Forest Health VERMONT *highlights* 2018

2018 Vermont Forest Health Highlights

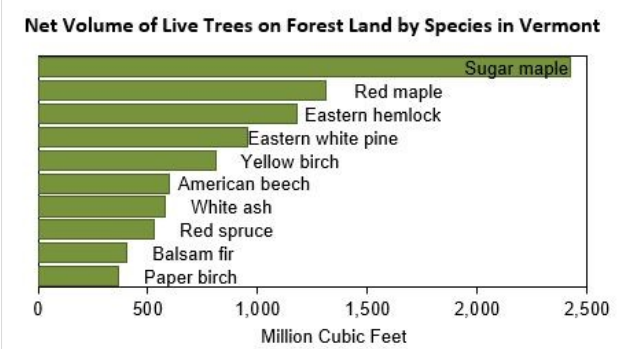
These Forest Health Highlights summarize information from the annual report on Forest Insect and Disease Conditions in Vermont. This summary provides an overview of the forest resource in Vermont, forest health program highlights, a weather summary, sections on hardwood and softwood insects and diseases which are native or established in the state, a section on exotic forest pests which are not known to occur in the state, a summary of activities related to non-native invasive plants, and forest health monitoring results.

Vermont forest health information is on-line at http://fpr.vermont.gov/forest/forest_health, or you can contact us:

- for assistance in identifying pests or diagnosing forest health problems
- to request on-site evaluations or management recommendations
- to obtain defoliation maps and hard-copy publications
- to participate in invasive pest citizen monitoring.

Forest Resource Summary

Vermont's forests cover about three-quarters of the state and include billions of trees. Eighty percent of the State's forest land is privately owned with 11% under Federal management in the Green Mountain National Forest and 8% managed by the State of Vermont. Sugar and red maple and eastern hemlock are the most common species by number and volume. More information on Vermont's forest inventory is at http://fpr.vermont.gov/forest/forest_business/forest_statistics/fia.



Net volume of live trees, by species, on forest land in Vermont. Source: Morin, Randall S. 2018. Forests of Vermont, 2017. Resource Update FS-164. U.S. Forest Service, https://doi.org/10.2737/FS-RU-164.

Forest Health Program Highlights

The Vermont Department of Forests, Parks and Recreation (FPR) conducts aerial and ground surveys to detect forest damage. In addition, long-term monitoring plots are inspected to evaluate forest health. FPR and the Agency of Agriculture, Food and Markets (AAFM) collaborate with USDA agencies to survey and manage **non-native forest pests**, and with University of Vermont (UVM) Extension on education and outreach.

In 2018, 128,872 acres of forest damage were sketchmapped during statewide **aerial detection surveys**. This represents just under 3% of Vermont's forestland, and an increase from the 98,555 acres mapped in 2017. Defoliation by forest tent caterpillar and white pine needle damage accounted for 55% and 32%, respectively, of the area mapped.

Healthy forests are ecologically functional and resilient to disturbance. They are valued by communities and have the capacity to produce economic benefits. The mission of the Vermont Division of Forests is to manage for and protect healthy forests. We work with Vermont citizens to promote forest health, supporting best management practices, sustainable use, and respect for the land.

The **Forest Pest Outreach Program** implemented by UVM resulted in 851 people receiving direct education at workshops and presentations and an estimated 190,023 people exposed to educational material through exhibits, newsletters, and social media messaging. A whiteboard-style video was developed to spread the message that buying firewood locally can limit the spread of invasive forest insects and diseases, and was shared on social media and provided to private campgrounds in Vermont to display on their websites. The website vtinvasives.org continues to offer information on terrestrial plants, forest pests, and aquatics, and serves as a clearinghouse for multi-agency information about emerald ash borer. Two Forest Pest First Detector trainings were held in central Vermont, with arborists, tree wardens, and concerned citizens attending. Volunteers assisted in pest detection surveys and community outreach.

The Forest Pest Outreach Program provided information to students at the Bend Career and Technical Center in Bradford. A whiteboard-style video was developed to spread the message that buying firewood locally can limit the spread of invasive forest pests. https://www.facebook.com/vtinvasives/videos/1992705404285380/. Photo: M. Whitney.

Vermont's **firewood quarantine**, the Rule Governing the Importation of Untreated Firewood into the State of Vermont, went into effect in 2016. Untreated firewood, less than 48 inches in length, cannot be brought into Vermont, unless a waiver has been granted to the person moving the firewood. Currently eighteen waivers are in effect for firewood from adjacent counties in New Hampshire, New York, and Massachusetts. Waivers for wood from counties known to have EAB do not allow the importation of untreated ash firewood.

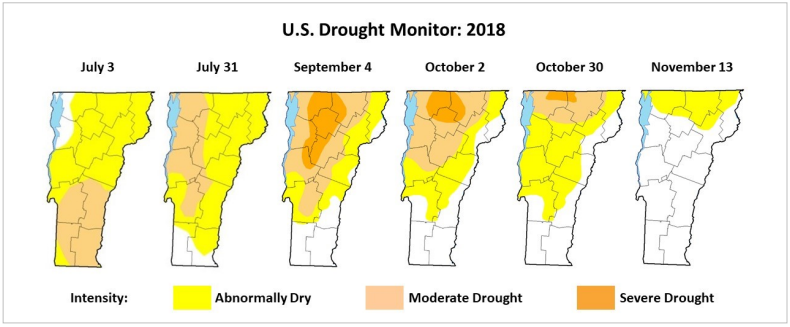
The **Forest Biology Lab** continues to provide invertebrate identifications, tree disease diagnoses and pest management recommendations, and support environmental education and outreach. In 2018, 37% of our inquiries came directly from the public; 25% came from state or federal agencies; questions from researchers and other professionals outside of state and federal government made up 16%; 13% of our inquiries came from other labs; and 9% involved outreach and education. Forest health inquiries came from all 14 Vermont counties, with highest numbers (about 18% each) from Addison, Chittenden and Washington Counties. Four percent of our inquiries were from out-of-state. Relocation of the Forest Biology Lab as part of the new Vermont Agriculture and Environmental Laboratory in Randolph is scheduled for February 2019.

The **Forest Ecosystem Monitoring Cooperative** (formerly Vermont Monitoring Cooperative) completed its 28th year of monitoring ecosystem health. Survey and monitoring results are available at the FEMC website.

2018 Weather Influences on Forest Health

Temperatures for meteorological winter, December 2017 to February 2018, averaged near normal despite some wild swings. Snowpack dropped off in February, then was above normal by mid-March, when over 50 inches of snow had fallen in parts of the state. March and April averaged below normal temperatures and with limited sunshine, winter-like weather continued through the end of April. Green-up was generally delayed. Ash, oak and red maple leaves were still not fully expanded at higher elevations by the end of May.

Below normal precipitation continued from May through early July statewide. The end of June marked the beginning of a heat wave, with temperatures remaining above average through the rest of the growing season. The U.S. Drought Monitor listed most of Vermont as abnormally dry starting on June 19. Moderate drought started in the southern counties on June 26 and shifted through the month of July as rainfall patterns started to diverge between northern and southern parts of the state. By early September, parts of northern Vermont were in severe drought, which persisted through the end of October near the Canadian border. During July aerial surveys, 2,107 acres of drought damage were mapped. Since this was well before the peak of drought conditions, the actual acres of damage to hardwood foliage was significantly larger.



Moderate drought started in the southern counties, but by early September, parts of northern Vermont were in severe drought. Map Author: David Simeral, Western Regional Climate Center, https://droughtmonitor.unl.edu/.

Early fall color started in August but, with the warm temperatures, was slow to progress. Widespread color change arrived about two weeks late. Brilliant early and mid-season color gave way to a muted late-season due to a cloudy October. With the late start, limited frost, and lack of stormy weather, leaves persisted on oaks, beech, and other late-turning species well into November.

Severe tree-damaging storms punctuated the growing season. A partial list includes strong winds and hail on May 4th, the remnants of Hurricane Bud including microburst storms on June 18th, severe storms in southern Vermont on July 27th and 28th, and on August 29th and September 4th in the northeast. In late November, Winter Storm Bruce dumped wet snow statewide, leaving over a foot at higher elevations. Tree breakage was widespread, resulting in approximately 90,000 power outages.

We continue to monitor **phenology** for the timing of budbreak, leaf out, and fall leaf color and drop. Sugar maple budbreak on May 7th was 4 days later than the long-term average, but the timing of full leaf-out was nearly indistinguishable from the long-term average. In fall, the timing of peak color for most species was similar to the long-term average in 2018. Although color development was initially slow, full leaf drop was just one day later than in 2017. Growing season length was 5 days longer than the long-term average.

While seed crops on most species were minimal, especially compared to the heavy seed year in 2017, ash seed production remained heavy. Squirrel populations, which erupted following the abundance of 2017, had a greatly reduced food supply in 2018, and increased squirrel damage to tree buds and bark is expected.

Following the drought of 2016, the late-season dry conditions in 2017, and the prolonged period of warm, dry weather in 2018, water availability continued to be a major driver of tree health and will interfere with tree recovery from defoliation and other stressors.

Hardwood Insects and Diseases

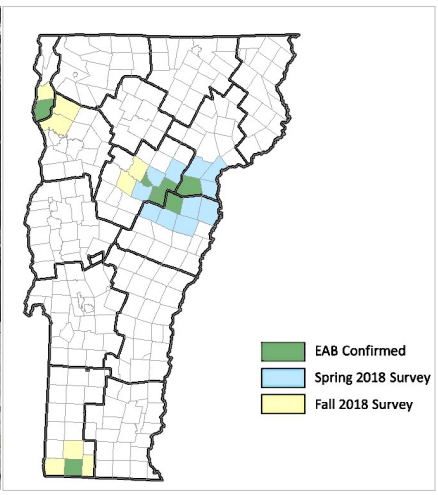
In late February, trees in the town of Orange suspected of being infested with **emerald ash borer (EAB)** were observed by a consulting forester and reported through the vtinvasives.org Report It webpage. The identification was confirmed by the USDA Animal & Plant Health and Inspection Service (APHIS). The source of the infestation is unknown.

Vermont became the 32nd state known to be infested. Elsewhere in the region, Rhode Island, Maine, New Brunswick and Nova Scotia also had their first detections in 2018, and EAB was found in two new counties in New Hampshire.

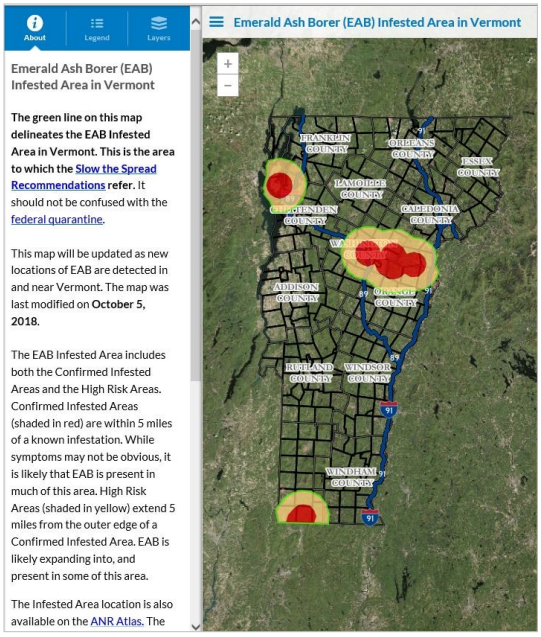
The Vermont detection initiated a multi-agency response by the Dept. of Forests, Parks, and Recreation, the Agency of Agriculture, Food and Markets (AAFM), APHIS, the US Forest Service and UVM Extension, as outlined in in the Vermont Forest Pest Advisory Committee's Emerald Ash Borer Action Plan. A delineation survey was conducted in March and April to determine if the detection represented part of a wider infestation. This was a visual survey, covering all towns adjacent to towns where EAB had been detected and confirmed. In all, fourteen towns were surveyed. EAB-infested trees were found in Groton, Plainfield and Barre.

Additional detections followed. In May, EAB-infested trees were next detected in Montpelier, as a result of an incidental observation. The USDA had 609 purple traps deployed throughout Vermont in 2018, and beetles were caught at two sites in Stamford and a second site in Groton. In late September, an off-duty forester reported symptomatic ash trees in South Hero. Additional delineation surveys are in progress in the eight towns adjacent to South Hero, Stamford, and Montpelier using the same methods as the spring survey. No EAB have been detected in these towns.

Maps indicating known EAB infested areas in Vermont have been made available at vtinvasives.org. These are regularly updated following new EAB detections. EAB is difficult to find when it first attacks a tree, so the mapped Infested Area extends well beyond where the insect has been observed. Any ash within ten miles of a known EAB location is considered to be at-risk. Including these High Risk areas, the mapped Infested Area now includes all or part of 47 towns in eight counties. The infested area is also available for download on the ANR Atlas http://anrmaps.vermont.gov/websites/anra5/.



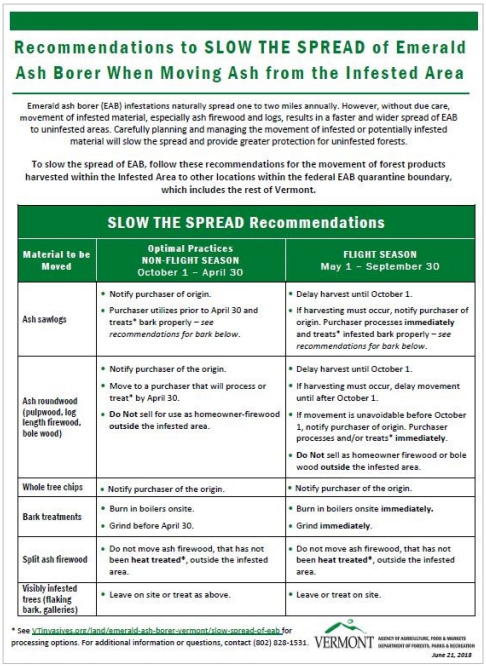
After EAB was detected in February, a delineation survey was conducted in neighboring towns. Similar surveys were conducted in the Fall following separate detections. As of November, EAB is known to occur in Orange, Plainfield, Groton, Montpelier, Stamford, and South Hero. Photo: B. Schultz



Due to the federal EAB quarantine, the State of Vermont needed to choose whether to have a state quarantine covering the three known infested counties or to include the entire state within the federal quarantine boundary. The Vermont Pest Advisory Committee determined that an intrastate quarantine would unnecessarily divert resources to areas that do not pose a risk, since the required quarantine boundaries would not align with the infestation in Vermont. By foregoing an intrastate quarantine, all of Vermont became part of the USDA quarantine.

Resources were focused on developing slow-the-spread recommendations for preventing unintended movement of EAB and information about ash management. Slowing the spread of EAB to uninfested areas slows mortality and financial impacts, and allows time to implement management and to develop better tools for protecting ash.

The Infested Area Map includes the area within 10 miles of any location where the insect has been observed.



Recommendations to SLOW THE SPREAD of Emerald Ash Borer When Moving Ash from the Infested Area

Emerald ash borer (EAB) infestations naturally spread one to two miles annually. However, without due care, movement of infested material, especially ash firewood and logs, results in a faster and wider spread of EAB to uninfested areas. Carefully planning and managing the movement of infested or potentially infested material will slow the spread and provide greater protection for uninfested forests.

To slow the spread of EAB, follow these recommendations for the movement of forest products harvested within the Infested Area to other locations within the federal EAB quarantine boundary, which includes the rest of Vermont.

SLOW THE SPREAD Recommendations

Material to be Moved	Optimal Practices NON-FLIGHT SEASON October 1 – April 30	FLIGHT SEASON May 1 – September 30
Ash sawlogs	• Notify purchaser of origin. • Purchaser utilizes prior to April 30 and treats* bark properly – *see recommendations for bark below.*	• Delay harvest until October 1. • If harvesting must occur, notify purchaser of origin. Purchaser processes **immediately** and treats* infested bark properly – *see recommendations for bark below.*
Ash roundwood (pulpwood, log length firewood, bole wood)	• Notify purchaser of the origin. • Move to a purchaser that will process or treat* by April 30. • **Do Not** sell for use as homeowner-firewood **outside** the infested area.	• Delay harvest until October 1. • If harvesting must occur, delay movement until after October 1. • If movement is unavoidable before October 1, notify purchaser of origin. Purchaser processes and/or treats* **immediately**. • **Do Not** sell as homeowner firewood or bole wood **outside** the infested area.
Whole tree chips	• Notify purchaser of the origin.	• Notify purchaser of the origin.
Bark treatments	• Burn in boilers onsite. • Grind before April 30.	• Burn in boilers onsite **immediately.** • Grind **immediately.**
Split ash firewood	• Do not move ash firewood, that has not been **heat treated***, outside the infested area.	• Do not move ash firewood, that has not been **heat treated***, outside the infested area.
Visibly infested trees (flaking bark, galleries)	• Leave on site or treat as above.	• Leave or treat on site.

* See vtinvasives.org/land/emerald-ash-borer-vermont/slow-spread-of-eab for processing options. For additional information or questions, contact (802) 828-1531. VERMONT

June 21, 2018

Recommendations for preventing unintended movement of EAB and information about ash management are available at https://vtinvasives.org/land/emerald-ash-borer-vermont.

Following are some of the resources available through vtinvasives.org:

Recommendations to Slow the Spread of EAB:

Moving Ash from the Infested Area: How and when it is safe to move ash forest products originating from the infested area.

Ash Processing Options: Treatments and processing measures that make ash wood material safe to move at any time of year.

For Forest Landowners: How forest landowners can avoid spreading EAB when conducting forest management activities.

For Tree Care and Clearing: How to safely handle ash material resulting from tree care, land clearing, ROW maintenance, and similar activities.

Transporting Ash Wood Products into Vermont Safely and Legally: How and when it is safe to move ash forest products originating from outside Vermont.

Information for Forest Landowners and Managers

Ash Management Guidance for Forest Managers

UVA Policy on Forest Management Plans and Amendments

Webinar: Silvicultural Considerations for Vermont's Ash within the Context of EAB Presented by Tony D'Amato, UVM.

Trap Tree Protocol for Forest Landowners: How to implement the most effective technique for early detection of EAB on a property.

Information for Homeowners and Municipalities

Homeowner's Guide to Emerald Ash Borer: Information to help decide what to do about ash trees at risk.

Options for Protecting Ash Trees from EAB with Insecticide Treatments: When to consider insecticide treatments and guidelines for having trees treated.

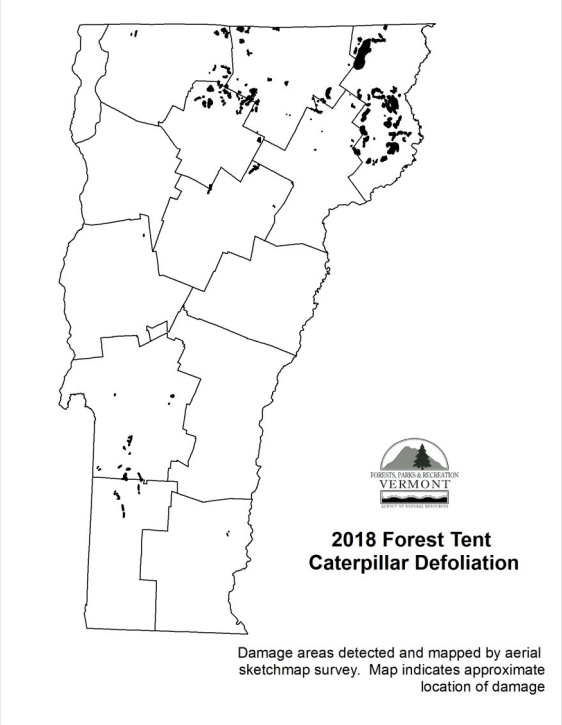
Community Planning: Goes VT Urban & Community Forestry's EAB Management website.

EAB is difficult to find when it first infests a new location, because it is under the bark and often high in the trees. Photo: K. Freeman

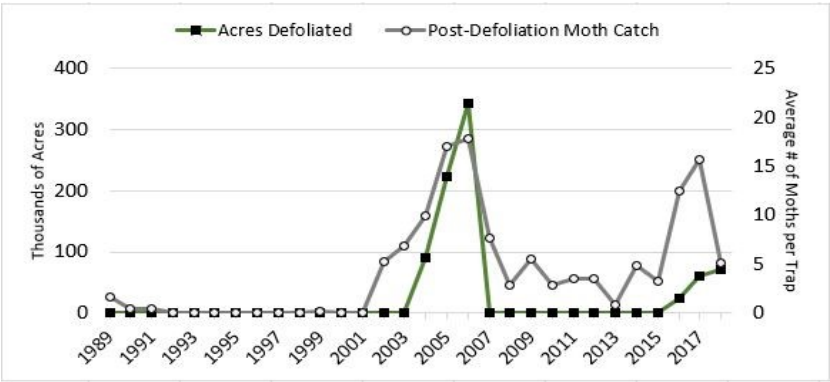
Forest tent caterpillar (FTC) populations increased again in 2018, with 71,315 acres of defoliation mapped during statewide aerial surveys compared to 60,584 acres mapped in 2017. This accounts for roughly 2% of the northern hardwood forest in Vermont. The area defoliated decreased in southern and central Vermont, but more than tripled in Essex County. Defoliation data are available on the ANR Natural Resources Atlas.

At four sites in northern Vermont monitored for spring FTC activity, hatching was first observed in mid-May, roughly 2 weeks later than in 2017. Caterpillar development progressed rapidly, and by the last week of May defoliation had begun.

In late 2017 and early 2018, FPR staff assisted landowners with FTC egg mass surveys to determine the likelihood of defoliation on their property. Of the 84 sugarbushes surveyed, 30 locations were identified as at risk of defoliation. Landowners made arrangements with an aerial applicator to have thirteen properties treated with Foray48, a *Btk* product that is registered for use in certified organic production. In total, these accounted for 4,129 acres. Several additional forest landowners also had their forestland treated. A sample of treated and untreated sites was evaluated once FTC feeding was complete. Among sites predicted to be defoliated based on egg mass surveys, untreated stands averaged 25% foliage loss compared to 15% for treated stands. Stands not predicted to be defoliated experienced only 5% foliage loss on average.



Forest tent caterpillar defoliation was mapped on 71,315 acres, with over half the acres mapped in Essex County.



FTC moth capture decreased dramatically from 2017. In the previous outbreak, this signaled a collapse of the population, with no defoliation mapped the following year.

FTC parasitoids known as friendly flies were reported throughout the defoliated areas, and there was some early caterpillar mortality likely due to viral and/or fungal infection. Pheromone traps for FTC were again deployed throughout the state in 2018, and moth capture decreased dramatically from 2017 levels. If results from the previous outbreak (2004-2007) are any indication, we may see a reduction in defoliation in 2019. While this is a hopeful sign, we will have a better prediction for defoliation in 2019 after winter egg mass surveys have been completed.

This year was also the first year in the current outbreak where tree mortality associated with FTC was visible. Most trees recover from FTC damage, but defoliation can incite tree decline if other stresses are present. In 2018, 4,550 acres of sugar maple dieback and mortality were mapped in locations which had been recently defoliated by forest tent caterpillar in previous years.

The presence of tree mortality following defoliation is likely related to refoliation failures that occurred in all years of the current outbreak (2016-2018). There were abnormally dry and drought conditions in all three years. Other contributing factors may have been the heavy seed on sugar maple in 2017, a late start of feeding in 2018 due to wet weather, and infection by leaf fungi.

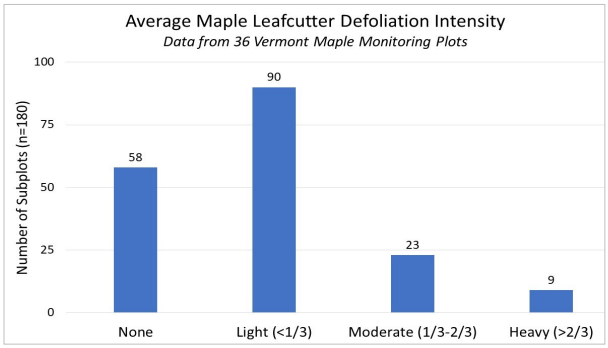
For more details on FTC biology and management, refer to the most recent Forest Tent Caterpillar Update.

Tree mortality following FTC defoliation was mapped on 4,550 acres. Abnormally dry to drought conditions, and subsequent refoliation failures in all three years of the outbreak, have worsened the impact of defoliation. Photo: T. Greaves

Defoliation of entire stands by maple leaf cutter was unusually heavy by early September. Photo: J. Halman

Maple leaf cutter (MLC) damage to lower foliage was noticeable statewide in July, but became unusually heavy by early September, when browning and defoliation of entire stands was obvious in many locations. Starting life as a leafminer, then becoming a casebearer in later instars, the MLC completes its life cycle in its movable dwelling, eventually crawling or fluttering to the ground where it overwinters in a cocoon within the leaf discs.

MLC defoliation was evaluated in late September in 36 maple monitoring plot locations. Heavy defoliation was only reported from plots in southeastern and northeastern Vermont, but moderate defoliation was observed throughout the state. Due to the late timing of defoliation, significant impacts to tree health are not expected.



Maple leaf cutter caterpillars feed within a case made of leaf discs. After feeding is complete, the insect moves to the ground in its movable dwelling. Photos: D. Dillner

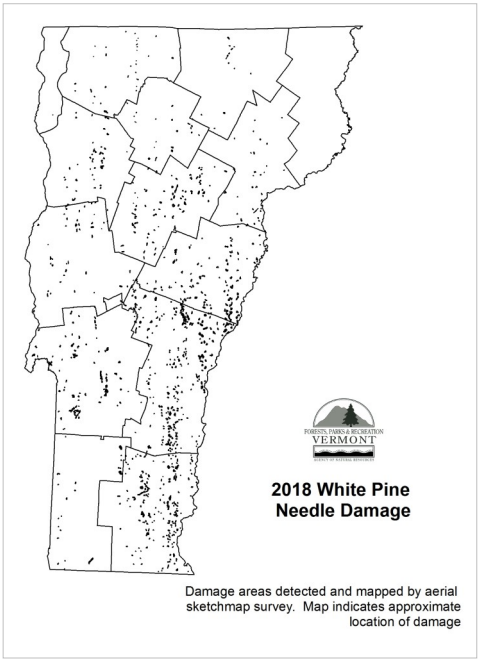
Damage was often confined to lower crowns, and over 80% of the subplots evaluated statewide had no, or only light, defoliation by the end of September.

Softwood Insects and Diseases

White pine needle damage (WPND) was widespread again this year with 40,745 acres mapped, more than doubling the 16,413 acres mapped in 2017. This may underestimate the area affected since damage is mapped from above, while much of the damage is in lower crowns. This damage has been attributed to a complex of fungal pathogens. Since symptoms appear the year following infection, the increase is likely due to the cooler and wetter weather in late spring 2017.

Symptoms showed up, later than normal, in early June. Bright yellow one-year-old needles were widely observed. Due to windy conditions, yellow needles also dropped quickly on many of the affected trees, leaving a carpet of newly cast needles in pine stands.

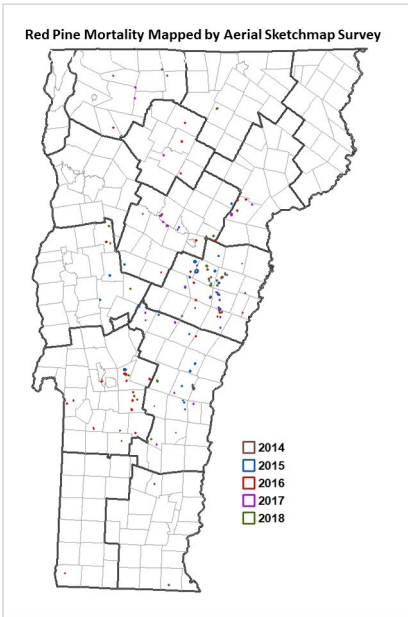
White pine needle damage was mapped on 40,745 acres. The increase in damage is likely related to cool, wet weather in late spring of 2017. Symptoms showed up later than normal in early June. Due to windy weather, needles dropped quickly leaving a carpet of newly cast needles. Photos: B. Schultz



The damage has been widespread since 2010, and the current epidemic has been building at least since 2005. Needle damage generally affects the same trees each year, and some are now exceedingly thin. Decline and mortality of white pine have been occasionally observed where other stress factors are also present.

This year marked the start of a multi-state project to evaluate site factors influencing WPND. In Vermont, crown health and stand characteristics were assessed at twenty sites. Needles were collected for lab evaluation to determine which needle diseases are present. The brown spot needle blight fungus, *Lecanosticta acicola,* was the most common pathogen on white pine needles from Vermont, while a newly described species, *Septorioides strobi*, was the second most abundant species. More information about the study can be found at https://fpr.vermont.gov/sites/fpr/files/Forest_and_Forestry/Forest_Health/Library/2018_VT%20FPR_White%20pine%20health%20monitoring%20leaflet.pdf

Twenty sites were assessed as part of a multi-state project to evaluate WPND. Photo: J. Halman

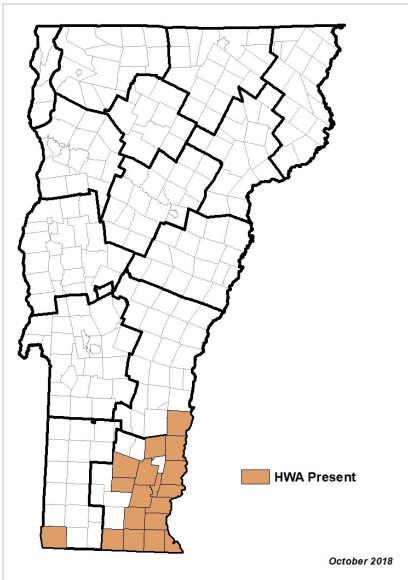


Reports of **red pine mortality** continued in 2018, with 765 acres mapped, scattered in six counties. The exotic insect, red pine scale, collected in 2015 in Rutland and Orange Counties, has not been detected since that time in declining red pine stands. While the expanding pattern of the mortality is consistent with a non-native organism, the cause remains unknown.

Recent red pine mortality was mapped in six counties in 2018. While the expanding pattern of the mortality is consistent with a non-native organism, the cause remains unknown. Photos: J. Halman

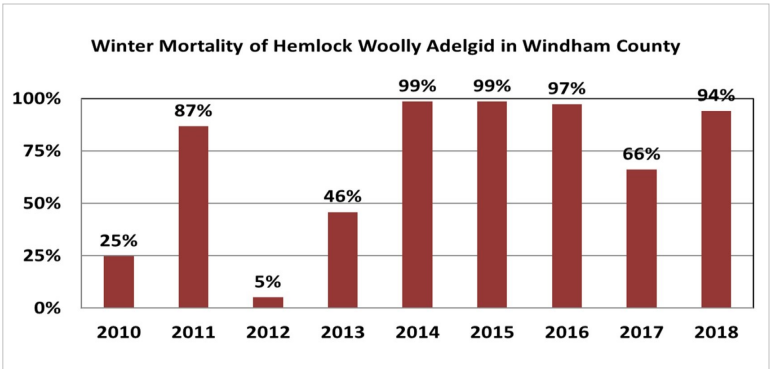
Vermont's **hemlock woolly adelgid** (HWA) infestation remains centered primarily in Windham County, with small spots in Springfield and Pownal. In winter 2017-18, the average winter mortality was 94%, which is considered adequate to restrict expansion of the infestation.

The emphasis of FPR's delineation survey program was shifted to focus on counties adjoining infested counties. Twenty sites were surveyed prior to summer 2018, targeting Rutland, Orange, and northern Windsor Counties. No expansion of the infestation was detected.



Laricobius nigrinus, the predatory beetle, was not recovered during fall sampling of the three sites where they had been released in 2009, 2012 and/or 2017, so the status of this introduction remains unknown.

Vermont's HWA infestation remains centered in Windham County, with no expansion to new towns detected in 2018.

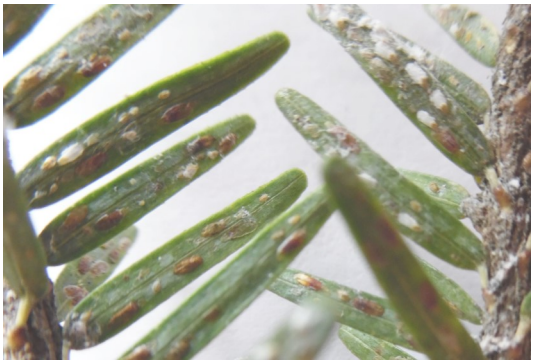


Overwintering mortality averaged 94%, which is considered adequate to restrict spread.

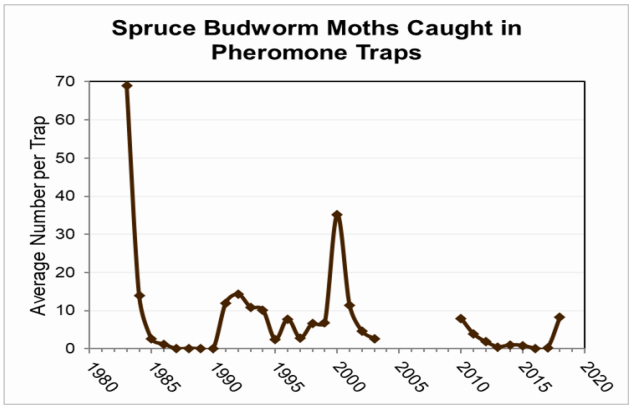
Compounding the risk to hemlock, **elongate hemlock scale** (EHS) is increasingly noticeable in Windham County. It was first detected in the towns of Brattleboro and Guilford in 2014. In addition, EHS has been occasionally been found on nursery-grown trees over the past 20 years. In 2018, an infested balsam fir planting was reported in Charlotte. No additional EHS suspects were found when wild hemlocks nearby were inspected. Fir and spruce are at least as susceptible to EHS as hemlock hosts.

Fir mortality caused by **balsam woolly adelgid** is continuing with 3,434 acres mapped compared to 1,641 acres in 2017. Active populations are rarely observed.

Spruce budworm continues to cause widespread defoliation in eastern Canada. The number of moths captured in our Vermont pheromone traps this summer increased from recent years but remains low.



Elongate hemlock scale is increasingly noticeable in Windham County. Elsewhere, it has been occasionally found on planted fir and other hosts. Photo: B. Guenther



Spruce budworm moth trap catches remain low.

Non-Native Invasive Plant Programs

Non-native invasive plant (NNIP) management efforts continued in 2018, with progress on mapping, control, outreach and education made possible through several grant funded opportunities. FPR's Invasive Plant Coordinator led 28 workshops and fielded over 250 inquiries about invasive plants. Since 2014, 2,279 volunteers have assisted with direct management of NNIP in southwestern Vermont.

This year a new program was launched for middle and high school groups. In 2018, 488 students from 11 different schools participated in the program, learned about invasive plant identification and ecosystem impacts, and got hands-on experience removing them.

In 2018, 488 students from 11 schools participated in a hands-on program to learn about non-native invasive plants. Photo: H. Ewing

Also new this year is a "train the trainer" opportunity for members of the public called the Forest Hero! Network. Ten participants attended the first training, co-hosted by Vermont Coverts. Participants agreed to conduct an outreach event for their communities.

The Mapping for Healthy Forests project continued to provide a resource for tracking NNIP across the landscape, with a focus on private and municipal lands. This citizen science project trains volunteers to assess NNIPs and prioritize treatment areas. All the information from this project is stored on the iNaturalist website and is accessible through this link: https://www.inaturalist.org/projects/mapping-for-healthy-forests-vermont.

Exotic Forest Pests Threatening Vermont

AAFM and USDA APHIS continue efforts to trap non-native forest insects. **Sirex woodwasp** has been trapped in twelve Vermont counties since 2007. In 2018, it was trapped in Caledonia, Orleans, and Windsor Counties. No new observations of Sirex infested trees were reported, with the only known location in Jericho.

The **common pine shoot beetle** has been found in many Vermont counties since it was detected in 1999. By federal quarantine, pine material is free to move within Vermont and through most of the region. See Pine Shoot Beetle Quarantine Considerations for more information.

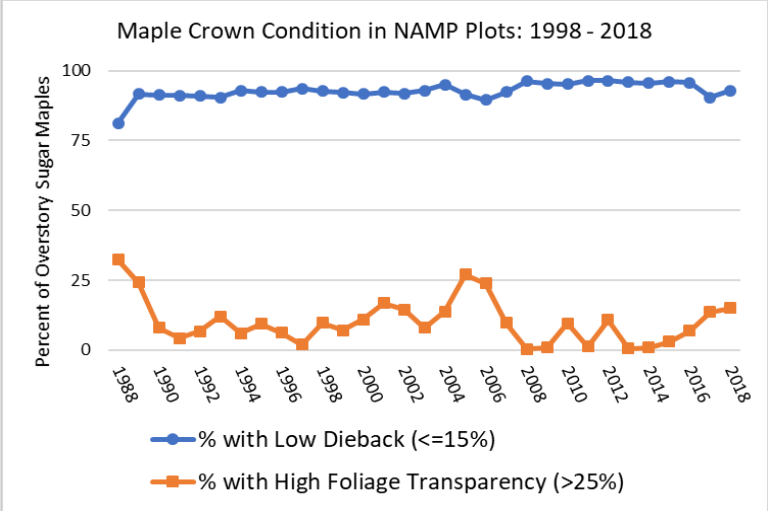
Asian longhorned beetle (ALB), is not known to occur in Vermont and no forest management changes are recommended in anticipation of the insect. Nonetheless, education and outreach that can promote early detection remains a priority. Elsewhere in the region, 2018 is the first year with no ALB detected during surveys around Worcester, MA.

Other **non-native insects and diseases that have not been observed in Vermont** include winter moth, spotted lanternfly, and the agents that cause oak wilt and thousand cankers disease.

Monitoring Forest Health

In Vermont, we have continued to monitor sugar maple health in sugarbushes and in maple stands since 1988. In these **North American Maple Project** (NAMP) plots, 93% of sugar maples were rated as having low dieback (less than 15%), nearly the same as in 2017 (90%).

Thin foliage due to forest tent caterpillar (FTC) defoliation was not noted in any of the 36 monitoring plots, which is notable since 2017 saw 25% of plots affected. Despite the reduction in defoliation from FTC, the number of trees with thin crowns continued to increase in 2018. Statewide, there was an increase in trees with thin foliage from 7% in 2016, to 14% in 2017, to 15% in 2018. Foliage transparency is sensitive to current stress factors. Other spikes in transparency were due to frost injury (2010, 2012, 2015), forest tent caterpillar defoliation (2004-2007, 2016), and pear thrips (1988-1989).



Sugar maple crown condition was similar to 2017 in maple health monitoring plots. Thin foliage and dieback have been higher than average due to successive years of dry weather and forest tent caterpillar defoliation.

In addition, 48 forest health monitoring plots were sampled across Vermont in 2018 as part of the **Forest Ecosystem Monitoring Cooperative** (FEMC). Statewide, dieback and foliar transparency both increased compared to 2017, but were comparable to 2016 levels. However, dieback (12%) was higher than the long-term average (8%), while transparency was indistinguishable from the long-term average (21%).

UrbanFIA work continued for the third year in Vermont. This US Forest Service program parallels traditional Forest Inventory and Analysis (FIA), measuring changes to forest demography and health through a network of long-term plots. Vermont was the first state to commit to a full UrbanFIA program, targeting urban areas statewide rather than focusing on a single metropolitan area. In 2018, all plots were completed by the end of June through the combined efforts of the USDA Forest Service, Vermont Department of Forests, Parks and Recreation, and the Forest Ecosystem Monitoring Cooperative. Data are collected on a seven year cycle, after which a statewide report will be published.

FORESTS, PARKS & RECREATION VERMONT
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