FOREST INSECT AND DISEASE CONDITIONS IN VERMONT
2013

AGENCY OF NATURAL RESOURCES
DEPARTMENT OF FORESTS, PARKS & RECREATION
MONTPELIER - VERMONT 05620-3801

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http://www.vtfpr.org/

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FOREST INSECT AND DISEASE CONDITIONS IN VERMONT

CALENDAR YEAR 2013

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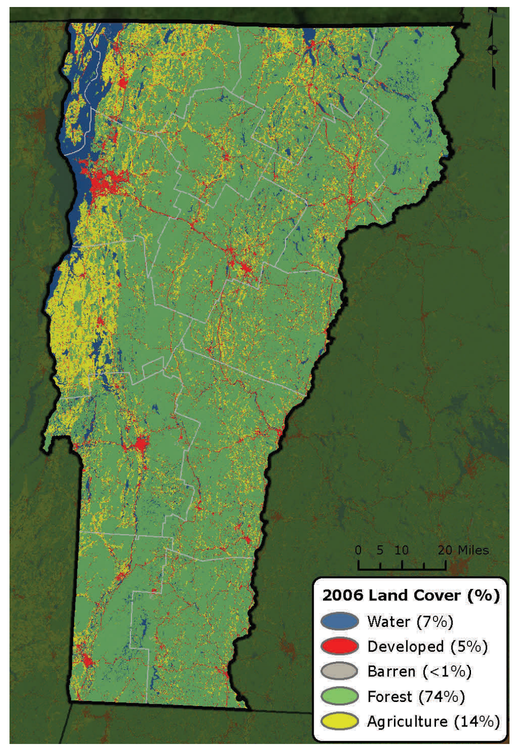
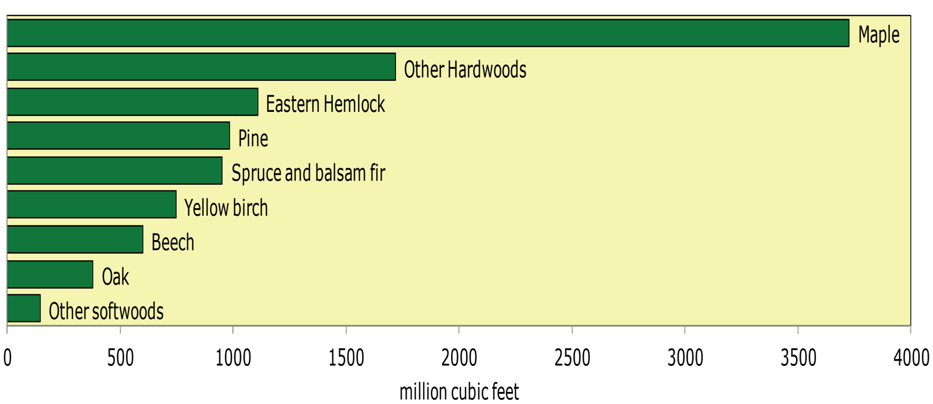
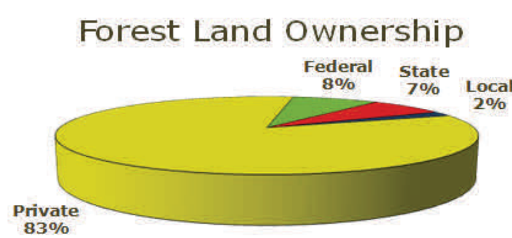


These highlights summarize information from the annual report on Forest Insect and Disease Conditions in Vermont. The complete annual report, as well as other Vermont forest health information, is posted online at www.vtfpr.org/protection/idfrontpage.cfm. To receive a copy by mail, for assistance in identifying pests, diagnosing forest health problems, on-site evaluations, and insect population sampling, to obtain defoliation maps, management recommendations, and other literature, or to participate in invasive pest citizen monitoring, contact Forest Resource Protection Personnel or your County Forester.

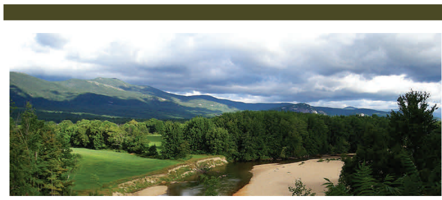
Forest Resource Summary

Forests cover 78% of Vermont. Over 83% of the state's forest land is privately owned with eight percent under federal management in the Green Mountain National Forest and 7% managed by the State of Vermont. Sugar and red maple, eastern hemlock, and white pine are the most common species by number and volume. More information on Vermont's forest inventory is at Vermont's Forest Resources, 2012.





Forest Resource summary from US Forest Service Forest Inventory and Analysis.

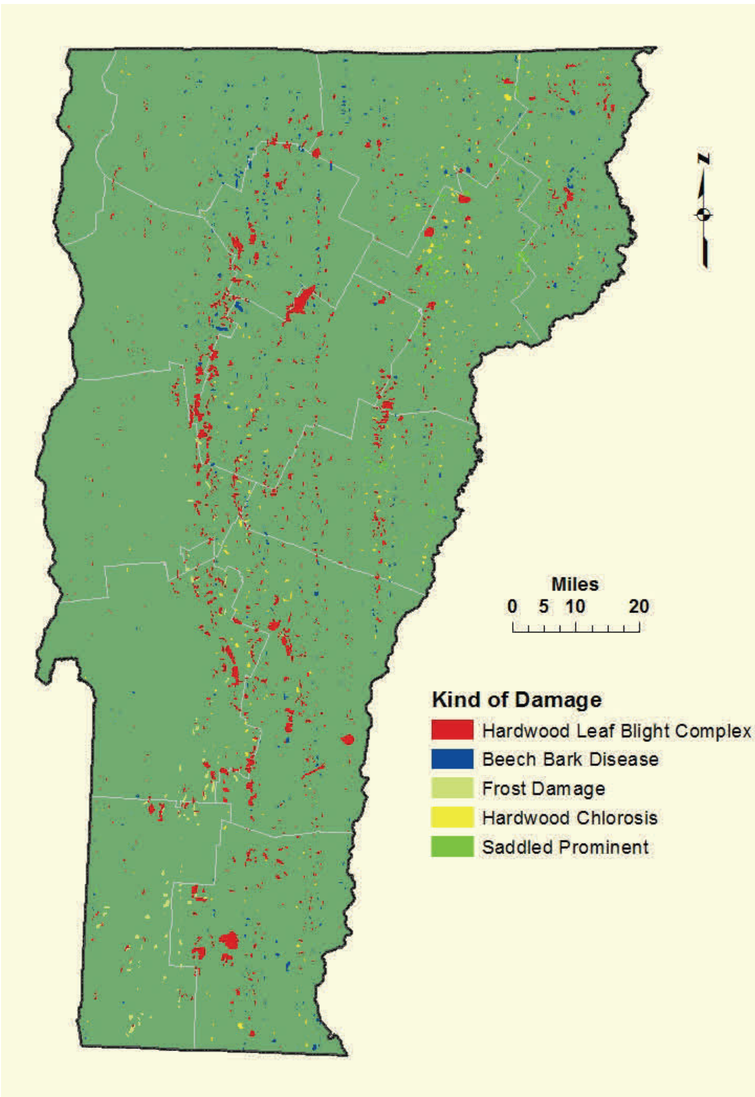


Forest Health Programs in the Northeast

Vermont Department of Forests, Parks and Recreation (FPR) works in partnership with the U.S. Forest Service to monitor forest conditions and trends in Vermont and respond to pest outbreaks to protect the forest resource.

Aerial Surveys

In 2013, 226,229 acres of forest damage were mapped statewide. This represents less than 5% of Vermont's forestland. Most of the acreage mapped was hardwood defoliation by leaf fungi, insect defoliators and/or frost. Beech bark disease, a non-native pest complex, accounted for 10% of the area mapped.



Forest Health Program Highlights

The Vermont Department of Forests, Parks and Recreation conducts aerial and ground surveys to detect forest damage. In addition, long-term monitoring plots are visited to evaluate forest health.

Invasive Pests and Plants are a key threat to forest health in the region. The Department of Forests, Parks and Recreation and the Agency of Agriculture, Food and Markets collaborate with USDA agencies to survey and manage non-native forest pests, and with UVM Extension on education and outreach. An interagency Invasive Forest Pest Action Plan is updated every year. The website dedicated to invasives, vtinvasives.org, covers non-native plants and tree pests, and provides information on reporting suspects, spreading the word, and getting involved as a volunteer. In 2013, Vermont's Forest Pest First Detector Program trained 25 new volunteers. Currently, there is a statewide network of 118 volunteers representing 109 communities. The program also provided an advanced workshop and a field trip for veteran volunteers to a New York EAB infestation.

The vtinvasives website provides information on reporting invasive pest suspects, and getting involved as a volunteer.

A network of 118 Forest Pest First Detectors, serving 109 communities, has conducted training, screening, outreach, surveys, and community preparedness activities.

Don't Move Firewood outreach continued. In 2013, the State of Vermont policy was adjusted to exclude all untreated firewood, originating from out-of state, from entry into all State Parks and State Forests. State Park campgrounds continued to exchange out-of-state firewood with local wood. The amount of firewood needing to be exchanged continues to decline.

Climate Change adaptation remained a focus in 2013. The Agency of Natural Resources completed a vulnerability assessment and a Climate Change Adaptation Framework Report. Climate change impacts and projections for forest health are part of a new collaboration with University of Vermont and the University Corporation for Atmospheric Research.

Scientists from the US Forest Service Northern Institute of Applied Climate Science led forest adaptation workshops for natural resource managers. A subset of the management plans developed in these workshops will be implemented as demonstration areas. A plan is near completion for one of these at The Narrows Wildlife Management Area in West Haven. The publication, "Creating and Maintaining Resilient Forests in Vermont: Adapting forests to climate change" will be distributed in early 2014.

Other Forest Health Initiatives which continued in 2013 include a multi-state project to slow the spread of hemlock woolly adelgid, a project to conserve germplasm of disease-resistant butternut, an investigation into causes for tree mortality in Vermont and adjacent states, and, with the University of Vermont, a study of forest carbon at sites affected by non-native earthworms.

We also provide diagnostic services, assist the VT Department of Health in monitoring tick populations, and participate in programs with the VT Invasive Exotic Plant Committee and the Endangered Species Subcommittee.

2013 Weather Influences on Forest Health

In general, the winter of 2013 was mild. Below zero temperatures were recorded on only twelve days. Snow was minimal for much of the winter. Sugaring season was long and sap was sweet, with many producers reporting their best season in a long time.

Spring was dry well into May. Spring buds on sugar maples got off to a slow start, then developed rapidly. Leaf buds at Proctor Maple Research Lab in Underhill did not break out of their scales until May 3rd, with full leaf expansion by May 7th.

In mid-May, the weather pattern made a dramatic flip-flop, turning cold and wet. In late May snow broke branches in the Northeast Kingdom, and cold temperatures led to widespread frost damage to fir Christmas trees, and to hardwoods at mid-high elevations. On June 2nd, strong winds and hail the size of ping pong balls knocked down trees in the St. Johnsbury area and between Rutland and Chelsea. The weather service used the term "train effect" to describe storms which lined up one after the other.

Frost damage to fir Christmas trees (right), and to hardwoods at mid-high elevations (below), was widespread.

"Train effect" described storms which lined up one after the other, often knocking down trees in their path.

After a soggy June, July was off to a similar start. The prolonged wet period set the table for a variety of leaf diseases on hardwoods and conifers alike. In Burlington, May was the wettest ever, and June just missed the record. Some farm fields were never planted all summer because water was everywhere. High winds associated with a fierce thunderstorm on July 19th damaged trees in a swath across the northern counties of New York and Vermont.

In August, trees responding to the stress of the summer's excessive soil moisture were easy to pick out: red maples flagging red in low lying areas and more than normal yellow on sugar maples statewide. Mid-September brought on the foliage season in earnest. Every year it seems that when any particular species doesn't contribute much to the fall foliage event, others shine brighter to compensate. Although ash and birch trees lost their leaves sooner than usual, sugar maples and red maples once again stole the show with spectacular splashes of color. Killing frosts came late (on October 29th in the Champlain Valley).

An ice storm in late December travelled across northern Vermont, with the most significant damage to trees in the northern towns of Franklin and Orleans Counties.

Many plants had very heavy flowering in 2013, including red maple, black locust, ash, basswood, cherry, and apple. Thin foliage was associated with heavy seed production on red maple and ash.

Heavy seed production led to thin foliage on red maple.

Hardwood Insects and Diseases

Hardwood Browning was mapped on 29,299 acres. The primary cause was anthracnose and other fungal diseases, although insect defoliators and frost contributed to the damage. Anthracnose was particularly heavy on ash and hophornbeam. Pear thrips damage was much reduced from 2012.

In August, 29,299 acres of brown hardwood were mapped during aerial surveys. Anthracnose was particularly heavy on ash, and on hophornbeam (right).

Defoliation of white birch by **Septoria Leaf Spot** was widespread with 98,329 acres mapped. This included damage in birch-dominated montane forests, but also at lower elevations. **Poplar Leaf Blight**, also attributed to a *Septoria* fungus, was common statewide on balsam poplar.

Oak skeletonizer damage (arrows) and refoliation contributed to the ragged appearance of defoliated oaks.

Oak Defoliation and Browning continued to draw attention. Leafrollers, oak skeletonizer, anthracnose, and frost damage were observed in association with the damage. Refoliation that resulted in a variation of leaf sizes and colors contributed to the ragged appearance.

Dieback from **Beech Bark Disease** was mapped on 25,150 acres. Levels were similar to 2012.

Saddled Prominent populations increased statewide. During aerial surveys, 12,924 acres were mapped, mostly in northeastern Vermont. Noticeable defoliation occurred in scattered locations statewide.

Sugarbushes and northern hardwood stands should be monitored for saddled prominent (left). Following the last outbreak, hardwood decline was significant on some sites (above).

Sugarbushes and important northern hardwood stands should be monitored for this insect. Following the last outbreak (1979-81) hardwood decline was significant on some sites. Defoliation tends to start at upper elevations. If a ridge-top is infested, anticipate defoliation downslope in subsequent years. Outbreaks are unstable. Areas often sustain complete defoliation where no damage was observed the previous year. Infestations often collapse suddenly, as well.

Softwood Insects and Diseases

Consecutive wet springs also continue to leave behind a legacy of conifer diseases, most notably **Needle Damage to White Pine**. During the aerial survey conducted over the Green Mountain National Forest in June, the US Forest Service mapped 2,662 acres of white pine needle damage.

The US Forest Service, in cooperation with UNH and affected states, continues to investigate this malady, including studies to clarify the roles of needlecast fungi and weather. Plots have been established to monitor impacts on tree growth.

Studies are being conducted to clarify the roles of fungi and weather in causing needle damage to white pine. Plots have been established to monitor the impact of this damage on tree growth.

Other **Shoot and Needle Diseases** that remain common are Sirococcus tip blight on hemlock, Diplodia shoot blight on red pine and Rhizosphaera needlecast on spruce. Fungal diseases are more severe on lower branches, and in stand openings or other protected pockets where moist air accumulates.

Phytophthora Root Rot and other root diseases were unusually common in Christmas tree plantations. Consecutive years of heavy rain have led to the saturated soil conditions that allow these diseases to spread. Infestations of **Balsam Twig Aphid** were also unusually severe in scattered plantations.

Phytophthora root rot increased in Christmas tree plantations due to saturated soil. Balsam twig aphid symptoms (below) were also common.

Exotic Forest Pests

We continue to address the invasion of **Non-Native Plants** into forest ecosystems. A new invasive plant category will be available for pesticide applicator certification in the coming months, and we are working with the Agency of Agriculture to finalize a training manual.

Vermont State Parks have initiated an extensive invasive plant management effort focusing on southwestern Vermont.

The Nature Conservancy (TNC) has supported iMapInvasives, a web based system used to report sightings and map infestations of invasive plants in Vermont. Trainings can be done online at: http://vtinvasives.org/plants/report-it/volunteer. TNC is also working on a project to conduct invasive plant management on three nature reserves.

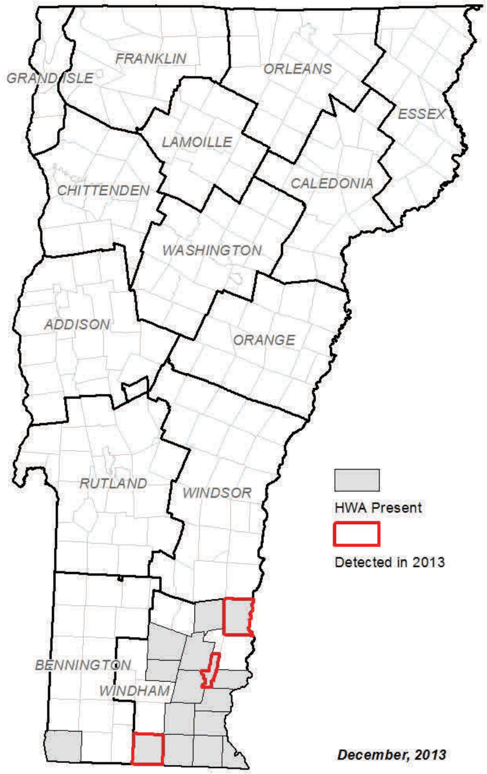
The increase in fungal foliage diseases in 2013 did not spare exotic plants. Defoliation and foliage distortion of glossy buckthorn caused by crown rust of oat, was observed in several locations. The impact on buckthorn is expected to be minimal.

The impact of defoliation by crown rust of oat on buckthorn health is expected to be minimal.

Hemlock Woolly Adelgid was not detected in any new counties. It is known to occur in 15 towns in Windham County, and only in Pownal in Bennington County.

Winter mortality averaged 46% at the five monitoring sites. Populations grew following the mild winter. Adelgids seemed more prevalent in areas already known to be infested and many new areas were reported.

During the 2012-2013 reporting period, a total of 88 surveys were done in 22 towns, including 5 surveys in each of the 13 towns adjoining known infested towns. Volunteers were involved in 9 of the 13 towns, accounted for 55% of the border town surveys, and made the first discoveries in Rockingham and Grafton. A logger reported the first occurrence known in Brookline. Training of volunteer surveyors for the 2014 season has begun.

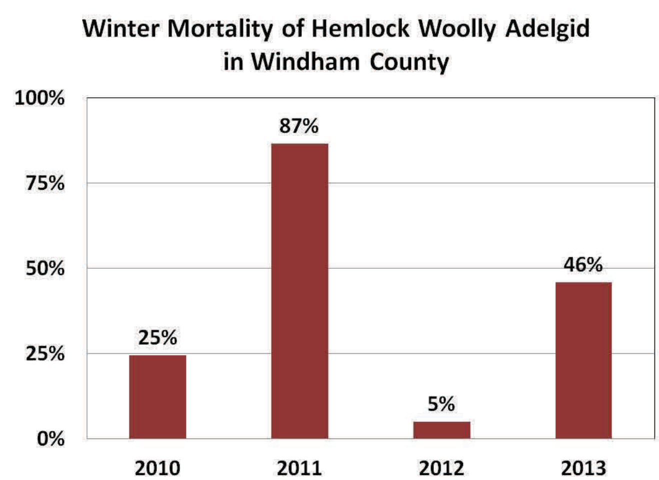


Hemlock woolly adelgid (HWA) winter mortality averaged 46% at monitoring sites, after a mild winter. HWA was detected in three new towns in 2013. Sixteen towns are now known to have active infestations.

Hemlock woolly adelgid impact plots have been installed at five locations on state or Nature Conservancy land. All measurements and crown assessments are scheduled to be completed this winter.

In December 2012, predatory beetles had been released for the first time in Pownal and to augment a previous release in Windham County. Monitoring of these sites is ongoing. The UVM Entomology Research Lab continued to work with native insect-killing fungi as a potential biocontrol.

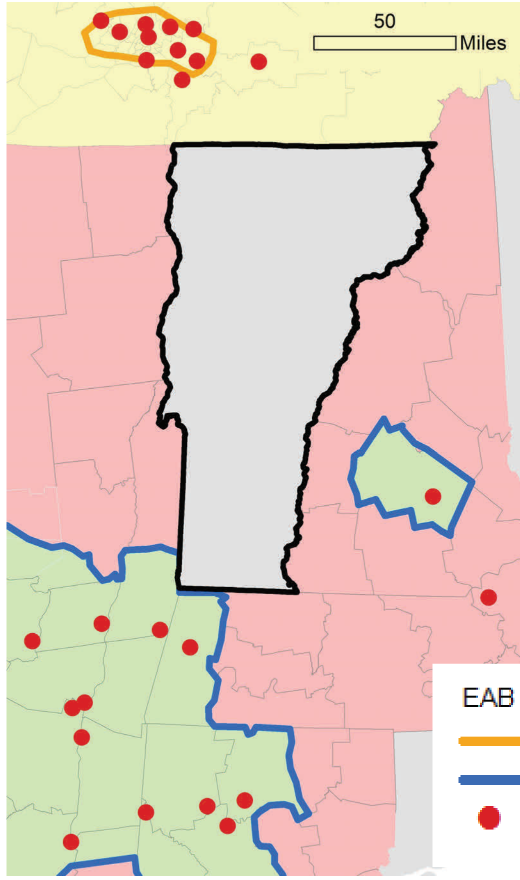
A *Best Management Practices Guide for Hemlock Resource Managers in Northern New England States*, addressing the threats of hemlock woolly adelgid and elongate hemlock scale, will be available in 2014.



Emerald Ash Borer (EAB) is not known to occur in Vermont and was not detected by public outreach or survey. However, it continues to advance. In 2013, there were several New County Detections nearby. A well-established infestation was discovered in Concord NH, and new counties were found to be infested in eastern New York, Connecticut, and Massachusetts. There were also new detections around Montreal, including some locations south of the area that was already regulated for EAB.

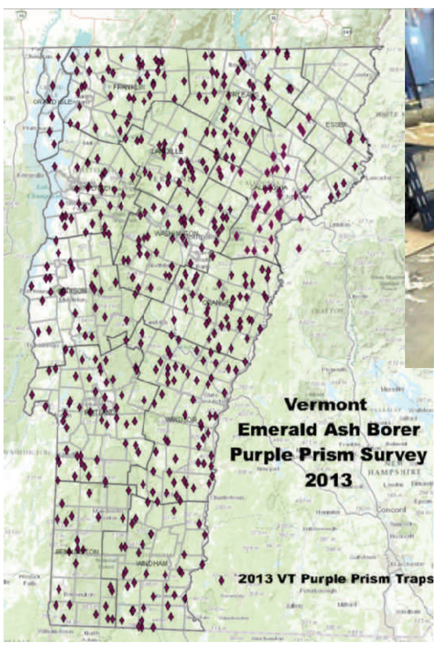
Anyone using firewood, ash sawlogs, or other ash products from infested states should be aware of the USDA quarantine regulations and compliance agreement conditions. You can start by contacting USDA APHIS, the VT Agency of Agriculture, Food, & Markets, or an FPR office below.

An aggressive emerald ash borer detection effort continues in Vermont. Purple panel traps were deployed at 438 sites in an effort led by USDA-APHIS. About 45 wasp watchers searched for and monitored nest sites of the predatory wasp *Cerceris fumipennis* in biosurveillance surveys. Although no emerald ash borer beetles were found, 1,074 buprestids were collected at 23 *Cerceris* nest sites in seven Vermont counties. We are also using girdled trap trees as a detection tool. In 2013, trap trees were girdled in nine counties in the spring, then harvested in December and peeled to look for EAB.



Emerald Ash Borer continues to advance. In 2013, it was detected, for the first time, in New Hampshire.

Map data from USDA APHIS. Approximate locations. For current information visit: http://www.aphis.usda.gov/plant_health/plant_pest_info/



Emerald Ash Borer has not been detected in Vermont in spite of intensive survey efforts. In 2013, USDA APHIS led the deployment of 438 purple traps. Volunteers assisted with monitoring 23 Cerceris wasp colony survey sites, and with peeling ash trap trees from nine counties.

In cooperation with UVM Extension, we continue to work with Vermont towns in developing Community Preparedness Plans. In 2013, 13 communities were awarded incentive grants. They have organized public meetings, inventoried roadside ash trees, and briefed decision-makers. Several towns are collaborating to share resources and coordinate outreach and fundraising efforts. Students have been important partners in pest planning, with 34 students from Middlebury College, UVM, Antioch University and the Community College of Vermont assisting with ash inventories and research.

The **European Wood Wasp** (*Sirex noctilio*) was collected in three traps deployed as part of the Exotic Wood Borer/Bark Beetle National Survey. Collection sites included East Burke (Caledonia County), Island Pond (Essex County), and Swanton (Franklin County). Former *Sirex noctilio* finds in Vermont were in Stowe 2007 (Lamoille County), Burlington 2010 (Chittenden County), and Brattleboro 2012 (Windham County). No infested trees have been seen in Vermont.

Elongate Hemlock Scale was detected in a planted landscape in Charlotte. Infested trees are being treated. No scale infestations were found in a survey of conifer hosts in the surrounding area. This insect is not known to be established in Vermont. It is a pest of concern since it infests fir and spruce as well as hemlock, and is reported to worsen the impact of hemlock woolly adelgid.

Elongate hemlock scale infests fir and spruce as well as hemlock. It has been detected on landscape trees in 2013, but is not known to be established in Vermont.

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.

Butternuts grafted from Vermont trees which seem to have resistance to butternut canker have been outplanted in two seed orchards.

Asian longhorned beetle is not known to occur in Vermont, and was not found in any of the 18 traps deployed in 2013.

Butternut Canker levels remain stable, with most butternuts showing symptoms of the disease. A project to conserve butternut germplasm moved forward when trees grafted from 30 different Vermont butternuts which seemed to have some disease resistance were planted in Vermont. Thirty-eight trees were planted in a seed orchard established by Middlebury College, and 29 trees were planted in Brandon to enhance a parallel effort on the Green Mountain National Forest.

Asian Longhorned Beetle (ALB) is not known to occur in Vermont. None were collected in the 18 panel traps deployed and checked bi-weekly in Vermont this year**.** However, ALB was found in a new location on Long Island, which is east of the previously known infested area. In addition, ALB was found in Mississauga, Ontario, just west of Toronto where ALB was recently declared eradicated.

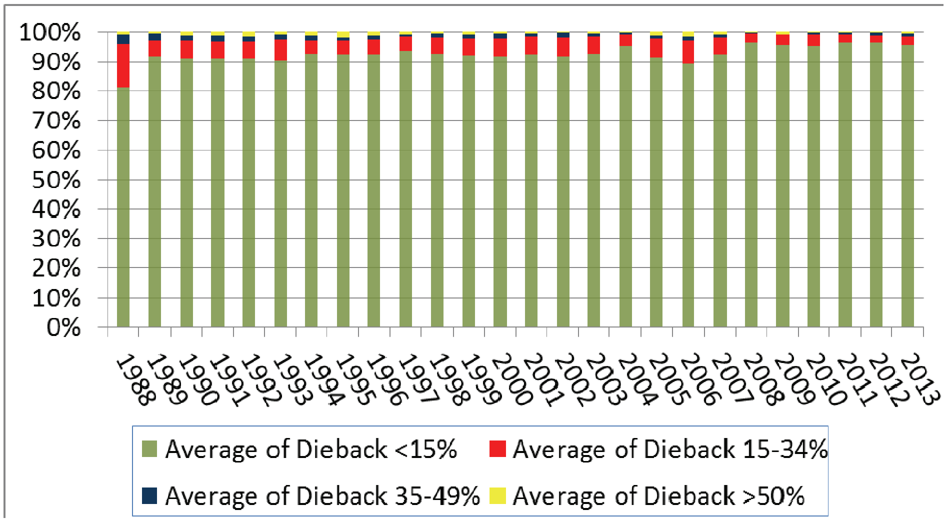
We don't recommend any management adjustments in anticipation of this insect. However, early detection is especially important for Asian longhorned beetle; small populations in other states have been successfully eradicated.

Other **Non-Native Species that Have Not Been Observed** in Vermont include winter moth, as well as the agents that cause oak wilt, thousand cankers disease, and sudden oak death.

Monitoring Forest Health

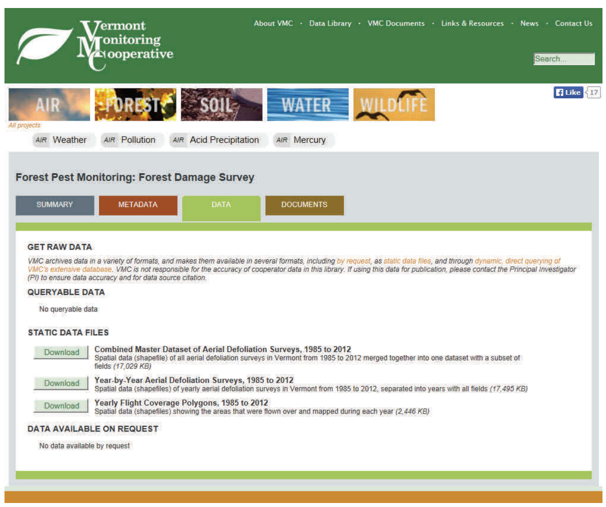
In **North American Maple Project** (NAMP) plots, over 90% of sugar maples were rated as having low dieback (less than 15%). Foliage was particularly dense this year, except in areas experiencing light defoliation. Saddled prominent, a native defoliating insect, was present on 30% of plots but at most sites, only light defoliation resulted. Also of note were the 20% of plots with non-native invasive plants in the understory, 23% of plots with evidence of wind damage, and 10% of the plots with evidence of moderate levels of deer browse impacting regeneration.

Over 90% of sugar maples were rated as having low dieback (<15%) in North American Maple Project plots.



The **Vermont Monitoring Cooperative** (VMC), Vermont's forest ecosystem monitoring and research collaborative, continued activities to collect and archive forest-related data and information. Dr. Jen Pontius took over as the new Principal Investigator on the retirement of Dr. Larry Forcier, one of VMC's founders. VMC continued a study of forest growth on Mount Mansfield, which will allow comparison with environmental trends, and completed the third year of a long-term urban tree health monitoring project, in collaboration with university staff.

Data storage and easy access, a major focus for the VMC, has become especially valuable with new access to current and historical spatial data from aerial surveys. Pest defoliators, tree declines, weather disturbances, and other forest health related observations have been mapped for decades and the 1985-2012 data are now accessible through the internet. http://www.uvm.edu/vmc/research/data.php.



Spatial data, acquired since 1985 from Vermont's forest damage aerial surveys, are now available through the VMC website.

Southern Vermont collaborators shared findings and opportunities for the future at a Lye Brook Wilderness Area Study Site Review. Air, water and land scientists and resource managers identified the need for long-term monitoring and data compilation at this VMC study site on the Green Mountain National Forest.

For more information, contact the Forest Biology Laboratory at 802-879-5687 or:		
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	Addison, Chittenden, Franklin & Grand Isle Counties.........	Essex Junction (802) 879-6565
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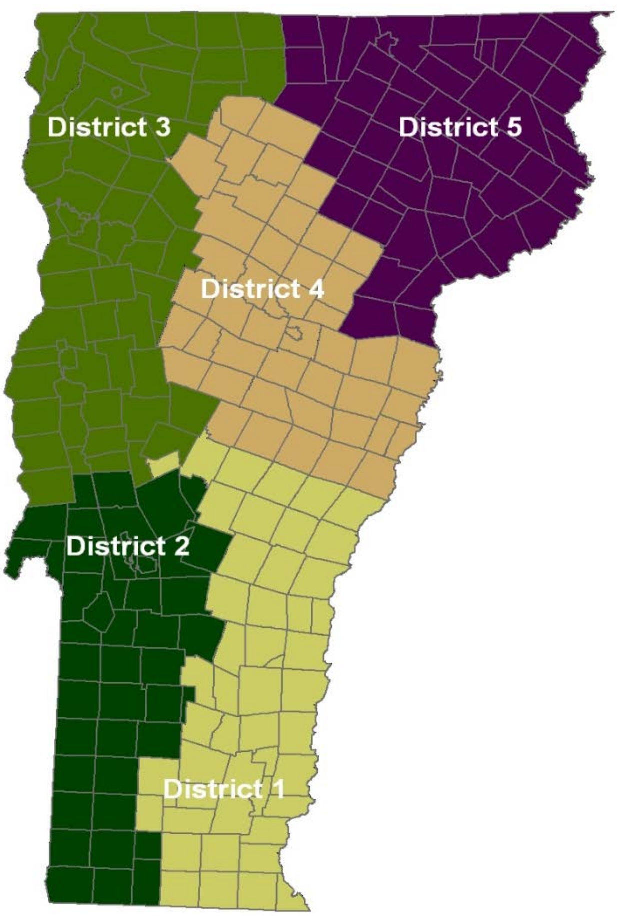

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INTRODUCTION

The information in this report is based on aerial surveys to detect forest damage, as well as ground surveys and observations by Vermont Forestry Division staff. A statewide aerial survey to map late season defoliators and general forest conditions was flown between August 19th and September 14th. All surveys were conducted using a digital sketch mapping system.

ACKNOWLEDGEMENTS

The **Forest Pest First Detector program** is in its second year. We thank the many continuing First Detectors, and welcome new volunteers, including Ruth Addante, John Akielaszek, Gwen Allard, Alice Allen, Marie Ambusk, Marnie Barry, Michelle Barth, Marvin Bicknell, Jon Binhammer, Corey Brink, Paul Brown, Greg Campbell, Andrew Cappello, VJ Comai, Bill Conn, Nilah Cote, Lindsay Cotnoir, Zapata Courage, Mike and Barbara Curran, Brian Daigle, Kathy Decker, Bob DeSiervo, Allaire Diamond, Mark Dillenbeck, Donn Downey, Peggy Ann Duckless, Elizabeth Eddy, Lauren Eno, Trevor Evans, Bob Everingham, Mike Fallis, Steven Farnham, Jim Faughnan, Jordan Fletcher, Frank Fomkin, Jim Frohn, Anastasia Gaszynski, Steve Gerard, Amanda Gervais, Seth Gillim, Gus Goodwin, Annette Goyne, Ted and Barbara Graham, Michael Gray, Cynthia Greene, Scott Hance, Charlie Hancock, James Harding, Jock Harvey, Dan Healey, Susan Hindinger, Anne Holdridge, Earl Holtz, Mary Houle, Candice Huber, Pamela Johnston, Janet Kane, Rick Kelley, Charlotte and William Kennedy, Rachel Klatzker, Chuck Kletecka, Deb Lacroix, Rick LaDue, Craig Lambert, Teri Lamphere, Susan Leskin, Pam Loranger, Marie Louka, Sue Lovering, Jen Lyod Pain, Jan McCoy, Andy McLean, Linda Miller, Carl Mohlenhoff, Veronica Norman, Jesse Palmer, Charlie Parant, Joe Parent, Nancy Patch, Roland Payne Jr., Lesley Porter, Matt Probasco, Michael Quinn, Brenda Raleigh, Doug Reaves, Andy Reed, Michael Rosenthal, Vincent Royce, Daniel Ruddell, Ruth Ruttenberg, Jason Saltman, Lucinda Sayre, Diane Sedra, Chris Simpson, Sarah Sincerbeaux, Fred Skwirut, Martin Smit, John Snell, Brian Sullivan, Jack Sumberg, Sally Thodal, Jeremy Tinker, Ray Toolan, Amalia Torres, Kurt Valenta, Pieter van Loon, Thomas Warhol, Jim White, Mike White, Josh Wilcox, Lisa and Elias Wyncoop, Xaxakwetet Little Tree, Jeff Young, and Robert Zimmerman.

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Thank you to Warren Kiel for assistance in rebuilding our insect collection and to Robert Acciavatti, Ross and Joyce Bell, Don Chandler, Rod Crawford, Scott Griggs, Dan Jennings, Chuck Lubelczyk, Warren Kiel, Michael Sabourin and Dave Wagner for taxonomic and other assistance to the Forest Biology Lab.

Support in many program areas was provided by staff of the US Forest Service Forest Health Protection; the Vermont Agency of Agriculture, Food, and Markets; University of Vermont; USDA APHIS; and the US Forest Service Northern Research Station, as well as many others in the VT Agency of Natural Resources.

WEATHER AND PHENOLOGY

Unless otherwise noted, all temperature and precipitation reports in the narrative below are from our Essex fire weather station.

Weather Summary 2013

Fall and Winter, 2012-2013. November was the first month in the previous twenty that did not record an above average monthly temperature. This broke a running record dating back to April of 2011. In spite of the cooler average temperatures, the month was dry and sunny…benefiting from the unusual situation of having a high pressure system to the Northeast. By Thanksgiving, many ski areas were able to make enough snow to open for the holiday. About an inch of snow covered the ground in the Champlain valley on the 26th and eight inches more fell in Underhill on the 29th. That night a cold arctic air mass moved in with lows in the single digits to keep the ground white. It did not stay that way for very long, however. Highs in the upper 40's and 50's in early December took away what little snow cover there was in the valleys (57^{0}F with light rain on December 4th).

Most of December was mild with much of the precipitation falling as rain. Vermont was on the warm side of the approaching weather systems. A little snow fell as the storm arrived, changing mostly to rain, and then a little snow again as the system departed. Christmas was technically "white" in the Champlain valley with a minimal 2" of snow at the Essex station, but just two days later, a significant snowstorm brought back memories of Christmas Past. Fourteen inches fell in Burlington, and again in just two more days, another ten inches fell across Vermont giving the state the deepest snowpack it would see all winter. There was twenty inches of snow on the ground at the Essex station on December 30th.

Much to the chagrin of winter enthusiasts and snow lovers in general, a dreaded snow-eating January thaw shrunk that impressive snowpack in the valleys to zero by the 15th of the month. Mount Washington, New Hampshire (our local bastion of frigid weather) even set a record high temperature of 48^{0}F on the 13th! From New Year's onward, the temperatures were on a roller coaster ride in Vermont. 25^{0}F in Island Pond on the 3rd of January; 50^{0}F in Essex on the 13th; back down into the deep freeze from January 20th to the 24th, and then another January thaw with a record setting 58^{0}F in Essex on the 30th accompanied by high winds and rain.

Snowmobilers had to travel to the north and east to enjoy their sport last winter. The VAST trail conditions report for February 14th (usually the heart of the season) stated: "Expect early season conditions in most areas with bare spots and exposed hazards." The skiers were a bit more fortunate. Late in February, Jay Peak and the surrounding towns were treated to a big snow event. Ecstatic "powder" skiers described it as a "snorkel session" the following day. Moist air from the west rode up the slopes of the northern Green Mountains and dropped a load of light, fluffy snow on those eastern Franklin county towns. St. Albans residents woke up to barely a dusting of snow, but just 15 miles away in Bakersfield, everyone was digging out from over 24" of white stuff.

In general, the winter was relatively mild. Although we had our share of cold air, below zero temperatures were recorded on only twelve days all winter, with -12^{0}F being the coldest recorded at Essex. The snowpack in the valley was spotty. For the 121 day period of December through March, only 20 days had a snow cover of 6" or more. 46 days in that stretch saw bare ground in the Champlain Valley. Ironically, the total snowfall for the season at the Burlington weather station was above average. That was hard to believe when the snow on the ground was so minimal or completely absent for so much of the winter.

Spring, 2013. Mild weather in late February and early March inspired thoughts of spring and conjured up visions of maple sap dripping from the trees into the awaiting collection devices. Indeed, March 9th through the 12th were near perfect sugaring days with high 40's and mid 50's by day and below freezing temperatures at night to charge the trees. Nothing stayed the same for very long last season, though, and the door slammed shut on this fortunate pattern with a cold snap that lasted for weeks. March can be a cruel month! One final snowfall on the last official day of winter (March 19th) blanketed the northeast with up to 18" of new snow in some areas (Essex had 7.1"). A very gradual, very steady warm-up in late March kept the maple sugaring season on track well into April. The sugaring season was long and the sap was sweet, with many producers reporting their best season in a very long time.

Dry air firmly in place well into May gave the state cool nighttime low temperatures and above normal daytime highs. Fire danger was increasing. The 18-day period from April 20th to May 7th had only 0.08 of rain! The only factor limiting a red flag warning was that the winds were very light. Special fire danger statements urging caution and/or postponement of outdoor burning were issued all over the state. However, the warm, sunny weather did advance the greening up of the landscape providing some shading and a mix of live and dead fuels to give a moderating effect on the fire danger in spite of the lack of rainfall. Spring bud development on the sugar maples at Proctor Maple Research Lab in Underhill got off to a slow start, then jumped rapidly. The leaf buds did not break out of their bud scales until May 3rd, with full leaf expansion by May 7th. Finally, on May 19th, the weather pattern made a dramatic flip-flop. Daily rounds of showers and thunderstorms moved across the north country. The weather service used the term "train effect" storms because the storms were lined up like trains on a track coming one after the other across the same area. Especially hard hit were eastern Chittenden and western Lamoille counties causing severe flash flooding with damage to roads and property. During that 8-day period starting on May 19th, the Essex weather station received 8.11" of rain—more than the total for the previous 4 months!

And just to top off a very unusual month, snow fell in elevations above 1700 feet in northeastern Vermont on May 26, Memorial Day weekend, with a trace to 6" falling in most locations but Mt. Mansfield received 16" of snow —the latest one foot plus snowfall on the mountain ever. Hardwood trees with a full crown of leaves were damaged by the weight of the snow. Montpelier set a low temperature record of 32° on May 28 and a high temperature record of 87° on May 31.

Summer and Fall, 2013. There were more rain and storms in June. On June 2nd, two areas were hit especially hard by strong, gusty thunderstorm winds and ping pong ball size hail. The St.Johnsbury/Danville area and the towns between Rutland and Chelsea had trees and power lines knocked down as up to 14,000 people lost their electricity. All through the month of June the air was very humid and the skies were frequently cloudy. By mid-month, the vegetable gardens were suffering from a lack of sun. Tomato and pepper transplants were languishing, making the dreams of plump, red tomatoes seem very far off. The grass and weeds, however, grew in lush abundance. Just ask anyone in Vermont that tried to keep their garden weeded or their lawn mowed last summer. Because of this peculiar weather matrix, or perhaps in spite of it, many plants had very heavy flowering and seed production. Black locust trees had an exceptional flowering year. Groups of these trees stood out on the distant hillsides with an amazing splash of white blooms. Ash, basswood, cherry, apple, elderberry, grape, and many more species were laden with flowers.

After a soggy June, July was off to a similar start. The same stagnant weather pattern spawned the same forecast: a chance of showers and thunder storms daily with locally heavy rain…warm and muggy. This prolonged period of wetting kept the leaf surfaces moist and set the table for a variety of leaf diseases on hardwoods and conifers alike (anthracnose, septoria, delphinella shoot blight, to name just a few). June just missed being the wettest June on record at Burlington and May was the wettest May ever recorded even though the first two weeks were so dry. Water was everywhere—standing in the farm fields, drowning the stunted corn plants and spoiling the strawberry crop. Some fields were never planted all summer because the farmers were not able to get equipment onto them. Instead of a gradual receding, Lake Champlain kept rising into the summer. The lake level hit an all-time July record high of 99.67', just 4" from flood stage!

The wet weather finally abated by mid-July, just in time for an unusually long heat wave. Five consecutive days from July 15th to July 19th saw high temperatures over 90^{0}F. This was only the 13th time since records were kept that this occurred at the Burlington weather station. High dewpoints and soaring temperatures brought on days of scattered severe storms. Most notably was a fierce thunderstorm on July 19th. High winds associated with this storm caused widespread damage to trees and power lines, primarily in a swath across the northern counties of New York and Vermont. The rest of the summer was relatively normal in regards to both precipitation and temperatures. All of the fruits, nuts and seeds that got their start during the heavy spring flowering had time to ripen.

Reports of early color began in August. Trees responding to the stress of the summer’s excessive soil moisture were easy to pick out on the landscape—red maples flagging red in the traditional low lying areas and a more than normal yellow on sugar maples statewide. A stretch of dry, cool and clear days in mid-September brought on the foliage season in earnest. Overnight lows were near freezing with daytime highs in the 70’s. Still there were no widespread hard frosts to bring out the bright red pigments. The upper elevation birches were plagued by leaf spot diseases, and generally turned brown and fell early. Likewise, the ash trees lost their leaves sooner than usual. Heavy seed and the dry, warm fall weather were contributing factors. Every year it seems that whenever any particular tree species doesn’t contribute much to the fall foliage event, others shine brighter to compensate. Sugar maples and red maples once again stole the show with spectacular splashes of color on the Vermont hillsides and village streets. October weather was very easy on all the locals and visitors alike that came out to enjoy the beautiful autumn in Vermont. The first three weeks of the month frequently had daytime temperatures in the 60’s and 70’s—it even hit 80^{0}F on the 7th. The first killing frost in the Champlain valley wasn’t until October 29th. Many of the leaves that were still clinging to the trees came fluttering down the next morning as the bright sunlight warmed them up.

Ice Storm of 2013. Rain started early on Saturday, December 21 in the Adirondacks and slowly spread east. Temperatures well below freezing were in place down the Champlain Valley from the Adirondacks to the Greens and along the northern border towns. Rain lingered through Saturday and Sunday December 22 before finally changing over to snow by early Monday the 23rd. Ice accumulations in the hardest hit areas of Franklin and Orleans counties, the northwestern slopes of the Greens and northern Champlain valley, were from 0.5 inches in Berkshire, Barton and Lincoln to 0.75 inches in Bakersfield, Cambridge and Milton to an inch in Jeffersonville.

Trees were damaged in the hardest hit areas and downed powerlines left 22,000 people without power at the height of the storm. Many had to wait several days before power was restored. Frigid temperatures following the storm and on Christmas eve and Christmas day kept the ice in place in the coldest spots. Where ice accumulations were not as severe, temperatures rose back above freezing by late Sunday morning through the day and night and into the following Monday allowing for ice melt and resulting in little to no damage to trees.

Maple producers had to wait to assess the extent of damage to their sugarbushes until the threat of breaking branches and ice had passed. Damage was primarily to infrastructure, roads and tubing, rather than significant crown or tree damage. The smaller trees, mostly sugar maple, birch, beech, and striped maple saplings, were damaged and this added to the infrastructure damage. Damage to older maple crowns was more sporadic. As of January 10, 2014 the Farm Services Agency (FSA) had received applications for Emergency Conservation Program assistance from 127 maple producers for damage to over 189,000 taps. We have updated our recommendations to landowners regarding recovery of ice-damaged trees based on recent results from long-term studies following the 1998 storm. http://www.vtfpr.org/protection/documents/IceDamage2014.pdf

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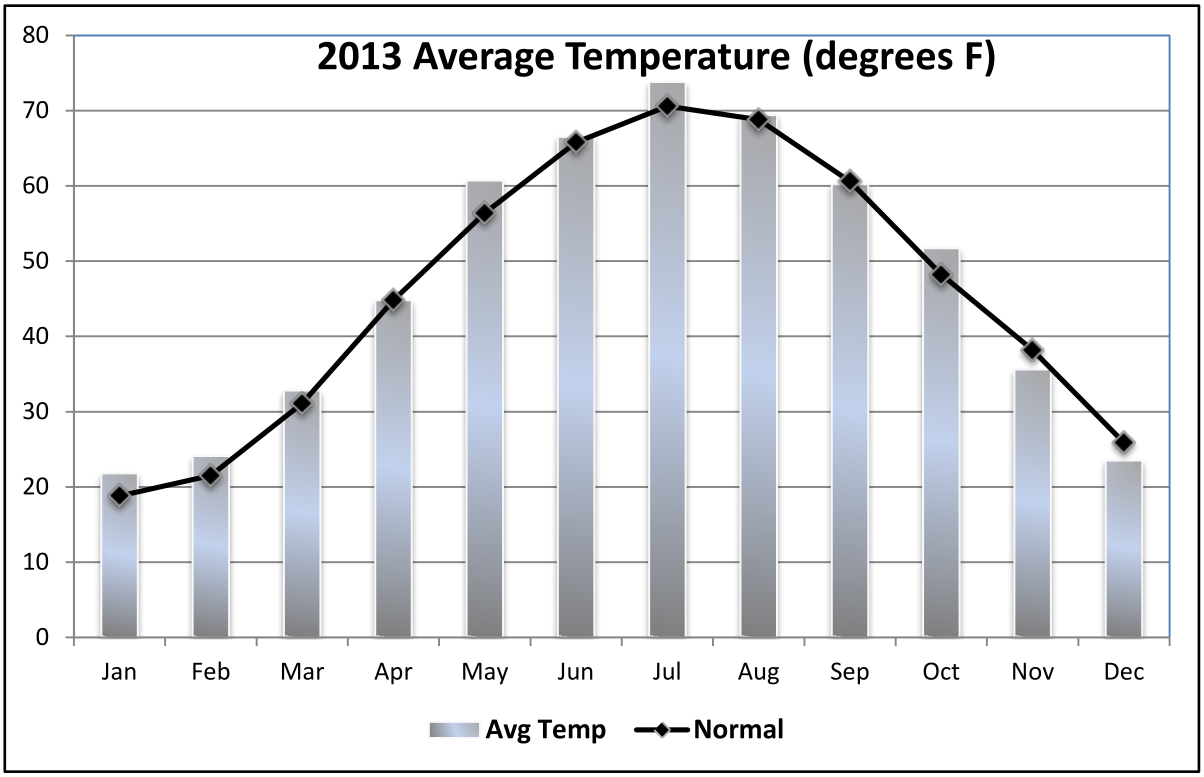
Links to maps and reports of 2013 damaging wind, rain and hail events from the National Weather Service, Burlington, Vermont:

- *The Damaging Wind and Large Hail Event of 2 June 2013*
- *Widespread Severe Thunderstorm Damaging Wind Event on 19 July 2013*
- *North Country Precipitation Total – Summer 2013 (Jun-Aug)*
- *Golf Ball Hail and Damaging Wind Event on 11 September 2013*

Figures 1-14 and Tables 1-2 *provide details on 2013 temperatures, precipitation and phenological observations.*



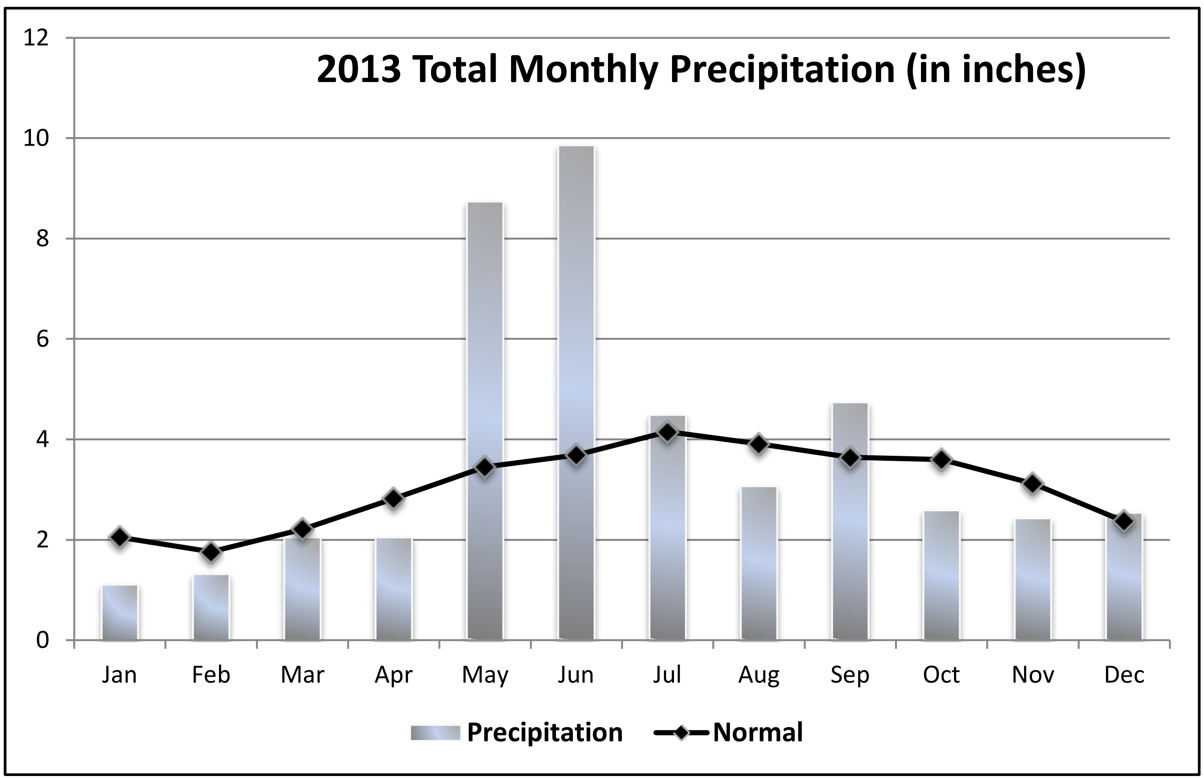


Figure 1. Monthly average temperature and monthly total precipitation in 2013, compared to normal for Burlington, Vermont. (Normals are for years 1981-2010.) *Source: National Weather Service, Burlington.*

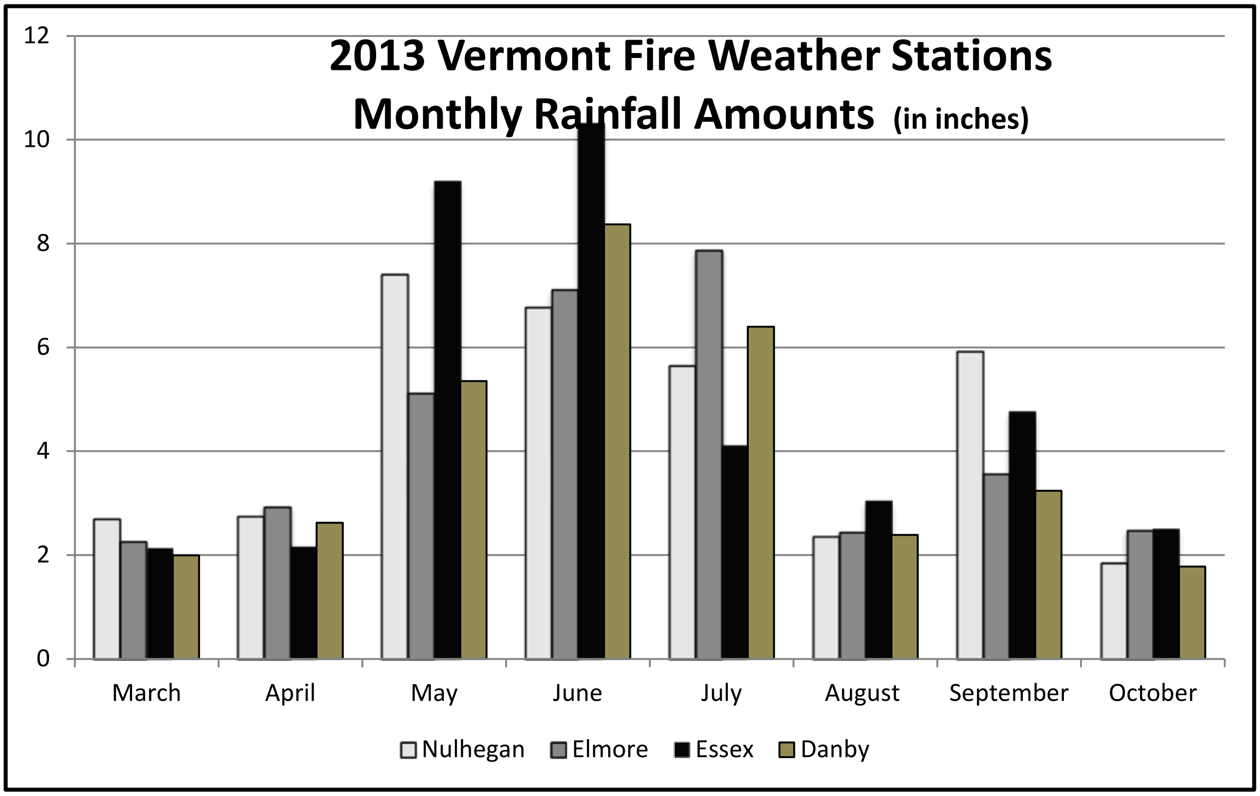


Figure 2. Monthly rainfall amounts (in inches) at Vermont fire weather observation stations through fire season, March-October, 2013. The Marlboro station was relocated to Woodford State Park in August. The dataset is incomplete for both locations and therefore not included in this report.

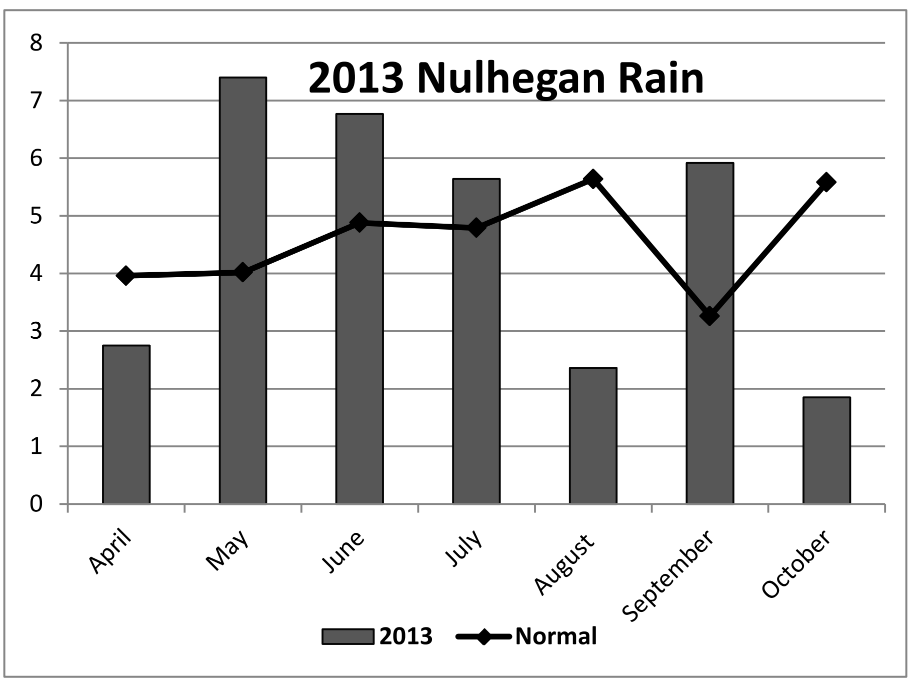


Figure 3. Monthly rainfall amounts (in inches) at the Nulhegan fire weather observation station in Brunswick, Vermont compared to normal through fire season, April-October, 2013. Normal is based on 11 years of data.

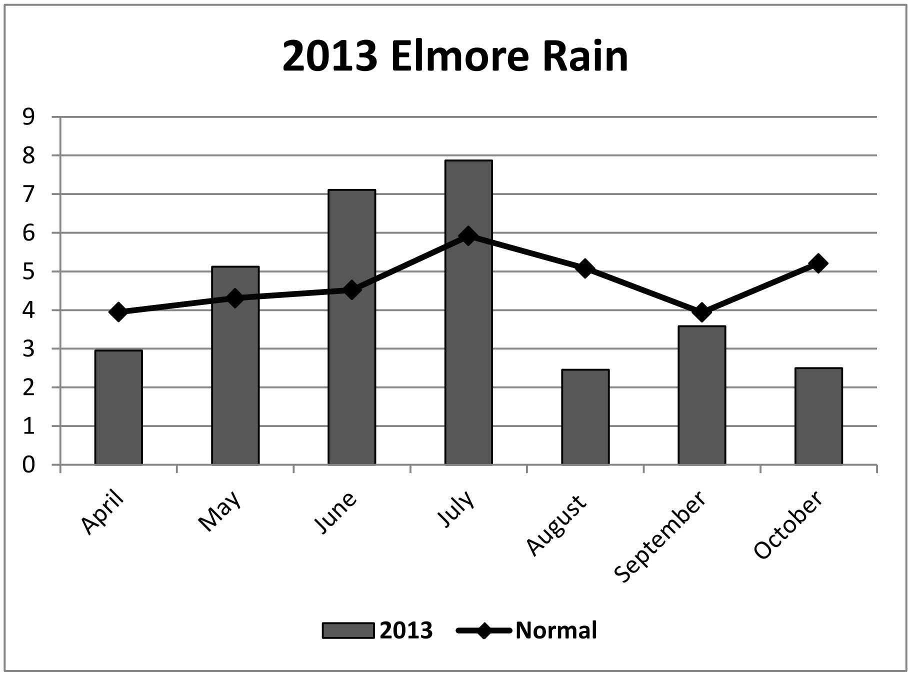


Figure 4. Monthly rainfall amounts (in inches) at the fire weather observation station in Elmore, Vermont compared to normal through fire season, April-October, 2013. Normal is based on 19 years of data.

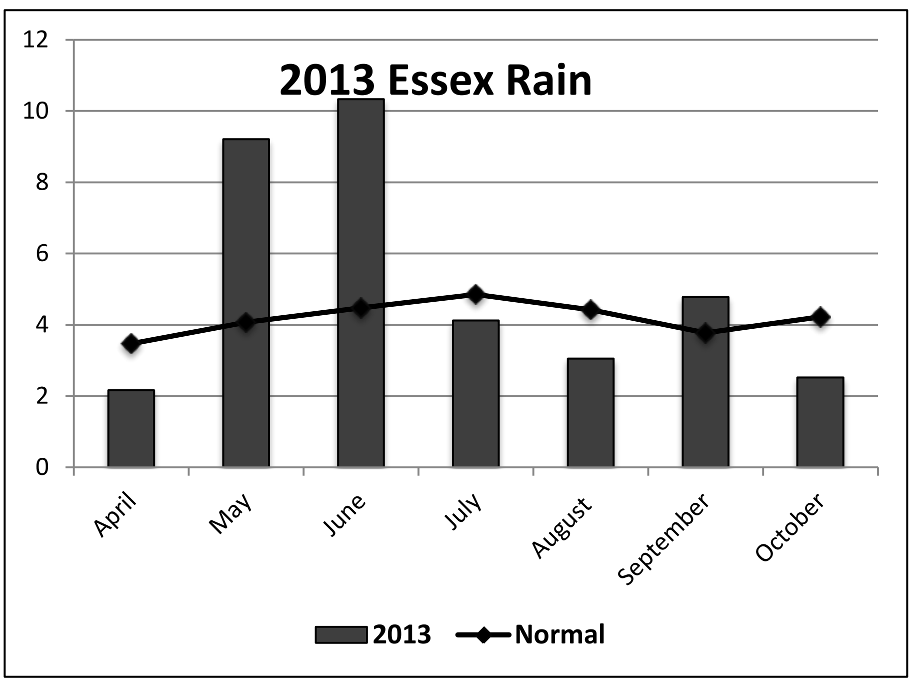


Figure 5. Monthly rainfall amounts (in inches) at the fire weather observation station in Essex, Vermont compared to normal through fire season, April-October, 2013. Normal is based on 20 years of data.

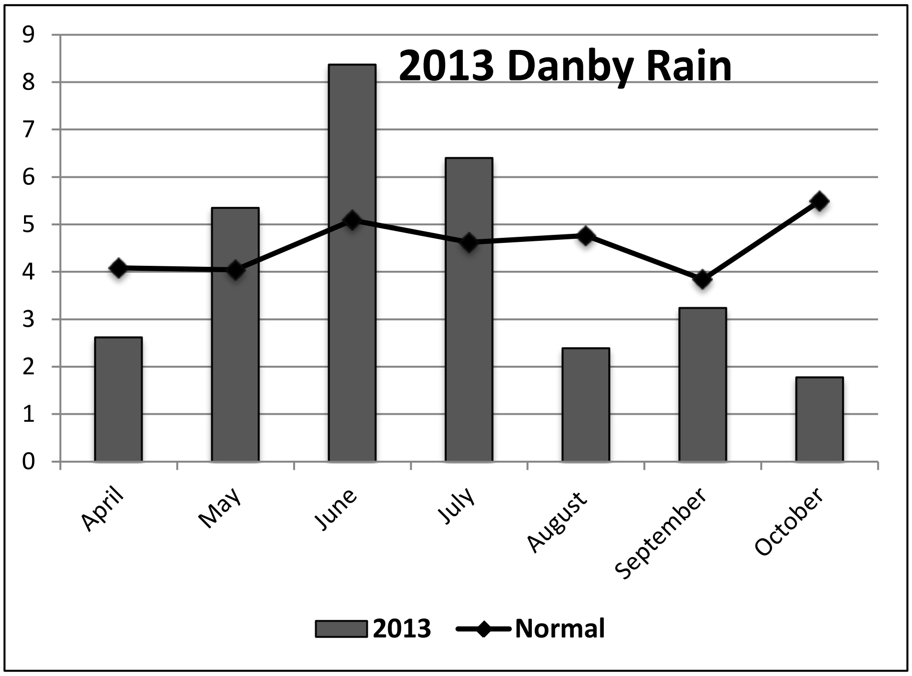


Figure 6. Monthly rainfall amounts (in inches) at the fire weather observation station in Danby, Vermont compared to normal through fire season, April-October, 2013. Normal is based on 16 years of data.

Spring Budbreak and Leaf Out At Mount Mansfield

Sugar maple trees were monitored for the timing of budbreak and leaf out in the spring at the Proctor Maple Research Center in Underhill as part of the Vermont Monitoring Cooperative. Buds are rated weekly using standards for vegetative and flower buds (Skinner, M. & Parker, B. L. 1994. “Field Guide for Monitoring Sugar Maple Bud Development”).

Sugar maple leaf bud expansion got off to a slow start in 2013. The timing of budbreak was similar to the long-term average date (Figure 1), but rapid bud expansion allowed full leaf-out timing to be much earlier than normal. Full leaf-out was 10 days ahead of the long-term average (Figure 2).

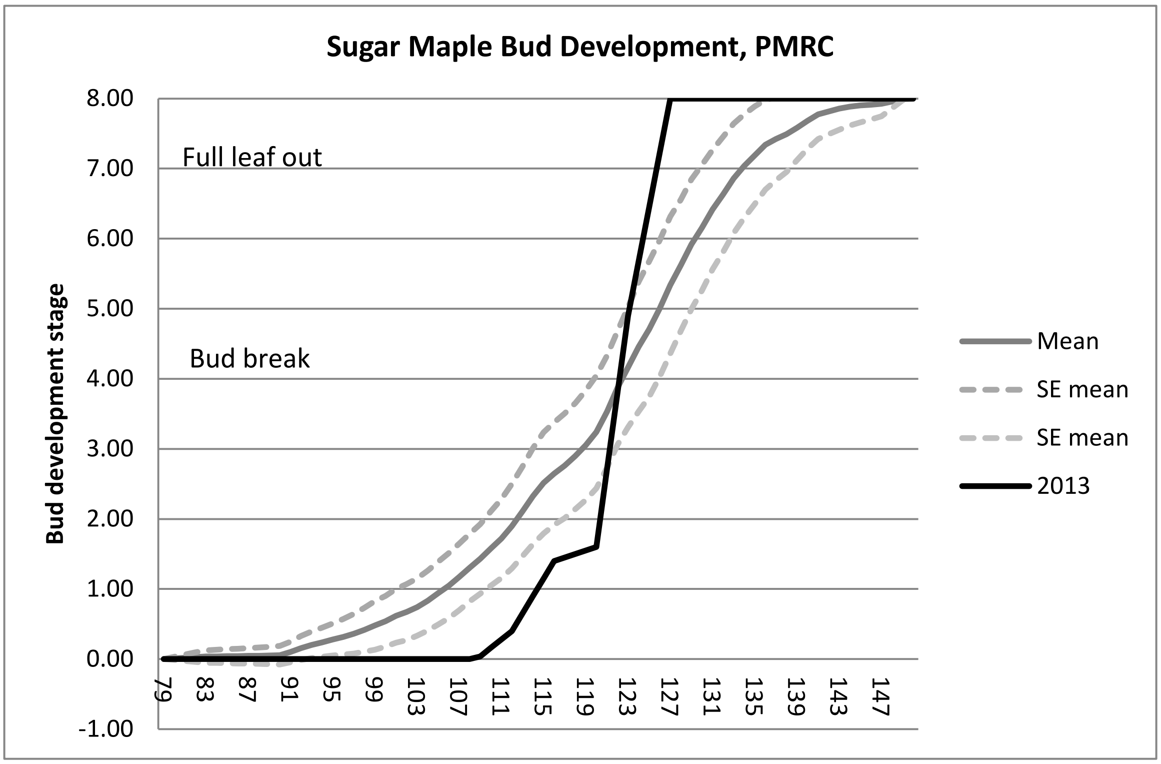


Figure 7. Timing of sugar maple bud development on trees compared to the long term average (22 years) at the Proctor Maple Research Center in Underhill.

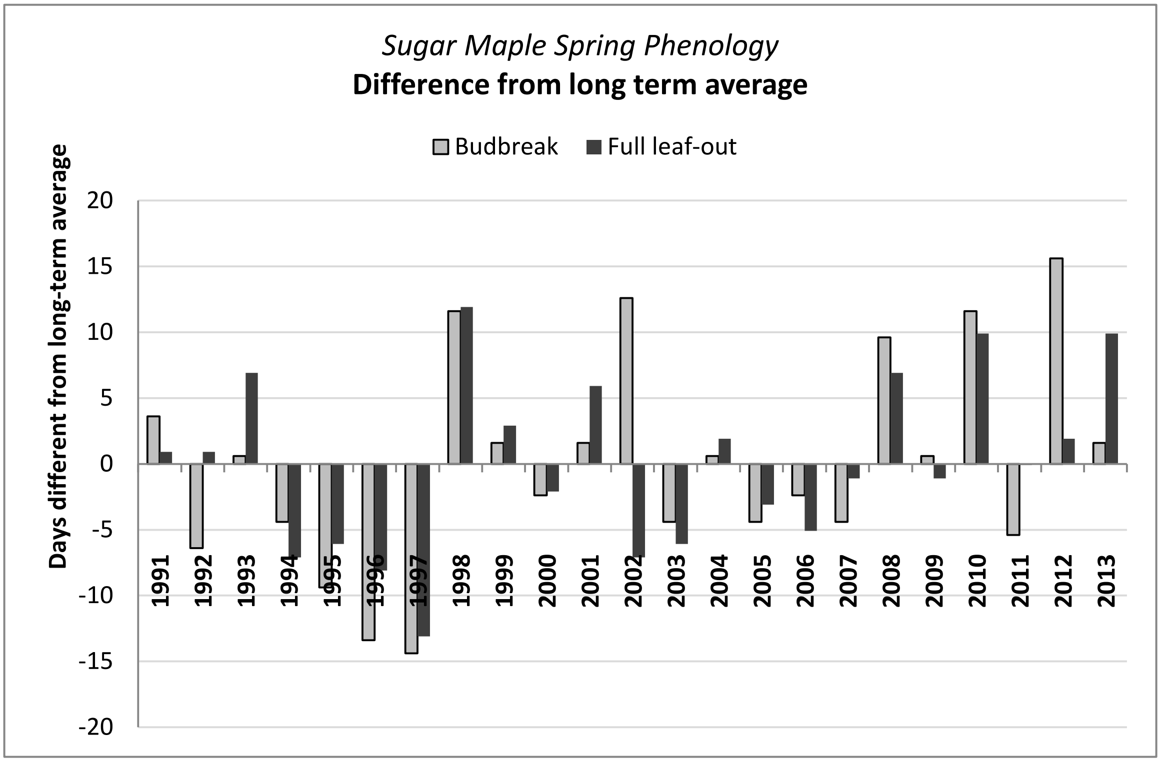


Figure 8. The timing of sugar maple budbreak and leaf out compared to the long term (22 year) average of trees monitored at the Proctor Maple Research Center in Underhill.

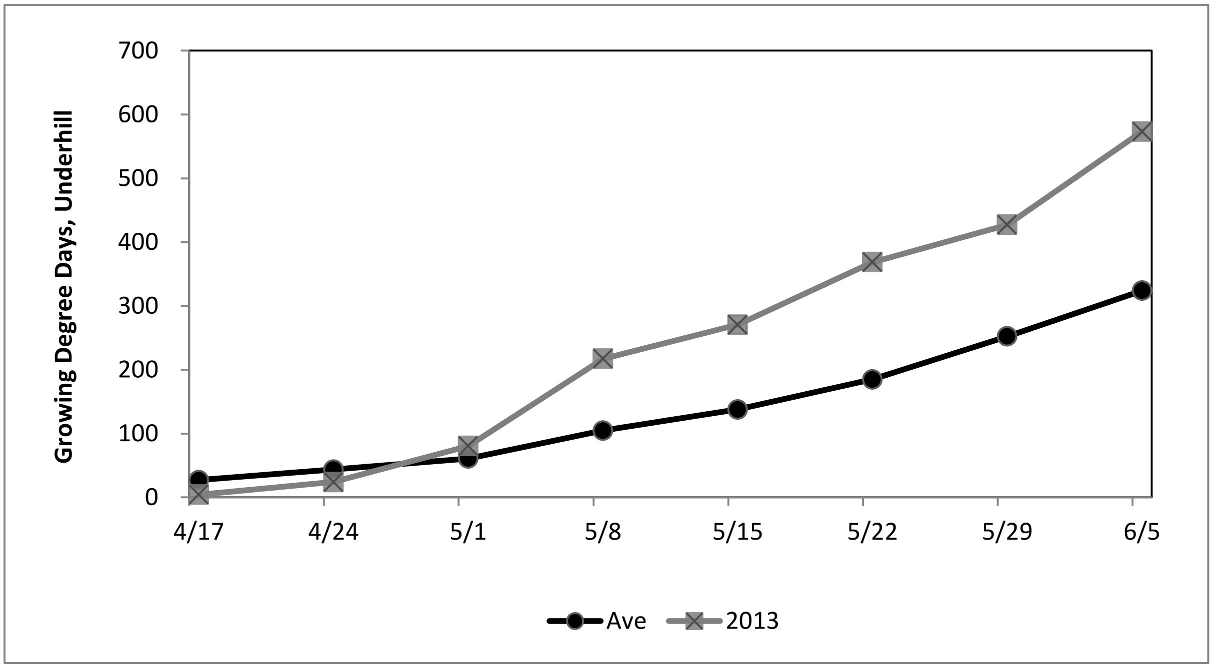


Figure 9. Weekly spring cumulative growing degree days for Underhill, Vermont, in 2013 compared to mean 1993-2013 accumulations. 50°F was used as the threshold of development.

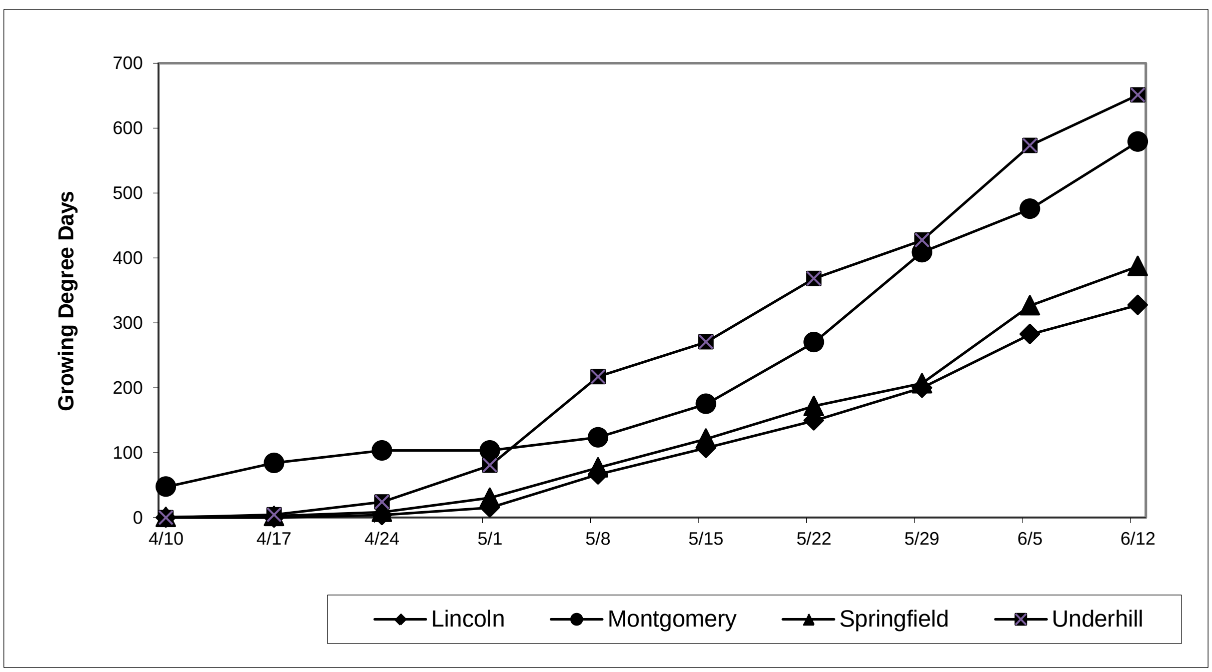


Figure 10. 2013 weekly spring cumulative growing degree days for Springfield, Underhill, Montgomery, and Lincoln, Vermont. 50°F was used as the threshold of development.

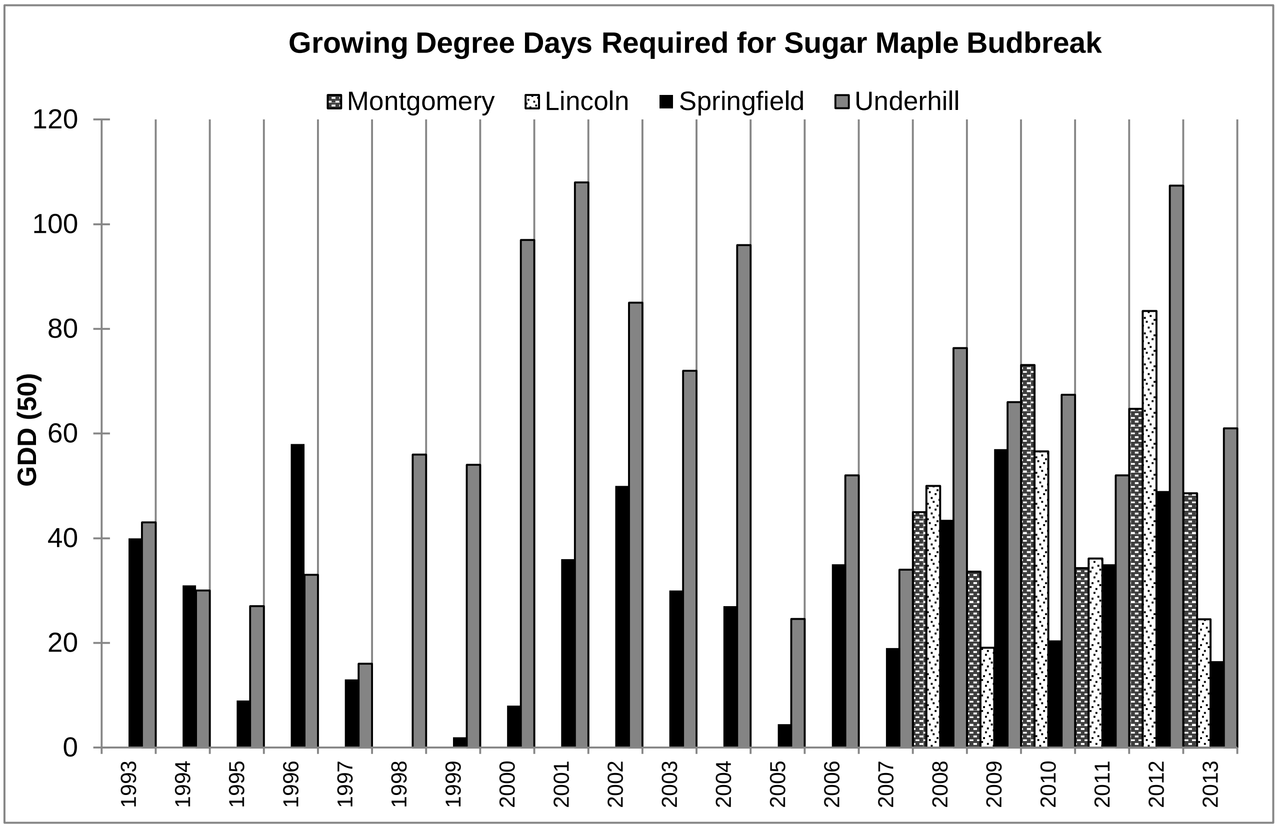


Figure 11. Growing degree days for sugar maple budbreak in Springfield and Underhill 1993-2013, and for Montgomery and Lincoln 2008-2013.

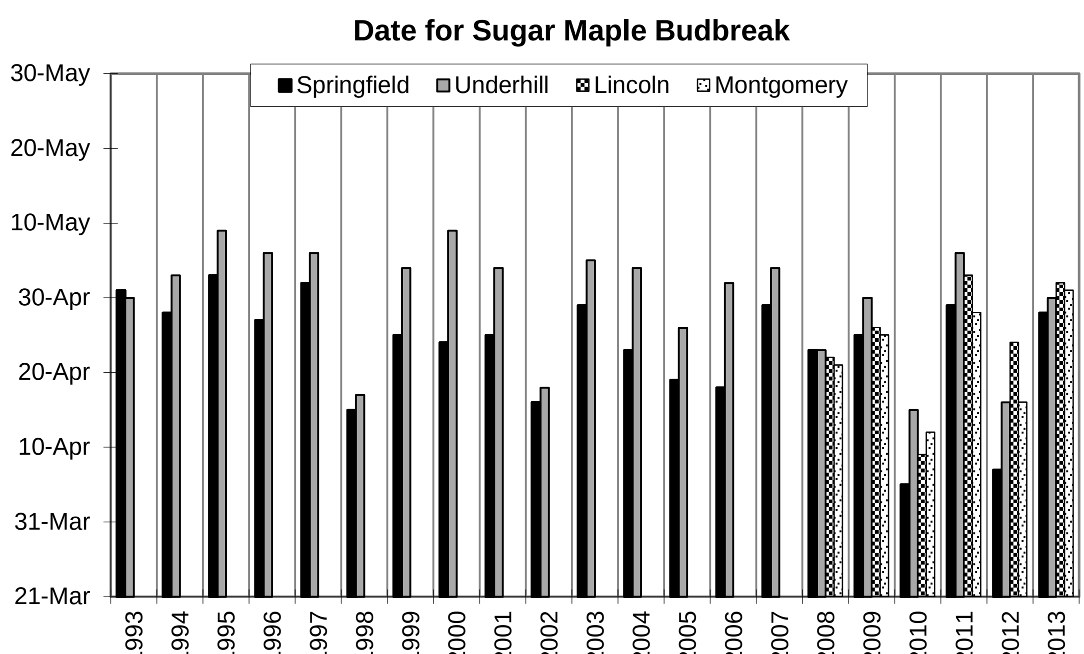


Figure 12. Dates of sugar maple budbreak in Springfield and Underhill 1993-2013 and for Montgomery and Lincoln 2008-2013.

Table 1. First observation dates of phenological development and growing degree day accumulations from 4 sites in Vermont for 2013. 50°F is used as the threshold of development.

Biological Indicator	Lincoln	Montgomery	Springfield	Underhill
PLANT DEVELOPMENT				
Showing Green				
Fir, Balsam		5/17 (242.5)		5/7 (194)
Hemlock		5/21 (284.5)	5/13 (121.5)	5/20 (329)
Spruce, Red		5/24 (326.2)		
Budbreak				
Ash, White		5/7 (134.7)	5/2 (38)	5/3 (116)
Aspen, Quaking	4/30 (12)	4/30 (44.4)		
Cherry, Black		4/30 (44.4)		
Cherry, Choke		5/1 (48.6)		
Elm, American		5/4 (91.7)		
Fir, Balsam	5/15 (107.5)	5/20 (272.7)		5/13 (266)
Hemlock		5/25 (326.2)		5/28 (413)
Lilac	4/29 (8)	5/2 (64.2)		
Maple, Red		5/5 (107.1)		5/3 (116)
Maple, Sugar	5/2 (24.5)	5/1 (48.6)	4/28 (16.5)	4/30 (61)
Oak, Red		5/5 (107.1)	5/2 (38)	
Shadbush	5/2 (24.5)			
Spruce, Red	5/19 (122.5)	5/28 (327.4)		
Flowers of Deciduous Trees and Shrubs				
Ash, White		5/5 (107.1)		5/7 (194)
Aspen, Quaking		5/5 (107.1)	4/13 (1)	
Cherry, Choke		5/21 (284.5)		
Lilac (first flowers)	5/17 (116.5)	5/12 (223.5)		5/17 (290)
Maple, Red	4/30 (12)	4/25 (17.6)	4/16 (1)	4/26 (24)
Maple, Sugar	5/4 (35)	4/30 (44.4)		5/3 (116)
Oak, Red		5/5 (107.1)		
Shadbush	5/5 (41)			5/6 (173)
Wildflowers (Budbreak)				
Marsh Marigold	5/4 (35)			
Virginia Spring Beauty	5/1 (15.5)	4/26 (17.6)		4/19 (16)
Wildflowers (First Flowers)				
Virginia Spring Beauty		4/30 (44.4)		
Wild Strawberry		5/11 (214.4)		
INSECT DEVELOPMENT				
Eastern tent caterpillar (first tent)		5/5 (107.1)		
Pear thrips (first adults)				4/22 (16)
OTHER OBSERVATIONS				
Spring peepers calling	4/29 (8)	4/24 (17.6)		
Full green up		5/28 (327.4)	5/30 (215.5)	

Fall Color Monitoring at Mount Mansfield

Trees at 3 elevations in Underhill at the base of Mount Mansfield were monitored for the timing of fall color and leaf drop (end of growing season). Sugar maple trees at the Proctor Maple Research Center (1400 feet) were consistent with the long term median (1991-2012) for both timing of color and leaf drop (Figures 1c & 2c). Other species and elevations were earlier than the long term median. Sugar maple at upper elevations (Figure 1d), 2200 feet, was nearly 10 days earlier than recent decades. White birch at upper elevations (2f), 2600 feet, was affected by leaf diseases and some trees dropped leaves earlier in the summer. An interesting observation is that female red maple trees have much earlier peak color than the male trees (Figures 1a&b), several weeks, whereas leaf drop is nearly the same.

Figure 13. Timing of fall color (Figure 13a-13i) and leaf drop (Figure 14a-14i) is monitored at three elevations on Mount Mansfield: 1400 feet at the Proctor Maple Research Center, and 2200 and 2600 feet above the Underhill State Park. Five species are monitored: sugar maple, red maple (male and female trees), white ash, white birch and yellow birch.

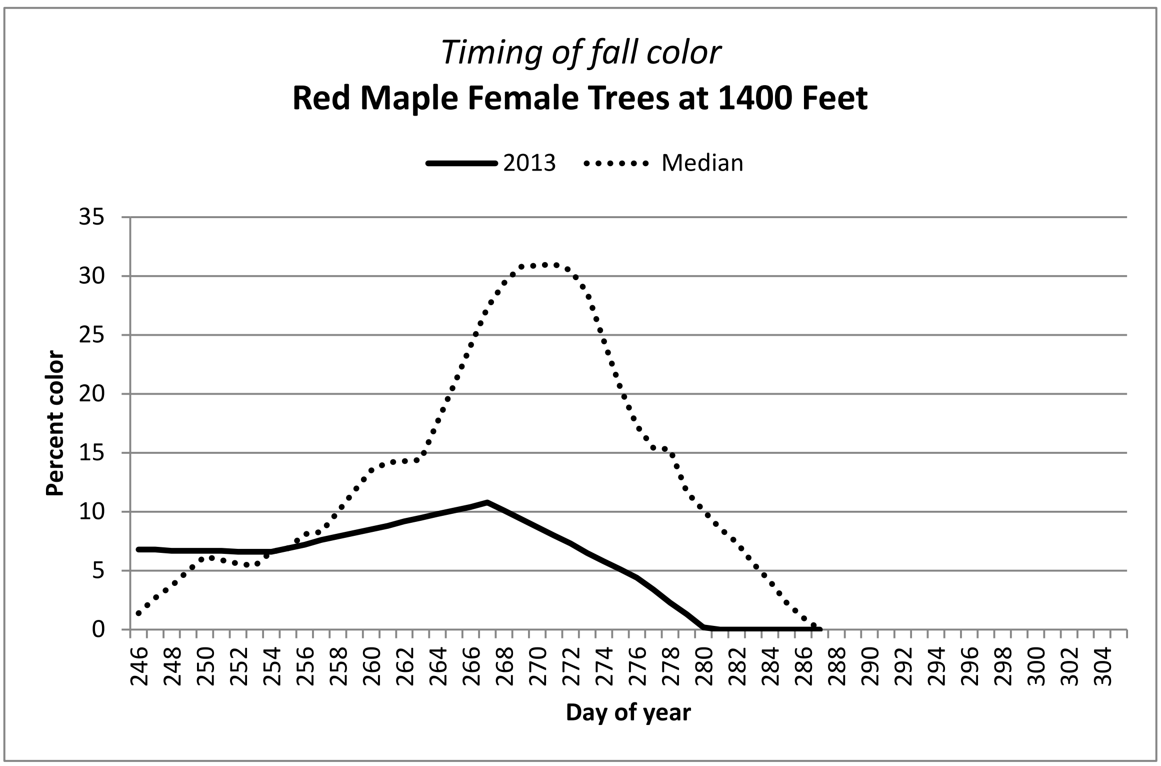


Figure 13a.

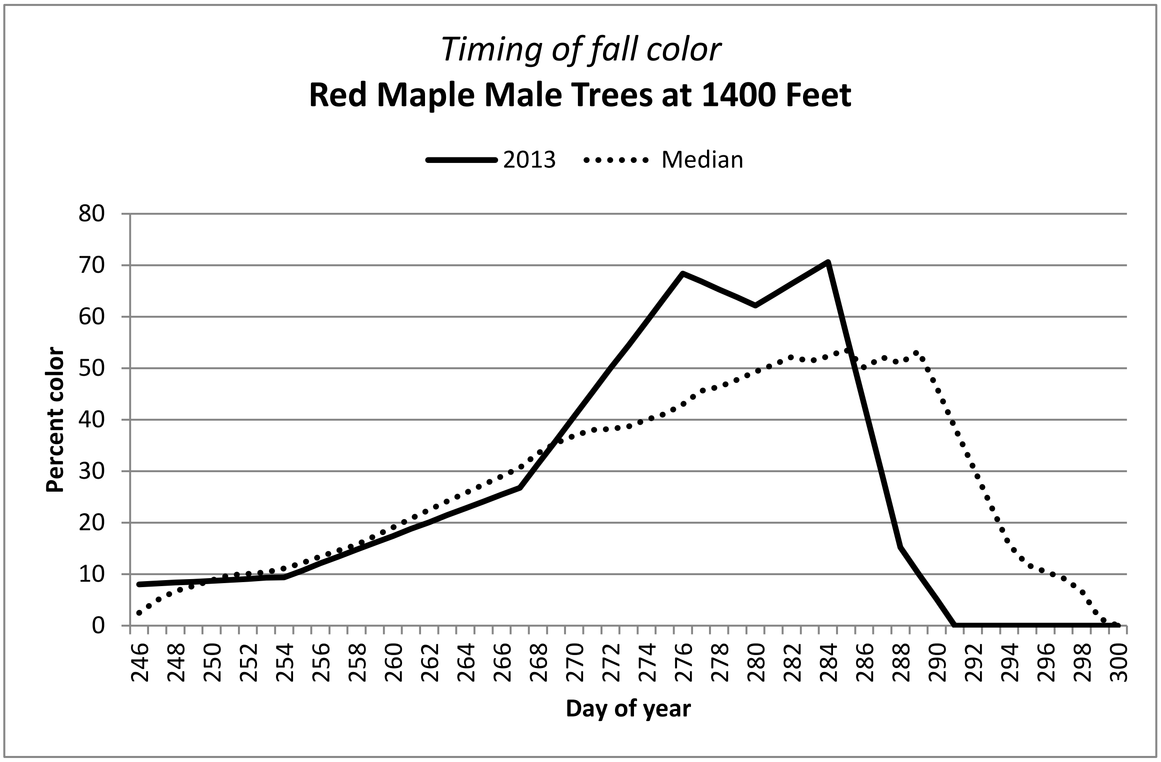


Figure 13b.

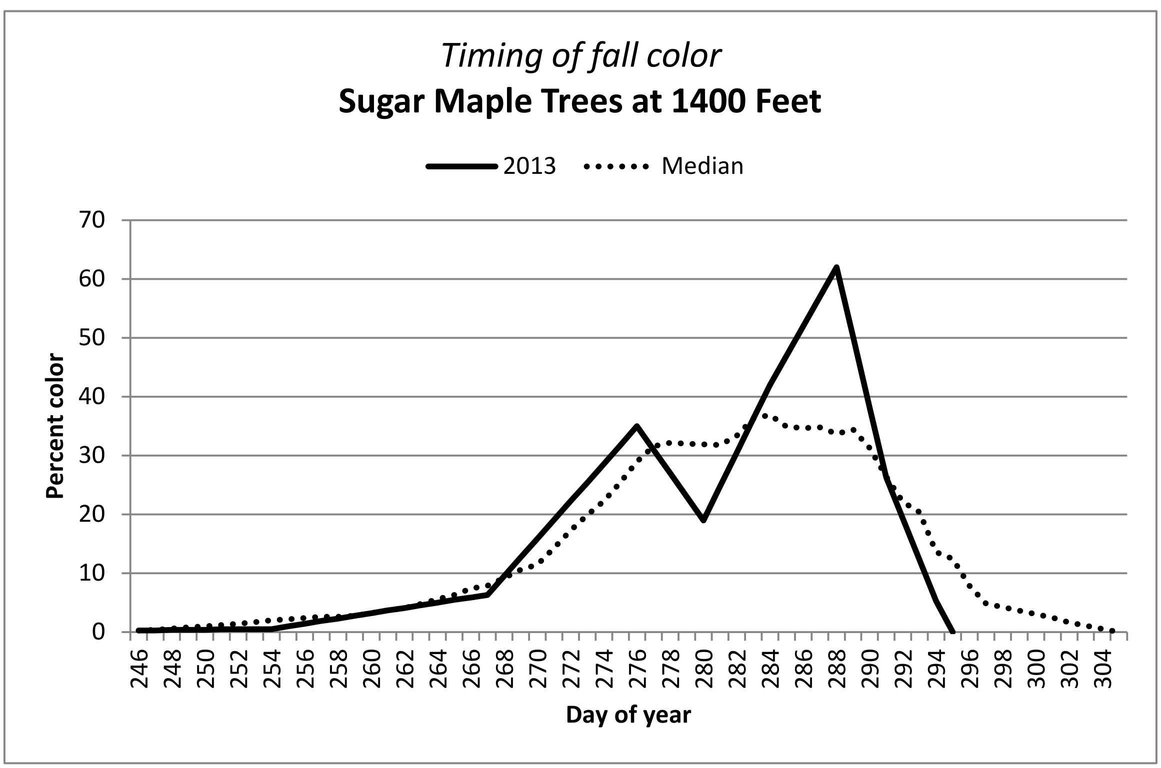


Figure 13c.

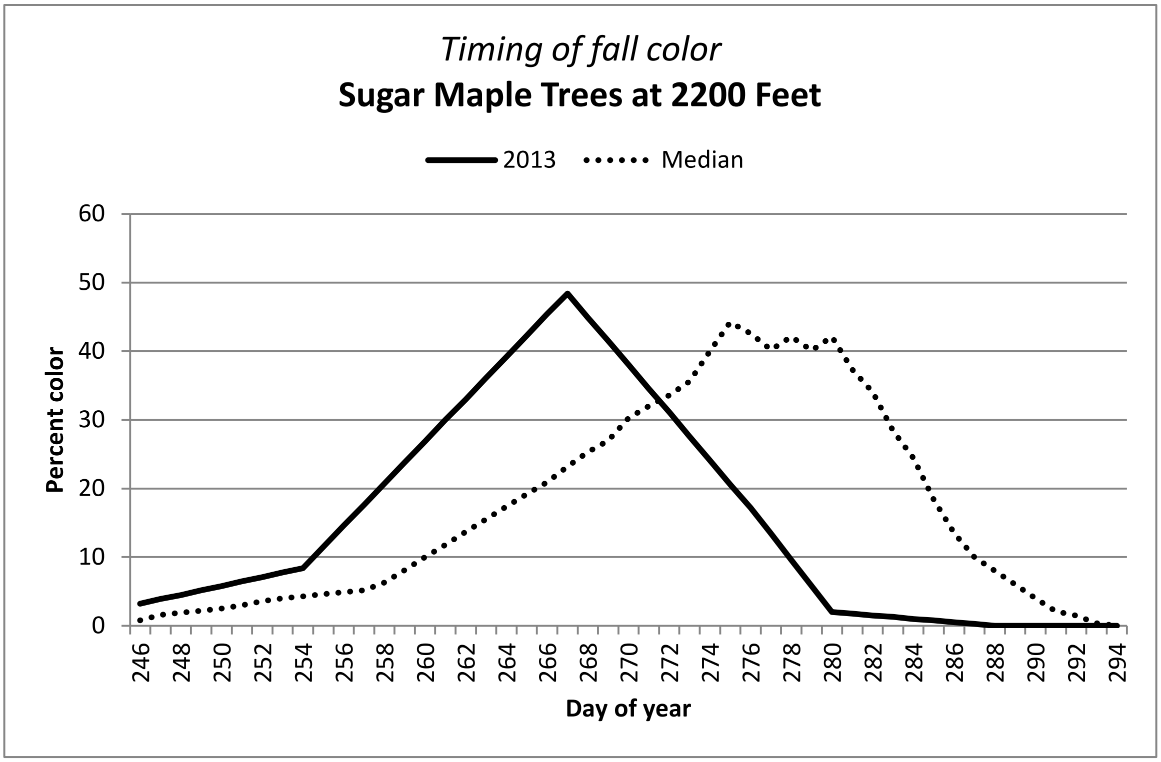


Figure 13d.

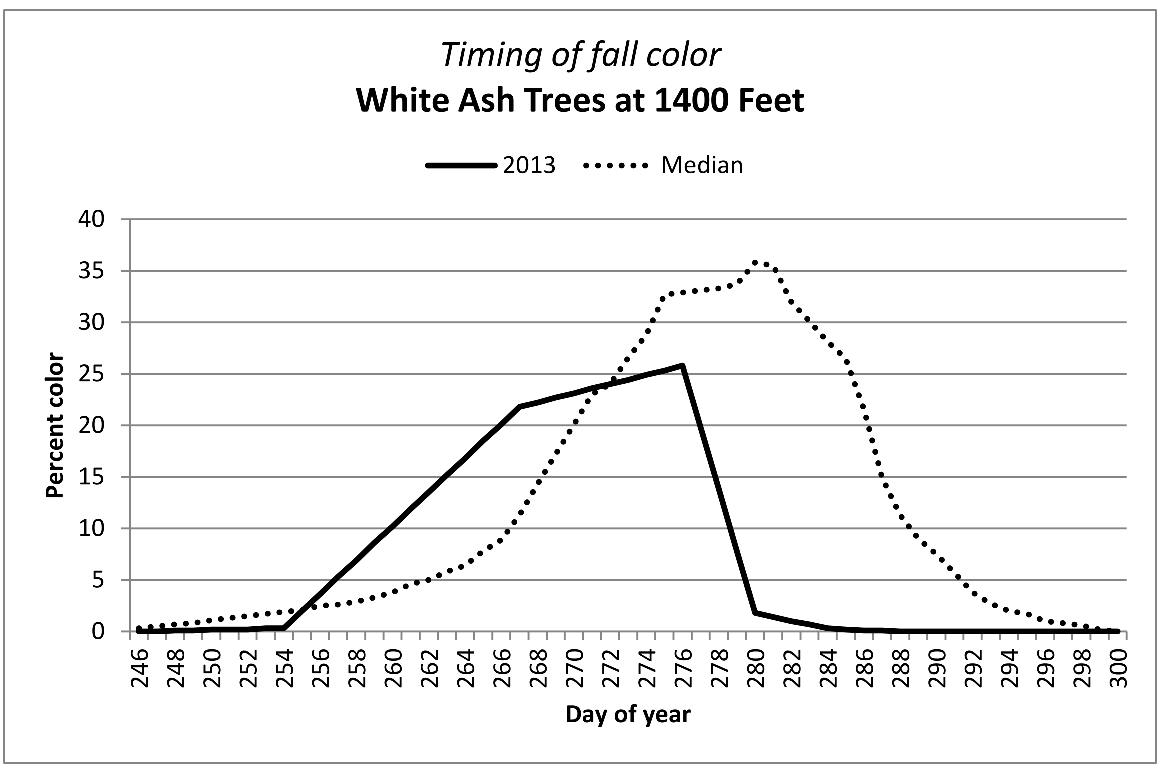


Figure 13e.

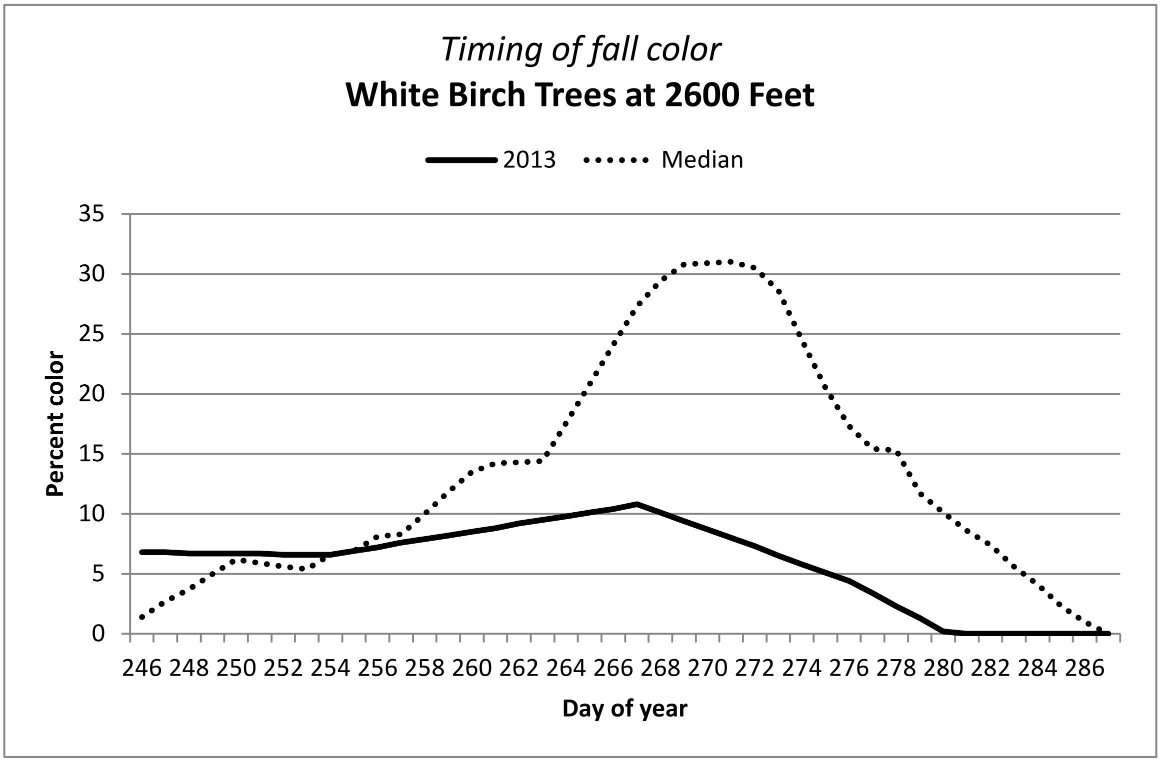


Figure 13f.

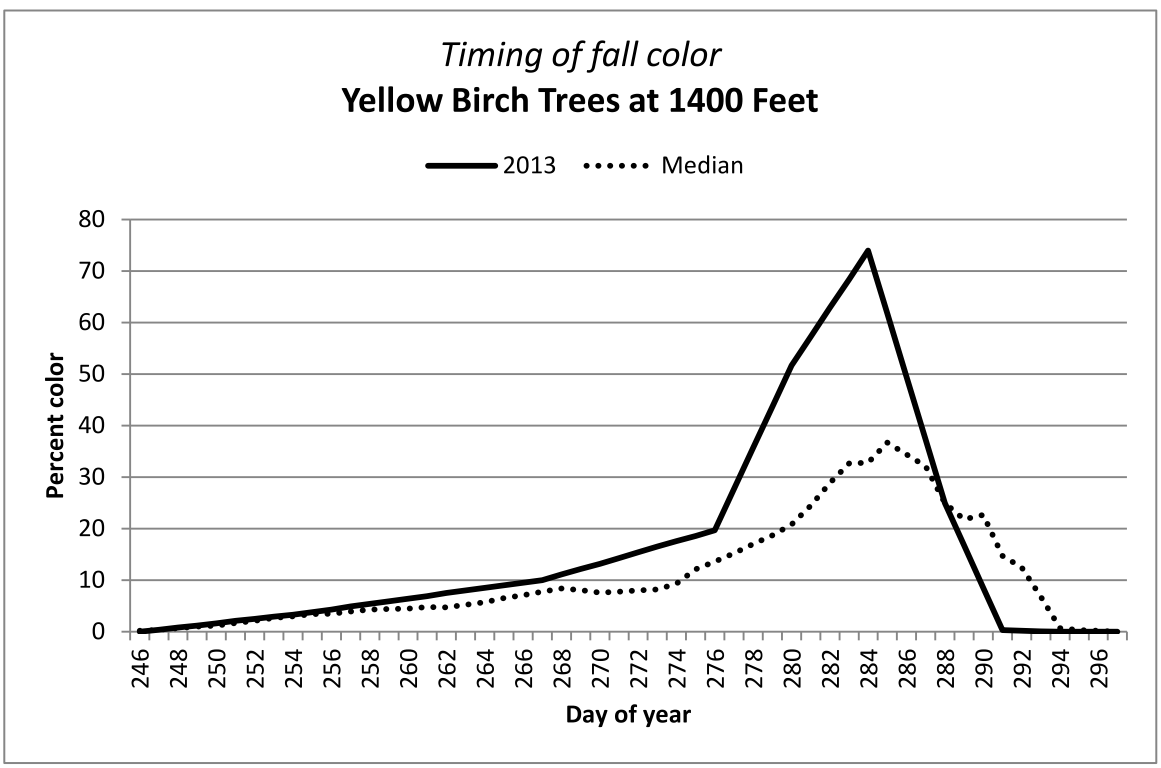


Figure 13g.

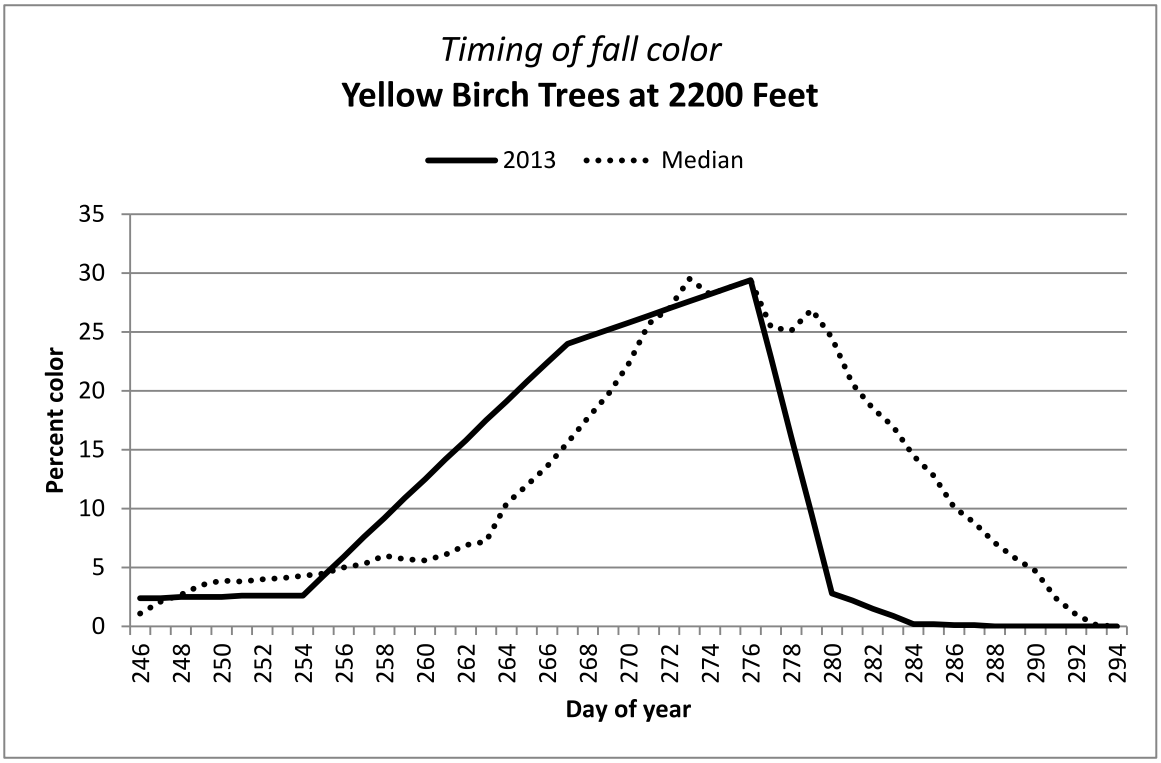


Figure 13h.

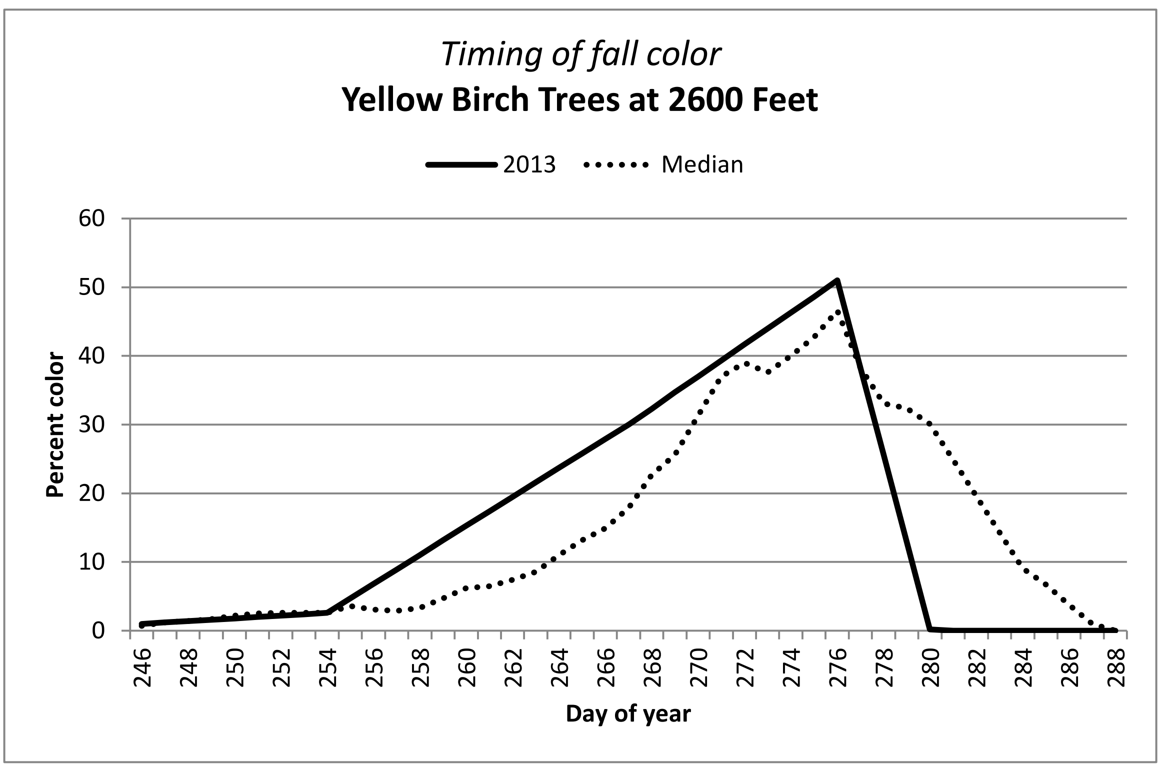


Figure 13i.

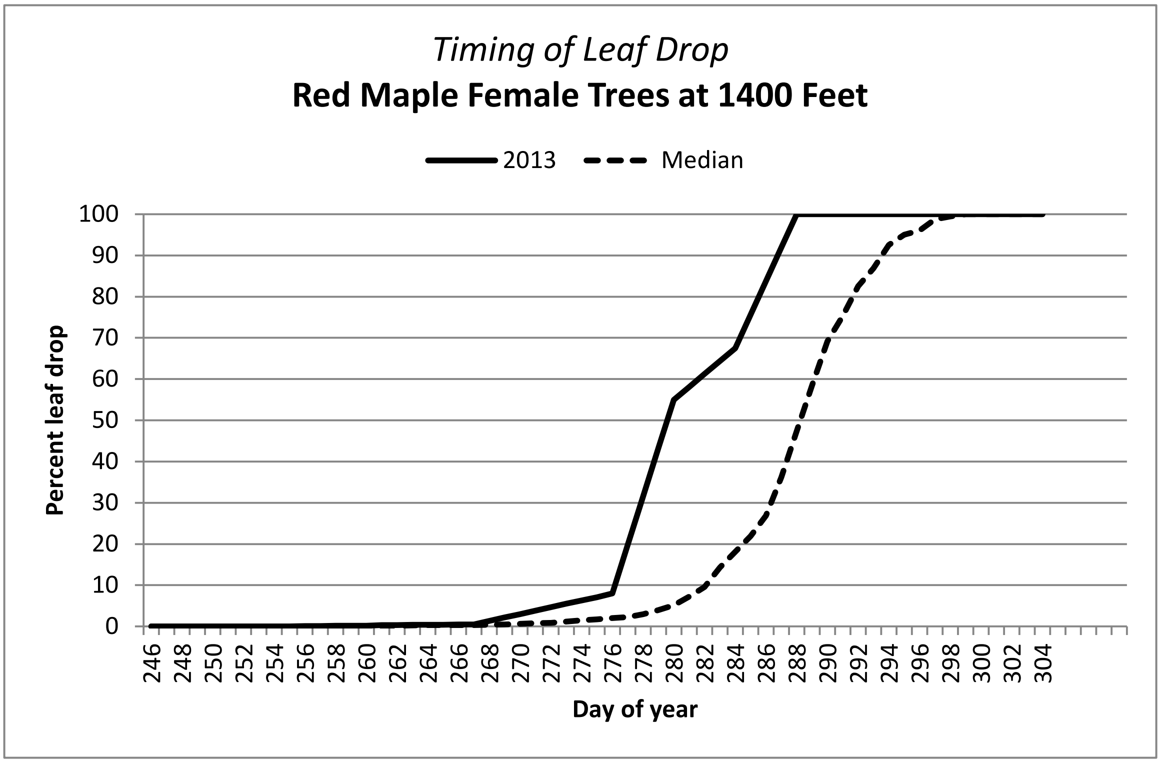


Figure 14a.

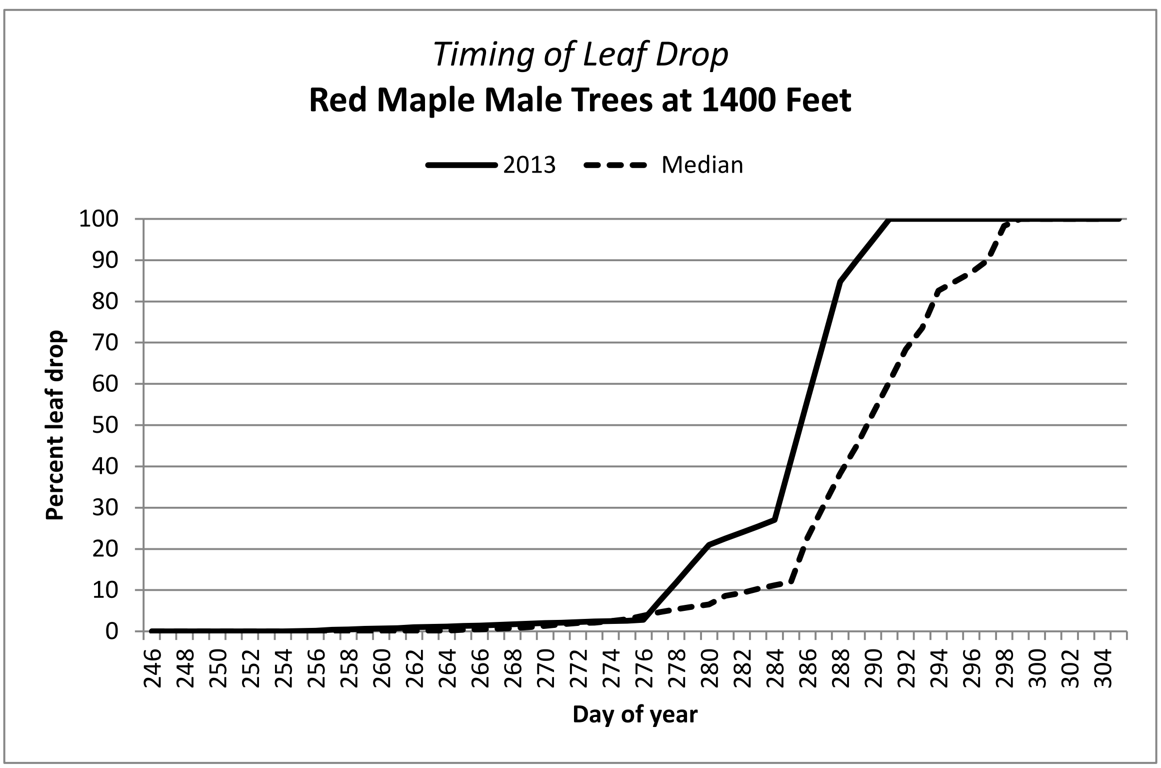


Figure 14b.

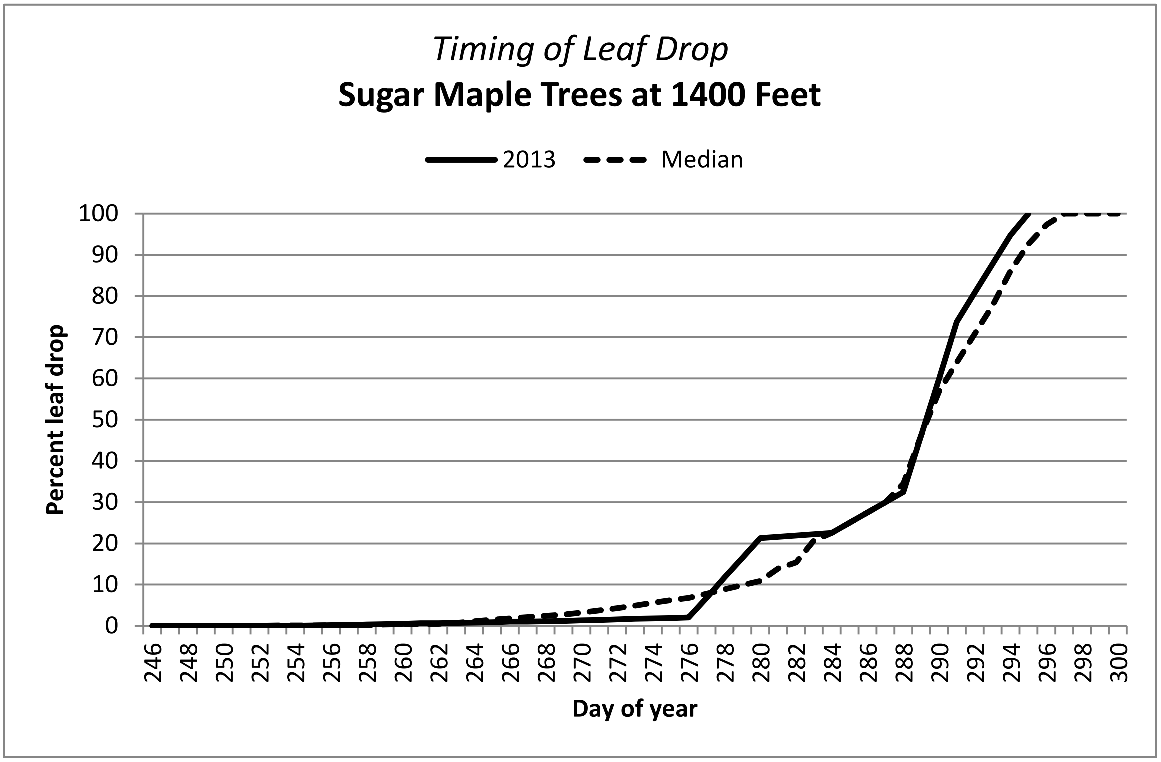


Figure 14c.

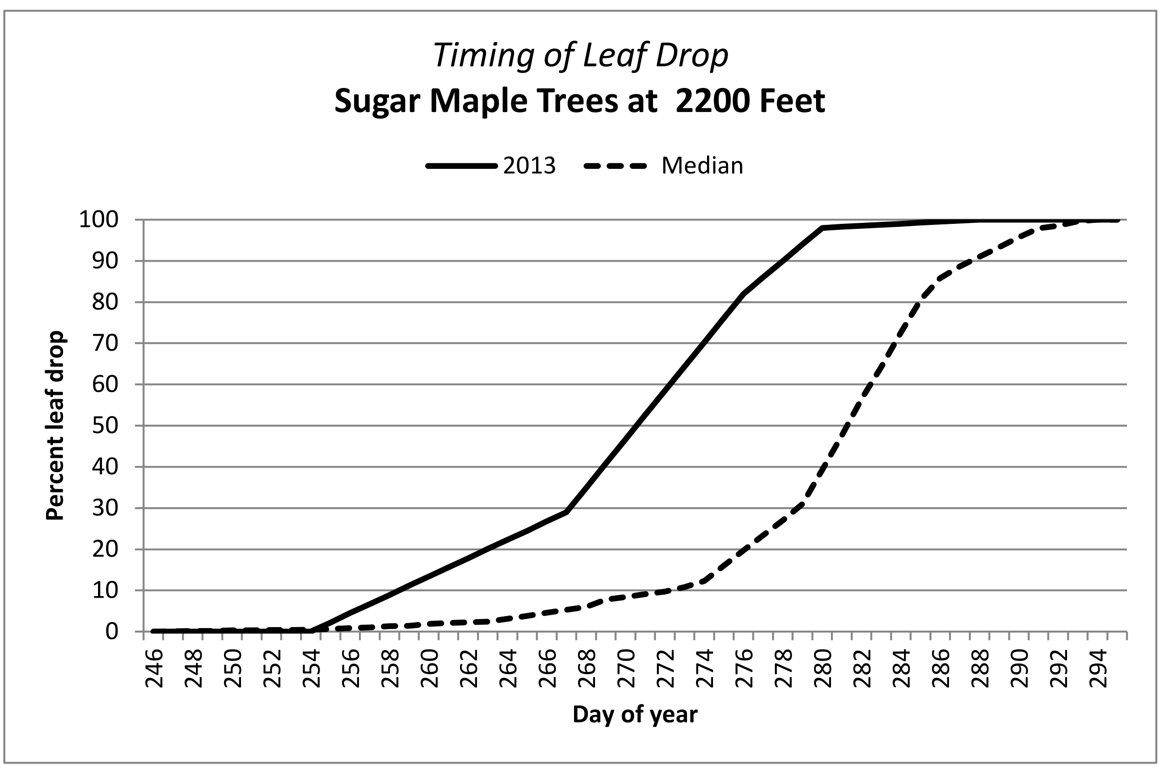
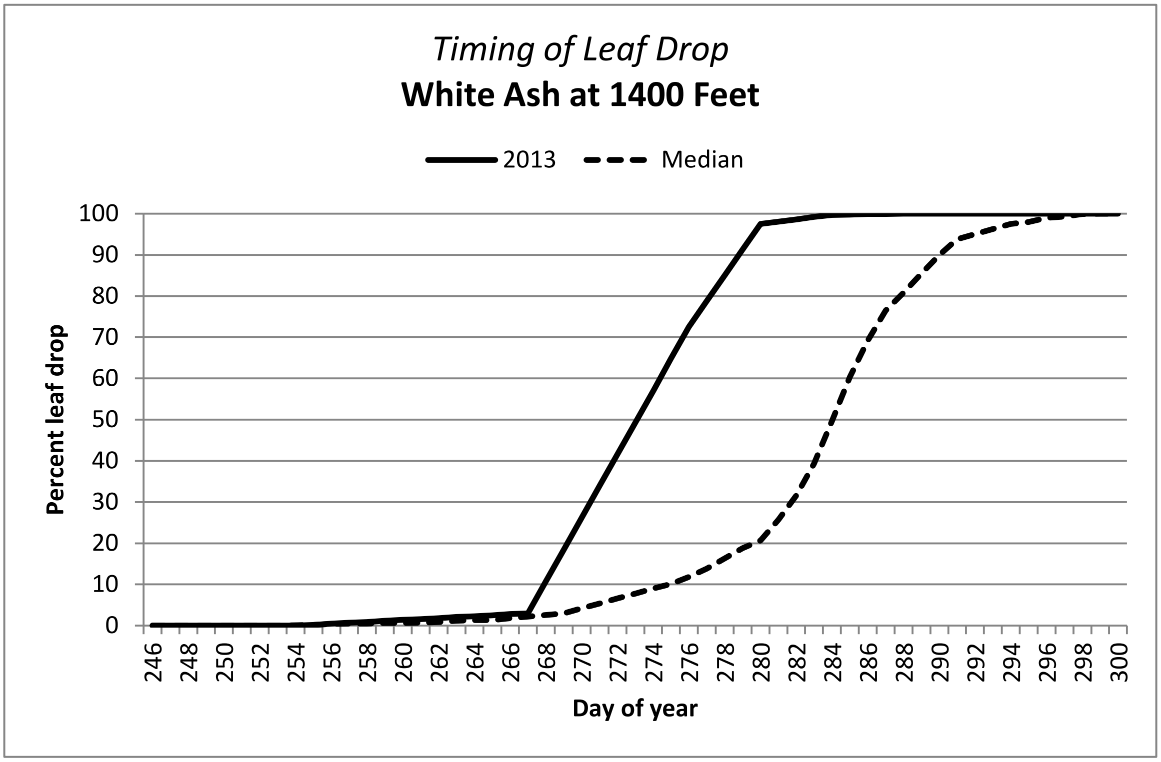


Figure 14d.



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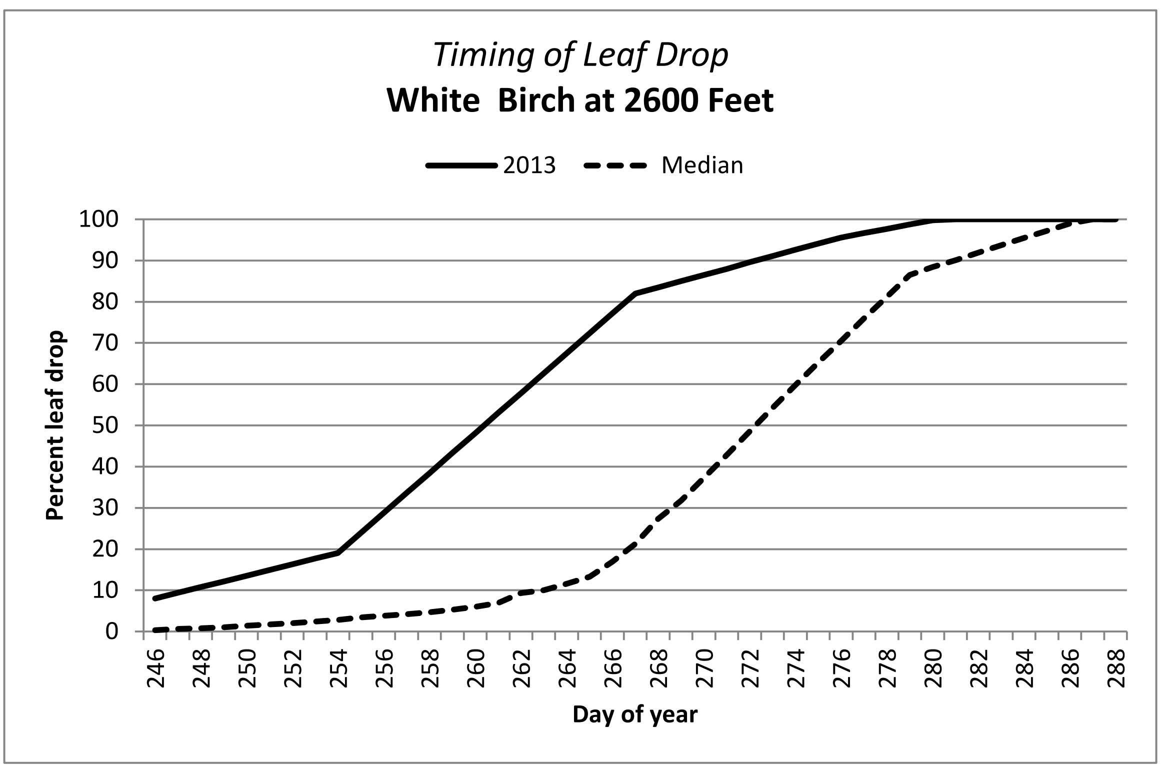


Figure 14f.

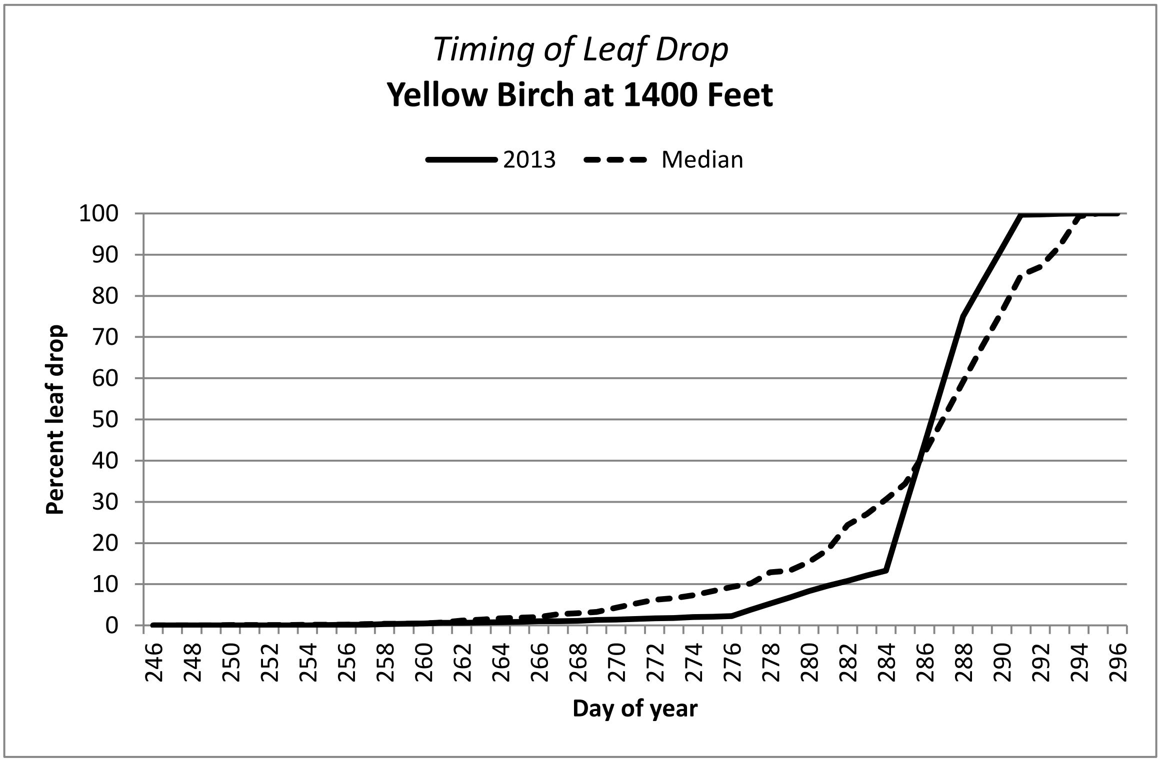


Figure 14g.

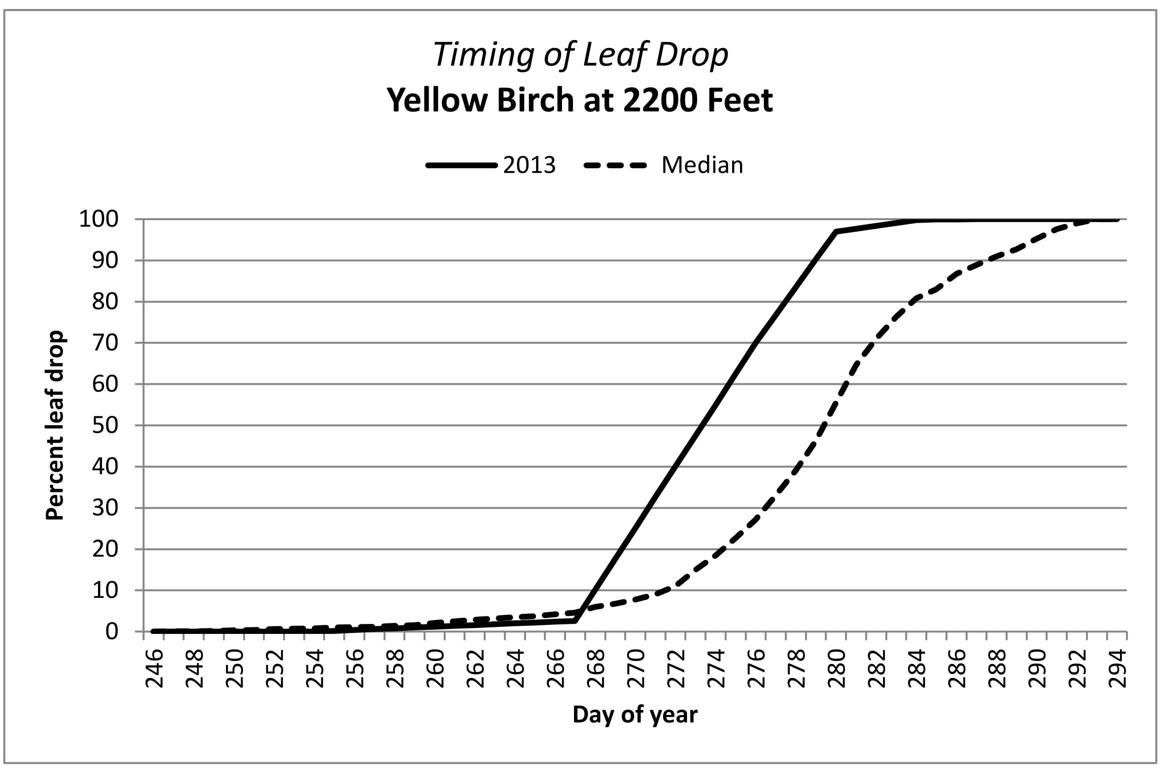


Figure 14h.

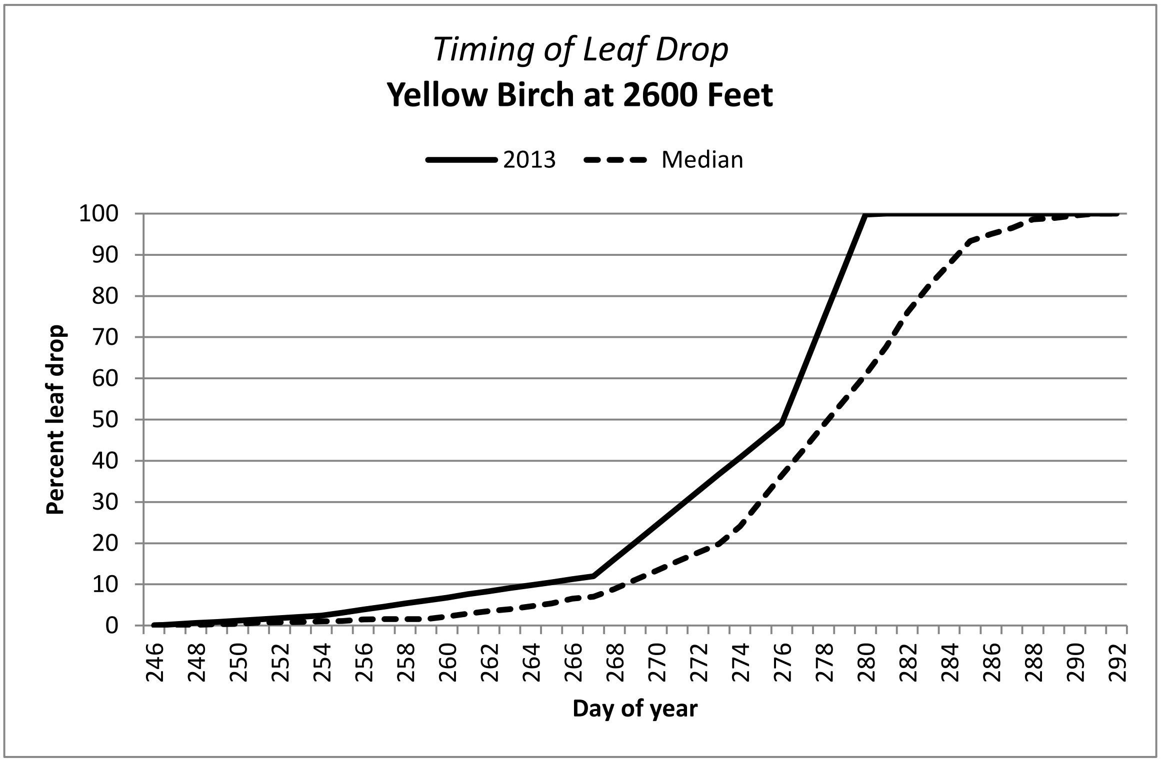


Figure 14i.

Table 2. Average dates of sugar maple bud break, end of growing season (leaf drop) and length of the growing season at the Proctor Maple Research Center in Underhill.

Year	Date of Bud break	Date of End of Growing Season	Length of growing season (days)
1992	5/7	10/13	159
1993	5/4	10/18	167
1994	5/6	10/14	161
1995	5/13	10/19	159
1996	5/14	10/22	161
1997	5/16	10/14	151
1998	4/17	10/15	181
1999	5/5	10/19	167
2000	5/9	10/17	161
2001	5/4	10/15	164
2002	4/18	11/5	201
2003	5/9	10/28	172
2004	5/4	10/27	175
2005	5/2	10/27	178
2006	5/2	10/16	167
2007	5/7	10/22	168
2008	4/22	10/15	175
2009	4/30	10/29	182
2010	4/22	10/26	187
2011	5/7	10/19	163
2012	4/16	10/16	186
2013	5/3	10/15	165
Long term Average (1991-2012)	**5/2**	**10/19**	**170**

HARDWOOD DEFOLIATORS

Birch Defoliation Birch defoliation was up considerably, with 98,329 acres observed in 2013, as opposed to 2,705 acres in 2012. Septoria leaf spot (see Foliar Diseases) was the major factor. A combination of insects, including birch leaf feeders, leaf miners and skeletonizers, are often part of this complex, but few of these were reported by field staff in 2013.

Forest Tent Caterpillar, *Malacosoma disstria*, populations remained very low. No defoliation or larvae were observed. Average moth catch in pheromone traps was down in all but two of 13 survey locations. In those two sites, Castleton and Roxbury, counts were up only slightly (Table 3 and Figure 15).

Table 3. Average number of forest tent caterpillar moths caught in pheromone traps, 2002-2013. Three multi-pher pheromone traps baited with PheroTech forest tent caterpillar lures were deployed at each survey location in 2013. One trap at the Waterville site was missing, and two at Rochester Mountain in Rochester could not be counted.

Site	Year											
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Castleton	----	----	----	17	17.3	8	1	4.7	1	1.7	0.3	2.3
Fairfield (NAMP 29)	----	1.3	1.7	----	4.3	4.7	4	10.3	2.0	6	4	1.7
Huntington (NAMP 027)	9.2	6.7	10	15.7	16	6.3	4.3	4.3	2.7	6.3	6	1.7
Killington/Sherburne (Gifford Woods)	6.8	9.7	20	15.3	21	17.3	7.3	8	2.7	0	1.0	0.7
Manchester (new site in 2008)							0	5.7	3	1	0.7	0.3
Rochester (Rochester Mountain)	5.9	4.7	9	4.7	29	10.3	0.7	----	0.3	0	0	0
Roxbury (Roxbury State Forest)	16	14.7	13	7.3	22	22.7	8.0	2.7	7.0	2	1.5	1.7
SB 2200 (Stevensville Brook)	3.8	11.7	18.3	23.3	35.3	6.3	5.7	10	2.7	6.3	8	0.3
Underhill (VMC 1400)	3.6	3	0.3	7.3	9.3	2.7	1.3	8.3	5.7	8.3	7.7	0.3
Underhill (VMC 2200)	3	7	6.3	11.7	6.3	4.7	1.3	4.3	2	2.7	4.7	0.3
Stowe (VMC 3800)	1	2.7	10.3	26	5.7	5	1.3	1.7	0.7	2	2	1.3
Waterbury (Cotton Brook)	2	0.7	2	41	22.3	0.3	1	5	3.3	4.3	7	0.3
Waterville (Codding Hollow)	0	1.3	1.3	17.7	24.7	2.7	2.3	1.3	3.0	4.3	3	1
Average	**5.2**	**6.9**	**10**	**17**	**17.8**	**7.6**	**2.9**	**5.5**	**2.8**	**3.5**	**3.5**	**0.9**

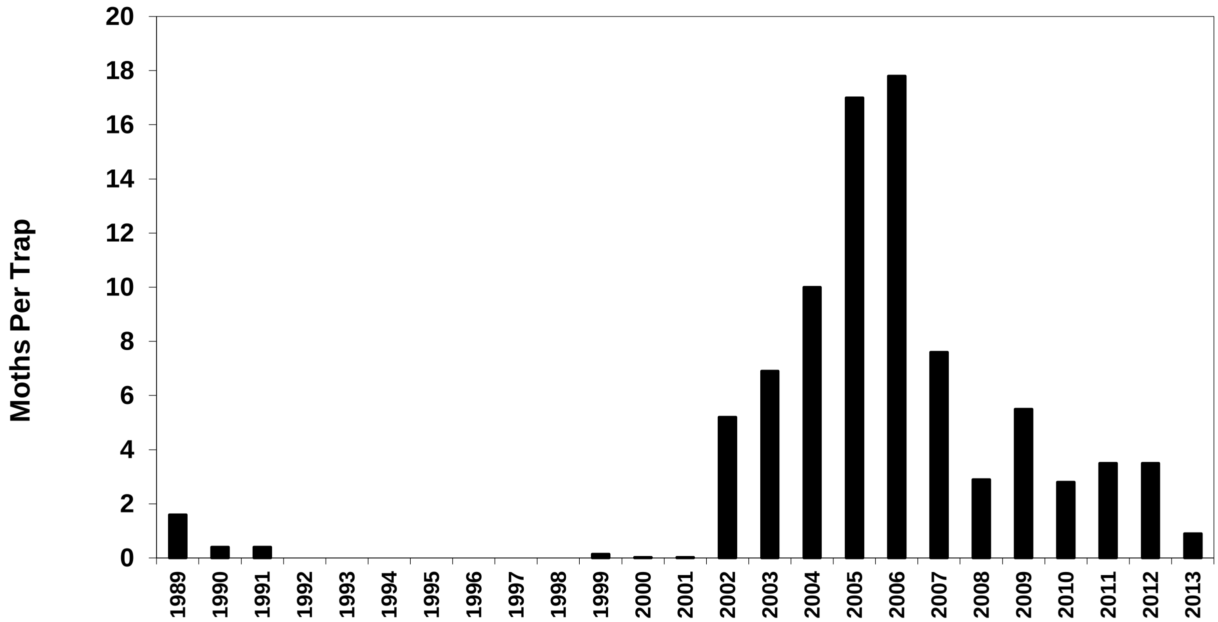


Figure 15. Average number of forest tent caterpillar moths caught in pheromone traps 1989-2013. Three multi-pher pheromone traps per site, with PheroTech forest tent caterpillar lures, were used in 2013. (Note that three traps were not recovered, one in Waterville (Codding Hollow) and two in Rochester (Rochester Mountain).

Gypsy Moth, *Lymantria dispar*, caterpillars were observed in northern parts of the state but feeding was minimal and few egg masses were observed. No egg masses were observed in focal area monitoring plots (Table 4 and Figure 16).

Table 4. Number of gypsy moth egg masses per 1/25th acre from focal area monitoring plots, 2003-2013. Average of two 15-meter diameter burlap-banded plots per location in 2013.

Site	Town	Year										
		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Arrowhead	Milton	1.5	2.5	0	0	0	2.5	0	0	0.5	0	0
Brigham Hill	Essex	2.5	2	1.5	0	0	0	0	0	0	0	0
Ft. Dummer	Guilford	0	-----	0	0	0	0	0	0	0.5	0	0
Middlesex	Middlesex	0	2	0	0.5	2	2.5	2.5	-----	-----	-----	-----
Minard's Pond	Rockingham	0.5	2	0	0	0	0	0.5	0	0	0	0
Mount Anthony	Bennington	1.5	0	0	0	0	0	0	0	0	0	0
Perch Pond	Benson	0	0	0.5	1	0	0.5	0	0.5	0	0	0
Rocky Pond	Rutland	0	0	0.5	3	3	0.5	0	0	0	0	0
Sandbar	Colchester	3	1.5	0	0	0	2.5	0.5	0	0	0	0
Tate Hill	Sandgate	0	30	18	3	0	1.5	0.5	0	0	0	0
Average		**1**	**4.4**	**2.1**	**0.8**	**0.5**	**1.0**	**0.4**	**0.06**	**0.11**	**0**	**0**

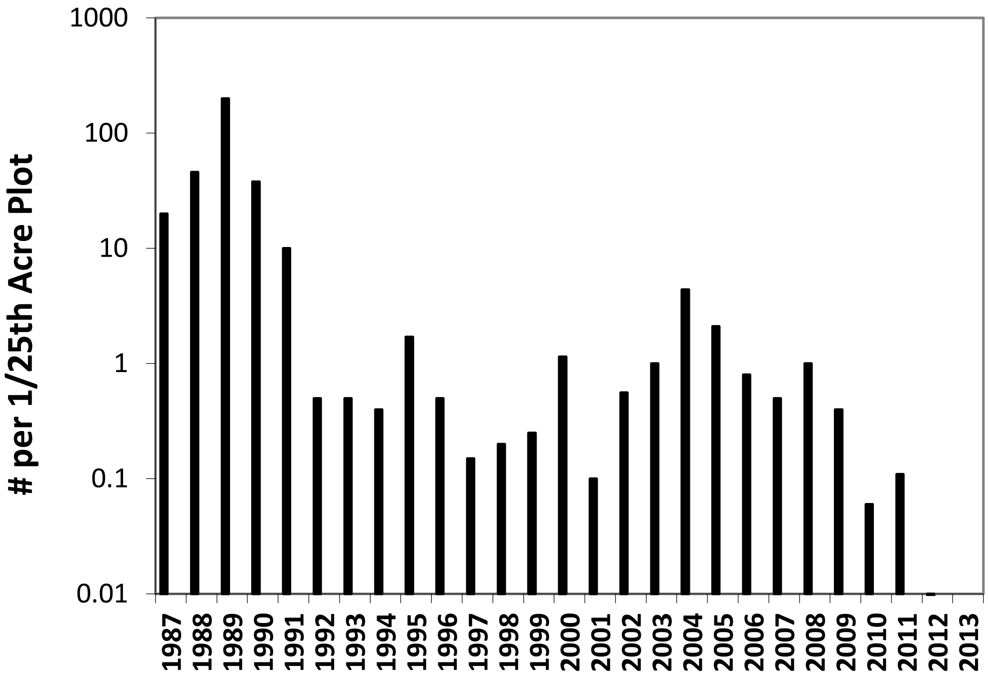


Figure 16. Number of gypsy moth egg masses per 1/25th acre from focal area monitoring plots, 1987-2013. Average of ten locations, two 15-meter diameter burlap-banded plots per location, in 2013. No egg masses were found in any plots in 2013.

Saddled prominent, *Heterocampa guttivitta*, populations increased statewide. During aerial surveys, 12,924 acres were mapped, mostly in northeastern Vermont (Table 5 and Figure 17). Noticeable defoliation occurred in scattered locations statewide.

Sugarbushes and important northern hardwood stands should be monitored for this insect. Following the last outbreak (1979-81) hardwood decline was significant on some sites. Outbreaks are unstable. Areas often sustain complete defoliation where no damage was observed the previous year. Infestations often collapse suddenly, as well.

Table 5 (*right*). Mapped acres of saddled prominent defoliation in 2013.

County	Acres
Addison	0
Bennington	60
Caledonia	6,544
Chittenden	0
Essex	2,411
Franklin	0
Grand Isle	0
Lamoille	0
Orange	1,945
Orleans	1,789
Rutland	154
Washington	21
Windham	0
Windsor	0
Total	**12,924**

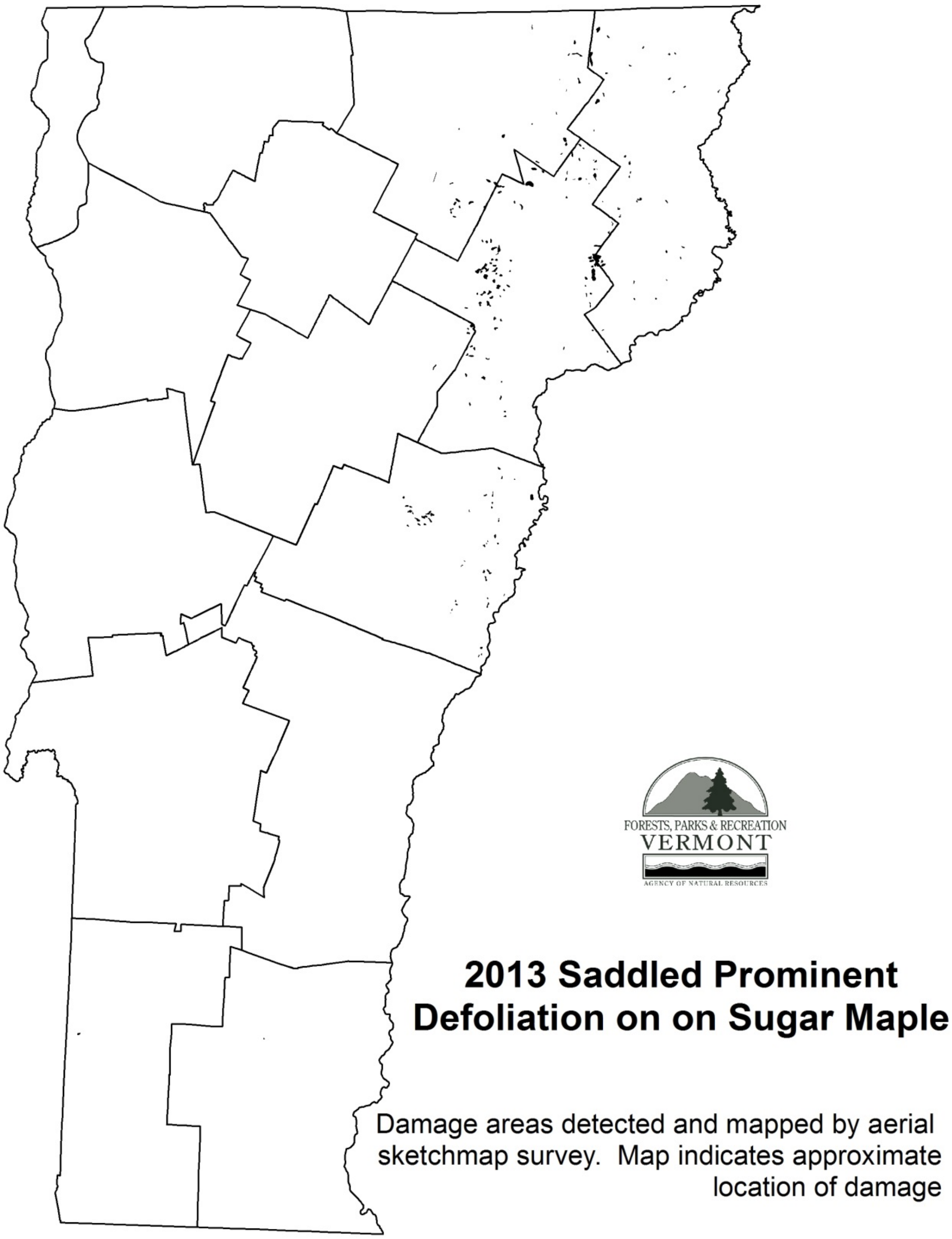


Figure 17. Saddled prominent defoliation mapped in 2013. Mapped area includes 12,924 acres.

OTHER HARDWOOD DEFOLIATORS

INSECT	LATIN NAME	HOST	LOCALITY	REMARKS
Aspen Serpentine Leafminer	*Phyllocnistis populiella*	Aspen	Walden	The larval stage of this tiny moth feeds on the contents of cells on both top and bottom surfaces of leaves, leaving the middle layer intact.
Birch Leaf Mining Sawflies	*Fenusa pusilla, Messa nana*	Birch	Orleans and Caledonia Counties	Light damage observed in NAMP plots and on hillsides. (See Foliar Diseases).
Bruce Spanworm	*Operophtera bruceata*	Sugar maple, aspen, beech and other hardwoods	Statewide	Numerous moths observed in flight, but no defoliation reported.
Cecropia Moth	*Hyalophora ceceropia*	Various trees and shrubs	Essex Junction, Groton, Montpelier	Adult moths observed. No defoliation reported.
Cherry Scallop Shell Moth	*Hydria prunivorata*	Black cherry	Northern Vermont	Nests were noticeable.
Dogwood Sawfly	*Macremphytus tarsatus*	Dogwood	Jamaica	Noted on ornamentals.
Eastern Tent Caterpillar	*Malacosoma americanum*	Cherry and apple	Throughout	Less common than usual; rarely observed in Southern Vermont.
Elm Sawfly	*Cimbex americana*	Elm, maple, birch, willow and basswood	Jeffersonville	Individual larvae observed; no damage noted.
Euonymus Caterpillar	*Yponomeuta cagnagella*	Euonymus	Hartford	Ornamentals; Euonymus/burning bushes with heavy webbing.
European Snout Beetle	*Phyllobius oblongus*	Maples and yellow birch	Widely scattered	Beetles occasionally observed.

OTHER HARDWOOD DEFOLIATORS

INSECT	LATIN NAME	HOST	LOCALITY	REMARKS
Fall Webworm	*Hyphantria cunea*	Hardwoods	Throughout	Remains common and noticeable in many locations throughout the state, but little significant defoliation.
Forest Tent Caterpillar	*Malacosoma disstria*			See narrative.
Gypsy Moth	*Lymantria dispar*			See narrative.
Hickory Tussock Moth	*Lophocampa caryae*	Various hardwoods	Scattered	Less noticeable than in 2012.
Japanese Beetle	*Popillia japonica*	Many	Statewide	Mostly scattered, light damage to a variety of trees; some instances of heavy damage.
Locust Leafminer	*Odontata dorsalis*	Black locust	District 3	Less damage observed than in past year.
Maple Leaf Cutter	*Paraclemensia acerifoliella*	Maples	Scattered	Very low levels, with only light damage observed.
Maple Trumpet Skeletonizer	*Epinotia aceriella*	Sugar maple	Scattered	Very low levels.
Mimosa Webworm	*Homadaula anisocentra*	Honeylocust	Springfield	Light damage continues in a single location.
Oak Leaf Tier and Leaf Roller Complex	*Croesia semipurpurana* and others	Red oak	Ascutney	Part of a complex of stress agents.
Oak Sawfly	*Acordulecera dorsalis*	Red oak	Benson	On ornamental.
Oak Skeletonizer	*Bucculatrix ainsliella*	Red oak	Westminster	On ornamental.
Orange-humped Mapleworm	*Symmerista leucitys*	Sugar maple	Southeastern VT	In sugarbush.

OTHER HARDWOOD DEFOLIATORS

INSECT	LATIN NAME	HOST	LOCALITY	REMARKS
Polydrusus Weevils	*Polydrusus* sp.	Birch	Walden	Metallic green weevils occasionally oberved.
Rose Chafer	*Macrodactylus subspinosus*	Many	Scattered	Fewer reports than in 2012.
Saddled Prominent	*Heterocampa guttivata*	Sugar maple		See narrative.
Viburnum Leaf Beetle	*Pyrrhalta viburni*	Viburnum	Scattered	Defolating ornamentals at campground entrance.
Winter Moth	*Operophtera brumata*	Hardwoods		Not known to occur in Vermont.

Hardwood defoliators not reported in 2013 include American Dagger Moth, *Acronicta americana;* Apple and Thorn Skeletonizer, *Choreutis pariana* ; Aspen Serpentine Leafminer, *Phyllocnistis populiella* ; Birch Leaf Folder, *Ancylis discigerana* ; Birch Skeletonizer, *Bucculatrix canadensisella;* Definite-Marked Tussock, *Orgyia definita* ; Green-striped Mapleworm, *Dryocampa rubicunda* ; Hickory Tussock Moth, *Lophocampa caryae* ; Lilac leafminer, *Caloptilia syringella* ; Mountain Ash Sawfly, *Pristiphora geniculata* ; Omnivorous Leafroller, *Archips purpurana* ; Pale Tussock Moth, *Halysidota tessellaris* ; Satin Moth, *Leucoma salicis* ; Spiny Oak-Slug Caterpillar, *Euclea delphinii* ; Spotted Tussock Moth, *Lophocampa maculata* ; Uglynest Caterpillar, *Archips cerasivorana* ; White Marked Tussock Moth, *Orgyia leucostigma* ; Yellownecked Caterpillar, *Datana ministra* .

SOFTWOOD DEFOLIATORS

Spruce Budworm, *Choristoneura fumiferana*, larvae were not seen in 2013, and no defoliation was observed. We used pheromone traps for spruce budworm for 20 years (1983-2003), then discontinued the survey for 2004-2009. We reinstated our pheromone trap efforts in 2010. In 2010 - 2013, traps were deployed in Orleans, Caledonia, Essex and Chittenden Counties. The traps in Burke (Caledonia County) showed a slight increase in numbers of moths collected, but all other sites captured fewer moths than in 2012 (Table 6 and Figures 18-19). We do not anticipate defoliation by the spruce budworm in 2014.

Table 6. Average number of spruce budworm moths caught in pheromone traps, 1991-2013. Trapping had been discontinued 2004-2009. There were 3 traps per location, one location per town 2013.

County and Town	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2010	2011	2012	2013
Essex Norton	3	10.7	5.7	2.3	1	1	1.3	26	34.7	29.7	17.7	1.3	2	5.3	1	1.3	0.7
Orleans Holland	3.3	11	2.3	1.3	0	1.7	1.3	5	4.7	29.3	5	5.7	3.7	6	8.0	1	0.7
Caledonia Walden	17.7	17.7	13	14.3	3	6.3	2	4.3	5	85	16.7	9.7	3.7	6.7	1	0.7	0
Essex Lewis	2.0	2.7	0.67	2	0	0.67	0	8	4.3	14	6.7	1.3	1.7	5.7	0.3	0	0
Chittenden Underhill	31.7	29	16	53	11.7	30.3	3.7	6	13.3	24.7	11.3	14.7	3.7	19	11.3	8	1.3
Caledonia Burke	3.5	2.3	6	3	0	2	3.7	7.3	6	30	15	3	1.7	4	1.7	0	0.3
Average	10.2	12.2	7.3	12.7	2.6	7.0	2.0	9.4	11.3	35.5	12.1	6.0	2.8	7.8	3.9	1.8	0.5

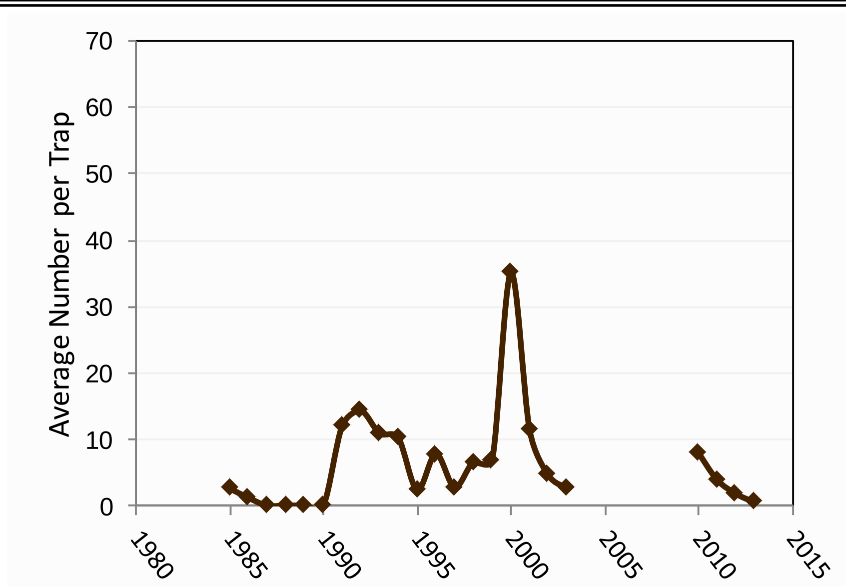
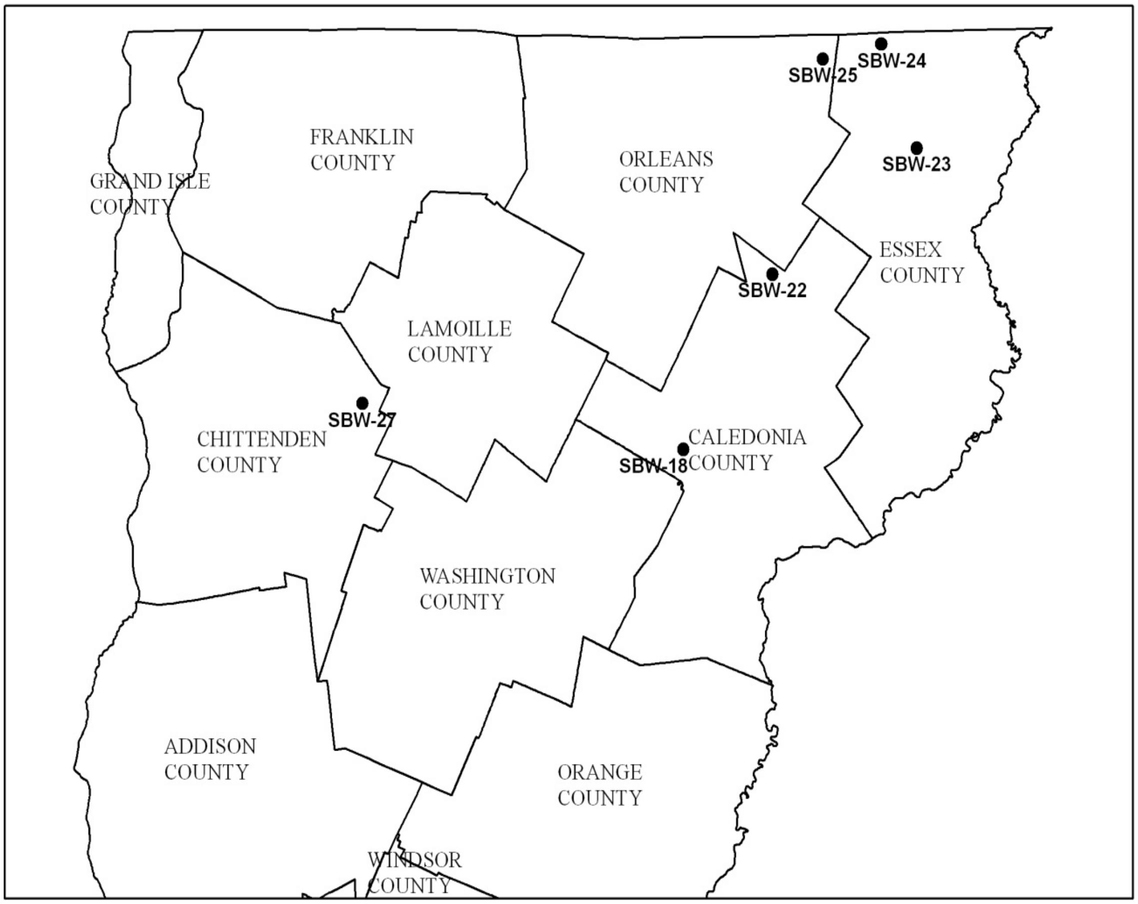


Figure 18. Average number of spruce budworm moths caught in pheromone traps 1983-2013. Trapping was discontinued, 2004-2009. Average of six locations in 2013.

Spruce Budworm Trap Locations



Trap #	Trap Location	Town	Latitude	Longitude
SBW-18	Steam Mill Brook WMA	Walden	44.48385	-72.25364
SBW-22	Willoughby S.F.	Burke	44.69555	-72.03616
SBW-23	Tin Shack/Silvio Conte	Lewis	44.85915	-71.74222
SBW-24	Black Turn Brook S. F.	Norton	44.99521	-71.81300
SBW-25	Holland Pond WMA	Holland	44.97610	-71.93103
SBW-27	VMC 1400	Underhill	44.52570	-72.86477

Figure 19. Locations of spruce budworm pheromone traps in 2013. Coordinates are NAD83.

OTHER SOFTWOOD DEFOLIATORS

INSECT	LATIN NAME	HOST	LOCALITY	REMARKS
Arborvitae Leaf Miner	*Argyresthia thuiella*	Arborvitae	Scattered	No significant damage reported.
Eastern Spruce Budworm	*Choristoneura fumiferana*	Balsam fir and spruce	Statewide	See narrative.
European Pine Sawfly	*Neodiprion sertifer*	Red pine	Pawlet	On ornamentals.
Fall Hemlock Looper	*Lambdina fiscellaria*	Hemlock	Windham County	Larvae seen, but no visible damage observed.
Larch Casebearer	*Coleophora laricella*	Larch	Northeast Kingdom	Moderate to heavy throughout the NEK.

Softwood defoliators not reported in 2013 included Introduced Pine Sawfly, *Diprion similis* .

SAPSUCKING INSECTS, MIDGES, AND MITES

Hemlock Woolly Adelgid (HWA), *Adelges tsugae,* was not discovered in any new counties in Vermont in 2013, but three new towns in Windham County were identified, bringing the total number of infested towns in Vermont to 16: Brattleboro, Brookline, Dummerston, Grafton, Guilford, Halifax, Jamaica, Marlboro, Newfane, Putney, Rockingham, Townshend, Vernon, Wardsboro, and Whitingham in Windham County and the town of Pownal in Bennington County (Figure 20).

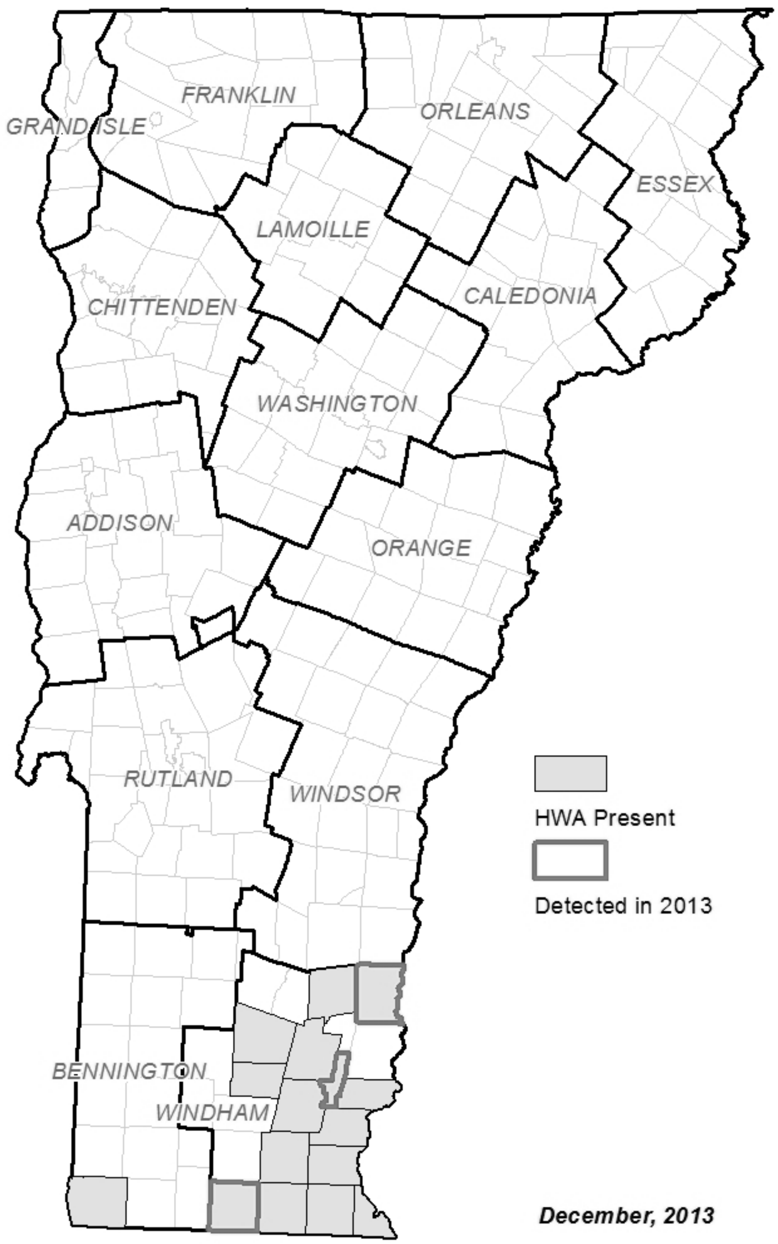


Figure 20. Towns known to have hemlock woolly adelgid-infested trees in 2013.

Survey work and reports from the public indicated that HWA populations grew last season following a mild winter. HWA seemed more prevalent in areas already known to be infested and many new areas were reported. During the 2012-2013 reporting period, a total of 88 surveys were done in 22 towns (Table 7). Five surveys were done in each of the 13 towns adjoining known infested towns. Volunteers were involved in 9 of the 13 towns and accounted for 55% of the border town surveying. The first discoveries in Rockingham and Grafton during the 2012-2013 survey season were made by volunteers. An informed logger reported the first occurrence known in Brookline during the summer of 2013. Recruitment and training of volunteer surveyors for the 2013-2014 season has begun.

Table 7. Hemlock woolly adelgid detection surveys conducted in 2013.

	# Surveyed in 2013	# of New Detections in 2013	# Known to be Infested
Towns	22	2	16
Sites	88	7	76

Since the winter of 2009-2010, we have been assessing overwintering mortality of HWA at five locations in Windham County. For this season, the Guilford site was discontinued, and was replaced by a second site in Brattleboro. Temperature data are collected with **iButton data loggers**. In 2013, these were installed at the sites on 1/10/13 and removed on 4/15/2013. Hemlock branch tips with new growth were sampled on 4/15/2013. At least 200 new sistens per site were examined under a dissecting microscope to determine the numbers of live and dead adelgids. Mortality at the five sites averaged 46% compared to 5% during the winter of 2011-2012 (Table 8 and Figures 21-22).

Table 8. Percent of hemlock woolly adelgid sistens that were dead in April 2013 at five Windham County sites, compared to minimum ambient temperature in the previous winter.

Town	**Winter 2009-2010**		**Winter 2010-2011**		**Winter 2011-2012**		**Winter 2012-2013**	
	Min. Temp. ^{0}C	**% Dead**	**Min. Temp. ^{0}C**	**% Dead**	**Min. Temp. ^{0}C**	**% Dead**	**Min. Temp. ^{0}C**	**% Dead**
Brattleboro (South)	-17	14%	-26	96%	-22	1%	-19.5	41%
Vernon	-17	13%	-24	56%	-19	11%	-20	42%
Guilford	-20	74%	-26	94%	-23	0%		
Townshend	-18	9%	NA	89%	-21	11%	-19.5	39%
Jamaica	-19	13%	-24	98%	-22	2%	-18.5	49%
Brattleboro (North)							-20.5	59%
Average	**-18**	**25%**	**-25**	**87%**	**-21.3**	**5%**	**-19.6**	**46%**

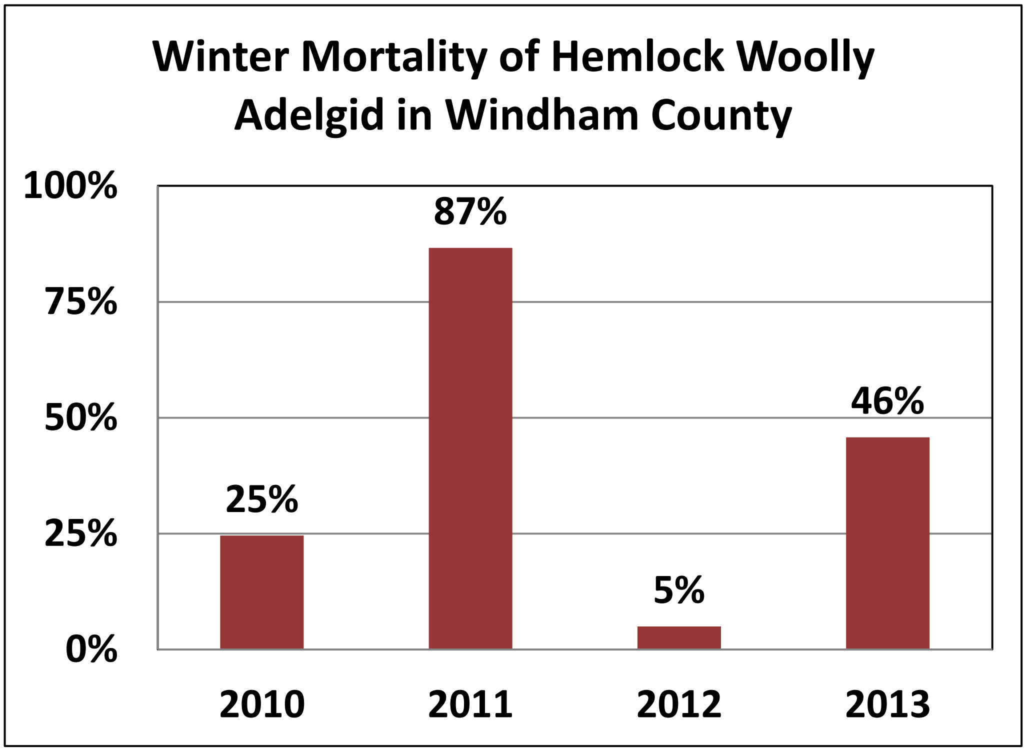


Figure 21. Overwintering mortality of hemlock woolly adelgid in Windham County 2010 - 2013.

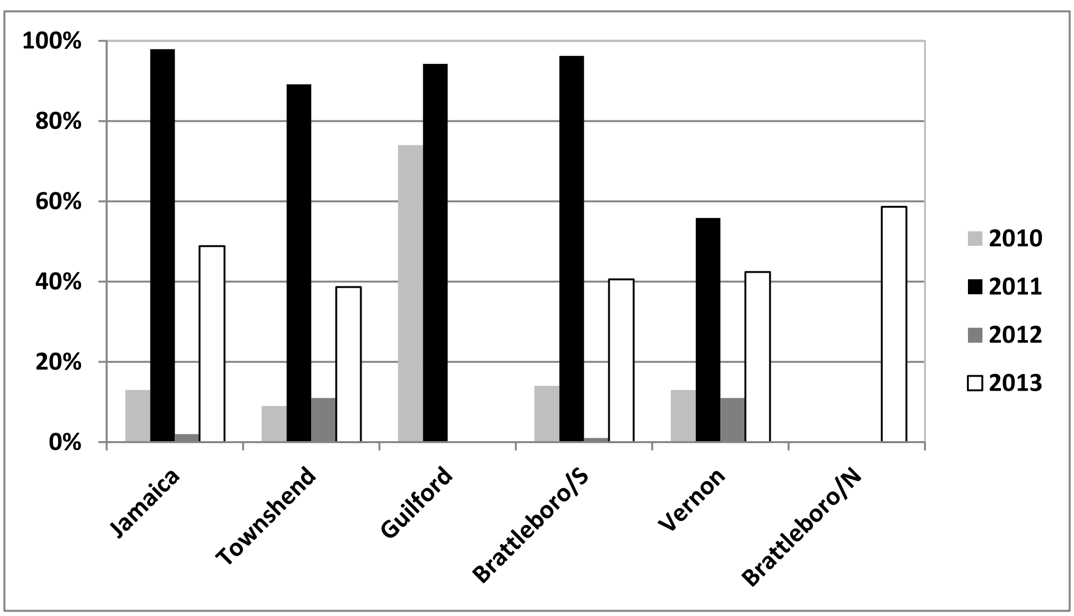


Figure 22. Comparison of mortality of hemlock woolly adelgid sistens at five Windham County sites 2010-2013.

Hemlock woolly adelgid impact plots have been located in five areas: Roaring Brook Wildlife Management Area in the towns of Guilford and Vernon, Fort Dummer State Park in Brattleboro, Townshend State Park in Townshend, Black Mountain Reserve in Dummerston (The Nature Conservancy) and Atherton Meadows Wildlife Management Area in Whitingham. Data from these sites will add to the understanding of forest impacts of HWA, and will be analyzed along with information collected in Maine and New Hampshire. All measurements and crown assessments are scheduled to be completed this winter.

The predatory beetle, *Laricobius nigrinus*, was introduced in Pownal for the first time on December 6, 2012. On that date, 375 beetles were released. On December 12, 2012, additional beetles were introduced to a site in Windham County where an original release of *Laricobius* took place in 2009. Monitoring of all was completed in November 2013. No beetles were recovered.

In a project funded by the US Forest Service and the Northeastern State Research Cooperative, personnel at the UVM Entomology Research Lab, with assistance from VT FPR, continued investigating the potential use of a native insect-killing fungus, *Myriangium* sp., for biocontol of HWA.

Early detection, appropriate management, and quarantine compliance rely on well-informed and engaged citizens. Recommendations for landowners and other informative materials are available on the Vermont Forestry Division website, vtforest.com, and at the Vermont Invasives website, vtinvasives.org. Hemlock woolly adelgid is a consideration for several communities completing an Invasive Forest Pest Preparedness and Response Plan.

A *Best Management Practices Guide for Hemlock Resource Managers in Northern New England States*, addressing the threats of hemlock woolly adelgid and elongate hemlock scale, is being prepared by the states of Maine, New Hampshire, and Vermont, and will be available in 2014.

Pear Thrips, *Taeniothrips inconsequens*, damage was much reduced in 2013. In long-term monitoring plots at Proctor Maple Research Center in Underhill, the first thrips appeared on yellow sticky traps during the week of April 15. Traps caught their highest numbers of the season during the week of April 22-30, with an average of 31 thrips per trap.

Overall thrips populations decreased at the monitoring location in 2013, with a total of 205 thrips as compared with 409 in 2012. (Table 9). Thrips counts on sticky traps by year for 1993 – 2013 appear in Figure 23.

Table 9. Total pear thrips counts on yellow sticky traps at Proctor Maple Research Center in Underhill, VT, from 2009-2013. Sticky traps are deployed in sets of four. Traps are evaluated and replaced each week and monitored throughout pear thrips emergence.

2009		2010		2011		2012		2013	
Sampling Dates	Number of Thrips	Sampling Dates	Number of Thrips	Sampling Dates	Number of Thrips	Sampling Dates	Number of Thrips	Sampling Dates	Number of Thrips
3/27 – 4/3	1					3/19 – 3/26	121		
4/3 – 4/9	0	4/2 – 4/7	408	4/6 – 4/12	0	3/26 – 4/2	6	3/29 - 4/5	0
4/9 – 4/16	25	4/7 – 4/15	100	4/12 – 4/21	2	4/2 – 4/9	7	4/5 - 4/15	0
4/16 – 4/23	111	4/15 – 4/23	102	4/21 – 4/29	191	4/9 – 4/16	84	4/15- 4/22	23
4/23 – 4/30	39	4/23 – 5/3	175	4/29 – 5/6	10	4/16 – 4/23	23	4/22 - 4/30	125
4/30 – 5/7	19	5/3 – 5/11	151	5/6 – 5/13	9	4/23 – 4/30	8	4/30 - 5/7	18
5/7 – 5/14	55	5/11 – 5/18	43	5/13 – 5/20	16	4/30 – 5/7	53	5/7 - 5/13	27
5/14 – 5/21	33	5/18 – 5/24	36	5/20 – 5/27	15	5/7 – 5/14	65	5/13 - 5/20	11
5/21 – 5/28	11	5/24 – 6/1	4	5/27 – 6/2	5	5/14 – 5/21	25	5/20 - 5/28	1
5/28 – 6/4	2	6/1 – 6/7	2			5/21 – 5/30	16	5/28 - 6/3	0
						5/30 – 6/4	1		
	296		**1,021**		**248**		**409**		**205**

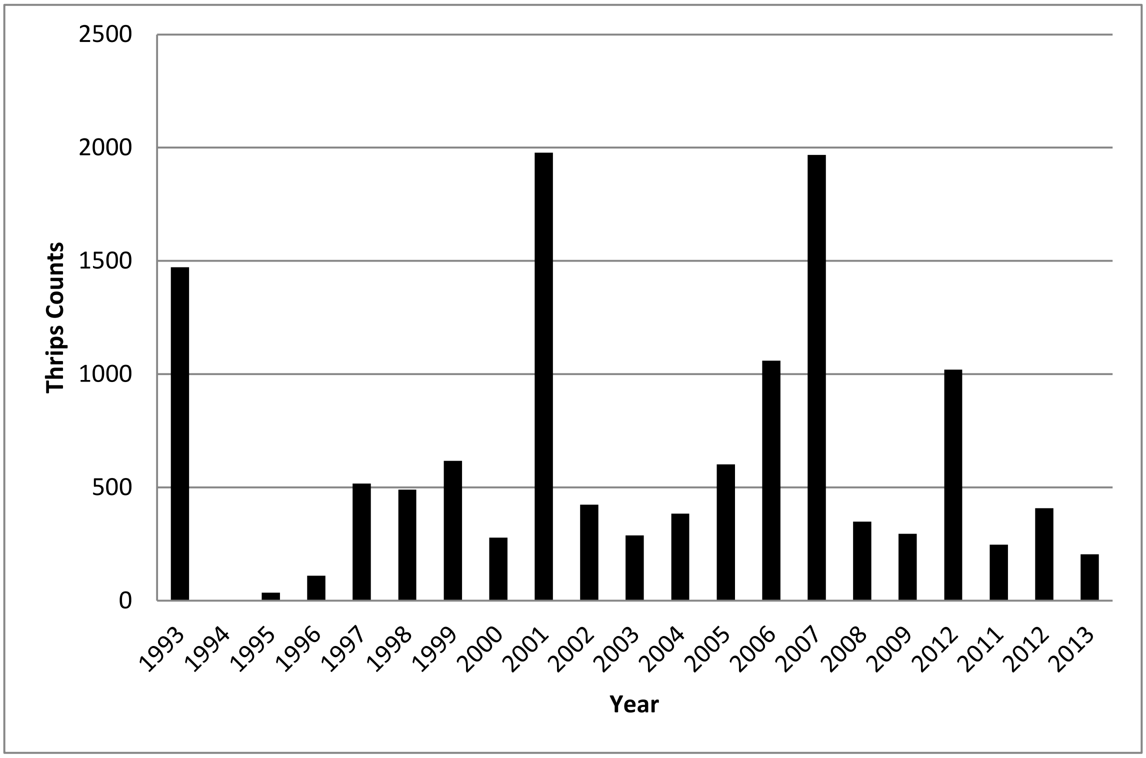


Figure 23. Total number of thrips collected at Proctor Maple Research Center in Underhill, VT on sets of four sticky traps, 1993-2013.

OTHER SAPSUCKING INSECTS, MIDGES, AND MITES

INSECT	LATIN NAME	HOST	LOCALITY	REMARKS
Ash Flowergall Mite	*Aceria fraxiniflora*	Ash	Hartford	Heavy population causing mortality.
Balsam Twig Aphid	*Mindarus abietinus*	Balsam fir, Serbian spruce	Champlain Valley, Albany	Observed in increasing numbers.
Balsam Gall Midge	*Paradiplosis tumifex*	Balsam fir	Wolcott and elsewhere	Heavy damage to Christmas trees in Wolcott. All adults examined were *Paradiplosis* so population is on the upswing.
Balsam Woolly Adelgid	*Adelges picea*	Balsam fir and Fraser fir	Windham County, Walden	Increase in dieback and mortality in previously infested trees. Heavy damage to Fraser fir Christmas trees in Walden, with gouting on Fraser reportedly much heavier than previously seen on balsam.
Beech Blight Aphid	*Grylloprociphilus imbricator*	Beech	Guilford	Reported as a curiosity.
Beech Scale	*Cryptococcus fagisuga*	Beech	Statewide	See Beech Bark Disease narrative.
Boxelder Bug	*Leptocoris trivittatus*	Boxelder	Throughout	Insects common with numerous fall "nuisance" reports; no damage to trees reported.

OTHER SAPSUCKING INSECTS, MIDGES, AND MITES

INSECT	LATIN NAME	HOST	LOCALITY	REMARKS
Brown Marmorated Stink Bug	*Halyomorpha halys*	Wide variety of hosts, including apples	Records exist for Lamoille County in 2010, Bennington, Washington, Windham and Windsor Counties in 2011 and Chittenden County in 2012.	There were no new specimens or observations reported in 2013. There is speculation that their march north may be proceeding more slowly than anticipated.
Cinara Aphids	*Cinara spp.*	Pine	Hyde Park	Observed, with tending ants, on scattered trees.
Cooley Spruce Gall Adelgid	*Adelges cooleyi*	Spruce	District 3	Not as obvious as in past years.
Elongate Hemlock Scale	*Fiorinia externa*	Ornamentals	Charlotte	Detected in a planted landscape, but not known to be established in Vermont. Infested trees are being treated. No scale infestations were found in a survey of conifer hosts in the surrounding area.
Fletcher Scale	*Parthenolecanium fletcheri*	Yew	Woodford	On ornamentals.
Hackberry Nipplegall Maker	*Pachypsylla celtidismamma*	Hackberry	District 3	Less than in 2012.
Hemlock Woolly Adelgid	*Adelges tsugae*	Hemlock	Windham and Bennington County	See narrative.
Lacebugs	*Corythucha* sp.	Oak and sycamore	Champlain Valley and Windsor County	Minor damage reported.
Lecanium Scale	*Lecanium sp.*	Pin Oak	St. Albans	On ornamentals.
Pear Thrips	*Taeniothrips inconsequens*	Hardwoods	Statewide	See narrative.

OTHER SAPSUCKING INSECTS, MIDGES, AND MITES

INSECT	LATIN NAME	HOST	LOCALITY	REMARKS
Planthoppers Family Flatidae	*Prob. Metcalfa pruinosa*	Black Locust	Springfield	Numerous on trees along recreation path.
Ragged Spruce Gall Adelgid	*Pineus similis*	Red Spruce	Bolton	On ornamentals.
Woolly Alder Aphid	*Paraprociphilus tessellatus*	Silver maple and alder	Castleton	Winged migrant adults, with abdomens covered in white fluffy wax, were observed.

Sapsucking Insects, Midges and Mites that were not reported in 2013 include Cottony Maple Scale, *Pulvinaria innumerabilis* ; Erineum Gall Mite, *Aceria elonagtus* ; Gouty Vein Gall Midge, *Dasineura communis* ; Honeylocust Plant Bug, *Diaphnocoris chlorionis* ; Oystershell Scale, *Lepidospaphes ulmi* ; Pear Leaf Blister Mite, *Phytoptus pyri* ; Pine Bark Adelgid, *Pineus strobi* ; Pine Fascicle Mite, *Trisetacus alborum* ; Pine Leaf Adelgid, *Pineus pinifoliae* ; Pine Needle Scale, *Chionapsis pinifoliae* ; Pine Spittlebug, *Aphrophora parallela;* Short Needle Conifer Scale, *Dynaspidiotus tsugae* ; Spruce Spider Mite, *Oligonychus ununguis* ; Sumac Gall Aphid, *Melaphis rhois.*

BUD AND SHOOT INSECTS

INSECT	LATIN NAME	HOST	LOCALITY	REMARKS
Common Pine Shoot Beetle	*Tomicus piniperda*	Pines	Throughout	Surveys between 1999-2005 confirmed the presence of this insect in 8 Vermont counties. A quarantine is in place to limit the spread of this exotic insect into non-affected states.
Eastern Pine Shoot Borer	*Eucosma gloriola*	Fraser and balsam fir	Albany, Jericho and Williston	Reports from Christmas tree plantations; killing some leaders.
Oak Twig Pruner	*Elaphidionoides parallelus*	Red oak	Western counties	Drooping, dead branches common.
Poplar Gall Saperda	*Saperda inornata*	Poplar	Leicester	Formation of globose galls on infested trees.
White Pine Weevil	*Pissodes strobi*	White pine and Colorado blue spruce	Throughout	Common at low levels.

Bud and Shoot Insects not reported in 2013 included Balsam Shootboring Sawfly, *Pleroneura brunneicornis* ; Maple Petiole Borer, *Caulocampus acericaulis;* Pine Gall Weevil, *Podapion gallicola.*

ROOT INSECTS

INSECT	LATIN NAME	HOST	LOCALITY	REMARKS
Conifer Root Aphid	*Prociphilus americanus*	Balsam fir	Essex, Morrisville, Bakersfield	Stunting young Christmas trees.
Japanese Beetle	*Popillia japonica*	Many	Throughout	Numbers observed quite variable from one location to another.
June Beetle	*Phyllophaga* spp.	Many	Throughout	Few reports received in 2013.

Root Insects not reported in 2013 included Conifer Swift Moth, *Korsheltellus gracillis* .

BARK AND WOOD INSECTS

Asian Longhorned Beetle (ALB), *Anoplophora glabripennis*, has been found in a number of locations throughout the eastern half of the US since it was first discovered in New York City in 1996. Quarantines and eradication efforts have been very successful in some areas, but the battle continues against infestations in New York, Ohio and Massachusetts. In 2013, ALB was found in a new site on Long Island, which is east of the previously infested area. The beetle was also found in Mississauga, Ontario, just west of Toronto, where ALB was recently declared eradicated. To date there have been no positive finds in Vermont.

Early detection of ALB remains critical. In 2013, with assistance from the USDA Forest Service, the Massachusetts Department of Conservation and Recreation, and Penn State University, we deployed 18 flight intercept/pheromone traps in Vermont for detection of ALB (Table 10, Figure 24). Lures used in the traps included a combination of six different pheromones and volatiles. Most trap sites were selected as potentially high risk for exposure to ALB based on the chance that infested firewood might have been in the area. Some trap sites were state campgrounds that had recorded visits from campers living in infested areas such as Worcester, MA.

Traps were deployed in June, checked every two weeks, and taken down in September. There was one lure change mid-season. No Asian Longhorned Beetles were collected in the traps, but several native woodboring species were found during the survey, including various Cerambycidae (longhorned beetles), Buprestidae (metallic woodboring beetles), and *Tremex columba*, in the family Siricidae (horntails). See Table 11 for notes on some of the non-target insects that turned up in ALB traps.

Table 10. Location of Asian Longhorned Beetle traps deployed in Vermont in 2013. Data include county, town, location, tree species and DBH, and coordinates.

County	Town	Location	Tree Species	DBH (in)	Latitude	Longitude
Addison	Addison	DAR State Park	Sugar maple	18	44.05592	-73.41523
Addison	Ferrisburgh	Button Bay State Park	Red maple	14	44.18379	-73.36095
Addison	Lincoln	Hanson/Curtis Property	Sugar maple	39	44.06174	-73.00594
Bennington	Bennington	Woodford State Park	Red maple	19.5	42.88485	-73.03968
Bennington	East Dorset	Emerald Lake State Park	Sugar maple	9.2	43.27000	-73.01113
Caledonia	Groton	Kettle Pond State Park	Sugar maple	10	44.29481	-72.30829
Essex	Brighton	Brighton State Park	Sugar maple	8	44.79853	-71.85388
Franklin	Enosburg Falls	Lake Carmi State Park	Red maple	14	44.95493	-72.88323
Grand Isle	Grand Isle	Grand Isle State Park	Sugar maple	22	44.68695	-73.29172
Lamoille	Elmore	Lake Elmore State Park	Sugar maple	14	44.54449	-72.53188
Rutland	Killington	Gifford Woods State Park	Sugar maple	6.6	43.67601	-72.81122

County	Town	Location	Tree Species	DHB (in)	Latitude	Longitude
Rutland	Poultney	Lake St. Catherine State Park	Sugar maple	32.9	43.48103	-73.20544
Washington	Waterbury	Little River State Park	Sugar maple	14	44.39005	-72.7658
Windham	Guilford	Fort Dummer State Park	Red maple	9	42.82373	-72.56628
Windham	Guilford	I-91 Visitor Center	Sugar maple	10	42.81263	-72.56592
Windham	Guilford	Schneski Sugarbush	Sugar maple	30	42.742961	-72.621242
Windham	Jamaica	Jamaica State Park	Sugar maple	8	43.10878	-72.77474
Windsor	Hartford	Quechee State Park	Sugar maple	6	43.63591	-72.40376

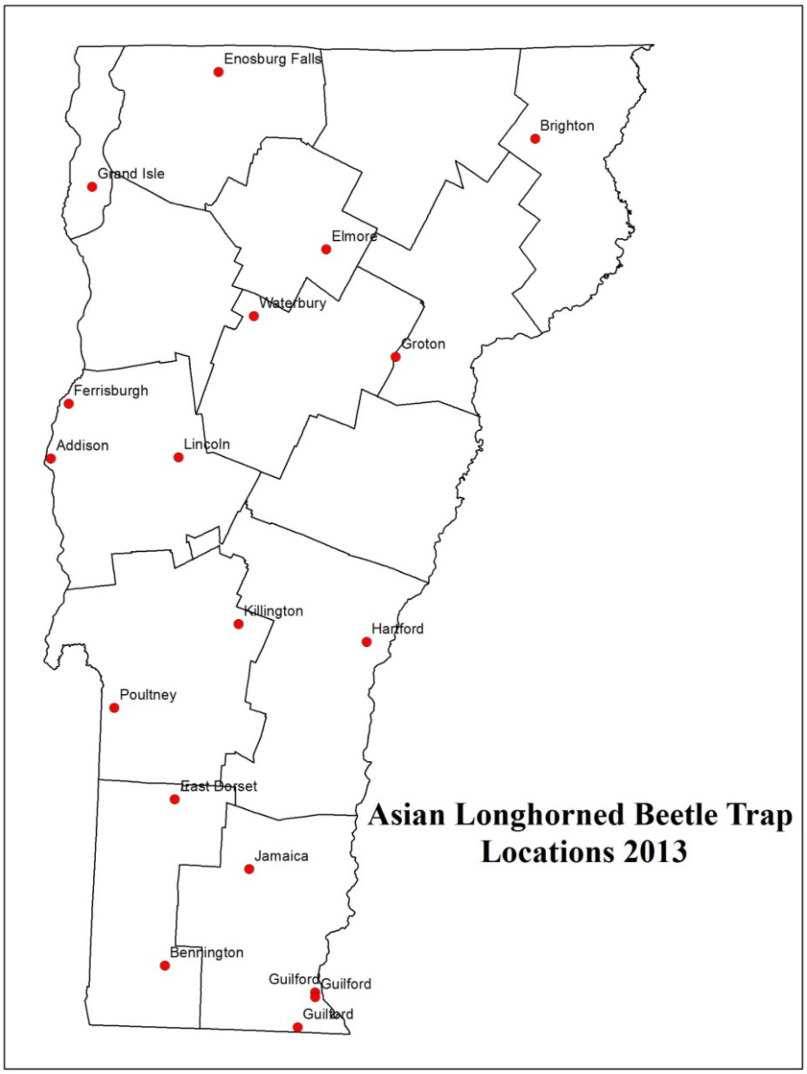


Figure 24. Asian Longhorned Beetle trap locations in 2013. There was a single trap at each location.

Table 11. Notes on some of the non-target insects collected in ALB traps in 2013. While many insects were likely lured to the combination of pheromones, others were probably accidental by-catches, simply intercepted by the traps. This list represents a small fraction of the insects that showed up in the trap containers.

Insect	Notes
Cerambycidae – Longhorned Beetles	
Astylopsis macula (11)	This species is found in and under the bark of hardwoods. It is attracted to freshly-cut maple and butternut trees and has been implicated as a possible vector of the Butternut Canker Fungus, which has been devastating butternut trees in Canada and the northeastern US.
Cyrtophorus verrucosus (1)	This longhorned beetle is found in deciduous forests and adjacent areas. Adults emerge in very early spring, and it is among the first cerambycids encountered each year. Adults take nectar and/or pollen on spring-flowering trees and shrubs. Larvae feed on a wide variety of hardwoods. The beetle is an extraordinary ant mimic, and even runs like an ant.
Eupogonius tomentosus (1)	Larvae of this small (5-10 mm) longhorned beetle feed in cedar, pine and spruce. Elytra have pubescent patches.
Hyperplatys maculata (1)	Hosts include a variety of hardwoods, especially linden, ironwood and serviceberry.
Liopinus sp. (2)	Members of this genus feed on various hardwoods and shrubs.
Microgoes oculatus (1)	So-named because of the black eyespots on the elytra, the larvae of this longhorn feed under the bark of various hardwoods, shrubs and also pine.
Orthosoma brunneum (1)	Commonly known as the brown prionid, this longhorned beetle is attracted to moist, decaying hardwoods and conifers, and often responds to sweet bait traps.
Psenocerus supernotatus (1)	Also known as the currant-tip borer, this beetle feeds in decaying branches of a number of hardwoods, vines and shrubs.
Stictoleptura c. canadaensis (1)	The red shouldered pine borer, so named because the elytra are usually black with a red base, feeds in various conifers and occasionally hardwoods.
Strangalepta abbreviata (1)	Larvae feed in a variety of decaying hardwoods and conifers.
Urgleptes querci (3)	Larvae of this longhorned beetle feed in branches of numerous hardwoods, especially maple.
Xylotrechus sp. (1)	There are several local species in this genus, with the so-called "rustic borer" (*X. colonus*) one of the more common.
Siricidae - Horntails	
Tremex columba (5)	This horntail (or woodwasp) prefers stressed trees of many species, including beech, elm, hickory, maple, oak, poplar, apple, pear, sycamore and hackberry. Adult exit holes are round.
Gryllidae - True Crickets	
Neoxabea bipunctata (1)	Commonly known as the two-spotted tree cricket, this foliage-feeding insect can be found on a wide variety of vegetation including maples, white pine and apple trees. Males of this species amplify the volume of their trill-like call by chewing a hole in a leaf over which they spread their wings in what is described as a "self-made baffle."

We continue to discourage the movement of firewood and other wood products that may be routes of entry for ALB. (See Firewood section below.)

Emerald Ash Borer (EAB), *Agrilus planipennis*, first discovered in the U.S. in Michigan in 2002, has now been found in nineteen states and two Canadian provinces. The closest infestations to Vermont are in Concord, NH, Dalton, MA, New York's Hudson Valley, and just 30 miles north of the Vermont border in Carignan, Quebec. In 2012, infestations were detected for the first time in Massachusetts and Connecticut; the New Hampshire location was found in spring of 2013. Some states where EAB is known to occur have continued to add to their list of infested counties. In Pennsylvania, for example, 15 new counties were added as positive for EAB in 2013. The Berkshire County, MA infestation now includes Pittsfield. EAB was detected in Colorado this summer, marking the westernmost detection to date. The new location closest to Vermont is in NY, near the VT/MA border.

EAB survey efforts in Vermont in 2013 centered on three activities: deployment of purple prism traps, preparation and evaluation of girdled trap trees, and monitoring of *Cerceris fumipennis* wasp nest sites in biosurveillance surveys.

Purple prism traps were deployed at 438 locations in Vermont in 2013 (Figure 25). USDA-APHIS installed 165 purple traps in the 5 northeastern counties (Orleans, Essex, Caledonia, Washington, and Lamoille), and a contractor put up 318 purple traps in the remainder of the state. All were found to be negative for EAB.

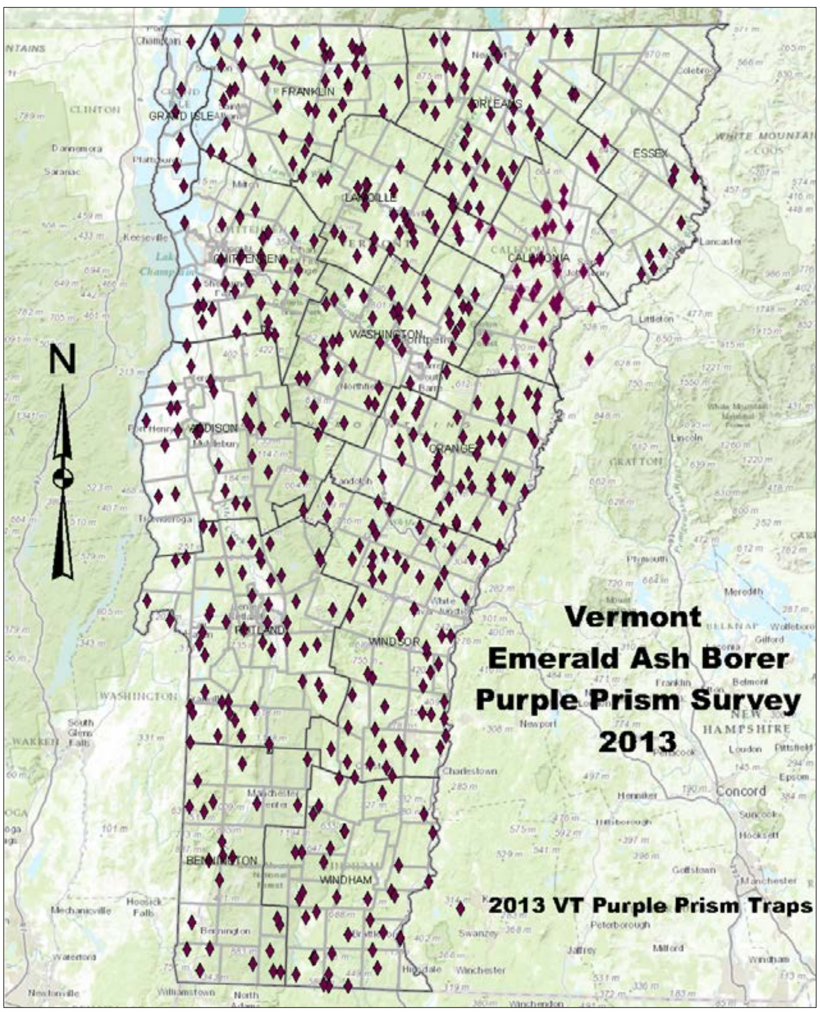


Figure 25. Location of emerald ash borer purple panel traps deployed in 2013. *Map credit: Rhonda Mace, USDA APHIS.*

Use of trap trees, widely recognized as a sensitive detection method for emerald ash borer, complemented survey work done with purple prism traps. Girdled trees from 13 locations were included in 2013 (Table 12 and Figure 26). As in past years, ash trees 4 – 10 inches in diameter that were exposed to the sun were girdled with a pruning saw to make two parallel cuts, 8-12 inches apart. A drawknife was used to remove the bark between these cuts. Trap trees were harvested in early December. One three foot section per 1 inch DBH was collected from each tree and peeled to look for signs of emerald ash borer. No signs were found.

Table 12. Locations of girdled trap trees used to survey for emerald ash borer in 2013. Data include district, town, county, coordinates and tree identification number.

District	Town	County	Latitude	Longitude	Tree #
1	Cavendish	Windsor	43.38813	-72.60053	13-1-1
1	Halifax	Windham	42.74651	-72.70215	13-1-2
1	Hartford	Windsor	43.64368	-72.33869	13-1-3
1	Andover	Windsor	43.25528	-72.72660	13-1-4
1	Wilmington	Windham	42.88338	-72.82620	13-1-5
2	Shaftsbury	Bennington	43.02052	-73.17912	13-2-1
2	Dorset	Bennington	43.28201	-73.00539	13-2-2
3	Franklin	Franklin	44.95784	-72.87463	13-3-1
3	Grand Isle	Grand Isle	44.68631	-73.29280	13-3-2
4	Johnson	Lamoille	44.63047	-72.68562	13-4-1
4	Morristown	Lamoille	44.56412	-72.59975	13-4-2
5	St. Johnsbury	Caledonia	44.39816	-72.02672	13-5-1
5	Barnet	Caledonia	44.36186	-72.04781	13-5-2

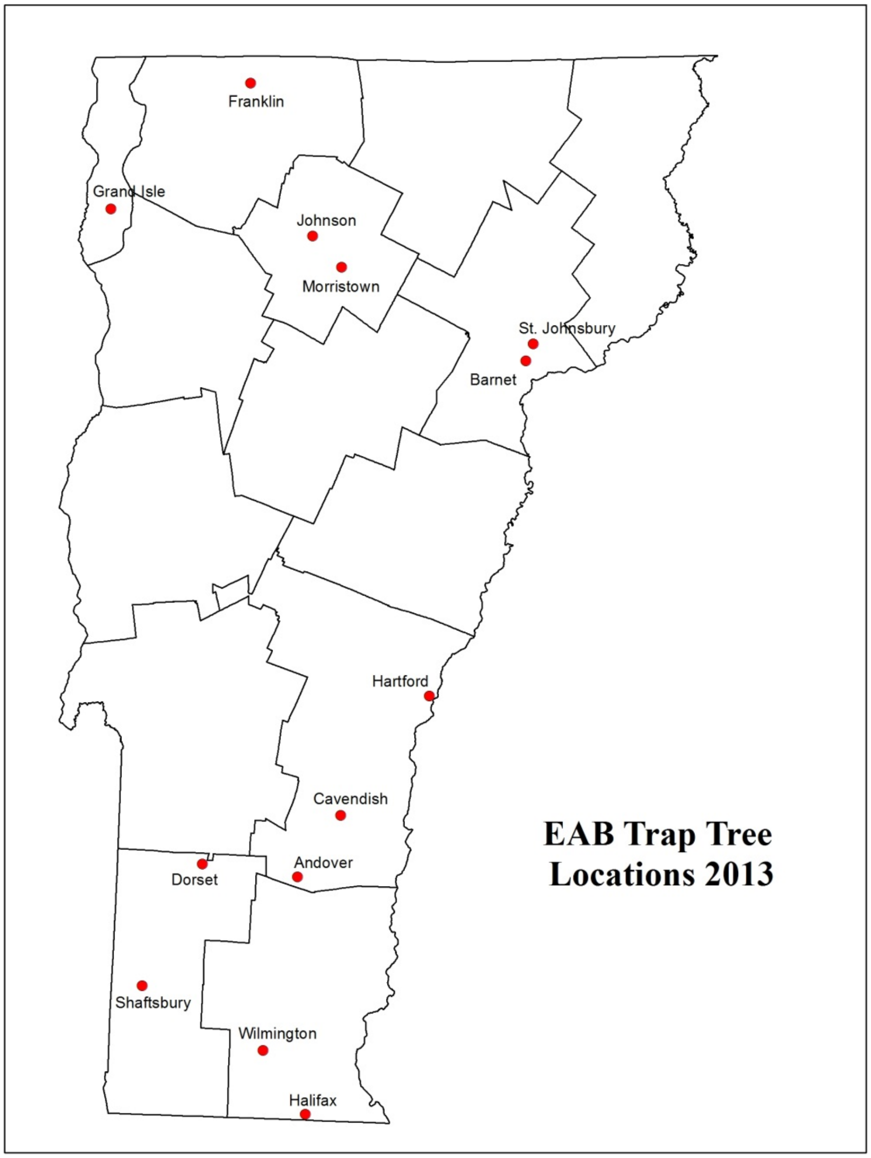


Figure 26. Location of ash trees girdled in 2013 as part of Vermont's survey for emerald ash borer.

Emerald ash borer biosurveillance using *Cerceris fumipennis* wasps continued in Vermont in 2013. This EAB survey component has become an increasingly valuable and effective monitoring and outreach element in early detection efforts. This year, about 45 volunteers contributed a total of over 200 hours to this effort by monitoring known *Cerceris* nest sites and searching for new locations. New recruits have joined the ranks and many seasoned wasp watchers continued their commitment to the project in Vermont in 2013.

Active *Cerceris* nests were found in 23 sites, representing seven counties (Table 13 and Figure 27). An additional 20 or more sites were visited as potential nest locations, but no *Cerceris* were found. Site disturbances and baseball field upgrades rendered some previous nest sites inactive, while new sites were in several areas where nests had not been discovered in previous years. Late season searches by newly-trained volunteers turned up some promising sites for next year.

No emerald ash borer beetles were found, but 1,074 other buprestid beetles were collected at *Cerceris* sites in 2013, and more than 50 beetles (our per-site goal) were found at 14 of the 23 sites. A total of 724 beetles were collected from sites as drops (i.e., found on the ground at a *Cerceris* nest location), while 281 beetles were steals, taken from incoming *Cerceris* wasps. We made a point of stealing not more than the equivalent of one beetle per wasp nest hole per search day. The collection method (dropped or stolen) was not distinguished for 69 beetles collected by volunteer wasp watchers.

Table 13. Vermont sites where *Cerceris fumipennis* nests were found in 2013. Data include county, town, site, coordinates, and numbers of buprestid beetles collected at each site.

County	Town	Site	Latitude	Longitude	Number of Buprestids
Bennington	N. Bennington	Lake Paran Baseball Field	42.92998	-73.23571	1
Bennington	Sunderland	Jones Quarry	43.11211	-73.1301	57
Franklin	Richford	Richford Playground	44.993795	-72.677627	56
Franklin	Swanton	Mississquoi Valley Union High School	44.93229	-73.1047	4
Orange	Thetford	Union Village Dam	43.793231	-72.259997	56
Orange	Wells River	Blue Mountain Union High School	44.155746	-72.083988	73
Rutland	Brandon	Estabrook Field	43.810583	-73.103448	66
Rutland	Castleton	Castleton Hubbardton Elementary School	43.619623	-73.211399	64
Rutland	Pittsford	Lothrop School	43.705447	-73.01867	34
Rutland	Poultney	Poultney Elementary School	43.524364	-73.23738	18
Rutland	Rutland Town	Dewey Field	43.60718	-73.013244	81
Rutland	West Rutland	Sabotkas Recreation Field	43.585506	-73.040778	3
Washington	Montpelier	Montpelier High School	44.26038	-72.58925	86
Washington	Montpelier	Montpelier Rec Field	44.27976	-72.57146	73
Washington	Montpelier	U-32 High School	44.242985	-72.526327	4
Windham	Bellows Falls	Bellows Falls Union High School	43.11172	-72.43839	88
Windham	Jamaica	Stephen Ballantine Memorial Field	43.07638	-72.73369	83
Windham	Marlboro	Augur Hole	42.9221	-72.7103	18
Windham	Putney	Sand Hill Pit	42.982761	-72.520881	66
Windham	Putney	Sand Hill Road	42.98179	-72.52043	77
Windsor	Hartland	Hartland Elementary School	43.53853	-72.392582	3
Windsor	Springfield	Springfield Commons	43.298916	-72.478126	7
Windsor	Windsor	Windsor Town Rec Field	43.46924	-72.40329	56
GRAND TOTAL					1,074

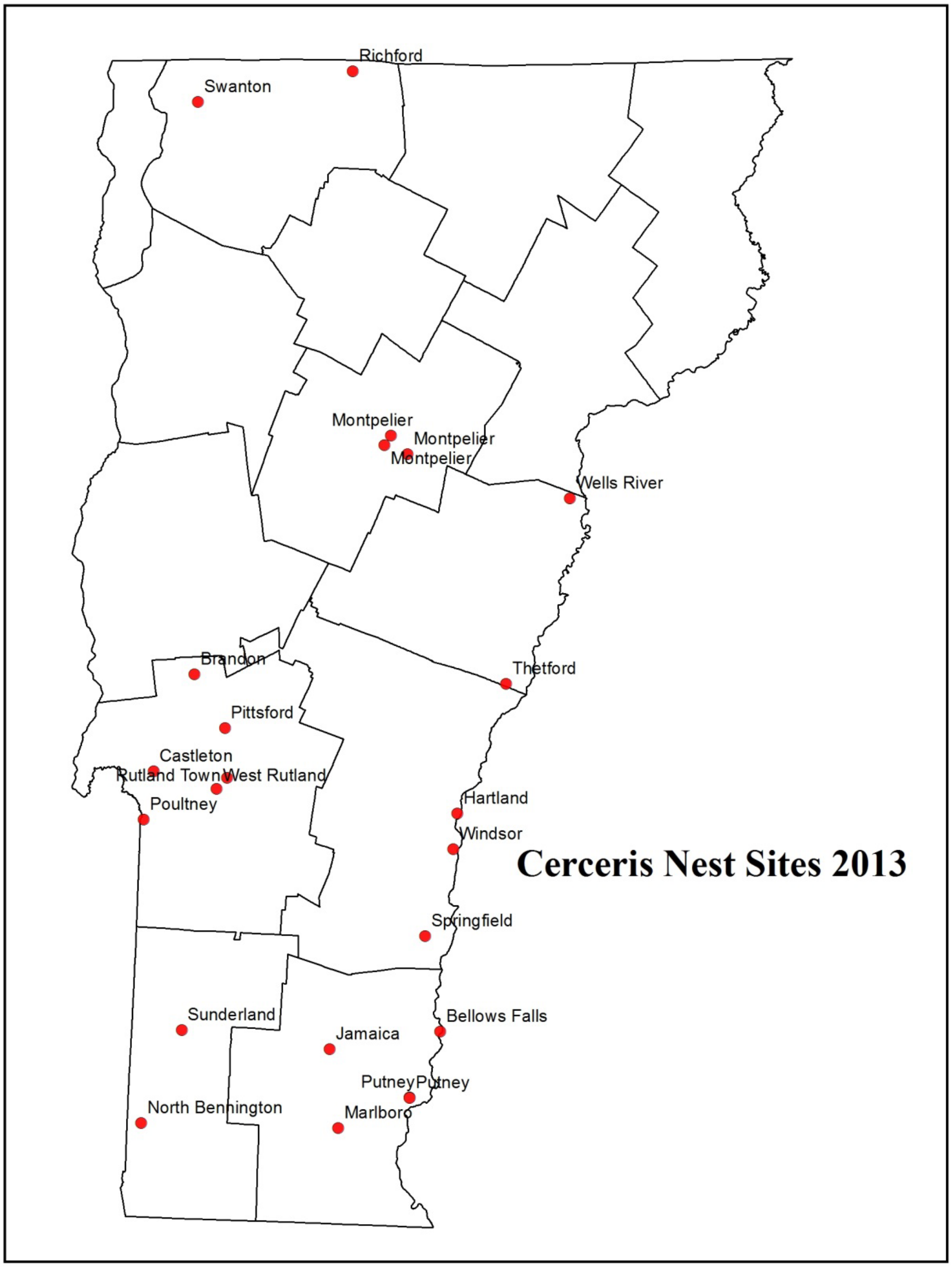


Figure 27. Location of Cerceris nest sites in 2013 as part of Vermont's survey for emerald ash borer.

Activities undertaken to better prepare us for a detection of Emerald Ash Borer in Vermont continued in 2013. Lessons learned and suggested improvements that resulted from our 2012 EAB detection response drill have been incorporated into our preparedness plans. Our technical publications that provide information to assist landowners and managers in making decisions about ash management remain up-to-date. (See Ash Management Guidance for Forest Managers and Policy on Forest Management Plans and Amendments for Land Enrolled in Vermont's Use Value Appraisal Program (UVA) Related to Emerald

Ash Borer.) Work continues on pre-planning for biological control, pesticide use, and quarantine compliance agreements.

The Vermont Invasives Program (VTInvasives) reached over 16,000 unique visitors though its website in 2013. (See http://vtinvasives.org/). Other outreach through VTInvasives E-News and Facebook has increased public awareness of threatening exotic-invasive organisms in Vermont.

The Vermont Forest Pest First Detector Program trained 25 new volunteers in 2013. Currently there is a statewide network of 118 volunteers representing 109 communities. The First Detector Program also provided an advanced workshop for veteran volunteers, a webinar on EAB community preparedness and a field trip to a New York EAB infestation. In 2013, First Detectors from 11 different counties reported their hours (25% response rate). Collectively, they spent a total of 660.5 hours surveying, screening, and conducting other outreach about emerald ash borer, Asian longhorned beetle, and hemlock woolly adelgid.

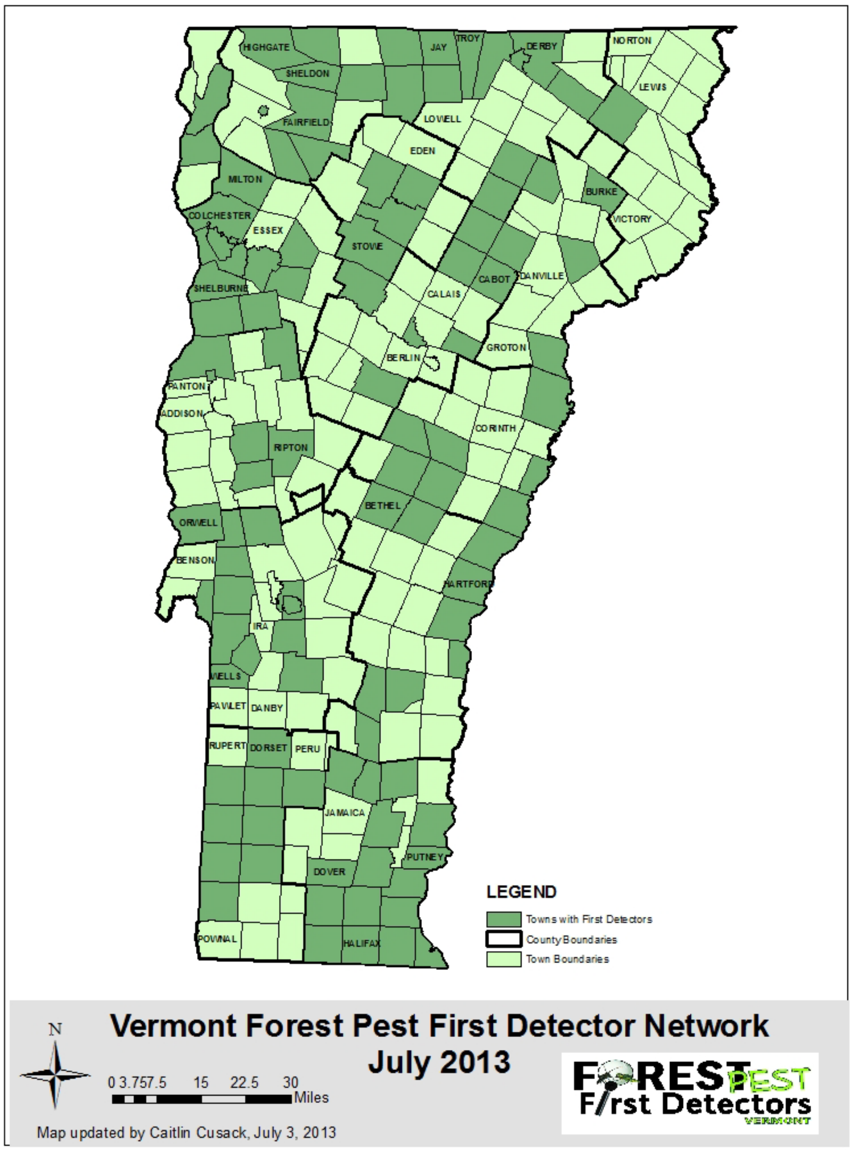


Figure 28. Towns in Vermont in 2013 that have Forest Pest First Detectors.

Under the guidance and support of FPR and UVM extension staff, a number of communities have been developing invasive pest action plans that outline municipality goals and objectives and the actions it will take to meet the current or anticipated impact of forest pests on its urban and community forests. In 2013, 13 communities were awarded EAB incentive grants. For more information, visit http://vtinvasives.org/tree-pests/community-preparedness.

Firewood

Our Don't Move Firewood outreach continues in Vermont State Parks in an effort to reduce the possibility of introducing non-native forest insects or diseases. The 2013 camping season was the fifth year the State Parks collected firewood brought in by campers from out of state and exchanged it for local wood. It is now the policy of the Vermont Department of Forests, Parks and Recreation that untreated firewood originating from any location outside Vermont cannot be transported into Vermont State Parks or State Forests (Policy #24 – Importation of Firewood).

The amount of firewood being exchanged has held steady for the last three years. This year 148 bundles of firewood (4 cords), were collected. Most of the wood originated from New York and the New England states, but wood was brought to Vermont from as far away as Idaho, Florida, Pennsylvania and Quebec.

Last year 136 bundles were collected so it appears that our downward trend has hit a bump. The parks that exchanged the most wood included Woodford State Park (31 bags), Little River State Park in Waterbury (23 bags), Maidstone State Park (13 bags) and Jamaica (10 bags). During November the double-bagged and sealed non-native firewood was opened and checked for signs of emerald ash borer, Asian Longhorned Beetle and other pests. No suspicious signs or insects were found. The wood will be used for heating of state-owned facilities this winter.

Table 14. Numbers of bags of firewood brought into Vermont State Parks during the 2009-2013 camping seasons. From 2009-2012, firewood from over 50 miles away was exchanged. In 2013, all out-of-state firewood was included in the exchange program.

Year	Number of bundles of firewood
2009	212
2010	379
2011	158
2012	136
2013	148

Exotic Wood Borer/Bark Beetle National Survey

The USDA and the Vermont Agency of Agriculture conducted surveys, using pheromone traps, for a variety of exotic woodboring beetles as part of the Exotic Wood Borer/Bark Beetle National Survey. APHIS personnel had 21 sites, with 63 traps total, and the Vermont Agency of Agriculture covered an additional 6 sites, with 21 traps total. Target areas included high risk sites such as mulch manufacturers, rest areas, lumber yards, sawmills, log yards, wood chip producers, wood chip fired power plants, college campuses, state parks, campsites, and stump dumps, as well as others.

Traps at each site were baited with various lures. There were three or four traps at most sites, including: (1) Multi-funnel traps baited with Exotic Bark Beetle Ipslure for detecting *Ips sexdentatus* (six-toothed bark beetle), *Ips typographus* (European spruce bark beetle), and *Orthotomicus erosus* (Mediterranean pine engraver); (2) Cross-vane panel traps baited with spruce blend, geranyl acetol and ultra-high release ethanol for detecting *Tetropium fuscum* (Brown Spruce Longhorned Beetle) and *Tetropium castaneum* (Black Spruce Beetle); and (3) Multi-funnel traps baited with alpha-pinene and ultra-high release ethanol for detecting *Hylurgops palliates* (Lesser Spruce Shoot Beetle), *Hylurgus ligniperda* (Red-haired pine bark beetle), *Tomicus destruens* (a pine shoot beetle). Some sites also included traps for *Sirex noctilio* (Sirex woodwasp). Traps were separated by about 30 yards, as specified in the trapping protocol, and checked every two weeks.

Three specimens of the **European Woodwasp**, *Sirex noctilio*, were collected in traps deployed as part of the 2013 Exotic Wood Borer/Bark Beetle National Survey. *Sirex* finds came from three towns in three separate counties, namely East Burke (Caledonia County), Island Pond (Essex County), and Swanton (Franklin County). Former *Sirex noctilio* finds in Vermont were in Stowe in 2007 (Lamoille County), Burlington in 2010 (Chittenden County) and Brattleboro in 2012 (Windham). No infested trees have been seen in Vermont.

Table 15. Trap locations where *Sirex noctilio* was captured in 2013. Data include town, county, coordinates, and date of collection. The cross-vane panel traps were baited with spruce blend, geranyl acetol and ultra-high release ethanol for detecting *Tetropium fuscum* (Brown Spruce Longhorned Beetle) and *Tetropium castaneum* (Black Spruce Beetle).

Town	County	Latitude	Longitude	Date collected
East Burke	Caledonia	44.58458	-71.94595	7/11/2013
Swanton	Franklin	44.9049	-73.1093	9/4/2013
Island Pond	Essex	44.81739	-71.87363	10/23/2013

Wind-Disturbed Site Beetle Surveys

In our 2012 Conditions Report, we gave results of survey work undertaken in Hinesburg Town Forest, where a windstorm had caused considerable damage in December 2010, for ambrosia beetles in the genus *Trypodendron*. Those surveys employed five uni-traps baited with lineatin pheromone, ethanol, and alpha-pinene in spruce stands, and with lineatin, ethanol and the natural lure of bruised yellow birch branches in hardwood stands. A total of 352 specimens of *Trypodendron*, including four species, were collected, along with 98 other members of the subfamily Scolytinae. (For more details, see page 55 of http://www.vtfpr.org/protection/documents/2012conditionsFINAL.pdf.)

In addition to the five uni-traps deployed for the *Trypodendron* work in 2012, we also positioned three Lindgren funnel traps (12-funnel series) at breast height on re-bar trap holders in three stands. These were at least a chain away from the *Trypodendron* traps. Sites included (1) WB-1: mixed hardwoods, with trees sapling-sized to about 12 inches DBH, (2) WB-2: mixed hardwoods, sapling to pole-sized, with considerable regeneration, and (3) WB-3: mixed spruce, with high components of Norway spruce and downed material.

The pheromone “Woodborer Combo” lure used in the Lindgren funnel traps consisted of two components: ultra-high release (UHR) ethanol and UHR alpha-pinene, where the alpha-pinene was 75 % S (-) enantiomer. The killing agent was 50:50 water and propylene glycol in a phosphate-free formula.

Traps ran from May 31 to September 8, 2012. There were 11 collection periods. Trap contents were emptied every two weeks through paint filters with screen inserts. Insects that were collected were frozen until samples could be processed.

During processing, specimens for each collection period and each trap were rinsed and sorted into four categories: bark beetles (Scolytinae), longhorn beetles (Cerambycidae), other coleoptera (beetles), and other insects. Thanks to assistance from Bob Acciavatti, (retired USFS), the bark beetle catch has been completely processed and identifications are complete so we can now contribute records of the Scolytinae collected in Lindgren funnel traps at this site in 2012.

There were 5,139 bark beetles collected during this part of our survey, and 29 species of bark beetles were represented. The trap located in the mixed spruce stand (WB-3) collected the highest number of beetles over the course of the trapping period (2,532 beetles) and was the most diverse in numbers of species collected, with an average of 11.5 species over the 11 collection periods (Table 16). The most numerous species were *Trypodendron borealis* at 53.2% (2,732 specimens), *Xylosandrus germanus* at 21.6% (1,109 specimens) and *Dryocoetes affaber* at 10.5% (540 specimens) (Table 17 and Figure 29).

Table 16. Site numbers, descriptions, coordinates, numbers of trapped Scolytinae and average numbers of species per collection period for three sites in Hinesburg Town Forest where Lindgren funnel traps baited with baited with UHR ethanol and alpha-pine were in place May 31 - September 8, 2012.

Site ID	Site description	Latitude	Longitude	Number of beetles collected	Average number of Scolytinae species/collection period
WB-1	Mixed hardwoods, with trees sapling-sized to about 12 inches DBH	44.31970	-73.02746	1,788	5.4
WB-2	Mixed hardwoods, sapling to pole-sized, with considerable regeneration	44.32131	-73.02989	789	7.4
WB-3	Mixed spruce, with high components of Norway spruce and downed material	44.32013	-73.03067	2,562	11.5

Table 17. Scolytinae collected in Lindgren funnel traps baited with UHR ethanol and alpha-pine at Hinesburg Town Forest (Town of Hinesburg in Chittenden County) from May 31 to September 8, 2012. Data include overall numbers and percent of each species collected.

Species	Number of this species found at each site			Total number of each species	Percent of total collection
	WB-1	WB-2	WB-3		
Anisandrus sayi	34	18	19	71	1.38
Cryphalus ruficollis	0	0	16	16	0.31
Crypturgus borealis	0	4	23	27	0.53
Dendroctonus valens	1	14	16	31	0.6
Dryocoetes affaber	44	22	474	540	10.51
Dryocoetes autographus	37	41	87	165	3.21
Gnathotrichus materiarius	8	20	13	41	0.8
Hylastes opacus	5	8	11	24	0.47
Hylastes porculus	0	0	6	6	0.12
Hylesinus pruinosus	0	0	2	2	0.04
Hylurgops rugipennis piniflex	1	17	9	27	0.53
Hypothenemus species	1	0	0	1	0.02
Ips calligraphus	0	0	2	2	0.04
Ips grandicollis	2	14	17	33	0.64
Ips pini	1	2	7	10	0.19
Monarthrum fasciatum	0	0	1	1	0.02
Monarthrum mali	0	3	7	10	0.19
Orthotomicus caelatus	13	13	50	76	1.48
Phloeotribus liminaris	0	0	2	2	0.04
Pitogenes hopkinsi	2	7	8	19	0.37
Pityophthorus sp.	2	1	9	12	0.23
Polygraphus rufipennis	1	20	117	138	2.69
Pseudopityophthorus sp.	0	0	2	2	0.04
Scolytus piceae	0	0	1	1	0.02
Tomicus piniperda	0	1	2	3	0.06
Trypodendron borealis	1088	379	1265	2732	53.16
Trypodendron lineatum	3	6	21	30	0.58
Xylosandrus germanus	542	192	375	1109	21.58
Xyloterinus politus	3	5	0	8	0.16
Totals	1788	789	2532	5139	100

		
Trypodendron borealis (male) Photo: Robert Acciavatti	*Xylosandrus germanus* (female) Photo: Jiri Hulcr, www.ambrosiasymbiosis.org	*Dryocoetes affaber* (male) Photo: Univ. of Alaska Museum, bugguide.net

Figure 29. Images of the three most common bark beetle species found in Lindgren funnel traps deployed at Hinesburg Town Forest May 31 – September 8, 2012.

More bark beetles (a total of 2,799 specimens) were found in the traps collected on May 27, 2012 than on any other date (Figure 30). This was true of traps at all three collection sites (Figure 31).

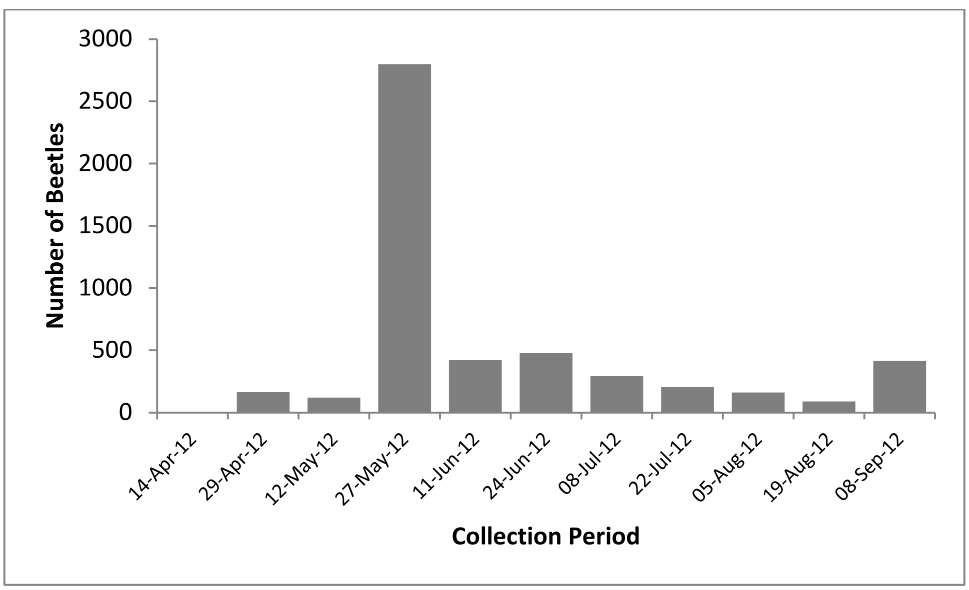


Figure 30. Bi-weekly numbers of bark beetles collected in Lindgren funnel traps deployed at Hinesburg Town Forest May 31 - September 8, 2012.

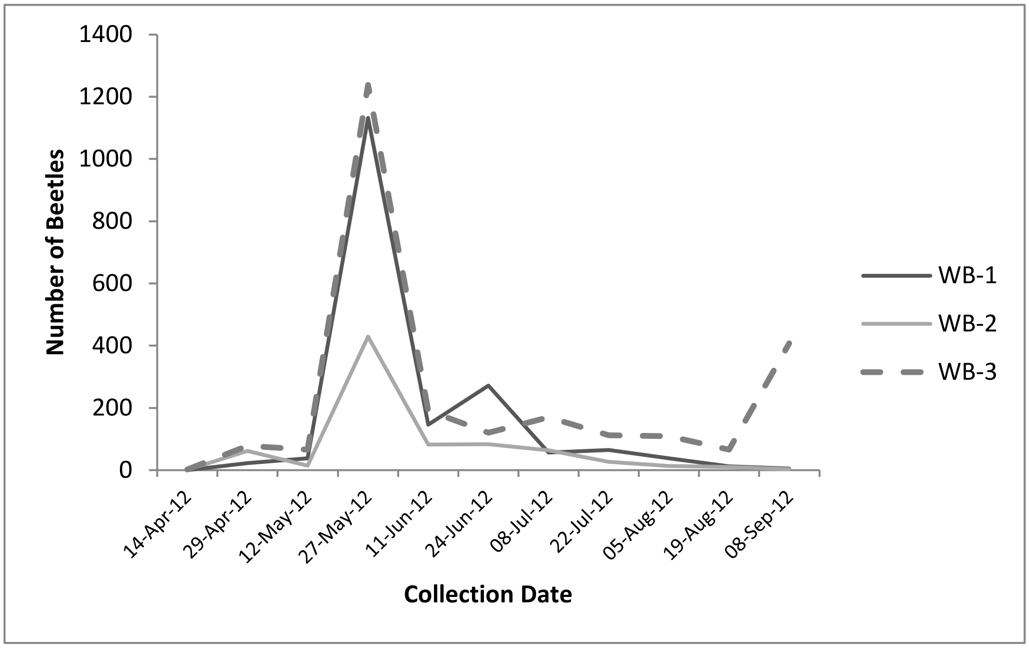


Figure 31. Bi-weekly numbers of bark beetles collected at each of three trap sites at Hinesburg Town Forest.

OTHER BARK AND WOOD INSECTS

INSECT	LATIN NAME	HOST	LOCALITY	REMARKS
A Horntail Wasp	*Urocerus albicornis*	Sugar maple	Champlain Valley	Individual insect observed.
Allegheny Mound Ant	*Formica exsectoides*	Ground nests	Scattered	Fewer reports than in 2012.
Asian Longhorned Beetle	*Anoplophora glabripennis*	Various hardwoods		Not observed or known to occur in Vermont. See narrative.
Bronze Birch Borer	*Argrilus anxius*	Birch	Scattered throughout	Noted on scattered individual paper birches that appeared low vigor.
Black Spruce Beetle	*Tetropium castaneum*	Spruce, pine, fir and larch		Not observed or known to occur in Vermont. (See narrative under Other Woodborers)
Brown Spruce Longhorned Beetle	*Tetropium fuscum*	Spruce, pine and fir		Not observed or known to occur in Vermont. (See narrative under Other Woodborers)
Brown Prionid	*Orthosoma brunneum*	Firewood	Monkton, Starksboro	Reared from firewood.
Brown Wood Borer	*Neandra brunnea*	Black locust	Fairfax	Adult emerged.
Carpenter Ant	*Camponotus* spp.	Conifers	Widespread observations	Reports of light to moderate populations.
Eastern Ash Bark Beetle	*Hylesinus aculeatus*	Ash	Scattered reports	Beetles encountered as they emerged from firewood and logs; galleries observed in downed ash.
Eastern Larch Beetle	*Dendroctonus simplex*	Larch	Northeast Kingdom	See Larch Decline. Heavy eastern larch beetle populations have been observed throughout the NEK.

OTHER BARK AND WOOD INSECTS

INSECT	LATIN NAME	HOST	LOCALITY	REMARKS
Emerald Ash Borer	*Agrilus planipennis*	Ash		Not observed or known to occur in Vermont. See narrative.
European Woodwasp	*Sirex noctilio*	Pines	New finds in Caledonia, Franklin and Essex Counties	Single specimens were found in traps in East Burke, Swanton and Island Pond in 2013, bringing the number of Vermont observations to six. (See Bark and Wood Insects narrative.)
Hemlock Borer	*Phaenops fulvoguttata*	Hemlock and occasionally other conifers	Colchester, Fairfield, North Hero,	Some affected trees appear to have been stressed from 2011 spring flooding prior to borer infestation. Others have limited root systems. Collected by *Cerceris fumipennis* wasps during biosurveillance surveys.
Japanese Cedar Longhorned Beetle	*Callidiellum rufipenne*	Arborvitae, eastern redcedar, juniper and others		Not observed or known to occur in Vermont. See narrative.
Northeastern Sawyer	*Monochamus notatus*	Conifers	Huntington	Adults observed during flight period.
Pigeon Tremex	*Tremex columba*	Sugar maple	Scattered throughout	Commonly observed in declining trees.
Red-shouldered Pine Borer	*Stictoleptura canadensis*	Pines	Scattered observations	Captured in ALB trap. (See narrative under Asian Longhorned Beetle.)
Red Turpentine Beetle	*Dendroctonus valens*	Red and white pine	Colchester	Typically attacks stressed trees, weakening them further and predisposing them to attacks by other bark beetles.

OTHER BARK AND WOOD INSECTS

INSECT	LATIN NAME	HOST	LOCALITY	REMARKS
Sugar Maple Borer	*Glycobius speciosus*	Sugar maple	Throughout	Old damage commonly observed throughout the state. Adult beetle photographed in Starksboro.
Whitespotted Sawyer	*Monochamus scutellatus*	White pine and other conifers	Common throughout	Many inquiries resulted from people suspecting this to be Asian longhorned beetle.

Other Bark and Wood Insects not reported in 2013 included Elm Bark Beetle, *Hylurgopinus rufipes* and *Scolytus multistriatus* ; Locust Borer, *Megacyllene robinae* ; Redheaded Ash Borer, *Neoclytus acuminatus;* Round-headed Apple Tree Borer, *Saperda candida*.

FRUIT, NUT AND FLOWER INSECTS

INSECT	LATIN NAME	HOST	LOCALITY	REMARKS
Asiatic Garden Beetle	*Autoserica castanea*	Many	Scattered observations	Fewer reports than in past years.
Pine Coneworms	*Dioryctria reniculelloides*	White spruce	Williston	Pitch dripping from cones.
Rose Chafer	*Macrodactylus subspinosus*	Many	Statewide	Present, but not reported as particularly numerous in 2013.
Russian Leather Beetle	*Osmoderma eremicola*	Hickory	Grand Isle	Large, fleshy larvae feed in decaying portions of trees.
Western Conifer Seed Bug	*Leptoglossus occidentalis*	Conifers	Statewide	No damage to Vermont conifers has been recorded, but a very common household invader.

Fruit, Nut and Flower Insects not reported in 2013 included Blister Beetle, *Lytta sayi* ; Butternut Curculio, *Conotrachelus juglandis;* Fir Coneworm, *Dioryctria abietivorella;* Green Stink Bug, *Chinavia hilaris;* Plum Curculio, *Conotrachelus nenuphar* .

STEM DISEASES

Beech Bark Disease, caused by *Cryptococcus fagisuga* and *Nectria coccinea var. faginata*, was the primary cause of dieback and mortality on 25,150 acres (Table 18, Figure 32). This non-native pest complex was the most common cause of decline and mortality mapped in 2013, and levels were similar to the 20,268 acres mapped in 2012. Observations of beech scale populations were variable, with some observers reporting more and some less than in 2012.

Table 18. Mapped acres of Beech Bark Disease in 2013.

County	Acres
Addison	351
Bennington	411
Caledonia	1,066
Chittenden	1,519
Essex	2,607
Franklin	2,981
Grand Isle	0
Lamoille	3,269
Orange	1,307
Orleans	3,082
Rutland	357
Washington	2,605
Windham	2,905
Windsor	2,690
Total	**25,150**

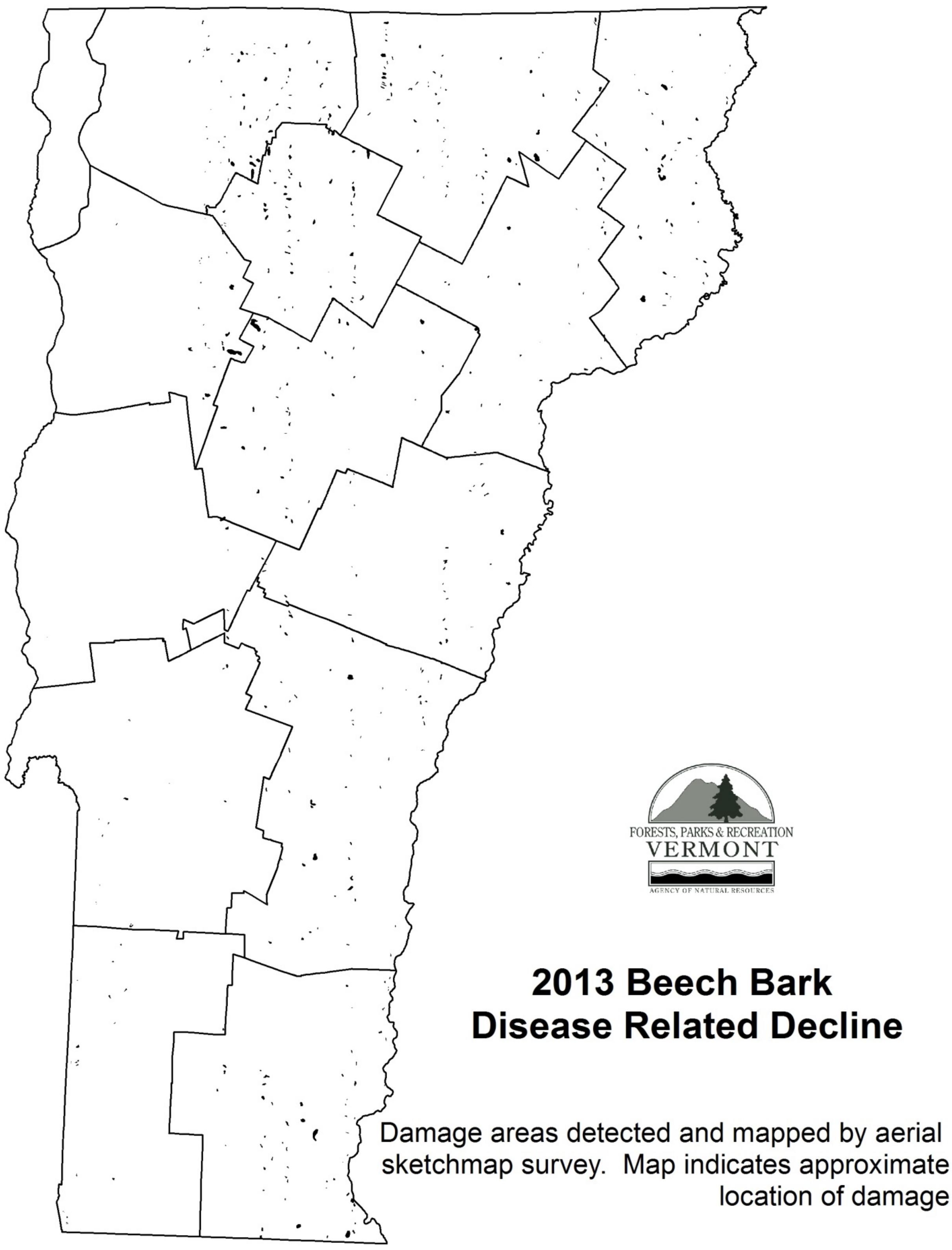


Figure 32. Beech Bark Disease related decline mapped in 2013. Mapped area includes 25,150 acres.

Butternut Canker, caused by *Sirococcus clavigignenta-juglandacearum*, remains stable, with most butternuts showing symptoms of the disease.

A project to conserve butternut germplasm moved forward when trees grafted from 30 different Vermont butternuts which seemed to have some disease resistance were planted in Vermont. Scion was collected cooperatively with Plant Technologies LLC, DNA tested to ensure it originated from a pure butternut, and grafted onto black walnut rootstock at the University of Missouri. Thirty-eight trees, representing 25 clones, were planted in a seed orchard established by Middlebury College, and 29 trees, representing 19 clones, were planted in Brandon to enhance a parallel effort on the Green Mountain National Forest. As of 2013, 56 clones were represented in the Brandon orchard.

OTHER STEM DISEASES

DISEASE	LATIN NAME	HOST	LOCALITY	REMARKS
Ash Yellows	*Candidatus Phytoplasma fraxini*	White ash	Southern and Northwestern Vermont	Remains heavy in scattered locations.
Beech Bark Disease	*Cryptococcus fagisuga and Nectria coccinea var. faginata*			See narrative.
Black Knot	*Dibotryon morbosum*	Cherry	Scattered throughout	Common at normal levels.
Butternut Canker	*Sirococcus clavigignenta-juglandacearum*			See narrative.
Caliciopsis Canker	*Caliciopsis pinea*	White pine	Dummerston	Associated with decline in stands stressed by wind and/or crowding.
Chestnut Blight	*Cryphonectria parasitica*	American chestnut	Southern Vermont, Champlain Valley	Observed on sprouts. The American Chestnut Foundation remains active in establishing seed orchards in Vermont.
Cytospora Canker	*Leucostoma kunzei*	Blue spruce	Widely scattered	Damage levels remain low.
Delphinella Tip Blight of Fir	*Delphinella balsamae*	Balsam fir	Northern Vermont	Christmas trees.
Diplodia Shoot Blight	*Sphaeropsis sapinea*	Red and Scots pine	Widely scattered.	Increasing in the Champlain Valley.
Dutch Elm Disease	*Ophiostoma novo-ulmi*	Elm	Throughout	Levels similar to 2012.
Hypoxylon Canker	*Hypoxylon pruinatum*	Poplar	Widely scattered	Damage levels low.
Nectria Canker	*Nectria galligena*	Hardwoods	Scattered throughout	
Oak Wilt	*Ceratocystis fagacearum*		Not observed or known to occur in Vermont.	

OTHER STEM DISEASES

DISEASE	LATIN NAME	HOST	LOCALITY	REMARKS
Red Ring Rot	*Phellinus pini*	White pine	Scattered throughout	Common in unthrifty stands, especially where basal area is high and soils are poorly drained.
Sirococcus Shoot Blight	*Sirococcus tsugae*	Hemlock	Widely scattered	Observed on ornamentals and understory hemlocks.
Verticillium Wilt	*Verticillium albo-atrum*	Sugar maple	Champlain Valley	
White Pine Blister Rust	*Cronartium ribicola*	White pine	Statewide	Levels remain higher than normal.
Yellow Witches Broom Rust	*Melampsorella caryophyllacearum*	Balsam fir	Widely scattered	Continues to be more noticeable than normal, especially in northeastern Vermont.

Other Stem Diseases not reported in 2013 included Eastern Dwarf Mistletoe, *Arceuthobium pusillum* ; Scleroderris Canker, *Ascocalyx abietina;* Sirococcus Blight, *Sirococcus conigenus;* Woodgate Gall Rust, *Endocronartium harknessii.*

FOLIAGE DISEASES

Anthracnose, caused by *Gloeosporium sp*. and other fungi, was noticeable on the landscape by mid-July. During the August aerial surveys, 49,299 acres of brown and defoliated hardwoods mapped (Table 19, Figures 33-34). Anthracnose on hophornbeam accounted for 1,591 acres. Foliage browning was also common on white ash, and red oak. Levels of sugar maple anthracnose declined significantly from 2012.

Table 19. Mapped areas of brown and defoliated hardwoods mapped in 2013.

County	Hophornbeam	Other Hardwoods	Total Acres
Addison	180	1,197	1,377
Bennington	0	647	647
Caledonia	0	6,496	6,496
Chittenden	739	690	1,429
Essex	0	3,166	3,166
Franklin	660	645	1,305
Grand Isle	0	147	147
Lamoille	0	1,611	1,611
Orange	0	3,634	3,634
Orleans	0	2,408	2,408
Rutland	0	3,028	3,028
Washington	12	4,309	4,321
Windham	0	8,486	8,486
Windsor	0	11,244	11,244
Total	**1,591**	**47,708**	**49,299**

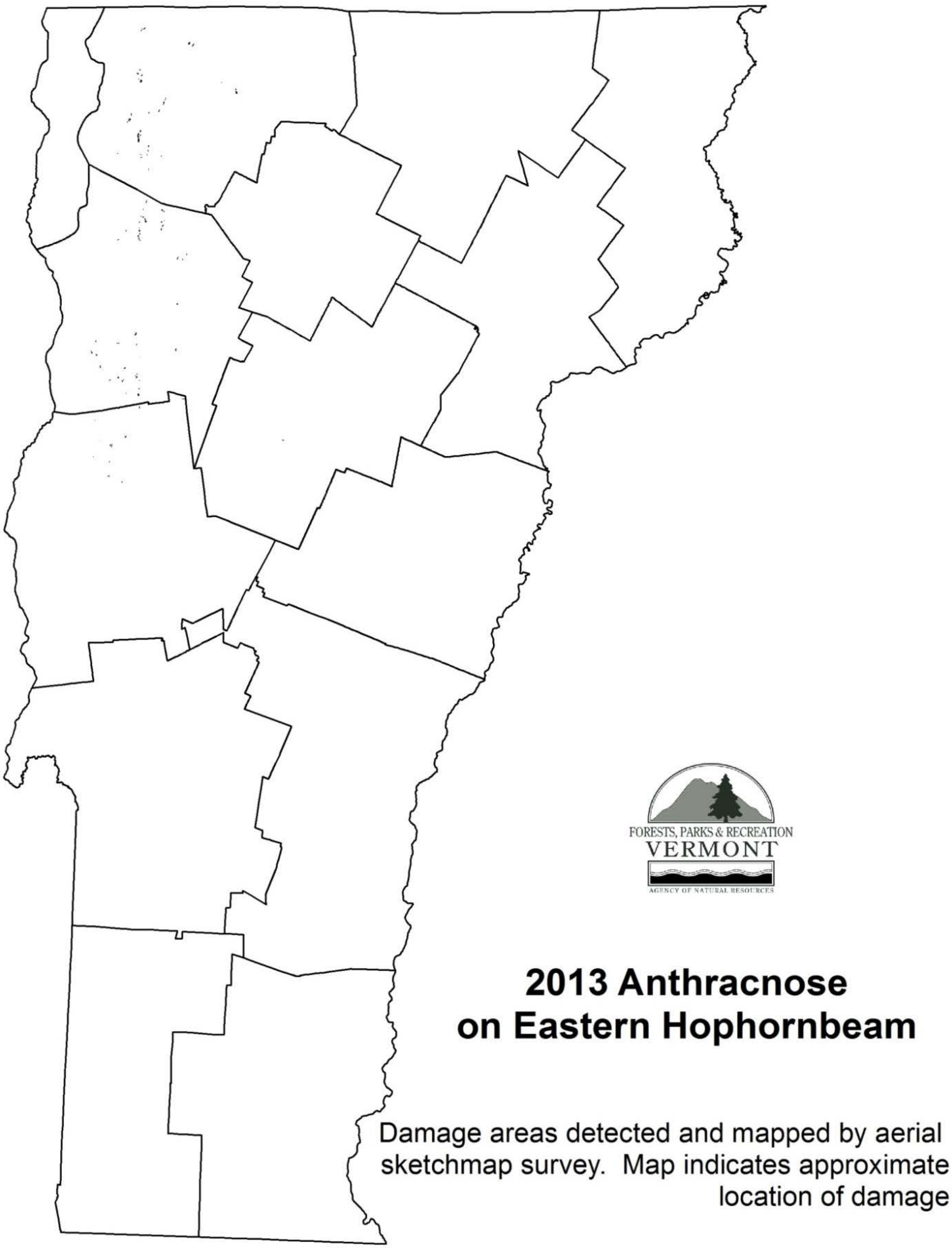


Figure 33. Anthracnose damage on Eastern Hophornbeam mapped in 2013. Mapped area includes 1,591 acres

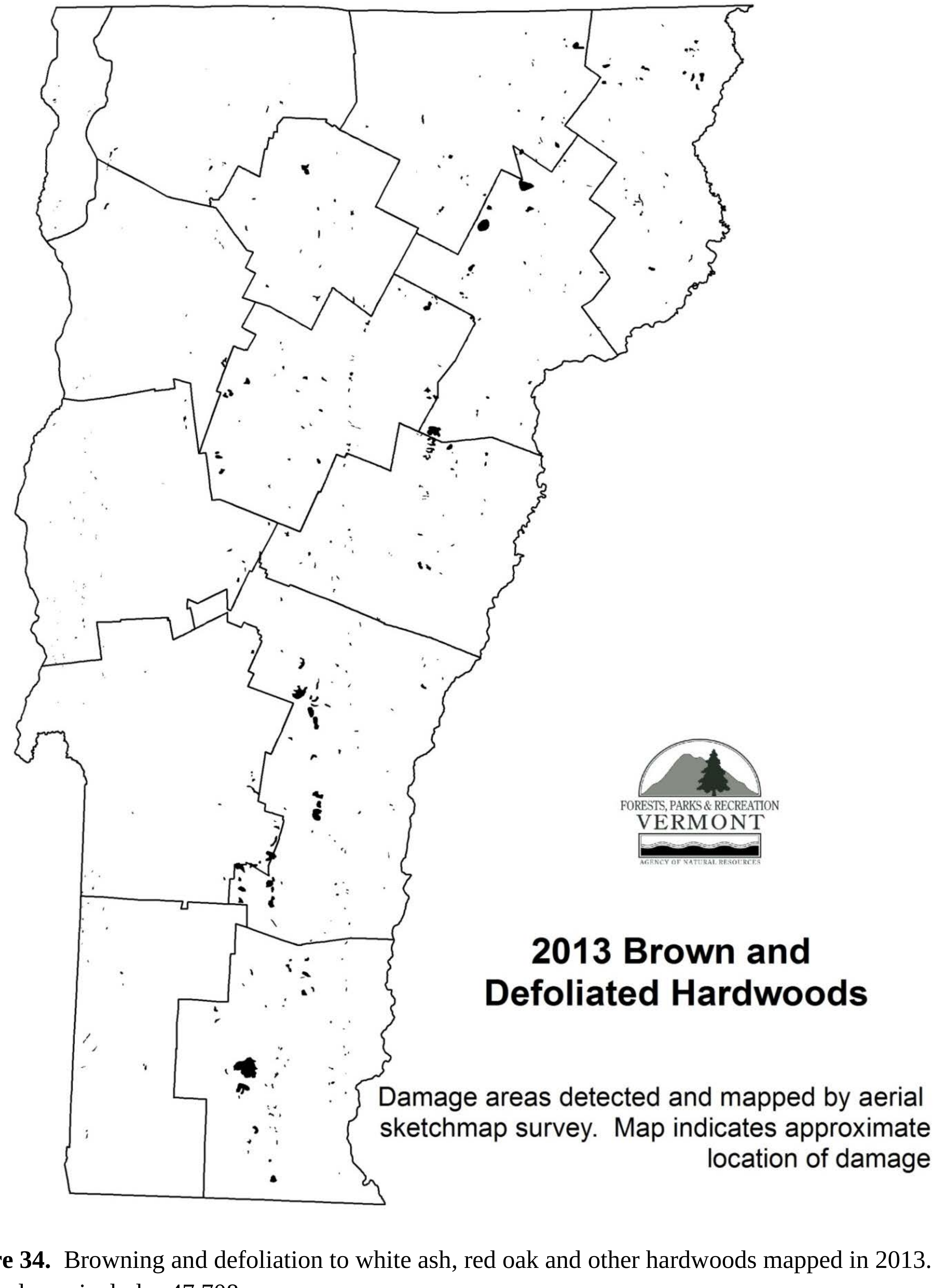


Figure 34. Browning and defoliation to white ash, red oak and other hardwoods mapped in 2013. Mapped area includes 47,708 acres.

Needle Diseases of White Pines, primarily attributed to the Brown Spot Needle Blight fungus, *Mycosphaerella dearnessii*, but also two needlecast fungi (*Canavirgella banfieldii* and *Bifusella linearis),* continued to be widespread. Thin crowns were noticed statewide. During the aerial survey conducted over the Green Mountain National Forest, the US Forest Service mapped 2,662 acres of white pine needle damage. This survey covered only a portion of Vermont, and the damage is difficult to detect by the August survey, so the total area affected statewide would be much larger than the acres mapped.

The US Forest Service, in cooperation with UNH and affected states, continues to investigate this malady, including studies to clarify the roles of needlecast fungi and weather. As part of this project, we are monitoring plots in Plymouth, Richmond, St. Johnsbury, and Springfield (Figure 35).

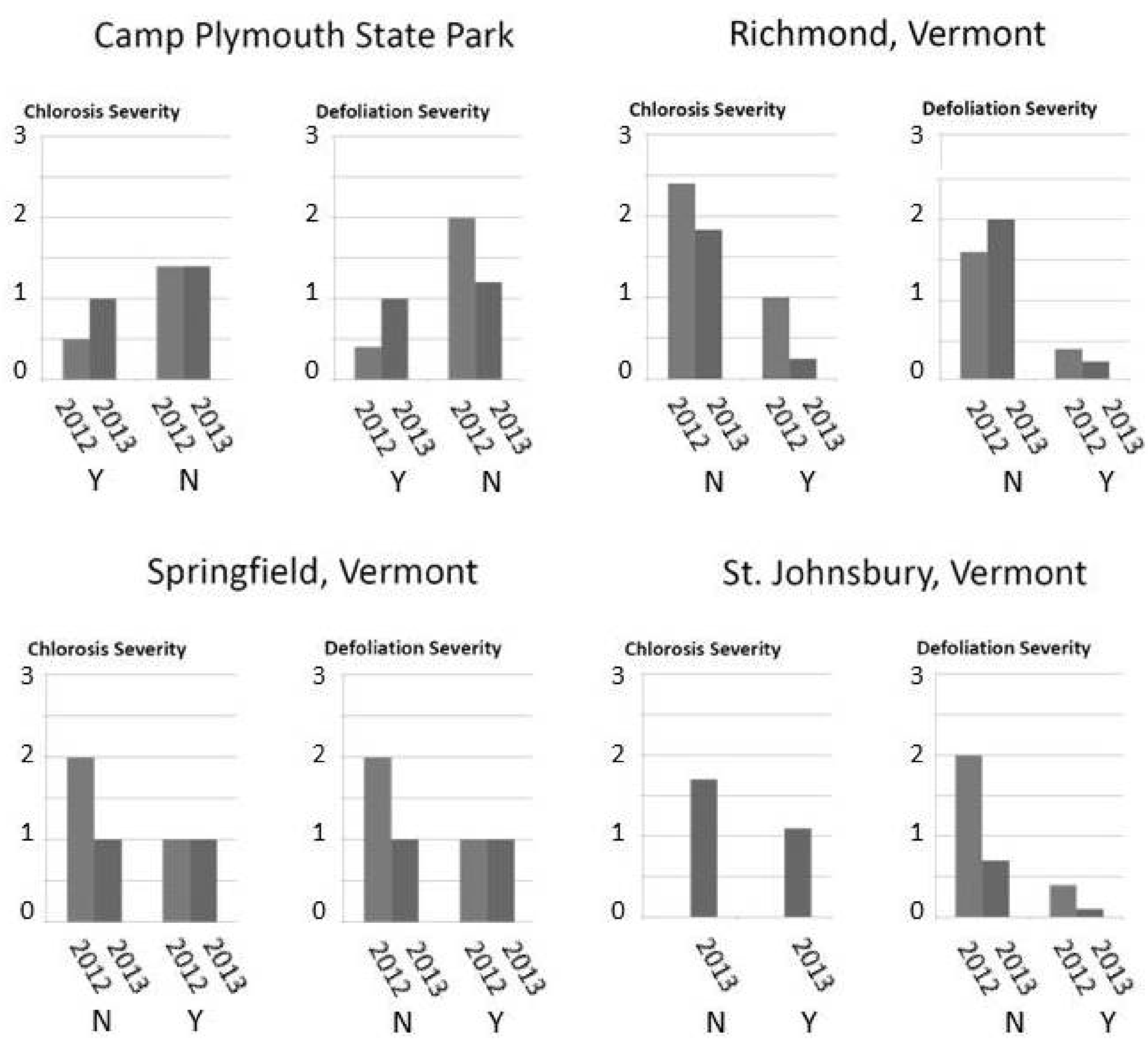


Figure 35. White pine chlorosis and defoliation severity at four needlecast monitoring sites in 2012 and 2013, by initial condition in 2012 (Y = healthy, N = not healthy), rated as **1**=<1/3 crown affected, **2**=one third to 2/3 crown affected, and **3**=more than 2/3 affected. Data summaries provided by the US Forest Service and University of New Hampshire.

Poplar Leaf Blight, attributed to *Marssonina sp*., was widespread on balsam poplar. During the August aerial surveys 431 acres of brown and defoliated poplars were mapped, mostly in riparian areas (Table 20).

Table 20. Mapped acres of poplar leaf blight in 2013.

County	Acres
Addison	0
Bennington	0
Caledonia	0
Chittenden	0
Essex	0
Franklin	114
Grand Isle	0
Lamoille	0
Orange	31
Orleans	6
Rutland	39
Washington	65
Windham	96
Windsor	80
Total	**431**

Septoria Leafspot on Birch, caused by *Septoria betulae*, increased substantially with 98,329 acres mapped during aerial surveys, compared to 2,427 acres in 2012 (Table 21, Figure 36). Defoliation of white birch by Septoria was unusually common at lower elevations and was also widespread in montane birch stands.

Table 21. Mapped acres of birch defoliation in 2013.

County	Acres
Addison	6,153
Bennington	2,964
Caledonia	3,259
Chittenden	9,108
Essex	4,475
Franklin	2,258
Grand Isle	0
Lamoille	15,528
Orange	5,861
Orleans	3,061
Rutland	11,209
Washington	17,727
Windham	5,174
Windsor	11,552
Total	**98,329**

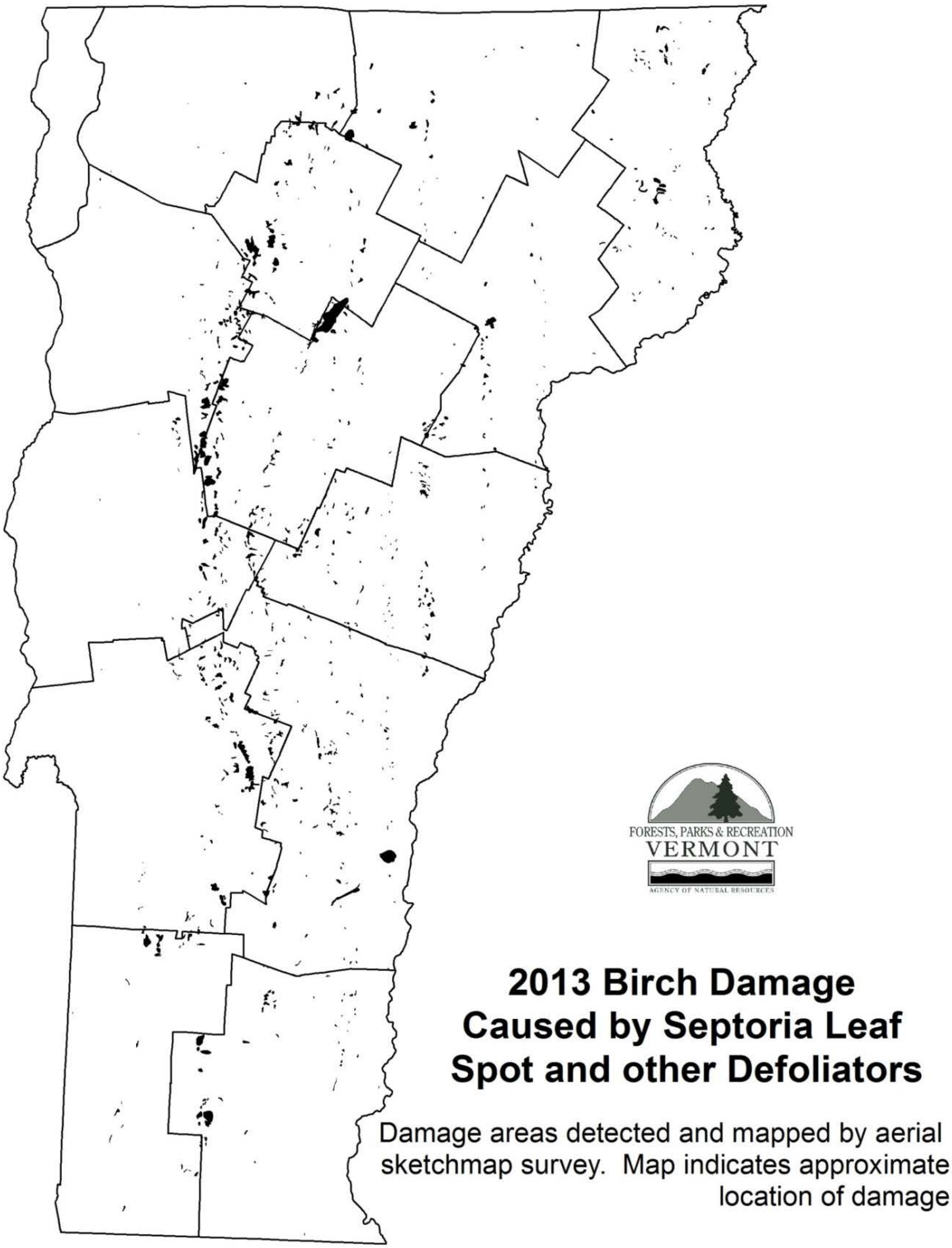


Figure 36. Birch damage caused by Septoria leaf spot and other defoliators mapped in 2013. Mapped area includes 98,329 acres.

OTHER FOLIAGE DISEASES

DISEASE	LATIN NAME	HOST	LOCALITY	REMARKS
Actinopelte Leaf Spot	*Actinopelte dryina*	Red oak	Newfane	
Anthracnose	*Glomerella spp.* *Apiognomonia spp.*			See narrative.
Ash Anthracnose	*Gloeosporium aridum*			See narrative.
Brown Spot Needle Blight	*Scirrhia acicola*	Scots pine	Statewide	Continues to be very noticeable. Contributing to decline of ornamentals.
Brown Spot Needle Blight	*Scirrhia acicola*	White pine		See White Pine Needlecast.
Canavirgella Needlecast	*Canavirgella banfieldii*			See White Pine Needlecast.
Crown Rust of Oat	*Puccinia coronata*	Glossy buckthorn	Widely scattered	Noticeable defoliation, but not expected to impact plant health.
Fir-Fern Rust	*Uredinopsis mirabilis*	Balsam fir	Widespread	Mostly light damage on forest understory and Christmas trees.
Giant Tar Spot	*Rhytisma acerinum*	Norway maple	Statewide	Continues to be observed, but damage levels remain low.
Lirula needlecast	*Lirula nervata*	Balsam fir	Franklin County	Christmas trees
Maple Anthracnose	*Gloeosporium sp.*			See narrative.
Phyllosticta Needlecast	*Phyllosticta spp.*	Balsam fir	Weston	Moderate damage to Christmas trees.
Poplar Leaf Fungus	*Marssonina spp.*			See narrative.

OTHER FOLIAGE DISEASES

DISEASE	LATIN NAME	HOST	LOCALITY	REMARKS
Rhizosphaera Needle Blight	*Rhizosphaera pini*	Balsam fir	Orwell	
Rhizosphaera Needlecast	*Rhizosphaera kalkhoffi*	Blue spruce	Scattered statewide	Continues to be less noticeable than in recent years. However, inoculum remains high, and new infections were observed where rains prevented trees from being sprayed.
Septoria Leaf Spot on Birch	*Septoria betulae*			See narrative.
Septoria Leaf Spot on Maple	*Septoria aceris*	Sugar maple	Northeastern Vermont	Areas of heavy damage had an impact on fall foliage.
Tar Spot	*Rhytisma americanum and R. punctatum*	Sugar, red, and striped Maple	Scattered statewide	Very light damage. See also Giant Tar Spot.

Foliage Diseases not reported in 2013 included Cyclaneusma Needlecast, *Cyclaneusma minus* ; Dogwood Anthracnose, *Discula destructiva;* Larch Needlecast, *Mycosphaerella sp.* ; Lophodermium Needlecast, *Lophodermium seditiosum;* Rhabdocline Needlecast, *Rhabdocline pseudotsugae;* Swiss Needlecast, *Phaeocryptopus gaeumannii.*

ROOT DISEASES

DISEASE	LATIN NAME	HOST	LOCALITY	REMARKS
Annosus Root Rot	*Heterobasidion annosum*			No new infection centers reported.
Armillaria Root Rot	*Armillaria spp.*	Balsam fir, blue spruce	Wardsboro	On Christmas trees planted among stumps.
		Hardwoods	Statewide	Commonly found on declining trees.
Fusarium Root Rot	*Fusarium spp.*	Balsam fir, Fraser fir	Bennington and Windham Counties	Isolated from unhealthy, well-established Christmas trees.
Phytophthora Root Rot	*Phytophthora cinnamomi*	Balsam fir, Fraser fir	Scattered statewide	Unusually common in Christmas tree plantations. Consecutive years of heavy rain have led to saturated soil conditions allowing the disease to spread.

Frost Damage was reported in parts of central and southern Vermont. Species most affected were oak, beech, maple and cherry. While no significant foliar damage was observed in northern reaches, the timing of the frost coincided with heavy flowering, in some cases causing flowers to abort. Bennington and Rutland Counties reported the most damage and a total of 12,900 acres of frost injured forest were mapped. Locations especially affected were upper elevations on Dorset Peak and on Mount Ascutney.

Table 22. Mapped acres of frost injury in 2013.

County	Acres
Addison	1,188
Bennington	6,145
Rutland	3,567
Washington	297
Windham	1,181
Windsor	612
Total	**12,990**

Larch Decline decreased from 2012 with only 177 acres mapped (Figure 37). Caledonia County continues to have the majority of larch decline mapped from aerial surveys, 130 acres. Observations of heavy larch casebearer and eastern larch beetle populations throughout the Northeast Kingdom may indicate a new wave of decline for the future.

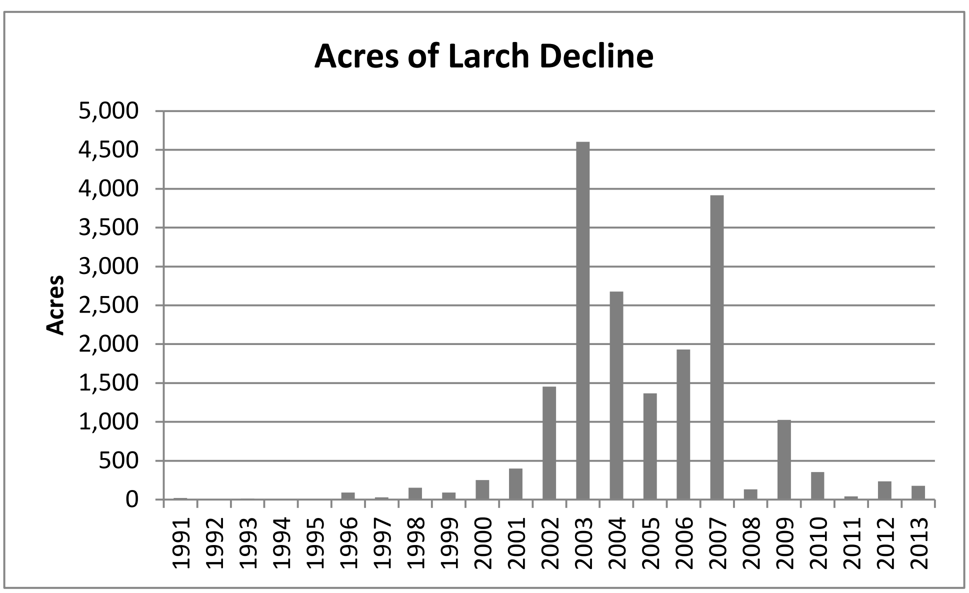


Figure 37. Trend in acres of larch decline mapped during aerial surveys. Mapped area in 2013 was 177 acres.

Tree stress related to recent **logging-related decline** remained low in 2013 with only 151 acres mapped during aerial surveys, a significant reduction from the high of nearly 4,000 acres in 2007. Only Franklin County, with 108 acres, and Windsor County, with 43 acres, were reported to have logging-related declines. Good growing conditions in 2013 likely favored tree recovery following harvesting.

Table 23. Logging related decline mapped in 2013.

County	Acres
Windsor	43
Total	**151**

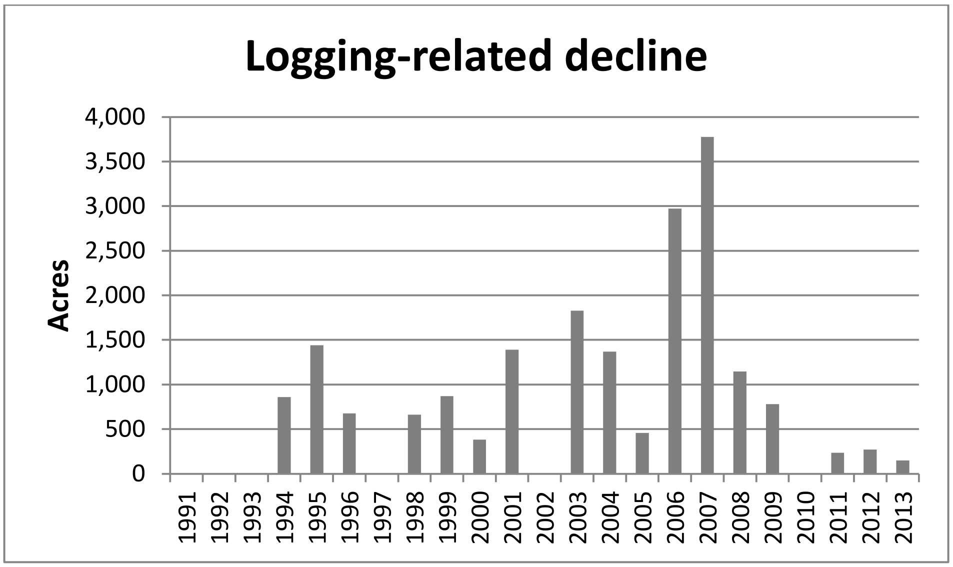


Figure 38. Trend in acres of logging-related tree declines mapped during aerial surveys.

Nine locations were visited in 2013 to survey for **ozone injury** to sensitive plant species (Table 24). Symptoms of ozone injury (stippling on upper leaf surface) were recorded at only one location, Clarendon, and on very few plants (one blackberry and one white ash). This follows recent trends towards lower ozone concentrations and reductions in foliar symptoms on bioindicator plants. Additional observations from Washington County reported injury on cherry at some locations. No ozone damaged forests were mapped during aerial survey.

Table 24. Ozone bioindicator sites visited in 2013 and observed ozone injury.

Town	Severity of Ozone Injury
Rupert	None
Sudbury	None
Clarendon	Light
Dover	None
Woodstock	None
Lunenburg	None
Orange	None
Rochester	None
Groton	None

Spruce-fir dieback and mortality statewide has decreased greatly from a recent high of over 16,000 acres in 2005, but Rutland County continues to increase in acreage mapped during aerial survey. Only 1,345 acres of decline was mapped in 2013, with 936 acres of this from Rutland County.

Table 25. Mapped acres of spruce-fir dieback and mortality in 2013.

County	Acres
Caledonia	97
Orange	112
Orleans	58
Rutland	936
Washington	65
Windham	50
Windsor	27
Total	**1,345**

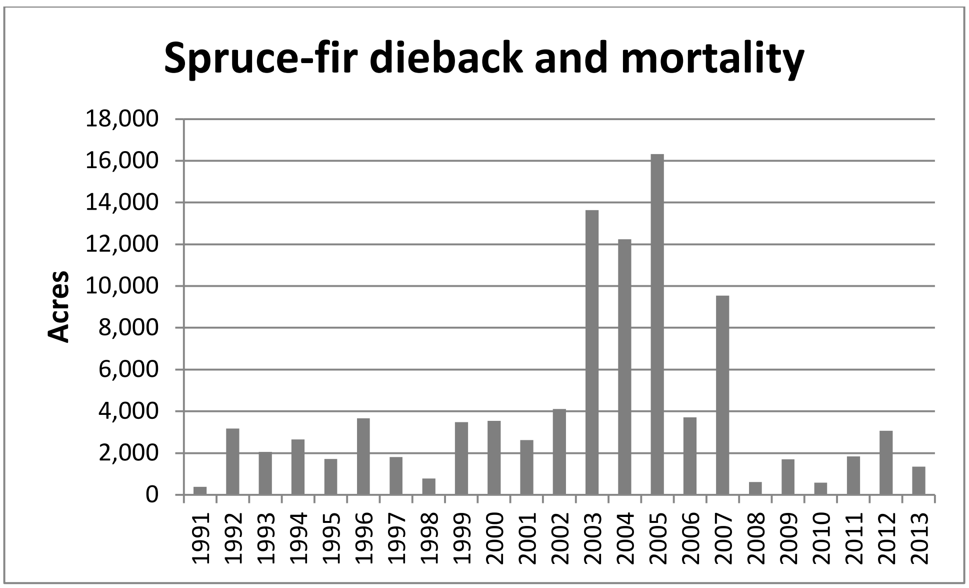


Figure 39. Trend in acres of spruce-fir dieback and mortality mapped during aerial surveys. Mapped area in 2013 was 1,345 acres.

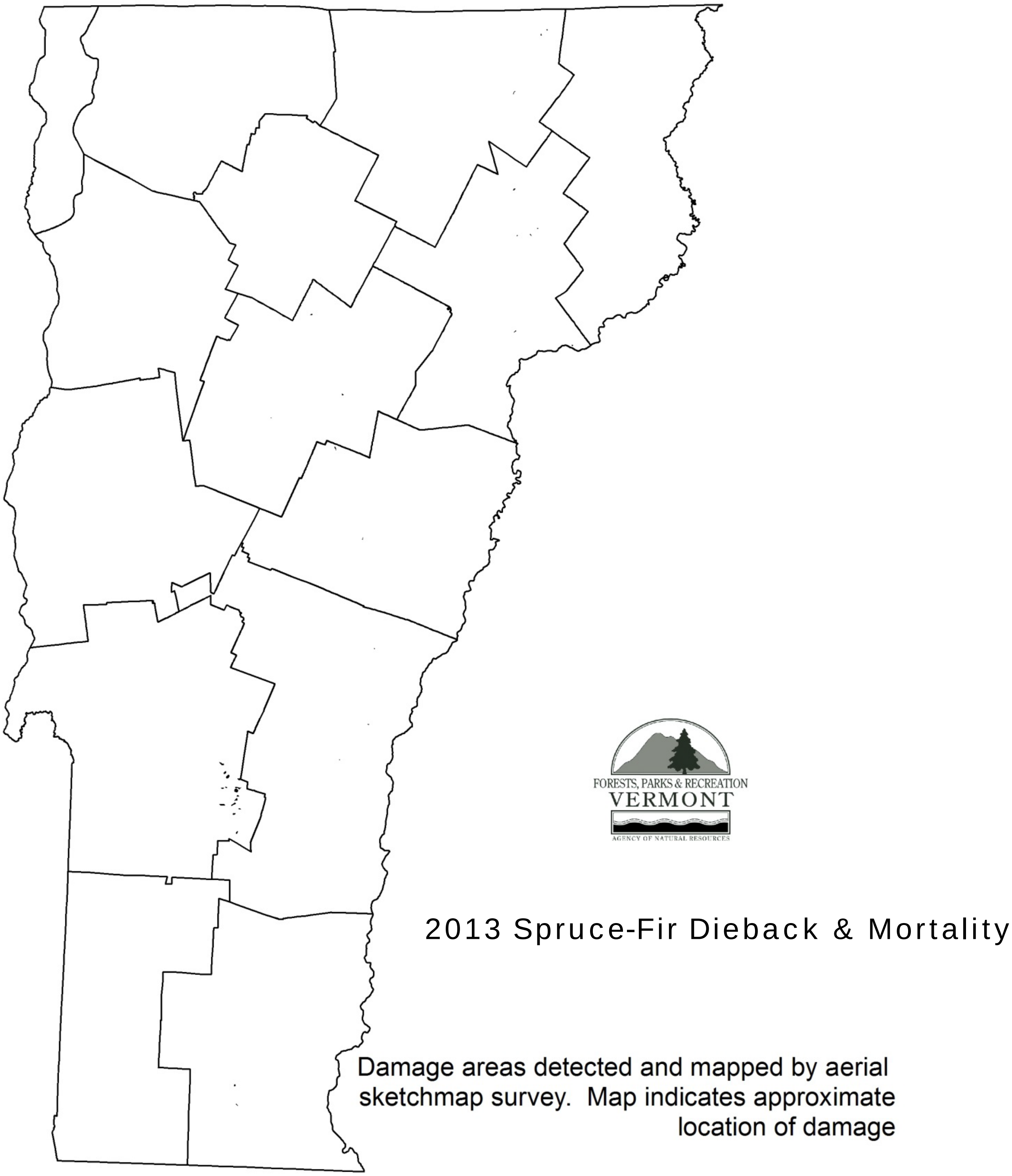


Figure 40. Spruce-fir dieback and mortality mapped in 2013. Mapped area includes 1,345 acres.

Extreme weather events affecting forests in 2013 included spring frost, tree declines from flooded or wet conditions, and extreme thunderstorms with strong associated winds that resulted in uprooting or breakage. In addition, a December ice storm affected large areas of northern Vermont but was not mapped during aerial survey (see Weather Section).

Table 26. Acres of forest damage from weather events (drought, flooding, frost, ice, snow breakage, wind, winter injury) mapped during aerial surveys and major factors involved.

Year	Total acres from weather damage	Extensive Damage Factors	Other Damage Factors
1991	64,529	Drought	
1992	17,790		Flooded sites, drought, frost
1993	54,067	Spruce winter injury	Flooded sites
1994	10,780		Flooded sites
1995	17,365		Flooded sites, drought
1996	19,324		Spruce winter injury, wet sites
1997	10,557		Flooded sites
1998	1,031,716	Ice storm, flooded sites	
1999	122,024	Drought	Ice, flooded sites, wind
2000	10,634		Flooded sites
2001	180,494	Drought	Flooded sites
2002	210,534	Drought	Flooded sites
2003	106,238	Spruce winter injury, flooded sites	Wind, drought
2004	19,877		Flooded sites
2005	11,078		Flooded sites
2006	6,786		Flooded sites
2007	21,656		Drought, flooded sites, wind
2008	2,401		Flooded sites
2009	15,315		Winter injury, flooded sites
2010	417,180	Frost	
2011	10,029		Flooded sites
2012	55,872	Frost	Flooded sites
2013	15,332*	Frost, ice*	Flooded sites, wind

*A December 2013 ice storm was not mapped during aerial survey but affected large areas in northern Vermont.

Wet or Flooded Sites decreased in 2013 from recent years, but wet spring weather did cause localized injury. In addition to 2,181 acres of forest decline mapped acres, flooding also resulted in the spread of root diseases in Christmas tree plantations.

Table 27. Mapped acres of forest decline associated with flooded or otherwise wet sites.

County	Acres
Addison	103
Bennington	57
Caledonia	213
Chittenden	89
Essex	92
Franklin	175
Grand Isle	414
Lamoille	152
Orange	79
Orleans	335
Rutland	55
Washington	82
Windham	196
Windsor	139
Total	**2,181**

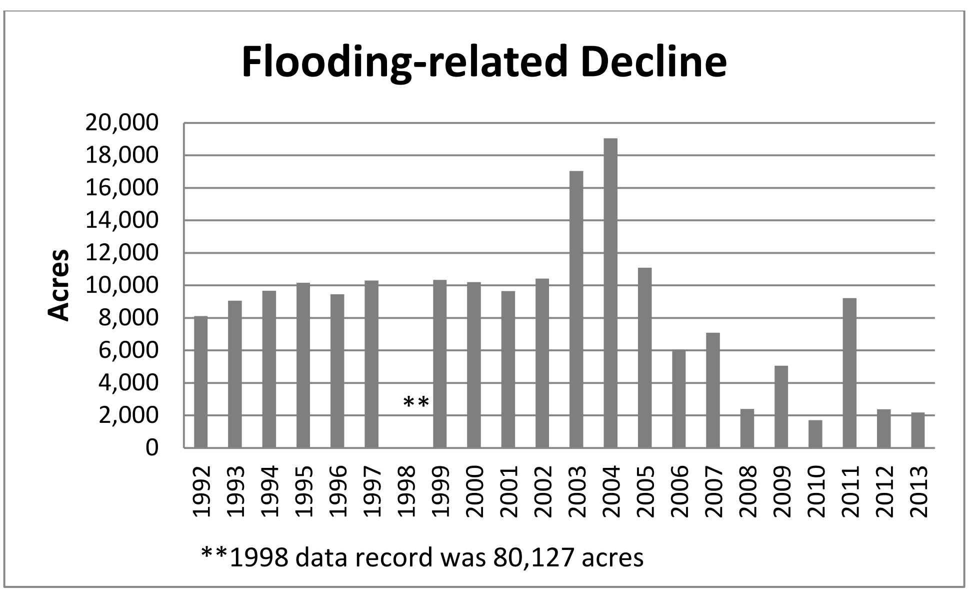


Figure 41. Trend in acres of forest decline related to wet or flooded sites mapped during aerial surveys. Mapped area in 2013 was 2,181 acres.

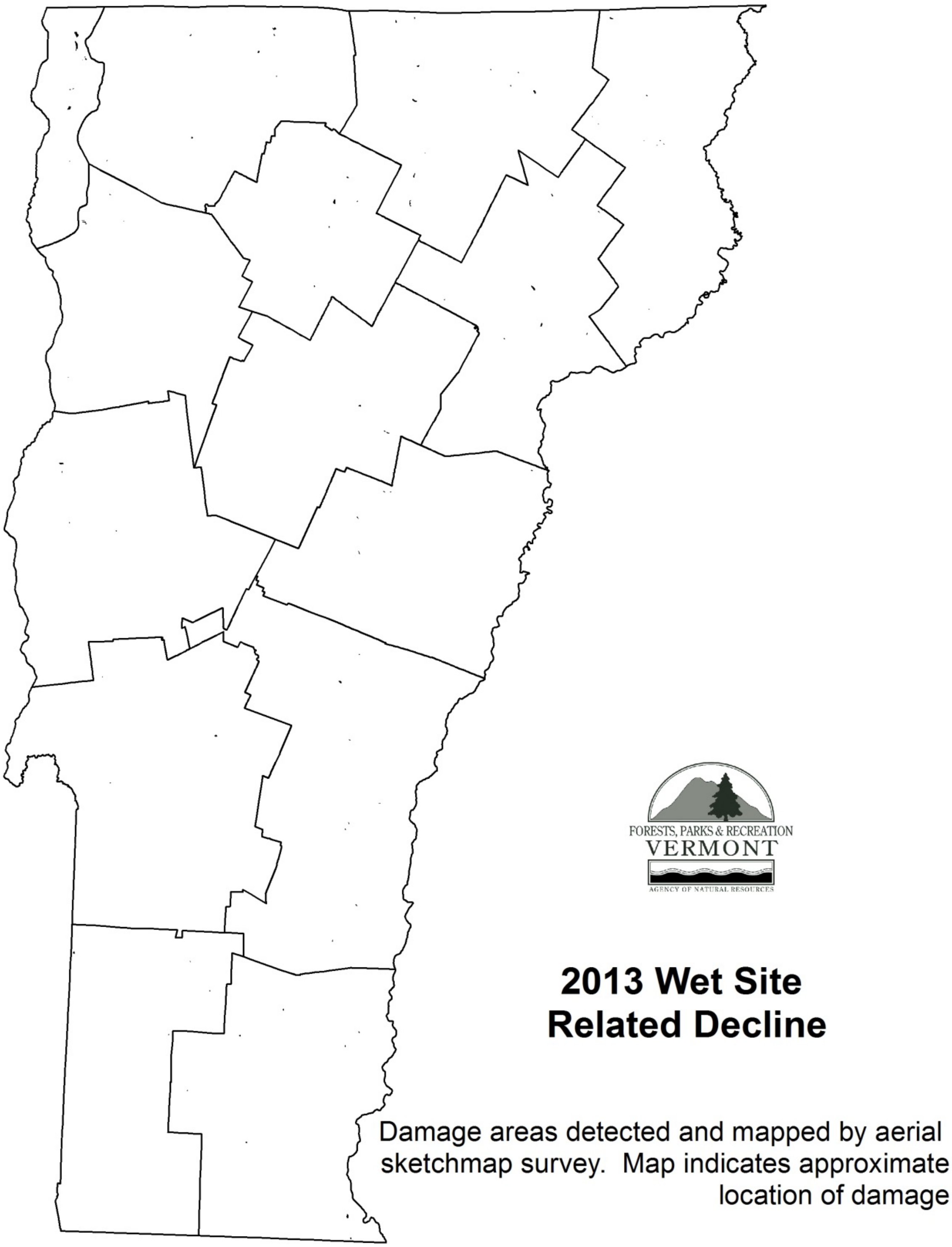


Figure 42. Wet or flooded site related decline mapped in 2013. Mapped area includes 2,181 acres.

Wind Damage from a July 19th thunderstorm resulted in tree breakage and uprooting across northern Vermont. Other scattered storms contributed to forest damage and 161 acres of wind damage was mapped during aerial surveys. Twenty-three percent of sugar maple monitoring plots reported some wind damage, especially in northeastern counties.

Table 28. Mapped acres of wind damage in 2013.

County	**Total Acres**
Addison	9
Caledonia	15
Chittenden	10
Essex	47
Franklin	27
Orleans	21
Washington	32
Total	**161**

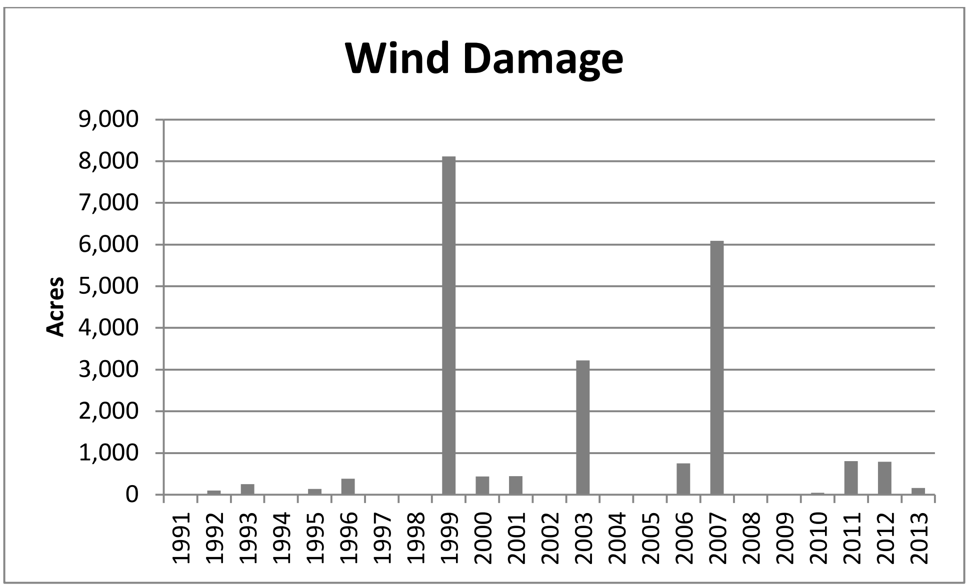


Figure 43. Trend in acres of tree damage from wind events mapped during aerial survey. Mapped area in 2013 was 161 acres.

OTHER DIEBACKS, DECLINES, AND ENVIRONMENTAL DISEASES

CONDITION	HOST	LOCALITY	REMARKS
Air Pollution Injury	Cherry	Washington County	Ozone damage on bioindicator plants was low this year statewide. See narrative.
Ash Decline	Ash	Champlain Valley, Northeast Kingdom, Washington County, and Weathersfield	Increase. Ash yellows (see other Stem Diseases) remains heavy in scattered locations.
Birch Decline	Birch	Northeast Kingdom, Weathersfield	This crowns, dieback, early leaf drop, some mortality. Mount Ascutney particularly affected.
Drought	Native species	Northwestern Vermont	Decrease.
Extreme Weather Events			See narrative.
Frost Damage	Hardwoods especially oak, beech, maple and cherry	Scattered locations statewide	See narrative.
Girdled Roots	Many	Northeastern Vermont	Common on homeowner tree plantings.
Hardwood Decline and Mortality		Scattered throughout northeast kingdom	More than usual.
Heavy Seed	Native species especially ash, red maple, bitternut hickory, boxelder, some sugar maples and cedars, and most softwoods	Statewide	Increase. In some locations heavy seed resulted in thin or off colored crowns.

OTHER DIEBACKS, DECLINES, AND ENVIRONMENTAL DISEASES

CONDITION	HOST	LOCALITY	REMARKS
Ice Damage	Many	Northern Counties	A December 2013 ice storm affected large areas of northern Vermont. Forest damages will continue to be assessed in 2014. (See Weather section.)
Larch Decline		Walden and scattered adjacent towns	See narrative.
Lightning	Honeylocust, white pine, sugar maple	Brattleboro, Grafton, Shrewsbury	Damage ranging from individual dead trees to patches of 30 or more.
Logging-related Decline		Franklin and Windsor Counties	See narrative.
Ozone Injury			See narrative.
Snow Damage	Many	Orleans county	Branch breakage and some trees down from snow storm Memorial Day weekend, after leaf out.
Spruce/Fir Dieback and Mortality	Balsam fir, some spruce	Scattered statewide	See narrative.
Wet or Flooded Sites	Native species and Christmas tree plantations	Scattered areas statewide	See narrative.
Wind Damage	Sugar maple and various species	Northern Counties	See narrative.
Winter Injury	Douglas Fir	Albany	

ANIMAL DAMAGE

ANIMAL	SPECIES DAMAGED	LOCALITY	REMARKS
Beaver	Many	Scattered throughout	Damage levels stable.
Deer	Regeneration	Statewide	Damage uncommon in the northeastern counties, and common in southern Vermont.
Moose	Many	Northern Vermont	
Porcupine	Many	Statewide	Uncommon.
Sapsucker	Many	Statewide	Observed causing mortality of apple, hemlock, and oak ornamentals.
Squirrel			Uncommon.

INVASIVE PLANTS

Vermont continues to make progress in combating invasive plants. Educational efforts throughout the state have targeted both professionals and non-professionals helping to increase awareness and move people towards action.

The **Vermont Chapter of The Nature Conservancy (TNC)** has continued to support iMapInvasives, a web based system used to report sightings and map infestations of invasive plants in Vermont. Trainings can be done online at: **http://vtinvasives.org/plants/report-it/volunteer.**

Through a USFS State and Private Forestry Grant, TNC has undertaken terrestrial plant monitoring and treatment within 3 of their preserves. This project has also provided outreach and technical assistance to private landowners whose property is within the high priority areas identified through this project.

The VT Agency of Agriculture, Food, and Markets is moving forward with planned revisions to the pesticide regulations. As a result, a new invasive plant category for certified pesticide applicators will be created and incorporated into the new regulations.

Sugar Maple Health in 2013

Sugar maple tree health, based on the amount of twig dieback, remained high in 2013, with 96% of trees rated as having dieback ≤ 15% on the 30 monitoring plots formerly part of the North American Maple Project (NAMP) (Figure 44). Foliage was particularly dense this year (Figure 45), except in areas experiencing defoliation. Most defoliation was considered light (Figure 46). There was 1 site with defoliation caused by gypsy moth feeding, but the majority of defoliation statewide (9 sites, 30% of plots) was due to saddled prominent, a native defoliating insect. Several additional sites had light defoliation but no causal agent was identified. Also of note were the 20% of plots with non-native invasive plants in the understory, 23% of plots with evidence of wind damage, and 10% of the plots with evidence of moderate levels of deer browse impacting regeneration.

Vigor ratings incorporate various tree health measures into a more comprehensive view of crowns. Vigor ratings have held steady for the past few years (Figure 47). Tree density can influence crown health by determining the level of competition between trees. Tree density on NAMP plots calculated as basal area per acre shows differences between the density of live sugar maples compared to all trees, live and dead (Figure 48). In 2013, there were 19 new dead overstory sugar maples (1.9 % mortality), evenly distributed across plots.

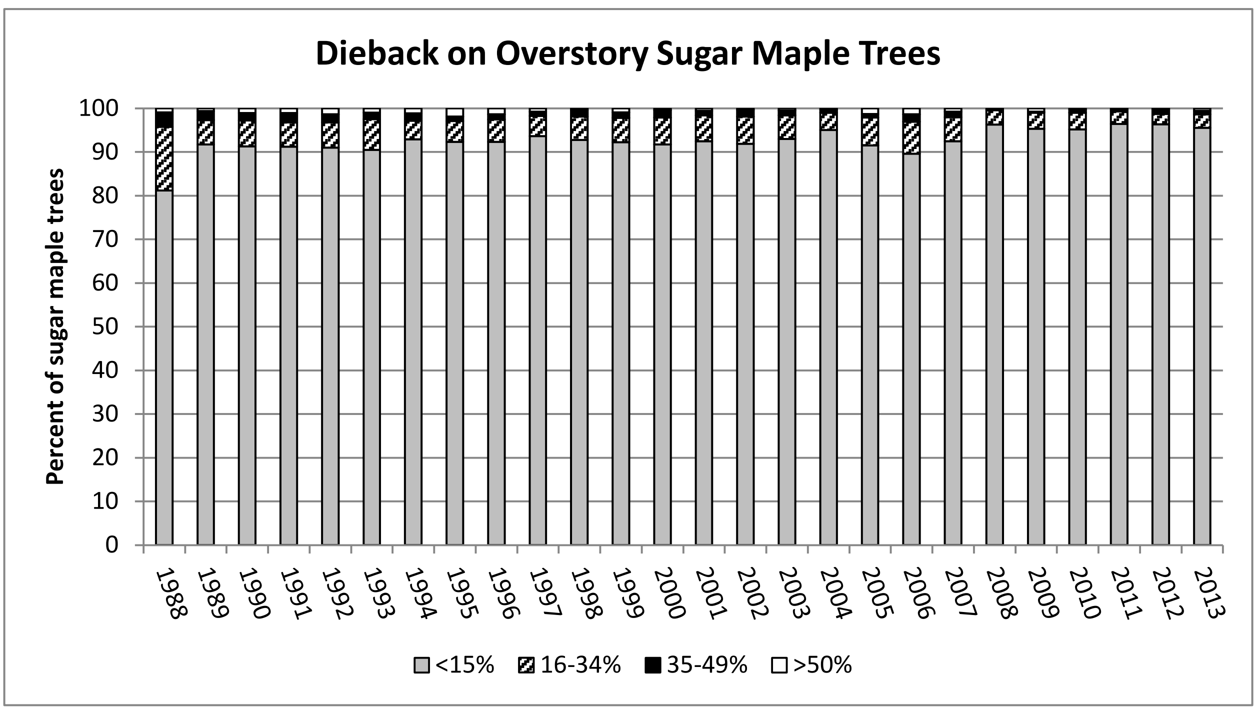


Figure 44. Percent of overstory sugar maple trees on NAMP plots with various levels of crown dieback. N=1000 trees at 30 sites.

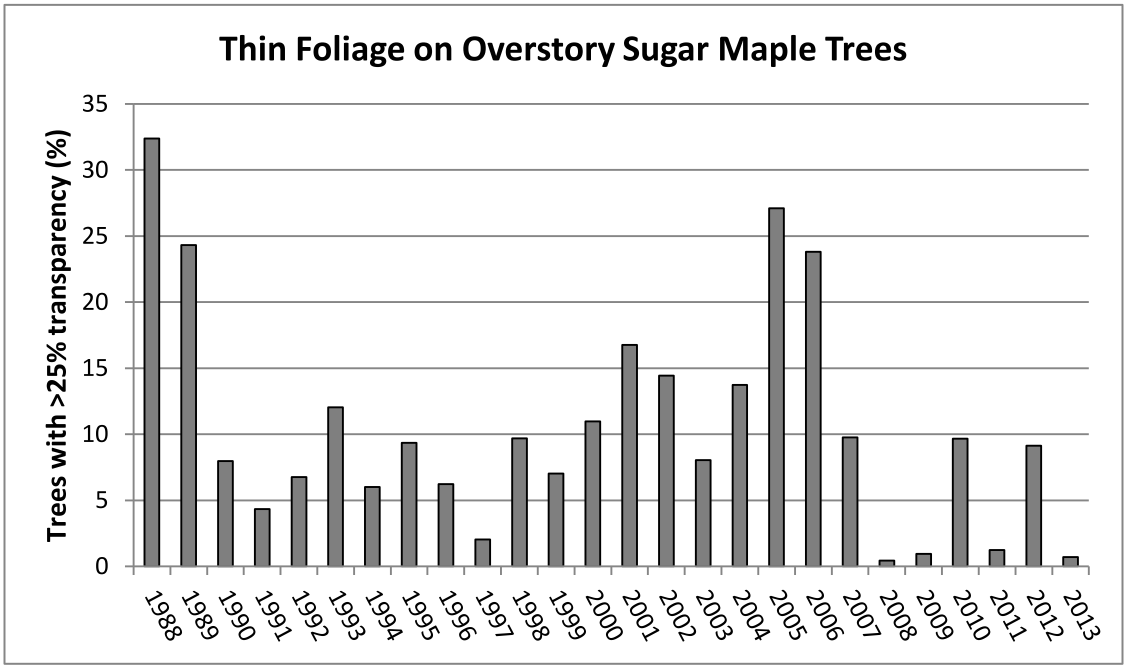


Figure 45. Trend in the percent of overstory sugar maple trees on NAMP plots with thin foliage, >25% foliage transparency. N=1000 trees at 30 sites.

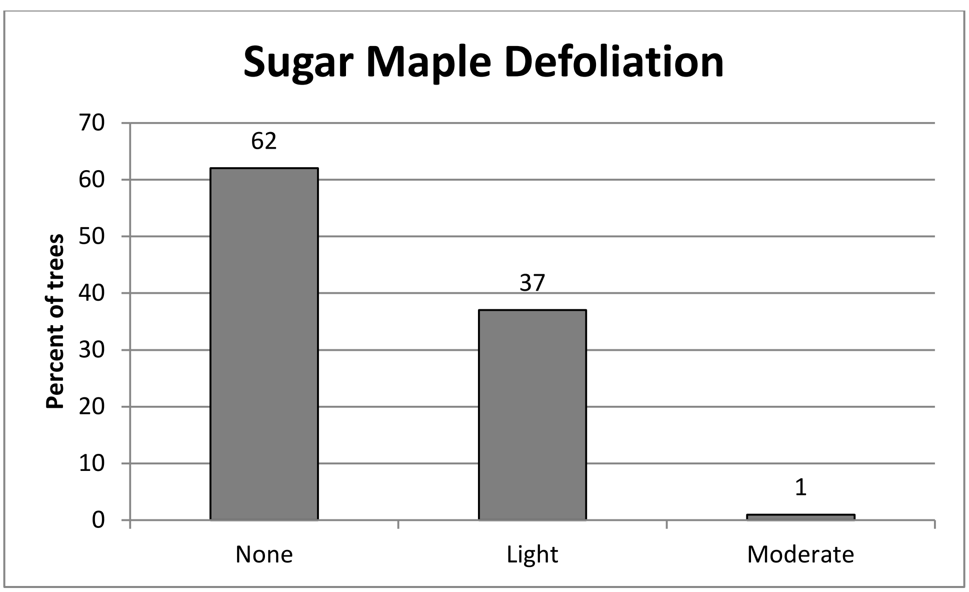


Figure 46. Percent of sugar maple trees on NAMP plots defoliated in 2013 grouped by severity of defoliation. N=1440 trees on 30 plots.

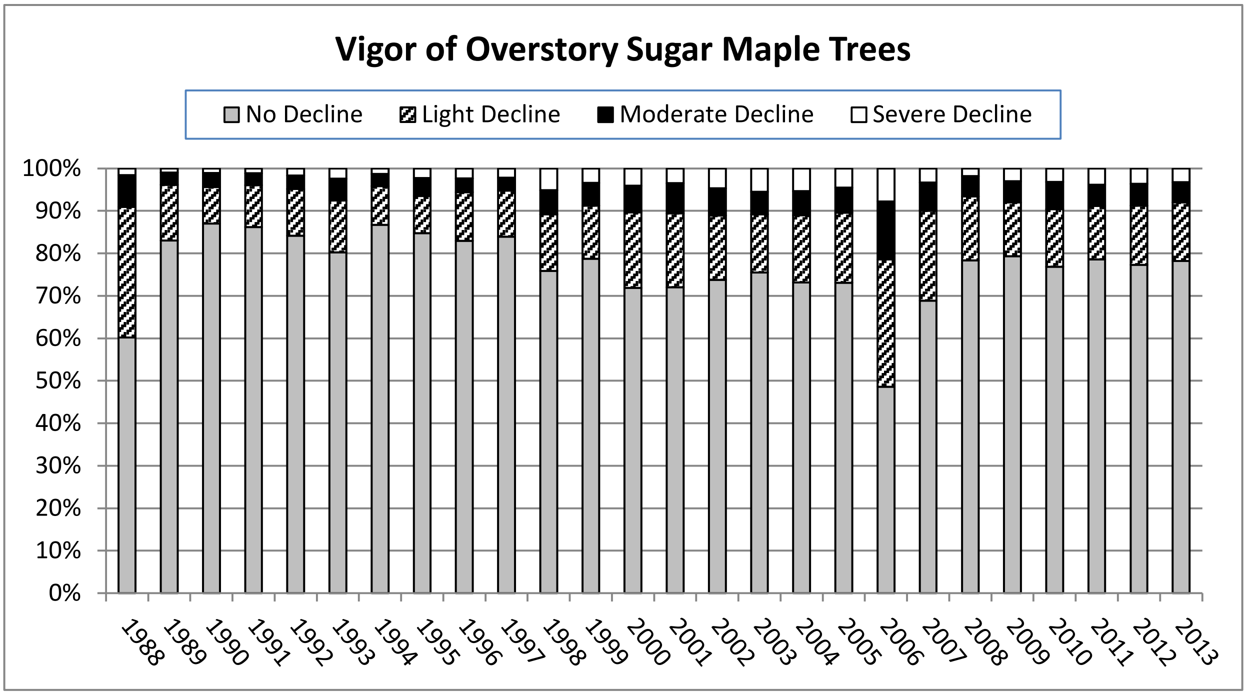


Figure 47. Trend in the percent of overstory sugar maple trees on NAMP plots with various vigor ratings. N=1000 trees at 30 sites.

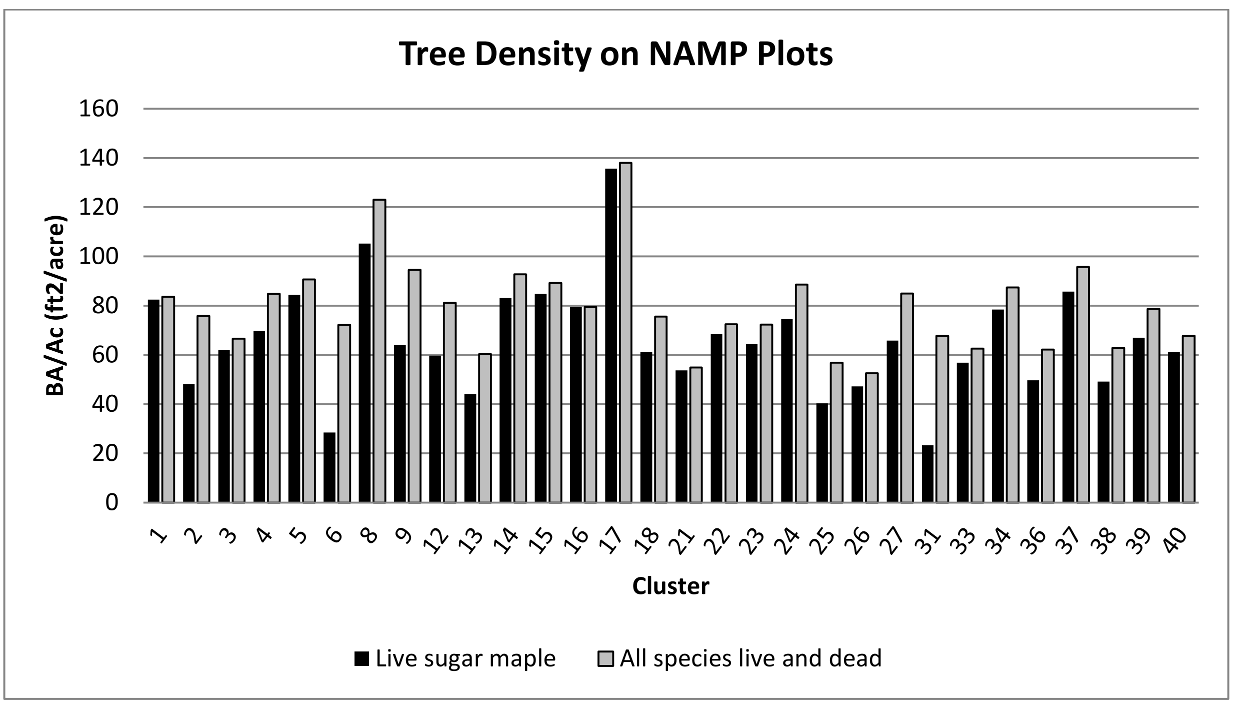


Figure 48. Tree density on NAMP plots calculated as basal area per acre showing differences between density of live sugar maples compared to all trees, live and dead.

Trends in Forest Health at Mount Mansfield in 2013

Eight forest health plots at 4 elevations on Mount Mansfield were re-measured for the 22nd year. Trees at all elevations except the summit (3800 foot plots) were in good condition as indicated by no trees with high dieback, thin foliage or low crown density (Figures 49-51). At the 3800 foot plots, the percent of trees with high dieback was 21% in 2013, an improvement from 2006 when 40% of trees had high dieback. However, 19 new dead trees were recorded since the last inventory in 2010, an annual mortality rate of 4% and 1.4% on the 2 plots at that elevation. Any improvement in forest condition may be related to the removal of these trees from the live tree inventory.

Tree damages were dominated by weather impacts. Over half of tree damages were a result of weather damage (Table 29). Beech bark disease and sugar maple borer damage both accounted for 9% of damaged trees. A total of 12% of trees on all plots had damages affecting tree health.

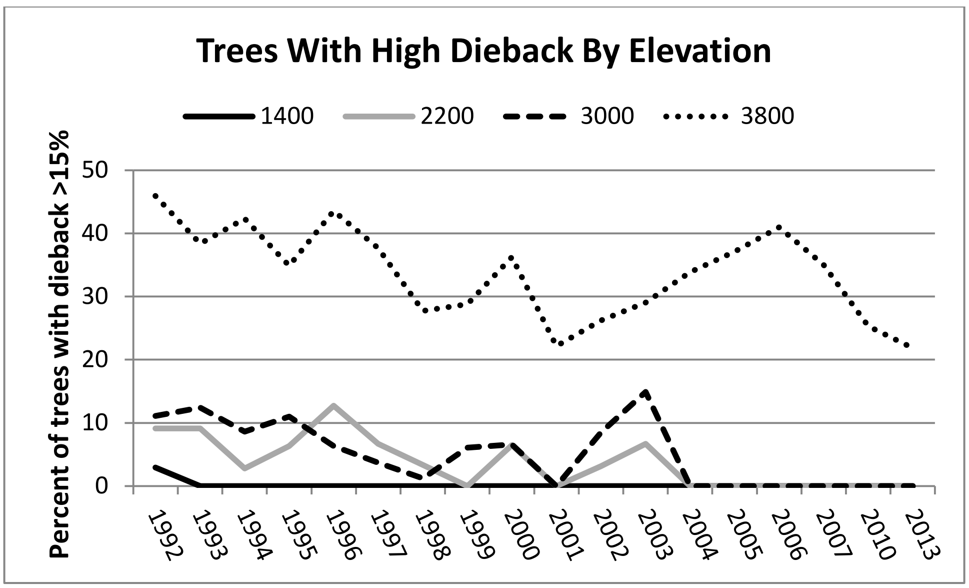


Figure 49. Trend in overstory trees with high dieback (>15%) on plots at 4 elevations on Mount Mansfield. Note: Since 2007 plots have been on a 3 year measurement cycle.

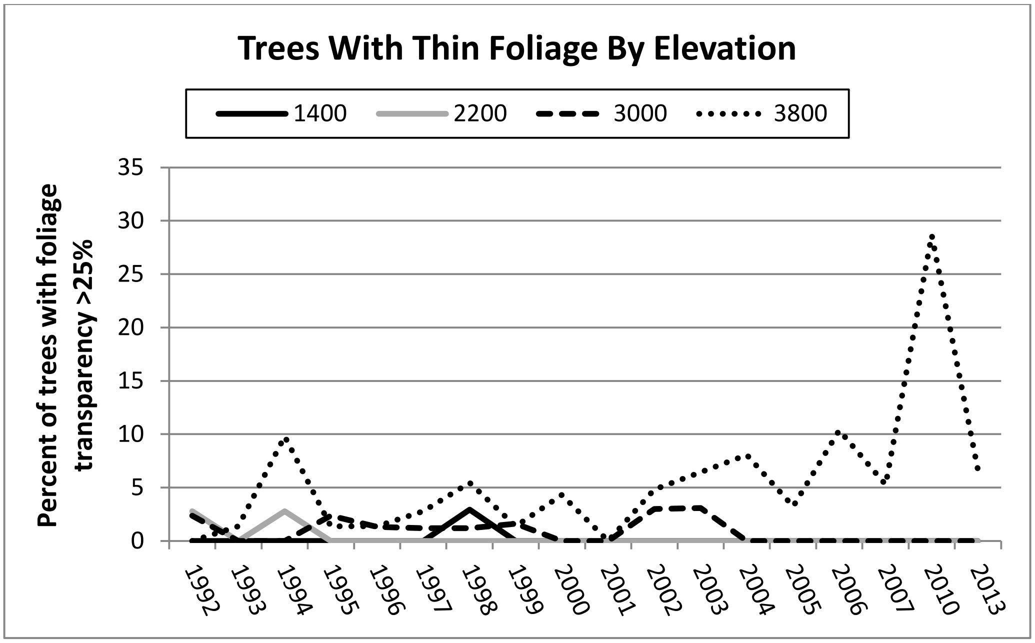


Figure 50. Trend in overstory trees with thin foliage (>25% foliage transparency) on plots at 4 elevations on Mount Mansfield. Note: Since 2007 plots have been on a 3 year measurement cycle.

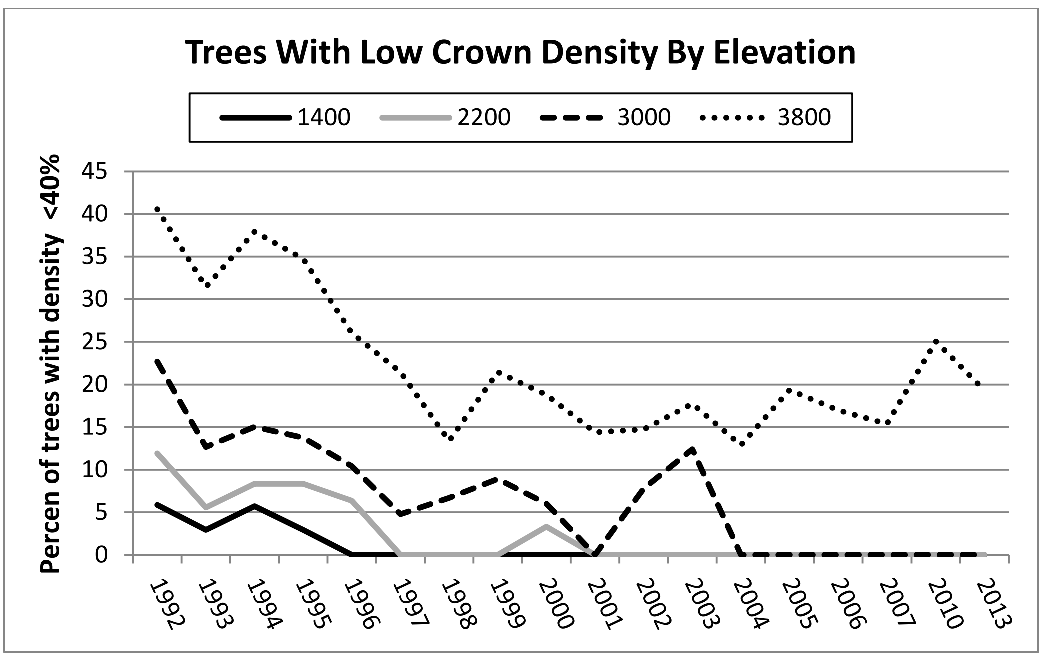


Figure 51. Trend in overstory trees with low crown density (<40%) on plots at 4 elevations on Mount Mansfield. Note: Since 2007 plots have been on a 3 year measurement cycle.

Table 29. Specific damage agents and frequency of occurrence for 2013.

Damage agent	Frequency (% of trees)
Weather damage	54.3
Beech bark scale and nectria	8.6
Sugar maple borer	8.6
Beech bark scale	5.7
Cracks and seams	5.7
Nectria canker	2.9
Eutypella canker	2.9
Cankers	2.9
Conks	2.9
Armillaria root rot	2.9