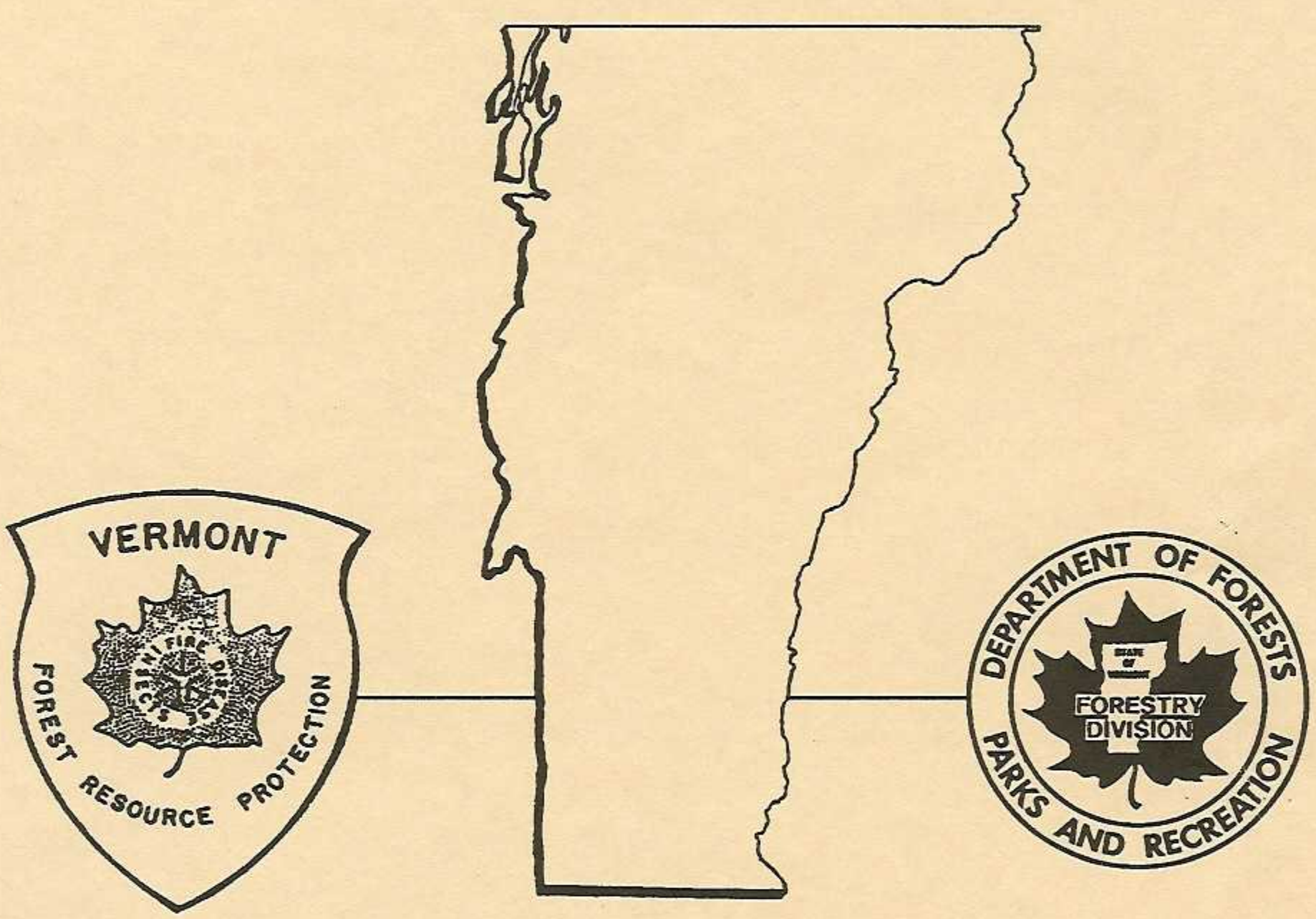
FOREST INSECT AND DISEASE CONDITIONS IN VERMONT 1992



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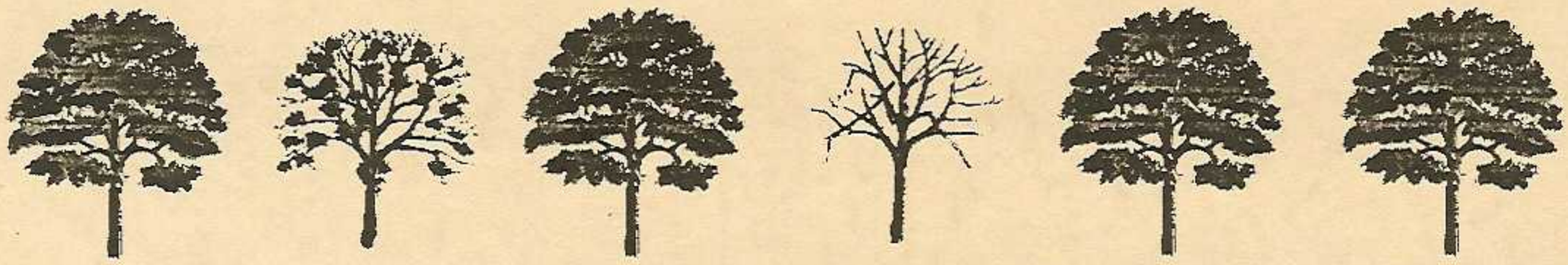

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FOREST INSECT AND DISEASE CONDITIONS IN VERMONT

CALENDAR YEAR 1992

PREPARED BY

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VERMONT
INSECT AND DISEASE HIGHLIGHTS
1992

Anthracnose was common on leaves of sugar maple and oak in the Champlain Valley.

Ash Dieback remains common at stable levels.

Balsam Gall Midge damage declined. No damage is expected in 1993.

Balsam Shootboring Sawfly caused less noticeable damage than in 1991.

Balsam Twig Aphid caused widespread moderate damage to native balsam and balsam fir Christmas trees. Damage is expected to decrease in 1993.

Beech Bark Disease symptoms were more noticeable with 1,960 acres mapped compared to 600 acres in 1991. Levels remained stable in monitoring plots.

Birch Decline was mapped on 130 acres. More dieback is expected at high elevations following consecutive years of defoliation.

Birch Defoliation decreased, with 10,200 acres of defoliation compared to 29,300 acres in 1991. Birch skeletonizer was responsible for much of the damage. Defoliation was heaviest in the central Green Mountains.

Bruce Spanworm caused scattered light damage. Moths were commonly seen in the fall.

Butternut Canker is commonly detected wherever butternut occurs.

Cherry Scallop Shell Moth continued to cause damage, but populations in southern Vermont have collapsed.

Drought conditions in early summer, compounded by dry conditions in 1991, caused leaf scorch mapped on 2,300 acres of sugar maple in the Northeast Kingdom, and hardwood chlorosis, mapped on 3,950 acres scattered throughout the state.

Eastern Spruce Gall Adelgid damage remains common at stable levels.

Fall Hemlock Looper caused only light defoliation, although moths were common statewide.

Forest Tent Caterpillar populations continued to be very low.

Frost Damage, mostly due to temperatures in the teens on May 25, was mapped on 3,320 acres. Most of the mapped damage was to beech. Damage to white ash and to Christmas trees was also widespread.

Gypsy Moth populations collapsed with only 160 acres of defoliation mapped, compared to 8,000 acres in 1991. No defoliation is expected next year.

Hardwood Decline and **Mortality** was mapped on 23,480 acres.

Heavy Seed was produced by maples and ash throughout the state.

Hemlock Woolly Adelgid was not found during statewide surveys or during surveys of the site where it was introduced in 1990.

Maple Leaf Cutter remained heavy in some areas, with 3,720 acres mapped, down from 5,200 acres in 1991. The damage remains heaviest in Caledonia, Orange and Windsor Counties.

Oak Leaf Tier moths were not caught in pheromone traps.

Oystershell Scale is becoming more evident on new shoots of beech. However, most damage is from infestations in the late 1980s.

Pear Thrips caused only scattered very light damage. Fall counts of thrips in the soil show higher populations in northern and central counties.

Red Ring Rot remains a cause of major value loss in pine and spruce stands.

Saddled Prominent populations remained very low.

Scleroderris Canker was not found in any new towns for the sixth consecutive year. However, some recent infection can be found within most of the quarantine zone.

Sirococcus Shoot Blight was found killing scattered shoots of red pine in two northern Vermont plantations.

Spring Hemlock Looper populations dropped, with no new defoliation mapped. Plots were established to monitor populations and impact of the 1991 defoliation. Fifty-six acres were sprayed with Bt.

Spruce Budworm trap catches continued at similar levels to 1991, when a sudden increase in moths occurred. However no defoliation was detected.

Spruce Mortality, primarily of upper elevation red spruce, was mapped on 3,170 acres.

Wet Site conditions led to mortality mapped on 8,120 acres, mostly due to past high water levels in the Champlain Valley.

White Pine Needle Blight caused heavy damage throughout the state.

VERMONT

1992 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 - Overall sugar maple health remained good this year, with few serious pest problems. A heavy seed crop resulted in thin tops on many trees.

Scorch on maples in hardwood stands in the Northeast Kingdom, and chlorosis in scattered locations throughout the state, occurred on droughty sites due to dry early summer conditions, compounded by dry conditions in 1991. Selective cutting activities should be minimized in these sites.

Maple Leaf Cutter continues to cause heavy defoliation, mostly in scattered Windsor, Orange and Caledonia County stands. Stands which have been defoliated for several consecutive years should not be disturbed, while other affected stands should be monitored for defoliation in 1993.

The abundance of maple flowers and dry late spring conditions may have contributed to the increase in pear thrips numbers in northern Vermont. Early in the season, stands should be monitored for damage by this insect, as well as leaf chewing by bruce spanworm, which was commonly seen flying in the fall. Although early season defoliators generally cause less impact than other pests, if damaged leaves persist, without refoliation, throughout the summer, tree stress may occur, and thinning should be delayed.

Birch - Several years of birch defoliation, combined with drought in some locations, have stressed birch trees, particularly at high elevations in the Green Mountains. Scattered paper birch dieback was observed in north-central and northeastern Vermont, while yellow birch dieback was observed in southern areas of the state. Although there was less yellow birch defoliation in 1992, paper birch defoliation continued to be widespread. Mid- to upper elevation birch stands should be evaluated for dieback. This may take place over several years, since the bronze birch borer frequently builds up in stressed stands. Trees with light dieback are likely to recover if left undisturbed. Once dieback exceeds 10%, paper birch are more likely to decline than other species, including yellow birch. If dieback is greater than 20%, trees should be salvaged quickly before stems are degarded by abrosia beetles.

Beech - Beech bark disease levels are generally stable, although symptomatic crowns were more noticeable in northern Vermont. These off-color crowns may be showing up because of dry 1991 and early 1992 conditions which also caused chlorosis on maple. Oystershell scale populations are building, although existing dieback is associated with past infestations.

Oak - With the collapse of gypsy moth populations, now is an ideal time for thinning and other selective harvest cuts in oak stands in most of the state. However, cutting should be delayed in those stands which were defoliated in 1992 to allow dieback symptoms to develop. Then, vigorous crop trees can be selected. Tree shelters may help increase survival of young trees in areas where oak is being regenerated.

Spruce-Fir - Spruce budworm and fall hemlock looper populations did not develop to defoliating levels, although moth levels continue to be higher than they were. While budworm populations remain low, managers should continue efforts to make spruce-fir stands more resistant to future outbreaks by favoring mixed species and discriminating against old growth balsam.

Balsam twig aphid damaged fir shoots throughout the state. This damage is important to brush collectors and Christmas tree growers, although no impact on tree health is expected.

Red spruce decline continues to be visible at high elevation sites.

White Pine - White pine needle blight was widespread this year, with tips of current needles browning in early August. The cause and the impact of this syndrome are unclear, however, the scattered distribution of symptomatic trees suggests that some trees are more susceptible than others. To reduce the impact of repeated needle blight, these individuals could be discriminated against.

Hemlock - No new defoliation by spring hemlock looper was detected, although stands defoliated in 1991 remained visible throughout the year. Many previously defoliated stands produced new shoots. The long term impact of defoliation is being followed in monitoring plots. Although populations appear to be collapsing, defoliated stands should not be disturbed to give the trees a chance to recover.

Fall hemlock looper moth populations remained high, although only light feeding was seen this year. Hemlock woolly adelgid was not found during surveys, and is not known to occur in western New England north of Springfield, Massachusetts.

Butternut - Butternut canker is found statewide. We recommend not cutting butternut trees that are not cankered or exhibiting dieback. These healthy appearing trees may be resistant and provide the future seed source for this vanishing species. Surveys will be started this year to determine the loss of this resource due to butternut canker disease.

VERMONT FOREST HEALTH, INSECT & DISEASE PUBLICATIONS: 1992

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

Bergdahl, D.R., J.R. Grehan, B.L. Parker, D.R. Tobi and S. Halik. 1992. Extent of injury and the fungi associated with feeding wounds created by conifer swift moth larvae on roots of red spruce and balsam fir. Phytopathology 82:(in press).

Bergdahl, D.R. and S. Halik. 1992. Persistence of *Bursaphelenchus xylophilus* in living *Pinus sylvestris*. Phytopathology 82:(in Press).

Bergdahl, D.R., S. Halik, D.R. Tobi, T.D. Scherbatskoy and D. Wang. 1992. Altered susceptibility of *Populus* to Melampsora leaf rust as a result of ozone and UV-b exposures. Proceedings: The effects of air pollution on terrestrial and aquatic ecosystems in New England and New York. Waterville Valley, New Hampshire.

Borer, C.H., D. Wang, D.H. DeHayes, J.R. Cumming and G.J. Hawley. 1992. Ozone sensitivity and genetic diversity of half-sib families of eastern white pine. Abstract *In:* The Effects of Air Pollution on Terrestrial and Aquatic Ecosystems in New England and New York. USDA.

Borer, C., D. Wang, D. DeHayes and G. Hawley. 1992. The effects of ozone on twenty half-sib families of eastern white pine seedlings. Contributed paper at Symposium on The Effects of Air Pollution on Terrestrial and Aquatic Ecosystems in New England and New York. October 19-21, 1992, Waterville Valley, New Hampshire. USDA Forest Service, NE Forest Experiment Stn.

Cumming, J.R., D.H. DeHayes, G.J. Hawley, R. Strimbeck and R.C. Wilkinson. 1992. The possible role of pollution-induced calcium perturbations in freezing injury of red spruce. Abstract *In:* The Effects of Air Pollution on Terrestrial and Aquatic Ecosystems in New England and New York. USDA Forest Service. 21 pp.

DeHayes, D.H. 1992. Winter injury and developmental cold tolerance of red spruce. *In:* Ecology and Decline of Red Spruce in the Eastern United States. C. Eagar and M.B. Adams *Eds*. Springer-Verlag, New York. pp. 295-337.

DeHayes, D.H. and G.J. Hawley. 1992. Genetic implications in the decline of red spruce. Water, Air, and Soil Pollution. 62:233-248.

DeHayes, D.H. and G.J. Hawley. Editors. 1992. Genetics in Forest Biology, First Northern Forest Genetics Conference Proceedings. The University of Vermont, School of Natural Resources, July 23-25. 187 pp.

Gage, S.F. and D.H. DeHayes. 1992. Variation in seasonal patterns of photosynthesis among red spruce and balsam fir provenances. Proceedings 1st Northern Forest Genetics Association. pp. 109-120.

Halik, S. and D.R. Bergdahl. 1992. Survival and infectivity of *Bursaphlenchus xylophilus* in wood chip-soil mixtures. Journal of Nematology 24:(in press).

Hawley, G.J. and D.H. DeHayes. 1992. Degree of red spruce-black spruce introgression in montane ecosystems (Abstract). Proceedings 1st Northern Forest Genetics Association. 25 pp.

Leonard, J.G., J.R. Grehan and B.L. Parker. 1992. First instar description of *Korscheltellus gracilis* (Grote) and *Sthenopis auratus* (Grote) (Lepidoptera: Hepialidae) with a consideration of cladistic relationships between setae. J. New York Entomol. Soc. 100:594-614.

Leonard, J.G. and B.L. Parker. 1992. Association of *Korscheltellus gracilis* larvae (Lepidoptera: Hepialidae) with canopy species and forest structure on Camel's Hump mountain in Vermont. Environ. Entomol. 21:1253-1257.

Shane, J.B. and D.H. DeHayes. 1992. Developmental relationships between photosynthesis and growth among yellow birch seedlings. Proceedings 1st Northern Forest Genetics Association. pp. 109-120.

Shane, J.B., J.R. Donnelly, D.R. Bergdahl, T.D. Scherbatskoy and D. Wang. 1992. Effects of ozone and UV-b exposures on leaf resistance of *Populus* and *Acer* seedlings. Proceedings: The effects of air pollution on terrestrial and aquatic ecosystems in New England and New York, Waterville Valley, New Hampshire.

Skinner, M. and B.L. Parker. 1992. Vertical distribution of pear thrips (Thysanoptera: Thripidae) in forest soils. Environ. Entomol. 21:1258-1266.

Waite, C.E. and D.H. DeHayes. 1992. Developmental cold tolerance of red spruce and balsam fir provenances. Proceedings 1st Northern Forest Genetics Association. pp. 99-108

Wang, D., D.R. Bergdahl, J.B. Shane and T.D. Scherbatskoy. 1992. The effects of ozone and UV-b on *Populus*, *Prunus* and *Acer* in open top chambers. Proceedings: The effects of air pollution on terrestrial and aquatic ecosystems in New England and New York. Waterville Valley, New Hampshire.

Wargo, P.M., D.R. Bergdahl, D.R. Tobi, and C.W. Olsen. 1992. Crown and root interactions in declining red spruce. Proceedings: The effects of air pollution on terrestrial and aquatic ecosystems in New England and New York. Waterville Valley, New Hampshire.

INTRODUCTION

The information in this report is based largely on aerial surveys to detect defoliation, dieback and mortality, ground surveys and observation of Forest Resource Protection personnel and other forestry staff, and from work at the department's Insect and Disease Lab. Diagnostic assistance was also provided by the University of Vermont, the Vermont Department of Agriculture, the U.S. Forest Service, the Maine Forest Service, and the University of Pennsylvania.

Complete aerial surveys were flown in July, mid to late August, and September, using newly-developed sketchmapping standards.

A survey is conducted annually on 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.

WEATHER AND PHENOLOGY

After a snowless winter, cool weather caused spring budbreak and leaf development to be generally one or two weeks later than normal. Budbreak at 1400' on Mt. Mansfield was 1½ weeks later than 1991. However, when budbreak did occur, foliage developed rapidly because of a succession of warm, sunny days.

A killing frost occurred in early May, and occasionally in some locations through June 15. A severe frost on May 25 resulted in heavy damage to tree foliage, especially to ash and to beech at higher elevations. Many first instar insects were also killed. The frost was preceded by a hot spell, with temperatures in the 90's from May 19 to 23.

The 1992 growing season was generally cold and cloudy, with near-normal precipitation. Rainfall was well-distributed throughout most of the season with enough light showers to keep things growing and making the weather seem wetter than what was actually recorded. June was dry but much cooler than normal and July was the coldest ever recorded in Vermont based on average temperatures throughout the state. Plant demands for water were probably reduced by this unusually cool weather and populations of many defoliating insects that were expected to increase in 1992 appeared to be put on hold. The delay in spring development and generally cool weather continued to cause a lag of 1-2 weeks in insect phenology throughout the growing season.

Fall weather was cool and sunny, leading to a brilliant and lengthy foliage season.

1992 was particularly heavy seed year for white ash and sugar maple. Weather conditions are summarized in Figure 1 and Table 1. Phenology is summarized in Table 2.

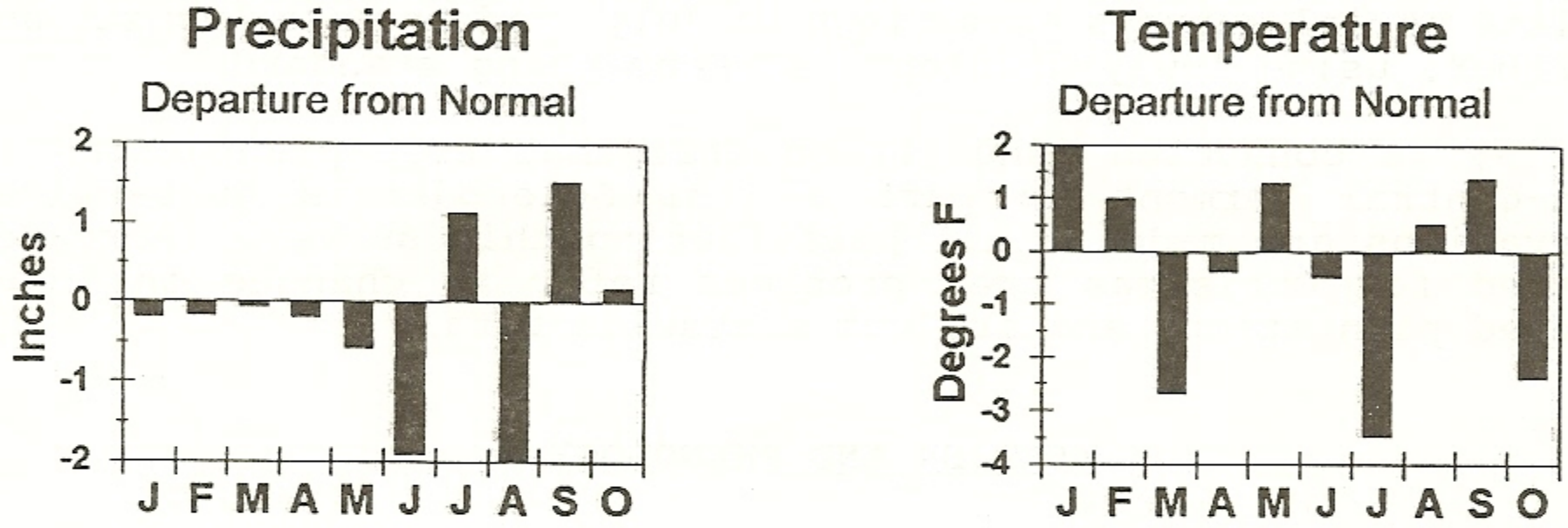


Figure 1. Departure from normal of 1992 precipitation and temperature at Burlington International Airport. Data from NOAA Local Climatological Data: Monthly Summary.

The entire Vermont meteorology database on computer disk, in an easily-used format is available from the Vermont Monitoring Cooperative. This database includes all National Weather Service main and cooperating weather stations in Vermont for their entire period of record. This is about 80 stations in total, of which 43 are currently active. Most stations have at least 40 years of data. Data include daily temperatures (mean, max, min) and precipitation (rain, snow, snow depth). Data can be accessed from any 286 or better PC running Windows.

Table 1. North-Central Vermont precipitation during the 1992 growing season.[1]

Month	Precipitation	Departure From Normal	% of Normal
April	3.04"	+ .19"	106%
May	2.77"	- .45"	86%
June	1.64"	- 1.63"	50%
July	4.10"	+ .44"	111%
August	2.82"	- .55"	84%
September	3.52"	+ .32"	110%
October	2.71"	- .24"	92%
April-October	20.60"	- 1.92"	91%

[1]Vermont Division of Forestry Stations in Wolcott, Barre, Orange, Randolph, Fairlee, and Worcester.

OZONE SUMMARY

In general, plant exposure to ozone was lower in 1992 than in other recent years. Levels were fairly high during the spring, but lower than normal in July and August. Much of the late summer low ozone levels can be attributed to cool, cloudy weather, which reduces the formation of this pollutant.

The levels of ozone that affect sensitive plants are well below the National Ambient Air Quality Standard for ozone, 0.120 ppm for 1 hour, which is intended to protect human health. Some sensitive plants can exhibit damage symptoms from levels as low as 0.060 ppm, and most sensitive species will show symptoms at 0.080 ppm concentrations.

There were no exceedances of the National Ambient Air Quality Standard for ozone in 1992, although levels damaging to sensitive plants were recorded. Table 3 shows the number of hours during the growing season (April through October) when levels of ozone were 0.060 ppm or higher (affecting some sensitive species) or 0.080 ppm or higher (affecting most sensitive species). "Episodes" reflect the number of times during the growing season when trees were exposed to long periods of high ozone levels.

Despite the relatively low ozone levels in 1992, symptoms of ozone injury were present in September on milkweed plants growing in Underhill. Milkweed is known to be sensitive to ozone. Other observations of sensitive plant species on statewide ozone biomonitoring plots did not detect injury. No ozone injury was detected on forest trees from aerial surveys.

Table 2. 1992 Growing degree days[1] and observations of phenological development.

Week Ending	Growing Degree Days		Phenology									
			Lamoille County				Springfield				Mt. Mansfield 1400'	Mt. Mansfield 2200'
	Stowe	Springfield	Budswell	Budbreak	Flowers	Full Size	Budswell	Flowers	Leaves	Full Size	Budbreak	Budbreak
4/18	9	6					S. Maple R. Maple	Popple R. Maple P. Birch	Willow			
4/25	35	43		Apple	R. Maple		P. Birch Beech	S. Maple	Cherry			
5/2	37	82	S. Maple				R. Oak W. Pine		S. Maple R. Maple P. Birch			
5/9	62	124		S. Maple E. Larch	Shadbush		R. Spruce		R. Oak Popple W. Ash		S. Maple	
5/16	124	215		B. Fir W. Ash	Hobblebush							S. Maple
5/23	238	327				S. Maple				Sugar Maple		
5/30	320	368										
6/6		450								Full Green Up		

[1] 86/50 calculations based on max.-min. thermometer.

Ozone may be important to the long-term health of Vermont's forests. Symptoms of ozone injury appear on the foliage, with reduced growth and vigor also known to occur, but it is difficult at this time to know what the total impact is to our forests.

Table 3. Ozone levels recorded during the 1992 growing season at two sites.[1]

Monitor Site	Total Number Hours With ≥ .060 ppm	Total Number Hours With ≥.080 ppm	Maximum Concentration[2] ppm	Date	Episodes[3]
Underhill	216	29	103	6-17	2
Bennington	292	50	95	4-20	3

[1] Data provided by the Vermont Air Pollution Control Division.
[2] Maximum recorded ozone level in a single hour.
[3] "Episodes" are two consecutive days when ozone levels exceeded 0.080 ppm for at least 2 hours.

FOREST INSECTS

Hardwood Defoliators

Birch Defoliation, caused by **Birch Skeletonizer**, *Bucculatrix canadensisella*, **Birch Leaf Folders**, *Ancylis discigerana*, and **Birch Leaf Miners**, *Fenusa pusilla* and *Messa nana*, decreased with 10,200 acres of defoliation aerially detected late in the season, compared to 29,300 in 1991 (Figure 2, Table 4).

Table 4. Mapped acres of late season birch defoliation in 1992.

County	Acres Mapped 1991	1992
Addison	900	600
Bennington	500	200
Caledonia	9,100	400
Chittenden	400	Trace
Essex	3,300	300
Franklin	200	Trace
Lamoille	0	200
Orange	0	2,400
Orleans	9,200	100
Rutland	900	1,900
Washington	500	1,300
Windham	1,200	300
Windsor	3,100	2,500
Total	29,300	10,200

The damage continued to be heaviest at mid to upper elevations in the central Green Mountains, although some damage could be found throughout. Birch skeletonizer caused most of the damage to both white and yellow birch in the mapped areas. An average of over 95% of the foliage was affected on white and yellow birch in areas mapped as having heavy damage.

Areas such as the Champlain Valley, where leaf miners are the most prevalent, had few acres mapped. Damage from birch leaf folder was down from last year. In the monitoring plot that was established in Granville State Forest, defoliation averaged 20%, compared to over 80% in 1991.

Bruce Spanworm, *Operophtera bruceata*, caused scattered light damage to overstory trees and more widespread light damage to sugar maple regeneration. Damage was more noticeable than in 1991. Sugarbushes in Vershire and Cabot received about 20-25 percent defoliation. Moths were commonly observed in many locations in November but were not more numerous than in 1991.

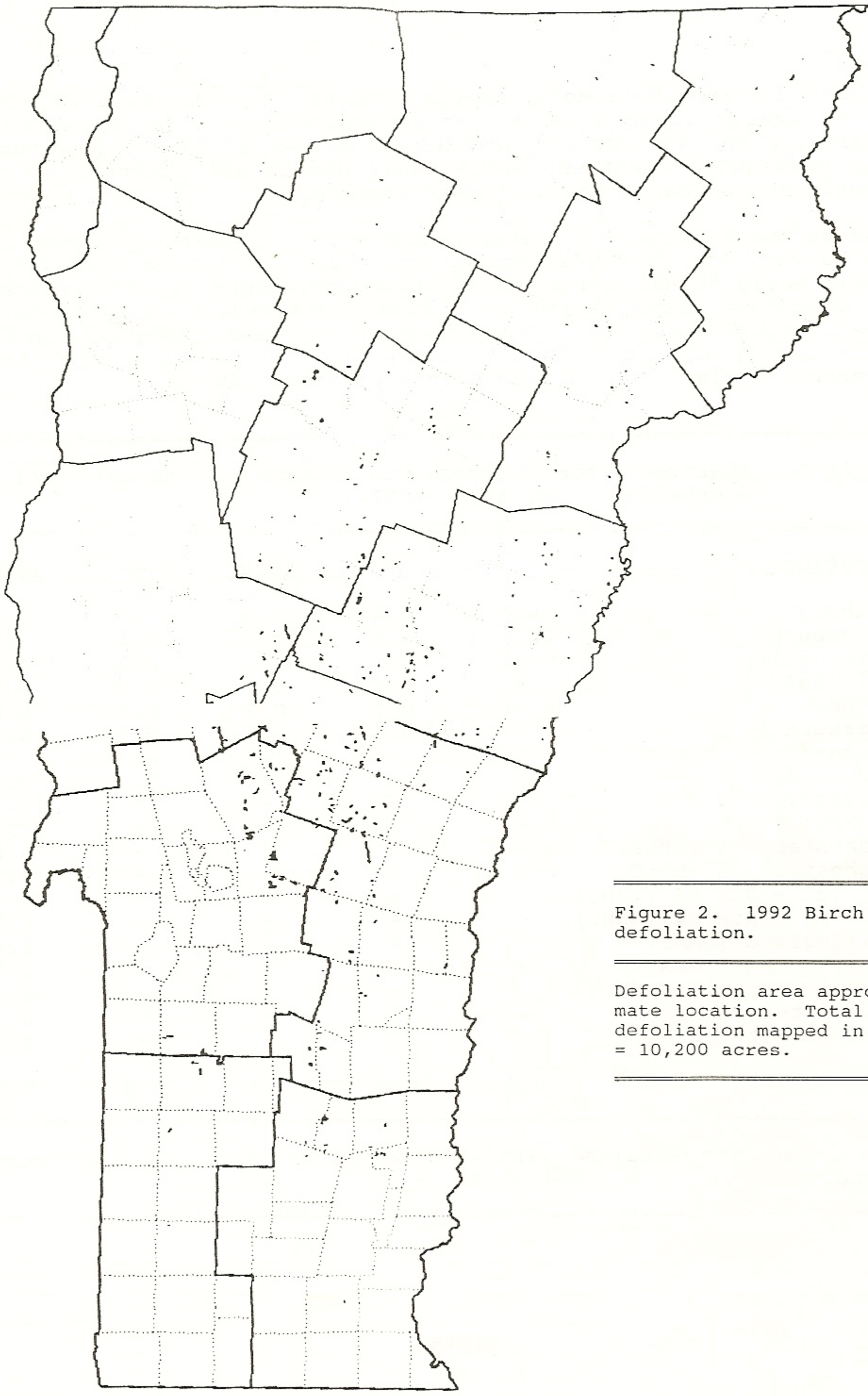


Figure 2. 1992 Birch defoliation.

Defoliation area approximate location. Total defoliation mapped in 1992 = 10,200 acres.

Cherry Scallop Shell Moth, *Hydria prunivorata*, heavily defoliated black cherry trees in a 140-acre hardwood stand in Greensboro. This area was also detected by aerial survey in 1991. In Windham and Bennington Counties, where heavy damage has occurred in the previous two years, no damage was reported.

Forest Tent Caterpillar, *Malacosoma disstria*, populations continued to be very low this year statewide. Few larvae were observed in sugar maple stands and no defoliation was observed. Moth catches in pheromone traps remain low. Moths were caught in only one of the 18 sites where traps were deployed this year (Table 5). Moths were easily caught in a Luminoc light trap in Hyde Park that combined a blue light source with a pheromone lure.

Table 5. Average number of forest tent caterpillar moths caught in pheromone traps, 1988, 1992.[1]

Location	1988	1989	1990	1991	1992
Roxbury	0.0	0.6	0.2	0.0	0.0
Waterbury	1.2	3.6	0.0	0.4	0.0
Waterville	0.2	2.2	0.0	0.0	0.0
Fairfield	-	0.0	0.0	0.0	0.0
Bethel	-	0.4	0.2	0.4	0.0
Sherburne	-	2.6	0.0	0.0	0.0
Barnard	0.6	-	2.6	2.2	-
Underhill - 1	-	-	-	0.0	0.0
Underhill - 2	-	-	-	-	0.0
Underhill - 3	-	-	-	-	0.0
Rochester - 1 (GMNF)	-	-	-	-	0.0
Rochester - 2 (GMNF)	-	-	-	-	0.5
Bristol - Rte 54 (GMNF)	-	-	-	-	0.0
Bristol - Rte 54 (GMNF)	-	-	-	-	0.0
Wallingford (GMNF)	-	-	-	-	0.0
Danby - Camp (GMNF)	-	-	-	-	0.0
Danby - Bridge (GMNF)	-	-	-	-	0.0
Manchester (GMNF)	-	-	-	-	0.0
East Dorset (GMNF)	-	-	-	-	0.0
Average	0.6	1.6	0.4	0.4	0.0

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

Gypsy Moth, *Lymantria dispar*, populations collapsed with just 160 acres of moderate defoliation in 1991 (Table 6, Figure 3). Defoliation of red oak in the mapped areas averaged about 25%, including some dieback from previous defoliations.

Table 6. Mapped acres of defoliation by gypsy moth in 1992.

County	Acres Mapped
Addison	30
Bennington	40
Chittenden	80
Grand Isle	10
Total	160

Dead larvae were common at the Arlington site, and in the focal area plot in Sandgate. Throughout, egg masses were hard to find in the fall, including in focal area monitoring plots (Table 7), where there were few pupal cases under burlap bands and where egg predation was common. No defoliation is expected in 1993.

Table 7. Gypsy moth egg mass counts from focal area monitoring plots 1986-1992.[1,2]

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

[1] Total number in 15m diameter burlap-banded plots.
[2] Average of 2 or 3 plots in 1986 and 2 plots in 1987-1992.
[3] Aerial sprayed with Bt (Foray) in 1990.
[4] Aerial sprayed with Bt (SAN415) in 1988.

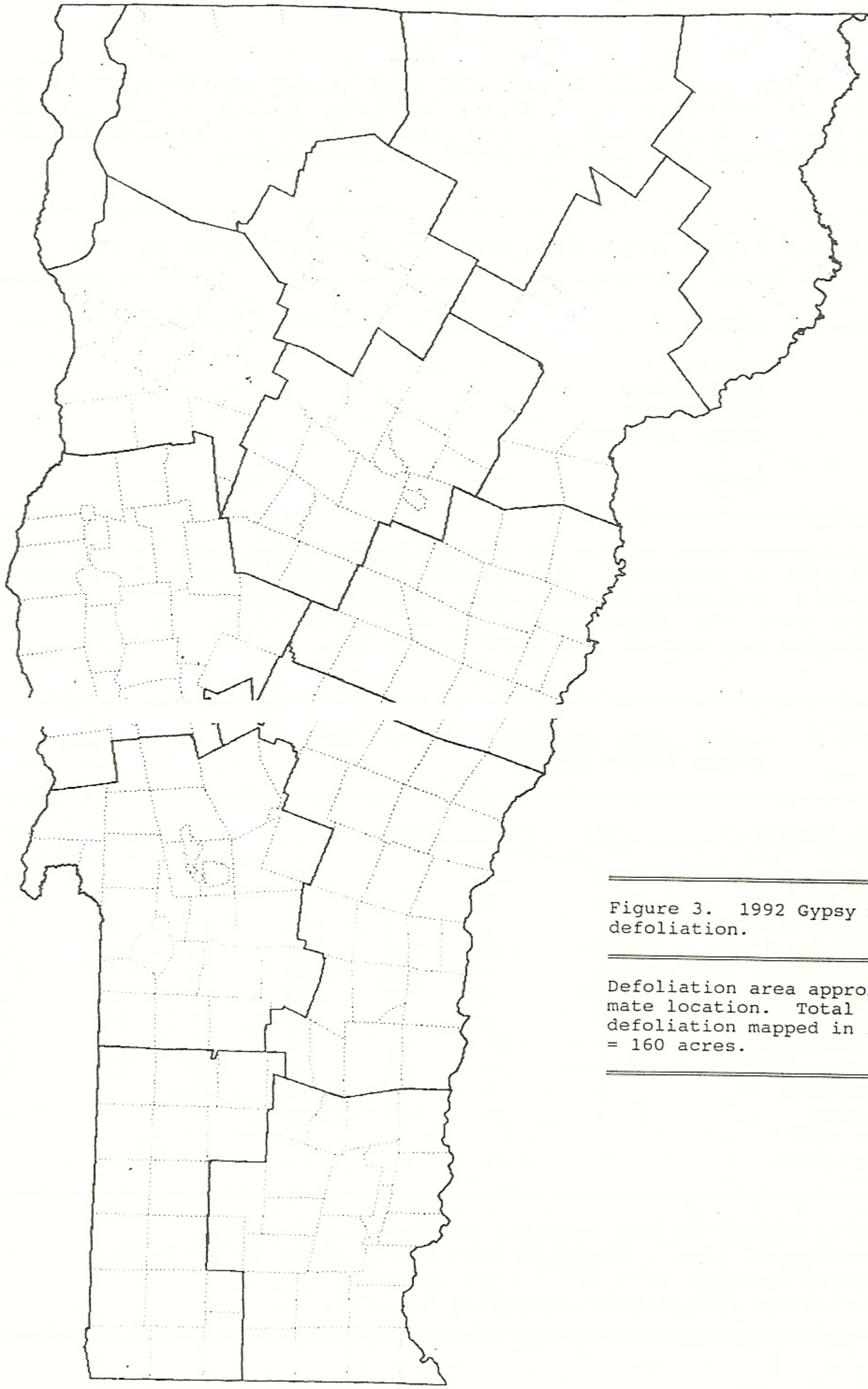


Figure 3. 1992 Gypsy moth defoliation.

Defoliation area approximate location. Total defoliation mapped in 1992 = 160 acres.

In an effort to regenerate oak in the aftermath of a gypsy moth outbreak, tubex tree shelters are being used experimentally in the Green Mountain National Forest. Shelters have allowed good acorn germination, height growth response, and protection from deer browse. However, since gypsy moth will defoliate trees in the tubes, the use of shelters must be done between outbreaks.

Maple Leaf Cutter, *Paraclemensia acerifoliella*, remained heavy in some areas, although damage was down from 1991. 3,720 acres of damage were mapped during aerial surveys, compared to 5,200 acres mapped last year (Table 8, Figure 4). Damage to sugar maple crowns averaged just over 50% in one mapped area.

Table 8. Mapped acres of defoliation by maple leaf cutter in 1992.

County	Acres Mapped
Addison	30
Caledonia	940
Chittenden	30
Orange	660
Orleans	30
Rutland	20
Washington	80
Windsor	1930
Total	3720

In several stands, heavy mining was observed early in the season, but damage did not develop. Injury from maple leaf cutter feeding could be found on regeneration and in lower crowns throughout. Populations were probably temporarily depressed due to cool weather, but may increase in 1993.

Oak Leaf Tier, *Croesia semipurpurana*, larvae or damage were not observed. No moths were caught in pheromone traps (Table 9).

Table 9. Oak leaf tier in pheromone traps 1988-1992.

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

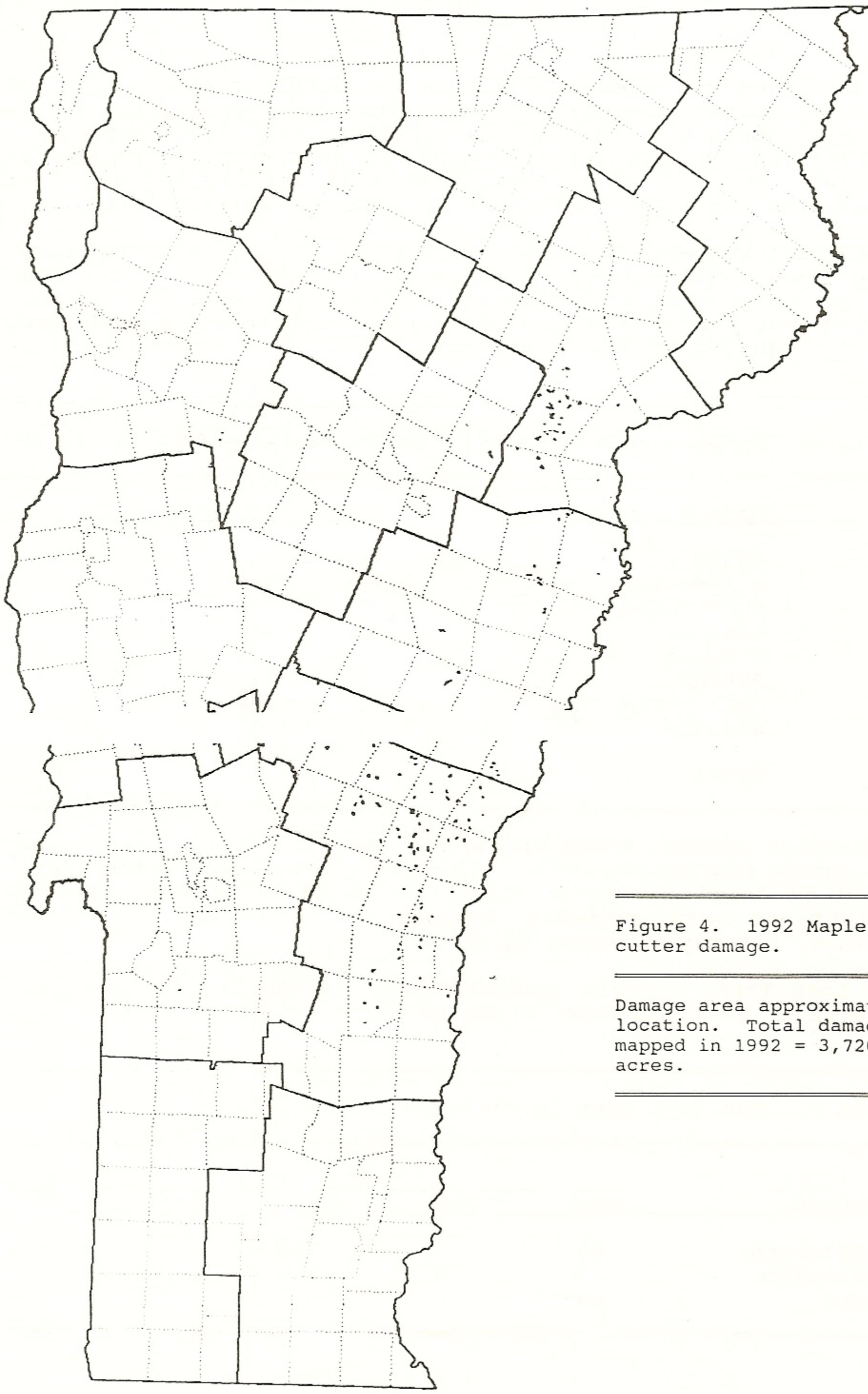


Figure 4. 1992 Maple leaf cutter damage.

Damage area approximate location. Total damage mapped in 1992 = 3,720 acres.

Saddled Prominent, *Heterocampa guttivata*, populations remained low, with larvae rarely observed. Although moths were easily caught in light traps, populations were very low in the two locations where egg sampling was done. There were no eggs on the ten leaf-clusters examined in Shrewsbury, and only four, of which three were parasitized, on the ten clusters sampled in Wilmington.

OTHER HARDWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Alder leaf beetle *Altica ambiens alni*	Alder	Victory Fairlee	Heavy infestation.
American Aspen Beetle *Gonioctena americana*			Not observed.
American Dagger Moth *Acronicta americana*			Not observed.
Apple Bucculatrix *Bucculatrix pomifoliella*	Shadbush	Windsor Co.	Ornamentals.
Aspen Leaf Roller *Pseudoexentera oregonana*	Poplar	Middlebury	Shade tree.
Birch Leaf Folder *Ancylis discigerana*			See narrative.
Birch Leaf Miner *Fenusa pusilla*			See narrative.
Birch Skeletonizer *Bucculatrix canadensisella*			See narrative.
Blackheaded Ash Sawfly *Tethida cordigera*	White Ash	Readsboro	Heavy damage in same roadside area defoliated in 1991.

OTHER HARDWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Bruce Spanworm *Operophtera bruceata*			See narrative.
Cecropia Moth *Hyalophora cecropia*			Not observed.
Cherry Scallop Shell Moth *Hydria prunivorata*			See narrative.
Comma Butterfly *Polygonia comma*			Not observed.
Dogwood Sawfly *Macremphytus sp.*			Not observed.
Early Birch Leaf Edgeminer *Messa nana*			See narrative.
Eastern Tent Caterpillar *Malacosoma americanum*	Cherry Apple	Throughout	Remains common, similar to 1991. Caterpillar mortality was observed in some nests in Rutland County following the May 25 freeze.
Elm Leaf Beetle *Pyrrhalta luteola*	Elm	Throughout	Heavy damage to ornamental in Springfield.
Elm Leaf Miner *Fenusa ulmi*			Not observed.
Elm Sawfly *Cimbex americana*	Birch	Lincoln	Isolated observation.
Euonymus caterpillar *Yponomeuta sp.*	Euonymus	Stowe	Heavy infestation on ornamentals.

OTHER HARDWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
European Snout Beetle *Phyllobius oblongus*	Sugar Maple	Addison Chittenden Lamoille Counties	Unusually common, causing light to moderate defoliation on ornamentals.
Fall Cankerworm	Hardwoods	Castleton	Larvae observed.
Alsophila pometaria	Willow	Addison & Franklin Counties	Light damage. Not observed in 1991.
Fall Webworm *Hyphantrea cunea*	Cherry Elm Other spp.	Throughout	Remains heavy in southeastern Windham County. Generally lighter damage than 1991.
Flat Leaf Tiers *Psilocorcis sp.*			Not observed.
Forest Tent Caterpillar *Malacosoma disstria*			See narrative.
Green Striped Mapleworm *Anisota rubicunda*			Not observed.
Gypsy Moth *Lymantria dispar*			See narrative.
Half Winged Geometer *Phigalia titea*			Not observed.
Imported Willow Leaf Beetle *Plagiodera versicolora*	Willows Poplar	Widespread in northern Vermont	Common again this year. Caused moderate defoliation. Most willows affected.

OTHER HARDWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Japanese Beetle *Popillia japonica*	Ornamentals	Widespread	More numerous than 1991 in northern Vermont. Damage less common than in previous years in southern Vermont.
Large Aspen Tortrix *Choristoneura conflictana*	Quaking Aspen	Morrisville	Blow-in of adult moths occurred in late June.
Linden Looper *Erranis tiliaria*			Not observed.
Locust Leaf Miner *Odontata dorsalis*	Black Locust	Chittenden & Windham Counties	Light-moderate damage. Down from 1991.
Maple Leaf Cutter *Paraclemensia acerifoliella*			See narrative.
Maple Leafblotch Miner *Cameraria aceriella*	Sugar Maple	Chittenden County	Very light.
Maple Basswood Leaf Roller *Sparganothis pettitana*	Sugar Maple	Clarendon Bristol	Light damage.
Maple Trumpet Skeletonizer *Epinotia aceriella*	Sugar Maple	Throughout	Common. Damage generally less than the past couple of years. Some heavy damage in the Northeast Kingdom. Moths seen in Windham County.

OTHER HARDWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Maple Webworm *Tetralopha asperatella*			Not observed. Common in 1991 but not reported this year.
Mountain Ash Sawfly *Pristiphora geniculata*	Mountain Ash	Rutland Barre	Ornamentals. Elsewhere, unusually absent.
Oak Leafroller *Archips semiferanus*			Not observed.
Oak-leaf Shot-hole *Japanagromyza viridule*	Red Oak	Underhill Center Montpelier	Single trees.
Oak Leaf Tier *Croesia semipurpurana*			See narrative.
Oak Skeletonizer *Bucculatrix ainsliella*			Not observed.
Orange-humped Mapleworm *Symmerista leucitys*			Not observed.
Pear Sawfly *Caliroa cerasi*			Not observed.
Pin Oak Sawfly *Caliroa sp.*			Not observed.
Red-humped Oakworm *Symmerista canicosta*	Cherry	Danville	Heavy on one bush.
Rose Chafer *Macrodactylus subspinosus*	Hardwood Ornamentals	Widespread	Heavier than in 1991.
Saddled Prominent *Heterocampa guttivata*			See narrative.

OTHER HARDWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Satin Moth *Leucoma salicis*	Cottonwood	Widespread	Locally, heavy defoliation, but less common than 1991. In several areas, defoliation occurred for the third consecutive year. Dieback is occurring in the Royalton area.
Solitary Oak Leaf Miner *Cameraria hamadryadella*			Not observed.
Spear-Marked Black Moth *Rheumaptera hastata*	Birch	Addison, Lamoille & Windsor Counties	Moths unusually abundant.
Spiny Elm Caterpillar *Nymphalis antiopa*			Not observed.
Spring Cankerworm *Paleacrita vernata*			Not observed.
Uglynest Caterpillar *Archips cerasivoranus*	Cherry	Northern Vermont	Occasionally observed. Similar to 1991.
White Marked Tussock Moth *Orgyia leucostigma*	Hardwoods	Whitingham	Egg mass.

SOFTWOOD DEFOLIATORS

Fall Hemlock Looper, *Lambdina fiscellaria*, caused only light defoliation in widely scattered northern Vermont locations, although moths had been common statewide in the fall of 1991.

Insect populations were sampled at 20 sites. Branches were collected in the winter for egg extraction, which was done by the Maine Forest Service. No defoliation other than light was predicted based on egg counts. In mid-June, larvae were sampled by beating 3 one-meter long branches of regeneration sized trees. In the fall a single pheromone trap was set out at each site (Table 10).

Table 10. Fall hemlock looper population counts in 1992-93.

Location		Winter 91-92	Summer 1992	Fall 1992	Winter 92-93
County	Town	Viable Eggs/3 m[1]	Larvae per 3 m[2]	Moths per Trap[3]	Viable Eggs/3 m[1]
Addison	Ferrisburg	0	0	38	5
Bennington	Dorset	3	0	15	0
Caledonia	Barnet	3	3	0	2
Caledonia	Waterford	3	2	241	0
Chittenden	Bolton	0	0	714	0
Chittenden	Underhill-1	-	-	325	-
Chittenden	Underhill-2	-	-	521	-
Franklin	Swanton	2	0	-	4
Grand Isle	Alburg	0	0	-	0
Lamoille	Morristown-W	3	1	342	-
Lamoille	Morristown-N	0	0	261	-
Orange	Strafford	1	0	454	0
Orange	Williamstown	3	0	316	3
Orleans	Derby	1	4	320	0
Rutland	Castleton	0	0	7	0
Rutland	Pittsford	1	0	10	1
Washington	Duxbury	-	-	666	-
Windham	Brattleboro	0	0	22	1
Windsor	Sharon	0	0	94	0
Windsor	Stockbridge	5	0	201	0
Average		1.5	0.6	264	1.1

[1] Number of eggs per three 1m long mid-crown branches (<4.5/3m=light defoliation).
[2] Number of larvae per 3m of foliage on understory trees (<30/3m=light population).
[3] Number of moths per Multi-pher trap baited with a fall hemlock looper pheromone.

Moths were commonly observed during September for the second consecutive year, though perhaps in fewer numbers. Egg samples have been taken again in monitoring plots to better predict damage. Numbers suggest some moderate defoliation may occur in 1993 (Table 10). Based on the Maine Forest Service sample procedure, five larvae on three branches indicates a chance for moderate defoliation.

Spring Hemlock Looper, *Lambdina athasaria*, caused only light damage in 1992. In 1991, 1,600 acres of mostly heavy damage were mapped in southeastern Windham County.

Early in the season, damage was more obvious in areas defoliated in 1991 than it had been the previous fall. Needles in these areas had dried over the winter, browned and dropped. Most areas produced new shoots this year, even where damage had been heavy. However, severely damaged hemlock in several stands was salvaged.

The biological relationship between pupal counts and subsequent damage is unknown. In April, pupae were sampled in 15 southeastern Windham County stands (Figure 5). Although there were high numbers of pupae in some plots, no heavy defoliation occurred.

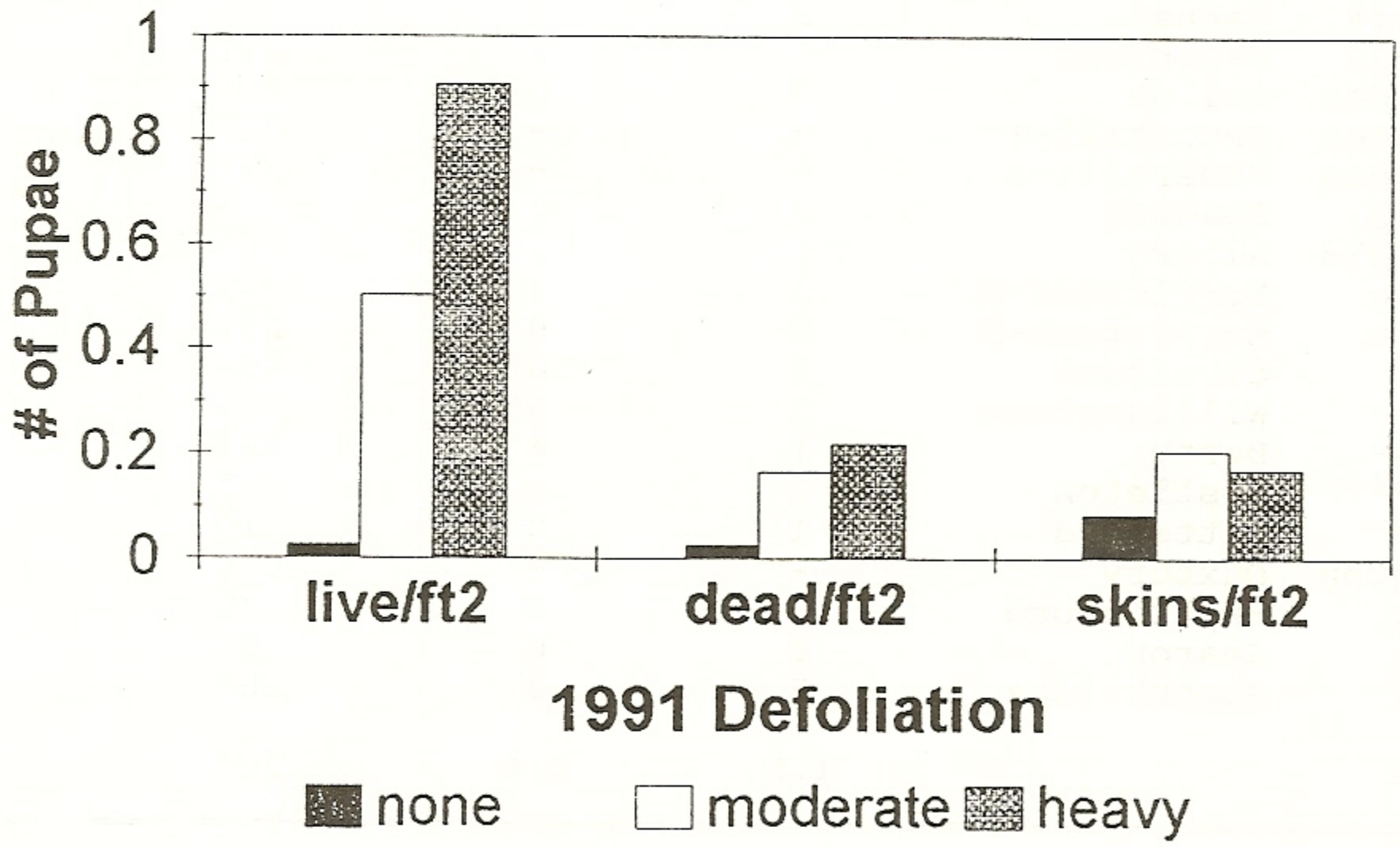


Figure 5. Numbers of spring hemlock looper live pupae, dead pupae, and pupal skins in the duff layer in April 1992 by defoliation in 1991.

Moth flights were heavy, again, in some stands. Most activity was in or near areas which had been defoliated in 1991, except large numbers of moths were reported from Westminster which had little previous defoliation. To monitor moth populations, 2 clusters of 3 traps were placed in each of 3 stands. In each stand, one cluster had traps baited with a lure developed for fall hemlock looper and one cluster had unbaited traps. Moths were caught in both baited and unbaited traps (Table 11). Moths appear to enter unbaited traps as a place of shelter.

Table 11. Number of spring hemlock loopers caught in unbaited multipher traps and traps baited with fall hemlock looper pheromone, Summer 1992.

Cluster Location	1991 Defoliation	Moths per Trap[1]	
		Unbaited	Baited
Vernon	None	2	22
Dummerston	Moderate	96	89
Vernon	Heavy	116	173

[1] Average of three traps.

Moths were also collected from a black light trap placed in a stand in Guilford. Catches are summarized in Table 12. Peak flight occurred in mid-June. Since insect development was slow in 1992, this suggests that early to mid-June would be the best time to look for this insect.

Table 12. Numbers of spring hemlock looper moths caught in a black light trap in Guilford, 1992.

Date	Total # of Moths Caught
	Thousands
6/11-6/16	2368
6/17-6/22	740
6/23-6/28	72
6/29-7/4	

Eggs were sampled in three stands in late June and were extracted by the Maine Forest Service. Counts were made of hatched eggs as well as viable eggs and larvae in 1992 (Table 13). The total number of hatched eggs minus the number of larvae on the branch was

assumed to be the number of eggs that hatched in 1991. The counts of viable eggs and larvae are well above numbers which have been found to cause hemlock defoliation by fall hemlock looper in Maine. However, the area which had had heavy defoliation in 1991 had only light defoliation in 1992. Because the other two sample areas were sprayed, subsequent natural defoliation is unknown.

Table 13. Spring hemlock looper eggs and larvae on mid-crown branches collected on 6/29/92, compared to 1991 defoliation and 4/92 pupal counts, where available.

1991 Defoliation	Live Pupae/Ft^2	Viable Eggs & Larve/m	# Eggs/m Hatched in '91[1]
Moderate	NA	17	30
Moderate-heavy	.74	20	29
Heavy	4.3	44	40

[1] Assumes that Total # Hatched Eggs - # Larvae = # Hatched in 1991.

Observations of insect development are summarized in Table 14.

Table 14. Phenological development of spring hemlock looper in 1992.

Date	Observation
5/26	Some emergence, mostly pupae
6/3-6/11	Moths numerous
6/19-6/25	Moths and eggs present
6/29	Male moths only, green & brown eggs, and 1st instar larvae
7/7-7/8	Male moths, brown eggs only, 1st & 2nd instar larvae
7/13	Occasional brown eggs, no moths, 1/3 1st instar, 2/3 2nd instar
7/20	2nd instars
7/29	No 1st instars, Some 2nds, Mostly 3rds

Hemlock looper impact monitoring plots were established in cooperation with the U.S. Forest Service, and the states of Maine, New Hampshire and Massachusetts. Fifteen stands in Vermont are being studied. Defoliation levels in those plots are shown in Figure 6.

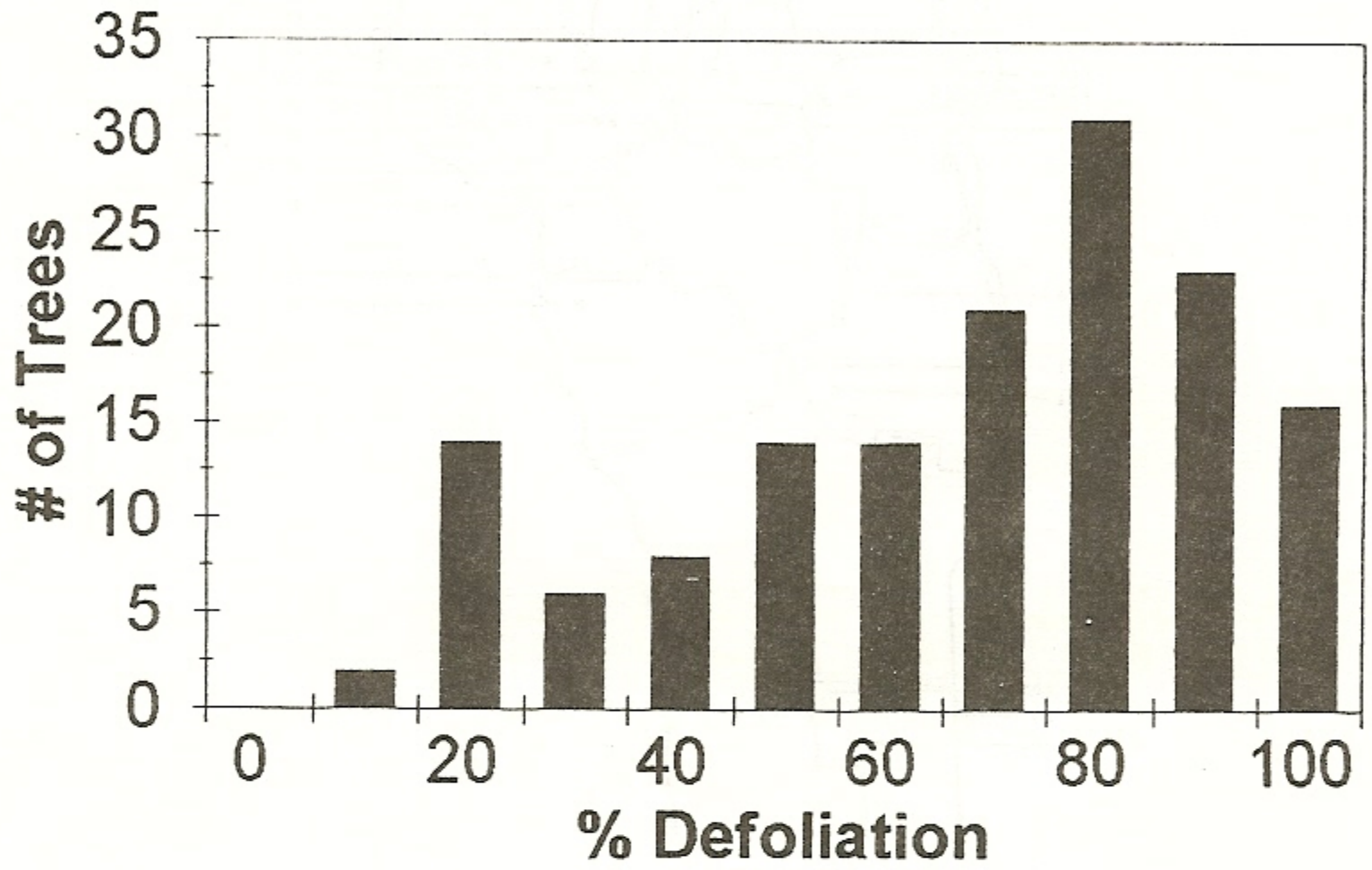
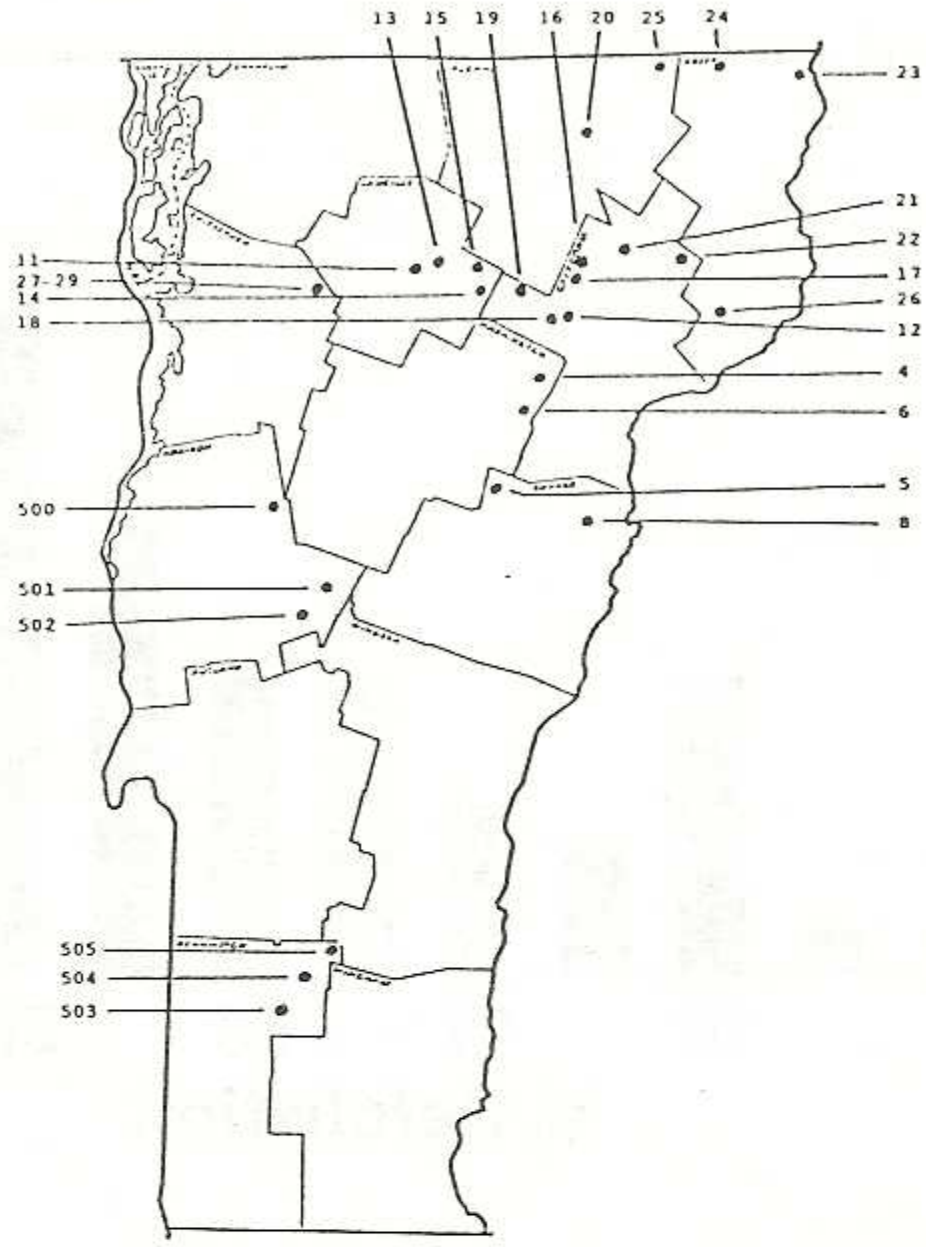


Figure 6. Number of trees in each defoliation category in spring hemlock looper impact plots, April 1992.

Two properties, totalling 56 acres were sprayed on July 20 with Foray 48B at 16 b.i.u. per acre. Landowner objectives for spraying were to protect aesthetic concerns, and to maintain foliage on trees that provide a sound barrier from the noise of I-91. One of the stands had been moderately defoliated in 1991 and had been recently logged; the other was undefoliated. After spraying, larvae remained common in one of the areas, but neither area was defoliated.

Spruce Budworm, *Choristoneura fumiferana*, continued at low levels, with no visible defoliation detected. The number of moths captured in pheromone traps in northern Vermont, which showed a sudden increase in 1991, continued at similar levels in 1992 (Figures 7 and 8). Moth catches were very low in traps placed by the U.S. Forest Service on the Green Mountain National Forest (Figure 7).

A special survey was conducted for large larvae in late June for the five locations with the highest moth catch in 1991. Ten 18" branches were collected per site. Two budworm larvae were collected in Walden during this survey, but none were found at the other four locations. This may indicate that the moths caught are a result of indigenous low-level populations rather than blow-ins and that populations have not increased enough to cause damage or readily find larvae.



Northern Vermont			Green Mountain National Forest		
Location		# of Moths/Trap	Location		Moths/Trap
4	Danville Hill	14.0	500	W. Lincoln	0.3
5	Reservoir	16.0	501	Granville	0.3
6	Marshfield Pd.	0.7	502	Hancock	1.0
8	Scotch Hollow	9.0	503	Winhall	0.0
11	Centerville	35.0	504	Peru	0.0
12	Coles Pd.	14.3	505	Landgrove	0.0
13	Diggins	13.3			
14	Wolcott F&G	5.3			
15	Bear Swamp	16.3			
16	Withers	15.3			
17	Mason	27.0			
18	Star School	17.7			
19	Beagle Club	18.3			
20	Brownington Pd.	24.0			
21	Calendar Brk.	24.3			
22	Chieppo	2.3			
23	Bunnel Brk.	2.7			
24	Norton Cem.	10.7			
25	Holland Pd.	11.0			
26	Victory Bog	4.0			
27	Underhill (VMC)	29.0			
28	Underhill-2	3.3			
29	Underhill-3	2.3			
	Average (excluding 28 & 29)	14.3		Average	0.3

Figure 7. Spruce budworm pheromone plot locations and average number of moths caught per trap in 1992.

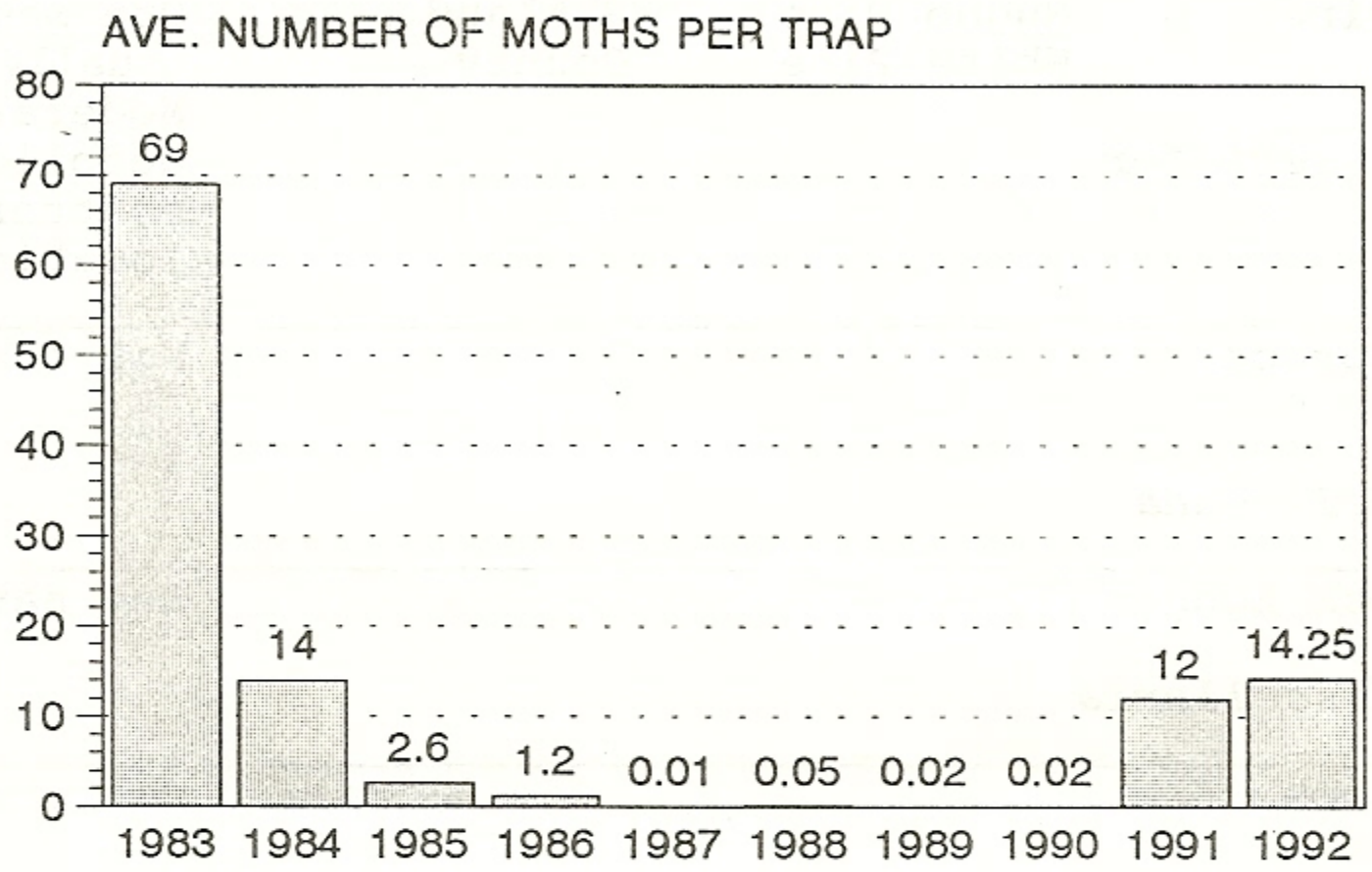


Figure 8. Average number of spruce budworm moths caught in pheromone traps, 1983-1992. Three to five traps per site, for 15-22 sites.

OTHER SOFTWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Arborvitae Leaf Miner *Argyresthia thuiella*	Arborvitae	Widespread in northern Vermont	Decreasing. Only light defoliation.
Balsam Fir Sawfly *Neodiprion abietis*			Not observed.
Dash-lined Looper *Protoboarmia porcelaria*	Many	Barnet	Hemlock-fir stand.
Dogwood Sawfly *Macremphytus tarsatus*	Red Pine	Barton	Found in pre-pupal stage in red pine cone in March.

OTHER SOFTWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
European Pine Sawfly *Neodiprion sertifer*	Mugho Pine White Pine	Rutland County	Ornamentals. Unusually abundant. Moderate-heavy defoliation in scattered locations.
European Spruce Needleminer *Taniva albolineana*			Not observed.
Fall Hemlock Looper *Lambdina fiscellaria*			See narrative.
Green Hemlock Needleminer *Coleotechnites apicitripunctella*			Not observed.
Introduced Pine Sawfly *Diprion similis*	Red Pine Scots Pine White Pine	Addison, Rutland & Windsor Counties	Widespread. Heavy damage to Christmas trees in Bridgewater. Down from 1991 in northern Vermont.
Larch Casebearer *Coleophora laricella*	Larch	Widely scattered	Light damage, similar to 1991 in northern Vermont, but not as high as in 1990-91 in southern Vermont.
Larch Sawfly *Pristophora erichsonii*			Not observed.
Microbagworm *Psychidae*	Many	Stowe	A few on a building.
Nursery Pine Sawfly *Diprion frutetorum*			Not observed.

OTHER SOFTWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Orange Spruce Needleminer *Pulicalvaria piceaella*			Not observed.
Pine False Webworm *Acantholyda erythrocephala*			Moderate-heavy Christmas tree damage 1991, but not observed in 1992.
Pine Webworm *Tetralopha robustella*			Not observed.
Red-Headed Pine Sawfly *Neodiprion lecontei*	Scots Pine	Bennington County	Light damage to Christmas trees.
Salt Marsh Caterpillar *Estigmene acrea*	Norway Spruce	Orwell	Isolated observation on spruce (not usual host).
Spring Hemlock Looper *Lambdina athasaria*			See narrative.
Spruce Bud Moth *Zeiraphera canadensis*	White Spruce Blue Spruce	Northern Vermont	Light infestations in Christmas tree plantations. Remains stable.
Spruce Budworm *Choristoneura fumiferana*			See narrative.
Web-spinning Sawfly *Pamphiliidae*	Scotch Pine	Bristol	Observed feeding on last year's needles; 15-20 "nests" per tree.
White Pine Sawfly *Neodiprion pinetum*			Not observed.

OTHER SOFTWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Yellow-headed Spruce Sawfly *Pikonema alaskensis*	Blue Spruce White Spruce	Northern Vermont	Heavier than usual on ornamentals.
Yellow-lined Conifer Looper *Nyctobia limitaria*	Hemlock	Swanton Cornwall	Collected in hemlock stands being examined for hemlock looper.

SAPSUCKING INSECTS, MIDGES, AND MITES

Balsam Gall Midge, *Paradiplosis tumifex*, damage to balsam fir Christmas trees declined this year, with only 20 acres of damage detected in the annual survey of northern Vermont plantations, compared to 146 acres in 1991. No damage is expected in 1993.

Balsam Twig Aphid, *Mindarus abietinus*, caused widespread, moderate damage to native balsam and balsam fir Christmas trees. Sooty mold was observed in some plantations, but levels were not unsightly. Some light damage to fraser fir Christmas trees was also observed.

Twig aphid populations did decrease slightly in northern Vermont. In the annual survey of northern Vermont plantations, 190 acres of mostly moderate damage were detected compared with 256 acres in 1991.

Eggs were sampled in several plantations in the spring or the fall. A plantation in Bennington sampled in the spring averaged 1.4 eggs/cm on damaged shoots and 0.8 eggs/cm on undamaged shoots. Two plantations in Windham county which were moderately damaged were sampled in the fall. Egg counts averaged .01 and .25 per cm. Damage should decrease in 1993.

Eastern Spruce Gall Adelgid, *Adelges abietus*, was commonly found on spruce causing noticeable damage, remaining at stable levels. In surveyed northern Vermont plantations, 34 acres of mostly light-moderate damage to white spruce Christmas trees was observed, compared to 32 acres in 1991. Curly shoots on white spruce in one Christmas tree plantation are thought to be from aborted galls.

Hemlock Woolly Adelgid, *Adelges tsugae*, was not observed. Seventeen hemlock sites, scattered throughout the state, were systematically sampled. No signs of the insect were observed. An intensive survey of hemlocks along Lake Morey where a vacation homeowner reported seeing cotton balls on his hemlocks two years ago also failed to detect the presence of this insect.

Monitoring continues at the Stockbridge site where hemlock woolly adelgid was introduced in 1990. During two systematic surveys in May and one in October, a total of 3 planted hemlock tublings and 5 hemlock wildlings were pulled and destroyed. There was no adelgid on any of them. Sixteen trees, known to be uninfested, were planted at the site to monitor whether the insect is still present. These trees should become infested with adelgids if the insects are still in the area.

To determine the general distance from the planting site to the nearest hemlock, survey lines were scouted in the four directions. The distance to the first overstory hemlock encountered was recorded. The closest hemlock was to the south (4,300 ft). In the other directions, hemlock was encountered at 5,800 ft. (north), 7,400 ft (west), and 13,500 ft (east).

Oystershell Scale, *Lepidosaphes ulmi*, is becoming more evident on new shoots of beech in scattered locations statewide. Nymphs were heavy in early June on dropped beech leaves in Wilmington.

Most of the damage to overstory trees particularly in northern Vermont is old damage from infestations in the late 80's. In our survey plot in Huntington, the number of scales on overstory trees is about the same as in 1991 or decreased somewhat, while levels on suppressed trees have increased to nearly 1988 levels (Table 15, Figure 9).

Table 15. Number of oystershell scales on current year beech twigs in Camel's Hump State Forest, 1987-1992[1].

	Average Number of Mature Viable Scales per:											
	Twig						Millimeter					
	1987	1988	1989	1990	1991	1992	1987	1988	1989	1990	1991	1992
Suppressed	3.7	3.4	1.7	2.1	0.9	2.6	0.10	0.22	0.05	0.05	0.04	0.19
Intermediate	6.8	2.8	1.0	8.5	5.9	6.8	0.07	0.12	0.01	0.13	0.14	0.09
Codominant	8.8	8.8	3.7	7.4	10.7	4.8	0.27	0.64	0.09	0.11	0.32	0.33

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

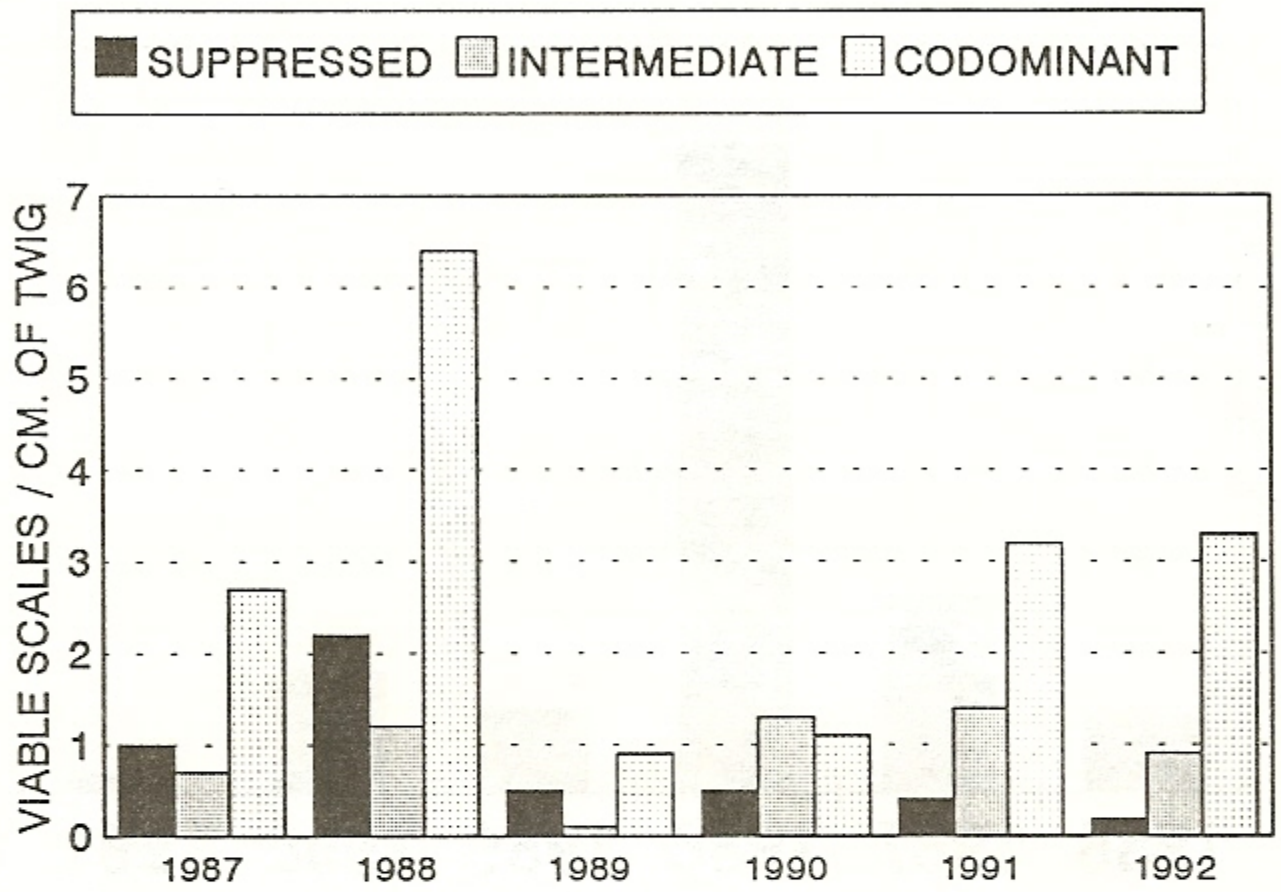


Figure 9. Oystershell scale populations in three tree canopy positions in Camel's Hump State Forest, 1987-1992. Average for 10 branches/tree per crown class, collected in autumn.

Pear Thrips, *Taeniothrips inconsequens*, caused only scattered, very light damage to sugar maple. For the second consecutive year, no defoliation was aerially mapped compared to 29,760 acres mapped in 1990. Insect populations were low and normal leaf flush helped reduce thrips damage.

Early leaf drop of cherry in southwestern Windham County was attributed to pear thrips. Damaged trees had refoliated by early July.

Bud counts remained low (averaging less than 1 thrips/bud) in the six sugarbushes which have been monitored since 1986 (Figure 10), although in one additional sugarbush in Wallingford, counts averaged one thrips per bud.

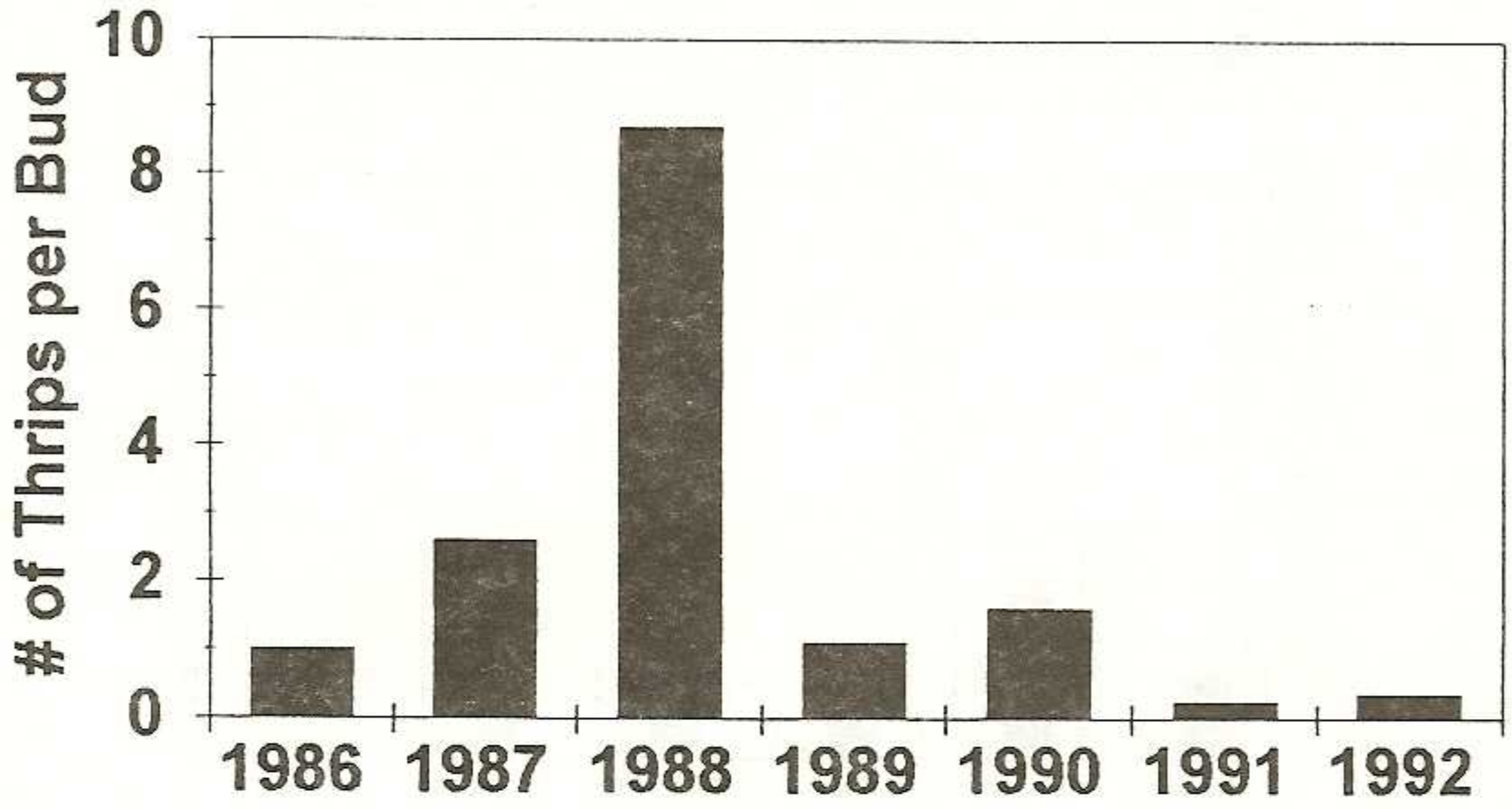


Figure 10. Average thrips counts in buds of sugar maple in southern Vermont 1986-1992. Average of 2 sugarbushes in 1986 and 6 sugarbushes in 1987-1992 (100 buds/sugarbush).

With heavy sugar maple flowering and little rainfall when the thrips returned to the ground, conditions were good for thrips survival. Soil samples were taken again in September from the same sites which have been sampled since 1988. Counts of overwintering thrips were similar to numbers in Fall 1991 in southern Vermont. Counts have increased two-fold in central Vermont, and four-fold in the most northern counties. However, numbers remain lower than in years when damage was mapped from the air (Figure 11).

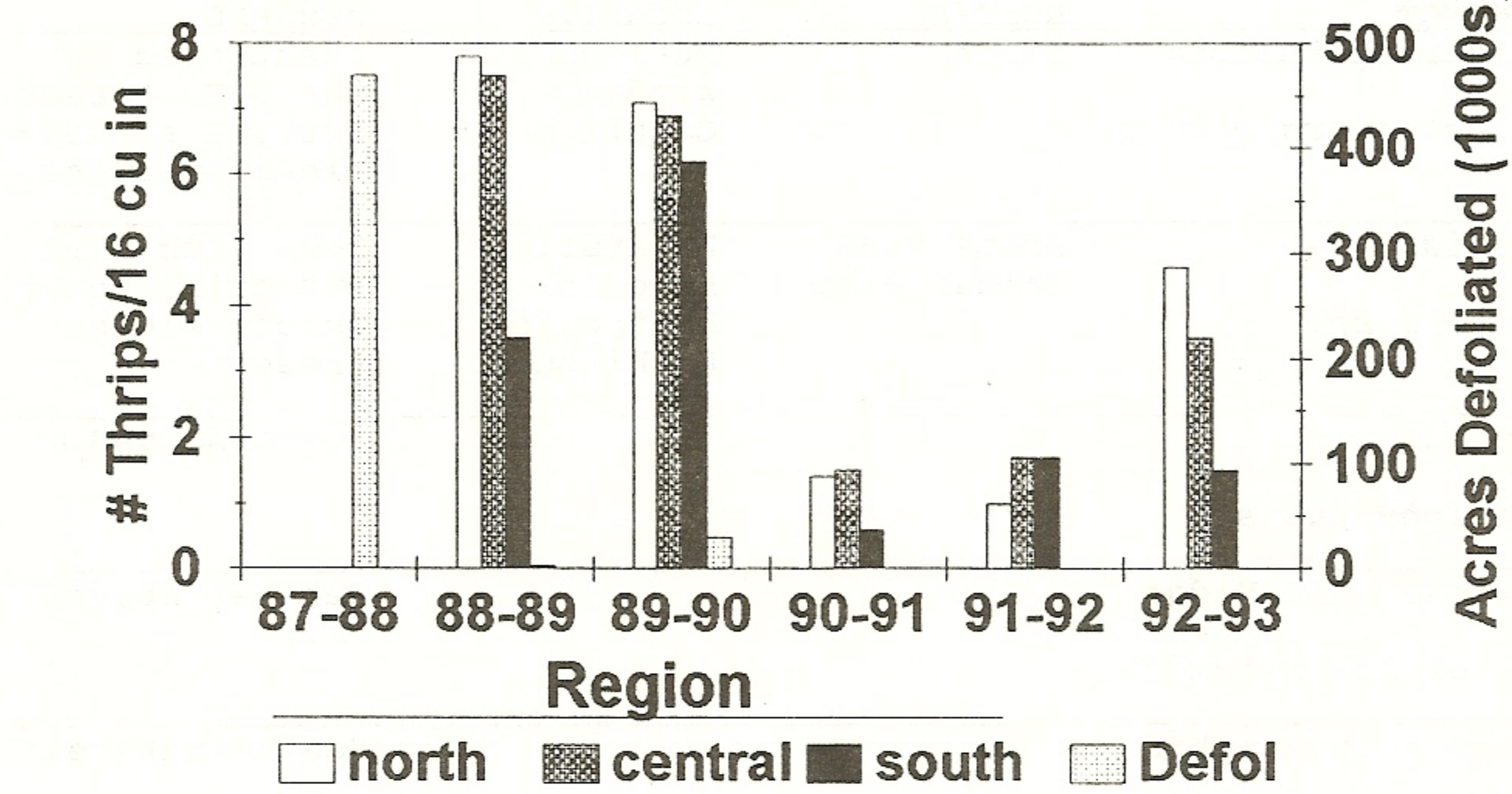


Figure 11. Average counts of overwintering pear thrips in soil samples (# of insects/16 cu. in.), by region of the state, compared to statewide defoliation by thrips mapped the following summer.

Research continues at the University of Vermont on biological control of pear thrips. New isolates of thrips-killing fungi are extracted from infected specimens each year for evaluation as potential biocontrol material. Formulated material of locally-occurring insect fungi is being field tested. Additional studies will include evaluation of this material on other maple pests and non-target organisms.

OTHER SAPSUCKING INSECTS, MIDGES AND MITES

INSECT	HOST(S)	LOCALITY	REMARKS
Alder Spittlebug *Clastoptera obtusa*	Birch	Rutland & Windsor Counties	Identified by the U.S. Forest Service at mid-elevation sites.
Aphids *Cinara sp.*	Scots Pine Balsam Pine	Bakersfield Lincoln Montpelier Rockingham	Down from 1991, but still heavy on occasional trees.
Aphids *Periphyllus sp.*			Not observed.
Balsam Gall Midge *Pardiplosis tumifex*			See narrative.
Balsam Twig Aphid *Mindarus abientinus*			See narrative.
Balsam Woolly Adelgid *Adelges picea*	Balsam Fir	Mt. Holly	Light.
Beech Scale *Cryptococcus fagisuga*			See Beech Bark Disease.
Birch Budgall Mite *Aceria rudis*			Not observed.
Catkin Bug *Kleidocerys sp.*	Yew	Bakersfield	Isolated observation on yew foliage.
Cooley Spruce Gall Adelgid *Adelges cooleyi*	Douglas Fir	S. Barre Starksboro Wolcott Brookfield Williamstown	Limited to moderate damage to Douglas fir Christmas trees. Similar to 1991.
Cottony Maple Scale *Pulvinaria innumerabilis*	Sugar Maple	Washington County	Common.

OTHER SAPSUCKING INSECTS, MIDGES AND MITES

INSECT	HOST(S)	LOCALITY	REMARKS
Eastern Spruce Gall Aphid *Adelges abietis*			See narrative.
Elm Spider Mite *Eotetranyches mathyssei*	Liberty Elm	Weston	Ornamental.
European Elm Scale *Gossyparia spuria*	Liberty Elm	Weston	Heavy infestation on ornamentals, with heavy sooty mold.
Fletcher Scale *Lecanium fletcheri*	Arborvitae Yew	Burlington Essex Jct. Weston Woodstock	Ornamentals.
Green Erineum Gall *Eriophyidae*			Not observed.
Hemlock Woolly Adelgid *Adelges tsugae*			See narrative.
Lacebugs *Corythuca sp.*	American Elm Basswood Butternut	Widespread	Moderate damage in scattered locations by mid-summer. Noticeable along roads and streams. Down from 1991.
Larch Gall Adelgid (a.k.a. Spruce Gall Aphid) *Adelges lariciatus*	European Larch	Montpelier	Observed on alternate host. Feeds in alternate years on spruce.
Leafhoppers *Cicadellidae*	Sugar Maple Other Hardwoods	Widespread	Very light damage noticeable in northern Vermont.

OTHER SAPSUCKING INSECTS, MIDGES AND MITES

INSECT	HOST(S)	LOCALITY	REMARKS
Lecanium Scale *Lecanium sp.*			Not observed.
Maple Leaf Spot Gall *Cecidomyia ocellaris*	Red Maple	Springfield	Ornamental.
Maple Spindle Gall Mites *Vasates aceris-crumena*	Sugar Maple	Widespread	Less noticeable than in years previous to 1991.
Oystershell Scale *Lepidosaphes ulmi*			See narrative.
Pear Thrips *Taeniothrips inconsequens*			See narrative.
Pine Bark Adelgid *Pineus strobi*	White Pine	Throughout	Remains heavy on individual trees in some areas, but down from levels in 1990-91.
Pine Leaf Adelgid *Pineus pinifoliae*	White Pine	Throughout	Scattered dead shoots from 1991 feeding. Causing heavy shoot mortality on regeneration in one stand from 1992 feeding. Elsewhere, little recent damage observed, although eggs and nymphs un-usually abundant.
Pine Needle Midge *Contarinea baeri*	Scots Pine Red Pine	Starksboro E. Berkshire	Light Christmas tree damage. Not detected in 1991.

OTHER SAPSUCKING INSECTS, MIDGES AND MITES

INSECT	HOST(S)	LOCALITY	REMARKS
Pine Needle Scale *Chionapsis pinifoliae*	Mugho Pine	Montpelier	
Pine Spittlebug *Aphrophora parallela*	Hemlock Conifers	Widespread	Decreasing. Usually common at light levels, but little damage observed in 1992.
Pine Thrips *Gnophothrips sp.*	Scots Pine	Bakersfield Wolcott	Moderate damage to 6 acres of Christmas trees. Commonly found elsewhere. Damage down from 1991.
Pine Tortoise Scale *Toumeyella parvicornis*	Red Pine	Bradford	
Psyllid *Cacopsylla annulata*	Sugar Maple	Woodstock	Common on expanded bud scales and tender green stems of regeneration.
Ragged Spruce Gall Aphid *Pineus similis*	Red Spruce	Widespread	Remains common. Less Christmas tree damage than in 1991.
Root Aphid *Prociphilus americanus*	Balsam Fir	Rockingham	Christmas tree.
Spruce Gall Aphid *Adelges lariciatus*	European Larch	Montpelier Salisbury Barre	

OTHER SAPSUCKING INSECTS, MIDGES AND MITES

INSECT	HOST(S)	LOCALITY	REMARKS
Spruce Spider Mite *Oligonychus ununguis*	Conifers	Widespread	Heavy in several southern Vermont Christmas tree plantations. Elsewhere, occasional damage, mostly to interior needles of ornamentals and Christmas trees. Down from 1991.
Succulent Oak Gall *Dryocosmos quercuspalustris*	Red Oak	Colchester	Observed on shade trees.
Spruce Bud Scale *Physokermes piceae*			Not observed.
Treehoppers *Membracidae*			Not observed.
Vagabond Aphid *Mordwilkoja vagabunda*	Poplar	St. Albans	Commonly observed.
Woolly Alder Aphid *Prociphilus tesselatus*	Alder	Walden Newark Groton Widely scattered	Moderate infestations.
Woolly Apple Aphid *Eriosoma lanigerum*			Not observed.
Woolly Elm Aphid *Eriosoma americana*	American Elm	Springfield	Ornamentals.
Woolly Fold Gall *Cecidomyia niveipila*	Red Oak	Colchester	Observed on shade trees.
Woolly Pine Scale *Pseudophilippia quaintancii*	Scots Pine	S. Barre	Heavy damage to a single Christmas tree.

BUD, SHOOT, AND STEM INSECTS

The **Balsam Shootboring Sawfly**, *Pleroneura brunneicornis*, caused less noticeable damage than in 1991, but actual damage may have been masked by the more abundant frost damage in many locations. A total of 93 acres of light to moderate damage to balsam and fraser fir Christmas trees in northern Vermont was reported compared to 197 acres in 1991.

OTHER BUD, SHOOT & STEM INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Allegheny Mound Ants *Formica exsectoides*	Balsam Fir	Ludlow	Scattered Christmas tree mortality. Apparently decreasing, as damage was not observed elsewhere.
Ambrosia Beetle *Scolytidae*	Paper Birch	Groton	Light damage. Similar to 1991.
Balsam Shootboring Sawfly *Pleroneura brunneicornis*			See narrative.
Butternut Curculio *Conotrachelus juglandis*			Not observed.
Cambium Miner *Phytobia spp.*	Yellow Birch	Milton	Pith-ray flecks common in logs from one stand.
Coneworm *Dioryctria spp.*			Not observed.
Linden Borer *Saperda vestita*	Tilia species	Hinesburg	Nursery.
Locust Borer *Megacyllene robiniae*			Not observed.

OTHER BUD, SHOOT & STEM INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Locust Twig Borer *Ecdytolopha insiticiana*	Black Locust	Addison, Windham & Windsor Counties	Regeneration.
Maple Petiole Borer *Caulocampus acericaulis*			Not observed.
Narrow-winged Tree Cricket *Oecanthus angustipennis*	Red Maple	Hinesburg	Common in a nursery.
Northeastern Sawyer *Monochamus notatus*	White Pine	Widely scattered	Numerous adults seen.
Northern Pine Weevil *Pissodes approximatus*			Not observed.
Pales Weevil *Hylobius pales*		Widespread	Damage to Christmas trees down. 60 acres of light to moderate damage reported in northern Vermont survey compared to 134 acres in 1991.
Pine False Webworm *Acantholyda erythrocephala*			Not observed.
Pine Gall Weevil *Podapion gallicola*	Red Pine	Baltimore Pittsford Thetford	Scattered branch mortality in pole-sized stands. De-creasing in the Thetford site.
Pine Root Collar Weevil *Hylobius radicis*			Not observed.

OTHER BUD, SHOOT & STEM INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Pitch Nodule Maker *Petrova albicapitana*			Not observed.
Pitted Ambrosia Beetle *Corthylus punctatissimus*	Sugar Maple seedlings	Widely scattered	Some damage visible. Similar to 1991.
Pseudanthonomus validus	Yellow Birch		Not observed.
Round-headed Apple Tree Borer *Saperda candida*	Apples Mountain Ash	Widely scattered	Damaging ornamental trees.
Sawyer *Monochamus sp.*	Balsam Fir	Widely scattered	Light shoot mortality common on Christmas trees.
Shothole borer *Scolytus rugulosus*	Apple		Waitsfield
Stem-gall Wasp *Hemadas nubilipennis*	Blueberry	Montpelier	Galls observed in August.
Sugar Maple Borer *Glycobius speciosus*	Sugar Maple	Throughout	Common in some stands. Abundant damage in some stands, especially where maples are slow-growing.
Twig Pruner *Elaphiodionoides villosus*	Red Oak	Widespread	Increasing. Dead shoots observed on ornamentals and forest trees throughout the range of oak.

OTHER BUD, SHOOT & STEM INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
White Pine Weevil *Pissodes strobi*	White Pine	Throughout	Damage down. Mostly moderate on 78 acres of Christmas trees in northern Vermont survey compared to 171 acres in 1991.
Zimmerman Pine Moth *Dioryctria zimmermanni*	White Pine	Grafton Windham	Ornamentals.

ROOT INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Broad Necked Root Borer *Prionus laticollis*			Not observed.
Conifer Swift Moth *Korsheltellus gracilis*	Red Spruce Balsam Fir	Northern Vermont	Associated with feeding wounds at high elevations.
June Beetle *Phyllophaga spp.*		Stowe	Adults more numerous than in 1991.
Wireworms *Elateridae*			Not observed.

MISCELLANEOUS INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Bark Lice *Psocids*	Sugar Maple	Barnet Orange Morrisville Corinth	Non-damaging.

BARK BEETLES

INSECT	HOST(S)	LOCALITY	REMARKS
Bronze Birch Borer *Agrilus anxius*	White Birch	Groton	Old damage observed.
Eastern Ash Beetle *Hylesinus aculeatus*	White Ash	Springfield Grafton	On dying trees. More noticeable than usual.
Eastern Larch Beetle *Dendroctonus simplex*	Eastern Larch	Widespread	Stable; little recent decline reported on 165 acres of scattered mortality mapped this year.
Elm Bark Beetles *Hylurgopinus rufipes* *Scolytus multistratiatus*			See Dutch Elm Disease.
Hemlock Borer *Melanophila fulvoguttata*			Not observed.
Ips avulsus			Not observed.
Peach Bark Beetle *Phloeotribus dentifrons*	Black Cherry	Pittsfield	Causing gum spots in a recently thinned stand on a shallow site.
Pine Engraver *Ips pini*	White Pine	Springfield	Associated with mortality of trees planted too deep.
Red Turpentine Beetle *Dendroctonus valens*			Not observed.
Rustic Borer *Xylotrechus colonus*	Hickory	Rutland County	In dying trees.
Tanbark Borer *Phymatodes testaceus*	Hickory	Rutland County	In dying trees.

FOREST DISEASES

Stem Diseases

Beech Bark Disease, caused by *Cryptococcus fagisuga* and *Nectia coccinea var. faginata* continues to cause scattered dieback and chlorosis. Symptoms were more noticeable than last year, with 1,960 acres mapped compared to 600 acres in 1991. (Table 16, Figure 12). All damage mapped from the air was in northern Vermont.

Table 16. Mapped acres of 1992 beech decline and mortality due to beech bark disease.

County	Acres
Addison	220
Caledonia	420
Essex	250
Franklin	100
Lamoille	40
Orange	110
Orleans	680
Washington	140
Total	1,960

Beech bark disease remains constant at low levels in monitoring plots (Figure 13). Nectria fruiting was somewhat higher than 1991, but still quite low.

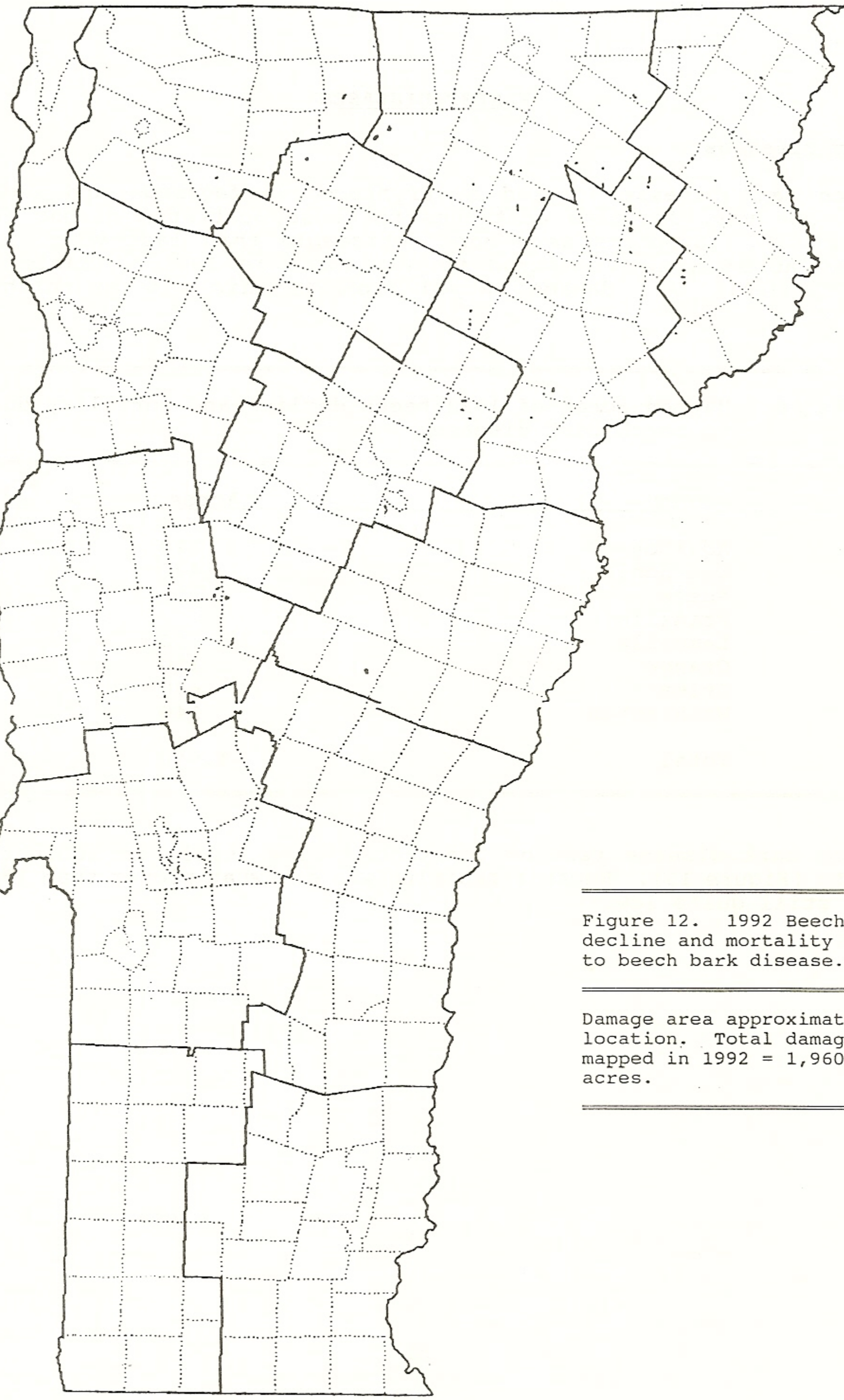


Figure 12. 1992 Beech decline and mortality due to beech bark disease.

Damage area approximate location. Total damage mapped in 1992 = 1,960 acres.

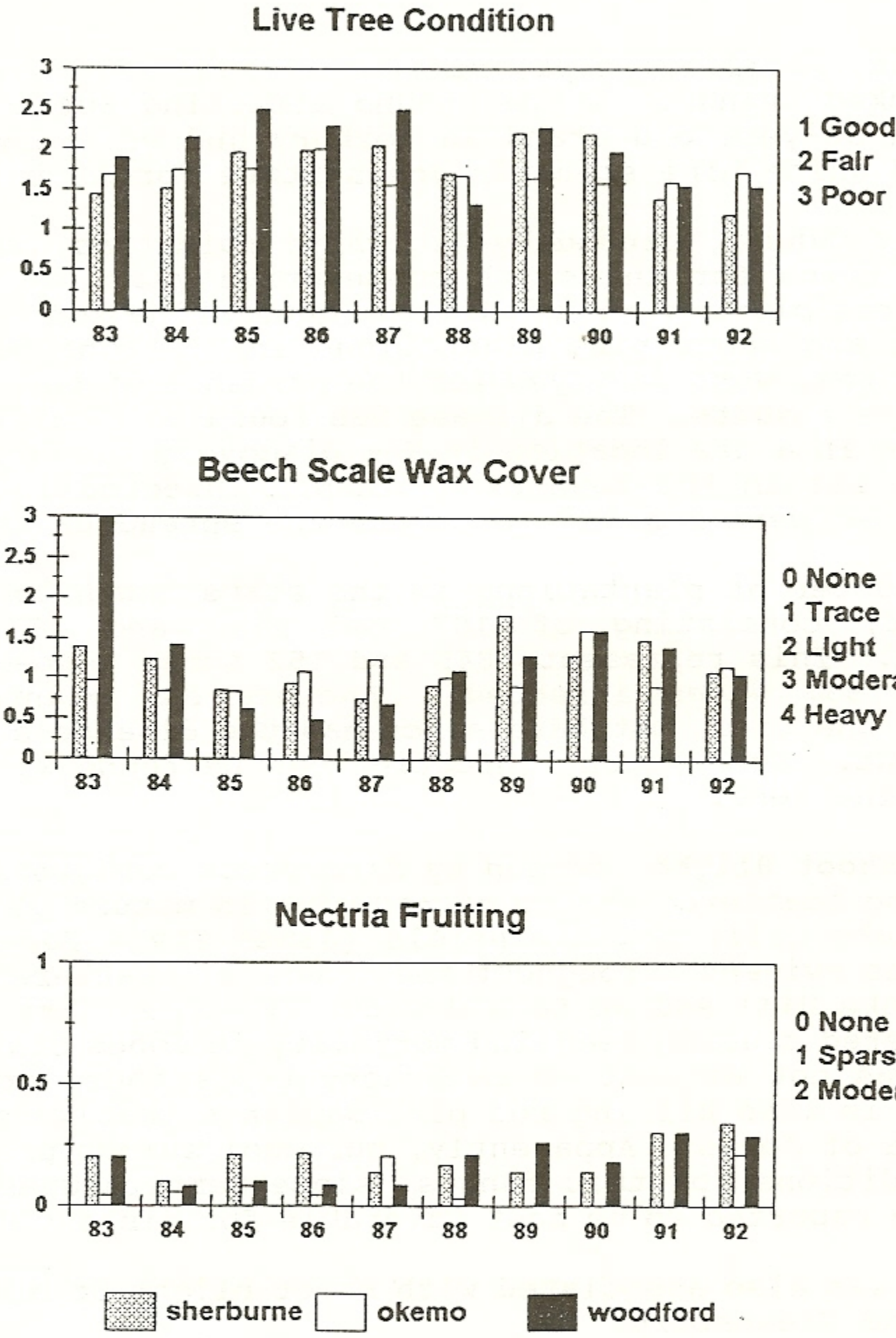


Figure 13. Summary of beech bark disease monitoring plots, 1983-1992.

Butternut Canker, caused by *Sirococcus clavigignenta-juglandacearum*, is widespread throughout the state with infection commonly detected wherever butternut occurs. A survey to confirm the presence of this serious disease in every county is planned for 1993.

Red Ring Rot, *Phellinus pini*, remains a cause of major value loss in overstocked stands. It was found affecting 60% of the Norway spruce in a 30-year old stand in Roxbury and was very heavy in a 50-year-old white pine stand in Jones State Forest in Plainfield.

Scleroderris Canker, caused by *Ascocalyx abientina*, was not found in any new towns for the sixth consecutive year. A total of 47 Christmas tree plantations within the quarantine zone (Figure 14), and 115 red and Scots pine plantations in 20 towns bordering the quarantine area, were surveyed for the presence of the disease, all with negative results. The disease was found to be affecting Scots and red pine in a new location in New Discovery Campground (Groton State Park) within the town of Peacham. Infected lower branches and dead trees were removed to reduce the spread of the disease.

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.

Sirococcus Shoot Blight, caused by *Sirococcus conigenus*, was found to be killing scattered shoots of red pine in mature plantations in Peacham (Blake Hill) and Plainfield (Jones State Forest). Shoot mortality was evident throughout the crowns of scattered individual trees in Blake Hill and up to mid-crown at Jones. The disease had been discovered causing seedling mortality in Jones State Forest in 1987, but was not evident on overstory trees there or elsewhere. The disease is also killing red pine saplings that were planted in another area of Jones. Apparently, our cool summer provided ideal growing conditions for this fungus, since temperatures between 61 and 68°F are reported to be most favorable for disease development.

This fungus was also associated with shoot blight of blue spruce in Waterbury and Greensboro.

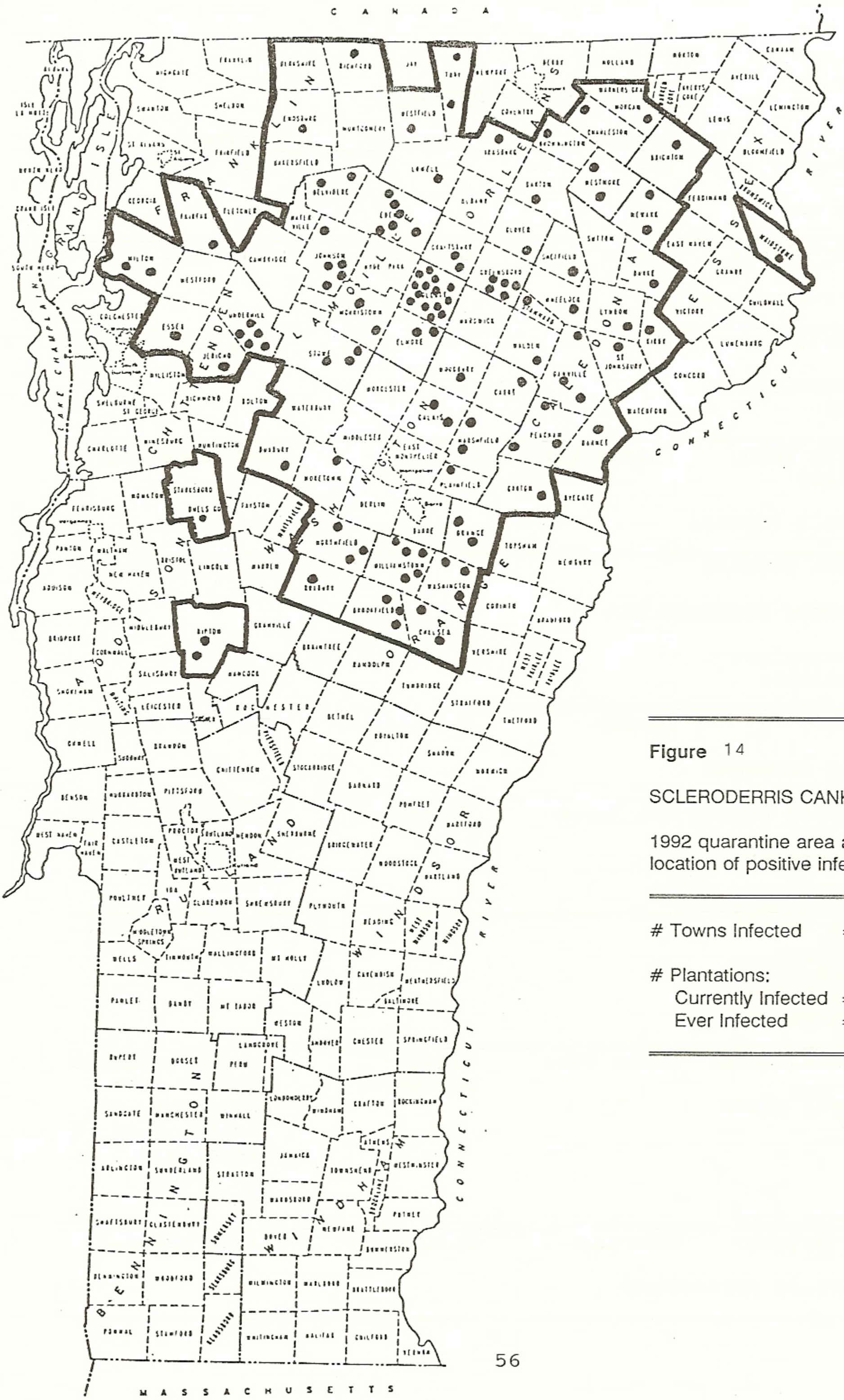


Figure 14

SCLERODERRIS CANKER

1992 quarantine area and location of positive infection

Towns Infected = 64

Plantations:
Currently Infected = 126
Ever Infected = 130

OTHER STEM DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Annual Canker *Fusarium sp.*	Sugar Maple		Not observed.
Ascochyta Blight *Ascochyta syringae*	Lilac	Bristol	Nursery.
Ash Yellows *Mycoplasma-like organism*	White Ash	Throughout	See Ash Dieback.
Balsam Fir Twig Abnormality *Sclerotinia kerneri*	Balsam Fir		Not observed.
Beech Bark Disease *Cryptococcus fagisuga* and *Nectria coccinea var. faginata*			See narrative.
Black Knot *Dibotryon morbosum*	Cherry	Widespread	Remains common.
Botrosphaera Canker *Botrosphaera sp.*	Red Maple	Hinesburg	Observed around pruning wounds in nursery setting.
Butternut Canker *Sirococcus clavigignenta-juglandacearum*			See narrative.
Caliciopsis Canker *Caliciopsis pinea*	White Pine	Widely scattered	Some improvement noticed in a previously infected stand in Plainfield. No new areas reported.
Chestnut Blight *Cryphonectria parasitica*	Chestnut	Colchester	Light damage.

OTHER STEM DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Cytospora Canker *Leucostoma kunzei*	Blue Spruce	Widespread	Decreasing. Mostly old infections observed.
Diplodia Shoot Blight *Diplodia pinea (Sphaeropsis pinea)*	Austrian Pine Mugho Pine	Chittenden County Morristown	Light damage only.
Dutch Elm Disease *Ceratocystis ulmi*	Elm	Throughout	Levels similar to previous years. Mortality in hardwood stands in forest health survey increased from 34% in 1986 to 65% in 1991. Caused death of a young Liberty elm in Woodstock.
Eastern Dwarf Mistletoe *Arceuthobium pusillum*			Not observed.
Fireblight *Erwinia amylovora*	Cherry Apple	Widely scattered	Up from 1991.
Fusarium Canker *Fusarium solani*	Red Maple	Essex Jct.	Observed around pruning wounds.
Hemlock Shoot Blight *Fusarium sp.*	Hemlock	Springfield	Hedge.
Hypoxylon Canker *Hypoxylon pruinatum*	Aspen	Throughout	Remains common. Cause of breakage in snow and ice storms. Heavy damage to a stand in Shrewsbury.

OTHER STEM DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Maple Canker *Steganosporium ovatum*	Sugar Maple	Brandon Springfield	Cause of shoot dieback on trees stressed from dry conditions in 1991.
Oak Wilt *Ceratocystis fagacearum*			No suspects seen by trained observers during aerial flights.
Phomopsis Canker *Phomopsis sp.*	Silver Maple	Brattleboro	Causing galls on ornamentals.
Phomopsis Twig Blight *Phomopsis sp.*	Thuja	Danville	Ornamental.
Red Rot			See narrative.
Sapstreak *Ceratocystis coerulescens*	Sugar Maple	Weathersfield	Cause of staining in a sugarbush with heavy wounding from past grazing and logging.
Scleroderris Canker *Asocalyx abietina*			See narrative.
Sirococcus Shoot Blight *Sirococcus strobilinus*			See narrative.
Smooth Patch *Dendrothele macrodens*	White Ash	Throughout	Particularly abundant in sites near water.
Tomentosus Butt Rot *Inonotus tomentosus*	White Spruce	Orange	Extensive decay in pole and saw-log size trees on former pastureland necessitated a 35-acre salvage clearcut.

OTHER STEM DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Verticillium Wilt *Verticillium albo-atrum* or *V. dahliae*	Sugar Maple	Stowe	Killed a 6" diameter ornamental.
White Pine Blister Rust *Cronartium ribicola*	White Pine	Throughout	Commonly observed, but incidence on Christmas trees stable. In northern Vermont survey, 62 acres infected compared to 66 acres in 1991. Cause of scattered mortality in a sawtimber-sized stand of formerly open grown trees in Peru.
Woodgate Gall Rust *Endocronartium harknessii*	Scots Pine	Throughout	Occasional heavy shoot mortality, similar to 1991. In northern Vermont survey, 82 acres of light-moderate damage compared to 86 acres in 1991.
Yellow Witches Broom Rust *Melampsorella caryophyllacearum*	Balsam Fir	Widespread	Common in many northern Vermont Christmas tree plantations this year, though not previously reported. Mostly light damage except for moderate damage in a Barton plantation.

Foliage Diseases

Anthracnose, caused by *Gloeosporium spp.*, was common on leaves of sugar maple and oak in the Champlain Valley, with 165 acres mapped (Addison County, 20 acres; Chittenden County, 141 acres; Franklin County, 4 acres) during the annual aerial survey (Figure 15).

OTHER FOLIAGE DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Anthracnose *Gloeosporium spp.*			See narrative.
Anthracnose (Ash) *Apiognomonia errabunda*	Ash	Hinesburg	Common in nursery.
Anthracnose (Oak) *Apiognomina guercina*	Oak	Hinesburg	Common in nursery.
Apple Scab *Venturia inequalis*	Mountain Ash Apples	Throughout	Similar to 1991 levels.
Cedar-Apple Rust *Gymnosporangium juniperi-virginianae*	Eastern Red Cedar Apple	Addison Chittenden Franklin Grand Isle Rutland Counties	More reports than usual. Moderate damage.
Coccomyces Leaf Spot *Blumeriella jaapii*	Black Cherry	Stowe	Moderate-heavy leaf damage to scattered trees.
Cyclaneusma Needlecast (formerly Naemacylcus) *Cyclaneusma minus*	Scots Pine	Throughout	Remains common but decreasing. Reported present in 71 acres of Christmas trees surveyed, compared to 103 acres in 1991 and 427 acres in 1990.

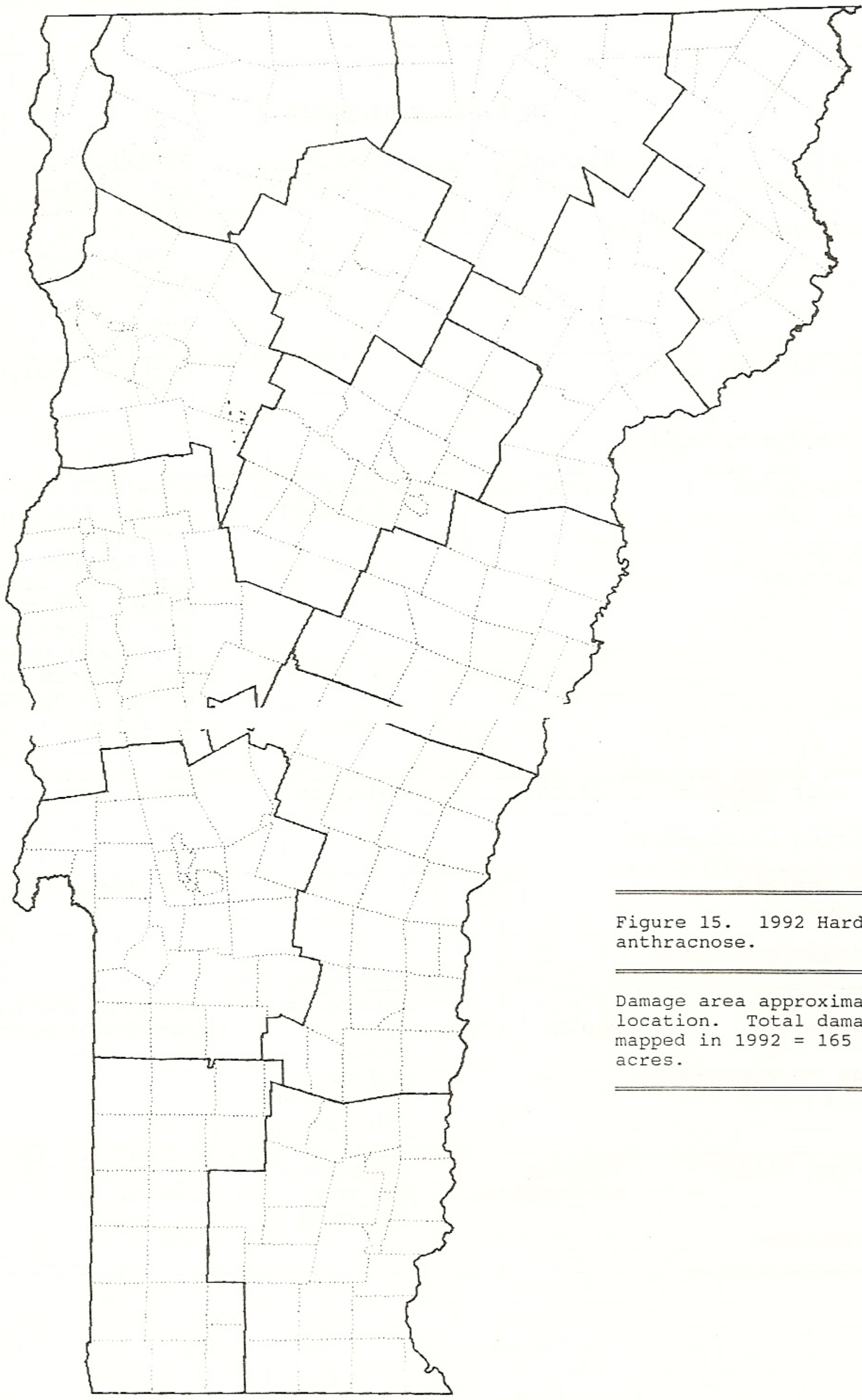


Figure 15. 1992 Hardwood anthracnose.

Damage area approximate location. Total damage mapped in 1992 = 165 acres.

OTHER FOLIAGE DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Fir-Fern Rust *Uredinopsis mirabilis*	Balsam Fir	Throughout	Increasing. In northern Vermont survey, 121 acres reported lightly infested compared to 56 acres in 1991.
Horsechestnut Leaf Blotch *Guignardia aesculi*			Not observed.
Lophodermium Needlecast *Lophodermium seditiosum*	Scots Pine	Widely scattered	Remains less common than Cyclaneusma. Increasing somewhat. Light damage reported for 38 acres of Christmas trees in northern VT survey compared to 19 acres in 1991.
Oak leaf blister *Taphrina caerulescens*	Red Oak	Colchester	Shade trees.
Phyllosticta Leafspot *Phyllosticta sp.*			Not observed.
Poplar Leaf Bronzing Virus or virus-like casual agent	Balsam Poplar	Caledonia Orleans Essex Orange Washington Counties	Remains common, but decreasing.
Powdery Mildew *Eryiphaceae*	Various ornamentals	Caledonia & Windsor Counties	Sometimes heavy damage.

OTHER FOLIAGE DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Rhabdocline Needlecast *Rhabdocline pseudotsugae*	Douglas Fir	Widely scattered	Moderate to heavy damage reported for 6 acres of Christmas trees.
Rhizosphaera Needlecast *Rhizosphaera kalkhoffi*	Blue Spruce White Spruce	Widely scattered	Heavier than usual in southern Vermont. Elsewhere, similar to 1991, with generally light damage to occasional Christmas trees and ornamentals.
Shoot and Leaf Blight *Venturia sp.*	Poplar	Middlebury	On 4-year old trees planted in heavy clay soil.
Sooty Mold *Perisporiaceae*	White Pine	Bakersfield E. Montpelier	Common on shoots following Cinara aphid infestations.
Swiss Needlecast *Phaeocryptopus gaumanni*	Douglas Fir	Widely scattered	Light to moderate damage to Christmas trees in 8 plantations.
Tar Spot *Rhytisma acerinum*			Not observed.

ROOT DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Annosus Root Rot *Heterobasidion annosum*	Red Pine	Arlington	Causing pockets of mortality. The stand will be rotated.
		Plainfield	Pockets of mortality in two new stands.
Cylindrocarpon Root Rot *Cylindrocarpon sp.*	White Spruce	Dummerston	Associated with stand opening in recently thinned trees.
Shoestring Root Rot *Armillaria spp.*	Fraser Fir	Whitingham	Causing pockets of mortality near old white pine stumps in a Christmas tree plantation.
	Norway Spruce	Williamstown	Disease centers found in two plantations (Ainsworth State Forest).
	All	Widely scattered	Common on stressed ornamental and forest trees.

DIEBACKS, DECLINES AND ENVIRONMENTAL DISEASES

Ash Dieback remains common in the Champlain Valley and southern Vermont. In the Vermont Hardwood Health Survey, white ash mortality increased from 1.8% in 1986 to 9.5% in 1991. This was attributed to ash yellows, a mycoplasma-like organism. Dieback is most obvious where the basal area of pole-sized white ash is substantial (30% or more). Ash yellows is most common in lower elevation sites, especially in sites that are abandoned farmlands.

Birch Decline and mortality was detected by aerial survey this year on 130 acres in widely scattered locations (Table 17, Figure 16). Decline was predicted last year because of widespread defoliation, combined with drought in some locations. Mid to upper elevation paper birch were the most heavily affected. In southern Vermont, shoot mortality was observed on yellow birch previously defoliated by the birch leaf folder. Decline is expected to increase in the future because of continuing defoliation.

Table 17. Acres of paper birch decline and mortality in 1992.

County	Acres Mapped
Addison	5
Caledonia	18
Chittenden	3
Essex	72
Franklin	33
Total	131

Drought conditions in early summer, compounded by 1991 dry conditions, caused leaf scorch on sugar maple in the Northeast Kingdom and probably contributed to the hardwood chlorosis evident in scattered locations throughout much of the state. Scorch was mapped for 2,300 acres and chlorosis for 3,950 acres (Table 18, Figure 17). This is down from 1991 when 55,600 acres of scorch and 6,800 acres of chlorosis were mapped. Species exhibiting chlorosis included sugar maple, red maple and beech. The scorch symptoms occurred in the same general areas as mapped in 1991.

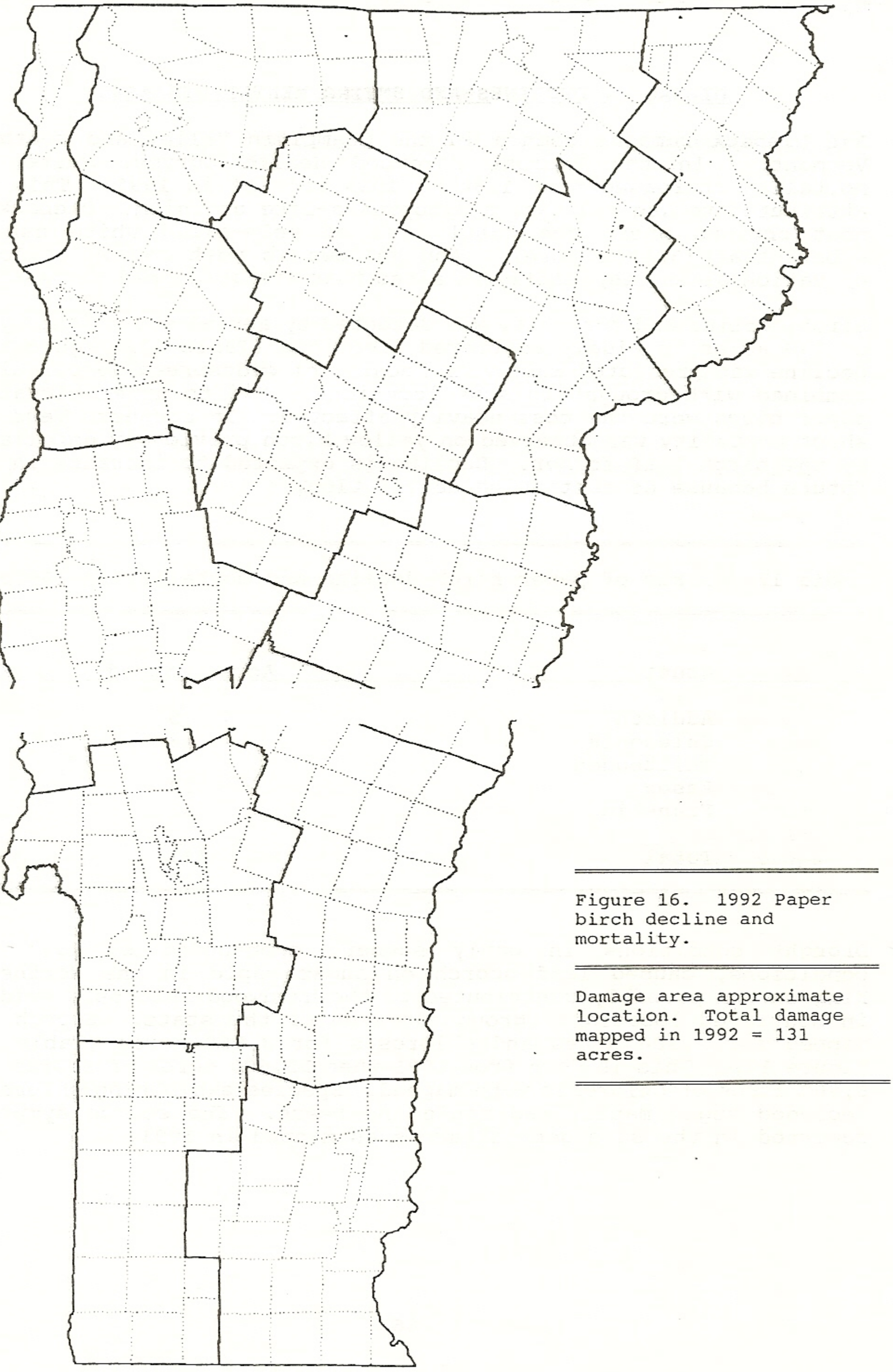


Figure 16. 1992 Paper birch decline and mortality.

Damage area approximate location. Total damage mapped in 1992 = 131 acres.

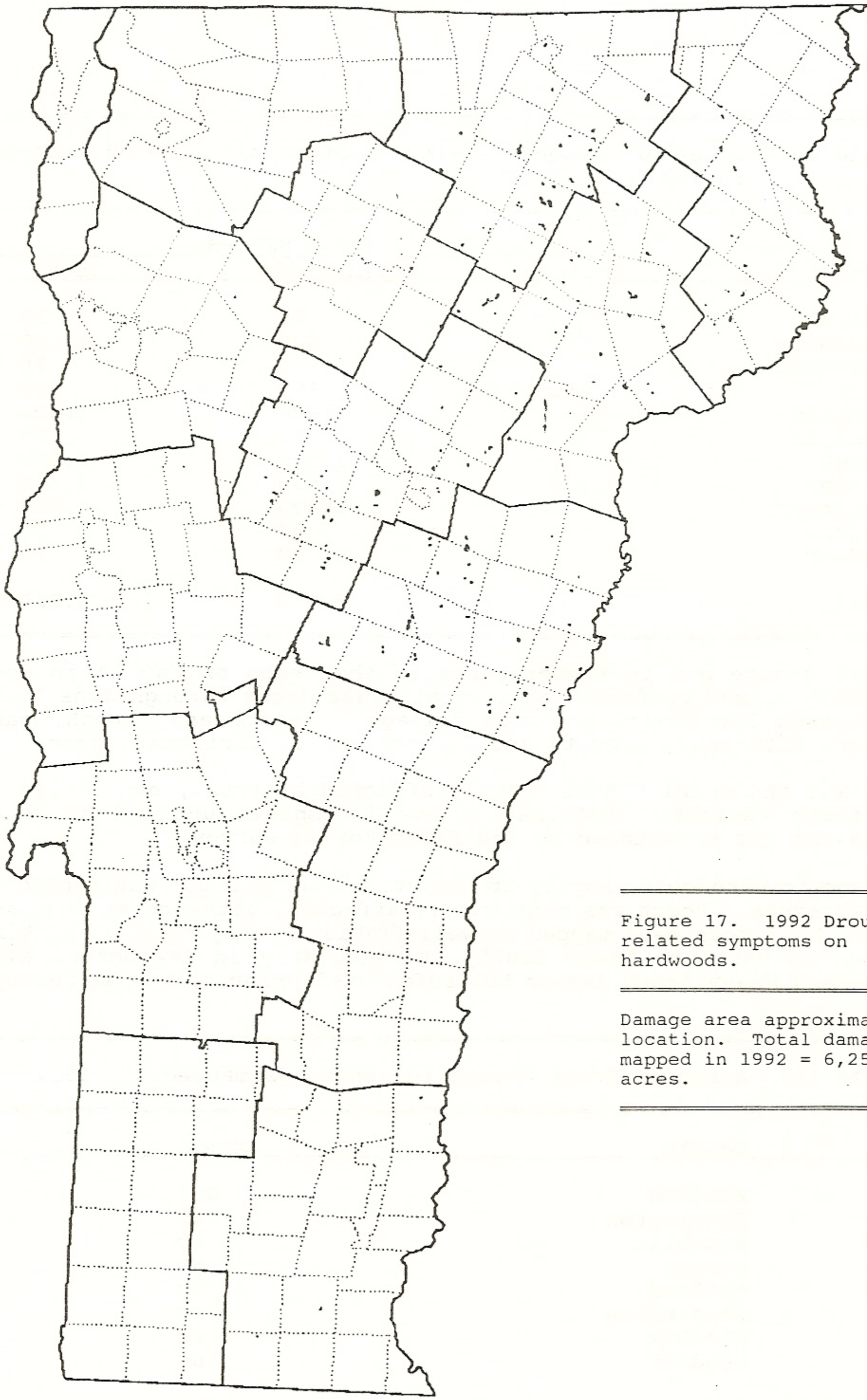


Figure 17. 1992 Drought related symptoms on hardwoods.

Damage area approximate location. Total damage mapped in 1992 = 6,250 acres.

Table 18. Acres of drought-related symptoms on hardwoods mapped in 1992.

County	Acres Mapped		
	Scorch	Chlorosis	Total
Addison		20	20
Caledonia	690	500	1,190
Chittenden		70	70
Essex	290	100	390
Franklin		Trace	Trace
Lamoille	190	80	270
Orange		1,590	1,590
Orleans	1,120	530	1,650
Washington	10	1,000	1,010
Windham		50	50
Windsor		10	10
Total	2,300	3,950	6,250

Frost Damage due to temperatures in the teens on May 25 in most locations, and to frosts on several other dates through June 15 in scattered locations, affected foliage of white ash, beech, oak, aspen, butternut, locust, and fir and spruce Christmas trees.

Ash was the species most heavily affected by frost, especially in northern Vermont. Refoliation was incomplete until late June. This was not detectable by the first aerial survey.

Damage to hardwoods, mostly at elevations above 2000' was mapped on 3,320 acres. Beech was most widely affected, although red oak and other hardwoods were mapped as well (Table 19, Figure 18). Quaking aspen in northern Essex County, particularly in Lemington, also received heavy frost damage but refoliated prior to aerial survey.

Table 19. Acres of frost damage to hardwoods mapped in 1992.

County	Acres
Addison	660
Bennington	440
Franklin	10
Orange	60
Rutland	1,300
Washington	270
Windham	20
Windsor	560
Total	3,320

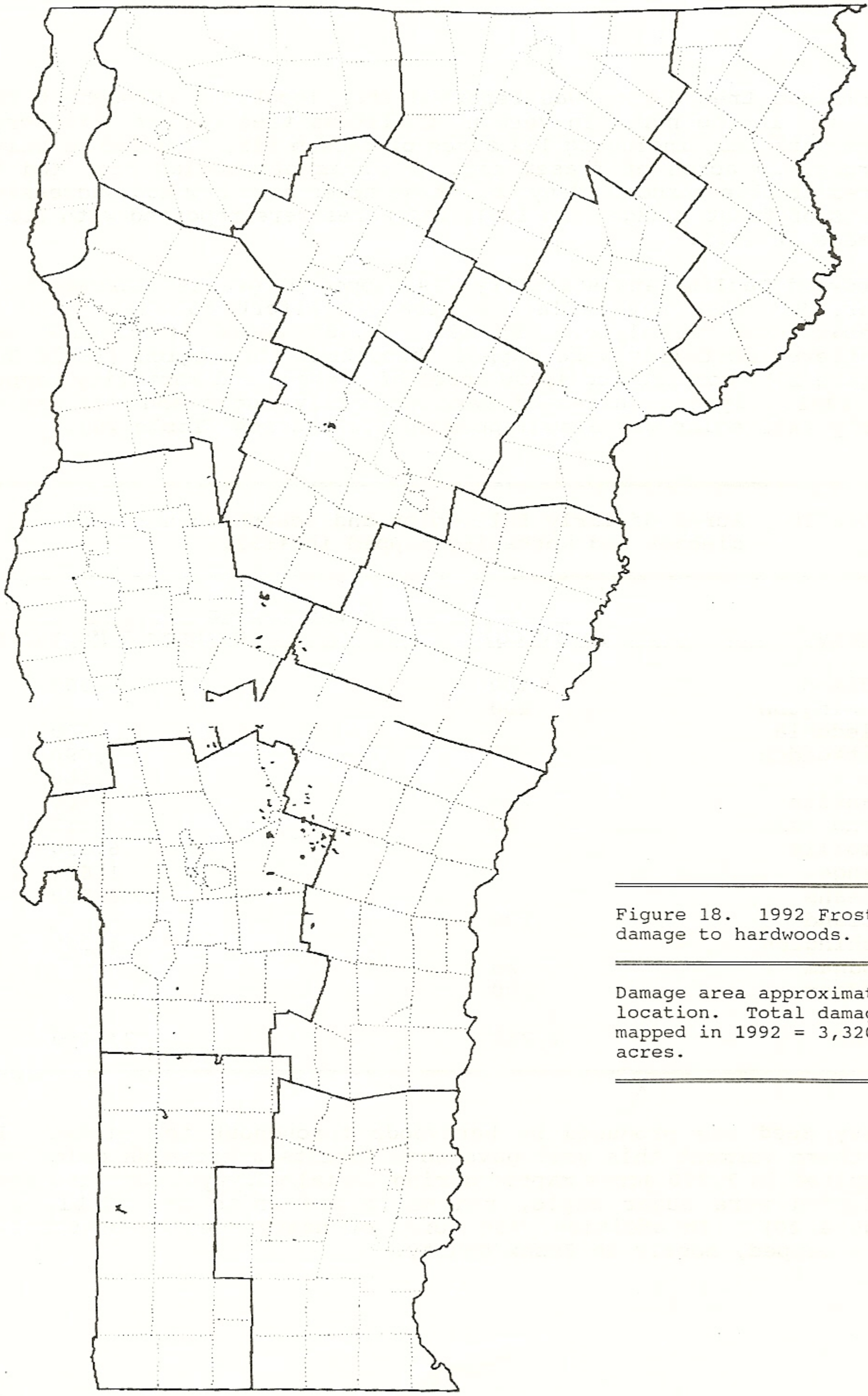


Figure 18. 1992 Frost damage to hardwoods.

Damage area approximate location. Total damage mapped in 1992 = 3,320 acres.

Christmas tree damage was reported from locations throughout the state. In the northern Vermont Christmas tree survey, 246 acres were detected, including 132 acres of balsam fir, 31 acres of white spruce, 20 acres of fraser fir, 17 acres of Douglas fir, and 10 acres of blue spruce. Many Christmas trees have now had successive years of frost damage. In 1991, 211 acres were reported with frost damage in 1991.

Hardwood Decline and Mortality was mapped on greater acreage this year, but this may reflect a stronger effort to map scattered dieback and mortality. In all, 23,480 acres of dieback and scattered mortality were mapped throughout the region (Table 20, Figure 19), compared to 3,300 acres of dieback and mortality mapped in 1991. Species affected were primarily sugar and red maple. Early fall color was also mapped on 1,230 acres (Table 20).

Table 20. Acres of early fall color and scattered hardwood dieback and mortality mapped in 1992.

County	Acres Mapped	
	Early Color	Dieback & Mortality
Addison	160	300
Bennington	200	
Caledonia		500
Chittenden	20	1,890
Essex		1,160
Franklin	250	100
Grand Isle	80	110
Lamoille		6,820
Orange		1,670
Orleans		6,590
Rutland	200	
Washington		4,340
Windham	20	
Windsor	300	
Total	1,230	23,480

Heavy Seed was produced by hardwoods throughout the state. In northern Vermont this year gave some forests a brownish color and resulted in 7,370 acres mapped during aerial surveys. Species most affected were sugar maple, red maple and white ash (Table 21, Figure 20). In addition, 190 acres of heavy seed on spruce-fir were mapped, mostly in Essex County.

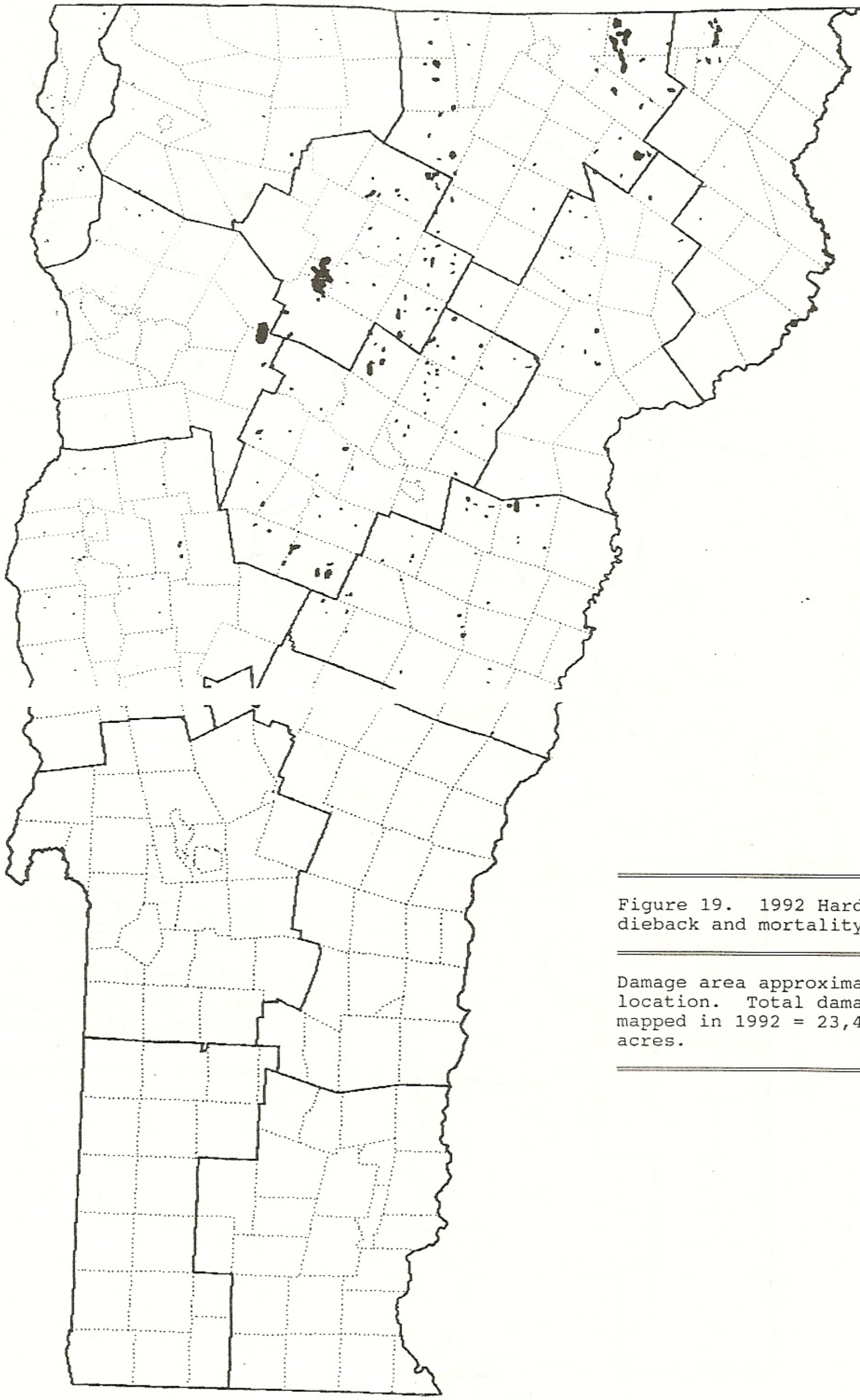


Figure 19. 1992 Hardwood dieback and mortality.

Damage area approximate location. Total damage mapped in 1992 = 23,480 acres.

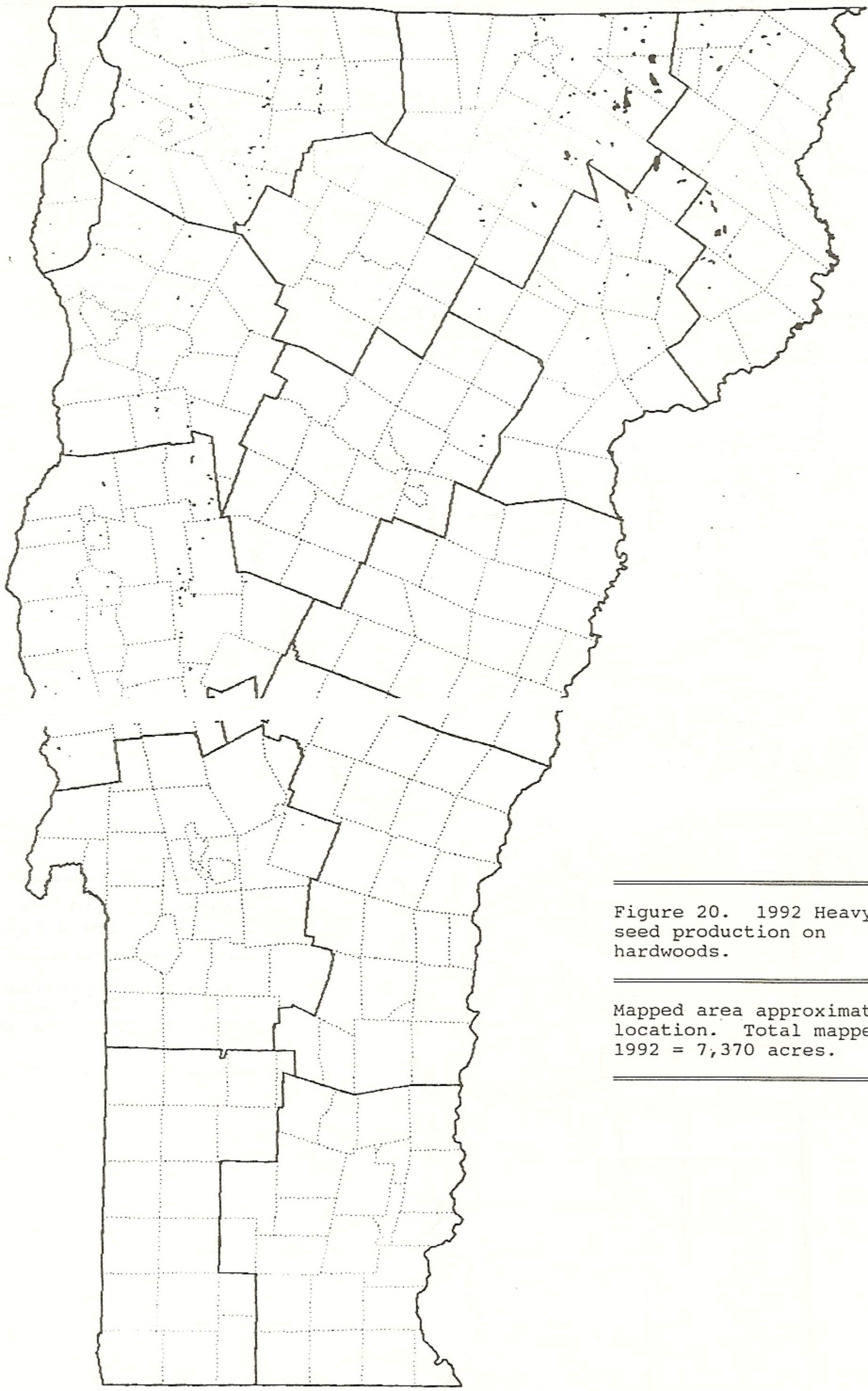


Figure 20. 1992 Heavy seed production on hardwoods.

Mapped area approximate location. Total mapped in 1992 = 7,370 acres.

Table 21. Acres of heavy seed production on hardwoods in 1992.

County	Acres Mapped				
	Sugar Maple	Red Maple	White Ash	Hardwood	Total
Addison	50		470		520
Caledonia	10	850			860
Chittenden			170		170
Essex		1,260			1,260
Franklin	10		590		600
Grand Isle			40		40
Lamoille			10		10
Orleans	720	3,040		90	3,850
Washington		60			60
Total	790	5,210	1,280	90	7,370

Spruce Mortality, primarily of upper elevation red spruce combined with some balsam fir, was mapped on 3,170 acres, mostly in northern Vermont (Table 22, Figure 21). This compares with only 380 acres mapped in Essex County in 1991. The difference may be due, in part, to a stronger effort to map mortality.

Table 22. Acres of red spruce mortality mapped in 1992.

County	Acres Mapped
Addison	260
Caledonia	320
Chittenden	310
Essex	170
Franklin	210
Lamoille	50
Orange	190
Orleans	980
Washington	640
Windham	40
Total	3,170

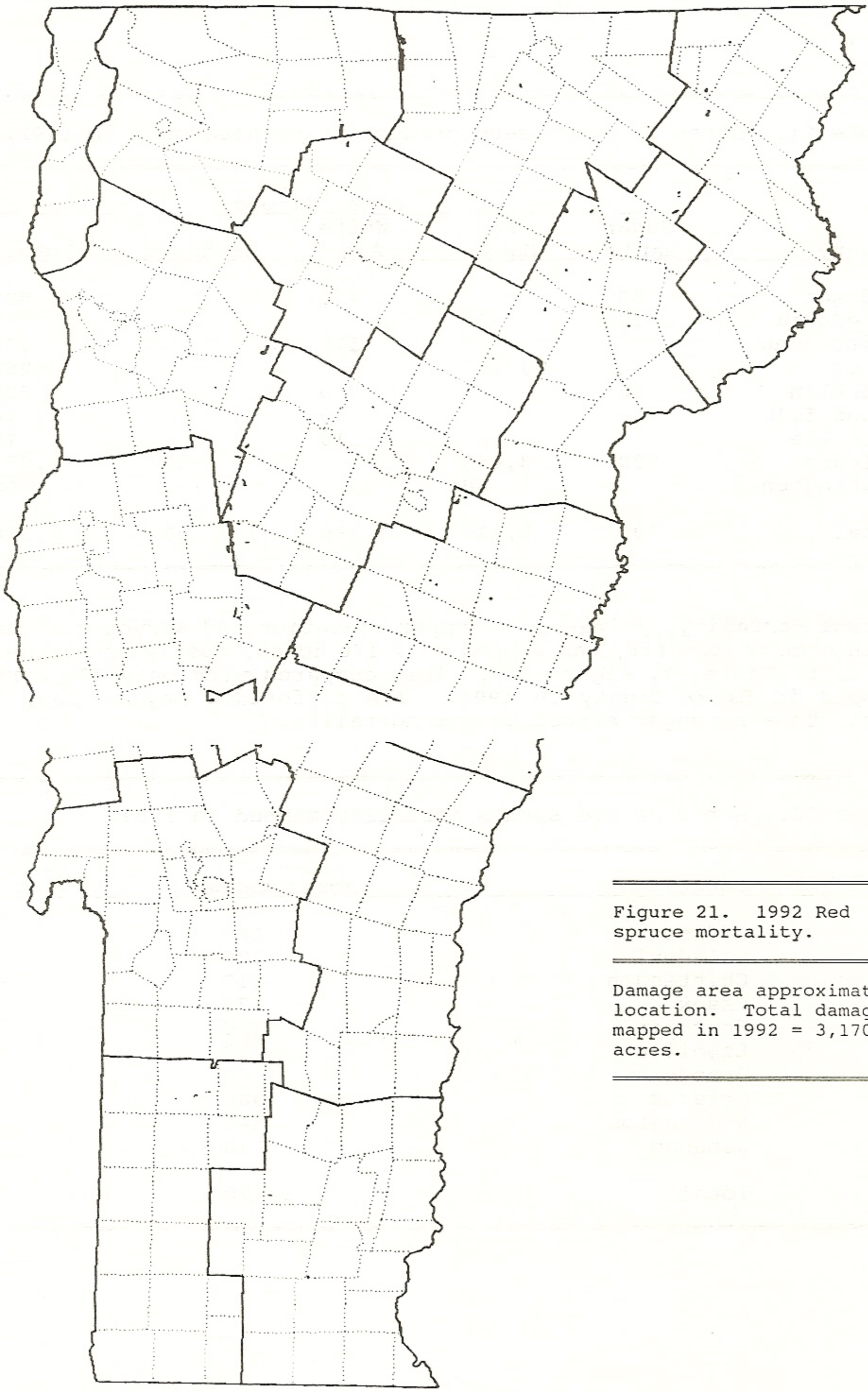


Figure 21. 1992 Red spruce mortality.

Damage area approximate location. Total damage mapped in 1992 = 3,170 acres.

Wet Site conditions were responsible for mortality of a variety of tree species. 8,120 acres were mapped during aerial surveys (Table 23, Figure 22). Some beaver-caused flooding was evident throughout the state, but most of the acreage was in the Champlain Valley, associated with Lake Champlain and its tributaries. High water levels in marginally wet sites during the wet growing seasons in 1989 and 1990 probably brought on the decline.

Table 23. Acres of dieback and mortality due to wet site mapped in 1992.

County	Acres
Addison	3,220
Bennington	Trace
Caledonia	10
Chittenden	830
Franklin	1,540
Grand Isle	2,070
Lamoille	100
Orange	10
Orleans	30
Rutland	100
Washington	100
Windham	40
Windsor	50
Total	8,120

Wet site was also the cause of dieback in several Windham County sugarbushes, and chlorosis and/or early needlecast of Christmas trees and ornamentals in scattered locations.

White Pine Needle Blight, also called Semi-mature tissue needle blight, caused heavy damage throughout the state, after affecting only scattered locations in 1991 and being absent in 1990. The needle browning resulted in unmarketable white pine Christmas trees in 8 widely scattered plantations, comprising 35 acres. The symptoms, which showed up in early August, are attributed to weather at needle elongation, with a fungus or ozone playing a possible role. Symptomatic trees have variable tip burn within a fascicle, on current growth.

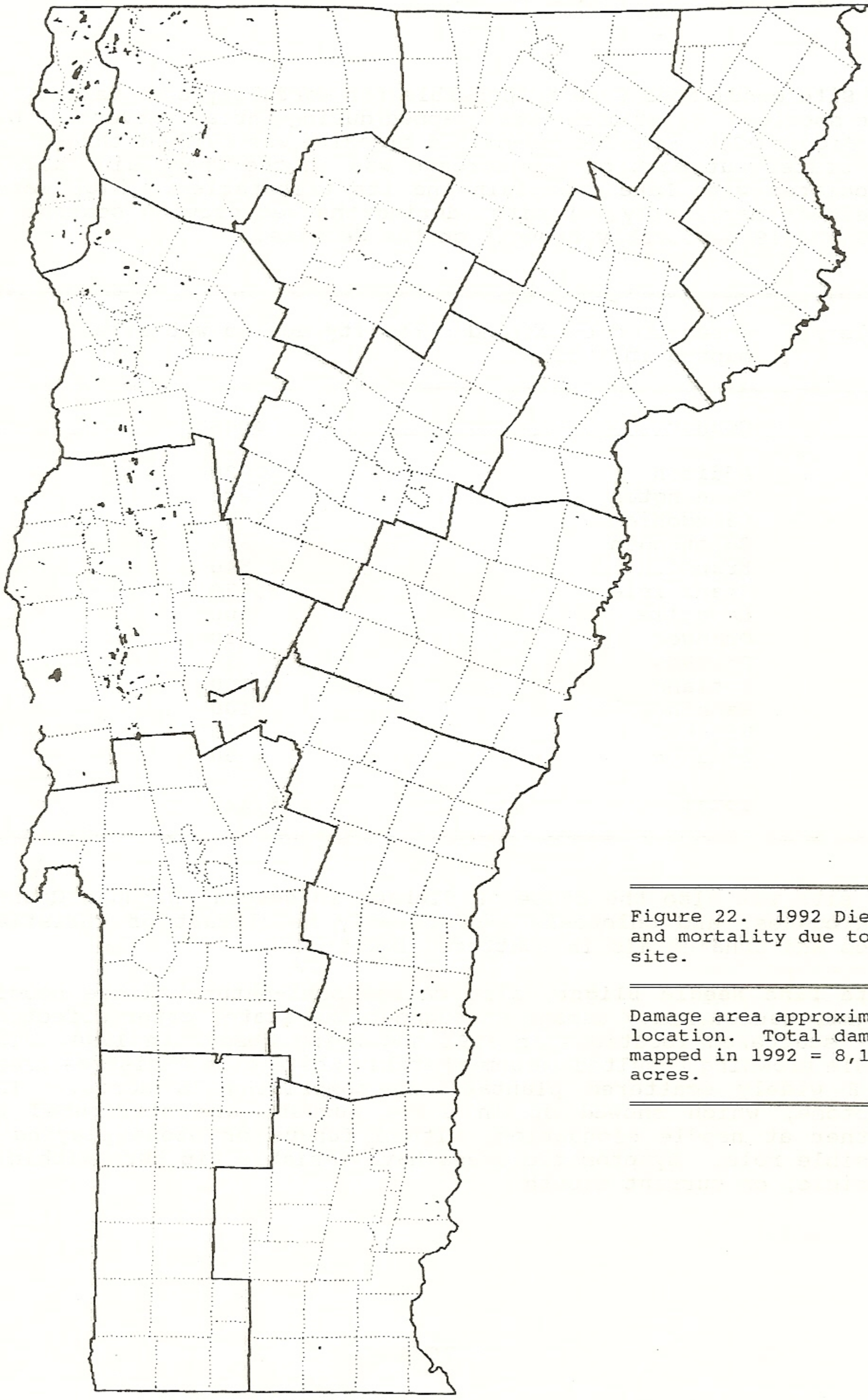


Figure 22. 1992 Dieback and mortality due to wet site.

Damage area approximate location. Total damage mapped in 1992 = 8,120 acres.

OTHER DIEBACKS, DECLINES AND ENVIRONMENTAL DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Ash Dieback			See narrative.
Birch Decline			See narrative.
Drought			See narrative.
Fertilizer Injury	Balsam Fir	Sutton	Branch dieback and mortality to Christmas trees on sandy soil. Spot applications during dry weather caused root mortality.
	Sugar Maple	Morrisville	
Frost Damage			See narrative.
Hardwood Decline and Mortality			See narrative.
Heavy Seed			See narrative.
Improper Planting	Ornamental and Christmas trees	Scattered throughout	Mortality caused by planting too deep, leaving tree wraps in place, and failure to keep watered.
Larch Decline	Tamarack	Scattered throughout	Has not progressed in previously affected areas. See Eastern Larch Beetle.
Lightning	White Pine	Peru	Cause of mortality in a stand of large-crowned trees.
Maple Decline			See Hardwood Decline and Mortality.

OTHER DIEBACKS, DECLINES AND ENVIRONMENTAL DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Mechanical Injury	Ornamental & Roadside trees, often Maples	Many locations	Damage from road maintenance and construction is associated with dieback and mortality.
Overtapping	Sugar Maple	Scattered throughout	Remains a problem associated with dieback.
Spruce Mortality			See narrative.
Wet Site			See narrative.
White Pine Needle Blight			See narrative.
Wind Damage	Many	Georgia/ Fairfax area	Localized down drafts caused blowdown on 100 acres detectable from the air.

ANIMAL DAMAGE

ANIMAL	SPECIES DAMAGED	LOCALITY	REMARKS
Beaver	Many	Throughout	Populations continue to increase. Many new ponds have been constructed, increasing flood damage. See Wet Site.
Deer	Many	Throughout	Generally scattered light damage.
	Balsam Fir	Woodstock	Heavy damage to Christmas trees at the plantation edge.
Grosbeaks			Not observed.
Moose	Mountain Ash	Lemington Walden Kirby	Heavy damage to regeneration.
Mouse			Not observed. Remains down from occasional heavy damage in 1990.
Porcupine	Many	Widely scattered	Increasing in Caledonia County, but stable or decreasing elsewhere.
Sapsucker	Apple White Birch Sugar Maple Norway Maple Hemlock Norway Spruce Scots Pine White Pine	Widespread	Remains common.
Squirrel	Maple Tubing		Not reported in 1991.

TRENDS IN FOREST CONDITION

More information on forest health will be available in the "Health and Productivity of Vermont's Forests - 1992" published by the Department of Forests, Parks and Recreation.

North American Maple Project - Sugar maple trees in Vermont plots (1,074 dominant and codominant trees) remained healthy, with crown conditions similar to 1991. Ninety-three percent of trees were healthy in the 1992 survey (Figure 23). Average dieback of dominant and codominant sugar maples was stable in 1992, as was new mortality. Foliage was slightly thinner than in the past few years, reflected in high average transparency ratings (Figure 24).

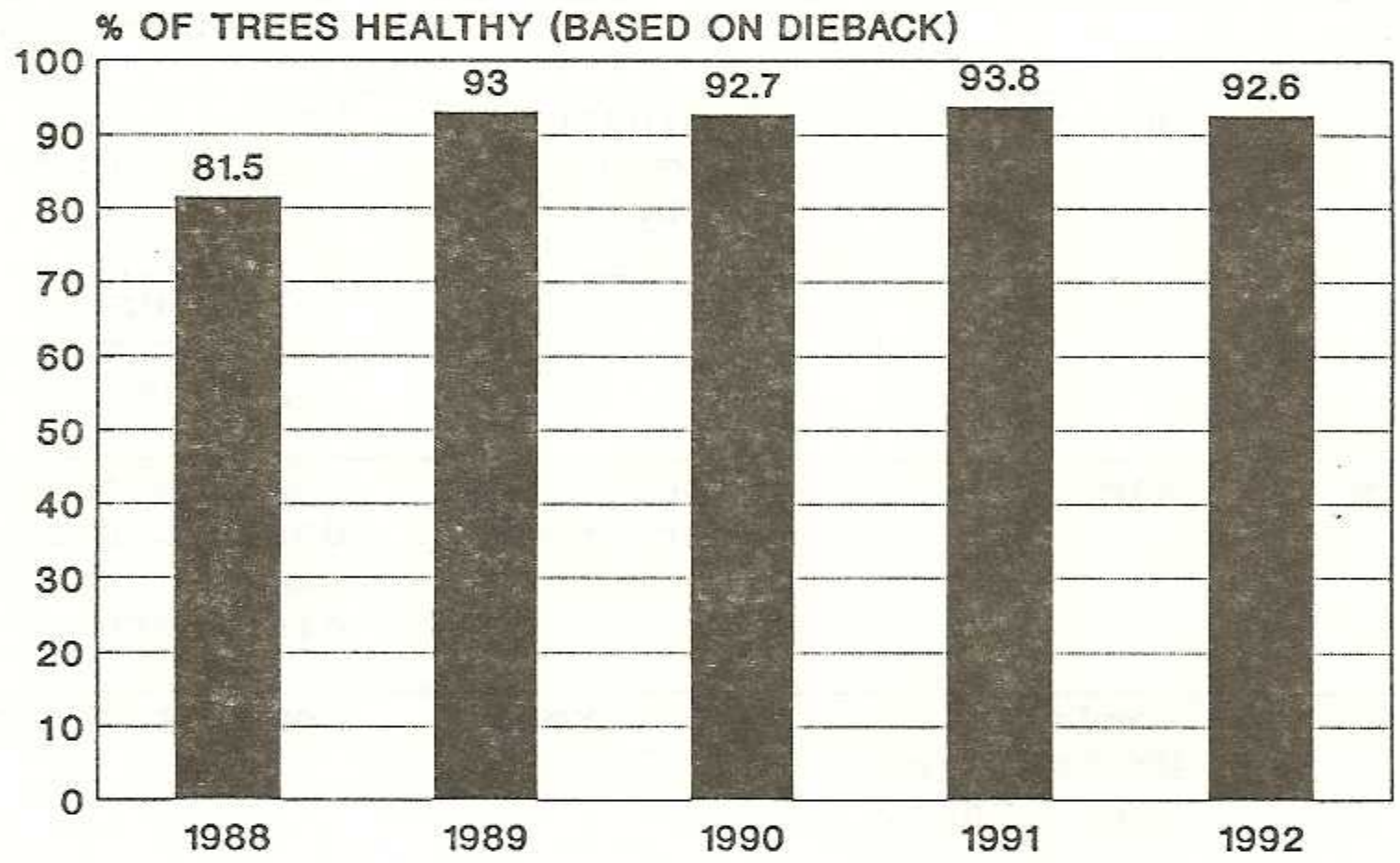


Figure 23. Trend in sugar maple health, 1988-1992. Based on 1,074 dominant/codominant trees in 29 Vermont North American Maple Project plots. Healthy trees have ≤15% dieback.

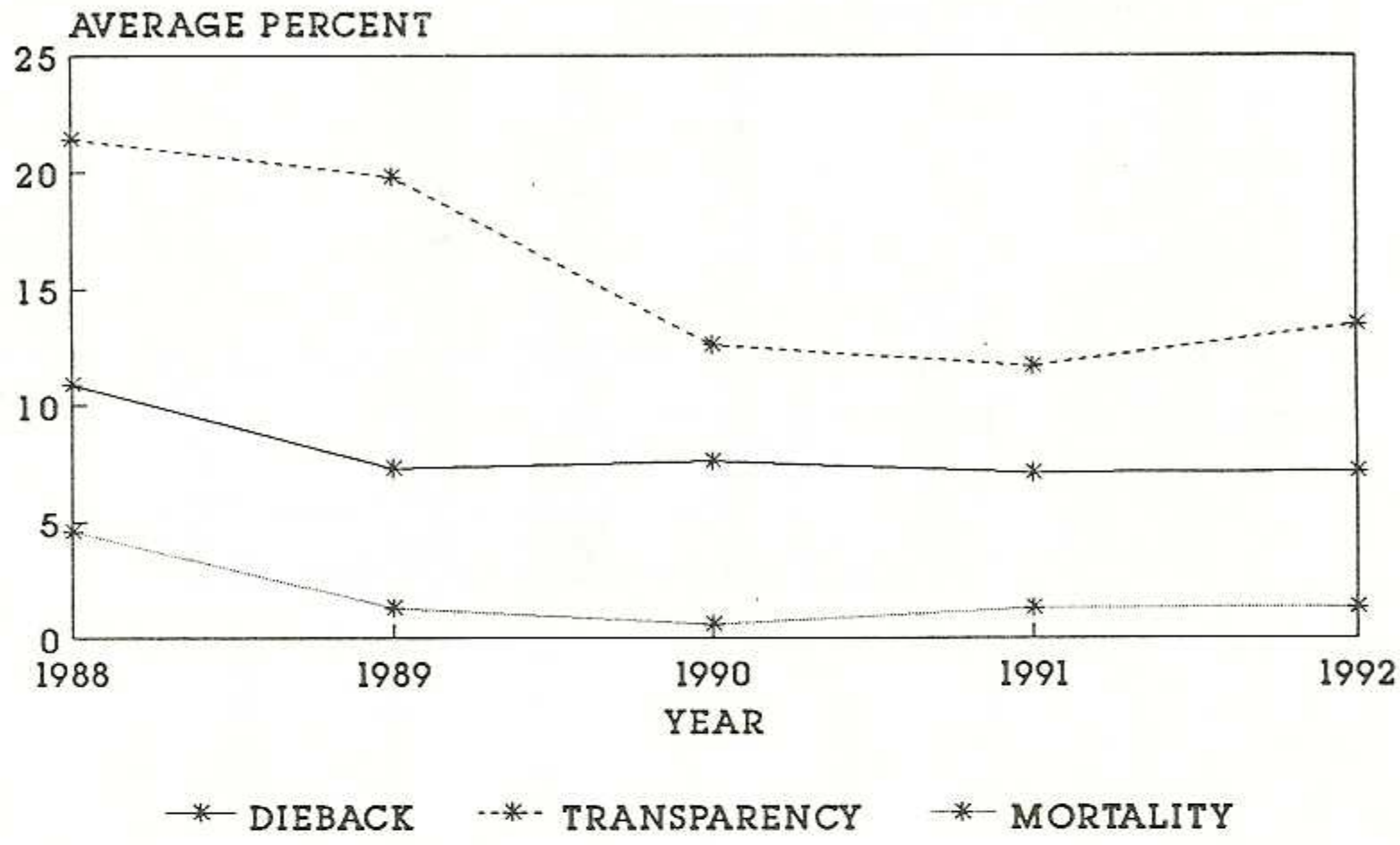


Table 24. Trend in sugar maple dieback, foliage transparency and mortality, 1988-1992. Based on 1,074 dominant/ codominant trees in 29 Vermont North American Maple Project plots.

National Forest Health Monitoring Program - Monitoring of tree condition under this program continued in 1992. Results will be available in "Health and Productivity of Vermont's Forests - 1992".

Vermont Monitoring Cooperative, Vermont's Intensive Forest Ecosystem Monitoring and Research Program - Activities include intensive monitoring of the condition of the forest on Mt. Mansfield. There are now 7 forest health plots established at this location for this purpose.

Forest health plots located at 4 different elevations on Mount Mansfield showed that tree condition declined with elevation (Figure 25). Over 90% of trees growing at 1400, 2200 and 3000 foot elevations were considered healthy (trees with ≤15% of the crown made up of recent dieback), whereas only 51% of trees growing at 3800 feet had healthy crowns. Likewise, standing dead trees were more prevalent at higher elevations (Figure 26).

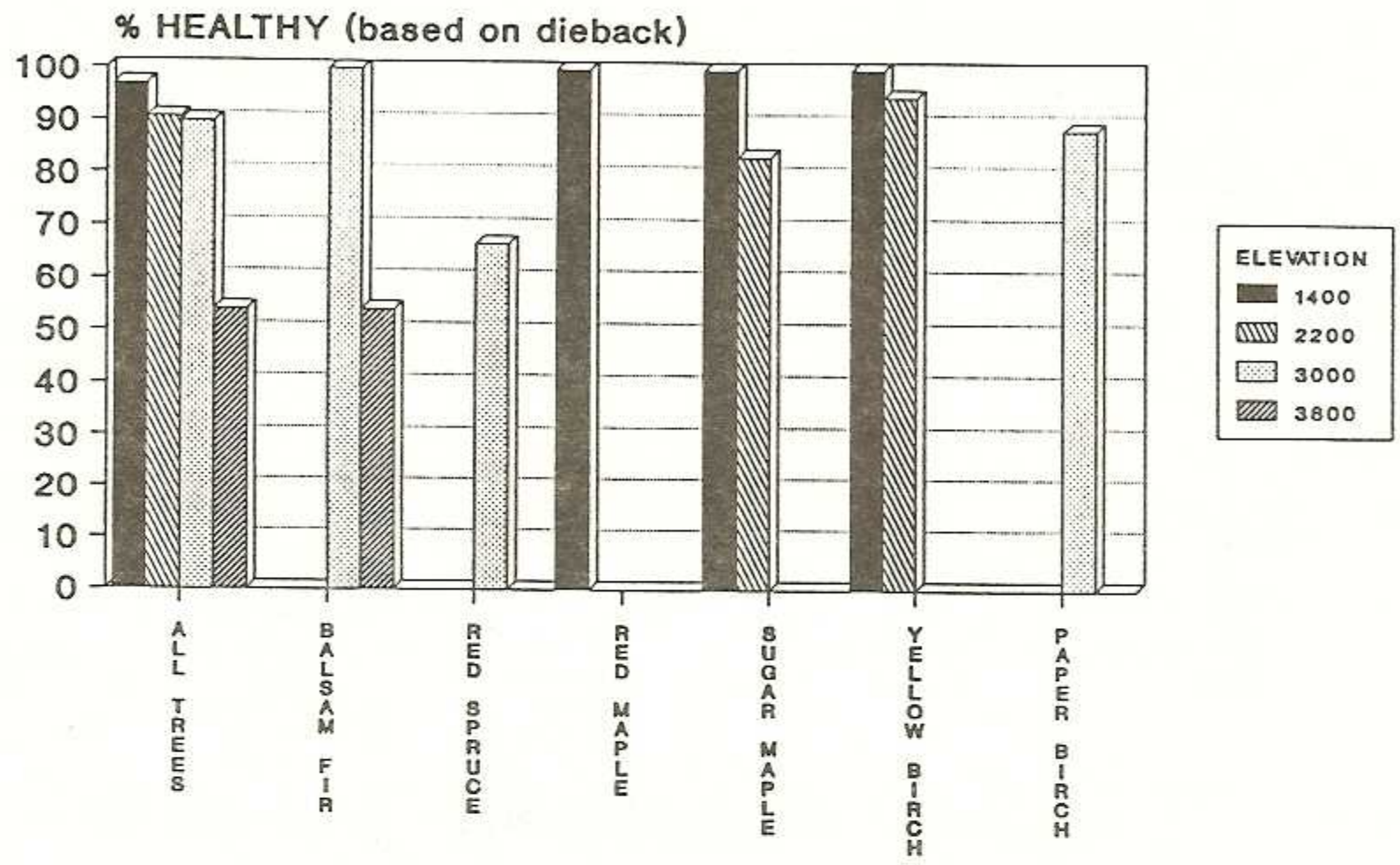


Figure 25. Health of dominant/codominant trees on Mount Mansfield at four elevations in 1992. Healthy trees have ≤15% dieback.

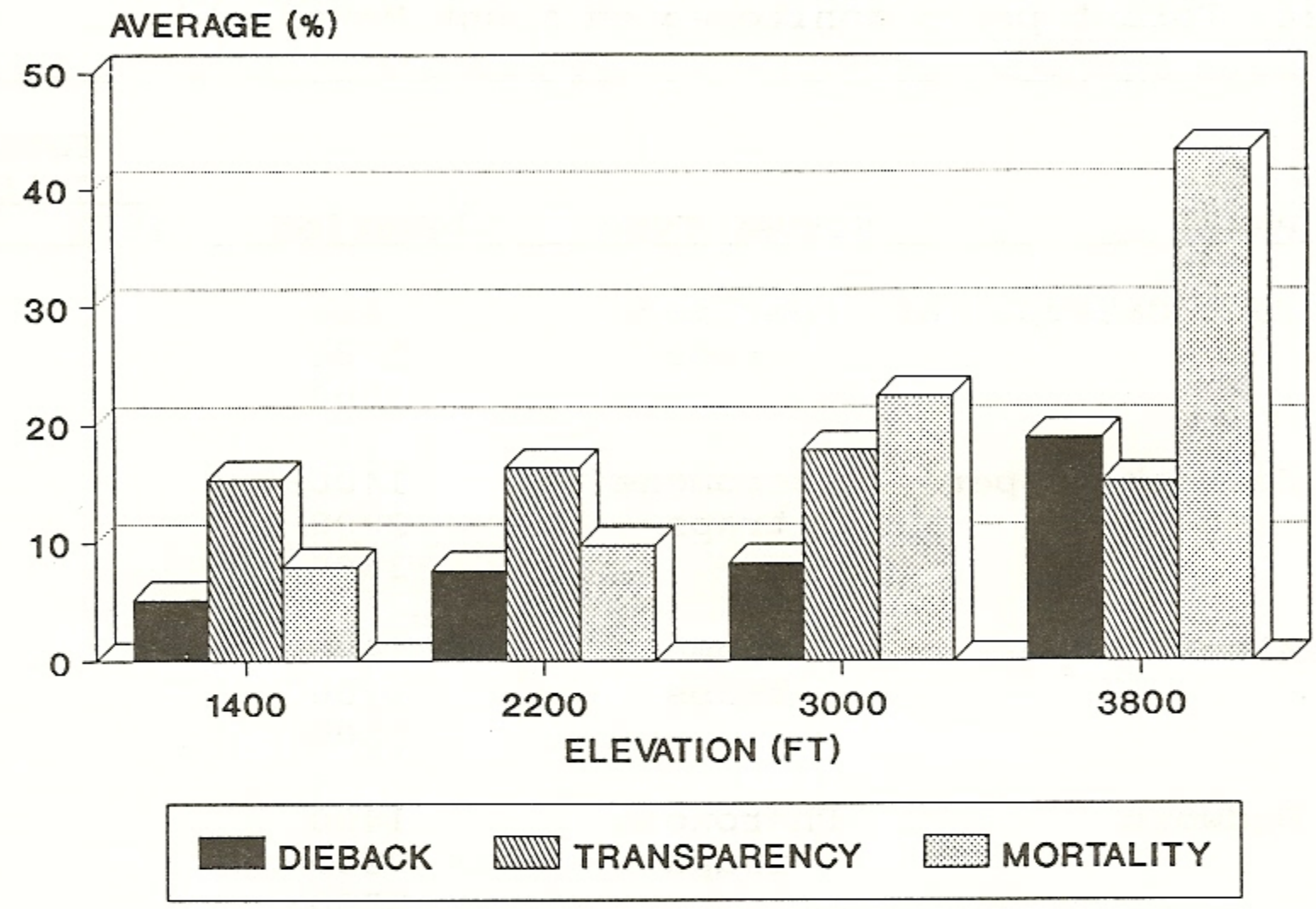


Figure 26. Baseline data on crown dieback, foliage transparency and standing dead trees (mortality) for all species (trees ≥5" DBH) in forest health plots on Mount Mansfield, 1992.

A variety of potential forest stress agents are monitored, including insects (forest tent caterpillar, spring and fall hemlock looper, spruce budworm, gypsy moth and pear thrips), ozone levels, and weather conditions.

Highlights of pest activity are listed in Table 24. Spruce budworm adults were detected at all elevations, although the lower elevations had the higher pheromone trap catches. A healthy gypsy moth population is present, at lower elevations, in a localized stand of poplars surrounded by predominantly sugar maple forest. Adult pear thrips catches on sticky traps and soil populations in the fall increased over 1991. This follows the general trend observed in other parts of northern Vermont. Light damage was observed on sugar maples at lower elevations from pear thrips and maple leaf cutter.

More detailed information on forest health monitoring conducted by the Vermont Monitoring Cooperative is available from the Waterbury Office of the Department of Forests, Parks and Recreation.

Table 24. Forest pests monitored on Mount Mansfield.

Target Pest	Survey Type	Elevation	Total No. Collected 1991	1992
Forest Tent Caterpillar	Pheromone traps	1400		0
		2200		0
		3800		0
Spring Hemlock Looper	Pheromone traps	1400		0
		2200		0
		3800		-
Fall Hemlock Looper	Pheromone traps	1400		325
		2200		521
		3800		-
Spruce Budworm	Pheromone traps	1400		87
		2200		10
		3800		7
Gypsy Moth	Burlap banded trees	1400		4
Pear Thrips	Sticky traps	1400	7	313
	Soil samples	1400	0.8	8.1

HEALTH OF SUGAR MAPLE IN VERMONT - 1992

Reported by the 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.

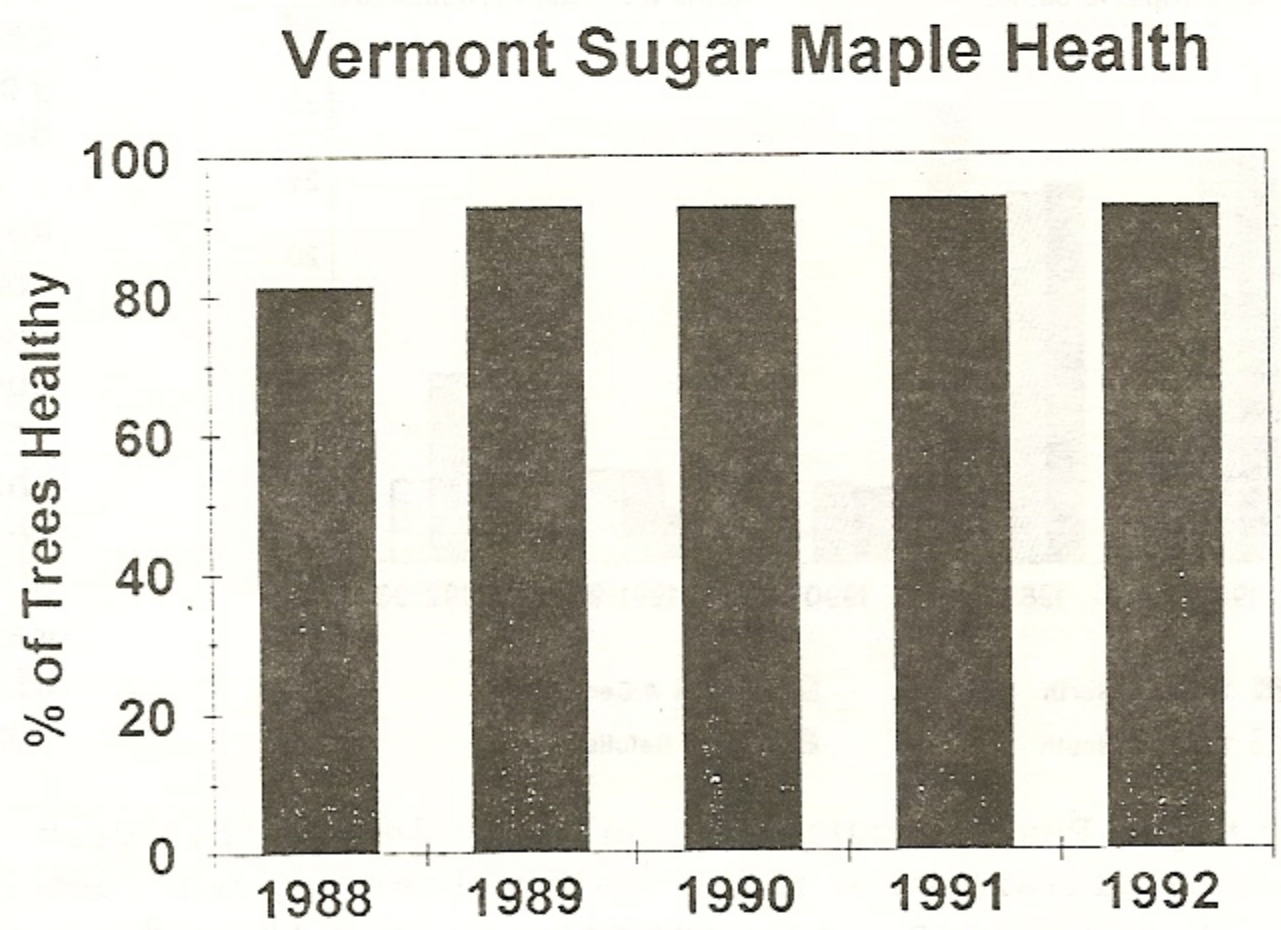
Insect and disease reports, identification requests, and information on control methods should be directed to the County Forester or Forest Resource Protection personnel at our local offices. The best way to find out about developing problems is to inspect your sugarbush periodically in the spring and summer for insects, chewed off pieces of leaf on the ground, or thin leaves overhead. 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 will 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 growing season began with bud break and leaf development generally one or two weeks later than normal. However, when budbreak did occur, foliage developed rapidly because of a succession of warm, sunny days. Damage to maples was minimal from a killing frost in late May, which caused widespread damage to foliage of other tree species. The summer was generally cooler than average, with enough moisture to keep things growing.

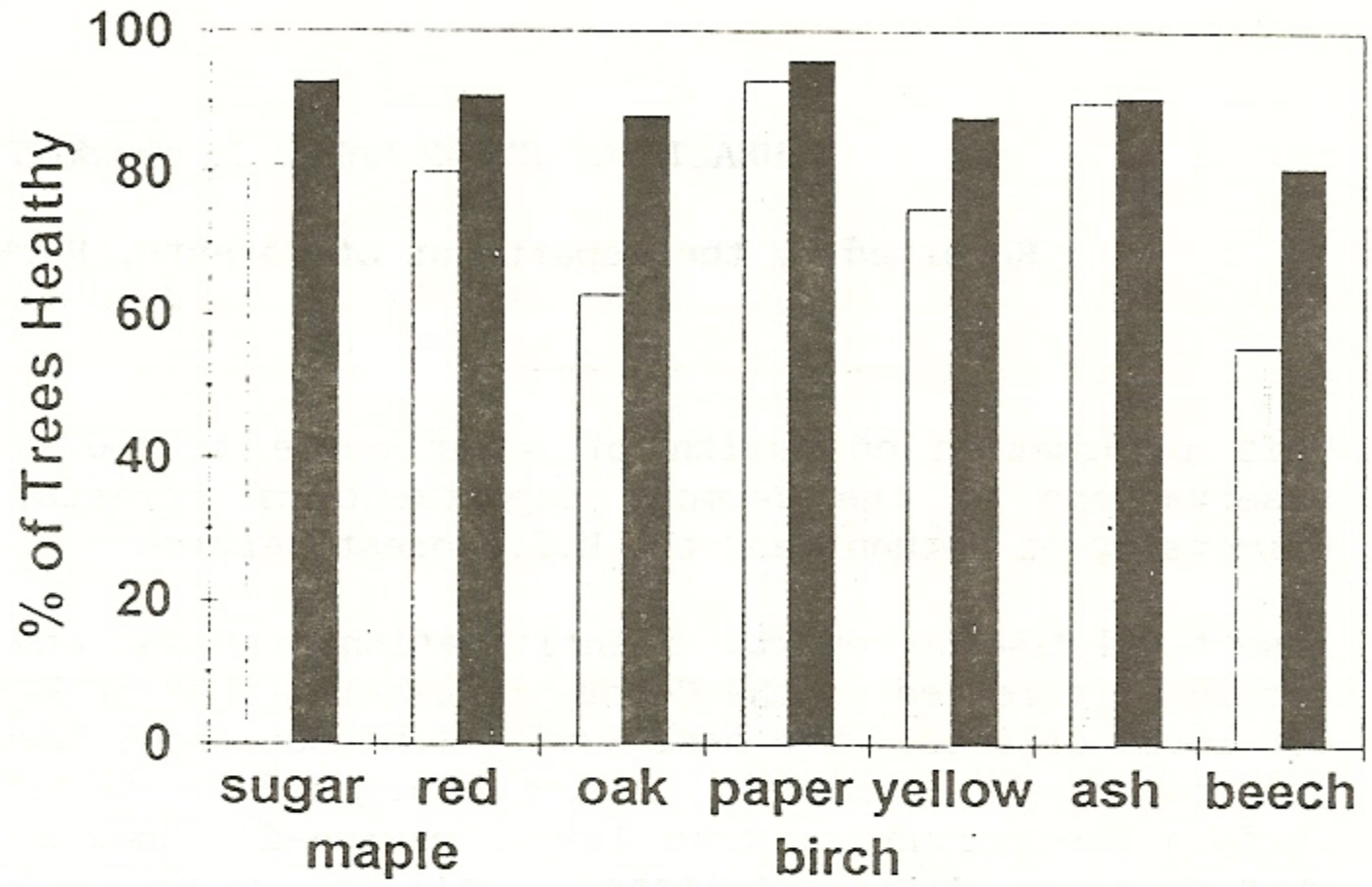
A Heavy Seed Crop throughout the state resulted in thin tops on many trees.

Scorch, probably caused by dry weather in the spring, and residual effects from dry conditions in 1991, was observed again. Although much less common than last year, brown foliage was mapped in the Northeast Kingdom, mostly in areas where it was seen in 1991.

Forest Health Monitoring continues on a number of plots in Vermont. Trees which are part of the North American Maple Project, the international effort to follow changes in maple health, were similar in condition to the previous three years (graph).



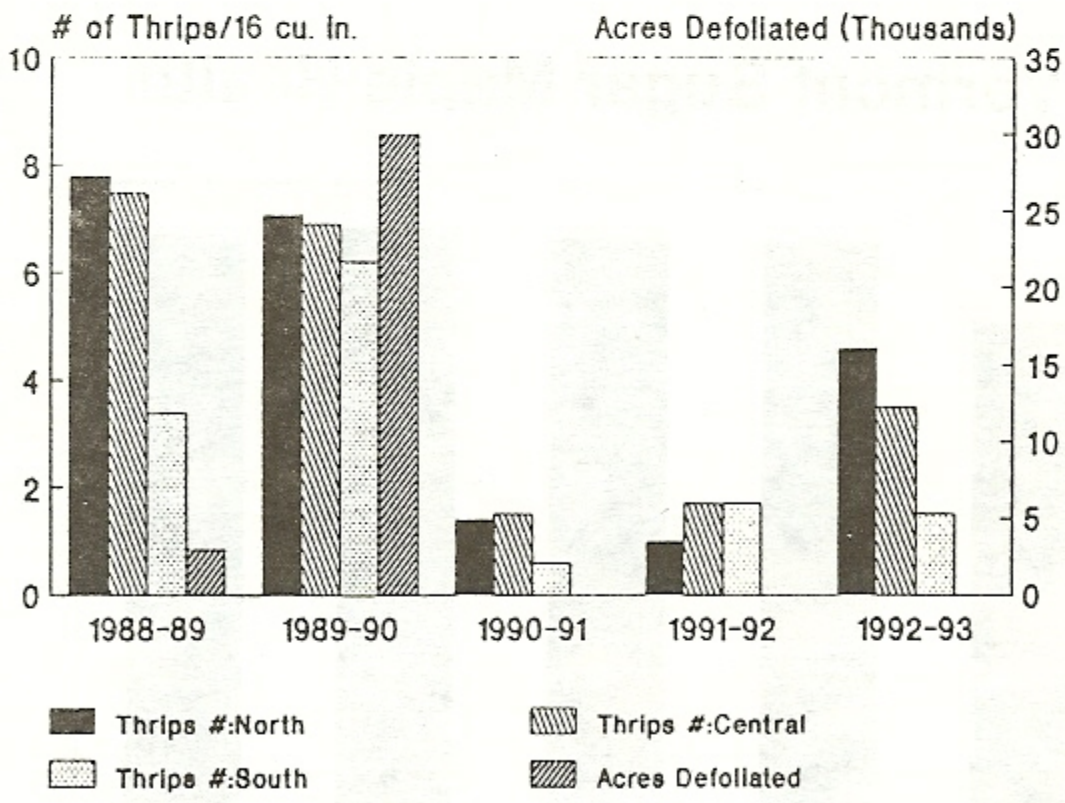
Data analysis was completed on the Vermont Hardwood Health Survey, which looked at the change in tree condition over a five year period (graph). Nearly all species of trees had more healthy crowns in 1991 than in 1986. A brochure which summarizes the results of this survey can be obtained from the Dept. of Forests, Parks, and Rec.



Maple Leaf Cutter damage was similar to 1991 with 4000 acres mapped from the air. Again, the most damage occurred in Caledonia, Orange, and Windsor Counties, with scattered damage elsewhere. Cool weather delayed development of the insect, and populations did not build as expected. Damage is expected again next year. Sampling in early June can determine whether populations are high enough to cause defoliation.

No defoliation by **Pear Thrips** was mapped from the air. A statewide survey indicated that numbers of thrips overwintering in the soil were low, and rapid leaf development also contributed to light damage levels.

Thrips in Vt Soil: Averages by Region
Compared to Annual Defoliation



Soil samples were taken again in the fall of 1992. Counts are higher than last year, except in southern Vermont, although they remain lower than counts from years when widespread defoliation occurred (graph).

Research on pear thrips is continuing in Vermont, and throughout the northeast. A fungus disease which has been isolated from infected pear thrips in Vermont soils has been tested in the laboratory for its ability to kill pear thrips and maple leaf cutter. The fungus will be field tested in the summer of 1993.

Other Maple Pests occurred at only low levels this year. Saddled Prominent and Forest Tent Caterpillars were occasionally observed, but caused no damage. Light feeding by Bruce Spanworm (a green inchworm) was seen throughout the state in the spring.

COMMON PESTS OF CHRISTMAS TREES IN VERMONT 1992
REPORTED BY THE
DEPARTMENT OF FORESTS, PARKS AND RECREATION

INSECTS

Balsam Gall Midge damage to balsam fir Christmas trees declined this year, with only 20 acres of damage detected in the annual survey of northern Vermont plantations, compared to 146 acres in 1991. No damage is expected in 1993.

Balsam Shootboring Sawfly caused less noticeable damage than in 1991, but actual damage may have been masked by the more abundant frost damage in many locations. A total of 93 acres of light to moderate damage to balsam and fraser fir Christmas trees in northern Vermont was reported compared to 197 acres in 1991.

Balsam Twig Aphid populations decreased somewhat in northern Vermont, but still caused widespread moderate damage to native balsam and balsam fir Christmas trees. Light damage to fraser fir Christmas trees was also observed. In the annual survey of northern Vermont plantations, 190 acres of mostly moderate damage were detected compared with 256 acres in 1991. Eggs present for 1993 are less numerous than in the spring of 1992, suggesting that populations should decrease further in 1993.

Cooley Spruce Gall Adelgid caused light to moderate damage to Douglas fir at levels similar to 1991.

Cinara Aphids were occasionally present on Balsam fir and Scots pine in northern Vermont, but little shoot mortality was observed compared to previous years.

Eastern Spruce Gall Adelgid damaged red and white spruce throughout the state at levels similar to 1991. Mostly light to moderate damage was reported for 34 acres in northern Vermont. Curly shoots on white spruce in one plantation are thought to be from aborted galls.

Mound Ants were again reported to be causing mortality of balsam fir in Ludlow.

Pales Weevil damage was down from 1991 levels, causing 60 acres of light to moderate damage, mostly on Scots pine, in northern Vermont. Damage in 1991 was reported on 134 acres.

Pine Leaf Adelgid eggs and nymphs were unusually abundant on white pine in early summer, but the only heavy shoot damage observed was to natural regeneration in Reading.

Pine Needle Midge damage to Scots pine appears to be increasing. Look for needles that bend downward from the fascicle and then droop, with damage most noticeable at the tops of trees.

Pine Spittlebug was rarely observed on Scots and white pine in 1992. Down from 1991.

Pine Thrips were commonly found on Scots pine but damage was lighter than in 1991.

Ragged Spruce Gall Adelgid damage to red spruce remains common but was less than in 1991.

Sawyer Beetles caused light shoot mortality to balsam fir in scattered locations, but damage was less noticeable than in 1991.

Spruce Spider Mite damage was heavy in several balsam fir and fraser fir plantations in southern Vermont but overall populations were down from 1991 levels. Only light damage was reported in northern Vermont.

White Pine Weevil remains common, but damage to Christmas trees was down from 1991 levels. Mostly moderate damage was reported for 78 acres in northern Vermont compared to 171 acres in 1991.

DISEASES

Cylaneusma Needlecast (formerly *Naemacyclus)* of Scots pine remains common, but decreasing. It was reported present in 71 acres of Christmas trees in northern Vermont compared to 103 acres in 1991 and 427 acres in 1990.

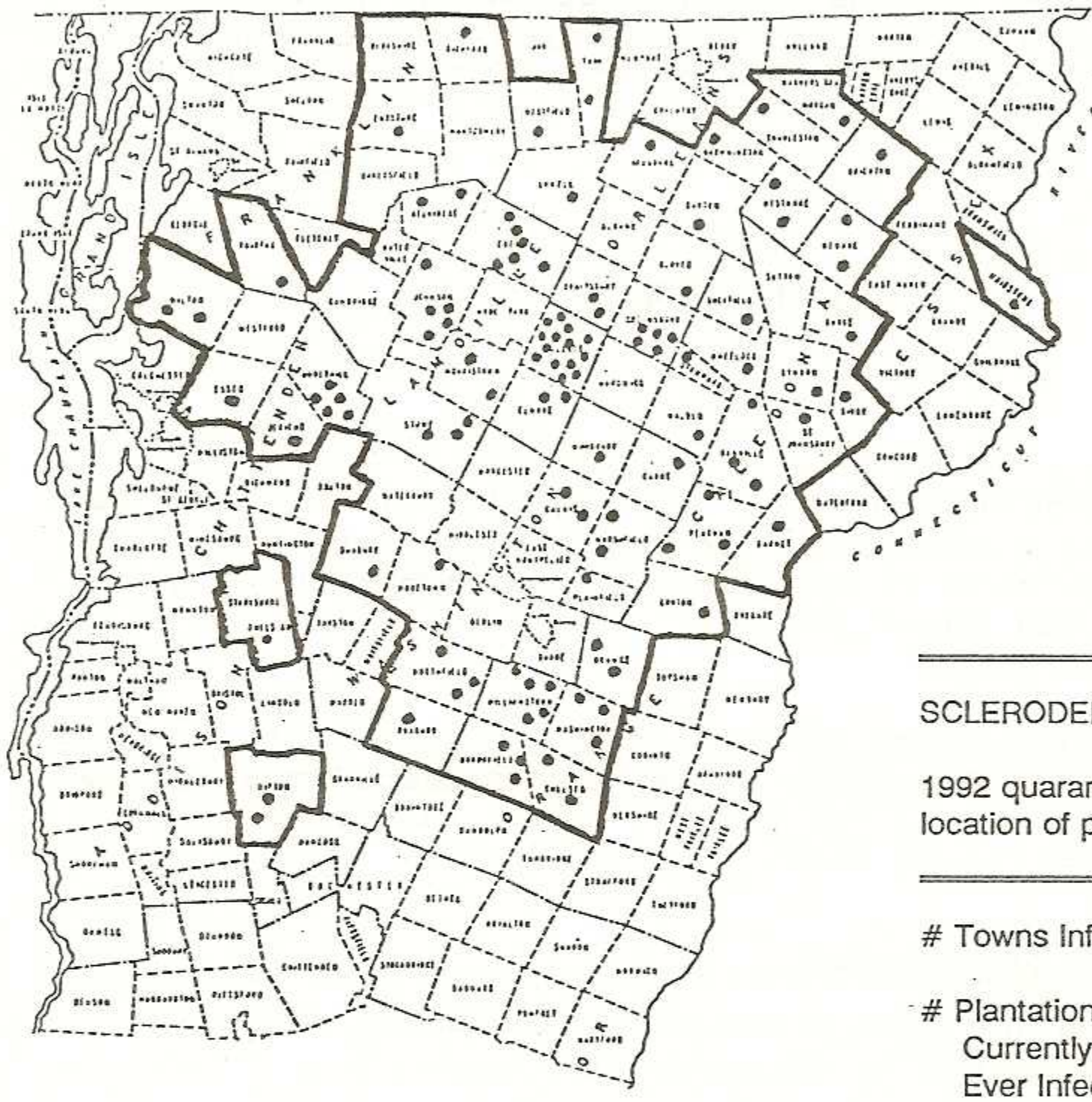
Fir-Fern Rust increased throughout the state for the second consecutive year, but damage to balsam fir remained mostly light. Light needle loss was reported for 121 acres in northern plantations compared to 56 acres in 1991.

Lophodermium Needlecast of Scots pine remains less common than *Cylaneusma*. Light damage was reported for 38 acres in northern Vermont compared to 19 acres in 1991.

Rhabdocline Needlecast remains present on Douglas fir in widely scattered locations, but damage remains down from past years.

Rhizosphaera Needlecast of blue and white spruce was generally light in widely scattered locations at levels similar to 1991.

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



SCLERODERRIS CANKER

1992 quarantine area and location of positive infection

# Towns Infected	= 64
# Plantations:	
Currently Infected	= 126
Ever Infected	= 130

Swiss Needlecast of Douglas fir caused moderate damage a plantation in Weathersfield and light to moderate damage in seven northern plantations.

White Pine Blister Rust remains common, but its incidence on Christmas trees remains down, being reported as light on 62 acres in northern Vermont survey.

White Pine Needle Blight, also called Semi-mature tissue needle blight, caused the heaviest damage yet observed in northern Vermont, after affecting only locally scattered trees in 1991 and being absent in 1990. The needle browning was noticeable on scattered trees throughout the state and resulted in unmarketable white pine Christmas trees in 8 widely scattered northern plantations, comprising 35 acres. The disease is attributed to weather at needle elongation, with a fungus or ozone playing a possible role. Symptomatic trees have variable tip burn within a fascicle of the current growth. This is the first very noticeable damage in four years.

Woodgate Gall Rust damage to Scots pine was similar to 1991 levels, causing 82 acres of light to moderate damage in northern Vermont.

Yellow Witches Broom Rust was common in many northern Vermont plantations surveyed this year, though it has not been reported in the past. Damage was mostly light except for moderate damage to a plantation in Barton.

Fertilizer Injury to a balsam fir Christmas tree plantation on sandy soil in Sutton resulted from placing handfuls of fertilizer in spots near trees. The same method used in 1991 in a Sheffield plantation caused similar problems. Root kill beneath the fertilizer spots resulted in branch dieback to portions of tree crowns and, in some cases, entire crowns. Spot applications should be avoided, particularly on well-drained soils during dry weather.

Frost Damage, due to a late spring frost on May 24 in most locations and on several other dates through June 15 in scattered locations, affected foliage of fir and spruce Christmas trees. In the northern Vermont survey, damage was reported for 132 acres of balsam fir, 31 acres of white spruce, 20 acres of fraser fir, 17 acres of Douglas fir, 10 acres of blue spruce, for a total of 246 acres. Many Christmas trees have now had successive years of frost damage. In northern Vermont, 211 acres was reported with frost damage in 1991.

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Samples may be submitted for identification by mailing or in person at the joint Vermont Department of Forests, Parks and Recreation and Vermont Department of Agriculture, Insect and Disease Laboratory in the Waterbury state office complex.

Mailing address:

Vermont Department of Forests, Parks and Recreation
Attn: Lab
103 South Main Street, 10 South
Waterbury, VT 05671-0601