

# ANNUAL ASSESSMENT OF FOREST HEALTH ON MOUNT MANSFIELD

Vermont Department of Forests, Parks & Recreation  
Sandra H. Wilmot

## Cooperators

H. Brenton Teillon, Thomas Simmons, Michael Johnson, Pete Reed, Bernard Barton, Jay Lackey, Bradley Greenough and Ronald Wells, Vermont Forestry Division; and the North American Maple Project.

## ABSTRACT

From 1988 to 1991, sugar maples monitored on a North American Maple Project plot-cluster improved in crown condition. But over the past two years, there has been some indication that trees are less healthy. Although average dieback remained stable from 1992 to 1993, the percentage of trees healthy and the foliage transparency of sugar maples was slightly worse, but still considered in good condition. This is similar to the statewide trend of trees on these monitoring plots. An increase in pear thrips populations and damage was observed in the stand this year, causing some trees to refoliate.

Results from additional forest health monitoring plots in the design of the National Forest Health Monitoring Program show an increase in dieback from 1992 at most elevations and on most species. Little change in other crown measurements (density and transparency) and no new mortality was recorded.

Balsam fir trees at the 3800 foot elevation continue to have high amounts of dieback (20.5%) and standing dead trees (45.5%). A high percentage of standing dead red spruce trees at the 3000 foot elevation plots continues to be of concern. However, an improvement in the amount of branch dieback on dominant and codominant spruce (from 15.6 to 11.1% dieback from 1992 to 1993) was recorded.

## INTRODUCTION

A system is now in place to conduct long-term monitoring of tree conditions on Mount Mansfield. The objective is to determine trends in conditions of trees along an elevational gradient, and relate changes in condition to trends in forest stressors. Ultimately, this information will aid in explaining statewide relationships between forest condition and forest stressors.

An additional goal is to standardize information on forest condition at this site with other sites in Vermont and nationwide that use the same set of measurements and plot design. This information should prove useful in evaluating statewide, regional and national forest ecosystem related issues.

### NORTH AMERICAN MAPLE PROJECT PLOT-CLUSTER

#### METHODS

The five-point plot-cluster establishment, site characterization, annual training and certification, and annual tree evaluations follow standardized NAMP protocols (Millers et al, 1991). In 1993, remeasurement of DBH, additional ingrowth, improvements to the tree vigor measurement and seed production ratings were completed in addition to the normal data collection of early defoliation rating and mid-season crown assessments.

#### RESULTS AND DISCUSSION

The condition of dominant and codominant sugar maple tree crowns has been slightly less healthy over the past two years as compared to 1991 conditions (Table 1). Dieback remained stable, but transparency (the amount of light coming through foliage) and the percent of trees healthy (less than 15% dieback) was not as good in 1993 as in the previous 2 years. This trend is similar to statewide trends as observed in other Vermont NAMP plots. No new mortality occurred in 1993.

Table 1. Trend in average dieback, transparency, new mortality and healthy trees (less than 16% dieback) for North American Maple Project plot-cluster at the Proctor Maple Research Center, Underhill, VT.

YEAR	DIEBACK (%)	TRANSPARENCY (%)	MORTALITY (%)	% HEALTHY TREES
1988	11.3	27.3	0	88.6
1989	7.1	23.0	0	91.4
1990	7.6	14.0	0	91.4
1991	3.0	10.9	0	97.1
1992	8.1	14.3	0	94.3
1993	8.1	15.0	0	92.0

An increase in pear thrips populations and damage was observed in the stand, causing some trees to refoliate. Maple leaf cutter damage remained light. Seed production was light. Low counts of sugar maple seedlings and saplings was recorded in NAMP plots.

## FOREST HEALTH MONITORING PLOTS

### METHODS

Eight paired plots are used to monitor tree condition at four elevations on the west slope of Mount Mansfield (1400, 2200, 3000 and 3800 feet). Seven plots were evaluated in 1992, and one plot was added at the 3800 foot elevation in 1993. The design and measurements are those used in the National Forest Health Monitoring Program (Conkling & Byers, 1993). Field crews are trained and certified along with the NFHM crews. Annual crown ratings and damage assessments are conducted on the plots in mid-season. Ozone bioindicator plants are only assessed at a low elevation plot at the Proctor Maple Research Center, since no large openings nor sensitive species have been found near the plots.

Additional information on within season variability in crown ratings is taken four times during the summer. Crown dieback, transparency and density variables are assessed at 3 week intervals on two plots.

### RESULTS AND DISCUSSION

Overall, there was an increase in the average dieback of dominant and codominant trees at all elevations except at the 3000 foot plots, where red spruce and paper birch had less dieback in 1993 than in 1992 (Table 2). No new mortality was recorded on plot trees, but the average number of standing dead trees increased at the 3000 foot level, due to missed trees the previous year, and at 3800 foot level, due to the additional plot established at that elevation in 1993.

Balsam fir trees monitored at 3000 feet had slightly fewer trees in the healthy category ( $\leq 15\%$  dieback) in 1993, but plots at the highest elevation, 3800 feet, had more healthy trees (Table 3). Transparency and density ratings remained similar between years. A few trees showed winter injury on 1 year old foliage, with only 5 - 10 % of total foliage affected.

Red spruce showed a small improvement in the average amount of dieback on dominant and codominant trees at 3000 feet. No new mortality was observed. There was no winter injury symptoms detected on red spruce trees in our plots, although other trees on the mountain were reported symptomatic from aerial surveys.

Hardwood species at the lower elevations (1400 and 2200 feet) had more dieback in 1993 than in 1992 (Table 2), except for yellow birch trees in plots at 1400 feet. No other trends in crown measurements were found from the data. Sugar maple trees in our plots showed light (1 - 30 %) defoliation from pear thrips, bruce spanworm and maple leaf cutter. Other trees on the mountain were more seriously defoliated by pear thrips, as recorded during our aerial survey.

Table 2. Average percent dieback by species and elevation of trees growing in long-term forest health monitoring plots on the west slope of Mount Mansfield, 1993.

SPECIES	ELEVATION	1992 DIEBACK (%)	1993 DIEBACK (%)
BALSAM FIR	3000	5.6	6.8
	3800	18.8	20.5
RED SPRUCE	3000	15.6	11.1
RED MAPLE	1400	3.0	6.0
SUGAR MAPLE	1400	4.2	5.6
	2200	8.3	10.8
YELLOW BIRCH	1400	5.7	5.7
	2200	6.6	7.1
PAPER BIRCH	3000	9.6	8.4
ALL SPECIES	1400	5.3	6.1
	2200	8.6	9.4
	3000	9.0	8.4
	3800	18.8	20.2

Table 3. The percentage of healthy trees, less than 15% dieback, by species and elevation, growing on long-term forest health monitoring plots on Mount Mansfield, 1993.

SPECIES	ELEVATION	1992 HEALTHY (%)	1993 HEALTHY (%)
BALSAM FIR	3000	100	91.3
	3800	54.0	60.6
RED SPRUCE	3000	66.7	77.8
RED MAPLE	1400	100	100
SUGAR MAPLE	1400	100	100
	2200	83.3	100
YELLOW BIRCH	1400	100	100
	2200	94.7	94.7
PAPER BIRCH	3000	88.5	83.3
ALL SPECIES	1400	97.0	100
	2200	90.6	90.6
	3000	89.8	88.5
	3800	54.0	60.6

## REMEASUREMENT PLOTS

### METHODS

Two hardwood plots were measured four times between mid-June and the end of August, at 3 week intervals, to determine the variability in crown ratings as a function of observation time. The three crown variables recorded were crown dieback, foliage transparency and crown density.

### RESULTS AND DISCUSSION

No trend was observed in any of the crown measurements taken four times during the field season (Table 4). Similar results were found in the past two years of this study. Although these results suggest that crown measurements can be taken at any time between June 15 and August 30 with no measurable difference, this may not be true in every year. If a moderate-heavy defoliation was to occur, or any other major stress event during the growing season, it is likely that the time when crown measurements were taken would be important. Since this did not occur during this study, the only conclusion that can be drawn is that under "normal" growing season conditions, crown measurements can be taken at any point within the sampling window. This study will not be repeated in 1994. It is expected that the National Forest Health Monitoring Program will initiated studies to address the issue of Index Period Stability using a wider variety of species and geographic locations, using larger sample sizes.

Table 4. Crown measurement results from two forest health monitoring plots revisited four times during the season. Mount Mansfield, 1993.

DATE	DIEBACK (%)	TRANSPARENCY (%)	DENSITY (%)
6-23-93	6.9	14.0	51.9
7-15-93	6.5	15.2	51.2
8-3-93	6.1	14.9	51.2
8-27-93	6.8	15.1	51.8

### REFERENCES

Conkling, B. L. and G. E. Byers (eds.). 1993. Forest Health Monitoring Field Methods Guide. Internal Report. U.S. Environmental Protection Agency, Las Vegas, NV.

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