

dcr Massachusetts Forest Health Update 2022

Massachusetts



Dept. of Conservation and Recreation
Forest Health Program

2022 Aerial Survey

54,687 Total Acres



30,895 acres

Spongy moth hardwood defoliation



6,213 acres

Mortality and dieback from emerald ash borer



5,999 acres

White pine needle damage



3,709 acres

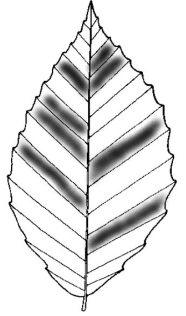
Decline and mortality from red pine scale



2,346 acres

Hemlock decline from multiple pests.

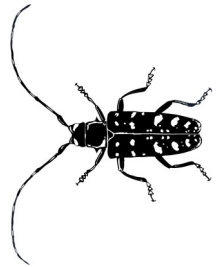
Currently, **93 communities** have confirmed beech leaf disease infections. The disease has rapidly spread throughout the state and is present in all counties. Some areas are already experiencing significant beech decline and mortality.



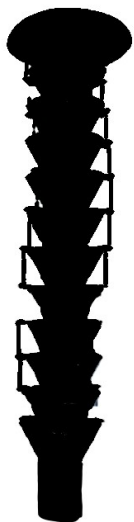
In 2022, **17,548 wasps** were released to control emerald ash borer. Three species of parasitic biocontrol wasp species were released at 5 sites.



300 ALB traps were deployed in and around the Worcester County ALB regulated area. In 2022, no ALB beetles or infested trees were found during survey efforts.



652 hemlock trees at 4 state parks were treated with dinotefuran to control hemlock woolly adelgid and elongate hemlock scale. HWA populations are rebounding following mild winter conditions in recent years.



Southern Pine Beetle Elevated Detections



Southern pine beetle (SPB) detections in Massachusetts increased in 2022 compared to the historically low levels. SPB were caught at 19 of 24 trap sites in spring 2022. This is the highest number of positive sites in a single year. Additionally, SPB were collected in numbers much higher than previous years.

SPB infested trees were confirmed in the state for the first time; two pitch pine with low level infestations were found in Mashpee this summer. Enhanced ground surveys are planned around positive trap sites this winter. And, increased trapping surveillance is planned for spring and fall 2023.



Forest Health Program 2022 Summary

Dept. of Conservation and Recreation
Forest Health Program
November 2022

Massachusetts DCR Forest Health Program Story Map

In January 2022, The DCR Forest Health Program released a Story Map to share information in an easily accessible and publicly available format. The story map highlights some of the work the DCR Forest Health Program does throughout the year, as well as, providing information about major diseases and pests afflicting Massachusetts forests. Each forest health concern has its own section with details on how to identify it, the lifecycle and host trees, and current detection maps. The story map also includes interactive maps of our two most recent years aerial survey results. To see up to date information and maps throughout the year, please visit our DCR Forest Health Program Story Map at <https://arcg.is/j8TiD>.

Aerial Survey Results

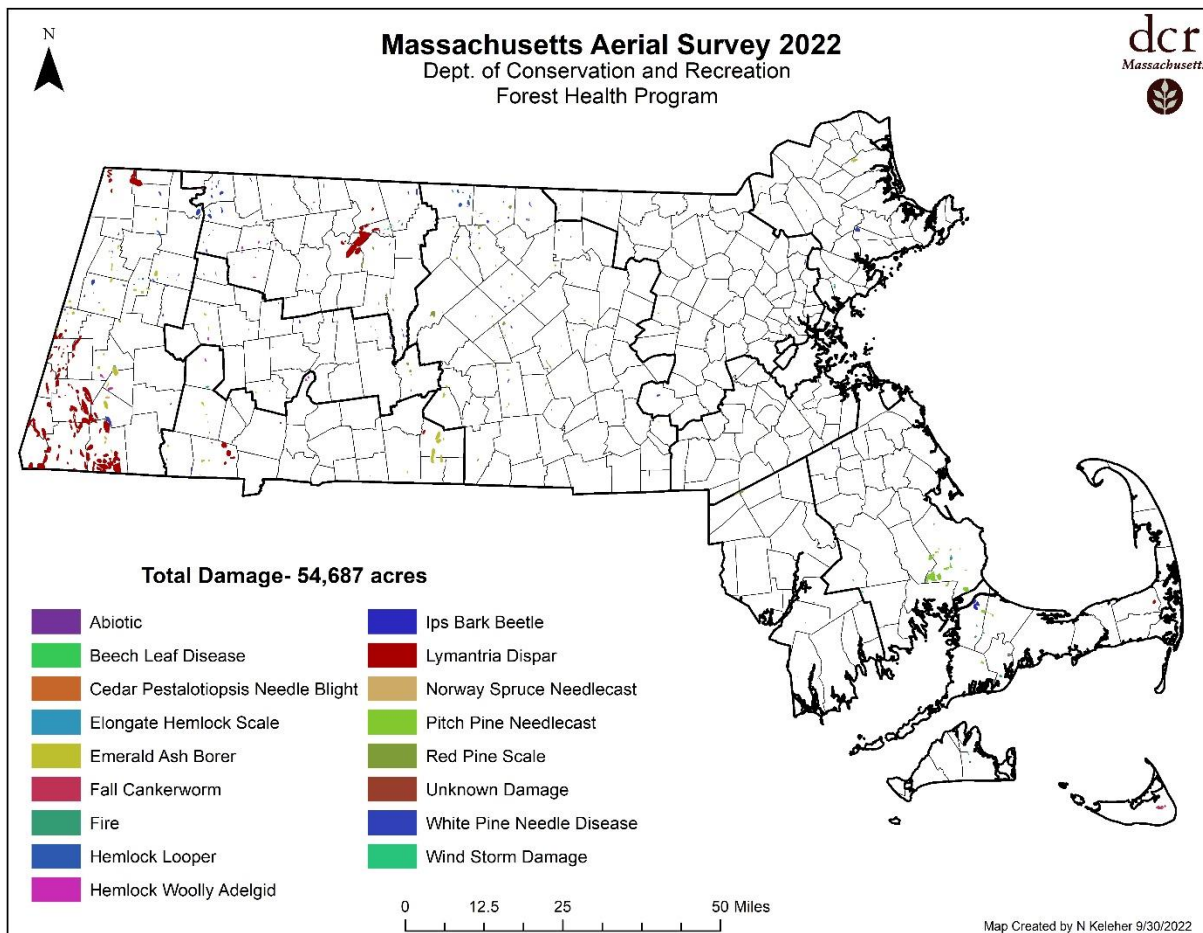


Figure 1. DCR Forest Health Program aerial survey results 2022.

The Forest Health Program completes an aerial survey each year to identify any significant forest damage events. Data collected helps highlight insects or disease of concern and guide field work in the upcoming year. This year, the aerial survey was completed between 6/27/22-7/1/22. The flights were timed to capture the peak impact of spongy moth defoliation and pine needle damage. Two members of the Forest Health team record data from a small aircraft using tablets. Mapped forest damage was ground truthed by Forest Health staff in July and August 2022. Foresters assess all mapped areas to identify the damage causing agent, the host trees impacted, and the severity of the impact.

Beech Leaf Disease

Beech leaf disease (BLD) was first found in Massachusetts in 2020 in Plymouth, MA. Since that time, BLD has been confirmed in all Massachusetts Counties. BLD has been detected in 72 new communities in 2022, for a total of 93 communities with confirmed infections. Infected communities have been detected through ground surveys performed by DCR Forest Health staff and from public reports. Foresters confirm all new community reports through site visits involving symptom identification and foliage sampling. The forest health program was flooded with public reports, questions, and concerns throughout the spring and summer; we received the highest numbers of calls and emails in June.

Beech leaf disease in Massachusetts has been observed in American beech and European beech trees and is affecting both our forested and urban trees. Symptoms have been seen in trees of all size classes, from seedlings to large mature trees. At some sites, the disease progression is advanced and impact very severe. Foresters identified multiple sites where infection was so severe that nearly all buds aborted and only thin, secondary flush foliage was present. There has been individual tree mortality likely attributed to BLD.

Much is still unknown about the disease.

The disease complex is associated with a foliar nematode species, *Litylenchus crenatae*, however, we do not yet know how it is spreading and infecting new areas. Additionally, the disease progression and timeline for decline is still not well understood. There are currently no officially approved treatment methods.

American beech in Massachusetts also suffer from beech bark disease (BBD). This disease has been devastating to our mature beech forests. Decline from BBD peaked in the second half of the 20th century, but we still occasionally map pockets of mortality during aerial survey. We do not yet know what the combine impact of BBD and BLD will be on our forest beech resources.

The DCR Forest Health Program participated in a regional BLD monitoring effort. Permanent monitoring plots were established in 2021 and once again assessed in 2022. Monitoring plot surveys were complete at 11 sites across the Commonwealth in June and July of 2022; foresters collected data on site composition, tree health metrics, and severity of BLD leaf symptoms. Results from these efforts will help



Figure 2. BLD infected American beech tree exhibiting severe symptoms including aborted buds and darkened, withered leaves. Plymouth, MA; June 2022

provide us with more information about how beech leaf disease progresses in our forests and the impact it will have on our beech resources.

Table 1. BLD Monitoring plot sites 2022.

Site	Town	County	Initial Status	Current Status
Destruction Brook Conservation Area	Dartmouth	Bristol	Infected	Infected
Bradley Palmer State Park	Topsfield	Essex	Infected	Infected
Erving State Forest	Erving	Franklin	Uninfected	Uninfected
Tolland State Park	Tolland	Hampden	Uninfected	Infected
DAR State Forest	Goshen	Hampshire	Uninfected	Infected
Holyoke Range State Park	Amherst	Hampshire	Uninfected	Infected
Middlesex Fells State Reservation	Medford	Middlesex	Uninfected	Infected
Blue Hills State Reservation	Quincy	Norfolk	Infected	Infected
Morton Town Park	Plymouth	Plymouth	Infected	Infected
Boynton Town Park	Paxton	Worcester	Infected	Infected
York Lake State Forest	Sandisfield	Berkshire	Infected	Infected

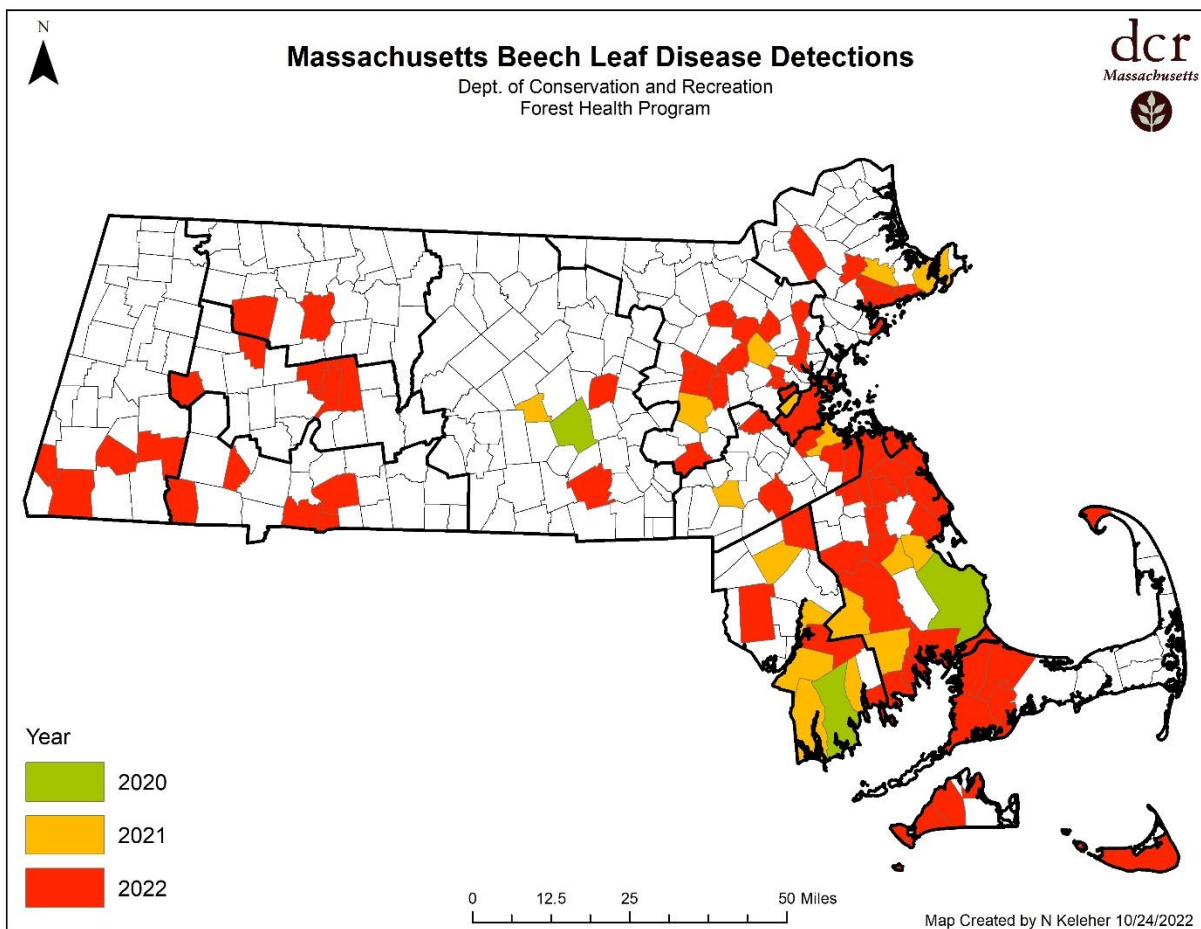


Figure 3. Massachusetts communities with confirmed beech leaf disease infections.

Emerald Ash Borer (Agrilus planipennis)

Emerald ash borer (EAB) is present in nearly all ash resources in Massachusetts. At this time, EAB has been detected in 11 Massachusetts Counties in a total of 256 communities. EAB was detected in 41 new communities in 2022. The EAB population density is high through all impacted counties, and we are observing significant ash mortality across the state. Approximately 6,213 acres of ash mortality and dieback were mapped during the annual aerial survey. But this is just a fraction of the impact across our landscape. This method only captures a small glimpse of ash mortality due to the limitations of aerial survey to detect the low percent ash component common in many areas of Massachusetts. The removal of declining ash continues to pose a public safety risk and financial burden for many communities and landowners.

The Forest Health Program has taken a step back from active EAB detection surveys. New community detections are driven by public reports. Forest Health Program staff visit suspicious report sites and confirm EAB presence through visual inspections and bark peeling. The Forest Health Program has continued to receive reports year-round from homeowners, other state programs, town representatives, and green industry professionals. Areas without confirmed EAB populations at this time are typically locations that have limited ash trees present, most of these communities have forest types where ash is not a common component of the ecosystem.

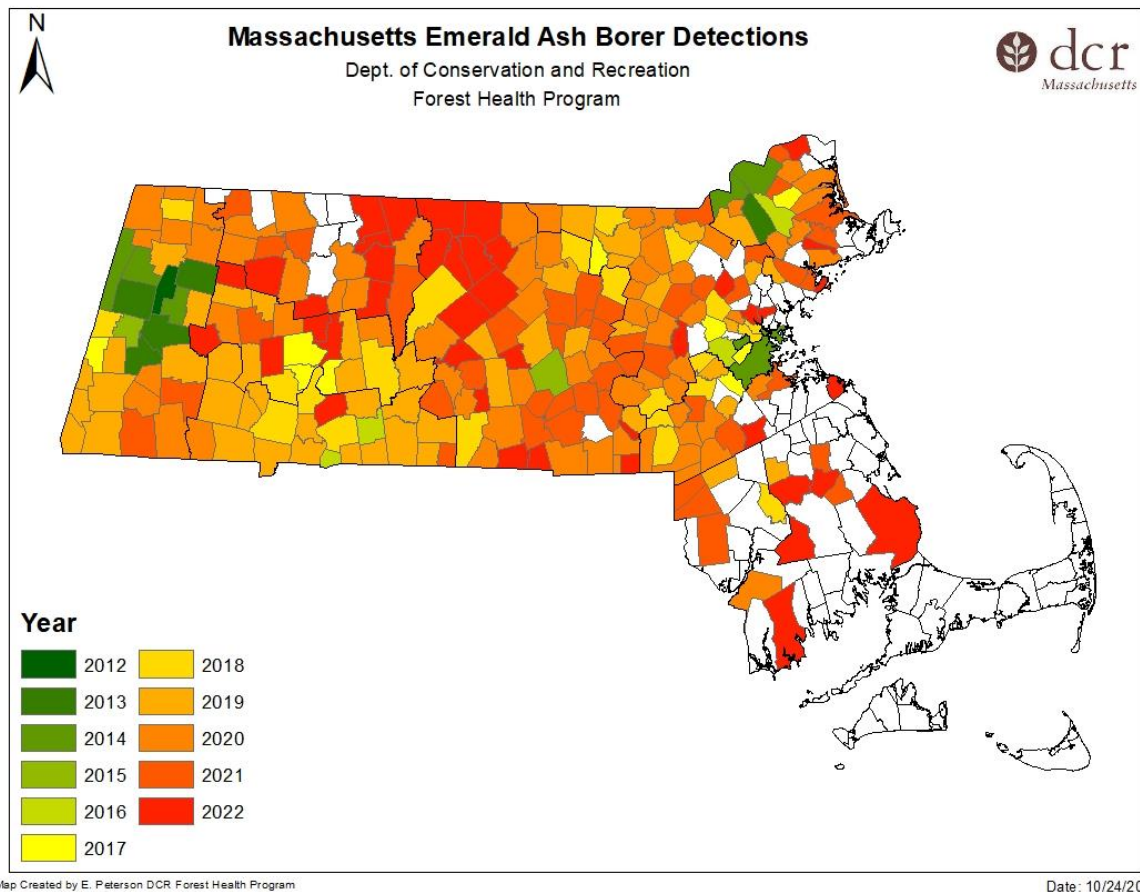


Figure 4. Massachusetts communities with confirmed EAB infestations.

In an effort to slow EAB population spread and growth, the Forest Health Program is part of the national effort to establish EAB host specific parasitic wasp biocontrol species. The Forest Health

Program receives parasitoids from the USDA APHIS rearing facility in Brighton, MI. Three species were released in Massachusetts in 2022: *Spathius galinae*, *Oobius agrili*, and *Tetrastichus planipennis*. Biocontrol species were released at 5 sites in 2022: Reading (Middlesex County), Oakham (Worcester County), Plainville (Norfolk County), West Bridgewater (Plymouth County), and Charlemont (Franklin County). For all sites, these were second- and third-year supplemental releases at a previous release site. All releases occurred between 6/1/2022 and 9/7/2022, release timing for each species depends on growing degrees days and EAB typical development at our latitude, as well as, rearing lab availability.

Table 2. DCR Forest Health Program EAB biocontrol release summary 2022.

Site	Town	County	<i>O. agrili</i>	<i>S. galinae</i>	<i>T. planipennis</i>
Camp Curtis Guild	Reading	Middlesex	1,200	1,433	0
Hockomock Swamp WMA	West Bridgewater	Plymouth	1,200	1,455	0
Mohawk Trail State Forest	Charlemont	Franklin	1,200	1,432	0
Plainville Conservation Area	Plainville	Norfolk	1,200	1,429	4,379
Ware River Watershed	Oakham	Worcester	1,200	1,420	0
2022 Release Total			6,000	7,169	4,379

Spongy Moth (Lymantria dispar)

The invasive insect *Lymantria dispar* underwent an official common name change in 2022. The organization responsible for insect common names, the Entomological Society of America, implemented the new name of spongy moth for the pest formerly known as gypsy moth. This change has been accepted and recognized by Massachusetts state agencies and will be used in all documents and publications going forward.

Spongy Moth has experienced a population resurgence in Western Massachusetts. Large areas of severe defoliation were observed in spring 2022 in Berkshire and Franklin Counties. Smaller pockets of defoliation were identified in Hampden, Hampshire, and Barnstable Counties. Statewide, 30,895 acres of defoliation were mapped during aerial survey efforts. This vivacious caterpillar feeder has a long history of forest disturbance in Massachusetts, but large-scale outbreaks have been infrequent and short lived on our western landscape. Historically, *L. dispar* outbreaks in Western Massachusetts have been less damaging than the impact of the pest in the eastern part of the commonwealth. However, a changing climate may alter the population dynamics in our forests.

Cool spring conditions this year caused late leaf out for oaks through many areas in Western Massachusetts. There was hope this deviation from normal timing would limit feeding options and decrease success for newly hatched spongy moth. But the caterpillars were able to successfully feed on other hardwood species and move onto the oaks once leaves emerged.

There were some public reports of areas with severe caterpillar mortality events from the fungal pathogen *Entomophaga maimaiga*. However, across the defoliated area we did not see a widespread pathogen impact. There was also minimal population impact from predators, parasites, and other diseases.



Figure 5. Spongy moth caterpillar hatch. Williamstown, MA; May 2022.

We observed high rates of pupation and maturation to the adult moth life stage this summer. The Forest Health Program is working on completing an extensive spongy moth egg mass survey to identify areas at risk of defoliation in 2023. Winter egg mass surveys are used to assess reproductive success and potential population densities next spring. Foresters survey randomized sampling points in locations with either detected defoliation in the last three years or historic high-risk areas that have frequently experienced outbreak reoccurrence.

Results from the egg mass survey are expected to be ready in February 2023. However, with the observations of this year's outbreak, we are expecting significant impact from spongy moth in 2023. We are anticipating severe defoliation once again in Berkshire County, Franklin County and communities in western Hampden and Hampshire Counties.



Figure 5. Spongy moth defoliation observed during annual aerial survey. Franklin County; June 2022.

Fall Cankerworm (Alsophila pometaria)

Fall cankerworm is a native caterpillar defoliator that has occasional population outbreaks that cause significant damage to hardwood forests in Massachusetts, particularly oaks in our eastern coastal areas. It is an early season feeder (the “fall” in the name refers to when the adult moths emerge) that feed as caterpillars on leaves shortly after emergence.

There has been an ongoing outbreak in Nantucket County since 2018 which has impacted the oak shrub barrens of the island’s interior. The population seems to be decreasing, but fall cankerworm still caused pockets of notable defoliation in 2022. The defoliated area was decreased from previous years and less severe. Collaborators have confirmed that the ongoing pressure from this outbreak event has caused tree mortality. Forest Health staff will assess stand impact and population density in the spring of 2023.



Figure 6. Comparing 2021 (left) and 2022 (right) oak defoliation caused by fall cankerworm. Nantucket, MA; June 2022.

Hemlock Woolly Adelgid (Adelges tsugae) and other Hemlock Pests

Hemlock woolly adelgid (HWA) is a persistent pest to eastern hemlocks statewide. HWA has been identified in all Massachusetts counties and in all communities with significant hemlock resources. However, the population has greatly fluctuated over the last three decades. HWA is vulnerable to the harsh winter conditions in New England. Population densities crash during cold winters or years with extreme temperature changes and build in mild or warm winters. HWA is bivoltine and parthenogenic, the population can and will rebound quickly in a year with ideal conditions.

Following several mild winters, HWA population densities remain high across the state in 2022. The DCR Forest Health Program tracks HWA population densities across the state and monitors population trends through winter and summer sisten generation mortality surveys. This year, we observed levels of winter HWA mortality lower than typical for the region. There was an average HWA winter mortality rate of 47% across 15 sites surveyed in February 2022.

In addition to HWA, hemlocks in Massachusetts are commonly impacted by the invasive pest elongate hemlock scale (*Fiorinia externa*; EHS). EHS has become prevalent in hemlocks statewide and is causing widespread needle damage. HWA stress on trees fluctuates with the highly climate influenced pest populations and provides the trees periods of recovery in low HWA density years. However, EHS stress appears to be more persistent year after year once a stand becomes infested. In 2022, 264 acres of hemlock decline was attributed to elongate hemlock scale. But hemlock stand decline and mortality is observed in the highest rates in stands with HWA and an additional stressor, such as EHS, fungal pathogens, or drought.

Targeted pesticide treatment program is implemented by the Forest Health Program in ecologically and culturally significant eastern hemlock stands on state forests to reduce infestation levels of hemlock woolly adelgid and elongate hemlock scale. Treatments occur at 12 sites across the state on a 3-year rotating schedule. In 2022, a total of 652 trees were treated at four DCR State Forests. Hemlocks at Mt Wachusett State Reservation, Tolland State Forest, Purgatory Chasm State Reservation, and Walden Pond State reservation were treated with dinotefuran this May. Two application methods were used. The majority of trees were treated with a basal bark spray (Safari applied at rate of 20oz product / gallon of solution). For hemlock trees close to water resources, they were treated with direct trunk injections (Dinocide applied at a rate of 2 oz product/ inch of DBH). All treatments were completed by a contractor selected through the competitive bid process. All treated trees are numbered, tagged, and locations information collected.

Table 3. Summary of hemlock treatments performed by DCR Forest Health Program in 2022.

Site	DBH	Trees	Area
Mt Wachusett State Reservation	1,842 inches	100 trees	2 acres
Purgatory Chasm State Reservation	3,658 inches	231 trees	7 acres
Tolland State Forest	3,860 inches	186 trees	21 acres
Walden Pond State Reservation	2,790 inches	135 trees	9 acres
2022 Total	12,150 inches	652 trees	39 acres

Tree growth, health metrics, and pest population density values were collected by forest health staff in a subset of treated hemlocks and untreated control trees. The survey is completed at the end of the growing season each year, after HWA sisten generation break aestivation, at all sites that have been treated in the last three years. The survey results allow us to assess and quantify the beneficial impact of treatments on overall hemlock health.



Figure 7. Forest Health Specialists surveying hemlock stands for biocontrol species. Sutton, MA; October 2022

The DCR Forest Health Program has worked to establish biocontrol species to mitigate the impact of HWA. Predatory beetles *Sasajiscymnus tsugae* and *Laricobius nigrinus* had been released in numerous sites previous years. In 2022, 500 *L. nigrinus* were released at Federated Women’s Club State Forest. This was a secondary release to supplement the population of beetles released in 2020. Additionally, two new biocontrol species were releases in the state in 2022, *Laricobius osakensis* and *Leucopis spp.* DCR Forest Health Program released 500 *L. osakensis* at Mt Tom State Reservation in Holyoke, MA and UMass Amherst researchers released 500 at Mt Toby in Sunderland, MA in October 2022. The *L. osakensis* and *L. nigrinus* beetles were provided

from the Virginia Tech rearing lab with facilitation by the U.S. Forest Service. UMass Amherst released *Leucopis spp.* at 5 sites in the spring of 2022. These biocontrols were provided by the rearing lab at Cornell University.

In Massachusetts, there has been limited recovery or confirmed establishment of the HWA biocontrol species. The Forest Health Program continues to monitor hemlock stands where *Sasajiscymnus tsugae* and *Laricobius nigrinus* predators were previously released. A foliage collection method was used at 3 sites in the spring to survey for larval predators. Beat sheeting survey method was used at 18 sites in the fall when conditions are favorable for adult beetles to be active and feeding. No predators were recovered in 2022.

There was a hemlock mortality event this year in northern Franklin and Worcester Counties attributed to the native caterpillar hemlock looper (*Lambdina*



Figure 8. Hemlock mortality damage caused by hemlock looper feeding. Winchendon, MA; July 2022

fiscellaria). Hemlock looper feeding in spring/summer caused severe defoliation and eventual mortality throughout hemlock stands. Some areas experienced a near total loss of all understory and midstory hemlocks and loss of a significant number of mature overstory trees. This looper population has been building and expanding for the last three years, and we expect to see feeding once again in 2023.

Red Pine Scale (Matsucoccus matsumarae)

Statewide, the Forest Health Program continues to observe the rapid decline of red pine stands caused by red pine scale. Large areas of mortality and crown discoloration in red pine plantations are being mapped annually; a total of 3,709 acres of red pine scale damage was detected in 2022. All counties with substantial red pines stands are impacted by this insect.

Due to most red pine resources being plantation style stands that have received minimal management, many red pine stands also exhibit symptoms of needle and root fungal pathogens that create a severe decline complex. Forest health staff collect foliage samples and analyze red pine scale densities when requested by DCR foresters, park staff, or other resource managers.



Figure 9. Declining red pine stand at Howe State Park, Spencer, MA; September 2022.

Southern Pine Beetle (Dendroctonus frontalis)



Figure 10. Pitch tubes visible on SPB infested pitch pine. Mashpee, MA; August 2022

Concern about the expanding range of Southern Pine Beetle (SPB) has increased with the looming threats of climate change. Devastating SPB outbreak levels in New York state in 2014 prompted New England states to begin monitoring efforts to enhance early detection and response capabilities. SPB has been detected in Massachusetts through trapping surveys since 2015. Adult beetles had been caught in low numbers across the state in pitch pine stands from 2015-2019. The DCR has continued to monitor for this pest but was unable to complete trapping surveys in 2020 and 2021.

The DCR Forest Health Program was able to resume trapping efforts and deployed SPB traps at 24 sites in 2022. The survey utilized black 12-funnel lindgren survey traps with wet collection. The traps were baited with Frontalin lure, alpha pinene lure, and Endo-brevicomin lure. Trap collection results produced the highest levels of SPB ever detected in Massachusetts. A total of 19 sites had SPB in the trap catch. The number of beetles caught at each site was much higher than previous years efforts.

SPB infested trees were identified for the first time in Massachusetts this year. Two pitch pine near a trap site in

Mashpee were confirmed to be infested with SPB. DCR Forest Health Program staff noticed multiple pitch tubes on the trees in June 2022. Samples were taken from the trees and SPB were found within the pitch and tunnels. It was determined to be a low-level infestation, each tree had less than 10 visible pitch tubes and there was no noticeable decline or other damage. In an abundance of caution, both trees were removed and destroyed in October 2022 by the DCR Forest Health hazard tree crew.

While the results of this year’s SPB surveys are concerning, we are not yet at the levels of an outbreak event. Proactive monitoring, development of response plans, and the ability to take swift action will help protect our pitch pine resources from this forest pest. Enhanced surveys are planned to help identify other potentially infested pitch pine trees. This fall and winter, Forest Health field staff will be completing visual ground surveys in buffers around all positive trap locations. Furthermore, we will be expanding our trapping efforts in 2023. The Forest Health Program will add additional sites and a second round of trapping in the fall. Final site locations will be dependent on winter ground surveys, site scouting, and stand risk.

Table 4. DCR Forest Health SPB trap survey results 2022.

Trap Number	Site	Town	County	SPB
MA-SPB-2022-01	Joint Base Cape Cod	Bourne	Barnstable	Yes
MA-SPB-2022-02	Joint Base Cape Cod	Bourne	Barnstable	Yes
MA-SPB-2022-03	Nickerson State Park	Brewster	Barnstable	Yes
MA-SPB-2022-04	Nickerson State Park	Brewster	Barnstable	No
MA-SPB-2022-05	Nauset Light Beach	Eastham	Barnstable	Yes
MA-SPB-2022-06	Frances Crane WMA	Falmouth	Barnstable	Yes
MA-SPB-2022-07	Mashpee Pine Barrens WMA	Mashpee	Barnstable	Yes
MA-SPB-2022-08	Quashnet Woods WMA	Mashpee	Barnstable	Yes
MA-SPB-2022-09	Beech Forest Trail	Provincetown	Barnstable	No
MA-SPB-2022-10	Shawme-Crowell State Forest	Sandwich	Barnstable	Yes
MA-SPB-2022-11	Pilgrim Heights	Truro	Barnstable	Yes
MA-SPB-2022-12	Wellfleet Bay Wildlife Sanctuary	Wellfleet	Barnstable	Yes
MA-SPB-2022-13	Marconi Beach	Wellfleet	Barnstable	No
MA-SPB-2022-15	Freetown-Fall River State Forest	Fall River	Bristol	Yes
MA-SPB-2022-16	Horseneck Beach State Reservation	Westport	Bristol	Yes
MA-SPB-2022-17	Manuel Correllus State Forest	Oak Bluffs	Dukes	Yes
MA-SPB-2022-18	Long Point Wildlife Refuge	Vineyard Haven	Dukes	Yes
MA-SPB-2022-19	Manuel Correllus State Forest	Vineyard Haven	Dukes	Yes
MA-SPB-2022-20	Montague Plains WMA	Montague	Franklin	No
MA-SPB-2022-21	Nantucket State Forest	Nantucket	Nantucket	Yes
MA-SPB-2022-22	Lost Farm Wildlife Sanctuary	Nantucket	Nantucket	Yes
MA-SPB-2022-23	Head of the Plains	Nantucket	Nantucket	Yes
MA-SPB-2022-24	Myles Standish State Forest	Carver	Plymouth	Yes
MA-SPB-2022-25	Myles Standish State Forest	Carver	Plymouth	No

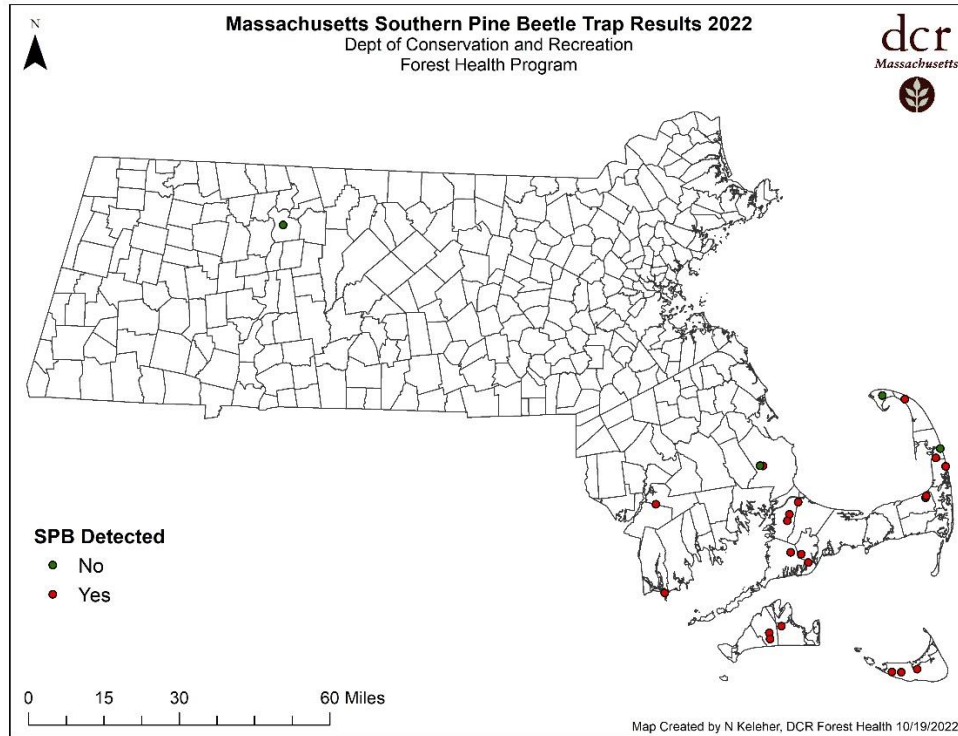


Figure 11. Massachusetts SPB trapping survey results 2022.

White pine decline

Eastern white pine needle damage disease continues to cause a significant impact across our landscape. The high infection rates of fungal needle pathogens have become common in our white pine stands over the last decade. Eastern white pines in all counties of the state suffer from crown discoloration, thinning canopies, and general decline caused by the stress of the fungal needle pathogens.



Figure 12. White pine mortality in Harold Parker Campground. Andover, MA; September 2022.

In 2022, approximately 5,999 acres of white pine stands with white pine needle damage was documented during our aerial survey.

DCR Forest Health staff have identified areas where the persistent stress of the needle cast disease has led to tree decline and eventual mortality. White pines have become more vulnerable to decline caused other stressors, including attack by native pests and pathogens that are typically of minor concern. These instances of white pine mortality have mostly been isolated individual trees on taxing sites (e.g. along roadways, disturbed/ construction areas, soils more vulnerable to drought/ extreme rain events), but we are beginning to observe larger pockets of mortality in historically suitable white pine sites.

DCR Foresters identified a pocket of approximately 25 mature white pines in Harold Parker Campground that all died suddenly during the summer this year. When the site and trees were assessed, it seemed likely that a fungal pathogen was the driver in the decline. Samples were sent to UMass Extension pathologist, Nick Brazee, for analysis and it was determined that

symptoms were caused by black stain root disease (*Leptographium procerum*). The fungus is a native species, widespread in our forests, and usually not a very aggressive but compounding stressors allowed it to infect and kill this stand of pines.

Asian Longhorned Beetle (Anoplophora glabripennis)

The DCR Forest Health Program continues to work in cooperation with USDA APHIS on Asian Longhorned Beetle Eradication efforts in Worcester County. The 110 sq mile quarantine area enforcement remains in all of Worcester, West Boylston, Boylston, and Shrewsbury, and portions of Holden and Auburn. Collaborative DCR and USDA teams complete ground and climbing visual inspection progressive surveys. No infested trees have been found in 2022.

The Asian Longhorned Beetle (ALB) trapping program placed 300 black flight interception traps with wet collection in 2022. Survey strategy was focused on placing traps in model derived high-risk infestation areas and areas of regulatory concern for host material movement. The majority of traps placed within the ALB Regulatory area; approximately 15% of the traps were set outside the regulated boundary. All traps were baited with lures that consisted of Z-3-Hexenol, Linalool, Trans-Caryophyllene, 4-(n-Heptyloxy) Butanol, 4-(n-Heptyloxy) Butanal. No ALB were found in any of the 2022 traps. However, significant and diverse cerambycid bycatch was collected.



Figure 13. ALB trapping team checking survey traps. Worcester, MA; July 2022.

Early Detection Rapid Response Survey

The DCR Forest Health Program participated in the national U.S. Forest Service lead Early Detection Rapid Response (EDRR) program. The goal of the survey is to use lured traps to target bark beetle species. The traps are set in wooded areas near high-risk introduction pathways in the hopes of identifying previously unknown non-native species.

Forest Health staff set traps at 12 sites across the state. Each site had a set of three funnel traps: ethanol lure trap in deciduous hosts, alpha-pinene and ethanol lure trap in conifer hosts, and three-component exotic *Ips* lure trap in conifer host. All trap samples were sent to Forest Service taxonomist Marc DiGirolomo for processing and identification.

The EDRR survey identified 69 total bark beetle species. Of those species collected, 13 were first official detections in Massachusetts: *Ambrosiodmus obliquus*, *Anisandrus maiche*, *Crypturgus borealis*, *Dryocoetes granicollis*, *Hyllocurus rudis*, *Hypothenemus dissimilis*, *Hypothenemus eruditus*, *Hypothenemus interstitialis*, *Hypothenemus rotundicollis*, *Phloeotribus piceae*, *Pseudopityophthorus pruinosis*, *Pseudothysanoes lecontei*, and



Figure 14. *Molorchus minor* specimen collected in EDRR trap. Worcester, MA; August 2022. Credit M.DiGirolomo USFS

Xyleborus bispinatus. There was also a new to North America species detection, one *Molorchus minor* specimen was collected in Worcester, MA. This is a longhorn beetle native to Europe commonly found in declining and weakened conifer trees. None of the species found are of concern at this time.

Deer Browse Impact Survey

The impact of deer browse on forest health and vegetation communities was investigated by DCR Forest Health Program staff at three DCR parks in 2022. A total of 15 plots were assessed in Blue Hills State Reservation, Wompatuck State Park, and Borderland State Park. The three parks are in areas of the state with high density deer population and represent three different deer management regulations. Each park had plots in five significant forest sub-types common to eastern Massachusetts: hemlock-hardwoods, oak-hardwoods, mixed oak, white pine-hardwoods, and white pine-oak.

The site surveys collected information on the forest composition, tree metrics, vegetation species diversity, invasive plant densities, and active browse impact. This data will be used to develop an overall browse impact rating for each forest sub-type at each site. Final data analysis will be completed this winter. This project is valuable in allowing us to better understand long term forest health effects from high density deer populations. We will continue surveys in 2023 and potentially expand to other state parks.

Other Minor Insect and Disease Observations

Throughout the year we observe, or receive reports of, a wide range of native and non-native insects and diseases causing tree damage. Usually, these are isolated pockets of minimal concern. But we do investigate and track these incidences to rule out more alarming issues and monitor trends of these potential threats.

White satin moth (*Leucoma salicis*) has been present in Massachusetts since 1920 but rarely causes significant defoliation. However, there has been an outbreak of white satin moth in Beartown State Forest (Monterey, MA; Berkshire County) since 2020. Over the last three years, we have observed a reoccurring small pocket of approximately 10 acres of defoliation. The white satin moth has primarily been feeding on willow and poplar species along streams and wetland areas with defoliation peaking in June. This year, white satin moth was seen feeding along side spongy moth. Spongy moth are typically more aggressive feeders with wider host range and will out compete the white satin moths.

Browntail moth (*Euproctis chrysorrhoea*) is another invasive defoliator that does not commonly cause notable damage in Massachusetts. It quickly became established, spread, and defoliated our eastern forests following its introduction in the late 1890's, but by the early 20th century the browntail moth population crashed and is now typically limited to small pockets in coastal shrubs. However, the insect has seen a resurgence in Maine where it has been causing widespread defoliation since 2015. There was an increase in public reports of adult browntail moths in summer 2021 in coastal communities in Massachusetts. DCR Forest Health Program staff completed visual winter web surveys to identify any areas of increased browntail moth population and at risk for defoliation. No areas of high web densities were detected from the surveys and no defoliation was identified in the spring or summer.



Figure 15. White satin moth and spongy moth in Beartown State Forest. Monterey, MA; June 2022

Over the last few years, we have been observing and increased occurrence of branch flagging on oaks. The issue is widespread throughout the state and is generally present on a small percent of branches scatter through the impacted trees canopy, occasionally a tree will be heavily impact with nearly all branches experience some levels of flagging. We see these symptoms in all our native oak species though it seems to be more common in Northern red oaks. It is most commonly seen on roadside or other edge oaks, and we begin to see symptoms in early summer. *Diplodia corticola* is the pathogen driving most of these symptoms and damage.

There was notable early season damage to maple leaves caused by pear thrips (*Taeniothrips inconsequens*) in Berkshire, Hampshire, and Hampden Counties. Pear thrips was observed in multiple locations throughout Western Massachusetts, but the highest number of reports came from Mt. Greylock State Reservation and surrounding forests. Most of the damage was light to moderate and did not cause significant harm to the trees.

We may not see the same level of devastating tree mortality that occurred in the 20th century, but Dutch elm disease is still present on our landscape and impacts our remaining American elm trees. The DCR Forest Health Program does treat and prune individual elm trees in DCR parks as needed to protect from the disease. In June 2022, one elm located in Beaver Brook Reservation (Belmont, MA) was treated with trunk injection of propizol.

This fall we received multiple reports from southeastern Massachusetts of large beech blight aphid (*Grylloprociphilus imbricator*) populations. Also known as “boogie woogie aphids”, these insects have a white, waxy coating, aggregate in large numbers on branches, and move when disturbed. We occasionally large numbers in the fall on American beech. Many of the reports were also concerned with the large black spots forming on the ground beneath their beech trees. These spots are sooty mold that grows where the aphid honey dew excrement drops.

Climate Change and Abiotic Damage

Massachusetts’ changing climate is already having direct and indirect effects on forest health. Changes to precipitation patterns and increased storm events cause notable injury to trees and the stress of these events increases their vulnerability to insects and diseases. Warming temperatures put us at risk for new invasive species and alters the impact of those already present. For example, mild winters the last



Figure 16. Windblown trees blocking the campground roadway in Erving State Forest. Erving, MA; July 2022

two years have allowed HWA populations to soar and the damage to hemlocks rapidly rise.

It can be challenging to capture and quantify the impact of climate change on our forests. Often, climate driven damage will be delayed in its observable effects. However, during our annual aerial survey we can detect some areas of abiotic damage including storm damage, fire damage, winter injury, and drought impact. Drought conditions in summer 2022 had a small observable effect but we expect to see lingering decline in future growing seasons caused by the stress. The dry conditions also increased the impact of fire this year, over 612 acres of damaged was caused by a mix of prescribed burns and wildfires in 2022.

A storm that came through central Massachusetts in July 2022 caused a microburst event in Franklin County. Over 120 acres of tree mortality was mapped in Erving and Warwick, MA. The wind event hit Erving State Forest where the campground was heavily impacted by the windblown trees and was closed for the remainder of the camping season. DCR hazard tree crews, fire control staff, and park operations staff provided emergency response to the event. Site hazard mitigation projects will be completed this winter.

Massachusetts Aerial Survey Results 2022

Dept. of Conservation and Recreation

Forest Health Program

Damage Agent	County	Area
Abiotic Damage	Berkshire	107
	<i>State Total</i>	<i>107</i>
Beech Leaf Disease	Bristol	26
	Plymouth	139
	<i>State Total</i>	<i>165</i>
Cedar Needle Blight	Plymouth	39
	<i>State Total</i>	<i>39</i>
Elongate Hemlock Scale	Berkshire	132
	Essex	18
	Hampden	90
	Worcester	24
	<i>State Total</i>	<i>264</i>
Emerald Ash Borer	Berkshire	3,126
	Bristol	30
	Essex	390
	Hampden	2,112
	Hampshire	173
	Norfolk	26
	Plymouth	10
	Worcester	346
	<i>State Total</i>	<i>6,213</i>
Fall Cankerworm	Nantucket	374
	<i>State Total</i>	<i>374</i>
Fire	Barnstable	266
	Dukes	46
	Essex	106
	Norfolk	37
	Plymouth	157
	<i>State Total</i>	<i>612</i>
Hemlock Looper	Franklin	160
	Worcester	680
	<i>State Total</i>	<i>840</i>
Hemlock Woolly Adelgid	Berkshire	406
	Franklin	448
	Hampden	222
	Hampshire	118
	Middlesex	48
	<i>State Total</i>	<i>1,242</i>

Ips Bark Beetle	Barnstable	638
	<i>State Total</i>	638
Lymantria Dispar	Barnstable	163
	Berkshire	24,350
	Franklin	5,094
	Hampden	1,257
	Hampshire	27
	Worcester	4
	<i>State Total</i>	30,895
Norway Spruce Needlecast	Berkshire	154
	<i>State Total</i>	154
Pitch Pine Needlecast	Barnstable	434
	Plymouth	2,848
	<i>State Total</i>	3,282
Red Pine Scale	Berkshire	75
	Bristol	272
	Franklin	598
	Hampden	33
	Hampshire	234
	Middlesex	227
	Norfolk	53
	Worcester	2,218
	<i>State Total</i>	3,709
Unknown Damage	Essex	32
	<i>State Total</i>	32
White Pine Needle Disease	Berkshire	2,059
	Bristol	39
	Dukes	46
	Essex	375
	Franklin	1,523
	Hampden	165
	Hampshire	305
	Middlesex	244
	Norfolk	23
	Plymouth	106
	Worcester	1,114
	<i>State Total</i>	5,999
Wind Storm Damage	Franklin	120
	<i>State Total</i>	120
<i>Total Statewide Damage 2022</i>		54,687