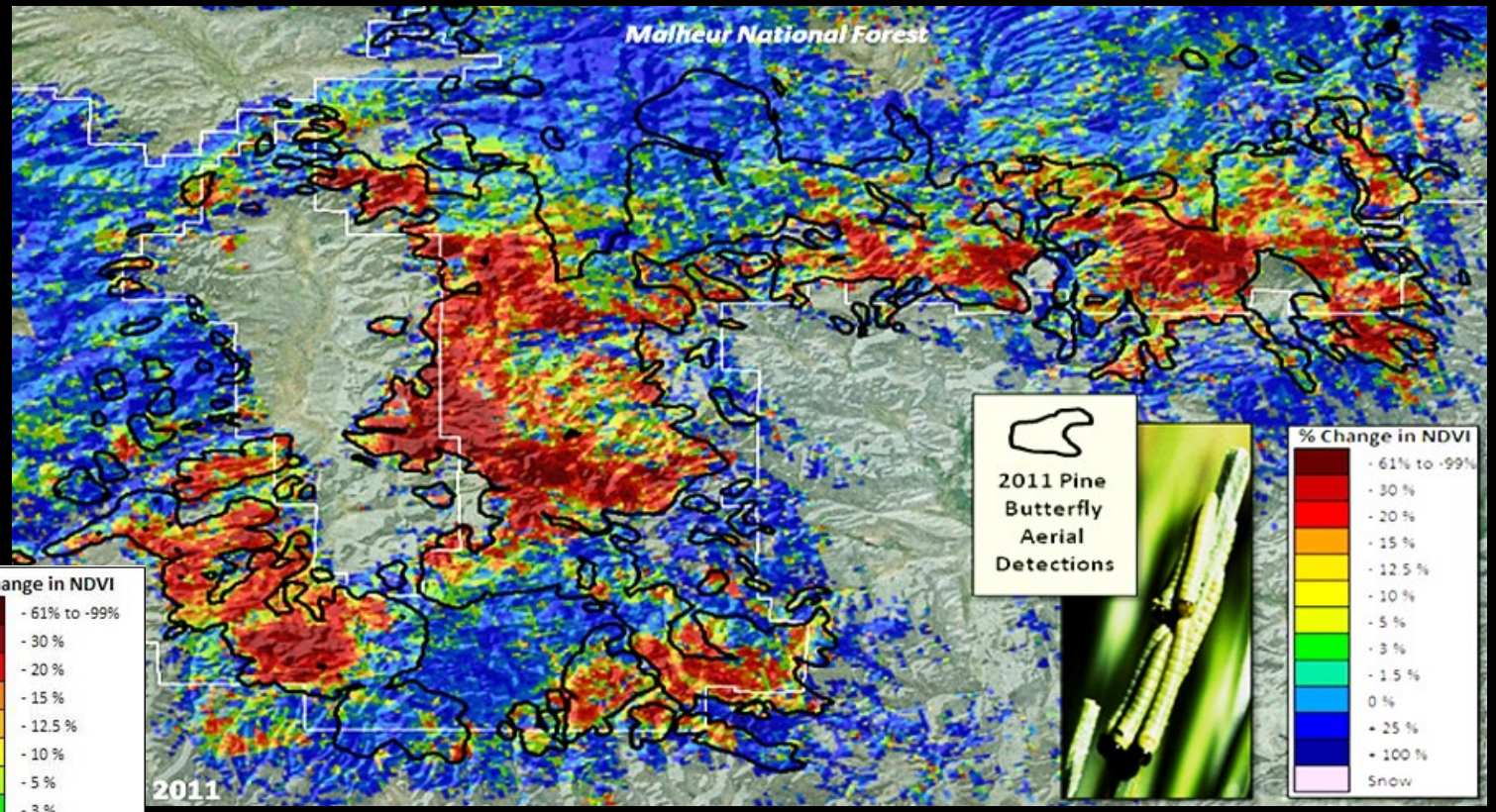
Natural Disturbance

Severe weather (tornadoes, wind, hail, ice)
Drought and flood events
Insects and disease outbreaks
Early/late – spring/fall timing
Snow
Wildfire events



Cypress Leaf roller – Forest Tent Caterpillar (LA)



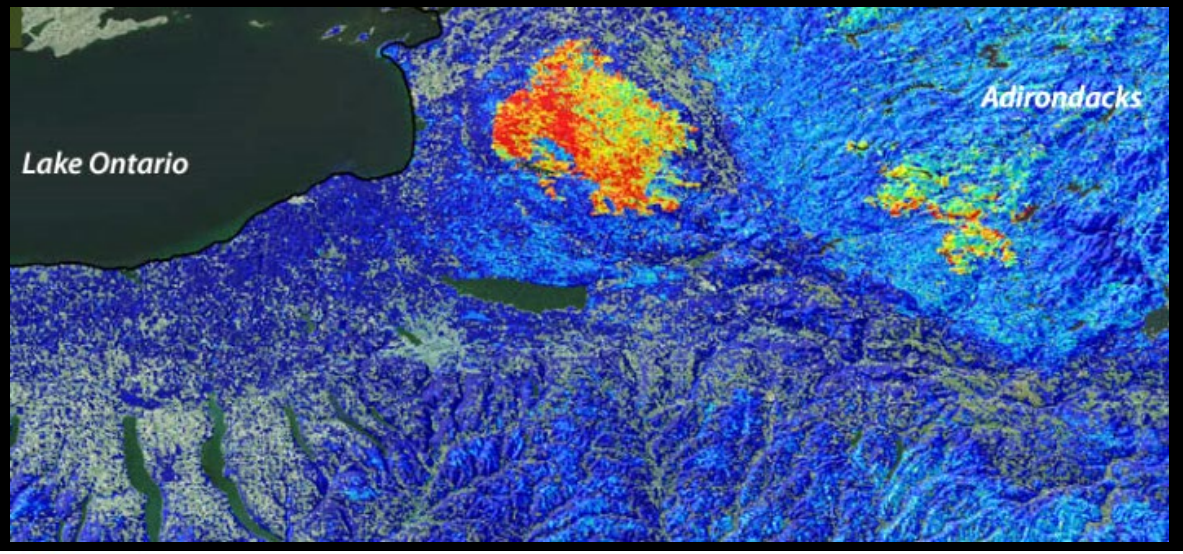


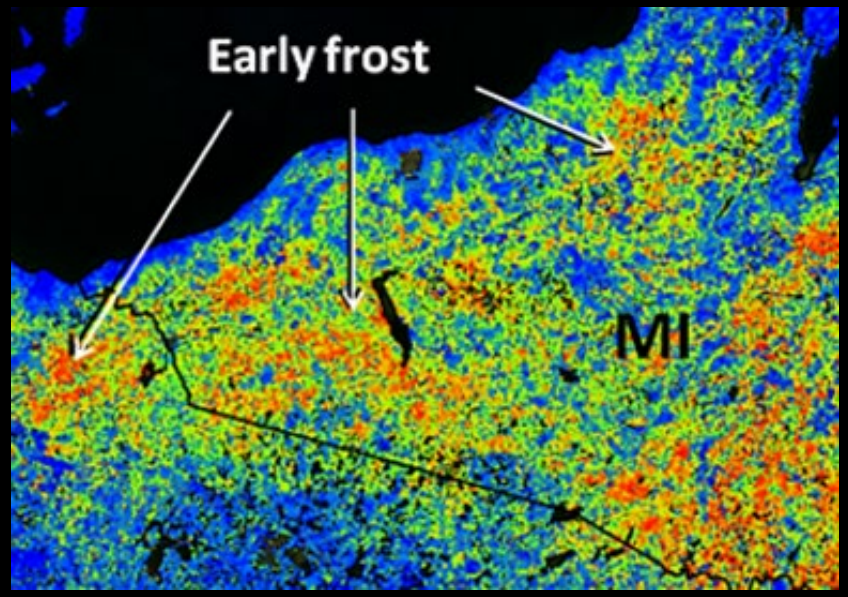
Pine Butterfly with ADS polygons
Malheur National Forest (OR)

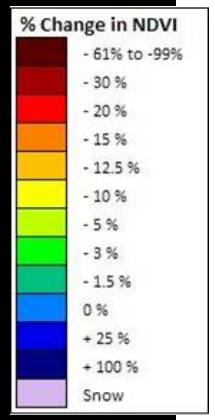
Examples of forest disturbance, or recovery, seen in the *ForWarn* forest change images

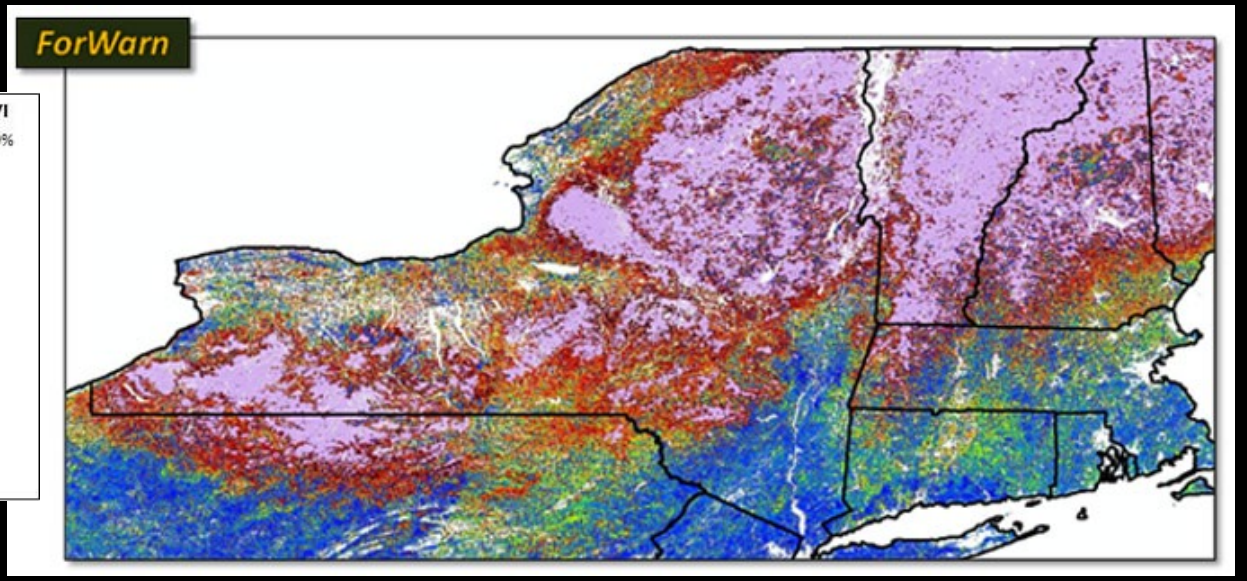
Natural Disturbance

Severe weather (tornadoes, wind, hail, ice)
Drought and flood events
Insects and disease outbreaks
Early/late – spring/fall timing
Snow, frost
Wildfire events









Examples of forest disturbance, or recovery, seen in the *ForWarn* forest change images

Natural Disturbance

Severe weather (tornadoes, wind, hail, ice)
Drought and flood events
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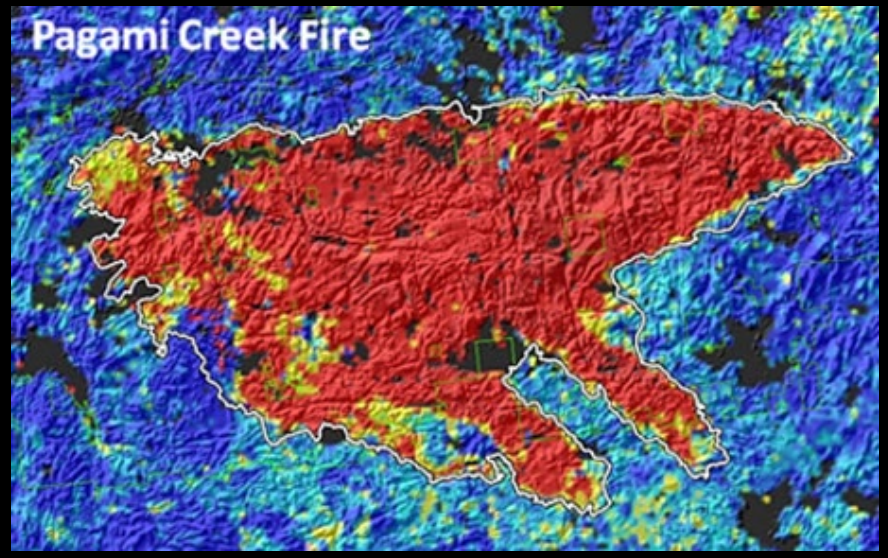
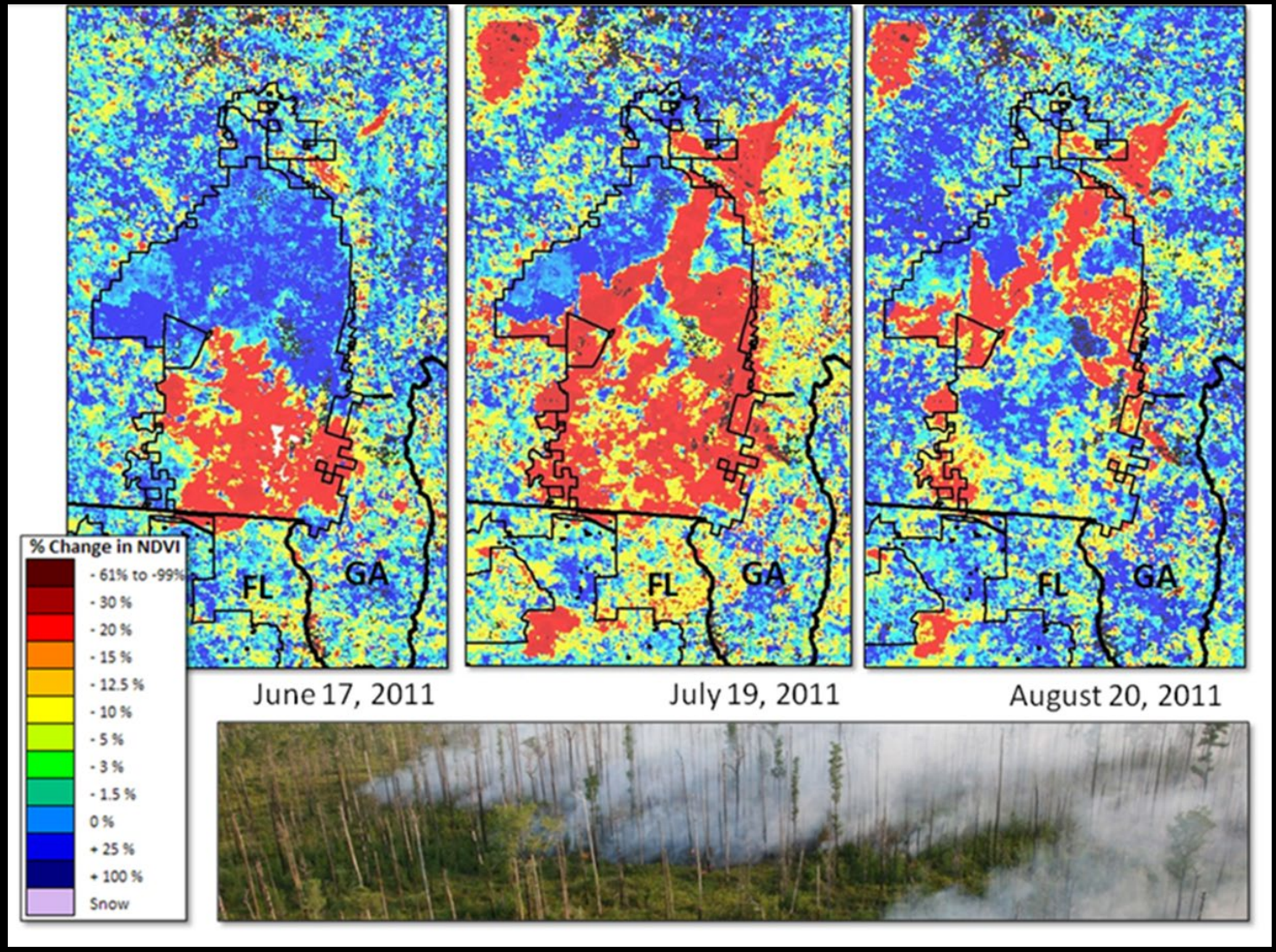
Early/late – spring/fall timing
Snow
Wildfire events



Okefenokee Swamp (GA)



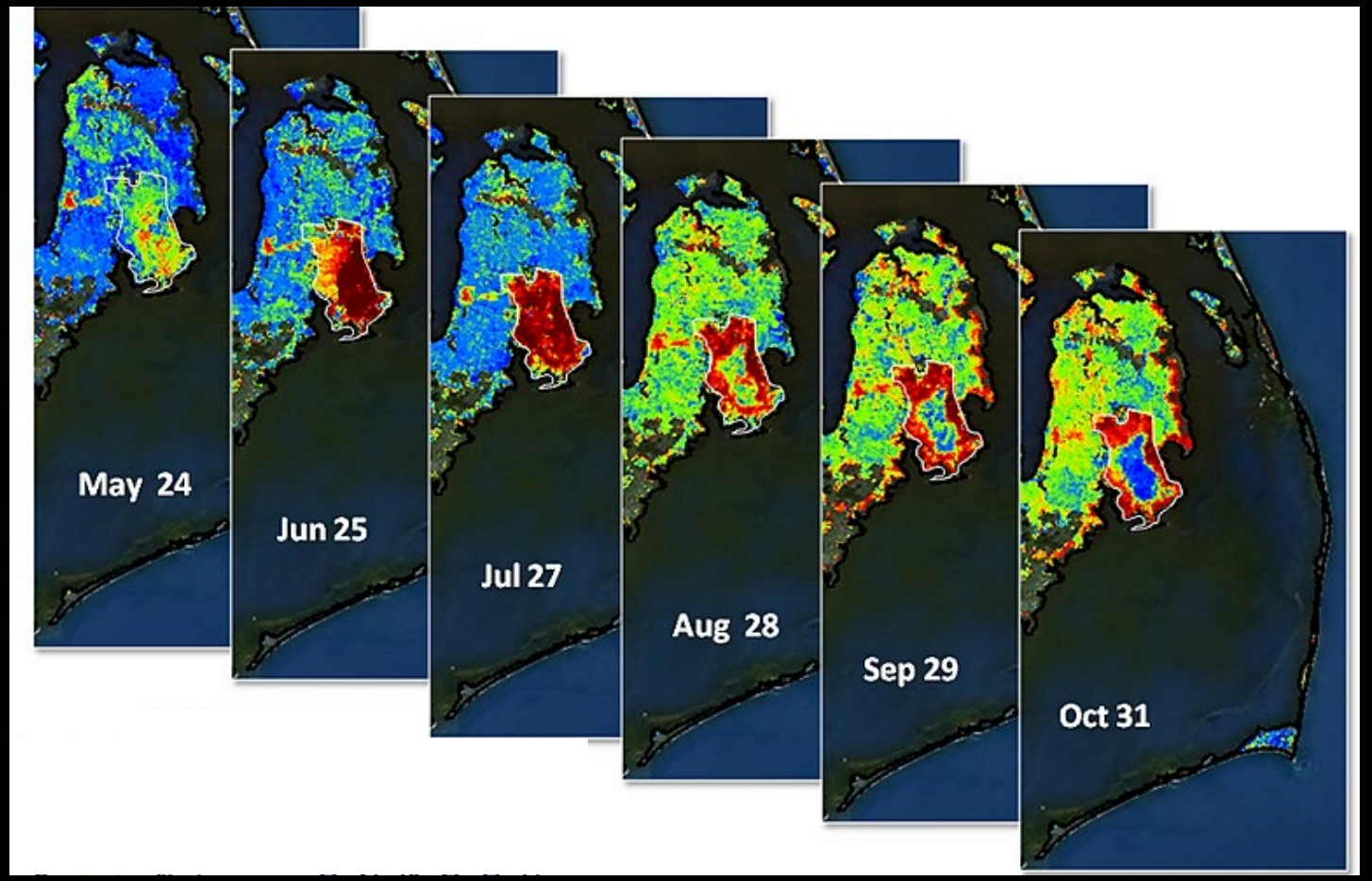
Examples of forest disturbance, or recovery, seen in the *ForWarn* forest change images

Natural Disturbance

Severe weather (tornadoes, wind, hail, ice)
Drought and flood events
Insects and disease outbreaks
Early/late – spring/fall timing
Snow
Wildfire events

Forest disturbance events often display degrees of severity. Variation in rates of recovery can relate to vegetative resilience.

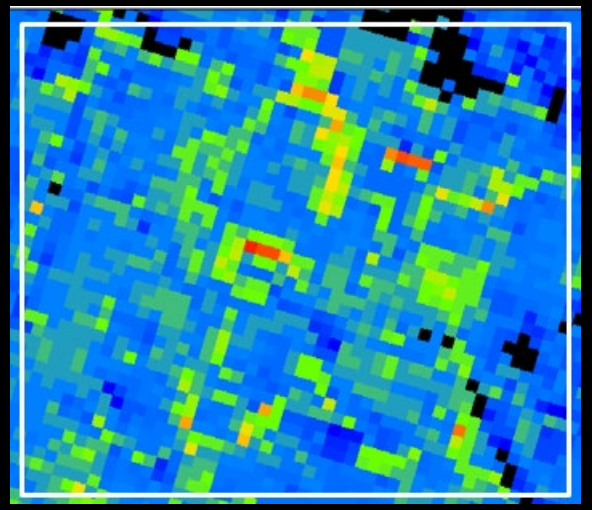
Pains Bay Wildfire (NC)



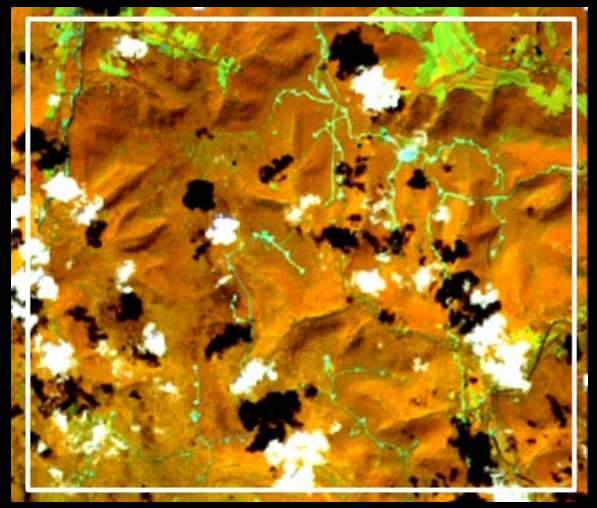
Examples of forest disturbance, or recovery, seen in the *ForWarn* forest change images

Anthropogenic Disturbance

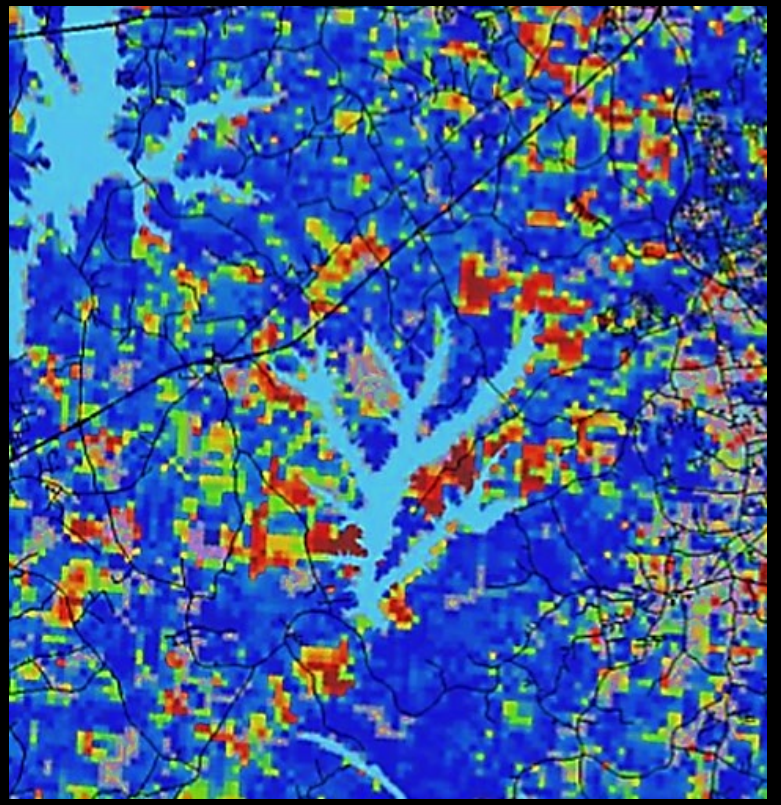
Forest Fragmentation, conversion and urban sprawl
Forest clear cutting, Rx and silvicultural operations
Mining, oil and gas activities
Climate variability
Arson wildfire



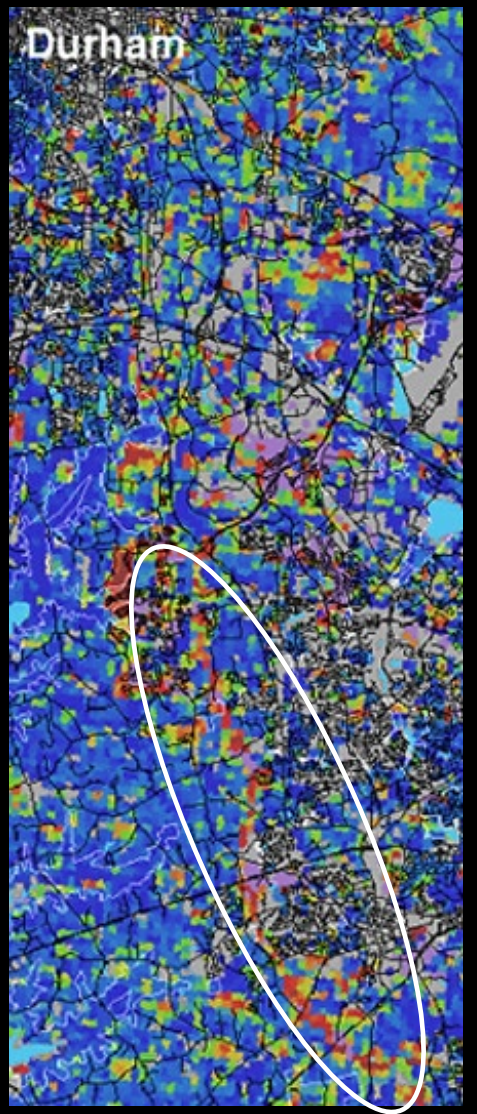
Oil and gas well construction (PA)



Landsat



Forest management (NC)



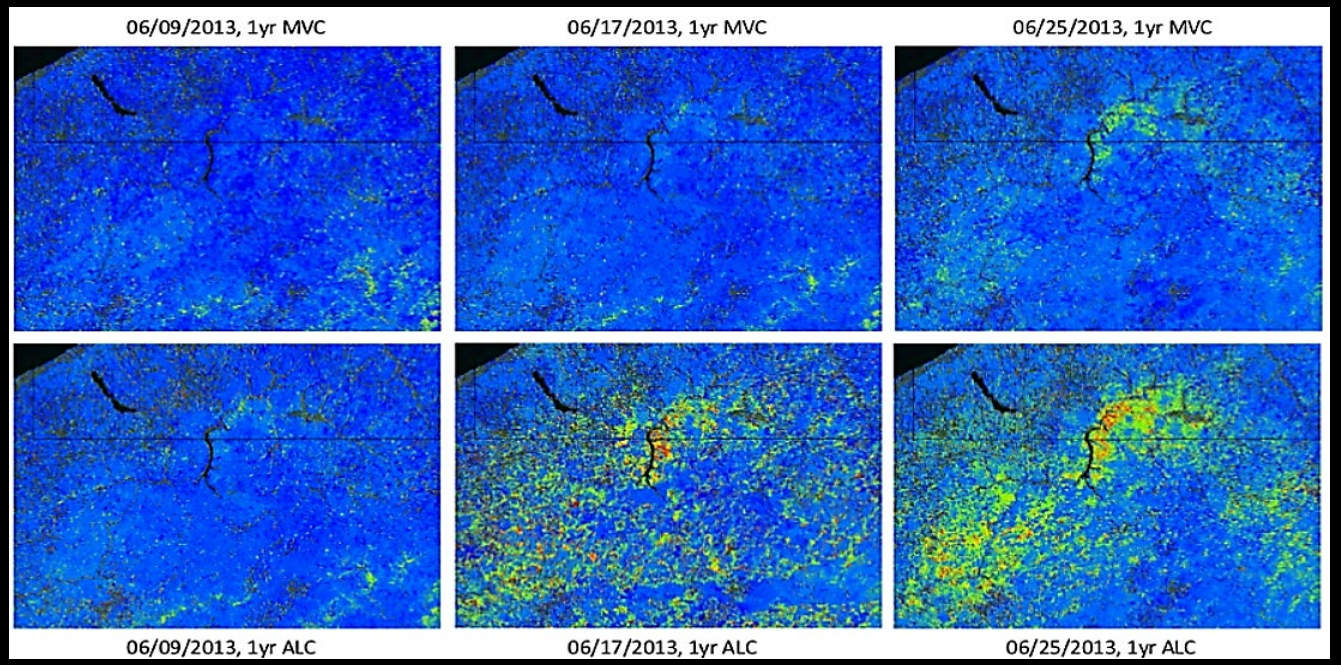
Road construction (NC)

Application Limitations

Detection Delay

24-day detection delay in the 'max-NDVI' standard products, except…

ForWarn 1yr Baseline 'Standard' Product vs. 1yr Baseline 'Early Detect' Product



*The 'Early Detect' product dramatically reduces **ForWarn** detection speeds, allowing the detection of disturbances in as few as one 8-day period*

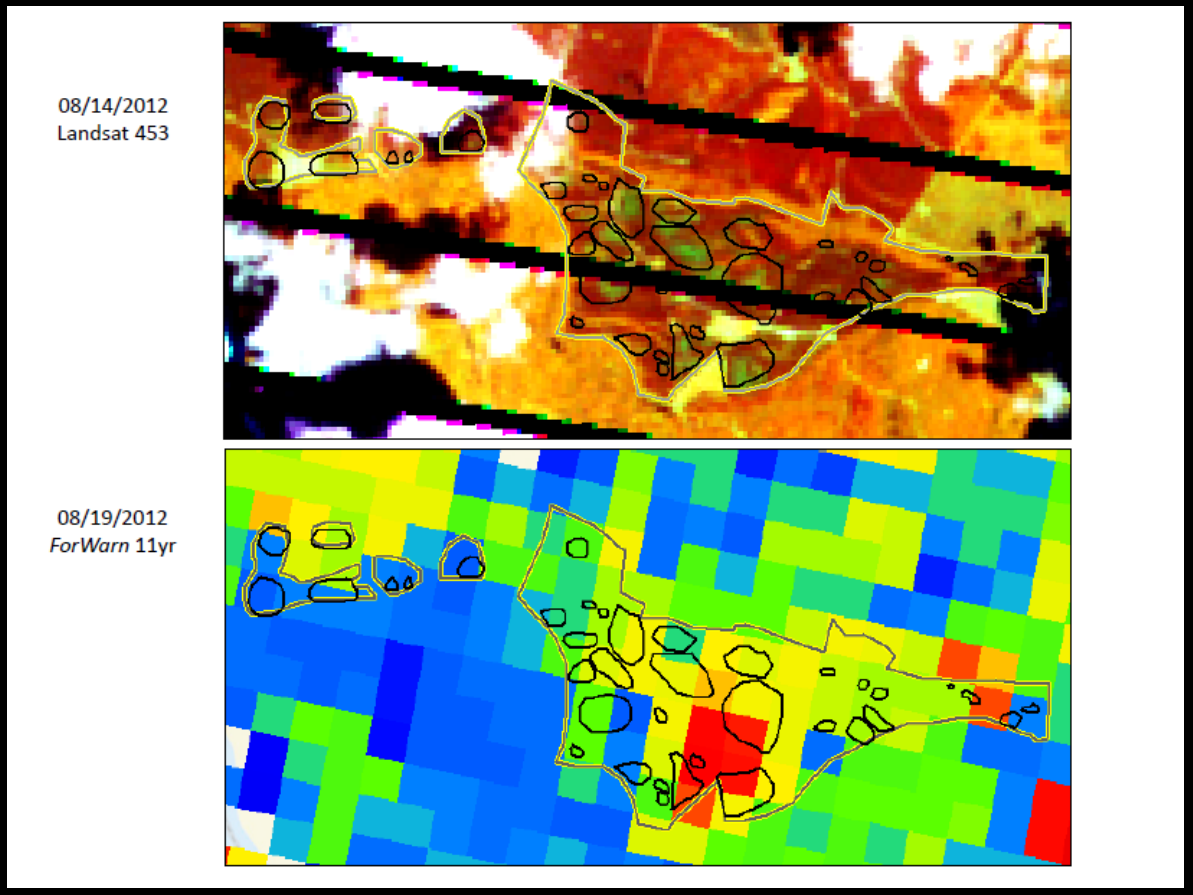
Application Limitations

‘Edge-of-the-mask’

low density, mixed composition forest
pixels are subject to show drought

Spatial Resolution

SPB / IPS have been difficult to detect



ForWarn Website: forwarn.forestthreats.org

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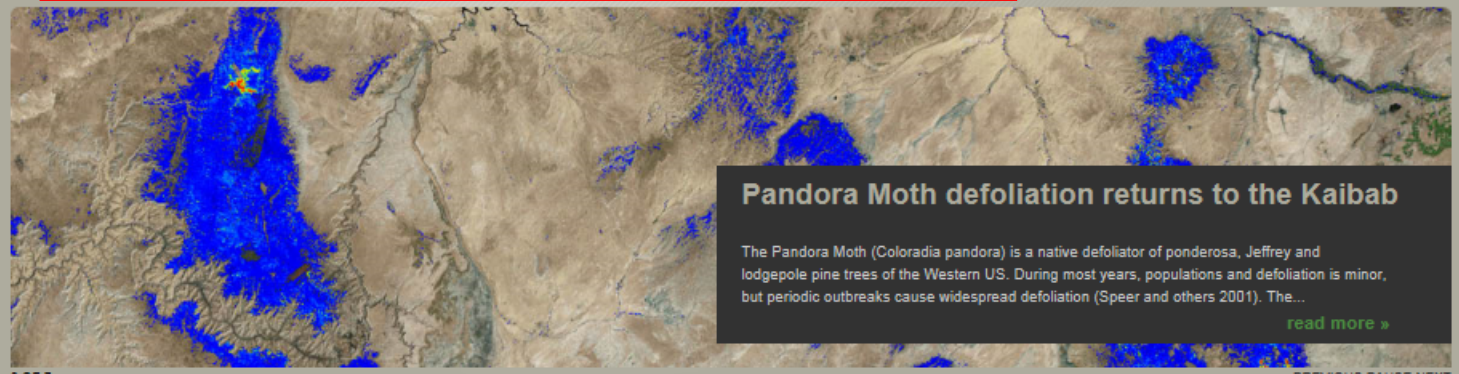
SEARCH

ForWarn

Satellite-Based Change Recognition and Tracking

Home | Overview | Highlights | Products | Support



Pandora Moth defoliation returns to the Kaibab

The Pandora Moth (Coloradia pandora) is a native defoliator of ponderosa, Jeffrey and lodgepole pine trees of the Western US. During most years, populations and defoliation is minor, but periodic outbreaks cause widespread defoliation (Speer and others 2001). The...

read more »

2 OF 7

PREVIOUS PAUSE NEXT

Get Started

ForWarn provides near-real-time tracking of vegetation changes across landscapes in the United States. Useful for both monitoring disturbance events as well as year-to-year variability, derived products can also be used to develop insights into seasonal and inter-annual dynamics.

» Introduction to ForWarn

» Data Access

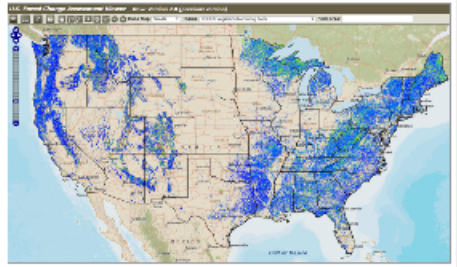
» Sign up for updates

» Contact Us

Forest Change Assessment Viewer

The Forest Change Assessment Viewer provides a vegetation change recognition and tracking system for *ForWarn* that uses high-frequency, moderate resolution satellite data.

FORWARN Viewer



Recent News

ForWarn featured in NASA Earth Observatory

11/16/2016 - 11:03 Sap-sucking insects called hemlock woolly adelgids are draining the life from a common evergreen tree in the eastern United States. Once the non-native bugs become well-established, the consequences...

Featured in Compass Magazine: Here Today or Here to Stay?

09/22/2016 - 09:47 Some disturbances come and go, leaving forests no worse for the wear. Hailstorms, insect defoliations, and light prescribed fires, for example, commonly occur early in the growing season, but,...

ForWarn data on Okefenokee National Wildlife Refuge presented at Texas fire conference

11/23/2015 - 13:49 ForWarn team members attended the 2015 Association for Fire Ecology Meeting in San Antonio, TX in November 2015 to present research on long-term monitoring based on ForWarn's NDVI products. You can...

more news »

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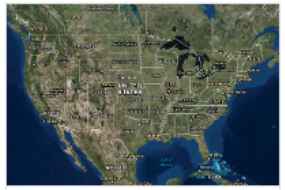
ArcGIS Online – An alternate delivery platform for ForWarn II change imagery

Home Gallery Map Scene Groups Content Organization

William forwarn

Forest Change using MODIS, (3) most recent 8-day periods

Overview



★ Remove from Favorites

Near-real-time percent NDVI change from MODIS, every 8-days, always the (3) most recent 8-day period's NDVI change image using the 1yr NDVI-max baseline, multiple masks by LULC class.

Web Map by USFSSouthResearchStation

Created: Aug 3, 2018 Updated: Aug 3, 2018 View Count: 47

Open in Map Viewer

Open in ArcGIS Desktop

Create Web App

Share

Description

Welcome to ForWarn II!

ForWarn II has enhanced sensitivity, now showing even slight disturbances earlier than ever before, and now covers a larger geographic area.

ForWarn II is mostly the same system with which you're already familiar, but now has a totally new production system that offers some exciting new capabilities, including some new products designed for specialized purposes. For example, disturbances within grasses, shrubs and other shallow-rooted vegetation can sometimes dominate the disturbance signal seen in ForWarn maps, particularly in the Western United States. Almost every ForWarn II disturbance map now has a "Muted Grass/Shrub" companion product that concentrates on the disturbance responses of trees, reserving more of the dynamic range in the maps for showing forest impacts.

Most new ForWarn II products are already available for the entire MODIS period starting in 2003 to present. Most of the data viewer features, like the Share-This-Map, the NDVI graphing tool, and the PestProximity tools, will still work just as always. Documentation is still being developed, so please pardon our virtual dust as we continue to carry these improvements throughout the entire Forest Change Assessment Viewer 2 and the ForWarn II website. Enjoy the new features, and we welcome your feedback!

For more information about ForWarn II - https://forwarn.forestthreats.org/

Details

Size: 8 KB

★★★★★

Owner

Change Owner

USFSSouthResearchStation

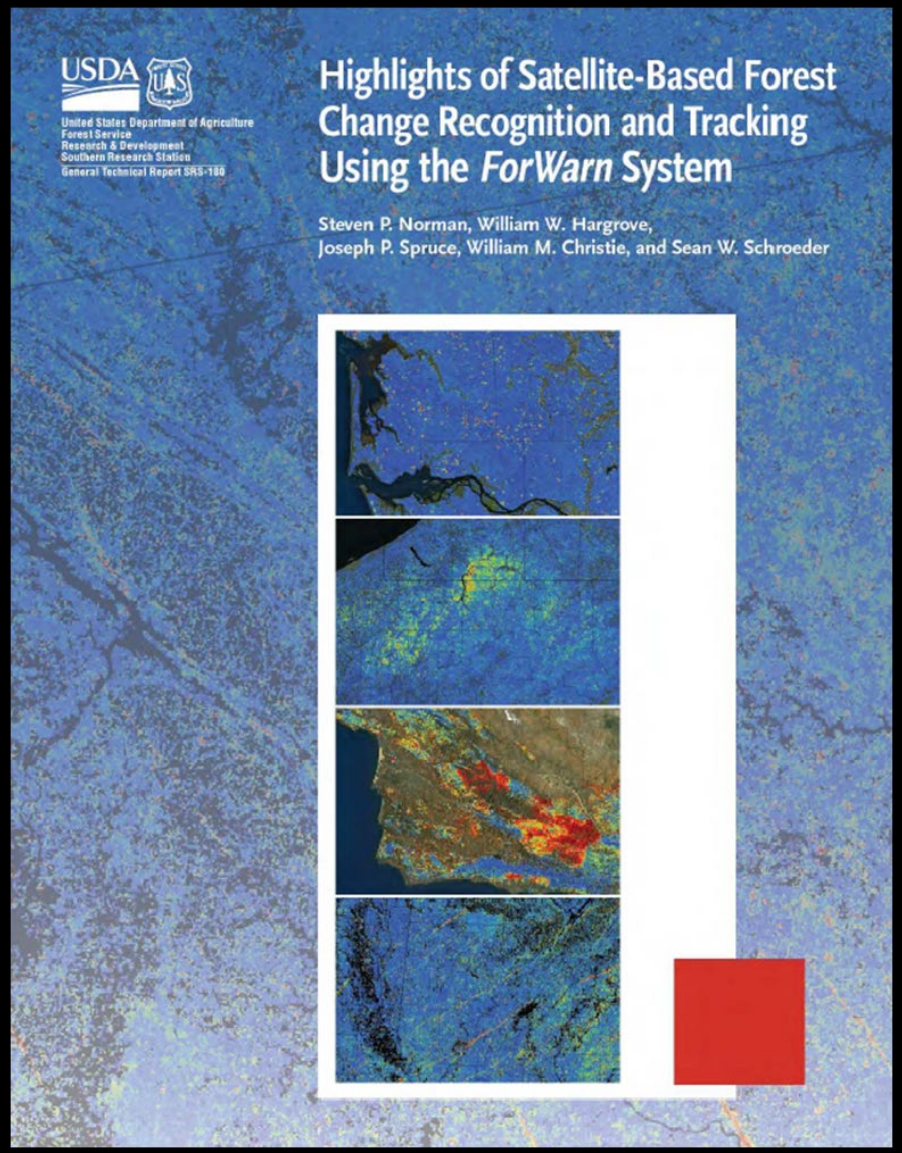
Categories

Weather and Climate | Forest Management | Fire and Aviation | Ecosystems | Vegetation

Tags

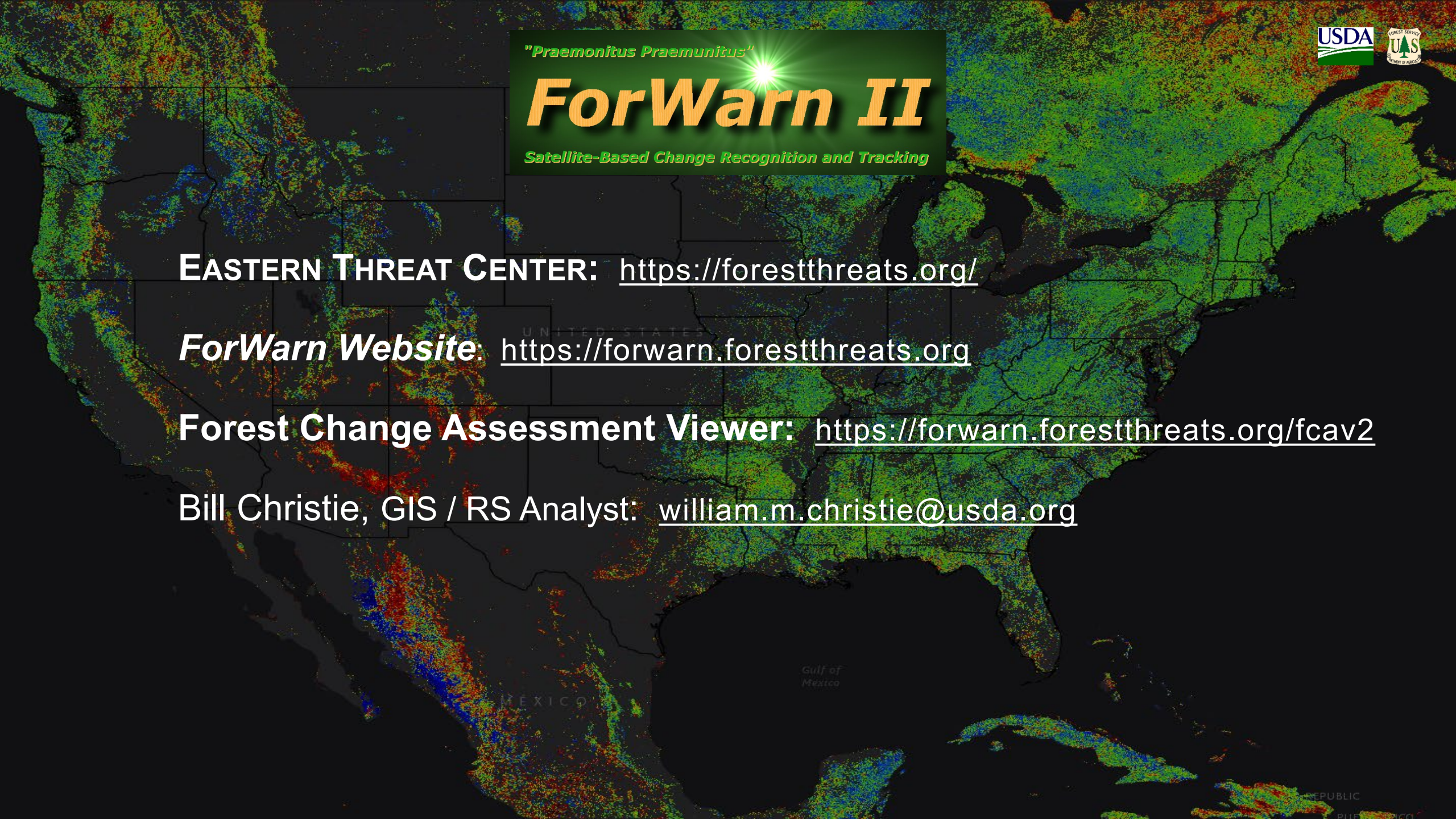
Requires an ESRI ArcGIS Online account

ForWarn General Technical Report



http://www.srs.fs.fed.us/pubs/gtr/gtr_srs180.pdf

Google *'forwarn gtr'*, first listing *(paper copies are also available)*



EASTERN THREAT CENTER: https://forestthreats.org/

ForWarn Website: https://forwarn.forestthreats.org

Forest Change Assessment Viewer: https://forwarn.forestthreats.org/fcav2

Bill Christie, GIS / RS Analyst: william.m.christie@usda.org

"Praemonitus Praemunitus"

ForWarn II

Satellite-Based Change Recognition and Tracking

- New Products every 8-days
- Landscape-scale analyses (231m)
  - Hurricane Damage
  - Wildfire
  - Drought affects
  - Regional Phenological Departure
  - Western Pine Beetle Mapping
  - Eastern Gypsy Moth, Forest Tent Caterpillar and Cypress Leaf Roller
  - ForWarn.forestthreats.org

HiForm

High-resolution forest mapping

- Cloud-based processing using Google Earth Engine and Sentinel-2 satellite imagery
- Tree Canopy Resolution (10m)
  - Forest Disturbance (view topographic effects)
  - SPB/Ips resolution
  - Patchy fire effects
  - Informal R8 Workshop Fall 2019
  - HiForM.org