Forest Health Review

January 2013

Green ash killed by the emerald ash borer near the Roanoke River in Halifax County, Virginia.

In this issue...

Greetings

A dramatic turn in the emerald ash borer saga in Virginia was unfolding during the writing of our last issue of Forest Health Review. Since this was the big forest health story of 2012, I continue to report in detail what transpired this year in the feature article. Another unfolding story during the writing of the last issue was an unprecedented fall cankerworm outbreak in eastern Virginia, further details of which are summarized in this issue. Other noteworthy items include the continued spread of thousand cankers disease of black walnut and the associated quarantine, as well as a significant outbreak of the periodical (17-year) cicada in the Blue Ridge and Shenandoah Valley, the latter occurrence described in a second article. Gypsy moth defoliation continued to be minimal this year while southern pine beetle activity continued to be modest with the exception of parts of Hanover County and Chincoteague and Assateague Islands on the Eastern Shore. The latter circumstance was interesting and unique in many respects and is the subject of a third feature article. As always, I hope you find this issue to be interesting and informative.

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The Emerald Ash Borer Marches On

The emerald ash borer (EAB) trapping survey was continued this year to cover a large swath of Virginia from the southwest to the east, approximately $^{2}/_{3}$ of the entire state. More than 5,000 traps were placed in a 2x2-mile grid across this area by federal contractors hired through USDA APHIS. While the federal survey excluded trapping in the northern Virginia counties where EAB was confirmed in past years, trapping was also continued in Prince William and Fairfax by those respective county governments. In contrast to last year when no new infested counties were detected from the trapping survey, by late June of this year, it was clear that this pattern was no longer holding.

This has been a "breakout" year for EAB in Virginia. Since 2008, EAB had been found only within the northern counties of Alexandria, Fairfax, Prince William and Frederick and municipalities therein. Random discovery of new infestations and the results of this summer's trapping effort, however, have produced finds in 13 additional

Photo by Nelson Shaw, VDOF forester.

Aerial view of dead ash near the Roanoke River, Halifax County, Virginia.

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The Emerald Ash Borer Marches On, continued

counties; these include Loudoun and Warren in the north, Caroline, Spotsylvania and Hanover in the northeast, Prince Edward, Pittsylvania, Halifax, Charlotte and Mecklenburg in the south Central, and Lee, Buchanan and Giles in southwestern portions of Virginia (Figure 1). While most of these new finds were due to recovery of adults from the purple prism traps, new infestations with extensive tree mortality were also discovered in forested sites. One was an area spanning approximately 7,000 acres in far northern Frederick County near Cacapon Mountain, bordering the West Virginia panhandle. This area was described in detail in our last issue. The other large area was along the Roanoke (Staunton) River, which represents the border of Halifax and Charlotte counties. Along a five-mile stretch of river were thousands of dead ash trees. It looks as though EAB had been present in this area at least five years based on the number of dead trees scattered along 10 to 15 miles of riverfront. This infested area extends from where Route 360 crosses the Staunton River, south to Staunton River State Park, west along the Dan River over to South Boston (Figure 1). Green ash is the predominant ash species along floodplains like this, where it can be very abundant. In upland habitats, one is more likely to find white ash as a very scattered tree that represents less than 5 percent of total volume. Statewide, all ash species combined represent approximately 1.8 percent of forested volume. It is likely that new infestations will materialize soon in other locations where traps have revealed EAB to be present, although there is always some lag time between trap catch and identification of infestations since EAB is exceedingly difficult to detect in the forest until trees begin to die and draw attention. Furthermore, infested areas where ash is much less abundant may not reveal themselves very easily if only a few scattered dead trees are present over an acre.

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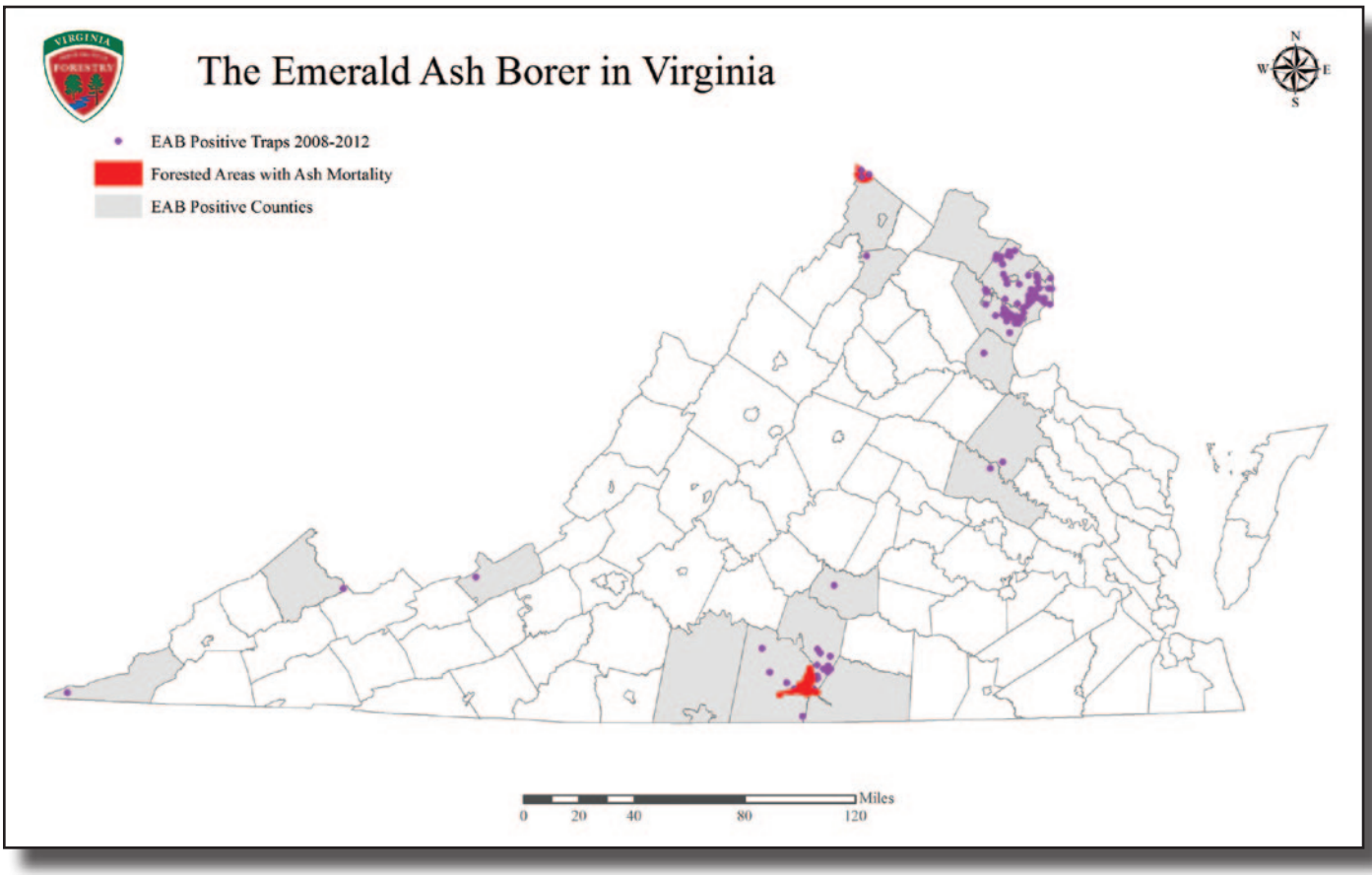

Map by T. Edgerton

Figure 1

The Emerald Ash Borer Marches On, continued

A full state quarantine, as well as a federal quarantine, is now in place. What this effectively means for movers of ash wood products is that there are no longer any restrictions for moving these items within Virginia's state line (meaning one does not have to have a compliance agreement with VDACS to move ash wood products). Given the degree to which emerald ash borer has spread across the Commonwealth, VDACS decided that county by county quarantines are no longer serving any purpose and will only become more difficult to enforce. A statewide quarantine, therefore, allows in-state commerce to proceed more smoothly without making the emerald ash borer situation any worse than it already is. The federal quarantine also eases transport of quarantine materials across state lines as long as adjacent states or parts of those states are also under the federal quarantine. For example, free movement of ash products without federal paperwork is permitted from Virginia to West Virginia, western Maryland and parts of Tennessee. North Carolina, eastern Maryland and most of Kentucky are not currently part of the federal quarantine, so no ash products or firewood may move into those states without proper paperwork and precautions taken. This, of course, is subject to change quickly given the dynamic nature of new emerald ash borer discoveries. Whether out-of-state locations are within the federal quarantine or not, distributors of ash wood products and firewood should always check with recipients and officials from other states to make sure they are following all precautions and complying with all the regulations of those states. At this point we cannot stop the emerald ash borer from spreading, but we can continue to slow it down if all partners in government, the private sector and the public make an attempt to do their part.

Dead green ash near the Roanoke River in Halifax County, Virginia.

Emerald ash borer galleries.

Periodical Cicada Outbreak

A periodical cicada adult.

As reported in the previous (July 2012) issue of the Forest Health Review, Brood I (The Blue Ridge Brood) of the periodical (17-year) cicada emerged in and along the Blue Ridge Mountains this May, from east and west of the Roanoke area, up along the Blue Ridge, Shenandoah Valley and Appalachians north to around Harrisonburg. Many locations within this region showed extensive "flagging" of vegetation due to oviposition damage by the cicadas. That is, the female uses her sharp ovipositor to cut into twigs and insert her eggs. If enough slits are made on a particular twig, girdling may occur which results in flagging. In some instances, this flagging was heavy enough on mid- to upper slopes that it could be seen from miles away, giving the foliage an off-color appearance as one would see with light defoliation. Oviposition and flagging can occur on almost any woody vegetation, including trees, shrubs and vines, but is most common on oak, hickory, ash, maple, hawthorn, apple, locust, birch and dogwood.

Periodical cicadas are divided into two "races," based on the time required to complete their life cycle: a 17-year northern race, and a 13-year southern race. Each race consists of three species, each with slight variations in song, size, color and oviposition preference. The most common cicada is *Magicicada septendecim*, which also happens to be the longest-lived insect in North America. Since adults live only for a few weeks, the vast majority of this life cycle is spent in the nymphal stage underground, where it feeds on sap from tree roots. This seemingly does no harm to the tree.

There are many different populations of cicadas, referred to as 'broods' and separated geographically (with some overlap) across much of the U.S. There are approximately 30 known broods, labeled using Roman Numerals, and the year they emerge can be predicted accurately. Brood size varies tremendously – some are so small that they are hardly noticed at all, while others are impressive events that span huge areas. Brood X is the largest of the 17-year cicadas, both numerically and geographically, and occurs over much of the northeastern U.S., including northern Virginia. Brood XIX is the largest of the 13-year cicadas and spans much of the southern U.S., including southeast Virginia. Therefore, while individual populations or broods of the periodical cicada emerge only every 13 or 17 years, these insects are emerging somewhere almost every year. A major emergence of Brood II across much of the Virginia Piedmont is expected next spring and will likely be bigger in area coverage than Brood I was this year.

In the eastern U.S., most people are more familiar with cicadas in the genus *Tibicen*, which includes up to a dozen different species and which are often referred to as dog-day or annual cicadas. However, the latter is a misnomer as it is generally thought that the life cycle of dog-day cicadas takes anywhere from two to five years. Because the broods overlap considerably, some adults appear every year during the summer and are a common part of the natural soundscape during July and August. Unlike the periodical cicadas, which are colored some combination of red, orange and black, dog-day cicadas usually have green and tan coloration.

Flagging from periodical cicada oviposition along the Blue Ridge Parkway in Rockbridge County, Virginia.

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Periodical Cicada Outbreak, continued

Flagging from periodical cicada oviposition along the Blue Ridge Parkway in Rockbridge County, Virginia.

Weather

There were 25 separate reports of wind damage in our IFRIS system, totaling 13,243 acres this past year from throughout the Commonwealth. On the night of June 29th-30th, a severe and long-lasting wind storm known to meteorologists as a "Derecho" caused severe damage and power outages across the state, although damage to forests was very scattered in nature. Ironically, some of the most extensive and widespread storm damage came from a different storm (tornado) that hit the area of Hanover County north of Richmond a few days earlier and caused far more damage than the Derecho did in that area. Other areas in eastern and southwestern Virginia saw impacts from isolated tornados during the spring.

After a mild and wet May and early June, the beginning of summer saw an intense heat wave, with many areas experiencing a week or more of 100+ temperatures. It was this hot, dry weather that preceded the Derecho of June 29th. The extreme heat extended into July but moderated by August, where temperatures were actually cooler than normal for most of the month and rarely reached 90 degrees. Precipitation for most of the year remained highly variable, but held up through the end of summer and early fall despite being below average in total for the year. A relatively dry October and potentially difficult fire season was "helped" by Hurricane Sandy, which battered coastal Virginia but caused relatively little forest damage and brought much-needed rainfall well inland. Cool weather prevailed through most of the fall, but November was exceedingly dry everywhere, extending fire season beyond the normal November 30th closing date.

The table presents the percent of average monthly precipitation and average degrees above (+) or below (-) monthly average temperature for each of nine geographic regions in Virginia (defined below). For monthly temperatures, a "0" indicates average.

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	SW	CW	NW	NP	CP	SP	NCP	SCP	ES
MAY Precip	50 to 150%	90 to 200%	90 to 150%	90 to 200%	70 to 150%	50 to 150%	70 to 130%	70 to 200%	100 to 200%
MAY Temp	0 to +4	+2 to +4	+2 to +4	+2 to +6	0 to +4	+2 to +4	0 to +4	0 to +4	+2 to +4
JUNE Precip	25 to 70%	50 to 70%	50 to 70%	25 to 70%	50 to 110%	25 to 90%	70 to 110%	50 to 110 %	25 to 110%
JUNE Temp	-2 to +1	-3 to -1	-2 to 0	-3 to 0	-3 to +1	-3 to +2	-1 to -2	-4 to -1	-3 to +1
JULY Precip	50 to 200%	70 to 150%	50 to 150%	50 to 130%	50 to 130%	25 to 110%	70 to 130%	50 to 150%	50 to 90%
JULY Temp	+2 to +4	+2 to +5	+2 to +4	+2 to +6	+2 to +6	+2 to +8	+2 to +6	+2 to +4	+2 to +6
AUG Precip	50 to 130%	90 to 150%	100 to 150%	70 to 150%	90 to 200%	50 to 200%	50 to 130%	90 to 300%	130 to 200%
AUG Temp	-2 to 0	-2 to 0	-1 to 0	-1 to +2	-1 to +1	-1 to +4	0 to +2	-1 to +1	0 to +2
SEPT Precip	110 to 200%	70 to 110%	90 to 150%	90 to 150%	50 to 70%	50 to 70%	50 to 90%	50 to 90%	70 to 110%
SEPT Temp	-2 to 0	-2 to +2	-2 to +1	0 to +2	0 to +1	0 to +2	0 to +2	0 to +2	+1 to +2
OCT Precip	70 to 90%	50 to 70%	50 to 110%	50 to 200%	50 to 150%	50 to 90%	70 to 400%	70 to 300%	300 to 400%
OCT Temp	0 to -2	0 to -2	-2 to +2	0 to +2	0 to +2	-2 to +2	-2 to 0	-2 to 0	0 to +4
NOV Precip	25 to 90%	10 to 25%	50 to 200%	50 to 200%	25 to 70%	10 to 25%	25 to 110%	25 to 70%	25 to 70%
NOV Temp	-6 to -2	-6 to -2	-6 to -4	-6 to -2	-6 to -2	-6 to 0	-6 to -2	-6 to -4	-6 to -3

SW = Southwest (Cumberland Gap to Abingdon to Blacksburg & Galax)
CW = Central West (Roanoke to Staunton)
NW = Northwest (Staunton to Winchester)
NP = Northern Piedmont (Loudoun/DC to Greene/Spotsylvania)
CP = Central Piedmont (Albemarle/Goochland to Bedford/Nottoway)
SP = Southern Piedmont (Campbell/Lunenburg to Henry/Mecklenburg)
NCP = North Coastal Plain (King George/Northumberland to Chesterfield/ Newport News)
SCP = South Coastal Plain (Dinwiddie/Brunswick to Virginia Beach)
ES = Eastern Shore

Hemlock Woolly Adelgid

The hemlock woolly adelgid continues to cause significant hemlock decline in many areas. However, trees in some areas that have supported infestations for many years are still hanging on, with many healthy trees remaining, especially in the small to mid-size classes. The adelgid continues to spread and has more-or-less permeated the entire range of hemlock within Virginia, minus a few pockets here and there. Hemlock mortality levels average about 20 percent in the southwest portion of the Commonwealth from Bath and Rockbridge counties southwest to Lee County. The release of predators of the adelgid is on-going in Virginia and other states and offers some long-term hope of reducing the impacts of the adelgid on the hemlock resource. We continue to monitor releases of predator beetles for biological control of the adelgid on a few of our State Forests and State Parks.

Thousand Cankers Disease

Thousand cankers disease (TCD) of black walnut, caused by a fungus (*Geosmithia morbida*) and spread by the walnut twig beetle (*Pityophthorus juglandis*), is believed to have originated throughout the southwestern U.S. (CA, AZ, NM, TX) and Mexico, throughout the ranges of four species of western walnuts. Presumably the walnut twig beetle (WTB) and the associated fungus made the jump to eastern black walnut as planting of this species became more widespread in western cities. The disease was first detected in Utah and Oregon in the 1990s, followed by New Mexico (2002), Colorado (2003), California (2008), Washington (2008), Arizona (2009) and Idaho (2009). In July 2010, fears that the beetle/fungus would find their way to the native range of eastern black walnut were realized when TCD was detected in Knoxville, TN.

Beginning in June 2011, positive identification of the fungus and the associated walnut twig beetle occurred for five counties and two municipalities: these include the counties of Henrico, Chesterfield, Hanover, Goochland and Powhatan, plus the cities of Richmond and Colonial Heights. In 2012, with the deployment of walnut twig beetle pheromone traps across the Commonwealth by VDACS, new TCD infestations were discovered in northern Prince William and Fairfax counties in northern Virginia. This now makes two major metropolitan areas in Virginia where WTB/TCD appear to be pretty widespread. In addition, positive confirmations of the twig beetle and/or fungus have recently occurred in New

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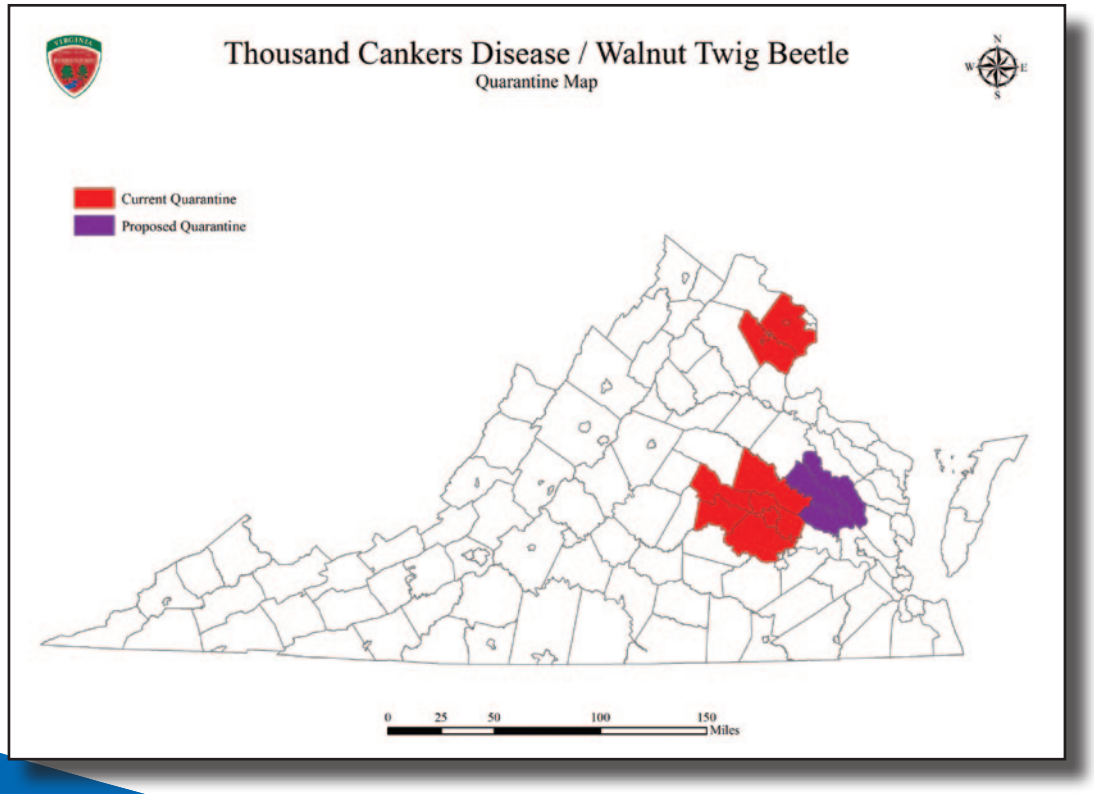
Thousand Cankers Disease, continued

Kent and King William counties. Therefore, it is likely that an expansion of the quarantine to those two counties plus nearby King and Queen County will occur soon (Figure 2).

According to the quarantine, regulated articles include any life stage of the walnut twig beetle or the *Geosmithia morbida* pathogen, as well as "all plants and plant parts of the genus Juglans including but not limited to nursery stock, budwood, scionwood, green lumber, firewood, and other material living, dead, cut or fallen including stumps, roots, branches, mulch, and composted and uncomposted chips." Specific exemptions include, but are not limited to "nuts, nut meats, hulls, processed lumber (100 percent bark-free, kiln-dried, with squared edges), and finished wood products without bark, including walnut furniture, instruments, and other items derived from the genus Juglans." VDACS can issue certificates or limited permits that allow for movement of regulated articles if certain conditions are met.

Gypsy Moth

For the third year in a row, we have reported 0 defoliated acres due to gypsy moth from aerial survey efforts, although 4 acres worth of light to moderate defoliation were reported from ground observations. The wet spring of 2009 and the resultant impact of *Entomophaga maimaiga* decimated gypsy moth populations across the Commonwealth. With successive wet springs each year since 2009, populations have not shown a significant resurgence to levels where defoliation can occur on a wide scale. This trend should hold until we see successive dry spring weather, especially during May, which will allow populations to gradually build up to damaging levels again.



Map by T. Edgerton

Figure 2

Fall Cankerworm

A cankerworm.

Cankerworm defoliation of chestnut oaks in Powhatan County, Virginia.

The second year of an extensive cankerworm outbreak spanned a very large area covering much of eastern Virginia. There was actually a mix of fall cankerworm, spring cankerworm, and a complex of other native defoliators in lesser amounts. The worst-hit areas included Chesterfield, Powhatan, Hanover and King William counties in mostly rural and suburban areas to the west and north of the Richmond city limits. In total, more than 15 counties and a total area in excess of 2.5 million acres were variably impacted, although a majority of this was light and patchy in nature. Approximately 246,000 acres were classified as having heavy but patchy defoliation, while an additional 14,000 acres were severely and continuously defoliated (Figure 3). Most of the severely defoliated trees were chestnut oaks, while scarlet oak, red maple and beech also saw some moderate to heavy defoliation. Most trees refoliated and are expected to live through the event, but some mortality of oaks was reported. While fall cankerworm is a recurring native defoliator in Virginia, the extent of this outbreak is unprecedented as far as records go.

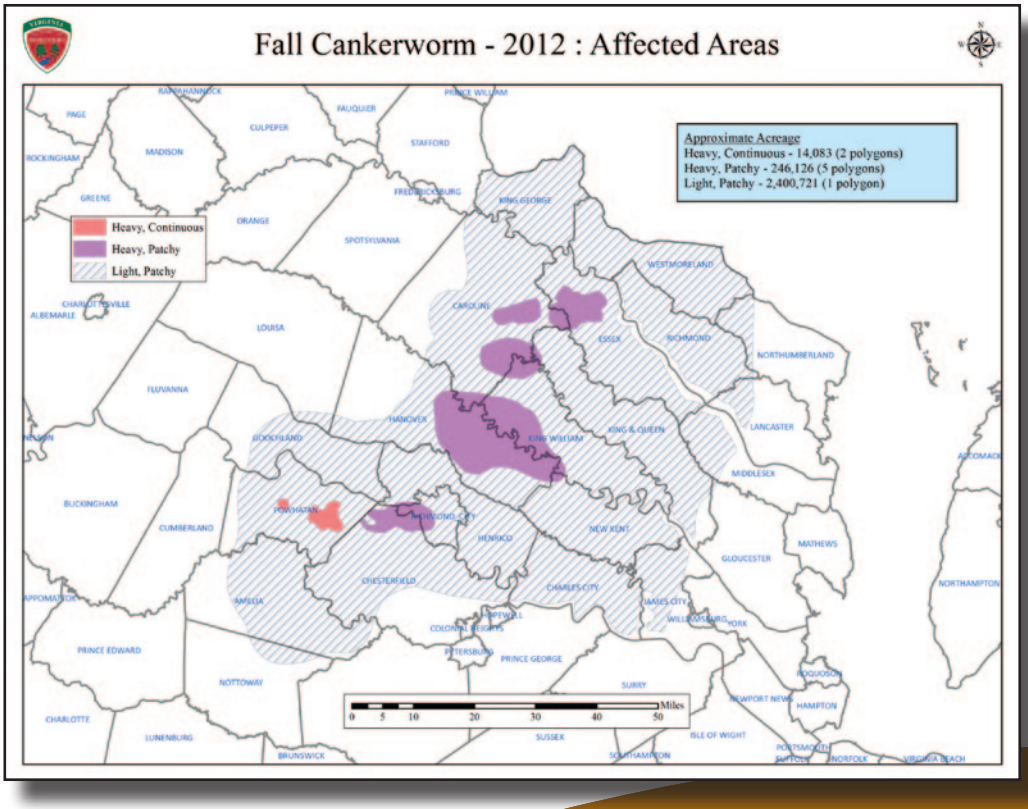


Figure 3

Map by T. Edgerton

Southern Pine Beetle

As forecast by our spring trapping season, southern pine beetle activity continues to be generally low across the Commonwealth, although localized activity has been picking up in a few areas. In total, 28 spots amounting to 323 acres of dead pine across 6 counties were detected. A large majority of this acreage came from one area in western Hanover County where, last year, a spot within an unthinned pine stand that was converted into subdivisions and had gone undetected for years was allowed to grow and was never reported or dealt with. About 400 acres of this area were finally clear-cut and managed, but due to the complex ownerships and insufficient cutting and removals, SPB has since spread to other adjacent properties. No spots were reported on federal land and no counties were in outbreak status. Affected counties were concentrated in the far eastern Piedmont and western Coastal Plain, as well as parts of the Eastern Shore.

We have exceeded 40,000 acres treated under the Southern Pine Beetle Prevention Program in Virginia. A majority of this acreage is from cost-sharing with landowners for pre-commercial thinning, but also includes longleaf pine restoration and first commercial thinning via our Logger Incentive Program. Unfortunately, the Logger Incentive Program has run out of funding for now, but we hope to resume it again if significant federal support is forthcoming in 2013.

Longleaf Pine Restoration

It's been a while since I've updated you on our efforts at longleaf pine restoration under the Southern Pine Beetle Prevention and Restoration Program. This is due in large part to the fact that many of these details are covered in the Forest Research Review, written by Jerre Creighton, the forest research manager for VDOF. However, it is a topic of great interest to many, so I felt like saying a few words here. Interest in longleaf pine restoration across the Southeast has really taken off in the last five years among many state and federal agencies. In particular, the US Forest Service, Natural Resources Conservation Service (NRCS), the Farm Service Agency (FSA) and US Fish and Wildlife Service are increasingly funding efforts to restore longleaf pine to areas where it was once much more common. Virginia's situation is unique because, unlike the other southeastern states where longleaf pine is native, Virginia's longleaf population is on the northern end of the range and nearly went extinct. It is now being brought back from the brink by focusing on seed collection from a couple hundred native, northern sources in southeast Virginia and northeastern North Carolina. Collective efforts by the federal agencies cited above along with VDOF, the Virginia Department of Conservation and Recreation, The Nature Conservancy, and other partners have established approximately 3,000 acres of longleaf pine on federal, state, and private lands across the southeastern portion of the Commonwealth. While this may seem a modest amount when compared to our neighbors to the South, it represents a huge increase from what existed before, which was virtually nothing. It is also only the beginning. Once our nascent longleaf seed orchards reach cone-bearing age, much more should be possible. There is also increasing evidence that our "northern-source" longleaf pine is genetically distinct and better adapted to this climate than more southerly sources, and was, therefore, worth preserving. This is a success story in the making – one we hope to share with others in the future as we work on a joint publication highlighting these collective efforts. Look for it soon!

Jerre Creighton, VDOF forest research manager, working in a longleaf pine provenance test site and future seed orchard at Garland Gray Forestry Center.

Fusiform Rust

A number of foresters have noted unusual levels of fusiform rust in plantations in far southeastern Virginia, specifically Southampton and Isle of Wight counties. Casual observations have suggested fusiform rust is becoming more common than it once was in the Commonwealth. As reported in past issues of the Forest Health Review (September 2005, November 2006, May 2008), Virginia has not had many problems with fusiform rust in the past. Therefore, our Garland Gray nursery historically had never treated seedlings for it or used rust-resistant varieties. However, a major rust infection in our nursery during 2004-2005 led to the out-planting of many infected seedlings (reported in September 2005 issue). While this resulted in understocking and replanting of only a handful of plantations, it has not been too uncommon to find young loblolly pine plantations with rust infestations that can be traced back to our seedlings from that year. On the other hand, Garland Gray now routinely treats all pine seedlings in the nursery to protect them from fusiform rust, and some of the more recent observations of rust occurred in younger plantations that could not be traced back to our seedlings from 2004.

It's worth pointing out that even the most rust-infected plantations we've seen have significantly less than 25 percent of stems infected by age 5. Typically, if a stem canker has not manifested by age 5, the bole of the tree remains canker free for the rest of the rotation. Therefore, if less than 25 percent of the trees in a young plantation have stem cankers, these trees can be culled out during a pre-commercial- or first-thinning and the remaining stand should be viable through rotation. Of course, if higher levels of rust cankers are present, the risk of losing a significant part of the stand to stem breakage is greater.

So far, the information we have on rust incidence in southeast Virginia is anecdotal. To make a determination of whether rust incidence is increasing in this region, more quantifiable data on percent occurrence of rust infections from many plantations across a broad area is required. This data is often hard to come by from busy field foresters, but would be valuable if an emerging problem is at hand. I would encourage folks who are concerned about this to report what they see by doing a quick 10-factor-prism- or mil-acre-survey across each plantation to try to quantify the percent volume of each stand that is infected with stem cankers. Fusiform rust was once less abundant in North Carolina as well, but the problem gradually advanced northward over the last several decades. It's difficult to know whether this was due to expanding seedling production and planting or a response to climate change, or both. Perhaps warming trends are creating a better environment for fusiform rust to thrive in Virginia than in the past, but at this point, this is all speculation.

Fusiform rust cankers in a loblolly pine plantation in Southampton County, Virginia.

Pine Management on Chincoteague And Assateague Islands on Virginia's Eastern Shore

The barrier islands of Chincoteague and Assateague lie between the northeast corner of Virginia's Eastern Shore (part of the Delmarva Peninsula) and the Atlantic Ocean. Chincoteague, which is approximately six miles long and one half to one mile wide, is just south of the Maryland state line and dominated by the Town of Chincoteague, numerous private campgrounds, mixed pine-hardwood forest, and a ring of tidal marsh habitat. Assateague Island to the east is a true barrier island barely a quarter mile wide in places with marsh habitat and mixed pine-hardwood forest on the interior (west-facing) side and sandy beaches on the eastern side facing the Atlantic. Between the two islands is the Chincoteague National Wildlife Refuge, while Assateague Island is the southern end of a National Seashore, which reaches north into Maryland by some 25 miles and is part of a barrier island chain that extends into Delaware. These islands are particularly well known for the population of wild ponies that inhabit the forest and marshlands and are a major tourist attraction.

This fall, I was asked by Robbie Lewis, the senior area forester for the Maritime Work Area, to address the Accomac Town Council and Mayor of Chincoteague regarding a developing problem with dying pines on the islands. Pines, mostly loblolly, are a very important commodity on both islands. On Assateague, pines are widespread and also abundant in pure, natural stands since they do well on poor, sandy soils and are somewhat resistant to salt spray. On Chincoteague, many natural pine stands exist, but pine also occurs as a plantation and landscape tree throughout the island. Most of the numerous campgrounds on the island consist of widely spaced, mature pine trees with very little growing underneath due to the spacing needs for campers, tents, mobile homes, sheds and other structures. What concerns the citizens most recently is activity by the southern pine beetle, which reportedly had already killed many trees on the island and was continuing to spread. Of course, it is always important to confirm that southern pine beetle is the culprit rather than less aggressive species, such as Ips and the black turpentine beetle. It is also important to consider what other factors may be going on in the environment that may be contributing to bark beetle problems.

Examining a bark beetle infested pine tree in Chincoteague, VA.

Pitch tubes on a pine infested with southern pine beetle.

On a visit to the island – November 19, 2012, I was able to confirm that southern pine beetle was indeed active across the island. There was plenty of material on the ground

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Pine Management on Chincoteague and Assateague, continued

in places from past infestations and past clearcuts to see the characteristic S-shaped gallery patterns under the bark and on the surface of the sapwood. In some cases, there were several acres of dead trees within a mature plantation, while in others cases they were scattered ornamentals that were dying or killed. I was also able to find Ips activity here and there, which is not surprising since they often co-occur with southern pine beetle. The campgrounds I described above were highly disturbed habitats, and it was not surprising that many trees had mechanical injuries near the base where some vehicle or machinery had banged into them at one time. Soil compaction near the root zone of many trees was also an issue.

Areas closer to the ocean had clear signs of saltwater intrusion, which is probably more of an essential problem than bark beetles as all trees have their salt tolerance limits and will eventually succumb to this stress factor even without the beetles. It should be noted that Hurricane Sandy hit these islands hard just a few weeks earlier, with extensive flooding on both islands. While the problems with dying pines were occurring long before Sandy, the occurrence of more frequent storms with greater storm surge due to rising tides will only exacerbate the problem of salt contamination. A recent report by the Virginia Institute of Marine Sciences states that monitoring stations around the Chesapeake Bay over the last 50 years have measured an average rate of sea level rise of 4mm. If this trend continues, the rate equates to approximately one foot of sea level rise by 2050 compared to sea levels during the mid-20th century. Such a rise could have profound effects during severe storms, adding significantly to storm surge during high tide. Normally, saltwater intrusion increases soil salt concentrations temporarily, but salt is gradually leached out by rainfall over time. However, if heavy storm surge becomes a more frequent occurrence and is followed by an extended drought, some soils may not have time to recover before salts reach toxic levels. There is also the issue of salt spray, which can be carried many miles inland during strong storms and hurricanes. Most of the loblolly pines on the island show signs of salt spray in that they tend to have a shrubby, tufted appearance in the crown

A basal injury to a pine tree in a campground.

Pines cut and left on the ground after being killed by the southern pine beetle.

A storm-damaged and beetle-killed pine stand in Chincoteague, Virginia.

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Pine Management on Chincoteague and Assateague, continued

due to shorter growth spurts and shorter needle length. All the same, many were able to thrive and live to be 50 to 100 years old, so clearly they are resilient to a certain amount of salt spray and are well adapted genetically to this harsh environment. That being said, all trees have their limits, and an increased frequency of severe storm activity, salt spray and saltwater intrusion could tip trees over the edge.

All told, this is a very complicated and challenging situation for the management of the pine resource on Chincoteague and Assateague islands, which collectively are facing a variety of stress factors: urban environments; human and vehicle traffic and associated mechanical injuries and soil compaction; exposure to high winds and salt (soil and airborne); the southern pine beetle and other bark beetles, and, in many cases, old age. Pines certainly do not live forever, and many of these trees would be approaching the end of their natural lifespan even under the best of circumstances. The southern pine beetle is aggressive enough that it may speed up the inevitable demise of many trees on the island. Outbreaks will likely continue to come and go until the islands' mature pines disappear – a process which could happen fairly quickly or take decades. Hopefully, the pines on the islands will be reduced slowly but not eliminated "overnight" so that the citizens have time to react and replant with other species that are more resilient to the difficult growing conditions. This may even be a great place to establish longleaf pine, which is more resistant to salt, wind, southern pine beetle and numerous other insect and disease pests. It certainly couldn't hurt to experiment with it in some places and see how it does. One could also consult a list of salt-tolerant hardwood trees and shrubs, such as this one available from the Virginia Cooperative Extension Service: http://pubs.ext.vt.edu/430/430-031/430-031.html. Note that some species are tolerant to salt spray but not soil contamination; some vice versa, and some both!

Young pines and other shrubby vegetation near the beach on Assateague Island that likely succumbed to salt water intrusion.

Typically when I discuss southern pine beetle, the setting is in an industrial pine plantation, where southern pine beetle management using thinning for prevention or cut-and-remove / cut-and-leave with a buffer strip for spot disruption is standard practice. The situation on Chincoteague and Assateague islands is an interesting and far more complicated circumstance involving a chaotic mix of underlying problems (old age and poor site conditions) with frequent abiotic disturbances (high winds, salt, mechanical injuries, urban tree issues) and bark beetles. Some landowners with the means to do so may be able hire a company to treat trees with insecticides, either by spraying the outer bark with a hydraulic sprayer or utilizing some of the newer insecticide injection technologies available. These options are expensive but may be cheaper than taking a large tree down, which could cost more than $1,000 on average. In the end though, these options may protect individual trees from bark beetles, but not from the ravages of time. The essential thing is to plan for what will replace the pines when they are ultimately gone. I wish the citizens of Chincoteague all the luck in dealing with these challenging circumstances in the future.

What's That Stuff On My Beech?

During late summer extending into fall, one can often observe beech trees covered with a white woolly substance on twigs, branches and leaves. If you were to get very close or wave your hand back and forth over this woolly substance, you would observe a flickering movement in response to your own motion. You might also notice a blackish film on the surface of the leaves, twigs, branches, trunk and ground below the location of this white woolly mass. What's going on here? You are looking at a colony of beech blight aphids or beech woolly aphids. The scientific name for this insect is *Grylloprociphilus imbricator* – yikes, say that 10 times fast.

Beech blight aphids secrete a filamentous, white waxy material that covers their bodies. Used for protection from predators and the elements, a waxy coating is a strategy used by many other sapsucking insects like adelgids and scales. For aphids, these little guys have a lot of charisma and often will react to your movement by shaking their filaments back and forth at you like they are doing the "boogie-woogie." When a whole colony does this in unison, it creates the appearance of something larger – like a stadium full of people doing "the wave" - which is probably also an evolved response to scare off would-be predators.

Despite the ominous sounding word "blight" in their name, these aphids are generally harmless to beech trees, even though they often form huge colonies on a branch. Often, where there is one colony of aphids, there are many more. In woods with a heavy beech component, it is not unusual to find an aphid colony on just about every beech tree encountered. These insects originated from Europe where, surprisingly, they seem to be more of a problem on European beech than they are here on our American beech.

On the other hand, they can be a nuisance because of the copious amount of "honeydew" they produce. Most sapsucking insects like aphids and scales secrete honeydew, which is basically sugar water but also contains a complex mixture of amino acids, proteins, other organic substances and minerals. These insects need to ingest large amounts (relative to their size) of plant sap to obtain enough nitrogen to meet their nutritional needs. Because nitrogen is much less abundant than sugar in plant sap, these insects end up ingesting far more sugar than they need before they meet their nitrogen requirement. This excess sugar is therefore secreted as honeydew. If you were to stand under a large colony of these aphids, you would probably feel small droplets of honeydew land on you as if it were raining very lightly ('misting' would probably be a more appropriate word, these droplets are quite small).

All of this available sugar is highly attractive to ants, bees and wasps, which can often be found congregating around infested trees. Ants will often "farm" aphids to collect sugar for their own colonies. In fact, in nature this relationship between a species of ant and aphid (or scale) often results in an intricate mutualism in which the ant benefits from the aphids' honeydew, while the aphids benefit from the ants

Beech aphid fungus after turning black during the fall.

aggressively protecting them from any would-be predators. In scientific terminology, we say such relationships are "facultative" when the species in question are not dependent on one another for ultimate survival, but rather take advantage of each other when the opportunity is there. Some mutualisms in nature are more rarely "obligate," meaning that each species is completely dependent on the other species for survival. The beech blight aphid relationship with ants is a facultative one.

The down side of honeydew is that it becomes moldy. A black sooty mold will grow on all surfaces covered with honeydew, including the ground. While this sooty mold is generally harmless to the tree, it is sticky and rather unpleasant if you get it on yourself. Parking your car under an infested beech tree for long periods of time is not a good idea. The sooty mold associated with the beech blight aphid is often a specific species called *Scorias spongiosa*, which is found only on American beech. On top of the black surface of the mold, it will often form into a yellowish, spongy mass or fruiting structure that is typically about the size of a fist, but can grow as big as a football! You will often see this structure in abundance where there are many beech blight aphid colonies. During the late fall and winter, this fruiting structure turns black and is quite noticeable after leaf fall. The next time you're in the woods in late summer or fall and there is a lot of beech around, keep your eyes open for this interesting insect-fungus association.

Photo by Tim Tigner

Beech twig infested with beech aphids (white, above) and fungus growing on honeydew secretions beneath (tan, below).

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