

FOREST HEALTH REVIEW

January 2020



Invasive plant removal at Lesesne State Forest



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GREETINGS

Forest health is an essential part of our livelihood and provides benefits to the economy, human health and wildlife of Virginia. The Virginia Department of Forestry (VDOF) monitors the Commonwealth for major forest health disturbances including insect pests, pathogens, non-native invasive plants and severe weather events. The forest health program at the VDOF aims to protect and improve the forest resource in Virginia, and makes recommendations, advice and decisions based on unbiased scientific data. Forest health staff was busy in 2019 monitoring a range of forest insect and disease pests. We investigated a novel approach to invasive plant control (page 4), documented increasing oak decline throughout the Commonwealth (page 11), incorporated new technology into our survey work (page 12), and continued to monitor the state for emerging and established invasive pests. VDOF forest health liaisons support the forest health program and are a great resource for regional forest health inquiries. Our current liaisons are highlighted throughout this publication. We hope this edition of the Forest Health Review is enjoyable and informative.

Please contact us with any questions and have a good 2020!



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FOREST HEALTH 2019 IN NUMBERS

- 1,341,490 acres of aerial survey
 - 13,350 acres with yellow poplar weevil defoliation
 - 7,800 spotted lanternfly temporary tattoos distributed
 - 4,512 parasitoid wasps released for emerald ash borer control
 - 2,788 acres thinned with southern pine beetle (SPB) prevention funds
 - 545 ash trees treated via VDOF ash treatment cost-share
 - 510 predator beetles released as biological control of hemock woolly adelgid129 forest health ground observations reported by VDOF personnel
 - **125 ash trees** treated on state land by VDOF personnel **90 goats** allowed to graze at Lesesne State Forest
 - **78 eastern hemlocks** treated with chemical trunk injections
 - 59 acres of longleaf restoration funded with SPB prevention funds
 - 49 attendees at the invasive plant workshop at Matthews State Forest
 - 25 southern pine beetle traps deployed
 - 24 forest health presentations given
 - 18 emerald ash borer traps monitored
 - 6 sites monitored for laurel wilt disease
 - 2 forest health drone pilots licensed

YELLOW-POPLAR WEEVIL

The yellow-poplar weevil was active in southwest Virginia mid-June through early July of 2019. Damage was reported by foresters and landowners in the region; some damage was so severe that it was noticeable from Interstate 81. This year, reports of this pest came from Roanoke, Bedford, Buchanan and Russell counties. VDOF forest health staff conducted an aerial survey on July 2nd and documented additional damage in Botetourt, Montgomery and Floyd counties. A total of 13,350 acres with defoliation (4,515 acres *of* defoliation) were mapped. Damage was patchy throughout the affected area where yellow-poplar exists throughout the forest.

Though their name implies they feed only on yellow-poplar, the yellow-poplar weevil will also feed on magnolia and sassafras. This weevil has a long proboscis, or nose-like appendage, that it uses to feed; it makes tiny notches shaped like a grain of rice in the leaf causing brown splotches on the leaf surface. This pest has a one-year life cycle in Virginia with adult weevils emerging in early June and feeding continuously until mid-summer when they go into a diapause period through the winter. The weevils emerge the following spring to mate and lay eggs on the underside of leaves. Newly-hatched larvae will then feed as leaf miners for three to four weeks until they pupate in mined feeding areas.

Since the yellow-poplar weevil is a native defoliator in the eastern United States, control is usually not warranted. Natural predators of the weevil normally regulate the population and keep it below damaging levels. Outbreaks tend to occur every Meet Forest Health Liaison MEGHAN MULROY – COMMUNITY FORESTER Blackwater Work Area

Favorite Forest Health Pest (or I guess least favorite): Hemlock woolly adelgid

Fun Fact: I have a special talent for finding four-leaf clovers.



Defoliation from the yellow-poplar weevil is visible during an aerial survey.

few years when weevil populations surpass natural predator populations. During outbreak years, leaf damage may be unsightly and alarming, but is mostly just cosmetic and does not cause long-term harm to trees. There have been six VDOF documented outbreaks in the last 25 years, all primarily in southwest Virginia. The outbreak in 2015 was a particularly large one with 38 reports totaling thousands of acres impacted. Fortunately, trees are simply weakened by feeding and mortality doesn't typically occur unless there are multiple years of defoliation.



RELEASE THE GOATS

Invasive plants are a common forest health disturbance throughout Virginia, and the VDOF Forest Health Program is frequently asked about invasive plant species control. In particular, deploying goats as a control method is a common inquiry that VDOF has never been able to attest to as the agency hasn't fully explored it as an option before this year. Goats are well-suited to grazing plants not typically eaten by other animals because they have the ability to consume woody plants and weeds. Some would also claim that it is the most entertaining form of weed control!

The idea of a case study involving goat grazing started in the fall of 2018 and was made possible with USDA Forest Service Nonnative Invasive Plant funds. The VDOF Forest Health Program identified Lesesne State Forest in Nelson County as the perfect location for this project due to the amount of problematic invasive plants in the forest. A four-acre section of woods was selected to be the study area that would receive a "treatment" of goats. The area was then divided into the following three subplots based on subsequent treatments: plot one received another round of goat grazing, plot two was a control with no second treatment, and plot three received chemical control.

A company based in Afton, VA, has a herd of Kiko goats that they utilize on a variety of landscapes to remove invasive species. This breed of goats is prized for its low maintenance needs, ability to eat many crummy plant species, and ruggedness. More than 90 goats arrived May 14th and grazed for a total of 13 days. Two Anatolian shepherd dogs accompanied the goats for protection.



Goats on the first day of their arrival.

The goats arrived again on August 6th to repeat grazing within plot one. In total, 60 goats were present for 6 days of this second treatment.

Plot two was our control plot to demonstrate what happens when no follow-up treatment occurs after initial grazing. The plot was much improved after initial grazing but with no treatment afterwards, the invasive plants are expected to return. On August 20th, a contractor treated plot three with herbicides. There was a significant amount of invasive species left within the plot that were either too high for the goats to reach or had leafed out again after the goats were removed. Tree-of-heaven was prevalent in this plot. All invasive plants in plot three were treated with herbicide applied with cut stump, foliar and hackand-squirt methods.

The results were variable within the three plots but the overall trend fit our expectations. Grazing followed by chemical application was the most effective treatment for controlling invasive plants in this case study. Two rounds of grazing had an impact on certain species, but much of the vegetation returned. Finally, when only one round of grazing was implemented, the invasive plants were initially removed but quickly regenerated. The disturbance of grazing even allowed new invasive plant species to appear on the landscape. The upside is that grazing also allowed for the regeneration of a number of native hardwood species including ash, sassafras, redbud, dogwood and hickory. Perhaps native seeds were finally able to break through the soil and receive more sunlight in the post-grazed landscape, enabling them to grow where previously outcompeted by invasive plants. The company that conducted the chemical treatments noted that the grazed landscape allowed for a much quicker and more targeted approach to applying herbicides. They were better able



Goats after they had grazed everything down!

GOATS. CONTINUED

to see and access target plants and could spray them directly without forging through dense brush or accidentally spraying desirable species.

To summarize, there is no easy way to control invasive plant species. Any treatment that is applied will require significant follow-up to keep the invasives at bay. Goats are an amazing resource to start fresh in areas where it would be extremely difficult or costly to remove all the invasive species that are

present. In areas that are inundated by invasive plants, goat grazing increases accessibility and makes follow-up treatment easier. The ability to start with a "clean slate" is not only more aesthetically pleasing, but also allows for a more targeted treatment approach since less herbicide is needed. Overall, these ruminants have proven to be very helpful in cleaning up woods, and that's not getting your goat!



Dead Ailanthus trees in the plot sprayed with herbicide.



Meet Forest Health Liaison BILL PERRY – FORESTER James River Work Area

Favorite Forest Health Pest: The first forest health pest I faced was gypsy moth in the late 1990s outbreak when I was a young forest technician with the National Park Service. I was amazed to learn that the larvae would feed on eastern white pine and even more amazed to watch one caterpillar eat pine needle after pine needle. The amount of caterpillar droppings that were showering the forest floor sounded like a steady rain. There were so many caterpillars crossing the Blue Ridge Parkway that the sides of our trucks were covered in green slime.

Fun Fact: I am a "collector" of vintage Volkswagen vans. My family and I camp and travel in a 1972 camper van that I had restored in 2003. I am currently working on restoring a 1985 Vanagon Westfalia camper.

Meet Forest Health Liaison **JESSE BANDER – TECHNICIAN** Capital Work Area



Favorite Forest Health Pest: I'd have to say my "favorite" pests are ambrosia beetles. They bore into trees so they can cultivate their fungal gardens, which they then eat. So really they are farmers and get my vote for most diligent workers in the forest.

Fun Fact: My love of trees is probably a result of my time spent in the tree-less deserts of Iraq and Afghanistan.

SPOTTED LANTERNFLY

The spotted lanternfly is a beautiful insect that should give you nightmares. The coloration of the nymphs and adults is quite attractive, and the clumsy way in which the insects move is rather charming, but the ecological and economical damage that this invasive insect could cause in Virginia is horrifying.

The spotted lanternfly is a phloem feeder that inserts its piercing sucking mouthparts into plant tissue and feeds on plant sap. It is known to feed on more than 65 host plants worldwide. They prefer tree-of-heaven (Ailanthus altissima), as well as grape vines, fruit trees, red maple and black walnut. In heavy populations, feeding can cause yellowing and browning of foliage, branch dieback, and can weaken plants making them more susceptible to other insect pests and diseases. On fruit crops, feeding reduces yield and increases the cost of production as frequent insecticide applications are needed. The spotted lanternfly is also a huge nuisance to homeowners. As the insect feeds, it ingests a lot of carbohydrate-rich liquid, which it does not completely digest and then excretes this excess sugary substance called honeydew. As honeydew accumulates on nearby plants, outdoor furniture, decks and vehicles, black sooty mold and other yeast-like organisms then develop on the honeydew and give off an unpleasant vinegar smell. This can certainly affect your quality of life if sooty mold is covering everything in your yard!

The spotted lanternfly is native to Asia and was first discovered in North America in Pennsylvania in 2014. It was found in Virginia in January 2018 and has also been confirmed in New Jersey, Delaware, Maryland and West Virginia. The spotted lanternfly infestation in Virginia was initially limited to Frederick County and the City of Winchester, but recently, adults and egg masses have been confirmed in Clarke County. In an effort to slow the spread of the spotted lanternfly, the Virginia Department of Agriculture and Consumer Services (VDACS) established a quarantine for

Frederick County and the City of Winchester. The quarantine requires businesses to obtain a permit from VDACS and inspect articles that are considered a risk for movement of the lanternfly. Regulated articles include plants,



Many adult spotted lanternfly feeding.

lumber, firewood, industrial or construction materials and equipment, stone, shipping containers (e.g., wood crates or boxes), outdoor household articles (e.g., grills, mowers and outdoor furniture), recreational vehicles, and any means of conveyance.

WHAT CAN YOU DO?

- Scout for spotted lanternfly and report findings to VDACS (Spottedlanternfly@vdacs.virginia.gov), your local Virginia Cooperative Extension office, or the VDOF forest health staff.
- Always inspect vehicles and outdoor equipment before leaving an infested area.
- Do not park or store items near infested trees.
- Don't move firewood buy local, burn local!
- Kill any spotted lanternfly you find.
- If you find spotted lanternfly on your property:
 - Scrape egg masses into a container of ethanol or hand sanitizer
 - Remove and stump-treat tree-of-heaven, the preferred host
 - Have a professional apply insecticides when appropriate

LEARN TO IDENTIFY THE SPOTTED LANTERNFLY!

Spotted lanternfly eggs hatch in the spring (April/May). The immature stage is called a nymph and goes through four instars

(developmental stages between molts); they are black with white dots for the first three instars and then turn



Honeydew and sooty mold on tree-of-heaven.

SPOTTED LANTERNFLY, CONTINUED

red by the fourth instar. Adults emerge in July and have tan/ grey forewings with black spots and hindwings that are banded black, white, and deep red. In September, females start laying eggs in rows, covering them with a waxy secretion that closely resembles mud splotches. At first the egg mass is shiny and white, but it darkens and turns powdery grey as it dries. Females lay eggs on any and all smooth surfaces – tree trunks, branches, rocks, stones, lawn furniture and vehicles – this life stage is easily transported to new locations via human-mediated movement. Egg masses overwinter, so be on the look-out before moving outdoor items this winter!



Spotted lanternfly nymphs (left), adult (middle), and egg mass (right).

PINE BARK BEETLES

A system for predicting southern pine beetle (SPB) infestation trends using pheromone traps has been implemented across the South since 1986. This spring, we placed 25 traps throughout the state in 12 counties (Sussex, Chesterfield, Cumberland, Gloucester, Halifax, Newport News, Appomattox, Franklin, Henry, Hanover, Henrico and Accomack). Samples were collected over a four-week period and all SPB, black turpentine beetles and clerid beetles were identified and counted. SPB was found in Chesterfield County traps, and a single beetle was found in the Gloucester County trap. The results of the 2019 prediction survey indicate that SPB infestations in Virginia are at low, static levels.

While southern pine beetle activity remains low in Virginia, *Ips* bark beetle spots began appearing on the landscape in late summer. *Ips* bark beetles are secondary pests that normally only attack weakened trees. Drought makes trees more susceptible to *Ips*, which explains the increase in *Ips* activity observed in late summer and early fall when Virginia experienced drought-like conditions. For the most part, these spots were small and patchy, but should still be monitored.

Meet Forest Health Liaison TOM SNODDY- FORESTER Mattaponi Work Area

Favorite Forest Health Activity: Treating ash trees to prevent damage from the EAB. It's a big responsibility to think that the only ash trees that will survive, are those that are treated.

Fun Fact: I was introduced to the field of forestry through the middle and high school Ag programs and Future Farmers of America. For those that remember Nelson Shaw and Billy Hall, they visited my high school to teach our class about forestry and forest firefighting. I was a member of Billy Hall's KVG (Keep Virginia Green) crew. After he showed the class how to rake fire line, he told us to 'Keep a pair of boots in your locker, in case we need to take you to a fire on short notice". I enjoy working with FFA groups and teenagers, to inspire them in the field of forestry and natural resources.

EMERALD ASH BORER

In 2019, the forest health staff continued to track the spread of the emerald ash borer (EAB) throughout Virginia with the help of many foresters in the Eastern Region. To date, EAB has been confirmed in 80 counties; only the very eastern part of Virginia remains unconfirmed. As EAB continues to munch through the phloem of Virginia's ash trees, we will continue the important work of treating select trees on State Lands and releasing biological control agents where it's appropriate.

To date, we have released a total of 3,370 parasitoids (tiny stingless wasps that solely parasitize EAB eggs and larvae) at Cumberland State Forest and 2,752 parasitoids at Whitney State Forest. We wanted to know if the parasitoid wasps are establishing. In February and April of 2019, with the help of Virginia Tech graduate student Max Ragozzino, we felled and completely debarked trees in both of these state forests and documented the fates of the EAB larvae that were uncovered along the way. Out of two trees at Whitney, we pulled 92 live EAB larvae and pre-pupae as well as two parasitized EAB larvae. However, the parasitism was caused by a native parasitoid *Balcha indica*, and a native predatory beetle, so we cannot determine

that our released parasitoids (*Oobius, Tetrastichus* and *Spathius*) have established at this site. Otherwise, we found that 32 percent of the larval galleries were disrupted by woodpecker predation and 44 percent of the galleries went undisturbed (leading to a successful EAB adult emergence hole) and four percent of EAB larvae were killed for unknown reasons. At Cumberland, we recovered 404 live EAB larvae and pupae as well as 14 parasitoids! Two of these parasitoids were native *Atanycolus cappaerti* wasps and the other 12 parasitoids were the introduced species *Spathius agrili* that we released. Hopefully the remainder of the *Spathius* population will thrive and protect ash seedlings from EAB (especially because woodpecker predation appears much lower at Cumberland)!

In more urban settings, sometimes it is best to remove ash trees before they die and pose a hazard to public safety. Creative solutions for urban wood utilization, such as woodchip bioreactors and handcrafted tables, are positive alternatives to generating more landfill wood or firewood. Please see the Virginia Urban Wood Group's business directory to locate crafters and millers near you: https://treesvirginia.org/education/directory



Continued on page 9

EMERALD ASH BORER, CONTINUED

When large or notable trees are healthy enough to treat, there are effective treatment options available. Our ash treatment cost-share program reimburses up to 50 percent of the treatment costs for trunk injections of emamectin benzoate products. Interested landowners and organizations (e.g., municipalities, nonprofits and HOAs) can find the application Form 6.5 and program information online in March 2020. In the meantime, you can find more information here: https://arcg.is/ P945r



Emerald ash borer larva found in Greensville County



Max Ragozzino and VDOF Forester Joe Rossetti removing an EAB larva from de-barked ash.



Woodchip bioreactor installed in a Harrisonburg city park using local ash wood. This pit of woodchips will mimic a small wetland, de-nitrifying stream water before it reaches a pond and reducing algal blooms.

Meet Forest Health Liaison

BILL SWEENEY – FORESTER Piedmont Work Area



Fun Fact: I enjoy outdoor photography, especially macro photograpahy.

Meet Forest Health Liaison

KINNER INGRAM – URBAN AND COMMUNITY FORESTRY SPECIALIST Potomac Work Area



Favorite Forest Health Pest: The most fascinating forest pest to me is the bagworm. The females of these species make a bag of twigs and silk to protect their eggs before they hatch. Once they hatch, they float on silk to the next branch or tree and restart the process.

Fun Fact: I grew up loving the outdoors. As a child, I spent the majority of my free time camping, hiking, hunting, fishing, kayaking... the list goes on and on. If it meant spending time in nature, I was there! During my summers in college, this love of nature was put to work at the local wildlife rehabilitation center. I was fortunate enough to work with everything from baby beavers to mature bald eagles. I still enjoy interacting with nature, though usually from a distance now, as I kayak, fish local lakes or being in the woods as a forester.

HEMLOCK WOOLLY ADELGID

The hemlock woolly adelgid (commonly known as HWA) is an invasive insect that attacks hemlock trees. This small insect feeds by inserting its piercing-sucking mouthparts at the base of the needle where it attaches to the branch and feeds on stored nutrients and photosynthate during the winter when the tree is dormant. Since this insect is not native to eastern North America, our eastern and Carolina hemlocks are not resistant; tree damage can be quite extensive and mortality may occur in as little as five to ten years.

The VDOF forest health team ramped up efforts to protect hemlocks in the Commonwealth this year. Biscuit Run, state-owned land in Albemarle County, has a stand of hemlocks ranging in size from four to 32 inches in diameter. These trees are rather unique for the region and have very low populations of HWA present at this time. Because of this, VDOF partnered with Albemarle County Parks and Recreation to treat this stand of hemlocks as a safeguard against HWA. Since HWA feeds on the tree sap, systemic insecticides applied as a soil drench or trunk injection are very effective at preventing and controlling HWA populations. The trees at Biscuit Run are in good health and have low infestations of HWA, so the moderate dose range of imidacloprid product was applied according to the label. We applied the insecticide as a trunk injection, which we determined was the safest and most direct application method for the site. A total of 78 trees were treated and the stand will be re-assessed each year to ensure that HWA populations are still controlled. After five years, the trees will be retreated so that the hemlocks will have continued protection.

<image>

Hemlock trees being treated with trunk injections in Albemarle County



Laricobius nigrinus beetles on HWA infested foliage (left) and release of beetles (right)

In addition to chemical control efforts, VDOF Forest Health continues to support biological

control of HWA. A release of the predatory beetle *Laricobius nigrinus* was conducted on November 1st at Nature Camp in Vesuvius. This site qualified for a release due to the amount of hemlocks in relative good health despite an active HWA infestation. In total, 510 small *L. nigrinus* beetles were released! The site will be monitored annually for HWA populations and post-release surveys will attempt to recover predatory beetles. By observing adelgid populations and number of predatory beetles over time, we can determine if the predator population is establishing and impacting the adelgid population.

OAK DECLINE

"My oak tree suddenly died!" This was the most commonly reported forest health observation in the summer of 2019. Landowners, foresters, arborists and citizen scientists from all over the Commonwealth observed leaf discoloration and death of both white and red oaks in urban and rural environments. All of this begs the question, is there a new damaging agent attacking oak trees or is this normal oak decline? While trees can't live forever, sometimes it's difficult to distinguish between natural tree death and a disturbing new trend. Oaks are particularly complicated because people value oak trees and are often more concerned over the death of an oak versus, let's say, a red maple. Additionally, confirmation bias convinces folks to search for dead trees that they wouldn't normally notice.

That being said, numerous natural resource professionals noticed an increase in oak decline this summer. Oak decline has been occurring in Virginia for decades and can be defined as the gradual failure in the health of a tree that results from the interaction between three groups of stress factors:

- Predisposing factors weaken the tree over time and often have to do with site conditions, such as poor soil, topography and stocking density. Advanced tree age and prolonged periods of drought are also common predisposing factors in Virginia. These factors reduce the tree's ability to fight off insect pests and disease, making them more susceptible to future disturbances.
- Inciting factors such as frost, drought, or defoliating insects are more short-term. They rarely kill the tree outright, but usually initiate decline by reducing growth, depleting the tree's stored food reserves, and/or causing dieback. Long-term studies show that drought events are key inciting factors and oak response to drought can last up to 10 years.
- Contributing factors are secondary insects or diseases that ultimately lead to tree mortality. These are the agents that finally "do the tree in" and are often blamed for the death of the tree when they are just the last nail in the coffin. Common contributing factors in Virginia are *Armillaria* root rot and the two-lined chestnut borer.

The key concept of oak decline is that it is the result of a combination of factors; there is no single causal agent. This complex is often visualized as a spiral that depicts multiple groups of stress factors wound together as the tree approaches its death. Oak decline is difficult to diagnose because symptoms may not be apparent in the early stages of decline. The earliest visible symptom of oak decline is crown dieback, which progresses from the top down and the outside inward. This crown dieback reflects an impaired root system usually due to root rot, a contributing factor. Once decline is initiated, tree mortality follows after a few years or even decades. It is a gradual process that may seem sudden if you have not been carefully observing the tree's health. In many cases, an oak tree that "suddenly dies" has actually been stressed for many years.

Was 2019 just another year of oak decline in Virginia, or was there something else at play? It does not appear that a single pest or disease is responsible. There is no evidence of aggressive insect feeding and neither sudden oak death nor oak wilt have been confirmed. Oak wilt was detected in western Virginia decades ago, but has not been found recently. Without any biotic factors to blame, the "answer" may be abiotic stressors. Virginia experienced excessive rainfall in 2018 through the spring of 2019. Oak trees not accustomed to saturated soil conditions were subjected to extended periods of anaerobic conditions caused by flooding, where fine roots are often damaged and more susceptible to root diseases. This wet weather was followed by a hot dry summer with very little rainfall occurring from mid-July through October. Trees that lost root mass and/or were infected with root disease earlier



in the year could not handle the summer drought-like conditions that followed. This is when tree foliage turned brown. We continue to investigate this phenomenon, but our best guess at this point is that we are observing oak decline that has been accelerated by weather extremes. Unfortunately, once oak decline is initiated, it is impossible to reverse the trend. It is only possible to extend the life of the tree by promoting overall tree health with practices such as irrigation in times of drought and proper mulching.

DRONES

Two members of the forest health team, Lori and Katlin, became FAA Part 107 Certified Remote Pilots over the past year. Gaining this certification allows us to fly any of the Department of Forestry's seven drones to monitor forest health disturbances. The VDOF drone fleet is made up of two DJI Phantom 4 Pro v. 2.0, three Mavic 2 Enterprise Dual with thermal cameras, one Mavic 2 Pro, and one Mavic 2 Zoom.

The main way that drones have been used by the forest health program so far is to assess stand-wide issues from above. This "periscoping" technique is utilized when we suspect a problem within a stand and we want to see the full extent of affected tree crowns. Drones have been flown to inspect stands where southern pine beetle was suspected, document *lps* bark beetle spots, and obtain images for publications. We will continue to investigate how drones can supplement our forest health monitoring activities. Five other VDOF staff within fire protection and water quality programs have become certified as well. The drone program at VDOF continues to grow and new applications of this technology in forestry are discovered every day.





VDOF drone pilots

Ips beetle spot

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