ANNUAL ASSESSMENT OF FOREST HEALTH ON MOUNT MANSFIELD 1995

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Cooperators

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Abstract

Forest health is monitored annually using two different methods. One plot-cluster of the North American Maple Project (NAMP) monitors trends in the condition of sugar maple at an elevation of 415 m (1360'). Site characterization, crown condition, and bole and crown damage are measured. In addition, 8 plots have been established following the design and measurement variables of the National Forest Health Monitoring Program. These are located on the west slope of the mountain along an elevation gradient, with pairs at 1400, 2200, 3000 and 3800 feet. Measurements taken on these plots are used to determine current tree health and to create a baseline for long-term monitoring.

Data on sugar maple condition has been collected since 1988 under the NAMP and shows a general improvement from 1988 to 1989, then a stable and generally healthy condition thereafter. In 1994, 95.8% of trees were considered healthy ($\leq$ 15% dieback), average dieback was 7.3%, transparency of foliage was 11.3%, and no new mortality was observed. Thinner foliage can be attributed to a spring and early summer drought conditions.

Tree health data from the other forest health plots showed slight increases in dieback, one indicator of tree condition, at the 1400, 2200 and 3000 foot elevations. Early season drought conditions may have been responsible. Dramatic improvements in tree condition at 3800 feet occurred, where balsam fir is the dominant species. However, balsam fir at the 3000 foot elevation has shown a steady increase in average dieback over the last 4 years. All other species showed small fluctuations in crown conditions. Few stress agents were active this year. There was an increase in mortality at the 3000 and 3800 foot elevations, where 1.3 and 4.0% mortality occurred in 1995. Mortality was preceded by poor crown vigor and damages to bole and crown.

Introduction

Annual assessments of crown condition, mortality, and damage are conducted on permanent plots located at four elevations. The purpose of these plots is to document changes in tree health over time and will aid in the identification of causes for declines, if they occur.

Two types of plots are used: one plot at low elevations is part of the North American Maple Project (NAMP) plot system, 8 additional plots use the design and measurement variables of the National Forest Health Monitoring Program (NFHM).

NAMP Plot Methods

Plot establishment, site characterization and annual tree evaluations follow standardized NAMP protocols (Millers et al, 1991). Annual evaluations of tree condition and foliage damage require two - three visits to the plot to determine extent of injury from early-, mid-, and late-season defoliators: one in mid-to-late June, July, and early September. Evaluators are trained and certified with other state and provincial field crews to maintain high Quality Control. Between-crew and between-state remeasurements are done on 12 % of the plot-clusters and with each field crew. Data entry is completed in-state, and statewide data is acquired following quality check by the NAMP data analyst at SUNY in Syracuse, NY. Metric units are used for data collection and analysis.

NAMP Plot Results and Discussion

Overstory sugar maple tree condition has improved since 1988 and maintained a generally healthy status since 1991. In 1995, average dieback and the percentage of trees considered healthy (< = 15% dieback) remained stable from the previous year. Transparency, a measure of current year stress, increased slightly. Early summer drought conditions may have been responsible, producing slightly thinner tree crowns. No other stress agents were active this year. No new mortality occurred in 1995.

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	8.2	14.3	0	91.5
1994	7.6	10.4	0	95.8
1995	7.3	11.3	0	95.8

Table 1. Tree health results for the NAMP plot at 415 m (1360 ft) at the Proctor Maple Research Center, Mount Mansfield, Vermont. Average crown dieback, average foliage transparency (the amount of light coming through the foliated portions of the crown), mortality, and percent of trees healthy are all used to assess the health of dominant and codominant sugar maple trees in this plot.

Forest Health Plot Methods

Eight permanent plots are used to monitor the health of forests on the west slope of Mount Mansfield, annually. Two plots at each of four elevations (1400, 2200, 3000 and 3800 feet) were established following the design and measurement variables of the NFHM program (Tallent-Halsell 1994). At each elevation, except 3800 ft, paired plots are located in each of the two watersheds: Browns River and Stevensville Brook. In the Stevensville Brook watershed, no canopy trees are present at the 3800 foot elevation, so the paired plots at this elevation are in the Browns River watershed. English units are used for data collection and analysis.

Forest Health Plot Results and Discussion

Trees monitored at 1400, 2200 and 3000 foot elevations had slightly greater dieback than in 1994. At all three elevations, fewer trees were considered healthy (< = 15% dieback) in 1995 (Tables 2a and 2b). At 3800 feet, there were dramatic improvements in tree health. Average dieback decreased to 17.1%, and the percentage of trees healthy increased to 64.7%. While lower elevations experienced below average precipitation conditions throughout the spring and early summer months, the high elevation forests had normal rainfall except for April and June, creating fairly normal growing conditions overall. These trees are still significantly less healthy than at all other elevations.

When compared to 3-year averages, trees on the 3000 foot plots had significantly higher dieback in 1995, while trees on the 3800 foot plots had significantly less dieback (Figures 1-3). Some of this improvement may be the result of removal of poor vigor trees from the sample due to mortality. Other crown health indicators, foliage transparency and crown density, were similar to past years.

Mortality increased on the 3000 and 3800 foot elevation plots, with 1.3 and 4.0% mortality, respectively. Mortality was preceded by years with poor crown vigor (high dieback and low density), and damages to boles and crowns. No mortality occurred on the 1400 and 2200 foot elevation plots.

Tree damages are injuries observed on any location of the tree that meet a minimum threshold. The most common type of damage found on survey plots is indicator of decay, which includes conks, fruiting bodies, decaying wood, etc. (Table 3).

Yellow birch at 2200 feet, paper birch at 300 feet, and balsam fir at 3800 feet had large percentages of trees affected by numerous types of damage. Over half of the overstory yellow birch trees had indicators of decay (58% of trees). Light defoliation by an early season shot hole defoliator occurred on 68% of the trees. Overstory paper birch were affected by indicators of decay (36% of trees), large open wounds (20% of trees) and dead terminals (4% of trees) Nearly half the overstory balsam fir trees had dead or broken terminals (43% of trees), probably due to adverse winter conditions. Other damages included indicators of decay (15% of trees) and broken branches on greater than 1/4 of the trees (10% of trees).

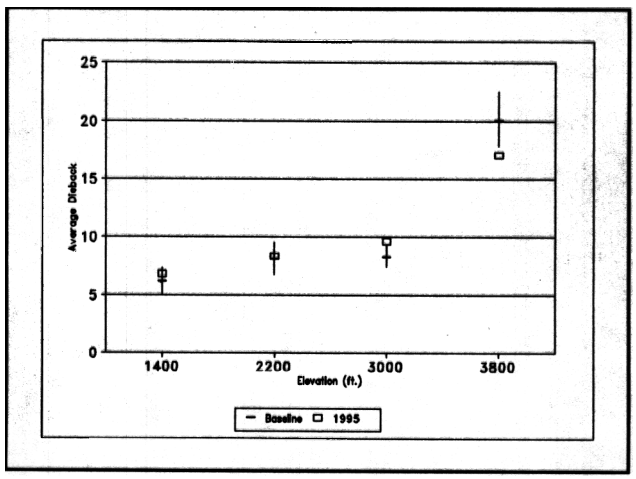
Table 2a. Average dieback for overstory trees of species growing on monitoring plots at different elevations on Mt. Mansfield from 1992 through 1995.

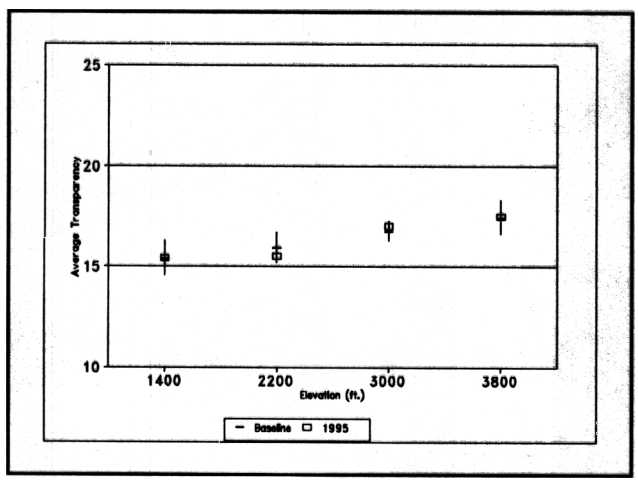
SPECIES	ELEVATION	1992 DIEBACK (%)	1993 DIEBACK (%)	1994 DIEBACK (%)	1995 DIEBACK (%)
BALSAM FIR	3000	5.6	6.8	8.2	9.8
	3800	18.8	20.5	20.3	16.9
SUGAR MAPLE	1400	4.2	5.6	5.6	5.0
YELLOW BIRCH	2200	6.6	7.1	5.4	6.6
PAPER BIRCH	3000	9.6	8.4	6.1	7.6
ALL SPECIES	1400	5.3	6.1	5.4	6.8
	2200	8.6	9.4	8.3	8.3
	3000	9.0	8.4	9.2	9.6
	3800	18.8	20.2	20.7	17.1

Table 2b. The percentage of overstory trees of different species growing at different elevations on Mt. Mansfield that are considered healthy ($\leq$ 15% dieback) over a 3 year period, 1992 through 1995.

SPECIES	ELEVATION	1992 HEALTHY (%)	1993 HEALTHY (%)	1994 HEALTHY (%)	1995 HEALTHY (%)
BALSAM FIR	3000	100	91.3	92	93
	3800	54.0	60.6	57	64.2
SUGAR MAPLE	1400	100	100	100	100
YELLOW BIRCH	2200	94.7	94.7	100	100
PAPER BIRCH	3000	88.5	83.3	97	92
ALL SPECIES	1400	97.0	100	100	97.6
	2200	90.6	90.6	97	95.1
	3000	89.8	88.5	92	91
	3800	54.0	60.6	57	64.7

Figures 1-3. Overstory tree health in 1995 compared to 3 year averages (baseline) for survey plots at 4 elevations on Mount Mansfield. Tree health indicators used are crown dieback, foliage transparency and crown density.





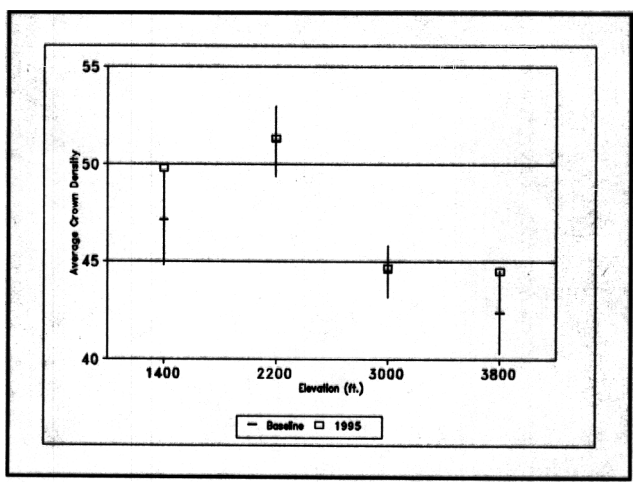


Table 3. Percent of trees affected by significant damages. Minimum thresholds for each type of damage are those considered significant for tree growth and vigor. Protocols follow those of the National Forest Health Monitoring Program.

Species (elevation)	Percent of trees and type of damage
Balsam Fir (3000 ft.)	2% with broken bole or roots, 2% with discolored foliage (30% of foliage), 2% with broken branches (40% of branches)
Balsam Fir (3800 ft.)	15% with indicator of decay, 43% with dead terminal, 10% with broken branches
Sugar Maple (1400 ft.)	12% with indicator of decay
Yellow Birch (2200 ft.)	58% with indicator of decay, 5% with open wound (size > 20% of circumference), 68% with light defoliation by unknown shot hole defoliator (<30% defoliation)
Paper Birch (3000 ft.)	36% with indicator of decay, 20% with open wound (size >20% of circumference), 4 % with dead terminal

References

Millers, I., D. Lachance, W. Burkman & D. Allen. 1991. North American Sugar Maple Decline Project: organization and field methods. Gen. Tech. Rep NE-154. Radnor, PA: U.S. Dept. of Agr., Forest Service, Northeastern Forest Experiment Sta. 26 p.

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