Interagency Collaborators Develop and Implement *ForWarn*, a National, Near Real Time Forest Monitoring Tool

ForWarn is a satellite-based forest monitoring tool that is being used to detect and monitor disturbances to forest conditions and forest health. It has been developed through the synergistic efforts, capabilities and contributions of four federal agencies, including the US Forest Service Eastern Forest and Western Wildland Environmental Threat Assessment Centers, NASA Stennis Space Center (SSC), Department of Energy's (DOE) Oak Ridge National Laboratory (ORNL) and US Geological Survey Earth (USGS) Earth Research Observation System (EROS), as well as university partners, including the University of North Carolina Asheville's National Environmental Modeling and Analysis Center (NEMAC). This multi-organizational partnership is key in producing a unique, path finding near real-time forest monitoring system that is now used by many federal, state and local government end-users. Such a system could not have been produced so effectively by any of these groups on their own.

The forests of the United States provide many societal values and benefits, ranging from ecological, economic, cultural, to recreational. Therefore, providing a reliable and dependable forest and other wildland monitoring system is important to ensure the continued health, productivity, sustainability and prudent use of our Nation's forests and forest resources. ***ForWarn*** does this by producing current health indicator maps of our nation's forests based on satellite data from NASA's MODIS (Moderate Resolution Imaging Spectroradiometer) sensors. Such a capability can provide noteworthy value, cost savings and significant impact at state and local government levels because at those levels of government, once disturbances are evident and cause negative impacts, a response must be carried out. The observations that a monitoring system like ***ForWarn*** provide, can also contribute to a much broader-scale understanding of vegetation disturbances.

To date, ***ForWarn*** has been shown to be a robust tool capable of detecting a wide range of regionally evident disturbances for multiple forest types. Detected disturbances include those associated with insects, disease, hurricanes, flooding, blowdowns, harvest, urbanization, landslides, and climatic effects (e.g., drought), all of which result in abnormally low vegetation canopy greenness. On a state level, specific examples, include, in 2012, the effects of Hurricane Sandy upon the eastern forests, across New Jersey, upstate New York and eastern Pennsylvania were detected (Figure 1). In 2012, there were several significant events ***ForWarn*** was able to detect. In Colorado, ***ForWarn's*** forest change products detected spruce beetle induced tree mortality in the Rio Grande National Forest and wildfires in Front Range forests of the High Park area; and in coastal Louisiana swamps and wetland forests, the effects of Hurricane Isaac, as well as spring defoliation from caterpillars were also observed. ***ForWarn*** also proved useful for aiding watershed management in North Carolina. Forest damage from a 2012 hailstorm in Asheville, North Carolina was conveyed to the Water Resources Department staff that were unaware of the hail storm impacts or the threat the storm damage posed to the watershed's management. "The branch wounds were particularly impressive, and suggested that the hailstones were at least the size of a quarter," said William Hargrove, Eastern Threat

Center ecologist and lead ***ForWarn*** researcher. “In our field check, we also saw a place across the watershed where trees had not even leafed out much at all since the storm.” In 2011, ***ForWarn*** was used to document location and extent of many weather related events, including tornadoes that ravaged Mississippi and Alabama (Figure 2), and severe drought that impacted Texas and adjacent states, including New Mexico, Texas, Oklahoma and Louisiana, biotic forest disturbances from summer budworm defoliation in Washington State (Figure 3), and fall defoliation from fall webworm in Pennsylvania were also documented.

ForWarn’s monitoring capabilities have helped natural resource managers to more effectively access science research and advanced technology, providing timely geographically displayed information on forest health issues. Such information helps the forest health management community to do their work in providing improved forest maintenance services to millions of Americans across the United States.

ForWarn is a successful example of how the government has brought the benefit of the taxpayer dollars full circle, from the federal back to the state and local level. This acknowledgement has been recognized at a national level when the ***ForWarn*** team won both the Federal Laboratory Consortium (FLC) Southeast Region’s 2012 Partnership Award for Technology Transfer and the 2013 National FLC Interagency Partnership Award. It is considered by many to be an innovative, new use of MODIS satellite data that successfully bridges the gap from research to an important, long needed operational use. The direct result of this collaborative agency effort is that this truly novel technology has been researched, applied, transferred, and used, *to transform science into practice*.

For additional information, see:

More information on the ***ForWarn*** Asheville Watershed Hailstorm Detection: http://forwarn.forestthreats.org/highlights/106

More information on ***ForWarn***: http://forwarn.forestthreats.org

The ***ForWarn*** Forest Change Assessment Viewer: http://forwarn.forestthreats.org/fcav

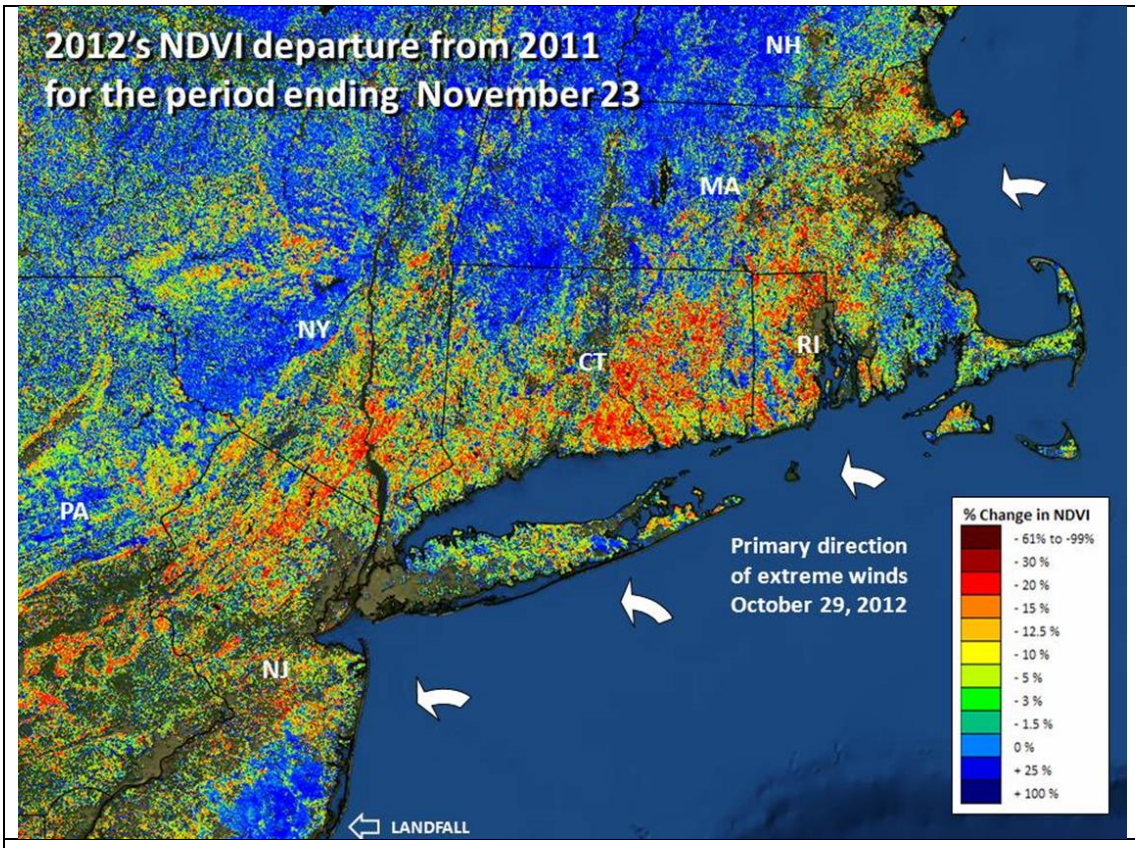

Figure 1. Eastern United States

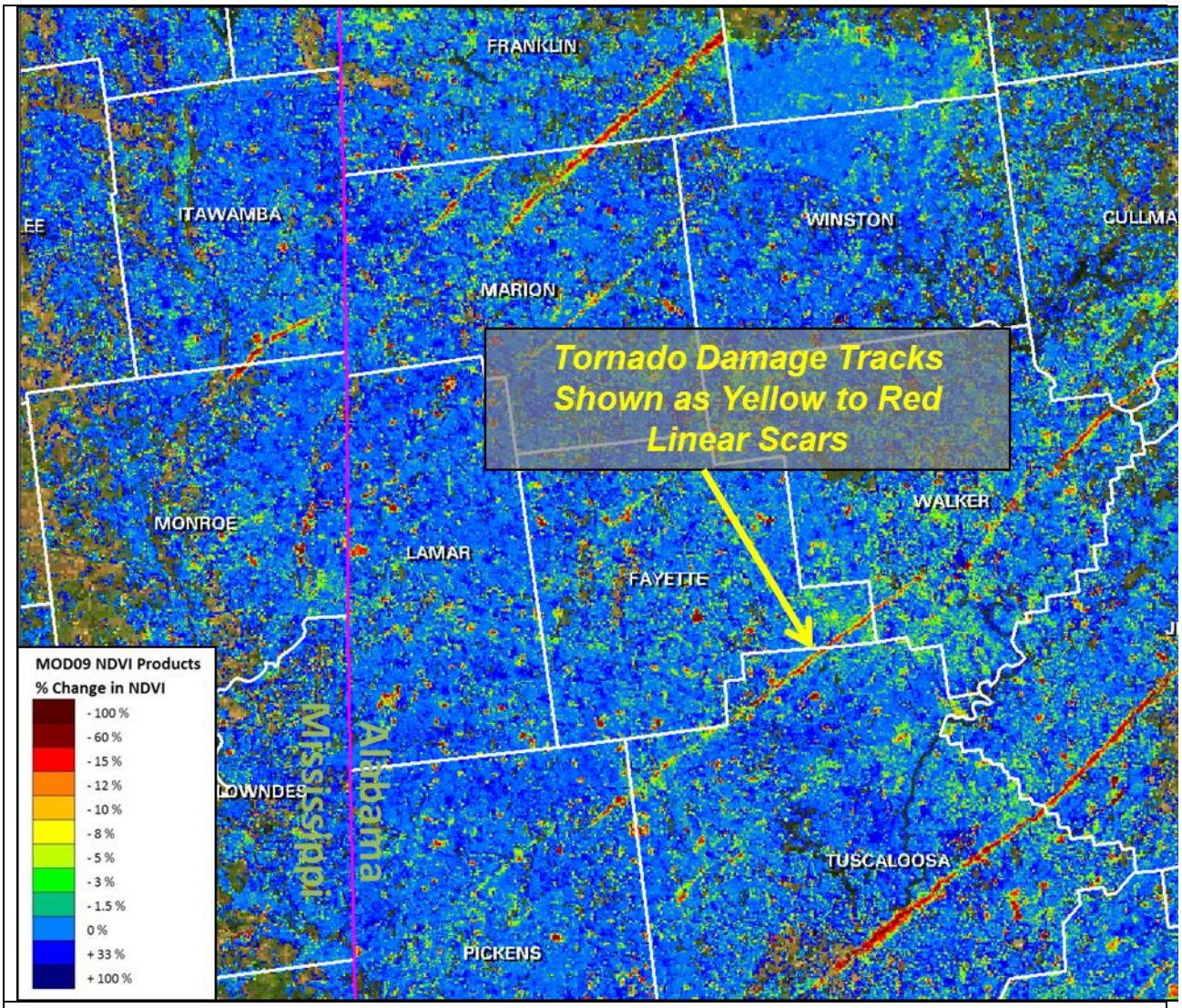

Figure 2. Central United States

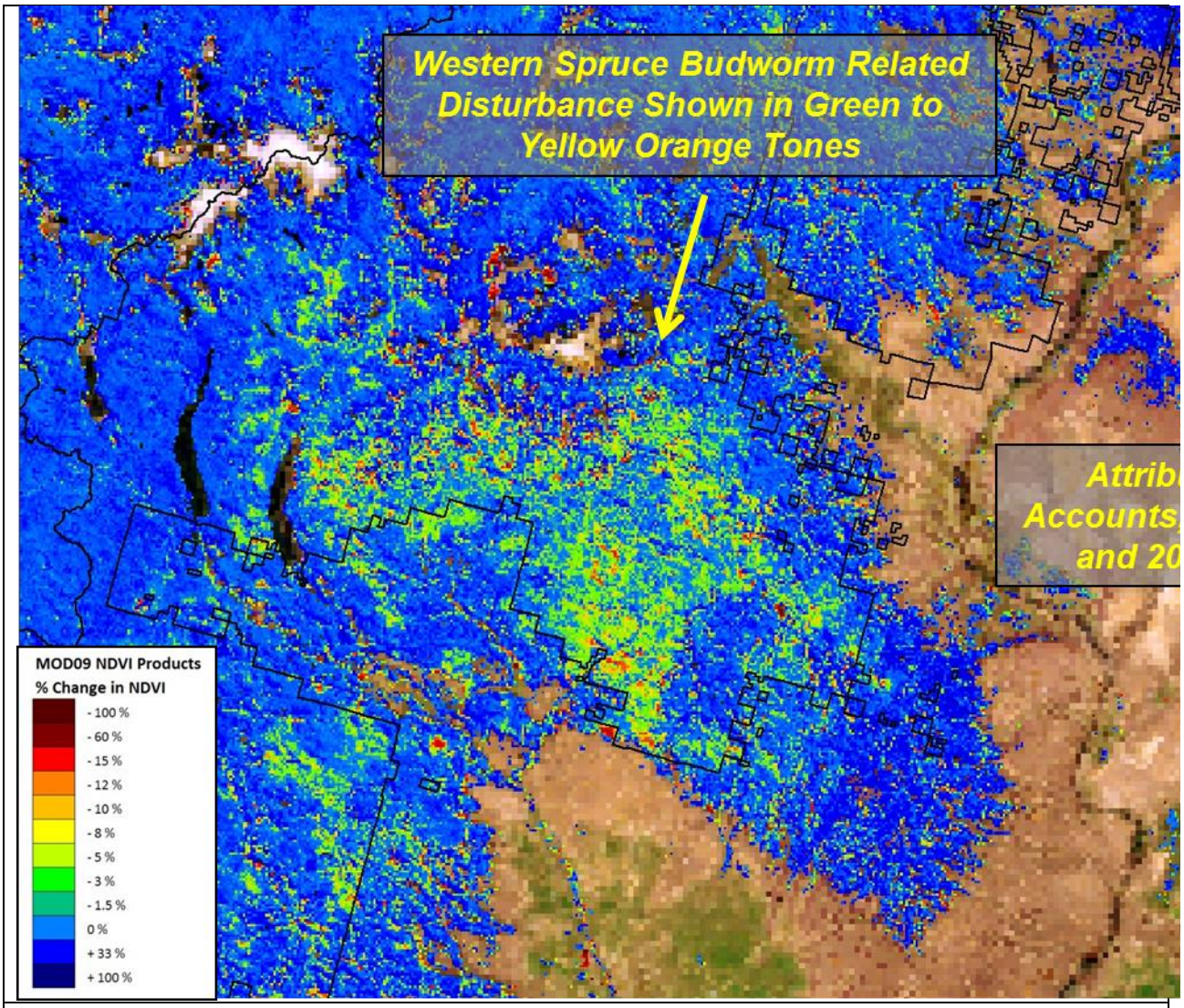

Figure 3. Western United States