Forest Health Highlights Vermont 2022

Forest Insects and Diseases

Asian Longhorned Beetle

Asian longhorned beetle (ALB, *Anoplophora glabripennis*) is an invasive wood-boring beetle of a variety of hardwood species including, but not limited to, maples, horse chestnut, willows, American elm, birch and sycamores. **This invasive insect has not been detected in VT.** As part of early detection efforts, six ALB combination pheromone traps were deployed statewide in mid-summer. No ALB were trapped this season.

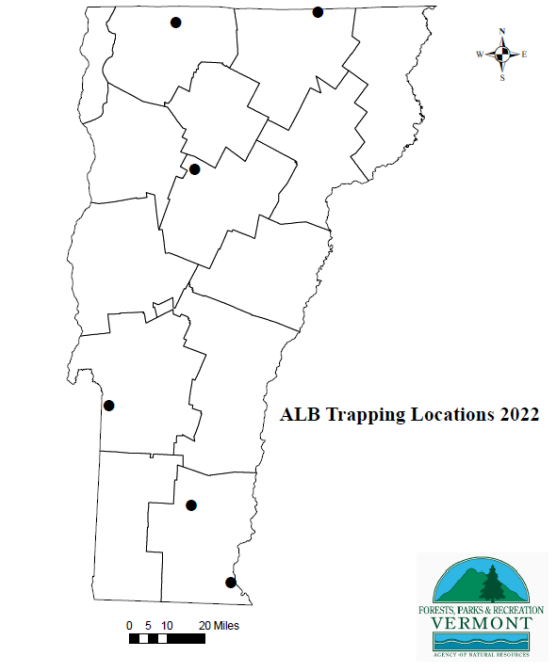


Figure 1. Locations of 6 Asian Longhorned Beetle traps deployed in Vermont in 2022.

Beech Bark Disease

Dieback from beech bark disease, caused by *Cryptococcus fagisuga* and *Nectria coccinea var. faginata*, was mapped on 31,086 acres in 2022, an increase from the 21,093 acres mapped in 2021.

Bark symptoms remain common and crown symptoms including early yellowing and dieback were increasingly noticeable by mid-summer. This may be due to drought conditions that increased the

survival of beech scale crawlers, the success of bark infections, and tree vulnerability.

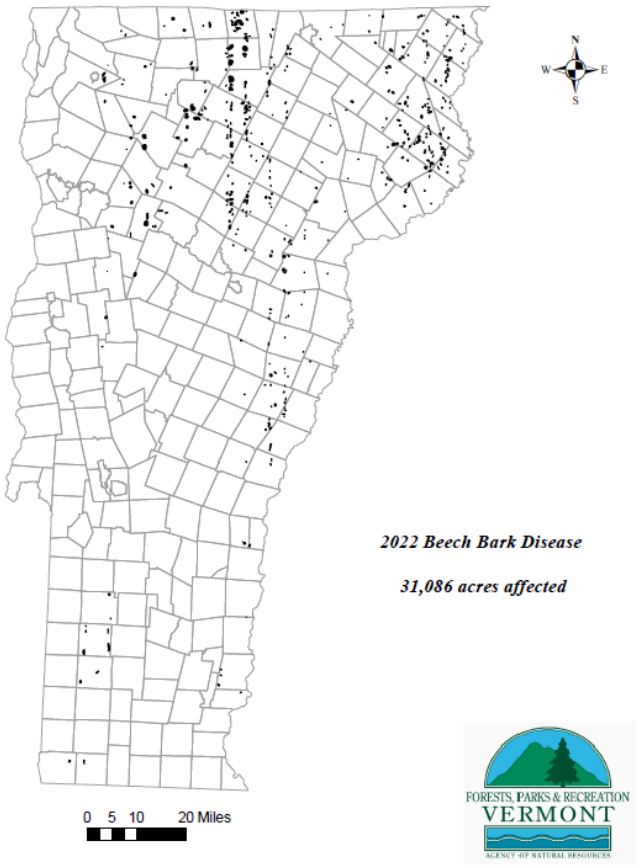


Figure 2. Locations of beech bark disease mapped during 2022 Aerial Detection Surveys. In total, 31,086 acres were affected by the disease complex.

Beech Leaf Disease

Eight long-term Beech Leaf Disease monitoring sites were established across Vermont. Beech leaf disease (BLD) affects both American and European beech trees and causes leaf deformation, dieback, and mortality of infested hosts. The causal agent of BLD is an introduced nematode from Japan, *Litylenchus crenatae mccannii*. This pest can affect all ages and sizes of beech, being most deadly to saplings and understory beech. This pest has currently been reported in 12 states, and Ontario, Canada. The most recent reports are in New Hampshire (2022), Maine (2021), Massachusetts (2020), and Rhode Island (2020). **This pest has currently not been observed in Vermont.**

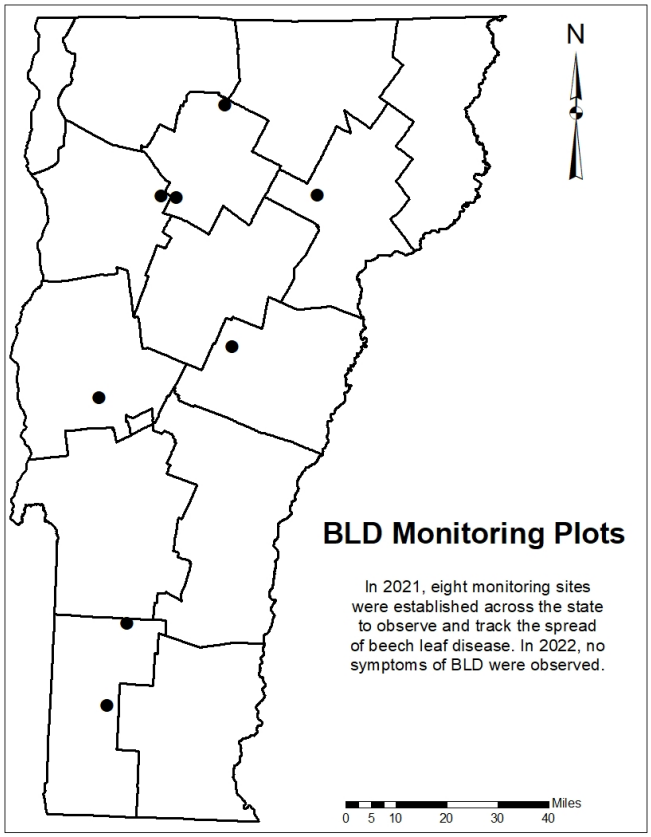


Figure 3. Locations of 8 beech leaf disease (BLD) monitoring plots in Vermont. 2022 was the second year of monitoring at these sites. BLD has not yet been confirmed in Vermont.

Emerald Ash Borer

After first detecting emerald ash borer (EAB) in Vermont in 2018, efforts have been made across the state to identify new detections, and to track the spread of the current infestation. In 2022, a total of 20 purple prism traps were established and monitored by a state forestry staff. Girdled trap trees were also established by state forestry staff and USDA Forest Service staff on state lands (n = 21) and the Green Mountain National Forest (n =10), respectively. Together with requested site visits, these tools resulted in 12 new detections and 9 new towns with EAB in Vermont in 2022. New towns in already infested counties include Barnet, Cabot, Milton, Pomfret, Poultney, Pownal, Somerset, Townshend, and Williston. Detections have been found in a total of 42 towns. Essex County is currently the only county in the state without a confirmed detection.

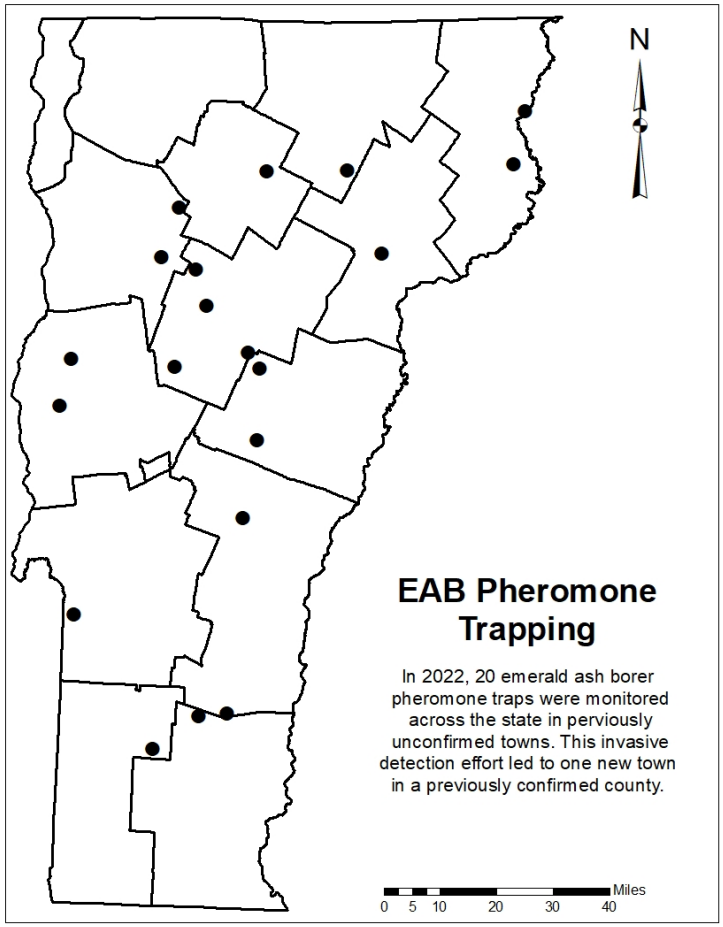


Figure 4. Locations of emerald ash borer (EAB) purple traps in Vermont in 2022.

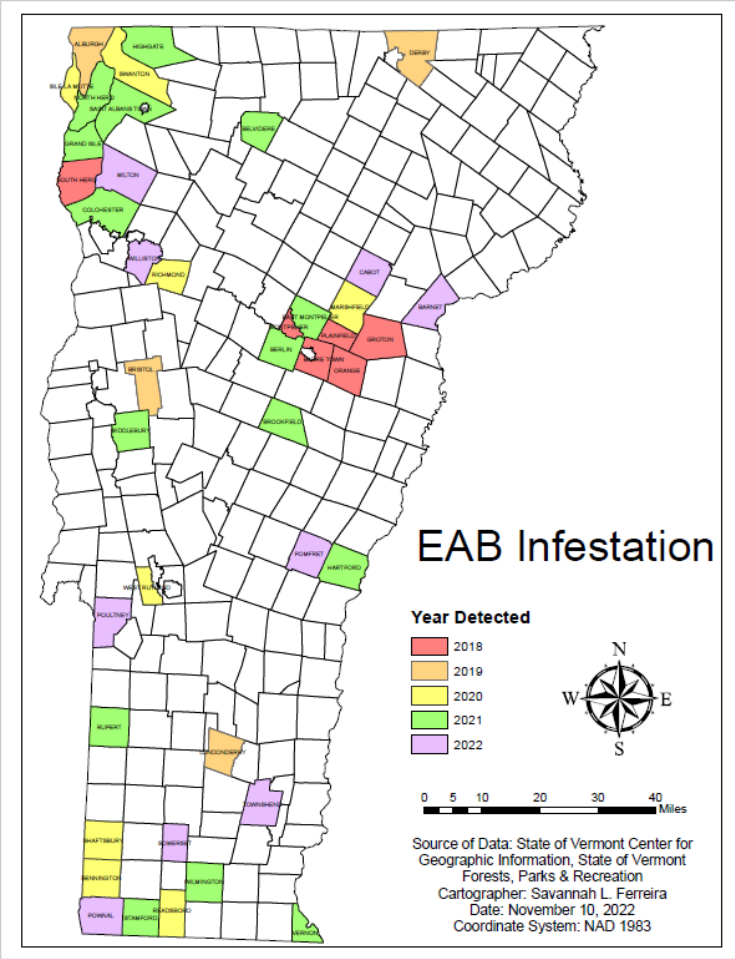


Figure 5. Towns in Vermont where emerald ash borer (EAB) has been confirmed. An additional 9 towns were confirmed to have EAB in 2022.

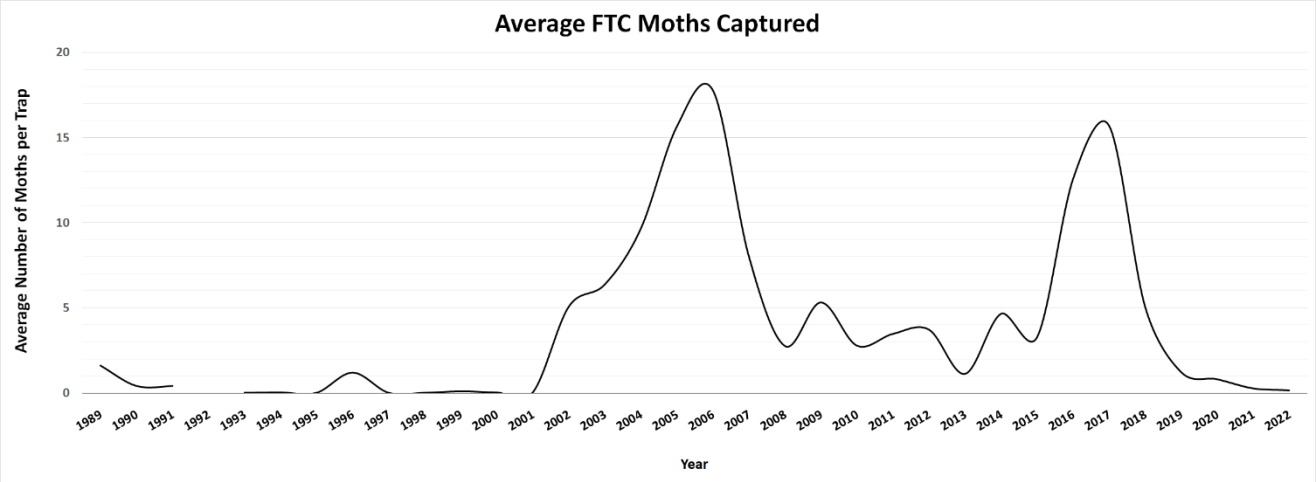
EAB Biocontrol

EAB biocontrol releases began in 2020 at two sites in Vermont, one at a private campground in South Hero, VT, the other at LR Jones State Forest (Plainfield, VT). The first year of releases included *Tetrastichus planipennisi* exclusively, with over 4300 wasps released at each site. In 2021, all three parasitoids were available for release, and each site received at least 4000 *T. planipennisi*, 1100 *Spathius galinae*, and 1000 *Oobius agrili*. Releases in 2022 at these sites included at least 300 *S. galinae* and 1800 *O. agrili* at each location. A new release site in Whipstock Hill Wildlife Management Area (Bennington, VT) was established in 2022, and all three parasitoid species were released. Recovery efforts will begin in 2023 for *T. planipennisi*, *S. galinae* and *O. agrili* at the two original locations, with another year of releases planned for Whipstock Hill. At least one new site for biocontrol releases in 2023 will be submitted to APHIS-PPQ for consideration in the program.

Forest Tent Caterpillar

Forest tent caterpillar (FTC, *Malacosoma disstria*) is a native hardwood defoliator commonly found feeding on sugar maples and ash in mixed hardwood forests. In consecutive years of severe outbreaks, trees may experience complete defoliation which can lead to dieback and mortality of infested hosts. To

track population outbreaks, pheromone traps for FTC were deployed statewide in mid-summer. In 2022, the number of moths per trap averaged 0.15, evidence that populations are continuing to decrease in Vermont following a 2016-2018 outbreak.



Spongy Moth

Vermont experienced significant defoliation from spongy moth caterpillars (*Lymantria dispar dispar*) for the second year in a row in 2022. The current outbreak began with more than 50,000 acres of defoliation in 2021, followed by defoliation of 42,797 acres in 2022. We continue to monitor populations through our long-term (i.e., 30+ years) egg mass plots, and expected to see even greater defoliation in 2022 based on these (an average of 267 egg masses per 1/25 ac. in 2021). A wet spring allowed the activity of the fungus *Entomophaga maimaiga* to increase and resulted in notable caterpillar mortality, which may help explain the reduction in acres defoliated. Defoliation was primarily mapped in the Champlain Valley of western Vermont, although a small number of locations in the Connecticut River Valley (eastern Vermont) were mapped as well. Reports of defoliation were received from Chittenden, Washington, Addison, Rutland, Bennington, Orange, Windham, and Windsor counties. As expected, oak species suffered most of the defoliation, but other hardwoods such as poplar and maple species were affected as well. Caterpillar populations were high enough that non-preferred hosts were targeted in some cases (e.g., spruce, hemlock, pine).

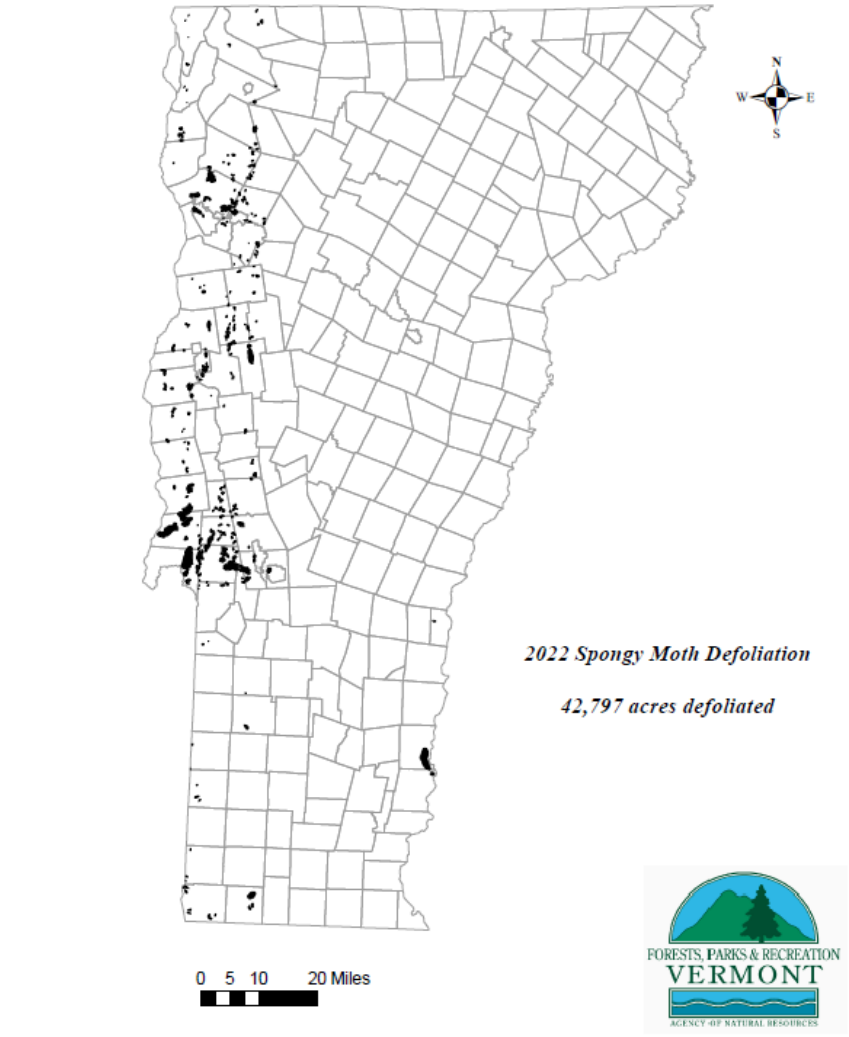
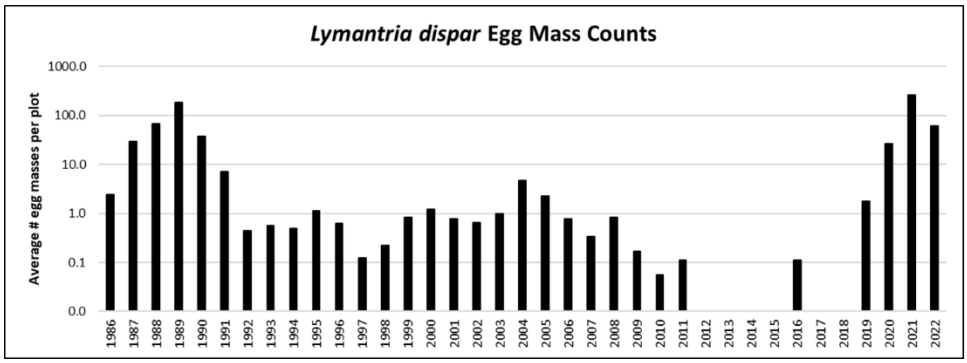


Figure 6. Defoliation by spongy moth caterpillars mapped in 2022. Despite a reduction in total acres defoliated, a total of 42,797 acres were found to have been defoliated in 2022.

Spongy moth egg mass surveys have been completed for 2022 from our 9 long-term monitoring plots, and numbers were found to be lower than 2021 with an average of 60 egg masses per 1/25-acre plot. Although a notable reduction from 2022, this suggests that we are likely to experience some level of defoliation again in 2023.

Table 1. Spongy moth egg mass counts from long-term monitoring plots (*n* = 9) in Vermont.



Hemlock Woolly Adelgid

Hemlock Woolly Adelgid (HWA), *Adelges tsugae*, continues to threaten hemlock trees in southern Vermont, especially in combination with drought and elongate hemlock scale. Traditionally infested sites are still infested, with a new observation in Athens, VT. This town has likely been infested for a number of years but was not included in historic survey efforts. No new towns along the leading infestation edge were observed despite low winter mortality and high population counts. As of 2022, known infested counties include Windham, Windsor, and Bennington counties.

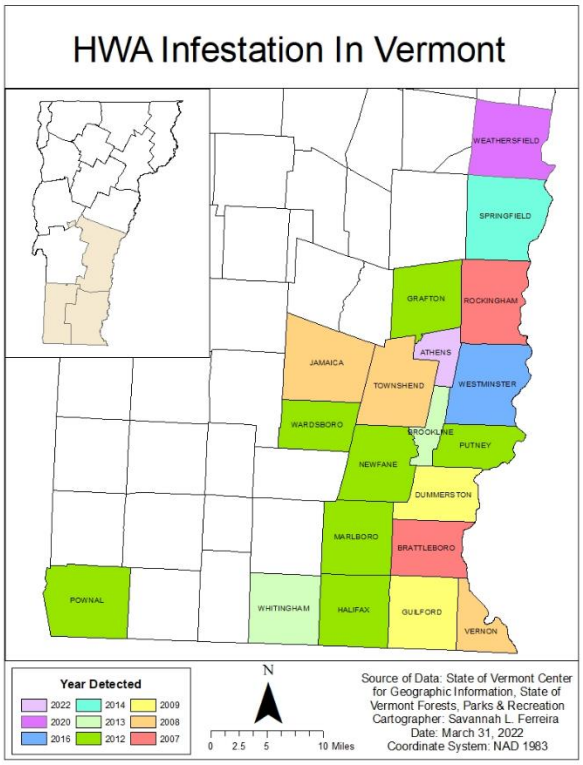


Figure 7. Confirmed locations of HWA in Vermont as of 2022.

We continue to maintain five HWA impact monitoring plots, which will be evaluated in late 2022. Biocontrol efforts continued in 2022 with 1000 wildlings of the predatory beetle *Laricobius nigrinus* released at Fort Dummer State Park this fall. An additional release is pending for late 2022. Follow-up

monitoring in winter and spring had no recoveries of *L. nigrinus*. Reports of hemlock decline and tree mortality began in 2021 and continued in 2022.

Sixty-one percent of the hemlock woolly adelgids (HWA) examined during the annual winter mortality survey were dead. Although winter temperatures were only slightly colder than last year, in February we experienced periods of warming temperatures followed by successive days of deep freezes. This fluctuation could have contributed to winter mortality by killing otherwise surviving HWA before they could reproduce. In the past, we have often found infestations in new locations following years with mild winters and low levels of HWA mortality.

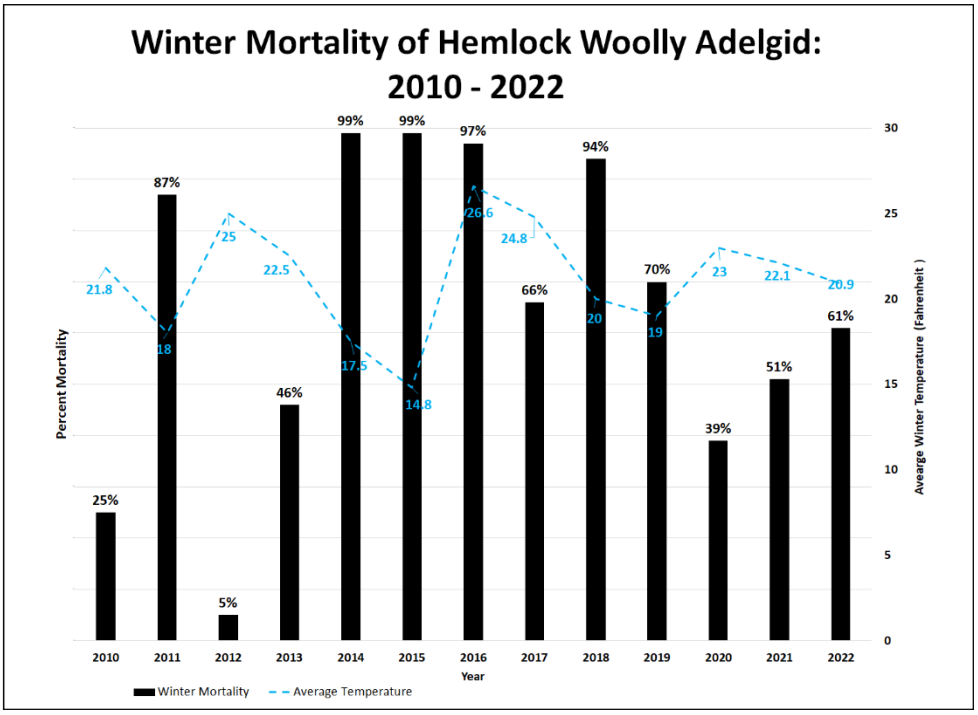


Figure 8. HWA winter mortality (black bars) and average winter temperature (blue dashed line). Data: FPR Staff and Northeast Regional Climate Center.

Spruce Budworm

Spruce Budworms (SBW) are native softwood defoliators of fir, spruce and occasionally larch, pine and hemlocks. In consecutive years of severe outbreaks, trees may experience complete defoliation which can lead to dieback and mortality of infested hosts. In 2022, SBW moth trap catches in Vermont increased to an average of 99.33 moths per trap, compared to an average of 3.70 moths per trap in 2021. Although this increase is not predictive of severe defoliation in 2023, increased survey and monitoring efforts are being planned to track this forest pest. Larval sampling will occur this winter in the areas where pheromone trapping took place, to determine the risk of defoliation in 2023.

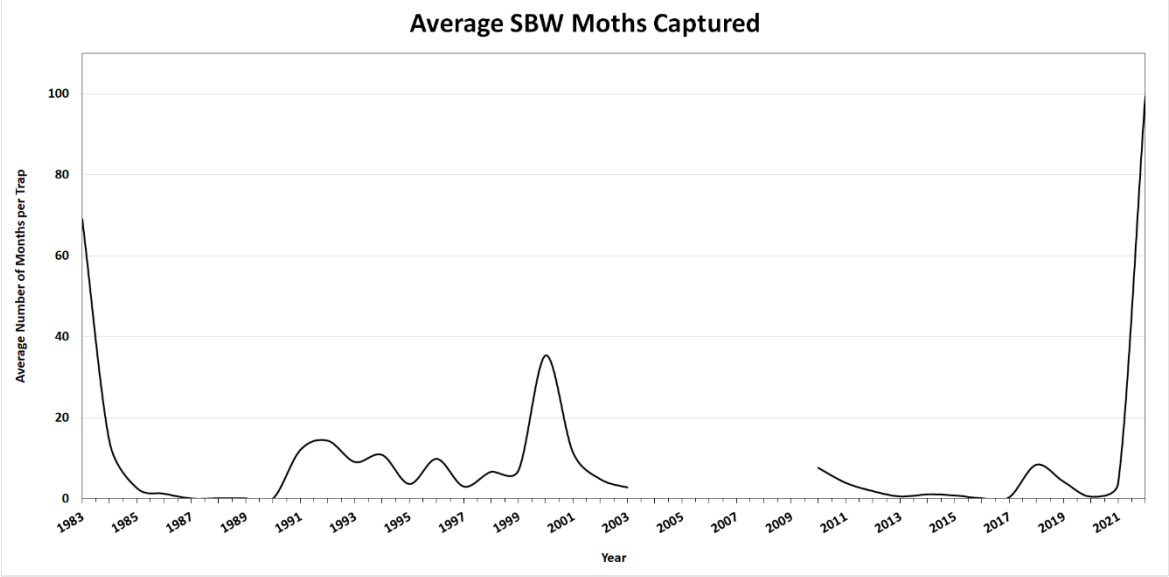


Figure 8. Average number of Spruce Budworm moths per trap over time. Moth numbers in 2022 were the highest recorded since monitoring began.

Saddled Prominent

Saddled prominent (SP) is a hardwood defoliator native to the northeastern United States. Although a native insect, heavy and repeated defoliation can lead to dieback and mortality of infested hosts. Increased reports of defoliation during the growing season of 2020 led to trapping efforts to resume in 2021. However, in 2022 no reports of defoliation were received, nor was any defoliation mapped during Aerial Detection Surveys.

To track population outbreaks, pheromone traps for SP were deployed statewide in late spring. The number of moths per trap averaged 2.15, evidence that populations are decreasing in Vermont compared to 3.30 moths per trap in 2021. We anticipate seeing a decrease in populations of SP in 2023.

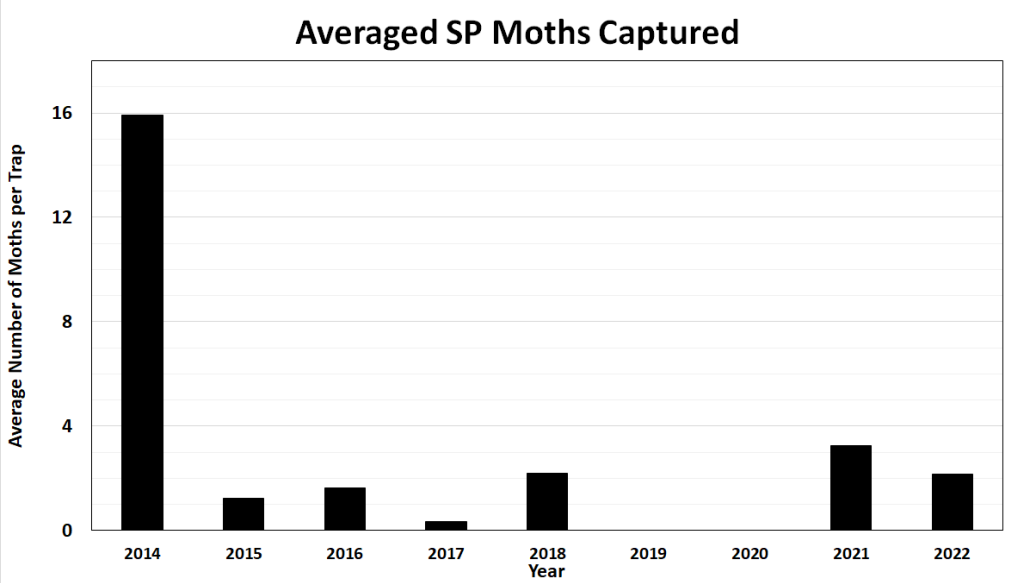


Figure 9. Average number of Saddled Prominent (SP) moths caught per trap. No trapping for SP was conducted in 2019 or 2020.

Oak Wilt

Oak Wilt, caused by the fungal pathogen *Bretziella fagacearum*, is not known to occur in Vermont. Due to recent detections in New York State, Vermont and nearby states are participating in a regional effort to monitor for this pathogen. In Vermont, the primary detection method is outreach, with an estimated 3,300 contacts through newsletters and social media and 531 contacts through workshops in 2022. As a result of this effort, two oak wilt suspects were reported in 2022, however, symptoms were not consistent with oak wilt and no samples were sent for lab testing.

Red Pine Health

Red pine (*Pinus resinosa*) has been in a state of undetermined decline across Vermont over the last decade. Starting in 2010, pests and pathogens observed in declining red pine stands included pine engravers (*Ips pini*), pine gall weevils (*Podapion gallicola*), parasitic woodwasps (family *Orussidae*), armillaria root rot (*Armillaria* spp.), diplodia shoot blight (*Diplodia sapinea*) and Sirococcus shoot blight (*Sirrococcus conigenus*). These observations remained consistent until 2013, with the addition of European pine sawflies (*Neodiprion sertifer*) and in 2015, with the addition of red pine scale (*Matsucoccus resinosae*). In 2017, annosus root rot (*Heterobasidion annosum*) was also observed. Although all biotic stressors are capable of reducing tree health and vigor, no individual pest or pathogen observed was determined to be the causal agent of this decline.

To try and determine the causal agent of this decline, 12 monitoring sites were established and sampled in 2020 to try and observe red pine decline symptoms across the state. Foliar pathogens included diplodia tip blight and sydowia blight (*Sydowia polyspora*). Insect pests observed included pine gall weevil, pine needle scale, and sawflies. Although no single observed stressor was identified to be the causal agent of this decline at this time, current hypotheses are that this declining pattern in red pine health is a combination of abiotic and biotic factors which include severe recent droughts, as well as the

before mentioned insect stressors and fungal pathogens. Plots monitoring is couniting in 2022, with the planned resampling as symptoms progress.

White Pine Needle Damage

White pine needle damage (WPND) is a fungal complex of four different foliar pathogens, *Bifusella linearis*, *Lecanosticta acicola*, *Lophophacidium dooksii*, and *Septorioides strobi*, that have been associated with both needle cast and needle blight on eastern white pine trees throughout Vermont. Although this is an increasingly damaging complex, individually these pathogens are not documented as causal agents of large-scale defoliation. Chlorosis (yellowing) and necrosis (browning) of 1-year-old needles from infected trees have been observed, with heavy infections causing defoliation and dieback. WPND accounted for 4,624 acres of observable damage on white pine trees throughout the state in 2022. Damage was higher than in 2021, with significant yellowing and early needle drop across the state.

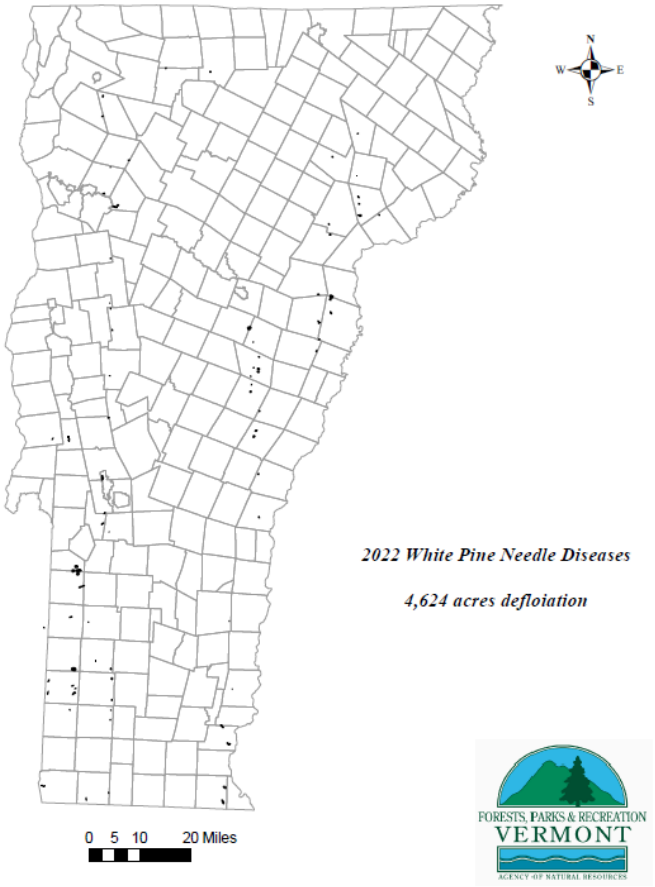


Figure 9. Defoliation from white pine needle disease (WPND) was mapped on 4,624 acres in Vermont in 2022.

The expression of WPND is linked to the amount of humidity and moisture from the previous spring (e.g., 2022 damage is influenced by 2021 weather). Spore production typically peaks in June during shoot elongation. We expect WPND to be present again in 2023, but to be more severe than in recent years due to the wet spring in 2022.

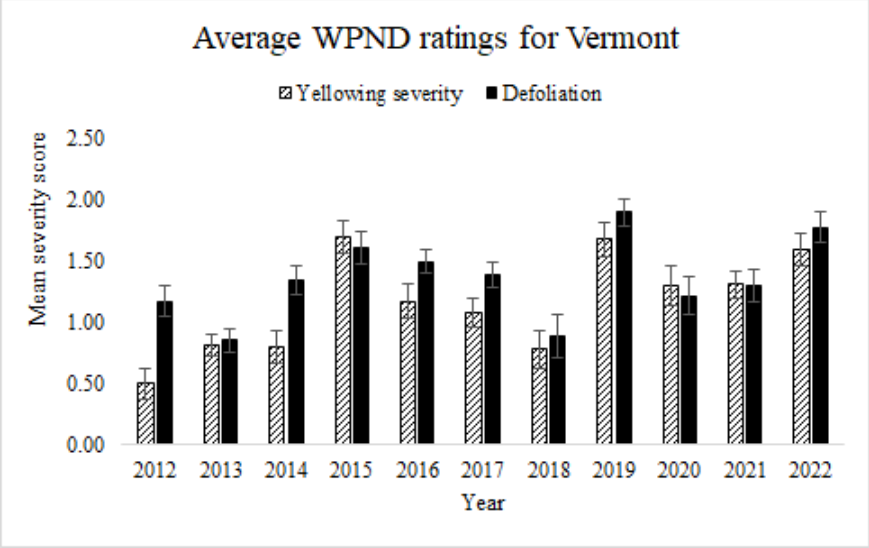


Figure 10. Average chlorosis (yellowing) and defoliation due to white pine needle disease (WPND) in Vermont.

Invasive Plant Programs

The Forest Health Invasive Plant Program (IPP) continued invasive plant management efforts. Research, outreach, and control projects progressed through multiple grant-funded streams.

Since 2014, almost 4,000 volunteers have assisted the program with direct management of invasive plants in Vermont, staff have fielded over 2,000 inquiries, staff have treated over 600 acres of invasive plants on state lands (contractors have treated 180+ acres of invasive plants on state lands), staff created/trained/ and maintain a volunteer network (Forest Hero! Network) of individuals to act as local leaders to motivate their communities to engage in invasive plant management. The IPP moved the training online in 2021, with 11 people completing the training in 2021. In total, 41 people have completed the training.

In 2022, a number of free resources were finalized and published on VTinvasives.org, including a curriculum and Youth Volunteer guide with associated teaching materials and activities, a “train the trainer” model for communities to develop their own versions of the Forest Hero! Network to engage and support local champions, digitized versions of the IPP outreach kits, a digital field guide on 12 common invasive plants in Vermont, and updated factsheets and treatment information for 11 species of invasive plants.

Also in 2022, the IPP began year one of a long-term phenology monitoring project of three invasive plants. Project sites are located throughout the state, overlapping with existing fire danger rating areas, to give representation to the various climatic and topographical differences across the landscape of Vermont. Data can be viewed through the National Phenology Network’s data visualization tool.

Figure 13. Observers recording phenophase data for invasive honeysuckle and buckthorn as part of the Vermont Invasive Plant Phenology Project, a project run by FPR in collaboration with the National Phenology Network.