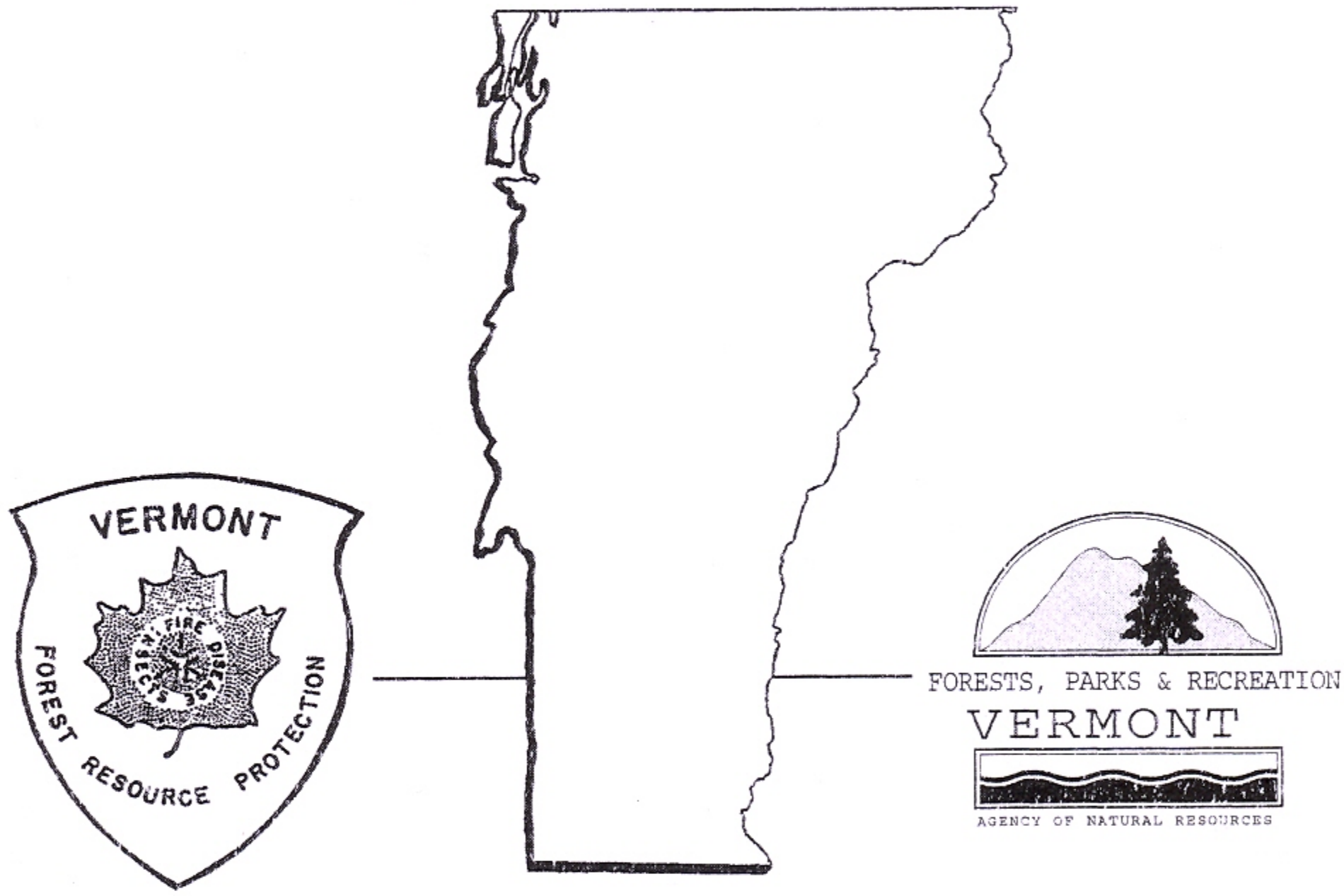
FOREST INSECT AND DISEASE CONDITIONS IN VERMONT 2002



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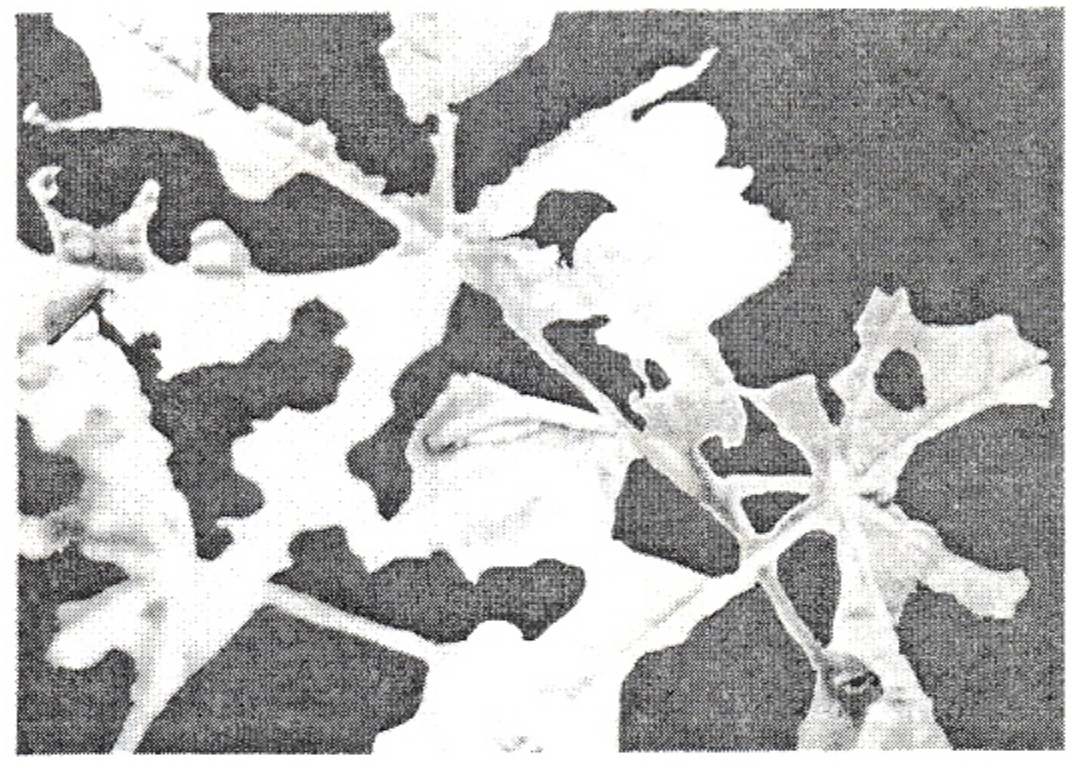
We gratefully acknowledge the financial and technical support provided by the USDA Forest Service, Northeastern Area State & Private Forestry that enables us to conduct the surveys and publish the results in this report.

FOREST INSECT AND DISEASE CONDITIONS IN VERMONT

CALENDAR YEAR 2002



Bruce Spanworm feeding on Sugar Maple Foliage

EDITED BY

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PREPARED BY

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TABLE OF CONTENTS

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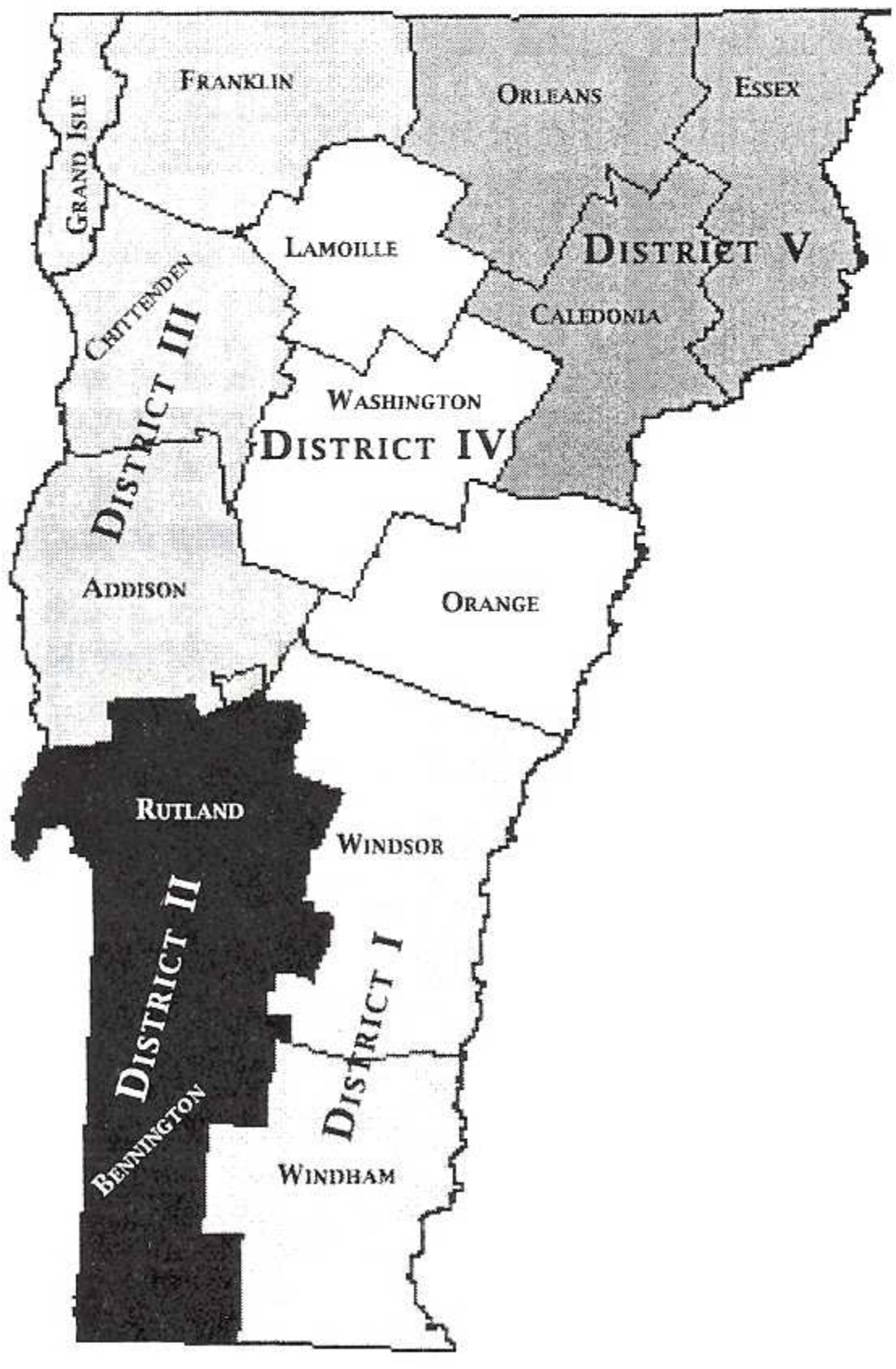

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2002 Vermont Forest Insect and Disease Highlights

Balsam Gall Midge populations dropped nearly everywhere after being at heavy levels for the past several years. Spray trials with Provado and Scimitar were conducted.

Balsam Shootboring Sawfly caused mostly light to moderate damage to Christmas trees, and is not expected to be a problem in 2003.

Balsam Twig Aphid commonly caused moderate damage in southern Vermont, but only light damage in northern Vermont.

Beech Bark Disease continued to be more conspicuous than normal due to increases in scale and Nectria, and recent droughts. In all, 55,962 acres were mapped. Tree condition also worsened for most sites in monitoring plots.

Birch Defoliation, caused by **Birch Leaf Miners**, was unusually widespread at moderate to heavy levels this year, with additional damage by **Birch Skeletonizer** at some mid elevation sites. In all, 84,121 acres of birch defoliation were mapped.

Birch Dieback on paper birch in monitoring plots remained stable.

Bruce Spanworm caused heavy defoliation in Essex and Orleans counties, and light to moderate defoliation statewide, with 3,222 acres mapped during aerial surveys. Damage is expected again in 2003.

Butternut Canker occurs statewide. The University of Vermont Forest Pathology Lab continues to research site factors and potential insect vectors.

Delayed Chlorophyll Development was widespread due to cold and wet weather after leaves expanded but before green-up.

Drought was the cause of widespread hardwood foliage browning and defoliation which was mapped on 200,123 acres, compared to 170,408 acres mapped in 2001. Damage was most severe on ridges and hilltops. Tree decline symptoms from the 2001 drought were also noticeable.

Exotic Woody Plants known to be invasive were present on 20% of sites evaluated in the 2001 Vermont Hardwood Health Survey. A noxious weed quarantine has been enacted.

Forest Tent Caterpillar, populations remain low, but increased from recent years. An increase in the number of moths caught in pheromone traps is probably due to a new lure.

Frost Damage from May 20 and May 22 affected Christmas tree plantations in scattered locations statewide. In southern Vermont, some forest and ornamental trees were also affected.

Gypsy Moth populations were at very low levels statewide, and are expected to remain low in 2003.

Hardwood Decline and Mortality was mapped on 1,486 acres.

Hemlock Woolly Adelgid is not known to occur in Vermont. No signs of adelgid were found when hemlock regeneration was inspected in 30 hemlock stands.

The **Ice Storm of 1998** continues to impact affected stands. Many trees are recovering, although some continue to decline.

Larch Decline and mortality is increasing in northeastern Vermont, and remains visible in small pockets elsewhere. In all, 1,454 acres were mapped.

Maple Leaf Cutter defoliation was less noticeable than previous years. In all, 5,954 acres of damage were mapped during aerial surveys compared to 23,634 acres in 2001.

Oystershell Scale populations were light in most locations, although numbers in the Huntington survey plot increased.

Ozone Injury symptoms on sensitive plant species were recorded at 30% of the sites assessed as part of the National Forest Health Monitoring Program.

Pear Thrips populations decreased dramatically, and no defoliation was mapped during aerial surveys. Numbers were low in fall soil samples, indicating that little damage will occur in 2003.

Pine Shoot Beetle trapping surveys were done in seven northern Vermont counties. The beetle was not found in any new counties.

Saddled Prominent populations remain very low. The fewest moths were caught since we initiated trapping in 1999.

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

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

Spruce-Fir Dieback and Mortality was mapped on 4,103 acres, mostly at upper elevations and in northeastern Vermont.

Wet Site conditions were mapped on 10,411 acres where tree dieback was occurring.

White Pine Blister Rust was found on 3% of canopy trees in mature stands, and 14% of trees in regenerating stands in a 2001 survey.

Vermont 2002 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.

Since the most significant **General Forest Health** impact was the drought... again... it's the same story as last year... only worse in some stands. The effects of lower carbohydrate reserves will continue for several years, decline may begin to show up in any of the next two or three years, and the greatest risk will be to wounded or diseased trees and trees on poor sites.

Birch condition may be of particular concern, since white birch are particularly sensitive to drought. Their shallow root systems are quite sensitive to soil temperature changes. We mapped extensive birch defoliation statewide. In some regions, this was from the drought alone. Elsewhere, drought exacerbated the impact of birch leaf miners and other insects. Where defoliation occurred, shading of the forest floor by the canopy was reduced for at least part of the growing season, increasing the risk of root loss. Watch these stands for early signs of dieback. Where dieback is occurring in stands close to maturity, consider salvage to reduce escalating losses from bronze birch borer and the rapid deterioration of dying birch.

Beech affected by drought will be more vulnerable to the current spike in beech bark disease. Retain resistant individuals and discriminate against susceptible individuals regardless of harvesting regime. Existing sprouts from the standing trees thrive from the increased light following the harvest. Where resistant trees are left standing, they will continue to produce both sprouts and seeds into the future.

Populations of **Maple** defoliators are changing. Maple leaf cutter damage is becoming less widespread and pear thrips populations remain low. However, Bruce spanworm damage has increased, especially in northeastern Vermont. This is a very early defoliator (May and June). If you miss the green inchworms, you may see the lacy defoliation of the leaves. By July, the margins of damaged leaves will have browned up. Should defoliation turn out to be severe in any maple stands, be sure to revisit these locations in July to make sure they refoliated.

There is some indication that forest tent caterpillar populations may be building. Increased sightings in Vermont this year and an outbreak on aspen in Ontario suggest it's an insect we should be on the lookout for. In the boreal aspen forests of Alberta affected by forest tent caterpillar, fragmentation decreases the effectiveness of insect parasitoids and the virus disease. These organisms are important natural enemies, so fragmentation may prolong outbreaks. This may or may not apply to Vermont maple stands. (Interestingly, in the same aspen forests, the biomass of forest tent caterpillars per acre in an outbreak would be equivalent to nearly 3 caribou per acre!)

The movement of **Pine** logs, bark, or unprocessed bark mulch from Essex, Orleans, and Caledonia Counties is still regulated. Products from all pine species are included. There are no new counties in the pine shoot beetle quarantine area.

Hemlock continues to be threatened by hemlock woolly adelgid. Although it has been found in new locations in New Hampshire and Massachusetts, the insect is not known to have moved any closer to Vermont. We continue to discourage hemlock salvage in anticipation of future losses, because of the spotty impact of the insect, the long delay before mortality occurs, and the many unknowns about its population dynamics as it moves further north.

Hemlocks and **Larch** stressed by drought, as well as defoliators, winter injury or poor site conditions, may experience a buildup of bark borers. Look for sawdust, exit holes, or bark which is sloughing off from woodpecker activity. This may occur even on trees which still have green foliage. Where beetles are active and salvage is desirable, cutting in groups or patches is often preferable to single tree selection.

INTRODUCTION

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

A statewide aerial survey was flown between August 19 and September 4 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.

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 2002 are summarized in Figure 1.

Winter

The winter of 2001-2002 had below normal snow cover and above normal temperatures. Winter didn't really "arrive" until mid-December. Frequent light snows allowed minimal snow cover to persist from mid-December until early March. March was the snowiest month, with the biggest snowfall in southern Vermont on March 20. November, 2001, was the warmest November on record for the Burlington weather station, and January was the 6th warmest January on record for the entire state, according to the Northeast Regional Climate Center (NERCC). The meteorologic winter (from about December 9 to March 9) was the warmest on record for Burlington.

There were no extreme events. Temperatures never dropped below zero in Burlington during the entire winter. An ice storm with heavy winds, in early February, caused some tree damage in southern Vermont, especially to white pine.

Maple Sugaring Season

The maple sugaring season started early and lasted quite a while. It ended up being one of the most productive seasons in recent years, with overall good quality as well. The New England Agricultural Statistics Service reported that Vermont production increased 80% over the 2001 season.

Spring

Spring began unusually hot and dry. Record high temperatures for four days in mid-April gave tree and shrub phenology a jump start. In Springfield, sugar maple leaves broke bud on April 16, and were fully expanded 3 days later (Figures 2-4).

However, before green-up, cool temperatures returned and lasted into June. It was the 12th coldest May on record for the state (NERCC). The persistent cool cloudy weather delayed chlorophyll development in leaves of red and sugar maple. Half-formed leaves remained on some trees for nearly a month. Many hillsides kept a red color into June.

Long-term monitoring at the Proctor Maple Research Center in Underhill showed that budbreak on April 22nd was 19 days earlier than the 10-year average. Full leaf expansion on May 24th was similar to the average, just 2 days later than normal (Figure 5). The delayed leaf expansion was accompanied by red foliage, apparently due to high anthocyanin content. Investigations into the role of anthocyanins and the chemical composition of spring foliage were initiated as a result.

Spring precipitation was above normal, giving trees a good start to the growing season. Heavy frosts occurred in late May in some areas. Several inches of snow fell on May 14 in Westminster.

A windstorm on May 3 resulted in some breakage. On June 8, a severe storm spawned tornadoes. Winds up to 150 mph uprooted trees in Wilmington. Other severe wind events occurred on 2/1, 5/31, and 10/4.

Spring phenology observations are summarized in Table 1.

Summer

Early summer was cooler and wetter than normal. 2002 had the 5th wettest June on record for the entire state (NERCC). This saturated the soil, loosening roots, and making trees more vulnerable to windthrow.

It turned hotter and drier, with below normal precipitation for July and August. Drought conditions developed and persisted through the summer, exacerbated by below average rainfall in 2001 and 1999. While the drought had been most severe in northern Vermont in 2001, it was more severe in the southern six counties in 2002. The Danby weather station recorded only .97 inches of rain for the month of July. It was the 10th driest August on record (NERCC).

The heat and dryness lasted until mid-September. Many leaves of upper elevation hardwood trees had turned brown and dropped by early September. The Burlington weather station recorded a temperature of 98 degrees on September 9, a new record high for the month of September. It was the second warmest September on record for the state (NERCC).

An unusual phenomenon occurred in early July. Smoke from numerous wildfires burning in northern Quebec blew south to New England and beyond. The Vermont Air Pollution Control Division detected record fine particle levels from these fires. The particles blocked out UV light and created a yellow cast to the air, blotting out the sun.

Fall

Warm weather continued into the fall, with no killing frosts in most of the region until October 15.

Frequent rainfall after mid-September brought precipitation up to above normal for the period of September through November and helped alleviate the drought.

Early fall color and leaf drop occurred in upper elevation areas with shallow soils due to drought conditions. Elsewhere, foliage season started late, but lasted longer than usual. Cold temperatures were not significant until early October. Foliage colors were brilliant in many areas, with plenty of red and orange leaves. The season persisted, since strong winds did not occur until after the peak of foliage.

- On Mount Mansfield, trees on droughty sites showed early color, browning and leaf drop. By early September, 2-3 weeks earlier than normal, most paper birch trees were bare on monitoring plots at 2600 ft,. and at high elevation landscape monitoring sites (Figures 6-7). The intensity of leaf drop was very pronounced. The rest of the landscape turned color later than usual, further accentuating the bare drought-affected areas. Sugar maple fall color and leaf drop on monitoring plots was 17 days later than the long-term average (Figure 8).

In generally warmer areas of the state, there were some trees which changed from green to yellow to brown in late October; or, in early November, from green straight to brown. This progression is similar to leaf senescence on juvenile trees, and may have been caused by a late season growth spurt caused by the sudden availability of water in the fall, after a summer of drought. There was also a lack of cold weather to promote abscission layer formation.

Several inches of snow accumulated in a storm in late October, followed by several storms in early November. Snow cover persisted in the mountains.

Seed Production

Heavy acorn production occurred in some areas. Flowering on sugar maple was heavy in Bennington County. Widespread cone production was observed on arborvitae and balsam fir. Otherwise, no unusually heavy seed crops were reported.

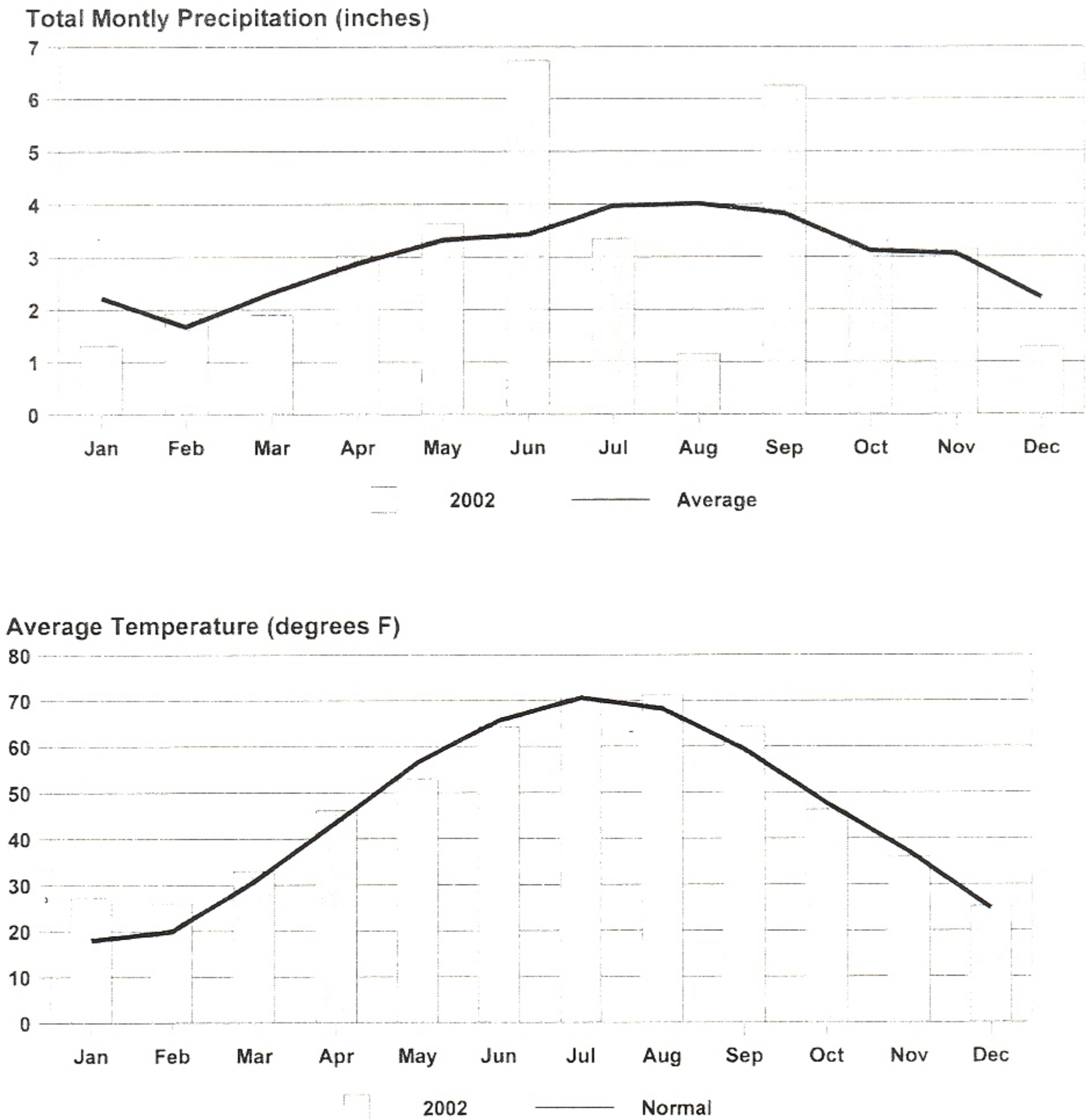


Figure 1. Monthly total precipitation and average temperature in 2002, compared to normal, for Burlington, Vermont. Data from the National Weather Service (http://www.erh.noaa.gov/er/btv/).

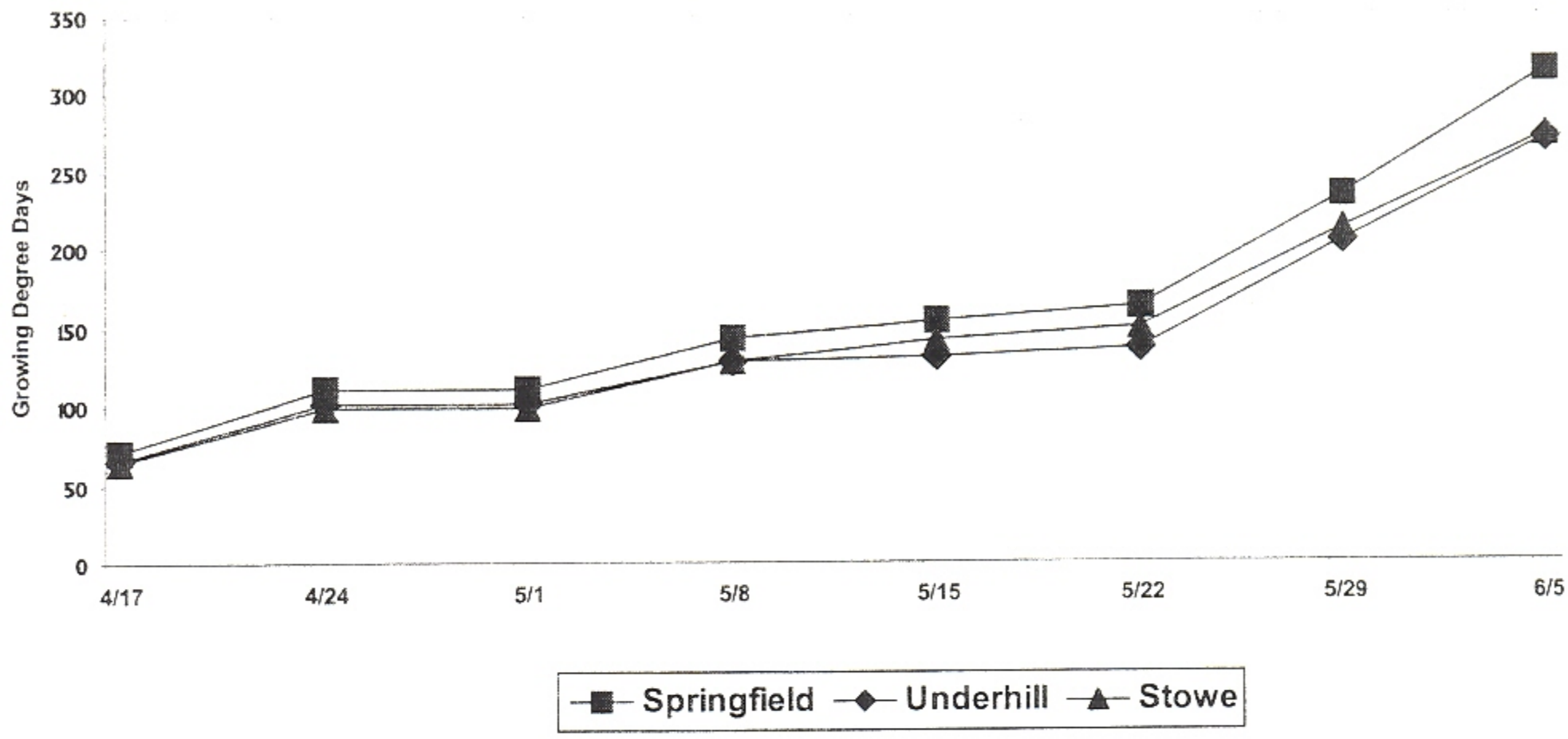


Figure 2. 2002 Weekly spring cumulative growing degree days for Stowe, Underhill, and Springfield, Vermont. 50 degrees is used as the threshold of development.

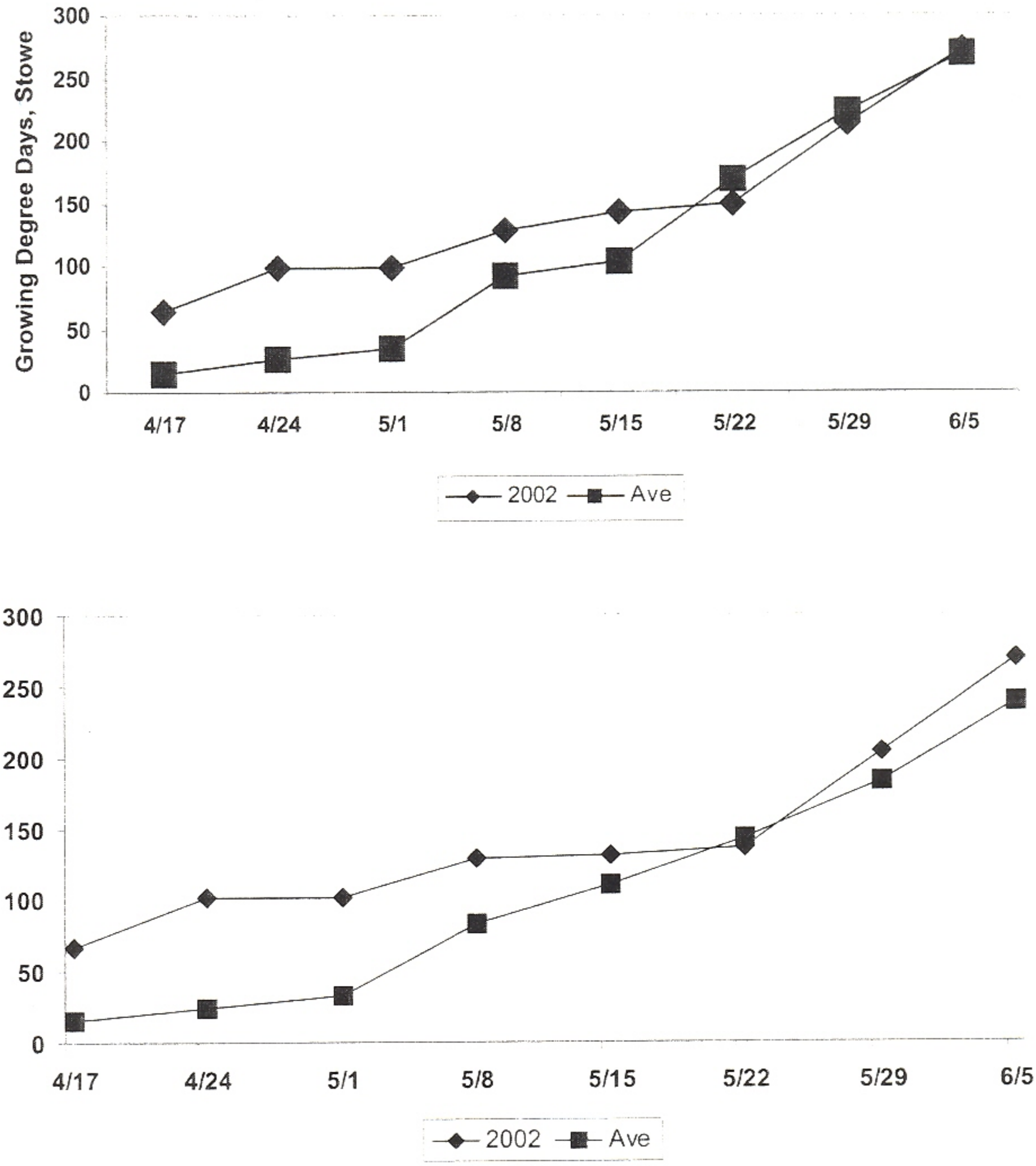


Figure 3. Weekly spring cumulative growing degree days for Stowe and Underhill, Vermont in 2002 compared with mean 1993-2001 accumulations. 50 degrees is used as the threshold of development.

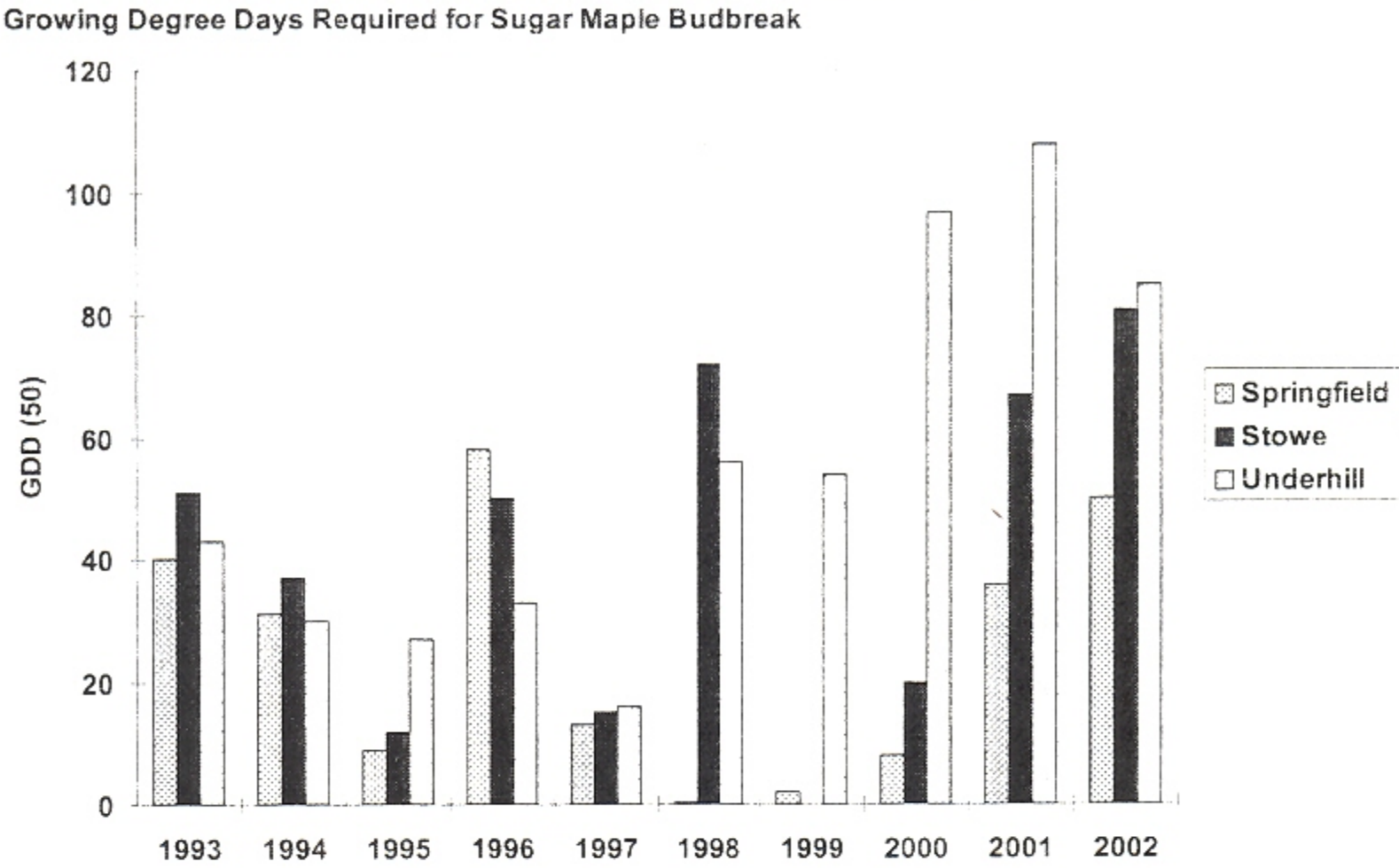


Figure 4a. Growing degree days for first sugar maple budbreak in Springfield, Stowe, and Underhill, 1993-2002.

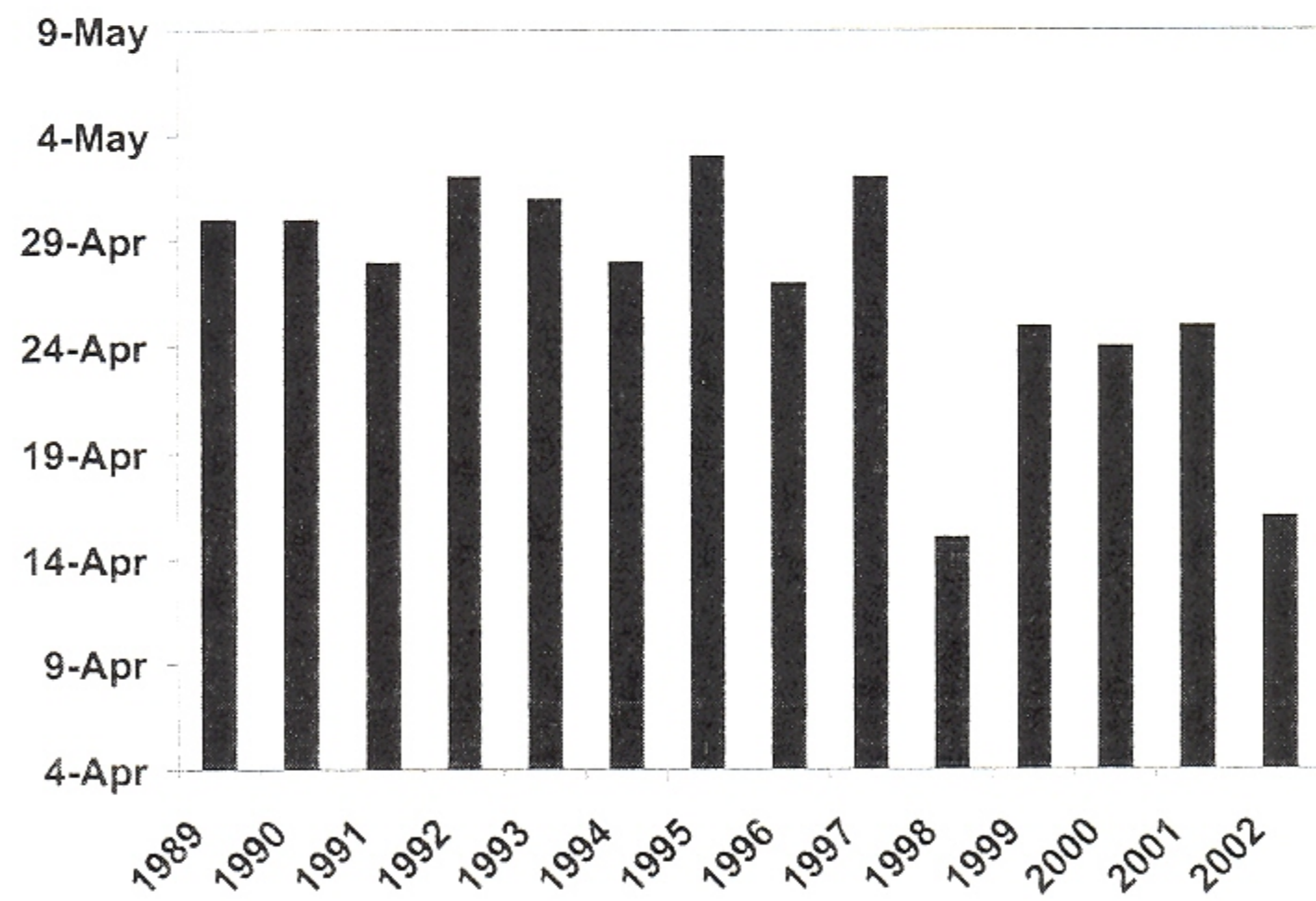
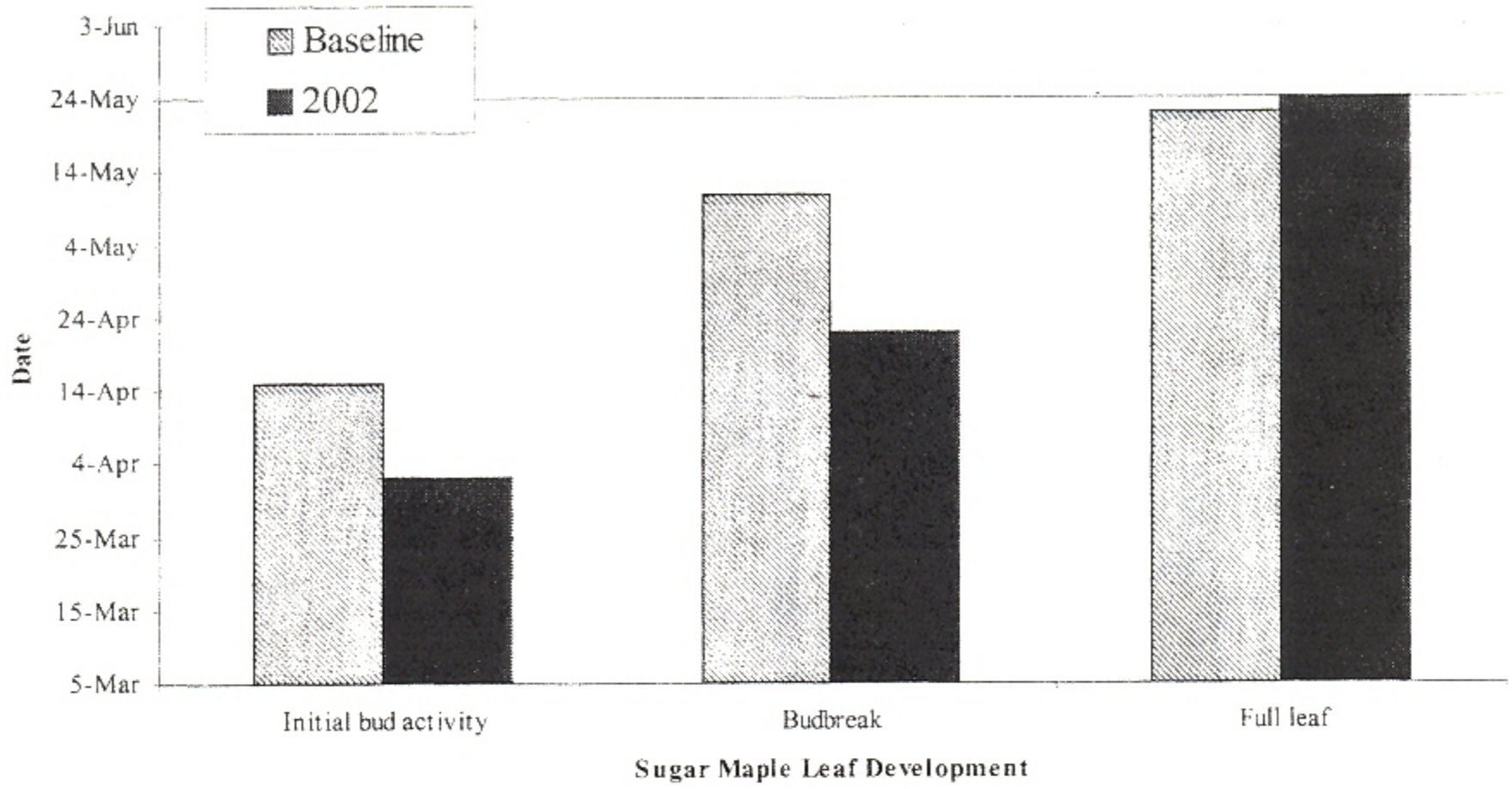


Figure 4b. Date of first sugar maple budbreak in Springfield, Vermont, 1989 - 2002.



Sugar Maple Leaf Development

Figure 5. Average date of sugar maple tree spring bud development at the Proctor Maple Research Center, Underhill, VT in 2002 compared to ten-year baseline average.

Table 1. 2002 First observation dates of phenological development and growing degree day accumulation from 3 sites in Vermont. 50 degrees F is used as the threshold of development.

Biological Indicator	Springfield	Stowe	Underhill
PLANT DEVELOPMENT			
Showing Green			
Fir, balsam		5/7 (124)	5/10 (131)
Budbreak			
Ash, White	4/21 (111)	5/8 (129)	4/22 (111)
Cherry, black	4/15 (25) (first leaves)*	4/15 (30)	
Fir, balsam	4/25 (111)	5/9 (130)	5/18 (136)
Fir, Fraser		5/31 (231)	
Hemlock	5/7 (137)	5/29 (213)	5/28 (136)
Maple, red	4/18 (92) (first leaves)*	4/16 (45)	
Maple, silver	4/18 (92) (first leaves)*		
Maple, sugar	4/16 (50)	4/18 (81)	4/22 (85)
Oak, red	4/19 (108)		

Biological Indicator	Springfield	Stowe	Underhill
Flower Budbreak			
Aspen, quaking	4/2 (0)		
Birch, paper	4/15 (33)		
Maple, red	4/10 (50)		
Maple, silver	4/1 (0)		
Flowers			
Apple	5/6 (122)	5/21 (150)	
Aspen, quaking		4/3 (0)	
Crocus	4/3 (0)		
Dolgo crab		5/17 (150)	
Elm, American	4/12 (5)		
Lilac		5/26 (179)	
Lilac (full bloom)		6/1 (273)	
Maple, red	4/10 (5)		
Maple, sugar		4/17 (64)	4/18 (85)
Plum, Canada		5/6 (107)	
Shadbush		4/26 (99)	5/5 (109)
Full Green Up	6/2 (292)		
INSECT DEVELOPMENT			
Balsam gall midge (adults laying eggs)		5/16 (144)	
Balsam gall midge (last adults seen)		5/28 (194)	
Balsam shootboring sawfly (first adults)		4/19 (95)	
Balsam shootboring sawfy (laying eggs)		5/7 (124)	
Balsam twig aphid stem mothers		5/7 (124)	
Eastern tent caterpillar	4/20 (111)		4/19 (102)
Maple leafcutter (adults)	5/20 (164)		5/14 (131)
Maple leafcutter (first cuts complete)		7/6 (768)	
Pear thrips (adults)	4/12 (5)	4/12 (5)	4/12 (6)
Plum curculio adults		5/31 (231)	
OTHER OBSERVATIONS			
Spring peepers calling		4/11 (1)	

* Budbreak and appearance of leaves occurred very quickly with some species, especially during a period of rapid accrual of degree days in April. We were unable to record observation dates of budbreak for species that went from bud stage to leafing out so rapidly.

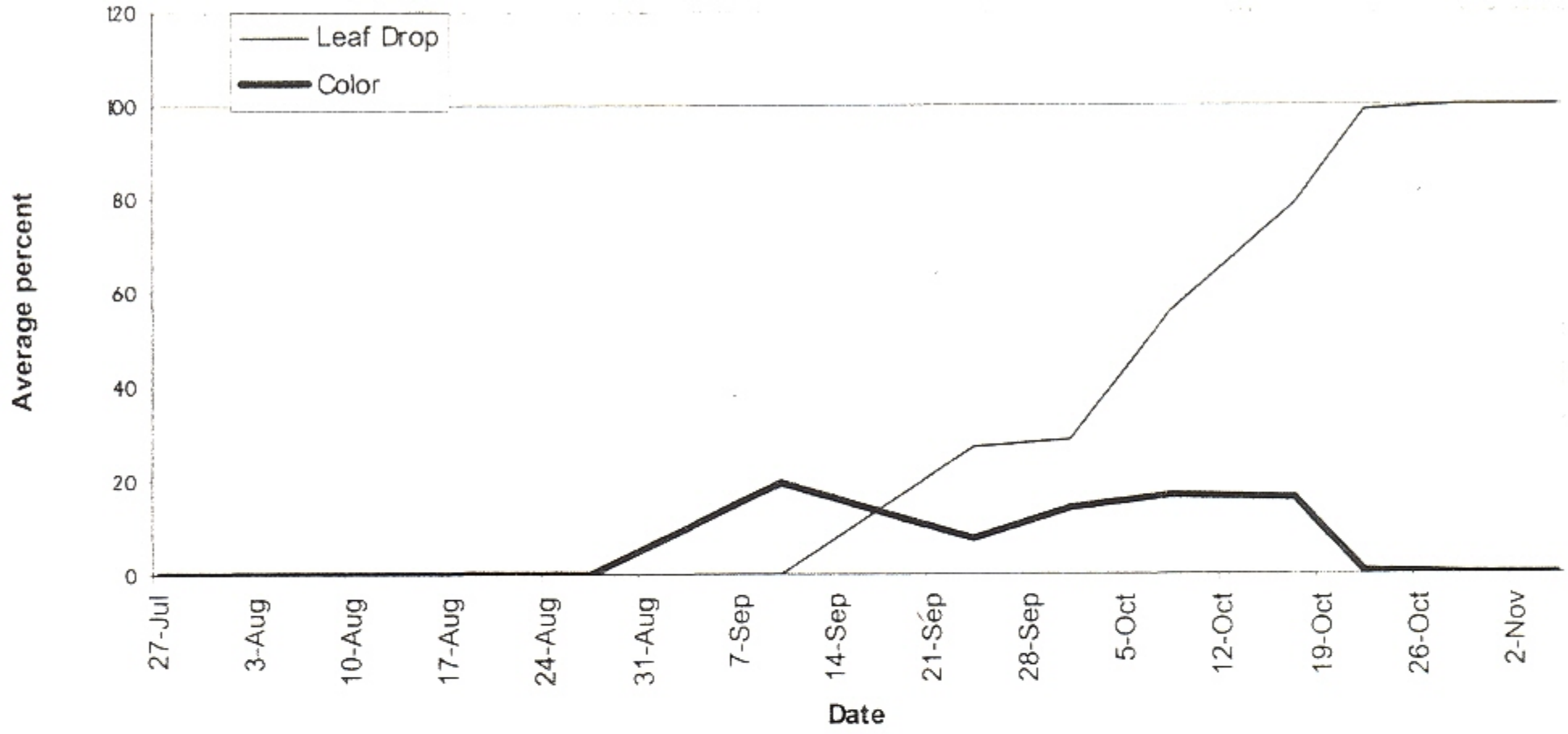


Figure 6. Paper birch fall color and leaf drop on monitoring plots at 2600 feet on Mount Mansfield, 2002.

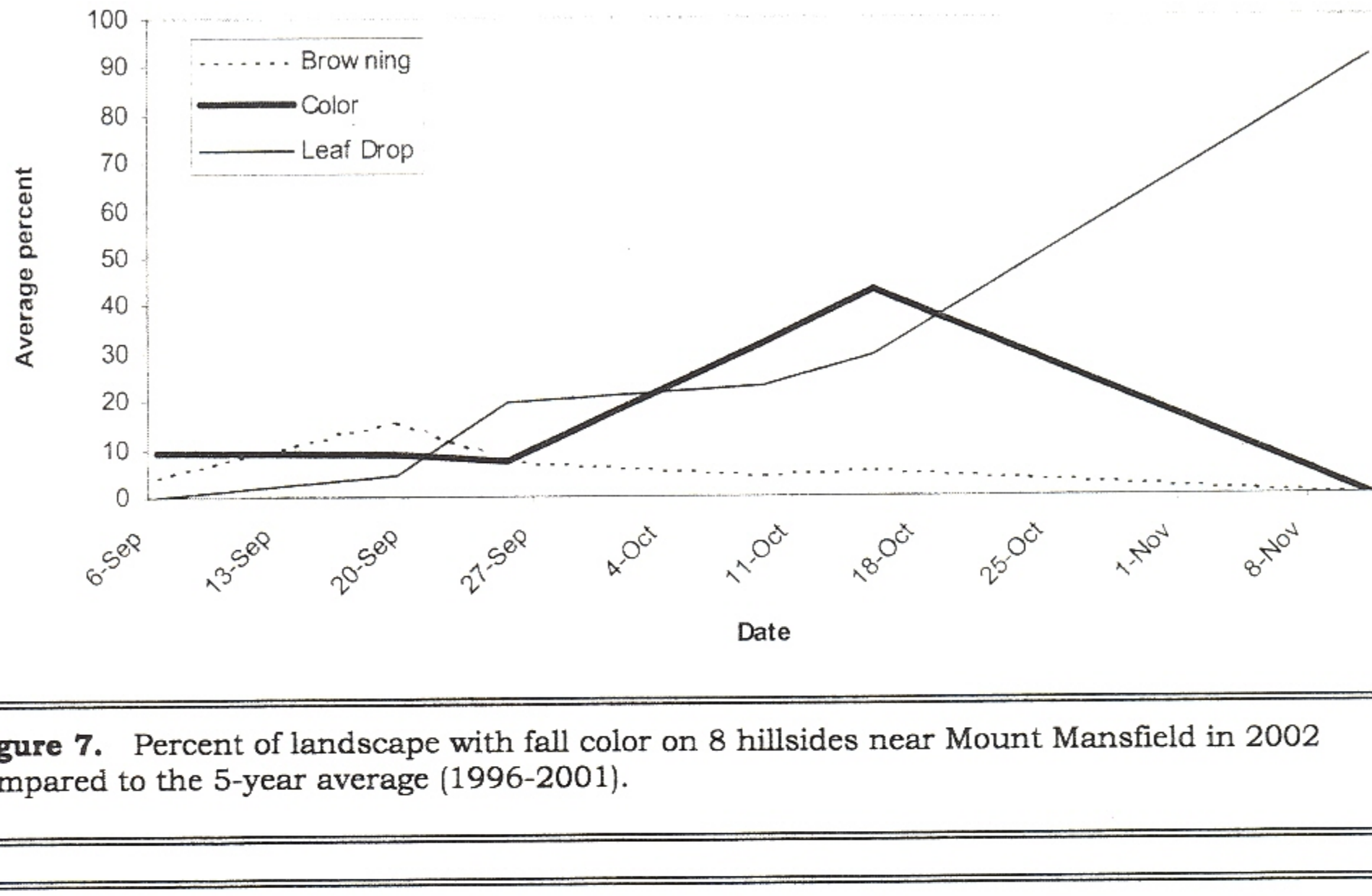


Figure 7. Percent of landscape with fall color on 8 hillsides near Mount Mansfield in 2002 compared to the 5-year average (1996-2001).

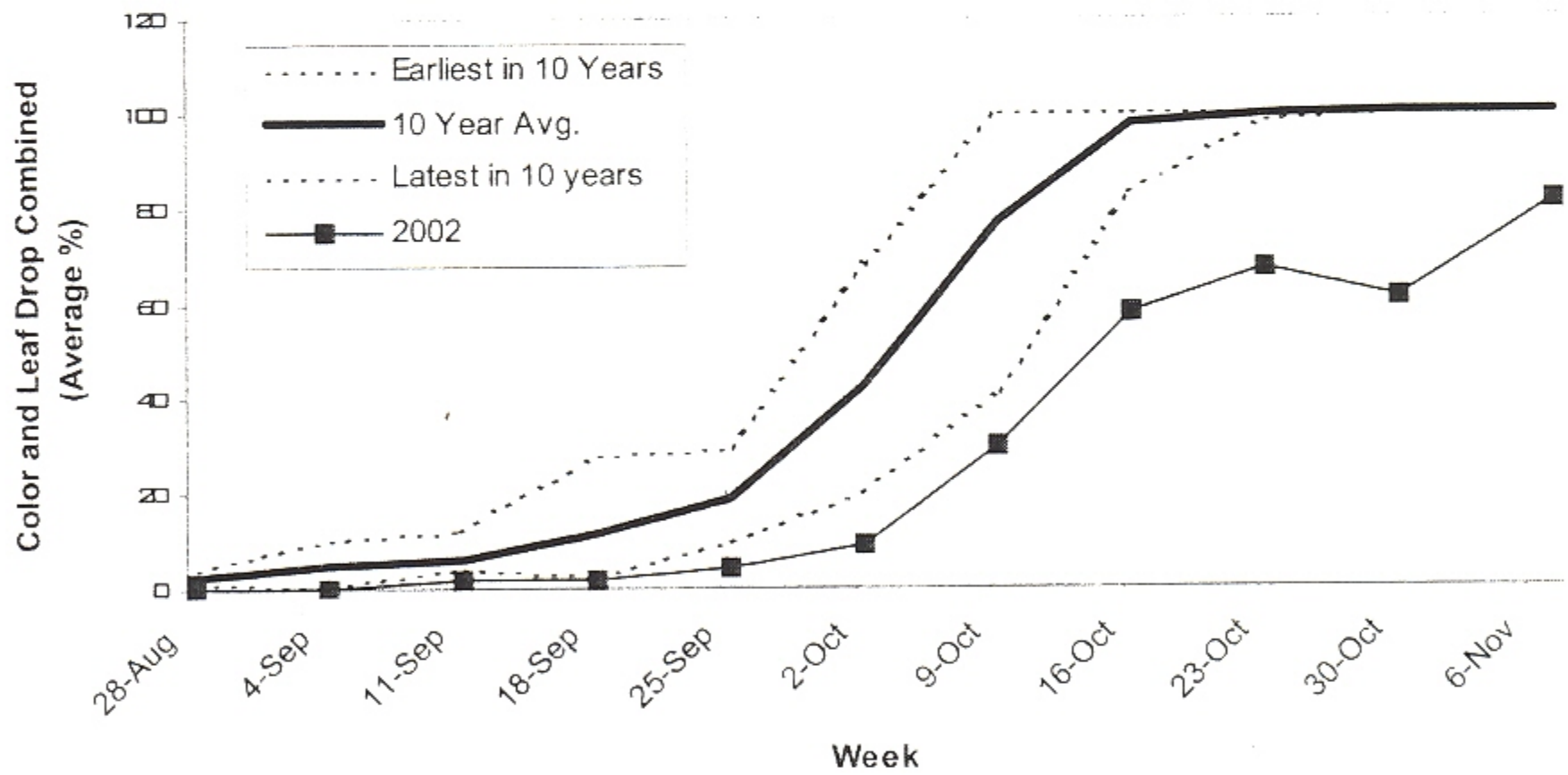


Figure 8. Percent fall color and leaf drop of sugar maple on Mount Mansfield in 2002 compared to 10 year average (1992-2001). Data from 1400 foot elevation.

HARDWOOD DEFOLIATORS

Birch Defoliation, caused by **Birch Leaf Miners**, *Fenusa pusilla* and *Messa nana*, and drought, was unusually widespread at moderate to heavy levels this year. Browning was visible on hillsides by mid-July. Damage by **Birch Skeletonizer**, *Bucculatrix canadensisella*, was also common, especially at mid elevations. These defoliators, combined with drought stress, left many paper birch trees leafless by late August. In all, 84,121 acres of birch defoliation were mapped, mostly at mid to upper elevation sites, compared to 20,881 acres mapped in 2001 (Table 2, Figure 9).

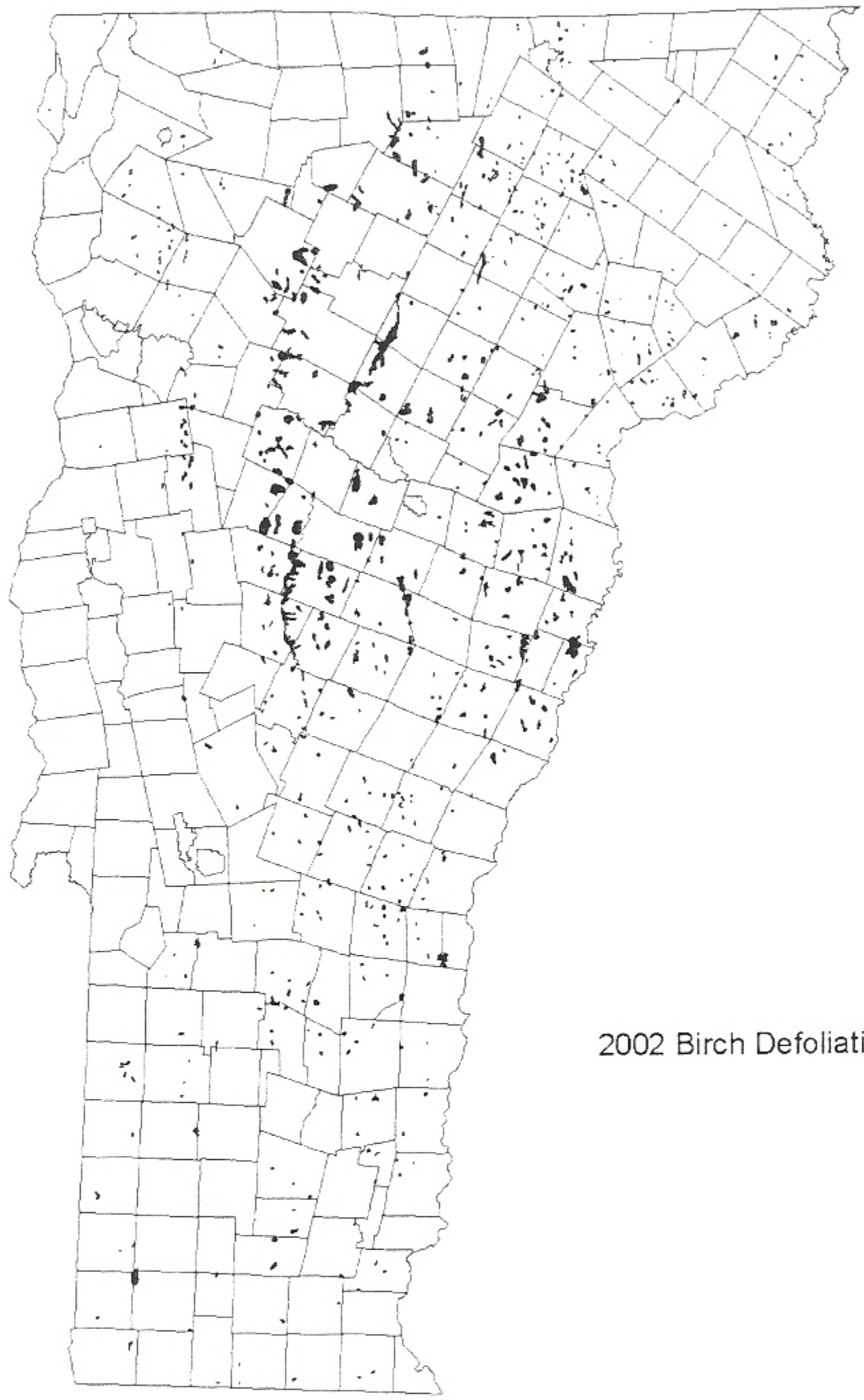
Table 2. Mapped acres of damage by birch defoliation by leaf miners, birch skeletonizer and drought in 2002.

County	Acres
Addison	3,188
Bennington	2,029
Caledonia	7,008
Chittenden	2,475
Essex	1,367
Franklin	1,558
Grand Isle	40
Lake Champlain	1
Lamoille	8,899
Orange	15,692
Orleans	7,151
Rutland	1,747
Washington	23,652
Windham	2,038
Windsor	7,276
Total	**84,121**

Bruce Spanworm, *Operophtera bruceata,* caused widespread light to moderate defoliation of sugar maple statewide. Damage was heavy in portions of Essex and Orleans counties. 3,222 acres were mapped during aerial surveys. Some defoliation from this insect could be seen in most any northern hardwood stand that was entered in early summer, especially in the upper crown. Occasionally, moderate damage led to foliage browning. Some refoliation occurred. In north-central and northeastern Vermont, feeding by the European snout beetle (*Phyllobius oblongus)* contributed to the damage.

Moths were very numerous this fall in many northern Vermont locations. A few of these locations were monitored by use of an egg-laying trap designed by a Quebec entomologist. Eggs laid per trap ranged from 339 in one Derby site to 684 eggs in Cabot, and 992 eggs in a second Derby site.

Forest Tent Caterpillar, *Malacosoma disstria*, populations remain low but increased from recent years. Light defoliation was reported from Orwell. More larvae were seen, including a noticeable infestation in a town park in St. Albans.



2002 Birch Defoliation

Figure 9. 2002 damage by birch defoliation by leaf miners, birch skeletonizer, and drought. Mapped area is 84,121 acres.

Although there was a sharp increase in the number of moths that were caught in pheromone traps, this is probably due to the use of a new, more attractive lure from PheroTech, Inc.(Figures 10-11). The U.S. Forest Service conducted paired tests of the new and old lure on the Green Mountain National Forest using 3 traps per lure type. The PheroTech lures, with a new matrix for the pheromone, caught 30 times as many moths as the RPC rubber septa lures. Based on this, our 2001 moth catch was similar to 2000 levels.

A Luminoc light trap in Hyde Park with a black light plus pheromone, run for four hours per night, caught nearly 80 moths compared to 1 moth in 2001. The trap was deployed on July 1 and moths were caught between July 8 and August 17, beginning at 800 growing degree days and ending at 1275 growing degree days (Figure 12). Most moths were caught during late July.

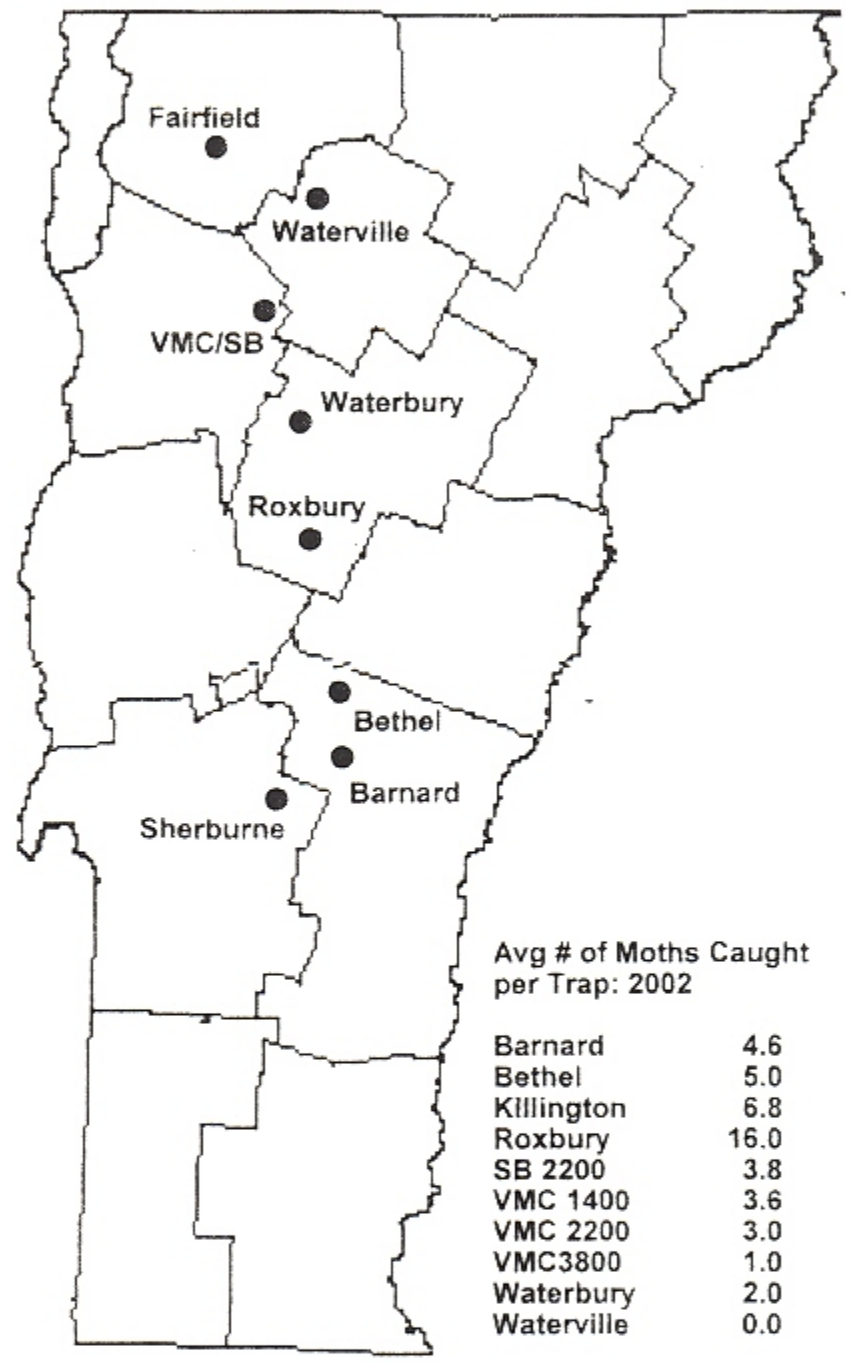


Figure 10. Average number of forest tent caterpillar moths caught in pheromone traps, 2002. Average of 4-5 traps per location.

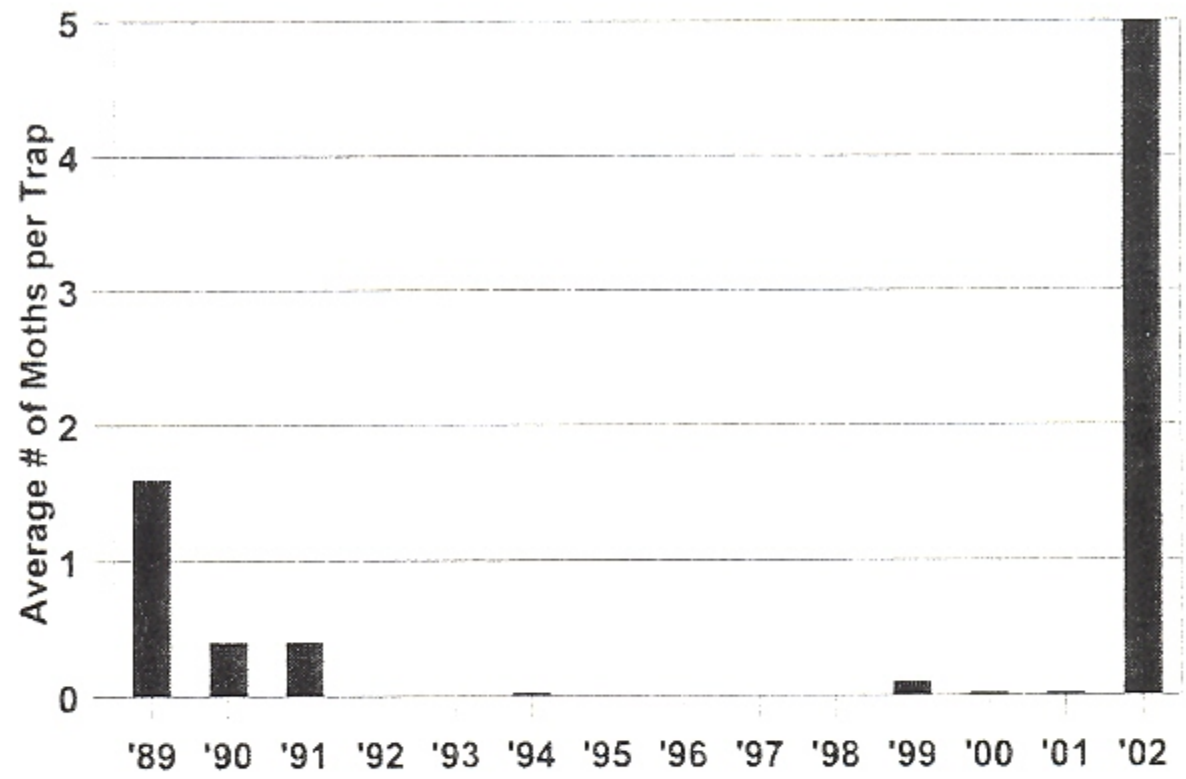


Figure 11. Average number of forest tent caterpillar moths caught in pheromone traps 1989 - 2002. Five multi-pher traps per location, baited with RPC-2 component lures 1989-2001, and with PheroTech lure in 2002. Average of 6-11 locations per year.

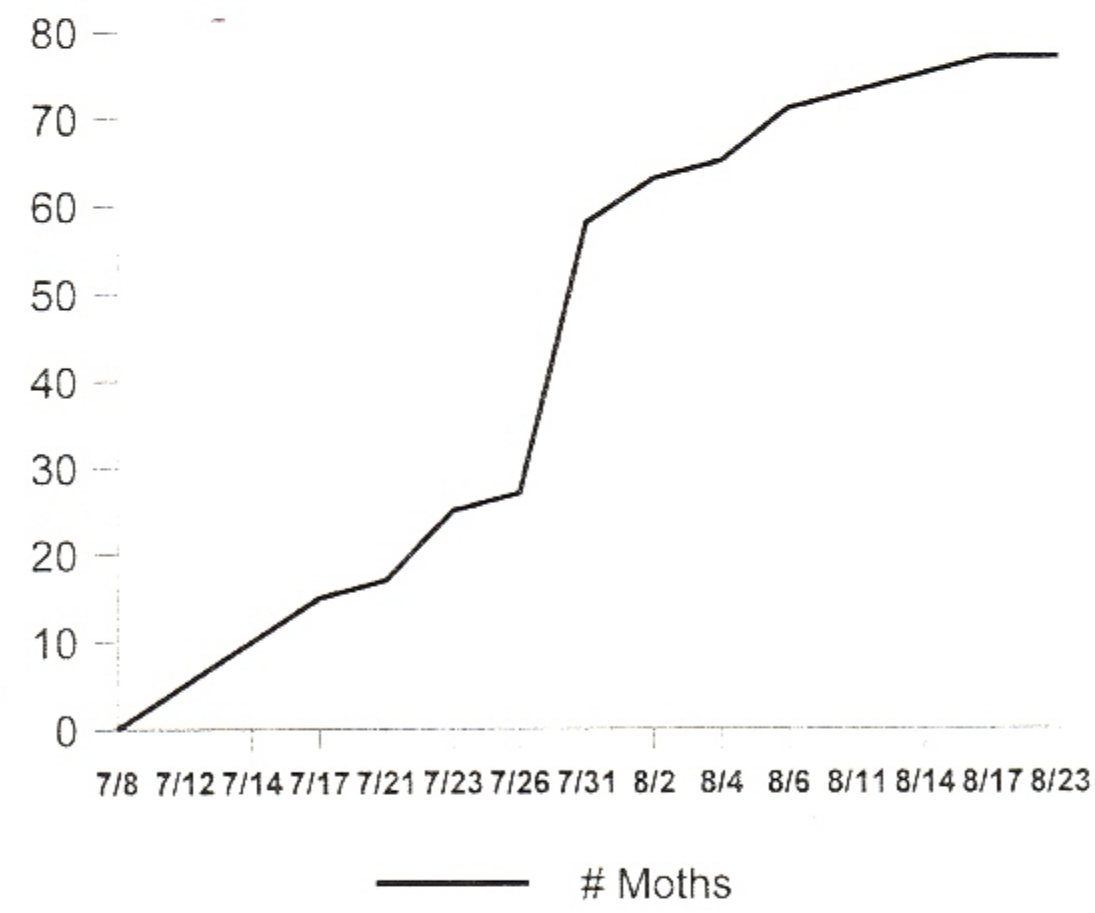


Figure 12. Cumulative number of forest tent caterpillar moths caught in 2002 in a Luminoc trap in Hyde Park containing a blacklight and a pheromone lure. Growing degree days (base 50) for moth catch were 800 to 1275.

Gypsy Moth, *Lymantria dispar*, populations decreased in Addison County this year, after causing noticeable defoliation in a few small areas last year. Elsewhere, populations appeared to be stable at very low levels. Individual egg masses were observed in the spring, and occasional larvae in the summer. Egg mass counts from focal area plots remain low, with an average of 0.6 egg mass per plot (Figures 13-14). Also, a few egg masses were found in control plots. Fewer adult males than usual were seen flying this summer. Populations are expected to remain low in 2003.

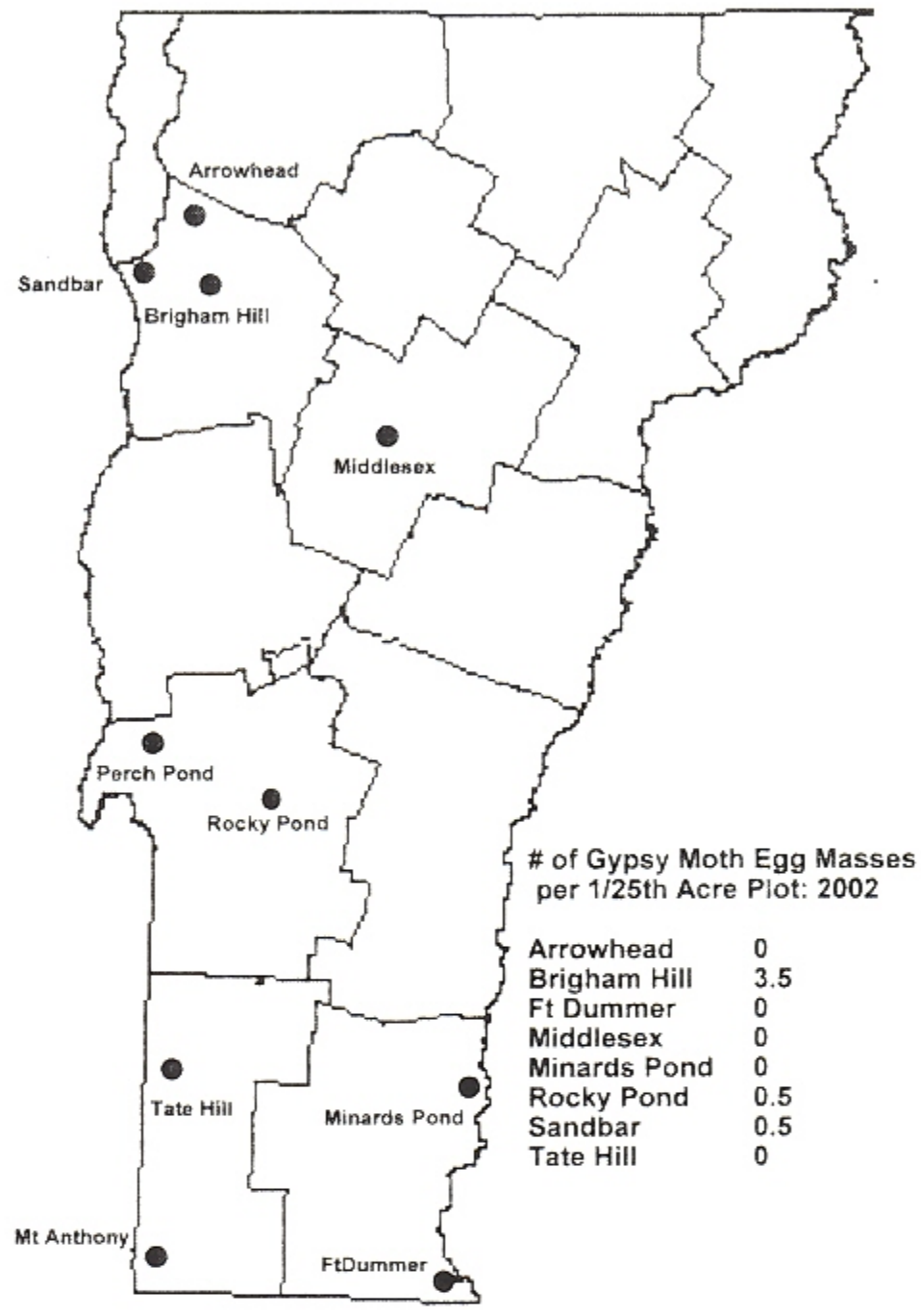


Figure 13. Gypsy moth egg mass counts from focal area monitoring plots, 2002. Average of two 15 meter diameter burlap-banded plots per location.

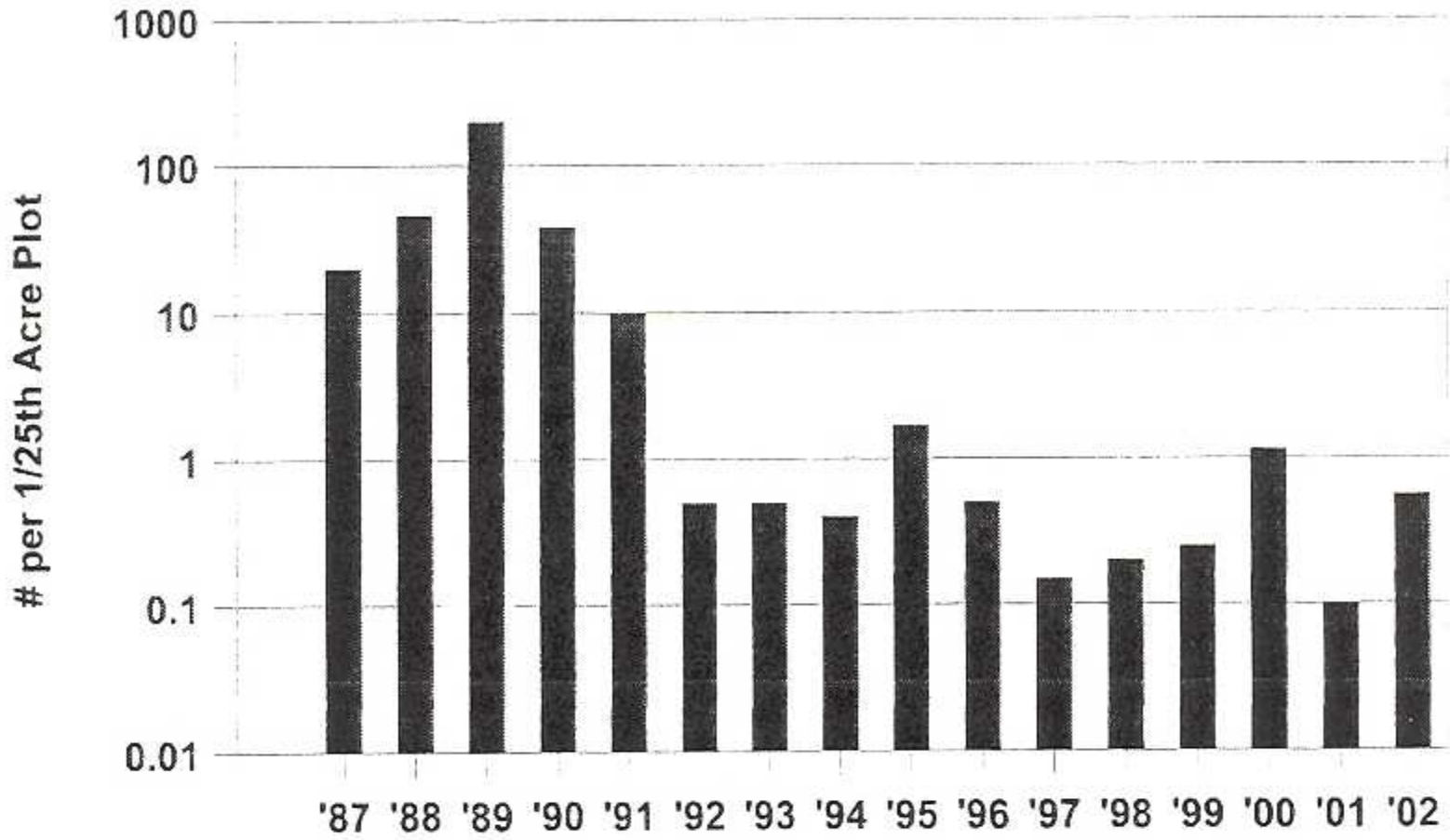


Figure 14. Gypsy moth egg mass counts from focal area monitoring plots, 1987-2002. Average of ten locations, two 15m diameter burlap-banded plots per location.

Maple Leaf Cutter, *Paraclemensia acerifoliella*, defoliation of sugar maple was widespread but less noticeable than previous years. Damage was variable, but mostly light. Some browning was observed as early as mid-July. In all, 5,954 acres of damage were mapped during aerial surveys compared to 23,634 acres in 2001 (Table 3). Most of these areas were <30 acres in size. One sugarbush in Cabot received moderate defoliation. Heavier damage was also reported from Bennington County.

Table 3. Mapped acres of damage by maple leaf cutter in 2002.

County	Acres
Addison	2,585
Bennington	219
Caledonia	600
Chittenden	694
Franklin	223
Lamoille	59
Orange	693
Orleans	105
Rutland	82
Windham	439
Windsor	255
Total	**5,954**

Saddled Prominent, *Heterocampa guttivata*, populations remain very low. No defoliation of sugar maple was detected. Pheromone traps caught an average of only 0.05 moths per trap, the fewest moths caught since we initiated trapping in 1999 (Figure 15). Just one moth was caught (Cabot).

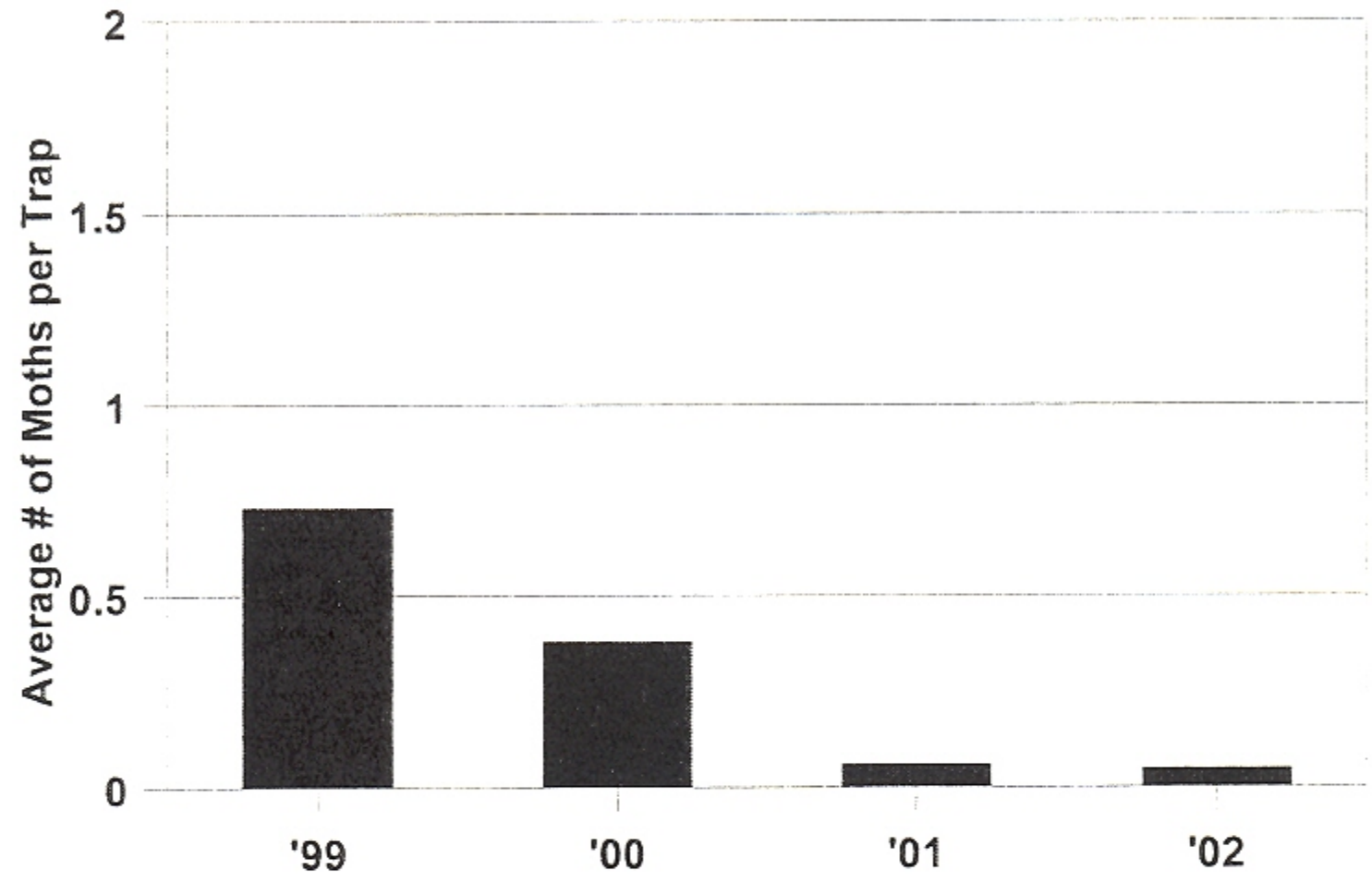


Figure 15. Average number of saddled prominent moths caught in pheromone traps 1999 - 2002. Average of 3-4 multi-pher traps per location, and 5-6 locations per year.

OTHER HARDWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Alder Leaf Beetle *Altica ambiens alni*	Speckled Alder	Essex County	Scattered light damage. Decreasing
American Dagger Moth *Acronicta americana*			Not reported
Apple-And-Thorn Skeletonizer *Choreutis pariana*	Hawthorn	Monkton	Ornamental
Birch Leaf Folder *Ancylis discigerana*	Yellow Birch Paper Birch	Lamoille County, Stockbridge & Bethel	Common at light levels

OTHER HARDWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Birch Leaf Miner *Fenusa pusilla*			See narrative
Birch Sawfly *Arge pectoralis*	Birch European White	Swanton	Heavy on ornamental white birch
Birch Skeletonizer *Bucculatrix canadensisella*			See narrative
Bruce Spanworm *Operophtera bruceata*			See narrative
Cherry Scallop Shell Moth *Hydria prunivorata*	Black Cherry	Stowe Killington	Heavy on trees
Dogwood Sawfly *Macremphytus tarsatus*	Dogwood	Burlington	Ornamental
Early Birch Leaf Edgeminer *Messa nana*			See narrative on Birch Defoliation
Eastern Tent Caterpillar *Melacosoma americanum*	Cherry Apple	Throughout	Increasing populations
Elm Leaf Beetle *Altica ulmi*	Elm	Derby	Heavy defoliation
Elm Leaf Beetle *Pyrrhalta luteola*	Elm	Orleans County St. Albans	Scattered heavy defoliation
Elm Leaf Miner *Fenusa ulmi*			Not reported
Elm Sawfly *Climbex americana*	American Elm	Woodbury	Larva
European Snout Beetle *Phyllobius oblongus*	Sugar Maple Red Maple Many Others	Widespread in Northern Vermont	Much more common than in the past. Some scattered heavy damage
Fall Cankerworm *Alsophila pometaria*			Not reported

OTHER HARDWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Fall Webworm *Hyphantria cunea*	Cherry	Throughout	Locally heavy populations sharply reduced from recent years in most locations
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
Hickory Tussock Moth *Lophocampa caryae*	Red Oak	Springfield	Individual larva
Imported Willow Leaf Beetle *Plagiodera versicolora*	Black Willow	Addison, Chittenden, Franklin & Grand Isle Counties	Some moderate defoliation. Stable populations
Japanese Beetle *Popillia japonica*	Many	Scattered throughout	More common now in northern Vermont. Overall populations were down this year
Large Aspen Tortrix *Choristoneura conflictana*	Quaking Aspen	Connecticut River Valley	Moderate defoliation widespread by late May
		Northeast Kingdom	3005 acres mapped during aerial survey. Generally present at low numbers
Linden Looper *Erannis tilaria*			Not observed
Locust Leaf Miner *Odontata dorsalis*	Black Locust	Widely Scattered	Increasing. 404 acres mapped during aerial survey. Heaviest damage seen in recent years in both historically affected and new locations. Some mortality has occurred

OTHER HARDWOOD DEFOLIATORS

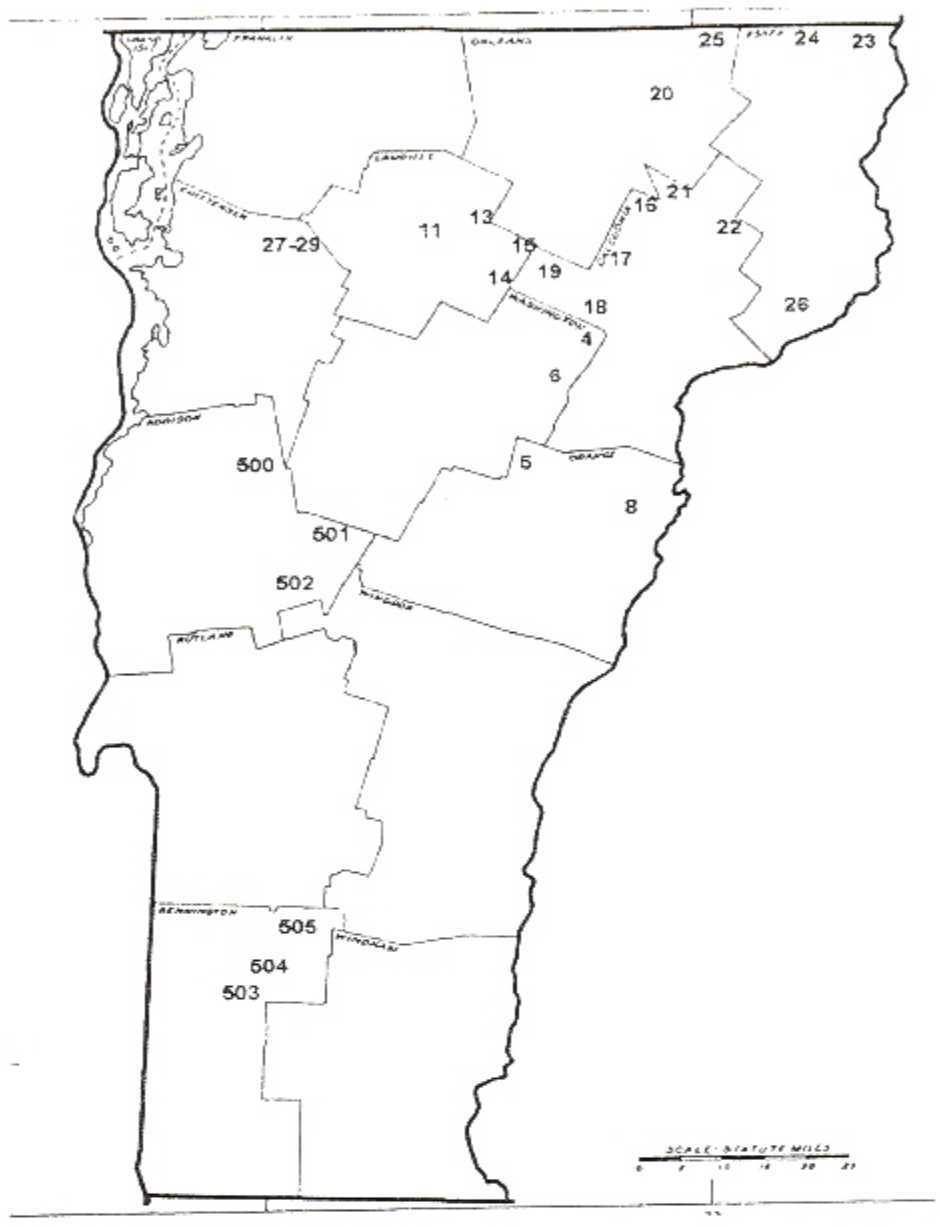
INSECT	HOST(S)	LOCALITY	REMARKS
Maple Basswood Leaf Roller *Sparganothis pettitana*			Not reported
Maple Leaf Cutter *Paraclemensia acerifoliella*			See narrative
Maple Leafblotch Miner *Cameraria aceriella*	Sugar Maple	Stowe Hyde Park	Light damage
Maple Trumpet Skeletonizer *Epinotia aceriella*	Sugar Maple	Widespread	Remaining at light population levels
Maple Webworm *Tetralopha asperatella*			Not reported
Mountain Ash Sawfly *Pristiphora geniculata*	Mountain Ash	Morrisville, Chittenden & Windsor Counties	Decreasing in northern Vermont
Oak Leaf Tier *Croesia semipurpurana*	Red Oak	Chittenden County	Decreasing
Oak Skeletonizer *Bucculatrix ainsliella*	Red Oak	Southern Connecticut River Valley	Widespread light defoliation. Webbing commonly observed in the fall
Orange-humped Mapleworm *Symmerista leucitys*	Sugar Maple	Hyde Park	Single larva
Poplar Hawk Moth *Pachysphinx modesta*	Poplar	Waterbury	Occasional larvae on single tree
Red-humped Oakworm *Symmerista canicosta*			Not reported
Rose Chafer *Macrodactylus subspinosus*	Many	Widely scattered	Generally decreasing damage. Populations variable
Saddled Prominent *Heterocampa guttivata*			See narrative

OTHER HARDWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Satin Moth *Leucoma salicis*	Quaking Aspen Silver Maple Cottonwood	Scattered throughout	Decreasing, but defoliation occasionally heavy
Small-Eyed Sphinx *Paonias myops*	At Large	Walden	Larvae feed on birches, hawthorns, poplars
Spring Cankerworm *Paleacrita vernata*			Not reported
Twomarked Treehopper *Enchenopa binotata*	Butternut	Morrisville	Remains abundant on an ornamental
Uglynest Caterpillar *Archips cerasivoranus*	Cherry	Scattered	A few observed. Populations very low
Viburnum Leaf Beetle *Pyrrhalta viburni*	Viburnum	Morrisville Waterbury	Generally lighter than last year, but some heavy defoliation of ornamentals
White Marked Tussock Moth *Orgyia leucostigma*			Not reported
Willow Flea Beetle *Rhychaenus rufipes*	Black Willow	Addison, Chittenden, Franklin & Grand Isle Counties	Populations increasing

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	2.3
5.	Reservoir	3.3
6.	Marshfield Pd.	2.0
8.	Scotch Hollow	7.0
11.	Centerville	0.3
14.	East Hill WMA	0.0
15.	Bear Swamp	0.7
16.	Withers	10.7
18.	Star School	9.7
19.	Beagle Club	9.3
20.	Brownington Pond	0.0
21.	Calendar Brook	3.3
22.	Chieppo	3.0
23.	Tin Shack	1.3
24.	Norton Cemetery	1.3
25.	Holland Pond	5.7
26.	Victory Bog	2.7
27.	VMC 1400	14.7
28.	VMC 2200	2.3
29.	VMC 3800	12.0
	Average	**4.6**

Figure 16. Spruce budworm pheromone plot locations and average number of moths caught per trap in 2002.

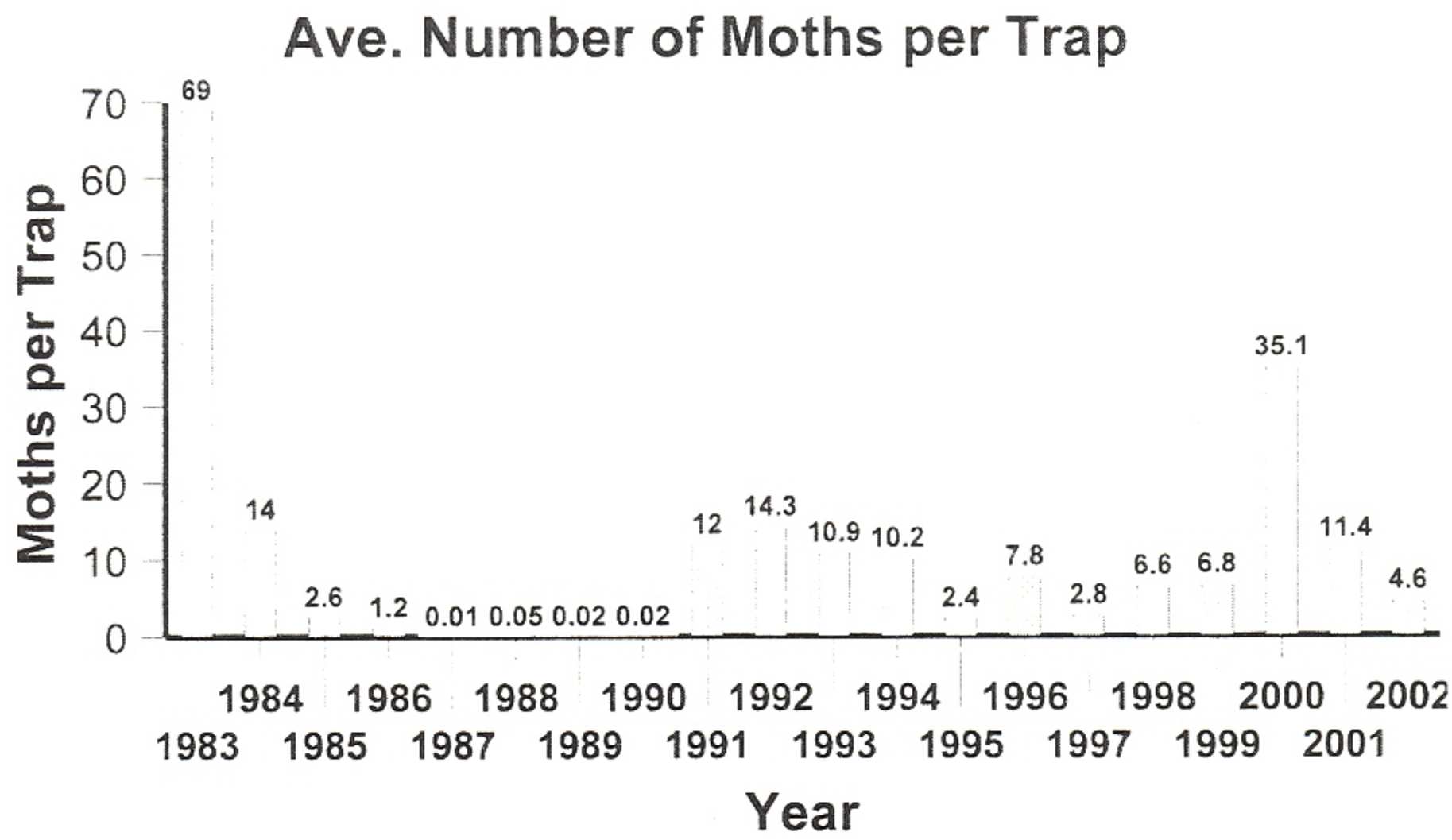


Figure 17. Average number of spruce budworm moths caught in pheromone traps, 1983 - 2002, based on 3 to 5 multi-pher traps per site for 15 to 23 sites.

OTHER SOFTWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Arborvitae Leaf Miner *Argyresthia thuiella*	Northern White Cedar	Washington, Caledonia & Orleans Counties	Scattered light defoliation
Balsam Fir Sawfly *Neodiprion abietis*			Not observed
European Pine Sawfly *Neodiprion sertifer*	Scots Pine	Chittenden County	Decreasing
European Spruce Needle Miner *Taniva albolineana*			Not reported
Fall Hemlock Looper *Lambdina fiscellaria*			Not reported

OTHER SOFTWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS
Green Hemlock Needle Miner *Coleotechnites apicitripunctella*	Hemlock	Throughout	Light damage widespread
Gypsy Moth *Lymantria dispar*	Spruce	Barre	Numerous on individual ornamentals
Introduced Pine Sawfly *Diprion similis*	White Pine	Springfield	Empty pupal cases. Elsewhere, decreasing. No defoliation reported this year after being common at moderate levels in 2000
Larch Casebearer *Coleophora laricella*	Eastern Larch	Orange, Chittenden, Calendonia, Orleans & Rutland Counties	Scattered light to moderate damage
Larch Sawfly *Pristophora ericksonii*			Not reported
Pine False Webworm *Acantholyda erythrocephala*			Not reported
Red-Headed Pine Sawfly *Neodiprion lecontei*			Not reported
Spring Hemlock Looper *Lambdina athasaria*			Not reported
Spruce Bud Moth *Zeiraphera canadensis*	White Spruce	Orleans County	Very light
Spruce Budworm *Choristoneura fumiferana*			See narrative
White Pine Sawfly *Neodiprion pinetum*	White Pine	Danville	Occasional larvae
Yellow-Headed Spruce Sawfly *Pikonema alaskensis*	White Spruce Blue Spruce	Northeast Kingdom, Windsor County	Some trees with heavy damage

SAPSUCKING INSECTS, MIDGES, AND MITES

Balsam Gall Midge, *Paradiplosis tumifex*, populations dropped nearly everywhere after being at heavy levels for the past several years. Only scattered light or moderate damage was observed in Christmas tree plantations, on ornamentals, and on wild balsam fir trees.

Spray trials with two new insecticides, Provado 1.6 and Scimitar GC, were conducted in Craftsbury and Stannard. Although some control was obtained, especially with Scimitar, neither material performed as well as the old standard, Diazinon AG500.

Balsam Twig Aphid, *Mindarus abietinus*, populations were variable. Damage had increased throughout the state in 2001. In southern Vermont, damage remains higher than in other recent years. Moderate damage was commonly found. In northern Vermont, only light levels of damage were observed in Christmas tree plantations in 2002. Several plantations with damage to balsam fir did not have any injury on adjacent Canaan fir.

Hemlock Woolly Adelgid, *Adelges tsugae*, was not observed or known to occur in Vermont, although the insect has moved westward in northern Massachusetts (Charlmont). 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.

Hemlock regeneration was inspected for adelgid in 30 hemlock stands. No signs of adelgid were found (Table 4).

Table 4. Number of southern Vermont hemlock stands inspected for hemlock woolly adelgid in 2002.

County	Town	Number of Stands Inspected
Bennington	Winhall	1
Windham	Brattleboro	3
Windham	Dummerston	7
Windham	Grafton	1
Windham	Guilford	3
Windham	Jamaica	1
Windham	Marlboro	3
Windham	Rockingham	1
Windham	Townshend	3
Windham	Vernon	3
Windsor	Chester	1
Windsor	Springfield	3

Assistance was provided to the University of Vermont for a hemlock woolly adelgid risk assessment project. One aspect of the project is mapping the hemlock forest type in Windham County. The University of Vermont Entomology Lab is continuing its research on fungi which may provide biological control for this insect, including testing field efficacy and potential impacts on non-target predatory insects.

Oystershell Scale, *Lepidosaphes ulmi*, populations on American beech were light in most locations, and dieback was not heavy enough to be detected by aerial survey. Populations of the scale insect in our survey plot in Huntington increased somewhat in 2002, especially for total number of scales (Table 5, Figure 18).

Table 5. Number of oystershell scales on current year beech twigs in Camel's Hump State Forest, 1993-2002[1].

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

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

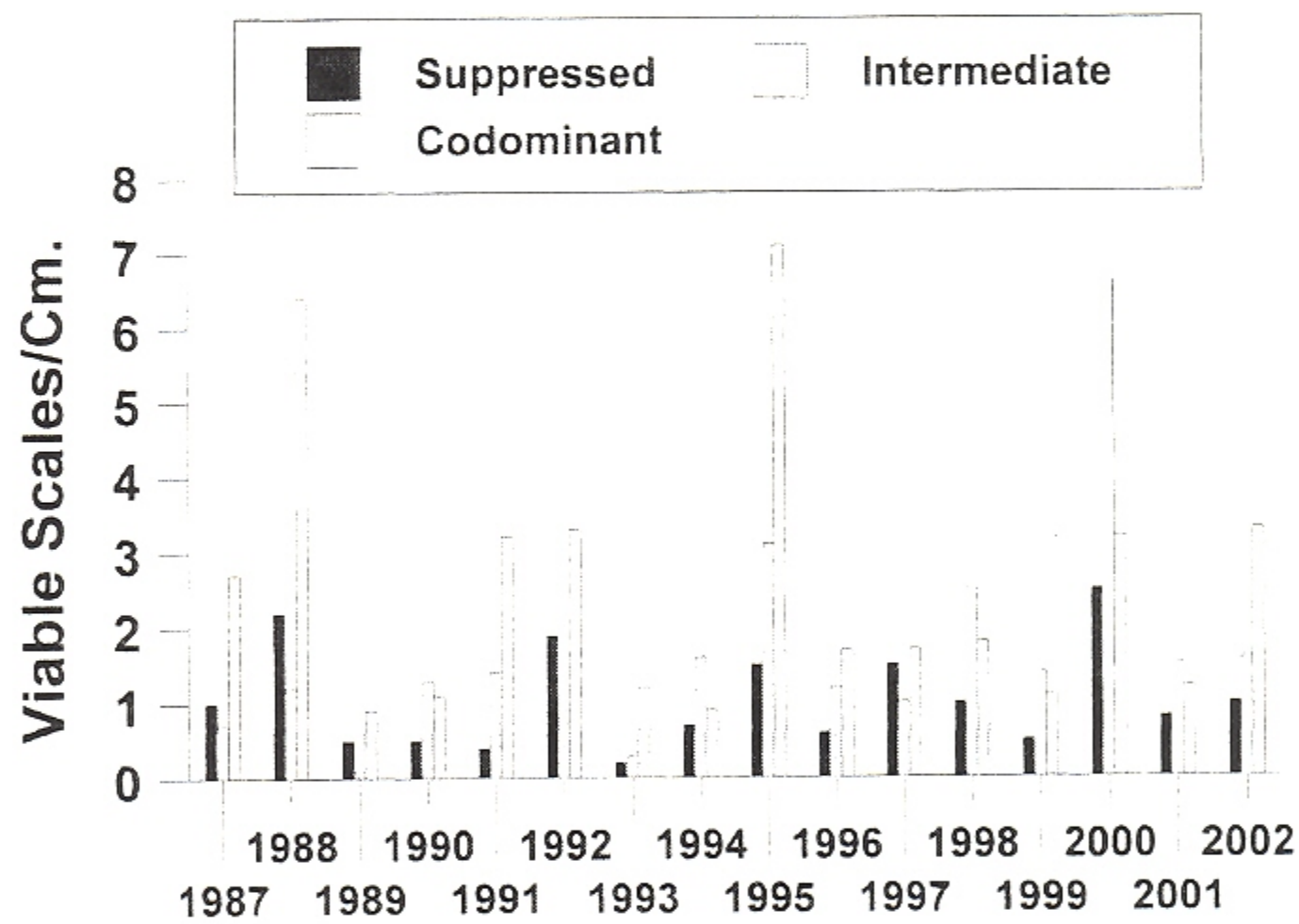


Figure 18. Oystershell scale populations in three tree canopy levels in Camel's Hump State Forest, 1987-2002[1]. Average for 10 current year twigs/tree per crown class, collected in autumn.

Pear Thrips, *Taeniothrips inconsequens*, populations decreased dramatically this year, causing only light damage statewide including scattered injury to sugar maple regeneration. No defoliation was mapped during aerial surveys. Although sugar maple leaf development was very rapid in warmer areas of southern Vermont, going from closed buds to expanded leaves in 3 days, leaf development was slow elsewhere in the state. It was fortunate that there were few adult thrips around to invade the sugar maple buds.

Soil samples collected in the fall of 2001 revealed very few thrips. The average of 0.6 per sample was seven times lower than the population level in 2000 which had led to some heavy damage in 2001. Bud development was so rapid that thrips were counted in the buds of only two sugarbushes. These counts were also lower than 2001 (Figure 19a). Sampling with sticky traps was discontinued in 2002 except at Proctor Maple Research Center (Figure 19b). Soil samples were taken in the fall of 2002, and pear thrips in these samples were counted after forced emergence. The numbers were low statewide, indicating that little damage will occur in 2003 (Figure 20).

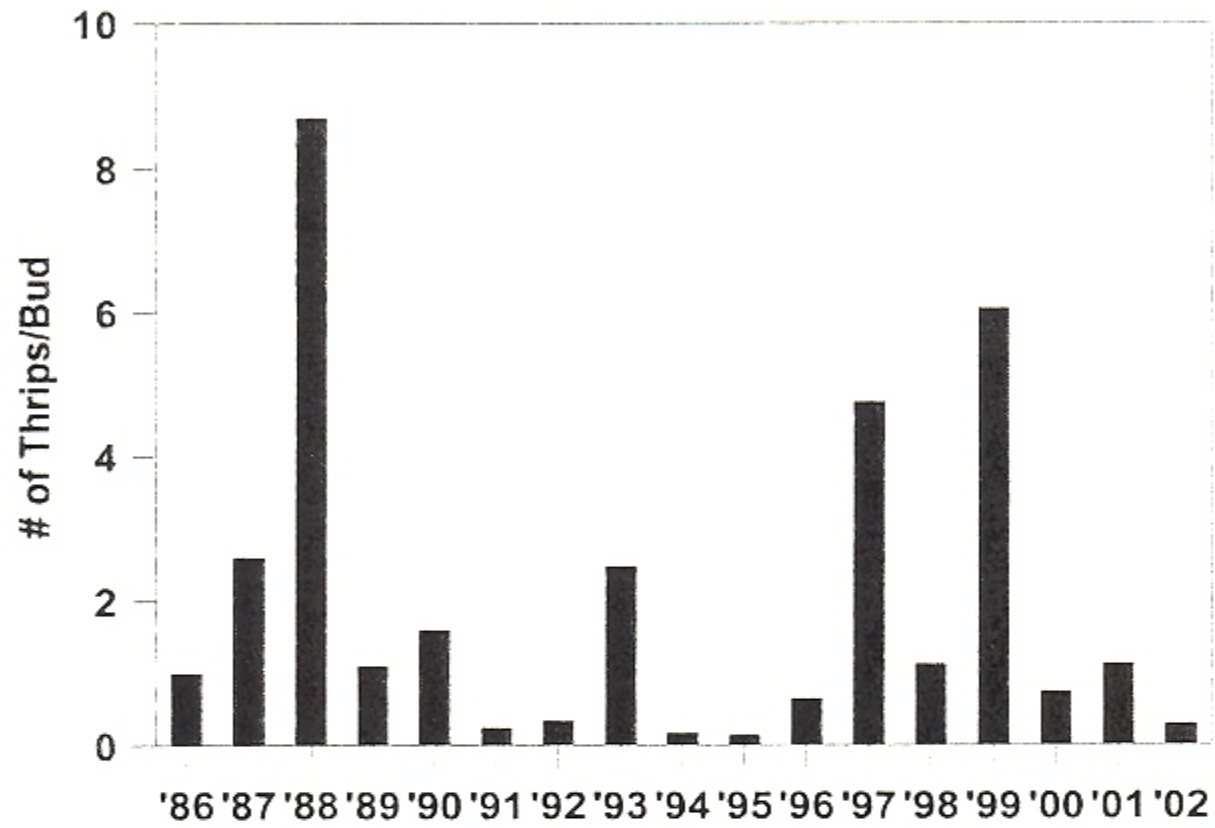


Figure 19a. Spring thrips counts in buds of sugar maple in southern Vermont 1986-2002. Average of 2 sugarbushes in 1986 & 2002, 5-6 sugarbushes 1987-2001 (100 understory buds/sugarbush).

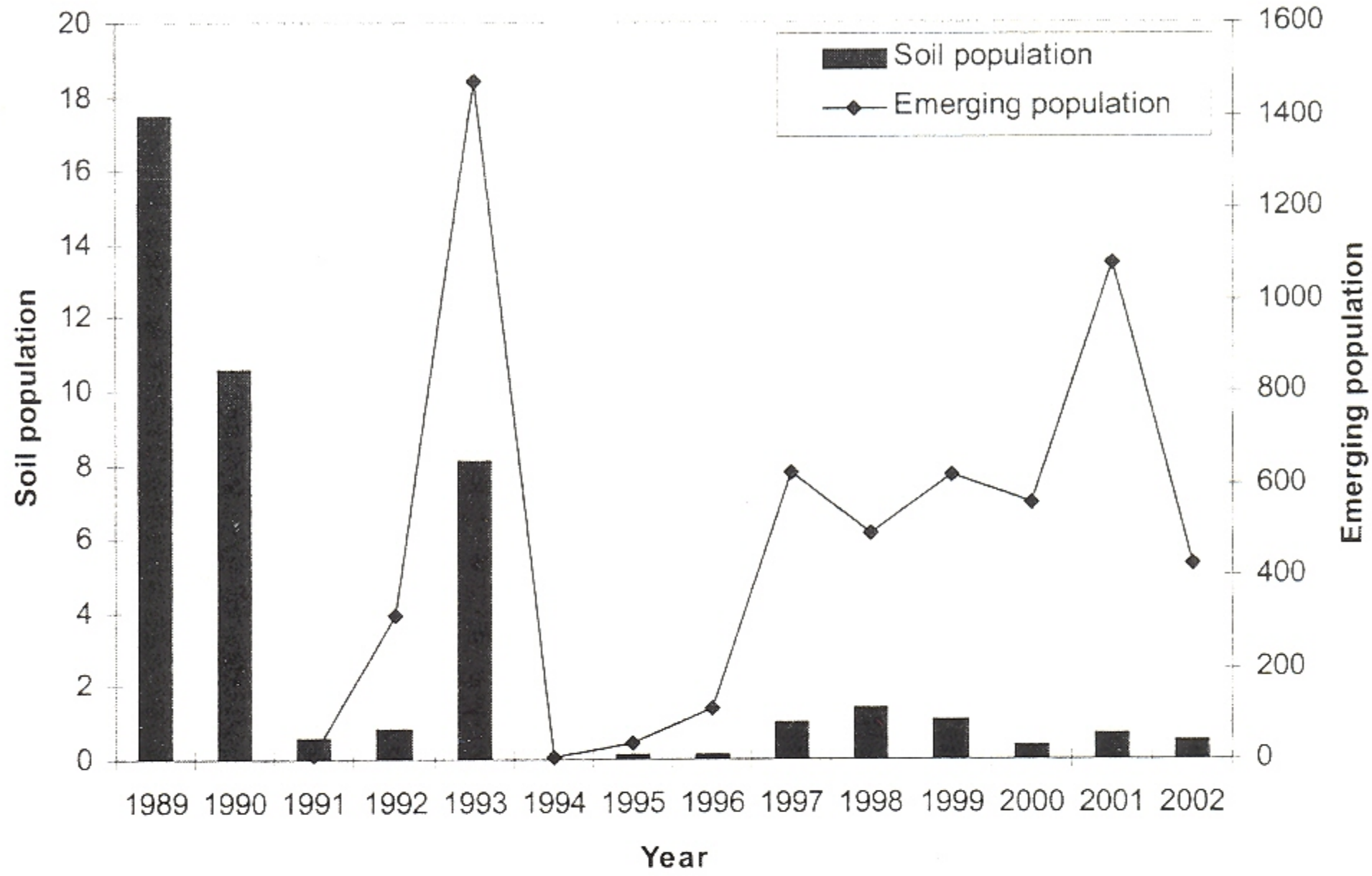


Figure 19b. Thrips counts on Sentry Multiguard sticky traps (6" x 8") caught between 1992-2002 and overwintering soil populations (# insects/16 in^3) in Underhill, sampled 1989-2002.

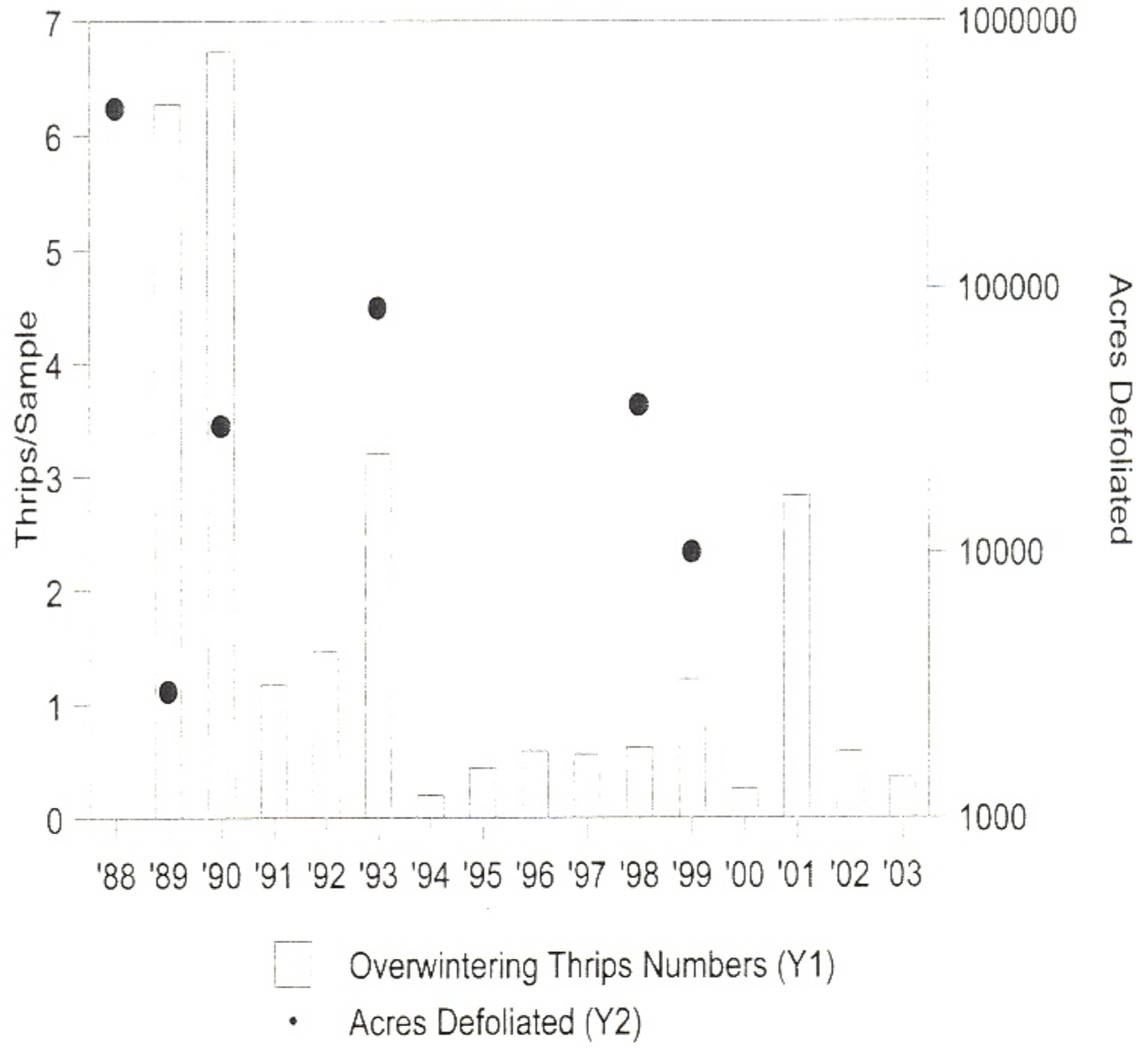


Figure 20. Average counts of overwintering pear thrips in soil samples (# of insects/16 in^3), compared to acres of thrips damage mapped statewide the following summer. Overwintering thrips numbers determined by extraction in 1989-93, and by forced emergence in 1994-2003. 41 sites were sampled to determine populations in winter 2002-2003.

OTHER SAPSUCKING INSECTS, MIDGES, AND MITES

INSECT	HOST(S)	LOCALITY	REMARKS
Aphids *Cinara sp.*	White Pine	Hardwick	On ornamentals
Aphids *Periphyllus sp.*			Not reported

OTHER SAPSUCKING INSECTS, MIDGES, AND MITES

INSECT	HOST(S)	LOCALITY	REMARKS
Adelges *Adelges spp.*	Spruce	Danville	Ornamental
Balsam Gall Midge *Paradiplosis tumifex*			See narrative
Balsam Twig Aphid *Mindarus abietinus*			See narrative
Balsam Woolly Adelgid *Adelges picea*	Balsam Fir	Groton Burke Victory Somerset Killington	Increasing to moderate levels on tree boles
Basswood Lacebug *Gargaphia tiliae*	Basswood	Arlington	Noticeable damage
Beech Blight Aphid *Fagifagus imbricator*	American Beech	Throughout Southern Vermont	Heavy populations on regeneration
Beech Scale *Cryptococcus fagisuga*			See Beech Bark Disease
Blister Mites *Family Eriophyidae*	Pear	Reading	Moderate population on fruit trees
Boxelder Bug *Leptocoris trivittatus*	Boxelder	Throughout	Commonly observed on trees and buildings. Occasional heavy populations
Butternut Erineum Mite *Eriophyes cinerae*	Butternut	Halifax	On ornamental
Cooley Spruce Gall Aphid *Adelges cooley*	Blue Spruce White Spruce Norway Spruce	Widely scattered	Remains common on Christmas trees and occasional ornamentals
Cottony Maple Scale *Pulvinaria innumerabilis*			Not reported
Eastern Spruce Gall Adelgid *Adelges abietis*	White Spruce Red Spruce	Widespread	Remains common on ornamentals and Christmas trees, at mostly light levels

OTHER SAPSUCKING INSECTS, MIDGES, AND MITES

INSECT	HOST(S)	LOCALITY	REMARKS
Hemlock Scale *Abgrallaspis ithacae*	Hemlock	Guilford	Occurring with Hemlock Needle Miner
Hemlock Woolly Adelgid *Adelges tsugae*			See narrative
Honeylocust Plant Bug *Diaphnocoris chlorionis*	Honeylocust	Springfield	Ornamental
Lacebugs *Corythucha sp.*	Elm Yellow Birch Paper Birch	Northern Vermont	Damage was common but was mostly light
Lecanium Scale *Lecanium sp.*	Hardwoods	Addison, Chittenden, Franklin & Grand Isle Counties St. Johnsbury	Light in the Champlain Valley. Heavy on an oak in St. Johnsbury
Maple Spindle Gall Mite *Vasates aceris-crummena*	Sugar Maple Red Maple	Throughout	More widely seen than recent years. Light damage
Oystershell Scale *Lepidospaphes ulmi*			See narrative
Pear Leaf Blister Mite *Phytoptus pyri*	Pear	Reading	Foliage spotting
Pear Thrips *Taeniothrips inconsequens*			See narrative
Pine Fascicle Mite *Trisetacus alborum*	White Pine	Lamoille & Orleans Counties	Light damage on Christmas trees and wild trees
Pine Leaf Adelgid *Pineus pinifoliae*	White Pine	Widely scattered	Was present on 16% of dominant/codominant trees and 33% of all trees in the 2001 White Pine Survey
Pine Needle Midge *Contarinea baeri*			Not reported
Pine Needle Scale *Chionapsis pinifoliae*	Scots Pine	Panton	Heavy damage to ornamentals

OTHER SAPSUCKING INSECTS, MIDGES, AND MITES

INSECT	HOST(S)	LOCALITY	REMARKS
Pine Spittlebug *Aphrophora parallela*	Conifers	Widely scattered	Very light
Potato Leafhopper *Empoasca fabae*	Various	Reading	On numerous hosts
Ragged Spruce Gall Aphid *Pineus similis*	Red Spruce	Widespread	Remains common
Root Aphid *Prociphilus sp.*	Balsam Fir	Shrewsbury	Heavy on individual trees
Rust Mites *Family Eriophyidae*	Beech	Pawlet	Causing noticeable bronzing
Snowball Aphid *Neoceruraphis viburnicola*	Viburnum	Craftsbury	On ornamentals
Spruce Gall Aphid *Adelges lariciatus*			Not reported
Spruce Gall Midge *Mayetiola piceae*	White Spruce	Barre	Moderate on one trees
Spruce Spider Mite *Oligonychus ununguis*	Conifers	Widely scattered	Eggs were numerous going into the season, indicating heavier damage. Widespread damage did not materialize. However, noticeable foliar injury was reported from Townshend and Canaan
Woolly Alder Aphid *Paraprociphilus tessellatus*	Alder	Cambridge	Heavy in one location
Woolly Elm Aphid *Eriosoma americana*		Orleans County	Light

BUD and SHOOT INSECTS

Balsam Shootboring Sawfly, *Pleroneura brunneicornis*, caused mostly light to moderate damage to fir Christmas trees this year compared to very light damage in 2001. This was expected, as damage is higher in even years due to a two-year life cycle for the majority of insects. Adults caught on 3x5 yellow sticky cards placed in mid-crowns of trees in Lamoille County averaged 7.0 per card compared to 0.4 in 2001, 16.6 in 2000, 1.1 in 1999 and 64.0 in 1998. This is fairly reflective of damage levels, as 1998 was by far the year with the heaviest damage. This insect is not expected to be a problem in 2003.

Pine Shoot Beetle, *Tomicus piniperda*, was surveyed for again using Lindgren funnel traps in each of the following counties: Franklin, Lamoille, Chittenden, Washington, Orange, Orleans, and Grand Isle. Beetles were only trapped in Orleans County in 2002, so no new counties were added to the quarantine area of Essex, Orleans, and Caledonia counties.

Preferred trap sites were stressed Scots pine plantings. Where this species was not available, red pine was preferred over white pine. Each of these counties, with the exceptions of Orleans and Grand Isle, had 10 trap sites (Table 5). Grand Isle, because of its small size and few pines, had 5 trap sites.

A single site in Orleans County, which was positive in 2000, was trapped in 2002. This site in northern Orleans County (Derby) was trapped very early (beginning 3/18) to determine first emergence of the beetles. This occurred the week of April 12-19 when the area had 4 days of record high temperatures in the low to mid 80s. A total of 51 adult pine shoot beetles was caught in this trap. The latest any beetles were caught was between June 18 and July 12 (Tables 6-7).

The State of Vermont enacted a Pine Shoot Beetle Quarantine in 2002. However, the compliance agreements that allow shipment of pine logs and bark out of the regulated counties are pending completion of final details. Quarantine regulations will be effective in late 2002 or early 2003. Questions on the quarantine regulations should be directed to the Forestry Division Waterbury Office.

Table 5. Number of sites surveyed for pine shoot beetle with Lindgren funnel traps by county, 1999-2002.

County	Number of Sites Trapped			
	1999	2000	2001	2002
Caledonia	—	10	1	—
Chittenden	—	10	10	10
Essex	7	—	—	—
Franklin	—	10	9	10
Grand Isle	—	—	5	5
Lamoille	—	10	10	10
Orange	—	—	9	10
Orleans	3	8	—	1
Washington	—	10	10	10

Table 6. Summary of Vermont pine shoot beetle surveys with Lindgren funnel traps, 1999-2002.

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

* 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.

Table 7. Number of adult pine shoot beetles caught in Lindgren funnel traps by location and trap date, 1999-2002.

County	Town	1999		2000		2001		2002	
		Trap Dates	# of Adults	Trap Dates	# of Adults	Trap Dates	# of Adults	Trap Dates	# of Adults
Essex	Brighton	27 Apr-12 May	2						
	Canaan	27 Apr-12 May	5						
		26 May-8 June	2						
Orleans	Morgan	27 Apr-12 May	1	2-15 May	1				
	Derby			6-24 April	7			12-19 April	38
				24 Apr-2 May	1			17-31 May	2
				2-5 May	4			31 May-11 June	7
								11-18 June	2
								18 June-12 July	2
	Derby Line			24 Apr-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**		**51**

OTHER BUD and SHOOT INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Azalea Stem Borer *Oberea myops*	Rhododendron	St. Johnsbury	Borer larvae found in stems
Balsam Shootboring Sawfly *Pleroneura brunneicornis*			See narrative
Bud Miner *Tortricidae*	Sugar Maple	Scattered throughout	Common on sugar maple regeneration
European Pine Shoot Moth *Rhyacionia buoliana*			Not reported
Northern Pine Weevil *Pissodes approximatus*			Not reported
Pales Weevil *Hylobius pales*			Not reported
Pine Gall Weevil *Podapion gallicola*	Red Pine	Chester	Some dieback on galled shoots
Pine Root Collar Weevil *Hylobus radicis*	Pine	Milton	
Pine Shoot Beetle *Tomicus piniperda*			See narrative
Twig Pruner *Elaphidionoides villosus*	Red Oak	Widespread	Commonly observed. Twigs dropping by mid-July. Decreasing in northern Vermont
	Sugar Maple	Hartford	Numerous twigs severed
White Pine Weevil *Pissodes strobi*	White Pine	Throughout	First flagging observed later than normal. Stable populations

OTHER BARK AND WOOD INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Allegheny Mound Ant *Formica exsectoides*	Christmas trees	Widely scattered	Light damage
Ambrosia Beetle *Scolytidae*	Hardwoods	Throughout	Occasionally observed
Black Timber Beetle *Xylosandrus germanus*	Bur Oak	Charlotte	Trees had come to nursery from Michigan
Bronze Birch Borer *Agrilus anxius*	Paper Birch Cutleaf Weeping Birch	Brookfield Stowe	Common in Birch plot. Killing ornamentals stressed by recent drought
Brown Spruce Longhorned Beetle *Tetropium fuscum*			Not observed or known to occur in Vermont
Carpenter Ant *Camponotus spp.*	Many	Throughout	Common
Eastern Larch Beetle *Dendroctonus simplex*	Eastern Larch	Widespread	Large increase due to abundance of drought-stressed trees; especially in the Northeast Kingdom
Four-eyed Spruce Bark Beetle *Polygraphus rufipennis*	Norway Spruce	Shaftsbury	Associated with topkill
Hemlock Borer *Melanophila fulvoguttata*	Eastern Hemlock	Addison County	Heavy on droughty sites
Japanese Cedar Longhorned Beetle *Callidiellum rufipenne*			Not observed or known to occur in Vermont
Linden Borer *Saperda vestita*	Lindens	Lowell	Infesting about 45 trees planted along a monastery driveway. Trees stressed by 2001 drought
Locust Borer *Megacyllene robiniae*	Black Locust	Addison, Chittenden, Franklin, Windsor & Grand Isle Counties	Appears stable

OTHER BARK AND WOOD INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Northeastern Sawyer *Monochamus notatus*	Eastern White Pine	Newport	Occasional adults collected during flight time
Pigeon Tremex *Tremex columba*	Beech Sugar Maple	Killington Reading Barre	Adult Emergence holes, associated with decay
Pine Engraver *Ips pini*	Red Pine White Pine	Widely scattered	Remains common on declining trees, especially those stressed by recent drought
Pitch Mass Borer *Synanthedon pini*	Norway Spruce	Shaftsbury Springfield	Incidence high on ornamentals and forest plantation trees
Pitted Ambrosia Beetle *Corthylus punctatissimus*	Sugar Maple		Noticeable mortality of small saplings. Increasing
Red Turpentine Beetle *Dendroctonus valens*	Red Pine White Pine	Bennington Chester Woodstock Hartford	Occasionally observed, sometimes on asymptomatic trees
Round-headed Apple Tree Borer *Saperda candida*	Apple	Danville Charleston	Orchard
Sawyer *Monochamus sp.*	Balsam Fir		Light damage commonly seen on Christmas trees
Sugar Maple Borer *Glycobius speciosus*	Sugar Maple	Throughout	Remains a common cause of defect on slow-growing maples
Whitespotted Sawyer *Monochamus scutellatus*	Various Conifers	Statewide	As has been the case for several years, these beetles are collected as Asian Longhorned Beetle suspects. One specimen was brought to state police by a concerned citizen. Specimens were submitted from over 40 towns
Zimmerman Pine Moth *Dioryctria zimmermanni*			Not reported

ROOT INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Black Vine Weevil *Otiorhynchus sulcatus*	Spruce Hemlock	Brattleboro	Found in litter beneath host
Conifer-Swift Moth *Korsheltellus gracilis*			Not reported
Dog Day Cicada *Tibicen sp.*	Various	Waterbury	Not found on host
Goldsmith Beetle *Cotalpa lanigera*	Poplar	Lyndon	Larvae feed on roots of various hardwoods, adult brightly colored
June Beetle *Phyllophaga spp.*	Many	Throughout	Light adult populations. Some lawn damage reported
Serica sp. *Family Scarabaeidae*	Sugar Maple	Orange Corinth	Found on foliage
Subterranean Cutworms *Family Noctuidae*	Various	Essex Junction	Associated with roots of ornamentals

FRUIT, NUT AND FLOWER INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Asiatic Garden Beetle *Autoserica castanea*	Many Flowers	Lamoille County	Heavy at dusk in early August
Japanese Beetle *Popillia japonica*			See Hardwood Defoliators
Mossy Rose Gall *Diplolepis rosae*	Rose	Barton	
Plum Curculio *Conotrachelus nenuphar*	Apple	Stowe	Adults numerous in early June. Heavier than in 2001
Rose Chafer *Macrodactylus subspinosus*			See Hardwood Defoliators

FRUIT, NUT AND FLOWER INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Say's Blister Beetle *Lytta sayi*	Lupines Honeylocust Flowers	Morrisville Derby	Flowers destroyed
Small Milkweed Bug *Lygaeus kalmii*		Randolph	Invading a house
Western Conifer Seed Bug *Leptoglossus occidentalis*	Conifers	Throughout	Known to feed on conifers but, with the exception of those found feeding on cones of Scotch pine in Bristol, all other specimens were found at large. In Fair Haven, huge numbers were found associated with a house that had cedar siding. Requests for identification were received from over 20 towns

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 8-10.

Table 8. Non-target moths caught in 2002 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)	2
Hesperidae	*Euphyes vestris* (Bdv., 1852)	1
Lymantriidae	*Lymantria dispar* (L., 1758)	713
Noctuidae	*Amphipyra pyramidoides* Gn., 1852 *Idia rotundalis* (Wlk., 1866) *Noctua pronuba* (L.) *Parallelia bistriaris* Hbn., 1818 *Syngrapha rectangula* (W. Kby., 1873) *Zanclognatha ochreipennis* (Grt., 1872)	1 2 1 1 2 1
Sphingidae	*Paonias myops* (J.E. Smith, 1797)	1
Tortricidae	*Olethreutes glaciana* (Mšsch., 1860)	1

Table 9. Non-target moths caught in 2002 in pheromone traps baited with lure for saddled prominent. Data are from 6 locations statewide.

Family	Species (Author)	Total Number Caught
Geometridae	*Besma quercivoraria* (Gn., 1857) *Homochlodes* sp. *Probole amicaria* (H.-S., 1855) *Selenia kentaria* (G. & R., 1867) *Zanclognatha* sp.	1 31 2 1 2
Lymantriidae	*Lymantria dispar* (L., 1758)	21
Noctuidae	*Phlogophora periculosa Gn., 1852* *Zanclognatha laevigata* (Grt., 1872)	1 10
Tortricidae	*Eulia ministrana* (L., 1758)	1
Undetermined microlepidoptera		16
Other undetermined species of moths		14

Table 10. Non-target moths caught in 2002 in pheromone traps baited with lure for spruce budworm. Data are from 21 locations statewide.

Family	Species (Author)	Total Number Caught
Drepanidae	*Eudeilinia herminiata* (Gn., 1857)	2
Geometridae	*Cyclophora pendulinaria* (Gn., 1857) *Dysstroma hersiliata* (Gn., 1857) *Homochlodes* sp. *Lambdina fiscellaria* (Gn., 1857) *Plagodis fervidaria* H.-S, 1854 *Prochoerodes transversata* (Drury, 1770) *Rheumaptera hastata* (L., 1758)	1 3 38 4 1 2 1
Lymantriidae	*Lymantria dispar* (L., 1758)	13
Noctuidae	*Charadra deridens* (Gn., 1852) *Polia detracta* (Wlk., 1857) *Zanclognatha laevigata* (Grt., 1872)	3 1 1
Pyralidae	*Anageshna primordialis* (Dyar, 1907) *Phlyctaenia coronata* (Hfn., 1767)	2 1
Undetermined microlepidoptera		98
Other undetermined species of moths		25

STEM DISEASES

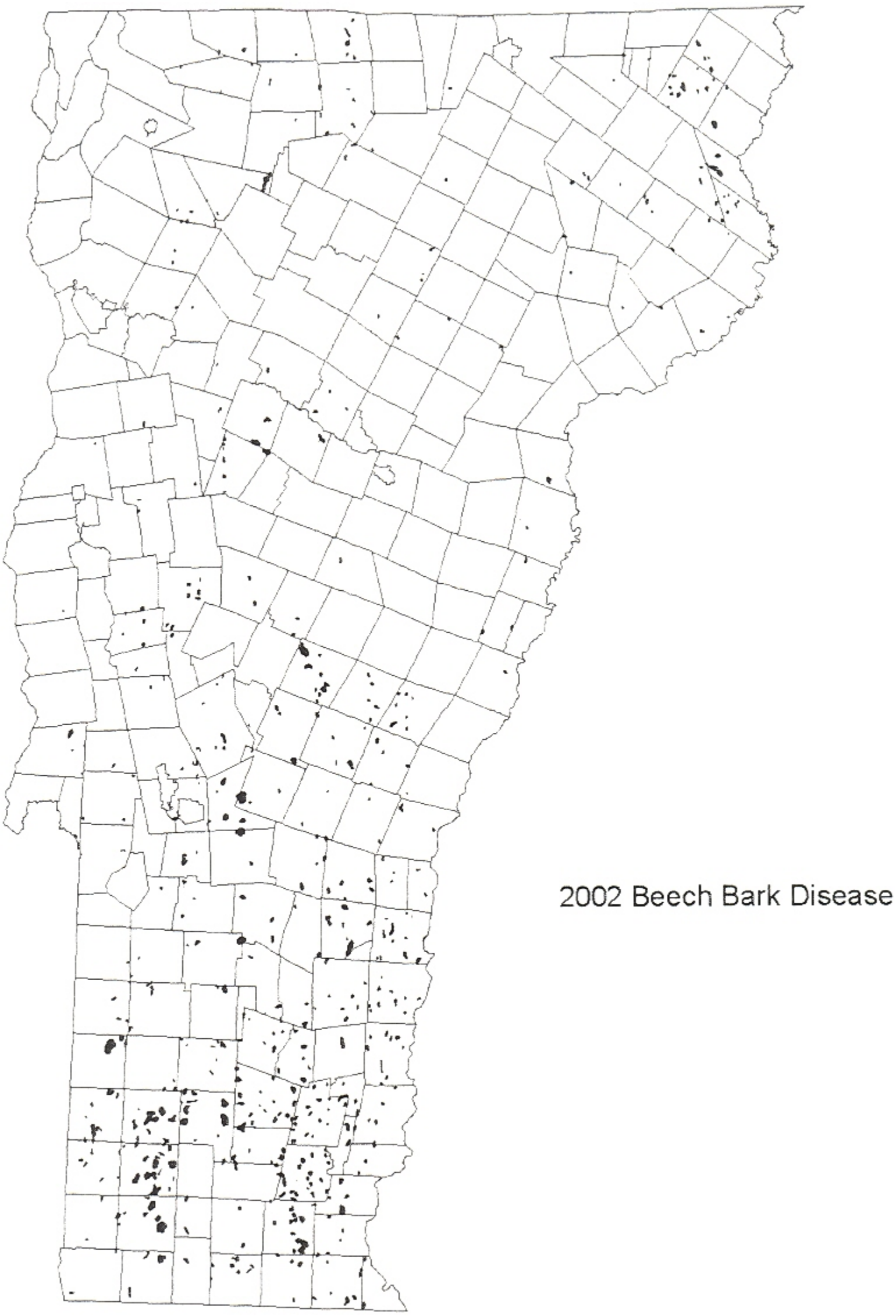
Beech Bark Disease, caused by *Cryptococcus fagisuga* and *Nectria coccinea* var. *faginata*, was more conspicuous than normal during aerial surveys for the second consecutive year due to increases in scale and Nectria and recent droughts (Table 11, Figure 21). The damage is the heaviest from beech bark disease since the killing front went through the state over thirty years ago. Chlorosis and new dieback was noticeable by June.

Some stands have very heavy Nectria fruiting, and large patches of dieback and mortality are beginning to develop. Some of the areas mapped during the aerial survey had over half the trees with visible symptoms, although most had <10% affected. Scale populations were reported to be high on beech saplings and poles on the Green Mountain National Forest.

Tree condition worsened for most sites in monitoring plots (Figures 22-23). Beech scale cover was the heaviest seen in many years in some locations. Scale cover increased in 4 of 8 monitoring plots, dramatically so in one plot in Waterbury. Nectria fruiting increased dramatically in this same plot, but there was little evidence of it in most of the other plots.

Table 11. Mapped acres of damage by beech bark disease in 2002.

COUNTY	ACRES
Addison	1,362
Bennington	13,020
Caledonia	414
Chittenden	324
Essex	2,959
Franklin	1,913
Lamoille	320
Orange	617
Orleans	275
Rutland	5,440
Washington	1,731
Windham	17,762
Windsor	9,822
TOTAL	**55,962**



2002 Beech Bark Disease

Figure 21. 2002 damage by beech bark disease. Mapped area is 55,962 acres.

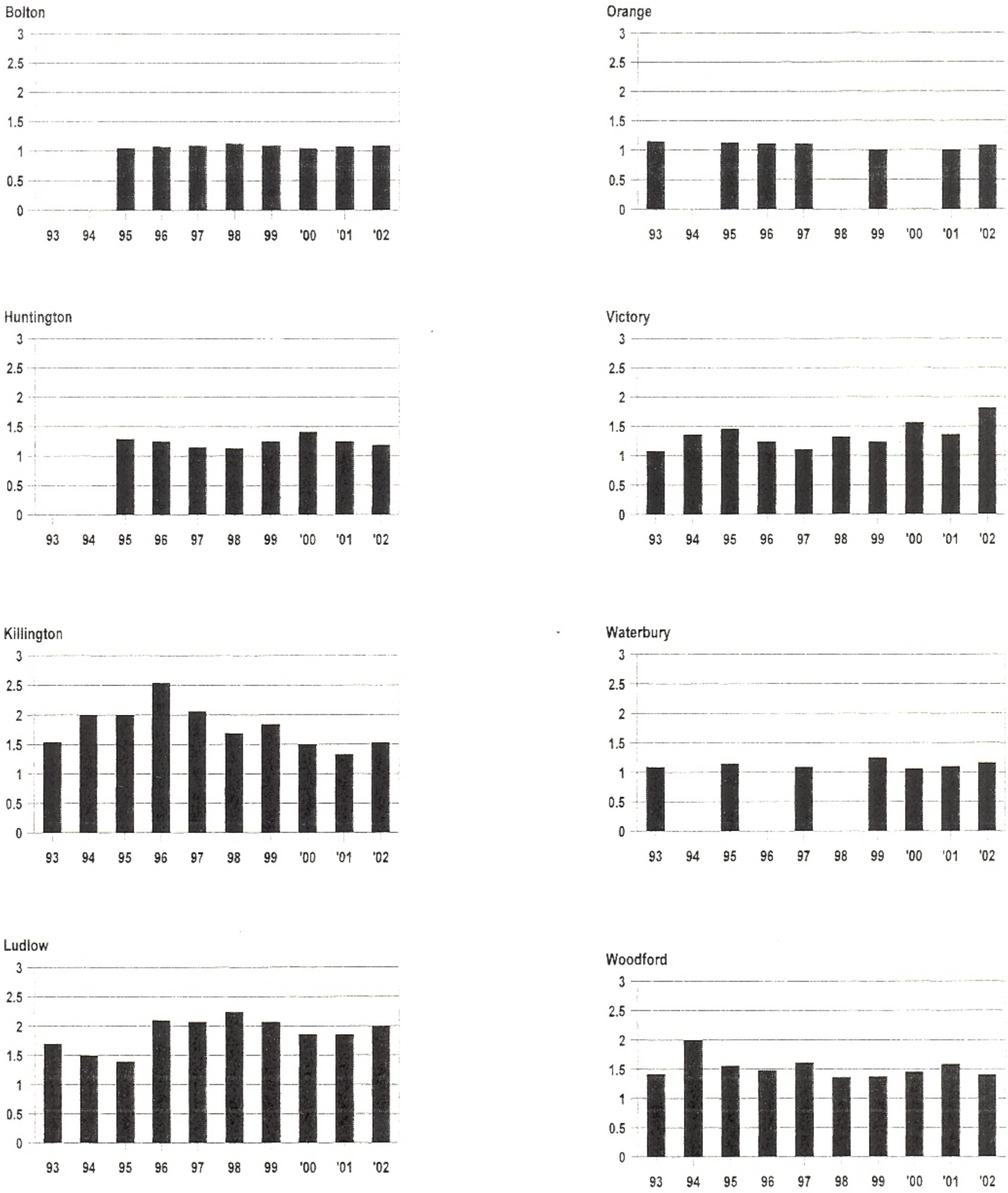
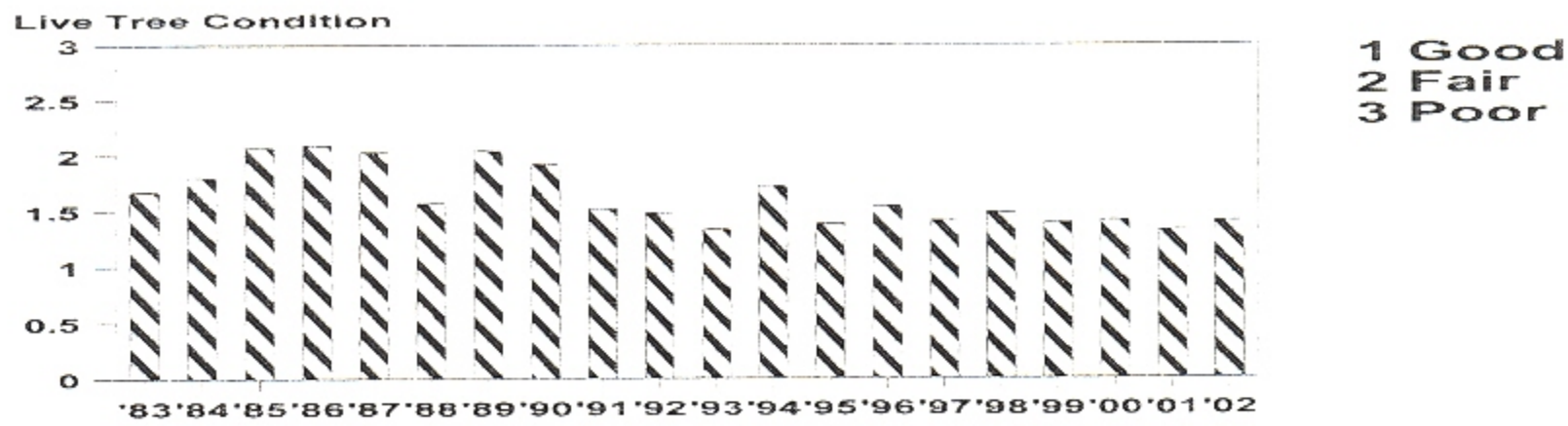
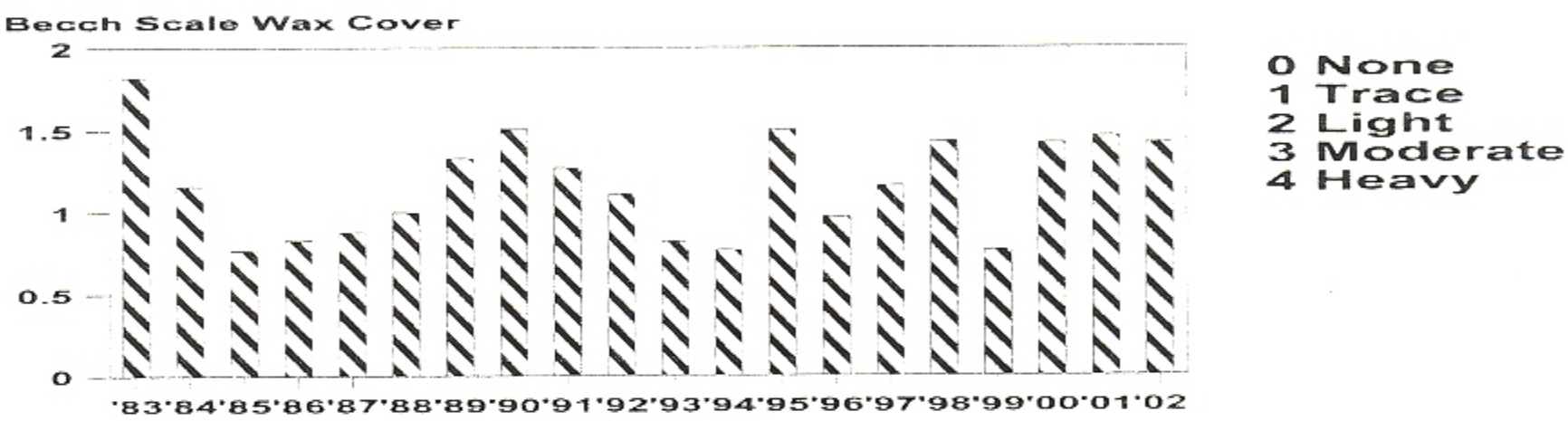


Figure 22. Change in average condition of live trees in eight beech bark disease monitoring plots, 1993-2002. Average of up to 60 surviving trees per plot, coded as 1= good, 2=fair, 3=poor.





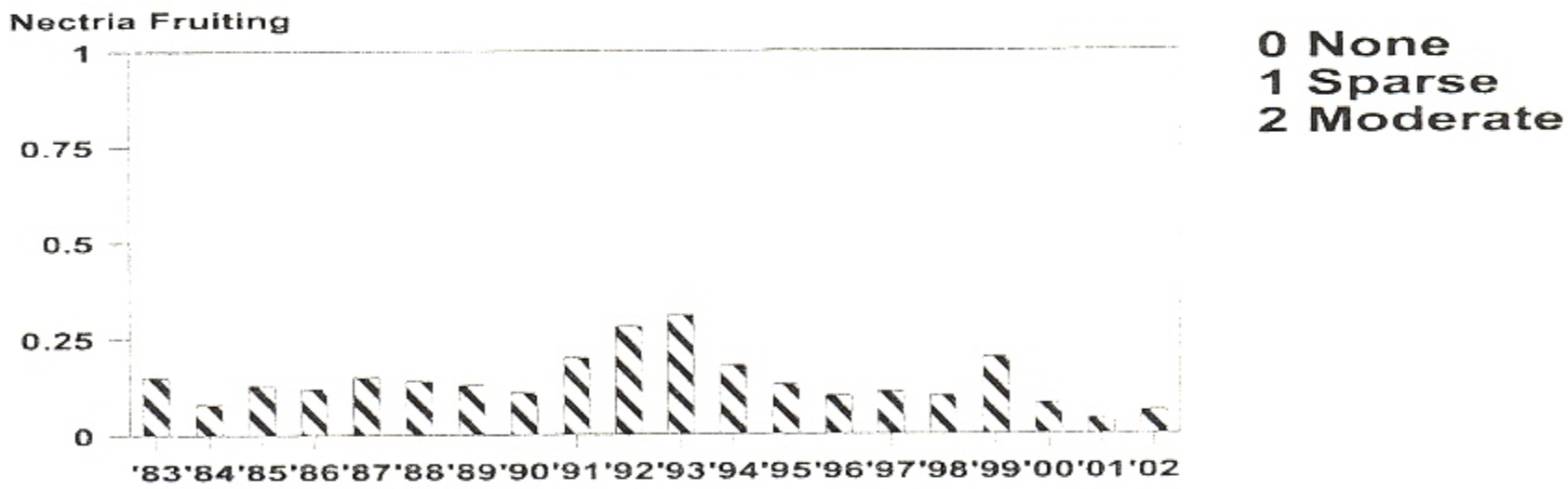


Figure 23. Average live tree condition, beech scale wax cover, and Nectria fruiting ratings, 1983-2001. Average of three southern Vermont locations, 1983-1992, and six to eight locations statewide, 1993-2002.

Butternut Canker, caused by *Sirococcus clavigignenta-juglandacearum* occurs statewide. Uncankered trees are occasionally observed, although rare in any age class. Mortality is common.

The University of Vermont Forest Pathology Lab continues to conduct research related to butternut canker. One project focuses on site factors related to the disease. Work also continues with potential insect vectors. At least 17 species of beetles were found to carry spores. These beetles were often collected from dead butternut stems and branches on which the fungus was fruiting and were occasionally found in crowns of butternut trees where they may be inoculating living and recently dead branches. The butternut curculio, *Conotrachelus juglandis*, was also found creating feeding and oviposition wounds. In artificial inoculation trials, butternut canker could be introduced through these wounds. Additional tests have demonstrated that spores can remain viable for extended periods of time on the exoskeletons and in the digestive tracts and fecal pellets of several beetle species associated with butternut. They conclude that it is highly probable that these beetles are helping to spread this fungus within and between butternut trees.

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

White Pine Blister Rust, caused by, *Cronartuim ribicola,* remains common. In a survey to evaluate the condition of white pine, conducted in 2001, 3 percent of all dominant/codominant trees in mature stands, and 14 percent of trees in regenerating stands, had blister rust.

OTHER STEM DISEASES

DISEASE	HOST	LOCALITY	REMARKS
Annual Canker *Fusarium sp.*			Not reported
Ash Yellows *Mycoplasma-like organism*	White Ash	Widespread	Increase in diagnostic requests in southern Vermont suggests that drought has increased symptoms from this disease
Beech Bark Disease *Cryptococcus fagisuga* and *Nectria coccinea var. faginata*			See narrative
Black Knot *Dibotryon morbosum*	Cherry	Widespread	Heavier than usual. Sporulating galls more commonly observed
Butternut Canker *Sirococcus clavigignenta-juglandacearum*			See narrative

OTHER STEM DISEASES

DISEASE	HOST	LOCALITY	REMARKS
Caliciopsis Canker *Caliciopsis pinea*	White Pine	Scattered	Remains common on smooth-barked trees. Symptoms resembling Caliciopsis cankers were present on 10% of dominant/codominant trees and 16% of young trees in 2001 White Pine Survey
Cedar-Apple Rust *Gymnosporangium juniperi-virginianae*	Red Cedar	Scattered	Galls less visible because of dry conditions
Chestnut Blight *Cryphonectria parasitica*	Chestnut	Windham County Weybride	Remains common on young trees Stable
Cytospora Canker *Leucostoma kunzei*	Blue Spruce Norway Spruce	Widely scattered	Light
Delphinella Tip Blight of Fir *Delphinella balsamae*	Balsam Fir White Fir	Northern Vermont	Decreasing. Mostly at light levels except for moderate damage to balsam fir in Wolcott and white fir in Danville
Diplodia Shoot Blight *Diplodia pinea* *(Sphaeropsis sapinea)*	Balsam Fir Fraser Fir White Pine Austrian Pine Mugo Pine Red Pine	Widespread Shaftsbury	Remains common on Christmas trees. Mostly at light levels except for heavy damage in a Waterbury plantation. Also heavy on ornamentals in Morrisville and Stowe Associated with heavy dieback and decline, in several stands
Dutch Elm Disease *Ceratocystis ulmi*	Elm	Widespread	Stable. Occasional specimen trees remain healthy. Many recently dead elms have been observed
Eastern Dwarf Mistletoe *Arceuthobium pusillum*			Not reported
Fireblight *Erwinia amylovora*	Apple Mountain Ash	Guilford Burlington	Ornamentals

OTHER STEM DISEASES

DISEASE	HOST	LOCALITY	REMARKS
Hypoxylon Canker *Hypoxylon pruinatum*	Aspen	Throughout	Remains a common cause of tree mortality and breakage
Lilac Blight *Pseudomonas syringae*	Common Lilac	Richford	
Maple Canker *Steganosporium spp.*	Sugar Maple	Brattleboro	Dieback on ornamental
Nectria Canker *Nectria galligena*	Hardwoods	Widespread	Stable at low levels
Oak Wilt *Ceratocystis fagacearum*			Not observed or known to occur in Vermont. No suspect areas observed during aerial surveys
Phomopsis Gall *Phomopsis sp.*	Hickory	Putney Rutland Mt. Philo	Galls observed
Red Ring Rot *Phellinus pini*	White Pine	Scattered	Present on 7% of dominant/codominant trees during the 2001 White Pine Survey
Sapstreak *Ceratocystis coerulescens*			Not reported
Scleroderris Canker *Ascocalyx abietina*			See narrative
Sirococcus *Sirococcus strobilinius*	White Spruce	Craftsbury	Light to moderate damage to Christmas trees
Tomentosus Butt Rot *Inonotus tomentosus*		Essex County	Found on trees in a park
Verticillium Wilt *Verticillium albo-atrum*	Sugar Maple	Reading Brattleboro Essex	On recently planted or established ornamentals
White Pine Blister Rust *Cronartium ribicola*	White Pine	Throughout	See narrative

OTHER STEM DISEASES

DISEASE	HOST	LOCALITY	REMARKS
Woodgate Gall Rust *Endocronartium harknessii*	Scots Pine Mugo Pine	Widely scattered	Decreasing in Christmas tree plantations as growers remove heavily-infected trees
Yellow Witches Broom Rust *Melampsorella caryophyllacearum*	Balsam Fir	Throughout	Remains common in Christmas trees at light levels. Down in 2001

FOLIAGE DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Actinopelte Leaf Spot *Actinopelte dryina*	Red Oak	Newfane	
Anthracnose *Glomerella spp.* *Apiognomonia spp.* *Gloeosporium spp.*	Hardwoods	Throughout	Spring conditions were good for infection, but mostly light, spotty damage was observed. Anthracnose may have played a role in symptoms attributed to "frost" or "drought." Heavy on an oak in Morrisville
Apple Scab *Venturia inaequalis*	Apple Crab Apple	Throughout	Heavier than in 2001 in most locations
Balsam Fir Needlecast *Lirula nervata*			Not reported
Brown Spot Needle Blight *Scirrhia acicola* *Mycosphaerella dearnessii*	White Pine	Hyde Park Charlotte	Still visible at light levels on trees heavily infected in past years. Decreasing
Cedar-Apple Rust *Gymnosporangium spp.*	Hawthorn Crabapple	Scattered	Spots by mid-July
Coccomyces Leaf Spot *Blumeriella jaapii*	Black Cherry	Lamoille	Very light damage seen. Decreasing
Cyclaneusma Needlecast (formerly Naemacyclus) *Cyclaneusma minus*	Scots Pine	Throughout	Remains common in Christmas trees but mostly at light levels
Dogwood Anthracnose *Discula destructiva*	Flowering Dogwood	Brattleboro Rockingham	No dogwood remains on some infected sites
Fir Fern Rust *Uredinopsis mirabilis*	Balsam Fir	Widespread	Mostly light damage to Christmas trees
Frogeye Leafspot *Botryosphaeria obtusa*	Apple	Guilford	
Giant Tar Spot *Rhytisma sp.*			See Tar Spot

FOLIAGE DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Lophodermium Needlecast *Lophodermium seditiosum*	Scots Pine	Scattered	Remains common in Christmas trees but mostly at light levels
Poplar Leaf Blight *Marssonina spp.*		Widely scattered	Remained light this year
Powdery Mildew *Eryiphaceae*	Hardwoods	Rockingham	Observed in early summer
	Paper Birch	Caledonia County	Looked similar to lacebug damage but was powdery mildew under the microscope
	Norway Maple		
Erysiphe polygoni	Shadbush	Newfane	
Rhabdocline Needlecast *Rhabdocline pseudotsugae*			Not reported
Rhizosphaera Needle Blight *Rhizosphaera pini*	Balsam Fir	Northern Vermont	At light levels in scattered locations. Decreasing
Rhizosphaera Needlecast of Spruce *Rhizosphaera kalkhoffi*	Blue Spruce White Spruce	Throughout	Common but at mostly light levels. Many infected ornamentals are thin-crowned
Sooty Mold *Perisporiacae*	Balsam Fir	Scattered	Associated with balsam twig aphid in Christmas tree plantations
Swiss Needlecast *Phaeocryptopus gaeumannii*	Douglas Fir	Widely scattered	Some moderate to heavy infection continues in Christmas tree plantations
Sycamore Anthracnose *Gnomonia platani*	Sycamore	Widespread	Heavy in 2002 wherever sycamore occurs
Tar Spots *Rhytisma spp.*	Sugar Maple Red Maple Silver Maple	Widespread	Common. Small tar spot *(R. punctatum)* very noticeable on sugar maple late in the year
	Norway Maple	Southern Vermont	Giant Tar Spot remains common. Defoliation mostly light

FOLIAGE DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Walnut Downy Leaf Spot *Microstroma juglandis*	Walnut	Panton	
White Pine Needle Blight *Canavirgella banfieldii*	White Pine	Widely scattered	Increasing. Mostly light to moderate infection levels in Christmas tree plantations. Heavy in Milton on hedgerow trees. See abiotic diseases

ROOT DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Annosus Root Rot *Heterobasidion annosum*	Red Pine	Peacham	Found on dying trees stressed by drought
Brown Cubical Root Rot *Polyporous schweinitzii*	Hemlock	Springfield	Young hedge
Dead Man's Fingers *Xylaria sp.*	Honeylocust	Springfield	Declining ornamental
Phytopthora Root Rot *Phytophthora spp.*	Fraser Fir	Brownington	Thought to be the cause of mortality of newly-planted Christmas trees
Shoestring Root Rot *Armillaria spp.*	Many	Throughout	Rhizomorphs, mycelial fans, or foxfire observed on unhealthy or recently dead forest trees

DIEBACKS, DECLINES AND ENVIRONMENTAL DISEASES

Birch Dieback on paper birch in monitoring plots remained stable. The health of yellow birch improved since the plots were last evaluated in 1999 (Figure 24). Paper birch appears to be more sensitive to stress than yellow birch. This was observed following the 1998 ice storm, when moderate breakage led to more dieback and mortality for paper birch than for other species. Now, we are seeing greater dieback for paper birch following recent drought periods and annual defoliation by insects such as birch leaf miners and birch skeletonizer. Paper birch mortality is especially high for the Brookfield plot, where 28 percent of the trees have died since the plot was established in 1993. This year, the Brookfield plot averaged 27 percent defoliation. The most recent hardwood health survey conducted in 2001 shows a similar trend for birch health, with 88 percent of paper birch healthy and 96 percent of yellow birch healthy compared to 95 percent and 92 percent, respectively, in 1996.

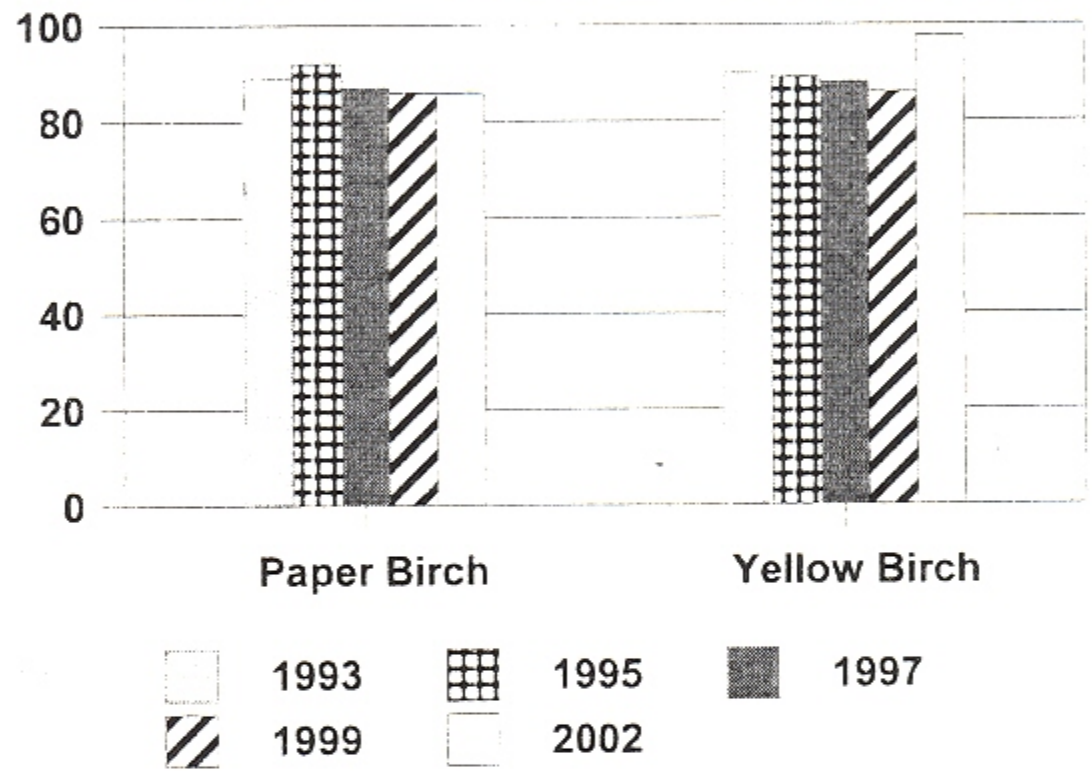


Figure 24. Average percent of live birch trees (5" DBH) with 0-10% dieback in 9 birch monitoring plots 1993-1999 and 7 plots in 2002.

Delayed Chlorophyll Development was widespread due to cold and wet weather after leaves expanded but before green-up. This resulted in a red color to many hillsides into June. Red color was most noticeable on sugar maple, but was reported as well on red maple and cherry. It gradually disappeared after a few weeks with normal amounts of sunshine.

Chlorophyll synthesis requires light, and the process slows down in cool temperatures, as is typical for enzymatically catalyzed reactions.

Drought was the primary forest health concern in 2002. It was the cause of widespread hardwood foliage browning and defoliation which was mapped on 200,123 acres during aerial surveys (Table 12, Figure 25). This was an increase from the 170,408 acres that were mapped in 2001. However, damage developed later and was distributed differently, with the most damage in southern and western counties. The most conspicuous symptoms were on hilltops of the Taconic range in Rutland County, where nearly every ridge or summit was orange by late August. In contrast, the 2001 drought occurred in early to mid-August and was heaviest in the Champlain Valley and in Washington, Caledonia and Essex Counties.

Damage was most severe on ridges and hilltops, with northern slopes more severely affected in some areas and southern slopes more severely damaged in others. Some trees dropped their leaves prematurely. No refoliation was observed. Beech, birches, red maple, and sugar maple were the species most severely affected. Symptoms were also common on white ash and hophornbeam and young red spruce.

Tree decline symptoms from the 2001 drought were also noticeable. Chlorosis of white pine foliage was widely reported in the spring. These needles dropped by June and the trees greened up by mid-summer. A few ridgetops with hardwood mortality, 25-100 acres in size, were mapped in Caledonia and Washington Counties. Drought-related mortality of red and Scots pine also occurred in small, widely scattered areas. The pine engraver and turpentine beetle are contributing factors in some of these areas.

Drought also increased damage severity from a number of other stressors. Beech Bark Disease causal agents and symptoms were heavy and widespread. Over half of the trees in some mapped areas had visible symptoms. Widespread browning of paper birch was a combination of drought and defoliation by birch leaf miners and/or birch skeletonizer.

The trees with visible symptoms were generally growing on poor sites, and the impact on timber productivity is expected to be minimal in these areas. However, growth losses are expected on all sites, even on better sites where foliar symptoms were not observed.

Table 12. Mapped acres of foliage symptoms caused by drought in 2002.

County	Acres
Addison	9,642
Bennington	14,983
Caledonia	10,145
Chittenden	7,422
Essex	6,379
Franklin	7,312
Grand Isle	149
Lake Champlain	4
Lamoille	10,962
Orange	15,721
Orleans	12,871
Rutland	41,549
Washington	24,208
Windham	11,543
Windsor	27,234
Total	**200,123**

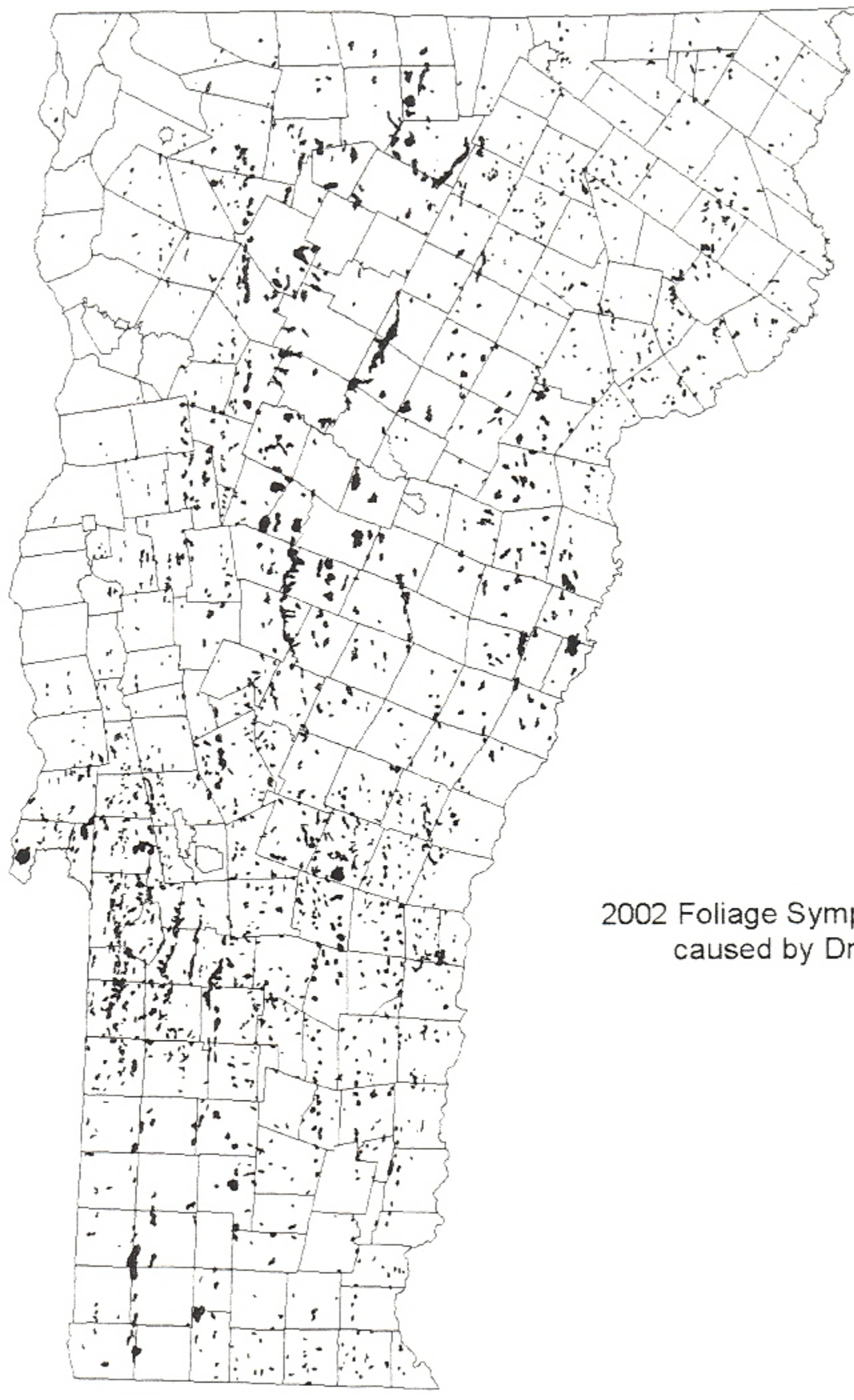


Figure 25. 2002 foliar symptoms cause by drought. Mapped area is 200,123 acres.

Frost damage from temperatures that dropped into the teens and low 20s in some locations on May 20 and May 22 affected Christmas tree plantations in scattered locations statewide. The damage ranged from light to heavy, and affected balsam fir, white spruce, Douglas-fir and blue spruce. Some damaged trees were unmerchantable in December. Little damage was seen to native balsam fir in natural stands.

In southern Vermont, forest and ornamental trees were also affected. Damage was widespread on oak, with some damage to white ash, red maple, sugar maple, and hemlock. Damaged trees soon refoliated.

Hardwood Decline and Mortality was mapped on 1,486 acres, compared to 23,432 acres in 2001 (Table 13). Many of the areas annually mapped as having hardwood decline symptoms, including stands in Sandgate, Glastonbury, and Woodford, had substantial levels of beech bark disease symptoms in 2002. Many of these areas were mapped as beech bark disease this year.

Table 13. Mapped acres of thin crowns, chlorosis, mortality, and dieback on hardwoods in 2002.

County	Acres
Addison	403
Chittenden	48
Essex	65
Franklin	456
Grand Isle	32
Lake Champlain	9
Lamoille	107
Orleans	192
Rutland	7
Windsor	167
Total	**1,486**

Recovery of stands affected by the **Ice Storm of 1998** continues. Some decline is occurring, including damaged sugar maples which leafed out well in spring 2002, but were dead by mid-summer. One research project at the University of Vermont has been examining production of epicormic branches. Beech, hardhack, red oak, paper birch and quaking aspen were among the species with the most epicormic branching. Paper birch and quaking aspen had among the heaviest ice breakage, while beech, oak, and hardhack had much lighter damage.

Larch Decline and mortality is increasing in northeastern Vermont, with many new areas showing decline. It remains visible in small pockets elsewhere that have been stressed by drought and/or larch casebearer. In all, 1,454 acres were mapped, compared to 399 acres mapped in 2001 (Table 14).

Table 14. Mapped acres of larch decline in 2002.

County	Acres
Caledonia	311
Essex	612
Franklin	17
Orleans	515
Total	**1,454**

Ozone Injury on sensitive plant species was assessed as part of the National Forest Health Monitoring Program. In 2002, 15 locations were visited in late summer, when ozone symptoms are at their peak. Symptoms of ozone injury were recorded at 30% of the sites, but in most cases, few plants exhibited injury. The severity of foliage symptoms was light (<25% of affected leaves with injury) on 2 plots, and moderate (25-50% of affected leaves with injury) on 3 plots. Black cherry plants were most commonly affected in 2002.

Early summer conditions were conducive to development of ozone injury, since adequate moisture was available in May and June. But very hot, dry conditions of late July and early August most likely prevented ozone uptake by plants, since stomata close during stressful environmental conditions. This limited ozone damage to leaves. No symptoms of ozone injury were observed during other routine forest observations of Vermont forests.

Table 15. Location of ozone bioindicator plots visited in 2002 and severity of ozone injury observed. (light=<25% of affected leaves with ozone injury, moderate=25-50% of affected leaves with ozone injury).

Town	Severity of Injury
Underhill	None
Rupert	Moderate
Dover	Moderate
Grafton	None
Springfield	None
Fletcher	Light
Dover	None
Sudbury	None
Ripton	Moderate
Waterford	None
Lunenburg	Light
Newark	None
Groton	None
Bakersfield	None
Hyde Park	None

Spruce-Fir Dieback and Mortality was mapped on 4,103 acres, mostly at upper elevations and in northeastern Vermont (Table 16). Acreage is similar to 2001, when 2,617 acres were mapped.

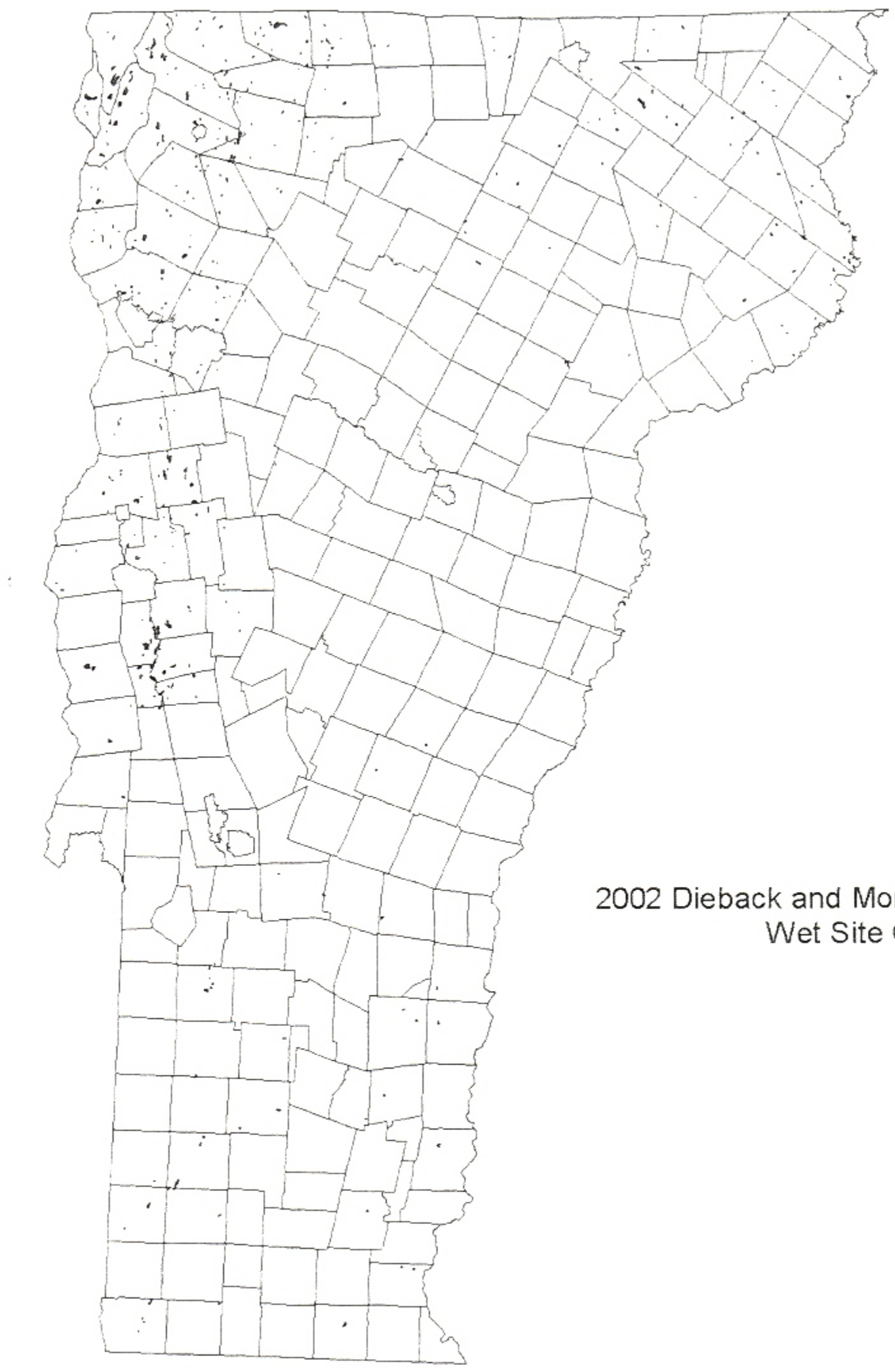
Table 16. Mapped acres of spruce-fir dieback and mortality in 2002.

County	Acres
Bennington	101
Caledonia	5
Chittenden	4
Essex	2,524
Franklin	323
Orange	185
Orleans	385
Rutland	87
Windham	75
Windsor	374
	41
Total	**4,103**

Wet Site conditions continue to contribute to decline and dieback. Symptoms related to the drought conditions of 2001 and 2002 were often most severe on these sites. Dieback attributed to wet site was mapped during aerial surveys on 10,411acres, compared to 9,640 acres in 2001 (Table 17, Figure 26).

Table 17. Mapped acres of dieback and mortality associated with wet site conditions in 2002.

County	Acres
Addison	2,749
Bennington	678
Caledonia	41
Chittenden	816
Essex	695
Franklin	2,253
Grand Isle	1,627
Lake Champlain	29
Lamoille	64
Orleans	729
Rutland	248
Washington	6
Windham	256
Windsor	221
Total	**10,411**



2002 Dieback and Mortality from
Wet Site Conditions

Figure 26. 2002 dieback and mortality associated with wet site conditions. Mapped area is 10,411 acres.

OTHER DIEBACKS, DECLINES, AND ENVIRONMENTAL DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Air Pollution Injury	Oak	Shoreham	Damage appears to be result of pollution from paper mill
Ash Dieback			See Ash Yellows
Birch Decline			See narrative
Delayed Chlorophyll Development			See narrative
Drought			See narrative
Fire Damage	Many	Widely scattered	Small but deep burning fires will result in mortality
Frost Damage			See narrative
Girdling Roots	Norway Maple Sugar Maple Hemlock	Dummerston Ludlow Pittsfield Brandon	Associated with dieback of 20-year old and older ornamentals
Hardwood Decline and Mortality			See narrative
Heavy Seed	Arborvitae Balsam Fir	Widespread	
Herbicide Injury	Sugar Maple	Ludlow	Herbicide in lawn fertilizer
Ice Damage	White Pine and Others	Southern Vermont	Damage from a windy ice storm in early February mostly to white pines and roadside tress
Improper Planting	Many	Throughout	Drought conditions exacerbated planting problems. Trees planted with inadequate root systems or not watered were particularly vulnerable
Larch Decline			See narrative
Maple Decline	Sugar Maple		See Hardwood Decline and Mortality
Mechanical Injury	Ornamentals	Throughout	Common
Norway Spruce Dieback	Norway Spruce	Shaftsbury	Top dieback in several locations ranging from very light to severe. Cause unknown

OTHER DIEBACKS, DECLINES, AND ENVIRONMENTAL DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS
Red Pine Dieback	Red Pine	Shaftsbury	Shoot dieback ranging from light to severe in several locations. Sometimes associated with Sphaeropsis
Salt Damage	White Pine Red Pine	Throughout	Common but much lighter than in 2001 due to fewer snow storms
Snow Damage	White Pine	Northeast Kingdom	Light damage
	Sugar Maple	Franklin County	An early snowstorm this autumn caused havoc in several sugarbushes
	Hardwoods White Pine	Scattered in southern Vermont	Heavy wet snow in late October and early November, when some hardwood leaves were still present caused scattered breakage
Spruce/Fir Dieback and Mortality			See narrative
Wet Site			See narrative
White Pine Needle Blight			Chlorosis of old foliage was widespread, and much heavier than usual early in the growing season. Damaged foliage dropped by mid-summer. Heaviest damage was observed on the same trees which have been affected year after year. See Drought and Other Foliage Diseases
Wind Damage			Damage from a variety of storms was widely scattered, including some heavy damage in Wilmington, Morrisville, Brookfield, Berlin, Williamstown, and Sheldon. Tree susceptibility to windthrow was increased in June because of saturated soil.
Winterburn	Spruce Fir	Northeast Kingdom	Light damage

INVASIVE PLANTS

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

Exotic woody plants known to be invasive were recorded on regeneration plots which were evaluated in 2001 as part of the Vermont Hardwood Health Survey. Exotic shrubs were reported present on 16 of 81, or 20%, or all sites. Buckthorn and honeysuckle were most often reported as "frequent" or "dense" within plots. Sixty percent of subplots had buckthorn present, and 40% had honeysuckle in the plots with exotic shrubs.

OTHER INVASIVE PLANTS

PLANT	REMARKS
Autumn Olive	Becoming invasive on good sites in Bennington County
Burning Bush	Reported as invasive in locations in Grafton, Rockingham, Putney, and Brattleboro
European Buckthorn Glossy Buckthorn	Widespread, particularly in the southern Connecticut and West River Valleys
Gooseberry	Associated with heavy white pine blister rust in a Springfield stand
Hayscented Fern	Statewide. Effect on regeneration is particularly severe in areas with heavy deer pressure
Japanese Barberry	Widespread, reported this year as invasive in forest stands in Newfane, Dummerston, and Springfield
Japanese Knotweed	Widespread, particularly in riparian areas
Oriental Bittersweet	Widespread, reported this year as invasive in forest stands in Pownal, Newfane, and Shaftsbury

ANIMAL DAMAGE

ANIMAL	SPECIES DAMAGED	LOCALITY	REMARKS
Beaver	Many	Widespread	Remains common
Deer	Many	Variable	Browsing worsens the impact of invasive exotic woody plants on forest regeneration. Damage to orchards and hedges
Grosbeak	Norway Spruce White Pine	Chester Brattleboro	Bud damage leading to crooks and multiple leaders
Moose	Fir Maple Birch	Scattered	Heavy damage above 2300 feet elevation in Essex County. Increasing at high elevations in southern Vermont. Damage also observed in Vernon!
Mouse			Not reported
Porcupine	Many	Scattered throughout	Porcupine sightings remain more frequent than in the recent past, and damage is more commonly observed in southern Vermont. Decreasing in northern Vermont
Sapsucker	Birch Hemlock Red Maple Apple Sugar Maple	Throughout	Many homeowner calls
Squirrel	Red Oak	Widespread	Shoot clipping frequently observed as high squirrel numbers harvest acorns
	Maple Tubing	Scattered	Stable

TRENDS IN FOREST CONDITION

To assess the general condition of maple stands, 1600 sugar maples were evaluated as part of the **North American Maple Project.** Their vigor remained similar to previous years, with 92% of the overstory sugar maples rated as healthy. Dieback, transparency, and mortality also remained constant (Figure 27). Summer drought conditions continued to cause thin foliage in some locations, while Bruce spanworm was a factor in others.

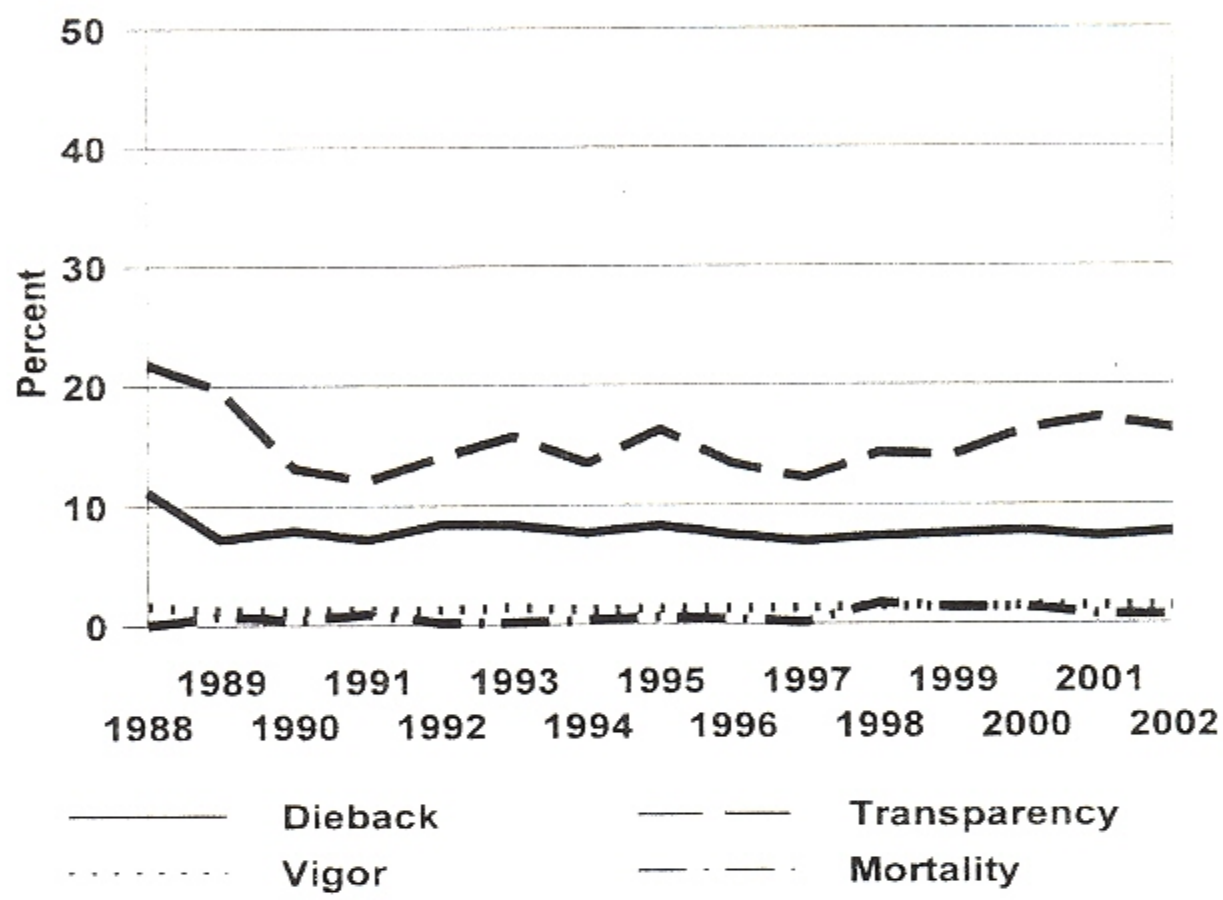


Figure 27. Trend in overstory sugar maple condition on North American Maple Project plots in Vermont, 1988-2002.

Other species evaluated under the North American Maple Project include beech, red maple, yellow birch and white ash (Figures 28-31). Beech trees on these plots remain less healthy than other species, with high average foliage transparency (21%) and dieback (14%). Both yellow birch and white ash crowns show continuing trends towards thinner foliage. Red maple trees appear to be improving over time.

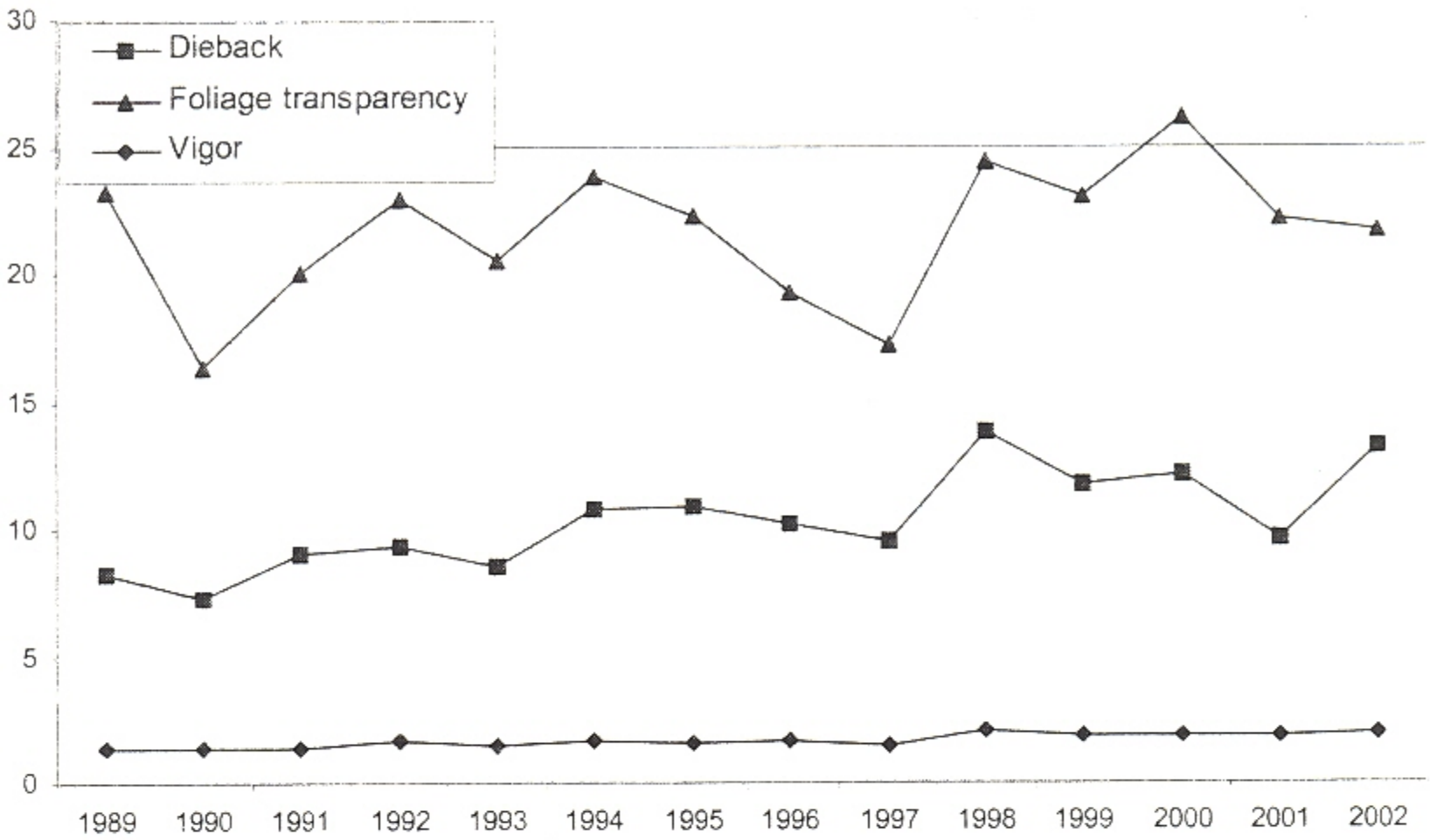


Figure 28. Trend in beech condition on North American Maple project plots in Vermont, 1989-2002.

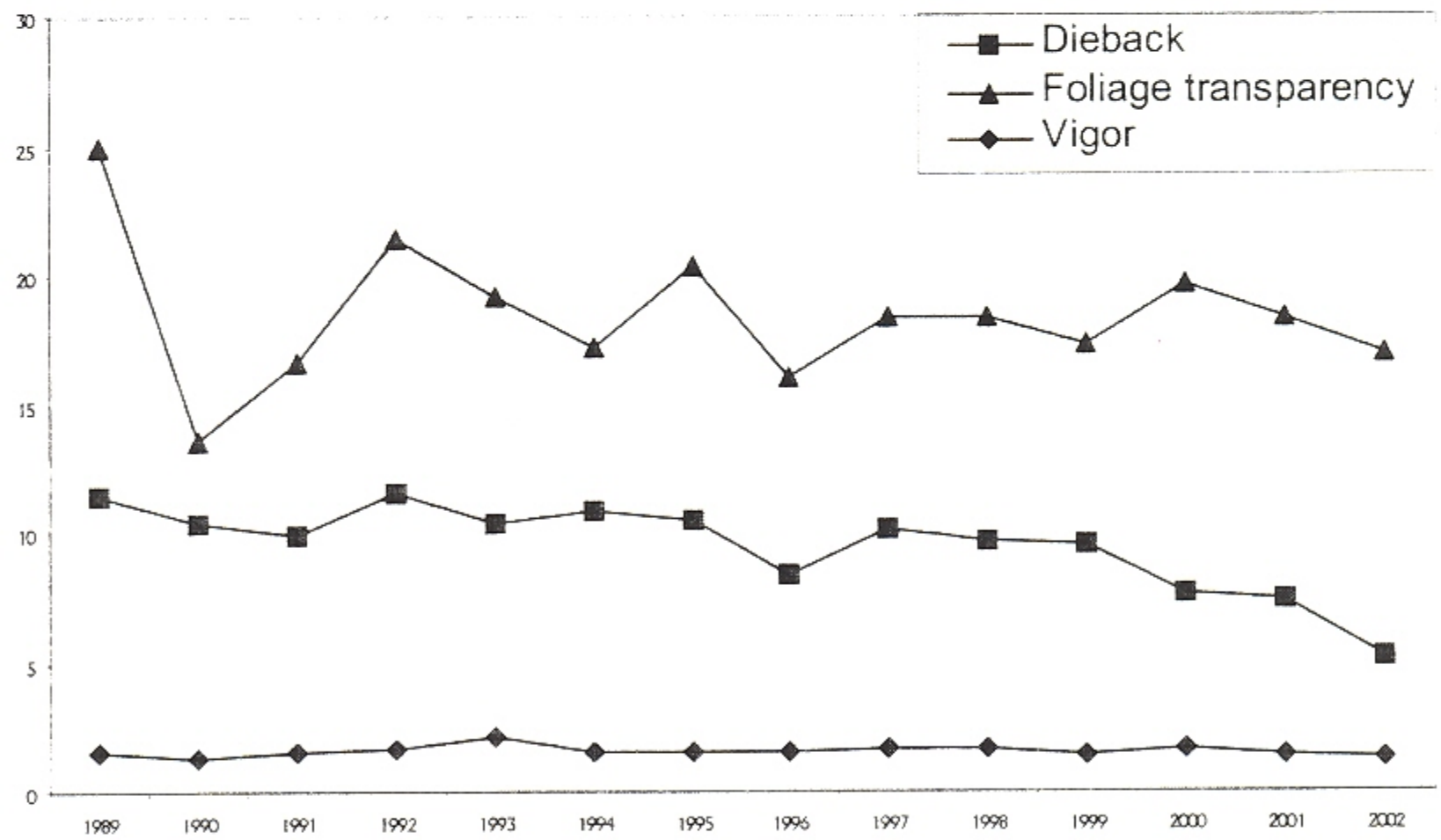


Figure 29. Trend in red maple condition on North American Maple project plots in Vermont, 1989-2002.

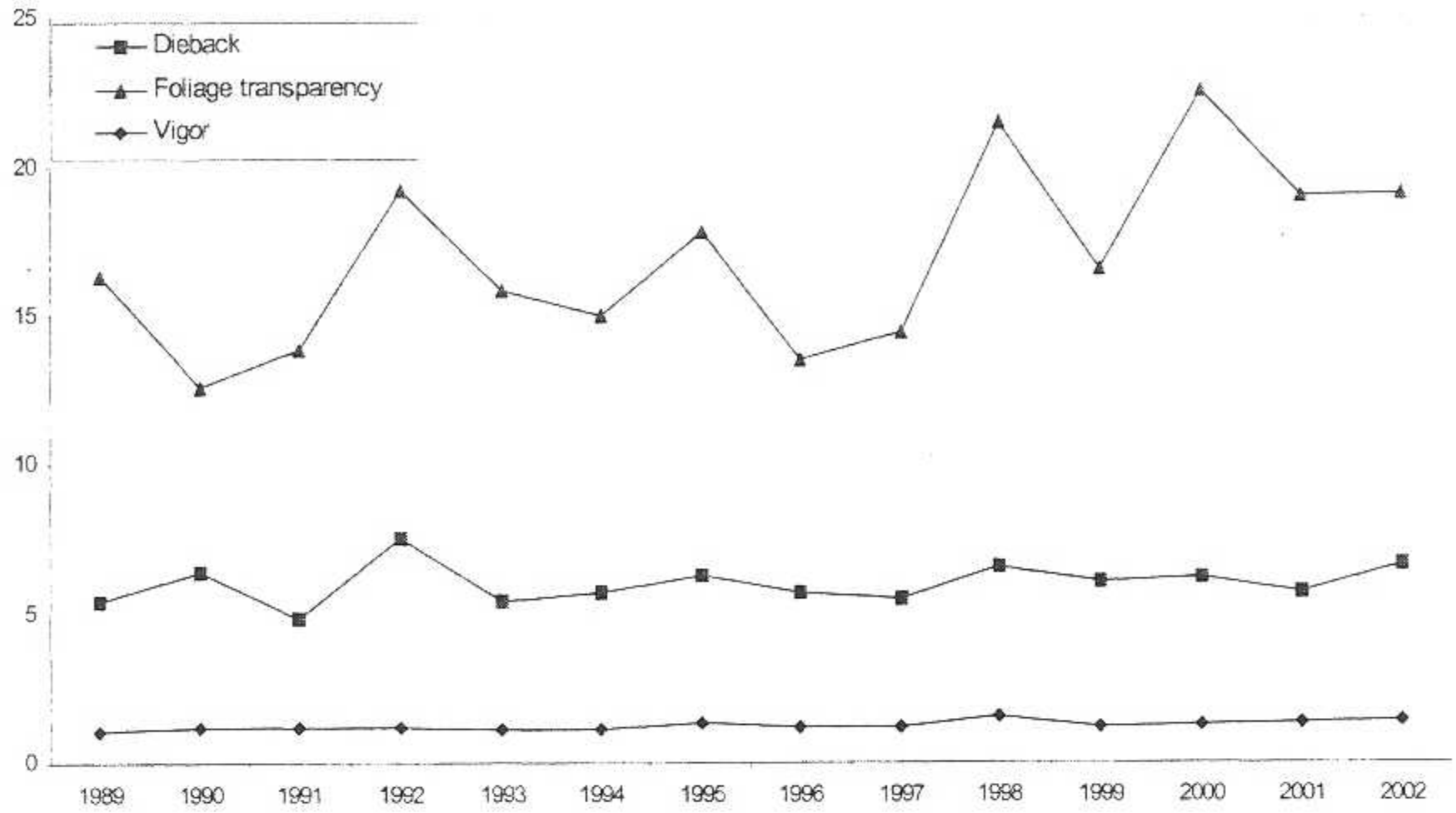


Figure 30. Trend in yellow birch condition on North American Maple project plots in Vermont, 1989-2002.

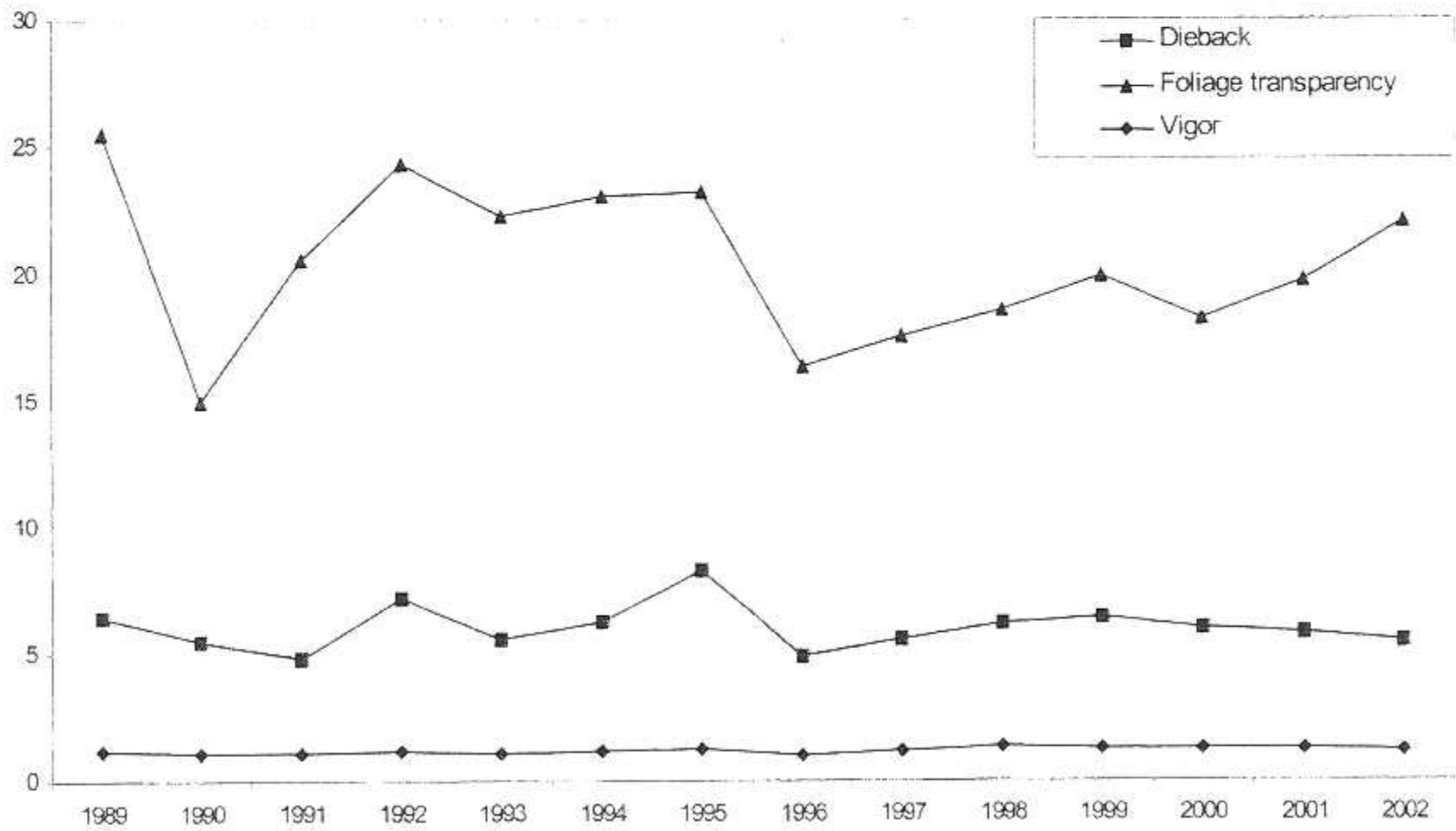


Figure 31. Trend in white ash condition on North American Maple project plots in Vermont, 1989-2002.

Analysis was completed for the 2000-2001 **Vermont Hardwood Health Survey**. Tree health has remained relatively stable since the last survey in 1995-96, after a dramatic improvement between 1985 and 1991 and continued improvement between 1991 and 1996. Of the 2.2 million acres of hardwoods estimated to occur statewide, only 1000 acres were estimated to have moderate mortality (10-30% of upper canopy trees dead). This is similar to the 1995 estimate, and an improvement over the 4000 acres of moderate mortality estimated from the 1990 photography.

Nearly 91% of the dominant and codominant trees remain healthy. Crown transparency was higher than normal (Figure 32). This probably reflects recent drought conditions, and could mean greater dieback in future years. Annual tree mortality increased from 0.8% in 1996 to 1.4% in 2001, probably as a result of the 1998 ice storm.

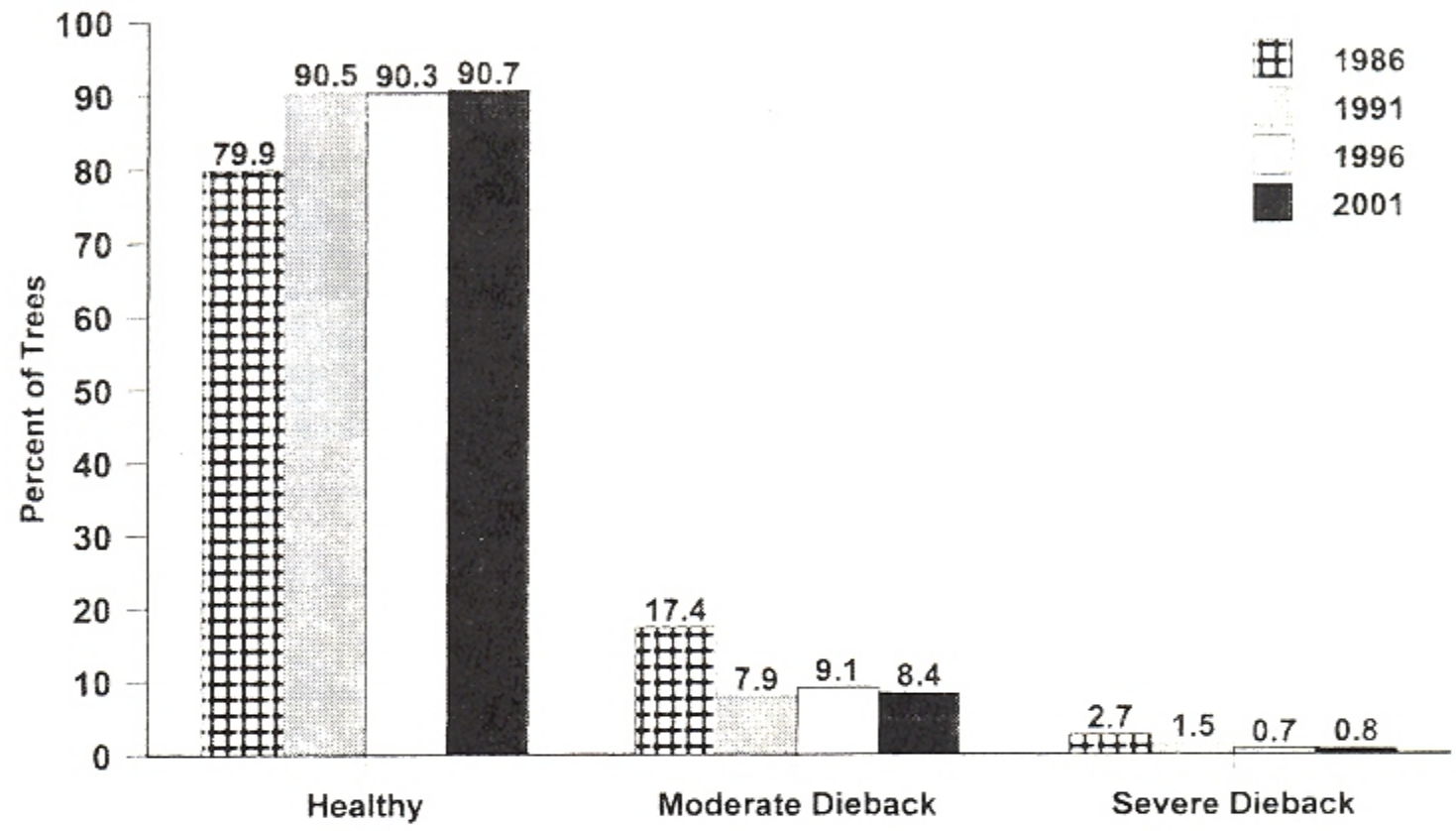


Figure 32. Crown dieback ratings in Vermont hardwood stands in 2001 compared to 1986, 1991 and 1996. Percent of all live dominant/codominant trees healthy (dieback affecting 0-10% of crown), with moderate dieback (11-50% of crown), and with severe dieback (51-99% of crown).

Data from the **2001 Vermont White Pine Survey** have been analyzed. This survey was conducted in 2001 to evaluate white pine condition and to examine factors related to symptom development. White pine stands were located on randomly selected 1:8000 color- infrared photos, which had been acquired in 2000 for the Vermont Hardwood Health Survey. At each of 21 stands, four 1/24th acre subplots were evaluated on the ground. In addition, 10 young white pine were rated in nearby regenerating stands.

Decline symptoms were not widespread. Eighty-nine percent of the overstory white pine in mature stands were rated as healthy, while 6% were dead. In young stands, 93% were healthy (Figure 33).

The most common biotic agents observed were not associated with tree health as rated by tree vigor and crown symptoms. White pine weevil was the most common biotic agent observed. Symptoms were present on 66% of live pines in mature stands. Ninety-one percent of these were healthy. Pine bark adelgid was present on 16% of pines, and was more common on healthy trees. Three percent of white pines in mature stands had blister rust symptoms, compared to 14% in young stands. Seventy-three percent of the trees in mature stands with blister rust were rated as healthy.

Where pines were unhealthy, difficult site conditions or disturbance were usually present. These conditions included poor drainage, recent logging, or shallow soil with bedrock close to the surface.

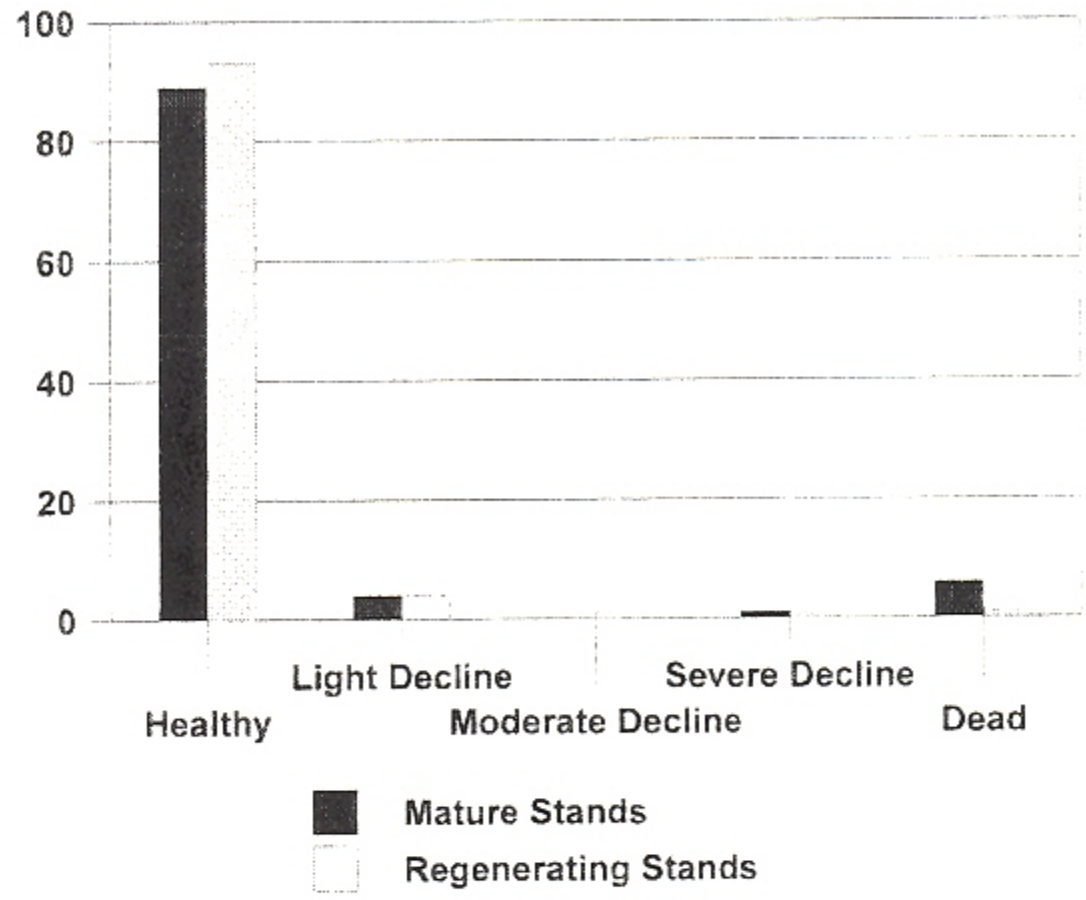


Figure 33. Percent of all dominant/codominant white pine in mature stands or of all white pine in regenerating stands in each of 5 condition classes. Data from 2001 Vermont white pine condition survey.

Some results from the national **Forest Health Monitoring** program are available on the web at http://www.na.fs.fed.us/spfo/fhm/

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

COMMON PESTS OF CHRISTMAS TREES IN VERMONT 2002

REPORTED BY THE

DEPARTMENT OF FORESTS, PARKS AND RECREATION

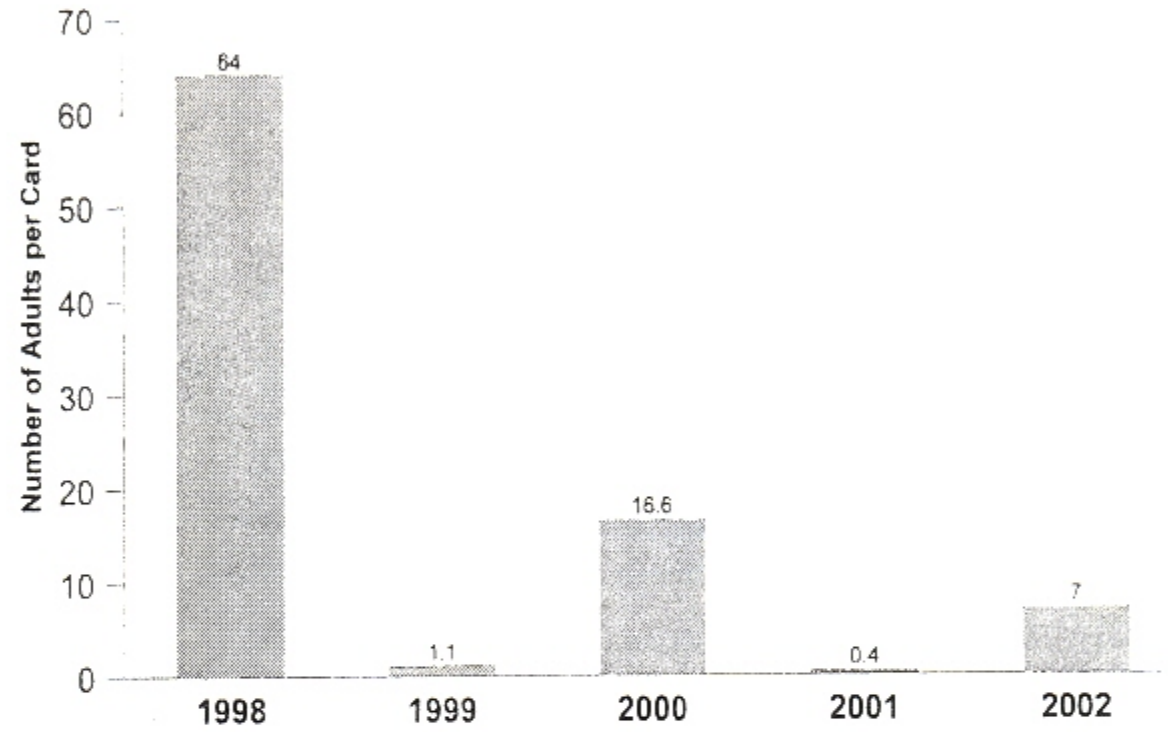
INTRODUCTION

Information in this report is based largely on observations by Forest Resource Protection personnel, including some spot-checks of key plantations in northern Vermont. There was no systematic survey of plantations in the Scleroderris Canker quarantine area this year, due to budget constraints.

INSECTS

Balsam Gall Midge populations dropped to light levels nearly everywhere in Christmas tree plantations and on wild balsam fir trees after being at heavy levels for the past several years. Spray trials with two new insecticides, Provado 1.6 (imidacloprid) and Scimitar GC (lambda-cyalothrin), were conducted in Craftsbury and Stannard. Although some control was obtained, especially with Scimitar, neither material performed as well as the old standard, Diazinon A6500. This insect is not expected to be a problem in 2003.

Balsam Shootboring Sawfly, caused mostly light to moderate damage to fir Christmas trees this year compared to very light damage in 2001. This was expected, as damage is higher in even years due to a two-year life cycle for the majority of insects. Adults caught on 3x5 yellow sticky cards placed in mid-crowns of trees in Lamoille County averaged 7.0 per card compared to 0.4 in 2001, 16.6 in 2000, 1.1 in 1999 and 64.0 on 1998. This is fairly reflective of damage levels, as 1998 was by far the year with the heaviest damage. This insect is not expected to be a problem in 2003.



Number of Balsam Shootboring Sawfly Adults Caught on 3x5" Yellow Sticky Cards from 1998 to 2002.

Balsam Twig Aphid populations were mostly at light levels after being at moderate levels in 2001.

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

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

Pine Spittlebugs occasionally observed, causing only light damage.

Root Aphids were heavy on individual balsam firs in a Shrewsbury plantation.

Spruce Spider Mite populations remained low in most locations despite numerous eggs going into the growing season. Exceptions were a balsam fir plantation in Canaan, where marketable size trees were so heavily infested that needles were dropping, and noticeable foliar injury in a Townshend plantation.

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

DISEASES

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

Delphinella Tip Blight was common in northern Vermont this year. It was mostly at light levels except for some moderate damage to balsam fir in Wolcott and Cabot and some moderate damage to white fir in Danville.

Diplodia (Sphaeropsis) Tip Blight caused some unusually heavy damage to a plantation in Waterbury, where infection was heavy on white pine and moderate on balsam fir. Elsewhere, it was very scattered at light levels.

Fir-Fern Rust widespread but damage was mostly light.

Lophodermium Needlecast remained common but mostly at light levels.

Rhizosphaera Needle Blight of Fir, caused by *Rhizosphaera pini*, remained at light levels in scattered locations.

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

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

Sirococcus Shoot Blight of spruce caused light to moderate damage to white spruce in Craftsbury.

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

White Pine Blister Rust damage remains common throughout the survey area.

White Pine Needle Blight infection increased this year. It was found at mostly light to moderate levels in scattered locations.

Woodgate Gall Rust damage to Scots pine is decreasing, as growers remove heavily damaged trees.

Yellow Witches Broom Rust of balsam fir remains common at light levels. Infection was down from 2001 levels.

Frost Damage from temperatures that dropped into the teens and low 20s in some locations on May 20 and May 22 affected Christmas tree plantations in widely scattered locations. Damage was mostly light to moderate but with some heavy damage, particularly in southern Vermont. Some trees were damaged too severely to be merchantable in December. Species affected included balsam fir, white spruce, Douglas-fir and blue spruce.

The following pests were not observed this year.

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

Diseases: Spruce Cushion Rust

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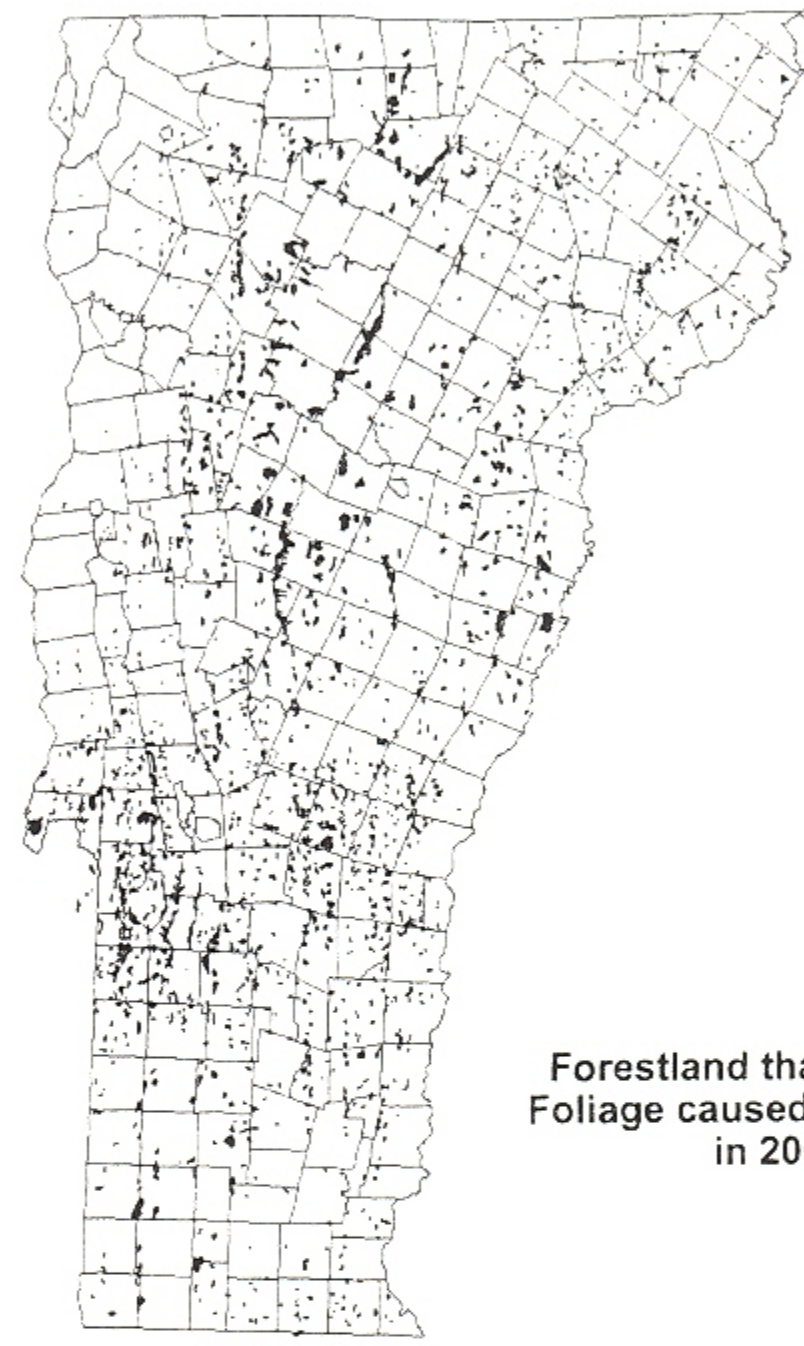
HEALTH OF SUGAR MAPLE IN VERMONT - 2002

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 2002, 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 conditions persisted through 2002, and this remained a major concern to the health of sugar maple. During aerial surveys, off-color foliage and premature leaf drop, were mapped on about 60,000 acres (Figure 1). Most of the damage was observed on hilltops, ridges and other sites with shallow soil. It was most conspicuous on hilltops of the Taconic range in Rutland County.

- Three out of the last four growing seasons were unusually dry (Figure 2). In 2001, drought symptoms were more widespread in northern Vermont. In 2002, the damage was more visible in the southern counties. Although beech, red maple and birch were more likely to have brown foliage than sugar maple, all trees were stressed by the water deficit.



Forestland that had Brown Foliage caused by Drought in 2002

Figure 1

Trees are perennial plants, with strategies for surviving the variety of weather conditions, including drought, that they're likely to encounter over their lives. When there is not enough water to sustain photosynthesis, trees shed their leaves to conserve water.

Growth losses are expected on all sites, even where foliage symptoms were not observed. The drought will reduce the size and number of next year's leaves. Shoots will be shorter. Less wood will be produced, so tapholes will close more slowly. Scattered trees which were already unhealthy may die.

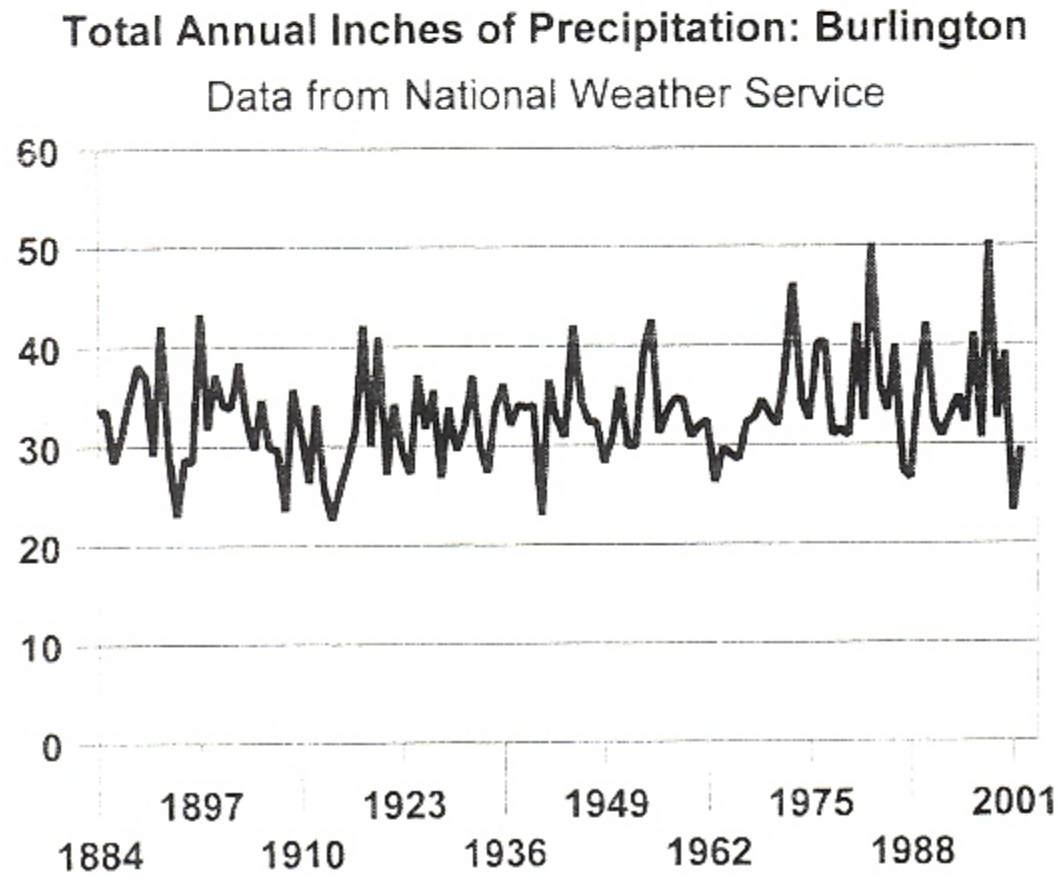


Figure 2

To assess the **General Condition** of maple stands, 2000 sugar maples were evaluated, in the summer of 2001, as part of the North American Maple Project. Their vigor remained similar to previous years, with 92% of the trees rated as healthy (Figure 3).

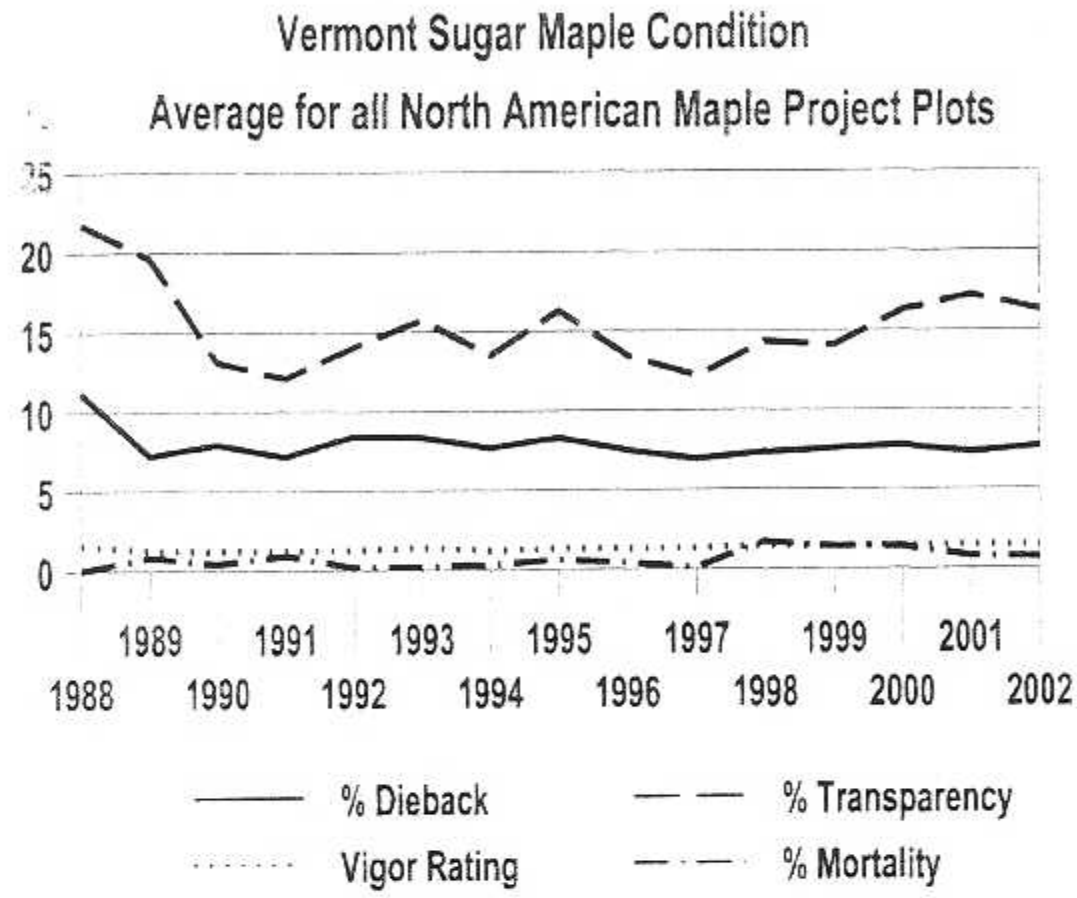


Figure 3

Results of Vermont's Hardwood Health Survey, which is repeated every 5 years, also show that sugar maple health has remained stable over the past decade. The health of some species, such as beech, oak, and paper birch, has declined since 1996 (Figure 4).

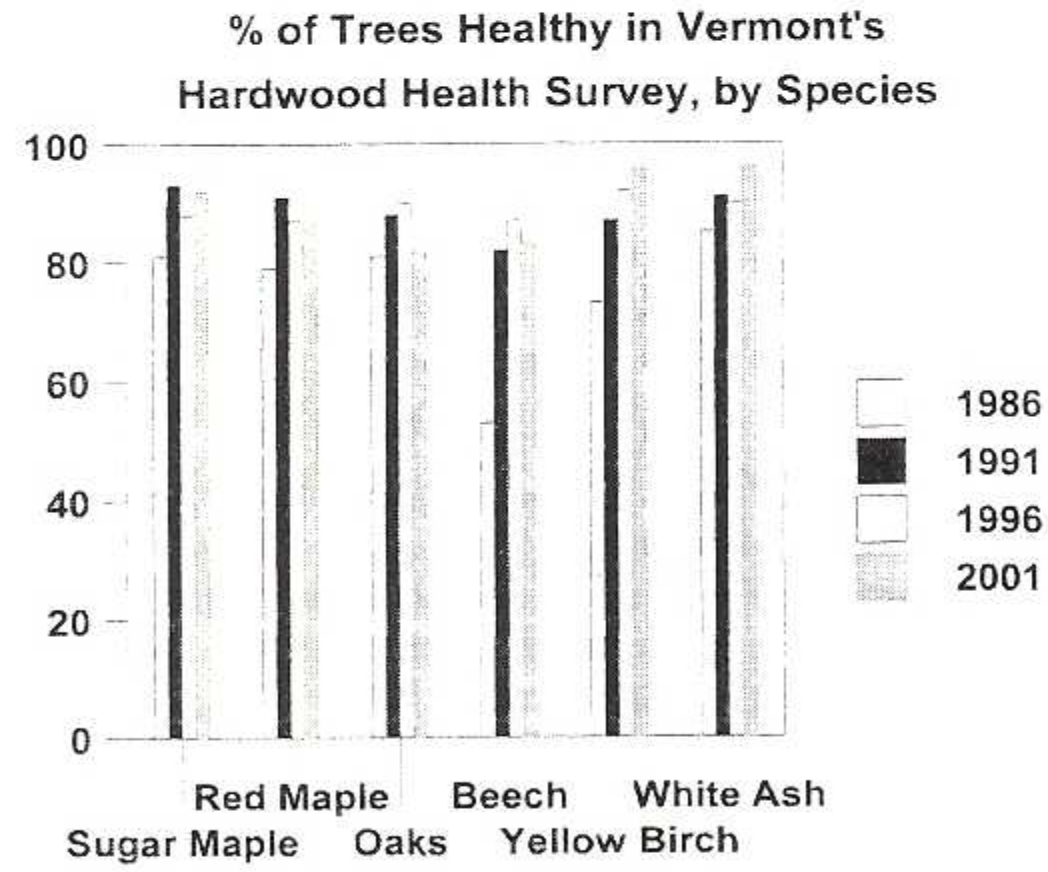


Figure 4

Maple Leaf Cutter was observed statewide this year, but only 6,000 acres of damage were mapped, compared to 24,000 acres in 2001. The most noticeable browning occurred in Washington County.

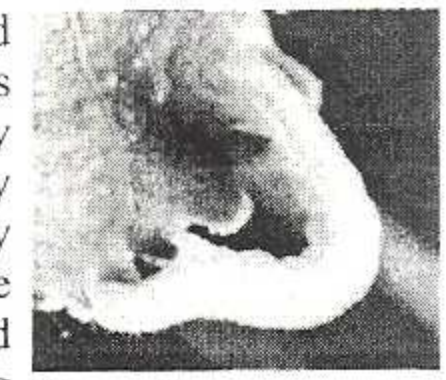


Figure 5

Bruce Spanworm caused light damage statewide. This green inchworm feeds in May and June (Figure 5). Lightly damaged leaves remain lacy all summer. There was some heavy defoliation in Essex and Orleans Counties including several sugarbushes. Moths were commonly observed in the fall and eggs have been recovered from traps in northern Vermont, indicating that defoliation will occur there in 2003.

Pear Thrips overwintering populations were down by 85% from winter 2000-01, and damage was negligible. In 2002, bud expansion occurred rapidly in warmer regions of the state, but slowly at higher elevations in northern and central Vermont. Had the thrips population been higher, damage may have occurred in areas with slower bud expansion.

Forest Tent Caterpillars were commonly observed in 2002 (Figure 6) and moth catches in traps increased from recent years. The highest populations observed were in the Orwell/Benson area.

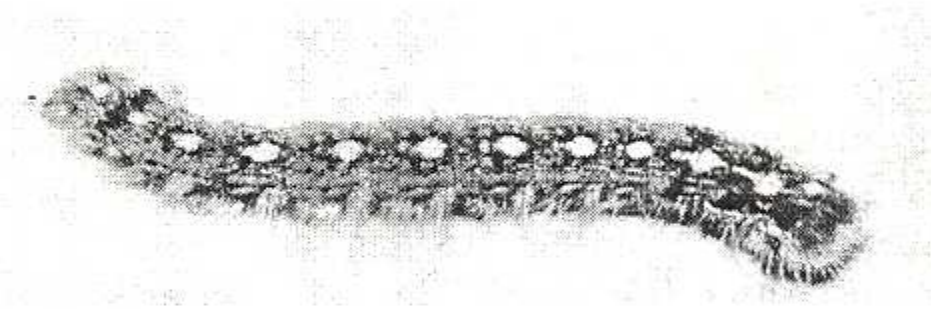


Figure 6

This insect can cause significant damage to sugar maple. Look for masses of these blue and white caterpillars resting on tree trunks and branches in June and for chewed leaf fragments on the forest floor.

For More Information: Insect and disease reports, and requests for identification, publications, and information on control, should be directed to our district or county offices.

County	County Forester	Forest Protection Specialist
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

Notes from the 20th Annual Forest Pest Workshop
January 6, 2003 Aiken Center, University of Vermont

Welcome given by **Dale Bergdahl** who spoke of the importance of this '20th' workshop as well as how the group has grown over the last two decades. Numbers have increased more than six fold since inception, from 25 to more than 150 members.

Larry Forcier provided an introduction on behalf of the School of Natural Resources and the University of Vermont. Larry spoke of the need to integrate the human component into ecosystem management. Human influence on the environment is constantly increasing and our management decisions are frequently based on artificial boundaries such as state or county lines. These artificial boundaries are especially problematic when dealing with invasive species. Proper management should also include a change in the way we define natural resources; no longer are natural resources purely extractive. Larry concluded by emphasizing the importance of including educators in our discussions and workshops. With additional perspectives, hopefully teachers can provide our children with a stronger background in the basics of life in the natural world.

Tom Vogelman and **Margaret Skinner** presented the Vermont Forest Pest Workshop Award to **Giovanna Morselli**, who graciously accepted on behalf of her late mother **Mariafranca Morselli,** Emeritus professor of Botany. Maria, who passed away in August, enjoyed a long and productive career, achieving national as well as international recognition for her work in maple science. Maria was an active participant at past Forest Pest Workshops and worked tirelessly as a proponent for women in science.

Kathy Decker from Vermont Department of Forests and Parks spoke about Sudden Oak Death (SOD). Currently, this new, introduced disease has only been found in isolated areas of California and Oregon. Mortality in oaks was first observed in 1995 with the causal pathogen finally being isolated and identified in 2000. Caused by the pathogen *Phytophthora ramorum,* SOD is known to affect a wide range of hosts, with 20 species now documented. Red and pin oak are believed to be susceptible so this is something we should keep an eye on, even here in the Northeast. Signs and symptoms include stem cankers without distinct margins, foliar infections, and twig dieback. The stem cankers often grow in size and girdle the tree, however, foliar infections rarely cause mortality. Infection is believed to occur via wind-borne spores and not via roots and can affect both healthy and unhealthy trees. Bark beetles and *Hypoxylon* sp. are commonly associated with SOD. Plant inspections and public education campaigns are currently underway on the west coast. State departments, APHIS, and the U.S.F.S. are developing a risk hazard map for the Pacific and Gulf coasts, as well as the Appalachian Mountain region. Additional information can be obtained at www.suddenoakdeath.org.

Trish Hanson from the Vermont Department of Forests and Parks brought us up to speed on work she has been doing in her lab in Waterbury. Pine shoot beetle trapping was recently conducted in 7 Vermont counties. A total of 51 beetles were collected, all in Derby (Orleans County). Trish also spoke of an extensive tick surveillance program involving 27 veterinarians from 9 Vermont counties. The program has proven a success with hundreds of ticks being submitted. This past year saw only 11 cases of indigenous Lyme disease (positively acquired in-state) reported, although these cases are likely underreported. Trish introduced us to numerous insects of interest during her presentation. Some of these included the European snout beetle, western conifer seed bug, boxelder bug, Bruce spanworm, lily leaf beetle, viburnum leaf beetle, Russian leather beetle, and the Abbott's sphinx moth.

Ron Kelley from Vermont Department of Forests and Parks gave us some insight into what he saw while out and about in 2002. It seems likely that we may see heavy defoliation this spring from Bruce spanworm (Hunter's moth). Ron also touched on the European snout beetle (starting to become more widespread), balsam woolly adelgid, beech scale, sphaeropsis shoot blight in Christmas tree plantations, bronze birch borer, linden borer, as well as larch decline. Much of the problems Ron saw in the woods seem to have been exacerbated by the drought. During this past year, Ron also observed some of the heaviest fir cone production he had ever seen in Vermont's Christmas tree plantations. Invasive exotic species such as common buckthorn, honeysuckle, and barberry were also of concern to Ron and should be to all of us as well.

Barbara Burns from the Vermont Department of Forests and Parks spoke to us about miscellaneous conditions and curiosities of 2002. During the year more than 60,000 acres were mapped and evaluated for drought symptoms and more than 23,000 acres were mapped and evaluated for beech bark disease. Like many things in 2002, the beech bark disease problem seems to have been compounded by the dry conditions. Gypsy moth egg mass counts came back low and are expected to stay that way for the foreseeable future. Barb asked for our help in diagnosing some mystery conditions found on both red pine and Norway spruce in the Shaftsbury area. She also reminded those in attendance that she would appreciate any input for the upcoming Forest Health Conditions Report for 2002.

Bruce Parker provided an introduction for the University entomology lab and spoke in detail of the work they have been doing with hemlock woolly adlegid (HWA) in western Massachusetts. His lab has been examining the adelgid's cold-hardiness and how our colder Vermont temperatures will affect its chances of becoming established here. Bruce also spoke of his upcoming work in Afghanistan where a research team will be experimenting with the use of fungi to control a serious pest of wheat.

Margaret Skinner of the UVM entomology lab spoke to us about the Asian long horned beetle (ALB). Unfortunately, a new infestation was found in New Jersey late in 2002. The beetle has now been confirmed in New York City, New Jersey and Chicago. Eradication work is ongoing in New York City where newly infected trees have been found in Central Park. More than 7,000 trees have now been removed and destroyed from the New York City area. Unfortunately, private property issues are seriously hampering detection efforts since many trees on private land have yet to be examined for the insect. Systemic insecticides are being experimented with but as of yet have not proven effective. Acoustical detection devices are also being tested to aid field crews in determining if a tree is infested. Like the systemic insecticides, the effectiveness and usefulness of these acoustical devices have yet to be proven. A pheromone-trapping program is being explored but as of yet an ALB sex pheromone has not been found. The battle against ALB is looking good in Chicago but is still on shaky ground in the New York City/New Jersey area. More information can be found at www.uvm.edu/albeetle/index.html.

Scott Costa of UVM entomology lab spoke to us about some ongoing hemlock woolly adelgid fungal trials also in western Massachusetts. Through Scott's work, an effective system to examine the efficacy of entomopathogenic fungi in the field has been developed. It is hoped that future HWA infestations can be controlled with these fungi. Future work will likely try to examine carryover effects of these fungi, explore new delivery techniques, and evaluate their effects on non-target species.

Don Tobi, also from the University's entomology lab, spoke about a biodiversity project that he has worked on at Mt Mansfield. He is hoping to evaluate how three different cutting prescriptions (single tree selection, group selection, and structural enhancement) affect insect

biodiversity. Don is also looking at the effects that different management techniques have on nuisance species in active sugar bushes. These management techniques include the traditional sugar maple monoculture, mixed woods with at least 25% non sugar maple, and mixed woods with at least 50% non sugar maple. Additionally, Don has been evaluating the recovery of different hardwood species following the ice storm of 1998. Finally, Don spoke of his prison work program that has proven very successful.

Jane Stewart from the UVM forest pathology lab spoke to us about her work with butternut canker. Jane has been looking at the vectoring potential of three beetle species (*A. macula, E. parochus,* and *G. sanguinolentus*) known to be associated with butternut canker. Her work has shown that all three species are capable of carrying viable spores for up to 16 days. Jane has also examined the effect of air-drying on spores and the viability of spores, which had passed through the insect digestive tract.

Tim Schmalz from the UVM forest pathology lab has been examining the effect of physical site factors on the occurrence and severity of butternut canker. Tim's work has updated and expanded upon a butternut health database already in existence. Using GIS, Tim is hoping to determine if links exist between site factors such as soil type, hydrology, and aspect and the severity of the canker disease. Tim has also included health assessments of more riparian trees. Unfortunately, he has found a three-fold increase in mortality since the original 1996 survey. On a more positive note, he has found 39 apparently resistant trees, all located within close proximity of cankered trees.

Chris Adams also from the UVM forest pathology lab asked for your help in locating concentrations of butternut trees in all counties of Vermont. He is hoping to expand upon the database that Tim Schmalz is currently working with to include study sites across Vermont. Ideally, he would like to find two sites per county with at least 20 trees on no more than 40 acres. However, these numbers are ideal and not written in stone. **If you know of any butternut concentrations that might be of interest he is asking you to contact him. He can be reached at: Christian.Adams@uvm.edu or home at 802-877-1521.**

Dale Bergdahl concluded the UVM forest pathology section by speaking to us about the fungal flora associated with the early stages of decomposition in ice-damaged wood. More than 20 fungal species have been found to be associated with 14 hardwood trees species. Dale hopes to eventually develop a pictorial guide that could be used for field identification. Dale also spoke of how both native and exotic wood staining fungi (specifically *Leptographium* sp) are being carried by both native and exotic beetles.

Dennis Souto from the USFS – Durham spoke to us about the emerald ash borer. Last summer saw a large amount of federal funding being reallocated out west to fight fires. This loss of resources significantly affected our work here in the east. The emerald ash borer, which is native to Asia, has become a serious concern in the Midwest. Since the larvae spends all of its time tunneling in the cambium it causes tree mortality rather quickly, often within 2-3 years. The insect is also capable of long distance dispersal on its own since the adults are strong fliers. Dennis spoke of how important it is to diversify our urban forest to lessen the impacts of exotics. He also mentioned the need to monitor for these exotics in the country of export, and be more proactive as opposed to reactive.

Scott Pfister from the Vermont Department of Agriculture introduced us to a 'Giant, Poisonous, Evil Weed' that can cause blistering burns when its sap contacts your skin. As it turns out, this 15 foot tall exotic weed from Asia, known as giant hogweed, has been here in Vermont for some

time. Scott also spoke to us about the need for better global pest detection as well as pathway analysis. He emphasized that we need to have a better understanding of how pests are moving around the world before we can hope to stop their spread.

Jon Turmel from the Vermont Department of Agriculture spoke to us about West Nile Virus. This mosquito-vectored virus has gotten a great deal of attention in the media as of late. The last three years has seen a very fast expansion of the virus from only four states in 1999 to 43 states in 2002. Although the seriousness of the virus should not be downplayed, more then 80% of healthy adults who become infected never show any symptoms or suffer any ill consequences. Recent work has shown that the virus can be transmitted via breast milk, blood transfusions and organ donation. Currently, researchers are working on a possible human vaccine but this is still in the early stages of development. Jon told us that the elimination of mosquito breeding sites and using repellants with deet are likely the best ways to avoid infection.

Sandy Wilmot from the Vermont Department of Forests and Parks titled her talk: Pathways to understanding forests and other road games. She spoke of the Vermont Monitoring Coop (VMC) and 2002's stalled spring and finicky fall. During the spring of 2002 we saw very early bud break but then the temperatures cooled down and things seemed to stagnate for some time. The fall brought early leaf color change and dropping, likely associated with the drought, as well as a second leaf change and drop a bit later. Sandy told us about ongoing ozone biomonitoring and air quality work that the VMC is working on. Mercury cycling studies, alpine community mapping, high elevation watershed studies, and forest sensitivity mapping are all underway as well.

Awards were given for **Most Unusual Pest** and **best poster/display**. All recipients had the opportunity to choose from a line up of top-notch prizes!

Most Unusual Pest winners:

1st Place: **Michael Johnson** for his vagabond aphid
2nd Place*: **Jane Stewart** for her leafy mistletoe
Don Tobi for his bottlebrush mite on *Rubus*
Jay Killer for his vine strangulation
*This was a three-way tie

Poster/Display winners:

1st Place: **Jane Stewart** – Potential Beetle Vectors of Butternut Canker
2nd Place: **Kathy Decker** – Invasive Exotic Plants
3rd Place: **Ron Kelley** – Hardwood Health Survey

Special thanks to **Brent Teillon** and the **Vermont Department of Forests, Parks and Recreation** for providing refreshments, lunch, and prizes; to **Dale Bergdahl** and **Brent Teillon** for program development; to the **UVM School of Natural Resources** for providing the meeting space; to **Larry Forcier** for his opening remarks on behalf of the University; to those who submitted posters and unusual pests; to **KC Hayes** for secretarial assistance and for keeping the refreshments fresh; to **Tim Schmalz** for taking care of the PowerPoint logistics; and to **Chris Adams** for typing up all these notes and thank-you's. And finally, thanks to all the participants and presenters for sharing your knowledge, information, and experiences with others.

Next year's meeting will be held on Monday, January 5, 2004. See you then!!!
Remember to hunt for that unusual pest!

The UNIVERSITY of VERMONT

Research Highlights 2002
PROCTOR MAPLE RESEARCH CENTER

The goals, approaches, and status of several ongoing PMRC research projects are described below.

FOOD SAFETY / SAP & SYRUP CHEMISTRY

Sources of Contamination in Maple Syrup: Lead is an undesirable contaminant of maple syrup. Our goal is to reduce lead levels in syrup by identifying the sources of lead in maple equipment and altering production practices to reduce lead contamination of sap and syrup where it occurs. We are also interested in identifying the natural levels of paraformaldehyde in maple sap (if any) and the influence of PF use on the level of formaldehyde in the finished product. *Perkins, van den Berg*

Adulteration of Maple Syrup: Spectrophotometric and viscometric analyses have shown qualitative and quantitative differences between authentic and adulterated syrup samples. Further extension of these methods to a broader sample range has the potential to become a reliable, high throughput battery of tests for detecting illegal additives in pure maple syrup products. *Baribault*

PRODUCTION OF SAP AND SYRUP / MAPLE EQUIPMENT

Effects of Forest Fertilization on Maple Sap Volume and Sweetness: Fertilization is a common tool in agriculture to increase crop production. Other than anecdotal information from sugarmakers who do fertilize, little research is available to determine the long-term effects of fertilization on maple sugar production. This project is examining the effects of fertilization on maple sap volume and sweetness, as well as tree health and growth, over a six-year period. Initial results indicate that fertilization may result in increased sap volume, but not sweetness, in low-moderate nutrition forest stands. *Perkins, Wilmot, Zando*

Evaluation of Small Spouts: This study compares sap production and wounding using normal and small spouts. Under most conditions, sap yield is roughly the same for either size spout using vacuum, but was occasionally a little less for small spouts with gravity flow. In large trees under gravity or vacuum, wood discoloration from small taphole wounds was significantly less than internal damage caused by large tapholes. *Perkins, Wilmot, Stowe, van den Berg, Isselhardt*

Timing of Tapping and Length of Sap Season Using Small and Large Spouts: During the past decade, the northeast has experienced an unusual number of early spring thaws, with ideal sugaring weather sometimes occurring before mid-February. Starting in 2000, groups of trees at the Proctor Center were tapped with small and large spouts at three different dates in the spring in order to determine which timing maximizes sugar yield. Results will vary depending on the weather and snowpack, making this a long-term project. Data from the first two seasons suggest that under gravity, the longevity of tapholes drilled very early and fitted with small spouts is greater than that of larger (7/16") tapholes. *Wilmot*

Physical Differences Between Tubing Types: Tubing for sap collection, particularly 5/16" tubing, is manufactured from a variety of plastics and carries many different trade names. We experimented with some of the properties of these materials, and we gathered information on advantages and disadvantages of various kinds of tubing from plastics manufacturers, equipment distributors and sugarmakers, with the goal of helping maple producers select the appropriate type of tubing for their woods. *Wilmot*

Vented versus Closed 5/16" Tubing: It is widely recommended that tubing systems be closed rather than open or vented. While sap appears to run faster through a vented compared to a non-vented tubing system, venting of tubing results in a significant loss of sap production, probably due to faster drying of tapholes and loss of natural vacuum on slopes. *Stowe*

Optimum Number of Spouts per 5/16" Line under Vacuum: We compared sap production from tubing setups with 1, 5, 10, and 15 spouts per 5/16" line. Single tap setups produced the most sap, with lesser amounts from the 10 tap (20% reduction) and 15 tap (28% reduction) lines. *Stowe, Isselhardt, van den Berg, Bill Peacock*

New Versus Used Tubing Under Vacuum: Occasionally sugarmakers will recycle used tubing or delay replacement of tubing in their sugarbush. We compared sap production from new and old 5/16" tubing. New tubing produced, on average over two seasons, 10-30% more sap than used tubing. *Stowe, Isselhardt, van den Berg, Bill Peacock*

Microspouts with Vacuum: Based upon initial research by Tim Wilmot with very small tapholes, Bob White (Underhill) developed a spout considerably smaller than the health spouts currently on the market. In a preliminary study, we found that these "micro" spouts produced about 72% of the sap volume compared to a standard healthspout. *Stowe, van den Berg*

MAPLE PHYSIOLOGY & GENETICS

Relationship Between Tapholes on Opposite Sides of a Tree: Taphole guidelines were established in part because it is believed that tapping a tree below a certain diameter with more than one hole will result in decreased sap yield from each hole. To further our understanding of the way that an open taphole changes sap flow in the rest of the tree, electronic sensors that measure sap pressure at the taphole will be used to compare pressure on one side of a tree while a taphole is either open or closed on the opposite side. Trees of different diameters will be compared. This is a new project for 2002. *Wilmot*

Meteorological Influences on Stem Pressure and Sap Flow in Sugar Maple: Cold nights and warm days will always provide the conditions necessary for good sap runs, but changes in global climate could affect the timing and success of sugaring in the Northeast. Using electronic sensors, we can measure air, wood and soil temperatures, as well as stem pressures and sap flow in sugar maple. Real time data are shown our web site each spring. Our collection of data contributes to our long term goal of constructing computer models relating sap flow to meteorological conditions. *Wilmot, Perkins*

-- more projects on reverse--

Nitrogen Effects on Stress Tolerance of Sugar Maple: Reasonably high levels of nitrogen are deposited on forests throughout the northeast in rain. We are testing the effects of nitrogen additions on sugar maple photosynthetic physiology and the ability of sugar maple to resist stress. *Cate, Perkins, van den Berg*

Molecular Genetics of Sap Sweetness: Mature, field grown trees and younger, plantation grown half sib families from both higher and lower yielding mother trees have been monitored extensively for their sap characteristics. The polymerase chain reaction techniques are being used to create a database of DNA fingerprints. Differences in fragment patterns are the focus of current experiments. Such DNA markers will later become the basis for identifying higher yielding trees at the seedling or sapling stage, thus saving time and energy in the production of improved stocks of sugar maple. *Baribault, Currier*

Portable Chlorophyll Meters as an Indicator of Maple Health and Nutrient Status: Research indicates the Minolta SPAD-502 portable chlorophyll meter is effective in estimating chlorophyll content and even relative nitrogen status in forest species and agricultural crops. Its effectiveness with sugar maple, to date, has not been investigated. Our research aims to determine the capability of this portable chlorophyll meter to estimate the chlorophyll content of sugar maple leaves. Our study will also evaluate nitrogen status and chlorophyll fluorescence in sugar maple leaves. *van den Berg, Perkins, Cate*

Fall Coloration in Sugar Maple: While important economically and scientifically, the process of fall coloration in sugar maple has not been widely studied. Our current research aims to improve the basic understanding of the process and identify factors that may be valuable in predicting the timing and quality of fall coloration. Specifically, anthocyanin pigments and their function and relation to physiological processes during fall senescence will be examined. *van den Berg*

FOREST ECOLOGY & HEALTH

Effects of Ice Storm Damage on Carbohydrate Reserves, Growth, and Survival in Sugar Maple: The Ice Storm of 1998 caused extensive damage to sugarbushes in New England, New York, and Canada. The loss of crowns resulted in depleted carbohydrate reserves in heavily damaged trees for two-three years after damage. The amount of carbohydrates stored in wood and root tissue was related to the amount of crown loss. This research is aimed at improving knowledge of how crown loss affects tree carbon reserves, sap production, growth, and survival in ice-storm-affected areas. *Perkins, Wilmot, van den Berg, Cate*

Calcium Effects on Maple Seedling Survival: Soil pH and soil calcium are often important factors in success of sugar maple regeneration. In the Green Mountains of Vermont, where most soils are quite acidic, pockets of soil enriched with calcium can often be identified by luxurious growth of young sugar maples. At six sites in the northern Green Mountains with differing soil chemistry, we measured seed fall from maples in late 2000 using seed traps. In 2001, we compared the survival of newly germinated sugar maples at each site in untreated plots, and in plots fertilized with different levels of lime. In 2002, we will track the health of survivors in these plots and determine the effectiveness of fertilizing to improve seedling vigor on acid soils. *Hane, Wilmot*

Potential Effects of Global Change on the Maple Sugaring Industry: This research is examining the potential effects of global warming on sap production in the northeast. A survey of sugarmakers will be conducted to find long-term records of production that might show evidence of global change. In addition, computer modeling will be employed to predict the effect of warmer spring seasons on maple flow. *Perkins, Wilmot*

Fern Effects on Sugar Maple Regeneration: Sugarmakers have long recognized that areas dense with hay-scented fern are often associated with poor regeneration of sugar maple. We compared sugar maple seedling survival of unmanipulated plots with plots that had ferns removed. Seedling survival is strongly correlated to fern density. Plots with high fern density had very low sugar maple seedling survival (and very low light levels), whereas plots with ferns removed had higher seedling survival (and higher light levels). removal may improve seedling densities in areas where regeneration is poor. *Hane*

Acid Rain Effects on Forested Ecosystems: Forest decline was a major concern throughout the 1980's and in the early 1990's. While the Clean Air Act of 1990 addressed some aspects of pollution, acid rain does continue to fall. Long-term vegetation plots on Camels Hump Mtn. are measured periodically to assess the current state of forest health and growth. *Perkins*

PMRC Scientists & Staff

Timothy D. Perkins, Ph.D. – Director
Tom Baribault, Ph.D. – Research Scientist
Elizabeth Hane, Ph.D. – Post-doctoral Research Associate
Timothy Wilmot, M.S. – Senior Maple Research Technician
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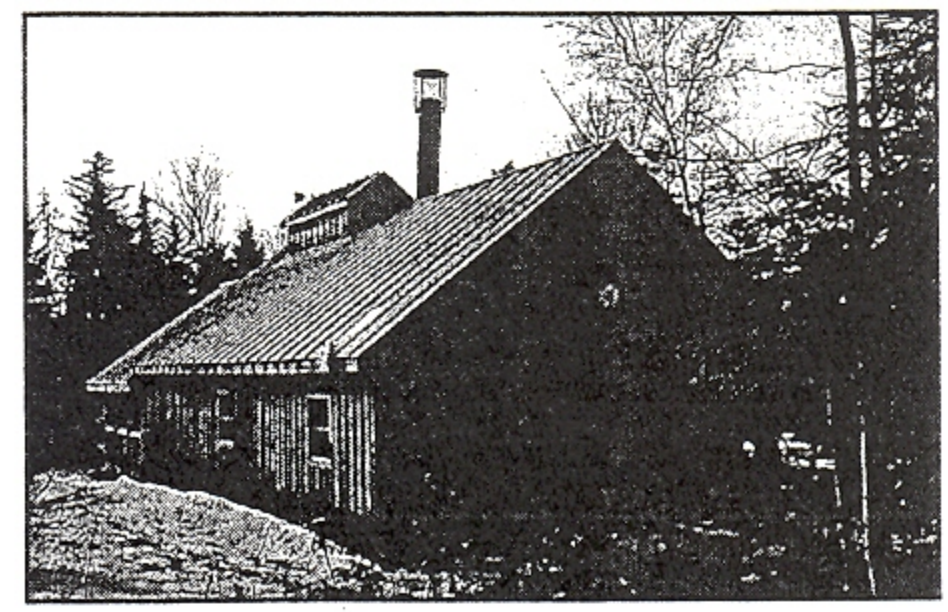

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Vermont Department of Agriculture, Food & Markets
Quarantine #3 - Noxious Weeds

Section I: Statement of Concerns

Whereas, the Vermont Department of Agriculture, Food & Markets having found that certain noxious weeds out compete and displace plants in natural ecosystems and managed lands; and

Whereas, competition and displacement of plants by certain noxious weeds has significant environmental, agricultural and economic impacts; and

Whereas, it has been determined to be in the best interest of the State of Vermont to regulate the importation, movement, sale, possession, cultivation and / or distribution of certain noxious weeds:

Therefore, the State of Vermont is hereby establishing this noxious weed quarantine regulation by the authority of 6 V.S.A., Chapter 84, Pest Survey, Detection and Management.

Section II: Definitions

"Class A Noxious Weed" means any noxious weed on the Federal Noxious Weed List (7 C.F.R. 360.200), or any noxious weed that is not native to the State, not currently known to occur in the State, and poses a serious threat to the State.

"Class B Noxious Weed" means any noxious weed that is not native to the state, is of limited distribution statewide, and poses a serious threat to the State, or any other designated noxious weed being managed to reduce its occurrence and impact in the State.

"Commissioner" means the Commissioner of Agriculture, Food & Markets, or his or her designee.

"Noxious Weed" means any plant in any stage of development, including parasitic plants whose presence whether direct or indirect, is detrimental to the environment, crops or other desirable plants, livestock, land, or other property, or is injurious to the public health.

"Plant and Plant Products" means trees, shrubs, and vines; forage, fiber, and cereal plants; cuttings, grafts, scions, buds and lumber; fruit, vegetables, roots, bulbs, seeds and wood; and all other plants, parts of plants, and plant products.

"Possession" means to grow, manage or cultivate through planting, pruning, watering, fertilization, weeding, propagation, or any other means that promotes the growth of the noxious weed. This does not include the incidental occurrence of a noxious weed on wild or managed land.

Section III: Designation as a Noxious Weed

(A) The following conditions shall be met for a plant or plant product to be designated as a Class A or B Noxious Weed:

(1) As determined by a pest risk assessment, a quarantined noxious weed must pose an actual or anticipated threat to a substantial agricultural, forestry or environmental interest and / or the general public.

(2) Establishment of a quarantine for a specified noxious weed is likely to contribute to the objective of preventing introduction or for limiting the spread and / or severity of the noxious weeds impact to the agricultural, forestry or environmental interest.

(3) No substitute or alternative mitigating action will accomplish the same pest prevention purpose.

(4) The economic and/or environmental benefits of quarantining a specified noxious weed outweigh the economic and/or environmental benefits associated with the noxious weed.

(B) The following biological factors shall be used to evaluate whether or not a plant or plant product has satisfied the conditions for designation as a Class A or Class B Noxious Weed.

(1) Native origin of the plant;
(2) Known distribution;
(3) Mechanism and potential for spread to and within Vermont;
(4) Past, current and potential environmental, economic and human health impacts;
(5) Feasibility of control and spread prevention;
(6) Regional and national perspective;
(7) Designation as a federal noxious weed; and / or
(8) Other pertinent factors.

(C) Designation as a Class A or Class B Noxious Weed shall occur through the Administrative Rule procedure as outlined in 3 V.S.A., Chapter 25.

Section IV: Designated Noxious Weeds

(A) Class A Noxious Weeds.

(1) All weeds listed in 7 C.F.R. 360.200 as amended, which is hereby incorporated by reference including subsequent amendments and editions.

(2) *Cabomba caroliniana*	(fanwort)
(3) *Egeria densa*	(Brazalian elodea)
(4) *Hydrilla verticillata*	(hydrilla)
(5) *Hygrophila polysperma* (Roxb.) T. Anderson	(E. Indian hygrophila)
(6) *Myriophyllum aquaticum* (Vell.) Verdc.	(Parrot feather)
(7) *Myriophyllum heterophyllum*	(variable-leaved milfoil)
(8) *Salvinia auriculata*	(giant salvinia)
(9) *Salvinia biloba*	(giant salvinia)
(10) *Salvinia herzogii*	(giant salvinia)
(11) *Salvinia molesta*	(giant salvinia)
(12) *Vincetoxicum hirundinaria* Medikus.	(pale swallow-wort)

(B) Class B Noxious Weeds.

(1) *Aegopodium podagraria* L.	(goutweed)
(2) *Ailanthus altissima*	(tree-of-heaven)
(3) *Alliaria petiolata* (*A. officinalis*)	(garlic mustard)
(4) *Butomus umbellatus*	(flowering rush)
(5) *Celastrus orbiculatus* Thunb.	(Oriental bittersweet)
(6) *Fallopia japonica* (Polygonum cuspidatum)	(Japanese knotweed)
(7) *Hydrocharis morsus-ranae* L.	(frogbit)
(8) *Lonicera x bella*	(Bell honeysuckle)
(9) *Lonicera japonica*	(Japanese honeysuckle)
(10) *Lonicera maackii*	(Amur honeysuckle)
(11) *Lonicera morrowii*	(Morrow honeysuckle)
(12) *Lonicera tatarica*	(Tartarian honeysuckle)
(13) *Lythrum salicaria*	(purple loosestrife)
(14) *Myriophyllum spicatum*	(Eurasian watermilfoil)
(15) *Nymphoides peltata* (Gmel.) Ktze.	(yellow floating heart)
(16) *Phragmites australis*	(common reed)
(17) *Potamogeton crispus* L.	(curly leaf pondweed)
(18) *Rhamnus cathartica*	(common buckthorn)
(19) *Rhamnus frangula*	(glossy buckthorn)
(20) *Trapa natans* L.	(water chestnut)

(21) *Vincetoxicum nigrum* L. (black swallow-wort)

Section V: Prohibitions

(A) The movement, sale, possession, cultivation, and / or distribution of Class A Noxious Weeds designated in Section IV of this quarantine regulation is prohibited.

(B) The movement, sale, and / or distribution of Class B Noxious Weeds designated in Section IV of this quarantine regulation is prohibited.

(C) Violation of any of the prohibitions listed in Section V of this regulation may result in:

(1) The issuance of cease and desist orders; and / or,
(2) Temporary or permanent injunctions; and / or,
(3) Administrative penalties not to exceed $1,000 per violation, as specified in 6 V.S.A., Chapter 84, Sections 1037 and 1038.

Section VI: Exemptions

(A) Scientific, economic and educational exemptions may be granted by the Commissioner to allow for the movement, possession and field experimentation of noxious weeds for scientific and educational purposes under such conditions as may be prescribed by the commissioner. When granting exemptions, the commissioner shall take into consideration the value of the scientific, economic or education purpose and the risk to Vermont's environment, economy and citizens.

(B) Transportation of any Class A or B Noxious weed on any road or highway of the state is exempt if any of the following is true:

(1) It is for disposal as part of a management control activity; or

(2) It is for the purpose of identifying a species or reporting the presence of a species, and the Class A or B Noxious weed is in a sealed container; or

(C) Preserved specimens in the form of herbaria or other preservation means are not subject to this regulation.

(D) Varieties, cultivars, hybrids and/or subspecies that have been shown through scientific research and analysis not to be invasive.

Adopted on 4/22/02

Non-Game Tick Survey – 2002
Forest Biology Lab
Vermont Department of Forests, Parks and Recreation

In 2002, the Departments of Agriculture, Health, and Forests, Parks and Recreation began working together to increase our understanding of the prevalence and distribution of tick vector species in Vermont. In the first year of this surveillance program, 569 ticks were submitted to the Forest Biology Lab from 27 veterinary clinics. Nine counties were represented, including Bennington, Caledonia, Chittenden, Franklin, Lamoille, Rutland, Washington, Windham and Windsor.

Seven species of ticks have been identified. These include *Ixodes cookei* (woodchuck tick), *Ixodes scapularis* (deer tick), *Ixodes muris, Dermacentor albipictus* (moose or winter tick), *Dermacentor variabilis* (American dog tick), *Rhipicephalus sanguineus* (brown dog tick), and *Amblyomma americanum* (Lone star tick). Numbers of each species, along with life stage and sex (for adult ticks), appear below (Table 1).

Table 1. Numbers, species and life stages of ticks submitted to the Forest Biology Lab by Vermont veterinarians in the first year (2002) of a cooperative tick surveillance program.

Species	Number of Adults		Number of Nymphs	Number of Larvae	Total
	Females	Males			
Ixodes cookei	21	0	13	20	54
Ixodes scapularis	292	24	13	0	329
Ixodes muris	1	0	0	0	1
Ixodes sp.	1	0	0	0	1
Dermacentor albipictus	0	0	1	0	1
Dermacentor variabilis	109	38	0	0	147
Rhipicephalus sanguineus	10	14	0	0	24
Amblyomma americanum	2	1	8	0	11
Total	436	77	35	20	569

This study was begun in the spring of 2002, so data for the early part of the year are not complete (Table 2). There were, however, peaks in numbers of certain species of ticks submitted for identification (Figure 1).

Table 2. Numbers of ticks submitted each month for identification.

Month	Number of ticks	Month	Number of ticks
January	0	July	53
February	1	August	21
March	1	September	21
April	21	October	166
May	82	November	105
June	87	December	4

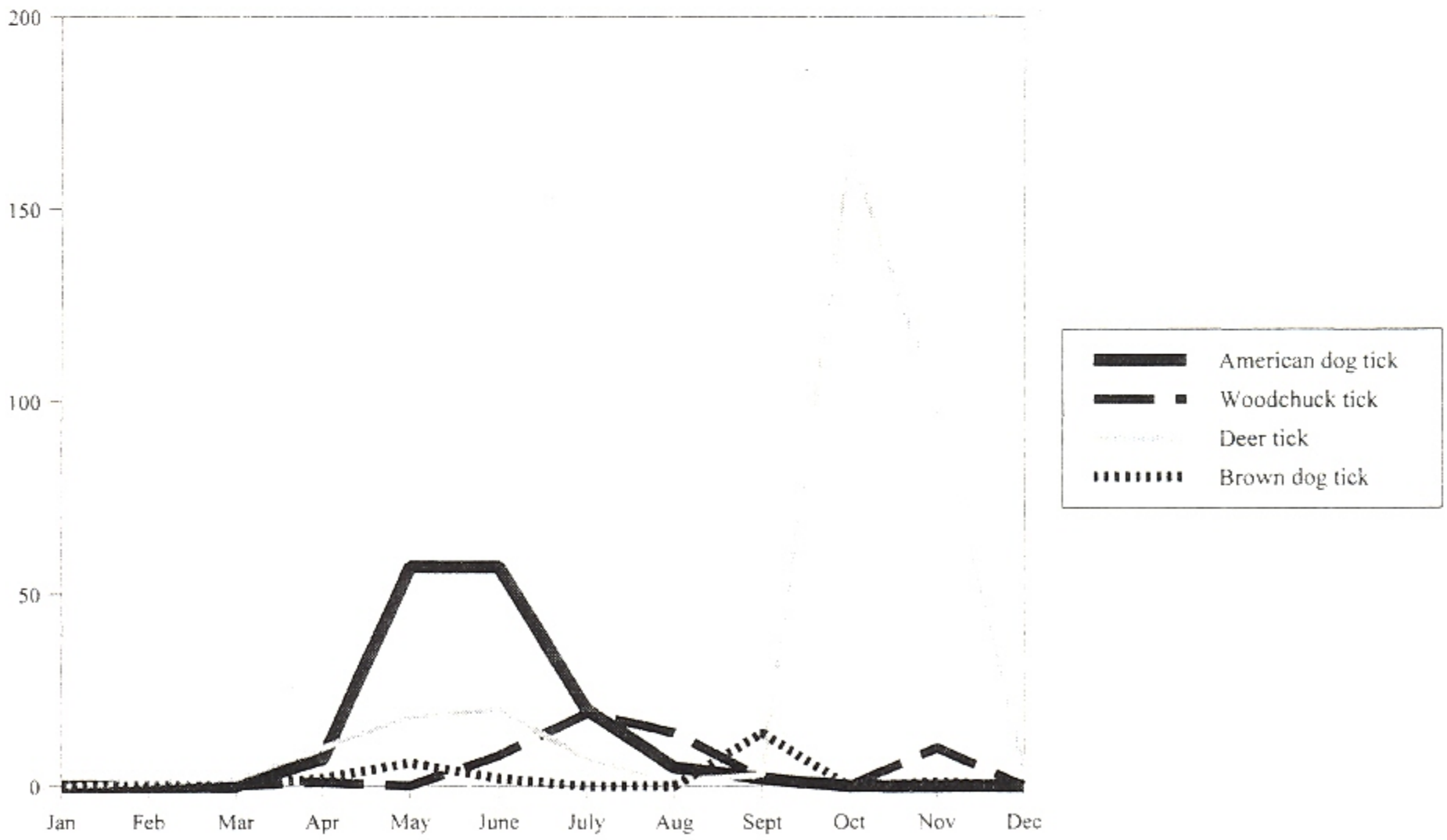

Figure 1. Monthly numbers of the four most common species of ticks identified during the first year of the tick surveillance project.

Ticks sent to the lab have been taken from a number of hosts (Table 3). In this survey, the majority of ticks came from dogs.

Table 3. Number of ticks found on various hosts.

Host	Number of Ticks Found
Dog	419
Cat	95
Human	36
Dragsheet	9
Raccoon	7
Skunk	2
No Host	1

Data on location of tick acquisition, if known, are part of our database. About 28 samples came from dogs that were known to have been out of state. All other ticks were thought to have been acquired in Vermont. All ticks collected during this survey are preserved in ethyl alcohol at the Forest Biology Lab in Waterbury. We plan to continue this program with the Vermont Department of Health and the Vermont Department of Agriculture in 2003. In addition to this information, we have several years' data on ticks collected from deer during opening weekend of rifle season.

State of Vermont

AGENCY OF NATURAL RESOURCES

Department of Fish and Wildlife
Department of Forests, Parks and Recreation
Department of Environmental Conservation

Preparing for Hemlock Woolly Adelgid

Suggestions which may help Reduce its Impact in Vermont

Accept only uninfested hemlocks for planting. Hemlock trees or seedlings brought into Vermont from infested states are required to have an inspection permit certifying that they are free of hemlock woolly adelgid. Before you buy trees, ask where they came from and whether or not they are permitted.

Be on the look-out for signs of hemlock woolly adelgid. Inspect ornamental or forest-grown hemlocks. Focus on trees that are planted within the past 20 years, located near bird feeders, or growing along ravines, trails, and other corridors. Look for white cottony masses on young twigs, at the base of needles. If you think you may have found the adelgid, leave the suspect branch where it is, and contact your county forester or any office of the Vermont Department of Forests, Parks, and Recreation.

Conserve the health of hemlocks growing on deeper soils with good water availability. Trees in these stands are more likely to survive adelgid infestation than those on poorer sites. Maintain the hemlock component, release young hemlocks, and avoid significant disturbance.

Don't rush to salvage hemlock. Hemlock timber value remains low, while the many other benefits it provides are high. Widespread salvage shrinks the gene pool of a species. Important genes, including those that may make hemlocks resistant to adelgid, could be lost. *You may be salvaging unnecessarily*. It's hard to know how severe the impact of adelgid will be when it gets here. Once a stand is infested, mortality doesn't begin for several years, and many trees may survive. We don't know when or where adelgid will first show up in Vermont. Our cold temperatures are expected to have an impact on the insect, and the introduction of natural enemies may reduce tree mortality to tolerable levels. Continuing research may uncover better management strategies.

Establish or maintain stands of other conifer species. 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.

Feed birds away from hemlocks. New infestations have often been spotted around feeders, carried there by seed-eating birds. If there are hemlocks nearby, it may be best to take feeders down between March and July when adelgids are in their mobile life stage.

Get other people involved. In nearly every case, new introductions of hemlock woolly adelgid have been detected by concerned members of the public. The more people looking, the more likely we are to find new introductions before they spread. Early detection provides more management options, including the possibility of eradication. A variety of printed materials are available for distribution.

Help support hemlock woolly adelgid research and management efforts. After maples, hemlock is the most common tree in Vermont. Hemlock woolly adelgid has the potential to cause substantial changes in our forest. Research and management efforts can help slow its spread, encourage the development of effective natural enemies, and provide better management tools.

Barbara Burns, Forest Health Specialist, *March 2002*