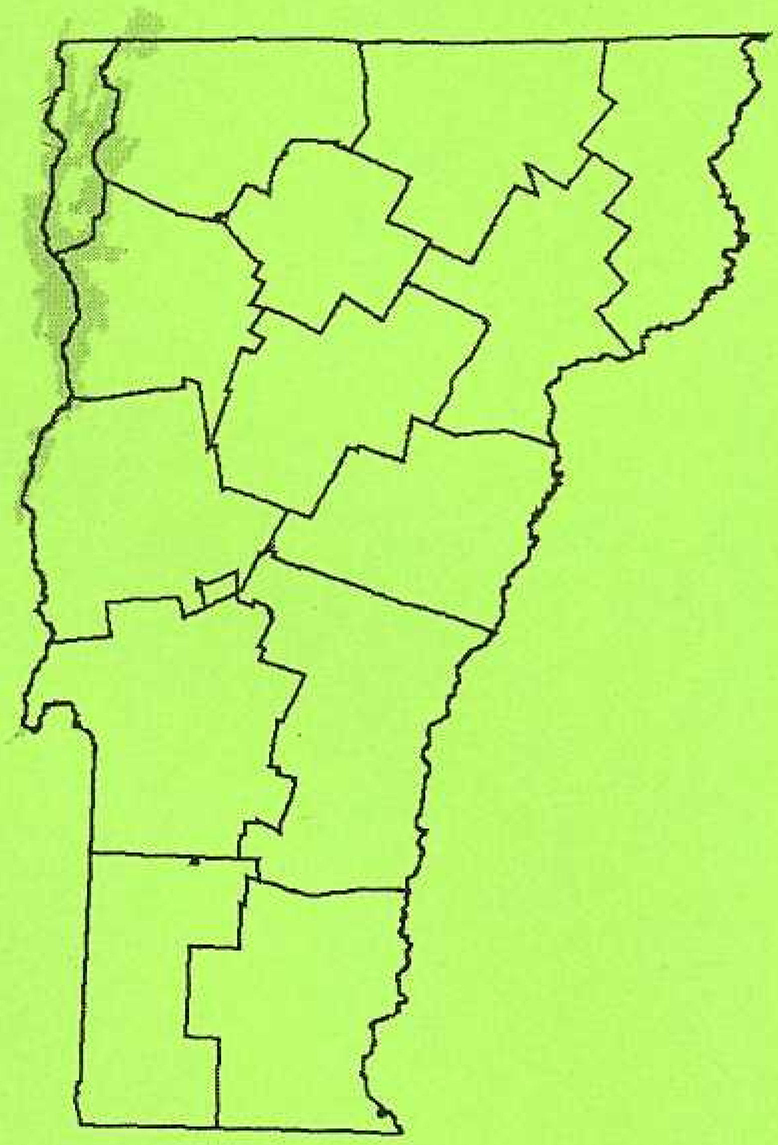
FOREST INSECT AND DISEASE CONDITIONS IN VERMONT 2005



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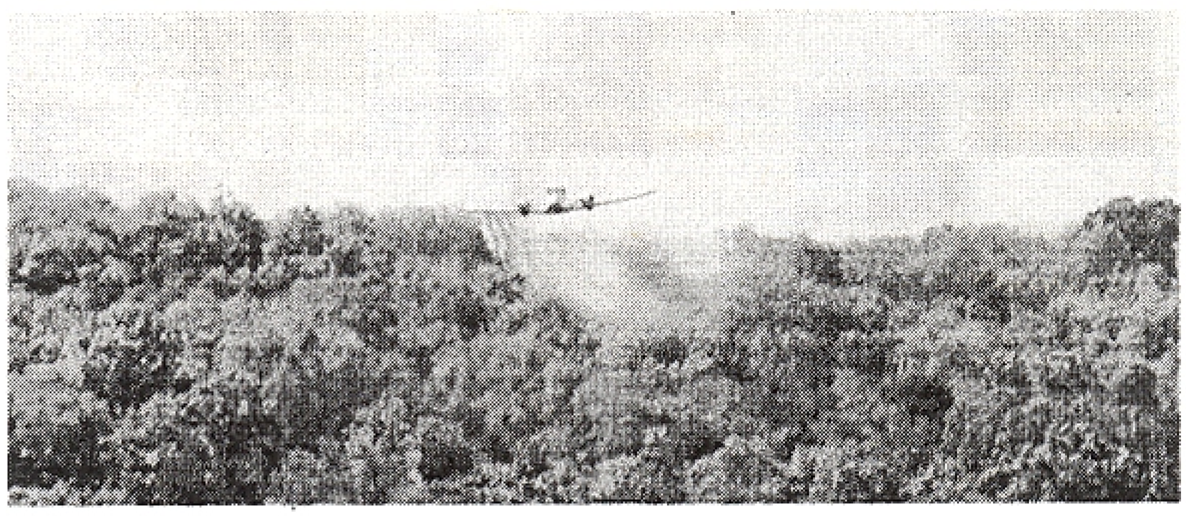
FOREST INSECT AND DISEASE CONDITIONS IN VERMONT

CALENDAR YEAR 2005



2005 FOREST TENT CATERPILLAR SPRAY PROJECT

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AGENCY OF NATURAL RESOURCES
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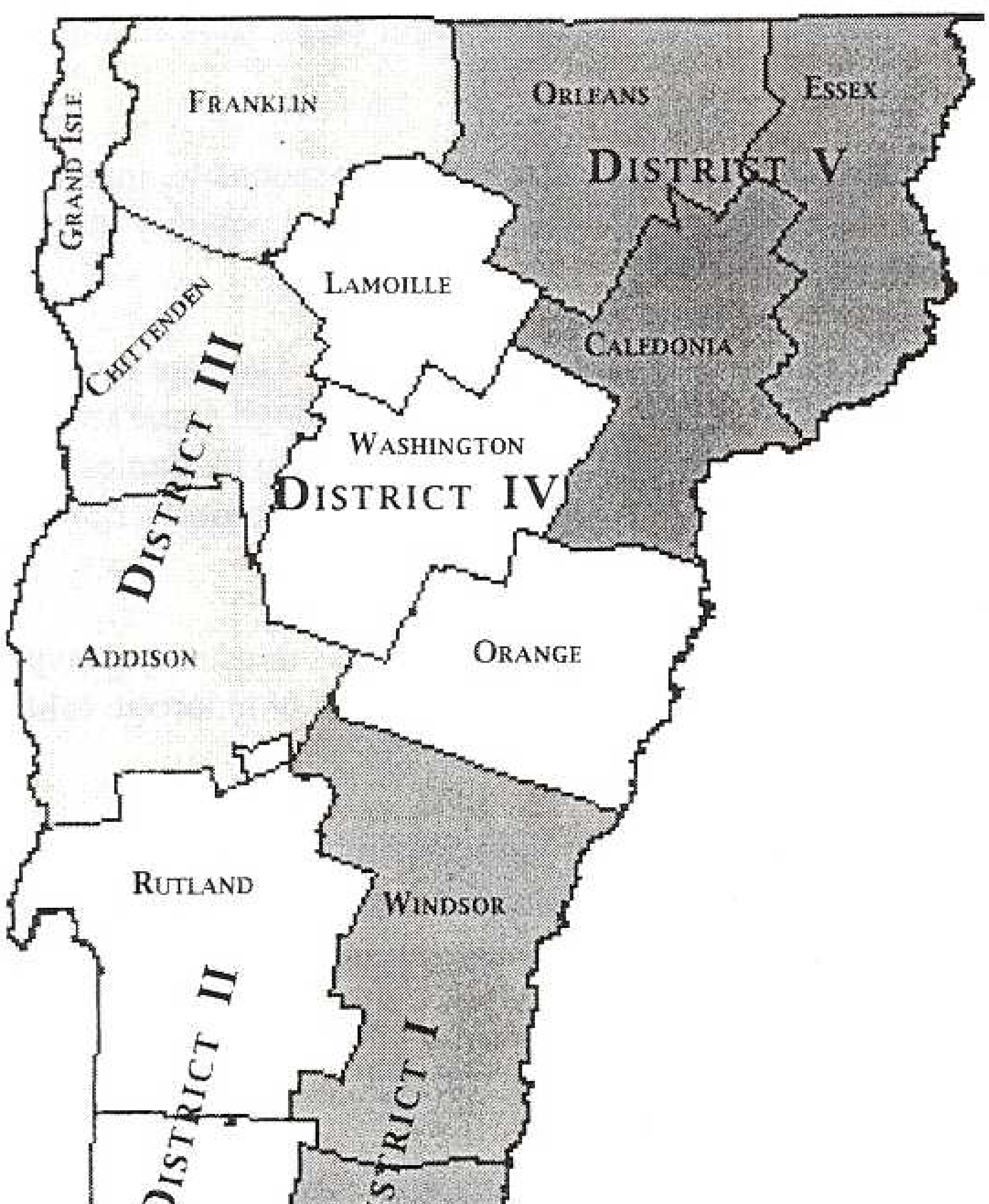

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2005 VERMONT FOREST INSECT AND DISEASE HIGHLIGHTS

Anthracnose, caused by *Glomerella, Apiognomonia and Gloeosporium spp.* was widespread throughout the state by mid-summer. Although browning related to anthracnose was mapped on just 7,812 acres during aerial survey, the extent of damage was much greater. Most noticeable was the damage to sugar maples. Brown foliage was present on lower crowns everywhere, and entire trees were brown and then defoliated in low-lying areas, near wet areas or water bodies, in hollows, and other sites with poor air drainage. Some hillsides had bands of brown foliage caused by anthracnose as well. Anthracnose was also observed on other hardwood species, including red oak, white ash and hop hornbeam.

Dieback and mortality caused by **Balsam Woolly Adelgid**, *Adelges piceae,* was down from 10,854 acres mapped in 2004 to 5,903 acres in 2005. Although decline of some trees continues and mortality is noticeable, no live adelgids were observed in southern stands in 2005.

Beech Bark Disease, caused by *Cryptococcus fagisuga and Nectria coccinea var. faginata*, was less noticeable during aerial survey this year, decreasing from 77,983 acres mapped in 2004 to 42,191 acres mapped in 2005. Mapped acreage generally increased in northern Vermont but decreased in southern Vermont. Decline and *Nectria* fruiting remain evident in stands heavily diseased during the past few years. The scale insect remains mostly at light population levels due to recent cold winters but appears to be increasing in some locations.

Birch decline and mortality was very noticeable this year especially on paper birch at upper elevations. Aerial surveys mapped decline on 7,865 acres. Decline began showing up after recent drought years, so is attributed to drought and successive years of defoliation.

Birch defoliation affected over 84,000 acres of forest. As in 2004, several agents were responsible, including the **birch skeletonizer,** *Bucculatrix canadensisella,* the **birch leafminer,** *Fenusa pusilla* and possibly other birch leafmining sawflies, and **Septoria leafspot**, *Septoria* sp.

A combination of agents resulted in 7,812 acres of noticeable **browning of maples** in 2005. Damage by **maple leafcutter**, *Paraclemensia acerifoliella*, was common, mostly at light to moderate levels, though some areas of heavy defolation were noted in the northern part of the State. Other known causes of browning in maples included **anthracnose**, **maple webworm** (*Tetralopha asperatella*), and **maple trumpet skeletonizer** (*Epinotia aceriella*).

Brown Spot Needle Blight, caused by *Scirrhia acicola* and *Mycosphaerella dearnessi*, was unusually heavy this year on Scots pine and white pine. It was also seen on red pine and Mugo pine. Brown or chlorotic foliage on white pine, some of which was due to this disease, was mapped on 1,157 acres.

The **Brown Spruce Longhorn Beetle**, *Tetropium fuscum,* which has been found attacking and killing apparently healthy red spruce trees in Nova Scotia, is not known to be established anywhere else in North America outside its native range. A survey was conducted to determine the presence of this species in Vermont. No evidence of the insect was found.

Bruce Spanworm, *Operophtera bruceata,* dropped to very light levels throughout the state.

Butternut Canker, caused by *Sirococcus clavigignenta-juglandacearium*, remains very common throughout the state, causing an increasing amount of dieback and mortality. Recent research at the University predicts that 85% of the butternut in Vermont will be dead by 2011.

Emerald Ash Borer, *Agrilus planipennis*, was not found in Vermont surveys in 2005. The insect continues to expand its range from the established areas in Michigan, to sites in Ontario, Indiana and Ohio. Ash trees were surveyed at high risk locations for introductions (nurseries with ash stock and sawmills processing ash) or areas where ash decline had been observed. Results from surveys at 34 sites and 480 trees found no emerald ash borer insects or confirmed symptoms.

The total mapped area of forest decline due to **flooding** decreased this year, but there were new areas affected in areas newly inundated by beavers. Aerial mapping showed 11,078 acres of decline associated with wet sites

Forest Tent Caterpillar, *Malacosoma disstria,* defoliated 230,000 acres in Vermont in 2005, with over 20,000 acres defoliated for the 2nd or 3rd year. Over 90% of the mapped defoliation occurred in our four southernmost counties. Unlike 2004, trees refoliated normally, although refoliation was usually smaller and yellower than normal foliage. Dieback is occurring in some stands defoliated for the second or third time.

Gypsy Moth, *Lymantria dispar*, larvae caused scattered, light defoliation in Vermont. Larvae were commonly observed in western Bennington and Rutland Counties. Often, larvae were observed where forest tent caterpillar was also present.

Hardwood decline and mortality continues to be evident but has improved over the past two years. Decline was mapped on 10,200 acres this year, compared to 31,583 and 50,039 acres in 2004 and 2003, respectively.

A **heavy wet snow** storm on October 25, 2005 caused widespread damage to trees and shrubs, especially those with leaves remaining. A map of snow depths after the storm showed that the largest snow fall occurred in northern Vermont. Hardest hit were beech, young oak, aspen, birch and large apple trees. Power outages lasting up to 6 days were common. A survey of tree damage in sugarbushes was conducted in response to concerns.

Hemlock decline was reduced from 2003 and 2004, with mortality occurring in some ledgey sites. Hemlock decline was mapped on 558 acres in western counties. Damage is attributed to droughts during previous years, and is now associated with hemlock borer.

Hemlock Woolly Adelgid, *Adelges tsugae*, was not observed or known to occur in Vermont in 2005. A survey was conducted to follow-up on the introduction and eradication of possibly infested nursery stock in 2004. Ten sites where trees from infested shipments had been planted were inspected. These sites were chosen because of proximity to native hemlock trees. Two hundred 1-meter long hemlock branches were examined at each site. All sites were negative for the adelgid.

Larch mortality continues in small patches. The recent increase in decline is attributed to drought years and subsequent invasion by eastern larch beetle.

Lecanium Scale, *Parthenolecanium corni,* showed a sharp increase from 2004 and was widespread throughout Vermont. In some stands, crown dieback is a concern to sugarmakers. Sooty mold was commonly observed on understory foliage, maple tubing, and any structure below infested hardwood trees. Overwintering scales have been observed on twigs, and noticeable populations are expected in 2006.

There was a decrease in mapped areas of **logging-related decline** this year, although it continues to be evident in widely scattered locations. Total area mapped during aerial survey is 458 acres.

Though heavy populations on ornamentals were occasionally observed, **Oystershell Scale**, *Lepidosaphes ulmi*, on American beech in forested settings was light in most locations, and dieback was not heavy enough to be detected by aerial survey.

In 2005, 14 locations were visited in late summer, when ozone symptoms are at their peak. Symptoms of **ozone injury** (stippling on upper leaf surface) were recorded at 29% of the sites. Where injury occurred, the severity was light to moderate. No locations had heavy injury. Symptoms were observed on black cherry and white ash, which are the only tree species known to be good visual indicators of ozone injury.

Pine Shoot Beetle surveys were conducted in the four southernmost counties of Vermont in 2005. Traps were deployed in Scots pine stands or red pine stands. Fragments of pine shoot beetle were recovered from traps in Rutland County. Currently pine shoot beetle is in 8 counties in Vermont.

Defoliation by the **saddled prominent**, *Heterocampa guttivata*, was not reported, but some larvae were observed. Populations may be on the rise, though the increase is not reflected in pheromone trap catches for 2005. Saddled prominent populations often increase simultaneously with other defoliating caterpillars and were the suspected cause of large frass droppings reported from several sites (notably in East Montpelier) in midsummer.

The **Siberian moth**, *Dendrolimus sibiricus,* is considered a significant defoliator of conifers in northern Asia and could be devastating to conifer forests in the northeast. Because early detection is essential to minimize the impact of any introduction, we conducted surveys for the second consecutive year to determine the presence and distribution of the Siberian moth in Vermont. No Siberian moths were caught at any of the trap locations.

Spruce-fir decline and mortality continue to be evident, at levels similar to 2004. Some of this is high elevation spruce affected by drought and winter injury in previous years, and some is lower elevation fir stressed by drought and balsam woolly adelgid.

VERMONT 2005 FOREST HEALTH MANAGEMENT RECOMMENDATIONS

The following recommendations summarize information of particular importance to forest managers. Additional information can be found in the full report on Forest Insect and Disease Conditions in Vermont 2005, under specific pests mentioned or in separate summaries for sugarbush and Christmas tree managers in the appendix. For assistance in identifying pests, diagnosing forest health problems, on-site evaluations, and insect population sampling, or to obtain copies of defoliation maps, management recommendations, and additional literature, contact forest resource protection personnel or your county forester.

Tree Condition was generally good throughout the state. Good weather conditions for growth continued in 2005, making three favorable years in a row. Stress from previous drought years did continue to cause impacts, particularly to white birch and eastern larch.

Wet conditions during spring leaf-out led to foliar diseases on many species. The brown midsummer foliage was often mischaracterized as drought. Whereas drought symptoms first appear on knolls with shallow soils, these brown leaves were concentrated in valley bottoms, small depressions, and along hillside bands where clouds concentrated moist air for long periods of time.

Wet conditions in the fall loosened roots, and made trees on shallow sites vulnerable to windthrow. The season's storms, plus a heavy October snowfall, caused considerable breakage to trees with bole cankers and forked stems. We are reminded to lean towards group selection on shallow, exposed sites and where desirable, to cull trees with defective stems.

Where **Hardwoods** are growing, forest tent caterpillar continues to be a threat. In addition to **sugar maple**, **oak, ash, basswood,** and **hickory** were often affected. Over 200,000 acres of defoliation were mapped in 2005, with over 20,000 acres defoliated for the 2nd or 3rd year. Although a single year of defoliation rarely causes significant impacts, symptoms of declining health may become obvious after the second year. Dead twigs are now noticeable in many trees that had been heavily defoliated in both 2004 and 2005. Dieback averages 30% in these trees compared to 6% in trees that were defoliated in 2004 only.

Although defoliated trees are expected to recover, further stresses could tip the balance against them. We recommend avoiding additional disturbances in order to cushion trees against future stresses that we can neither predict nor control. Drought, in particular, can be a killer, if it comes on the heels of defoliation and disturbance. Maples growing on less-forgiving acidic sites are known to be more vulnerable to decline following defoliation.

We do expect this outbreak to collapse naturally in those areas which have already been defoliated, and to move into new areas. Although moth catches have increased sharply in northern Vermont and declined a bit in the south, egg mass surveys predict that the region affected in 2006 will be similar to 2005. In these regions, timber management projects in oak or northern hardwood should be assessed for forest tent caterpillar defoliation prior to being offered for sale. Sales should be postponed where there is moderate or heavy defoliation, and remarked if necessary once recovery has occurred. Wait two or three years after the outbreak to see which ones remain healthiest, amending Use Value Appraisal plans if necessary. It's best to mark sales of recently defoliated stands during the growing season, so crown condition can be rated. Even if the caterpillar has not been heavy in the region, be flexible when scheduling timber sales, so they can be postponed if populations build.

The State of Vermont will be coordinating another aerial spray project for sugarmakers in 2006. Only actively tapped maple stands are being included in this project. We are not encouraging aerial spraying of forestland, where a crop does not need to be harvested annually, and where activities can be postponed to allow tree recovery. Research has shown that widespread spraying of forestland can actually prolong outbreaks. Such an impact is unlikely if spraying is restricted to small sugarbush blocks.

Other insects are of concern on **Hardwoods**. When one caterpillar is in outbreak, populations of other caterpillar species may also be increasing. Outbreaks of saddled prominent frequently follow those of forest tent caterpillar. Learn how to recognize this insect, and look for it on maple and beech in July.

Lecanium Scale was heavy on twigs throughout the state. Although the affect of this insect is unclear, the level of feeding almost certainly is causing an impact in some stands. The encouraging news? The heaviest feeding occurs on the more-expendable lower branches. Also, the species of lecanium scale that occurs in Vermont is thought to be native to this area.

Gypsy moth caterpillars, and even defoliation, have been more noticeable, so oak stands should be watched for gypsy moth life stages. Outbreaks are building elsewhere in the northeast, which suggests that populations may increase here as well.

The **Beech** Bark Disease outbreak continues to progress, with dieback and mortality common among severely infested trees. With the recent spike in the disease, it's a good time to select clean-stemmed, healthy crowned beech for retention. They're not only a better bet for the current stand, they will also produce a larger share of the understory sprouts if they are retained in the overstory.

White Birch, particularly at higher elevations in the northern Green Mountains is showing the impact of multiple recent stresses, including drought and defoliation. While most of the affected stands are outside of commercial forestland, their condition may become a hazard for recreational users and may open up some now-gladed ski trails. Low elevation trees have fared better, and are not expected to decline.

While the range of **Pine** shoot beetle has expanded (now including Rutland County), the quarantine affecting the movement of pine logs, bark, and unprocessed bark mulch has not changed. With the whole state of Vermont under quarantine, pine may be moved freely within the state. However, all shipments from Vermont to southern New England or to parts of New York and Maine, are regulated. Quarantine details can be found at www.vtfpr.org/protection/quarantine.cfm.

Although **Hemlock** remains threatened by hemlock woolly adelgid, the 2004 eradication effort still looks successful. No infested hemlocks were found during checks around ten of the potentially infested sites. To reduce the risk of similar threats in the future, the quarantine has been amended to restrict all hemlock nursery stock from infested counties. Hemlock logs, lumber with bark, and chips will remain admissible from areas under quarantine, to sites with a compliance agreement.

We continue to discourage pre-infestation salvage of hemlock. Widespread salvage eliminates habitat benefits, and could decrease genetic diversity with the loss of genes that might make hemlocks resistant to adelgid. Salvage may not be pressing, or even necessary, once the adelgid becomes established. Mortality doesn't begin for several years, and many trees survive. Our cold temperatures and introduced natural enemies may also limit adelgid numbers to tolerable levels.

Balsam Fir and **Eastern Larch** mortality continued from a complex of stressors, including past insect damage (balsam woolly adelgid, European larch beetle and larch casebearer), drought stress, bark beetles and root pathogens. Although new mortality areas should be rare, trees may continue to decline in existing areas. With root rots and bark beetles established in those sites, harvesting activities should be done in large groups, patch clearcuts, or other non-selective methods.

INTRODUCTION

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

A statewide aerial survey was flown between July 11 and July 26 in Districts 1,2,3 and 4 to target the early defoliators. District 5 was surveyed between September 12 and September 14 to target late season defoliators and general forest condition. Part of the survey was conducted using the digital sketchmapping tool developed by the US Forest Service.

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We gratefully acknowledge the financial and technical support provided by the USDA Forest Service, Northeastern Area State & Private Forestry that enables us to conduct the surveys and publish the results in this report.

Finally, this document about current forest health, and the diagnostic and survey work required to produce it, would not be possible without support from the State of Vermont and from citizens who find the information useful.

WEATHER AND PHENOLOGY

2005 weather statistics based on Burlington data are summarized in Figure 1. All temperature and precipitation in the narrative below are from our Essex weather station unless otherwise noted.

Winter

Winter-like temperatures didn't waste any time getting started in November of 2004. The thermometer dropped to 12°F on the 13th and 11°F on the 14th. Many of the days were uncharacteristically sunny for the cloudiest month of the year as several storms tracked south of Vermont. Thanksgiving Day had a high temperature reading of 62°F with a thunderstorm and rapidly falling temperatures to a low of 19°F with scattered snow flurries overnight. December 3rd marked the first overall covering of snow with 1-3" in the Champlain Valley.

Several small snowfalls kept the ground white throughout December and cold temperatures made sure that no melting would occur—an overnight low of -9°F on the 20th and a daytime high of only -4°F…the following night went to -15°F! Within the next two days, however, a precipitous warm-up went all the way to 54°F—a turnaround of 69 degrees in just over 48 hours. Christmas Eve was 57°F, and nearly an inch of rain fell wiping out the promise of a white Christmas. There was a tiny ½" of snow during the night to whiten the ground. During the day after Christmas, the forecasted scattered snow showers turned into about 5" of snow in the Champlain Valley.

The temperatures fluctuated through the first half of January—several melts leaving patches of ground bare, only to be whitened up again by light snowfalls. Bitter cold moved into the area for the end of January. From January 18th to January 31st, every night was below zero with a -20°F on the 22nd. The previous day saw a high temperature of -3°F. By February 7th, 11 days had passed without precipitation. The minimal snow cover was shrinking and disappearing under softwood stands and on south-sloping roadsides in the Champlain Valley. The first significant snowfall of the season fell on February 10th and 11th…10½" at Essex. This snow would last through March, with a maximum depth of 17" on the ground at the Essex observation station after the addition of an 8" snowfall on March 1st.

Spring

By mid-March the sugarmakers were getting antsy due to the very low overnight temperatures…sap runs didn't start until late afternoon and then shut down soon after sunset. Overnight lows were in the teens even though the days were warm and sunny with highs in the 40's. By the end of March, the weather had switched so that it was no longer freezing at night—further frustrating the sugarmakers. Early in April, many sugarmakers called it quits for the year with lackluster results…just over half a crop for many. Statewide, maple syrup production was down 18%. Some late sugarbushes, however, were still boiling in mid-April, when a stretch of nearly ideal weather conditions produced some late sap runs.

The snowpack had disappeared in the valleys by April 1st, exposing the dead grass fields to cool, dry winds. On the 16th, a relative humidity value of 8% was recorded in Burlington—near desert-like air. Dry, windy air masses from Canada repeatedly deflected rainstorms from Vermont, encouraging parched conditions. By the 18th of the month, the fire potential had gotten critical. The Department of Forests, Parks and Recreation posted a burn ban for all of Vermont and a red flag warning was issued out of the Burlington weather office for the Champlain Valley of Vermont and New York. The fire situation got a lot of press on the radio and television with the evening news frequently leading off their broadcasts with the warnings and precautions. April 20th marked the end of the dry conditions as 0.68" of rain fell during the late afternoon and evening. The next few days were wet and cool…defusing the dangerous fire conditions and allowing the fields and forests to green up. May continued the pattern of cool, cloudy weather with light, frequent rains. A hard frost on the 13th of May (25°F) blackened some tender growing tips throughout the Champlain valley. Weekly spring cumulative growing degree days appear in Figures 2 and 3. Sugar maple phenology observations are summarized in Figures 4 and 5 and Table 1.

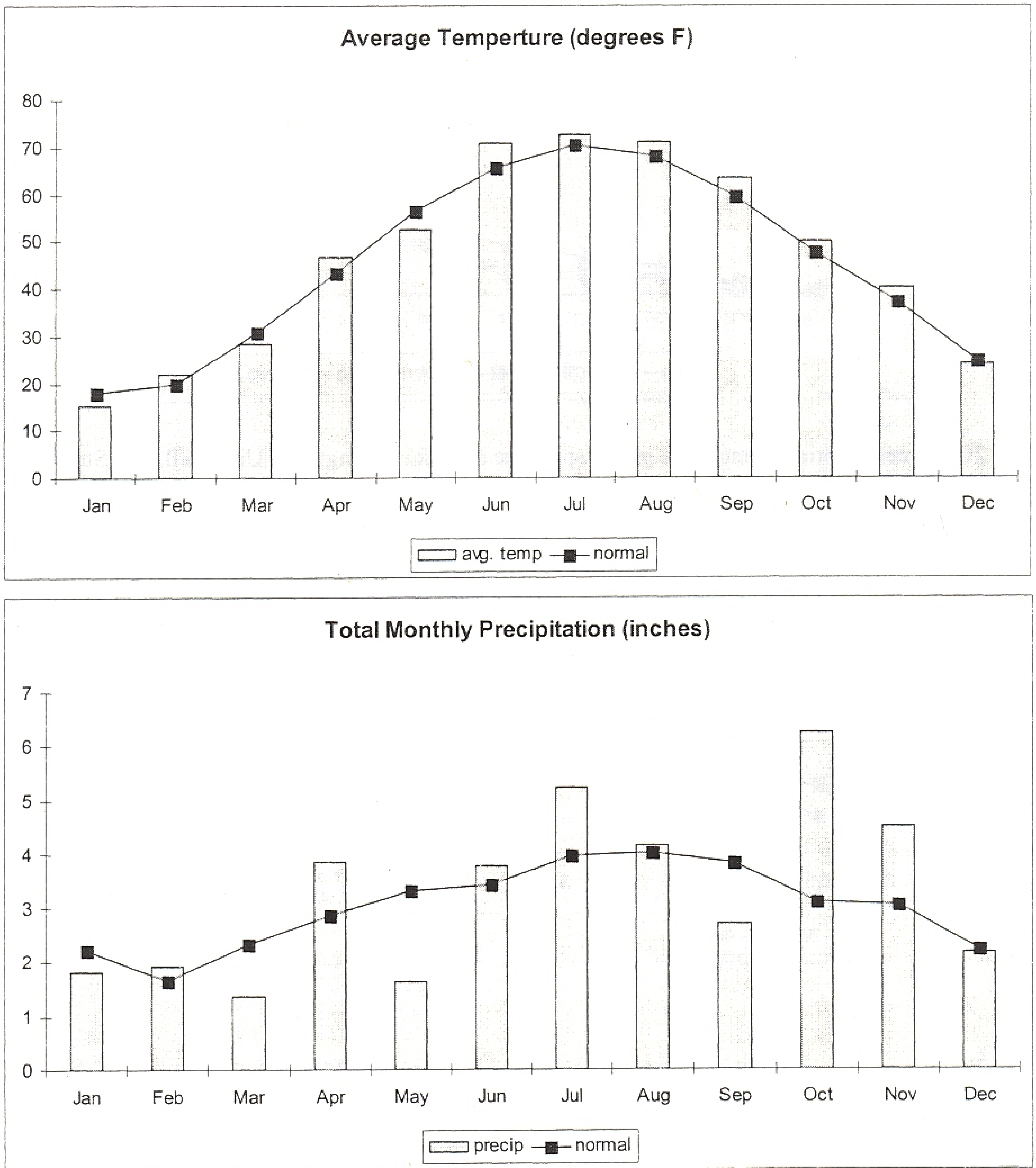


Figure 1. Monthly average temperature and monthly total precipitation in 2005, compared to normal, for Burlington, Vermont. Normals are for years 1971-2000.

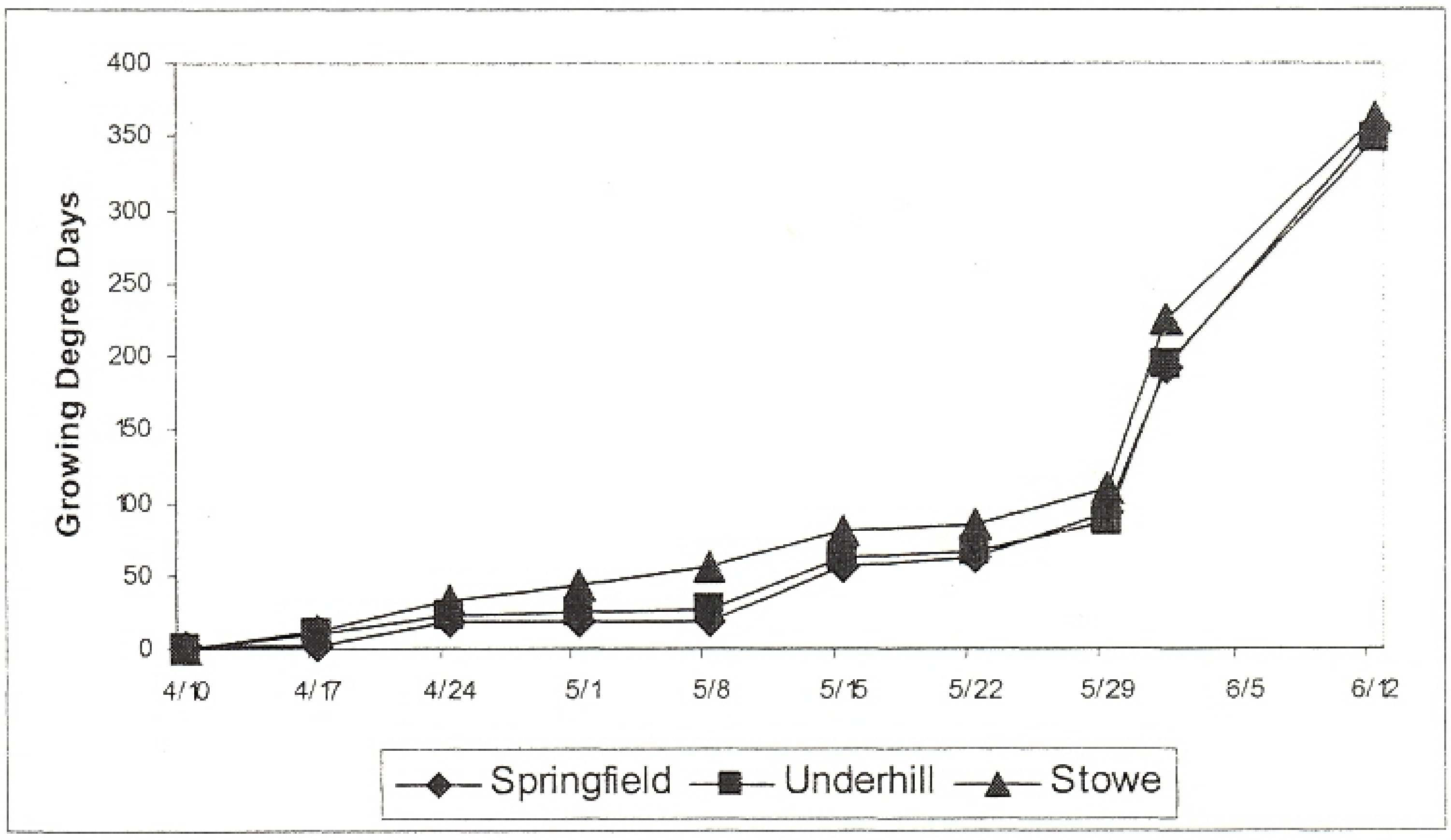


Figure 2. 2005 weekly spring cumulative growing degree days for Springfield, Underhill, and Stowe, Vermont. 50°F is used as the threshold of development.

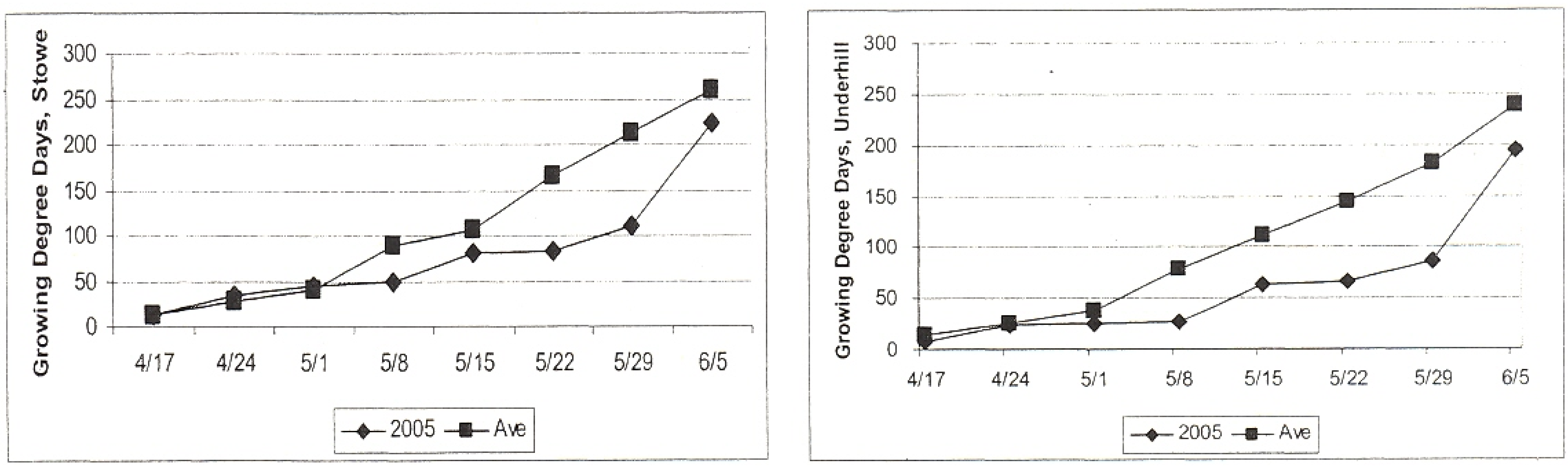


Figure 3. Weekly spring cumulative growing degree days for Stowe and Underhill, Vermont, in 2005 compared with mean 1993-2005 accumulations. 50°F is used as the threshold of development.

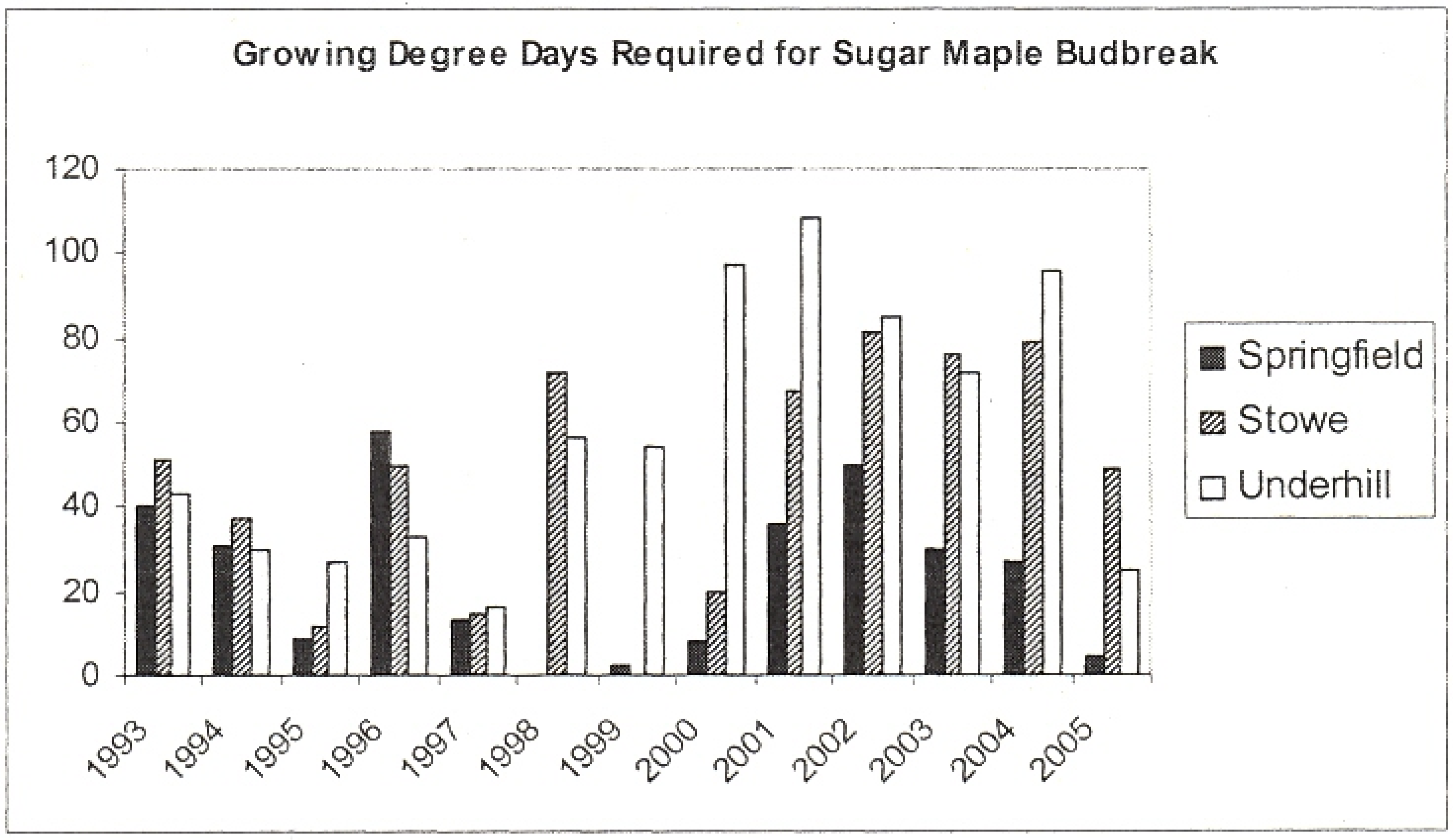


Figure 4. Growing degree days for sugar maple budbreak in Springfield, Stowe and Underhill 1993-2005.

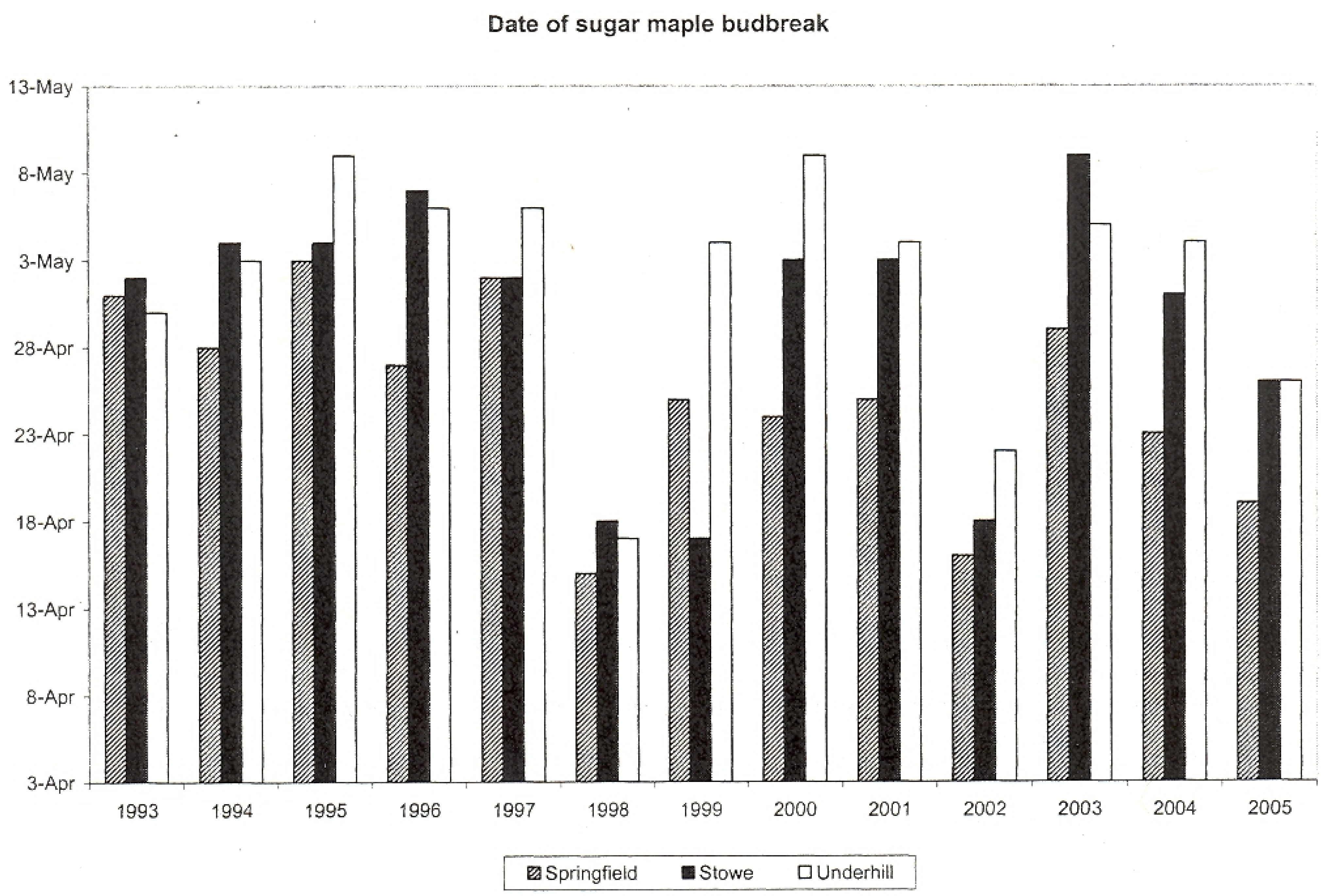


Figure 5. Dates of sugar maple budbreak in Springfield, Underhill and Stowe, Vermont, 1993-2005.

Table 1. 2005 First observation dates of phenological development and growing degree day accumulation from 3 sites in Vermont. 50°F is used as the threshold of development.

Biological Indicator	Springfield	Stowe	Underhill
PLANT DEVELOPMENT			
Showing Green			
Fir, Balsam		5/9 (55)	5/17 (63)
Budbreak			
Apple, MacIntosh		4/24 (33)	
Ash, White	4/28 (20)	5/11 (76)	
Cherry, Black	4/15 (2)		
Fir, Balsam		5/10 (65)	5/24 (69)
Fir, Fraser		5/29 (110)	
Hemlock			5/31 (105)
Maple, Red		4/26 (33)	
Maple, Sugar	4/19 (5)	5/6 (49)	4/26 (25)
Oak, Red	5/5 (20)		
Flowers			
Apple, Dolgo Crab		5/18 (84)	
Aspen, Quaking	4/5 (0)		
Crocus	4/4 (0)		
Dandelion	4/21 (17)		
Elm, American	4/10 (2)		
Honeysuckle, Tartarian		5/30 (119)	
Lilac (first flowers)		5/31 (138)	6/3 (156)
Lilac (full bloom)		6/5 (224)	
Maple, Red	4/10 (2)	4/17 (12)	
Maple, Silver	3/27 (0)		
Maple, Sugar		4/29 (43)	5/2 (25)
Plum, Canada		5/11 (76)	
Shadbush		5/9 (55)	5/13 (57)
INSECT DEVELOPMENT			
Balsam shootboring sawfly adult		5/9 (55)	
Eastern tent caterpillar (egg hatch)	4/14 (2)		4/19 (22)
Eastern tent caterpillar (first nest)	4/18 (3)		4/26 (25)
Pear thrips (first adults)			4/12 (1)
Plum curculio (first adults)		6/6 (245)	
OTHER OBSERVATIONS			
Spring peepers calling		4/18 (12)	

Summer

Summer began in earnest on June 3rd. A four day warm spell turned out to be just the beginning of a long, hot summer. Throughout the season, high temperatures were consistently above average. The growing degree days measured at the Essex weather station were 28% above the average—that is indicative of very warm days and warm nights, high dewpoints and stalled weather systems. There were five hot spells of 10 days or more, when the high temperatures averaged nearly 90°F for the period. According to the Northeast Regional Climate Center, this was the second warmest summer on record for Vermont.

Rain came in large doses when it did come (often the remnants of hurricanes that hit the gulf states—Cindy in July, Katrina in August and Rita in September). These storms dropped several inches in a day or two with fairly long dry spells in between. The final totals for precipitation (except for May), however, were average or above average for the summer months.

Heavy flowering was noted especially on black cherries, oaks, silver maples and blackberries. Silver maple seed was so heavy that many trees looked tan, not green! Overall, the growing season was a good one with plenty of moisture and warm temperatures. The one exception might be those plants growing on marginally droughty soils. The frequent, week-long hot/dry spells between the rainstorms were too long for the vegetation on these sites to maintain good growth…and the summer just kept going. After the remnants of Katrina blew through the state at the end of August, the rest of the summer and early fall could not have been more pleasant. Clear, sunny and warm days with cool nights and only scattered rains lasted until the second week in October.

Fall

After a particularly balmy few days in early October (with highs near 80°F and overnight lows in the upper 50's), the cool, wet and cloudy fall finally arrived. Starting with heavy rain from tropical depression Tammy and lasting for nearly three weeks, light, intermittent, and then more heavy rain dampened many a foliage drive in the Northeast. No frost was recorded anywhere in the state until October 21st! This lack of cold nights pushed the fall colors noticeably late. Data collected from Vermont Monitoring Coooperative tree phenology plots on the west slope of Mt. Mansfield indicate that 2005 "peak color" (% color) in sugar maple (*Acer saccharum*), red maple (*Acer rubrum*), and yellow birch (*Betula alleghaniensis*) was 8-13 days later than the 5 year average (2000-2004) (Figure 6). Many leaf-peeping tours were greeted by mostly green mountainsides well into October. The lack of sub-freezing temperatures in September and most of October led to low production of anthocyanin (red pigments), a key mechanism for the brilliant colors in maples. Fall 2005 in Vermont will be remembered as unusually warm, with lackluster color and notably late senescence.

The final blow to the foliage season came on October 25th. An all day rain from the remnants of hurricane Wilma changed to snow—switching sooner in the mountains than in the valley. There were 3" of wet, clinging snow at the Essex weather station compared to nearly 2 feet of snow in Bolton. Many trees and shrubs still had their leaves which added to the surfaces that could be coated with the heavy, wet snow. Considerable damage was done throughout the northern half of the state as trees bent over and broke branches under the weight. Damage was the worst on beeches, birches, apples and ornamental shrubs. The storm was a headache especially for the electric companies and for the sugarmakers with tubing knocked down by falling branches. The foliage season was late to start, short in duration and plagued by bad weather…definitely not one of the best years for the show of fall colors.

Precipitation in October set records across the state with many locations receiving up to 9" or more. The fire weather station in Marlboro received a whopping 19.85 inches of rain for the month also setting a record. Monthly rainfall amounts at Vermont Fire Weather Stations are summarized in Figure 7.

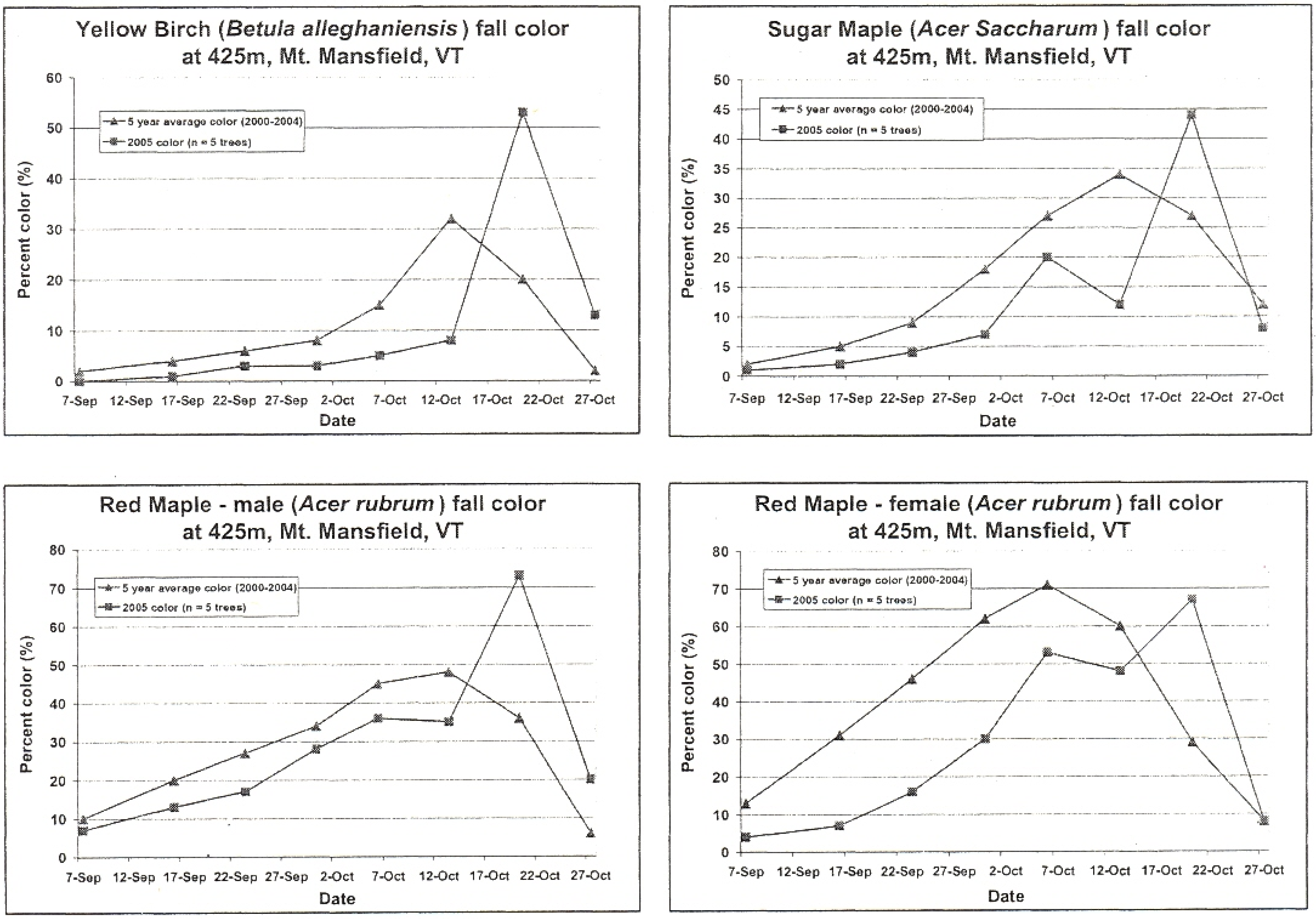


Figure 6. Progression of fall color for Yellow Birch, Sugar Maple and Red Maple at 425M at Mt. Mansfield Vermont, compared to a 5 year average.

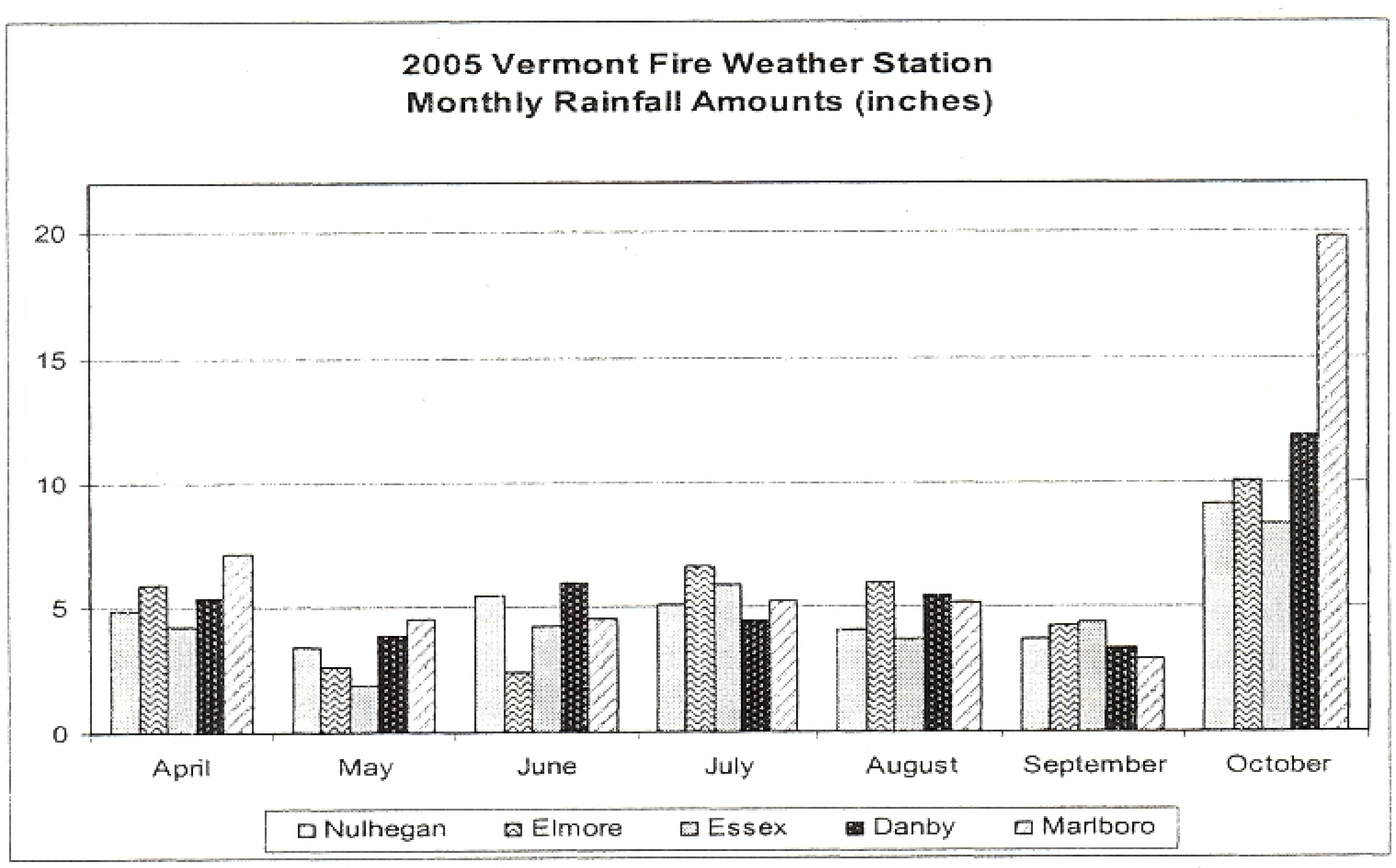


Figure 7. Monthly rainfall amounts (in inches) at Vermont fire weather observation stations through fire season, April - October 2005. Remnants from hurricanes and/or tropical storms/depressions were the rainmakers during 2005. Monthly rainfall deficits from stretches with little to no rain were erased by these storms.

HARDWOOD DEFOLIATORS

Birch Defoliation

Birch defoliation affected over 84,000 acres of forest (Table 2, Figure 8). As in 2004, several agents were responsible, including the **birch skeletonizer,** *Bucculatrix canadensisella,* the **birch leafminer,** *Fenusa pusilla* and possibly other birch leafmining sawflies, and **Septoria leafspot**, *Septoria* sp.

Table 2. Mapped acres of birch defoliation by birch leafminers, birch skeletonizer, Septoria leafspot and other agents in Vermont in 2005.

County	Acres
Addison	139
Bennington	0
Caledonia	11,013
Chittenden	0
Essex	27,632
Franklin	5,724
Grand Isle	3
Lamoille	8,951
Orange	2,456
Orleans	11,000
Rutland	2,103
Washington	9,498
Windham	1,953
Windsor	3,765
Total	84,237

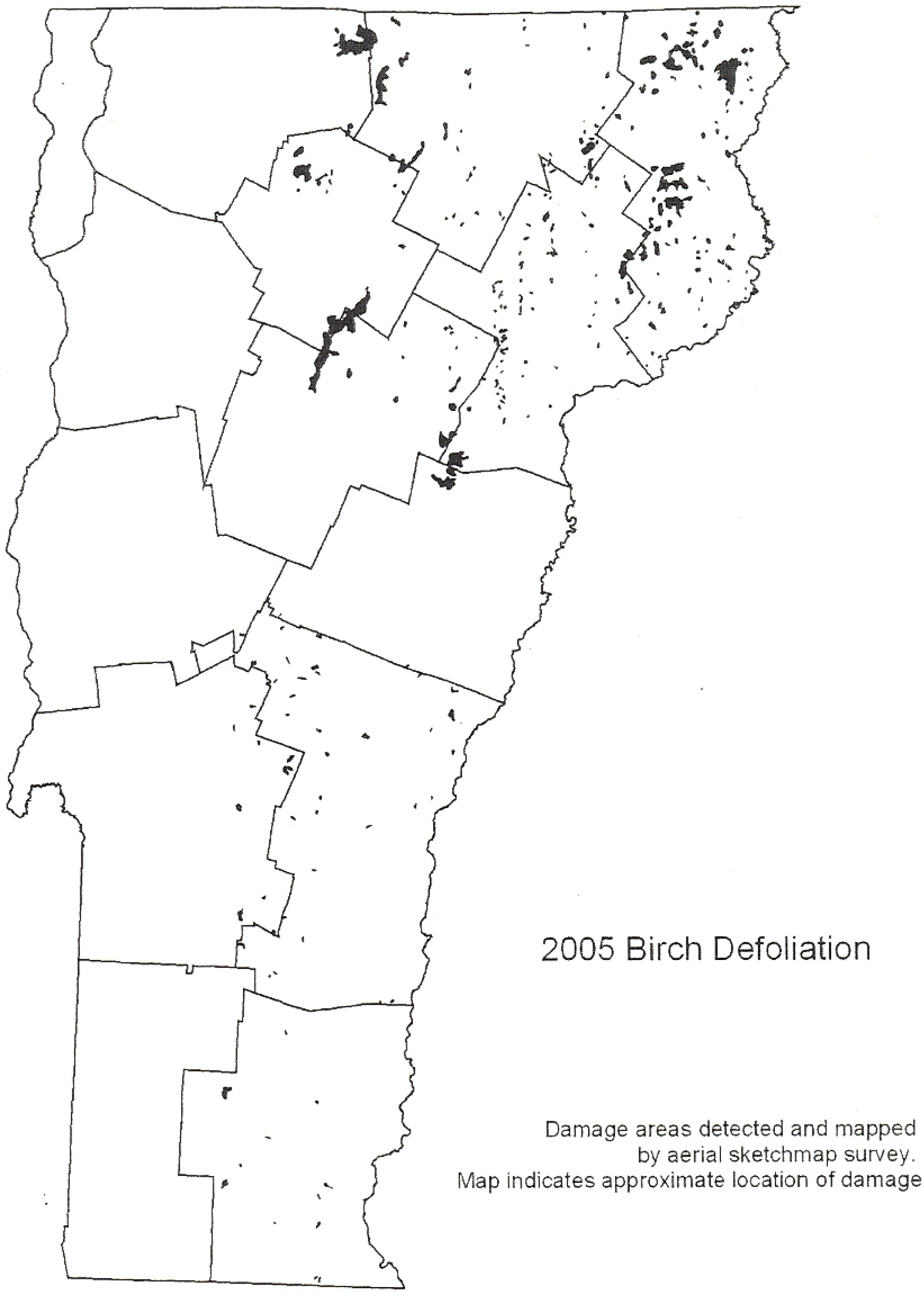


Figure 8. Mapped acres of birch defoliation in Vermont in 2005.

Bruce Spanworm

Bruce Spanworm, *Operophtera bruceata,* dropped to very light levels throughout the state. Egg-laying traps were placed in sugarbushes of concerned landowners. Counts from four locations in 2002 yielded 270 to 992 eggs per trap and averaged 570, while resulting defoliation in these sites in 2003 ranged from 5% to 27% and averaged 16 percent. In 2003, 14 traps were deployed and egg counts ranged from 0 in Greensboro to 1061 in Killington, and averaged 223. Traps were deployed at five sites in 2004, and no eggs were found on any of the traps. In 2005, 5 traps were deployed, and egg counts ranged from 0 to 4 (Table 3). Damage is expected to remain low in 2006.

Table 3. Number of Bruce spanworm eggs on traps deployed in late fall of 2002-2005.

Town	Number of eggs in 2002	% defoliation in 2003	Number of eggs in 2003	Number of eggs in 2004	Number of eggs in 2005
Sheldon	270	5	52		
Cabot	680	14	484		
Derby	339	27	18		
Derby	992	18	6		
Richford			282		
Underhill			40	0	0
Cabot			333		
Belvidere			367		
Greensboro			0		
Vershire			158		
Vershire			24		
Killington			1,061	0	0
Pittsfield			272	0	0
Shaftsbury			24	0	4
Huntington				0	0
Total	2,281	64	3,121	0	4
Average	570	16	223	0	<1

Forest Tent Caterpillar

Forest Tent Caterpillar, *Malacosoma disstria,* defoliated 230,000 acres in Vermont in 2005, with over 20,000 acres defoliated for the 2nd or 3rd year. Over 90% of the mapped defoliation occurred in our four southernmost counties (Table 4, Figure 9). Unlike 2004, trees refoliated normally, although refoliation was usually smaller and yellower than normal foliage. Dieback is occurring in some stands defoliated for the second or third time.

Twenty-seven sugarbushes, totaling 1600 acres, were sprayed in late spring with Foray, a formulation of the biological insecticide Bt. Costs were split between participating landowners and government funds. The treatment was effective in most sugarbushes, and caterpillars died wherever spraying occurred. Rainy weather delayed the pesticide application. In some southern locations, defoliation was already heavy by the time spraying could occur.

The number of forest tent caterpillar moths caught in traps increased this summer, indicating there will be defoliation in 2006 (Figures 10-12). We expect more noticeable damage in northern Vermont. Egg mass surveys predict defoliation in many sugarbushes that were defoliated in 2005 and in new areas as well.

Table 4. Mapped acres of damage by forest tent caterpillar in 2005.

County	Acres
Addison	9,035
Bennington	33,541
Caledonia	65
Chittenden	2,524
Essex	0
Franklin	1,068
Grand Isle	203
Lamoille	0
Orange	2,496
Orleans	0
Rutland	82,936
Washington	600
Windham	33,338
Windsor	63,896
Statewide	229,702

We tested root starch in four sugarbushes that were defoliated in 2004. Those study trees that weren't heavily defoliated in 2005 had ample food reserves in the fall. Most that were heavily defoliated two years in a row were low or depleted in starch reserves (Figure 13).

This outbreak will collapse naturally, but, so far, that doesn't seem to be happening. Historically, outbreaks last 1-3 years in one region, but 3-8 years statewide, as new regions are defoliated. The State of Vermont plans to provide assistance to sugarmakers again in 2006 by doing egg mass surveys and by coordinating an aerial spray project.

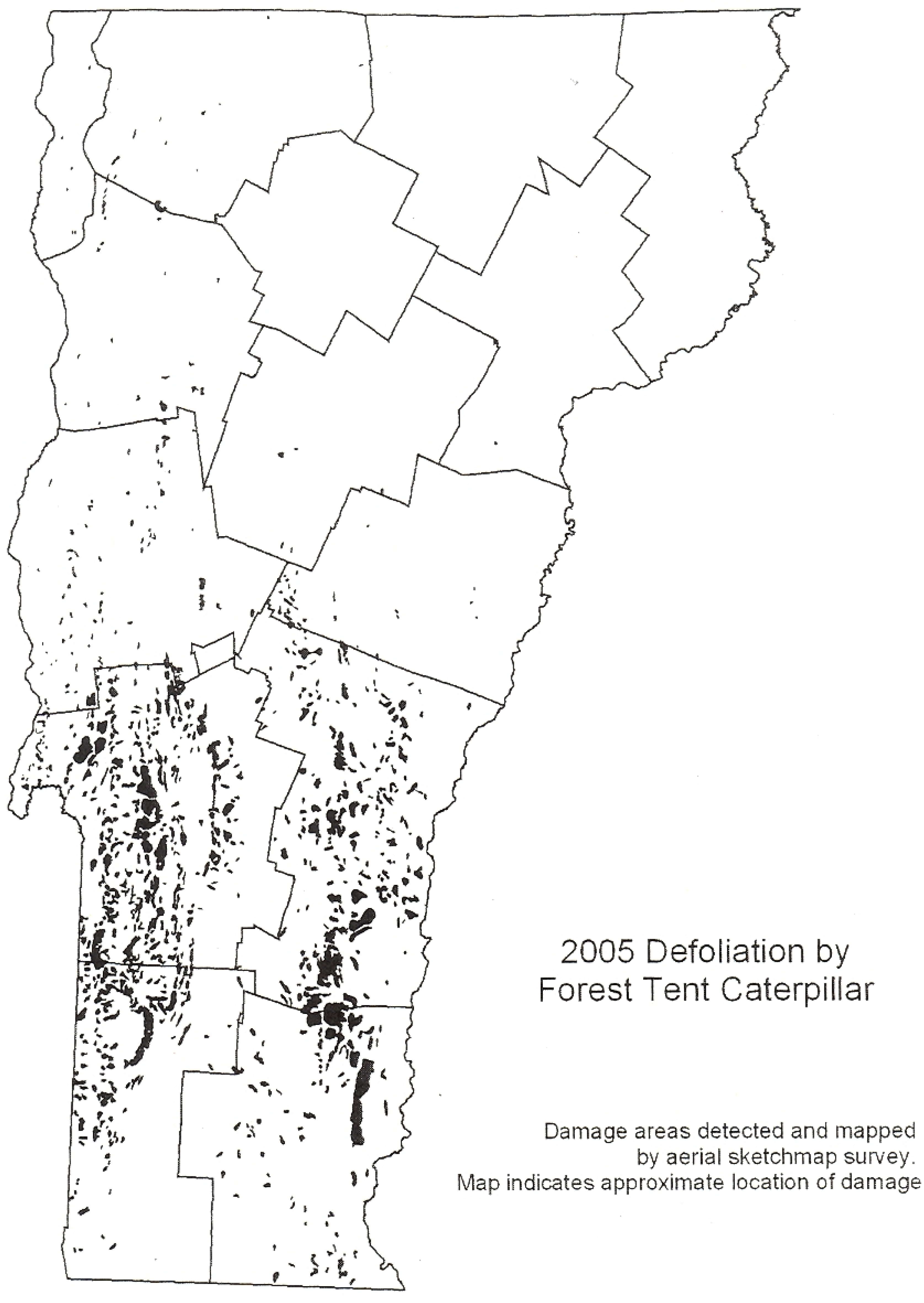
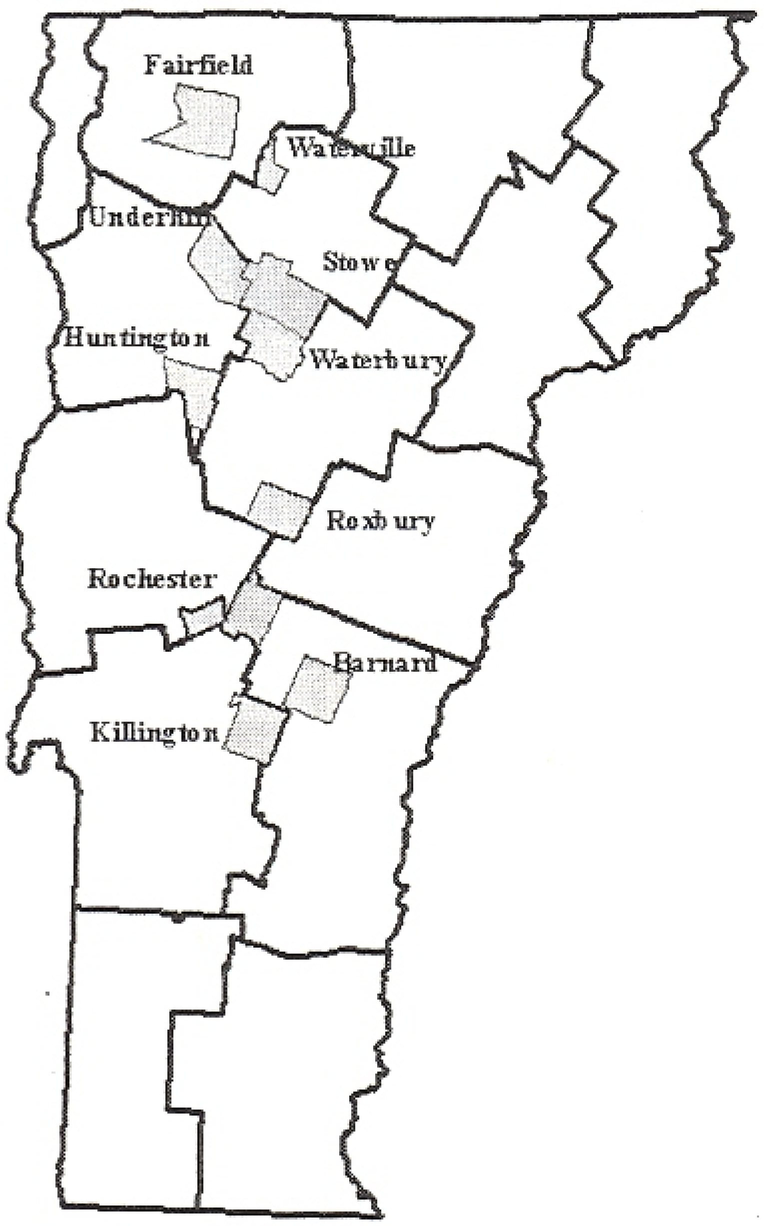


Figure 9. Mapped acres of forest tent caterpillar defoliation in Vermont in 2005.



Average # of moths caught/trap

	2002	2003	2004	2005
Barnard	4.6	12.3	23.0	----
Castleton	----	----	----	17.0
Fairfield	----	1.3	1.7	----
Huntington	9.2	6.7	5.0	15.7
Huntington (NAMP 027)	6.0	6.7	10.0	----
Killington	6.8	9.7	20.0	15.3
Rochester	5.9	4.7	9.0	4.7
Roxbury	16.0	14.7	13.3	7.3
SB 2200	3.8	11.7	18.3	23.3
VMC 1400, Underhill	3.6	3.0	0.3	7.3
VMC 2200, Underhill	3.0	7.0	6.3	11.7
VMC 3800, Stowe	1.0	2.7	10.3	26.0
Waterbury	2.0	0.7	2.0	41.0
Waterville	0.0	1.3	1.3	17.7
Average	**5.2**	**6.9**	**10.0**	**17.0**

Figure 10. Average number of forest tent caterpillar moths caught in pheromone traps, 2002-2005. There were 4-5 traps per location in 2002 and 3 traps per location in 2003-2005.

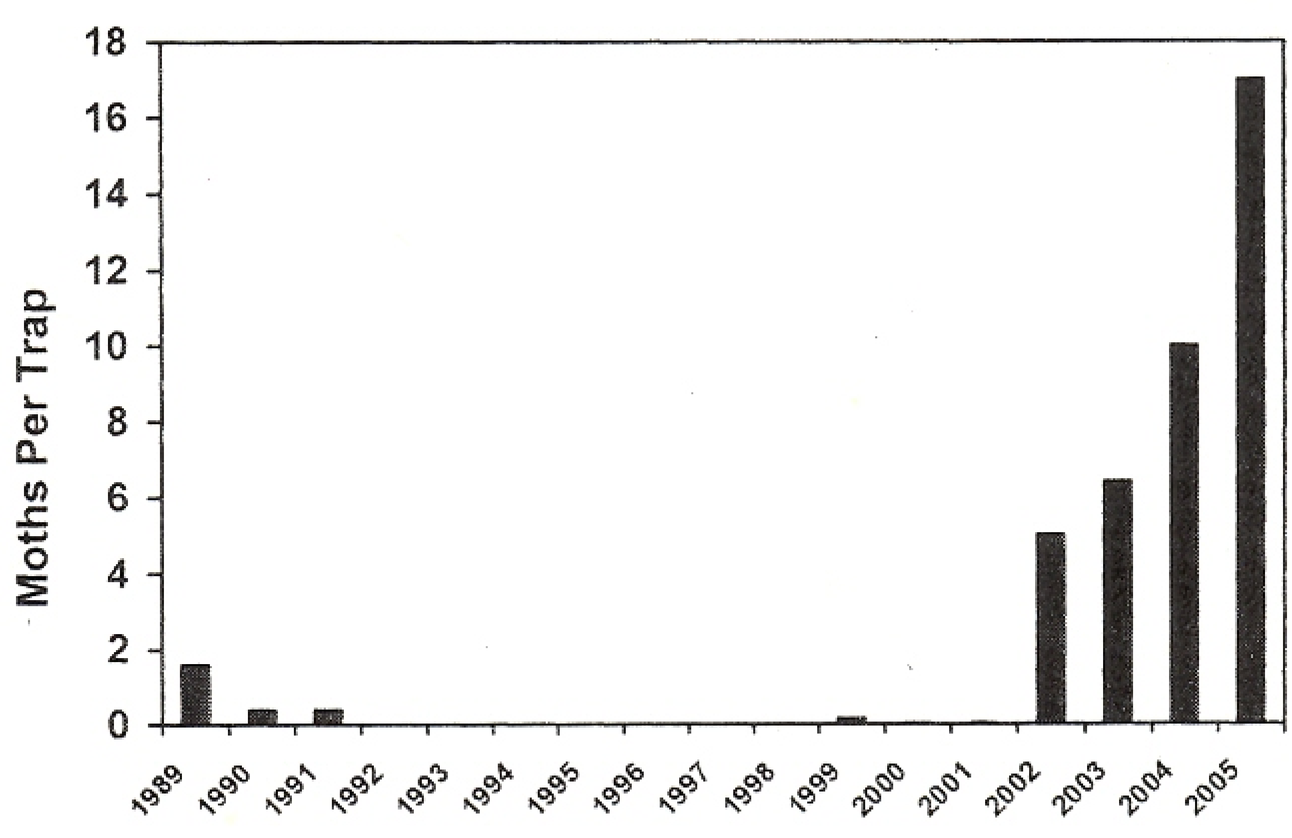


Figure 11. Average number of forest tent caterpillar moths caught in pheromone traps 1989-2005. Five multi-pher traps per site baited with RPC 2-component lures through 2001. PheroTech lures were used in 2002-2005. There were three traps per site in 2003-2005.

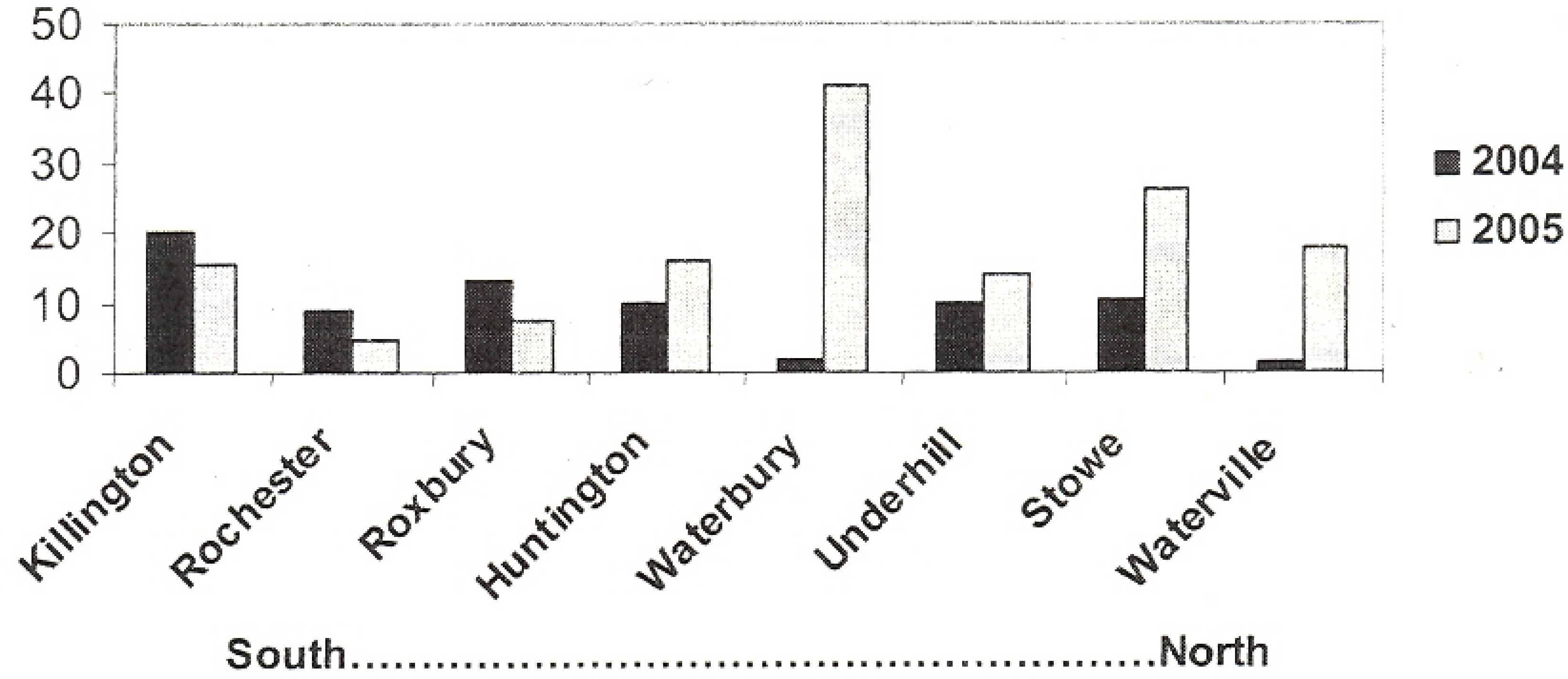


Figure 12. Average number of forest tent caterpillar moths caught in pheromone traps south to north in 2004 and 2005. Three multi-traps baited with PheroTech lures were deployed at each site.

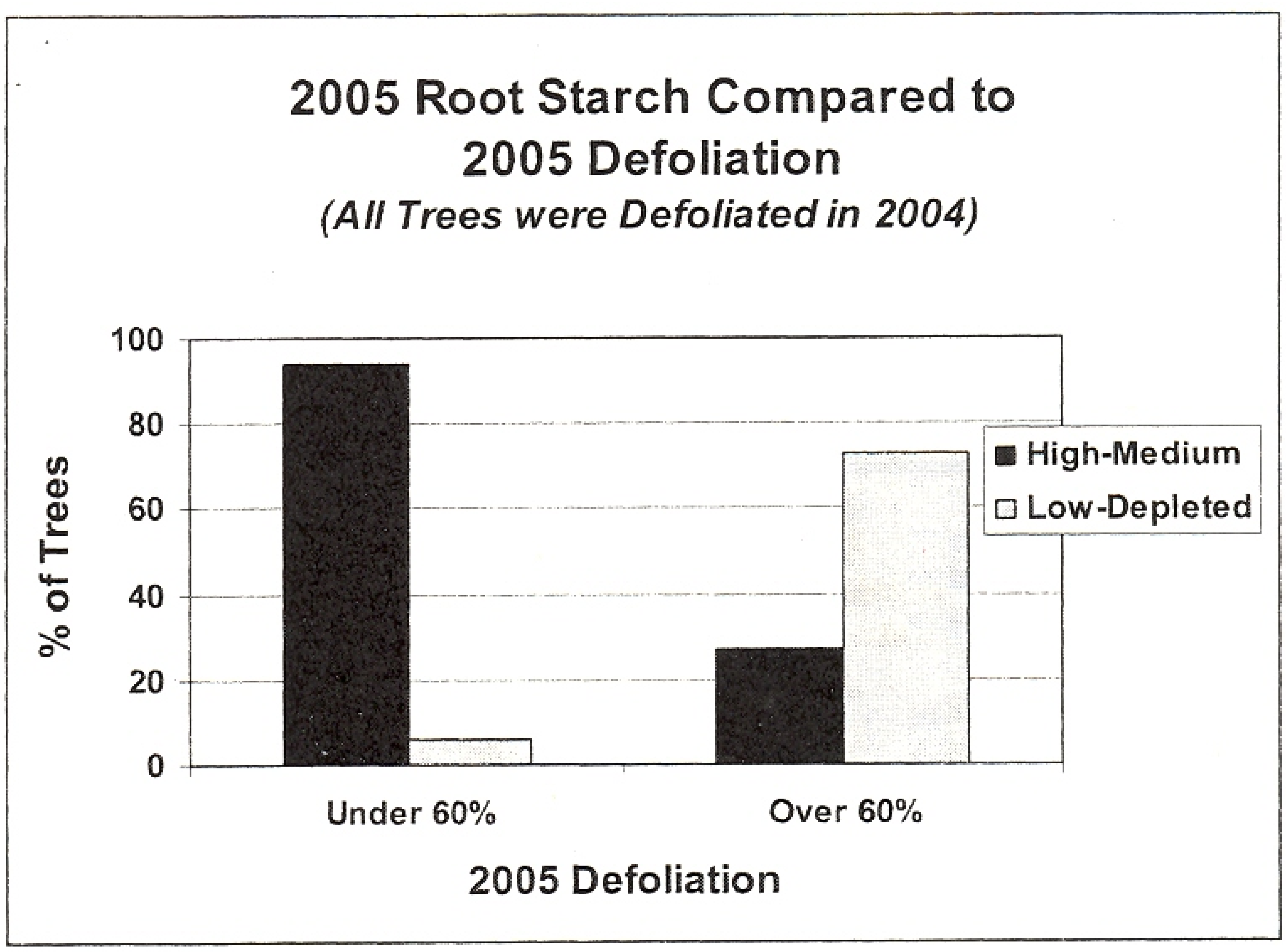
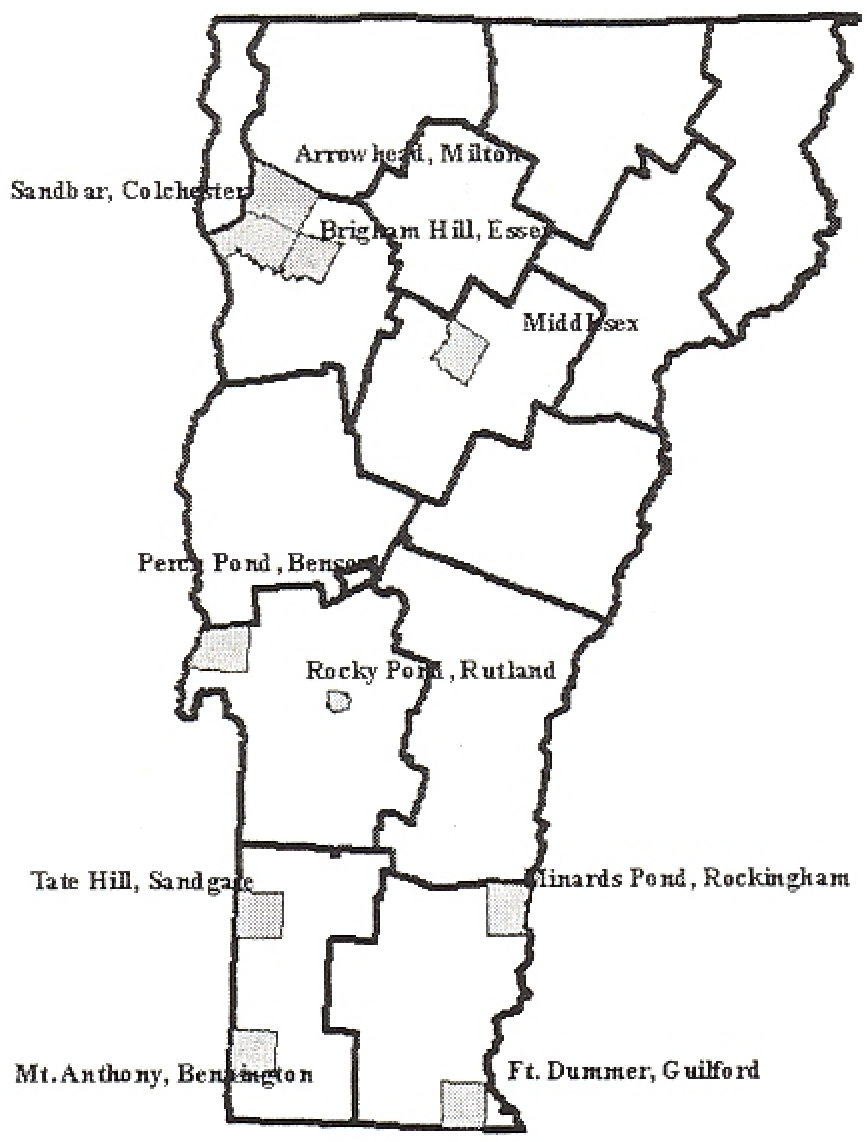


Figure 13. 2005 root starch content compared to defoliation in sugar maples in some Vermont sugarbushes. (All trees were defoliated in 2004.)

Gypsy Moth

Gypsy Moth, *Lymantria dispar*, larvae caused scattered, light defoliation in Vermont. Larvae were commonly observed in western Bennington and Rutland Counties. Often, larvae were observed where forest tent caterpillar was also present. In one Sandgate monitoring plot, defoliation was over 50%. Dead larvae covered with fungus were also reported. There was no increase in overall average egg mass count in focal area monitoring plots and control plots, though there was a slight increase at two sites, namely Perch Pond and Rocky Pond in Rutland County (Figures 14-15).



# of Gypsy Moth Egg Masses per 1/25th Acre Plot:

	2003	2004	2005
Arrowhead	1.5	2.5	0
Brigham Hill	2.5	2.0	1.5
Ft. Dummer	0	-----	0
Middlesex	0	2.0	0
Minards Pond	0.5	2.0	0
Mount Anthony	1.5	0	0
Perch Pond	0	0	0.5
Rocky Pond	0	0	0.5
Sandbar	3.0	1.5	0
Tate Hill	0	30.0	18.0
Average	**1.0**	**4.4**	**2.1**

Figure 14. Gypsy moth egg mass counts from focal area monitoring plots, 2005. Counts are an average of two 15 meter diameter burlap-banded plots per location.

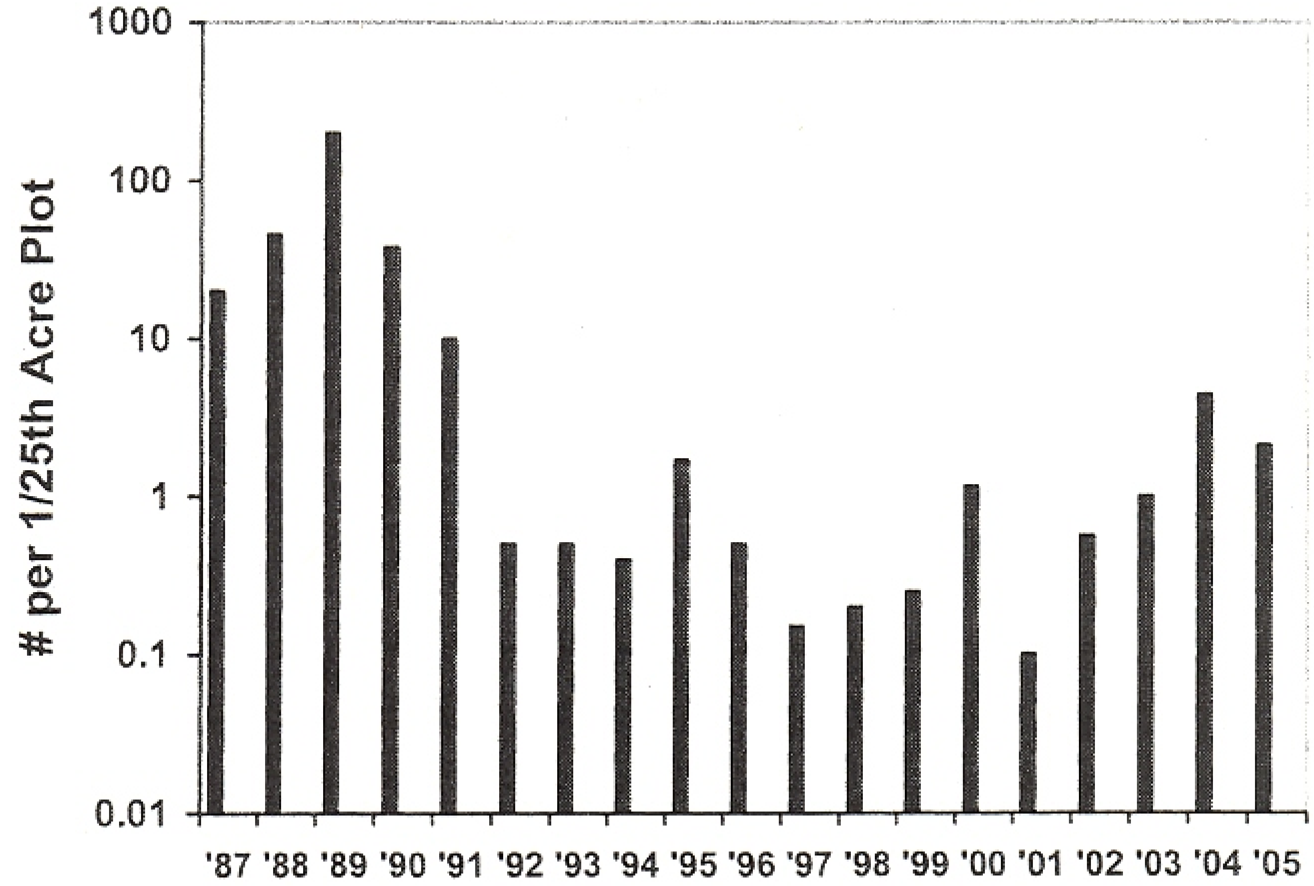


Figure 15. Gypsy moth egg mass counts from focal area monitoring plots, 1987-2005. Data reflect average counts of the ten locations with two 15m diameter burlap-banded plots per location.

Maple Leafcutter and other Causes of Browning in Maples

A combination of agents resulted in 7,812 acres of noticeable browning of maples in 2005 (Table 5, Figure 16). Damage by **maple leafcutter**, *Paraclemensia acerifoliella*, was common, mostly at light to moderate levels, though some areas of heavy defolation were noted in the northern part of the State. Other known causes of browning in maples included **anthracnose**, **maple webworm** (*Tetralopha asperatella*), and **maple trumpet skeletonizer** (*Epinotia aceriella*).

Table 5. Mapped acres of maple browning in 2005.

County	Acres
Addison	0
Bennington	0
Caledonia	565
Chittenden	177
Essex	554
Franklin	0
Grand Isle	0
Lamoille	2,543
Orange	251
Orleans	1,906
Rutland	0
Washington	1,770
Windham	91
Windsor	0
Statewide	7,857

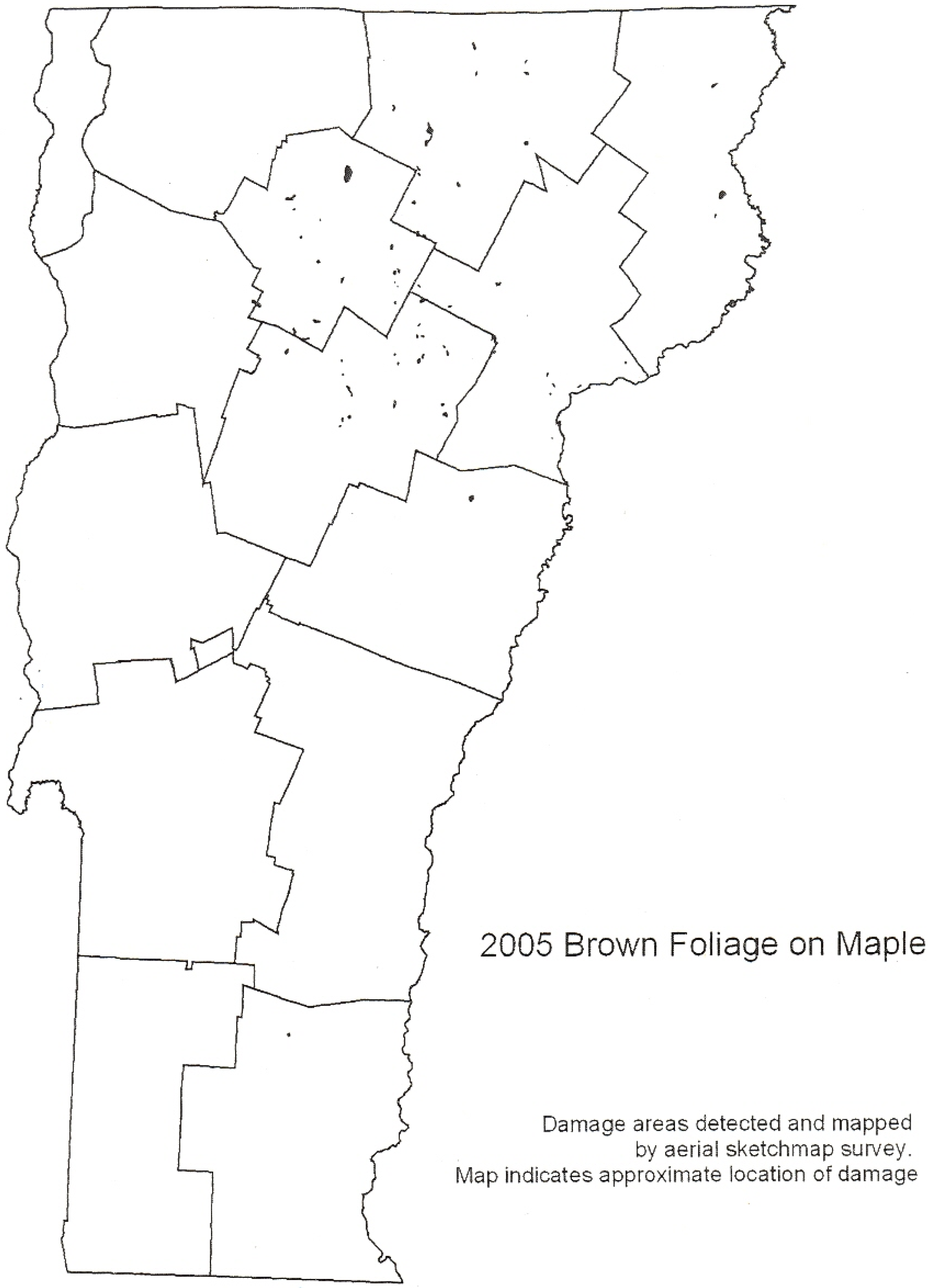
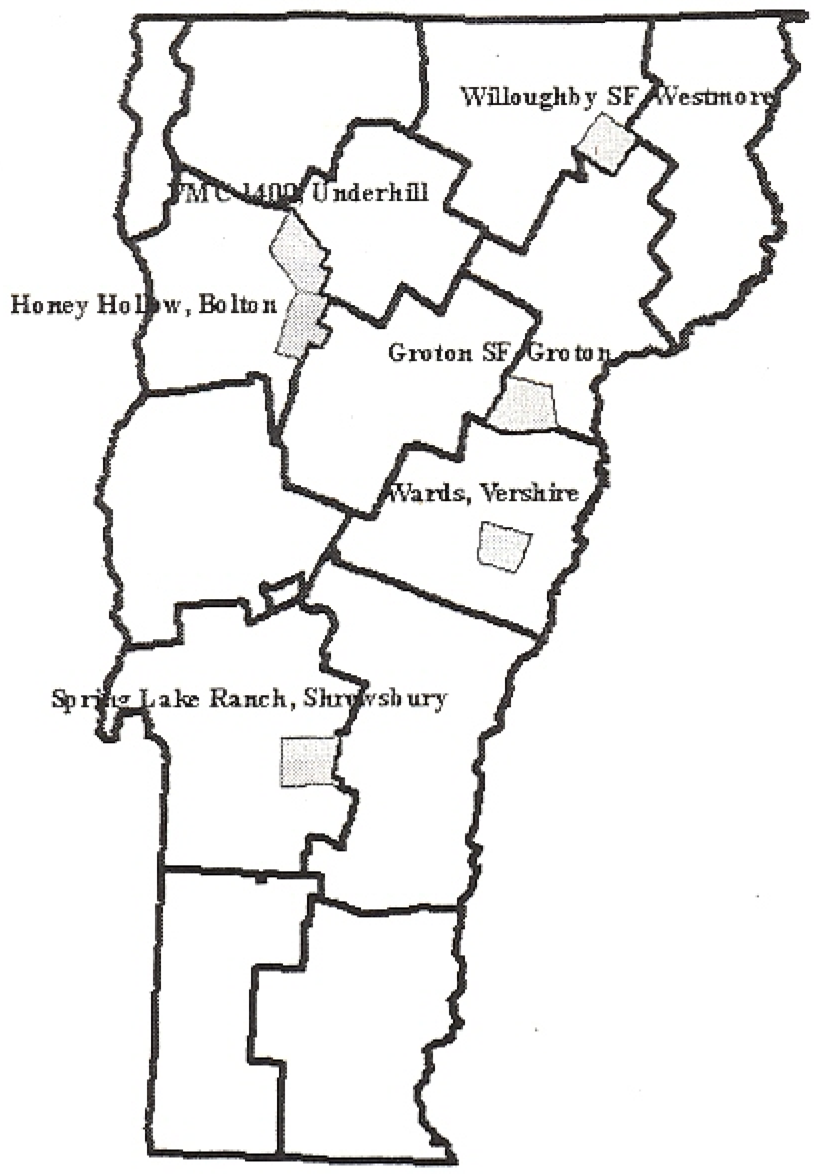


Figure 16. Acres mapped with brown foliage on maple in Vermont 2005.

Saddled Prominent

Defoliation by the saddled prominent, *Heterocampa guttivata*, was not reported, but some larvae were observed. Populations may be on the rise, though the increase is not reflected in pheromone trap catches for 2005 (Figures 17-18). Saddled prominent populations often increase simultaneously with other defoliating caterpillars and were the suspected cause of large frass droppings reported from several sites (notably in East Montpelier) in midsummer.



Average # of moths caught per trap

	2004	2005
VMC 1400	0	0.3
Groton SF	2.3	0
Honey Hollow	0.3	0.7
Spring Lake Ranch	2.0	0
Wards	1.0	0
Willoughby SF	0	0
Average	0.9	0.2

Figure 17. Average number of saddled prominent moths caught in pheromone traps in Vermont in 2005.

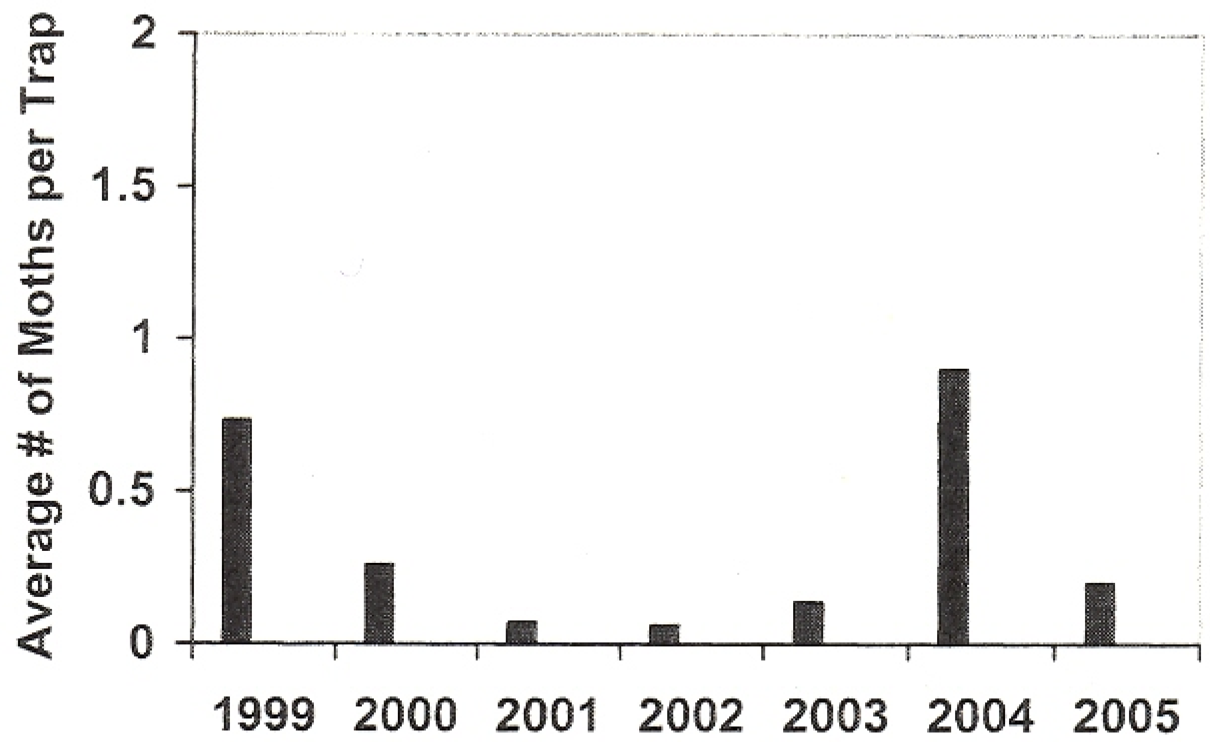


Figure 18. Average number of saddled prominent moths caught in pheromone traps 1999-2005. Counts are the average of 3-4 multi-pher traps per location, and 5-6 locations per year.

OTHER HARDWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Basswood Leaf Roller *Pantographa limata*	American basswood	Moretown	Moderate damage to roadside trees.
Beech Leaftier *Psilicorsis reflexella*	American Beech	Widely scattered	Light but noticeable.
Birch Leaffolder *Ancylis discigerana*	Yellow birch	Widespread	Remains common but light.
Birch Leaf Mining Sawflies *Fenusa pusilla* and others	Paper birch White birch	Throughout	Although birch leaf miners were widely present, the damage was not as severe as damage by Septoria and/or other leaf blights. See Birch Defoliation.
Birch Skeletonizer *Bucculatrix canadensisella*	Paper birch Yellow birch	Throughout	Principal cause of birch defoliation in many locations, but lighter than in 2004. See Birch Defoliation.
Bruce Spanworm *Operophtera bruceata*	Sugar maple	Throughout	Larval feeding and moth flights decreased from 2003 and 2004 levels.
Cherry Scallop Shell Moth *Hydria prunivorata*	Cherry	Widely scattered	Occasional nests on saplings.
Eastern Tent Caterpillar *Malacosoma americanum*	Cherry Apple	Throughout	Heavy damage throughout southern Vermont. Defoliated trees refoliated. In northern regions, scattered moderate damage that was down from heavy levels seen in 2004.
Fall Cankerworm *Alsophila pometaria*	Boxelder and others	Chittenden County	Populations collapsed. Only light defoliation in the Winooski River Valley.
Fall Webworm *Hyphantria cunea*	Hardwoods	Widespread	Heaviest damage ever seen in northern Vermont, but mostly moderate. Webs widely scattered in southern Vermont, but noticeable throughout the region. Lower than 2004.
Forest Tent Caterpillar *Malacosoma disstria*			See narrative.
Gypsy Moth *Lymantria dispar*			See narrative.

INSECT	HOST(S)	LOCALITY	REMARKS
Half Winged Geometer *Phigalia titea*	Boxelder	Orwell	Occasional larvae
Hickory Tussock Moth *Lophocampa caryae*	Hardwoods	Widely scattered	Larvae occasionally observed.
Imported Willow Leaf Beetle *Plagiodera versicolora*	Black Willow	Widely Scattered	Noticeable browning in many locations.
Japanese Beetle *Popillia japonica*	Many	Throughout	Populations down somewhat from 2004. Damage to white birch hedgerow trees in Brattleboro noted.
Locust Leaf Miner *Odontata dorsalis*	Black locust	Widely scattered	Common where locust occurs but much lighter than in 2003 and 2004.
Maple Leafcutter *Paraclemensia acerifoliella*			See narrative.
Maple Trumpet Skeletonizer *Epinotia aceriella*	Sugar maple	Widely scattered	Heavier than recent years. Often associated with maple webworm.
Maple Webworm *Tetralopha asperatella*	Sugar maple	Widespread	More widespread than in 2004. Very common at light levels in northern regions. Noticeable and frequently heavy throughout southern Vermont in late summer. Often occurring in leaves rolled by forest tent caterpillar.
Mountain Ash Sawfly *Pristiphora geniculata*	Mountain ash	NE Kingdom	Heavy damage to some trees.
Pear Slug Sawfly *Caliroa cerasi*	Red oak	Morrisville	Occasional larvae.
Saddled Prominent *Heterocampa guttivata*			See narrative.
Satin Moth *Leucoma salicis*	Poplars	Widely scattered	Decreasing in most locations.
Viburnum Leaf Beetle *Pyrrhalta viburni*	Viburnum	Widespread	Continues to expand range and heavily defoliate viburnums, especially high bush cranberry.
Willow Flea Beetle *Rhynchaenus rufipes*	Black willow	Champlain Valley	Four acres of damage mapped in Chittenden County.

SOFTWOOD DEFOLIATORS

Siberian moth

The Siberian moth, *Dendrolimus sibiricus,* is considered a significant defoliator of conifers in northern Asia and could be devastating to conifer forests in the northeast. Because early detection is essential to minimize the impact of any introduction, we conducted surveys for the second consecutive year to determine the presence and distribution of the Siberian moth in Vermont. Surveys were conducted in two counties, Chittenden and Orleans. Sites included bonsai dealers in the towns of Jericho (Chittenden County) and Derby (Orleans County). Two modified gypsy moth milk carton traps, each baited with lures attractive to the Siberian moth, were placed near favored host tree species at high-risk sites in northern and central Vermont. Traps were deployed on June 17, 2005, checked every two weeks, and were retrieved on September 16, 2005. No *D. sibiricus* moths were caught at either of the survey sites. A summary of trap locations, trapping dates and number of site visits appears in Table 6.

Table 6. Summary of site and collection data for 2005 Vermont survey for Siberian moth. Data include counties, towns, GPS coordinates, trapping dates, numbers of visits, site description and numbers of Siberian moths collected during the survey.

County	Town	GPS Points – (NAD83)	Start/End dates	Number of visits	Type of Business and trap placement	# of exotics
Chittenden	Jericho	N44.44941, W72.99321	6/17/05 – 9/16/05	7	Bonsai: Natural evergreens on outskirts of sales area	0
Orleans	Derby	N45.00237, W72.09606	6/17/05 – 9/16/05	7	Bonsai: Natural evergreens on outskirts of sales area	0

OTHER SOFTWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Arborvitae Leaf Miner *Argyresthia thuiella*	Northern white cedar	Widespread	Widespread, but mostly at light levels. Total of 640 acres mapped, with 219, 117 and 243 acres in Caledonia, Orange, and Washington Counties, respectively. Good tree recovery in areas that were heavily hit in 2004.
European Pine Sawfly *Neodiprion sertifer*	Scots pine Mugo pine	Chittenden County	Noticeable damage.
Introduced Pine Sawfly *Diprion similis*	White pine	Springfield	Pupae common.
Larch Casebearer *Coleophora laricella*	Larch	Scattered	Damage remains low with continued light defoliation. Appears to be increasing.
Pine Webworm Species unknown	White Pine	Shaftsbury	Ornamentals.
Siberian moth *Dendrolimus sibiricus*			See narrative.
Spruce Bud Moth *Zeiraphera canadensis*	Blue spruce	Widely scattered	Light damage.
Spruce Budworm *Choristoneura fumiferana*	Balsam fir White spruce	Widespread	Populations remain low, with no visible defoliation.
Yellow-Headed Spruce Sawfly *Pikonema alaskensis*	Blue spruce	NE Kingdom	Some light damage to ornamentals.

SAPSUCKING INSECTS, MIDGES AND MITES

Balsam Woolly Adelgid

Dieback and mortality caused by Balsam Woolly Adelgid, *Adelges piceae,* was down from 10,854 acres mapped in 2004 to 5,903 acres in 2005 (Table 7, Figure 19). Although decline of some trees continues and mortality is noticeable, no live adelgids were observed in southern stands in 2005. However, light populations were observed on main stems in Groton.

Table 7. Mapped acres of damage by balsam woolly adelgids in 2005.

County	Acres
Addison	241
Bennington	1,856
Rutland	2,155
Washington	42
Windham	1,506
Windsor	103
Total	5,903

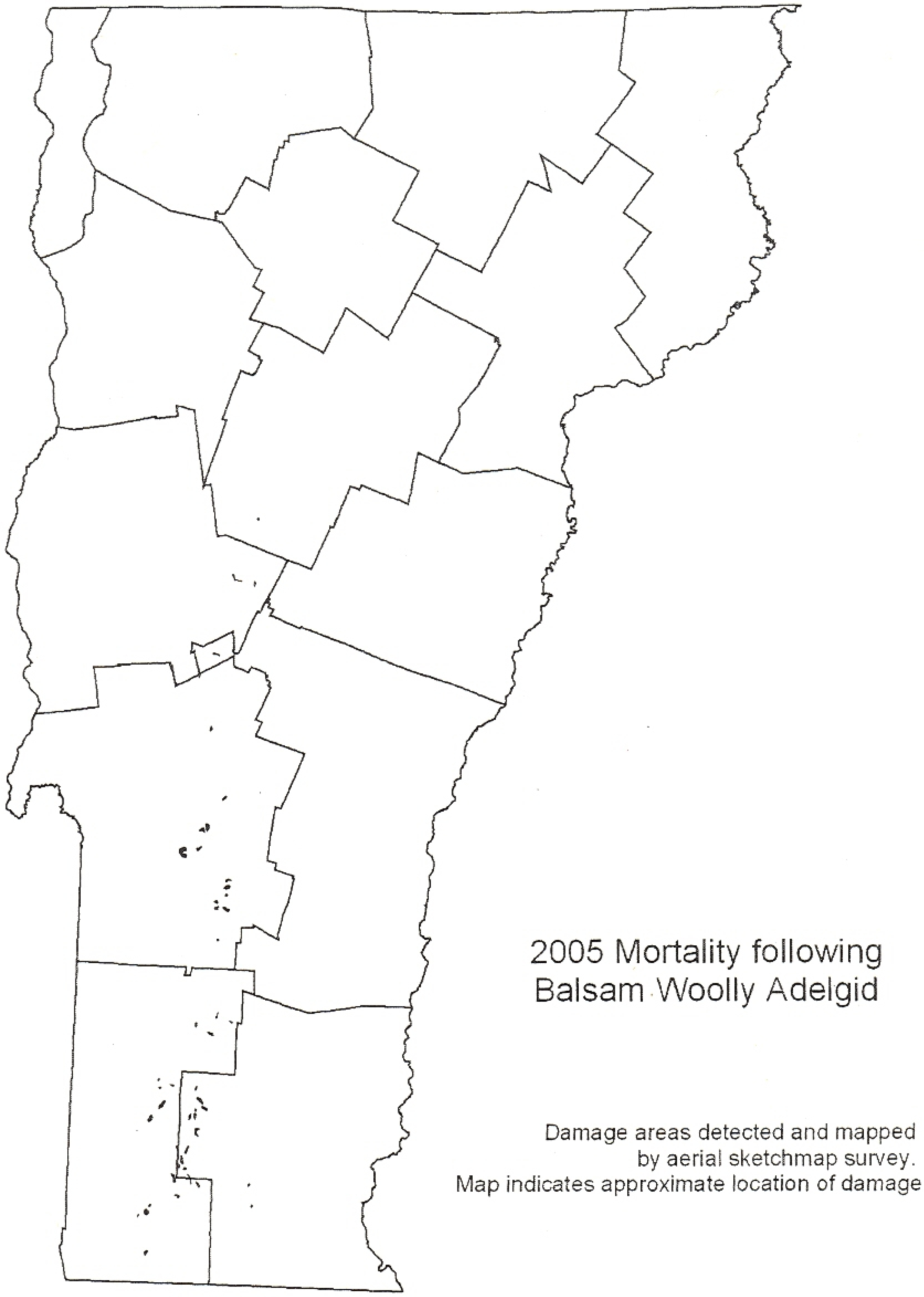


Figure 19. 2005 damage by balsam woolly adelgid. Mapped area is 5,903 acres.

Hemlock Woolly Adelgid

Hemlock Woolly Adelgid, *Adelges tsugae*, was not observed or known to occur in Vermont in 2005. A survey was conducted to follow-up on the introduction and eradication of possibly infested nursery stock in 2004. Ten sites where trees from infested shipments had been planted were inspected. These sites were chosen because of proximity to native hemlock trees. Two hundred 1-meter long hemlock branches were examined at each site. All sites were negative for the adelgid. As part of a more general detection survey, two hundred branches were also examined in ten additional hemlock forest stands in Windsor and Windham counties. Again, all sites were negative.

The quarantine regulating the movement of hemlock nursery stock into Vermont was amended this year to restrict all hemlocks from infested counties.

Lecanium Scale

Lecanium Scale, *Parthenolecanium corni*, showed a sharp increase from 2004 and was widespread throughout Vermont. In some stands, crown dieback is a concern to sugarmakers. Sooty mold was commonly observed on understory foliage, maple tubing, and any structure below infested hardwood trees. Overwintering scales have been observed on twigs, and noticeable populations are expected in 2006. Two special studies were conducted to learn more about lecanium scale: a statewide lecanium scale population survey and a whole tree lecanium distribution study.

STATEWIDE LECANIUM SCALE POPULATION SURVEY

Introduction

A statewide lecanium scale survey was conducted on the North American Maple Project (NAMP) plots in July and August. The purpose was to learn more about the distribution and abundance of lecanium scale in sugar maple forests, and to associate scale populations with current and future tree health.

Methods

Visual estimates were made of scale populations on understory and lower branches of sugar maple using the abundance rating system listed below. Ten branches per subplot were examined and rated, using the branch portion with the most scales. Ratings were made to estimate the surface area covered with scales on 12 inches of growth (starting at internode marking previous year's growth). The minimum, maximum and average rating were recorded for each of the 5 subplots. When scales were not present or visible, other evidence of scales was recorded: honeydew, sooty mold, crawlers on leaves.

Lecanium scale abundance rating system

- None
- Trace : spotty single scales
- Light : less than 30% of twig surface area with scales
- Moderate : 30-60% of twig surface area with scales
- Heavy : more than 60% of twig surface area with scales
- Other evidence of scale presence: honey dew, sooty mold, crawlers
- No understory sugar maple to rate

Results

Results from the 38 NAMP plots showed scale populations present in each of the 12 counties surveyed Figures 20-21). At 42% of the sites (16 sites), moderate to heavy populations were measured, while at 21% (8 sites) there was no visible population. Several locations had poor tree health, but there was no correlation between lecanium scale populations and tree health.

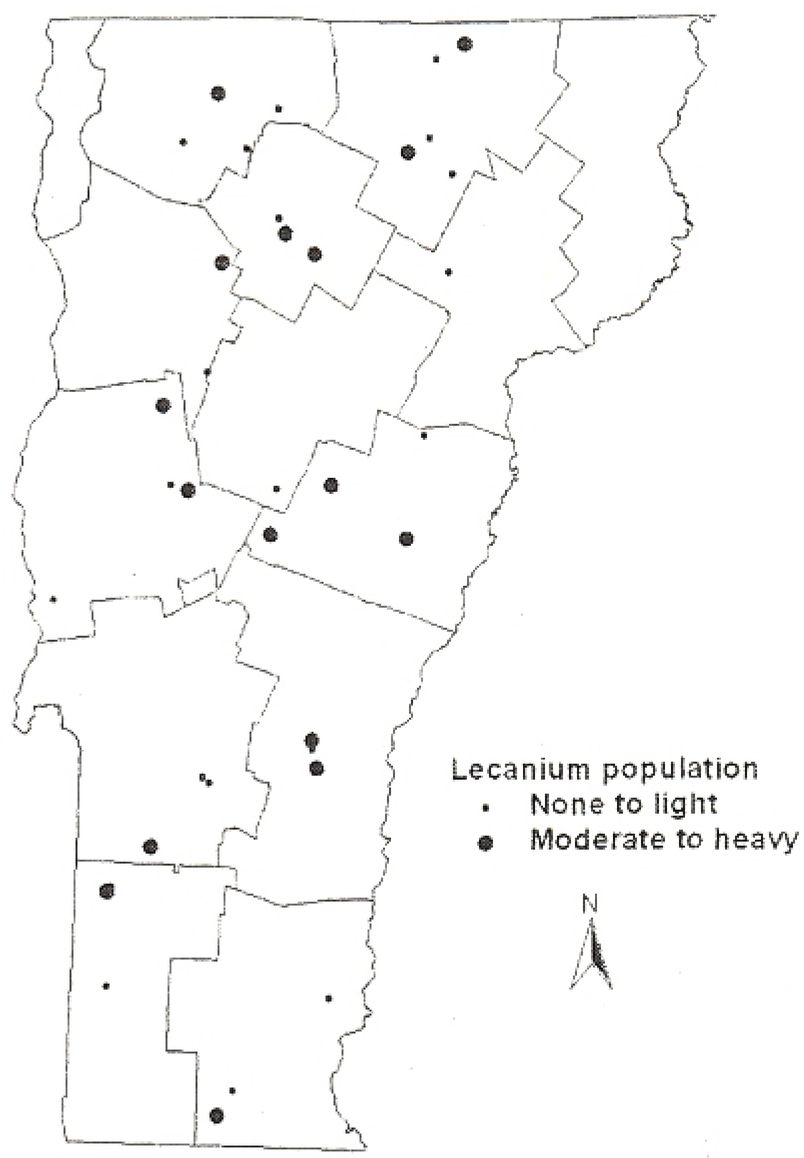


Figure 20. Lecanium scale population levels on NAMP plots in 2005.

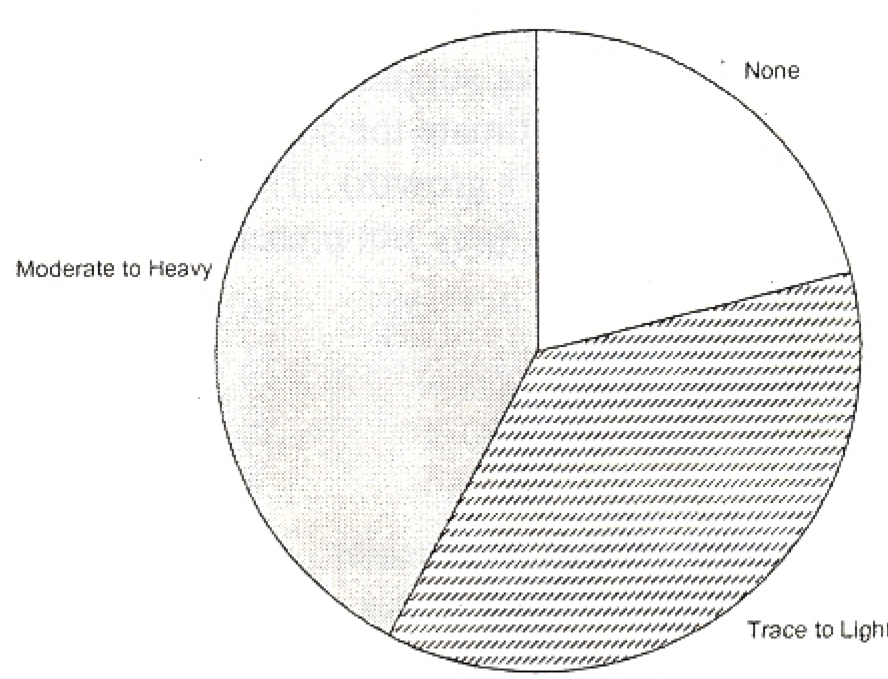


Figure 21. Lecanium scale abundance on 38 NAMP plots statewide, 2005.

WHOLE TREE LECANIUM DISTRIBUTION STUDY

Introduction

Recently felled sugar maples located in a sugarbush in Johnson were utilized to study the distribution of lecanium scale. Trees were selected and evaluated in late August to answer the following questions: (1) how do scale population levels on understory vegetation compare with levels at different tree heights?, (2) does lecanium scale have a preference for shaded branches over sun branches? and (3) is the distribution of the immature scale crawlers on leaves similar to that of mature scales on the branches.

Methods

Scale abundance was rated for shoots on seven intermediate-canopy-height sugar maples and adjacent understory sugar maple seedlings using the same abundance rating system as described for the North American Maple Project plots. The lowest branches to the nearest 10-foot mark were used for initial tree branch selection, with additional branches selected at 10-foot intervals up each tree. Two outer (sun) branches and one inner (shade) branch was selected per height. Three understory seedlings were also evaluated adjacent to each felled tree. One leaf cluster was collected from each seedling and three tree branches at each of five tree heights. Four leaves per cluster were later counted under magnification in the laboratory by placing a 5x10 cm. grid over each leaf and counting number of crawlers per centimeter.

Results

The distribution of mature scales varied significantly depending on location in tree crowns. Most notably, understory scale population levels were significantly lower than those on lower tree canopy branches (Figure 22). Mature scale population levels were the same on shaded inner branches as on outer sun branches.

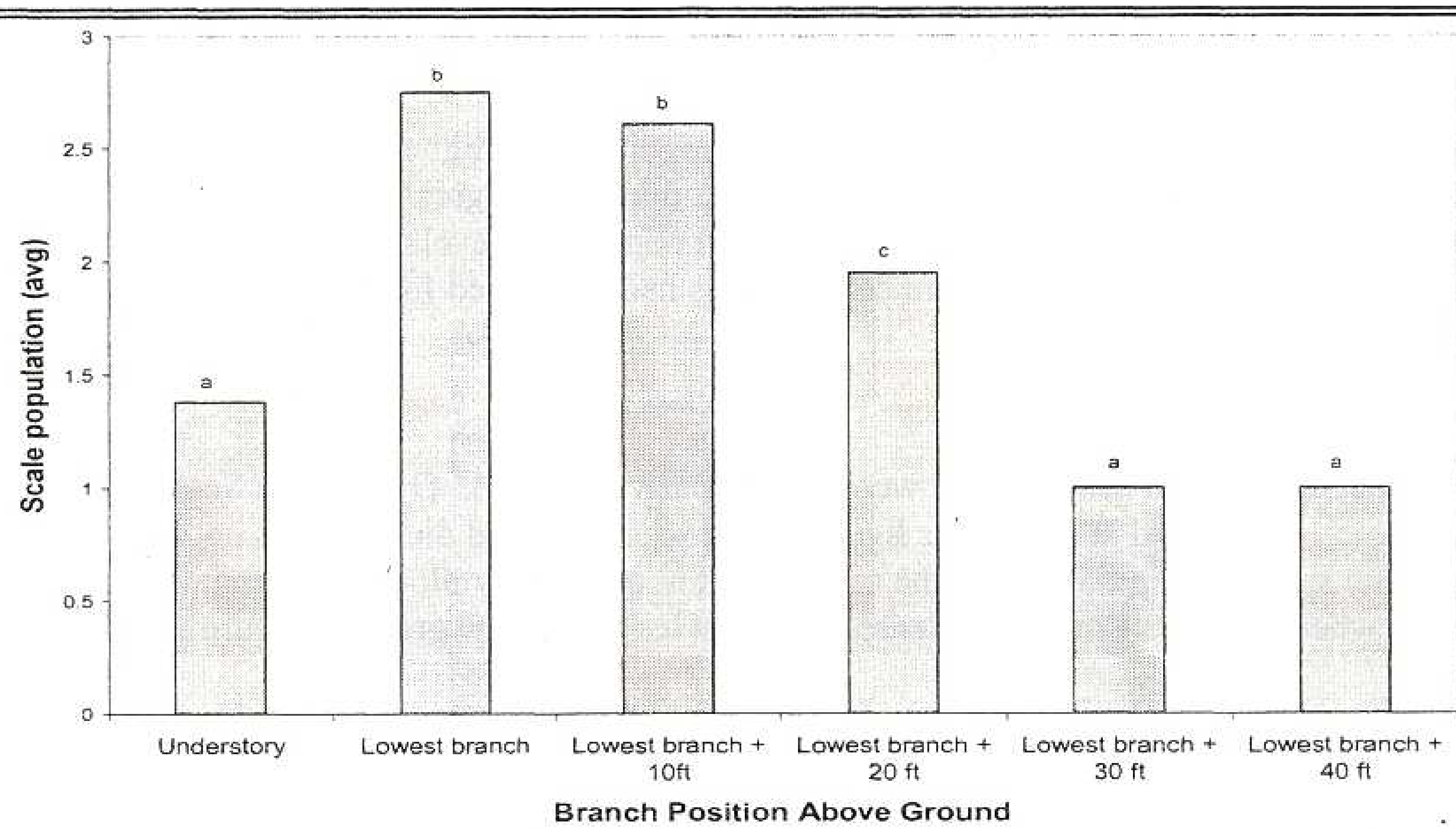


Figure 22. Density of mature scales by branch position above ground (means with different letters are significantly different at the 0.05 level).

Scale crawler population levels were not related to mature scale population levels, regardless of how data were aggregated. Crawler populations varied significantly depending on location in the tree but were the most abundant on the lowest tree branches (Figure 23).

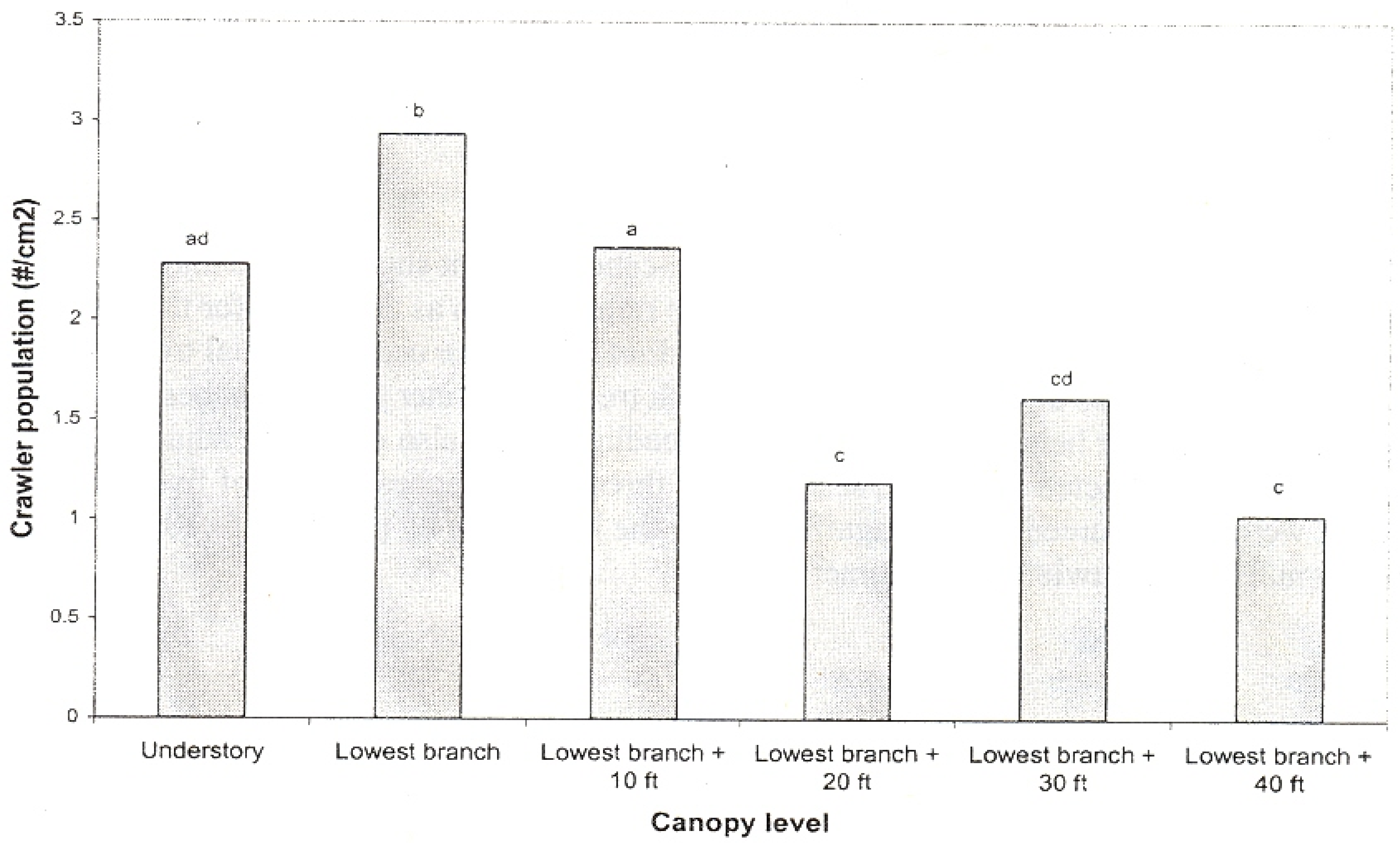


Figure 23. Crawler population levels on understory leaves and on tree leaves at different branch positions above ground (means with different letters are significantly different at the 0.05 level).

At the upper three canopy levels, crawler numbers were significantly higher on the shaded inner leaves compared to the outer sun leaves. It could be that dispersal losses are greater on upper outer leaves that are more subject to the effects of wind. Differences between population levels on lower branches compared to upper branches might be greater if dominant canopy trees had been used for this study.

Oystershell Scale

Though heavy populations on ornamentals were occasionally observed, Oystershell Scale, *Lepidosaphes ulmi*, on American beech in forested settings was light in most locations, and dieback was not heavy enough to be detected by aerial survey. Populations of the scale insect in our survey plot in Huntington dropped to the lowest level ever seen when viewed as number of scales per unit length of new growth (Figure 24, Table 8.)

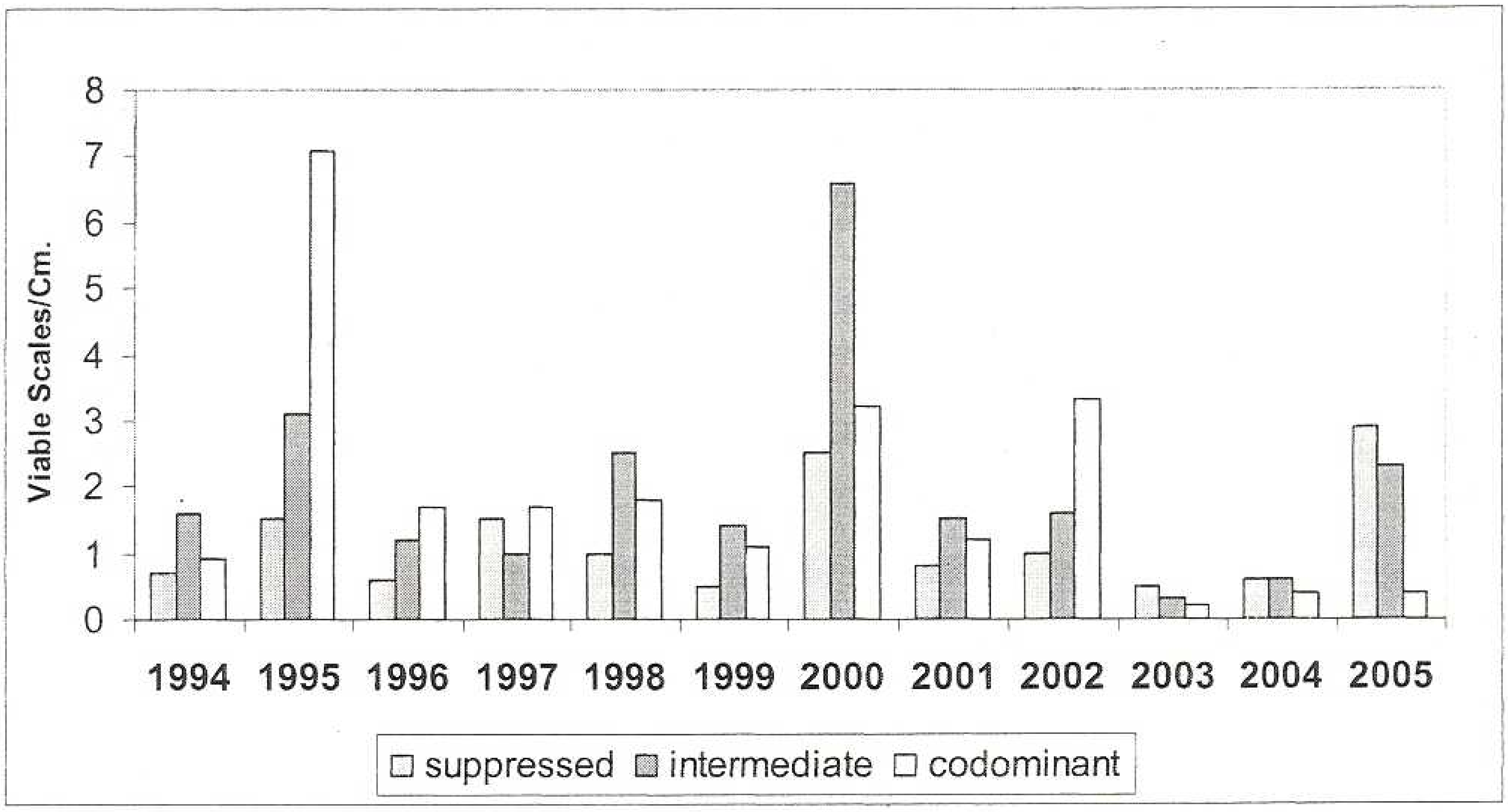


Figure 24. Oystershell scale populations in three tree canopy levels in Camel's Hump State Forest, 1994-2005. Average for 10 current year twigs/tree per crown class, collected in autumn.

Table 8. Number of oystershell scales on current year beech twigs in Camel's Hump State Forest, 1994-2005.

	Average Number of Mature Viable Scales Per Twig											
	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Suppressed	2.1	9	0.6	2.1	4	0.7	2.9	4.2	11	2.1	1.4	5.6
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
Codominant	3.4	11.3	0.2	4.5	4.2	2.7	7.3	1.4	4	0.7	2	2

OTHER SAPSUCKING INSECTS, MIDGES, AND MITES

INSECT	HOST(S)	LOCALITY	REMARKS
Aphids *Cinara* sp.	Balsam fir White Spruce	Bakersfield Bellows Falls	Heavy infestation in single Christmas tree. Ornamentals.
Ash Flowergall Mite *Aceria fraxiniflora*	Ash	Scattered throughout	Occasional trees with damage.
Balsam Gall Midge *Paradiplosis tumifex*	Balsam fir	Cabot	No damage reported by Christmas tree growers in southern Vermont. In the north, damage remained noticeable in one Christmas tree plantation in Cabot. Populations elsewhere in the north remain extremely low but some light damage was seen where it was absent last year.
Balsam Twig Aphid *Mindarus abietinus*	Balsam fir	Widely scattered in southern Vermont; more widespread in the north.	Mostly light damage north and south, but some moderate damage seen for the first time in three years in northern Vermont.
Balsam Woolly Adelgid *Adelges picea*			See narrative.
Beech Scale *Cryptococcus fagisuga*			See beech bark disease.
Boxelder Bug *Leptocoris trivittatus*	Boxelder	Rockingham and elsewhere	Reported invading homes in the fall.
Cooley Spruce Gall Aphid *Adelges cooleyi*	Blue spruce Douglas fir	Scattered	Populations remain very low. Spruce galls difficult to find in most locations, but insects more commonly seen on Douglas fir.
Eastern Spruce Gall Adelgid *Adelges abietis*	White spruce	Throughout	Remains common on ornamentals and Christmas trees at mostly light levels.
Elm Scurfy Scale *Chionaspis fletcheri*	Liberty Elm	Hyde Park	Heavy on planted tree.
Erineum Gall Mite *Aceria elongatus*	Sugar maple	Throughout	Remains light, similar to 2004.

INSECT	HOST(S)	LOCALITY	REMARKS
Hemlock Woolly Adelgid *Adelges tsugae*			See narrative.
Lecanium Scale *Parthenolecanium corni*			See narrative.
Maple Bladder Gall Mite *Vasates quadripedes*	Sugar maple Red maple	Widespread	Remains common but light.
Maple Spindle Gall Mite *Vasates aceris-crummena*	Sugar maple Red maple	Throughout	Remains common but light.
Oystershell Scale *Lepidospaphes ulmi*			See narrative.
Pear Thrips *Taeniothrips inconsequens*	Sugar maple	Widespread	Light to moderate damage observed in northern Vermont despite low numbers of adults. Some heavy damage in a Northfield sugarbush.
Pine Bark Adelgid *Pineus strobi*	White pine	Scattered throughout	Remains noticeable at moderate and sometimes heavy levels on scattered individual trees.
Pine Leaf Adelgid *Pineus pinifoliae*	White pine	Morristown Stockbridge	Moderate damage to a few trees in Morristown. Heavy populations are thought to be the cause of noticeable shoot dieback in a sawtimber-sized stand in Stockbridge.
Pine Needle Scale *Chionapsis pinifoliae*	Scots pine White pine	Morrisville	Light population levels.
Pine Spittlebug *Aphrophora parallela*	White pine Other conifers	Widespread	Only light damage reported in southern Vermont. Light to moderate levels observed on ornamentals and Christmas trees in the north. Thought to be increasing.
Ragged Spruce Gall Aphid *Pineus similis*	Red spruce	Throughout	Remains common.
Root Aphid *Prociphilus americanus*	Fraser fir	Essex	Associated with dieback and mortality of young Christmas trees in Essex.
Scurfy Scale *Chionaspis sp.*	Plum	Brattleboro	Ornamentals.
Spruce Spider Mite *Oligonychus ununguis*	Fraser fir Balsam fir Spruces	Throughout	Occasional light to moderate damage to balsam fir Christmas trees, especially on inner crowns.

BUD AND SHOOT INSECTS

Pine Shoot Beetle

Delimiting surveys using Lindgren funnel traps for the Pine Shoot Beetle, *Tomicus piniperda*, began in Vermont in 1999. First records for the following counties were made: Essex and Orleans Counties in 1999; Caledonia County in 2000; Washington County in 2003; and Addison, Grand Isle, and Lamoille Counties in 2004. In September 2004, the entire state of Vermont was quarantined for the pine shoot beetle.

In 2005, the four southernmost counties of Vermont were surveyed. Ten Lindgren funnel traps baited with alpha-pinene lure and UHR ethanol were placed in Bennington, Rutland, Windham and Windsor Counties. Scots pine sites near major roads received the highest priority for trapping, followed by red pine. Traps were placed in the field March 9 - 16, well before temperatures rose above 50 degrees F. Trap contents were emptied every two weeks until the end of June. Trap sites per county between 1999 and 2005 are summarized in Table 9.

Fragments of pine shoot beetles were recovered from traps in three Rutland County sites in 2005. These include Pawlet and two sites in Castleton. Bennington, Windham and Windsor Counties remain negative for *T. piniperda.* A total of about 7,793 other Scolytid beetles were collected in the traps (Table 10). Trap locations, dates, stand types, numbers of visits to trap sites and trap catches for 1999 –2005 are summarized in Table 11.

Non-target scolytids (over 22,000 specimens) that were captured in *Tomicus piniperda* traps from 2000-2004 were identified by Dr. Jessica J. Rykken. About 40 species were cataloged and their distributions by town were mapped (see Appendix).

Table 9. Number of sites per county surveyed for the pine shoot beetle, *Tomicus piniperda*, with pheromone-baited Lindgren funnel traps, 1999-2005.

County	Number of Sites Trapped						
	1999	2000	2001	2002	2003	2004	2005
Addison	--	--	--	--	--	10	--
Bennington	--	--	--	--	--	--	10
Caledonia	--	10	1	--	--	--	--
Chittenden	--	10	10	10	10	10	--
Essex	7	--	--	--	--	--	--
Franklin	--	10	9	10	10	10	--
Grand Isle	--	--	5	5	5	5	--
Lamoille	--	10	10	10	10	10	--
Orange	--	--	9	10	10	10	--
Orleans	3	8	--	1	--	--	--
Rutland	--	--	--	--	--	--	10
Washington	--	10	10	10	10	--	--
Windham	--	--	--	--	--	--	10
Windsor	--	--	--	--	--	--	10
Total	10	58	54	56	55	55	40

Table 10. Summary of 2005 pine shoot beetle pheromone trapping.

County	# Traps	Date Out	Date In	# Trap Checks	# *Tomicus piniperda*	# Other Scolytids
Bennington	10	3/25/05	7/15/05	50	0	1,072
Rutland	10	3/31/05	7/21/05	79	3	2,899
Windham	10	3/25/05	7/9/05	63	0	978
Windsor	10	4/1/05	7/22/05	73	0	2,844
Total	40			265	3	7,793

			1999		2000		2001		2002		2003		2004		2005	
County	**Town**	**Stand Type**	**Trap Date**	**# PSB**	**Trap Date**	**# PSB**	**Trap Date**	**# PSB**	**Trap Date**	**# PSB**	**Trap Date**	**# PSB**	**Trap Date**	**# PSB**	**Trap Date**	**# PSB**
Essex	Brighton	Red pine	4/27/99-5/12/99	2												
	Canaan	Red pine	4/27/99-5/12/99	5												
			5/26/99-6/8/99	2												
Orleans	Morgan	Red pine	4/27/99-5/12/99	1	5/2/00-5/15/00	1										
	Derby	Scotch pine			4/6/00-4/24/00	7			4/12/02-4/19/02	38						
					4/25/00-5/2/00	1			5/17/02-5/31/02	2						
					5/2/00-5/5/00	4			5/31/02-6/11/02	7						
									6/11/02-6/18/02	2						
									6/18/02-7/12/02	2						
	Derby Line	Scotch pine			4/24/00-5/2/00	2										
					5/15/00-5/26/00	1										
	Barton	Scotch pine			5/15/00-5/26/00	1										
					5/26/00-6/12/00	1										
					6/12/00-6/21/00	1										
Caledonia	Kirby	Scotch pine			4/4/00-4/18/00	1	4/27/01-5/11/01	2								

			1999		2000		2001		2002		2003		2004		2005	
County	**Town**	**Stand Type**	**Trap Date**	**# PSB**	**Trap Date**	**# PSB**	**Trap Date**	**# PSB**	**Trap Date**	**# PSB**	**Trap Date**	**# PSB**	**Trap Date**	**# PSB**	**Trap Date**	**# PSB**
Washington	Barre Town	Scotch pine									4/17/03-5/1/03	1				
Addison	Ferrisburg	Red and Scotch pine mix											4/26/04-5/5/04	1		
Lamoille	Wolcott	Scotch pine											4/7/04-4/20/04	1		
Grand Isle	Isle La Motte	Red pine											4/7/04-4/20/04	1		
Rutland	Castleton	Red pine													3/31/05-4/15/05	1
	Pawlet	Scotch pine													3/31/05-4/15/05	1
	Castleton	Red pine													3/31/05-4/15/05	1
				10		20		2		51		1		3		3

Table 11. Number of adult pine shoot beetles caught in Lindgren funnel traps by location and date during the 1999-2005 survey program in Vermont.

OTHER BUD AND SHOOT INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Balsam Shootboring Sawfly *Pleroneura brunneicornis*	Fraser fir Balsam fir	Widespread	Populations remain low but damage was disproportionately above normal on balsam fir Christmas trees due to prolonged bud development during the cool spring.
Oak Twig Pruner *Elaphidionoides parallelus*	Red oak	Champlain Valley	Populations down.
Pine Gall Weevil *Podapion gallicola*	Red pine	Scattered throughout	Very heavy in young sawtimber-sized stand in Barnard. Associated with Diplodia and shoot dieback.
Pine Shoot Beetle *Tomicus piniperda*			See narrative.
White Pine Weevil *Pissodes strobi*	White pine Spruces	Throughout	Common but populations appear to be stable.
White-spotted sawyer *Monochamus scutellatus*	White pine	Scattered	Only a few adults submitted for identification.

BARK AND WOOD INSECTS

Emerald Ash Borer

Emerald Ash Borer, *Agrilus planipennis*, was not found in Vermont surveys in 2005. The insect continues to expand its range from the established areas in Michigan, to sites in Ontario, Indiana and Ohio. In 2005, Vermont surveyed ash trees at locations at high risk for introductions (nurseries with ash stock and sawmills processing ash) or areas where ash decline had been observed (Table 12). Results from surveys at 34 sites and 480 trees found no emerald ash borer insects or confirmed symptoms. Surveys were done in 12 of the 14 counties (Table 13). Species of ash and ash health were recorded along with symptoms from other ash boring insects (Table 14). The data was collected using national survey protocols and was added to the US Forest Service national database. In addition, the Agency of Agriculture conducted surveys in nurseries and areas of high public use, such as campgrounds.

Table 12. Number of sites surveyed for emerald ash borer in each risk category, Vermont, 2005.

Site Risk Categories	Number of Sites
Adjacent to nursery	25
Adjacent to sawmill	5
Ash decline site	4
Total Sites	34

Table 13. Number of sites surveyed for emerald ash borer in Vermont counties, 2005.

County	Number of Sites
Addison	3
Bennington	5
Chittenden	6
Franklin	1
Grand Isle	1
Lamoille	2
Orange	3
Orleans	1
Rutland	4
Washington	2
Windham	1
Windsor	5
Total Sites	34

Table 14. Number of trees surveyed by ash species, health category, and presence of other borers, 2005.

Ash Species	Number of Trees
Green	43
Undetermined	4
White	433
Total Trees	480
Health	Number of Trees
Healthy	327
Branch Dieback	122
Epicormic Sprouts	44
Yellow Leaves	84
Dead	36
Other Borers	Number of Trees
Adults	1
Larvae	2
Galleries	27

Brown Spruce Longhorn Beetle

The Brown Spruce Longhorn Beetle, *Tetropium fuscum,* which has been found attacking and killing apparently healthy red spruce trees in Nova Scotia, is not known to be established anywhere else in North America outside its native range. A survey was conducted (1) to determine the presence and distribution of the target species, (2) to monitor the advent of new exotic species over time, (3) to aide in tracking patterns of infestation throughout the U.S. and possible pathways for introduction, and (4) to identify the characteristics of high risk habitats or sites. Large, cross-vane Colossus Panel Traps, baited with BSLB lure (a host volatile) and UHR ethanol were used to survey four sites for the presence of the Brown Spruce Longhorn Beetle in spruce stands in Essex, Orleans, and Windsor Counties in Vermont (Table 15). At survey sites, traps were placed one (1) meter from the nearest living spruce tree. A cup containing a preserving solution was used to collect specimens. New solution was added to the collection cup during each site visit. All specimens were removed with forceps or by screening and placed in alcohol in labeled plastic vials, and transported to the Forests, Parks and Recreation Forest Biology Lab in Waterbury, VT. Beetles collected during the survey were screened to separate Cerambycids from other Coleoptera. Cerambycids, Scolytids and other selected beetles were labeled and maintained for our permanent collections.

Table 15. Summary of site and collection data for 2005 Vermont survey for *Tetropium fuscum*, the brown spruce longhorn beetle. Data include counties, towns, sites, GPS coordinates, trapping dates, numbers of visits, and numbers of *T. fuscum* collected during the survey.

County	Town	Site	GPS Points (NAD83)	Start/End dates	# of visits	# of exotics
Essex	Norton	Black Turn Site 1	N44.99360, W71.81328	5/20/05 to 8/26/05	5	0
Essex	Norton	Black Turn Site 2	N45.00237, W71.81213	5/20/05 to 8/26/05	5	0
Essex	Warren's Gore	Bill Sladyk WMA	N44.93901, W71.88710	5/20/05 to 8/26/05	5	0
Windsor	Woodstock	Marsh Billings	N43.63189, W72.51995	6/1/05 to 9/5/05	5	0

Six specimens, representing two species of Cerambycid beetles, required diagnostic follow-up by specialists. These beetles did not match the description of the target species, but were difficult to identify using our reference collection. Four representatives were sent to Jonathan Sweeney, Research Scientist at Natural Resources Canada in Fredericton, New Brunswick. Only one specimen was in the genus *Tetropium*, but, according to the specialist, the beetle was definitely not *T. fuscum*. The specimen, possibly *T. cinnamopterum*, was sent on for confirmation to Serge LaPlante at the Canadian National Collection in Ottawa, Ontario.

Warehouse beetles

Many exotic bark and longhorned beetles that pose a risk to the health of North America forests gain entrance to new locations by arriving in solid wood packing materials. Target species for the warehouse trapping surveys include all exotic wood boring beetles selected by the CAPS committee as part of the National Exotic Woodborer/Bark Beetle Survey. We conducted surveys for exotic bark and longhorn beetles in Vermont warehouses that import foreign products in solid wood packing materials. Lindgren funnel traps and three different attractants were used for this detection survey.

A total of nine Lindgren funnel traps were deployed in Vermont warehouses in 2005. Three traps, baited with exotic bark beetle lure, alpha-pinene and ethanol, respectively, were placed at each of three warehouses that receive imported commodities from high-risk countries. Traps were deployed between April 12 and May 6 and were removed between September 28 and October 11, 2005. Contents were collected periodically throughout the trap period. Alpha-pinene lures and killing strips were replaced midway through the trapping period. No exotic beetles were collected, but a total of 389 Scolytidae were held for our permanent collection (Table 16).

Table 16. Summary of site and collection data for 2005 Vermont warehouse beetle survey. Data include counties, towns, GPS coordinates, trapping dates, numbers of visits, and numbers of exotic beetles collected during the survey.

County	Town	GPS Points (NAD83)	Start/End dates	Number of visits	Number of exotics
Windham	Grafton	N43.15874, W72.57542	4/12/05-9/28/05	8	0
Washington	Barre	N44.18708, W72.49461	4/19/05-10/11/05	6	0
Washingon	Barre	N44.20130, W72.51105	4/19/05-10/11/05	6	0

OTHER BARK AND WOOD INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Allegheny Mound Ant *Formica exsectoides*	Christmas trees	Widely scattered	Continues to cause scattered mortality.
Asian Longhorned Beetle *Anoplophora glabripennis*			Not observed or known to occur in Vermont.
Bronze Birch Borer *Agrilus anxius*	Paper birch White birch	Throughout	Light damage to stressed ornamental trees.
Brown Spruce Longhorned Beetle *Tetropium fuscum*			See narrative.
Carpenter Ant *Camponotus spp.*	Many	Throughout	Very common.
Eastern Larch Beetle *Dendroctonus simplex*	Eastern larch	Throughout	Populations still increasing and killing drought-stressed trees. See also larch decline.
Elm Bark Beetle *Hylurgopinus rufipes* and *Scolytus multistriatus*			See Dutch Elm Disease.
Emerald Ash Borer *Agrilus planipennis*			See narrative.
Hemlock Borer *Melanophila fulvoguttata*	Hemlock	Widely scattered	Few reports this year. See Hemlock Decline.
Japanese Cedar Longhorned Beetle *Callidiellum rufipenne*			Not observed or known to occur in Vermont.
Locust Borer *Megacyllene robiniae*	Black locust	Shaftsbury	Every tree infested in a large planting of black locusts in Shaftsbury. Scattered Damage occasionally seen elsewhere.
Northeastern Sawyer *Monochamus notatus*	Various conifers	Northeast Kingdom	A few seen.
Pigeon Tremex *Tremex columba*	Sugar maple	Scattered	Occasionally observed in decayed or dying trees.

INSECT	HOST(S)	LOCALITY	REMARKS
Pine Root Collar Weevil *Hylobius radicis*	White pine	Bennington	Several infested Christmas trees.
Pine Engraver *Ips pini*	Red pine	Chittenden and Addison Counties	Some damage.
Pitted Ambrosia Beetle *Corthylus punctatissimus*	Sugar Maple	Throughout	Scattered seedling mortality unusually common this year.
Red Turpentine Beetle *Dendroctonus valens*	White pine	Danby Cavendish	Associated with scattered mortality where other stressors present.
Round-headed Apple Tree Borer *Saperda candida*	Apples	Northeast Kingdom	A few seen.
Sugar Maple Borer *Glycobius speciosus*	Sugar maple	Throughout	Remains a common cause of defect on slow-growing maples.
Warehouse Beetles Various species			See narrative.
Whitespotted Sawyer *Monochamus scutellatus*	Balsam fir White pine	Throughout	Light populations. Feeding on log house reported.

ROOT INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
June Beetles *Phyllophaga* spp.	Many	Widespread	Light damage.

FRUIT AND FLOWER INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Asiatic Garden Beetle *Autoserica castanea*	Many flowers		Not seen after being common in 2003-2004.
Western Conifer Seed Bug *Leptoglossus occidentalis*	Conifers	Throughout	Reports of sightings in homes continue.

STEM DISEASES

Beech Bark Disease, caused by *Cryptococcus fagisuga and Nectria coccinea var. faginata*, was less noticeable during aerial survey this year, decreasing from 77,983 acres mapped in 2004 to 42,191 acres mapped in 2005 (Table 17). Mapped acreage generally increased in northern Vermont but decreased in southern Vermont. Decline and *Nectria* fruiting remain evident in stands heavily diseased during the past few years. The scale insect remains mostly at light population levels due to recent cold winters but appears to be increasing in some locations.

Table 17. Mapped acres of damage by beech bark disease in 2005.

County	Acres Mapped
Addison	2,286
Bennigton	9,695
Caledonia	221
Chittenden	305
Essex	1,641
Franklin	58
Grand Isle	0
Lamoille	4,738
Orange	290
Orleans	1,131
Rutland	5,367
Washington	4,255
Windham	9,060
Windsor	3,144
Total	**42,191**

Butternut Canker, caused by *Sirococcus clavigignenta-juglandacearium*, remains very common throughout the state, causing an increasing amount of dieback and mortality.

Recent research at the University of Vermont by Dale Bergdahl's graduate students Tim Schmalz and Dan Ruddell predicts that 85% of the butternut in Vermont will be dead by 2011.

OTHER STEM DISEASES

DISEASE	HOST	LOCALITY	REMARKS
Annual Canker *Fusarium sp.*			Not reported.
Ash Yellows *Mycoplasma-like organism*	White Ash	Throughout	Continues to cause ash decline and mortality, particularly in the warmer hardiness zones. Ash cracks, presumably due to yellows, were commonly observed.
Beech Bark Disease *Cryptococcus fagisuga* and *Nectria coccinea var. faginata*			See narrative
Black Knot *Dibotryon morbosum*	Black Cherry	Throughout	Remains common. Reported on ornamentals in Halifax and Hubbardton.
Botryosphaeria Blight *Botryosphaeria sp.*	Various	Urban trees	Cause of dieback on stressed trees
Brown Cubical Rot *Polyporus schweinitzii*			See root diseases.
Brown Rot *Monilinia fructicola*			Not reported.
Butternut Canker *Sirococcus clavigignenta-juglandacearum*			See narrative.
Caliciopsis Canker *Caliciopsis pinea*	White Pine	Widespread	No new reports.
Cedar-Apple Rust *Gymnosporangium juniperi-virginianae*	Juniper Apple	Scattered	
Chestnut Blight *Cryphonectria parasitica*	American Chestnut	Widely scattered	Common where young chestnut occurs.
Cytospora Canker *Leucostoma kunzei*	Blue Spruce	Widely scattered	Problem on a few ornamentals.
Delphinella Tip Blight of Fir *Delphinella balsamae*	Fir Concolor Fir	Wolcott Johnson	Mostly decreasing on Christmas trees. Some trees still not saleable, especially Concolor fir.

DISEASE	HOST	LOCALITY	REMARKS
Diplodia Shoot Blight *Diplodia pinea* *(Sphaeropsis pinea)*	White Pine Balsam Fir Fraser Fir Austrian Pine Mugo Pine Red Pine White Spruce	Widespread	Damage to Christmas trees was again more common than usual this year. Some heavy damage to white pine understory saplings. Dieback common on infected red pine.
Dutch Elm Disease *Ceratocystis ulmi*	American Elm	Throughout	Remains common at stable levels.
Eastern Dwarf Mistletoe *Arceuthobium pusillum*			Not reported.
Fireblight *Erwinia amylovora*	Apple	North-central	Occasionally observed.
Hypoxylon Canker *Hypoxylon pruinatum*	Aspen	Throughout	Remains common. Many cankered trees broke during wind or snow storms.
Lilac Blight *Pseudomonas syringae*	Lilac	Widespread	Remains common. Some mortality of shrubs heavily infected in 2004.
Maple Canker *Steganosporium spp.*	Sugar Maple	Widespread	Fruiting on previously stressed or damaged branches.
Nectria Canker *Nectria galligena*	Hardwoods	Throughout	Common.
Oak Wilt *Ceratocystis fagacearum*			Not observed or known to occur in Vermont. No suspect areas seen during aerial survey.
Phomopsis Gall *Phomopsis sp.*			Not reported.
Red Ring Rot *Phellinus pini*	White Pine	Widespread	Some concern with decay in stagnated stands and incipient ring rot in cut logs, especially in southern Vermont.
Sapstreak *Ceratocystis coerulescens*	Sugar Maple	Vernon	Ornamental
Scleroderris Canker *Ascocalyx abietina*	Scots Pine Red Pine	Widespread	Little shoot dieback. Has not been found in any new towns since 1986.
Sirococcus Shoot Blight *Sirococcus strobilinius*			Not reported.
Tomentosus Butt Rot *Inonotus tomentosus*			Not reported.

DISEASE	HOST	LOCALITY	REMARKS
White Pine Blister Rust *Cronartium ribicola*	White Pine	Throughout	Remains common, including pole size trees planted for screening and on Christmas trees. Some breakage at cankers in upper crowns of large trees.
Woodgate Gall Rust *Endocronartium harknessii*	Scots Pine	Widely scattered	Commonly seen on unmanaged trees. Some individual trees highly susceptible.
Yellow Witches Broom Rust *Melampsorella caryophyllacearum*	Balsam Fir	Widely scattered	Light to moderate damage to Christmas trees.

FOLIAGE DISEASES

Anthracnose, caused by *Glomerella, Apiognomonia and Gloeosporium spp.* was widespread throughout the state by mid-summer. Although browning related to anthracnose was mapped on just 7,812 acres during aerial survey the extent of damage was much greater (Table 18). Most noticeable was the damage to sugar maple. Brown foliage was present on lower crowns everywhere, and entire trees were brown and then defoliated in low-lying areas, near wet areas or water bodies, in hollows, and other sites with poor air drainage. Some hillsides had bands of brown foliage caused by anthracnose as well. Anthracnose was also observed on other hardwood species, including red oak, white ash and hop hornbeam.

Table 18. Mapped acres of anthracnose damage in 2005.

County	Acres Mapped
Addison	0
Bennigton	0
Caledonia	565
Chittenden	177
Essex	554
Franklin	0
Grand Isle	0
Lamoille	2,543
Orange	251
Orleans	1,906
Rutland	0
Washington	1,725
Windham	91
Windsor	0
Total	**7812**

Brown Spot Needle Blight, caused by *Scirrhia acicola* and *Mycosphaerella dearnessi*, was unusually heavy this year on Scots pine and white pine. It was also seen on red pine and Mugo pine. Brown or chlorotic foliage on white pine, some of which was due to this disease, was mapped on 1,157 acres (Table 19).

Table 19. Mapped acres of brown spot needle blight damage to white pine in 2005.

County	Acres Mapped
Addison	0
Bennigton	0
Caledonia	99
Chittenden	78
Essex	160
Franklin	0
Grand Isle	0
Lamoille	89
Orange	101
Orleans	0
Rutland	75
Washington	43
Windham	60
Windsor	452
Total	**1,157**

OTHER FOLIAGE DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Actinopelte Leaf Spot *Actinopelte dryina*	Red Oak	Sparse	Showing up on some trees.
Anthracnose *Glomerella spp.* *Apiognomonia spp.* *Gloeosporium spp.*			See narrative.
Apple Scab *Venturia inaequalis*	Apples Hawthorn	Throughout	Heavy damage common this year due to warm, humid weather. Some defoliation occurred.
Brown Spot Needle Blight *Scirrhia acicola* *Mycosphaerella dearnessii*			See narrative.
Bullseye Spot *Cristulariella moricola*			Not reported.
Cedar-Apple Rust *Gymnosporangium spp.*			See stem diseases.
Coccomyces Leaf Spot *Blumeriella jaapii*	Black Cherry	Throughout	Light damage.
Cyclaneusma Needlecast (formerly Naemacyclus) *Cyclaneusma minus*	Scots Pine	Widespread	Remains a common cause of needle loss.
Dogwood Anthracnose *Discula destructiva*			Not reported.
Fir-Fern Rust *Uredinopsis mirabilis*	Balsam Fir	Throughout	More common and heavier than in 2004. Mostly light to moderate damage but some individual Christmas trees, particularly plantation edge trees, had heavy damage.
Larch Needlecast Possibly *Mycosphaerella sp.*	European Larch Japanese Larch	Shaftsbury	Heavily defoliated by mid summer.
Lirula Needlecast *Lirula nervata*	Balsam Fir	Craftsbury	Heavy damage to lower crowns on a couple of Christmas trees.
Linospora Leaf Blight *Linospora tetraspora*	Balsam Poplar	Widespread	Heavy in some locations.

DISEASE	HOST(S)	LOCALITY	REMARKS
Lophodermium Needlecast *Lophodermium seditiosum*	Scots Pine	Scattered	Sometimes seen on ornamentals and Christmas trees.
Phyllosticta Leafspot *Phyllosticta sp.*			Not reported.
Poplar Leaf Blight Marssonina spp.	Balsam Poplar	Widespread	Common at light levels.
Powdery Mildew Eryiphaceae	Willow Lilac	Widespread	Very common on trees and shrubs.
Rhabdocline Needlecast *Rhabdocline pseudotsugae*			Not reported
Rhizosphaera Needle Blight of Fir *Rhizosphaera pini*	Balsam Fir	Scattered	Mostly light damage to Christmas trees.
Rhizosphaera Needlecast *Rhizosphaera kalkhoffi*	Blue Spruce White Spruce	Throughout	Very common on ornamentals and blue spruce Christmas trees. Heavy needle loss on some trees, usually lower crowns.
Septoria Leaf Spot *Septoria aceris*	Sugar Maple	Widespread	Very common this year at moderate levels.
Septoria *Septoria sp.*	Paper Birch	Widespread	Browning common, especially at high elevations, contributing to acres mapped of birch defoliation (see Hardwood Defoliators).
Sooty Mold *Perisporiaca*	Sugar Maple	Throughout	Very noticeable on trees infested with lecanium scale.
Swiss Needlecast *Phaeocryptopus gaumanni*	Douglas-fir	Widely scattered	The most common cause of needle loss on this species.
Tar Spots *Rhytisma spp*	Sugar Maple Red Maple Norway Maple	Widespread	Very common this year. Giant tar spot on Norway Maple especially noticeable, but rarely causing defoliation.
Venturia Leaf Blight *Venturia acerina* *Venturia populina*	Red Maple Quaking Aspen	Widespread	Very common this year at light to moderate levels. Venturia on aspen a common cause of dieback.
Tubakia Leafspot Actinopelte dryina			See actinopelte leaf blight

DISEASE	HOST(S)	LOCALITY	REMARKS
White Pine Needle Blight *Canavirgella banfieldii*	White Pine	Scattered	Present on some Christmas trees and also natural stands along river valleys in southern Vermont.
Willow Scab *Venturia saliciperda*	Willow	Rutland County	Riparian areas.

ROOT DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Annosus Root Rot *Heterobasidion annosum*			Not reported.
Brown Cubical Root Rot *Polyporous schweinitzii*	White Pine	Danby Brattleboro	Associated with scattered mortality of pine sawtimber. In Danby, probably infected via past grazing wouinds.
Dead Man's Fingers *Xylaria sp.*	Hardwoods	Belvidere	Fruiting at base of sugar maple stump.
Phytophthora Root Rot *Phytophthora sp.*	Fraser Fir Balsam Fir	Throughout	Remains an increasing problem for Christmas trees on poorly drained sites. Worst for Fraser but sometimes affecting balsam.
Shoestring Root Rot *Armillaria spp.*	Many	Throughout	Commonly found on drought-stressed trees and inter-planted Christmas trees. Was associated with a lightning-struck white pine in Cavendish that died. Prolific fruiting of mushrooms this fall.

DIEBACKS, DECLINES, AND ENVIRONMENTAL DISEASES

Birch Decline and Mortality
Birch decline and mortality was very noticeable this year especially on paper birch at upper elevations. Aerial surveys mapped decline on 7,865 acres (Table 20 and Figure 25). Decline began showing up after recent drought years, so is attributed to drought and successive years of defoliation (also see Trends in Forest Condition, Vermont Monitoring Cooperative).

Table 20. Mapped acres of birch decline and mortality in 2005.

County	Acres
Addison	1,047
Caledonia	92
Chittenden	789
Franklin	492
Lamoille	1,378
Orange	1,316
Orleans	202
Rutland	85
Washington	2,104
Windsor	360
Total	7,865

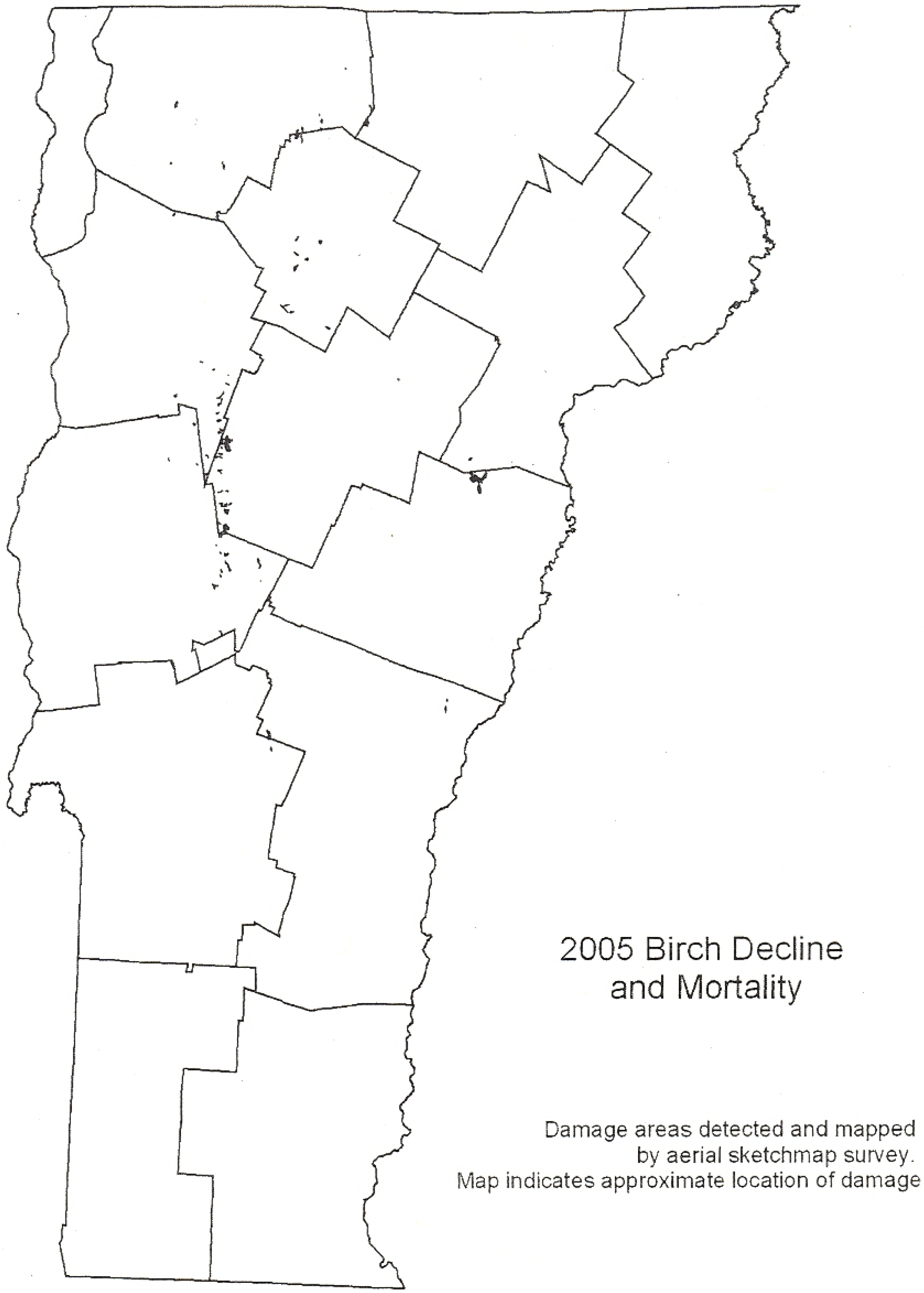


Figure 25. Birch decline and mortality in 2005. Mapped area is 7,865 acres.

Hardwood Decline and Mortality

Hardwood decline and mortality continues to be evident but has improved over the past two years. Decline was mapped on 10,200 acres this year (Table 21, Figure 26), compared to 31,583 and 50,039 acres in 2004 and 2003, respectively.

Table 21. Mapped acres of hardwood decline and mortality in 2005.

County	Acres
Addison	506
Bennington	33
Caledonia	472
Chittenden	765
Essex	153
Franklin	236
Grand Isle	249
Lamoille	1,629
Orange	200
Orleans	193
Rutland	2,180
Washington	3,032
Windham	281
Windsor	271
Total	10,200

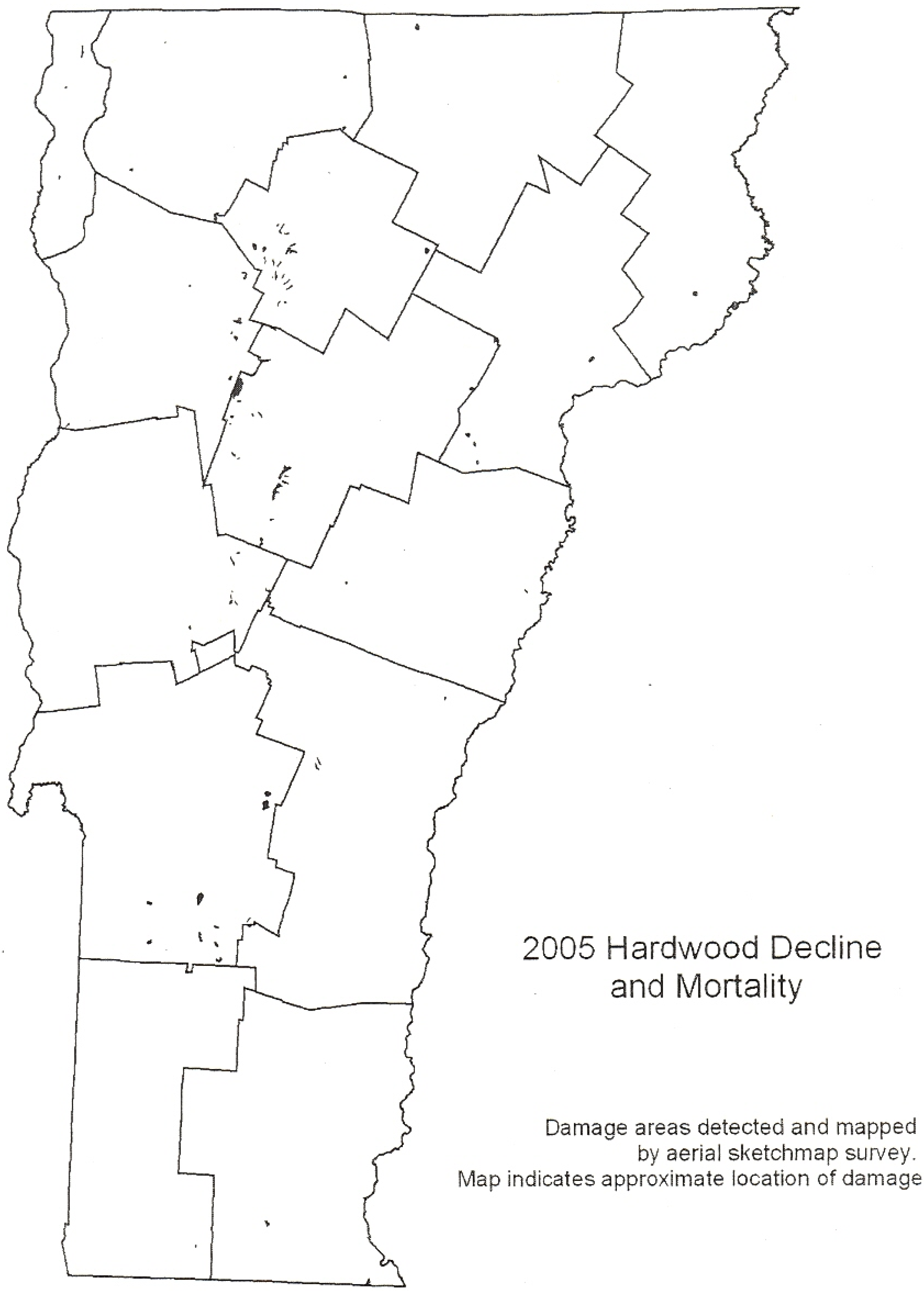


Figure 26. Hardwood decline and mortality in 2005. Mapped area is 10,200 acres.

Hemlock Decline
Hemlock decline was reduced from 2003 and 2004, with mortality occurring in some ledgey sites. Hemlock decline was mapped on 558 acres in western counties (Table 22). Damage is attributed to droughts during previous years, and is now associated with hemlock borer.

Table 22. Mapped acres of hemlock decline and mortality in 2005.

County	Acres
Addison	84
Chittenden	62
Grand Isle	141
Rutland	271
Total	558

Larch Decline
Mortality continues in small patches. The recent increase in decline is attributed to drought years and subsequent invasion by eastern larch beetle (Table 23, Figure 27).

Table 23. Mapped acres of larch decline in 2005.

County		Acres
Bennington		171
Caledonia		184
Lamoille		41
Orange		166
Orleans		115
Rutland		175
Washington		515
Total		1,367

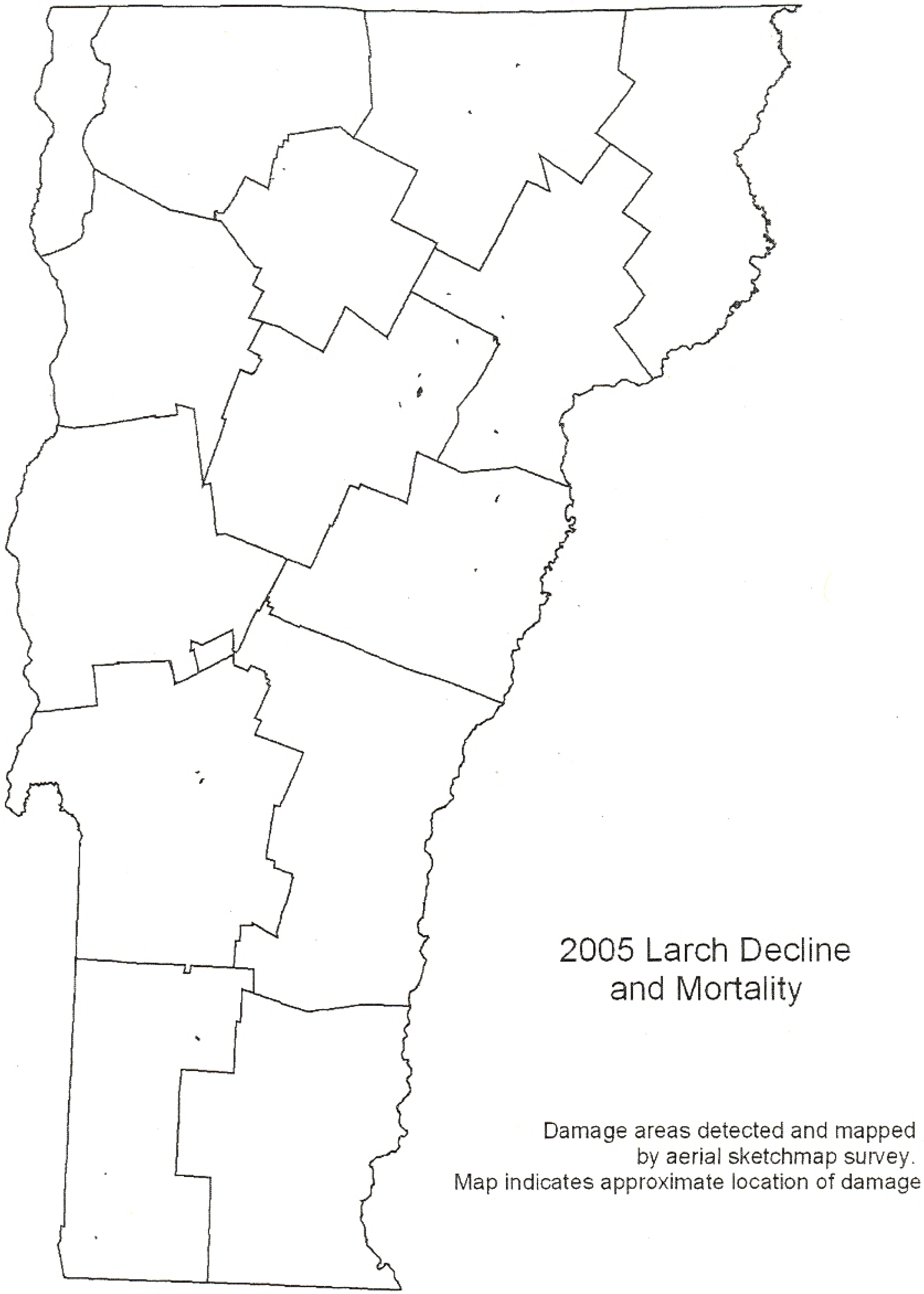


Figure 27. Larch decline in 2005. Mapped area is 1,367 acres.

Logging-related Decline

There was a decrease in mapped areas of logging-related decline this year, although it continues to be evident in widely scattered locations. Total area mapped during aerial survey is 458 acres (Table 24).

Table 24. Mapped acres of logging-related decline and mortality in 2005. Mapped area is 458 acres.

County	Acres
Franklin	33
Orange	160
Orleans	45
Windham	220
Total	458

Ozone Injury

In 2005, 14 locations were visited in late summer, when ozone symptoms are at their peak. Symptoms of ozone injury (stippling on upper leaf surface) were recorded at 29% of the sites (Table 25). Where injury occurred, the severity was light to moderate. No locations had heavy injury. Symptoms were observed on black cherry and white ash, which are the only tree species known to be good visual indicators of ozone injury. Other species monitored include: milkweed, blackberry, dogbane, pin cherry, and big leaf aster. A new site was added in Woodstock at the Marsh-Billings National Park, and 4 locations were dropped due to poor bioindicator site conditions: Grafton, Newark, Sunderland (Lye Brook Area), and Waterbury. Information on symptoms of ground-level ozone injury on sensitive plant species is collected annually as part of the National Forest Health Monitoring Program. No symptoms of ozone injury were observed during other routine forest observations of Vermont forests. Although our bioindicator monitoring frequently reports ozone symptoms on individual plants, the degree of forest damage from ozone is still being researched.

Table 25. Ozone biodindicator sites visited in 2005 and severity of ozone injury (light = <25% of affected leaves with ozone injury, moderate = 25-50% of affected leaves with ozone injury).

Town	Site Number	Severity of Injury
Bakersfield	4407277	None
Clarendon	4307268	Light
Dover	4307215	None
Groton	4407222	None
Hancock	4307287	None
Hyde Park	4407255	None
Lunenburg	4407168	None
Orange	4407223	None
Rupert	1050002	Moderate
Springfield	4307244	Light
Sudbury	4307372	None
Underhill	1050001	None
Waterford	4407137	None
Woodstock	1050005	Light

Snow Breakage

A heavy wet snow storm on October 25 caused widespread damage to trees and shrubs, especially those with leaves remaining. A map of snow depths after the storm showed that the largest snow fall occurred in northern Vermont (Figure 28). Hardest hit were beech, young oak, aspen, birch and large apple trees. Power outages lasting up to 6 days were common. A survey of tree damage in sugarbushes was conducted in response to concerns.

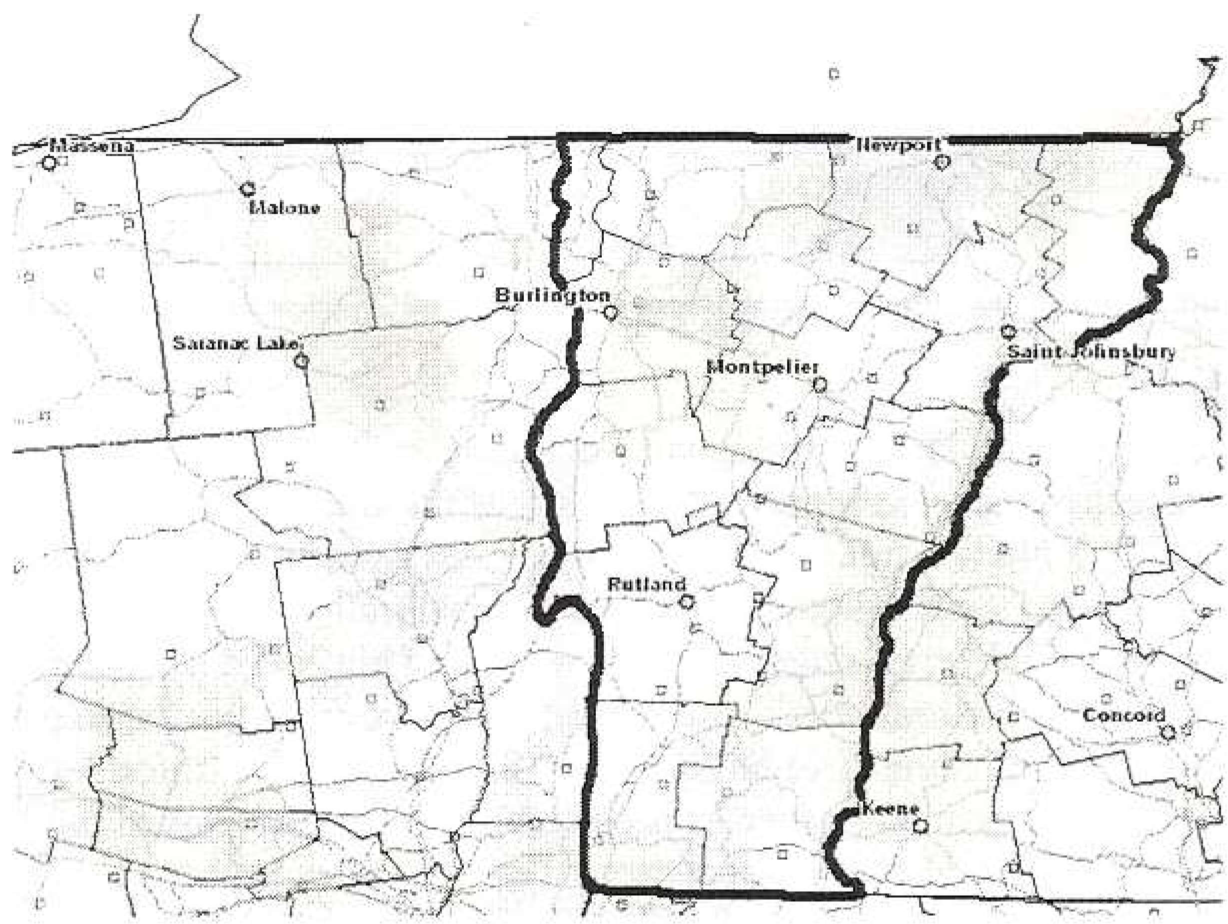


Figure 28. Map of snow depths footprint reported during the October 25 snow storm. Darker shading indicates larger snow depths. Image from NOAA web site for October 26, 2005: www.nohrsc.noaa.gov/interative/

Snow Storm Sugarbush Damage Survey

Reports of sugarbush damage were received from scattered locations but the bulk of complaints were from Orleans County. To assess damage, 6 of the sugarbushes where heavy damage had been reported in Orleans and Chittenden Counties were evaluated. In selecting areas for evaluation, an attempt was made for geographical spread. A prism point tally of sugar maples was used to evaluate trees large enough to tap (10" dbh and up) and trees under 10 inches, using 8 points per sugarbush. In all, 372 trees were evaluated.

Results

Most of the damage was to large sapling and small pole size understory trees that bent over or broke off and damaged pipeline tubing systems. Understory beech and red oak trees, which had leaves at the time of the storm, suffered the most damage, followed by birch, conifers and other hardwoods. In Orleans County damage generally decreased with decreasing latitude. Only one of the sugar maples large enough to tap suffered more than 50% crown loss and most had less than 11% crown loss (Table 26). For sugar maples under 10 inches in diameter, most had crown loss of less than 50%, but 23% suffered crown loss in excess of 50% and 22% had broken or bent main stems (Table 27). Most maples, except those whose main stems were severely bent or broken, should fully recover.

Table 26. Percent of trees by crown loss and bent or broken main stems for sugar maples 10 inches dbh and greater.

Location	0-10% crown loss	11-25% crown loss	26-50% crown loss	51-75% crown loss	76-100% crown loss	Main stem bent or broken
Derby	71	25	4	0	0	0
Derby	68	30	3	0	0	0
Newport	67	24	9	0	0	0
Orleans	73	27	0	0	0	0
Lowell	92	8	0	0	0	0
Huntington	80	14	3	0	1	3
Ave.	**75**	**21**	**3**	**0**	**0**	**1**

Table 27. Percent of trees by crown loss and bent or broken main stems for sugar maples under 10 inches dbh.

Location	0-10% crown loss	11-25% crown loss	26-50% crown loss	51-75% crown loss	76-100% crown loss	Main stem bent	Main stem broken
Derby	33	33	4	8	22	11	11
Derby	0	0	0	0	100	0	100
Newport	50	50	0	0	0	0	0
Orleans	73	27	0	0	0	0	0
Lowell	92	8	0	0	0	0	0
Huntington	83	7	3	0	7	0	7
Ave.	**56**	**21**	**1**	**1**	**22**	**2**	**20**

Spruce-Fir Decline and Mortality

Spruce-fir decline and mortality continue to be evident, at levels similar to 2004 (Table 28 and Figure 29). Some of this is high elevation spruce affected by drought and winter injury in previous years, and some is lower elevation fir stressed by drought and balsam woolly adelgid.

Table 28. Mapped acres of spruce-fir decline and mortality in 2005.

County	Acres
Addison	394
Bennington	297
Caledonia	869
Chittenden	111
Essex	7,899
Franklin	630
Lamoille	288
Orange	854
Orleans	1,595
Rutland	2,372
Washington	319
Windham	175
Windsor	516
Total	16,319

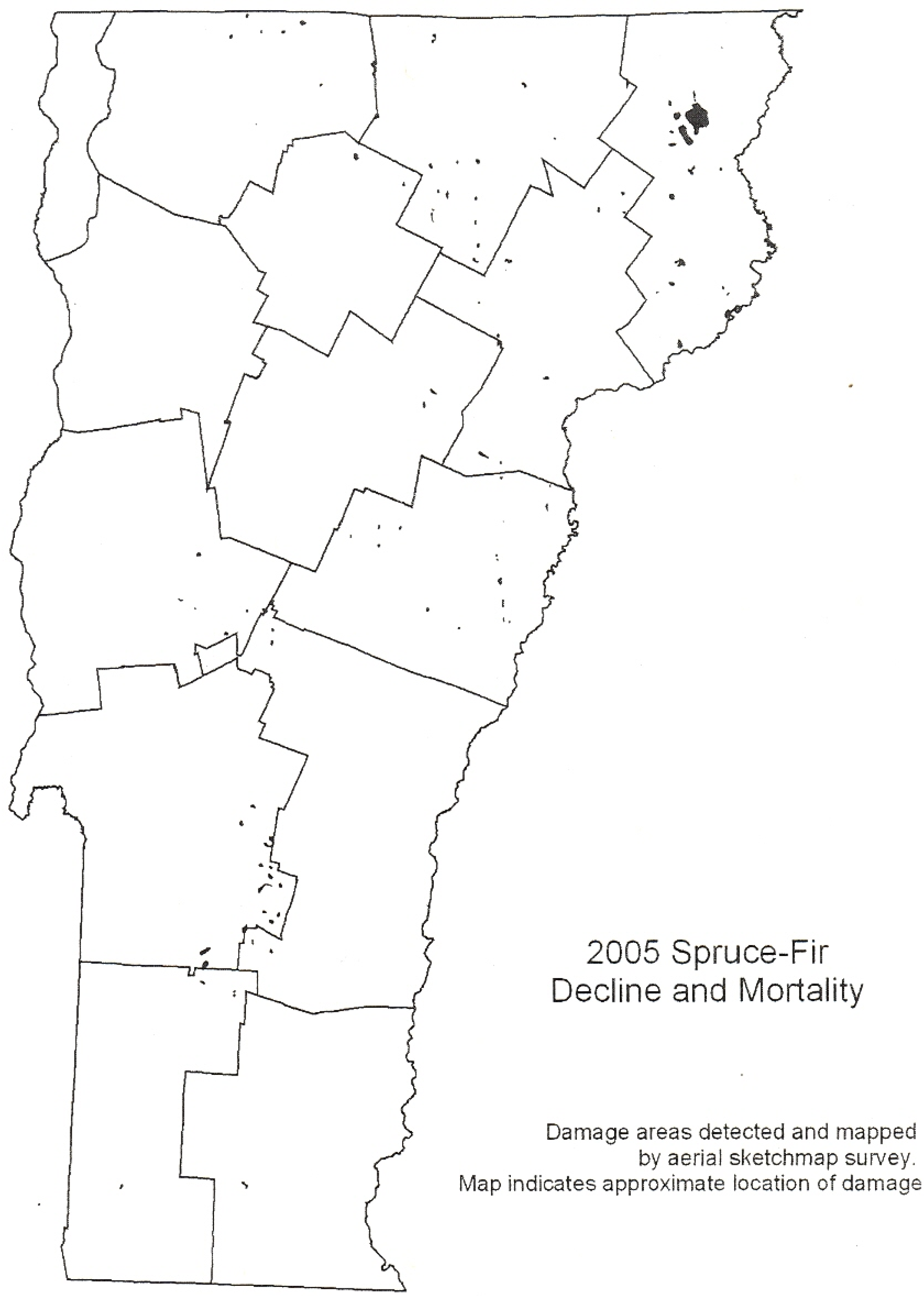


Figure 29. Spruce-fir decline and mortality mapped in 2005. Mapped area is 16,319 acres.

Wet Sites

The total mapped area of forest decline due to flooding decreased this year, but there were new areas affected in areas newly inundated by beavers. Aerial mapping showed 11,078 acres of decline associated with wet sites (Table 29, Figure 30).

Table 29. Mapped acres of dieback and mortality associated with wet site conditions in 2005.

County	Acres
Addison	583
Bennington	932
Caledonia	277
Chittenden	343
Essex	549
Franklin	2,129
Grand Isle	959
Lamoille	591
Orange	754
Orleans	1,493
Rutland	723
Washington	85
Windham	954
Windsor	706
Total	11,078

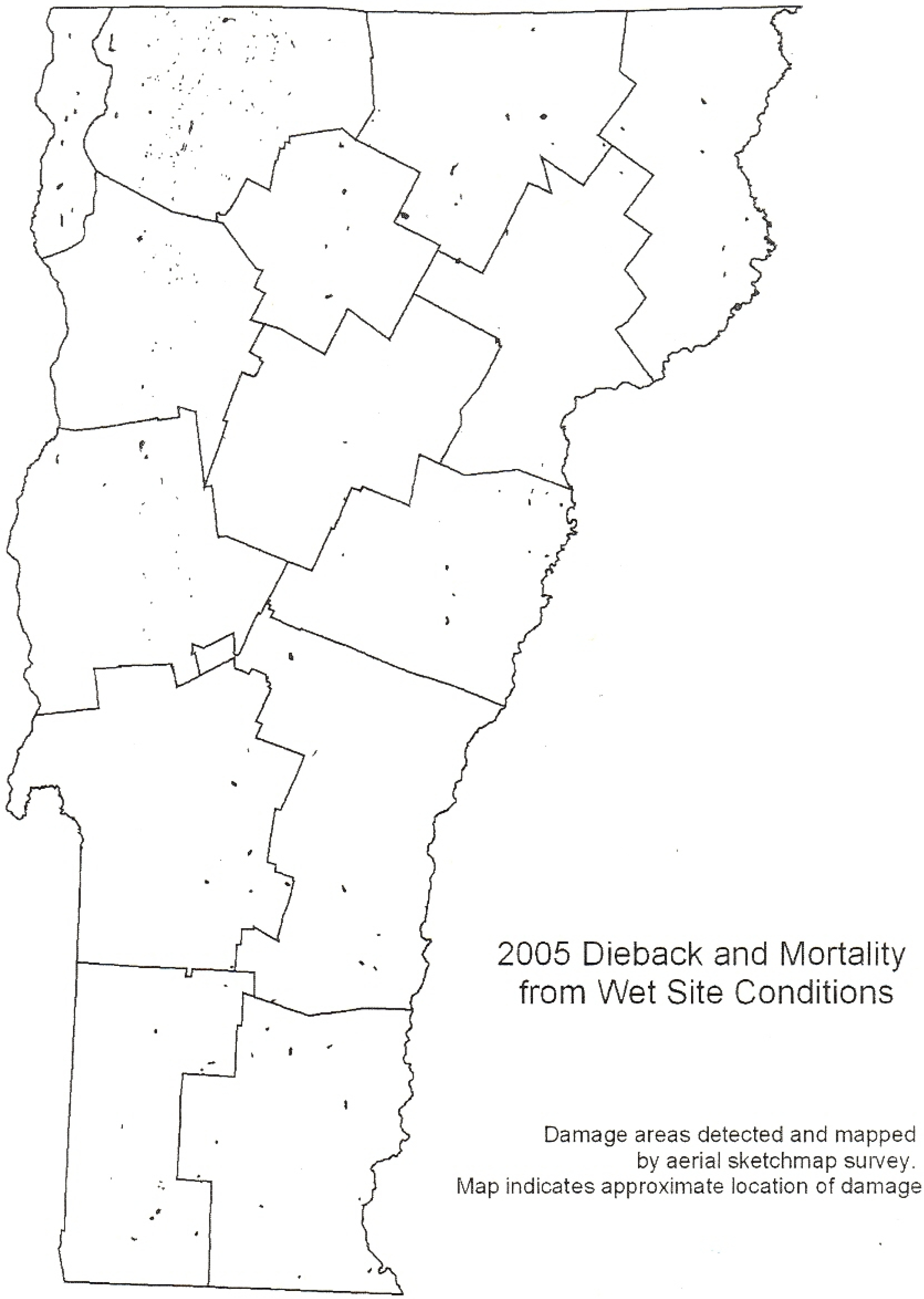


Figure 30. Declines associated with wet site conditions in 2005. Mapped area is 11,078 acres.

OTHER DIEBACKS, DECLINES, AND ENVIRONMENTAL DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Air Pollution Injury			See narrative. (Ozone Injury)
Ash Dieback	White ash	Widespread	See narrative. (Ash Yellows)
Birch Decline	White birch Yellow birch	Higher elevations	See narrative.
Delayed Chlorophyll Development			Not reported.
Drought	Numerous	Scattered	Ongoing drought stress from previous years resulted in decline on a wide variety of tree species, especially at upper elevations and on drought prone sites.
Edema			Not reported.
Fertilizer Injury			Not reported.
Fire Damage		Addison County	Mapped 19 acres of fire damage from aerial survey.
Frost Damage	Christmas trees	North and North-central Vermont	Light damage occasionally seen in colder areas of north-central and northeastern Vermont.
Hardwood Decline and Mortality			See narrative.
Heavy Seed	Silver Maple Cherry and Oak	Northern Vermont	Seed was so heavy that many trees looked tan instead of green. Heavy flowering was reported.
Herbicide Injury			Not reported.
Ice Damage			Not reported.
Improper Planting	Many	Throughout	Common on ornamentals. Shows up as planting failures.
Interior needle drop			Not reported.
Larch Decline			See narrative.
Lightening	White Pine	Cavendish	Pockets of mature tree mortality
Logging-related Decline			See narrative.
Maple Decline	Sugar Maple	Scattered statewide	Some decline in sugarbushes, often associated with forest tent caterpillar defoliation or heavy lecanium scale
Mechanical Injury			Not reported.
Pesticide Injury			Not reported.
Salt Damage	Many	Throughout	Common but no major reports of injury
Snow Breakage			See narrative.
Spruce/Fir Dieback and Mortality	Red Spruce Balsam Fir	Statewide	See narrative.
Wet Site			See narrative.
White Pine Needle Blight			See foliage diseases.
White Pine Mortality			Not reported.
Wind Damage	Many	Widely scattered	A series of tropical storms led to breakage but no serious damage. Wet soil conditions increased the incidence of windthrow.
Winterburn	Fir Christmas Trees	Craftsbury	South side of fir Christmas trees where previously shaded.
Winter Injury			Not reported.

ANIMAL DAMAGE

ANIMAL	SPECIES DAMAGED	LOCALITY	REMARKS
Beaver	Many	Throughout	Remains a common cause of direct mortality and indirect mortality from inundations.
Cattle			See Cubical Rot.
Deer	Many	Throughout, particularly eastern Windham and Windsor Counties	Continues to impact regeneration of commercial species in managed stands.
		Scattered	Some damage to ornamental trees.
Dog	Arborvitae	Chester	Lower foliage shiny black, then turning brown.
Moose	Many	High elevations	Concern about damage continues to increase in the south.
		Widely scattered especially Essex County	Browsing damage plus small trees knocked over.
Mouse and Vole		Widely Scattered.	Mostly light damage following winter 2004-05.
		Northeast Kingdom	Light damage in Christmas tree plantations with little weed control.
Porcupine	Many	Scattered throughout	Occasionally observed.
Sapsucker	Paper birch Apple Hemlock	Widespread	Commonly observed. Some weakened trees snapped off during wind or snow storms. Occasional heavy damage to ornamentals.
Squirrel	Maple Tubing	Champlain Valley	Some damage. No severe damage reported. Populations expected to Increase following good seed crop in 2005.

INVASIVE PLANTS

Non-native, invasive plant species have become common in many of New England's forests and is a growing concern within Vermont. Invasive species can out-compete native plants for nutrients, water, light, and germination sites and often become the dominant vegetation type, threatening the regeneration of native species important for wildlife habitat, biodiversity, and timber production. As a result, the successful, long-term management of New England's forests will increasingly depend on the ability of land managers to develop and implement techniques and strategies to control invasive species populations and restore native plant communities. The Northeastern Area Invasive Forest Plant Species Project (NEA Invasive Project) was developed with funding from the USDA Forest Service, State and Private Forestry to provide land managers with a working knowledge of invasive plant ecology and strategies for control. The project established demonstration control plots for several invasive plants in southern Vermont. A workshop was held in September of 2005 with approximately 70 attendees who toured the demonstration plots.

A booklet was produced which provides an overview of invasive plant ecology, traits, and general control strategies, and serves as a guide to the NEA Invasive Project's demonstration control plots. The plots were designed to incorporate several invasive plant species often found in New England's forests and to showcase some commonly used control methods. Photographs and written documentation of methods, labor, and materials were provided to help attendees understand the scope and costs of the work involved. Demonstration plots were also mapped and photographed at permanent photo plots to help evaluate the long-term response to treatment, and to facilitate the use of the demonstration plots for future workshops. The plots were designed in the spring of 2005 and control was implemented during the summer of 2005. The project was planned and managed through collaboration between the USDA Forest Service, State and Private Forestry, the Vermont Department of Forests, Parks and Recreation, including the Office of the Windham County Forester, the Windham County Natural Resources Conservation District, and Ellsworth Land Management, LLC of Somerville, Massachusetts. The project managers wish to acknowledge the landowners who have kindly allowed access to their land. The booklet can be reviewed at the following web address:
http://www.vtfpr.org/protection/documents/InvasivesProjectbookletWeb_000.pdf

Invasive exotic plant species were surveyed on NAMP plots in 2005. Refer to "Trend in Forest Condition" for results of this survey.

North American Maple Project (NAMP)

Sugar Maple Health

Sugar maple plots were surveyed for the 18^{th} year in 2005 and although 92% of trees were healthy, tree health problems were detected at some locations (Figure 31). Average foliage transparency, a measure of current year stress, was the highest on record, 23% (Figure 32). Defoliation by forest tent caterpillar caused significant defoliation on a third of the 38 plots (16 plots) and resulted in higher foliage transparency ratings. Most trees were able to refoliate later in the summer. Average dieback remained steady, indicating that no long-term tree health effects are noticeable on NAMP plots, although other defoliated sugar maple stands have seen tree decline. Lecanium scale surveys were conducted on NAMP plots to learn about the distribution and abundance of scales around the state, and to compare to current and future tree health. (See Lecanium section.)

Tree species diversity may be important to the resiliency of forests under the current forest tent caterpillar outbreak. NAMP plots were originally selected based on a high sugar maple component, so may not represent all sugarbushes or maple-dominated forests. Currently, the majority of NAMP plots have over 75% sugar maple (Figure 33). The NAMP plots with the most extensive defoliation by FTC were those where most trees were sugar maple (Figure 34). There have been improvements in diversity over the past 10 years, with 37% of NAMP plots increasing in diversity (Figure35).

NAMP plots were surveyed for exotic plant species using the protocols developed for the Vermont Hardwood Health Survey (HHS) in 2001. An updated list of species of concern was developed (Table 30). Exotic plants were found on 26% of plots surveyed. During the 2001 survey on HHS plots, only 18% of sites sported exotics. Buckthorn, honeysuckle, barberry and multiflora rose were the 4 species found growing on plots, in order of abundance. Most species were not abundant on plots (trace), but buckthorn and honeysuckle were abundant on some plots (light or moderate) (Figure 36).

Changes in tapping methods are reflected on NAMP plots, with 77% of landowners now using health spouts (7/64") (Figure 37). There was also a 10% decrease in number of sites that are tapped for syrup production. When established, 50% of NAMP sites were active sugarbushes, whereas in 2005, only 40% of sites were active sugarbushes.

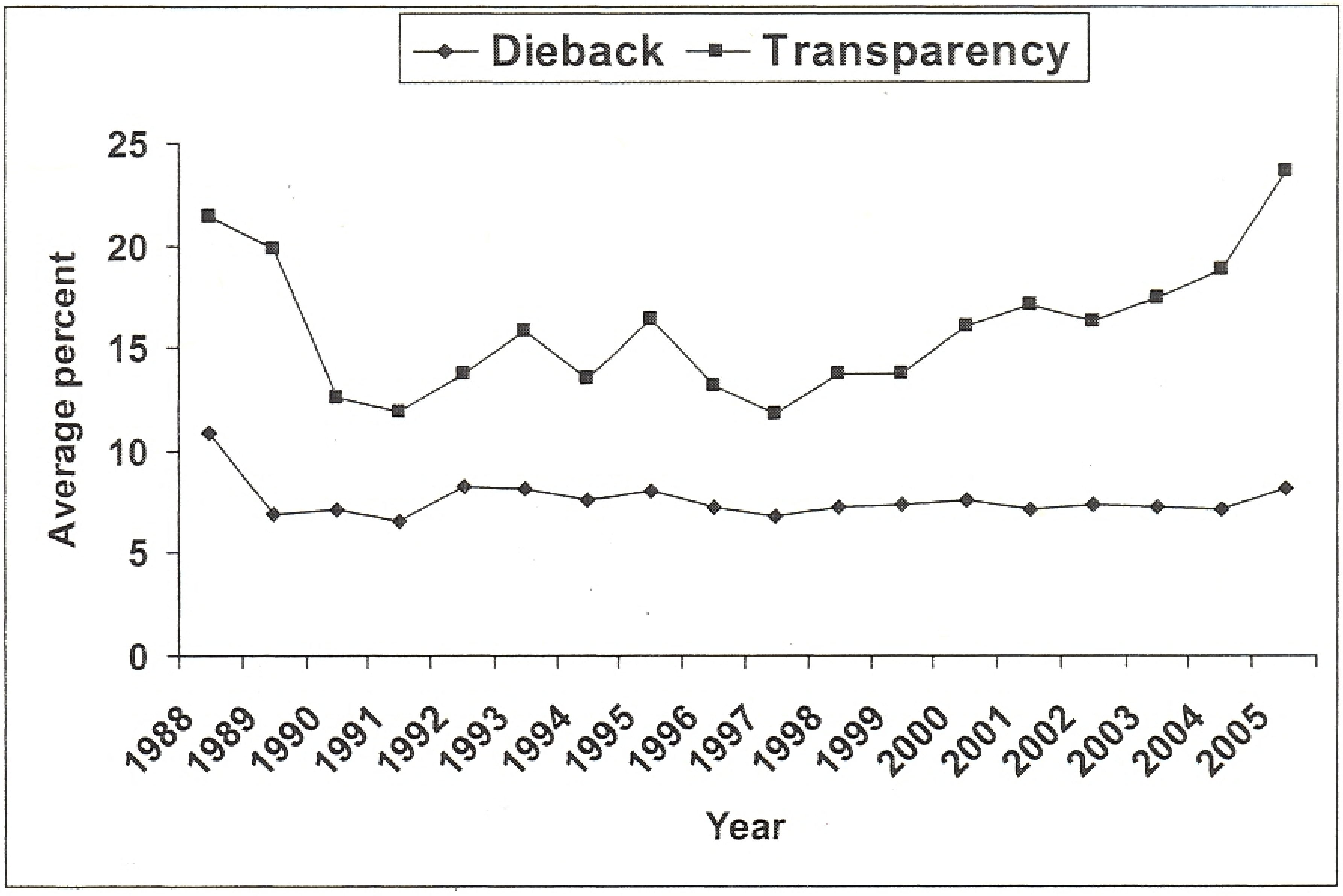


Figure 31. Trend in overstory sugar maple condition from 1988 to 2005.

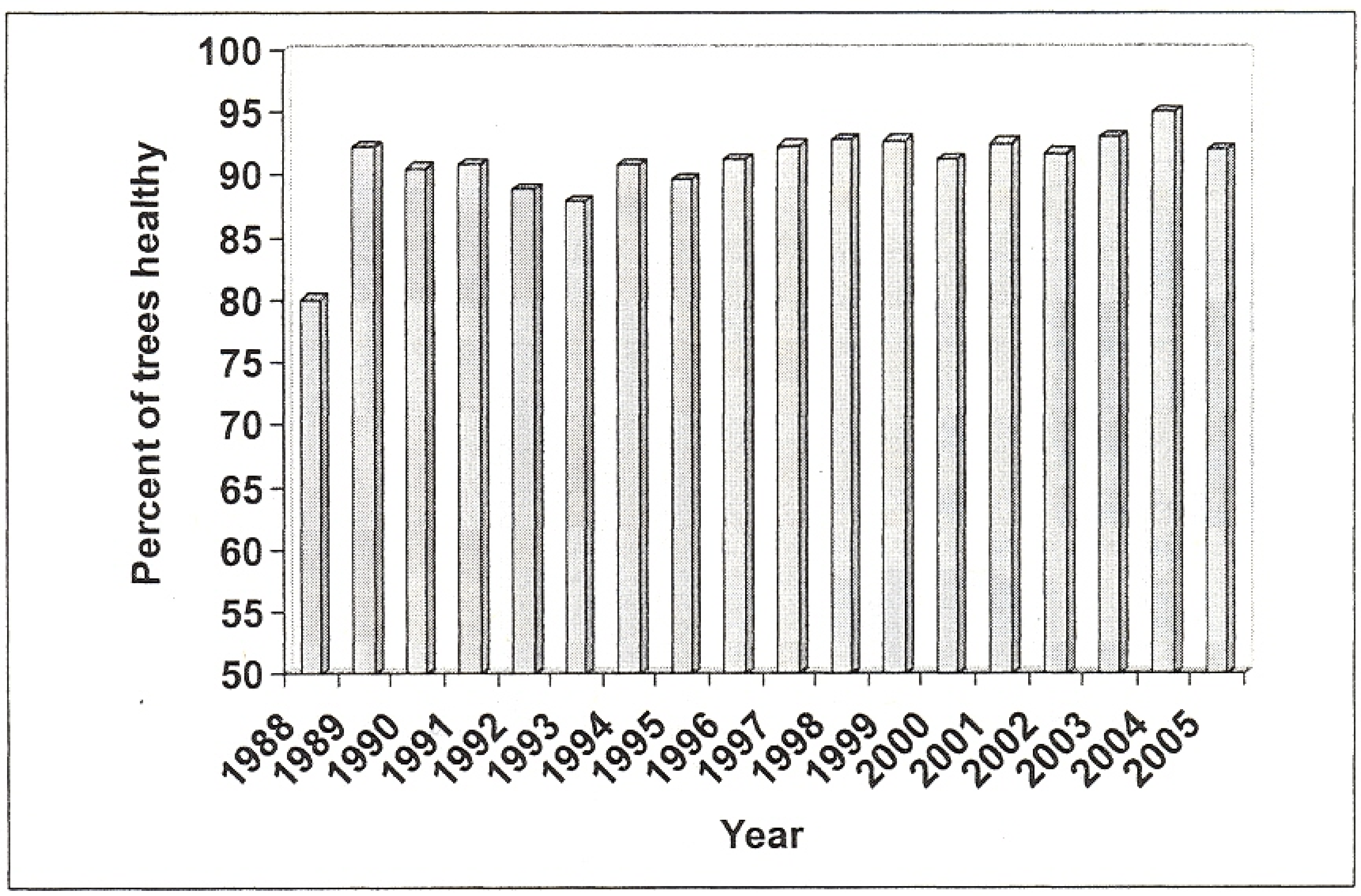


Figure 32. Trend in healthy overstory sugar maple trees on NAMP plots. Health based on trees with less than 15% dieback.

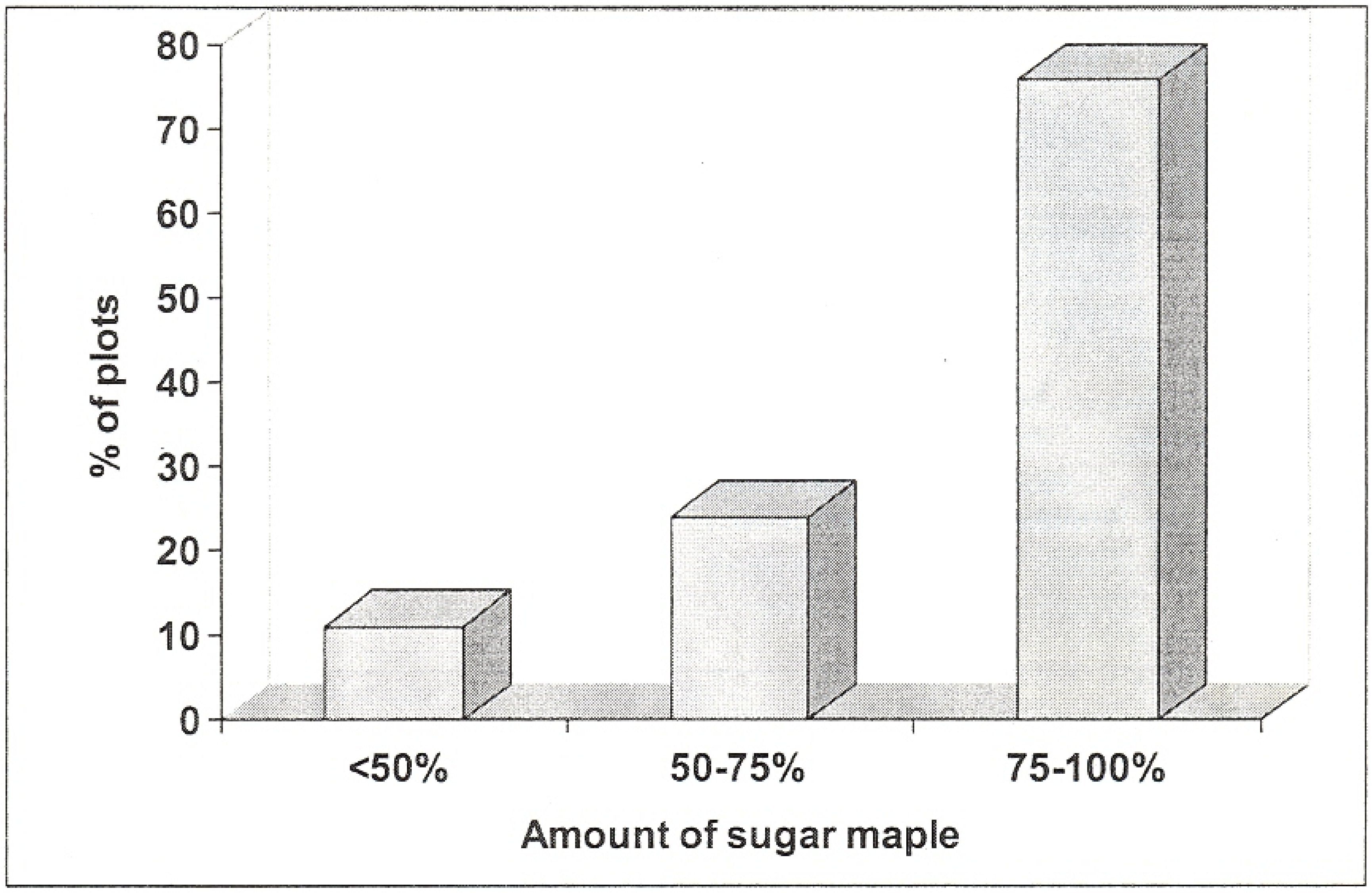


Figure 33. Abundance of sugar maple on NAMP plots in 2005.

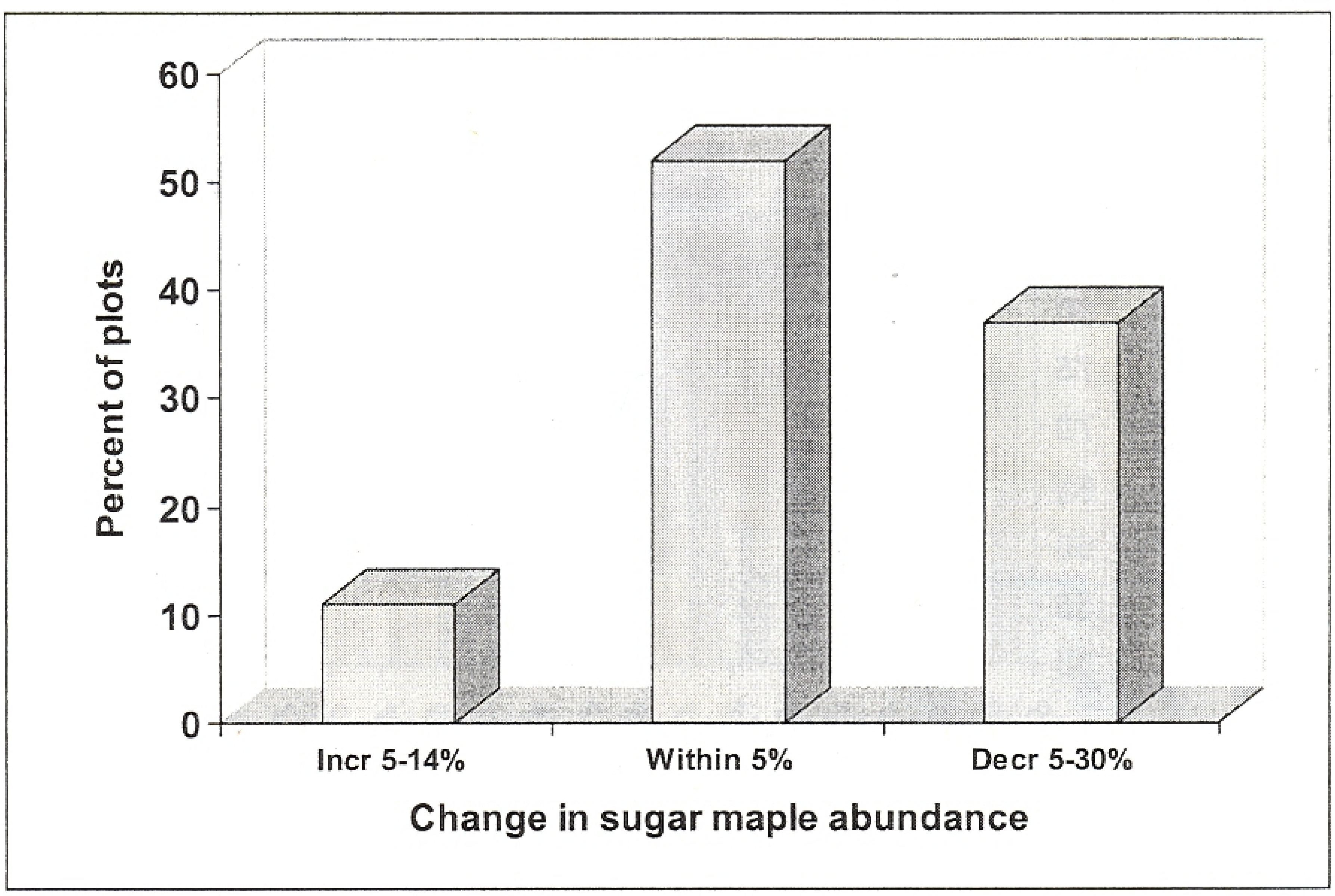


Figure 34. Abundance of sugar maple on NAMP plots defoliated by forest tent caterpillar in 2005.

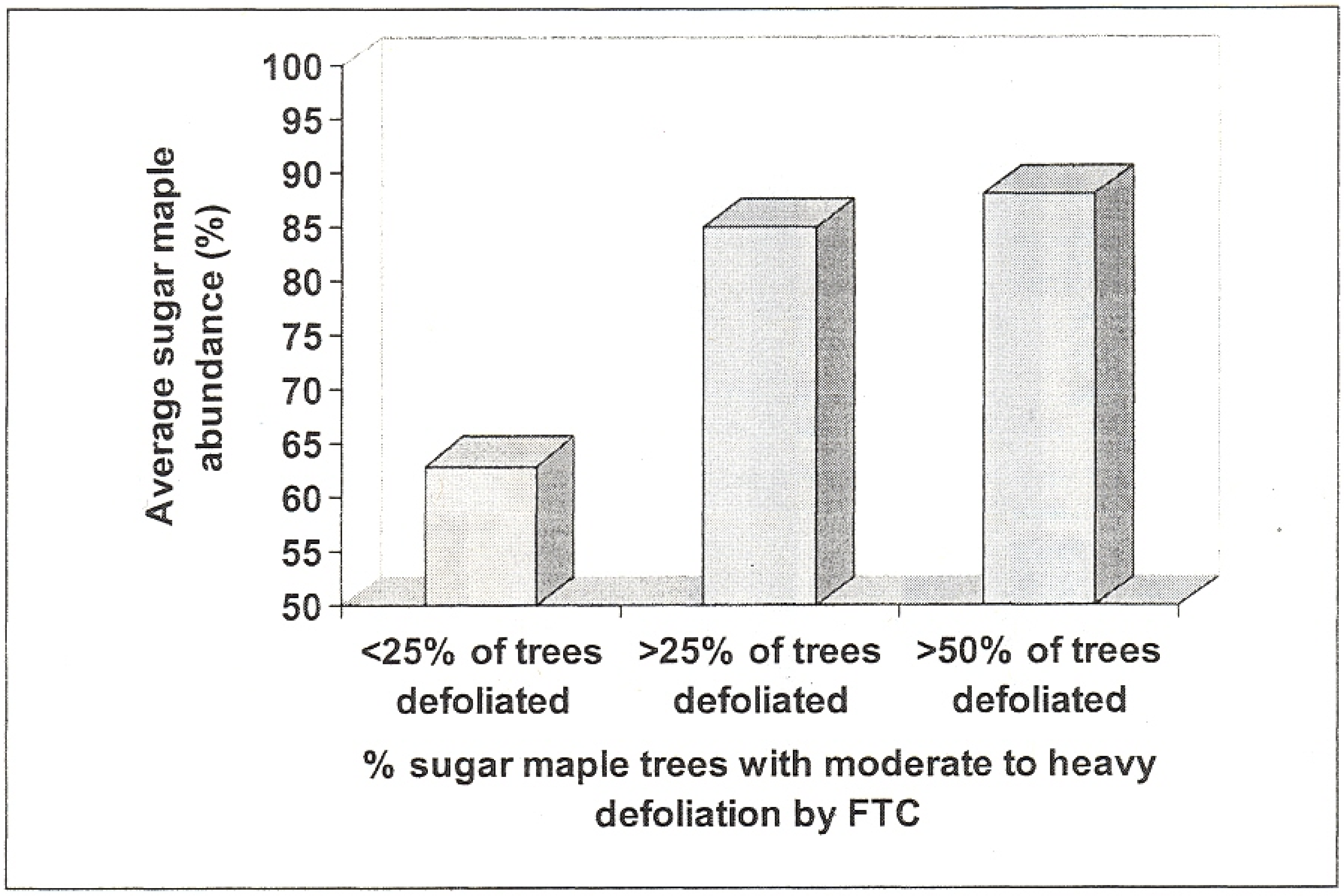


Figure 35. Change in sugar maple abundance on NAMP plots over a 10 year period: 1995-2005.

Table 30. Exotic plant species included in the 2005 surveys on NAMP plots.

Common Name	***Latin Name***
Barberry, Japanese and common	*Berberis thunbergii, B. vulgaris*
Buckthorn: common or glossy	*Rhamnus cathartica, R. frangula*
Bittersweet, oriental	*Celastrus orbiculatus*
Honeysuckle: Bell, Japanese, Amur, Morrow or Tartarian	*Lonicera X bella, L. japonica, L. maackii, L. morrowii, L. tatarica*
Multiflora Rose	*Rosa rugosa*
Norway Maple	*Acer platanoides*
Autumn Olive	*Elaeagnus umbellata*
Japanese knotweed	*Fallopia japonica (Polygonum cuspidatum)*
Garlic Mustard	*Alliaria petiolata (A. officinalis)*
Privet	*Ligustrum vulgare*
Tree of Heaven	*Ailanthus altissima*
Wild Chervil (cow parsnip)	*Anthriscus sylvestris*
Burning Bush or winged Euonymus	*Euonymus alatus*
Goutweed	*Aegopodium podagraria*
Amur Maple	*Acer ginnala*
Russian Olive	*Elaeagnus angustifolia*
Other (please specify)	

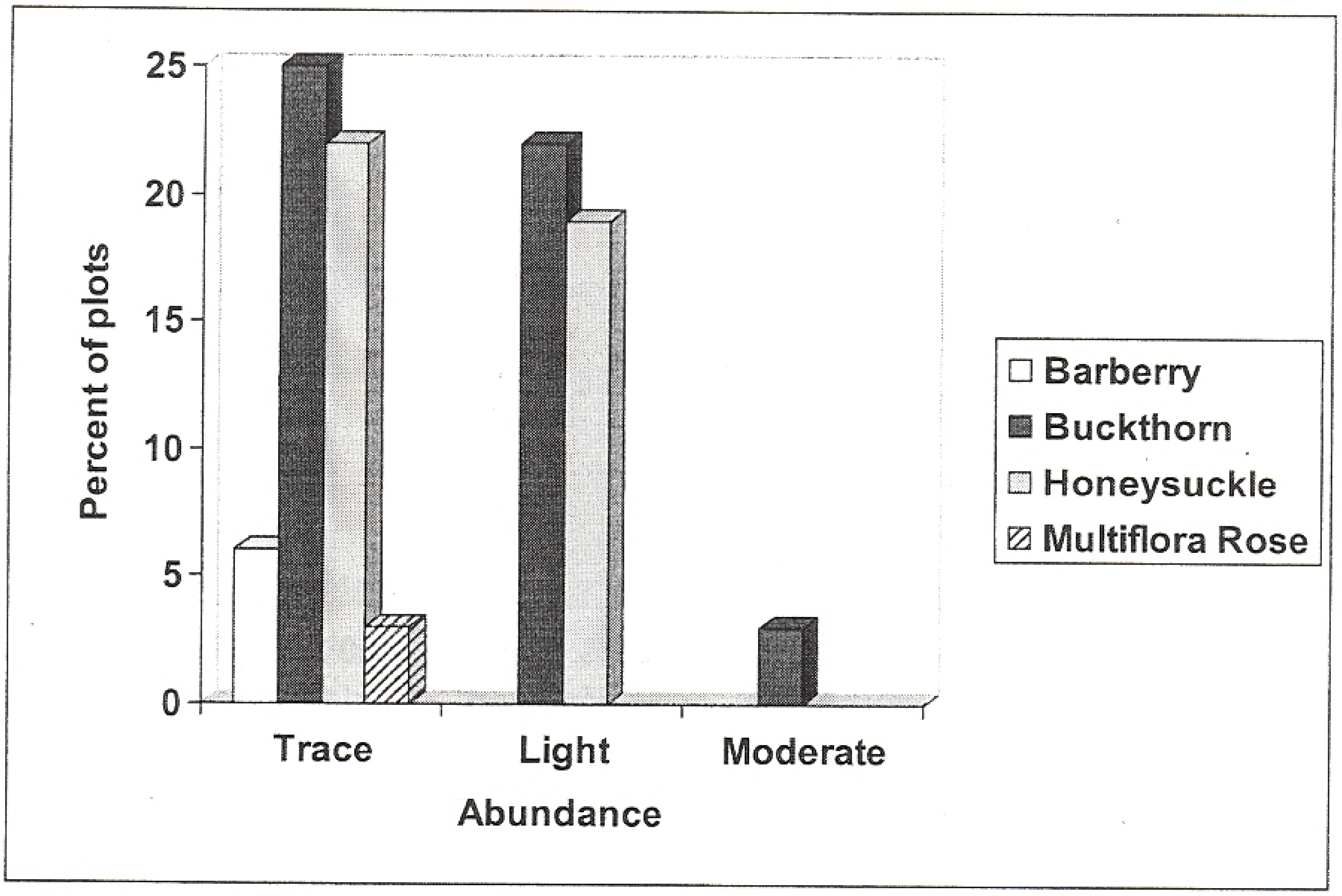


Figure 36. Abundance of exotic plant species on NAMP plots in 2005.

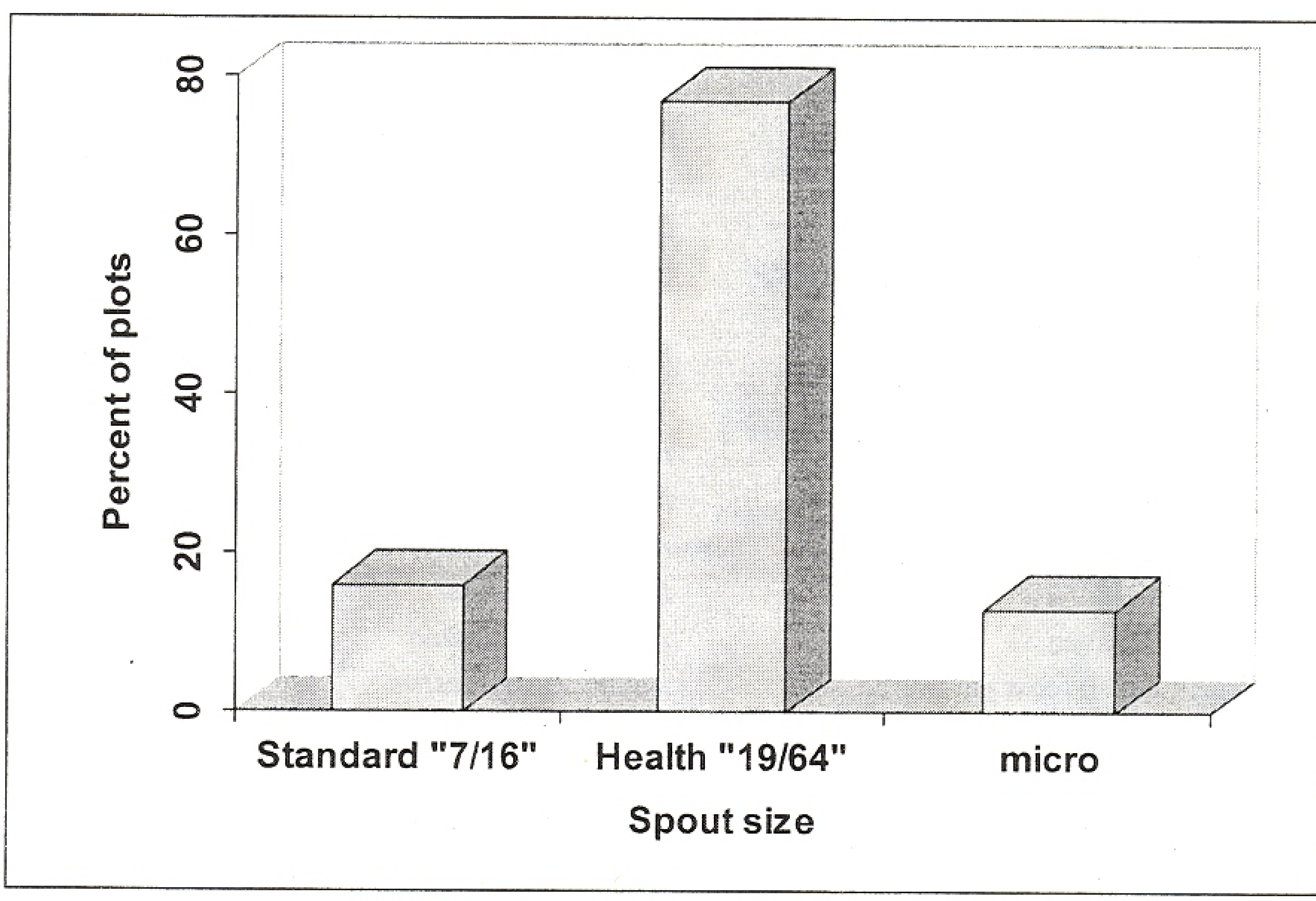


Figure 37. Spout sizes used on NAMP plots in 2005.

Trends in tree health in the Lye Brook Wilderness Area

Five plots on the Lye Brook Wilderness Area have been monitored since 1994 to detect trends in tree condition. Tree crown health is measured using 3 indicators: foliage transparency (a measure of current year foliage density), dieback (a measure of current and past stress effects on tree growth) and crown density (a measure combining tree branch density, dieback and foliage density).

Since 1998, a variety of stress agents have resulted in thin foliage at the 1400 foot elevation plots. In 2005, 26% of trees had thin foliage (foliage transparency >25%) (Figure 38). There were no observations of major defoliators on plots, but lingering effects from drought years in 1999, 2001 and 2002 are likely contributors. Trees at 2300 foot elevation plots recovered from the 1998 ice storm, and have remained fairly healthy since then (Figures 38-40). In 2005, only 4% of trees had thin foliage, 7% of trees had high dieback (>15% dieback), and 9.6% of trees had thin crowns (<40% crown density). A variety of stress agents were observed on plots in 2005 (Table 31).

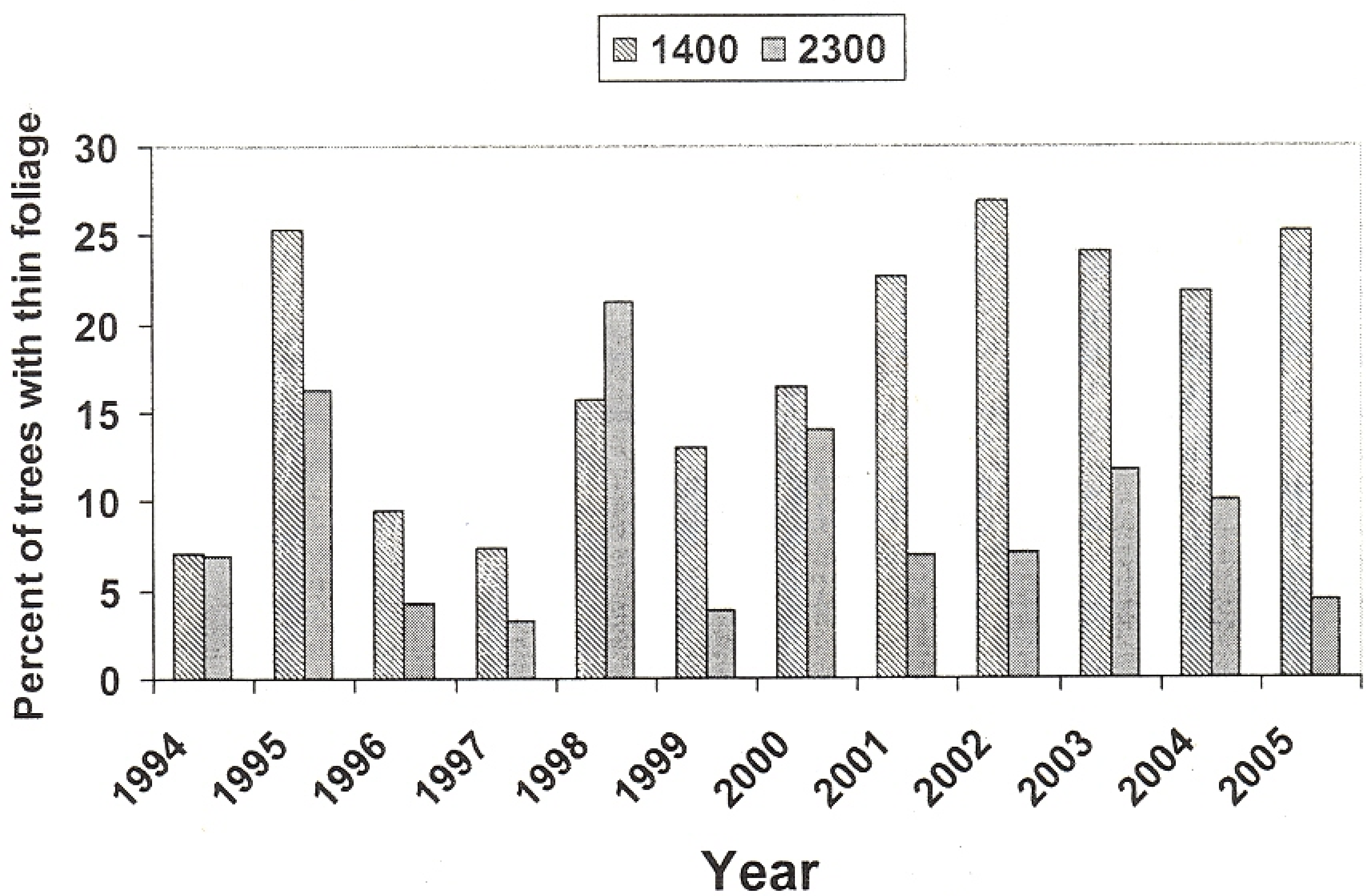


Figure 38. Trend in the percent of trees with thin foliage (foliage transparency >25%) at two elevations in the Lye Brook Wilderness Area.

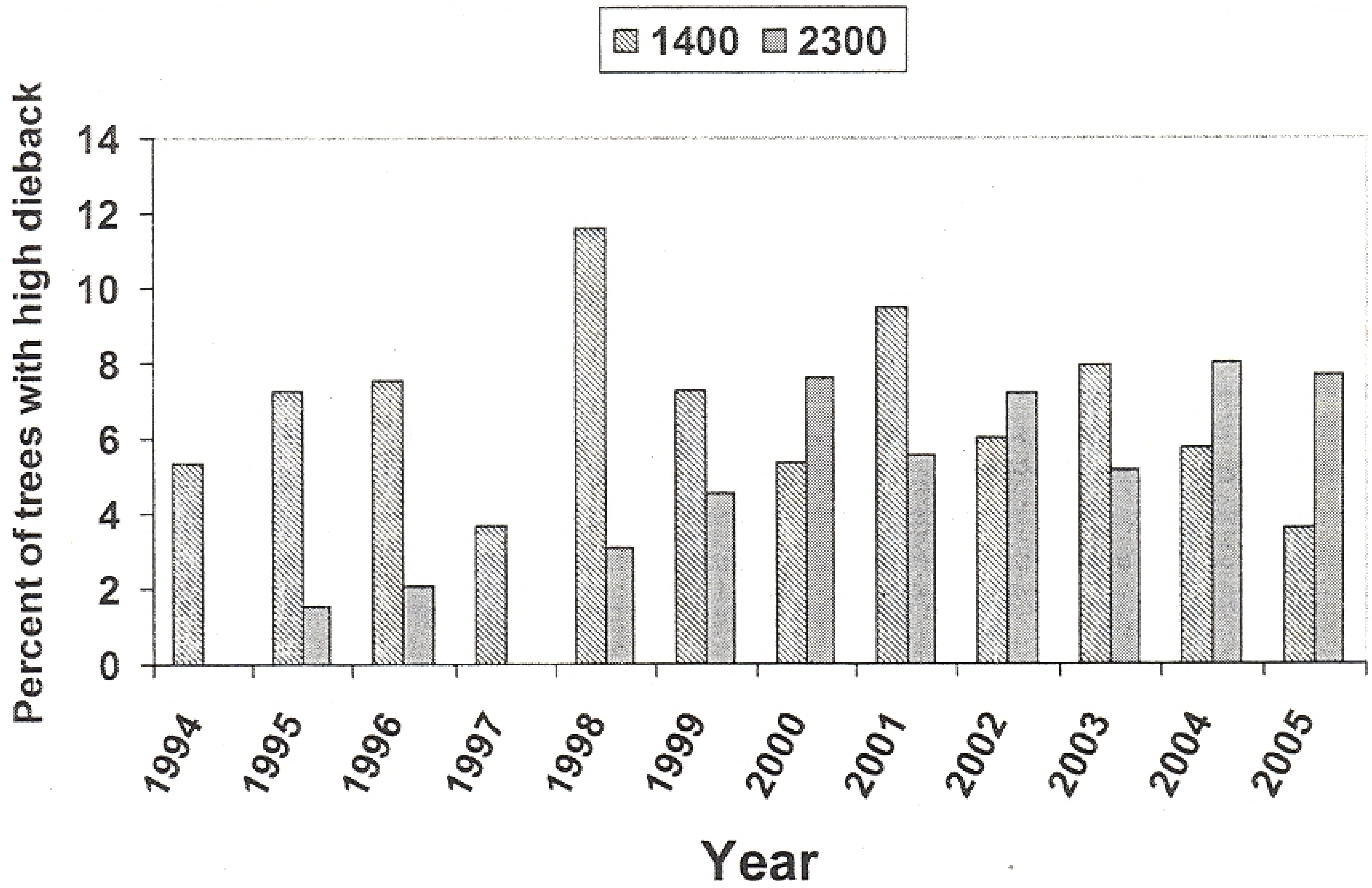


Figure 39. Trend in the percent of trees with high dieback (>15%) at two elevations in the Lye Brook Wilderness Area.

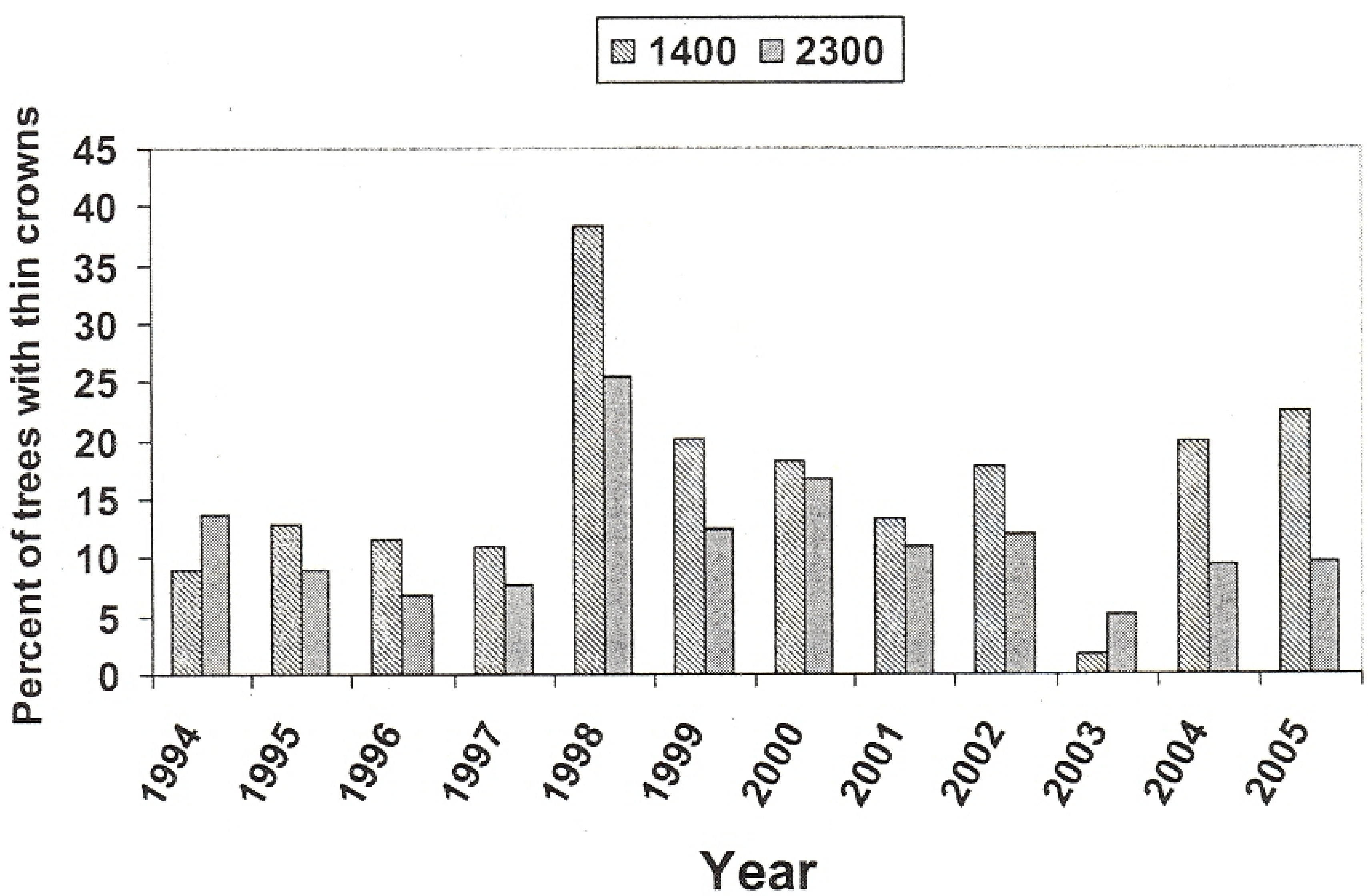


Figure 40. Trend in the percent of trees with thin crowns (<40% crown density) at two elevations in the Lye Brook Wilderness Area.

Table 31. Tree notes from forest health plots in the Lye Brook Wilderness Area, 2005.

Elevation	Species	Tree Notes	Elevation	Species	Tree Notes
	Black Cherry	Eastern Tent Caterpillars		Balsam Fir	Brown needles
	Black Cherry	Very thin crown		Balsam Fir	Witches broom
1400	Red Maple	Little Early Color	2300	Balsam Fir	Witches broom
	Red Maple	Root sprung		Balsam Fir	Yellowing needles
	Red Maple	Maple Leaf Cutter-light defoliation		Balsam Fir	Yellowing needles
	Paper Birch	Bronze birch borer		Red Maple	Red leaves
	Paper Birch	Bronze birch borer		Red Maple	Broken off at 16 ft.
				Red Maple	Broken off at 7'
				Red Maple	Light Feeding
				Red Maple	Little Early Color
				Red Maple	Porcupine
				Red Maple	Red leaves
				Red Maple	Slight Color
				Red Maple	Slight Color
				Paper Birch	Light Feeding
				Beech	BBD Severe
				Beech	BBD Severe
				Beech	BBD Severe
				Beech	BBD Severe
				Beech	BBD Severe

Trends in tree health on Mount Mansfield

Low elevation trees monitored on the west slope of Mount Mansfield remained healthy in 2005, while high elevation and east slope forests continued to show tree health problems (Figure 41). Percent of overstory trees with thin crowns (<40% crown density), thin foliage (>25% foliage transparency), and high dieback (>15% dieback) are used to measure current and recent past stress impacts on trees.

The east slope plots are dominated by birch, which tends to be drought sensitive. Paper birch in particular has been affected by recent drought events. The composition of yellow birch vs paper birch on the 2200 and 3000 foot elevation plots accounts for the differences in high dieback results on the east and west slopes (Figure 42). Trends in birch health since 1997 show 2 waves of health problems, peaking in 2000 and in 2004. Drought is the likely culprit.

Trees on the summit plots, predominantly balsam fir, improved from 1992 to 2001, but have experienced increasing dieback over the past 4 years (Figure 43). Drought and heavy seed production may be involved.

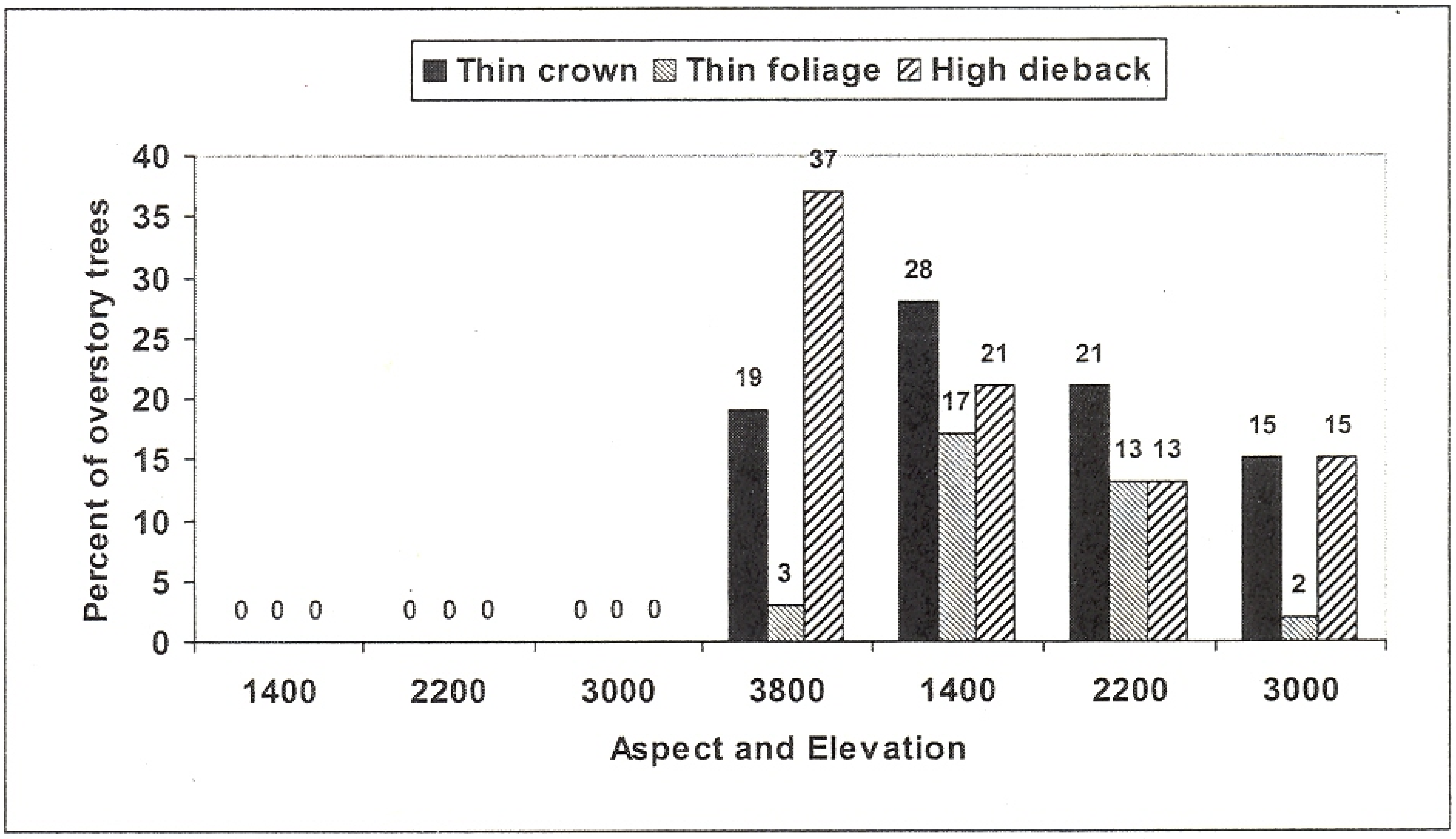


Figure 41. Percent of overstory trees on the west and east slope of Mount Mansfield with thin crowns (<40% crown density), thin foliage (>25% foliage transparency), and high dieback (>15% dieback) in 2005.

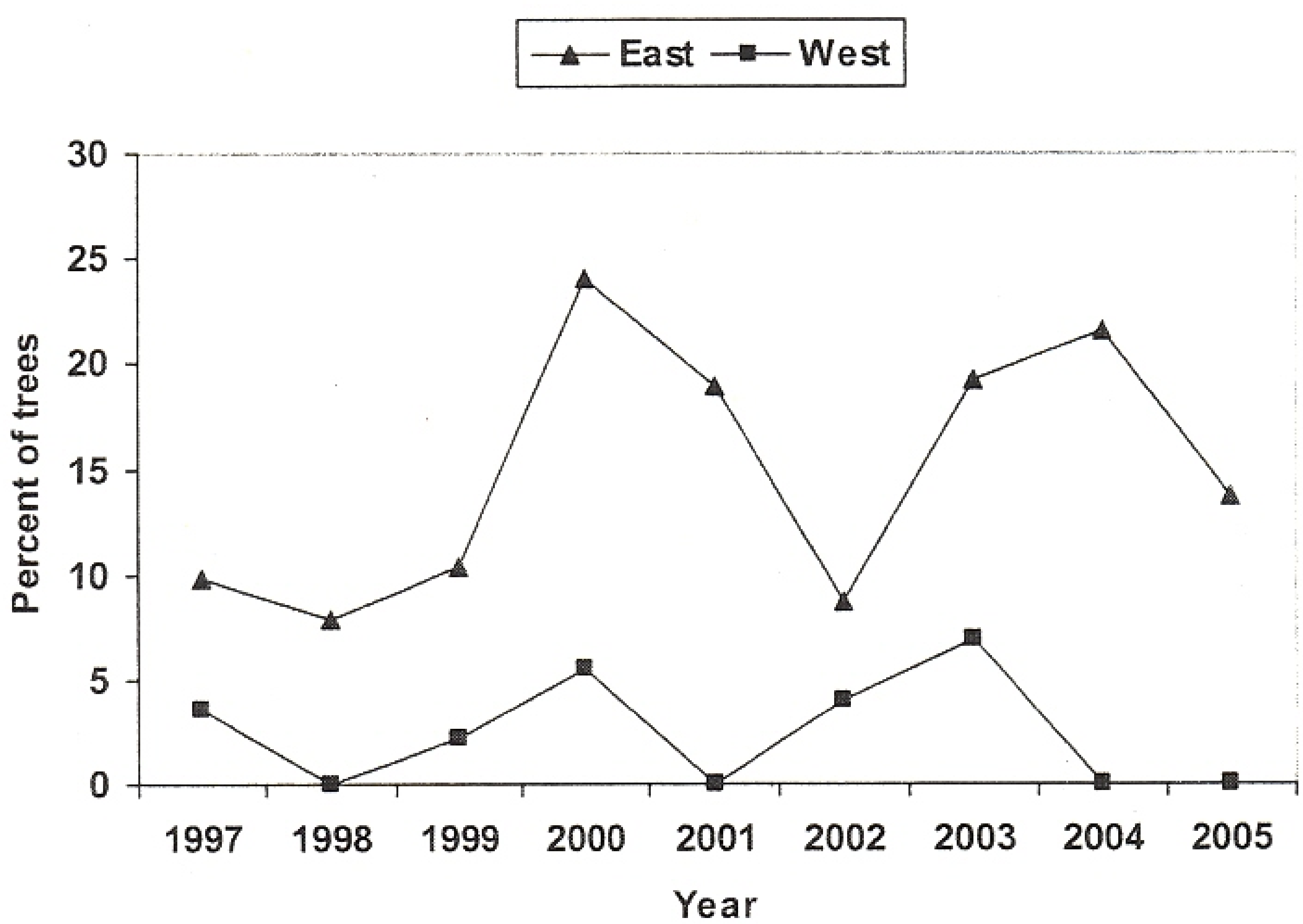


Figure 42. Trend in birch trees with high dieback (>15%) on the east vs west slopes of Mount Mansfield. Data are from four plots at 2200 and 3000 foot elevations on each side of the mountain, and include overstory yellow birch and paper birch trees.

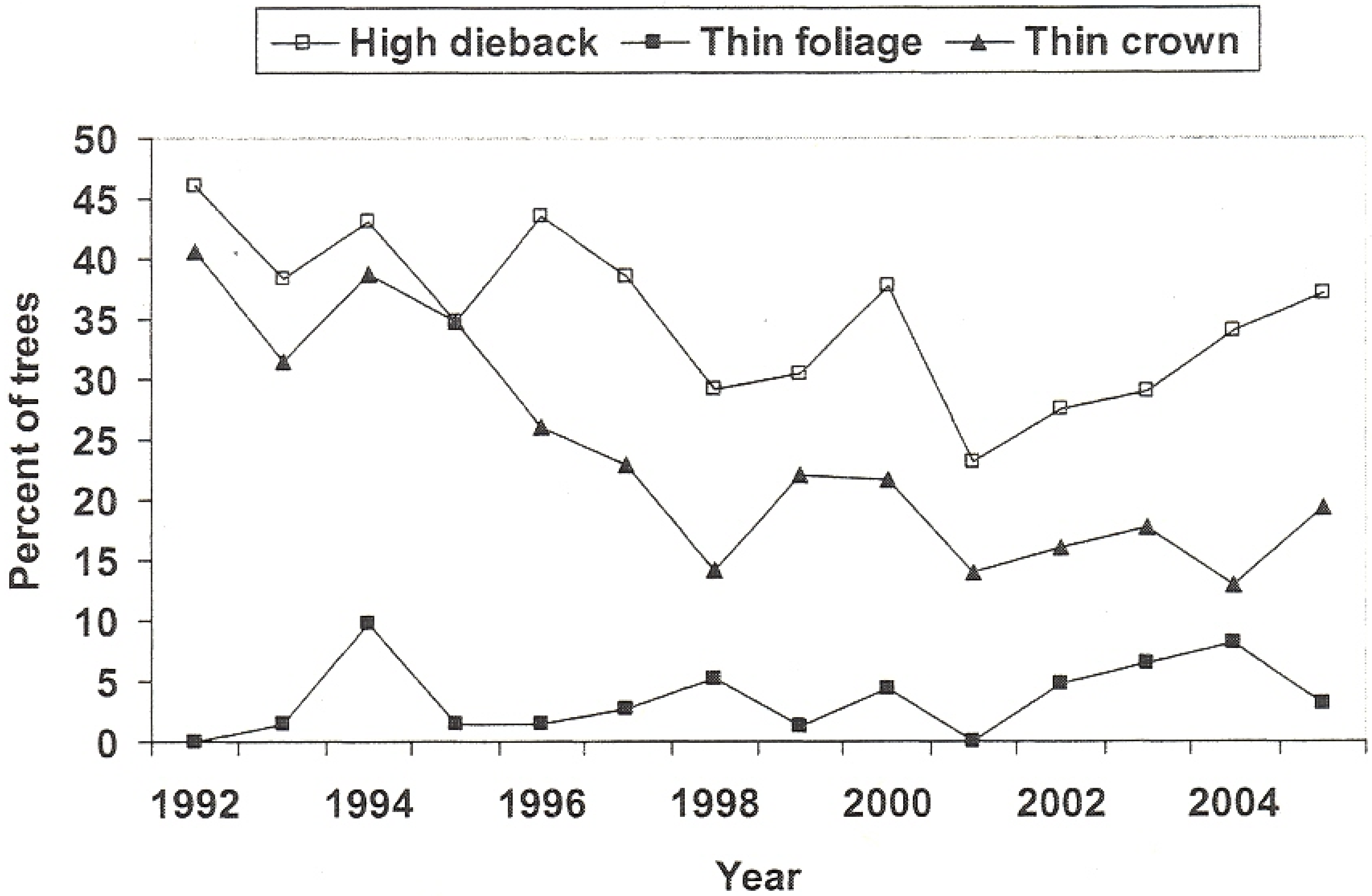


Figure 43. Trend in trees with poor health at the summit of Mount Mansfield. Data are from 70 overstory trees on 2 plots at a 3800 foot elevation.

URBAN AND COMMUNITY FORESTRY

About the Program
Funded in part by a grant from the USDA Forest Service, Vermont's Urban & Community Forestry Program is designed to help communities plan, plant, and care for their community trees. Since the program's inception in 1991, the program has provided technical and financial assistance to over 150 Vermont communities and more than $965,000 in competitive grants have been awarded to Vermont municipalities and volunteer organizations all over Vermont. Visit the web site at www.Vtcommunityforestry.org.

Financial Support
Trees for Local Communities (TLC) Cost-share Program provides money to Vermont communities for the purpose of developing and implementing local urban and community forestry programs.

Technical Assistance
Consultation and on-site technical assistance is available from the District Urban and Community Foresters in 5 regional offices, the Community Involvement Coordinator, the Program Coordinator and the Forest Health Specialists.

Information & Education
The Town Green newsletter, a quarterly publication, can be found at:
http://www.vtfpr.org/urban/for_urbcomm_towngreen.cfm

Urban Tree Health
Information on each specific pest is located in the appropriate section within this document, but a summary of insect and diseases of concerns follows.

From records kept at the Forest Biology Lab, the top urban tree insect pest concerns for 2006 were viburnum leaf beetle, European fruit lecanium scale and ants associated with honeydew. Other pests of concern were forest tent caterpillar, birch leafminer, euonymous caterpillar, Asiatic garden beetle, and Japanese beetle. Three nuisance invaders, boxelder bug, western conifer seed bug, and Harmonia ladybeetles were rampant across the state.

Stem diseases which drew attention on urban trees were black knot on cherry, botryosphaeria causing dieback on stressed trees and cytospora canker on blue spruce. Lilac blight and fireblight of apple were also noticed in significant numbers. Pine foliage was affected by lophodermium needlecast and spruce was by rhizosphaera needlecast. The fungal disease, giant tar spot, damaged many Norway maple. This alone and in combination with anthracnose caused many Norway maples to exhibit brown foliage by mid-to-late August and followed by early defoliation.

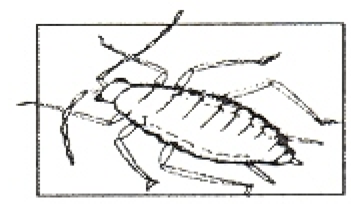
COMMON PESTS OF CHRISTMAS TREES IN VERMONT 2005

REPORTED BY THE

DEPARTMENT OF FORESTS, PARKS AND RECREATION

INTRODUCTION

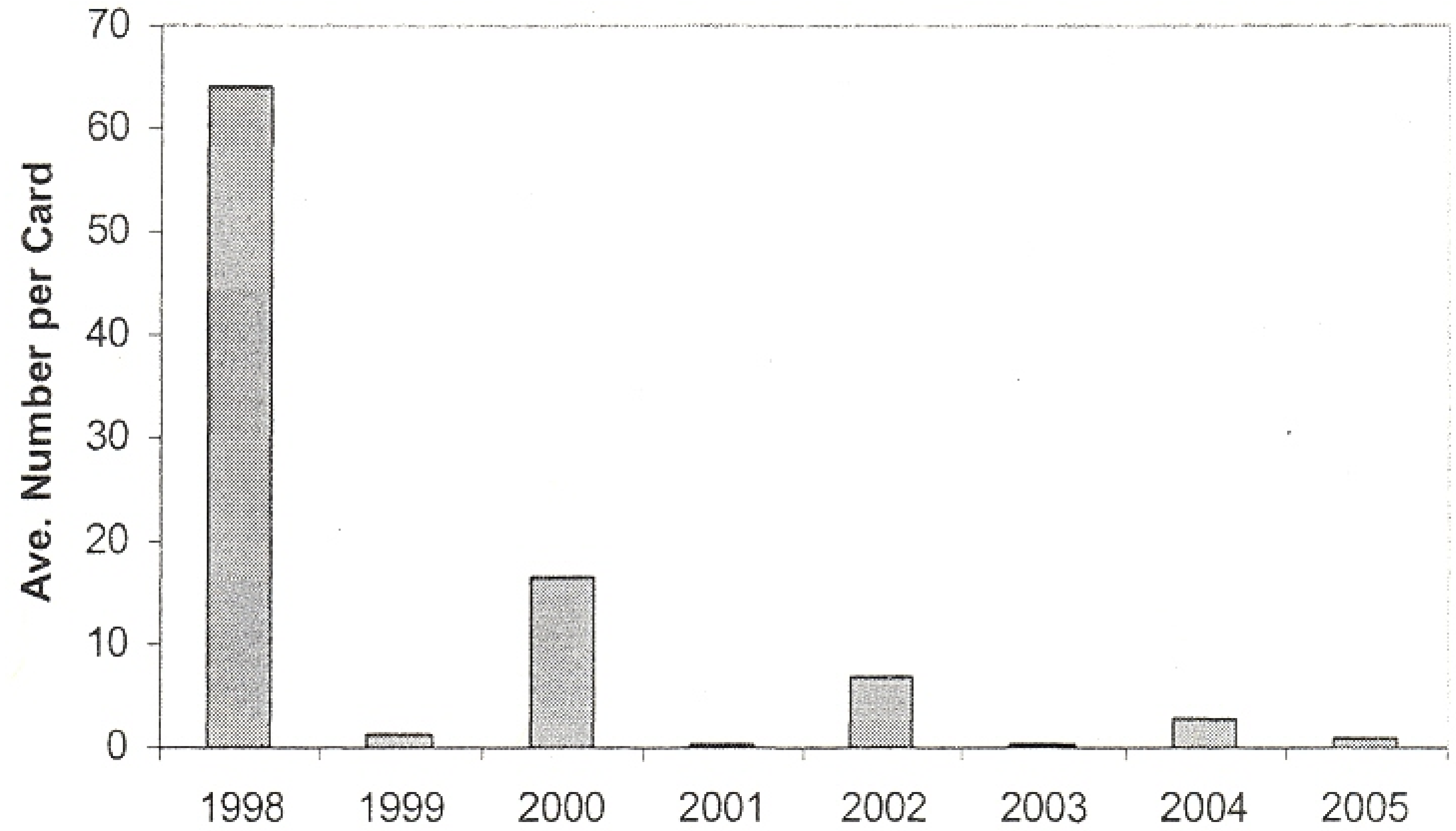
Information in this report is based largely on observations by Forest Resource Protection personnel, including some spot-checks of key plantations. This was an excellent growing season for Christmas trees, similar to 2003 and 2004, and again many growers reported that their trees had few insect and disease problems.



INSECTS

Balsam Gall Midge populations remained extremely low, with little or no damage in most Christmas tree plantations. Damage remained noticeable in one Cabot plantation and there were a few reports of very light damage visible in some areas where it was not noticeable in 2004. Populations appear to be increasing slightly but if they follow past patterns, this insect should not be a problem in most locations during the next 1 – 2 years.

Balsam Shootboring Sawfly population levels were low, this being an odd year, but damage to balsam fir Christmas trees was higher than normal for the number of adults emerging. This is thought to be due to the prolonged cool spring weather that kept balsam buds at the right developmental stage for egg-laying for a long time. Adults caught on 3x5 yellow sticky cards placed in mid-crowns of trees in Lamoille County increased somewhat for an odd year but were still at very low levels (0.8 per card). The pattern of adults caught is fairly reflective of damage levels, as 1998 was by far the year with the heaviest damage. This insect is expected to increase some in 2006 and has the potential to become a problem once again.



Number of Balsam Shootboring Sawfly Adults Caught on 3x5" Yellow Sticky Cards from 1998 to 2005.

Balsam Twig Aphid damage was mostly light but with some moderate damage reported for the first time in 3 years. This slight increase in damage is compared to an almost total absence of damage last year. Expect populations to increase in 2006.

Balsam Woolly Adelgid populations collapsed due to cold temperatures in January. This insect was not observed on Christmas trees in 2004 or 2005.

Cinara Aphids were noticed on a single fir tree in Bakersfield.

Cooley Spruce Gall Adelgid galls on blue spruce were found in only one location this year, in a Brownington plantation. Light populations were commonly seen on the alternate host, Douglas-fir.

Eastern Spruce Gall Adelgid damage to white spruce remains common, at mostly light to moderate levels.

Gypsy Moth caused light defoliation of spruce Christmas trees in West Pawlet.

Pine Root Collar Weevil was found to be infesting several white pine Christmas trees in Bennington.

Pine Spittlebugs were seen on white pine, balsam fir and other conifers scattered throughout the state but were at light levels.

Root Aphids were associated with discoloration and dieback of young fir trees in plantations in Springfield and Essex.

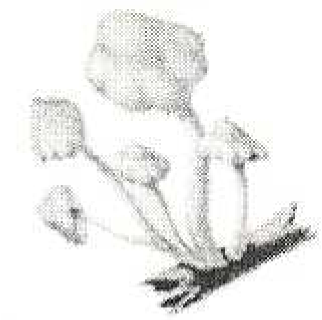
Sawyer Beetle adults were sometimes seen but damage was infrequent.

Spruce Bud Moth damage was common at light levels on blue spruce in widely scattered locations in northern Vermont.

Spruce Spider Mite populations remained mostly low. One plantation in Barton had a trace of damage but it was not observed elsewhere in northern Vermont. In southern Vermont, there was occasional moderate damage to balsam fir, especially affecting the inner crowns.

White Pine Weevil damage to pine and spruce trees remained common throughout the state area but damage remained mostly at light levels.

DISEASES



Armillaria Root Rot continues to be a problem associated with tree mortality in more and more plantations. This is particularly true for Fraser fir and for plantations where trees are inter-planted near old stumps. Drought conditions in 2001-02 probably made trees more susceptible.

Brown Spot Needle Blight was widespread and often heavy on white, red and Scots pines this year. Very light damage was seen on Scots pine Christmas trees in Brownington. If anyone still growing this species had an abnormal amount of needle casting this year, brown spot may be involved. Look for reddish-brown, resinous spots bordered by yellow on current year needles.

Cyclaneusma Needlecast of Scots pine remains very common but mostly at light levels.

Delphinella Tip Blight damage to balsam fir remained at light levels this year except for an occasional tree with moderate or heavy damage. Damage to Concolor fir was more serious, with most infected trees unmarketable.

Diplodia (Sphaeropsis) Tip Blight was commonly seen this year, with light to moderate damage. Hosts included balsam fir, Fraser fir and white pine.

Fir-Fern Rust, which was very common in 2004, was even more widespread this year, with damage increasing to moderate or heavy levels on some individual trees in some plantations, particularly edge trees that were partially shaded during the day.

Lirula Needlecast was observed on a couple of trees in a Craftsbury plantation. One of the trees had heavy browning of previous year needles up to the mid-crown level.

Lophodermium Needlecast remained common at mostly light levels.

Phytopthora Root Rot continues to be associated with the death of Fraser fir and occasionally balsam fir growing on poorly or somewhat poorly drained sites in more and more locations. It appears that once the organism gets established during wet years, it persists and becomes more of a problem in years with average precipitation.

Rhizosphaera Needle Blight of Fir, caused by *Rhizosphaera pini*, remains at mostly light levels in scattered locations. Harvesting of crowded trees and low pruning in plantations where this was a problem in the past seems to have helped alleviate the damage.

Rhizosphaera Needlecast of white and blue spruce remains very common, with some heavy damage to blue spruce.

Scleroderris Canker has not been found in any new towns since 1986.

Spruce Needle Rust was observed on individual blue spruce trees in a few scattered locations.

Swiss Needlecast of Douglas-fir remains common at moderate to heavy levels in some plantations in widely scattered locations.

White Pine Blister Rust damage remains common throughout the state and continues to kill white pines at moderate levels in plantations that have had the problem in the past.

White Pine Needle Blight showed up at moderate levels on white pines in a few locations.

Winter Injury was observed on the south side of fir Christmas trees where the shading trees to the south had been harvested last December, in one Craftsbury plantation. Otherwise, winter injury to Christmas trees was not reported this year.

Woodgate Gall Rust damage to Scots pine is decreasing, as growers remove heavily damaged trees.

Yellow Witches Broom Rust of balsam fir remains common at light to moderate levels.

Frost Damage was only occasionally seen this year. One plantation in Craftsbury had light damage on balsam fir.

The following pests were not observed on Christmas trees this year:

Insects: Introduced Pine Sawfly, Pine Leaf Adelgid, Pine Needle Midge, Pales Weevil, and Yellow-Headed Spruce Sawfly. .

Diseases:, Sirococcus Shoot Blight and Rhabdocline Needlecast.

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HEALTH OF SUGAR MAPLE IN VERMONT - 2005

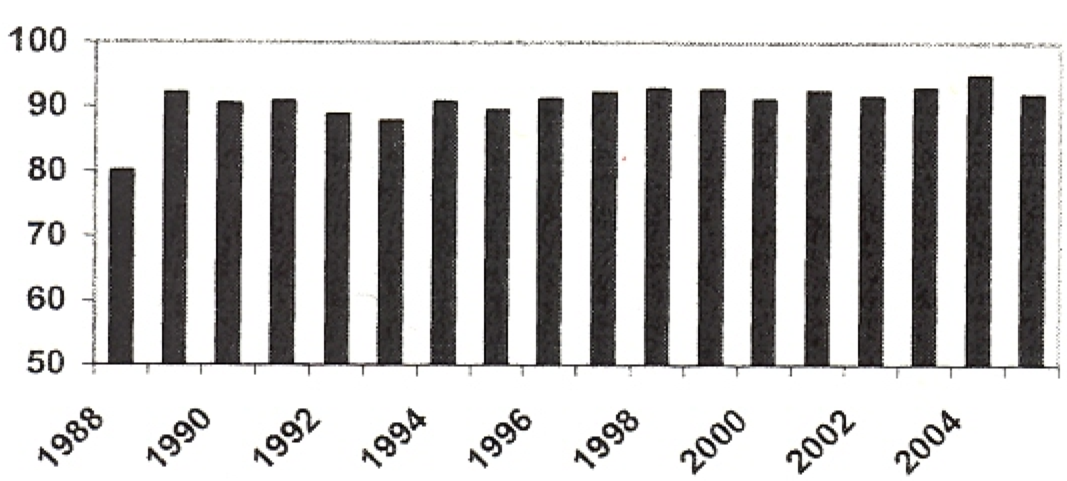
Reported by the State of Vermont Department of Forests, Parks, and Recreation

This information on health of sugar maple is based on aerial surveys and field observations by the VT Dept. of Forests, Parks, and Recreation, the University of Vermont and the U.S. Forest Service. Every year, the Department of Forests, Parks, and Recreation looks at tree health from the ground and from the air. In 2005, all 4.7 million acres of forestland were evaluated from an airplane at least once. In addition, crews assessed monitoring plots on the ground to rate tree condition.

Weather Conditions in 2005 were generally good for sugar maple. Winter weather was not severe, and late spring frosts were uncommon. Moisture was adequate throughout the growing season. In most of the state, weather stayed warm through fall leaf drop.

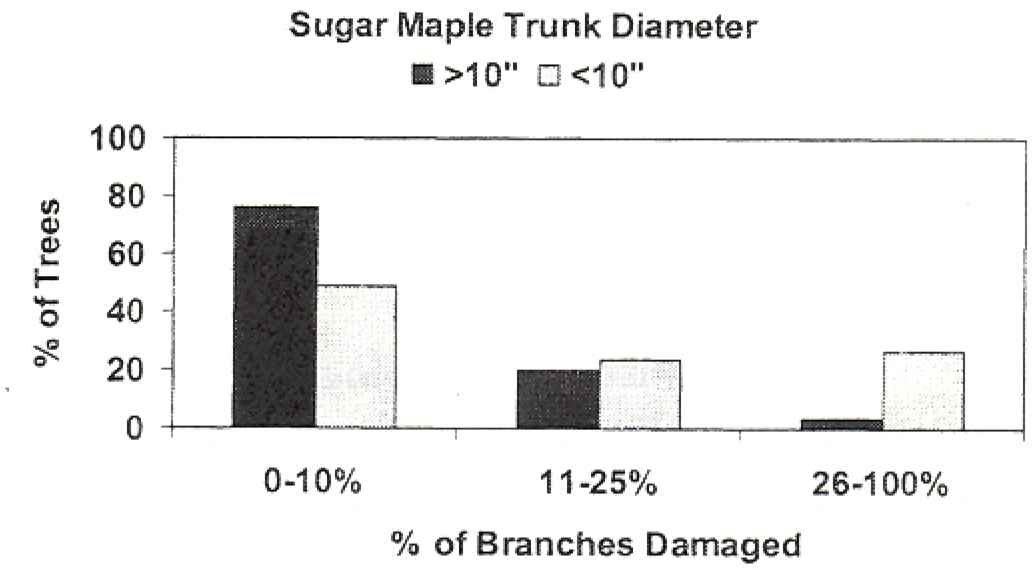
To assess the **General Condition** of maple stands, 2000 sugar maples were evaluated as part of the North American Maple Project. Over 90% of sugar maple trees on survey plots remained healthy in 2005, and mortality was low. On average, crown vigor declined from 2004, with much of the decline attributed to insect damage.

Sugar Maple Condition in Vermont: % of Trees Rated Healthy
North American Maple Project Plots



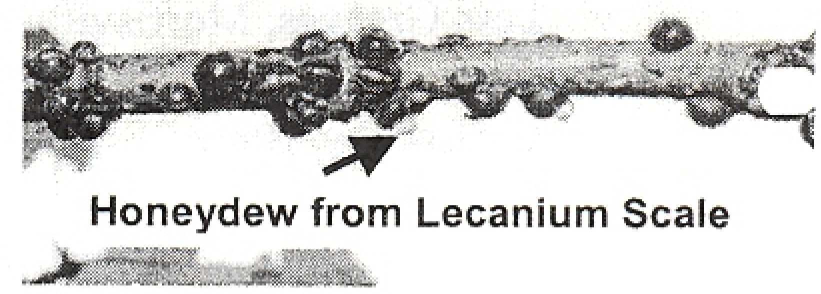
Heavy wet snow from the **October 25 Storm** caused widespread damage to trees and shrubs. Reports of sugarbush damage were received from scattered locations, especially from Orleans County. Maples were evaluated in five of these sugarbushes. The most serious impact was from small trees that bent or broke and damaged tubing systems. Understory beech trees, which had leaves at the time of the storm, were most likely to be affected, followed by birch, conifers and other hardwoods. Damage generally decreased with decreasing latitude. No sugar maples large enough to tap lost more than half of their branches and most lost less than 10%. Three-quarters of the smaller sugar maples (under 10" in diameter) lost less than 10% of their branches, but 24% had broken or bent main stems.

Impact of October 25 Snow Storm on Sugarbushes in Orleans County



Most maples, except those with severely bent or broken main stems, should fully recover.

Lecanium Scale was heavy on hardwoods throughout the northeast, including sugar maple in Vermont. Scale covered at least 30% of the twig surface in 43% of the maple plots we evaluated. We think it will be noticeable again next year, because there are a lot of young insects on the twigs of infested sugarbushes this winter.

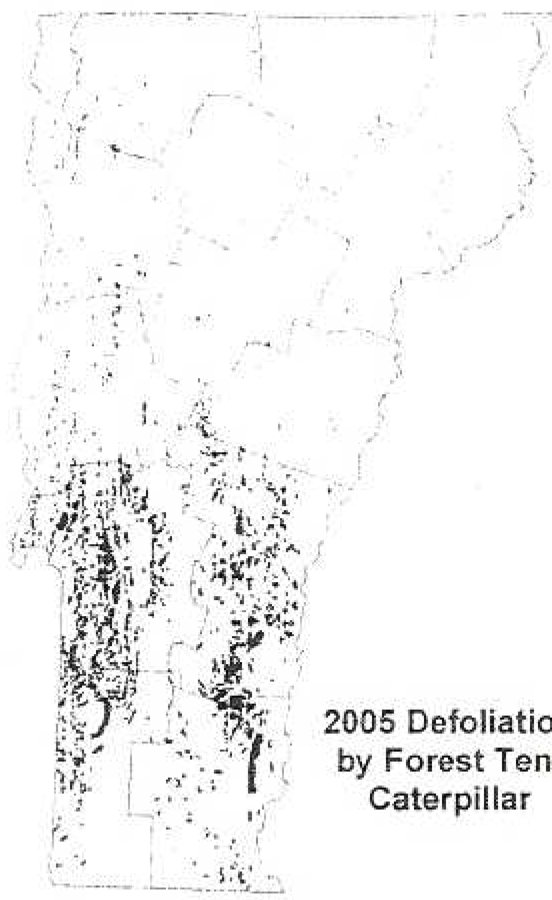


Honeydew from Lecanium Scale

If you were aware of "rain" in late spring, or had a black coating on your tubing, your trees were fed on by this sucking insect. As it feeds, Lecanium scale excretes a sweet liquid. This "honeydew" supports the growth of a black sooty mold.

There is much we don't know about this insect, including why populations are so high, or what its impact will be. Specimens were collected from a variety of hosts, and confirmed to be the native European Fruit Lecanium by the USDA. Twig dieback was associated with the scale in some sugarbushes, and may be related to scale feeding.

By late summer, the leaf disease called **Maple Anthracnose** was widespread. Leaves were infected during the wet spring, then dried out over the course of the summer. Damage was worse on lower branches, near wetlands, valleys, and low-lying areas. Although these trees didn't contribute much to fall foliage, the impact of the browning on tree health shouldn't be too bad, since the damage occurred so late in the season…except if the trees were also defoliated by forest



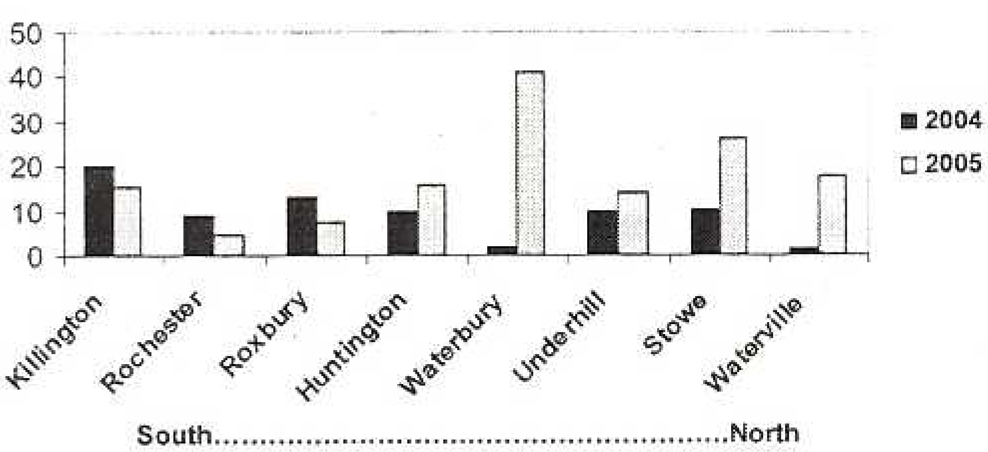
2005 Defoliation by Forest Tent Caterpillar

tent caterpillar. **Forest Tent Caterpillar** defoliation was widespread, with the most extensive damage in Rutland, Bennington, Windsor and Windham Counties. The revised area mapped is 230,000 acres in 12 counties Unlike 2004, trees refoliated normally.

Twenty-seven sugarbushes, totaling 1600 acres were sprayed in late spring with Foray, a formulation of the biological insecticide Bt. Costs were split between participating landowners and government funds. The treatment was effective in most sugarbushes, and caterpillars died wherever spraying occurred. Rainy weather delayed the pesticide application. In some southern locations, defoliation was already heavy by the time spraying could occur.

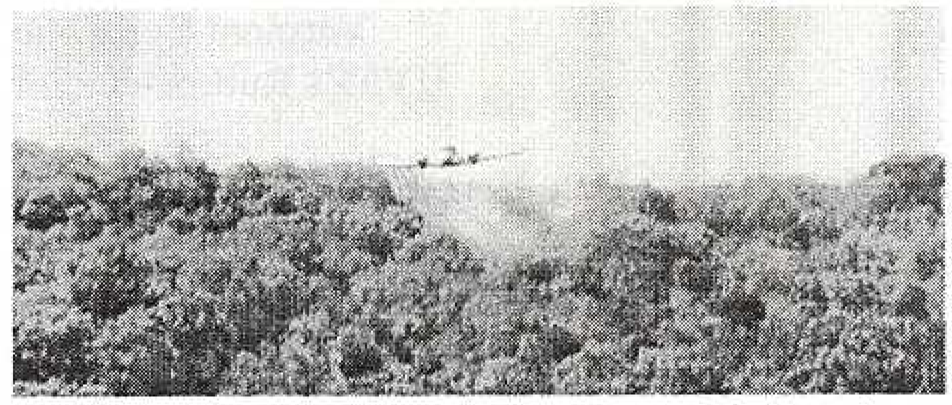
The number of forest tent caterpillar moths caught in traps increased this summer, indicating there will be defoliation in 2006. We expect more noticeable damage in northern Vermont. Egg mass surveys predict defoliation in many sugarbushes that were defoliated in 2005 and in new areas as well.

Average Number of Forest Tent Caterpillar Moths per Trap



This outbreak will collapse naturally, but, so far, that doesn't seem to be happening. Historically, outbreaks last 1-3 years in one region, but 3-8 years statewide, as new regions are defoliated.

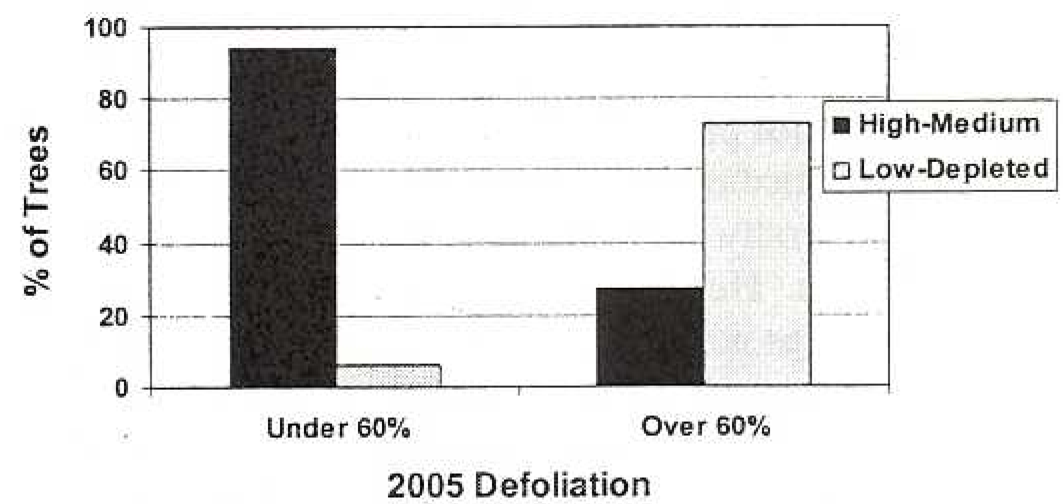
The State of Vermont will provide assistance to sugarmakers again in 2006 by doing egg mass surveys and by coordinating an aerial spray project. *Please pay attention to the deadlines if you may want to be part of the spray project.* We're going to have to stick to a schedule in order to get the spraying done on time. Landowners must sign up for on-site population surveys by February 15th, and commit to spraying by March 1st.



We continue to discourage tapping defoliated trees. Most importantly, tapping trees that have been defoliated two years in a row is flirting with trouble. A drought in the next year or two could put these trees over the edge. Be especially conservative if your soil is very acidic, or if your trees are unhealthy to begin with.

We tested root starch in four sugarbushes which were defoliated in 2004. Those study trees which weren't heavily defoliated in 2005 had ample food reserves in the fall. Most that were heavily defoliated two years in a row were low or depleted in starch reserves.

2005 Root Starch Compared to 2005 Defoliation
(All Trees were Defoliated in 2004)



It's a good time to switch to smaller spouts if you haven't already, and a bad time for timber harvesting. Be flexible, so you can postpone cutting. While thinning usually benefits tree health, during an outbreak it can increase damage from defoliation. Current Use plans can be amended by contacting the county forester.

Maple Webworm was very noticeable late in the year, especially in sugarbushes where there had been a lot of forest tent caterpillars. This insect feeds inside rolled up leaves, and thrived on leaves that were already rolled by forest tent caterpillars in the process of making cocoons.

Meeting Summary

23rd Vermont Forest Pest Workshop

January 4, 2006

UVM Aiken Center

Co-sponsored by

Vermont Department of Forests, Parks and Recreation and

UVM's Rubenstein School of Environment and Natural Resources

Moderators: **Dale Bergdahl**, UVM forest pathologist, and **Scott Pfister**, Vermont's Chief of Forest Protection

Jonathan Wood, Vermont's Commissioner of Forests, Parks and Recreation, presented an award to **Senator Patrick Leahy** for long time support of research and service to Vermont's environment and forests. **Bob Paquin** was present to accept the award for Senator Leahy.

Kevin Dodds, entomologist with the USFS in Durham, gave an update on *Sirex noctilio*, the European wood wasp, detected in western NY and in Ontario. The wasp is known to favor hard pines such as Scots, red, Jack, pitch and Austrian. Kevin filled us in on the intricate biology of *Sirex*, including the toxic mucus and symbiotic fungus, *Amylostereum areolatum*, the ovipositing female injects into the host tree. Kevin discussed possible control methods including silvicultural thinning of suppressed, weakened trees, which the wasp tends to favor; a nematode that lives in the host trees and sterilizes the female wasp; as well as native parasitoids.

Juli Gould, with USDA APHIS, presented on the emerald ash borer (EAB). She reviewed the history and life cycle of and damage caused by the beetle now found in Michigan, Indiana, Ohio, and Ontario, with isolated (hopefully eradicated) incidences in Maryland and Virginia. As of 2005, the borer has now been captured in the Upper Peninsula of MI. She emphasized the dangers of firewood spread, explained the early suppression methods in MI, and outlined current research by APHIS, Forest Service, and Michigan State University, including host, control, and survey studies. Juli's own research involves searching for biological controls using insect parasites from China, one of the countries of origin of EAB.

UVM Forest Entomology Lab

Don Tobi presented his work on the effects of three sugarbush management techniques on incidence and abundance of several insect pests. He listed the advantages to sugarmakers to increasing tree species biodiversity in their maple stands from increasing parasites and predators for pest insects to reducing dispersal of pests. He surveyed for a long list of maple defoliators, such as maple leaf cutter, forest tent caterpillar, and others, as well as Lecanium scale, sugar maple borer, and eutypella canker. He found increased defoliation, dieback, and incidence of pests in pure maple stands vs. mixed stands. However, he found no relationship with pear thrips since this insect will readily feed on other host species. Don recommends keeping sugarbushes at 75% sugar maple and retaining regeneration of other species.

Vladimir Gouli reported on the Lab's efforts to find a fungal biocontrol for elongate hemlock scale, introduced from Japan and often found on hosts with hemlock woolly adelgid. Using fungi isolated from the scale in NY, PA, and MA, they have identified several genera of promising fungi, but are focusing on *Myriangium* sp., a well-known control of armored scale, and *Lecanicillium* sp. Neither fungus is lethal to plants.

Adane Kassa introduced us to a new formulation for spreading biocontrol fungi especially in hemlock woolly adelgid management. He is studying the use of fluid whey, a by-product of cheese manufacturing. The whey-based medium acts as a carrier, protectant, nutrient-source, shield, and sticker for the biocontrol fungus and can be sprayed onto host trees with no adverse environmental impact.

Agency of Agriculture

Tim Schmalz, new plant pathologist, summarized the EAB survey program he worked on this past summer. The plan is to locate and map Vermont's forest ash trees, urban ash trees, firewood use areas, campgrounds, and sawmills that process ash.

Vermont Department of Forests, Parks and Recreation

Barbara Burns reported on forest tent caterpillar conditions. The insect defoliated 230,000 acres statewide in 2005, mostly in southern Vermont. She reviewed the aerial Bt spray program and admitted loss of confidence in their egg survey methods. Binoculars and spotting scopes are not proving as efficient in detecting egg masses as the laborious pole pruners. 2006 could bring another heavy FTC defoliation year based on the high number of moths trapped during the summer.

With his usual beautiful photography, **Ron Kelley** brought to life the European Fruit Lecanium Scale, a pest causing dieback of sugar maple, oak, and ash. He showed us the life stages, the oozing and dripping of honeydew that attracts sooty mold, and natural enemies, both fungi and insects. Surveys showed the scale present throughout VT in varying population levels. He also presented data showing the relationship of scale presence to height within a tree. Other insects Ron ran across this year included: elm scurfy scale, beech leaf tier, maple-basswood leaf roller, maple webworm, and saddled prominent.

Sandy Wilmot, presented draft concepts for Healthy Forests: A New Model for the Vermont Forestry Division. The old model balanced environmental, economic, and social values for sustainable forests. In the new model, healthy forests are considered most important. The belief is that a healthy forest has the capacity for self-renewal of its ecological productivity, diversity, complexity, and resiliency. The work group is developing criteria and indicators to use to measure healthy forests. They will incorporate economic and social values later.

Sean Lawson, of the Vermont Monitoring Cooperative, went over changes in the VMC over the last year, not the least of which is the launching of their new website. The monitoring tower was reconstructed at Proctor in Underhill, a 3-way mercury collector comparison was initiated at Underhill, the mercury deposition network site at Underhill was expanded, and a new red spruce study was begun at Mt. Mansfield. He discussed the fall phenology study on Mt. Mansfield with the objective to time fall coloration. 2005 brought later color and later frost than average.

Ben Machin, of Redstart Forestry, discussed his joint projects with UVM, the State, the Forest Service, and others focused on pest risk assessment throughout Vermont. ForAgProtect is a statewide GIS decision support system. Their work has produced statewide maps of ash sawmills and state park campgrounds as part of a risk assessment for emerald ash borer and maps of nurseries and seasonal residences as potential pathways for hemlock woolly adelgid introduction. On a more local scale, his work with Marsh Billings Rockefeller National Park has produced maps pinpointing parcels of greatest risk to HWA introduction.

UVM Forest Pathology Lab:

Shari Halik reported on her work with potential insect vectors of the butternut canker fungus. Two beetle species, commonly found on dead/dying butternut, carry and consume abundant spores of the fungus. Lab studies show that the spores remain viable and pathogenic to butternut seedlings after passage through the digestive tracts of these beetles. Although not proven vectors, these beetles are probably carrying spores to new sites within butternut crowns or to new trees where they may deposit the spores in fecal pellets and cause new infections.

Dale Bergdahl discussed the status of butternut in Vermont. Work done by grad students **Tim Schmalz** and **Dan Ruddell** predicts 85% mortality of butternut throughout Vermont by 2011. Dale also reported on the exotic blue stain fungi he has found associated with *Tomicus piniperda*, the European pine shoot beetle, and other native and exotic bark beetles in Scots pine in Derby, VT. He then summarized the winter severity index and HWA risk assessment work completed by former grad student **Shane Lishawa** in the southern 4 counties of Vermont.

Prize Winners:
Poster/Display Contest:
1st Hiding in the Forest by **Trish Hanson**
2nd Exotic Invasive Tree Diseases by **Cindy Ash**
3rd Assessment of Butternut Canker by **Dale Bergdahl** et al.

Most Unusual Pest Contest:
1st Horseshoe Tree Miner collected by **Jim White**
2nd Ash Hole Borer collected by **Mike Johnson**
3rd Spruce Nest collected by **Don Tobi**

Special thanks to the Vermont Department of Forests, Parks and Recreation for providing lunch and refreshments and to the UVM Rubenstein School of Environment and Natural Resources for providing meeting space in the Aiken Center.

Also, many thanks to Marcia Caldwell and other Rubenstein staff for preparing coffee and setting up lunch and Shari Halik for providing us with this summary.

Thanks to all (80+) who attended. Hope to see you again next year!

BARK BEETLES IN VERMONT

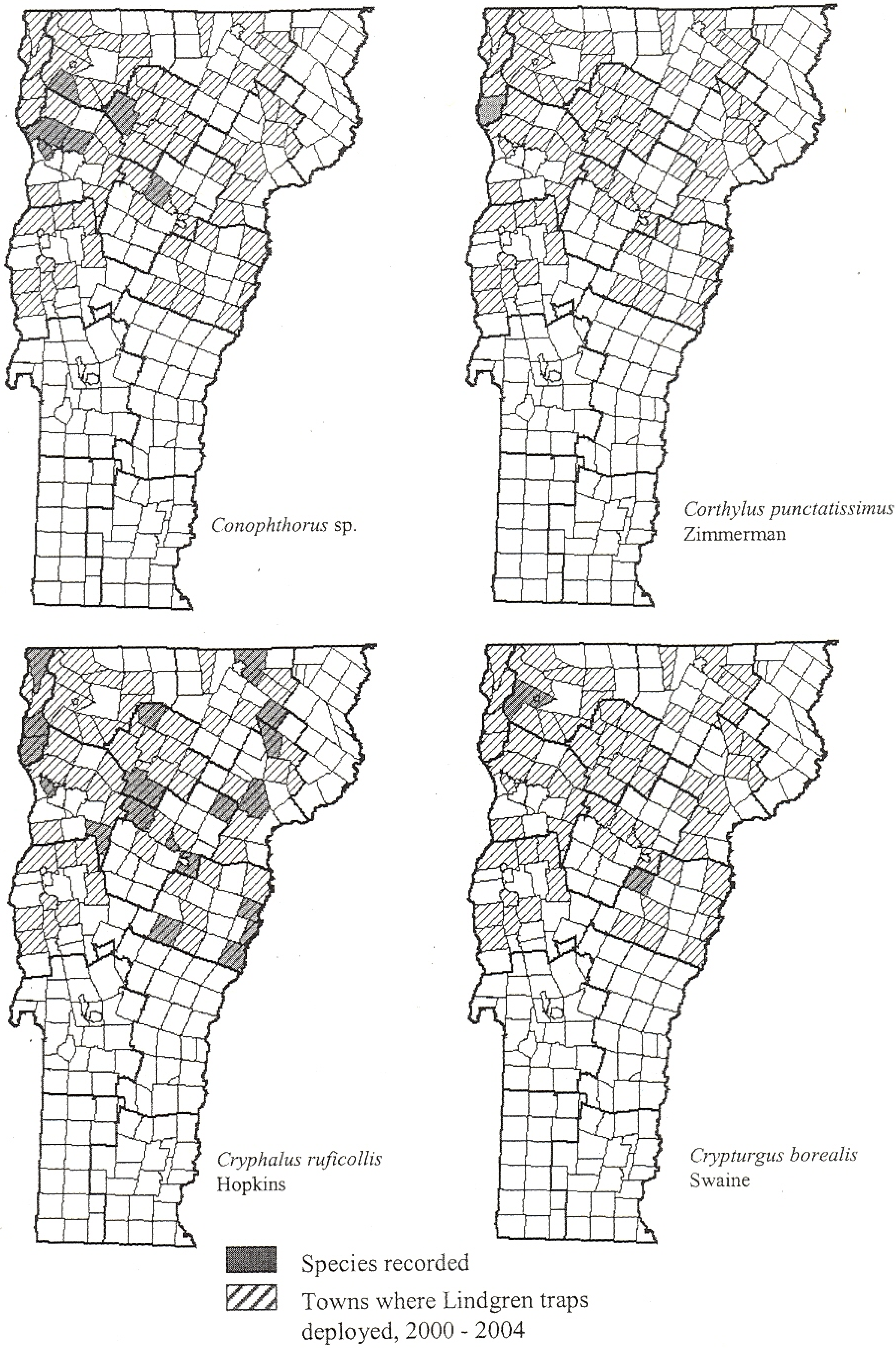
With support from the Cooperative Agriculture Pest Survey Program (CAPS), the Forest Biology Lab was able to secure the assistance of Jessica Rykken of the Museum of Comparative Zoology at Harvard University in Cambridge, MA to identify almost 22,000 bark beetles (Scolytidae) that were captured in *Tomicus piniperda* traps in Vermont from 2000-2004. Bob Rabaglia of the USFS (Washington DC) provided additional taxonomic expertise. Over 40 species of bark beetles were identified in these "bycatches" (Table 1).

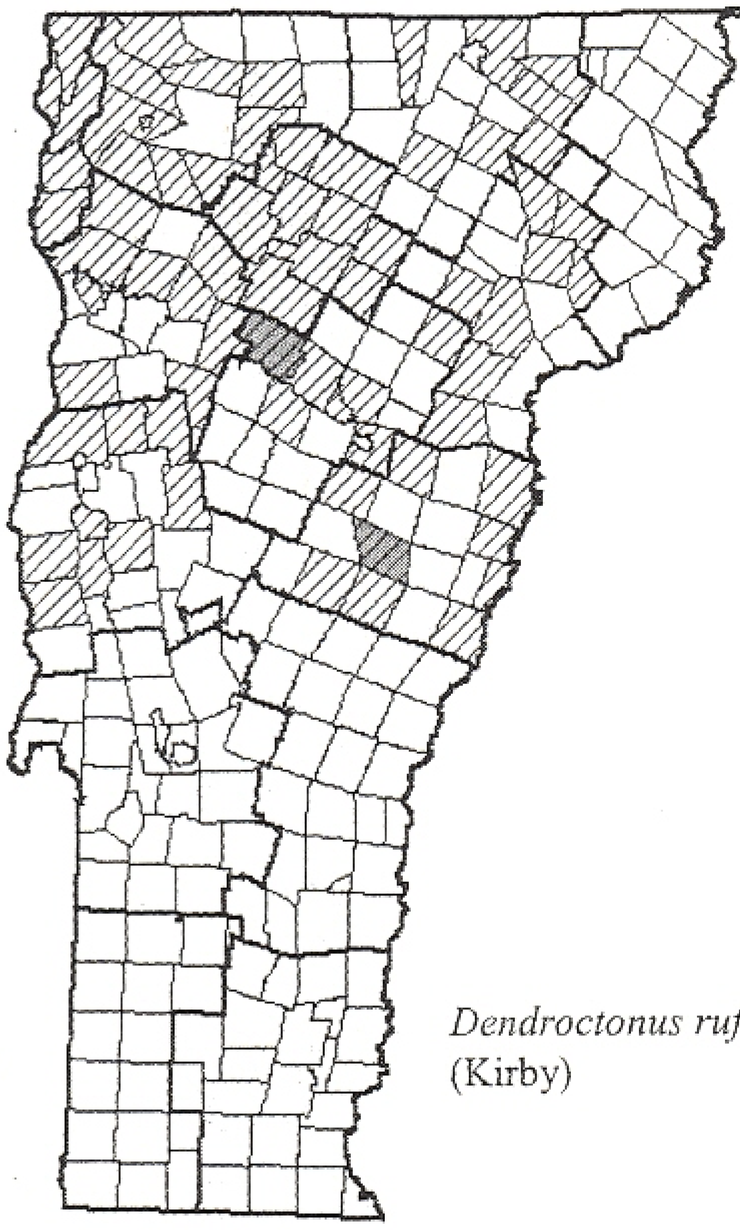
Table 1. Species and numbers of scolytids identified in collections made during *Tomicus piniperda* surveys with Lindgren funnel traps in Vermont in 2000-2004.

Species	Author	# of Towns	Number
Conophthorus sp.		6	8
Corthylus punctatissimus	Zimmerman	1	1
Cryphalus ruficollis	Hopkins	19	119
Crypturgus borealis	Swaine	2	2
Dendroctonus rufipennis	(Kirby)	2	2
Dendroctonus simplex	LeConte	1	1
Dendroctonus valens	LeConte	55	1,139
Dryocoetes affaber	(Mannerheim)	46	234
Dryocoetes autographus	(Ratzeburg)	50	745
Gnathotrichus materiarius	(Fitch)	41	369
Hylastes opacus	Erichson	69	1,163
Hylastes porculus	Erichson	54	513
Hylastinus obscurus	(Marsham)	6	8
Hylesinus aculeatus	(Say)	6	7
Hylurgops rugipennis	(Mannerheim)	55	1,022
Ips calligraphus	(Germar)	1	1
Ips grandicollis	(Eichhoff)	40	269
Ips latidens	(LeConte)	1	1
Ips pini	(Say)	15	40
Monarthrum mali	(Fitch)	5	5
Orthotomicus caelatus	(Eichhoff)	38	102
Phloeosinus canadensis	Swaine	2	2
Phloeotribus piceae	Swaine	1	1
Pityogenes hopkinsi	Swaine	9	16
Pityogenes plagiatus plagiatus	(LeConte)	1	1
Pityokteines sparsus	(LeConte)	3	3
Pityophthorus sp.		2	2
Pityophthorus sp. A		12	12
Pityophthorus sp. B		3	7
Pityophthorus sp. C		4	4
Pityophthorus sp. D		42	181
Pityophthorus sp. E		1	2
Pityophthorus sp. F		2	7
Polygraphus rufipennis	(Kirby)	48	257
Trypodendron lineatum	(Olivier)	59	15,069
Trypodendron retusum	(LeConte)	2	2
Xyleborinus alni		1	1

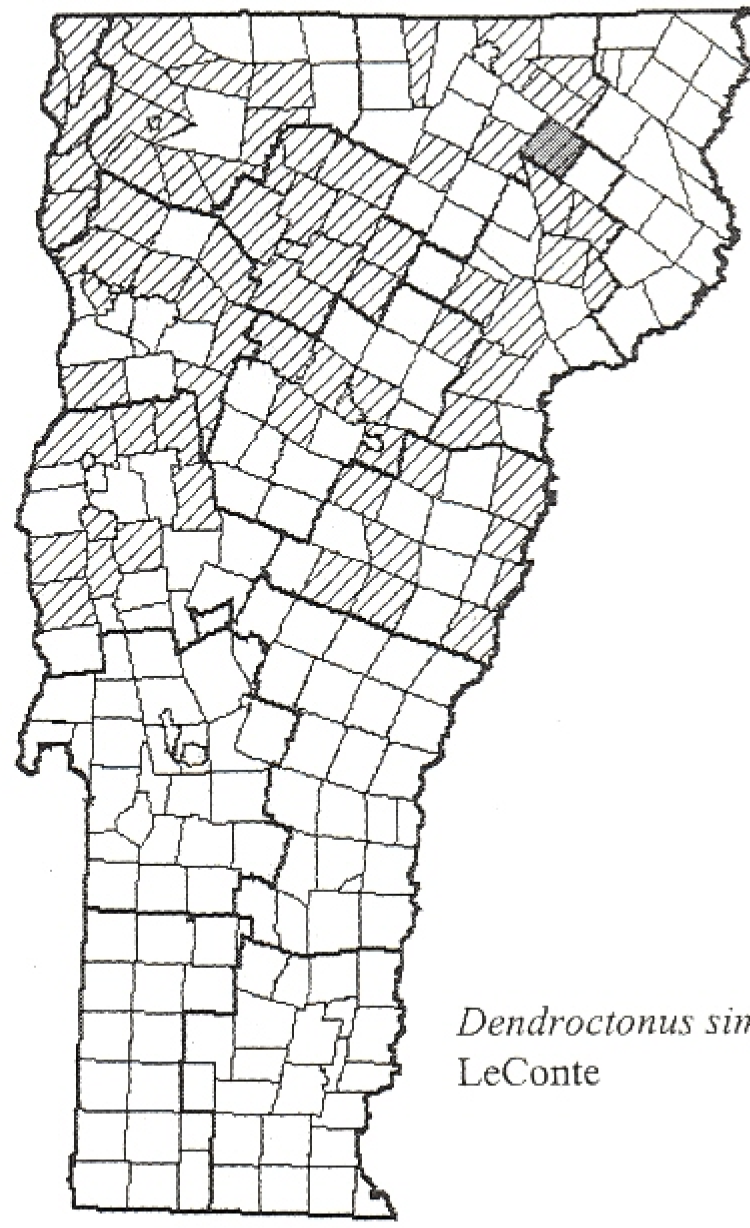
Species	Author	# of towns	Number
Xyleborus dispar	(Fabricius)	2	2
Xyleborus obesus	LeConte	3	4
Xyleborus sayi	(Hopkins)	47	346
Xylechinus americanus	Blackman	1	1
Xylosandrus germanus	(Blandford)	16	85
Xyloterinus politus	(Say)	39	92
Total			21,852

Distribution maps for each species are shown on the following pages. The complete database, with specimen identifications, geographic locations, and dates of collections, is maintained at the Forest Biology Lab in Waterbury, VT. We hope to add to these Scolytid distribution maps as additional beetle collections are sorted and identified.

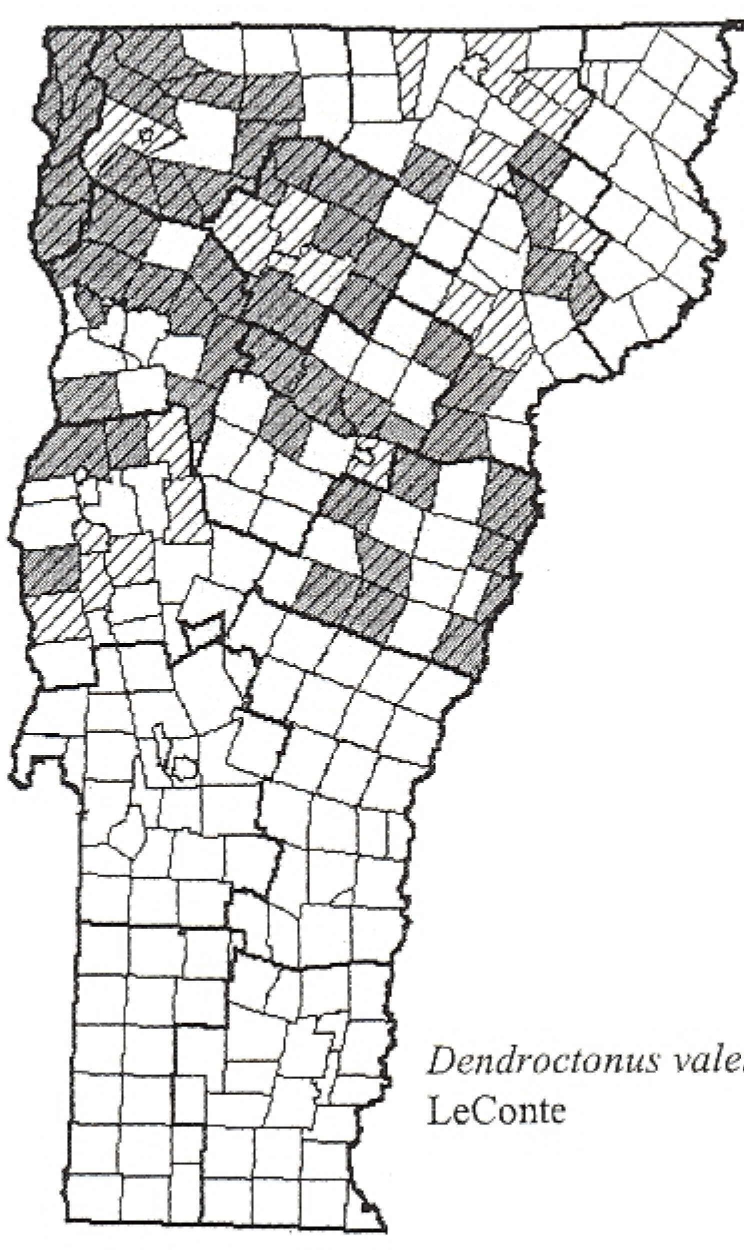

Conophthorus sp.
Corthylus punctatissimus Zimmerman
Cryphalus ruficollis Hopkins
Crypturgus borealis Swaine
Species recorded
Towns where Lindgren traps deployed, 2000 - 2004



Dendroctonus rufipennis (Kirby)



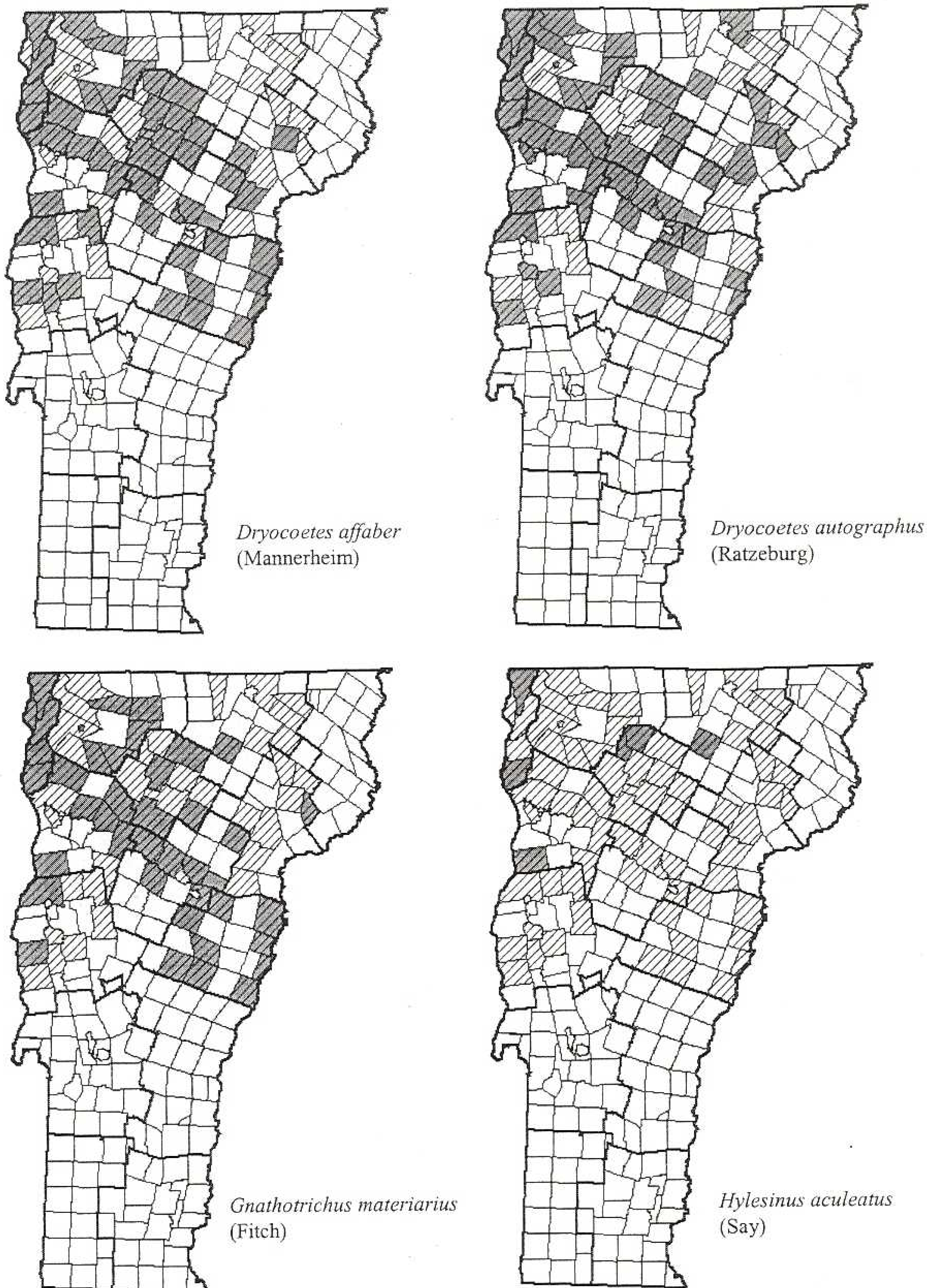
Dendroctonus simplex LeConte



Dendroctonus valens LeConte

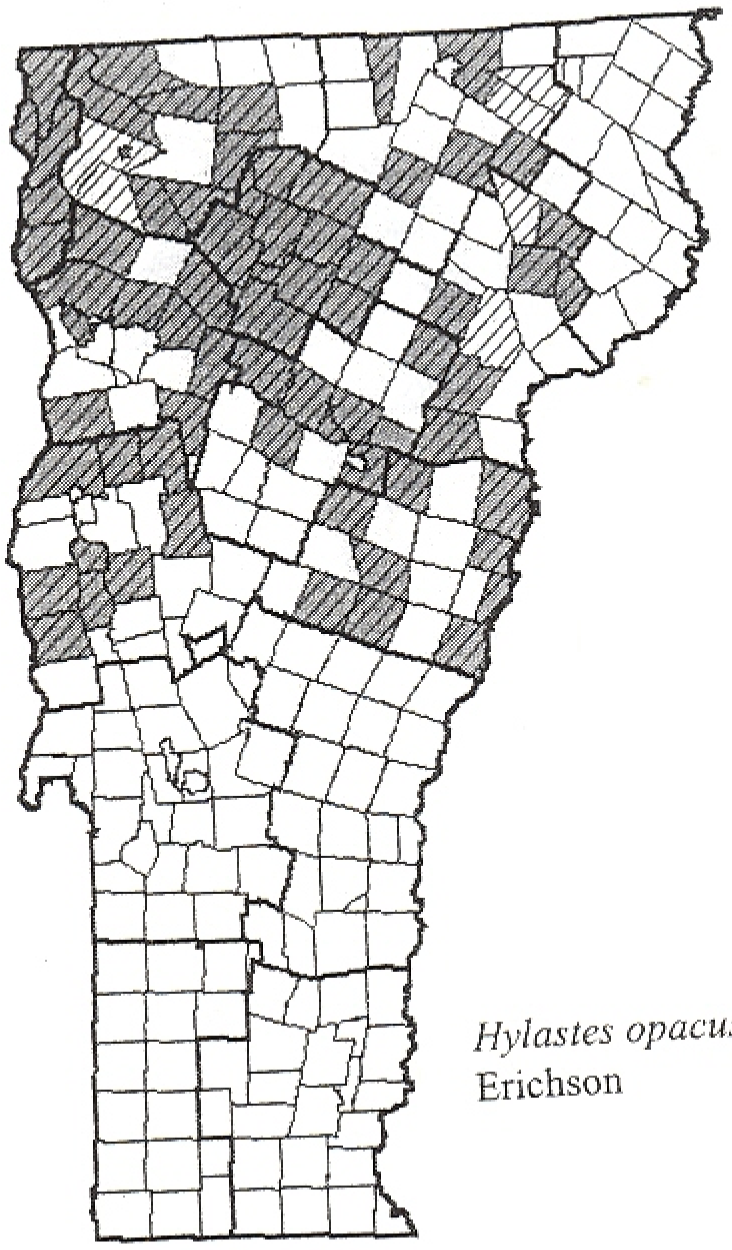
Species recorded

Towns where Lindgren traps deployed, 2000 - 2004

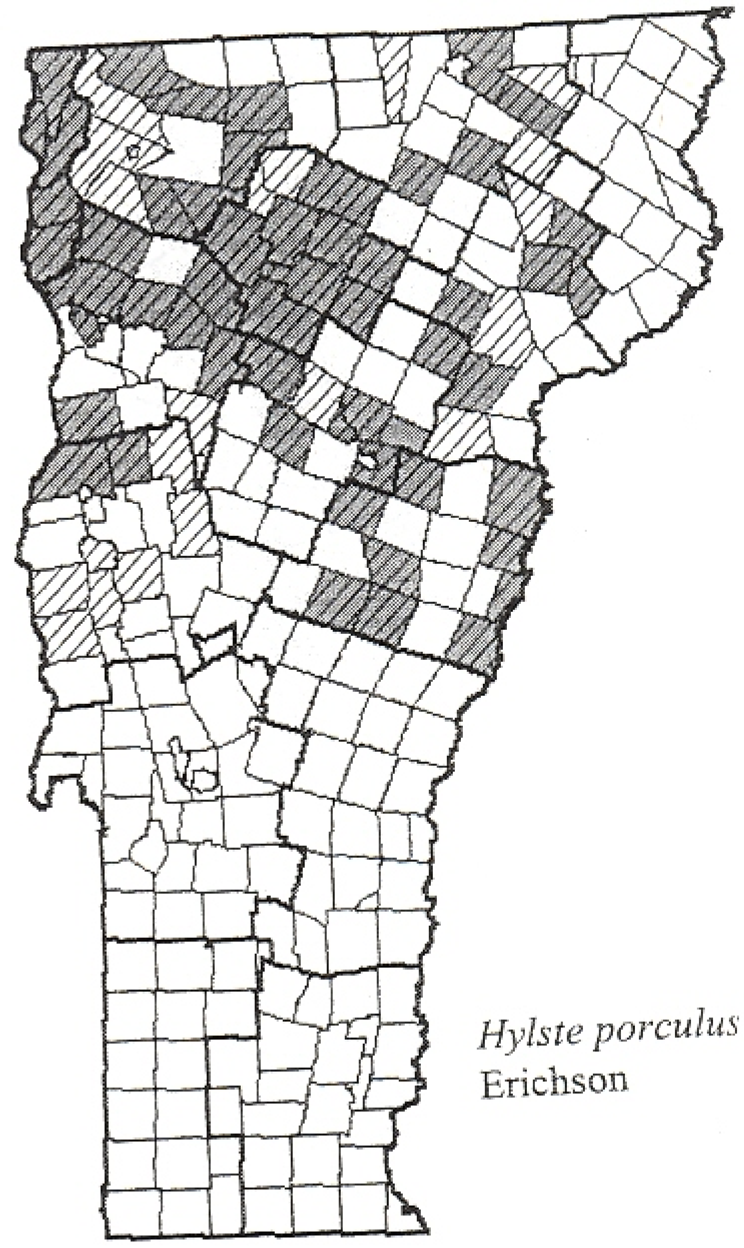


Species recorded

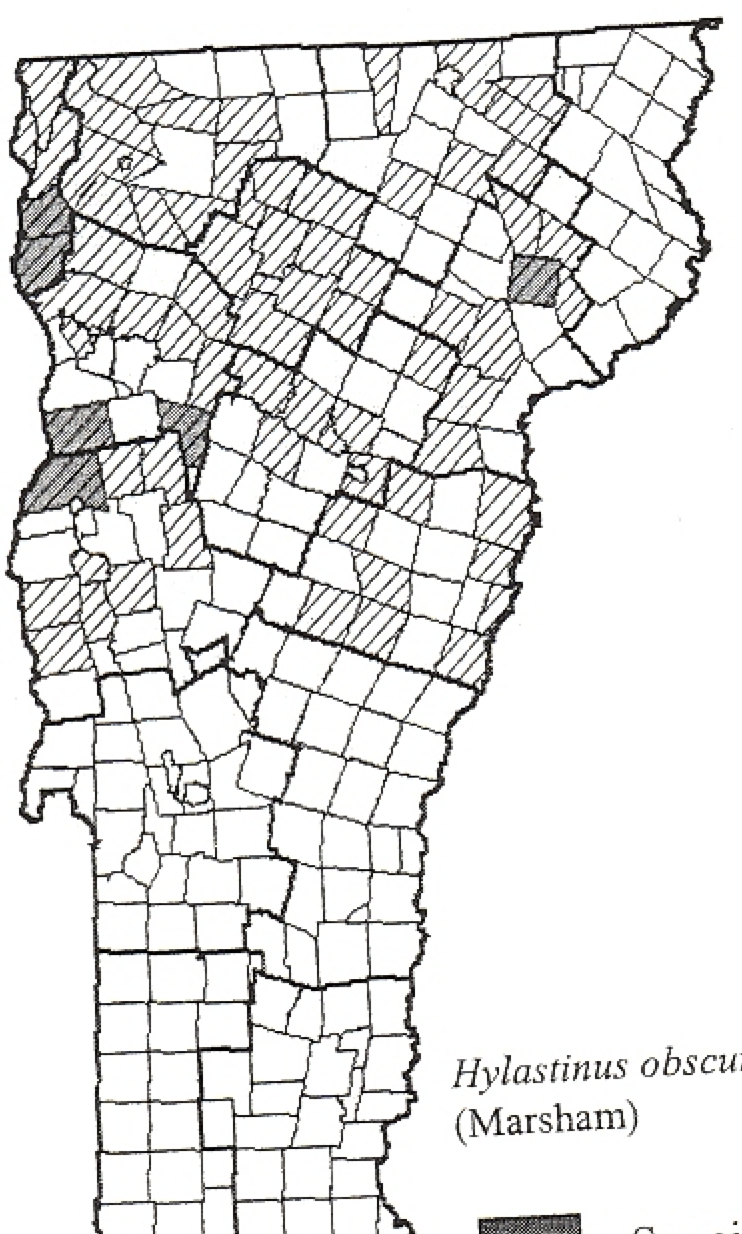
Towns where Lindgren traps deployed, 2000 - 2004



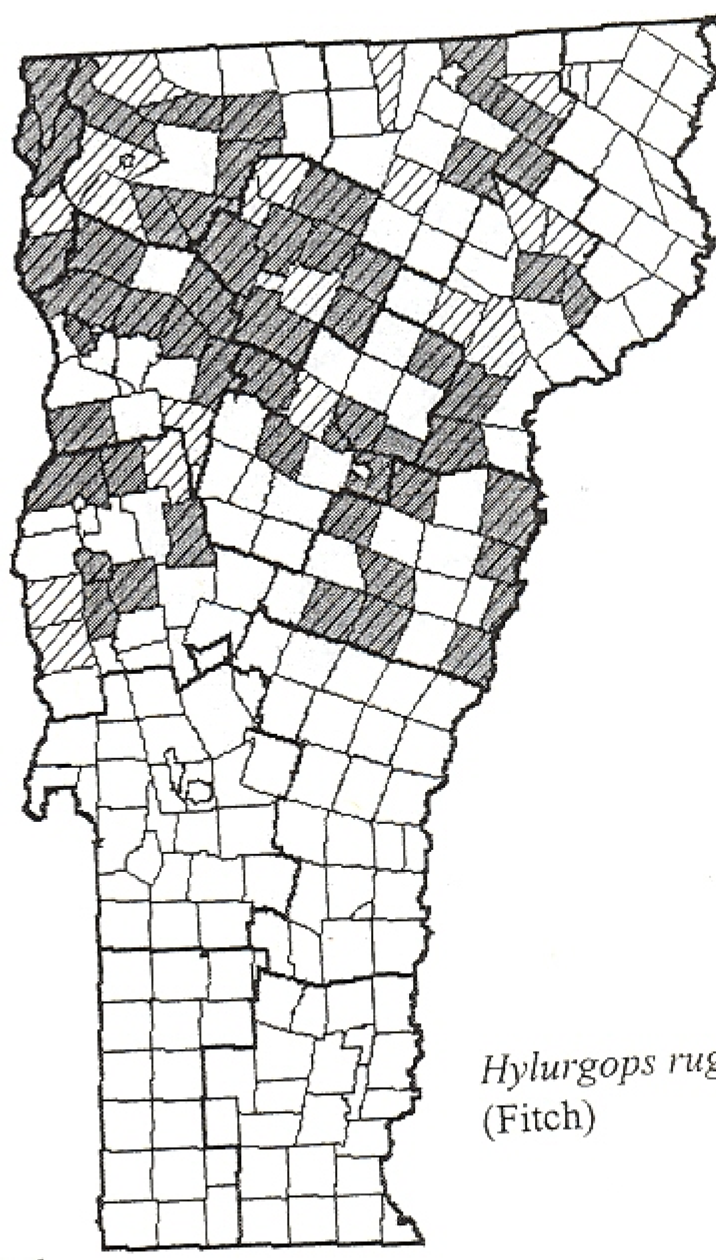
Hylastes opacus Erichson



Hylste porculus Erichson



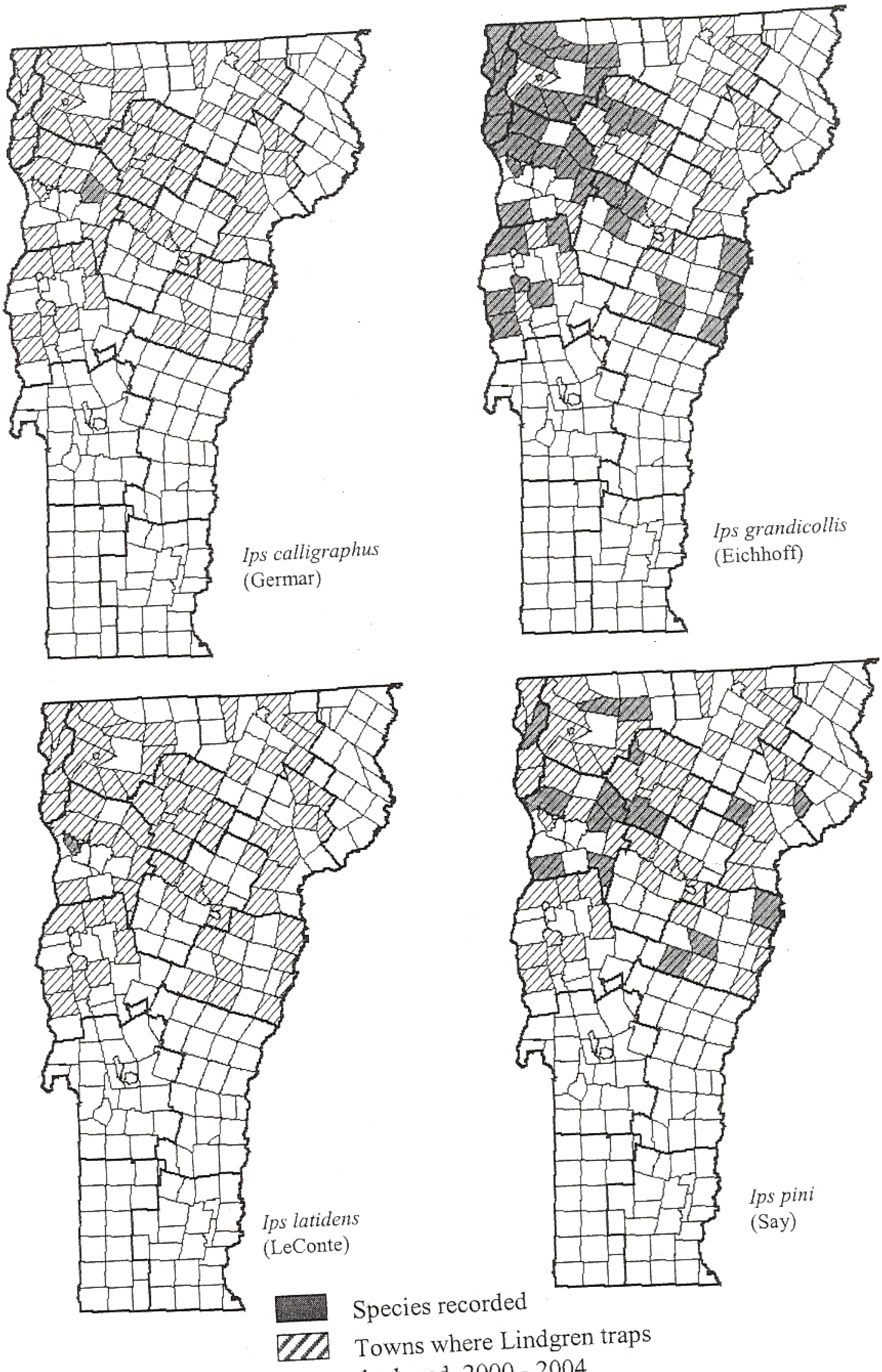
Hylastinus obscurus (Marsham)

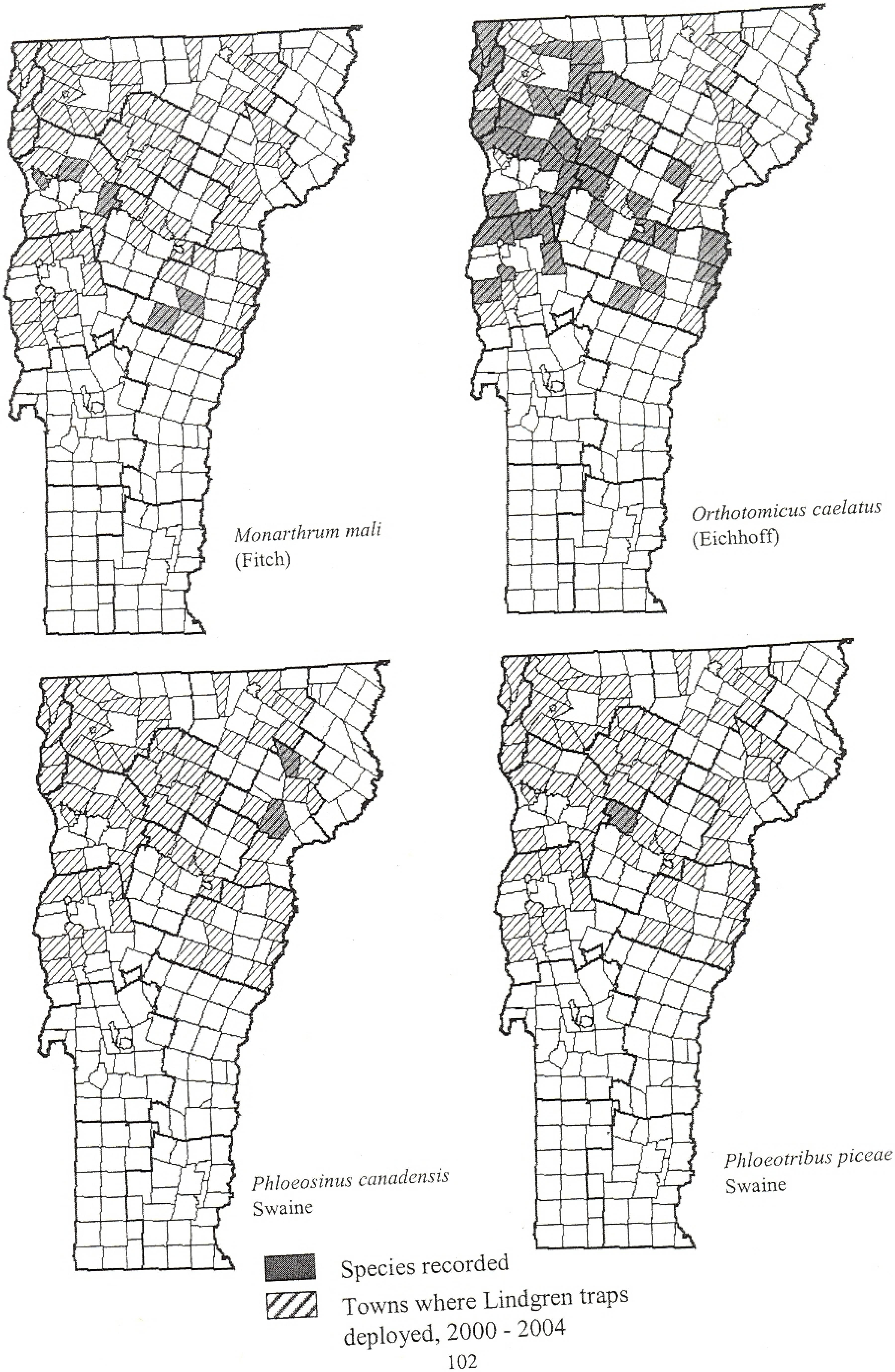


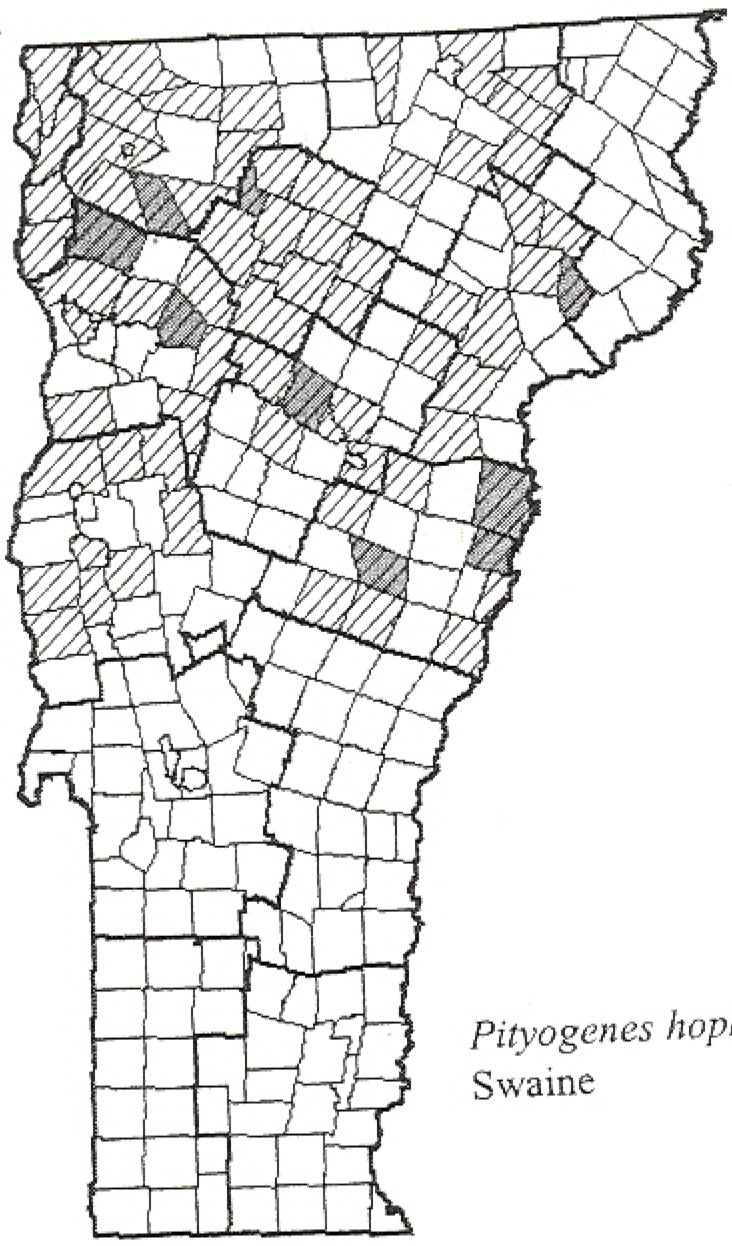
Hylurgops rugipennis pinifex (Fitch)

Species recorded

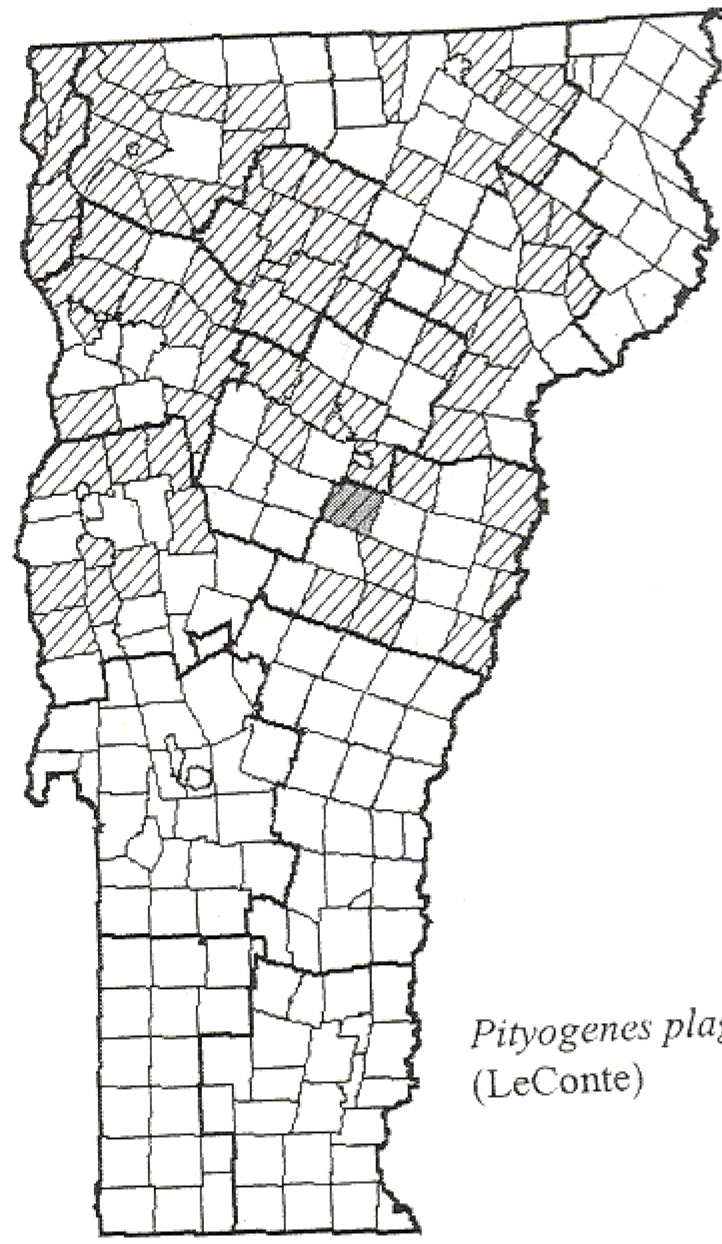
Towns where Lindgren traps deployed, 2000 - 2004


Ips calligraphus
(Germar)
Ips grandicollis
(Eichhoff)
Ips latidens
(LeConte)
Ips pini
(Say)
Species recorded
Towns where Lindgren traps deployed, 2000 - 2004

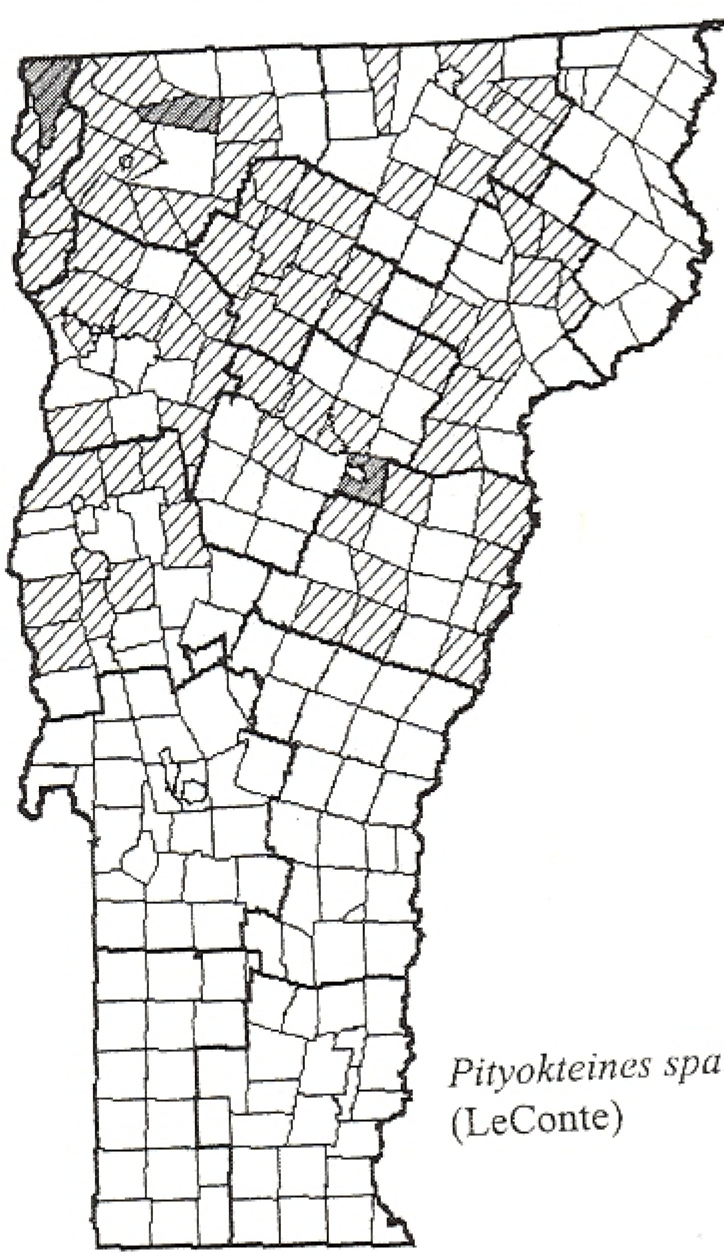

Monarthrum mali
(Fitch)
Orthotomicus caelatus
(Eichhoff)
Phloeosinus canadensis
Swaine
Phloeotribus piceae
Swaine
Species recorded
Towns where Lindgren traps
deployed, 2000 - 2004



Pityogenes hopkinsi Swaine



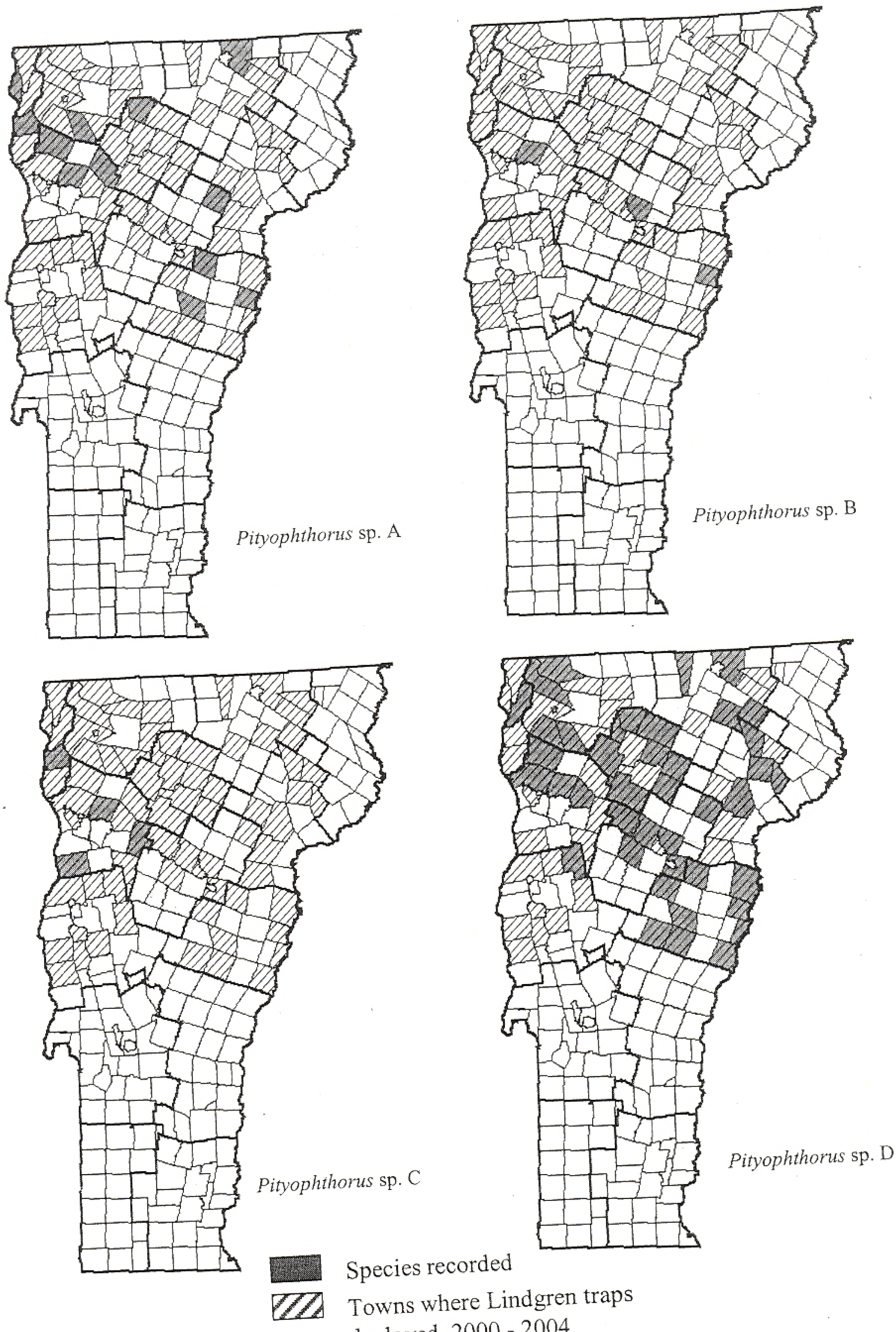
Pityogenes plagiatus plagiatus (LeConte)



Pityokteines sparsus (LeConte)

Species recorded

Towns where Lindgren traps deployed, 2000 - 2004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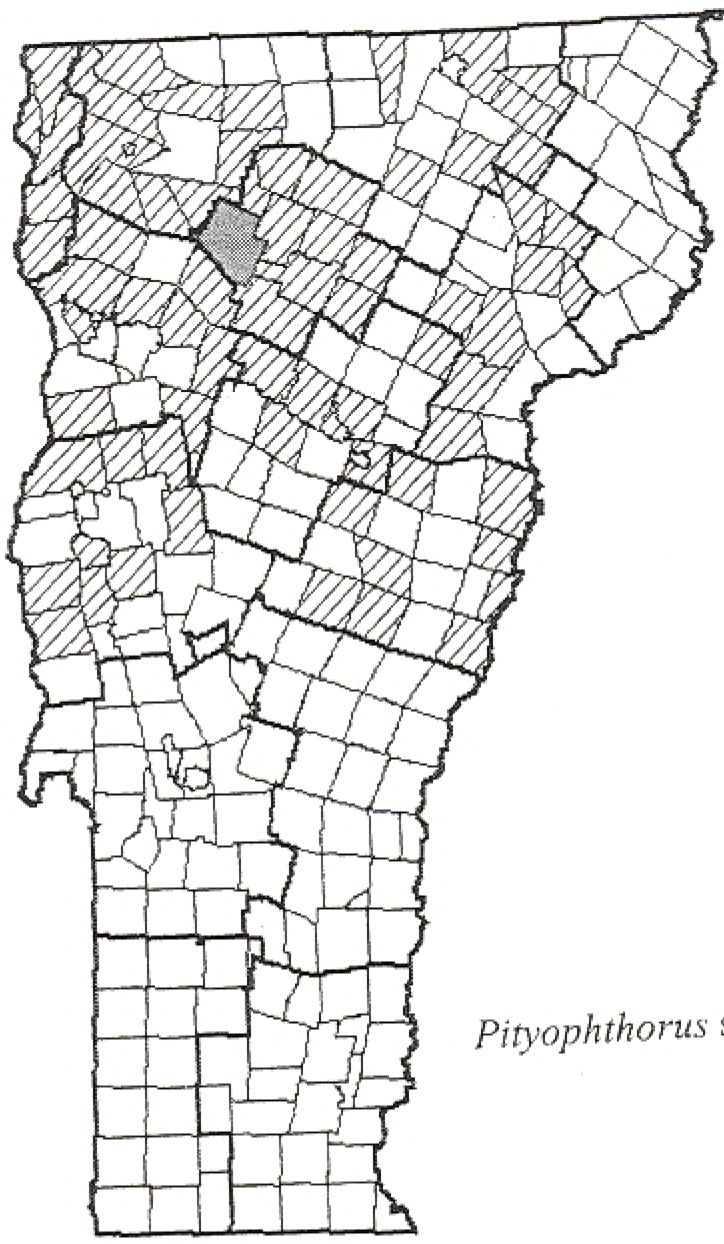
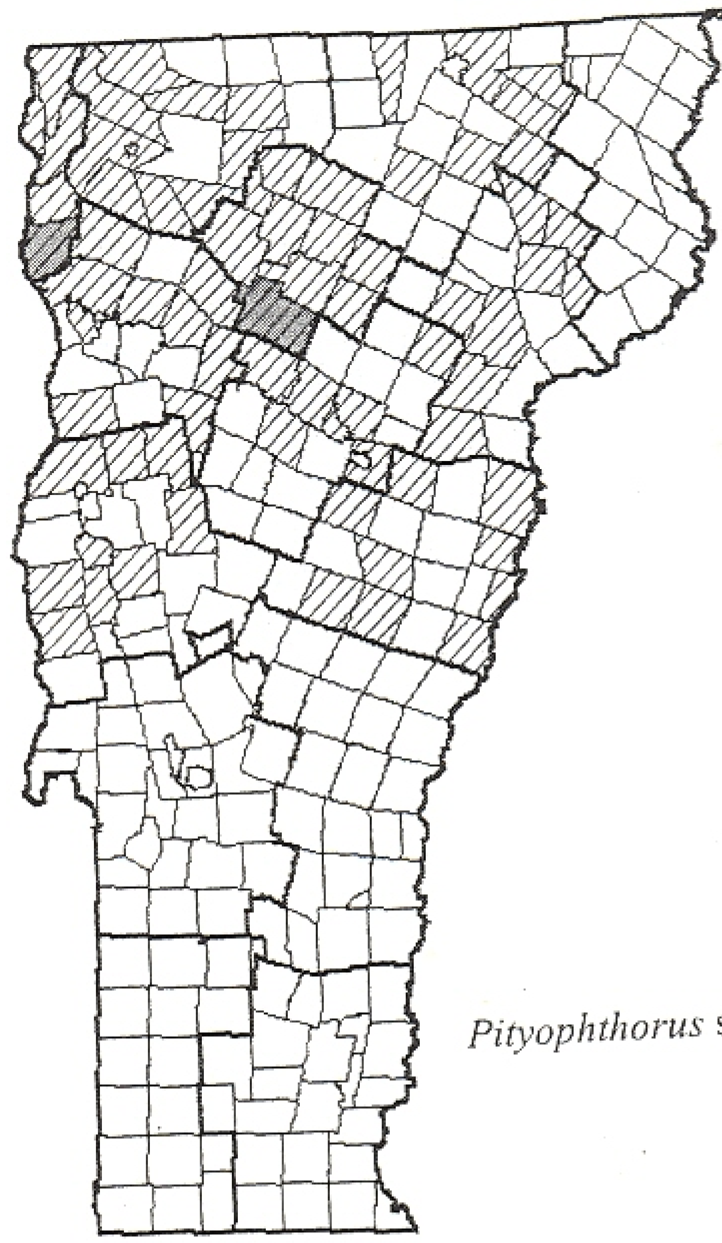
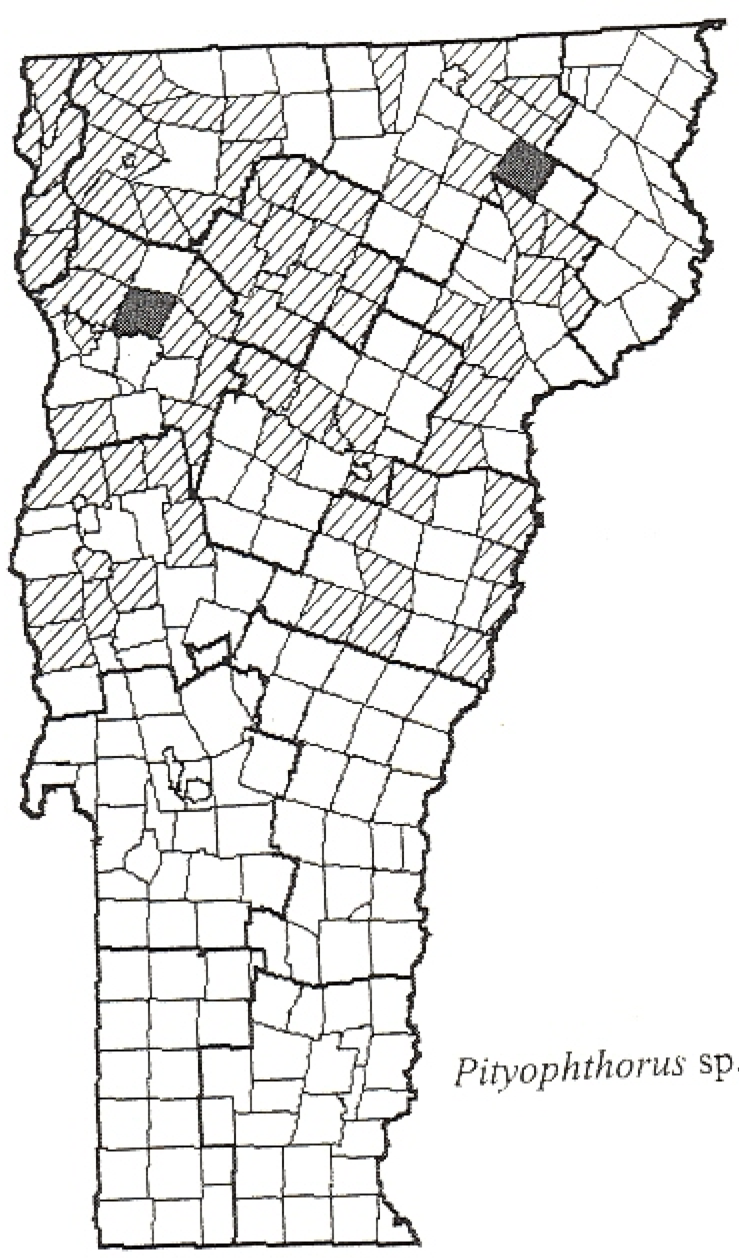
Pityophthorus sp. B
Pityophthorus sp. C
Pityophthorus sp. D
Species recorded
Towns where Lindgren traps deployed, 2000 - 2004



Pityophthorus sp. E



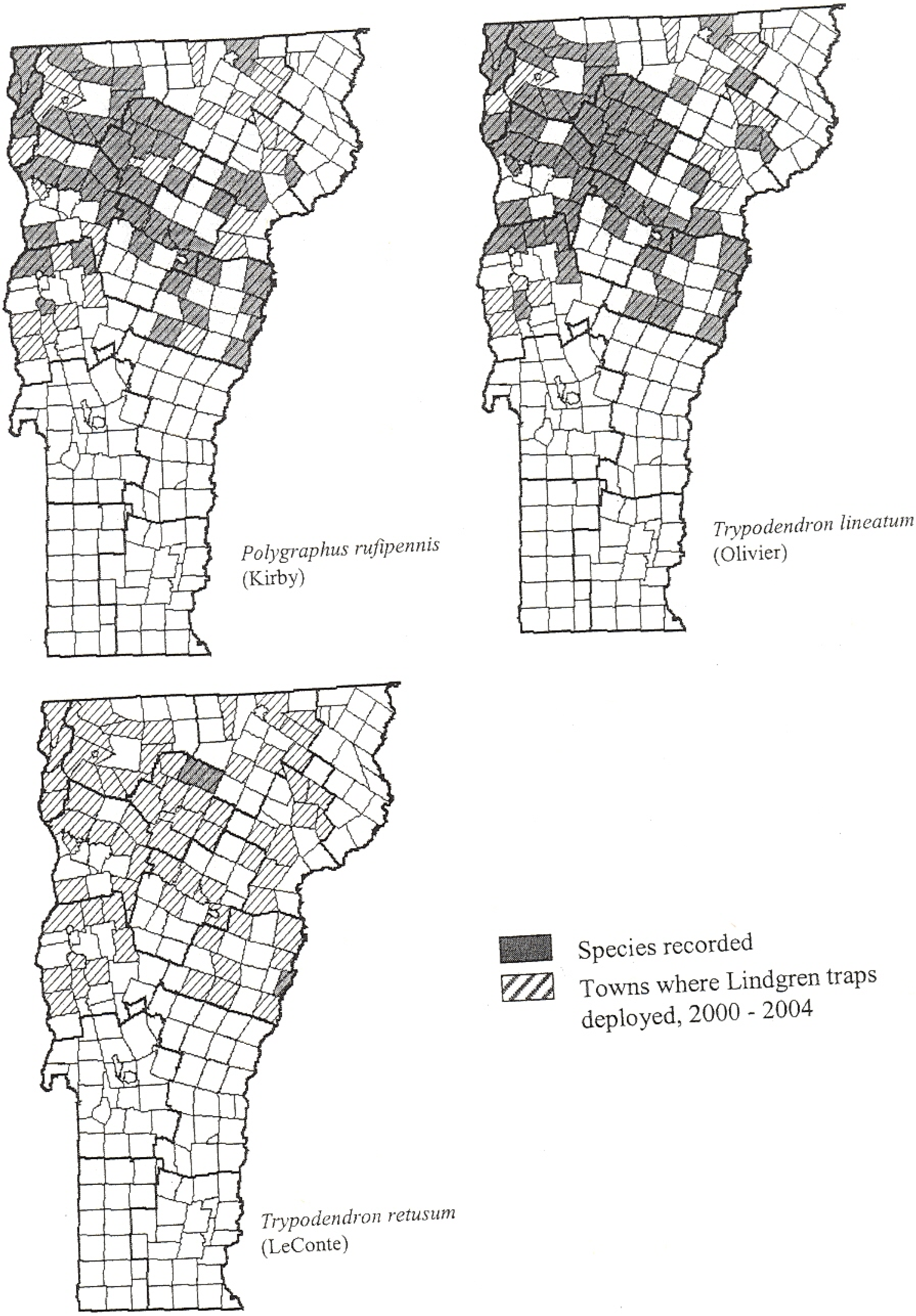
Pityophthorus sp. F



Pityophthorus sp.

Species recorded

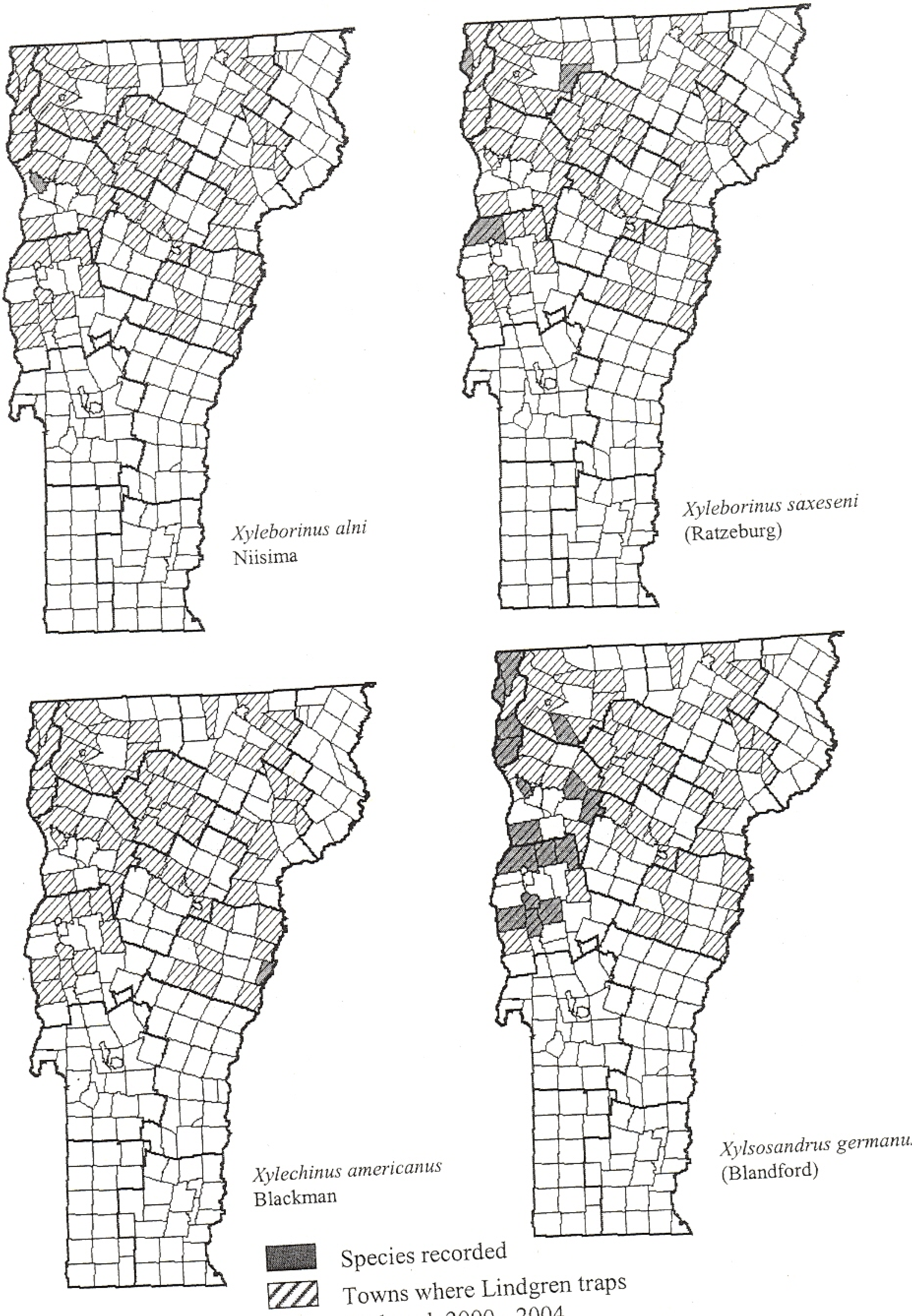
Towns where Lindgren traps deployed, 2000 - 2004

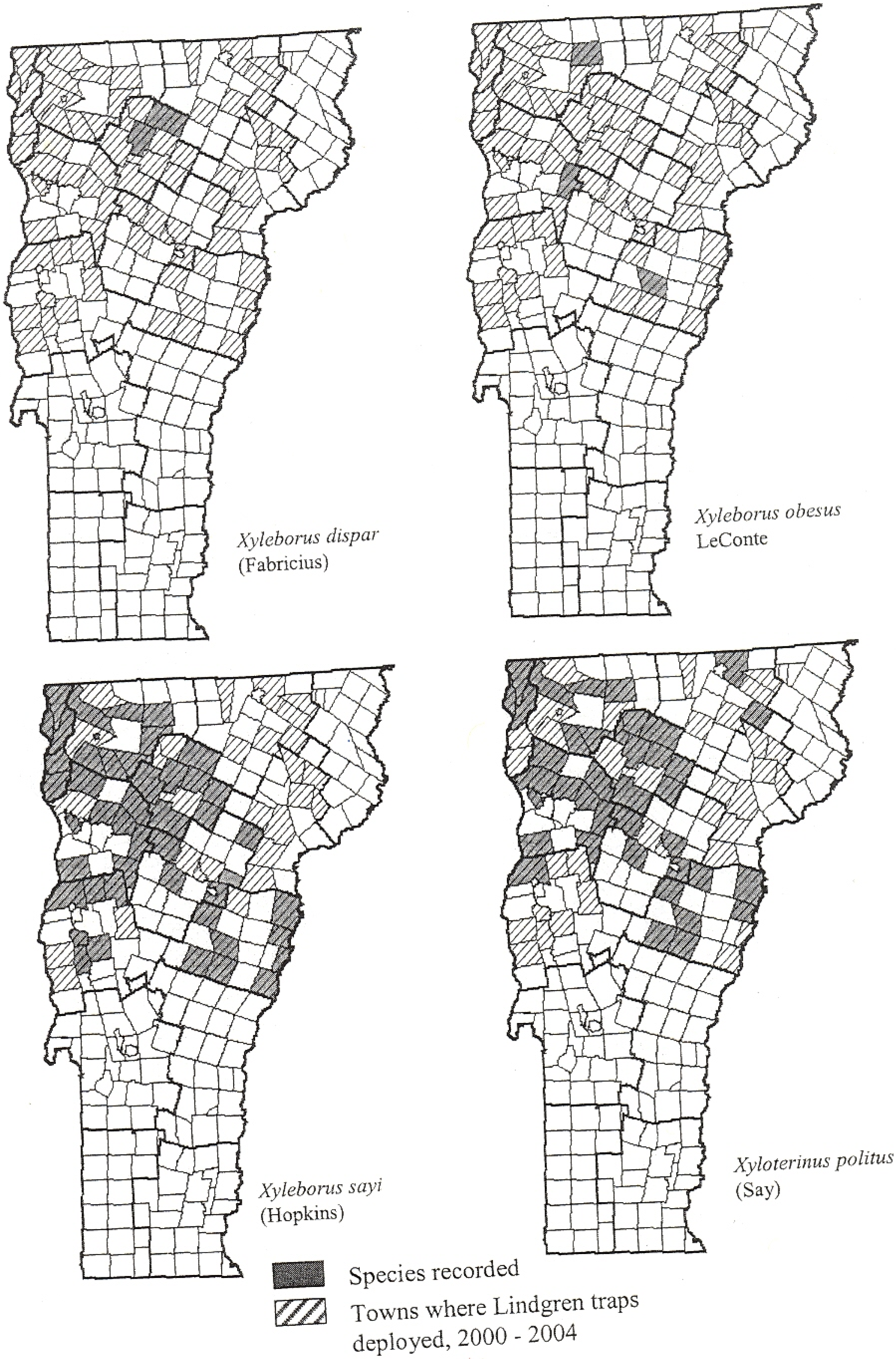


Polygraphus rufipennis (Kirby)

Trypodendron lineatum (Olivier)

Trypodendron retusum (LeConte)


Xyleborinus alni
Niisima
Xyleborinus saxeseni
(Ratzeburg)
Xylechinus americanus
Blackman
Xylsosandrus germanus
(Blandford)
Species recorded
Towns where Lindgren traps deployed, 2000 - 2004


Xyleborus dispar
(Fabricius)
Xyleborus obesus
LeConte
Xyleborus sayi
(Hopkins)
Xyloterinus politus
(Say)
Species recorded
Towns where Lindgren traps deployed, 2000 - 2004