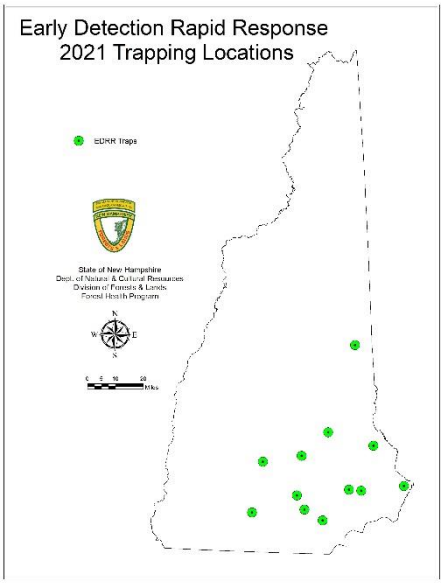
IN THIS ISSUE:

Click on the HYPERLINKS throughout for more information

FIELD SURVEYS

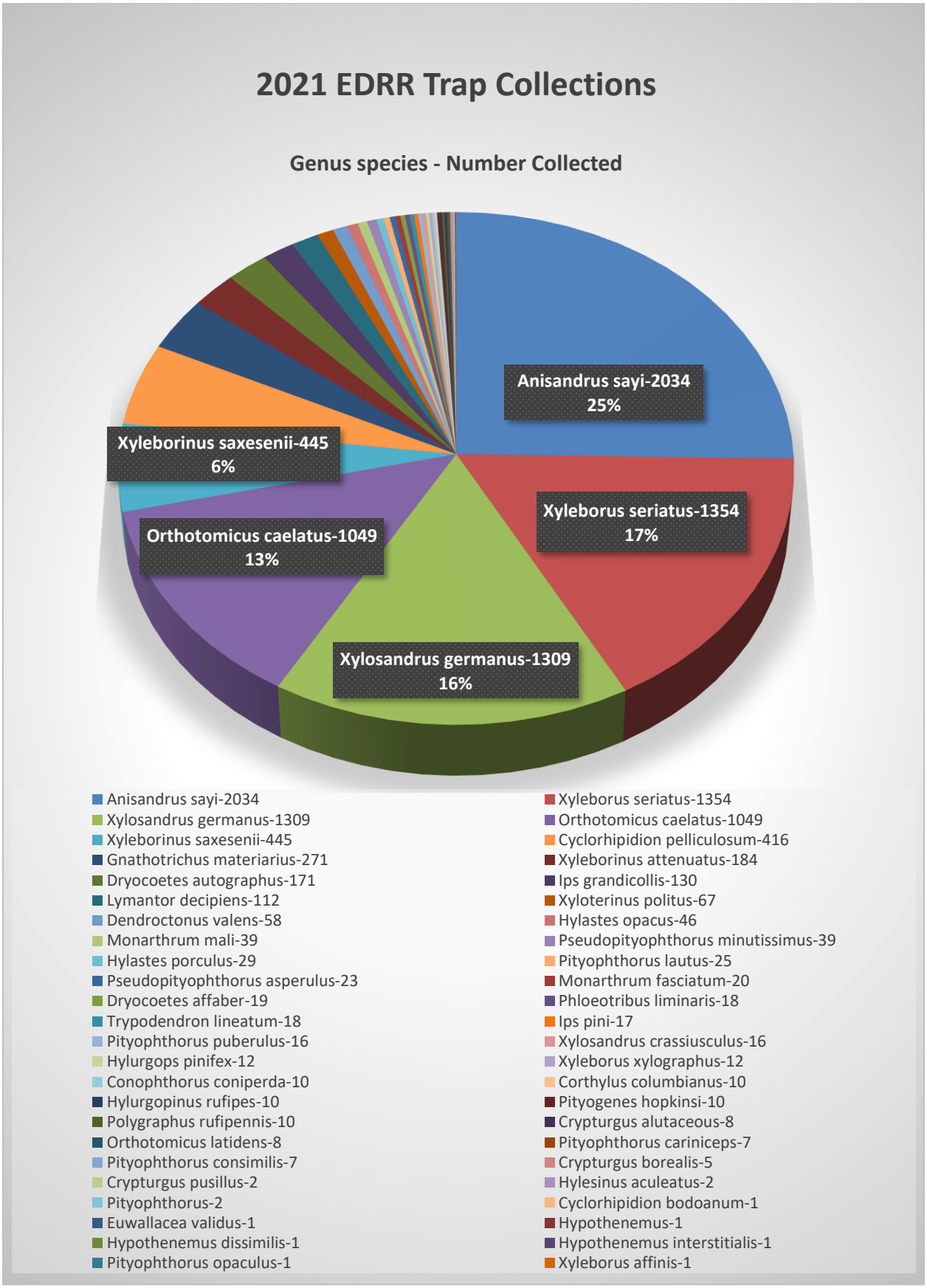
By: Jen Weimer

EDRR



Early summer we participated in a regional Early Detection and Rapid Response (EDRR) trapping effort funded by the USDA Forest Service to detect and monitor newly introduced exotic scolytid beetles at 12 high-risk sites in NH. We collected 8047 Scolytines from 48 species including *Heteroborips seriatus*, which was first found through EDRR in Massachusetts in 2008 and has spread to NH, VT, ME and PA in the last couple of years. There has not been any hosts or tree damage reported for this species yet in North America and they have only been collected in traps. We also trapped *Xylosandrus crassiusculus*, the Granulate Ambrosia Beetle, for the first time in NH. It is an Asian species, first introduced in the south in the 1970's, but has been steadily expanding its range and is now in every eastern state south of NH and as far west as Kansas (with an outlier record in Oregon). It is a serious pest of nurseries and orchards. In addition we trapped two native species for the first time in NH; *Hypothenemus interstitialis* and *Hypothenemus dissimilis*, which are also not considered pest species.

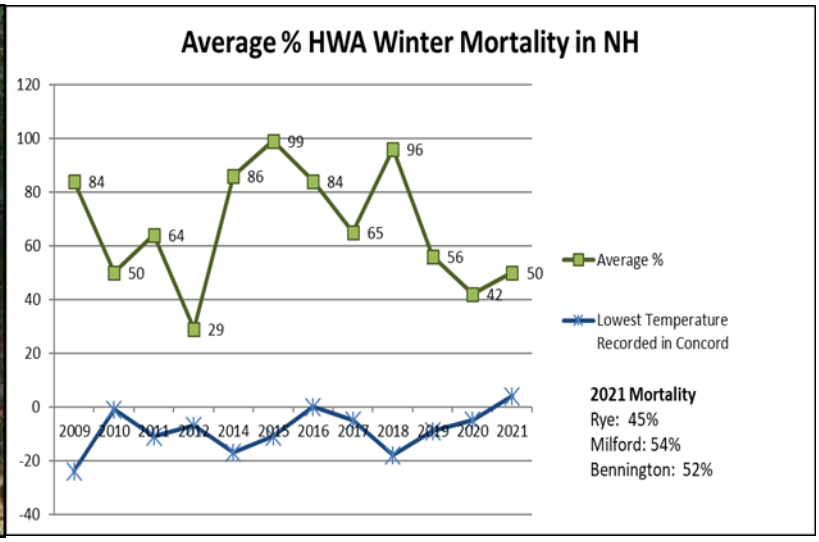
2021 EDRR Trap Collections



Hemlock Woolly Adelgid and Elongate Hemlock Scale

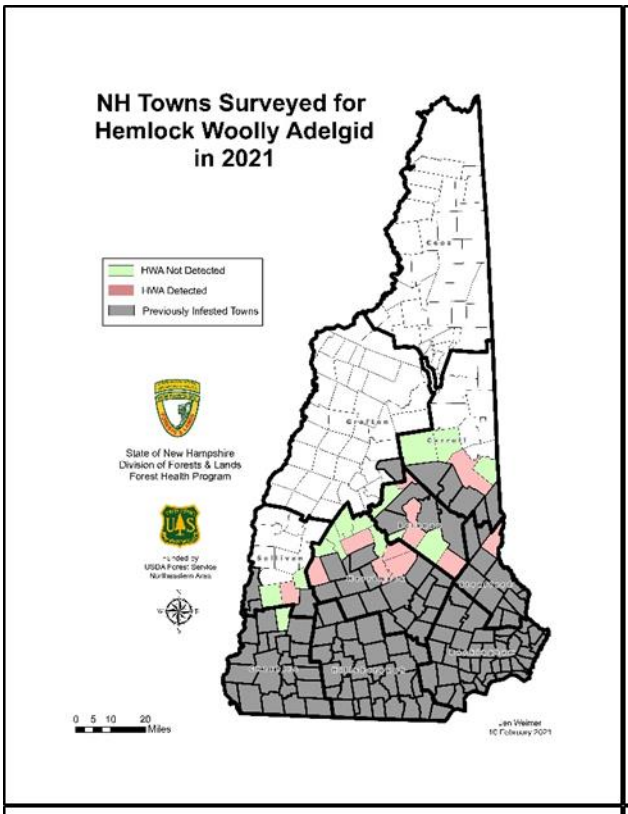
Hemlock Woolly Adelgid (HWA) surveys for 2021 were conducted in 26 towns that border infested areas. Towns surveyed included Marlow, Newbury, New London, Wilmot, Danbury, Hill, Andover, Franklin, Boscawen, Canterbury, Northfield, Tilton, Belmont, Gilmanton, Barnstead, Laconia, New Hampton, Center Harbor, Milton, Ossipee, Tamworth, Sandwich, Effingham, Goshen, Lempster, and Acworth. Infestations were found in Newbury, Andover, Boscawen, Canterbury, Northfield, Belmont, Barnstead, Laconia, Center Harbor, Milton, Ossipee, and Lempster. Landowners in Bristol, Conway, and Jackson made additional reports.

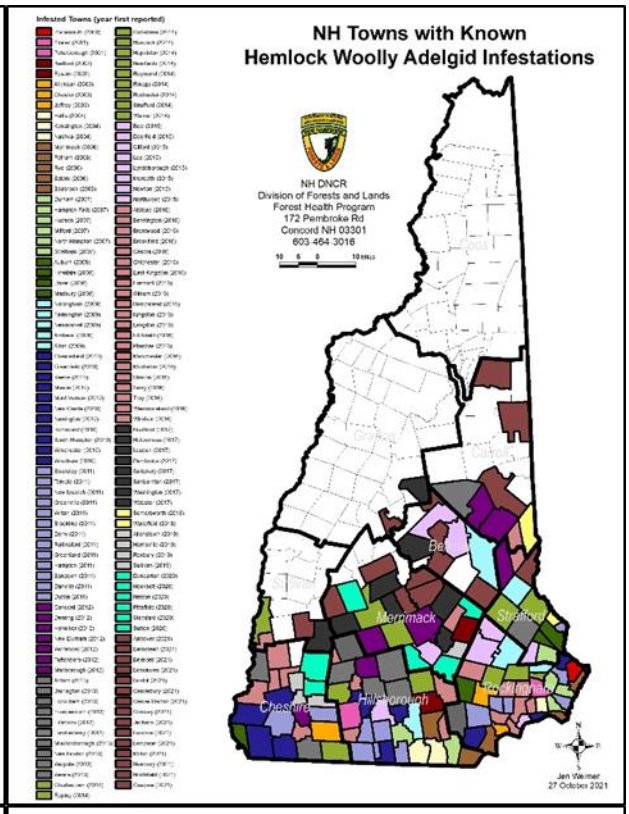
Winter mortality surveys were conducted for HWA at three sites with an average mortality of 50%, which was down from prior years. In addition, larval sampling was done at three sites where *Laricobius nigrinus* (Ln) had been previously released for HWA biocontrol. Ln larvae were recovered at the Durham field insectary. In October, we released 2000 Ln adults at Fox Forest in Hillsborough. Surveys for Ln adults were done at four sites in November. Recoveries were made at the field insectaries in Durham and the Urban Forestry Center in Portsmouth.

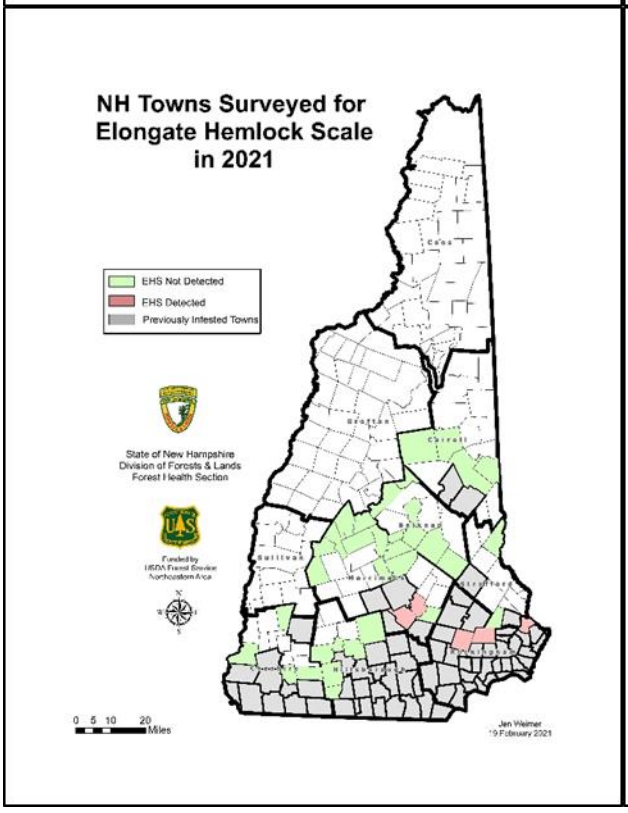


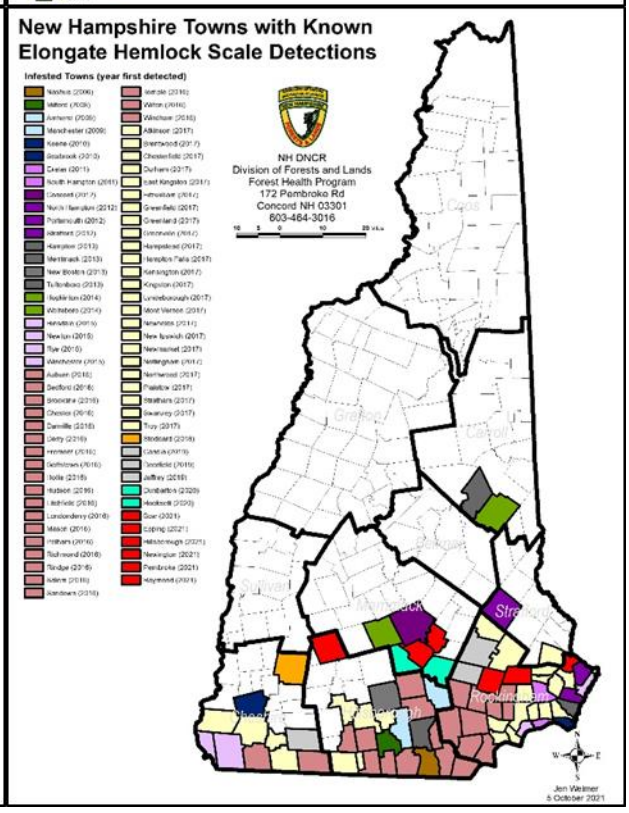
Ln Released at Fox Forest
(Photo: Jen Weimer)

Elongate Hemlock Scale surveys for 2021 were conducted in 42 towns. Towns surveyed included Marlow, Newbury, New London, Wilmot, Danbury, Hill, Andover, Franklin, Boscawen, Canterbury, Northfield, Tilton, Belmont, Gilmanton, Barnstead, Laconia, New Hampton, Center Harbor, Milton, Ossipee, Tamworth, Sandwich, Effingham, Goshen, Lempster, and Acworth, Sharon, Peterborough, Dublin, Marlborough, Westmoreland, Hancock, Bennington, Francestown, Weare, Bow, Pembroke, Allenstown, Raymond, Epping, Lee, and Newington. New infestations were detected in Bow, Pembroke, Raymond, Epping, and Newington. One additional site was later detected in Hillsborough.









Click on maps to enlarge

Sirex noctilio

Late summer we deployed traps at Pawtuckaway State Park for *Sirex noctilio*, an exotic woodwasp, which had been reported by someone doing research in the area last year. We also placed several log samples in barrels taken from dying trees for insect rearing. To date we have not confirmed *Sirex noctilio* at this site. In October, the NH Department of Agriculture trapped and confirmed *Sirex noctilio* in roadside traps in Greenfield and Keene.

Genome Project

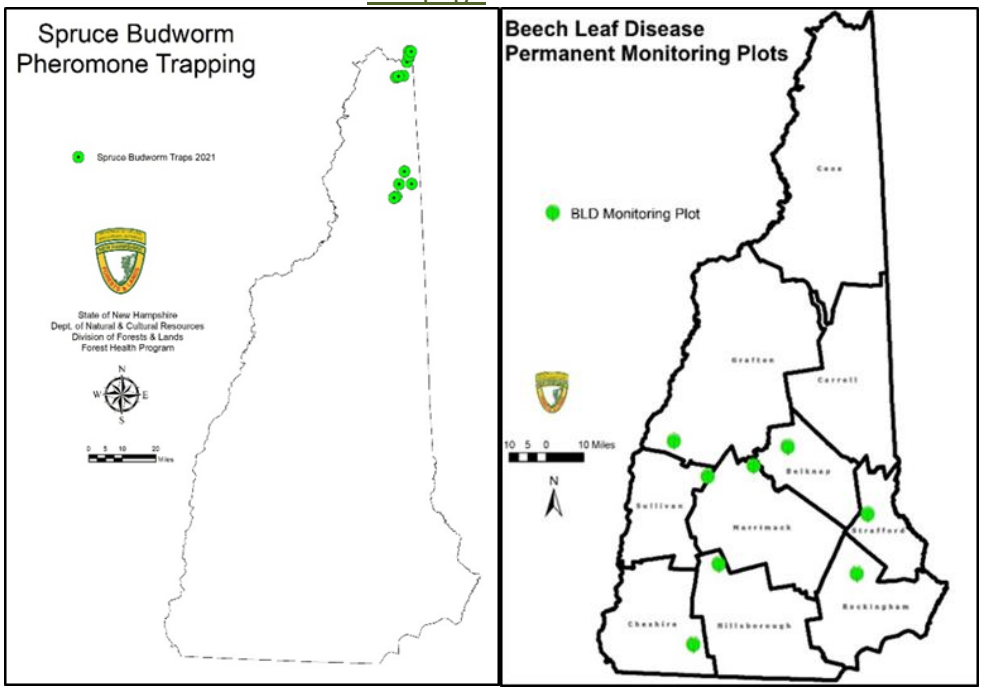
Additionally this year we saved the bycatch (non-target species) from all of our trapping for a genome project being conducted at the University of New Hampshire Hubbard Center for Genome Studies. The goal of this project is to grow the arsenal for surveillance to include screening of all bycatch through DNA barcoding, a tool that can demonstrably improve detection rates and response times for combatting forest insect pests.

Caliciopsis pinea

In order to better understand the biology of *Caliciopsis pinea*, the fungus that causes pine canker disease, we cooperated on a regional project with Michigan State University to collect fungal spores. Spore collection traps were set up in late May at two sites in NH and collections continued into mid-November. The University of New Hampshire Office of Woodlands assisted with collections at one site in Durham.

Spruce Budworm

Trapping for spruce budworm continued this year and catches remain at endemic levels. You can find out more info and view an interactive map of the current outbreak in Maine and Canada on the Maine SBW Task Force webpage.

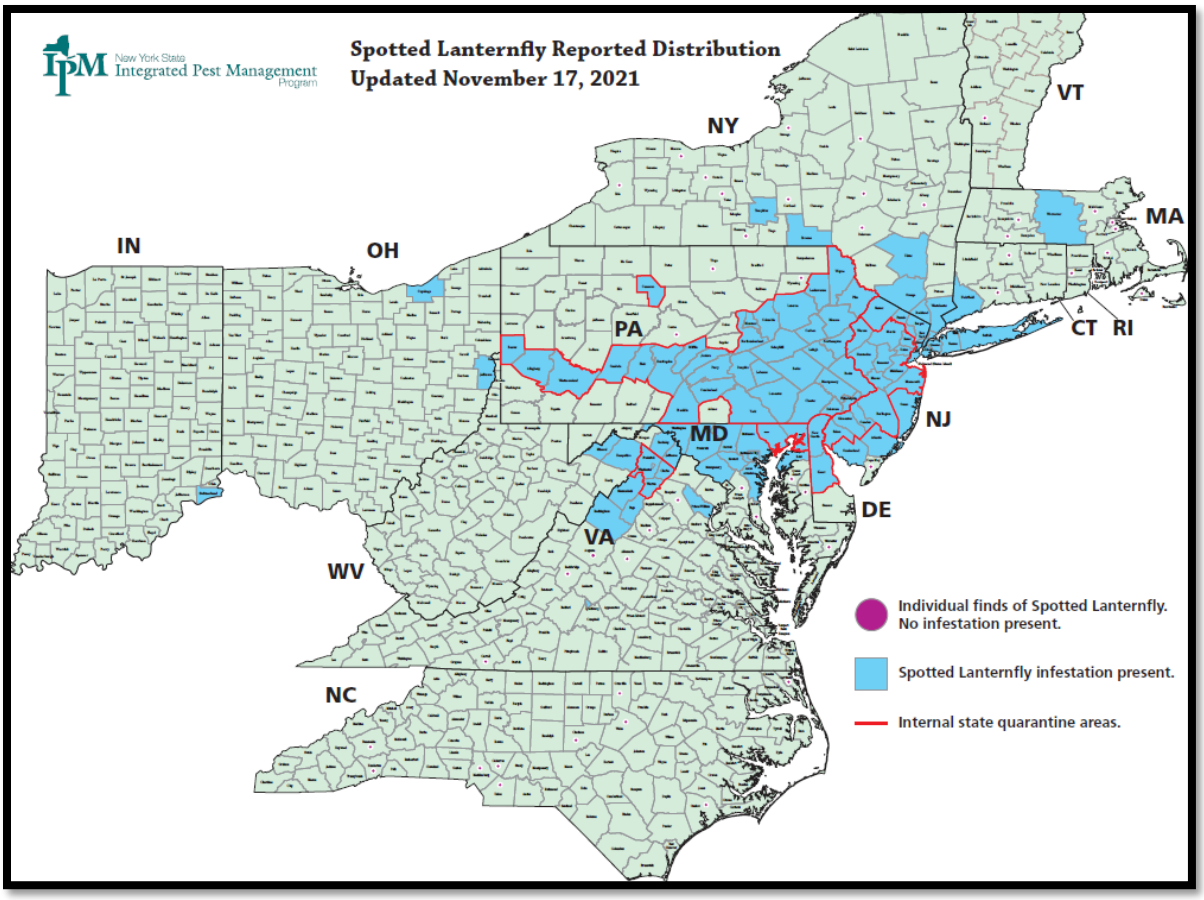


Beech Leaf Disease

We are keeping a close eye out for beech leaf disease (BLD) after numerous reports in Massachusetts and Maine. In anticipation of its arrival in NH, we established eight permanent BLD monitoring plots on state lands throughout the southern half of the state. The USFS has established two additional plots near the seacoast.

Spotted Lanternfly

We conducted surveys for spotted lanternfly (SLF) adults and egg masses on host trees including tree of heaven, its preferred host, at three high-risk sites in NH this fall due to a recent detection of an infestation in Fitchburg Massachusetts. No SLF was detected.



Southern Pine Beetle

A UNH graduate student trapped southern pine beetle (SPB) at two sites in Ossipee in October. This is the farthest north this destructive native beetle has been detected. While it has been expanding its range northward, it is currently not known to be infesting trees or causing tree mortality in any of the New England states where it has been detected. We trapped for SPB in NH from 2015 through 2019 with no detections. While trapping had been done at the same sites where it was recently detected, we had only trapped in the spring. This new detection late season may indicate we need to trap later in the fall in northern states. We plan to trap again next year likely in the spring and/or fall. Read more about SPB in the Feature Creatures section.

FEMC UPDATE

By: Bill Davidson

In 2021 the New Hampshire Forest Health Program began a partnership with the Forest Ecosystem Monitoring Cooperative (FEMC), an organization whose mission is to evaluate long term trends in health of the forests of the Northeast region of the United States. The FEMC was inspired by the Vermont Monitoring Cooperative (VMC) and is building upon over three decades of environmental research conducted by the VMC intended to benefit natural resource management, education, and public interest. As part of the New Hampshire Division of Forest Health's involvement in this partnership, this spring we established a network of 28 long term monitoring plots throughout the state with all of New Hampshire's diverse forest types included. This network of plots, which will be surveyed yearly, will help us track changes to our forests over time, and also serve as a springboard to launch other projects aimed at evaluating forest health as measured by their chemical, physical, and biological properties. A service provided by The FEMC to the State of New Hampshire is that they carryout short-term projects known as "Sprint" projects which focus on issues specific to our state. An example of a recent Sprint project is an analysis of the rate, extent and timing of all timber clearing in the state over an 18 year period in order to better understand patterns of silviculture and forest conversion. Other recent Sprint projects include a detailed analysis of carbon storage and sequestration rates between managed and unmanaged forest at Pisgah State Park, and development of a forest health indicators dashboard which conveys a quick snapshot of the status of New Hampshire's forests. More information about the FEMC, including current and past projects, can be found at their website: https://www.uvm.edu/femc/

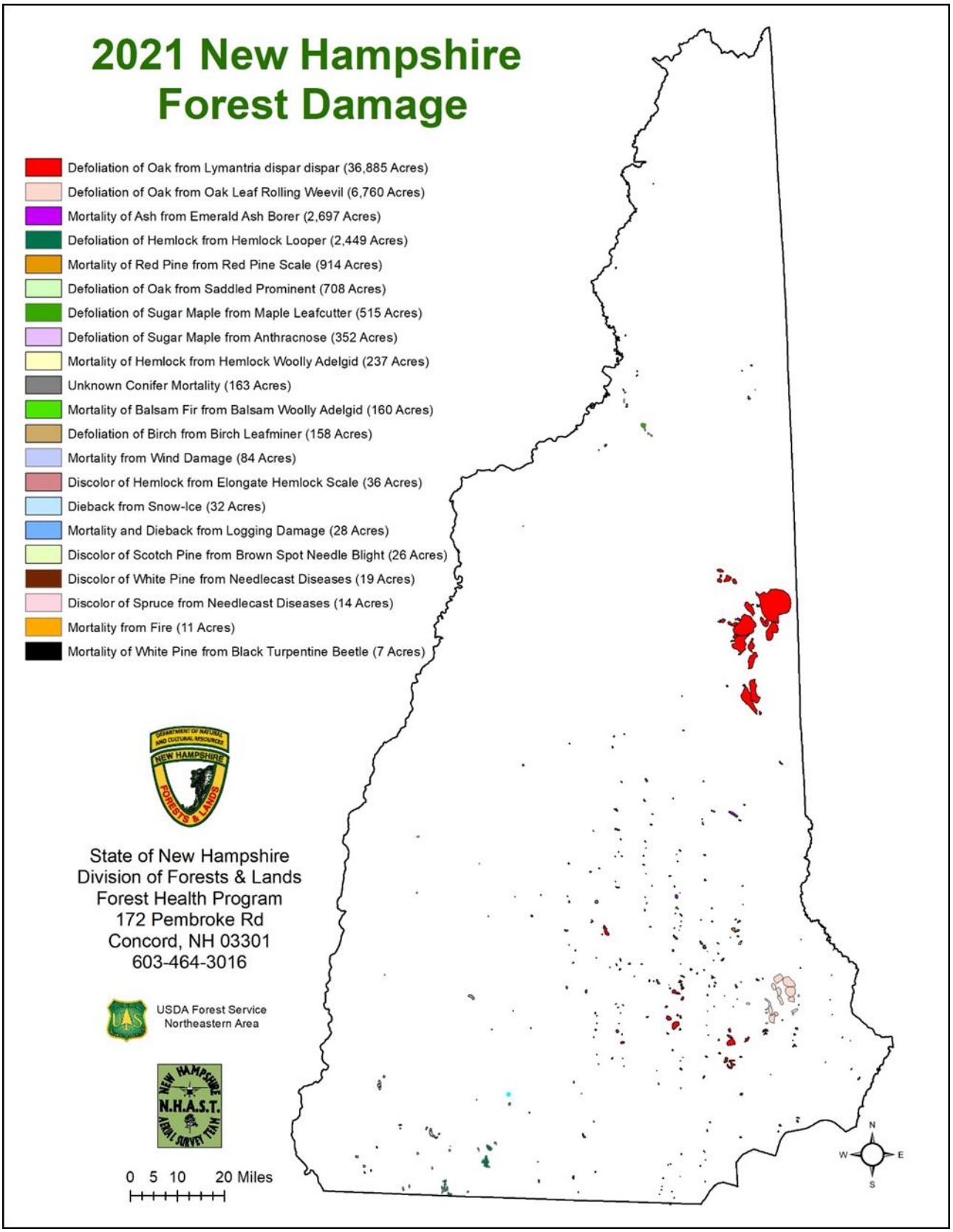
AERIAL SURVEY HIGHLIGHTS

By: Jen Weimer

We mapped over 52,000 acres of damage in this year's aerial survey. The most common damage seen this year was defoliation from *Lymantria dispar* (formerly known as Gypsy Moth) which was mapped on 36,885 acres of red oak, mostly in the White Mountains region. We also mapped defoliation of oak from Oak Leafrolling Weevil on 6,760 acres in the southeastern part of the state, defoliation of hemlock from Hemlock Looper on 2,449 acres in the southwestern part of the state, defoliation of oak from Saddled Prominent on 708 acres in the Monadnock region, and defoliation of sugar maple from Maple Leafcutter on 515 acres throughout the state. Notable tree mortality was also mapped this year from Emerald Ash Borer (2,697 acres) and Red Pine Scale (914 acres).

Hemlock Looper defoliation (Photo-Bill Davidson)

Lymantria dispar defoliation (Photo-Bill Davidson)


2021 New Hampshire Forest Damage
Defoliation of Oak from Lymantria dispar dispar (36,885 Acres)
Defoliation of Oak from Oak Leaf Rolling Weevil (6,760 Acres)
Mortality of Ash from Emerald Ash Borer (2,697 Acres)
Defoliation of Hemlock from Hemlock Looper (2,449 Acres)
Mortality of Red Pine from Red Pine Scale (914 Acres)
Defoliation of Oak from Saddled Prominent (708 Acres)
Defoliation of Sugar Maple from Maple Leafcutter (515 Acres)
Defoliation of Sugar Maple from Anthracnose (352 Acres)
Mortality of Hemlock from Hemlock Woolly Adelgid (237 Acres)
Unknown Conifer Mortality (163 Acres)
Mortality of Balsam Fir from Balsam Woolly Adelgid (160 Acres)
Defoliation of Birch from Birch Leafminer (158 Acres)
Mortality from Wind Damage (84 Acres)
Discolor of Hemlock from Elongate Hemlock Scale (36 Acres)
Dieback from Snow-Ice (32 Acres)
Mortality and Dieback from Logging Damage (28 Acres)
Discolor of Scotch Pine from Brown Spot Needle Blight (26 Acres)
Discolor of White Pine from Needlecast Diseases (19 Acres)
Discolor of Spruce from Needlecast Diseases (14 Acres)
Mortality from Fire (11 Acres)
Mortality of White Pine from Black Turpentine Beetle (7 Acres)
State of New Hampshire
Division of Forests & Lands
Forest Health Program
172 Pembroke Rd
Concord, NH 03301
603-464-3016
USDA Forest Service
Northeastern Area
N.H.A.S.T.
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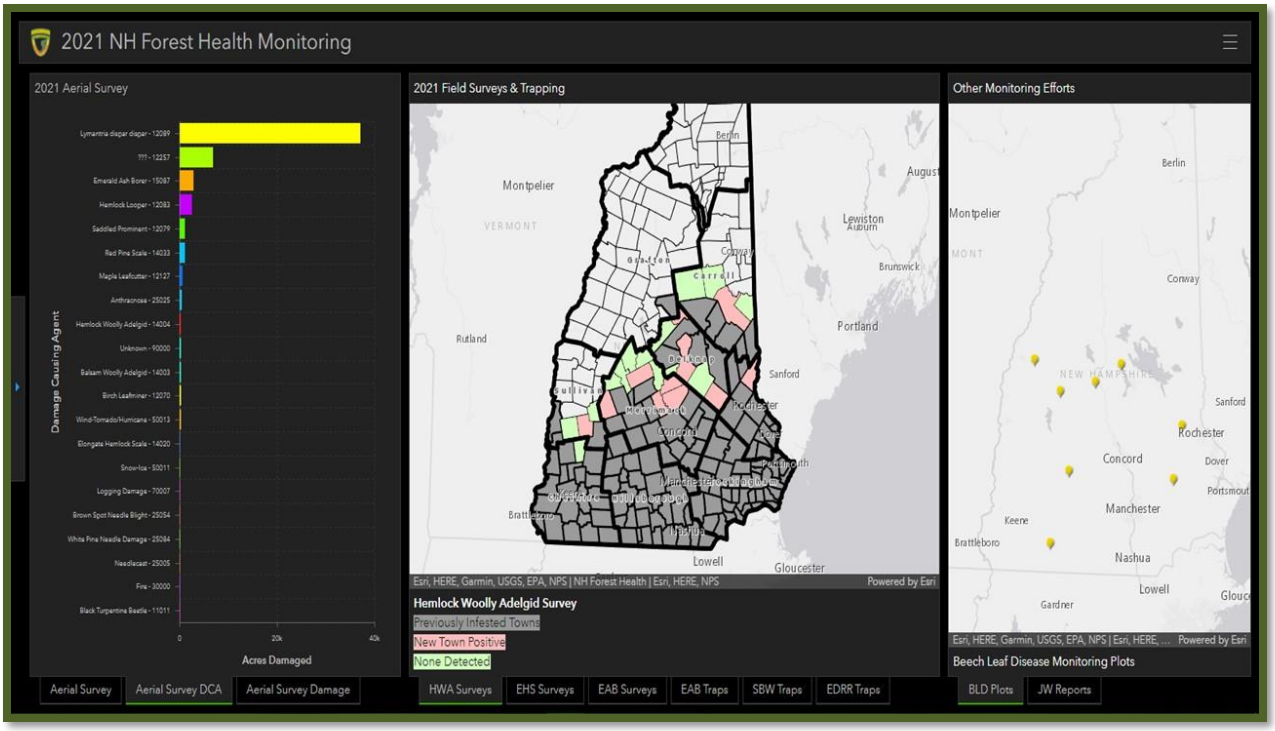


Check out our Forest Health Monitoring Dashboard for interactive maps of this year's field and trapping surveys.

EAB UPDATE

By: Bill Davidson

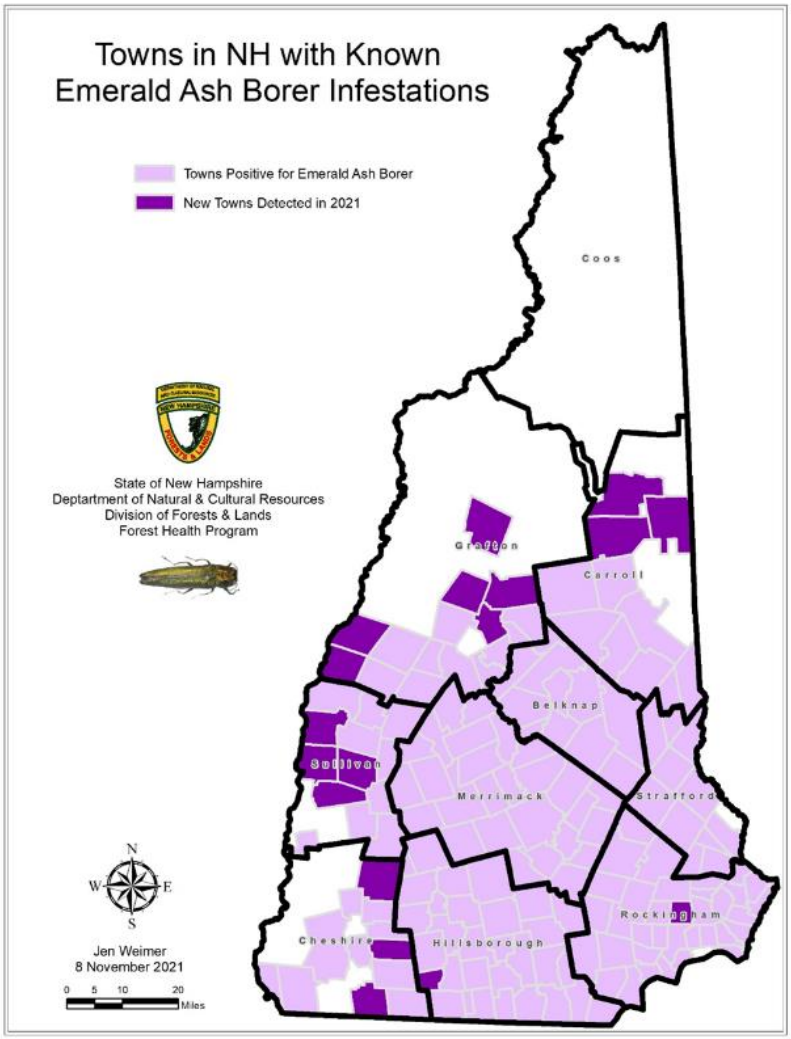
Emerald ash borer was detected in the following 18 new towns in New Hampshire in 2021: Newport, Plymouth, Campton, Rumney, Stoddard, Dublin, Sharon, Fitzwilliam, Claremont, Unity, Lebanon, Woodstock, Albany, Conway, and Bartlett, Brentwood, Cornish, and Hanover. Eleven of these detections were made via visual surveys, three through purple prism traps, and four were reports that came in from the public. There are now 165 infested towns in the state located throughout 9 of our 10 counties.

Three species of parasitic wasps (*Tetrastichus planipennisi, Oobius agrili,* and *Spathius galinae*) were released at three sites in the towns of Hillsboro, Croydon, and Rindge throughout the summer. In total, just over 13,000 wasps were released through the biological control program. Evaluation of biocontrol establishment and spread found *O. agrili* at a location ~1 mile from the nearest release site in Hopkinton, NH. *T. planipennisi* was recovered from a release site in Alton and another two sites each roughly 5 miles from the nearest release site. *S. galinae* was recovered from a previous release site in Hill, NH along with an additional location 1 mile from the nearest release site. These recoveries, along with consistent recovery in previous years, provides good evidence that the parasitoids utilized through the biological control program are becoming established throughout New Hampshire and are beginning to spread throughout the ash forests in the state.

We are also in the second year of a treatment project where we aim to protect a dozen ash trees at ten sites in each of our 10 counties for a total of 100 sites. In 2021 we treated 30 of these sites in 8 counties and have treated 60 sites over the past two years. Pockets of treated trees throughout the state will serve as refugia as the wave of emerald ash borer infestation crashes over the state. Protected trees will act as a seed source which will help jump-start the process of ash re-incorporating into our forests and in doing so, will preserve valuable local genetic diversity that might otherwise be lost.

Trunk Injection with Emamectin Benzoate.

(Photo-Bill Davidson)

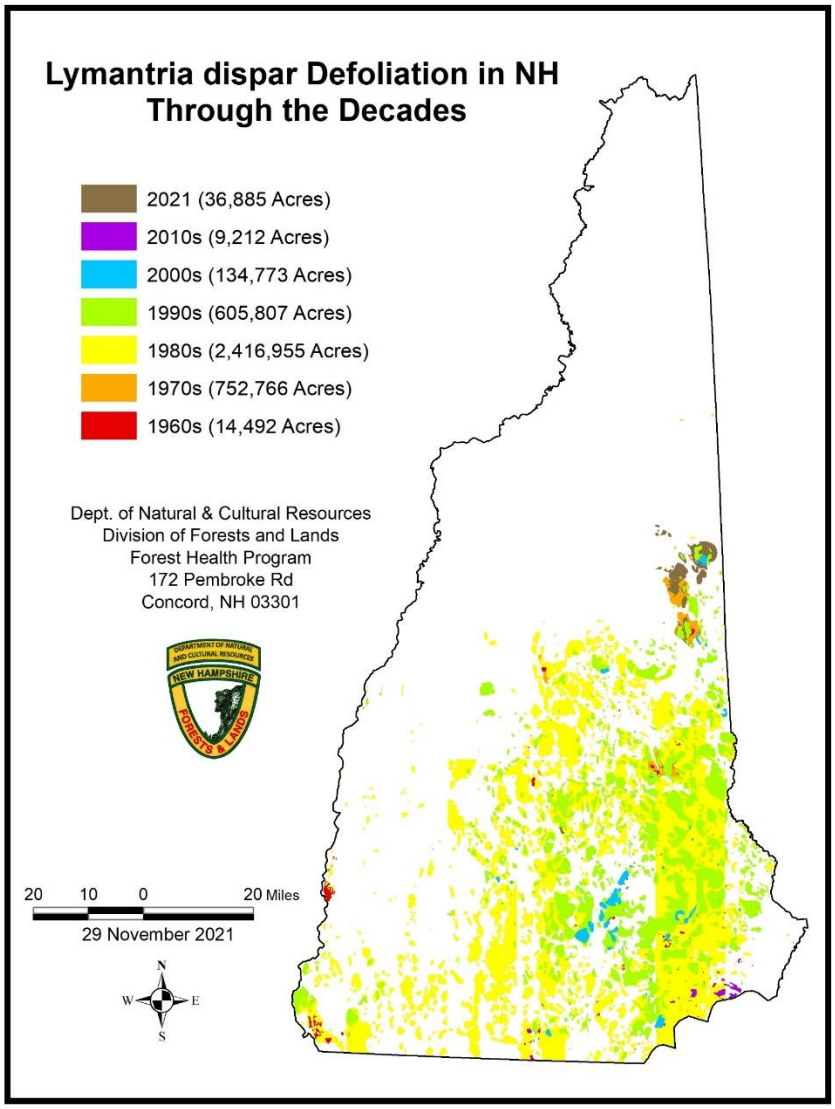


FEATURE ARTICLE

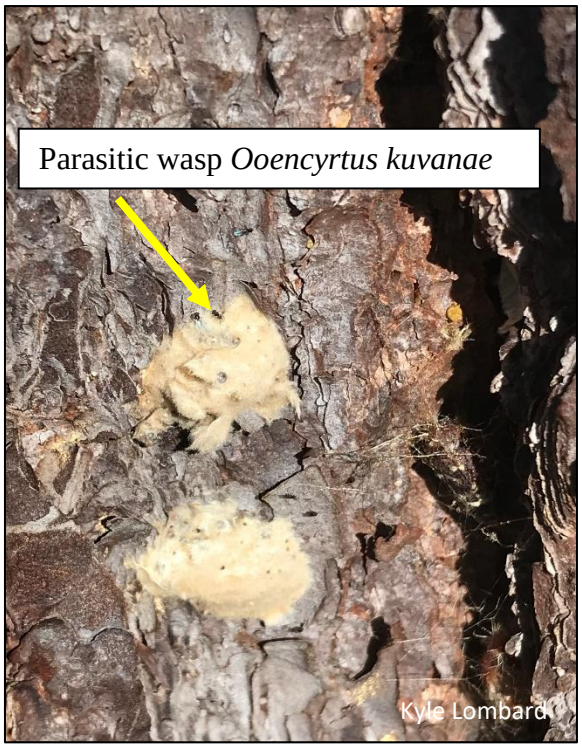
By: Kyle Lombard

Gypsy Moth and Hemlock Looper Causing Problems Again

It took 30 years but it's back. For how long? Good question. Probably not long, but let's go over several issues that have risen. First, is that "gypsy moth" is getting a name change in the near future. The American Entomological Society who have authority over common names of insects in the U.S has announced they are working to remove "gypsy moth" as the common name of *Lymantria dispar* (LD) and replace it with a new name. The reasoning is that they believe the word "gypsy" is derogatory. Lymantria dispar has been known as "gypsy moth" around the world for 175 years so it will take some time to adjust and re-educate foresters and the general public. Stay tuned for the new name, it's expected in early 2022.

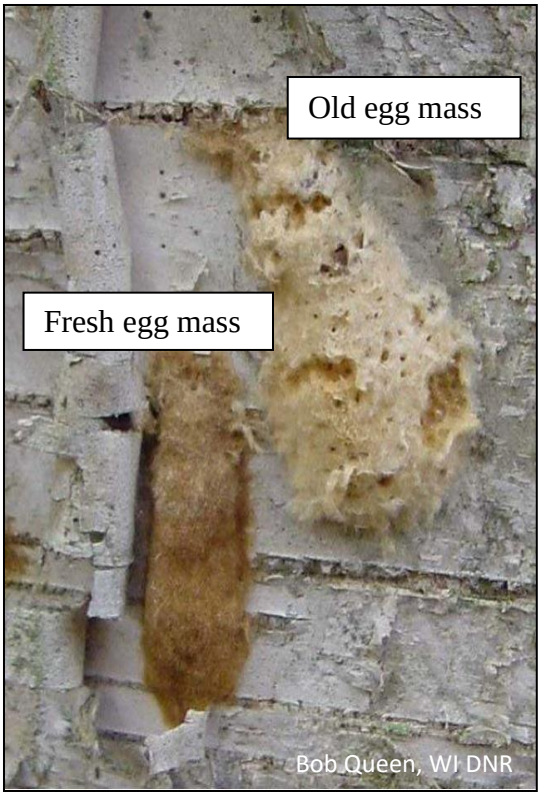


There was a big outbreak of *Lymantria dispar* in MA and surrounding southern states from 2015 to 2019 with defoliated acreage in the 100's of thousands. In NH we saw a few thousand acres of defoliation in that timeframe throughout southern Hillsborough and Rockingham County. By 2020 that outbreak had subsided leaving a fair amount of dead white oak on droughty soils throughout the mid Atlantic states. And we actually saw scattered oak mortality in Rockingham County too. BUT then, this past summer we mapped a new outbreak centered in the Conway area which defoliated 37,000 acres. This is the most gypsy moth damage in NH in 30 years. It was not uncommon in the 1980's and early 90's to annually have 100,000 acres of oak forests defoliated in NH. After 1993 we've seen very sporadic amounts ranging from 100-800 acres each year. The likely cause for this lack of defoliation is the controlling effects from *entomophaga maimaiga*, a bio-control fungi released throughout the area in the early 1900's. This fungi is annually found in the larval population in NH. So why the outbreak in 2021? It's probable that the very dry conditions in 2020 did not allow for the fungi to control the growing population. Thus many egg masses were produced in 2020 and in 2021 we had significant tree defoliation. We're very hopeful that predators, parasites and biocontrol fungi all had a banner year this summer with good rain conditions and the outbreak will be short lived. For example on a warm sunny day in September we visited a site in Conway and noticed large numbers of *Ooencyrtus kuvanae* swarming around the egg masses laying their eggs in the eggs of the gypsy moth. Ooencyrtus was released as a bio-control in the early 1900's and it's well established throughout the range of Lymantria dispar. The Ooencyrtus can only parasitize the outer few layers of eggs as it has a short ovipositor. Let's hope this little wasp gets some help from rodents and birds feeding on the egg masses and we get a few hot days in November which kills eggs and some cold days in January that kills eggs. If they can all work together the outbreak will be short lived.



Egg masses are produced in August as the female moth places around 200 eggs per clump on trees, lawn furniture or anything else she may crawl on in the forest. She does not have the ability to fly. She protects the eggs by covering them with her belly hair and they overwinter in that state.

While we wait for biocontrol populations to build, we should have a plan with regard to oak forests and their management. We recommend you monitor your forest with the "5 minute egg mass count" method of survey. Tally any current year egg masses while walking for five minutes and if the total is over 50 you will likely have moderate or higher defoliation in the coming year. Egg mass counts are most productive in the spring but fall counts are still valuable insight if you're planning a winter harvest. We also recommend you wait until two years after the last defoliation before doing any partial harvest silviculture. Thinning stands during the outbreak diverts large larval populations to fewer trees and creates an environment that is less favorable for bio-controls. For individual urban trees there are pesticide options. Most adulticides work well and are labeled for gypsy moth but we try to only recommend products with Btk (Bacillus thuringiensis var. kurstaki). Btk is considered organic and is a naturally occurring bacteria in the soil. It's specially designed to be activated by the mid-gut pH of the gypsy moth larvae.



Hemlock looper is a native forest pest in New Hampshire and periodically outbreaks every 20-30 years. The name "looper" comes from the description of the larvae as it moves. It only has legs at the head and tail of the body so it grabs the branch with its front legs and draws its hind end up to meet the front end. Grabs with the hind legs and lets go with the front legs to stretch out flat again to grab the branch with the front legs. These insects are sometimes called "inchworms". The shape it creates when the front and hind legs come together looks like a loop.

Previous to 2021 the last outbreak was from 1990 to 1992. Approximately 4000 acres were defoliated in Cheshire and Hillsborough County. We also have records of one other outbreak in 1965 on the shores of Lake Winnipesaukee. Several hundred acres were sprayed with an aerial application of Malathion.

This past summer the annual aerial survey recorded 2500 acres of severe defoliation in Rindge, Sharron and Peterborough. The heavy damage was striking in most of the co-dominant and intermediate hemlock trees. The dominant hemlocks seem to have retained the upper 20% of their crown so we have hope that those trees will survive the outbreak. The smaller trees with 100% defoliation are not expected to survive. Hemlock is notoriously poor at responding to severe crown damage and with the added stress of the last decade of hemlock woolly adelgid feeding in this area, the prognosis is not good.


Gabe Roxby, SPNHF

The looper moths lay eggs from late August through September all over the branches, needles and bark. The eggs over-winter and hatch in June. The larvae feed in a damaging and wasteful manner. They take a few bites from each needle and move on. The damaged needles die and fall to the forest floor. If the larvae are disturbed by wind or predators they have the ability to dangle by silken threads to find a new host tree.


Kyle Lombard

The expectation is that this outbreak will last two or three years until all of the native parasitoids and entomophthora fungi build to levels capable knocking the looper populations back to endemic levels. There is already some encouraging signs in that we did not see heavy moth activity in the defoliated area's in September. The hope is that the solid amount of rain we got in 2021 invigorated the entomophthora fungi and that fungi attacked late instar larvae.

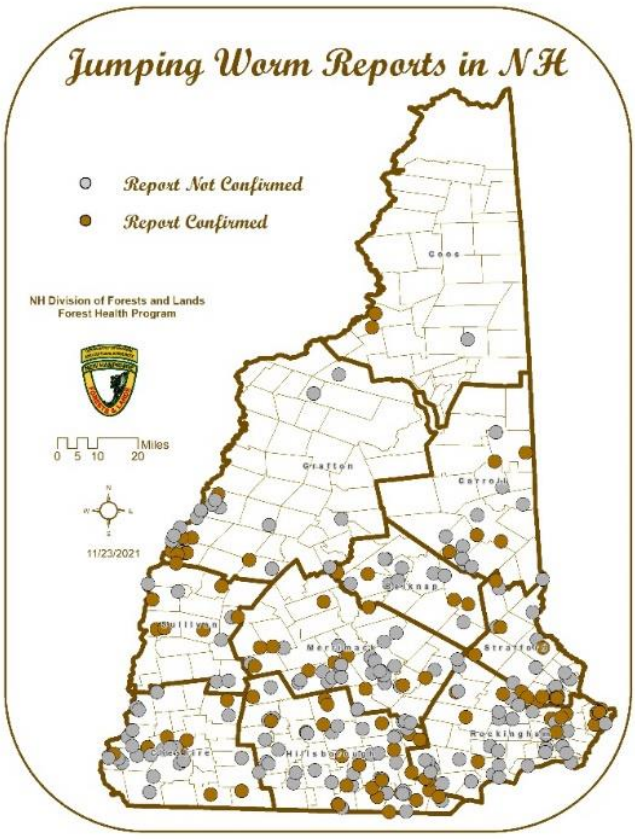
Control options involve pesticides so that would most likely only be used in urban settings where individual trees can be treated by a single landowner. Landowners with large blocks of hemlock effected will have to wait it out or salvage what they can from the dead and dying trees. If there is a desire to maintain a hemlock stand in the area where heavy defoliation occurred we recommend waiting to do any harvesting until two years after the outbreak. At that point the trees capable of surviving and rebuilding their vigor will express themselves. During the outbreak it's very difficult to determine the winners and losers. You don't want to cut trees that would have survived and leave trees that end up dying.

FEATURE CREATURES

Jumping Worms

By: Jen Weimer

There is a new potential forest health threat jumping up all over New Hampshire. This one is neither an insect nor a disease but rather a snake-like worm, which acts a bit crazy when disturbed. Hence, they are often referred to as crazy worms or jumping worms. Originating in Asia, the first report of jumping worms in NH was in Portsmouth in 2017 or 2018. We had a few more reports in 2019 and about forty in 2020. This jump in reports was concerning and led to an increase in outreach to determine just how wide spread it was. As a result, we received over 200 new reports in 2021 encompassing all 10 counties in NH. About half of the reports were confirmed with photos. The majority of reports were from homeowners who found them in their lawns and gardens but a few were noted in wooded areas. Most reports were associated with recent plantings from garden centers or additions of compost or mulch from either garden stores or local municipal sources. These reports suggest that careful consideration and inspection is needed when purchasing new plantings, moving plants, or adding soil amendments to your lawn or garden.



In addition to destroying your lawn and gardens, this nonnative invasive earthworm can change the structure of the forest floor, negatively affecting native plants and animals. They are very invasive and can easily devour all of the leaf litter and organic matter in the soil leaving behind mounds of coffee ground-like castings. Because they reside in the upper layers of

the soil, they can be easily disturbed when raking or doing other activities that disturb the soil. Jumping worms are gray brown in color with a smooth white band that encircles the entire body near the head. Once disturbed they will thrash about and even drop their tail if picked up. Their movements are much quicker than other earthworms and appear snake-like.

We are currently planning surveys for next year to determine the extent and impact of this new pest in NH forests. If you think you have seen an overabundance of aggressive worms in your garden or forest that could be jumping worms, we would like to hear from you. Learn how to ID them and report your sightings at nhbugs.org.

Southern Pine Beetle

By: Bill Davidson

The Southern Pine Beetle (*Dentroctonus frontalis*) is a bark beetle which is native to the southeastern United States and Central America where it is a serious pest of pine forests. In recent years this insect has been expanding its range northwards, likely due to a warming of extreme winter temperatures. The historic northern limit of the Southern Pine Beetle has been New Jersey it but has recently been detected in New York in 2014, and Connecticut, Massachusetts, and Rhode Island in 2015. This October, Caroline Kanaskie, a graduate student at the University of New Hampshire, captured several adult beetles in traps at two locations in Ossipee and Madison, the first detections in the state and the most the most northerly observations of Southern Pine Beetle to date. This recent northern expansion has led to serious

tree mortality of pitch pine on Long Island in New York, but all detections in New England have been in traps with no infested trees observed in the field. Given its prevalence throughout southern New England, it is likely these recent detections in New Hampshire represent natural range expansion of southern pine beetle and that populations are probably now endemic in pitch pine forests throughout the state.

In the southeastern United States the preferred hosts are loblolly, shortleaf, pond, and Virginia pines. In the northern portion of its range it prefers pitch pine, but has occasionally been observed attacking white pine, Scotch pine and Norway spruce during outbreak events.

SPB Adult (Photo-Mark Digirolomo, USFS)

Pitch Tubes (Photo-Kyle Lombard)

Larval Galleries (Photo-Kyle Lombard)

Southern pine beetle has a cyclical population dynamic where it will exist on the landscape at near undetectable levels for years at a time but can rapidly enter an outbreak phase where localized population levels spike resulting in “hot spots” of tree mortality. Infested trees can be identified by the presence of pitch tubes at the location of attack points on the outer bark of the trunk along with orange frass in bark crevices, and in heavily infested trees distinctive S-shaped galleries below the bark and discoloration of foliage. Adult beetles are dark reddish brown to black and about 3mm in body length, while larvae are crescent shaped and about the size of a grain of rice. Upon selecting a suitable host tree, female beetles will begin to bore into the trunk while attracting males via release of aggregation pheromones. At endemic levels most attacks pitched out by the tree, but during outbreaks the number of attacking beetles will overwhelm the trees defenses.

Pitch pine forests are not common in New Hampshire but they are ecologically significant as they occupy areas with sandy, nutrient poor soils and frequent fire regimes, which few our native trees species are suited to colonize. These forests also host an abundance rare plants and support unique floral communities. Risk of southern pine beetle outbreaks increase as tree density within a stand increases, therefore preemptive thinning can reduce the risk of an outbreak, however, the risk of such an outbreak in New Hampshire the near future is low. To date, the most northern outbreaks have occurred within Long Island Central Pine Barrens in New York, with no infested trees yet found in New England. As this beetle continues to expand

its range northward we expect outbreaks to pop up in the southern New England states, which have less severe winters and more expansive pitch pine forests, well before conditions are suitable for outbreaks in our state. We will continue to monitor the situation in our neighbors to the south, but currently there is not an immediate cause for alarm here in New Hampshire.

Declining Trees in NY (Photo-Kyle Lombard)

Office Notes

The NH Forest Health Program office and lab is located at the Caroline A. Fox Research and Demonstration Forest in Hillsboro. Our small staff monitors the condition of NH's 4.8 million acres of forest. You can help by contacting us if you observe any forest damage. Photos can be uploaded at NHBugs.org or you can contact us directly. Follow us on social media to keep up to date on forest health issues. We currently have 2,008 followers on Facebook, 866 followers on Twitter, and 1,349 followers on Instagram. Thanks for being so social with us! **Our current Facebook page will be going away at the end of the year. Be sure to follow us at our new page facebook.com/NHForestHealthNEW.** In addition, we email quarterly updates in March, June, and September. If you are not already on the mailing list, you can sign up here.

Forest Health Program Contacts

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Get social with us @NHForestHealth

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