

ANNUAL ASSESSMENT OF FOREST HEALTH ON MOUNT MANSFIELD 1997

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Cooperators

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Introduction

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

Two types of plot designs and measurements are used: one plot at low elevations is part of the North American Maple Project (NAMP) plot system; 14 additional plots use the design and measurement variables of the National Forest Health Monitoring Program (NFHM).

NAMP Plot Methods

One 5-point cluster plot was established in an operating sugarbush at the Proctor Maple Research Center in 1988. Plot establishment, site characterization and annual tree evaluations follow standardized NAMP protocols (Cooke et al, 1995) and are comparable to the other 39 plots in Vermont, and over 200 plots in the U.S. and Canada. 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 10 % 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

Sugar maple trees examined as part of the North American Maple Project continue to maintain a generally healthy condition. Over 94.9% of overstory sugar maples were considered healthy in 1997, slightly fewer than in 1996. Other indicators of health likewise fluctuated to-

wards less healthy this year: average dieback was 8.1% and average foliage transparency was 10.8%. Although these indicators show a less healthy condition, they are within the range of normal for healthy sugar maple. There was no new mortality in 1997.

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 were located in each of the two watersheds: Browns River and Stevensville Brook. In the Stevensville Brook watershed, no canopy trees were 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.

In 1997, 6 additional plots were established on the east slope of the mountain, in the Ranch Brook watershed. Paired plots at three elevations (1400, 2200, and 3000 feet) provide an opportunity to compare tree health between west and east aspects.

Forest Health Plot Results and Discussion

West slope plot results

An analysis of the health of major tree species at each elevation showed that species at all elevations improved in average dieback this year (Figure 1), while crown density remained stable (Figure 2). Foliage transparency was also stable, except for an increase in balsam fir transparency on trees monitored at 3800 feet elevation (Figure 3).

When comparing tree health in 1997 to the 5 year baselines for each health indicator (dieback, transparency and density), there was a significant improvement in dieback at the 1400 and 2200 foot plots in 1997 (Figure 4). Other indicators of crown condition, foliage transparency and crown density (Figure 5-6) showed no change in foliage and crown density in 1997, despite the good growing conditions.

In general, trees at lower elevations are healthier than at higher elevations. For all indicators (dieback, foliage transparency and crown density) trees at 1400 feet are healthier than at 3800 feet (Figures 4-6). Trees at 3800 feet have remained in poor condition since monitoring began in 1992. The percentage of healthy trees is low (58.5%), and average dieback is high (20.7%). There was no new mortality in 1997 in any of the plots.

Damages to trees can play a significant role in tree health. Trees in the 1400 foot elevation plots had fewer damages than at the other elevations (Table 2). The most common type of damage at the 1400, 2200, and 3000 foot elevation plots was indicators of decay (past wounds that have begun to decay). At the 3800 foot elevation plots, broken or dead tops was the most common damage, probably due to severe winter weather that includes heavy ice loads and strong winds.

East slope results and comparison with west slope

Tree composition at each elevation is similar on the east and west slopes with a few exceptions. At the 1400 foot elevation plots, sugar maple is the predominant species, but nearly half the trees in the west slope plots are this single species, while east slope plots have a better mix of sugar maple, beech and yellow birch (Table 3). At the 2200 foot elevation plots both aspects have a dominance of yellow birch. Paper birch comprises 23% of trees on the east slope, but is not present on west slope plots. At 3000 feet, west slope plots have an equal abundance of balsam fir and paper birch, but the east slope plots have a dominance of paper birch (53% of trees).

Trees on the west slope plots are healthier than on the east slope. Average dieback and transparency are lower, and crown density is higher on the west slope plots at all elevations (Table 3). Likewise, a higher percent of trees have less than 15% dieback (healthy category) on the west slope than on the east slope, with the exception of the 2200 foot elevation, where 96% of trees are healthy on the east slope compared to 93% on the west slope. Transparency and crown density differences could be explained by the difference in species composition. Although there is higher average dieback and fewer trees healthy on the east slope plots, the 1400 and 2200 foot values are still considered healthy (over 90% of trees healthy). Relatively high dieback (11%) and low percent of trees healthy (78%) at the 3000 foot elevation on the east slope indicates a recent stress event affecting tree health. Since half the trees on these plots are paper birch, which is susceptible to environmental stresses such as drought or ice damage, this may account for the difference between east and west slope tree health.

References

Cooke, R., D., Lachance, W. Burkman & D. Allen. 1995. North American Sugar Maple Decline Project: organization and field methods. Updated from: Gen. Tech. Rep NE-154. Radnor, PA: U.S. Dept. of Agr., Forest Service, Northeastern Forest Experiment Sta. 22 p.

Tallent-Halsell, N.G. (ed.). 1994. Forest Health Monitoring 1994 Field Methods Guide. EPA/620/R-94/027. U. S. Environmental Protection Agency, Washington, D.C. 1997 version.

Figure 1. Trend in **average dieback** of overstory trees for species at different elevations on the west slope of Mount Mansfield, 1992-1997.

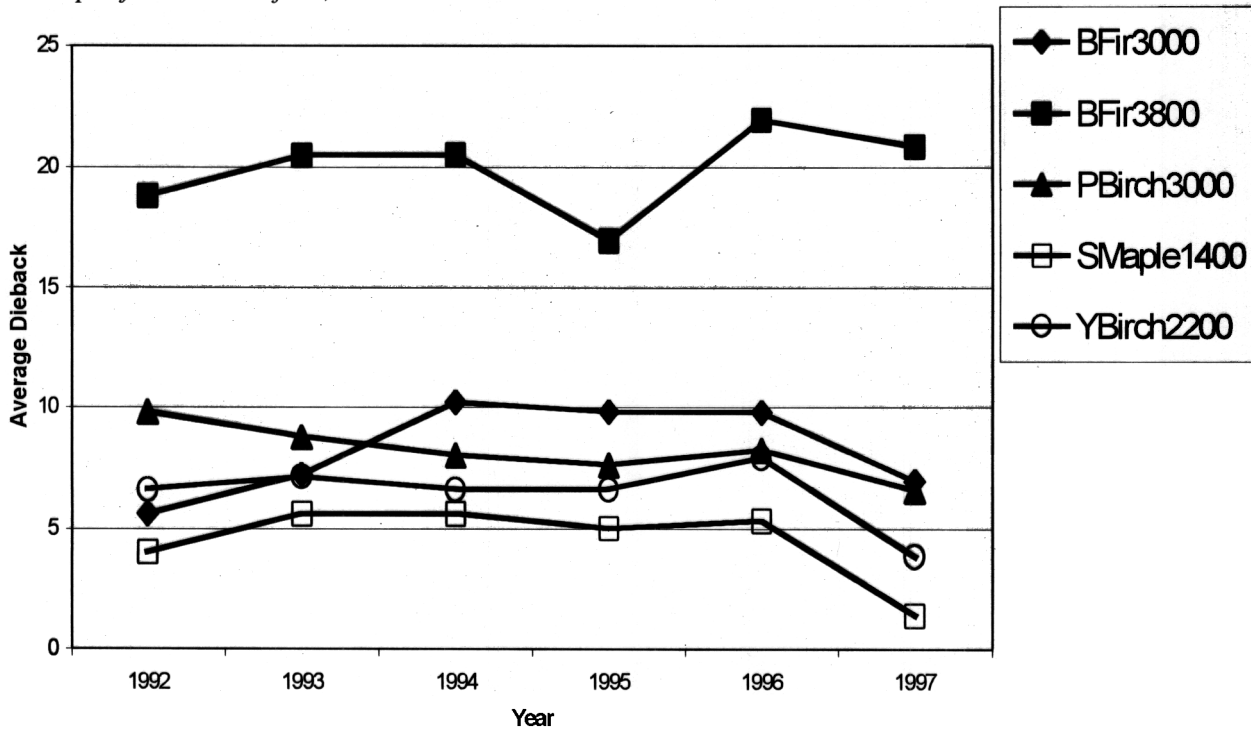


Figure 2. Trend in **average crown density** of overstory trees for species at different elevations on the west slope of Mount Mansfield, 1992-1997.

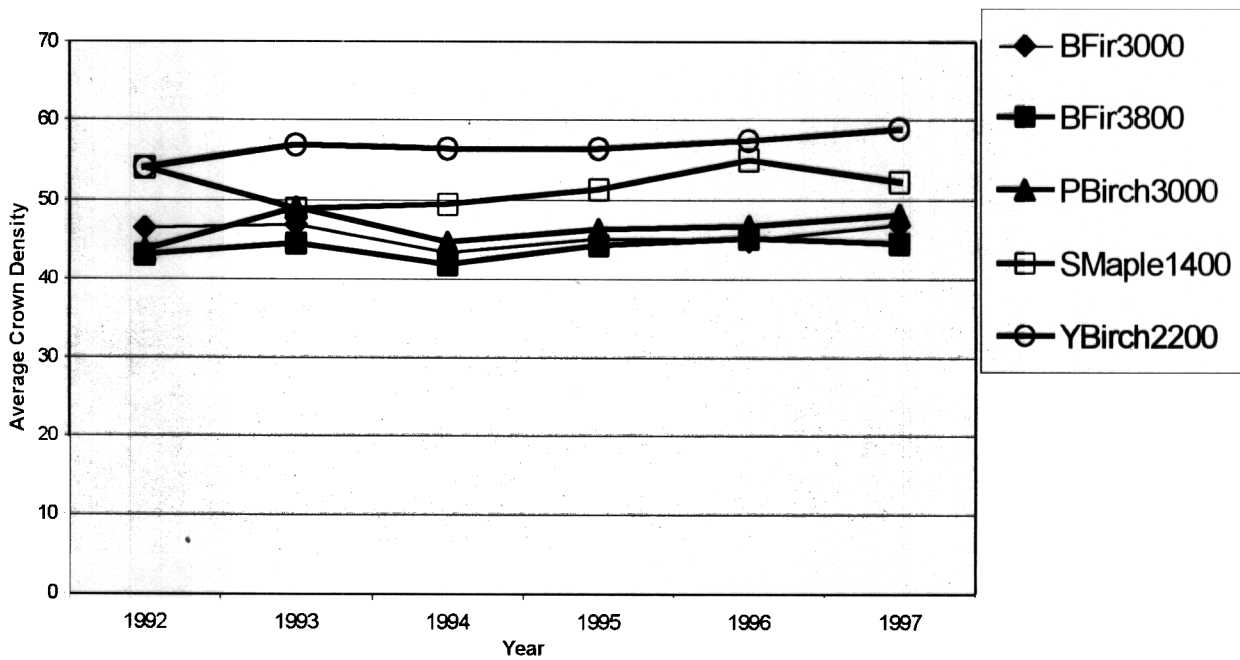


Figure 3. Trend in foliage transparency of species at different elevations on the west slope of Mount Mansfield, 1992-1997.

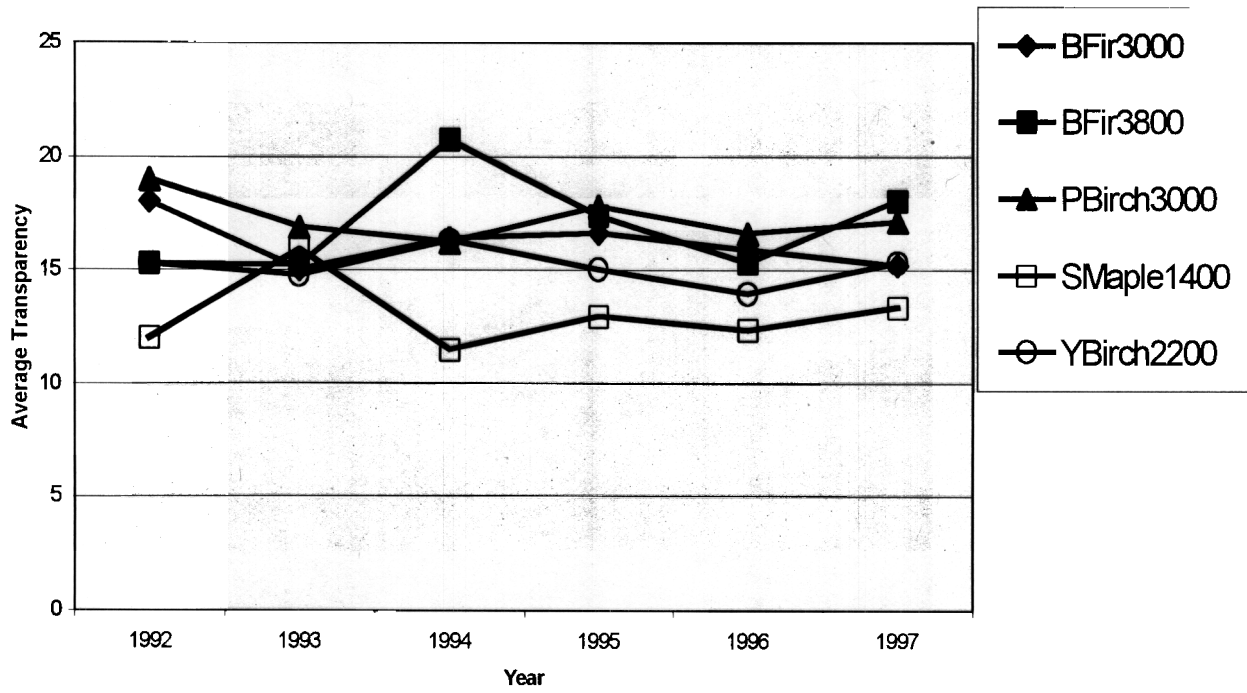


Figure 4. Overstory tree health in 1997 compared to the 5 year average (baseline) for crown dieback at 4 elevations on the west slope of Mount Mansfield.

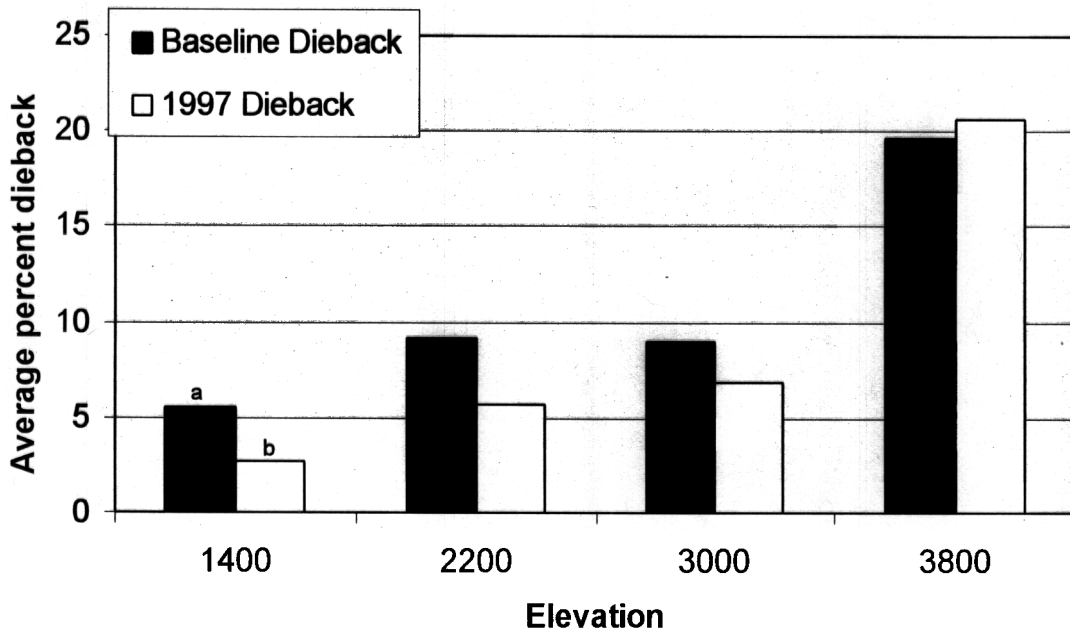


Figure 5. Overstory tree health in 1997 compared to the 5 year average (baseline) for foliage transparency at 4 elevations on the west slope of Mount Mansfield.

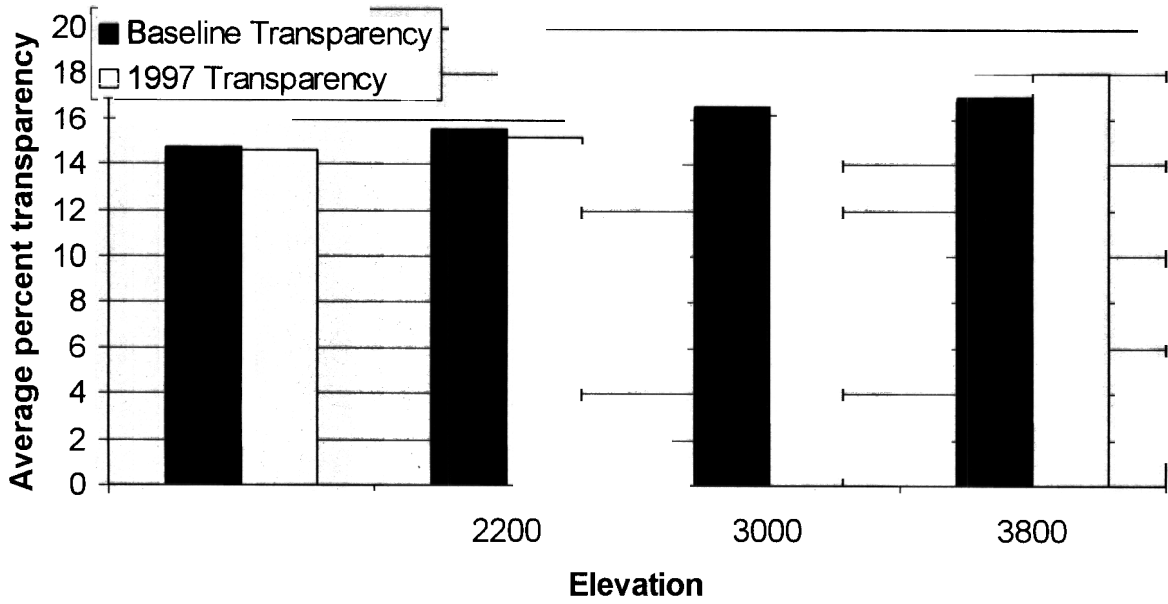


Figure 6. Overstory tree health in 1997 compared to the 5 year average (baseline) for crown density at 4 elevations on the west slope of Mount Mansfield.

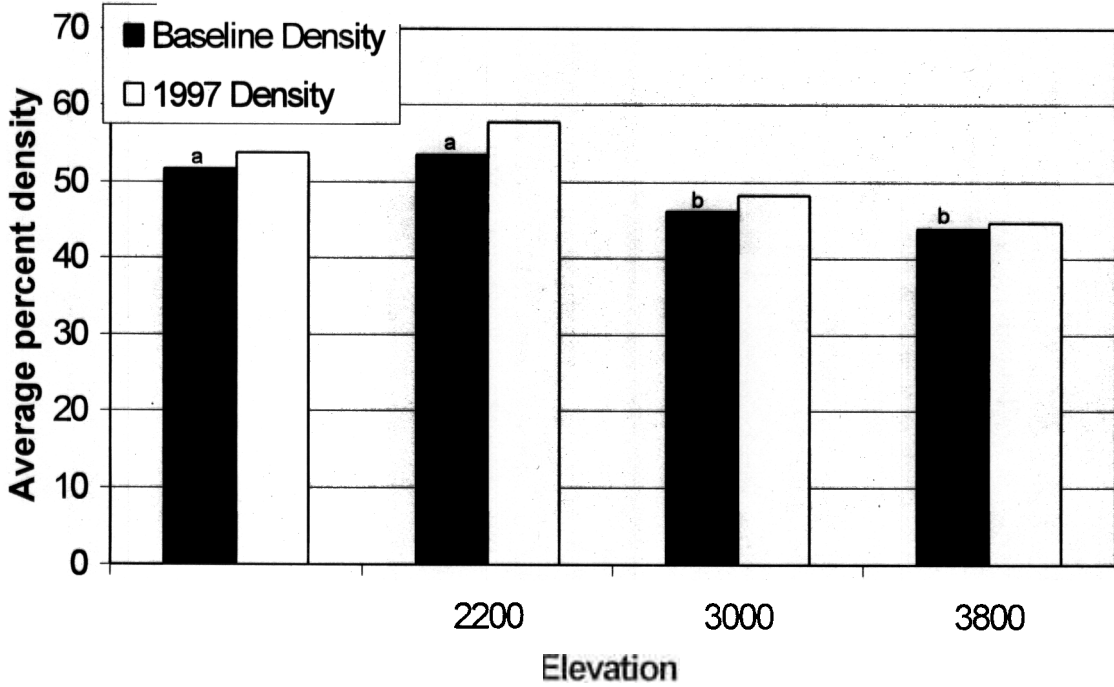


Table 1. Tree health results for the NAMP plot at 415 m (1360 ft) at the Proctor Maple Research Center, Mount Mansfield, Vermont. Average crown dieback, average foliage transparency (the amount of light coming through the foliated portions of the crown), mortality, and percent of trees healthy are all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

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
1996	6.9	9.5	0	95.7
1997	8.1	10.8	0	94.9

Table 2. Percent of trees on west slope plots affected by significant damages in 1997. 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.

Elevation (feet)	Percent of trees with damage	Percent of trees affected by each type of damage
1400	20.4%	18.2% Indicator of decay
		6.8% Canker
		2.3% Dead or broken top
2200	40.5%	44.2% Indicator of decay
		7.0% Canker
		7.0% Open wound
		4.6% Dead or broken top
3000	33.3%	20.8% Indicator of decay
		6.9% Canker
		4.2% Open wound
		2.8% Dead or broken top
		2.8% Broken branches
		2.8% Other
3800	36.8%	27.6% Dead or broken top
		11.8% Indicator of decay
		10.5% Broken branches
		5.3% Open wounds
		5.3% Broken bole or roots
		2.6% Other

Table 3. Species composition differences between plots on the west and east slope of Mount Mansfield.

Elevation	Species	West slope percent of trees	East slope percent of trees
1400	Sugar Maple	48.6	37.8
	Beech	40.8	24.4
	Yellow Birch	21.6	22.2
	Red Maple	13.5	8.9
	Other	5.4	6.6
2200	Yellow Birch	63.0	48.9
	Sugar Maple	22.2	17.0
	Beech	11.1	8.5
	Other	3.7	2.1
	Paper Birch	0	23.4
3000	Balsam Fir	41.3	28.8
	Paper Birch	41.3	53.4
	Red Spruce	11.1	16.4
	Other	6.3	1.4

Table 4. Comparison of tree health on the west and east slope of Mount Mansfield using dieback, foliage transparency, crown density and the percent of trees healthy as health indicators.

Health indicator	West Slope			East Slope		
	1400	2200	3000	1400	2200	3000
Dieback	2.7	5.7	6.9	5.0	6.8	11.2
Transparency	14.6	15.2	16.2	16.8	16.6	18.8
Density	53.8	57.8	48.3	51.2	49.3	44.7
Percent healthy	100	92.6	96.6	97.8	95.7	78.1