FOREST INSECT AND DISEASE CONDITIONS IN VERMONT 2012

AGENCY OF NATURAL RESOURCES
DEPARTMENT OF FORESTS, PARKS & RECREATION
WATERBURY - VERMONT 05671-0601

STATE OF VERMONT
PETER SHUMLIN, GOVERNOR

AGENCY OF NATURAL RESOURCES
DEBORAH L. MARKOWITZ, SECRETARY

DEPARTMENT OF FORESTS, PARKS & RECREATION
Michael C. Snyder, Commissioner
Steven J. Sinclair, Director of Forests

http://www.vtfpr.org/

We gratefully acknowledge the financial and technical support provided by the USDA Forest Service, Northeastern Area State and Private Forestry that enables us to conduct the surveys and publish the results in this report. This report serves as the final report for fulfillment of the Cooperative Lands – Survey and Technical Assistance and Forest Health Monitoring programs.

This document is available upon request in large print, Braille or audio cassette.

FOREST INSECT AND DISEASE CONDITIONS IN VERMONT

CALENDAR YEAR 2012

Wind Damage from severe weather event, July 4, 2012, Walden Heights, Vermont. Photo credit: T. Greaves

PREPARED BY:

Barbara Burns, Kathy Decker, Tess Greaves,
Trish Hanson, Tom Simmons, Sandra Wilmot

AGENCY OF NATURAL RESOURCES
DEPARTMENT OF FORESTS, PARKS & RECREATION

TABLE OF CONTENTS

FIGURES

TABLES

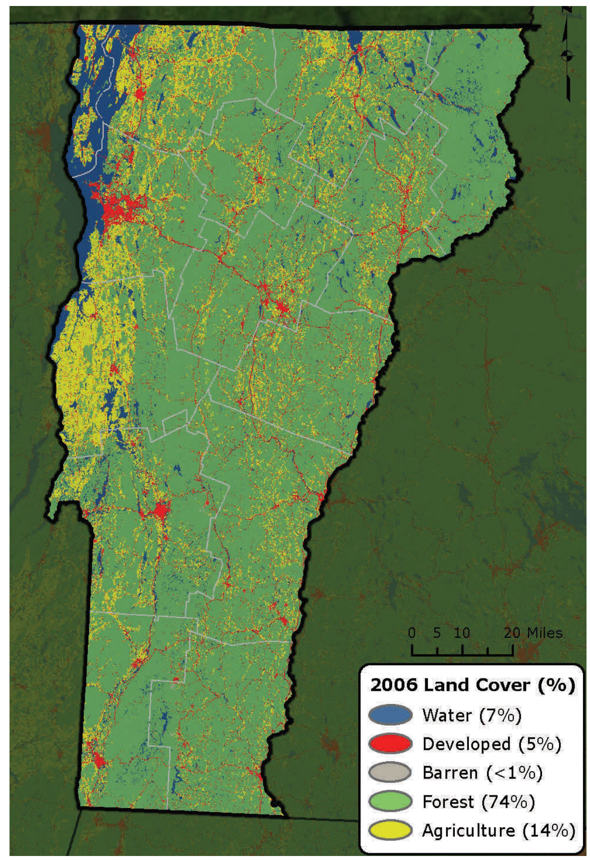
Forest Health

VERMONT *highlights*

2012

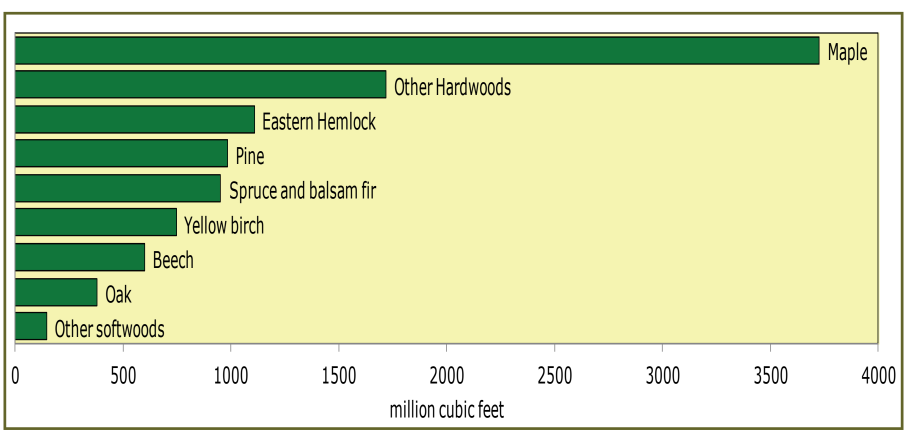


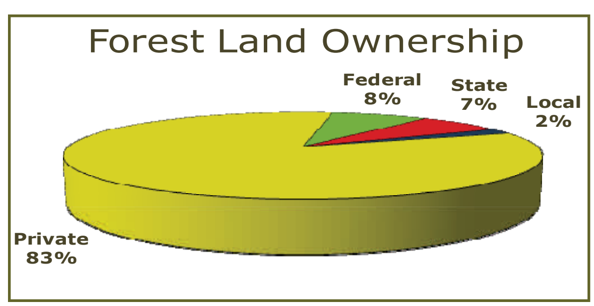
These highlights summarize information from the annual report on Forest Insect and Disease Conditions in Vermont. The complete annual reports, as well as other Vermont forest health information, are posted on-line at www.vtfpr.org/protection/idfrontpage.cfm. To receive a copy by mail, for assistance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

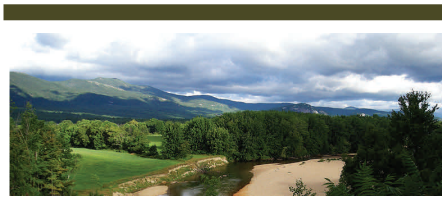


Forest Resource Summary

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, 2011.





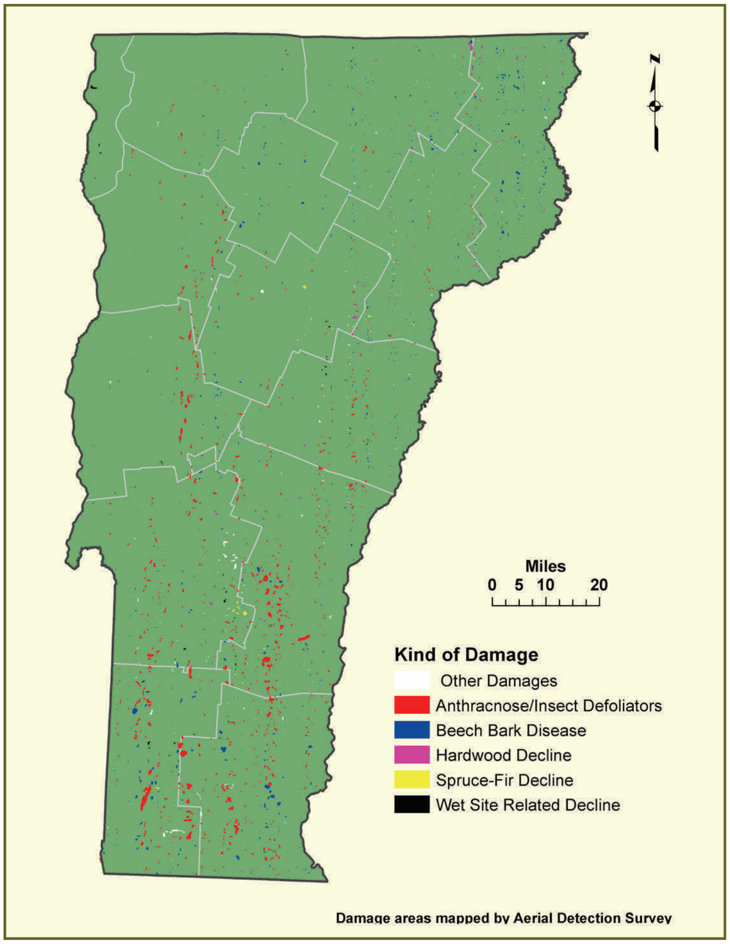


Forest Health Programs in the Northeast

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 2012, 88,286 acres of forest damage were mapped statewide. This represents 2% of Vermont's forestland, indicating that forest condition is generally healthy. Much of the acreage mapped was hardwood defoliation by leaf fungi, frost, and/or pear thrips. All of these damages are related to spring weather conditions. Nearly a quarter of the damage was due to the non-native pest complex, beech bark disease.



Damage areas mapped by Aerial Detection Survey

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 continue to impact 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. 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. A video, *Invasion Vermont*, was completed by Riverbank Media.

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

To support these efforts, a Forest Pest First Detectors program has been initiated. Ninety-three volunteers have been trained to assist their communities with early detection and rapid response. They have spent 1500 hours on training, screening, outreach, surveying and community preparedness activities in 92 communities.

In 2013, invasive pest preparedness activities will continue, including mini-grants that will be offered to communities so they can prepare invasive forest pest response plans.

Ninety-three Forest Pest First Detectors have spent 1500 hours on training, screening, outreach, surveying and community preparedness activities in 92 communities.

Climate Change vulnerability assessments and adaptation strategies are being developed in collaboration with TetraTech and the Manoment Center for Conservation Sciences. Among the results will be an assessment of 30 Vermont tree species, climate factors most likely to affect their long-term health, and silvicultural techniques to address stresses and build more resilient forests. We are also establishing a demonstration area to model how climate vulnerability can be assessed at the parcel-scale, and how management options can be developed to build a more climate-resilient forest.

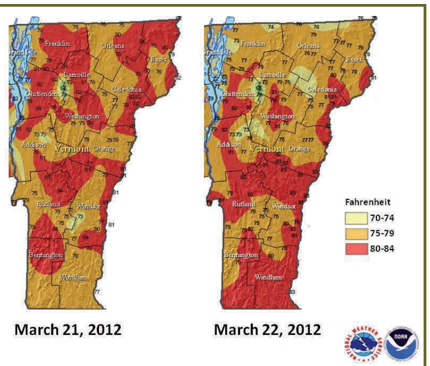
Other Forest Health Initiatives which continued in 2012 include the following:

- Efforts to discourage long-distance firewood movement
- A multi-state project to slow the spread of hemlock woolly adelgid
- An investigation into causes for tree mortality in Vermont and adjacent states
- An effort to build capacity for an invasive plant management program
- A project to conserve germplasm of disease resistant butternut
- With the University of Vermont, a study of forest carbon at recently harvested sites

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

24 Hour High Temperatures

Maps from the National Weather Service



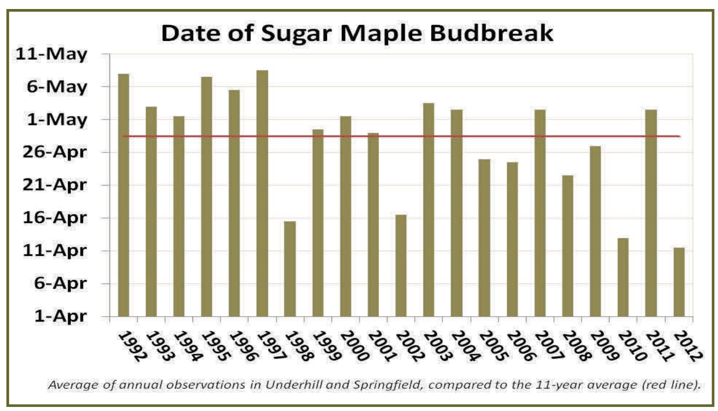
In most of the state, temperatures went above 80° in March. Sugar maple bud development was more than two weeks ahead of average. Desiccation symptoms appeared by spring on evergreens, especially fir Christmas trees.

2012 Weather Influences on Forest Health

Weather conditions, once again, drew the blueprint for tree health in 2012. Winter 2011-12 was referred to as "the winter that wasn't", with little snow and warmer than average temperatures. The open conditions froze shallow roots.

Winter also ended early and mud season was epic. Grass fire activity started in February, and many maple sugarmakers began boiling just after Valentine's Day. In March, record highs were observed for 5 consecutive days when temperatures topped out in the upper 70's and low 80's. Sugar maple flower buds were 30 days ahead of average at the Proctor Maple Research Center in Underhill. Vegetative buds on saplings and trees were also earlier, by 22 and 17 days respectively.

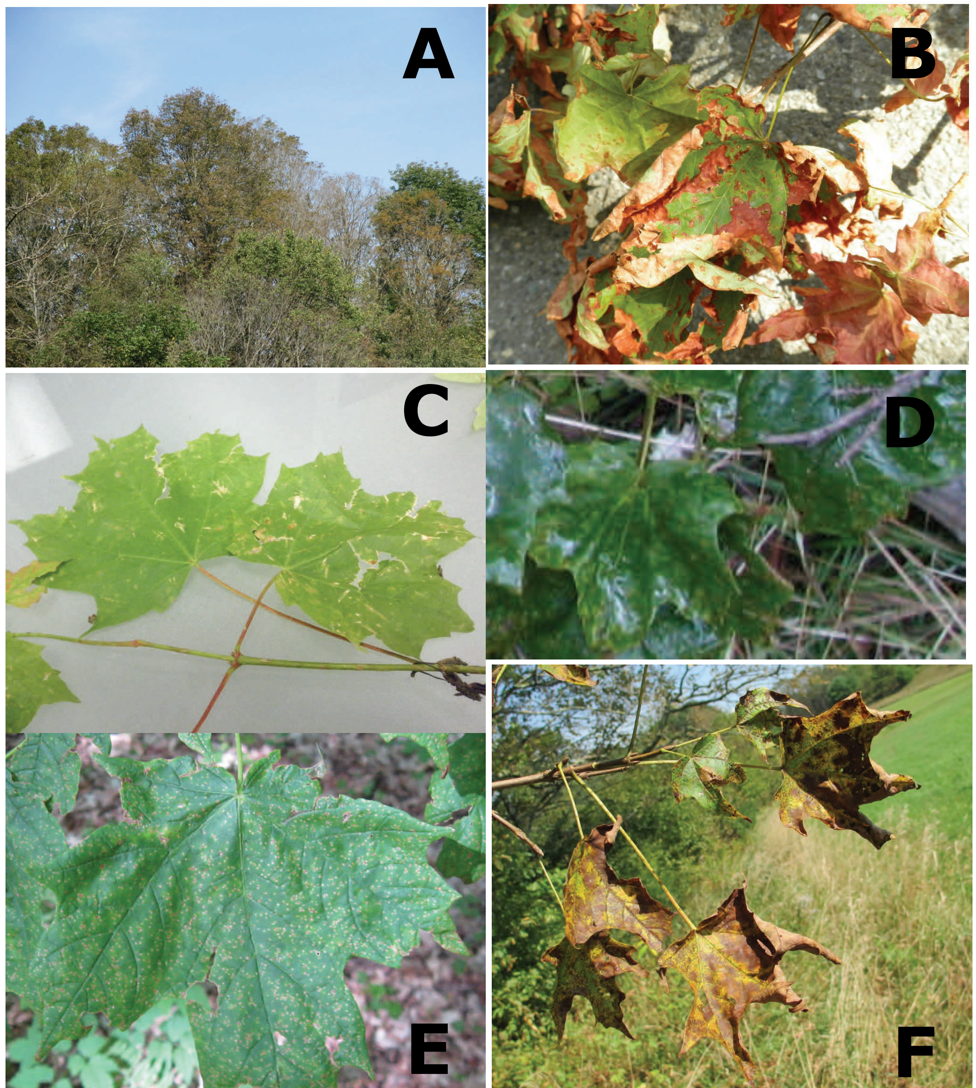
Desiccation symptoms appeared early in the year when planted evergreens, especially fir Christmas trees, were unable to keep up with transpiration demands. The geographic pattern of damage reported by NH-VT Christmas Tree Association growers roughly coincided with the footprint of extreme weather patterns. Shallow fir root systems are vulnerable to freezing, especially without the humus layer of their natural environment. Growers reported the worst damage on sites with poor drainage (41% of growers) and recent transplants (80%).



Average of annual observations in Underhill and Springfield, compared to the 11-year average (red line).

Leaf development stalled with cool weather in early April. Hard frosts occurred in late April and, on May 11th, nipped tender leaf margins. Add to these events a few localized hail storms or wind events. Many leaves were blown off completely, and the ones remaining looked worse for the wear. In addition, the long, moist period of bud development fostered fungal leaf diseases and pear thrips damage. Although summer precipitation averaged out to be fairly normal, every month had 10-day stretches without rain. Trees on shallow soils and, in some cases seedlings and ferns, were affected by drought.

The first widespread hard frost didn't occur until October 13th. Without cold nights, the fall foliage was slow to change color. Early leaf drop made for a short foliage season in the upper elevations. Once again, however, fears of a less than prime fall color display were quelled when reports of brilliant foliage started coming in. The season came to a dramatic end with winds from "Superstorm Sandy".



In August, 52,600 acres of brown hardwoods (A) were mapped during aerial surveys. Contributing to these symptoms were late spring frost (B), localized hail (C) or wind events, pear thrips feeding (D), fungus diseases such as leaf spot (E) and anthracnose (F), refoliation, and mid-summer drought. Leaf blight was common on Balsam Poplar (G).

Hardwood Insects and Diseases

Hardwood Browning, was mapped on 52,600 acres. A complex of sugar maple defoliators, pear thrips, anthracnose, *Septoria* and other leaf spots, drought, and frost, was widespread. Damage levels varied substantially. **Pear Thrips** damage was sometimes moderate, and even heavy in southern Vermont. Total number of adults trapped was up only slightly from 2011 in Underhill, but they emerged early, starting by March 23rd. Very little refoliation occurred, so trees went through the season with subnormal foliage.

Defoliation of white birch by **Septoria Leaf Spot** was unusually common at lower elevations. However, acres mapped were down substantially from 2011 due to less damage in birch-dominated montane forests. Birch skeletonizers and leaf folders were occasionally observed, but birch leaf miners were abnormally rare.

Poplar Leaf Blight, also attributed to a *Septoria* fungus, was common statewide on balsam poplar.

Dieback from **Beech Bark Disease** was mapped on 20,268 acres. This increase over 2011 may be due to drought-stress, which makes bark more vulnerable to canker diseases.

Most of the **Oak Defoliation** observed this year was damage was from oak anthracnose on lower branches. There was little defoliation by the oak leaf tier and leaf roller complex. However, some dieback and mortality occurred in locations that had noticeable defoliation from this complex between 2008-2011, including a conspicuous pocket of mortality on a shallow, exposed site in Middlesex.

Drooping dead branches caused by **Oak Twig Pruner** were common, with very noticeable damage in Bennington County. **Early Acorn Drop** on red oak was attributed to high grey squirrel populations. In a year with spotty mast production, this left even fewer acorns to mature on the trees.

Ash Decline continues to be reported from scattered locations, including Chittenden, Washington, and Windham Counties. Symptomatic trees from one site in Windham County tested negative for the ash yellows disease. The heavy anthracnose and copious seed production in 2011 may have been a stressor to some trees. However, much decline pre-dates those events. Since only the outer rings transport water in ash, it is particularly susceptible to fluctuations in water availability.

There was little damage by **Defoliating Caterpillars.** Nests of fall webworm and cherry scallop shell moth caterpillars were widely noticeable. There were also sporadic reports of noticeable feeding by gypsy moth, including in Sheldon and Hartford, but overall egg mass counts were very low. Hickory tussock moth caterpillars were even more common statewide than in 2011, and other tussock caterpillars were also observed. Saddled prominent, greenstriped mapleworm and bruce spanworm larvae were reported from northern Vermont. Trap catches of both spruce budworm and forest tent caterpillar moths remained very low.

There was little damage by defoliating caterpillars, although some, like hickory tussock moth caterpillars, were common statewide.

Some **Defoliating Beetles** were active. The work of locust leafminer gave affected trees a bronzy-brown appearance. Following heavy viburnum leaf beetle damage in scattered locations, egg niches could be seen chewed into twigs. Damage by the European snout beetle was seen on maples and yellow birch in several central and western Vermont locations.

Flagging branches from **Dutch Elm Disease** were quite noticeable. The fungus is supposed to move more readily in tree vessels when the weather is wet, and we've had a number of wet years in a row. If flagging is observed on a specimen tree, it may be possible to save it by proper sanitation pruning and fungicide injection.

Softwood Insects and Diseases

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.

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 3,494 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. In the plot established a year ago, pines that had the most disease symptoms in 2011 were also those with the most severe browning in 2012.

Damage from **White Spotted Sawyer** maturation feeding on the bark of conifer twigs and small branches was been more common than normal.

Rust diseases were commonly observed, including Fir-Fern Rust (left) and Hemlock-Blueberry Rust (right).

Many **Rust Diseases** are foliage diseases on at least one of their hosts, and some were commonly observed in 2012. Fir-fern rust was widespread on balsam fir. Needles are infected shortly after budbreak by spores from diseased ferns. Branch flagging from white pine blister rust was common, and there has been an increase in mortality of occasional white pines. Numerous observations of blister rust infection on "resistant" currant cultivars have been made in other states, raising concern about expanding currant production. Yellow witches' broom on fir was also widely reported, and hemlock-blueberry rust was observed in several locations.

During a regional survey for **Hemlock Shoot Blight**, the US Forest Service examined hemlock regeneration in FIA plots. Seedlings from plots in Washington and Orange Counties had very little if any symptoms. In contrast, seedlings from plots in Rutland and Lamoille Counties had up to 50% of shoots affected.

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

We're not completely sure what caused the occasional **Yellow Branches on Hemlock** reported from scattered locations in 2012. This symptom has been observed previously in years that were dry.

Occasional stands with **Larch Decline** and mortality remain active. Browning from **Larch Casebearer** defoliation was widely observed in the Northeast Kingdom, and could initiate a new episode of decline. This exotic caterpillar has been in New England since the 1880's.

Larch Casebearer defoliation can initiate episodes of larch decline.

Exotic Pest Update

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 manual.

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.

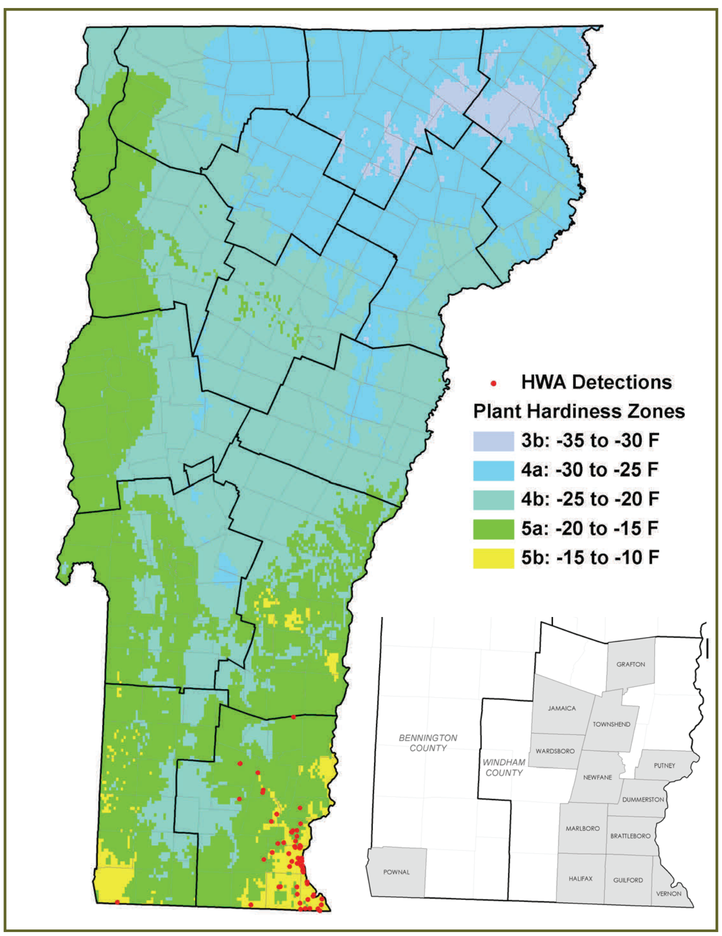
To help locate and remove infestations of Japanese knotweed initiated by Hurricane Irene, the Agency of Natural Resources hired a Japanese knotweed program coordinator, who has worked with a wide range of volunteers, including conservation commissions and students. Thousands of plants have been removed through this effort.

Volunteers are assisting with an effort to remove Japanese knotweed infestations initiated by Tropical Storm

On-the-ground management groups have been increasingly active. The Upper White River Cooperative Weed Management Area hired a part time coordinator, did a series of Garlic Mustard pull events, and conducted town road and trail surveys. The National Fish and Wildlife Foundation supported two interns with the Upper Connecticut River Watershed CISMA who mapped invasive plants to target control work. It also supported two interns for the Ottauquechee CISMA, who mapped and removed invasives on conserved lands in the Woodstock area.

Don’t Move Firewood outreach continued. The 2012 camping season was the fourth year the State Parks collected firewood brought from over 50 miles away, and exchanged it with local wood. The amount of firewood being exchanged continues to decline, but 136 bundles of wood were still collected, including wood from as far away as North Carolina, and from areas under quarantine, including Virginia, Pennsylvania, the ALB regulated area in New York and Quebec. More information on firewood, including a downloadable Don’t Move Firewood poster, is available on the website, firewood.vt.gov.

Due to the mild winter, **Hemlock Woolly Adelgid** (HWA) survival was high, with only 5% mortality in our monitoring plots, compared to 87% in the winter of 2010-2011. HWA was detected in seven new towns in 2012, including a new county (Bennington). A Forest Pest First Detector found infested trees on municipal land in Pownal. The insect is thought to have spread naturally from nearby Massachusetts. To reduce its potential impact, 379 adults of the predatory beetle, *Laricobius nigrinus*, were released at this site. (Sixty-five additional beetles were added to a previous release site in Brattleboro.) Amendments to the hemlock woolly adelgid quarantine will be necessary in 2013.



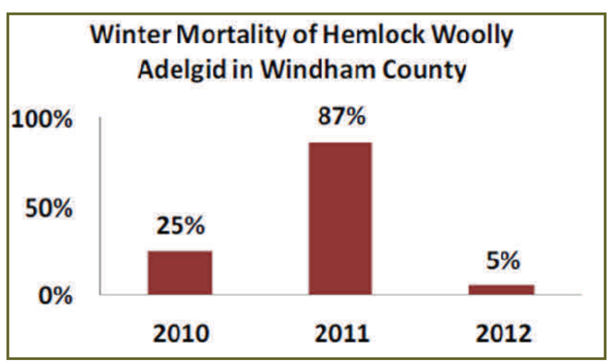
Hemlock woolly adelgid was detected in Bennington County. The predatory beetle, Laricobius nigrinus, was released at this site in Pownal.

We are seeing some symptomatic trees in infested areas. These have a gray/green look from a distance, some yellow needles, and little-to-no new growth. Updated hemlock woolly adelgid recommendations for landowner response can be found at http://www.vtfpr.org/protection/idfrontpage.cfm.

We continue to track the spread of HWA by surveying five sites in each town adjacent to infested towns, with assistance from citizen volunteers, and collaborate with other New England states to manage this insect as it spreads north. A University of Vermont project is studying a native fungus that may have potential as a biocontrol.

A single **European Wood Wasp** (*Sirex noctilio*) was captured in a trap in Brattleboro. This insect has been recovered from traps twice before: in Stowe (2007) and Burlington (2010). No infested trees have been seen 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.



Hemlock woolly adelgid was detected in 7 new towns in 2012. Due to mild temperatures, winter mortality was only 5%. Thirteen towns are now known to have active infestations.

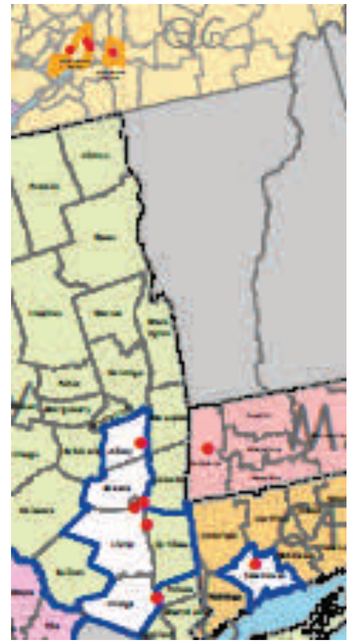
Emerald Ash Borer (EAB) is not known to occur in Vermont and was not detected by public outreach or survey. However, it continues to advance. In 2012, there were several Initial County Detections nearby. Well-established infestations were discovered in Connecticut's New Haven County, and there have been several detections east of the Hudson River in New York. A beetle was trapped in the western Massachusetts town of Dalton, where an infested tree was detected by follow-up survey. There are also new Areas Regulated for Emerald Ash Borer in Canada, but none are closer to Vermont than infestations already known to exist.

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 1,195 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, 996 buprestids were collected at 18 *Cerceris* nest sites in eight Vermont counties. We are also using girdled trap trees as a detection tool. In 2012, 20 trap trees were girdled in nine counties in the spring, then harvested in December and peeled to look for EAB.

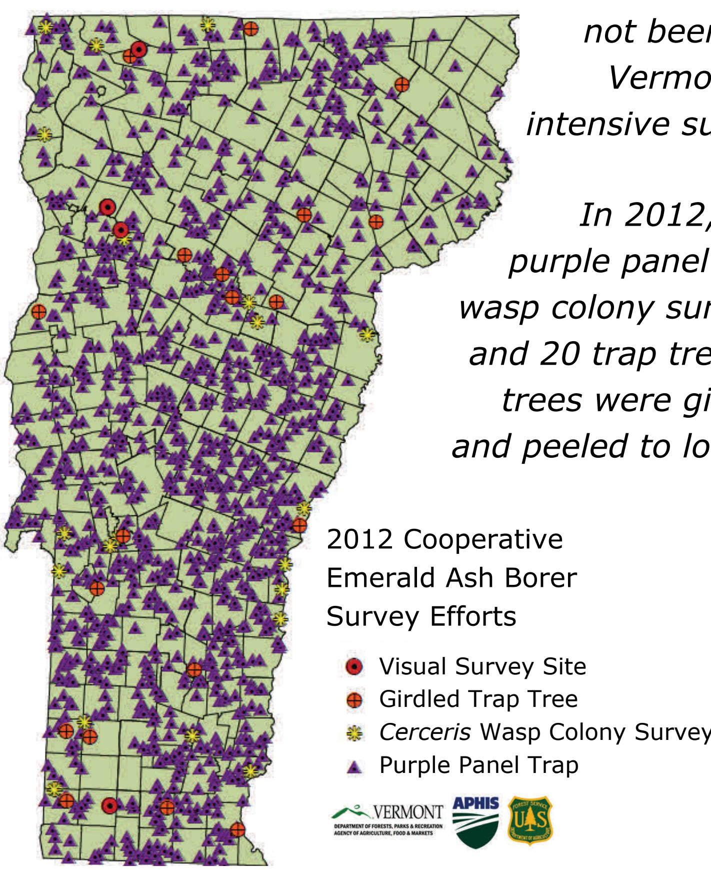
Emerald Ash Borer continues to advance. In 2012, it was detected in Connecticut, Massachusetts, and east of the Hudson River in New York.

(Map: USDA Cooperative Emerald Ash Borer Project)



A variety of other preparedness activities are ongoing. A one-day drill to simulate a delimiting survey was conducted to ensure coordination between responsible agencies before an actual occurrence of EAB. A technical publication providing Ash Management Guidance for Forest Managers was completed.

Emerald Ash Borer has not been detected in Vermont in spite of intensive survey efforts.



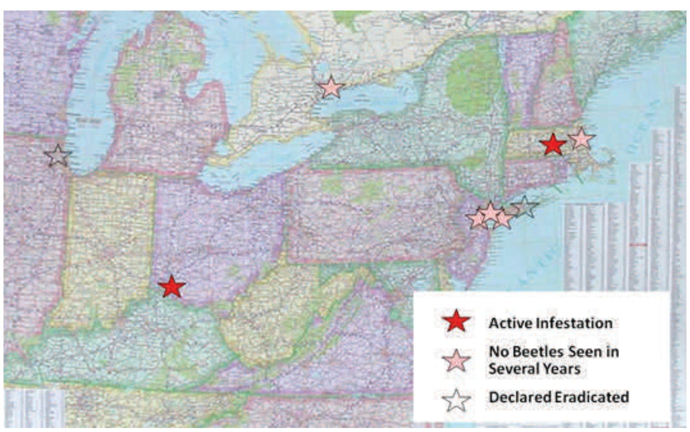
In 2012, there were 1,195 purple panel traps, 18 Cerceris wasp colony survey sites (above), and 20 trap tree locations, where trees were girdled in the spring and peeled to look for EAB (right).

A drill was conducted to ensure coordination before an actual occurrence of EAB.

Butternut Canker levels remain stable, with most butternuts showing symptoms of the disease. Sixty-seven trees, grafted from 30 different Vermont butternuts which seemed to have some disease resistance, are being maintained by the University of Missouri. In 2013, we will be outplanting these trees in Vermont seed orchards in an effort to conserve butternut germplasm. The Green Mountain National Forest is leading a parallel effort.

Butternuts grafted from trees which seem to have resistance to Butternut Canker are being outplanted in Vermont seed orchards.

Asian Longhorned Beetle is not known to occur in Vermont. We don't recommend any management adjustments in anticipation of this insect. However, early detection is especially important for Asian longhorned beetle. In Worcester County, MA, where the infestation is about twenty years old, delineation and eradication efforts continue. Improved efficacy of traps deployed in the area suggests that we may have a better detection tool in the future.



Asian longhorned beetle was not detected in any new locations in 2012. Eradication efforts are continuing in infested areas.

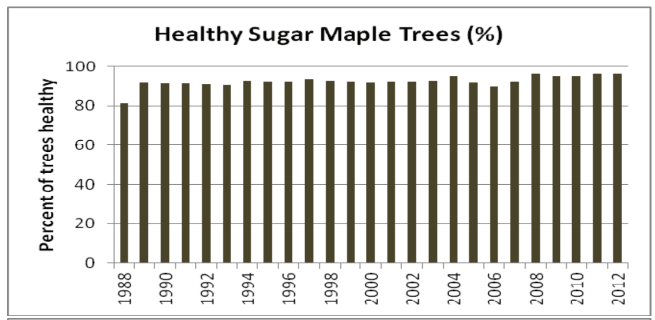
Brown Spruce Longhorn Beetle has been established in Nova Scotia since at least 1990. In 2011, it was detected in New Brunswick. This insect has not been seen in Vermont, including in pheromone traps deployed in 2012. A trap in Brunswick did attract 85 specimens of an indigenous *Picea*-feeding species in the same genus, *Tetropium cinnamopterum*.

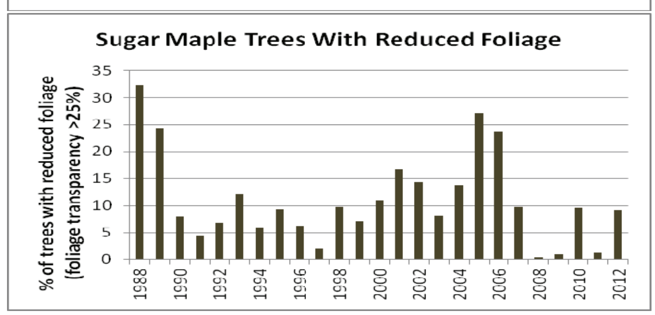
Other **Non-Native Species that Have Not Been Observed** in Vermont include elongate hemlock scale and winter moth, as well as the agents that cause oak wilt, thousand cankers disease, and sudden oak death.

Monitoring Forest Health

In **North American Maple Project** (NAMP) plots, over 90% of sugar maples were rated healthy (low dieback). Foliage problems reduced the size or abundance of leaves (high foliage transparency). This was due to a variety of causes, including frost, pear thrips, and anthracnose. Defoliation was noticeable on most of the 30 plots, but only 7% of trees had moderate (30-60%) or heavy (>60%) defoliation.

There were 14 new dead overstory sugar maples, representing an annual mortality rate of 1.4%. Mortality was evenly distributed across plots. Of the trees which died, 8 trees were considered healthy in 2011.





Over 90% of sugar maples were healthy (low dieback) in North American Maple Project plots. Foliage problems reduced leaf size or abundance, but only 7% of trees had > 30% defoliation.

A poster about the ongoing **Investigation into Increased Mortality,** measured in the 2006-2008 FIA forest inventory, showed the value of using multiple datasets to investigate forest health. Preliminary results show the 1998 ice storm, balsam woolly adelgid, beech bark disease, past logging injury, and age as factors in tree declines. The poster is online at http://www.fs.fed.us/foresthealth/fhm/posters/posters12/Wilmot_Poster.pdf

The **Vermont Monitoring Cooperative**, Vermont's forest ecosystem monitoring and research collaborative, continued activities to collect and archive forest-related data and information. New for 2012:

- Sampling was completed on the five long term soil monitoring study plots during the summer of 2012. This collaborative effort monitors trends in soil nutrients (e.g., calcium) and soil toxins (e.g., mercury). Regeneration data associated with soil pits is showing correlations between soil calcium levels and sugar maple (high calcium) vs. beech (low calcium) .

The Vermont Monitoring Cooperative's long term soil plots are sampled to monitor trends in soil nutrients and toxins.

- VMC supported a new study of forest growth on Mount Mansfield, which will allow comparison between environ-mental trends (climate, air quality, soil productivity) and tree response.
- VMC, in collaboration with university staff, successfully completed the second year of a long-term urban tree health monitoring project. University of Vermont natural resources students infiltrated the Burlington community to take data on tree health, vegetation, invasive plants, and exotic pests as part of a community service learning initiative.
- Several long-term air quality monitoring stations were discontinued or substantially reduced due to lack of federal support.

According to the most recent **Greenhouse Gas Inventory**, Vermont forests continue to play an important role in removing carbon dioxide from the atmosphere. Over the past 5 years, tree growth rate and average age have increased. This follows a period when both carbon storage and uptake were adversely affected by the 1998 ice storm and by reduced acres of forestland. Because of these changes, our forests are once again functioning as a carbon sink.

Wind-Disturbed-Site Beetle Surveys are being conducted in a mixed forest in Hinesburg that was damaged by a December 2010 windstorm. These will document the diversity of woodboring beetles, and also focus on ambrosia beetles in the genus *Trypodendron*.

Beetle trap surveys at a wind-disturbed site will document the diversity of wood-boring beetles and of ambrosia beetles in the genus Trypodendron (bottom right).

For more information, contact the Forest Biology Laboratory at 802-879-5687 or:	Windsor & Windham Counties………………………….. Bennington & Rutland Counties………………………… Addison, Chittenden, Franklin & Grand Isle Counties…………... Lamoille, Orange & Washington Counties ……..…… Caledonia, Orleans & Essex Counties…………………	Springfield (802) 885-8845 Rutland (802) 786-0040 Essex Junction 802) 879-6565 Barre (802) 476-0170 St. Johnsbury (802) 751-0110

Forest Health Protection
USDA Forest Service
Northeastern Area State and Private Forestry
271 Mast Rd.
Durham, NH 03824
603–868–7708
http://www.na.fs.fed.us

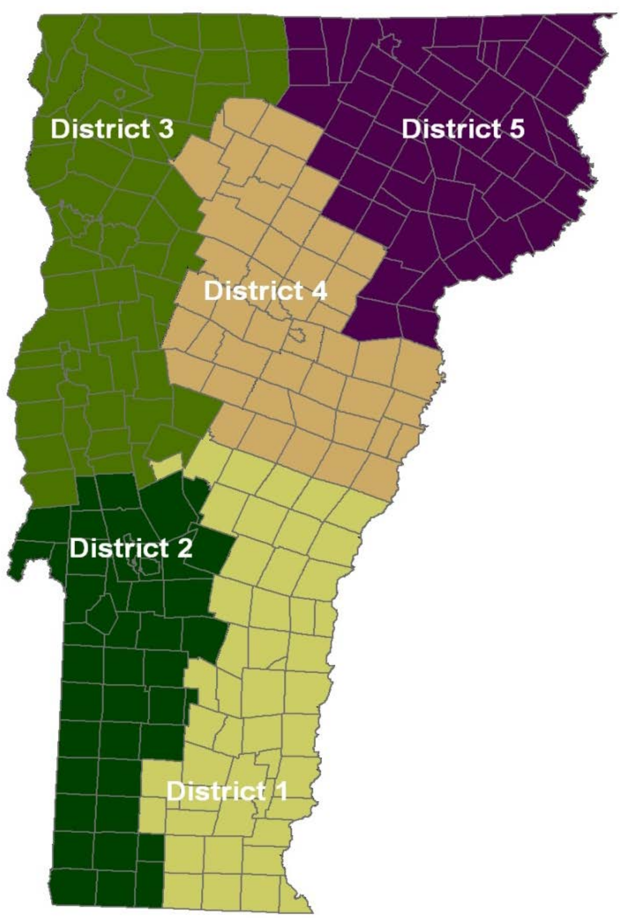
Vermont Department of Forests, Parks, and Recreation
103 South Main Street
Waterbury, VT 05671-0601
802–241-3678
http://www.vtfpr.org

Forest health programs in the Vermont Department of Forests, Parks, and Recreation are supported, in part, by the US Forest Service, State and Private Forestry, and conducted in partnership with the Vermont Agency of Agriculture, Food, and Markets, USDA-APHIS, the University of Vermont, cooperating landowners, resource managers, and citizen volunteers. Photo contributors include R. Acciavatti, W. Boccio, C. Casey, C. Cusack, R. Kelley, and T. Sienkiewycz.

STATE OF VERMONT – DEPARTMENT OF FORESTS, PARKS & RECREATION
FOREST RESOURCE PROTECTION PERSONNEL

Barbara Burns Forest Health Program Manager Dept. of Forests, Parks & Recreation 100 Mineral Street, Suite 304 Springfield, VT 05156-3168 Work Phone: 802-885-8821 Cell Phone: 802-777-2082 barbara.burns@state.vt.us	**Wendy Richardson** Administrative Assistant Dept. of Forests, Parks & Recreation 103 South Main St., 10 South Waterbury, VT 05671-0601 Work Phone: 802-241-3678 wendy.richardson@state.vt.us	**Kathy Decker** Plant Pathologist/Invasive Plant Program Manager/District Manager Dept. of Forests, Parks & Recreation 1229 Portland St., Suite 201 St. Johnsbury, VT 05819 Work Phone: 802-751-0117 Cell Phone: 802-473-0007 kathy.decker@state.vt.us
Trish Hanson Forest Protection Entomologist Dept. of Forests, Parks & Recreation 111 West St. Essex Junction, VT 05452 Work Phone: 802-879-5687 trish.hanson@state.vt.us	**Mary Burnham** Environmental Scientist II Dept. of Forests, Parks & Recreation 111 West St. Essex Junction, VT 05452 Work Phone: 802-871-3389 mary.burnham@state.vt.us	**Sandra Wilmot** Forest Health Specialist/Climate Change Program Coordinator Dept. of Forests, Parks & Recreation 111 West St. Essex Junction, VT 05452 Work Phone: 802-879-5691 Cell Phone: 802-777-5295 sandy.wilmot@state.vt.us

DISTRICT FORESTRY PROTECTION SPECIALISTS



District 1: Jim Esden 802-885-8822 (o); 802-777-1591 (cell) 100 Mineral St., Suite 304 Springfield, VT 05156 jim.esden@state.vt.us
District 2: Lars Lund 802-786-3856 (o); 802-777-4188 (cell) 271 North Main Street, Suite 215 Rutland, VT 05701 lars.lund@state.vt.us
District 3: Dan Dillner 802-879-5683 (o); 802-777-3079 (cell) dan.dillner@state.vt.us **Tom Simmons** 802-879-5685 (o) 111 West St. Essex Junction, VT 05452 tom.simmons@state.vt.us
District 4: Jay Lackey 802-476-0178 (o); 802-793-3608 (cell) 5 Perry St., Suite 20 Barre, VT 05641-4265 jay.lackey@state.vt.us
District 5: Tess Greaves 802-751-0116 (o); 802-535-5727 (cell) 1229 Portland St., Suite 201 St. Johnsbury, VT 05819 tess.greaves@state.vt.us

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 July 31st and August 24th. All surveys were conducted using a digital sketch mapping system.

ACKNOWLEDGEMENTS

Volunteers have been key to our program. The Forest Pest First Detector program completed a very successful first year, and we are very grateful to our charter participants: Ruth Addante, John Akielaszek, Gwen Allard, Marie Ambusk, Marnie Barry, Marvin Bicknell, Jon Binhammer, Corey Brink, Paul Brown, Andrew Cappello, VJ Comai, Bill Conn, Nilah Cote, Zapata Courage, Mike Curran, Barbara Curran, Brian Daigle, Kathy Decker, Bob DeSiervo, Allaire Diamond, Mark Dillenbeck, Donn Downey, Elizabeth Eddy, Bob Everingham, Mike Fallis, Steven Farnham, Jim Faughnan, Jordan Fletcher, Frank Fomkin, Jim Frohn, Steve Gerard, Amanda Gervais, Gus Goodwin, Annette Goyne, Ted Graham, Barbara Graham, Cynthia Greene, Scott Hance, Charlie Hancock, James Harding, Jock Harvey, Susan Hindinger, Earl Holtz, Mary Houle, Pamela Johnston, Janet Kane, Rick Kelley, Charlotte Kennedy, William Kennedy, Chuck Kletecka, Deb Lacroix, Craig Lambert, Teri Lamphere, Xaxakwetet Little Tree, Pam Loranger, Sue Lovering, Jen Lyod Pain, Jan McCoy, Andy McLean, Linda Miller, Carl Mohlenhoff, Veronica Norman, Charlie Parant, Joe Parent, Nancy Patch, Lesley Porter, Matt Probasco, Michael Quinn, Brenda Raleigh, Doug Reaves, Andy Reed, Michael Rosenthal, Ruth Ruttenberg, Jason Saltman, Diane Sedra, Chris Simpson, Sarah Sincerbeaux, Fred Skwirut, Martin Smit, John Snell, Brian Sullivan, Sally Thodal, Ray Toolan, Amalia Torres, Kurt Valenta, Pieter van Loon, Thomas Warhol, Mike White, Jim White, Lisa Wyncoop, Elias Wyncoop, Jeff Young, and Robert Zimmerman.

We're also thankful for the contributions of other volunteers who assisted with special projects: Emily Bragonier, Mary Ellen Copeland and the Dummerston Conservation Committee, Jonathan Decker, Joe DeFelice, Susan Grabowski, Mark Halverson, Dan Healey, Pat Jaquith, Bert Kaeppel, Dan Kilborn, Jon Lamb, Londonderry Conservation Commission, Logan Sears, Andy Sheere (HWA surveys), Luke Curtis and Ben, Sam and Jessica Dillner (phenology monitoring), Virginia Barlow, Sam and Suze Barlow, Luke Curtis, Scott, Grace and Noah Diedrich, Chris Doyle, Sheryl, Liam and Aiden Fletcher, Deborah Foote, Pat Goyne, Emmy Henard, Joan Hildreth, Mary Holland, Bruce Jenson, Lisa Sheridan, Joan Waltermire, and MaryLou Webster (EAB biosurveillance) and Jayson Benoit and Dave Shepard (trap tree surveys).

Thank you to Jonathan Decker for assisting with spatial data archives and to Warren Kiel for his assistance in rebuilding our moth reference collection after Tropical Storm Irene. Additional contributions to the collection came from Mara Gitlin and her students at CVUHS and from Dan Dillner.

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

We benefited from collaborations with Margaret Skinner and David Orwig (HWA), Dale Bergdahl and Chris Casey (butternut canker), and Lindsay Watkins and Randy Morin (decline study). Taxonomic and diagnostic assistance came from Cheryl Smith, Ross and Joyce Bell, Rod Crawford, Dan Jennings, Don Chandler, Chuck Lubelczyk, Robert Acciavatti, Dale Schweitzer, Dave Wagner, Don Miller, Scott Griggs, Michael Sabourin, and Warren Kiel.

Sharon Plumb, through her work at The Nature Conservancy, has provided leadership in launching many invasive plant activities, which have given us tools and an infrastructure for continuing this effort.

2012 PUBLICATIONS

Anderson, G. "New Publication to Help Forest Land Managers Deal with Tree Killer." Vermont Agency of Natural Resources, Department of Forests, Parks & Recreation. Web. 25 Apr. 2012.

Burns, B. "White Pine Needlecast Conspicuous Throughout Vermont." Vermont Agency of Natural Resources, Department of Forests, Parks & Recreation. Web. 7 Jun. 2012.

Duarte, N., Pardo, L. H., Robin-Abbott, M. J. "Susceptibility of Forests in the Northeastern U.S. to Nitrogen and Sulfur Deposition: Critical Load Exceedance and Forest Health." USDA Forest Service. Web. November 2011. Updated October 2012.

Esden, J. "Invasive Insect Spotted in Pownal." WCAX, Burlington, Vermont. Television. 2 Aug. 2012.

Esden, J. "Beetles Released to Attack Hemlock Pest in Vermont." WCAX, Burlington, Vermont Television 7 Dec. 2012.

Esden, J. "Researchers Hope Beetle Will Eat Hemlock Woolly Adelgid." VPR, Burlington, Vermont. Radio. 19 Dec. 2012.

Esden, J. "Beetles Released to Control Spread of Hemlock Woolly Adelgid." Vermont Agency of Natural Resources, Department of Forests, Parks & Recreation. Web. 10 Dec. 2012.

Esden, J. "Hemlock Woolly Adelgid Found in Bennington County by Volunteer." Vermont Agency of Natural Resources, Department of Forests, Parks & Recreation. Wed. 16 Jul. 2012.

Hanson, T. et al. "Vermont Forest Health Leaflets 2012." Vermont Division of Forestry, Vermont Department of Forests, Parks & Recreation. Web. 2012.

Knowles, M., Ross, D., Wilmot, S., and Juillerat, J. "Carbon and Nutrient Dynamics of Managed Vermont Forest Soils." ECANUSA proceedings. Web. 2012.

Lackey, J. "Cyrogenics, ALB and EAB: An Amazing Survival Story." *Vermont First Detector Newsletter*. VT Invasives. Web. 29 Feb. 2012.

Lackey, J. "Firewood Exchange Nabs Wood from States with EAB and ALB Quarantines." *Vermont First Detector Newsletter*. VT Invasives. Web. 11 Dec. 2012.

McKearnan, S. et al. "Resilience, A Report on the Health of Vermont's Environment." Vermont Agency of Natural Resources. Web. 2011. 28 pp.

Miller, E. et al. "Steady-State Critical Loads and Exceedance for Terrestrial and Aquatic Ecosystems in the Northeastern United States." Multi Agency Critical Loads Project. Final Technical Report." Web. January 12, 2012 .

"VT Invasives Enewsletters." Vermont Invasives. Web. 2012.

Wilmot, S., DeGeus, R., Morin, R., and Watkins, L. "FIA Plots, Aerial Survey, and Health Plots Integrated to Understand Tree Mortality in Vermont." Poster presented at the 2012 Forest Health Monitoring National Workgroup Meeting. Web. 2012

WEATHER AND PHENOLOGY

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

Weather Summary 2012

Fall and Winter, 2011-2012. The leaves had fallen in northern Vermont and the higher elevations by late October 2011. Southern New England still had some lingering foliage though when an early snow storm hit. Snow-laden branches broke and took down utility lines leaving many without power. The October 29th storm left snow totals of 12” in southern Vermont and considerably more further south—28” in some places in Massachusetts! Barely a trace fell in the Champlain Valley.

The month of November proved to be mild and dry—often even sunny. It was the second warmest November on record at the Burlington weather station. By mid-December, there had still been no significant snowfall generally throughout the state. Minimal snow cover in the north and in the mountains gave some semblance of a “normal” winter, but warmer temperatures with widespread rain the next week ended those hopes for skiers and snowmobilers. On December 20th, there was only 4” of snow at the stake on Mount Mansfield—a site usually known to provide a rather generous reading of the data. November and December of 2011 were nearly 5^0F above average for temperature and snowfall for December was more than 12” less than average in Burlington. The skiing season was suffering with no natural snow, and the frequent warm-ups with rain dampened the snowmaking efforts.

The first respectable snowfall for the Champlain Valley fell on January 13th…4.5” at the Essex station. Roller coaster temperatures on that weekend went from 42^0F on Friday to 7^0F that Saturday morning with the snow. Sunday morning was even colder at -9^0F, and then back up to 32^0F on Monday. The north country was stuck in an unpopular pattern of cold, dry days followed by warm and wet low pressure systems. What little snow cover there was became compacted and glazed by frequent light rains alternating with bitter cold temperatures. Ice was everywhere—roadways, sidewalks, driveways and even most lawns! Ice skaters on Lake Champlain were able to go for miles on nearly perfect ice.

People began to talk about the winter that “wasn’t”. The meteorologists’ frequent refrain was, “No big storms on the horizon, but we’ll take what we can get.” Many maple sugarmakers got sap runs and began boiling just after Valentine’s Day. The frost was coming out of the rural roads by late February prompting some towns to post the mud season weight limits, putting an end to log hauling from active timber sales across the state. Grass fire activity started in February this year with reports from Addison and Rutland counties.

One big snowstorm hit northern Vermont on February 24th and 25th (35” in Bakersfield, but only 2.8” in Essex). Even this amount of snow could not withstand the warm-up that was to come in the next few weeks. On March 12th the high temperature in Burlington was 63^0F—a new record. The next day, 67^0F, another record. A few days later, record highs were observed for 5 consecutive days (March 18-22) when temperatures topped out in the upper 70’s and low 80’s. The 80^0F reading on March 20th marked the earliest occurrence of 80 degrees in a calendar year in the historical record dating back to 1884. Needless to say, March 2012 was the warmest March on record. This was a month that featured 8 days of record –breaking high temperatures in Burlington.

Spring, 2012. The sugaring season was over for many producers before it really got started. Those that tapped early managed to salvage their season, but the others came away with barely half of a crop. Silver maple trees were in full bloom in the Champlain Valley by Saint Patrick's Day. The state Health Department began taking pollen counts by March 13th and the tree pollen numbers were already high. Many ski areas closed their doors after the weekend of March 23rd—the earliest in recent memory. The bare fields and the warm temperatures of late March and early April resulted in red flag warnings and/or fire weather watches throughout the period. The record setting March temperatures jumped the bud development of many plants. Sugar maple flower buds were 30 days ahead of average at the Proctor Maple Research Center in Underhill. The early leaf development stalled with the return of cool and dry weather in early April. Some wild apple trees in the Champlain valley that flowered during the early warmth lost almost all of their fruit to the cold. Many Christmas tree growers reported dieback on their balsam fir trees that traced back to desiccation during the unusually warm winter and early spring. There were hard frosts at the end of April and again on May 11th. Tender growth on many plants was nipped on the leaf margins. Add to these events a couple of localized hail storms and at least one strong wind event. A lot of leaves were blown completely off the trees. The ones remaining were looking worse for the wear. In addition to all of this, sugar maples suffered some moderate thrips damage. Looking at the mountains from a distance, the trees appeared off-color and thin. During the annual aerial detection survey last summer, foresters mapped 52,500 acres of "brown hardwoods" which was a compilation of all of these symptoms.

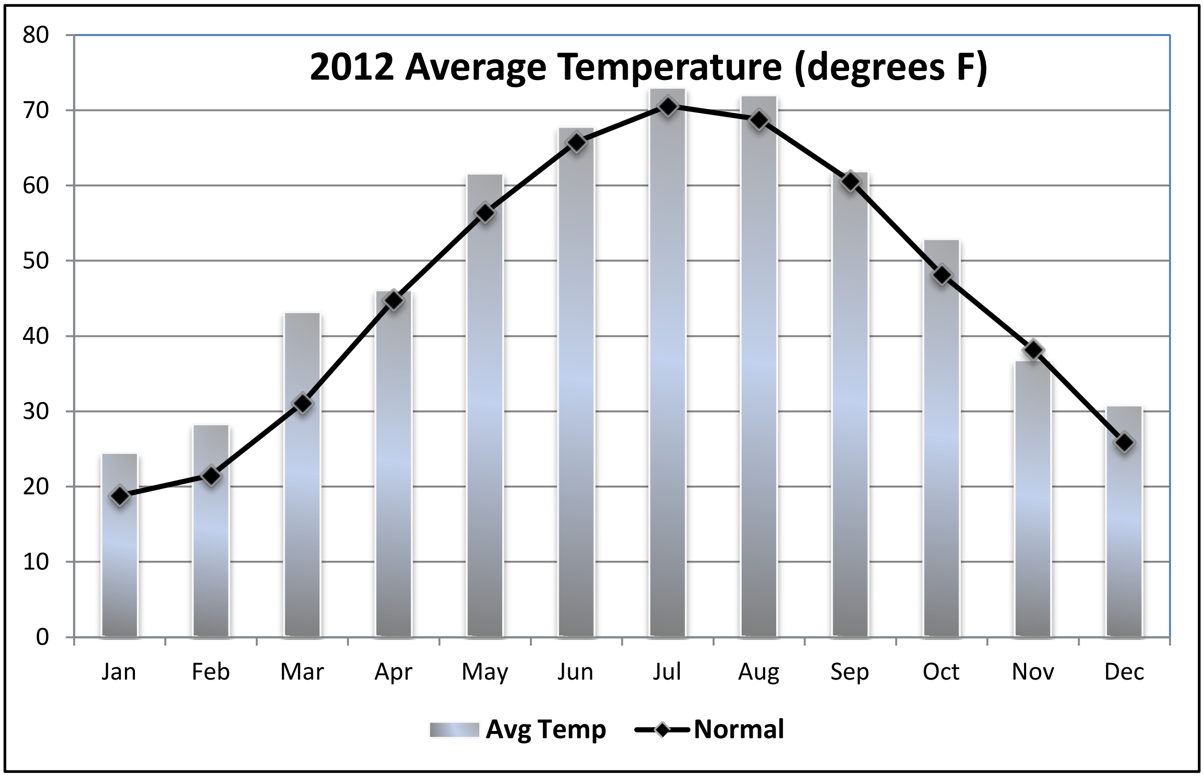
Summer and Fall, 2012. Summer got off to a hot beginning with a couple of record setting temperatures in Burlington (95^0F on June 20th and 97^0F on the next day). Only 0.31" of rain fell during this eleven day hot, dry spell. Vermont was warm, but most of the central and eastern U.S. was sweltering in a serious heat wave—100^0F plus temperatures day after day. On July 4th, a quick-moving storm in northwest Vermont dropped nearly 2" of rain in less than one hour. Streets flooded; high winds knocked down trees. Power outages and blocked roads were common. A fallen tree crushed a picnic table at Sandbar State Park where people had been eating just minutes before. The wind blew the canoes all over the Sandbar beach and set one down on top of a barbecue grill. Some people were kayaking on South Willard Street in Burlington in the flood waters that came rushing down the hill. It was all over in time for the fireworks display that evening. A second cluster of several thunderstorms with damaging winds, hail and torrential rain brought down trees and powerlines in eastern Washington County and the Northeast Kingdom.

The summer was hot and the weekends were dry, making for a generally enjoyable season. Fourteen days were 90 degrees or hotter. Although the precipitation averaged out to be fairly normal, there were stretches of days without rain (June 14th to the 24th, July 5th to the 15th, August 18th to the 27th). Trees on shallow soils and, in some cases, seedlings and ferns in the woods were affected by drought. July was the warmest July on record for the continental U.S. Forty six percent of the country was classified as being dry, very dry or extremely dry. Vermont's dry weather ended in early September with heavy rains overnight on the 5th. 1.2" of rain fell in just one hour from 1:00 AM to 2:00AM! That storm dropped 2.97" of rain in total compared to August when only 2.42" fell during the entire month.

The first widespread hard frost didn't occur until October 13th, and then only a couple of light frosts until the first week of November. Without the cold nights, the fall foliage was slow to change color. Early leaf drop due to the summer dryness and the various wind and hail events made for a short foliage season in the upper elevations. Once again, however, fears of a less than prime fall color display were quelled when the foliage reports started coming in using words like "brilliant" and "stunning" to describe the spectacle. The weather was cool and wet throughout the peak foliage, so the leaf-peepers had to pick their moments as the rare breaks of sun highlighted the brilliant colors. October, 2012 marked the 19th month in a row of above average temperatures—the longest stretch on record for Vermont.

The foliage season came to a dramatic end when Hurricane Sandy (then downgraded to "Superstorm Sandy") came onshore from the Atlantic on October 29th. Vermont was largely spared from the damaging wind and the rain, but our neighbors to the south caught the brunt of the damage. It was named "Superstorm" because the storm was nearly 1000 miles in breadth and it had the lowest air pressure ever recorded in an Atlantic storm. Sandy came onshore in New Jersey, very close to New York City. Along with the wind, there was copious rain and a storm surge enhanced by a full moon. That 13' storm surge annihilated several oceanside towns along the New York and New Jersey shores.   New York City's subway system was shut down for days and people were without power for nearly two weeks, some stranded in their high-rise apartments without a functioning elevator. 120 deaths were attributed to the storm. Northern Vermont and the Champlain valley got less than a quarter inch of rain and the winds rarely gusted over 40 mph.

Figures 1-17 and Tables 1-2 provide details on 2012 temperatures, precipitation and phenological observations.



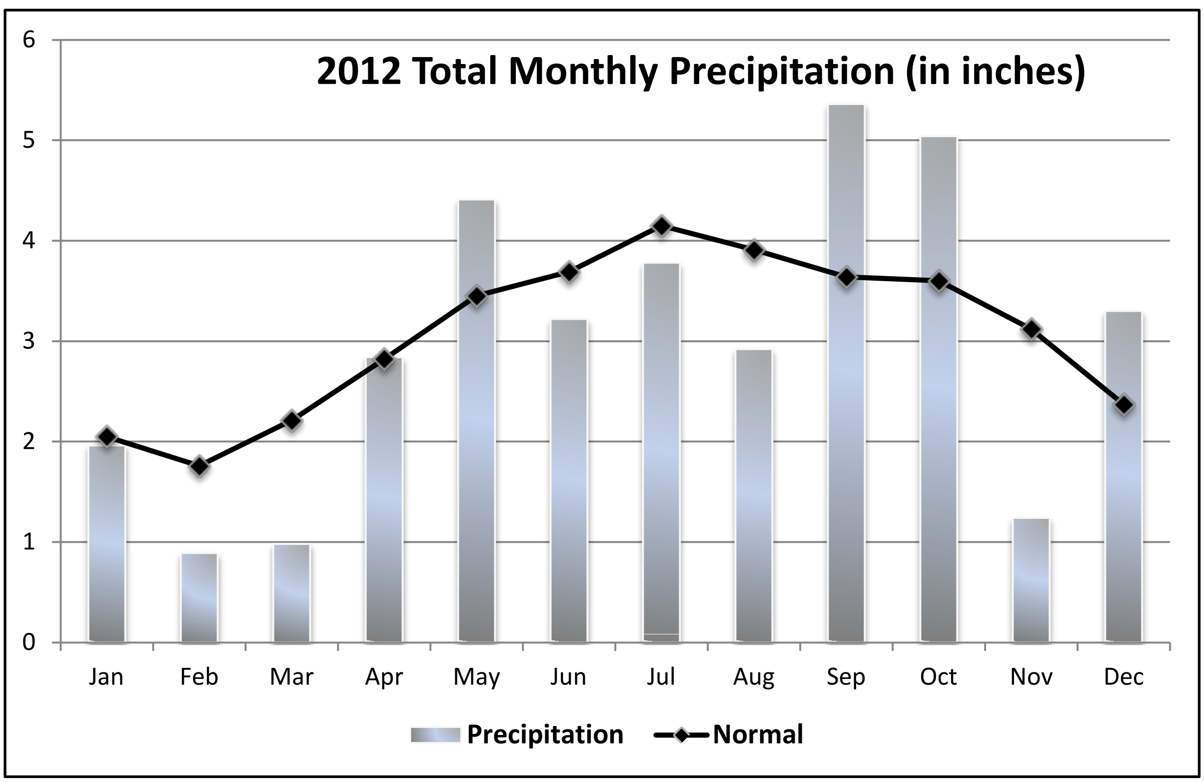


Figure 1. Monthly average temperature and monthly total precipitation in 2012, compared to normal for Burlington, Vermont. (Normals are for years 1981-2010.) *Source: National Weather Service, Burlington.*

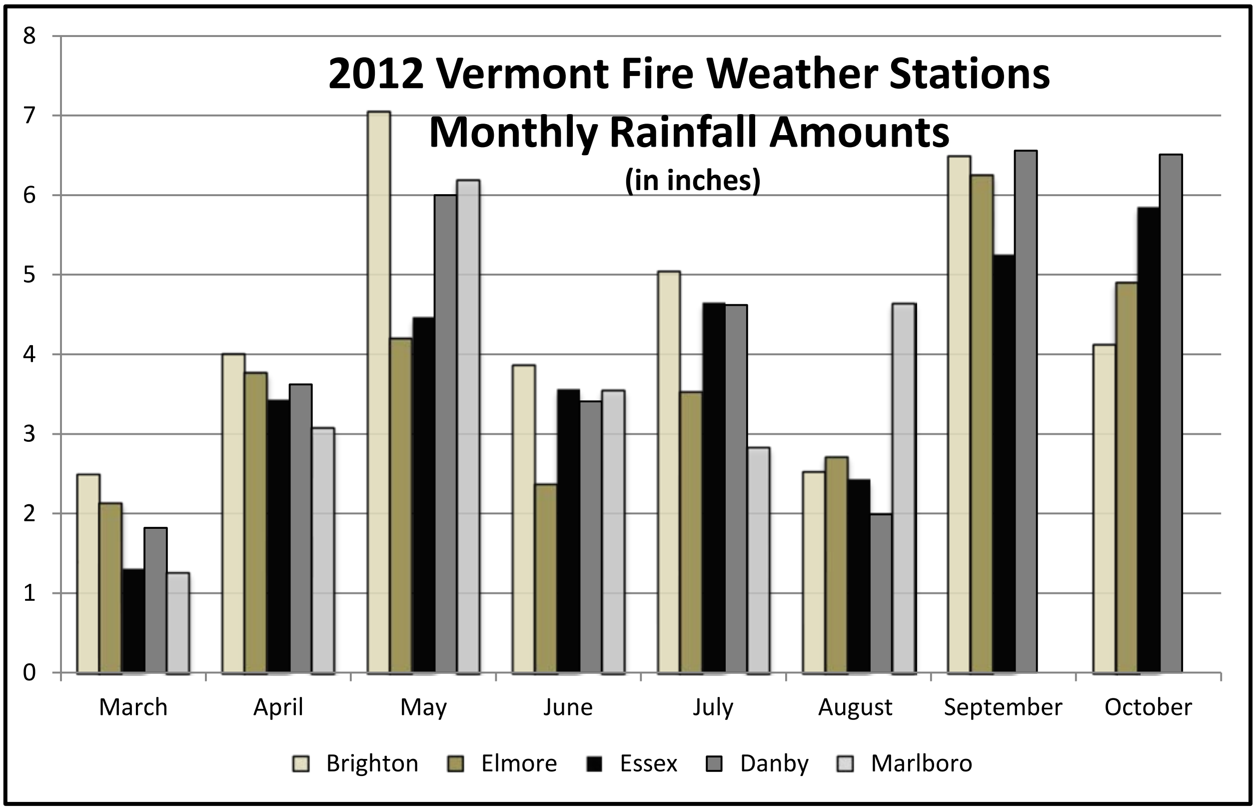


Figure 2. Monthly rainfall amounts (in inches) at Vermont fire weather observation stations through fire season, March-October, 2012 except for Marlboro which goes through August, 2012.

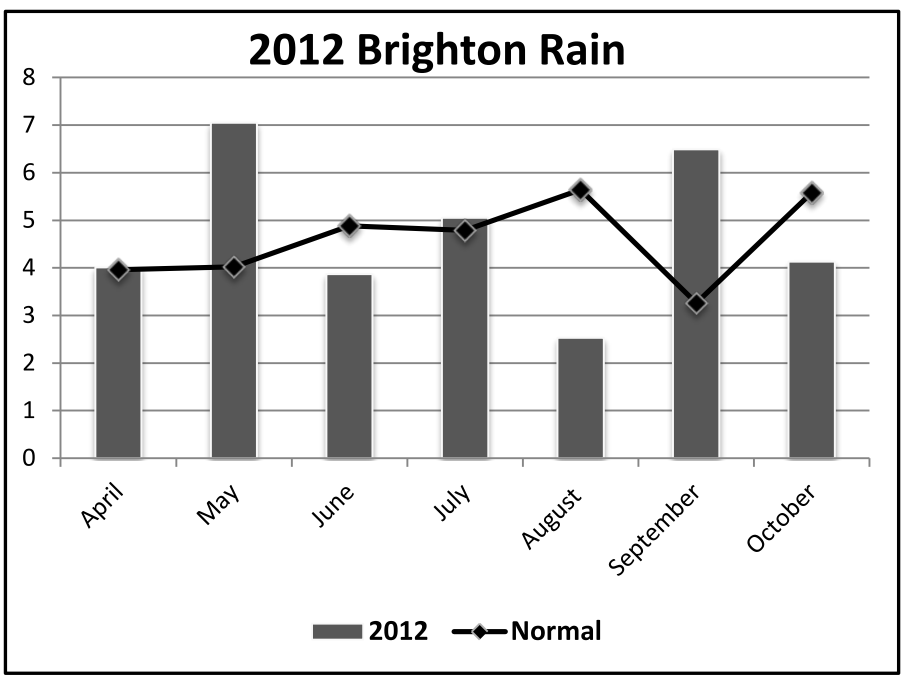


Figure 3. Monthly rainfall amounts (in inches) at the Nulhegan fire weather observation station in Brighton, Vermont compared to normal through fire season, April-October, 2012. Normal is based on 10 years of data.

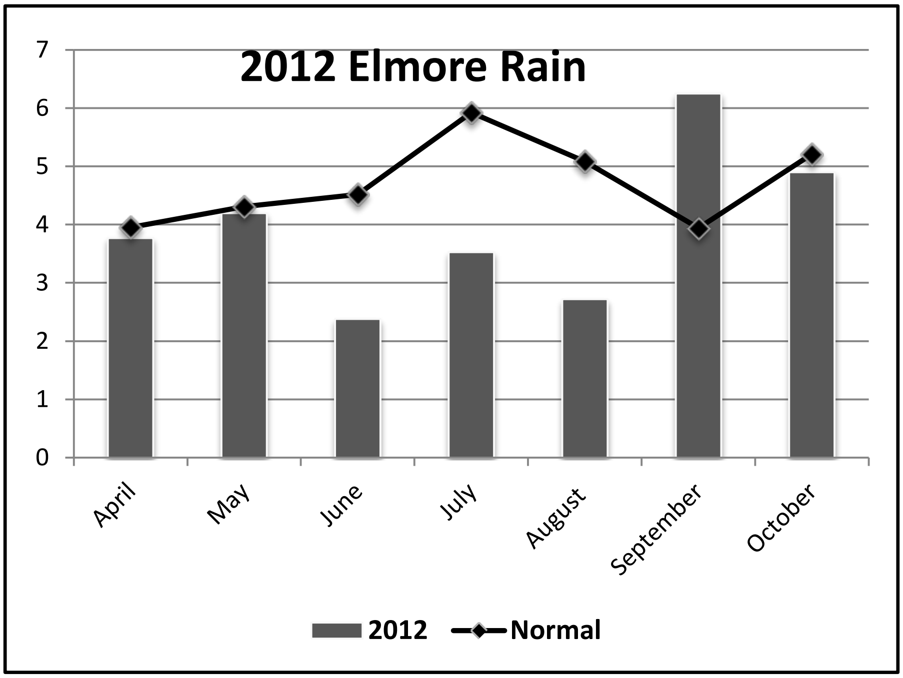


Figure 4. Monthly rainfall amounts (in inches) at the fire weather observation station in Elmore, Vermont compared to normal through fire season, April-October, 2012. Normal is based on 18 years of data.

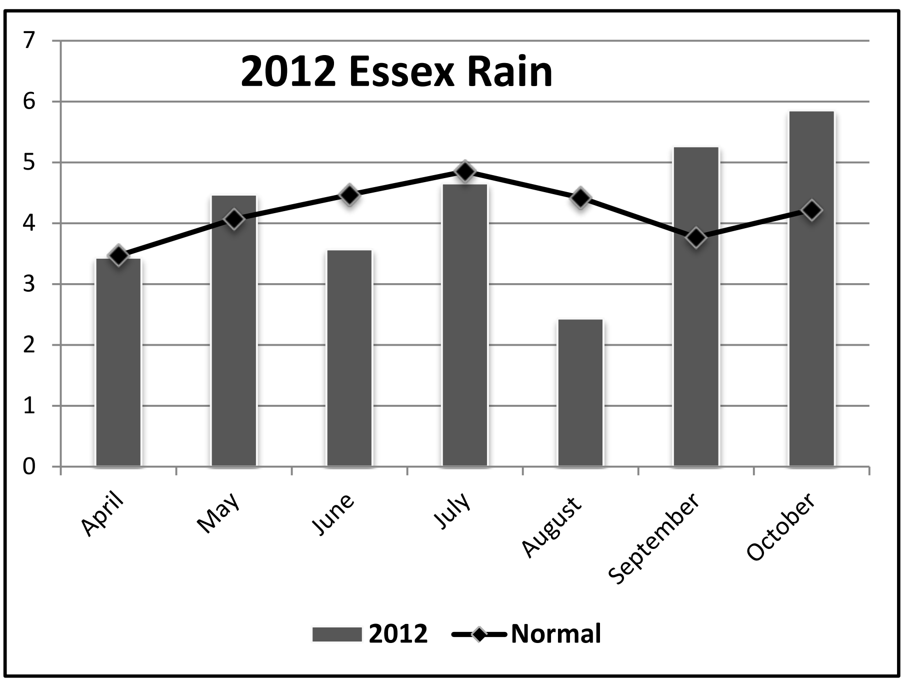


Figure 5. Monthly rainfall amounts (in inches) at the fire weather observation station in Essex, Vermont compared to normal through fire season, April-October, 2012. Normal is based on 19 years of data.

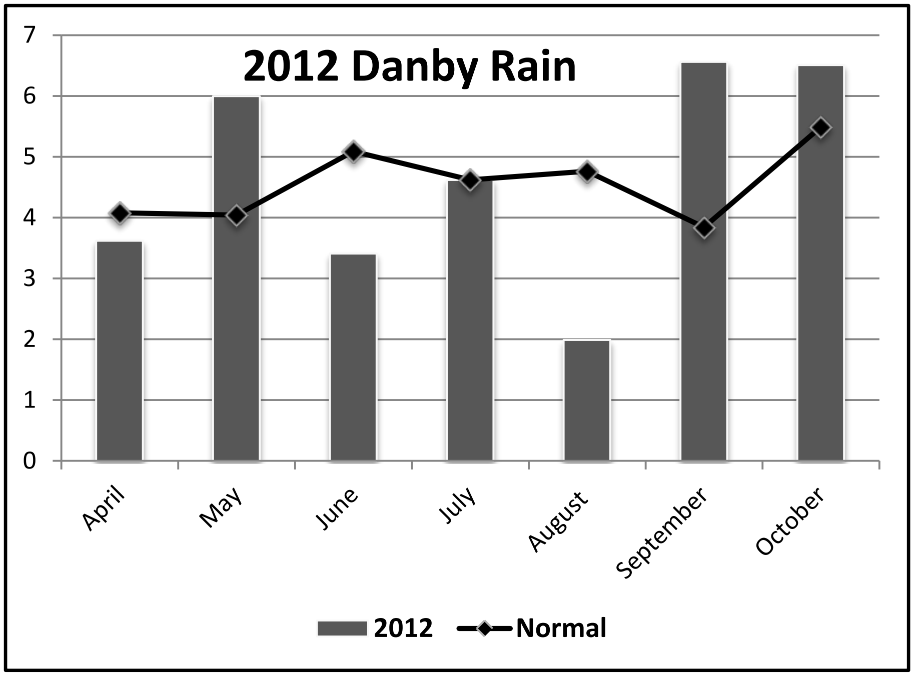


Figure 6. Monthly rainfall amounts (in inches) at the fire weather observation station in Danby, Vermont compared to normal through fire season, April-October, 2012. Normal is based on 15 years of data.

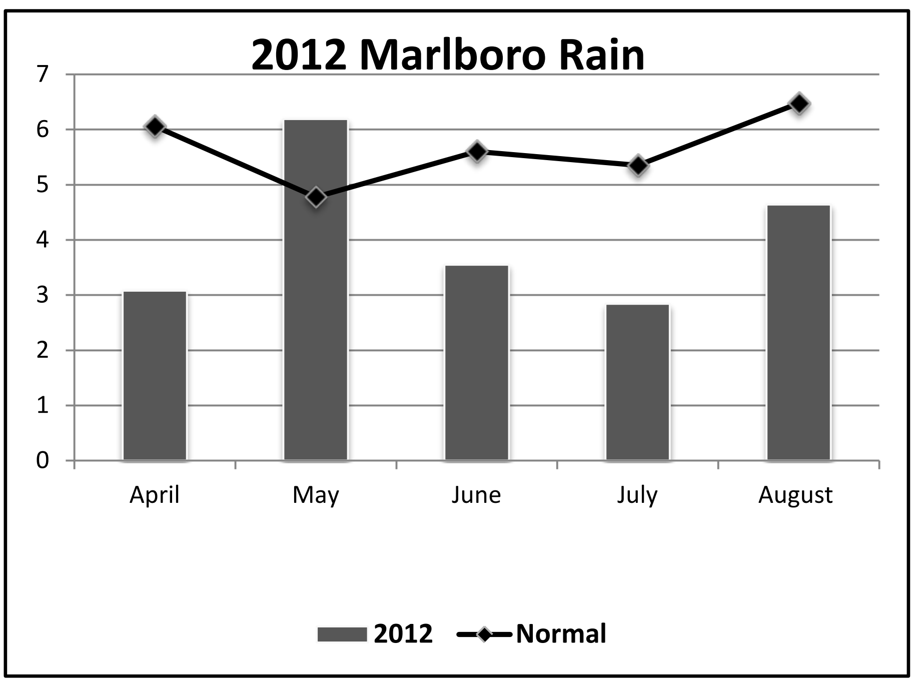


Figure 7. Monthly rainfall amounts (in inches) at the fire weather observation station in Marlboro, Vermont compared to normal through fire season, April-August, 2012. Normal is based on 10 years of data.

Spring Bud Break and Leaf Out At Mount Mansfield

Sugar maple trees were monitored for the timing of bud break 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." University of Vermont Agricultural Experiment Station Research report no. 70. 31 p.).

An unusually warm period in March initiated bud development and when trees were visited on the usual start date of April 1st for monitoring, flower buds were already swollen and nearing bud break (Figure 8). Buds on regeneration were also obviously swollen (V2 and V3) (Figure 9) and tree buds were somewhat swollen (V1 and V2) (Figure 10). Flower bud development on April 1st was 30 days earlier than the long term average. Vegetative buds on saplings and trees were also earlier, by 22 and 17 days respectively. Flower and regeneration buds continued to advance way earlier than normal, but cooler weather stalled tree bud development, such that bud break and leaf out were within the range of normal compared to the long term average.

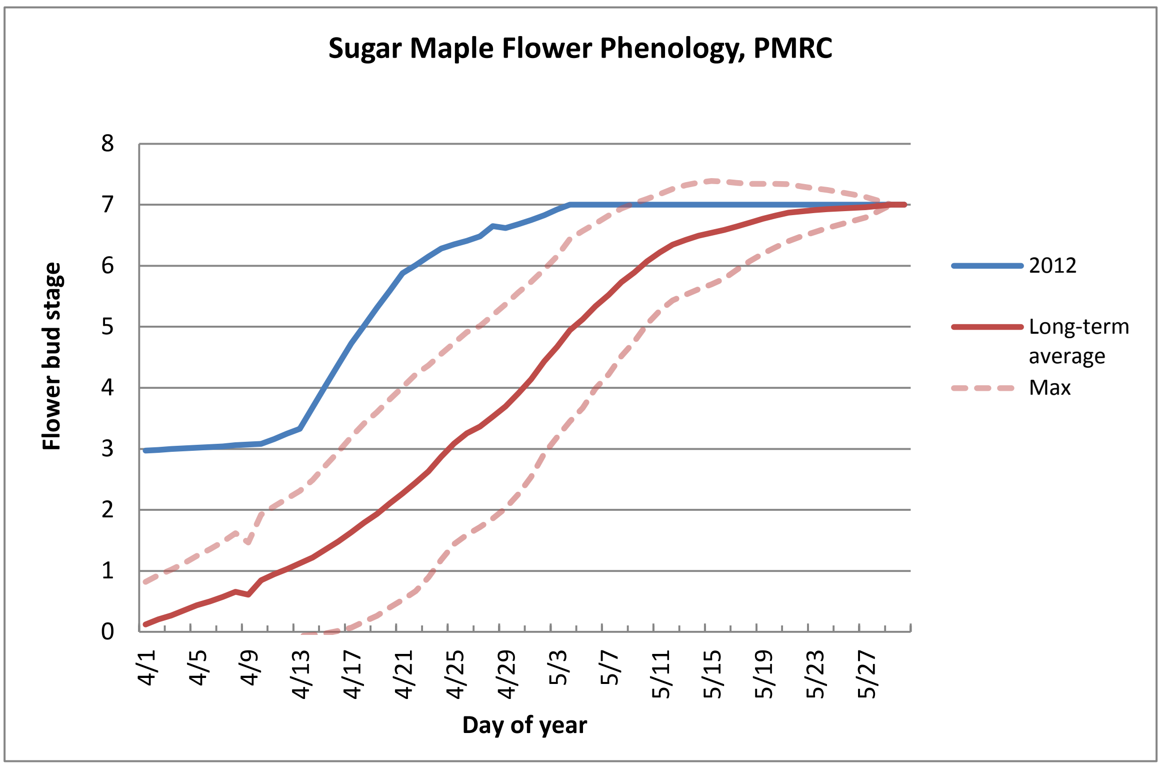


Figure 8. Timing of sugar maple flower development compared to long term average (21 years) at the Proctor Maple Research Center in Underhill.

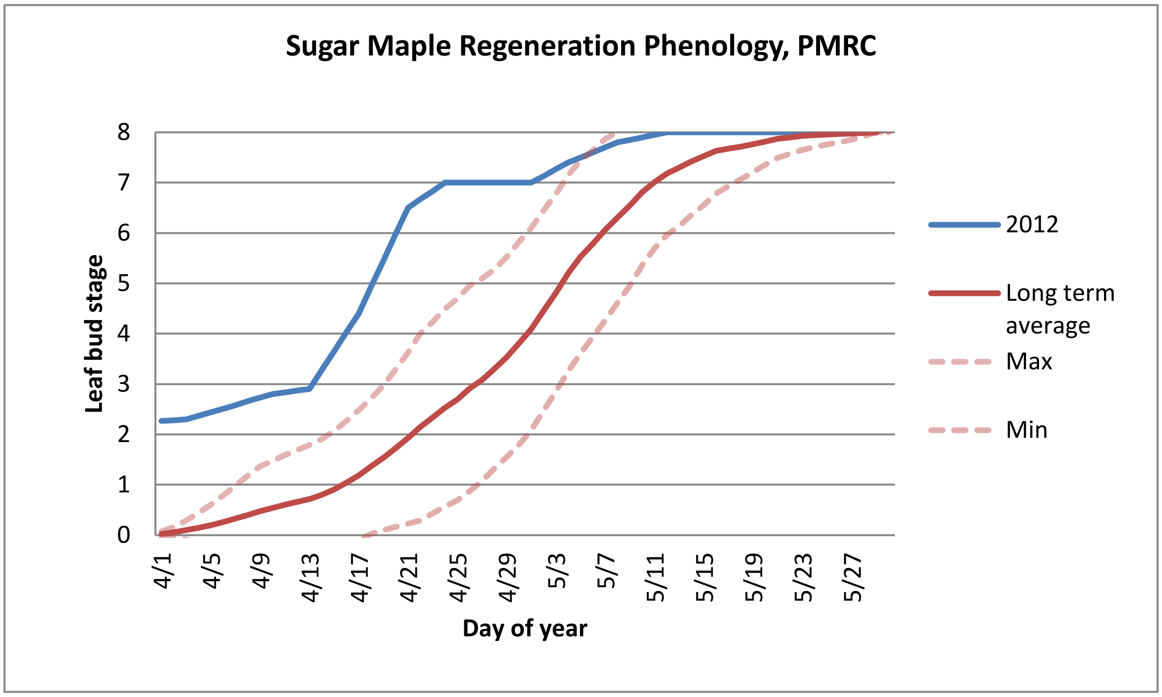


Figure 9. Timing of sugar maple bud development on saplings compared to the long term average (21 years) at the Proctor Maple Research Center in Underhill.

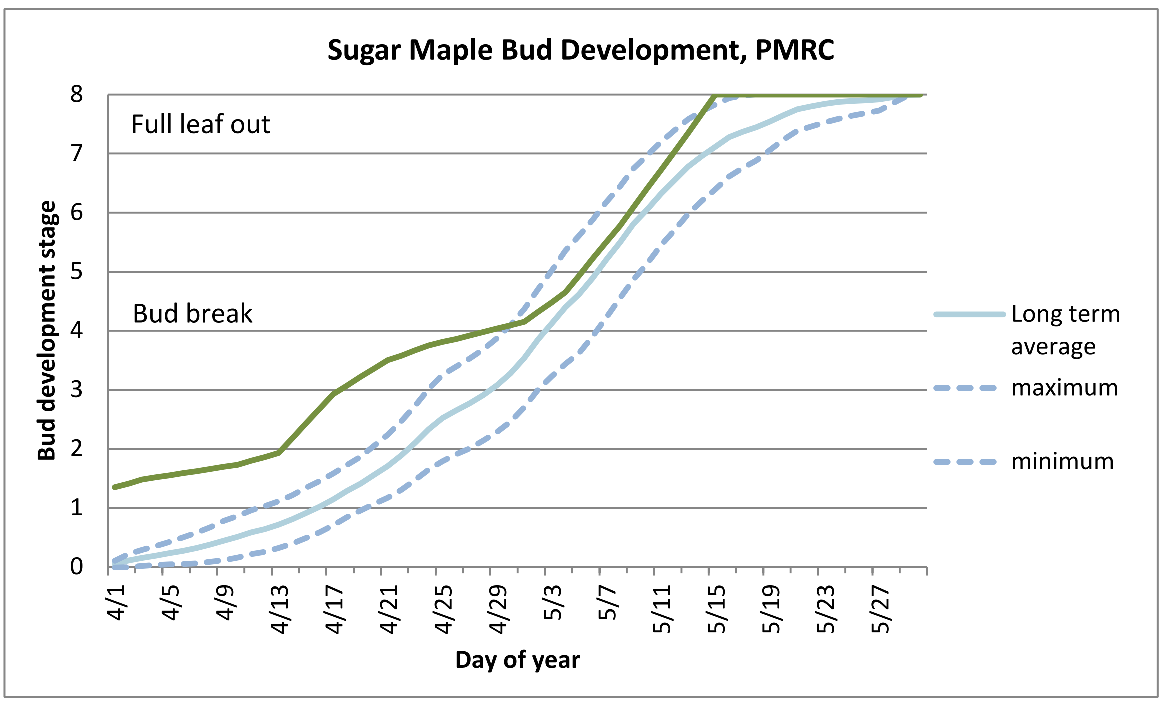


Figure 10. Timing of sugar maple bud development on trees compared to the long term average (21 years) at the Proctor Maple Research Center in Underhill.

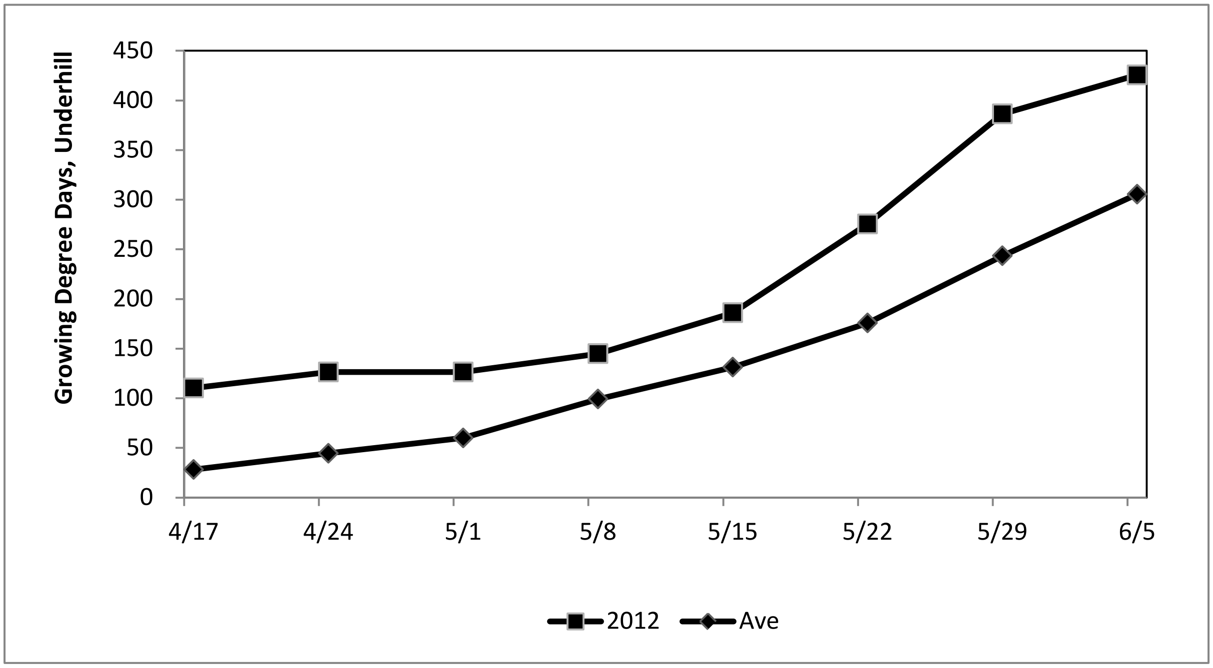


Figure 11. Weekly spring cumulative growing degree days for Underhill, Vermont, in 2012 compared to mean 1993-2012 accumulations. 50°F was used as the threshold of development.

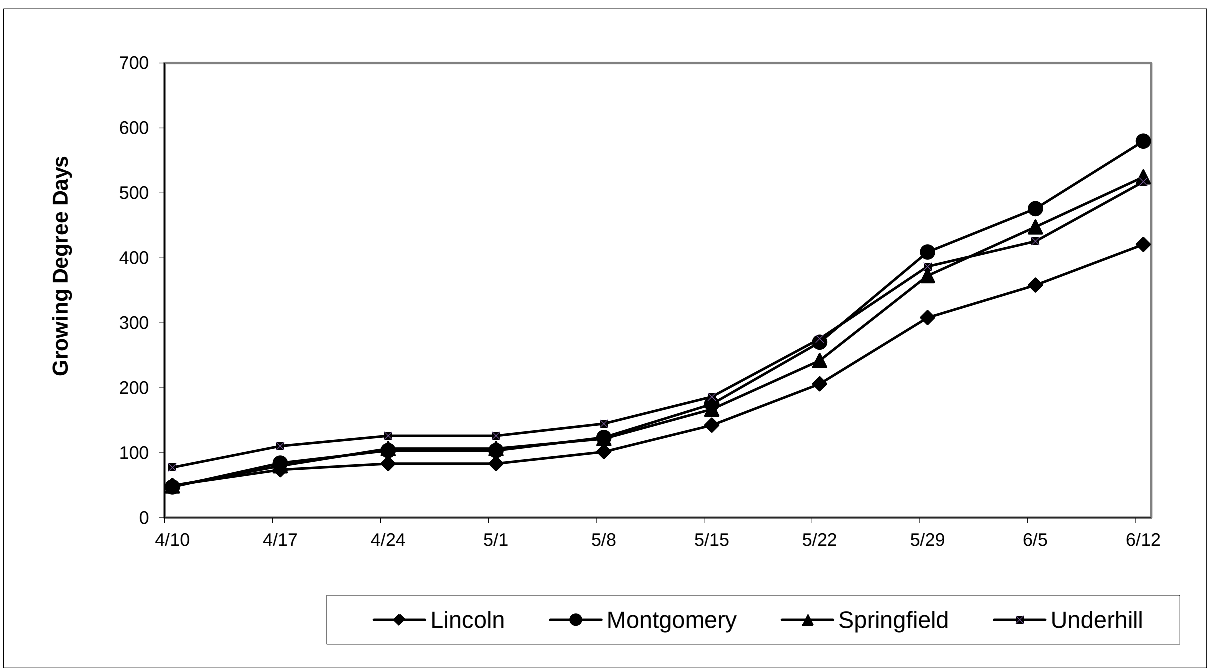


Figure 12. 2012 weekly spring cumulative growing degree days for Springfield, Underhill, Montgomery, and Lincoln, Vermont. 50°F was used as the threshold of development.

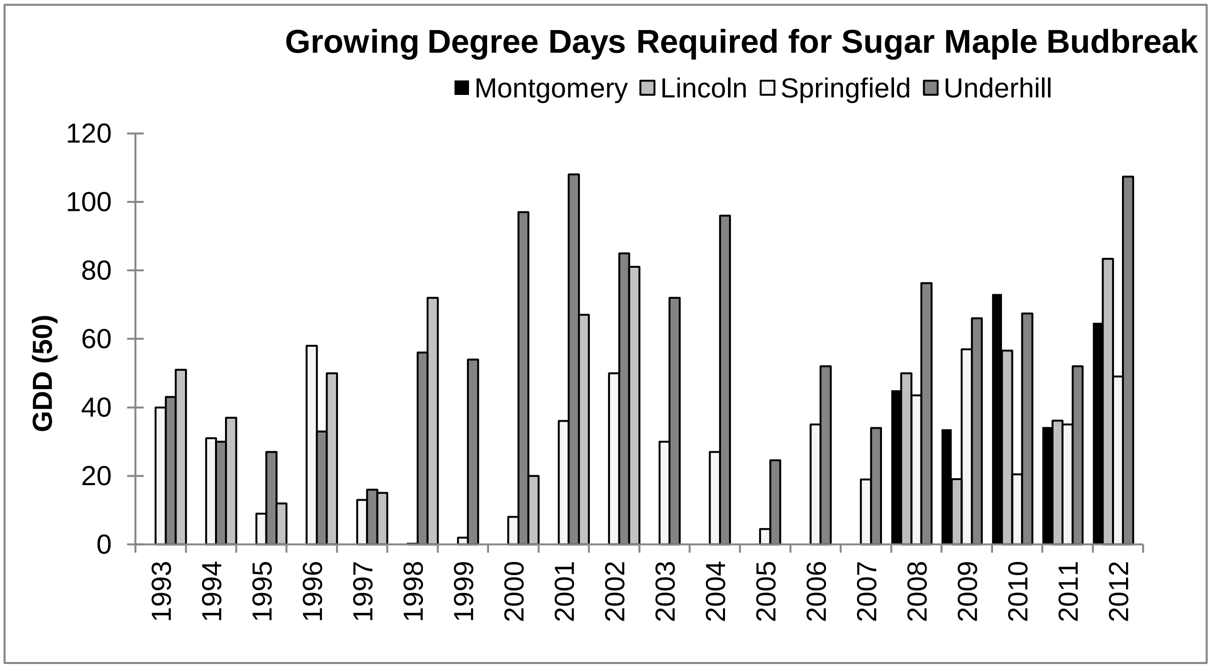


Figure 13. Growing degree days for sugar maple budbreak in Springfield and Underhill 1993-2012, and for Montgomery and Lincoln 2008-2012.

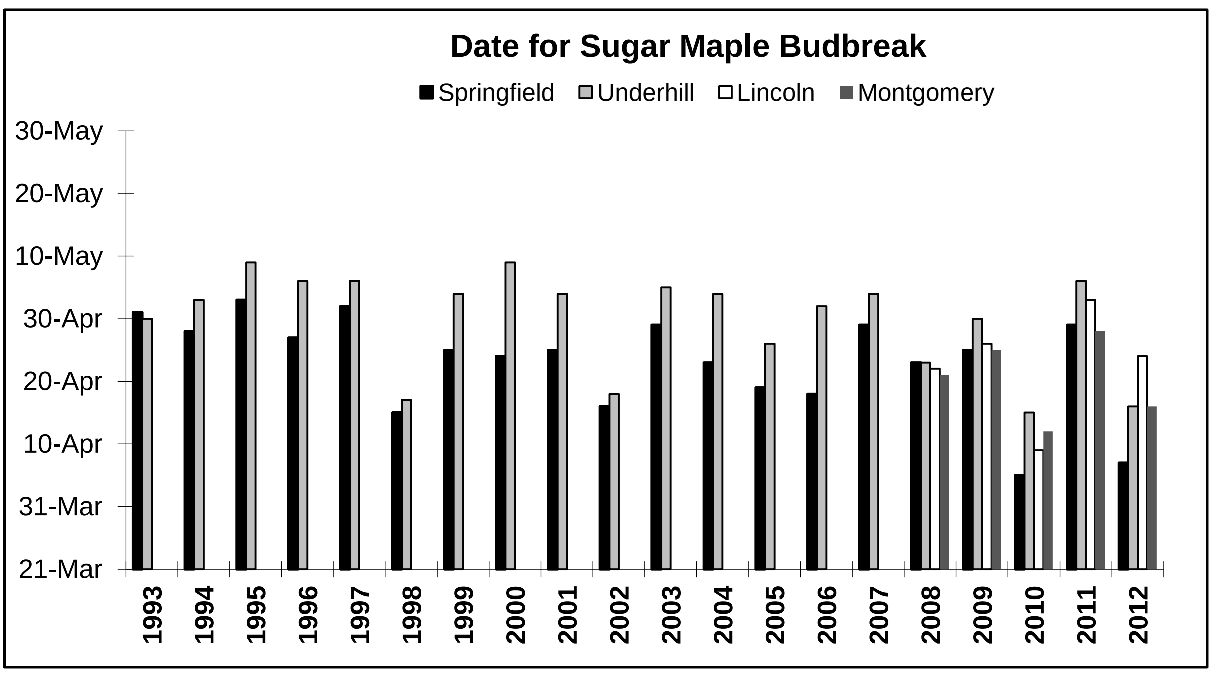


Figure 14. Dates of sugar maple budbreak in Springfield and Underhill 1993-2012 and for Montgomery and Lincoln 2008-2012.

Table 1. First observation dates of phenological development and growing degree day accumulations from 4 sites in Vermont for 2012. 50°F is used as the threshold of development.

Biological Indicator	Lincoln	Montgomery	Springfield	Underhill
PLANT DEVELOPMENT				
Showing Green				
Fir, Balsam	4/30 (83.4)	5/10 (135.6)		5/7 (143)
Hemlock		5/17 (194.3)	5/5 (112.5)	
Spruce, Red		5/21 (245.1		
Budbreak				
Ash, White		5/12 (135.6	4/21 (98)	5/7 (143)
Aspen, Quaking	4/18 (73.9)	4/15 (47.6)		
Cherry, Black	3/21 (27.7)	3/23 (47.5)	3/23 (44)	
Cherry, Choke		4/15 (47.6)		
Elm, American		4/26 (103.5)		
Fir, Balsam		5/18 (194.4)		5/14 (179)
Hemlock		5/19 (201.3)		
Lilac	3/22 (39.8)	3/22 (39.3)		
Maple, Red	4/30 (83.4)	4/21 (101.5)		5/3 (130)
Maple, Silver				
Maple, Sugar	4/24 (83.4)	4/16 (64.7)	4/7 (49)	4/16 (107.37)
Oak, Red		5/12 (135.6)	4/19 (85.5)	
Shadbush	4/15 (51.4)			
Spruce, Red		5/27 (371.9)		
Flowers of Deciduous Trees and Shrubs				
Ash, White		None observed		
Aspen, Quaking		3/21 (34.4)	3/16 (0)	
Cherry, Black		4/20 (94)		
Cherry, Choke		4/22 (101.6)		
Elm, American		None observed	3/21 (22.5)	
Lilac (first flowers)		5/10 (135.6)		
Maple, Red	3/23 (50.2)	3/21 (34.4)	3/19 (7.5)	3/21 (62)
Maple, Silver			3/16 (0)	
Maple, Sugar		4/15 (47.6)		
Oak, Red		5/12 (135.6)		
Shadbush	4/19 (73.9)		4/16 (57)	4/20 (126)
Wildflowers (Budbreak)				
Coltsfoot			3/21 (22.5)	
Daffodils			3/24 (49)	
Virginia Spring Beauty	4/15 (51.4)	4/10 (47.5)		
Wild Strawberry		4/14 (47.5)		
Wildflowers (First Flowers)				
Virginia Spring Beauty		4/13 (47.5)		
Wild Strawberry		4/22 (101.6)		
INSECT DEVELOPMENT				
Eastern tent caterpillar (first tent)		5/15 (47.6)		4/30 (126)
Pear thrips (first adults)				3/23 (78)
OTHER OBSERVATIONS				
Spring peepers calling	4/16 (59.9)		3/22 (33)	
Full green up	6/1 (342.1)	5/28 (387.8)	5/23 (256.5)	

Fall Color Monitoring at Mount Mansfield

Sugar maple trees at the Proctor Maple Research Center in Underhill were monitored for the timing of fall leaf color and leaf drop (end of growing season). Color development was similar to the long term average (1991-2011) (Figure 15), but a comparison of each decade of monitoring shows a shift to later fall color development since 2001 (Figure 16). The average length of the growing season, from budbreak to leaf drop, was 186 days in 2012, 16 days longer than the long term average (Table 2). Eight of the last 11 years have had longer than normal growing seasons (Figure 17).

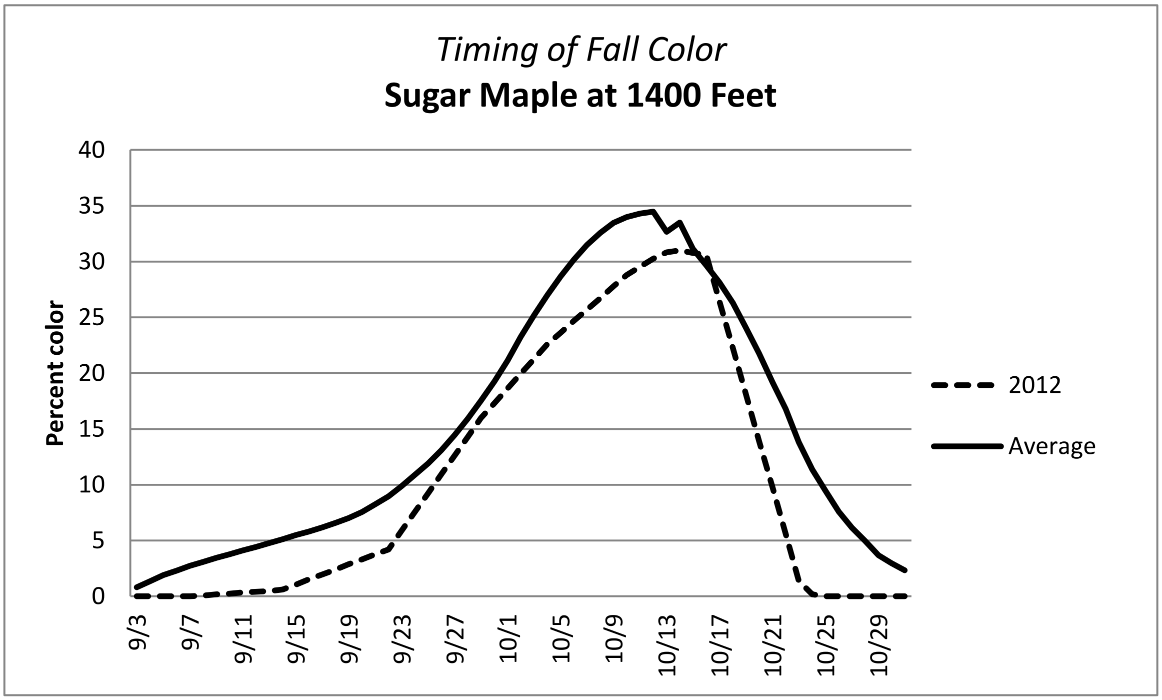


Figure 15. Timing of fall color on sugar maple trees monitored at the Proctor Maple Research Center in Underhill in 2012 compared to the 21-year average.

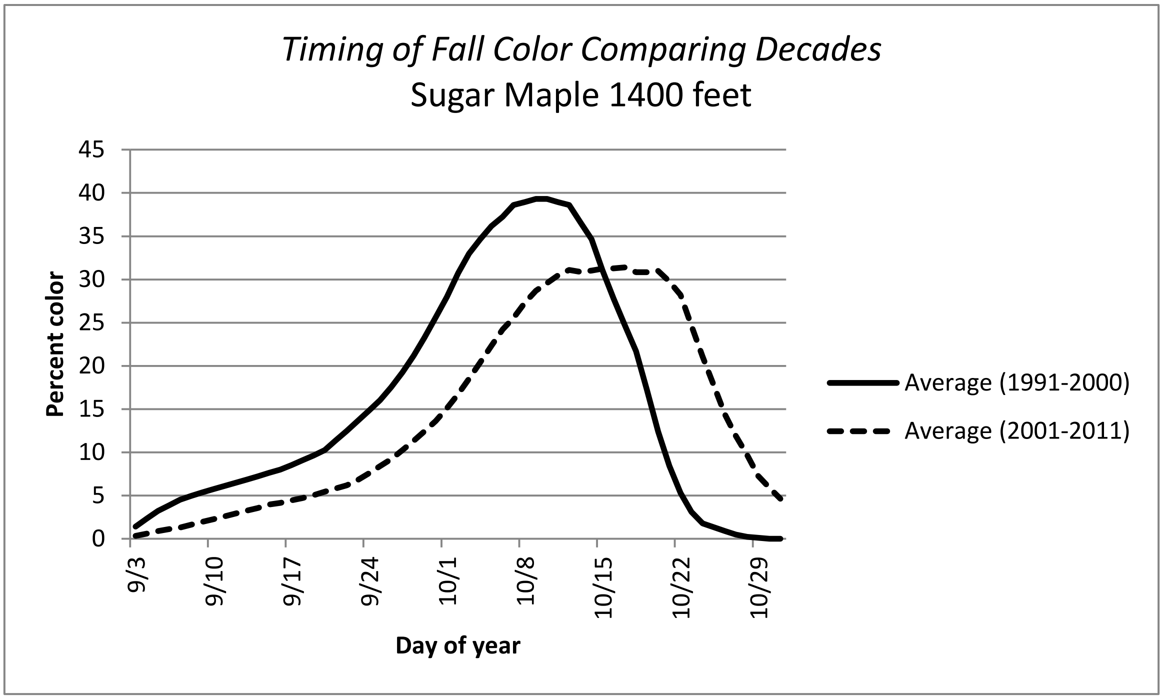


Figure 16. Comparison of sugar maple fall color development averaged over 2 time periods: 1991-2000, and 2001-2011, showing a shift towards later fall color in recent years.

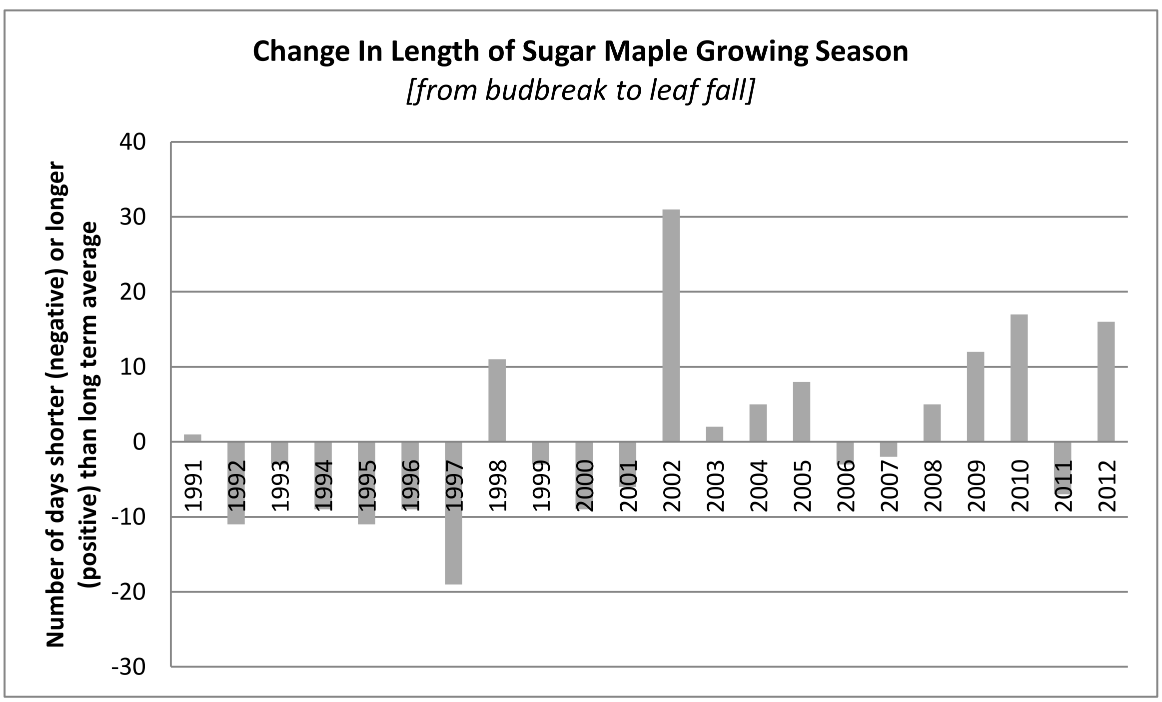


Figure 17. Annual length of sugar maple growing season, from budbreak to leaf drop, is compared to the long term average (1991-2011, shown as zero) and is shown as the number of days shorter (negative) or longer (positive).

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

Year	Date of Budbreak	Date of End of Growing Season	Length of growing season (days)
1991	4/28	10/15	171
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
Long term Average (1991-2011)	**5/3**	**10/20**	**170**

HARDWOOD DEFOLIATORS

Birch Defoliation was observed on 2,705 acres in 2012, as opposed to 24,975 acres in 2011, and was mostly cause by Septoria leaf spot (See Foliar Diseases). Birch leaf folder (*Ancylis discigerana*) was observed causing light damage to yellow birch in the southern Green Mountains. Birch skeletonizers were occasionally detected, but birch leafminers were atypically infrequent.

Forest Tent Caterpillar, *Malacosoma disstria*, populations remained insignificant. No defoliation or larvae were observed. Average moth catch in pheromone traps was up slightly in four of 13 survey locations (Table 3 and Figure 18).

Table 3. Average number of forest tent caterpillar moths caught in pheromone traps, 2002-2012. There were three multi-pher pheromone traps baited with PheroTech forest tent caterpillar lures deployed per location in 2012, but four traps went missing, one in Roxbury (Roxbury Town Forest), one in Waterbury (Cotton Brook) and two at Rochester Mountain in Rochester.

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

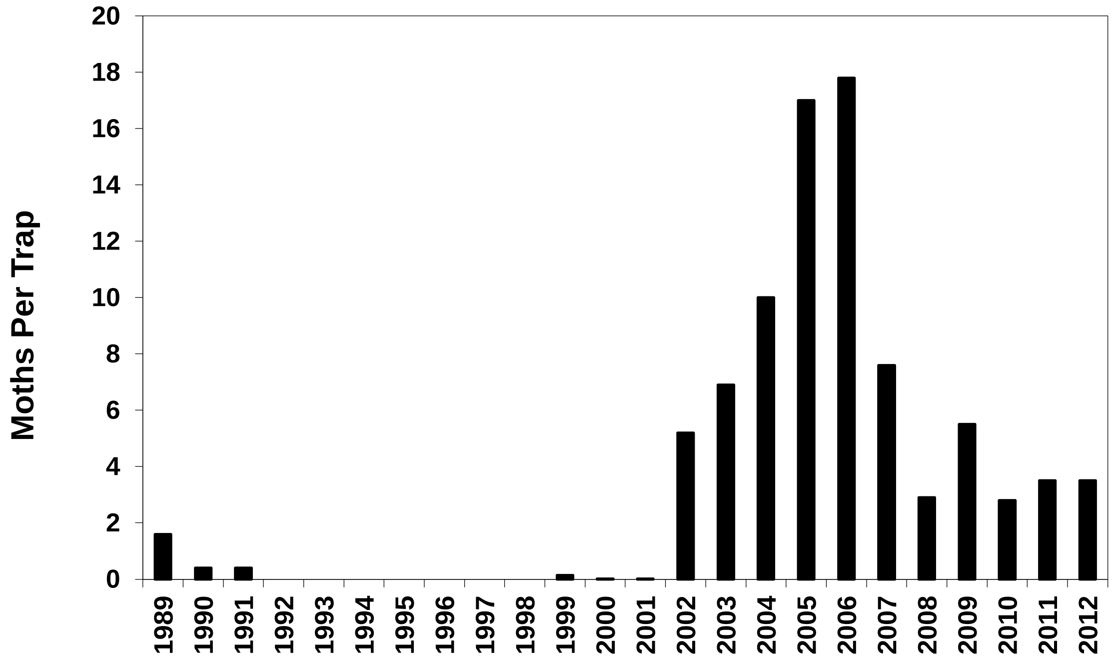


Figure 18. Average number of forest tent caterpillar moths caught in pheromone traps 1989-2012. Three multi-pher pheromone traps per site, with PheroTech forest tent caterpillar lures, were used in 2012. (Note that 4 traps were not recovered, one in Roxbury (Roxbury Town Forest), one in Waterbury (Cotton Brook) and two at Rochester Mountain in Rochester.)

Gypsy Moth, *Lymantria dispar*, caused noticeable feeding in some areas, including in Sheldon and Hartford, but few egg masses were observed. Egg mass counts at focal area monitoring plots turned up no masses at all (Table 4 and Figure 19).

Table 4. Number of gypsy moth egg masses per 1/25th acre from focal area monitoring plots, 2003-2012. Average of two 15-meter diameter burlap-banded plots per location in 2012.

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

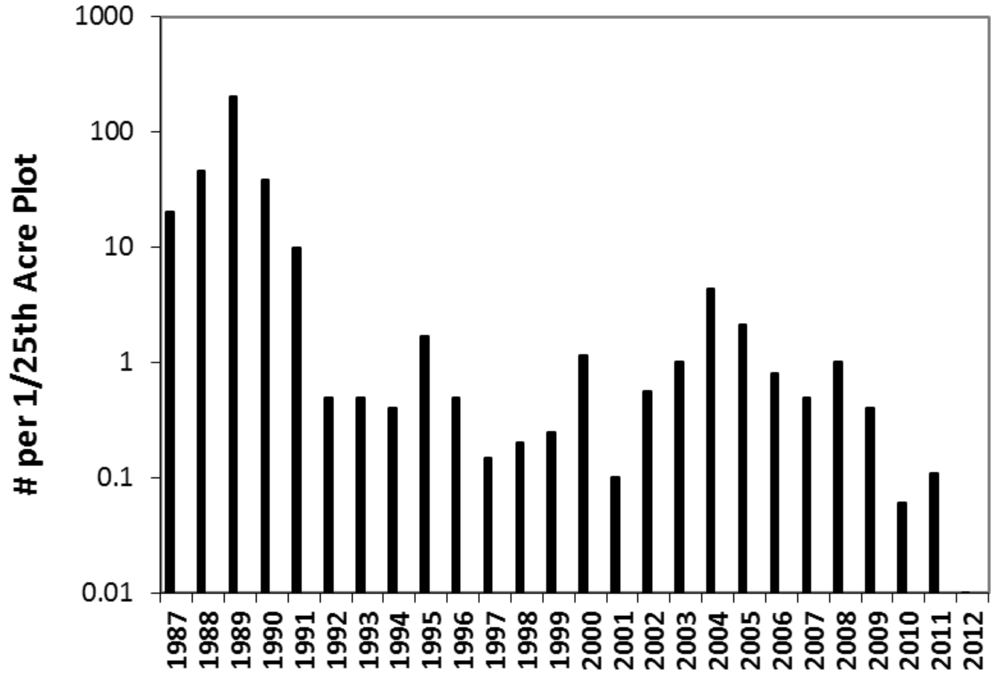


Figure 19. Number of gypsy moth egg masses per 1/25th acre from focal area monitoring plots, 1987-2012. Average of ten locations, two 15-meter diameter burlap-banded plots per location, in 2012. No egg masses were found in any plots in 2012.

OTHER HARDWOOD DEFOLIATORS

INSECT	LATIN NAME	HOST	LOCALITY	REMARKS
American Dagger Moth	*Acronicta americana*	Hardwoods	Northern Vermont	Occasionally observed.
Apple and Thorn Skeletonizer	*Choreutis pariana*	Apple	Hyde Park, Wolcott	Heavy defolation reported.
Aspen Serpentine Leafminer	*Phyllocnistis populiella*	Aspen	Swanton	Extensive epidermal mining noteworthy on single tree.
Birch Leaf Mining Sawflies	*Fenusa pusilla, Messa nana*	Birch	Statewide	Rarely observed. See Birch Defoliation narrative.
Birch Leaf Folder	*Ancylis discigerana*	Birch	Statewide	Occasionally observed; only light damage.
Birch Skeletonizer	*Bucculatrix canadensisella*	Birch	Orange and Washington	Occasionally observed; only light damage.
Bruce Spanworm	*Operophtera bruceata*	Sugar maple, aspen, beech and other hardwoods	Northern Vermont	Though larvae were observed, only light defoliation was reported; fewer moths seen than in 2011, when moth flight was the largest observed in many years.
Cherry Scallop Shell Moth	*Hydria prunivorata*	Black cherry	Statewide	Nests were widely noticeable. Moderate damage reported on cherry saplings in Hyde Park.
Definite-Marked Tussock	*Orgyia definita*	Hardwoods	Scattered	Individual larvae reported from several locations.
Dogwood Sawfly	*Macremphytus tarsatus*	Dogwood	Londonderry, Fairlee, Dummerston	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	Belvidere	Individual larvae observed; no damage noted.
Euonymus Caterpillar	*Yponomeuta cagnagella*	Euonymus	Chittenden	Ornamentals; Euonymus/burning bushes with heavy webbing.
European Snout Beetle	*Phyllobius oblongus*	Maples and yellow birch	Widely scattered	Beetles numerous at some sites in central and western Vermont.

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.
Flea Beetles	Chrysomelidae, Alticinae	Alder	Troy	Moderate population reported.
Forest Tent Caterpillar	*Malacosoma disstria*	Sugar maple	Statewide	See narrative.
Green-striped Mapleworm	*Dryocampa rubicunda*	Sugar maple	Northern Vermont	Occasionally observed.
Gypsy Moth	*Lymantria dispar*			See narrative.
Hickory Tussock Moth	*Lophocampa caryae*	Hardwoods	Scattered throughout	As in 2011, larvae very numerous. No damage noted, just a lot of caterpillars.
Japanese Beetle	*Popillia japonica*	Many	Statewide	Scattered, usually light damage to a variety of trees; some instances of heavy damage.
Locust Leafminer	*Odontata dorsalis*	Black locust	Widely scattered	Moderate to heavy damage reported in some locations. In other locations, locusts were not affected.
Maple Leaf Cutter	*Paraclemensia acerifoliella*	Maples	Scattered	Only light damage observed.
Maple Trumpet Skeletonizer	*Epinotia aceriella*	Sugar maple	Scattered	Minor damage observed.
Mimosa Webworm	*Homadaula anisocentra*	Honeylocust	Springfield	Light damage in a single location.
Mountain Ash Sawfly	*Pristiphora geniculata*	Mountain Ash	Episodic	Low to moderate damage reported on ornamentals.
Oak Leaf Tier and Leaf Roller Complex	*Croesia semipurpurana* and others	Red oak	Scattered	Some dieback and mortality occurred in a few locations that have had noticeable defoliaton since 2008, including a noticeable pocket of mortality on a shallow, exposed site in Middlesex.

OTHER HARDWOOD DEFOLIATORS

INSECT	LATIN NAME	HOST	LOCALITY	REMARKS
Omnivorous Leafroller	*Archips purpurana*	Apple	Essex	Larvae form feeding shelters by rolling leaves, sometimes into tight cylinders.
Pale Tussock Moth	*Halysidota tessellaris*	Hardwoods	Scattered	Part of the cadre of tussock moth caterpillars widely observed in 2012.
Pergid Sawfly	Pergidae, Genus *Acordulecera* (species not determined)	Red Oak	West Rutland	Larvae observed feeding gregariously on oak foliage.
Rose Chafer	*Macrodactylus subspinosus*	Many	Scattered	Fewer reports than in 2011.
Saddled Prominent	*Heterocampa guttivata*	Hardwoods	Northern Vermont	Very light damage; seen in combination with other defoliators.
Satin Moth	*Leucoma salicis*	Silver maple, poplar, willow	Underhill	Moths observed in flight, but no defoliation damage reported.
Spiny Oak-Slug Caterpillar	*Euclea delphinii*	Oak	Underhill	Individual larva observed as a curiosity.
Spotted Tussock Moth	*Lophocampa maculata*	Hardwoods	Northern Vermont	Caterpillars seen in combination with other tussock moth larvae.
Uglynest Caterpillar	*Archips cerasivorana*	Cherry	Shrewsbury	Unsightly webs observed on chokecherry.
Viburnum Leaf Beetle	*Pyrrhalta viburni*	Viburnum	Scattered	Egg niches seen chewed into twigs at some locations.
White Marked Tussock Moth	*Orgyia leucostigma*	Many	Statewide	Larvae observed but no damage reported.
Winter Moth	*Operophtera brumata*	Hardwoods		Not known to occur in Vermont.
Yellownecked Caterpillar	*Datana ministra*	Birch	Morgan	Early instars observed feeding gregariously on leaves.

Hardwood defoliators not reported in 2012 include Lilac Leafminer, *Caloptilia syringella* ; Orange-humped Mapleworm, *Symmerista leucitys.*

SOFTWOOD DEFOLIATORS

Spruce Budworm, *Choristoneura fumiferana*, larvae were not seen in 2012, 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 - 2012, traps were deployed in Orleans, Caledonia, Essex and Chittenden Counties. The traps in Norton (Essex County) showed a slight increase in numbers of moths collected, but all other sites captured fewer moths than in 2011 (Table 5 and Figures 20-21). We do not anticipate defoliation by the spruce budworm in 2013.

Table 5. Average number of spruce budworm moths caught in pheromone traps, 1991-2012. Trapping had been discontinued 2004-2009. There were 3 traps per location, one location per town 2012.

County and Town	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2010	2011	2012
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
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
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
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
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
Caledonia Burke	3.5	2.3	6	3	0	2	3.7	7.3	6	30	15	3	1.7	4	1.7	0
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

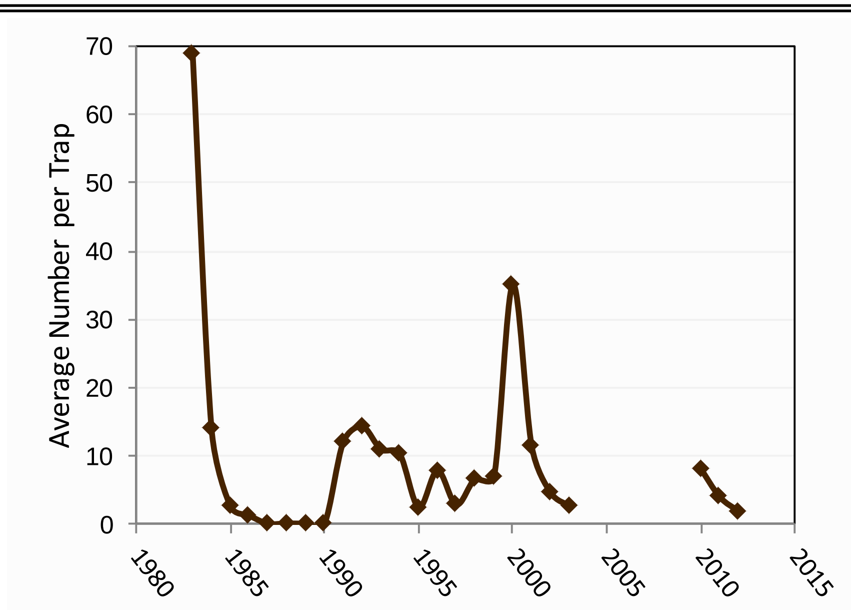
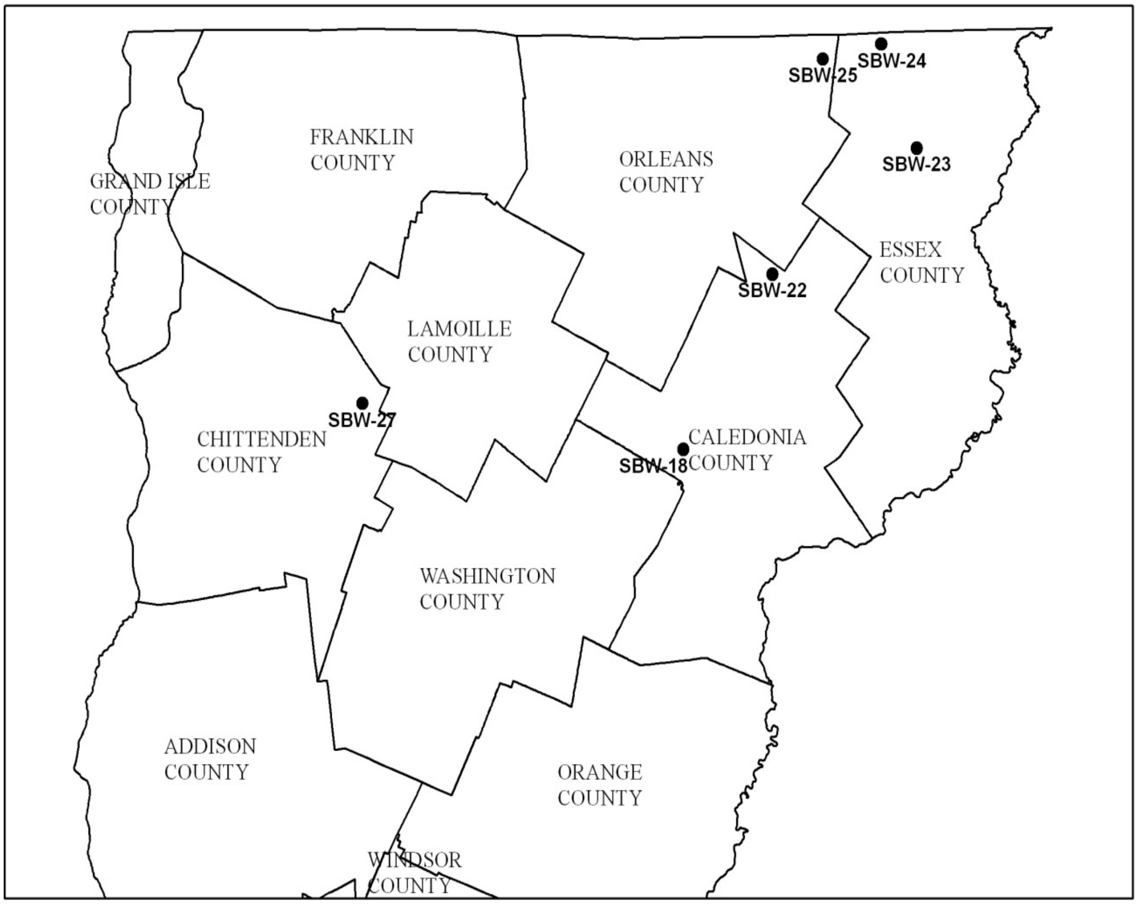


Figure 20. Average number of spruce budworm moths caught in pheromone traps 1983-2012. Trapping was discontinued, 2004-2009. Average of six locations in 2012.

Spruce Budworm Trap Locations



Trap #	Trap Location	Town	Latitude	Longitude
SBW-18	Steam Mill Brook WMA	Walden	N44.48385	W-72.25364
SBW-22	Willoughby S.F.	Burke	N44.69555	W-72.03616
SBW-23	Tin Shack/Silvio Conte	Lewis	N44.85915	W-71.74222
SBW-24	Black Turn Brook S. F.	Norton	N44.99521	W-71.81300
SBW-25	Holland Pond WMA	Holland	N44.97610	W-71.93103
SBW-27	VMC 1400	Underhill	N44.52570	W-72.86477

Figure 21. Locations of spruce budworm pheromone traps in 2012. Coordinates are NAD83.

OTHER SOFTWOOD DEFOLIATORS

INSECT	LATIN NAME	HOST	LOCALITY	REMARKS
Arborvitae Leaf Miner	*Argyresthia thuiella*	Arborvitae	Western Vermont	Present at usual levels in ornamentals.
Dioryctria Caterpillars	*Dioryctria spp.*	Fraser Fir	Jericho	Of concern in a Christmas tree plantation.
Eastern Spruce Budworm	*Choristoneura fumiferana*	Balsam Fir and Spruce	Statewide	See narrative.
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.
Obliquebanded Leafroller	*Choristoneura rosaceana*	Fraser Fir	Jericho	Of concern in a Christmas tree plantation.
Speckled Green Fruitworm	*Orthosia hibisci*	Spruce	Woodstock	Found in opening buds of spruce; more often observed in association with deciduous trees.

Softwood defoliators not reported in 2012 included European Pine Sawfly, *Neodiprion sertifer* ; Introduced Pine Sawfly, *Diprion similis* .

SAPSUCKING INSECTS, MIDGES, AND MITES

Hemlock Woolly Adelgid, *Adelges tsugae,* previously detected in only Windham County, was discovered in seven new towns in 2012, including Pownal, a town in Bennington County. Infestations are known to be active at 69 locations in 13 towns: Brattleboro, Dummerston, Grafton, Guilford, Halifax, Jamaica, Marlboro, Newfane, Pownal, Putney, Townshend, Vernon, and Wardsboro (Figure 22).

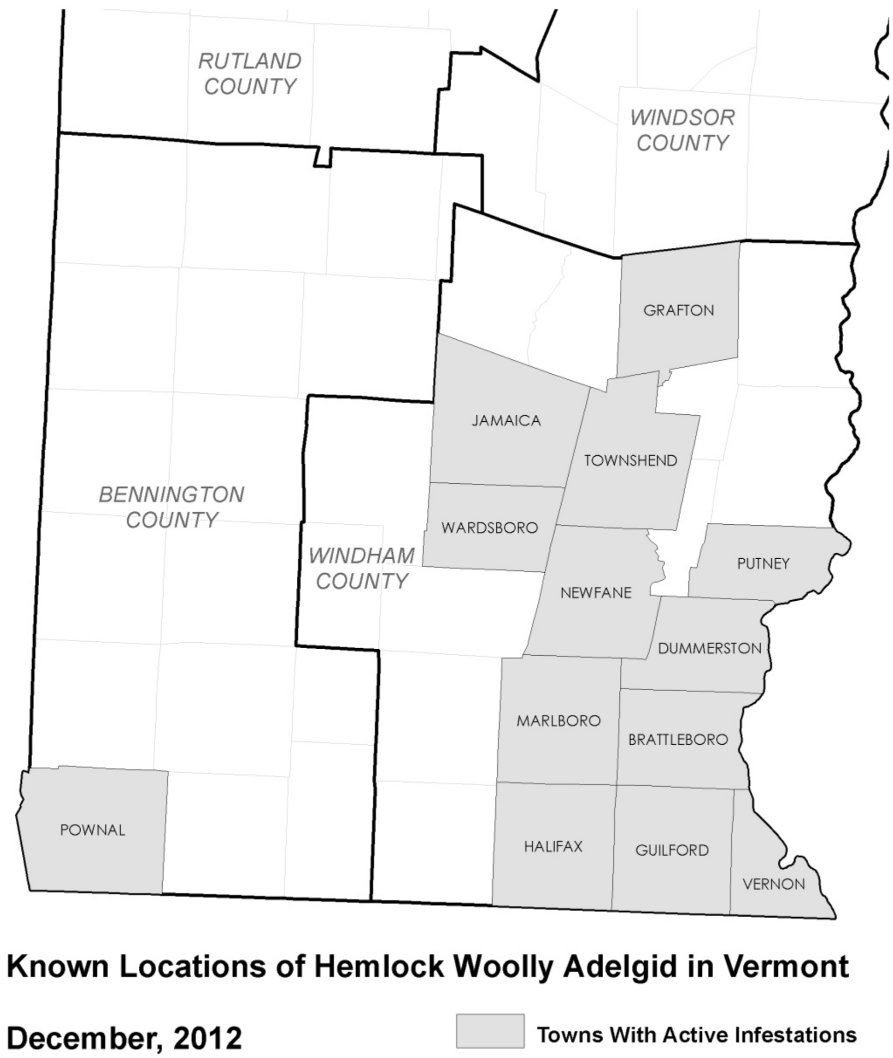


Figure 22. Towns known to have hemlock woolly adelgid infested trees in 2012.

All bordering towns with known infestations of hemlock woolly adelgid were surveyed. In each town, five high risk sites were visited. High risk sites included locations near water, travel corridors, and infestations in neighboring towns. A minimum of 200 branches per site was examined for hemlock woolly adelgid. Research suggests that, at this sampling intensity, the likelihood of missing a detectable population is low.

Nineteen towns had survey work done, and a total of 65 sites were surveyed (Table 6). Trained volunteers assist in detection surveys. Twenty-nine citizen monitors completed 26 of the site surveys.

Two blitz surveys, one in Newfane and one in Grafton/Athens area, were conducted in 2012. Fifteen volunteers surveyed 8 sites. The first discoveries of HWA in Newfane were made during one of these blitzes. Volunteers were also instrumental in conducting a delimiting survey of the Pownal infestation. The six volunteers helped confirm the Pownal infestation to be about 2 acres in size.

We also received reports of suspect infestations from Tree Wardens, First Detectors, and informed citizens. All reported suspects were followed up in the lab or by field visit.

Table 6. Hemlock woolly adelgid detection surveys conducted in 2012.

	# Surveyed in 2012	# of New Detections in 2012	# Known to be Infested
Towns	19	7	13
Sites	65	32	69

Outreach supports early detection, appropriate management, and quarantine compliance. Hemlock woolly adelgid materials were made available on the Vermont Forestry Division website, **vtforest.com**, including an update of the leaflet, "Hemlock Woolly Adelgid in Vermont: Recommendations for Landowner Response", and the annual revision of "Vermont Invasive Forest Pest Update: Hemlock Woolly Adelgid." Hemlock woolly adelgid information has also been prepared for the Vermont Invasives website, **vtinvasives.org**.

Overwintering mortality was assessed at five locations with **iButton data loggers**. These were installed at the sites on 12/13/11 and removed on 4/17/12. Hemlock branch tips with new growth were sampled between 4/16 - 4/20. At least 200 new sistens per site were examined under a dissecting microscope to determine the numbers of live and dead adelgids.

Winter of 2011-2012 was warmer than the previous year, and overwintering mortality of the adelgids was minimal. Mortality at the five sites averaged 5%, compared to 87% in 2010-2011 (Table 7 and Figure 23).

Table 7. Percent of hemlock woolly adelgid sistens that were dead in April 2012 at five Windham County sites, compared to minimum ambient temperature in winter 2011-2012.

Town	Winter 2009-2010		Winter 2010-2011		Winter 2011-2012			
		% Dead	Min. Temp. ^0C	% Dead	Min. Temp. ^0C*	% Dead	# of Sistens Examined	Site
Brattleboro	-17	14%	-26	96%	-22	1%	1001	World Learning
Vernon	-17	13%	-24	56%	-19	11%	215	Scott Rd
Guilford	-20	74%	-26	94%	-23	0%	202	Wilkens Hill
Townshend	-18	9%	NA	89%	-21	11%	791	Townshend SP
Jamaica	-19	13%	-24	98%	-22	2%	235	Jamaica SP
Average	**-18**	**25%**	**-25**	**87%**	**-21.3**	**5%**		

* The minimum temperature occurred on 1/16/12 at all sites.

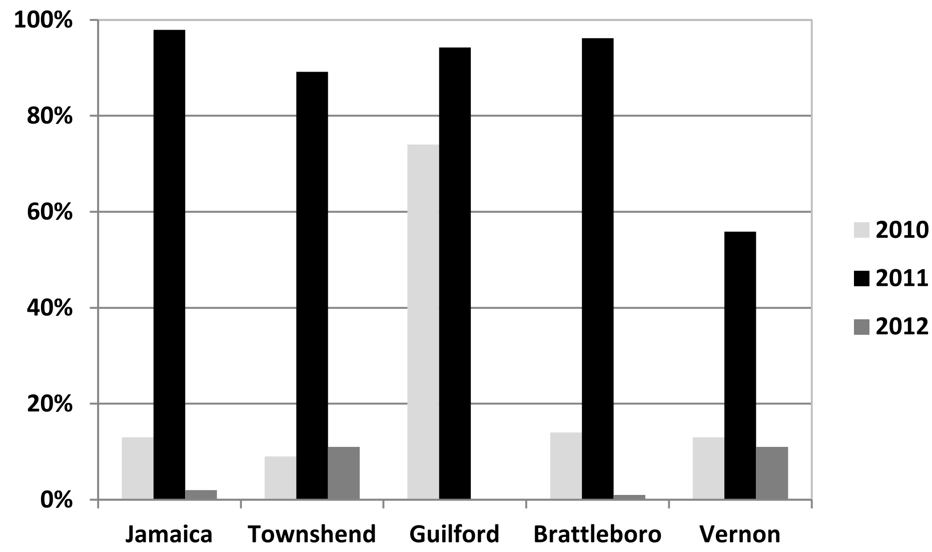


Figure 23. Comparison of mortality of hemlock woolly adelgid sistens at five Windham County sites 2011-2012.

The "State of Vermont Joint Quarantine #2: Hemlock Woolly Adelgid" remains in effect to slow the spread of hemlock woolly adelgid. With the addition of a new infested Vermont County, we plan to revise this quarantine in 2013. Currently eight facilities have hemlock woolly adelgid compliance agreements. Four of these sites were resurveyed in fall 2012 to ensure that no hemlock woolly adelgid has spread to nearby trees. We worked with two communities to develop methods for safely disposing of potentially infested hemlock debris.

The two sites where the predatory beetle, *Larcicobius nigrinus,* was released in fall 2009 were sampled for beetles on April 30th with Dr. Geena Davis from the University of Massachusetts. Seven *L. nigrinus* larvae were recovered at each site. On December 13th, 65 beetles more Idaho-strain adults, reared at the NJ Dept of Agriculture Beneficial Insect Rearing Laboratory, were released to supplement the population. On December 6th, 379 Idaho-strain adults, reared at Virginia Tech, were released at the newly detected site in Pownal.

Work continued on the cooperative investigation into the potential use of native insect-killing fungi for the biocontrol of hemlock woolly adelgid, being conducted by the University of Vermont Entomology Research Laboratory. In 2012, *Myriangium* sp. was applied to infested hemlock trees at two sites in Brattleboro. One treatment occurred in May, the second in August. Evaluation is ongoing. This work is funded by the US Forest Service and the Northeastern States Research Cooperative.

Vermont continues to collaborate with the states of New Hampshire and Maine and with the US Forest Service to develop a regional approach to managing this insect. Impact monitoring plots are being established. In 2013, we plan to complete BMPs for managing hemlock, and conduct treatments at selected high-value demonstration sites. Hemlock woolly adelgid will be a consideration for several communities completing an Invasive Forest Pest Preparedness and Response Plan.

Pear Thrips, *Taeniothrips inconsequens*, in concert with anthracnose, Septoria and other leaf spots, drought and frost, caused widespread concern in some parts of the state. These agents were difficult to separate during aerial surveys; the damage mapped (52,558 acres) is categorized as Hardwood Defoliation Complex under Foliage Diseases (page 68).

Thrips damage ranged from moderate to heavy in 2012. An increase in numbers of thrips was anticipated due to heavy pollen production in 2011 because a diet that includes pollen significantly increases adult longevity and number of eggs laid by thrips.

Heaviest damage was in southern Vermont. Although some refoliation occurred, most trees retained damaged leaves all summer. Impacts on tree health are expected due to diminished photosynthetic capacity.

In long-term monitoring plots at Proctor Maple Research Center in Underhill, the first thrips appeared on yellow sticky traps on March 23rd. During that week (March 19 through March 26), a total of 121 thrips was collected on the traps, reflecting significant early activity. Overall thrips populations increased at the monitoring location in 2012, with a total of 409 thrips as compared with 248 in 2011. In 2010, 1,021 were captured, and there were high numbers early that year as well, beginning the week of April 4 – 7, when 408 thrips were counted on the traps (Table 8). Overall thrips counts on sticky traps by year for 1993 – 2012 appear in Figure 24.

Table 8. Total pear thrips counts on yellow sticky traps at Proctor Maple Research Center in Underhill, VT, from 1993-2012. Sticky traps are deployed in sets of four. Traps are evaluated and replaced each week and monitored throughout pear thrips emergence.

2008		2009		2010		2011		2012	
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 – 4/10	0	4/3 – 4/9	0	4/2 – 4/7	408	4/6 – 4/12	0	3/26 – 4/2	6
4/10 – 4/16	13	4/9 – 4/16	25	4/7 – 4/15	100	4/12 – 4/21	2	4/2 – 4/9	7
4/16 – 4/25	261	4/16 – 4/23	111	4/15 – 4/23	102	4/21 – 4/29	191	4/9 – 4/16	84
4/25 – 5/2	12	4/23 – 4/30	39	4/23 – 5/3	175	4/29 – 5/6	10	4/16 – 4/23	23
5/2 – 5/9	36	4/30 – 5/7	19	5/3 – 5/11	151	5/6 – 5/13	9	4/23 – 4/30	8
5/9 – 5/23	19	5/7 – 5/14	55	5/11 – 5/18	43	5/13 – 5/20	16	4/30 – 5/7	53
5/23 – 6/10	9	5/14 – 5/21	33	5/18 – 5/24	36	5/20 – 5/27	15	5/7 – 5/14	65
		5/21 – 5/28	11	5/24 – 6/1	4	5/27 – 6/2	5	5/14 – 5/21	25
		5/28 – 6/4	2	6/1 – 6/7	2			5/21 – 5/30	16
								5/30 – 6/4	1
Total	**350**		**296**		**1,021**		**248**		**409**

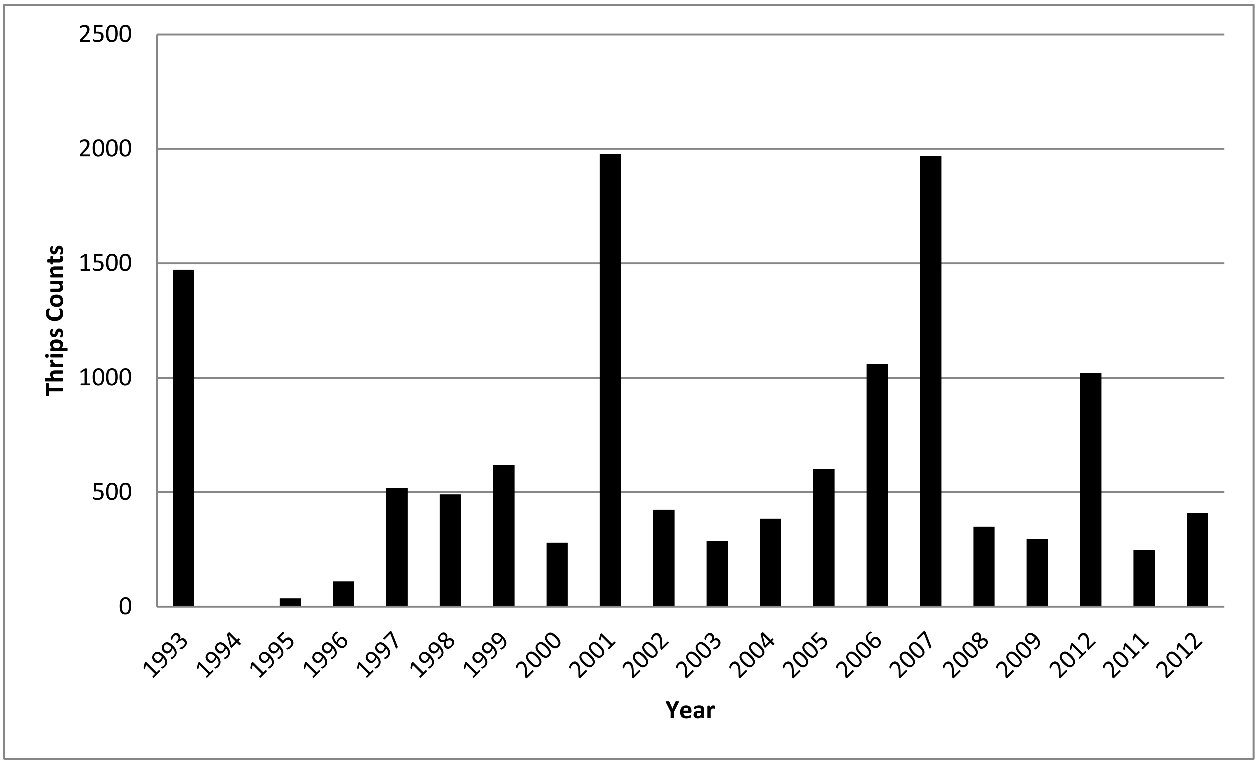


Figure 24. Overall thrips counts on sticky traps by year, 1993-2012.

OTHER SAPSUCKING INSECTS, MIDGES, AND MITES

INSECT	LATIN NAME	HOST	LOCALITY	REMARKS
Balsam Gall Midge	*Paradiplosis tumifex*	Balsam fir	Springfield	Isolated pocket of heavy damage.
Balsam Twig Aphid	*Mindarus abietinus*	Balsam fir	Throughout	Present, but only at a low level on Christmas trees.
Balsam Woolly Adelgid	*Adelges picea*	Balsam fir	Windham County	Increase in dieback and mortality in previously infested trees.
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.
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.	No significant damage has been reported. Though this insect has been reported in Vermont, it may not reproduce here.
Cinara Aphids	*Cinara spp.*	Balsam fir	Craftsbury	Observed on scattered trees.
Elongate Hemlock Scale	*Fiorinia externa*	Hemlock		Not known to occur in Vermont, but targeted during surveys for hemlock woolly adelgid.
Fletcher Scale	*Parthenolecanium fletcheri*	Juniper	Manchester	Combined with winter kill.
Gouty Vein Gall Midge	*Dasineura communis*	Maple	Bristol, Waterbury	Elongate pouch galls obvious in major leaf veins.
Hemlock Woolly Adelgid	*Adelges tsugae*	Hemlock	Windham and Bennington County	See narrative.
Hickory Spider Mite	*Oligonychus* sp.	Shagbark hickory	Brattleboro	Minor bronzing.

OTHER SAPSUCKING INSECTS, MIDGES, AND MITES

INSECT	LATIN NAME	HOST	LOCALITY	REMARKS
Lacebugs	*Corythucha* sp.	Oak and sycamore	Champlain Valley and Windsor County	Minor damage reported.
Pear Leaf Blister Mite	*Phytoptus pyri*	Pear	St. Johnsbury	Increased injury by this insect has been reported when spring conditions are cooler than normal.
Pear Thrips	*Taeniothrips inconsequens*	Hardwoods	Statewide	See narrative.
Pine Bark Adelgid	*Pineus strobi*	White pine	Southern Vermont	Light populations.
Pine Leaf Adelgid	*Pineus pinifoliae*	White pine and Red spruce	Stowe, Halifax	Resultant drooping and discoloration of new lateral shoots observed on pine.
Pine Needle Scale	*Chionapsis pinifoliae*	Pines and sometimes other conifers	St Johnsbury and Brattleboro	In Brattleboro, found on hemlock; in St. Johnsbury, found on balsam fir.
Short Needle Conifer Scale	*Dynaspidiotus tsugae*	Balsam fir	St. Johnsbury	Light population.
Spruce Gall Adelgids	*Adelges* spp.	Spruce	Widely scattered	Not unusual on spruce in the higher elevations.
Spruce Spider Mite	*Oligonychus ununguis*	Conifers	Statewide	Only light damage observed.
Sumac Gall Aphid	*Melaphis rhois*	Sumac	Waterbury	Seen as a curiosity rather than a threat to the health of the tree.
Woolly Alder Aphid	*Paraprociphilus tessellatus*	Silver maple and alder	Plainfield	Winged migrant adults, with abdomens covered in white fluffy wax, were observed.

Sapsucking Insects, Midges and Mites that were not reported in 2012 include Beech Blight Aphid, *Grylloprociphilus imbricator* ; Cottony Maple Scale, *Pulvinaria innumerabilis* ; Erineum Gall Mite, *Aceria elonagtus* ; Honeylocust Plant Bug, *Diaphnocoris chlorionis* ; Oystershell Scale, *Lepidospaphes ulmi* ; Lecanium Scale, *Lecanium* sp., Pine Fascicle Mite, *Trisetacus alborum* ; Pine Spittlebug, *Aphrophora parallela* ; Ragged Spruce Gall Aphid, *Pineus similis.*

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. In 2012, an adult beetle was collected at Hinesburg Town Forest in Chittenden County, a new county record. A federal 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	Bennington County	Drooping, dead branches common.
Pine Gall Weevil	*Podapion gallicola*	Red pine	Williamstown	Light damage to a red pine plantation.
White Pine Weevil	*Pissodes strobi*	White pine and Colorado blue spruce	Throughout	Common at low levels.

Bud and Shoot Insects not reported in 2012 included Balsam Shootboring Sawfly, *Pleroneura brunneicornis* ; Maple Petiole Borer, *Caulocampus acericaulis* .

ROOT INSECTS

INSECT	LATIN NAME	HOST	LOCALITY	REMARKS
Conifer Root Aphid	*Prociphilus americanus*	Balsam Fir	Essex, Morrisville	Stunting young Christmas trees.
Green June Beetle	*Cotinus nitida*	Many	Newfane	Showy adult observed, but no damage was reported. Larvae feed on roots, while adults feed on pollen, fruit and leaves of many hosts.
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 2012.

Root Insects not reported in 2012 included Conifer Swift Moth, *Korsheltellus gracillis* .

BARK AND WOOD INSECTS

Asian Longhorned Beetle, *Anoplophora glabripennis,* is not known to occur in Vermont and we do not recommend any management adjustments in anticipation of this insect. Early detection is particularly important, however, and we continue to concentrate our cooperative efforts in the State on tactics aimed toward this end. These strategies involve surveys and follow-up on any inquiries about potential sightings or infestations. We prioritize outreach to improve public awareness through presentations and press releases, with special focus on discouraging the movement of firewood and other wood products that may be routes of entry. (See Firewood section below.) We encourage everyone to familiarize themselves with the signs and symptoms of Asian longhorned beetle presence or attack and to keep their eyes open for potential infestations. An action plan has been developed to improve our ability to respond in the event that the Asian longhorned beetle is discovered in Vermont.

Brown Spruce Longhorn Beetle, *Tetropium fuscum*, and **Black Spruce Beetle**, T. *castaneum*, two nationally-targeted longhorned beetles, were part of a Cooperative Agriculture Pest Survey (CAPS) pheromone-baited trap survey in Vermont again in 2012. No target *Tetropium* species were found in Vermont.

Tetropium fuscum is an invasive wood boring beetle from Europe. It has been established in Halifax, Nova Scotia since at least 1990, and was recently detected in New Brunswick. *T. castaneum* is not known to be established in North America, but it has been intercepted in western Canada (British Columbia) and in the western United States (two sites in Oregon).

In 2012, FPR deployed a single trap in Essex County, VT in the town of Brunswick at Denis Pond (N44.72199, W-71.64670). The trap was in place from May 15 through August 21. No target *Tetropium* beetles were found at the trap site. However, a total of 85 specimens of the indigenous *Picea*-feeding species, *T. cinnamopterum*, were collected. The non-target by-catch included two cerambycids (*Spondylis upiformis* and *Monochamus s. scutellatus*) and about 20 scolytids (Table 9). APHIS set an additional 19 traps in the following counties: Addison, Caledonia, Orleans, Rutland, Washington, Windham and Windsor and the Vermont Agency of Agriculture, Food and Markets deployed five traps in Chittenden and Franklin Counties (Figure 25). A single specimen of *Sirex noctilio* was found in August 2012 in a *Tetropium* trap in Brattleboro, VT.

Table 9. Placement and collection dates and numbers of target and non-target Cerambycids found during 2012 *Tetropium* spp. pheromone trap surveys in the town of Brunswick in Essex County, VT.

Placement Date	Collection Date	Number of Target Insects	*Tetropium cinnamopterum*	Other Cerambycids	Count
15-May-12	31-May-12	0	49	*Spondylis upiformis*	1
31-May-12	11-Jun-12	0	11	none	
11-Jun-12	25-Jun-12	0	22	*Monochamus s. scutellatus*	1
25-Jun-12	09-Jul-12	0	3	none	
09-Jul-12	23-Jul-12	0	10	*Monochamus s. scutellatus*	1
23-Jul-12	06-Aug-12	0	7	*Monochamus s. scutellatus*	1
				Stictoleptura canadensis	2
06-Aug-12	21-Aug-12	0	0	none	

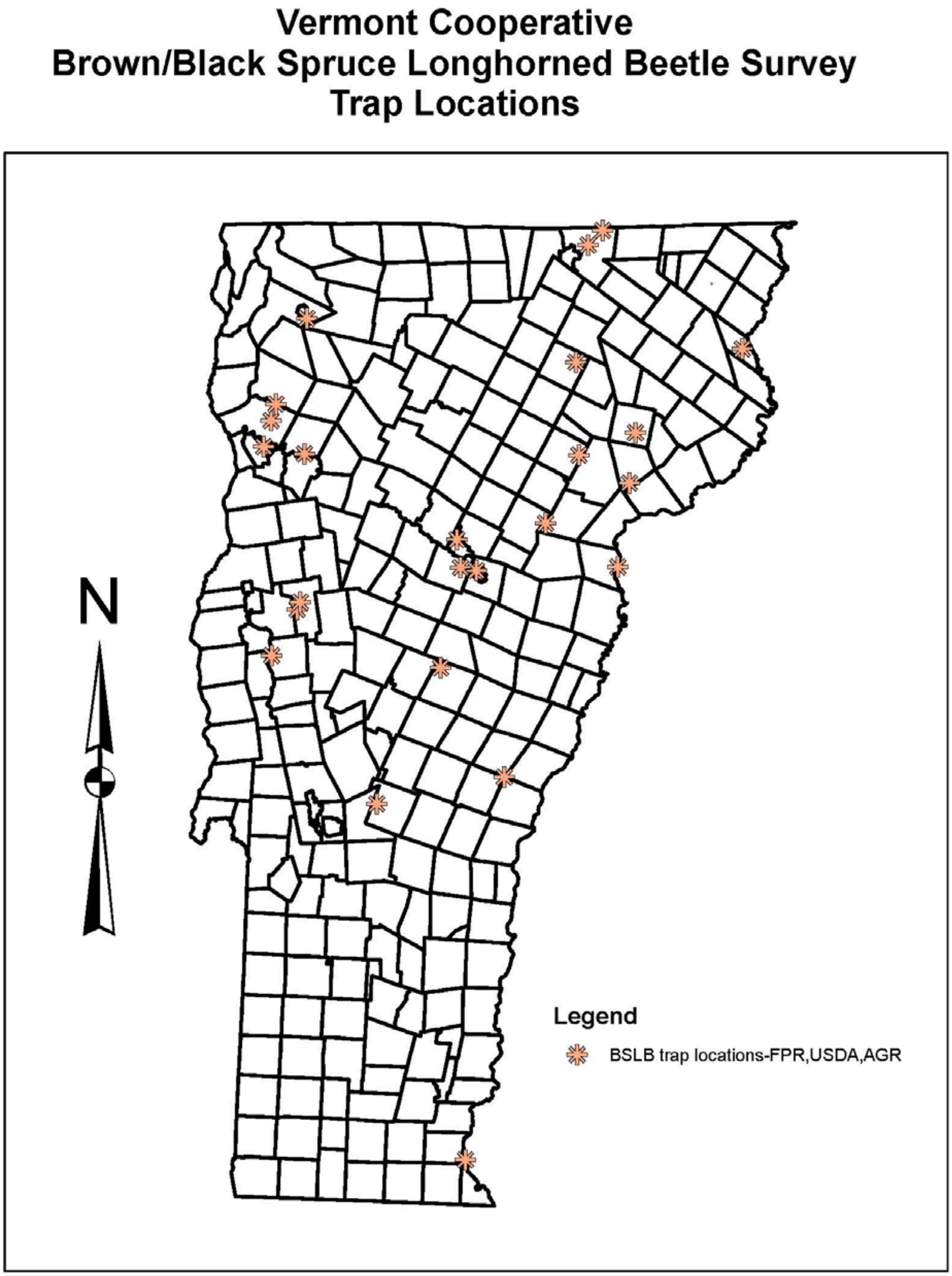


Figure 25. Location of traps deployed for *Tetropium* species in 2012 by FPR, USDA APHIS and Vermont Agency of Agriculture, Food and Markets. *Map credit: Rhonda Mace, USDA APHIS.*

Emerald Ash Borer (EAB), *Agrilus planipennis,* is not known to occur in Vermont and was not detected by public outreach or survey. In 2012, new EAB infestations were detected in New Haven County in Connecticut and in the town of Dalton in western Massachusetts. There were also several detections east of the Hudson River in New York. EAB was also detected in some new Quebec locations in 2012, but none of these newly-detected sites are closer to Vermont than infestations already known to exist.

Survey efforts for EAB in Vermont in 2012 included purple traps, girdled trap trees, and monitoring *Cerceris fumipennis* wasp nest sites in biosurveillance surveys.

Purple traps were deployed at 1,281 locations in Vermont in 2012 in an effort led by USDA-APHIS (Figure 26). The Agency of Agriculture, Food and Markets set out 90 of these traps, USDA deployed 85, and a contractor put up an additional 1,196. No suspects were found on purple traps.

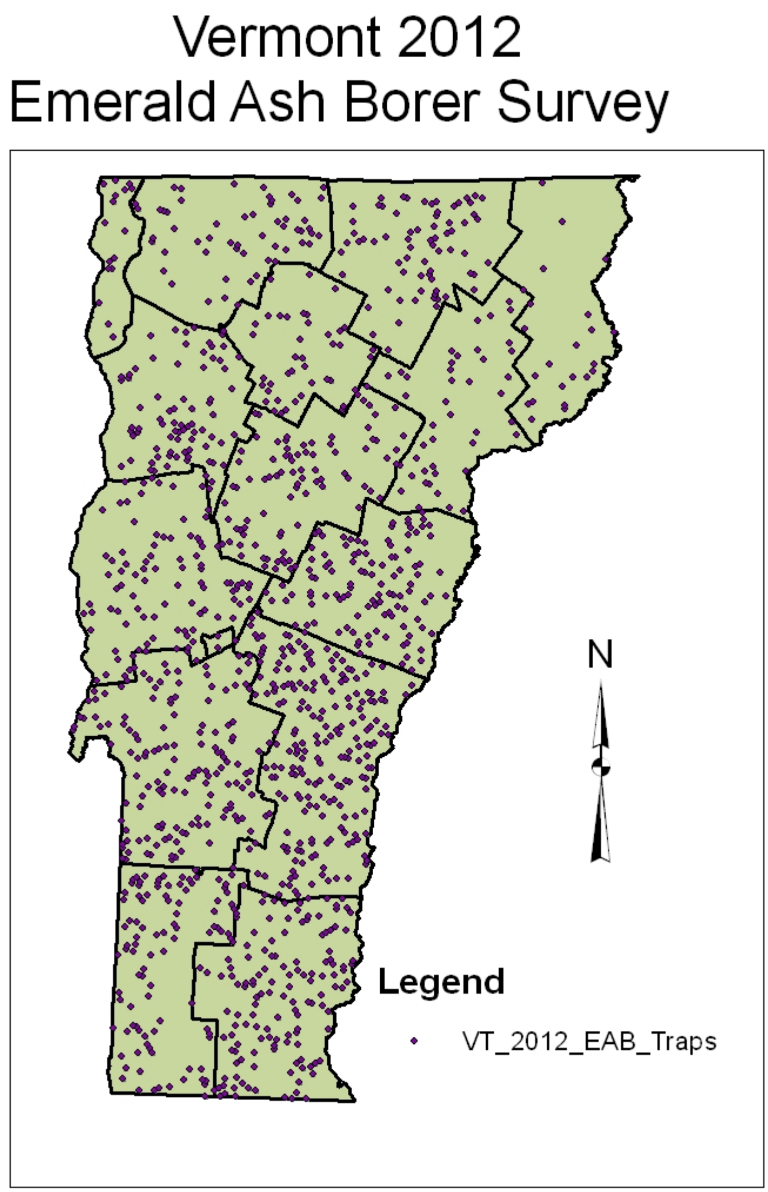


Figure 26. Location of emerald ash borer purple panel traps deployed in 2012. *Map credit: Rhonda Mace, USDA APHIS.*

We continued to use girdled trap trees as a detection tool in 2012. There were a total of 20 trap trees including 9 trees girdled by 6 volunteers (Table 10 and Figure 27). Ash trees 4 - 10" 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" DBH was collected from each tree and peeled to look for signs of emerald ash borer. No signs were found.

Table 10. Locations of girdled trap trees used to survey for emerald ash borer in 2012. Data include district, town, county, coordinates and tree identification numbers.

Trap Tree Locations 2012					
District	**Town**	**County**	**Latitude**	**Longitude**	**Tree Number**
1	Hartford	Windsor	N43.64368	W-72.33869	2012-I-01
1	Guilford	Windham	N42.82405	W-72.56664	2012-I-02
1	Andover	Windsor	N43.25528	W-72.72660	2012-I-03
1	Wilmington	Windham	N42.88338	W-72.82620	2012-I-04
2	Bennington	Bennington	N42.90100	W-73.19316	2012-II-01
2	Rutland City	Rutland	N43.61420	W-72.99360	2012-II-02
2	Middletown Springs	Rutland	N43.47234	W-73.08811	2012-II-03
2	Arlington	Bennington	N43.08888	W-73.19788	2012-II-04
2	Sunderland	Bennington	N43.07367	W-73.11163	2012-II-05
3	Sheldon	Franklin	N44.90658	W-72.97750	2012-III-01
3	Ferrisburg	Addison	N44.21656	W-73.31248	2012-III-02
4	Montpelier	Washington	N44.25772	W-72.58858	2012-IV-01
4	Waterbury	Washington	N44.37251	W-72.76875	2012-IV-02
4	Middlesex	Washington	N44.31833	W-72.62742	2012-IV-03
4	Plainfield	Washington	N44.24566	W-72.42316	2012-IV-04
5	Jay	Orleans	N44.97986	W-72.51887	2012-V-01
5	St. Johnsbury	Caledonia	N44.45888	W-72.04855	2012-V-02
5	Charleston	Orleans	N44.82799	W-71.94781	2012-V-03
5	Hardwick	Caledonia	N44.48046	W-72.31855	2012-V-04 (4.1"dbh)
5	Hardwick	Caledonia	N44.48046	W-72.31855	2012-V-05 (4.5"dbh)

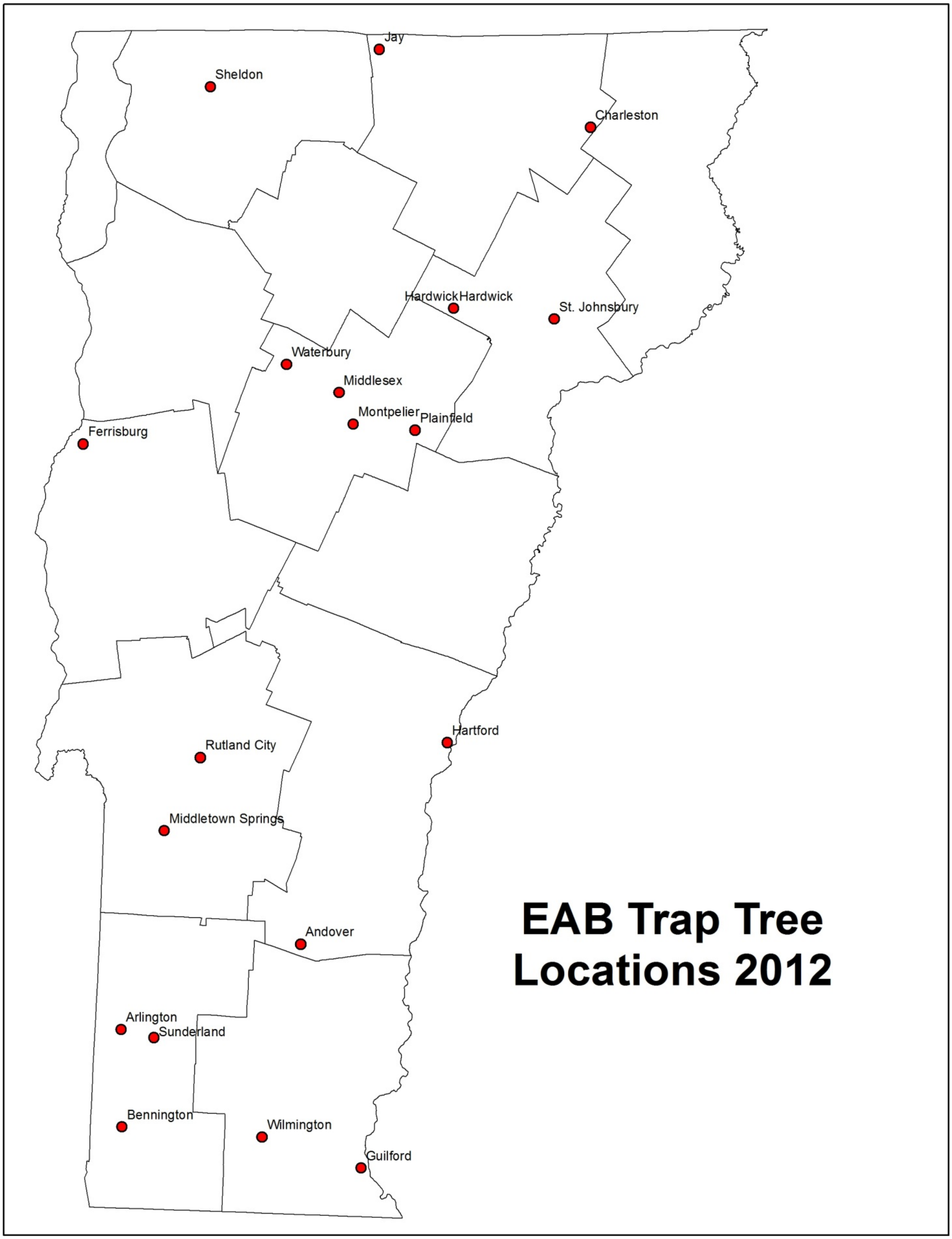


Figure 27. Locations of ash trees girdled in 2012 as part of Vermont's survey for emerald ash borer.

Surveys for the predatory wasp, *Cerceris fumipennis*, were conducted in over 50 sites in 11 Vermont counties in 2012. Addison County was not included in the 2012 explorations because that area had been covered very thoroughly in past years. Essex County warrants further work in future years. Nests were found in two counties (Bennington and Grand Isle) where we had not previously been able to locate *Cerceris* colonies. In all, 24 sites with nests were visited in 2012, and Buprestid collections were made, where possible (Table 11 and Figure 28). About 45 volunteers contributed to the survey effort by monitoring known *Cerceris* nest sites and searching for new locations. No emerald ash borer beetles were found, but 996 other buprestid beetles (species identifications pending) were collected at 18 *Cerceris* nest sites in eight Vermont counties.

During visits to Stephen Ballantine Memorial Field in Jamaica, which is one of the larger *Cerceris* nest sites we've found in Vermont, we were surprised at the number of dropped buprestid beetles we found. These were mostly *Dicerca* species. Because these beetles were clearly abandoned (*Cerceris* wasps rarely return to a site later to retrieve a dropped beetle), volunteers and others collected these beetles. At the end of the season, the beetle count from that site (438) reflected the prevalence of dropped buprestids found there.

Table 11. Vermont sites where *Cerceris fumipennis* nests were found in 2012. Data include site name, town, county, coordinates, and numbers of buprestid beetles collected at each site.

County	Town	Site	Latitude	Longitude	Number of Buprestids
Bennington	Sunderland	Jones Quarry	N43.11211	W-73.13010	51
Bennington	North Bennington	Lake Paran Baseball Field	N42.92998	W-73.23571	9
Bennington	North Bennington	North Bennington Baseball Field	N42.93102	W-73.24038	38
Bennington	Bennington	Willow Park	N42.89938	W-73.19405	1
Chittenden	Richmond	Camel's Hump Middle School	N44.41288	W-72.99572	0
Franklin	Richford	Richford Playground	N44.99380	W-72.67763	30
Franklin	Swanton	Mississquoi Valley UHS	N44.93299	W-73.10489	0
Grand Isle	Grand Isle	Alburgh Elementary	N44.98001	W-73.29717	0
Grand Isle	Grand Isle	Grand Isle Recreation Field	N44.69233	W-73.29803	2
Orange	Wells River	Blue Mountain UHSD	N44.15575	W-72.08399	58
Rutland	Castleton	Castleton Hubbardton Elem. School	N43.61962	W-73.21140	29
Rutland	Rutland Town	Dewey Field	N43.60718	W-73.01324	118
Rutland	Brandon	Estabrook Field	N43.81058	W-73.10345	59
Rutland	Poultney	Poultney High School	N43.51696	W-73.22875	0
Rutland	West Rutland	Sabotkas	N43.58551	W-73.04078	1
Washington	Barre	Spaulding High School	N44.19011	W-72.49460	1
Washington	Montpelier	U-32 High School	N44.24299	W-72.52633	3
Windham	Marlboro	Old gravel pit on Augur Hole North	N42.92210	W-72.71030	15
Windham	Putney	Sand Hill Road	N42.98179	W-72.52043	65
Windham	Jamaica	Stephen Ballantine Memorial Ballfield	N43.07638	W-72.73369	438
Windsor	Hartland	Hartland Elementary School	N43.53853	W-72.39258	1
Windsor	Wilder	Dothan Brook Elementary	N43.68891	W-72.32156	0
Windsor	Weathersfield	Wilgus State Park	N43.39086	W-72.40875	0
Windsor	Windsor	Windsor Town Rec Field	N43.46924	W-72.40329	77
GRAND TOTAL					**996**

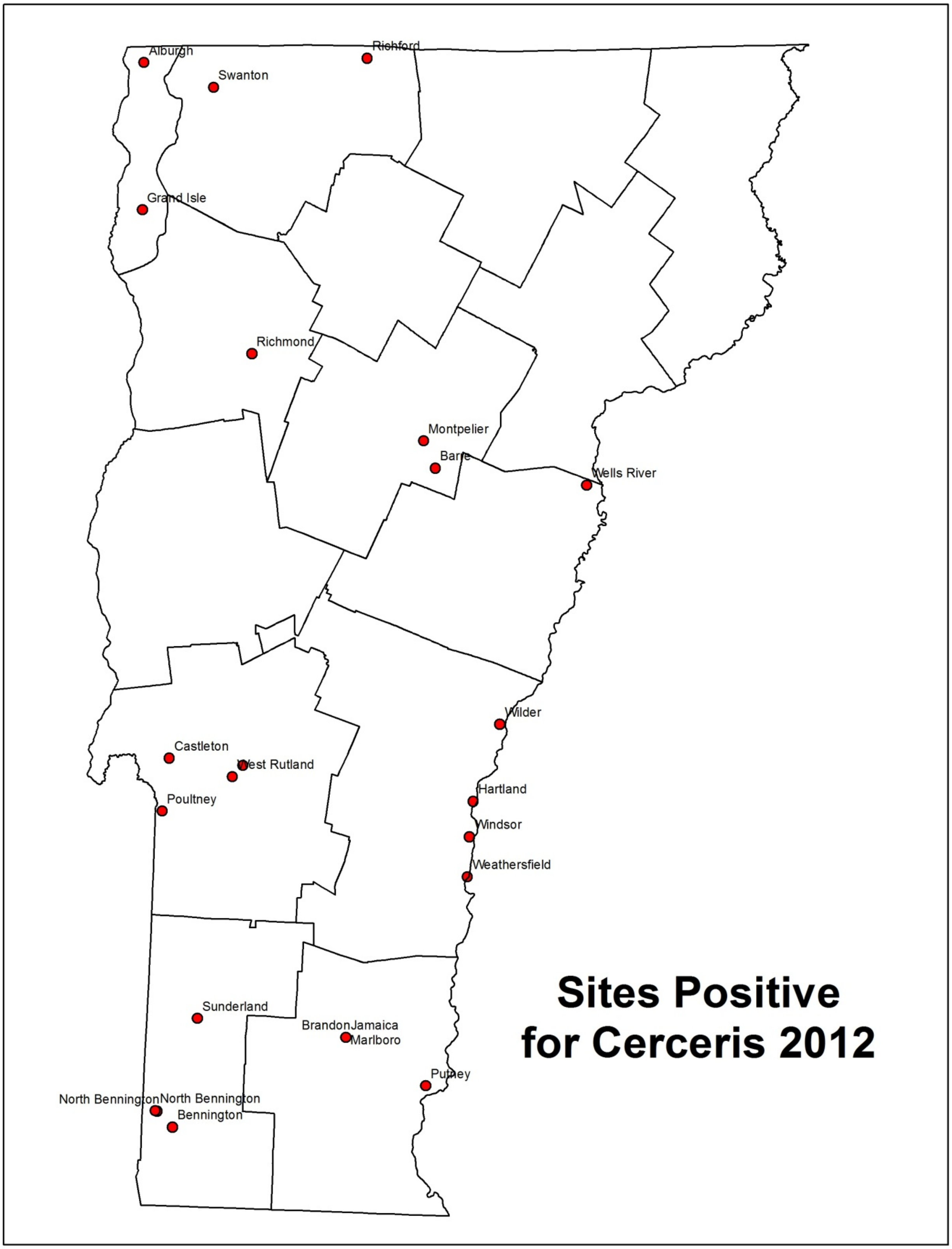


Figure 28. Location of sites where *Cerceris fumipennis* nests were found in Vermont in 2012.

A variety of preparedness activities was carried out in 2012, including an EAB detection response drill to simulate and test-drive coordination efforts between responsible agencies before an actual EAB detection in Vermont. We also completed a technical publication that provides information to assist landowners and managers in making decisions about ash management. (See **Ash Management Guidance for Forest Managers.)** A **Policy on Forest Management Plans and Amendments for Land Enrolled in Vermont's Use Value Appraisal Program (UVA) Related to Emerald Ash Borer** has been developed. Plans to treat ash in response to emerald ash borer will be approved for UVA lands as long as they adhere to the program's minimum standards.

In 2013, there will be a push to work with communities to develop invasive pest action plans. Work continues on pre-planning for biological control, pesticide use, and quarantine compliance agreements.

Firewood

Don't Move Firewood activities continued in 2012 to slow the spread of non-native bark and wood insects and pathogens. The 2012 camping season was the fourth year of the firewood exchange program. As in past years, FPR Forest Resource Protection staff worked with Vermont State Park Rangers throughout the summer to collect bags of firewood from campers who brought the wood to campgrounds from more than 50 miles away. In November the double-bagged and sealed parcels of firewood were opened. Each stick of wood was given a quick examination for evidence of Asian longhorned beetle or emerald ash borer. The firewood was given to a state facility for burning this winter. Though the amount of exchanged firewood has declined over the past two years, 136 bundles were collected in 2012 from as far away as North Carolina, and from areas under quarantine, including from EAB regulated areas in Virginia and Pennsylvania, the New York City federal ALB quarantine area, and from Quebec in violation of a firewood prohibition. Table 12 summarizes the number of bags of firewood collected for each year of the program, and Table 13 provides information about points of origin of confiscated wood.

Table 12. Numbers of bags of firewood from over 50 miles away that were brought into Vermont State Parks during the 2009-2012 camping seasons.

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

Table 13. Points of origin of firewood brought by campers to Vermont State Parks in 2012, and notes about each state's regulations and quarantines.

Point of origin of firewood	State/Province Rules and Regulations
Connecticut	One county in CT has a federal and state quarantine for EAB. Unknown where in CT this wood originated.
Maine	Legal to move firewood out of state.
Massachusetts	There are several ALB-infested towns in MA. Unknown where in MA this wood originated.
New Hampshire	Legal to move firewood out of state.
New Jersey	There are two ALB quarantined counties in NJ. Unknown where in NJ this wood originated.
New York	In 2012, one bag of wood from the New York City federal ALB quarantine area was brought into a Vermont State Park.
North Carolina	Legal to move firewood out of state.
Pennsylvania	Four bags of wood came from an EAB infested County. Illegal to move.
Rhode island	Legal to move firewood out of state.
Virginia	Illegal to move firewood out of state due to federal EAB quarantine.
Quebec	Illegal to bring firewood over the Canadian border (either way).

Trypodendron **Bark Beetle Surveys**

In 2012, we continued our cooperation in a taxonomic study to help ascertain the status and distribution of members of the ambrosia beetle genus *Trypodendron* in North America. Five Uni-Traps were deployed at a wind-disturbed mixed forest in Hinesburg (Hinesburg Town Forest). Two traps were set in mixed spruce stands and three traps were set in mixed hardwood stands.

In the spruce stands, we used lineatin pheromone, alpha-pinene and ethanol. In the hardwood stands, we used a combination of lineatin, ethanol and the "natural lure" of small, cut branches of yellow birch that were bruised and draped with a wire over the traps. We used dry cups with vapona killing strips for collecting insects lured to the traps. Traps were emptied every two weeks from March 12 to September 8, 2012. Beetles were identified by Robert Acciavatti, US Forest Service.

A total of 450 bark beetles was collected in the traps. *Trypodendron* beetles (352 specimens) were collected at all five sites, and included four species, *T. borealis, T. lineatum*, *T. retusum,* and *T. rufitarsis*. The most numerous species of bark beetle collected during the survey (294 specimens) was *Trypodendron borealis.* Other species of Scolytinae collected during the survey included *Anisandrus sayi* (40 specimens), *Crypturgus borealis* (1), *Dryocoetes affaber* (5), *Dryocoetes autographus* (1), *Hylastes opacus* (1), *Hylesinus aculeatus* (2), *Hylurgops rufipennis piniflex* (1), *Hypothenemus* sp. (5), *Orthotomicus caelatus* (2), *Pitogenes hopkinsi (1), Pityophthorus* sp. (22), *Polygraphus rufipennis* (2), *Pseudopityophthorus* sp. (1), *Xyleborinus alni* (1), *Xylosandrus germanus* (10), and *Xyloterinus politus* (3).

Table 14. Trap sites and collection dates for *Trypodendron* taxonomic survey conducted in Vermont in 2012. All traps were in Chittenden County at the Hinesburg Town Forest. Data include trap site code, coordinates, trap and lure types, host trees, collection dates, and species and numbers collected.

Location	Coordinates (NAD 83)	Monitoring System	Pheromone Type	Tree Species	Placement Date	Collection Date	*Trypodendron betulae*	*Trypodendron borealis*	*Trypodendron lineatum*	*Trypodendron retusum*	*Trypodendron rufitarsis*
Hinesburg, Chittenden County, VT: Hinesburg Town Forest Spruce 1	N44.31934, W-73.03344	Uni-trap	Lineatin, alpha-pinene and ethanol	Mixed spruce and pine	12-Mar-12	31-Mar-12	0	0	1	0	6
					31-Mar-12	14-Apr-12	0	0	0	0	0
					14-Apr-12	29-Apr-12	0	0	0	0	0
					29-Apr-12	12-May-12	0	0	0	0	0
					12-May-12	27-May-12	0	31	10	0	0
					27-May-12	11-Jun-12	0	11	7	0	0
					11-Jun-12	24-Jun-12	0	57	0	0	0
					24-Jun-12	08-Jul-12	0	33	1	0	0
					08-Jul-12	22-Jul-12	0	46	0	0	0
					22-Jul-12	05-Aug-12	0	4	0	0	0
					05-Aug-12	19-Aug-12	0	0	0	0	0
					19-Aug-12	8-Sept-12	0	0	0	0	0
				TOTALS			0	182	19	0	6
Hinesburg, Chittenden County, VT: Hinesburg Town Forest Spruce 2	N44.32048, W73.03131	Uni-trap	Lineatin, alpha-pinene and ethanol	Mixed spruce; mostly Norway	12-Mar-12	31-Mar-12	0	12	0	2	0
					31-Mar-12	14-Apr-12	0	3	0	1	0
					14-Apr-12	29-Apr-12	0	4	0	2	0
					29-Apr-12	12-May-12	0	0	0	0	0
					12-May-12	27-May-12	0	11	11	0	0
					27-May-12	11-Jun-12	0	9	8	1	0
					11-Jun-12	24-Jun-12	0	30	29	1	0
					24-Jun-12	08-Jul-12	0	27	27	0	0
					08-Jul-12	22-Jul-12	0	26	24	0	0
					22-Jul-12	05-Aug-12	0	0	0	0	0
					05-Aug-12	19-Aug-12	0	0	0	0	0
					19-Aug-12	8-Sept-12	0	0	0	0	0
				TOTALS			0	122	99	7	0
Hinesburg, Chittenden County, VT: Hinesburg Town Forest Birch 1	N44.31939, W-73.03114	Uni-trap	Lineatin, ethanol and birch branch	Birch and other mixed hardwood species	12-Mar-12	31-Mar-12	0	0	0	0	0
					31-Mar-12	14-Apr-12	0	0	0	0	0
					14-Apr-12	29-Apr-12	0	0	0	0	0
					29-Apr-12	12-May-12	0	0	0	0	0
					12-May-12	27-May-12	0	2	0	0	0
					27-May-12	11-Jun-12	0	1	0	0	0
					11-Jun-12	24-Jun-12	0	1	0	0	0
					24-Jun-12	08-Jul-12	0	1	0	0	0
					08-Jul-12	22-Jul-12	0	3	0	0	0
					22-Jul-12	05-Aug-12	0	0	0	0	0
					05-Aug-12	19-Aug-12	0	0	0	0	0
					19-Aug-12	8-Sept-12	0	0	0	0	0
				TOTALS			0	8	0	0	0

Location	Coordinates (NAD 83)	Monitoring System	Pheromone Type	Tree Species	Placement Date	Collection Date	*Trypodendron betulae*	*Trypodendron borealis*	*Trypodendron lineatum*	*Trypodendron retusum*	*Trypodendron rufitarsis*
Hinesburg, Chittenden County, VT: Hinesburg Town Forest Birch 2	N44.32056, W-73.02851	Uni-trap	Lineatin, ethanol and birch branch	Birch and other mixed hardwood species	12-Mar-12	31-Mar-12	0	0	1	1	0
					31-Mar-12	14-Apr-12	0	0	0	0	0
					14-Apr-12	29-Apr-12	0	0	1	0	0
					29-Apr-12	12-May-12	0	0	0	0	0
					12-May-12	27-May-12	3	1	0	0	3
					27-May-12	11-Jun-12	0	1	0	0	0
					11-Jun-12	24-Jun-12	0	2	0	0	0
					24-Jun-12	08-Jul-12	0	1	0	0	0
					08-Jul-12	22-Jul-12	0	0	0	0	0
					22-Jul-12	05-Aug-12	0	0	0	0	0
					05-Aug-12	19-Aug-12	0	0	0	0	0
					19-Aug-12	8-Sept-12	0	0	0	0	0
				TOTALS			3	5	2	1	3
Hinesburg, Chittenden County, VT: Hinesburg Town Forest Birch 3	N44.31985, W73.02725	Uni-trap	Lineatin, ethanol and birch branch	Birch and other mixed hardwood	12-Mar-12	31-Mar-12	0	0	0	1	2
					31-Mar-12	14-Apr-12	0	0	0	0	0
					14-Apr-12	29-Apr-12	0	0	0	1	0
					29-Apr-12	12-May-12	0	0	0	0	0
					12-May-12	27-May-12	0	1	0	0	0
					27-May-12	11-Jun-12	0	0	0	0	0
					11-Jun-12	24-Jun-12	0	0	1	0	0
					24-Jun-12	08-Jul-12	0	1	0	1	0
					08-Jul-12	22-Jul-12	0	0	0	0	0
					22-Jul-12	05-Aug-12	0	0	0	0	0
					05-Aug-12	19-Aug-12	0	0	0	0	0
					19-Aug-12	8-Sept-12	0	0	0	0	0
				TOTALS			0	2	1	3	2
				GRAND TOTAL			**0**	**294**	**32**	**5**	**21**

OTHER BARK AND WOOD INSECTS

INSECT	LATIN NAME	HOST	LOCALITY	REMARKS
A Horntail Wasp	*Urocerus albicornis*	Sugar maple	Swanton	Individual insect observed.
Allegheny Mound Ant	*Formica exsectoides*	Ground nests	Scattered	Nests especially large and noticeable in some locations this year.
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. Collected by *Cerceris fumipennis* wasps during biosurveillance surveys.
Black Spruce Beetle	*Tetropium castaneum*	Spruce, pine, fir and larch		Not observed or known to occur in Vermont. (See narrative under Brown Spruce Longhorn Beetle.)
Brown Spruce Longhorned Beetle	*Tetropium fuscum*	Spruce, pine and fir		Not observed or known to occur in Vermont. (See narrative under Brown Spruce Longhorn Beetle.)
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	Throughout	See Larch Decline. Mapped acres of larch decline increased in 2012.
Emerald Ash Borer	*Agrilus planipennis*	Ash		Not observed or known to occur in Vermont. See narrative.

OTHER BARK AND WOOD INSECTS

INSECT	LATIN NAME	HOST	LOCALITY	REMARKS
European Woodwasp	*Sirex noctilio*	Pines	Brattleboro	A single specimen was found in August 2012, in a trap in Brattleboro baited for *Tetropium* species. (See Brown Spruce Longhorn Beetle.) There are two previous Vermont records: a single adult found in a pheromone baited trap in Stowe in 2007 and Burlington in 2010.
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	Johnson, Morrisville, Underhill	Adults observed during flight period.
Pigeon Tremex	*Tremex columba*	Sugar maple	Scattered throughout	Occasionally observed in declining trees.
Pine Engraver	*Ips pini*	Pines	Hinesburg	Populations built up in trees damaged from December 2010 windstorm.
Pitch Mass Borer	*Dioryctria abietivorella*	Fraser Fir	Jericho	Found in a Christmas tree plantation.
Red-shouldered Pine Borer	*Stictoleptura canadensis*	Pines	Scattered observations	Captured in a trap baited for *Tetropium* species. (See narrative under Brown Spruce Longhorn Beetle.)

OTHER BARK AND WOOD INSECTS

INSECT	LATIN NAME	HOST	LOCALITY	REMARKS
Red Turpentine Beetle	*Dendroctonus valens*	Red and white pine	Mendon, Londonderry	Typically attacks stressed trees, weakening them further and predisposing them to attacks by other bark beetles.
Round-headed Apple Tree Borer	*Saperda candida*	Apple	Scattered observations	Observed in ornamental and orchard settings; brought about the final demise of one tree planted too deep.
Sugar Maple Borer	*Glycobius speciosus*	Sugar maple	Throughout	Old damage commonly observed throughout the state.
Whitespotted Sawyer	*Monochamus scutellatus*	White pine and other conifers	Common throughout	Maturation feeding on twigs more common than usual. Many inquiries resulted from people suspecting this to be Asian longhorned beetle.

Other Bark and Wood Insects not reported in 2012 included Brown Prionid, *Orthosoma brunneum*; Elm Bark Beetle, *Hylurgopinus rufipes* and *Scolytus multistriatus*; Locust Borer, *Megacyllene robinae*; Redheaded Ash Borer, *Neoclytus acuminatus.*

FRUIT, NUT AND FLOWER INSECTS

INSECT	LATIN NAME	HOST	LOCALITY	REMARKS
Asiatic Garden Beetle	*Autoserica castanea*	Many	Champlain Valley	Present at consistent levels.
Banasa Stink Bug	*Banasa dimidiata*	Pear	St. Johnsbury	Known to feed on a variety of fruits and seeds.
Blister Beetle	*Lytta sayi*	Honeylocust and lupines	Scattered observations	Present in large numbers for short period mid-late June; disappeared when all flowers were consumed.
Fir Coneworm	*Dioryctria abietivorella*	Balsam fir	Essex Junction	Larvae usually feed internally on cones, but may also feed on needles, twigs, and under bark.
Green Stink Bug	*Chinavia hilaris*	Many, including fruit trees	Widely scattered	UVM Extension reported that this year's populations were quite high. Sapsucking damage, which results in fruit deformities, also provides entry site for disease.
Rose Chafer	*Macrodactylus subspinosus*	Many	Statewide	Present, but not reported as particularly numerous in 2012.
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 2012 included Butternut Curculio, *Conotrachelus juglandis;* Plum Curculio, *Conotrachelus nenuphar* .

STEM DISEASES

Symptoms of **Ash Yellows**, caused by *Candidatus* Phytoplasma fraxini, continue to be common in southeastern and southwestern Vermont. Samples from one site in Halifax, where ash decline was occurring but no witches' brooms were observed, were sent to Agdia Testing Services. Increment core samples of bark and outer sapwood were collected from the exposed roots or root collar. Ash trees with dieback symptoms were selected for sampling, if present. The sample tested negative for the presence of phytoplasmas, according to the Phytoplasma nested Polymerase Chain Reaction (PCR) test, reinforcing the conclusion that not all ash decline is caused by ash yellows.

Beech Bark Disease, caused by *Cryptococcus fagisuga* and *Nectria coccinea var. faginata*, was the primary cause of dieback and mortality on 20,268 acres (Table 15, Figure 29). This non-native pest complex was the most common cause of decline and mortality mapped in 2012, and represented an increase over 2011. The increase may be due to the greater vulnerability of drought-stressed tissue to canker diseases.

Table 15. Mapped acres of Beech Bark Disease in 2012.

County	Acres
Addison	458
Bennington	3,775
Caledonia	1,391
Chittenden	243
Essex	3,625
Franklin	381
Grand isle	0
Lamoille	1,104
Orange	1,017
Orleans	1,410
Rutland	916
Washington	535
Windham	3,565
Windsor	1,849
Total	**20,268**

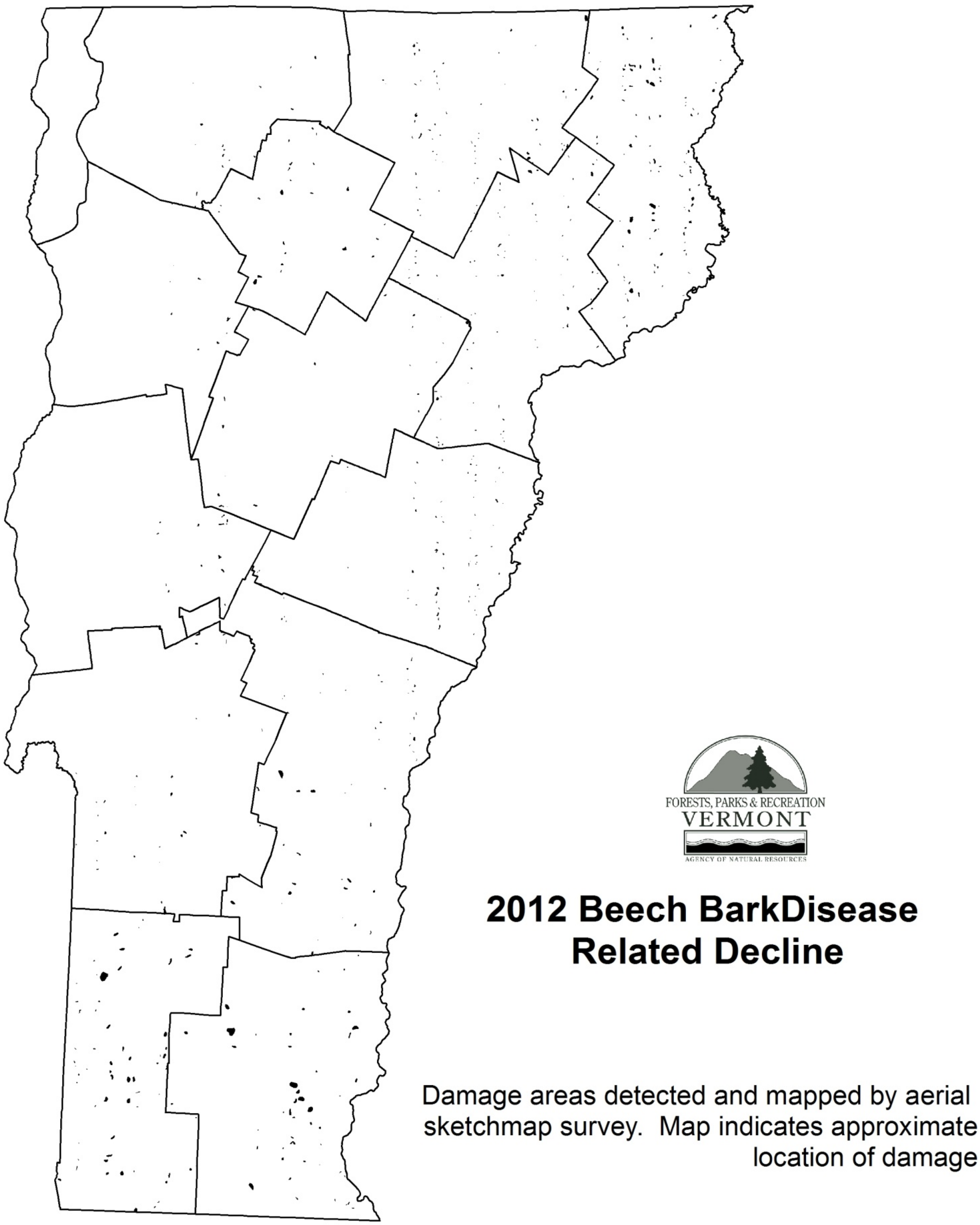


Figure 29. Beech Bark Disease related decline mapped in 2012. Mapped area includes 20,268 acres.

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

We continue to participate in a multi-state project, with Plant Technologies LLC and the Green Mountain National Forest, to conserve butternut germplasm. Sixty-four trees, grafted from 21 parent butternuts on the Green Mountain National Forest which seemed to have some disease resistance, were planted in a seed orchard in Brandon. Sixty-seven trees grafted from 30 additional Vermont butternuts are being maintained by the University of Missouri. In 2013, these trees will be outplanted in Vermont.

Hemlock Shoot Blight, caused by *Sirococcus tsugae*, was confirmed by the US Forest Service in Rutland, Windham, Windsor, Orange, and Lamoille Counties while evaluating hemlocks in FIA plots. Seedlings from plots in Rutland and Lamoille Counties had severe symptoms with, ~26-50% of shoots affected and 25-50% of the crown defoliated. Samples were collected at each plot and sent to the University of Wisconsin-Madison for PCR diagnoses.

White Pine Blister Rust, caused by *Cronartium ribicola*, continues to cause noticeable branch flagging and mortality, with 322 acres of scattered damage mapped during aerial surveys. Numerous reports of blister rust infection on “resistant” currant cultivars raise concern as interest in producing these fruits increases.

OTHER STEM DISEASES

DISEASE	LATIN NAME	HOST	LOCALITY	REMARKS
Annual Canker	*Fusarium sp.*	Red oak	Central Vermont	Scattered individual trees.
Ash Yellows	*Candidatus Phytoplasma fraxini*	White ash	Southern Vermont	See narrative.
Beech Bark Disease	*Cryptococcus fagisuga and Nectria coccinea var. faginata*	Beech	Statewide	See narrative.
Black Knot	*Dibotryon morbosum*	Cherry	Throughout	Common at normal levels.
Butternut Canker	*Sirococcus clavigignenta-juglandacearum*	Butternut	Statewide	See narrative.
Chestnut Blight	*Cryphonectria parasitica*	American chestnut	Southern Vermont, Champlain Valley	Observed on chestnut sprouts. The American Chestnut Foundation remains active in establishing seed orchards in Vermont.
Cytospora Canker	*Leucostoma kunzei*	Blue spruce	Widely scattered	More commonly reported from central Vermont.
Delphinella Tip Blight of Fir	*Delphinella balsamae*	Balsam fir	Widely scattered	Only light damage observed to Christmas trees.
Diplodia Shoot Blight	*Sphaeropsis sapinea*	Austrian pine	Colchester	
Dutch Elm Disease	*Ophiostoma novo-ulmi*	Elm	Throughout	Levels remain higher than normal, with noticeable flagging and mortality of roadside trees.
Fireblight	*Erwinia amylovora*	Apple	Rockingham	Recent planting.
Hypoxylon Canker	*Hypoxylon pruinatum*	Poplar	Widely scattered	More commonly reported from northern Vermont.
Nectria Canker	*Nectria galligena*	Hardwoods	Scattered throughout	

OTHER STEM DISEASES

DISEASE	LATIN NAME	HOST	LOCALITY	REMARKS
Oak Wilt	*Ceratocystis fagacearum*		Not observed or known to occur in Vermont.	Cultures were taken from dying trees in Middlesex at UVM. The oak wilt fungus was not recovered.
Red Ring Rot	*Phellinus pini*	White pine	Scattered throughout	Common in unthrifty stands, especially where basal area is high and soils are poorly drained.
Sapstreak	*Ceratocystis coerulescens*	Sugar maple	Guilford	Mortality of tree with root damage from construction.
Sirococcus Blight	*Sirococcus conigenus*	Red pine	Williamstown, Chelsea	Tip blight on overstory and understory trees.
Tip Blight on Eastern Hemlock	*Sirococcus tsugae*	Hemlock	Widely scattered	See narrative.
White Pine Blister Rust	*Cronartium ribicola*	White pine	Statewide	See narrative.
Willow Black Canker	*Glomerella miyabeana*	Willow	Charlotte	Heavy defoliation in early summer.
Yellow Witches Broom Rust	*Melampsorella caryophyllacearum*	Balsam fir	Widely scattered	More noticeable than normal, with heavy damage to individual trees.

Other Stem Diseases not reported in 2012 included Caliciopsis Canker, *Caliciopsis pinea;* Eastern Dwarf Mistletoe, *Arceuthobium pusillum;* Scleroderris Canker, *Ascocalyx abietina;* Verticillium Wilt, *Verticillium albo-atrum;* Woodgate Gall Rust, *Endocronartium harknessii.*

FOLIAGE DISEASES

Anthracnose, especially sugar maple anthracnose caused by *Gloeosporium sp.*, was a major contributor to the widespread **Hardwood Defoliation Complex** mapped in 2012. In all, 52,558 acres were mapped during the August aerial surveys, with the most widespread damage in southern Vermont (Table 16, Figure 30). See also Pear Thrips, Frost Damage, and Drought, which all contributed to the widespread hardwood symptoms.

Anthracnose damage was also widespread on lower branches of red oak at lower elevations in southern Vermont. However, damage to white ash was mostly light, and much less severe than in 2011.

Table 16. Mapped areas of hardwood damage caused by a complex of anthracnose, pear thrips, Septoria and other leaf spots, drought and frost in 2012.

County	Acres
Addison	3,613
Bennington	9,555
Caledonia	863
Chittenden	2,443
Essex	329
Franklin	577
Grand Isle	0
Lamoille	143
Orange	2,414
Orleans	431
Rutland	6,330
Washington	785
Windham	11,609
Windsor	13,468
Total	**52,558**

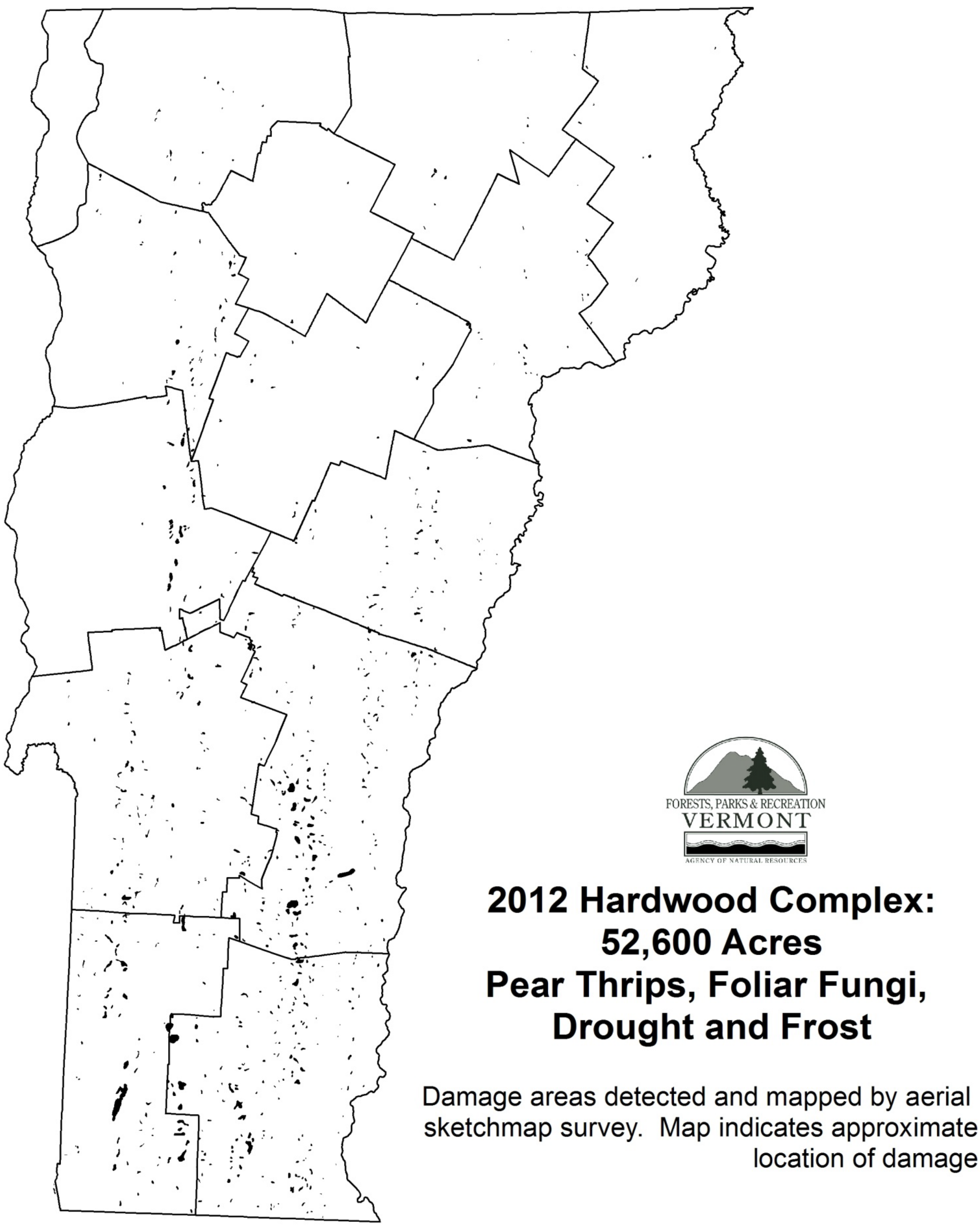


Figure 30. Hardwood damage caused by a complex of anthracnose, pear thrips, Septoria and other leaf spots, drought and frost in 2012. Mapped area includes 52,558 acres.

Septoria Leafspot on Birch was much less widespread at high elevations than in recent years, with only 2,427 acres mapped during aerial surveys, compared to 24,975 acres in 2011 (Table 17). However, defoliation of white birch by Septoria was unusually common at lower elevations in southern Vermont, and leafspot symptoms were observed statewide.

Table 17. Mapped acres of birch defoliation in 2012.

County	Acres
Addison	0
Bennington	294
Caledonia	77
Chittenden	55
Essex	18
Franklin	0
Grand Isle	0
Lamoille	0
Orange	34
Orleans	15
Rutland	1,191
Washington	29
Windham	501
Windsor	213
Total	**2,427**

Needle Diseases of White Pines continued to be widespread, with straw-colored one-year-old needles showing up suddenly in late May. Heavy flowering of white pine made the foliage look thinner still. During the aerial survey conducted over the Green Mountain National Forest on June 14 and 15, the US Forest Service mapped 3,494 acres of white pine needle damage. Although most symptomatic needles had fallen by our August survey, 552 additional acres were mapped at that time.

The USFS Northeastern Area Durham Field Office has found brown spot needleblight (*Mycosphaerella dearnessii),* and/or two needlecast fungi (*Canavirgella banfieldii* or *Bifusella linearis)* on symptomatic needles, and is continuing to investigate the roles of needlecast fungi and weather, the impact on tree growth, in cooperation with UNH and affected states. As part of this effort, we established impact plots in Plymouth, Richmond, St. Johnsbury, and Springfield.

OTHER FOLIAGE DISEASES

DISEASE	LATIN NAME	HOST	LOCALITY	REMARKS
Anthracnose	*Glomerella spp.* *Apiognomonia spp.*			See narrative.
Apple Scab	*Venturia inaequalis*	Crabapple	Barre	Several inquiries about ornamentals.
Ash Anthracnose	*Gloeosporium aridum*			See narrative.
Balsam Fir Needle Blight	*Rhizosphaera pini*	Balsam fir, Fraser fir	Scattered statewide	Increasing as a problem on Christmas trees, with occasional heavy damage observed.
Brown Spot Needle Blight	*Scirrhia acicola*			See White Pine Needlecast.
Canavirgella Needlecast	*Canavirgella banfieldii*			See White Pine Needlecast.
Cedar-Apple Rust	*Gymnosporangium juniperi-virginianae*	Crabapple	Brattleboro	
Cherry Leaf Spot	*Coccomyces hiemalis*	Black Cherry	Hyde Park	Noticeable damage.
Fir-Fern Rust	*Uredinopsis mirabilis*	Balsam fir	Widespread	Very noticeable in June-July on wild and plantation trees. Some pockets of heavy Christmas tree damage. Unlike most years, early and late-budding trees were equally affected.
Giant Tar Spot	*Rhytisma acerinum*	Norway maple	Statewide	Common, but scattered occurrence. Very little damage to foliage.
Hemlock-Blueberry Rust	*Pucciniastrum vaccinii*	Hemlock	Athens, Windham	Light damage to foliage.
Maple Anthracnose	*Gloeosporium sp.*			See narrative.
Phyllosticta Leaf Spot	*Phyllosticta spp.*	Red maple	Wilmington	

OTHER FOLIAGE DISEASES

DISEASE	LATIN NAME	HOST	LOCALITY	REMARKS
Poplar Leaf Fungus	*Marssonina spp.*	Balsam poplar	Widely scattered.	Increasingly noticeable in late summer. Under-reported in aerial surveys due to scattered occurrence.
Rhabdocline Needlecast	*Rhabdocline pseudotsugae*	Douglas Fir	Brattleboro	
Rhizosphaera Needlecast	*Rhizosphaera kalkhoffi*	Blue spruce	Scattered statewide	Most reports from the Champlain Valley. Generally less new damage than in recent years.
Septoria Leaf Spot on Birch	*Septoria betulae*			See narrative.
Septoria Leaf Spot on Maple	*Septoria aceris*	Sugar maple	Scattered statewide	Light damage.
Swiss Needlecast	*Phaeocryptopus gaeumannii.*	Douglas Fir	Castleton	Young Christmas trees.
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 2012 included Actinopelte Leaf Spot, *Actinopelte dryina* ; Balsam Fir Needlecast, *Lirula nervata* ; Cyclaneusma Needlecast, *Cyclaneusma minus* ; Dogwood Anthracnose, *Discula destructiva* ; Larch Needlecast, *Mycosphaerella sp.* ; Lophodermium Needlecast, *Lophodermium seditiosum.*

ROOT DISEASES

DISEASE	LATIN NAME	HOST	LOCALITY	REMARKS
Annosus Root Rot	*Heterobasidion annosum*	Red Pine	Not reported in 2012	Sporax was applied to stumps during thinning of a 52 acre 91 year old plantation in the Peacham Block of Groton State Forest.
Armillaria Root Rot	*Armillaria spp.*	Balsam Fir	Widely scattered	Scattered dead balsam fir unusually common. Armillaria often present. Also on Christmas trees planted among stumps.
		Hemlock, White Pine	Rutland, Londonderry	Dying trees at the woods' edge with a lawn.
		Red Oak	Middlesex	Associated with mortality of several dozen oaks previously defoliated by the oak-leaftier complex.
		Hardwoods	Statewide	Commonly found on declining trees.
Brown Root and Butt Rot	*Polyporus schweinitzii*	White Pine	Westminster	Mortality.
Phytophthora Root Rot	*Phytophthora cinamomi*	Fraser Fir	Ripton	Killing trees in a poorly-drained pocket.

Balsam fir Christmas tree dieback and decline was reported throughout the state. Often the damage was severe enough to cause branches, upper crowns, or entire trees to dry out completely. The damage is attributed to exceptionally high March temperatures, which caused excessive evapotranspiration resulting in cavitation of tree water columns. Leading up to this, soil was saturated for parts of 2011, the open winter allowed soil to freeze, and drought conditions developed in late winter. Then, March temperatures topped 80 degrees stimulating unseasonal transpiration rates that resulted in plant desiccation.

The NH-VT Christmas Tree Association surveyed growers to learn more about the unexplained tree loss and found that although 80% of growers reported the worst damage on younger trees, 57% reported some losses to larger trees. Nearly half of growers reported the worst damage on heavy or wet soils, and 15% reported limited root systems. Armillaria root rot, streaking/phytophthora and pine sawyer injury were also reported. Although snow on the ground was rare, trees under snow cover were okay.

High elevation **white birch decline and mortality** diminished again in 2012, following a peak in 2006 (Figure 31). Aerial survey mapping recorded 278 acres of birch decline.

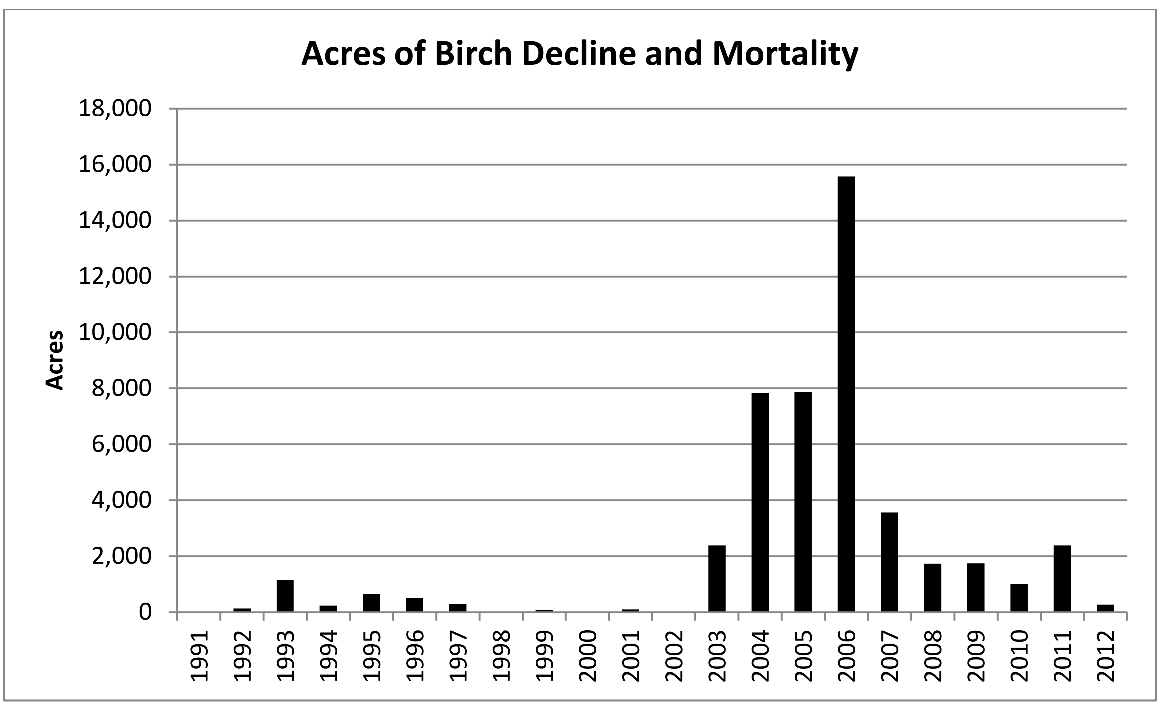


Figure 31. Trend in acres of birch decline and mortality mapped during annual aerial surveys. Mapped area was 278 acres.

In parts of the state, **frost damage**, contributed to widespread hardwood defoliation, in concert with pear thrips, anthracnose, Septoria and other leaf spots, and drought. These agents were difficult to separate during aerial surveys; the damage mapped (52,558 acres) is categorized as a Hardwood Defoliation Complex under Foliage Diseases (page 68).

In the central Green Mountains, there was scattered heavy damage to mid-slope sugar maples (1200-1500 foot elevations) with up to 100% defoliation in the upper crown. Some of this was from heavy frost damage to the flower buds. Further north, the damage was at lower elevations. Frost injury to ash, oak, apple, sycamore, and lilac have also been reported. A late spring frost in 2010 damaged 414,901 acres of predominantly sugar maple forests. Tree recovery from this single stress event was generally good, but the 2012 injury was confounded by multiple stress factors.

Late May storms brought significant hail to parts of the state. **Hail damage** in Albany followed a storm on May 29th. Damaged foliage became brown and in some cases refoliated. Other Vermont towns where hail was reported on May 29th included Alburgh, Benson, Bethel, Colchester, Cornwall, Eden Mills, Enosburg Falls, Highgate Center, Ira, Lowell, Malletts Bay, Middlebury, North Clarendon, Pittsford, Rutland, Sheldon, Shoreham, South Royalton, Springfield, Swanton, West Berkshire, and West Glover. A tornado was confirmed in Glover from that same storm.

Larch Decline was widely scattered in Caledonia, Essex, Orange and Orleans Counties, and increased slightly from last year. Mapped area was 236 acres. This represents a significant improvement from damages recorded last decade (Figure 32).

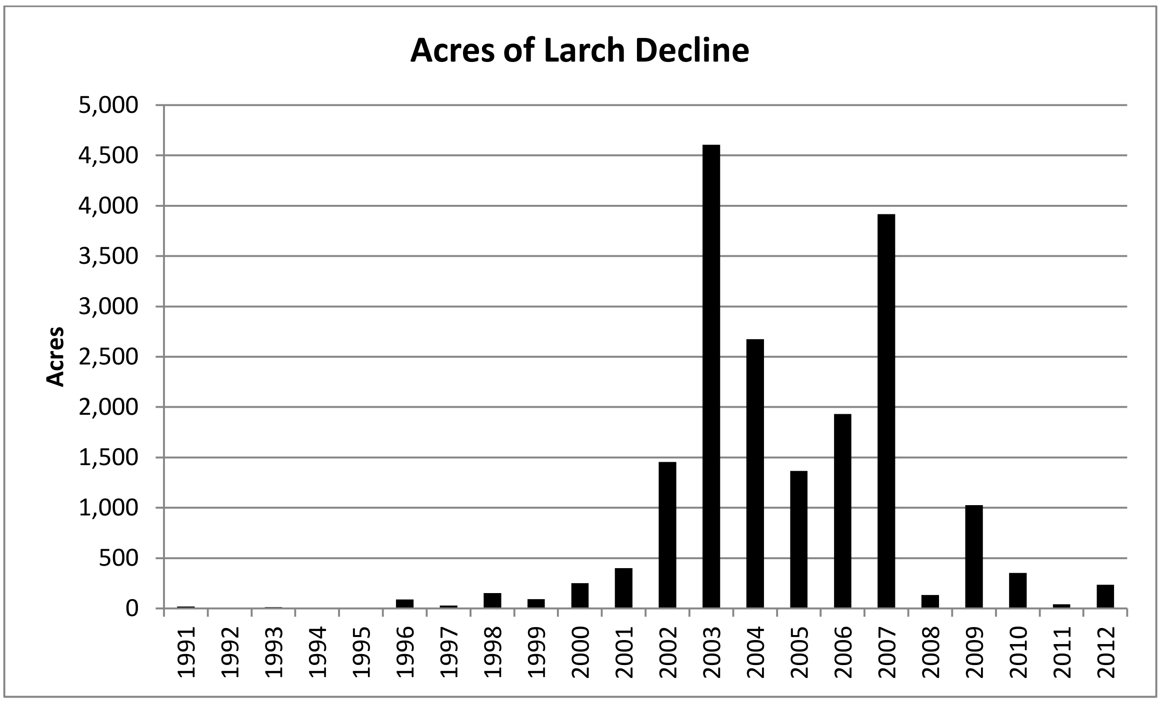


Figure 32. Trend in acres of larch decline mapped from 1991 to present. In 2012 mapped area was 236 acres.

Nine locations were visited in 2012 to survey for **ozone injury** to sensitive plant species (Table 18). Symptoms of ozone injury (stippling on upper leaf surface) were recorded at two of the sites, Rupert and Dover. At Rupert, 5 plant species were surveyed, but only milkweed showed symptoms. Ten percent of milkweeds showed injury that was moderate (25-50% of affected leaves showed injury). At the Dover site, 4 plant species were surveyed, but only white ash plants showed ozone symptoms. Ten percent of white ash plants showed injury that was heavy (>50% of affected leaves showed injury). In recent years there had been little to no ozone injury, so this represents an increase although limited to southern Vermont sites.

Table 18. Ozone bioindicator sites visited in 2012 and observed ozone injury.

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

There was a slight increase in areas of **spruce and fir decline** mapped in 2012 (Table 19 and Figures 33-34). In northeastern areas, mortality of scattered individual balsam fir trees was observed. Total area mapped during aerial survey was 3,068 acres.

Table 19. Mapped acres of spruce and fir decline in 2012.

County	Acres
Addison	0
Bennington	173
Caledonia	571
Chittenden	0
Essex	453
Franklin	0
Grand Isle	0
Lamoille	0
Orange	207
Orleans	272
Rutland	763
Washington	450
Windham	25
Windsor	154
Total	**3,068**

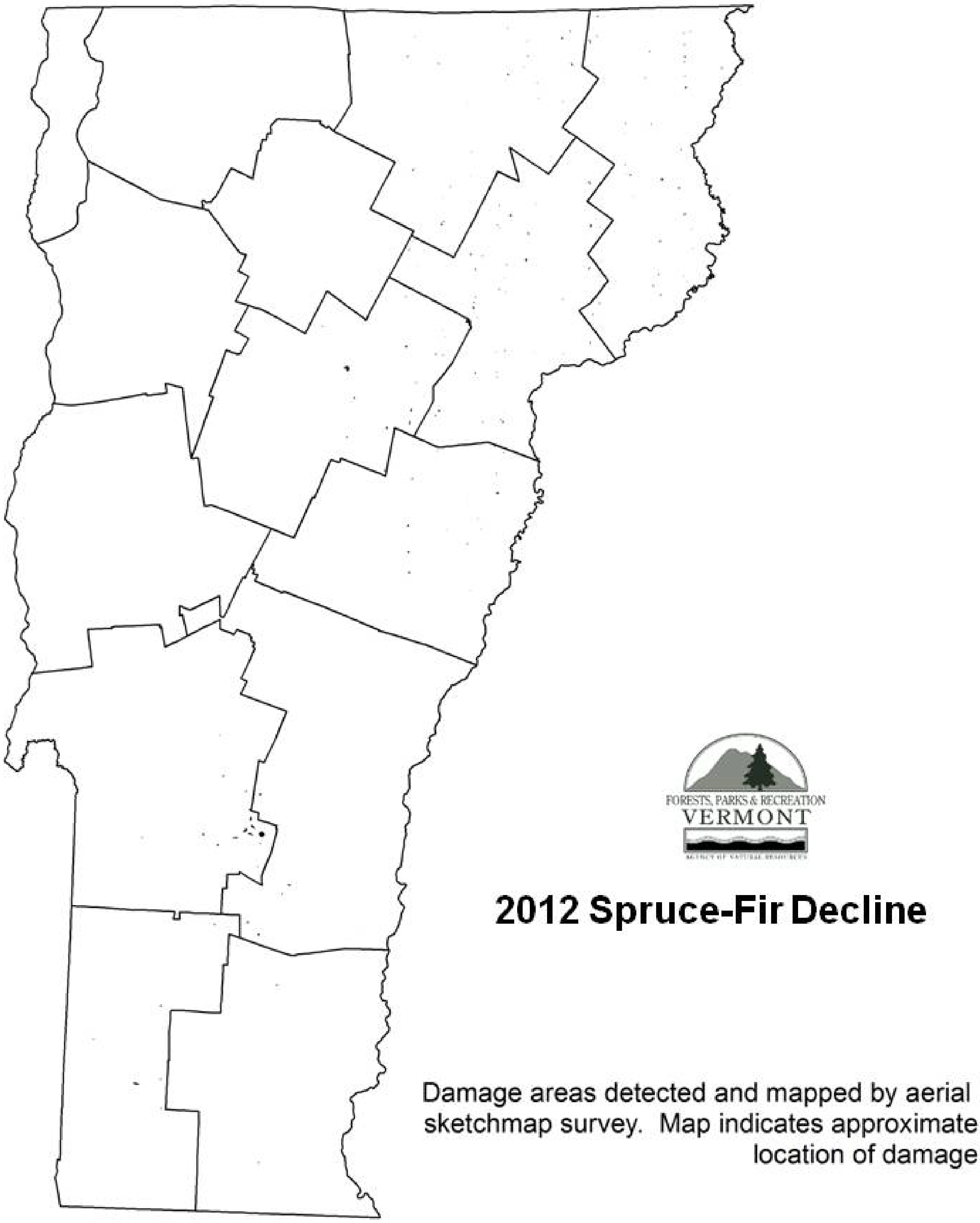


Figure 33. Spruce and fir decline mapped in 2012. Mapped area includes 2,068 acres.

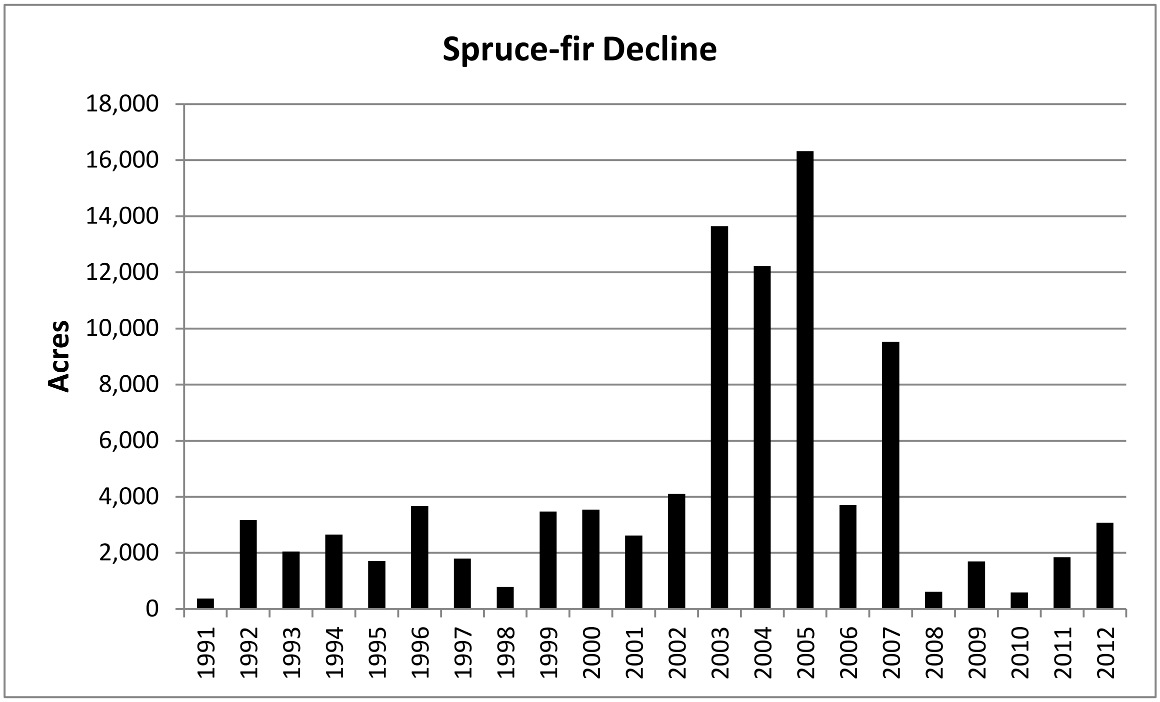


Figure 34. Trend in acres of spruce and fir decline since 1991. In 2012, 3,068 acres were mapped during aerial survey.

Extreme weather events periodically affect large areas of forests. In 2012, spring weather created conditions for a foliar damage complex from frost, pear thrips, drought and anthracnose. Records since 1991 show variations in tree damages related to extreme weather events (Table 20).

Table 20. Trend in acres of forest damage from weather events mapped during aerial surveys and major factors involved.

Year	Total Weather Damage Acres	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
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	Wind, drought
2004	19,877		Flooded sites
2005	11,078		Flooded sites
2006	6,786		Flooded sites
2007	21,656		Drought, flooded sites,
2008	2,401		Flooded sites
2009	15,315		Winter injury, flooded
2010	417,180	Frost	
2011	10,029		Flooded sites
2012	55,872	Complex (frost, drought and biotic factors)	Flooded sites

Acres of decline associated with **wet sites** was mapped at 2,385 (Figure 35, Table 21). This was a decrease from 2011(Figure 36).

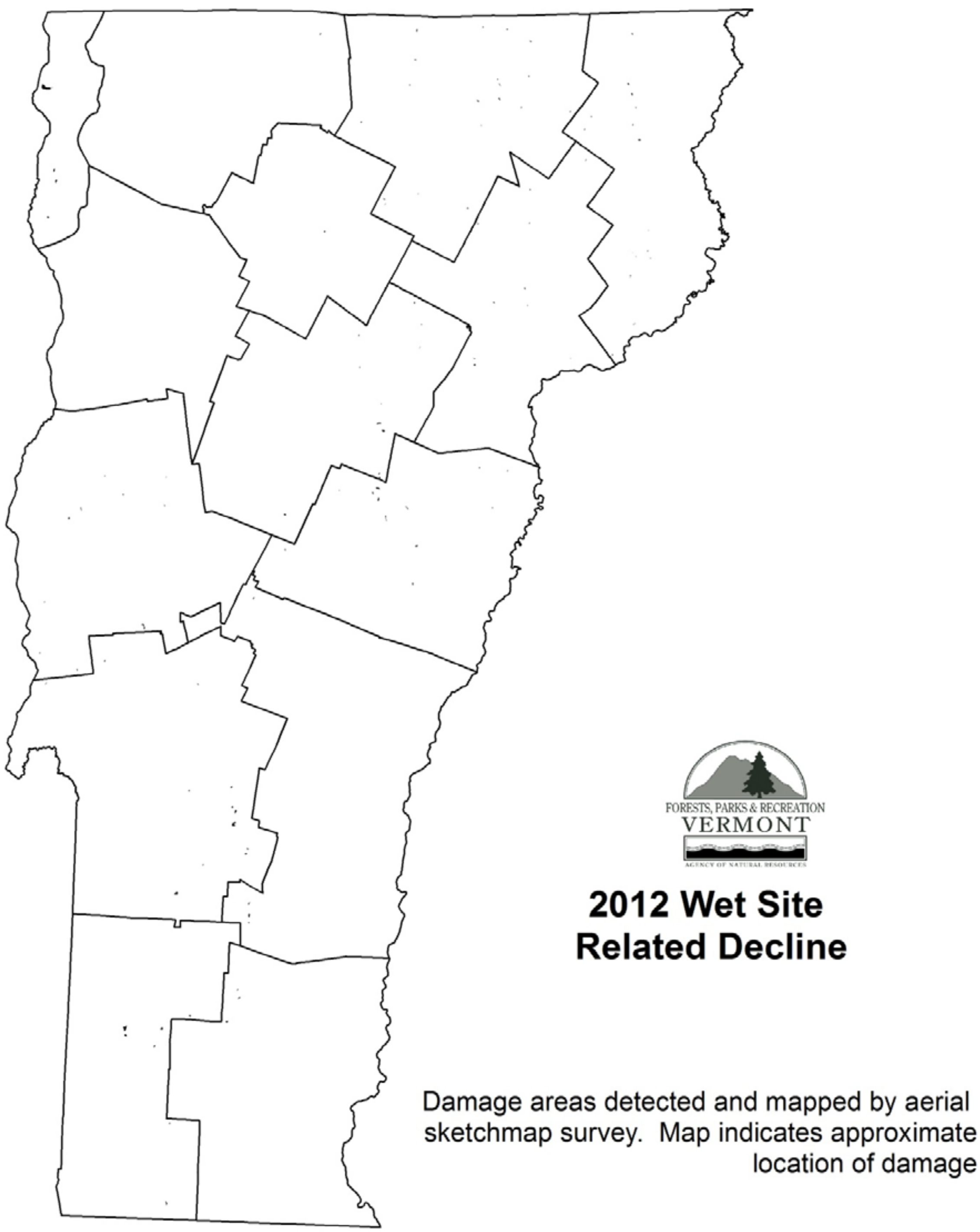


Figure 35. Wet or flooded site related decline mapped in 2012. Mapped area includes 2,385 acres.

Table 21. Mapped acres of forest decline associated with flooded or otherwise wet sites.

County	Acres
Addison	161
Bennington	291
Caledonia	112
Chittenden	0
Essex	188
Franklin	18
Grand Isle	371
Lamoille	11
Orange	261
Orleans	231
Rutland	375
Washington	215
Windham	57
Windsor	95
Total	**2,385**

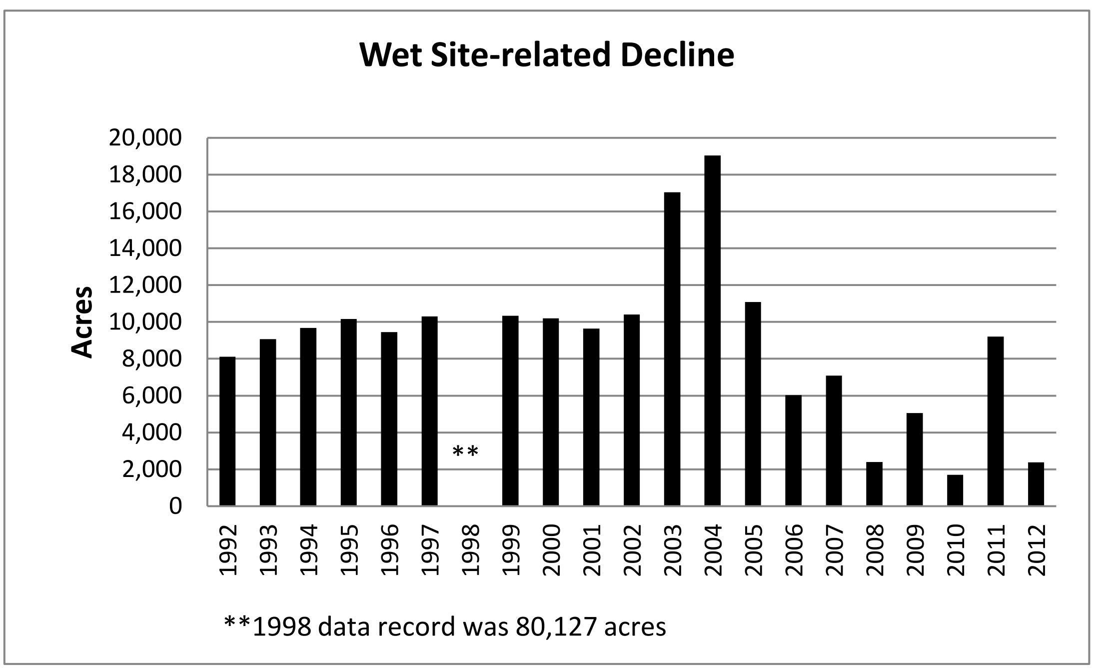


Figure 36. Trend in acres of forest decline related to wet or flooded sites.

Wind Damage. A strong wind event on June 1 contributed to thin crowns and refoliation. Sugar maples were especially hard hit. This damage was fairly localized to the western slopes of the Green Mountains. On July 4, two well organized severe thunderstorms caused widespread damage in the Champlain Valley and in northeastern Vermont and the Northeast Kingdom. A wind gust of 63 mph was measured at Burlington International Airport and winds of 70 mph were estimated in Walden with downed trees and power lines resulting.

A total of 278 acres of wind damage was mapped during aerial survey. Wind events are generally localized, but can affect large areas, as was seen in 1999 and 2007 (Figure 37).

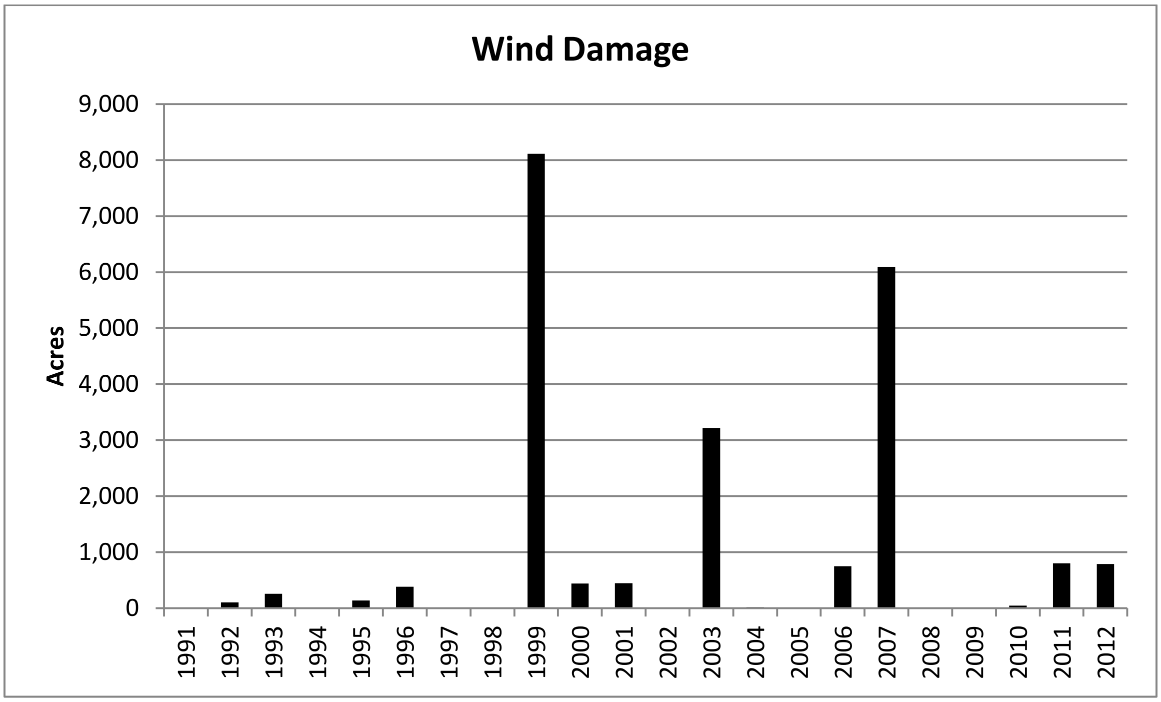


Figure 37. Trend in acres of tree damage from wind events. 278 acres of wind damage were mapped during aerial survey in 2012.

OTHER DIEBACKS, DECLINES, AND ENVIRONMENTAL DISEASES

CONDITION	HOST(S)	LOCALITY	REMARKS
Air Pollution Injury		Rupert and Dover	Ozone bioindicator plants surveyed in 9 locations statewide; 2 sites with injury. See Ozone Injury.
Ash Dieback	White ash	Widely scattered	Halifax sample tested negative for ash yellows. Recent reports of decline from Halifax, Williston, and Williamstown.
Birch Decline	White birch	Higher elevations	Decrease in acres mapped. See narrative.
Compaction	Sugar maple	Brattleboro	
Drought	Hardwoods; Hemlock; European mountain ash	Widely scattered	Increase in damage mapped to 131 acres. Most common on shallow, rocky or ledgey sites.
Fire Damage	Colorado blue spruce	Fairfax	
Frost Damage	Many	Widespread, although worse in the north	See narrative.
Hardwood Decline and Mortality	Hardwoods	Scattered throughout	Decrease to 4,611 acres.
Hail	Many	Northern Vermont	Significant in some locations. See narrative.
Heavy Seed	Sugar maple	Washington County	Scattered individual trees.
Larch Decline	Tamarack	Widely scattered in Caledonia, Essex, Orange and Orleans Counties	Increase in damage mapped to 236 acres. See narrative.
Leaf Scorch	Maples and other hardwoods	Lamoille County	Mostly roadside trees.
Mechanical Injury	Sugar maple Cherry	Milton Stowe	
Oak Decline	Red oak	Middlesex	Decline and mortality due to multiple stress factors: several years of defoliation by an oak leaf tier/leaf roller complex, spring drought due to high temperatures, and sandy soils that are also shallow to ledge.
Salt Damage	Many	Statewide	Less than normal.
Spruce/Fir Dieback and Mortality	Red spruce Balsam fir	Higher elevations statewide	Increase in damage mapped to 3,073 acres. See narrative.

CONDITION	HOST(S)	LOCALITY	REMARKS
Sunscald	Sugar maple	Chester	Ornamental
Wet Site/Flooding	Many	Widespread	Decrease in acres mapped to 2,386 acres. See narrative.
Wind Damage	Many	Widely scattered	See narrative.
Winter Injury	Balsam fir; Douglas fir; Arborvitae	Widely scattered	Increased over 2011.

ANIMAL DAMAGE

Squirrel Damage was common due to an eruption of grey squirrels in southern Vermont and the Champlain Valley brought on by abundant mast in 2011. Beechnut production was low in 2012, and acorn production was spotty, leading squirrels to seek other sources of food. Bark feeding was noted on thin-barked beech trees. Premature drop of red oak acorns, as early as late July, was attributed to squirrel activity, leaving even fewer acorns to mature on the trees.

ANIMAL DAMAGE

ANIMAL	SPECIES DAMAGED	LOCALITY	REMARKS
Beaver	Many	Scattered throughout	Damage levels stable.
Deer	Regeneration	Statewide	Uncommon in the northeastern counties, and common in southern Vermont.
Moose	Many	Northern Vermont	Balsam fir damage in decline study plots.
Porcupine	Many	Statewide	Uncommon.
Sapsucker	Many	Statewide	Increasingly noticeable.
Squirrel	Red oak, sugar maple, beech, Norway spruce	Widely scattered, including Burlington, Stannard, and Brandon	Only light damage observed.

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.**

TNC received a grant through the USFS State and Private Forestry to conduct invasive plant management on three nature reserves. In the coming 2 years they will also be conducting outreach to landowners and land managers about the reserves.

The Department of Forests, Parks and Recreation has been working with the VT Agency of Agriculture, Food, and Markets to create a new **invasive plant category for certified pesticide applicators**. The new category will need to be approved through the regulatory process, which is anticipated to take place in the coming months.

Cooperative Invasive Species Management Areas and Cooperative Weed Management Areas have been very active in the past year. Two Vermont CISMAs received funding through the National Fish and Wildlife Foundation.

- The Upper Connecticut River Watershed CISMA, located in northeastern Vermont and northwestern New Hampshire, hired 2 interns this past summer. The interns mapped invasive plant locations throughout the 900,000 acre CISMA area. Surveys were targeted along known pathways, rivers and tributaries, roads, and trails. This information will be used in the next few years to aim control work.
- The Ottauquechee Cooperative Invasive Species Management Area (OCISMA) hired 3 interns. They spent time mapping and removing invasives on public and private conserved lands in the Woodstock area. Information they collect will be uploaded into iMapInvasives and used by CISMA partners to make management decisions.
- The Upper White River Cooperative Weed Management Area has been focusing on conducting non-native invasive plant surveys and early detection rapid response (EDRR) projects on town roads and developing community outreach and education programs. The focus area for all work is located in the Upper White River watershed, specifically, east of Route 100 from the Town of Granville south to the Town of Stockbridge. In May 2012, the Association hired a part-time project coordinator to assist with delivery of these goals.

When Tropical Storm Irene hit Vermont August 2011, along with the widespread destruction of roads, homes, and infrastructure came the dislodging and **movement of Japanese Knotweed** along affected rivers. The Agency of Natural Resources was able to hire a part time employee, Brian Colleran, to help locate and remove these newly formed infestations. Brian worked with a wide range of groups from conservation commissions to students. He conducted 25 educational programs and led many volunteer efforts to remove new Japanese Knotweed populations. It is estimated that between 3,100 and 5,000 plants were removed, covering approximately 30 acres in 6 towns across 5 watersheds.

Sugar Maple Health in 2012

The condition of sugar maples, based on the amount of twig dieback, remained good in 2012, with 96% of trees rated as healthy on the 30 monitoring plots formerly part of the North American Maple Project (NAMP) (Figure 38). Defoliation affected nearly half the sugar maple trees, but only 7% of trees had moderate to heavy defoliation (Figure 39). The most common causes for defoliation were anthracnose, frost, pear thrips, Bruce spanworm, and Septoria leaf spot. There were commonly multiple sources for defoliation at a site. Other noted causes for defoliation were: green striped maple worm, maple leaf cutter, gypsy moths, saddled prominent, scorch, and storm damage (wind and/or hail). This array of defoliation factors resulted in an increase in trees with thin foliage (Figure 40), while dieback decreased (Figure 41). Crown condition in 2012 was worse than the long term average (Figure 42). Crown condition index takes into account both foliage density (transparency) and recent dieback, and shows annual condition relative to normal for these sites. Tree foliage seems to be the main cause for poorer than normal crown condition. There were 14 new dead overstory sugar maples (1.4% mortality), evenly distributed across plots. Of these 8 had been healthy the previous year, and only 1 had moderate decline.

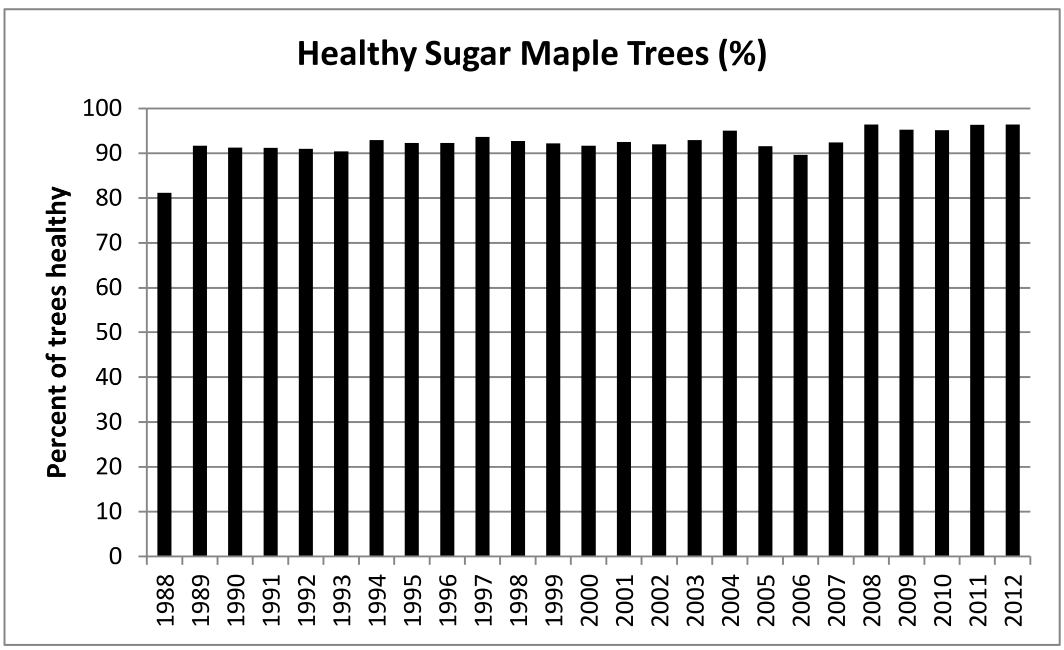


Figure 38. Percent of overstory sugar maple trees on NAMP plots rated healthy ($\leq$15% dieback). N=1004 trees at 30 sites; 14 were not sugar bushes, and of the 16 sugar bushes, 2 used standard spouts and 14 used small spouts.

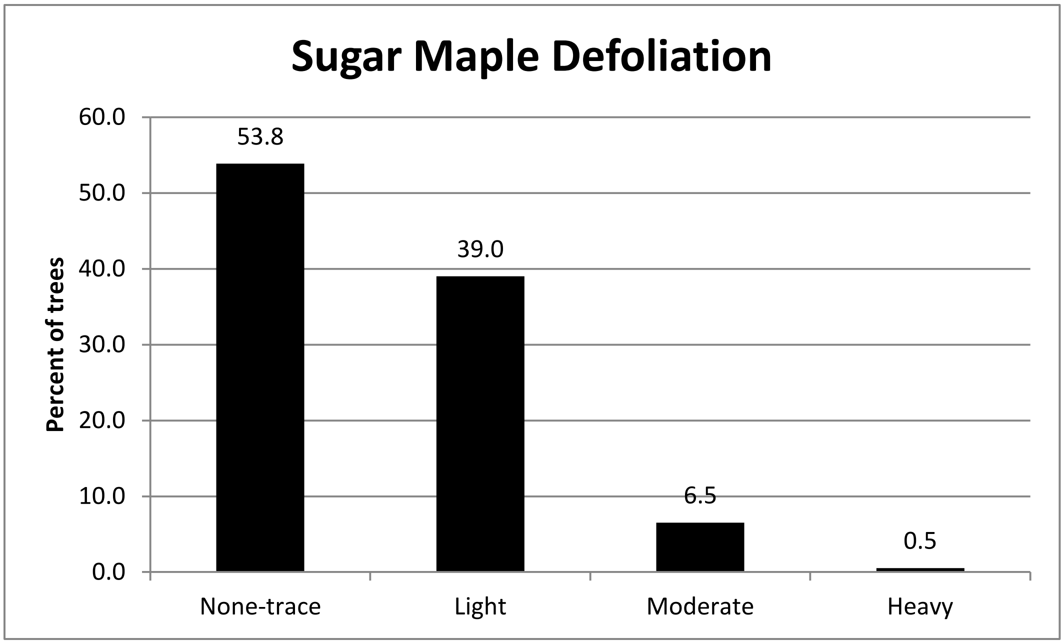


Figure 39. Percent of sugar maple trees on NAMP plots defoliated in 2012, grouped by severity of defoliation.

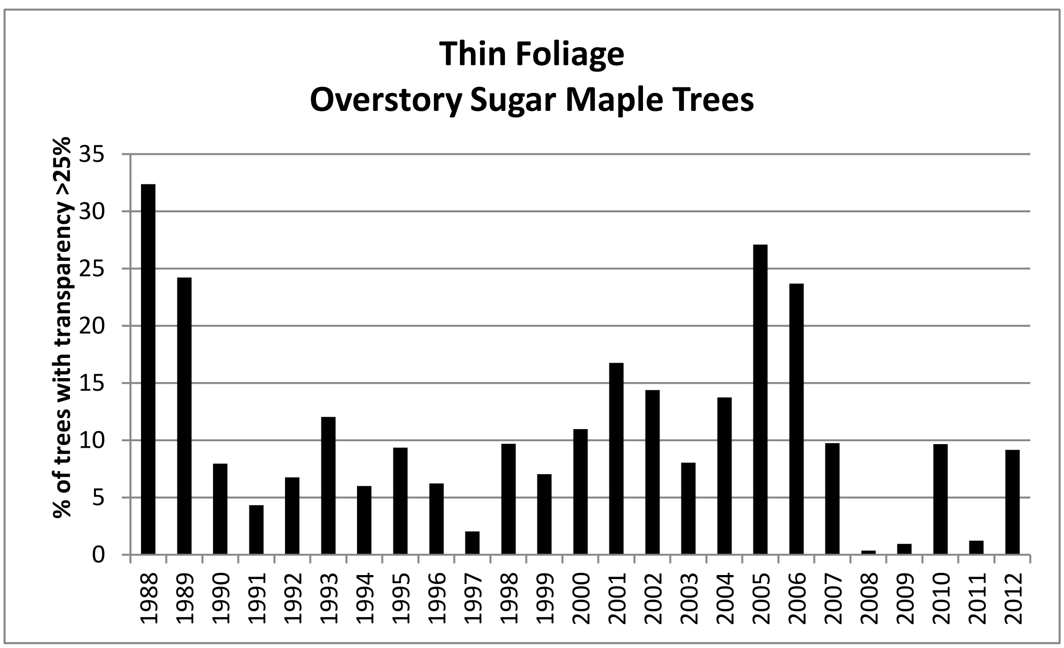


Figure 40. Trend in the percent of overstory sugar maple trees on NAMP plots with thin foliage (>25% foliage transparency). N=2004 trees at 30 sites.

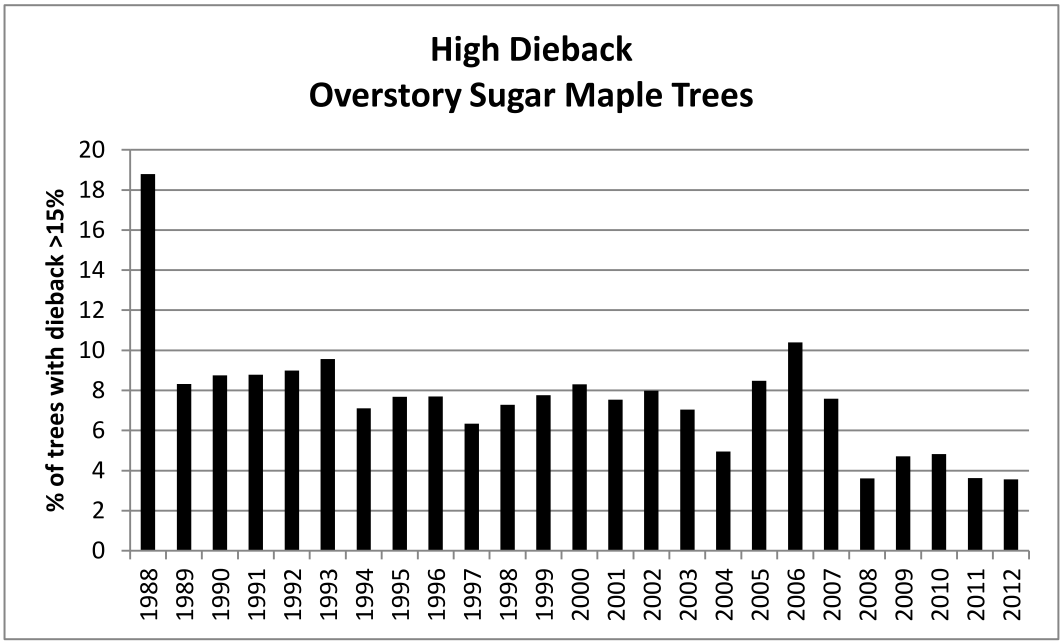


Figure 41. Trend in the percent of overstory sugar maple trees on NAMP plots with high dieback (>15% dieback). N=1004 trees at 30 sites.

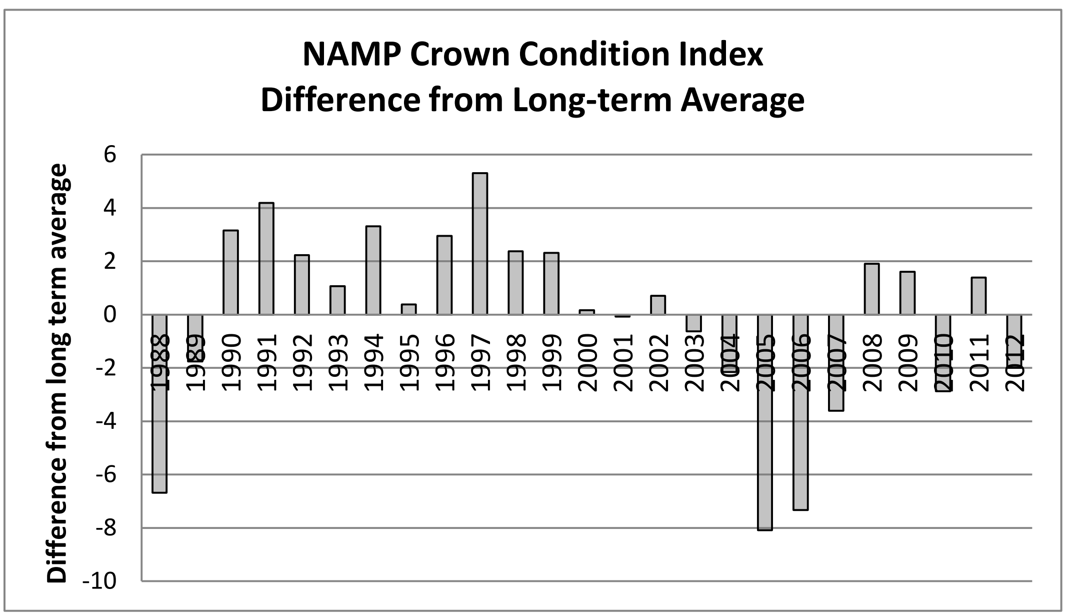


Figure 42. Trend in overstory sugar maple crown condition index on NAMP plots. Zero is the long term average crown condition index. Positive values mean crown condition was better than normal. Negative values mean crown condition was worse than normal. N=2004

Vermont Monitoring Cooperative

Trends in Forest Health in the Lye Brook Wilderness Area

Five forest health plots in the VMC Lye Brook Area, established eighteen years ago, were re-measured. Over this time period, general trends showed an increase in annual average dieback and foliage transparency (Figure 42).

The percent of trees with high dieback (>15%) has been consistently higher since 1998 than it was in the mid 1990's (Figure 44). There is a similar pattern with thin foliage (>25% transparency) and low crown density (<35%), although less consistent (Figures 45 & 46). Some of the crown rating fluctuations can be explained by death of unhealthy trees. Mortality has remained above 2% annually for the past 10 years (Figure 47). A significant ice storm occurred in January 1998, and damage from that storm may be a factor in ongoing tree health problems.

Specific damages recorded in 2012 do not include any of the new non-native pests (Table 22), but beech bark disease, a non-native, is the predominant damage agent reported.

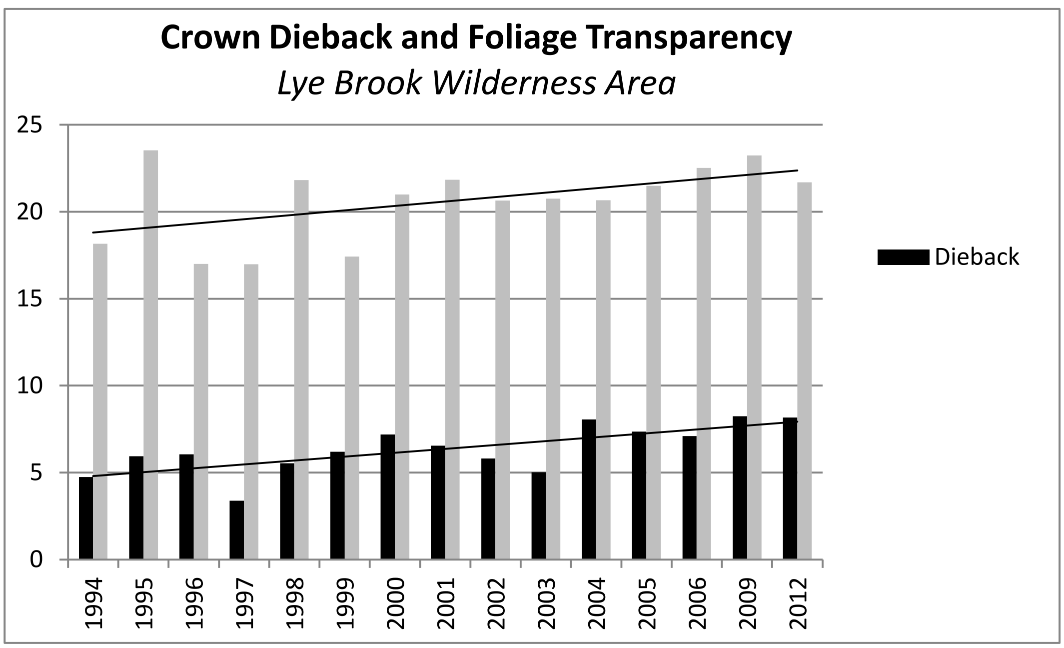


Figure 43. Trend in dieback and foliage transparency of overstory trees on forest health plots in the VMC Lye Brook Wilderness Area.

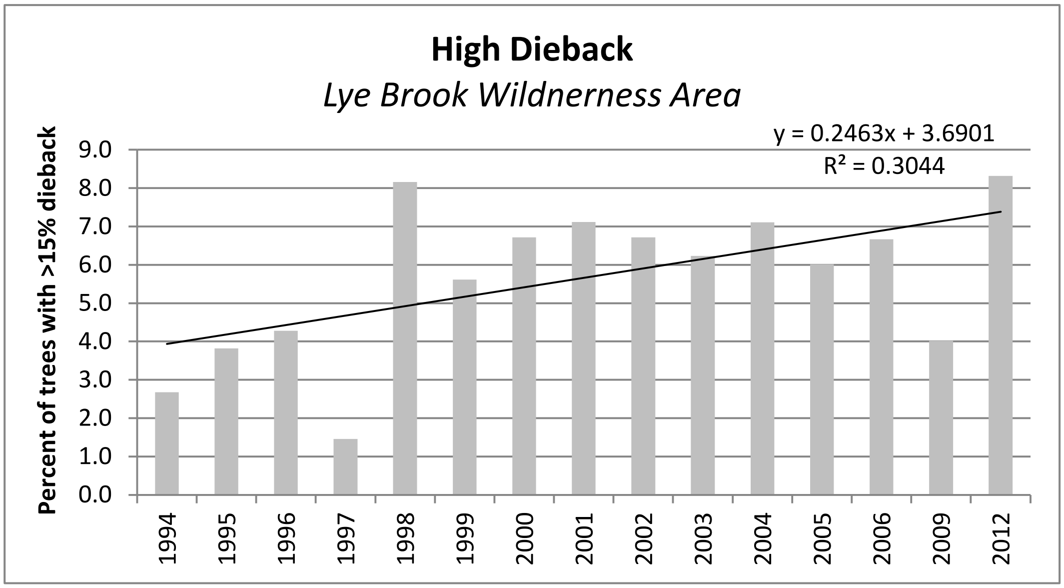


Figure 44. Trend in overstory trees with high dieback (>15%) on plots in the VMC Lye Brook Wilderness Area.

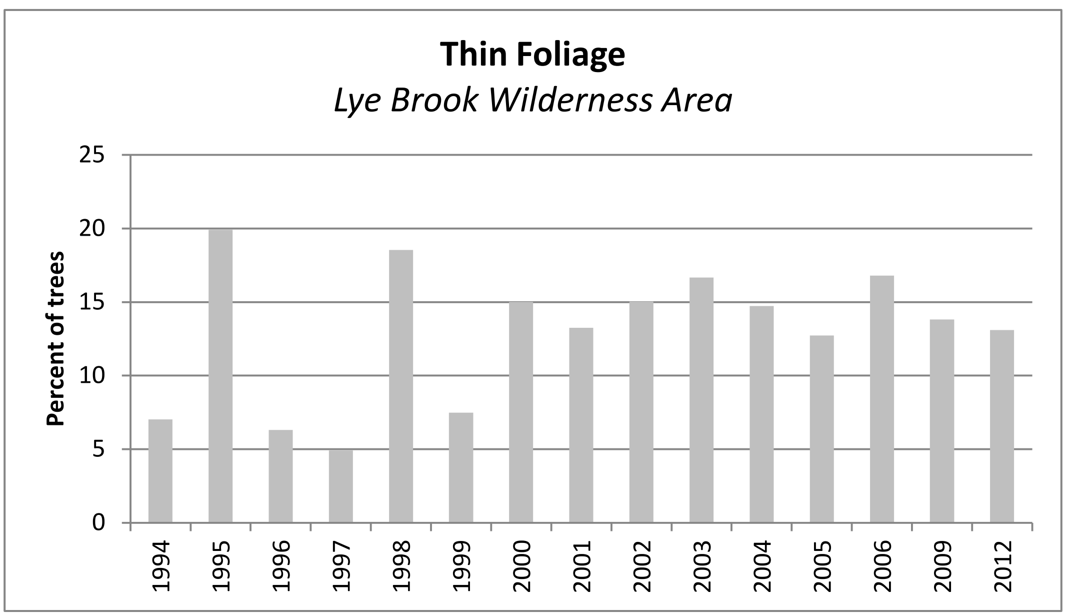


Figure 45. Trend in overstory trees with thin foliage (>25% foliage transparency) on plots in the VMC Lye Brook Wilderness Area.

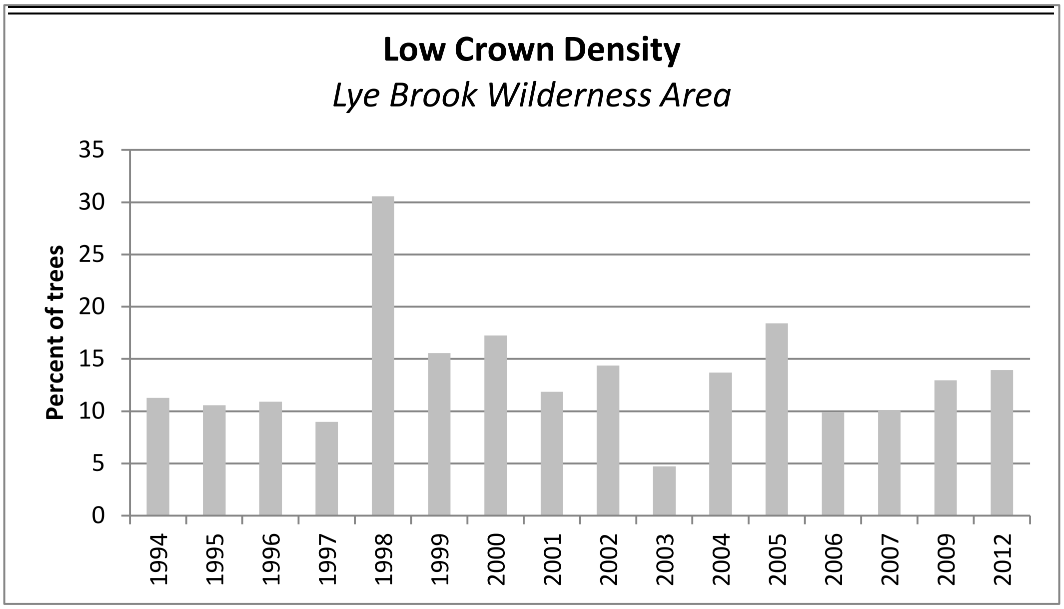


Figure 46. Trend in overstory trees with low crown density (<35%) on plots in the VMC Lye Brook Wilderness Area.

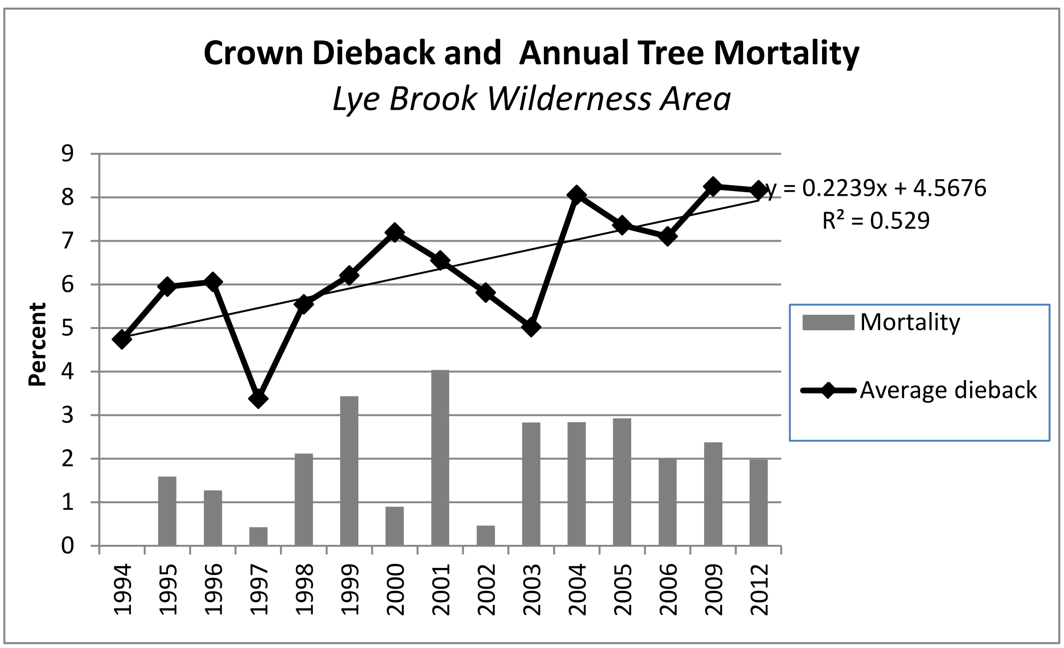


Figure 47. Trend in annual mortality compared to average dieback on plots in the VMC Lye Brook Wilderness Area.

Table 22. Specific damage agents and frequency of occurrence on VMC Lye Brook forest health plots.

Damage agent	Species	Frequency (no. trees)
Beech bark scale and nectria	American beech	10
Frost crack	Paper birch	2
Weather damage	Red maple	1
Canker/conk	Red maple	1
Nectria canker	Black birch	1
Emerald ash borer	Ash	0
Asian longhorned beetle	Many	0
Hemlock woolly adelgid	Hemlock	0
Balsam woolly adelgid	Balsam fir	0
Oak wilt	Oak	0