



North Carolina Forest Health Highlights



2011

Our Forests

North Carolina's forests cover 18.6 million acres, or about 60 percent of the state's land area. The majority of the state's forested land, some 14.2 million acres, is in non-industrial private ownership, while approximately 1.1 million acres are in national forests. Forestry is the state's second most important industry, providing 180,000 jobs and producing \$23 billion in annual revenue. North Carolina's forests are also prized for their scenic beauty, supporting tourism and outdoor recreation, and providing wildlife habitat from the Appalachian Mountains to the lowlands of the Atlantic Coastal Plain. Major forest types in the state include oak-hickory, loblolly-shortleaf pine, oak-pine, and oak-gum-cypress. Longleaf-slash pine forests, historically much more widespread, now comprise only 2 percent of the state's forests.

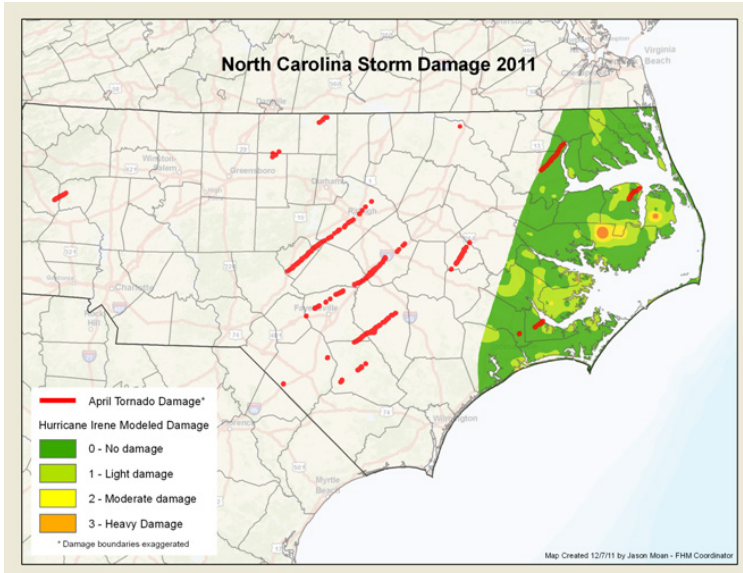


Robert Trickel, NC Forest Service

2011 Influences on Health of Forests in North Carolina

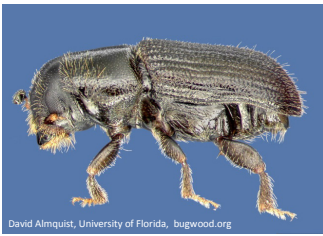
Weather Events Affected Forests

The health of forests in North Carolina continued to be influenced by the affects of lingering **drought conditions**. While average annual rainfall amount was near normal, there were long periods with no precipitation. This contributed to prolonged tree stress and direct mortality. Scattered pine mortality associated with **bark beetles** remained common across the entire state and was the result of increased susceptibility brought on by drought conditions in previous years. Oak mortality associated with drought and **oak decline** was also commonly observed.



Spring tornados and Hurricane Irene also impacted forests in the state in 2011. Compared to other parts of the country **tornado activity** was mild. However, aerial surveys detected 4,749 timberland acres of affected timberland in 22 counties resulting in over \$4 million worth of timber damage. In addition, **Hurricane Irene** damaged caused timber damage on over 287,000 acres in eighteen counties on the Outer Banks and northern coastal plain of North Carolina in August. In all, nearly \$79.7 million worth of timber damage was observed due to this hurricane. Also in August, leaves on trees across the state trembled from the impacts of the earthquake that hit central Virginia. No long term impacts are anticipated.

Bark Beetles—Ips Beetles Still Prevalent



David Almquist, University of Florida, bugwood.org

The **southern pine beetle (SPB)** has been North Carolina's most significant forest insect pest. From 1999 through 2002, the beetle killed at least \$84 million worth of timber in North Carolina. Most of the mortality during this outbreak was in the mountains and western piedmont areas. Since then, beetle activity has been relatively low. While the pest's attack on North Carolina pine trees appears to have subsided throughout the state, prevention efforts remain important because the insect periodically increases to epidemic proportions for reasons not entirely understood. Reports show **Ips engraver beetles** had

moderate to heavy activity statewide due to lingering drought conditions. Although *Ips* infestations tend to be relatively small and scattered, and usually cannot be effectively controlled or efficiently salvaged, their economic impact may approach that caused by southern pine beetles on some sites.

Cost-Share Available For Thinning To Prevent SPB

Southern pine beetle prevention efforts remain important during periods of low beetle activity. The Southern Pine Beetle Prevention Program, funded through a grant from the USDA Forest Service, will reimburse non-industrial private forest landowners in North Carolina for some of the cost of pre-commercial thinning of pine stands. During a pre-commercial thinning, trees with no commercial value are removed in order to allow remaining trees to grow with less competition for food and sunlight. Such thinning improves the health of the remaining trees and reduces the stand's susceptibility to the southern pine beetle.

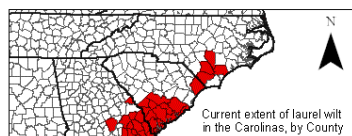
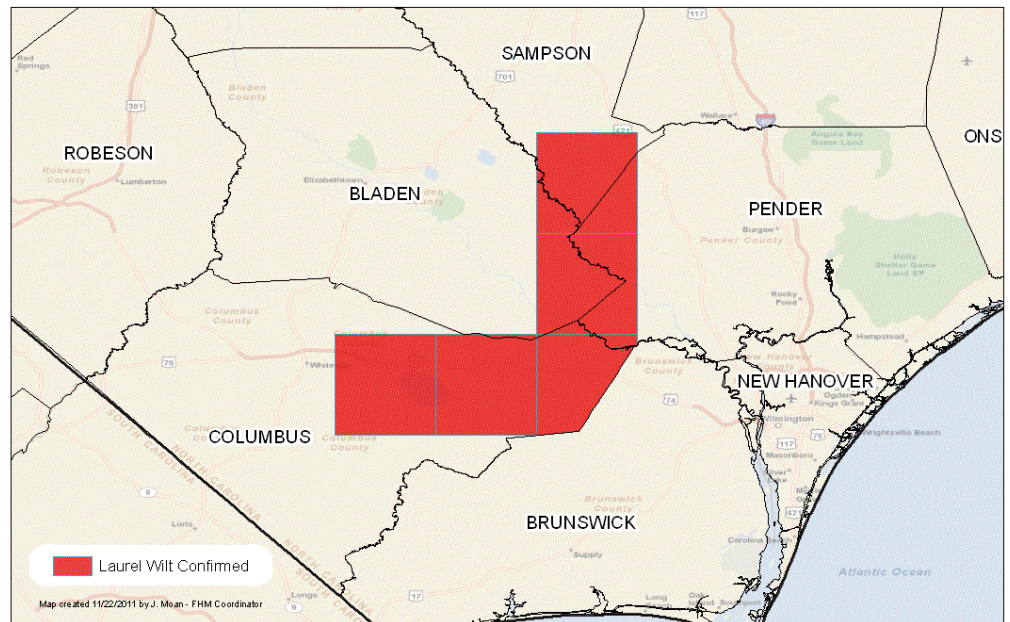
In the past five years, nearly 60,000 acres have been thinned through this program to encourage proper management conditions for pine stand health and to reduce the likelihood of southern pine beetle infestations.

Laurel Wilt Detected in North Carolina

A new tree disease that is sweeping across much of the South was confirmed in North Carolina in 2011. The pathogen that causes laurel wilt is from Asia and was first discovered in Georgia in 2003. Since then, it has spread into six states in the southeast, including North Carolina. In South Carolina, Georgia, and Florida, this disease has killed more than 95 percent of susceptible trees in infected stands and has gained the attention of forest pathologists for its ability to kill healthy, mature trees in only a few weeks.

In North Carolina, this disease is currently found in portions of Bladen, Columbus, Pender, and Sampson counties. Laurel wilt most likely spread into North Carolina through movement of beetle-infested wood.

Only plants in the Laurel family are susceptible to laurel wilt. The most severely affected species is redbay, which is a medium sized tree commonly found throughout the eastern part of the state, particularly in our coastal forests. Other susceptible trees and shrubs in the Laurel family include sassafras, spicebush, pondspice, and pondberry.



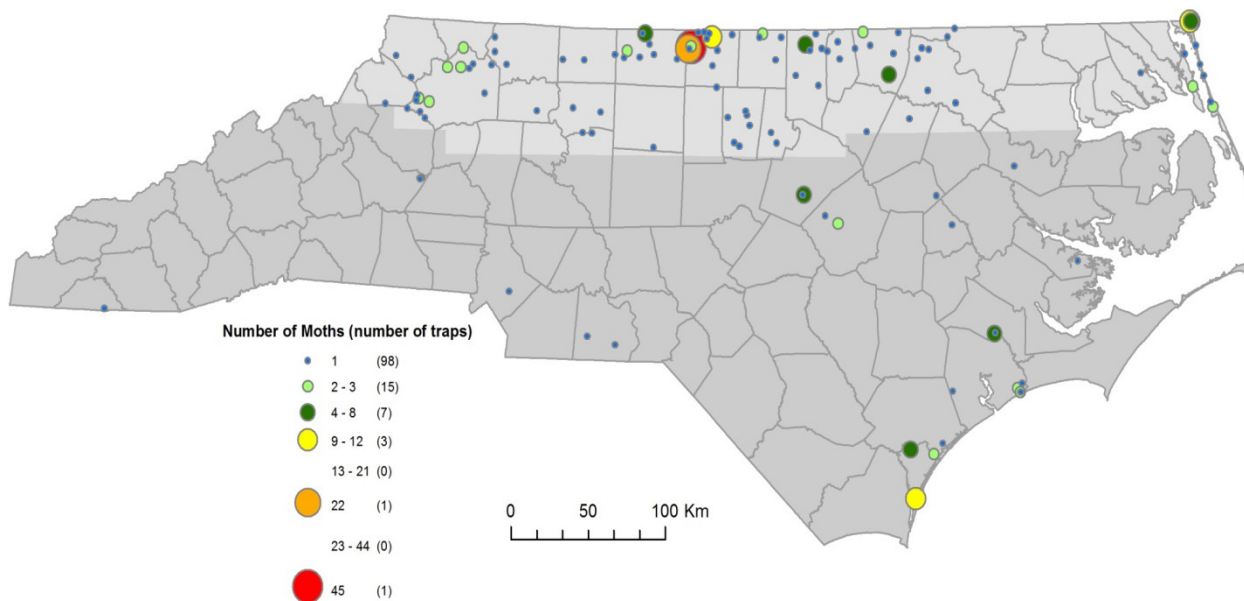
Laurel wilt is a devastating invasive disease of plants in the Laurel family. (Note: This does NOT include mountain-laurel or rhododendron)

Susceptible plants in North Carolina are redbay, swampbay, spicebush, pondberry, and pondspice. This disease is spread by the redbay ambrosia beetle and can be moved to new locations in woody material from infested trees.



Gypsy Moth Monitoring Continues

The entire state of North Carolina has been monitored for gypsy moth since 1982 through a cooperative effort of the N.C. Department of Agriculture and Consumer Services - Plant Industry Division, with assistance from the N.C. Forest Service. The 2011 statewide gypsy moth trapping has been completed and once again North Carolina avoided any new gypsy moth establishment, though Currituck County and a portion of Dare County remain in quarantine for the insect. In fact, the 2011 trapping season had the lowest total trap capture in at least 20 years. Trap data is used to determine patterns of gypsy moth infestations, though the presence of trapped male moths does not necessarily indicate there is a reproducing gypsy moth population in the area. Data compiled over several years can reveal with more confidence whether a location is infested with a reproducing gypsy moth population, or if the moths caught were likely blown in during a weather event. Plant Industry Division is only planning to treat one location in 2012 as a result of this year's trap data.



2011 trapping results which show the majority of advancing gypsy moths caught in northern North Carolina.

Hemlock Woolly Adelgid Found Throughout Entire Range of Hemlocks in North Carolina

Infestations of the hemlock woolly adelgid (HWA) continued to spread and intensify in western and central North Carolina. The adelgid now infests the entire native range of both eastern and Carolina hemlocks in the state. Mortality is very apparent in infested areas and will continue to increase during the next several years. There are some control options available but these are often cost prohibitive in large forested tracts. The use of systemic insecticides has been the primary control method used on state and private lands and limited release of several species of predatory beetles has occurred on state forests. Most control efforts are limited to urban landscape trees, and trees of high aesthetic, historical, or sentimental value on both public and private lands.



Treatment on public lands is primarily on trees near visitor centers, campgrounds, and scenic road and trails. The Alliance for Saving Threatened Forests (part of the Center for Integrated Pest Management at NC State University) is now looking for naturally occurring eastern and Carolina hemlock trees that have survived HWA infestations to take and propagate cuttings and evaluate them for natural resistance to HWA. Any potentially resistant hemlocks can then be propagated in hopes of producing offspring that have an increased resistance to adelgids. These seedlings may then be used to someday reintroduce hemlocks back to their natural range.

Non-Native Invasive Plants Provide Challenges to Effective Forest Management

North Carolina foresters, landowners, and homeowners have been increasingly encountering and attempting to control a large variety of non-native invasive plant species on properties they own and manage. These weedy plants create problems for forests and forest management by outcompeting/displacing native vegetation, impacting species composition, reducing biodiversity in stands, damaging wildlife habitat, providing challenges to management, site preparation and reforestation, and increasing the risk and intensity of wildfires.

The N.C. Forest Service, along with North Carolina State University's Forestry and Environmental Outreach Program, conducted three non-native invasive plant workshops for forest landowners across the state in 2011. Participants were polled on what invasive plant species most affect forests and forest management on their forest land. Close to fifty species were listed and the top five most problematic weeds for each region are listed below. These plants, and other nonnative invasive plant species, are receiving increasing attention in forest management and fire management throughout the state.

Top 5 Problematic Non-Native Invasive Plant Species by Physiographic Region in North Carolina

<u>Coastal Plain</u>	<u>Piedmont</u>	<u>Mountain</u>
1. Chinese privet	1. Chinese privet	1. Multiflora rose
2. <i>Microstegia</i> /Stiltgrass	2. Kudzu	2. Kudzu
3. Kudzu	3. <i>Wisteria</i>	3. Oriental bittersweet
4. <i>Phragmites</i> /Common reed	4. <i>Microstegia</i> /Stiltgrass	4. Chinese privet
5. <i>Wisteria</i>	5. Tree of Heaven; Japanese honeysuckle (tie)	5. Japanese honeysuckle

Early Detection and Rapid Response

Emerging Threats Can Greatly Impact a Variety of Forest Tree Species in the Future

In addition to the "forest influences" already occurring within the state's borders, there are a number of non-native invasive insect, disease, and plant species that threaten to move into the state and affect our forests in the future. These species are constantly being monitored and plans are being updated to deal with these threats as they make their way into North Carolina. The following pests are not known to be present in North Carolina but are found in adjacent states or have the capability to move large distances, either naturally or through human-assisted introduction. These species have potential to cause immeasurable damage to a variety of tree species and forest ecosystems in the state, especially since most are recent introductions to the United States and control practices have not yet been developed. Through information and education efforts to limit spread, surveys to detect introductions early, and rapid responses to threats, the N.C. Forest Service personnel, along with other state and federal agencies, will enact control efforts where feasible to delay or minimize the threats caused by these pests.

Thousand Cankers Disease
Cankers



Emerald Ash Borer
Galleries



Sudden Oak Death
Mortality



Cogongrass
Invading Woodlands



Thousand Cankers Disease of Walnut Trees Found in Tennessee and Virginia

Black walnut trees in North Carolina are at risk of infection leading to eventual mortality from a disease that was previously known to be active only in western states. The fungus that causes **thousand cankers disease (TCD)** is carried by the **walnut twig beetle**, a tiny bark beetle. Both the fungus and the insect vector were found in walnut trees for the first time in the east in Knoxville, TN in July 2010, and more recently in at least four surrounding counties.

This year, TCD was found in 6 counties near Richmond, VA. Experts suspect that the disease could have been present in the eastern U.S. for 15-20 years. In North Carolina, an external quarantine was implemented against importation of firewood and other walnut products from areas where the disease is known to be present. An early detection survey in 10 North Carolina mountain counties was conducted by the North Carolina Forest Service with state and federal partners and found no evidence to date that the beetle or the pathogen are present in this state.

Emerald Ash Borer Close to North Carolina

First discovered in Michigan in the summer of 2002, this tiny wood boring insect most likely arrived in the United States in solid wood packing material from Asia. Since its discovery, the **emerald ash borer** has killed tens of millions of ash trees in Michigan, Ohio, Illinois, Indiana, Pennsylvania, West Virginia, Maryland, Virginia, Missouri, Wisconsin, Minnesota, Kentucky, as well as Ontario and Quebec, Canada. More recently, emerald ash borer was detected in Knoxville, TN, making its entrance into North Carolina seem more imminent. Quarantines have been placed around areas of known infestations to limit movement of firewood and ash wood products into non-infested areas. All species of ash found in North Carolina can be attacked and killed by this insect. Currently, there is no reliable control method to stop this insect from spreading. The inevitable arrival of this insect in North Carolina poses a serious threat to ash species; localized extinction of ash is likely, but the long term effects of such a dramatic change in forest species composition is poorly understood. One of the major contributors to dispersal of this insect is the movement of firewood. Movement of wood materials, including non-heat treated firewood, from all but local sources is discouraged to slow the spread of this destructive insect into the state.

Pathogen causing Sudden Oak Death detected in stream, not found in forest environs

Tens of thousands of oak and tanoak trees in the coastal areas of California and Oregon have been killed by this plant disease caused by a fungus-like microorganism. Many of North Carolina's native oak species are also known to be susceptible to this pathogen. While the list of host plants that can be infected is very large, oaks are the most seriously affected and can be killed in just a few years. Other plant species, such as our native rhododendron and mountain laurel, along with a wide variety of ornamentals commonly used for landscaping, may only suffer from leaf and shoot blight symptoms but can spread the disease to nearby oaks. Suitable hosts and cool, moist weather conditions make forests in the mountains and foothills especially at risk, though all of North Carolina is threatened. The pathogen causing **sudden oak death** and **ramorum leaf blight** was first introduced into North Carolina in 2004 in plant nursery shipments of mostly camellias and rhododendrons from California; affected plants were quickly destroyed. Since then, the N.C. Department of Agriculture and Consumer Services - Plant Industry Division has inspected plant nurseries on a regular basis and has put a high priority on detecting and eradicating any new introductions of infected nursery stock. As a part of a cooperative national project coordinated and funded by the USDA Forest Service, the N.C. Forest Service conducts annual surveys of areas outside of suspected high risk nurseries to determine if the pathogen may have escaped into the environment. The pathogen that causes sudden oak death (*Phytophthora ramorum*) was confirmed in a stream sample outside of an infected nursery in the summer of 2010. Additional samples in 2011 have confirmed the continued presence of this pathogen. Surveys are ongoing to determine if the pathogen is present in the surrounding plant communities. To date, surveys in North Carolina have not detected the presence of the pathogen in forest or landscape vegetation outside of nurseries receiving infected plants.

Aggressive Cogongrass Spreading Throughout the Southeast

Cogongrass has been ranked as one of the ten worst weeds in the world. The perennial grass was introduced from Southeast Asia in packing material and as potential forage and erosion control vegetation and is now found in Alabama, Florida, Georgia, Mississippi, South Carolina and Tennessee. Disturbed roadsides, forests, and open fields can be invaded and overtaken by cogongrass. It forms dense thatch and leaf mats that make it virtually impossible for other plants to compete or coexist. In addition, cogongrass is cold hardy, and tolerant of shade, high soil salinity and drought. Large infestations of cogongrass can alter the normal fire regime of a fire-driven ecosystem by causing more frequent and intense fires that injure or destroy native plants. Cogongrass displaces a large variety of native plant species used by animals (e.g., insects, mammals, and birds) as forage, host plants and shelter. Some ground-nesting species have also been known to be displaced due to the dense cover that cogongrass creates.

Forest Health Threats Related to the Movement of Firewood

Firewood Movement Traced To Unintentional Introductions of Hitchhiking Pests

Insects and diseases that are transported by way of commercial, residential, or recreational firewood affect many species of forest trees. The following table illustrates the various non-native invasive forest pests capable of damaging North Carolina's forest trees that are directly traceable to interstate and intrastate movement of firewood. Natural movement of invasive pests may be limited to a few hundred feet or up to 20 miles per year. However, movement of pests in firewood can be 300 to 600 miles per day. A national campaign is underway to limit the movement of firewood due to the potential for transporting pests, primarily non-native invasive insects and diseases, from one geographic area to another. The state of North Carolina has started an educational effort to encourage residents and visitors to use local firewood or firewood that has been treated and thoroughly inspected for hitchhiking pests.



Forest threat organisms potentially transported in firewood:

Insects

Asian longhorn beetle
Emerald ash borer
Gypsy moth*
Redbay ambrosia beetle*
Sirex woodwasp
Walnut twig beetle

Diseases/Pathogens

Beech bark disease*
Laurel wilt*
Oak wilt*
Thousand Cankers Disease of Walnut

*Currently found in parts of North Carolina

Forest Health Assistance in North Carolina

With assistance and support from the USDA Forest Service, the N.C. Forest Service is responsible for providing assistance to the forest landowners of the state in the detection and control of destructive forest insects and diseases. A staff of forest health specialist in the Forest Protection Section directs this responsibility. Services are provided to forest landowners by district and county personnel with the Forest Health Branch staff providing appropriate training along with professional and technical expertise in the diagnosis and control of destructive insects and diseases.

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