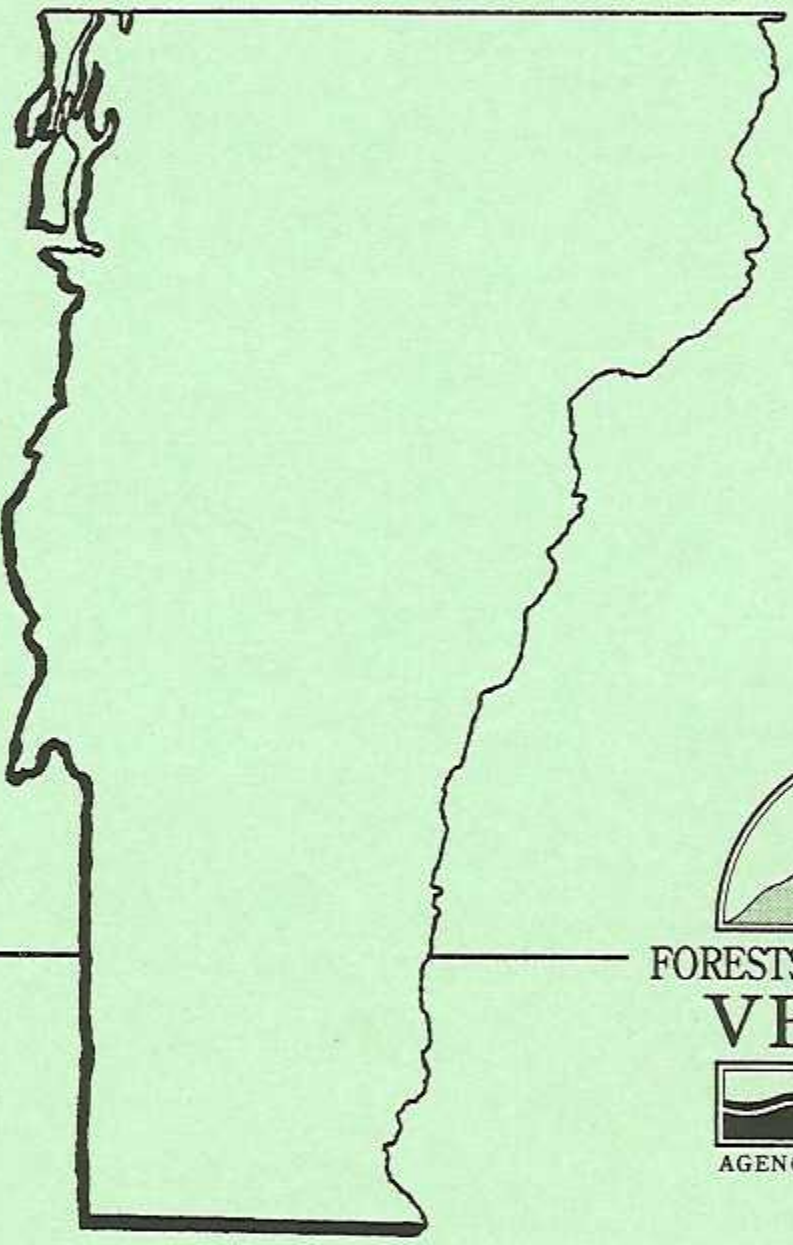
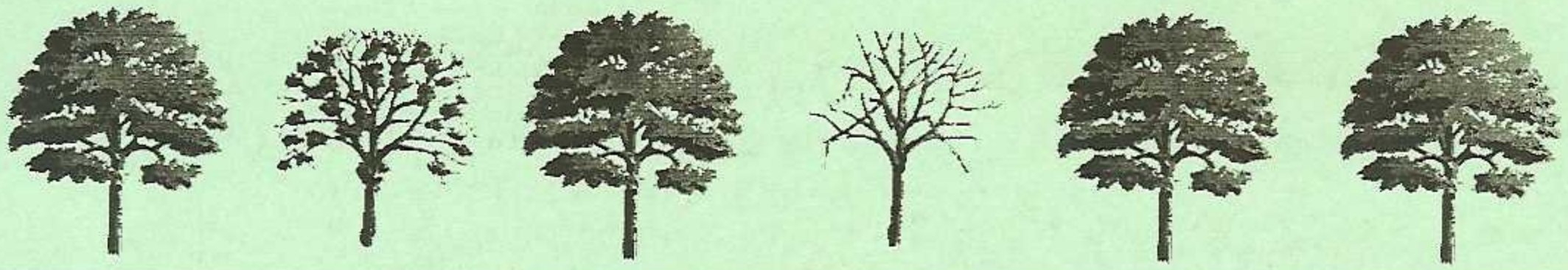
FOREST INSECT AND DISEASE CONDITIONS IN VERMONT 1994



VERMONT
FOREST RESOURCE PROTECTION
FIRE INSECTS DISEASES

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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FOREST INSECT AND DISEASE CONDITIONS IN VERMONT

CALENDAR YEAR 1994

PREPARED BY

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AGENCY OF NATURAL RESOURCES

DEPARTMENT OF FORESTS, PARKS AND RECREATION

Division of Forestry

Forest Resource Protection Section

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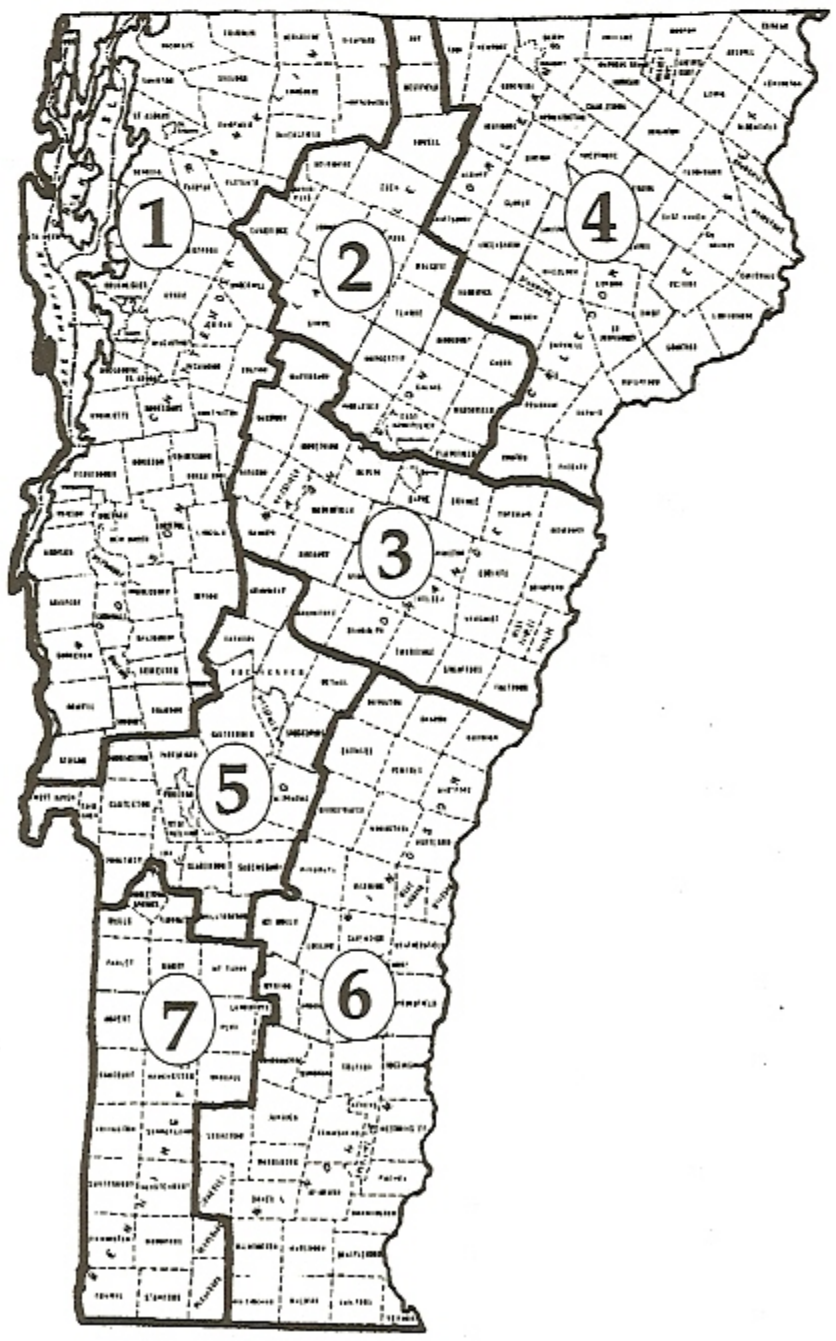

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1.	Pete Reed	879-6565 (B)
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	Tom Simmons	879-6565 (B)
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2.	Bernie Barton	888-5733 (B)
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3.	Jay Lackey	479-3241 (B)
	Barre	476-8125 (R)
4.	Hollis Prior	748-8787 (B)
	St. Johnsbury	684-2276 (R)
	John St. Arnauld	748-8787 (B)
	St. Johnsbury	748-2446 (R)
5.	John Barrows	483-2314 (B)
	Pittsford	746-8340 (R)
6.	Allan Sands	886-2215 (B)
	N. Springfield	875-2279 (R)
7.	Nate Fice	362-5533 (B)
	Manchester	362-6181 (R)

Vermont
Insect & Disease Highlights
1994

Anthracnose was observed on birch, maple, and red oak, causing scattered, occasionally heavy, damage.

Arborvitae Leaf Miner caused mostly light damage to northern white cedar. Moderate-heavy damage was mapped on 222 acres in northern Vermont.

Ash Dieback was mapped on 1650 acres, compared to 150 acres in 1993. However, many trees that had thin crowns from heavy seed in 1993 have recovered.

Balsam Gall Midge damage remains low.

Balsam Shootboring Sawfly increased, causing up to 30% shoot mortality to fir Christmas tree plantations. Fraser fir was more severely damaged than balsam.

Balsam Twig Aphid populations declined, although some mostly light damage was detected.

Beech Bark Disease symptoms were less noticeable than 1993, although tree condition continues to decline in monitoring plots.

Birch Defoliation, caused by birch skeletonizer and birch leaf miners, decreased, with only 6650 acres mapped compared to 23090 acres in 1993. Birch defoliation has been widespread since 1991.

Birch Decline and mortality remain noticeable, particularly in scattered locations in the Northeast Kingdom.

Brown Spot Needle Blight was confirmed for the first time in Vermont in Scots pine in Huntington.

Bruce Spanworm caused widespread, mostly light to moderate damage in sugarbushes and other maple stands in late spring. Moths were common in the fall.

Butternut Canker continues to cause widespread mortality of butternuts.

Delphinella Tip Blight was found damaging fir in several widely scattered locations, and was confirmed for the first time in Vermont.

Dogwood Anthracnose was confirmed to be present on all of the native flowering dogwood sites on record.

Dolthistroma Needlecast was detected for the first time in Vermont on Austrian pine in Barre.

Fall Hemlock Looper caused only very light damage in a few northern Vermont locations.

Fall Webworm populations increased noticeably throughout the state, with scattered trees in some valley areas completely defoliated.

Forest Tent Caterpillar populations continued to be very low, with no defoliation observed. Light trap catches showed a noticeable increase.

Frost Damage was much reduced from previous years, although hardwood damage was mapped on 740 acres in southern Vermont, and scattered damage occurred to Christmas trees statewide.

Gyspy Moth population remained very low. No defoliation was detected, and none is expected in 1995.

Hardwood Decline and Mortality was mapped on 20430 acres, similar to 1992, but down from 1993 when decline was made more visible in stands with thrips damage.

Heavy Seed was produced on a number of species, and was mapped on 11200 acres.

Hemlock Woolly Adelgid was not observed either in statewide detection efforts or during surveys of the site where it was introduced in 1990.

Logging Wounds to sugar maple, in plots originally established in 1980, were reevaluated to determine the internal volume of discoloration and decay. The incidence of decay exceeded 80% for wounds originally covering 20% of stem circumference or greater.

Maple Leaf Cutter defoliation decreased with only 160 acres mapped, compared to nearly 3000 in 1993.

Oak Leaf Tier larvae or damage were not observed.

Oystershell Scale populations remain low, although old damage to beech remains visible.

Ozone Injury symptoms were observed on sensitive species at locations throughout the state.

Pear Thrips populations were extremely low, and only light damage was observed occasionally. Soil populations increased only slightly in winter 1994-95.

Pine Leaf Adelgid decreased in northern Vermont, but was noticeable in several southern Vermont locations.

Pine Needle Midge populations decreased.

Red Rot indicators are conks, punky knots, and weevil spikes, according to data collected from sixteen white pines.

Saddled Prominent larvae were rarely observed.

Satin Moth damage was not observed, although dieback from previous defoliation is noticeable in Windsor County.

Scleroderris Canker was not found in any new towns for the eighth consecutive year.

Sirococcus Shoot Blight was much less noticeable in the mature plantations where it is being monitored, but more noticeable in Christmas trees in northern Vermont.

Spring Hemlock Looper was not detected. The condition of trees in monitoring plots defoliated in 1990-91 is improving.

Spruce Spider Mite populations were occasionally heavy going into the season, but damage was much less common than 1993.

Spruce Budworm defoliation was not detected. Moth populations were stable for the fourth year.

Spruce Mortality remained stable, with 2650 acres mapped.

Tomentosus Root Rot infected trees did not change in condition in a monitoring plot in Dummerston.

Unthrifty Hardwood Crowns associated with logging activities were aerially mapped on 860 acres.

Wet Site conditions caused dieback and mortality which was mapped on 9670 acres, similar to the 9060 acres mapped in 1993.

White Pine Needle Blight caused only trace damage to 1994 growth.

Winter Browning of red spruce was slight. Trees with dieback in plots established to monitor the impact of the widespread browning in 1993, improved in 1994.

Winter Injury from extreme cold temperatures in January and February caused dieback on species near the edge of their hardiness range.

Vermont
1994 Forest Insect & Disease 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 sampling, or to obtain copies of defoliation maps, management recommendations, and additional literature, contact forest resource protection personnel (page 1) or your county forester.

Sugar Maple - Growing conditions for sugar maple have been good, and surveys indicate that the general health of maples is stable, with most in good condition. Major maple pests, including saddled prominent, forest tent caterpillar, maple leaf cutter, and pear thrips, were at low levels in 1994, and are not expected to be problems in 1995.

Forest tent caterpillar is at outbreak levels in western New York and Pennsylvania, and moth catches in light traps were up slightly in Vermont. It is too early to know what the population is going to do, and we are not making special recommendations at this time. However, selective cutting immediately prior to an outbreak increases the chances of dieback and mortality. Since there is a potential for buildup over the next couple of years, look out for this insect in June, especially in stands which have been historically defoliated. You may be aware of leaf fragments on the forest floor, clumps of caterpillars on the bark, or excessive light coming through the canopy.

Data from a study of wounds made during a logging operation in the late seventies suggests that, as wound size and the percent of circumference wounded increase, the amount of associated decay and discoloration after 10 years also increase. If large wounds are made to logs that would currently yield high value lumber, these should be harvested while the defect would be removed in the slab rather than allowing decay to occur. However, trees with smaller wounds, or those with the potential to produce clear wood outside of the defective area, should not be prematurely salvaged.

Birch - Late season defoliation was common for the fourth consecutive year, although the damage was less widespread in 1994. Where birch are stressed, bronze birch borer and ambrosia beetles have the potential to attack, and degrade can occur rapidly. Generally, trees with over 20% dieback are unlikely to recover.

Beech - Levels of beech bark disease remain stable, with stem defect and crown dieback occurring in some stands. The presence of hemlock in a stand creates environmental conditions which favor beech scale. Unless beech are resistant, expect stem defect in stands where these species grow together. Maintaining small, separate groups of beech or hemlock may be preferable in stands where it is desired to maintain both species.

Oak - Oak seedlings were unusually numerous following a heavy acorn crop in 1993. However, in some locations, deer browsing will limit the survival of these species. Tree shelters can bring seedlings along in areas where oak regeneration is critical. Where management practices are limited by deer feeding, managers may want to contribute to the dialogue about appropriate deer herd levels in their region.

Since gypsy moth is not expected to be a problem in the near future, now is an appropriate time to do selective cuts in oak stands. Data from the US Forest Service indicate that stands with the highest potential for defoliation have at least 80% of basal area in oak species, while those with the lowest have less than 20% oak. Modifying the species composition can change the susceptibility of stands prior to the next outbreak.

White Ash - Most trees are recovering from dieback related to heavy seed production, although some with very heavy dieback are continuing to decline. Ash yellows remains the problem of most concern. A leaflet, *"How to Identify and Manage Ash Yellows in Forest Stands and Home Landscapes"*, was printed this year by the US Forest Service, and is available from our department.

Spruce-Fir - Monitoring plots indicate that the widespread red spruce winter injury in the spring of 1993 did not lead to dieback or other noticeable health problems. Because many spruce and fir pests, such as spruce budworm and fall hemlock looper, remained low, and others, such as balsam shootboring sawfly, were a problem primarily to Christmas trees, no special management practices are recommended.

White Pine - A study of red ring rot signs indicated that trees with fruiting bodies of *Fomes pini*, or several swollen, punky knots, and those with spikes in the lower bole from past weeviling, are likely to have red rot. By discriminating against these trees, and by maintaining stocking levels that allow rapid growth, the levels of red rot in the residual stand can be reduced.

Hemlock - Hemlock woolly adelgid is not known to occur in Vermont, but in 1994, it was confirmed from trees in Northampton, Massachusetts, about 30 miles from the Vermont border. Best management practices for stands threatened by this insect are being developed under the leadership of the US Forest Service.

VERMONT FOREST HEALTH, INSECT & DISEASE PUBLICATIONS: 1994

For copies of the publications listed below, contact the authors or Forest Resource Protection personnel (page 1).

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Brownbridge, M. 1995. Prospects for mycopathogens in thrips management. *In* B.L. Parker, M. Skinner and T. Lewis [eds.], Thrips biology and management, Proc. 1993 Int. Conf. on Thysanoptera, Burlington, VT, Plenum Publ. Corp., New York. In press.

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Hanson, P.M., C. Eliopoulos and A. Walker. 1995. Field collection, laboratory rearing and intake introductions for the herbivorous aquatic weevil, *Euhychiopsis lecontei*, in Vermont. Prepared for Vermont DEC and Region 1, U.S. Environmental Protection Agency, Boston, MA. (unpubl.) 41 pp.

Hanson, T., B. Teillon and B. Burns. 1994. Regional forest pest survey manual for New England and New York. VT Dept. of For., Parks & Rec., Waterbury, VT.

Leonard, J.G. and B.L. Parker. 1994. Periodical appearance of *Korscheltellus gracilis* (Lepidoptera: Hepialidae). Ann. Entomol. Soc. Am. 87(5):566-571.

Liebhold, A.M., W.L. MacDonald, D.R. Bergdahl and V.C. Mastro. 1994. Invasion by exotic forest pests: A threat to forest ecosystems. Forest Science Monograph. (Accepted for publication: In Press).

Parker, B.L. and M. Skinner. 1994. The thrips network: A worldwide directory of specialists and individuals concerned with the Thysanoptera. AVRDC Publ. 94-42853. Shanhua, Tainan, Taiwan.

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INTRODUCTION

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

Two complete aerial surveys were flown this year. The first one was in late June-July to detect any early to mid-season defoliators. The last survey, in cooperation with the US Forest Service, was flown in late August to early September, and targeted defoliation by maple leaf cutter and birch defoliators.

Diagnostic assistance was provided by the Division of Forestry Diagnostic Laboratory, the University of Vermont, the Vermont Department of Agriculture, Pennsylvania State University, and the US Forest Service.

A survey is conducted annually on nearly 2300 acres of Christmas tree plantations in North-Central Vermont as part of the Scleroderris quarantine. 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.

Thanks to the many individuals who contributed to this report, including Trish Hanson, Sandy Wilmot, Jay Lackey, Tom Simmons, John Barrows, Hollis Prior, Pete Reed, Bernie Barton, John St. Arnauld, Allan Sands, and Nate Fice from our Forest Resource Protection Staff, Dale Bergdahl, Shari Halik and Margaret Skinner from the University of Vermont, and Jon Turmel and Scott Pfister from the VT Department of Agriculture. Assistance in preparing maps and survey acreages was provided by John Dudley and Diane Morse from the VT Agency of Natural Resources and Tom Luther and Bob Cooke from the US Forest Service, Forest Health Protection. A special thanks to Melissa Currier for preparing the manuscript.

WEATHER AND PHENOLOGY

Winter 93-94 was generally colder and snowier than average. Periods of extreme cold in January led to widespread winter injury of marginally cold-hardy plants.

Spring development was somewhat slow, due to below average temperatures in April and May, and dry conditions in late April. Lake Champlain flood level from the heavy snow melt nearly reached last year's record level of 101.89 feet when it reached 101.36 feet in Burlington. Flowering of plants, such as shadbush and lilac, was about one week later than normal.

Moist conditions for the remainder of the spring led to the development of some fungus diseases. Several late spring frosts, including a frost on May 28 with temperatures in the teens in some locations, resulted in injury to higher elevation forests and developing conifers.

Growing conditions were generally good in the summer. The weather became more seasonable in June and then turned hot, with July being the fourth warmest on record for New England and for Burlington. Cooler weather returned in August, which averaged somewhat cooler than normal. Precipitation was above-average and was well distributed throughout the growing season. Humidity levels were also above normal, contributing to an abundance of foliar diseases.

Early autumn conditions were cool and wet, causing a limited foliage season at the higher elevations. However, October and November were unusually warm and dry, leading to a prolonged foliage season in the warmer parts of the state. In many areas, there was no killing frost until mid-November.

1994 was a particularly heavy seed year for sugar and red maple, red, white, and Norway spruce, hemlock, and balsam fir. More sporadic heavy seed production also occurred on red oak and white pine.

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

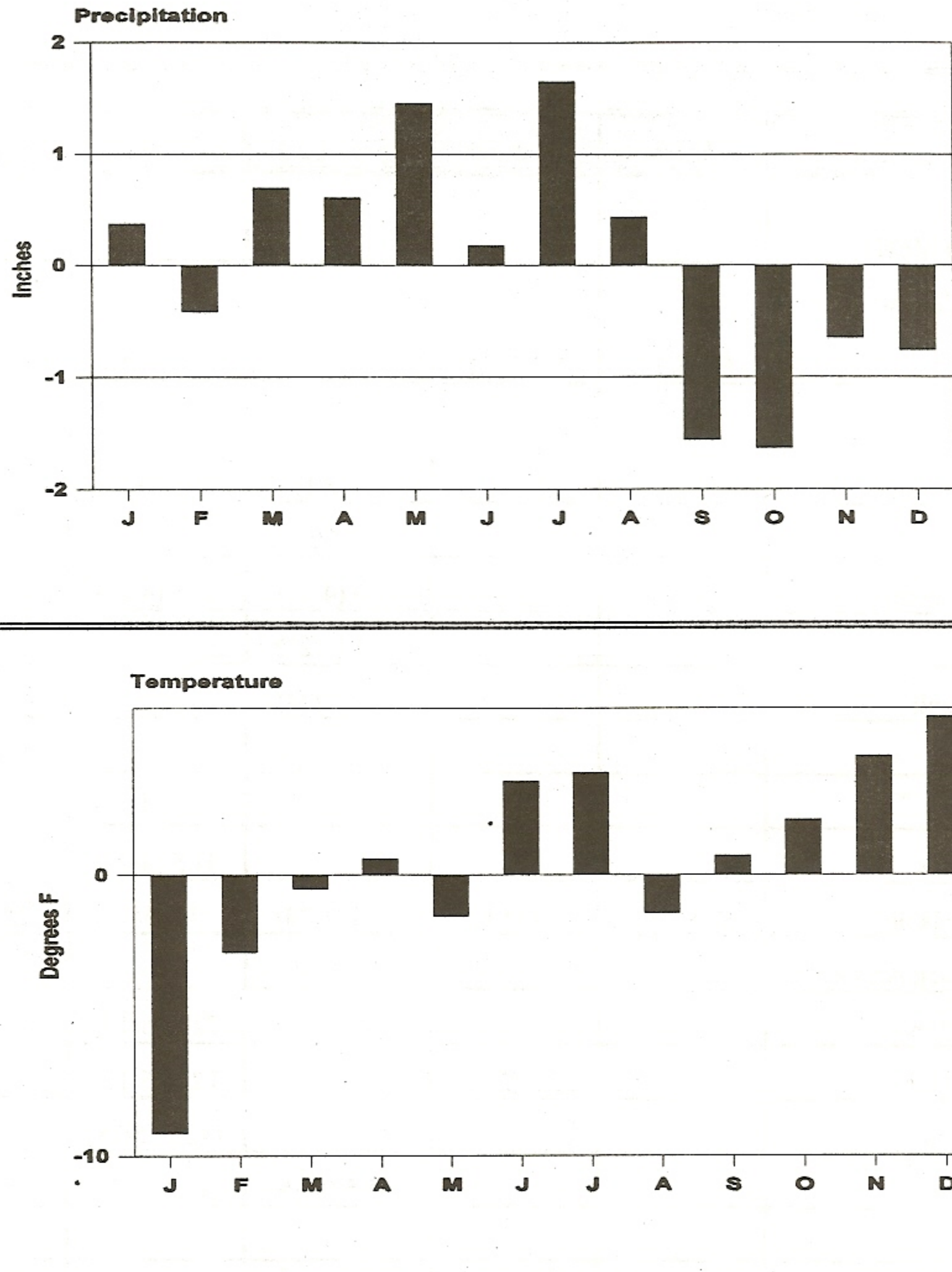
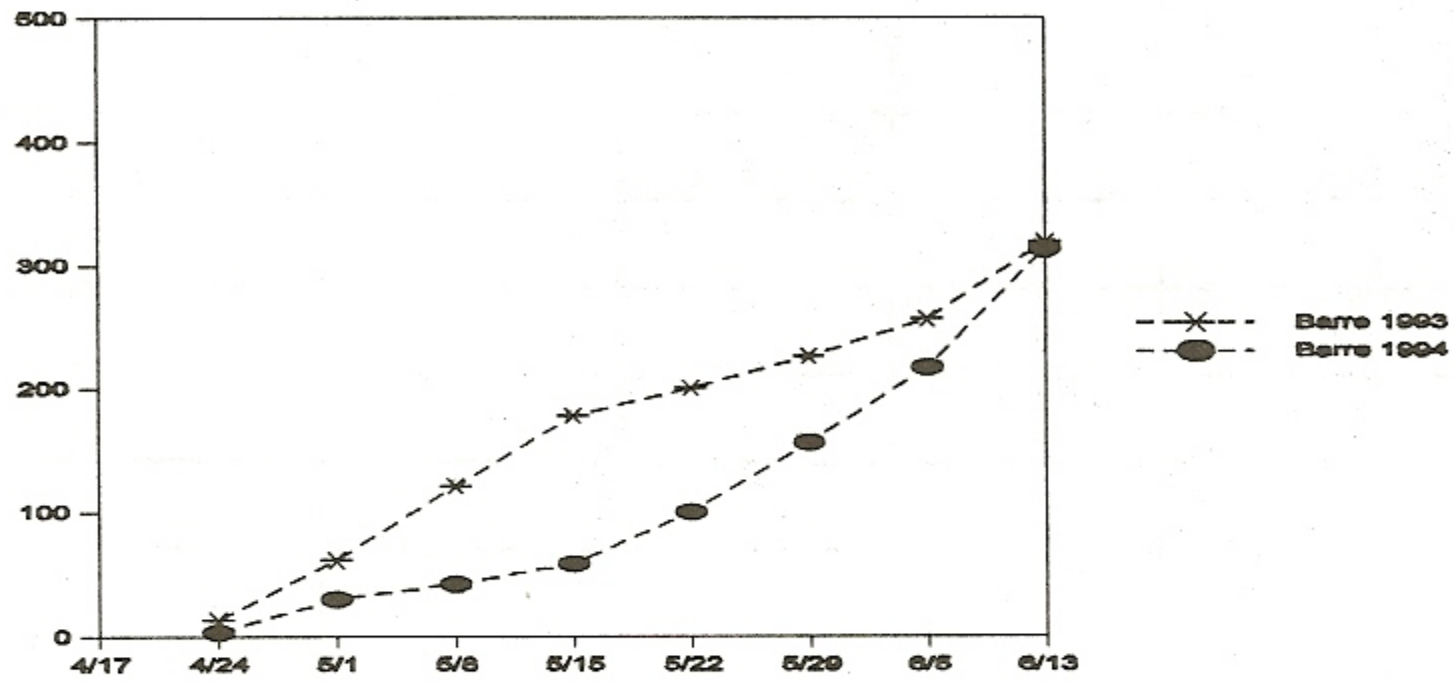


Figure 1. Departure from normal of 1994 precipitation and temperature at Burlington International Airport. Data from NOAA Local Climatological Data: Monthly Summary.

Table 1. 1994 Growing degree day accumulations and observation dates of phenological development in 5 sites in Vermont. 50 degrees F used as the threshold of development.

Biological Indicator	Barre	Hardwick	Springfield	Stowe	Underhill
PLANT DEVELOPMENT					
Showing Green					
Balsam Fir	58 (5/12)	25.5 (5/10)		55 (5/9)	45.7 (5/13)
Budbreak					
Apple			37 (5/1)	35.5(5/2)	
Beech			45 (5/5)		
Black Cherry			17.5 (4/24)	31.5 (4/27)	
Elm			30.5 (4/28)		
Red Maple			17.5 (4/24)		18.1 (4/24)
Red Oak			54 (5/7)		
Ribes				31.5 (4/29)	
Shadbush				31.5 (4/29)	
Sugar Maple	33.5 (5/6)	19 (5/8)	30.5 (4/28)	37 (5/4)	29.9 (5/3)
Trembling Aspen			37 (5/1)		
White Ash			68.5 (5/10)	72.5 (5/15)	45.7 (5/13)
Balsam Fir		25.5 (5/13)		72.5 (5/15)	
Fraser Fir				142.5 (5/28)	
Hemlock			105.5 (5/19)	114.5 (5/22)	118.5 (5/27)
Flowers					
Dandelion			37 (5/2)		
Dolgo Crab				114.5 (5/22)	
Lilac			87.5 (5/14)	165 (5/30)	123.9 (5/29)
Pin Cherry				75.5 (5/17)	
Red Maple			3 (4/19)	16 (4/25)	
Shadbush	30 (5/3)	37.5 (5/19)		59.5 (5/11)	45.7 (5/13)
Silver Maple		0 (4/11)			

Biological Indicator	Barre	Hardwick	Springfield	Stowe	Underhill
Flowers (Cont.)					
Sugar Maple			14.5 (4/28)	37 (5/4)	40.7 (5/6)
Trembling Aspen		1.5 (4/16)	0 (4/10)	1.5 (4/20)	
Full Green Up			275 (6/3)		
Fall Color					
25%					(10/2)
50%					(10/8)
INSECT DEVELOPMENT					
Balsam Shootboring Sawfly Adult				59.5 (5/10)	
Balsam Shootboring Sawfly Larvae dropping				217.5 (6/3)	
Eastern Tent Caterpillar Nest	58 (5/13)		45 (5/6)		29.9 (5/3)
June Beetle Adults		28 (5/15)			
Maple Leafcutter Adult				134.5 (5/24)	
Pear Thrips Adult				35.5 (5/2)	13.7 (4/22)
Plum Curculio Ovipositing				259.5 (6/7)	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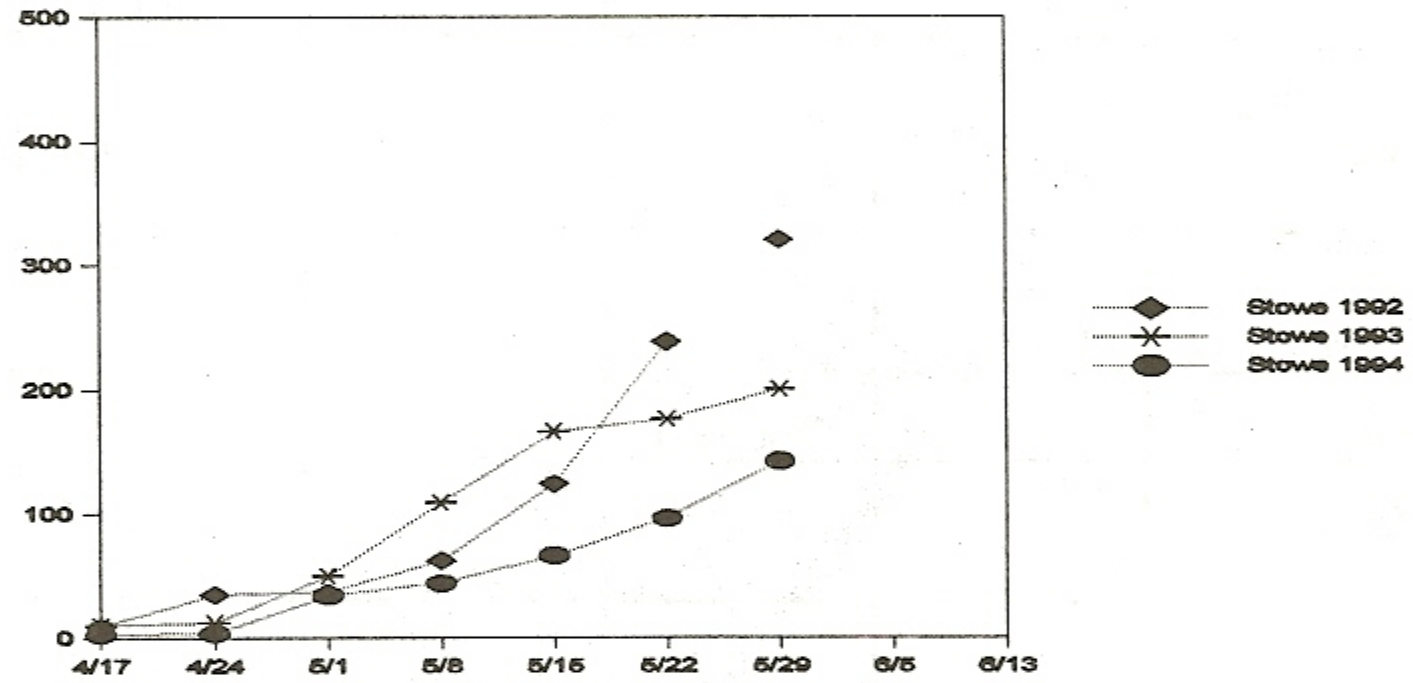
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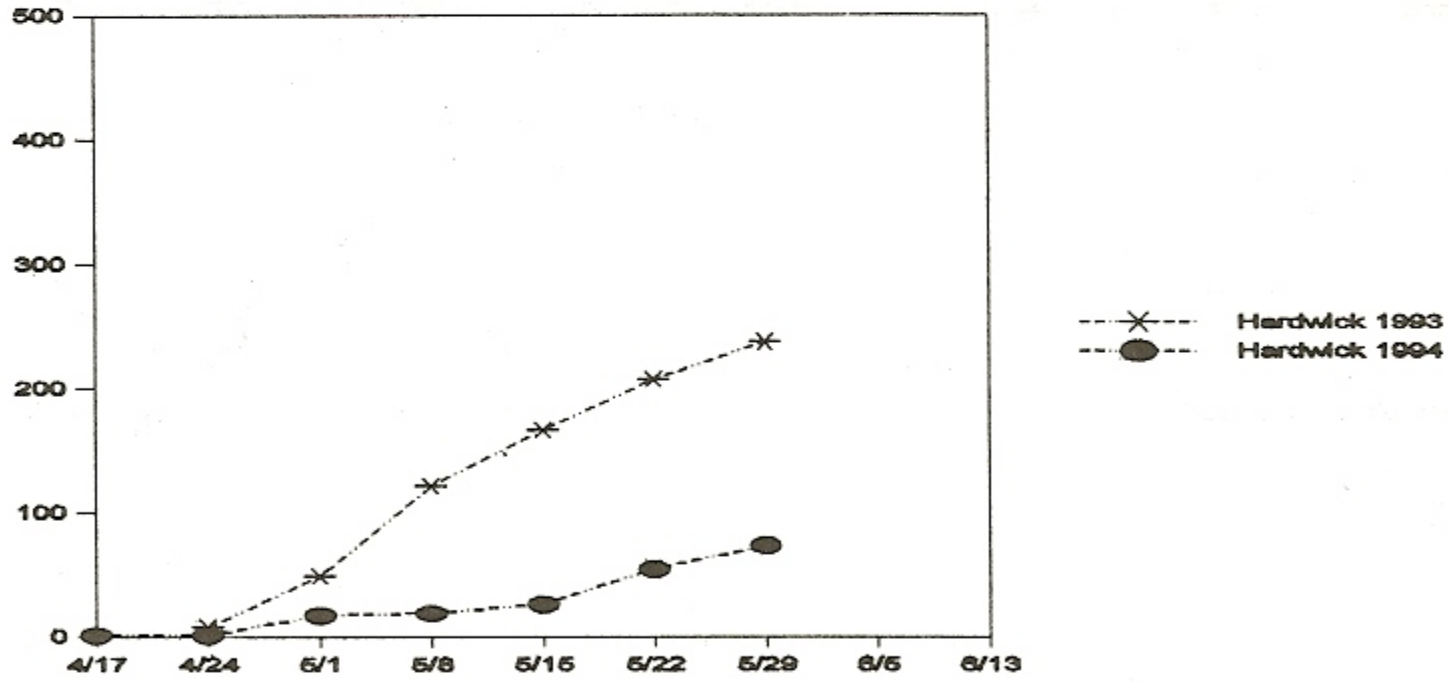
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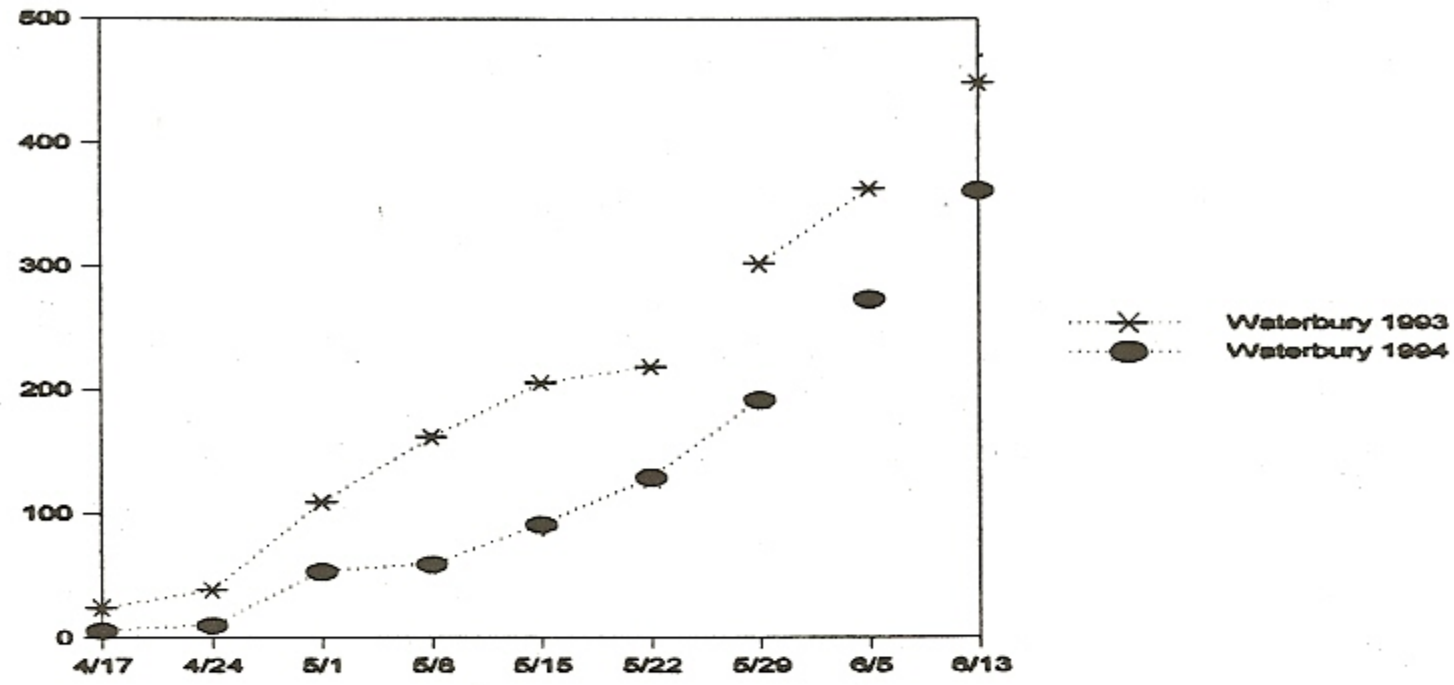
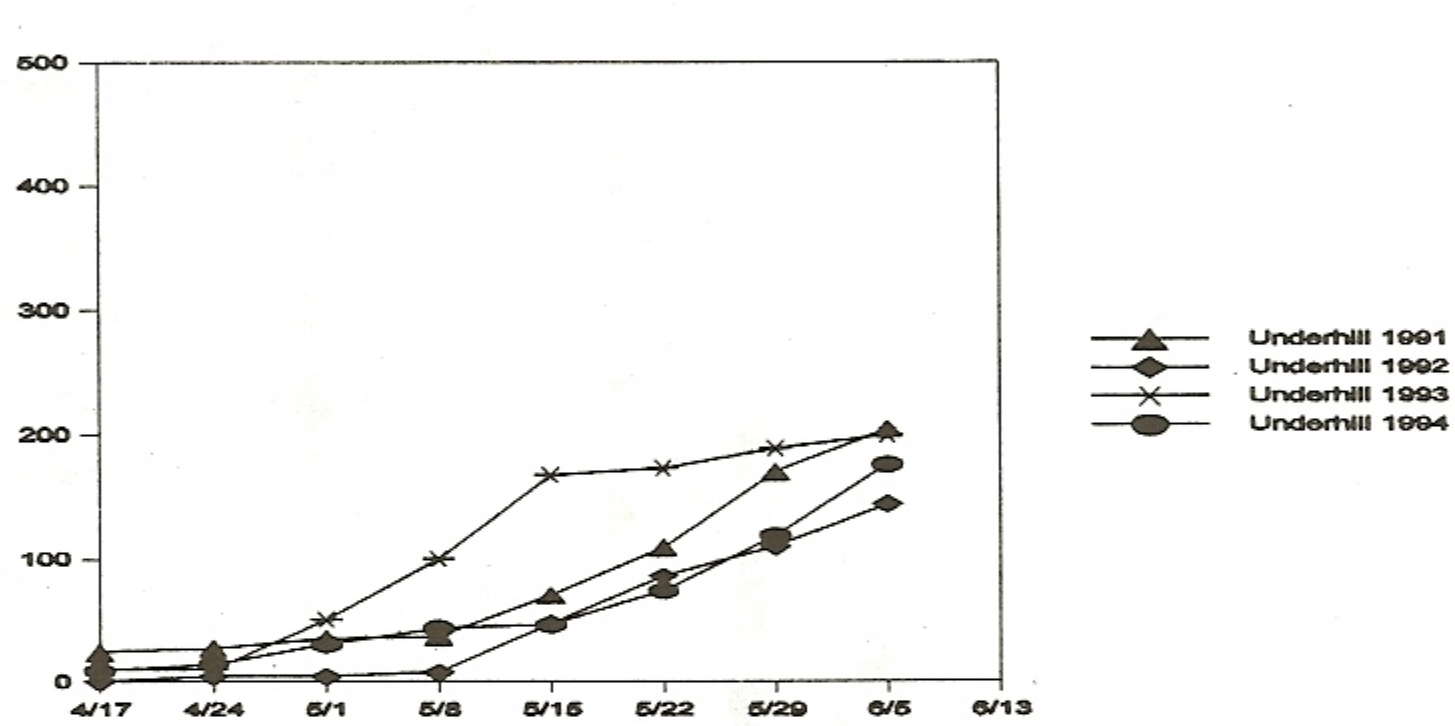




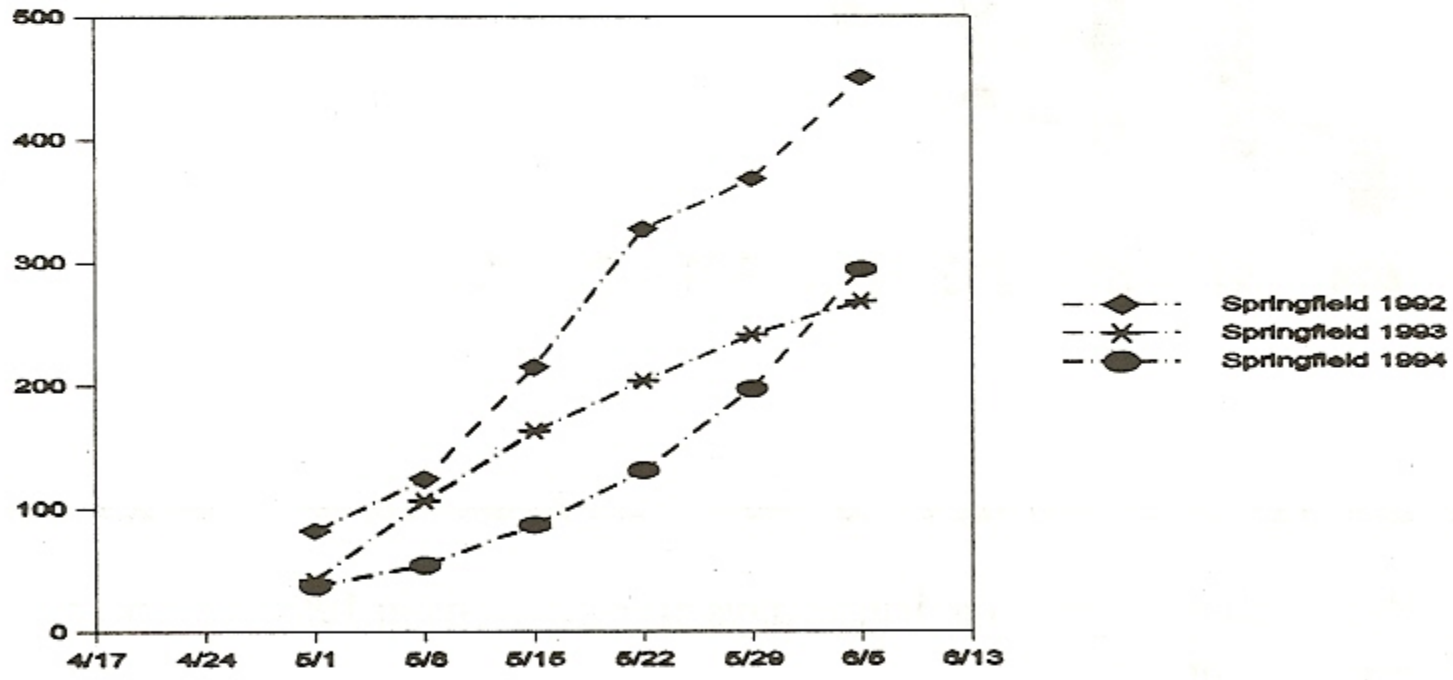


Figure 2. Weekly cumulative growing degree days at 6 locations by year through 1994. 50 degrees F used as a threshold of development.

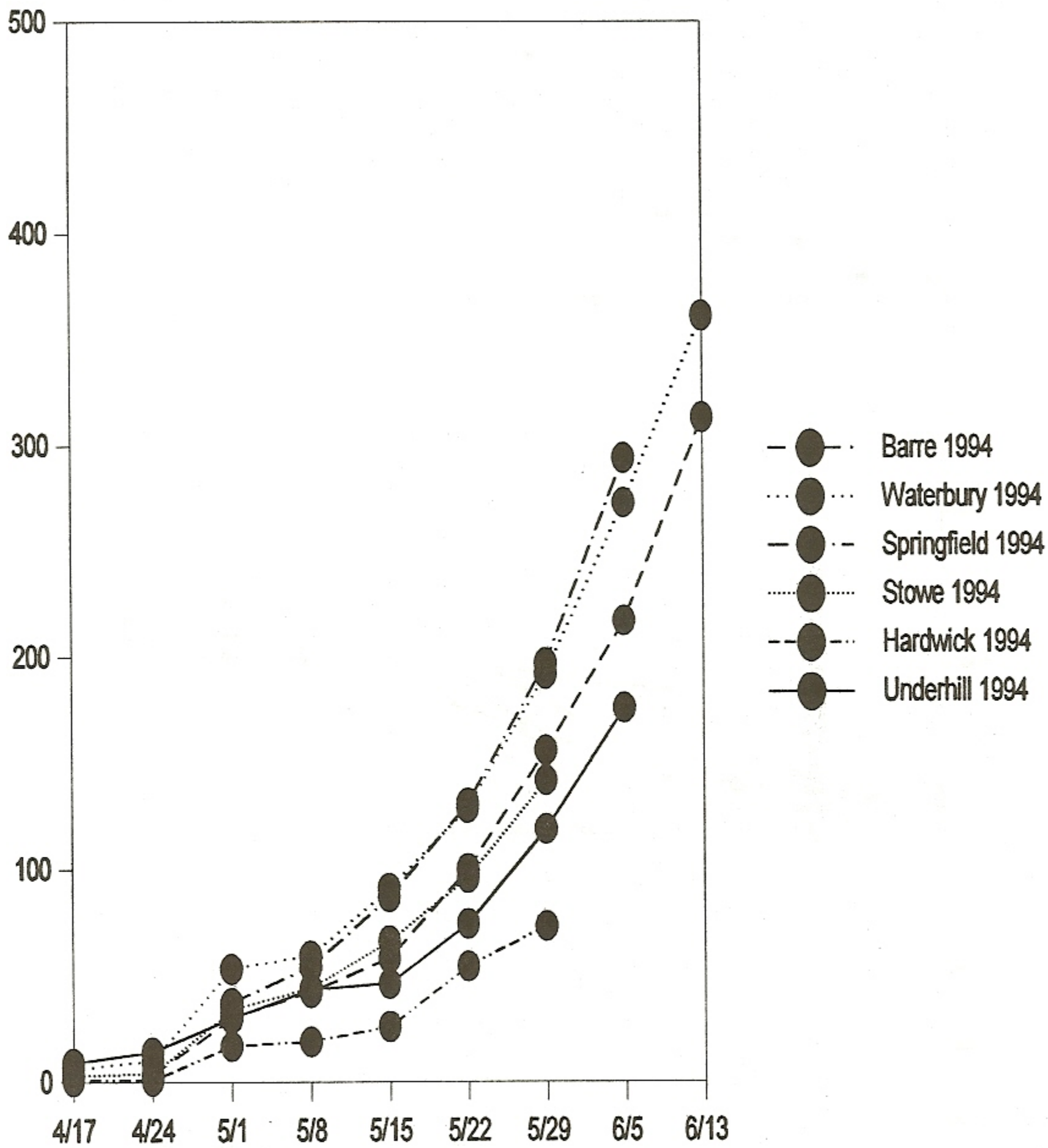


Figure 3. Weekly cumulative growing degree days at 6 locations in 1994. 50 degrees F used as the threshold of development.

OZONE SUMMARY

Measured ozone levels were lower in 1994 as compared to 1993 (Table 2). The maximum ozone concentration recorded at Underhill was 0.093 ppm (0.096 ppm in 1993) and at Bennington was 0.101 ppm (0.112 ppm in 1993). Ozone levels at both sites were below the National Ambient Air Quality Standard of 0.120 ppm for 1 hour, a level set for the protection of human health. Peak concentrations at both sites occurred in mid-June.

Although the number of hours where ozone levels were above 0.080 ppm were lower in 1994 than in 1993, both sites had more hours above 0.060 ppm. Most plant species sensitive to ozone can show symptoms of injury when exposed to levels of 0.080 ppm or greater. Some plant species respond to levels of only 0.060 ppm.

Other biological indices of ozone levels include SUM 60, SUM 80 and W126. Each of these have been used to relate ozone levels with injury to plants. They are presented as a frame of reference when relating Vermont's ozone levels for 1994 with other locations and years.

Table 2. Ozone levels recorded during the 1994 growing season at two sites.

Monitor Site	Total Number Hours With		Maximum Level		SUM 60 (ppm)	SUM 80 (ppm)	W126 (ppb)
	≥.060 ppm	≥.080 ppm	ppm	Date			
Underhill	296	6	0.93	6/11	19.46	.51	19.24
Bennington	325	37	.101	6/13	22.50	3.19	20.33

FOREST INSECTS

Hardwood Defoliators

Birch Defoliation, caused by **Birch Skeletonizer**, *Bucculatrix canadensisella,* and **Birch Leaf Miners**, *Fenusa pusilla* and *Messa nana*, late in the season decreased this year. Damage was mapped on 6,650 acres in 1994, compared to 23,090 acres in 1993 (Table 3, Figure 4). Damage was heaviest in Windsor and Essex Counties, and at higher elevations. Some shade trees were also affected. About 40% of the foliage of white birches was brown or missing in one area mapped as having moderate damage.

Table 3. Mapped acres of birch defoliation in 1994.

County	Damage Level		Total Acres
	Moderate (30-60%)	Heavy (>60%)	
Addison	60	0	60
Bennington	530	110	640
Caledonia	60	0	60
Chittenden	240	0	240
Essex	1410	0	1410
Franklin	80	0	80
Grand Isle	10	0	10
Orange	90	10	100
Orleans	300	0	300
Rutland	10	0	10
Windham	800	30	830
Windsor	240	2670	2910
Total	**3830**	**2820**	**6650**

Most of the damage to both white and yellow birch continued to be from birch skeletonizer and birch leaf miners. Birch leaf folder damage was light and scattered.

The plots which were established statewide in 1993 to monitor the impact of late-season defoliation of birch, which has been widespread since 1991, will be revisited again in 1995.

Evaluation of yellow birch that was heavily damaged by birch leaf folder continues in Granville Gulf. Defoliation this year remained very light, and dieback from previous defoliation has not developed (Table 4).

Table 4. Average percent defoliation and dieback of 25 yellow birch trees in Granville defoliated by birch leaf folder in 1991-92.

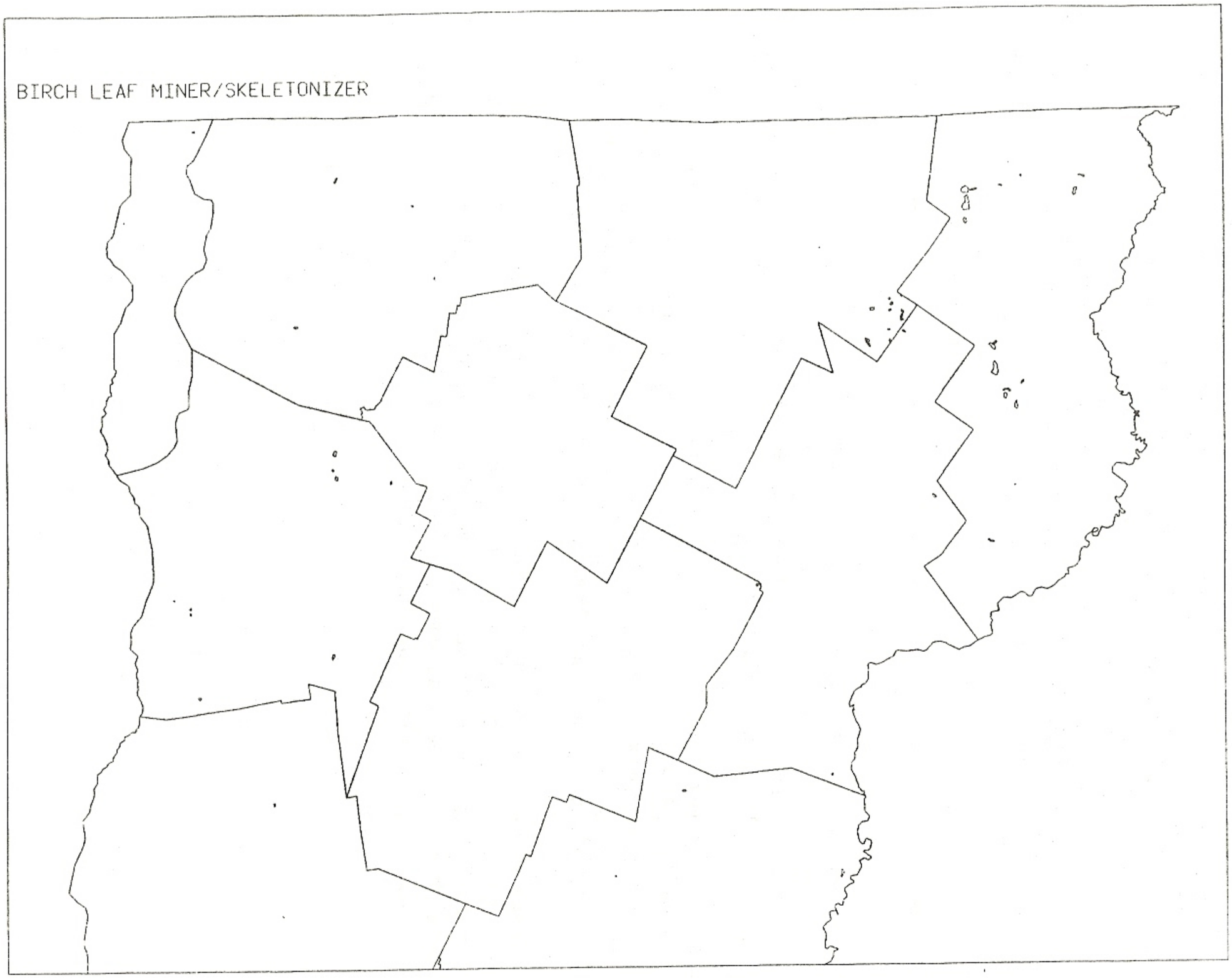
Average %	1991	1992	1993	1994
Defoliation	80	20	5	<5
Dieback	NA	NA	5	5

Bruce Spanworm, *Operophtera bruceata*, damage was widespread again in late spring. Mostly light to moderate damage occurred in sugarbushes and other maple stands. Damage was rarely severe enough to cause refoliation and was not detected by aerial survey. For the fourth year in a row, moths were commonly seen throughout the region in the fall.

Fall Webworm, *Hyphantria cunea*, was common throughout, especially on ornamental and roadside trees. Although damage was at similar levels to last year in the extreme southern towns, populations increased noticeably elsewhere. Damage in some valley areas was so extensive that entire trees were covered with webbing. Hickories, cherries, apples, birches, oaks, and elms were the species most likely to be affected. In Addison County, 20 acres were mapped during aerial survey.

Forest Tent Caterpillar, *Malacosoma disstria*, populations continued to be very low this year statewide. There was a slight increase in the number of larvae observed in Champlain Valley, but not elsewhere, and no defoliation was observed. Moth catches in pheromone traps remain low. Only one moth was caught in pheromone traps this year (Table 5). However, light trap catches in Chittenden County showed a noticeable increase over the past 3 years.

BIRCH LEAF MINER/SKELETONIZER



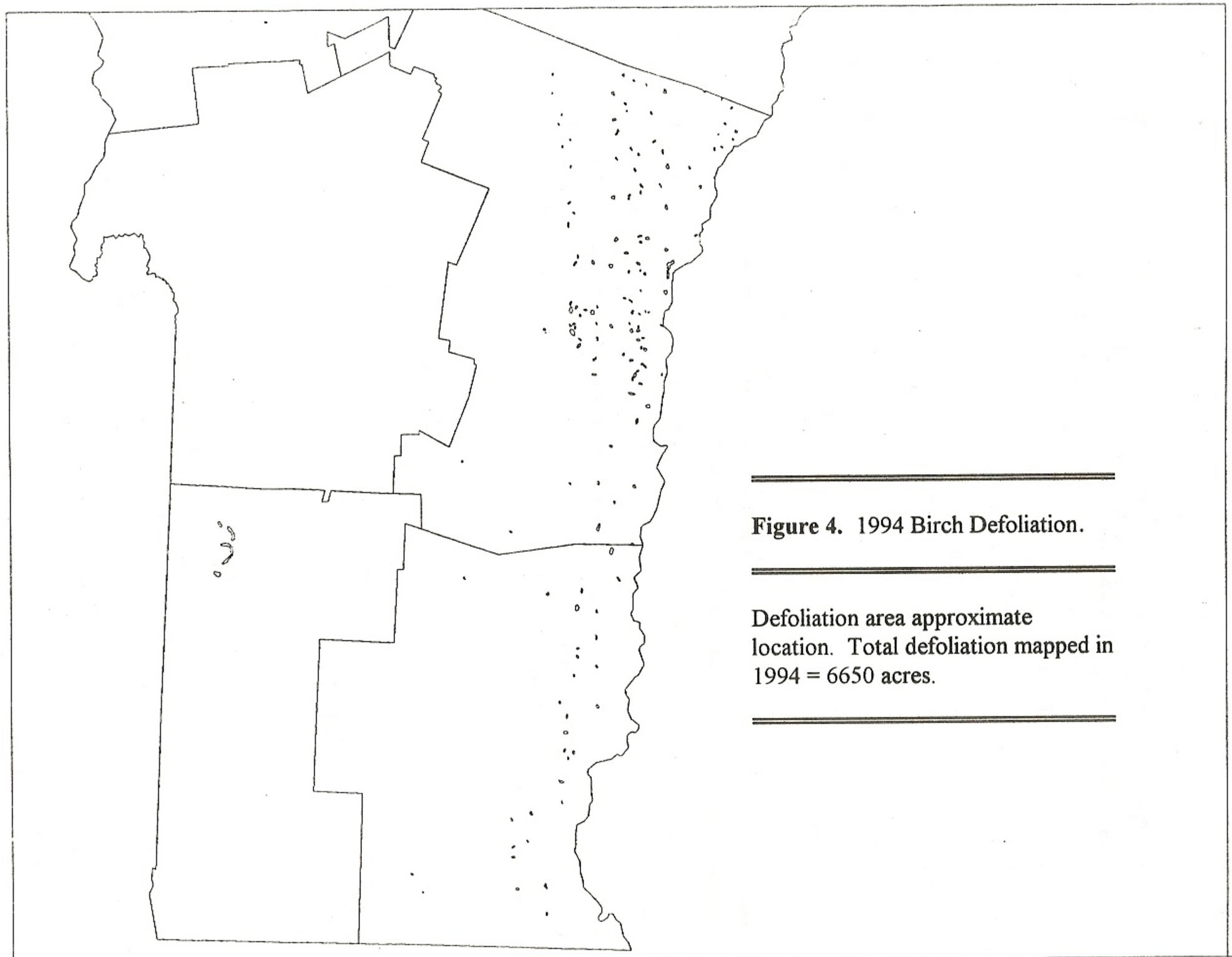


Figure 4. 1994 Birch Defoliation.

Defoliation area approximate location. Total defoliation mapped in 1994 = 6650 acres.

Table 5. Average number of forest tent caterpillar moths caught in pheromone traps, 1988-1994.[1]

Location	1988	1989	1990	1991	1992	1993	1994
Roxbury	0.0	0.6	0.2	0.0	0.0	0.0	0.0
Waterbury	1.2	3.6	0.0	0.4	0.0	0.0	0.0
Waterville	0.2	2.2	0.0	0.0	0.0	0.0	0.0
Fairfield	-	0.0	0.0	0.0	0.0	0.0	0.0
Bethel	-	0.4	0.2	0.4	0.0	0.0	0.2
Sherburne	-	2.6	0.0	0.0	0.0	0.0	0.0
Barnard	0.6	-	2.6	2.2	-	0.0	0.0
Underhill (VMC 1400)	-	-	-	0.0	0.0	0.0	0.0
Underhill (VMC 2200)	-	-	-	-	0.0	0.0	0.0
Underhill (VMC 3800)	-	-	-	-	0.0	0.0	0.0
Average	**0.6**	**1.6**	**0.4**	**0.4**	**0.0**	**0.0**	**0.2**

[1]Multi-pher traps baited with RPC-2 component lures, 5 traps per location.

Gypsy Moth, *Lymantria dispar*, populations remained low with no defoliation detected and none expected in 1995. Egg mass counts in focal area monitoring plots (Table 6) were low, at levels similar to 1993. Occasional egg masses were seen elsewhere in widely scattered locations outside of oak forest type.

Table 6. Gypsy moth egg mass counts from focal area monitoring plots 1986-1994.[1, 2]

Plot Location	1986	1987	1988	1989	1990	1991	1992	1993	1994
Minards Pond	0	0	7	99	10	0	0	0.5	0
Fort Dummer	2	0	1	1	0	0	0	0.5	0
Handley Mtn.	1	1	4	417	7	2	1	0	0
Perch Pond	0	115	226	168	1	1	0	0	0
Rocky Pond	0	6	53	>400	11	0	0.5	0	0
Petersburg	1	0	1	296	89	51	1	0	0
Tate Hill	0	0	6	498	5	25	0	0	0
Arrowhead[3]	5	21	48	96	3	2	0	0	2.5
Brigham Hill[4]	10	37	28	74	212	22	0	0.5	0.5
Middlesex	0	0	1	19	23	3	0	0	0.5
Sandbar	-	45	173	226	57	6	3	3	1.0
VMC 1400	-	-	-	-	-	-	-	1	0
Average	**2**	**20**	**46**	**200**	**38**	**10**	**0.5**	**0.5**	**0.4**

[1] Total number in 15m diameter burlap-banded plots.
[2] Average of 2 or 3 plots in 1986 and 2 plots in 1987-1994.
[3] Aerial sprayed with Bt (Foray) in 1990.
[4] Aerial sprayed with Bt (SAN415) in 1988.

Maple Leaf Cutter, *Paraclemensia acerifoliella*, defoliation decreased, with mostly light defoliation and few aerial detections. Only moderate defoliation was mapped, with 20 acres in Caledonia County, 110 acres in Orange County, and 30 acres in Windsor County, for a total of 160 acres. Nearly 3,000 acres were mapped in 1993. Frequent heavy rainfalls when adults were emerging may have depressed populations and/or led to a greater incidence of disease in the leaf mining stage. Heavy defoliation is not expected in 1995.

Oak Leaf Tier, *Croesia semipurpurana*, larvae or damage were not observed. Again, moths were caught in the Rockingham pheromone trap site, but not in Rupert. No results are available from Brattleboro. (Table 7).

Table 7. Oak leaf tier moths caught in pheromone traps 1988-1994.

Location	# of Moths/Trap*						
	1988	1989	1990	1991	1992	1993	1994
Brattleboro	40	0	1.3	0	0	0	-
Rockingham	60	0	1.3	26	0	16.3	0.3
Rupert	-	0	0	0	0	0	0

Saddled Prominent, *Heterocampa guttivata*, populations remained low, with larvae rarely observed. Trace feeding was observed in Orleans County.

Satin Moth, *Leucoma salicis*, damage was not observed indicating a drop from 1993. However, dieback from defoliation in 1990-1992 was still obvious in Royalton, and was mapped on 15 acres. Cottonwood dieback in one mapped area averaged 35%.

OTHER HARDWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Alder Leaf Beetle			Not observed.
Altica ambiens alni			
American Aspen Beetle			Not observed.
Gonioctena americana			
American Dagger Moth	Red Maple	Wolcott	Moderate defoliation of ornamental in late summer.
Acronicta americana		Windsor County	Larvae observed occasionally.
	Silver Maple Hardwoods	St. Albans Duxbury Middlebury	
Angulose Prominent	Oak	West Rutland	
Peridea angulosa			
Apple & Thorn Skeletonizer			Not observed.
Choreutis pariana			

OTHER HARDWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Aspen Leaf Roller			Not observed.
Pseudoexentera oregonana			
Attelabus bipustulatus (Coleoptera: Attelabidae--leaf-rolling weevils)	Red Oak	Barnet	Eggs laid near tip of leaf, then rolled toward petiole in neat cylinder.
Big Poplar Sphinx	Poplar	N. Duxbury	
Pachysphinx modesta			
Birch Leaf Folder			See narrative.
Ancylis discigerana			
Birch Leaf Miner			See narrative.
Fenusa pusilla			
Birch Skeletonizer			See narrative.
Bucculatrix canadensisella			
Bruce Spanworm			See narrative.
Operophtera bruceata			
Cecropia Moth			Not observed.
Hyalophora cecropia			
Cherry Scallop Shell Moth	Black Cherry	Springfield	Roadside trees.
Hydria prunivorata			
Chocolate Prominent	Maple	Caledonia County	Scattered sugarbush.
Peridea ferruginea			
Comma Butterfly			Not observed.
Polygonia comma			
Dogwood Sawfly			Not observed.
Macremphytus sp.			
Early Birch Leaf Edgeminer			See narrative.
Messa nana			

OTHER HARDWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Eastern Tent Caterpillar *Malacosoma americanum*	Cherries, Apples, Hophornbean	Throughout	Generally more than 1993 on field and roadside trees in southern Vermont. Elsewhere, populations steady or down somewhat.
Elm Leaf Beetle *Pyrrhalta luteola*	American Elm	Orleans & Windsor Counties	Common on roadside trees.
Elm Leaf Miner *Fenusa ulmi*			Not observed.
Euonymus Caterpillar	Burning Bush Euonymous	Danville Lincoln	Ornamental.
Yponomeuta multipunctella			
European Snout Beetle *Phyllobius oblongus*	Sugar Maple	Stowe	Light defoliation.
Fall Cankerworm *Alsophila pometaria*			Not observed.
Fall Webworm *Hyphantrea cunea*			See narrative.
Flat Leaf Tier *Psilocorcis reflexella*	Quaking Aspen	Derby	
Great Tiger Moth *Arctia caja americana*	At large	Fayston	
Forest Tent Caterpillar *Malacosoma disstria*			See narrative.
Friendly Probole *Probole amicaria*	Sugar Maple	Peacham	Numerous in sugarbush.
Great Tiger Moth *Arctia caja americana*	Poplar	St. Johnsbury	Light defoliation.
Green Fruitworm *Lithophane antennata*	Oak	Colchester Barnet	

OTHER HARDWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Green Striped Mapleworm *Anisota rubicunda*	Sugar Maple	Peacham Pittsfield	Light defoliation. Adults observed around lights.
Gypsy Moth *Lymantria dispar*			See narrative.
Hagmoth Caterpillar (Monkey Slug) *Phobetron pithecium*	Sugar Maple	Colchester	
Half Winged Geometer *Phigalia titea*			Not observed.
Hickory Tussock Moth *Halysidota caryae*	Butternut	Underhill	
Imported Willow Leaf Beetle *Plagiodera versicolora*	Willows	Springfield	Ornamentals.
Japanese Beetle *Popillia japonica*	Ornamentals Raspberries	Widespread	Heavy populations in North-Central VT- even worse than 1993. Elsewhere, less common than 1993.
Large Aspen Tortrix *Choristoneura conflictana*			Not observed.
Leaf Beetle *Paria quadriguttata*			Not observed.
Lilac Leaf Miner *Caloptilia syringella*	Lilac	Williston Brattleboro	
Linden Looper *Erranis tiliaria*			Not observed.
Locust Leaf Miner *Odontata dorsalis*	Black Locust	Chittenden Caledonia Windsor and Windham Counties	Heavy defoliation mapped on 65 acres in Chittenden County, and 30 acres in Windham County during aerial survey. In southeastern Vermont, not as severe as 1993.

OTHER HARDWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Luna Moth Caterpillar	Beech	Underhill	
Actias luna			
Maple-basswood Leaf Roller	Sugar Maple	Lamoille & Chittenden Counties	Very light.
Sparganothis pettitana			
Maple Leaf Cutter			See narrative.
Paraclemensia acerifoliella			
Maple Leafblotch Miner			Not observed.
Cameraria aceriella			
Maple Trumpet Skeletonizer	Sugar Maple	Caledonia Lamoille Rutland Washington Counties	Light populations. Rarely observed.
Epinotia aceriella			
Maple Webworm	Sugar Maple		Not observed - populations dropped.
Tetralopha asperatella			
Mountain Ash Sawfly	Mountain Ash	Addison Caledonia Chittenden Franklin Counties	Heavy in spots in the Champlain Valley; very light elsewhere.
Pristiophora geniculata			
Oak Leafroller	Red Oak	Barnet	Light.
Archips semiferanus			
Oak-leaf Shot-hole	Red Oak	Middlesex	Light.
Japanagromyza viridule			
Oak Leaf Tier			See narrative.
Croesia semipurpurana			
Oak Leaf-Rolling Weevil	Red Oak	Barnet	Trace.
Attelabus bipustulatus			
Oak Sawfly	Red Oak	Barnet	Trace.
(undetermined species)			
Oak Slug Sawfly	Red Oak	Stowe Essex Junction	Heavy on ornamental.
Caliroa fasciata			

OTHER HARDWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Oak Phylloxerids	Red Oak	Victory	Trace.
Phylloxeridae			
Oak Skeletonizer	Red Oak	Waterford Middlesex	Light damage.
Bucculatrix ainsliella		Dummerston Brattleboro	
Oakworm	Red Oak	Middlesex	On seedlings.
Anisota sp.			
Orange-humped Mapleworm			Not observed.
Symmerista leucitys			
Pear Sawfly (Slug)			Not observed.
Caliroa cerasi			
Pin Oak Sawfly			Not observed.
Caliroa sp.			
Polyphemus Caterpillar	Sugar Maple	Coventry	
Antheraea polyphemus			
Poplar Leafmining Sawfly	Balsam Poplar	Derby	
Messa sp.			
Poplar Serpentine Leaf Miner	Balsam Poplar Quaking Aspen	Derby	
Phyllocnistis populiella			
Promethea Caterpillar	Red Oak	Middlesex	
Callosamia promethea			
Red-cheeked Looper	Sugar Maple	Butterfield Peacham	
Probole americaria			
Red-humped Caterpillar	Crimson Maple	Fairfax	
Schizura concinna			

OTHER HARDWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Red-humped Oakworm			Not observed.
Symmerista canicosta			
Rose Chafer	Linden Apple	St. Johnsbury Lamoille	Light-moderate.
Macrodactylus subspinosus	Roses Raspberries	Washington Counties	Locally heavy.
Rusty Tussock Moth Caterpillar	Ornamentals	St. Albans	
Orgyia antigua			
Saddled Prominent			See narrative.
Heterocampa guttivata			
Satin Moth			See narrative.
Leucoma salicis			
Slug Caterpillar Moth Larva	Beech Sugar Maple	Victory Underhill	
Limacodidae			
Solitary Oak Leaf Miner			Not observed.
Cameraria hamadryadella			
Sparganothis acerivorana	Sugar Maple	Underhill	
Spear-Marked Black Moth			Not observed.
Rheumaptera hastata			
Spiny Elm Caterpillar	Willow	Manchester	Larvae.
Nymphalis antiopa			
Spiny Oak Sawfly	Oak	Essex Junction	
Periclista sp.			
Spotted Tussuck	Beech	Victory	Trace.
Lophocama maculata			
Spring Cankerworm			Not observed.
Paleacrita vernata			
Systena frontale	Silky Dogwood	Essex Junction	

OTHER HARDWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Twin-spotted Sphinx	Beech	Lincoln	
Smerinthus jamaicensis			
Uglynest Caterpillar	Cherry	Lamoille County	Light and scattered.
Archips cerasivoranus		Rochester	Regeneration in an eight acre field covered with nests.
Variable Oakleaf Caterpillar	Beech	Victory Underhill	Abundant light feeding.
Lochmaeus manteo			
Viceroy Caterpillar	Willow	Danville	
Limenitis archippus			
Warty Birch Caterpillar	Birch	Groton Danville	Trace damage.
Drepana bilineata			
Waved Sphinx	Oak	Montpelier	
Ceratomia undulosa			
White Marked Tussock Moth	Hardwoods	Washington Orange Counties	Occasionally observed.
Orgyia leucostigma			
Willow Flea Beetle	Black Willow	Lamoille County	Scattered, light.
Rhynchaenus rufipes			

SOFTWOOD DEFOLIATORS

Arborvitae Leaf Miner, *Argyresthia thuiella*, caused mostly light browning of northern white cedar. A total of 222 acres were mapped in the following five counties: Addison - 67 acres, Franklin - 37 acres, Grand Isle - 3 acres, Orange - 3 acres (detected by aerial survey), and Washington - 112 acres. All the damage was classified as moderate except for 23 acres of heavy defoliation in Addison County.

Fall Hemlock Looper, *Lambdina fiscellaria*, caused only very light defoliation in widely scattered northern Vermont locations, although moths have been common statewide since 1991. Average moth catch increased slightly from 1993 levels but remained well below 1992 levels (Table 8).

Table 8. Fall hemlock looper counts in 1992-1994.

Location		Fall 1992	Fall 1993	Fall 1994
County	Town	Moths per Trap[1]	Moths per Trap[1]	Moths per Trap[1]
Addison	Ferrisburg	38	86	-
Bennington	Dorset	15	126	71
Caledonia	Barnet	-	118	11[3]
Caledonia	Waterford	241	133	187
Chittenden	Bolton	714	288	137
Chittenden	Underhill-1400	325	80	123
Chittenden	Underhill-2200	521	-	133
Chittenden	Underhill 3800	41	0	0
Chittenden	Underhill-S	41	27	25
Franklin	Swanton	-	55	92
Grand Isle	Alburg	-	-	-
Lamoille	Morristown-W	342	129	280
Lamoille	Morristown-N	261	112	383
Orange	Strafford	454	117	202
Orange	Williamstown	316	160	141
Orleans	Derby	320	154	185
Rutland	Castleton	7	33[3]	50
Rutland	Pittsford	10	67	103
Washington	Duxbury	666	250	173
Windham	Brattleboro	22	84	16[2]
Windham	Dummerston	-	-	65[2]
Windham	Vernon	-	-	50[2]
Windsor	Sharon	94	165	268
Windsor	Stockbridge	201	175	41
Average		**264**	**118**	**144**

[1] Number of moths per Multi-pher trap baited with a fall hemlock looper pheromone.
[2] Traps were collected early; not included in average.
[3] Traps disturbed; not included in average.

Spring Hemlock Looper, *Lambdina athasaria*, larvae or defoliation were not observed in 1994. No moths were caught in pheromone traps (Table 9).

Table 9. Number of spring hemlock looper moths caught in traps baited with fall hemlock looper pheromone (1992-1994) [1].

County	Town	1991 Defoliation	Moths/Trap		
			1992	1993	1994
Chittenden	Underhill-1	None	-	0	0
Chittenden	Underhill-2	None	-	0	0
Lamoille	Stowe	None	-	0	0
Windham	Brattleboro	None	2	31	NA
Windham	Dummerston	Moderate	96	2	NA
Windham	Vernon	Heavy	116	11	NA

1. Average of three multipher traps in 1992 and one in 1993-1994

Damage from the 1990 and 1991 defoliation in southeastern Windham County continues to be visible from the air, with 210 acres of dieback and mortality mapped this year (Figure 5).

Monitoring continues in plots established to determine the impact of defoliation in 1990-91, in cooperation with the U.S. Forest Service, and the states of Maine, New Hampshire, and Massachusetts. The overall condition of affected trees is improving, even in the heavily defoliated stands (Figure 6).

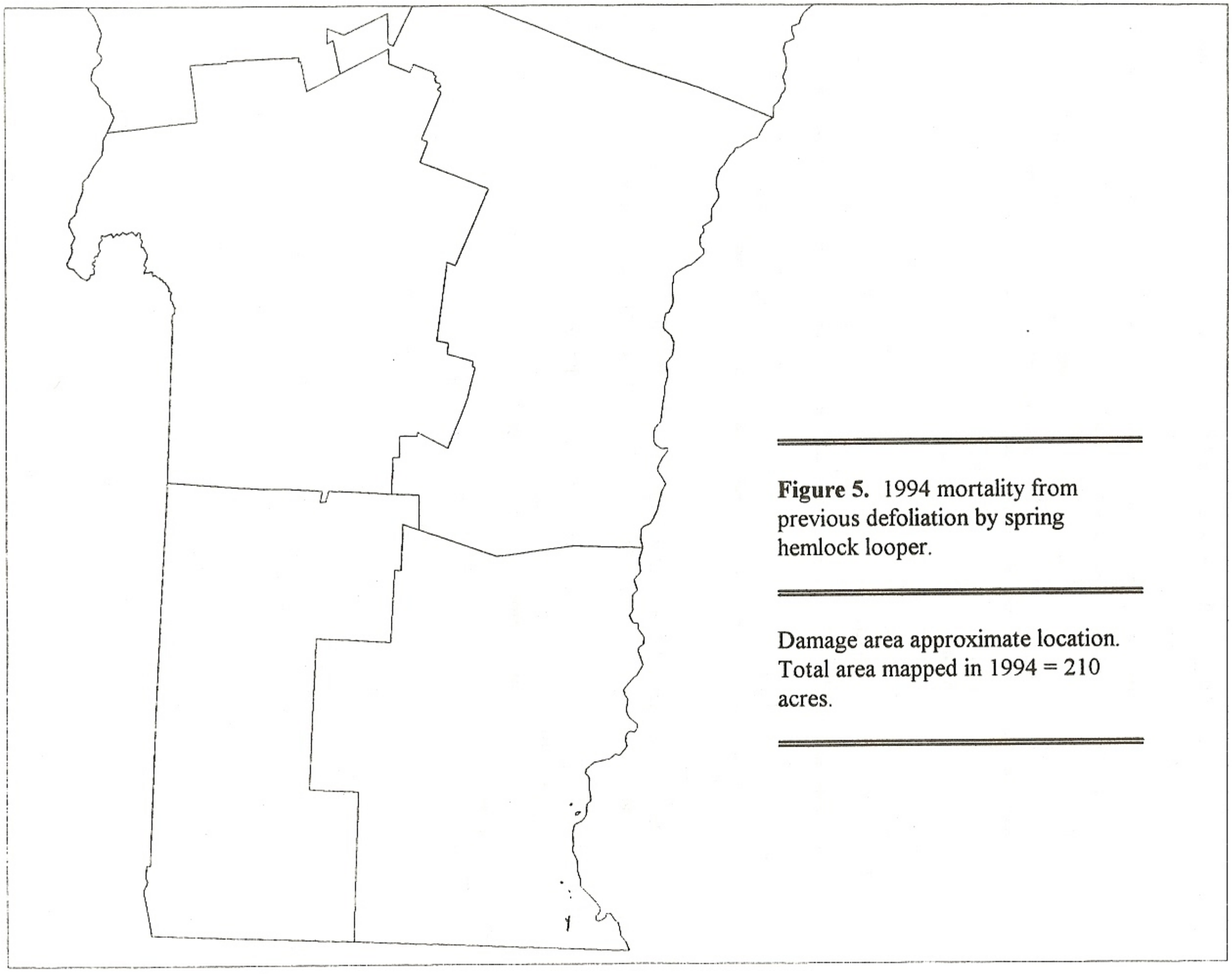


Figure 5. 1994 mortality from previous defoliation by spring hemlock looper.

Damage area approximate location. Total area mapped in 1994 = 210 acres.

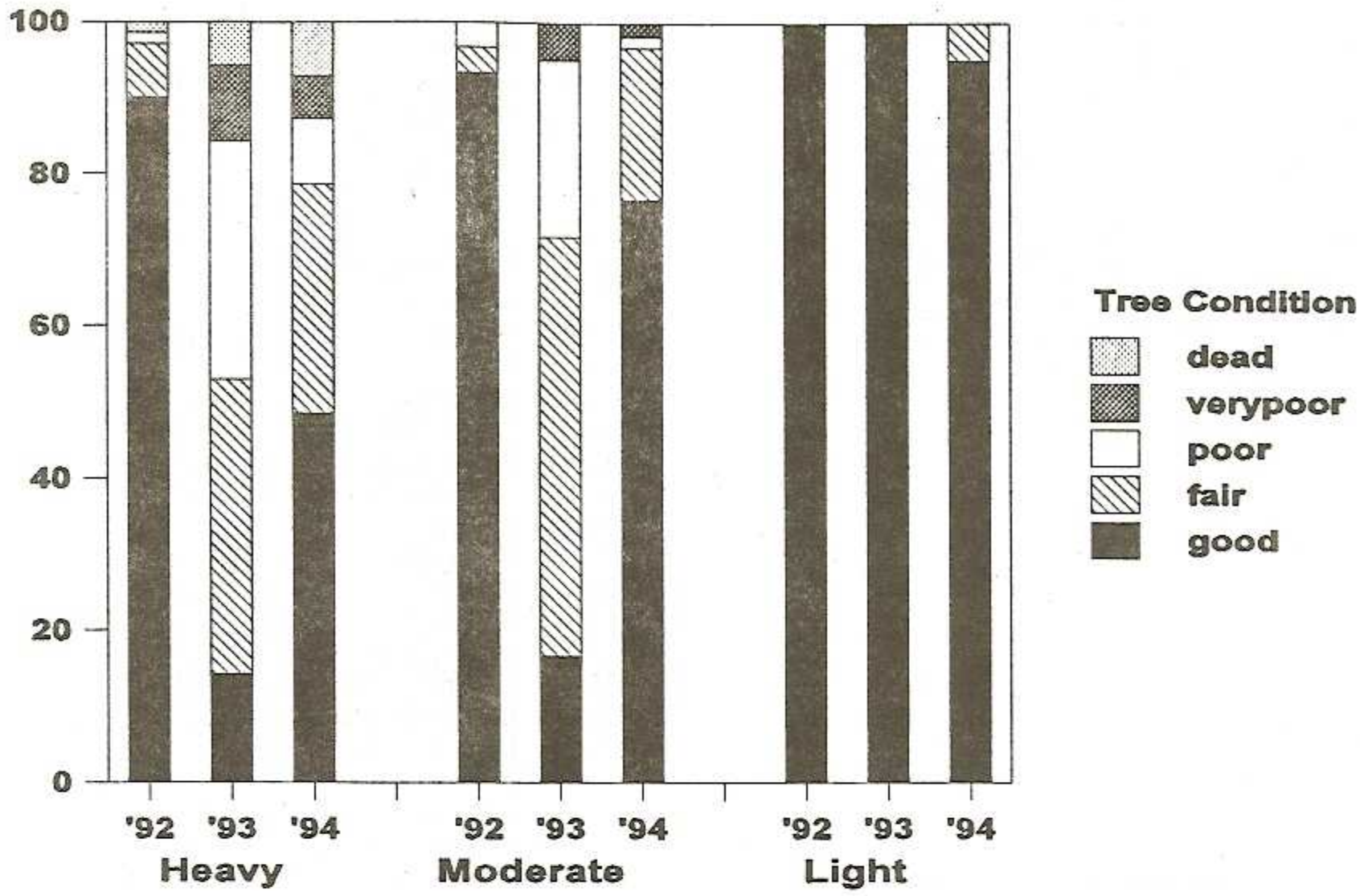
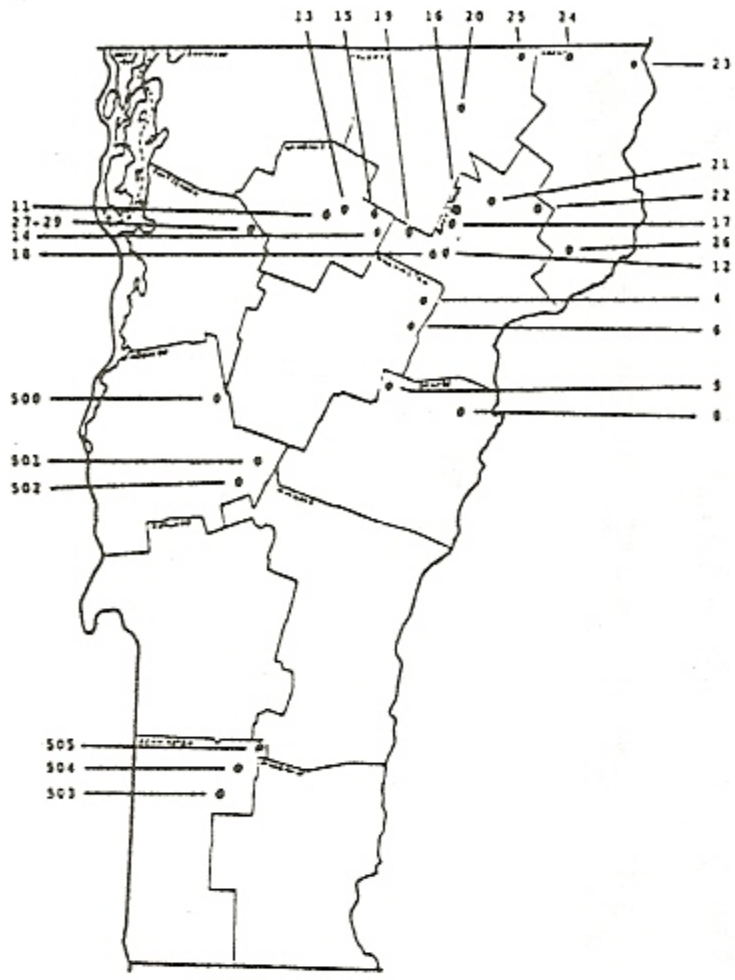


Figure 6. Percent of trees in spring hemlock looper impact plots in each of five condition classes when evaluated in spring of 1992-1994, by defoliation severity in 1991. Data are from ten trees in each of seven stands which had heavy defoliation, six which had moderate defoliation, and two which had 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 (Figure 7) which showed a sudden increase in 1991, and continued at similar levels in 1992, decreased only slightly this year (Figure 8).



Location No.	Name	# of moths/trap
4.	Danville Hill	8.7
5.	Reservoir	18.7
6.	Marshfield Pd.	9.0
8.	Scotch Hollow	15.3
11.	Centerville	12.0
12.	Coles Pd.	7.0
13.	Diggins	5.0
14.	Wolcott F&G	3.0
15.	Bear Swamp	14.3
16.	Withers	7.3
17.	Mason	5.3
18.	Star School	14.3
19.	Beagle Club	8.0
20.	Brownington Pd.	5.3
21.	Calendar Brk.	13.7
22.	Chieppo	3.0
23.	Bunnel Brk.	2.0
24.	Norton Cem.	2.3
25.	Holland Pd.	1.3
26.	Victory Bog	4.7
27.	Underhill (VMC 1400)	53.0
28.	Underhill (VMC 2200)	16.3
29.	Underhill (VMC 3800)	18.7
	Average (excluding 28, 29)	10.2

Figure 7. Spruce budworm pheromone plot locations and average number of moths caught per trap in 1994.

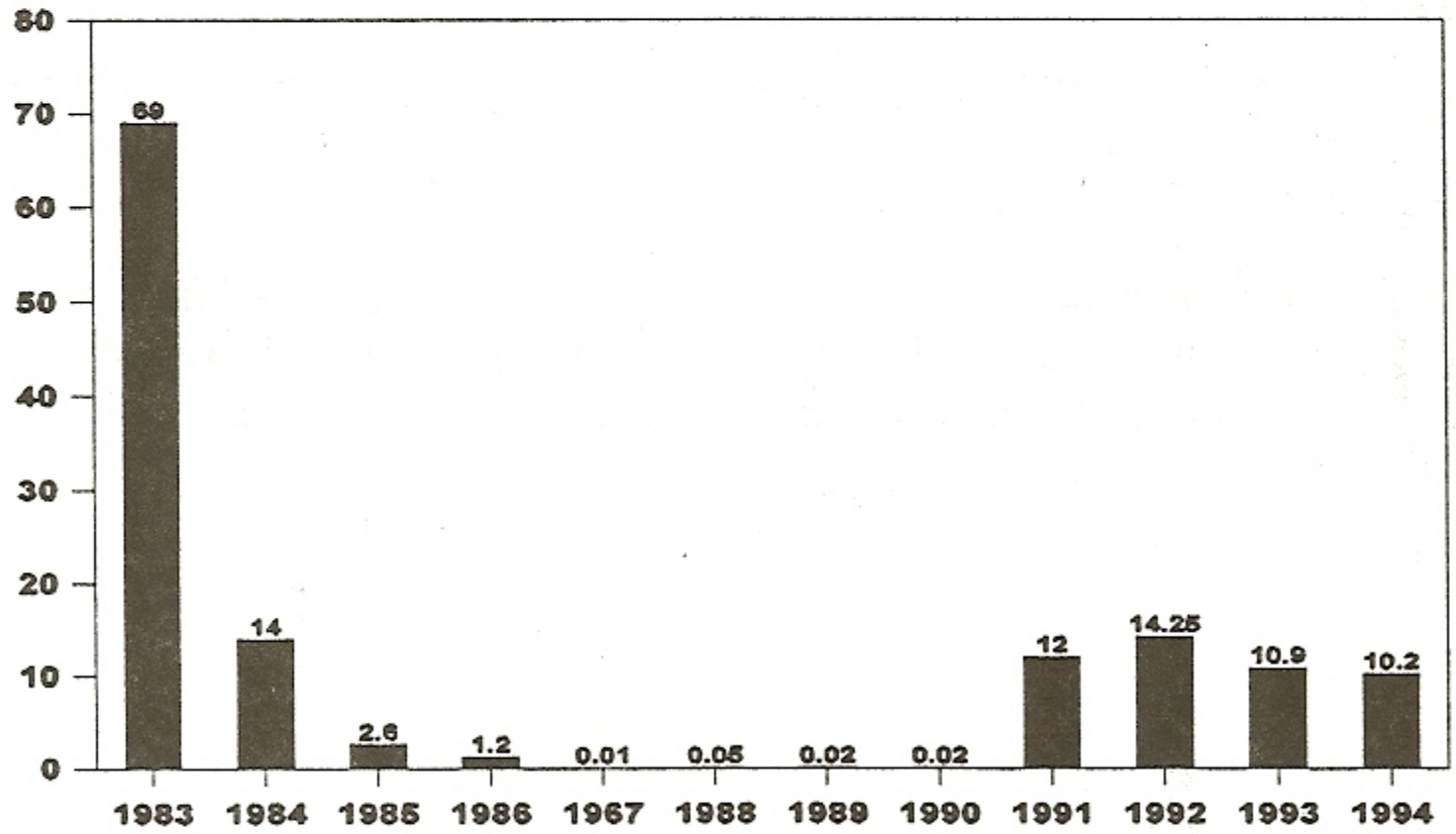


Figure 8. Average number of spruce budworm moths caught in pheromone traps, 1983-1994. Three to 5 pheromone traps per site for 15-23 sites.

OTHER SOFTWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Arborvitae Leaf Miner			See narrative.
Argyresthia thuiella			
Balsam Fir Sawfly			Not observed.
Neodiprion abietis			
European Pine Sawfly			Not observed.
Neodiprion sertifer			
European Spruce Needleminer	Blue Spruce	Fair Haven	Ornamental.
Taniva albolineana			
Fall Hemlock Looper			See narrative.
Lambdina fiscellaria			
Green Hemlock Needleminer			Not observed.
Coleotechnites apicitripunctella			
Gypsy Moth			See narrative.
Lymantria dispar			
Introduced Pine Sawfly	Scots Pine	Weybridge	On Christmas trees.
	White Pine	Fairfax	
Diprion similis			
Larch Casebearer	Eastern Larch	Chittenden County	Populations increasing.
Coleophora laricella		Lamoille County	Light and scattered.
Larch Looper			Not observed.
Semiothisa sexmaculata			
Larch Sawfly	Eastern Larch	Woodbury	Light damage.
	Larch	Worchester	
Pristophora erichsonii			
Microbagworm	White Pine	Cavendish	Cases only.
Psychidae			
Nursery Pine Sawfly			Not observed.
Diprion frutetorum			

OTHER SOFTWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Orange Spruce Needleminer			Not observed.
Pulicalvaria piceaella			
Pine False Webworm			Not observed.
Acantholyda erythrocephala			
Pine Tree Sphinx	Pine	Willison	
Lapara bombycoides			
Pine Webworm			Not observed.
Tetralopha robustella			
Red-Headed Pine Sawfly			Not observed.
Neodiprion lecontei			
Spring Hemlock Looper			See narrative.
Lambdina athasaria			
Spruce Bud Moth	White Spruce	Caledonia County	Remains very light.
Zeiraphera canadensis			
Spruce Budworm			See narrative.
Choristoneura fumiferana			
Tussock Moth			Not observed
Orygia sp.			
White Pine Sawfly			Not observed
Neodiprion pinetum			
Yellow-headed Spruce Sawfly	Blue Spruce White Spruce	Chittenden County Caledonia County Orleans County	Locally heavy. On ornamentals and one Christmas tree plantation in Albany.
Pikonema alaskensis		Lamoille County	

SAPSUCKING INSECTS, MIDGES, AND MITES

Balsam Gall Midge, *Paradiplosis tumifex*, populations remain low. During the annual northern Vermont Christmas tree survey, only 20 acres of light damage was reported. If populations of the insect follow the same trend as the last two outbreaks, then an increase should occur within the next couple of years.

Balsam Twig Aphid, *Mindarus abietinus*, populations declined from 1993, although damage still occurred in scattered Christmas tree plantations. Damage was detected on 237 acres of fir in northern Vermont compared to 329 acres in 1993. Most of this was very light except for 50 acres of moderate damage. The lightest population levels tended to be in the most northern acres while moderate populations were more common in plantations that were not near natural balsam fir stands.

Some of the decline may be due to increased control activities in plantations where the insect has been a problem. Scattered heavy damage was observed, where control was not practiced or not successful. In a plantation in Springfield, there were only 2 eggs per 50 shoots before budbreak, and little damage occurred. Growers should lmonitor their plantations during green bud stage in the spring to see if control is necessary in 1995.

Hemlock Woolly Adelgid, *Adelges tsugae*, was not observed. Monitoring continued at the site in Stockbridge where the insect was introduced, and no adelgids were found. No adelgids have been found there since fall 1991, although 7 surveys have been done since then. No hemlock seedlings were found during a survey in May. In October, eight seedlings were found, apparently wildlings. These were examined in the laboratory, and no signs of adelgid were observed. No signs of adelgid were observed on the hemlock seedlings which had been planted at the site in 1993 as trap trees.

Oystershell Scale, *Lepidosaphes ulmi*, populations remain low. Old damage to beech trees from infestations in the late 80's remains visible but only light infestions of the insect were reported. In our survey plot in Huntington, the number of scales increased slightly after being at very low levels in 1994 (Table 10, Figure 9).

Table 10. Number of oystershell scales on current year beech twigs in Camel's Hump State Forest, 1990-1994[1].

	Average Number of Mature Visible Scales per:									
	Twig					Millimeter				
	1990	1991	1992	1993	1994	1990	1991	1992	1993	1994
Suppressed	2.1	0.9	2.6	1.2	2.1	0.05	0.04	0.19	0.04	0.74
Intermediate	8.5	5.9	6.8	1.4	8.4	0.13	0.14	0.09	0.04	0.16
Codominant	7.4	10.7	4.8	4.8	3.4	0.11	0.32	0.33	0.10	0.08

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

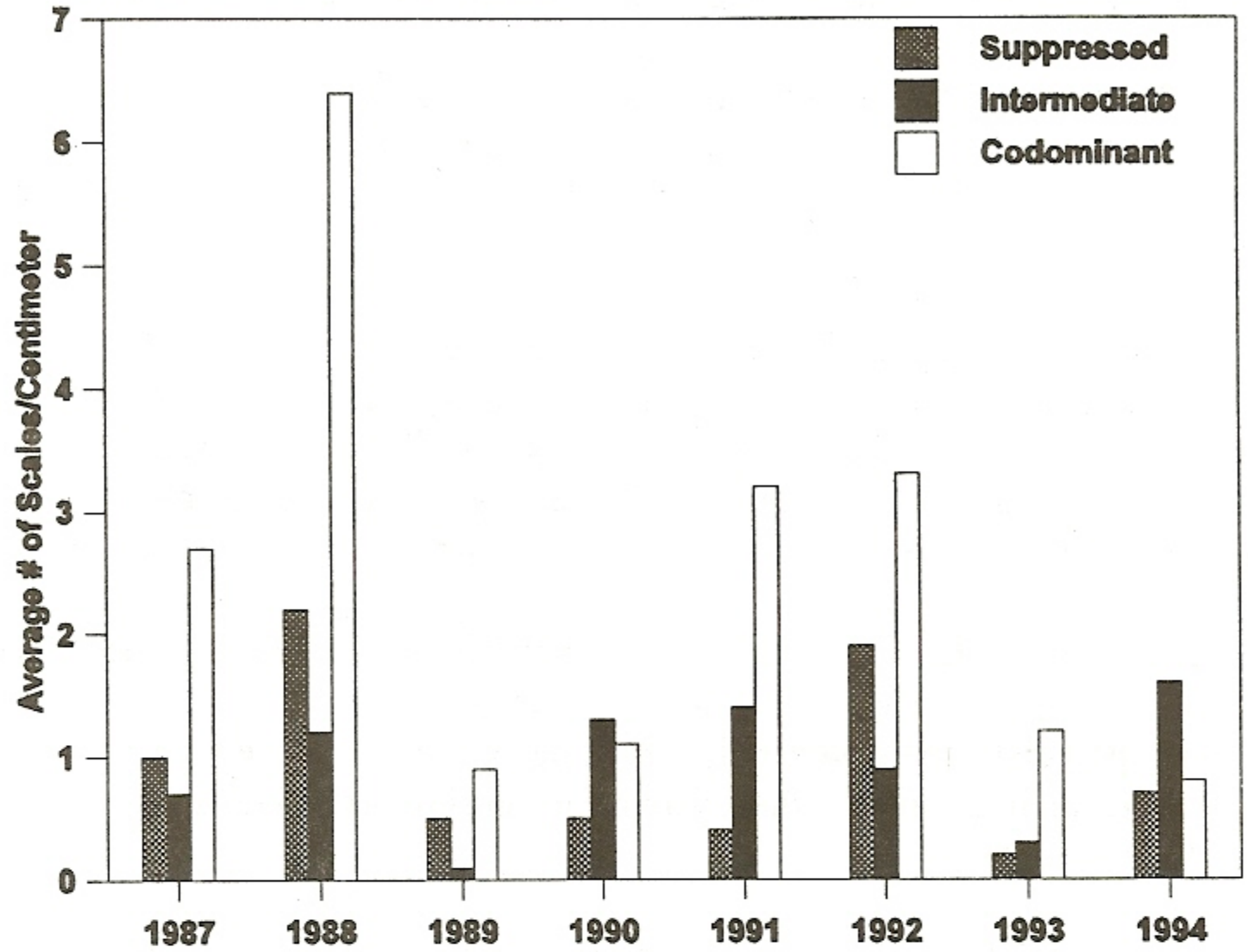


Figure 9. Number of viable oystershell scales per centimeter of current year twig in three tree canopy positions, Camel's Hump State Forest 1987-1994. Average for 10 current year twigs/tree per crown class, collected in autumn.

Pear Thrips, *Taeniothrips inconsequens*, populations were extremely low, after defoliating nearly 84,000 acres mapped in 1993. There was only occasional light damage, and no damage was mapped from the air.

The light damage was due to extremely low populations. Soil counts of overwintering thrips were the lowest since 1988, when soil sampling began (Figure 10). Had populations been higher, damage may have been significant because of the cool spring, with its slow bud development.

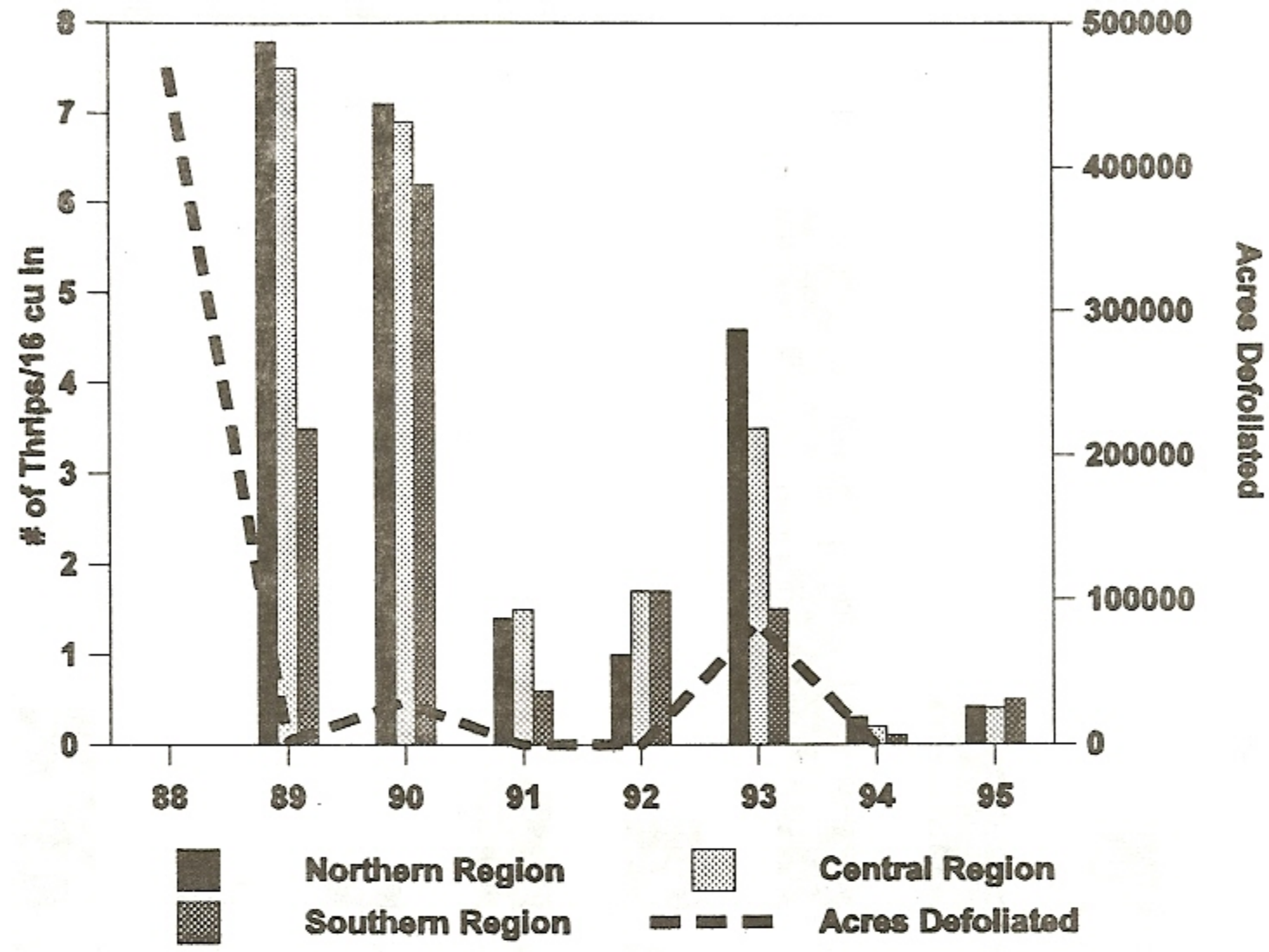


Figure 10. Average counts of overwintering pear thrips in soil samples (# of insects/16 in^3) by region of the state, compared to acres of thrips damage mapped statewide the following summer. Overwintering thrips numbers determined by extraction in 1989-93, and by forced emergence in 1994-95.

Counts of adult thrips in developing buds were made again in the spring, and reflected the low numbers of thrips found in the soil. Numbers were the lowest they have been in the nine years that counts have been made, averaging less than two live thrips per 100 buds (Figure 11). In one sugarbush, over half the thrips in the buds were dead, perhaps due to cold April temperatures. Four additional sugarbushes were sampled this year in Rutland County, where the counts averaged just over four per 100 buds. Soil populations increased only slightly in the fall of 1994. Only light defoliation from thrips is expected in 1995.

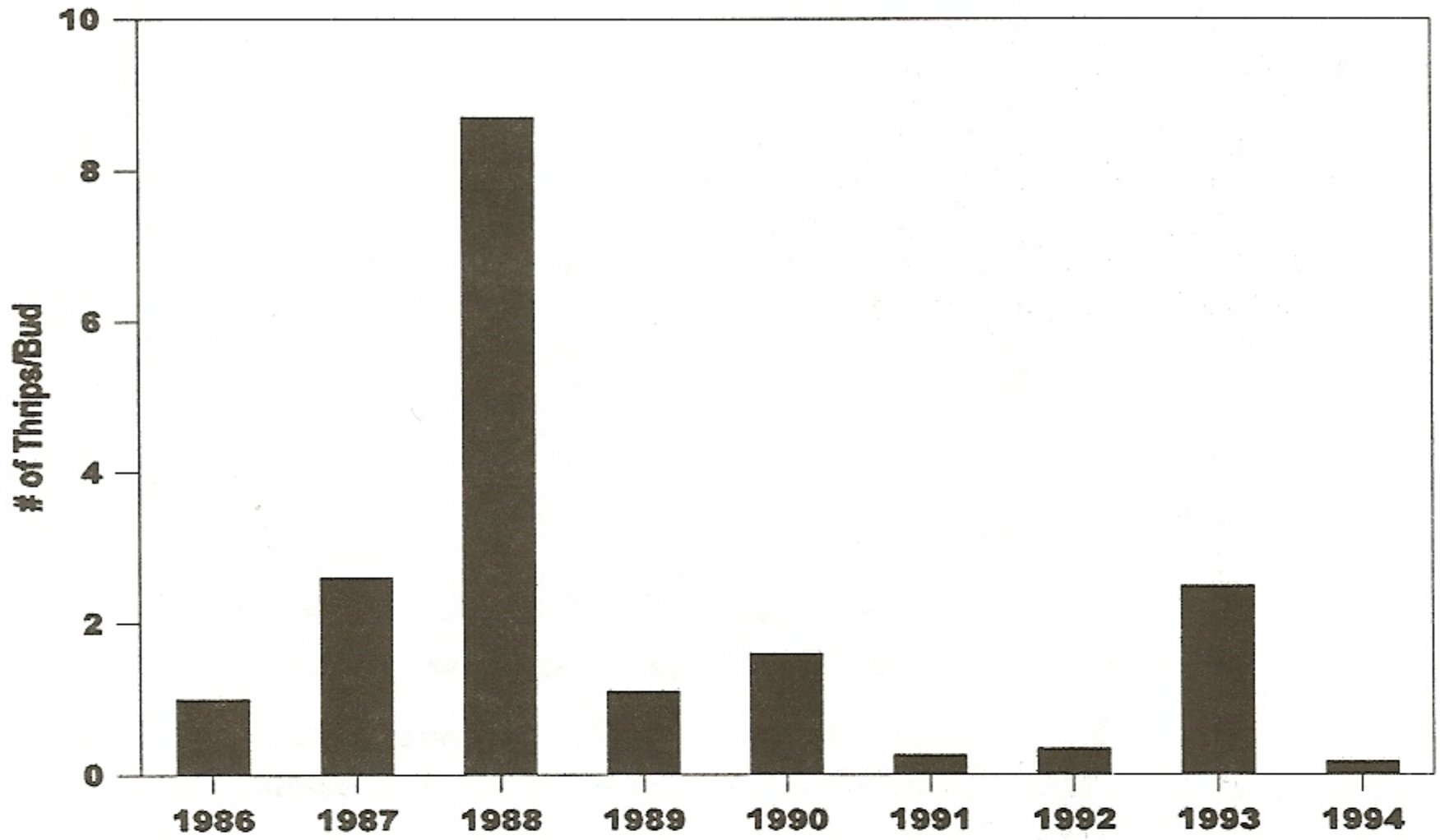


Figure 11. Average thrips counts in buds of sugar maple in southern Vermont 1986-1994. Average of 2 sugarbushes in 1986 and 6 sugarbushes in 1987-1994 (100 buds/sugarbush).

Pine Leaf Adelgid, *Adelges pinifoliae*, decreased in northern Vermont, but was noticeable in several southern Vermont locations. Damage was present on 127 acres in the northern Vermont Christmas tree survey. Fifty acres had moderate-heavy damage; the remainder had light damage.

At several locations in Reading, where galls on red spruce were common, adelgids could be easily found feeding on white pine shoots in late June. At one site, there was scattered severe damage to white pine from 1992 feeding. This was a higher elevation site, where red spruce was common.

Pine Needle Midge, *Contarinea baeri*, populations decreased this year, with 127 acres of damage to Scots pine Christmas trees reported for northern Vermont compared to 266 acres in 1993. All but 2 acres of this was light damage, with only scattered needle loss. Damage was also observed in Townshend.

Spruce Spider Mite, *Oligonychus ununguis*, populations were variable going into the season, with eggs common in some plantations where damage had occurred in 1993, and hard to find in others. However, 1994 damage was much less common than the previous year. Frequent heavy rains throughout most of the summer apparentlly suppressed populations. The warm dry fall may have led to increases in mites late in the year so growers should monitor for the tiny reddish mites early in the growing season in 1995.

OTHER SAPSUCKING INSECTS, MIDGES AND MITES

INSECT	HOST(S)	LOCALITY	REMARKS
Aphids *Cinara sp.*	Pines	Danville Lyndon	Light on ornamentals.
Aphids *Periphyllus sp.*	Norway Maple	Addison Chittenden Franklin Counties	Common on shade trees.
Arborvitae Aphid *Cinara tujafilina*			Not observed.
Ash Flowergall Mite *Aceria fraxiniflora*	Ash	Hinesburg Williston	
Ash Plant Bug *Tropidosteptes amoenus*	Ash	Pittsford	
Balsam Gall Midge *Paradiplosis tumifex*			See narrative.
Balsam Twig Aphid *Mindarus abietinus*			See narrative.
Balsam Woolly Adelgid *Adelges piceae*	Balsam Fir	Groton	Light.
Bark Lice *Psocidae*	Many, including Sugar Maple	Scattered throughout	Non-damaging; locally heavy.
Beech Scale *Cryptococcus fagisuga*			See Beech Bark Disease.
Birch Budgall Mite *Aceria rudis*			Not observed.
Black Pineleaf Scale *Nuculaspis californica*			Not observed.
Blister Mite *Eriophyes sp.*			Not observed.
Bowlegged Aphid *Cinara curvipes*	Balsam Fir	Morrisville	

OTHER SAPSUCKING INSECTS, MIDGES AND MITES

INSECT	HOST(S)	LOCALITY	REMARKS
Cooley Spruce Gall Aphid *Adelges coolelyi*	Douglas Fir Blue Spruce	Throughout	Populations decreased. In N. VT Christmas tree survey, 73 acres of mostly light damage compared to 109 acres of mostly moderate-heavy damage in 1993.
Cottony Maple Scale *Pulvinaria innumerabilis*			Not observed.
Eastern Spruce Gall Aphid *Adelges abietis*	White, Red & Norway Spruce	Throughout	Scattered light damage. Down slightly in N. VT Christmas tree survey. 131 acres of mostly light damage compared to 160 acres light-moderate damage in 1993.
Erineum Gall *Eriophyidae*	Hardwoods	Scattered throughout	Much less common than 1993 in southern Vermont. Commonly seen elsewhere.
European Birch Aphid *Adelges cooleyi*			Not observed.
Fletcher Scale *Lecanium fletcheri*			Not observed.
Gouty Vein Midge *Dasineura communis*			Not observed.
Hemlock Woolly Adelgid *Adelges tsugae*			See narrative.
Lacebugs *Corythucha sp.*	Yellow Birch Elm Balsam Poplar	Lamoille Caledonia Counties	Common at light levels. Light damage
Leafhoppers *Cicadellidae*	Hardwoods	Caledonia County	Common at trace levels.
Lecanium Scale *Lecanium sp.*	Red Oak	Hartford	Young ornamental in an urban site.

OTHER SAPSUCKING INSECTS, MIDGES AND MITES

INSECT	HOST(S)	LOCALITY	REMARKS
Maple Bladdergall Mites *Vasates quadripedes*	Sugar Maple	Lamoille Washington Counties	Common, light.
Maple Spindle Gall Mites *Vasates aceris-crumena*	Sugar Maple	Lamoille Washington Counties	Common, light.
Oak Gall caused by *Contarinia sp.*	Red Oak	Essex Junction	
Oak Gall *Dryocosmus quercuspalustris*	Red Oak	Barnet	
Oak Gall *Amphibolips quercusinanis*	Red Oak	Barnet	
Oak Phylloxera *Phylloxera sp.*	Red Oak	Barnet	
Oak Wool Sower's Gall *Callirhytis seminator*			Not observed.
Oystershell Scale *Lepidosaphes ulmi*			See narrative.
Pear Thrips *Taeniothrips inconsequens*			See narrative.
Phyllocoptes didelphis (mite)	Quaking Aspen	Derby	
Pine Bark Adelgid *Pineus strobi*	White Pine	Scattered Throughout	Remains common, but populations are generally low.
Pine Leaf Adelgid *Pineus pinifoliae*			See narrative.
Pine Needle Midge *Contarinea baeri*			See narrative.

OTHER SAPSUCKING INSECTS, MIDGES AND MITES

INSECT	HOST(S)	LOCALITY	REMARKS
Pine Needle Scale	Mugho Pine White Pine	Scattered Throughout	Common, but little damage.
Chionapsis pinifoliae			
Pine Spittlebug	Scots Pine White Pine	Scattered Throughout	Populations decreasing. Only 37 acres of damage in N. VT Christmas Tree Survey compared to 99 acres in 1993. However, a heavy infestation was reported for 15 acres of Scots pine in Danville. Heavy on occasional ornamentals.
Aphrophora parallela			
Pine Thrips	Scots Pine	Widespread	Common at very light levels.
Gnophothrips sp.			
Pine Tortoise Scale			Not observed.
Toumeyella parvicornis			
Ragged Spruce Gall Aphid	Red Spruce	Northern Vermont	Scattered, light.
Pineus similis			
Root Aphid	Christmas Trees	Burke	Light.
Prociphilus americanus			
Smooth Vein Pocket			Not observed.
Macrodiplosis goruca			
Snowball Aphid	Viburnum	Springfield	Ornamental
Neoceruraphis viburnicola			
Spruce Bud Scale			Not observed.
Physokermes piceae			
Succulent Oak Gall			Not observed.
Dryocosmos quercuspalustris			
Spruce Spider Mite			See narrative.
Oligonychus ununguis			
Treehoppers	Bittersweet	St. Johnsbury	Ornamentals.
Membracidae			

OTHER SAPSUCKING INSECTS, MIDGES AND MITES

INSECT	HOST(S)	LOCALITY	REMARKS
Two-marked Treehopper	Viburnum	St. Johnsbury Colchester	
Enchenopa binotata			
Vagabond Aphid	Poplar	Hinesburg Colchester	
Mordwilkoja vagabunda		Middlebury	
Vein Pocket Gall			Not observed.
Macrodiplosis erubescens			
Woolly Alder Aphid	Speckled Alder	Caledonia Essex	Scattered-more common than in past few years. Not
Prociphilus tesselatus		Lamoille Counties	observed on silver maple.
Woolly Apple Aphid			Not observed.
Eriosoma lanigerum			
Woolly Fold Gall			Not observed.
Cecidomyia niveipila			

BUD, SHOOT & STEM INSECTS

Balsam Shootboring Sawfly, *Pleroneura brunneicornis*, has increased in recent years, and this year it was the single most damaging agent on fir Christmas trees. It was reported infesting 655 acres of 850 acres surveyed in Northern Vermont, compared to 329 acres in 1993. Fraser fir was generally preferred over balsam fir by this insect. Of 24 plantations in northern Vermont intensively surveyed for this insect, percent of shoots killed per tree per plantation averaged 6 percent for balsam and 10 percent for fraser but ranged up to 30 percent on fraser compared to 14 percent on balsam.

Despite these high levels of shoot mortality, larger, tightly-sheared trees tended to have acceptable appearance by late summer. Small trees that hadn't attained a full shape yet, and trees damaged in previous years by other agents such as frost, tended to have the poorest appearance as a result of damage by this insect. An assessment of shootboring sawfly damage to firs planted in Woodbury for seed-source trials revealed that those balsam fir originating from the most northern locations and earliest to break bud had the least damage. Fraser fir and fraser-balsam crosses had the most damage.

In the northern Vermont Christmas tree survey, the only heavy damage reported was on fraser fir. There were 217 acres of moderate damage to fraser fir compared to 144 acres of moderate damage to balsam fir (Table 11). The heaviest damage tended to be in plantations near natural balsam fir stands. Plantations in areas outside the fir range were generally undamaged.

Table 11. Acres of damage to balsam and fraser fir by the balsam shootboring sawfly by county (out of 850 acres surveyed).

County	Balsam fir				Fraser fir			
	Light	Mod.	Hvy.	Total	Light	Mod.	Hvy.	Total
Addison	0	0	0	0	0	0	0	0
Caledonia	72	56	0	128	0	76	15	91
Franklin	0	0	0	0	12	0	0	12
Lamoille	66	40	0	106	0	82	0	82
Orange	42	0	0	42	36	0	0	36
Orleans	11	12	0	23	0	29	0	29
Washington	20	36	0	56	0	30	20	50
Total	**211**	**144**	**0**	**355**	**48**	**217**	**35**	**300**

The adult sawflies are probably laying eggs through the bud sheath very early in the spring before bud swell. First stage larvae were found in unswollen buds this year and third stage larvae (the insect has 5 larval instars) were found in buds beginning to break open.

OTHER BUD, SHOOT & STEM INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Allegheny Mound Ants	Many	Throughout	Occasionally observed killing Christmas trees.
Formica exsectoides			
Ambrosia Beetle			Not observed.
Scolytidae			
Balsam Shootboring Sawfly			See narrative.
Pleroneura brunneicornis			
Birch Catkin Weevil	Birch Catkins	Underhill	
Apion simile			
Black Vine Weevil			Not observed.
Otiorhynchus sulcatus			
Brachyleptura rubrica	In decaying logs	Brighton	
Brown Prionid	In firewood	Duxbury	
Orthosoma brunneum			
Butternut Curculio			Not observed.
Conotrachelus juglandis			
Cambium Miner			Not observed.
Phytobia spp.			
Carpenter Ants	Ornamentals	Reading	Contributing to tree hazard.
Camponotus pennsylvanica	Cherry Roots	N. Springfield	
Coneworm			Not observed.
Dioryctria spp.			
Glischrochilus faciatus or *quadrisignatus* (Coleoptera: Nitidulidae)	Silver Maple	Essex Junction	
Hylobius congener	Cedar logs	Franklin	
Hylastes porculus	Cedar logs	Franklin	

OTHER BUD, SHOOT & STEM INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Linden Borer *Saperda vestita*		S. Burlington	Brought in on "Greenspire" planting stock - killing some of them.
Locust Borer *Megacyllene robiniae*			Not observed.
Locust Twig Borer *Ecdytolopha insiticiana*			Not observed.
Maple Petiole Borer *Caulocampus acericaulis*			Not observed.
Narrow-winged Cricket *Oecanthus angustipennis*	Red Maple	Williston	
Northeastern Sawyer *Monochamus notatus*	White Pine	Scattered	Adults commonly observed in June-July.
Northern Pine Weevil or Deodar Weevil *Pissodes approximatus* or *Pissodes nemorensis*	Douglas Fir Austrian Pine	Townshend Bennington	Larval feeding in trees dying from planting too deep.
Pales Weevil *Hylobius pales*	Scots Pine	Scattered	Populations down. Only occasional light damage on Christmas trees.
Pigeon Tremex *Tremex columba*	In firewood Black Locust	Duxbury Colchester	
Pine Gall Weevil *Podapion gallicola*	Red Pine	Scattered	Occasionally seen.
Pine Root Collar Weevil *Hylobius radicis*			Not observed.
Pitch Nodule Maker *Petrova albicapitana*	Scots Pine Jack Pine	Berlin Albany Richmond	Scattered light damage during N. VT Christmas tree survey.
Pitted Ambrosia Beetle *Corthylus punctatissimus*	Sugar Maple Seedlings	Orleans Caledonia Counties	Light scattered damage in sugarbushes.

OTHER BUD, SHOOT & STEM INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Poplar Borer *Saperda calcarata*	Poplar	Burton Island	
Pseudanthonomus validus			Not observed.
Pyralidae Moth Larva in subfamily Phycitinae	Bitternut Hickory	New Haven	In buds.
Red Oak Borer *Monochamus sp.*			Not observed.
Round-headed Apple Tree Borer *Saperda candida*	Mountain Ash Flowering Crab	Addison Caledonia Chittenden Franklin Counties	Locally heavy.
Sawyer *Monochamus sp.*	Balsam Fir	Washington Lamoille Counties	Adults occasionally observed.
Striped Ambrosia Beetle *Trypodendron lineatum*			Not observed.
Sugar Maple Bud Borer prob. *Proteotera sp.*	Sugar Maple	Woodstock, Dummerston	High numbers in buds dissected for pear thrips counts. In Woodstock, 23 of 100 buds were infested.
Sugar Maple Borer *Glycobius speciosus*	Sugar Maple	Widespread	Remains common. Dissection of 10 trees in Duxbury revealed that recent attacks were most common in 1990.
Twig Pruner *Elaphidionoides villosus*	Red Oak	Addison Chittenden Franklin Lamoille Windham Counties	Mostly light. Heaviest increases seen in Colchester.
White Pine Weevil *Pissodes strobi*	White Pine Norway Spruce White Spruce	Scattered	Remains common. Decreased in N. VT Christmas tree survey with 282 acres exhibiting injury, compared to 510 acres in 1993.
White Spotted Sawyer *Monochamus scutellatus*		Essex Caledonia Washington Counties	Observed numerous adult beetles in June-July.
Zimmerman Pine Moth *Dioryctria zimmermanni*	Scots Pine	Fairfax	Approximately 50 trees infested.

BARK INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Bark Beetle			Not observed.
Orthotomicus caelatus			
Bronze Birch Borer	Paper Birch	Scattered throughout	On declining trees.
Agrilus anxius			
Eastern Ash Bark Beetle	Ash	Waterbury	
Hylesinus aculeatus			
Eastern Larch Beetle	Tamarack	Widespread	Mostly stable at light levels. Locally heavy mortality on Groton State Forest.
Dendroctonus simplex			
Elm Bark Beetles			See Dutch Elm Disease.
Hylurgopinus rufipes *Scolytus multistriatus*			
Hemlock Borer			Not observed.
Melanophila fulvoguttata			
Lesser Peachtree Borer			Not observed.
Synanthedon pictipes			
Peach Bark Beetle			Not observed.
Phloeotribus dentifrons			
Pine Engraver	White Pine	Springfield	Attacking a tree struck by lightening.
Ips pini			
Pityophthorus sp.	Scots Pine	Waterbury	
Red Turpentine Beetle			Not observed.
Dendroctonus valens			
Rustic Borer			Not observed.
Xylotechus colonus			
Tanbark Borer			Not observed.
Phymatodes testaceus			

ROOT INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Broad Necked Root Borer *Prionus laticollis*			Not observed.
Conifer Swift Moth *Korsheltellus gracilis*			Not observed.
June Beetle *Phyllophaga spp.*	Balsam Fir	Caledonia Lamoille Orange Washington Counties	Commonly observed.
Strawberry Root Weevil *Otiorhynchus ovatus*			Not observed.
Wireworm *Elateridae*			Not observed.

MISCELLANEOUS INSECTS

Miscellaneous insects caught in pheromone traps were tallied for traps with lures for oak leaf tier in 1994 (Table 12).

Table 12. Insects caught in pheromone traps with oak leaftier lures in 1994.

Location	Trap #	Date	Insect	Number
Rupert--Merck Forest	1	7 June 1994 to 14 July 1994	Oak leaftier	0
			Tortricids (3 species)	3
			Noctuids	4
			Geometrids	1
			Cerambycids	4
			Other Coleoptera	9
			Homoptera	9
			Syrphids	1
			Other Diptera	2
Rupert--Merck Forest	2	7 June 1994 to 14 July 1994	Oak leaftier	0
			Tortricids	1
			Noctuids	1
			Notodontids	1
			Gelechiids (2 species)	3
			Geometrids (*Eulithus* sp)	1
			Nepticulids	1
			Tipulids	1
			Syrphids	2
			Other Diptera (1 species)	17
			Psocids	1
			Cerambycids	4
Rupert--Merck Forest	3	7 June 1994 to 14 July 1994	Oak leaftier	0
			Tortricid (*Acleris* sp)	1
			Tortricid (*Oleuthreutes* sp)	1
			Other Tortricids	1
			Noctuids	2
			Geometrids	1
			Elaterids	2
			Coleoptera	3
			Homoptera	20
			Diptera	1

Location	Trap #	Date	Insect	Number
Rockingham	1	9 June 1994 to 13 July 1994	Oak leaftier	1
			Croesia curvalana	1
			Oecophorids	1
			Lampyrids	1
			Cerambycids	1
			Elaterids	2
			Other Coleoptera	2
			Homoptera	8
Rockingham	2	9 June 1994 to 13 July 1994	Oak leaftier	0
			Membracids	2
			Spiders	2
			Other Homoptera	12
			Formicids	1
			Cerambycids	1
			Lampyrids	1
			Diptera	6
Rockingham	3	9 June 1994 to 13 July 1994	Oak leaftier	0
			Tortricids	1
			Coccinellids	1
			Cerambycids	2
			Diptera	2
			Membracids	1
			Other Homoptera	19

All non-target moths caught in pheromone traps with lures for spruce budworm (Tables 13-14), fall hemlock looper (Tables 15-16), forest tent caterpillar (Tables 17-18), spring hemlock looper (Tables 19-20), and oak leaftier (Tables 21-22) were tallied in 1993-1994. The numbers in the tables are from Hodges, R. W. et al. 1983. *Check List of the Lepidoptera of America North of Mexico*. E.W. Classey Limited and the Wedge Entomological Research Foundation, London. 284 p.

Table 13. Non-target moths caught in pheromone traps with spruce budworm lures in 1993.

31	**Korscheltellus gracilis** (Grt., 1864). (conifer swift moth, graceful ghost moth) Hepialidae
951	**Machimia tentoriferella** (Clem., 1860). (gold-striped leaftier, deciduous leaffolder) ecophoridae
2467	**Argyresthia oreasella** (Clem., 1860). (cherry shootborer) Argyresthiidae
2509	**Schrenckensteinia festaliella** (Hbn., 1818-19). (blackberry skeletonizer) Heliodinidae
3548	**Acleris variana** Fern., 1886. (eastern blackheaded budworm) Tortricidae
3635	**Choristoneura rosaceana** (Harr., 1841). (obliquebanded leafroller) Tortricidae
4716	**Scoparia biplagialis** Wlk., 1866. Pyralidae
4919	**Scoparia basalis** Wlk., 1866. Pyralidae
5176	**Anageshna primordialis** (Dyar, 1907). Pyralidae
6286	**Itame brunneata** (Thumb., 1784). Geometridae
6347	**Semiothisa pinistrobata** Fgn., 1972. (white pine angle, white pine looper) Geometridae
6667	**Lomographa vestaliata** (Gn., 1857). (white spring moth) Geometridae
6811	**Homochlodes lactispargaria** (Wlk., 1861). Geometridae
6888	**Lambdina fiscellaria** (Gn., 1857). (hemlock looper) Geometridae
6964	**Tetracis cachexiata** Gn., 1857. (white slant-line) Geometridae
6965	**Eugonobapta nivosaria** (Gn., 1857). (snowy geometer) Geometridae
7009	**Nematocampa resistaria** (H.-S., 1855). (filament bearer, horned spanworm) Geometridae
7316	**Perizoma basaliata** (Wlk., 1862). (square-patched carpet) Geometridae
7388	**Xanthorhoe ferrugata** (Cl., 1759). (red twin-spot) Geometridae
7445	**Horisme intestinata** (Gn., 1857). (brown bark carpet) Geometridae
8338	**Phalaenophana pyramusalis** (Wlk., 1859). (dark-banded owlet) Noctuidae
8345	**Zanclognatha laevigata** (Grt., 1872) (variable zanclognatha) Noctuidae
8397	**Palthis angulalis** (Hbn., 1796). (dark-spotted palthis, spruce harlequin) Noctuidae
8942	**Syngrapha rectangula** (W. Kby., 1873). (salt-and-pepper moth, looper moth, angulated cutworm) Noctuidae
9189	**Charadra deridens** (Gn., 1852). (the laugher) Noctuidae
9546	**Phlogophora iris** Gn., 1852. (olive angle shades) Noctuidae
9547	**Phlogophora periculosa** Gn., 1852. (brown angle shades) Noctuidae
9549	**Enargia decolor** (Wlk., 1858). (aspen twoleaf tier) Noctuidae

Olethreutes sp. Tortricidae
Scoparia sp. Pyralidae
Orthosia sp. Noctuidae

Table 14. Non-target moths caught in pheromone traps with spruce budworm lures in 1994.

31	**Korscheltellus gracilis** (Grt., 1864).(conifer swift moth, graceful ghost moth) Hepialidae
2467	**Argyresthia oreasella** (Clem., 1860). (cherry shootborer) Argyresthiidae
2823	**Olethreutes fasciatana** (Clem., 1860). Tortricidae
3504	**Croesia curvalana** (Kft., 1907). (blueberry leafworm) Tortricidae
4195	**Pieris napi oleracea** (Harr., 1829). (grey veined white, mustard white) Pieridae
4949	**Ostrinia nubilalis** (Hbn., 1796). (European corn borer) Pyralidae
4953	**Phlyctaenia coronata** (Hufn., 1767). (elderberry leaftier) Pyralidae
5176	**Anageshna primordialis** (Dyar, 1907). Pyralidae
5226	**Palpita magniferalis** (Wlk., 1861). (ash leafroller) Pyralidae
6235	**Habrosyne scripta** (Gosse, 1840). (lettered hasbrosyne, false owlet moth) Thyatiridae
6237	**Pseudothyatira cymatophoroides** (Gn., 1852) (tufted thyatirid, birch and alder caterpiller) Thyatiridae
6330	**Semiothisa ulserata** (Pears., 1913). Geometridae
6811	**Homochlodes lactispargaria** (Wlk., 1861). Geometridae
6813	**Homochlodes disconventa** (Wlk., 1860). Geometridae
6838	**Probole amicaria** (H.-S., 1855). (friendly probole, redcheeked looper) Geometridae
6863	**Caripeta divisata** Wlk., 1863. (gray spruce looper) Geometridae
6965	**Eugonobapta nivosaria** (Gn., 1857). (snowy geometer) Geometridae
7009	**Nematocampa resistaria** (H.-S., 1855). filament bearer, horned spanworm) Geometridae
7139	**Cyclophora pendulinaria** (Gn., 1857). (sweetfern geometer) Geometridae
7159	**Scopula limboundata** (Haw., 1809). (larger lace wave, large lace-border) Geometridae
7182	**Dysstroma citrata** (L., 1761). (dark marbled carpet) Geometridae
7188	**Dysstroma walkerata** (Pears., 1909). Geometridae
7206	**Eulithis explanata** (Wlk., 1862). (white eulithis) Geometridae
7399a	**Euphyia unangulata intermediata** (Gn., 1857). (sharp-angled carpet) Geometridae
8345	**Zanclognatha laevigata** (Grt., 1872). (variable zanclognatha) Noctuidae
8397	**Palthis angulalis** (Hbn., 1796). (dark-spotted palthis, spruce harlequin) Noctuidae
8442	**Bomolocha baltimoralis** (Gn., 1854). (Baltimore bomolocha) Noctuidae
8444	**Bomolocha palparia** (Wlk., 1861) (mottled bomolocha) Noctuidae
8452	**Bomolocha edictalis** (Wlk., 1859). (large bomolocha) Noctuidae
8717	**Zale horrida** Hbn., 1818. (horrid zale, large false looper) Noctuidae
8727	**Parallelia bistriaris** Hbn., 1818. (maple looper moth, maple caterpillar) Noctuidae
8923	**Autographa ampla** (Wlk., 1858). (large looper moth) Noctuidae
9546	**Phlogophora iris** Gn., 1852. (olive angle shades) Noctuidae
9547	**Phlogophora periculosa** Gn., 1852. (brown angle shades) Noctuidae
9551	**Enargia mephisto** Franc., 1939. Noctuidae
9678	**Elaphria versicolor** (Grt., 1875). (variegated midget, fir harlequin caterpillar) Noctuidae

Table 15. Non-target moths caught in pheromone traps with fall hemlock looper lures in 1993.

367	**Acrolophus morus** (Grt., 1881). (burrowing webworm) Tineidae
7433	**Epirrita autumnata** (Bkh., 1794). (autumnal or november moth) Geometridae
8318	**Lymantria (=Porthetria) dispar** (L., 1758). (gypsy moth) Lymantriidae
9886	**Lithophane patefacta** (Wlk., 1858). Noctuidae
9957	**Sunira bicolorago** (Gn., 1852). (bicolored sallow) Noctuidae

Table 16. Non-target moths caught in pheromone traps with fall hemlock looper lures in 1994.

3548	**Acleris variana** Fern., 1886. (eastern blackheaded budworm) Tortricidae
4950	**Fumibotys fumalis** (Gn., 1854). Pyralidae
6796	**Campaea perlata** (Gn., 1857). (fringed looper, pale beauty) Geometridae
6813	**Homochlodes disconventa** (Wlk., 1860). Geometridae
7433	**Epirrita autumnata** (Bkh., 1794). (autumnal or november moth) Geometridae
8318	**Lymantria (=Porthetria) dispar** (L., 1758). (gypsy moth) Lymantriidae
8345	**Zanclognatha laevigata** (Grt., 1872). (variable zanclognatha) Noctuidae
8442	**Bomolocha baltimoralis** (Gn., 1854). (Baltimore bomolocha) Noctuidae
8452	**Bomolocha edictalis** (Wlk., 1859). (large bomolocha) Noctuidae
8465	**Plathypena scabra** (F., 1758). (green cloverworm) Noctuidae
8587	**Panopoda rufimargo** (Hbn., 1818). (red-lined panopoda) Noctuidae
9889	**Lithophane petulca** Grt., 1874. (wanton pinion) Noctuidae
10942	**Xestia adela** (Franc., 1980). Noctuidae

Table 17. Non-target moths caught in pheromone traps with forest tent caterpillar lures in 1993.

2363	**Plutella porrectella** (L., 1758). Plutellidae
3310	**Epinotia transmissana** (Wlk., 1863). (birch catkin moth) Tortricidae
3638	**Choristoneura fumiferana** (Clem., 1865). (spruce budworm) Tortricidae
6813	**Homochlodes disconventa** (Wlk., 1860). Geometridae
6888	**Lambdina fiscellaria** (Gn., 1857). (hemlock looper) Geometridae
7139	**Cyclophora pendulinaria** (Gn., 1857). (sweetfern geometer) Geometridae
7440	**Eubaphe mendica** (Wlk., 1854). (the beggar) Geometridae
7701	**Malacosoma americanum** (F., 1793). (eastern tent caterpillar) Lasiocampidae
8318	**Lymantria (=Porthetria) dispar** (L., 1758). (gypsy moth) Lymantriidae
8326	**Idia rotundalis** (Wlk., 1866). (rotund idia) Noctuidae
8345	**Zanclognatha laevigata** (Grt., 1872). (variable zanclognatha) Noctuidae
8452	**Bomolocha edictalis** (Wlk., 1859). (large bomolocha) Noctuidae
8942	**Syngrapha rectangula** (W. Kby., 1873). (salt-and-pepper moth, looper moth, angulated cutworm) Noctuidae
9678	**Elaphria versicolor** (Grt., 1875). (variegated midget, fir harlequin caterpillar) Noctuidae
9957	**Sunira bicolorago** (Gn., 1852). (bicolored sallow) Noctuidae
10275	**Polia nimbosa** Gn., 1852. (stormy arches) Noctuidae
10891	**Ochropleura plecta** (L., 1761). (flame-shouldered dart) Noctuidae

Table 18. Non-target moths caught in pheromone traps with forest tent caterpillar lures in 1994.

597 **Caloptilia burgessiella** (Zell., 1873). (Dogwood leafcone caterpillar) Gracillariidae
2099 **Chionodes obscurusella** (Cham., 1872). (boxelder leafworm) Gelechiidae
6811 **Homochlodes lactispargaria** (Wlk., 1861). Geometridae
6884 **Besma endropiaria** (G. & R., 1867). (straw besma) Geometridae
6888 **Lambdina fiscellaria** (Gn., 1857). (hemlock looper) Geometridae
6966 **Eutrapela clemataria** (J.E., Smith. 1917). (purplishbrown looper, cureve-toothed looper) Geometridae
6796 **Campaea perlata** (Gn., 1857). (fringed looper, pale beauty) Geometridae
7159 **Scopula limboundata** (Haw., 1809). (larger lace wave, large lace-border) Geometridae
8318 **Lymantria (=Porthetria) dispar** (L., 1758). (gypsy moth) Lymantriidae
8345 **Zanclognatha laevigata** (Grt., 1872). (variable zanclognatha) Noctuidae
8397 **Palthis angulalis** (Hbn., 1796). (dark-spotted palthis, spruce harlequin) Noctuidae
8421 **Hypenodes fractilinea** (Sm., 1908) (brokenline hypenodes) Noctuidae
8452 **Bomolocha edictalis** (Wlk., 1859). (large bomolocha) Noctuidae
9545 **Euplexia benesimilis** McD., 1922. (American andle shades) Noctuidae
9638 **Amphipyra pyramidoides** Gn., 1852. (American copper underwing, pyramidal fruitworm, humped green fruitworm) Noctuidae
9681 **Elaphria festivoides** (Gn., 1852). (festive midget) Noctuidae
10275 **Polia nimbosa** Gn., 1852. (stormy arches) Noctuidae
10406 **Lacinipolia olivacea** (Morr., 1874). (olive arches, dandelion cutworm) Noctuidae
10663 **Agrotis ipsilon** (Hufn., 1766). (black cutworm, ipsilon dart, greasy cutworm) Noctuidae
10928 **Graphiphora auger haruspica** (Grt., 1875). (soothsayer dart) Noctuidae
10943 **Xestia normaniana** (Grt., 1874). (Norman's dart) Noctuidae

Scoparia sp. Pyralidae
Eupithecia sp. Geometridae
Hydriomena sp. Geometridae
Acleris spp. Tortricidae
Olethreutes sp. Tortricidae

Table 19. Non-target moths caught in pheromone traps with spring hemlock looper lures in 1993. Traps were baited with fall hemlock looper pheromone.

912	**Semioscopis packardella** (Clem., 1863). Oecophoridae
3374	**Ancylis comptana** (FrÖlich, 1828). (strawberry leafroller) Tortricidae
4919	**Scoparia basalis** Wlk., 1866. Pyralidae
6811	**Homochlodes lactispargaria** (Wlk., 1861). Geometridae
10942	**Xestia adela** (Franc., 1980). Noctuidae

Table 20. Non-target moths caught in pheromone traps with spring hemlock looper lures in 1994. Traps were baited with fall hemlock looper pheromone.

6588	**Iridopsis larvaria** (Gn., 1857). (bent-line gray) Geometridae
6796	**Campaea perlata** (Gn., 1857). (fringed looper, pale beauty) Geometridae
6677	**Cabera erythemaria** Gn., 1857. (yellow-dusted cream moth) Geometridae
6811	**Homochlodes lactispargaria** (Wlk., 1861). Geometridae
8318	**Lymantria (=Porthetria) dispar** (L., 1758). (gypsy moth) Lymantriidae
8942	**Syngrapha rectangula** (W. Kby., 1873). (salt-and-pepper moth, looper moth, angulated cutworm) Noctuidae

Table 21. Non-target moths caught in pheromone traps with oak leaftier lures in 1993.

3682	**Clepsis persicana** (Fitch, 1856). (whitetriangle tortrix) Tortricidae
8318	**Lymantria (=Porthetria) dispar** (L., 1758). (gypsy moth) Lymantriidae

Olethreutes sp. Tortricidae
Croesia sp. Tortricidae

Table 22. Non-target moths caught in pheromone traps with oak leaftier lures in 1994.

3504 Croesia curvalana (Kft., 1907). (blueberry leafworm) Tortricidae

Olethreutes sp. Tortricidae
Acleris sp. Tortricidae
Eulithus sp. Geometriidae

OTHER MISCELLANEOUS INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Asian or Halloween Ladybeetle *Harmonia axyridis*	In houses	Statewide	Commonly observed in late summer and early fall.
Bark Lice *Psocoptera*	Pine Sugar Maple	Windsor Fairfax Chester	Scattered throughout.
Clytus ruricola	At large	Fayston	

FOREST DISEASES

Stem Diseases

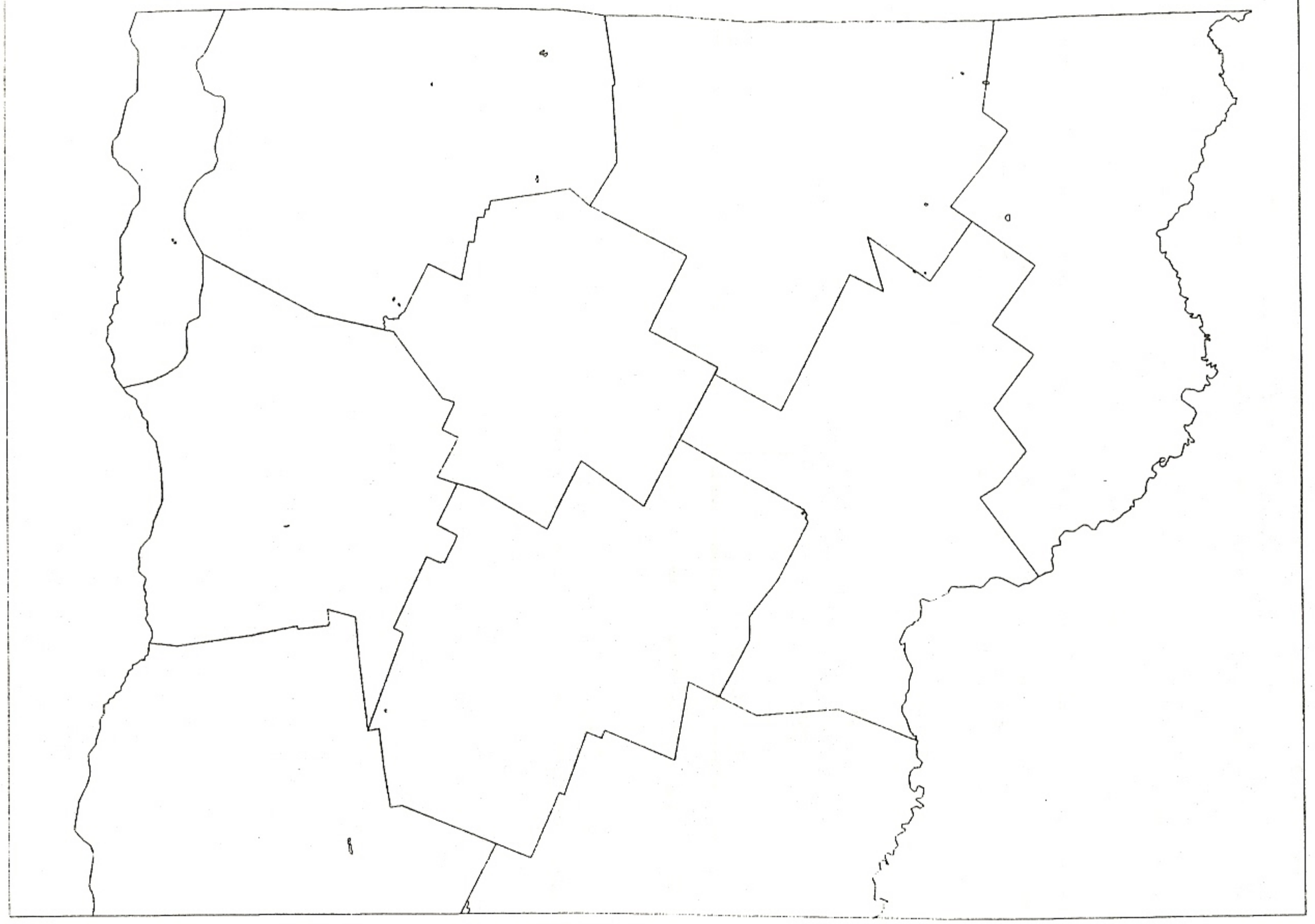
Beech Bark Disease, caused by *Cryptococcus fagisuga* and *Nectria coccinea var. faginata*, continues to cause scattered dieback, chlorosis and stem defect. Symptoms were generally less noticeable with 770 acres of scattered damage mapped from the air, compared to 3,290 acres in 1993. (Table 23, Figure 12).

Table 23. Mapped acres of beech decline and mortality due to beech bark disease in 1994.

County	Total Acres
Addison	140
Caledonia	10
Essex	140
Franklin	210
Grand Isle	30
Orleans	90
Washington	10
Windham	140
Total	**770**

Although levels of beech scale and Nectria remain stable in monitoring plots, tree condition has declined somewhat in three out of four areas (Figure 13).

BEECH BARK DISEASE



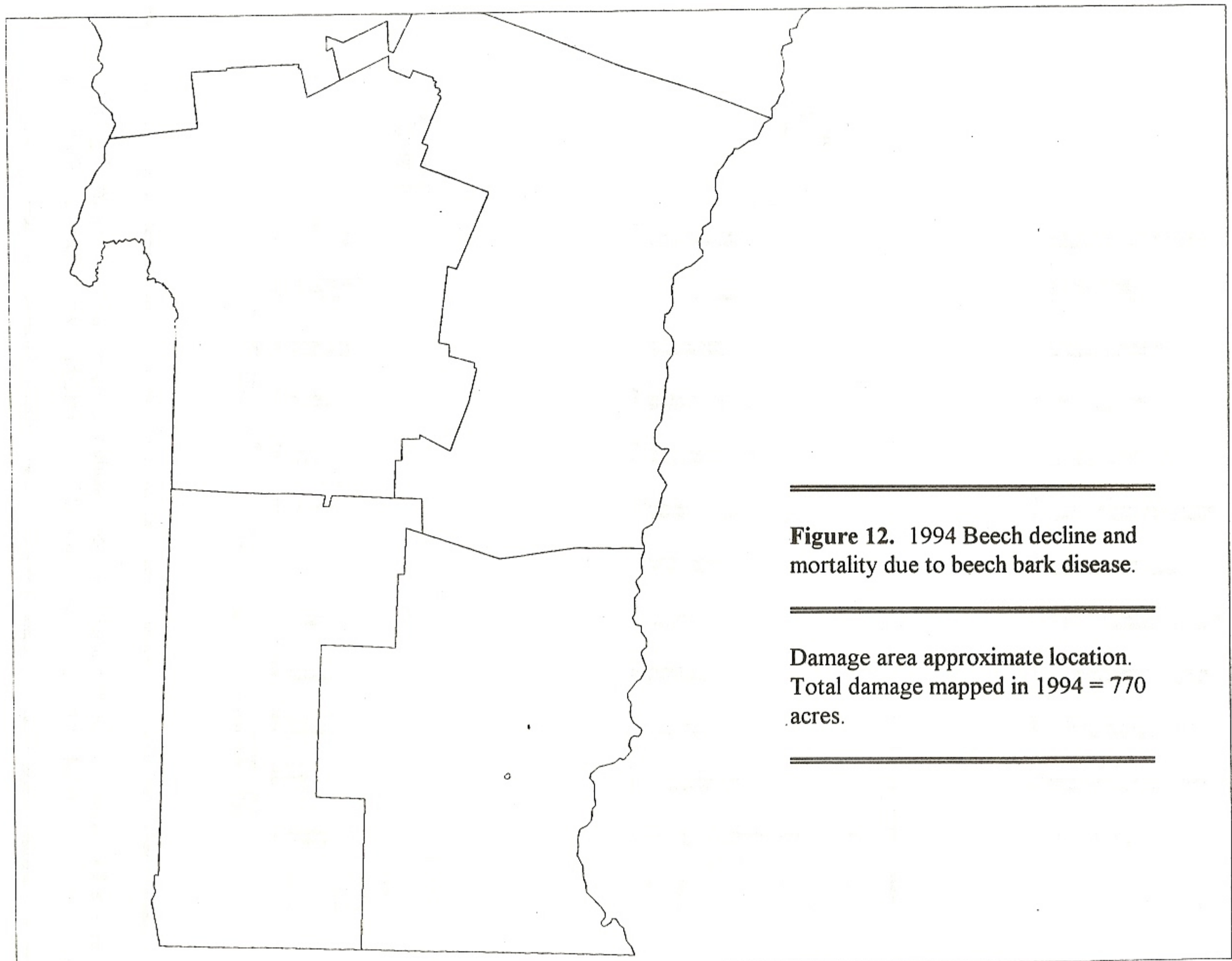
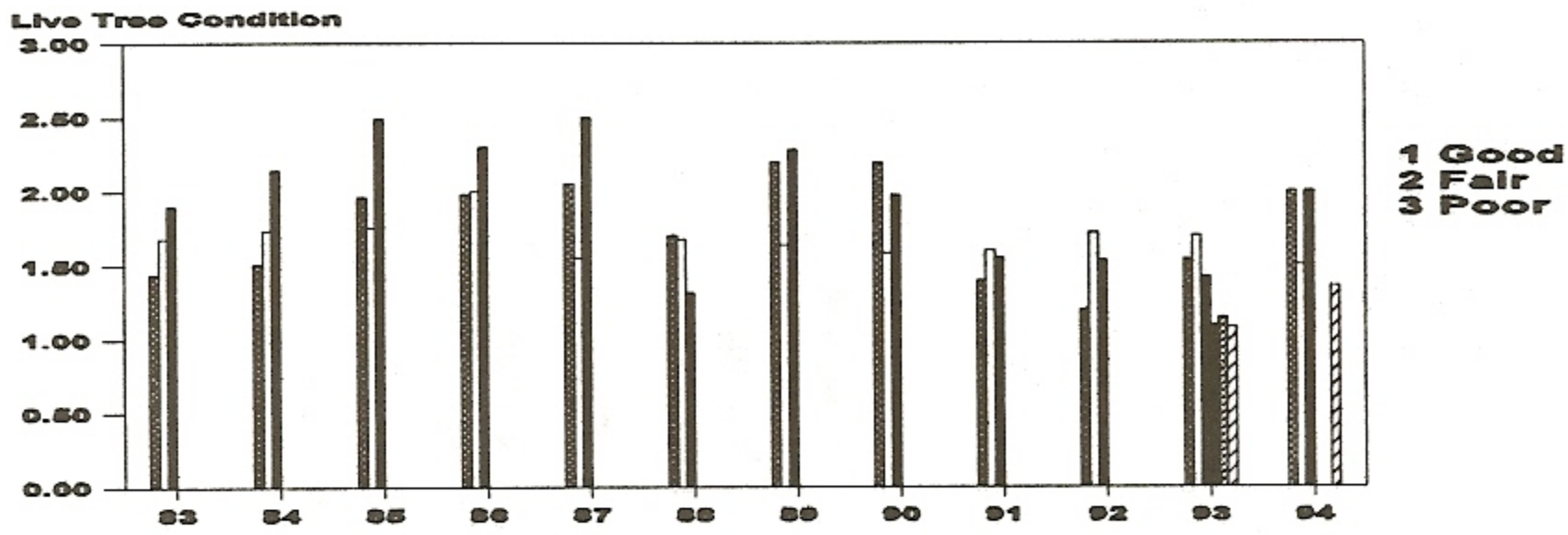
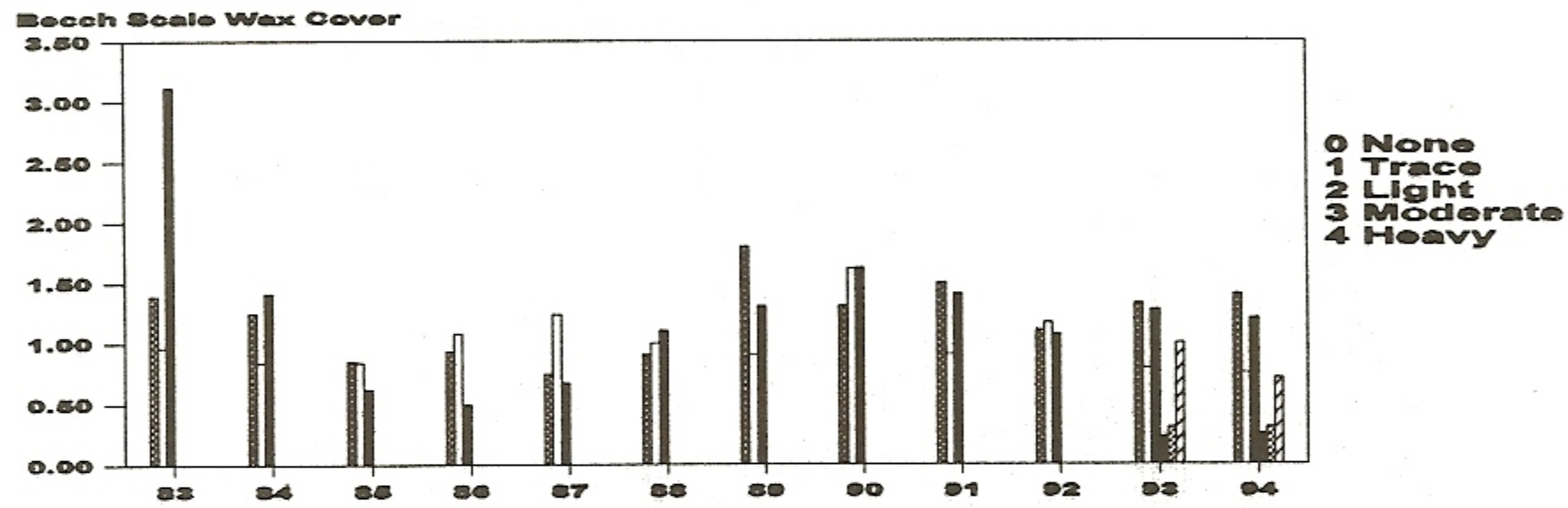


Figure 12. 1994 Beech decline and mortality due to beech bark disease.

Damage area approximate location. Total damage mapped in 1994 = 770 acres.





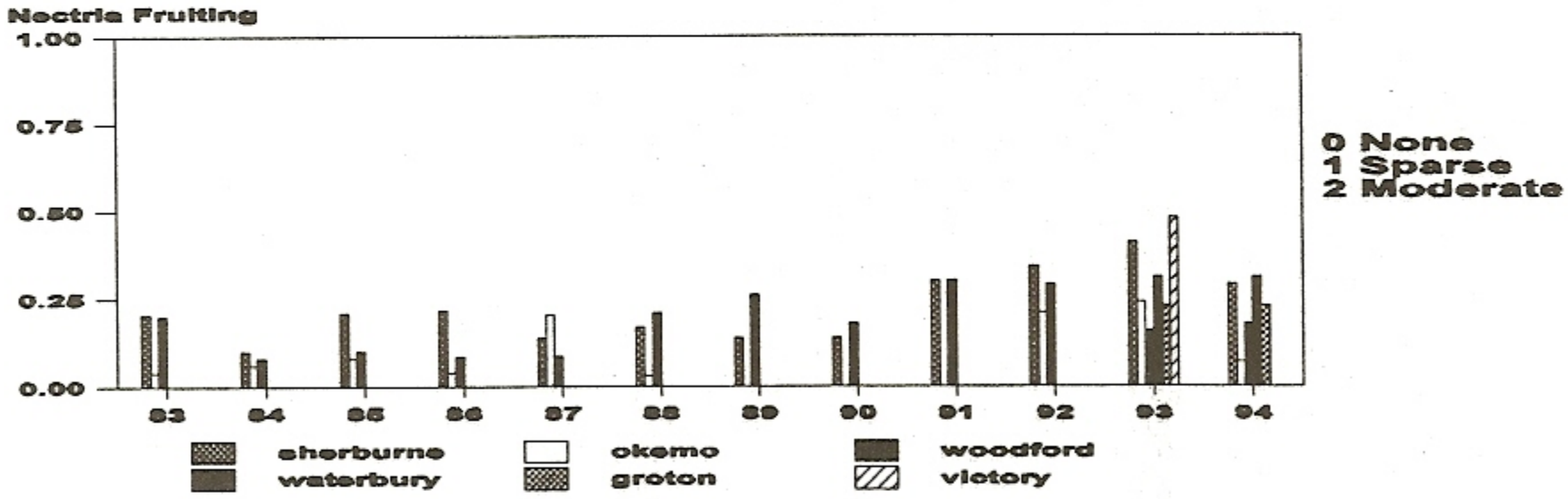


Figure 13. Average live tree condition, beech scale wax cover, and Nectria fruiting ratings in six locations, 1982-1994. No crown ratings available for Waterbury and Groton in 1994.

Butternut Canker, caused by *Sirococcus clavigignenta-juglandacearum*, continues to cause widespread, and in some cases almost complete, mortality of butternut throughout the state. It was found to be the least healthy tree in a statewide roadside tree survey this year, with only 22% of the trees healthy compared to 44% for elm, the next poorest species. This disease was especially prevalent in Addison County. In a Rutland County survey, no disease-free-butternuts were observed out of 100 checked.

Red Rot, caused by *Fomes pini*, continues to devalue white pine timber, and necessitate removal of hazardous ornamentals. In Addison County, it was commonly observed where pines were growing on heavy soils and grazed woodlots.

A report was completed on a study of the relationship between internal defect and external red rot indicators. Sixteen white pine trees had been examined for the presence of possible indicators. After felling, the presence, pattern, and severity of discoloration and decay was rated at the stump and at 12'. Conks of *F. pini*, punky knots, and weevil spikes were associated with red ring rot, while pitchy knots and internodes, wounds, and seams were not. Pruned trees were less likely to have red rot inside (Figure 14).

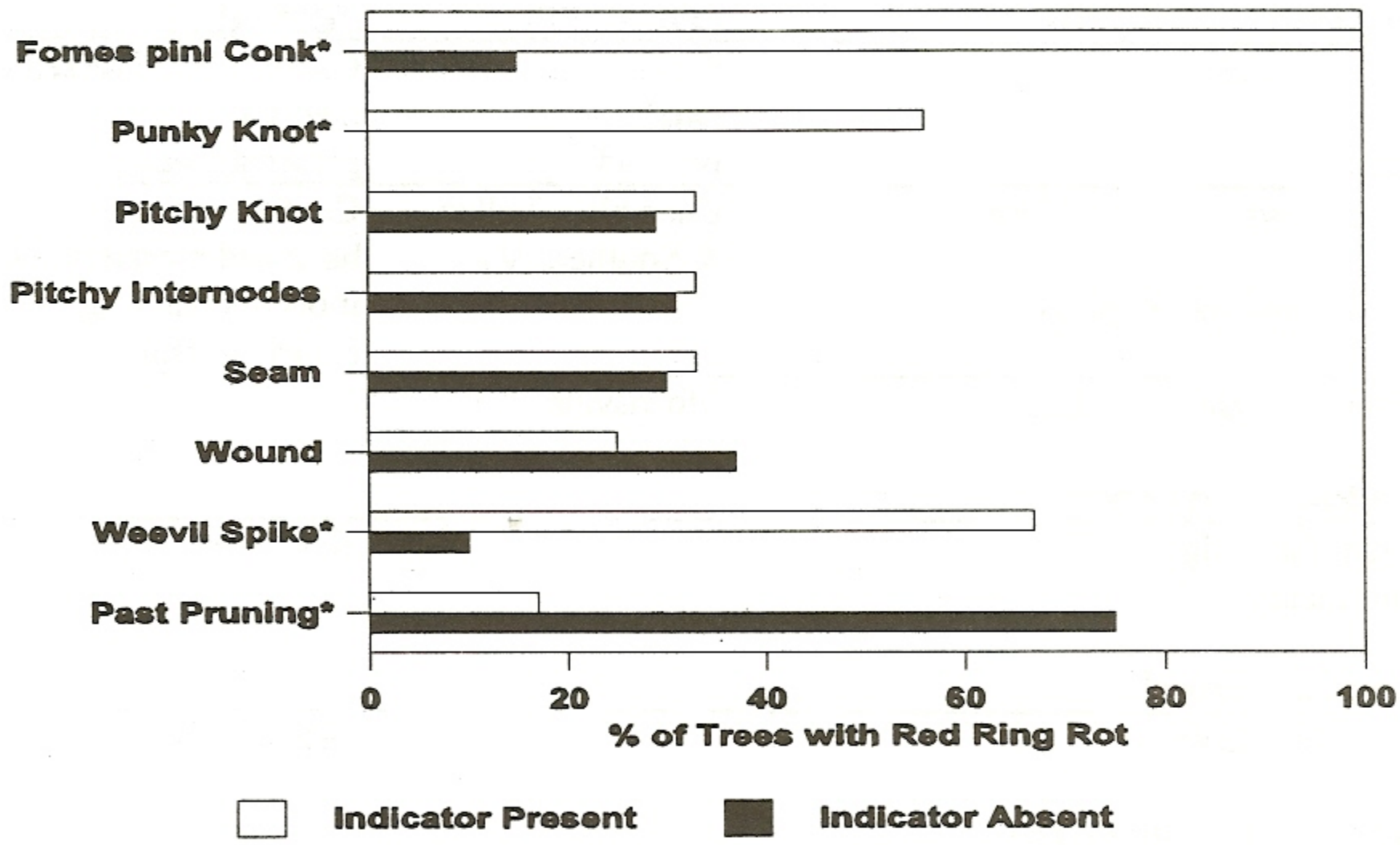


Figure 14. Percent of trees with red ring rot present at the stump end of the butt log, by presence or absence of various external indicators in the lower bole. Lower bole is under 24' for weevil spikes, and under 12' for all others. * indicates significance at the $p<.05$ level.

Scleroderris Canker, caused by *Ascocalyx abietina*, was not found in any new towns for the eighth consecutive year. A total of 37 Christmas tree plantations within the quarantine zone (Figure 15), and 133 red and Scots pine plantations in 28 towns bordering the quarantine area, were surveyed for the presence of the disease, all with negative results.

The total number of plantations in the state known to be infected is now 126, consisting of 107 red pine and 19 Scots pine plantations. This represents 845 and 152 acres respectively, for a total of 997 acres infected. Another six plantations were infected at one time, but have since had the disease eradicated or the trees cut. Some recent infection can be found within most of the quarantine zone, but it is less noticeable than in the past.

Sirococcus Shoot Blight, caused by *Sirococcus conigenus*, was much less noticeable in mature plantations in Peacham (Blake Hill) than in 1992 and 1993. Shoot mortality for white spruce Christmas trees was more noticeable than in 1993 and was observed in virtually all the same plantations during the annual northern Vermont Christmas tree survey.

OTHER STEM DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Annual Canker *Fusarium sp.*	Sugar Maple	Montpelier Duxbury Rutland	Common on stressed ornamentals. On small, slow-growing trees.
Ash Yellows *Mycoplasma-like organism*	White Ash	Champlain Valley & Southern VT	Continues to cause ash die-back and mortality wherever it occurs, although some trees appear resistant.
Bacterial Blight *Pseudomonas syringae*	Lilac	Morrisville	
Balsam Fir Twig Abnormality *Sclerotinia kerneri*			Not observed.
Beech Bark Disease *Cryptococcus fagisuga* and *Nectria coccinea var. faginata*			See narrative.
Black Knot *Dibotryon morbosom*	Black Cherry	Throughout	Severe on scattered, often stressed individuals.
Bleeding Canker *Phytophthora cactorum*	Red Maple	Springfield	Symptoms of this disease occurred on a declining, root-girdled ornamental.
Botryosphaera Canker *Botryosphaera sp.*	American Chestnut	Springfield	Associated with winter injury.

OTHER STEM DISEASES

INSECT	HOST(S)	LOCALITY	REMARKS
Brown Rot *Monilinia fructicola*	Cherry	Dorset Springfield	Ornamentals.
Butternut Canker *Sirococcus clavigignenta-juglandacearum*			See narrative.
Caliciopsis Canker *Caliciopsis pinea*			Not observed.
Chestnut Blight *Cryphonectria parasitica*	American Chestnut	Windham County	Common on remaining regeneration.
Coral Spot Canker *Nectria cinnabarina*	Sugar Maple	Derby	Common on young trees stressed by improper handling when planted and on branches partially girdled by squirrel chewing.
Cytospora Canker *Leucostoma kunzei*	Blue Spruce White Spruce	Widespread	Commonly observed, especially on ornamental blue spruce.
Diplodia Shoot Blight *Diplodia pinea (Sphaeropsis pinea)*	Austrian, White, Scots Pine Fir Christmas trees	Bridport Bristol Widespread	On ornamentals. Caused scattered shoot mortality.
Dutch Elm Disease *Ceratocystis ulmi*	American Elm	Throughout	Stable, causing scattered mortality, mid-summer dieback, and flagging. Elm mortality was mapped on 4 acres in Addison County.
Eastern Dwarf Mistletoe *Arceuthobium pusillum*			Not observed.
Fir Broom Rust *Melampsorella caryophyllacearum*	Balsam Fir	Throughout	Remains common but light in Christmas tree plantations. Reported for 116 acres in N. VT Christmas tree survey compared to 190 acres in 1993. More commonly reported than normal in southern VT.

OTHER STEM DISEASES

INSECT	HOST(S)	LOCALITY	REMARKS
Fireblight *Erwinia amylovora*	Apple Pear	Caledonia Essex Orleans Counties	Numerous calls on this disease. Associated with tree in heavy soil.
Fusarium Canker	Mountain Ash Ash	Enosburg Falls	
Hypoxylon Canker *Hypoxylon pruinatum*	Aspen	Throughout	Cause of snap of occasional trees. Especially common where old fields and pastures are growing up to aspen.
Maple Canker *Steganosporium ovatum*			Not observed.
Nectria Canker	Mountain Ash Ash	Enosburg Falls	
Oak Wilt *Ceratocystis fagacearum*			No oak wilt suspects observed by trained observers in aerial flights. Samples from one ornamental tree in Rutland County with dieback, scorch, and brown streaking in the xylem were sent to the University of Vermont for culturing. The fungus isolated from this tree was not *C. fagacearum*.
Oak Canker *Botryosphaeria quercuu*	Red Oak	Johnson	Heavy on ornamental.
Phomopsis Canker *Phomopsis sp.*			Not observed.
Phomopsis Twig Blight *Phomopsis sp.*			Not observed.
Red Ring Rot *Fomes pini*			See narrative.
Sapstreak *Ceratocystis coerulescens*	Sugar Maple	Washington Orange Franklin Counties	Occasionally observed.

OTHER STEM DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Scleroderris Canker *Asocalyx abietina*			See narrative.
Sirococcus Shoot Blight *Sirococcus strobilinus*			See narrative.
Smooth Patch *Dendrothele macrodens*			Not observed.
Tubercularia Canker *Tubercularia vulgaris*	Sugar Maple	Danville	
Verticillium Wilt *Verticillium albo-atrum* or *V. dahliae*	Sugar Maple	Sherburne	Ornamental.
White Pine Blister Rust *Cronartium ribicola*	White Pine	Throughout	Decreasing; active infections less frequently noticed than in previous years. 221 acres of Christmas trees infected but less moderate-heavy than 1993.
Woodgate Gall Rust *Endocronartium harknessii*	Scots Pine	Scattered Throughout	Light in Groton and Lyndon State Forests. Stable, remains common in Christmas tree plantations (180 acres reported in 1994). Also observed on ornamentals.

Foliage Diseases

Anthracnose, caused by *Discula spp.*, was observed in scattered locations on a variety of species, sometimes causing locally heavy damage.

Birch Anthracnose was thought to be the cause of a leaf disease on yellow birch heavy enough that 20 acres of heavy damage was mapped in Essex County and 40 acres in Caledonia County during the aerial survey.

Maple Anthracnose led to browning and defoliation of a 16 acre area in Bennington. Damage to overstory and understory sugar maple was uniform throughout the stand by mid-June. Other species, such as red maple, ash, and cherry, had no symptoms. A leafspot symptom, rather than leaf blotch or marginal necrosis, was the most common symptom. Similar damage occurred in the same area in 1992 and 1993.

Elsewhere, maple anthracnose was observed occasionally on ornamental and forest trees in Chittenden, Lamoille, Rutland, Washington, and Windham Counties.

Red Oak Anthracnose, caused by *Discula quercina*, caused light damage to forest and ornamental trees in Lamoille, Orleans and Windham Counties. Dieback was observed on lower branches of occasional ornamentals.

Brown Spot Needle Blight, caused by *Scirrhia acicola*, was confirmed for the first time in Vermont, on overgrown Scots pine in Huntington, and was the suspected cause of needle browning in a Christmas tree plantation in Berlin.

Delphinella Tip Blight of Fir, caused by *Delphinella balsameae*, heavily damaged two balsam fir plantations in East Montpelier. This is also the first confirmed report of this disease in Vermont. Infected trees had dead lateral shoots as well as dead scattered individual needles. *Rhizosphaera pini* was also detected on needles from one of these plantations but its role in the needle loss is thought to be secondary. Delphinella was also found to be causing light damage to balsam and fraser fir in plantations in Danville, Barton, and Wolcott, and the disease is expected to occur throughout.

Dogwood Anthracnose, caused by *Discula destructiva*, was found in three additional sites in 1994. The presence of the fungus was confirmed by Dr. Dale Bergdahl at the University of Vermont. Samples had leaf spots and small elliptical twig cankers, characteristic of dogwood anthracnose.

Combined with the two sites sampled in 1993, all five native flowering dogwood sites on record with the Vermont Natural Heritage Program have now been confirmed to be infected with dogwood anthracnose.

Data on dogwood conditions is summarized in Table 24. There is considerable variation between sites. In the Brattleboro (North) site, where there were few trees to begin with, they are all dead or in very poor condition, and no regeneration was found. In the Westminster site, the trees were in good or fair condition, and regeneration was abundant. However, even at that site, symptoms of anthracnose were common, and the fungus was confirmed to be present.

Table 24. The general health of dogwoods, occurrence of regeneration, average % dieback, and ratio of dead to alive dogwood trees in the general area sampled for dogwood anthracnose, and the occurrence of dieback on sample trees, for the five sites sampled in 1993-1994.

Location	General Health of Dogwoods			Regeneration Present?	Average % Dieback			Ratio of Dead/ Alive Trees
	Healthy	>20% Dieback	Dead		Sample Trees	All Trees	All Live Trees	
Westminster	✓	✓		yes	10			
Brattleboro (South)		✓	✓	no	75			
Bellows Falls	✓	✓	✓	yes	65	87	45	25/8
Brattleboro (North)		✓	✓	no	95	95	80	5/2
Pownal		✓		yes	55			

Dothistroma Needlecast of Austrian pine, caused by *Dothistroma pini*, was detected, for the first time in Vermont, in Barre. This is a serious disease of Austrian pines capable of killing trees.

OTHER FOLIAGE DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Anthracnose *Disula sp.*			See narrative.
Apple Scab *Venturia inequalis*	Apple	Throughout	Heavy infections were common.
Brown Spot Needle Blight *Scirrhia acicola*			See narrative.
Cedar-Apple Rust *Gymnosporangium juniperi-virginianae*	Apples Red Cedar	Addison County	Common throughout the county.
Chrysomyxa Rust *Chrysomyxa weirri*	Blue Spruce	Essex Junction	

OTHER FOLIAGE DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Coccomyces Leaf Spot *Blumeriella jaapii*	Black Cherry	Stowe	Light-moderate damage.
Diplodia Tip Blight *Diplodia pinea*	Pine	Waterbury	
Cyclaneusma Needlecast (formerly Naemacylcus) *Cyclaneusma minus*	Scots Pine	Throughout	Remains common in Scots pine Christmas tree plots. Reported for 176 acres in N. VT Christmas tree survey. Especially noticeable in Addison County.
Delphinella Tip Blight of Fir *Delphinella balsamae*			See narrative.
Dogwood Anthracnose *Discula destructiva*			See narrative.
Dothistroma Needlecast *Dothistroma pini*			See narrative.
European Larch Needlecast *Mycosphaerella laricina*			Not observed.
Fir-Fern Rust *Uredinopsis mirabilis*	Balsam Fir	Widespread	Decreased. 154 acres of mostly light infection found during N. VT Christmas tree survey compared to 314 acres in 1993.
Giant Tar Spot *Rhytisma sp.*	Norway Maple	Bennington	Moderate to heavy damage to naturalized trees in overstory and understory.
Horsechestnut Leaf Blotch *Guignardia aesculi*	Horsechestnut	Weathersfield Londonderry	Complete defoliation of seedlings in nursery.
Lophodermium Needlecast *Lophodermium seditiosum*	Scots Pine	Widespread	Also remains common in Scots pine Christmas tree plots. Reported for 102 acres in N. VT Christmas tree survey.

OTHER FOLIAGE DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Marssonia Leaf Spot			Not observed.
Marssonia sp.			
Mycosphaerella Leaf Spot	Apple	Springfield	Associated with late-season defoliation
Mycosphaerella pyri			
Oak Leaf Blister			Not observed.
Taphrina caerulescens			
Peach Leaf Curl	Peach	Springfield	Light damage
Taphrina deformans			
Phyllosticta Leafspot	Japanese Maple	Windham	Associated with scorch.
Phyllosticta sp.			
Poplar Leaf Bronzing	Balsam Poplar	Caledonia Orleans Counties	Remains common.
Virus or *virus-like causal agent*			
Powdery Mildew	Oak Lilac	Caledonia County	Common.
Eryiphaceae			
Rhabdocline Needlecast	Douglas Fir	Widespread	More heavy damage in N. VT Christmas tree survey this year. Out of 65 acres where this organism was detected, 20 acres had heavy damage.
Rhabdocline pseudotsugae			
Rhizosphaera Needlecast	Blue Spruce White Spruce	Throughout	Commonly detected. In S. VT more commonly seen than usual on ornamentals. During the N. VT Christmas tree survey, reported for 160 acres (226 acres in 1993). Also found causing heavy branch mortality to closely-planted blue spruce ornamentals in Northfield.
Rhizosphaera kalkhoffi			
Sooty Mold	White Pine	Montpelier	

OTHER FOLIAGE DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Swiss Needlecast *Phaeocryptopus gaumanni*	Douglas Fir	Widely Scattered	Was less common than Rhabdocline for the first time during the N. VT Christmas tree survey, with 52 acres reported light to moderately infested (112 acres in 1993).
Sycamore Anthracnose *Gnomonia platani*	Sycamore	Windham County	Early defoliation along riverbanks.
Tar Spot *Rhytisma acerinum*	Red Maple	Scattered Throughout	Light spotting late in the season.
Tar Spot *Rhytisma punctatum*			Not observed.

ROOT DISEASES

Tomentosus Root Rot, caused by *Polyporus tomentosus*, is associated with the decline of white spruce trees in Dummerston. Mortality was first observed in 1991, following a thinning. Monitoring plots were established in 1993, and revisited in 1994. The condition of trees did not change significantly between the two years. Tree condition, and other measures of tree health, such as density, dieback, and transparency, were strongly correlated to distance to the nearest cut stump (Figure 16), suggesting that fungus build-up in cut stumps was responsible for the stand opening.

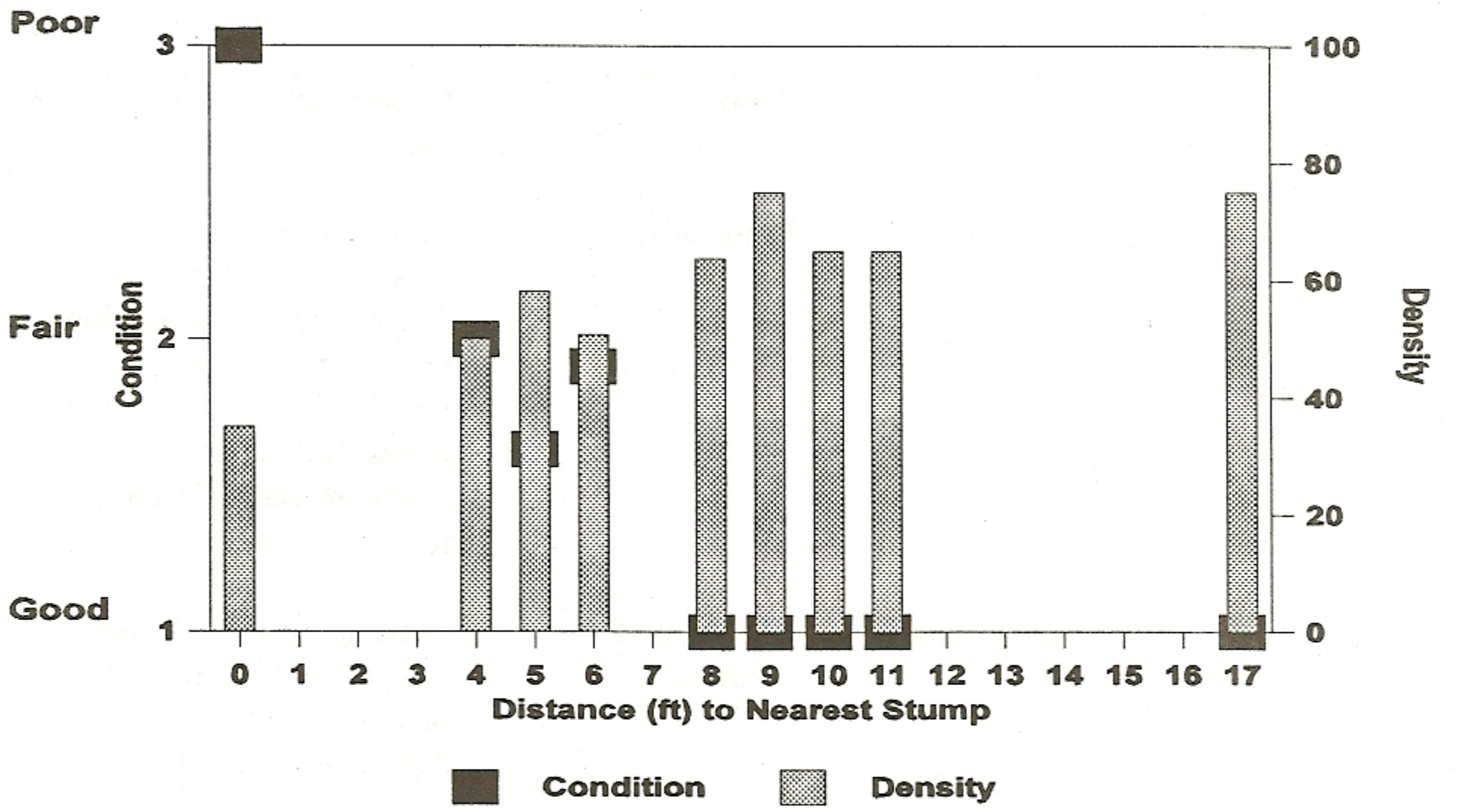


Figure 16. Condition and crown density of white spruce in 1994 by distance to nearest cut stump. Data are from thirty trees thinned in 1990.

OTHER ROOT DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Annosus Root Rot			Not observed.
Heterobasidion annosum			
Cylindrocarpon Root Rot			Not observed.
Cylindrocarpon sp.			
Phytophthora	Balsam Fir	Lincoln	
Phytophthora sp.			
Shoestring Root Rot	Many	Throughout	Occasionally observed attacking stressed trees.
Armillaria spp.			
	Red Maple	Manchester	Trees continue to die in an enlarging infection center. Sugar maple regeneration is not affected. Dissections by Dr. Phil Wargo of the U.S. Forest Service indicated that roots are well infected prior to tree mortality.
	Christmas Trees	Townshend Ludlow	Causing decline and mortality of Christmas trees. Food base may be from adjacent hedgerow and old stumps at plantation edge.
Tomentosus Root Rot			See narrative.
Polyporus tomentosus			
Velvet Top Fungus	White Pine	Castleton	Ornamental.
Polyporus schweinitzii			

DIEBACKS, DECLINES AND ENVIRONMENTAL DISEASES

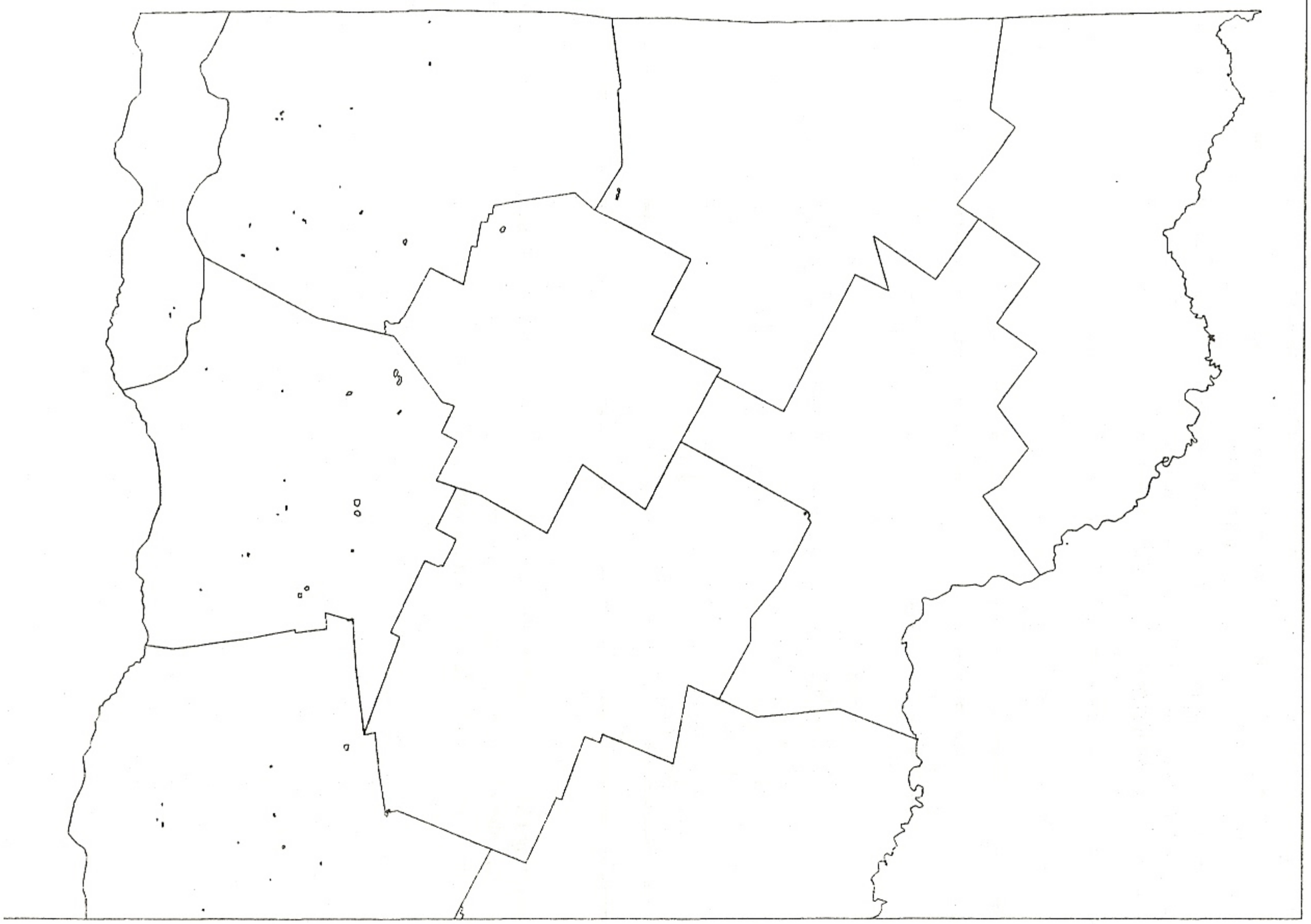
Ash Dieback remains common, especially in the Champlain Valley and southern Vermont. Many of the very thin white ash crowns observed in scattered locations in 1993 appeared to have mostly recovered in 1994. However, trees that were severely affected by heavy seed production in 1992 continue to show symptoms. Occasional trees produced two flushes of leaves in 1994, and there was an increase in small dead twigs on some trees. Ash dieback was more noticeable during aerial survey, when 1,680 acres were mapped compared to 150 acres in 1993 (Table 25, Figure 17).

Table 25. Mapped acres of ash dieback in 1994.

County	Total Acres
Addison	310
Bennington	30
Chittenden	720
Franklin	270
Grand Isle	10
Lamoille	230
Orleans	80
Washington	30
Total	1680

In a monitoring plot in Woodstock, the general condition of ash trees declined. However, trees with dieback only related to seed production generally improved (Figure 18). Trees with less than 20% dieback in 1993 improved in density. Those with 20-40% dieback got worse (Figure 19).

ASH DIEBACK/THIN/DEAD



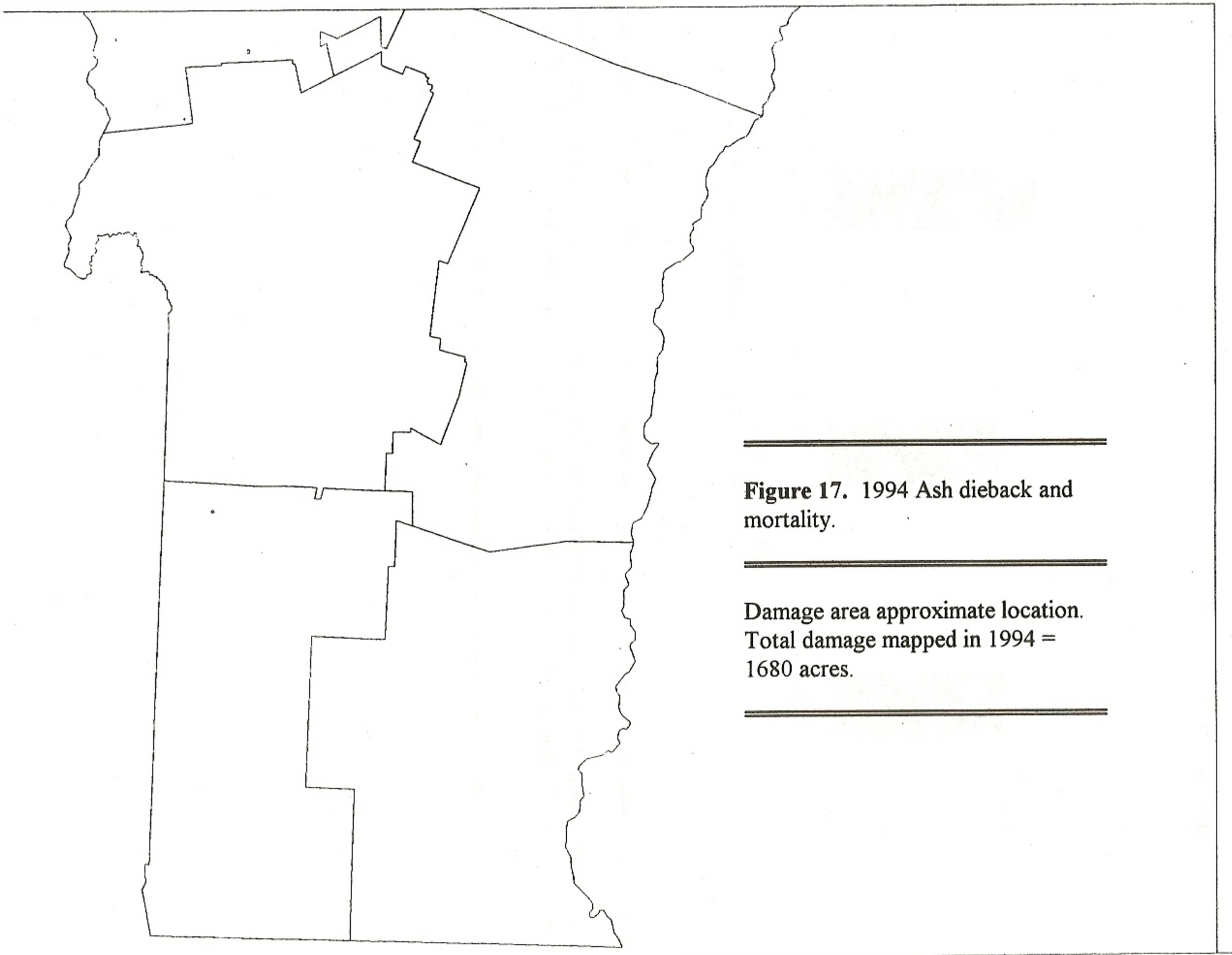


Figure 17. 1994 Ash dieback and mortality.

Damage area approximate location.
Total damage mapped in 1994 = 1680 acres.

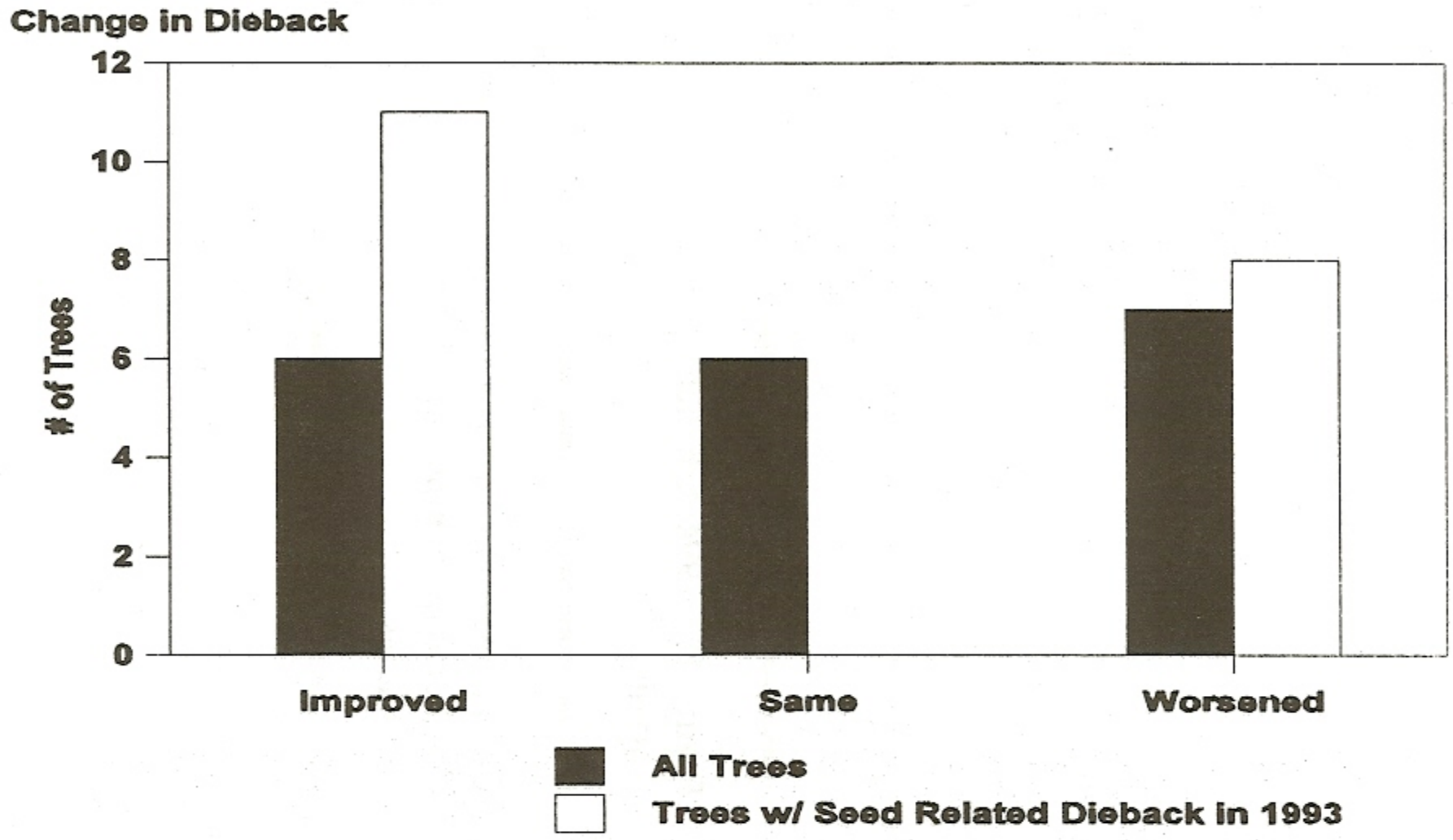


Figure 18. Number of ash trees in monitoring plot that improved, stayed the same or worsened in percent crown dieback, summarized for all trees, and just those with dieback in 1993 related to seed production.

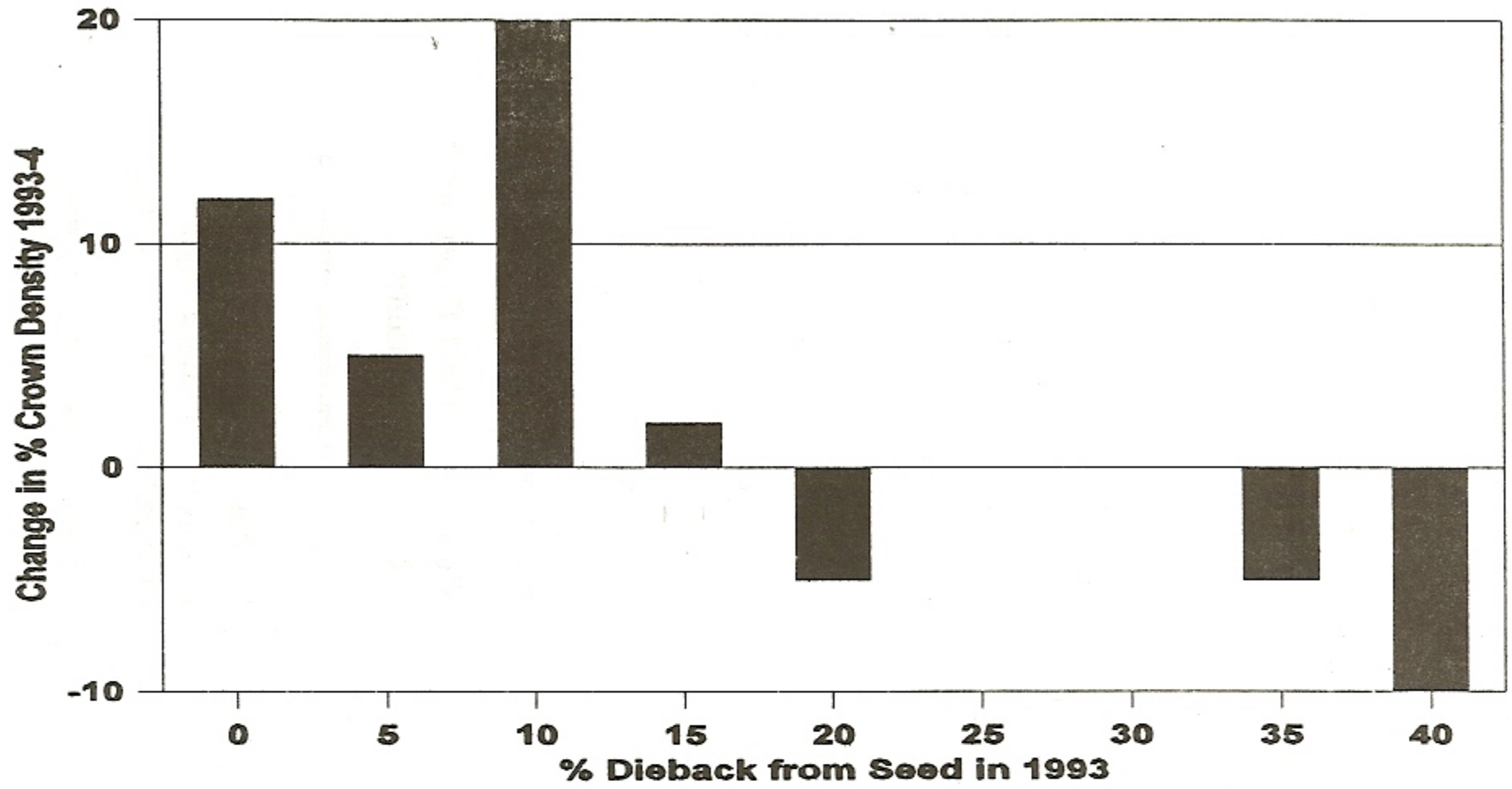


Figure 19. Change in percent crown density of ash trees in monitoring plot between 1993-1994, by percent dieback in 1993 related to seed production.

Birch Decline and mortality remains noticeable in paper and yellow birch stands in Burke Mountain, Groton, and Victory State Forests (Caledonia and Essex Counties) and occasionally elsewhere at high elevations. Paper birch dieback and decline was mapped on 240 acres (Table 26, Figure 20).

Table 26. Mapped acres of birch decline and mortality in 1994.

County	Total Acres
Addison	20
Chittenden	20
Essex	150
Franklin	10
Lamoille	30
Orange	10
Total	**240**

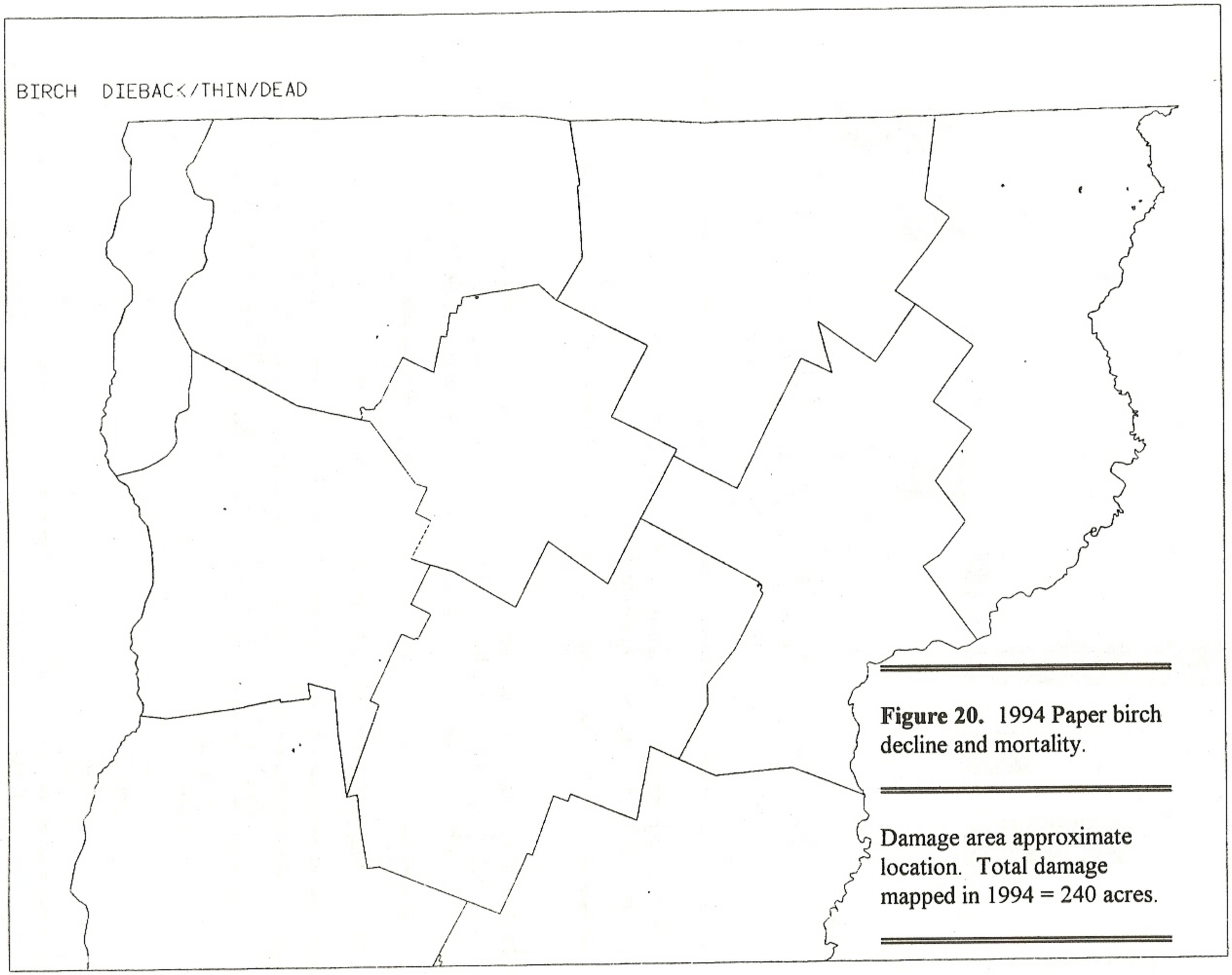


Figure 20. 1994 Paper birch decline and mortality.

Damage area approximate location. Total damage mapped in 1994 = 240 acres.

Frost Damage was much reduced from recent previous years. Damage was observed occasionally in Southern Vermont, following heavy frosts in some locations in late May, and a light frost in early June. Sugar maple and beech were damaged at some higher elevation sites in Windsor and Rutland Counties, where 740 acres of damage were mapped from the air (Table 27, Figure 21). In one ground-checked plot, visited in early July, the average damage to maple and beech foliage was 65%. Ash in the same area were undamaged. Elsewhere, some light frost injury to butternut and white ash was observed in Lamoille County.

Table 27. Mapped acres of frost damage to hardwoods in 1994.

County	Damage Severity		
	Moderate	Heavy	Total
Bennington	240	60	300
Rutland	280	0	280
Windham	50	0	50
Windsor	110	0	110
Total	680	60	740

There was also scattered light and moderate damage to Christmas trees. In the northern Vermont survey, frost injury was reported on 210 acres compared to 452 acres in 1993. Most of this (159 acres) was light. Balsam fir was the species most affected, with 90 acres of visible damage, followed by white spruce with 50 acres. In southern Vermont, occasional balsam fir and Douglas fir Christmas trees and young transplants were affected, particularly at lower elevations.

Hardwood Decline and Mortality was mapped on fewer acres this year. This is largely because many areas with thrips damage in 1993 also had thin crowns and scattered dieback. These were mapped as both thrips damage and decline. In all, 20,430 acres were mapped as dieback, mortality and occasional chlorosis compared to 80,930 acres in 1993 (Table 28, Figure 22). This is closer to the 23,480 acres mapped in 1992.

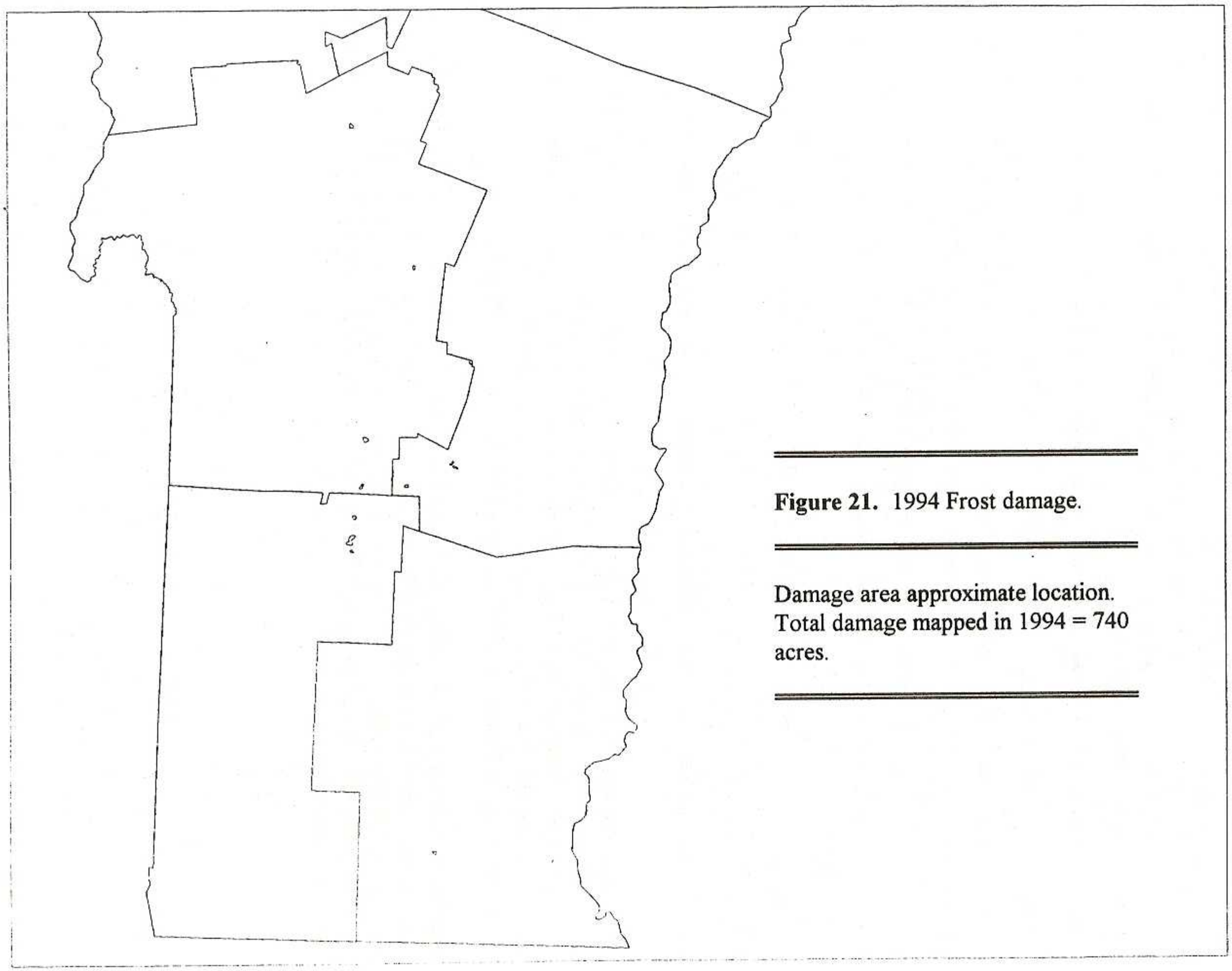


Figure 21. 1994 Frost damage.

Damage area approximate location.
Total damage mapped in 1994 = 740 acres.

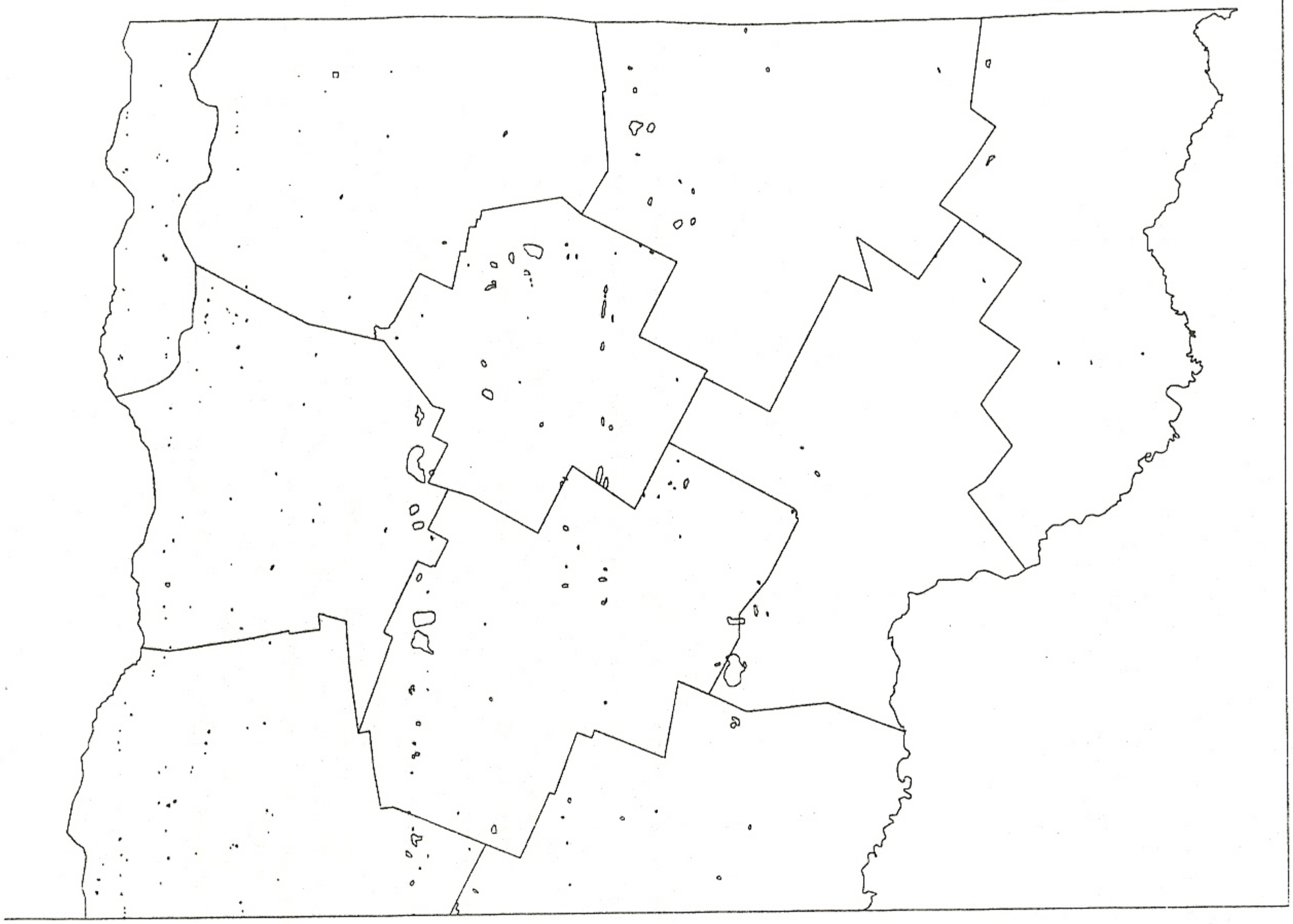
Table 28. Mapped acres of hardwood dieback, mortality, thin crowns, chlorosis and scorch in 1994.

County	Damage Pattern		Total Acres
	<30% of Trees	>30% of Trees	
Addison	350	490	840
Bennington	930	2530	3460
Caledonia	2180	130	2310
Chittenden	170	2870	3040
Essex	10	220	230
Franklin	40	250	290
Grand Isle	130	10	140
Lamoille	760	2250	3010
Orange	110	400	510
Orleans	530	810	1340
Rutland	10	860	870
Washington	540	3150	3690
Windham	0	30	30
Windsor	110	560	670
Total	**5870**	**14560**	**20430**

Generally, conditions were good for tree growth with adequate rainfall and warm temperatures, and trees were generally healthy. Areas of dieback and chlorosis included shallow sites and areas with heavy seed production.

Heavy Seed crops were produced on a variety of species, including red maples, red, white, and Norway spruce, arborvitae, hemlock, balsam fir, beech, yellow birch, butternut, hophornbeam, and hazelnut. Heavy seed crops also occurred, although less consistently, on red oak and white pine. Sugar maples flowers were so abundant in early spring that hillsides appeared yellow instead of the usual light-green. However, in many locations, very few seeds formed. On some red maples, almost no leaves were produced early in the season, with all new growth being put into seed production. Many red maples had produced a second flush of leaves by late June. Discoloration of tops from heavy seed resulted in 11,200 acres being mapped during aerial surveys (Table 29, Figure 23)

HARDWOOD DIEBACK/THIN/DEAD/COLOR/CHLORISIS/SCORCH



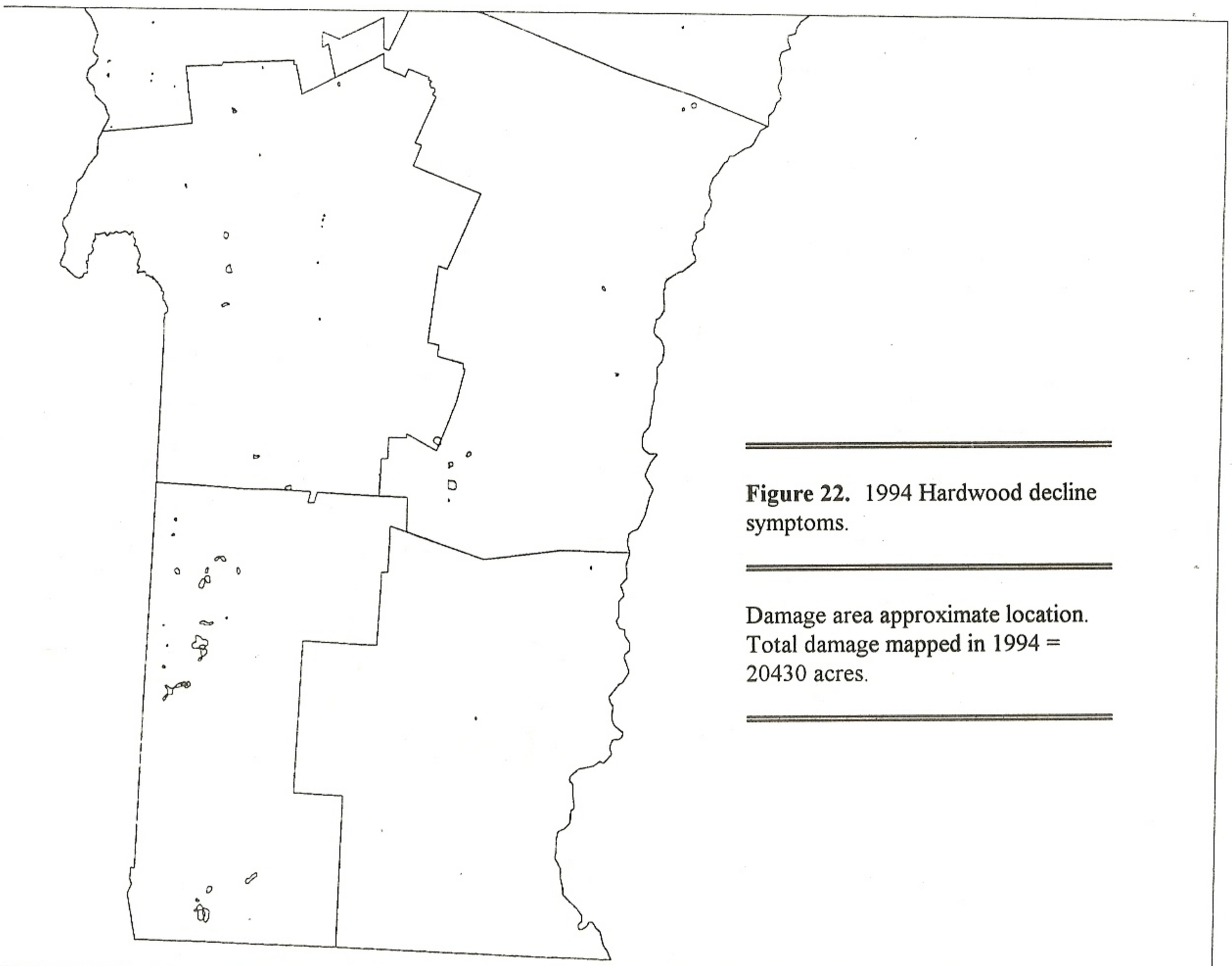
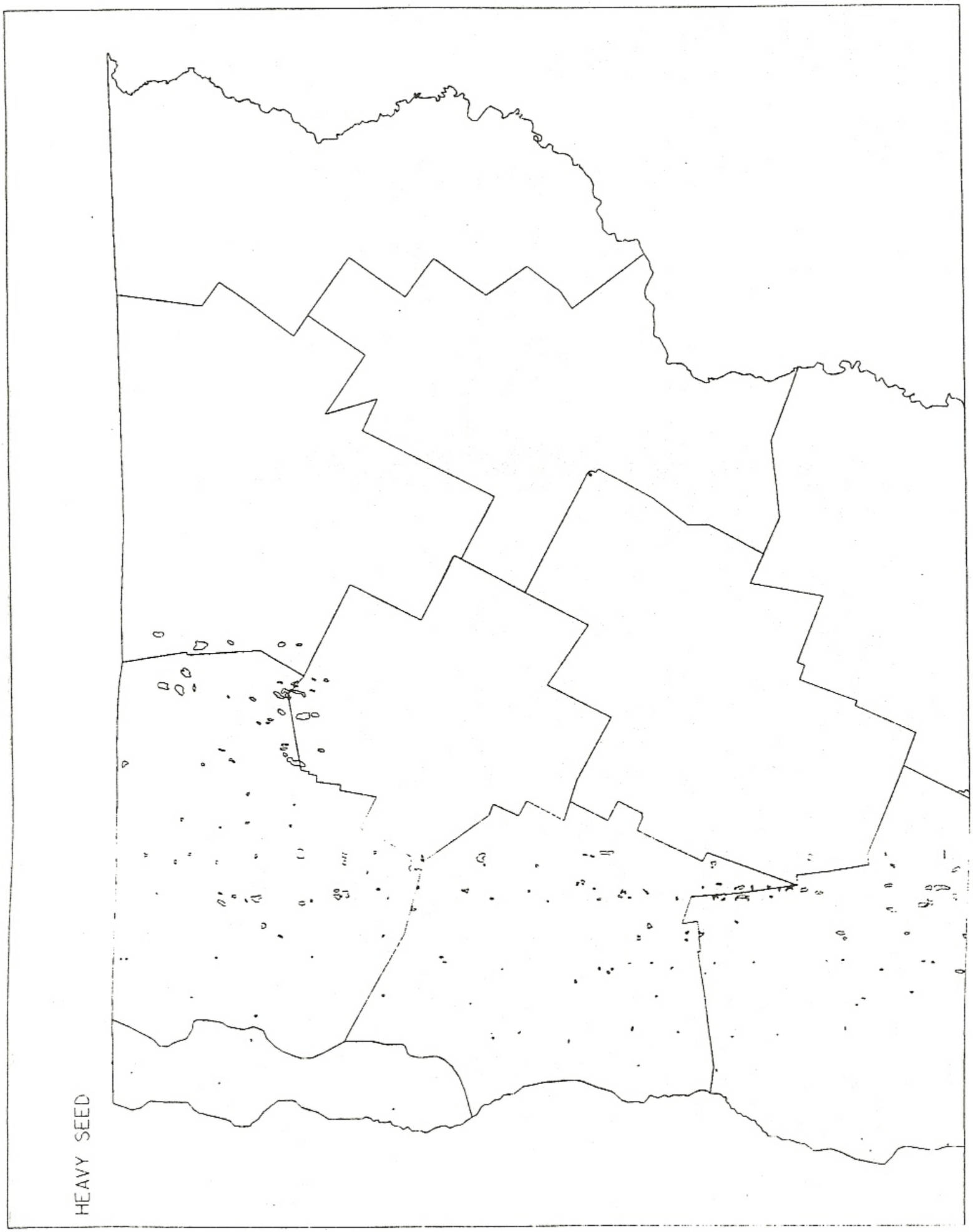


Figure 22. 1994 Hardwood decline symptoms.

Damage area approximate location. Total damage mapped in 1994 = 20430 acres.


HEAVY SEED

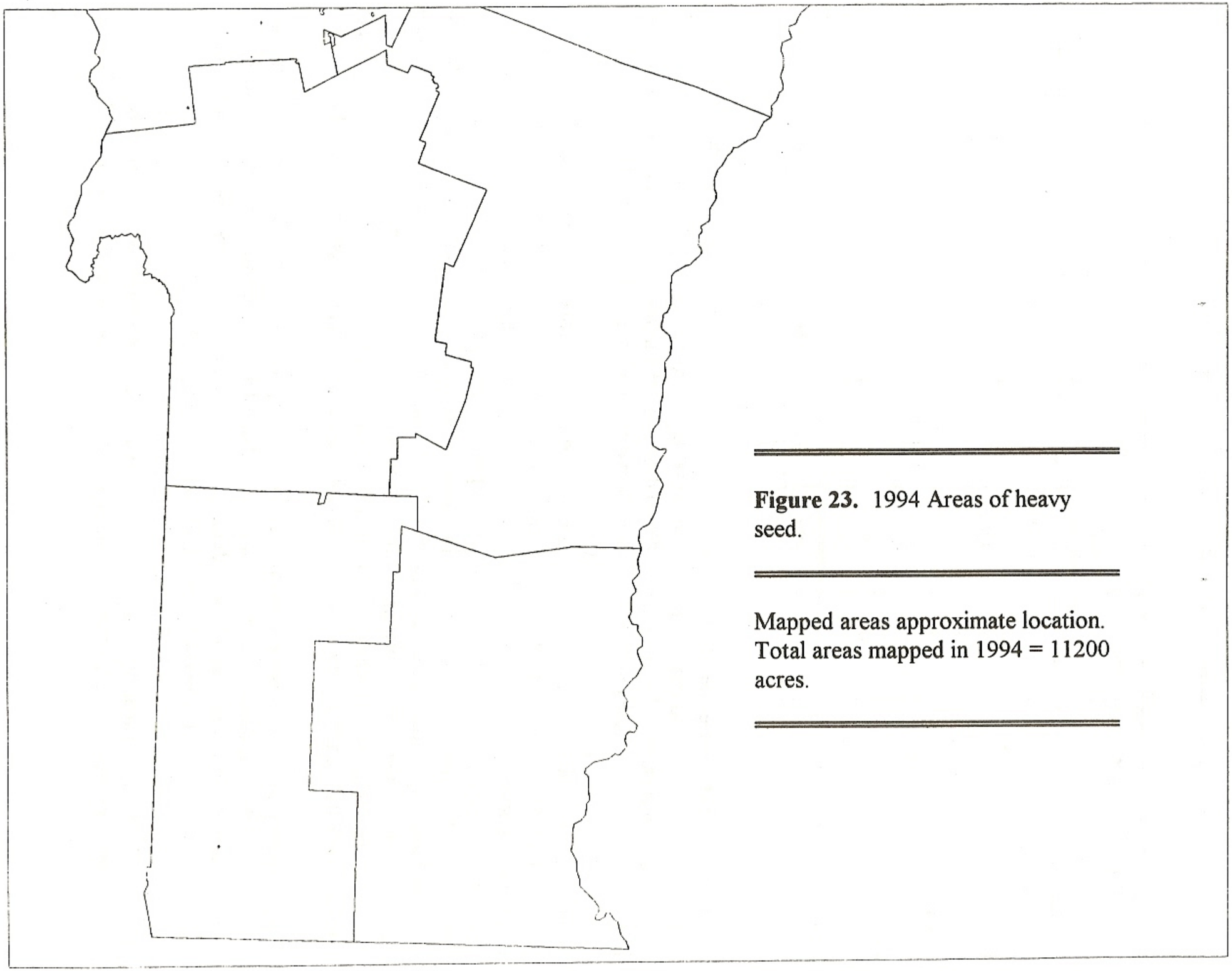


Figure 23. 1994 Areas of heavy seed.

Mapped areas approximate location. Total areas mapped in 1994 = 11200 acres.

Table 29. Mapped acres of heavy seed production in 1994.

County	Red Maple	Beech	Red Maple/ Beech	White Pine	Butternut	Cedar	Fir	Total
Addison	1010	120	1550	0	30	5	0	2715
Bennington	30	0	0	0	0	0	0	30
Chittenden	1080	400	330	20	50	0	80	1880
Franklin	1520	0	2700	90	0	0	0	4390
Grand Isle	30	0	0	0	0	5	0	35
Lamoille	160	0	820	0	0	0	0	980
Orleans	0	80	740	0	0	0	0	820
Washington	0	0	90	0	0	0	0	90
Windsor	0	0	260	0	0	0	0	260
Total	**3830**	**600**	**6490**	**110**	**80**	**10**	**80**	**11200**

Logging Wounds were reevaluated in sixteen 1/5 acre plots in Duxbury, originally established in 1980, for current size and condition of wounds that had occurred in 1977-79. A sub-sample of 26 sugar maples was harvested in the fall of 1994 to determine the internal volume of discoloration and decay. These maples averaged 8.8" dbh when harvested and ranged from 5 to 13".

Wounds were evaluated based on the percent of tree circumference wounded when the trees were first rated in 1980. None of the 10% circumference wounds resulted in wood decay, while the incidence of decay for wounds of 20% circumference or greater exceeded 80%. Vertical spread of discoloration averaged 1, 1.3, 2.4, and 4.8 feet, respectively, for 10, 20, 30, and 40% wounds. More than 50% of the wounds that exceeded 4" in original width had decay, while all the wounds 6" wide or wider had decay. Decay incidence was related to wound size, but not to wound location. Volume of discoloration and decay increased with increasing wound size and was not related to wound closure. Wounds at least 6 inches wide or 40% of circumference had extensive decay that occupied approximately half of the volume of the discoloration column 15 years after wounding (Figure 23A).

Ozone Injury symptoms were observed on sensitive species (such as black cherry, white ash, milkweed, blackberry, dogbane, and big leaf aster) in August at locations throughout the state (Figure 24). However, no ozone damage was detected on forest trees from aerial surveys nor from leaf collections taken from hardwood trees on Mount Mansfield in August.

Spruce Mortality, primarily of upper elevation red spruce combined with some balsam fir, was mapped on 2,650 acres, not dramatically different from the 2,050 acres mapped in 1993 (Table 30, Figure 25).

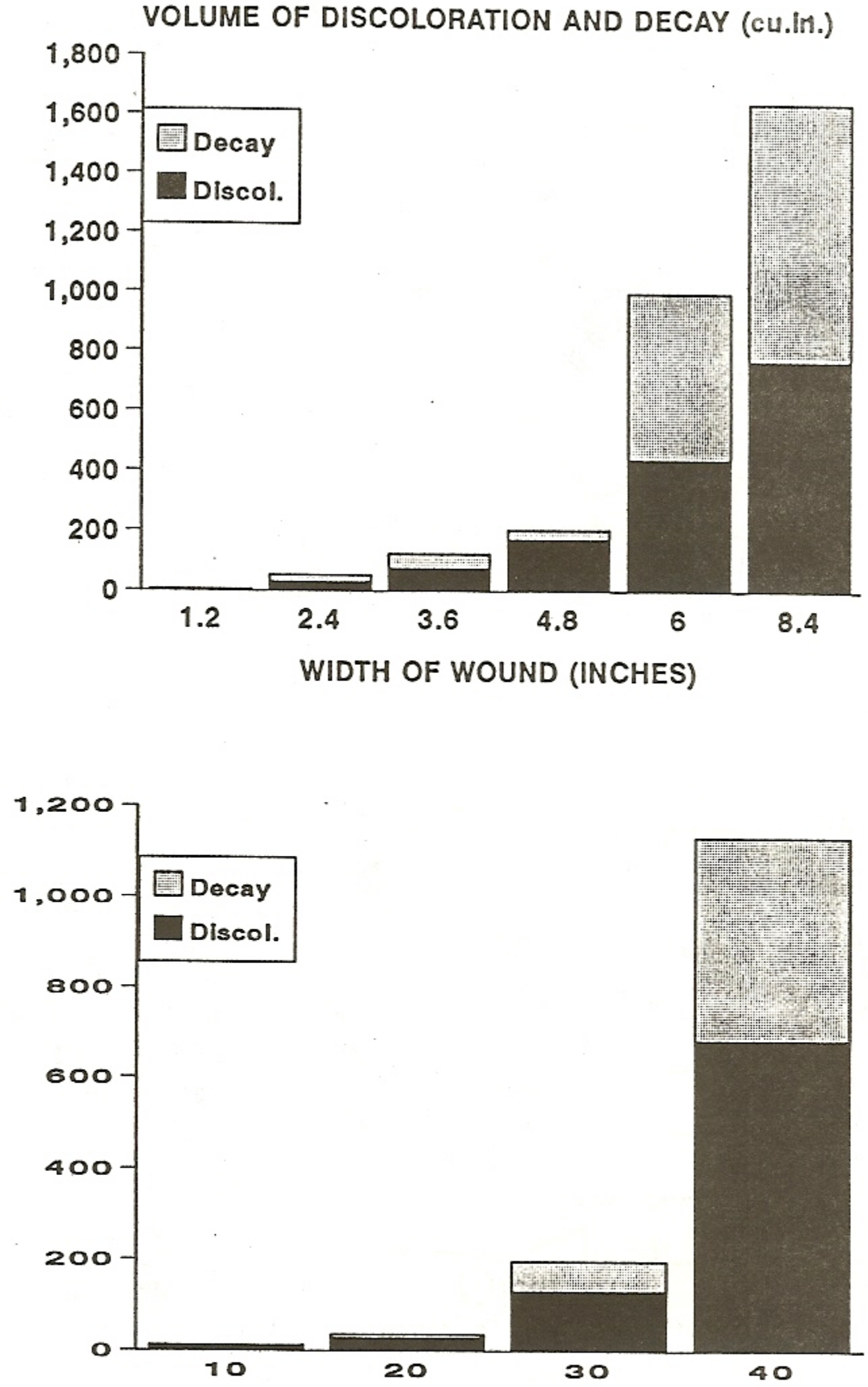
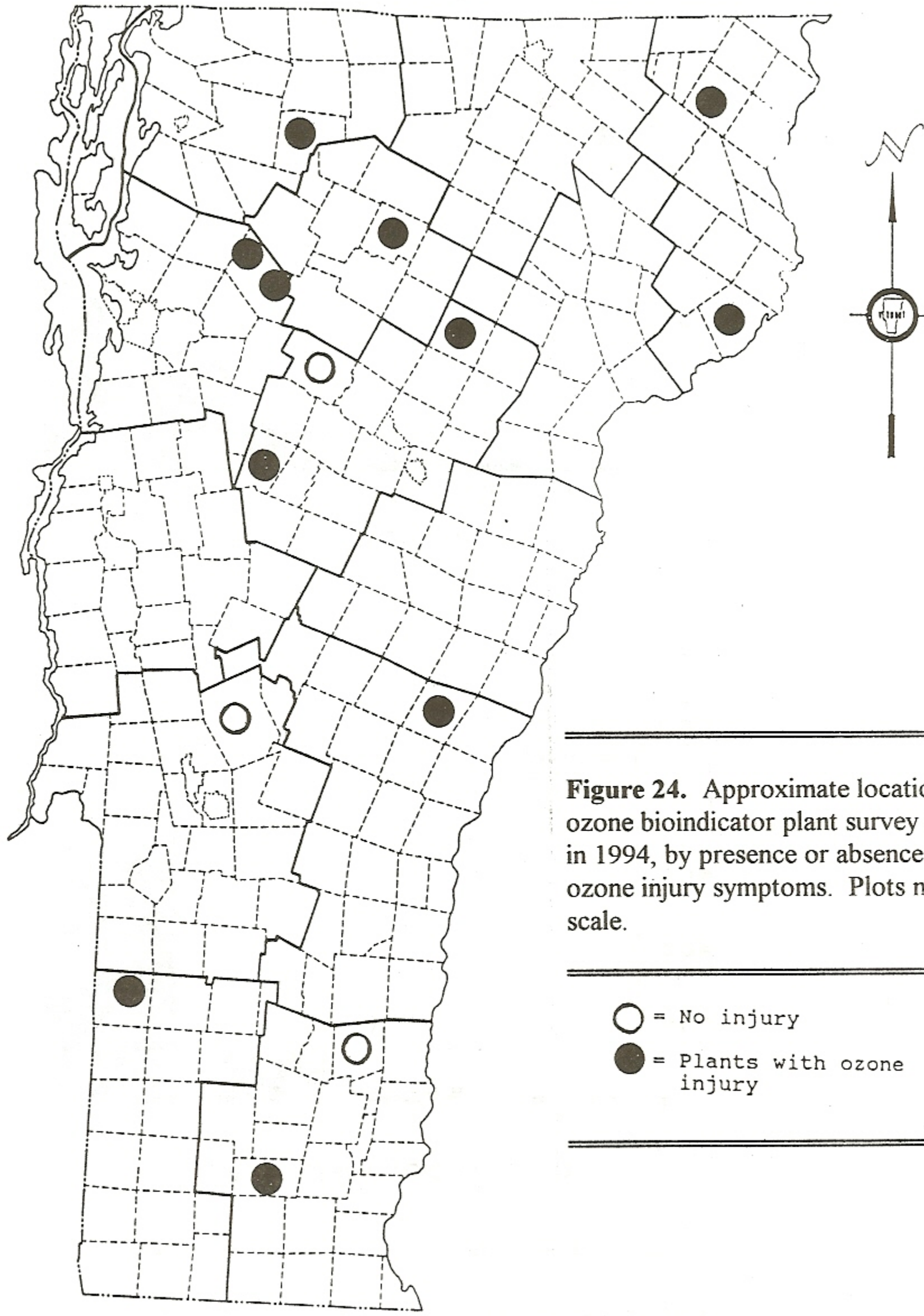


Figure 23A. **Volume of discoloration and decay in sugar maples with 15-year-old logging wounds of increasing size.**



N

Figure 24. Approximate location of ozone bioindicator plant survey plots, in 1994, by presence or absence of ozone injury symptoms. Plots not to scale.

○ = No injury

● = Plants with ozone injury

Table 30. Mapped acres of spruce mortality in 1994.

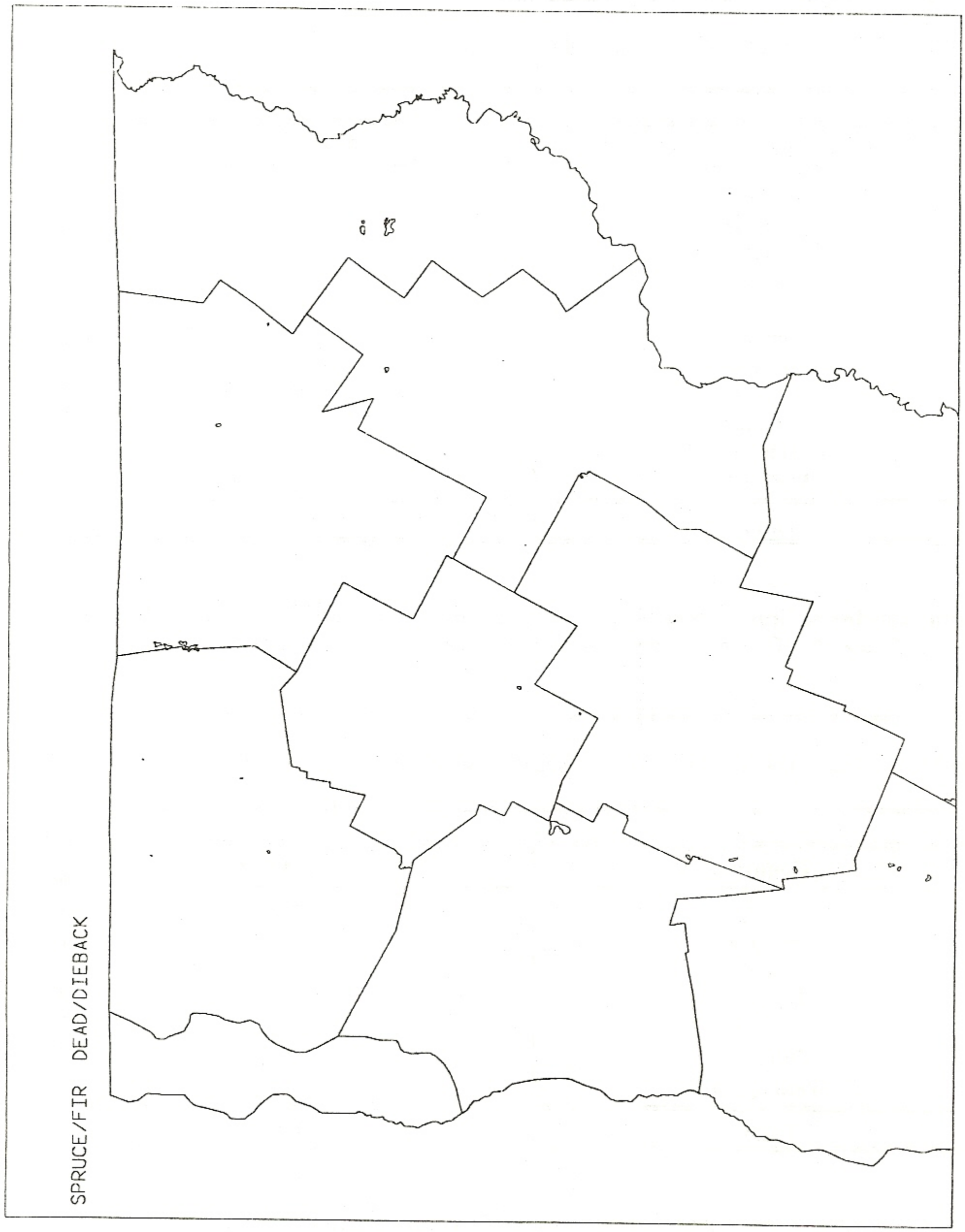
County	Total Acres
Addison	210
Caledonia	70
Chittenden	670
Essex	630
Franklin	110
Lamoille	50
Orange	30
Orleans	550
Rutland	70
Washington	210
Windham	50
Total	**2650**

Unthrifty Hardwood Crowns, associated with logging activities, were aerially mapped on 860 acres (Table 31, Figure 26). Orleans County, with 640 acres, had the most area affected.

Table 31. Mapped acres of unthrifty crowns associated with logging activities in 1994.

County	Total Acres
Addison	70
Caledonia	5
Essex	5
Franklin	130
Orange	5
Orleans	640
Washington	5
Total	**860**

Wet Site conditions were responsible for mortality of a variety of tree species. High spring water levels from deep snow cover, followed by ample rainfall, resulted in some flooding. Again, most of the acreage was in the Champlain Valley associated with Lake Champlain and its tributaries.


SPRUCE/FIR DEAD/DIEBACK

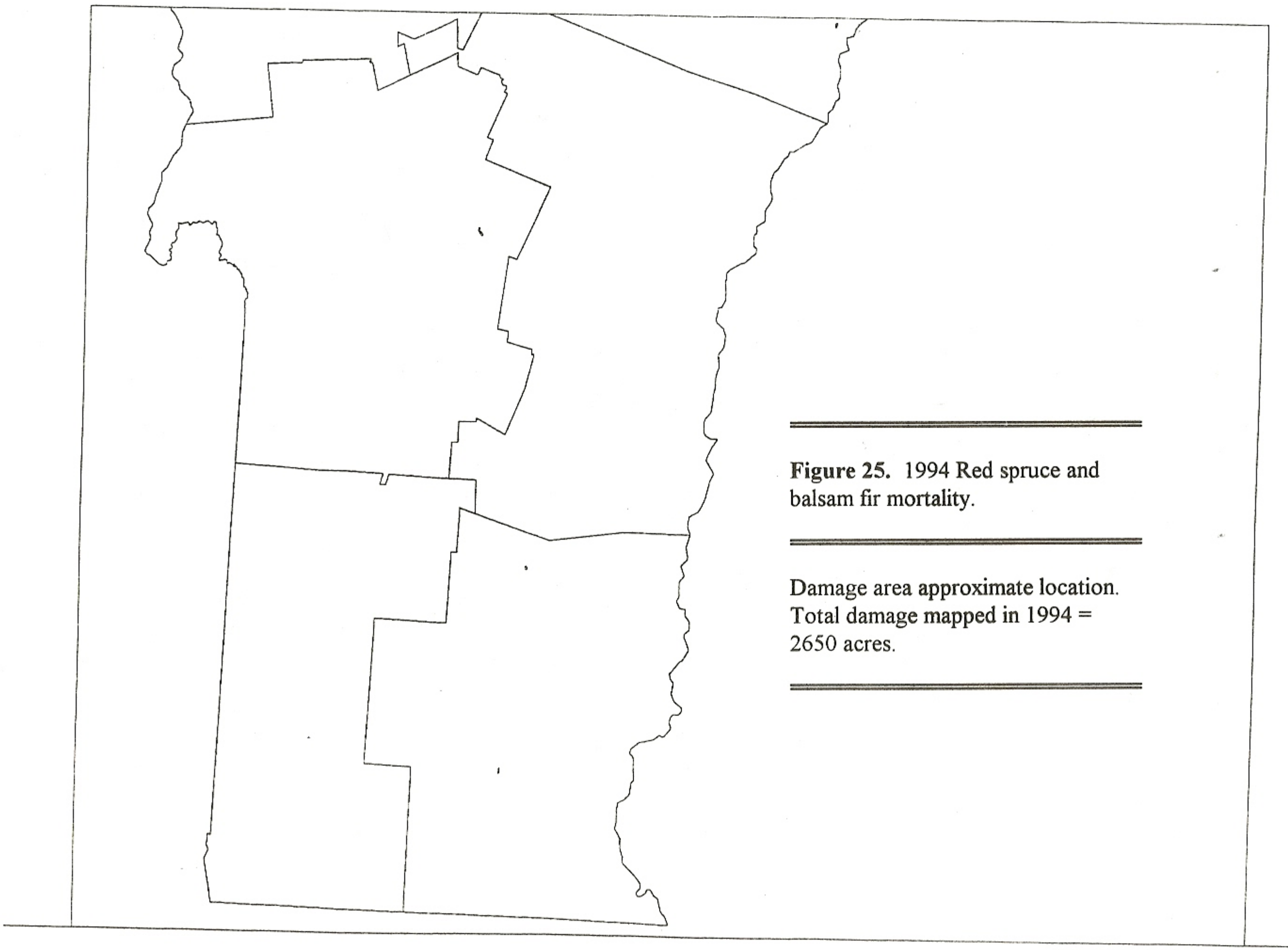
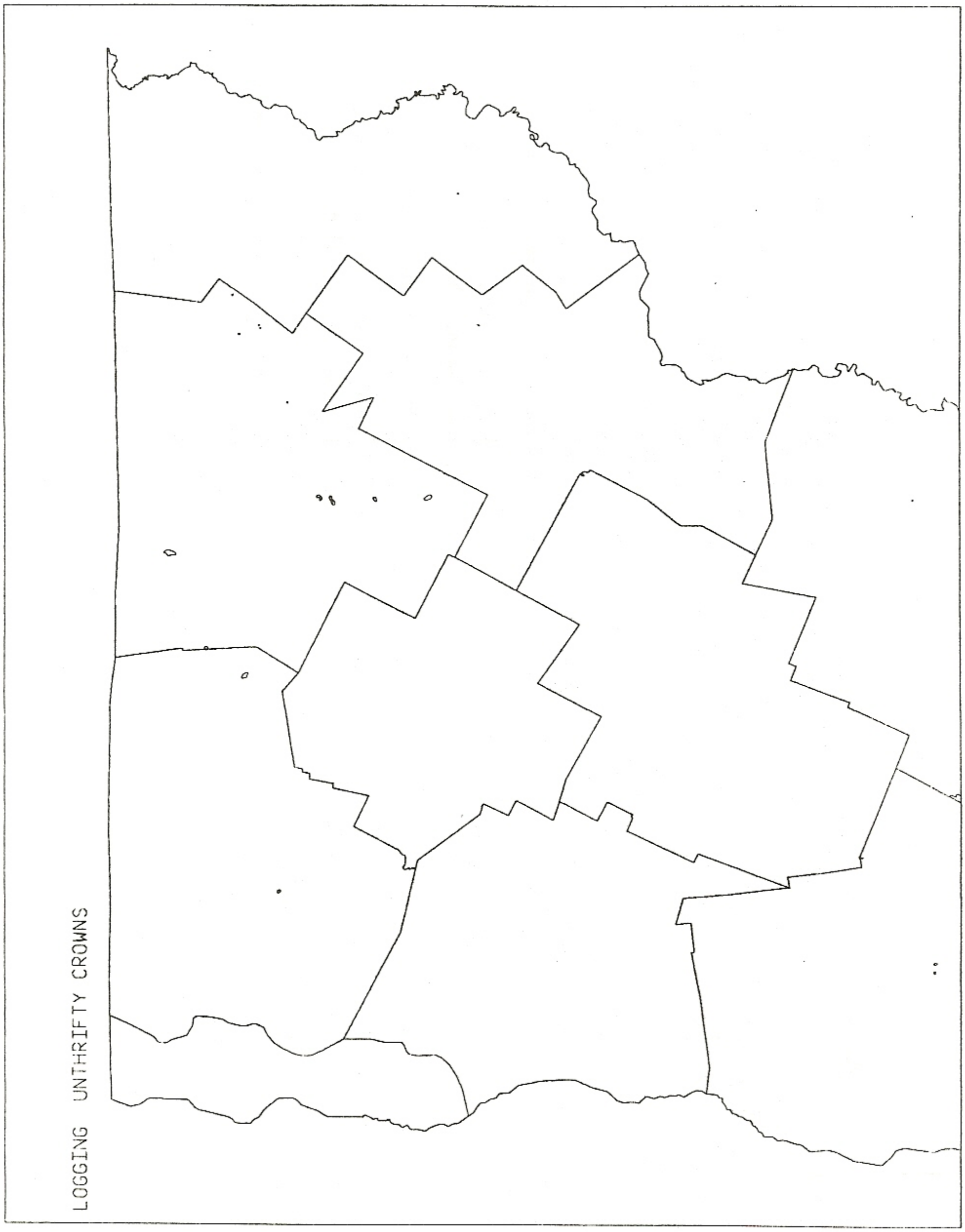


Figure 25. 1994 Red spruce and balsam fir mortality.

Damage area approximate location. Total damage mapped in 1994 = 2650 acres.


LOGGING UNTHRIFTY CROWNS

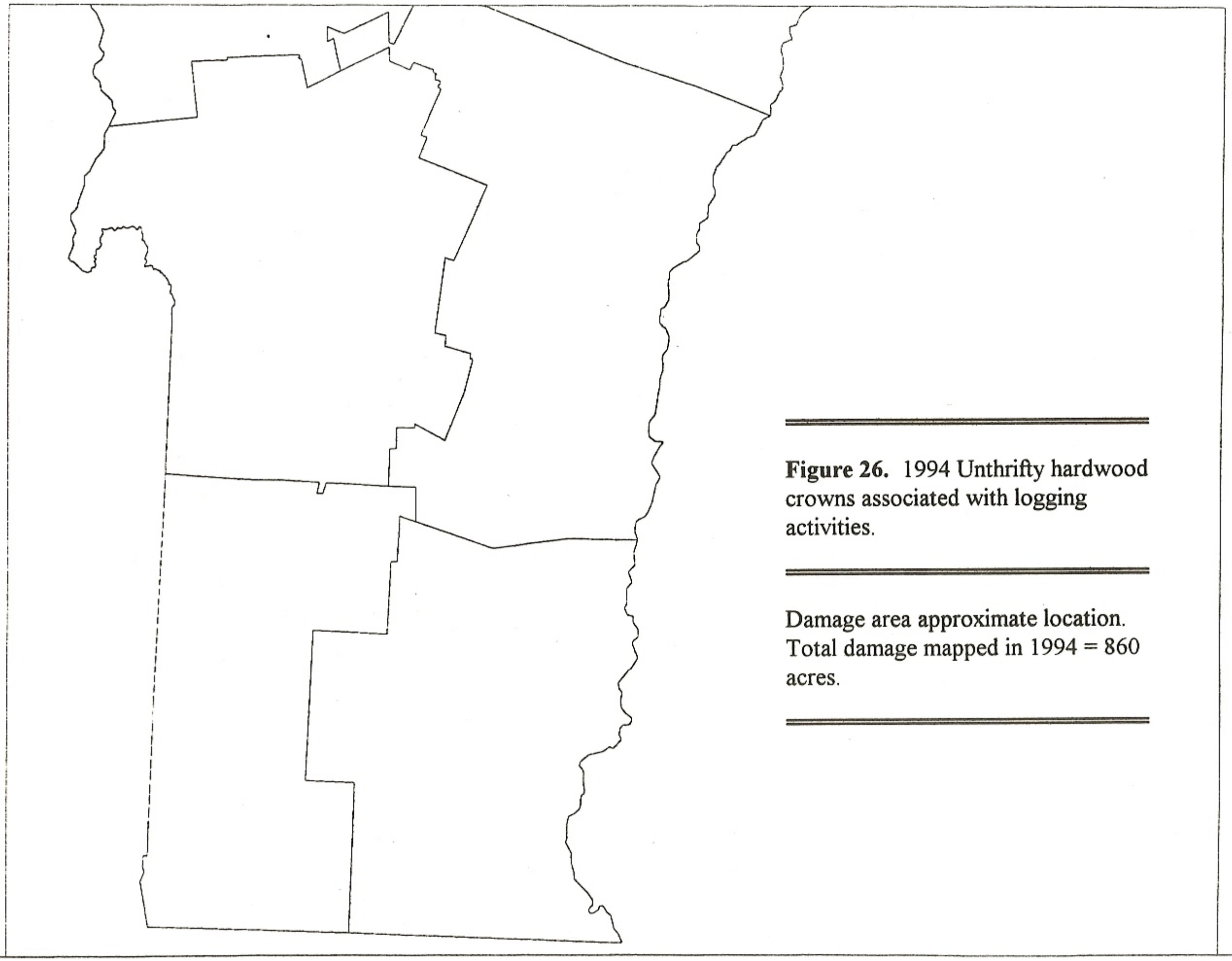
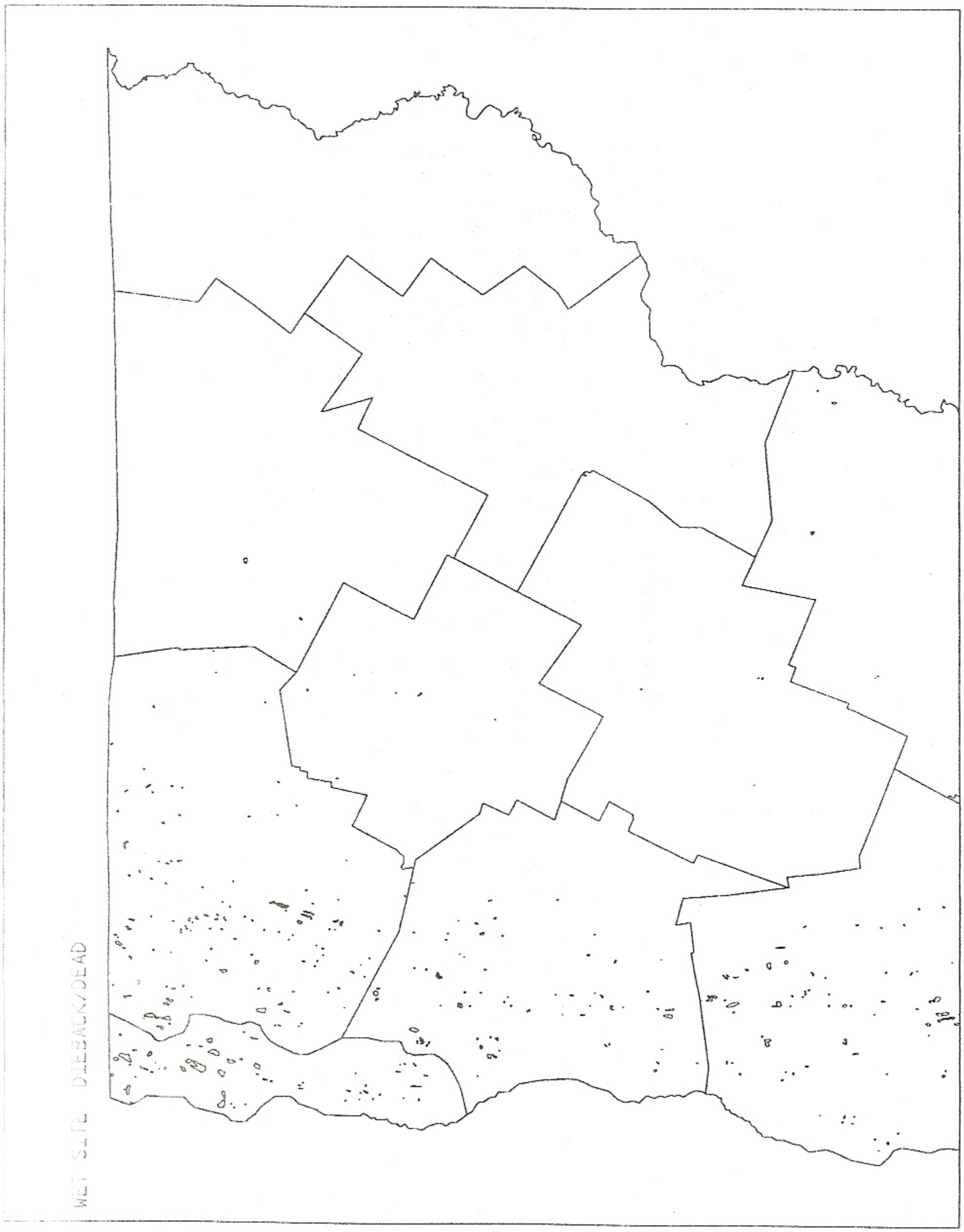


Figure 26. 1994 Unthrifty hardwood crowns associated with logging activities.

Damage area approximate location. Total damage mapped in 1994 = 860 acres.


WET SITE DIEBACK/DEAD

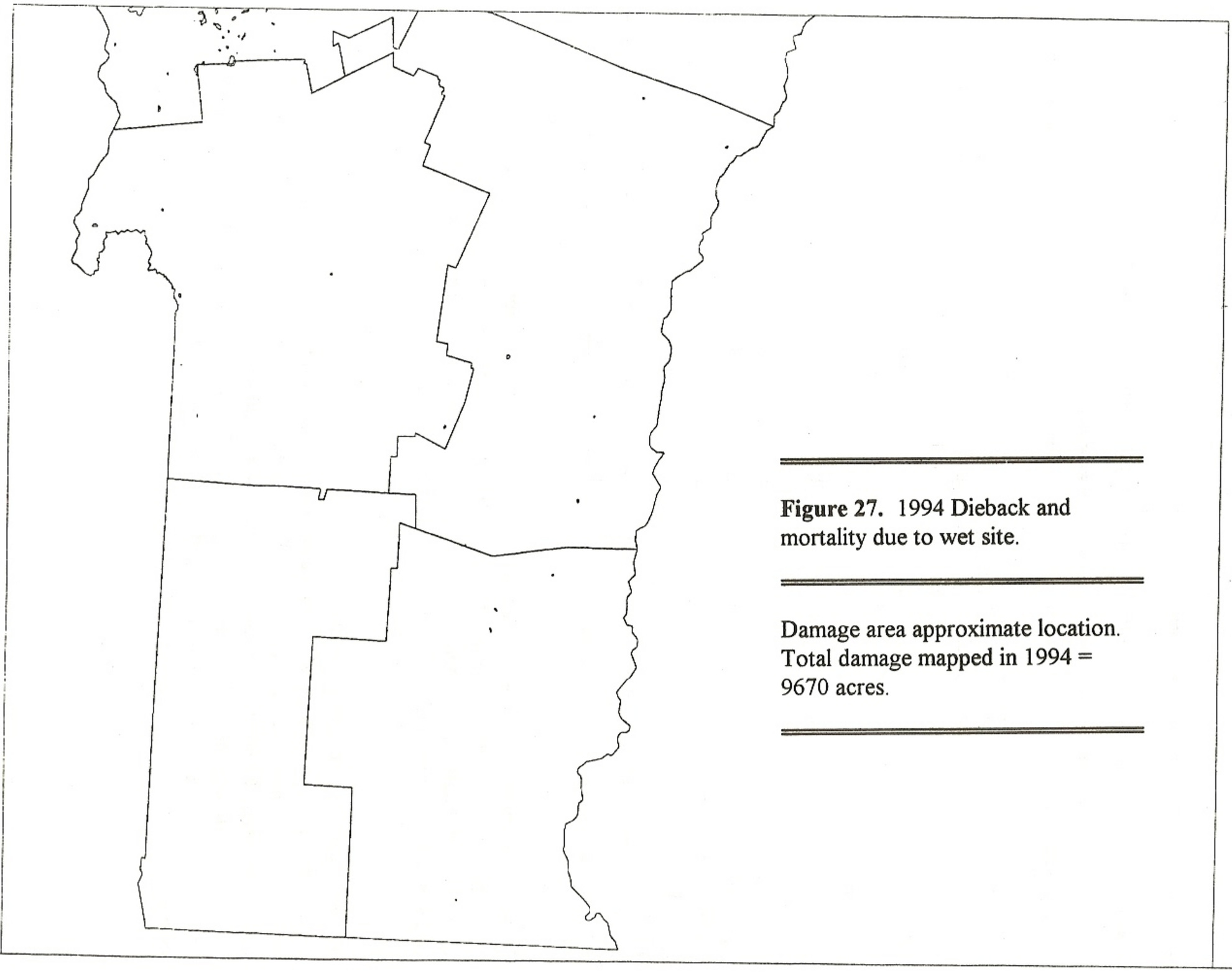


Figure 27. 1994 Dieback and mortality due to wet site.

Damage area approximate location. Total damage mapped in 1994 = 9670 acres.

Acres mapped were similar to 1993 with 9,670 acres compared to 9,060 acres in 1993 (Table 32, Figure 27). Wet conditions also contributed to off-color, and thin crowns in a Christmas tree plantation in Ludlow, and to sugar maple shade trees in Shrewsbury.

Table 32. Mapped acres of dieback and mortality due to wet site in 1994.

County	Damage Level		Total Acres
	<30% of Trees	>30% of Trees	
Addison	2070	1550	3620
Chittenden	280	840	1120
Franklin	510	1490	2000
Grand Isle	540	1700	2240
Lamoille	0	50	50
Orange	0	80	80
Orleans	0	90	90
Rutland	100	160	260
Washington	0	30	30
Windham	0	70	70
Windsor	0	110	110
Total	3500	6170	9670

White Pine Needle Blight, also called Semi-mature tissue needle blight, was visible on 220 acres of white pine plantations due to damage in 1992 but only a trace of damage to 1994 growth was detected. This blight is now thought to be caused by a needlecast fungus (unnamed *Pseudovirgella sp.*) which does not produce fruiting bodies until the following spring about the time that new needles are emerging.

Winter Browning of **Red Spruce** was slight this spring following widespread damage in 1993. An exception to this was high elevation spruce in Essex and Orleans Counties. Severe cold temperatures were common in January and February, 1994, but there were no thaws during this time and snow cover was deep. Moderate browning of spruce was aerially detected on only 160 acres, compared to 44,300 statewide in 1993 (Table 33, Figure 28). Dieback has improved in plots established to monitor the impact of the '93 injury, regardless of the amount of foliage that was affected that year (Figure 29).

Table 33. Mapped acres of winter browning of red spruce in 1994.

County	Total Acres
Orange	10
Orleans	100
Rutland	20
Windham	30
Windsor	Trace
Total	160

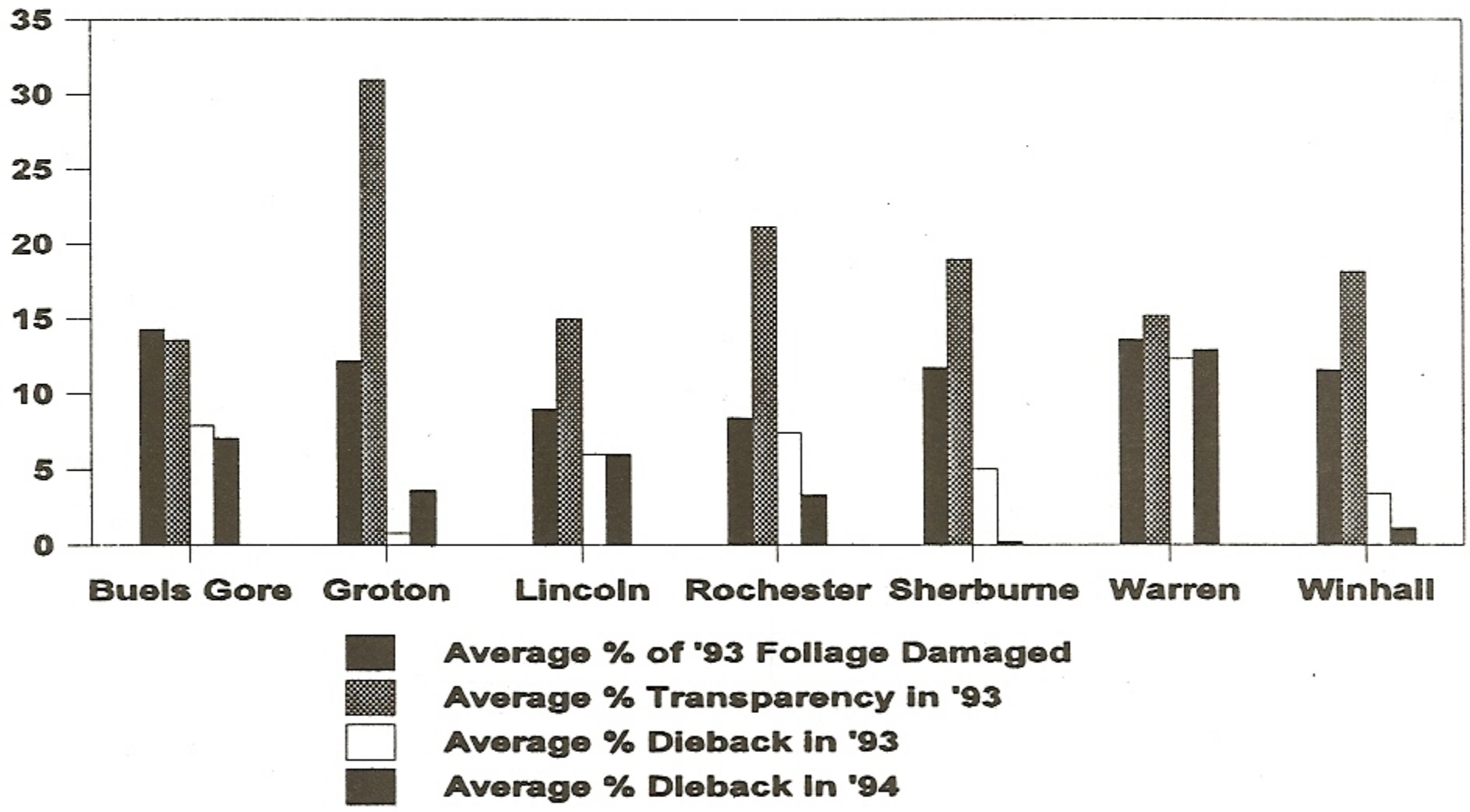
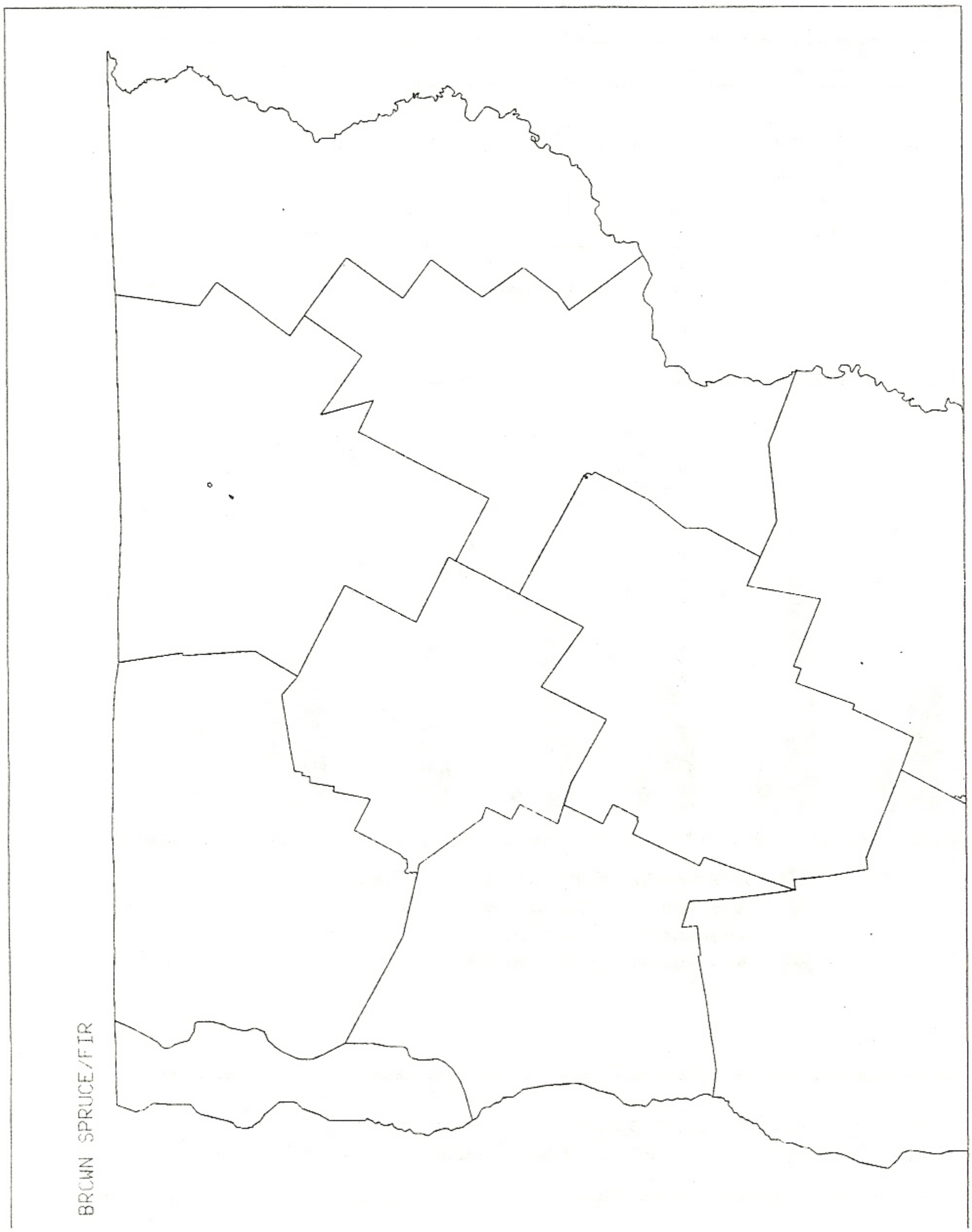


Figure 29. Average percent of foliage damaged by winter injury and foliage transparency in 1993 and percent dieback in 1993 and 1994, in seven red spruce plots established to assess the winter injury impact.


BROWN SPRUCE/FIR

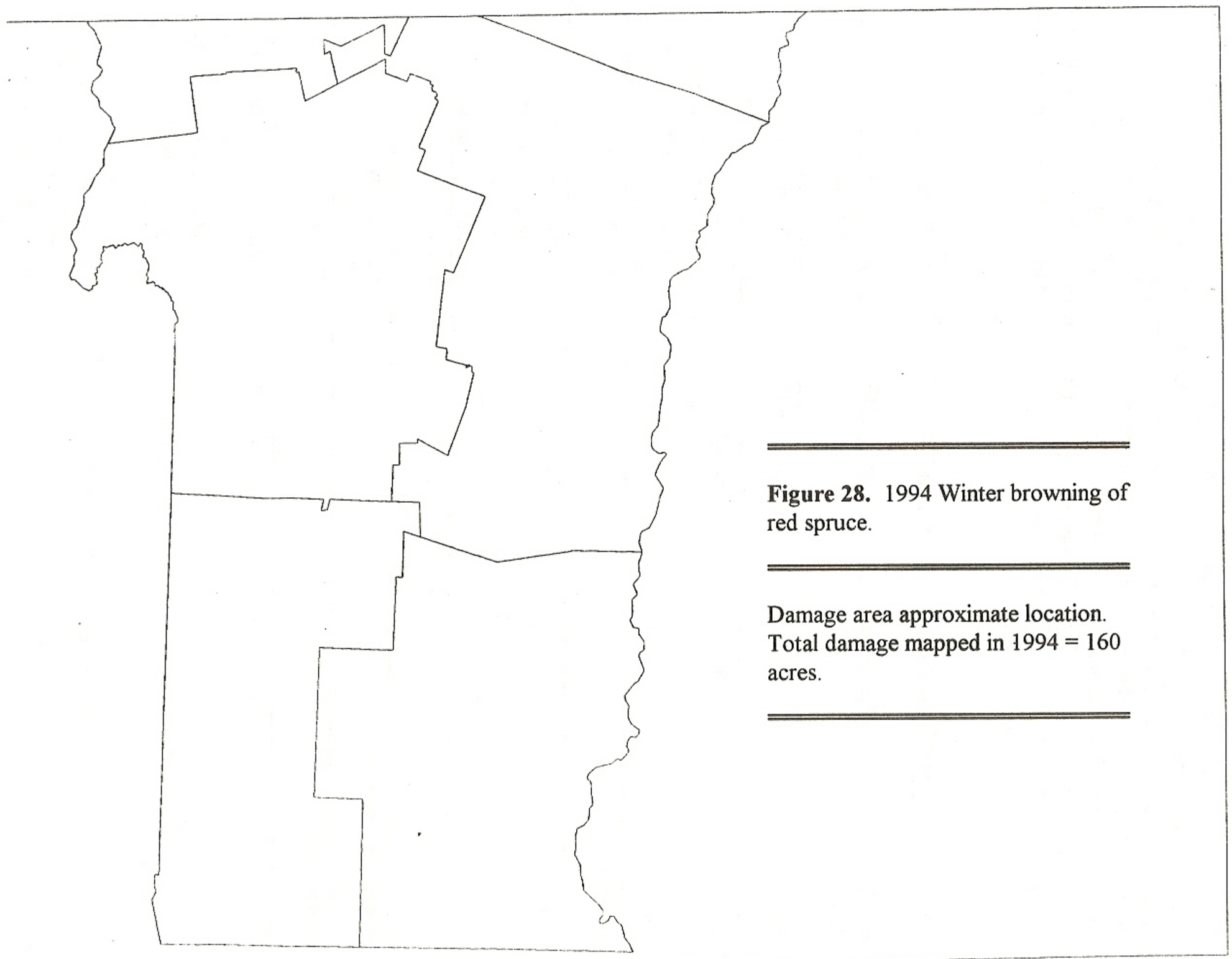


Figure 28. 1994 Winter browning of red spruce.

Damage area approximate location. Total damage mapped in 1994 = 160 acres.

Winter Injury, from extreme cold temperatures in January and February (as low as -29° in Burlington), caused widespread twig and branch mortality on species and varieties outside or at the edge of their hardiness range. Affected tree and shrub species included sweet cherry, black and Carpathian walnut, Japanese maple, European birch, hybrid chestnut, quince, forsythia, euonymus, autumn olive, spirea, and privet. Several varieties of flowering crabapple were also commonly damaged, including Adams, floribunda, Mary Potter, sargent, and Robinson. Damaged plants often had live branches below the snow line, and, frequently, live shoots at the top, with dead twigs and branches in most of the rest of the crown. Many severely affected plants produced sprouts from the roots. Damage such as this highlights the fact that origin and hardiness are important considerations in choosing plant materials. There was no winter injury of Christmas trees reported this year, probably due to the tremendous snowpack.

OTHER DIEBACKS, DECLINES AND ENVIRONMENTAL DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Ash Dieback			See narrative.
Birch Decline	Paper Birch	Throughout	Noticeable at high elevations.
Drought	Balsam Fir	Springfield	Mortality of trees on a gravelly site. Improper planting contributed to the problem.
Fertilizer Injury			Not observed.
Fire	Many	Scattered	Mortality from fire was mapped on 40 acres in Addison, Windham & Windsor Counties.
Frost Damage			See narrative.
Hardwood Decline and Mortality			See narrative.
Heavy Seed			See narrative.
Herbicide Injury	Balsam Fir	Shrewsbury	Princep phytotoxicity may have resulted from low pH, runoff or reduced organic component due to site disturbance.
	Red Oak, Lilac	Springfield	Damage from pramitol applied to control weeds in a driveway. Sugar maples not affected.

OTHER DIEBACKS, DECLINES AND ENVIRONMENTAL DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Improper Planting	Ornamentals	Throughout	Planting too deep, excessive mulching, leaving burlap and wire baskets around the root ball. In one development in Springfield, failure to remove plastic burlap 25 years ago is leading to dieback of planted sugar maple, cherry, and spruce.
Insecticide Injury			Not observed.
Larch Decline	Eastern Larch	Scattered	A few small pockets in Orleans and Caledonia Counties with continuing decline. Past mortality visible elsewhere.
Lightning	White Pine	Springfield	Leading to decline of ornamental.
Logging Wounds			See narrative.
Maple Decline			See Hardwood decline and mortality.
Mechanical Injury	Many species	Throughout	Wounding remains a common contributor to decline, especially in roadside and urban settings.
Needle Loss	Balsam Fir, White Spruce	Ludlow, Dummerston	Occasional Christmas trees losing needles at the proximal end of current growth in the upper crown in the growing season. Cause unknown.
	Cut Balsam Fir Christmas Trees	Scattered Throughout	Occasional serious needle drop of cut trees attributed to the warm, generally dry weather in late fall.
Salt Damage	Conifers, especially Hemlock	Southern Vermont	Damage more severe than normal. Hemlocks 100' from roads affected by salt spray. Heavier than normal snowfall required frequent salt use.

OTHER DIEBACKS, DECLINES AND ENVIRONMENTAL DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Scorch	Sugar Maple		Milton
Spruce Mortality			See narrative.
Stand Opening	Hemlock	Cavendish	Dieback and mortality of a pocket of wounded hemlocks following cutting.
Wet Site			See narrative.
White Pine Dieback & Mortality	White Pine	Scattered	Mapped on 20 acres in Addison, Windham & Windsor Counties.
White Pine Needle Blight			See narrative.
Wind Damage			Not observed.
Winter Browning			See narrative.
Winter Injury			See narrative.
Witches' Broom	Balsam Fir	Fairfax Lincoln	

ANIMAL DAMAGE

ANIMAL	SPECIES DAMAGED	LOCALITY	REMARKS
Beaver	Many	Throughout	Appear to be increasing everywhere. Beaver ponds continue to be responsible for decline and mortality in wet areas.
Deer	Many	Throughout	Heavy damage to balsam and fraser fir Christmas trees in scattered Southern Vermont locations. Damage to oak seedlings limits the potential to regenerate this species, especially in parts of Windham County.
Grosbeaks			Not observed.
Moose	Mountain Ash Red Maple Striped Maple	Lemington Walden Kirby Wheelock	Heavy damage to regeneration.
	Many	Green Mountains	Bark stripping.
Mouse	Many, including Sumac, Conifers	Southern Vermont and Champlain Valley	Unusually heavy damage, particularly in roadside areas, thought to be due to heavy snow. Less damage in Lamoille County than in 1993.
	Sugar Maple	Danby	Probable cause of extensive basal wounds in a developing sugarbush.
Porcupine	Many	Scattered Throughout	Damage remains low in Southern Vermont. In Northern Vermont, common, but mostly light damage. Increase in damage reported for Caledonia County.
Sapsucker	Many	Throughout	Damage less common than 1993.
Squirrel	Hemlock Red Oak	Windham County	Thought to be responsible for dropping of green hemlock shoots in late winter and snipping of healthy oak leaves in early fall.
	Sugar Maple	Caledonia & Orleans Counties	Clipping and girdling branches.

TREND IN FOREST CONDITION

North American Maple Project

Sugar Maple

The percent of overstory sugar maple trees on NAMP plots which are healthy has remained constant over the past six years with 92% of trees on all plots considered healthy (Figure 30). The 11 plots added in 1992 had higher average dieback ratings than the original 29 plots, but showed little change from 1993 to 1994 (Figure 31).

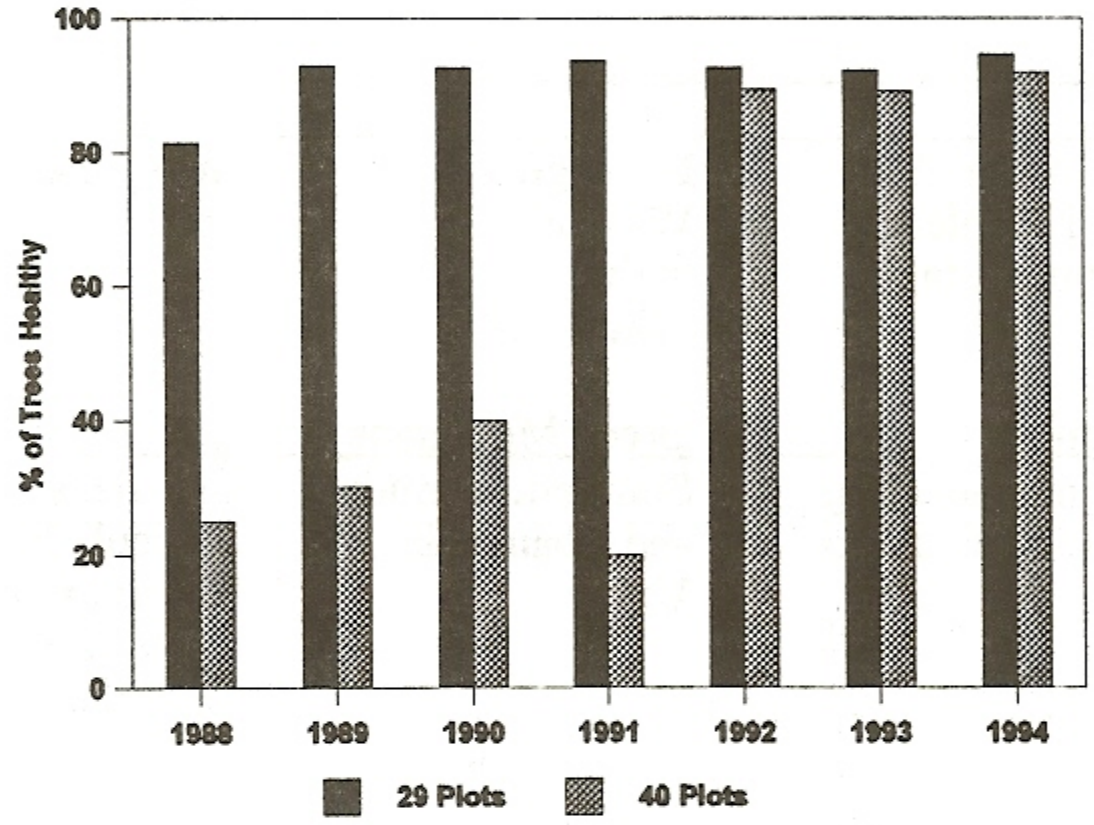


Figure 30. Percent of sugar maple trees in North American Maple Project plots with ≤ 15% dieback (considered healthy), 1988-1994. Considering only the 29 plots which have been evaluated since 1988, and all 40 plots which are currently in the program.

Foliage on sugar maples was less transparent (i.e. denser) this year than in 1993, probably due to the lack of defoliation by pear thrips in 1994. Light defoliation by bruce spanworm and maple leaf cutter occurred on many plots, but moderate defoliation occurred on only 3% of trees.

New mortality has remained low over the past 6 years, with only 0.6% new mortality in 1994. Ten of the 11 trees dying this year were moderate to severely declining in 1993.

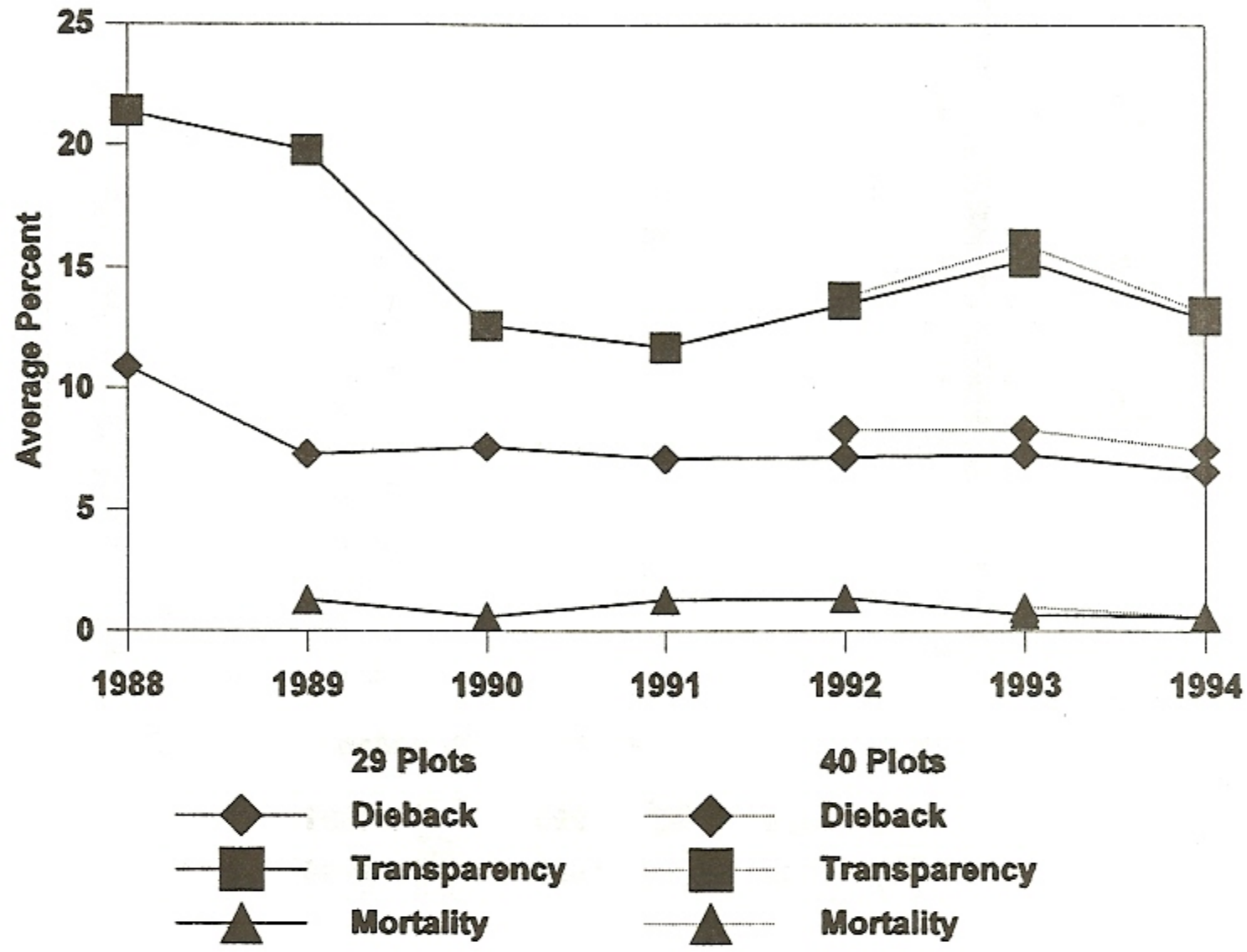


Figure 31. Average percent transparency (amount of light coming through foliage), dieback and new mortality of dominant and codominant sugar maples over 10 cm DBH in the North American Maple Project plots, 1988-1994. Data are from 1,057 trees on 29 original plots and 2,277 trees on 40 current plots.

Other Hardwood Species

For ash, yellow birch and beech, less trees were considered healthy in 1994 than in 1993, based on the amount of dieback (Figure 32). Red maple, conversely, had more trees healthy in 1994. No new mortality occurred for ash, yellow birch and red maple, while 2.2% of beech trees died in 1994.

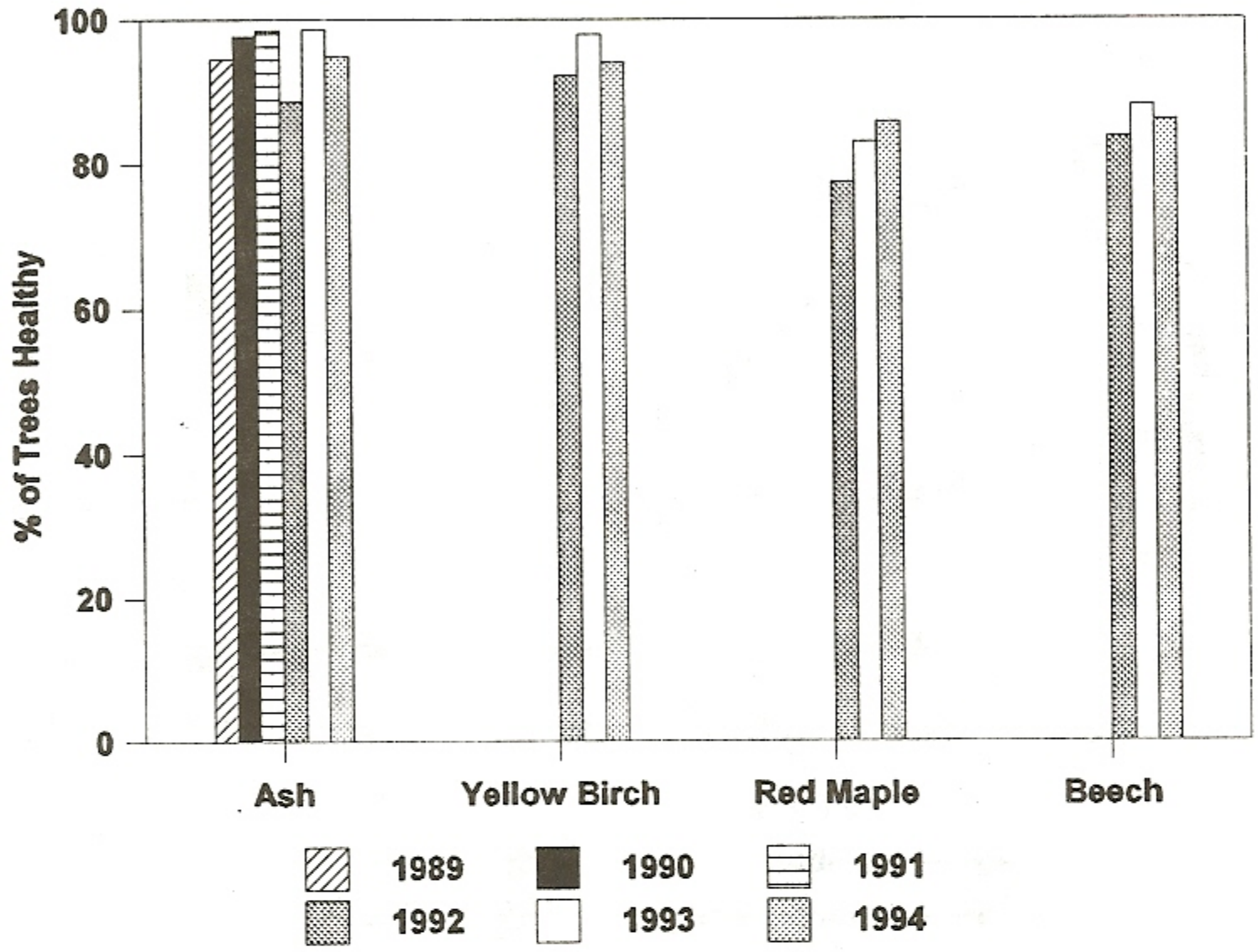


Figure 32. Percent of white ash, yellow birch, red maple and beech trees in the North American Maple Project plots with ≤ 15% dieback (considered healthy), 1989-1994.

Roadside Tree Health Survey

A survey using national forest health monitoring standards was developed for assessing roadside tree health. Seventy-four percent of roadside trees were healthy compared to nearly 86% for forest trees. Lawn trees were healthier than other open grown trees, hedgerow trees, or trees along the forest edge. The full report of this survey is in the appendix.

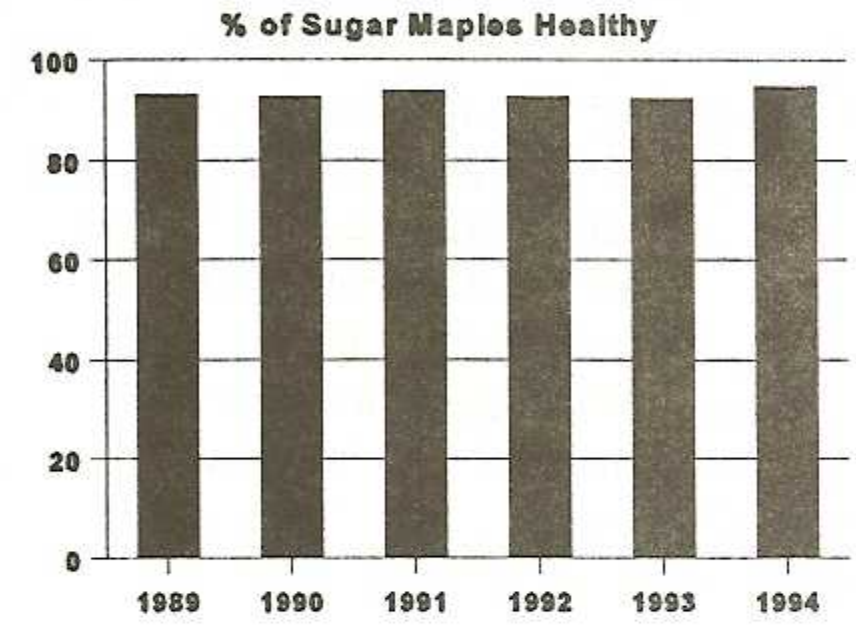
HEALTH OF SUGAR MAPLE IN VERMONT - 1994

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 Vermont Department of Forests, Parks, and Recreation, the University of Vermont and the U.S. Forest Service.

Insect and disease reports, and requests for identification and information on control, should be directed to the County Forester or Forest Resource Protection personnel at our district or county offices. The best way to find out about developing problems is to inspect your sugarbush periodically in the spring and summer for dead twigs, thin or off-color leaves, insects, or chewed off pieces of leaf on the ground. Poor health may be caused by many factors, such as site, crowding, and management practices. If defoliation is occurring, knowing the date of defoliation, and whether or not trees refoliated, will help you determine the effect on tree health. If trees were defoliated, or if there are other signs of poor vigor (like slow taphole closure or dead branches), reduced tapping may help trees recover. You may also want to keep track of changes in the health of your trees by establishing a monitoring plot using the Take-A-Plot kit.

General Health of maples remained good this year. The health of trees which are part of the North American Maple Project (the international effort to follow changes in maple health) has remained constant over the past six years, with 92% of the trees on all plots considered healthy (see graph). New mortality has remained low over the past 6 years, with only 0.6% of the trees dying between 1993 and 1994.



Heavy Flowering occurred on sugar maples, as well as a variety of other species. Sugar maple flowers were so abundant that hillsides appeared yellow in early spring, instead of the usual light green. In some cases, few seeds were formed in spite of heavy flowering. In others, heavy seed crops did develop. These seeds will germinate next spring.

Trees need to divert energy into seed production when seed crops are heavy. This may reduce the food reserves available for recovering from other stresses. Fortunately, maple grow-ing conditions have been good, with no widespread insect and disease problems. Long term health impacts from this seed year are not expected.

Maple Leaf Cutter damage decreased, with mostly light defoliation. Only 160 acres were mapped from the air, compared to 2950 in 1993. Populations of this insect have been high since 1989. Low levels in 1994 may signal an end to this outbreak.

Pear Thrips caused very little damage after defoliating 84,000 acres in 1993. In 1994, no damage was mapped from the air, and trees assessed from the ground had mostly no damage, or only light damage.

Low damage levels were due to low thrips populations. Soil populations in the fall of 1993 were the lowest since 1988, when soil sampling began. Counts of thrips in developing buds were the lowest in the nine years that bud counts have been made. Had populations been higher, damage may have been significant because of the cool spring, with its slow bud development. Heaviest damage generally occurs when thrips are able to feed within developing buds for a long time.

Soil samples were taken again in the fall of 1994, from a number of sugarbushes throughout the state. These indicate how high thrips populations will be next spring. Samples are currently being analyzed at the University of Vermont. When results are available, they will be distributed to all county directors of the Vermont Maple Sugarmakers' Association.

Scientists at the University of Vermont have been field testing fungus diseases of pear thrips as a potential thrips management tool. The fungi were applied to thrips infested sites to evaluate both their effectiveness in killing thrips and how long they last in the soil. Early results look promising, with over 50% of thrips infected by disease in one study.

Hardwood Decline and Mortality continued to be evident in scattered locations, and was mapped on 20,000 acres. This is similar to the acreage mapped in 1992, but quite a decrease from 1993. Scattered dieback was observed over a large area in 1993 where heavy thrips defoliation exposed dead branches.

Bruce Spanworm caused widespread light defoliation throughout the state in late spring, although heavy damage was only seen occasionally. This insect is a light green inchworm, whose feeding makes leaves look lacey. The damage can be distinguished from pear thrips damage, which also shows up early, because thrips damaged leaves are also crinkled and mottled. Additional Bruce spanworm defoliation is expected in 1995, because moths were common again in November.

Forest Tent Caterpillar damage was not seen in 1994. However, catches of moths in light traps were up noticeably over the past three years, indicating that the population is building. This insect caused heavy defoliation of maple stands in parts of western New York and Pennsylvania.

Forest tent caterpillar is of particular concern to sugarmakers because it has historically defoliated large areas when at outbreak levels. Maple decline may be initiated by the defoliation. Look for activity by this insect in late June. The furry, blue-grey caterpillar has white spots on its back. Although it does not make a nest, clusters of caterpillars may be found resting on larger branches. Where defoliation has occurred, leaf fragments will be found on the forest floor. In July and August, rolled leaves, with white webbing inside, persist where the insect has formed cocoons.

COMMON PESTS OF CHRISTMAS TREES IN VERMONT 1994
REPORTED BY THE
DEPARTMENT OF FORESTS, PARKS AND RECREATION

INTRODUCTION

A survey is conducted annually on nearly 1800 acres of Christmas tree plantations in North-Central Vermont as part of the Scleroderris quarantine. Observations are made on all pests during this survey. In 1994, pest incidence was evaluated on the following tree species: balsam fir - 606 acres, Fraser fir - 252 acres, Scots pine - 540 acres, white pine - 422 acres, white spruce - 312 acres, blue spruce - 88 acres, and Douglas-fir - 49 acres. Acreage comparisons reported for Christmas tree problems refer to changes in these surveyed plantations and are not statewide totals.

INSECTS

Balsam Gall Midge populations remain low. During the annual northern Vermont Christmas tree survey, only 20 acres of light damage were reported. If populations of this insect follow the same trend as the last two outbreaks, then an increase should occur within the next couple of years.

Balsam Shootboring Sawfly has increased in recent years and this year it was the single most damaging agent on fir Christmas trees. It was reported infesting 655 acres in northern Vermont compared to 329 acres in 1993. Fraser fir was generally preferred over balsam fir by this insect. Of 24 plantations in northern Vermont intensively surveyed for this insect, percent of shoots killed per tree per plantation averaged 6 percent for balsam and 10 percent for fraser but ranged up to 30 percent on fraser compared to 14 percent on balsam.

Despite these high levels of shoot mortality, larger, tightly-sheared trees tended to have acceptable appearance by late summer. Small trees that hadn't attained a full shape yet, and trees damaged in previous years by other agents such as frost, tended to have the poorest appearance as a result of damage by this insect. An assessment of shootboring sawfly damage to firs planted in Woodbury for seed-source trials revealed that balsam fir from the most northern locations had the least damage, while fraser fir and fraser-balsam crosses had the most damage.

In the northern Vermont Christmas tree survey, the only heavy damage reported was on fraser fir, and fraser had 217 acres of moderate damage compared to 144 acres of moderate damage to balsam fir (Table 1). The heaviest damage tended to be in plantations near natural balsam fir stands while plantations in areas outside the fir range, such as in Addison County, tended to avoid the damage.

Table 1. Acres of damage to balsam and fraser fir by the balsam shootboring sawfly by county.

	Balsam fir				Fraser fir			
County	**Light**	**Mod**	**Hvy**	**Total**	**Light**	**Mod**	**Hvy**	**Total**
Addison	0	0	0	0	0	0	0	0
Caledonia	72	56	0	128	0	76	15	91
Franklin	0	0	0	0	12	0	0	12
Lamoille	66	40	0	106	0	82	0	82
Orange	42	0	0	42	36	0	0	36
Orleans	11	12	0	23	0	29	0	29
Washington	20	36	0	56	0	30	20	50
Total	211	144	0	355	48	217	35	300

The adult sawflies are probably laying eggs through the bud sheath very early in the spring before bud swell, since first stage larvae were found in unswollen buds this year and third stage larvae (the insect has 5 larval instars) were found in buds beginning to break open.

Balsam Twig Aphid damage was detected on 237 acres of fir in northern Vermont compared to 329 acres in 1993. Most of the damage this year was very light except for 50 acres of moderate

damage. The lightest population levels tended to be in the most northern acres while moderate populations were more common in plantations that were not near natural balsam fir stands. Growers should monitor their plantations during green bud stage in the spring to see if control is necessary in 1995.

Cooley Spruce Gall Adelgid damage to Douglas-fir decreased, with 73 acres of mostly light damage detected compared to 109 acres of mostly moderate to heavy damage in 1993.

Cinara Aphids were not detected this year.

Eastern Spruce Gall Adelgid damage to white spruce decreased slightly, with 131 acres of damage detected compared to 160 acres in 1993. Most of the damage (92 acres) was light, while 39 acres received moderate injury.

Mound Ants were responsible for light, scattered mortality of Christmas trees in Ludlow.

Pales Weevil damage remained down this year, with only occasional individual trees in Christmas tree plantations exhibiting damage during the annual survey of northern Vermont plantations.

Pine Leaf Adelgid injury to white pine shoots was reported for 127 acres. Most of the damage was light (77 acres), with 30 acres of moderate and 20 acres of heavy damage. Adelgids were also observed on white pine shoots in several southern Vermont locations. This insect spends every other year on spruce, its alternate host, so should not damage pine in 1995, but shoots fed upon in 1994 may show symptoms in 1995.

Pine Needle Midge populations decreased this year, with 120 acres of damage to Scots pine compared to 266 acres in 1993. All but 2 acres of this was light damage, with only scattered needle loss. Look for needles that bend downward from the fascicle and then droop, with damage most noticeable at the tops of trees.

Pine Spittlebug was less commonly observed innorthern Vermont, where damage was light, but heavy detected populations on white pine were reported for scattered locations in Southern Vermont.

Pine Thrips damage to Scots pine was very light and scattered this year.

Red Spruce Gall Adelgid damage to red spruce remains common.

Sawyer Beetles were responsible for light balsam fir shoot mortality in widely scattered locations. Adults emerge in early summer and feed on the undersides of shoots. They were more commonly observed this year than in past years.

Spruce Spider Mite appeared to be a significant pest in spruce and fir plantations in early summer. However, frequent heavy rains throughout most of the summer apparently suppressed populations. The warm dry fall may have led to increases in mites late in the year so growers should monitor for the tiny reddish mites early in the growing season in 1995.

White Pine Weevil damage decreased this year. A total of 282 acres of pine and spruce was reported damaged this year compared to 510 acres in 1993. As usual, white pine received the most damage (242 ac), but blue spruce and Scots pine also were commonly attacked.

DISEASES

Cylaneusma Needlecast (formerly *Naemacyclus)* of Scots pine remains common with 176 acres of damage reported for northern Vermont, compared to 280 acres in 1993. Some of the reduction in 138 acres is because less Scots pine is being grown. Moderate damage was also reported for a Clarendon plantation. If 1994 is a wet year, this damage is likely to increase.

Diplodia (*Sphaeropsis*) Tip Blight caused widespread scattered shoot mortality of pine and fir throughout northern Vermont. Infected shoots often form a crook from the point of infection.

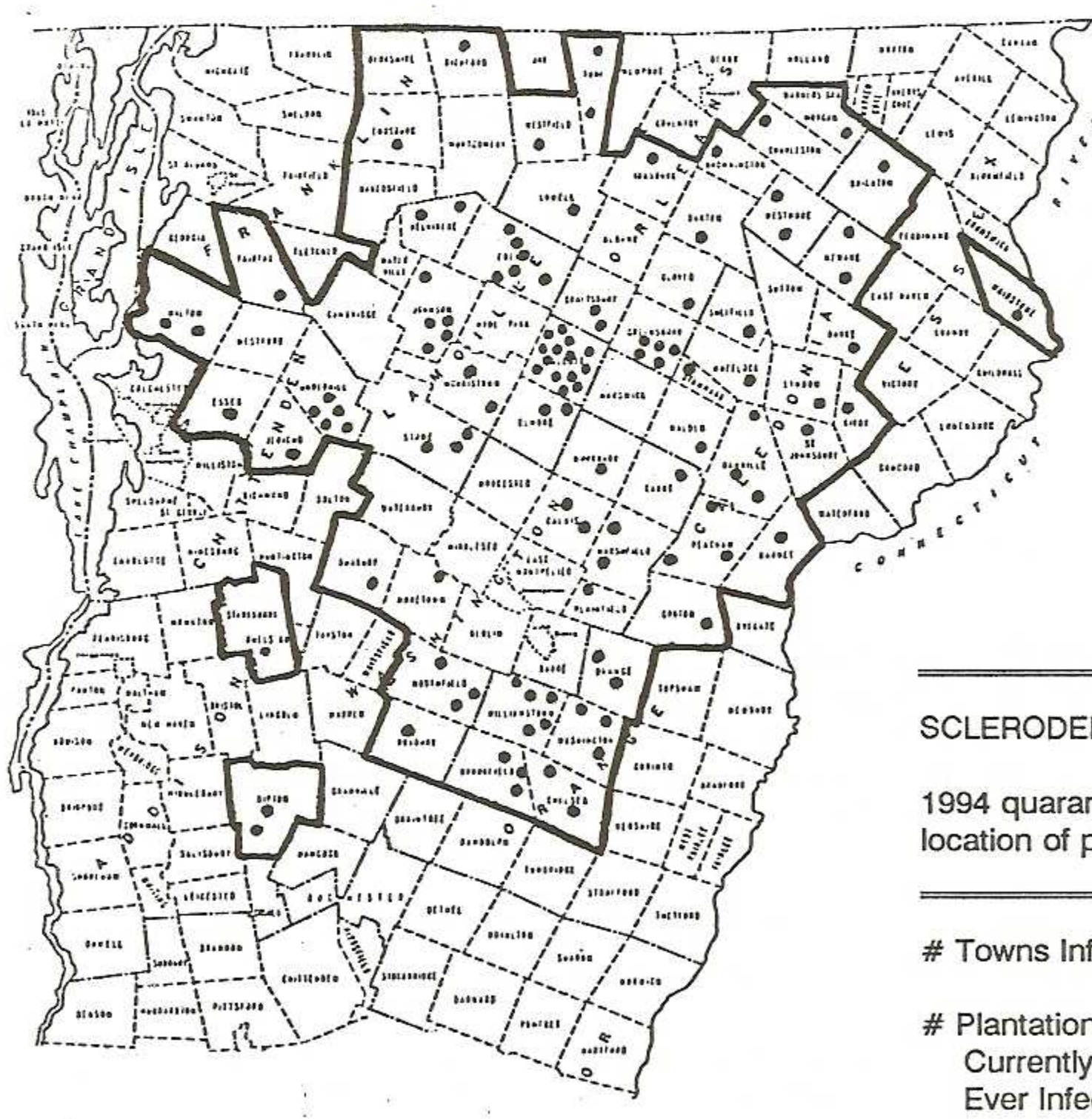
Fir-Fern Rust decreased, with 154 acres of mostly light damage to balsam and fraser fir this year compared to 314 acres in 1993. Eliminating sensitive fern, the alternate host, is the best long-term solution to controlling this disease.

Lophodermium Needlecast of Scots pine remained common this year, but only 102 acres (86 ac - light) of damage was reported compared to 345 acres in 1993. Moderate damage was observed for three plantations (16 acres) in northern Vermont as well as one plantation in Rochester. Many of these pine plantations also have *Cylaneusma* present.

Rhabdocline Needlecast was observed on 65 acres of Douglas-fir compared to 104 acres in 1993, but damage was more severe this year.

Rhizosphaera Needlecast of blue and white spruce, as with the other needlecasts, remained common, with 160 acres damaged compared to 226 acres in 1993. Damage was light on 115 acres, and moderate on 45 acres. Most of the injury was on blue spruce. Damage to ornamental blue spruce also resulted in more inquires than usual this year.

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



SCLERODERRIS CANKER

1994 quarantine area and location of positive infection

Towns Infected = 64

Plantations:
Currently Infected = 126
Ever Infected = 130

Shoestring Root Rot (Armillaria) was reported to be killing balsam fir in a Ludlow plantation. Old stumps at the edge of the plantation were thought to be the food base for the fungus. This root rot was also killing Douglas-firs in Townshend where as adjacent hedgerow was probably the source of infection.

Sirococcus Shoot Blight was reported on white spruce in virtually all of the plantations where it was observed in 1993. Shoot mortality from this fungus was more noticeable than in 1993.

Swiss Needlecast of Douglas fir decreased, with 52 acres of light to moderate infection compared to 112 acres of moderate to heavy infection in 1993. This disease has always been more common than Rhabdocline in northern locations but this year it was slightly less prevalent. Nonetheless, between these two diseases Douglas-fir plantations throughout the region are degraded.

White Pine Blister Rust damage remained common, with 221 acres of mostly light damage reported.

White Pine Needle Blight, also called Semi-mature tissue needle blight, was visible on 219 acres of white pine plantations due to damage in 1992 but little damage to 1994 growth was detected. This disease is now thought to be caused by a needlecast fungus (new unnamed species).

Woodgate Gall Rust damage to Scots pine was similar to 1993 levels, with 180 acres reported compared to 238 acres in 1993. Most of the damage was moderate (98 acres), with 62 acres of light damage and 20 acres of heavy damage.

Yellow Witches Broom Rust of balsam fir was found within 116 acres of balsam and fraser fir plantations (190 acres in 1993). This was usually limited to just a few trees per plantation with one or two small brooms. In most cases, the brooms can be removed from the tree and the tree will recover to a normal density in another growing season or two.

Winter Injury was not reported this year, possibly due to deep snow that protected trees from dessication.

Needle Loss of current growth in the upper crowns of Balsam fir and white spruce was observed in Ludlow and Dummerston. The cause is unknown.

Needle Drop on cut Christmas trees and wreath material was more common than usual this year, probably due to the extended warm, dry autumn weather.

Frost Damage was again reduced from recent previous years. Frost injury was reported on 210 acres but most of this (160 acres) was light. Balsam fir was the species most affected with 90 acres of visible damage, followed by white spruce with 50 acres. This is less than the 452 acres of mostly light damage reported in 1993.

Princep Phytoxicity observed on balsam fir in Shrewsbury may have been due to low pH, runoff, or a reduced organic layer component due to site disturbance.

DISEASES FOUND FOR THE FIRST TIME IN 1994

Brown Spot Needle Blight was confirmed for the first time, on overgrown Scots pine in Huntington, and was the suspected cause of needle browning in a Christmas tree plantation in Berlin.

Delphinella Tip Blight of Fir heavily damaged two plantations in East Montpelier. This is also the first confirmed report of this disease in Vermont. Infected trees had dead lateral shoots as well as dead scattered individual needles. Rhizosphaera pini was also detected on needles from one of these plantations but its role in the needle loss is not fully understood.

Dothistroma Needlecast of Austrian pine was detected for the first time in Barre. This is a serious disease of Austrian pines capable of killing trees.

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Vermont Roadside Tree Health Survey 1993 - 1994

Reported by the Department of Forests, Parks and Recreation

INTRODUCTION

Monitoring of tree health in forest stands is now common in the Northeast, but the tree condition that the majority of people see and relate to is that of the roadside trees they drive by every day. In 1993, a roadside tree health survey was developed and tested in Lamoille County in north-central Vermont, then modified and expanded statewide in 1994. This survey uses national forest health monitoring standards for dieback and transparency but simplifies the procedures for use on roadside trees.

METHODS

Two roads per town (1 paved, 1 unpaved) were selected from a list of frequently-traveled town highways within 25 towns. Where possible, the starting point for each road survey was randomly selected as 0.2, 0.4, 0.6, 0.8, or 1.0 mile from the beginning of each road (usually its intersection with a state highway.) Each starting and ending point was described by odometer readings and location of landmarks. For each road, the first 100 trees (at least 5.0 inches in diameter) within 20 feet of the road edge with crowns visible from the road were evaluated for dieback and transparency (5% increments) by two observers. Trees with more than 10 percent crown dieback were considered unhealthy.

Observers stood diagonally opposite one another on the road or its shoulder to evaluate each tree. To compare this with normal "opposite sides of the tree" observations, every tenth tree was also evaluated with one observer behind the tree opposite the road.

Trees were grouped into broad diameter classes that could be estimated from the road. Trees were not permanently marked. Any resurvey should rate approximately the same trees. With roadside trees, any problem with variation in repeatability can more easily be reduced by sampling more trees.

Trees were classified as hedgerow (receiving light from 2 sides), forest edge (receiving light from one side), lawn (on a maintained lawn) or open field (receiving light from all sides).

Tree condition was compared with forest trees surveyed in 1991 as part of the Vermont hardwood tree health survey. Although we are comparing trees in different years, conditions for tree growth have been relatively stable and good since 1991 and data from other forest health monitoring plots show very little change in crown condition since 1991.

RESULTS

Species Rated

Tree species most frequently rated in this survey were (1) sugar maple, (2) red maple, (3) white pine, (4) white ash and (5) aspen (Figure 1). Because many roadside locations are former fields, there tends to be a greater number of species that are not very tolerant of shade (i.e. aspen, white pine, white ash) in such a survey compared to forest surveys. There were also a large number of "other species that tend to be more common in urban settings, such as apples, boxelder, cottonwoods and silver maple.

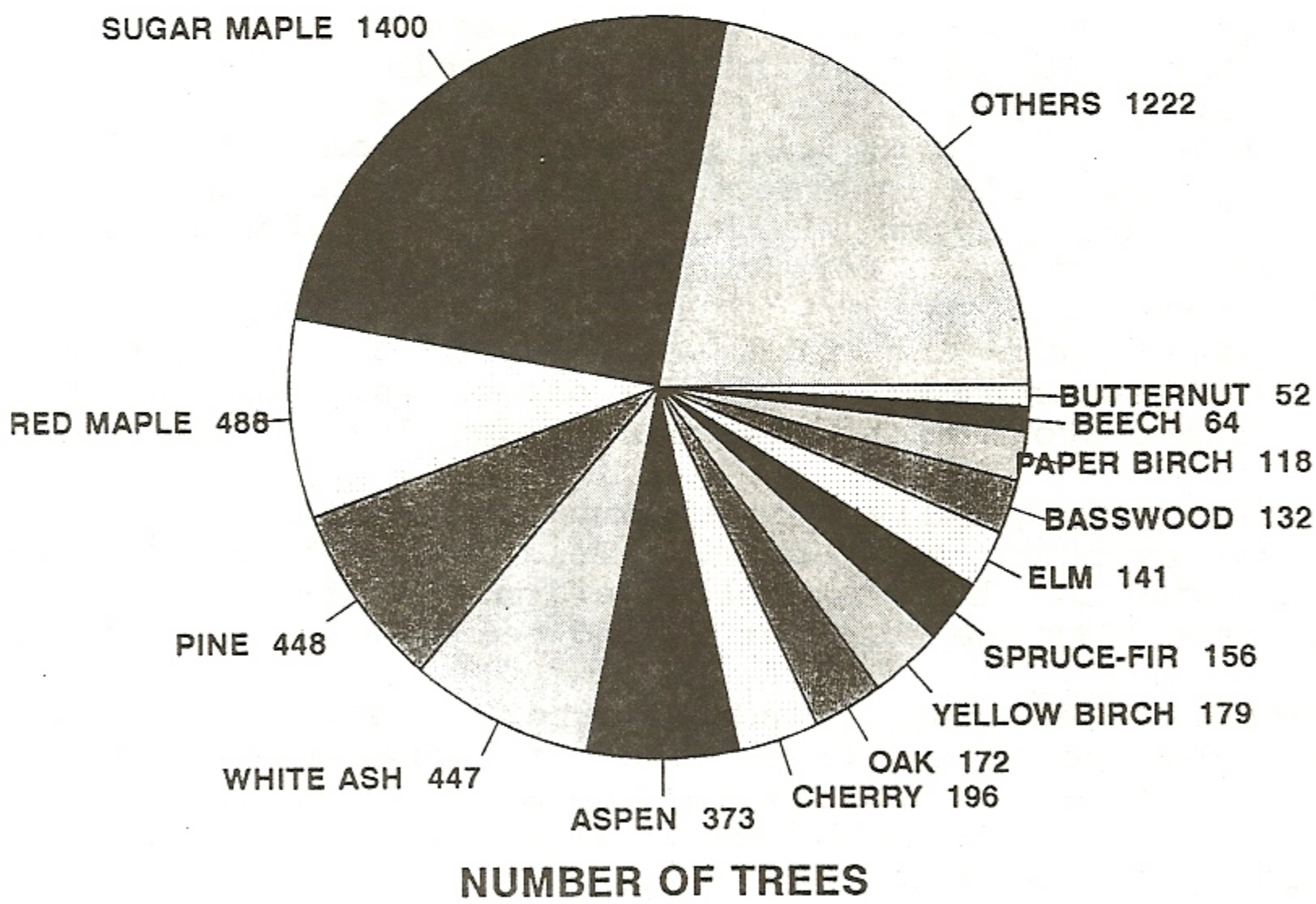
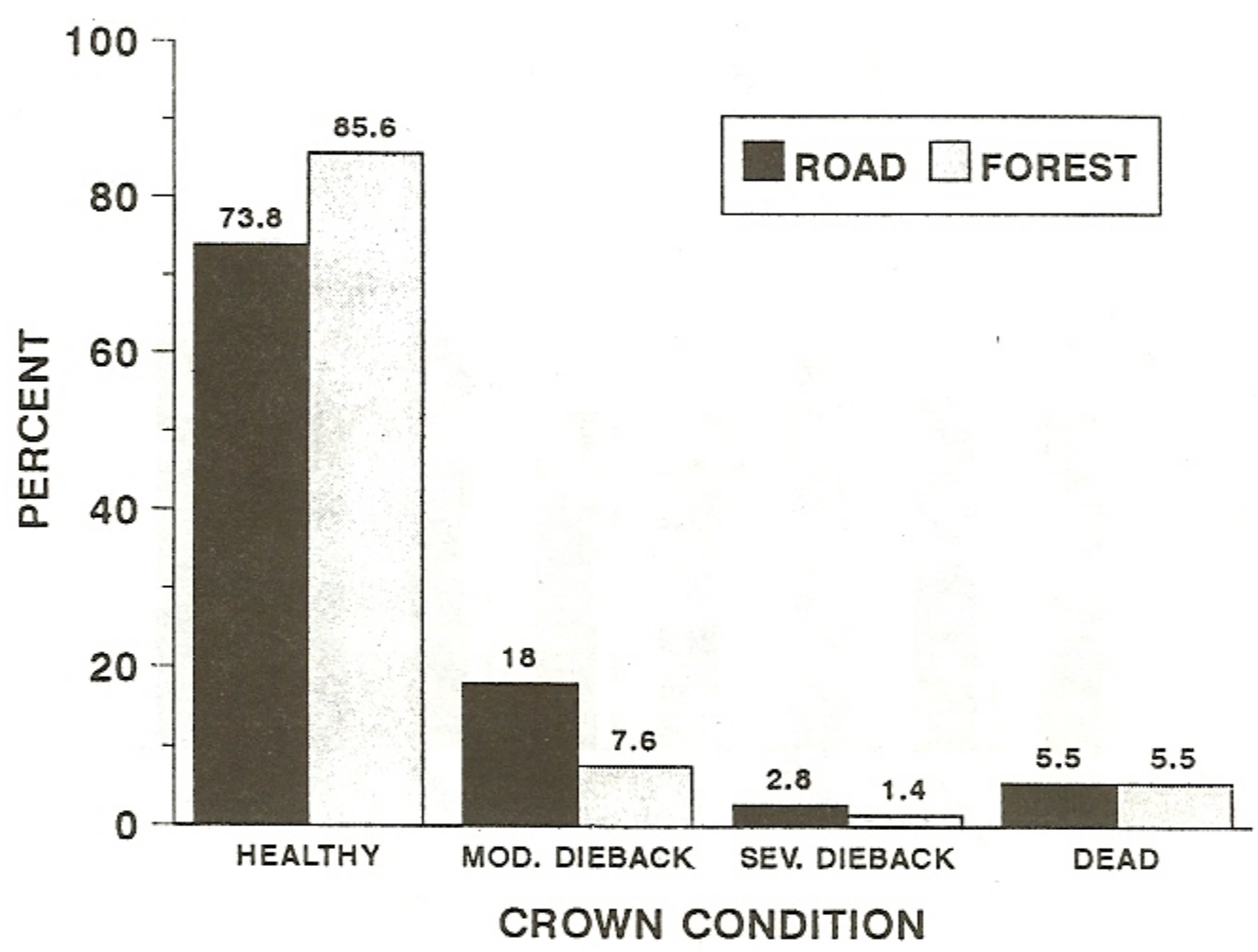


Figure 1. Tree species distribution in the 1993-94 Roadside Tree Health Survey.

Crown Condition

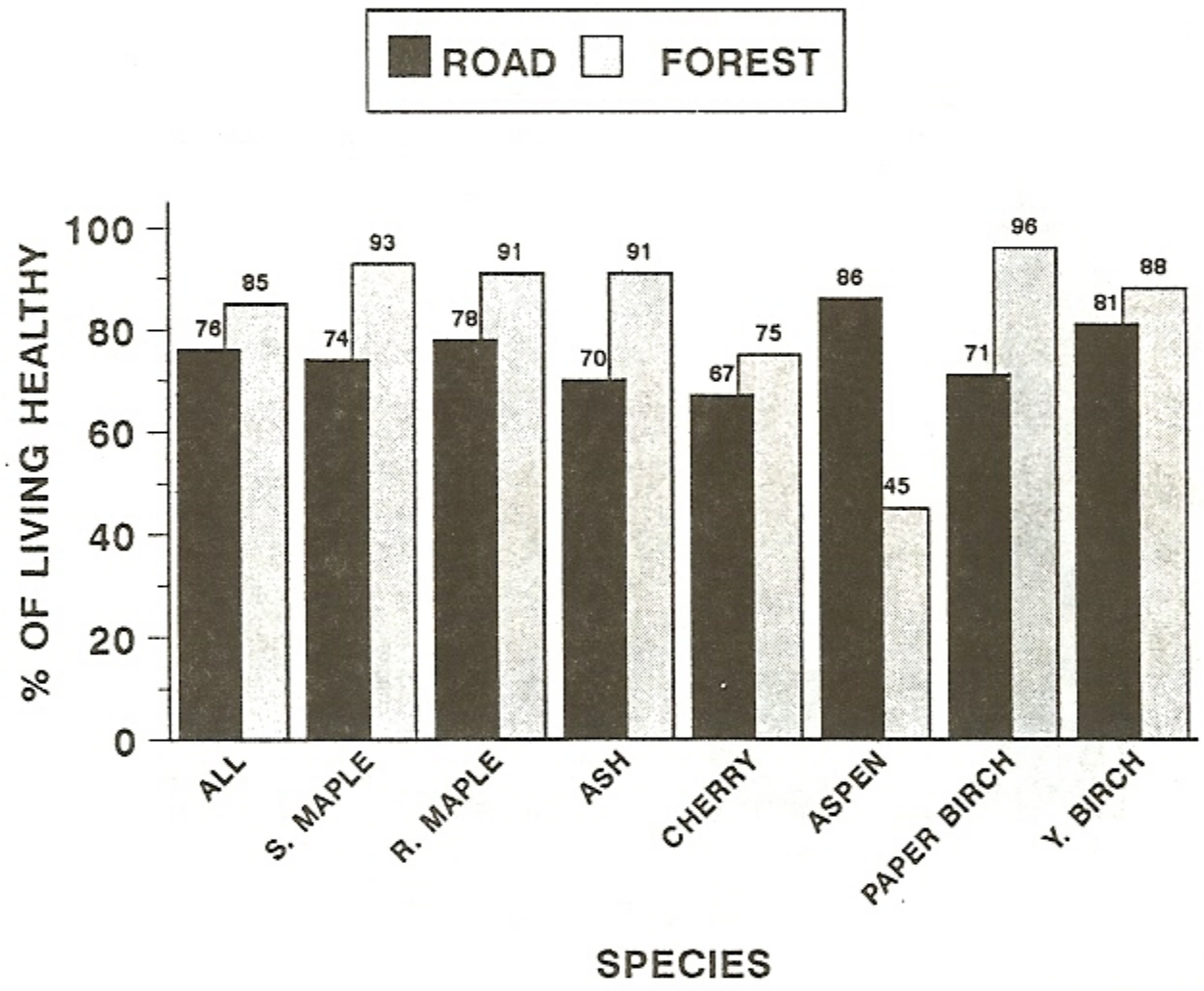
As one might expect, trees along roads were less healthy then those in the forest. About 74 percent of roadside trees were healthy compared to nearly 86 percent for forest trees (Figure 2).



HEALTHY: <=10% CROWN DIEBACK MODERATE DIEBACK: 11-50% CROWN DIEBACK
SEVERE DIEBACK: >50% CROWN DIEBACK DEAD: ALL STANDING DEAD EXCEPT SNAGS
ROAD TREES IN 1993-94 VS. FOREST TREES IN 1991 (VHHS)

Figure 2. Crown condition of roadside trees compared to forest trees (1991 hardwood survey)

Most tree species have a better life in the forest than next to a road (Figure 3). Aspen is the exception, and for this species the benefit of higher light levels appears to outweigh the effects of wounding, ditching, filling and salt.



Healthy = 0-10% crown dieback
Road trees in 1993-94 vs. forest trees in 1991 (VHHS)

Figure 3. Percent of trees healthy along roads compared to forests for some common species.

Butternut, because of butternut canker, fared the worst, with only 22 percent of the surveyed trees healthy (Figure 4) Elms,, which suffer from Dutch elm disease, were in slightly better condition than butternut, with 46 percent healthy. Beech, with beech bark disease and 54% healthy, was also below average in crown condition. Most conifers along roads were above average in percent of trees healthy.

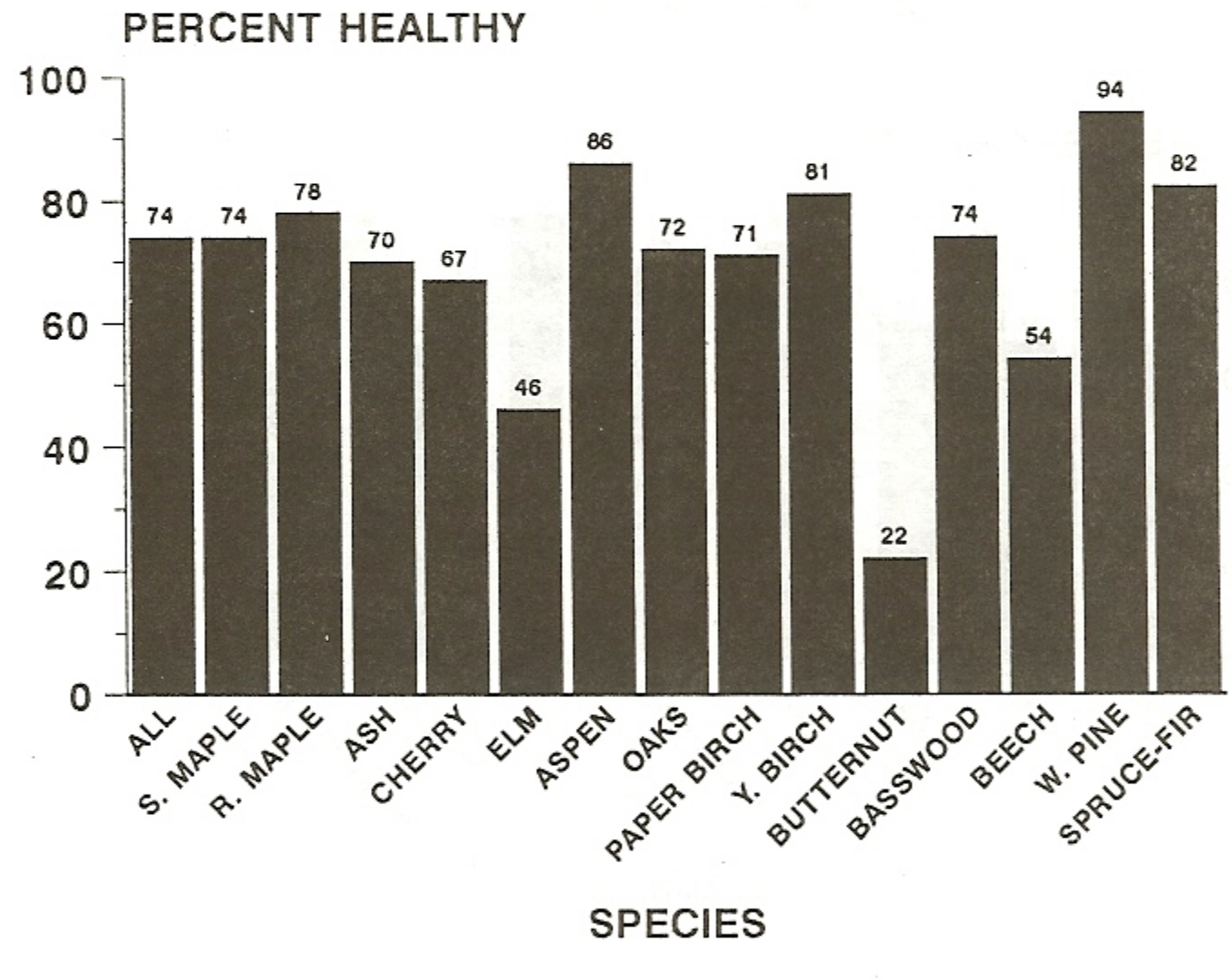


Figure 4. Percent of trees along roads healthy by tree species.

Paved Roads Versus Gravel Roads

The salt sensitive (by root uptake) maples fared better along gravel (dirt) roads than paved roads as did the moderately sensitive black cherries (Figure 5). The salt-tolerant oaks and aspens did equally well in either location. Pines, which are largely salt-sensitive, also did equally well in this survey. It is unclear why the salt-tolerant paper birches were healthier next to paved roads or the similarly tolerant white ash trees fared better along gravel roads.

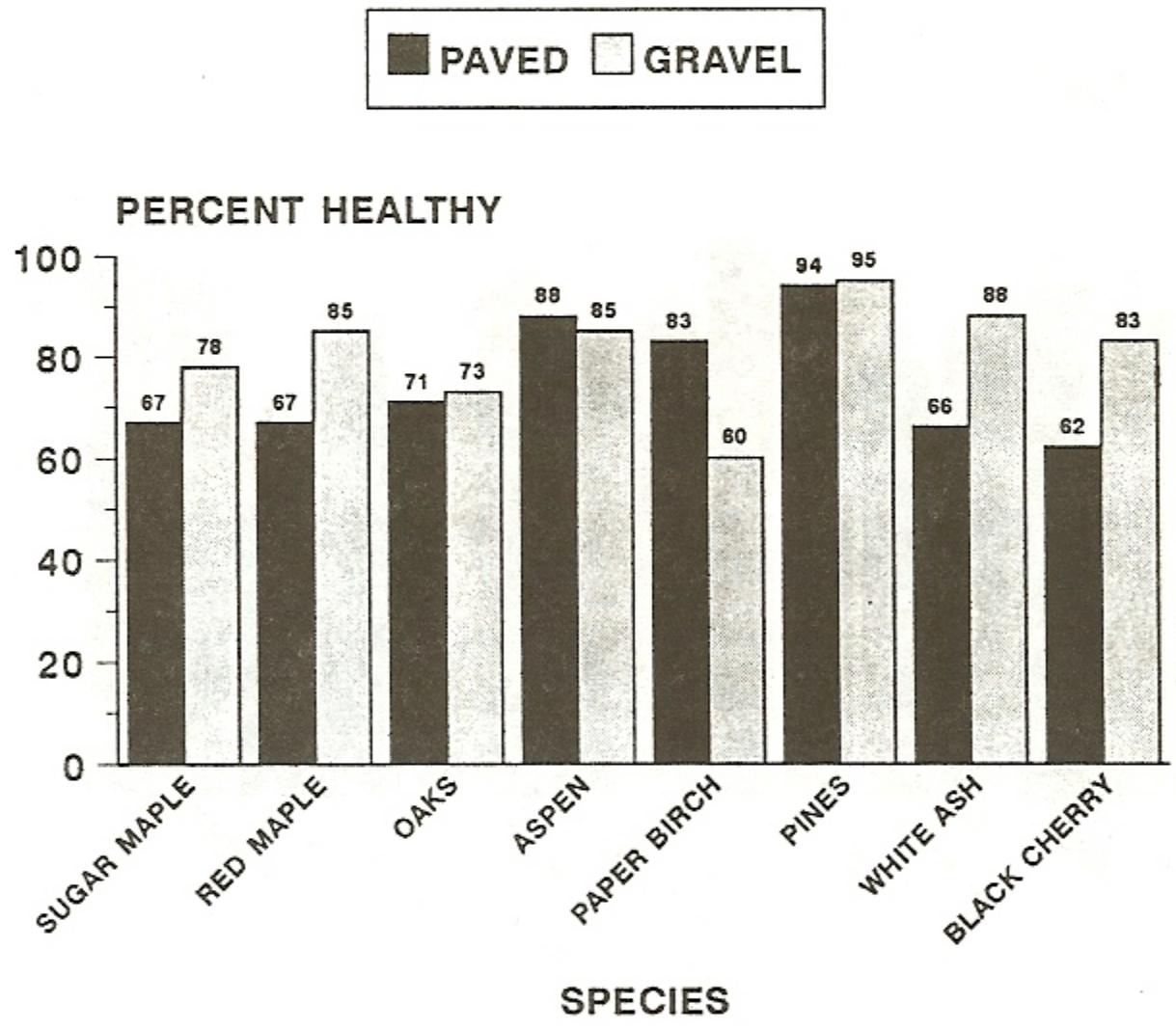


Figure 5. Health of trees along paved roads compared to gravel roads.

Tree Location

Lawn trees tended to be healthier than trees in other locations (Figure 6). Perhaps this is due to better care on the part of homeowners. Forest edge trees were the least healthy, perhaps due to increased competition from other trees in these locations.

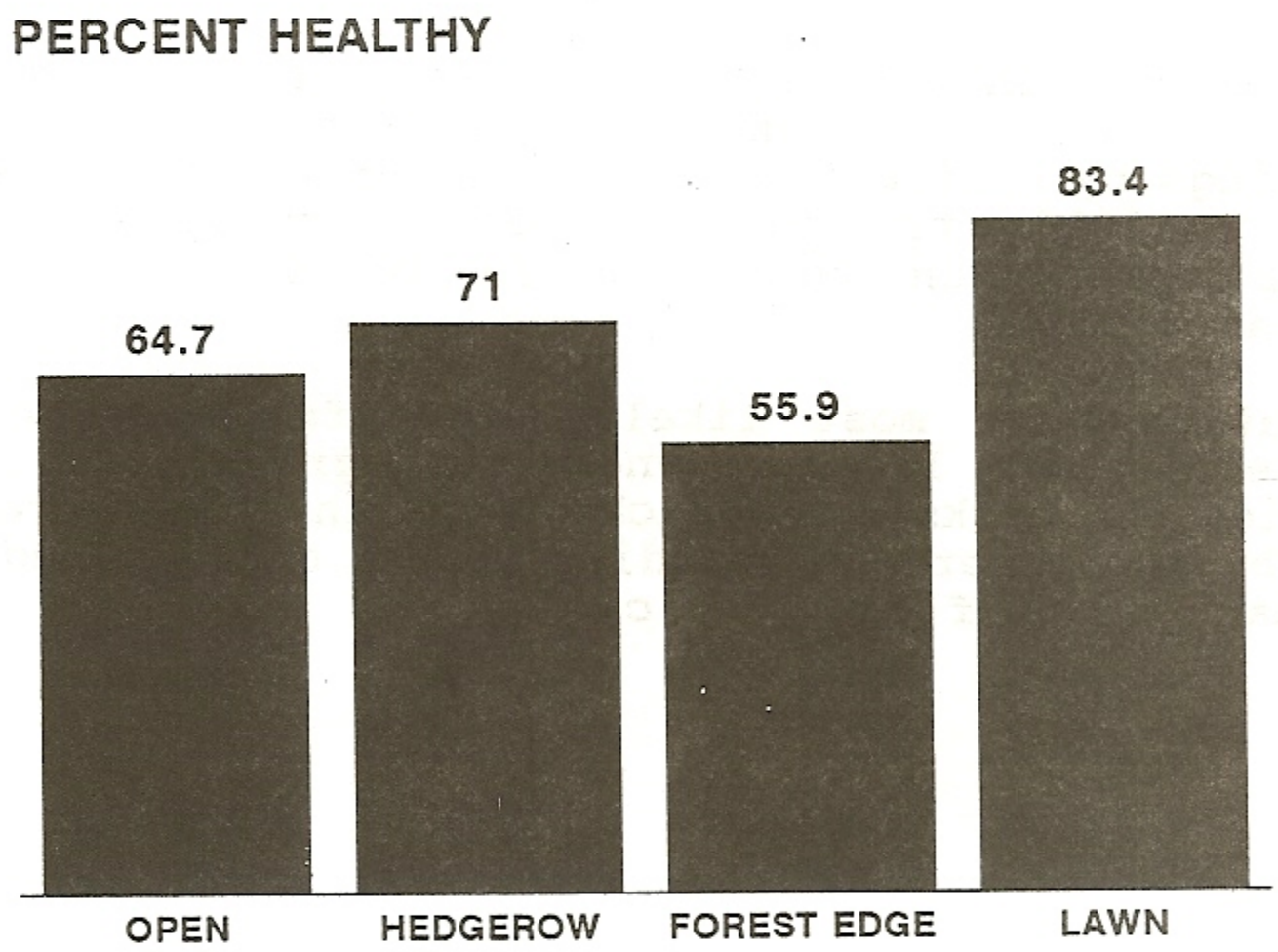


Figure 6. Percent of trees healthy based on location.

APPENDIX

An evaluation of observation viewpoint
in crown ratings for roadside trees.

Nearly 500 trees that were rated for dieback and transparency, both from the road by two people, and from opposite sides by two people, were evaluated to see how the ratings compared.

Dieback ratings by both methods were very similar. Eighty-nine percent of the trees had identical ratings by each method and only three trees (<1%) exceeded the roadside dieback rating by more than a 10% category. The correlation coefficient between dieback rated from the road and dieback rated from a full crown view was a high 0.98.

Transparency ratings had a slightly greater tendency to differ between the two methods. Eighty-four percent of the trees had identical ratings by each method and again, only three trees (<1%) exceeded the roadside transparency rating by more than a 10% category. The correlation coefficient for transparency done by the two methods was 0.95.

Crown ratings are most likely to differ between the two methods when evaluating large-crowned, open-grown trees. If care is taken to view the backside of such trees, then most trees can be safely rated by two observers standing at the opposite edge of the road off to each side of the tree crown.