FOREST INSECT AND DISEASE CONDITIONS IN VERMONT 2009

FOREST, PARKS & RECREATION
VERMONT
AGENCY OF NATURAL RESOURCES

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DEPARTMENT OF FORESTS, PARKS & RECREATION
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http://www.vtfpr.org/

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FOREST INSECT AND DISEASE CONDITIONS IN VERMONT

CALENDAR YEAR 2009

In Memory of EDWARD BRADFORD "TED" WALKER

August 27, 1923 – September 18, 2009

Chief of Vermont Forest Pest Control 1965 -1975

Director of Vermont State Forests and Parks 1975 – 1986

PREPARED BY:

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Trish Hanson, Sandra Wilmot

AGENCY OF NATURAL RESOURCES
DEPARTMENT OF FORESTS, PARKS & RECREATION

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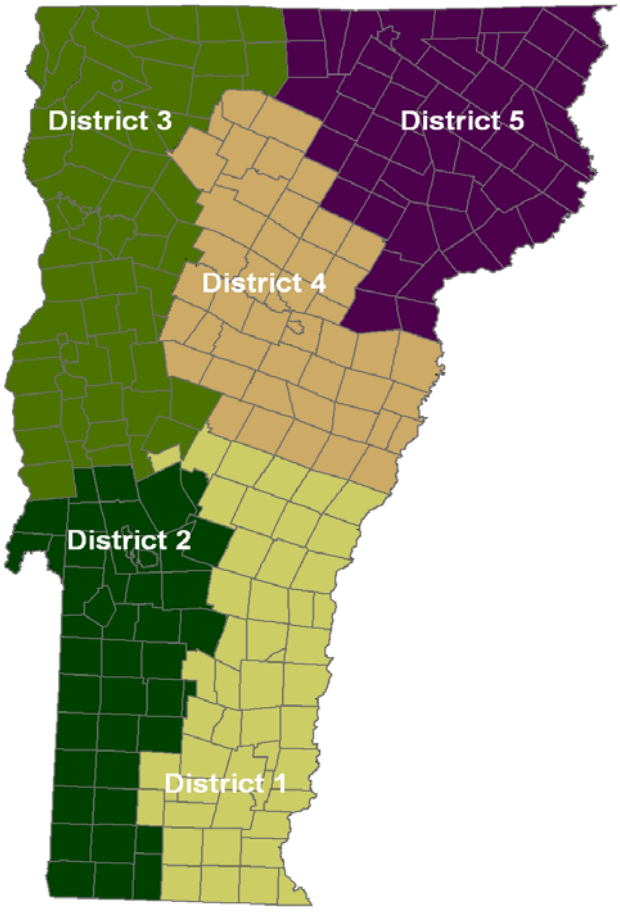

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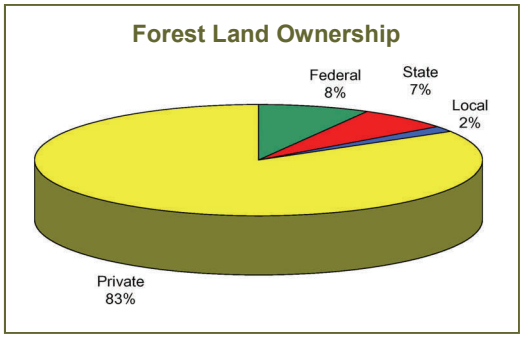
2009 Forest Health highlights

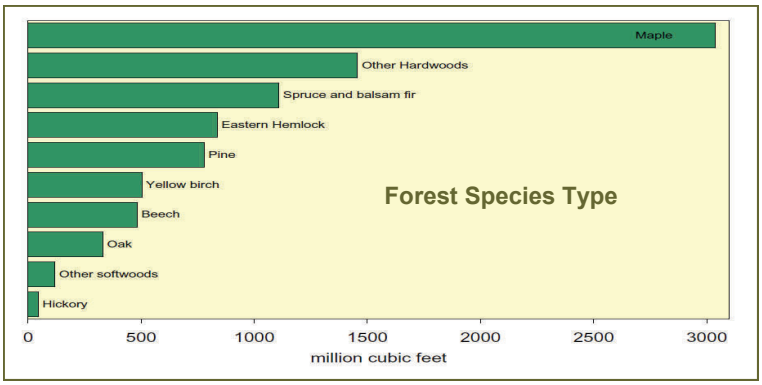
VERMONT

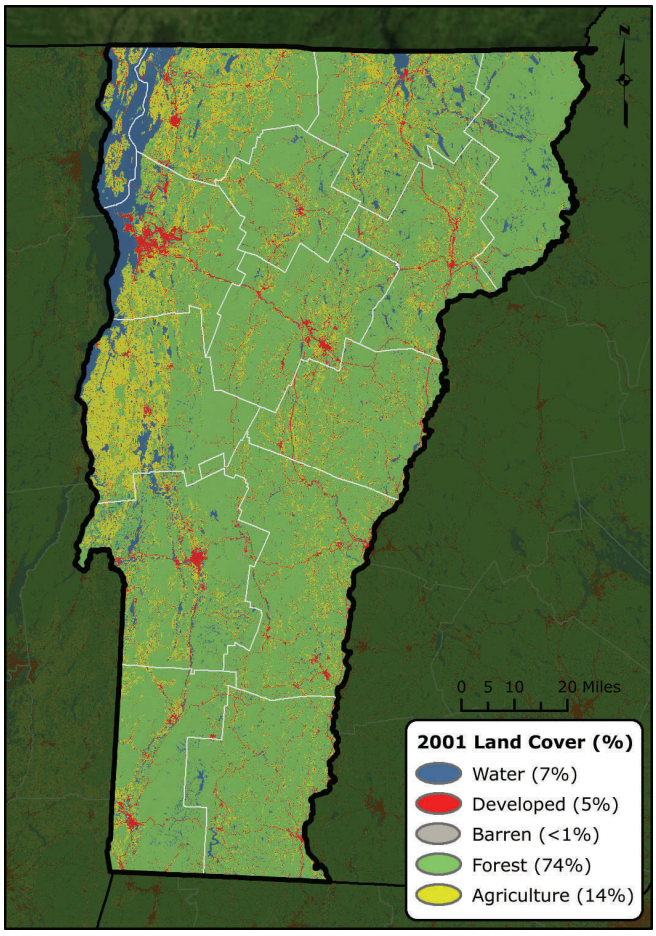
These highlights summarize information from the Vermont Department of Forests, Parks, and Recreation report on Forest Insect and Disease Conditions in Vermont 2009. The complete annual report, as well as other Vermont forest health information, is posted on-line at http://www.vtfpr.org/protection/idfrontpage.cfm. Contact Forest Resource Protection personnel, or your County Forester, to receive a copy by mail or for assistance in identifying pests, diagnosing forest health problems, and to obtain defoliation maps or additional literature. They can also provide on-site evaluations, insect population sampling, management recommendations, and information if you wish to participate in invasive pest citizen monitoring.

Forest Resource Summary

Forests cover 78% of Vermont. Sugar and red maple remain the most common species. However, the percentage of beech, spruce and fir are increasing, while sugar maple and white pine are decreasing. Over 83% of the state's forest land is privately owned.







Data from US Forest Service, Forest Inventory and Analysis

Forest Health Programs in the Northeast

State forestry agencies work in partnership with the U.S. Forest Service to monitor forest conditions and trends in their State and respond to pest outbreaks to protect the forest resource.

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Vermont Department of Forests, Parks and Recreation
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Web site: www.vtfpr.org

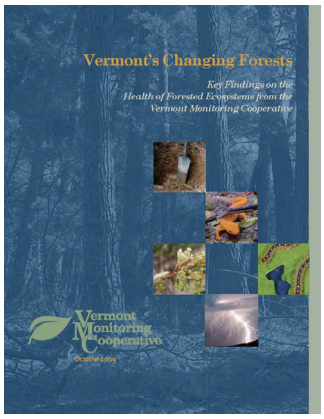
Forest Health Program Highlights

In 2009, Vermont celebrated the centennial of the state's Forestry Division, with the theme "Get into the Forest". Information on centennial activities can be found at http://www.vtfpr.org/htm/for_cen_home.cfm.

The Forestry Division is updating the Vermont Forest Resource Plan, to be completed in 2010. This will include a state forest assessment and outline resource strategies to address new and emerging issues.

Vermont forests play a major role in reducing carbon dioxide and mitigating climate change. A Vermont-specific website on climate change and forests can be found at http://www.vtfpr.org/htm/for_climatechange.cfm.

The Vermont Monitoring Cooperative, Vermont's intensive forest ecosystem monitoring and research program, completed a report synthesizing 18 years of ecosystem monitoring. The report, "Vermont's Changing Forests: key findings on the health of forested ecosystems from the Vermont Monitoring Cooperative," is posted at http://sal.snr.uvm.edu/vmc/.



The report, Vermont's Changing Forests, is available on the Vermont Monitoring Cooperative website.

2009 Forest health initiatives include:

- An ongoing effort to discourage long-distance firewood movement
- Expanding our citizen monitoring program for forest invasives
- Projects to detect emerald ash borer and Asian longhorned beetle through public awareness, biosurveillance, trapping and targeting high-risk sites
- A multi-state project to slow the spread of hemlock woolly adelgid
- An investigation into causes for tree mortality in Vermont and adjacent states
- A project to conserve germplasm of disease resistant butternut
- A trap survey for non-native bark beetles
- A survey for new exotic pests of oak
- Planning for a public campground invasive species survey, control, and outreach project in collaboration with the Green Mountain National Forest

We continue to provide diagnostic services at the Forest Biology Lab, assist the Vermont Department of Health in monitoring tick populations, and participate in programs with Vermont's Climate Change Collaborative and the Vermont Invasive and Exotic Plant Committee.

2009 Forest Damage

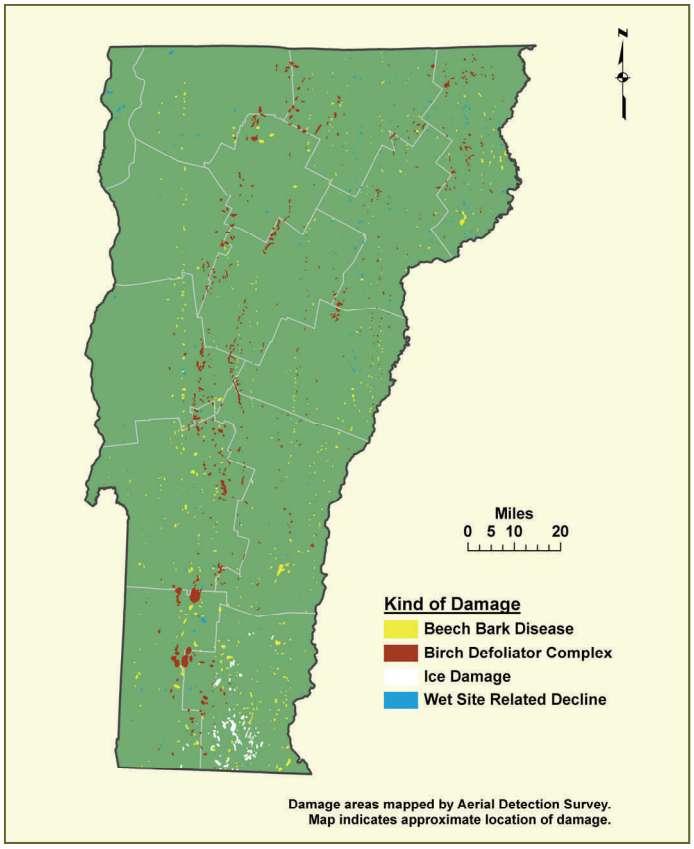
The Vermont Department of Forests, Parks and Recreation conducts aerial and ground surveys to detect forest damage. In addition, monitoring plots are visited to evaluate forest health.

Tree health was generally good in 2009 following several years with adequate moisture and low pest activity. With wet conditions early in the season, fungus diseases remained common.

Nearly half of the damage detected during aerial surveys was **Birch Defoliation**, which was mapped on 46,150 acres. This was a substantial increase from the 4,287 acres in 2008. Over 15% of the birch forestland in the state was brown by late summer. Most of this was a result of Septoria leaf spot on paper birch, with birch leafmining sawflies also causing some damage.

Birch defoliation was widespread at upper elevations.

As far as we know, the fungus that causes Septoria leafspot is native. Persistent cloud moisture at upper elevation sites created ideal conditions for fungus growth during the past few summers. *The impact on commercial forests should be minor because mountain-top birch stands were the most likely to be defoliated*. However, at higher elevations, defoliation may contribute to **Birch Decline and Mortality**, which otherwise appears to be stable with 1,743 acres, of mostly old mortality, mapped this year compared to 1,736 acres in 2008.



Beech Bark Disease was the primary cause of dieback and mortality on 25,469 acres. We've had a recent spike in the disease because dry fall conditions early in the decade allowed levels of beech scale to increase. When beech scale increases, the Nectria fungus that kills the bark is never far behind. A recent increase in beech scale, observed in parts of the state, suggests that heavy beech mortality will continue.

Although we associate diagnostic bark symptoms with this disease, trees and branches which die quickly may not have any defects. The sunken patches only develop when diseased trees survive long enough to grow around dead areas in the bark. While a smooth-barked dead tree may have died from this disease, trees which are smooth-barked and healthy may be genetically resistant. Leaving these trees, while removing susceptible beech, will increase the proportion of seedlings resistant to beech bark disease.

Beech trees which die quickly from beech bark disease may not have diagnostic stem defects.

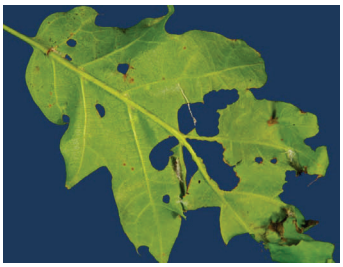
Severe Storms caused scattered damage. Trees in southeastern Vermont are recovering from the December 12, 2008 ice storm. Breakage from that storm was mapped on 10,282 acres. A windstorm on December 10, 2009 caused damage in Addison County. *Most trees damaged over the winter recover quickly if at least half the crown is intact*, and most with one-quarter remaining are expected to survive. The exception is paper birch, which is at risk even if three-quarters of the crown remains.

Damaging summer storms included the May 9th tornado/hailstorm in central and southern Vermont, a May 31st windstorm from Addison County through northeastern Vermont, and a July 16th tornado, hail and thunderstorm event in central Vermont.

Trees damaged from the December 2008 ice storm are expected to survive if 25% of the branches remain.

Hardwood Defoliation, caused by leaf-feeding insects and anthracnose, was mapped on a total of 7,474 acres. Although there was some refoliation in affected stands, the damage remained noticeable throughout the growing season. At least 3,344 of these acres were **Oak Defoliation** by a complex of leaf rollers and other caterpillars. Damage by these insects was also reported from other states in the region.

It was the second year of oak defoliation in some of the affected areas. Similar damage in the 1980s led to mortality in New Hampshire and Massachusetts. *Keep an eye out for oak defoliators at leaf-out in May, 2010*. They may be feeding inside rolled up leaves, or inside leaves they tie together with webbing. Continue to monitor tree condition in defoliated stands.



Look for oak leaf roller damage when leaves expand in May.

Forest Tent Caterpillar caused no noticeable defoliation, although occasional larvae were observed. Areas of mortality, primarily red oak and sugar maple, are still noticeable in the Taconic range. *Although the outbreak is fading from memory, don't forget to consider forest tent caterpillar defoliation history if you encounter hardwood dieback or mortality*. You can request defoliation records to determine whether damage was mapped in the area.

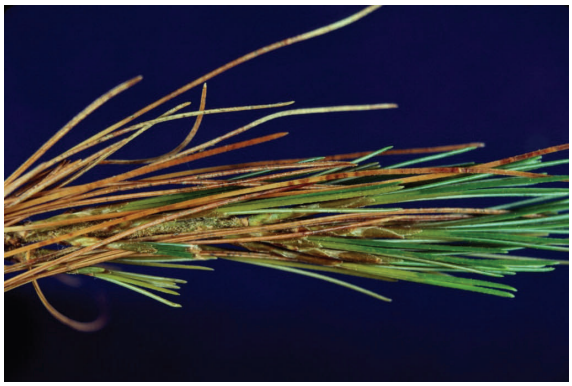
Brown Spot Needle Blight was heavy again on white pine, and other pine species, for the 5th consecutive year. Previous year needles turned brown in early spring. By mid-summer, when new growth emerged and brown needles had been cast, trees looked green, but thin. *Because damage from this fungus disease is heaviest in moist, low-lying areas, it may accelerate white pine decline in marginally wet sites.*

Populations of **Balsam Woolly Adelgid** increased in the Northeast Kingdom, with light levels commonly observed. This exotic insect has been here for a century. In south central Vermont, new mortality was common in stands previously affected by the insect.

Like its cousin on hemlock, balsam woolly adelgid is sensitive to extremely cold winters, so populations fluctuate with the weather. *With no extreme cold in the winter of 2009-10, we expect damage from this insect to increase.* Look for white wool on fir trunks as well as twigs.

Fir mortality is occurring in some stands where balsam woolly adelgid was previously heavy, but may no longer be noticeable.

Balsam fir may continue to decline in existing mortality areas. With root rots and bark beetles established in those areas, harvesting should be done in large groups, patch clearcuts, or other non-selective methods.



Previous year needles on white pine killed by brown spot needle blight are shed by mid-summer.

Damage from **Wet Site Conditions** was mapped on 8,904 acres.

Gypsy Moth egg mass counts have been low, but decreased further, indicating continued low populations for 2010.

Hardwood Chlorosis, mostly on sugar maple in low-lying areas and at the base of slopes, was evident again, especially in northern Vermont.

Larch Decline was mapped on 1,027 acres, a level similar to previous years, with some new mortality in pockets of previously dead trees.

Poplar Defoliation by a complex of leaf rollers was noticeable in scattered locations.

Spruce-Fir Decline remains stable at high elevations with 1,702 acres mapped.

Heavy Seed Production on Ash compromised leaf size and therefore tree productivity.

Fall Webworm populations were high across the State, with scattered patches of heavy defoliation.

Exotic Pest Update

Restrictions on long-distance firewood movement were implemented to prevent new introductions. Firewood may not be brought to State Parks from over fifty miles away. Out-of-state firewood may not be brought to the Green Mountain National Forest. A Federal quarantine on the movement of firewood across the U.S. border is now in effect. In addition, Vermont has an active program to alert the public about transporting pests when moving firewood. Details are available at http://www.firewood.vt.gov.

Volunteers are increasingly important to our exotic pest program, and *we welcome new volunteers to participate in our surveys*. Volunteers assist with hemlock woolly adelgid monitoring, surveys for emerald ash borer and Asian longhorned beetle, and don't-move-firewood efforts. With UVM Extension and the Nature Conservancy, we are participating in a project to develop best practices and tools for a citizen monitoring program for invasives in urban forests.

With the Agency of Agriculture, Food and Markets, we are actively surveying for possible introductions or expansions of a number of non-native forest pests. The Vermont Invasive Forest Pest Action Plan has been updated, identifying agency roles and prioritizing actions if a new pest is detected. The Agency of Natural Resources has recently completed a Report on Invasive Species in response to a 2009 directive from the Vermont legislature.

Vermont participated in the regional Northeast Forest Pest Outreach and Survey Project. The objective of this project was to promote early detection of Asian longhorned beetle and emerald ash borer through increased public awareness and targeted surveys. Twenty-five state and private campgrounds were surveyed for these pests. Targeted surveys were also conducted in large areas of Brattleboro and Burlington.

Campground surveys targeted State Parks which had been frequently visited by residents of Asian longhorned beetle infested areas of Massachusetts.

Surveys for non-native bark and ambrosia beetles were conducted in cooperation with the national Early Detection and Rapid Response (EDRR) program at eight sites in Vermont. A total of 46 species were collected, including two target species considered potential forest pests.

More information on exotic pests of interest to Vermont can be found at http://www.vermontagriculture.com/ARMES/plantindustry/caps/forestPests/index.html.

Asian Longhorned Beetle is not known to occur in Vermont and was not detected by public outreach or survey. Our campground surveys targeted State Parks with a history of heavy use by visitors from the Worcester area. In addition, a questionnaire was sent to the 198 Massachusetts residents from Asian longhorned beetle infested areas who own property in Vermont to determine if firewood may have been moved. To follow-up, trees and woodpiles were inspected on selected properties.

An Asian longhorned beetle collected in Worcester, MA.

We don't recommend any management adjustments in anticipation of this insect. Its infestations expand gradually, and mortality is not rapid. *However, early detection is especially important for Asian longhorned beetle*. If an infestation is found when it's still small, there's a realistic chance it can be eradicated. This has already happened in Chicago and at one of the infested locations in New Jersey. An excellent guide to Asian Longhorned Beetle Injury, covering diagnostic features and look-alikes, is at http://www.glfc.forestry.ca/VLF/invasives/alhbdetecguide_e.pdf.

Butternut Canker levels remain stable, with most butternuts showing symptoms of the disease. We are participating in a multi-state project, coordinated in Vermont by Plant Technologies LLC, to conserve butternut germplasm as a first step in species restoration efforts. We will be establishing an orchard of butternuts grafted from trees which seem to have some disease resistance. *Please contact us if you know of a stand with healthy butternuts located close to cankered trees.*

The **Common Pine Shoot Beetle** was first detected in 1999 in northern Vermont. Since then, the beetles have been found in many counties. Tree damage in Vermont is difficult to find and is limited to new shoot injury. A federal quarantine is in place to limit the spread of this exotic insect, but pine material is free to move inside Vermont, and to most of the surrounding region. Quarantine details can be found at http://www.anr.state.vt.us/fpr/vtfpr/protection/quarantine.cfm.

Emerald Ash Borer is not known to occur in Vermont and was not detected by public outreach or survey. Purple traps were deployed at 143 campgrounds and other high risk sites in an effort led by the Agency of Agriculture, Food, and Markets. A trap tree survey was completed by examining ash from four locations in Grand Isle County that had been girdled in 2008. As part of the regional emerald ash borer biosurveillance program, 19 nest sites of *Cerceris fumipennis* were located. This wasp provisions its nests with metallic wood borers. We can look for emerald ash borer by examining beetles the wasps have collected.

For the trap tree survey, ash trees were girdled to attract any emerald ash borers that might be present in the area. Trees are then checked for emergence holes and galleries.

Government agencies are making a serious effort to slow the spread of the emerald ash borer infestation just east of Montreal. In addition to prohibiting the movement of ash out of the regulated area, some cutting has been done to reduce the reservoir of infested material, and research is being done on biological control.

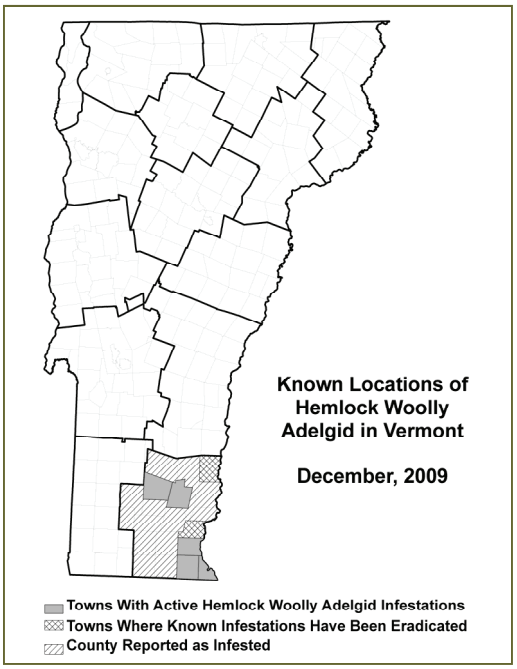
The leaflet, "Preparing for Emerald Ash Borer: Recommendations to Reduce the Impact in Vermont", has been updated. *In stands with a high percentage of ash, particularly if it exceeds 25% of the basal area, consider treatments to enhance other species, but don't rush to remove all the ash*.

European Wood Wasp was not observed, although 140 traps were deployed by the Agency of Agriculture, Food, and Markets and USDA-APHIS. The survey included Lamoille County, where a single adult was trapped in 2007. This remains the only European wood wasp collected in Vermont. *There are no federal or state quarantines on this pest.*

Hemlock Woolly Adelgid detections increased in Windham County, but no new counties were reported as infested. This insect has now been detected in 30 locations in seven towns. Approximately 450 volunteers have been trained and are assisting with detection surveys. The Vermont Agency of Agriculture, Food, and Markets continues to monitor nurseries for possible introductions of hemlock woolly adelgid on imported trees.

Vermont is collaborating with the states of New Hampshire and Maine and with the US Forest Service to develop a regional approach to managing this insect. In cooperation with Dr. Dave Mausel from the University of Massachusetts, the predatory beetle, *Larcicobius nigrinus*, was released at sites in Brattleboro and Vernon.

Hemlock products from Windham County are now subject to existing hemlock woolly adelgid quarantines. These vary from state to state. *Responsibility for quarantine compliance lies with sawmills, biomass plants, and other facilities that receive hemlock logs and chips.* Loggers and truckers may be asked to identify the town where hemlock was harvested. Facilities in Vermont may receive hemlock freely, as long as they have a compliance agreement. This requires some recordkeeping and allows us to conduct tree inspections. Without a compliance agreement, quarantined products may not be moved into any Vermont county from an infested county. Known infestations are posted at http://www.na.fs.fed.us/fhp/hwa/.



These wood shavings contain Laricobius *beetles, a natural enemy of hemlock woolly adelgid.*

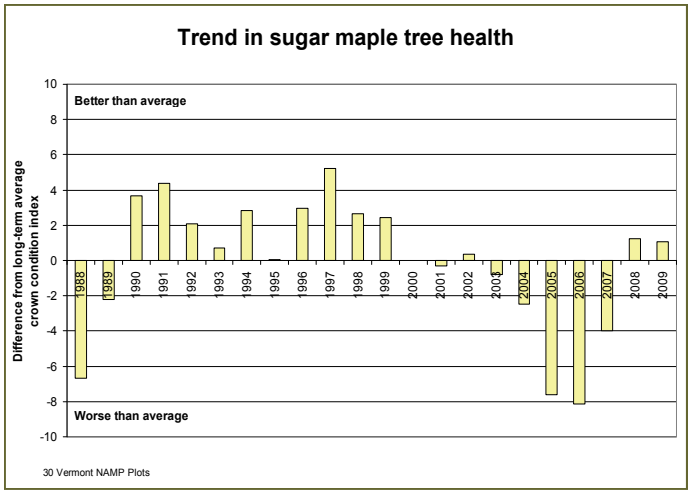
Non-native Invasive Plants continue to prevent regeneration of native species, especially in southern and central Vermont. In 2009, our activities related to invasive plants included: developing a protocol for use in the 2010 public campground surveys, compiling invasive plant detection records for the state resource assessment, and several control projects on state lands. Forest impacts were among the concerns addressed at the Invasive Plant Network Meeting organized by the Vermont Invasive Exotic Plant Committee. The Green Mountain National Forest has begun the process of seeking public input for its Forest-wide Non-native Invasive Plant Control Project.

Oak Wilt was not observed or known to occur in Vermont. We have increased our vigilance in looking for this disease since it was detected near Albany, NY. Samples were taken and cultured from one oak in Shaftsbury, but the oak wilt fungus was not recovered.

Monitoring Forest Health

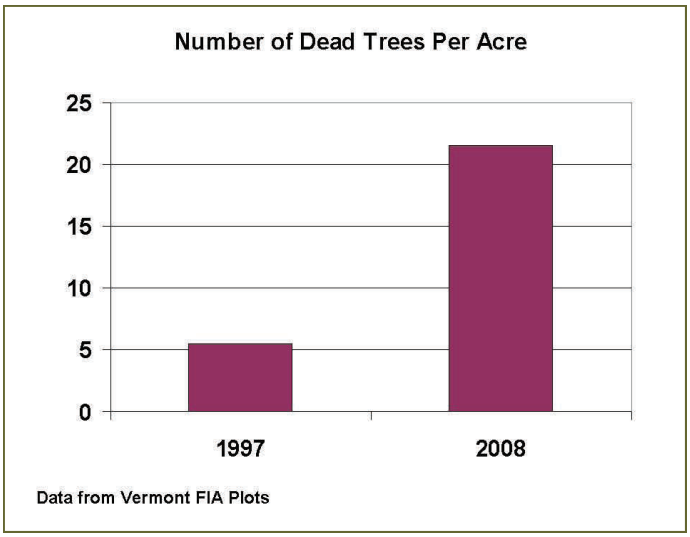
Forest surveys help determine trends in sustainability indicators such as biodiversity, forest ecosystem health, climate change, carbon cycles, and soil and water conservation.

In Vermont's **North American Maple Project** (NAMP) plots, 95% of the sugar maples were healthy in 2009. This represents better than normal tree health, especially considering major stress events during this decade: the 1999-2001 droughts and the 2003-2006 forest tent caterpillar outbreak. The crown condition index (reflecting twig dieback and foliage transparency) was also better than the long-term average. However, sugar maple mortality continued to be above normal (1.2% of canopy trees). In some areas, especially the Taconic region of southwestern Vermont, mortality lingers from past forest tent caterpillar defoliation.



Vermont cooperates with the U.S. Forest Service to assess forest resource trends through the **Forest Inventory and Analysis** (FIA) program. The current inventory of Vermont was completed in 2008. Updated results are available at http://fia.fs.fed.us/ and a comprehensive report is planned for 2010.

The 2008 Vermont FIA data showed a 28% increase in mortality of growing stock volume since the last inventory of 1996-1997, with the number of dead trees increasing from 5 trees per acre to 22 trees per acre statewide. New York, New Hampshire and Maine FIA data show a similar trend. A study has been initiated to investigate potential causes of this mortality and identify site conditions that may have contributed.



Evaluations of plant injury from ozone exposure have been collected on a subset of Vermont plots since 1994. Dramatic reductions in ozone-induced damage have been recorded over this time period. However, some sensitive plants, including white ash, black cherry, milkweed and blackberry, continue to have symptoms, especially in southern Vermont where ozone levels tend to be higher.

Additional forest health measurements have been collected on a some of the FIA (P3) plots. Descriptions and updates on additional monitoring measurements are available at http://www.fia.fs.fed.us/program-features/indicators/.

For more information, contact the Vermont Department of Forests, Parks and Recreation:	Windsor & Windham Counties.....	Springfield (802) 885-8845
	Bennington & Rutland Counties.....	Rutland (802) 786-3851
	Addison, Chittenden, Franklin, & Grand Isle Counties.....	Essex Junction (802) 879-6565
	Lamoille, Orange & Washington Counties.....	Barre (802) 476-0170
	Caledonia, Orleans & Essex Counties.....	St. Johnsbury (802) 751-0110

INTRODUCTION

The information in this report is based on aerial surveys to detect forest damage, as well as ground surveys and observations by Vermont Forestry Division staff.

A statewide aerial survey to map late season defoliators and general forest conditions was flown between August 1st and September 2nd. Special surveys were flown over southeastern Vermont on March 17th to map ice damage and over parts of north-central Vermont on June 25th to assess oak defoliation. All surveys were conducted using a digital sketch mapping system.

ACKNOWLEDGEMENTS

Thanks to the many individuals who contributed to this report, including Mary Burnham, Dan Dillner, Jim Esden, Jay Lackey, Lars Lund, Sean Lawson, and Tom Simmons from our Forest Resource Protection staff, as well as former Chief of Forest Resource Protection, Scott Pfister, currently Director of Forest Pest Programs for USDA-APHIS, and Ron Kelley who recently retired as Forest Resource Protection Regional Supervisor. Louis Bushey, Stewardship Forester, and Sam Schneski, Windham/ Windsor County Forester, assisted in conducting aerial detection surveys; help with processing map data was provided by Bill Frament and Tom Luther, US Forest Service, Forest Health Protection. Jon Turmel, Emilie Inoue, Amanda Priestley, and Tim Schmalz, Vermont Agency of Agriculture, and Mark Michaelis and Steve Lavallee, USDA APHIS, provided diagnostic and other support.

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Special thanks go to Ben Dillner and Luke Curtis for their contributions to our phenology and weather databases, to Doug Burnham for the many hours he contributed to facilitate the completion of our Early Detection – Rapid Response surveys, and to Mary Ellen Copeland, Ed Anthes, Pieter van Loon and Shelly Stiles for facilitating citizen monitoring for hemlock woolly adelgid. The contributions of Redstart Forestry are gratefully acknowledged. Finally, we appreciate the support and assistance of Dennis Souto, who retired at the end of 2009, Margaret Miller-Weeks, Michael Bohne and Kevin Dodds from the US Forest Service.

SPECIAL ACKNOWLEDGEMENT

Ron Kelley, Forest Resource Protection Regional Supervisor covering the northern half of the state, retired in 2009 after 35 years with Vermont's Department of Forests, Parks and Recreation. A native of Derby, Vermont, Ron went to Colorado for a geophysical engineering degree after he graduated from high school, but ended up with one in forestry. The late Ted Walker hired him as a temporary employee in Forest Pest Control for the department in 1967, sparking his interest in entomology and pathology. In graduate school at SUNY College of Forestry and Environmental Science, he majored in forest pathology but took an equal number of courses in forest entomology. There he met his wife, Ann Spearing, who was a graduate student in botany. Ron spent three years as an entomologist at an EPA laboratory in Beltsville, Maryland before returning to Vermont in 1974.

Ron's work as an insect and disease specialist in Vermont's Forest Resource Protection Section involved a broad range of activities, including working on tree health problems with homeowners, landowners, sugarmakers, foresters, and Christmas tree growers. His ground-breaking work on the biology of the balsam shootboring sawfly, *Pleuroneura brunneicornis*, has been instrumental in improving Christmas tree health. By following trees over time, Ron contributed to our understanding on how timber trees recover from logging wounds, how hardwoods recover from defoliation decline, and how sugarbushes recover from ice damage. An avid photographer, his pictures are included in many department publications and on its website, on the Forestry Images website and on several USFS Pest Alert publications. We are grateful for Ron's observations and expertise in forest health which have contributed substantially to this, and preceding Forest Insect and Disease Conditions Reports.

2009 PUBLICATIONS

Burns, B. "Ice Damage Recovery: Drawing on the Lessons from 1998." *Vermont Woodlands Association Members Newsletter* 5-8 Mar 2009: 4. http://www.vermontwoodlands.org/documents/VWANewsMarch09.pdf

Burns, B. "Overview of Quarantine Requirements for Moving Hemlock Wood Products from Vermont to Sites within the Region." Vermont Division of Forestry, Vermont Department of Forests, Parks & Recreation. 2009. http://www.vtfpr.org/protection/idfrontpage.cfm

Burns, B. "Preparing for Emerald Ash Borer, Recommendations to Reduce the Impact to Forest Management in Vermont." Vermont Division of Forestry, Vermont Department of Forests, Parks & Recreation. 2009. http://www.vtfpr.org/protection/idfrontpage.cfm

Burns, B. "We're Being Invaded! …What's a Forester to Do?" *New England Society of American Foresters News Quarterly* 70-3 June 2009: 7. http://www.nesaf.org/userfiles/Quarterlies/2009/june_issue_2009-color2.pdf

Hanson, Trish. "Beaver Beetles Revisited." *VES News, Vermont Entomological Society Newsletter* 62 Winter 2009: 5. http://www.vermontinsects.org/vesnews/VES%20News%20-%20Winter%202008-2009.pdf

Hanson, T. "Attachment Issues: Be on the Lookout for Ticks." *Vermont Woodlands Association Members Newsletter* 6-1 June 2009: 4. http://www.vermontwoodlands.org/documents/VWANewsJune09.pdf

Vermont Monitoring Cooperative. 2009. Vermont's Changing Forests: Key Findings on the Health of Forested Ecosystems from the Vermont Monitoring Cooperative. David Sleeper, ed., report October 2009, 40pp. http://sal.snr.uvm.edu/vmc/reports/synthesisReport.pdf

Lubelczyk, C., Cahill, B.K., Hanson, T., Turmel, J., Lacombe, E., et al. "Tick (Acari: Ixodidae) Infestation at Two Rural, Seasonal Camps, Maine and Vermont, U.S.A." J Parasitol. 2009 Nov 19:1; pp. 442-443. http://www.journalofparasitology.org/perlserv/?request=get-abstract&doi=10.1645%2FGE-2170.1

Ross, D.S., Wilmot, S., Juillerat, J. 2009. Soil Carbon and Other Quality Indicators in Managed Northern Forests. http://www.uvm.edu/~soilcrbn/index.html

Wilmot, S. 2009. Sugar Maple Health: the Good, the Bad, the Ugly. *Vermont Woodlands Association Members Newsletter* 6-2, December, 2009, http://www.vermontwoodlands.org/documents/VWANews-Dec09-12pages.pdf

Wood, D.M, R.D. Yanai, D.C. Allen, and S. Wilmot. 2009. Sugar maple decline following defoliation by forest tent caterpillar. Journal of Forestry 107(1): 29-37

WEATHER AND PHENOLOGY

The 2009 weather statistics based on Burlington data are summarized in Figure 1. Unless otherwise noted, all temperature and precipitation reports in the narrative below are from our Essex weather station.

Fall and Winter, 2008-2009. Temperatures at the end of 2008 were above normal for September, November and December. November, 2008, started out very mild. From the 4th to the 8th, the daytime high temperatures were in the 60's (67°F on the 6th). The warm weather caused elevated levels of fine particles in the air prompting an air quality warning of "Moderate" in most locations. Areas subject to air stagnation were classified as "Unhealthful for Sensitive Groups." The warm temperatures only lasted for half the month, though. The average daytime high temperature for the first 18 days of November was 52.3°F; the average high for the last 12 days was only 33.3°F. Precipitation of any kind was light for the month. Only 1.0" of snow fell in the Champlain Valley.

The first lasting snow at the Essex station fell on the 7th of December. A fierce cold front that night dropped the temperatures from 30°F to -3°F. High winds blew the 3" of snow around, glazing the roads for the morning commute. The month was characterized by several radical temperature swings. On the 10th, the thermometer dropped 19 degrees in one hour (from 53°F to 34°F).

A major Nor'easter hit New England on December 11th and 12th. Most of the northern areas saw precipitation as snow; however, southern Vermont, southern New Hampshire and northern Massachusetts experienced a severe icing event. In some places the damage was equivalent to or worse than the '98 ice storm. The extensive tree damage closed roads, schools and knocked out power to thousands. Windham County was hardest hit especially along Route 9 in Marlboro and Wilmington. The Marlboro fire danger rating station was offline from December 11 to December 15 when temperatures warmed above freezing and allowed the ice build-up to melt.

The ten days before Christmas had three snow storms spaced a day or two apart. Cold temperatures assured a white holiday with a settled 10" of snow on the ground. Two days later, however, a major meltdown began with rain heavy at times. The snow was gone in the Champlain Valley by the 28th of the month, and the thermometer climbed to 53°F that day in Essex.

Although the month of December had an above average amount of snowfall, much of the ground was bare by the end. This unusual situation was caused in part by the low water content of the snows. The liquid to snow ratio was 18 to1, meaning that for every 18" of snow there would be only 1" of water. The lower the water content of the snow, the more settling occurs, and the easier it is for the snow to melt. The combination of low water content and warm spells ended up melting all the snow in most valley locations. Even Mount Mansfield had only 33" at the stake after a relatively snowy November and December.

January was cold with numerous light snows to keep everything looking fresh and white. Only five days all month had daytime highs over the freezing mark. One stretch from the 14th to the 17th had below zero readings each night (-20°F on the 16th). The first big storm of the season started on the morning of January 28th. It snowed all day, leaving about 8" in the Champlain Valley, but considerably more to the south and east. Continued cold into February kept a protective blanket of snow on the ground during the worst of the winter's cold.

The first thaw in a very long time started on the 7th of February. Lots of slush formed on the frozen lakes hindering the ice fishermen. The warm-up continued from the 10th to the 12th with a high temperature of 57°F on the 11th. Half of the moisture for the whole month fell as rain on the 11th and 12th. The snowpack was disappearing rapidly, and flood watches were posted. For the season, the peak winter stretch (from December 1 to February 28) was the 6th snowiest on record at the Burlington weather station—67" at the Essex cooperator station.

One last cold spell ran into early March. Overnight lows were in the single digits either side of zero. After March 4th, however, every daytime high temperature was above 32°F on into the spring with the one exception of March 12th. The snow cover was gone in the Champlain Valley by the 11th of March, and no more measurable snow fell for the entire remainder of the season (except for a 1" snow on April 8th). Snow depth down the Green Mountain chain and east of the mountains, however, remained deep with anywhere from one to three feet of snow. By mid-March, above freezing temperatures and a little rain depleted the snow cover in the Connecticut River valley and low elevations of eastern Vermont but lingered in the higher elevations until April.

Spring, 2009. The lengthening days of mid-March brought perfect sugaring weather with lows in the 20's and highs near 50°F each day from the 13th to the 18th. Gradually, the overnight lows got lower—too low for the trees to bounce back soon enough in the day to keep up the good sap runs. Fifteen days of no rain ended on the 26th of March. More favorable weather brought more sap runs through the end of the month. April weather started out wet and cool—not good for most sugarmakers. Most people in the southern counties shut down their operations after those last runs in March. The overnight low temperatures and the daytime highs were no more than 8 or 10 degrees apart, with most nights not falling below the freezing point. In spite of the less than ideal weather conditions, and in spite of there being too much snow in some central Vermont counties, the state led the nation in maple syrup production with 920,000 gallons—a 30% increase over 2008! The increase was credited to localized stretches of ideal weather, to technological innovations such as the conversion to stainless steel spouts and greater use of vacuum systems, and to a surge in the number of new taps added by sugarmakers.

There were very few "spring fever" days to lift one's spirits by Easter, April 12th. Snow flurries, brisk winds and very cold temperatures moved the holiday celebrations indoors. Dry conditions across the state (only 0.08" of precipitation from April 9th through 21st), low afternoon relative humidity, and northwest winds in the 15-25 mph range combined to give us our usual spring fire season. Red flag warnings were posted throughout the region several times in April. (Rainfall observations from the fire weather stations in Vermont are presented in Figures 2-7.) A brief but intense warm spell late in the month brought the thermometer up to 89°F on the 27th—a temperature we would not exceed for almost four months until the middle of August!

Early spring warm weather accelerated initial bud development. Spring tree phenology at the Proctor Maple Research Center monitoring plots in Underhill showed that in 2009 sugar maple budbreak was 4 days earlier than normal (Figure 8). May was cooler than normal across most of the state prolonging full leaf out; however, full leaf out matched the long-term average (Figure 9). Full green up occurred by mid-May thus ending spring fire season (Figures 10-13 and Table 1).

On May 9th severe weather caused considerable damage across central and southern Vermont. Downed trees closed roads near Middlebury and were also reported in Windsor and Orange Counties. One inch hailstones were reported in Northfield. An EF1 tornado was confirmed in the town of Washington leaving a ½ mile path of damage to trees, roofs, and buildings (See National Weather Service report on page 25 and Figure 14). Twenty-four hour rainfall totals the following morning were over two inches in

parts of Orleans, Lamoille, and Chittenden Counties. The highest rainfall total of 3.18" was recorded at the Jeffersonville, Vermont Co-Op station.

For the eighteen warm weather weekends (May through August), only four were without precipitation. That's almost 4 out of 5 rainy weekends! There was a lot of talk about the summer that wasn't. The last day of May was a particularly crazy weather day with showers, some sun, high winds, hail…even snow squalls in the Adirondacks. Air temperatures dropped 15 degrees in about one hour, and frost warnings were issued for the overnight. The strongest recorded wind gusts were in Calais with 62 mph and New Haven with 54 mph. Average wind gusts were between 30-40 mph.

Summer, 2009. Frost/freeze warnings continued into early June. Highs were in the 60's, and the nights frequently dropped into the 30's. There were only four days in June that exceeded 80°F! Only eleven days in July reached that mark. It wasn't until August 15th that we recorded our first 90°F reading at the Essex weather station. That was in the middle of the only hot spell of the summer. For those six days in August (8/13-8/18), the daytime high temperatures were either side of 90 with no rain.

Any summary of last summer's weather has to mention the severe thunderstorms on the 16th of July. During that particularly damaging storm, a tornado was confirmed touching down near the Williamstown-Chelsea town line leaving a path of destruction 2 ½ miles long (See National Weather Service report on page 26 and Figures 15-16). Reports of hail were common that day, with the record hail stone measured at 3.3" in Westford (Figure 17). The trees in the vicinity of that report suffered such severe hail damage that it was picked up on our aerial survey a month later.

Torrential rain, flash flooding and severe thunderstorms occurred on August 21. Southern Vermont counties were hardest hit with average rainfall amounts between 1-2" and localized rainfall amounts over 3". Roads were closed due to flooding in Vernon, Chelsea and Vershire.

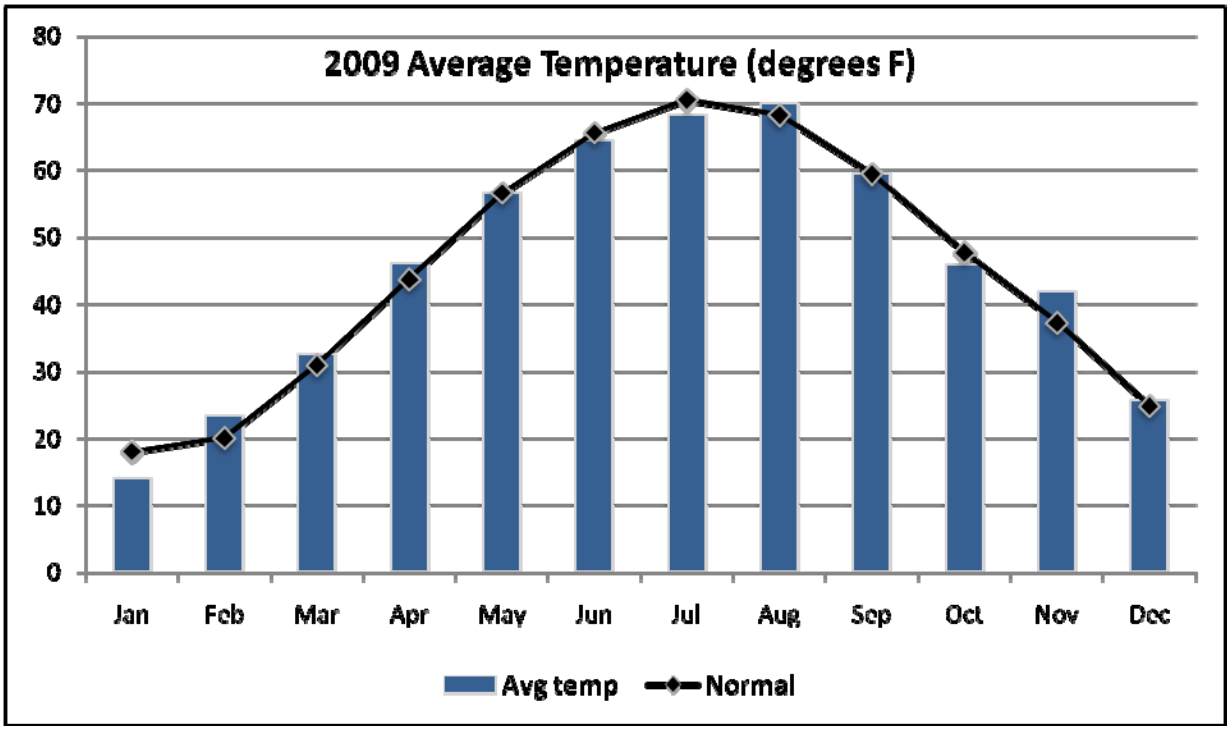
Fall, 2009. One especially pleasant stretch of weather started just as August was ending and continued until September 12th. A strong high pressure in place over New England stubbornly pushed away any approaching storm systems. Instead, we enjoyed dry, sunny weather with low humidity and cool nights, a perfect recipe for good fall color. Often, during this spell, the mornings were foggy, but the daytimes were spectacular with highs in the 70's. It wasn't long, however, before the more typical weather of overcast skies and frequent rainy days returned. Temperatures remained mild, though, and a long foliage season began. Plenty of moisture over the summer prevented any early drought-induced leaf drop and a low occurrence of insect-damaged leaves provided an ample palette. The 2009 foliage season rivaled last year despite its slow start.

The annual sugar maple fall color and leaf drop monitoring at the Proctor Maple Research Center in cooperation with the Vermont Monitoring Cooperative found that peak fall color, the date of maximum color on each tree for the year, was later than normal in 2009. Sugar maple fall color at the 1400 feet monitoring site peaked the week of October 16th in 2009, 2 weeks later than the 19 year average of October 3rd (Table 2). Trees retained their foliage until October 29th, 10 days longer than normal.

The length of the growing season for these sugar maples, budbreak to dormancy, was 13 days longer than the long-term average of 169 days (Table 3). In 2009, average budbreak was on May 3rd, and the average date for end of growing season (no more green leaves) was on October 29th. A Green Index (100-(% color + %leaf drop)), where "0" (the point when all the tree's leaves are either colored or have fallen) was used to determine the end of the growing season for this monitoring program (Figures 18-19).

The first widespread hard frost didn't occur until the 12th of the month. During the overnight hours of October 15th -16th, the air temperature dropped to 23°F at Essex. As the next day dawned cold and clear, a large proportion of the remaining leaves came fluttering down in a colorful shower as the sun's rays warmed them.

Winter, 2009. The first winter storm of 2009 brought heavy snow, sleet, freezing rain and gale force winds to the state. Trees were downed, thousands were without power, and 335 schools canceled classes or delayed openings. Snowfall was heaviest in eastern and southern Vermont while wind damage was greatest along of western slopes. A wind gust of 87 mph was reported in Huntington. A localized area of downed trees in Addison County was also reported. The damaged will be mapped by aerial survey in February, 2010.



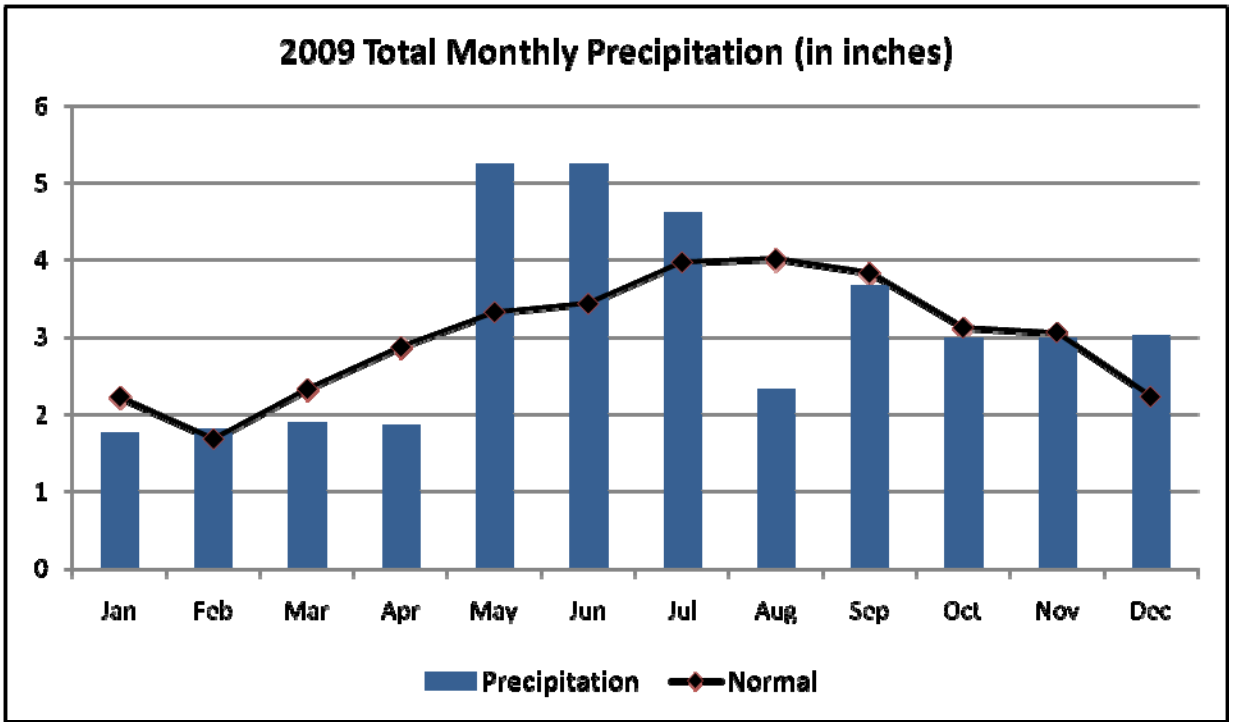


Figure 1. Monthly average temperature and monthly total precipitation in 2009, compared to normal for Burlington, Vermont. (Normals are for years 1971-2000.)

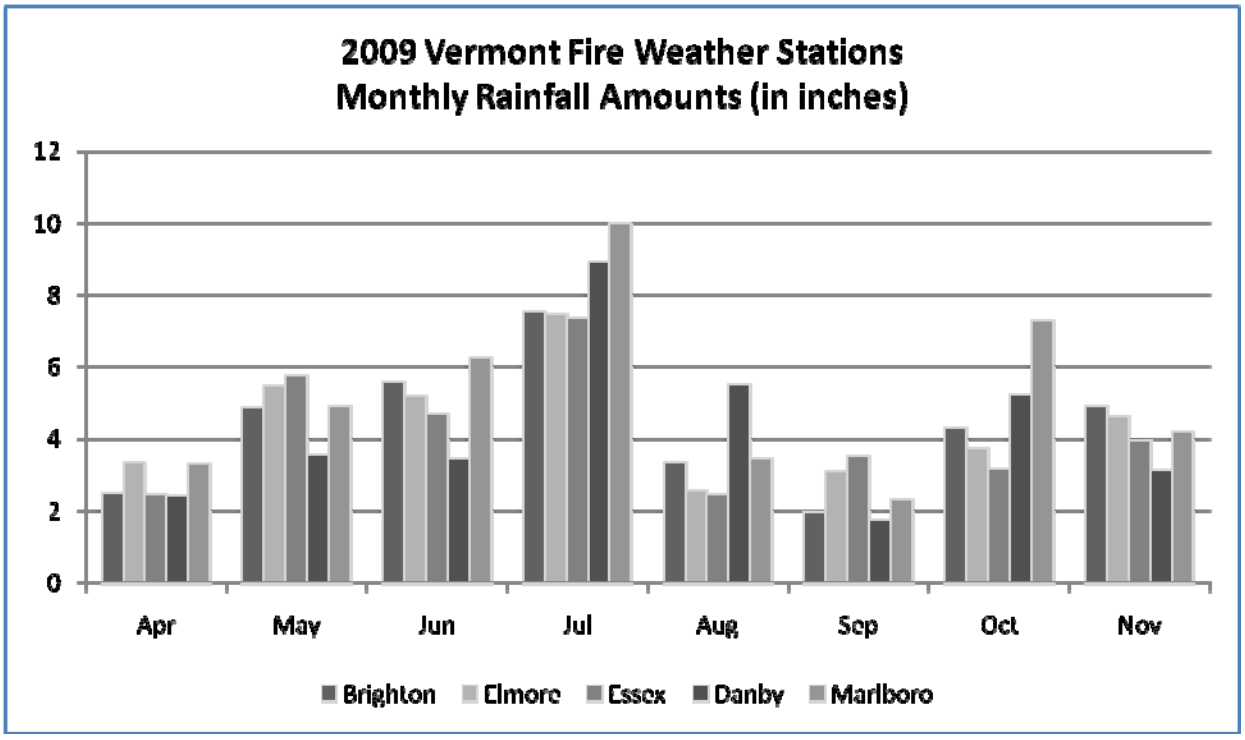


Figure 2. Monthly rainfall amounts (in inches) at Vermont fire weather observation stations through fire season, April-November, 2009.

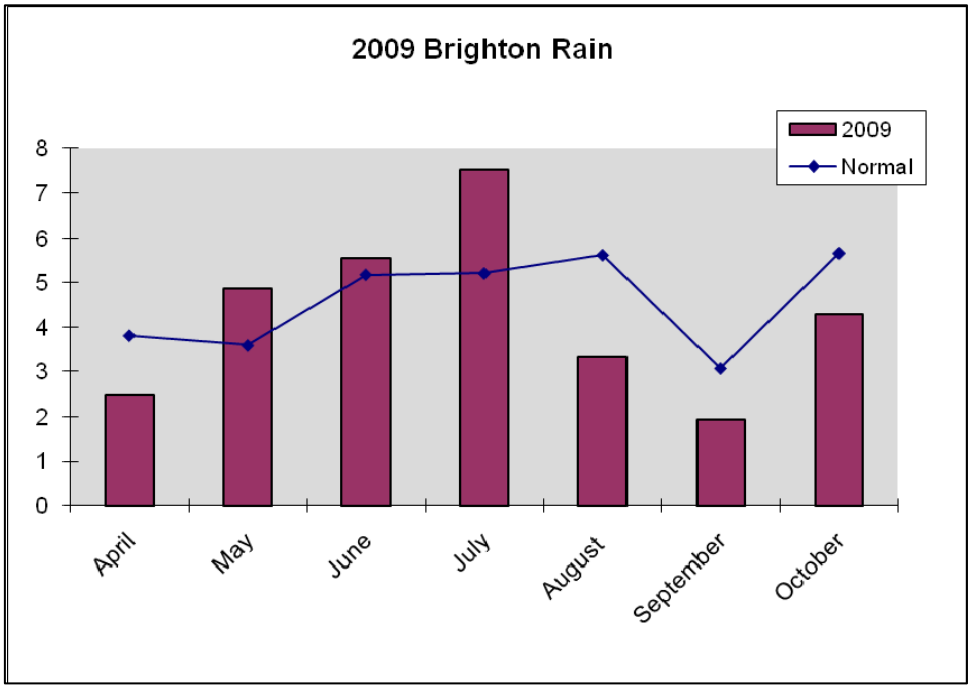


Figure 3. Monthly rainfall amounts (in inches) at the Nulhegan fire weather observation station in Brighton, Vermont compared to normal through fire season, April – October, 2009. Normal is based on 7 years of data.

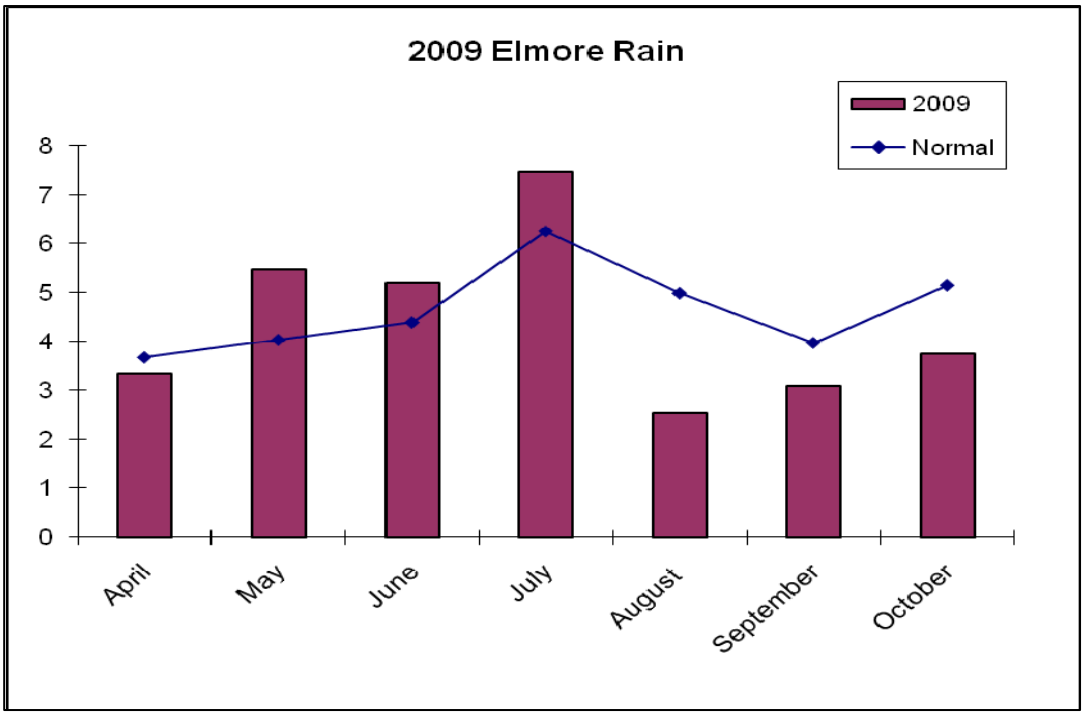


Figure 4. Monthly rainfall amounts (in inches) at the fire weather observation station in Elmore, Vermont compared to normal through fire season, April – October, 2009. Normal is based on 15 years of data.

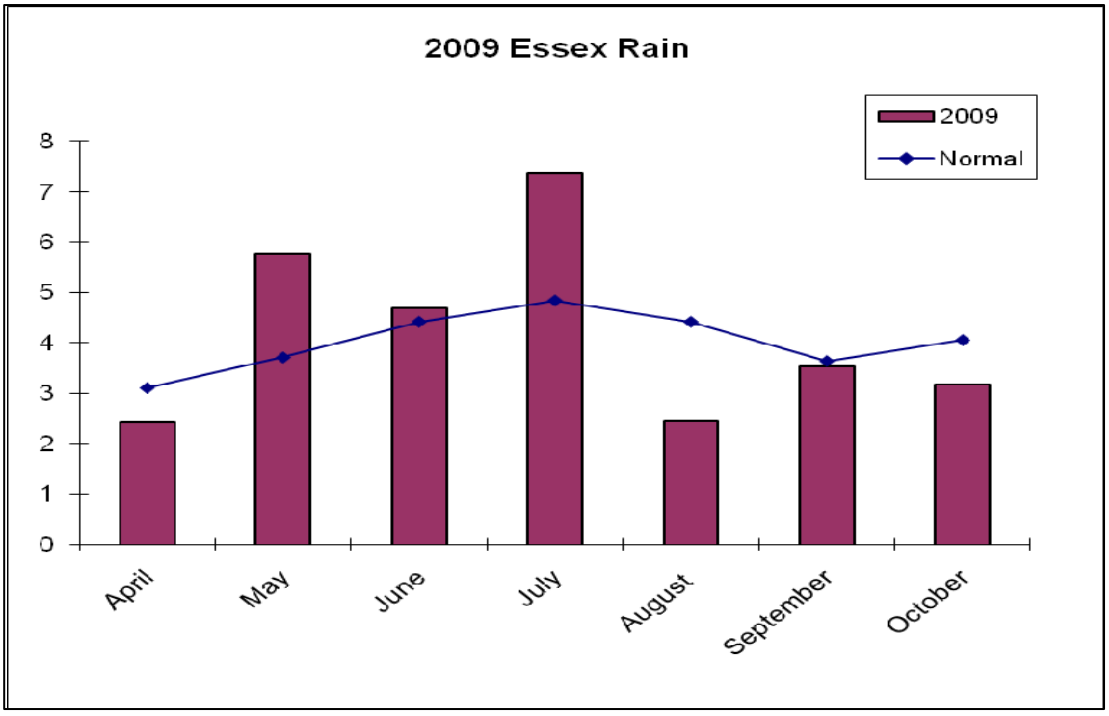


Figure 5. Monthly rainfall amounts (in inches) at the fire weather observation station in Essex Junction, Vermont compared to normal through fire season, April – October, 2009. Normal is based on 16 years of data.

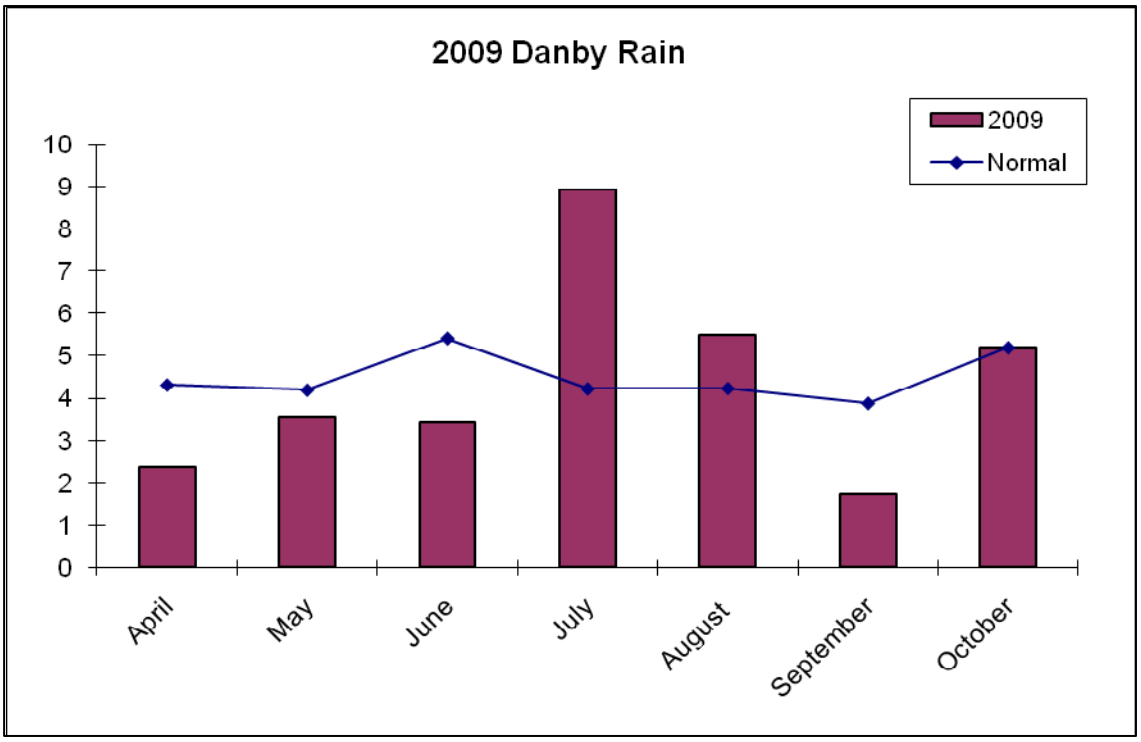


Figure 6. Monthly rainfall amounts (in inches) at the fire weather observation station in Danby, Vermont compared to normal through fire season, April – October, 2009. Normal is based on 12 years of data.

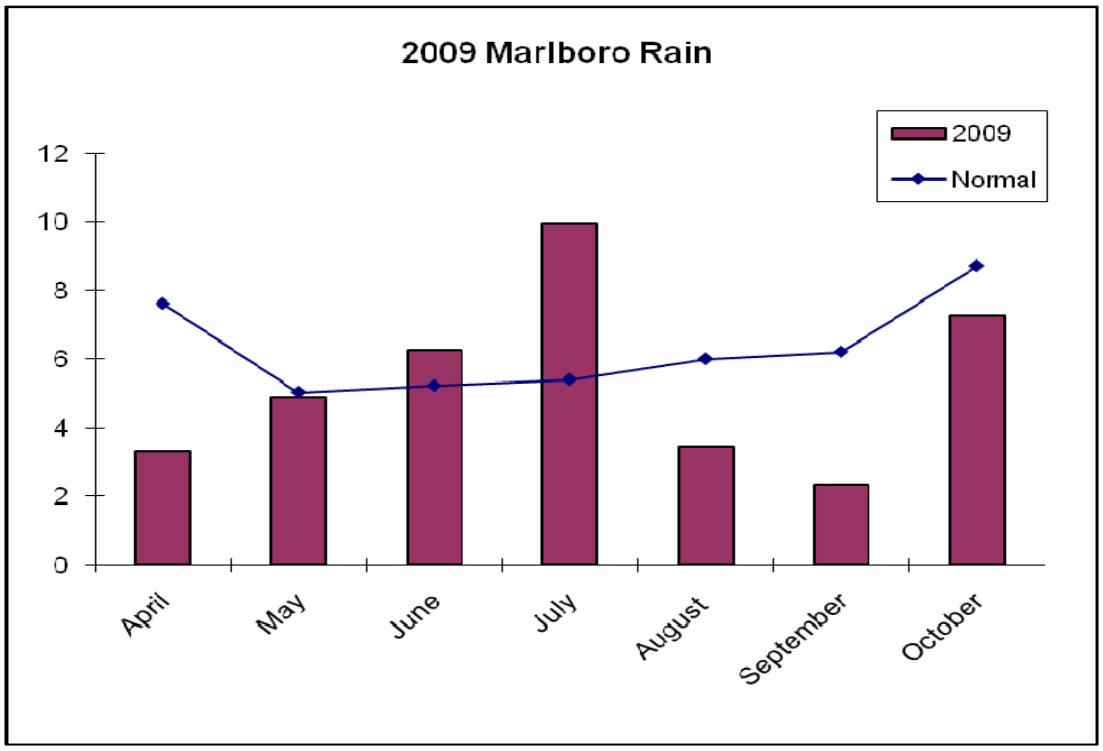


Figure 7. Monthly rainfall amounts (in inches) at the fire weather observation station in Marlboro, Vermont compared to normal through fire season, April – October, 2009. Normal is based on 7 years of data.

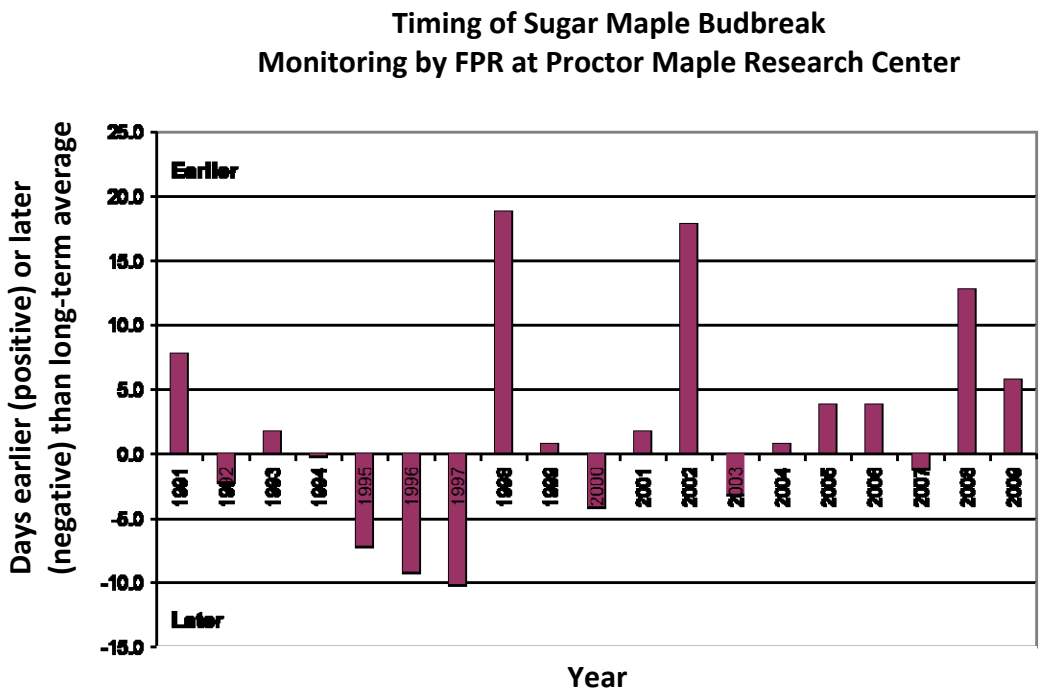


Figure 8. Timing of sugar maple budbreak at Proctor Maple Research Center. In 2009 sugar maple budbreak was 4 days earlier than normal.

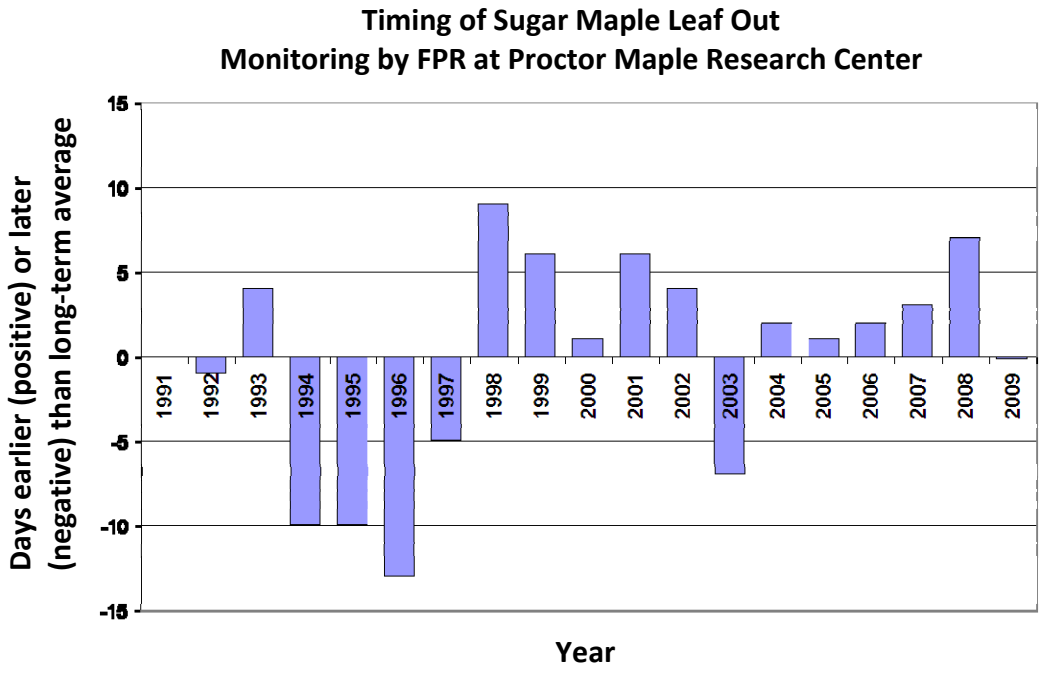


Figure 9. Timing of sugar maple leaf out at Proctor Maple Research Center. In 2009 sugar maple leaf out matched the long-term average.

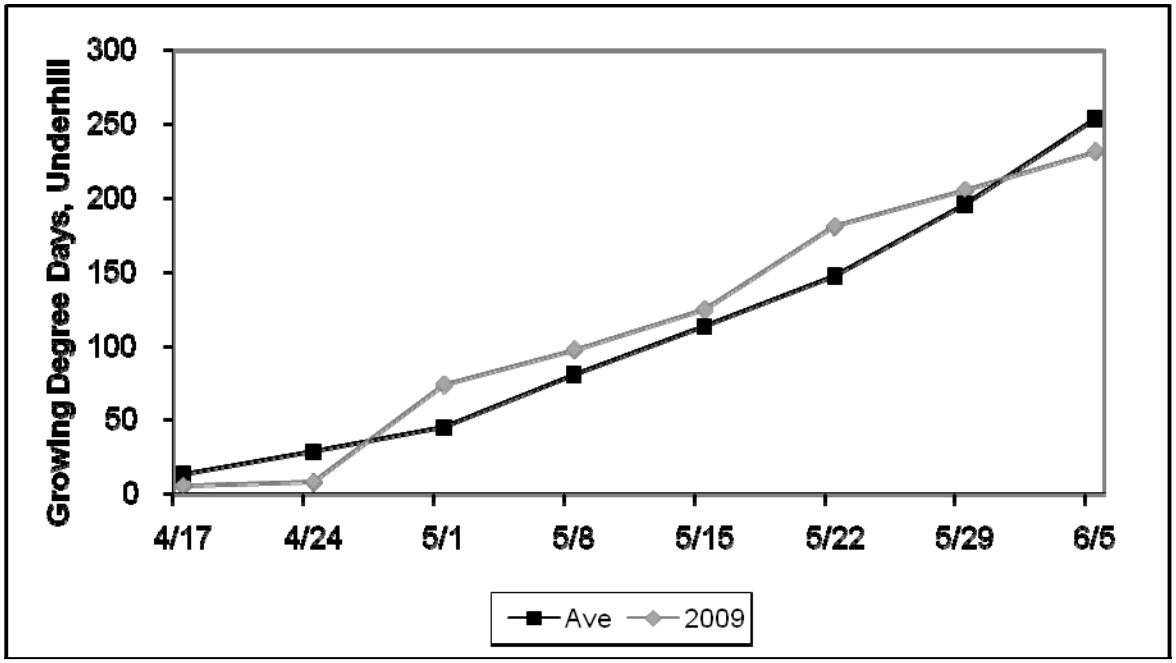


Figure 10. Weekly spring cumulative growing degree days for Underhill, Vermont, in 2009 compared with mean 1993-2009 accumulations. 50° F was used as the threshold of development.

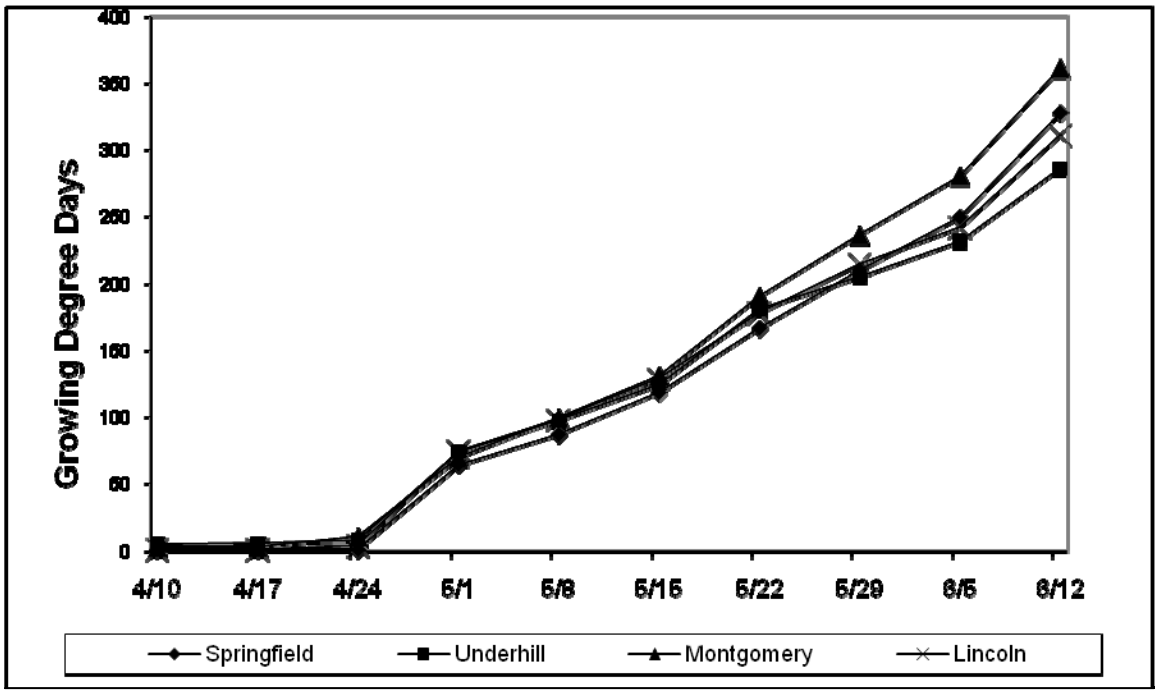


Figure 11. 2009 weekly spring cumulative growing degree days for Springfield, Underhill, Montgomery, and Lincoln, Vermont. 50° F was used as the threshold of development.

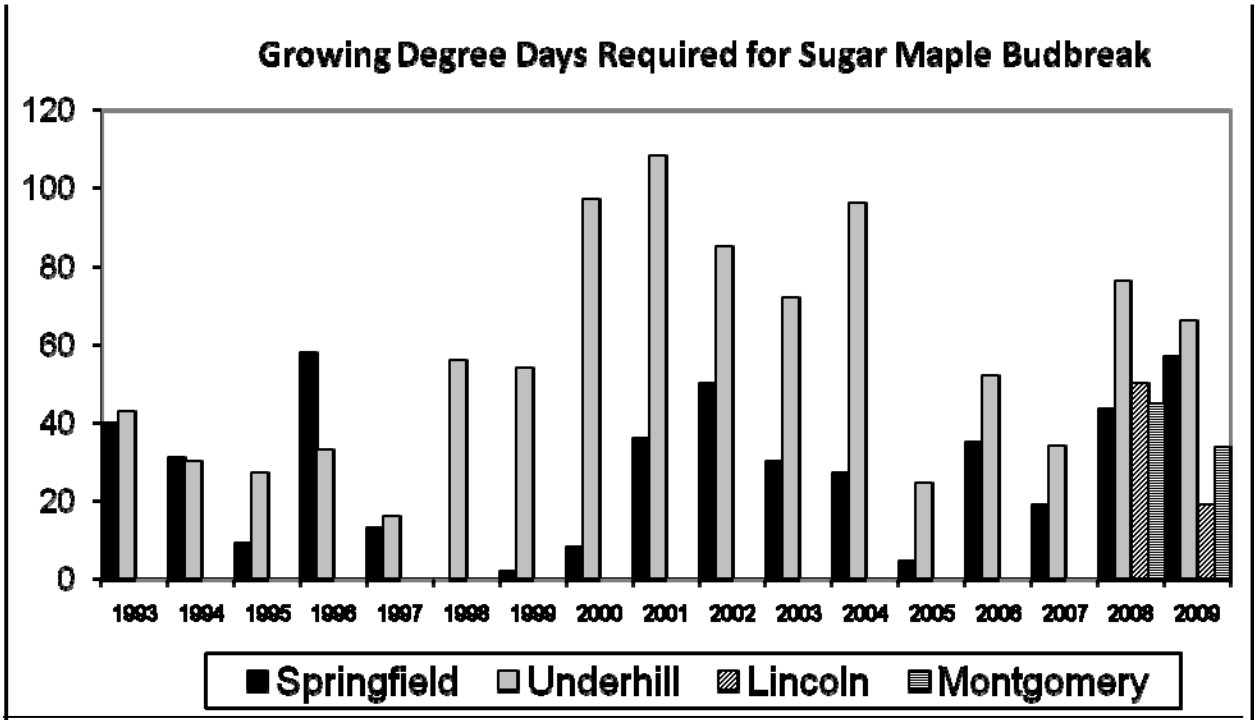


Figure 12. Growing degree days for sugar maple budbreak in Springfield and Underhill 1993-2009, and for Montgomery and Lincoln 2008-2009.

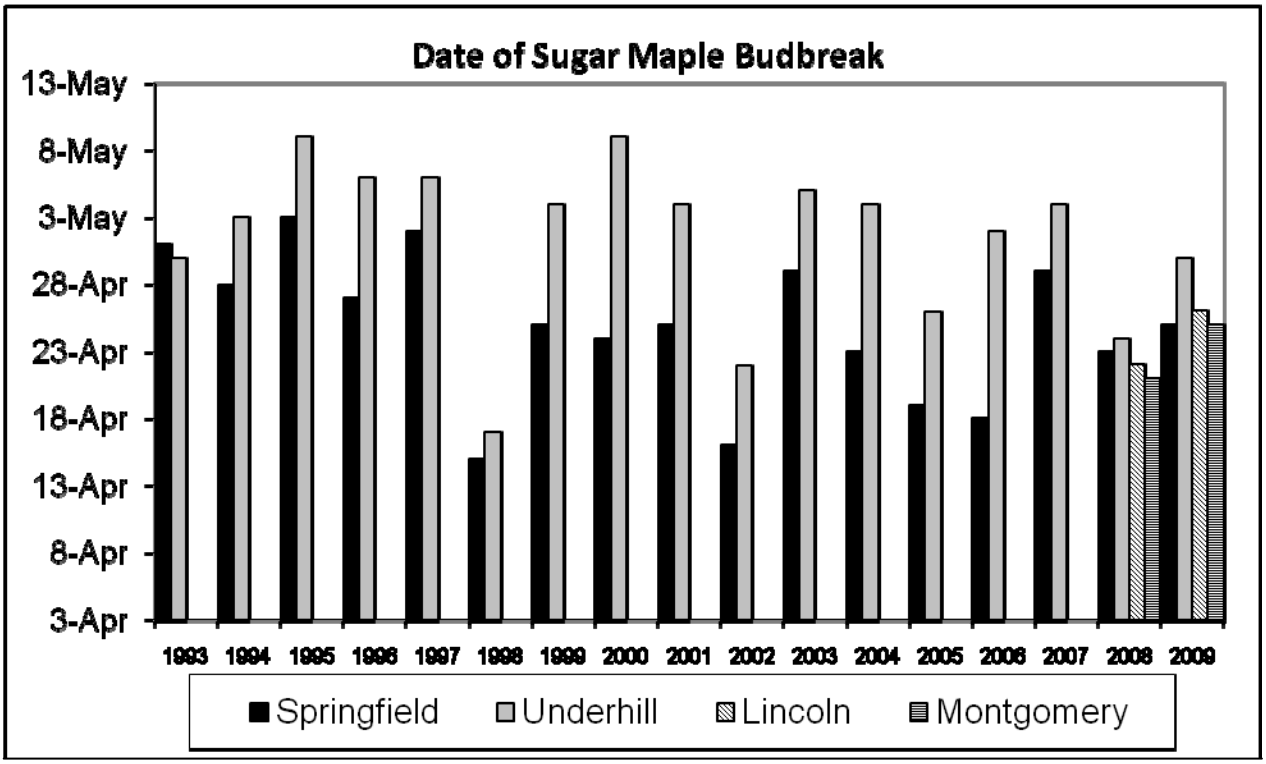


Figure 13. Dates of sugar maple budbreak in Springfield and Underhill 1993 and for Lincoln and Montgomery 2008-2009.

Table 1. First observation dates of phenological development and growing degree day accumulation from 4 sites in Vermont for 2009. 50° F is used as the threshold of development.

Biological Indicator	Lincoln	Montgomery	Springfield	Underhill
PLANT DEVELOPMENT				
Showing Green				
Fir, Balsam	6/8 (98)	5/10 (117)		5/7 (90)
Hemlock		5/19 (146)		5/14 (118)
Spruce, Red		5/29 (236)		
Budbreak				
Ash, White			4/29 (57)	
Aspen, Quaking		4/26 (30)		
Birch, Yellow	4/25 (9)			
Boxelder				
Cherry, Black	4/25 (9)	4/21 (6)	4/25 (57)	
Cherry, Choke	4/25 (9)	4/21 (6)		
Elm, American		4/26 (30)	4/26 (57)	
Fir, Balsam		5/19 (146)		5/14 (118)
Hemlock		5/21 (163)	5/8 (71)	5/22 (181)
Lilac	4/23 (4)	4/20 (6)		
Maple, Red		4/26 (30)	4/25 (57)	5/4 (83)
Maple, Striped	4/25 (9)			
Maple, Sugar	4/26 (19)	4/27 (34)	4/25 (57)	4/30 (66)
Oak, Red		5/7 (97)	4/26 (57)	
Shadbush			4/26 (57)	
Spruce, Red		6/4 (273)		
Virginia Spring Beauty				
Wild Strawberry			4/26 (57)	
Flowers of Deciduous Trees and Shrubs				
Ash, White		4/27 (34)		
Aspen, Quaking		4/18 (3)	4/7 (0)	
Cherry, Black		5/31 (253)	4/26 (57)	
Cherry, Choke		5/17 (146)		
Elm, American		4/27 (34)	4/14 (0)	
Lilac (first flowers)		5/16 (139)	5/8 (71)	5/21 (170)
Maple, Red	4/24 (9)	4/20 (6)	4/10 (0)	4/19 (6)
Maple, Silver			4/3 (0)	
Maple, Sugar	4/28 (59)	4/27 (34)		4/30 (66)
Oak, Red		5/9 (112)		
Shadbush	5/4 (81)			5/4 (83)
Wildflowers				
Marsh Marigold	5/3 (79)			
Virginia Spring Beauty	4/19 (4)	4/24 (11)		4/16 (5)
Wild Strawberry		5/4 (79)		5/18 (133)
INSECT DEVELOPMENT				
Eastern tent caterpillar (first tent)		5/15 (131)		5/16 (133)
Gypsy moth (egg hatch)	5/6 (90)			
Pear thrips (first adults)	4/20 (4)			4/3 (5)
OTHER OBSERVATIONS				
Spring peepers calling	5/1 (75)	4/25 (13)	4/9 (0)	
Full green up		6/10 (328)	5/29 (157)	

Severe Weather Events – May 9, 2009 Tornado

The following are excerpts from the Burlington, Vermont National Weather Service office reports of the May 9, 2009 and July 16, 2009 severe weather events across the North Country.

"On May 9th, 2009 several meteorological ingredients came together to produce a challenging severe weather event across northern New York and parts of central and southern Vermont. The highest concentration of severe weather occurred from Essex County, New York into Addison, Orange, Rutland, and Windsor Counties across central and southern Vermont. The severe weather reports included a tornado, which was rated an EF1 on the enhanced Fujita scale (86-110 mph), severe hail, and wind damage. The tornado occurred in Orange County, Vermont near the Village of Washington. The length was approximately one half mile, with a width of several hundred yards at its strongest location. The damage included trees uprooted and snapped off, an entire apartment roof was removed, and a steel barn was destroyed. The degree of damage to these structures was consistent with winds ranging from 90 to 100 mph.

In addition to the confirmed tornado, other severe weather reports included, trees down which closed roads near Middlebury, Vermont, one inch hail in Northfield VT, dime size hail near Moriah and Newcomb New York, and several areas of trees down across Windsor and Orange Counties. The scattered thunderstorms resulted in over 5,000 customers losing power across Vermont."
Tornadoes are relatively rare in Vermont. On average, one tornado is reported every two years. A tornado occurrence in May is even rarer. This tornado was the second earliest confirmed tornado in the state since 1950. The earliest tornado on record occurred in Bennington County on March 22, 1955. That tornado was rated an F2 (118-161 mph) on the old Fujita scale."

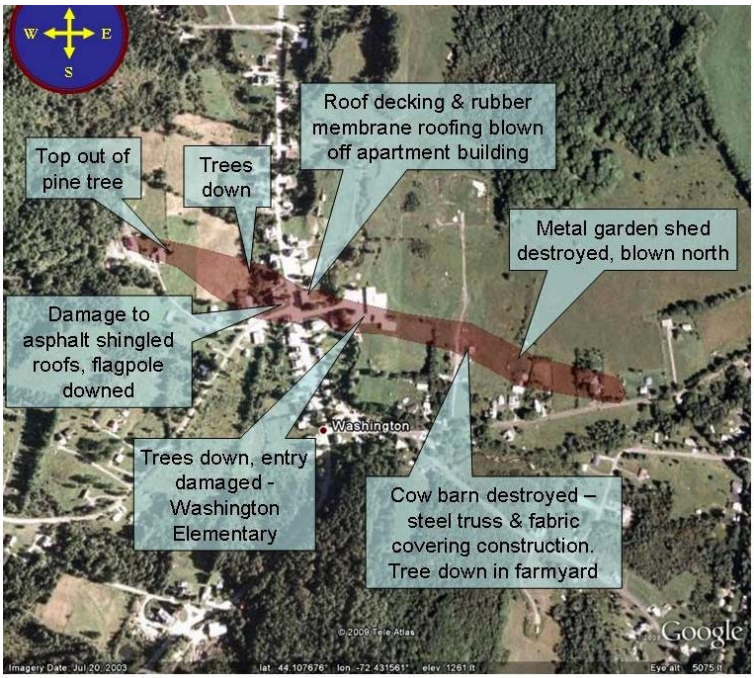


Figure 14. Damage survey summary near the town of Washington, Vermont by the National Weather Service, Burlington, Vermont.

Severe Weather Events – July 16, 2009 Tornado and Record-Breaking Hail

"On 16 July 2009 a significant severe weather event occurred across northern New York as well as central and northern Vermont. This event included several long lived supercell thunderstorms, which produced an EF0 tornado near Williamstown, Vermont and over 3 inch diameter hail in Westford, Vermont. A National Weather Service (NWS) storm survey team estimated maximum winds ranged from 55 to 75 mph associated with this weak EF0 tornado.

Figure 15 shows the damage path caused by the EF0 tornado, with the red shading signifying winds of 40 to 50 mph and the white shading indicating winds of 55 to 75 mph.

Figure 15. Tornadic path near Williamstown, Vermont by NWS/Burlington, Vermont.

The supercell near Westford produced the largest hail stone ever documented in Vermont. This record breaking hail stone measured 3.3 inches in diameter, had a circumference of 6.8 inches, and weighed 2.1 ounces. In addition, several areas reported trees and power-lines down, caused by severe thunderstorm winds."

The four photographs below are courtesy of the National Weather Service.

Figure 16. Damage to trees from tornado in Williamstown, Vermont.

Figure 17. Largest hailstone ever documented in Vermont (top: diameter, bottom: circumference).

Table 2. Timing of fall color and leaf drop at the Proctor Maple Research Center

Sugar maples at 1400 feet	Long-term average	2009
Peak Fall Color	Oct. 3	Oct. 16
Full Leaf Drop	Oct. 19	Oct. 29

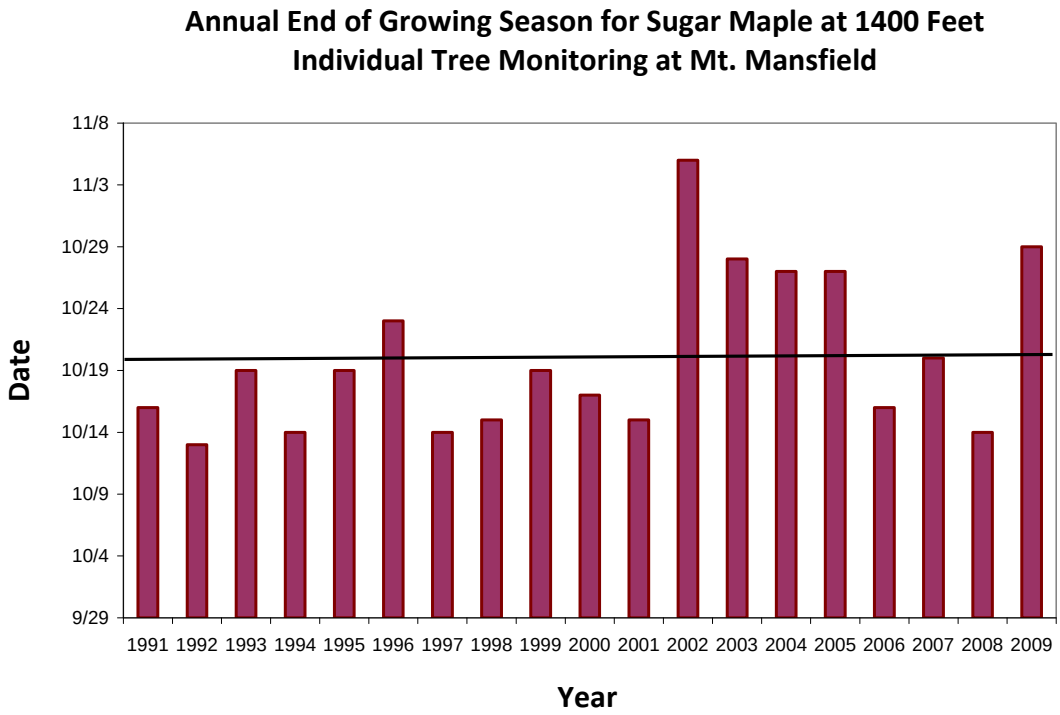


Figure 18. End of growing season for sugar maple at Proctor Maple Research Center compared to 19 year average. In 2009, sugar maple trees at 1400 feet retained their foliage until October 29th, 10 days longer than average.

Year	Day of Year Annual Budbreak	Day of Year End of growing season (<10%green index)	Length of growing season (days)
1991	118	289	171
1992	128	287	159
1993	124	291	167
1994	126	287	161
1995	133	292	159
1996	135	296	161
1997	136	287	151
1998	107	288	181
1999	125	292	167
2000	130	291	161
2001	124	288	164
2002	108	309	201
2003	129	301	172
2004	125	300	175
2005	122	300	178
2006	122	289	167
2007	127	295	168
2008	113	288	175
2009	120	302	182
Average	124	293	169

Table 3. Length of the growing season (budbreak to end of growing season) for sugar maple at the Proctor Maple Research Center. Average budbreak was May 3rd, and average end of growing season was October 29th. In 2009, the length of the growing season was 13 days longer than the long-term average of 169 days.

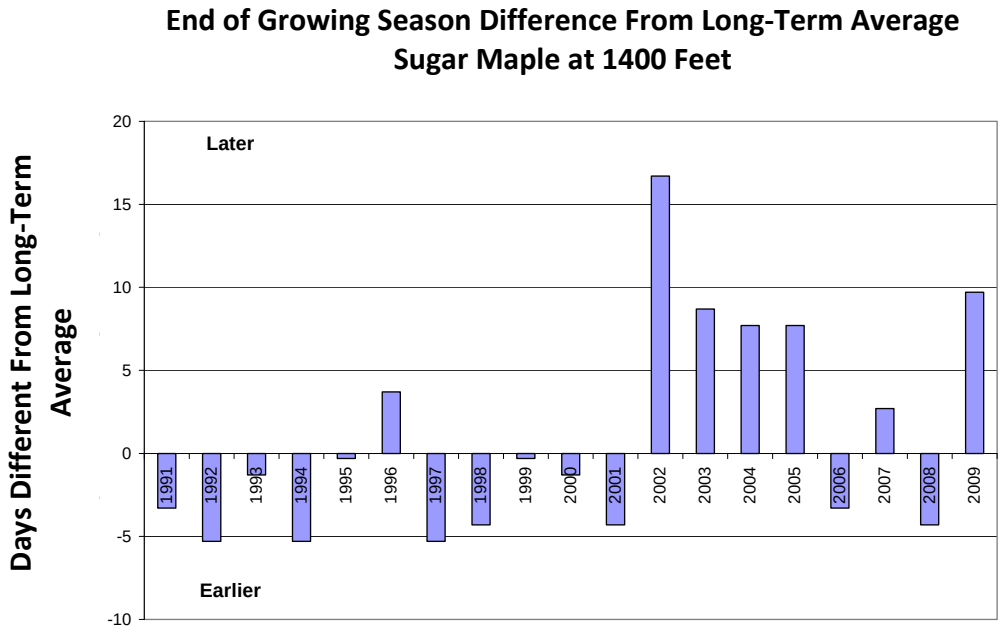


Figure 19. End of growing season (no more green leaves) difference from 19 year average for sugar maple at the Proctor Maple Research Center. In 2009, the end of the growing season was 9 days later than the long-term average. A Green Index (100 - (% color + % leaf drop)), where "0" (the point when all the tree's leaves are either colored or have fallen) was used to determine the end of the growing season for this monitoring program.

HARDWOOD DEFOLIATORS

Birch Defoliation, caused primarily by birch leafmining sawflies and leaf fungi (*Septoria* sp.), was mapped during aerial survey on a total of 45,936 acres (Table 4 and Figure 20).

Table 4. Mapped acres of birch defoliation by birch defoliator complex in 2009.

County	Acres
Addison	3,601
Bennington	8,428
Caledonia	1,808
Chittenden	1,554
Essex	3,377
Franklin	1,125
Grand Isle	0
Lamoille	3,099
Orange	1,533
Orleans	4,011
Rutland	5,975
Washington	3,884
Windham	4,276
Windsor	3,265
Total	**45,936**

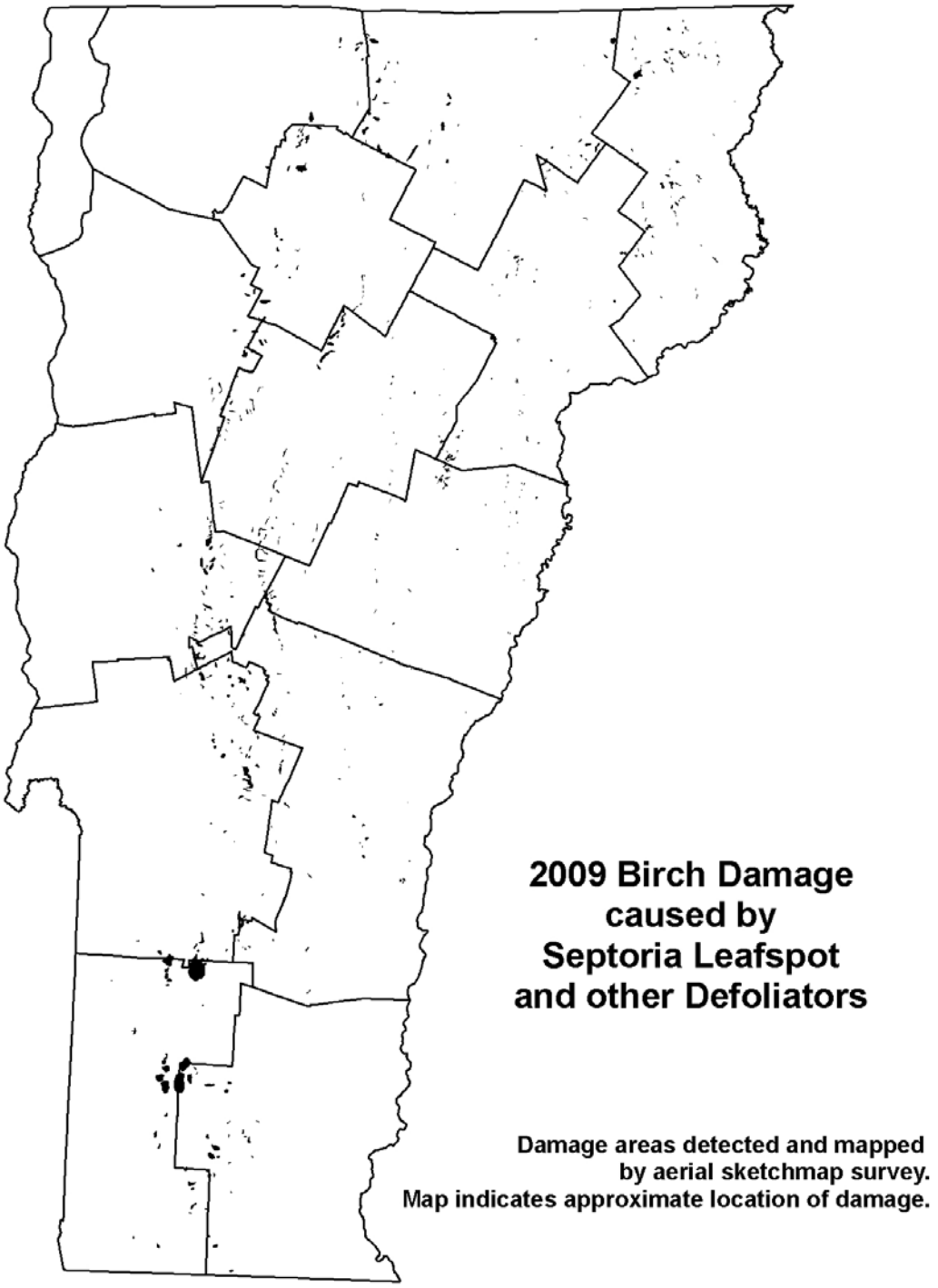


Figure 20. Late season defoliation of birch and other hardwoods in 2009. Mapped area includes 45,936 acres attributed to birch leafmining sawflies and leaf fungi.

Forest Tent Caterpillar, *Malacosoma disstria***,** caused no noticeable defoliation, although occasional larvae were observed. Areas of mortality are still noticeable in the Taconic range. In Rutland County, decline attributed to forest tent caterpillar defoliation was mapped on 33 acres. Elsewhere, previously defoliated stands continue to recover. Moth catch in pheromone traps increased or remained the same in 9 of the 12 trap sites this year compared to 2008 (Table 5 and Figure 21).

Table 5. Average number of forest tent caterpillar moths caught in pheromone traps, 2002-2009. There were 4-5 traps per location in 2002 and 3 traps per location in 2003-2009. Roxbury was an exception, with only one trap in 2008.

Site	Year							
	2002	2003	2004	2005	2006	2007	2008	2009
Castleton	----	----	----	17	17.3	8	1	4.7
Fairfield	----	1.3	1.7	----	4.3	4.7	4	10.3
Huntington (NAMP 027)	9.2	6.7	10	15.7	16	6.3	4.3	4.3
Killington/Sherburne	6.8	9.7	20	15.3	21	17.3	7.3	8.0
Manchester (new site in 2008)							0	5.7
Rochester	5.9	4.7	9	4.7	29	10.3	0.7	----
Roxbury	16	14.7	13	7.3	22	22.7	8	2.7
SB 2200	3.8	11.7	18.3	23.3	35.3	6.3	5.7	10.0
VMC 1400, Underhill	3.6	3	0.3	7.3	9.3	2.7	1.3	8.3
VMC 2200, Underhill	3	7	6.3	11.7	6.3	4.7	1.3	4.3
VMC 3800, Stowe	1	2.7	10.3	26	5.7	5	1.3	1.7
Waterbury	2	0.7	2	41	22.3	0.3	1	5.0
Waterville	0	1.3	1.3	17.7	24.7	2.7	2.3	1.3
Average	**5.2**	**6.9**	**10**	**17**	**17.8**	**7.6**	**2.9**	**5.5**

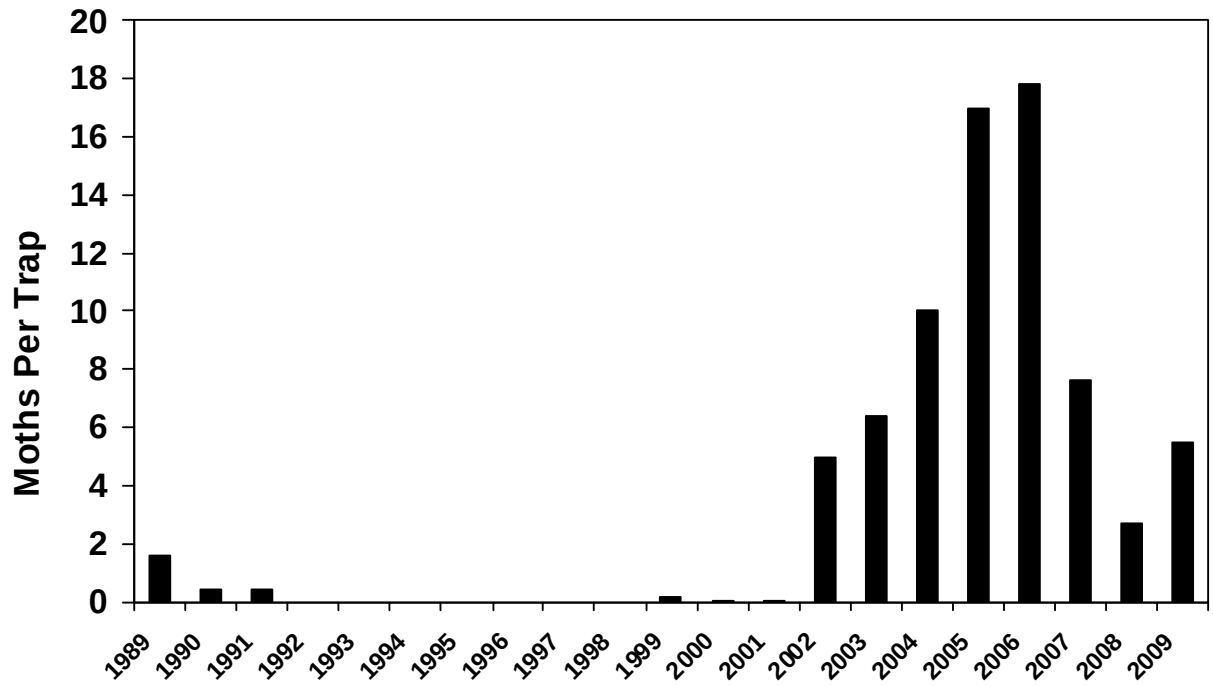


Figure 21. Average number of forest tent caterpillar moths caught in pheromone traps 1989-2009. Five multi-pher traps per site were baited with RPC 2-component lures through 2001. PheroTech lures were used in 2002-2009. Three traps per site in 2003-2009, except for Roxbury, with only one trap.

Gypsy Moth, *Lymantria dispar*, caused no noticeable defoliation, although occasional egg masses or larvae were observed. Egg mass counts per 1/25th acre monitoring plot at focal areas, already low, decreased further in five of the ten monitoring sites (Table 6 and Figure 22), indicating a prediction of continued low populations for 2010.

Table 6. Gypsy moth egg mass counts from focal area monitoring plots, 2003-2009. Average of two 15-meter diameter burlap-banded plots per location.

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

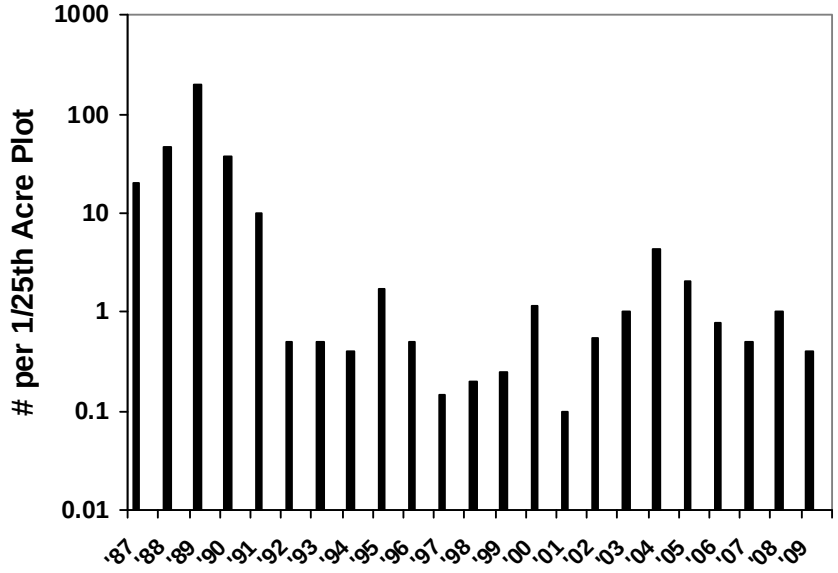


Figure 22. Gypsy moth egg mass counts from focal area monitoring plots, 1987-2009. Average of ten locations, two 15m diameter burlap-banded plots per location.

Hardwood Defoliation, caused by leaf-feeding insects and anthracnose, was mapped on a total of 7,474 acres (Figure 23 and Table 7). Although there was some refoliation in affected stands, the damage remained noticeable throughout the growing season. Of the 7,474 acres of hardwood defoliation mapped during aerial surveys, at least 3,344 acres was **damage to oaks**. (See Oak Defoliation below.) In addition, 438 acres of **willow defoliation** was mapped, and thought to be caused by willow leaf beetle and leaf disease fungi. This included 331 acres in Franklin County, and 26 and 81 acres, respectively, in Rutland and Washington Counties.

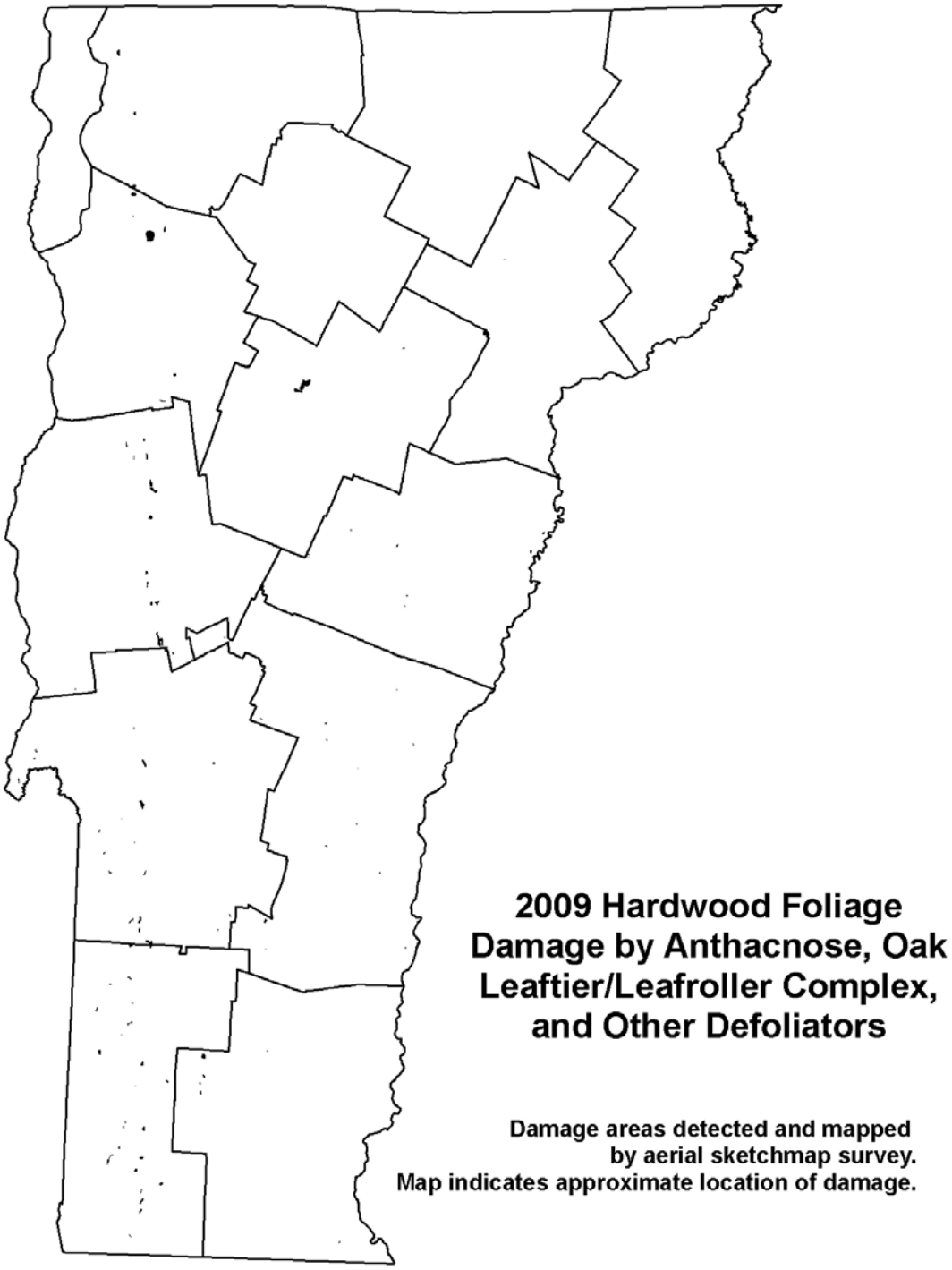


Figure 23. Hardwood foliage damage mapped in 2009. Total area mapped is 7,474 acres.

Oak Defoliation by a complex of leaf rollers and leaftiers was noticeable in scattered locations, including areas that were reported as defoliated by a similar complex in 2008, and areas that had not been reported previously. These included stands in Middlesex, Waterbury, Jamaica, Norwich, Sharon, West Rutland, and Bradford. Damage began at leaf-out in May. We collected foliage from Jamaica (5/12/09), Waterbury (5/14/09) and Jericho (6/10/09) to see if we could determine what insects were involved in the defoliation. A few caterpillars were identifiable, but most required rearing to adulthood to confirm identities. Research indicated that there could be 10 or more common species on *Quercus* in the early spring of the year.

The species that we documented in 2009 included *Argyrotaenia quercifoliana*, *Sparganothis directana* complex (the immature is a larva with a dark shield), and *Chionodes* sp. (possibly *C. bicostomaculella*) (all reared to adulthood from material we collected), *Orthosia rubescens* (identification from larvae), and *Lithophane* sp., perhaps *L. patefacta* (also identified from larvae). (We would not expect either the *Orthosia* or the *Lithophane* to be significant defoliators on their own.)

As a point of interest, in 2009 we participated in a Cooperative Agricultural Pest Survey (CAPS) project in oak stands that involved use of sticky traps and pheromones for *Adoxophyes orana* (the so-called summer fruit tortrix), *Archips xylosteanus* (the variegated golden tortrix), and *Epiphyas postvittana* (the light brown apple moth). (See below for more on the CAPS project.) Traps baited for summer fruit tortrix that were collected from Jamaica (6/8/09) and Jericho (6/10/09) contained 65 and 20 specimens of the so-called oak leaftier, *Croesia semipurpurana*, respectively. That species has been associated with areas of extensive defoliation in New England in the 70s and early 80s. In Vermont in 1980, records show that a leaftier complex caused moderate defoliation in the Waterbury-Middlesex area, and was attributed to the combined work of a number of insects including *Psilicorsis reflexella*, *Tetralopha* sp., *Pseudotelphusa quercinigracella*, and *Morrisonia confusa*, with *P. reflexella* being the most important. Similar damage was apparently noted in the late 1980s in New Hampshire and Massachusetts, and that resulted in some oak mortality.

Table 7. Acres of defoliation of oak and other hardwoods mapped in 2009.

County	Acres
Addison	1,433
Bennington	1,536
Caledonia	15
Chittenden	1,168
Franklin	312
Orange	208
Rutland	1,260
Washington	885
Windham	354
Windsor	304
Total	**7,474**

Oak Commodity Survey
This Cooperative Agriculture Pest Survey (CAPS) was part of an effort initiated by the US Department of Agriculture to determine if a number of nationally-targeted oak pests were present in oak stands in Vermont. In this study, we used a combination of visual surveys, trap trees and baited traps at sites in Bolton, Jamaica, and Arlington.

Three pheromone wing traps baited with three different lures were deployed at each survey site. Target insects included three moths, the summer fruit tortrix (*Adoxophyes orana*), the light brown apple moth (*Epiphyas postvittana*) and the variegated golden tortrix (*Archips xylosteanus*). The variegated golden tortrix is of special concern because it was found to be infesting trees in St. John's, Newfoundland in 2005. Traps were visited every 5 weeks until late August to replace lures and collect insects.

Trap trees were also prepared at the site to study the European oak bark beetle, *Scolytus intricatus*, and visual surveys were conducted at each site for oak decline caused by a pathogen called *Phytophthora ramorum*. None of these target pests was found in Vermont during our 2009 surveys.

Table 8. Summary of site and collection data for 2009 oak commodity survey for the summer fruit tortrix (*Adoxophyes orana*), the light brown apple moth (*Epiphyas postvittana*) and the variegated golden tortrix (*Archips xylosteanus*). Data include counties, towns, GPS coordinates, dates of trapping survey, and numbers of target species found.

County	Town	GPS Points (NAD83)	Dates of trapping survey	Number of site visits	# of target species found
Bennington	Arlington	N 43.08644 W073.25983	5/6/09 – 10/14/09	4	0
Chittenden	Jericho	N 44.43158 W 72.93513	5/11/09 – 8/31/09	4	0
Windham	Jamaica	N 43.128189 W 72.77211	5/11/09 – 9/21/09	4	0

Poplar Defoliation by a complex of leaf rollers was noticeable in scattered locations along the Interstate highways in Hartford and Sharon. Most affected stands have been defoliated several years in a row. Damage remained visible throughout the growing season. Foliage collected in Hartford on May 21 was held in the lab to see if any of the leafrollers would reach adulthood. On July 30, a single moth (*Gypsonoma substitutionis* in the subfamily Olethreutinae of the family Tortricidae) emerged. It seems likely that this was a predominant species involved with the Hartford leafrolling because every leaf collected from that site had the same type of roll at the lower edge of the leaf. We could find very little information about this species, though we did note that some other members of the genus are also associated with species of *Populus*.

OTHER HARDWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Birch Leaf Miner *Fenusa pusilla*	Paper birch White birch	Southern Vermont	Only light damage observed. See foliage diseases.
Cherry Scallop Shell Moth *Hydria prunivorata*	Cherry	Northeast Kingdom	Only rarely observed.
Early Birch Leaf Edgeminer *Messa nana*	White birch	Southern Vermont	Only light damage. See foliage diseases.
Eastern Tent Caterpillar *Malacosoma americanum*	Cherry Apple	Statewide	Occasionally observed along roadways. Otherwise, populations low with few tents seen.
Fall Webworm *Hyphantria cunea*		Statewide, particularly in Southern Vermont	Widespread, including scattered heavy defoliation in southern Vermont. Occasionally observed elsewhere.
Forest Tent Caterpillar *Malacosoma disstria*			See narrative.
Gypsy Moth *Lymantria dispar*			See narrative.
Hickory Tussock Moth *Lophocampa caryae*	Hardwoods	Rutland and Bennington Counties	Increased sightings of individual larvae; no damage observed.
Japanese Beetle *Popillia japonica*	Ornamentals	Addison, Chittenden, Grand Isle and Franklin Counties	Down from 2008.
Locust Leaf Miner *Odontata dorsalis*	Black locust	Champlain Valley	Up from 2008. 93 acres mapped in Chittenden County. Elsewhere, remains low.
Maple Leaf Cutter *Paraclemensia acerifoliella*	Sugar maple	Throughout	Only very light damage observed.

INSECT	HOST(S)	LOCALITY	REMARKS
Maple Trumpet Skeletonizer *Epinotia aceriella*	Sugar maple	Statewide	Frequently noticeable in lower crowns, but only light damage. Down from 2008.
Oak Leaftier *Croesia semipurpurana*			See Oak Defoliation.
Pecan Casebearer *Acrobasis caryae*	Butternut/Black Walnut	West Haven	Ornamentals.
Tortricid Leaf Rollers on Poplar			See Poplar Defoliation.
Uglynest Caterpillar *Archips cerasivoranus*	Rubus and other shrubs	Shrewsbury	Ornamentals.

Hardwood defoliators not reported in 2009 included Alder Flea Beetle, *Altica ambiens;* Birch Sawfly, *Arge pectoralis;* Birch Skeletonizer, *Bucculatrix canadensisella*; European Snout Beetle, *Phyllobius oblongus*; Maple Leafblotch Miner, *Cameraria aceriella;* Maple Webworm, *Tetralopha asperatella*; Mountain Ash Sawfly, *Pristophora geniculata*; Oak Skeletonizer, *Bucculatrix ainsliella;* Orange-humped Mapleworm, *Symmerista leucitys*; Pear Slug Sawfly, *Caliroa cerasi*; Saddled Prominent, *Heterocampa guttivata*; Satin Moth, *Leucoma salicis*; Viburnum Leaf Beetle, *Pyrrhalta viburni*; White Marked Tussock Moth, *Orgyia leucostigma.*

SOFTWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Arborvitae Leaf Miner *Argyresthia thuiella*	Northern white cedar	Widely scattered	Remains low.
Larch Casebearer *Coleophora laricella*	Tamarack	Rutland County	Remains low.
Sawflies Families Diprionidae and Tenthredinidae	Spruce and other softwoods	Scattered	On ornamentals. Species not determined because observations were made after defoliation had taken place.

Softwood defoliators not reported in 2009 included European Pine Sawfly, *Neodiprion sertifer;* European Spruce Needle Miner, *Taniva albolineana;* Introduced Pine Sawfly, *Diprion similis;* Redheaded Pine Sawfly, *Neodiprion lecontei*; Spruce Budworm, *Choristoneura fumiferana;* Yellow-Headed Spruce Sawfly, *Pikonema alaskensis.*

SAPSUCKING INSECTS, MIDGES, AND MITES

Balsam Woolly Adelgid, *Adelges piceae*, populations increased in the Northeast Kingdom, with light levels commonly observed. In south central Vermont, new mortality was common in stands previously affected by the insect. In all, 5,297 acres of balsam woolly adelgid decline were mapped during aerial surveys (Table 9 and Figure 24).

Table 9. Mapped acreage of balsam woolly adelgid-related decline in 2009.

County	Acres
Addison	129
Bennington	327
Caledonia	43
Lamoille	12
Orange	89
Orleans	12
Rutland	1,653
Washington	302
Windham	2,281
Windsor	448
Total	**5,297**

Hemlock Woolly Adelgid, *Adelges tsugae*, detections increased in Windham County, but no new counties were reported as infested. Infestations have now been detected in 30 locations in seven towns. Infested trees have been destroyed in Rockingham (2007) and Dummerston (2009), but infestations are active in Brattleboro, Vernon, Guilford, Townshend and Jamaica. Vermont is collaborating with the states of New Hampshire and Maine and with the US Forest Service to develop a regional approach to managing this insect.

In all, detection surveys were conducted at 27 sites in 2009 (Figure 25). A number of volunteers have been assisting with our detection surveys. Twenty-two training sessions were conducted in 2009 with approximately 450 people attending. Volunteer surveyors detected 3 new infested sites, and have surveyed over 20 locations.

In cooperation with Dr. Dave Mausel from the University of Massachusetts, the predatory beetle, *Larcicobius nigrinus*, was released at two infested sites. Beetles collected from Idaho were released on October 22nd in Brattleboro. Beetles collected from the Seattle area were released on November 19th in Vernon. Two hundred and two beetles were released at each site.

Hemlock foliage was collected from sites in Barre and Londonderry to contribute to an effort to describe the genetic diversity of eastern hemlock across its range being conducted by Camcore an International Tree Conservation and Domestication Program at North Carolina State University.

The Vermont Agency of Agriculture, Food, and Markets continues to monitor nurseries for possible introductions of hemlock woolly adelgid on live trees.

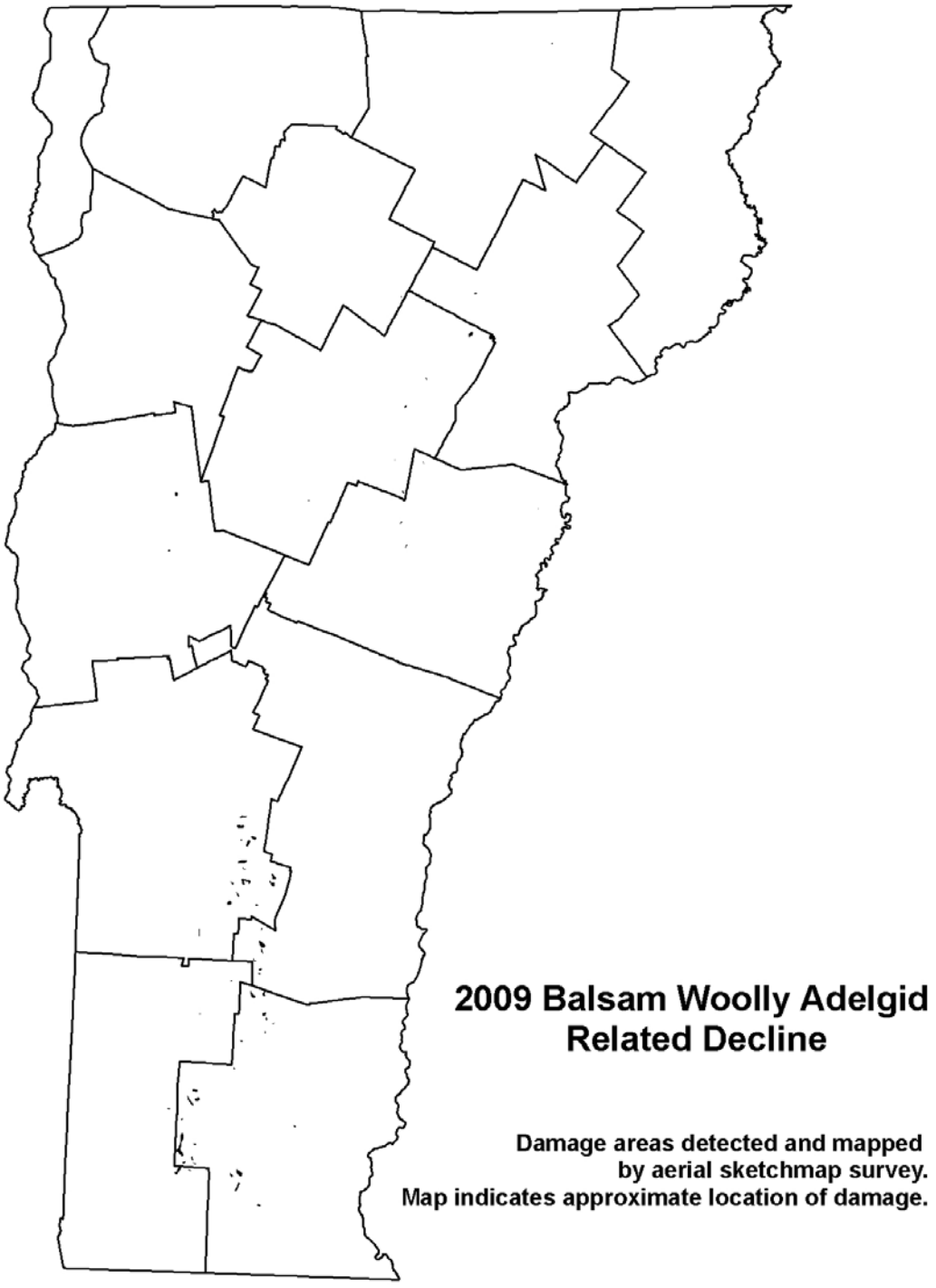


Figure 24. Mapped acres of balsam woolly adelgid-related decline in 2009.

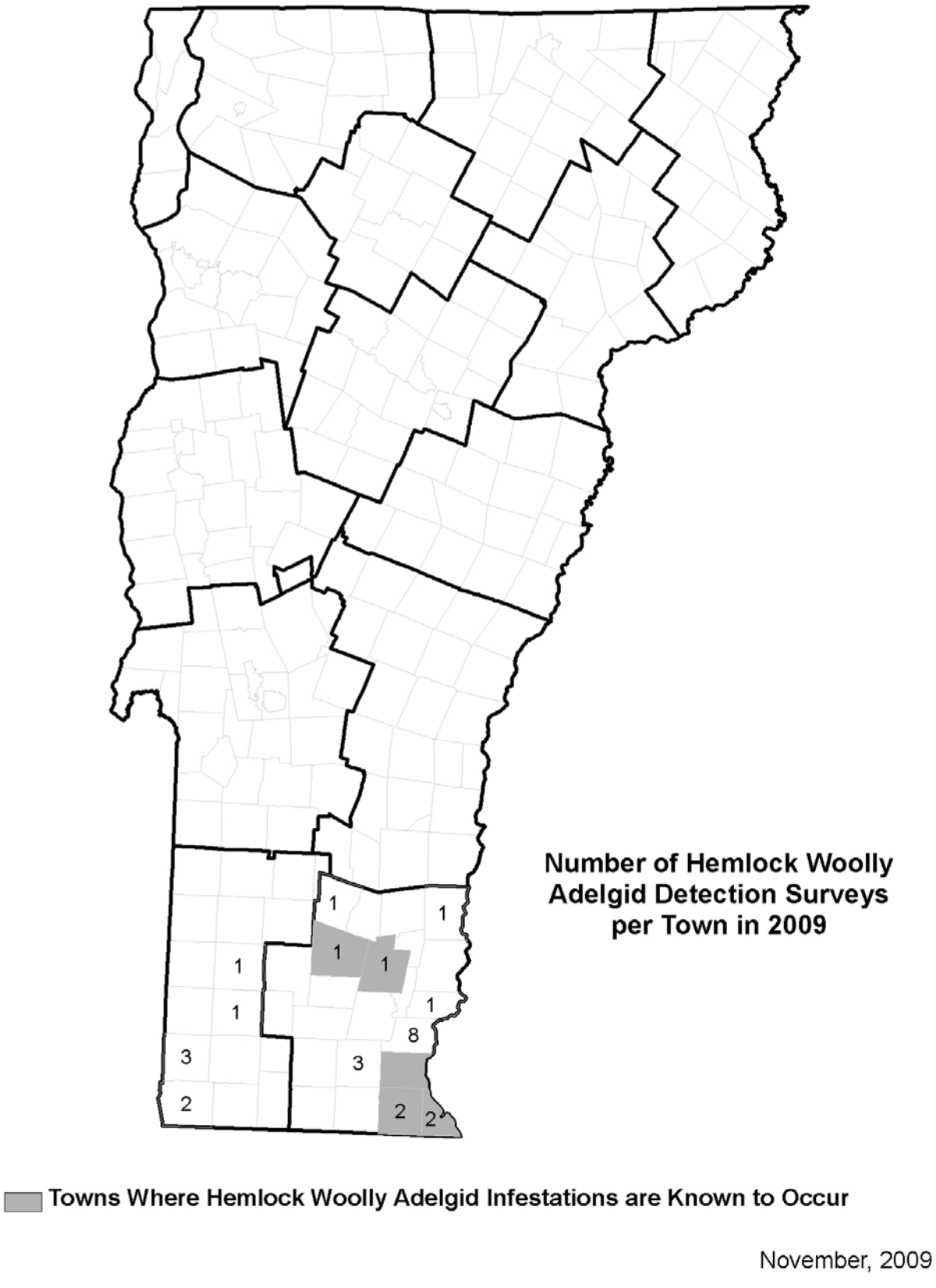


Figure 25. Vermont towns with hemlock woolly adelgid detections as of November, 2009**.**

Oystershell Scale, *Lepidosaphes ulmi*, populations remained light, and no dieback was detected during aerial surveys. Yearly counts of oystershell scale in survey plots at three tree canopy levels (suppressed, intermediate and codominant) at Camel's Hump State Forest are shown below (Table 10 and Figure 26).

Table 10. Number of oystershell scales on current year beech twigs in Camel's Hump State Forest, 1994-2009.

	Average Number of Mature Viable Scales per Twig															
	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Suppressed	2.1	9	0.6	2.1	4	0.7	2.9	4.2	11	2.1	1.4	5.6	4	3.3	1.9	4.9
Intermediate	8.4	16.8	1.2	2.6	3.3	2.8	12.1	10.4	14.7	1.2	3.4	3.8	6.2	11.9	2.4	2.4
Codominant	3.4	11.3	0.2	4.5	4.2	2.7	7.3	1.4	4	0.7	2	2	3.4	9.6	0.9	3.6

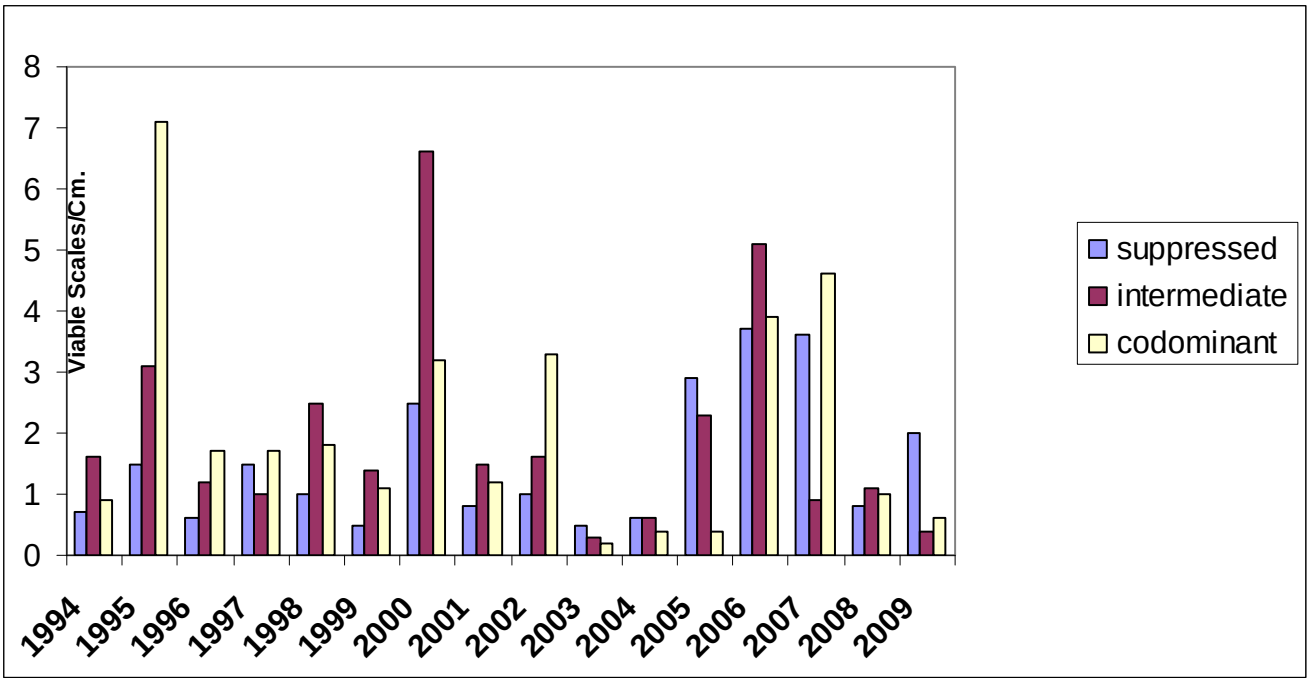


Figure 26. Oystershell scale population in three tree canopy levels in Camel's Hump State Forest, 1994-2009. Average for 10 current year twigs/tree per crown class, collected in autumn.

OTHER SAPSUCKING INSECTS, MIDGES, AND MITES

INSECT	HOST(S)	LOCALITY	REMARKS
Ash Flowergall Mite *Aceria fraxiniflora*	Green ash	Widely scattered	Ornamental plants.
Balsam Gall Midge *Paradiplosis tumifex*	Balsam fir	Widely scattered	Remained a problem in some plantations; some growers sprayed for it again this year. In a plantation in Walden, populations had decreased a bit compared to the previous year.
Balsam Twig Aphid *Mindarus abietinus*	Balsam fir	Bennington Springfield	Ornamentals.
Balsam Woolly Adelgid *Adelges piceae*			See narrative.
Beech Scale *Cryptococcus fagisuga*			See Beech Bark Disease.
Black Pineleaf Scale *Nuculaspis californica*	Mugo pine	Stowe	On ornamental plantings.
Boxelder Bug *Leptocoris trivittatus*	Boxelder	Throughout	Received notably fewer inquiries about this fall nuisance household invader.
Cooley Spruce Gall Aphid *Adelges cooleyi*	Blue spruce White spruce	Scattered	Occasional damage observed.
Eastern Spruce Gall Adelgid *Adelges abietis*	White spruce Red spruce	Throughout	Common at normal levels.
Hackberry Psyllids *Pachypsylla celtidismamma* *Pachypsylla celtidisvesicula*	Hackberry	Weathersfield	Nipplegalls and blistergalls on ornamental trees.
Hemlock Woolly Adelgid *Adelges tsugae*			See narrative.

INSECT	HOST(S)	LOCALITY	REMARKS
Lecanium Scale *Lecanium* sp.	Sugar maple	Champlain Valley	Practically non-existent.
Oystershell Scale *Lepidosaphes ulmi*			See narrative.
Pear Thrips *Taeniothrips inconsequens*	Sugar maple	Throughout	Insects observed, but no damage reported.
Pine Needle Scale *Chionaspsis pinifoliae*	Concolor fir	Chester	Ornamentals.
Pine Spittlebug *Aphrophora parallela*	Hemlock	Widely scattered	Occasionally noticeable.
Ragged Spruce Gall Aphid *Pineus similis*	Red spruce	Throughout	Remains common. Very heavy damage observed in Brattleboro.
Spruce Spider Mite *Oligonychus ununguis*	Balsam fir	Bennington Springfield	Ornamentals.
Woolly Alder Aphid *Paraprociphilus tessellatus*	Silver maple	Castleton	Ornamentals.
Woolly Fold Gall *Cecidomyidae*	Red oak	Andover	Noticeable damage.

Sapsucking insects, midges and mites that were not reported in 2009 included Aphids, *Cinara sp.* and *Periphyllus sp.;* Ash Flowergall Mite, *Aceria fraxiniflora;* Beech Blight Aphid, *Fagiphagus imbricator*; Birch Lacebug, *Corythuca palipes*; Boxelder Erineum, *Aceria negundi*; Butternut Blister Mite, *Aceria cinereae*; Cottony Maple Scale, *Pulvinaria innumerabilis*; Erineum Gall Mite, *Aceria elongatus*; Hemlock Scale, *Abgrallaspis ithacae*; Lacebugs, *Corythucha* sp.; Maple Bladdergall Mite, *Vasates quadripedes*; Maple Spindlegall Mite, *Vasates aceris-crummena*; Pine Bark Adelgid, *Pineus strobi*; Pine Fascicle Mite; *Trisetacus alborum*; Pine Leaf Adelgid, *Pineus pinifoliae*; Red Pouch Gall, *Pemphigus rhois*; Vagabond Aphid, *Mordwilkoja vagabunda*; Woolly Elm Aphid, *Eriosoma americana*.

BUD AND SHOOT INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Balsam Shootboring Sawfly *Pleroneura brunneicornis*	Fraser fir Balsam fir	Scattered	2010 damage should be higher than 2009 because it's an even year. (Even-year populations are larger and most have a 2-yr life cycle.)
Common Pine Shoot Beetle *Tomicus piniperda*	Scotch, Red and White pine		Two specimens were collected in Lindgren funnel traps during Early Detection-Rapid Response (EDRR) surveys. (See Bark and Wood Insects.) Otherwise, none observed and no damage reported. A federal quarantine is in place to limit the spread of this exotic insect into non-affected states. Pine material is free to move inside Vermont. Quarantine details can be found at: www.vtfpr.org/protection/for_protect_forhealth.cfm
Oak Twig Pruner *Elaphidionoides parallelus*	Red oak	Addison, Chittenden and Lamoille Counties	Down from 2008.
White Pine Weevil *Pissodes strobi*	White pine Spruces	Throughout	Damage remains common at low levels.
Whitespotted Sawyer *Monochamus scutellatus*	White pine Balsam fir	Scattered	Although damage rarely observed, reports increased generated by publicity about Asian longhorned beetle.

Bud and shoot insects not reported in 2009 included European Pine Shoot Borer, *Eucosma gloriola*; Locust Twig Borer, *Ecdytolopha insiticiana*; Maple Petiole Borer, *Caulocampus acericaulis;* Pine Gall Weevil, *Podapion gallicola.*

ROOT INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Japanese Beetle *Popillia japonica*	Many	Throughout	Populations low throughout the state.
June Beetle *Phyllophaga* spp.	Many	Throughout	Population low throughout the state.

Root insects not reported this year included Conifer Swift Moth, *Korsheltellus gracilis*; Root Aphid, *Prociphilus similis.*

BARK AND WOOD INSECTS

Asian Longhorned Beetle, *Anoplophora glabripennis,* was not observed and is not known to occur in Vermont.

Vermont participated in the regional Northeast Forest Pest Outreach and Survey Project. The objective of this project was to promote early detection through increased public awareness and targeted surveys. The project was funded by USDA APHIS and the US Forest Service, and included nine northeastern states. In Vermont, the project was carried out by the Department of Forests, Parks, and Recreation and the Agency of Agriculture, Food, and Markets.

August was declared Asian Longhorned Beetle Awareness Month by governor's proclamation. Intensive one-day surveys were done of high risk locations in Brattleboro (2,000 trees) and Burlington (3,406 trees). Outreach included fourteen "Train the Trainer" sessions, and over thirty other events.

With assistance from Redstart Forestry and the Vermont Land Trust, we have developed a mailing list of Vermont property owners with zip codes from Asian Longhorned Beetle regulated areas in Massachusetts, New York, and New Jersey. There are over 2,000 Vermont properties owned by residents of these areas. Mailings have gone out to the 198 property owners from Massachusetts; 96 have responded. Responses to the mailing were used to target on-site visual surveys. All eleven properties where owners had brought firewood or live trees to Vermont were surveyed in 2009 (Figure 27).

State park campgrounds were also prioritized by number of recent visitors from the Worcester area. Between 2002-2008, Vermont received 1,820 visits from the infested area. A survey was conducted of frequently-visited campgrounds, as well as private and municipal campgrounds geographically close to the Worcester and Carignan infestations. In all, 24 campgrounds were surveyed for Asian longhorned beetle and emerald ash borer by December 31st (Figure 28).

Visitors to State Park campgrounds were asked to burn any firewood brought from over 50 miles away within 24 hours. Firewood that couldn't be burned in that timeframe was collected and exchanged for local wood. (The 2009 program is summarized below.) Starting in July, the Green Mountain National Forest prohibited bringing out-of-state firewood into the forest. We are continuing to spread the ***Don't Move Firewood*** message through press releases, brochures, fair exhibits, and advertisements.

Firewood Program Summary:

As a result of our policy of not allowing firewood into any Vermont State Park from a distance of more than 50 miles, park employees collected 212 large contractor bags of imported firewood during the 2009 camping season. All confiscated firewood was exchanged for park firewood, double bagged, secured with cable ties and held in storage until after November 1. Twelve bags of firewood imported from Massachusetts, Maine, New Hampshire, Quebec and Virginia were delivered to the Forest Health staff in Hillsboro, New Hampshire, and placed in rearing barrels to be held until summer of 2010. The remaining 200 bags were opened between November 3 and December 7, and every piece of host-species firewood was examined by Forest Protection staff for signs of Asian Longhorned Beetle or Emerald Ash Borer. No target insects or evidence of their presence was found on any of the firewood. We did recover one live (non-worrisome) adult wood borer along with a few wood boring larvae as well as a predictable assemblage of insects and arthropods commonly associated with decayed wood. After examination, the

confiscated firewood was delivered to state buildings with wood-burning furnaces. Facility managers agreed to burn all wood this winter.

- **Amount of imported firewood collected:** 212 bags. Approximately 1 cord.

- **Parks that collected imported firewood:** Branbury, Half Moon, DAR, Mt Philo, Gifford Woods, Quechee, Ascutney, Molly Stark, Allis, Townshend, Elmore, Stillwater, Maidstone, Grand Isle, Underhill. (This list may not include every park but is close.) By far Grand Isle State Park collected the most firewood with a count of 85 bags.

- **States and Provinces firewood was imported from:** New Hampshire, Massachusetts, Maine, Connecticut, New York, New Jersey, Virginia, Quebec, Ontario. (This is not an all-inclusive list as some parks did not label the bags as to source.)

- **State buildings accepting firewood for disposal:** Button Bay State Park, Gifford Woods State Park, Essex District Office, Northeast Regional Correctional Facility in St. Johnsbury.

- **Interesting facts:** (1) It is illegal to move firewood across the Canadian border, yet we received firewood from Quebec and Ontario (EAB provinces). (2) A piece of firewood from Virginia contained a live wood-boring larva.

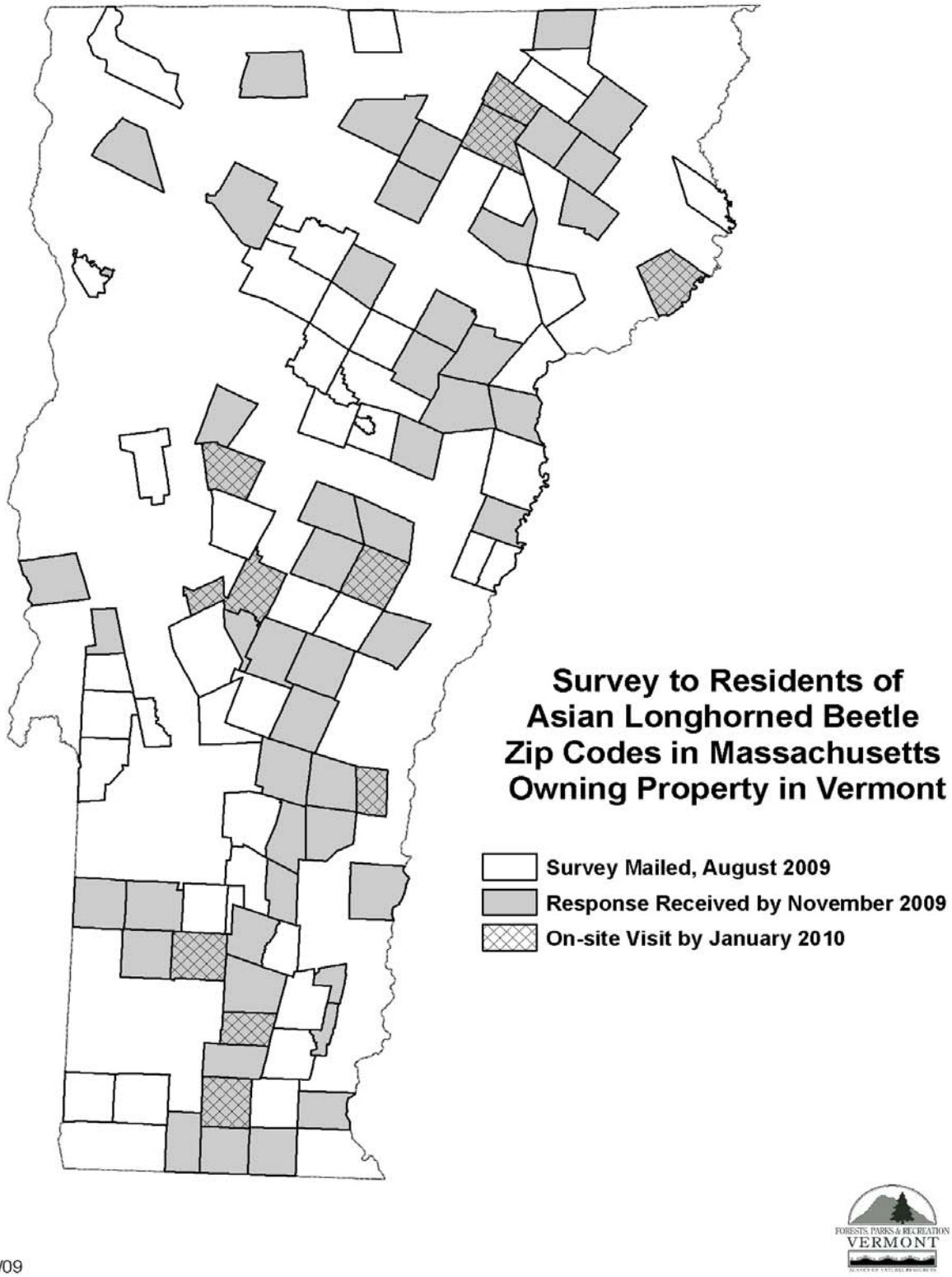


Figure 27. Results of survey conducted in 2009 of out-of-state landowners who had brought firewood or live trees to Vermont.

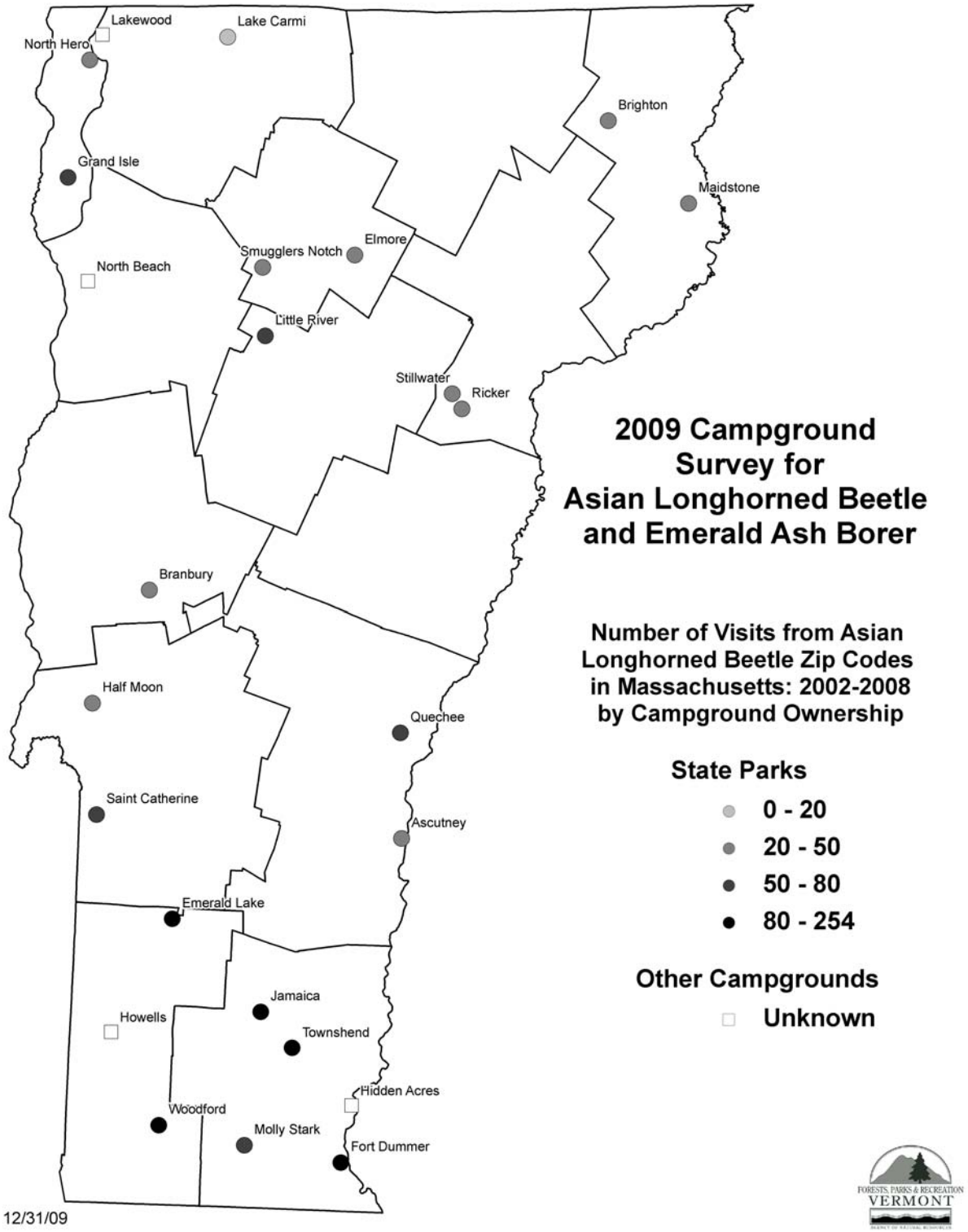


Figure 28. Sites surveyed in 2009 in public, private and municipal campgrounds frequently visited by campers from known areas of Asian Longhorned Beetle and Emerald Ash Borer infestation, or in close proximity to infestations in Worcester, MA and Carignan, Quebec.

Emerald Ash Borer, *Agrilus planipennis*, was not observed and is not known to occur in Vermont. Emerald ash borer awareness and survey programs were incorporated into the Northeast Forest Pest Outreach and Survey Project described under Asian longhorned beetle. In addition, several surveys specific to emerald ash borer were conducted. In cooperation with the Agency of Agriculture, Food, and Markets, 143 purple traps were deployed at campgrounds and other high risk sites. In addition, the remaining two trap trees from each of four locations in Grand Isle County were harvested in October, and peeled to look for signs of emerald ash borer. These trees had been girdled in July 2008 to make them more attractive to the insect.

Vermont participated in the regional emerald ash borer biosurveillance program, using *Cerceris fumipennis* to help detect low populations. 130 recreation fields were surveyed, and wasp colonies were detected in 19 of these sites (Table 11 and Figure 29).

Table 11. Locations of *Cerceris fumipennis* nest sites found in Vermont in 2009. Data include county, town, site, coordinates, and numbers of nests observed.

County	Town	Site	Latitude	Longitude	Approx # of nests
Franklin	Bakersfield	Elementary School	44.78405	72.80314	10
Rutland	Brandon	Otter Valley Union HS	43.76577	73.05139	6
Rutland	Brandon	Estabrook Field	43.81077	73.10340	3
Rutland	Castleton	Castleton Elementary School	43.62039	73.21114	50+
Chittenden	Colchester	Private home stone patio	44.57926	73.20976	not counted
Franklin	Enosburg	Enosburg Elementary School	44.90552	72.80164	4
Franklin	Highgate	Highgate Elementary	44.94076	73.04375	100
Lamoille	Hyde Park	LUHS	44.60264	72.62866	10
Lamoille	Hyde Park	Rte 15 ballfield	44.60137	72.63450	3
Windham	Jamaica	Stephen Ballantine Memorial Field	43.09994	72.77928	116
Chittenden	Jericho	Mills River Park	44.51671	72.94713	12 to 15
Chittenden	Jericho	Jericho Elementary School	44.50519	72.98883	12 to 15
Washington	Montpelier	City Recreation Field	44.27979	72.57137	6
Windsor	Springfield	Riverside Park	43.30483	72.49527	30
Franklin	Swanton	Mississquoi Valley Union HS	44.93229	73.10470	20
Orange	Tunbridge	Tunbridge Town Recreational Field	43.89550	72.48426	30
Washington	Waterbury	Old outdoor ice rink	44.34295	72.75724	1
Windsor	Windsor	Town Rec Field	43.46924	72.40329	200
Windsor	Windsor	Back Mountain Gravel Pit	43.43135	72.39985	12 to 20

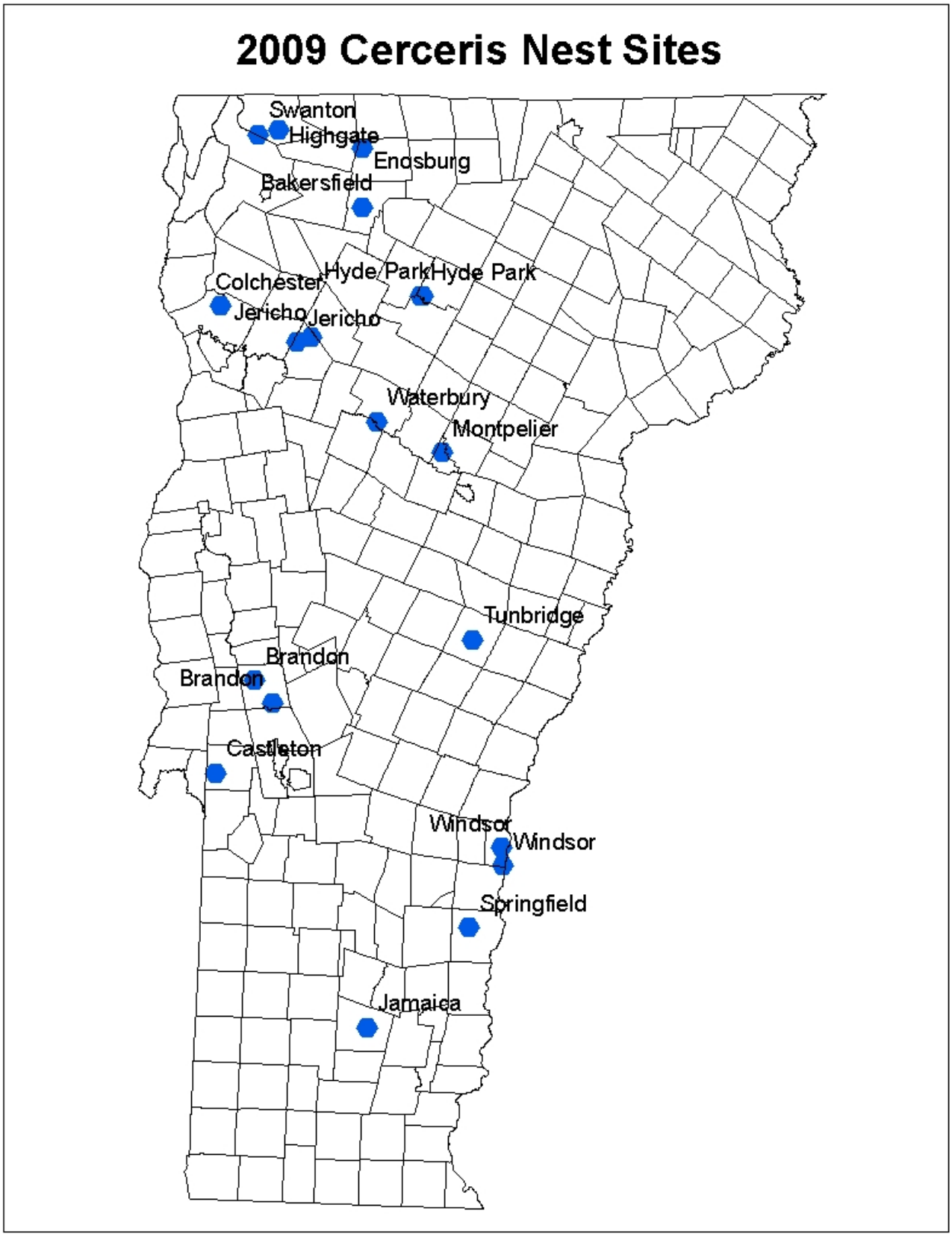


Figure 29. Sites where *Cerceris fumipennis* nest sites were found in Vermont in 2009.

European Wood Wasp, *Sirex noctilio,* was not observed. 140 traps were deployed by the Agency of Agriculture, Food, and Markets and USDA-APHIS, including in Lamoille County, where a single adult was trapped in 2007. The 2007 detection remains the only individual of this species ever collected in Vermont.

Early Detection – Rapid Response (EDRR) Surveys for exotic bark beetles and other insects were conducted at eight sites in Vermont where wood or wood products were prepared or marketed. There were three traps per site, and each of the three was baited with a separate lure, either (1) ultra-high release (UHR) ethanol, (2) three-component Ips lure, or (3) UHR ethanol and alpha-pinene. Traps were checked every 2 weeks for 20 or 22 weeks (Table 12).

In total, 254 samples were collected. These samples provided 5,033 scolytids (46 species). Two species collected, *Tomicus piniperda* and *Xyleborinus alni*, were on the target list (Table 13).

The bycatch included one dozen siricids and many bees whose records will be helpful to investigators studying bee distribution in Vermont. In addition to these EDRR surveys for exotic bark beetles, the Vermont Agency of Agriculture conducted Hot Zone Surveys (that have a similar focus but different habitats) in 29 sites.

Table 12. Trap sites and collection dates for Early Detection – Rapid Response surveys conducted in Vermont in 2009. Data include first and last collection dates, number of collections, counties, towns, and coordinates. There were three traps per site, baited with ethanol, a three-component Ips lure, or alpha-pinene and ethanol. Traps were emptied every two weeks for 20 – 22 weeks (10 or 11 collections).

Site	First Trap Date	Last Trap Date	Number of Collections	County	Town	Latitude	Longitude
1	4/2/2009	9/2/2009	11	Essex	Norton	45.00611	71.79821
2	4/2/2009	9/2/2009	11	Orleans	Newport	44.95420	72.19839
3	4/2/2009	9/2/2009	11	Caledonia	St. Johnsbury	44.48227	72.01539
4	4/9/2009	9/8/2009	10	Caledonia	Ryegate	44.21444	72.05670
5	4/9/2009	9/8/2009	10	Washington	Berlin	44.21815	72.56597
6	4/8/2009	9/8/2009	11	Addison	Bristol	44.11945	73.08876
7	4/6/2009	9/8/2009	10	Rutland	Clarendon	43.57251	72.96402
8	4/1/2009	9/9/2009	11	Windham	Brattleboro	42.89569	72.54163

Table 13. List of bark beetle (Scolytinae) species and numbers collected from eight sites over 20-22 weeks during Early Detection-Rapid Response Survey in Vermont in 2009.

Species (by numbers)	**#**	**Status**	**Species (alphabetically)**	**#**
Hylastes porculus	908	Common	*Anisandrus dispar*	31
Anisandrus sayi	755	Uncommon	*Anisandrus obesus*	3
Dendroctonus valens	740	Common	*Anisandrus sayi*	755
Xyleborinus alni	340	Target, new to state	*Corthylus punctatissimus*	3
Polygraphus rufipennis	313	Uncommon	*Cryphalus*	31
Dryocoetes autographus	305	Uncommon	*Crypturgus*	9
Trypodendron lineatum	257	Common	*Dendroctonus punctatus*	1
Orthotomicus caelatus	174	Uncommon	*Dendroctonus rufipennis*	1
Gnathotrichus materiarius	162	Common	*Dendroctonus valens*	740
Xylosandrus germanus	155	Common	*Dryocoetes affaber*	36
Hylesinus aculeatus	142	Uncommon	*Dryocoetes autographus*	305
Hylurgops rugipennis pinifex	121	Common	*Euwallacea validus*	2
Hylastes opacus	106	Uncommon	*Gnathotrichus materiarius*	162
Xyloterinus politus	64	Common	*Hylastes opacus*	106
Pityogenes hopkinsi	59	Uncommon	*Hylastes porculus*	908
Xyleborinus saxesenii	52	Common	*Hylesinus aculeatus*	142
Pityophthorus	42	Uncommon	*Hylesinus criddlei*	6
Trypodendron borealis	42	Uncommon	*Hylesinus pruinosus*	1
Ips pini	41	Uncommon	*Hylurgopinus rufipes*	6
Ips grandicollis	36	Common	*Hylurgops rugipennis pinifex*	121
Dryocoetes affaber	36	Uncommon	*Ips grandicollis*	36
Anisandrus dispar	31	Uncommon	*Ips pini*	41
Cryphalus	31	Uncommon	*Lymantor decipiens*	20
Lymantor decipiens	20	Uncommon	*Monarthrum fasciatum*	7
Phloeosinus canadensis	18	Uncommon	*Monarthrum mali*	16
Monarthrum mali	16	Common	*Orthotomicus caelatus*	174
Crypturgus	9	Uncommon	*Phloeosinus*	1
Monarthrum fasciatum	7	Common	*Phloeosinus canadensis*	18
Phloeotribus liminaris	7	Uncommon	*Phloeotribus liminaris*	7
Hylesinus criddlei	6	Uncommon	*Pityogenes hopkinsi*	59
Hylurgopinus rufipes	6	Uncommon	*Pityogenes plagiatus*	1
Pityokteines sparsus	6	Uncommon	*Pityokteines sparsus*	6
Xyleborus pelliculosus	4	new to state	*Pityophthorus*	42
Anisandrus obesus	3	Uncommon	*Polygraphus rufipennis*	313
Corthylus punctatissimus	3	Uncommon	*Pseudopityophthorus*	2
Trypodendron	3	Uncommon	*Tomicus piniperda*	2
Tomicus piniperda	2	Target	*Trypodendron*	3
Euwallacea validus	2	Uncommon	*Trypodendron borealis*	42
Pseudopityophthorus	2	Uncommon	*Trypodendron lineatum*	257
Dendroctonus punctatus	1	Uncommon	*Trypodendron retusum*	1
Dendroctonus rufipennis	1	Uncommon	*Xyleborinus alni*	340
Hylesinus pruinosus	1	Uncommon	*Xyleborinus saxesenii*	52
Phloeosinus	1	Uncommon	Xyleborus pelliculosus	4
Pityogenes plagiatus	1	Uncommon	Xylechinus americanus	1
Trypodendron retusum	1	Uncommon	Xylosandrus germanus	155
Xylechinus americanus	1	Uncommon	Xyloterinus politus	64
Total Number of Scolytinae	5,033			5,033

Trypodendron Bark Beetle Surveys

In 2009, we cooperated in a taxonomic study to help ascertain the status and distribution of members of the ambrosia beetle genus *Trypodendron* in North America. We used Uni-Traps baited with lineatin pheromone lure, alpha-pinene low release lure, and ethanol pouch low release lure (lures used depended on stand type). Alpha-pinene was not used in the birch stand, as it is a deterrent to the *Trypodendron* species that might be found in hardwood stands. We used dry cups with vapona killing strips for collecting insects lured to the traps. Beetles were identified by Robert Acciavatti (USDA).

We trapped *Trypodendron* beetles at three sites: a red pine stand in Isle La Motte (where previous records of *Trypodendron* were obtained as a result of *Tomicus piniperda* surveys), a yellow birch stand in Lincoln, VT (where we hoped to locate *Trypodendron betulae*), and a red spruce stand in Lincoln. Twenty-seven specimens of three species of *Trypodendron* were collected during the course of the survey, including 10 *T. rufitarisis*, 14 *T. lineatum*, and 3 *T. retusum.* In addition, 8 specimens of *Xyleborinus alni* were collected (Table 14).

Table 14. Trap sites and collection dates for *Trypodendron* taxonomic survey conducted in Vermont in 2009. Data include counties, towns, host trees, lures, coordinates, and first and last collection dates, species and numbers collected.

County	Town	Coordinates	Host Trees	First Collection	Last Collection	Species Collected	Total Number
Addison	Lincoln Site 1	N44.03690, W73.00305	Birch, Yellow	3/29/09	4/28/09	*T. lineatum*	13
						T.retusum	2
						T. rufitarsis	7
						X. alni	1
Addison	Lincoln Site 2	N44.03560, W73.00116	Spruce, Red	3/29/09	5/8/09	*T. lineatum*	0
						T.retusum	1
						T. rufitarsis	2
						X. alni	7
Grand Isle	Isle LaMotte	N44.87568, W73.32529	Pine, Red	4/1/09	4/21/09	*T. lineatum*	1
						T.retusum	0
						T. rufitarsis	1
						X. alni	0

OTHER BARK AND WOOD INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Asian Longhorned Beetle *Anoplophora glabripennis*	Sugar maple Other hardwoods		See narrative.
Bronze Birch Borer *Agrilus anxius*	White birch	Springfield	Dying ornamentals.
Brown Prionid *Orthosoma brunneum*	Dead wood of various species	Statewide	Increase in reports generated by publicity about Asian longhorned beetle.
Brown Spruce Longhorned Beetle *Tetropium fuscum*			Not observed or known to occur in Vermont.
Eastern Larch Beetle *Dendroctonus simplex*	Tamarack	Widely scattered	Levels of larch decline are similar to previous years.
Elm Bark Beetle *Hylurgopinus rufipes* and *Scolytus multistriatus*			See Dutch Elm Disease.
Emerald Ash Borer *Agrilus planipennis*			See narrative.
European Wood Wasp *Sirex noctilio*	Red pine Scots pine White pine		See narrative.
Exotic Bark Beetles and other species			See narrative under Early Detection – Rapid Response.
Japanese Cedar Longhorned Beetle *Callidiellum rufipenne*			Not observed or known to occur in Vermont.
Linden Borer *Saperda vestita*	Linden	Springfield	Recent transplants.
Locust Borer *Megacyllene robiniae*	Black locust	Champlain Valley	Common throughout.

INSECT	HOST(S)	LOCALITY	REMARKS
Northeastern Sawyer *Monochamus notatus*	Softwood	Statewide	Increase in reports generated by publicity about Asian longhorned beetle.
Pigeon Tremex *Tremex columba*	Maple	Statewide	Increase in reports generated by publicity about Asian longhorned beetle.
Round-headed Apple Tree Borer *Saperda candida*	Mountain ash Apple	Franklin & Caledonia Counties	Ornamental and fruit trees
Sirex Woodwasp *Sirex noctilio*			See narrative.
Sugar Maple Borer *Glycobius speciosus*	Sugar maple	Throughout	Remains common at low levels.
Trypodendron spp.			See narrative.
Whitespotted Sawyer *Monochamus scutellatus*	Various conifers	Statewide	Increase in reports generated by publicity about Asian longhorned beetle.

Bark and Wood insects not reported in 2009 included Allegheny Mound Ant, *Formica exsectoides;* Hemlock Borer, *Melanophila fulvoguttata*; Maple Callus Borer, *Synanthedon acerni*: Northern Engraver, *Ips borealis borealis*; Pitted Ambrosia Beetle, *Corthylus punctatissimus;* Redheaded Ash Borer, *Neoclytus acuminatus*.

FRUIT, NUT AND FLOWER INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Ash flowergall mite *Aceria fraxiniflora*	Green ash	Widely scattered	Ornamental plants.
Asiatic Garden Beetle *Autoserica castanea*	Many flowers and ornamentals	Throughout	Reports of high numbers in St. Johnsbury and Underhill.
Lily Leaf Beetle *Lilioceris lilii*	*Lilium* and *Fritillaria*	Throughout	Numerous observations and reports. The beetle lays eggs and develops only on *Liliuim* and *Fritillaria* species, though it will feed on some other hosts.
Plum Curculio *Conotrachelus nenuphar*	Apple Plum	Statewide	Remains common.
Western Conifer Seed Bug *Leptoglossus occidentalis*	Conifers	Statewide	Although damage was not observed, reports increased due to publicity about Asian longhorned beetle. Populations may be high due to heavy seed crop on white pine.

STEM DISEASES

The recent spike in **Beech Bark Disease** caused by *Cryptococcus fagisuga* and *Neonectria faginata* continues statewide. Advanced decline was more commonly reported, with 25,469 acres mapped during aerial surveys. This is an increase from 2008, but similar to 2007. The lack of bark symptoms on some recently dead trees indicates rapid mortality before callous tissue formed around dead patches. Mortality has threatened the suitability of some mast production areas as bear habitat. An increase in beech scale observed in parts of the state suggests that heavy beech mortality will continue. (Table 15 and Figure 30)

Table 15. Mapped acres of beech bark disease in 2009.

County	Acres
Addison	1,847
Bennington	3,214
Caledonia	711
Chittenden	694
Essex	2,295
Franklin	790
Lamoille	1,103
Orange	1,353
Orleans	898
Rutland	3,357
Washington	601
Windham	5,571
Windsor	3,036
Total	25,469

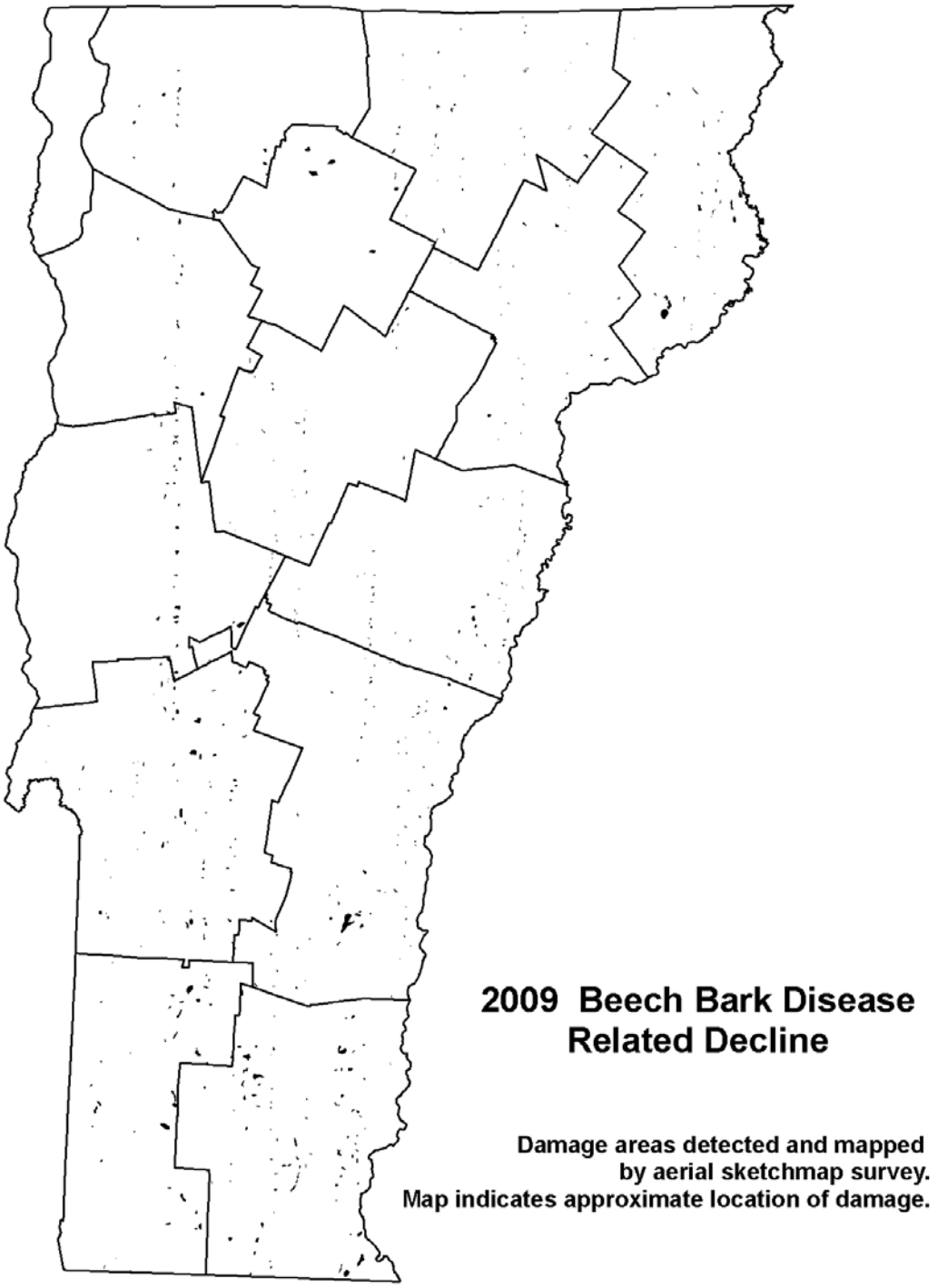


Figure 30. Beech bark disease related decline mapped in 2009. Mapped area includes 25,469 acres.

Levels of **Butternut Canker,** *Sirococcus clavigignenta-juglandacearum,* remain stable, with most surviving butternuts showing symptoms of the disease. We have begun a project in collaboration with the states of Iowa, Connecticut, Pennsylvania, and Indiana to preserve butternut germplasm. Apparently resistant trees will be tested genetically to confirm that they are, in fact, butternut. Scions will be grafted to rootstock, and outplanted in seed orchards for preservation and observation. The work in Vermont is being coordinated by Dr. Dale Bergdahl of Plant Technologies LLC.

Oak Wilt, *Ceratocystis fagacearum,* was not observed or known to occur in Vermont. We have increased our vigilance in looking out for this disease since it was detected near Albany, NY. Samples were taken and cultured from one oak in Shaftsbury, but the oak wilt fungus was not recovered. We also looked for symptoms of this disease, as well as Sudden Oak Death (caused by *Phytophthora ramorum*) in our Oak Commodity Survey plots in Jamaica, Arlington, and Jericho.

OTHER STEM DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Annual Canker *Fusarium sp.*	Red maple	Central Vermont	Occasionally observed.
Ash Yellows *Mycoplasma-like organism*	White ash	Widely scattered	Remains stable at low levels. Pockets of decline detected in Weathersfield.
Beech Bark Disease *Cryptococcus fagisuga* and *Nectria coccinea var. faginata*	American beech		See narrative.
Black Knot *Dibotryon morbosum*	Cherry	Scattered throughout	Less noticeable than 2008 in the Champlain Valley.
Botryosphaeria Blight	Apple	Scattered throughout	Commonly found around old pruning wounds, extending along branches causing decline or structural failure.
  Botryosphaeria sp.	Rhododendron		Widespread overwintering damage to Rhododendron is attributed, in part, to this canker.

DISEASE	HOST(S)	LOCALITY	REMARKS
Butternut Canker *Sirococcus clavigignenta-juglandacearum*	Butternut		See narrative.
Caliciopsis Canker *Caliciopsis pinea*	White pine	Jamaica	Associated with unthrifty trees.
Cedar-Apple Rust *Gymnosporangium juniperi-virginianae*	White cedar	Widely scattered	Common at low levels.
Chestnut Blight *Cryphonectria parasitica*	American chestnut	Southeastern and northwestern Vermont	Common on surviving young chestnuts.
Cytospora Canker *Leucostoma kunzei*	Blue spruce	Northeastern and north central Vermont	Frequently observed on ornamentals.
Fireblight *Erwinia amylovora*	Apple	Barre	Ornamental.
Hypoxylon Canker *Hypoxylon pruinatum*	Poplars	Widely scattered	Remains common at stable levels.
Lilac Blight *Pseudomonas syringae*	Lilac	Northeastern Vermont	Common.
Maple Canker *Steganosporium spp.*	Sugar maple	Statewide	Found on small twigs in lower parts of trees.
Nectria Canker *Nectria galligena*	Hardwoods	Scattered throughout	Remains common at stable levels.
Oak Wilt *Ceratocystis fagacearum*			See narrative.
Phomopsis Gall *Phomopsis sp.*	Hickory	Scattered in Southern Vermont	Heavy infestation on individual trees.

DISEASE	HOST(S)	LOCALITY	REMARKS
Red Ring Rot *Phellinus pini*	White pine	Scattered throughout	Occasionally observed.
Verticillium Wilt *Verticillium alboatrum*	Norway, sugar maple	Chittenden county, Chester	More commonly detected than usual
White Pine Blister Rust *Cronartium ribicola*	White pine	Statewide	Remains common, with increased scattered mortality of mature trees. 472 acres of light white pine mortality were mapped from the air.
Yellow Witches Broom Rust *Melampsorella caryophyllacearum*	Balsam fir	Northern Vermont	Found occasionally on individual trees.

Stem diseases not reported in 2009 included Brown Cubical Rot, *Phaeolus schweinitzii,* Delphinella Tip Blight of Fir, *Delphinella balsamae,* Eastern Dwarf Mistletoe, *Arceuthobium pusillum,* Sapstreak, *Ceratocystis coerulescens,* Scleroderris Canker, *Ascocalyx abietina,* Sirococcus, *Sirococcus strobilinius,* Woodgate Gall Rust, *Endocronartium harknessii.*

FOLIAGE DISEASES

Brown Spot Needle Blight, caused by *Scirrhia acicola* and *Mycosphaerella dearnessii,* was heavy again on white pine for the 5th consecutive year. Previous year needles on many trees browned up in early spring. Trees looked better once new growth emerged and brown needles had been cast. The disease was also observed on other pine species. We have been reporting heavy damage by this fungus since 2005, but are not aware of significant impacts to tree health outside of wet areas where the fungus disease is unusually heavy and trees are already stressed by soil saturation.

Septoria Leafspot, *Septoria betulae***,** was common, especially at higher elevations, and responsible for most of the 45,936 acres of birch defoliation. This was a substantial increase from the 4,287 acres of birch defoliation mapped in 2008. However, similar levels of birch defoliation by Septoria and other defoliators were mapped in prior years. (Table 16 and Figure 31)

Table 16. Mapped acreage of Septoria leafspot damage in 2009.

County	Acres
Addison	3,601
Bennington	8,428
Caledonia	1,808
Chittenden	1,554
Essex	3,377
Franklin	1,125
Lamoille	3,099
Orange	1,533
Orleans	4,011
Rutland	5,975
Washington	3,884
Windham	4,276
Windsor	3,265
Total	**45,936**

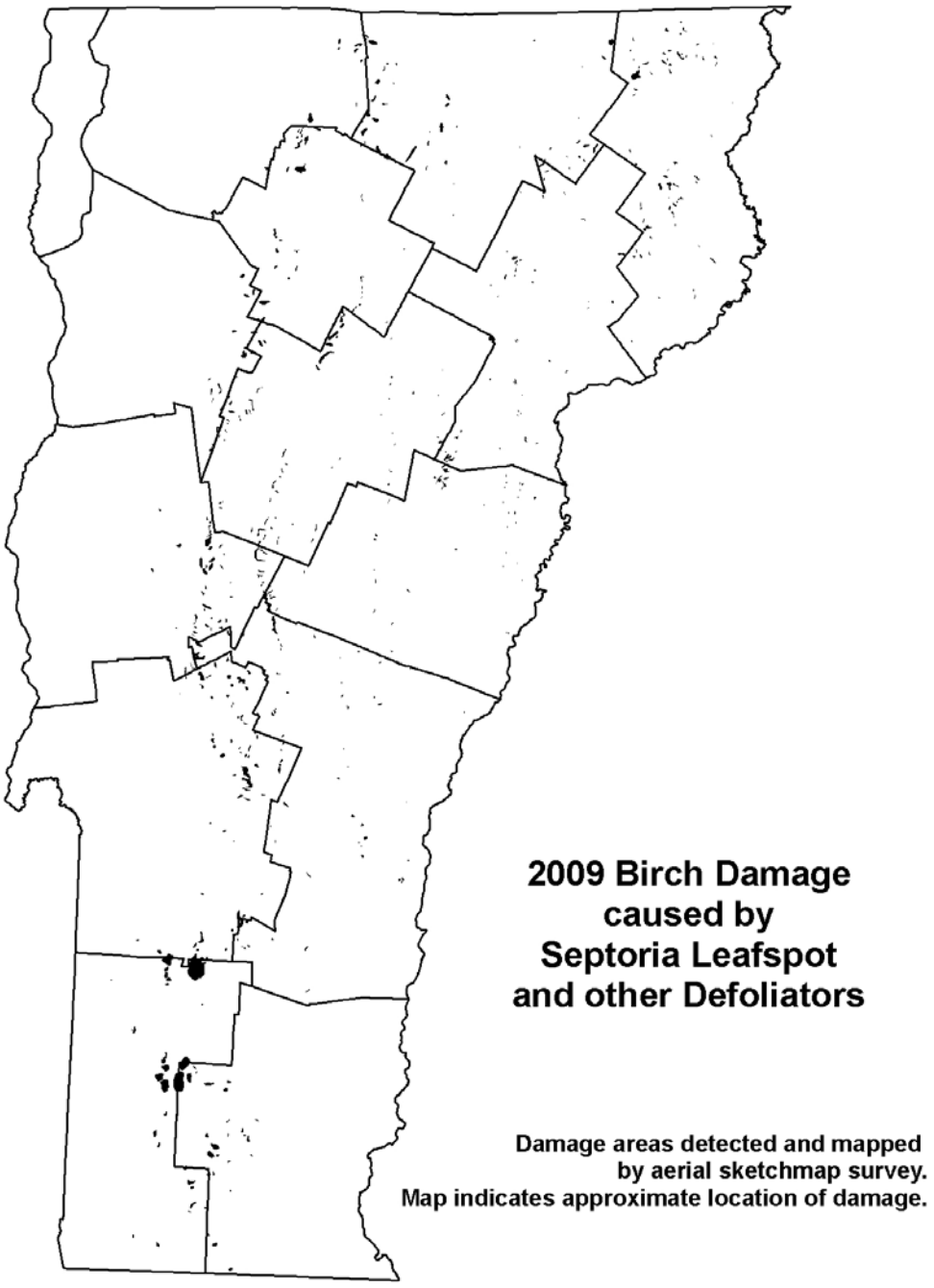


Figure 31. Damage from Septoria leafspot and other defoliators mapped in 2009. Mapped area is 45,936 acres.

OTHER FOLIAGE DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Anthracnose *Glomerella spp.* *Apiognomonia spp.* *Gloeosporium spp.*	Sugar maple and other hardwoods	Statewide	Especially common in northern Vermont, Damage to sugar maple mostly light damage.
Apple Scab *Venturia inaequalis*		North central and northeastern Vermont	Common on ornamentals.
Ash Anthracnose *Gloeosporium aridum*	White ash	Southern Vermont and Champlain Valley	Common. Occasionally heavy damage, but no refoliation observed.
Balsam Fir Needlecast *Lirula nervata*	Balsam fir	Northeastern Vermont	Common on current year's foliage in understory trees.
Brown Spot Needle Blight *Scirrhia acicola* *Mycosphaerella dearnessii*			See narrative.
Bullseye Spot *Cristulariella moricola*	Boxelder	Northeastern Vermont	Common.
Coccomyces Leaf Spot *Blumeriella jaapii*	Cherry	Northeastern Vermont	Moderate in some areas.
Giant Tar Spot *Rhytisma sp.*	Norway maple	Throughout	Commonly observed, at levels similar to 2008. Defoliation lighter than 2007.
Larch Needlecast Possibly *Mycosphaerella sp.*	Larch	Franklin County	Common.
Phyllosticta Needlecast *Phyllosticta sp.*	Concolor fir	Chester	Ornamentals.

DISEASE	HOST(S)	LOCALITY	REMARKS
Poplar Leaf Blight *Marssonina spp.*	Balsam poplar	Widely scattered	Occasional heavy defoliation.
Rhizosphaera Needlecast of Spruce *Rhizosphaera kalkhoffi*	White and Blue spruce	Statewide	Although lighter than previous years, remains common, and sometimes heavy. Occasional mortality of ornamental trees.
Septoria Leaf Spot *Septoria aceris*	Sugar maple	Scattered	Low levels observed.
Septoria Leaf Spot *Septoria betulae*	Birch	Statewide	See narrative.
Swiss Needlecast *Phaeocryptopus gaeumannii*	Douglas fir	Vernon	Hedge.
White Pine Needle Blight *Canavirgella banfieldii*	White pine	Widely scattered	Increase in northwestern and north central Vermont.

Foliage diseases not reported in 2009 included Fir Fern Rust, *Uredinopsis mirabilis, Uredinopsis spp.,* Linospora Leaf Blight, *Linospora tetraspora,* Rhizosphaera Needle Blight, *Rhizosphaera pini,* Spruce Repeating Rust, *Chrysomyxa weirii,* Venturia Leaf Blight, *Venturia macularis.*

ROOT DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Brown Cubical Root Rot *Polyporous schweinitzii*	Balsam fir	NE Kingdom	Many larger diameter fir trees are affected with this fungus, increasing potential failure of the tree.
Shoestring Root Rot *Armillaria spp.*	Various	Statewide	Frequently observed on dead/declining trees and trees previously stressed by other causes.
Tomentosus Butt Rot *Inonotus tomentosus*	White spruce	Hartland	Associated with basal pitching and occasional tree mortality in pole-sized plantation. Fruiting bodies common.

Root diseases not reported in 2009 included Annosus Root Rot, *Heterobasidion annosum*, Feeder Root Rot, *Phytophthora* species.

DIEBACKS, DECLINES, AND ENVIRONMENTAL DISEASES

Birch Decline and Mortality appears to be stable with 1,743 acres mapped this year compared to 1,736 in 2008 (Table 17). Most of this damage is old mortality that remains evident, especially on paper birch at upper elevations.

Table 17.
Mapped acres of birch decline and mortality in 2009.

County	Acres
Addison	347
Caledonia	72
Chittenden	397
Essex	32
Lamoille	499
Rutland	243
Washington	83
Windsor	71
Total	**1,743**

Hardwood Chlorosis was evident again, especially in northern Vermont, although it was less noticeable than in 2008. Symptoms were most common on sugar maple. The area mapped decreased from 15,034 acres in 2008 to 3,058 acres in 2009 (Table 18). Chlorosis was especially noticeable in low-lying areas and at the base of slopes, and may be related to soil moisture and growing season rainfall.

Table 18.
Mapped acres of hardwood chlorosis in 2009.

County	Acres
Addison	754
Caledonia	1,229
Chittenden	284
Essex	92
Orleans	592
Washington	26
Windsor	82
Total	**3,058**

Hardwood Decline and Mortality was evident in widely scattered locations but only 791 acres were mapped in the state this year. There have been several growing seasons in a row with adequate moisture and little insect defoliation.

Recovery continues after the storm on December 12, 2008 which caused heavy **Ice Damage** in Windham County and nearby towns. Damage was mapped during an aerial survey on March 17th. In all, 10,267 acres of damage were mapped. (Figure 32)

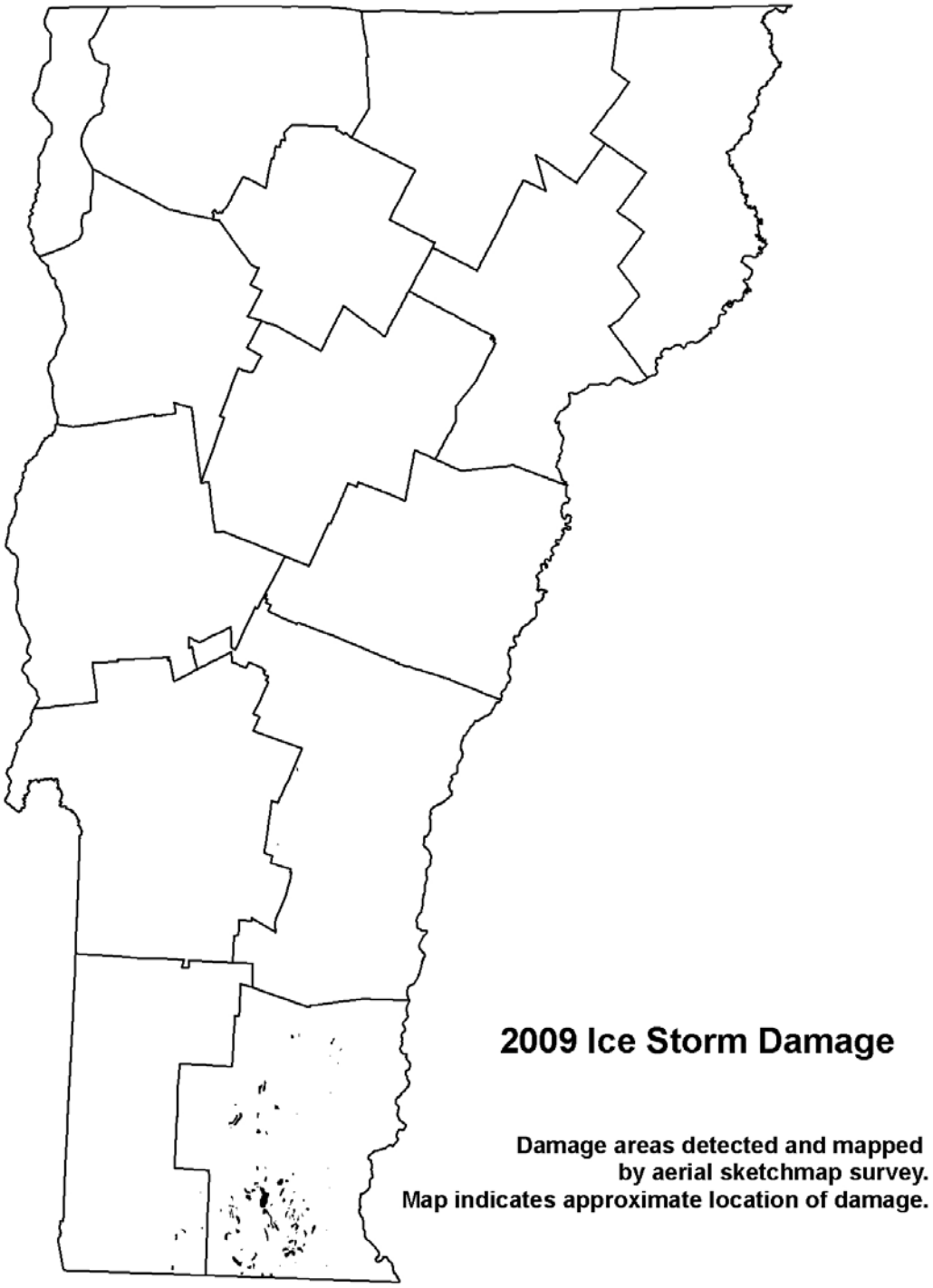


Figure 32. 2009 Ice storm damage in southern Vermont. 10,267 acres of damage were mapped.

Larch Decline continues, at levels similar to previous years, with some new mortality in pockets of previously dead trees. During aerial surveys, 1,027 acres were mapped (Table 19).

Table 19. Mapped acres of larch decline in 2009.

County	Acres
Caledonia	431
Essex	35
Franklin	183
Orange	11
Orleans	227
Rutland	109
Washington	30
Total	**1,027**

Logging-Related Decline symptoms were again evident this year but mapped acreage decreased, again, from 1,147 acres in 2008 to 781 acres in 2009.

Spruce-Fir Decline remains stable at high elevations with 1,702 acres mapped. Heavy mortality of red spruce regeneration was observed in a stand in Grafton, where overstory spruce remained healthy. Episodes of spruce regeneration mortality have been observed in the past, and attributed to a dry spell around the time of budbreak affecting shallow-rooted young trees.

Decline and mortality on **Wet Sites** remains common at stable levels. 5,049 acres were mapped, compared to 2,401 in 2008 (Table 20). Some hardwood chlorosis was evident again at low elevations, which may be related to growing season moisture. Wet site conditions continue to cause decline where Fraser fir are planted for Christmas trees.

Table 20. Mapped acres of decline and mortality on wet sites in 2009.

County	Acres
Addison	300
Bennington	681
Caledonia	438
Chittenden	22
Essex	787
Franklin	459
Grand Isle	638
Lamoille	78
Orange	243
Orleans	487
Rutland	278
Washington	297
Windham	155
Windsor	187
Total	**5,049**

OTHER DIEBACKS, DECLINES, AND ENVIRONMENTAL DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Air Pollution Injury	Black cherry, Ash	Statewide	Ozone damage was minor on statewide ozone plots this year.
Ash Dieback	White ash	Widely scattered	Fairly common, but appears stable. See ash yellows.
Birch Decline			See narrative.
Bleeding Canker	White birch	Springfield	Ornamentals.
Curly Leaves	White ash	Rutland County	Cupping attributed to water loss on hot summer days.
Frost Damage	Butternut, White ash, Balsam fir	Scattered in southern Vermont	Leaf and shoot damage to species with late budbreak.
Hardwood Chlorosis			See narrative.
Hardwood Decline and Mortality			See narrative.
Heavy Seed	White ash, White pine	Statewide	Thin crowns associated with very heavy seed production.
Ice Damage			See narrative.
Interior Needle Drop	Hemlock	Rutland county	Observed in scattered locations.
Larch Decline			See narrative.
Lightning	Spruce	Weathersfield	Ornamental.
Logging-Related Decline			See narrative.
Maple Decline			See hardwood decline.
Salt Damage	Conifers	Throughout	Lighter than normal.
Spruce/Fir Dieback and Mortality			See narrative.
Wet Site			See narrative.
Wind Damage			See tornado damage narrative in Weather and Phenology section.
Winter Injury	Rhododendron	Southern Vermont	Widespread overwintering dieback and mortality. Biotic agents such as *Botryosphaeria* canker are thought to be involved.

ANIMAL DAMAGE

ANIMAL	SPECIES DAMAGED	LOCALITY	REMARKS
Beaver			Damage levels remain stable.
Deer	Native woody plants	Widely scattered	Regeneration damage heavy on some sites.
Moose	Native regeneration	Northeast Vermont	Regeneration damage heavy in many areas.
Porcupine			Damage levels remain stable.
Sapsucker	Many, including Hemlock, Sugar maple, Birch and Elm	Scattered throughout	Occasional cause of dieback and mortality.
Squirrel	Sugar maple, Oak, Hemlock, Spruce, White pine	Widely scattered	Heavy damage from feeding with twigs on the ground and pine cone feeding.

INVASIVE PLANTS

Non-native Invasive Plants continue to prevent regeneration of native species, especially in southern and central Vermont. The Department of Forests, Parks, and Recreation and Fish and Wildlife Invasive Plant Working Group was not active in 2009 but work in invasive plant efforts moved forward. The following is a list of accomplishments across the state:

- The Department of Forests, Parks and Recreation secured funding through an American Recovery and Reinvestment Act of 2009 (ARRA) grant to conduct invasive plant surveys and control on state and federal land. Work on this 2-year project will begin in 2010. Survey protocols will be developed for use in public campgrounds. Expected outcomes include surveying 30 State Parks and 30 recreation areas on the Green Mountain National Forest.

- The Vermont Invasive Exotic Plant Committee (VIEPC) held a statewide stakeholders meeting on April 8, 2009. The purpose was to bring interested parties together to brainstorm strategies for working collaboratively on invasive plant issues statewide. The VIEPC is also active in trying to add several new species to the quarantine list including Barberry, Norway maple and Euonymus.

- The Nature Conservancy was awarded a grant through the National Fish and Wildlife Foundation. One of the deliverables in this grant is Best Management Practices for invasive plants with Vermont-based information. Completion of this grant is expected in 2012.

- A public scoping process was initiated for the Forest-wide Non-native Invasive Plant Control Project by the Green Mountain National Forest.

- Invasive plant detection records were compiled to help identify key forest-related issues and priorities as part of the State Assessment and Resource Strategy (SARS).

- Monitoring and control of invasive plants continue on state land.

North American Maple Project (NAMP) Plots

Sugar Maple Health

In 2009, sugar maple health continued to show improvements following significant stress events early this decade. Sugar maple trees on NAMP plots had dense foliage for the second year in a row. Of the 1,017 canopy sugar maples monitored, 95% were healthy (15% dieback or less) (Figure 33). Only 1% of trees had thin foliage (less than 25% foliage transparency), and 5% of trees had high dieback (Figures 34 and 35). There were 10 new dead trees, a 1% mortality rate.

A Crown Condition Index that combines crown health indicators (dieback and foliage transparency) showed that for the second year in a row, crown health improved (Figure 36). Compared to the long-term average, crown health in 2009 was 1.4% better.

A new system for recording bole damages was implemented in 2007. The presence of bole damages likely to cause significant health problems was recorded for 21 types of injuries. Only 140 bole damages were recorded for all sugar maples on all plots. The most frequent damages in 2009 were sugar maple borer wounds, cracks and seams, and conks. (Table 21).

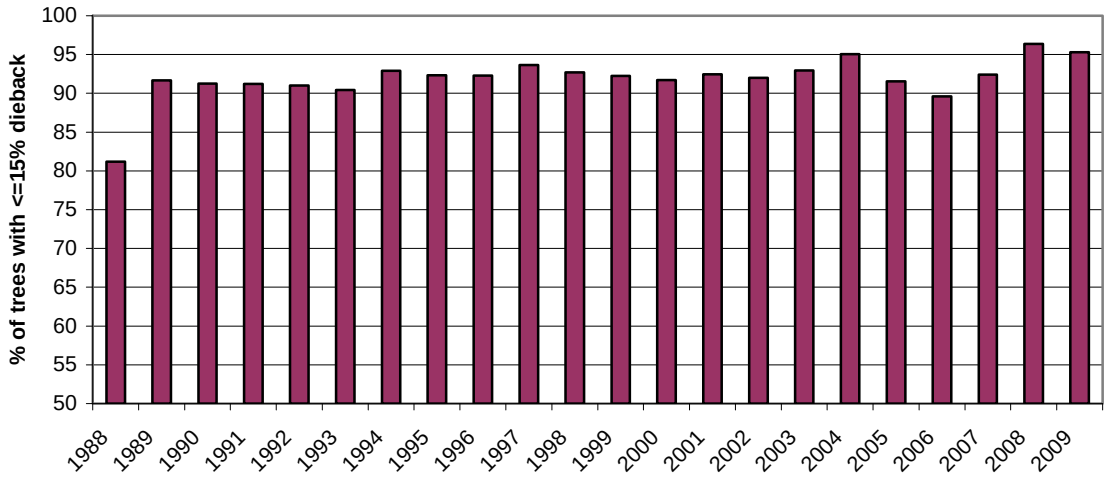


Figure 33. Trend in healthy overstory sugar maple trees on NAMP plots, 1988-2009. Health based on trees with less than 15% dieback.

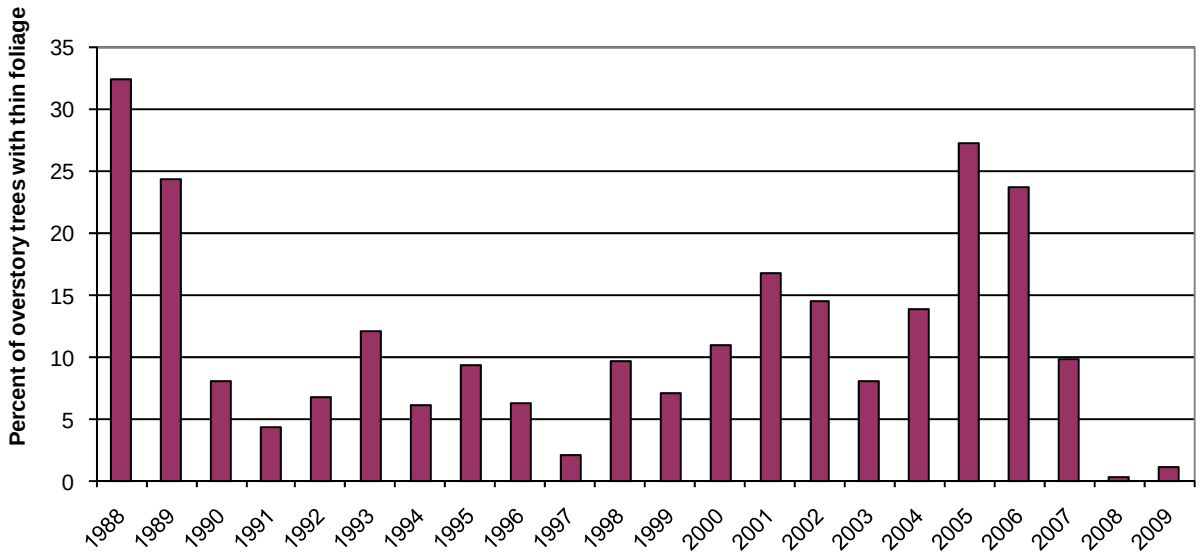


Figure 34. Percent of overstory sugar maple trees on NAMP plots with thin foliage (foliage transparency >25%) showing dense foliage in 2008 and 2009.

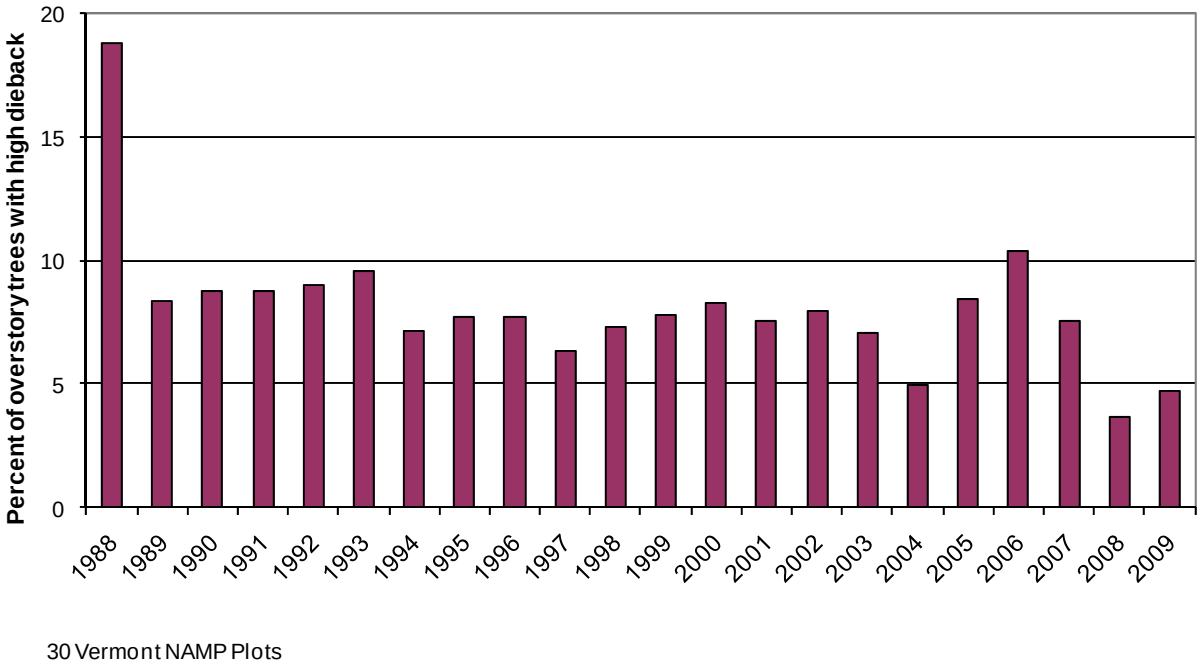


Figure 35. Percent of overstory sugar maple trees on NAMP plots with high dieback (>=15%) showing few trees with signs of stress in 2008 and 2009.

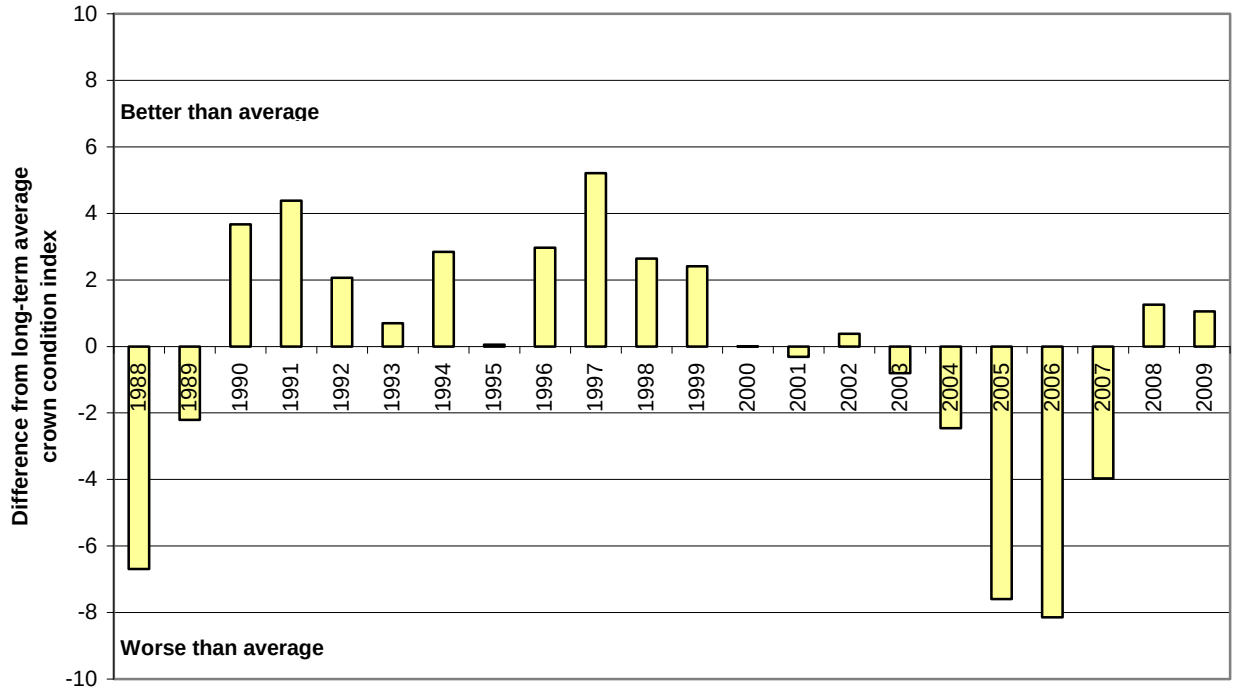


Figure 36. Annual variation in the Crown Condition Index (CCI) on NAMP plots shows improvement in sugar maple condition in 2008 and 2009. The CCI is calculated using both dieback and transparency. Positive CCI values indicate better than average crown condition.

Table 21. Sugar maple bole damages 2007-2009 on NAMP plots.

Damage Type	2007	2008	2009	Total	% of damages
Sugar maple borer	165	5	23	193	29.02
Cracks and seams	132	3	8	143	21.50
Other conks	64	8	12	84	12.63
Other weather damage	7	1	53	61	9.17
Eutypella canker	27	3	15	45	6.77
Other canker	26	2	2	30	4.51
Broken bole	12	9	9	30	4.51
Logging damage	18	2	2	22	3.31
Nectria canker	14	1	5	20	3.01
Wind thrown/uprooted	9	3	3	15	2.26
Sapsucker damage	6	4	4	14	2.11
Other animal damage		4	4	8	1.20

Vermont Monitoring Cooperative (VMC) Tree Health

Trends in tree health on the Lye Brook Wilderness Area

In 2009, five forest health monitoring plot-clusters were evaluated in the Lye Brook Wilderness Area. Plot-clusters were measured at 2 elevations: 1,400 and 2,300 feet, for a total of 167 live trees and 125 overstory live trees. Trees at both elevations have been declining over the past decade as a variety of stress events have impacted tree health. In 2009, average dieback and foliage transparency was greater than the long-term average on all the plots (Figures 37 and 38). Likewise, the percentage of trees with thin foliage (20%) and high dieback (13%) remained higher than most years.

A Crown Condition Index combining crown health indicators (dieback and foliage transparency) was used to identify unhealthy trees (Figure 39). Although 2009 appears to have fewer unhealthy trees than recent years, overall there have been an increasing percentage of unhealthy trees. The species involved have varied from year to year, but in 2009, most of the unhealthy trees were Balsam fir, Red maple and Red spruce. The annual mortality rate of overstory trees was also high in 2009, with 3.1% new dead trees.

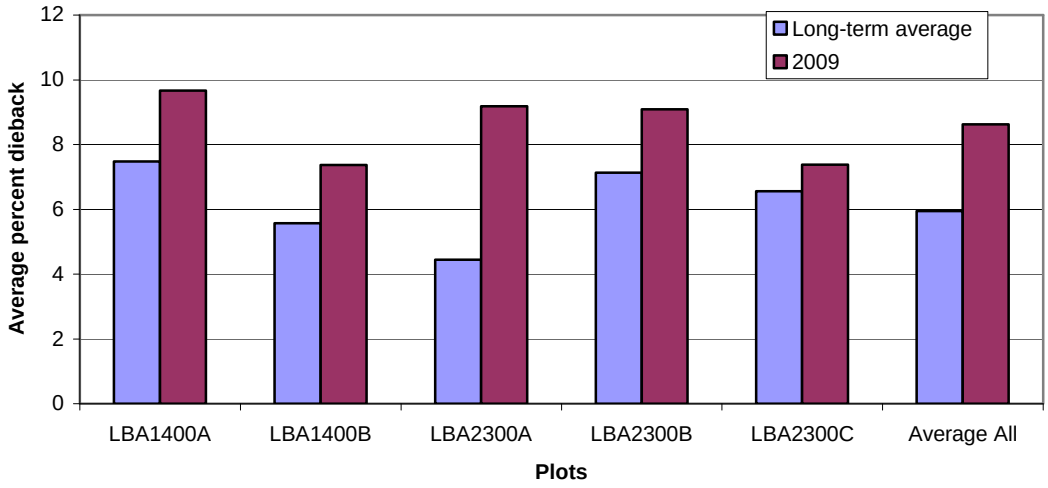


Figure 37. Dieback in 2009 compared to the long-term average on each monitoring plot in the Lye Brook Wilderness Area.

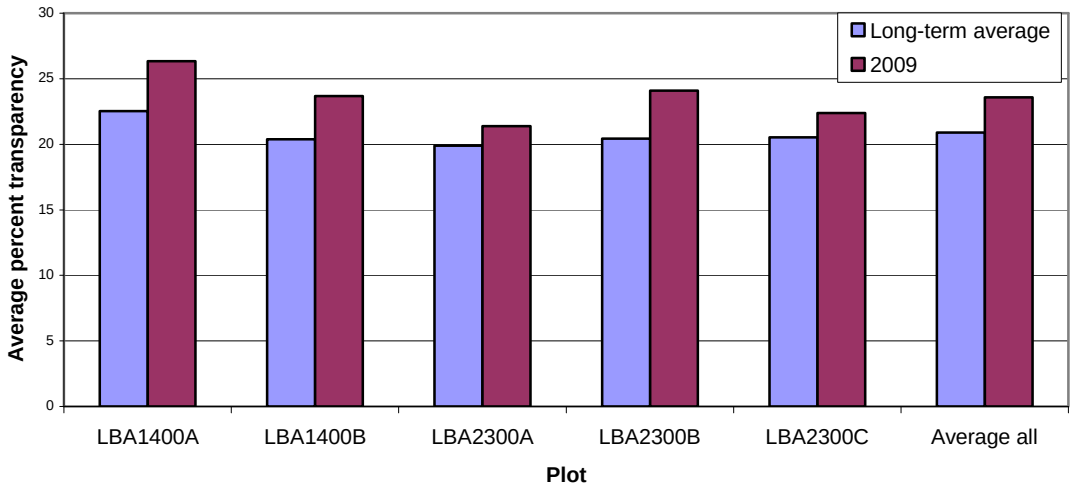


Figure 38. Foliage transparency in 2009 compared to the long-term average on each monitoring plot in the Lye Brook Wilderness Area.

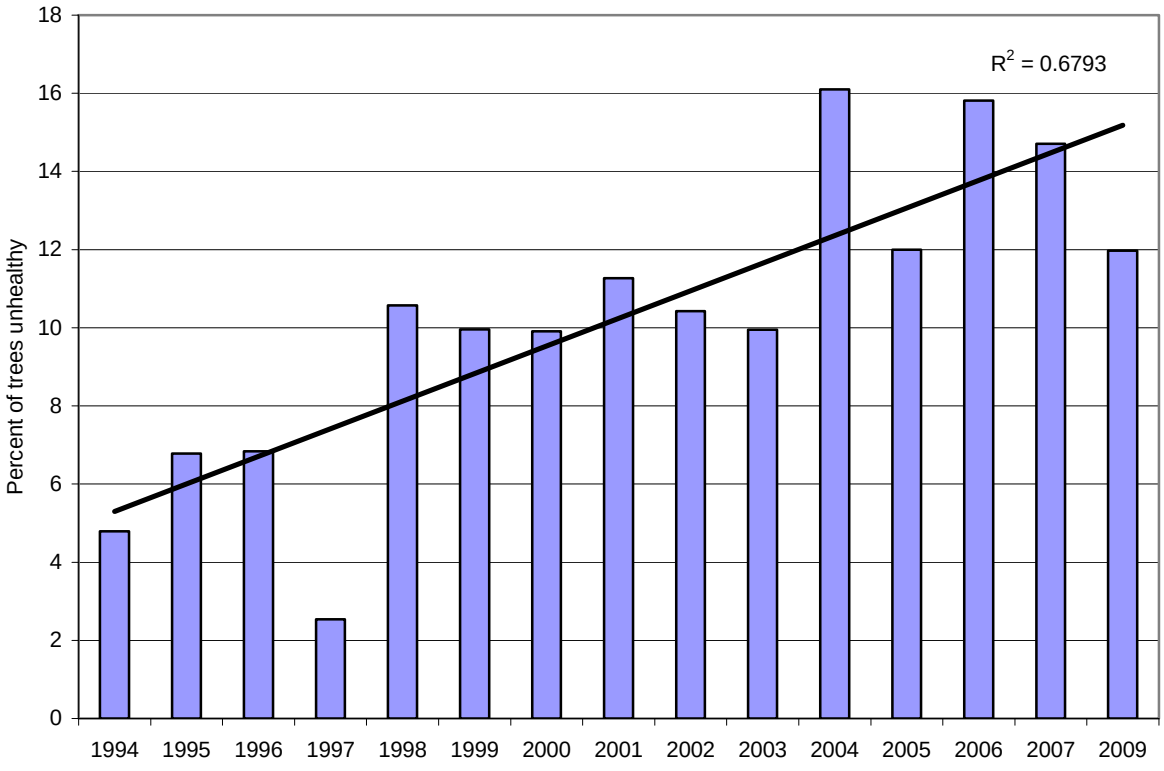


Figure 39. Crown Condition Index of unhealthy trees 1994-2009 (crown condition index >=.25) showing an increasing percentage of unhealthy trees on Lye Brook Wilderness Area plots. Note: data were not collected in 2008.