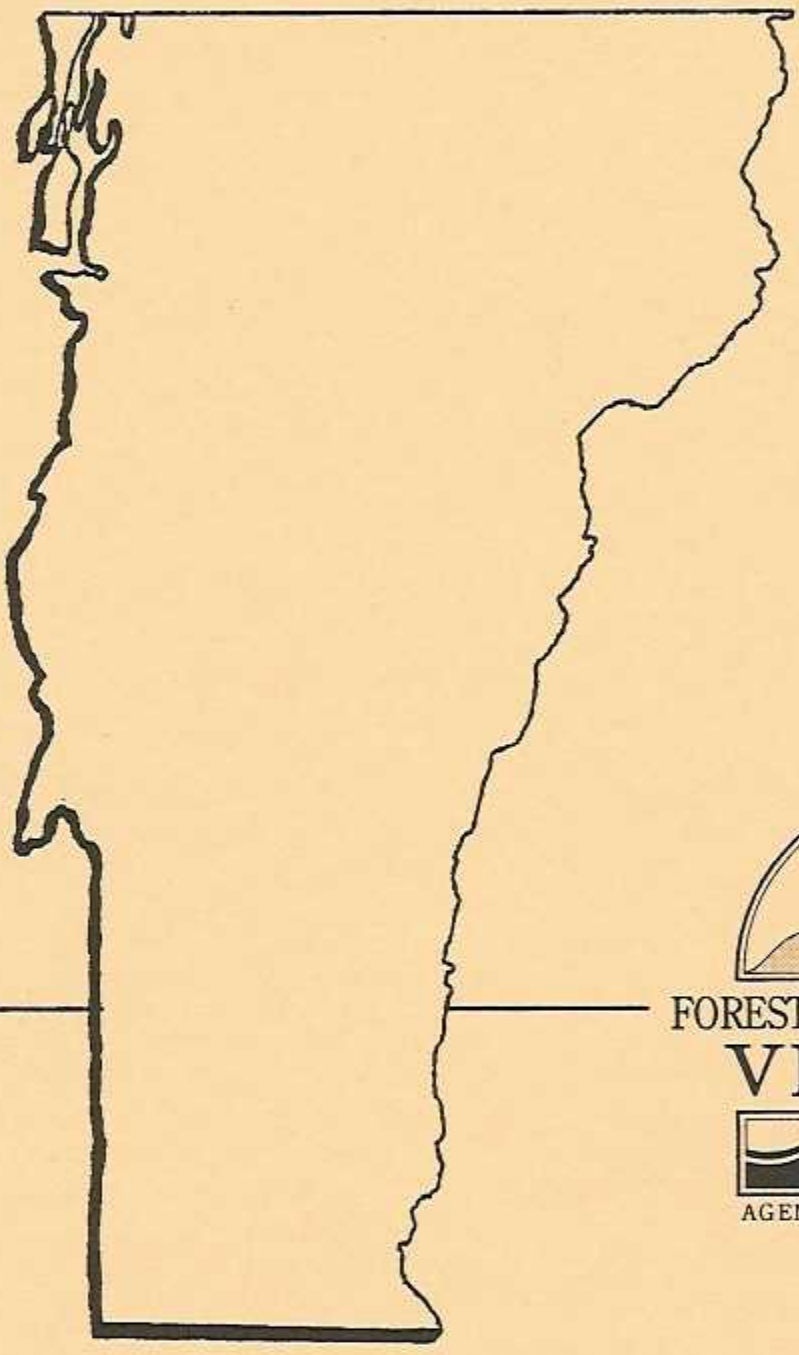
FOREST INSECT AND DISEASE CONDITIONS IN VERMONT 2001



VERMONT
FOREST RESOURCE PROTECTION

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

FOREST INSECT AND DISEASE CONDITIONS IN VERMONT

CALENDAR YEAR 2001

Hardwood defoliation from the 2002 drought

EDITED BY

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PREPARED BY

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AGENCY OF NATURAL RESOURCES
DEPARTMENT OF FORESTS, PARKS AND RECREATION
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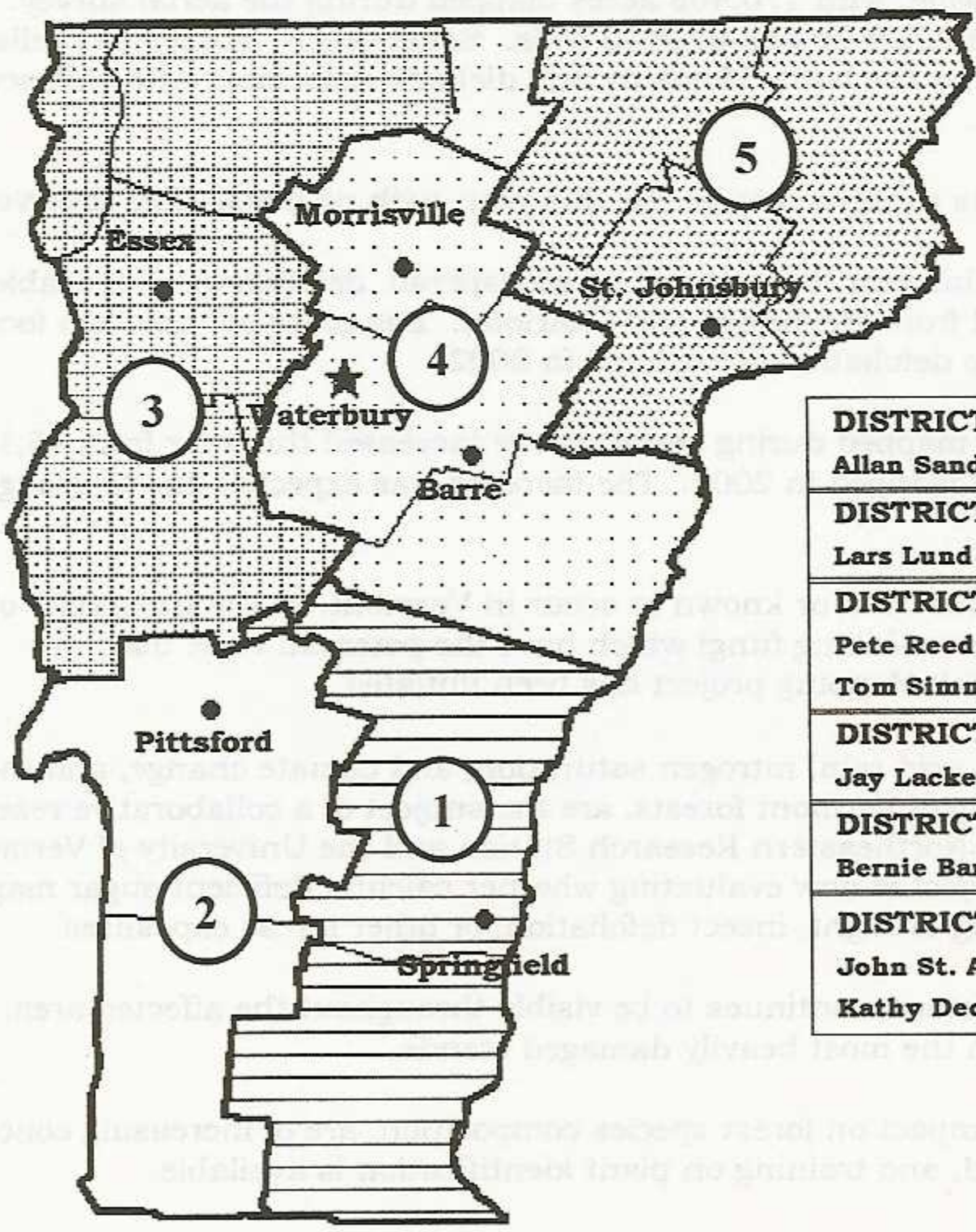

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2001 Vermont Forest Insect and Disease Highlights

Balsam Gall Midge populations remained high. The current infestation is lasting much longer, with much heavier damage, than previous infestations of this pest.

Balsam Shootboring Sawfly caused only trace to light amounts of damage in Christmas tree plantations this year, as expected. This insect should be more noticeable in 2002.

Balsam Twig Aphid populations increased dramatically after seeing decreasing levels since 1996.

Beech Bark Disease, and chlorotic beech crowns, were much more conspicuous than normal. A total of 57,914 acres were mapped compared to 1,395 acres mapped in 2000, and 4,004 in 1999. Populations of beech scale were very heavy in some areas.

Birch Defoliation, caused by **Birch Leaf Miners**, was mostly light. The damaged area mapped during aerial surveys decreased from 30,569 acres in 2000 to 20,881 acres in 2001.

Butternut Canker remains widespread. The University of Vermont Forest Pathology Lab continues to study insect vectors of butternut canker, and patterns of disease occurrence.

Deer damage to regeneration, lower branches, and bark in and around deer wintering areas was high due to heavy snow. Impact on regeneration remains high in the Connecticut River valley.

Drought damage was observed statewide, with 170,408 acres mapped during the aerial survey. The most noticeable damage occurred on shallow or well-drained soils. Some beech, maple, and yellow birch on severely impacted sites have no live buds. Mortality and dieback associated with this severe drought is likely to be evident in 2002.

Forest Tent Caterpillar populations continued to be low this year, with no defoliation observed.

Gypsy Moth populations increased this year, but caused no widespread defoliation. Noticeable defoliation of forest trees was reported from Weybridge and Charlotte. Egg mass counts from focal area plots remained low in the fall. No defoliation is expected in 2002.

Hardwood Decline and Mortality mapped during aerial survey increased this year from 15,180 acres mapped in 2000 to 23,432 acres mapped in 2001. The increase was expected due to drought stress.

Hemlock Woolly Adelgid was not observed or known to occur in Vermont. At the University of Vermont, research is continuing on insect-killing fungi which have the potential to be used in biological control, and a Forest Pest Risk Mapping project has been initiated.

Human-Induced Stresses, such as acid rain, nitrogen saturation, and climate change, and their impact on the health and sustainability of Vermont forests, are the subject of a collaborative research project between the US Forest Service Northeastern Research Station and the University of Vermont School of Natural Resources. The project is now evaluating whether calcium deficient sugar maple may be predisposed to decline following drought, insect defoliation, or other stress exposures.

Ice Damage from the January 1998 storm continues to be visible throughout the affected area. Leaf cover increased, from 2000 to 2001, in the most heavily damaged stands.

Invasive Exotic Plants, and their impact on forest species composition, are of increasing concern. A reporting system has been developed, and training on plant identification is available.

Larch Decline increased in northeastern Vermont, with many new areas showing decline following the 1999 and 2001 droughts.

Maple Leaf Cutter caused scattered moderate to heavy defoliation with 23,634 acres mapped. In most areas, scattered heavy defoliation was observed only on reproduction and lower crowns.

Mouse and Vole damage was sometimes heavy on young ornamentals and roadside woody plants during winter 2000-2001.

Oystershell Scale populations on American beech were heavy on regeneration in scattered locations in the two southern counties, but were light elsewhere.

Pear Thrips caused scattered moderate to heavy defoliation in Lamoille, Rutland, Washington and Windsor Counties. Populations had generally increased from 2000. If leaf flush hadn't been as rapid as it was, damage would have been worse. Counts of overwintering thrips in soil samples collected in fall 2001 are down from 2000.

Pine Shoot Beetle was not found in any new counties, although detection traps were placed in 54 sites in northern Vermont. Pine shoot beetle is a regulated, introduced pest, and a state quarantine should go into effect by spring 2002. This will impact the movement of pine wood and bark products from the known infested counties of Essex, Orleans and Caledonia.

Pine Wilt Disease is the subject of research at the University of Vermont Forest Pathology Lab. Scots pine trees were found to harbor populations of the pine wilt nematode for up to 11 years without developing symptoms.

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

Spruce Budworm continued at low levels, with no visible defoliation detected.

Squirrel populations are high following several years of heavy crops of acorns, cones, and other food sources. Increased damage is expected.

Wet Site conditions continue to contribute to decline of trees. However, less dieback attributed to wet site was mapped during aerial surveys, with 9,640 acres mapped compared to 10,194 acres in 2000.

White Pine Blister Rust remains common, with cankers and flagging branches frequently observed. A white pine survey was conducted this summer which will provide information about the incidence of this disease on forest trees.

White-spotted Sawyer remains widespread on white pine and balsam fir. It is the subject of investigation by the University of Vermont Forest Pathology Lab.

Vermont 2001 Forest Health Management Recommendations

The following recommendations summarize information in this report of particular importance to forest managers. Additional information can be found under specific pests mentioned. Separate summaries for sugarbush and Christmas tree managers are in the appendix.

For assistance in identifying pests, diagnosing forest health problems, on-site evaluations, and insect population sampling, or to obtain copies of defoliation maps, management recommendations, and additional literature, contact forest resource protection personnel (page 1) or your county forester.

The most significant **General Forest Health** impact in 2001 was the *Drought*. Its effects will continue for several years, since many rootlets have died and trees photosynthesized less. With lower food reserves, leaf and shoot size in subsequent years will be reduced. In addition, low carbohydrate levels will make it harder for trees to survive severe winters.

Two or three years following drought is when trees which are already wounded or diseased may begin to decline, even if ample water becomes available.

The impact of drought is most severe where trees already have limited root systems, as on sites shallow to bedrock or poorly drained sites. Avoid additional disturbance to these trees. Maples on calcium-poor sites, and perhaps other species as well, will recover more slowly than those growing in richer soils.

Bark beetles may build up stressed trees, particularly pine, larch, birch or hemlock. Look for sawdust, exit holes, or bark which is sloughing off from woodpecker activity. Where beetles are active and salvage is desirable, cutting in groups or patches is often preferable to single tree selection.

Following a recent two-year drought in Wisconsin, mortality was highest in white birch, which tended to be on shallower soils and have shallow root systems. An infestation of bronze birch borer followed the drought, and about 1/3 of the white birch resource was lost. Birch which were not salvaged the year of the drought decayed too quickly to provide merchantable products. Northern pin oak and black oak also sustained heavy mortality, enhanced by a build-up of two-lined chestnut borer. In general, red maple, sugar maple, and basswood came through the drought without major health impacts. Both green and white ash often had top dieback, but limited mortality.

Acidic Deposition remains a forest health concern. Vermont is a pilot state for the New England Governors/Eastern Canadian Premiers' Forest Sensitivity Mapping Project, which is assessing sustainable levels of deposition on forest soils. Intensive harvesting may not be sustainable over the long term, on sites with low cation levels, unless pollution levels improve. More information can be found on-line at http://www.cmp.ca/DataWoBorders.pdf.

The health of **Beech** is also of particular concern after 2001. Populations of *Beech Scale* increased statewide, and the incidence of chlorotic crowns jumped substantially. In the short term, average beech health is expected to worsen. The *Nectria* fungus will colonize the bark of beech recently infested with high levels of scale. However, many beech are genetically resistant to scale. With beech bark disease at high levels, now is a good time to identify these individuals.

Recent research by the US Forest Service suggests methods to increase the regeneration of scale-resistant beech, and reduce the regeneration of susceptible beech. Most important is to retain resistant individuals and discriminate against susceptible individuals regardless of harvesting regime. Not only do sprouts from the standing trees thrive from the increased light following the harvest, if left standing, they will continue to produce both sprouts and seeds into the future. Winter harvest was somewhat preferable for sprout development, growth, and persistence.

The movement of **Pine** forest products from is regulated by quarantine to reduce the spread of *Pine Shoot Beetle*. Stipulations affecting the movement of logs, bark, or unprocessed bark mulch from Essex, Orleans, and Caledonia Counties are in the appendix. Products from all pine species are included.

Hemlock continues to be threatened by *Hemlock Woolly Adelgid*, still within ten miles of the Vermont border in the town of Greenfield, Massachusetts. Although the news from infested areas is remains variable, all agree that hemlock woolly adelgid can be devastating where trees are under stress or where site conditions are poor. Where hemlock mortality is high, the young trees that replace them have been hardwoods.

Natural spread should move hemlock woolly adelgid up the Connecticut River valley into southeastern Vermont within the next few years. It is often found first along forest corridors like ravines and trails. In developed areas, the first infestations are often found near bird feeders. These are good places to look for the insect. Spread on infested nursery trees could carry the insect anywhere.

It would be a mistake to salvage hemlock at this time in anticipation of future losses. We don't know where and when hemlock woolly adelgid will show up, and what the impact of Vermont winters and biological control efforts will be. Even once it's established, tree mortality doesn't begin for several years, and many may survive, providing time for salvage in the future. Continuing research may uncover better management strategies. Finally, widespread salvage could shrink the hemlock gene pool. Important genes, including those that may make hemlocks resistant to adelgid, could be lost.

Other strategies could help to preserve the hemlock resource or some of the benefits that hemlock now provides. Hemlocks growing on deeper soils with good water availability are more likely to survive adelgid infestation than those on poorer sites. Maintain the hemlock component on these sites, by releasing young hemlocks and avoiding significant disturbances.

If the adelgid causes significant mortality, other conifer species will be needed to provide some of the wildlife and aesthetic benefits now provided by hemlock stands. Maintaining or establishing stands of other conifer species will help sustain some of these benefits.

INTRODUCTION

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

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

A survey of Christmas tree plantations is conducted annually in North-Central Vermont as part of the Scleroderris quarantine. This year, twenty plantations, comprising 272 acres, were surveyed. Observations are made on all pests during this survey. Acreages reported for Christmas tree problems refer to changes in these surveyed plantations, and are not statewide totals.

ACKNOWLEDGMENTS

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

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WEATHER AND PHENOLOGY

Weather statistics for 2001 are summarized in Figure 1.

Winter

Winter 2000-2001 saw average temperatures with no extreme cold. There were no substantial thaws and frequent snowfall kept accumulating. With continuous snow cover, and a dense snowpack, the ground never froze. At Essex, the weather station had snow cover from December 18 until April 13.

A series of Noreaster storms through March broke greatest total snowfall records in locations throughout Vermont, and made this the seventh wettest March on record (NERCC). Burlington recorded 47.6" of snowfall for the month of March. This is the 2nd time in ten years that the record, since 1886, of 37" has been broken. (1993 had 39.9") Mt. Mansfield's stake near the top of the mountain recorded 130" of snow on the ground (72" is average). The twelve-foot stake had an additional two feet added for fear it would be lost. The Essex weather station had 31" of snow on the ground and Huntington gap had over 60". Collapsed roofs and downed limbs from conifers, especially pine, were a common sight by Mid-March.

Maple Sugaring Season

Maple sugaring activity was delayed by a cold March. Many operations were curtailed or shut down by sap lines buried in the snow. Sap production was poor. It was thought that the snow absorbed what little rain there was, resulting in no moisture to the roots. The season was short and, according to the USDA, maple syrup production was 52% of its 20 year average and down 40% from 2000. Production in 2001 was the second poorest since records have been kept. Only 1971 had a smaller syrup crop, according to records kept since 1916, with 1987 being the same as 2001.

Spring

Huge banks of snow still present on the first of April were virtually gone by the middle of the month. There was little or no mud season. Fears of severe flooding that would have occurred from a rapid snow melt were eliminated by the onset of cool, dry weather, producing the third driest April on record (NERCC). This dry trend continued into May with no measurable rain falling from April 23 to May 12 in many locations. The amounts received on May 12 varied from over 1" in Franklin County to just .07" in St. Johnsbury.

Relative humidities were unusually low in early May with several days below 20%. Cool, dry weather changed to hot and dry, with record high temperatures recorded in several locations throughout Vermont during the first week. St. Johnsbury broke old records on May 2 with 85°; May 3 with 88°; and May 4 with 89°. In Burlington, new high temperature records of 86, 87 and 89 degrees, respectively, were recorded on May 1, 2 and 3 (Figures 2 - 3).

This early warmth put tree phenology about two weeks ahead of normal. Sugar maple leaves developed quickly. Sugar maple tree monitoring at the Proctor Maple Research Center shows this year's leaves emerging 11 days earlier than normal. Despite a late start, buds developed rapidly into leaves. But it's not the first time leaves flushed early. In the 10-year record of monitoring bud development, 1998 was the record for early spring leaf development. By May 5th of that year, sugar

maple leaves were fully formed. That's 6 days ahead of this year! It's not surprising that 1998 was the warmest year of the century, according to the National Oceanic and Atmospheric Administration (Figures 4 - 5, Table 1).

High fire danger from dry conditions combined with either high winds or low relative humidities during the first two weeks in May prompted many Town Forest Fire Wardens to stop issuing burning permits. On May 7, Vermont initiated a statewide burning ban for the second time in three years. The 'no burn order' reduced the threat of escaped permitted burns, however we continued to receive reports of escaped un-permitted burns and suspected arson fires. Dry lightning was responsible for starting a small fire in southeastern Vermont on May 12. The ban was allowed to expire on May 21 when the fire danger dropped to a lower level due to minimal amounts of precipitation, higher RH's and the normal progression of spring green up.

The warm, dry spring, coupled with moisture from snow melt, made for an excellent early planting season. The last week of May brought the first substantial moisture to Vermont soils since the snow melted in mid April. This wet period in mid-late May kept new red oak foliage from greening up in southern Vermont. Temperatures took a dive by the end of May with low temperatures near freezing at many locations throughout Vermont. On May 30, 6 ½" of new snow fell at the top of Mt. Mansfield.

Two weeks later, on June 14, temperatures soared, reaching the 90° mark in Burlington for the first time since September 4, 1999. High temperatures recorded at the fire weather stations on June 14 were: 90° in St. Johnsbury; 91° at Elmore and Danby; and 92° at Essex. This early heat wave lasted for the next 2 days, breaking on Father's Day with a significant statewide rain event. Regular June rainfall, while still below normal, was significant enough to keep lawns and gardens growing.

Summer

Hot weather in July spawned severe storms early in the month. A series of severe thunderstorms occurred in Rutland County on July 1, 4 and 9, producing winds up to 65 mph and knocking down trees and power lines. Severe storms occurring from July 9 through 12 also dropped dime sized hail in parts of Addison and Grand Isle Counties, causing damage to crops and hardwood leaves.

The dry conditions accelerated in July as well, breaking additional records in Burlington, including the second driest July ever. Only .77" fell in Burlington during the month. This marked the end of the driest April-July on record, with only 48% of normal precipitation received in Burlington during this period. From July 15 to August 8 (25 days) the fire weather station in Essex received only .08" of rain. Rainfall in northern Vermont was below normal by as much as 9" in several locations by mid-August.

Many farmers suffered severe damage to forage crops from both the drought and a severe outbreak of armyworms. Understory vegetation in many forest stands began to wilt and turn yellow. In August, the State Climatologist's office issued a statement calling the current situation a "flash drought" due to a more rapid onset than the drought of 1999. The Palmer Drought Index classified northern Vermont in a severe drought starting August 4, 2001. Southern Vermont did receive more rainfall than the rest of the state, especially in June and early July.

By early August, leaf scorch on hardwood trees growing on shallow, rocky soils became noticeable on hillsides throughout northern Vermont especially along Route 2 in Marshfield and Danville. Many trees dropped their leaves by mid-August.

Fall

Fall foliage color was generally brilliant despite the premature leaf drop from drought affected trees. Red colored leaves were more prevalent than usual. The timing of fall color in drought-resistant forests was similar to that of the last decade. However, leaves persisted on the trees longer than usual in southern Vermont (well beyond mid-October), with no hard frosts or heavy winds.

On Mount Mansfield, fall color and leaf drop proceeded as normal according to data from trees at 3 elevations which have been monitored since 1991 (Figure 6). From landscape-level monitoring in Underhill, the timing of fall color and leaf drop at 8 locations was also normal compared to the last 4 years, except in drought prone ridgetops with shallow soils (Figure 7). At one of the ridgetop sites, fall color was up to a month ahead of normal.

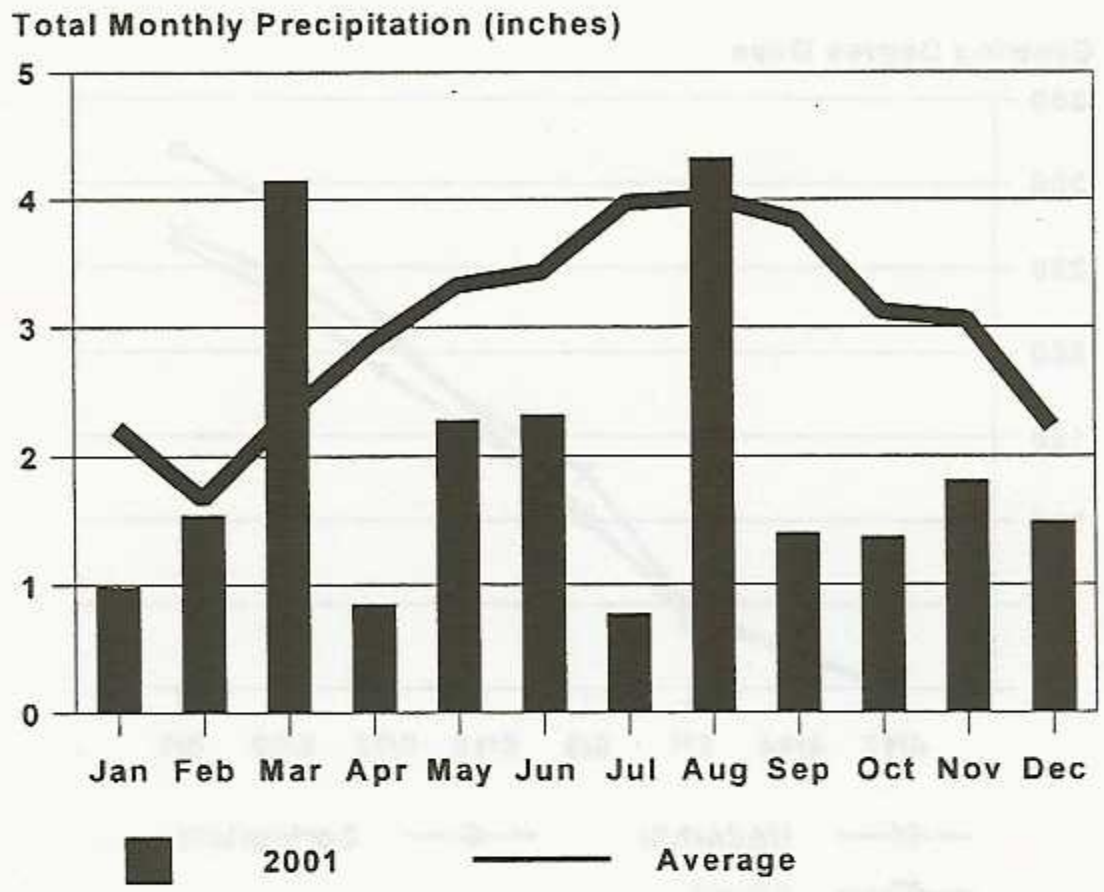
Autumn continued mild and dry. The level of Lake Champlain dropped to a forty-year low, at 93.5 feet. Hydro-generation of power in Vermont dropped to nearly zero.

The National Weather Service reported that 2001, in the Burlington Vermont area, was the 3rd driest year "to date" (since 1883) for the April 1 to October 29 period, with only 13.16" of precipitation compared to a normal 23.20". The continuing drought resulted in an extended fire season well into November with fire danger fluctuating between low and moderate back to high and very high with clear skies and steady winds.

The year ended with warmer than normal temperatures and below normal precipitation. Many locations had minimal snow cover by the end of the year. The National Weather Service reported that December was the second warmest in Burlington and 2001 was the 4th driest on record. Fairbanks Museum in St. Johnsbury reported that 2001 was their driest ever. As of December 27, the annual total precipitation amount at Fairbanks was 26.75", well below the annual mean total precipitation amount of 37.77" and the previous low of 27.33" set in 1921. The last Palmer Drought Index of 2001 listed western Vermont in severe drought and the remainder of northern Vermont in moderate drought.

Seed Production

There was heavy seed on red and silver maples, heavy acorn production, but a sparse beechnut crop. Weather was dry when apples were in bloom, and fruit production was heavy on wild apples. Pine pollen production was heavy, predicting a large white pine cone crop in 2002.



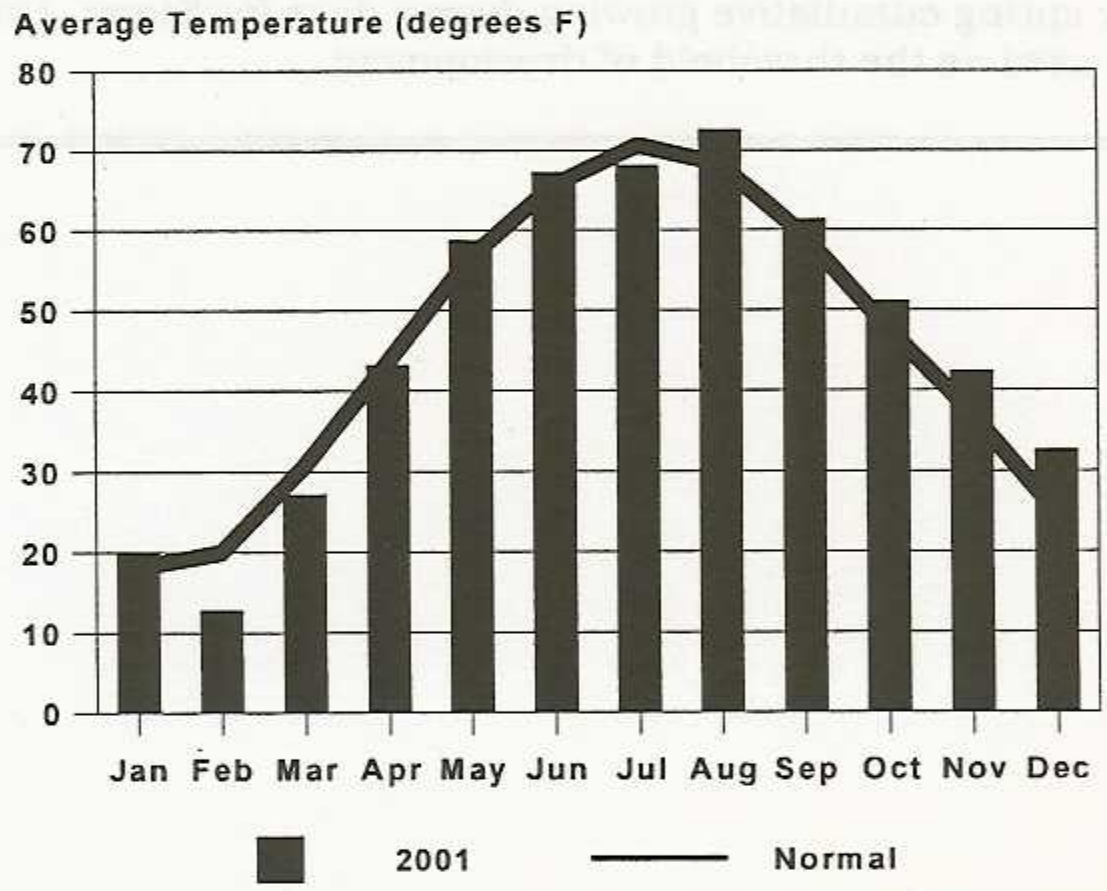


Figure 1. Monthly total precipitation and average temperature in 2001, compared to normal, for Burlington, Vermont. Data from the National Weather Service (http://www.erh.noaa.gov/er/btv/).

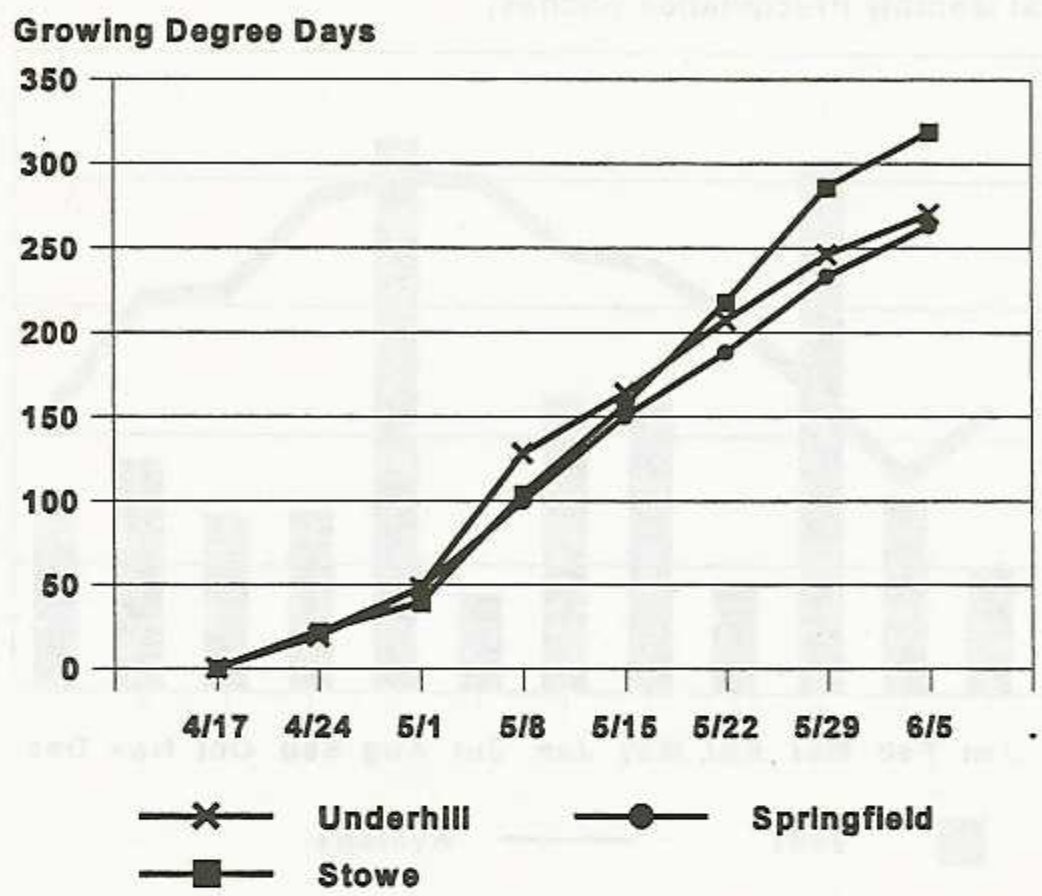
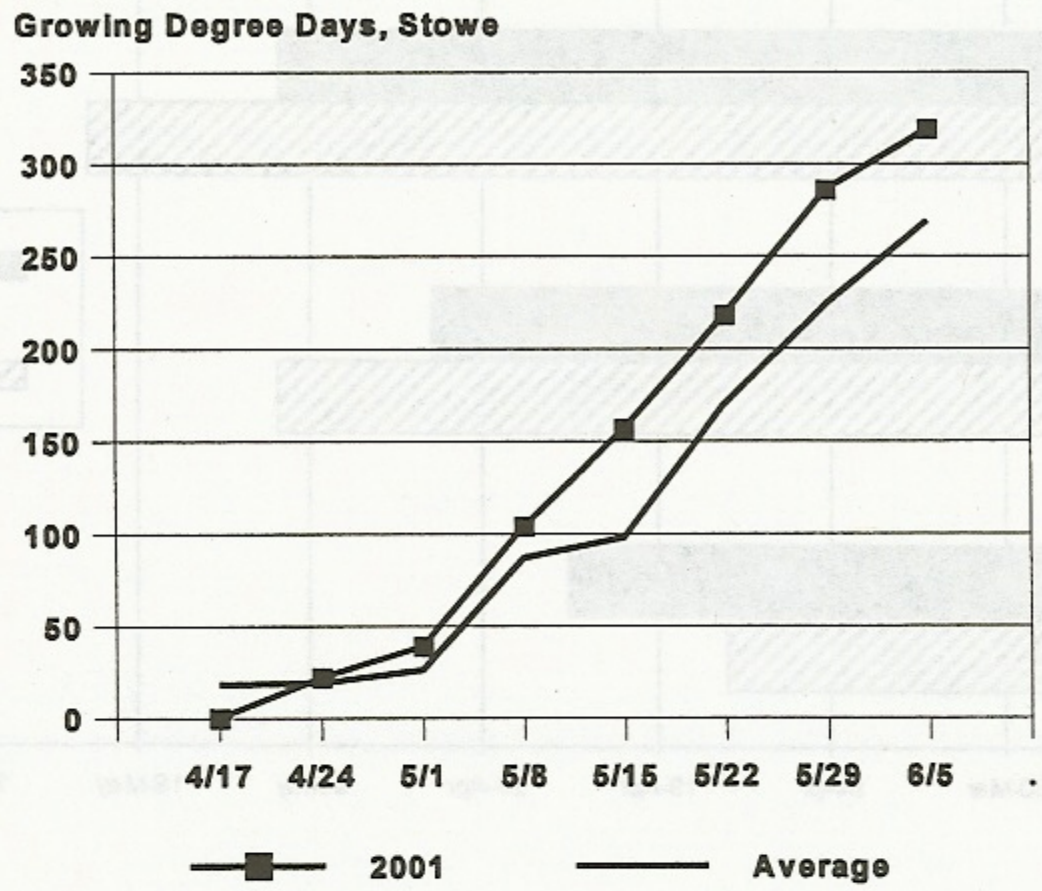


Figure 2. 2001 Weekly spring cumulative growing degree days for Stowe, Underhill, and Springfield, Vermont. 50 degrees is used as the threshold of development.



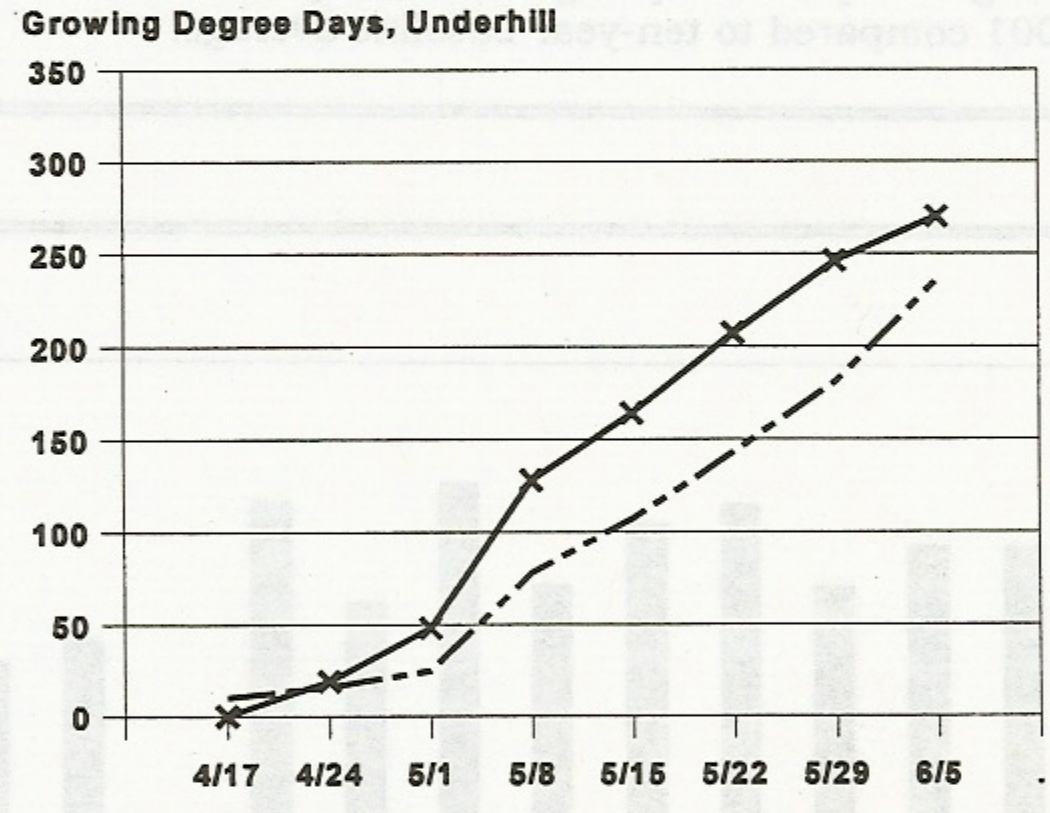


Figure 3. Weekly spring cumulative growing degree days for Stowe and Underhill, Vermont in 2001 compared with mean 1993-2001 accumulations. 50 degrees is used as the threshold of development.

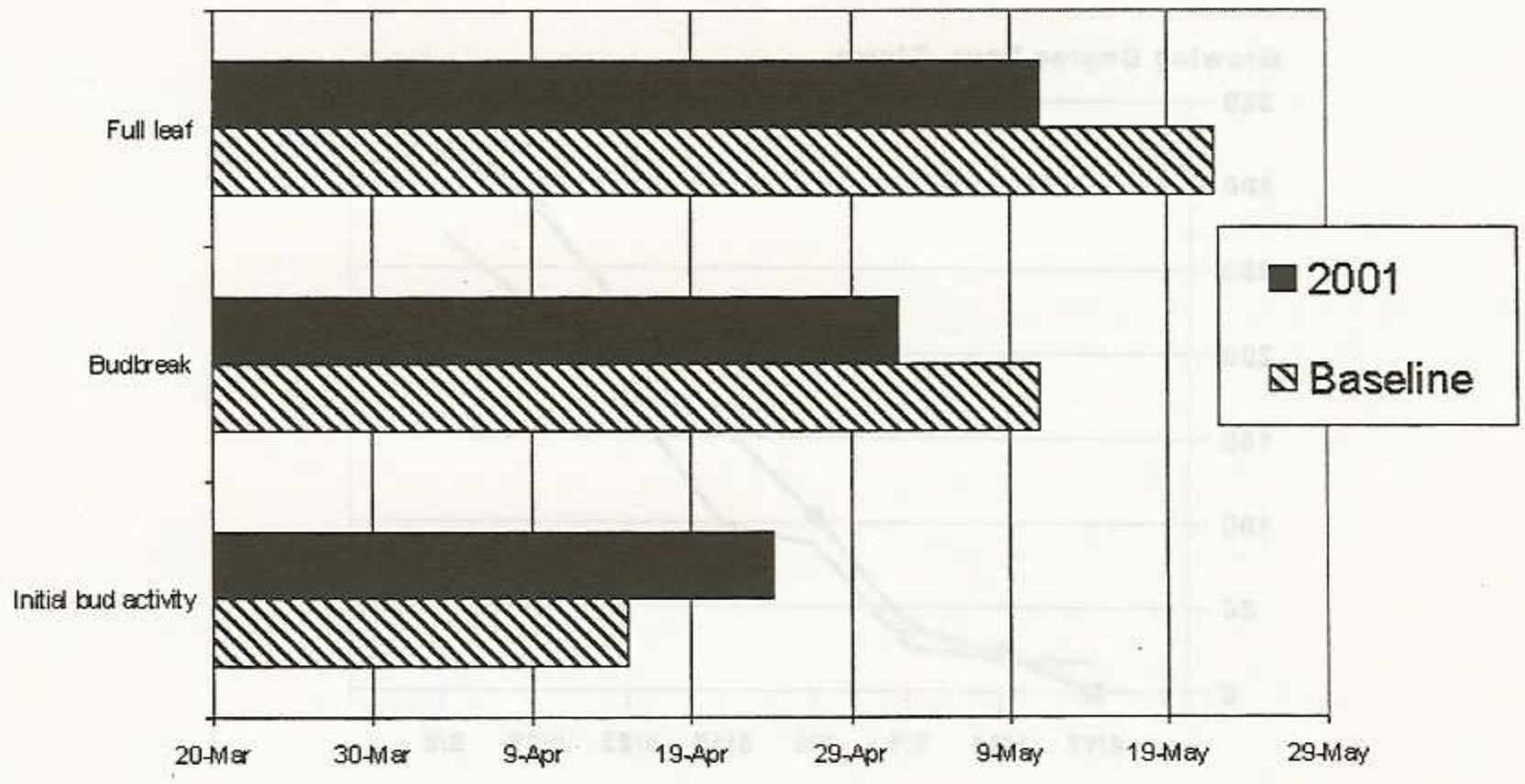


Figure 4. Average date of sugar maple tree spring bud development at the Proctor Maple Research Center, Underhill, VT in 2001 compared to ten-year baseline average.

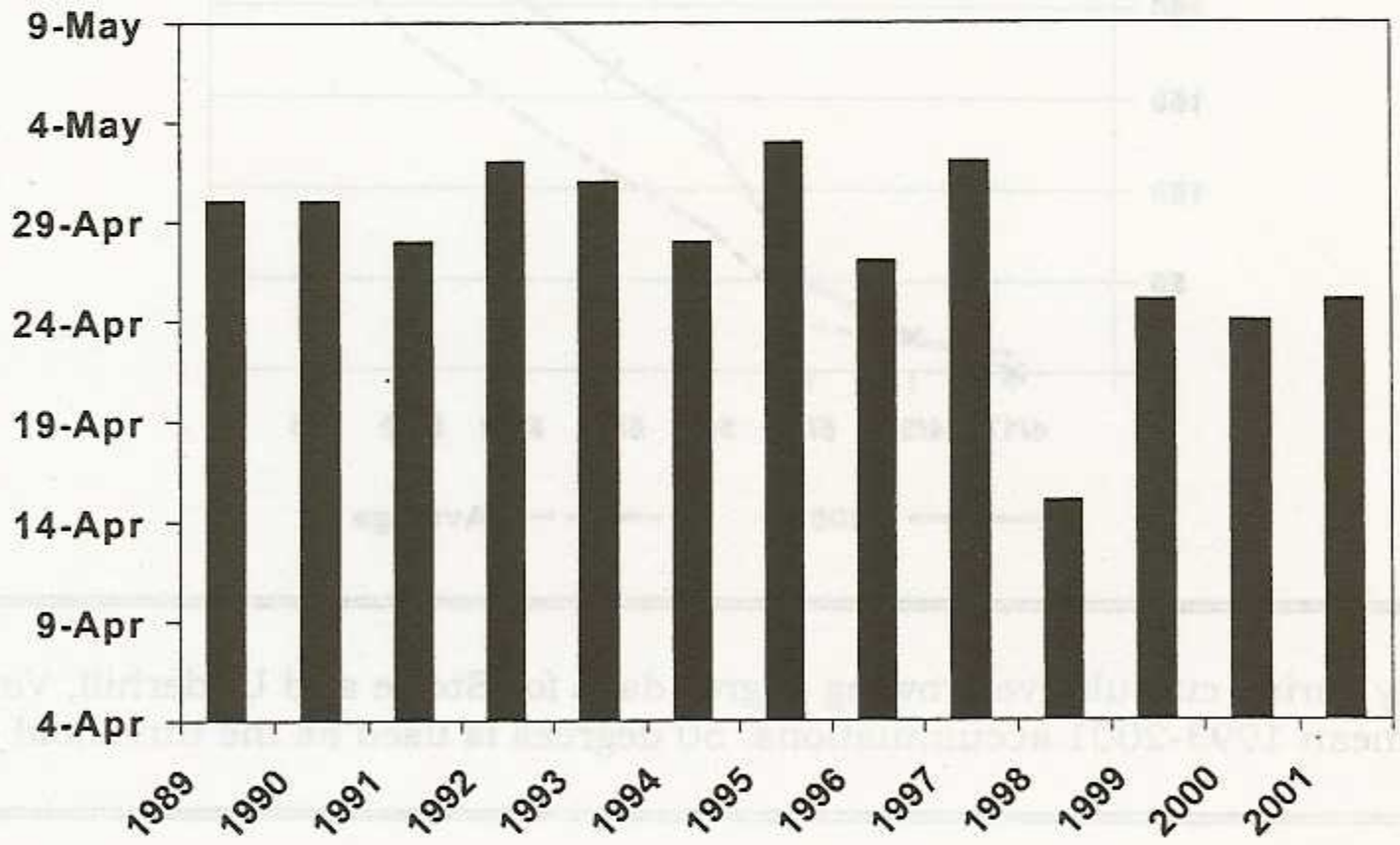


Figure 5. Date of sugar maple budbreak in Springfield, Vermont, 1989 - 2001.

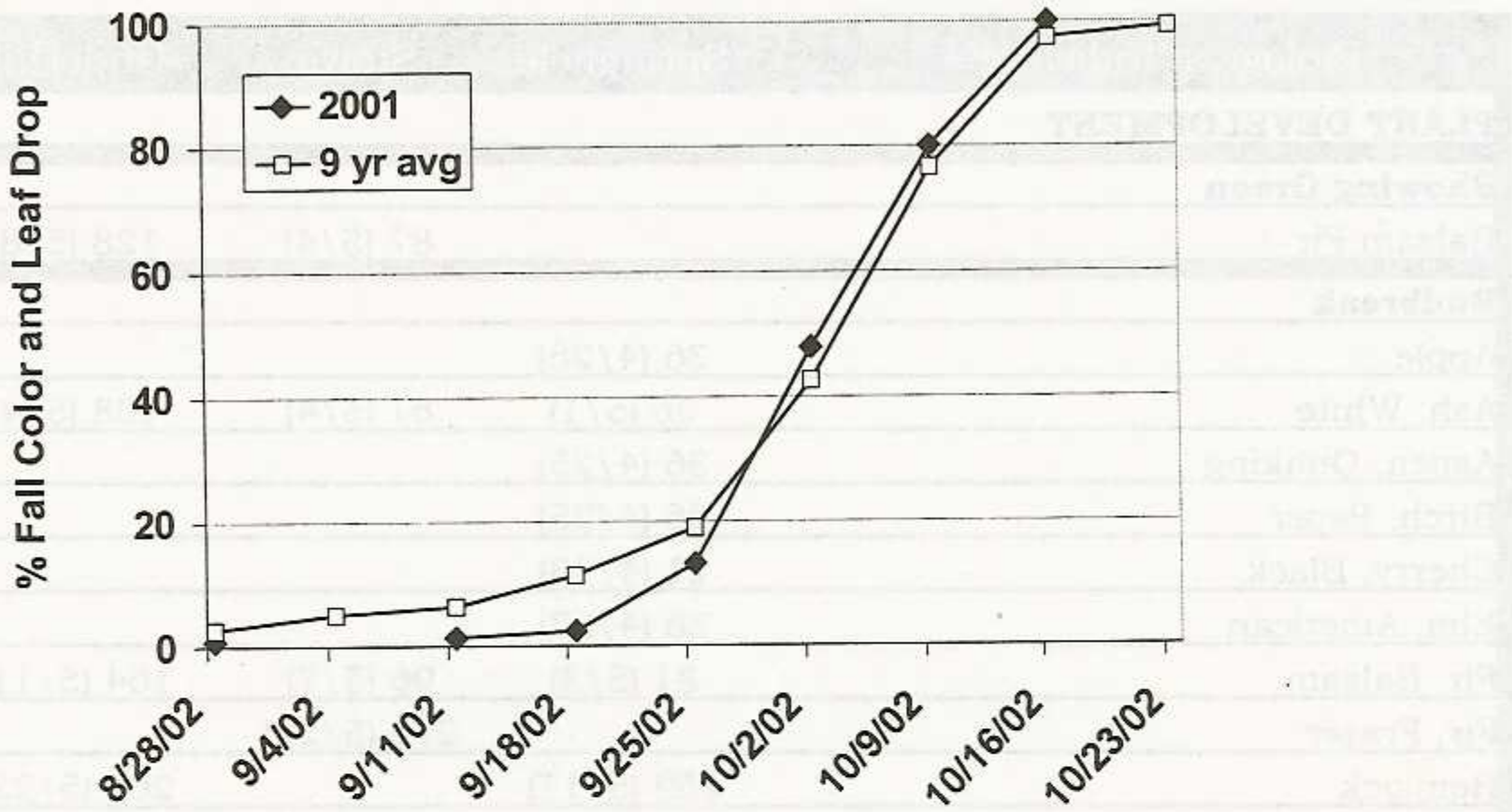


Figure 6. Percent fall color and leaf drop of sugar maple on Mount Mansfield in 2001 compared to 9 year average (1993-2001). Data from 3 elevations.

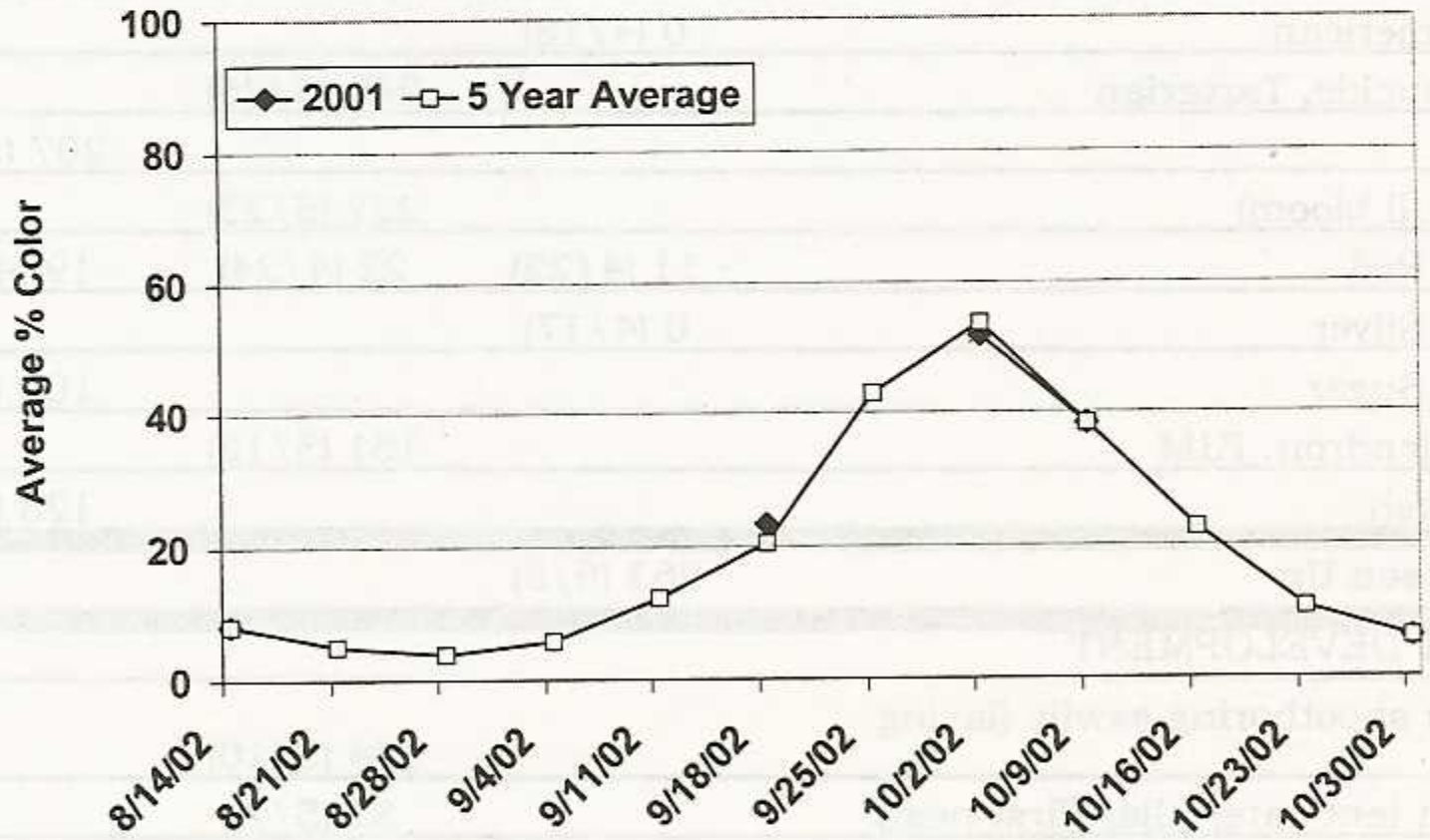


Figure 7. Percent of landscape with fall color on 8 hillsides near Mount Mansfield in 2001 compared to the 5-year average (1996-2001).

Table 1. 2001 Growing degree day accumulations and first observation dates of phenological development in 3 sites in Vermont. 50 degrees F is used as the threshold of development.

Biological Indicator	Springfield	Stowe	Underhill
PLANT DEVELOPMENT			
Showing Green			
Balsam Fir		87 (5/4)	128 (5/8)
Budbreak			
Apple	36 (4/26)		
Ash, White	36 (5/1)	87 (5/4)	108 (5/4)
Aspen, Quaking	36 (4/25)		
Birch, Paper	36 (4/25)		
Cherry, Black	21 (4/23)		
Elm, American	36 (4/27)		
Fir, Balsam	81 (5/3)	96 (5/7)	164 (5/11)
Fir, Fraser		212 (5/21)	
Hemlock	159 (5/17)		207 (5/22)
Maple, Red	36 (4/24)		
Maple, Sugar	36 (4/25)	67 (5/3)	108 (5/4)
Oak, Red	36 (5/1)		
Flowers			
Apple, Dolgo Crab		151 (5/12)	
Apple, MacIntosh (petal fall)		260 (5/26)	
Aspen, Quaking	0 (4/17)	0 (4/20)	
Crocus	0 (4/9)		
Dandelion	36 (4/24)		
Elm, American	0 (4/18)		
Honeysuckle, Tartarian		249 (5/25)	
Lilac			207 (5/22)
Lilac (full bloom)		227 (5/23)	
Maple, Red	11 (4/22)	22 (4/24)	19 (4/24)
Maple, Silver	0 (4/17)		
Maple, Sugar			108 (5/4)
Rhododendron, PJM		151 (5/12)	
Shadbush			128 (5/8)
Full Green Up	263 (6/5)		
INSECT DEVELOPMENT			
Balsam shootboring sawfly (laying eggs)		124 (5/10)	
Eastern tent caterpillar (first nest)		51 (5/2)	
European snout beetle		286 (5/29)	
Maple leafcutter (first adults)			177 (5/18)
Maple leafcutter (first cuts)		643 (6/24)	
Pear thrips (first adults)		15 (4/23)	19 (4/24)
OTHER OBSERVATIONS			
Spring peepers calling		22 (4/24)	
First fall frost		2170 (9/30)	

HARDWOOD DEFOLIATORS

Birch Defoliation, caused by **Birch Leaf Miners**, *Fenusa pusilla* and *Messa nana*, was common but mostly light. The damaged area mapped during aerial surveys decreased from 30,569 acres in 2000 to 20,881 acres in 2001 (Table 3, Figure 10). The reason for the decrease is unknown. Maple leaf cutter damage also decreased suggesting that dry conditions may have caused the larvae of mining insects to fail. Additionally, foliar pathogens, which increase the acreage of brown birch foliage, were not a factor in 2001.

Table 3. Mapped acres of damage by birch leaf miners in 2001.

County	Acres
Addison	3,285
Bennington	556
Caledonia	317
Chittenden	1,481
Essex	90
Franklin	2,014
Lamoille	2,714
Orange	361
Orleans	580
Rutland	1,442
Washington	2,297
Windham	973
Windsor	4,771
Total	**20,881**

Forest Tent Caterpillar, *Malacosoma disstria*, populations continued to be low and no defoliation was observed. However, more individual larvae were seen. Just one moth was caught in a pheromone trap (in Underhill) out of 55 traps placed at eleven sites (Figures 11-12). A Luminoc light trap in Hyde Park with a black light for four hours per night, plus pheromone, caught one moth compared to none caught in 2000.

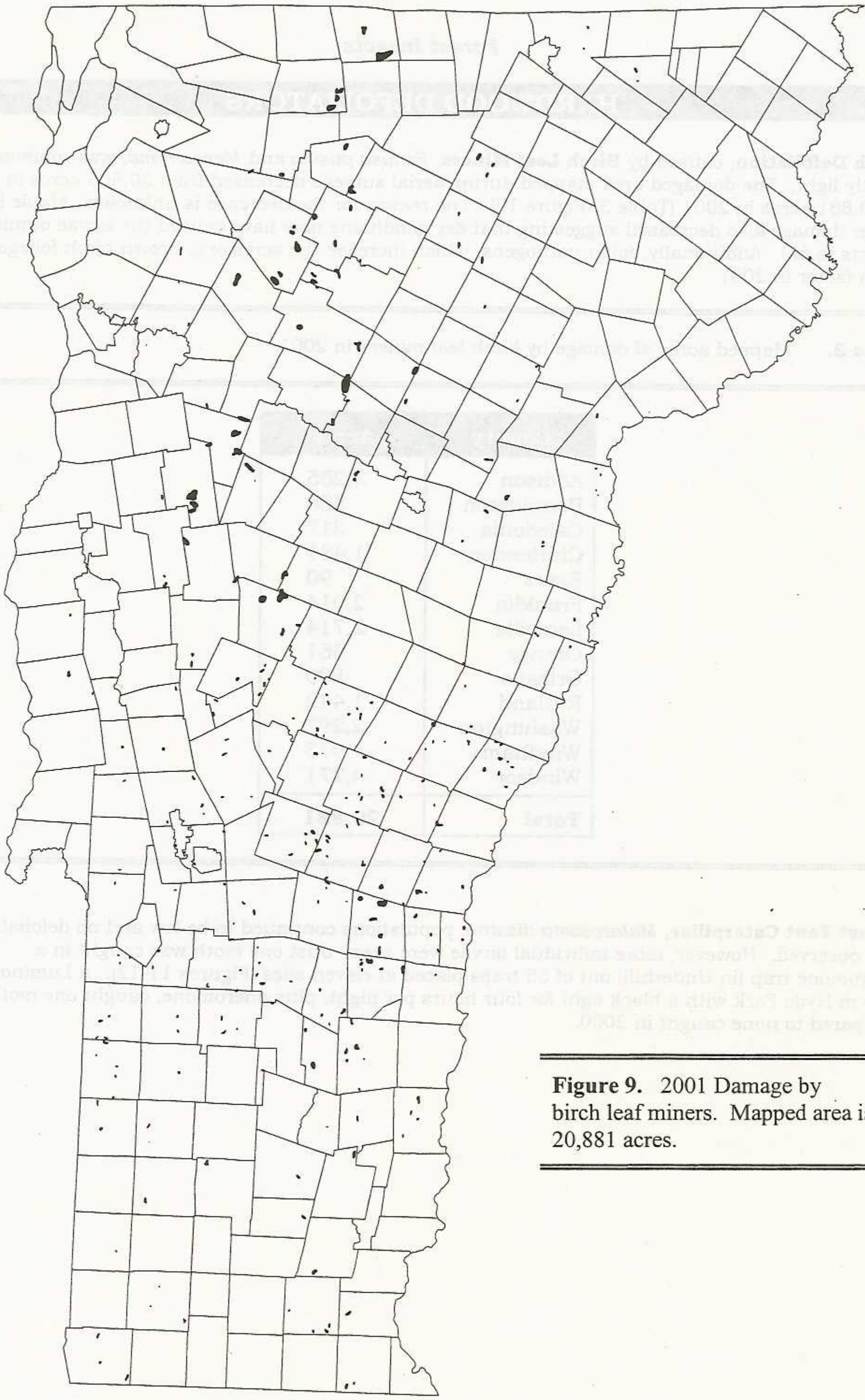


Figure 9. 2001 Damage by birch leaf miners. Mapped area is 20,881 acres.

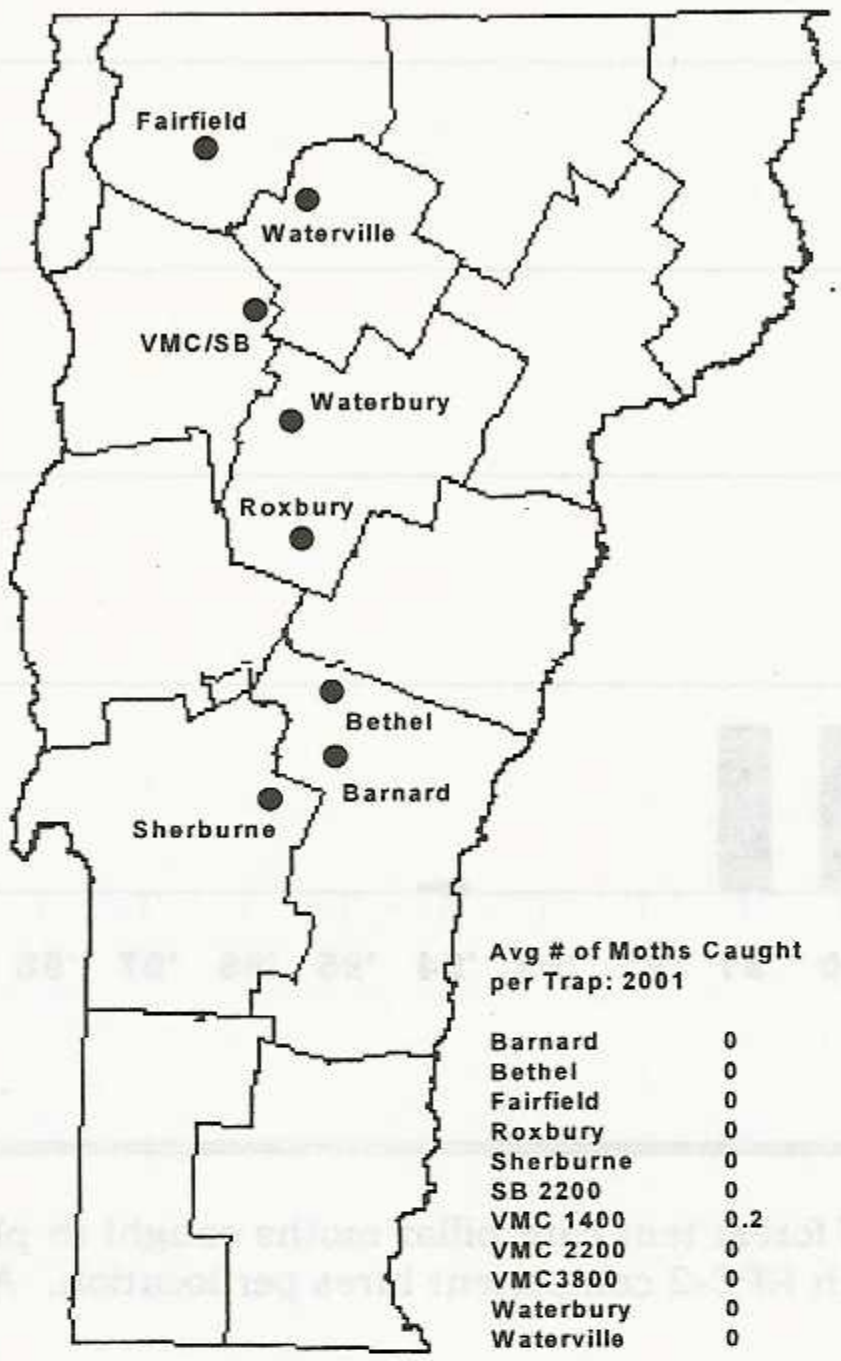


Figure 11. Average number of forest tent caterpillar moths caught in pheromone traps, 2001. Average of 4-5 traps per location.

Clusters of three pheromone traps, baited for forest tent caterpillar, were placed at twelve locations on the Green Mountain National Forest by Forest Health Protection. Only four moths were caught in all: at Bristol Hollow Road, Liberty Hill, and Moosalamoo.

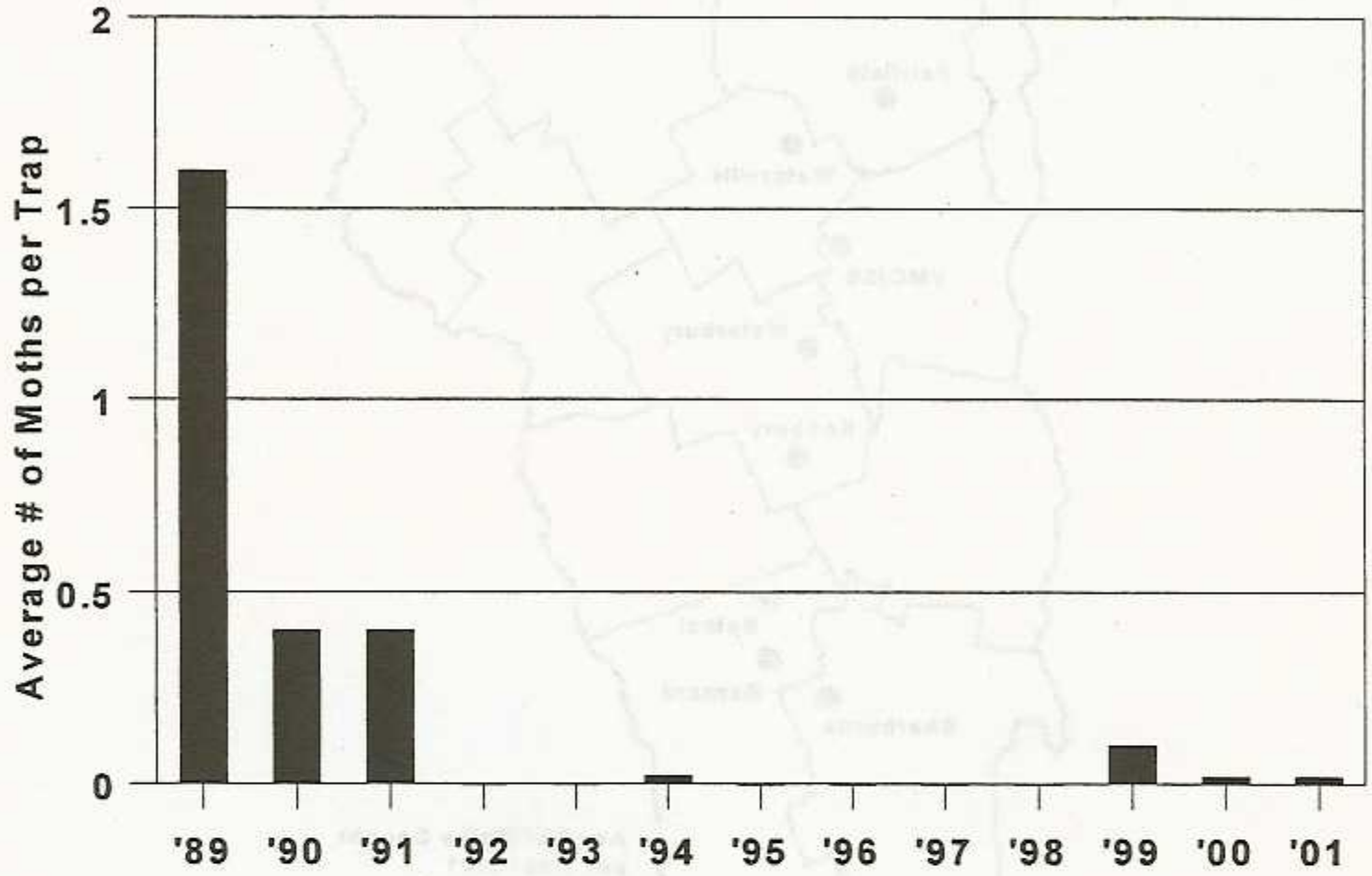


Figure 12. Average number of forest tent caterpillar moths caught in pheromone traps 1989 - 2001. Five multi-pher traps baited with RPC-2 component lures per location. Average of 6-11 locations per year.

Gypsy Moth, *Lymantria dispar*, populations increased this year, but caused no widespread defoliation. One landowner in Weybridge reported heavy defoliation in a 30-acre oak-beach-maple stand. Another landowner in Charlotte reported noticeable defoliation of forest trees. Noticeable defoliation for the forested residential area in Colchester with heavy egg mass counts in the fall of 2000 never materialized.

Elsewhere, larvae were observed occasionally. The numbers of adult males seen flying this summer were fewer than in 2000, but they were observed into September.

Fewer larval remains were present in monitoring plots than in 2000. Egg mass counts from focal area plots remained low in the fall (Figures 13-14). No defoliation is expected in 2002.

In other northeastern states the fungus, *Entomophaga maimaiga*, helped depress populations despite the dry weather.

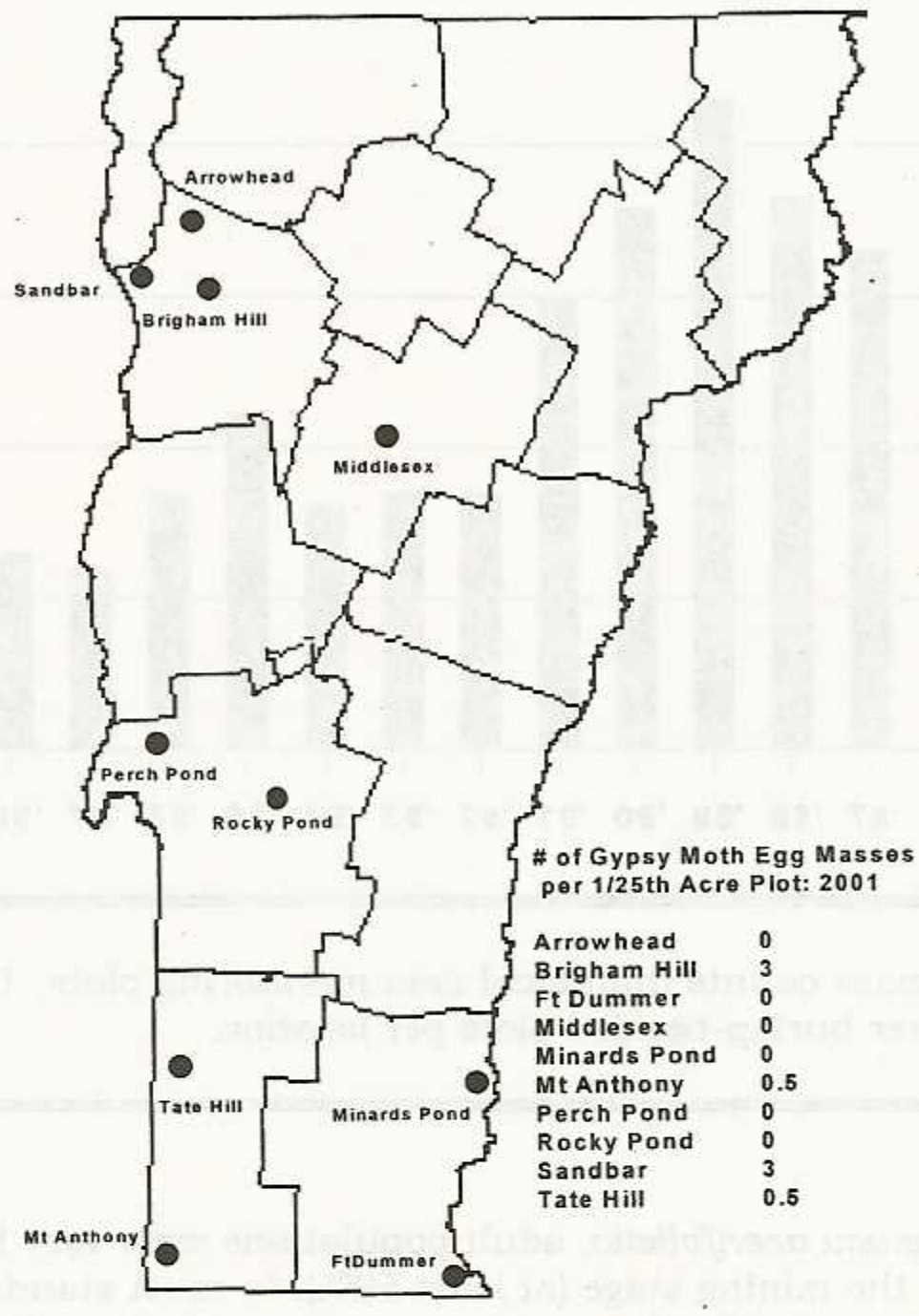


Figure 13. Gypsy moth egg mass counts from focal area monitoring plots, 2001. Average of two 15 meter diameter burlap-banded plots per location.

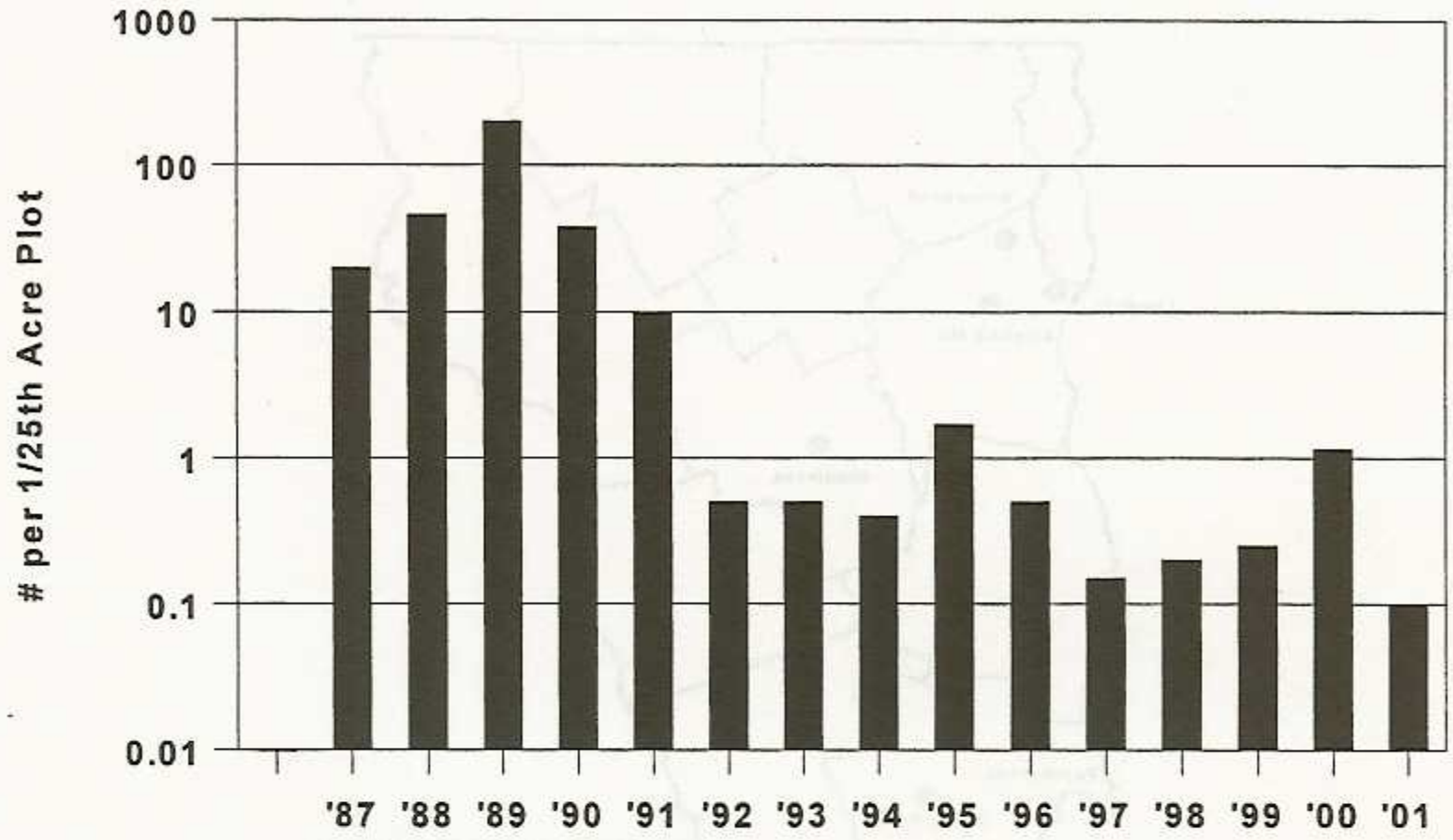


Figure 14. Gypsy moth egg mass counts from focal area monitoring plots, 1987-2001. Average of ten locations, two 15m diameter burlap-banded plots per location.

Maple Leaf Cutter, *Paraclemensia acerifoliella*, adult populations were very high in the spring. However, many larvae died in the mining stage (at least 50%). In most stands, scattered heavy defoliation was observed only on reproduction and lower crowns. Damage did increase in some areas, with scattered moderate to heavy defoliation of sugar maple stands and sugarbushes with 23,634 acres mapped during aerial surveys (Table 4, Figure 15). In southern Vermont, defoliation of overstory trees was much lighter than in 2000.

Table 4. Mapped acres of damage by maple leaf cutter in 2001.

County	Acres
Addison	4,216
Bennington	201
Caledonia	24
Chittenden	5,463
Franklin	8,046
Lamoille	835
Orange	1,825
Orleans	594
Rutland	764
Washington	844
Windham	143
Windsor	680
Total	**23,634**

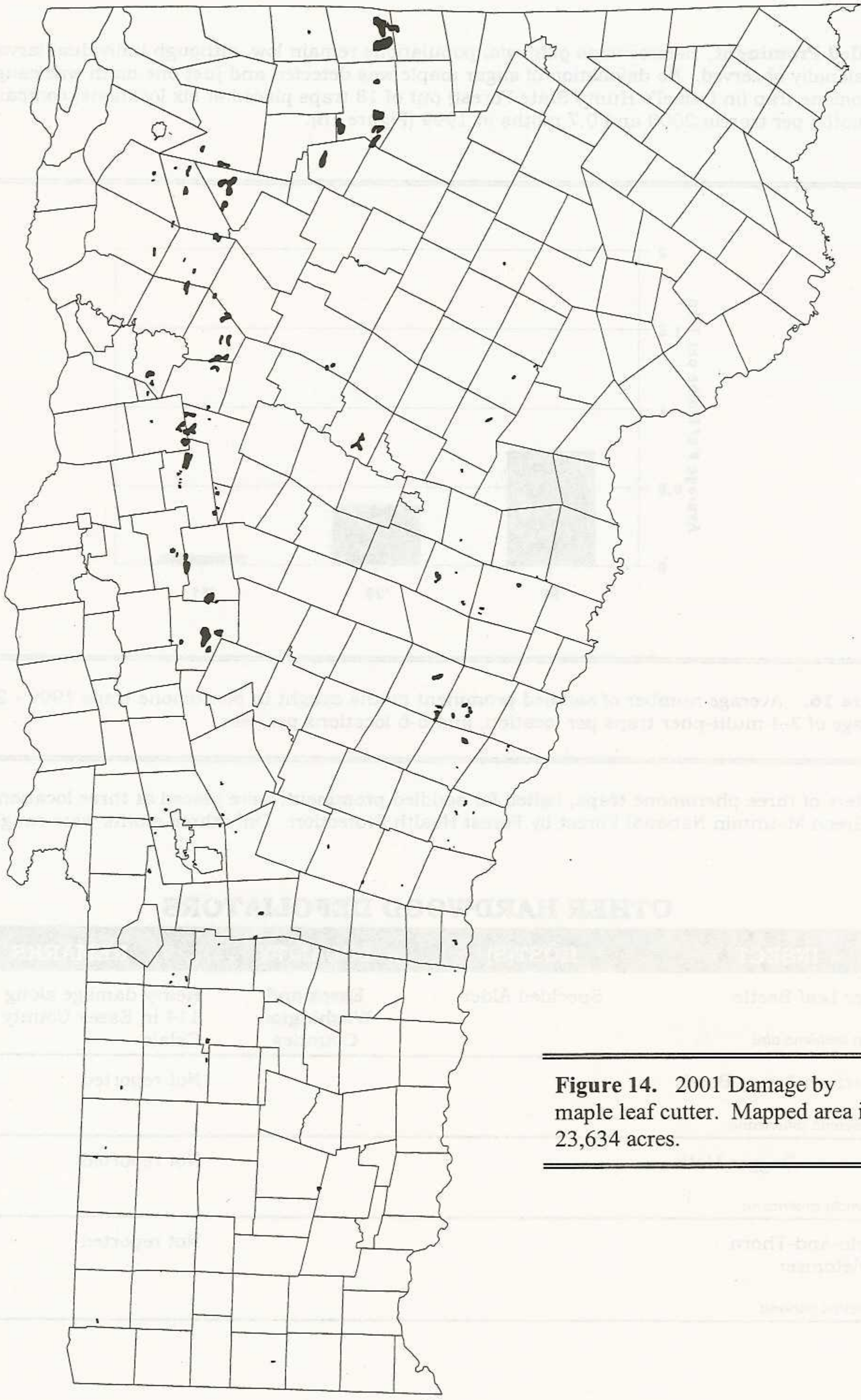


Figure 14. 2001 Damage by maple leaf cutter. Mapped area is 23,634 acres.

Saddled Prominent, *Heterocampa guttivata*, populations remain low, although individual larvae were occasionally observed. No defoliation of sugar maple was detected and just one moth was caught in a pheromone trap (in Camel's Hump State Forest) out of 18 traps placed at six locations, compared to 0.4 moths per trap in 2000 and 0.7 moths in 1999 (Figure 16).

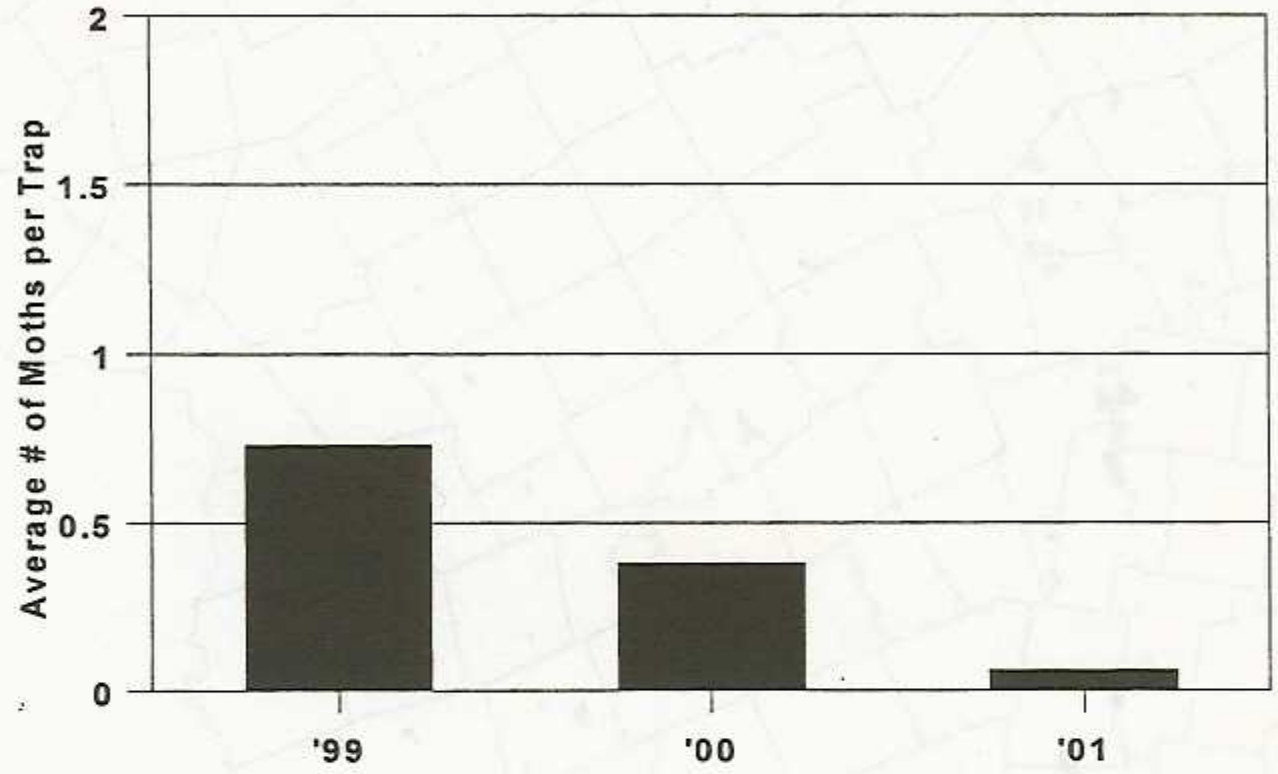


Figure 16. Average number of saddled prominent moths caught in pheromone traps 1999 - 2001. Average of 3-4 multi-pher traps per location, and 5-6 locations per year.

Clusters of three pheromone traps, baited for saddled prominent, were placed at three locations on the Green Mountain National Forest by Forest Health Protection. Only three moths were caught in all.

OTHER HARDWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Alder Leaf Beetle *Altica ambiens alni*	Speckled Alder	Essex and Washington Counties	Heavy damage along Rte. 114 in Essex County and Calais
American Aspen Beetle *Gonioctena americana*			Not reported
American Dagger Moth *Acronicta americana*			Not reported
Apple-And-Thorn Skeletonizer *Choreutis pariana*			Not reported

OTHER HARDWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Apple Leaf Skeletonizer *Choreutis pariana*			Not reported
Birch Leaf Folder *Ancylis discigerana*	Yellow Birch	Essex County, Lamoille County, Stockbridge	Widely scattered and very light
Birch Leaf Miner *Fenusa pusilla*			See Birch Defoliation
Birch Skeletonizer *Bucculatrix canadensisella*	Paper Birch	Northeastern Vermont	Light damage
Bruce Spanworm *Operophtera bruceata*	Sugar Maple	Throughout	Light damage observed in Landgrove, Hartland, and Vershire. Moth populations high throughout north-central and southern Vermont in the fall
Cherry Scallop Shell Moth *Hydria prunivorata*	Black Cherry	Southern Vermont	Light damage to occasional hedgerow trees
Distinct Quaker *Achatia distincta*	Sugar Maple	Milton	Found occasionally.
Early Birch Leaf Edgeminer *Messa nana*			See Birch Defoliation
Eastern Tent Caterpillar *Melacosoma americanum*	Cherry, Apple	Throughout	Populations remain low. Webs more common than 2000 in southern Vermont
Elm Leaf Beetle *Pyrrhalta luteola*	Elm	Southern Vermont	Occasionally observed
Elm Leaf Miner *Fenusa ulmi*			Not reported
Euonymous Caterpillar *Yponomeuta cagnagella*	Euonymous	Barre, Middlebury, Springfield	Heavy defoliation of naturalized spindletrees in Springfield
European Snout Beetle *Phyllobius oblongus*	Basswood, Butternut, Sugar Maple	Williston, Coventry, Stowe	Ornamentals

OTHER HARDWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Fall Cankerworm *Alsophila pometaria*			Not reported
Fall Webworm *Hyphantria cunea*	Hardwoods	Throughout	Common, but decreasing in most locations
Flat Leaftier *Psilocorsis reflexella*			Not reported
Flea Beetles *Family Chrysomelidae, Alticinae*			Not reported
Forest Tent Caterpillar *Malacosoma disstria*			See narrative
Green Striped Mapleworm *Anisota rubicunda*			Not reported
Gypsy Moth *Lymantria dispar*			See narrative
Half Winged Geometer *Phigalia titea*			Not reported
Imported Willow Leaf Beetle *Plagiodera versicolora*	Black Willow	Northwestern Vermont	Some moderate defoliation. Stable populations. 677 acres mapped during aerial survey
Japanese Beetle *Popillia japonica*	Many	Scattered throughout.	Adults occasionally heavy on ornamentals, but fewer than usual
Large Aspen Tortrix *Choristoneura conflictana*			Not reported
Lilac Leafminer *Caloptilia syringella*	Common Lilac	Williston Castleton Brattleboro	Ornamentals
Linden Looper *Erannis tilaria*			Not reported

OTHER HARDWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Locust Leaf Miner *Odontata dorsalis*	Black Locust	Putney, Champlain Valley	Heavy defoliation in Putney by early August. Moderate in the Champlain Valley. Light elsewhere. 169 acres mapped during aerial survey
Maple Basswood Leaf Roller *Sparganothis pettitana*			Not reported
Maple Leaf Cutter *Paraclemensia acerifoliella*			See narrative
Maple Spanworm *Ennomos magnaria*	Sugar Maple	Waterbury	Occasionally found
Maple Trumpet Skeletonizer *Epinotia aceriella*	Sugar Maple	Throughout	Decreasing, but light defoliation in Mendon and Chittenden
Maple Webworm *Tetralopha asperatella*			Not reported
Mountain Ash Sawfly *Pristiphora geniculata*	Mountain Ash	Widely scattered	Occasional defoliation. Generally decreasing
Oak Leaf Tier *Croesia semipurpurana*	Red Oak	Chittenden County	Decreasing
Oak Skeletonizer *Bucculatrix ainsliella*	Red Oak	Southern Vermont	Scattered light damage. Overwintering cocoons noticeable in the fall
Oak Slug Sawfly *Caliroa fasciata*			Not reported
Oblique Banded Leafroller *Choristoneura rosaceana*	Common Lilac	Castleton	Heavy damage
Orange-humped Mapleworm *Symmerista leucitys*	Sugar Maple	Hyde Park	Larva
Pandora sphinx *Eumorpha pandorus*	Hardwood	Reading	Larva

OTHER HARDWOOD DEFOLIATORS

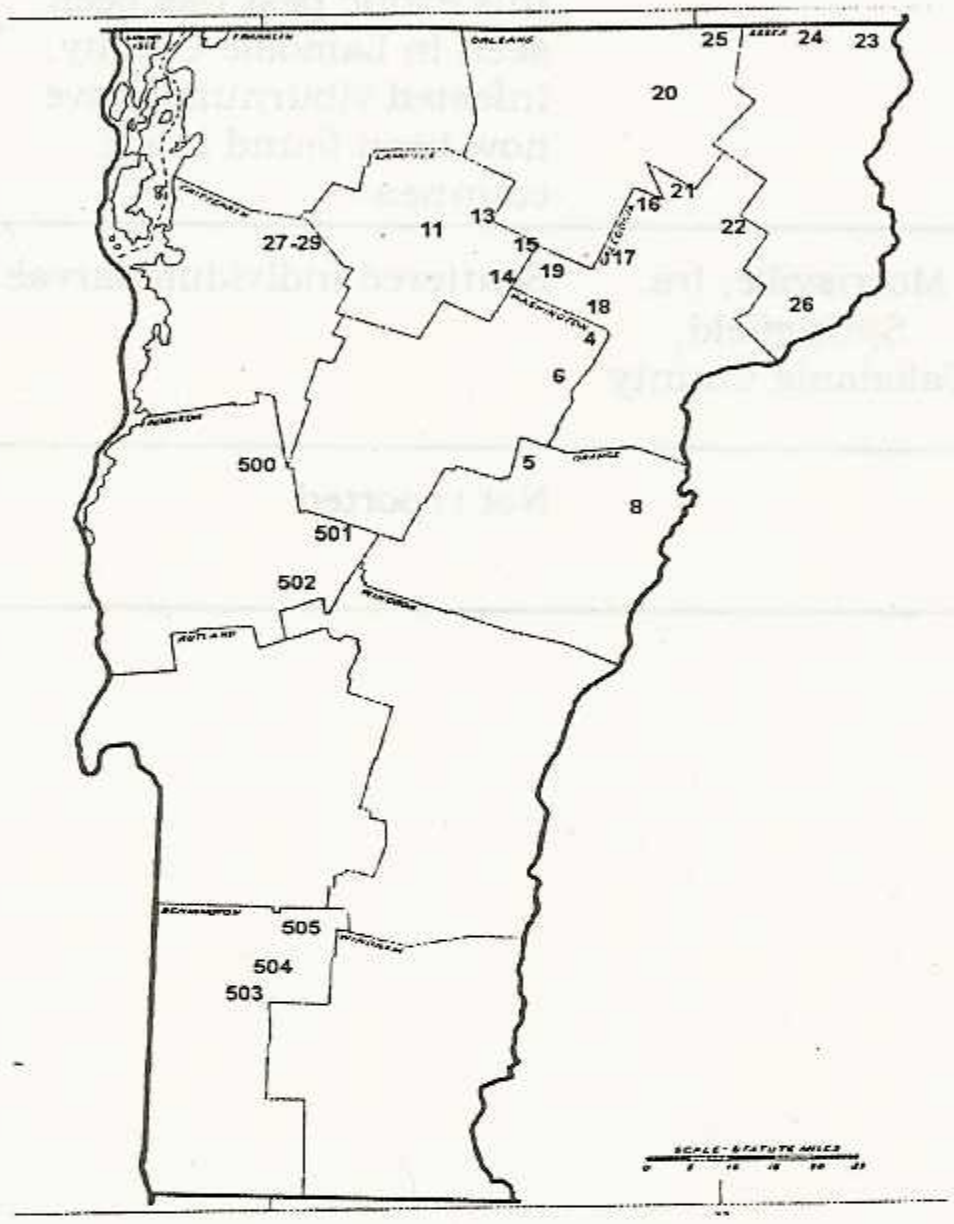
INSECT	HOST(S)	LOCALITY	REMARKS
Pear Sawfly *Caliroa cerasi*			Not reported
Pink Striped Oakworm *Anisota virginiensis virginiensis*	Red Oak	Rockingham	Larva
Promethea Moth *Callosamia promethea*	Ash	Landgrove	Several cocoons on single ash tree
Red-humped Oakworm *Symmerista canicosta*			Not reported
Rose Chafer *Macrodactylus subspinosus*	Rose, Rubus, Littleleaf Linden	Caledonia, Orleans, Lamoille Counties	Decreasing. Many calls, but fewer than in 2000
Saddled Prominent *Heterocampa guttivata*			See narrative
Satin Moth *Leucoma salicis*	Quaking Aspen, Poplar	Hartland, Coventry, Washington & Orange Counties	Heavy defoliation of aspens in Orange County and Hartland. Common elsewhere on ornamentals
Scarlet Oak Sawfly *Caliroa quercuscoccineae*	Pin Oak	Woodstock	Ornamental
Speared Dagger Moth *Acronicta hasta*	Red Oak	Rockingham	Found under burlap bands used to monitor gypsy moths
Spiny Elm Caterpillar *Nymphalis antiopa*			Not reported
Spiny Oak Sawfly *Periclista sp.*	Oak	Lincoln	Heavy on young oaks
Spiny Oak-Slug Moth *Euclea delphinii*	Prunus	Springfield	Several of these odd-looking "slug" caterpillars found at base of tree. Light defoliation
Spring Cankerworm *Paleacrita vernata*			Not reported
Striped Alder Sawfly *Hemichroa crocea*	Paper Birch	Northeastern Vermont	Decreasing. Not mapped in 2001 during aerial surveys

OTHER HARDWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Uglynest Caterpillar *Archips cerasivoranus*	Cherry	North-Central Vermont	A few seen. Stable
Viburnum Leaf Beetle *Pyrrhalta viburni*	Viburnum	Morrisville North Hero	Heavy infestations on ornamentals. First time this exotic pest has been seen in Lamoille County. Infested viburnums have now been found in six counties
White Marked Tussock Moth *Orgyia leucostigma*	Hardwoods	Morrisville, Ira, Springfield, Caledonia County	Scattered individual larvae
Willow Flea Beetle *Rhychaenus rufipes*			Not reported

SOFTWOOD DEFOLIATORS

Spruce Budworm, *Choristoneura fumiferana*, continued at low levels, with no visible defoliation detected. The number of moths captured in pheromone traps in northern Vermont dropped this year after being at the highest level seen since the end of the last outbreak, in 2000. (Figures 16 - 17).



Location No.	Name	# of moths/trap
4.	Danville Hill	14.7
5.	Reservoir	00.0
6.	Marshfield Pd.	5.0
8.	Scotch Hollow	00.0
11.	Centerville	6.3
14.	East Hill WMA	1.7
15.	Bear Swamp	5.7
16.	Withers	15.0
17.	Masons	6.7
18.	Star School	16.7
19.	Beagle Club	35.7
20.	Brownington Pond	13.3
21.	Calendar Brook	31.7
22.	Chieppo	15.0
23.	Tin Shack	6.7
24.	Norton Cemetery	17.7
25.	Holland Pong	5.0
26.	Victory Bog	8.0
27.	VMC 1400	11.3
28.	VMC 2200	2.7
29.	VMC 3800	17.0
Average (excluding 28, 29)		**11.4**

Figure 16. Spruce budworm pheromone plot locations and average number of moths caught per trap in 2001.

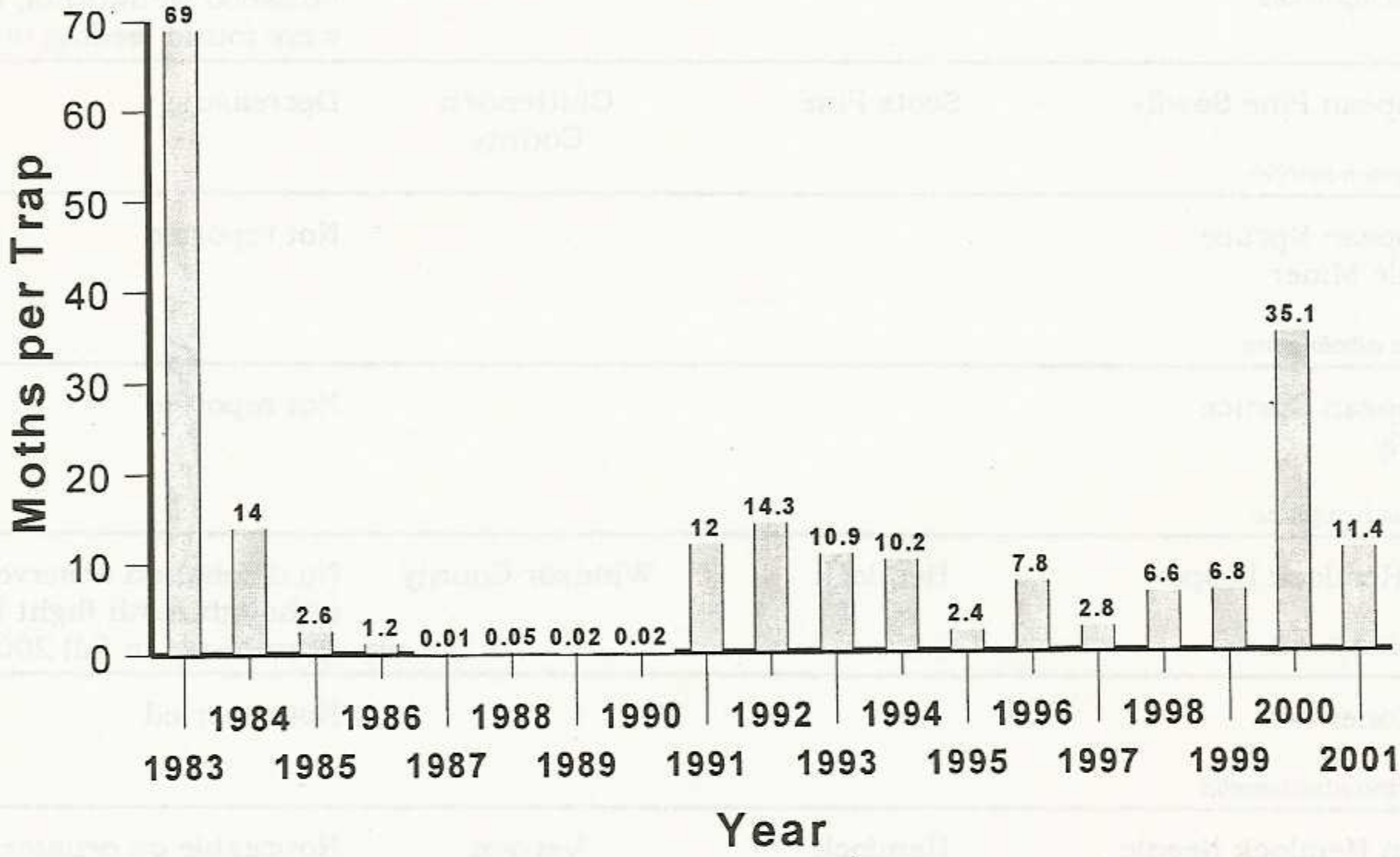


Figure 17. Average number of spruce budworm moths caught in pheromone traps, 1983 - 2001, based on 3 to 5 multi-pher traps per site for 15 to 23 sites.

Clusters of three pheromone traps, baited for spruce budworm, were placed at six locations on the Green Mountain National Forest by Forest Health Protection. An average of 19 moths were caught per trap, a slight increase over 2000.

OTHER SOFTWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Arborvitae Leaf Miner *Argyresthia thuiella*			Not reported
Balsam Fir Sawfly *Neodiprion abietis*			Not reported

OTHER SOFTWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Boxwood Webworm *Galasa nigrinodis*	Yew	Colchester	Though the caterpillars found are known as boxwood webworms, they were found feeding on yew
European Pine Sawfly *Neodiprion sertifer*	Scots Pine	Chittenden County	Decreasing
European Spruce Needle Miner *Taniva albolineana*			Not reported
European Spruce Sawfly *Gilpinia hercyniae*			Not reported
Fall Hemlock Looper *Lambdina fiscellaria*	Hemlock	Windsor County	No defoliation observed although moth flight had been heavy in fall 2000
Fir Coneworm *Dioryctria abietivorella*			Not reported
Green Hemlock Needle Miner *Coleotechnites apicitripunctella*	Hemlock	Vernon	Noticeable on ornamental and forest trees in many locations
Introduced Pine Sawfly *Diprion similis*	White Pine	Throughout	On ornamental and forest trees. Moderate populations
Larch Casebearer *Coleophora laricella*	Eastern Larch	Chittenden County	Stable at light levels
Larch Sawfly *Pristophora ericksonii*			Not reported
Pine False Webworm *Acantholyda erythrocephala*			Not reported
Pine False Webworm *Acantholyda erythrocephala*			Not reported
Pine Tube Moth *Argyrotaenia pinatubana*	White Pine	St. Johnsbury	Tubes seen in pines throughout forest in some sites
Pine Webworm *Tetralopha robustella*			Not reported

OTHER SOFTWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Red-Headed Pine Sawfly *Neodiprion lecontei*			Not reported
Spring Hemlock Looper *Lambdina athasaria*			Not reported
Spruce Bud Moth *Zeiraphera canadensis*	White Spruce	Scattered	Only occasional light damage seen
Spruce Budworm *Choristoneura fumiferana*			See narrative
Spruce Needle Miner *Unidentified species*	Blue Spruce	Stowe	Heavy on ornamental
White Pine Sawfly *Neodiprion pinetum*			Not reported
Yellow-Headed Spruce Sawfly *Pikonema alaskensis*	White Spruce	Hartford, Derby	Moderate to heavy defoliation of young ornamentals

SAPSUCKING INSECTS, MIDGES, AND MITES

Balsam Gall Midge, *Paradiplosis tumifex*, populations remained surprisingly high in Christmas tree plantations and on wild balsam fir trees. Browning also continued from 2000 damage. The current infestation is lasting much longer, with much heavier damage, than previous infestations of this pest.

Mostly moderate to heavy damage was reported in the northern Vermont Christmas tree survey. Balsam fir generally had heavier damage then Fraser fir, but three plantations, in Starksboro, Brookfield and South Barre, had moderate damage on Fraser fir that approached the level of damage on balsam fir.

A number of Lamoille County plantations were surveyed for the presence of *Dasineura balsamicola* (the "good" midge) that controls the gall-maker. Percent of galls containing the good midge ranged from 60% to 100%, indicating likely population crashes in some plantations but continuing damage at various levels in many other plantations in 2002.

Balsam Twig Aphid, *Mindarus abietinus*, populations increased dramatically after seeing decreasing levels since 1996. Mostly moderate damage was recorded in the northern Vermont Christmas tree survey, compared to light damage in 2000. As usual, balsam fir was more heavily damaged then Fraser fir. However, three plantations had moderate damage to Fraser as well as balsam fir. Sooty mold developed on heavily infested shoots.

Hemlock Woolly Adelgid, *Adelges tsugae*, was not observed or known to occur in Vermont.

Trap trees which have been in place at the site where the insect was eradicated in Stockbridge were checked in May and November. No signs of adelgid were observed on these trees.

At the University of Vermont Entomology Lab, research is continuing on insect-killing fungi which have the potential to be used in biological control. Fungi collected from China, and native fungi, are being tested against hemlock woolly adelgid.

Hemlock woolly adelgid will be the focus of a Forest Pest Risk Mapping project in cooperation with the US Forest Service and the University of Vermont Forest Pathology Lab.

Oystershell Scale, *Lepidosaphes ulmi*, populations on American beech were heavy on regeneration in scattered locations in the two southern counties, but were light elsewhere. Populations of the scale insect in the survey plot in Huntington decreased after peaking last year (Table 5, Figure 18).

Table 5. Number of oystershell scales on current year beech twigs in Camel's Hump State Forest, 1993-2001[1].

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

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

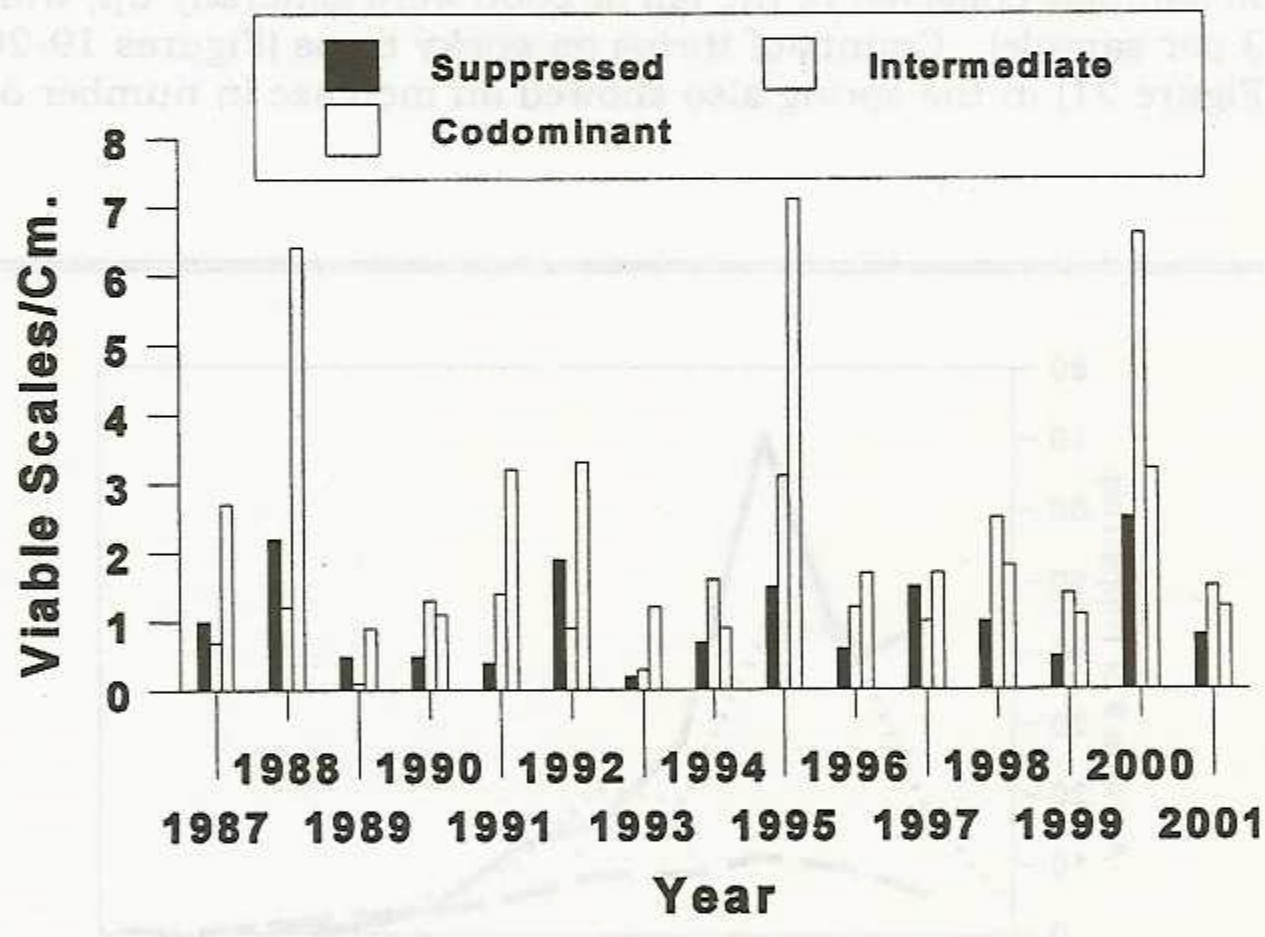


Figure 18. Oystershell scale populations in three tree canopy levels in Camel's Hump State Forest, 1987-2001[1]. Average for 10 current year twigs/tree per crown class, collected in autumn.

Pear Thrips, *Taeniothrips inconsequens*, caused scattered moderate to heavy defoliation in Lamoille, Rutland, Washington and Windsor Counties. Early browning from thrips defoliation quickly disappeared in northern Vermont, so that by the time an aerial flight could be made on July 10, it was difficult to detect. In southern locations, damage was most severe at higher elevations (2400-2900'), and was still visible in late July. These trees had refoliated by the mid-August survey. Consequently, only 2,662 acres of damage were mapped (Table 6).

Table 6. Mapped acres of damage by pear thrips in 2001.

County	Acres
Addison	373
Lamoille	675
Rutland	1,221
Washington	392
Total	**2,662**

In southern Vermont, occasional light damage was observed on ash, red oak, and sugar maple. Scattered red maples had very thin crowns early in the season. Heavy thrips oviposition on their seed petioles indicated that thrips feeding was responsible for the thin crowns. Some blighting was also observed on first year sugar maple seedlings associated with anthracnose.

Populations had generally increased from 2000. If leaf flush hadn't been rapid, the damage would have been worse. Soil samples collected in the fall of 2000 were generally up, with high numbers for Lamoille County (4.3 per sample). Counts of thrips on sticky traps (Figures 19-20) and in buds in southern Vermont (Figure 21) in the spring also showed an increase in number of adults for most locations.

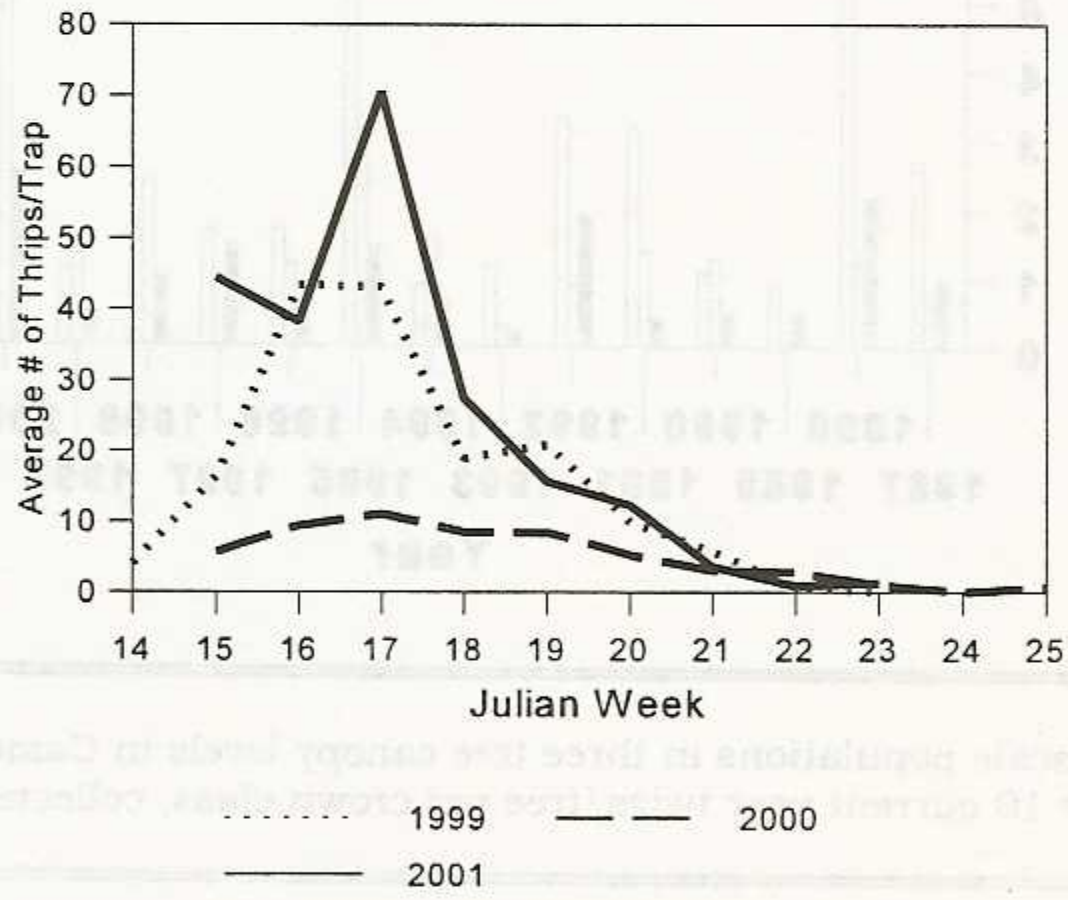


Figure 19. Average number of thrips caught on sticky traps, 1999-2001, by week. Number is average of 9 sites and 4 Sentry Mulitguard 6"x8" sticky cards per site, attached to wooden stakes and replaced weekly.

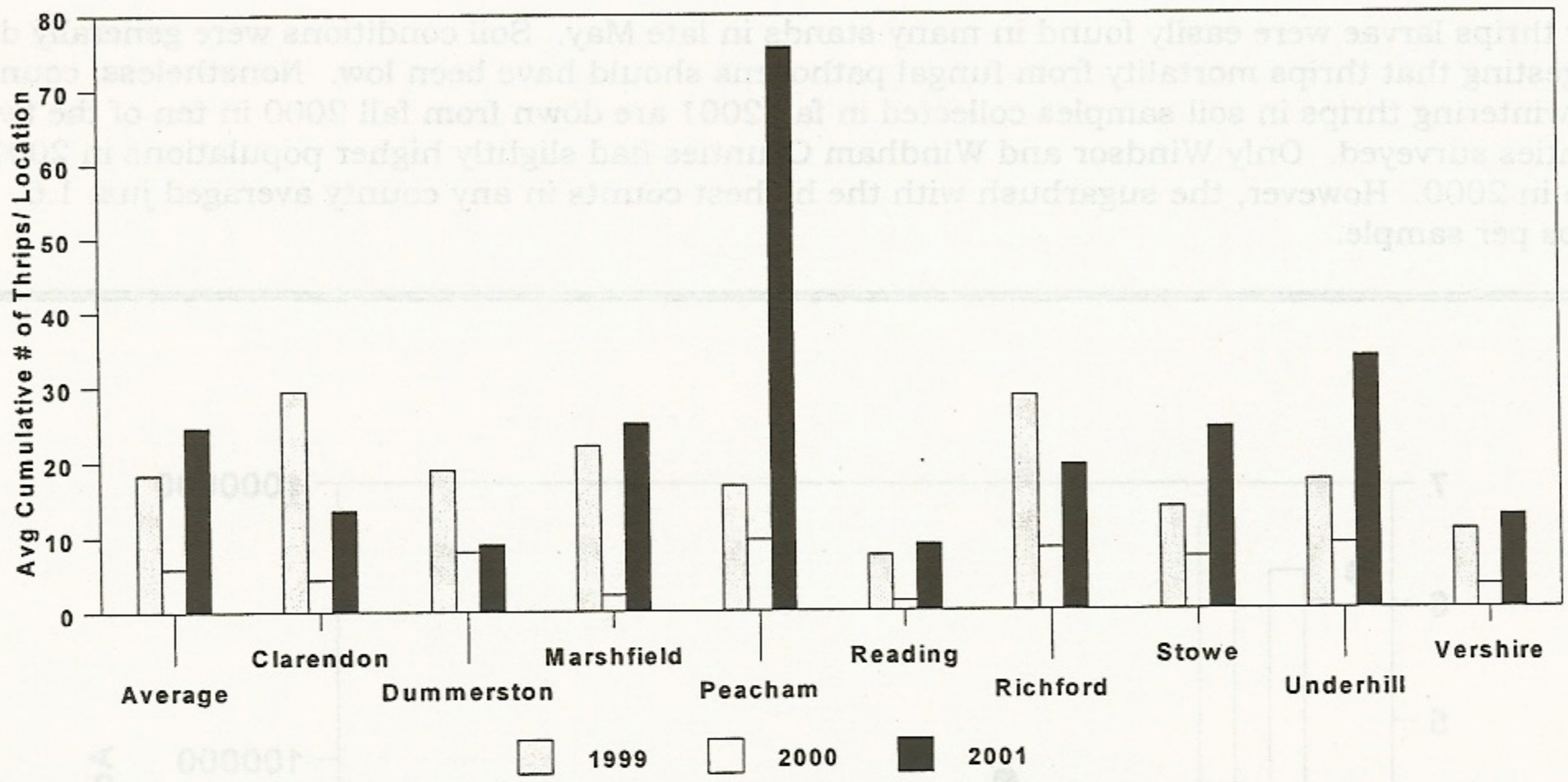


Figure 20. Average number of thrips per sticky trap site, 1999-2001. Traps placed weekly between early April and early June. Data are cumulative for the season, average of four sites per location.

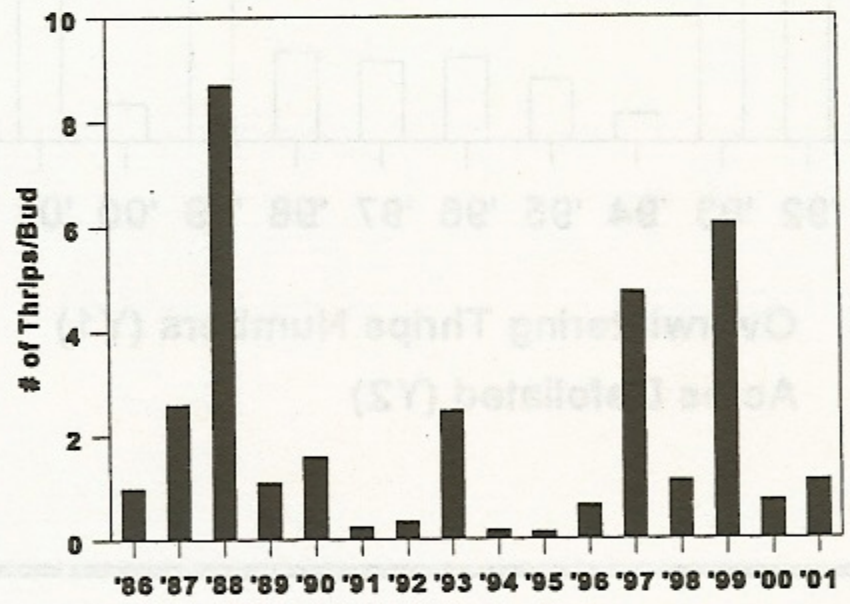


Figure 21. Spring thrips counts in buds of sugar maple in southern Vermont 1986-2001. Average of 2 sugarbushes in 1986, 5-6 sugarbushes 1987-2001 (100 understory buds/sugarbush).

Pear thrips larvae were easily found in many stands in late May. Soil conditions were generally dry, suggesting that thrips mortality from fungal pathogens should have been low. Nonetheless, counts of overwintering thrips in soil samples collected in fall 2001 are down from fall 2000 in ten of the twelve counties surveyed. Only Windsor and Windham Counties had slightly higher populations in 2001 than in 2000. However, the sugarbush with the highest counts in any county averaged just 1.6 thrips per sample.

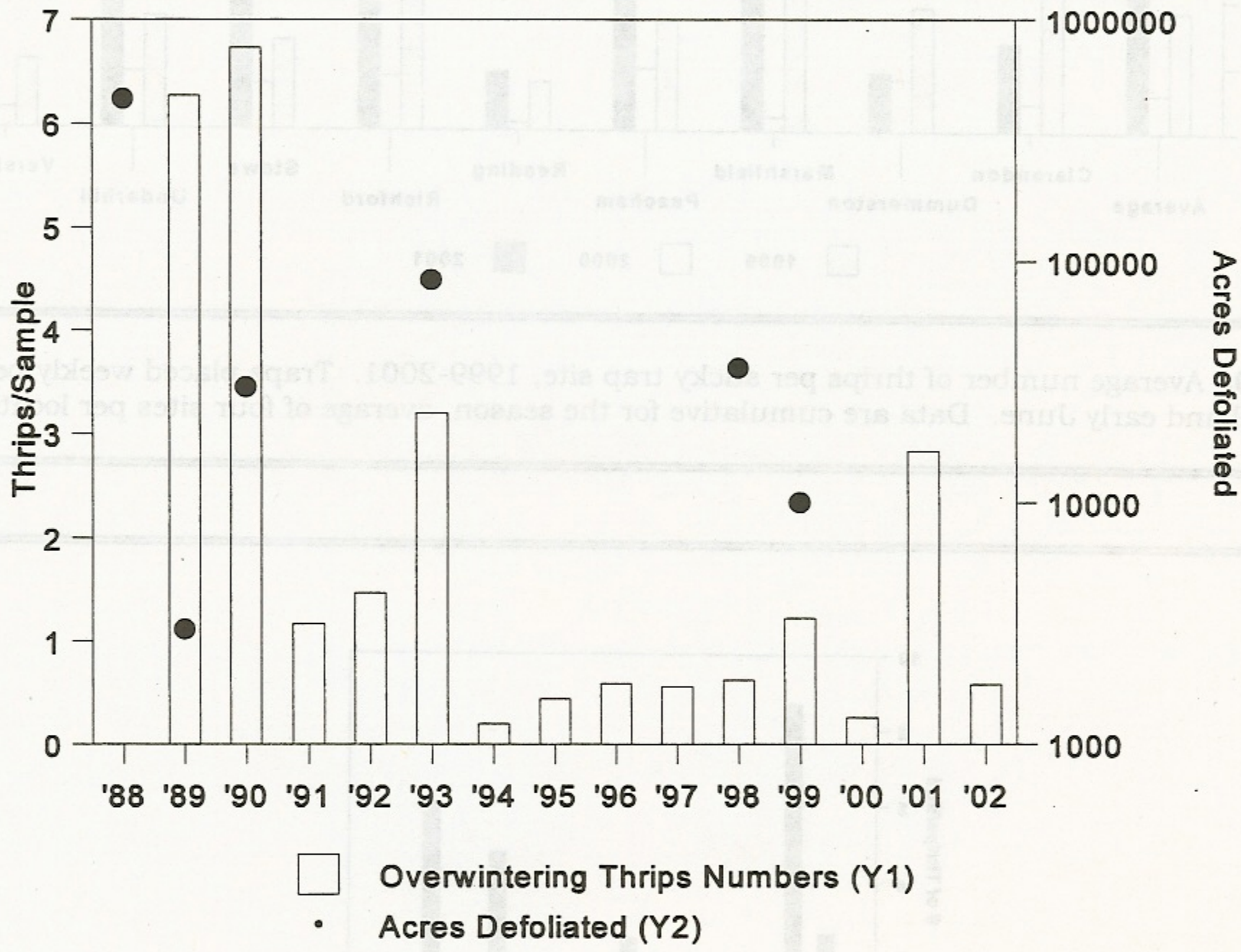


Figure 22. Average counts of overwintering pear thrips in soil samples (# of insects/16 in^3), compared to acres of thrips damage mapped statewide the following summer. Overwintering thrips numbers determined by extraction in 1989-93, and by forced emergence in 1994-2002. Forty-four sites were sampled to determine populations in winter 2001-2002.

OTHER SAPSUCKING INSECTS, MIDGES, AND MITES

INSECT	HOST(S)	LOCALITY	REMARKS
Aphids *Cinara sp.*	Balsam Fir	Scattered	Very light populations on Christmas trees
Aphids *Periphyllus sp.*			Not reported
Balsam Gall Midge *Paradiplosis tumifex*			See narrative
Balsam Twig Aphid *Mindarus abietinus*			See narrative
Balsam Woolly Adelgid *Adelges picea*	Balsam Fir	Groton, Burke, Victory	Increasing, but not heavy yet
Basswood Lacebug *Gargaphia tiliae*	Basswood	Charlotte Southern Vermont	Occasionally heavy
Beech Blight Aphid *Fagifagus imbricator*			Not reported
Beech Scale *Cryptococcus fagisuga*			See Beech Bark Disease
Boxelder Bug *Leptocoris trivittatus*	Boxelder	Winooski, Windsor	Numerous in houses
Cooley Spruce Gall Aphid *Adelges cooley*	Blue Spruce White Spruce Douglas Fir	Widely scattered	Remains common on ornamentals and Christmas trees at mostly light levels
Cottony Maple Scale *Pulvinaria innumerabilis*			Not reported
Dog Day Cicada *Tibicen sp.*	Norway Maple	Brattleboro	Castings found
Eastern Spruce Gall Adelgid *Adelges abietis*	White Spruce Red Spruce	Widespread	Remains common at mostly light levels
Elongate Hemlock Scale *Fiorinia externa*			Not reported

OTHER SAPSUCKING INSECTS, MIDGES, AND MITES

INSECT	HOST(S)	LOCALITY	REMARKS
Fletcher Scale *Parthenolecanium fletcheri*			Not reported
Gall Mites *Family Eriophyidae*	Walnut	Townshend	Of minor significance
Hemlock Scale *Abgrallaspis ithacae*	Eastern Hemlock	Vernon	Only a couple of scales found on foliage that was heavily infested with green hemlock needle miner
Hemlock Woolly Adelgid *Adelges tsugae*			See narrative
Hickory Leaf Stem Gallmakers *Phylloxera sp.*	Hickory	Bridport	Causing leaf and petiole galls
Honeylocust Plant Bug *Diaphnocoris chlorionis*			Not reported
Introduced Basswood Thrips *Thrips calcaratus*			Not reported
Lacebugs *Corythucha sp.*	Sugar Maple	Newfane	Light damage
Larch Woolly Adelgid *Adelges laricis*	Larch	Morrisville	Ornamental
Leafhoppers *Cicadellidae*	Maple	Barnet	A few insects observed
Lecanium Scale *Lecanium sp.*	Hardwoods	Champlain Valley	Light, but increasing
Linden Wart Gall Midge *Cecidomyia verrucicola*	Basswood	Williston Charlotte	Moderate number of galls on ornamentals
Maple Bladdergall Mite *Vasates quadripedes*			Not reported
Maple Spindle Gall Mite *Vasates aceris-crummena*	Sugar Maple Red Maple	Widespread	Remains common, but light damage only

OTHER SAPSUCKING INSECTS, MIDGES, AND MITES

INSECT	HOST(S)	LOCALITY	REMARKS
Oak Marginal Fold Gall *Contarinia sp.*	Oak Pin	Middlebury	Seen as a curiosity
Oystershell Scale *Lepidospaphes ulmi*			See narrative
Pear Thrips *Taeniothrips inconsequens*			See narrative
Pearleaf Blister Mite *Phytoptus pyri*	Pear	Danville	Light infestation
Phylloxerans *Phylloxera caryaecaulis*			Not reported
Pine Bark Adelgid *Pineus strobi*	White Pine	Throughout	Heavy in a young sawtimber stand in Marlboro. Elsewhere, only scattered light populations observed on forest, ornamental, and nursery trees
Pine Fascicle Mite *Trisetacus alborum*	White Pine	Stowe	Light damage
Pine Leaf Adelgid *Pineus pinifoliae*	White Pine	Widely scattered	Increasing. Dead shoots occasionally observed on wild and ornamental trees. Light to moderate levels on 40 acres in the northern Vermont Christmas tree survey
Pine Needle Midge *Contarinea baeri*	Scots Pine	Morristown	Heavy defoliation of a few leaders
Pine Needle Scale *Chionapsis pinifoliae*	Scots Pine	Morristown	Light infestations
Pine Spittlebug *Aphrophora parallela*	Scots Pine White Pine Hemlock	Widespread	Increasing. Light damage observed on Christmas trees
Pine Thrips *Gnophothrips sp.*	Scots Pine	Bakersfield	Trace damage

OTHER SAPSUCKING INSECTS, MIDGES, AND MITES

INSECT	HOST(S)	LOCALITY	REMARKS
Pine Tortoise Scale *Toumeyella parvicornis*			Not reported
Ragged Spruce Gall Aphid *Pineus similis*	Red Spruce	Widespread	Remains common
Root Aphid *Prociphilus sp.*	Balsam Fir Fralsam Fir	Jericho	On young Christmas trees
Spider Mites *Family Tetranychidae*	Northern White Cedar	Charlotte	Light infestation
Spruce Gall Adelgid *Adelges lariciatus*			Not reported
Spruce Gall Midge *Mayetiola piceae*	White Spruce	Barre	Moderate on one tree
Spruce Spider Mite *Oligonychus ununguis*	Conifers	Widely scattered	Only trace damage early in the season from low populations due to rainy conditions in 2000. However, mite populations built up over the summer, and damage was observed on Christmas trees late in the season
Taxus Mealybug *Dysmicoccus wistariae*			Not reported
White Pine Scale *Matsucoccus macrocicatrices*			Not reported
Woolly Alder Aphid *Paraprociphilus tessellatus*	Silver Maple	Enosburg, Ripton Jericho, Springfield	Occasionally heavy on ornamentals
Woolly Elm Aphid *Eriosoma americana*			Not reported
Woolly Larch Adelgid *Adelges laricis*	European Larch	Duxbury	On ornamental larch

BUD and SHOOT INSECTS

Balsam Shootboring Sawfly, *Pleroneura brunneicornis*, caused only trace to light amounts of damage in Christmas tree plantations this year, as expected. Damage was detected in five of the northern plantations that are annually surveyed, compared to ten plantations in 2000. Adults caught on 3x5 yellow sticky cards placed in mid-crowns of trees in Lamoille County averaged 0.4 per card compared to 16.6 in 2000, 1.1 in 1999 and 64 in 1998. Since damage is heaviest in even years, growers should expect this insect to be more noticeable in 2002. However, damage should not approach the heavy levels seen in 1998.

Pine Shoot Beetle, *Tomicus piniperda*, was the target of a re-survey using lindgren funnel traps in seven counties (Table 7). The Caledonia County site was the location in Kirby where one beetle was trapped in 2000. Preferred trap sites were stressed Scots pine plantings. Where this species was not available, red pine was preferred over white pine. Trapping was a cooperative effort with the USDA Animal & Plant Health Service and the Vermont Department of Agriculture, Food & Markets.

Two beetles were trapped in the Caledonia County location this year, but all other traps were negative for the presence of this beetle (Tables 8-9).

Pine shoot beetle bores into pine shoots during the summer, especially Scots pine and red pine, killing the shoots. No noticeable damage to pine has been observed during ground surveys of sites where adult beetles have been trapped.

Table 7. Number of sites surveyed for pine shoot beetle with Lindgren funnel traps by county, 1999-2001.

County	Number of Sites Trapped		
	1999	2000	2001
Caledonia	—	10	1
Chittenden	—	10	10
Essex	7	—	—
Franklin	—	10	9
Grand Isle	—	—	5
Lamoille	—	10	10
Orange	—	—	9
Orleans	3	8	—
Washington	—	10	10

Table 8. Number of adult pine shoot beetles caught in Lindgren funnel traps by location and trap date, 1999-2001.

County	Town	1999		2000		2001	
		Trap Dates	# of Adults	Trap Dates	# of Adults	Trap Dates	# of Adults
Essex	Brighton	27 Apr - 12 May	2				
	Canaan	27 Apr - 12 May	5				
		26 May - 8 June	2				
Orleans	Morgan	27 Apr - 12 May	1	2-15 May	1		
	Derby			6-24 April	7		
				24 Apr - 2 May	1		
				2-15 May	4		
	Derby Line			24 Apr - 2 May	2		
				15-26 May	1		
	Barton			15-26 May	1		
				26 May - 12 June	1		
				12- 21 June	1		
Caledonia	Kirby			4-18 April	1	27 Apr -11 May	2
Total			**10**		**20**		**2**

Table 9. Summary of Vermont pine shoot beetle surveys with Lindgren funnel traps, 1999-2001.

	1999	2000	2001
Number of counties trapped	2	6	6
Number of traps	10	58	54
Number of *Tomicus piniperda* collected	10 (9 in Essex County, 1 in Orleans)	20 (1 in Caledonia County, 19 in Essex County)	2 (Caledonia County)
Number of scolytids collected	39	755 *	764*

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

No pine shoot beetles were caught in funnel traps baited for this insect during a survey of warehouses in Grafton and Barre.

Pine shoot beetle is a regulated, introduced pest, and a state quarantine should go into effect by spring 2002. This will impact the movement of pine wood and bark products from the known infested counties of Essex, Orleans and Caledonia.

OTHER BUD and SHOOT INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Balsam Shootboring Sawfly *Pleroneura brunneicornis*			See narrative
Eastern Pine Shoot Borer *Eucosma gloriola*			Not reported
European Pine Shoot Moth *Rhyacionia buoliana*			Not reported
Hickory Shoot Curculio *Conotrachelus aratus*	Butternut		New state record reported by UVM
Maple Petiole Borer *Caulocampus acericaulis*	Sugar Maple	Clarendon	Suspected cause of early leaf drop

OTHER BUD and SHOOT INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Pales Weevil *Hylobius pales*	Balsam Fir Scots Pine	Northern Vermont	Mostly light damage in Christmas tree plantations
Pine Gall Weevil *Podapion gallicola*	Red Pine	Springfield, Baltimore	Damage to plantation trees
Pine Shoot Beetle *Tomicus piniperda*			See narrative
Pitch Nodule Maker *Petrova spp.*	Scotch Pine	Lyndon	Found on tree with extensive dieback. *Sphaeropsis* also found
Sawyer *Monochamus sp.*	Balsam Fir	Scattered throughout	Shoot dieback from injury in previous years
Twig Pruner *Elaphidionoides villosus*	Red Oak	Southern Vermont, Champlain Valley	Scattered light damage. Generally decreasing
White Pine Weevil *Pissodes strobi*	Conifers	Throughout	Common. Generally less damage than some years. Wilting occurred early due to dry conditions (first seen on July 9)

White-spotted Sawyer, *Monochamus scutellatus* (Say), remains widespread on white pine and balsam fir. It is frequently submitted as Asian longhorned beetle suspect.

This insect remains the subject of investigation by the University of Vermont Forest Pathology Lab, since this beetle is known to transmit the pinewood nematode. Observations of white spotted sawyer were made on a recently burned 30,000 acre area of black spruce and jack pine in Ontario. During and immediately following the active burn, extensive numbers of beetles were observed in flight, and found breeding on and attacking fire damaged or killed trees. However, they were not observed in areas where crown fires killed trees. Apparently, excessive heat generated during crown fires, destroys the trees attractiveness to white-spotted sawyers.

OTHER BARK AND WOOD INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Allegheny Mound Ant *Formica exsectoides*	Scots Pine	Barre	Found in a Christmas tree plantation
Ambrosia Beetle *Scolytidae*	Norway Maple Paper Birch Sugar Maple	Southern Vermont	More commonly reported than other years on ornamentals
Antlered Powered Post Beetle *Ptilinus ruficornis*			Not reported
Asian Longhorned Beetle *Anoplophora glabripennis*			Not detected or known to occur in Vermont
Black Carpenter Ant *Camponotus pennsylvanicus*	Norway Spruce	Brattleboro	Colonizing an ornamental with a large seam
Broadnecked Root Borer *Prionus laticollis*	Rhododendron	Essex	In ornamental
Bronze Birch Borer *Agrilus anxius*	Paper Birch European Birch	Panton, Springfield, Groton, Bennington	Occurring on stressed trees
Brown Spruce Longhorned Beetle *Tetropium fuscum*			Not reported or known to occur in Vermont
Eastern Ash Bark Beetle *Hylesinus aculeatus*	Ash	Springfield	Adults flying in early evening

OTHER BARK AND WOOD INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Eastern Larch Beetle *Dendroctonus simplex*	Eastern Larch	Northern Vermont	Large increase due to abundance of drought-stressed trees, especially in northeastern counties
Elm Bark Beetles *Hylurgopinus rufipes* *Scolytus multistriatus*			See Dutch Elm Disease
Hemlock Borer *Melanophila fulvoguttata*	Hemlock	Putney	Associated with dead trees
Japanese Cedar Longhorned Beetle *Callidiellum rufipenne*			Not detected or known to occur in Vermont
Locust Borer *Megacyllene robiniae*	Black Locust	Shrewsbury	On young dead transplants
Northeastern Sawyer *Monochamus notatus*	White Pine	Pittsford	In declining tree
Northern Pine Weevil *Pissodes approximatus*	White Pine	Bennington	On young dead trees
Pigeon Tremex *Tremex columba*	Sugar Maple Beech	Richmond, Lincoln Monkton, Springfield	Emergence holes common in maples in many locations. Galleries contained adults and larvae
Pine Engraver *Ips pini*	White Pine Red Pine	Scattered	Remains common on declining trees. Adults observed flying in June
Pine Root Collar Weevil *Hylobius radicis*			Not reported
Pitted Ambrosia Beetle *Corthylus punctatissimus*			Not reported
Red Turpentine Beetle *Dendroctonus valens*	White Pine	Dummerston, Hubbardton, Springfield	Associated with individual thin and dying trees in disturbed stands
Round-headed Apple Tree Borer *Saperda candida*	Apple Crabapple Mountain Ash	Scattered	Heavier than recent years. Common problem on ornamental trees

OTHER BARK AND WOOD INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Sawyer *Monochamus sp.*			See Bud and Shoot Insects
Sugar Maple Borer *Glycobius speciosus*	Sugar Maple	Throughout	Common cause of defect in old, disturbed and slow-growing maples
Tanbark Borer *Phymatodes testaceus*			Not reported
Teeny Weeny White Pine Beetle *Pityogenes hopkinsi*			Not reported
Whitespotted Sawyer *Monochamus scutellatus*			See narrative
Xyleborus sp. *Xyleborus sp.*	Swiss Stone Pine	Colchester	Extensive galleries
Zimmerman Pine Moth *Dioryctria zimmermanni*	White Pine Austrian Pine	Rutland Bennington	Young trees

ROOT INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Conifer Swift Moth *Korsheltellus gracilis*			Not reported
June Beetle *Phyllophaga spp.*			Not reported

FRUIT, NUT AND FLOWER INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Ash Flowergall Mite *Aceria fraxiniflora*			Not reported
Japanese Beetle *Popillia japonica*			See Hardwood Defoliators
Plum Curculio *Conotrachelus nenuphar*	Apple	Wilmington	Damage seen midsummer
Western Conifer Seed Bug *Leptoglossus occidentalis*	At Large	Throughout	Though these insects are believed to feed on cones and seeds of conifers, we have not seen damage to trees. Rather, the insects come to our attention as common autumn household invaders

MISCELLANEOUS INSECTS AND OTHER ARTHROPODS

Non-Target Moths Caught in Pheromone Traps used in surveys for forest tent caterpillar, saddled prominent, and spruce budworm were identified. Results are in Tables 10-12.

Table 10. Non-target moths caught in 2001 in pheromone traps baited with lure for forest tent caterpillar. Data are from 11 locations statewide.

Family	Species (Author)	Total Number Caught
Arctiidae	*Halysidota tessellaris* (J.E. Smith, 1797).	1
Geometridae	*Lambdina fiscellaria* (Gn., 1857).	12
Lymantriidae	*Lymantria dispar* (L., 1758).	302
Noctuidae	*Bomolocha abalienalis* (Wlk., 1859). *Idia americalis* (Gn., 1854). *Xestia normaniana* (Grt., 1874). *Zanclognatha laevigata* (Grt., 1872).	1 1 1 1
Pyralidae	*Anageshna primordialis* (Dyar, 1907).	12
Tortricidae	*Acleris cervinana* (Fern., 1882). *Pandemis lamprosana* (Rob., 1869).	1 1

Table 11. Non-target moths caught in 2001 in pheromone traps baited with lure for saddled prominent. Data are from 6 locations statewide.

Family	Species (Author)	Total Number Caught
Arctiidae	Halysidota tessellaris (J.E. Smith, 1797).	1
Geometridae	*Lambdina fiscellaria* (Gn., 1857). *Scopula limboundata* (Haw., 1809).	1 1
Incurvariidae	*Paraclemensia acerifoliella* (Fitch, 1854).	2
Pyralidae	*Phlyctaenia coronata* (Hufn., 1767)	1

Table 12. Non-target moths caught in 2001 in pheromone traps baited with lure for spruce budworm. Data are from 21 locations statewide.

Family	Species (Author)	Total Number Caught
Geometridae	*Caripeta divisata* Wlk., 1863. *Horisma intestinata* (Gn., 1857). *Hydria prunivorata* (Fgn., 1955). *Iridopsis larvaria* (Gn., 1857). *Lambdina fiscellaria* (Gn., 1857).	1 1 2 1 2
Lymantriidae	*Lymantria dispar* (L., 1758).	12
Noctuidae	*Charadra deridens* (Gn., 1852). *Xestia normaniana* (Grt., 1874). *Zanclognatha laevigata* (Grt., 1872).	1 1 1
Pyralidae	*Anageshna primordialis* (Dyar, 1907)	1
Thyatiridae	*Pseudothyatira cymatophoroides*	1

The organisms reported below were sent to the Forest Biology Lab for identification. They were not associated with damage to trees or shrubs. Many were collected "at large," and therefore could not be associated with a particular host at the time of collection.

ORDER COLEOPTERA: BEETLES

INSECT	SITE FOUND	SCIENTIFIC NAME	LOCALITY
Antelope Beetle	At Large	*Dorcus parallelus*	Lincoln
Black Carpet Beetle	Household	*Attagenus unicolor*	Barre
Carrion Beetles	At Large	Family Silphidae	Huntington
Clover Weevil	Household	*Trachyphloeus sp.*	Jeffersonville
Dogbane Leaf Beetle	Dogbane	*Chrysochus auratus*	Waterbury
Dung Beetle Ground Beetles	Dog Household	*Geotrupes splendidus* Family Carabidae	Lincoln Waterbury
Halloween Lady Beetle	Household (very unpopular this year)	*Harmonica axyridis*	Throughout
Larder Beetle	Stored Food Product	*Dermestes lardarius*	Montpelier
Rove Beetles	Household	Family Staphylinidae	Burlington
Soldier Beetles	At Large	Family Cantharidae	Williston
Strawberry Root Weevil	Strawberry	*Otiorhynchus ovatus*	Lincoln

ORDER COLEOPTERA: BEETLES

INSECT	SITE FOUND	SCIENTIFIC NAME	LOCALITY
Varied Carpet Beetle	At Large	*Anthrenus verbasci*	Waterbury
Wireworms (Click Beetles)	On Cherry and At Large	Family Elateridae	Woodbury Waterbury
Yellow Mealworm	Household	*Tenebrio molitor*	Morrisville

ORDER DIPTERA: FLIES

INSECT	SITE FOUND	SCIENTIFIC NAME	LOCALITY
Black Flies	At Large	Family Simuliidae	Shaftsbury and elsewhere
Cluster Flies	Household	*Pollenia rudis*	Hinesburg
Crane Flies	At Large	Family Tipulidae	Morrisville
Darkwinged Fungus Gnats	Houseplants	Family Sciaridae	Williston South Hero
Fungus Gnats	At Large	Family Mycetophilidae	Woodbury
March Flies	At Large	Family Bibionidae	Bakersfield
Moth Flies	Household	Family Psychodidae	Hinesburg Windsor
Syrphid Flies	Feeding on Aphids	Family Syrphidae	Charlotte
Tachinid Flies	At Large	Family Tachinidae	Montpelier

ORDER HEMIPTERA: TRUE BUGS

INSECT	SITE FOUND	SCIENTIFIC NAME	LOCALITY
Cinch Bugs	Lawn	*Blissus sp.*	St. Johnsbury
Giant Water Bug	Aquatic	Family Belostomatidae	Waterbury
Masked Hunter	Household	*Reduvius personatus*	Middlebury
Shieldbacked Bugs	At Large	Family Pentatomidae Scutellerinae	Williston

ORDER HYMENOPTERA: ANTS, BEES, AND WASPS

INSECT	SITE FOUND	SCIENTIFIC NAME	LOCALITY
Allegheny Mound Ant	Household	*Formica exsectoides*	Morrisville
Baldfaced Hornet	Household	*Dolichovespula maculata*	Norwich Newport
Carpenter Ants	Household	*Camponotus spp.*	Morrisville
Leafcutting Bees	Household	Family Megachilidae	Burlington
Pelecinid	At Large	*Pelecinus polyturator*	Montpelier
Pharaoh Ant	Household	*Monomorium pharaonis*	Barre
Squareheaded Wasp	Household	*Ectemnius cephalotes*	Newport
Vespid Wasps	At Large	Family Vespidae	Barre Town
Yellowjackets	At Large	*Vespa pennsylvanica*	Lincoln

ORDER LEPIDOPTERA: BUTTERFLIES AND MOTHS

INSECT	SITE FOUND	SCIENTIFIC NAME	LOCALITY
Armyworm	Mixed Grasses	*Pseudaletia unipuncta*	Elmore
Beautiful Wood-Nymph	Virginia Creeper	*Eudryas grata*	Burlington
Galium Sphinx	Bedstraw	*Hyles gallii*	Waterbury Morgan
Grapeleaf Skeletonizer	Grape	*Harrisina americana*	Middlebury
Indian Meal Moth	Stored Food Product	*Plodia interpunctella*	Tinmouth
Lettered Sphinx	At Large	*Deidamia inscripta*	St. Johnsbury
Luna Moth	At Large	*Actias luna*	Waterbury
Pandorus Sphinx	Grape	*Eumorpha pandorus*	Grand Isle
Polyphemus Moth	At Large	*Antheraea polyphemus*	Calais
Pyralid Moths	Household	Family Pyralidae	St. Johnsbury
Virgin Tiger Moth	At Large	*Grammia virgo*	Waterbury

ORDER MISCELLANEOUS INSECT ORDERS

INSECT	SITE FOUND	SCIENTIFIC NAME	LOCALITY
Common Green Lacewig	Household Basswood	Order Neuroptera *Chrysopa carnea*	Williston Hinesburg
Dobsonfly/Helgrammite	At Large	Order Neuroptera *Corydalus cornutus*	Burlington Montpelier
Caddisflies	At Large	Order Trichoptera	Waterbury
Snowfleas	Snow	Order Collembola *Hypogastrura nivicola*	Milton
Springtails	Balsam Fir	Order Collembola	Springfield
	Household	Order Collembola	Windsor
Earwigs	Household	Order Dermaptera	Lincoln Warren
Psyllids	Vegetables Blackberry	Order Homoptera Family Psyllidae	Hubbardton

ORDER ACARI: MITES (FROM NON-TREE HOSTS) AND TICKS*

ARTHROPOD	SITE FOUND	SCIENTIFIC NAME	LOCALITY
Clover Mite	Household	*Bryobia praetiosa*	Windsor Bennington
Deer Tick	Dog	*Ixodes scapularis*	Morrisville
Deer Tick	Cat		Morrisville
Deer Tick	Cat		Danville
Deer Tick	Dog		Shelburne
Deer Tick	Dog		Obtained out of state
Deer Tick	Human		Obtained out of state
Deer Tick	Human		Lunenburg
Deer Tick	Human		Jericho

* See the Forest Biology Lab Report.

ORDER ARANEIDA: SPIDERS

ARTHROPOD	SITE FOUND	SCIENTIFIC NAME	LOCALITY
Black Widow Spider	In Home	*Latrodectus variolus*	Burlington Randolph
Fishing Spider	Aquatic	*Dolomedes tenebrosus*	Danville Montpelier
Jumping Spiders	In Building	Family Salticidae	Waterbury
Longlegged Spiders	In Building	Family Pholcidae	Waterbury
Nursery-Web Spiders	In Building	Family Pisauridae	Waterbury
Orb Weavers	In Building	Family Araneidae	Waterbury
Silver Argiope	At Large	*Argiope vargentata*	Waterbury
Wolf Spiders	In Building	Family Lycosidae	Waterbury

OTHER ORDERS OF ARTHROPODS

ARTHROPOD	SITE FOUND	SCIENTIFIC NAME	LOCALITY
House Centipede	Household	*Scutigera immaculata coleoptrata*	Bristol
House pseudoscorpion	In Building	*Order Pseudoscorpiones*	Hinesburg South Hero Woodstock

STEM DISEASES

Beech Bark Disease, caused by *Cryptococcus fagisuga* and *Nectria coccinea* var. *faginata*, was much more conspicuous than normal during aerial surveys. Dense patches of chlorotic trees and scattered dieback were observed. A total of 57,914 acres were mapped compared to 1,395 acres mapped in 2000, and 4,004 in 1999 (Table 13, Figure 23).

Table 13. Mapped acres of damage by beech bark disease in 2001.

COUNTY	ACRES
Addison	4,006
Bennington	3,637
Caledonia	897
Chittenden	1,881
Essex	1,253
Franklin	4,528
Lamoille	1,866
Orange	667
Orleans	1,666
Rutland	7,877
Washington	2,618
Windham	15,938
Windsor	11,081
TOTAL	**57,914**

Populations of beech scale were very heavy in some areas. Mild winters and dry conditions in fall 1999 were ideal for the survival of beech scale. The 2001 drought made bark more susceptible to Nectria infection, and increased foliar symptom expression. Both beech scale and chlorosis were reported to be the heaviest ever seen. Resistant trees have become particularly noticeable in some areas of high beech scale.

In a review of the White River watershed involving the Green Mountain National Forest, it was determined that the biggest environmental change due to the loss in beech was an increase in temperature. Also of concern is the impact on the larger, nut-producing trees.

In monitoring plots, tree condition has declined slightly while beech scale wax cover levels increased slightly. Nectria fruiting may increase as the disease progresses (Figure 24).

Butternut Canker, caused by *Sirococcus clavigignenta-juglandacearum*, remains widespread. Few living butternuts remain in some locations, although trees without cankers are occasionally observed in heavily infected stands. In one Pittsfield property, all 27 butternuts and nearby seedlings are cankered.

The University of Vermont Forest Pathology Lab continues to work with butternut canker. In a greenhouse study, the butternut curculio successfully vectored spores of the butternut canker fungus to its own feeding/oviposition wounds. In a study looking at the longevity and survival of the spores on the exoskeletons of 3 beetle species, the beetles carried viable spores up to 16 days. Of the 824 trees examined in a study on the spatial analysis of canker occurrence, more than 85% are infected and there has been an increase in mortality of butternut since the survey in the mid-1990s on the same sites in Vermont.

Pine Wilt Disease, caused by the **Pinewood Nematode**, *Bursaphelenchus xylophilus*, is the subject of research at the University of Vermont Forest Pathology Lab. Scots pine trees were found to harbor populations of the nematode for up to 11 years after inoculation without inciting pine wilt disease. Since the pinewood nematode can persist for many years in asymptomatic trees, sanitation efforts may be ineffective. Also, harvesting of healthy-appearing trees may not be an adequate measure to prevent movement of the nematode in roundwood or other wood products.

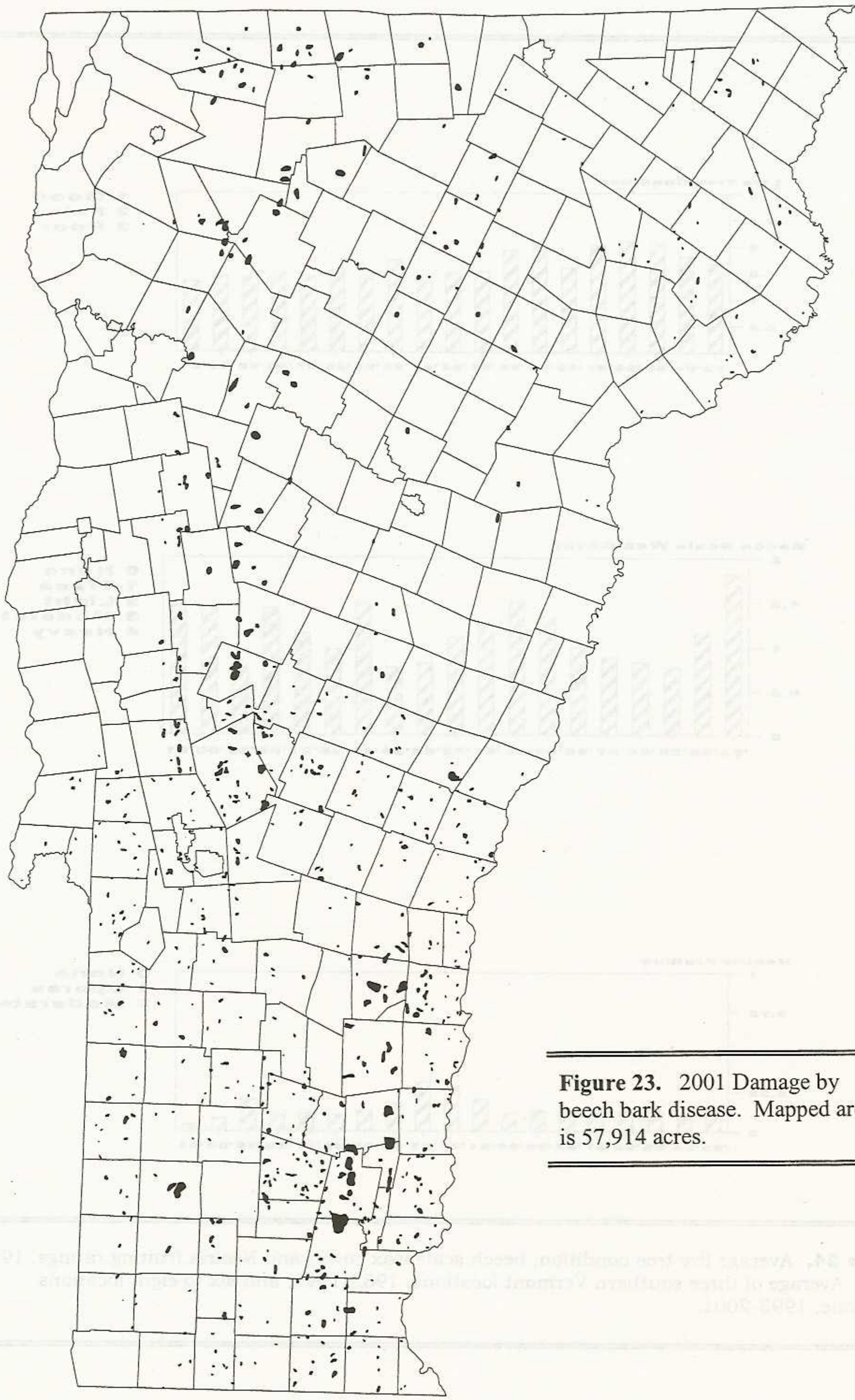
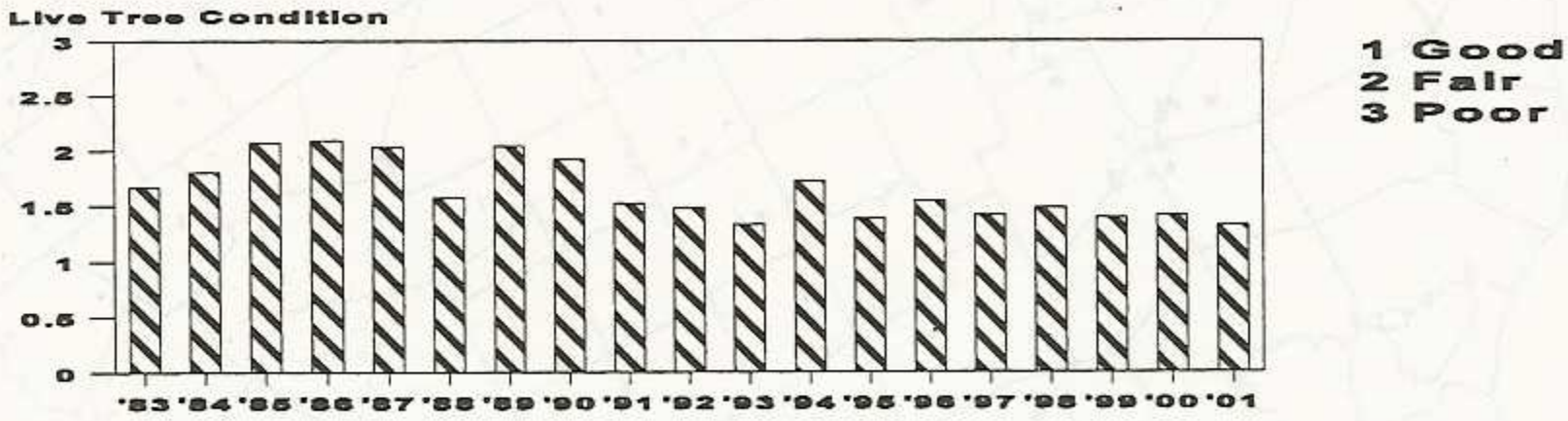
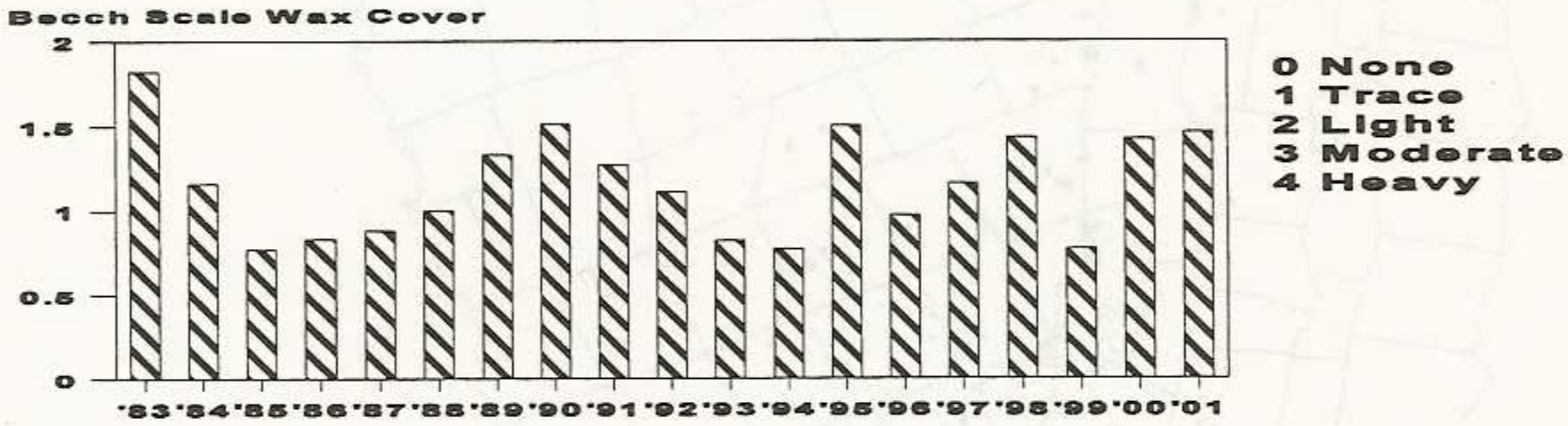


Figure 23. 2001 Damage by beech bark disease. Mapped area is 57,914 acres.





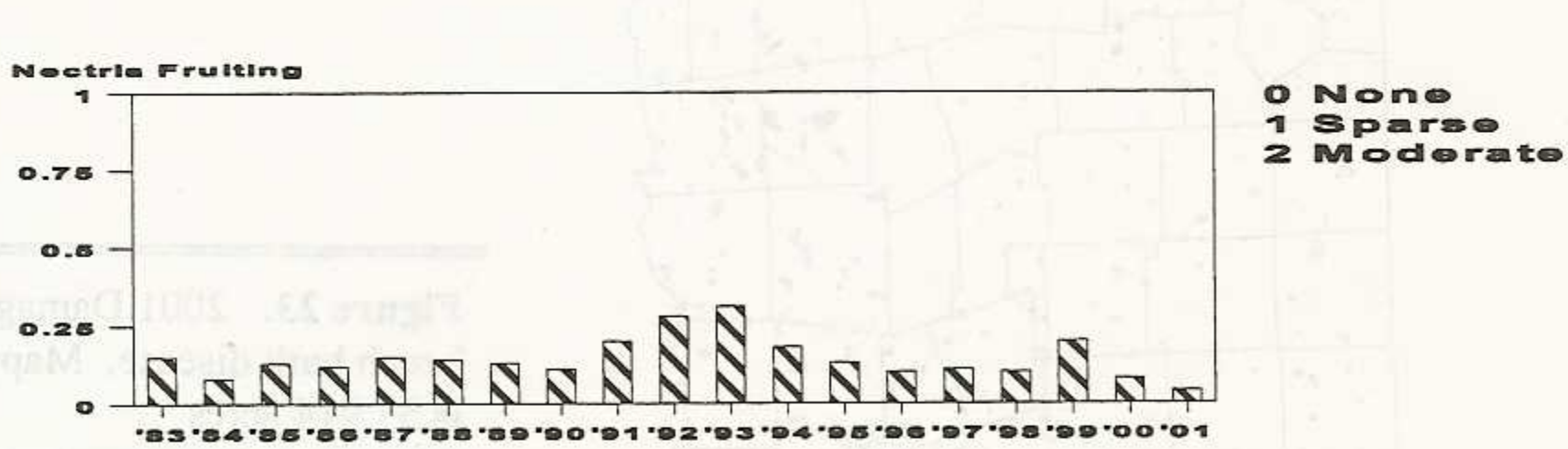


Figure 24. Average live tree condition, beech scale wax cover, and Nectria fruiting ratings, 1983-2001. Average of three southern Vermont locations, 1983-1992, and six to eight locations statewide, 1993-2001.

Scleroderris Canker, caused by *Ascocalyx abietina*, has not been found in any new towns since 1986. Twenty pine Christmas tree plantations within the quarantine zone (Figure 25) were surveyed for the presence of the disease this year and all were found free of the disease.

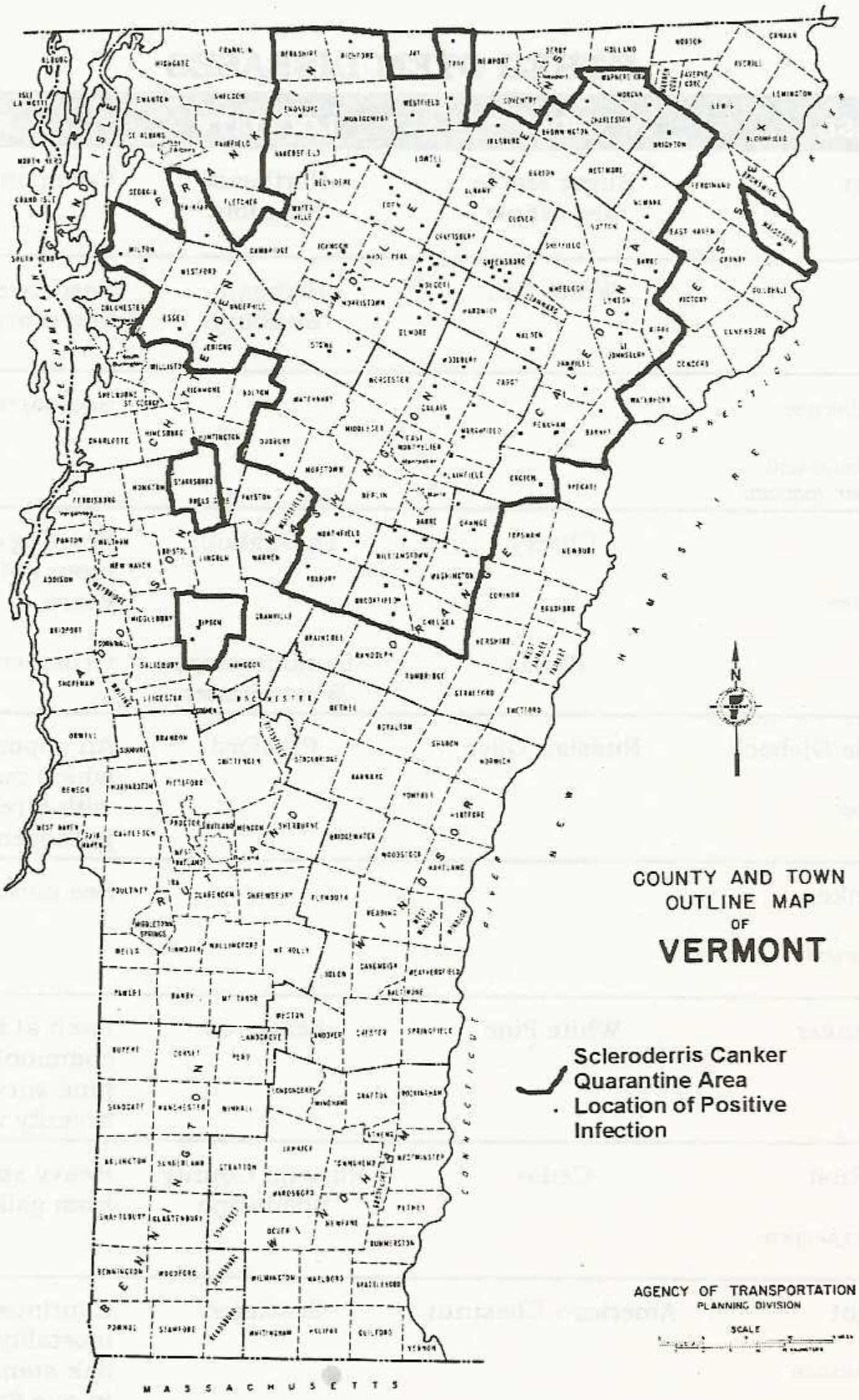


Figure 25. 2001 Scleroderris canker quarantine area and location of positive infections.

White Pine Blister Rust, caused by, *Cronartuim ribicola,* remains common, with cankers and flagging branches frequently observed. During the annual northern Vermont Christmas tree survey, light infection was reported for 195 acres and moderate infection was reported for 32 acres in northern Vermont. A special white pine survey of forest trees was conducted this summer and should give us the incidence of this disease for stands chosen at random.

OTHER STEM DISEASES

DISEASE	HOST	LOCALITY	REMARKS
Annual Canker *Fusarium sp.*	Sugar Maple Red Maple	Northeast Kingdom	Common in forests
Ash Yellows *Phytoplasma*	White Ash	Highgate, Sudbury	Associated with dieback and mortality
Beech Bark Disease *Cryptococcus fagisuga* and *Nectria coccinea var. faginata*			See narrative
Black Knot *Dibotryon morbosum*	Cherry	Throughout	Fruiting of galls much more noticeable than other years
	Plum	Dummerston, Westminster	Ornamentals
Botryosphaeria Dieback *Botryosphaeria spp.*	Russian Olive	Richford	An opportunistic pathogen which may be associated with stress or other pathogens
Butternut Canker *Sirococcus clavigignenti-juglandacearum*			See narrative
Caliciopsis Canker *Caliciopsis pinea*	White Pine	Scattered	Pitch at internodes commonly seen in white pine survey. However, severity was mostly light
Cedar-Apple Rust *Gymnosporangium juniperi-virginianae*	Cedar	Rutland County Shelburne	Heavy spore production from galled trees
Chestnut Blight *Cryphonectria parasitica*	American Chestnut	Scattered	Continues to cause mortality of young trees in oak stands. Last escapes in one Stockbridge stand now infected
Coral Spot Nectria *Nectria cinnabarina*			Not reported

OTHER STEM DISEASES

DISEASE	HOST	LOCALITY	REMARKS
Cytospora Canker *Leucostoma kunzei*	Blue Spruce Norway Spruce White Pine	Widely scattered	A few reports. Found on white pine with longitudinal cankerss and affected by pitch mass borer
Cytospora Canker *Cytospora spp.*	Oak	Not Given	Present on oak twig along with the fungus *Endothia* and bacteria
	Pin Oak	Morrisville	Found in cankered area on twig expressing dieback. Bacteria also present
	Sugar Maple	St. Albans Town	Found on dead branches of trees expressing dieback
Delphinella Tip Blight of Fir *Delphinella balsamae*	Balsam Fir	Widely scattered	Remains common in several Christmas tree plantations. Some heavy damage reported
Diplodia Shoot Blight *Sphaeropsis sapinea*	Scots Pine Balsam Fir Fraser Fir White Pine	Widespread	Remains common on Christmas trees, but mostly at light levels
Dutch Elm Disease *Ceratocystis ulmi*	Elm	Throughout	Increasing. Symptoms more noticeable than usual early in the season
Eastern Dwarf Mistletoe *Arceuthobium pusillum*			Not reported
Fir Broom Rust *Melampsorella caryophyllacearum*	Balsam Fir	Throughout	Remains common in Christmas tree plantations at mostly light levels
Fireblight *Erwinia amylovora*			Not reported
Hypoxylon Canker *Hypoxylon pruinatum*	Aspen	Throughout	Remains a common cause of tree mortality and breakage
Lilac Blight *Pseudomonas syringae (lilac)*			Not reported
Maple Canker *Steganosporium spp.*	Sugar Maple	Essex	Seen in parks and off-site trees

OTHER STEM DISEASES

DISEASE	HOST	LOCALITY	REMARKS
Nectria Canker *Nectria galligena*	Apple	Essex Junction	Damage found on branch
Nectria Canker *Nectria sp.*	Euonymous	Moretown	Fungus fruiting on twig samples
Oak Twig Blight *Coryneum kunzei*	Red Oak	Rockingham	Not positive of species but fungus *Coryneum* was present on twigs which had dieback
Oak Wilt *Ceratocystis fagacearum*			Not observed. No suspects seen during aerial surveys
Phomopsis Twig Blight *Phomopsis spp.*			Not reported
Pine Wilt Disease *Bursaphelenchus xylophilus*			See narrative
Red Ring Rot *Phellinus pini*	White Pine	Throughout	Pitchy knots commonly observed in the white pine survey. Conks observed infrequently. Also observed in an unmanaged stand in Ryegate
Sapstreak *Ceratocystis coerulescens*	Sugar Maple	Hubbardton	Flagging started with a small branch. Infection court apparently root wounds created by windstorm
Scleroderris Canker *Ascocalyx abietina*			See narrative
Sirococcus *Sirococcus strobilinius*	Red Pine White Spruce	Groton Waterville	Only light damage observed
Sumac Wilt *Fusarium sp.*			Not reported
Tomentosus Butt Rot *Inonotus tomentosus*			Not reported

OTHER STEM DISEASES

DISEASE	HOST	LOCALITY	REMARKS
Verticillium Wilt *Verticillium albo-atrum*	Sugar Maple	Grand Isle, Essex	One tree wilting with grayish-green flecking observed under bark
White Pine Blister Rust *Cronartium ribicola*			See narrative
Woodgate Gall Rust *Endocronartium harknessii*	Scots Pine Mugo Pine	Throughout	Increasing. Common in Christmas tree plantations at light to moderate levels
Yellow Witches Broom Rust *Melampsorella caryophyllacearum*			Not reported

FOLIAGE DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Actinopelte Leaf Spot *Actinopelte dryina*			Not reported
Anthracnose *Colletotrichum gloeosporiodes*	Catalpa	Grand Isle	Appeared as browning of foliage on several shade trees
Anthracnose *Discula sp.*	Red Maple	Norwich	Infected leaves being cast
Anthracnose *Discula quercina*	Red Oak	Westminster	Spring browning of forest trees
Anthracnose *Gloeosporium sp.*	Hardwoods	Champlain Valley	Light and decreasing
Anthracnose *Gloeosporium apocryptum*	Sugar Maple	Southern Vermont	Scattered damage to seedlings in early June. Associated with thrips damage in defoliated areas
Apple Scab *Venturia inaequalis*	Apple Crabapple	Scattered	Much lighter than 2000. 58 acres mapped from the air
Balsam Fir Needlecast *Lirula nervata*			Not reported
Bifusella Blight *Bifusella linearis*	White Pine	Bethel	Observed in white pine survey
Brown Rot *Monilinia fructicola*			Not reported
Brown Spot Needle Blight *Scirrhia acicola* *Mycosphaerella dearnessii*	White Pine	Lamoille County	Still visible on trees heavily infected in past years. Decreasing
Cedar-Apple Rust *Gymnosporangium juniperi-virginianae*			See Stem Diseases
Coccomyces Leaf Spot *Blumeriella jaapii*	Black Cherry	Lamoille County	Light damage seen. Decreasing

FOLIAGE DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Cyclaneusma Needlecast (formerly Naemacyclus) *Cyclaneusma minus*	Scots Pine	Throughout	Remains common in Christmas trees but at light levels
Dothistroma Needle Blight *Dothistroma pini*			Not reported
Fir Fern Rust *Uredinopsis mirabilis*	Balsam Fir	Widespread	Increasing. More common this year, but mostly light damage to Christmas trees
Giant Tar Spot *Rhytisma sp.*	Norway Maple Crimson King Maple	Southern Vermont	Tar spots very noticeable, but less defoliation than recent years
Horsechestnut Leaf Blotch *Guignardia aesculi*			Not reported
Lophodermium Needlecast *Lophodermium seditiosum*	Scots Pine	Scattered	Defoliation continues from prior years' infections. Common in Christmas trees mostly at light levels
Oak Leaf Blister *Taphrina caerulescens*			Not reported
Phyllosticta Leaf Spot *Phyllosticta spp.*	Red Maple	Hyde Park	Fruiting bodies present
Poplar Leaf Blight *Marssonina spp.*	Aspen Poplar	Widely scattered in northern Vermont	Very light this year. Mapped on 243 acres
Powdery Mildew *Eryiphaceae*	Lilac Cherry	Scattered	Ornamentals infected after periods of high humidity without rain
Rhabdocline Needlecast *Rhabdocline pseudotsugae*	Douglas Fir	Widely scattered	Stable at light to moderate levels in Christmas trees
Rhizosphaera Needle Blight *Rhizosphaera pini*	Balsam Fir	Weston	Trees also affected by Lirula and gall midge
		Northern Vermont	Decreasing. Christmas trees had 47 acres of light damage and 90 acres of trace

FOLIAGE DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Rhizosphaera Needlecast of Spruce *Rhizosphaera kalkhoffii*	White Spruce Blue Spruce	Throughout	Common but decreasing. Has led to thin crowns on many ornamentals
Septoria Leaf Spot *Septoria aceris*	Sugar Maple	Northern Vermont	Very light compared to last year
Spruce Needle Rust *Chrysomyxa weirii*	Blue Spruce	Barre	Found along with Rhizosphaera
Swiss Needlecast *Phaeocryptopus gaeumannii*	Douglas Fir	Widely scattered	Some moderate damage on Christmas trees and ornamentals
Sycamore Anthracnose *Gnomonia platani*	Sycamore	Charlotte, Morrisville	Ornamentals
Tar Spots *Rhytisma acerinum* *Rhytisma punctatum*	Sugar Maple Beech	Champlain Valley Victory	Light and decreasing. See Giant Tar Spot
White Pine Needle Blight *Canavirgella banfieldii*	White Pine	Widely scattered	Much less than previous years. Mostly light infection levels in Christmas tree plantations

ROOT DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Annosus Root Rot *Heterobasidion annosum*			Not reported
Cylindrocarpon Root Rot *Cylindrocarpon sp.*			Not reported
Phytopthora Root Rot *Phytophthora spp.*			Not reported
Shoestring Root Rot *Armillaria spp.*	Many	Throughout	Remains common on stressed trees
	Balsam Fir	Shrewsbury	Associated with dying, J-rooted Christmas trees
	White Pine	Dummerston, Guilford	Associated with scattered dead sawtimber trees in thinned stands

DIEBACKS, DECLINES AND ENVIRONMENTAL DISEASES

Drought damage was observed statewide, with 170,408 acres mapped during the aerial survey (Table 14, Figure 26). Much of the damage mapped was on ledgey hilltops, with the most noticeable damage on shallow or well-drained soils in the Champlain Valley and in Washington, Caledonia, and Essex counties.

Table 14. Mapped acres of foliage symptoms caused by drought in 2001.

County	Acres
Addison	504
Bennington	1,372
Caledonia	42,567
Chittenden	3,277
Essex	64,818
Franklin	9,802
Grand Isle	165
Lamoille	1,023
Orange	3,798
Orleans	25,835
Rutland	2,818
Washington	4,266
Windham	4,682
Windsor	5,481
Total	**170,408**

In early July, understory vegetation on dry sites began to turn yellow, with some plants wilting and dropping their leaves. By early to mid-August large areas of leaf scorch and defoliation were observed.

Interior needle loss, or "fading out" was observed on Christmas trees and ornamental conifers. Other drought symptoms observed on ornamental and roadside trees included scorch, dieback, and defoliation.

All hardwood species were affected. Beech and yellow birch appeared to suffer the most in northern Vermont, while symptomatic sugar maple, paper birch, and white ash were most commonly observed in southern Vermont. Some beech and maples that were checked in the Northeast Kingdom have no live buds. In Lamoille County, some yellow birch had no live buds, while the beech had abnormally small buds. White pine dieback and mortality was also observed on a ledgey site in Dummerston and Barnet. Oak ledges in the Taconics where drought symptoms have been mapped in previous years were not noticeably affected

Drought is thought to have played a role in the high incidence of chlorosis associated with beech bark disease. Scorching of bilberry and other alpine plants at the summit of Mt. Mansfield was attributed to drought by staff of the Green Mountain Club.

Mortality and dieback associated with this severe drought is likely to be evident in 2002.

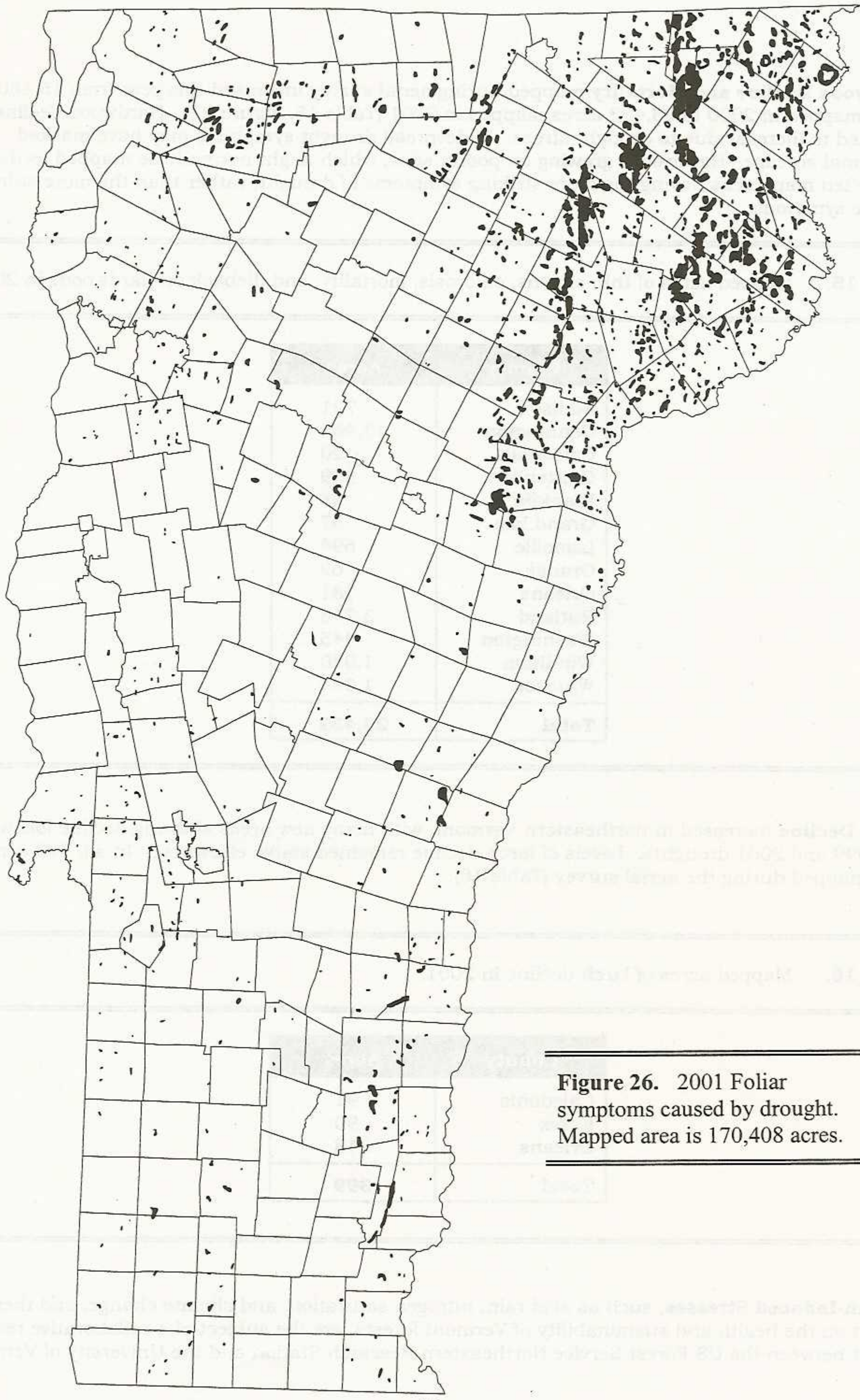


Figure 26. 2001 Foliar symptoms caused by drought. Mapped area is 170,408 acres.

Hardwood Decline and Mortality mapped during aerial survey increased this year from 15,180 acres mapped in 2000 to 23,432 acres mapped in 2001 (Table 15, Figure 27). Hardwood decline was expected to increase due to drought stress. Widespread drought symptoms may have masked additional acreage. Hardwoods growing on poorer sites, which might normally be mapped as decline, were often mapped as having the more striking symptoms of drought, rather than the more subtle decline symptoms.

Table 15. Mapped acres of thin crowns, chlorosis, mortality, and dieback on hardwoods in 2001.

County	Acres
Addison	721
Bennington	13,465
Caledonia	20
Chittenden	939
Franklin	98
Grand Isle	87
Lamoille	694
Orange	62
Orleans	181
Rutland	3,748
Washington	445
Windham	1,930
Windsor	1,044
Total	**23,432**

Larch Decline increased in northeastern Vermont, with many new areas showing decline following the 1999 and 2001 droughts. Levels of larch decline remained stable elsewhere. In all, 399 acres were mapped during the aerial survey (Table 16).

Table 16. Mapped acres of larch decline in 2001.

County	Acres
Caledonia	91
Essex	90
Orleans	218
Total	**399**

Human-Induced Stresses, such as acid rain, nitrogen saturation, and climate change, and their impact on the health and sustainability of Vermont forests, are the subject of a collaborative research project between the US Forest Service Northeastern Research Station and the University of Vermont

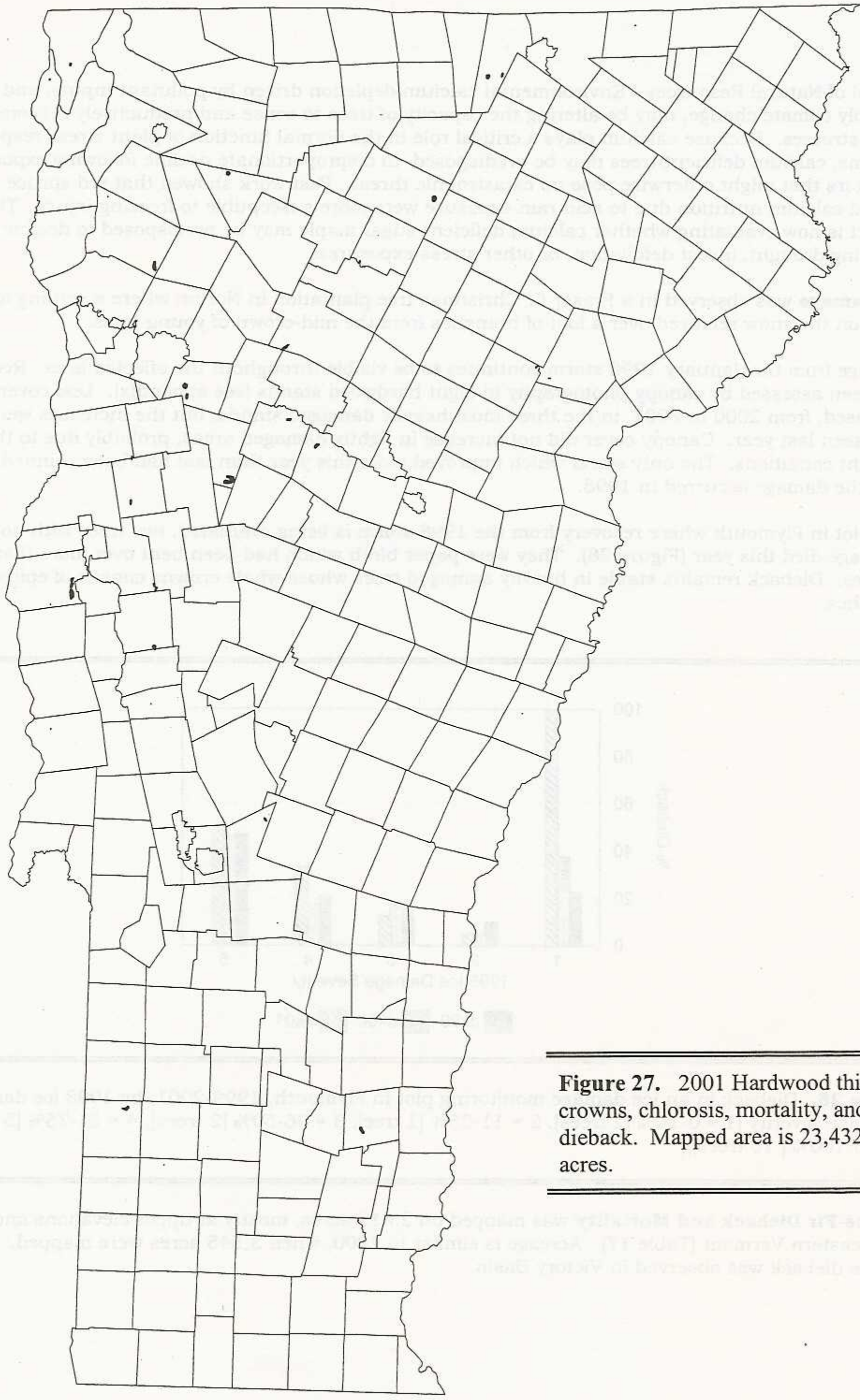


Figure 27. 2001 Hardwood thin crowns, chlorosis, mortality, and dieback. Mapped area is 23,432 acres.

School of Natural Resources. Environmental calcium depletion driven by pollutant inputs, and possibly climate change, may be altering the capacity of trees to sense and productively respond to other stresses. Because calcium plays a critical role in the normal function of plant stress response systems, calcium deficient trees may be predisposed to disproportionate decline following exposure to factors that might otherwise pose no catastrophic threat. Past work showed that red spruce with altered calcium nutrition due to acid rain exposure were more susceptible to freezing injury. The project is now evaluating whether calcium deficient sugar maple may be predisposed to decline following drought, insect defoliation, or other stress exposures.

Ice Damage was observed in a Fraser fir Christmas tree plantation in Norton where a settling icy crust on the snow removed over a foot of branches from the mid-crown of young trees.

Damage from the January 1998 storm continues to be visible throughout the affected area. Recovery has been assessed by canopy photography in eight hardwood stands (see appendix). Leaf cover increased, from 2000 to 2001, in the three most heavily damaged stands, but the increases were less than seen last year. Canopy cover did not increase in lightly damaged areas, probably due to the drought conditions. The only stand which improved more this year than last had been thinned soon after the damage occurred in 1998.

In a plot in Plymouth where recovery from the 1998 storm is being evaluated, two trees with no ice breakage died this year (Figure 28). They were paper birch which had been bent over more than 90 degrees. Dieback remains stable in heavily damaged trees whose whole crowns consist of epicormic branches.

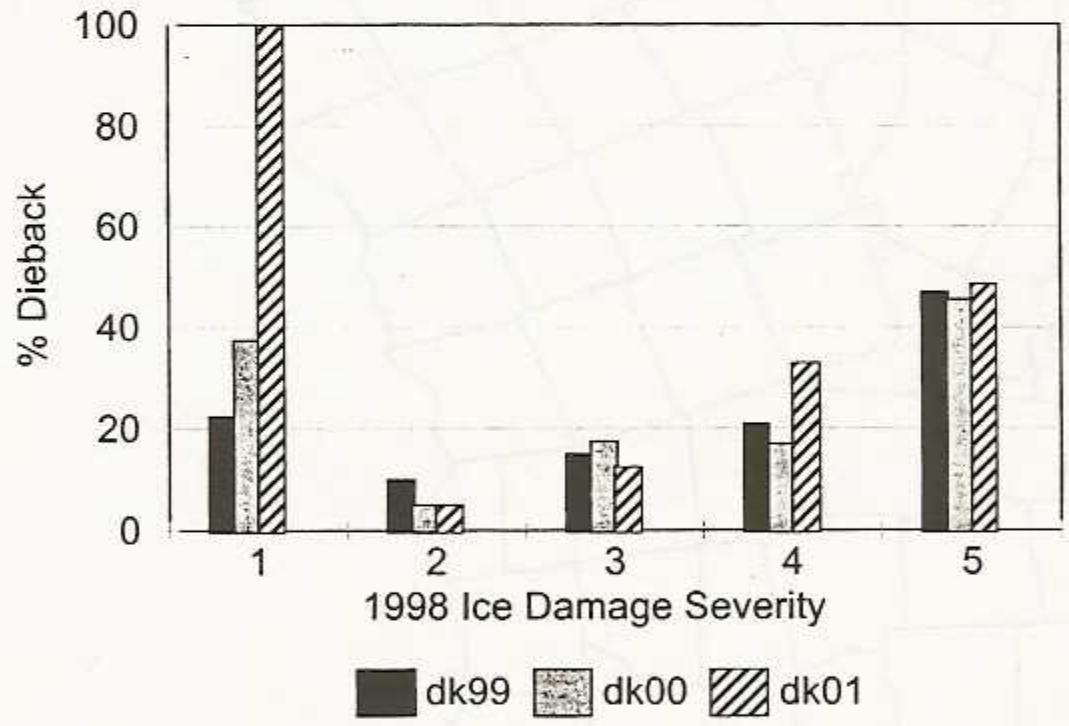


Figure 28. Dieback in an ice damage monitoring plot in Plymouth, 1999-2001, by 1998 ice damage breakage severity (1 = 0-10% [2 trees], 2 = 11-25% [1 tree], 3 = 26-50% [2 trees], 4 = 51-75% [5 trees], 5 = 76-100% [10 trees]).

Spruce-Fir Dieback and Mortality was mapped on 2,617 acres, mostly at upper elevations and in northeastern Vermont (Table 17). Acreage is similar to 2000, when 3,545 acres were mapped. Black spruce dieback was observed in Victory Basin.

Table 17. Mapped acres of spruce-fir dieback and mortality in 2001.

County	Acres
Addison	482
Bennington	400
Chittenden	70
Franklin	17
Grand Isle	9
Orange	157
Orleans	862
Rutland	435
Windham	5
Windsor	179
Total	**2,617**

Wet Site conditions continue to contribute to dieback and decline of trees in sugarbushes, Christmas tree plantations, forestland, and ornamental plantings. However, less dieback attributed to wet site was mapped during aerial surveys, with 9,640 acres mapped compared to 10,194 acres in 2000 (Table 18, Figure 29).

Table 18. Mapped acres of dieback and mortality associated with wet site conditions in 2001.

County	Acres
Addison	2,917
Bennington	195
Caledonia	18
Chittenden	924
Essex	618
Franklin	1,389
Grand Isle	2,571
Lamoille	21
Orleans	412
Rutland	342
Washington	7
Windham	152
Windsor	72
Total	**9,640**

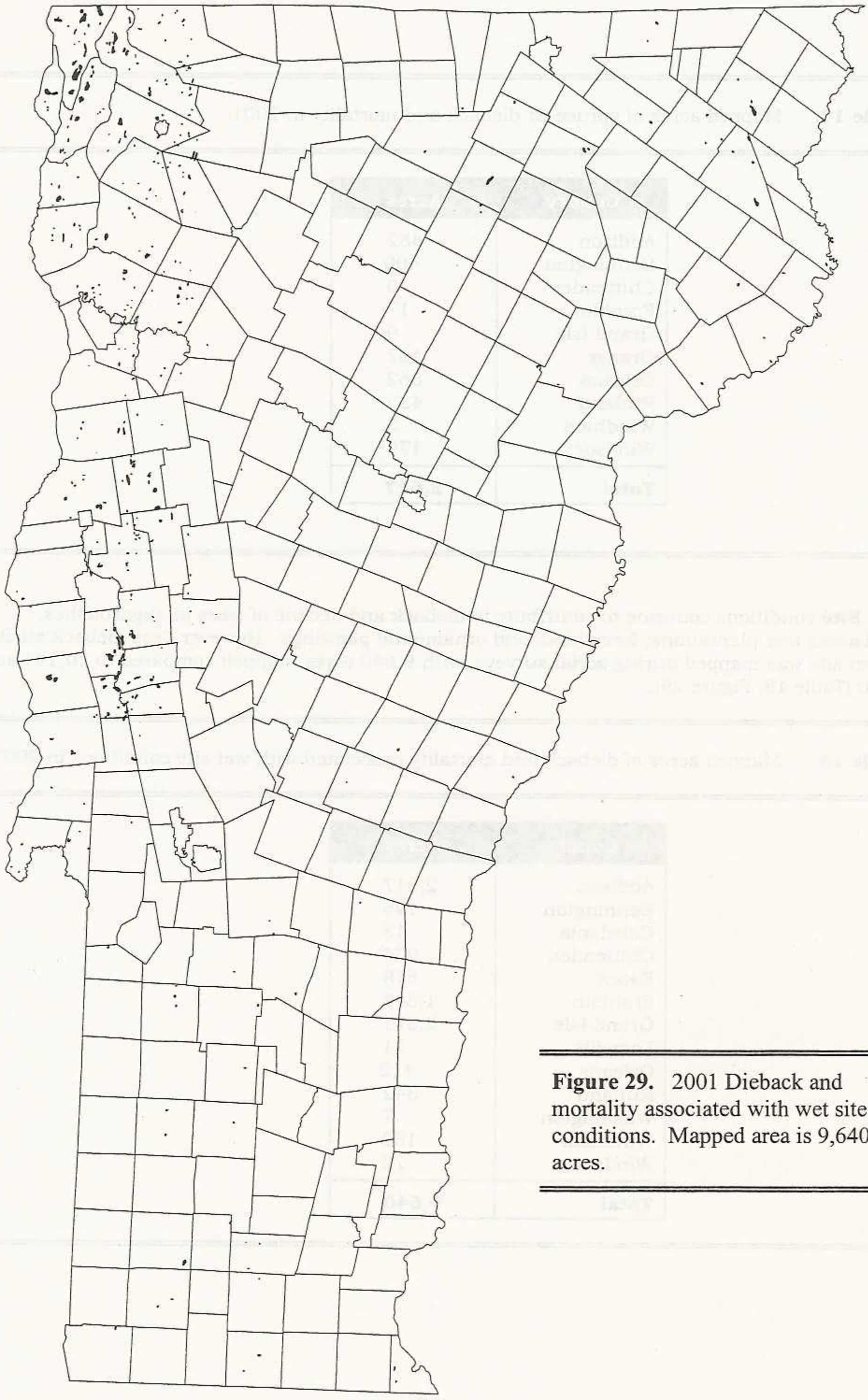


Figure 29. 2001 Dieback and mortality associated with wet site conditions. Mapped area is 9,640 acres.

OTHER DIEBACKS, DECLINES, AND ENVIRONMENTAL DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Ash Dieback	White Ash	Highgate, Ferrisburg	Mostly drought-induced decline
Birch Decline	Paper Birch Yellow Birch	Throughout	102 acres mapped during aerial surveys. Symptoms common on droughty or compacted soils
Cold Temperatures	Black Cherry	Wilmington	Extreme cold in winter 1980-81 may be responsible for black rings in sawlogs
Delayed Chlorophyll Development	Red Oak	Southeastern Vermont	Foliage remained red colored into late May because of cool cloudy conditions
Construction Injury	Many	Scattered throughout	Symptoms related to excavation including fill, compaction, and wounding. 24 acres mapped during aerial survey
Drought			See narrative
Fire Damage	Norway Spruce	Weathersfield	Wound from a structure fire. 31 acres mapped during aerial survey
Frost Damage	Balsam Fir White Spruce Pines	Northern Vermont Weston, Chester	Some light to moderate damage to Christmas trees. No frost damage to oaks was observed, although it was widespread in southeastern New England
Hail Damage	Balsam Fir	Springfield	Cause of scattered shoot mortality of Christmas trees
Hardwood Decline and Mortality			See narrative
Heavy Seed	Red Maple Silver Maple	Southern Vermont	Little to no foliage at the tops of some trees in early July. Thrips damage common on some affected trees
Ice Damage			See narrative
Improper Planting	Ornamentals	Throughout	Too deep planting, J-roots, girdling roots, and wrapping left on remain common causes of dieback and mortality

OTHER DIEBACKS, DECLINES, AND ENVIRONMENTAL DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Larch Decline			See narrative
Lightning	Sugar Maple White Ash Beech	Widely scattered	Dieback and mortality of affected trees
Logging Related Decline	Many	Scattered	Mapped on 1,390 acres
Maple Decline			See Hardwood Decline and Mortality
Mechanical Injury	Ornamentals	Throughout	Common
Nutrient Deficiency	Balsam Fir	Springfield	pH too high in former agricultural field
	Sugar Maple	Shrewsbury, Chester	Low pH associated with poor vigor of sugarbush trees
Overtapping	Sugar Maple	Scattered	Heavy tapping of trees growing under stressful conditions contributes to maple decline
Pesticide Injury	Honeylocust Red Maple	Springfield	Dieback in two locations associated with recent application of Halts
Salt Damage	Conifers	Throughout	Heavy foliar damage from airborne salt particularly common in northern Vermont due to frequent application in winter 2000-01
	Many	Mt. Holly	Severe damage along Route 103
Snow Breakage	White Pine	Scattered throughout	Occasional heavy branch loss
	Sugar Maple	Scattered throughout	Breakage led to tubing damage and the need to clear sugarbush roads
	Many	Northern Vermont	Due to late winter heavy wet snowstorm
Spruce/Fir Dieback and Mortality			See narrative
Sunscald	Norway Maple Sugar Maple	Springfield	High incidence of cracking in a planting of 2-3" trees

OTHER DIEBACKS, DECLINES, AND ENVIRONMENTAL DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Wet Site			See narrative
White Pine Decline	White Pine	Scattered	Mapped on 67 acres
White Pine Needle Blight			Less observed than recent years. See Foliage Diseases
Wind Damage	Many	Scattered	Breakage of ornamentals in Rutland County following July windstorm. 446 acres mapped during aerial survey
Winterburn	Arborvitae	Brattleboro	Ornamentals
	Juniper	Plainfield	

ANIMAL DAMAGE

DISEASE	REMARKS
Beaver	Numbers of beaver and damage remain high. See Wet Site conditions
Deer	Due to heavy snow, damage to regeneration, lower branches, and bark in and around deer wintering areas was high. Impact on regeneration remains high in the Connecticut River valley, where heavy deer feeding may increase the success of unpalatable exotic plants. In northern Vermont, there were fewer complaints regarding damage to ornamental and fruit trees
Moose	Damage remains common in Essex County and scattered locations elsewhere
Mouse and Vole	Some heavy damage to young ornamentals and roadside woody plants during winter 2000-2001. Considerable damage in many areas. Populations are high going into winter 2001-2002
Pileated Woodpecker	Scattered damage
Porcupine	Populations increasing in southern Vermont and the Northeast Kingdom. Old and recent heavy damage observed to high elevation beech in Rupert. Elsewhere, little damage was reported
Sapsucker	Damage reported from widely scattered locations on birch, hemlock, red maple, apple, and white pine
Squirrel	Damage was observed on ornamental pines in Burlington, spruce trees in St. Albans, and elm with seeds in Morrisville. Populations of both red and grey squirrels are high following several years of heavy crops of acorns, cones, and other food sources. Increased damage is expected

TRENDS IN FOREST CONDITION

To assess the general condition of maple stands, 2000 sugar maples were evaluated as part of the **North American Maple Project**. Their vigor remained similar to previous years, with 93% of the overstory sugar maples rated as healthy. Dieback also remained constant. Average transparency, the amount of sunlight coming through the leaves, increased to 17% in 2001 (Figure 30). Summer drought conditions may have contributed to poor foliage at some locations. In addition, defoliation activity was visible on one third of the sites, mostly from pear thrips or maple leaf cutter. Mortality decreased to 0.75% as the impact of the 1998 ice storm is tapering off.

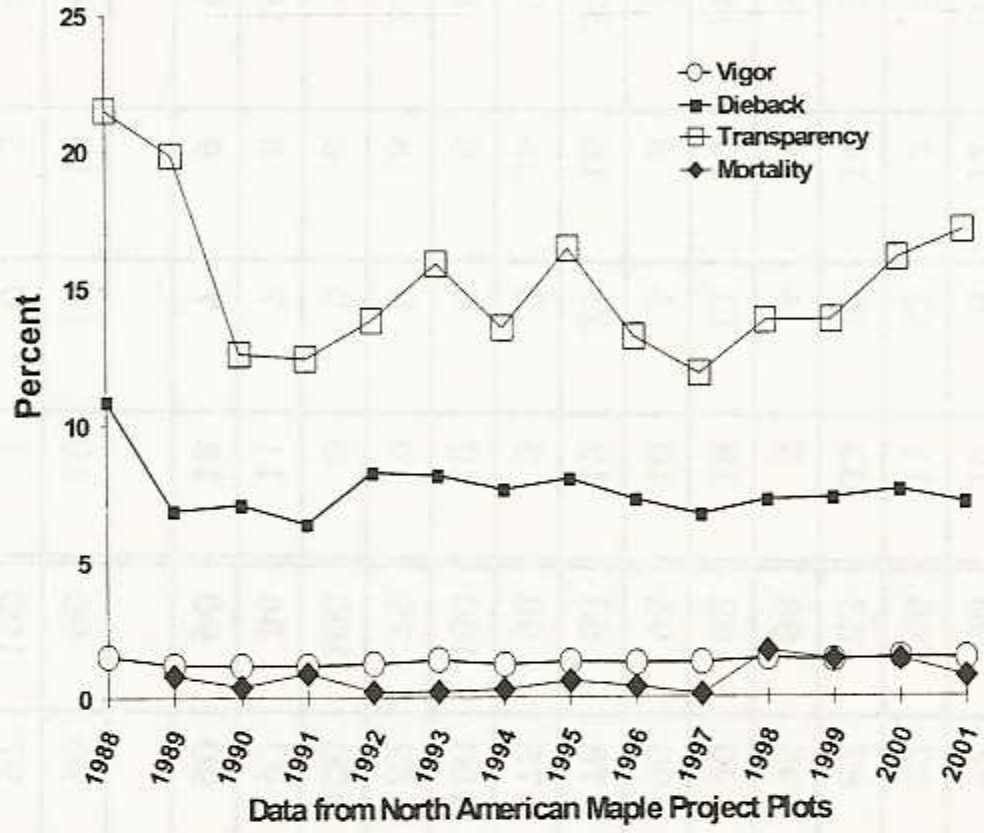


Figure 30. Trend in overstory sugar maple condition on North American Maple Project plots in Vermont, 1988-2001.

Ground data collection was completed for the fourth statewide **Hardwood Tree Health Survey**. Results are summarized in Table 19.

White Pine Condition was assessed on 21 plots statewide, as a Forest Health Monitoring evaluation project. Pine stands were chosen randomly from photos taken for the hardwood health survey. Young pine stands nearby were also evaluated.

The **Vermont Monitoring Cooperative** has a new web site http://vmc.snr.uvm.edu where data can be accessed or graphed on-line. There are "fast track" summaries written for general audiences, materials for teachers, and guidelines for high elevation management for bird conservation. The new ecosystem management demonstration project will be testing forest management techniques that promote old growth forest characteristics. The area to be treated in 2002 includes significant beech bark disease and other forest health concerns.

Vermont is a pilot state for the New England Governors/Eastern Canadian Premiers' **Forest Sensitivity Mapping Project,** which is assessing sustainable levels of acidic deposition to forest soils. Preliminary findings from the pilot study should be available this winter. Plans are underway to begin outreach to foresters and other interested groups in New England.

Five landowners continue to participate in the **Take-A-Plot** program.

Table 19. Percentage of live dominant/codominant trees healthy, with moderate dieback, or with severe dieback, by tree species in Vermont hardwood stands, 1986, 1991, 1996 and 2001.

Species	Trees per Acre				Crown Condition Class [1]											
					Healthy				Moderate Dieback				Severe Dieback			
	.....Number.....				- - - - - - - - - - - - - - - - Percent - - - - - - - - - - - - - - - -											
Hardwoods	**1986**	**1991**	**1996**	**2001**	**1986**	**1991**	**1996**	**2001**	**1986**	**1991**	**1996**	**2001**	**1986**	**1991**	**1996**	**2001**
Sugar Maple	29.4	27.3	27.0	27.3	81	93	88	92	15	6	11	8	4	1	1	0
Red Maple	29.2	26.5	21.1	20.8	79	91	87	90	19	6	12	10	2	2	1	0
Yellow Birch	16.3	11.6	10.8	20.5	73	87	92	96	11	13	7	4	12	0	1	0
American Beech	13.3	10.6	18.5	11.2	53	82	87	83	33	16	14	2	11	2	0	15
Paper Birch	7.5	9.3	9.3	8.2	94	96	95	88	5	4	4	8	2	0	1	4
Oak	6.0	5.4	5.3	4.1	81	88	90	82	18	12	10	18	1	0	0	0
White Ash	4.3	3.9	3.1	3.0	85	91	90	96	10	5	8	3	2	4	2	1
Black Cherry	2.9	2.9	2.5	1.8	84	79	78	63	12	21	16	37	5	0	6	0
Basswood	1.5	1.5	0.5	1.0	95	98	75	98	5	2	26	2	0	0	0	0
American Elm	0.6	0.2	0.2	0.2	76	100	100	100	10	0	0	0	8	0	0	0
Aspen	2.7	1.4	1.1	2.2	91	75	82	79	9	0	18	21	0	13	0	0
Hickory	1.0	1.3	0.6	1.7	100	100	100	100	0	0	0	.0	0	0	0	0
Other Hardwoods	12.7	9.8	7.6	10.1	87	91	92	86	11	7	8	10	2	2	0	4
All Hardwoods	**127**	**113**	**108**	**112**	**79**	**91**	**90**	**90**	**18**	**7**	**9**	**9**	**3**	**2**	**1**	**1**
Conifers																
Spruce	3.6	3.3	2.8	2.2	79	84	90	90	10	15	10	10	14	0	0	0
Balsam Fir	3.7	4.2	2.4	3.7	99	100	97	100	1	0	3	0	0	0	0	0
Pine	1.4	1.1	1.3	1.2	98	95	100	100	2	5	0	0	0	0	0	0
Hemlock	2.5	2	2.7	1.1	96	99	93	98	4	2	7	2	0	0	0	0
Other Conifers	0.3	0.3	0.3	0.3	97	100	100	100	2	0	0	0	0	0	0	0
All Conifers	**11.4**	**10.9**	**9.5**	**8.4**	**92**	**90**	**94**	**97**	**3**	**5**	**6**	**3**	**5**	**0**	**0**	**0**
All Species	**139**	**129**	**117**	**122**	**80**	**90**	**90**	**91**	**15**	**8**	**9**	**8**	**5**	**2**	**1**	**1**

[1]Healthy = 0-10% crown dieback; moderate dieback = 11-50% crown dieback; severe dieback = more than 50% crown dieback.

INVASIVE PLANTS

We continue to broaden our focus on Invasive Exotic Plants. A reporting system has been developed, and training for foresters and others working in the field is planned.

Observations suggest that Glossy Buckthorn is the most prevalent species in southeastern Vermont, and Honeysuckle (generally Tartarian and Morrow) is most well established in southwestern Vermont. Other species which are frequently invasive, and impact regeneration, in woodlands are Oriental Bittersweet, European Buckthorn, European Barberry, and Japanese Barberry. Woody species which have also been observed invading brush and forestland include Burning Bush, Norway Maple, Autumn Olive, Russian Olive, European Spindletree, and White Poplar.

The Invasive Exotic Plant Committee in Vermont has developed a list of invasive plant species for quarantine to become effective in spring 2002. Many are sold in the aquarium and water garden trade. Thirteen of the species do not yet occur in the state and 21 of the species occur in Vermont, some with widespread distribution, such as purple loosestrife, knotweed, and buckthorn.

The following criteria were developed to for inclusion of plants on the list:

- as determined by a pest risk assessment, the invasive plant targeted must pose an actual or anticipated threat to a substantial agricultural, forestry or environmental interest and/or the general public. However, the absence of complete biological knowledge of a pest will not necessarily prohibit the adoption of a quarantine.

- establishment of a quarantine for a specified invasive plant is likely to contribute to the objective of preventing introduction or for limiting spread and/or severity.

- no substitute or alternating mitigating action will accomplish the same pest prevention purpose.

- the economic and/or environmental benefits outweigh the economic and/or environmental costs associated with the quarantine.

The list includes 33 species, including goutweed, tree-of-heaven, garlic mustard, oriental bittersweet, Japanese knotweed, common buckthorn, glossy (European) buckthorn, Bell's honeysuckle, Japanese honeysuckle, Amur honeysuckle, Morrow's honeysuckle, Tartarian honeysuckle, black swallowwort and pale swallow wort.

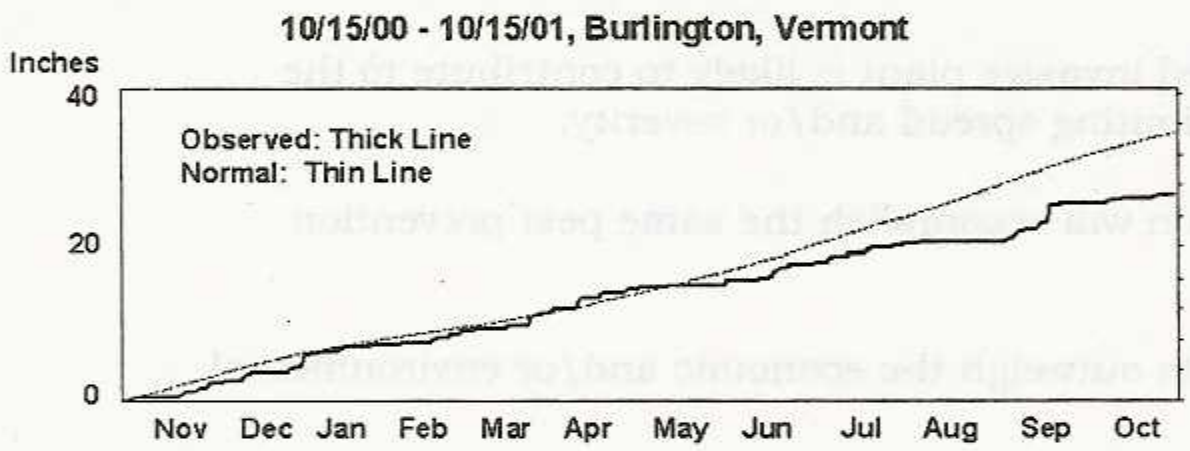
HEALTH OF SUGAR MAPLE IN VERMONT - 2001

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

This information on health of sugar maple is based on aerial surveys and field observations by the VT Dept of Forests, Parks, and Recreation, the University of Vermont and the U.S. Forest Service. Every year, the Department of Forests, Parks, and Recreation looks at tree health from the ground and from the air. In 2001, all 4.7 million acres of forestland were evaluated from an airplane at least once. In addition, survey crews assessed monitoring plots on the ground to rate tree condition.

Drought was a major influence on forest health in 2001. Precipitation was below normal beginning in late spring, and drought conditions increased throughout the growing season (Figure 1).

Figure 1: Cumulative Precipitation Departure from Normal



Data provided by the National Weather Service

During aerial surveys, off-color foliage, leaf scorch (Figure 2), premature leaf drop, and some bud mortality were observed on many ridgetops. Although symptoms were observed statewide, they were most severe in northern Vermont, where the driest conditions occurred. In addition to maples, beech, yellow birch, and oaks were most commonly affected. Some mortality was observed to understory trees.

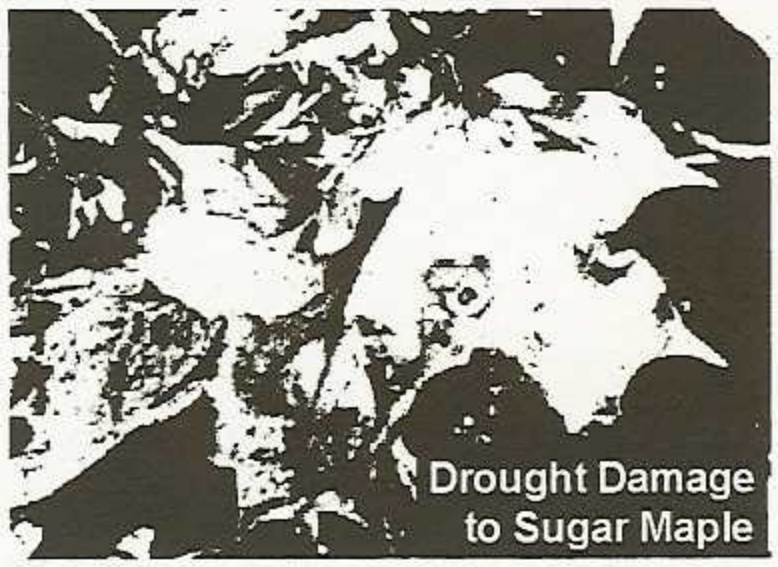
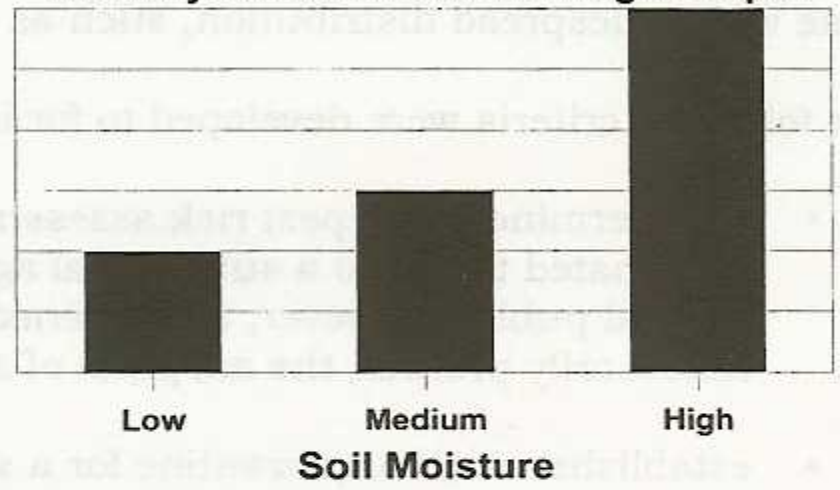


Figure 2

Drought impacts are expected to continue for several years. Many rootlets have died because of drought conditions. When soil moisture is low, trees photosynthesize less (Figure 3). With lower food reserves, leaf and shoot size in subsequent years is reduced. In addition, low carbohydrate levels make it harder for trees to survive severe winters.

Figure 3: Impact of Water Stress on Carbohydrate Reserves of Sugar Maple



Data from the US Forest Service

An outbreak of **Maple Leaf Cutter** continued. The small, red-headed moths were commonly seen laying eggs on foliage in the spring. Although damage was widespread, there was less than in 2000. Because browning occurred late in the season, no severe impact on tree health is expected.

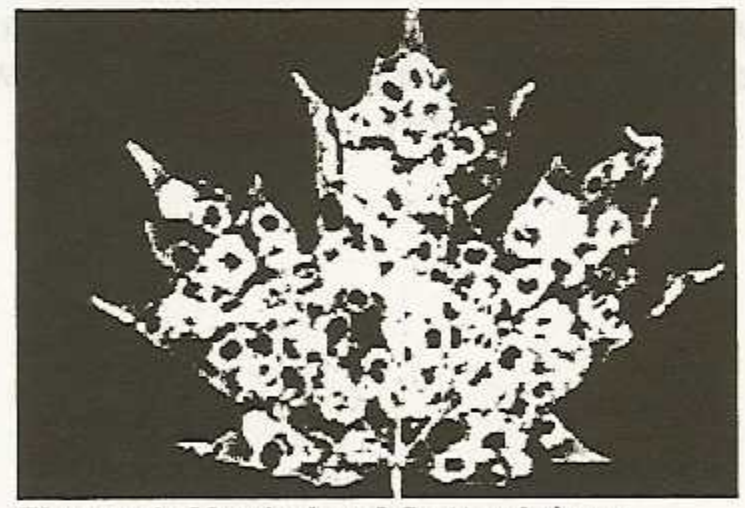


Figure 4: Maple Leaf Cutter Injury

Forest Tent Caterpillar and **Saddled Prominent** populations remain low.

Squirrel populations are very high, and an increase in damage is expected.

No new locations with **Asian Longhorned Beetle** were detected in 2001. Eradication efforts continue around New York City and Chicago, with over 6,000 trees removed so far. This insect has not been found in New England.

Overwintering **Pear Thrips** populations going into 2001 had increased from 2000, according to soil counts. By spring, however, statewide numbers were down, with 25 thrips per sticky trap in 2001, compared to 47 per trap in 2000. Spring weather conditions limited damage. Some moderate to heavy damage (Figure 5) did occur in north-central Vermont and scattered high elevation sites elsewhere. Most trees with damage refoliated by early summer.

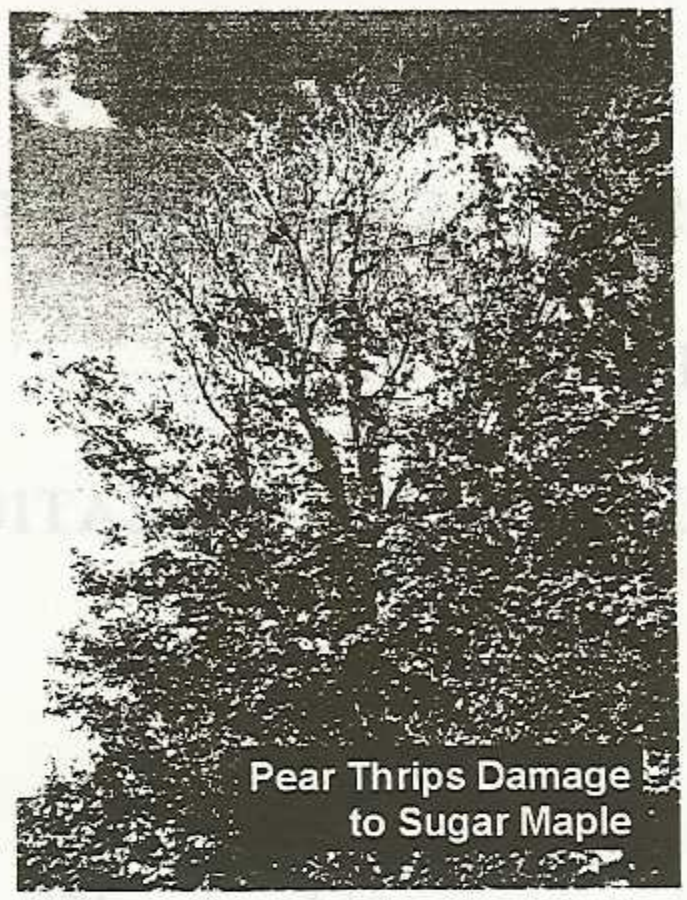
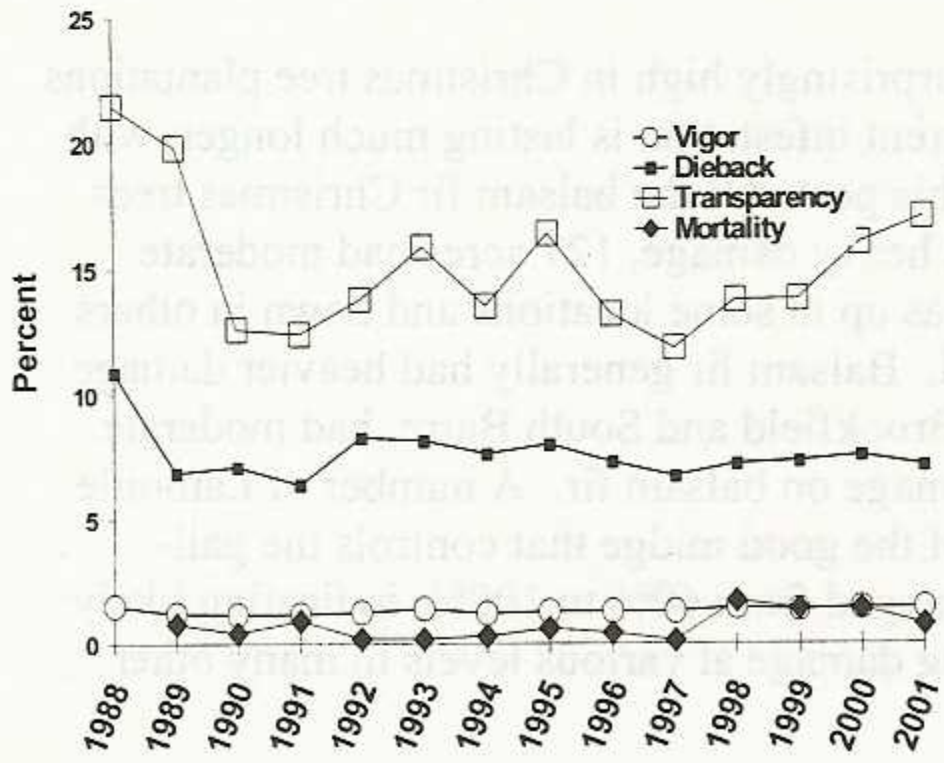


Figure 5

To assess the **General Condition** of maple stands, 2000 sugar maples were evaluated as part of the North American Maple Project. Their vigor remained similar to previous years, with 93% of the trees rated as healthy. Transparency, the amount of sunlight coming through the leaves, increased in 2001 (Figure 6). Summer drought conditions may have contributed to poor foliage at some locations. In addition, defoliation activity was visible on one third of the sites, mostly from pear thrips or maple leaf cutter. Mortality from the 1998 ice storm is tapering off.

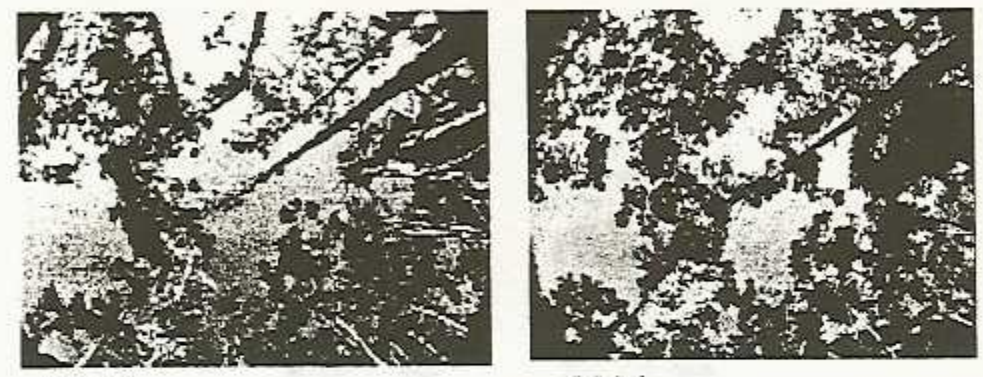
Figure 6:

Condition of Sugar Maples in Vermont's North American Maple Project Plots



Ice Damage Recovery was assessed by canopy photography in eight hardwood stands (Figure 7). Leaf cover increased, from 2000 to 2001, in the three most heavily damaged stands, but the increases were less than seen last year. Canopy cover did not increase in lightly damaged areas, probably due to the drought conditions. The only stand which improved more this year than last had been thinned soon after the damage occurred in 1988. It appears that thinning delayed recovery in comparison with undisturbed stands.

Figure 7: **Recovery from the 1998 Ice Storm**


1999 2001

Vermont is a pilot state for the New England Governors/Eastern Canadian Premiers' Forest Sensitivity Mapping Project, which is assessing sustainable levels of **Acidic Deposition** to forest soils. More information can be found on-line at http://www.cmp.ca/DataWoBorders.pdf.

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

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

COMMON PESTS OF CHRISTMAS TREES IN VERMONT 2001

REPORTED BY THE

DEPARTMENT OF FORESTS, PARKS AND RECREATION

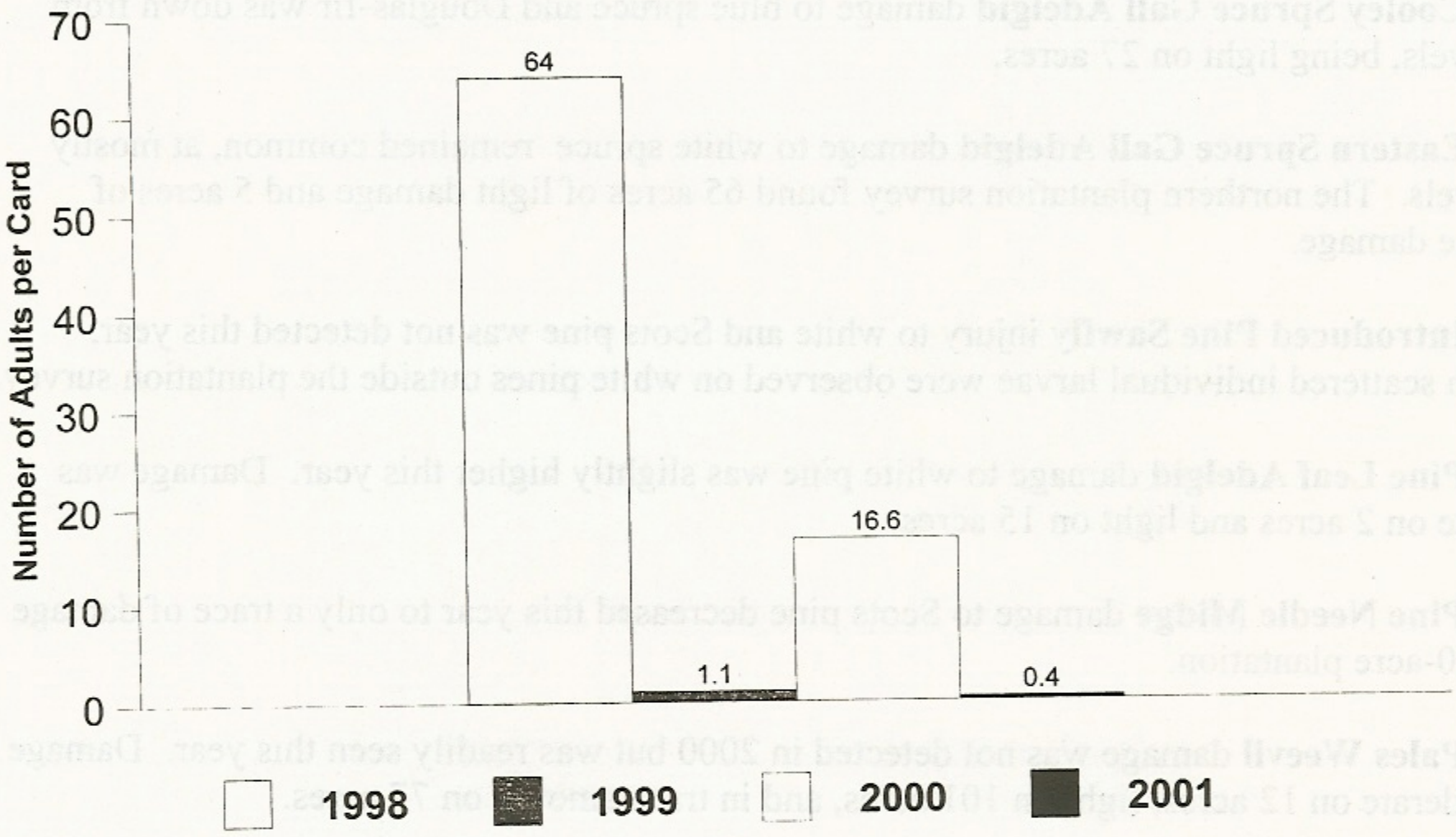
INTRODUCTION

Information in this report is based largely on a systematic annual survey of Christmas trees in northern Vermont as part of the Scleroderris quarantine. This year, twenty plantations comprising 272 acres were surveyed in northern Vermont compared to 138 acres in 2000. Observations by Forestry Division personnel throughout the state are also incorporated. Acreage trend information reported refers to changes in surveyed plantations in northern Vermont only.

INSECTS

Balsam Gall Midge populations remained surprisingly high in Christmas tree plantations and on wild balsam fir trees again this year. The current infestation is lasting much longer, with much heavier damage than previous infestations of this pest. Of the balsam fir Christmas trees visited in the northern Vermont survey, 31 acres had heavy damage, 127 acres had moderate damage and 119 acres had light damage. Damage was up in some locations and down in others but similar or somewhat heavier than in 2000 overall. Balsam fir generally had heavier damage than Fraser fir, but three plantations, in Starksboro, Brookfield and South Barre, had moderate damage on Fraser fir that approached the level of damage on balsam fir. A number of Lamoille County plantations were surveyed for the presence of the good midge that controls the gall-maker. Percent of galls containing the good midge ranged from 60% to 100%, indicating likely population crashes in some plantations but continuing damage at various levels in many other plantations in 2002.

Balsam Shootboring Sawfly, caused only trace to light amounts of damage in Christmas tree plantations this year, as expected. Damage was detected in five of the northern plantations that are annually surveyed, compared to ten plantations in 2000. Adults caught on 3x5 yellow sticky cards placed in mid-crowns of trees in Lamoille County averaged 0.4 per card compared to 16.6 in 2000, 1.1 in 1999 and 64 in 1998. Since damage is heaviest in even years, growers should expect this insect to be more noticeable in 2002. However, damage should not approach the heavy levels seen in 1998.



Number of Balsam Shootboring Sawfly Adults Caught on 3x5" Yellow Sticky Cards from 1998 to 2001.

Balsam Twig Aphid populations increased dramatically after seeing decreasing levels since 1996. Mostly moderate damage was recorded for Christmas tree plantations surveyed compared to light damage in 2000. As usual, balsam fir was more heavily damaged than Fraser fir. However, three plantations had moderate damage to Fraser as well as balsam fir. Sooty mold developed on heavily infested shoots.

Cinara Aphids were seen in very small numbers, in 5 northern plantations. None were seen in 2000.

Cooley Spruce Gall Adelgid damage to blue spruce and Douglas-fir was down from 2000 levels, being light on 27 acres.

Eastern Spruce Gall Adelgid damage to white spruce remained common, at mostly light levels. The northern plantation survey found 65 acres of light damage and 5 acres of moderate damage.

Introduced Pine Sawfly injury to white and Scots pine was not detected this year, although scattered individual larvae were observed on white pines outside the plantation survey.

Pine Leaf Adelgid damage to white pine was slightly higher this year. Damage was moderate on 2 acres and light on 15 acres.

Pine Needle Midge damage to Scots pine decreased this year to only a trace of damage in one 10-acre plantation.

Pales Weevil damage was not detected in 2000 but was readily seen this year. Damage was moderate on 12 acres, light on 101 acres, and in trace amount on 77 acres.

Pine Spittlebugs were readily seen this year, after not being detected in 2000. Population levels were moderate on 5 acres, light on 133 acres and in trace amounts on 25 acres.

Pine Thrips damage was seen in only trace amounts in one plantation.

Sawyer Beetle damage was detected in six plantations at trace to light levels.

Spruce Spider Mite populations remained low this year despite the hot, dry weather. Only trace amounts were recorded in two plantations during the northern Vermont survey. Some plantations had very large numbers of **Oribated** mites this year. These are tiny beetle-like mites that are scavengers known to feed on fungi. Populations began building during the wet summer of 2000, which probably increased the amount of food present for these non-harmful mites.

Spruce Bud Moth damage was rare this year. Only one individual was seen, on white spruce in a Brookfield plantation.

White Pine Weevil damage to pine and spruce trees remained common throughout the survey area but damage was lighter than in 2000. Only light damage was recorded for 110 acres in the northern Vermont survey, mostly on white pine. 40 acres of moderate damage had been observed in 2000.

DISEASES

Cyclaneusma Needlecast of Scots pine remains very common. Light infection was detected within 35 acres of Christmas trees, with trace amounts on 94 acres.

Delphinella Tip Blight increased from last year when light infection of balsam fir was observed for two plantations totaling 20 acres. This year, heavy damage was observed for two plantations (Wolcott and Montpelier) and light damage was observed for seven plantations. The disease also occurred on white fir in Brookfield.

Diplodia (Sphaeropsis) Tip Blight was again commonly detected in Christmas trees this year, but damage decreased from levels seen in 2000. Only 15 acres had light infection from this disease, while 89 acres had trace levels of infection. Some moderate damage was seen in 2000.

Fir-Fern Rust infection was up this year. It was detected at moderate levels on 10 acres of fir plantations, light levels on 142 acres and trace levels on 110 acres. Every fir plantation had some noticeable needle loss due to this disease.

Lophodermium Needlecast of Scots pine was observed in five plantations in northern Vermont but mostly at light levels.

Rhabdocline Needlecast of Douglas-fir was observed at moderate infection levels in a 15-acre plantation in Brookfield and at light levels in a 12-acre plantation in Bakersfield. Infection levels appear to be stable.

Rhizosphaera Needle Blight of Fir, caused by *Rhizosphaera pini*, decreased again this year. Light infection was reported for 47 acres of balsam fir, with trace amounts on 90 acres.

Rhizosphaera Needlecast of spruce remains common, with 134 acres of light damage reported. Most infection occurred on lower branches and was related to crowding of trees.

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

Sirococcus Shoot Blight of spruce was observed in eight plantations, at mostly very light levels.

Spruce Cushion Rust was reported for blue spruce in one plantation in Bakersfield.

Swiss Needlecast of Douglas-fir remained common at moderate levels in plantations in Brookfield, Starksboro and Bakersfield.

White Pine Blister Rust damage remains common throughout the survey area. Light infection was reported for 195 acres and moderate infection was reported for 32 acres in northern Vermont.

White Pine Needle Blight infection decreased this year. Only 3 plantations were reported to have this disease. Light infection was reported for 50 acres, with a trace of infection on 12 acres.

Woodgate Gall Rust damage to Scots pine increased, with moderate damage reported for 37 acres and light to trace levels for 135 acres. Only light damage was reported in 2000.

Yellow Witches Broom Rust of balsam fir remains common at light levels. This disease was detected in 6 plantations in northern Vermont, but only one had more than a trace level of infection (light on 15 acres).

Branch Breakage due to heavy snow was common this year. Moderate damage to white pine occurred on 10 acres in Williamstown. Elsewhere, light damage was reported on 85 acres and a trace level of damage on 157 acres. Young Fraser firs in Norton lost about 20 inches worth of mid-crown branches when the thick icy snow crust settled in the spring. Nearby balsam firs were unaffected.

Drought Conditions led to many planting failures as well as visible foliar injury on some mature spruce and fir trees in northern Vermont.

Frost Damage was higher than last year, with some damage in all plantations on all species. Moderate damage was recorded for 50 acres, light damage for 160 acres, and a trace level of damage for 47 acres.

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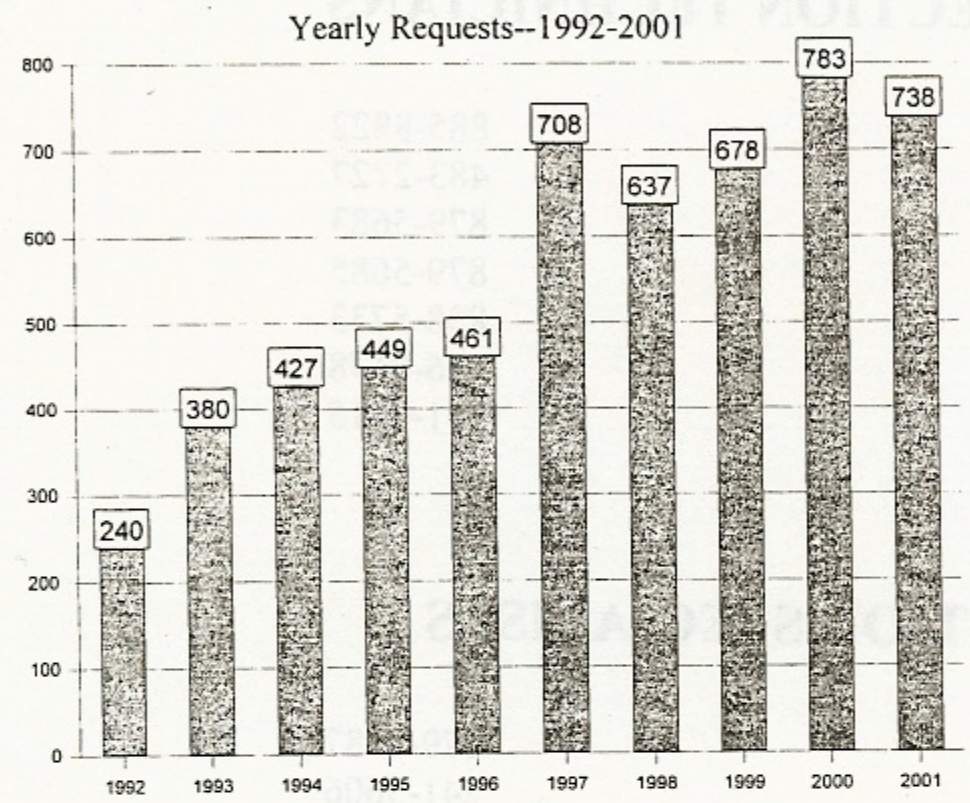
ACKNOWLEDGMENTS

We thank Matt Lewis, Forestry Technician, for his observations and reports on with much of this summary is based.

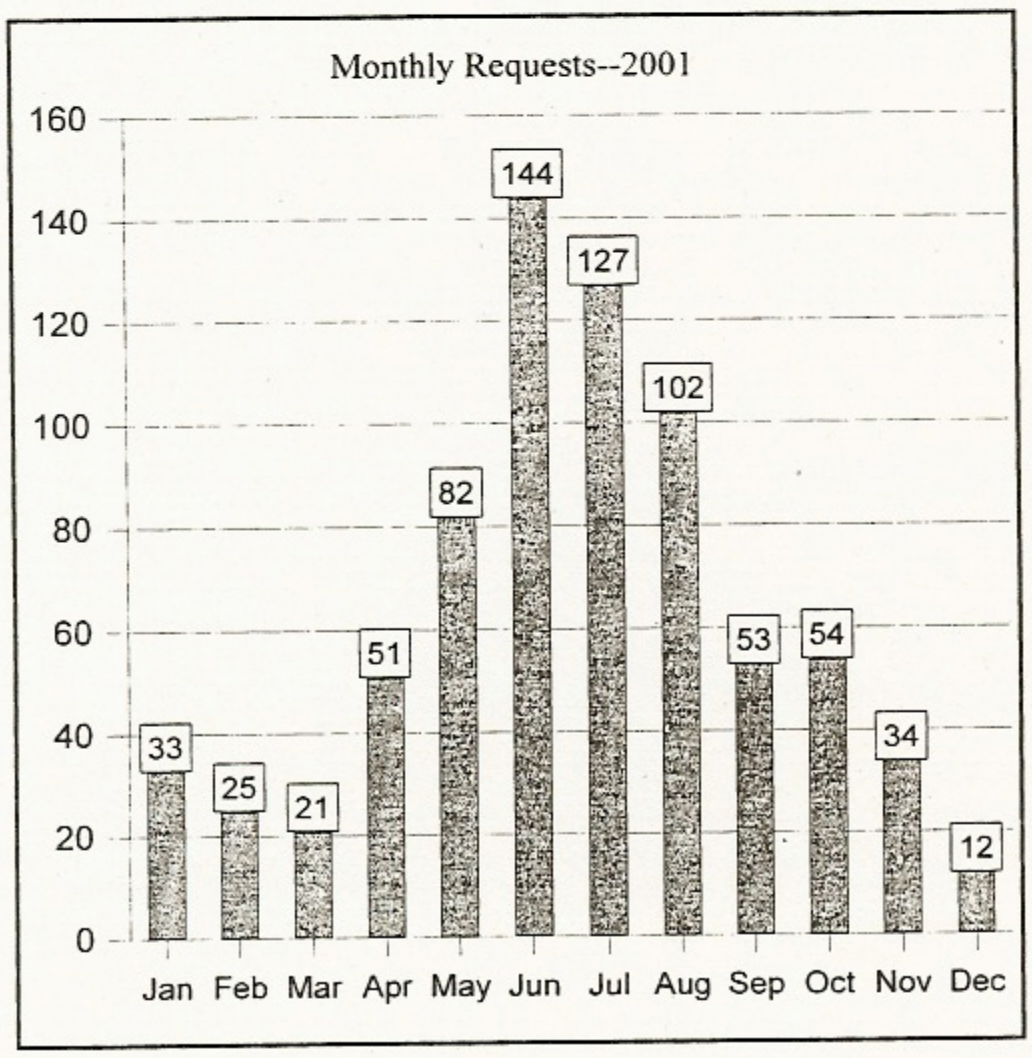
FOREST BIOLOGY LABORATORY -2001

Laboratory Service Statistics

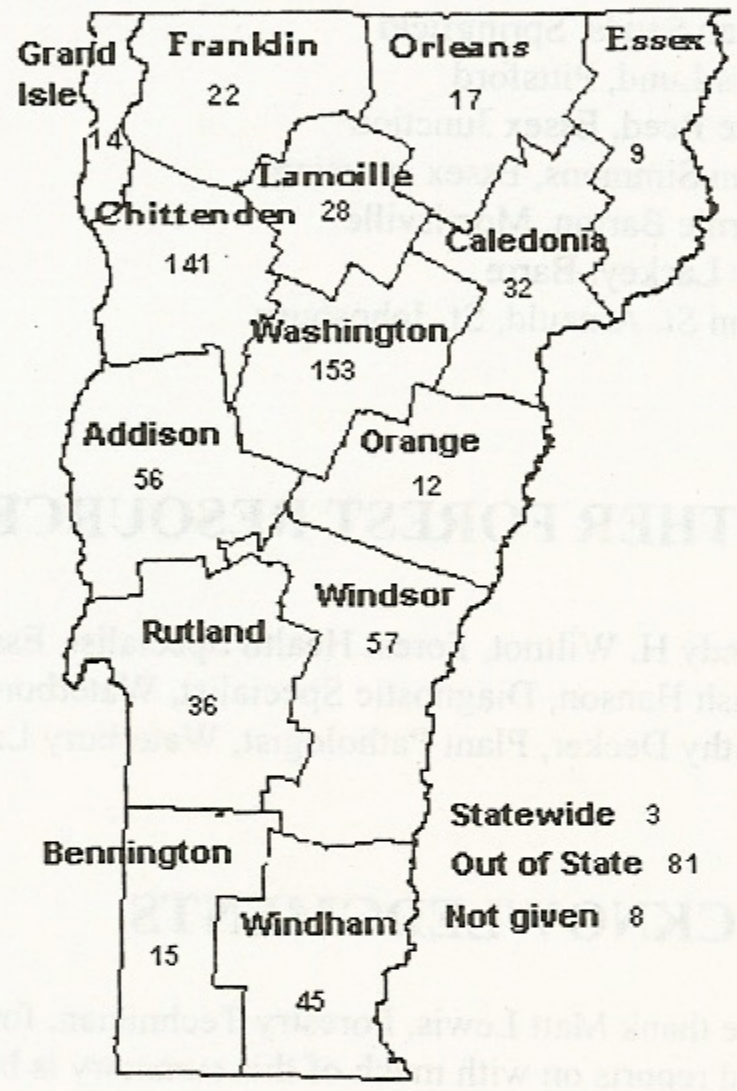
In 2001, we received 738 requests for identifications, advice and information.



Numbers of inquiries peaked in June (144), with July a close second (127). Many early-fall inquiries were related to drought effects on trees. (See weather section of Conditions Report.)



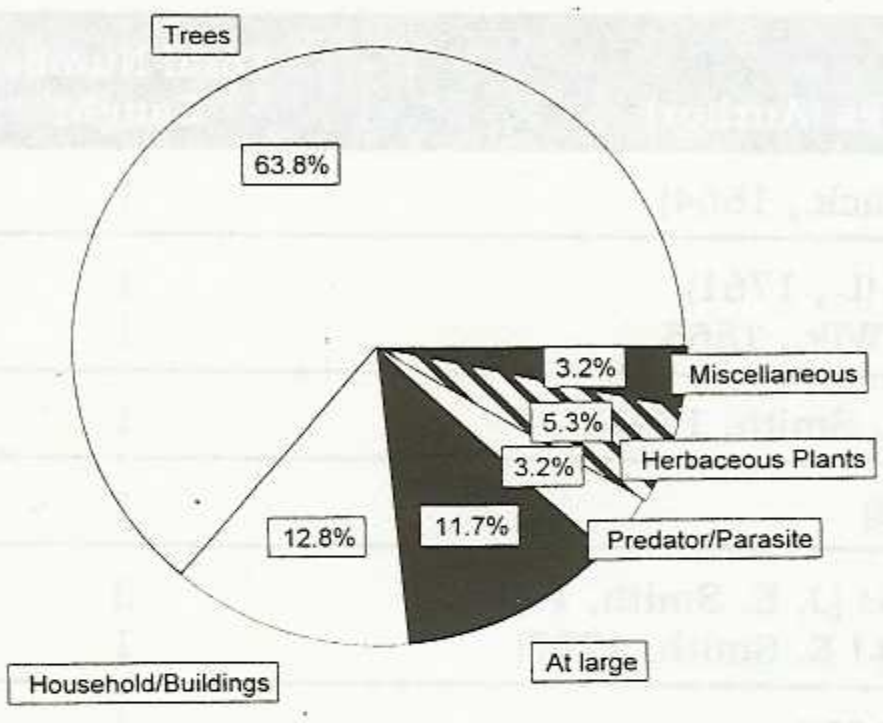
We received inquiries from all counties in Vermont (see map). The highest number of requests came from people in Washington County (153), while the lowest number came from Essex County (9). Eleven per cent (81) requests came from states other than Vermont.



Types of requests fell into four main categories: identification of specimens (50%), information about biology, management and other aspects of insects and diseases (36%), photographic images, supplies, and specimens (11%), and presentations and exhibits (3%).

Where were specimens found? About 60% of the samples sent to the Forest Biology Lab came from trees (see figure below). Insects found in buildings and collected "at large" (ie., not associated with a host at the time of collection) made up 12.8 and 11.7 percent, respectively. Insects and diseases of herbaceous plants contributed 5.3% to the total, and predators and parasites made up 3.2%. The

remainder of specimens came from a variety of sites and situations, including soil, snow, and water samples.



Tick Surveillance

For the past three years, the Forest Biology Lab has collaborated with the Department of Fish and Wildlife in baseline studies to help ascertain the abundance and distribution of tick populations in our state. At 18 Vermont deer check stations, the first 30 deer reported during opening weekend of rifle season were examined by F&W staff for the presence of ticks and other ectoparasites. Specimens were sent to the Forest Biology Lab for identification and preservation. Data are summarized in the table below.

	2000	2001
Total number of deer examined	412	510
Total number of ticks collected	102	149
Number of deer ticks	80	84
Number of moose ticks	22	65
Number of each sex for deer ticks	31 females, 49 males	42 females, 42 males
Life stages of deer ticks	All adults	All adults
Condition of deer ticks	20 of the 31 females were engorged	29 of the 42 females were engorged
Life stages of moose ticks	13 larvae, 9 nymphs	36 larvae, 29 nymphs
Highest numbers of ticks per deer	11 on deer from Bennington and Springfield	19 on a deer from Arlington
Number of deer with both deer ticks and moose ticks	None	None
Mean percent of deer checked that had ticks of any species	11% (45 of the 412 deer checked)	11% (56 of the 510 deer checked)
Mean percent of deer checked that had deer ticks	8% (33 of the 412 deer checked)	6% (31 of the 510 deer checked)

Beginning in the spring of 2002, the Departments of Health, Agriculture, and Forests, Parks and Recreation will be working together to increase our understanding of the prevalence and distribution of tick vector species in Vermont. Tick specimens collected by veterinarians in all Vermont counties will be submitted as part of this study. Ticks will be identified by personnel at the Forest Biology Lab and at the Department of Agriculture. Historical tick data from sources such as the Department of Health Laboratory, the University of Vermont and others, will be included in this database.

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

Lepidoptera Species Caught in Light Traps 1997, Monkton, Vermont

Lepidoptera species caught in light traps at Dick Murphy residence in Monkton, VT. Collections made on a periodic basis between June 6 and December 2, 1997, were frozen when collected and examined in 2001.

Date	Family	Species (Author)	Total Number Caught
6/7/97	Drepanidae	*Drepana bilineata* (Pack., 1864)	1
	Noctuidae	*Ochrophleura plecta* (L., 1761)	1
		Psaphida resumens Wlk., 1865	1
	Notodontidae	*Nadata gibbosa* (J.E. Smith, 1797)	1
	Saturniidae	*Actias luna* (L., 1758)	1
7/3/97	Arctiidae	*Halysidota tessellaris* (J. E. Smith, 1797)	3
		Pyrrharctia isabella (J.E. Smith, 1797)	1
	Noctuidae	*Polia nimbosa* Gn., 1852	1
	Notodontidae	*Nadata gibbosa* (J.E. Smith, 1797)	1
	Sphingidae	*Paonias excaecatus* (J. E. Smith, 1797)	1
		Smerinthus cerisyi Kby., 1837	1
7/11/97	Arctiidae	*Halysidota tessellaris* (J.E. Smith, 1797)	3
		Pyrrharctia isabella (J.E. Smith, 1797)	1
	Geometridae	*Euphyia unangulata intermediata* (Gn., 1857)	1
		Itame subcessaria (Wlk., 1861)	1
		Scopula inductata (Gn., 1857)	1
		Semiothisa signaria (Hbn., 1800-09)	1
		Xanthotye sospeta (Drury, 1773)	2
	Lasiocampidae	*Malacosoma disstria* Hbn., 1820	4
	Noctuidae	*Abagrotis alternata* (Grt., 1864)	1
		Agrotis ipsilon (Hufn., 1766)	1
	Notodontidae	*Nadata gibbosa* (J.E. Smith, 1797)	3
		Peridea basitriens (Wlk., 1855)	3
	Pyralidae	*Agriphila vulgivagella* (Clem., 1860)	1
7/21/97	Drepanidae	*Drepana arcuata* Wlk., 1855	3
	Geometridae	*Eusarca confisaria* Hbn., 1813	1
		Itame pustularia (Gn., 1857)	2
		Scopula limboundata (Haw., 1809)	1
	Lasiocampidae	*Malacosoma disstria* Hbn., 1820	1
	Noctuidae	*Amphipoea americana* (Speyer, 1875)	1
		Apamea amputatrix (Fitch, 1857)	1
		Lacinipolia renigera (Steph., 1829)	1
		Leucania pseudargyria Gn., 1852	1

Date	Family	Species (Author)	Total Number Caught
	Notodontidae	*Gluphisia septentrionis* Wlk, 1855	1
	Pyralidae	*Crambus agitatellus* Clem., 1860	2
		Crambus girardellus Clem., 1860	1
		Urola nivalis (Drury, 1773)	1
	Tortricidae	*Sparganothis pettitana* (Rob., 1869)	1
8/4/97	Arctiidae	*Halysidota tessellaris* (J.E. Smith, 1799)	3
		Hypoprepia fucosa Hbn., 1827-1831	72
		Phragmatobia fuliginosa (L., 1758)	2
	Drepanidae	*Drepana arcuata* Wlk., 1855	5
	Geometridae	*Epirrhoe alternata* (MŸller, 1764)	1
		Itame pustularia (Gn., 1857)	1
		Pero honestaria (Wlk, 1860)	1
	Lasiocampidae	*Malacosoma disstria* Hbn., 1820	1
	Noctuidae	*Agrotis volubilis* Harv., 1874	2
		Amphipoea americana (Speyer, 1875)	3
		Archanara oblonga (Grt., 1882)	3
		Feltia jaculifera (Gn., 1852)	1
		Lacinipolia renigera (Steph., 1829)	3
		Noctua pronuba (L.)	2
		Ochrophleura plecta (L., 1761)	6
		Xestia smithii (Snell., 1896)	1
	Notodontidae	*Nadata gibbosa* (J.E. Smith, 1797)	1
8/25/97	Arctiidae	*Hypoprepia fucosa* Hbn., 1827-1831	8
	Drepanidae	*Drepana arcuata* Wlk, 1855	2
	Geometridae	*Euphyia unangulata intermediata* (Gn., 1857)	2
		Pero honestaria (Wlk., 1860)	1
		Plagodis alcoolaria (Gn., 1857)	1
		Xanthorhoe lacustrata (Gn., 1857)	1
	Lymantriidae	*Lymantria (=Porthetria) dispar* (L., 1758)	1
	Noctuidae	*Amphipoea americana* (Speyer, 1875)	1
		Anathix ralla (G. & R., 1868)	1
		Euplexia benesimilis McD., 1922	3
		Euxoa detersa (Wlk., 1856)	1
		Feltia herilis (Grt., 1873)	2
		Lacinipolia renigera (Steph., 1829)	7
		Noctua pronuba (L.)	1
		Rivula propinqualis Gn. 1854	3
		Xestia bicarnea (Gn. 1852)	5
		Xestia normaniana (Grt., 1874)	2
	Tortricidae	*Pandemis lamprosana* (Rob., 1869)	1
9/3/97	Geometridae	*Campaea perlata* (Gn., 1857)	1
	Lasiocampidae	*Tolype velleda* Stoll., 1791	1

Date	Family	Species (Author)	Total Number Caught
	Noctuidae	*Amphipoea americana* (Speyer, 1875)	1
		Amphipyra pyramidoides Gn., 1852	4
		Metaxaglaea inulta Grt., 1874	1
		Nephelodes minians Gn., 1852	4
		Noctua pronuba (L.)	3
9/8/97	Geometridae	*Campaea perlata* (Gn., 1857)	3
		Cyclophora pendulinaria (Gn., 1857)	1
	Noctuidae	*Amphipoea americana* (Speyer, 1875)	1
		Amphipyra pyramidoides Gn., 1852	2
		Catocala subnata Grt., 1864	1
		Nephelodes minians Gn., 1852	9
		Ochropleura plecta (L., 1761)	6
		Pseudaletia unipuncta Haw., 1809	1
9/17/97	Geometridae	*Prochoerodes transversata* (Drury, 1770)	1
	Noctuidae	*Zanclognatha ochreipennis* (Grt., 1872)	2
10/5/97	Geometridae	*Lambdina fiscellaria* (Gn., 1857)	14
	Lasiocampidae	*Tolype laricis* (Fitch, 1856)	1
	Noctuidae	*Acronicta americana* (Harr., 1841)	2
		Amphipyra pyramidoides Gn., 1852	2
		Sunira bicolorago (Gn., 1852)	1
10/13/97	Geometridae	*Epirrita autumnata* (Bkh., 1794)	1
	Noctuidae	*Sunira bicolorago* (Gn., 1852)	3
10/20/97	Noctuidae	*Amphipyra pyramidoides* Gn., 1852	4
		Pseudaletia unipuncta Haw., 1809	1
11/1/97	Geometridae	*Operophthera bruceata* (Hulst, 1886)	1
		Thera juniperata (L., 1758)	1
11/11/97	Geometridae	*Operophthera bruceata* (Hulst, 1886)	1
12/2/97	Pyralidae	*Herpetogramma theseusalis* (Wlk., 1859)	5

Evaluating Crown Canopy Changes In Vermont Ice-Damaged Forests by Image Analysis

2001 Progress Report

Methods

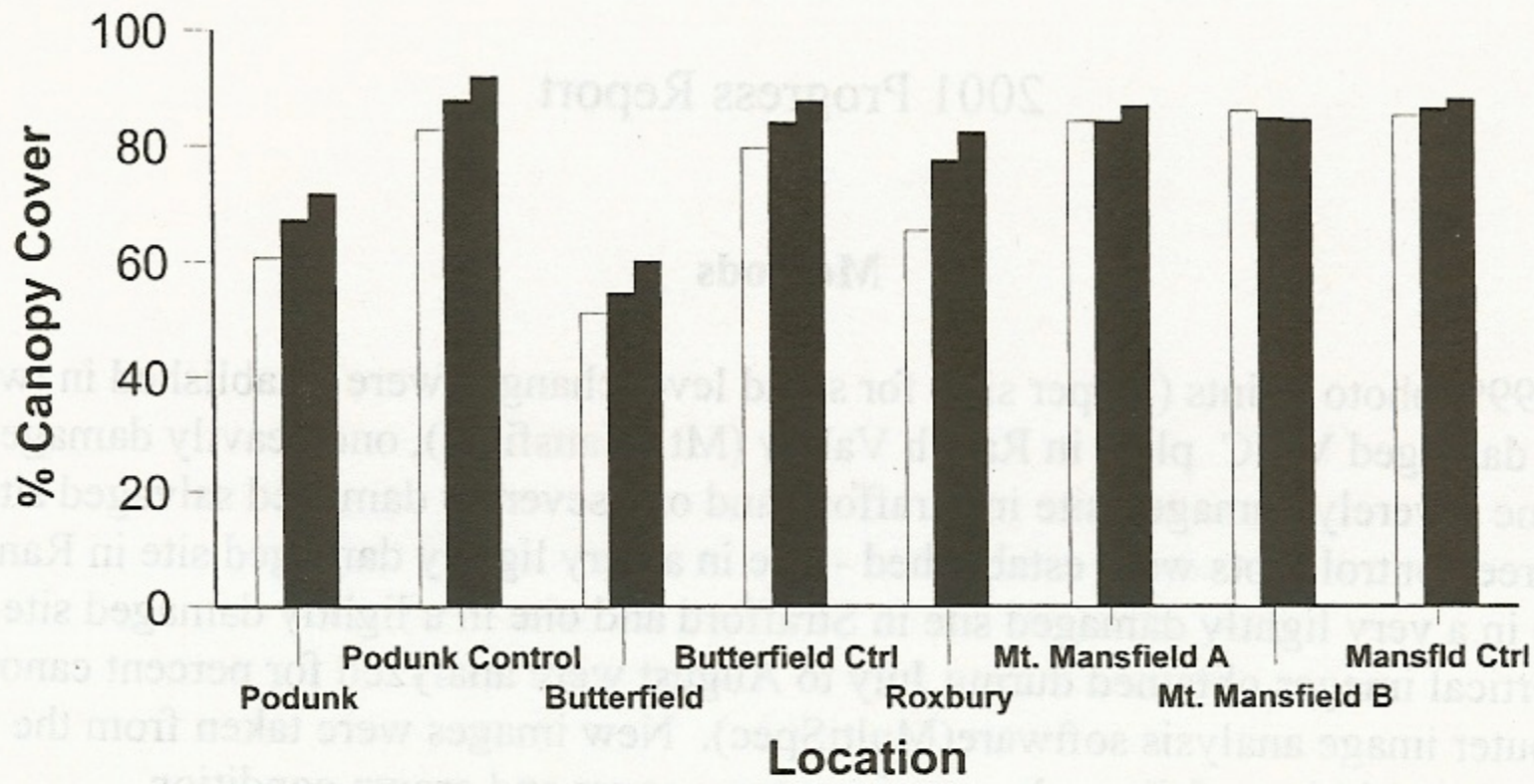
In 1999, photo points (20 per site) for stand level changes were established in two light to moderately damaged VMC plots in Ranch Valley (Mt. Mansfield), one heavily damaged site in Roxbury, one severely damaged site in Strafford and one severely damaged salvaged site in Orange. Three control plots were established - one in a very lightly damaged site in Ranch Valley, one in a very lightly damaged site in Strafford and one in a lightly damaged site in Orange. Vertical images obtained during July to August were analyzed for percent canopy cover using computer image analysis software(MultiSpec). New images were taken from the same points in 2000 and 2001 to follow changes in canopy cover and crown condition.

An additional 72 photo points were established for oblique photography of individual dominant or codominant tree crowns in various crown loss categories. Most of the trees selected had lost 70 to 80 percent of their original crown due to the 1998 ice storm. Trees selected included 44 sugar maple, 6 white ash, 15 yellow birch, 3 beech, 2 paper birch and 2 black cherry. These were photographed again in 2000 and 2001 to follow crown recovery or demise.

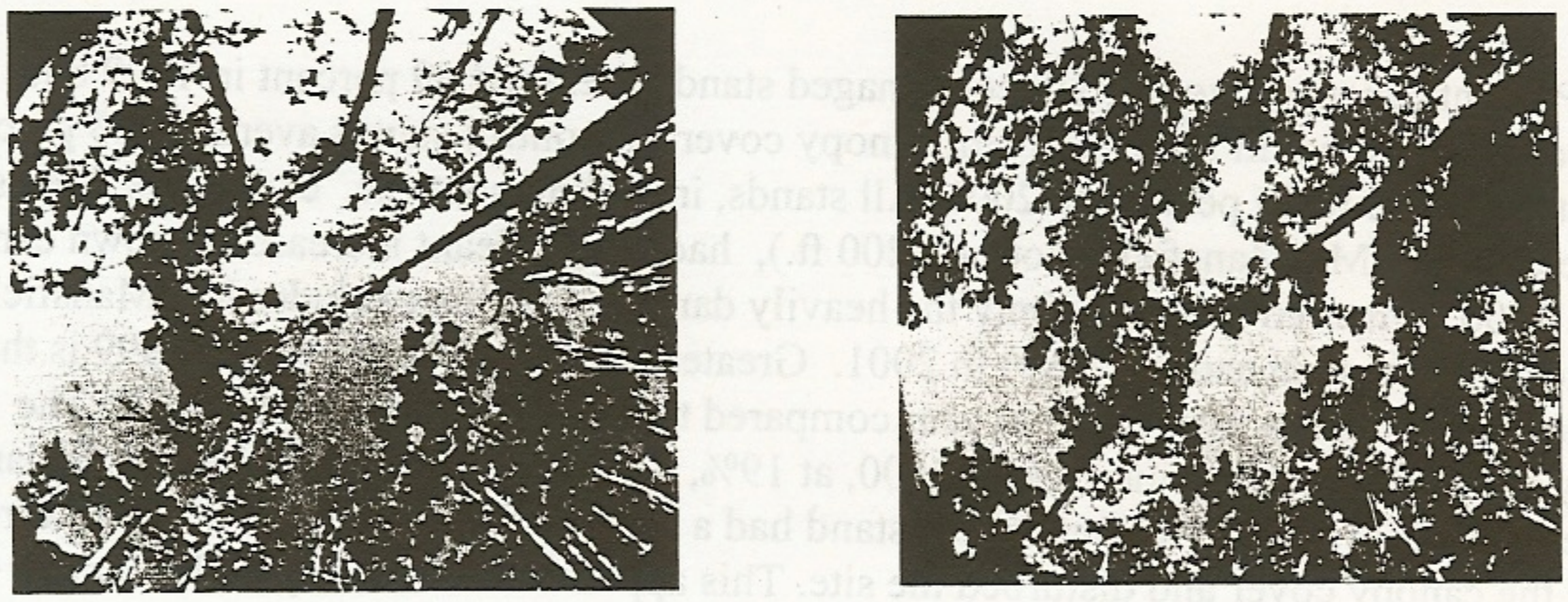
Results

Percent canopy cover for all ice-damaged stands averaged 69 percent in 1999 but increased to 77 percent in 2001. Percent canopy cover for control stands averaged 83 percent in 1999 but increased to 89 percent in 2001. All stands, including controls, except the three stands at high elevations(Mt. Mansfield plots at 2200 ft.), had a significant increase in crown canopy cover in 2000 compared to 1999. Only the heavily damaged stands(excludes Mt. Mansfield) had a significant increase in canopy cover in 2001. Greater canopy cover growth in 1999 is thought to be due to abundant moisture in that year compared to drought conditions in 2001. The Roxbury site had the largest increase in 2000, at 19%, while the Butterfield site had the largest increase in 2001, at 10%. The Butterfield stand had a salvage thinning in 1998, which further reduced the canopy cover and disturbed the site. This appears to have delayed the canopy growth response by one year in comparison to similar undisturbed stands.

Crowns of individual trees used for oblique photography improved in foliage color during the first two years and in crown density over the three years. Some showed dramatic improvement, with increases in crown density up to 80% between 1999 and 2000. Three of the trees died in 2000: 1 yellow birch with 95% crown loss, 1 sugar maple with 90% crown loss and 1 paper birch with 30% crown loss. One yellow birch with 70% crown loss died in 2001. In 2001, the only sugar maples whose crowns appeared to be declining were two wounded trees in the Butterfield stand that initially had 70-80% crown loss. Each of these trees had a severe basal logging wound as a result of the salvage thinning.



Percent canopy cover in 2001 compared to 2000 and 1999.



1999 **2001**

Crown canopy images from one point at Podunk(Strafford), illustrating the kind of improvement seen in some of the more heavily damaged sites.

R. S. Kelley 01/31/02

Insects Collected at the Silvio O. Conte National Wildlife Refuge

Essex County, Vermont
Town of Lewis
June 13, 2000

On June 13, 2000, the Vermont Department of Forests, Parks and Recreation met with members of the Vermont and Maine Entomological Societies for an opportunity to observe and collect insects and other arthropods in a couple of sites in the Nulhegan Basin of the Silvio O. Conte National Wildlife Refuge in the former Champion Lands of the Northeast Kingdom of Vermont. Though identifications of a number of specimens (including spiders and their kin) are pending, the majority of insects collected during this field trip have now been prepared and identified. Many thanks to Ross and Joyce Bell (UVM), Dick Dearborn, Kimberly Foss and Chris Werle (Maine Forest Service), and Bob Nelson (Colby College) for their contributions to this project. The list is presented here.

COLEOPTERA

CARABIDAE
- *Omophron americanum* Dejean
- *Nebria pallipes* Say
- *Elaphrus californicus* Mannerheim
- *Bembidion nigrum* Say
- " " *versicolor* LeConte
- " " *quadrimaculatum oppositum* Say
- " " *semicinctum* Notman
- *Poecilus lucublandus* Say
- *Harpalus sp.*
- *Pterostichus adstrictus* (Eschscholtz)
- " " *pennsylvanicus* LeConte
- " " *stygicus* (Say)
- " " *coracinus* Newman
- " " *mutus* (Say)
- *Agonum cupripenne* (Say)
- " " *fidele* Casey
- *Amara laevipennis* Kirby
- *Anisodactylus nigerrimus* Dejean
- *Chlaenius sericeus* Forster
- *Harpalus* sp. Latreille
- *Lebia fuscata* (Dejean)
- " " *tricolor* Say

CICINDELIDAE
- *Cicindela purpurea purpurea* Olivier
- " " *sexguttata* Fabricius
- " " *tranquebarica* Herbst
- " " *limbalis* Klug
- " " *longilabris* Say
- " " *repanda* Dejean

HYDROPHILIDAE
- *Cymbidyota vindicata* Fall

STAPHYLINIDAE
- *Heterothops fusculus* LeConte
- *Creophilus maxillosus* (Gravenhorst)

SILPHIDAE
- *Oiceoptoma noveboracensis* (Forster)

SCARABAEIDAE
- Melolonthinae 2 spp.
- *Serica sericea* (Illiger)

ELATERIDAE
- *Ascoliocerus sanborni* (Horn)
- *Hypnoidus abbreviatus* (Say)
- *Dalopius sp.* Eschscholtz
- *Agriotes limosus* (LeConte)
- " " *fucosus* (LeConte)

LAMPYRIDAE
- *Ellychnia corrusca* (L.)

CANTHARIDAE
- *Cantharis mandibularis* Kirby.

DERMESTIDAE
- *Dermestes cadaverinus*

ENDOMYCHIDAE
- *Mycetina perpulchra* (Newman)

CLERIDAE
- *Necrobia rufipes* (DeGeer)
- " " *violacea* (L.)

COCCINELIDAE
- *Coccinella trifasciata perplexa* Mulsant
- *Anatis mali* (Say)

TENEBRIONIDAE
- *Arthromacra aenea* Say

COLEOPTERA (cont.)

LAGRIIDAE
- *Arthromacra aenea* Say

OEDOMERIDAE
- *Ditylus caeuleus* (Randall)

CHRYSOMELIDAE
- *Plateaumaris sp.* Thompson
- *Donacia sp.* Fabricius
- *Ophraella cribrata* LeConte
- " " *americana* (Fab.)

Calligrapha spp. (2) Chevrolat
Neochlamisus bebbiana (Brown)
Microrhopala excavata (Olivier)
Disonycha alternata (Illiger)
Gonioctena americana (Schaeffer)
Altica sp. Muller

CURCULIONIDAE
Homorus undulatus (Uhl.)
Attelabus rhois (Boh.)
Phyllobius oblongus L.
Elleschus ephippiatus Say

HOMOPTERA

CICADELLIDAE
Oncometopia lateralis (Fab.)

HETEROPTERA

PENTATOMIDAE
Euschistus tristigmus luridus Dal.

RHOPALIDAE
Stictopleurus crassicornis Dell

MEMBRACIDAE
Publilia concava Say

LEPIDOPTERA

HESPERIIDAE
Erynnis icelus (Scudder and Burgess)

LYCAENIDAE
Celastrina agriolus (L.)

PYRALIDAE
Anageshna primordialis Munroe
Anania funebris glomeralis (Strom)

GEOMETRIDAE
Ematurga amitaria (Gn.)
Lomographa vestaliata (Gn.)
Petrophora subaequaria (Wlk.)
Tetracis cachexiata Gn.

HYMENOPTERA

FORMICIDAE
Tetramorium caespitum (L.)
Formica exsectoides Forel
Camponotus sp. Mayr

TENTHREDINIDAE
One sp.

ANDRENIDAE
Andrena sp. Fabricius

HALICTIDAE
Dialictus sp. Robertson

DIPTERA

EMPIDIDAE
Empis sp. L.

Notes from the 19th Annual Forest Pest Workshop
January 7, 2002—Aiken Center, University of Vermont

Introduction by **Brent Teillon** who summarized the past year as an interesting forest health year in Vermont because of the severe drought.

Ron Kelley reported pear thrips damage in Lamoille County this past spring was fairly heavy and soil counts of thrips are up again for next year. There were 1000's of maple leaf cutter moths this spring, but damage was not considered heavy. Dutch elm disease flagging showed up earlier in the summer than usual along with yellowing from beech bark disease. However, the drought was by far the biggest event of the summer, especially for trees on shallow rocky soils. Leaf scorch was rampant along roadsides, and trees were yellow in early August and dropping foliage by mid-August. On many beech, birch, and maple trees, there were no live buds for next year. Whole hillsides were browned up. Ron reminded us that this stress can lead to greater susceptibility to secondary organisms, reduced growth, dieback, and mortality.

Trish Hanson reported on events associated with the Forest Biology Lab in Waterbury. The VT and Maine Entomological Societies met for a field inventory of non-pest insects and Trish gave us a run-down of the interesting insects found. She also told us how an author of children's books and an artist were inspired by their visits to the Lab.

Scott Costa of UVM's Entomology Lab reported on their work with hemlock wooly adelgid (HWA). There have been spot infestations in ME and NH but so far not in VT. He is working with insect-killing fungi and hoping to come up with a biological control. They have collected fungi from China that they are testing against HWA in the lab and are getting promising spore production. Once they get some good strains, they will do field tests. They are also looking at the non-target effects on insects used in bio-control of HWA.

Don Tobi of UVM's Entomology Lab reported on their Asian long-horned beetle (ALB) and HWA public awareness/education projects in coordination with APHIS, US Fish & Wildlife, and the states of NH, VT, ME, and MA. Their latest gimmicks are beetle boxes that contain everything someone needs to give a presentation to the public on ALB. Don gave us the address for the ALB website: www.uvm.edu/albeetle. He is continuing to look at Carabidae (ground beetles) and Collembola (snow fleas) as indicator species in ice damaged stands. He is expanding this project to look at biodiversity on differently managed forest stands, in particular in the Stevensville Brook area with natural resources professor **Bill Keeton**. A similar project will look at different types of sugar bush management relative to insect biodiversity.

The UVM Forest Pathology Lab continues to work with butternut canker. **Shari Halik** showed the results of a greenhouse study in which the butternut curculio successfully vectored spores of the butternut canker fungus to its own feeding/oviposition wounds. Graduate student **Jane Stewart** updated us on her thesis work looking at the longevity and survival of the spores on the exoskeletons of 3 beetle species. In a lab study, the beetles carried viable spores up to 16 days. Grad student **Tim Schmalz** filled us in on the biology and symptoms of butternut canker and updated us on his thesis work on the spatial analysis of the occurrence of the canker and its site relationships. Of the 824 trees he has looked at thus far, more than 85% are infected and there has been an increase in mortality of butternut since the survey in the mid-1990s on the same sites in VT.

Florence Peterson, forest health specialist with the Forest Service in Durham, filled us in on the reorganization of the Durham office and several new staff positions. She mentioned their work on invasive plants and urban forestry issues, among others. She also gave us their new web address: www.fs.fed.us/na/durham.

Sandy Wilmot reintroduced the Vermont Monitoring Co-op for those unfamiliar with it. She explained that they have 2 research monitoring sites, one on Mt. Mansfield and one on the Lye Brook Wilderness Area in Manchester, VT. There are 60 Co-op scientists on 140 projects that involve the Agency of Natural Resources,

UVM, and the Green Mountain National Forest. The Co-op's most important task is data management and making data accessible to the public. The Co-op has a new web site (//vmc.snr.uvm.edu) which contains project summaries, current issues, management guidelines, and material for educators. Sandy highlighted some of the current projects: outreach on mercury in forest ecosystems; re-initiation of the ecosystem management demo project looking at silvicultural treatments with Don Tobi and Bill Keeton; completion of the second Vermont Atlas of Reptiles and Amphibians by **Jim Andrews** of Middlebury; and public consultations on the forest sensitivity mapping project focusing on acid rain. Data collected this year showed average monthly soil moisture at Mt. Mansfield dropped extremely low in August 2001. The heavy seed/cone production of 2000, combined with the drought of 2001, increased crown transparency along with maple leaf cutter, thrips, and forest tent caterpillar. The length of the growing season was longer, and leaf-out and flowering were earlier in the second half of the 1990s. **Tom Simmons** of the Essex Forests and Parks office has collected the understory plant data since 1991 at 2 elevations on Mansfield. Phenology data has been collected since 1993 in Springfield, Stowe, and Underhill. With increased growing degree days, they are finding earlier plant and insect development. Fall color and leaf drop have been recorded since 1991 on Mt. Mansfield and they are trying to correlate weather patterns with it, but still have a lot to learn as they continue to collect monitoring data. Sandy listed the titles of new publications put out by the Co-op: *Preparing for a Changing Climate* and *Why the Acid Rain Problem is Not Solved*. You can also contact her for websites of the Acid Rain Partnership.

Scott Pfister reported from the VT Dept. of Agriculture. He educated us about the ins and outs of quarantines. To justify a quarantine, the organism must be a pest based on good data, no other control method will work, the quarantine must do some good at preventing spread, and economic benefits must outweigh the detriments. The Invasive Exotic Plant Committee met in Vermont and came up with a plant list and complete info on all invasive plant species considered for quarantine. Many are sold in the aquarium and water garden trade. Thirteen of the species do not yet occur in the state and 21 of the species occur in Vermont, some with widespread distribution, such as purple loosestrife, knotweed, and buckthorn. After public comment period, the quarantine should go into effect.

Jon Turmel of the VT Dept. of Agriculture has been busy once again working on mosquito populations, survival, identification, and locations in relation to West Nile Virus. Through a grant from the VT Dept. of Health, he has been running a statewide mosquito survey, which in the future will include ticks. So far, all dead birds and mosquitoes collected have tested negative for West Nile Virus. Being a dry year helped keep mosquito populations down. Jon reported that they finally have a surveillance plan written for WNV.

Doug Allen of SUNY Syracuse told us how much he appreciates all the information he has garnered from these meetings over the years for his Forest Entomology course. He reported on his pine false webworm work. The results from his research on secondary insect activity following the ice storm show there is no evidence of secondary attack. He is now looking at the biology of peach bark beetle in orchards.

Our guest speaker this year was **Chris Mattrick**, Botanist and Senior Conservation Program Manager of the New England Wild Flower Society. His talk was on invasive plants. He introduced us to several different species that are found in Vermont. He explained the difference between exotic plants, invasive exotic plants, and explosive native plants and the mechanisms by which invasives win out over native species. He then went on to list mechanical, chemical, and biological control methods for invasive plants.

The afternoon was broken into 3 concurrent, rotating sessions on invasive exotic plants:
1. Identification of exotic weeds important to forests with **Ana Ruesink (aruesink@tnc.org)** of The Nature Conservancy.
2. Survey for exotic weeds in forested environments with **Kathy Decker (kdecker@fpr.anr.state.vt.us)** of VT Forests and Parks.
3. Control of exotic weeds in forested ecosystems with **Chris Mattrick (cmattrick@newfs.org)** of the New England Wild Flower Society.

We thank the above individuals for sharing their knowledge with us during this afternoon workshop on invasive exotic plants. The following written materials were provided by **Chris Mattrick** and **Brent Teillon** (bteillon@fpr.anr.state.vt.us):

1. New England Wild Flower: Conservation Notes of the New England Wild Flower Society, Volume 2, No. 3, 1998, Featuring "Invaders".

2. Collection of photocopies on "Invasive Plants" by Keynote Speaker Chris Mattrick

Don Tobi reasserted himself as the King of Most Unusual Pest Collectors again this year after last year's sour defeat.

Awards for Most Unusual Pest:
First Place: **Don Tobi** for his sponges on ash
Second Place: **Kathy Decker** for her giant puffball photo
Third Place: **Jim White** for his spruce twig twister

Awards for best poster/display:
First Place: **Trish Hanson** for her display Can Boring Insects Be Interesting?
Second Place: **Ron Kelley** for his ice storm damage and recovery photo display
Third Place: **Jane Stewart** for her poster on using SEM to observe spores of the butternut canker fungus on three beetle species.

Dale Bergdahl says to gear up for next year's 20th Anniversary by providing a wide array of new posters/displays and, of course, most unusual pests.

Special thanks to **Brent Teillon** and the **Vermont Dept. of Forests, Parks and Recreation** for providing refreshments, lunch, and prizes; and to **Dale Bergdahl** and **Brent Teillon** for program development; and to the **UVM School of Natural Resources** for providing the meeting space; and to **KC Hayes** for secretarial assistance and for keeping refreshments fresh; and to **Shari Halik** for typing up all these notes and thank you's. And thanks to all participants for sharing their knowledge, information, and experiences with others.

Next year's meeting will be held on Monday, January 6, 2002. It marks the 20th Anniversary of the Vermont Forest Pest Workshop! See you then!!

Beetle May Cripple Timber Industry in the Northeast Kingdom

WCAX Channel 3 News

November 8, 2001

A non-native beetle is doing a number on the logging and lumber industry in our region. The bug — known as the Pine Shoot Beetle — is forcing state officials to impose a quarantine on pine trees harvested in the Northeast Kingdom.

The Tomicus Piniperda — or Pine Shoot Beetle — feeds on pine tree shoots. It's been found in Essex, Orleans, and Caledonia counties. Forestry and Agriculture officials want to stop it from spreading further.

It's a small beetle that has the potential to cause big problems. That's why the State of Vermont says it has no choice but to quarantine the three counties in the Northeast Kingdom. Otherwise the Federal government will step in and quarantine the entire state.

The quarantine prevents the shipment of raw pine logs and bark outside the three counties. The most susceptible pine species — Christmas trees. It's bad news for growers. But others in the wood business will also be affected — landowners, loggers, truckers and sawmills. About 12-million feet of pine is harvested each year in the Northeast Kingdom. That's 3-million dollars worth of wood.

Brent Teillon of Vermont Forest Resource Protection told Darren Perron that loggers, landowners, truckers and sawmills will all be impacted, but that sawmills will have it the worst. That's because they'll have to abide by more rules and regulations.

There are 16 mills and more than 300 loggers in the Northeast Kingdom, according to Jack Dwyer, a Wood Utilization Specialist for the state of Vermont.

If the bark is composted and ground up the bug dies. So state officials are trying to get around the quarantine by setting those standards. But that does nothing for loggers and truckers who haul raw material out of the area.

"If you remove the bark you can ship it," Dwyer said. "But that's not cost effective for loggers. They'd have to have a debarker right on the landing in the woods."

Right now about a dozen states are dealing with the bug. There's been no wide-spread devastation in the U.S. — but there has been overseas. So even though only a handful of the bugs have been found in Vermont, federal officials are so concerned they've ordered the quarantine. It will take effect in January or February.

STIPULATIONS FOR PINE SHOOT BEETLE

COMPLIANCE AGREEMENTS FOR

FRANKLIN AND OXFORD COUNTIES IN MAINE

COOS COUNTY IN NEW HAMPSHIRE

ESSEX, ORLEANS, AND CALEDONIA COUNTIES IN VERMONT

April 2002

Conditions for a compliance agreement with a logger within the regulated area shipping outside the regulated area.

Pine logs harvested and shipped from April 1 through June 30 may only be shipped during this time period if fumigated at point of origin according to specifications listed in 7CFR 301.50-10 or if debarked. Fumigation must be conducted under PPQ supervision. Shipments will be certified with the issuance of a PPQ 540, Domestic Movement Certificate, issued by the inspector certifying the treatment.

Pine logs harvested April 1 – June 30 may be shipped to a regulated mill under compliance agreement after June 30, when accompanied by a PPQ 530, Limited Permit.

Pine logs harvested from July 1 through Sept. 30 may be shipped during this time period only if accompanied by a PPQ 540, Domestic Movement Certificate, issued by an inspector or individual operating under a valid compliance agreement with USDA and the SPRO.

Pine logs harvested from Oct 1 through March 31 may be shipped during this time period only if accompanied by a PPQ 530, Limited Permit, issued by an inspector or individual operating under a valid compliance agreement with USDA and the SPRO. Shipments may only take place to receiving mills operating under a valid compliance agreement with USDA and the SPRO.

Conditions for a compliance agreement with a mill located outside the regulated area receiving regulated items (logs w/bark attached) from within the regulated area.

Pine logs harvested and received from April 1 through June 30 may only be received if fumigated at point of origin according to specifications listed in 7CFR 301.50-10 or if debarked. Fumigation must be conducted under PPQ supervision. Shipments will be certified with the issuance of a PPQ 540, Domestic Movement Certificate, issued by the inspector certifying the treatment.

Pine logs harvested from April 1 through June 30 may be received from a regulated mill or logger under compliance agreement after June 30, when accompanied by a Limited Permit, PPQ 530.

Pine logs harvested and received from July 1 through Sept. 30 may be received if accompanied by a PPQ 540, Domestic Movement Certificate, issued by an inspector or individual operating under a valid compliance agreement with USDA and the SPRO.

Pine logs harvested from Oct 1 through March 31 may be received if accompanied by a PPQ 530, Limited Permit, issued by an inspector or individual operating under a valid compliance agreement with USDA and the SPRO. These logs and associated residue must be processed within 10 days of receipt. Mechanical debarking of the logs will be considered acceptable processing. All pine logs received from within the regulated area will be kept in a segregated area and identified as Pine Shoot Beetle Quarantine Regulated Wood. Any bark or debris that has accumulated at the storage site will be burned on site, buried on site to a depth of 3 feet or more, ground to * 1 inch or less diameter, or returned to the regulated area by April 1 of each year.

The mill will allow access to all areas where processing and/or storing regulated logs occurs to identified Federal and/or State inspectors and will provide a representative upon notification of arrival, who will ensure that safety regulations/requirements are met.

Bark that is ground to 1 inch or less average diameter under the terms of Limited Permit of PPQ 530, will be allowed movement without further restrictions.

*Provisional stipulation pending bark research studies

Conditions for a compliance agreement with a mill within the regulated area shipping residue (bark or unprocessed bark mulch) outside the regulated area.

Bark from pine logs harvested from April 1 through June 30 may be shipped only under one of the following conditions:

1) Bark that is fumigated according to specifications listed in 7CFR 301.50-10, under PPQ supervision may be shipped under a PPQ 540, Domestic Movement Certificate, issued by the inspector certifying the treatment.

2) Bark that is composted according to PPQ specifications may be shipped under a PPQ 540, Domestic Movement Certificate, issued by the inspector certifying the treatment.

3) * Bark that is ground to a maximum diameter of 1 inch or less may be shipped under a PPQ 540, Domestic Movement Certificate, issued by the inspector certifying the treatment.

Bark from pine logs harvested from April 1 through June 30 may be shipped after June 30 to a mill under compliance agreement when accompanied by a Limited Permit, PPQ 530.

Bark from pine logs harvested from July 1 through September 30 that is removed through the normal mechanical debarking process may be shipped, if accompanied by a PPQ 540, Domestic Movement Certificate, issued by an inspector or individual operating under a valid compliance agreement with USDA and the SPRO.

Bark from pine logs harvested from October 1 through March 31 may be shipped when accompanied by a Limited Permit, PPQ 530 and processed by grinding to a maximum of 1" or less before April 1.

* Provisional stipulation pending bark processing research studies

Procedures for Composting Bark

The procedure for composting bark in a pile follows:

Step 1 – Start a compost pile of at least 200 cubic yards

Step 2 – Allow the compost pile to remain undisturbed until the temperature reaches 120 °F (49 °C) for at least 4 continuous days.

Step 3 Using a front-end loader or a bulldozer, remove the outer layer of the compost pile to a depth of 3 feet.

Step 4 – Start a second compost pile using the recently-removed cover material as a core.

Step 5 – Move the core material from the first compost pile and place on the second compost pile as a cover at least 3-feet deep. (Leave some composted material to serve as "inoculum" for subsequent piles.)

Step 6 – Allow the second compost pile to remain undisturbed until the temperature reaches 120 °F (49 °C) for at least 4 continuous days.

Step 7 – Remove the second compost pile and use as fully-composted material

Step 8 – Repeat procedure.

The procedure for Composting Bark in a Trench

Step 1 – Start a compost pile of at least 200 cubic yard in one end of a trench

Step 2 – Allow the compost pile to remain undisturbed until the temperature reaches 120°F (40°C) for at least 4 continuous days.

Step 3 – Using a front-end loader or a bulldozer, remove the outer layer of the compost pile to a depth of 3 feet.

Step 4 – Down the trench, start a second compost pile using the recently-removed cover material as a core.

Step 5 – Move the core material from the first compost pile and place on a second compost pile as a cover at least 3-feet deep. (Leave some composted material to serve as "inoculum" for subsequent piles.)

Step 6 – Allow the second compost pile to remain undisturbed until the temperature reaches 120°F (49°C) for at least 4 continuous days.

Step 7 – Remove the second compost pile and use as fully-composted material

Step 8 – Repeat procedure