



North Carolina Forest Health Highlights



2009

The Resource

North Carolina's forests cover 18.6 million acres, more than 57 percent of the state's land area. The majority of the state's forested land, some 12 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 97,000 jobs and producing \$6 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, while other minor types account for an additional 3 percent.



Infestations of the hemlock wooly adelgid continued to spread within infested counties and intensify in the Appalachian region in 2009.

2009 Forest Influences and Programs

Weather

Drought conditions that persisted across much of North Carolina for the last few years have diminished. Many trees are recovering while others are just beginning to show direct and indirect impacts from long term water shortages. Previous drought conditions are still to blame for moderate **Ips engraver beetle** activity resulting in scattered pine mortality across the entire state. Mortality of oaks associated with drought and **oak decline** remained high across the state. There were no major storms affecting North Carolina in 2009. Only 48 acres of storm damage was reported in northeastern North Carolina resulting from a suspected tornado.

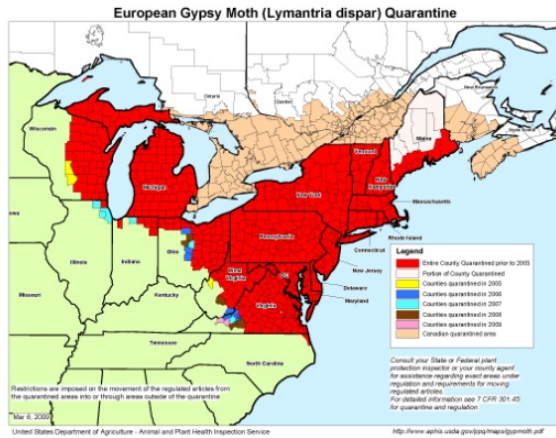


Bark Beetles

The **southern pine beetle** is North Carolina's most significant forest insect pest. No southern pine beetle (SPB) infestations were observed on state or private lands in North Carolina in 2009. A few spots of low activity were present on the Croatan NF. This insect is suspected to be present at very low population levels across much of the state. There was moderate **Ips engraver beetle** activity resulting in scattered pine mortality statewide in response to drought conditions, though this level was noticeably less than in 2008.

An ongoing SPB prevention cost-share program was initiated in 2005 to assist landowners in timber stand improvement work (particularly thinning) to create healthier stands to reduce the likelihood of SPB infestations. 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, young trees with no commercial value are removed 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.

While the SPB attacks appear to have recently subsided in North Carolina, prevention efforts remain important. Insect populations periodically increase to epidemic proportions for reasons not entirely understood.



Gypsy Moth

The leading edge of **gypsy moth** infestation continues to run along the line between North Carolina and Virginia. Though the leaf eating caterpillar has made pushes into North Carolina, efforts of the U.S. and N.C. Departments of Agriculture have had some success in keeping most populations out of the state. Two counties, Currituck and Dare, remain the only two generally infested areas in the state. As part of the gypsy moth Slow the Spread program, North Carolina continued to monitor populations and treated isolated infestations ahead of the edge of the generally infested area. A total of 507 acres in Dare County and 175 acres in Granville County were sprayed with biological insecticides to help prevent suspected infestations of

gypsy moth populations from spreading during the spring, 2009. Based on 2009 trapping data, the following counties contain populations large enough to propose treatment in the spring of 2010: Onslow (561 acres), Wayne (330 acres), Currituck (1,711 acres), Caswell (17,010 acres) and Warren (519 acres). Of greatest concern is an isolated infestation on Bear Island off the coast of mainland Onslow County. Trapping and subsequent investigation revealed a reproducing population of gypsy moths on the island feeding primarily on live oak and willow. Control strategies are currently being formulated by the N.C. Department of Agriculture and Consumer Services Gypsy Moth Program.

Hemlock Woolly Adelgid

Infestations of the **hemlock woolly adelgid** continued to spread within infested counties and intensify in the Appalachian region in 2009. The adelgid has infested hemlocks throughout most of the native ranges of both eastern and Carolina hemlocks in the state. Mortality is very apparent in infested areas, and will continue to increase during the next few years. 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 public lands. Most chemical 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, scenic road and trails, and near certain streams. However, the adelgid continues to outpace control efforts.

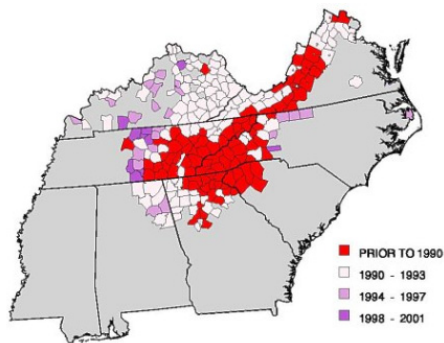
Larger Elm Leaf Beetle

The most serious elm defoliator in the United States is the **larger elm leaf beetle**. A large infestation of the larger elm leaf beetle was reported in Halifax County in August 2009. Defoliation of elm trees in the area exceeded

90 percent. Defoliated elms were primarily confined to approximately 15,500 acres in a 15 mile section along the Roanoke River. While defoliation was severe, no serious long term damage is expected. The area will be monitored in 2010 for continued activity.

Beech Bark Disease

The non-native **beech bark disease** causes significant mortality and defect in American beech trees. The disease results when bark, attacked and altered by the beech scale, is invaded and killed by two species of *Neonectria* fungi. Beech bark disease is still a major concern in western North Carolina, almost exclusively at higher elevations (above 4000 feet). Tree mortality is a continuing problem in and around the Great Smoky Mountains National Park. No significant change in disease severity was observed in 2008 compared to preceding years, however the disease was observed at several new sites in Clay, Cherokee, Graham, and Macon counties.



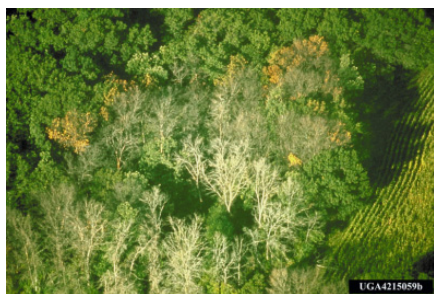
Spread of dogwood anthracnose by county

Dogwood Anthracnose

Killing native dogwoods, **dogwood anthracnose** is a disease that occurs in the forest environment at higher elevations and in cool moist areas in the western one-third of the state. A 20 year study of permanent plots shows that dogwood populations have decreased by 90 percent, with 64 percent of this decline being attributed to dogwood anthracnose. A small survey in 2009 did not find the disease to be located outside of the currently known range. Efforts will continue in 2010 to ensure dogwood anthracnose has not spread to additional counties.

Oak Decline

Not caused by a single insect or disease, **oak decline** is instead the product of the interaction between environmental conditions and forest pests. This decline complex can be problematic in both urban areas and forests. The incidence of oak decline in North Carolina remained high in 2009. No portion of the state is free of the disease complex. Oaks in both the red oak and white oak groups were affected. Prolonged drought conditions in 2005 through 2008 have led to an increase in oak decline incidence and severity. The long term effects of the drought and the resulting incidence and severity of oak decline (and its associated stress agents) will continue to be monitored in subsequent years.



Oak Wilt

An aggressive disease that affects many species of oaks, **oak wilt** is one of the most serious tree diseases in the eastern United States. It is known to kill oaks in forests, woodlots, and home landscapes. Historically, oak wilt levels have remained essentially unchanged in North Carolina since 1955, with activity confined to five counties (Buncombe, Haywood, Jackson, Madison, and Swain counties). No oak wilt has been confirmed in the state since 2002, including during aerial surveys conducted in 2008 and 2009.

Aerial surveys will be conducted again in 2010.

Non-Native Invasive Weeds

In addition to well known **kudzu** infestations, foresters, landowners and homeowners have been more and more frequently encountering and attempting to control a large variety of non-native invasive plant species. *Alianthus* (abundant in the mountains), *Microstegia* (abundant statewide and spreading mainly in poorly drained sites), and oriental bittersweet (abundant in the mountains) have become well established in the state. In addition, **Bradford pears**, previously thought to be sterile, are seeding into dense stands in old fields, powerline right of ways and along roadways mostly in the coastal plain and piedmont. Others commonly reported are: **garlic mustard, japanese knotweed, meadowsweet, Miscanthus, Paulownia, and Chinese and Japanese privets.**

Insects, Diseases and Weeds on the North Carolina Watch List

The following pests have not yet entered North Carolina, but are found in adjacent states or have the capability to move large distances, either naturally or artificially. These species have potential to invade North Carolina within the next few years and to do great damage to a variety of tree species and forest ecosystems in the state. The North Carolina Division of Forest Resources, along with other state and federal agencies are constantly monitoring for the movement of these pests into the state and will direct control efforts where feasible with resources available to the state.

Emerald Ash Borer

First discovered in Michigan near Detroit 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, **emerald ash borer** has killed tens of millions of ash trees in southeastern Michigan alone. Additional trees have been lost in Ohio, Illinois, Indiana, Pennsylvania, West Virginia, Maryland, Virginia, Missouri, Wisconsin, Minnesota, Kentucky, and Ontario and Quebec, Canada, as of July, 2009. Quarantines have been placed around areas of known infestations. All species of ash found in North Carolina can be attacked and killed by this insect. Though ash is a minor component of the forests in the state, green ash is a very popular street tree and shade tree planted in many urban landscapes. Currently, there



is no reliable control method to stop the local spread of this insect. Arrival of this pest in the state before the discovery of any effective controls can lead to the extirpation (local extinction) of ash within a reasonable distance of new infestations, thus changing forest species composition in those areas. One of the major vectors 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.

Laurel Wilt

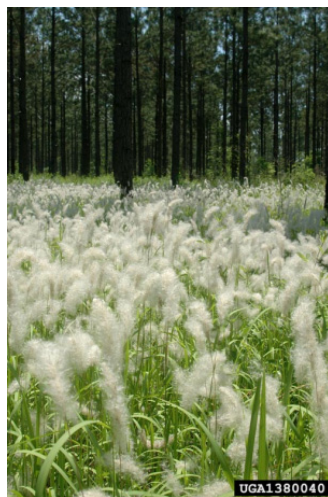
Redbay ambrosia beetles serve as insect vectors for a fungus causing **laurel wilt**, a destructive disease of redbay and other trees in the laurel family. In addition to redbay, laurel species include swampbay, Sassafras, spicebush and pondspice. Redbay and swampbay are prominent species in North Carolina's coastal plain. Pondspice and spicebush are less common, but also found in the coastal plain and sassafras is found throughout the state. Various species of wildlife may be impacted by the reduction or elimination of laurel wilt host species. Songbirds, bobwhite quail and turkeys often feed on the fruit, while deer and bears frequently feed on foliage and fruit of redbay and sassafras. Several rare species of swallowtail butterflies are heavily reliant on redbay, sassafras and spicebush for completion of their life cycle. The non-



native beetle was first detected in the United States near Savannah, Georgia, in 2002. The beetle is believed to have been introduced in wooden crating material imported through the shipment of goods from its native range in Southeast Asia. The non-native, highly virulent invasive wilt inducing fungus, which is introduced into host trees by the redbay ambrosia beetle, is believed to have arrived in the U.S. along with the beetle. Spreading south, west and north, laurel wilt has caused high levels of redbay mortality in coastal plain areas of South Carolina, Georgia, and Florida. In November, 2009, laurel wilt was observed in Horrie County, near Myrtle Beach, South Carolina. Mortality has been documented to spread on average about 20 miles per year. It has not been detected in North Carolina, but its arrival in North Carolina is imminent. At this time, there are no reliable controls for either the tree killing fungus or its insect vector. Movement of infected wood debris and firewood is discouraged to minimize spread of the insect and disease.

Sudden Oak Death

Tens of thousands of oak and tanoak trees in the coastal areas of California and a small area of Oregon have been killed by this recently discovered plant disease caused by a fungus-like microorganism. While the destruction from this disease is far away, the pathogen causing **ramorum leaf blight** and **sudden oak death** was first introduced into North Carolina in 2004 in plant nursery shipments from California, mostly on landscape camellia and rhododendron plants. Affected plants were quickly eradicated. Since then, the North Carolina Department of Agriculture, Plant Industry Division has inspected plant nurseries on a regular basis and put a high priority on detecting and eradicating any new introductions on nursery stock. In addition, the N.C. Division of Forest Resources conducts annual surveys of areas outside of suspected nurseries to detect the presence of any pathogen that may have escaped into the environment. This survey is conducted as a part of a cooperative national project coordinated and funded by the USDA Forest Service, Forest Health Protection Program. To date, surveys in North Carolina have not detected the presence of the pathogen outside of nurseries receiving infected plants. The host list for this disease is broad, continues to expand, and includes a good number of forest and landscape trees species found in North Carolina, including native oaks. While the disease can kill oaks, it does not usually kill susceptible non-oak hosts. Instead, depending on the plant, it may cause symptoms such as leaf spots, defoliation, twig and branch dieback, or blighting. However, fungal spores produced on these non-oak hosts can spread and subsequently infect and kill susceptible oaks. An abundance of potential host understory plants such as rhododendron and mountain laurel can act as sources of spores for infection of oaks. All areas of the state may be vulnerable to this disease, but suitable hosts and cool moist weather conditions make forests in the mountains and true foothills especially at risk.



Cogongrass

This weed has been ranked as one of the ten worst weeds of the world. The 2-4 foot tall perennial grass was introduced from Southeast Asia as packing material and as potential forage and erosion control vegetation. Currently found in Alabama, Florida, Georgia, Mississippi, South Carolina and Tennessee, **cogongrass** is working its way toward North Carolina, mainly from the south. 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, cogon grass is cold hardy, and tolerant of shade, high soil salinity and drought. It has even been found growing on sand dunes and up to the edge of ponds and lakes. 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 native 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.

PHOTO CREDITS: Hemlock woolly adelgid at Linville Gorge, Brian Heath, NC Division of Forest Resources; Southern pine beetle, www.bugwood.org, David T. Almquist, University of Florida; Gypsy moth, <http://www.aphis.usda.gov/ppq/maps/gypmoth.pdf>, APHIS; Hemlock woolly adelgid, www.bugwood.org, Chris Evans, River to River CWMA; Elm leaf beetle, www.bugwood.org, Clemson University; Oak decline, www.bugwood.org, Joseph O'Brien, USDA Forest Service; Oak wilt, www.bugwood.org, D.W. French, University of Minnesota; Beech bark disease, <http://www.na.fs.fed.us/spfo/pubs/fidls/beechnbark/fidl-beech.htm>, David R. Houston and James T. O'Brien, Forest Insect & Disease Leaflet 75, USDA Forest Service; Dogwood anthracnose map, www.fs.fed.us/r8/foresthealth/hosf/dogwood.htm; Emerald ash borer, www.bugwood.org, David Cappaert, Michigan State University; Laurel wilt, www.bugwood.org, Bud Mayfield, Florida Division of Forestry; Sudden oak death bleeding symptom, www.bugwood.org, Joseph O'Brien, USDA Forest Service; Cogon grass, www.bugwood.org, Chris Evans, River to River CWMA

Forest Health Assistance in North Carolina

North Carolina Division of Forest Resources

1616 Mail Service Center

Raleigh, NC 27699-1616

919-857-4858

rob.trickel@ncdenr.gov

www.dfr.state.nc.us/

www.dfr.state.nc.us/forest_health/forest_health.htm

USDA Forest Service

Southern Region, State & Private Forestry

Forest Health Protection

200 W.T. Weaver Road

Asheville, NC 28804

828-257-4320

www.fs.fed.us/r8/foresthealth/