FOREST INSECT AND DISEASE CONDITIONS IN VERMONT 2003

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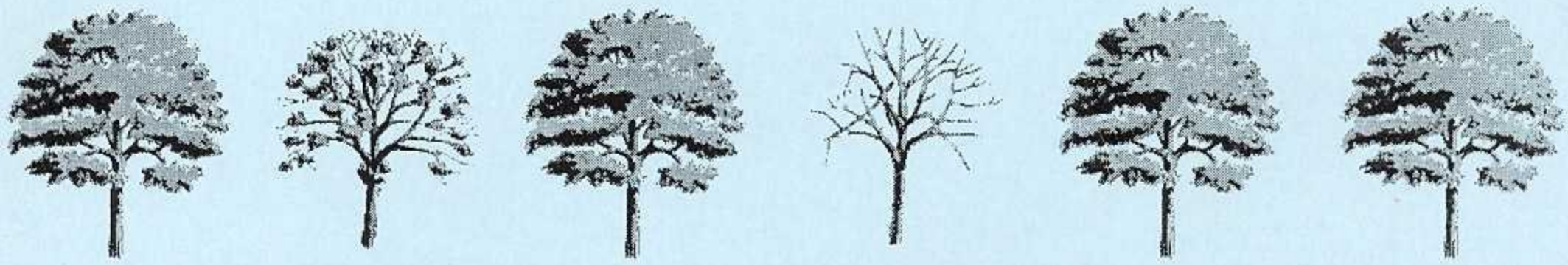

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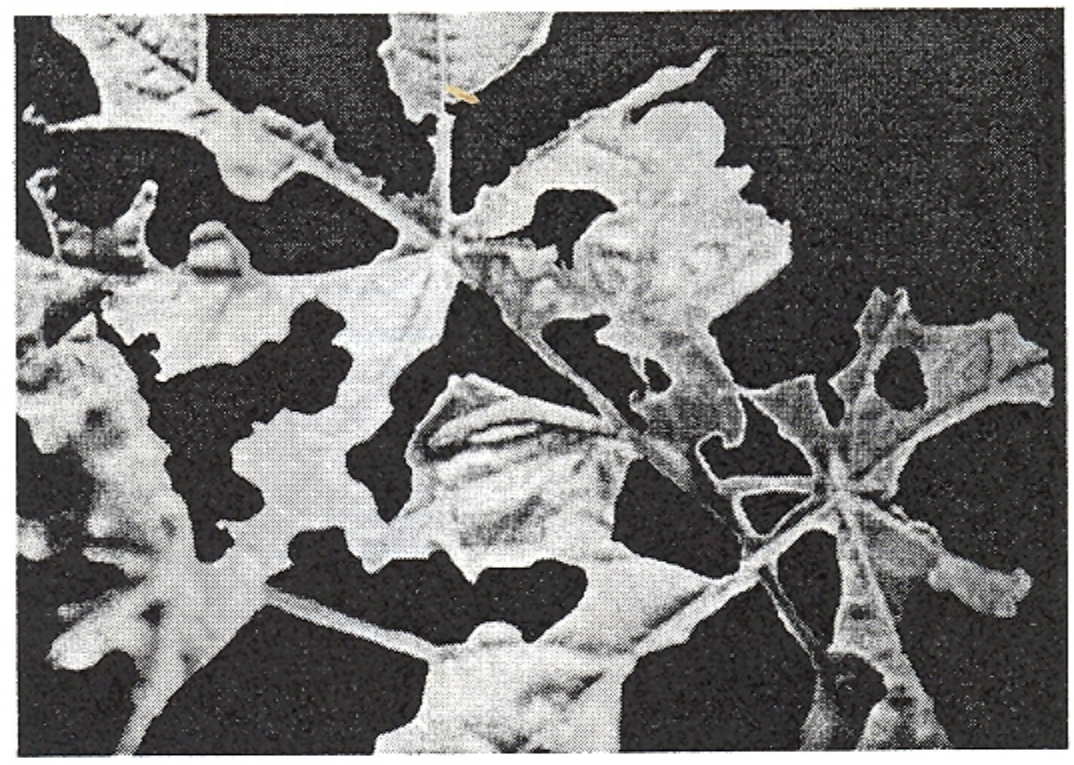
STEVEN SINCLAIR, DIRECTOR

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. This report serves as the final report for fulfillment of the Cooperative Lands - Survey and Technical Assistance and Forest Health Monitoring programs.

FOREST INSECT AND DISEASE CONDITIONS IN VERMONT

CALENDAR YEAR 2003



BRUCE SPANWORM FEEDING ON SUGAR MAPLE FOLIAGE

PREPARED BY

H. Brenton Teillon, Barbara S. Burns, Ronald S. Kelley,
Trish Hanson, Sandra Wilmot, and Kathleen Decker

AGENCY OF NATURAL RESOURCES
DEPARTMENT OF FORESTS, PARKS AND RECREATION
Division of Forestry

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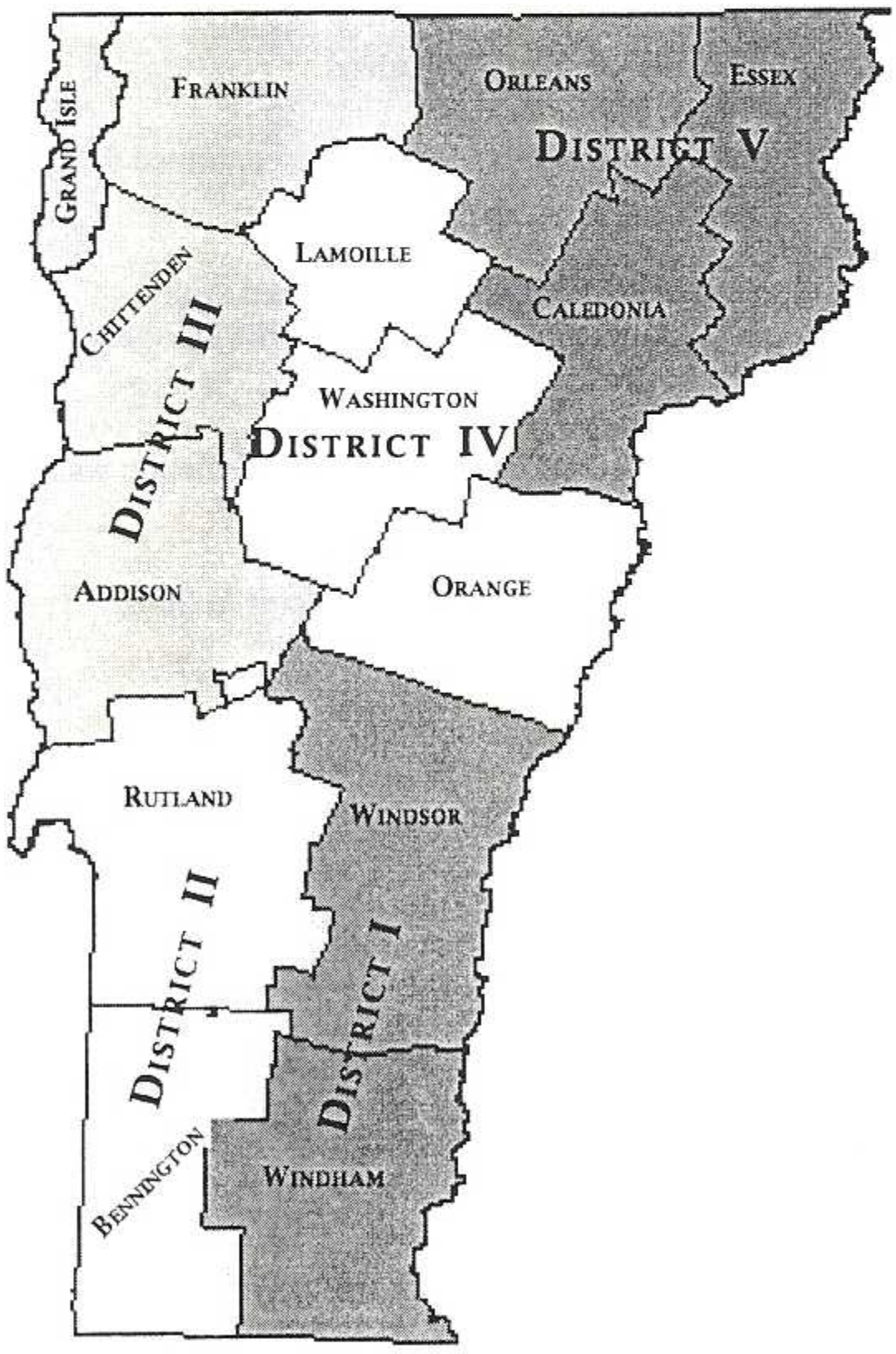

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2003 VERMONT FOREST INSECT AND DISEASE HIGHLIGHTS

Balsam Gall Midge populations collapsed with little or no damage in Christmas tree plantations.

Balsam Shootboring Sawfly caused little or no damage to fir Christmas trees in 2003 compared to light to moderate damage in 2002.

Balsam Twig Aphid damage was light to non-existent in most locations in 2003.

Balsam Woolly Adelgid damage was visible in balsam fir areas throughout the Green Mountain range. Significant fir mortality was observed in some south central towns.

Beech Bark Disease was more conspicuous than normal during aerial surveys for the third consecutive year. The damaged area mapped during aerial surveys increased from 56,000 in 2002 to 92,000 in 2003.

Birch Defoliation was widespread and heavy late in the season. **Birch skeletonizer** was the principal defoliator but 2 species of **Birch Leaf Folders** as well as **Birch Leaf Miners** were also common. The damaged area mapped during aerial surveys increased from 84,121 acres mapped in 2002 to 171,367 acres in 2003.

Bruce Spanworm populations increased, causing widespread light to moderate defoliation of sugar maple throughout the region. Damage was often heavy in low to mid crowns of sugar maple making it difficult to detect during aerial surveys.

Butternut Canker remains common throughout the state, causing high levels of mortality.

Drought conditions did not occur in 2003, but stress from dry conditions in the past few years continued to cause visible symptoms.

Forest Tent Caterpillar populations remained low in some areas, though populations increased with noticeable defolation in Windsor and Rutland counties. This year's trap counts, combined with the numbers of egg masses observed in some areas, suggest that populations will be noticeable again in 2004.

Gypsy Moth populations appeared to be increasing, but populations failed to develop, and no defoliation was observed.

Hardwood Decline and Mortality was mapped on 50,039 acres compared to only 1,486 acres in 2002. Many of the areas mapped were associated with areas prone to drought stress.

Recovery from the **1998 Ice Storm** continued, but some new mortality was observed.

Mapped acres of **Larch Decline** increased from 1,454 acres in 2002 to 4,606 acres in 2003.

Oystershell Scale populations on American beech were light in most locations, and dieback was not heavy enough to be detected by aerial survey.

Pear Thrips populations remained very low this year, causing only very light damage throughout the state.

Pine Shoot Beetle surveys continued in 6 counties in 2003. One beetle was found in a trap in Washington County causing this county to be added to the quarantine.

Saddled Prominent populations remained very low. No defoliation of sugar maple was detected.

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

Spruce Budworm populations remain low with no visible defoliation detected.

Spruce-Fir Dieback and Mortality was mapped on 13,641 acres, a substantial increase from 2002. Drought, balsam woolly adelgid and spruce winter injury are thought to be involved.

Wet Site conditions continue to contribute to dieback and mortality and increased to 17,046 acres, from 10,411 acres in 2002.

Winter Injury was much more extensive and severe than usual this year. Drought stress is thought to be a contributing factor. Red spruce winter injury was mapped on 84,478 acres during a special spring aerial survey.

Wind Damage from a severe storm caused widely scattered, but severe, blowdown in Bennington, Rutland and Windsor Counties. 3,221 acres were mapped during aerial survey.

VERMONT 2003 FOREST HEALTH MANAGEMENT RECOMMENDATIONS

The following recommendations summarize information in this report of particular importance to forest managers. Additional information can be found under specific pests mentioned. Separate summaries for sugarbush and Christmas tree managers are 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 (page 1) or your County Forester.

With good growing season weather conditions, our forests got a much-needed break and a chance to recover from drought-stress. However, our forests are not "out of the woods". The bumper crop of Armillaria mushrooms in the fall is a reminder that "secondary" fungi and insects have built up. Armillaria can be assumed to be established in the occasional unhealthy root present on just about every tree, poised for another stress event which would allow it to progress into the root collar. Similarly, canker fungi have hastened the death of lower branches, and are waiting for a chance to move into the mainstem. Bark beetles have built up, with elevated populations ready to emerge and spread. With another year of good growing conditions, many of these potential problems can be expected to fade away. A drought in 2004 will justify extreme caution in any woods work.

Where **Sugar Maple** is growing, keep a sharp eye out for forest tent caterpillar in 2004. Moth catches have been increasing, and some heavy defoliation was observed in Rutland County. The last outbreak also began in that area. That outbreak peaked in 1982, with over 300,000 acres defoliated statewide. By 1984, sugar maple decline and mortality were noticeable on about 30,000 acres which had been defoliated.

To tell whether the insect is present, look for the brown egg masses wrapped around twigs. These are shiny until they hatch in May. The caterpillars are most noticeable when they loiter in groups on the upper boles of host trees. Remember, they don't make tents. In areas where a lot of sunlight is reaching the forest floor, look for chewed, tattered, or lacy leaves, particles of leaf on the ground, brown caterpillar pellets collecting on the leaves of groundcover plants, or the "pitter-patter" of the pellets raining down. Healthy trees with significant damage will refoliate. Refoliated leaves are small and light green or reddish in color, compared to darker undamaged leaves.

If evidence of forest tent caterpillar is noticeable, this would be a bad time to do any thinning or other selective harvests. Reducing the basal area concentrates the same number of insects on fewer trees. It also piles another disturbance on trees which may be low on carbs. In 2003, bruce spanworm was the more widespread defoliator. If this is the insect is present, defoliation occurs earlier, and trees with the same amount of damage recover faster than they do from forest tent caterpillar. (If the caterpillars are green, the trees will stay green; if the caterpillars are blue, you'll be blue, too.... not a reliable rule of thumb, but true in this case.)

We are very concerned with the threat to **Ash** from emerald ash borer. This exotic insect has spread rapidly in parts of Michigan, Ohio, and Ontario, where over 7 million trees have died. We may miss an introduction of this insect if we assume that any ash decline we observe is caused by ash yellows. Look for signs of the borer wherever there is ash dieback and mortality, bark flaking from woodpeckers, cracks, or callusing. Examine the bark on the trunk and branches for the small D-shaped exit holes of the insect. Peel off dead bark to look for serpentine, frass-filled larval galleries which score the wood, but don't disappear into it. And please report any suspect trees you find.

In a few areas, ash developed cracks over winter 2002-03 thanks to drought, cold, and/or prior wounding. At this point, the wounds are mostly superficial, but can become significant as the tree grows and the defect becomes buried. These cracks were in otherwise healthy trees, and had no insect activity associated with them.

Beech continues to decline from beech bark disease as the latest outbreak progresses from scale, to Nectria infection, and now to dead spots in the cambium, crown symptoms, and tree mortality. Some beech trees, especially those on shallow sites most impacted by drought, lacked the vitality to respond at all to Nectria infection. These trees up-and-died without producing the patchy, figured or callused bark we normally associate with beech bark disease. At this point in the outbreak, white flocculence on the mainstem may be beech scale or the asexual fruiting of the Nectria fungus… hard to distinguish at first, but easy when you know how… and use a

hand lens. If you see clean-stemmed, healthy crowned beech, retain them. They likely have the genetic resistance we need to maintain this species.

It's amazing that **Birch**, especially white birch, continues to thrive in Vermont. Tens of thousands of acres of birch defoliation are mapped every year during our aerial surveys. In dry years, it's birch leaf mining sawflies. In wet years, foliage diseases. The species is vulnerable to root mortality from hot soil and xylem cavitation during cold winters. Birch were clobbered by the 1998 ice storm. And this year, we had an outbreak of birch skeletonizer. The bronze birch borer is poised to take advantage of stressed trees… those without the vigor to fight back by producing callus around borer attacks. Management recommendation? Remember that the species is *supposed* to be "short-lived".

Oak had a good year: a chance to recover from drought stress and a light acorn crop to minimize the drain on carbohydrates. Anthracnose showed up here and there, but the impact should be minimal. Most auspicious was the collapse in what looked to be a building gypsy moth population. Wet weather came at just the right time, and the fungus, Entomophaga, killed a lot of young caterpillars. No management adjustments due to widespread health concerns are currently needed for oaks.

New areas of **Balsam Fir** mortality showed up around the state this year. A complex of stressors seems to be involved. Drought stress, bark beetles and root pathogens, like Armillaria and Tomentosus root rots, have all contributed to fir mortality. In addition, balsam woolly adelgid, an exotic insect with a bad reputation (but quiescent for decades in Vermont), has made a comeback.

Balsam woolly adelgid may be found on the bark of twigs, stems and branches, where its feeding can kill trees. (A hand lens can help you figure out whether you're looking at the white wool produced by this tiny insect, or a fleck of pitch.)When it feeds on shoots near the buds, it can cause a swelling, called "gout", and shoot mortality. Several years in a row of this feeding leads to deformed, flat crowns.

The good news about balsam woolly adelgid is that it can be killed by cold winter temperatures. This may explain the drop in adelgid levels, in northern Vermont, between 2002 and 2003. With the cold winter 2003-04, additional population reductions are expected statewide. If the adelgid population crashes, the rate of fir mortality should slow down. Because root rots have become established in mortality areas, any harvesting activities should be done in large groups, patch clearcuts, or other non-selective methods.

Red Spruce winter injury occurred statewide in spring 2003. Following the winter injury event of 1993, foliage density was reduced and the amount of crown dieback increased for several years according to data from impact plots established by the Vermont Division of Forestry. A study from the University of Vermont indicates that some reduction in radial growth should also be expected.

With the additional stress of drought, scattered dieback and mortality of red spruce regeneration was observed in 2003. Where this regeneration is critical, on-site inspections are recommended. Otherwise, no severe impacts are expected from this winter injury event, and management adjustments are probably unnecessary.

Movement of **Pine** continues to be affected by the exotic pine shoot beetle. The quarantine now includes Washington County, as well as the three counties in the Northeast Kingdom. Pine logs, bark, and unprocessed bark mulch are regulated.

We continue to get reminders that borax treatment of stumps is a good investment when thinning young white pine. Fomes annsosus can infect this species. Instead of killing trees outright, it usually results in hidden butt rot, which becomes increasingly significant as the stand matures. Stands thinned between mid-summer and full-blown winter (consistently cold and/or snow-covered) are most important to treat.

Hemlock remains on the exotic insect watch list. The status of hemlock woolly adelgid remains unchanged. It's established within miles of the southeastern corner of Vermont. Keep looking for it, especially in top-wood slash. This insect often shows up first in the tops of the larger trees in the path of wind and migrating birds. Encourage vigorous hemlock . These stands will probably be more tolerant of this insect when the infestation arrives in Vermont. A project at the University of Vermont has developed a risk map of Windham County indicating where stands are more likely to be vulnerable.

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 mid August and mid September to target late season defoliators, drought damage, and general forest condition. Part of the survey was conducted using the digital sketchmapping tool developed by the US Forest Service.

ACKNOWLEDGEMENTS

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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.

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WEATHER AND PHENOLOGY

2003 weather statistics based on Burlington data are summarized in Figure 1.

Winter

The winter of 2002-2003 averaged nearly 4 degrees below normal for the state in temperature and 2.4 inches below normal for precipitation (NRCC – based on Burlington data). Winter came early when a major nor'easter brought mixed precipitation that ended with 10 inches of snow in the Champlain Valley and higher amounts in the mountains. This loaded down wet tree limbs and needles and caused considerable branch breakage. The winter was unusual in that many of the snowstorms tracked further south than usual and dropped less snow in northern Vermont than in southern Vermont. A January 3-4 storm dropped 13 inches of snow at the Essex weather station, but the next snowfall in excess of 4 inches didn't occur there until March 30. The Blizzard of 2003 occurred President's Day weekend, February 17-19, 2003. This nor'easter hit the Atlantic coast particularly hard (2-3 feet of snow just north of Washington, DC), but also left 6-18 inches in southern Vermont with locally higher amounts up to 2 feet.

January was especially cold, averaging 6.2 degrees below normal for the state (NRCC) so snow cover remained, and there was no January thaw. Temperatures remained below normal in February and March, with several nights below -20°F. As a result, winter injury of red spruce was the greatest seen since 1993.

Spring

The maple sugaring season had a brief start in late February for a few sugarmakers, but a return to cold weather shut that down in a hurry. Sugaring was slow and sporadic for most of March, but a cold spell in late March and early April salvaged what would have been a dismal season and turned it into an average season for most northern Vermont sugarmakers. In southern Vermont, sugaring started late and was generally disappointing at lower elevations. Production was better at higher locations. Although syrup was darker than average, the quality in some valleys and foothills was reported to be excellent.

Another snowstorm on April 3rd dumped over a foot of snow in parts of the state delaying the onset of Spring. Snowmelt progressed quickly however, and by mid-April the ground was bare and dry especially in lower elevations sparking a brief spring fire season. Weekly spring cumulative growing degree days appear in figures 3-4. Sugar maple bud development was similar to a 10 year baseline at Mount Mansfield. Spring phenology observations are summarized in figures 5-6 and in Table 1.

There were no significant late frosts.

Summer

The first hot spell of the summer began on June 23 and lasted seven days, resulting in the highest temperature for the summer in Burlington at 96°F on June 26. A drying pattern began in June as well and most of the state received below normal rainfall for June into early July. Rain began in the form of severe storms in late July accompanied by high winds that downed trees and power lines. One such wind event, variously described as a microburst or tornado, occurred on July 21. Severe winds, up to 120 mph, touched ground in widely scattered spots in Bennington and Windsor counties.

Heavy winds caused damage again on July 24. In addition to the wind, heavy rains were responsible for flooding in parts of Addison, Rutland and Windsor counties. A new 24-hour rainfall record was set at the Fairbanks Museum in St. Johnsbury on that day. 2.10 inches of rain fell breaking the previous one-day record of 1.15 inches set in 1976.

For most of August, Vermont experienced oppressive humidity levels. This weather pattern brought torrential rain that caused flooding in many locations and occurred when a trough reaching from the Great Lakes to the Gulf of Mexico carried moist air up to the Northeast. This tropical air mass carried a lot of moisture and light winds kept it in place for weeks. The one positive note from this tropical weather was that temperatures remained relatively low (only in the upper 80's) for the duration unlike a typical hazy, hot and humid weather pattern.

Heavy rains accompanied the tropical weather pattern causing flash flooding in 9 of Vermont's 14 counties (Addison, Bennington, Essex, Orange, Orleans, Rutland, Washington, Windham, Windsor). From August 1 through August 14, Vermont received varied amounts of rainfall, i.e. the Champlain valley (Chittenden and Franklin counties) received less than 2 inches; locations across central Vermont received between 2 and 4 inches; and some southern Vermont areas received up to 11 inches. The fire weather station at Marlboro College received 11.74 inches for the month of August.

Despite a wet August in most of Vermont, Franklin and Chittenden counties remained below normal in precipitation by 5+ inches since January 1 following a 16 day dry spell in mid to late August.

Except for a strong strawberry season, the summer berry crop was very poor. The blueberry growers declared it the worst blueberry season ever, blaming the "wet" cold winter and spring weather for a failure to set fruit. Wild berries were also scarce.

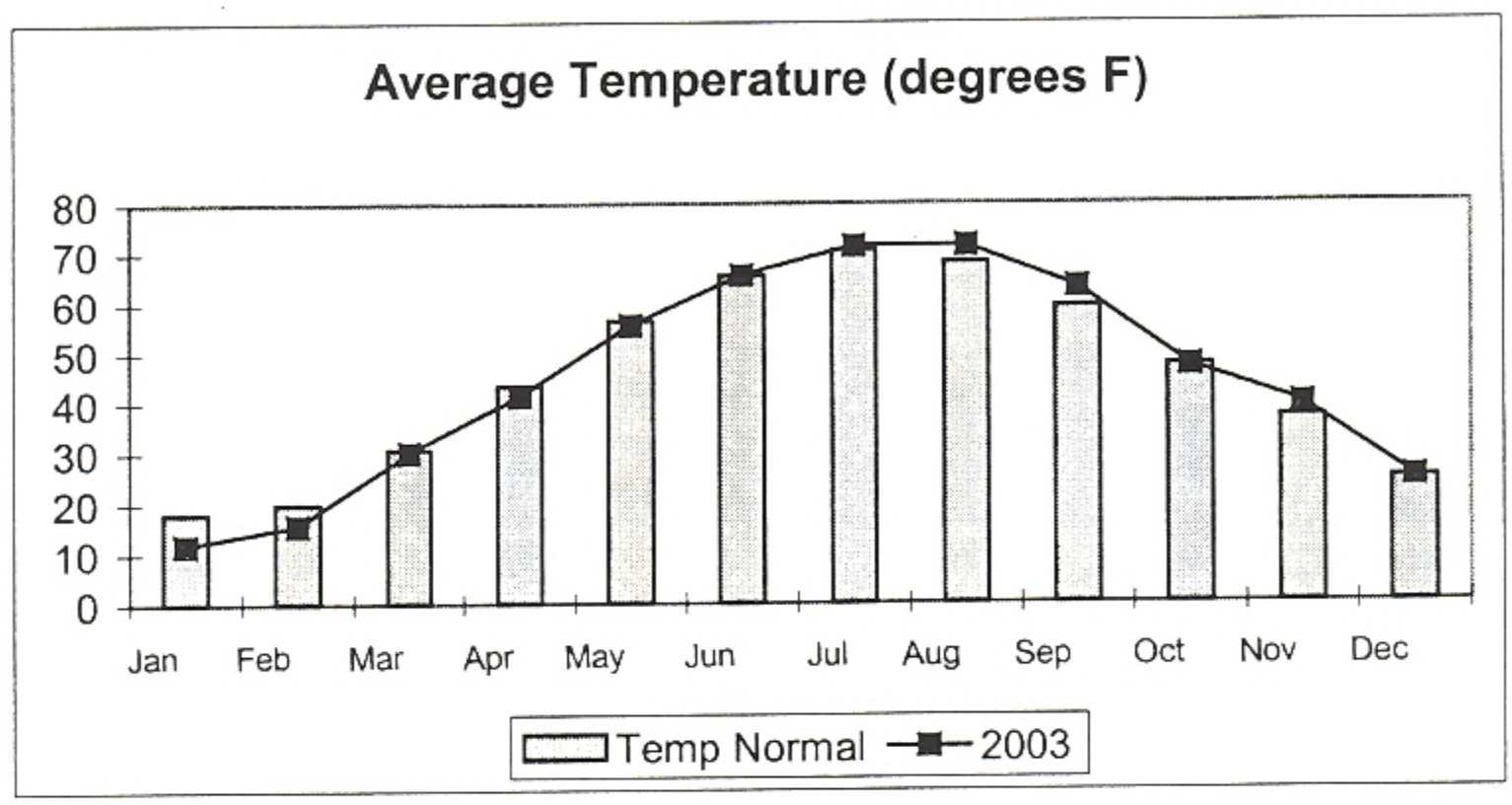
Fall

Early September brought a welcome relief to the heat and humidity with a stretch of sunny, clear days, cool nights, light breezes and low humidities. Dry conditions continued in northwestern Vermont into September. Some perennial garden plants in the Champlain Valley began shriveling up – even some smaller shrubs had curling leaves, prompting landscape gardeners to begin a salvation watering of their favorite plants.

Hurricane Isabel on September 18 and 19 brought wind to Northern Vermont but only 0.06" of rain at Essex and 0.02" of rain at Elmore. Southern Vermont received more substantial rain from Hurricane Isabel – Marlboro had 1.27". Rainfall events became numerous statewide in October. It was the fourth wettest October on record for the state (NRCC). The largest storm event dropped 4.25 inches of rain at the Elmore weather station over the 3-day period of October 27-29 and caused widespread flooding. This same storm dropped 6.22 inches of rain at the Marlboro weather station. *(From May 1 – October 31, the Marlboro station recorded 44.65". This is well above the average annual precipitation amount of 43.39" in only 6 months. See Figure 2.)*

The onset of the fall foliage season was right on schedule in northern Vermont, with leaves beginning to turn in mid-September but somewhat late for southern regions. Leaf drop was a bit later than usual at a monitoring site on Mount Mansfield, extending the foliage viewing period. Cool nights and warm sunny days maximized enjoyment of the fall foliage. In some areas, upper elevations were not very colorful, although the browning was not as widespread as in 2002. Lingering effects of drought and a high population of leaf-mining insects are thought to be responsible. October turned out to be near normal in temperature with no hard frost until mid-October.

This was generally a light seed year for most species, including sugar maple, oak, beech, balsam fir, and apple. However, there were lots of red maple, striped maple, and white ash seeds, and a crop of white pine cones is maturing. The crops of traditional mast nuts, of beechnuts and acorns, were rare.



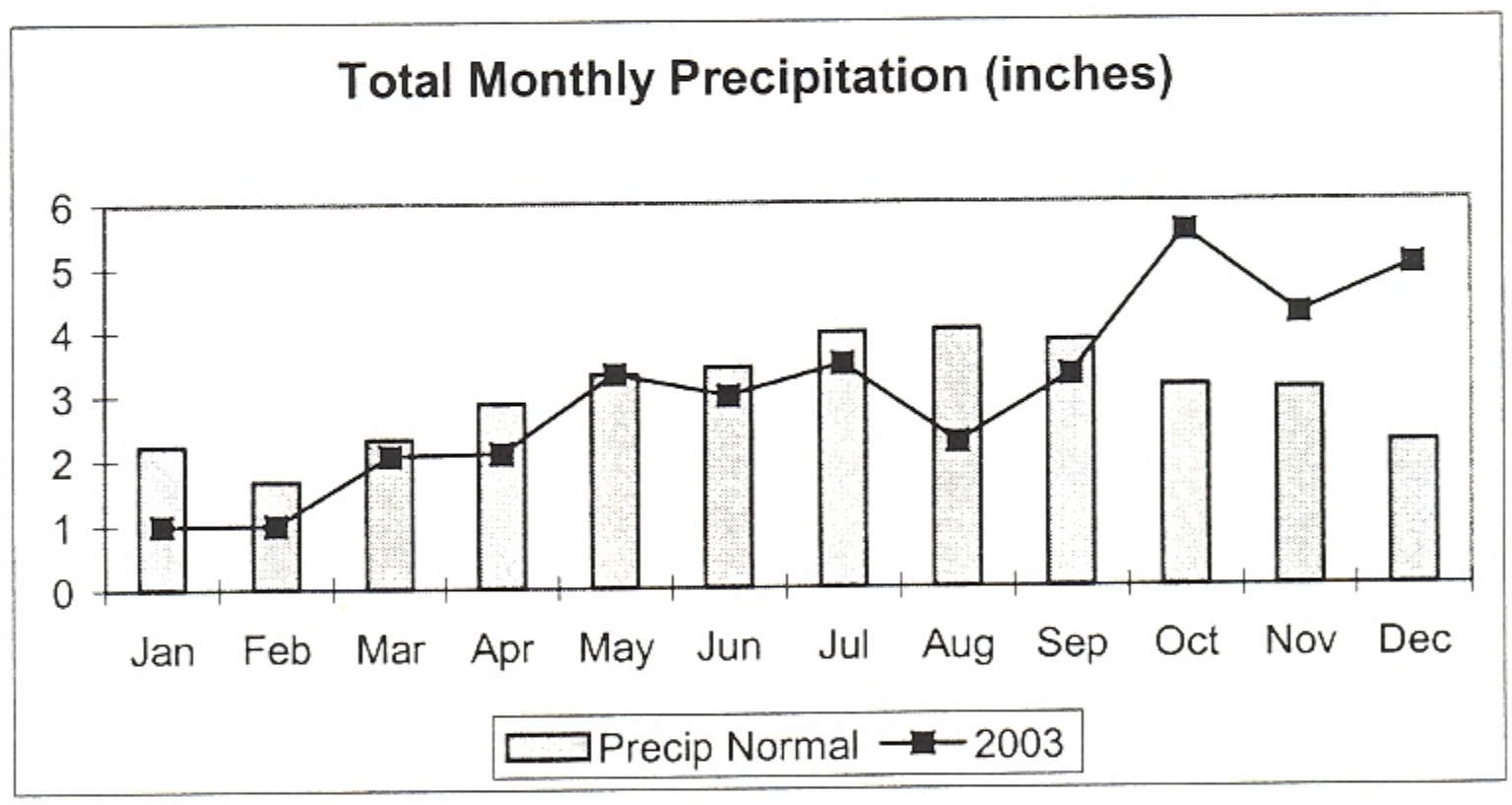


Figure 1. Monthly average temperature and monthly total precipitation in 2003, compared to normal, for Burlington, Vermont. Data from the National Weather Service (http://www.erh.noaa.gov/er/btv/).

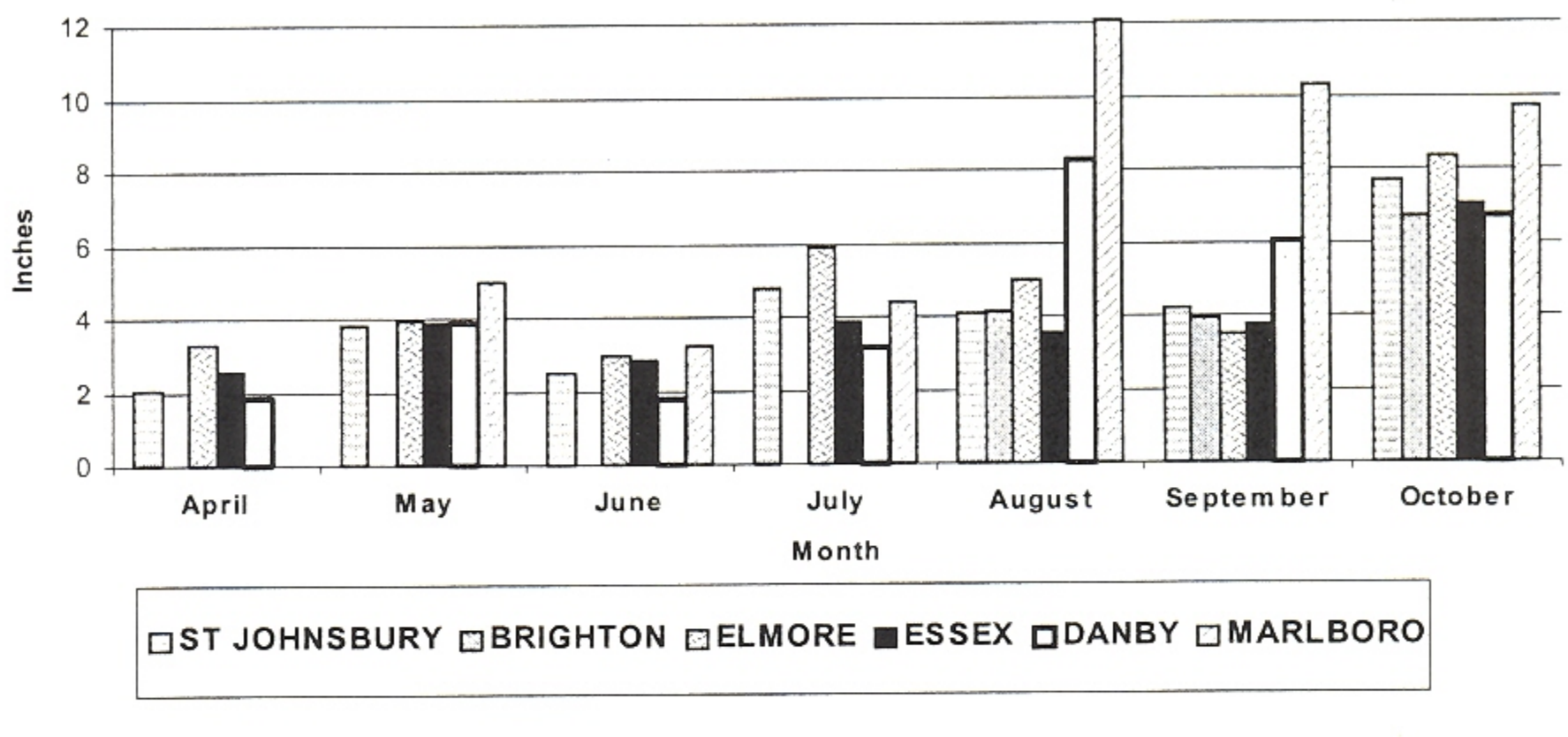


Figure 2. Rainfall amounts at Vermont fire weather stations through fire season, April-October, 2003.

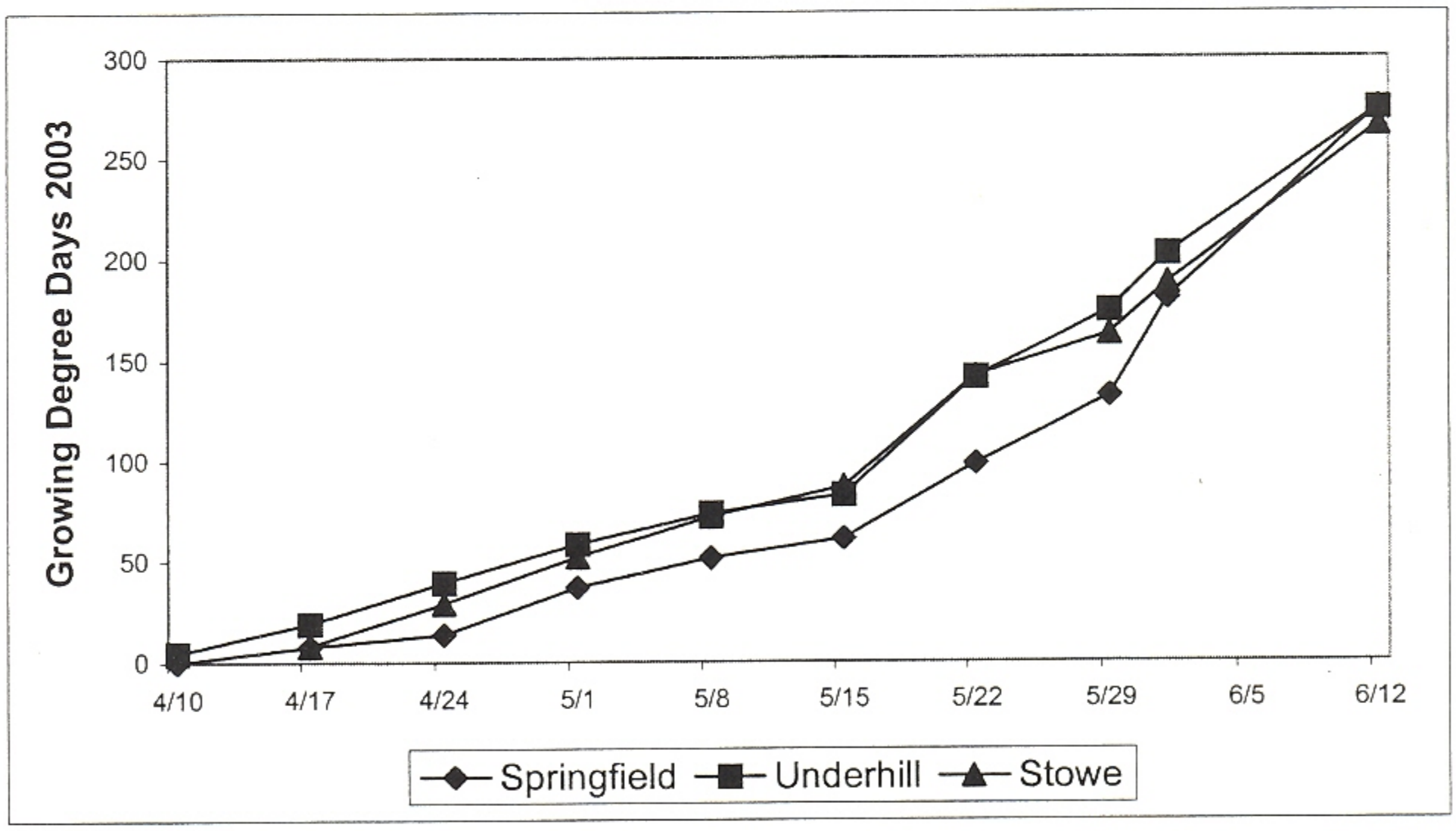
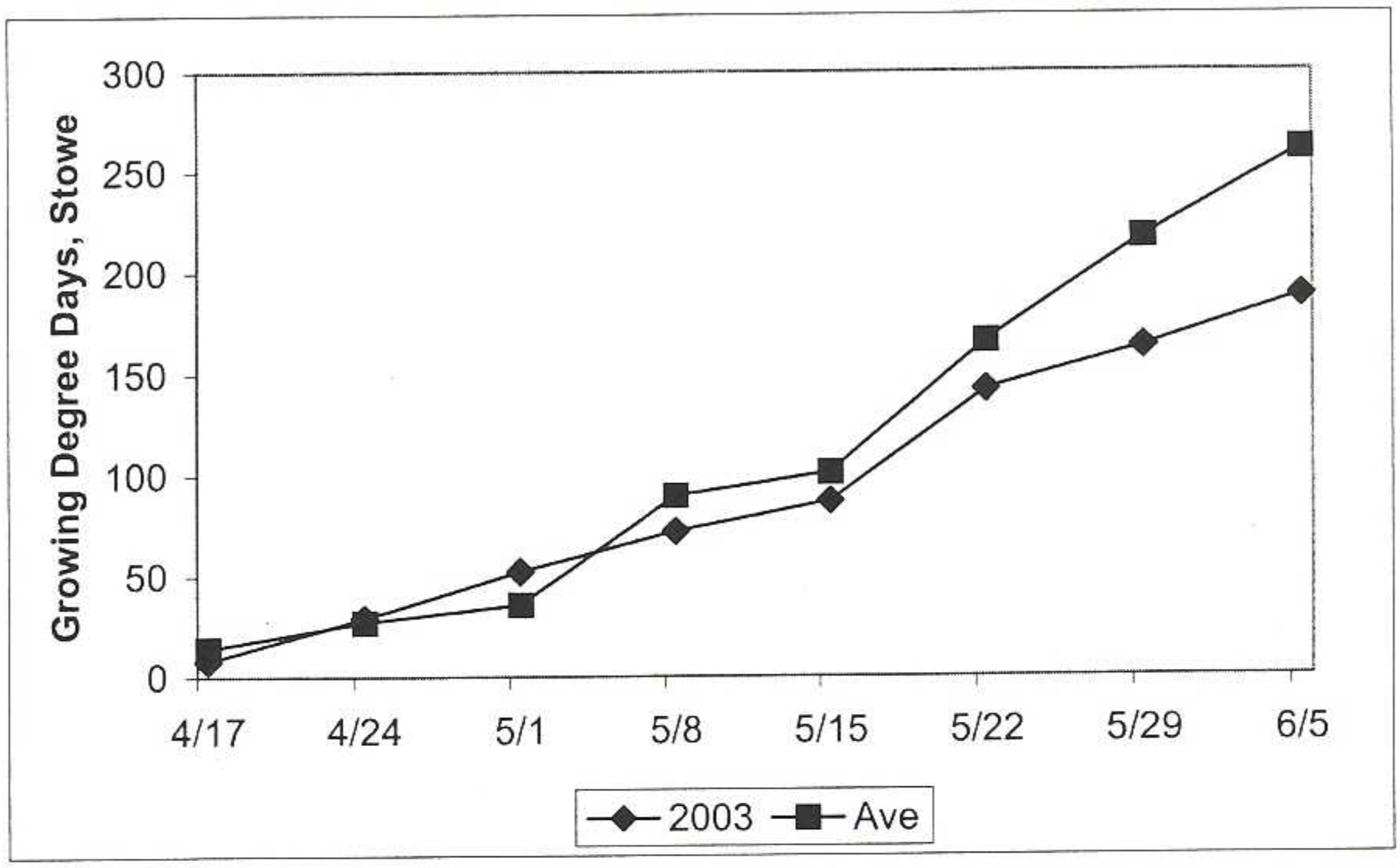


Figure 3. 2003 Weekly spring cumulative growing degree days for Springfield, Underhill and Stowe, Vermont. 50 degrees is used as the threshold of development.



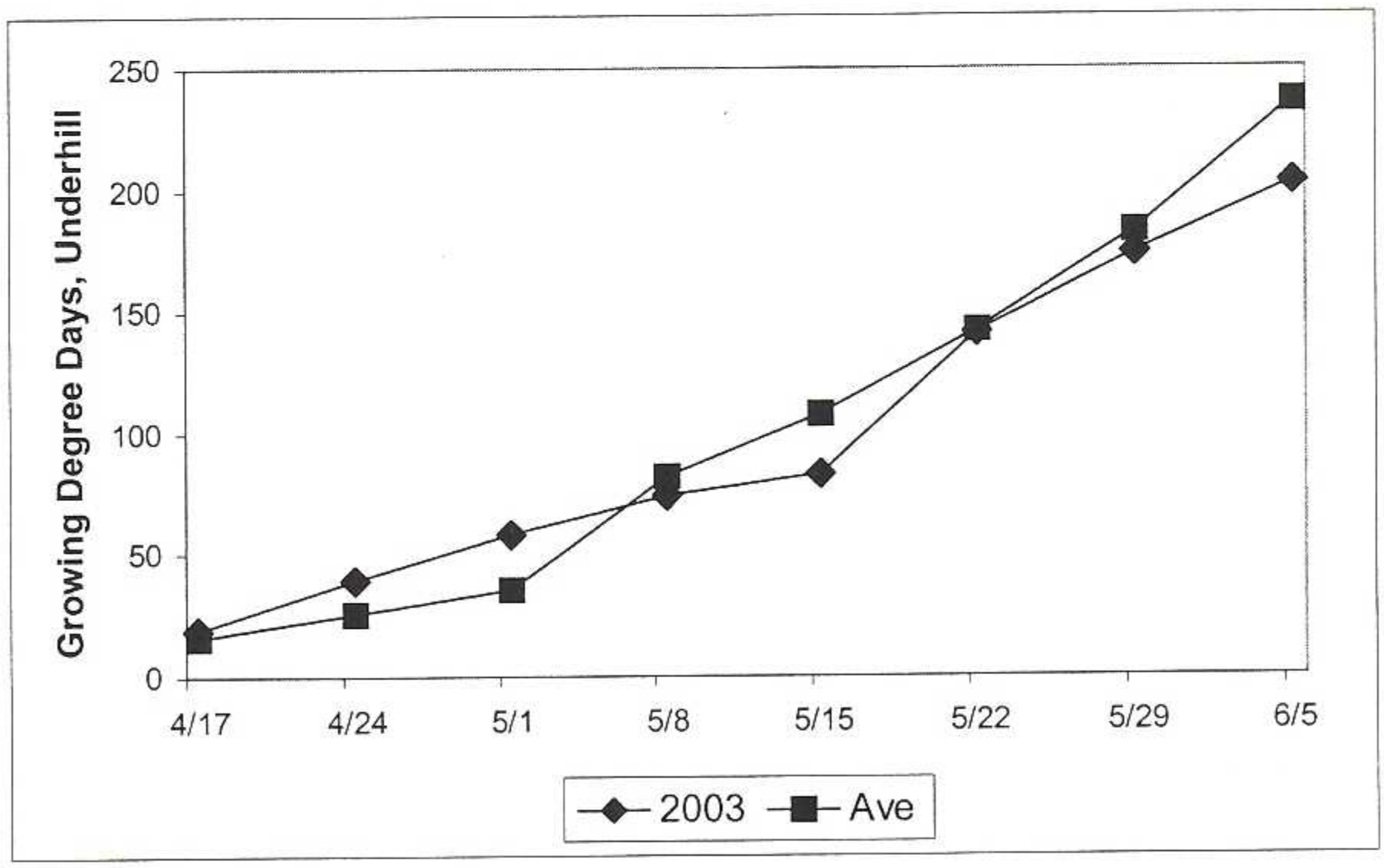


Figure 4. Weekly spring cumulative growing degree days for Stowe and Underhill, Vermont in 2003 compared with mean 1993-2003 accumulations. 50 degrees is used as the threshold of development.

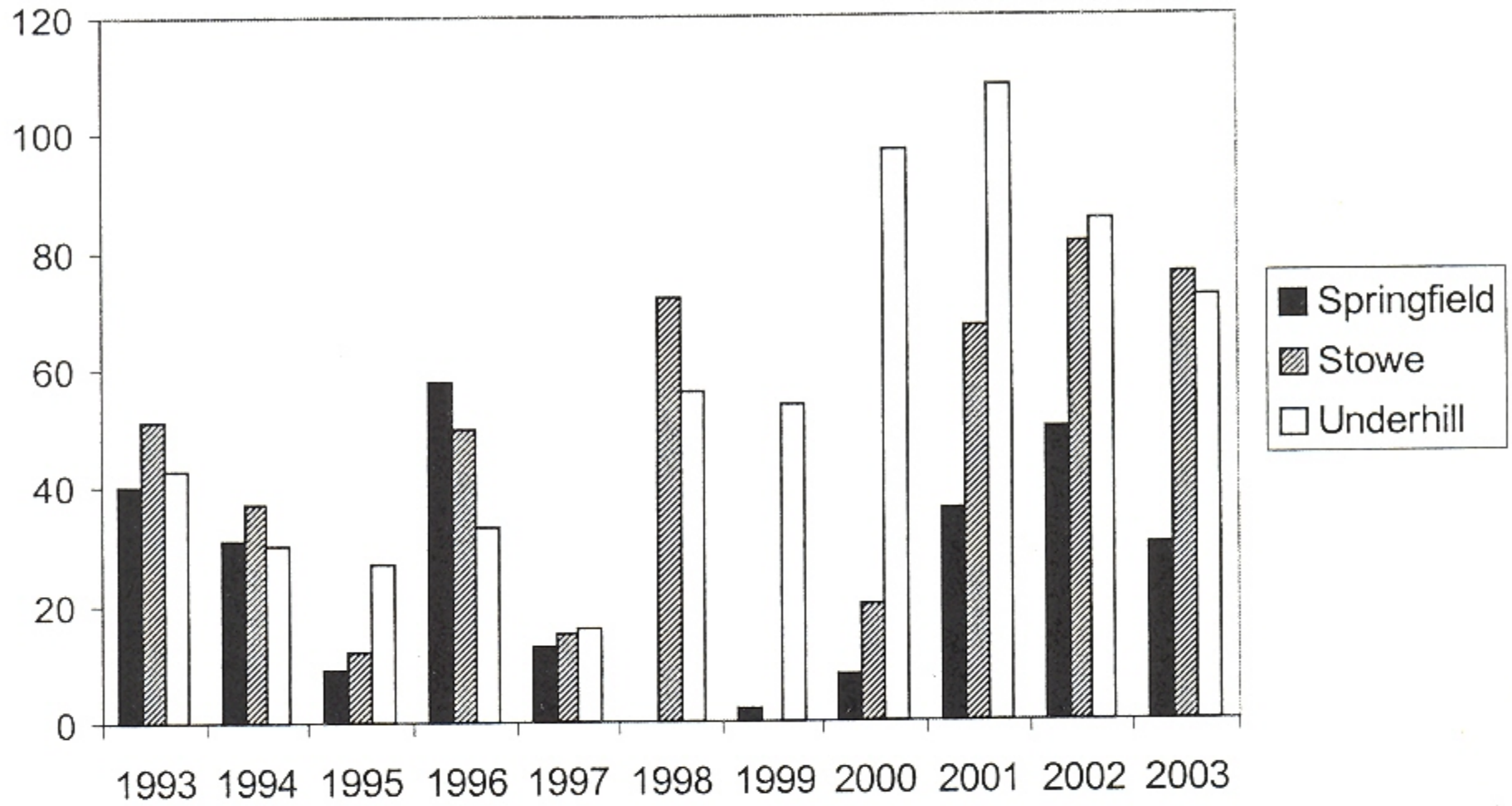


Figure 5. Growing degree days for sugar maple budbreak in Springfield, Stowe and Underhill, 1993-2003.

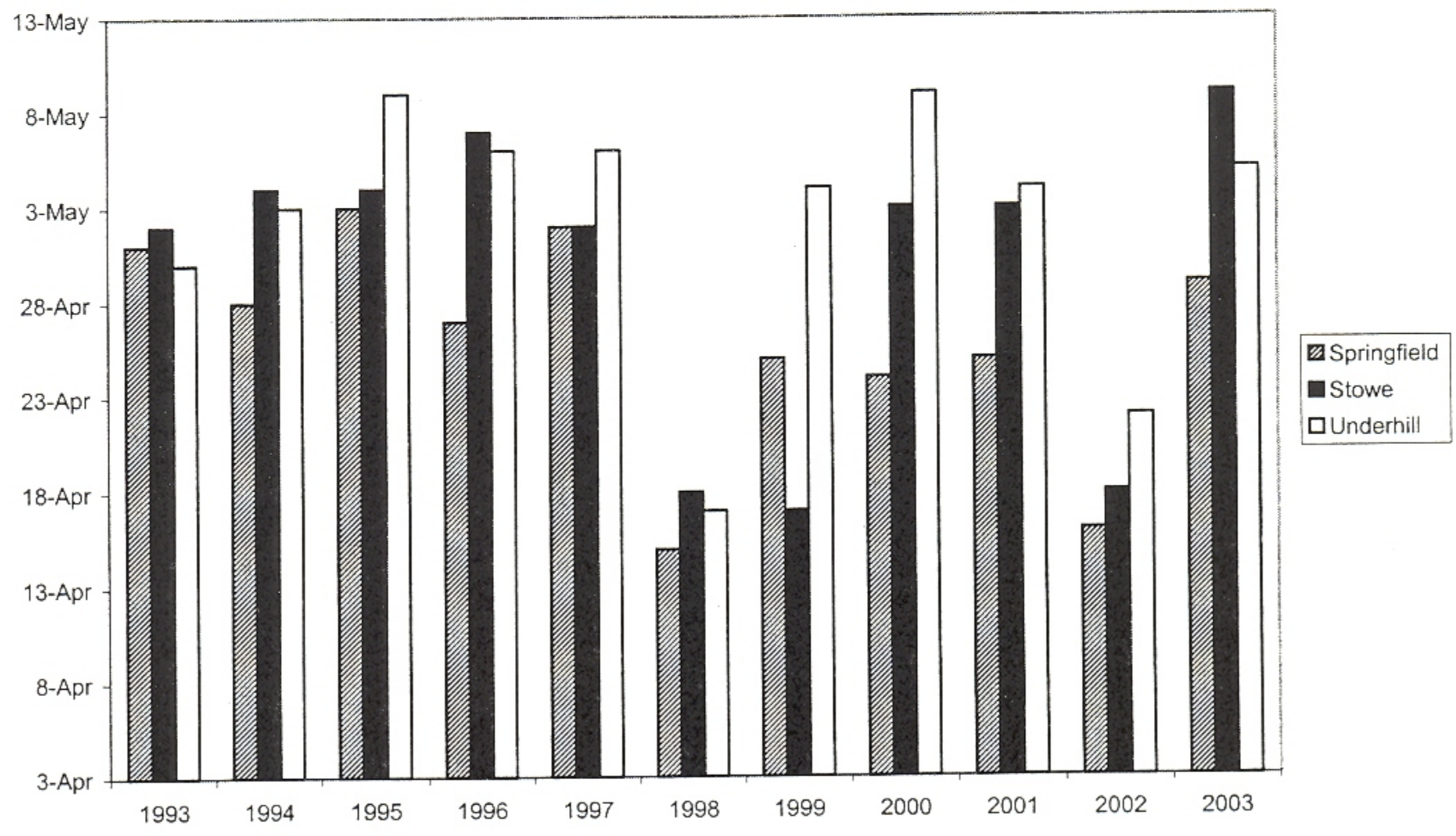


Figure 6. Dates of sugar maple budbreak in Springfield, Underhill and Stowe, Vermont, 1989-2003.

Table 1. 2003 First observation dates of phenological development and growing degree day accumulation from 3 sites in Vermont. 50 degrees F is used as the threshold of development.

Biological Indicator	Springfield	Stowe	Underhill
PLANT DEVELOPMENT			
Showing Green			
Balsam Fir		5/5 (57)	5/19 (118)
Budbreak			
Apple, MacIntosh		4/28 (36)	
Ash, White		5/12 (85)	5/9 (74)
Beech		5/12 (85)	
Cherry, Black	4/29 (30)		
Fir, Balsam	5/9 (54)	5/9 (76)	5/21 (141)
Fir, Fraser		5/28 (162)	
Hemlock	5/27 (117)	5/27 (159)	5/23 (147)
Maple, Red			
Maple, Sugar	4/29 (30)	5/9 (76)	5/5 (72)
Flowers			
Apple, Dolgo Crab		5/18 (105)	
Apple, MacIntosh		5/20 (130)	
Aspen, Quaking (female flower)	3/23 (0) (female flower budbreak)		
Aspen, Quaking (male flower)	4/15 (5) (male flower)	4/15 (8)	
Crocus	4/13 (0)		
Dandelion	5/2 (41)		
Elm, American	4/17 (8)		
Honeysuckle, Tartarian		5/27 (159)	
Honeysuckle, Tartarian (full bloom)		6/4 (185)	
Lilac	5/18 (65)		5/23 (147)
Lilac (full bloom)		6/1 (171)	
Maple, Red	4/18 (8)		4/25 (40)
Maple, Silver	4/13 (0)		
Maple, Sugar		5/4 (52)	5/5 (72)
Plum, Canada		5/11 (83)	
Shadbush		5/7 (68)	5/11 (80)
Full Green Up	6/8 (216)		

INSECT DEVELOPMENT			
Balsam shootboring sawfly (laying eggs)		5/10 (76)	
Balsam twig aphid stem mothers		5/10 (76)	
Eastern tent caterpillar (first nest)	5/4 (41)		5/3 (59)
European snout beetle		5/30 (166)	
Maple leafcutter (first adults)			5/23 (147)
Pear thrips (first adults)		4/21 (25)	4/15 (19)
Plum curculio (first adults)		6/4 (185)	
OTHER OBSERVATIONS			
Spring peepers calling		4/19 (8)	

HARDWOOD DEFOLIATORS

Birch Defoliation

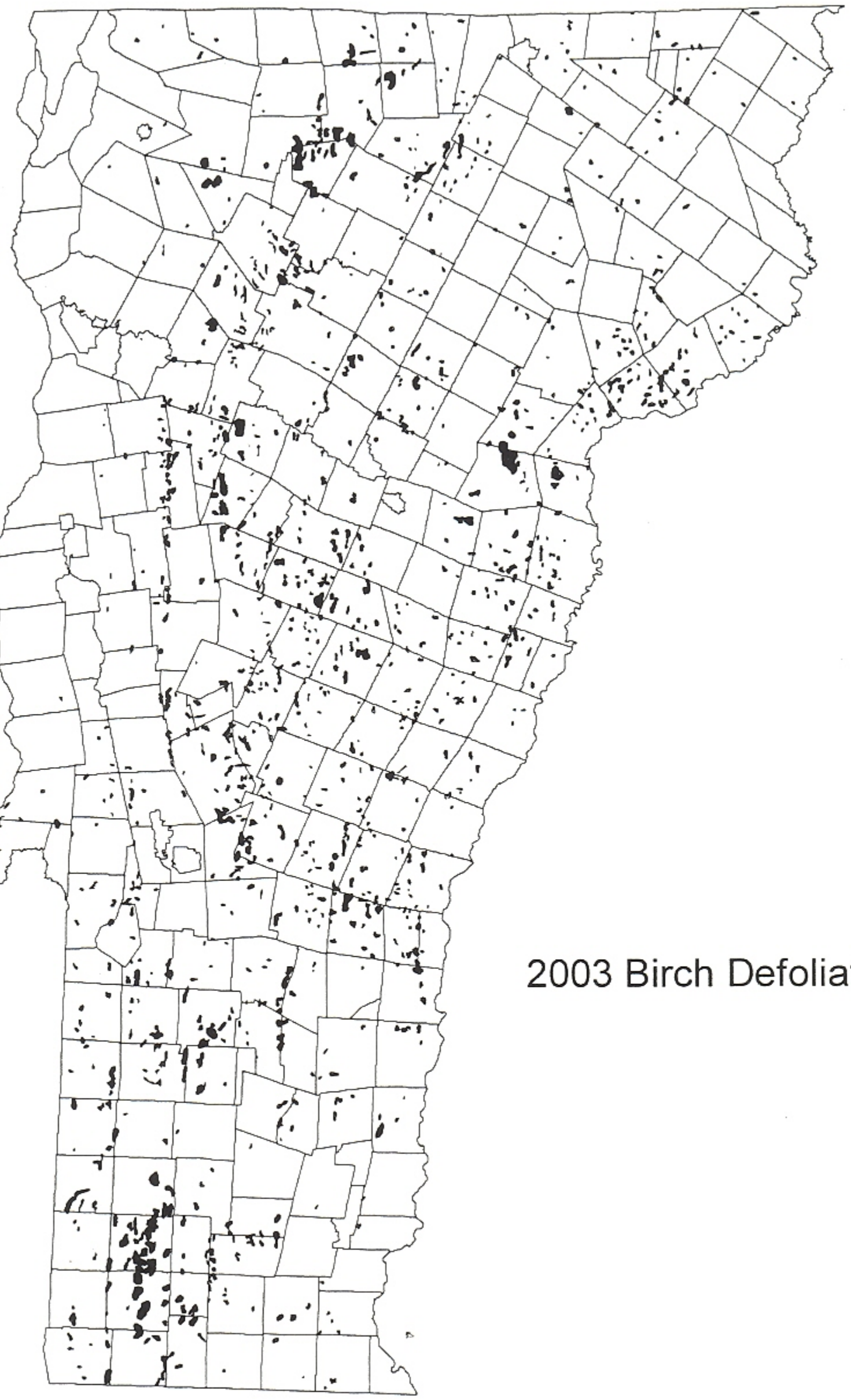
Birch defoliation and browning was widespread and heavy late in the season (Table 2, Figure 7), with a different mix of defoliators responsible for the damage. **Birch skeletonizer**, *Bucculatrix canadensisella*, was the principal defoliator, its populations exploding from moderate levels in 2002. Heavy defoliation of yellow birch, and also white birch, occurred in the central part of the state, particularly between Plymouth and Rochester. **Birch Leaf Folders**, *Ancylis discigerana* and *Acleris logiana* were also common and caused some scattered heavy damage to yellow birch. **Birch Leaf Miners**, *Fenusa pusilla* and *Messa nana,* were common but their damage was much lighter than the moderate to heavy levels seen last year. Other defoliators found on birch leaves included the omnivorous leafroller, *Archips purpurana,* the oblique banded leaf-roller, *Choristoneura rosaceana*, another leaf folder thought to be the gold-striped leaf-folder, *Machimia tentorifella* and a probable *Psilicorsis* sp. leaftier. White and paper birch at high elevations were defoliated throughout the region as a result of **Septoria Leafspot**, caused by *Septoria sp*.

Table 2. Mapped acres of birch defoliation by leaf miners, birch skeletonizer, Septoria leafspot and other agents in 2003.

County	Acres
Addison	6707
Bennington	26893
Caledonia	11871
Chittenden	7344
Essex	4727
Franklin	9747
Grand Isle	0
Lamoille	13603
Orange	14420
Orleans	7081
Rutland	22028
Washington	16958
Windham	7611
Windsor	22377
Total	171367

Bruce Spanworm

Bruce spanworm, *Operophtera bruceata,* populations increased, causing widespread light to moderate defoliation of sugar maple throughout the region. Throughout Vermont, damage was heavier and more common than in 2003. Heavy sugar maple defoliation was observed in Bennington, Rutland and Windsor Counties, including the towns of Rupert, Dorset, Killington, Pittsfield, and Bridgewater. The number of acres defoliated is difficult to estimate because, though damage was often heavy in low to mid crowns of sugar maple,



2003 Birch Defoliation

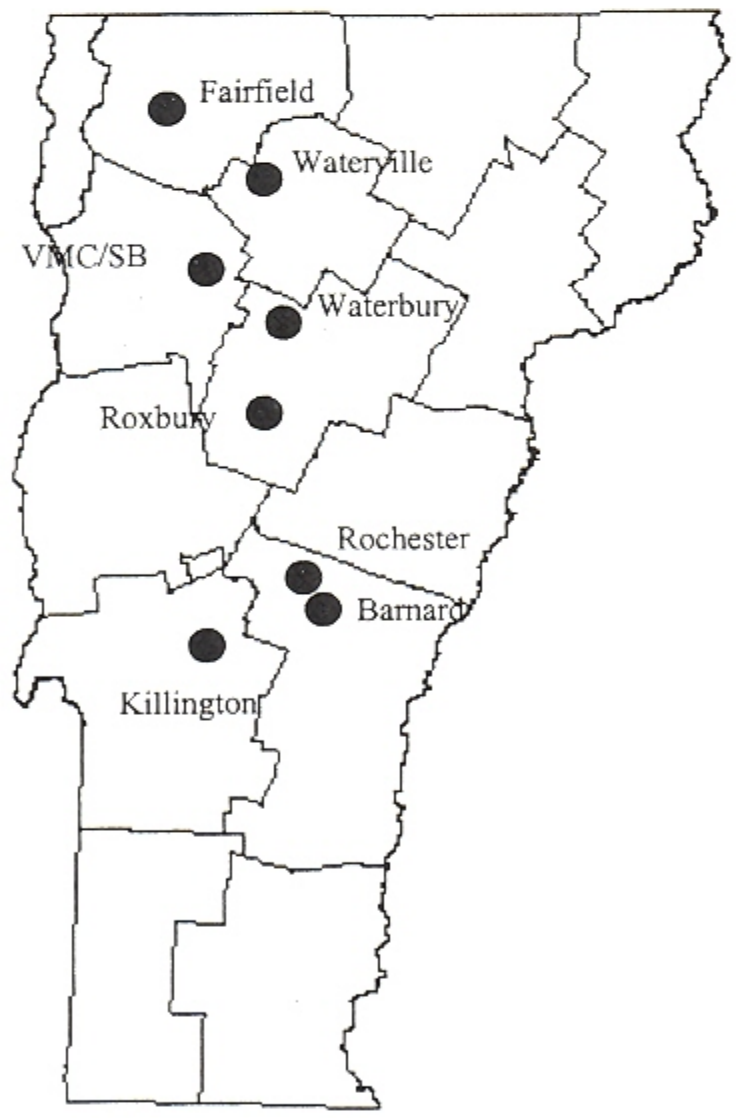
Figure 7. 2003 birch defoliation by leaf miners, birch skeletonizer, Septoria leafspot and other agents.

it was not heavy enough to show up during aerial survey. Also, aerial survey flights were made several months after damage had occurred, and refoliation was occurring by mid-July. Nonetheless, aerial surveys showed 189 acres in Addison County and 44 acres in Orleans County (233 total acres mapped) defoliated by Bruce spanworm. Male moths were very noticeable in the fall.

A number of sugarmakers from north-central and northeastern Vermont expressed concern about the defoliation. A new survey procedure using egg-laying traps placed in sugarbushes of concerned landowners was tried for the first time in the fall of 2003. Traps from four locations in 2002 yielded 270 to 990 eggs per trap and averaged 570 while resulting defoliation in these sites in 2003 ranged from 5% to 27% and averaged 16 percent. More traps were deployed last fall to track population trend and get a better idea of the relationship between egg counts and defoliation the next year. Egg counts made in late fall of 2003 indicate that populations in most areas are down considerably from 2002.

Forest Tent Caterpillar

Forest tent caterpillar, *Malacosoma disstria,* populations remained low in some areas, though populations increased with noticeable defoliation in Castleton, Mt. Holly, Shrewsbury, Killington, Stockbridge, Pittsfield, and Rochester. Larvae, sometimes numerous, were observed throughout the region. Hundreds of wilted caterpillars were seen in the town of Killington. One sugarmaker in Braintree reported seeing a dozen or more caterpillars on most trees in his sugarbush. Aerial surveys detected 371 acres of defoliation in Rutland County. Pheromone trap catch was similar to last year, averaging 5.5 moths per trap from the region compared to 4.8 last year (Figures 8 and 9). More moths were caught in southern Vermont, increasing the statewide average from 5 in 2002 to 6.4 in 2003. This year's trap counts, combined with the numbers of egg masses observed in some areas, suggest that populations will be noticeable again in 2004.



GRAY - 2 moths - 1 trap

Average # of moths caught/trap			
	2002	2003	04
Barnard	4.6	12.3	23
Fairfield	----	1.3	1.7
Huntington	9.2	6.7	5.0
Killington	6.8	9.7	20.0
Rochester (Bethel)	5.9	4.7	9.0
Roxbury	16.0	14.7	13.3
SB 2200	3.8	11.7	18.3
VMC 1400	3.6	3.0	0.3
VMC 2200	3.0	7.0	6.3
VMC 3800	1.0	2.7	10.3
Waterbury	2.0	0.7	2.0
Waterville	0.0	1.3	1.3
Average	**5.0**	**6.4**	

NAMROD set of 3 15
8
7
Camel's Hump SF
Burrows 6.0 6.7 10

Figure 8. Average number of forest tent caterpillar moths caught in pheromone traps, 2002 and 2003. There were 4-5 traps per location in 2002 and 3 traps per location in 2003.

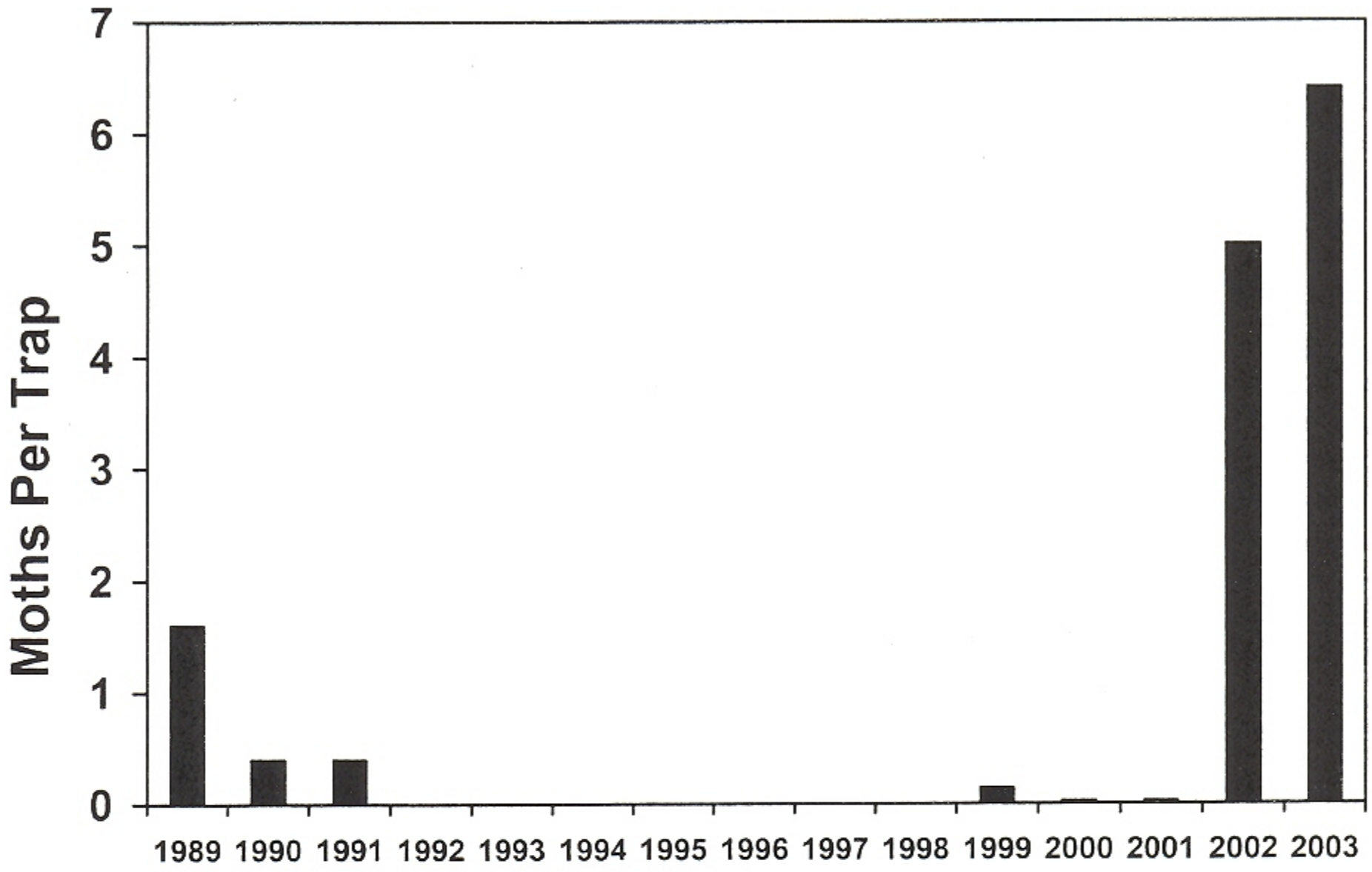
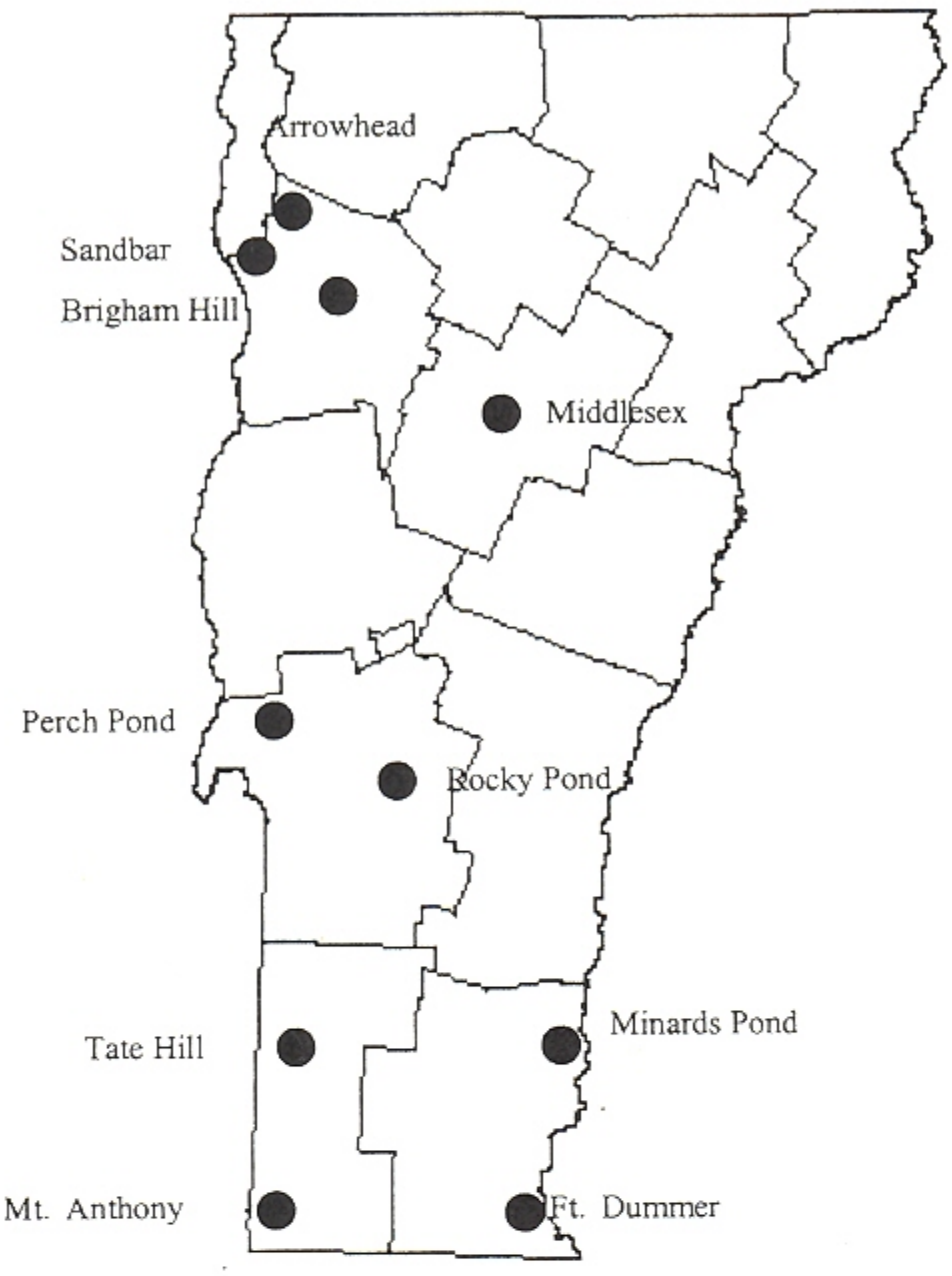


Figure 9. Average number of forest tent caterpillar moths caught in pheromone traps 1989-2003. Traps baited with RPC 2-component lures through 2001, PheroTech lures in 2002-2003. Five multipher traps per site through 2002, three traps per site in 2003.

Gypsy Moth

Gypsy moth, *Lymantria dispar*, populations appeared to be increasing, but populations failed to develop, and no defoliation was observed. Although larvae were commonly observed throughout the region, the pathogen, *Entomophaga maimaiga*, is credited with substantial larval mortality in Vermont and throughout the northeastern US, thanks to wet spring and early summer weather.

Egg masses in focal area monitoring plots remained low, with an average of fewer than 2 egg masses per plot. Also, a few egg masses were found in control plots (Arrowhead - ave. of 1/plot, Sandbar- ave. of 2.5/plot - Brigham Hill - ave. of 0.5/plot) (Figures 10-11). Elsewhere, they were frequently observed outside of preferred gypsy moth host types, where the fungus spore load would be low, and *Entomophaga* may not have had a significant impact. In pheromone traps placed for other moth species, the incidental catch of male gypsy moths was higher than in previous years. Although gypsy moths will continue to be present in 2004, no defoliation is expected.



# of Gypsy Moth Egg Masses per 1/25th Acre Plot:	
Arrowhead	1.5
Brigham Hill	2.5
Ft. Dummer	0
Middlesex	0
Minards Pond	0.5
Mount Anthony	1.5
Perch Pond	0
Rocky Pond	0
Sandbar	3.0
Tate Hill	0
Average	**1.0**

Figure 10. Gypsy moth egg mass counts from focal area monitoring plots, 2003. Average of two 15 meter diameter burlap-banded plots per location.

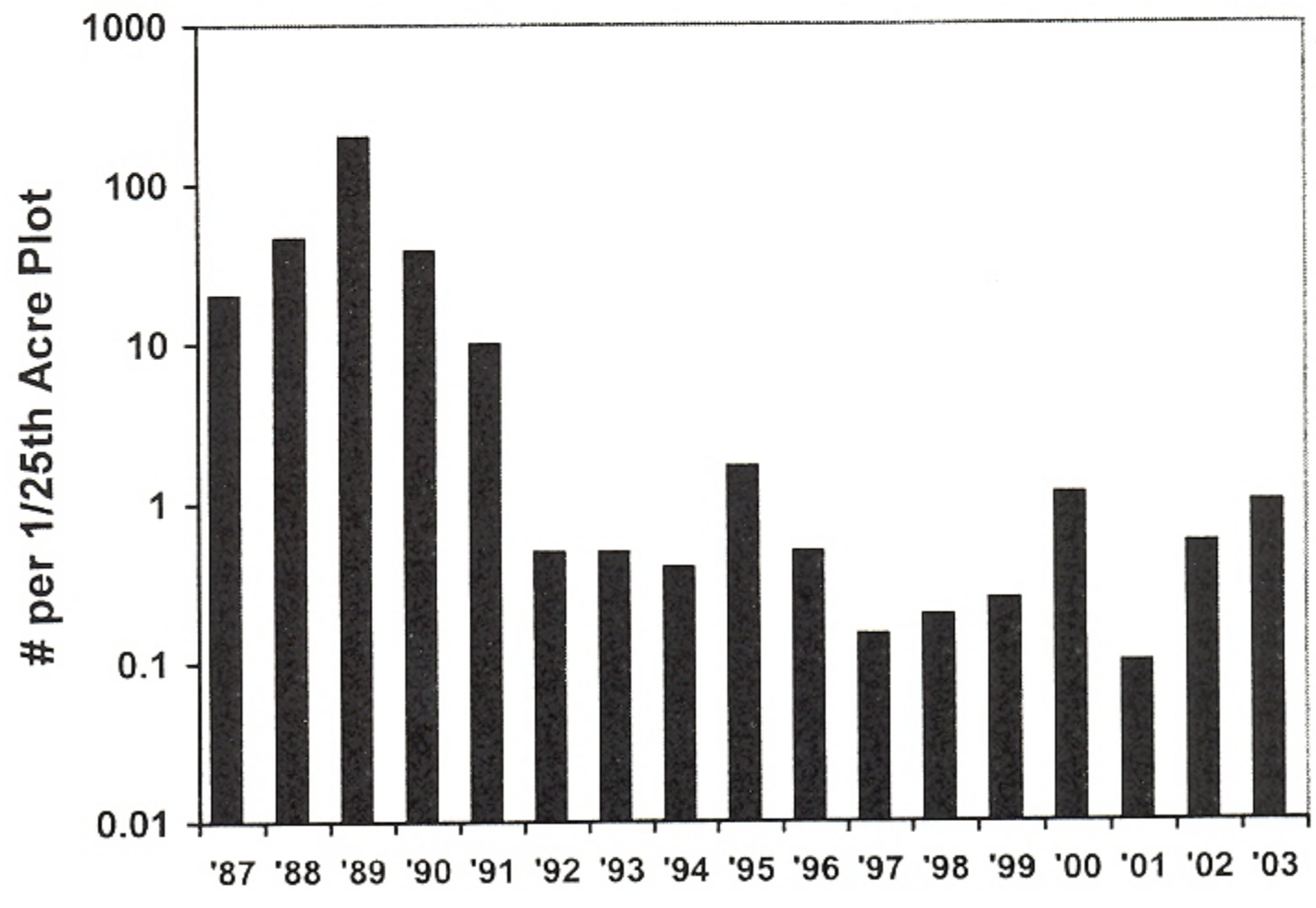


Figure 11. Gypsy moth egg mass counts from focal area monitoring plots, 1987-2003. Average of ten locations, two 15m diameter burlap-banded plots per location.

Locust Leaf Miner

Locust Leaf Miner, *Odontata dorsalis,* populations increased dramatically, even though damage showed up later than normal. Heavy defoliation was observed in Rutland, Windsor and Windham Counties, with the most severe defoliation in the town of Putney. In aerial surveys, a total of 1,437 acres of defoliation was attributed to the locust leaf miner (Table 3). Where defoliation has occurred for a number of years in a row, locust borer, which prefers smaller diameter stems, is causing mortality of young trees and killing the branches of larger trees. On the larger trees, epicormic sprouting is common.

Table 3. Mapped acres of damage by locust leafminer in 2003.

County	Acres
Chittenden	100
Grand Isle	19
Windham	1041
Windsor	277
Total	1437

Maple Leaf Cutter

Maple leaf cutter, *Paraclemensia acerifoliella*, defoliation of sugar maple was widespread this year but remained mostly at light levels, especially in overstory trees, with some moderate defoliation in the Northeast Kingdom. In the southern part of the state, there was noticeable defoliation in Ludlow and Mount Holly. Heavy damage to regeneration was observed in Pittsfield (Table 4).

Table 4. Mapped acres of damage by maple leaf cutter in 2003.

County	Acres
Franklin	15
Lamoille	145
Orange	41
Rutland	283
Washington	147
Windsor	274
Total	905

Saddled Prominent

Saddled prominent, *Heterocampa guttivata*, populations remained very low. No defoliation of sugar maple was detected and pheromone traps caught an average of only 0.1 moths per trap, up only slightly from the lowest counts in 2002 (Figure 12).

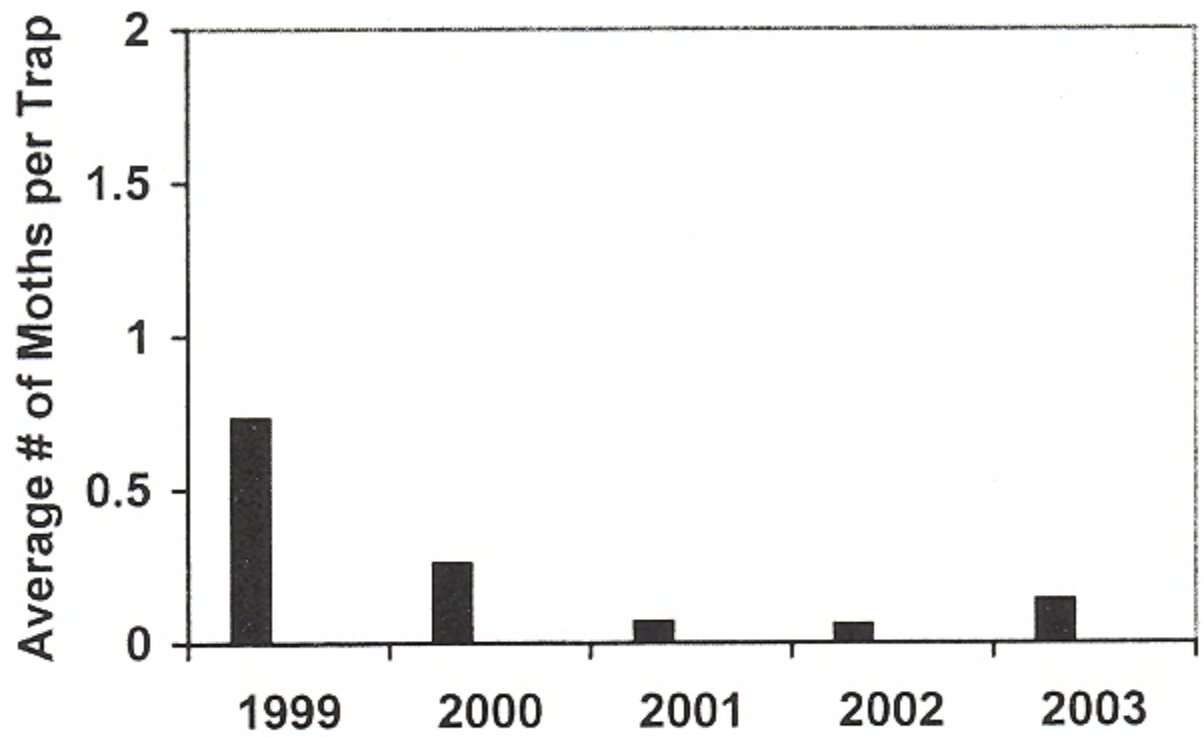


Figure 12. Average number of saddled prominent moths caught in pheromone traps 1999-2003. Average of 3-4 multi-pher traps per location, and 5-6 locations per year.

OTHER HARDWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Alder Flea Beetle	Alder	Throughout	Alder turned brown in many locations by early August. Scattered heavy damage. Total of 565 acres of defoliation was mapped: Essex County- 468 acres; Franklin County – 15 acres; Orleans County – 82
Altica ambiens			
Birch Leaf Folder			See Birch Defoliation
Ancylis discigerana			
Birch Leaf Miner			See Birch Defoliation
Fenusa pusilla			
Birch Sawfly	White birch	Brattleboro, Hartland	Ornamentals
Arge pectoralis			
Birch Skeletonizer			See Birch Defoliation
Bucculatrix canadensisella			
Bruce Spanworm			See narrative
Operophtera bruceata			
Cherry Scallop Shell Moth	Cherry	Widely scattered	Occasional nests; individual small trees affected
Hydria prunivorata			

OTHER HARDWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Eastern Tent Caterpillar *Melacosoma americanum*	Cherry, Apple	Throughout	In northern Vermont, common but not as heavy as in 2002; in southern Vermont, heavier than in 2002
European Snout Beetle *Phyllobius oblongus*	Red Maple and many other hosts	Scattered	Only small numbers observed after being very abundant in 2002
Fall Webworm *Hyphantria cunea*	Hardwoods	Throughout	Common at low levels similar to 2002. Appears to be increasing in Champlain Valley
Forest Tent Caterpillar *Malacosoma disstria*			See narrative
Gypsy Moth *Lymantria dispar*			See narrative
Hickory Tussock Moth *Lophocampa caryae*	Hardwoods	Widely scattered	Individual larvae
Japanese Beetle *Popillia japonica*	Many	Throughout	More common now in northern Vermont but overall populations, though noticeable, remained down this year. Locally heavy on Linden in Newport
Locust Leaf Miner *Odontata dorsalis*			See narrative
Maple Basswood Leaf Roller *Sparganothis pettitana*	Sugar maple	Poultney	Light defoliation
Maple Budminer Family Tortricidae	Sugar maple	Corinth	Common in opening buds in a sugarbush
Maple Leaf Cutter *Paraclemensia acerifoliella*			See narrative
Maple Leafblotch Miner *Cameraria aceriella*	Sugar maple	Lamoille and Caledonia Counties	Light damage overall. Some heavy damage to individual leaves
Maple Trumpet Skeletonizer *Epinotia aceriella*	Sugar maple	Widely scattered	Lower levels than in previous years; little damage seen

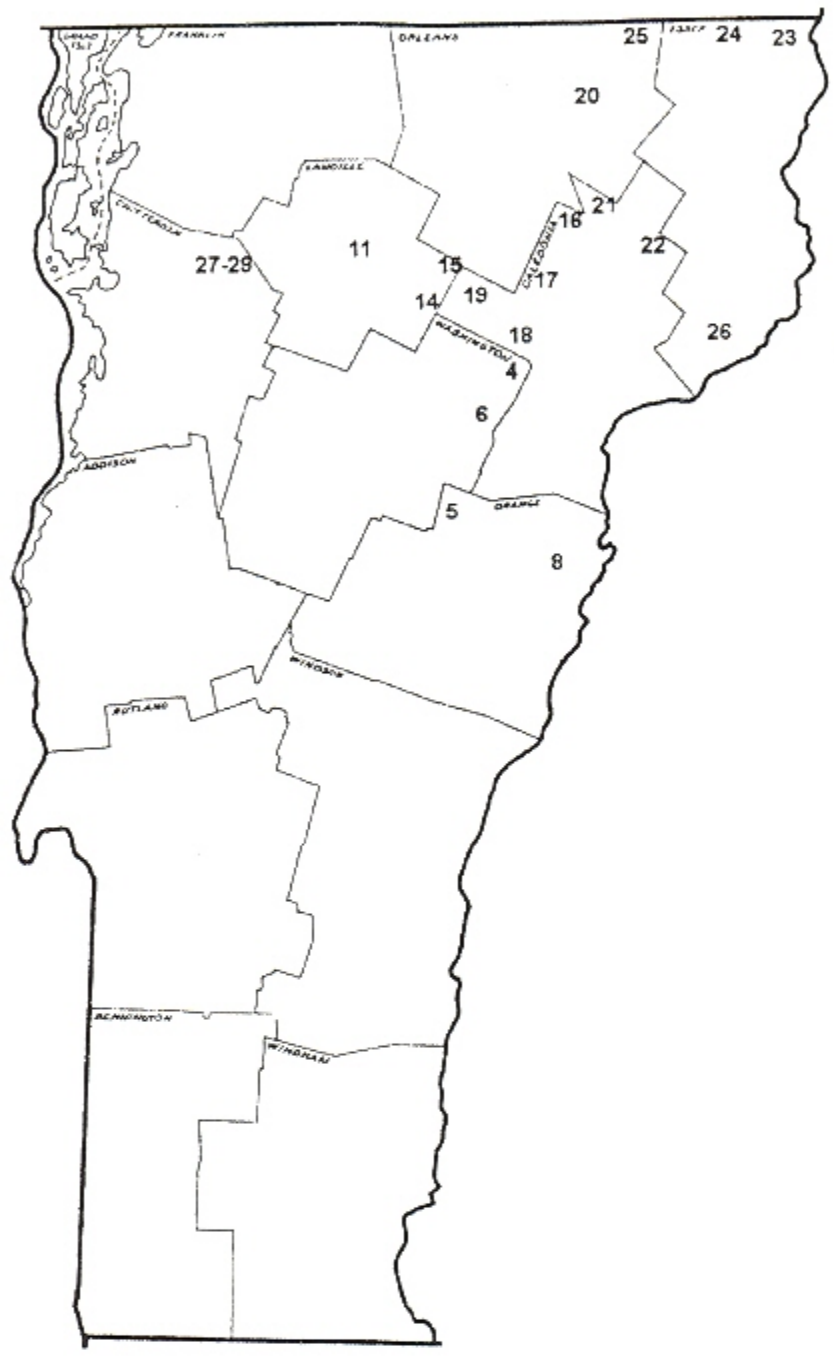
OTHER HARDWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Maple Webworm *Tetralopha asperatella*	Sugar maple	Springfield, Poultney, Hyde Park	Individual nests; appears to be increasing, with light damage
Mimosa Webworm *Homadaula anisocentra*	Honeylocust	Springfield	Ornamental
Mountain Ash Sawfly *Pristiphora geniculata*	Mountain ash	Ludlow and Chittenden County	Defolation observed in Ludlow; generally low populations, with few seen
Oak Leaf Tier *Croesia semipurpurana*	Red oak	Chittenden County	Decreasing
Oak Skeletonizer *Bucculatrix ainsliella*	Red oak	Brandon, Danville	Light defoliation; otherwise, populations dramatically down from 2002
Orange-humped Mapleworm *Symmerista leucitys*	Sugar maple	Mendon	Individual larva; not observed elsewhere
Pear Slug Sawfly *Caliroa cerasi*	Hawthorn	Weathersfield	Ornamental
Saddled Prominent *Heterocampa guttivata*			See narrative
Satin Moth *Leucoma salicis*	Poplars	Hartford and Sharon; Lamoille, Chittenden and Washington Counties	Decreasing; seen on only a few trees this year. Some mortality from prior defoliation in Hartland
Uglynest Caterpillar *Archips cerasivoranus*	Cherry	Stowe, Underhill	A few observed; populations very low
Viburnum Leaf Beetle *Pyrrhalta viburni*	Viburnum	Morrisville Waterbury Hyde Park	Moderate to heavy damage. This species is now known to occur in Addison, Caledonia, Chittenden, Essex, Franklin, Grand Isle, Lamoille, Orange and Washington Counties
White Marked Tussock Moth *Orgyia leucostigma*	Hardwoods	Widely scattered	Individual larvae
Willow Flea Beetle *Rhychaenus rufipes*	Black willow	Widespread	Populations increasing. 119 acres mapped in Rutland County

SOFTWOOD DEFOLIATORS

Spruce Budworm

Spruce budworm, *Choristoneura fumiferana*, continued at low levels, with no visible defoliation detected. The number of moths captured in pheromone traps in northern Vermont dropped again this year after being at the highest level seen since the end of the last outbreak, in 2000 (Figures 13 and 14).



Location No.	Name	# of moths/trap
4.	Danville Hill	2.0
5.	Reservoir	3.0
6.	Marshfield Pond	4.0
8.	Scotch Hollow	2.0
11.	Centerville	4.3
14.	East Hill WMA	2.3
15.	Bear Swamp	4.0
16.	Withers	2.7
17.	Mason	2.3
18.	Star School	3.7
19.	Beagle Club	3.0
20.	Brownington Pond	1.7
21.	Calendar Brook	2.3
22.	Chieppo	1.7
23.	Tin Shack	1.7
24.	Norton Cemetery	2.0
25.	Holland Pond	3.7
26.	Victory Bog	1.3
27.	VMC 1400	3.7
28.	VMC 2200	0.7
29.	VMC 3800	4.7
	Average	**2.7**

Figure 13. Spruce budworm pheromone plot locations and average number of moths caught per trap in 2003.

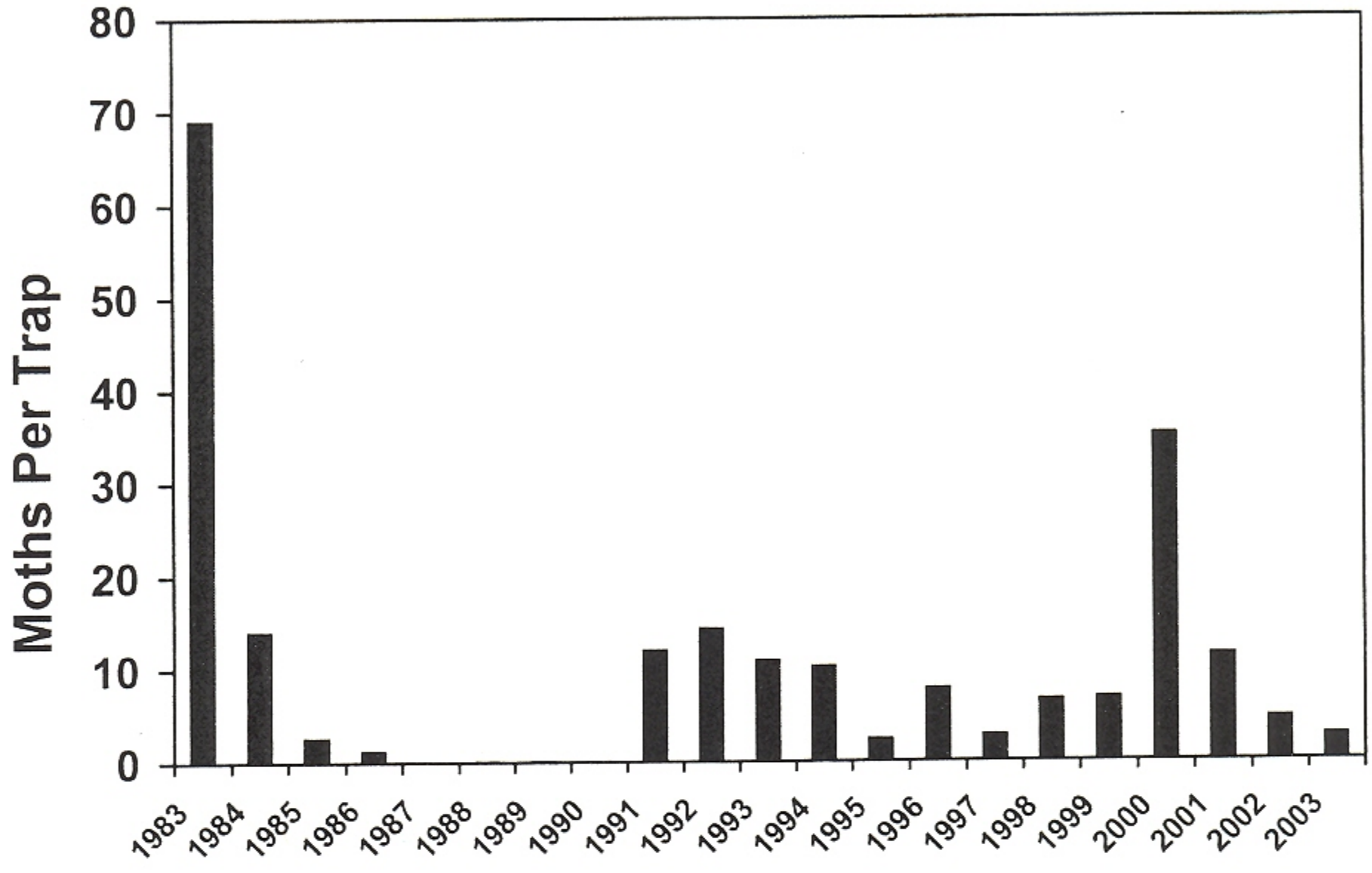


Figure 14. Average number of spruce budworm moths caught in pheromone traps in Vermont, 1983-2003, based on 3 to 5 multi-pher traps per site for 15 to 23 sites.

OTHER SOFTWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Arborvitae Leaf Miner *Argyresthia thuiella*	Northern white cedar	Bennington, Caledonia, Essex, Orleans, Rutland and Washington Counties	Heavy damage in scattered locations
European Pine Sawfly *Neodiprion sertifer*	Scots pine	Chittenden County	Some defoliation; stable populations
European Spruce Needle Miner *Taniva albolineana*	White spruce	Chittenden, Franklin, Addison and Grand Isle Counties	Common at light levels. Some moderate damage to Christmas trees in St. Albans
Introduced Pine Sawfly *Diprion similis*	Red and white pine	Brattleboro, Springfield	Increasing in southern region; not observed in northern part of Vermont
Larch Casebearer *Coleophora laricella*	Tamarack	Caledonia, Orleans and Essex Counties; Bethel, Mendon and Pittsford	Scattered light damage; less than in 2002
Spruce Budworm *Choristoneura fumiferana*			See narrative
Yellow-Headed Spruce Sawfly *Pikonema alaskensis*	White and blue spruce	Jay, Stowe, Newport, Danville, Burke	Some trees with heavy damage

SAPSUCKING INSECTS, MIDGES AND MITES

Balsam Gall Midge

Balsam gall midge, *Paradiplosis tumifex*, populations collapsed, with little or no damage in Christmas tree plantations that had heavy damage in 2000 and 2001. If populations follow past patterns, this insect should not be a problem during the next 3 - 4 years.

Balsam Twig Aphid

Balsam twig aphid, *Mindarus abietinus*, damage was light to non-existent in most locations in 2003. Many Christmas tree growers who frequently apply pesticides to control twig aphid did not spray at all this year. There were a few exceptions, with a few growers reporting some moderate damage and a couple with severe damage.

Balsam Woolly Adelgid

Balsam woolly adelgid, *Adelges piceae,* damage was visible in balsam fir areas throughout the Green Mountain range (Table 5, Figure 15). In infested areas, mortality and gouting were common, indicating that the insect had been present at significant levels in prior years. Significant fir mortality was observed in the south central towns of Somerset, Stratton, Londonderry, Searsburg, Sunderland, Mt. Holly, Shrewsbury, Wallingford, and Winhall, among others. Low populations were observed in Groton, Burke and Victory. Trunk and twig infestations are currently light, suggesting that cold winter temperatures in early 2003 may have knocked the population down in northeastern Vermont. Observations indicated that most overwintering larvae above snow line on fir stems had died. Previous years' drought conditions may also have played a role in mortality, especially in poorly drained, lowland sites. Bark beetles are building up in recently dead stems, and can be found infesting some trees which are still green.

Table 5. Mapped acres of damage by balsam woolly adelgid in 2003.

County	Acres
Addison	293
Bennington	1298
Caledonia	0
Chittenden	924
Essex	362
Franklin	64
Grand Isle	0
Lamoille	273
Orange	1037
Orleans	438
Rutland	2276
Washington	1176
Windham	303
Windsor	457
Total	8901

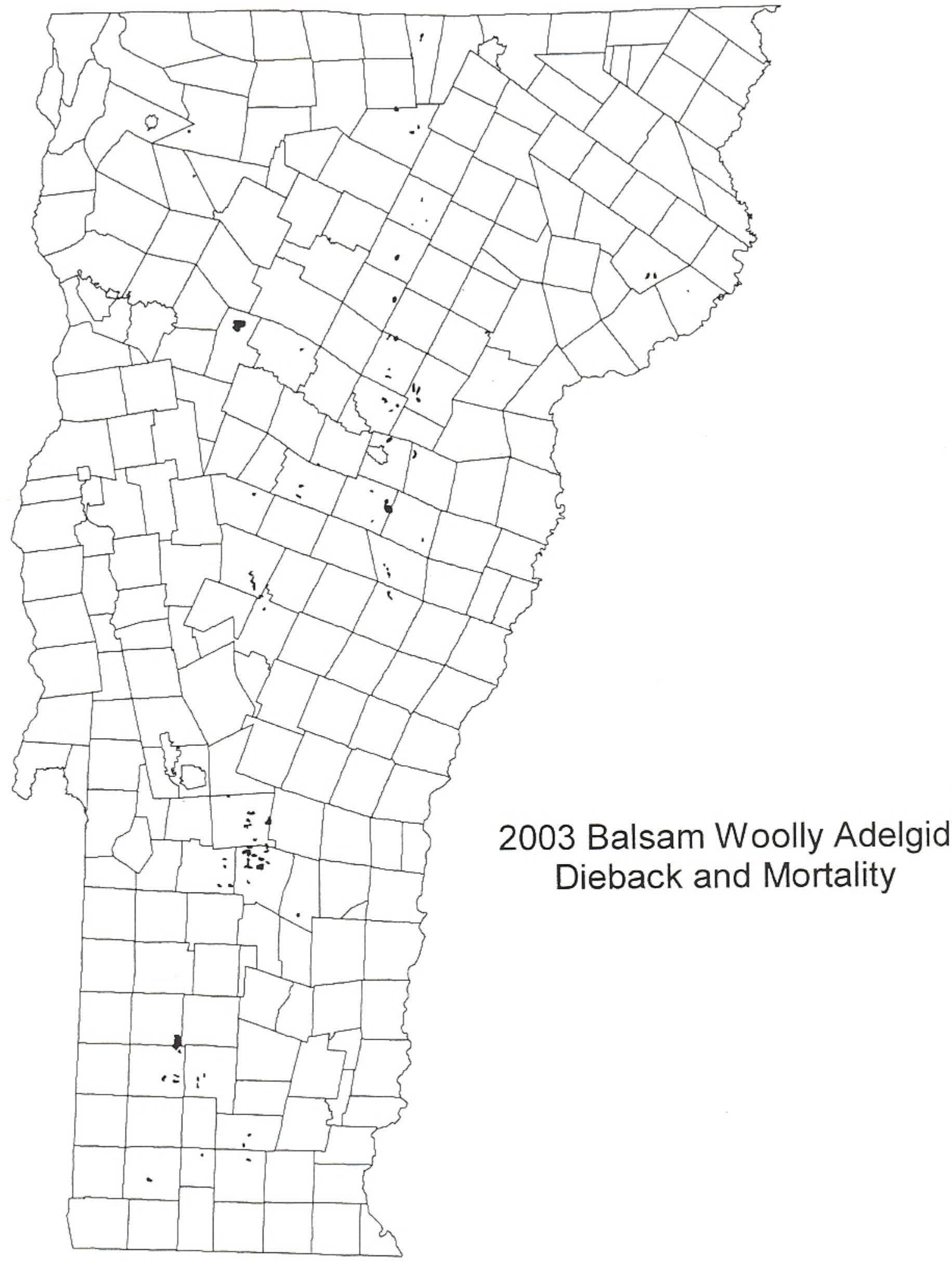


Figure 15. 2003 damage by balsam woolly adelgid. Mapped area is 8,901 acres.

Oystershell Scale

Oystershell scale, *Lepidosaphes ulmi*, populations on American beech were 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 16, Table 6).

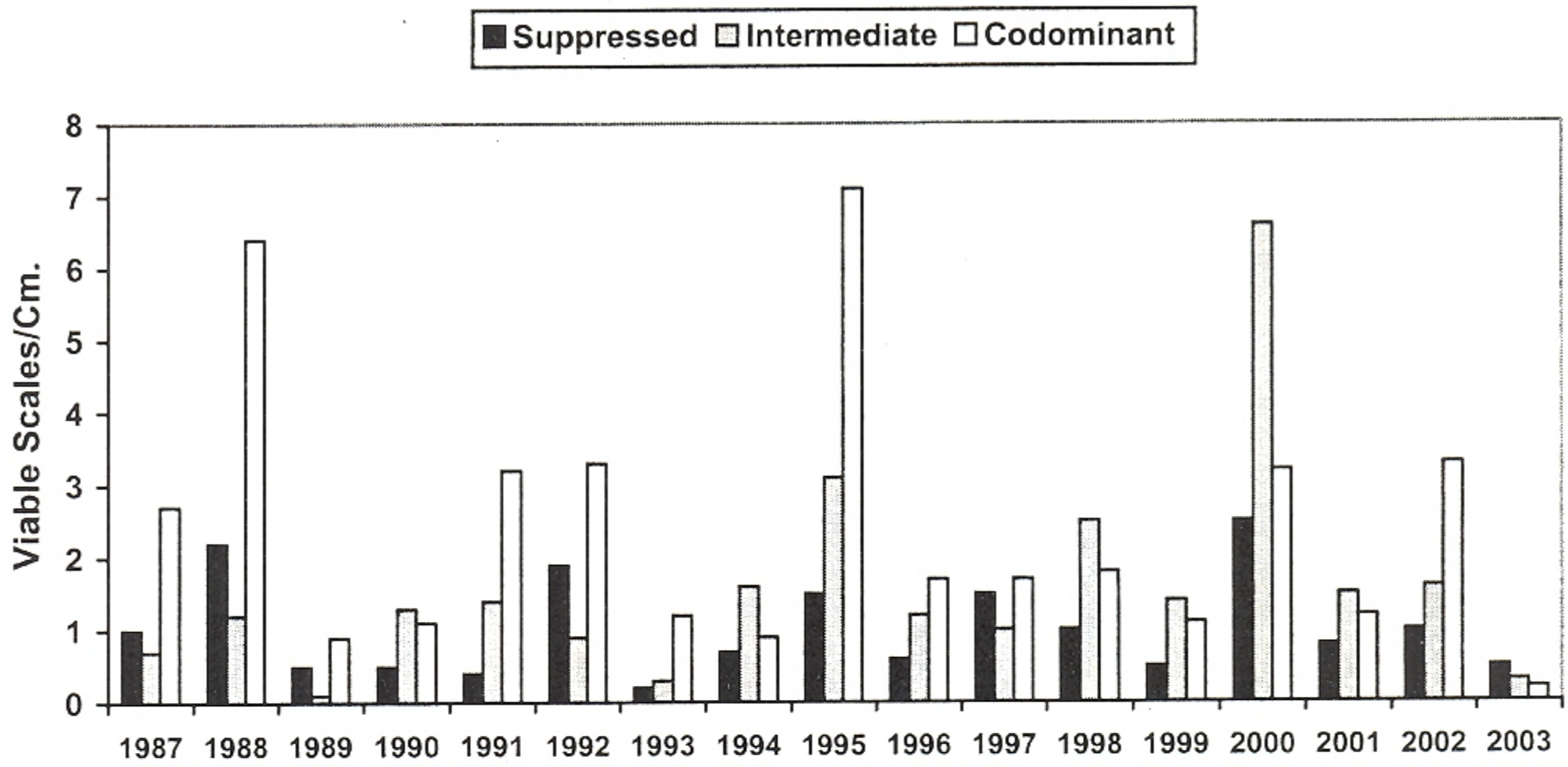


Figure 16. Oystershell scale populations in three tree canopy levels in Camel's Hump State Forest, 1987-2003. Average for 10 current year twigs/tree per crown class, collected in autumn.

Table 6. Number of oystershell scales on current year beech twigs in Camel's Hump State Forest, 1993-2003.

	Average Number of Mature Viable Scales Per Twig										
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Suppressed	1.2	2.1	9.0	0.6	2.1	4.0	0.7	2.9	4.2	11.0	2.1
Intermediate	1.4	8.4	16.8	1.2	2.6	3.3	2.8	12.1	10.4	14.7	1.2
Codominant	4.8	3.4	11.3	0.2	4.5	4.2	2.7	7.3	1.4	4.0	0.7

Pear Thrips

Pear thrips, *Taeniothrips inconsequens,* populations remained very low this year, causing only very light damage throughout the state. Some noticeable damage occurred in northeastern Windsor County. Soil samples collected in the fall of 2002 revealed very few thrips. (Figure 17) . The average of 0.3 per sample for the region was half the level found in 2001 and was far below the 3.6 per sample in 2000 that led to some heavy damage in 2001. Populations emerging in the spring, as sampled using yellow sticky traps, mirrored the low soil population estimates (Figure 18). Soil samples were taken again in the fall of 2003 to predict 2004 pear thrips population levels. Results show that soil populations have increased statewide, and are especially high in Windham County. There may be an increase in damage in 2004 if sugar maple bud development is slow, providing thrips with feeding time in buds and emerging leaves.

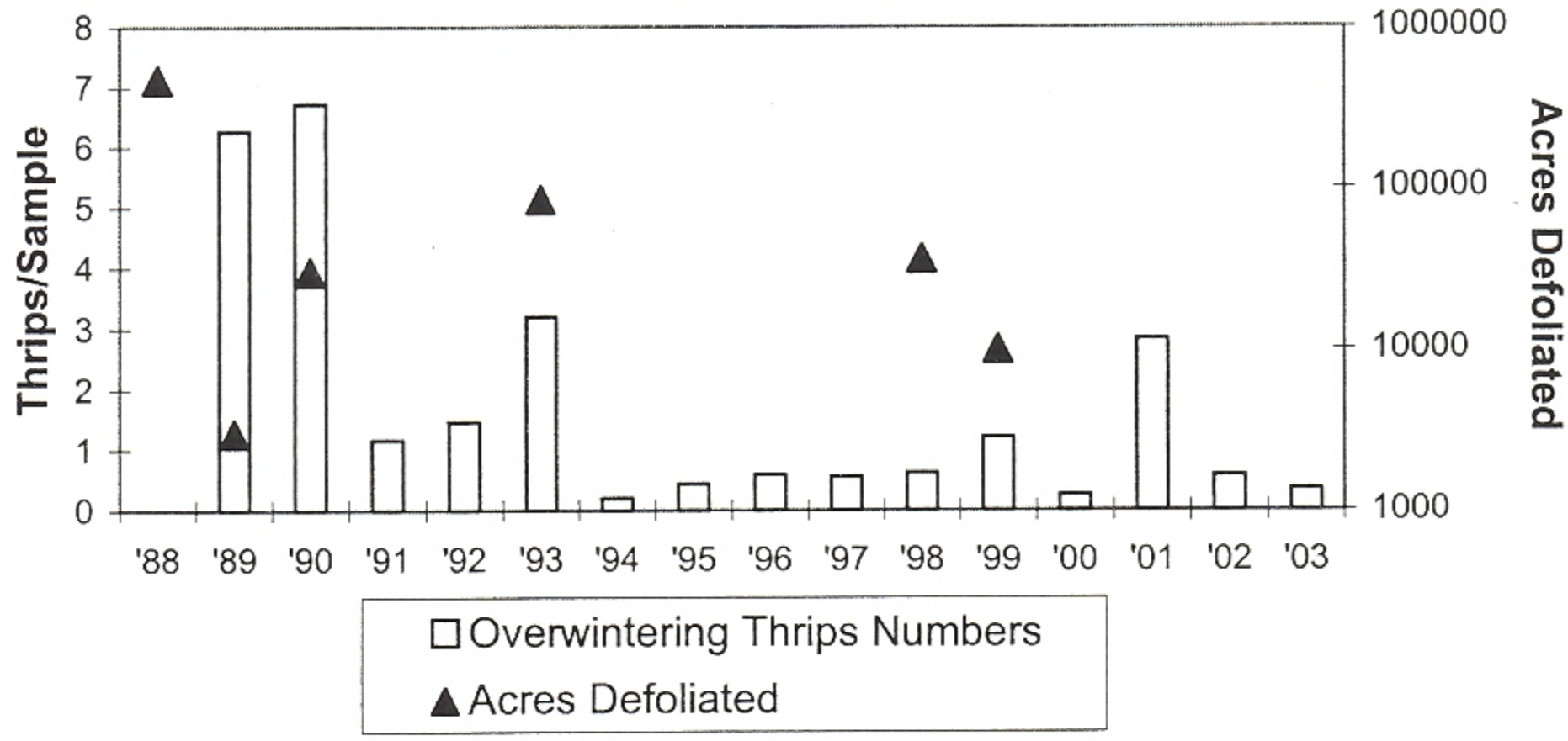


Figure 17. Average counts of overwintering pear thrips in soil samples (# insects/16 in^3), compared to acres of thrips damage mapped statewide the following summer. Overwintering thrips numbers determined by extraction in 1989-93, and by forced emergence in 1994-03. 43 sites were sampled to determine populations in the winter of 2003-2004.

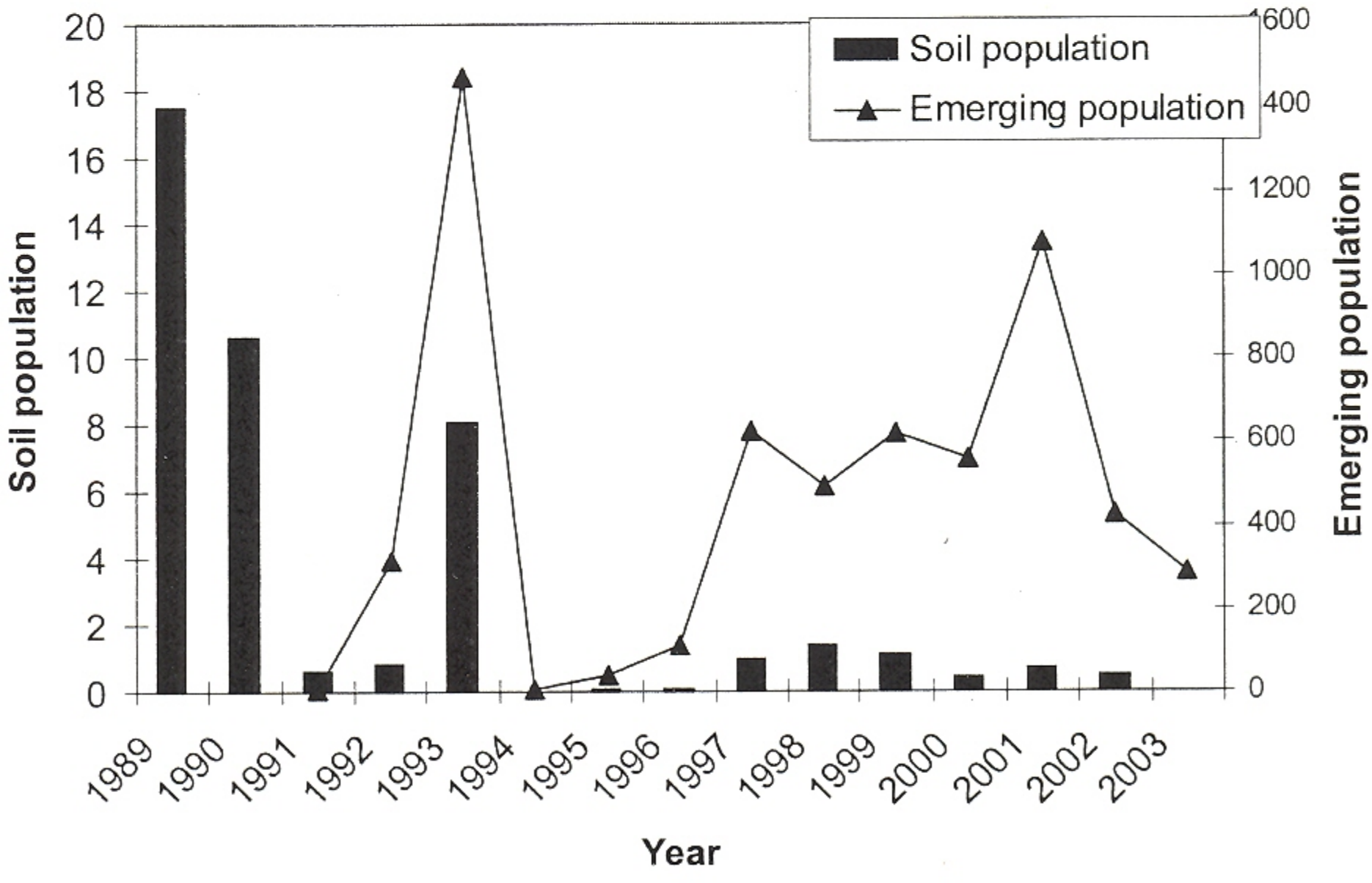


Figure 18. Trend in pear thrips populations at the Proctor Maple Research Center from 1989-2003 using soil sampling to estimate the overwintering population (# insects/16 in^3), and sticky traps to estimate the emerging population (4, Sentry Multiguard traps, 6"X8").

OTHER SAPSUCKING INSECTS, MIDGES, AND MITES

INSECT	HOST(S)	LOCALITY	REMARKS
Aphids *Cinara sp.*	Spruce Eastern white pine	Shaftsbury Hardwick	Observed on individual ornamental trees
Aphids *Periphyllus sp.*	Hawthorn	Weathersfield	Observed on fertilized trees
Ash flowergall mite *Aceria fraxiniflora*	Ash	Chittenden, Franklin, Addison and Grand Isle Counties	Scattered
Balsam Gall Midge *Paradiplosis tumifex*			See narrative
Balsam Twig Aphid *Mindarus abietinus*			See narrative
Balsam Woolly Adelgid *Adelges picea*			See narrative
Beech Scale *Cryptococcus fagisuga*			See Beech Bark Disease
Birch Lacebug *Corythuca palipes*	White birch	Windsor	Stippling
Boxelder Bug *Leptocoris trivittatus*	Boxelder	Widespread	Commonly seen around houses in fall. No damage observed
Boxelder Erineum *Aceria negundi*	Boxelder	Springfield	Ornamental
Butternut Blister Mite *Aceria cinereae*	Butternut	West Windsor	Ornamental
Cooley Spruce Gall Aphid *Adelges cooley*	Blue, white and Norway spruce	Widely scattered	Ornamentals; remains common in Christmas trees
Cottony Maple Scale *Pulvinaria innumerabilis*	Sugar maple	Reading	Light on regeneration
Eastern Spruce Gall Adelgid *Adelges abietis*	Red, white and Norway spruce	Throughout	Remains common on ornamentals and Christmas trees at mostly light levels
Erineum Gall Mite *Aceria elongatus*	Sugar maple	Throughout	Lighter than usual

OTHER SAPSUCKING INSECTS, MIDGES, AND MITES

INSECT	HOST(S)	LOCALITY	REMARKS
Hemlock Scale	Balsam fir	Springfield	Scales observed on Christmas trees
Abgrallaspis ithacae			
Hemlock Woolly Adelgid			Not observed or known to occur in Vermont
Adelges tsugae			
Lacebugs	Basswood	Windsor County	Damage by early June
Corythucha sp.			
Leafhoppers	Serviceberry	West Windsor	Ornamentals
Family Cicadellidae			
Lecanium Scale	Various	Addison, Chittenden, Franklin, Grand Isle Counties;	Light in the Champlain Valley
Lecanium sp.	White ash	Topsham	Heavy on young white ash
Maple Bladder Gall Mite	Sugar and red maple	Widespread	Common but remains light
Vasates quadripedes			
Maple Spindle Gall Mite	Sugar and red maple	Widespread	Present by early June; common but remains light
Vasates aceris-crummena			
Oystershell Scale			See narrative
Lepidospaphes ulmi			
Pear Thrips			See narrative
Taeniothrips inconsequens			
Pine Bark Adelgid	White pine	Throughout	Common, mostly scattered light populations; moderate to heavy levels observed on suppressed, pole-size trees in Brattleboro
Pineus strobi			
Pine Fascicle Mite	White pine	Lamoille County	Very light damage on Christmas trees and wild trees
Trisetacus alborum			
Pine Leaf Adelgid	White pine	Bethel	Very light damage
Pineus pinifoliae			
Pine Needle Scale	Scots pine	Morrisville	Very light populations
Chionapsis pinifoliae			
Pine Spittlebug	Conifers	Springfield Danville	Observed in June; heavy populations on scattered trees
	Scots pine	Bakersfield	Some heavy populations on Christmas trees
Aphrophora parallela			

OTHER SAPSUCKING INSECTS, MIDGES, AND MITES

INSECT	HOST(S)	LOCALITY	REMARKS
Ragged Spruce Gall Aphid *Pineus similis*	Red spruce	Widespread	Remains common
Red Pouch Gall *Pemphigus rhois*	Staghorn sumac	Dummerston	Noticeable
Spruce Spider Mite *Oligonychus ununguis*	Conifers	Throughout	Only light populations and damage were observed on Christmas trees. Rains were heavy enough to prevent population buildup from light levels in 2002. Some heavier damage to ornamental white spruce in Landgrove and an arborvitae in Benson
Vagabond Aphid *Mordwilkoja vagabunda*	Cottonwood	Charlotte	Heavy in many trees in stand; other trees unaffected
Woolly Alder Aphid *Paraprociphilus tessellatus*	Alder	Orleans, Caledonia and Essex Counties	Low populations
Woolly Elm Aphid *Eriosoma americana*	Serviceberry	Morristown	Low populations

BUD AND SHOOT INSECTS

Balsam Shootboring Sawfly

Balsam shootboring sawfly, *Pleroneura brunneicornis*, caused little or no damage to fir Christmas trees this year compared to light to moderate damage in 2002. This was expected, as damage is lowest in odd years due to a two-year life cycle for the majority of insects. Adults caught on 3x5 yellow sticky cards placed in mid-crowns of trees in Lamoille County dropped to the lowest level yet seen (0.3 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 not expected to be a problem in 2004.

Pine Shoot Beetle

Pine shoot beetle, *Tomicus piniperda*, surveys continued in 2003 (Table 7). Following the Pine Shoot Beetle Survey Protocol, 10 Lindgren funnel traps baited with alpha pinene lure and UHR ethanol were placed in each of the following counties: Franklin, Orange, Lamoille, Chittenden and Washington. An additional 5 traps were to be placed in Grand Isle County, a county with few host trees. Scots pine sites near major roads received the highest priority for trapping, followed by red pine and then white pine. Scots pine sites were substituted for red pine sites used in the past whenever Scots pine could be located. Trap collection cups were modified to allow better water drainage by drilling additional holes in the bottom and covering with fine mesh screening. Traps were placed in the field between February 27 and March 11, well before temperatures rose above 50 degrees Fahrenheit. Trap contents were emptied every two weeks until the end of June.

One *Tomicus piniperda* was captured in one Washington County location between April 17 and May 5. This was reported as a new county record. All other traps in previously negative counties remained negative for *T. piniperda*. A total of 15, 091 other Scolytid beetles were examined from the contents of the traps (Table 8). Summary tables compare year to year numbers and sites of traps, and dates that *Tomicus piniperda* were captured in traps (Tables 9-10).

A Pine Shoot Beetle Quarantine was enacted by U.S.D.A. and the State of Vermont in 2002. The compliance agreements that allow shipment of pine logs and bark out of the regulated counties are pending completion of final details and are in the adoption process. Quarantine regulations listing the newly adopted bark management plan will be effective by mid July, 2004. As of December 31, 2003, the Pine Shoot Beetle has been found in Essex, Orleans, Caledonia and Washington Counties.

Questions on the quarantine regulations should be directed to the Protection Section, Forestry Division in the Waterbury office.

Table 7. Number of sites per county surveyed for the pine shoot beetle, *Tomicus piniperda*, with pheromone-baited Lindgren funnel traps, 1999-2003.

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

Table 8. Summary of 2003 pine shoot beetle pheromone trapping.

County	# Traps	Date Out	Date In	# Trap Checks	# Samples Examined*	# *Tomicus piniperda*	# Other Scolytids
Chittenden	10	3/11/03	6/30/03	80	61	0	759
Franklin	10	3/10/03	6/30/03	80	60	0	938
Grand Isle	5	3/11/03	6/30/03	40	31	0	462
Lamoille	10	2/27/03	6/27/03	80	47	0	2,238
Orange	10	3/7/03	7/2/03	70	60	0	6,267
Washington	10	2/27/03	6/26/03	90	65	1	4,427
Total	55			440	324	1	15,091

* Discrepancy between number of traps checks made and # of samples examined reflects occasions when traps were field checked and found empty.

Table 9. Trap catch summaries for pine shoot beetle surveys in Vermont, 1999-2003.

	1999	2000	2001	2002	2003
Number of counties trapped	2	6	6	7	6
Number of traps	10	58	54	56	55
Number of *Tomicus piniperda* collected	10 (9 in Essex County, 1 in Orleans)	20 (1 in Caledonia County, 19 in Essex County)	2 (Caledonia County)	51 (Orleans County)	1 (Washington County)
Number of scolytids collected	39	750*	750*	1,183	15,091

* Note: The total number of scolytids taken from Lindgren funnel traps that were baited for *Tomicus piniperda* are approximate because we did not receive all trap contents from those counties surveyed by APHIS or the Vermont Agency of Agriculture.

Table 10. Number of adult pine shoot beetles caught in Lindgren funnel traps by location and trap date.

		1999		2000		2001		2002		2003	
County	**Town**	**Trap Dates**	**# of Adults**	**Trap Dates**	**# of Adults**	**Trap Dates**	**# of Adults**	**Trap Dates**	**# of Adults**	**Trap Dates**	**# of Adults**
Essex	Brighton	27 Apr-12 May	2								
	Canaan	27 Apr-12 May	5								
		26 May-8 June	2								
Orleans	Morgan	27 Apr-12 May	1	2-15 May	1						
Derby				6-24 April	7			12-19 Apr	38		
				25 Apr – 2 May	1			17-31 May	2		
				2-5 May	4			31 May-11 June	7		
								11-18 June	2		
								18 June – 12 July	2		
Derby Line				24 Apr-2May	2						
				15-26 May	1						
Barton				15-26 May	1						
				26 May-12 June	1						
				12-21 June	1						
Caledonia	Kirby			4-18 Apr	1	27 Apr-11 May	2				
Washington	Barre Town									17 Apr-1 May	1
Total			10		20		2		51		1

OTHER BUD AND SHOOT INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Balsam Shootboring Sawfly *Pleroneura brunneicornis*			See narrative
Common Pine Shoot Beetle *Tomicus piniperda*			See narrative
European Pine Shoot Borer *Eucosma golriola*	White pine	Stowe	Ornamental
Locust Twig Borer *Ecdytolopha insiticiana*	Black locust	Putney	On trees defoliated by locust leaf miner
Maple Petiole Borer *Caulocampus acericaulis*	Sugar maple	Caledonia and Orange Counties	Heavy damage on individual trees
Oak Twig Pruner *Elaphidionoides parallelus*	Red Oak	Addison, Franklin, Chittenden, Orleans and Grand Isle Counties; also in Newfane	Generally little damage, decreasing. Noticeable damage in Newfane
Pine Shoot Beetle *Tomicus piniperda*			See narrative
White Pine Weevil *Pissodes strobi*	Conifers	Throughout	Remains common; stable populations. Damage similar to previous years. Adults seen laying eggs on May 9 in Vernon. White pine weevil injuries remain an important infection court for *Phellinus pini* red ring rot
Whitespotted Sawyer *Monochamus scutellatus*	Balsam fir	Throughout	Light damage commonly seen on shoots of Christmas trees. (See also Bark and Wood Insects)

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*	White and paper birch	Brattleboro and Franklin, Chittenden, Addison and Grand Isle Counties	Galleries in young transplants in Brattleboro; occasionally seen in other areas
Brown Prionid *Orthosoma brunneum*	Decaying hardwoods and conifers	Randolph, Manchester, Jericho	Adult beetles found wandering
Brown Spruce Longhorned Beetle *Tetropium fuscum*			Not observed or known to occur in Vermont
Carpenter Ant *Camponotus spp.*	Many	Throughout	Populations increased over summer
Eastern Larch Beetle *Dendroctonus simplex*	Tamarack	Widely scattered in southern Vermont and widespread in northern areas	Associated with larch decline; large increase due to abundance of drought-stressed trees, especially in the northeast part of Vermont
Elm Bark Beetle *Hylurgopinus rufipes* and *Scolytus multistriatus*			See Dutch Elm Disease
Emerald Ash Borer *Agrilus planipennis*			Not observed or known to occur in Vermont
Fir Weevil Probably *Pissodes dubius*	Balsam fir	Shrewsbury	In cambium and inner bark of dying trees infested with balsam woolly adelgid
Hemlock Borer *Melanophila fulvoguttata*	Eastern hemlock	Castleton, Hubbardton, Fair Haven, Guilford, West Haven, Shelburne	Associated with mortality of drought-stressed trees on ledgey or disturbed and often exposed sites next to bodies of water. Most common where nearby logging has resulted in high borer populations. Heavy woodpecker activity while trees are still green

BARK AND WOOD INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Japanese Cedar Longhorned Beetle *Callidiellum rufipenne*			Not observed or known to occur in Vermont
Locust Borer *Megacyllene robiniae*	Black locust	Southern Vermont Champlain Valley	Cause of mortality in areas repeatedly defoliated by Locust Leaf Miner. Stable elsewhere
Maple Callus Borer *Synanthedon acerni*	Red maple	Brattleboro	In recent transplant
Northern Engraver *Ips borealis borealis*	White spruce	Greensboro	Attacking drought-stressed forest trees
Northeastern sawyer *Monochamus notatus*	White pine	Weston	Emerging from stressed trees
Pigeon Tremex *Tremex columba*	Sugar maple	Widely scattered	Associated with stressed trees
Pine Engraver *Ips pini*	White and red pine	Wells, Castleton, Proctor, Brandon and other locations	Remains common on declining trees, especially those stressed by recent drought on ledgey or wet sites. Predatory clerid beetles associated with some populations
Pitted Ambrosia Beetle *Corthylus punctatissimus*	Sugar maple	Derby, Coventry	Noticeable mortality of small saplings. Increasing
Redheaded Ash Borer *Neoclytus acuminatus*	Ash	Highgate	Infesting weakened tree
Round-headed Apple Tree Borer *Saperda candida*	Apple	Champlain Valley Northeast Kingdom Woodstock	Associated with ornamental trees
Russian Leather Beetle Osmoderma eremicola	Beech	Middlebury	Found in decayed cavity of weakened tree
Sugar Maple Borer *Glycobius speciosus*	Sugar maple	Throughout	Remains a common cause of defect on slow-growing maples
Whitespotted Sawyer *Monochamus scutellatus*	White pine and balsam fir	Throughout	Active infestations seen in weakened and dying conifers. Adults not as common at large as last year, although some continue to be brought in to verify that they are not Asian longhorned beetles

ROOT INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Conifer Swift Moth *Korsheltellus gracilis*			Not observed
Japanese Beetle *Popillia japonica*	Many	Throughout	More common now in northern Vermont but overall populations, though noticeable, remained down this year
June Beetle *Phyllophaga spp.*	Many	Throughout	Light

FRUIT, NUT AND FLOWER INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Asiatic Garden Beetle *Autoserica castanea*	Many flowers	Lamoille County	Fewer calls than in 2002
Ash flowergall mite *Aceria fraxiniflora*	Ash	Scattered throughout	Scattered. (See also Other Sapsucking Insects, Midges and Mites)
Butternut curculio *Conotrachelus juglandis*	Butternut	Williamstown, Springfield	Nuts contained numerous fly larvae along with curculios
Mossy Rose Gall *Diplolepis rosae*	Rose	Morristown	Caused by a cynipid gall wasp
Plum Curculio *Conotrachelus nenuphar*	Plum	Westminster	Small orchard
Western Conifer Seed Bug *Leptoglossus occidentalis*	Conifers	Throughout	No damage observed on host trees, but bugs commonly seen around houses in fall

MISCELLANEOUS INSECTS AND OTHER ARTHROPODS

Records and specimens of non-pest insects and other arthropods are maintained by the Forest Biology Lab. We report below on non-target moths that were collected during pheromone trap monitoring and also provide a record of organisms submitted to FPR personnel that do not appear in previous sections of the Conditions Report.

A project that might be of interest to readers of this report is the Vermont Butterfly Survey (VBS), a five-year (2002-2006) census sponsored by the Vermont Institute of Natural Science, to document the relative abundance and distribution of butterflies across Vermont. The results, in the form of data tables and general distribution maps for each species encountered in the project, will eventually be published and available on the Internet. Field work relies heavily on volunteers. For more information, see http://www.uvm.edu/~vbap/index.html.

Of special note for 2003 were sightings of the **Spicebush Swallowtail, *Papilio troilus*, and the Tawny Emporer, *Asterocampa clyton***. The swallowtail was found in Bennington County by Kevin Hemeon. According to *Chrysalis*, newsletter of the Vermont Butterfly Survey, this species was previously represented in Vermont by a single but reliable sighting. The presence of the Tawny Emperor was confirmed on August 19 along the Winooski River in Richmond when Tom Fiore and Kristine Wallstrom spied and photographed the butterfly.

Surveys for dragonflies and damselflies (Order Odonata) are also underway in Vermont. In 2003, there were two new species records for the State. These include the **Subarctic Darner, *Aeshna subarctica*,** collected in Essex County on September 10 and the **Spangled Skimmer, *Libellula cyanaea***, collected July 7 in Weathersfield. Both records were provided by Bryan Pfeiffer. For more information on dragonflies and damselflies in Vermont, see http://campus.greenmtn.edu/dept/NS/Dragonfly/.

Non-Target Moths

Non-target moths caught in pheromone traps used in surveys for saddled prominent, forest tent caterpillar and spruce budworm were identified (Tables 11-13).

Table 11. Non-target moths caught in 2003 in pheromone traps baited with lure for saddled prominent. Data are from 6 locations statewide.

Family	Species (Author)	Total Number Caught
Geometridae	*Anticlea vasiliata* Gn., 1857	2
	Besma endropiaria (G. & R., 1867)	1
	Besma quercivoraria (Gn., 1857)	1
	Homochlodes disconventa (Wlk., 1860)	24
	Homochlodes sp.	10
	Mesoleuca ruficillata (Gn., 1857)	1
	Mesoleuca ruficillata (Gn., 1857)	1
	Plagodis serinaria H.-S., 1855	1
	Probole amicaria (H.-S., 1855)	1
	Tetracis cachexiata Gn., 1857	1
	Undetermined species	1
Incurvariidae	*Paraclemensia acerifoliella* (Fitch, 1854)	1
Noctuidae	*Zanclognatha laevigata* (Grt., 1872)	2
Undetermined microlepidoptera		13
Other undetermined species of moths		3

Table 12. Non-target moths caught in 2003 in pheromone traps baited with lure for forest tent caterpillar. Data are from 11 locations statewide.

Family	Species (Author)	Total Number Caught
Geometridae	*Besma endropiaria* (G. & R., 1867)	1
	Besma quercivoraria (Gn., 1857)	1
	Campaea perlata (Gn., 1857)	2
	Homochlodes disconventa (Wlk., 1860)	7
	Homochlodes sp.	20
	Lambdina fiscellaria (Gn., 1857)	22
Lymantriidae	*Lymantria (=Porthetria) dispar* (L., 1758)	1787
Noctuidae	*Catocala ultronia* (Hbn., 1823)	1
	Parallelia bistriaris Hbn., 1818	1
	Phlogophora periculosa Gn., 1852	2
	Polia nimbosa Gn., 1852	1
	Protorthodes oviduca (Gn., 1852)	1
	Zanclognatha laevigata (Grt., 1872)	1
		2
Undetermined microlepidoptera		20
Other undetermined species of moths		88

Table 13. Non-target moths caught in 2003 in pheromone traps baited with lure for spruce budworm. Data are from 21 locations statewide.

Family	Species (Author)	Total Number Caught
Arctiidae	*Eilema bicolor* (Grt., 1864)	2
	Halysidota tessellaris (J.E. Smith, 1797)	1
Geometridae	*Campaea perlata* (Gn., 1857)	2
	Caripeta divisata Wlk., 1863	3
	Cyclophora pendulinaria (Gn., 1857)	3
	Eubaphe mendica (Wlk., 1854)	1
	Euchlaena serrata (Drury, 1770)	1
	Eulithis explanata (Wlk., 186	2
	Homochlodes disconventa (Wlk., 1860)	31
	Homochlodes lactispargaria (Wlk., 1861)	1
	Homochlodes sp.	4
	Horisma intestinata (Gn., 1857)	1
	Lambdina fiscellaria (Gn., 1857)	20
	Nematocampa limbata (Haw., 1809)	2
	Semiothisa bisignata (Wlk., 1866)	1
	Tetracis cachexiata Gn., 1857	1
	Undetermined species	4
Lymantriidae	*Lymantria (=Porthetria) dispar* (L., 1758).	39
Noctuidae	*Acronicta innotata* Gn., 1852	1
	Bomolocha baltimoralis (Gn., 1854)	5
	Charadra deridens (Gn., 1852).	16
	Diachrysia aeroiodes (Grt., 1864).	1
	Parallelia bistriaris Hbn., 1818.	2

	Tricholita signata (Wlk., 1860) *Zanclognatha laevigata* (Grt., 1872).	1 1 1
Notodontidae	*Nadata gibbosa* (J.E. Smith, 1797)	1
Pyralidae	*Anageshna primordialis* (Dyar, 1907)	6
Tortricidae	Undetermined species	1
Undetermined microlepidoptera		197
Other undetermined species of moths		10

Other Miscellaneous Insects

A number of insects and other arthropods are submitted to the Forest Biology Lab each year. These specimens are found in a variety of habitats and represent a number of taxonomic orders (Tables 14-21).

Table 14. Flies (Diptera) observed or submitted to the Forest Biology Lab for identification.

DIPTERA: FLIES

INSECT	HABITAT	LOCALITY	REMARKS
Cluster Flies Pollenia rudis	Household	Statewide	Average number of inquiries received.
Bot or Warble Flies Family Oestridae	At large	Stowe	Adult fly found on hiker's shoulder on top of Mount Mansfield.
Dark-winged Fungus Gnats Family Sciaridae	Household	Several inquiries from Montpelier	Usual number of calls about these flies in homes.
Fungus Gnats Mycetophilidae	In alleyway	Springfield	Associated with decaying vegetation.
Gall Midges Family Cecidomyiidae	Woodland plants	Lincoln	Causing the formation of interesting galls on jewelweed (Impatiens).
Horse Flies Family Tabanidae	Horse Stable	Lincoln	Specimens captured by curious farrier.
Louse Flies or Keds Family Hippoboscidae	Generally associated with birds and animals other than humans.	Plainfield	Found on human who had been handling deer.

DIPTERA: FLIES

INSECT	HABITAT	LOCALITY	REMARKS
Midges	Rich woodland	Manchester	Numerous individuals in "swarm."
Family Chironomidae			
Mosquitoes	Various	Statewide	Monitoring efforts continue statewide under direction of Jon Turmel at the Vermont Agency of Agriculture; 42 species of mosquitoes have been identified to date. 116 of 827 birds collected in 2003 tested positive for West Nile Virus.Three humans and 4 horses tested positive for West Nile Virus.
Family Culicidae			
Moth or Drain Flies	In restrooms	Waterbury	Perpetual appearance of flies in this site.
Family Psychodidae			
Small Dung Flies	In home entryway	Montpelier	Homeowner frustrated with inability to find source of flies since no appropriate habitat seemed apparent.
Family Sphaeroceridae			
Snipe Flies	Found in sugarbush	St. Johnsbury	Found in stand with heavy Bruce spanworm population; question about whether snipe flies might feed on spanworm caterpillars.
Family Rhagionidae			

Table 15. Other beetles (Coleoptera) observed or submitted to the Forest Biology Lab for identification.

COLEOPTERA: BEETLES

INSECT	HABITAT	LOCALITY	REMARKS
Scarab Beetle	At large	Barnet	Probably associated with decaying logs.
Anthophylax sp.			
Varied carpet beetle	Household	Waterbury, Essex	Beetles found in association with stored fabrics.
Anthrenus verbasci			
Asparagus beetle	Asparagus	Vershire	Both larvae and adults found feeding on host plant.
Crioceris asparagi			

COLEOPTERA: BEETLES

INSECT	HABITAT	LOCALITY	REMARKS
Goldsmith beetle *Cotalpa lanigera*	At large	Waterbury	Showy adult beetle. Adult eats foliage and larva feeds on roots.
Larder beetle *Dermestes lararius*	Household	Statewide	Usual number of inquiries about stored products infested with these beetles.
Scarab Beetle *Dichelonyx* sp.	In woodland	Greensboro and elsewhere	Larvae thought to feed on tree roots, but not considered of economic significance.
Ground Beetles Family Carabidae	At large in a huge variety of habitats	Statewide	Familiar family of mostly predacious species.
Lady Beetles, including the twice-stabbed lady beetle (*Chilocorus stigma*), the multicolored Asian lady beetle (*Harmonia axyridis*) and others. Family Coccinellidae	Forest, field and household	Vernon, Springfield and elsewhere.	In early May, 30 twice-stabbed lady beetles were counted on one beech scale-infested tree in southern Vermont. We received slightly fewer than the usual number of inquiries for household-invading *Harmoniaa axyridis.*
Blister Beetle *Lytta sayi*	Lupine	Rockingham	Present in large numbers; heavy feeding on lupines.
Carrion beetle Necrodes surinamensis	At large in various habitats.	Plainfield, Huntington, Lincoln	Usually found in association with dead animals.
White Grubs *Phyllophaga* sp.	In soil samples	Waterbury	Fewer calls than last year.
Salpingid Beetle *Rhinosimus viridiaeneus* Family Salpingidae	Lichen	Arlington	Similar in appearance to ground beetles (Carabidae) but this specimen has a great wide beak, like some of the primitive weevils.
Sap beetles Family Nitidulidae	Found in sap buckets	Montpelier	Several species found floating in sap buckets at the end of sugaring season.
Tortoise beetles Family Chrysomelidae, Cassidinae	At large	Wells	Interesting larva submitted for identification.
Clover Weevil *Trachyphloeus* sp.	Household	Lowell	Gray beetles sometimes numerous in homes; one of a number of weevil species associated with clover roots.

Table 16. Other bees, ants and wasps (Hymenoptera) observed or submitted to the Forest Biology Lab for identification.

HYMENOPTERA: ANTS, BEES AND WASPS

INSECT	HABITAT	LOCALITY	REMARKS
Bumble Bees Family Apidae, Subfamily Bombinae	Perennial gardens	Coventry, Westmore	These spring bumble bees appeared extra large. They were overwintered, fertile queens (normally much bigger than workers) that survived the winter. The queen must forage for the newly established colony in the spring. After the first set of smaller workers matures, the queen stays home in the underground nest, so bumble bees seen later in the season appear to observers to have shrunk.
Cornfield Ant *Lasius alienus*	Fields, often near wooded areas	Springfield, Woodbury, Waterbury	Causing excitement during mass mating flights in the fall.
Digger Bees Family Anthophoridae	Soil	Morrisville	These bees nest in burrows in the ground or in banks.
Gall Wasps Family Cynipidae	Oak	St Albans and other sites	Sent to the lab as a novelty.
Great Black Wasp *Sphex pennsylvanicum*	At large	Pittsford, Waterbury	Single individual taken from each site. This insect preys on "false katydids" (Scudderia and Microcentrum).
Leafcutting Bees Family Megachilidae	Rolled leaf with pupal cells taken from bird house	Monkton	Adult bees emerged from pupal case in lab.
Odorous House Ant *Tapinoma sessile*	Household electrical circuit box	Essex	Ant colony very large; discovered when electricity failed and ants poured out of circuit box.
Paper Wasps *Polistes* sp.	Resting on flowers	Manchester	Usual concerns about proximity of nest sites to dwellings of humans.
Pavement Ant *Tetramorium caespitum*	Nesting beside sidewalks, driveways and building foundations	Springfield	A major structure-invading ant.

HYMENOPTERA: ANTS, BEES AND WASPS

INSECT	HABITAT	LOCALITY	REMARKS
Pelecinid Wasp *Pelecinus polyturator* Family Pelecinidae	Adults seen on turf	Newport, Stowe, Lincoln and elsewhere	Parasites of June beetles; adult wasps were quite numerous this year
Sawfly: *Dolerus* sp.	Sedges	Middlebury	Individual specimen sent to lab.
Family Tenthridinidae			
Sweat Bees Family Halictidae	Nesting in burrows in the ground	Ludlow, Waterbury	Two species were involved, the brilliant green *Agapostemon* sp. and the red and black *Specodes* sp.
Tiphiid Wasp Family Tiphiidae	At large	Stowe	Larvae are parasites of scarab beetle larvae.

Table 17. Butterflies and moths (Lepidoptera) submitted to the Forest Biology Lab for identification.

LEPIDOPTERA: BUTTERFLIES AND MOTHS

INSECT	HOST	LOCALITY	REMARKS
Abbott's Sphinx *Sphecodina abbottii*	Grapes	Colchester	Comes to flowers, bait and lights.
The Asteroid *Cucullia asteroides*	Asters, goldenrods and other composites	Waterbury	One of six species of *Cucillia* in our region.
Beautiful Wood-Nymph *Eudryas grata*	Buttonbush, grapes, hops, Virginia creeper, ampelopsis	St. Johnsbury	These moths roll up their wings at rest, giving the wings the appearance of bird droppings.
Black Swallowtail Papilio polyxenes asterius	Parsley, fennel, carrot and other umbellifera	Westmore	Found in open areas and sometimes in disturbed habitats.
Cecropia *Hyalophora cecropia*	Many trees and shrubs, including apple trees, ashes, beeches, birches, elms, maples, poplars, *Prunus* species, *Ribes* spcies, white oak and willows	Westmore, Morrisville	Adults are often found during the day, though they are also attracted to lights at night.

LEPIDOPTERA: BUTTERFLIES AND MOTHS

INSECT	HOST	LOCALITY	REMARKS
Hummingbird clearwing *Hemaris thysbe*	Hawthorns, honeysuckles, *Prunus* species	Westmore, Bristol	Adults attracted to phlox flowers. Moths are daytime feeders and resemble hummingbirds.
Bedstraw Hawkmoth or Galium sphinx *Hyles gallii*	Galium	Springfield, Morrisville, Waterbury, Hardwick	Numerous sightings of caterpillar stage.
Pandoras sphinx *Eumorpha pandorus*	Grapes, Virginia creeper, and ampelopsis	Hubbardton	Beautiful specimen.
Polyphemus Moth *Antheraea polylphemus*	Many trees and shrubs including ashes, birches, grapes, hickories, maples, oaks, pines and members of the rose family	Colchester	Cocoon hangs from food plant through winter.
Viceroy *Basilarchia archippus*	Willow, poplar, oak and apple	Orleans	Seems to prefer wet areas with willows or open areas adjacent to water.

Table 18. Crickets and related insects (Orthoptera) submitted to the Forest Biology Lab for identification.

ORTHOPTERA AND RELATIVES: GRASSHOPPERS, CRICKETS

INSECT	HABITAT	LOCALITY	REMARKS
Camel Cricket *Ceuthophilus guttulosus*	Found in basement, where this species often seeks an overwintering site	Waterbury	In deep fallen leaves
Field and House Crickets Family Gryllidae	Found in fields and dwellings	Springfield and other locations	Found invading homes.
False Katydid Family Tettigoniidae	Found in field	Morrisville, Waterbury	Of interest to observers because of large size and showy appearance.

Table 19. True bugs (Hemiptera) submitted to the Forest Biology Lab for identification.

HEMIPTERA: TRUE BUGS

INSECT	HABITAT	LOCALITY	REMARKS
Giant Water Bug	Aquatic	Hardwick, Cabot, Calais	Attracted to lights at night.
Family Belostomatidae			
Masked Hunter	Household	Alburg	Specimen was a nymph, camouflaged with dust and lint, hence the name "masked."
Reduvius personatus			
Predatory Stink Bug	In rock gardens	Hubbardton, New Haven	Found in large aggregations.
Podisus sp.			
Squash Bug	In vegetable gardens	Barre, Barnet	Observed more frequently than in past years.
Anasa tristis			
Stink Bugs	Field sites	Mount Holly, Montpelier	Living up to their name.
Family Pentatomidae			

Table 20. Other miscellaneous insects from various orders submitted to the Forest Biology Lab for identification.

OTHER MISCELLANEOUS INSECT ORDERS

INSECT	HABITAT	LOCALITY	REMARKS
Book Lice	In building	Waterbury	Taken from books and other stored paper products.
Order Psocoptera			
Dobsonflies	Around lights	Waterbury, Montpelier	Drawing attention because of their large size.
Corydalus cornutus			
Order Neuroptera			
Earwigs	Household invaders	Statewide	Numerous calls about and sightings of earwigs over spring and summer months.
Dermaptera			

OTHER MISCELLANEOUS INSECT ORDERS

INSECT	HABITAT	LOCALITY	REMARKS
German Cockroach *Blatella germanica*	Household	Newport	Submitted by pest control operator.
Stoneflies Order Plecoptera	Wandering on snow; captured near pool	Hartland, Morrisville	Early spring presence of interest to observer.
Fleas Order Siphonaptera	On dog	Waterbury	Only one inquiry about fleas this year!
Silverfish Order Thysanura	In basement	Bristol	Making fleeting appearances in pottery studio.

Table 21. Other miscellaneous invertebrates submitted to the Forest Biology Lab for identification.

OTHER MISCELLANEOUS INVERTEBRATES

INVERTEBRATE	HABITAT	LOCALITY	REMARKS
Pseudoscopions Order Pseudoscorpiones	In homes	Montpelier, Bristol	Observed on walls in homes
Mites Order Acari	Human	Waterbury and elsewhere	A number of mites that were not associated with trees and shrubs were submitted to the Forest Biology Lab. These included species associated with rashes in humans
Spiders Order Aranae	In buildings and outdoors in various settings	Statewide	Spiders representing a number of families were submitted for identification. These included nursery web spiders, esp. the fishing spider *Dolomedes tenebrosus* (Pisauridae), jumping spiders (Salticidae) orb-weavers (Araneidae), sac spiders (Clubionidae), sheetweb spiders (Linyphiidae) and grass spiders (Agelinidae).

STEM DISEASES

Beech Bark Disease

Beech Bark Disease, caused by *Cryptococcus fagisuga* and *Nectria coccinea var. faginata,* was more conspicuous than normal during aerial surveys for the third consecutive year, with nearly 92,000 acres mapped compared to 56,000 acres in 2002 (Table 22, Figure 19). Recent droughts have probably contributed to the large increase in decline and mortality. Causal agents, chlorosis and stem damage remain unusually high and Nectria fruiting is now more obvious, often with the sporodochial stage observed. Monitoring plots were discontinued in 2003 except for four plots that were evaluated one last time. Of these, one had a noticeable deterioration in tree condition and one had a large increase in Nectria fruiting (Figure 20). Occasionally, beech dieback and mortality were observed without bark symptoms, suggesting that drought may be the primary factor or may be preventing trees from producing callus as a response to infection.

Table 22. Mapped acres of damage by beech bark disease in 2003.

COUNTY	ACRES
Addison	3,783
Bennington	7,631
Caledonia	882
Chittenden	4,304
Essex	2,255
Franklin	6,075
Grand Isle	0
Lamoille	4,418
Orange	3,893
Orleans	1,907
Rutland	13,911
Washington	6,260
Windham	22,091
Windsor	14,516
TOTAL	**91,926**

Butternut Canker

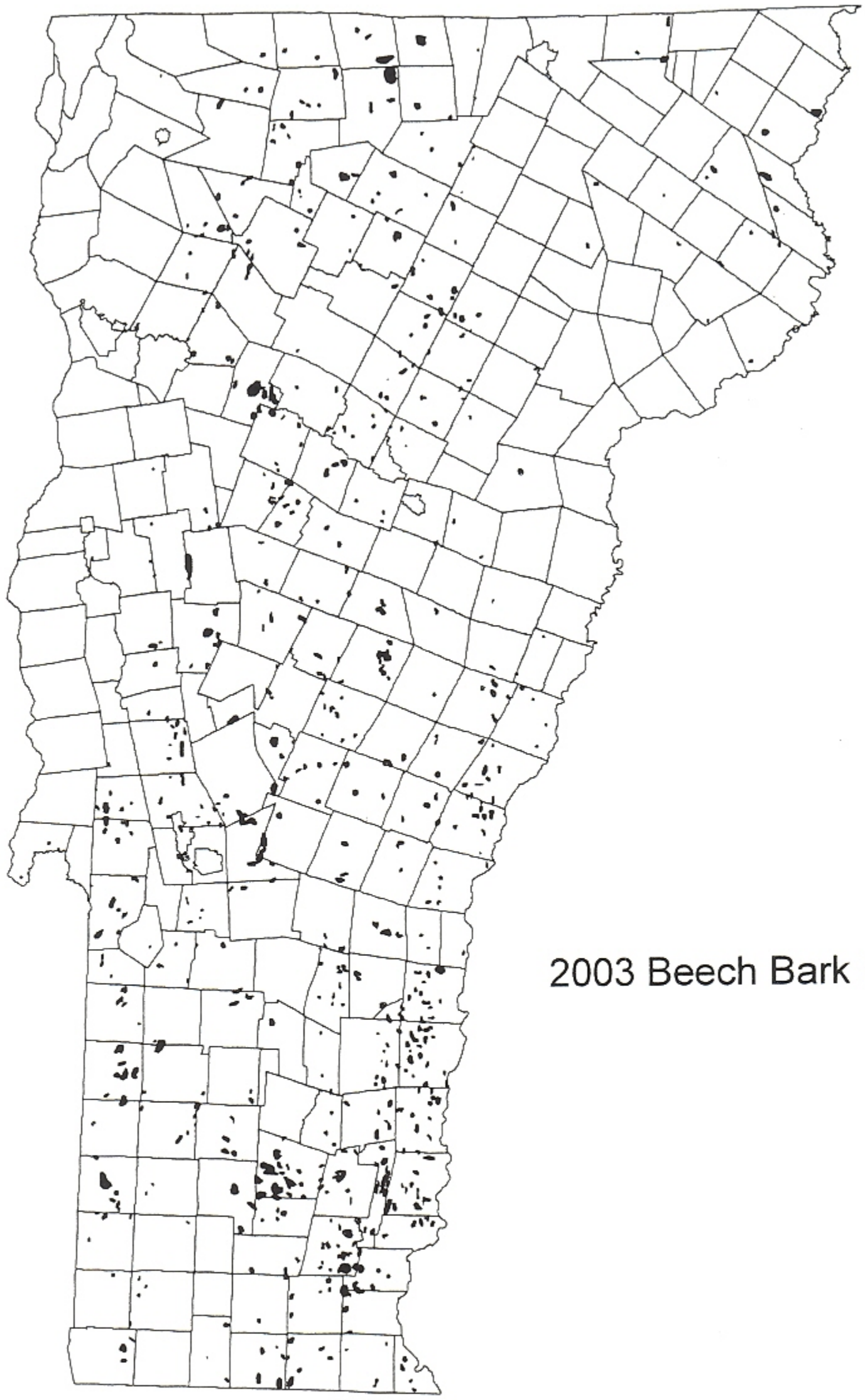
Butternut Canker, caused by *Sirococcus clavigignenta-juglandacearium*, remains common throughout the state, causing high levels of mortality. Uncankered trees are rare but are occasionally observed.

A Canker on **Glossy Buckthorn**

A Canker on Glossy Buckthorn was found to be causing widespread mortality of young sprouts and older trees on a property in Westminster. Symptoms included tarry spots as well as cankers. A *Phomopsis* species was isolated from symptomatic plant material by the University of Vermont Forest Pathology Laboratory and may be the causal organism.

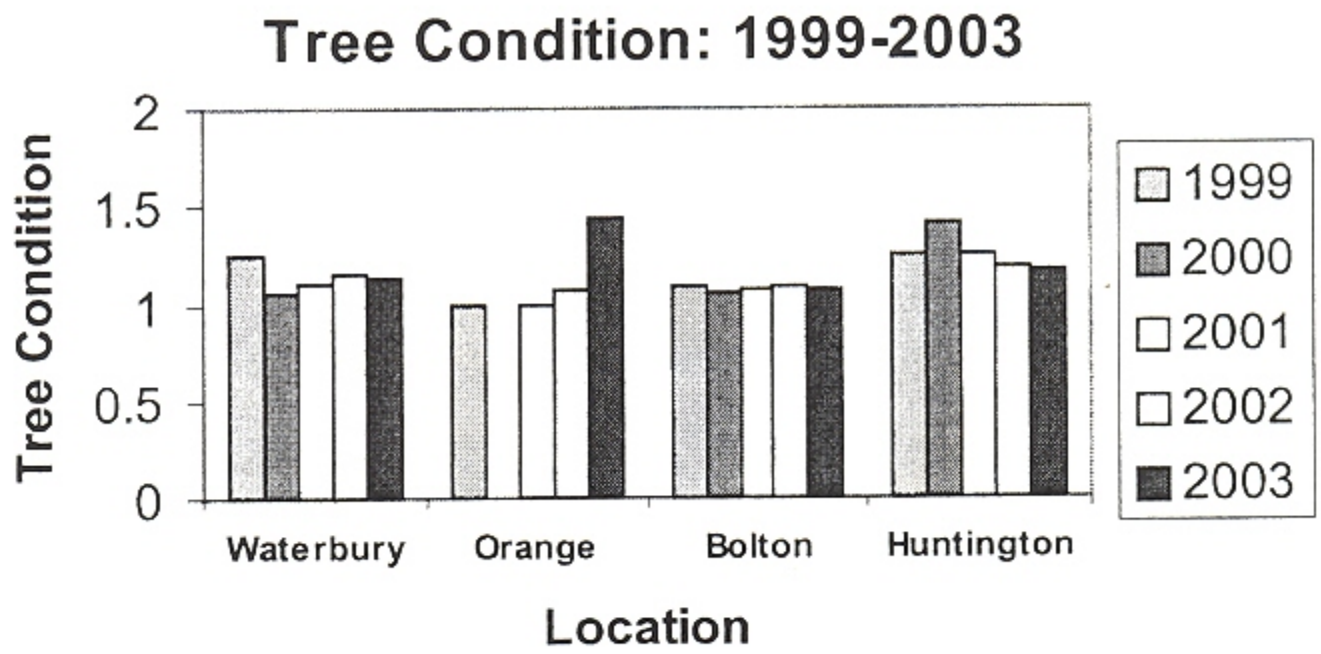
Scleroderris Canker

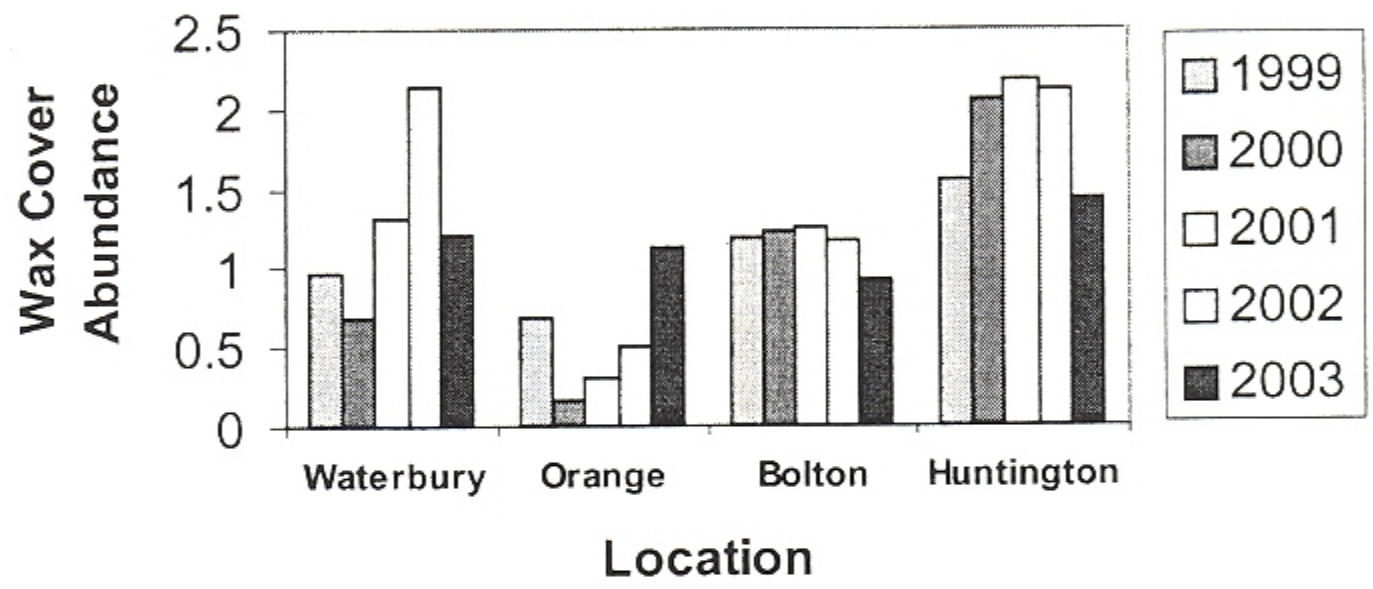
Scleroderris Canker caused by *Ascocalyx abietina*, has not been found in any new towns since 1986. Only two growers requested an inspection and certificate to ship pine Christmas trees out of the quarantine area this year.



2003 Beech Bark Disease

Figure 19. 2003 damage by beech bark disease. Mapped area is 91,926 acres.





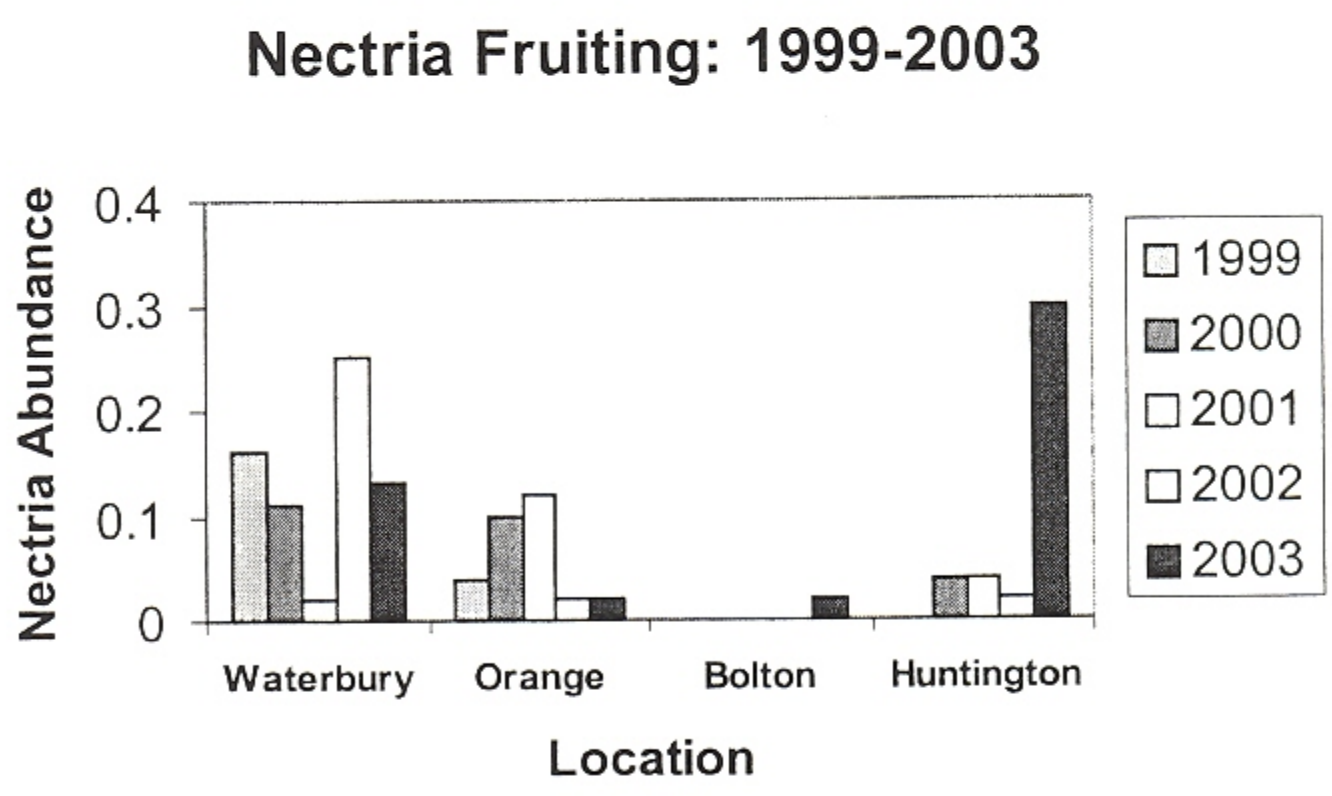


Figure 20. Average live tree condition, beech scale wax cover, and Nectria fruiting ratings, 1999-2003 in four northern monitoring plots. Average of 46 live trees per plot, coded as 1 = good, 2 = fair, 3 = poor.

OTHER STEM DISEASES

DISEASE	HOST	LOCALITY	REMARKS
Annual Canker *Fusarium sp.*	Red Maple	Londonderry	Forest trees
Ash Yellows *Mycoplasma-like organism*	White Ash	Throughout	Witches brooms common in warmer hardiness zones
Beech Bark Disease *Cryptococcus fagisuga* and *Nectria coccinea var. faginata*			See narrative
Black Knot *Dibotryon morbosum*	Black Cherry	Widespread	Most noticeable in colder hardiness zones where cherry is at the edge of its range.
Botryosphaeria Blight *Botryosphaeria sp.*	Red Oak	Pomfret Newfane	Causing significant shoot dieback
Brown Cubical Rot *Polyporus schweinitzii*	White pine	Springfield	In stagnated sawtimber stand
Brown Rot *Monilinia fructicola*	Plum Cherry	Widely scattered	Shoot blight and gum exudation common on ornamentals and forest trees near openings
Butternut Canker *Sirococcus clavigignenta-juglandacearum*			See narrative
Caliciopsis Canker *Caliciopsis pinea*	White Pine	Widespread	Remains common. No change reported
Cedar-Apple Rust *Gymnosporangium juniperi-virginianae*			Not reported
Chestnut Blight *Cryphonectria parasitica*	Chestnut	Widely scattered	Remains stable
Cytospora Canker *Leucostoma kunzei*	Blue spruce	Widespread	No change observed
Delphinella Tip Blight of Fir *Delphinella balsamae*	Balsam Fir White Fir	Wolcott Danville	Mostly light damage in Christmas tree plantations infected in the past
Eastern Dwarf Mistletoe *Arceuthobium pusillum*			Not observed

OTHER STEM DISEASES

DISEASE	HOST	LOCALITY	REMARKS
Fireblight *Erwinia amylovora*	Apple	Northeast Kingdom	Light damage
Hypoxylon Canker *Hypoxylon pruinatum*	Aspen	Throughout	Cankered trees vulnerable to 2003 windstorms
Lilac Blight *Pseudomonas syringae*	Lilac	Essex Orleans & Caledonia Counties	Heavy damage in scattered locations
Maple Canker *Steganosporium spp.*	Sugar Maple	Widely scattered	Fruiting on drought-stressed branches
Nectria Canker *Nectria galligena*	Hardwoods	Throughout	No change reported
Oak Wilt *Ceratocystis fagacearum*			Not oberved or known to occur in Vermont. No suspect areas seen during aerial surveys
Phomopsis Gall *Phomopsis sp.*			Not reported
Red Ring Rot *Phellinus pini*	White Pine	Throughout	Continues to be a problem in sawtimber stands. Damage is most severe in stands with past weeviling and logging wounds. Stands with a high incidence of red rot also tended to have slow growth from stagnation or wet sites
Sapstreak *Ceratocystis coerulescens*			Not reported
Scleroderris Canker *Ascocalyx abietina*			See narrative
Sirococcus *Sirococcus strobilinius*	White Spruce	Craftsbury	Light damage
Tomentosus Butt Rot *Inonotus tomentosus*	Balsam Fir	Greensboro	Causing butt rot in an overstocked sawtimber stand
Verticillium Wilt *Verticillium albo-atrum*			Not reported

OTHER STEM DISEASES

DISEASE	HOST	LOCALITY	REMARKS
White Pine Blister Rust *Cronartium ribicola*	White Pine	Throughout	Commonly observed in pole trees, Christmas trees and landscape trees. Causing scattered mortality in sawtimber stands, especially where management has not removed diseased trees. No change observed
Woodgate Gall Rust *Endocronartium harknessii*	Scots Pine	Widely scatterred	Remains common but decreasing as heavily infected trees are removed
Yellow Witches Broom Rust *Melampsorella caryophyllacearum*	Balsam Fir	Throughout	Remains common on Christmas trees. Occasionally seen on forest trees

FOLIAGE DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Actinopelte Leaf Spot *Actinopelte dryina*	Oak	Bennington	Causing premature leaf drop
Anthracnose *Glomerella spp.* *Apiognomonia spp.* *Gloeosporium spp.*	Hardwoods	Throughout	Common on many species. Good infection conditions due to rainy summer weather. See Ash, Maple and Sycamore Anthracnose
Apple Scab *Venturia inaequalis*	Apple	Throughout	Frequent and increasing
Ash Anthracnose *Gloeosporium aridum*	White Ash	Throughout	Browning common by late summer, especially on regeneration. Heavy defoliation of overstory trees in central river valleys
Balsam Fir Needlecast *Lirula nervata*			Not reported
Brown Spot Needle Blight *Scirrhia acicola* *Mycosphaerella dearnessii*			Not reported, after dropping to light levels in 2002
Bullseye Spot *Cristulariella moricola*	Boxelder	Springfield	Hedgerow trees
Cedar-Apple Rust *Gymnosporangium spp.*	Crabapple	Essex Orleans & Caledonia Counties	Moderate damage
Coccomyces Leaf Spot *Blumeriella jaapii*	Black Cherry	Lamoille County	Dropped to very light levels
Cyclaneusma Needlecast (formerly Naemacyclus) *Cyclaneusma minus*	Scots Pine	Throughout	Remains common but mostly at light to moderate levels
Dogwood Anthracnose *Discula destructiva*			Not reported
Fir Fern Rust *Uredinopsis mirabilis*	Balsam Fir	Throughout	More common than usual this year, especially on Christmas trees but also on forest trees

FOLIAGE DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Fraser Fir Canker Probably *Fusarium sp.*	Fraser Fir	Bennington	Producting sporodochia on dead and dying Christmas tree branches.
Giant Tar Spot *Rhytisma sp.*	Norway Maple	Widespread	Common by late summer but not as severe as in some previous years
Larch Needlecast Possibly *Mycosphaerella sp.*	European Larch Japanese Larch	Sharon Springfield Dorset Shaftsbury	Heavy late-season browning on plantation and ornamental trees
Linospora Leaf Blight *Linospora tetraspora*	Balsam Poplar	Throughout	Severe browning by late summer, especially in northern Vermont
Lophodermium Needlecast *Lophodermium seditiosum*	Scots Pine	Scattered	Remains common on Christmas trees and ornamentals but mostly at light levels
Maple Anthracnose *Gloeosporium sp.*	Sugar Maple	Widely scattered	Some severe browning by late summer but less common than expected
Peach leaf Curl *Taphrina deformans*	Peach	Woodstock	Light damage
Phyllosticta Needlecast *Phyllosticta sp.*	White Fir	Brattleboro	Heavy defoliation of lower foliage on specimen ornamentals
Poplar Leaf Blight *Marssonina spp.*			Not reported
Powdery Mildew *Eryiphaceae* *Erysiphe polygoni*	Trees, shrubs and ornamentals	Scattered throughout	Some moderate to heavy damage
Rhabdocline Needlecast *Rhabdocline pseudotsugae*			Not reported
Rhizosphaera Needle Blight *Rhizosphaera pini*	Balsam Fir	Scattered	Dropped to very light levels in northern Vermont Christmas tree plantations where it was heavy in the past
Rhizosphaera Needlecast of Spruce *Rhizosphaera kalkhoffi*	Blue Spruce White Spruce	Throughout	Common but damage is decreasing

FOLIAGE DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Swiss Needlecast *Phaeocryptopus gaeumannii*	Douglas-fir	Widely scattered	Some moderate to heavy infection occurs in Christmas tree plantations
Tar Spots *Rhytisma acerinum* *Rhytisma punctatum*	Sugar Maple Red Maple	Widespread	Common. Small tar spot (*R. punctatum*) especially noticeable on sugar maple in northern Vermont in late summer
Tubakia Leafspot *Actinopelte dryina*	Red Oak	Newfane	Ornamental
Venturia Leaf Blight *Venturia acerina*	Red Maple	Lamoille Orleans Counties	Noticeable leaf spotting
Walnut Downy Leaf Spot *Microstroma juglandis*			Not reported
White Pine Needle Blight *Canavirgella banfieldii*	White pine	Widely scattered	Light levels in Christmas tree plantations and ornamentals
Willow Scab *Venturia saliciperda*	Willows	Rutland County	Riparian areas

ROOT DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Annosus Root Rot *Heterobasidion annosum*	White Pine	Springfield	Causing butt rot in trees thinned in the 1950's
Brown Cubical Root Rot *Polyporous schweinitzii*	White Pine	Springfield	Sawtimber stand
Dead Man's Fingers *Xylaria sp.*			Not reported
Feeder Root Rot Unidentified fungi	Fraser Fir	Brattleboro Walden Wolcott Lincoln	Mortality of Christmas trees wherever they are poorly drained. Feeder root rot-like symptoms often present. *Fusarium* and *Cylindrocarpon* but not *Phytophthora* isolated from Brattleboro trees by UVM pathology lab. See Drought Stress under Diebacks, Declines and Environmental Diseases
Shoestring Root Rot *Armillaria spp.*	Many	Throughout	Increasing incidence following recent droughts. Fraser fir Christmas trees, balsam fir forest trees and red spruce in a recently thinned stand in Londonderry especially affected. See Drought Stress under Diebacks, Declines and Environmental Diseases

DIEBACKS, DECLINES AND ENVIRONMENTAL DISEASES

Birch Decline

Birch decline was mapped on 2,390 acres (Table 23). A combination of factors is involved. High elevation birch decline is associated with drought stress from the past several years. Drought periods and annual defoliation by a variety of birch leaf miners and birch skeletonizers, in conjunction with leaf diseases have stressed both yellow and paper birch trees, leading to decline and mortality.

Table 23. Mapped acres of birch decline in 2003.

County	Acres
Addison	767
Chittenden	71
Essex	96
Orange	456
Orleans	58
Rutland	111
Windsor	831
Total	**2,390**

Cracks on White Ash

Cracks on White Ash were observed in the spring in several widely scattered locations in Rutland and Windham Counties (Figure 21). Cracks developed in the lower bole of young sawtimber trees over the winter on otherwise healthy white ash. In one site in Stratton, evidence of prior cracking was noticed. Cracking was not obviously associated with a particular face of the trees.

Drought conditions may have made ash trunks more sensitive to extreme winter temperatures. Dehydration causes tangential tension from shrinkage in the cambium. Even in normal years, ash trees are known to go into the winter with drier xylem than most species, and their large rays make them particularly vulnerable to cracks. Additionally, late growth in the fall, which occurred in 2002 because of good September growing conditions, leads to delayed dormancy and greater susceptibility of early low temperatures.

Similar etiology may be responsible for swellings on pole and small sawtimber-sized ash trunks in a stand in Wallingford. The defect was initiated in the past, and swellings are produced by callus formation.

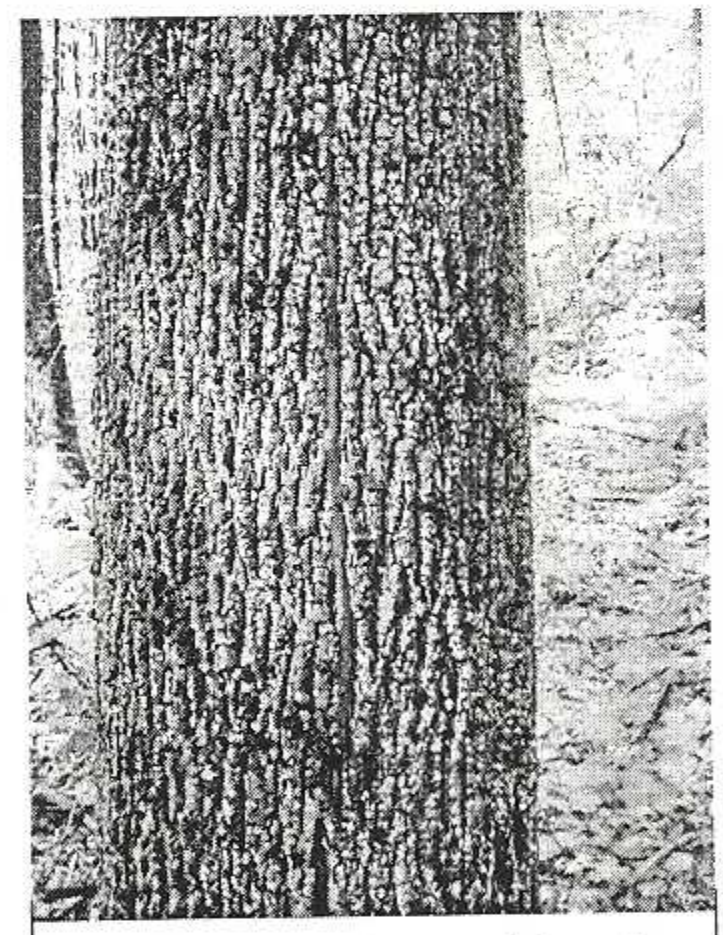


Figure 21. Cracks on white ash.

Drought Stress

Drought conditions did not occur in 2003, but stress from dry conditions in three out of the previous four years continued to cause visible symptoms. Mapped areas of drought symptoms were observed on 1,493 acres, plus additional areas attributed to specific species. Drought stress was particularly important in the early growing season, when there was generally less precipitation than occurred later on. Some drought-related problems, observed in 2003, are listed below (Table 24).

Table 24. Drought-related problems observed in 2003.

HOST(S)	LOCATION	SYMPTOMS
Balsam Fir	Northern VT	Dieback and mortality in overstocked stands, or on poorly or excessively drained sites, often associated with secondary invasions of sawyer beetles
Christmas Trees	Widely scattered	Mortality, above average decline or winter injury, especially on poorly drained sites
Conifers	Roadsides	Road salt injury especially severe
Hardwoods	Scattered throughout	Susceptibility increased to beech bark disease, and secondary canker diseases such as Coral Spot Nectria and Botryosphaeria
Hardwoods, especially Red Oak	Widely scattered, but especially dramatic on Taconic Range, and in Franklin and Lamoille Counties	Dieback and mortality especially on shallow soils and ridge-top sites
Hemlock	Widely scattered	Sspring browning on shallow or poorly drained sites Some trees attacked by hemlock borer on ledgey, exposed or disturbed sites
Many Species	Throughout	Heavy mushroom production by Armillaria may be due to widespread success of the fungus in invading drought-stressed roots
Many Species	Wet sites	Drought increased mortality as shallow-rooted trees succumbed
Northern White Cedar	Barre	Severe browning where combined with Arborvitae leaf miner damage and heavy seed
Ornamentals	Scattered throughout	Dieback and mortality of wounded or improperly planted trees and those growing on ledge
Red Pine	Widely scattered	Occasional decline and mortality on ledgey or excessively drained sites associated with turpentine beetle and pine engraver
Red Spruce	Green Mountains	Occasional dieback and mortality, especially regeneration
Tamarack(Eastern Larch)	Widely scattered	New larch decline areas were observed. Trees invaded by eastern larch beetle
White Pine	Widely scattered	Spring browning on shallow or poorly drained sites. Occasional decline and mortality on ledgey or excessively drained sites, associated with turpentine beetle and pine engraver
White Spruce	Greensboro	Mortality in overstocked stands

Hardwood Decline and Mortality

Decline and mortality was mapped on 50,039 acres, compared to only 1,486 acres in 2002 (Table 25). Many of the areas of decline are along the spine of the Green Mountains (Figure 22), and associated with areas prone to drought stress (see Drought narrative for more details).

Table 25. Mapped acres of hardwood decline and mortality in 2003.

County	Acres
Addison	4,739
Bennington	14,718
Caledonia	365
Chittenden	3,932
Essex	1,910
Franklin	8,613
Grand Isle	29
Lamoille	6,010
Orange	294
Orleans	2,342
Rutland	2,061
Washington	2,473
Windham	1,123
Windsor	1,430
Total	**50,039**

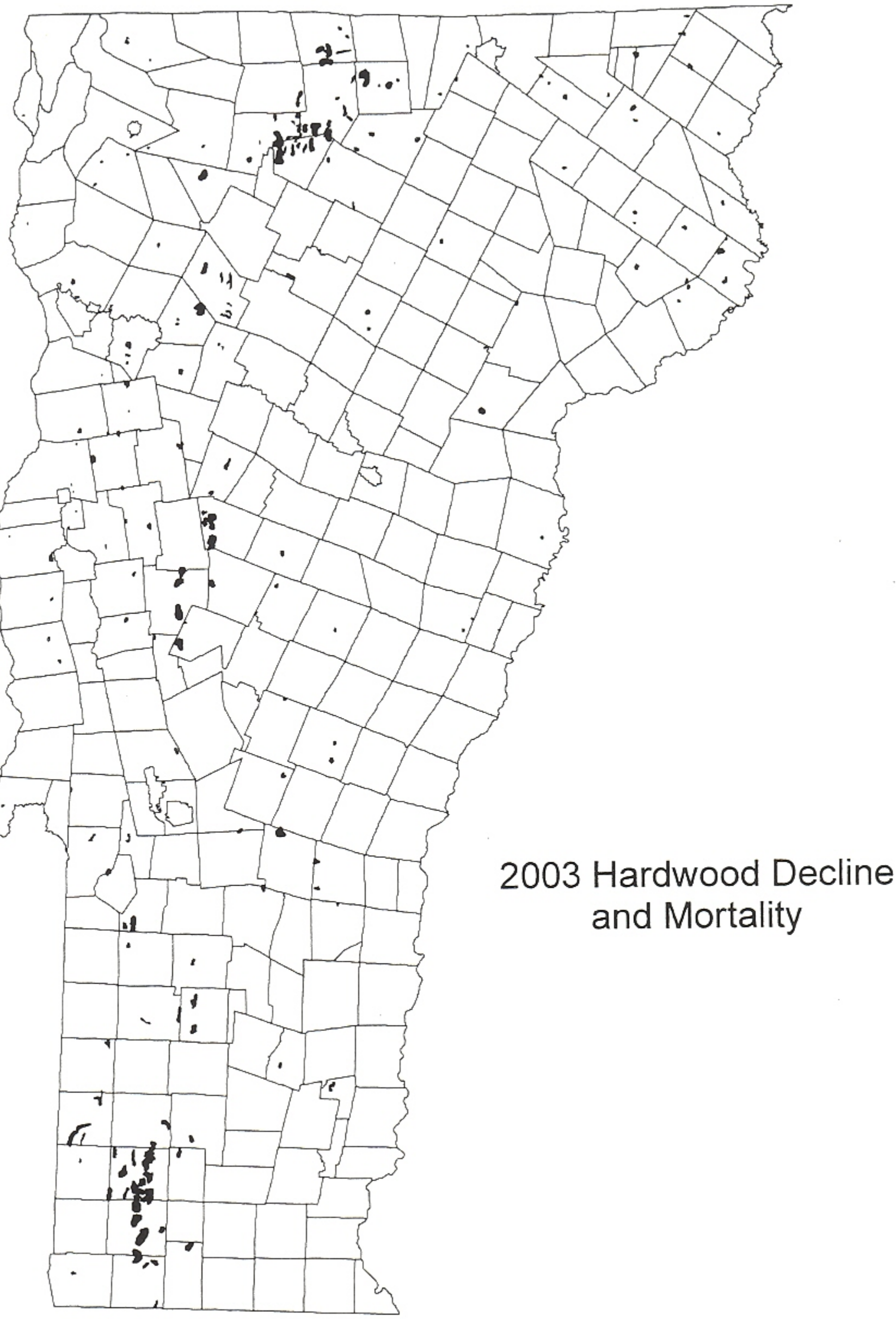


Figure 22. 2003 decline and mortality on hardwoods. Mapped area is 50,039 acres.

1998 Ice Storm

Recovery from the 1998 Ice Storm continued, but some new mortality was observed, and ice damaged areas continue to be visible during the aerial survey (Figure 23). In the monitoring plot in Plymouth, paper birch trees that had been bent over but had no crown breakage in 1998, died in 2003 after several years of increasing decline.

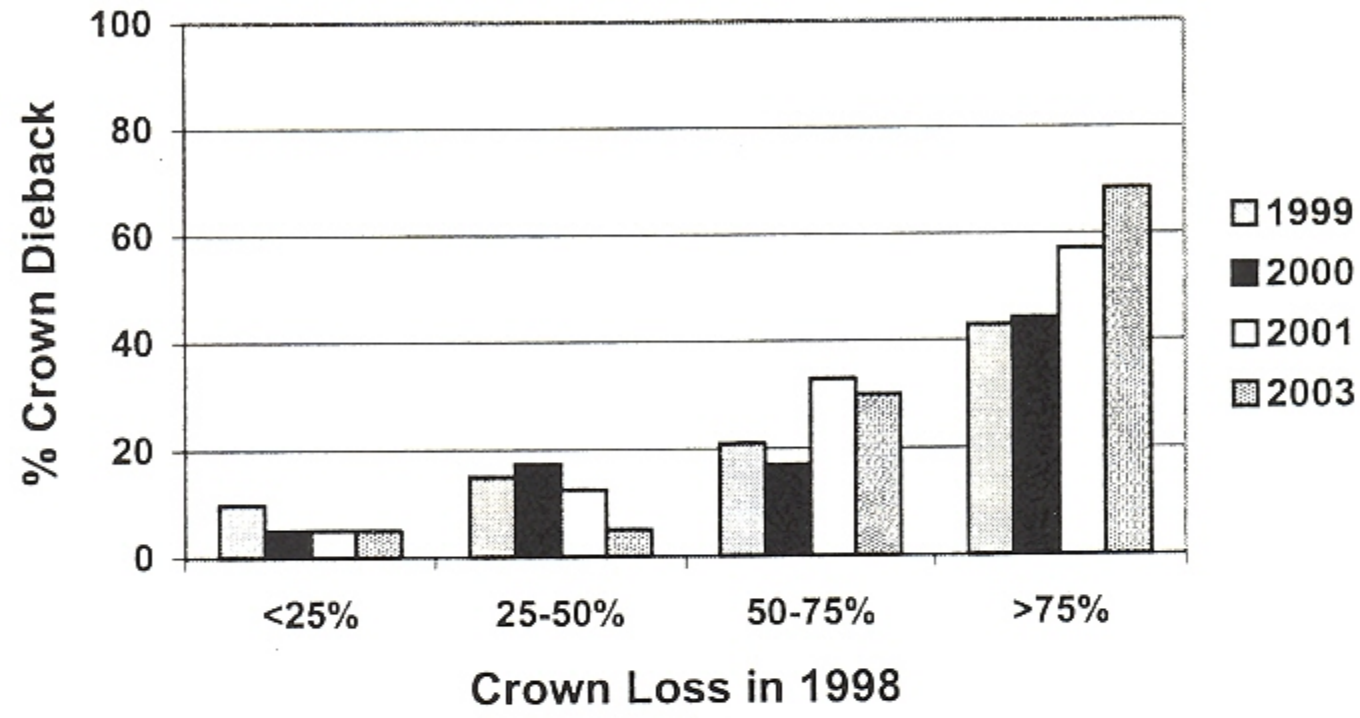


Figure 23. Average percent dieback in Slack Hill ice damage plot, grouped by the percent of crown lost in 1998. Data are from 20 trees, 1999 – 2003.

Larch Decline

Larch decline and mortality was mapped on 4,606 acres, compared to 1,454 acres in 2002, and is increasing dramatically, especially in North Central and Northeastern Vermont (Table 26). Trees are being invaded by the eastern larch beetle. Many new areas are showing decline following 1999, 2001, and 2002 droughts.

Table 26. Mapped acres of larch decline in 2003.

County	Acres
Addison	41
Bennington	1,180
Caledonia	475
Essex	1,302
Franklin	79
Lamoille	81
Orange	252
Orleans	469
Rutland	567
Washington	137
Windham	23
Total	**4,606**

Logging-related Decline

Logging-related dieback and mortality was mapped on 1,830 acres in 2003, and was especially prevalent in Orleans County (Table 27).

Table 27. Mapped acres of logging-related decline and mortality in 2003.

County	Acres
Bennington	118
Chittenden	144
Essex	124
Franklin	126
Orange	217
Orleans	907
Washington	60
Windham	134
Total	**1,830**

Spruce-Fir Dieback and Mortality

Spruce and fir dieback and mortality (Figure 24) was mapped on 13,641 acres, a dramatic increase from 4,103 acres in 2002 (Table 28). Drought, balsam fir woolly adelgid, and spruce winter injury may all be involved. In some areas of southern Vermont, decline was observed along elevational bands (Figure 25). Some dieback and mortality of regeneration was attributed to drought impacts on shallow-rooted young trees.

Figure 24. Balsam fir decline associated with balsam woolly adelgid and drought.

Table 28. Mapped acres of spruce-fir dieback and mortality in 2003.

County	Acres
Addison	125
Bennington	269
Caledonia	1,418
Chittenden	37
Essex	4,776
Franklin	1,563
Grand Isle	0
Lamoille	1,248
Orange	1,329
Orleans	1,744
Rutland	201
Washington	395
Windham	107
Windsor	429
Total	**13,641**

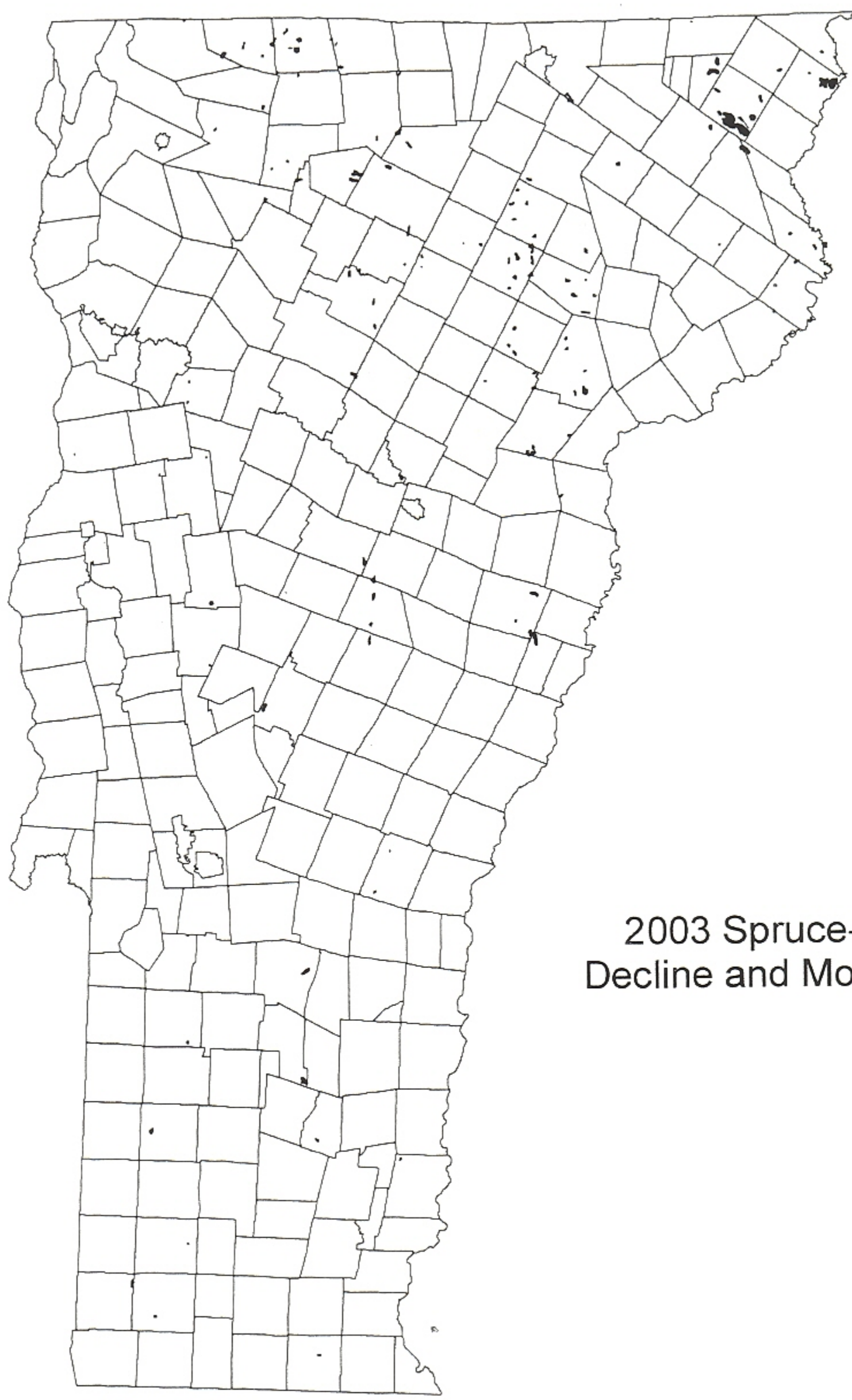


Figure 25. 2003 dieback and mortality of spruce-fir. Mapped area is 13,641 acres.

Wind Damage

Wind damage from a severe storm on July 21 caused widely scattered, but severe, blowdown in Bennington, Rutland, and Windsor Counties, affecting 3,221 acres (Table 29). The most significant damage occurred in southwestern Windsor County (Figure 26 and 27). The wind event, variously described as a downburst or tornado, had winds up to 120 mph. Downbursts, like tornadoes, may cause trees to be laid down in a circular pattern. Following this storm, both straight-line and circular patterns were observed. The damage in any single area occurred within a 20 second period, according to the National Weather Service. Damaged patches followed the line of the storm from SSW to NNE.

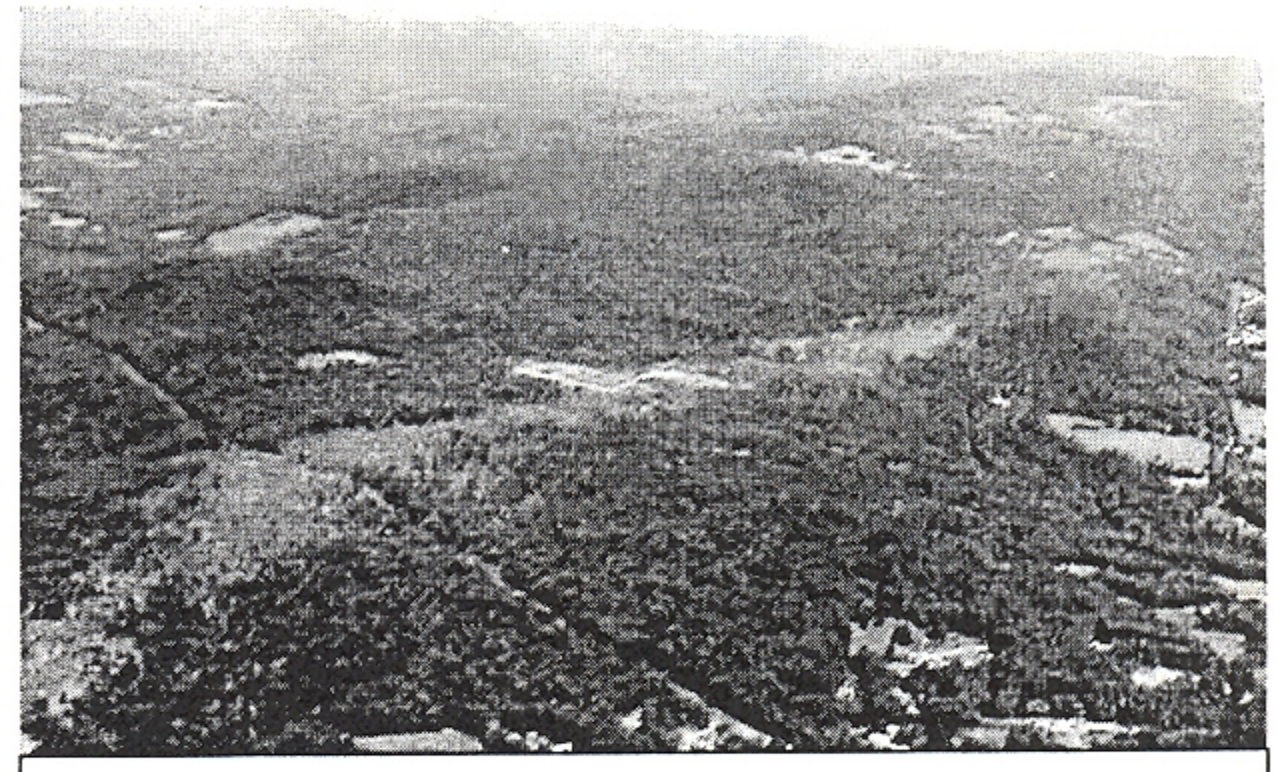


Figure 26. Wind damage in southern VT in 2003.

Residual basal area in damaged stands ranged from 0 to 20 ft-sq. per acre. Many trees were uprooted, while others were snapped off at heights ranging from close to ground level, to about 50'. Usually, there was no zone with moderate damage where severely damaged areas abutted stands with just scattered minor breakage. In lightly impacted areas, the only damaged trees were growing on ledgey hilltops or hard-pan mid-slope sites and uprooted.

The wind shattered some logs, while others were suitable for salvage. Within a week, bark beetles and bluestain had invaded broken white pine. Trees that were uprooted degraded more slowly.

Table 29. Mapped acres of wind breakage in 2003.

County	Acres
Addison	79
Bennington	441
Chittenden	17
Essex	180
Windham	792
Windsor	1,712
Total	**3,221**

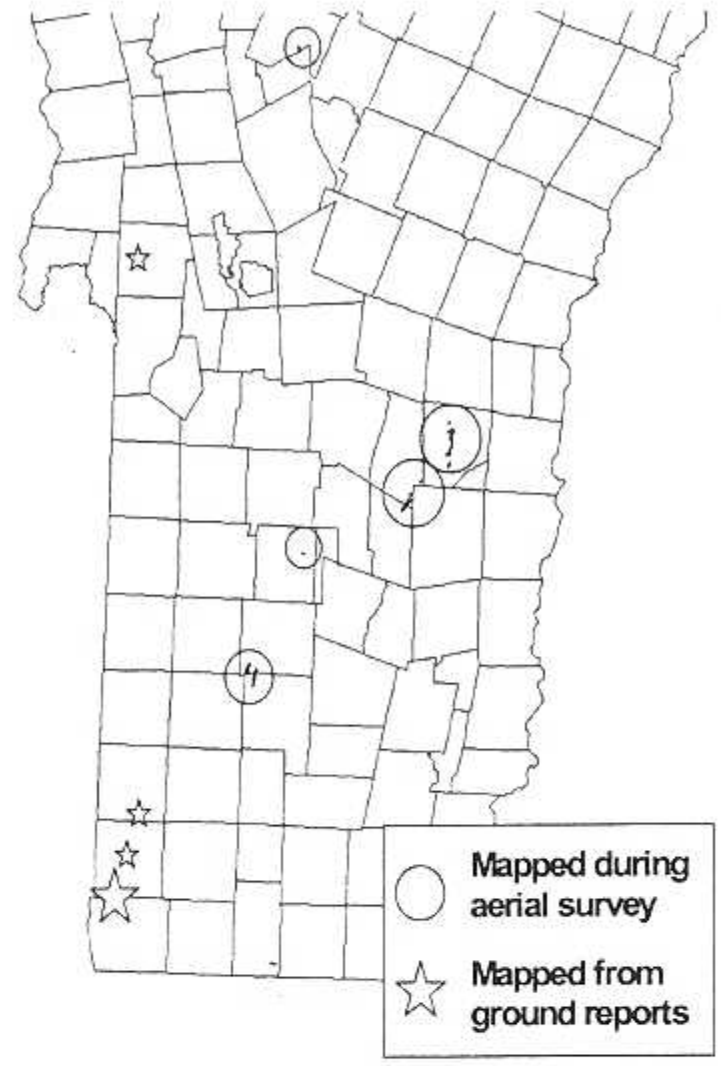


Figure 27. Locations of blowdown areas from July 21, 2003 windstorm mapped during aerial survey and ground reports.

Wet Site Decline

Wet site conditions continue to contribute to dieback and mortality, and increased to 17,046 acres, from 10,411 acres in 2002 (Table 30, Figure 28). Many of the affected areas succumbed to drought, which can be especially severe to trees with shallow root systems as seen in wet, flooded forests.

Table 30. Mapped acres of dieback and mortality associated with wet site conditions in 2003.

County	Acres
Addison	2,450
Bennington	353
Caledonia	1,704
Chittenden	785
Essex	1,972
Franklin	1,603
Grand Isle	1,647
Lamoille	418
Orange	440
Orleans	4,586
Rutland	398
Washington	350
Windham	184
Windsor	156
Total	**17,046**

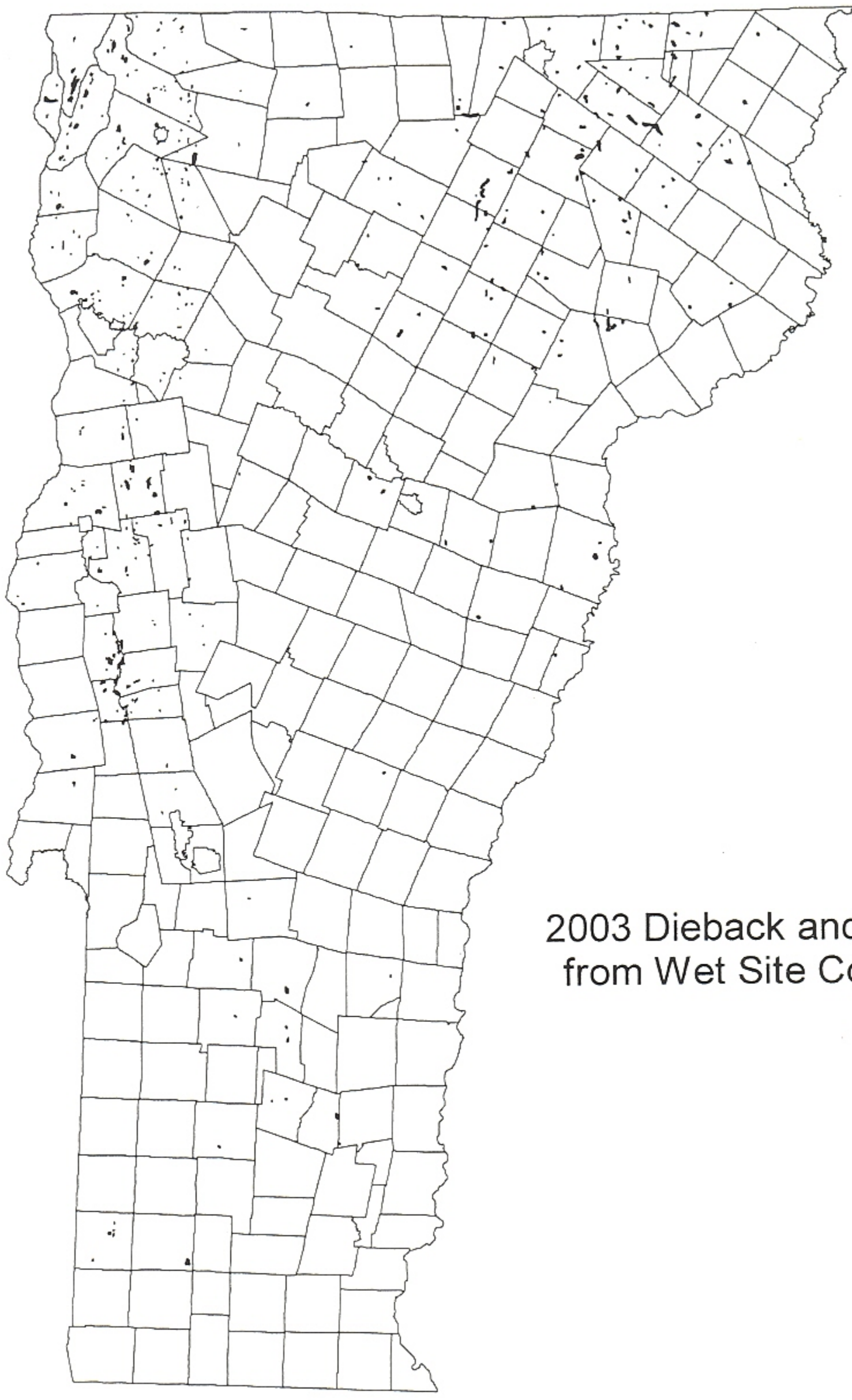


Figure 28. 2003 dieback and mortality associated with wet site conditions. Mapped area is 17,046 acres.

Winter Injury

Winter injury was much more extensive and severe than usual this year and drought stress is thought to be a contributing factor. Red spruce winter injury was the most seen since 1993, with symptoms mapped on 84,478 acres during a special spring aerial survey (Table 31, Figure 29). Symptoms were most severe at higher elevations, especially on steep or ledgey sites, and west-facing slopes, although less intense than in 1993. In addition to browning of 2002 needles, previous years' foliage was sometimes damaged. Some bud mortality was observed on established trees, especially on drought-prone sites. Exposed upper crowns were most likely to have dead buds. Needlecast occurred sporadically, with some brown foliage dropping by early May and some still attached in late August. Other conifers, including hemlock, pine, cedar and fir also exhibited an abnormal amount of injury this year. For roadside trees, salt injury was also a major factor.

Table 31. Mapped acres of spruce winter injury in 2003.

County	Acres
Addison	7,228
Bennington	12,964
Caledonia	4,794
Chittenden	4,523
Essex	14,089
Franklin	1,308
Grand Isle	23
Lamoille	2,786
Orange	1,608
Orleans	3,478
Rutland	11,009
Washington	10,148
Windham	3,666
Windsor	6,854
Total	**84,478**

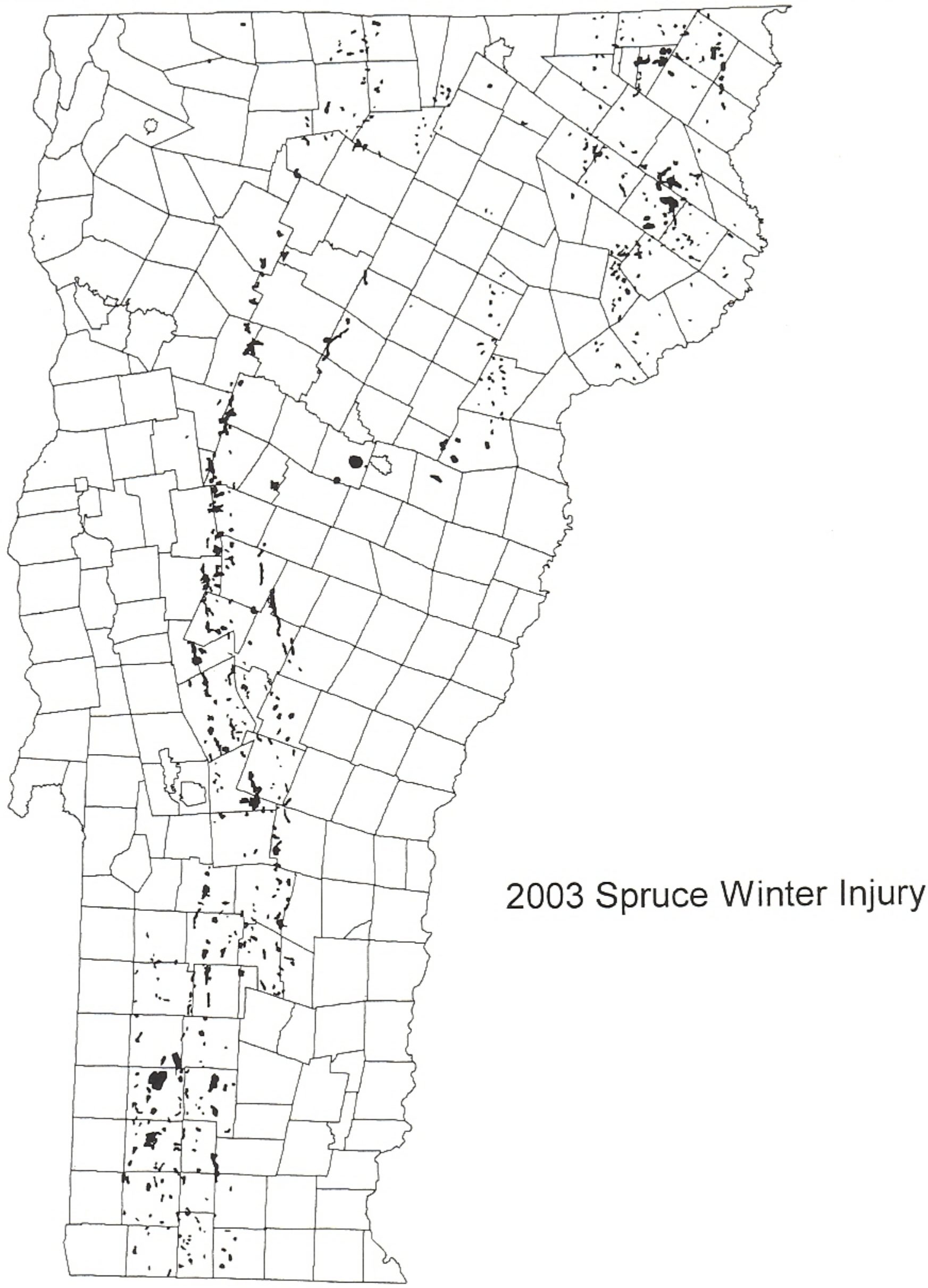


Figure 29. 2003 red needles, dieback and mortality associated with winter injury to red spruce trees. Mapped area is 84,478 acres.

ANIMAL DAMAGE

ANIMAL	SPECIES DAMAGED	LOCALITY	REMARKS
Beaver	Many	Widespread	Noticeable activity throughout
Cattle	Hardwoods	Springfield	Basal wounds and exposed roots
Deer	Hardwoods Cedar Hedges Apples	Widespread	Lower elevations, especially Windham and Windsor Counties. Browsing of native regeneration continues to favor the invasion of less palatable species such as black birch, beech, and exotic woody plants
Moose	Many, especially Hardwood Regeneration	Scatttered, especially Essex County	Becoming a real problem for establishment of regeneration in localized areas. Noticeable in Londonderry, Reading and Barnard on ridges with heavy salvage cutting following '98 ice storm
Mouse and Vole	Young hardwoods On roadsides and in ornamental plantings	Southern Vermont	Some heavy girdling in winter 2002-2003
Porcupine	Many	Scattered	Continues to increase in the Champlain Valley and in southern Vermont
Sapsucker	Many	Throughout	Many homeowner calls Drought increased the visible dieback on affected trees
Squirrel	Red Oak Conifers	Widespread	Shoot clipping in the fall Heavy cone feeding may be due to lack of hard mast in the fall
	Maple tubing	Champlain Valley	Stable at light levels
Woodpecker	Hemlock	Castleton, Hubbardton	Heavy foraging in hemlock borer infested bark

INVASIVE PLANTS

A noxious weed quarantine was enacted in April 2002 to reduce the risk of introduction and spread of non-native plants. The quarantine includes 13 terrestrial species in addition to 19 aquatic plants. While it is legal to possess plants on the list which already occur in Vermont, such as common and glossy buckthorns, Japanese honeysuckle and Japanese barberry, they cannot be moved or sold. The quarantine text is available at http://www.vermontagriculture.com/invasive.htm.

Below is a list of plants that are either on the quarantine list, or are thought to be invasive in other New England states. Forestry staff continue to gather information regarding the presence of these exotic invasive plants as well as those on the quarantine. Although this is not a formal survey, reporting can provide needed information regarding the distribution of these plants. The report form below is used in reporting the presence of these exotic plant species.

Acer platanoides	Norway maple
Aegopodium podagraria	goutweed
Ailanthus altissima	tree-of-heaven
Alliaria petiolata	garlic mustard
Berberis thumbergii, B. vulgaris	Japanese and common Barberry
Celastrus orbiculatus	Oriental bittersweet
Elaeagnus umbellata, E. angustifolia	Autumn and Russian Olive
Euonymus alatus	Winged Euonymus or Burning Bush

Invasive Plant Report Form

Return to: Kathy Decker, Forest Biology Lab, 103 S. Main St. Waterbury, VT 05671

Reported By: Telephone #:

Address:

Date: Town:

Location: (GPS Coordinates, Topo map, or description)

Species:_____ Abundance:_____

Species:_____ Abundance:_____

Species:_____ Abundance:_____

Species:_____ Abundance:_____

TRENDS IN FOREST CONDITION

Sugar Maple Health

The general condition of maple stands was monitored as part of the **North American Maple Project**, with over 1300 overstory (canopy) sugar maple trees evaluated for a variety of indicators of health. The percent of healthy sugar maple trees remained constant in 2003, with 94% of overstory trees rated as healthy. Foliage transparency has remained elevated above 15% since 2000 (Figure 30), attributable to several factors. Bruce spanworm and a combination of other defoliating insects have been active over the past several years. In 2003, 42% of NAMP sites had trees with moderate to heavy defoliation, affecting an average of 13% of trees across all plots (Figure 31). Some locations have experienced multiple years of defoliation, which may result in long-term health problems. Many locations are also impacted by drought stress, which has affected different parts of the state since 2000.

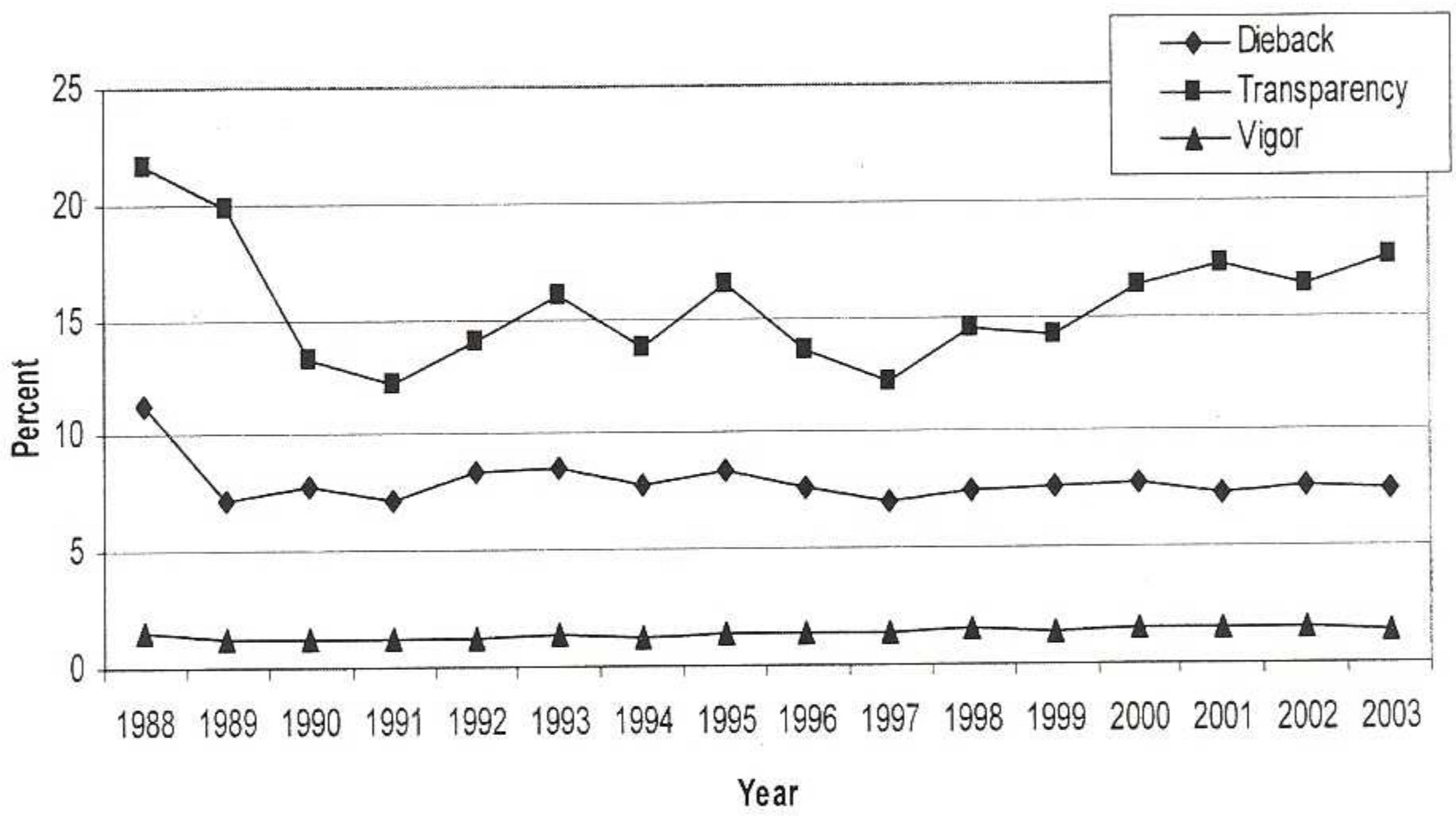


Figure 30. Trend in overstory sugar maple condition on North American Maple Project plots in Vermont, 1988-2003.

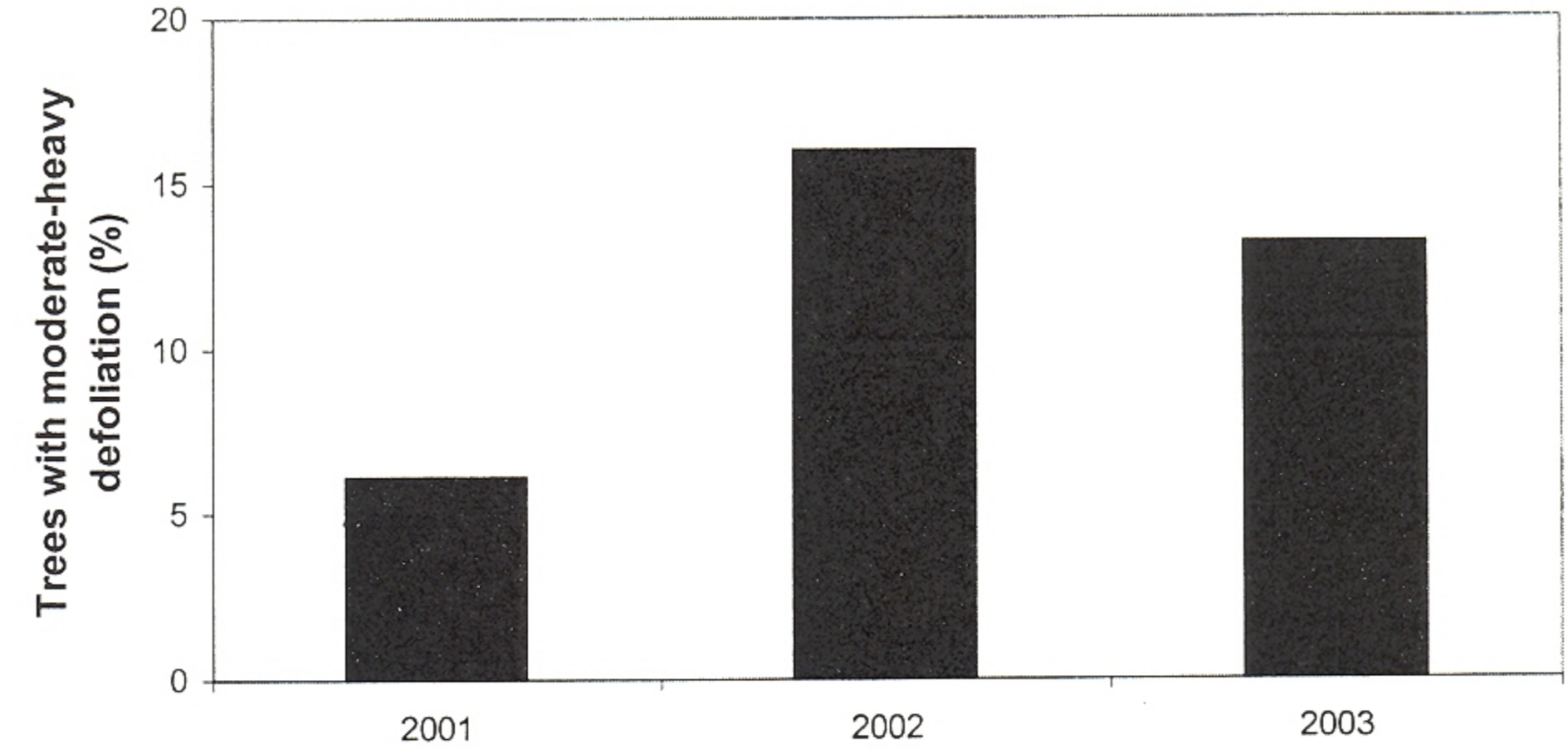


Figure 31. Average percent of overstory sugar maple trees with moderate-heavy defoliation during 2001 through 2003.

Other Hardwood Species Health

Four additional species occur frequently on NAMP plots (more than 30 overstory trees) and were assessed for health: red maple, yellow birch, white ash and American beech (Figure 32-35). While most species showed stable health (no change in average dieback and vigor), foliage transparency increased. Defoliation contributed to thinner foliage, and yellow birch leaf diseases were common. Thinner crowns may also reflect ongoing effects from drought stress. No new mortality occurred on these species. An additional evaluation of only those trees with high dieback (>15%) or thin foliage (>25% transparency) illustrates poor beech health compared with other species (Figure 36). Similar beech health concerns have been observed during other statewide assessments.

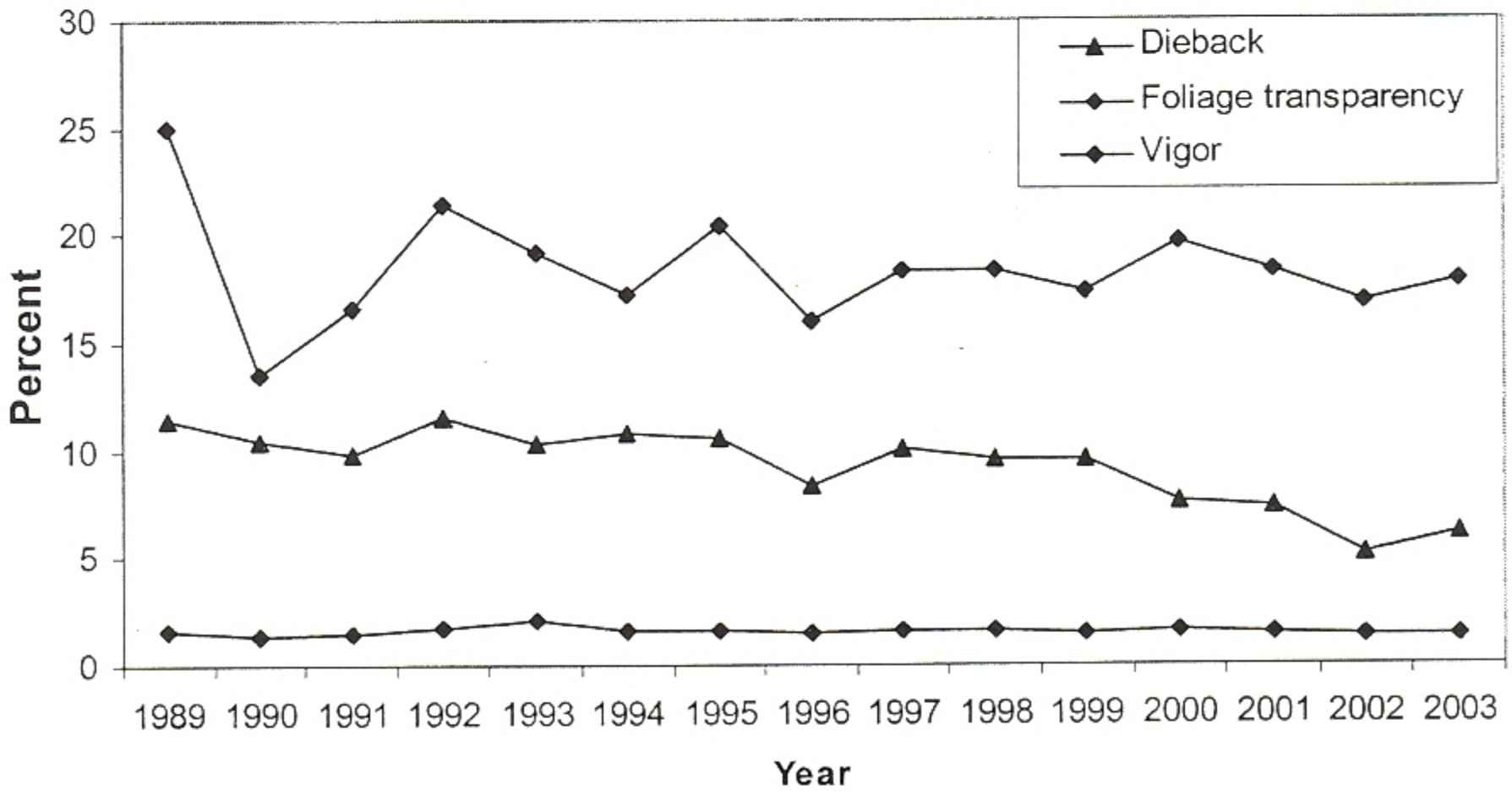


Figure 32. Trend in red maple condition on North American Maple Project plots in Vermont, 1989-2003.

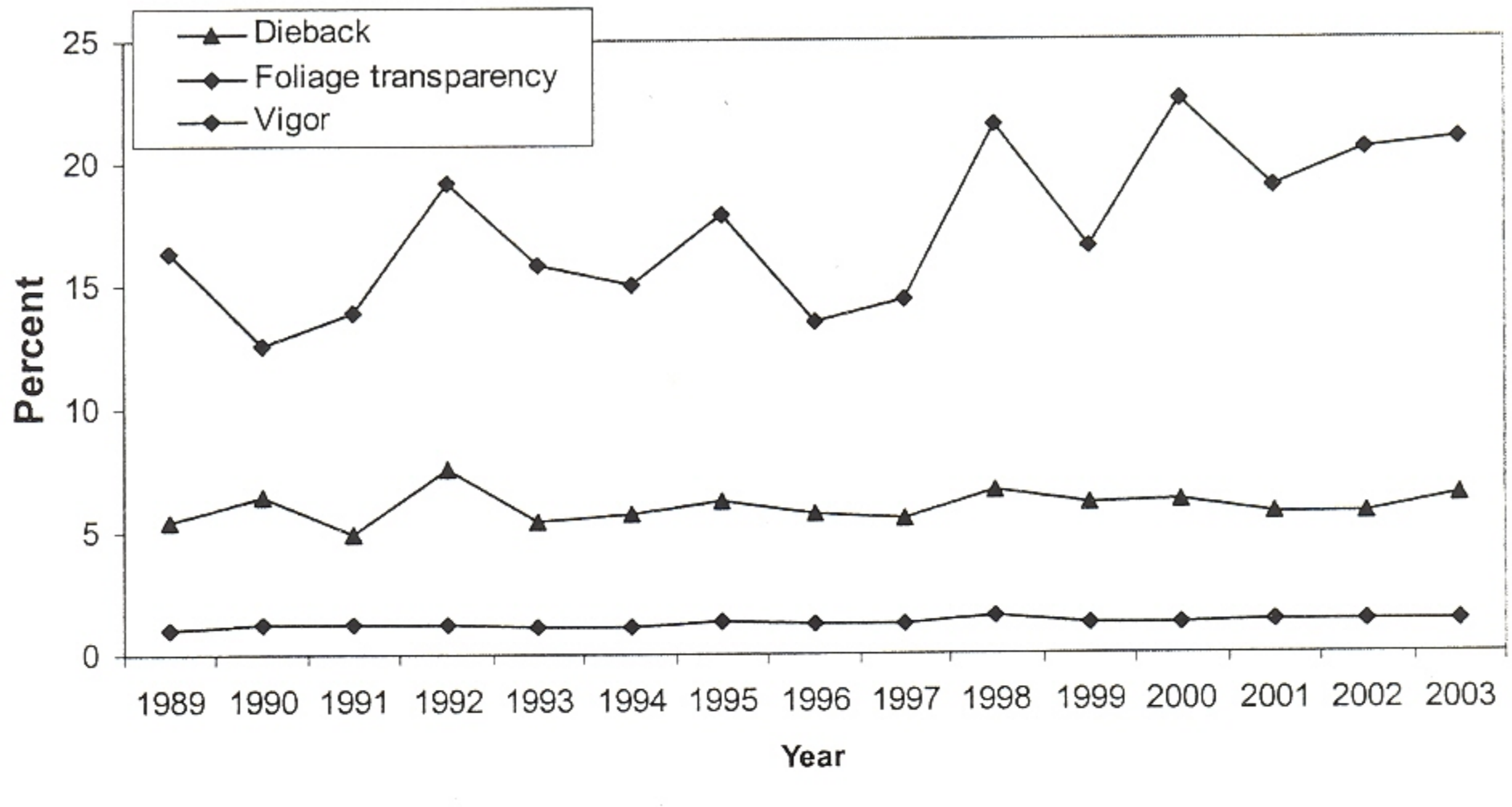


Figure 33. Trend in yellow birch condition on North American Maple Project plots in Vermont, 1989-2003.

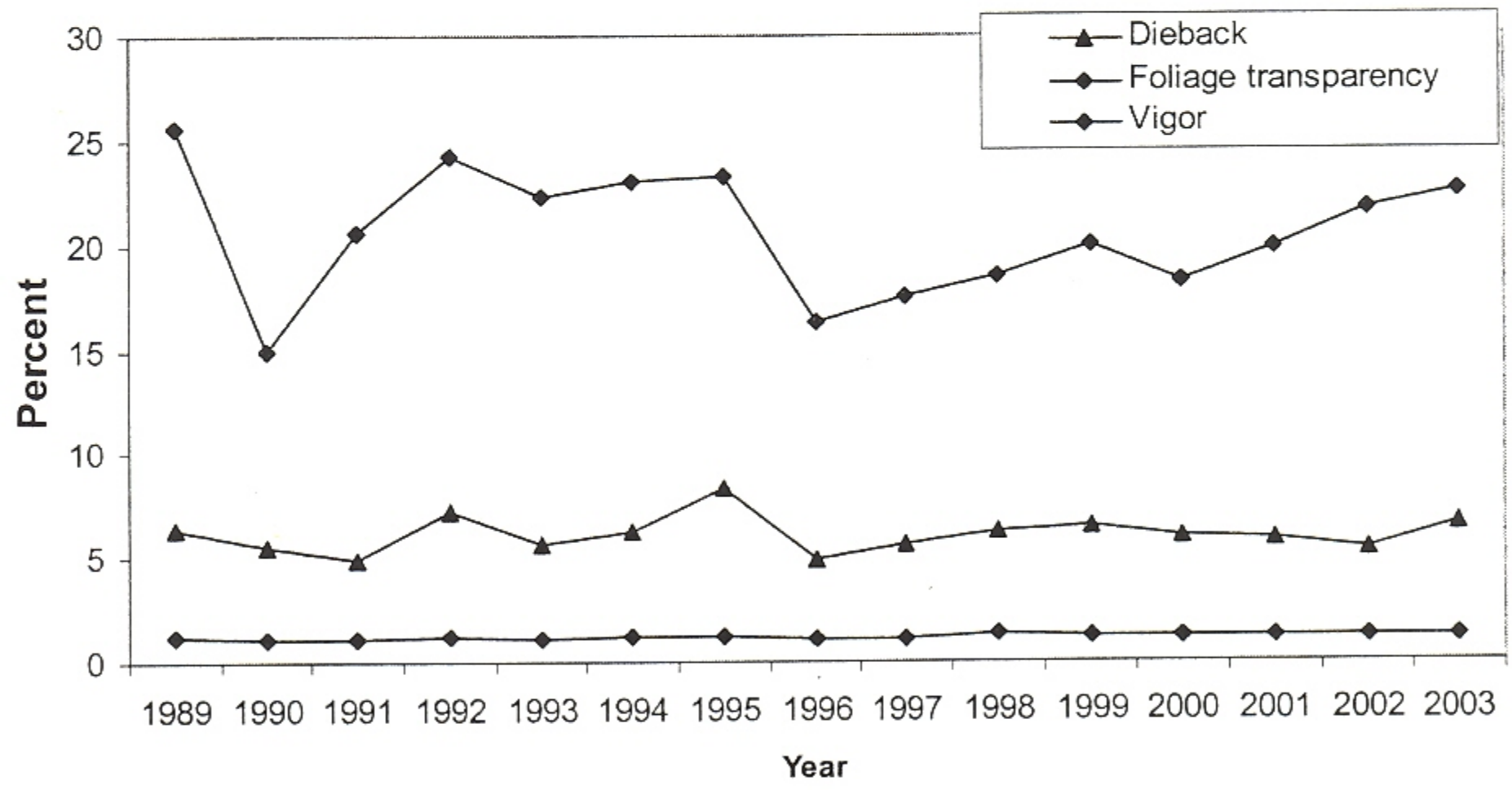


Figure 34. Trend in white ash condition on North American Maple Project plots in Vermont, 1989-2003.

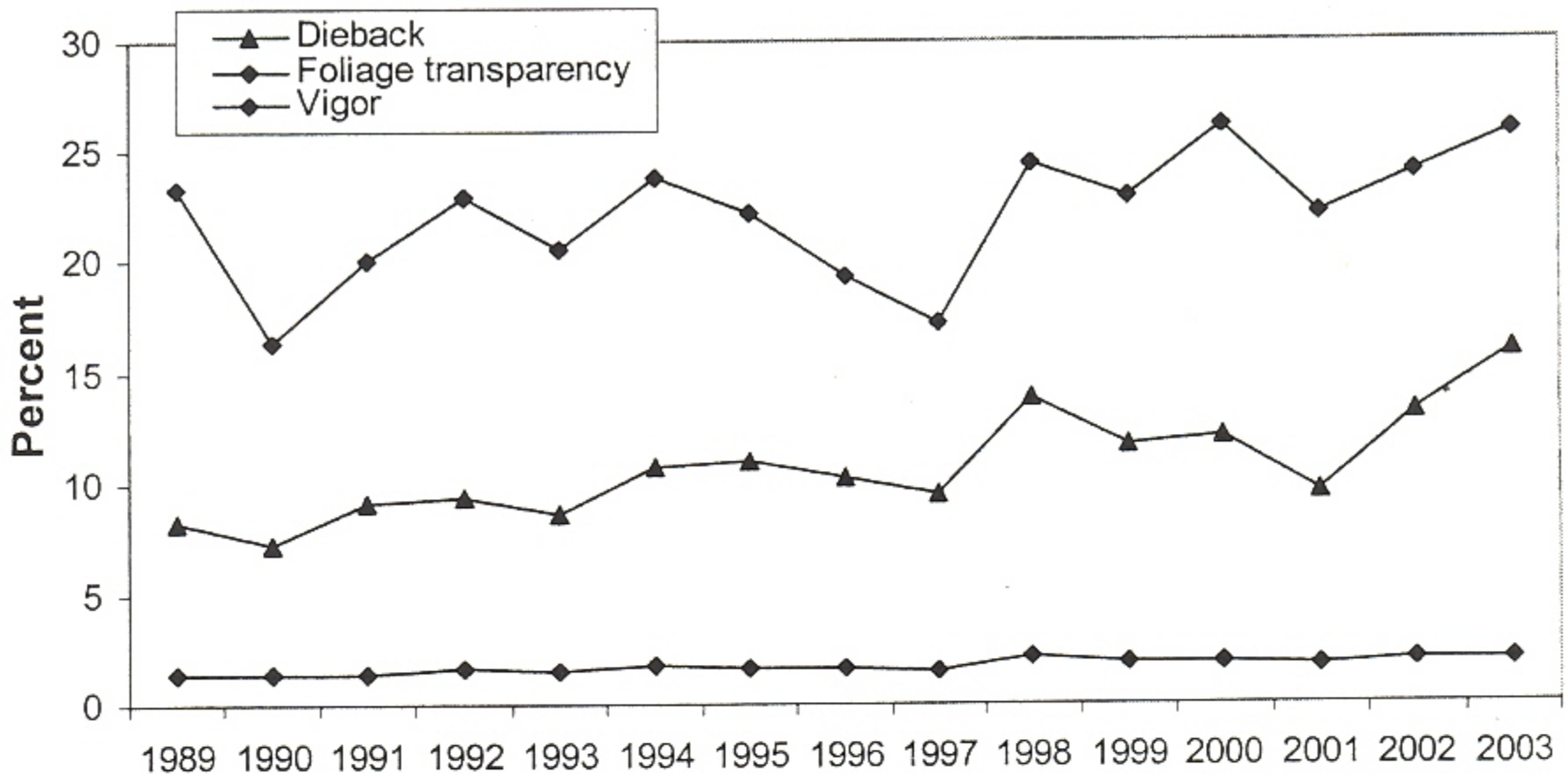


Figure 35. Trend in beech condition on North American Maple Project Plots in Vermont, 1989-2003.

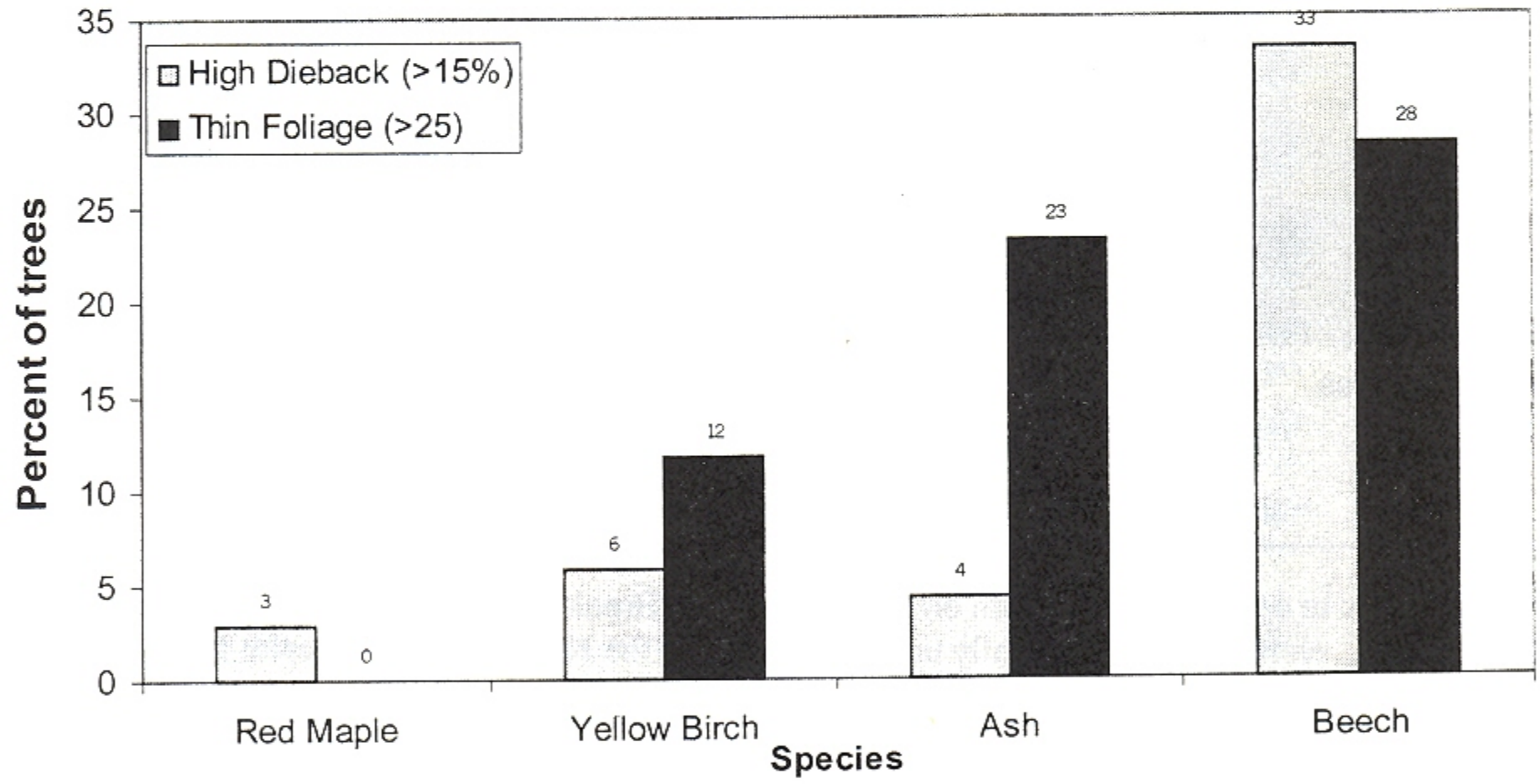


Figure 36. Percent of overstory trees on NAMP plots with high dieback or thin foliage in 2003 for red maple, yellow birch, white ash and beech.

Vermont Monitoring Cooperative Tree Health

Trends in tree health in the Lye Brook Wilderness Area

Ten years of monitoring tree health on plots in the Lye Brook Wilderness Area is showing early signs of decline. Five monitoring sites at 2 elevations (1400 and 2300 feet) have been evaluated annually since 1994 using protocols of the National Forest Health Monitoring Program. Two of the tree health indicators, dieback and foliage transparency, measure current year and recent stress impacts to tree heath. Results of overstory trees (dominant and codominant) with dieback greater than 15% (declining) or foliage transparency greater than 25%

(thin foliage) showed few unhealthy trees during 1994 and 1997 (**Figure 8**). These correspond with years where the growing season was favorable to tree health, and few significant insect, disease or weather-related events affected trees. Then starting in 1998, the percent of trees with thin foliage or declining increased and has not returned to these lower, "normal", levels. A combination of factors may be involved (**Table 1**). Drought during the growing seasons of 1999, 2001, and 2002 are the major stress factor involved. Similar drought symptoms were reported across Vermont during those years, and aerial surveys mapped drought affected forests on 85,000 acres, 200,000 and 170,500 acres statewide in respective years. Monitoring of plots at Lye Brook will continue to assess tree recovery or further decline.

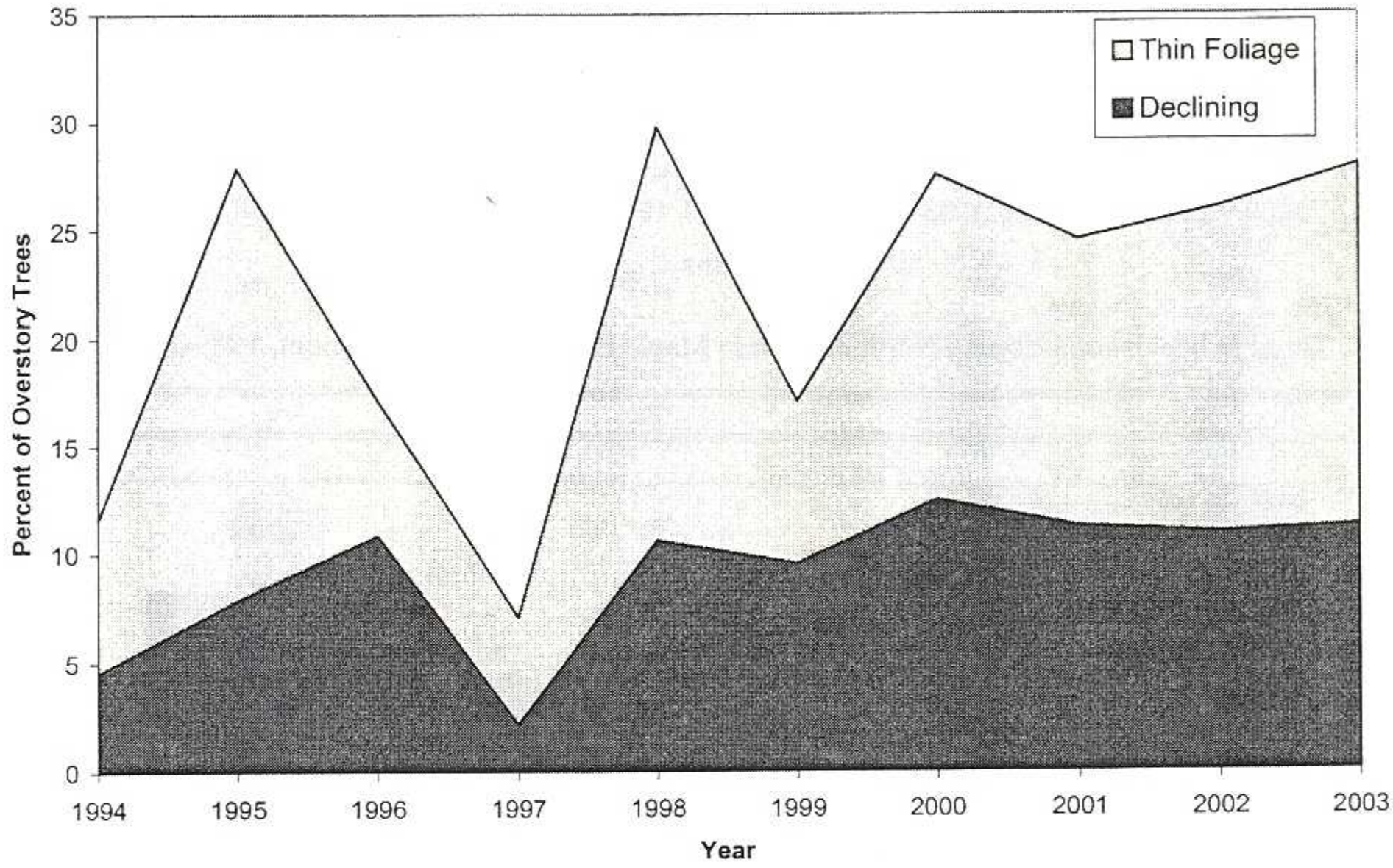


Figure 37. Trends in overstory tree health on plots in the Lye Brook Wilderness Area. Results are from 5 monitoring plots evaluated annually using protocols of the National Forest Health Monitoring Program.

Table 32. Insect, disease, and weather-related events affecting tree health in the Lye Brook Wilderness Area.

Year	Factor(s) affecting tree health
1994	Good growing conditions
1995	Pear thrips defoliation, drought
1996	Spruce winter injury, moist conditions for leaf diseases, birch leaf miner
1997	Good growing conditions
1998	Ice storm, leaf diseases (anthracnose), pear thrips defoliation on red maple, heavy seed, May tornado
1999	Drought, pear thrips
2000	Leaf diseases
2001	Drought, some pear thrips
2002	Drought
2003	Drought effects, spruce winter injury, beech bark disease, birch leaf diseases

Trends in tree health on Mount Mansfield

In 2003, there was an increase in the percent of trees declining on plots at the 3 lower elevations: 1400, 2200 and 3000 feet **(Figure 38)**. This was especially dramatic at the 3000 foot elevation, where nearly one third of trees are in a state of decline. At these elevations, trees are growing on steep slopes on very shallow, rocky, soil, so is prone to damage from ongoing drought stress. Conversely, trees on the highest elevation plots have been steadily improving since 1996, and showed no such drought-related effects. The percent of trees with thin foliage also increased on plots at all elevations, and was especially high at the two lower elevations: 1400 and 2200 feet **(Figure 39)**. This might be explained by species composition, since hardwood species dominate at lower elevations and tend to exhibit changes in foliage density or size more than the upper elevation balsam fir and red spruce trees. Despite the increase in percent of trees with thin foliage, levels in 2003 were much lower than those of 2001 at 1400 feet, where a combination of defoliating insects (pear thrips and maple leaf cutter) resulted in over 20% of trees with thin foliage.

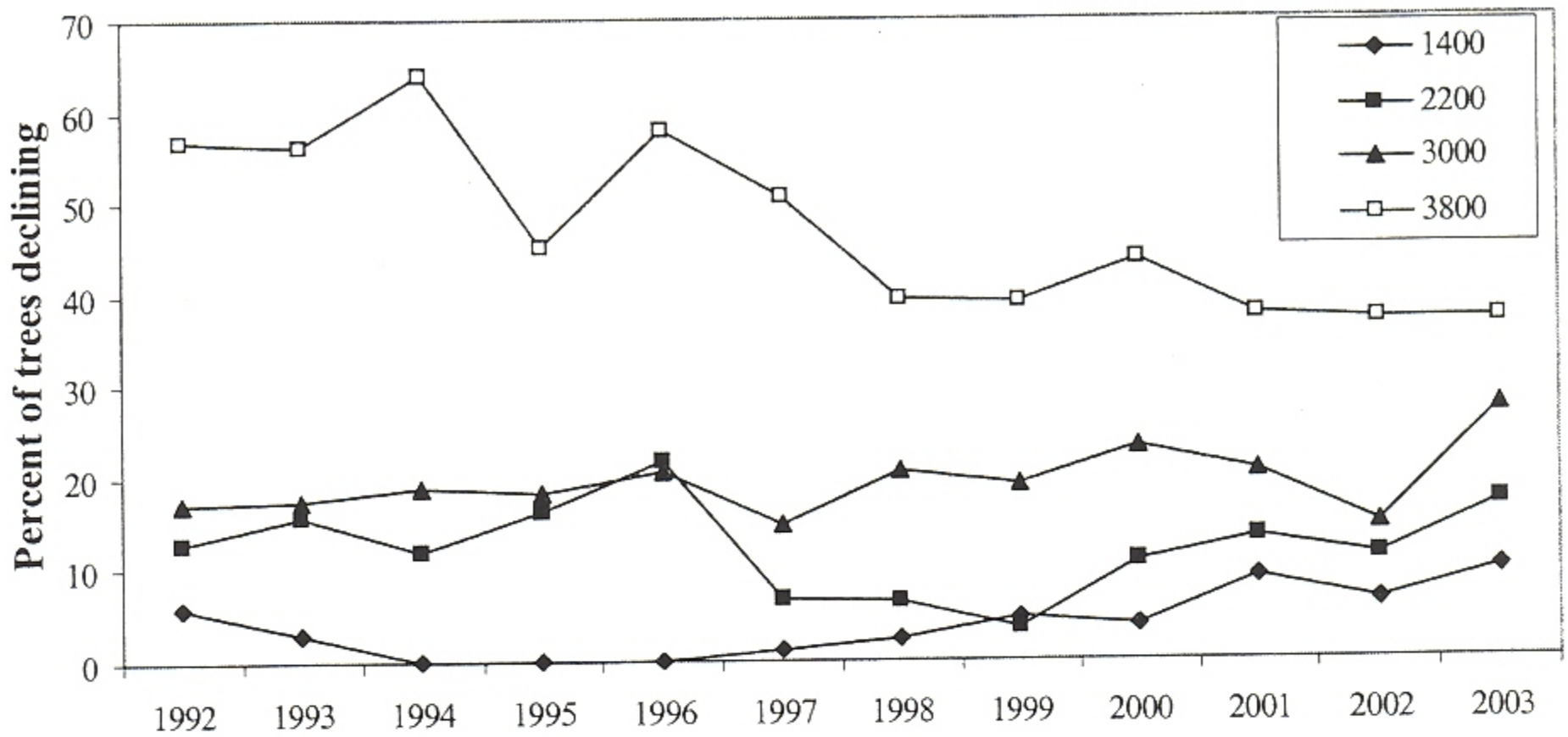


Figure 38. Trend in percent of trees declining (>=15% dieback) at 4 elevations on Mount Mansfield. Results from 14 plots on the west and east slope of Mount Mansfield using protocol from the National Forest Health Monitoring Program.

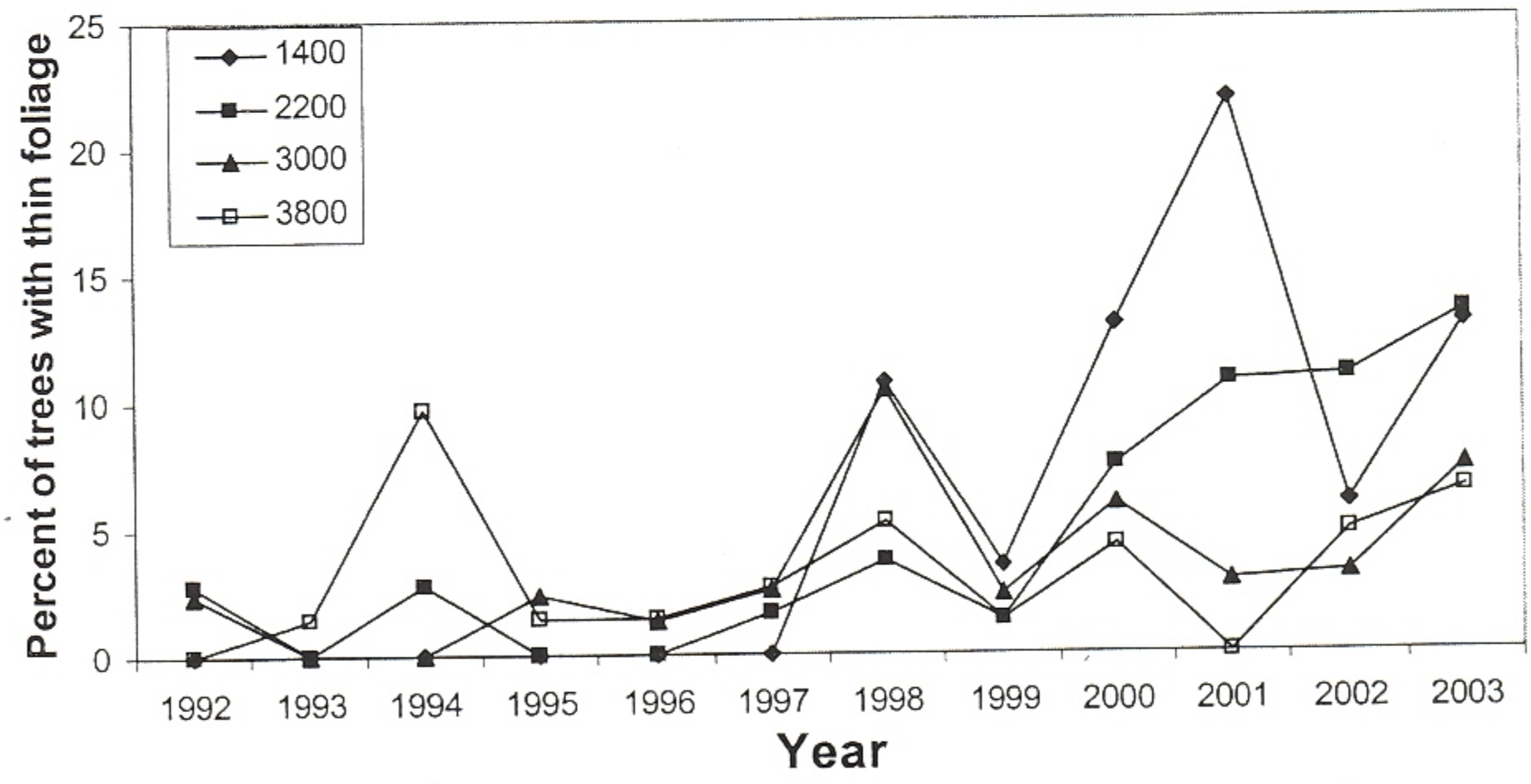


Figure 39. Trend in percent of trees with thin foliage (foliage transparency >25%) at 4 elevations on Mount Mansfield. Results from 14 plots on the west and east slope of Mount Mansfield using protocol from the National Forest Health Monitoring Program.

COMMON PESTS OF CHRISTMAS TREES IN VERMONT 2003

REPORTED BY THE

DEPARTMENT OF FORESTS, PARKS AND RECREATION

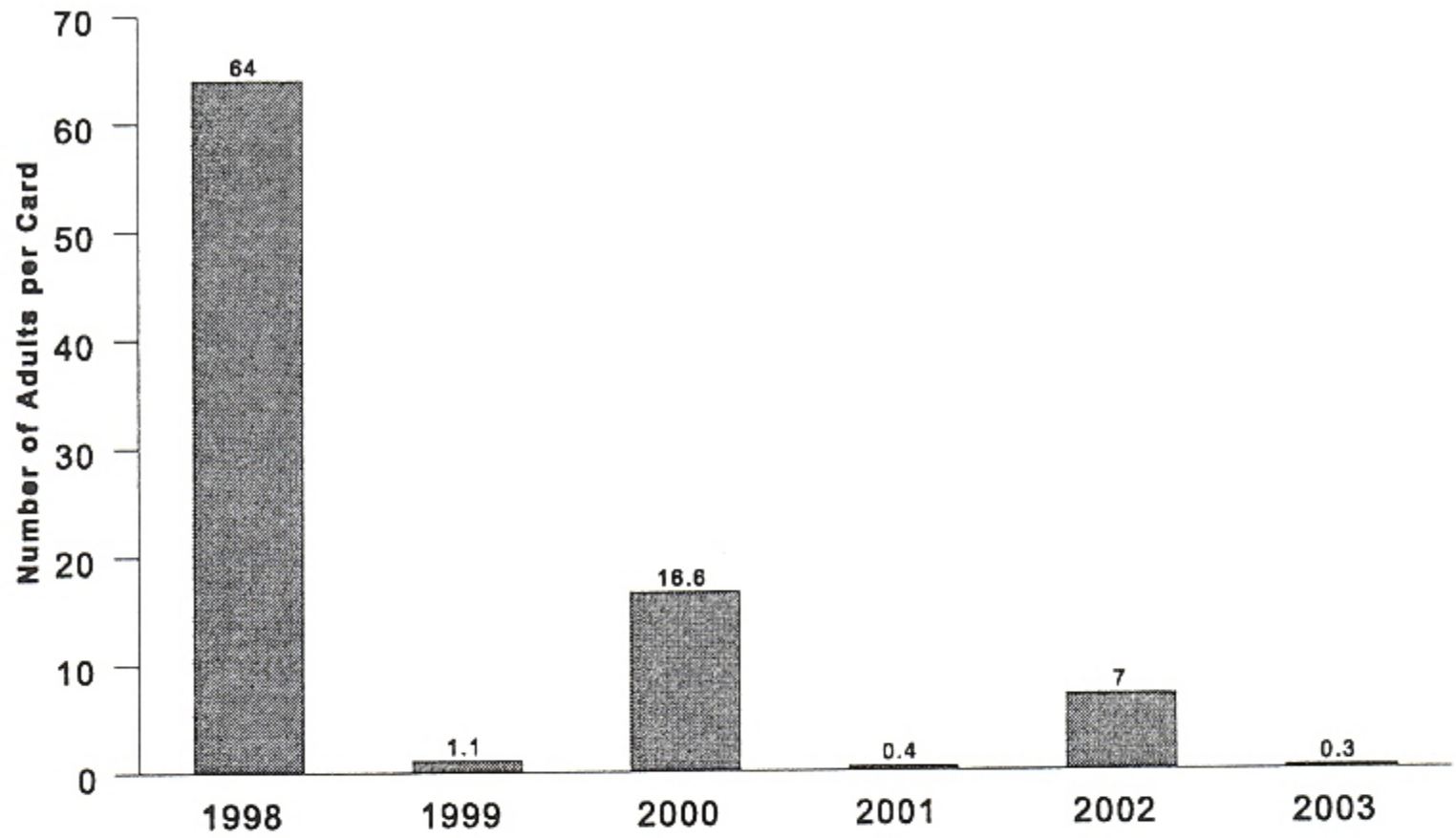
INTRODUCTION

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 and many growers reported that their trees had the fewest insect and disease problems ever seen.

INSECTS

Balsam Gall Midge populations collapsed, with little or no damage in Christmas tree plantations that had heavy damage in 2000 and 2001. If populations follow past patterns, this insect should not be a problem during the next 3 - 4 years.

Balsam Shootboring Sawfly, caused little or no damage to fir Christmas trees this year compared to light to moderate damage in 2002. This was expected, as damage is lowest in odd years due to a two-year life cycle for the majority of insects. Adults caught on 3x5 yellow sticky cards placed in mid-crowns of trees in Lamoille County dropped to the lowest level yet seen (0.3 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 not expected to be a problem in 2004.



Number of Balsam Shootboring Sawfly Adults Caught on 3x5" Yellow Sticky Cards from 1998 to 2003.

Balsam Twig Aphid damage was light to non-existant in most locations after being at light levels in 2002. Many growers that frequently apply pesticides to control twig aphid did not spray at all this year. There were a few exceptions, with a few growers reporting some moderate damage and a couple with severe damage.

Cooley Spruce Gall Adelgid remains common on blue and white spruce.

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

Hemlock Scale was observed on balsam fir in Springfield.

Pine Spittlebugs were reported to be heavy in one plantation in Bakersfield.

Sawyer Beetles caused some branch mortality in scattered locations but also were invading the stems of mature drought-stressed Fraser fir in Walden. Adults were not as commonly seen as in 2002.

Spruce Spider Mite populations remained very low. Only light numbers and damage were observed in southern Vermont. Rains were heavy and frequent enough to prevent populations from increasing.

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

DISEASES

Armillaria Root Rot appears to be an increasing problem associated with tree mortality. This is particularly true for Fraser fir and for plantations that have an accumulation of old stumps. Recent drought conditions probably made trees more susceptible. In some cases, decay of feeder roots during past wet years reduced the number of roots and probably made trees more susceptible to drought stress and Armillaria during the recent dry years.

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

Delphinella Tip Blight damage to balsam fir dropped to light levels this year except for an occasional tree with moderate or heavy damage.

Diplodia (Sphaeropsis) Tip Blight was one of the most common disease problems seen this year but was mostly at light levels. Hosts included balsam fir, Fraser fir and white pine.

Feeder Root Rot from past wet years or in situations where drainage is a problem continues to cause some tree mortality in widely scattered locations, especially with young trees. Symptoms are similar to that caused by Phytophthora but there are a number of fungi that could be responsible. In some cases, large trees were affected but didn't die until this year, following drought stress in 2001-2002.

Fir-Fern Rust was widespread and more common than usual, but damage was mostly light.

Lophodermium Needlecast remained common at light to moderate levels.

Rhizosphaera Needle Blight of Fir, caused by *Rhizosphaera pini*, dropped to very light levels in scattered locations.

Rhizosphaera Needlecast of spruce remains common, with mostly light damage reported.

Scleroderris Canker has not been found in any new towns since 1986. Only two growers requested an inspection and certificate to ship pine out of the quarantine area this year.

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

White Pine Blister Rust damage remains common throughout the state.

White Pine Needle Blight infection was found at light levels in scattered locations.

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 seldom seen this year. Light damage was reported for one plantation in Craftsbury.

Drought Stress due to severe drought in 2001 and moderate drought in 2002 appears to be a major factor in the death of mature Fraser fir, balsam fir and white pine.

Winter Injury was commonly observed but damage was mostly light. Species affected included white spruce, Fraser fir, balsam fir and white pine.

The following pests were not observed this year.

Insects: Cinara Aphids, Introduced Pine Sawfly, Pine Leaf Adelgid, Pine Needle Midge, Pales Weevil, Spruce Bud Moth and Yellow-headed Spruce Sawfly

Diseases: Spruce Needle Rust, Sirococcus Shoot Blight, and Rhabdocline Needlecast

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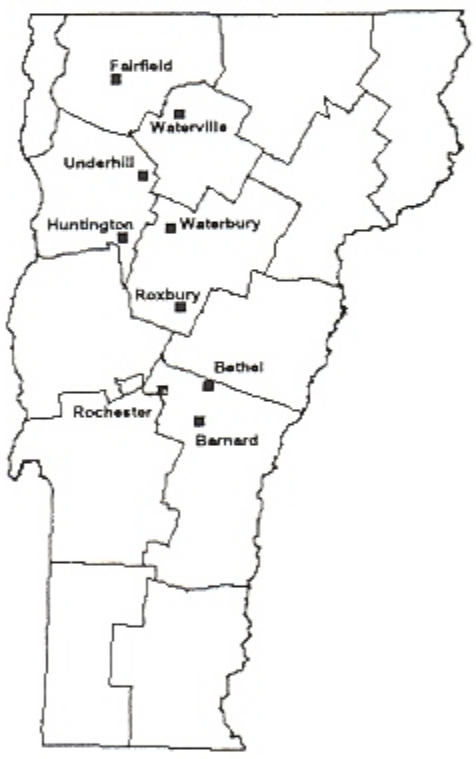
HEALTH OF SUGAR MAPLE IN VERMONT - 2003

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 2003, 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.

Several **Forest Defoliators** are currently threatening maple health. Although pear thrips and maple leaf cutter caused limited damage, bruce spanworm defoliation was widespread, and forest tent caterpillar populations are building.

Keep a sharp eye out for **Forest Tent Caterpillar** in 2004. Moth catches in traps designed to track this insect have been increasing over the past few years. In 2003, defoliation, sometimes heavy, was observed in locations scattered throughout Rutland County.

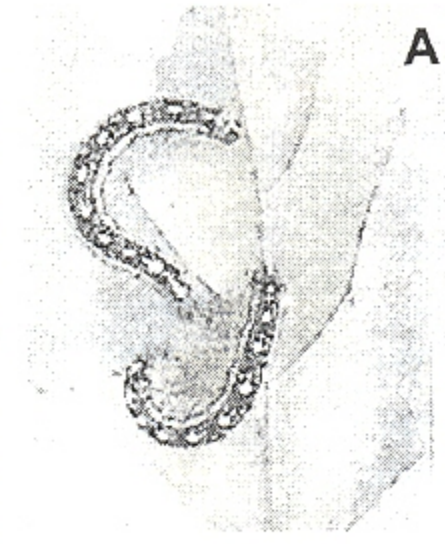


Average # of Forest Tent Caterpillar Moths per Trap

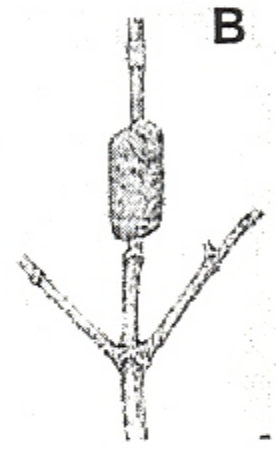
	2002	2003
Barnard	5	12
Bethel	5	10
Fairfield		1
Huntington	9	7
Rochester	7	5
Roxbury	16	15
Underhill (SB2200)	4	12
Underhill (VMC 1400)	4	3
Underhill (VMC 2200)	3	7
Underhill (VMC 3800)	1	3
Waterbury	2	1
Waterville	0	2
Statewide Average	**5.6**	**6.9**

To Detect Activity by Defoliating Caterpillars, walk through the sugarbush periodically during the growing season. In addition to looking for the insect eggs, caterpillars, cocoons, and moths, look for:

- Areas where a lot of sunlight is reaching the forest floor.
- Chewed, tattered, or lacy leaves. If the chewed edges are brown, the damage is at least several weeks old.
- Particles of leaf on the ground.
- Brown caterpillar pellets collecting on the leaves of groundcover plants, or the "pitter-patter" of the pellets raining down.
- Two different kinds of leaves growing from the same shoots: older, damaged leaves and newer refoliation. Refoliated leaves are smaller and light green or reddish in color, compared to the darker damaged leaves.

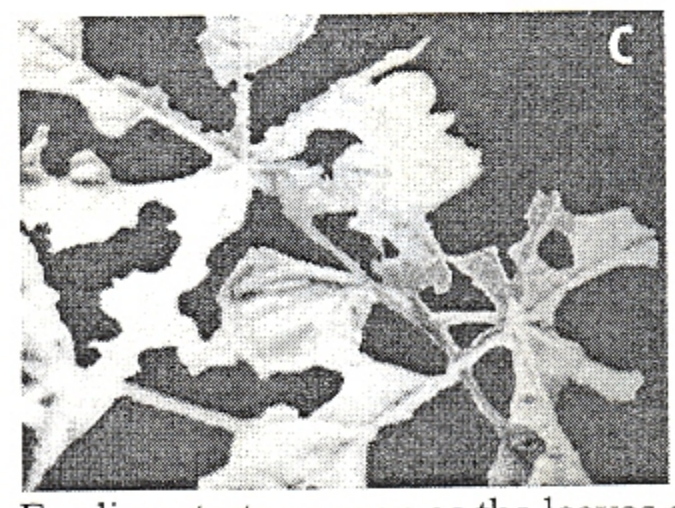


Forest tent caterpillar (A) was a significant problem to sugarbushes in the early 1980s. In 1982, over 300,000 acres were defoliated. We know, from that outbreak, that *forest tent caterpillar can cause a lot of damage, including mortality, to maple trees*. By 1984, sugar maple decline and mortality were noticeable on about 30,000 acres which had been defoliated.



It's possible to forecast whether or not a sugarbush is going to be severely damaged by surveying between September and April. Before the leaves come out, look around for the shiny brown egg masses (B) wrapped around twigs in young trees you can reach, or, better yet, in the tops of maples that have been cut down. It requires a close look, since their color is not too different from the twig itself. If you see some and want to know more, you can call the VT Dept of Forests, Parks, and Recreation. Forestry staff can do a more systematic search.

If defoliation is predicted, damage can be reduced by spraying the organic insecticide, Bt, from the air, in late May. A ballpark cost to the landowner has been $20-$30 per acre. This would require substantial advanced planning, since permit applications for aerial spraying are issued on a site-by-site basis, and the aerial applicator would most likely be a contractor based out-of-state.



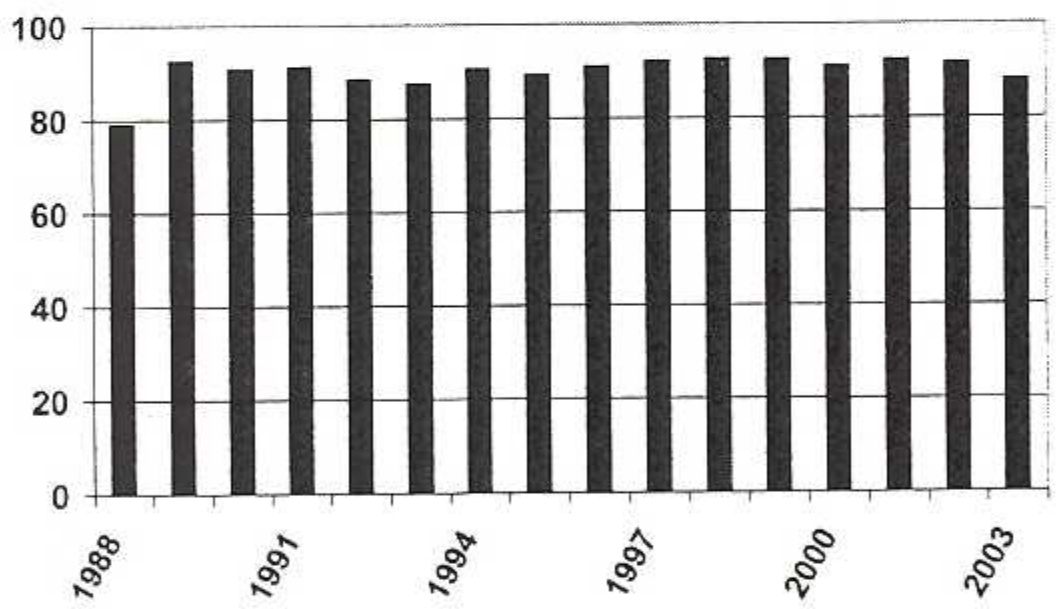
Bruce Spanworm caused defoliation throughout the state in 2003, with some trees putting out a second flush of leaves. Bruce spanworms are green inchworms whose feeding results in lacy looking leaves (C). Feeding starts as soon as the leaves come out, and refoliation occurs by mid-July. The impact on tree health is not severe because defoliated trees have an opportunity to replenish their food reserves by the end of the growing season. We do not recommend aerial suppression of this insect. The VT Department of Forests, Parks, and Recreation is working on a method to predict damage from this insect based on egg numbers on "traps" placed in sugarbushes in late fall.

Weather conditions in 2003 were generally good for sugar maple. Although the previous winter included some cold temperatures, continuous snow cover prevented root damage. Late spring frosts were uncommon. Moisture was adequate throughout the growing season. Although it was wet enough to cause some fungus diseases on sugar maple foliage, none were widespread. The impact of July windstorms was severe in isolated locations, but unimportant elsewhere.

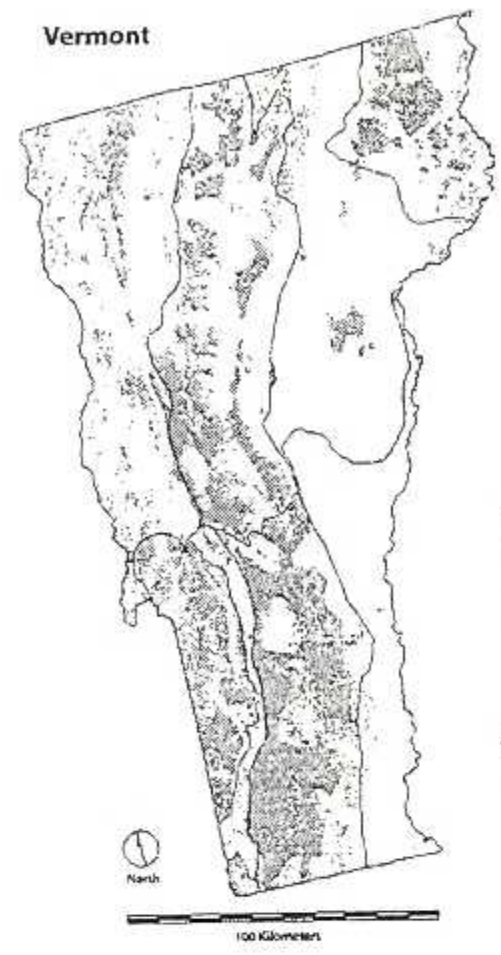
However, the impact of recent **Drought** continues to be visible. There was an increase in the acreage of hardwood dieback and mortality that was mapped from the air. This was particularly noticeable on ledgey ridgetops. Another impact is harder to see. The fall brought a huge crop of honey mushrooms, the fruiting structure of shoestring root rot. This fungus infects the roots of stressed trees. We can assume it got a toehold in many trees during the drought, and is poised to be damaging if these trees suffer additional stresses in the next year or two.

To assess the **General Condition** of maple stands, 2000 sugar maples were evaluated as part of the North American Maple Project. On average, the condition of these trees was worse than last year, with 88% of the trees rated as healthy. Over the past 16 years, this rating has fluctuated, generally in response to rainfall and insect defoliators. In 2003, tree condition is still reflecting the impact of recent drought, as well as widespread bruce spanworm defoliation.

Percent of Overstory Sugar Maples Rated Healthy



There's good news and bad news regarding **Asian Longhorned Beetle**, the black and white beetle from China which was first recognized in North America in 1996. In 2003, infested trees were detected for the first time in Canada, in an industrial area in and around Toronto. The good news is that the Chicago infestation is coming under control. Beetles were almost impossible to find there this summer. Meanwhile, in the New York metropolitan area, eradication efforts continue, with some successes, and some new finds. This insect has never been found in Vermont.



Air Pollution impact on sugar maple is out of the news, but concern hasn't gone away. Although the sulfur component of acid deposition has gone down, thanks to reduced emissions, the nitrogen component remains high.

Forested areas sensitive to nutrient deficiencies as the result of atmospheric deposition of sulfur and nitrogen. This map, provided by permission of the Forest Mapping Work Group, is based on modeling results rather than current impact data.

Soil calcium content is one of the factors that determine how likely forests are to become deficient in nutrients as a result of deposition. High deposition levels, slow release rates of minerals into the soil, and the presence of species, like sugar maple, that need a lot of calcium are other important factors. Calcium content varies a lot within the state, and throughout the maple region. A project to map forest sensitivity to acid deposition has been sponsored by the New England Governors and Eastern Canadian Premiers. Preliminary maps for Vermont are available via the internet at http://www.ecosystems-research.com/fmi/VT-NF-Forest-Sensitivity-Report.pdf.

For More Information: Insect and disease reports, and requests for identification, publications, and information on control, should be directed to the County Forester or Forest Resource Protection personnel at our district or county offices.

Addison	388-4969	879-6565
Bennington	375-1217	483-2314
Caledonia	751-0111	751-0110
Chittenden	879-5694	879-6565
Essex	751-0111	751-0110
Franklin	524-6501	879-6565
Grand Isle	524-6501	879-6565
Lamoille	888-5733	476-0170
Orange	476-0173	476-0170
Orleans	334-7325	751-0110
Rutland	483-2730	483-2314
Washington	476-0172	476-0170
Windham	257-7967	885-8855
Windsor	296-7630	885-8855

The 21st Annual Vermont Forest Pest Workshop, January 5th 2004

Thanks to Dale Bergdahl for all the work needed to orchestrate the conference and make it a success for 21 years. Also thanks to Brent Teillon for speaking and the state of Vermont for funding the conference.

A **Beech Bark Disease Symposium will be held June 16-18 at Saranac Lake in New York**. The spread of the disease into Michigan and the Lake States has sparked new interest and interesting new research on the disease.

Summary:

The State of Vermont Department of Forests, Parks, and Recreation:
Kathy Decker, forest pathologist St. Johnsbury, reported on surveys and monitoring projects of exotic pests in Vermont. Kathy and company have focused their efforts on monitoring and looking for three exotic species.
The Siberian moth (*Dendrolimus superans*) is not currently found in the U.S. It is a native of NE Asia where it feeds extensively on pine, spruce, and fir species. Five sites were used for monitoring using pheromone traps. Fortunately, no Siberian moths were found this season.
The emerald ash borer (*Agrilus planipennis*), currently found in southeast Michigan, northwest Ohio, on nursery stock in Maryland, and in southern Ontario, attacks all ash species. D shaped holes, "bark crack", and S shaped galleries are characteristic of emerald ash borer infestation. Three sites are being monitored for introduction in Vermont.
The third exotic pest of concern is garlic mustard (*Allaria petiolata*). Unlike many invasive herbaceous plants which are common in disturbed, high light, and edge sites, garlic mustard is a shade tolerant understory species. It commonly outcompetes native species. Current known populations of garlic mustard in the state were monitored, looking for any changes. Cornell University is working on bio-control techniques using a beetle.

Trish Hanson of the Forest Biology Lab gave their annual report. The Forest Biology Lab identified 701 insect requests this year along with processing the contents of the state's pheromone traps.

TICK TALK
Trish provided some general information about mites and ticks. Some interesting facts of relevance: these two groups transmit the widest variety of pathogens of any arthropods, tick sex is easily determined because of the occurrence of a large scutum nearly covering the entire back of the male, comparatively females have a much smaller scutum, the presence of ticks in an area is largely dependent upon high humidity and the presence of a variety of different host animals suitable for the different tick instars, and male ticks are generally much more interested in sex than in food.
Trish spoke about The Vermont Tick Surveillance Program. This program involves contacting and sending the veterinarians of Vermont tick ID forms. Vets fill out the form

and send in tick samples. The information gleaned from this process allows the state to determine tick population trends. A deer survey, done on the first day of rifle season, also contributes to the state's tick database. Thus far the program has been a success.

Ron Kelley reported on northern Vermont conditions in 2003. Ron provided the conference with pictures and relayed observations of interesting insects and forest health conditions that he observed during his 2003 field season.
Here is a list of some of the things that Ron saw this year:

Insects

- Bruce spanworm defoliation (and evidence of turkey predation)
  -sugar bushes experienced moderate defoliation last year
- Alder flea beetles
- Birch skeletonizer defoliation
- Locust leaf miner
- Maple leaf blotch miner
- Maple webworm
- Pine shoot beetle (Washington county, new county reported)
- Linospora leaf blight on balsam poplar

Drought Related Problems

- In white pine
- Cedar browning and Arborvitae leaf miner
- Fraser fir Christmas tree mortality
- Larch decline

Other forest health issues

- mortality in spruce-fir stands
- sawyer beetle larvae invading fir
- 50,000 acres of hardwood dieback in 2003

Barbara Burns reported the 2003 Vermont Forest Health Conditions. Barbara showed some dramatic photos of the July 27th blowdown in Cavandish. She then spoke of forest health issues of this year.

- Sugar maple health decline owing to last year's drought conditions
- Salt damage increased this year
- Hemlock borer increased
- *Armillaria* increased (drought)
- Beech bark disease continues to spread
- Maple leaf cutter observed
- Ash anthracnose defoliation was observed
- Birch defoliation occurring at high and low elevation

Some pest comebacks were observed

- Forest tent caterpillar
- Maple web worm
- Balsam woolly adelgid

On a positive note, Barbara observed cankering and mortality of buckthorn.

The next group to speak was from the **University of Vermont Forest Entomology Lab**. **Bruce Parker** introduced the lab and spoke of some current issues in the field and current research being done at UVM. The Asian longhorned beetle has been found in New York City, Chicago, and Toronto. In New York's Queens, 65 trees have been reported infected. Chicago has reported 6 new trees infested outside of the quarantine area. The lab is researching entomopathogenic fungi as potential biological control of hemlock woolly adelgid.

Don Tobi introduced the Vermont Forest Ecosystem Management Demonstration Project. It is being conducted on the western slope of Mt. Mansfield and is replicated in UVM's Jericho research forest. This project is looking at the biodiversity of mammals, birds, amphibians, and insects in plots under 3 different management treatments; single tree selection, group selection, and structural enhancement. The entomology lab is looking at the diversity of carabids and collembola in these plots.
In other research news, sugar maple pathogens and insects are being studied in stands varying in percent sugar maple at sites in Underhill, Procter Maple Research Center, and in various private sugar maker stands.

Vladimir Gouli spoke about the elongate hemlock scale. This insect is a pest on eastern, Carolina, and Japanese hemlock. It was introduced from Asia and became established in the US in 1908. The scale has been found coexisting with HWA. It has been found infected with the fungus *Aschersonia marginata*. The entomology lab is receiving funding to work on this insect and they intend to study the *Aschersonia* species as a potential bio-control.

Scott Costa next presented Grappling with Hemlock Woolly Adelgid. The most recent report showed that HWA is found only two miles from the southern Vermont border. 2003 HWA research activities included: investigating the *Verticillium* fungus used to manage HWA, nontarget effects of the fungus, the micro-climate of HWA winter habitat, cold tolerance of HWA and the predatory beetle *Pseudoscimnus tsugae*, and developing a HWA field sampling plan.

The University of Vermont Forest Pathology Lab

Shari Halik presented on potential butternut canker insect vector studies of 2003. The canker is caused by *Sirococcus clavigignenti juglandacearum* (SCJ) a suspected exotic of unknown origin. There are 17 species of beetles known to carry spores of SCJ in Vermont. The laboratory studies focus on two species, *Eubulus parochus*, and *Astylopsis maculus*. Beetles were artificially treated and/or fed SCJ spores in the lab. The viability of spores on exoskeletons and in fecal pellets were tested at various time intervals from application and ingestion. The studies concluded that both species of beetles may act as vectors for the butternut canker disease.

Tim Schmalz next spoke about his work on the status of spatial analysis of physical site factors related to occurrence and severity of butternut canker. His work has found evidence that aspect appears to play a role in the presence of cankers on trees and roots.

Preliminary evidence indicates that east and southeast facing slopes are less likely to be infected with SCJ and those infested are less likely to exhibit mortality. It also appears that butternuts are doing most poorly on lacustrine soils.

Ben Machin spoke about his work on HWA risk mapping. His work looked at Windham County and predicts the potential impact of HWA by addressing the susceptibility and vulnerability of different sites to infestation. Factors such as low winter temperatures and distance to potential human introduction points were used in combination with GIS technology to produce his results. The advantages of this risk mapping model is that it is flexible so as to allow perpetual modification and could potentially be modified to address new and different forest pests.

Dale Bergdahl presented his work on the fungus-beetle association between the introduced *Leptographium wingfieldii* and pine shoot beetle *Tomicus piniperda* in North America. L. wingfieldii has been found in association with the native bark beetles *Dendroctonus* and *Ips* species.

New York

Jerry Carlson next spoke about New York State Forest Health Issues.

Defoliation

- Hemlock looper trap catches were up, no visible defoliation
- Fall webworm
- Locust leaf miner
- Orange striped oakworm, anthracnose, and gyspy moth associates
- Forest and Eastern tent caterpillar

Bark Beetles

- Peach bark beetle, populations on the rise
- Hickory bark beetle, some reports of severe damage
- Ips beetle complex, in red pine
- Red turpentine beetle, pine barrens mortality
- Pine shoot beetle, 7 new counties infested

Disease

- Anthracnose, various but notable on oak, sycamore, and maple
- Tar spot, on maples
- Maple *Fusarium* annual canker

Threats

- Asian longhorned beetle, new infestations, potential port threat from Toronto
- HWA, a new county and several new townships infested and heading north, also found in Buffalo and Rochester
- Emerald Ash Borer

Paul Schaberg from the USFS in Burlington spoke about red spruce winter injury. 2003 was the most damaging winter for red spruce since 1993. It appears that something is causing the cold tolerance of red spruce to decrease in Vermont and Paul and his colleges are attempting to isolate what this something is. They are following a three-fold

investigation pathway, looking at the temporal context, spatial context, and ecological context of winter injury. Patterns of greater injury in Vermont appear to increase with elevation, western longitudes, and western aspect. We can expect to learn more in the coming years as this research continues.

Scott Pfister from the VT Agency of Agriculture spoke of the Cooperative Agricultural Pest Survey Program (CAPS). This program intends to detect and analyze exotic and invasive plant pests through surveying and cooperative action between the groups such as the USDA, APHIS/PPQ, VT Agency of Agriculture, and UVM extension. Some pest species of concern include: the leek moth, giant hogweed, viburnum leaf beetle, potato wart, soybean pod borer, Siberian moth, and pine shoot beetle. In the coming year the VTAA will be conducting vegetation commodity and emerald ash borer surveys, UVM extension will be doing an apple sentinel survey, and the VTFPR will be conducting a Siberian moth survey.

Bonnie MacCulloch of the Agency of Agriculture next spoke about the North American Slug Project and Snail Survey (NASP). She expressed the lack of information known about North American mollusks and their potential as plant pests and vectors for parasites and fungus. L*aevicaulis alle, Amon rufus*, and *Xerolenta obvia*, are three examples of recently introduced slug pest-fungal vector species. Because so little is known, the potential for problems and new introductions is great. NASP is attempting to identify what species are already here so that we may determine the next appropriate steps to deal with them. Bonnie has called on all of us to help participate in the survey.
When you find a slug, first submerge it in water for no more than 12 hours, then transfer it to a 75% ethanol solution and submit it to the Agency of Agriculture.
For more information contact Bonnie at:

Bonnie MacCulloch
VT Agency of Agriculture
116 State St. Drawer 20
Montpelier VT 05620
(802) 828-1246
bmac@agr.state.vt.us

Sandy Wilmot of the Vermont Monitoring Cooperative spoke about the Forest Ecosystem Monitoring and Research Program. **Melody Burkins** was named as the new executive director of the program. **Eric Miller** is the new mercury project coordinator. She recommended that anyone interested in the Vermont Forest Ecosystem Management Demonstration Project should schedule a site tour. Forest health research and concerns highlighted included; tree health concerns at Lye Brook, long term monitoring plots at Lye Brook and at Mt. Mansfield, and the long term effects of acid deposition.

USDA, APHIS/PPQ

Andi Rosen from APHIS spoke of the action taken when an *Alternaria* fungus, known to cause a Chinese pear disease, was found on Ya pears in the US. This fungus is suspected to infect apples. Fortunately steps were taken soon enough to prevent the spread of this fungal pathogen into Vermont.

Bob Miller of the New York and New England office of APHIS at Rouses Point wrapped up the speakers by introducing a potential exotic species introduction point source resulting from uninhibited global trade. In December, a pine cone eating Indian longhorned *Cerambycid* beetle was found in Target stores. The beetles were discovered feeding on pine cones in potpourri and decorations imported from India. Bob concluded with the foreboding words "we're in trouble, what can I say."

Most Unusual Pest winners

1st Trish Hanson: maple yam gall
2nd Lou Bushy: cat spruce gall
3rd Jim White: emerald longhorned stem bender

Poster/Display winners

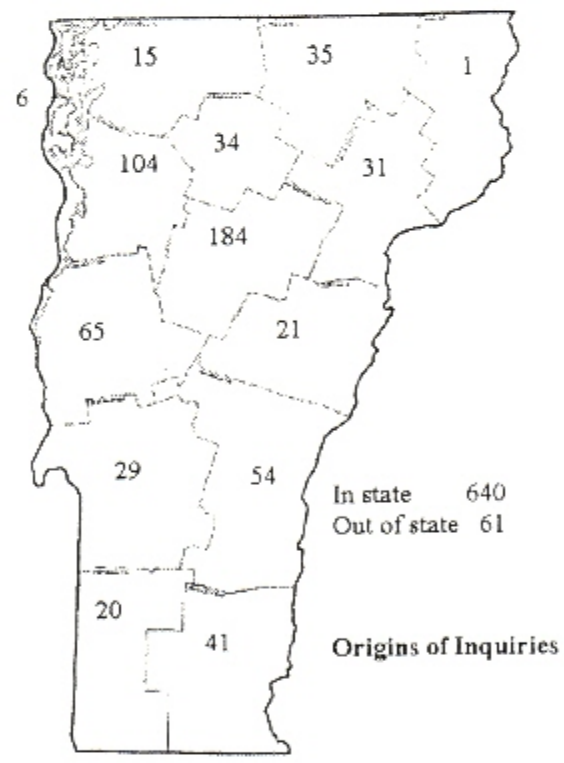
1st Bill Keeton and Don Tobi: Forest Ecosystem Management Demonstration Area
2nd Ron Kelly: Recovery of Trees from Ice Storm Damage, Photo Display
3rd Barbura Burns, Kathy Decker, and Dale Bergdahl: White Pine Health in Vermont, Including White Pine Blister Rust and Caliciopsis Canker

FOREST BIOLOGY LABORATORY
2003

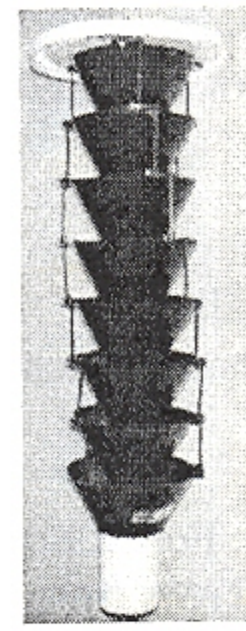
FOREST PROTECTION DIVISION
Department of Forests, Parks and Recreation

The Forest Biology Lab was established in the Environmental Laboratory Building in Waterbury in 1990. Our goal is to approach forest health issues and management through complementary programs in research, public education, and extension activities. We provide diagnostic services, recommendations and advice on appropriate control strategies and materials for pest problems. Factors that affect the health of our forests (eg., weather, insects and disease) are routinely monitored. We maintain a state reference collection, document and analyze insect and disease records, evaluate the extent and significance of real or potential environmental or human damage to forests and help broaden public awareness of factors that affect forest health.

Inquiries and Diagnostic Work. For much of the year we are busy providing identifications, advice and information about insects and diseases associated with trees in urban, forest and plantation settings. This year, we responded to 1,329 requests for information. These inquiries included 628 tick specimens from veterinarians. (See below.) The remaining 701 inquiries were received from the public (43%), county foresters, other forestry professionals and the green industry (27%), educators, researchers, students and writers (13%), other labs (10%), media (2%) and miscellaneous other users (5%). Information about insects and diseases diagnosed at the Forest Biology Lab appear in appropriate sections in the body of this report.



Insect Monitoring. At the lab, we are responsible for screening the contents of pheromone and sticky traps, and identifying target and non-target insects captured during these monitoring activities. In 2003, surveys



continued for spruce budworm, forest tent caterpillar and saddled prominent. Results of trapping appear in this report under "Hardwood Defoliators" and "Softwood Defoliators." Non-targets are reported under "Miscellaneous Insects."

Lindgren funnel traps for pine shoot beetle, *Tomicus piniperda*, were deployed in 6 counties (55 traps total) and thousands of beetles were recovered from these, including 15,091 bark beetles. Only one of the beetles collected in 2003 was the target insect, but the find in Washington County represented a new county record. Details about the pine shoot beetle survey appear in "Bud and Shoot Insects" section of this report.

Tick Surveillance. The presence of Lyme disease in Vermont is of increasing concern. Beginning in the spring of 2002, we have been working with the Department of Health and the Agency of Agriculture to increase our understanding of the prevalence and distribution of tick vector species in Vermont. Tick specimens collected by veterinarians are submitted as part of this study. A total of 628 ticks were submitted in 2003 as part of this surveillance project. In addition, for the past four years the Forest Biology Lab has collaborated with the Department of Fish and Wildlife in baseline studies to help ascertain the abundance and distribution of deer and moose tick populations in our state. At 18 Vermont deer check stations, the first 30 deer reported during the opening weekend of rifle season are examined by F&W staff for the presence of ticks and other ectoparasites. Specimens are sent to the Forest Biology Lab for identification and preservation.

For more information or to add your name to the mailing list for our lab newsletter (Bug Bytes), contact us at

Forest Biology Lab
103 S. Main Street
Waterbury, VT 05671
241-3606 (Trish Hanson and Mary Burnham)
751-0117 or 241-1449 (Kathy Decker)

Vermont White Pine Survey

A variety of health concerns have been noted on eastern white pine (*Pinus strobus*) in northern New England over the past decade. A survey was conducted in 2001 to evaluate white pine condition in Vermont and to examine factors related to symptom development.

Objectives of the survey were to:

- Determine the conditions and extent of symptoms on eastern white pine in Vermont
- Assess the incidence of insects, diseases, and other stressors associated with white pine, and evaluate their role in symptom development.
- Examine the relationship between site factors, stand history, and white pine symptoms.
- Compare white pine symptoms in Vermont to other pine declines in the region.

White pine stands were located on randomly selected 1:8000 overlapping color-infrared photos, acquired in 2000 for the Vermont Hardwood Health Survey. 2.5 acre cells were evaluated on selected photos. A sample cell had to be over 75% forested with at least 75% of the canopy in white pine and the nearest such cell to the center of the center photo.

Stand location was transferred to mapping software. GPS coordinates (latitude and longitude) were determined to aid in locating plots on the ground. A total of 21 stands were located (Figure 1). At each stand, four 1/24th-acre subplots were evaluated on the ground. In addition, 10 young white pine were rated in nearby regenerating stands.

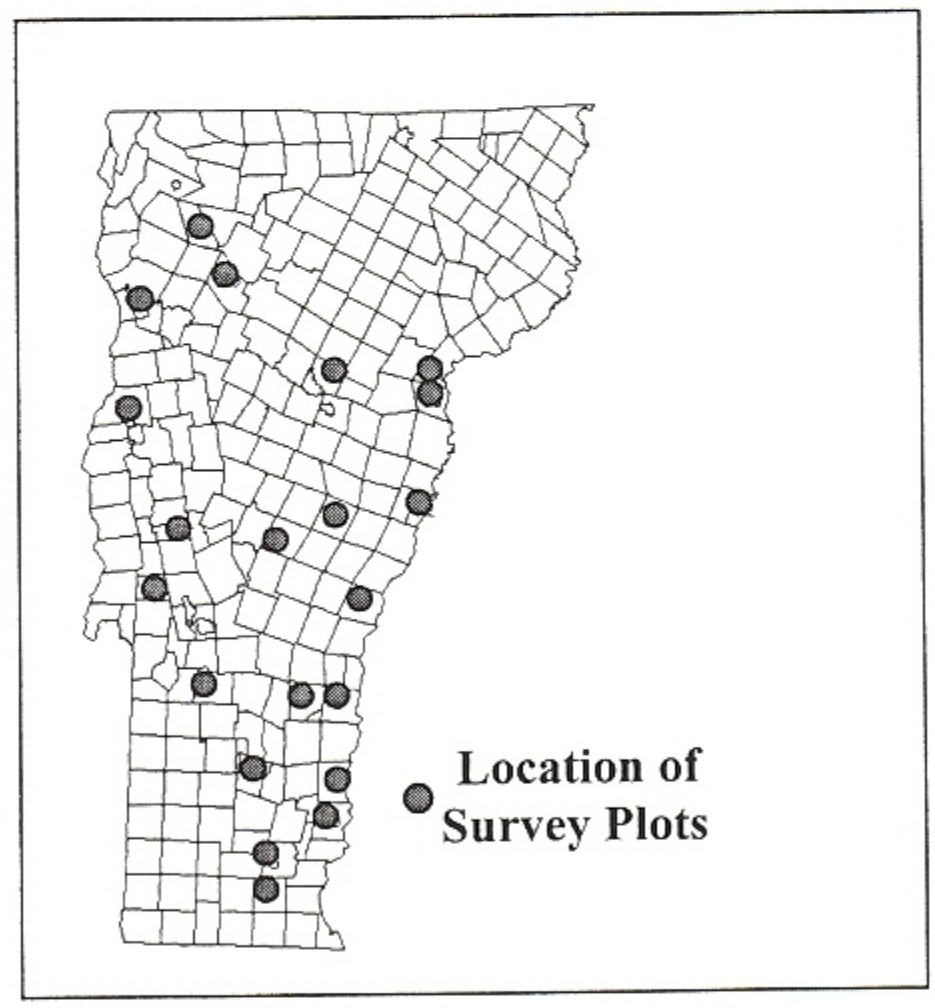


Figure 1. Location of 21 white pine stands evaluated in 2001.

Site data were taken for each stand. Information such as origin, % slope, aspect, geography, presence of outcrops, drainage, crown closure, presence of roads, logging history, indicator plants, presence of *Ribes*, site index and growth and regeneration were taken. Data taken for all trees 5" DBH within the subplots consisted of species, DBH, history, vigor and crown class. In the case of dead trees, diameter,

estimated crown class prior to mortality, and cause of death were noted. Data on white pine also included quality code, crown competition, crown ratio, density, dieback and transparency, symptoms, location of symptoms, severity and causal agent if known, presence of cones, weevil hits and number of white pine blister rust infections.

Results

A total of 747 white pine trees including 547 mature trees and 200 young trees, were evaluated on the 21 plots. Eighty nine percent of overstory trees in mature stands and 93% of young trees in regenerating stands were found to be healthy (Figure 2). Ten percent of all trees were dead, including 6% of mature trees and 1% of regenerating trees.

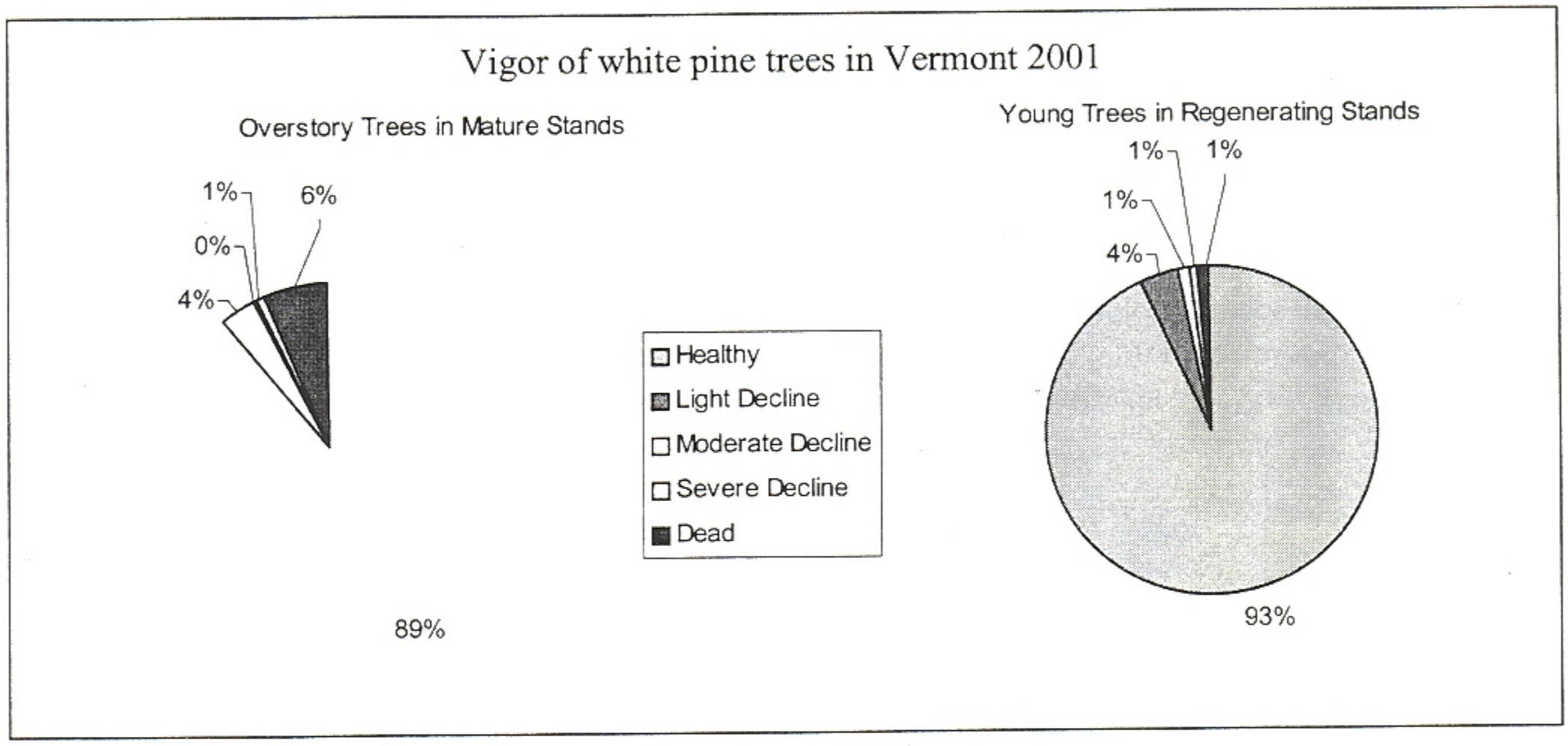


Figure 2. Vigor of overstory trees in mature stands and young trees in regenerating stands of white pine in Vermont in 2001.

The percent of trees expressing various symptoms is found in Table 1. Young trees were found to have a higher percentage of chlorosis, flagging, stem canker and white wax than mature trees. Mature trees were found to have a higher percentage of pitchy knots, punky knots, pitch from internodes, pitch from whorls and weevil spikes.

Table 1. Percentage of trees with various symptoms expressed as percent of mature, young and total trees.

	Chlorosis	flagging	stem canker	white wax	broken branches	brown foliage
mature	7	5	7	15	3	7
young	19	18	18	38	3	7
total	10	8	10	21	3	7

	pitchy knots	punky knots	pitch/internodes	pitch / whorls	weevil spikes
mature	19	6	33	30	64
young	2	1	27	21	47
total	15	5	31	27	60

The percent of trees affected by various causal agents is found in Table 2. Young trees were affected by *Caliciopsis*, white pine blister rust and pine bark adelgid at a higher percentage than mature trees. Mature trees were more affected by *Fomes pini* and white pine weevil than young trees.

Table 2. Percentage of trees with various causal agents expressed as percent of mature, young and total trees.

	Caliciopsis	WPBR*	Pine bark adelgid	*Phellinus pini*	White pine weevil
mature	8	3	14	6	71
young	16	14	33	1	48
total	10	6	19	4	65

*White Pine Blister Rust

Biotic agents affecting trees, but not found to be associated with tree health, are shown in Figure 3.

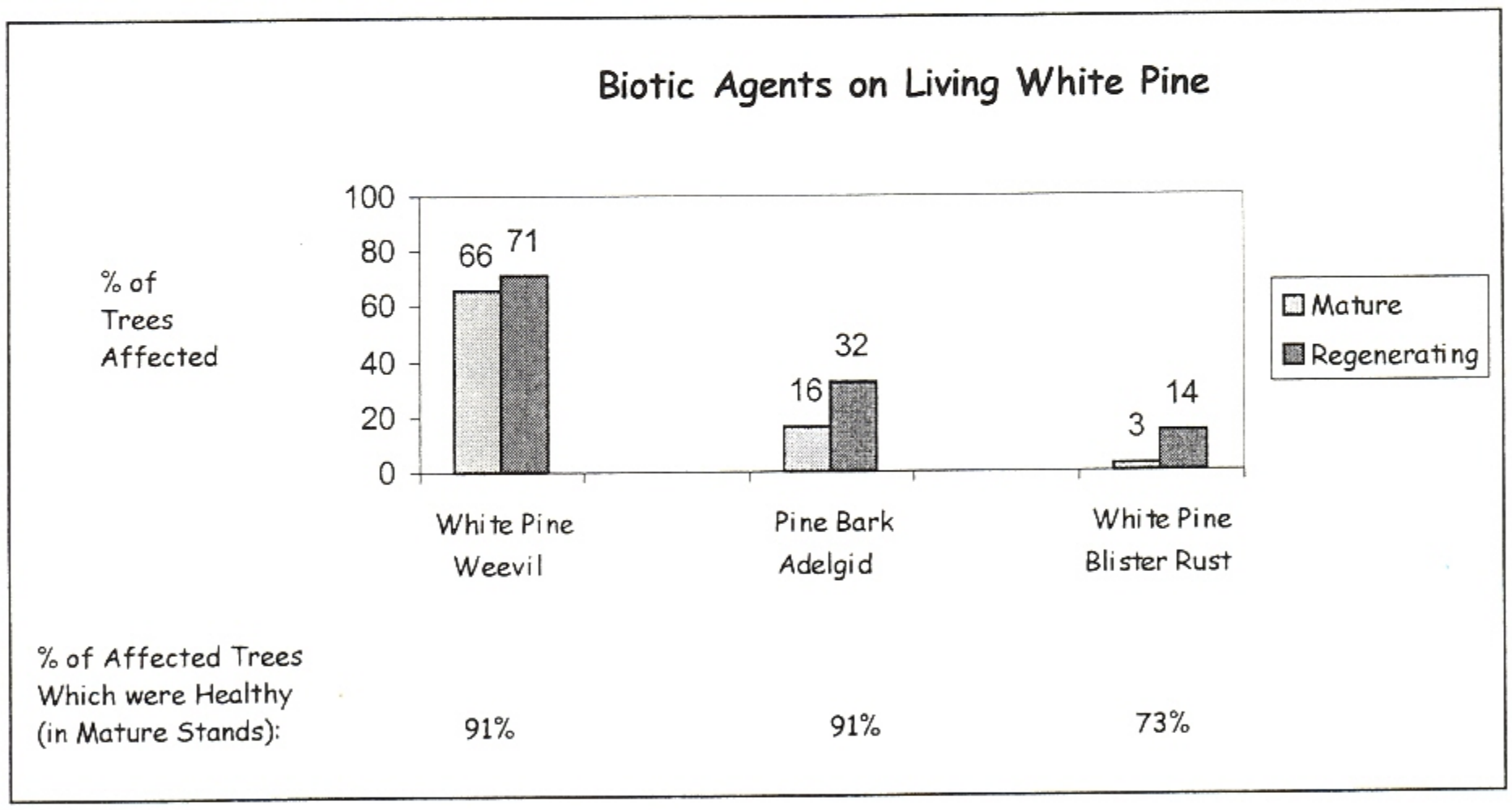


Figure 3. Biotic Agents on Living White Pine.

Symptoms found on the 49 unhealthy mature white pine and their causes are summarized in Table 3. The cause of most of these symptoms on unhealthy trees was unknown. Of the known causes, *Calciopsis*, *Phellinus* and White Pine Blister Rust were among the highest.

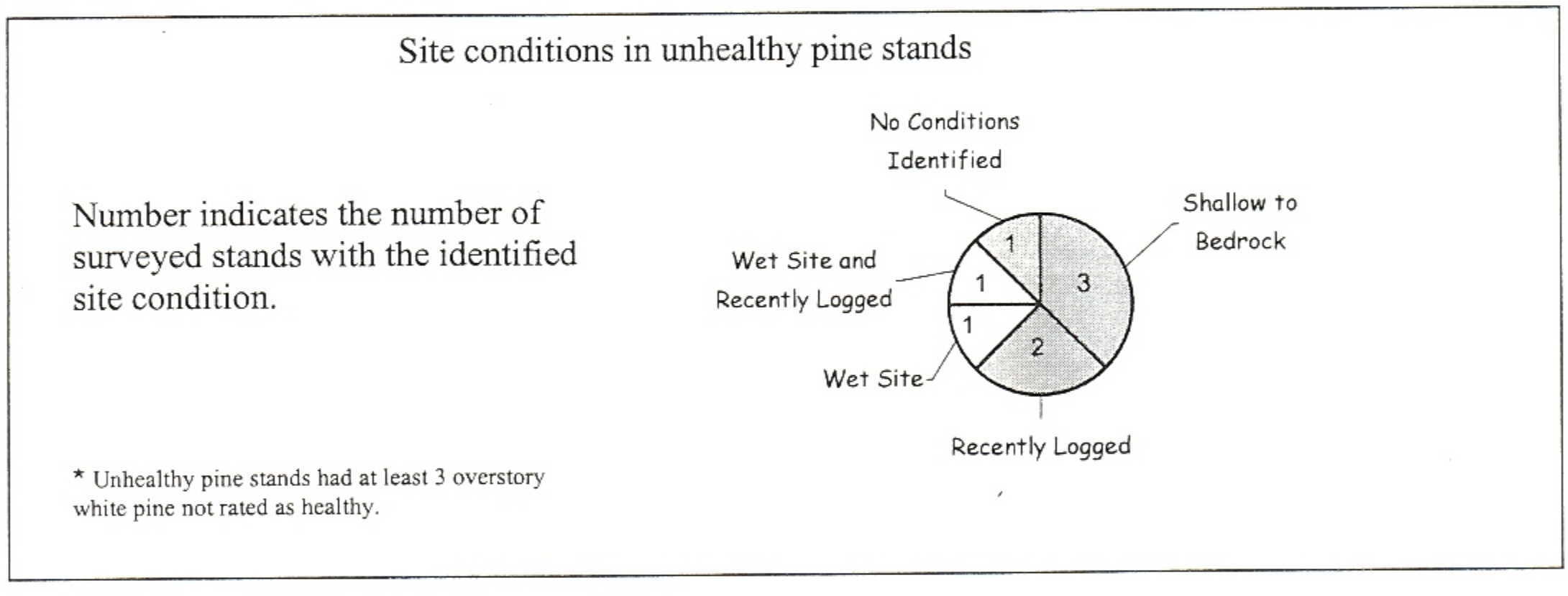
Table 3. Symptoms exhibited by unhealthy mature white pine trees and their associated causes.

Symptom (% of trees)	Cause (% of trees)	Cause (% of trees)	Cause (% of trees)	Cause (% of trees)
Pitch from internodes (35)	Unknown (22)	Caliciopsis (8)	Other wound (2)	Ice/snow (2)
Pitch from whorls (14)	Unknown (8)	Phellinus pini (6)		
Stem Canker (12)	WPBR (6)	Caliciopsis (6)		
Wound (12)	Other wound (6)	Bird/animal (2)	Logging (2)	Unknown (2)
Chlorosis (12)	Unknown(12)			
Flagging (8)	Unknown (4)	Competition (4)		
Dead top (6)	Logging (4)	WPBR (2)		

Among the highest known causes of death were competition (19%) and white pine blister rust (10%). Mature white pine affected by white pine blister rust had more dieback and a slightly lower live crown ratio and crown density than mature trees without white pine blister rust.

Stands which had at least 3 overstory white pine not rated as healthy were scored as unhealthy stands. In these stands several different site conditions were observed, (Figure 4) the most common being shallow soils. Wet site conditions and logging were also associated with these unhealthy stands.

Figure 4. Site conditions in unhealthy pine stands*.



As in a study conducted in Maine, tree decline and mortality were found to be related to rooting restrictions. These restrictions were associated with plow pans, shallow soil and high water tables. Although the Vermont study did not look at historical land use, shallow soil and high water tables were associated with 63% of the unhealthy stands.

No insect or disease outbreak was found to be associated with white pine decline symptoms in Vermont. Site conditions, especially those that limit rooting space, appear to be associated with unhealthy trees.