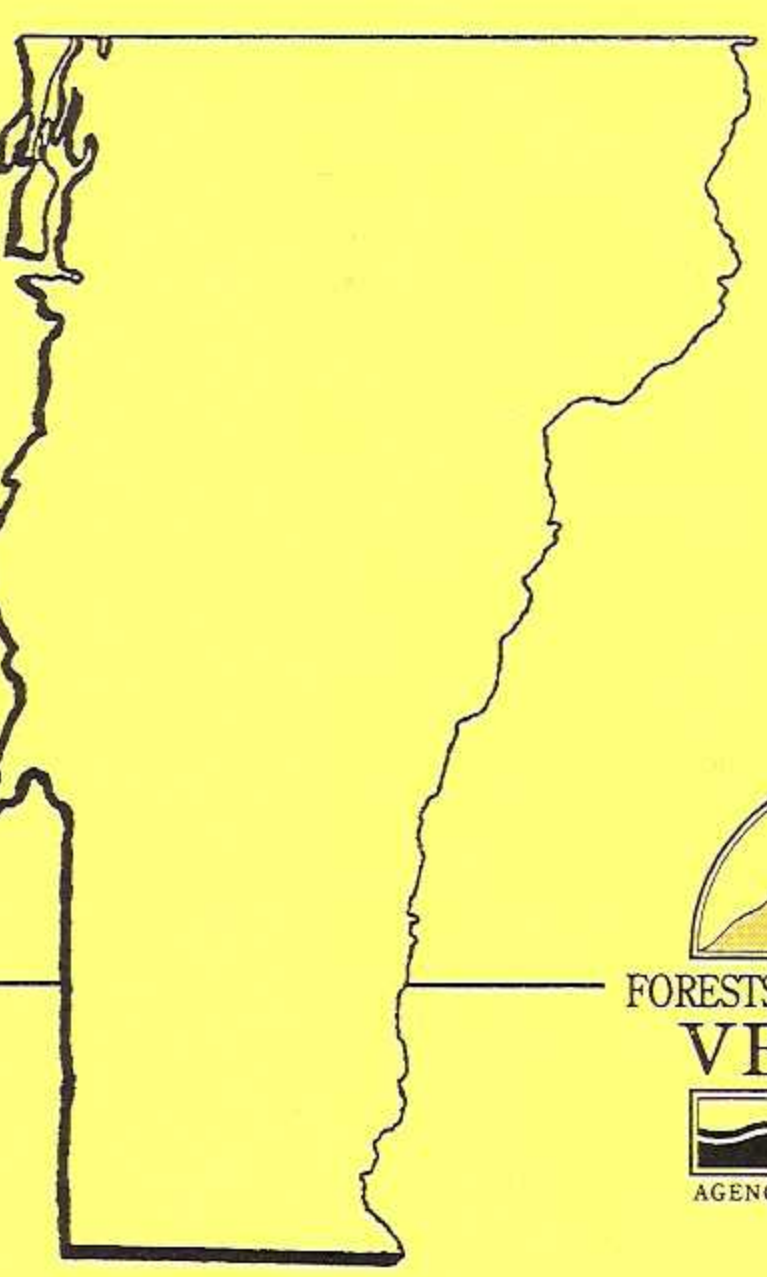
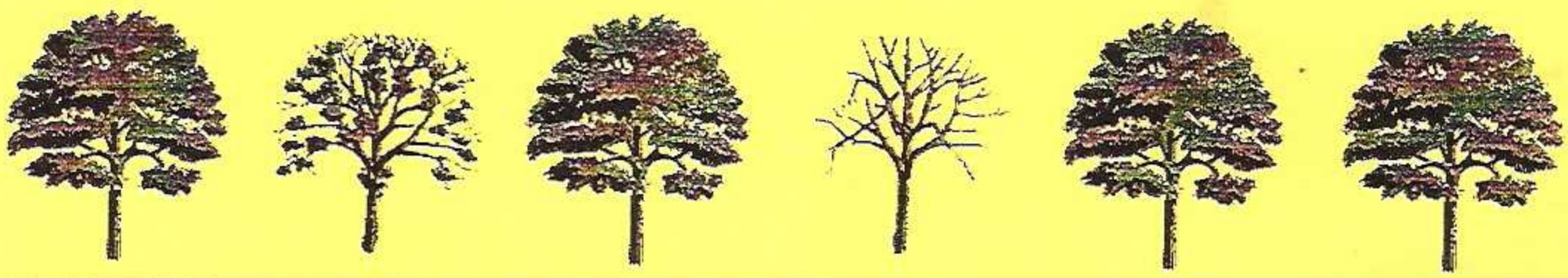
FOREST INSECT AND DISEASE CONDITIONS IN VERMONT 1998



VERMONT
FOREST RESOURCE PROTECTION
WI FIRE DISEASE INSECTS

FORESTS, PARKS & RECREATION
VERMONT
AGENCY OF NATURAL RESOURCES

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



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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.

FOREST INSECT AND DISEASE CONDITIONS IN VERMONT

CALENDAR YEAR 1998

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AGENCY OF NATURAL RESOURCES

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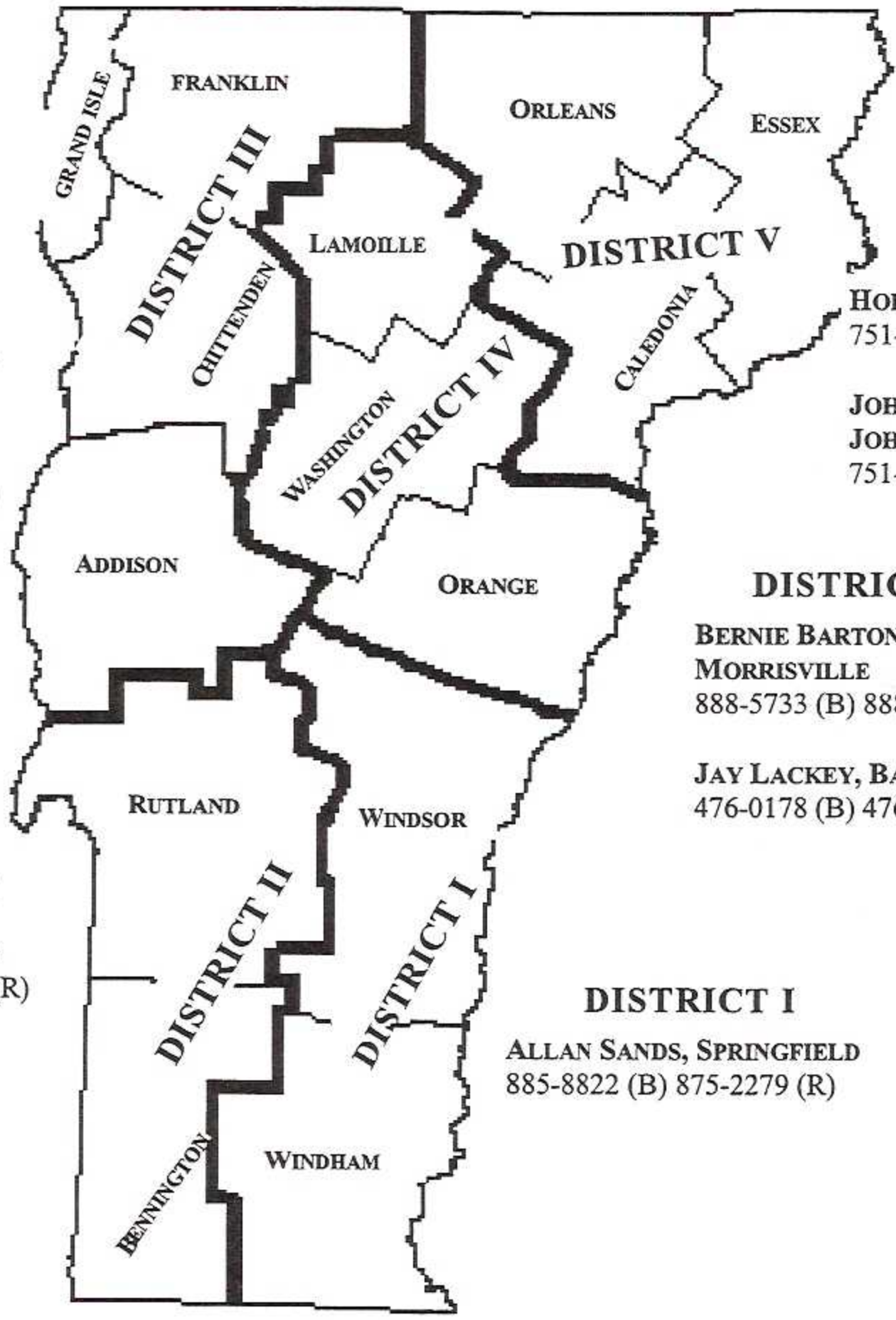

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1998 Vermont Forest Insect and Disease Highlights

Anthracnose and other hardwood foliage diseases were widespread, with damage heaviest on sugar maple, paper birch, and yellow birch. Statewide, 243,730 acres of damage were mapped. Although it is not possible to predict anthracnose for 1999, there is a high load of inoculum should suitable weather occur.

Asian Longhorned Beetle has not been found in Vermont, but concern remains high. Lindgren funnel traps at six sites were negative for long-horned beetles or other wood borers.

Balsam Gall Midge populations were high, with damage observed statewide. Galls were found throughout the northern Vermont Christmas tree survey. Damage is at peak levels, indicating it should decrease in 1999.

Balsam Shootboring Sawfly populations increased to the highest levels ever seen. Bud kill averaged 30% on Fraser fir and 22% on balsam. Control was difficult to obtain due to the abundance of adults over a long period of time. Lighter damage is expected in 1999.

Balsam Twig Aphid damage decreased. Populations have been declining since 1996.

Beech Bark Disease symptoms were mapped on only 752 acres during aerial surveys. Symptoms were not as visible in 1998 as other years because ample moisture was available.

Birch Defoliation, caused by **Birch Leaf Miners** and **Birch Anthracnose**, was mapped on 21,283 acres, compared to 3,842 acres in 1997. The increase from 1997 was due to a heavy seed crop and wet weather.

Delphinella Tip Blight of Fir continued to cause some needle loss and shoot mortality in northern Vermont balsam fir plantations, but damage was generally less than in 1997.

Diplodia (Sphaeropsis) Tip Blight caused widespread scattered shoot mortality of pine and fir throughout the Christmas tree survey area again this year.

Fall Webworm was common statewide, with the heaviest damage in the Connecticut River Valley.

Forest Tent Caterpillar populations continued to be very low. Few caterpillars were seen, no forest defoliation was observed, and no moths were caught in pheromone traps.

Gypsy Moth larvae and light feeding were observed in scattered locations, but populations remained very low. Male moths were numerous, but egg masses remained sparse. No defoliation is expected in 1999.

Hardwood Decline and Mortality was less widespread in 1998, with the mapped area 5,675 acres, compared to 26,256 acres in 1997. Historically, mapped acreage decreases in wet years.

Hemlock Woolly Adelgid was not observed.

Ice Damage was widespread following a severe ice storm the second week of January. Damage was mapped on 951,585 acres, or 1/5th of the forest land in the state. Based on a questionnaire survey, an estimated 75,000 taps were lost in sugarbushes. By the end of the summer, many broken trees had produced epicormic sprouts, but food reserves in recovering trees are now low. Requests for information, recommendations, and assistance inspired a large ice storm recovery program.

Locust Leaf Miner, caused the heaviest damage observed in at least 20 years in southeastern Vermont locations. In Chittenden County, damage was down from 1997 levels.

Maple Leaf Cutter was widespread. However, heavy damage was only observed in northern Vermont and Bennington County.

Maple Trumpet Skeletonizer built up to the highest levels "old-timers" can recall. Combined with anthracnose, some affected stands were completely brown by the end of the season.

Oak Skeletonizer populations built up, and damage was visible from the ground in oak stands throughout southern Vermont by the end of the summer.

Oystershell Scale on beech remained low. No dieback was detected by aerial survey.

Pear Thrips numbers were down from 1997 in developing buds. However, wet weather at budbreak allowed thrips damage and anthracnose infection to occur in southern Vermont. Damage was mapped in early July on 36,081 acres. Because of anthracnose, some maples had little foliage all summer. Overwintering soil counts indicate that populations had increased slightly by fall 1998.

Poplar Leaf Blight was widespread due to wet conditions. Many quaking aspens and balsam poplars were completely defoliated by late August.

Rhizosphaera Needle Blight of Fir remained common. Spore trapping and spray trials were conducted in a heavily infected plantation.

Saddled Prominent populations remained low, but light defoliation occurred in scattered locations. Pheromone traps with experimental lure were deployed.

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

Spring Hemlock Looper was not observed. Recovery continues in monitoring plots that were heavily defoliated in 1991.

Spruce Budworm continued at low levels, with no visible defoliation detected. Pheromone trap counts this year were higher than in 1997, but similar to 1996 levels.

Spruce Mortality and Dieback was mapped on only 784 acres, mostly at high elevations.

Unthrifty Crowns Associated with Logging were observed in scattered locations.

Wet Site conditions caused tree decline and mortality throughout the state. Mapped area increased from 10,297 acres in 1997 to 80,127 acres in 1998 due to 1998's rainfall.

White Pine Decline occurred in scattered locations, especially in northwestern Windham County. No single problem was identified.

Willow Leaf Blight was severe in some riparian areas. Damage was mapped on 1,967 acres.

Vermont 1998 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.

General - Ice damage affected one-fifth of the forestland in the state. Therefore, management of ice-damaged areas is of concern to many. Although management guidelines were produced for foresters, landowners, and sugarmakers shortly after the storm, the following should be kept in mind.

- Decline or recovery take time. Trees going into the 1999 season, and beyond, have low root reserves, since they were functioning with deficient crowns in 1998. (Research in Ontario on sugar maple has shown lower overwintering starch reserves in damaged sugar maples.) This is unlike the carbohydrate status of damaged trees going into the 1998 season. Some trees which seemed to be recovering in 1998 may look worse in the following growing seasons. Following other stress events, we consider that 3-5 years are required before the "survivors" and "losers" are sorted out.

- Decay takes time. Even large wounds created by the storm will not produce much decay within a few years. The amount of decay that occurs will depend on wound size, species, amount of prior defect, and genetics. Anticipate more decay from wounds comprising 40% or more of the circumference, and less from wounds comprising 20% or less. Anticipate more decay from wounds to birch, and a lot less from wounds to sugar maple. (Work at the US Forest Service Northeastern Forest Experiment Station is demonstrating that some sugar maples which sustained storm damage a decade ago have very little decay beyond the location of the wound itself.) Anticipate more decay if previous storm damage or careless harvesting has left a lot of wounds in the stand already. And anticipate more decay if trees are poor branch healers.

- Information takes time. A lot of research is being done on trees with ice storm damage. Keep listening. Every year, the amount of available information based on good data will increase.

Outside of ice damage areas, trees are generally healthy going into 1999 where foliage problems were not severe. All things being equal, rainfall drives the health of trees from year to year, and several growing seasons in succession have been moist. Some crowns will be thin because heavy seed crops have occurred on many species.

Hardwoods - Browning of foliage was very noticeable in 1998 because of widespread anthracnose and late-season defoliators. In most of the state this will not cause a problem because food reserves had a chance to build up earlier in the season. However, anthracnose fungi have built up and could be a problem in 1999 if wet conditions occur again.

Maple - There is cause for concern in southeastern Vermont, where the combination of thrips and anthracnose resulted in poor foliage on some sugar maple maples for the entire growing season. Any effort to reduce additional stress (avoid harvesting, road construction, tapping) will increase the opportunity for stand recovery. In the Taconics, pay special attention to the condition of red maple, which was thin for much of the summer. Above all, encourage friends and relatives to leave their firewood at home if traveling to Vermont from out of state. It will take only one small pile of firewood at a campsite or condominium to spread the Asian longhorned beetle from any of the sites where it is now known to occur.

Poplar - Monitor the health of poplar, particularly in low-lying areas, where there have been several consecutive years of fungus defoliation. In addition, satin moth and large aspen tortrix populations have been building in northern New England. We do not know of any areas where poplar mortality is occurring because of this defoliation, but timely salvage is more important for poplar than other species because it degrades quickly.

Oak - Growing conditions for oak continue to be good. Gypsy moth populations remain low, but neighboring states have experienced some gypsy moth defoliation. Oak skeletonizer could build up quickly, as it produces two generations in a year. In the mid-Atlantic states, aphids, oak leaftier, and oak slug sawfly are at high populations on oak. Although no management adjustments are currently necessary, keep informed on the status of oak defoliators.

Spruce-Fir - Spruce and fir received little damage from the ice storm, and there was little winter injury. Spruce and fir defoliators are at low levels. Outside of Christmas tree plantations, the greatest health problem to spruce or fir was in fir regeneration. Fungal diseases and balsam gall midge, which are normally innocuous, had a significant impact in some stands. Most affected trees should recover as gall midge populations drop, and if drier growing seasons slow down the spread of fungal pathogens. If spruce-fir stands are to be regenerated, inspect the condition of existing regeneration before making the decision to cut.

White Pine - In south-central Vermont, there are areas with unthrifty white pine crowns. The cause is unknown. We will continue to follow the condition of trees in this region to determine if the condition changes, and to try to pinpoint a cause. Inspect crown condition carefully in selecting crop trees in white pine; some trees with clear, straight stems may have crowns which will produce little growth in the years to come.

There is a renewed interest in growing currants by small fruit growers throughout the region. Although white pine blister rust remains a concern, resistant varieties of currants are available. Many of our white pine stands are now above the age where heavy infection occurs. However, continue to monitor regeneration and young pole-sized trees to assess the importance of blister rust in these areas.

Management Recommendations prepared by Barbara S. Burns

INTRODUCTION

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

Three major aerial surveys were flown this year. The entire state was flown for ice damage. This survey was flown while ice was still on the trees in most of the state; in the Northeast Kingdom, it was flown later. A survey was flown in early July in southern Vermont for pear thrips. A statewide survey was flown in August to target defoliation by anthracnose, leaf miners, and declines. In addition to Forests, Parks and Recreation flights, surveys were also flown by the US Forest Service over the Green Mountain National Forest.

A survey of Christmas tree plantations is conducted annually in North-Central Vermont as part of the Scleroderris quarantine. This year, 261 acres were surveyed. Observations are made on all pests during this survey. Acreages reported for Christmas tree problems refer to changes in these surveyed plantations and are not statewide totals.

ACKNOWLEDGMENTS

Thanks to the many individuals who contributed to this report, including Kathy Decker, Sandy Wilmot, Jay Lackey, Tom Simmons, Hollis Prior, Pete Reed, Bernie Barton, John St. Arnauld, Allan Sands, Lars Lund, Tess Greaves, and John Barrows from our Forest Resource Protection staff. Assistance in conducting aerial detection surveys and ground checks was provided by members of our Forest Management staff including Ron Wells, Brad Greenough, Mike Johnson, Lisa Thornton, Jon Bouton, Dave Willard, Gary Sawyer, Jeff Briggs, Jay Maciejowski, Dave Wilcox, and Dick Greenwood. Matt Mancini assisted in surveys of Christmas tree plantations. Information on the Green Mountain National Forest was provided by Bob Burt and George Saufly. Diagnostic assistance and other data was provided by Dale Bergdahl, Shari Halik, Margaret Skinner, Mike Brownbridge, and Gordon Nielson (emeritus) from the University of Vermont; Jon Turmel and Scott Pfister from the Vermont Department of Agriculture; Bill Merrill and Nancy Wenner from Pennsylvania State University, Doug Allen and Jenna Spear from SUNY-College of Environmental Science and Forestry; Charlie Burnham and Ken Gooch from Massachusetts Dept. of Environmental Management, and Dick Dearborn and Clark Granger from the Maine Forest Service. Assistance in preparing maps and survey acreages was provided by Tom Luther and Bob Cooke from the US Forest Service, Forest Health Protection and Tom Merrifield and Laura Cadmus from the Vermont Agency of Natural Resources. Title page photo is from W.A. Cole and D.C. Allen 1973.

A special thanks to Melissa Currier for preparing the manuscript. 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.

Vermont Forest Health, Insect, and Disease Publications: 1998

Bergdahl, D.R. and D.W. French. 1998. Colonization of the primary tissues of *Pinus banksiana* by *Cronartium comandrae*. IUFRO Rusts of forest trees. Lapland, Finland. Proceedings, Meeting, August 1998.

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Vermont Agency of Natural Resources. 1999. Environment 1999: An assessment of the quality of Vermont's environment. Waterbury, VT. 19 pp.

WEATHER AND PHENOLOGY

The winter of 1997-98 was above normal for precipitation and was the fifth warmest winter on record for Vermont[1]. No extreme temperatures occurred.

Snow cover was adequate to prevent root injury throughout the winter. The first snow arrived in mid-November, and stayed through most of December, followed by a heavy snowstorm on December 30. There was little snow in midwinter. Significant snowfall occurred again in March, with a heavy accumulation on March 21.

1998 started off with a bang (or, more correctly, a multitude of snaps) with the year's defining forest health event. A melt down occurred when rain arrived on January 5. This turned to freezing rain between January 7-11, causing the most severe ice storm in the experience of many Vermonters. Trees and utility poles broke off, and there were extensive power outages. The storm extended from southern Ontario and Quebec to New York, Vermont, New Hampshire, and Maine, affecting about 25 million acres of forestland. This is the largest acreage of forestland damaged by an ice storm in this century.

Maple sugaring season was early and short. There were good runs in late February and early March, but sapflow was interrupted by cold weather until late March. Some sugarmakers who were not already finished had a good run in early April, but then sugaring shut down because of warm weather. Although production was down, much of the syrup produced was fancy.

The hot, dry spell in late March included temperatures in the 70s and low 80s. This created a short early fire season, and an early spring. A wet period of 7-10 days followed soon after, and some trees were stalled at budbreak for about 10 days. Heavy rains and rapid snowmelt caused Lake Champlain to exceed the 100' high water mark for the third time in the past five years. Bud development was generally three weeks early, and phenology stayed about three weeks ahead of schedule even into August. Although water availability varied from very low to very high, spring was just above normal for precipitation.

1998 was the second wettest summer on record for the state[1]. May and June were very wet, but rainfall averages showing above average precipitation tell only part of the story. Weather vacillated between very wet, with some torrential rains, and then long dry spells. Flooding was common, especially in central and northern Vermont, following the rains in mid and late June. Tornadoes and lightening in late May caused some damage to trees in Bennington County.

Variable rainfall continued throughout the summer, with some severe localized storms in July and August. During June, July, and August, the Fairbanks Museum weather station in St. Johnsbury recorded 18.5" of rain, and the Department of Forests, Parks and Recreation weather station in Elmore recorded 21.4". This weather resulted in abundant foliar diseases on nearly every species of tree and shrub. There were very few extremely hot days. A severe storm on August 24 caused some tree blowdown in Bethel.

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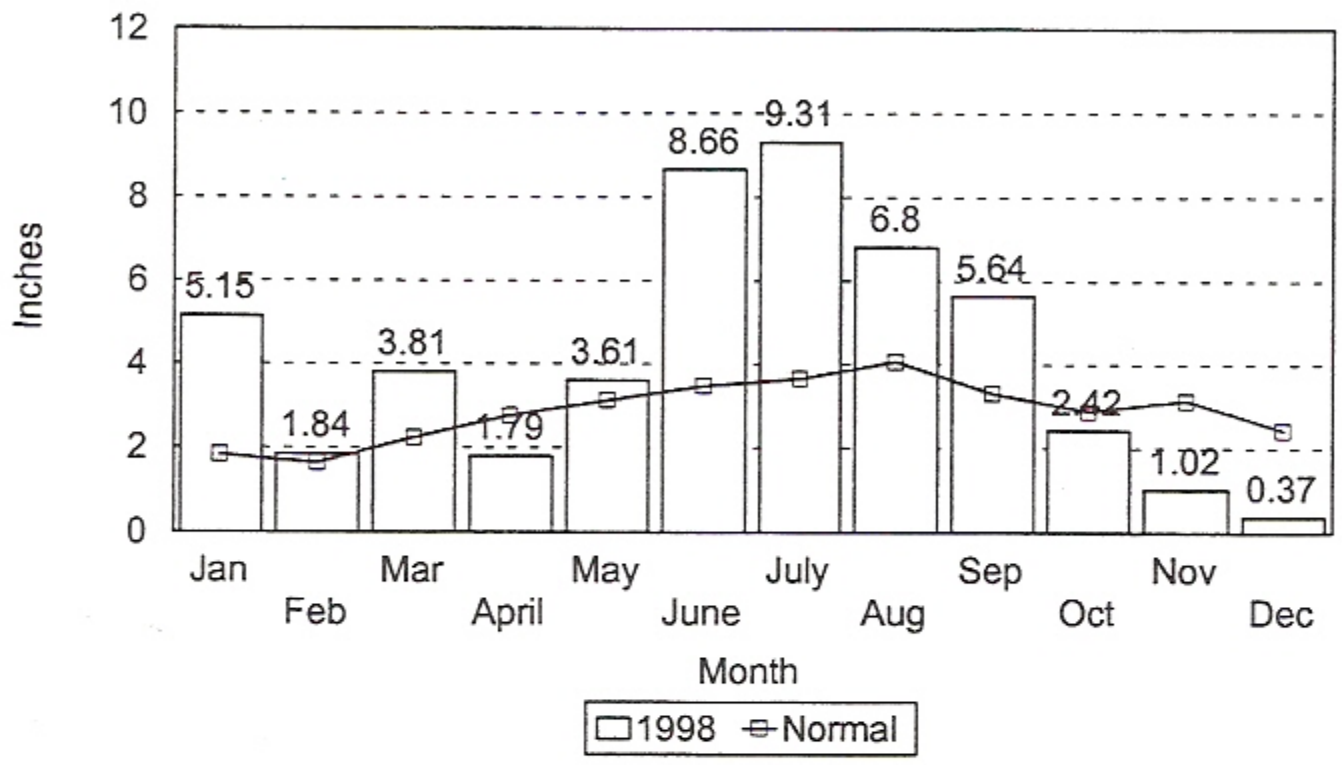
[1] Data from the Northeast Regional Climate Center.

Autumn averaged one degree above normal for temperature, and dropped a bit below normal for precipitation. Although the sumac was outstanding, it was difficult for pessimistic foliage viewers to find positive adjectives to describe the foliage in 1998. With heavy rains, widespread foliage diseases, and maple insects, there were thin crowns, a lot of brown, and less red than usual. The ice storm also produced a different foliage texture. The peak of sugar maple color occurred around October 6-10 in southern Vermont, being slightly earlier in northern regions.

There was a heavy seed crop on most species. Sugar maple pollen was unusually heavy. Although apples blossomed heavily, rainfall during bloom interfered with apple production in some areas. Other species with heavy seed were spruce, fir, pine, red maple, paper and yellow birch, oak, and beech. There was some early beechnut drop.

Statewide weather conditions are summarized in Figure 1. Phenology is summarized in Table 1 and Figures 2-3.



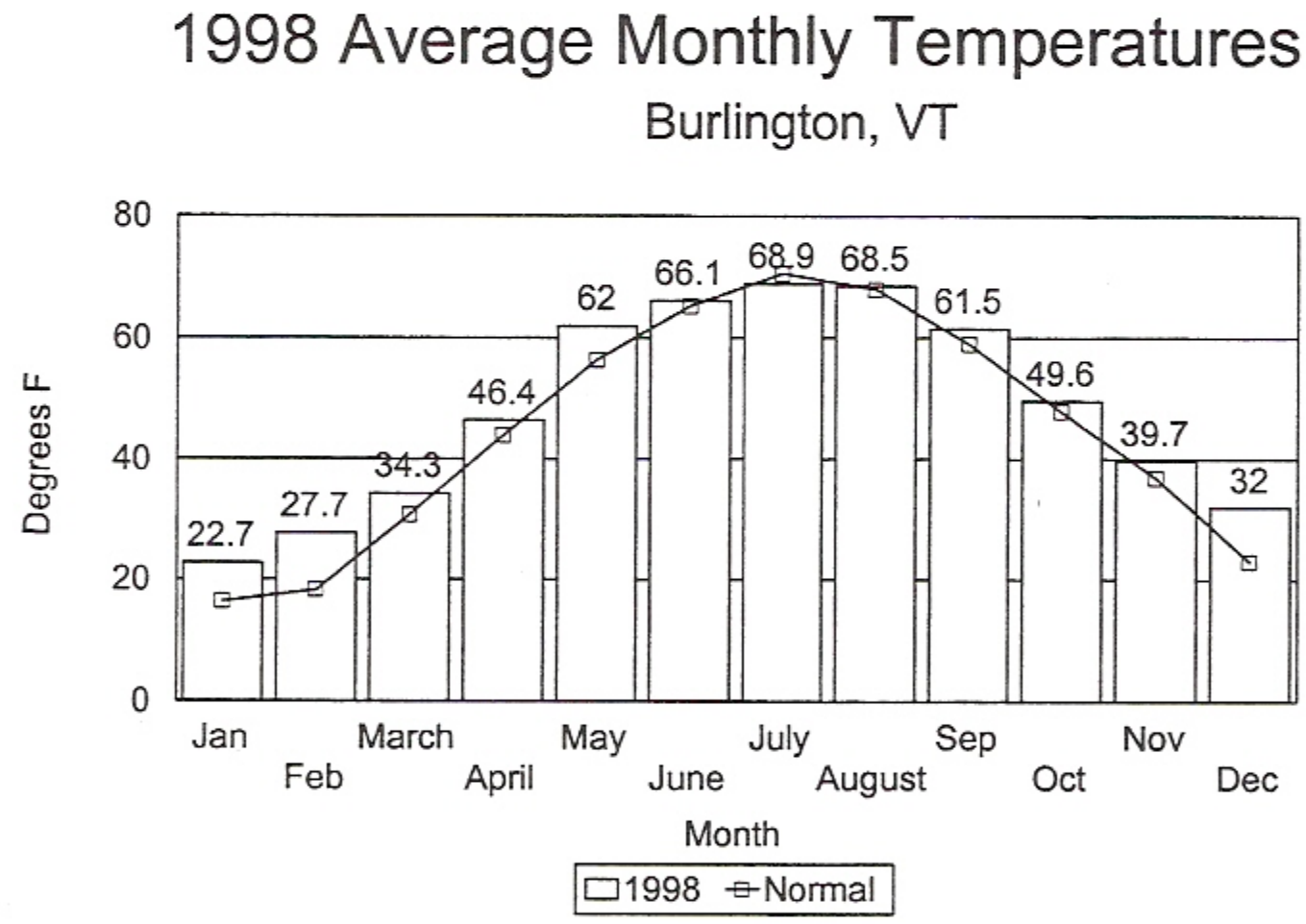
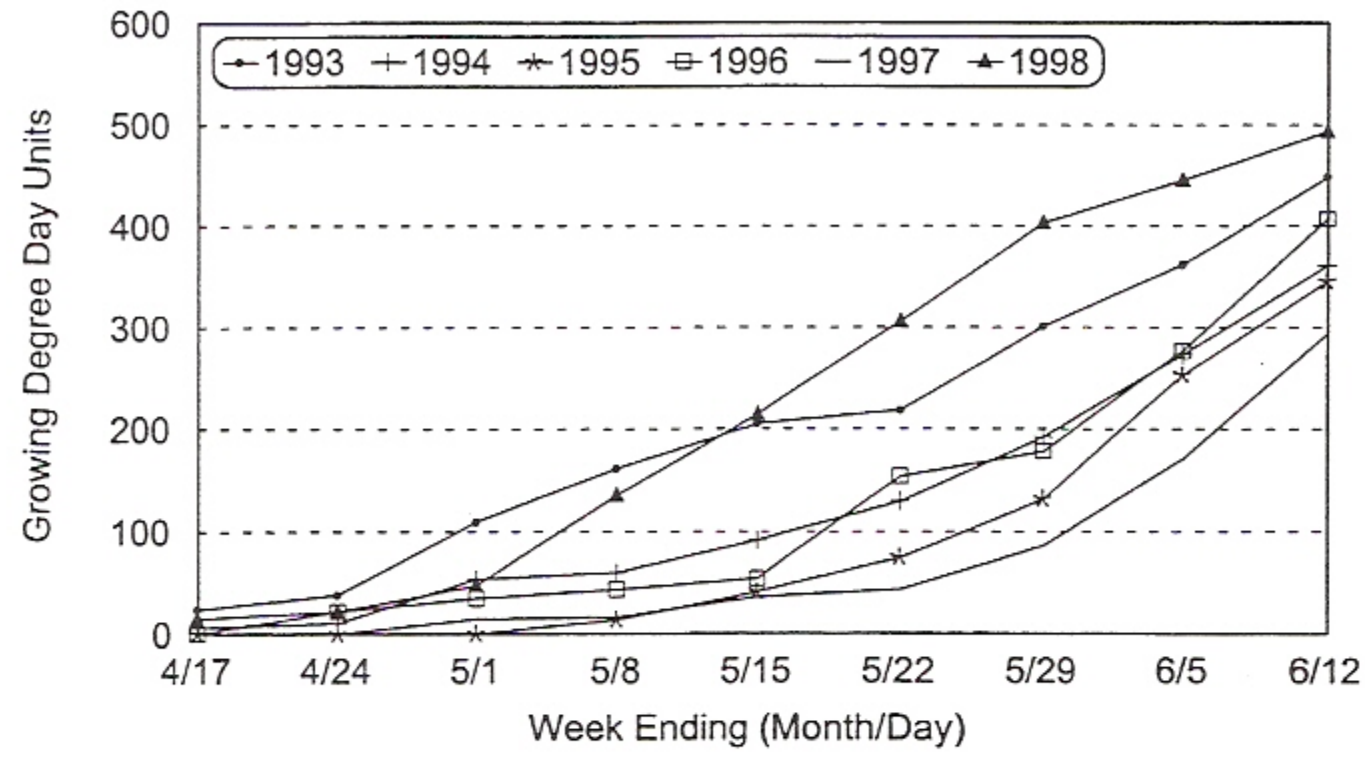
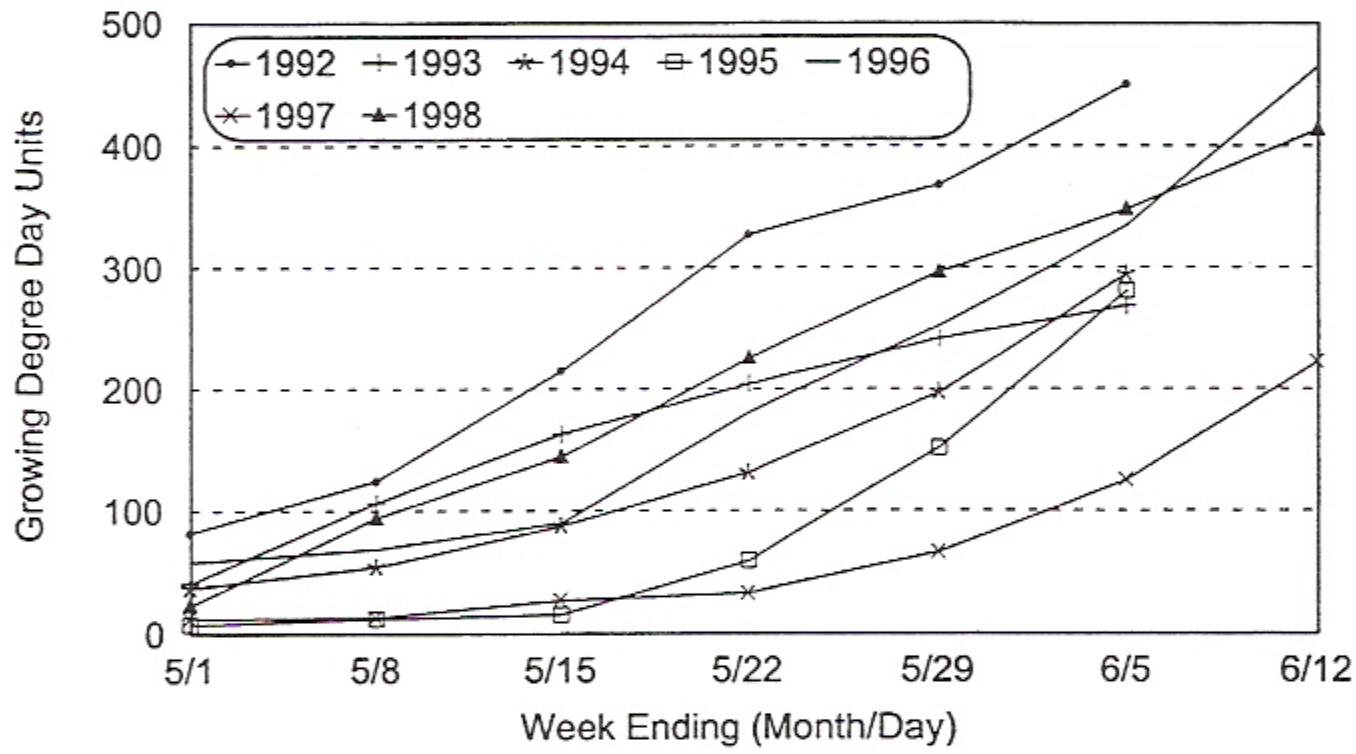


Figure 1. Average monthly precipitation and temperature for 1998 and departure from normal data from the National Weather Service, Burlington. Numbers above the bars indicate total monthly precipitation and average monthly temperature in 1998.

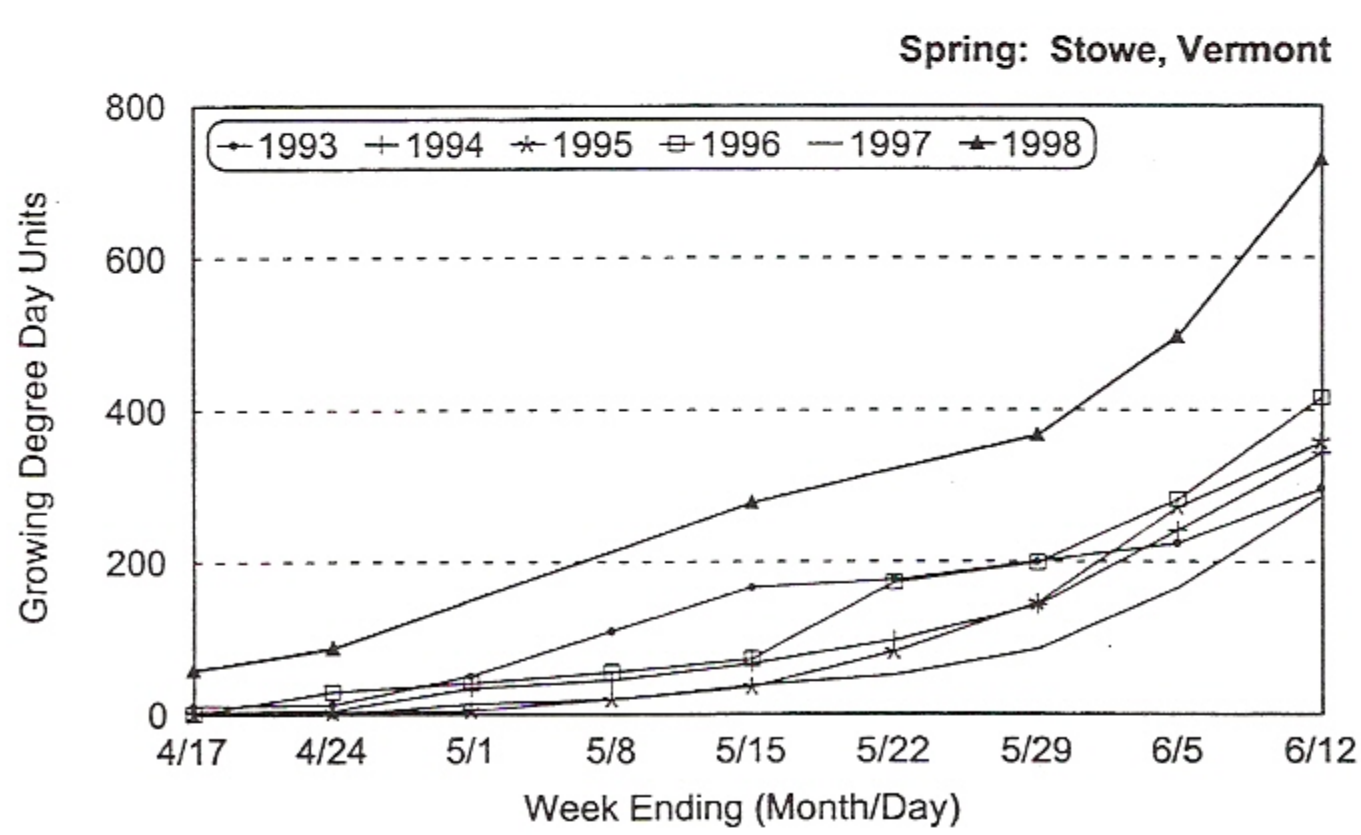
Spring: Barre, Vermont

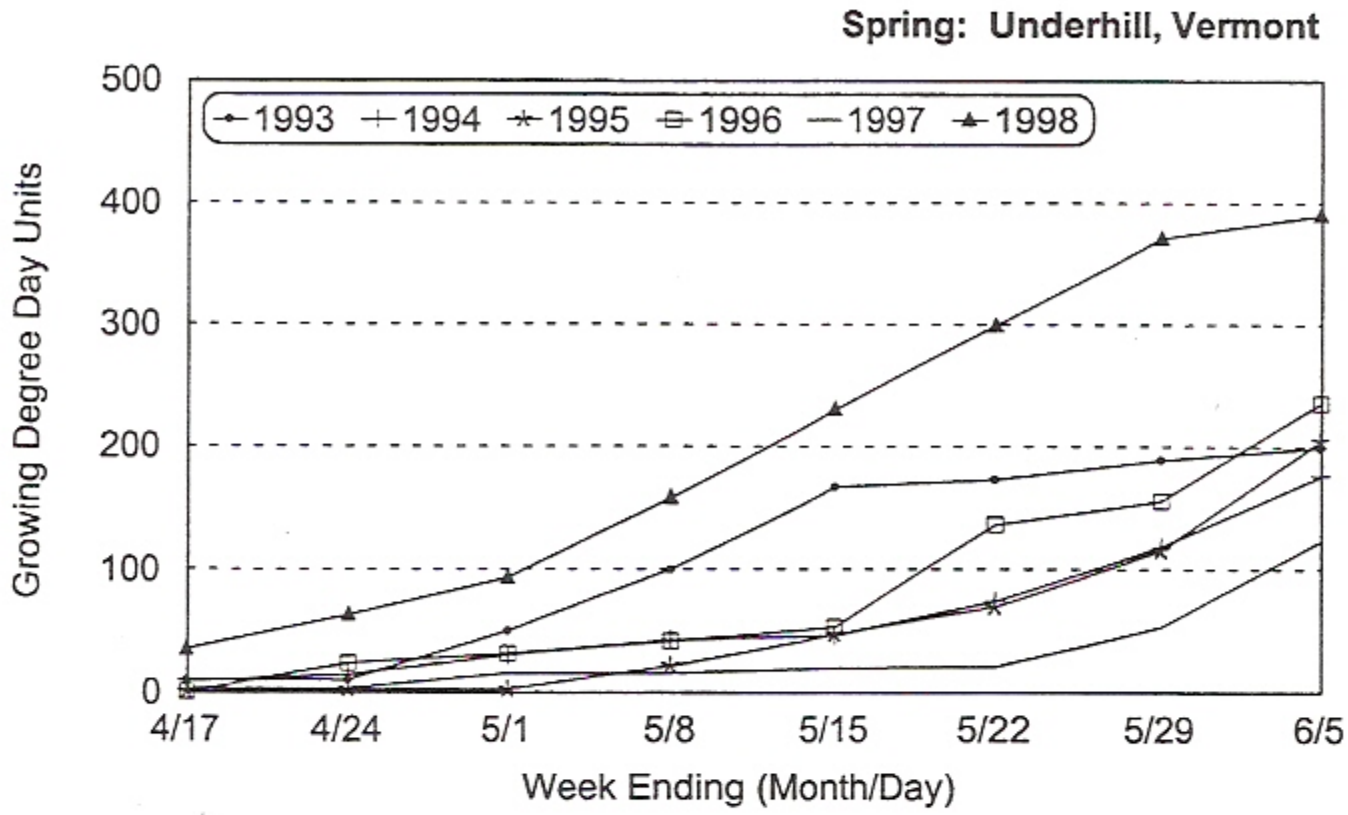


Spring: Springfield, Vermont



Spring: Stowe, Vermont





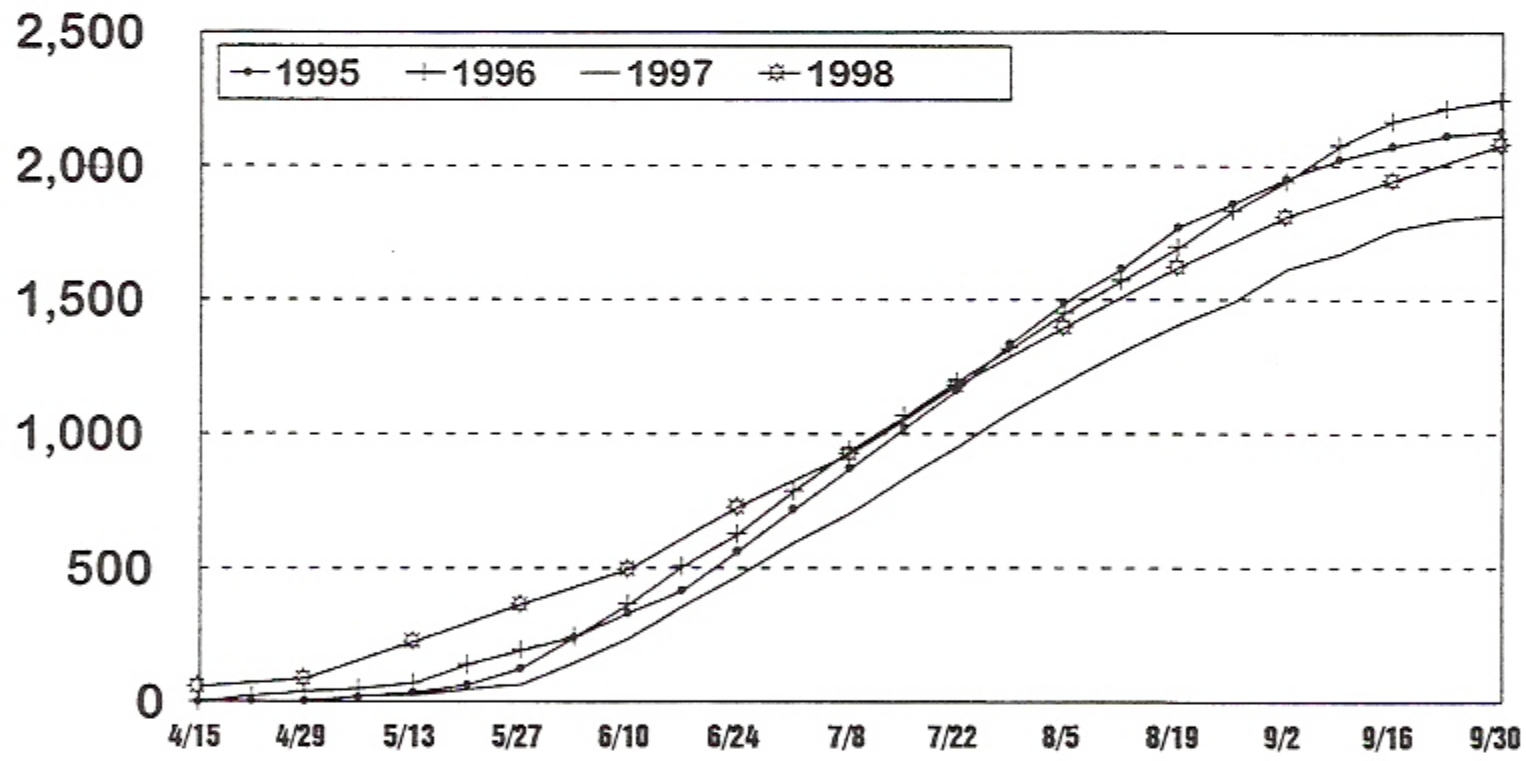
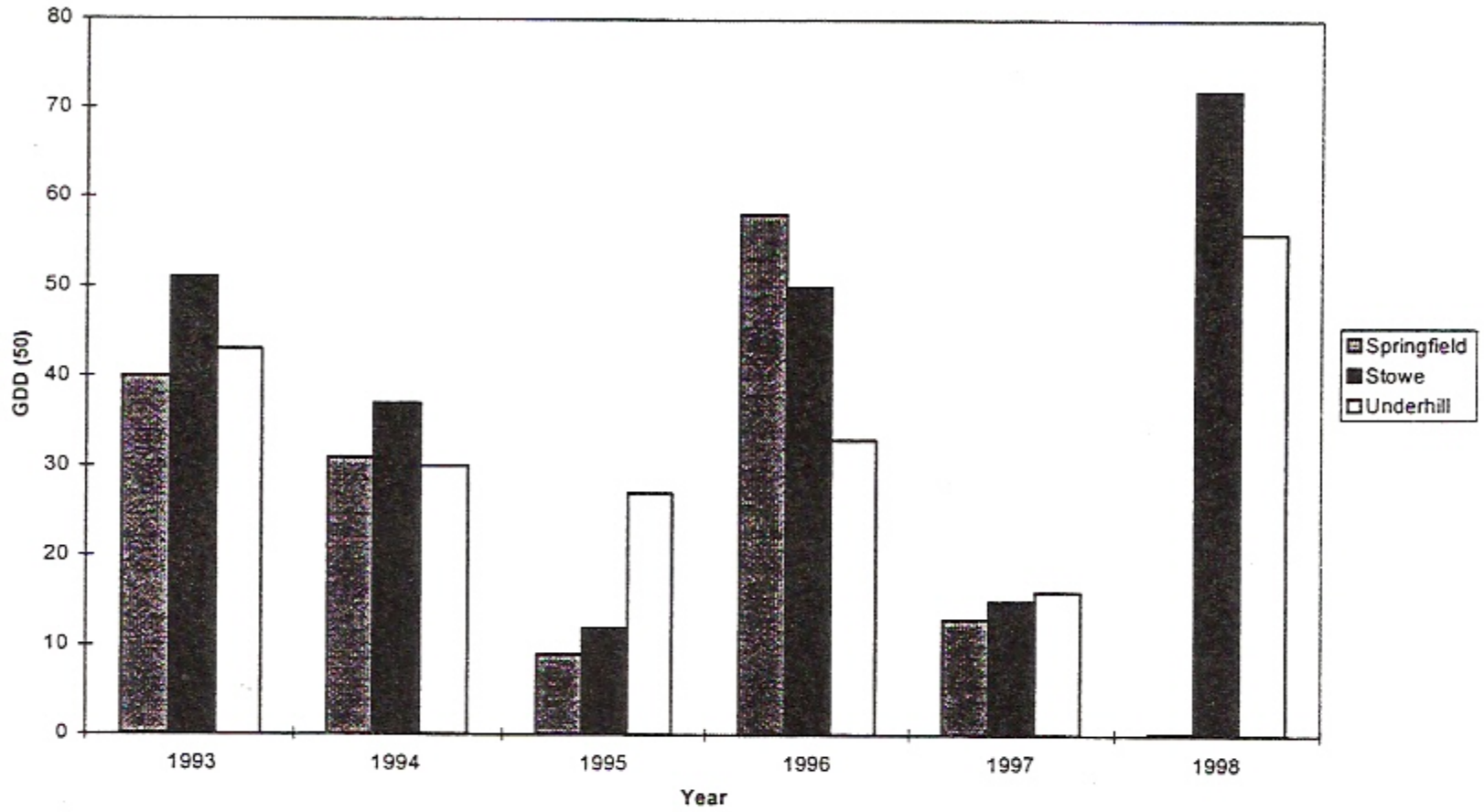
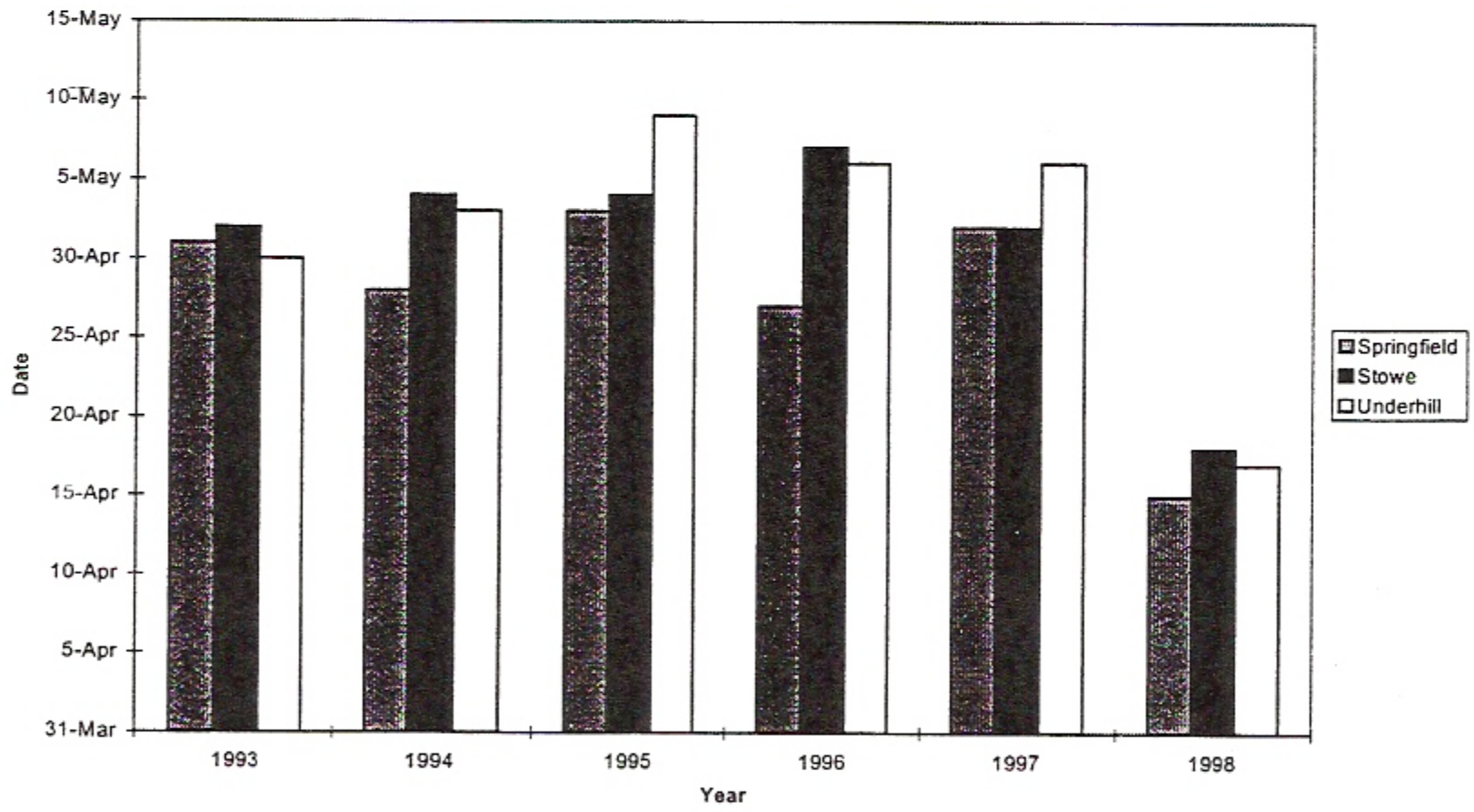


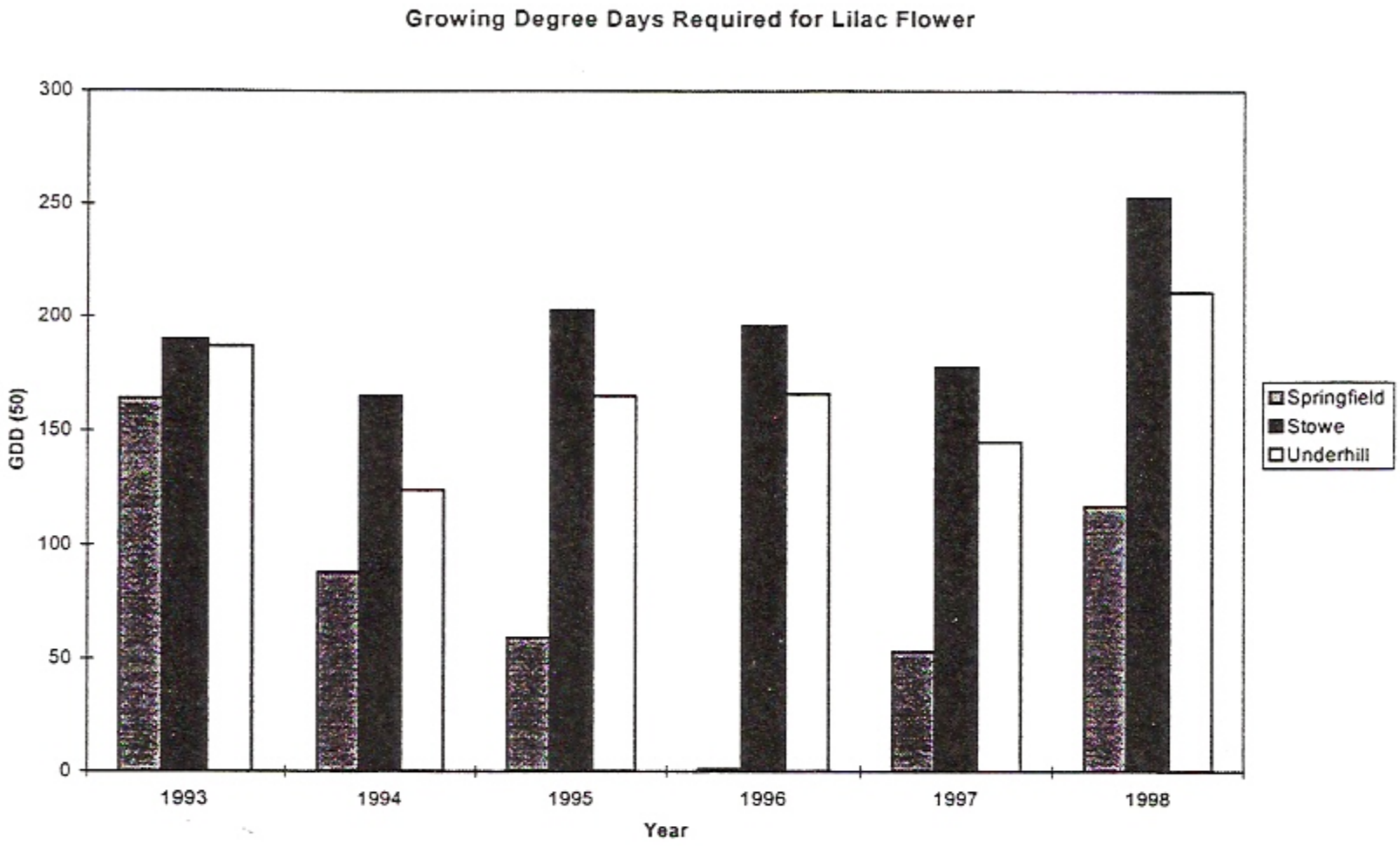
Figure 2. Weekly spring cumulative growing degree days at four locations, and cumulative growing season degree days for one location (Stowe), by year through 1998. 50°F used as the threshold of development.

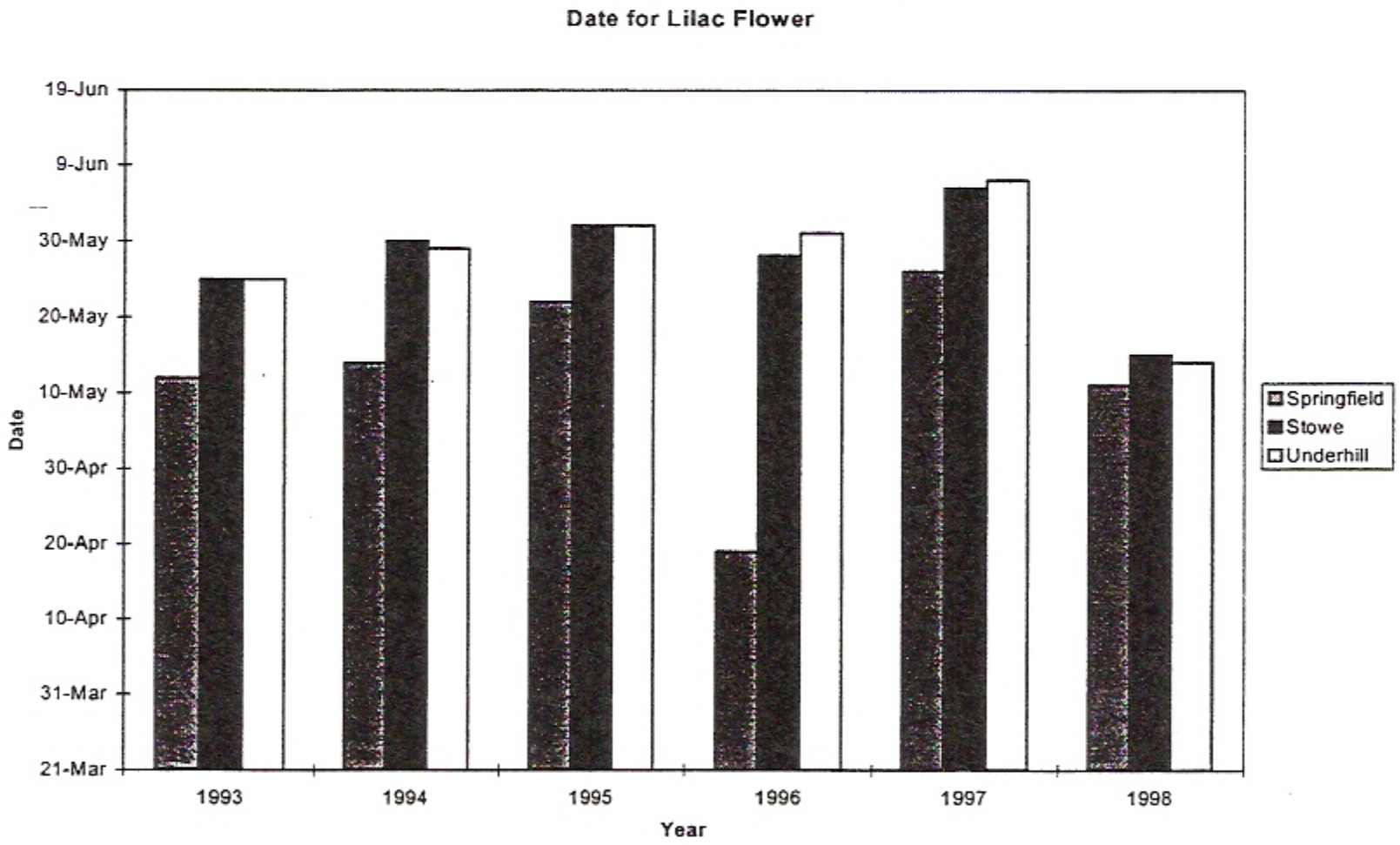
Growing Degree Days Required for Sugar Maple Budbreak



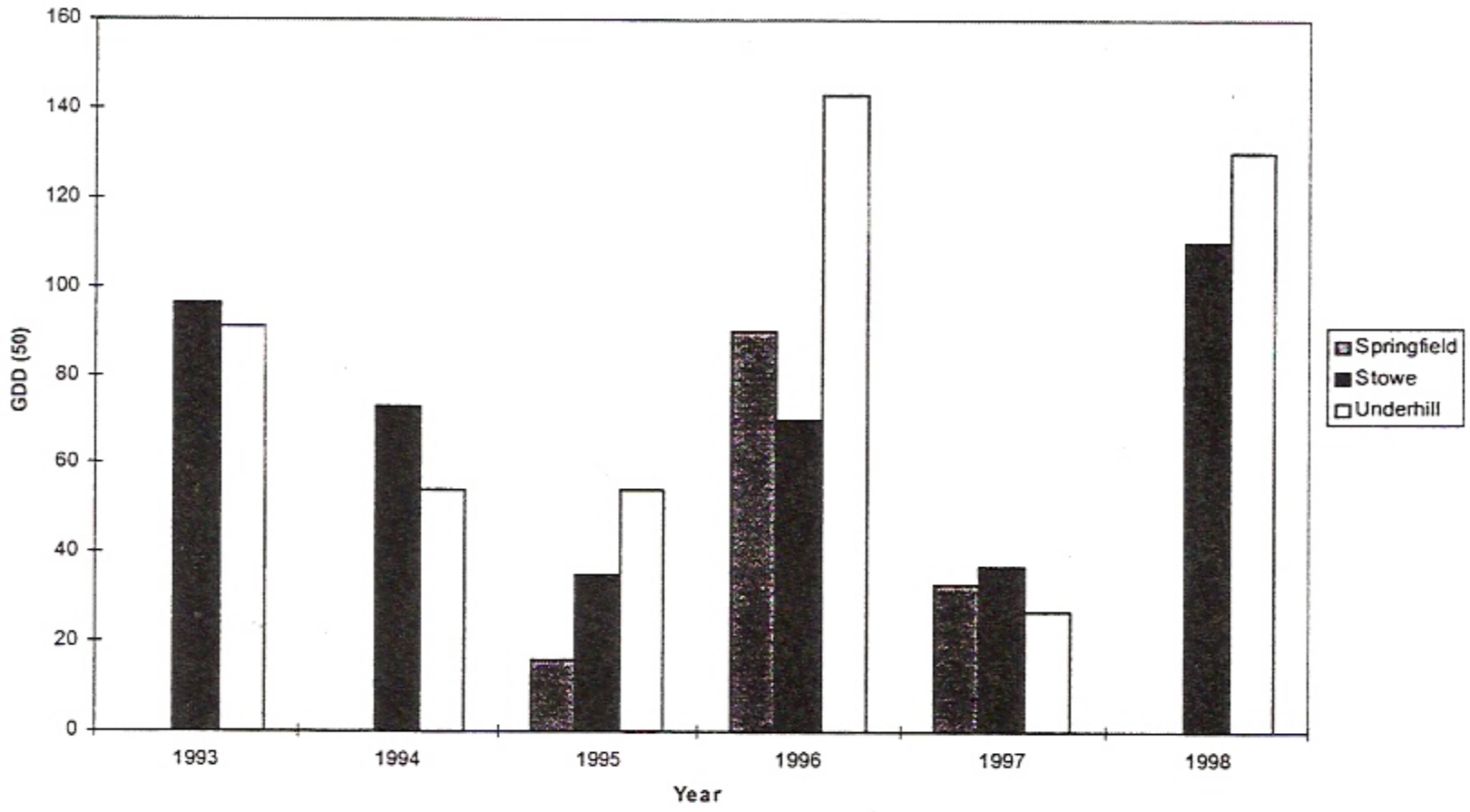
Date for Sugar Maple Budbreak



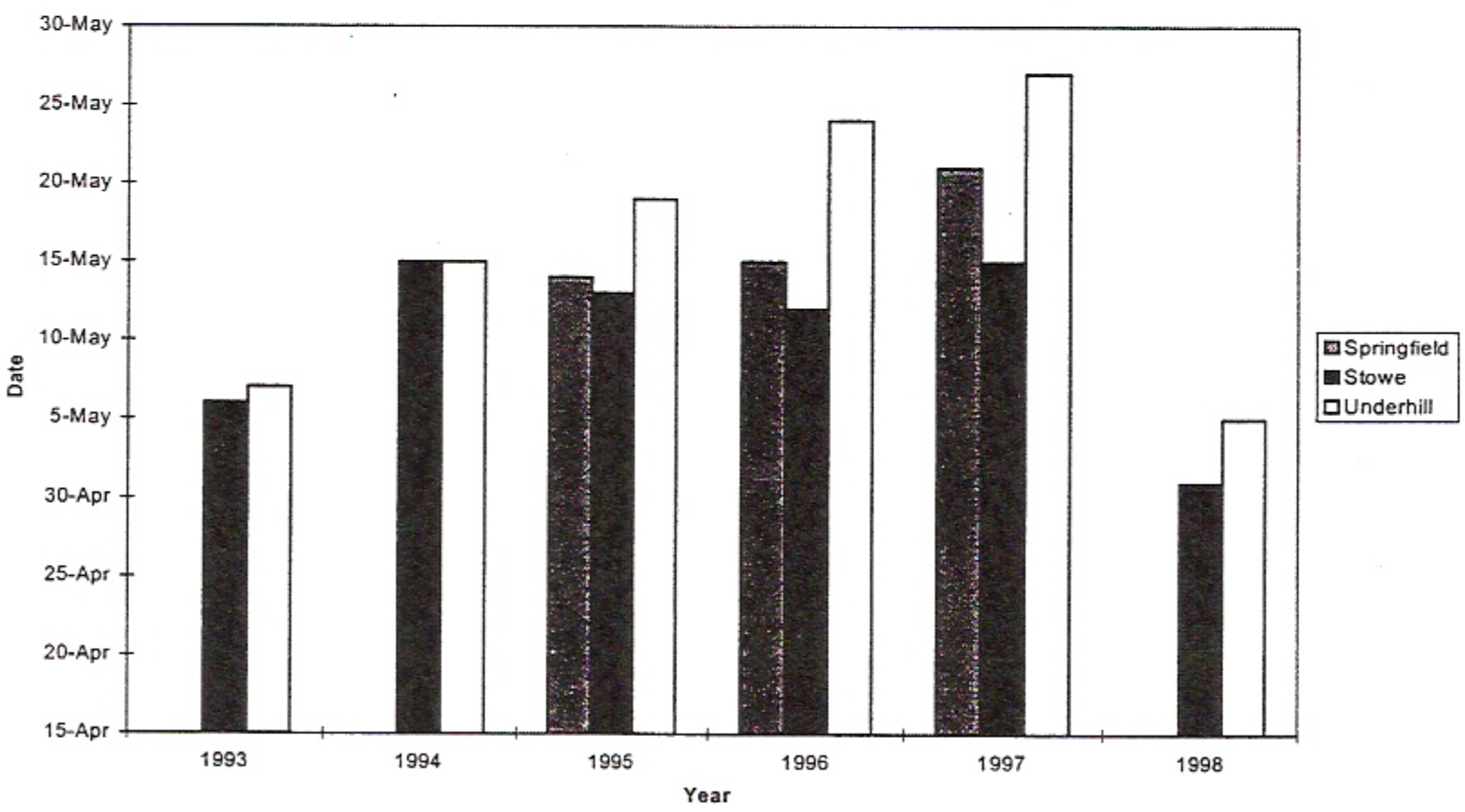

Growing Degree Days Required for Lilac Flower
GDD (50)
300
250
200
150
100
50
0
1993
1994
1995
1996
1997
1998
Year
Springfield
Stowe
Underhill

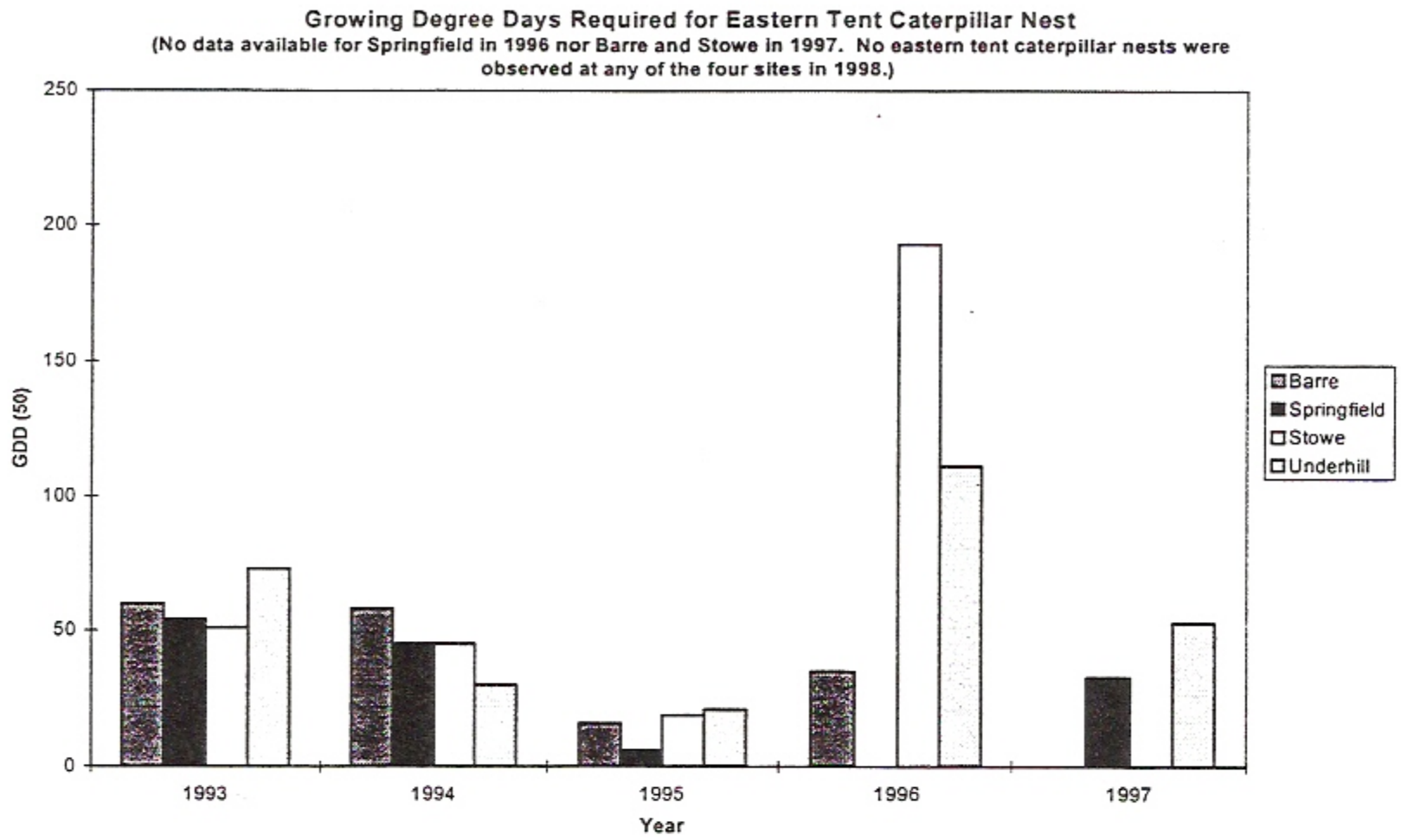

Date for Lilac Flower
Date
19-Jun
9-Jun
30-May
20-May
10-May
30-Apr
20-Apr
10-Apr
31-Mar
21-Mar
1993
1994
1995
1996
1997
1998
Year
Springfield
Stowe
Underhill

Growing Degree Days Required for Balsam Fir Budbreak
(No data available for Springfield in 1993, 1994 and 1998)



Date for Balsam Fir Budbreak
(No data available for Springfield in 1993, 1994 and 1998)





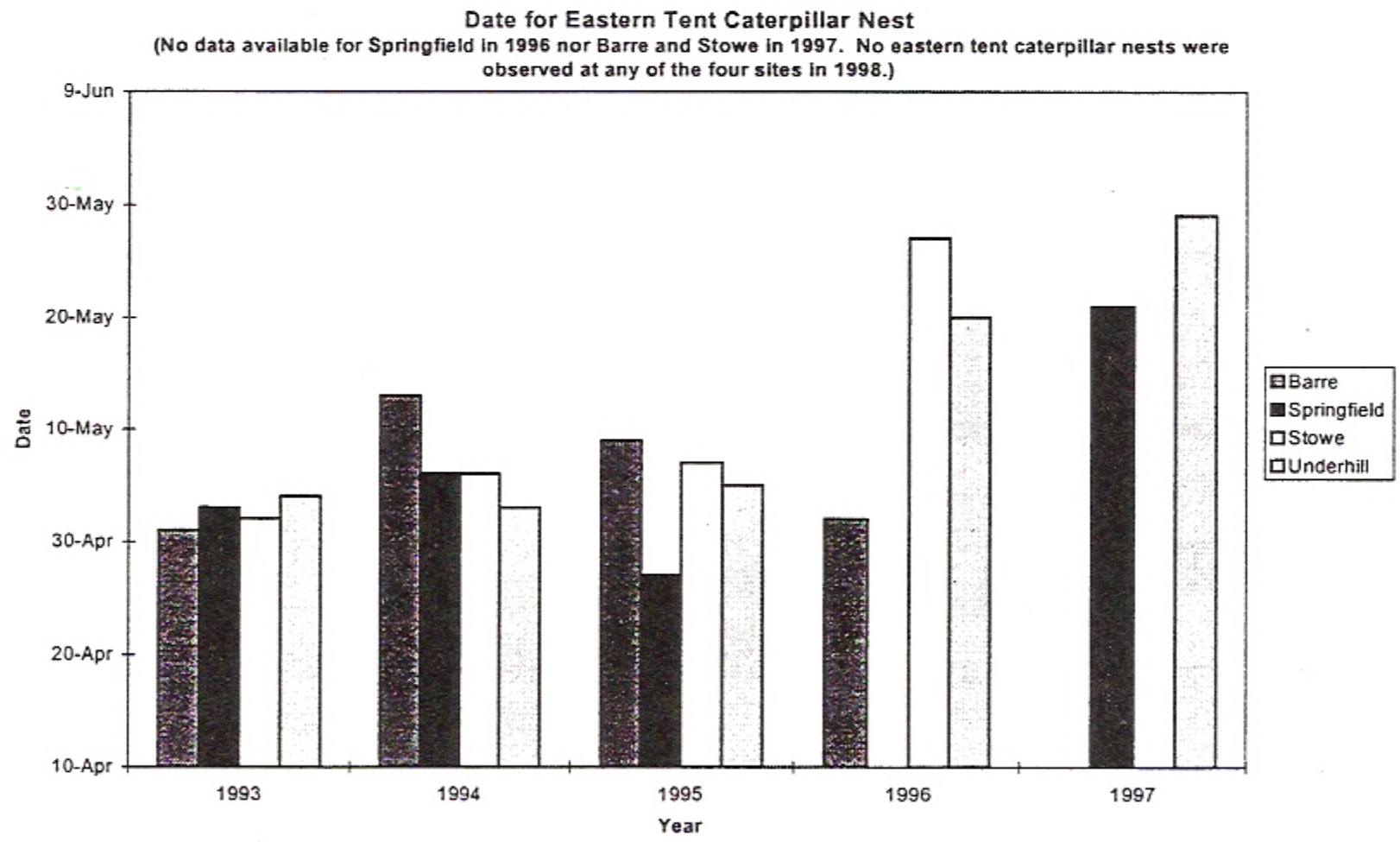


Figure 3. Growing degree days and date of occurrence for phenological events at three locations 1993-1998. 50°F used as the threshold of development.

Table 1. 1998 Growing degree day accumulations and first observation dates of phenological development in 4 sites in Vermont. 50°F used as the threshold of development.

Biological	Barre	Springfield	Stowe	Underhill
PLANT				
Showing Green				
Balsam Fir	47 (5/1)		78 (4/23)	93 (5/1)
Fraser Fir			227 (5/13)	
Budbreak				
Balsam Fir			110 (5/1)	130 (5/5)
Hemlock		94 (5/8)		158 (5/8)
Red Maple			53 (4/12)	
Red Oak		6 (4/24)		
Sugar Maple		0 (4/15)	72 (4/18)	56 (4/17)
Tartarian			53 (4/12)	
White Ash		23 (5/1)		79 (4/30)
Flower Budbreak				
Lilac			53 (4/1)	
Red Maple			53 (4/1)	
Flowers				
Dolgo Crab			174 (5/7)	
Lilac		117 (5/11)	253 (5/15)	211 (5/14)
Popple/Aspen		0 (3/29)	53 (4/1)	
Red Maple		0 (3/31)	53 (4/7)	35 (4/7)
Shadbush		6 (4/24)		79 (4/30)
Sugar Maple		0 (4/13)	72 (4/18)	56 (4/21)
Leaves				
Red Maple		5 (4/19)		
Full Green Up		186 (5/18)		
INSECT				
Balsam Gall Midge			139 (5/4)	
Balsam			72 (4/17)	
Balsam			253 (5/15)	
Balsam Twig			82 (4/24)	
European Snout			316 (5/19)	
Maple leafcutter			305 (5/18)	188 (5/12)
Pear thrips (larvae)				188 (5/12)
Pear thrips (adults)				35 (3/31)
OTHER				
Spring Peepers			53 (4/13)	

OZONE SUMMARY

The maximum ozone levels at both Vermont stations were lower this year than in 1997, and below the National Ambient Air Quality Standard of 0.124 ppm for 1 hour, a level set for the protection of human health (Table 2). The air quality standard is being changed to an index that uses daytime ozone levels over a series of days, and should better protect sensitive plant and animal species.

There are many ways to express ozone data so that they are more meaningful to plant health. Minimum ozone levels that adversely affect sensitive plant and tree species (i.e. black cherry and white ash) are from 0.060 to 0.080 ppm. The number of hours greater than 0.060 or 0.080 ppm, the SUM06, and the SUM08, are all indices used to relate ozone levels with potential plant injury. These indices reflect a cumulative exposure to ozone levels that are known to cause damage to sensitive plant species.

Ozone levels in 1998, as reflected by the indices in the table below, show an increase in ozone exposure over 1997 levels at the northern Vermont site in Underhill, and a decrease in levels at the southern Vermont site in Bennington.

Table 2. Ozone levels recorded during the 1998 growing season at two stations. Data provided by the Vermont Air Pollution Control Division.

Monitor Site	Total Number of Hours with		Maximum Level		SUM06 (ppm-hr)	SUM08 (ppm-hr)
	≥0.060 ppm	≥0.080 ppm	ppm	Date		
Underhill	330	11	85	7/15	22.0	0.9
Bennington	387	20	94	7/27	18.7	1.7

Ozone injury symptoms were observed on sensitive plant species at 60% of the locations surveyed throughout the state (Figure 4). The severity of foliage symptoms ranged from light (1-2) to heavy (4-5) [using a rating system of 0 (no injury) to 5 (>75% injury on affected leaves]. Three locations had moderate to heavy injury this year: Underhill, Sudbury and Hyde Park. The overall effect of ozone injury to forest health is not currently known, but may include reductions in growth and vigor. No ozone damage was detected on forest trees from aerial and ground surveys.

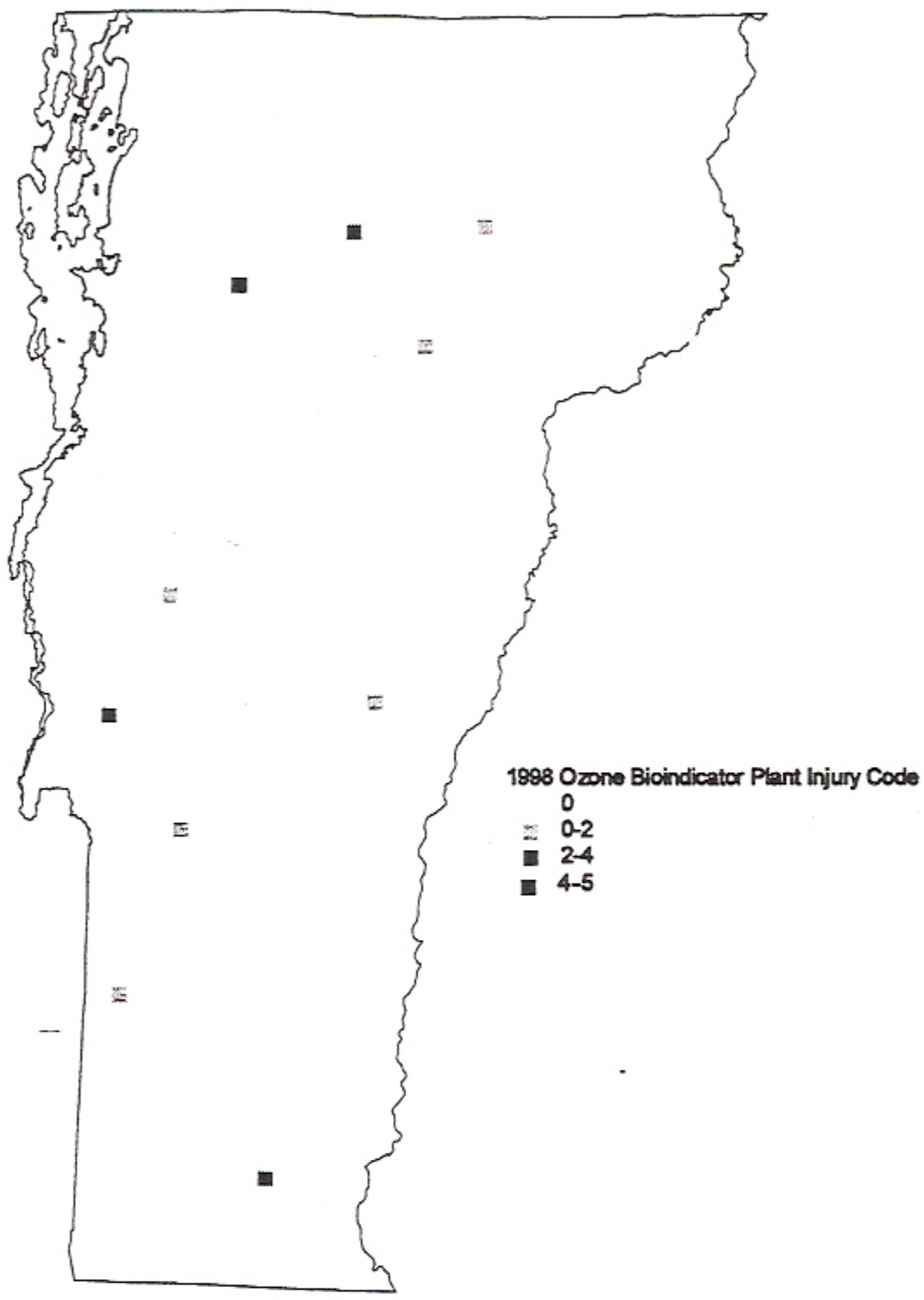


Figure 4. Approximate locations where ozone injury to sensitive plants was evaluated in 1998. Severity of foliage symptoms was coded as: 0=none, 0-2=<25%, 2-4=25-75%, 4-5=>75% of surface area affected on symptomatic leaves. Ozone readings taken as part of the National Forest Health Monitoring program.

Forest Insects

HARDWOOD DEFOLIATORS

Birch Defoliation, caused by **Birch Leaf Miners,** *Fenusa pusilla* and *Messa nana,* and **Birch Anthracnose** caused by *Marsonnina betulae* and *Septoria sp.* on paper birch, was mapped on 21,283 acres, compared to 3,842 acres in 1997 (Table 3, Figure 5). Some damage had occurred by early July. The increase from 1997 was due to a heavy seed crop and wet weather. The weather led to widespread foliar diseases, and allowed a buildup of leaf mining insects in 1998. The damage mapped was, nonetheless, lower than in many recent years (Figure 6). The browning from leaf miners may be more visible in dry years as damaged foliage desiccates. It was difficult to differentiate damage caused by birch leaf miner from the widespread browning to other hardwoods during aerial surveys. Therefore, some birch defoliation was mapped, and reported, as anthracnose.

Table 3. Mapped acres of birch defoliation caused by birch leaf miners, along with leaf fungi and other insects, in 1998.

County	Acres
ADDISON	312
BENNINGTON	210
CALEDONIA	2702
CHITTENDEN	344
ESSEX	9203
FRANKLIN	576
LAMOILLE	65
ORANGE	1176
ORLEANS	1459
RUTLAND	461
WASHINGTON	530
WINDHAM	626
WINDSOR	3619
Grand Total	**21283**

BIRCH LEAFMINER

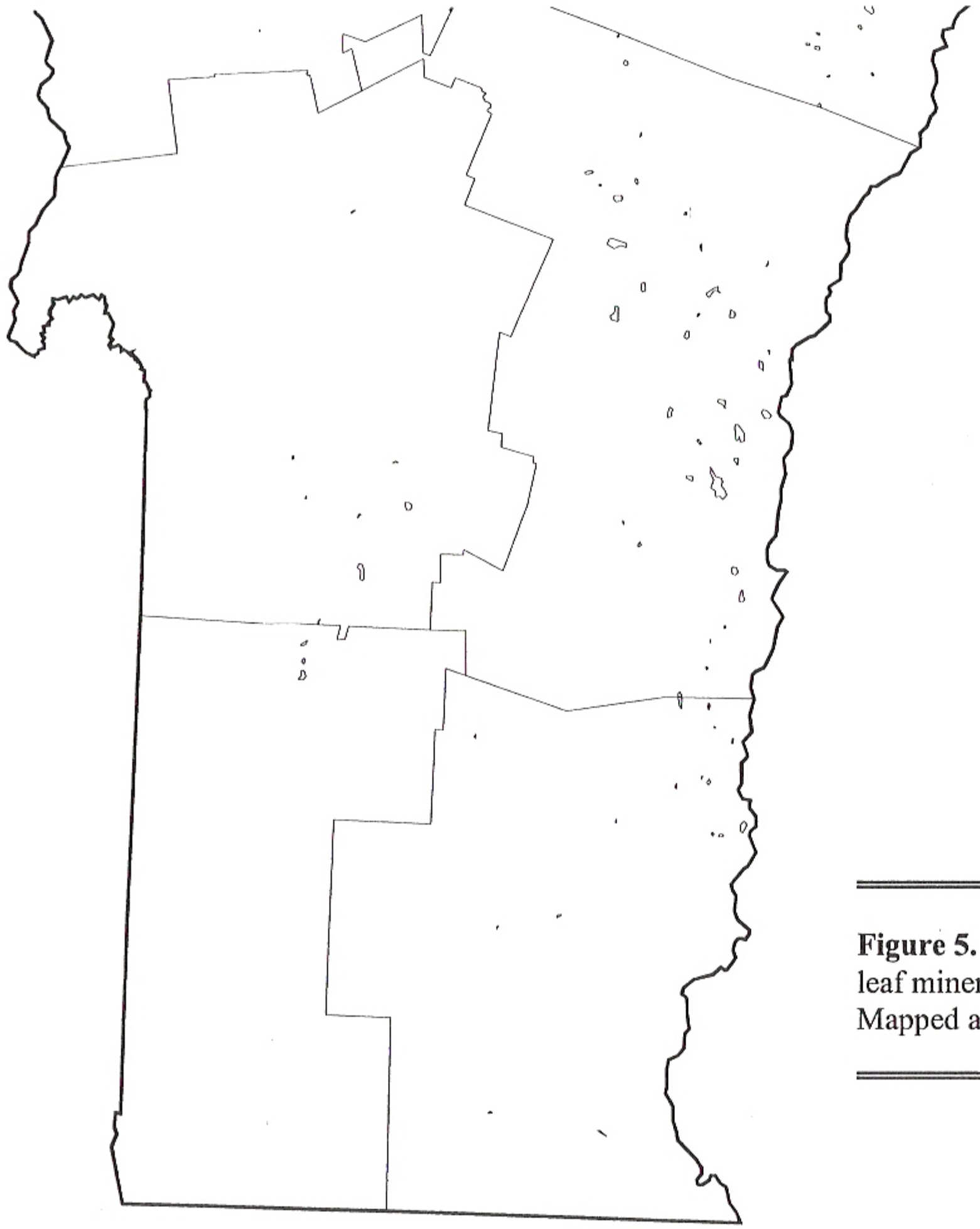


Figure 5. Mapped acres of birch defoliation by birch leaf miners, along with fungi and other insects, in 1998. Mapped area is 21,283 acres.

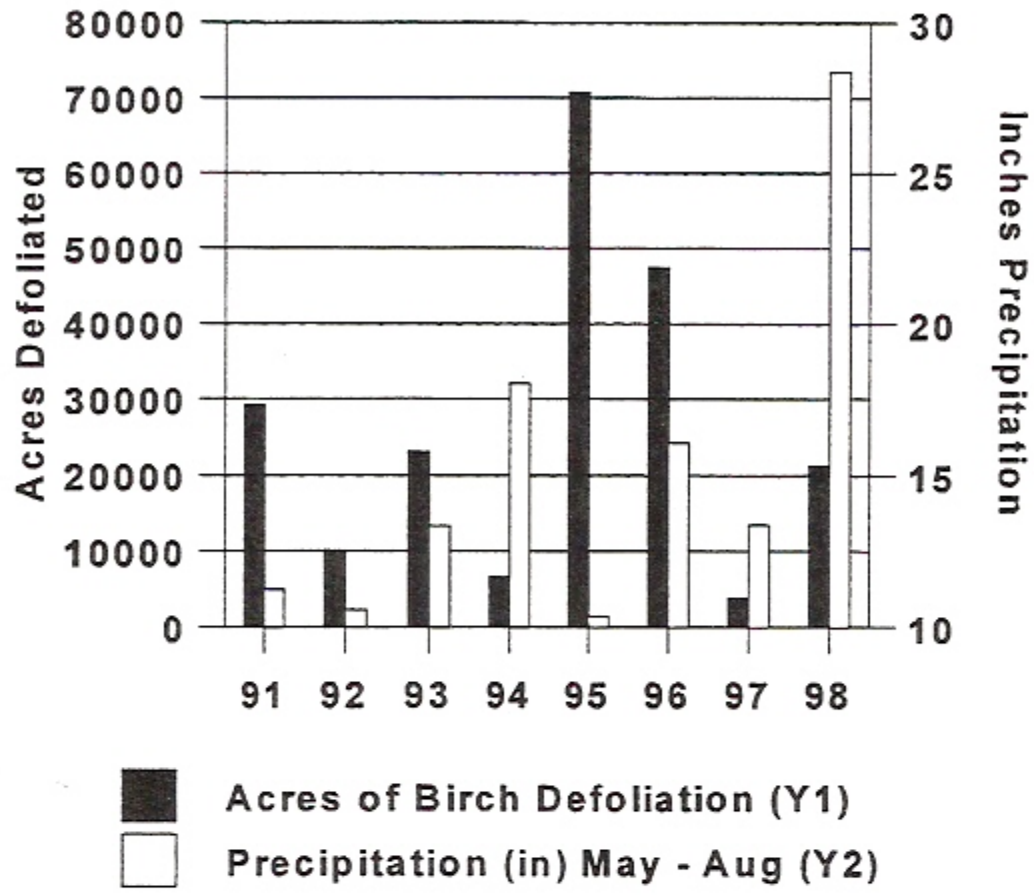


Figure 6. Mapped acres of birch defoliation in Vermont and inches of precipitation in May through August recorded at Burlington by NOAA, 1991-1998.

Fall Webworm, *Hyphantria cunea,* was common statewide, with the heaviest damage in the Connecticut River Valley. Webbing and defoliation were visible from the air, and many complaints were received. As an alternative to insecticide or disgust, homeowners are advised to visit infested trees at daybreak on a sunny morning when webs glisten with dew.

Forest Tent Caterpillar, *Malacosoma disstria,* populations continued to be very low. Few caterpillars were seen, and no forest defoliation was observed. No moths were caught in pheromone traps (Figures 7 & 8). A luminoc trap in Hyde Park with a blue light plus pheromone for four hours per night caught no moths for the second year in a row compared to 27 moths in 1995.

Forest tent caterpillar is a serious pest of northern hardwoods. Monitoring for this pest, particularly in sugar maple stands, remains a high priority.

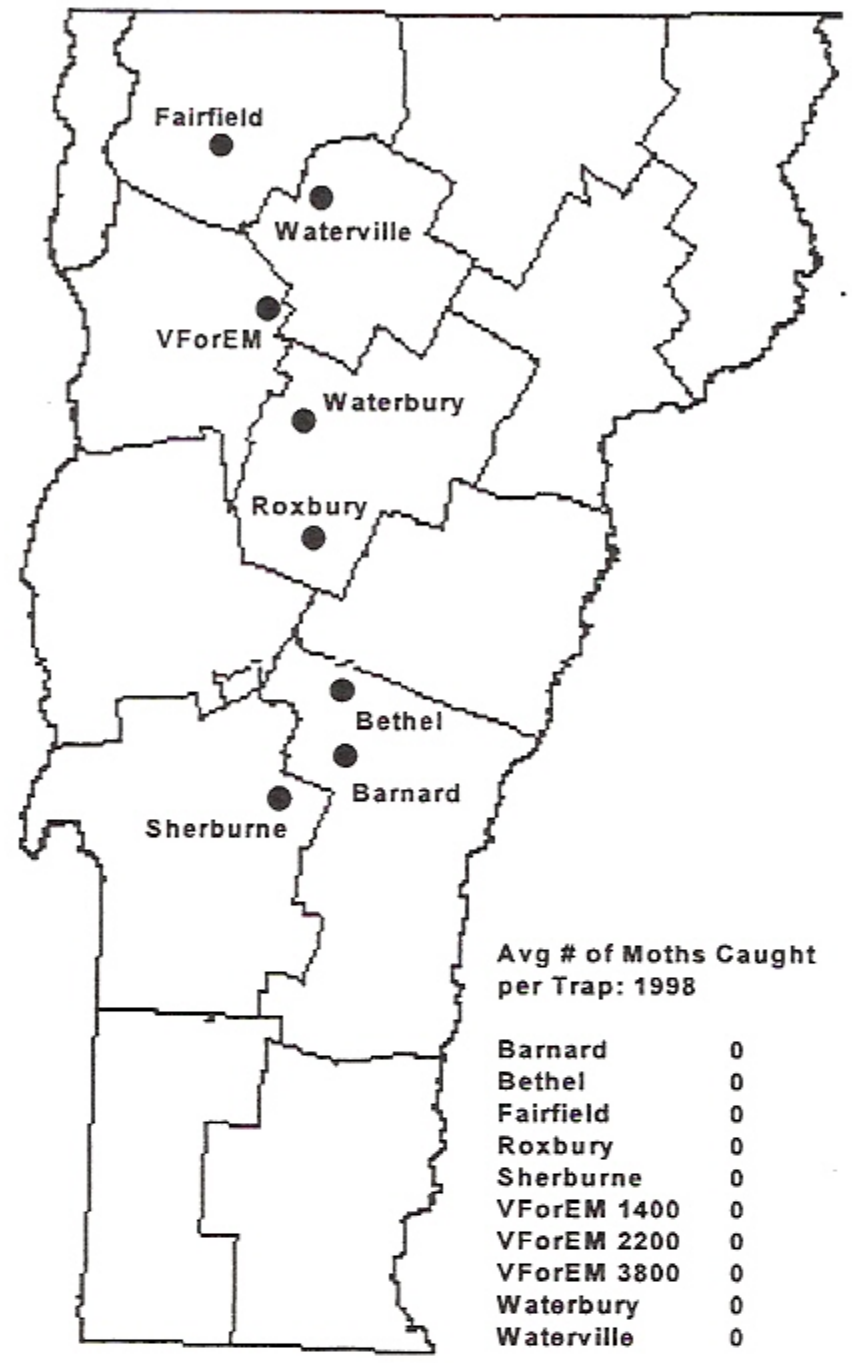


Figure 7. Average number of forest tent caterpillar moths caught in pheromone traps, 1998.

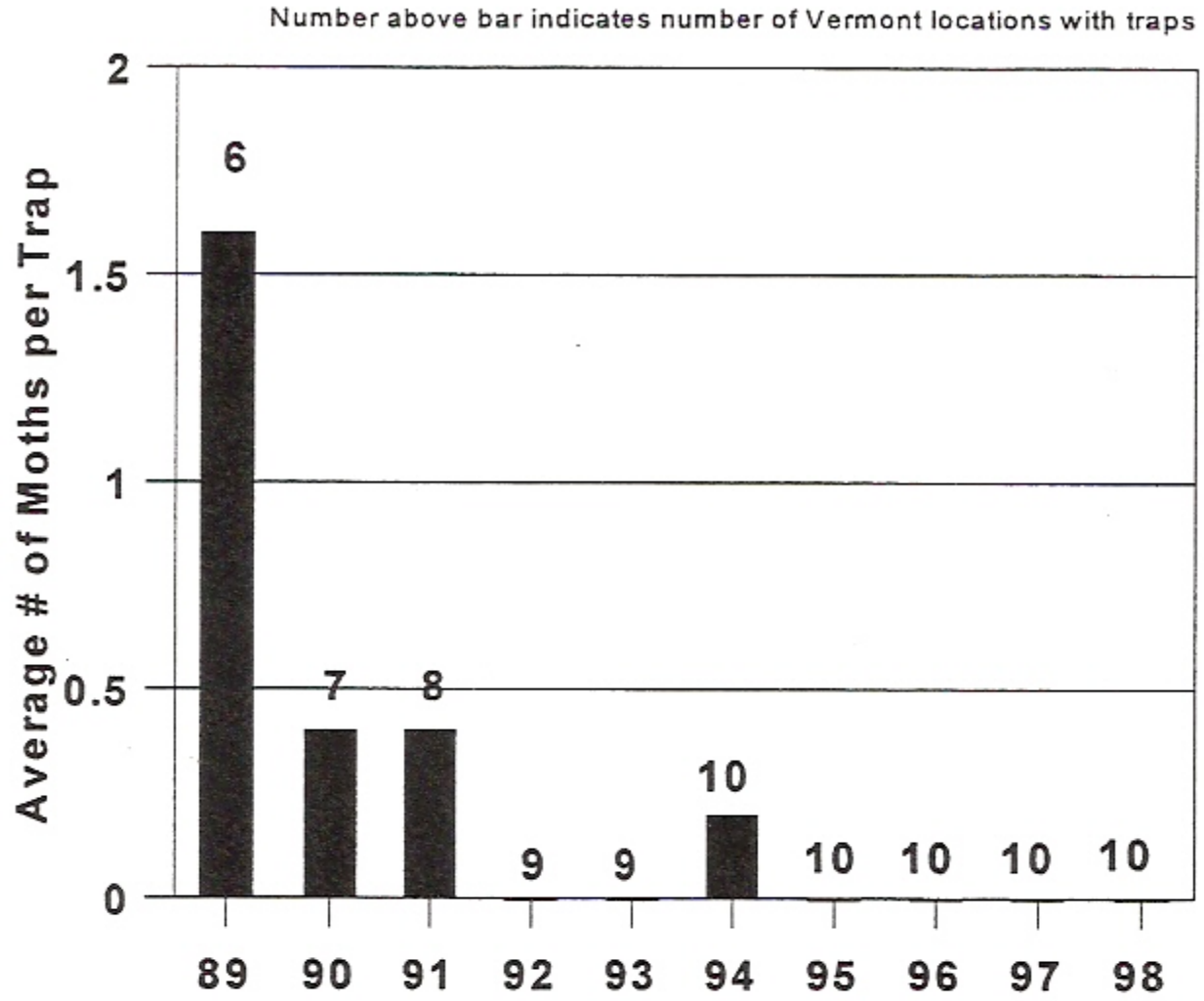


Figure 8. Average number of forest tent caterpillar moths caught in pheromone traps 1989-1998. Five multi-pher traps baited with RPC-2 component lures per location.

Gypsy Moth, *Lymantria dispar,* larvae were observed in scattered locations, but populations remained very low this year. Light feeding on ornamentals, and caterpillars dead from disease, were observed in southern Vermont. Because spring weather conditions were wet, the disease is assumed to be the fungus *Entomophaga*, but this was not confirmed. Populations were too sparse for starvation to play a role. Male moths were commonly observed, flying well into September. Individual egg masses were observed in the fall outside of host forest type in scattered locations.

Evidence of gypsy moth presence, spent larval skins, pupal cases, and dead larvae, were observed in "focal area" monitoring plots. However, only two of the plots had egg masses (Figures 9-10). Egg masses were observed in the "control" monitoring plots in Bennington, Benson, and Colchester. However, these control plots, which are mesic, lower slope or bottomland oak stands, are not included in our annual summaries.

Although there was more evidence of gypsy moth in 1998, and defoliation was observed nearby around Keene, NH and Lake George, NY, no defoliation is expected in 1999. Disease appears to be preventing a population increase. Male moths were numerous, but egg masses remain sparse.

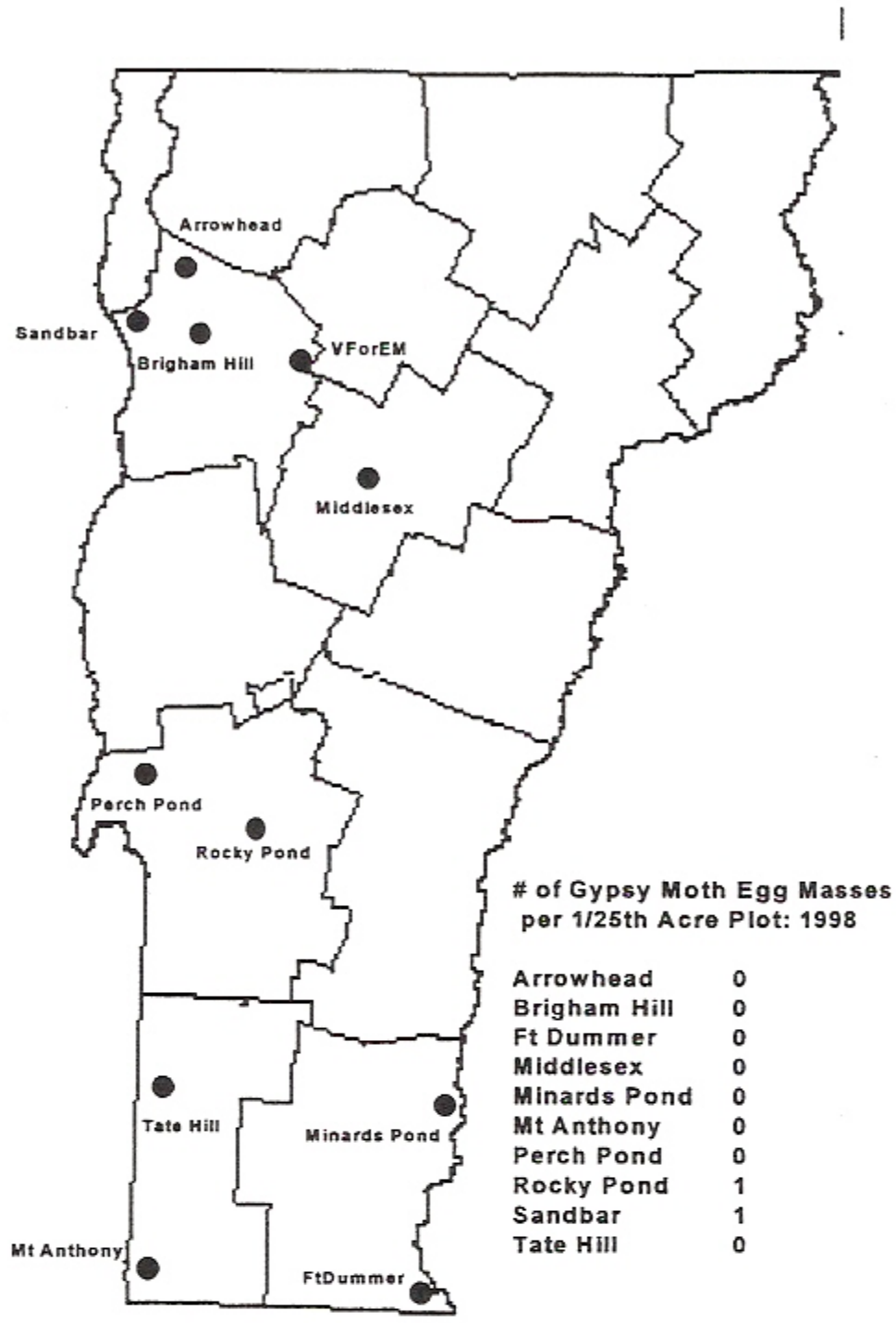


Figure 9. Gypsy moth egg mass counts from focal area monitoring plots, 1998. Average of two 15 meter diameter burlap-banded plots per location.

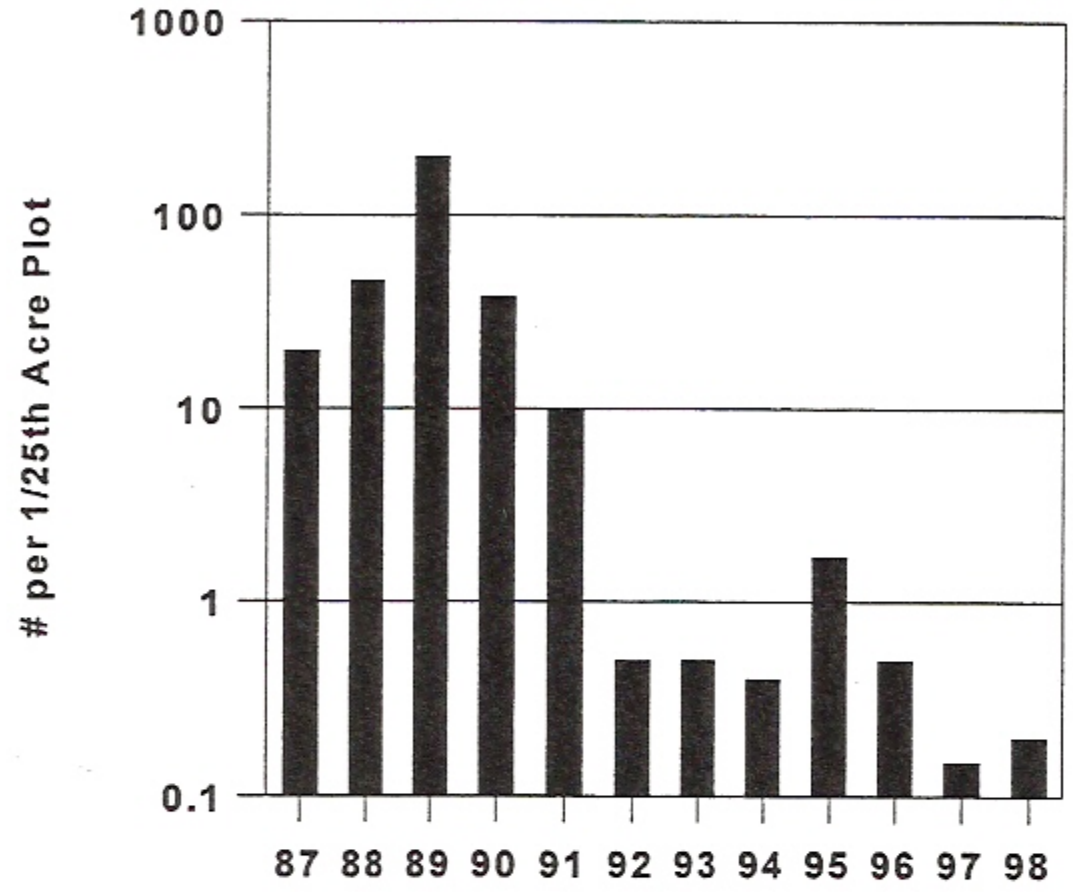


Figure 10. Gypsy moth egg mass counts from focal area monitoring plots, 1998. Average of two 15m diameter burlap-banded plots per location.

Locust Leaf Miner, *Odontata dorsalis,* caused the heaviest damage observed in at least twenty years in a few locations in Dummerston, Putney, and Hartland that are repeatedly damaged by this insect, while nearby locusts were undamaged. In Chittenden County, damage was down from 1997 levels, with 78 acres mapped.

Damage occurred earlier than normal. No foliar pathogens were observed by the UVM Forest Pathology Lab on damaged leaves. Some mortality has occurred, including a damaged area in Hartland where a third of the stems are dead.

Maple Leaf Cutter, *Paraclemensia acerifoliella,* was widespread, but heavy damage occurred only in widely scattered locations. Damage was mapped on 1336 acres in northern Vermont, up from 581 in 1997 (Table 4). Some heavy defoliation was also observed in Bennington County but not mapped. Damage was not uniform among trees within a stand. Elsewhere, damage was lighter; however, the presence of anthracnose in many areas led to complete foliar browning around damaged leaves.

Table 4. Mapped acres of damage by maple leaf cutter in 1998.

County	Acres
CALEDONIA	831
CHITTENDEN	286
ESSEX	113
ORANGE	23
ORLEANS	52
WASHINGTON	31
Grand Total	**1336**

Maple Trumpet Skeletonizer, *Epinotia aceriella,* built up statewide to the highest levels "old-timers" can recall. Some stands had damage to every leaf. Where it was lighter, damage was heaviest in the lower crown. Combined with anthracnose, some affected stands were completely brown by the end of the season. Because maple trumpet skeletonizer damage was mixed with anthracnose and maple leaf cutter, the damage is included in the acreage listed under anthracnose.

Oak Skeletonizer, *Bucculatrix ainsliella,* populations built up, and damage was visible from the ground in oak stands throughout southern Vermont by the end of the summer. However, no damaged stands were mapped from the air. The second generation of skeletonizers was particularly heavy, and there were many complaints from homeowners and landowners in Rutland County. Overwintering pupal cases coated trees of all species and fallen leaves in oak stands in affected areas. Unless populations collapse, damage is expected in 1999.

Saddled Prominent, *Heterocampa guttivata,* populations remained low, but larvae were widely observed, with light defoliation in scattered locations. An egg survey was done in a Westminster sugarbush in July. Only 3 eggs were found on 11 leaf clusters, indicating that no defoliation would take place. Defoliation from saddled prominent was very light in that location.

Pherocon 1C traps baited with experimental lure were deployed in Coolidge State Park in Plymouth and Molly Stark State Park in Marlboro. This was part of a study being done by SUNY College of Environmental Science and Forestry. Sticky traps were changed twice weekly. Study results indicated that pheromone traps could be useful for monitoring saddled prominent.

In summary, saddled prominent populations have appeared to be building for several years. However, larval numbers have remained low and no damaging defoliation has been observed. Because a good predictive monitoring tool for this insect is lacking, it is difficult to forecast damage in 1999. However, trends from past years suggest that light damage will continue. This is another serious pest of northern hardwoods that is continually monitored.

OTHER HARDWOOD DEFOLIATORS			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Alder Leaf Beetle *Altica ambiens alni*			Not observed.
Alder Woolly Sawfly *Eriocampa ovata*	Alder	Danville	On nursery stock.
American Dagger Moth *Acronicta americana*	Sugar Maple	Morrisville Johnson	Larvae feeding singly on foliage.
Aspen Blotch Miner *Phyllonorycter tremuloidiella*	*Populus* sp.	GMNF	Reported by FHP - DFO.
Azalea Sawfly *Amauronematus azalae*	Azalea	Chester	Done feeding by 7/1.
Beech Skeletonizer *Bucculatrix packardella*	Beech	Bennington County	Light damage.
Birch Leaf Folder *Ancylis discigerana*	Yellow Birch	Ascutney Dover	Light.
Birch Leafminers *Fenusa pusilla* and *Messa nana*			See narrative.
Birch Sawfly *Arge pectoralis*	Birch	Richmond	Ornamental.
Birch Skeletonizer *Bucculatrix canadensisella*	Birch	Throughout	Light damage. Noticeable on yellow birch, often occurring with leaf miner and anthracnose.
Bruce Spanworm *Operophtera bruceata*	Sugar Maple	Groton GMNF Stowe	Very light defoliation. Few moths seen; not numerous.

OTHER HARDWOOD DEFOLIATORS			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Cecropia Moth *Hyalophora cecropia*	Maple	Milton Stowe Montpelier Waterbury	Larvae and adults were seen and reported more often than in past several years.
Cherry Scallop Shell Moth *Hydria prunivorata*	Black Cherry	Widely scattered	Scattered light to moderate damage by late August. Common this year. Increasing.
Early Birch Leaf Edgeminer *Messa nana*			See Birch Leaf Miner.
Eastern Tent Caterpillar *Malacosoma americanum*	Cherry Apple	Scattered	Very light populations.
Elm Leaf Beetle *Pyrrhalta luteola*	Elm	Orleans County GMNF	Very light feeding on roadside trees.
Elm Leaf Miner *Fenusa ulmi*	Weeping Elm	St. Albans GMNF	Ornamental. Reported by FHP-DFO.
Euonymous Caterpillar *Yponomeuta cagnagella*	Burning Bush	Addison, Rutland & Chittenden Counties Newport	Heavy defoliation. "Creepy webs".
European Snout Beetle *Phyllobius oblongus*	Sugar Maple Butternut Apple Birch	Rutland, Caledonia, Orleans & Lamoille Counties	More common than usual this year.
Fall Cankerworm *Alsophila pometaria*	Red Maple Cherry	Addison County	Light defoliation.

OTHER HARDWOOD DEFOLIATORS			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Fall Webworm *Hyphantrea cunea*			See narrative.
Forest Tent Caterpillar *Malacosoma disstria*			See narrative.
Green Striped Mapleworm *Anisota rubicunda*	Sugar Maple	Jamaica Winhall Montpelier Waterbury	Larvae and adults seen.
Gypsy Moth *Lymantria dispar*			See narrative.
Half Winged Geometer *Phigalia titea*	Maple	Walden	Light defoliation.
Hickory Tussock Moth *Lophocampa caryae*	Many	Essex Junction Colchester Groton Montpelier	Caterpillars especially numerous this year.
Imported Willow Leaf Beetle *Plagiodera versicolora*	Willow		See Willow Leaf Blight.
Japanese Beetle *Popillia japonica*	Many	Scattered	Occasionally heavy. Fewer calls to the lab than in 1997.
Large Aspen Tortrix *Choristoneura conflictana*	Aspen	GMNF	Reported by FHP-DFO.
Lilac Leafminer *Catoptilia (=Gracillaria) syringella*	Lilac	Huntington Rutland	Ornamentals.
Linden Looper *Eranis tilaria*			Not observed.

OTHER HARDWOOD DEFOLIATORS			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Locust Leaf Miner *Odontata dorsalis*	Black Locust		See narrative.
Maple Basswood Leaf Roller *Sparganothis pettitana*	Sugar Maple	Orleans County	Very light on roadside trees.
Maple Leaf Cutter *Paraclemensia acerifoliella*			See narrative.
Maple Leafblotch Miner *Cameraria aceriella*	Sugar Maple	Caledonia & Orleans Counties	Less noticeable than in past years.
Maple Petiole Borer *Caulocampus acericaulis*	Sugar Maple	GMNF Pittsford	Reported by FHP-DFO. Light damage.
Maple Trumpet Skeletonizer *Epinotia aceriella*			See narrative.
Maple Webworm *Tetralopha asperatella*	Sugar Maple	Lamoille County	Light damage.
Mountain Ash Sawfly *Pristiphora geniculata*	Mountain Ash	Chester	Ornamentals.
Oak Leaf Tier *Croesia semipurpurana*	Oak	GMNF	Reported by FHP-DFO.
Oak Skeletonizer *Bucculatrix ainsliella*			See narrative.
Oak Slug Sawfly *Caliroa fasciata*	Red Oak	Stowe	Same ornamental as in past years. Heavier this year.

OTHER HARDWOOD DEFOLIATORS			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Orange-humped Mapleworm *Symmerista leucitys*	Sugar Maple	Concord	Solitary feeders in NAMP plot.
Pale Tussock Moth Caterpillar *Halysidota tessellaris*	Oak Birch Willow Poplar Beech	Addison, Chittenden & Windham Counties	Larvae especially prevalent this year.
Pear Slug Sawfly *Caliroa cerasi*	Cherry Apple	Montpelier Marshfield	Ornamentals.
Pepper and Salt Moth Caterpillar *Biston betularia*	Apple	Danville	Ornamentals.
Red-humped Oakworm *Symmerista canicosta*			Not observed.
Rose Chafer *Macrodactylus subspinosus*	Many	Johnson Castleton Waterbury Greensboro Lyndonville	Common.
Saddled Prominent *Heterocampa guttivata*			See narrative.
Satin Moth *Leucoma salicis*	Poplar Cottonwood	Franklin County Sheffield Pawlet St. Albans	Increasing, causing light defoliation. Not observed in 1997.
Solitary Oak Leaf Miner *Cameraria sp.*	Oak	GMNF	Reported by FHP-DFO.

OTHER HARDWOOD DEFOLIATORS			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Sphinx Moth Caterpillars Various species	Various hosts	Isle La Mott Montpelier Waterbury Plymouth	More inquiries than usual about sphinx moth caterpillars.
Spiny Elm Caterpillar *Nymphalis antiopa*			Not observed.
Spiny Oak Slug *Periclista albicollis*	Oak	Montpelier	Caused irritation to skin when caterpillar dropped on human.
Spotted Grapevine Beetle *Pelidnota punctata*	Grapes	Morrisville	Found on leaves but little injury.
Spotted Tussock Moth *Lophocampa maculata*	Willow Poplar	Addison, Chittenden, Orleans & Washington Counties	Caterpillars prevalent.
Spring Cankerworm *Paleacrita vernata*			Not observed.
Uglynest Caterpillar *Archips cerasivoramus*	Cherry	Widely scattered	Mostly light damage but unusually heavy in locations in Stowe and Danville.
Wavy-lined Heterocampa *Heterocampa biundata*	Sugar Maple	Corinth	Very light infestation.
White Marked Tussock Moth *Orgyia leucostigma*	Many	Springfield Moretown	Individual larvae.
Willow Flea Beetle *Rhychaenus rufipes*	Willow	GMNF	Reported by FHP-DFO.

OTHER HARDWOOD DEFOLIATORS			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Woolly Bear *Pyrrharctia isabella*	At large	Addison, Chittenden & Washington Counties	Caterpillars extremely abundant in the fall.
Wool Sower Gall *Callirhytis seminator*	White Oak	Addison County	Down from 1997 levels.
Yellow-necked Caterpillar *Datana ministra*	Apple	Norwich	Light population.

SOFTWOOD DEFOLIATORS

Spring Hemlock Looper, *Lambdina athasaria*, was not observed. In 1998, only 23 acres of mortality were mapped in the Windham County area where 1,600 acres of defoliation were mapped in 1991. This indicates that most of the surviving trees, in stands where mortality occurred, are recovering. In monitoring plots, recovery continues in heavily defoliated plots, and tree condition remains stable in moderately defoliated and non-defoliated plots (Figure 11).

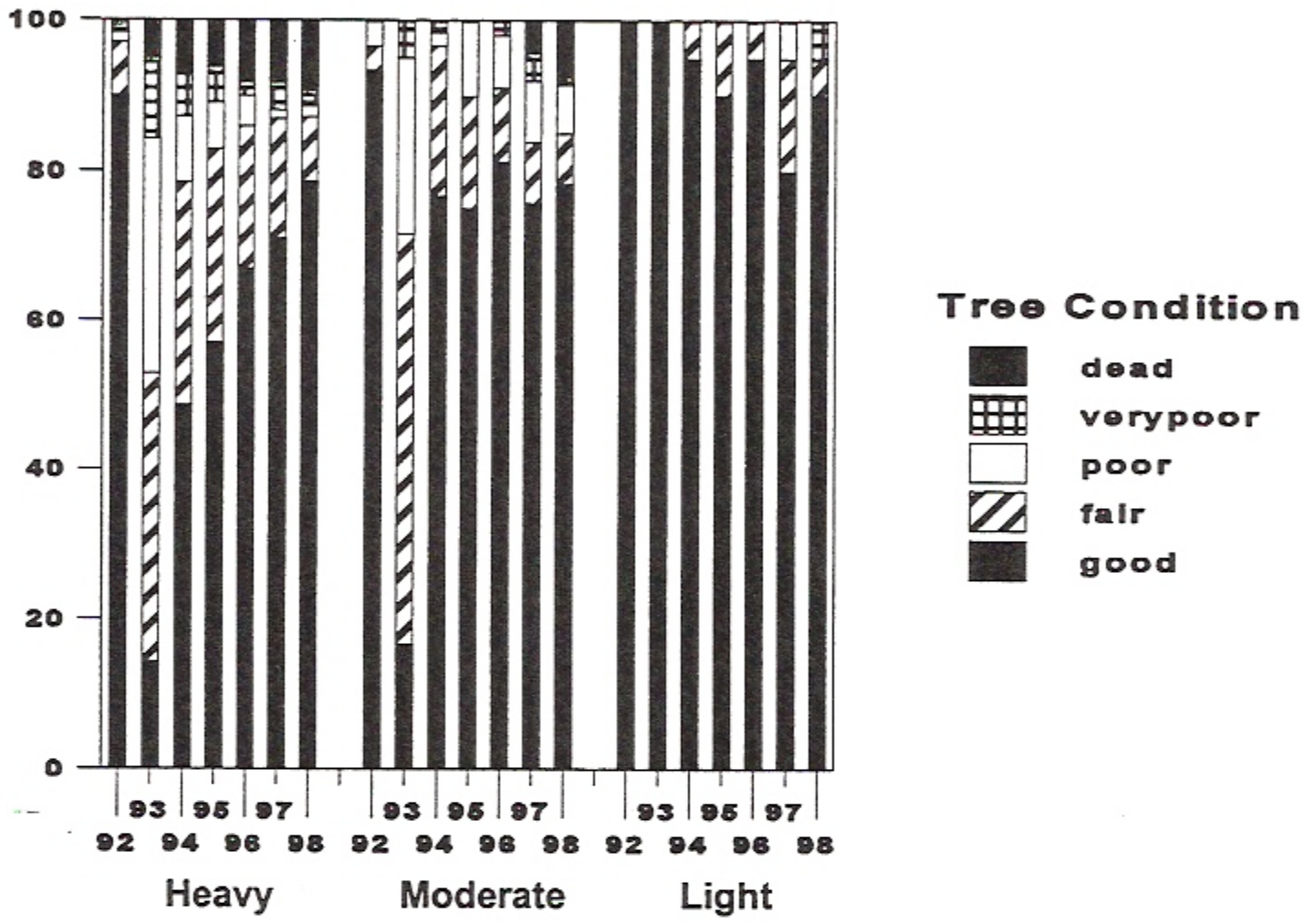


Figure 11. Percent of trees in spring hemlock looper impact plots in each of five condition classes when evaluated in spring of 1992-1998, by defoliation severity in 1991. Data are from ten trees in each of seven stands which had heavy defoliation, six which had moderate defoliation, and two which had no defoliation.

Spruce Budworm, *Choristoneura fumiferana*, continued at low levels, with no visible defoliation detected. The number of moths captured in pheromone traps in northern Vermont has been fluctuating at low levels. Trap counts this year were higher than in 1997, but similar to 1996 levels (Figures 12-13).

Trap catch on the Green Mountain National Forest (Figure 12, sites 500-505) was also low, averaging 1.4 moths per trap compared to 2 per trap in 1997 and a high of only 3 per trap in 1996.

Location No.	Name	# of moths/trap
4.	Danville Hill	9.3
5.	Reservoir	8.0
6.	Marshfield Pd.	2.3
8.	Scotch Hollow	0
11.	Centerville	6.2
13.	Diggins	2.7
14.	Wolcott F&G	2.3
15.	Bear Swamp	4.3
16.	Withers	11.3
17.	Mason	3.7
18.	Star School	4.3
19.	Beagle Club	8.3
20.	Brownington	11.3
21.	Calendar Brk.	9.7
22.	Chieppo	7.3
23.	Bunnel Brk.	Discontinued
24.	Norton Cem.	26.0
25.	Holland Pd.	5.0
26.	Victory Bog	3.7
27.	VForEM 1400	6.0
28.	VForEM 2200	0.7
29.	VForEM 3800	5.0
	Average (excluding 28, 29)	6.6

Location No.	Name	Average # of moths/trap
500-505	Green Mountain National Forest	1.4

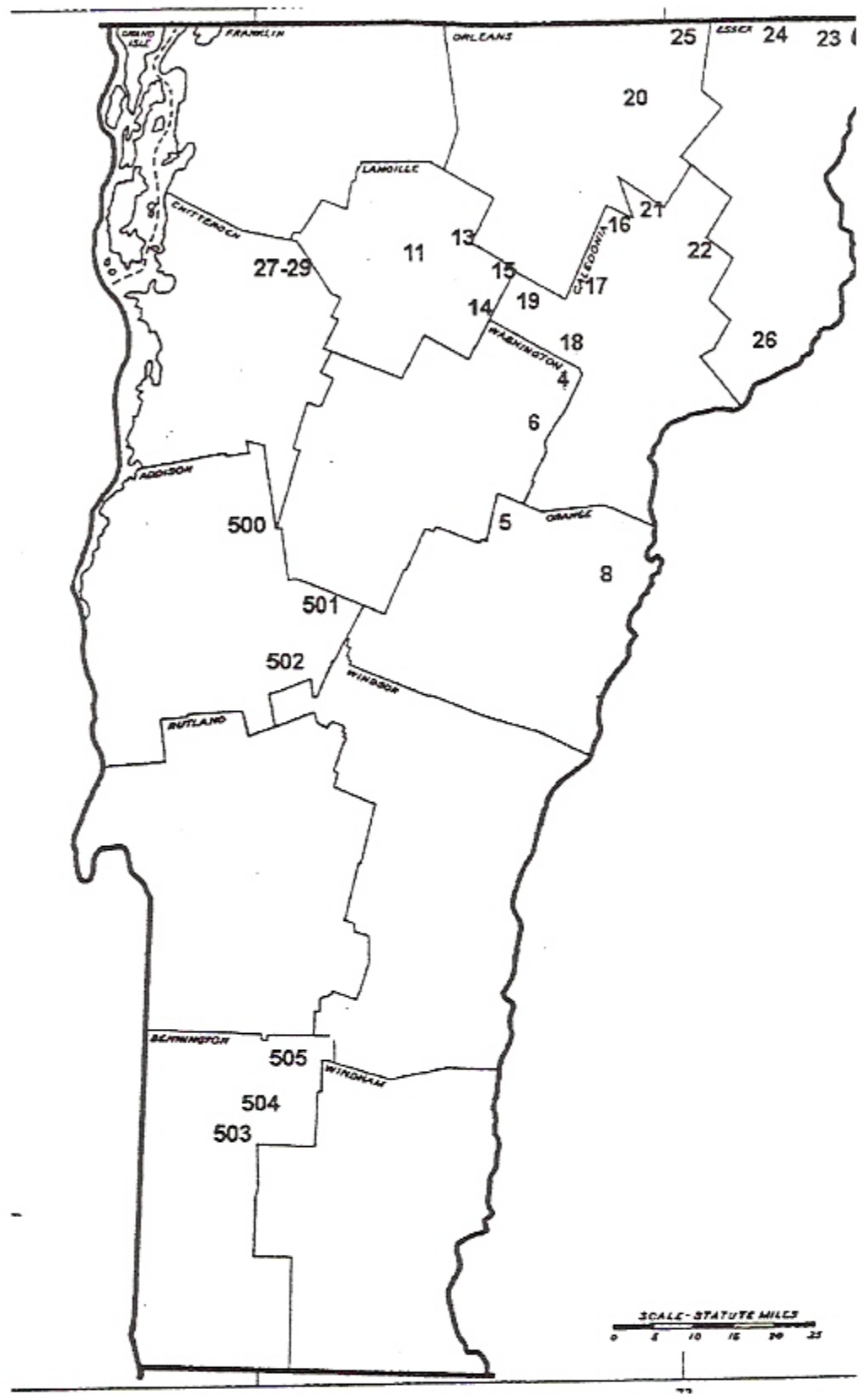


Figure 12. Spruce budworm pheromone plot locations in 1998.

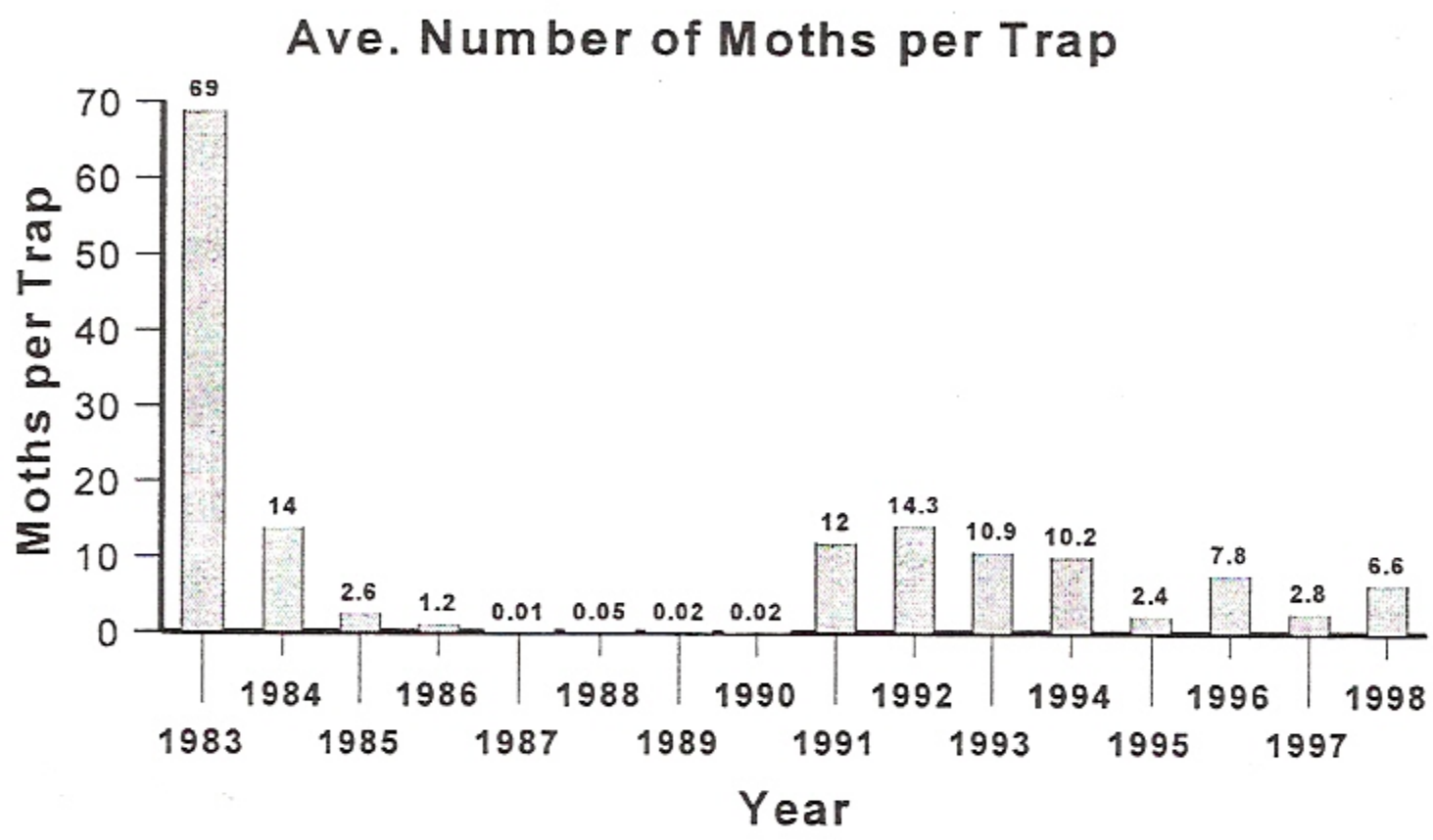


Figure 13. Average number of spruce budworm moths caught in pheromone traps by year, 1983 to 1998, based on 3 to 5 multi-pher traps per site for 15 to 23 sites. Data from all trap sites not located on the Green Mountain National Forest.

OTHER SOFTWOOD DEFOLIATORS			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Arborvitae Leaf Miner *Argyresthia thuiella*	Northern White Cedar	Widespread	Increasing damage in Chittenden County. Elsewhere, mostly light damage except for heavy damage to ornamentals in Newport.
Balsam Fir Sawfly *Neodiprion abietis*			Not observed.
Black Vine Weevil *Otiohynchus sulcatus*	Yew	Morrisville	Found entering home.
European Pine Sawfly *Neodiprion sertifer*	Scots Pine	Chittenden & Franklin Counties	Increasing; not observed in 1997.

OTHER SOFTWOOD DEFOLIATORS			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
European Spruce Needle Miner *Taniva albolineana*			Not observed.
Fall Hemlock Looper *Lambdina fiscellaria*	Hemlock	Throughout	Though caterpillars were not seen, moths were observed.
Introduced Pine Sawfly *Diprion similis*	White Pine	Scattered throughout	Light defoliation. Many solitary feeders observed.
Larch Casebearer *Coleophora laricella*	Eastern Larch	Throughout	Lighter populations than some years.
Larch Sawfly *Pristophora ericksonii*			Not observed.
Nursery Pine Sawfly *Diprion fruteōrum*			Not observed.
Pine False Webworm *Acantholyda erythrocephala*			Not observed.
Pine Webworm *Tetralopha robustella*			Not observed.
Red-Headed Pine Sawfly *Neodiprion lecontei*			Not observed.
Spring Hemlock Looper *Lambdina athasaria*			See narrative.
Spruce Bud Moth *Zeiraphera canadensis*	White Spruce	Essex, Caledonia & Orleans Counties	Widely scattered light damage.

OTHER SOFTWOOD DEFOLIATORS			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Spruce Budworm *Choristoneura fumiferana*			See narrative.
Spruce Coneworm *Dioryctria reniculelloides*	Norway Spruce	Rutland	Ornamental.
Spruce Webspinning Sawfly *Cephalcia fascipennis*	Norway Spruce	Rutland	Several larvae collected from single ornamental.
White Pine Sawfly *Neodiprion pinetum*			Not observed.
Yellow-Headed Spruce Sawfly *Pikonema alaskensis*	Blue Spruce White Spruce	Widely scattered	Decreasing. Only a few reports this year.

SAPSUCKING INSECTS, MIDGES, AND MITES

Balsam Gall Midge, *Paradiplosis tumifex,* populations were at high levels, with damage observed statewide on wild and planted balsam fir. Heavy damage was common within the native range of balsam fir. Galls were found in nearly every balsam fir Christmas tree plantation visited in the northern Vermont survey. About half of the plantations had moderate to heavy damage. In some locations, shoot growth was not well synchronized with adult emergence, making control more difficult. Damage is at peak levels, indicating populations should begin decreasing in 1999.

Balsam Twig Aphid, *Mindarus abietinus,* damage decreased statewide again this year. Damage in the balsam fir Christmas tree plantations surveyed was mostly light compared to mostly moderate damage in 1997, and moderate to heavy damage in 1996.

Hemlock Woolly Adelgid, *Adelges tsugae,* was not observed. Trap trees planted in Stockbridge, at the site where the insect has been eradicated, were inspected in the spring and in the fall. No adelgids were found. Proving that wild insect rumors can spread even faster than wildfire, the report of adelgid, allegedly observed in Rockingham, had covered northern New England before it was demonstrated that the alleged infestation was, in fact, lichen. The threat to Vermont hemlock continues as new infestations are detected in Massachusetts.

Oystershell Scale, *Lepidosaphes ulmi*, populations on American beech remained low 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 changed little since 1996 and remained fairly low, following an all-time high in 1995 (Table 5, Figure 14).

Table 5. Number of oystershell scales on current year beech twigs in Camel's Hump State Forest, 1993-1998.

	Average Number of Mature Viable Scales per:											
	Twig						Millimeter					
	1993	1994	1995	1996	1997	1998	1993	1994	1995	1996	1997	1998
Suppressed	1.2	2.1	9.0	0.6	2.1	4.0	0.03	0.07	0.15	0.06	0.15	0.10
Intermediate	1.4	8.4	16.8	1.2	2.6	3.3	0.05	0.16	0.31	0.12	0.10	0.25
Codominant	4.8	3.4	11.3	0.2	4.5	4.2	0.11	0.08	0.71	0.17	0.17	0.18

[1]Average for 10 branches from one tree per crown class, collected in each autumn.

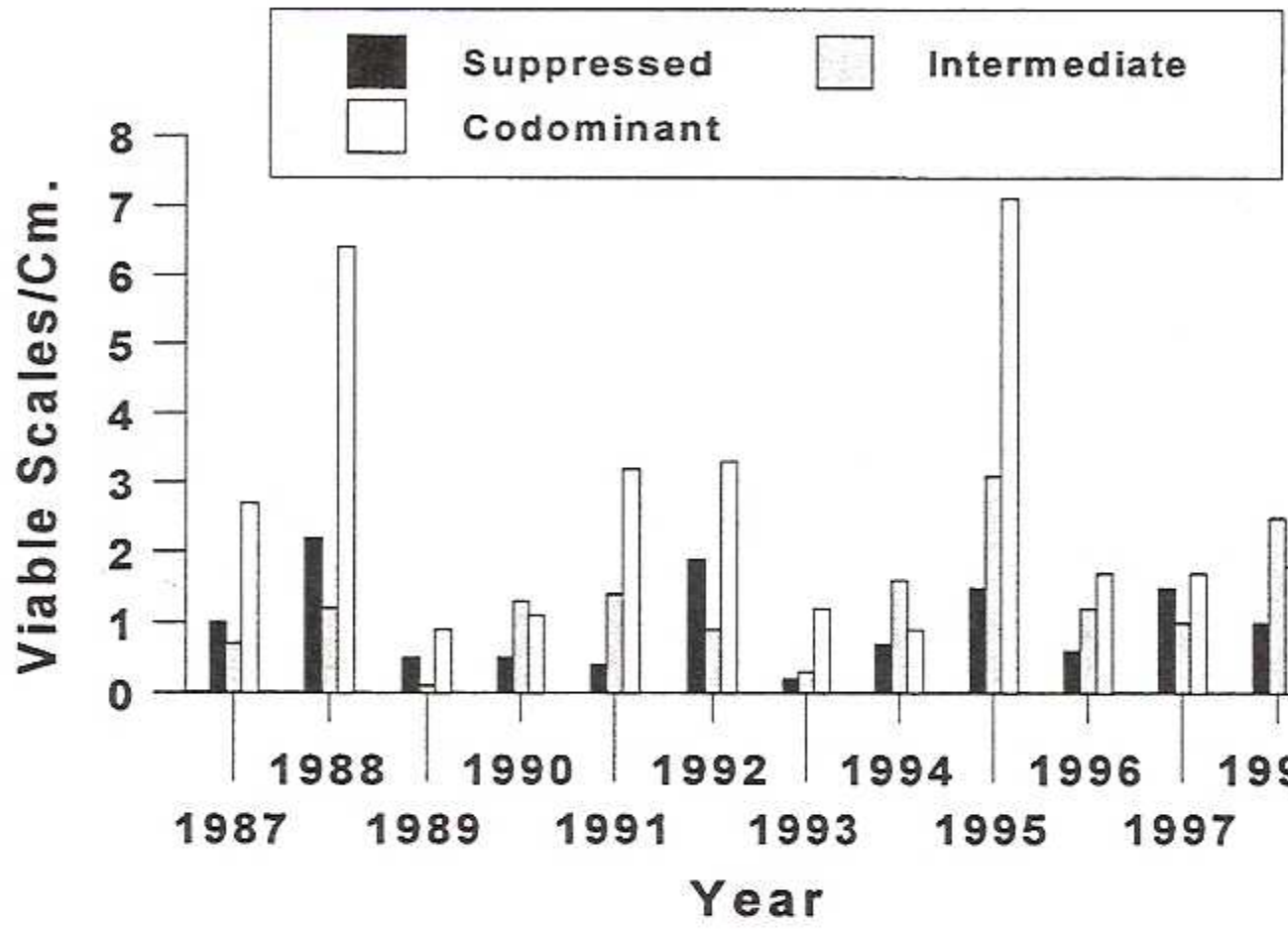
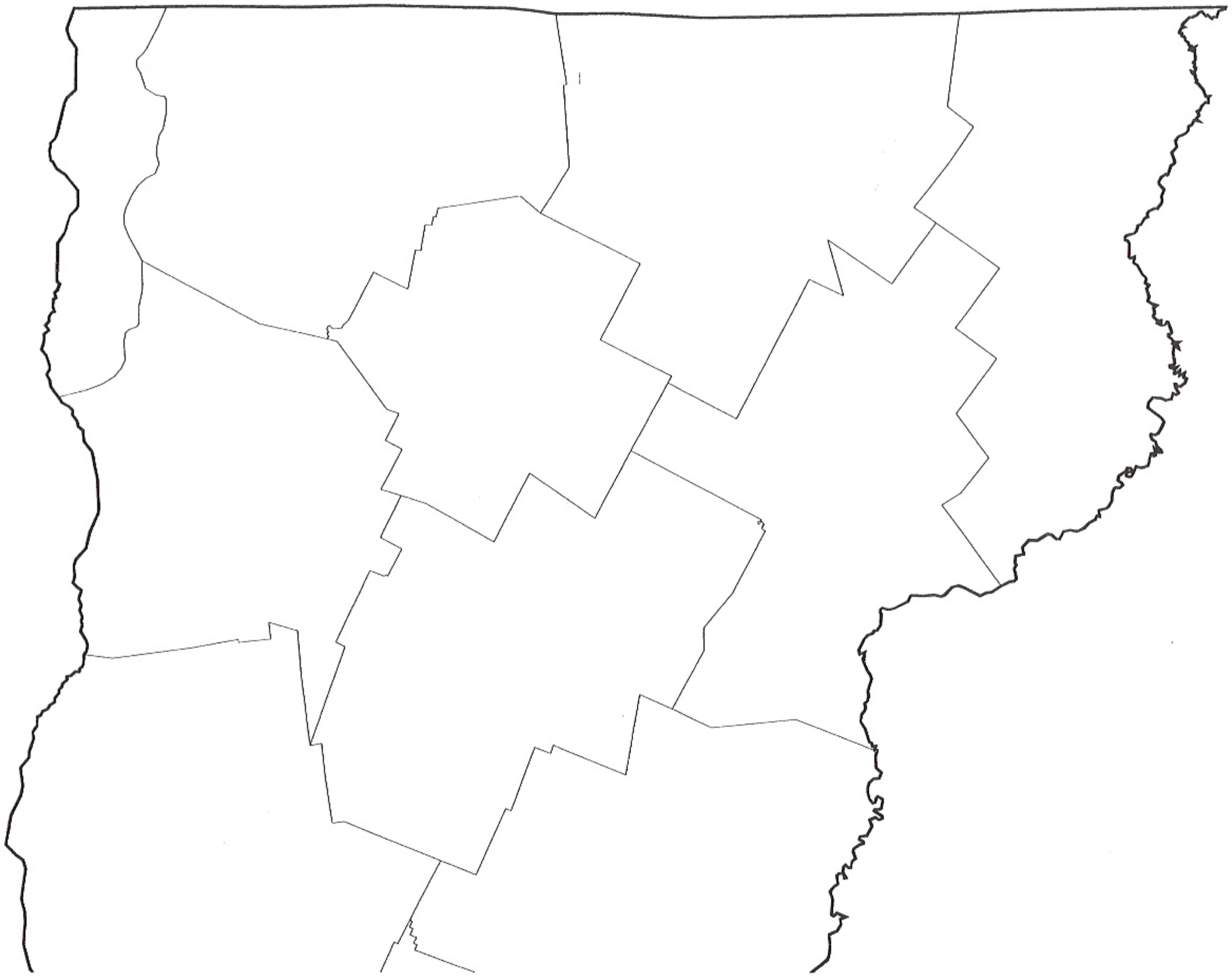


Figure 14. Oystershell scale populations in three tree canopy levels in Camel's Hump State Forest, 1987 -1998. Average for 10 current year twigs/tree per crown class, collected in autumn.

Pear Thrips, *Taeniothrips inconsequens,* numbers were up only slightly in overwintering soil samples, and down in developing buds from 1997 (Figure 15). At the Proctor Maple Research Center in Underhill, a total of 491 thrips were caught at four sticky trap sites over an eight-week period (3/31-5/27).

However, the 7-10 days of wet weather when budbreak was occurring in southern Vermont allowed thrips damage to occur to trees which were slow to leaf out Conditions were also ideal for the development of anthracnose in injured young leaves, resulting in widespread damage to sugar maple in Windham County, and scattered locations elsewhere in southern Vermont. Damage was mapped in early July on 36,081 acres (Table 6, Figure 16). In the Taconic range, damage was most severe on red maple. Because of the important role of anthracnose, damage was often most severe at the edge of openings and along roadsides

PEAR THRIPS



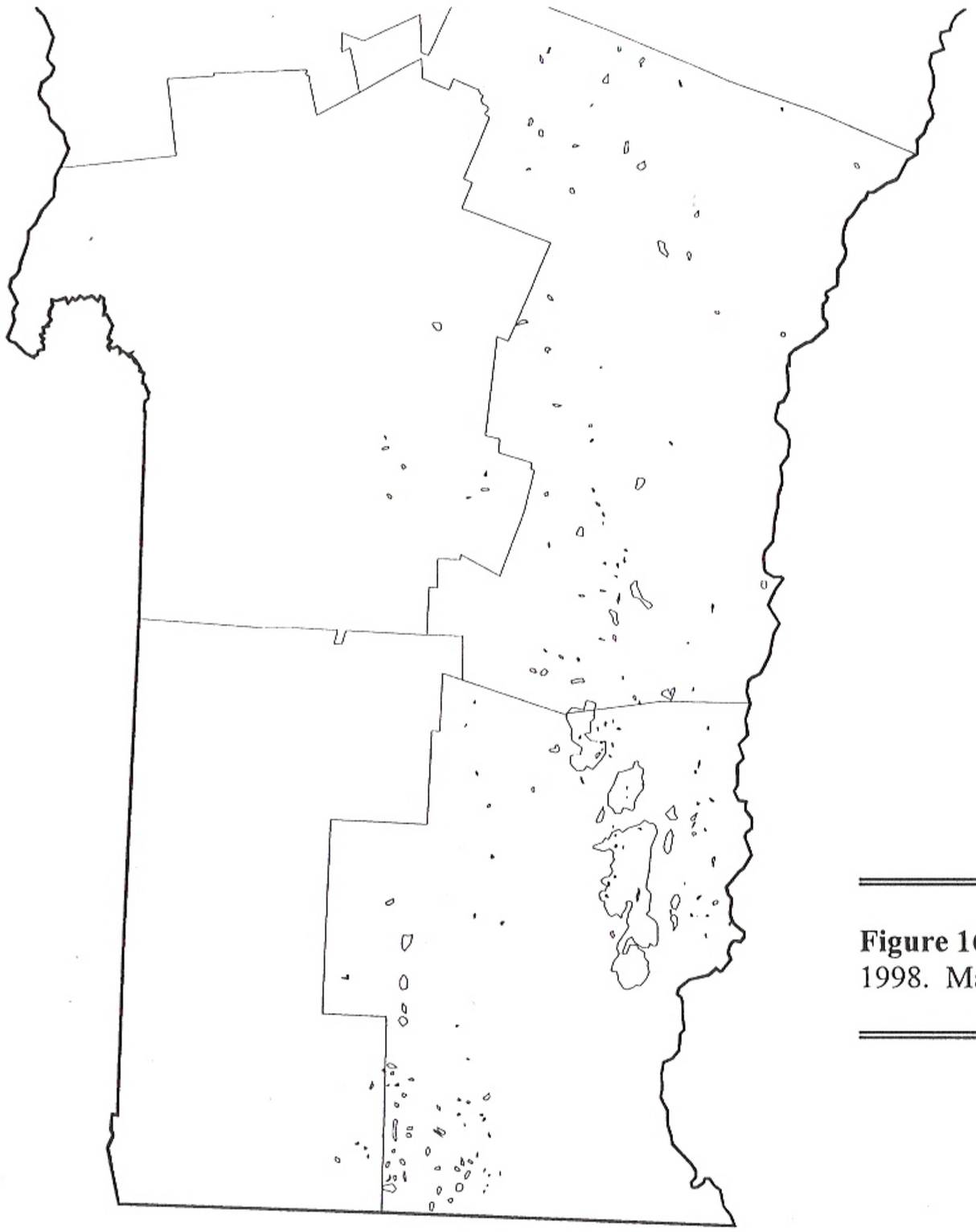


Figure 16. Mapped acres of pear thrips damage in 1998. Mapped area is 36,081 acres.

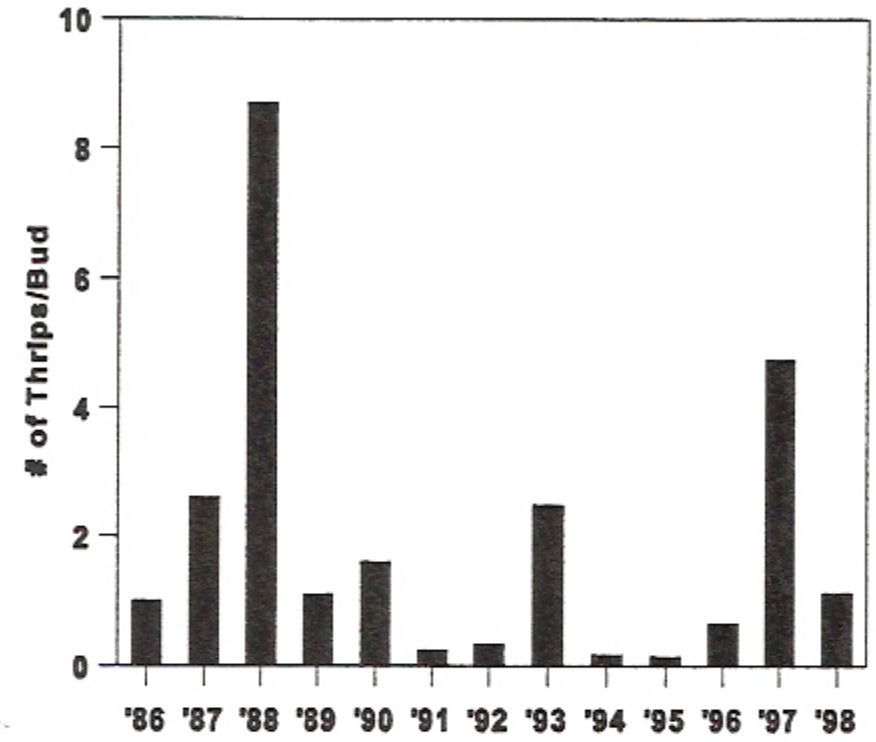


Figure 15. Spring thrips counts in buds of sugar maple in southern Vermont 1986-1998. Average of 2 sugarbushes in 1986, 5-6 sugarbushes 1987-1998 (100 understory buds/sugarbush).

Outside of the damage areas in southern Vermont, only light defoliation was observed. However, where overstory damage did not occur, thrips damage could be observed on sugar maple regeneration.

Table 6. Mapped acres of pear thrips damage in 1998.

County	Acres
ADDISON	2
BENNINGTON	246
RUTLAND	466
WINDHAM	30552
WINDSOR	4815
Grand Total	**36081**

Ground assessment of areas damaged by pear thrips and anthracnose also showed that damage was worse in the southeastern part of the region, as indicated by the transparency ratings made at eleven sites (Table 7). Transparency is a measure of the amount of light coming through foliated portions of the crown. Transparency averaged 20% in damaged areas compared to a normal of 5 or 10% for healthy, full-leafed sugar maples.

Table 7. Average transparency (amount of light coming through the foliated portion of the crown) of sugar maple foliage in southern Vermont sugarbushes damaged by pear thrips in 1998.

County	Town	Average transparency of five sugar maple trees	Average per County
Bennington	Pownal	14	15
	Sunderland	15	
Rutland	Clarendon	16	14
	Danby - East	16	
	Danby - West	10	
Windham	Dummerston	26	26
	Grafton	33	
	Marlboro	24	
	Whitingham	22	
Windsor	Bridgewater	22	22
	Reading	21	
Average		**20**	

The widespread anthracnose and continuing wet weather blighted much of the refoliation, so some damaged maple trees had little or no foliage all summer. New leaves which survived were mostly small and yellow because rainy weather interfered with the absorption of soil nutrients.

Overwintering soil counts indicate that pear thrips populations have increased slightly (Figure 17). Additional samples were made in Windham County sugarbushes which had received damage in 1998, to locate high populations for the UVM Entomology lab fungal pathogen study. Counts from that survey are in the table below (Table 8).

Table 8. Average # of pear thrips per 16 in^3 soil sample, collected in fall 1998, in six sugarbushes in southeastern Windham County with moderate-heavy damage in 1998.

Location	Average # of Thrips per Sample
Brattleboro	2.6
Guilford - North	1.4
Guilford - South	6.3
Newfane	4.8
Whitingham - North	0.2
Whitingham - South	2.2
Average for Damaged Windham County Stands	**2.9**
Average for Annual Statewide Survey	**1.2**

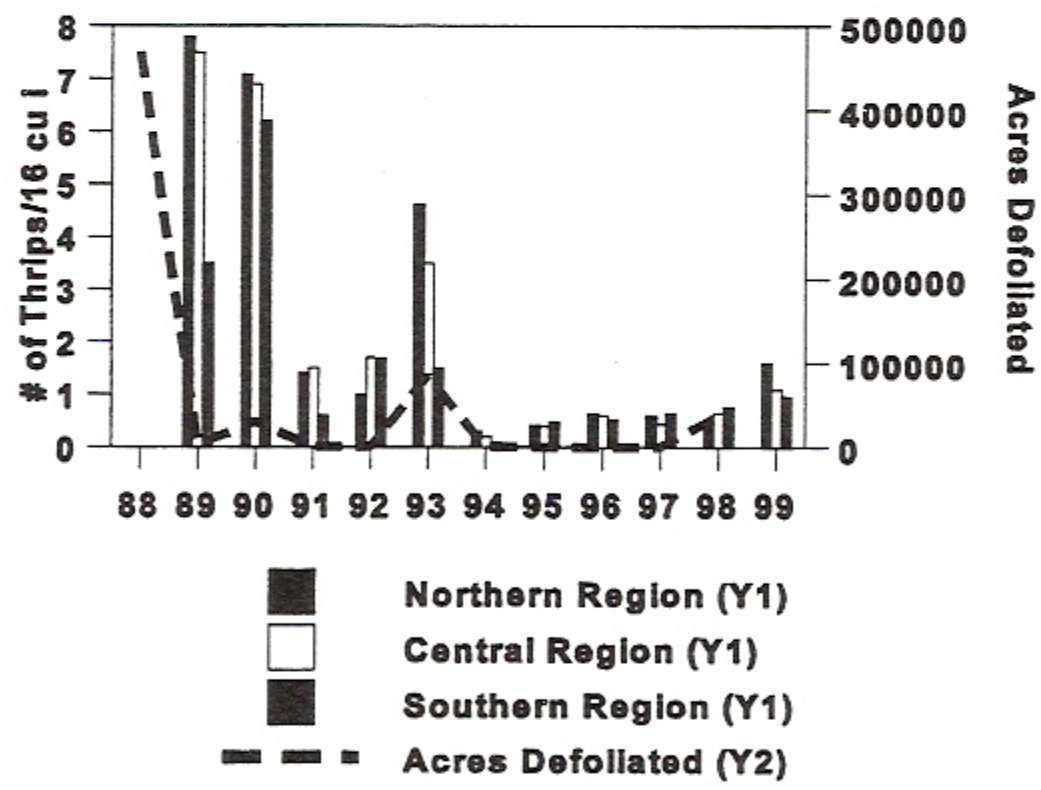


Figure 17. Average counts of overwintering pear thrips in soil samples (# of insects/16 in^3) by region of the state, compared to acres of thrips damage mapped statewide the following summer. Overwintering thrips numbers determined by extraction in 1989-93, and by forced emergence in 1994-1999. 41 sites were sampled in winter 1998-99.

"...'Vectored by thrips,' now what is a thrip, Roger, I don't even know that."

"Thrips," said Roger. "Even if you're talking about just one, it has an 's' on the end. Thrips are the insects that spread the virus among the peanut plants. Tiny little things, you can hardly see them."

"Well, damn their little souls, Roger," said Eula.

from Quite a Year for Plums by Bailey White, 1998

OTHER SAPSUCKING INSECTS, MIDGES, AND MITES

INSECT	HOST(S)	LOCALITY	REMARKS
Acorn Gall *Amphibolips prunus*	Oak	Waterbury Bristol	Ground under host trees littered with galls.
Aphids *Cinara sp.*	Balsam Fir White Pine	Widely scattered	Mostly light populations except for a large stressed ornamental fir in Morrisville with a very heavy infestation.
Aphids *Periphyllus sp.*	Sugar Maple	Scattered	Occasionally observed on young maples. Heavier populations than have been recently observed.
Aphids Species undetermined	Lilac Sugar Maple Paper Birch	Waterbury Springfield Fairlee Pittsfield Barre	Light populations.
Balsam Gall Midge *Paradiplosis tumifex*			See narrative.
Balsam Twig Aphid *Mindarus abietinus*			See narrative.

OTHER SAPSUCKING INSECTS, MIDGES, AND MITES			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Balsam Woolly Adelgid *Adelges piceae*			Not observed.
Beech Scale *Cryptococcus fagisuga*			See Beech Bark Disease.
Birch Budgall Mite *Aceria rudis*	Birch	Pittsford	Light population.
Birch Catkin Bug *Kleidocerys resedae*	European Birch	Manchester	Causing moderate damage to catkins.
Bowlegged Aphids *Cinara curvipes*	Balsam Fir	Barre	Extremely numerous on selected trees.
Cooley Spruce Gall Adelgid *Adelges cooleyi*	Blue Spruce White Spruce	Widely scattered	Some light to moderate damage on Christmas trees and ornamentals.
Cottony Maple Scale *Pulvinaria innumerabilis*	Red Maple	Rockingham	Ornamental.
Eastern Spruce Gall Adelgid *Adelges abietis*	White Spruce Red Spruce	Widespread	Mostly moderate damage to Christmas trees similar to past levels.
Eriophyid Mite *Aceria cinereae*	Butternut	Waterbury	Leaves and nuts affected.
Fletcher Scale *Parthenolecanium fletcheri*	Taxus	Montpelier	Heavy, persistent population on ornamentals.
Hemlock Woolly Adelgid *Adelges tsugae*			See narrative.

OTHER SAPSUCKING INSECTS, MIDGES, AND MITES			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Honeylocust Plant Bug *Diaphnocoris chlorionis*	Honeylocust	St. Albans	Damage amplified by presence of leafhoppers and other minor pests.
Lacebugs *Corythucha sp.*	Many	Throughout	Common.
Leafhoppers *Cicadellidae*	Maple	Barton	Ornamental tree.
Lecanium Scale *Lecanium sp.*			Not observed.
Maple Bladdergall Mite *Vasates quadripedes*	Silver Maple	Brandon	Common.
Maple Spindle Gall Mites *Vasates aceris-crumena*	Sugar Maple Red Maple	Widespread	Common this year.
Oak Apple Gall *Amphibolips confluenta*	Oak	Addison & Chittenden Counties	Collected as a novelty.
Oak Twig Gall *Callirhytis quercusgemmaria*	Red Oak	Essex Junction	Collected as a novelty.
Oystershell Scale *Lepidosaphes ulmi*			See narrative.
Pear Thrips *Taeniothrips inconsequens*			See narrative.
Pine Bark Adelgid *Pineus strobi*	White Pine	Cavendish Wilmington	Light populations. Elsewhere, populations back to trace levels.

OTHER SAPSUCKING INSECTS, MIDGES, AND MITES			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Pine Fascicle Mite *Trisetacus alborum*	White Pine	Widespread	Scattered light damage. Similar to 1997 levels.
Pine Leaf Adelgid *Pineus pinifoliae*	White Pine	Widely scattered	Mostly light populations on Christmas trees except for moderate level in a Craftsbury plantation. Increasing but no shoot mortality.
Pine Needle Midge *Contarinea baeri*	Scots Pine	Widely scattered	Decreasing. Some light to moderate needle loss in Christmas trees.
Pine Needle Scale *Chionapsis pinifoliae*			Not observed.
Pine Spittlebug *Aphrophora parallela*	White Pine Eastern Larch Mugo Pine	Widely scattered	Only trace levels detected on Christmas trees.
Pine Thrips *Gnophothrips sp.*	Scots Pine		Light damage detected in only one Christmas tree plantation. Decreasing.
Pine Tortoise Scale *Toumeyella parvicornis*	Scots Pine	Barre	Not detected at this site, for the first time in several years.
Psyllids Species undetermined	Alder Amelanchier	Newbury Woodstock	Psyllids initiated galls to form on alder leaves.
Ragged Spruce Gall Aphid *Pineus similis*	Red Spruce	Widespread	Remains common.

OTHER SAPSUCKING INSECTS, MIDGES, AND MITES			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Root Aphid *Prociphilus americanus*	Balsam Fir	Poultney	Observed on Christmas trees.
Snowball Aphid Viburnam *Neoceruaphis viburnicola*	Snowball County	Chittenden	Decreasing.
Spruce Gall Aphid *Adelges lariciatus*			Not observed.
Spruce Gall Midge *Mayetiola piceae*	Spruce	St. Albans Fairfax	Heavy on individual trees in Christmas tree plantation.
Spruce Spider Mite *Oligonychus ununguis*	Conifers	Throughout	Populations and damage very low, probably due to heavy spring rains.
Tarnished Plant Bug *Lygus lineolaris*	Various Ornamentals	New Haven	Moderate population.
Woolly Alder Aphid *Prociphilus tessellatus*	Alder	Lamoille Halifax Reading Elmore	Common on alder in the fall. Not observed on silver maple.
Woolly Beech Aphid *Phyllaphis fagi*	Beech	Bennington	On Mt. Anthony.
Woolly Elm Aphid *Eriosoma americana*			Not observed.

BUD AND SHOOT INSECTS

Balsam Shootboring Sawfly, *Pleroneura brunneicornis*, populations increased dramatically in 1998 to the highest levels ever seen in northern Vermont. In southern Vermont, light damage was observed in plantations located where native fir is common.

Many Christmas tree growers who had not experienced damage from this insect in the past had noticeable damage this year. Most fir plantations examined during the regular northern Vermont Christmas tree survey received moderate damage (190 acres), while 57 acres had light damage and 12 acres had heavy damage. A more intensive damage evaluation (20 trees/plt., 40 buds/tree) was conducted for 13 fraser fir and 9 balsam fir plantations in Caledonia, Franklin, Lamoille, Orleans, and Washington counties. This showed that fraser fir bud kill ranged from 11 to 57 percent per plantation and averaged 30 percent, while balsam bud-kill ranged from 6 to 58 percent and averaged 22 percent. Some individual trees had as many as 88% of their buds killed. Similar surveys have been conducted in approximately the same plantations since 1994, confirming that 1998 had the heaviest damage.

Shootboring sawfly adults began emerging and laying eggs the first week in May in Lamoille County. With continued warm weather, they continued to lay eggs over the next two weeks, with a peak of activity about May 8. This was three weeks earlier than in 1997 but similar to 1995. Adults caught on 3" x 5" yellow sticky cards placed in mid-crowns of trees in four Lamoille County plantations averaged 73 per card compared to 0.30 in 1997 and 3.1 in 1996.

Larvae drop from damaged shoots to the soil in late May to early June. This has been monitored for the past three years in one Wolcott plantation and confirmed that 1998 population levels were the highest ever seen. Larvae averaged 3.7 per square foot this year compared to 0.06/ft^2 in 1996.

Control was difficult to obtain this year due to the abundance of adults over a long period of time. One Morrisville grower made three applications of Lorsban during May to kill adults and still ended up with an average of 25% bud kill. Larvae can be killed within shoots if trees are sprayed with Diazinon A6500 or Lorsban just before they begin dropping to the soil. For balsam fir, this is just as lilacs are blooming. It is probably a week or two later for fraser fir. Killing larvae may not reduce damage the following year because some of the insects spend more than one year in the soil but could be the best long-term maintenance strategy, unless a border of larger balsams are the primary source of the insects. Growers should expect lighter damage in 1999.

OTHER BUD AND SHOOT INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Balsam Fir Sawyer *Monochamus marmorator*	Balsam Fir	Barre Town Weston	Single individual found October 1. Light feeding.
Balsam Shootboring Sawfly *Pleroneura brunneicornis*			See narrative.

OTHER BUD AND SHOOT INSECTS			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Eastern Pine Shoot Borer *Eucosma gloriola*			Not observed.
European Pine Shoot Moth *Rhyacionia buoliana*			Not observed.
Locust Twig Borer *Ecdytolopha insiticiana*	Black Locust	Dummerston Monkton	Heavy on some trees.
Pine Gall Weevil *Podapion gallicola*	Red Pine	Orange County Pittsford	Remains present at previously known locations. Associated with thin crowns on some trees.
Pitch Nodule Maker *Petrova albicapitana*	Scots Pine	Orleans	On a Christmas tree.
Tree Cricket *Oecanthus sp.*	Arborvitae	Bennington	Nursery.
Twig Pruner *Anelophus (= Elaphidionoides villosus)*	Red Oak	Addison County Hartland Tunbridge Highgate Tinmouth Springfield	Small groups of trees affected.
White Pine Weevil *Pissodes strobi*	Blue Spruce White Pine Scots Pine White Spruce	Throughout	Occasionally heavy. Scattered damage in Christmas tree plantations. Flagging occurred earlier than normal.

BARK AND WOOD INSECTS

The **Asian Longhorned Beetle**, *Anoplophora glabripennis*, has not been found in Vermont, but public interest in this beetle remains high. Six Lindgren funnel traps baited with a home-brewed apple-beer mash were placed in six sites in Addison, Chittenden, Franklin, and Grand Isle counties to attract this beetle or other wood-boring beetles. All traps were negative for long-horned beetles or other wood borers. Because of the potential damage to Vermont's urban forests from this exotic pest, continued monitoring will take place.

OTHER BARK AND WOOD INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Allegheny Mound Ant *Formica exsectoides*	Balsam Fir	Concord Albany	Killing Christmas trees.
Ambrosia Beetle *Xyleborus dispar*	"Emerald" Maple	Tunbridge	Adults emerged from ornamental maple.
Ambrosia Beetle *Xyloterinus politus*	Sugar Maple Firewood	Marlboro Monkton	Adults recovered from firewood.
Ambrosia Beetle *Scolytidae*	White Birch	Bridgewater	Light damage.
Ash and Lilac Borer *Podesia syringae*	Green Ash	Brattleboro	Young trees in parking lot.
Asian Longhorned Beetle *Anoplophora glabripennis*			See narrative.
Bark Lice *Psocids*	White Pine	Ferrisburg	Forested area.
Bronze Birch Borer *Agrilus anxius*	White Birch	Scattered throughout	Occasional damage observed. If on ornamentals, heavier on European birches.
Carpenter Ant *Camponotus sp.*	Coniferous Slabwood	Brattleboro	Mistaken as termites by landowner.

OTHER BARK AND WOOD INSECTS			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Eastern Larch Beetle *Dendroctonus simplex*	Eastern Larch	Widespread	Remains common on scattered larch, killing stressed trees in certain locations, especially in the Northeast Kingdom.
Elm Bark Beetles *Hylurgopinus rufipes* *Scolytus multistriatus*			See Dutch Elm Disease.
Hemlock Borer *Melanophila fulvoguttata*			Not observed.
Hister Beetle *Hololepta sp.*	Hardwood	Essex Junction	These beetles are predacious and were undoubtedly feeding on some other insect that had invaded the log.
Longhorned Beetle *Clytus ruricula*	Decaying hardwood	Tunbridge	Single individual collected.
Longhorned Beetle *Phymatodes dimidiatus*	Spruce	Orange	Single individual collected.
Northeastern Sawyer *Monochamus notatus*	Conifers	Scattered	Fewer specimens than 1997.
Northern Pine Weevil *Pissodes approximatus*	White Pine	Reading	Dying trees.
Pales Weevil *Hylobius pales*			Not observed.
Pear Blight Beetle *Xyleborus dispar*	Norway Maple "Emerald Queen"	Tunbridge	Attacking stressed, recently planted trees.

OTHER BARK AND WOOD INSECTS			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Pigeon Tremex *Tremex columba*	Sugar Maple	Wallingford Monkton Putney North Fayston	Found in unhealthy trees cut for firewood.
Pine Engraver *Ips pini*	Red Pine White Pine	Pawlet Whitingham	Associated with mortality on ledgey site. Hedge.
Pitted Ambrosia Beetle *Corthylus punctatissimus*			Not observed.
Red Turpentine Beetle *Dendroctonus valens*	Red Pine White Pine	Tunbridge Pawlet Pittsford Manchester Sharon	Decreasing in stand where it was found last year, following initial infestation in 1995-96. No foliar symptoms observed. Associated with mortality on ledgey site. Plantation trees with thin crowns. Inciting stress unknown. Stressed tree.
Round-headed Apple Tree Borer *Saperda candida*	Apple Mountain Ash	Washington & Chittenden Counties Danville Pawlet Andover	Occasional problem on ornamentals.
Sawyer *Monochamus sp.*	Balsam Fir	Widely scattered	Damage detected in only one Christmas tree plantation this year.

OTHER BARK AND WOOD INSECTS			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Sugar Maple Borer *Glycobius speciosus*	Sugar Maple	Widespread	Common cause of defect on slow-growing maples. Several calls confused with Asian Longhorned Beetle.
Whitespotted Sawyer *Monochamus scutellatus*	White Pine Spruces Balsam Fir	Throughout Wilmington	Only a few adults seen compared to many in 1997. Wounded ornamentals.
Zimmerman Pine Moth *Dioryctria zimmermanni*			Not observed.

FRUIT, NUT, AND FLOWER INSECTS

FRUIT AND FLOWER INSECTS			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Butternut Curculio *Conotrachelus juglandis*	Butternut	Stowe	Single tree.
Rose Chafer *Macrodactylus subspinosus*	Roses	Widespread	Very common this year.
Western Conifer Seed Bug *Leptoglossus occidentalis*	Balsam White and other Pines White Spruce Hemlock	Bennington Monkton Rupert Springfield Castleton Lincoln Pittsford Waterbury	Readily entering homes and other structures for overwintering; not observed feeding on scales or seed pulp of conifer seeds.

ROOT INSECTS

ROOT INSECTS			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Asiatic Garden Beetle *Autoserica castanea*	Many	Montpelier Burlington	Scattered reports.
Broad-necked Root Borer *Prionis laticollis*	Hardwoods	Essex Junction	Insect observed at large.
Conifer Swift Moth *Korsheltellus gracilis*			Not observed.

MISCELLANEOUS INSECTS DIPTERA: FLIES			
INSECT	**HABITAT**	**LOCALITY**	**REMARKS**
Cluster Flies *Pollenia rudis*	Household	Statewide	Average number of inquiries received.
Dark-winged Fungus Gnats *Sciara sp.* Family Sciaridae	Household	Montpelier Danville Morrisville	Associated with house plants.
Dung Flies *Leptocera sp.* Family Sphaeroceridae	Household	Montpelier	Common around windows for period of days.
Fruit Flies *Drosophila sp.*	State buildings	Montpelier	Found in large numbers until food source was discovered and eliminated.
Gall Gnats Family Cecidomyiidae	On window screen	Grafton	Present in large numbers, causing homeowner concern.
"Humpbacked" Flies Family Phoridae	Buildings	Rockingham	Adults associated with decaying vegetation.
Little House Flies *Fannia sp.*	State buildings	Northfield	Found flying aimlessly around the center of the room in a "jerky zig-zag manner."
March Flies Family Bibionidae	Duff layer (larvae) Covering everything in backyard (adults)	Lyme, NH (larvae) Milton (adults)	Larvae were being fed upon by bears; adults were found in tremendous numbers over a period of 1-2 days.

MISCELLANEOUS INSECTS

DIPTERA: FLIES

INSECT	HABITAT	LOCALITY	REMARKS
Phantom Crane Fly Family Ptychopteridae	Aquatic habitat	Bolton	In flight, only the white leg bands may be visible, making the insect look phantom-like.

MISCELLANEOUS INSECTS

HYMENOPTERA: ANTS, BEES, AND WASPS

INSECT	HABITAT	LOCALITY	REMARKS
Agapostemon virescens Family Halictidae	In ground	Starksboro Waterbury	Concern whether these showy metallic ground-dwelling bees would attack humans.
Carpenter Ants *Camponotus sp.*	Household	Morrisville New Haven Plainfield Bolton Waterbury Essex Junction Rutland Middlebury	Roaming individuals and swarms reported.
Carpenter Bee *Xylocopa virginica*	In bee hive	Waterbury	Carpenter bee had entered honeybee hive, presumably for some free honey.
Cornfield Ants *Lasius sp.*	At large in and around homes and other buildings, on windshields, sidewalks, and elsewhere	Morrisville	Present in large numbers in August and September during mating flights.
Honeybee Swarm *Apis mellifera*	At large	Barton	Large swarm of bees reported in lumber mill.

MISCELLANEOUS INSECTS

HYMENOPTERA: ANTS, BEES, AND WASPS

INSECT	HABITAT	LOCALITY	REMARKS
Pavement Ants *Tetramorium caespitum*	At large in public buildings	Burlington White River Junction	Found foraging in heated buildings throughout the year, though present in largest numbers in the summer.

MISCELLANEOUS INSECTS

COLEOPTERA: BEETLES

INSECT	HABITAT	LOCALITY	REMARKS
Bumble Flower Beetle *Euphoria inda*	On Oak	North Springfield	Larvae live in decaying wood; adults feed on fruit. It wasn't clear whether these specimens were actively feeding, or just resting on the oak.
Carpet Beetles, including *Attagenus megatoma, Anthrenus scrophulariae, Dermestes lardarius* and others Family Dermestidae	Stored food and textiles	Fayston Morrisville Montpelier Bolton Marshfield Moretown Waterbury Center	Dermestids of several species were found feeding on a variety of plant and animal products, including stored food products, hides, and rugs. *Dermestes lardarius* was found in cedar siding.
Carrion Beetles *Necrodes surinamensis*	At large in home	Barre	Associated with dead rodent.
Drugstore Beetle *Stegobium paniceum*	Stored food products	Morrisville	Heavy damage to stored foods.

MISCELLANEOUS INSECTS COLEOPTERA: BEETLES			
INSECT	**HABITAT**	**LOCALITY**	**REMARKS**
Ground Beetles including *Harpalus pennsylvanicus* and several other species Family Carabidae	At large	Hardwick Waterbury	Inquiries about ground beetles were common. Several specimens were collected in homes. Most carabids are predaceous on other insects.
Lampyrid Beetles Family Lampyridae	Various substrates	Statewide	These common beetles often show up in sap buckets in early spring, but are regularly seen on tree trunks and other surfaces.
Lily Leaf Beetle *Lilioceris lilii*	Lilies	Franklin	First Vermont record of this European insect (introduced into Canada around Montreal in the 1940s). Both adults and larvae feed on lily foliage, usually leading to death of the plants.
Minute Brown Scavenger Beetles *Corticaria fulva* Family Lathridiidae	In home	Fayston Georgia	Associated with moist building conditions.
Multicolored Asian Lady Beetle *Harmonia axyridis* Family Coccinellidae	In homes	Statewide	Many inquiries received, particularly during the final weeks of October, when lady beetles were entering homes by the hundreds.
Rice Weevil *Sitophilus oryza*	Rice	Morrisville	Heavy infestation in stored products in home.

MISCELLANEOUS INSECTS COLEOPTERA: BEETLES			
INSECT	**HABITAT**	**LOCALITY**	**REMARKS**
Sap Beetles *Glischrochis sanguinoleatus* Family Nitiduidae	Red Pine	Pawlet Monkton	These showy beetles were associated with bark beetle damage.
Sawtoothed Grain Beetle *Oryzaephilus surinamensis*	Stored food products	St. Johnsbury	Heavy infestation in stored products in home.
Soldier Beetle *Podabrus sp.* Family Catharidae	At large	Warren	Adult soldier beetles are usually found in flowers; larvae are predaceous on other insects.

OTHER MISCELLANEOUS INSECT ORDERS			
INSECT	**HOST**	**LOCALITY**	**REMARKS**
Assassin Bug Family Reduvidae Order Hemiptera	Found on tree	Rutland	Found on Norway spruce where it was feeding on insects.
Baltimore Butterfly Caterpillars *Euphydryas phaeton* Order Lepidoptera	Feeding on turtlehead leaves	Montpelier	Numerous larvae observed at this location over several years, with good adult emergence later in season.
Book Lice Order Psocoptera	In building	Burlington	Collected on sticky traps used to monitor insects in buildings.
Caddisflies Order Trichoptera	At large	Shaftsbury Monkton	Attention was drawn to large groups of adults present in woodland setting.

OTHER MISCELLANEOUS INSECT ORDERS			
INSECT	**HOST**	**LOCALITY**	**REMARKS**
Dobsonflies *Corydalus cornutus* Order Neuroptera	Around lights	South Royalton Waterbury	Drawing attention because of their large size.
Earwigs Order Dermaptera	Household	East Montpelier New Haven Danville	Populations very persistent and insidious for some homeowners.
Giant Water Bugs Belostomatidae Order Hemiptera	In ponds	Plainfield Bolton Starksboro	People who submitted these specimens wanted information about their habits and whether they could hurt humans.
Indian Meal Moth *Plodia interpunctella*	Stored products	Newport Burlington Swanton Montpelier Orleans	Infestations discovered when moths became plentiful.
Lacewings Order Neuroptera	On leaves of various trees and shrubs	Hardwick	Adults feeding on aphids.
Masked Hunter *Reduvius personatus* Order Hemiptera	In buildings	Burlington Corinth Waterbury	Specimens were al nymphs, "camouf-laged" with dust and lint, hence the name masked.
Snow Fleas (Springtails) *Hypogastrura nivicola* Order Collembola	Snow	Montpelier Burlington Morrisville Norwich Brattleboro Bradford	Found in very large numbers on snow.
Stoneflies Order Plecoptera	In buildings	Huntington White River Junction	In large numbers on window screens.

OTHER MISCELLANEOUS INVERTEBRATES			
INVERTEBRATE	**HABITAT(S)**	**LOCALITY**	**REMARKS**
Centipedes *Scutigera coleoptrata* (House centipede) *Geophilus vittatus*	In homes In rotting beech	Montpelier Vergennes Jericho	Causing concern for homeowners. Large centipede submitted to lab for identification.
Clover Mites *Bryobia praetiosa*	Entering homes	Rutland South Burlington	Entering homes in large numbers, causing homeowner concern.
Gordian, or Horsehair, Worms Nematomorpha	Swimming pool	Springfield	Concern over whether this threadlike, unsegmented worm was problematic for humans.
Millipedes Order Diplopoda	On house	Essex	For second year, found in tremendous numbers climbing up sides of home.
Pseudoscorpions Order Pseudoscorpiones	In homes	Woodstock Danville	Observed on walls in homes.
Sowbugs Order Isopoda	In soil	Montpelier Fair Haven	Landowners concerned about whether sowbugs could damage wood.
Spiders Order Araneae			See separate table.
Ticks Order Acari			See separate table.
Velvet Mite Family Trombidiidae	At large	Moretown	Adult mites eat insect eggs; larvae are parasites of insects and other arthropods.

PESTS OF HUMANS AND OTHER ANIMALS			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Bed Bugs *Cimex lectularious*	In bedding	Burlington	Insect not found feeding, but caused concern of homeowner.
Filarial Worms, possibly *Wehrdikmansia cervipedis*	Deer hocks	Springfield	Worms evacuated venison when deer hocks were boiled.
Fleas *Ctenocephalides spp.*	Cats and dogs	Statewide	As in past years, some fleas were recovered from traps in state buildings.
Horsefly *Hymbomytria cinta*	Horse	Chesterfield, NH	These showy horseflies were plaguing a horse and worrying the owner.
Tapeworms Class Cestoda	Cat	Monkton	Proglottids of this parasite were received at the Forest Biology Lab for identification.

TICKS			
TICK	**HOST**	**LOCALITY**	**DATES COLLECTED**
America Dog Tick *Dermacentor variabilis*	Dog Human	Lincoln Vergennes Lincoln	6/8/98 5/9/98 11/9/98
Deer Tick *Ixodes scapularis*	Dog Human	Morrisville Lincoln Putnam, CT	1/19/98 11/22/98 5/11/98
Lone Star Tick *Amblyomma americanum*	Human	Williamsburg, VA	5/8/98
Woodchuck Tick *Ixodes cookei*	Human	Western NY	6/25/98

SPIDERS			
SPIDER	**HABITAT**	**LOCALITY**	**REMARKS**
Argiope *Argiope trifasciata*	Flowering Meadow	Huntington Richford	Showy spiders that prefer sunny sites among shrubbery, tall plants, and flowers.
Barn Spiders *Araneus cavaticus*	Under ceiling on porch	Morrisville Rochester	Found in shady locations; egg masses were attached to shady supports near web.
Crab Spider *Misumena vatia*	In flower garden	Barre City Swanton	These spiders may be white or yellow, depending on the color of the flower on which they reside.

SPIDERS			
SPIDER	**HABITAT**	**LOCALITY**	**REMARKS**
Cross or Garden Spider *Araneus diadematus*	On house	Hardwick	Common orb weaver that eats remains of previous night's web and spins a new web each night.
Fishing Spiders *Dolomedes tenebrosus*	At large	Springfield Claremont, NH Montpelier Fair Haven Moretown Waterbury Barre City	These spiders hunt for prey on water surface, in water, and on land.
Grass Spiders Family Agelenidae	At large	Hardwick	Quick-moving spiders that build funnel webs.

WOOD PRODUCTS INSECTS			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Carpenter Ants *Camponotus spp.*	Structural Wood Firewood	Throughout	Many sightings, including two situations where numerous alates were present in homes.

Forest Diseases

STEM DISEASES

Beech Bark Disease, caused by *Cryptococcus fagisuga* and *Nectria coccinea* var. *faginata*, symptoms were mapped on only 752 acres during aerial surveys. Although beech bark disease remains common, symptoms were not as visible because ample moisture was available. Also, symptoms of other health problems were widespread, and masked the scattered symptomatic beech.

Table 9. Mapped acres of damage from beech bark disease in 1998.

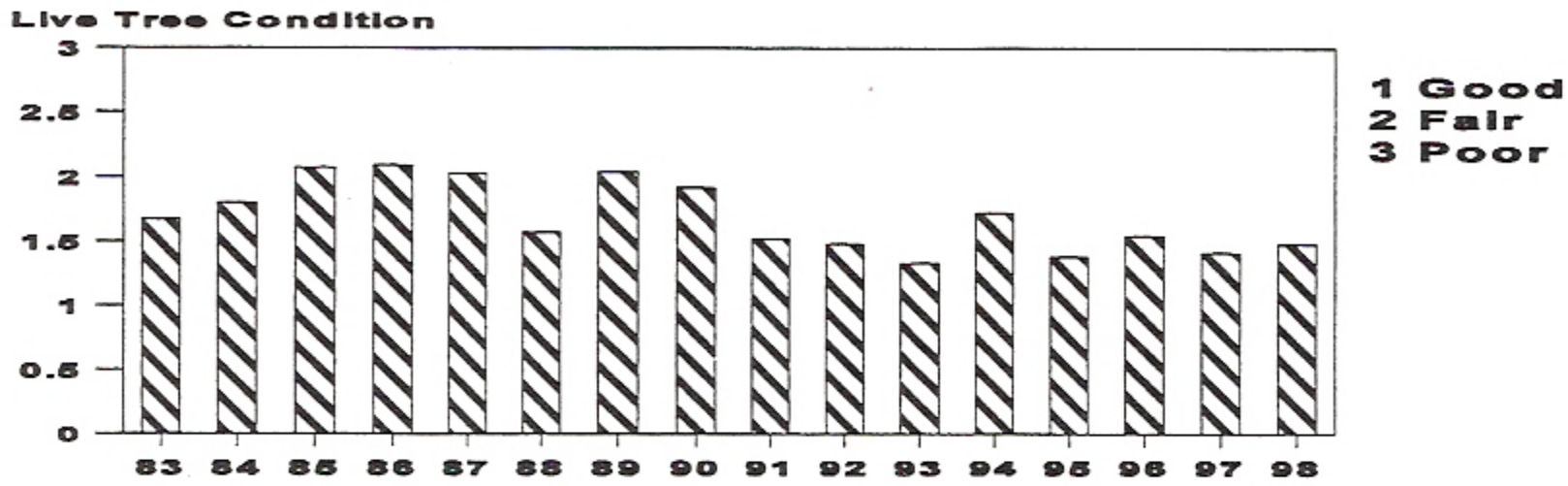
County	Acres
ADDISON	56
CHITTENDEN	61
ESSEX	68
ORLEANS	200
WASHINGTON	367
Grand Total	**752**

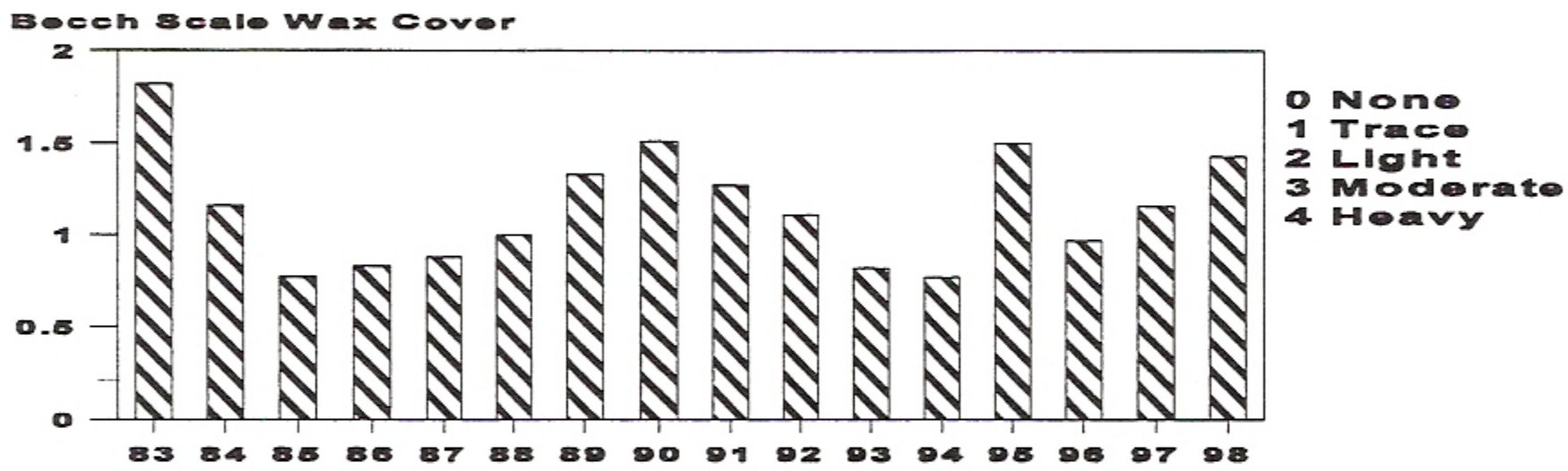
In monitoring plots, there were some increases in beech scale, probably due to the mild winter of 1997-98, but there was little change in tree condition or abundance of Nectria (Figure 18).

Delphinella Tip Blight of Fir, caused by *Delphinella balsamae*, continued to cause some needle loss and shoot mortality in the five northern Vermont balsam fir plantations where it was known to occur, but damage was generally less than in 1997. Mostly moderate damage was observed, compared to moderate to heavy damage in 1997. Light damage was detected in southern Vermont. Trees can be protected by applying Cleary's Protect T/O fungicide shortly after budbreak, and again 10 days later.

Diplodia (Sphaeropsis) Tip Blight, caused by *Sphaeropsis sapinia*, caused widespread scattered shoot mortality of pine and fir throughout the Christmas tree survey area again this year. Frequency of the disease was greater than that seen in 1996. The tip blight was detected in 48% of the fir plantations, and 61% of the pine plantations surveyed. It was also detected on balsam fir in southern Vermont.

Scleroderris Canker, caused by *Asocalyx abietina*, has not been found in any new towns since 1986. A total of 17 pine Christmas tree plantations within the quarantine zone were surveyed for the presence of the disease this year (Figure 19). All were found free of the disease.





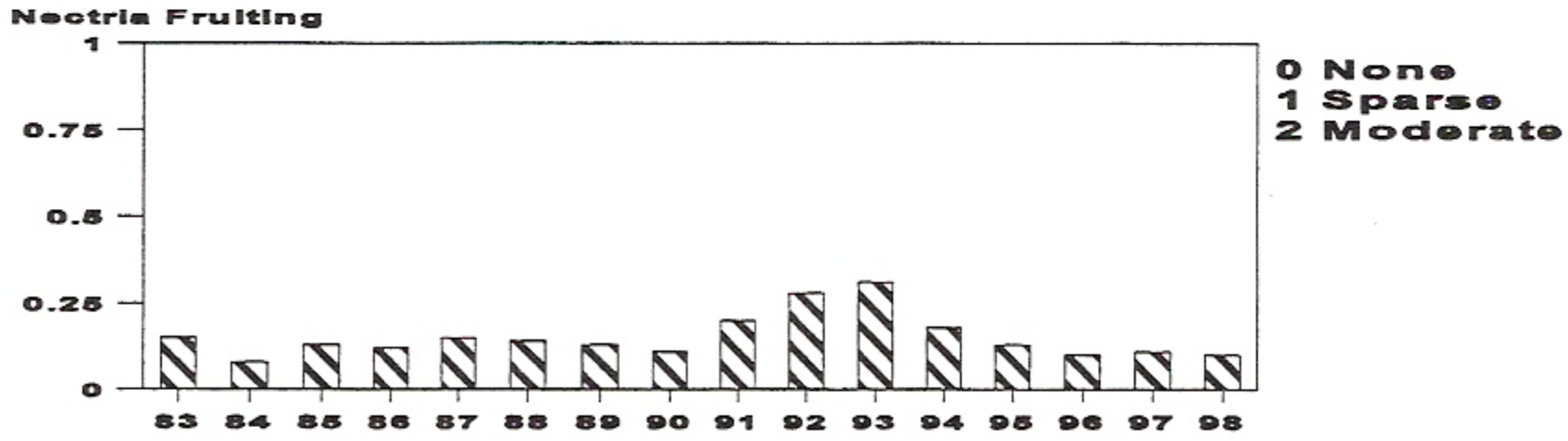


Figure 18. Average live tree condition, beech scale wax cover, and Nectria fruiting ratings, 1992-1998. Average of three southern Vermont locations, 1983-1992, and six to eight locations statewide, 1993-1998.

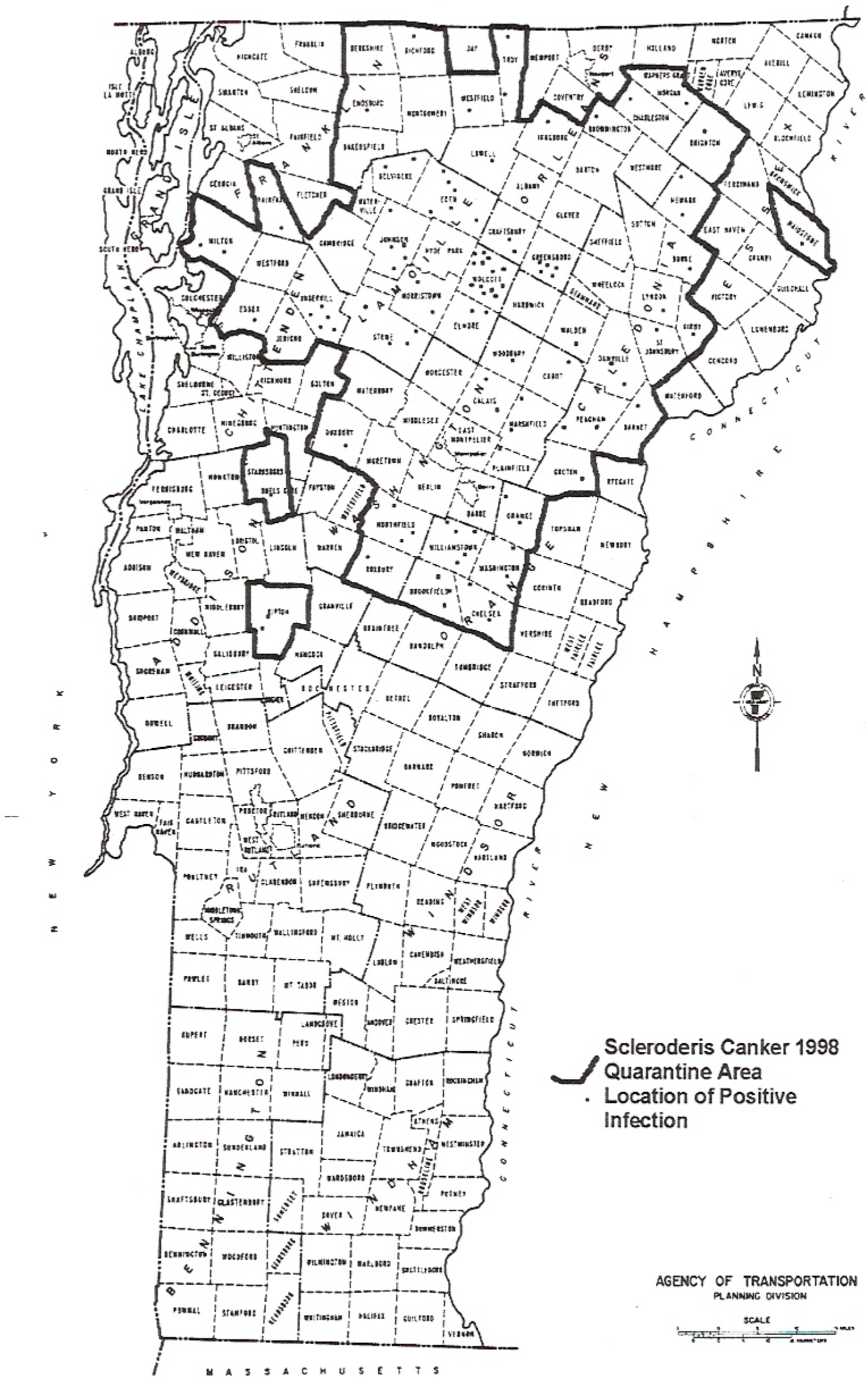


Figure 19. 1998 Scleroderris canker quarantine area and locations of positive infections.

OTHER STEM DISEASES			
DISEASE	**HOST(S)**	**LOCALITY**	**REMARKS**
Annual Canker *Fusarium sp.*			No new reports.
Ash Yellows *Mycoplasma-like organism*	White Ash	Cavendish	Scattered dieback. Elsewhere, stable levels.
Beech Bark Disease *Cryptococcus fagisuga* and *Nectria coccinea var. faginata*			See narrative.
Black Knot *Dibotryon morbosom*	Black Cherry	Ira	Lower 1/3 of an ornamental affected. Remains common elsewhere.
Botryodiplodia Canker *Botryodiplodia sp.*	American Elm	Waitsfield	Found on a single large elm, associated with Nectria canker causing dieback.
Botryosphaeria Canker *Botryosphaeria spp.*	Red Oak Butternut	Tunbridge Greensboro	Invading stems of newly-planted trees. Invading trees stressed by too much water.

OTHER STEM DISEASES			
DISEASE	**HOST(S)**	**LOCALITY**	**REMARKS**
Butternut Canker *Sirococcus clavigignenta-juglandacearum*	Butternut	Hancock Throughout	Collection of healthy tree scions were made for NH Division of Forests & Lands grafting project. FHP-DFO reports that the trees in resistant planting are generally healthy. Remains a common cause of mortality. Trees without cankers occasionally observed in heavily-infected stands.
Caliciopsis Canker *Caliciopsis pinea*	White Pine	Throughout	Common, especially in Orange County, but no foliar symptoms seen.
Camouflage Fungus *Fomes robustus*	Hemlock	Wardsboro	Previously-logged stand.
Cedar Apple Rust *Gymnosporangium juniperi-virginianae*	Red Cedar	Springfield Pawlet	10 year old trees. Tree removed.
Chestnut Blight *Cryphonectria parasitica*	American Chestnut	Andover Stockbridge	Two individuals which had escaped the disease are now blighted.
Coral Spot Nectria *Nectria cinnabarina*	Sugar Maple	Plymouth Reading	Fruiting common on ice-damaged material.
Crown Gall *Agrobacterium tumifaciens*	Balsam Fir	Bennington County	8" diameter gall on Christmas tree.

OTHER STEM DISEASES			
DISEASE	**HOST(S)**	**LOCALITY**	**REMARKS**
Cytospora Canker *Leucostoma kunzei*	Blue Spruce Norway Spruce	Lyndonville Stowe Rockingham	A few calls this year.
Delphinella Tip Blight of Fir *Delphinella balsamae*			See narrative.
Diplodia Shoot Blight *Diplodia pinea (Sphaeropsis pinea)*			See narrative.
Dutch Elm Disease *Ophiostoma ulmi*	Liberty Elm American Elm	Montpelier Weston Throughout	Although liberty elm, is a resistant American elm, it is not immune to the disease. Appears stable. Mortality of young roadside elms common.
Eastern Dwarf Mistletoe *Arceuthobium pusillum*			No new reports.
Fireblight *Erwinia amylovora*	Apple Mountain Ash	Essex, Caledonia & Orleans Counties	Several calls on ornamentals.
Hypoxylon Canker *Hypoxylon pruinatum*	Aspen	Throughout	Remained a common cause of tree mortality and breakage, especially during the January ice storm.
Kabatina Blight *Kabatina juniperi*	Spreading Juniper Blue Rug Juniper	Randolph Shoreham Williston	Found in landscape and garden center locations.

OTHER STEM DISEASES			
DISEASE	**HOST(S)**	**LOCALITY**	**REMARKS**
Lilac Blight *Pseudomonas syringae*	Lilac	Newfane	Increased occurrence due to heavy spring rains.
Maple Canker *Steganosporium ovatum*			Not observed.
Nectria Canker *Nectria sp.*	American Elm	Waitsfield	Found on large American elm, associated with Botryodiplodia canker. Elsewhere, similar to other years.
Oak Wilt *Ceratocystis fagacearum*			Not observed. No suspects seen during aerial surveys.
Phomopsis Twig Blight *Phomopsis sp.*	Eastern Red Cedar	Addison County	Increasing.
Red Ring Rot *Phellinus pini*	White Pine	Throughout	Common cause of volume loss in logging operations.
Sapstreak *Ceratocystis coerulescens*	Sugar Maple	Middletown Springs	Near woods road.
Scleroderris Canker *Asocalyx abietina*			See narrative.
Sirococcus *Sirococcus strobilinus*	Red Pine	Peacham	Remains present at Blake Hill. Trace levels in Christmas tree plantations.
Tomentosus Butt Rot *Inonotus tomentosus*			See Root Diseases.

OTHER STEM DISEASES			
DISEASE	**HOST(S)**	**LOCALITY**	**REMARKS**
Valsa Canker *Valsa sp. (Cytospora sp.)*	Sugar Maple	Irasburg	Commonly affects dead and weakened tissue.
Verticillium Wilt *Verticillium albo-atrum* or *V. dahliae*	Sugar Maple	Charlotte Burlington Essex	Found on ornamental sugar maples.
Volutella Blight *Volutella pachysandricola*	Pachysandra	Montpelier	Can cause damage to pachysandra beds especially in springs after heavy snow cover.
White Pine Blister Rust *Cronartium ribicola*	White Pine	Castleton Cavendish Wilmington Dorset	Increase in requests relative to ornamentals. Elsewhere, common. Requests also increasing for information about planting resistant currants.
Willow Blight *Venturia saliciperda*	Weeping Willow	Derby	Caused defoliation and twig dieback, increased occurrence during wet season.
Woodgate Gall Rust *Endocronartium harknessii*	Scots Pine	Throughout	Remains common. Found in 50% of Scots pine Christmas tree plantations during the northern Vermont survey.
Yellow Witches Broom Rust *Melampsorella caryophyllacearum*	Balsam Fir	Throughout	Remains common.

FOLIAGE DISEASES

Anthracnose and other hardwood foliage diseases were widespread statewide, with damage heaviest on sugar maple, paper birch, and yellow birch. Damage to sugar maples was particularly severe in southern Vermont, from Jamaica, south. Paper birch damage was worst in the Northeast Kingdom, with many trees completely brown by late summer. Wet weather in the spring, and recurrent periods of wet weather throughout the summer allowed early primary infections, and frequent re-infections. By the late August aerial survey, browning was so widespread that the forest in the south-central hills was mottled green and brown as far as the eye could see.

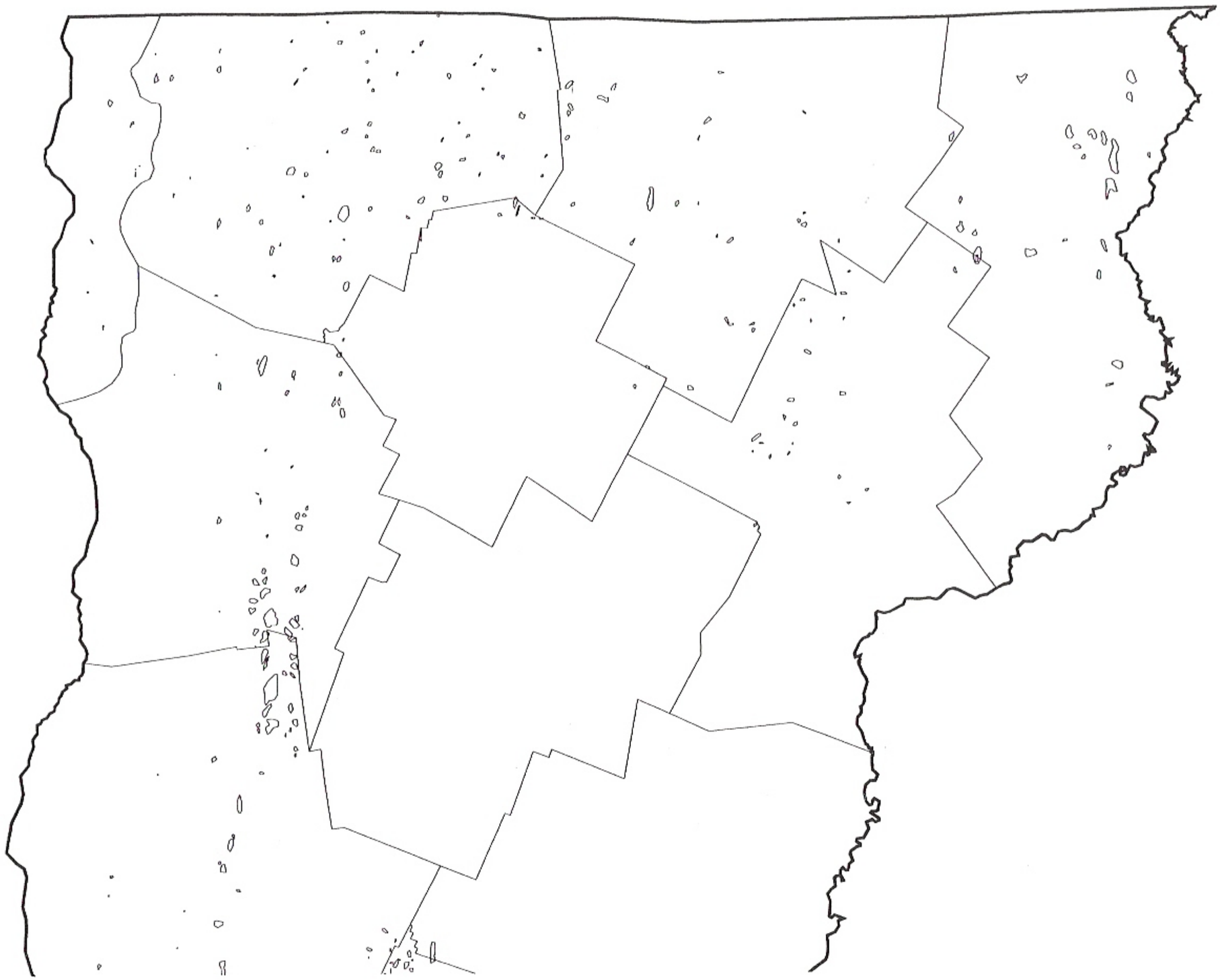
Statewide, 243,730 acres of damage were mapped (Table 10, Figure 20). This is mostly damage by anthracnose and other foliar pathogens, but may include pear thrips, maple leaf cutter, and maple trumpet skeletonizer. The predominant species affected was sugar maple, with damage also occurring on red maple, yellow birch, beech, and white ash. In the Taconics, damage was more severe on red maple than sugar maple. Damage was less severe on species which foliate later in the spring. Oak symptoms were rarely heavy enough to map from the air. Although browning on paper birch, poplars, and willows was mapped separately where possible, some defoliation of these species is also included.

Table 10. Mapped acres of hardwood browning by anthracnose and other defoliators in 1998.

County	Acres
ADDISON	5441
BENNINGTON	69180
CALEDONIA	1043
CHITTENDEN	4282
ESSEX	4524
FRANKLIN	3688
GRAND ISLE	181
LAMOILLE	412
ORANGE	283
ORLEANS	2154
RUTLAND	24505
WINDHAM	90019
WINDSOR	38018
Grand Total	**243730**

Eight polygons mapped during the aerial survey were checked on the ground. Twenty overstory trees were checked in each location. Table 11 shows the percent of crowns with symptoms on the 160 trees, and the 70 sugar maples, in these plots.

ANTHRACNOSE



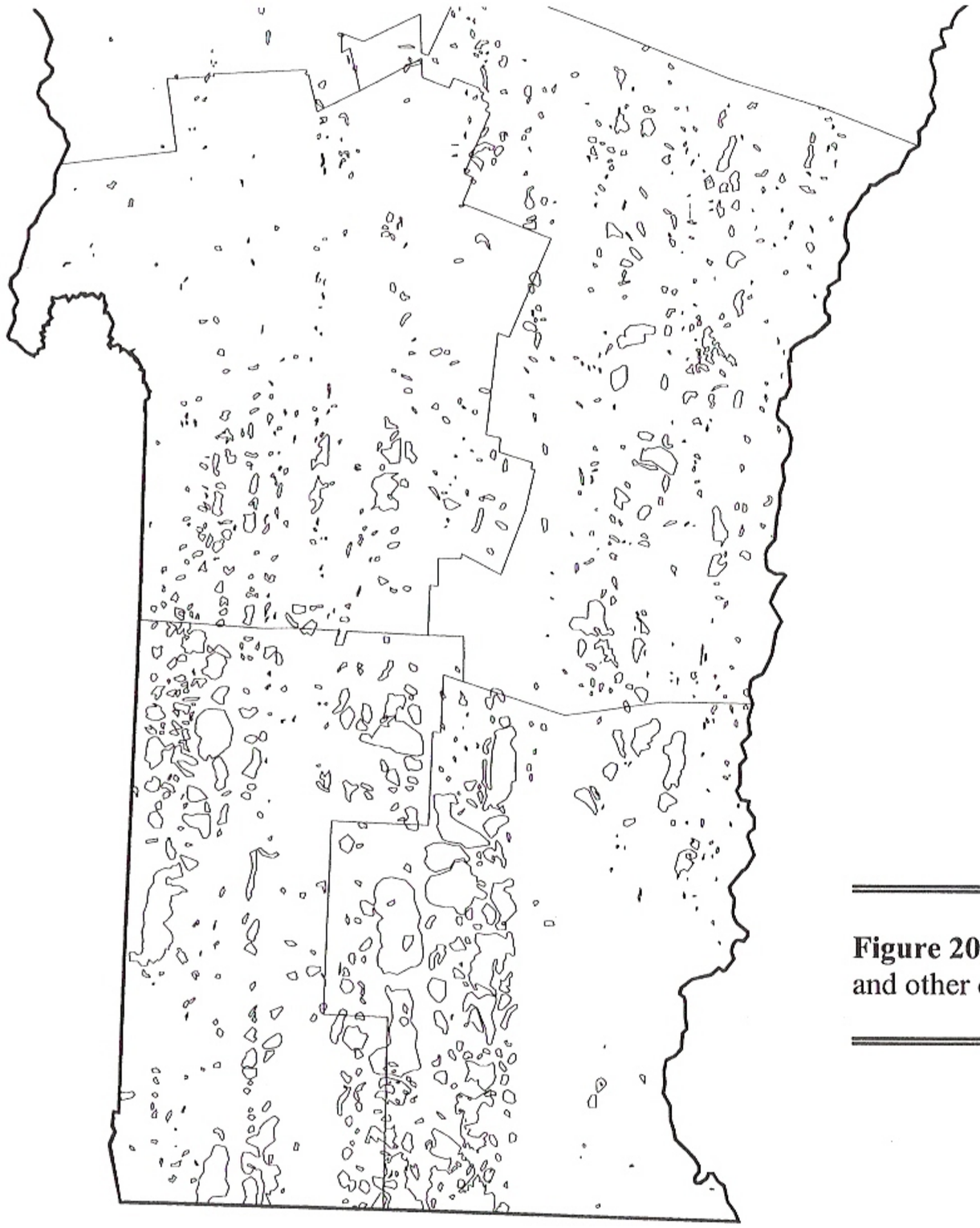


Figure 20. 1998 Hardwood browning by anthracnose and other defoliators. Mapped area is 243,730 acres.

Table 11. Symptom severity on trees within polygons mapped as anthracnose during August 1998 aerial surveys. Data are from ground checks twenty trees in each of eight polygons.

Location	Number of Sugar Maples	Average % of Crown with Symptoms: Sugar Maple	Average % of Crown with Symptoms: All Trees	Other Species Present
Ascutney	11	61%	40%	Red Oak, White Ash, Black & Yellow Birch
Cuttingsville	12	75%	50%	White Ash, Beech, Red Maple, Yellow Birch, Basswood
Dover	7	61%	63%	Beech, Yellow Birch, Red Maple
Halifax	8	66%	52%	Red Maple, Beech, White Ash, Cherry, Red Oak
Pittsfield	10	80%	55%	White Ash, Yellow Birch, Beech, Paper Birch
Rochester	15	67%	50%	White Ash, Yellow Birch, Red Spruce, Beech
Sherburne	3	75%	50%	Beech, Yellow Birch, White Ash, Black Cherry
Wilmington	5	55%	56%	Red Maple, White Ash, Black Cherry, Yellow Birch
Average		**70%**	**52%**	

Conditions were conducive to the buildup of many different fungi. Table 12 indicates fungal species were identified during laboratory analysis by the UVM Forest Pathology Lab and the US Forest Service Durham Field Office.

Table 12. Pathogens identified by the University of Vermont Forest Pathology lab and the US Forest Service Forest Health Protection from brown foliage collected in summer 1998.

Host	Pathogen	Location	Identified by
Sugar Maple	*Pestalotia* spp.	Rockingham	UVM Forest Pathology Lab
	Gloeosporium spp.		
Yellow Birch	Thought to be *Gloeosporium* spp.	Athens	
White Ash	*Discosis* spp.	Winhall	
Hardwood	*Coniothyrium* spp.	GMNF	Forest Health Protection - DFO
	Powdery Mildew		

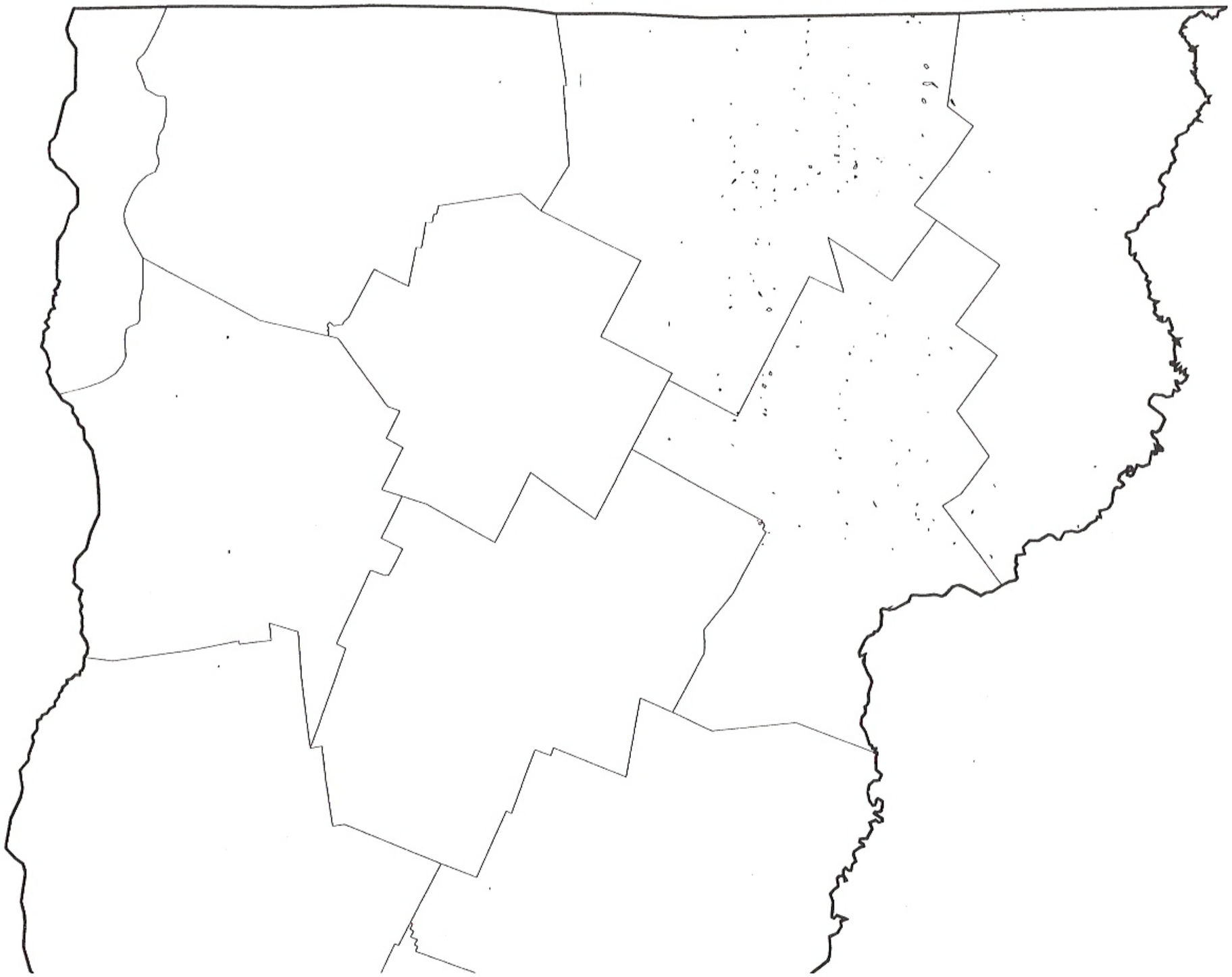
In one sugarbush in Westminster, transparency ratings of sugar maples were taken in September. At the lower elevations, including a wet site, where damage had occurred early in the season, average transparency ranged from 30-40%. At the upper slope, where anthracnose accompanied maple trumpet skeletonizer late in the season, transparency averaged 30%.

Anthracnose and other foliage diseases also caused damage to hardwoods in a tree shelter study being carried out on the Green Mountain National Forest.

In areas damaged by pear thrips, where anthracnose infected trees early and refoliation was blighted by anthracnose as well, some sugar maples had a substandard complement of leaves all summer. These trees are under stress going into 1999. Although it is not possible to predict anthracnose for 1999, since weather plays such an important role in the development of foliar diseases, there is a high load of inoculum should suitable weather occur.

Poplar Leaf Blight, caused by *Marssonina* spp. and other fungi, was widespread due to repeated wet conditions (Table 13, Figure 21). Many quaking aspens and balsam poplars were completely defoliated by late August. Some damage to poplar or aspen was mapped separately from anthracnose during the late August aerial survey.

POPLAR DEFOLIATION



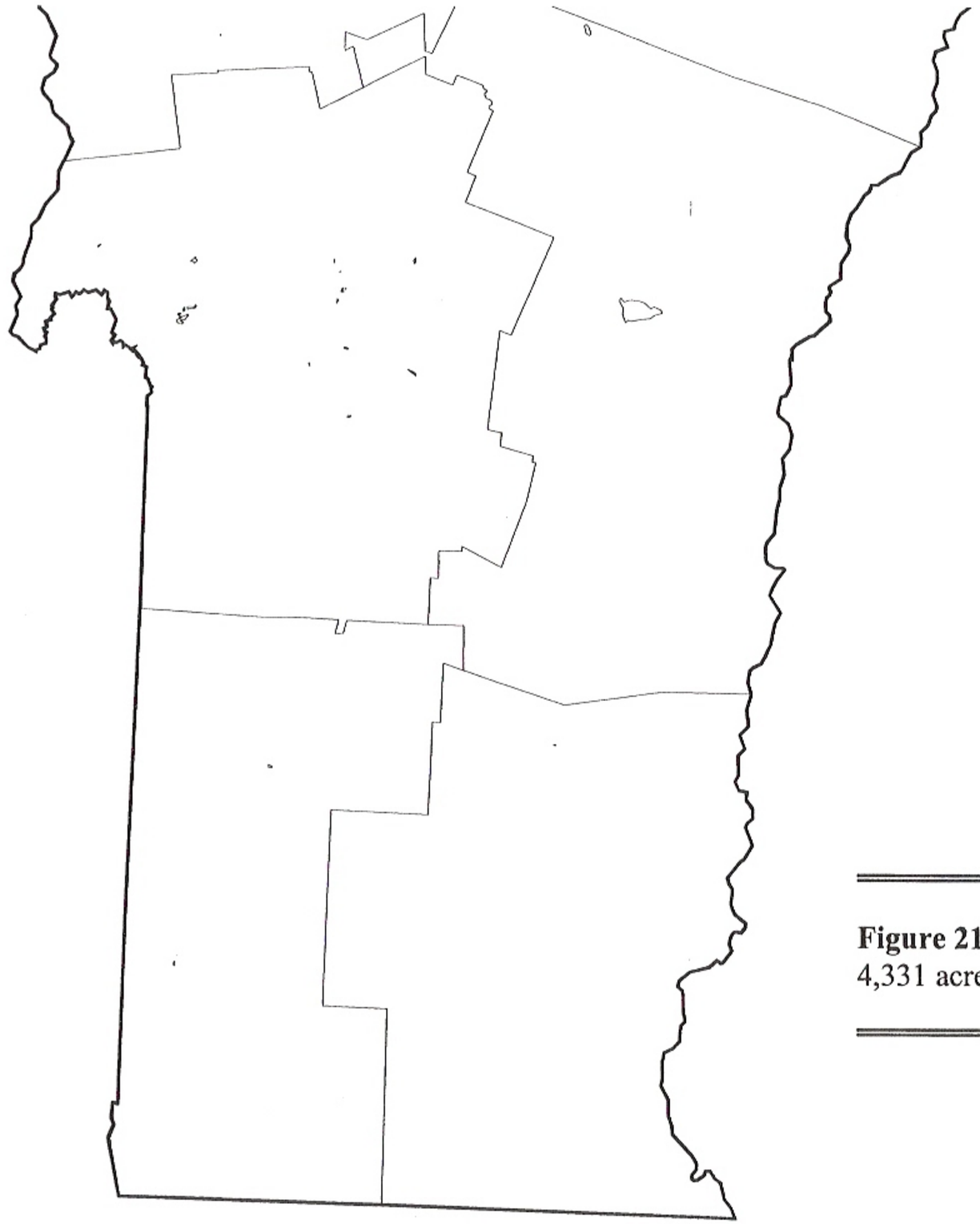


Figure 21. 1998 Poplar defoliation. Mapped area is 4,331 acres.

Table 13. Mapped acres of brown foliage on poplar and aspen caused by fungus diseases in late August 1998.

County	Acres
ADDISON	12
BENNINGTON	42
CALEDONIA	525
CHITTENDEN	48
ESSEX	172
FRANKLIN	6
ORLEANS	1153
RUTLAND	511
WASHINGTON	6
WINDHAM	7
WINDSOR	1849
Grand Total	**4331**

Conditions were conducive to the buildup of many different fungi. Table 14 indicates fungal species were identified on poplar and aspen during laboratory analysis.

Table 14. Fungi identified on brown poplar and aspen foliage collected in summer 1998. Identifications were made by the University of Vermont Forest Pathology lab and the US Forest Service Forest Health Protection.

Pathogen	Location	Identified by
Marssonina spp.	Athens	UVM Forest Pathology Lab
Apioplagistoma populi	GMNF	Forest Health Protection - DFO
Venturia populia		
Mycosphaerella populorum		
Venturia tremulae		

Rhizosphaera Needle Blight of Fir, caused by *Rhizosphaera pini*, remained common and widespread this year, but infection rates in northern Vermont Christmas tree plantations appeared to be similar to 1997 rates. The disease was noticeable again on wild balsam fir trees , but at lower levels than seen in 1997.

Spore trapping was conducted in a heavily infected Danville plantation by placing vaseline-coated slides beneath tree crowns, with weekly slide collection and replacement by the grower. Counts showed a peak of spore release between May 26 and July 2, with some spores at all other times between May 6 and August 26. The grower conducted spray trials with Cleary's Protect T/O and Bravo 500 again this year, but with better timing than in 1997. The first application was May 25, just before the first spike in spore catch and after complete budbreak, with a second treatment June 10. This resulted in 90% control compared to 50% last year. Again, there was no significant difference between the two treatments, and no phytotoxicity from the Bravo (chlorothalonil).

R. pini is able to infect any age needle, but it was not known how much infection in any one year occurs on older needles. To determine this, all old needles were removed from 23 flagged balsam fir branches in the Danville plantation in early spring and the number of infected needles on 1998 and 1997 growth were counted on August 28, 1998. This revealed that infection of older (1997) needles was only 12.5% of the total for all needles on 1997 and 1998 shoots.

Willow Leaf Blight, thought to be caused by the willow scab fungus, *Venturia saliciperda*, and the imported willow leaf beetle, *Plagiodera versicolora*, was severe in some riparian areas. Damage was mapped during the August aerial survey (Table 15).

Table 15. Mapped acres of brown foliage on willow, caused by fungus disease and the imported willow leaf beetle, in late August 1998.

County	Acres
ADDISON	162
BENNINGTON	1259
CHITTENDEN	120
FRANKLIN	119
RUTLAND	157
WINDSOR	1509
Grand Total	**3326**

OTHER FOLIAGE DISEASES			
DISEASE	**HOST(S)**	**LOCALITY**	**REMARKS**
Anthracnose *Discula sp.*	Green Ash	Putney	Combination of anthracnose and other fungi, causing foliage spotting.
Anthracnose *Gloeosporium spp.* and others			See narrative.
Apple Scab *Venturia inaequalis*	Apple Crabapple	Throughout	Heavy on unsprayed trees. 150 acres mapped during aerial survey.
Arborvitae Leaf Blight *Pestalotiopsis*	Arborvitae	Athens	Heavy damage on shaded portion of hedge.
Balsam Fir Needlecast *Lirula nervata*	Balsam Fir	Cabot	Remains present in one Christmas tree plantation, particularly in low areas with poor air circulation.
Black Rot *Botryosphaeria obtusa*	Mountain Ash	Brattleboro	The extra wet growing season promoted this pathogen.
Brown Spot *Scirrhia acicola*	Mugo Pine	Rutland	Found on mature ornamentals.
Cedar-Apple Rust *Gymnosporangium juniperi-virginianae*	Eastern Red Cedar	Addison County	Stable.
Cedar Quince Rust *Gymnosporangium clavipes*	Crabapple Hawthorn	Wilmington	Found on ornamentals.

OTHER FOLIAGE DISEASES			
DISEASE	**HOST(S)**	**LOCALITY**	**REMARKS**
Coccomyces Leaf Spot *Blumeriella jaapii*	Black Cherry	Widely scattered	Heavier than usual this year, leading to early leaf drop on some trees.
Cyclaneusma Needlecast (formerly Naemacyclus) *Cyclaneusma minus*	Scots Pine	Throughout	Unusually severe on ornamentals in Lamoille County, resulting in browning of current-year as well as one-year-old foliage. Mostly light damage to Christmas trees.
Dogwood Anthracnose *Discula destructiva*	Flowering Dogwood	Brattleboro	Foliage green on previously infected tree.
Fir-Fern Rust *Uredinopsis mirabilis*	Balsam Fir	Throughout	Increasing on Christmas trees and forest regeneration, however mostly at light levels.
Giant Tar Spot *Rhytisma sp.*			See Tar Spot.
Horsechestnut Leafblotch *Guignardia aesculi*	Horsechestnut	Rockingham	Ornamental.
Lophodermium Needlecast *Lophodermium seditiosum*	Scots Pine	Throughout	Severe on some ornamentals in Lamoille and Windsor Counties, but mostly light damage to Christmas trees.

OTHER FOLIAGE DISEASES			
DISEASE	**HOST(S)**	**LOCALITY**	**REMARKS**
Phyllosticta Leaf Spot *Phyllosticta sp.*	Mountain Ash	Brattleboro	Not a health threat to trees. Increase this year due to wet growing season.
Powdery Mildew *Eryiphaceae*	Flowers	Essex, Caledonia & Orleans Counties	Common throughout on many flower species.
Poplar Leaf Blight *Marssonina spp.*			See narrative.
Rhabdocline Needlecast *Rhabdocline pseudotsugae*	Douglas Fir	Widely scattered	Light to moderate infection of some Christmas trees.
Rhizosphaera Needlecast *Rhizosphaera kalkhoffi*	Blue Spruce White Spruce	Throughout	Remains common on ornamentals and Christmas trees. Present in 38% of blue spruce plantations surveyed.
Septoria Leaf Spot *Septoria sp.*	Eastern Cottonwood Balsam Poplar Trembling Aspen Birch	Danville Derby Essex County Waitsfield Pittsford Waitsfield	Found causing severe spotting and defoliation especially on balsam poplar. Causing spotting of roadside foliage.
Shoot Blight *Phomopsis sp.*	Hemlock	Manchester	Hedge.
Sooty Mold *Perisporiacae*	Pear	Weathersfield	On fruit.
Swiss Needlecast *Phaeocryptopus gaumanni*	Douglas Fir	Widespread	Remains common wherever Douglas fir is planted.

OTHER FOLIAGE DISEASES			
DISEASE	**HOST(S)**	**LOCALITY**	**REMARKS**
Tar Spot *Rhytisma spp.*	Red Maple Sugar Maple Striped Maple Norway Maple Silver Maple	Throughout	Widespread on all maple species.
Venturia Leaf and Shoot Blight *Venturia sp.*	Trembling Aspen	Whitingham	Increased occurrence during wet seasons.
White Pine Needle Blight *Canavirgella banfieldii*	White Pine	Widespread	Heaviest damage seen in many years, especially near roads. Caused moderate to heavy damage in 37% of the white pine Christmas tree plantations surveyed in northern Vermont. Symptoms on large trees most severe on lower half of crown.

ROOT DISEASES			
DISEASE	**HOST(S)**	**LOCALITY**	**REMARKS**
Annosus Root Rot *Heterobasidion annosum*			No new reports.
Phytopthora Root Rot *Phytopthora spp.*	Fraser Fir	Widespread	Commonly associated with Christmas tree mortality in areas with poor drainage, especially in this extremely wet summer of 1998.
Shoestring Root Rot *Armillaria spp.*	Many	Throughout	Remains common on stressed trees.
	Fraser Fir	Bennington	Causing decline and mortality of Christmas trees.
	Hemlock	Pittsford	Associated with mortality on forest trees affected by wounding, road construction, and/or wet site.
		Wardsboro	Associated with disturbed site.
	White Pine	Reading	Pockets of mortality of pole sized trees.
	Black Cherry	Plymouth	Hazard tree.
Tomentosus Root Rot *Polyporus tomentosus*	Red Spruce	Plymouth	Fruiting bodies occurring in a stand with some blowdown.

DIEBACKS, DECLINES, AND ENVIRONMENTAL DISEASES

Ash Dieback remained common in the Champlain Valley and in southern Vermont, at stable levels. Evaluation monitoring was done to follow-up on the unexplained ash defoliation observed in 1997, as part of a National Forest Health Monitoring program. No symptoms were observed in areas that were defoliated in 1997. Monitoring plots were established in several of these areas to track changes in tree condition.

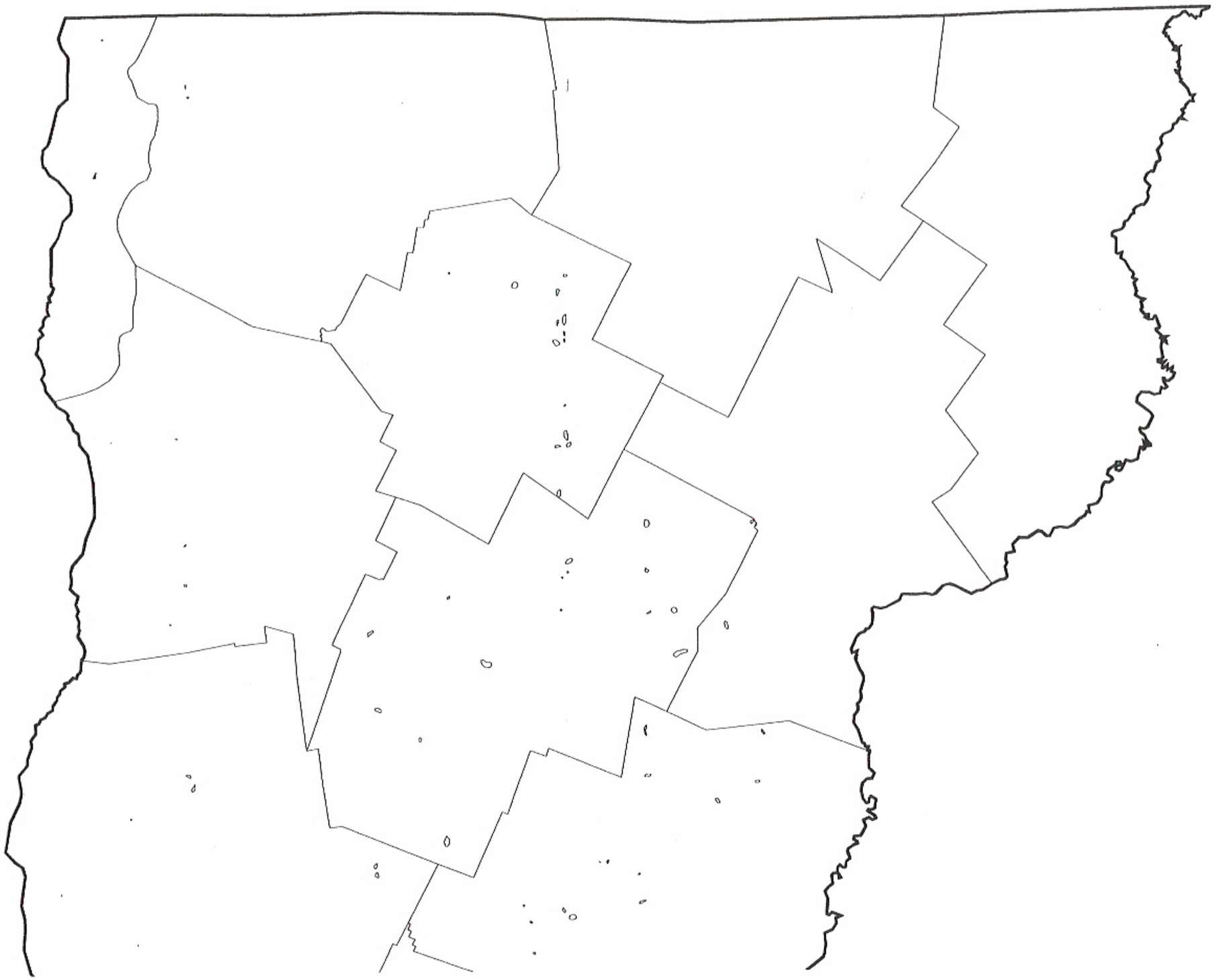
Hardwood Decline and Mortality was less widespread in 1998, according to aerial surveys (Table 16, Figure 22). Dieback was mapped for sugar maple, red maple, and paper birch in areas outside those known to be affected by the ice storm.

Table 16. Mapped acres of hardwood decline and mortality in 1998, excluding ice storm damage.

County	Acres
ADDISON	320
BENNINGTON	84
CALEDONIA	96
CHITTENDEN	66
FRANKLIN	22
GRAND ISLE	32
LAMOILLE	999
ORANGE	1038
RUTLAND	79
WASHINGTON	1405
WINDHAM	968
WINDSOR	566
Grand Total	**5675**

Mapped acreage has historically decreased in years with wetter growing seasons (Figure 23). Ample rainfall for most of the last decade and low populations of defoliators have provided good growing conditions for maples and other species. However, the widespread defoliation in 1998 may have an impact in the future.

HARDWOOD DECLINE



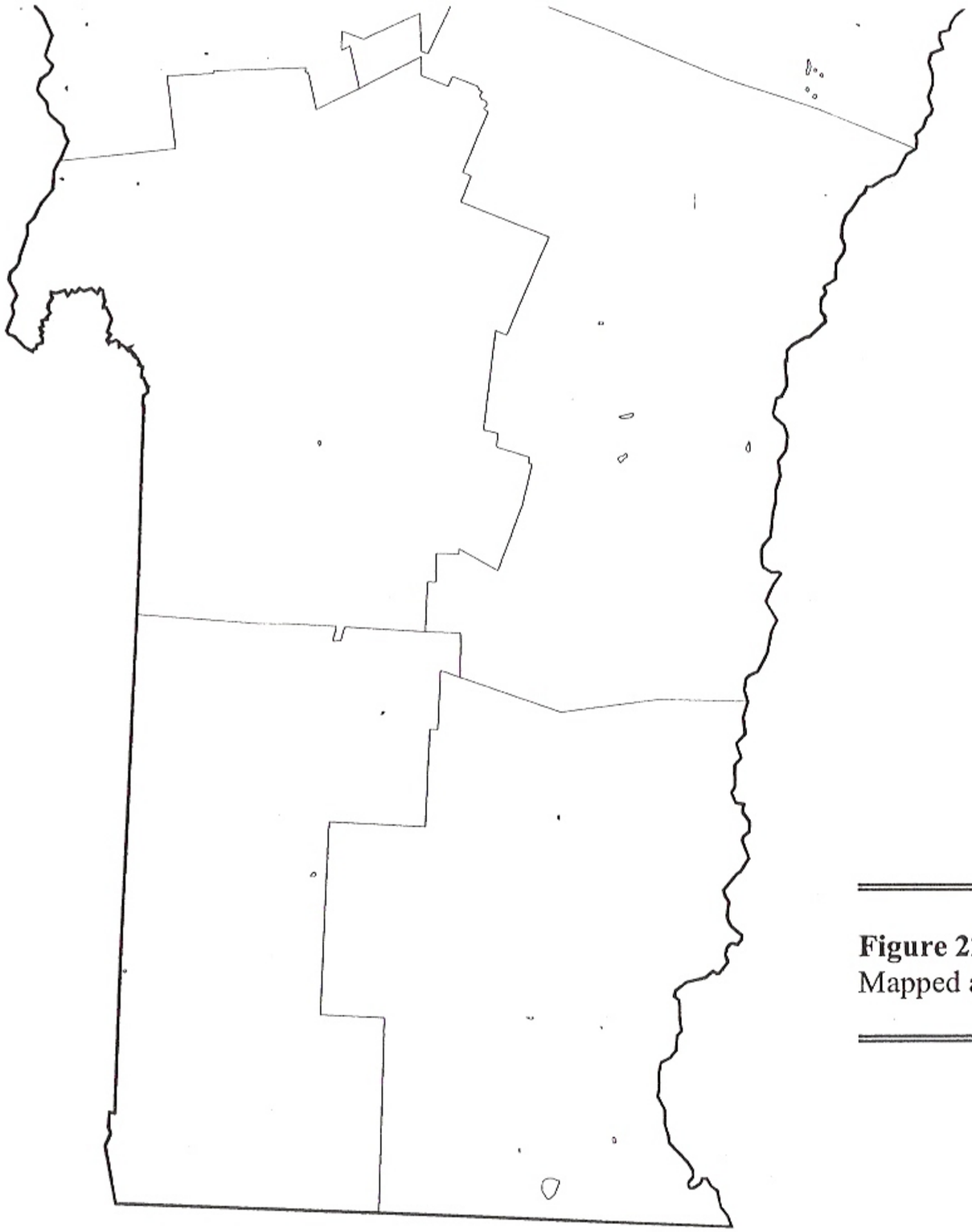


Figure 22. 1998 Hardwood decline and mortality. Mapped area is 5,675 acres.

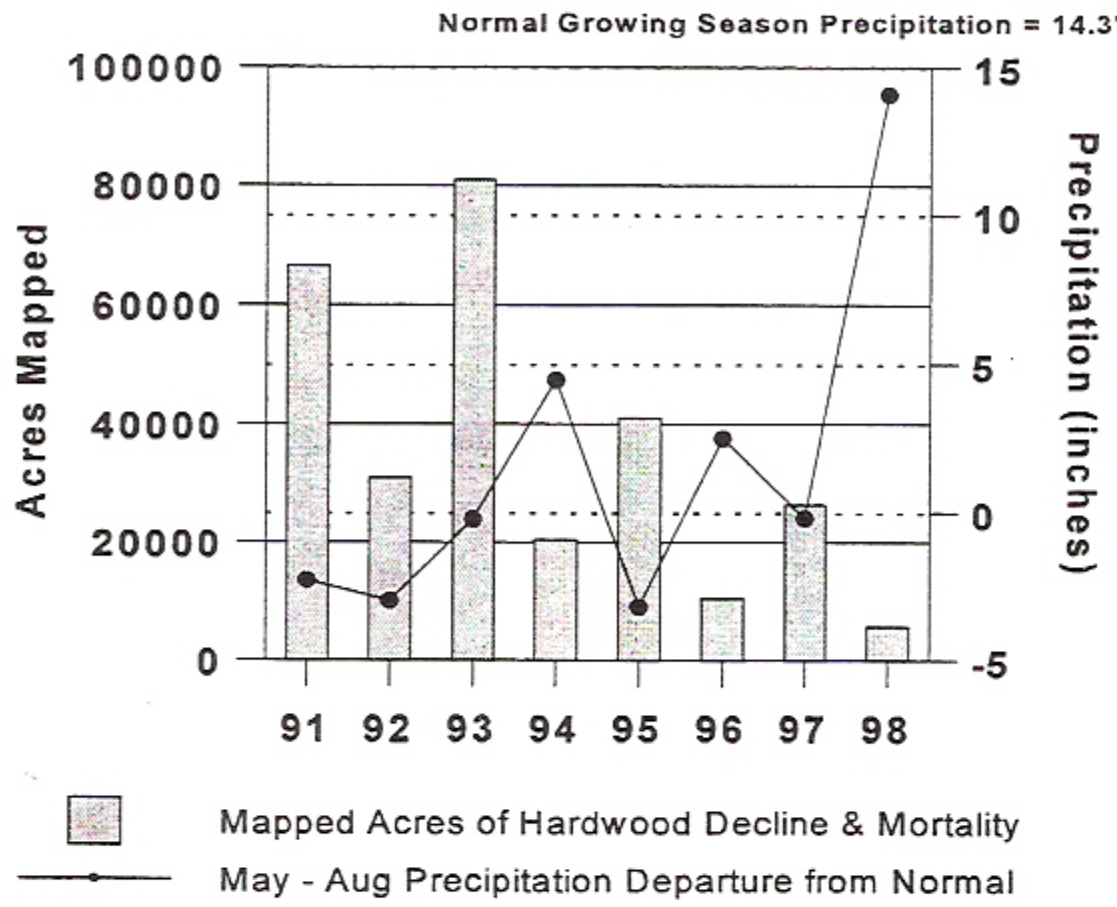


Figure 23. Acres mapped of hardwood decline and mortality during annual aerial survey, compared to growing season precipitation, 1991-1998. Precipitation data from National Weather Service, Burlington.

Ice Damage was widespread following a severe ice storm the second week of January, and was the most significant factor affecting tree health in 1998. Although, according to the US Army Corps of Engineers Cold Regions Research Laboratory, the thickness of the ice was typical of storms that are expected to occur several times in a century, the area covered was exceptional. Aerial surveys for ice were flown within a week, while ice was still on the trees. Additional ice-damaged areas were visible and mapped in during the summer surveys.

Damage occurred in every county in the state and was mapped on 951,589 acres, or 1/5th of the forest land in the state (Table 17, Figure 24). This includes 30,000 acres damaged on the Green Mountain National Forest. The Champlain Valley received the most continuous severe damage. Elsewhere, damage was scattered at mid elevations, generally above 1400 feet, but especially above 1800 feet. East-facing slopes had the heaviest damage.

Table 17. Mapped acres of ice damage in 1998. Heavily damaged areas had over 25% crown damage on over 25% of the trees.

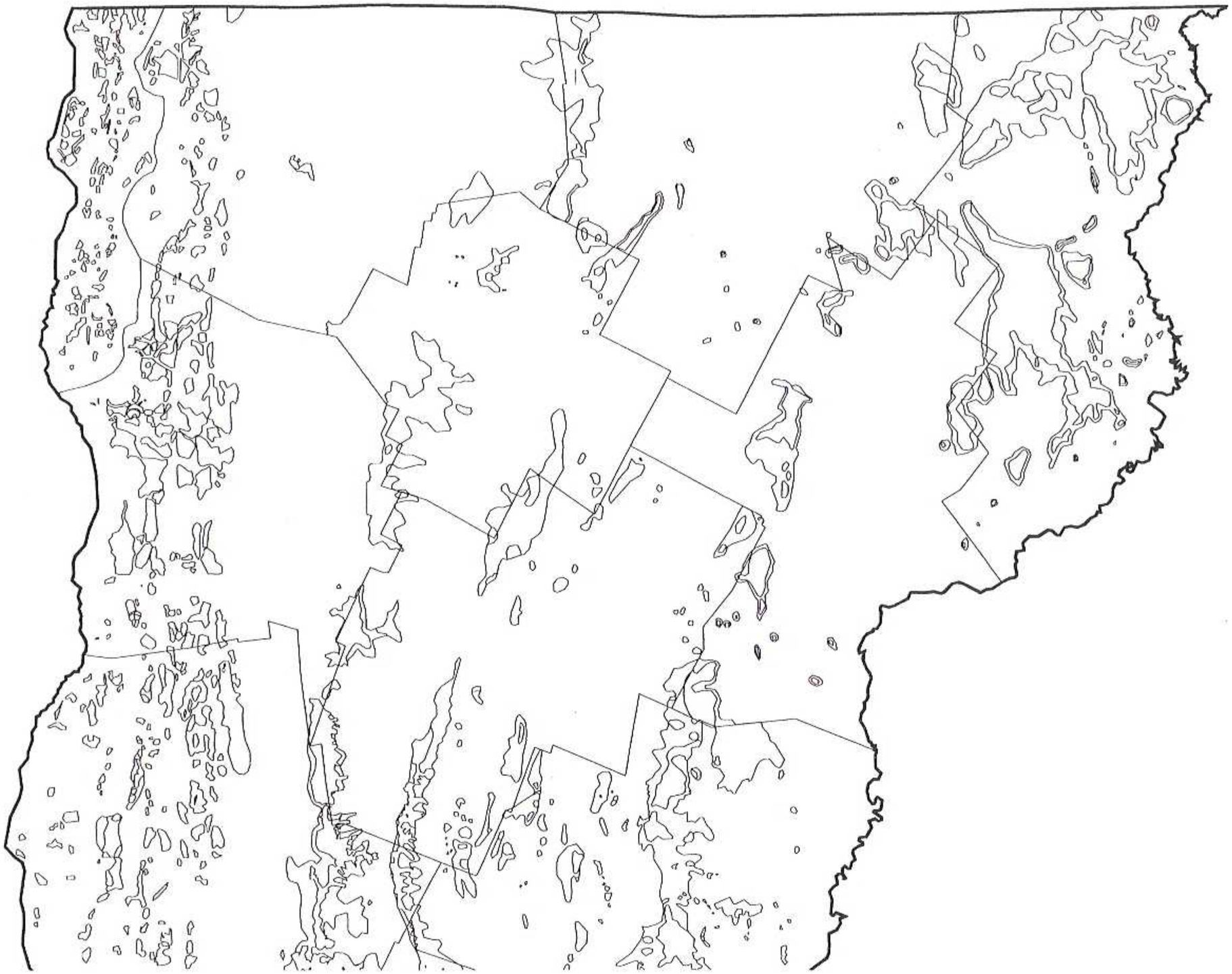
County	Damage Severity		Total
	Heavy	Light	
ADDISON	33821	75780	109601
BENNINGTON	7517	6640	14157
CALEDONIA	20856	25984	46840
CHITTENDEN	23470	44278	67748
ESSEX	79032	71175	150207
FRANKLIN	3010	22148	25158
GRAND ISLE	12560	4408	16968
LAMOILLE	1354	34508	35862
ORANGE	22720	75583	98303
ORLEANS	17174	27994	45168
RUTLAND	34676	55816	90492
WASHINGTON	21918	42716	64634
WINDHAM	8515	18645	27160
WINDSOR	99724	59567	159291
Grand Total	**386347**	**565242**	**951589**

Damage was most severe to hardwoods, and recently thinned stands had more breakage than unthinned stands. Most vulnerable to breakage were branches less than 8" in diameter, and pole-sized trees. Many paper birch mainstems bent to the ground, and some areas of young regeneration were flattened. Most of these stems straightened over the course of the growing season. Tip-up of root systems occurred rarely, and only on shallow sites. In addition to causing breakage to trees, damage made woods roads and trails impassable, and made many sugarbush tubing lines and tree shelters unusable.

Sugarbush damage was estimated by a questionnaire survey mailed to 2500 sugarmakers. Based on a 26% response, 14% said that their sugarbush was damaged by the ice storm. Of these, 25% said that the damage was heavy, 31% said it was moderate, and 44% said it was light. Based on this questionnaire, an estimated 75,000 taps were lost.

About 18% of the permanent plots examined for forest health monitoring evaluations were damaged. These will continue to be revisited to assess tree condition. Leaf production and size on many of the climax species with heavy damage (more than 50% crown loss) was not very impressive. These trees will need continued monitoring to see if they will survive. A summary of damage on Hardwood Tree Health plots is in the appendix.

ICE DAMAGE



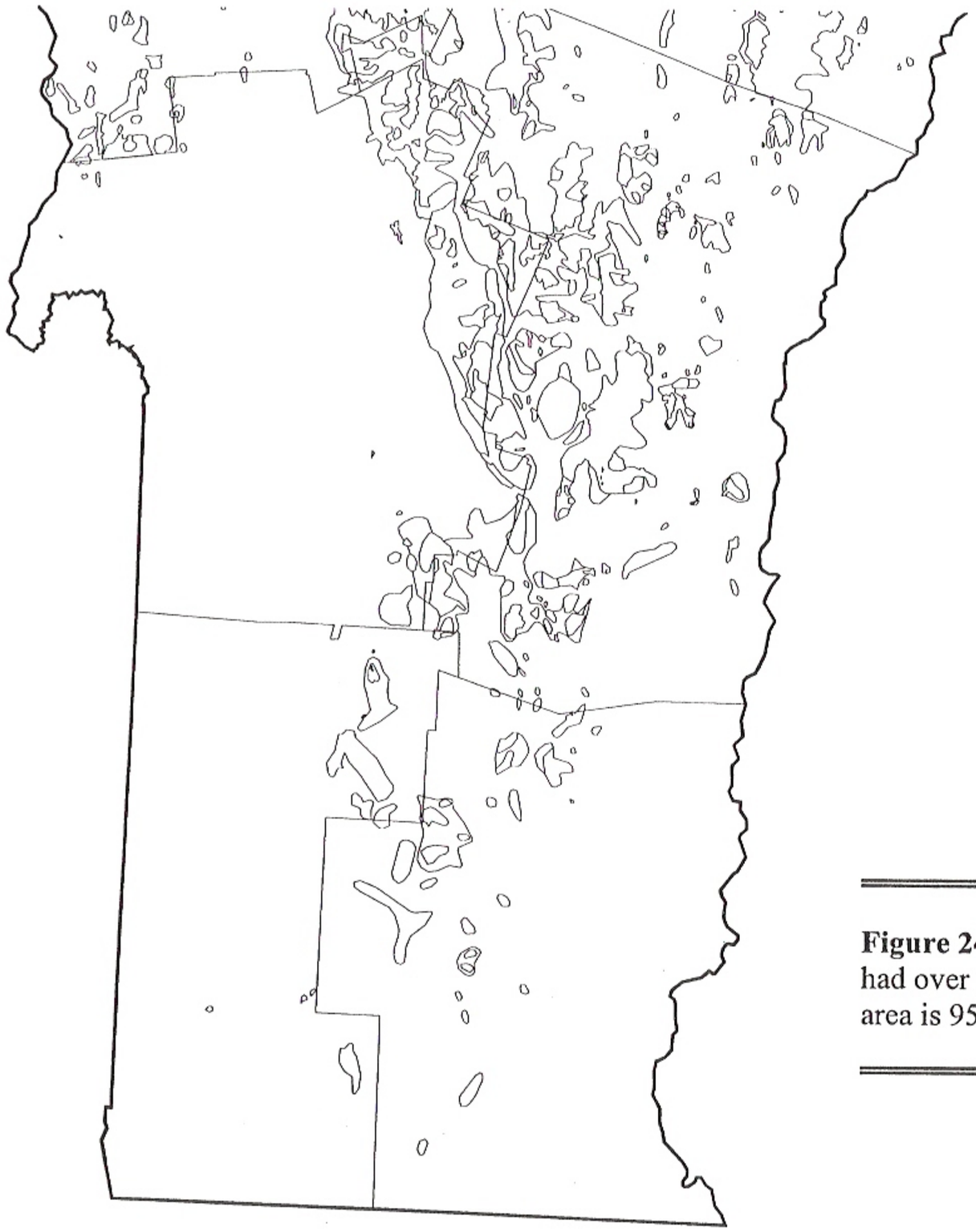


Figure 24. 1998 Ice damage. Heavily damaged areas had over 25% damage to over 25% of trees. Mapped area is 951,589 acres.

Assessments of damage were made in the seven maple stands which are part of the North American Maple Project that were impacted by the ice storm. Only 2% of the trees which were rated were down, usually from failure to the root system. Four percent of the trees which were standing had broken mainstems. Of the trees with breakage in the top, 89% had breakage of small branches only. Results of the crown damage ratings are in Table 18.

Table 18. Percent of trees in each of five crown damage categories in seven North American Maple Project plots which were damaged by the ice storm. Data are from 624 trees.

Crown Rating: Percent of Crown Damaged by Ice	Percent of Trees
Dead Tree	19%
None	20%
1-10%	26%
11-25%	12%
26-50%	10%
51-75%	6%
76-100%	7%

By the end of the summer, many broken trees had produced epicormic sprouts. White ash responded particularly vigorously to the breakage. Epicormic shoot production on sugar maple occurred late, and leaves stayed green late into the fall, and , like other juvenile shoots, sometimes did not drop leaves, which stayed brown on the tree. These epicormic shoots will continue to grow straight with little branching until they become more mature.

Coral spot nectria was commonly seen fruiting on broken limbs. This weak pathogen may cause some cankering in the future on stressed trees.

Food reserves in recovering trees are now lower than they were a year ago. Less food was produced because trees had fewer leaves than normal during the growing season. Additionally, trees had to divert food energy to closing wounds and growing new shoots.

Requests for information, recommendations, and assistance inspired a large ice storm recovery program. Additional information about the many ice storm related activities can be found in other Department of Forests, Parks & Recreation and US government publications.

Spruce Mortality and Dieback was observed mostly at high elevations, but very little was mapped during aerial surveys (Table 19). Most damage was observed on red spruce, with some also occurring on balsam fir. No winter injury of red spruce was reported this year.

Table 19. Mapped acres of spruce mortality and dieback in 1998.

County	Acres
CHITTENDEN	69
FRANKLIN	266
ORLEANS	356
RUTLAND	62
WASHINGTON	10
WINDHAM	21
Grand Total	**784**

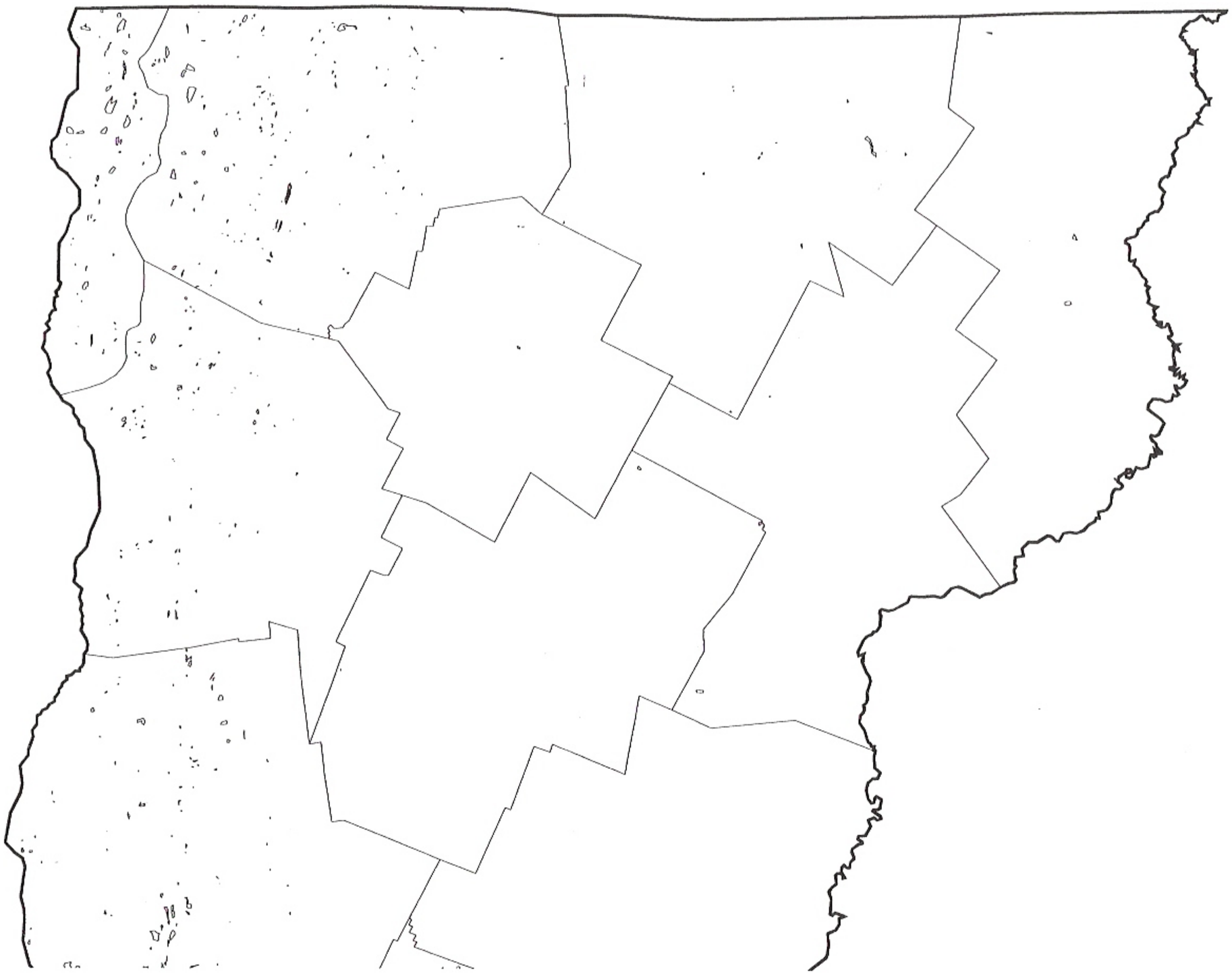
Unthrifty Crowns Associated with Logging were observed in scattered locations, and mapped during aerial survey (Table 20). Primary species affected were sugar maple, paper birch, and yellow birch.

Table 20. Mapped acres of unthrifty crowns associated with logging in 1998.

County	Acres
ADDISON	0
BENNINGTON	149
CHITTENDEN	65
FRANKLIN	118
RUTLAND	53
WINDHAM	55
WINDSOR	224
Grand Total	**664**

Wet Site conditions caused tree decline and mortality throughout the state (Table 21, Figure 25). Mapped area increased from 10,297 acres in 1997 to 80,127 acres in 1998. Many marginal sites, which have adequate drainage most years, were overwhelmed by 1998's rainfall. In addition, beavers continued to build new impoundments. Wet site conditions were also responsible for fraser fir Christmas tree mortality in many locations, related to the unusually wet summer.

WET SITE DIEBACK and MORTALITY



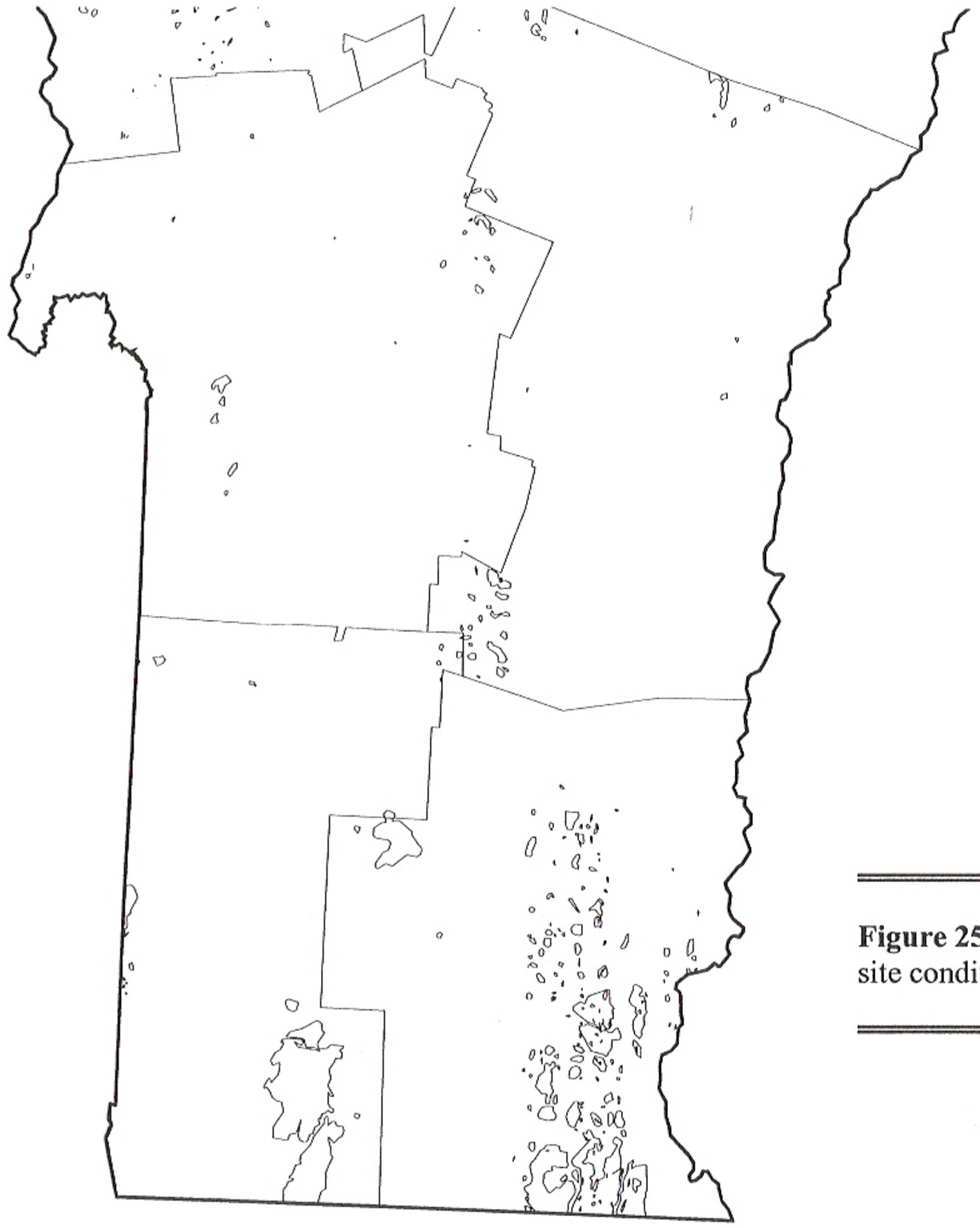


Figure 25. 1998 Dieback and mortality caused by wet site conditions. Mapped area is 80,127 acres.

Table 21. Mapped acres dieback and mortality caused by wet site conditions in 1998.

County	Acres
ADDISON	2672
BENNINGTON	24920
CALEDONIA	78
CHITTENDEN	1185
ESSEX	198
FRANKLIN	2879
GRAND ISLE	2327
LAMOILLE	46
ORANGE	0
ORLEANS	322
RUTLAND	2059
WASHINGTON	40
WINDHAM	38997
WINDSOR	4404
Grand Total	**80127**

White Pine Decline occurred in scattered locations, especially in northwestern Windham County. Stands of pole- or sawlog-sized trees were affected. Tufted and short, thin foliage was the most common symptom. Occasional trees had scattered dead terminal shoots in the upper crown.

Samples were sent to several diagnostic labs (FPR, UVM, MFS). No single problem was identified, although pine leaf adelgid, white pine sawfly feeding, fascicle mites, free-feeding mites, *Matsucoccus matrocicatrices* scale, and an *Aureobasidium*-like fungus were present. The heavy cone crop was expected to have caused further stress.

A similar decline was observed in Maine in 1997. According to Clark Granger and Dick Dearborn of the Maine Forest Service, a variety of insects and diseases were observed on affected trees, but none were identified as the primary cause. Drought was thought to play a role, since there had been a distinct growth reduction on symptomatic trees in 1995, and the heaviest damage was on drought-prone sites. As of summer 1998, there had been no signs of recovery. This syndrome may also be related to the pole blight of western white pine.

OTHER DIEBACKS, DECLINES, AND ENVIRONMENTAL DISEASES			
DISEASE	**HOST(S)**	**LOCALITY**	**REMARKS**
Ash Dieback			See narrative.
Birch Decline			See Hardwood Decline and Mortality.
Bud Abortion	Fraser Fir Balsam Fir	Throughout	Very common on Christmas trees. Moderate winter with frequent thaws may be a factor. Observed in 27% of plantations inspected in northern Vermont.
Drought	Red Pine	Pawlet	May have initiated mortality on ledgey site.
Edema	Balsam Fir	Bennington County	Causing needle symptoms.
Fertilizer Injury	Balsam Fir Sugar Maple	Springfield Forestdale	10-10-10 on Christmas trees. Miracle gro.
Fire	Norway Spruce	Pittsford	Heat from brush fire.
Frost Damage	Balsam Fir Douglas Fir Maple	Rutland Townshend Orleans County	Light on Christmas trees. Generally little frost damage in 1998. Light damage to ornamentals.
Girdling Root	Sugar Maple	Andover Springfield	Ornamentals.
Gummosis	Black Cherry	Windham County Barnard	Several requests related to poor site.
Hardwood Decline and Mortality			See narrative.

OTHER DIEBACKS, DECLINES, AND ENVIRONMENTAL DISEASES			
DISEASE	**HOST(S)**	**LOCALITY**	**REMARKS**
Heavy Seed	Red Maple Conifers Yellow Birch Beech	Widespread	Sometimes causing thin crowns.
Ice Damage			See narrative.
Improper Planting	Norway Spruce Ornamentals	Rupert Throughout	2-2 transplants planted too deep. Continues to be a problem for ornamental plantings.
Landscape Cloth	Paper Birch	Springfield	Caused dessication. Second set of roots was produced above landscape cloth in mulch.
Larch Decline	Eastern Larch	Northeast Kingdom	Continue to lose trees annually in scattered locations. 152 acres mapped in Caledonia, Essex, and Orleans Counties.
Larch Defoliation	European Larch	Sharon	Ten acres defoliated in early September. No pathogens found at UVM pathology lab.
Lightening	Several Maple	Middletown Springs Brattleboro	10-20 pole sized trees dead on wet site. Ornamental.
Maple Decline	Sugar Maple		See Hardwood Decline and Mortality.
Mechanical Injury	Ornamentals	Throughout	Common, especially in the Northeast Kingdom.

OTHER DIEBACKS, DECLINES, AND ENVIRONMENTAL DISEASES			
DISEASE	**HOST(S)**	**LOCALITY**	**REMARKS**
Ozone Injury	White Ash	Pawlet	Ridge top.
Pesticide Injury	Sugar Maple	Springfield Ludlow Manchester	2, 4-D.
Red Pine Mortality	Red Pine	Pawlet	Mortality of red pine, but not white pine, on ledgey site attributed to prior drought stress. Pine engraver and turpentine beetles present.
Salt Damage	Many	Scattered	Less than some years. Heaviest damage at high elevations around ski areas.
Snow Breakage	Many	Northeast Kingdom	Heavy snow added to the ice to cause additional breakage in upper elevation areas.
Spruce Mortality and Dieback			See narrative.
Stand Opening	Hemlock	Manchester	Edge trees by agricultural field disturbed when field was expanded.
Unthrifty Crowns Associated with Logging			See narrative.
Wet Site			See narrative.

OTHER DIEBACKS, DECLINES, AND ENVIRONMENTAL DISEASES			
DISEASE	**HOST(S)**	**LOCALITY**	**REMARKS**
Wet Weather	Many	Scattered	Chlorosis caused by lack of nutrient uptake due to waterlogged soil, nitrate leaching, and/or lack of evapotranspiration.
White Pine Decline			See narrative.
White Pine Needle Blight			See Other Foliage Diseases.
Wind Damage	Many	Bennington County	Blowdown from May storm.
		Northeast Kingdom	Spotty damage from high winds associated with thunderstorms.
	Mostly White Pine	Bethel	Blowdown from August storm.
	Northern Hardwoods	Dummerston	Labor Day weekend storm.
Winterburn	Red Spruce Ornamentals		Not observed.

ANIMAL DAMAGE			
ANIMAL	**SPECIES DAMAGED**	**LOCALITY**	**REMARKS**
Beaver	Many	Throughout	Appears to be increasing. Many new ponds.
Deer	Hardwoods Christmas Trees	Widely scattered	Beginning to become a problem on hardwood regeneration where deer populations are high. Some severe damage to fir Christmas trees in plantations where they had not been a problem in the past.
Moose	Hardwoods Christmas Trees	Widely scattered	Some damage to maple tubing.
Mouse	Many	Widely scattered	Populations generally low but some tree girdling evident.
Porcupine	Many	Throughout	Stable. Little damage seen.
Sapsucker	White Birch Apple Sugar Maple	Widespread	Many homeowner calls. Attacking only one of 24 large paper birch in Hubbardton.

ANIMAL DAMAGE			
ANIMAL	**SPECIES DAMAGED**	**LOCALITY**	**REMARKS**
Squirrel	Spruce	Widespread	Feeding on shoots in the winter in pole sized and larger trees, leaving the ground carpeted with clipped shoots in the spring. Populations unusually high from heavy mast in Fall '96.
	Balsam Fir	Groton	Feeding on sap from sapsucker wounds. Heavy damage.
Woodpecker	Maple Shadbush	Middletown Springs	Ornamentals.

TREND IN FOREST CONDITION

This information on forest condition is from North American Maple Project plots in Vermont. Four indicators of tree condition have been used to determine trends over the last 11 years. Tree vigor, crown dieback, foliage transparency and mortality are all measures of tree health that vary depending on site, stress levels, disturbance and year. In the NAMP, 5 tree species are represented in large enough samples to monitor over time: sugar maple, beech, yellow birch, white ash and red maple.

Sugar Maples

Trends in overstory sugar maple condition on a statewide basis varied little from previous years, with 93% of sugar maples in NAMP plots in a healthy condition (≤15% dieback). The only indicator that showed significant change was mortality (Figure 1). Average annual mortality of overstory trees from 1989 to 1997 was between 0.1 and 0.9%, but rose to 1.7% in 1998.

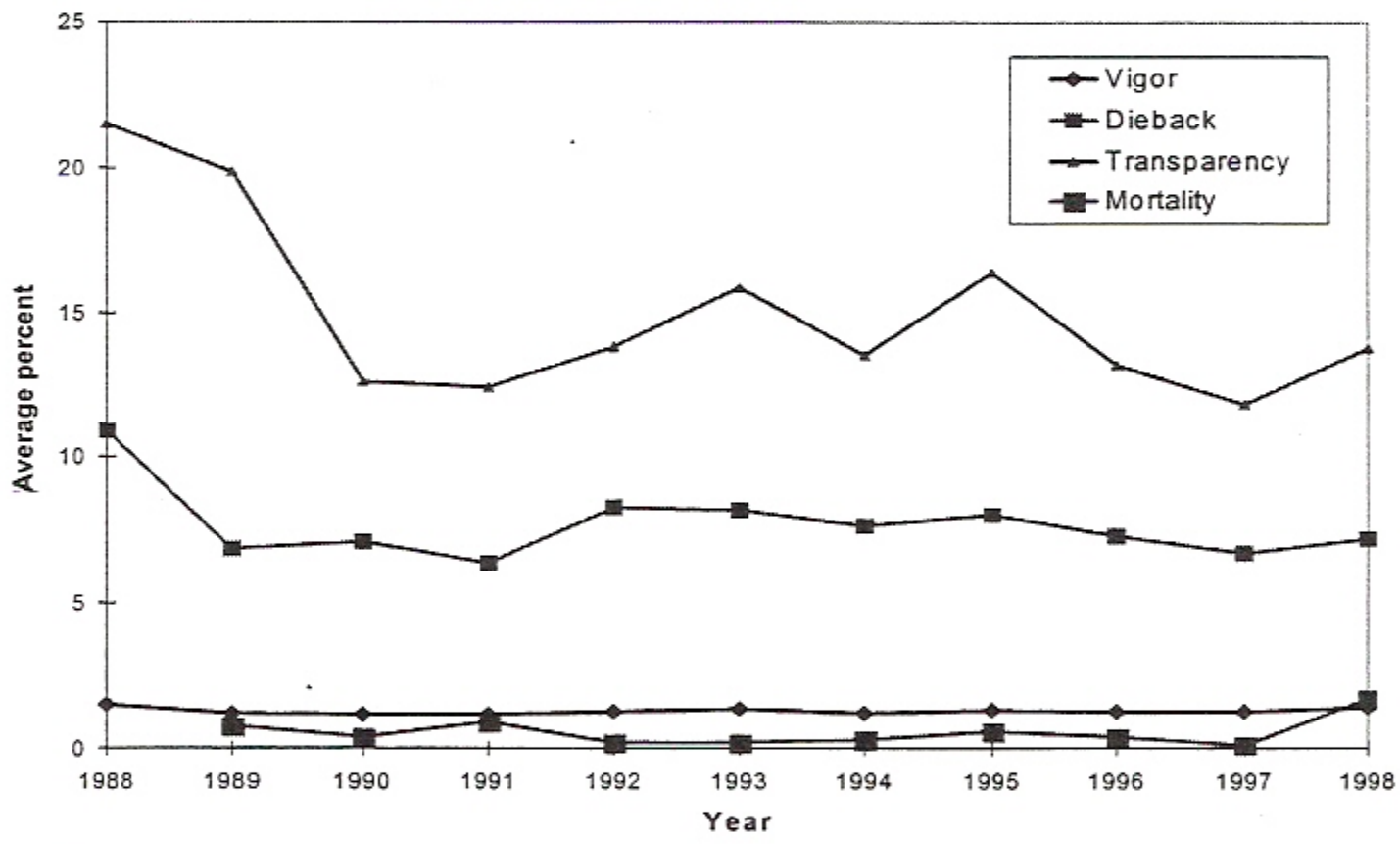


Figure 1 Trend in overstory sugar maple condition on NAMP plots.

The 1998 ice storm was a major disturbance in those forests affected by heavy ice loads. Seven of the 40 NAMP plots received light to heavy damage from the ice storm. Average dieback of sugar maple trees in ice damaged plots was 8.9% compared to 7.0% for unaffected plots (Figure 2). Transparency of foliage was 18.7% in ice damaged plots compared to 13.4% in unaffected plots. And mortality was 5.0% on ice damaged plots compared to 3.4% on other plots.

Other stresses on forests in 1998 included abundant precipitation, resulting in a variety of foliar diseases. Moderate to heavy seed production was observed on 12% of plots.

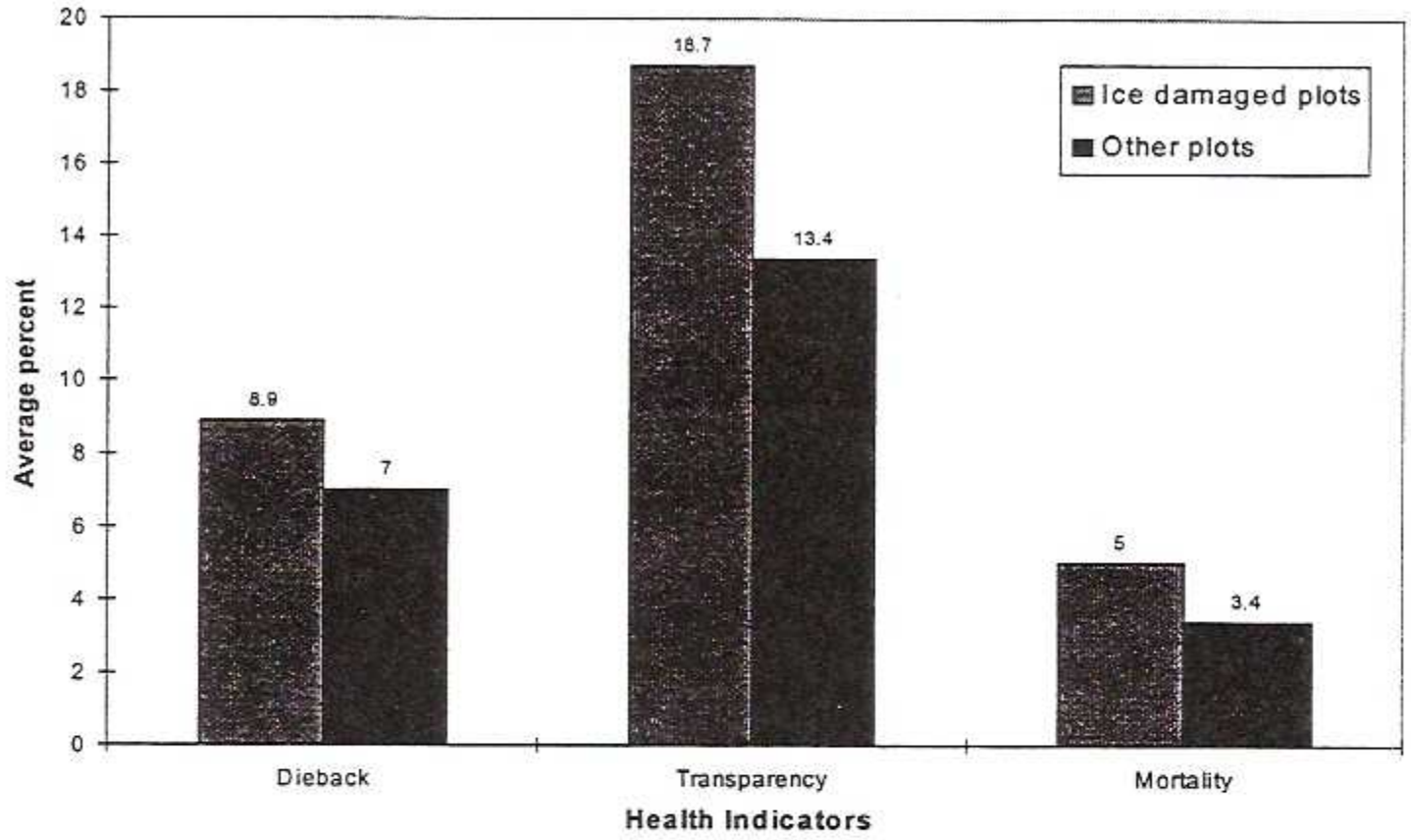


Figure 2 Sugar maple health in ice affected NAMP plots.

Other Hardwood Species

Indicators of tree condition for 1998 showed that red maple (Figure 3) and white ash (Figure 4) on NAMP plots remained in stable condition. Yellow birch foliage was thinner than normal (Figure 5). Beech foliage was thin and dieback increased dramatically over previous years (Figure 6). These two species may have been affected by foliar diseases and ice injury in affected plots.

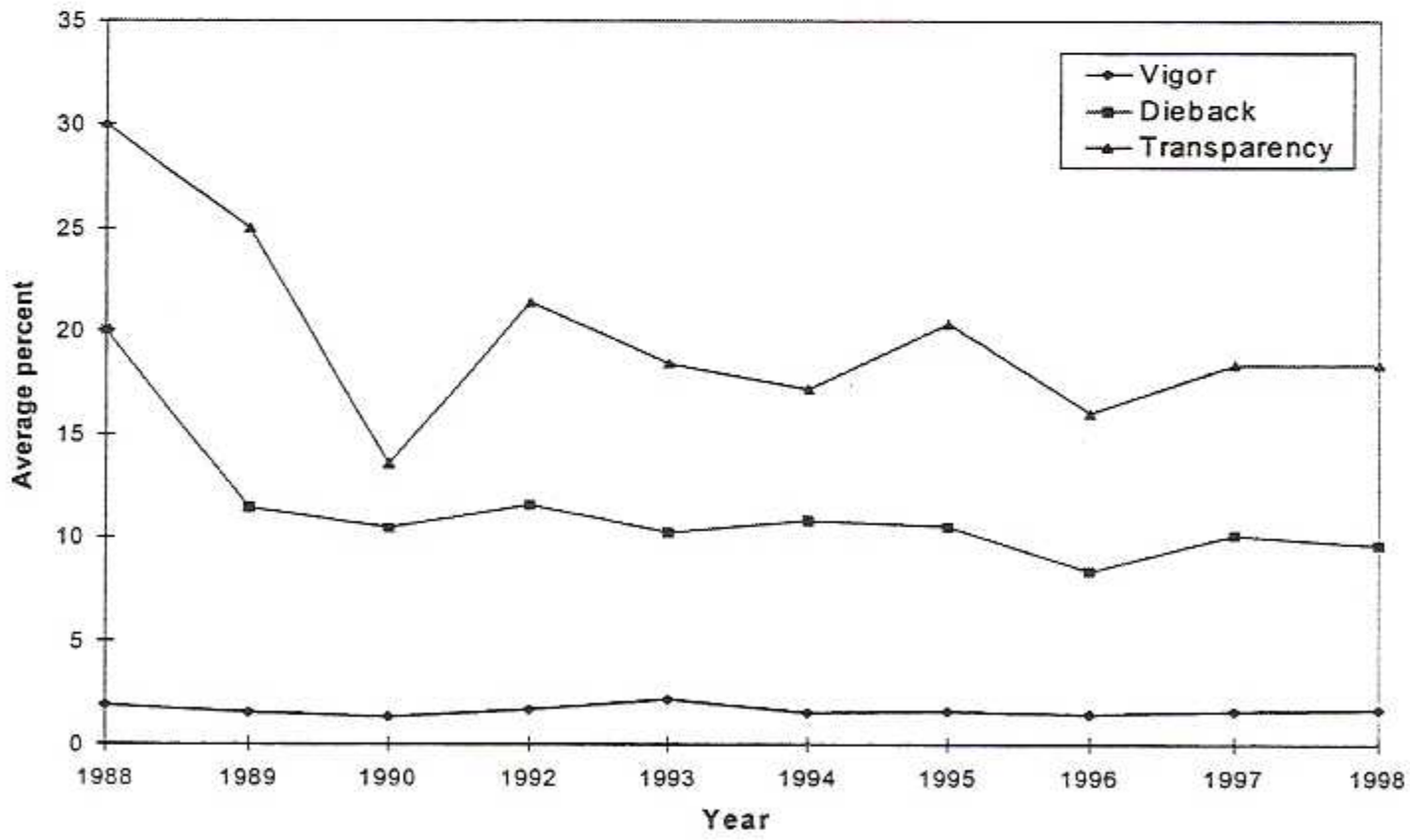


Figure 3 Trend in red maple tree condition on NAMP plots.

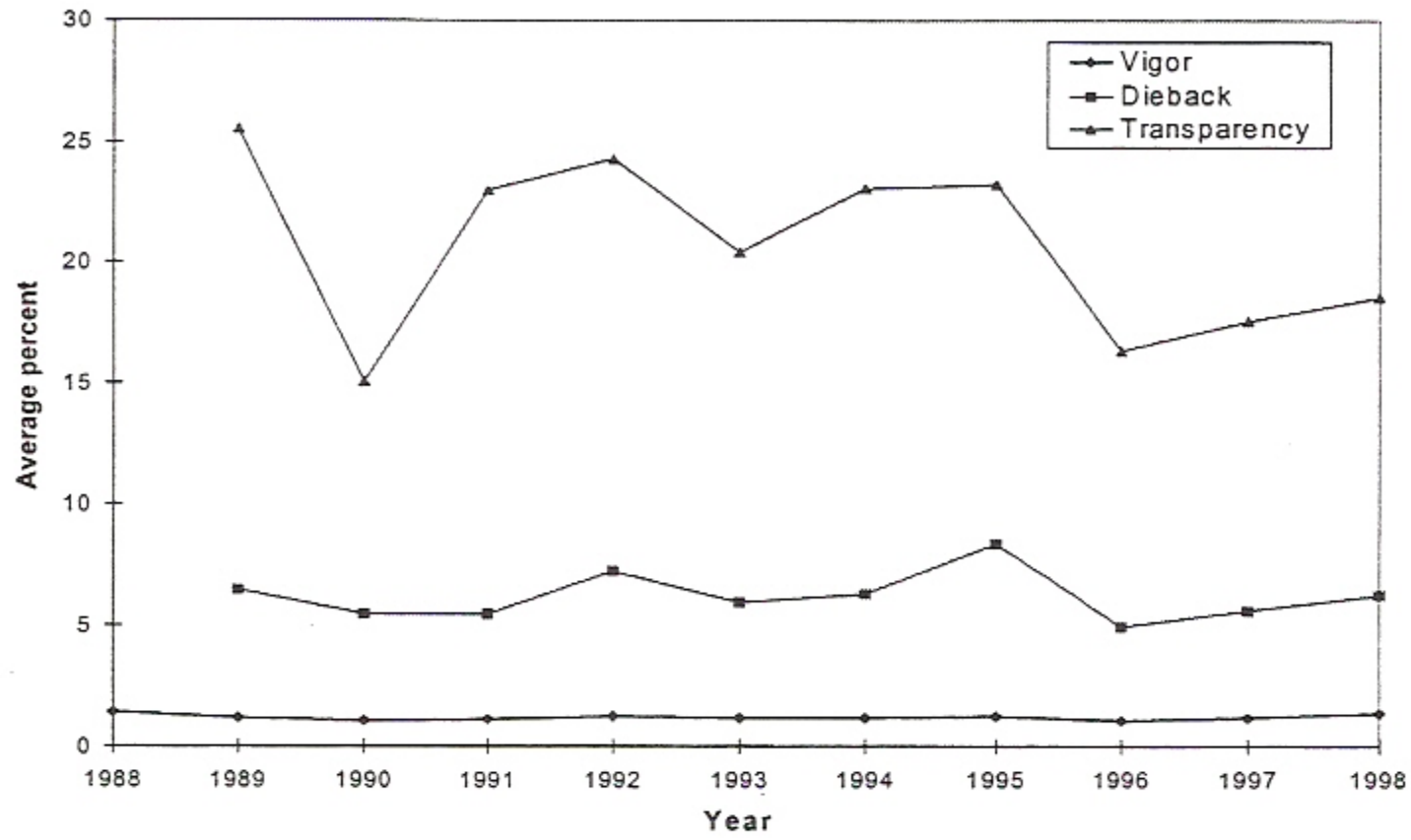


Figure 4 Trend in white ash tree condition on NAMP plots.

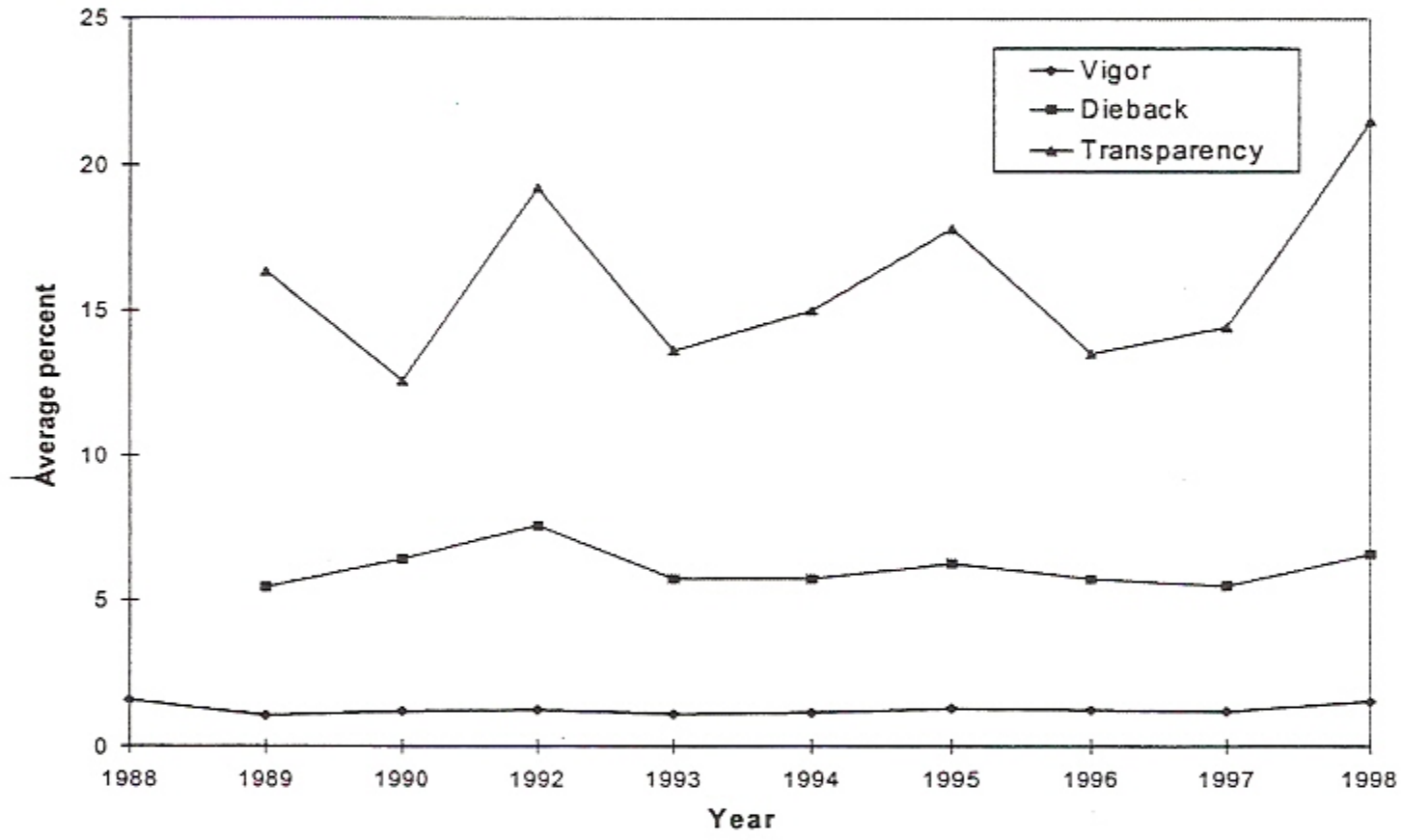


Figure 5 Trend in yellow birch tree condition on NAMP plots.

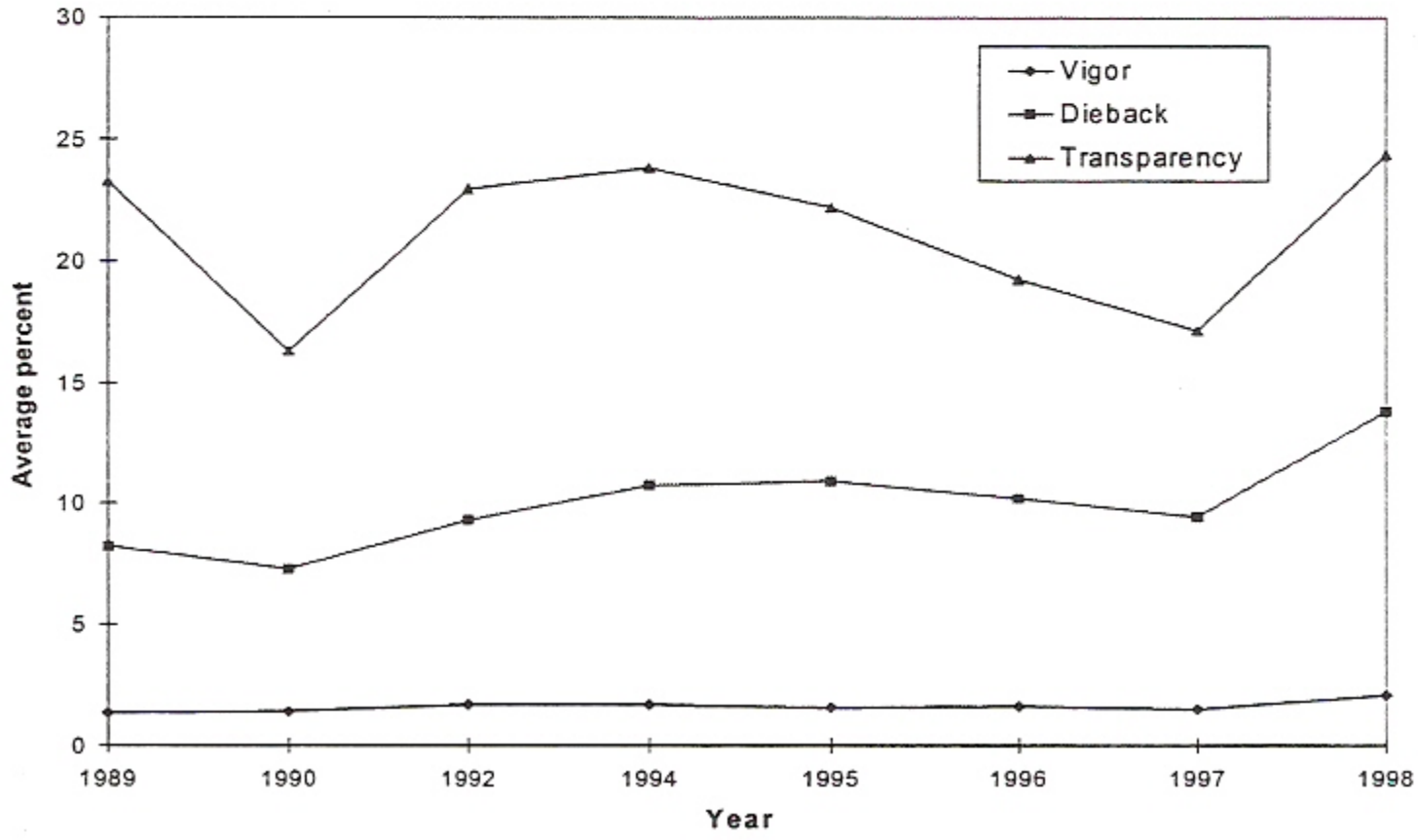


Figure 6 Trend in beech tree condition on NAMP plots.

Damage to Vermont Hardwood Tree Health Plots By The January 1998 Ice Storm

Introduction

The Vermont Hardwood Tree Health plot system consists of 84 ground plots distributed throughout the state. Plots were randomly selected based on mortality classes from interpretation of 1985 photography. Each plot consists of five, 10-factor prism points.

In the spring of 1998, all plots that fell within areas aerially mapped as having been impacted by the ice storm were visited to collect damage information. The ice storm damaged 17 of the plots but some of these had only very light damage. It was decided that only those plots that had two or more dominant/codominant trees with more than 25 percent crown loss due to the ice storm would be revisited for summer crown evaluations. Data analysis was done for the 9 plots (containing 437 trees) that exceeded that threshold. Five of these plots were located in Shelburne and South Burlington (Champlain Valley) at elevations of 300 to 400 feet. Three were in Jay at elevations above 2,100 feet and one was in Roxbury at an elevation of 2,000 feet.

Methods

North American Maple Project guidelines were followed for the early spring ice damage evaluations. Bole breakage was recorded as: 0) none, 1) single bole broken, 2) multiple bole with at least 1 unbroken or 3) multiple bole, all broken. Crown loss due to breakage was recorded as: 0) none, 1) 1-10%, 2) 11-25%, 3) 26-50%, 4) 51-75% or 5) 76-100%. Crown dieback and transparency was recorded to the nearest 5% (FHM standards) during a follow-up summer visit.

Results

The majority of trees in these plots received either light or no damage (Figure 1). Dominant/codominant trees received more crown damage than trees in other canopy positions, except for trees down on the ground or with boles broken below the crown (100% crown loss). The small pole-size trees were the ones most likely to break due to heavy ice loading. About 15 percent of the dominant/codominant trees had severe crown damage (more than 50%).

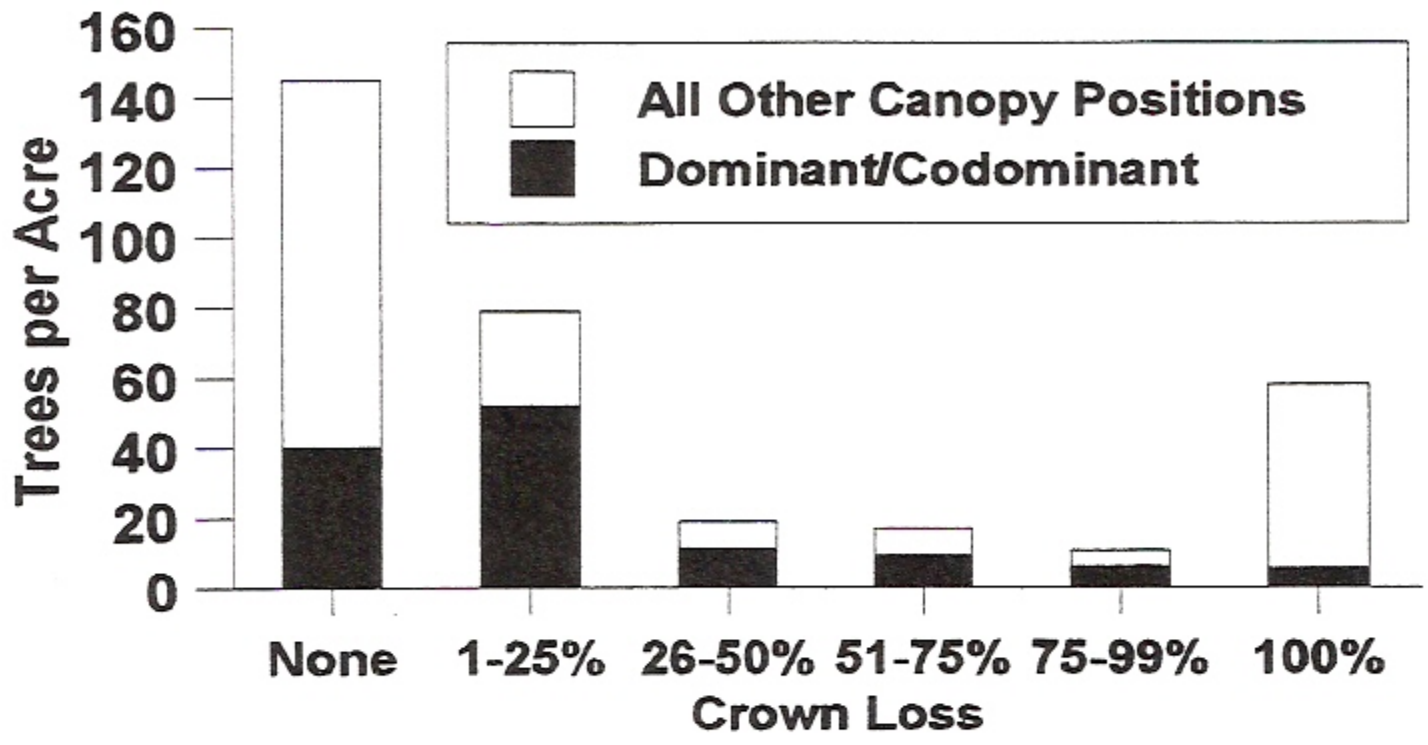


Figure 1. Crown loss due to the January 1998 ice storm.

Beech trees suffered the most severe damage (Figure 2) but all of these trees were located in one very heavily damaged plot. More than 25 percent of the dominant/codominant black cherries, red maples and hickories had heavy to severe damage. Next to beech, more of the sugar maples were killed by the storm than any other species.

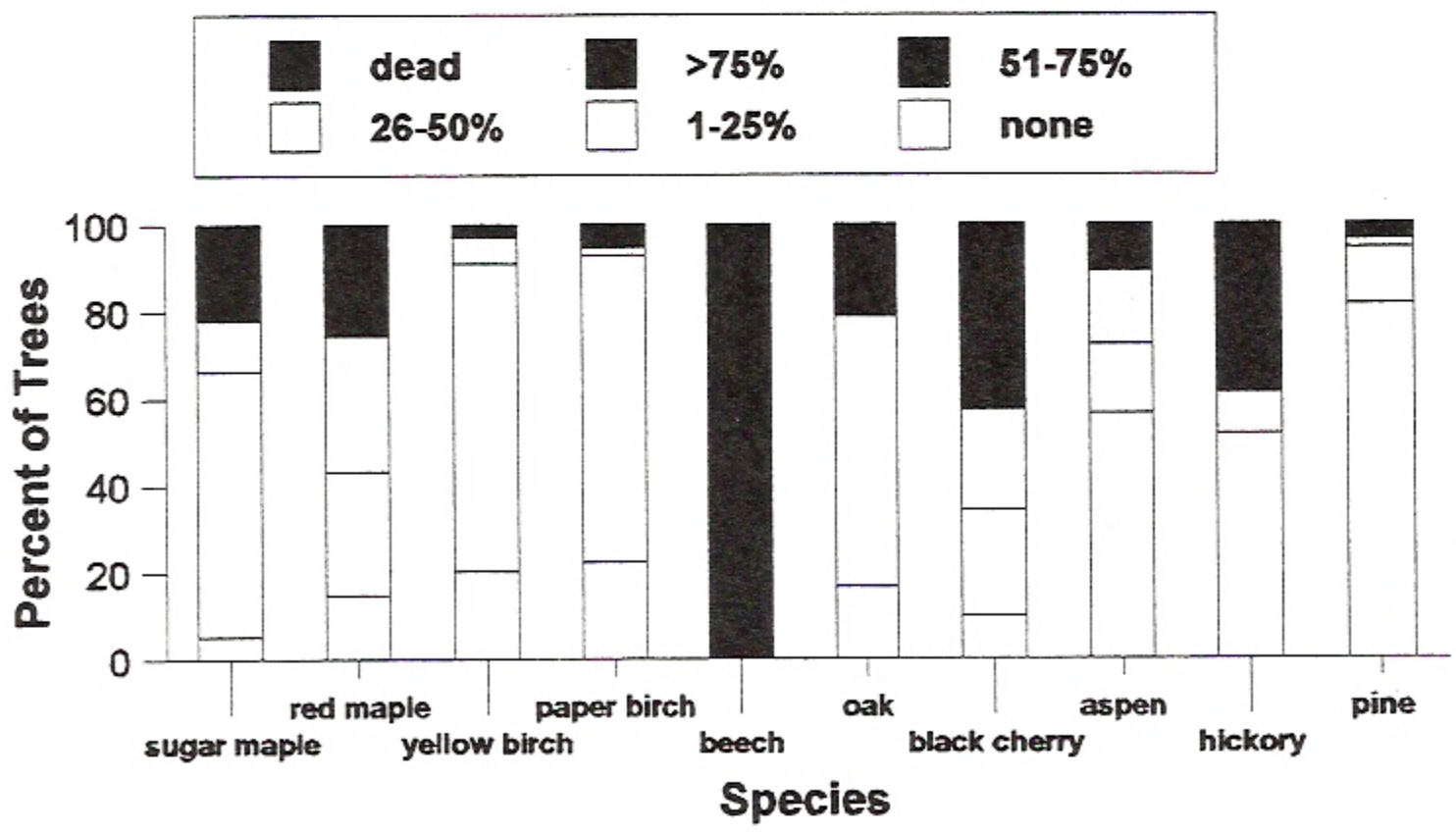


Figure 2. Crown loss due to the January 1998 ice storm for dominant/codominant trees by species.

Average dieback and transparency increased dramatically in these ice-damaged plots compared to when evaluations were last conducted in 1996 (Figure 3). Many of the heavily damaged trees were observed to have poor foliage production along many of the remaining branches, as well as smaller than normal leaf size. These trees will continue to be monitored to determine whether they survive.

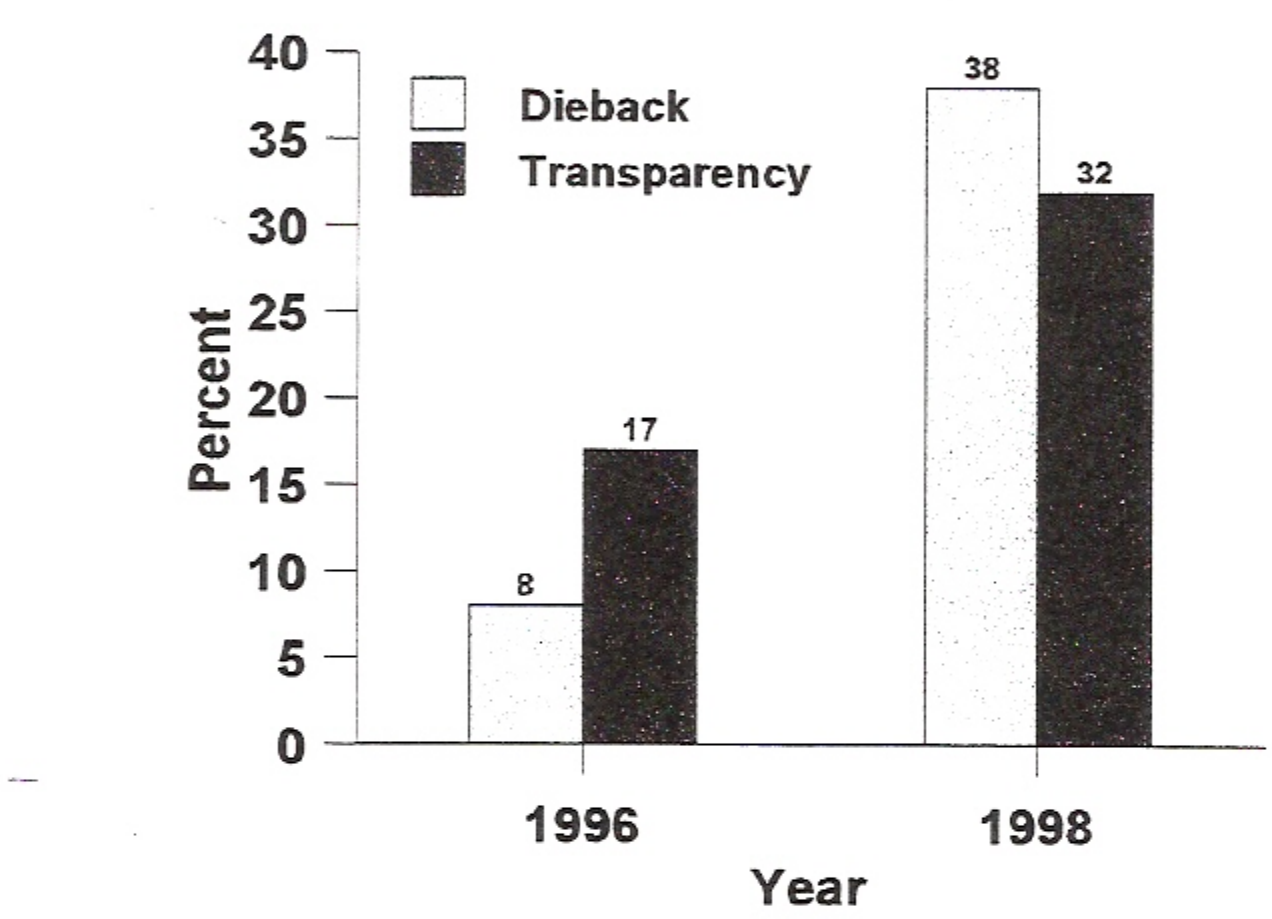


Figure 3. Average crown dieback and transparency for dominant/codominant trees before (1996) and after (1998) the January ice storm.

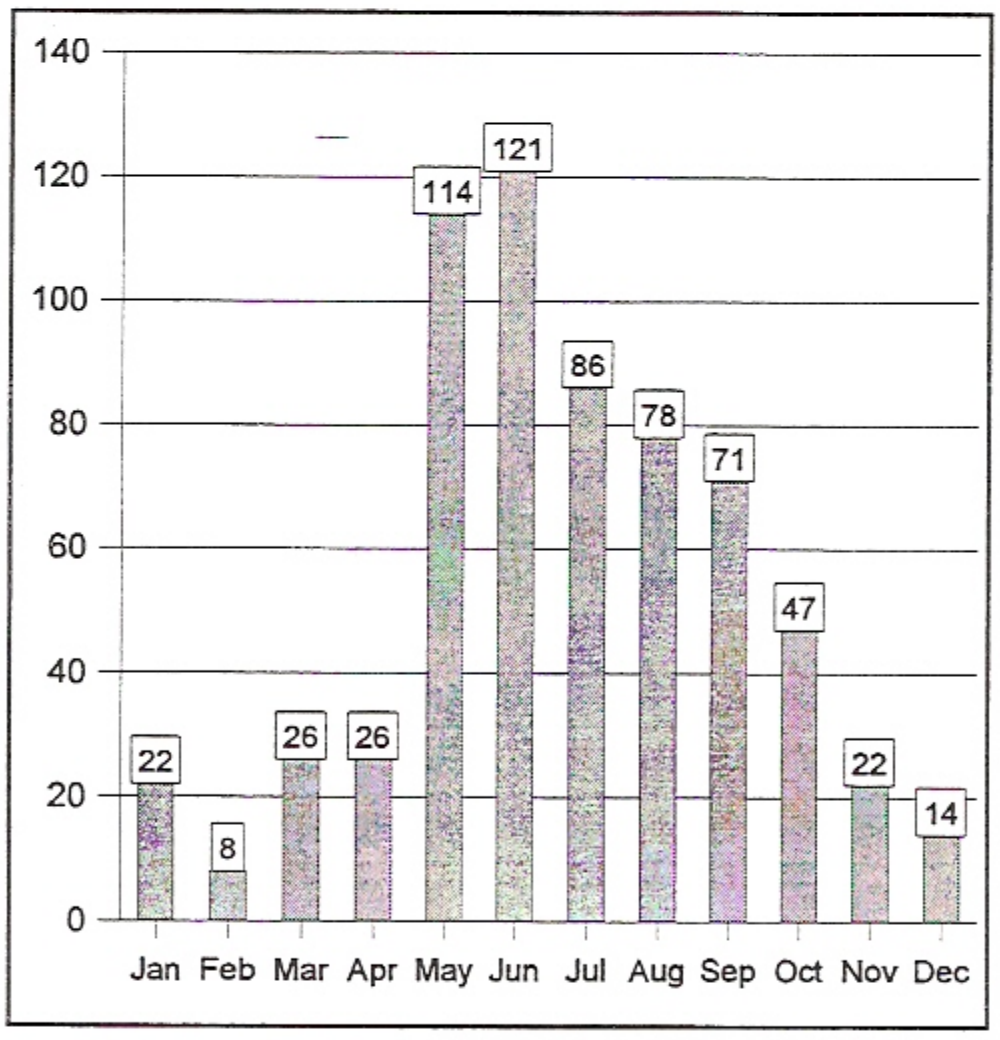
Ronald S. Kelly
3 May 1999

FOREST BIOLOGY LABORATORY -1998

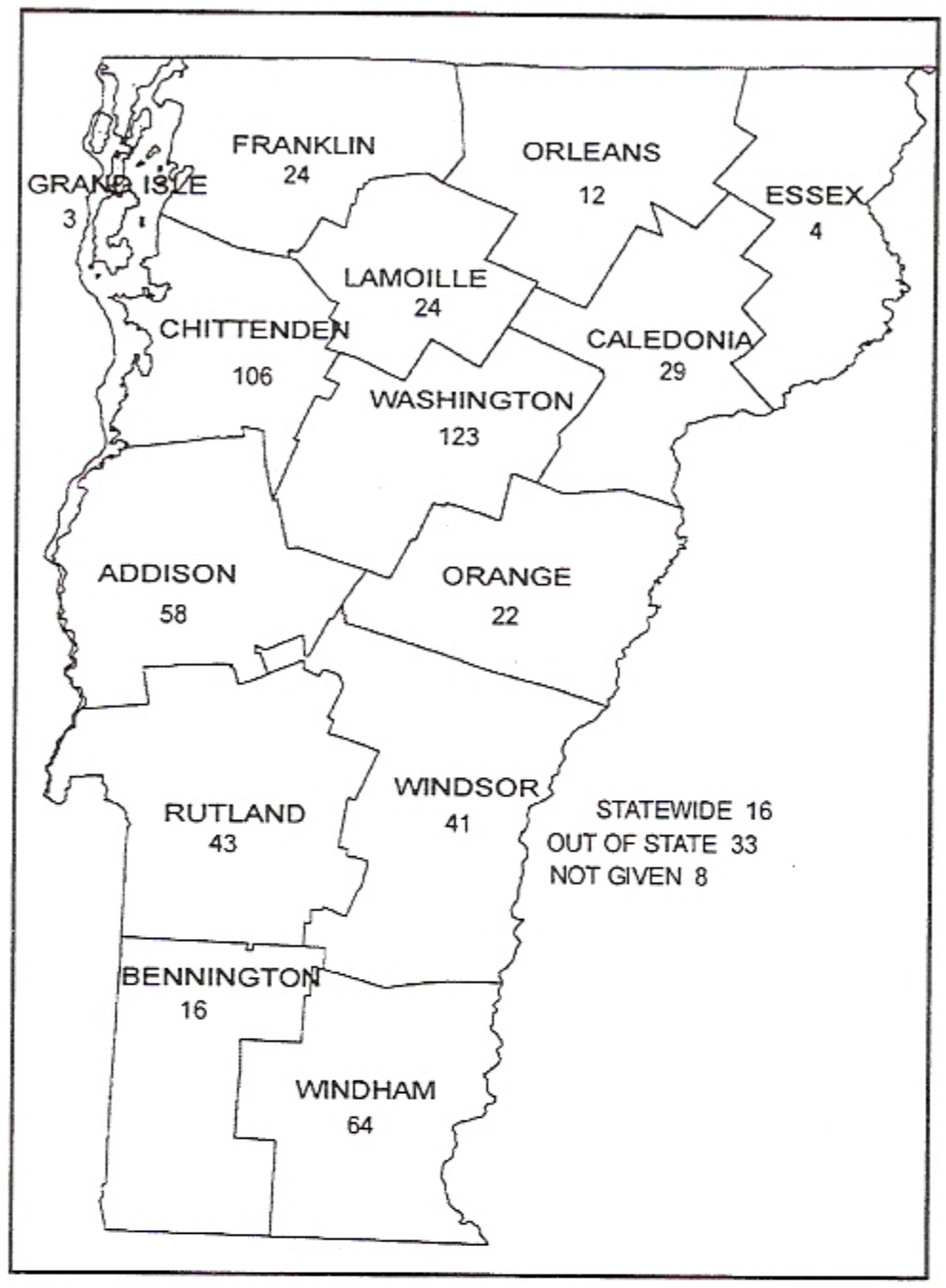
Laboratory Service Statistics

In 1998, we received 635 requests for identifications, advice and information. This number was down from 708 the previous year, which was particularly high because we received about 230 Asian longhorned beetle (*Anoplophora glabripennis*) "suspects", most of which were the white-spotted sawyer (*Monochamus scutellatus)*. In 1998, we received very few inquiries about the Asian longhorned beetle, perhaps because people became aware of and began to recognize the differences between the exotic pest and the sawyer.

As usual, numbers of inquiries peaked in June. In 1998, May was a close second. In previous years, July has been our second busiest in terms of inquiries.



We received inquiries from all counties in Vermont. The highest number of requests came from people in Washington County (123), while Grand Isle inquiries numbered 3. Thirty-three requests for information came from states other than Vermont.



Diseases and insect specimens were taken from 59 species of hard- and softwood hosts (260 requests). Sugar maple, balsam fir, white pine and oak were most commonly involved. About 90 insect specimens sent to the lab were not associated with a particular host, but were collected "at large". Inquiries about insects found in homes and other buildings made up a total of 89 inquiries. Many of these were associated with house-plants and stored products. We received 134 requests for educational materials. Responses to these requests included a variety of materials, ranging from specimens for artists and information to journalists to reference lists on particular topics for teachers. We had 20 inquiries about insects or other arthropods associated with deer, dogs, cats, and humans. Firewood, slab- and seasoned wood insect inquiries numbered about 15. Insects and diseases of herbaceous plants totaled approximately 25 requests.

Three New Pests on the Horizon

Part of our responsibility at the Forest Biology Lab is to provide information on insects and diseases that are new to our area, or whose status has changed so that they are of particular concern. To that end, we provide the following descriptions of the three insects.

The presence of the **lily leaf beetle** (*Lilioceris lilli*) was confirmed in Vermont in 1998. The insect was found on Asiatic lilies in the town of Franklin. This insect pest, which is native to Europe, was discovered near Montreal in 1945. Damage was limited to that area for decades until the insect was found in Cambridge, MA in 1992. The infested area has spread westward in Massachusetts and north into parts of New Hampshire and Maine.

Though lily leaf beetles will feed lightly on many plants, they will only lay eggs and develop on *Lilium* species (Turk's cap lilies, tiger lilies, Easter lilies, Asiatic and Oriental lilies), and species of *Fritillaria*.

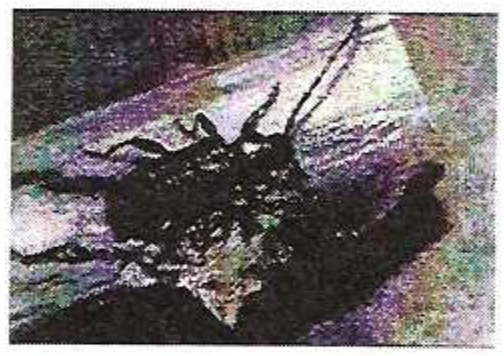
The adult beetles are1/4 to 3/8 inch long with a bright scarlet body and black legs, head, antennae and undersurface. Adults and older larvae feed on leaves, stems, buds and flowers of the host plant. Eggs are laid on the underside of foliage and hatch within 7-10 days. Larvae resemble slugs and they secrete and carry their excrement on their backs.

The **small hive beetle,** *Aethina tumida*, is a sap beetle (Nitidulidae) that was first discovered in Florida in June of 1998, and has now been found in 3 other states, Georgia, South Carolina, and North Carolina.

The beetle has not been found in Vermont, but beekeepers are being advised to be on the lookout for it. The small hive beetle is considered a secondary hive pest in southern Africa, where it is found in weak or failing hives. Reports of infestations suggest that the beetles may be more damaging here than in Africa.

The adult beetle is dark brown to black and about 1/4 - 3/8 inch long. Adults may live up to 6 months and can be found almost anywhere in the hive. Females lay irregular masses of eggs in cracks or crevices in a hive. Larvae feed on pollen and honey before leaving the hive, burrowing into the soil, and pupating. Besides ruining the combs, larvae defecate in honey, and their activity can cause fermentation and frothiness in the honey. Bees abandon heavily-infested hives.

The **smaller Japanese cedar longhorned beetle,** *Callidiellum rufipenne*, was discovered in Connecticut in September, 1998. The beetle is a native of Asia, where it is known to attack only dead and dying wood. In Connecticut, it has been found on live arborvitae and yellow cedar. The initial infestation was found in a tree shipped to a garden center from British Columbia; most subsequent sightings also involved trees from British Columbia.



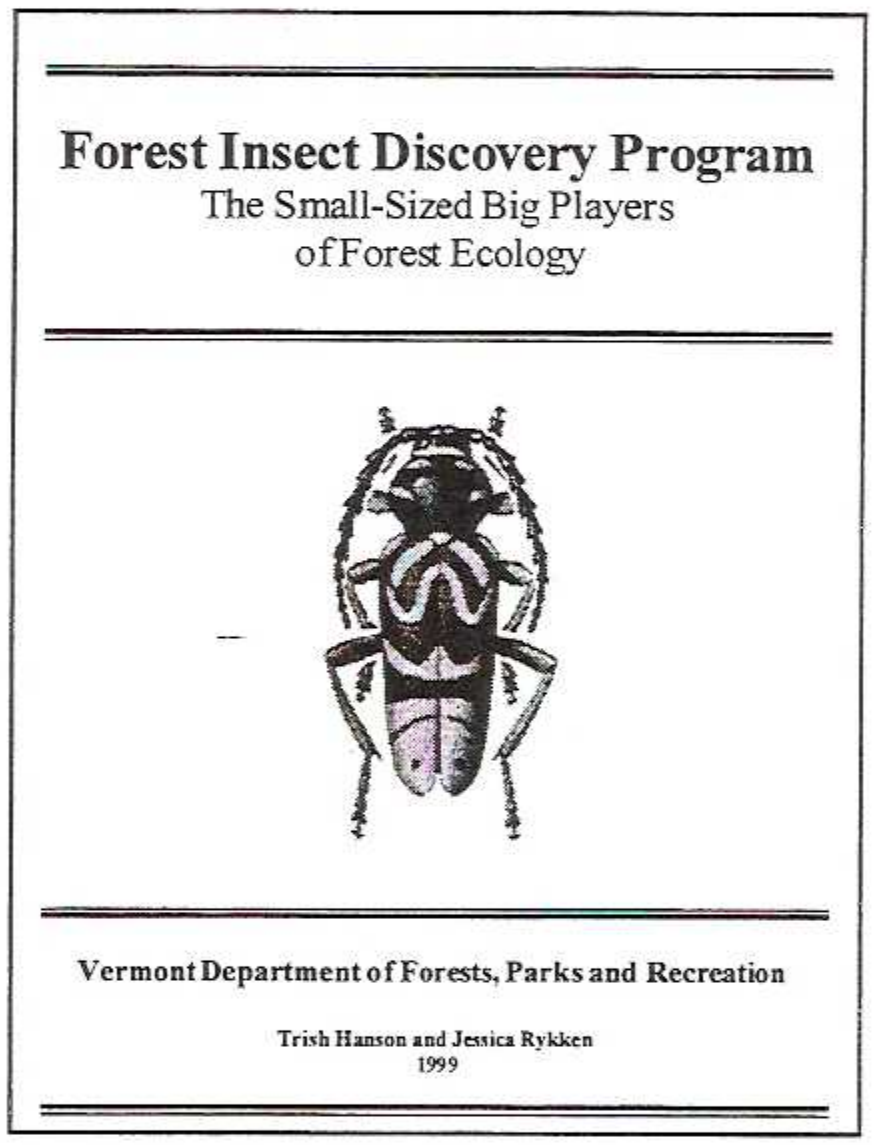
Adult beetles are 1/4 - ½ inch long. Males are iridescent deep blue to black with brownish-red to red patches on the upper corners of their wing covers. Antennae in males are slightly longer than body length. Females have brownish-red to red wing covers and their antennae are about 3/4 the body length.

Damage is the result of larval tunneling under the bark of living plants. At first, larvae burrow into the phloem and cambium, moving into the sapwood, where they pupate, in late summer. Winter is spent in the adult stage at the pupation site. In spring, adults emerge through the sawdust-filled tunnel made by the larva. In the fall, sinuous larval galleries may be visible.

Entomologists in Connecticut are encouraging people who have purchased arborvitae during 1997 and 1998 to check trees for evidence of beetle damage. Until other control methods are developed, infested plants are being cut off at ground level, the roots are examined, and the infested material is destroyed.

Work in Progress at the Forest Biology Lab

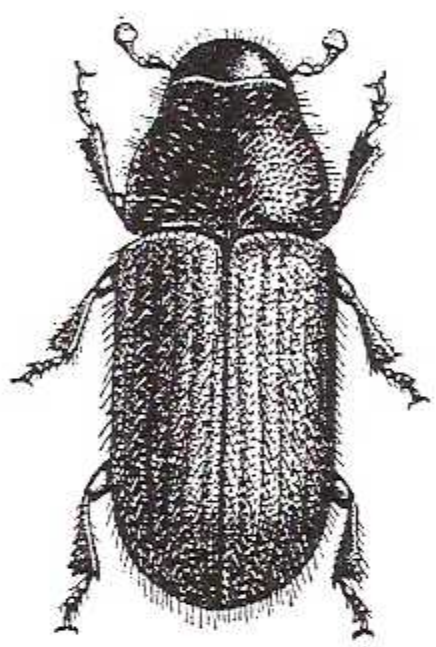
Over the past few years, we have received focus funding from the USDA Forest Service, Northeastern Area State and Private Forestry for special projects. Two of these are nearing completion. The first is an instructional kit entitled ***Forest Insect Discovery Program: The Small-Sized Big Players of Forest Ecology*** that can be taken into the classroom by a natural resources manager or used by a teacher for an introductory session in forest entomology. Materials include an outline and notes for the instructor as well as components developed to acquaint students with the variety and importance of our forest insects.



The kit was designed to familiarize students with (l) major groups of forest insects commonly found in northeastern forests, (2) survey and monitoring tools for determining insect presence and abundance, and (3) the diversity of insects associated with different forest types and their role as indicators of forest health. The kit consists of three discrete but complementary activities: "Following the Trail", a hunt based on insect damage and signs; "Collecting a Sample", an overview of procedures for detecting and monitoring insects; and "Sorting it Out", a card game that introduces major groups of forest insects and their habitats. These activities can be carried out singly or in any sequence.

Availability of this kit will be announced in *Bug Bytes* (the lab newsletter) and other references.

Jessica Rykken and Trish Hanson have written a ***Guide to Common Bark Beetles (Coleoptera: Scolytidae) Endemic to the Northeastern United States***. This publication was prepared to aid foresters, biologists, and amateur naturalists in identifying some of the more common bark beetles found in the Northeast.



The publication describes the natural history and morphology of scolytid beetles and provides an identification key to 11 genera common in the northeastern United States Fifteen phloem-feeding species are included. Descriptions for each species include the following information: a common name (if one exists); a diagnosis summarizing the most obvious and distinctive morphological features; host plant species in the Northeast and colonization habits; a brief summary of the life history; a narrative summary of distribution within the Northeast (New England and New York), North America, and the world; a list of other species (including established introduced species) within the genus that are known to occur in the Northeast; a brief description of any similar-looking exotic species; and one or more references that can provide more detailed information. By becoming more familiar with the bark beetles common in our area, we can manage our forests more effectively, and add substantially to our knowledge of regional species diversity.

The USDA Forest Service, Forest Health Technology Enterprise Team, Morgantown, West Virginia is publishing this document. We expect it to be available in June, 1999.

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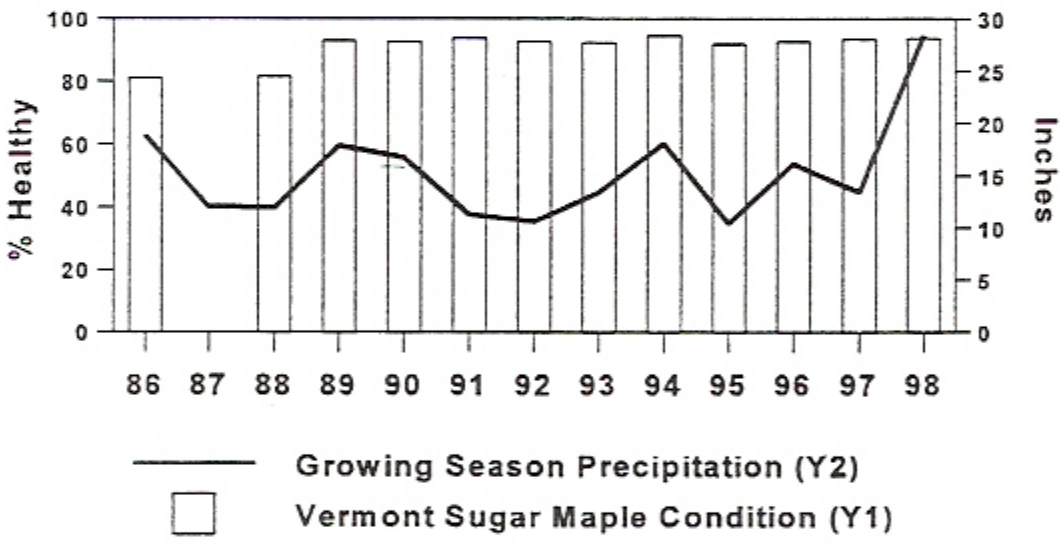
HEALTH OF SUGAR MAPLE IN VERMONT - 1998

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 1998, all 4.7 million acres of forestland were evaluated from an airplane twice; with a third survey for pear thrips in southern Vermont. In addition, survey crews walked to over 150 forested locations to rate tree condition.

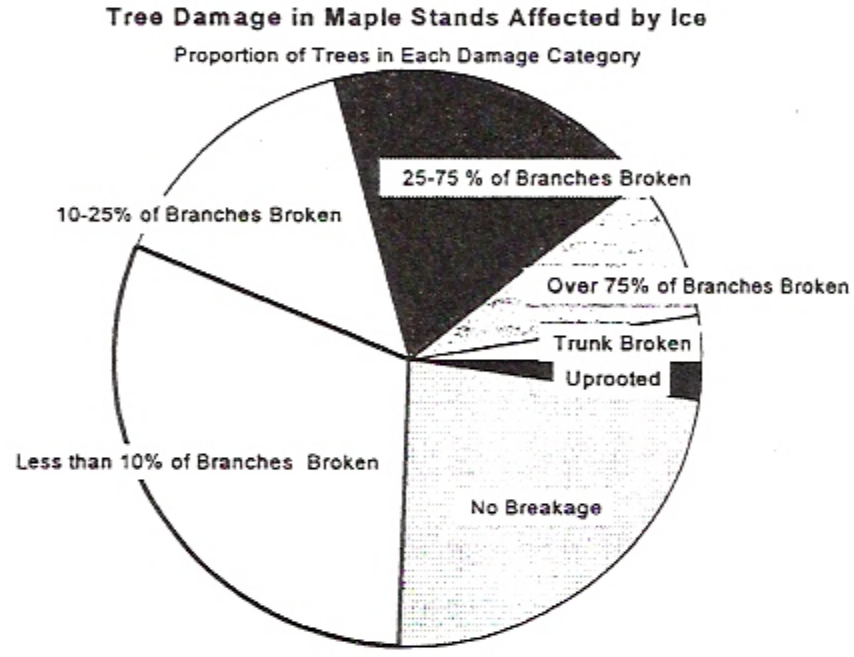
To assess the **General Condition** of sugar maples in 1998, 2000 sugar maples were evaluated for the North American Maple Project. Only 3% of them were unhealthy, based on how many dead twigs they had.



The **Ice Storm** during the first week of January deposited a layer of ice up to 3" thick on 943,000 acres of Vermont forestland. Ice damage was most severe in the Champlain Valley and on east-facing slopes above 1800'.

A survey was done of Vermont sugarmakers to assess the extent of damage to sugar production. Thirteen percent of respondents indicated that they had damage. Guidelines were produced recommending that trees with over 10% of branches broken be tapped only lightly or not at all, and that trees with over 75% of branches lost had a poor chance of survival.

All forest health monitoring plots in the affected area were evaluated to determine the long-term impact on tree condition. Seven out of 40 of the North American Maple Project plots and 17 out of 84 Vermont Hardwood Health Survey plots were in the affected area. The graph below shows what trees in the damaged North American Maple Project plots looked like when they were evaluated in March '98.



Broken trees continued to show evidence of disruption throughout the season. Many produced sprouts from the trunk or broken limbs. These sprouts will lead to structural weakness and defective sawlogs. Foliage from the sprouts often failed to drop in the fall. A bark-infecting fungus, Coral Spot, was common on broken branches. This may cause cankers on weakened or drought-stressed trees in the next few years.

Sugarmakers should continue to be conservative when tapping broken trees in 1999. Food reserves will be even lower than last year because of their reduced leaf area this summer.

Early Maple Browning in Southern Vermont was observed on scattered maples. The main cause was infection by a fungus called *anthracnose*. This was worst on trees which were made more susceptible to the fungus because they had early damage from *pear thrips*. Populations of thrips were not particularly high, and spring was, in general, early and fast, so damage was not expected. However, scattered trees were still in bud when cooler, wet weather hit. Thrips damage to these trees allowed anthracnose to get an early start. In early July, we mapped 36,000 acres of damage.

Normally, defoliated trees would put out a second set of leaves within a few weeks. However, the long stretch of wet weather allowed anthracnose to blight this "refoliation". New leaves developed sparsely, or not at all. Those new leaves which did survive were mostly small and yellow because rainy weather interfered with the absorption of soil nutrients. In addition, the fungus spread to other trees, and the extent of damage grew.

Some maples had almost no green foliage all summer. A similar situation occurred in Pennsylvania in 1994. Defoliation by caterpillars in June was followed by anthracnose on the refoliation in July. This combination caused dieback and mortality the following year. In one county, over 30% of the maples were dead on 35,000 acres. Recent research in Pennsylvania, in Vermont at the Proctor Maple Research Center, and in Quebec, indicates that soil fertility is an important factor in determining whether stressed sugar maples will recover or continue to decline.

Dr. Phil Wargo, a forest pathologist with the US Forest Service, has spent his career studying the impact of defoliation. He warned that landowners of affected trees should expect to see some dieback next year. "The trees will be in pretty tough shape; I suspect that food reserves will be very low". He suggested that sugarmakers consider not tapping affected trees in the spring. "If more than 50% of the foliage is missing, I would be concerned", he said.

Late Season Browning Statewide occurred because of heavy populations of two other insects, maple leaf cutter and maple trumpet skeletonizer

(at left). Damage by the trumpet skeletonizer was heavier than it has been for at least the past forty years. In some sugarbushes, nearly every leaf had the characteristic damage: a rolled, brown leaf gnawed down to the network of veins, with webbing and a hard black tube inside. The caterpillar actually feeds from inside the tube. By late August, due to the buildup of anthracnose and these two insects, the area of brown hardwoods mapped during the aerial survey jumped to 234,000 acres. However, damage from these late defoliators should not affect tree health.

Asian Longhorned Beetle is still a serious threat to maple health, even though it hasn't been seen in Vermont. Sugar maple is a favored host species, and it sometimes kills trees in less than three years. Based on its distribution in China, researchers believe the Asian longhorned beetle would be able to survive Vermont winters.

Because newly infested trees are difficult to detect, experts predict that it will take about 10 years to eliminate the Asian longhorned beetle from the two infestations on Long Island, in spite of the fact that over 2,000 trees have already been cut down. In 1998, an additional infestation was found in Chicago. Eradication efforts will continue there and in New York.

The Asian longhorned beetle has usually entered this country in wood used to pack pipe, granite blocks, and heavy machinery shipped from China. This beetle has been intercepted in warehouses in fourteen states. To reduce the risk of bringing it to new locations, the US Department of Agriculture has enacted an interim rule requiring that imported wood packing material be treated before use.

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
Caledonia	751-0110
Chittenden	879-6565
Essex	751-0110
Franklin	524-6501/879-6565
Grand Isle	524-6501/879-6565
Lamoille	888-5733
Orange	479-3241/476-0170
Orleans	334-7325/751-0110
Rutland	483-2314
Washington	476-0170
Windham	257-7967/885-8855
Windsor	296-7630/885-8855

COMMON PESTS OF CHRISTMAS TREES IN VERMONT 1998
REPORTED BY THE
DEPARTMENT OF FORESTS, PARKS AND RECREATION

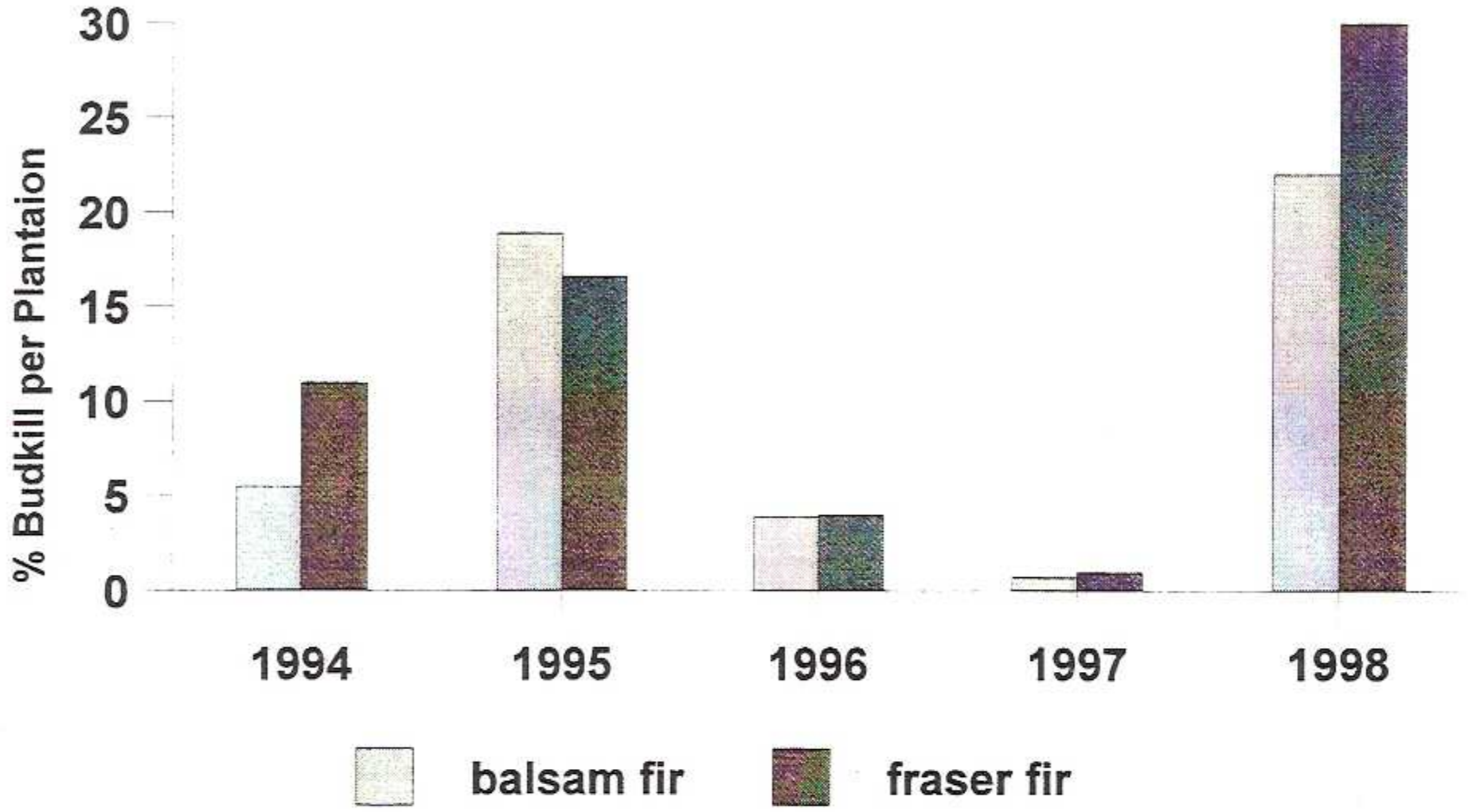
INTRODUCTION

Information in this report is based largely on a systematic annual survey of Christmas trees in northern Vermont as part of the Scleroderris quarantine. This year 260 acres were surveyed in northern Vermont. Observations by Forestry Division personnel throughout the state are also incorporated. Acreage trend information reported refers to changes in surveyed plantations in northern Vermont and is not statewide totals.

INSECTS

Balsam Gall Midge populations were at peak levels this year. Galls were found in nearly every balsam fir Christmas tree visited in the northern Vermont survey. About half the plantations had moderate to heavy damage. Damage was also heavy in many other locations throughout the state. In some locations, shoot growth was not well synchronized with insect development, making control more difficult. Damage should begin decreasing in 1999.

Balsam Shootboring Sawfly populations increased dramatically in 1998 to the highest levels ever seen. Many Christmas tree growers who had not experienced damage from this insect in the past had noticeable damage this year. Most fir plantations examined during the regular northern Vermont Christmas tree survey received moderate damage (190 acres), while 57 acres had light damage and 12 acres had heavy damage. A more intensive damage evaluation (20 trees/plt., 40 buds/tree) was conducted for 13 fraser fir and 9 balsam fir plantations in Caledonia, Franklin, Lamoille, Orleans and Washington counties. This showed that fraser fir bud kill ranged from 11 to 57 percent per plantation and averaged 30 percent, while balsam bud-kill ranged from 6 to 58 percent and averaged 22 percent. Some individual trees had as many as 88% of their buds killed. Similar surveys have been conducted in approximately the same plantations since 1994, confirming that 1998 had the heaviest damage.



Balsam Shootboring Sawfly Damage to Plantations in Northern VT: 1994-98

Shootboring sawfly adults began emerging in mid April in Lamoille County and began laying eggs the first of May. With continued warm weather, they continued to lay eggs over the next two weeks, with a peak of activity about May 8. This was three weeks earlier than in 1997 but similar to 1995. Adults caught on 3" x 5" yellow sticky cards placed in mid-crowns of trees in four Lamoille County plantations averaged 73 per card compared to 0.30 in 1997 and 3.1 in 1996.

Larvae drop from damaged shoots to the soil in late May to early June. This has been monitored for the past three years in one Wolcott plantation and confirmed that 1998 population levels were the highest ever seen. Larvae averaged 3.7 per square foot this year compared to $0.06/ft^2$ in 1997 and $0.54/ft^2$ in 1996.

Control was difficult to obtain this year due to the abundance of adults over a long period of time. One Morrisville grower made three applications of Lorsban during May to kill adults and still ended up with an average of 25% bud kill. Larvae can be killed within shoots if trees are sprayed with Diazinon A6500 or Lorsban just before they begin dropping to the soil. For balsam fir, this is just as lilacs are blooming. It is probably a week or two later for fraser fir. Killing larvae may not reduce damage the following year because some of the insects spend more than one year in the soil but could be the best long-term maintenance strategy, unless a border of larger balsams are the primary source of the insects. Growers should expect lighter damage in 1999.

Balsam Twig Aphid damage decreased statewide again this year. Damage in the balsam fir Christmas tree plantations surveyed was mostly light compared to mostly moderate damage in

1997 and moderate to heavy damage in 1996.

Cinara Aphids were detected lightly infesting 32 acres of pine and balsam fir in northern Vermont. This is similar to last year, with small clusters that caused no visible injury.

Eastern Spruce Gall Adelgid damage to white spruce has remained common, with 57 acres of mostly moderate damage detected during the northern Vermont survey.

European Pine Sawfly was observed on Scots pine in southern Vermont.

Pales Weevil damage was not detected in 1998 for the second consecutive year.

Pine Leaf Adelgid adults were detected on 114 acres of white pine. Populations increased over last year, but no shoot damage was observed.

Pine Needle Midge damage to Scots pine was less common than last year. A total of 42 acres received light to moderate needle loss compared to 70 acres of moderate damage in 1997.

Introduced Pine Sawfly injury to white and Scots pine was observed more frequently this year. 107 acres received light damage. No larvae were observed in 1997.

A Pine Fascicle Mite remained less abundant than in 1996, causing scattered small spots of yellow discoloration on shoots of white pine in northern Vermont. These spots darken and become less noticeable by the time trees are harvested.

Pine Shoot Borer injury was not detected this year. These moth larvae survive best in hot, dry seasons.

Pine Thrips were detected at one plantation this year. Damage was scattered and light. No damage was detected in 1997.

Pine Tortoise Scale was not detected at its only known site in Barre. No tree mortality due to this insect has ever been observed here.

Root Aphid injury was observed in Poultney.

Sawyer Beetle damage to balsam branches was detected at only one site in the survey this year. This plantation is naturally regenerating and contains brush and slash. These materials should be removed to discourage breeding. Adult beetles were much less frequently observed than in 1997.

Spruce Spider Mite damage continues to be low. Populations were detected within 65 acres early in the summer while conditions were drier. Periodic rains wash mites from feeding sites.

White Pine Weevil damage to pine and spruce Christmas trees remains common. Pine, mostly white, received light to moderate leader damage on 117 acres. Blue spruce received moderate damage within 99 acres surveyed.

DISEASES

A Balsam Fir Needlecast, caused by *Lirula nervata*, continues its presence at plantations where it has been previously reported. Infection is most frequently observed in low areas with poor drying and air circulation. Balsams in a Weston Plantation that were treated with Cleary's Protect T/O in May 1997 were evaluated in June 1998. Damage to foliage within 2 feet of the ground averaged 7% for treated trees and 17% for untreated trees.

Cyclaneusma and **Lophodermium Needlecast** of Scots pine remained very common. Levels of infection declined this year within inspected Christmas tree plantations. Infection was light throughout 147 acres. Only one plantation of 12 acres had moderate infection. However, damage to ornamentals in Lamoille County was the heaviest ever seen, with even current-year needles browning up by late summer. Very heavy damage was also reported for other Christmas trees in scattered locations.

Delphinella Tip Blight to Fir continued to cause some needle loss and shoot mortality in the five northern Vermont balsam fir plantations where it was known to occur, but damage was generally less than in 1997. Mostly moderate damage was observed, compared to moderate to heavy damage in 1997. Light damage was detected in southern Vermont. Trees can be protected by applying Cleary's Protect T/O fungicide shortly after budbreak and again 10 days later.

Diplodia (Sphaeropsis) Tip Blight, caused by *Sphaeropsis sapinea*, caused widespread scattered shoot mortality of pine and fir throughout the Christmas tree survey area. The tip blight was detected in 48% of the pine plantations and 61% of the fir plantations surveyed. It was also detected on balsam fir in southern Vermont.

Fir-fern Rust infection appeared to be building throughout the state. It was detected in all of the northern Vermont fir plantations surveyed. All damage was light except for 50 acres of moderate infection. This is an increase from the trace to light damage detected in 1997.

Rhabdocline and **Swiss Needlecast** of Douglas fir continue their presence wherever Douglas fir is planted in Vermont. Levels of infection were light to moderate, similar to 1997 levels.

Rhizosphaera Needle Blight of Fir, caused by *Rhizosphaera pini*, remained common and widespread this year, but infection rates in Christmas tree plantations appeared to be similar to 1997 rates. The disease was noticeable again on wild balsam fir trees but at lower levels than seen in 1997.

Spore trapping was conducted in a heavily infected Danville plantation by placing vaseline-coated slides beneath tree crowns, with weekly slide collection and replacement by the grower. Counts showed a peak of spore release between May 26 and July 2, with some spores at

all other times between May 6 and August 26. The grower conducted spray trials with Cleary's Protect T/O and Bravo 500 again this year, but with better timing than in 1997. The first application was May 25, just before the first spike in spore catch and after complete budbreak, with a second treatment June 10. This resulted in 90% control compared to 50% last year. Again, there was no significant difference between the two treatments and no phytotoxicity from the Bravo (chlorothalonil).

R. pini is able to infect any age needle, but it was not known how much infection in any one year occurs on older needles. To determine this, all old dead needles were removed from 23 flagged balsam fir branches in the Danville plantation in early spring and the number of infected needles on 1998 and 1997 growth were counted on August 28, 1998. This revealed that infection of older (1997) needles was only 12.5% of the total for all needles on 1997 and 1998 shoots.

Rhizosphaera Needlecast of spruce remained common.

Rhizosphaera Needlecast of blue spruce was present in 38 percent (92 acres) of the blue spruce plantations surveyed. Most infection was light, similar to 1997 levels.

Scleroderris Canker has not been found in any new towns since 1986. Nineteen Christmas tree plantations within the quarantine zone were inspected this year and found free of the disease.

Sirococcus Shoot Blight of spruce has decreased since 1996. Two plantations, totaling 30 acres, were found with trace levels of infection again this year.

White Pine Blister Rust damage remains common and stable throughout the survey area. Eighty percent of the plantations surveyed had infection, generally restricted to scattered lateral branches and mostly at low infection levels throughout the state.

White Pine Needle Blight was common again this year within the plantations surveyed. Thirty-seven percent of the plantations surveyed were infected, and 42% had moderate infection. One plantation in Brookfield had heavy damage where nearly all current foliage was infected.

Woodgate Gall Rust damage to Scots pine was reported on 50 percent of the entire Scots pine plantation acreage surveyed. Damage was heavy in one 2-acre plantation but light in the remaining 127 acres. Levels of infection appear to be stable.

Yellow Witches Broom Rust of balsam fir remains common in plantations where it has been reported in the past. Look for brooms in the spring, for they break bud earlier and are off color, thus easier to spot. The next step in control is the eradication of the alternate host, chickweed.

Armillaria Root Rot continues to cause tree mortality in scattered locations.

Bud Abortion of Fir was detected throughout the northern Vermont survey region. Twenty-seven percent of the plantations inspected had noticeable amounts of aborted buds. A moderate winter with frequent thaws could be cause for this increase.

Frost Damage was rare this year, but some damage was visible on balsam fir in Rutland and Weathersfield and Douglas-fir in Townshend.

Wet Site conditions resulted in the loss of fraser fir in many locations, and balsam fir in a few locations, due to the extremely wet summer. Improving drainage is the only possible solution. Sites with poor drainage should be avoided when planting fraser fir. Some yellowing of balsam foliage this year also appeared to be weather related.

Deer injury to balsam fir was reported at two plantations in the survey: Waterville and Brookfield. Damage included feeding on lateral branches and injury to the main stems.

Planting Too Deep led to spruce mortality in Pawlett.

Roundup Herbicide Injury to fir was observed in Weathersfield.

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