THE NORTH AMERICAN MAPLE PROJECT *Reprinted from Farming, the Journal of Northeast Agriculture January, 2010*

In the 1980's, sugar maple appeared to be in a serious state of decline over a wide variety of locations, in both sugarbushes and non-sugarbushes. Canadian researchers reported unusual dieback and mortality of sugar maple over much of its range in Quebec. Huge areas of the maple forest in Vermont were defoliated in 1988 by the new pest Pear Thrips, which many people felt would be become a permanent threat to the region. Researchers from New York, Pennsylvania and Massachusetts also reported large numbers of maples in poor health. Symptoms included declining growth rates, poor taphole closure, abnormally small leaves, crown dieback and early fall coloration. Various causes and contributing factors were blamed, including acid rain, nutrient deficiencies, drought, insect defoliation, root freezing and logging damage. A former manager of the University of Vermont Proctor Maple Research Center considered selling the land because he felt that the forest was dying off.

Enter the North American Maple Project (NAMP), a cooperative program between the United States and Canada, begun in 1988 with the goal of evaluating and monitoring trees from Nova Scotia to Minnesota. NAMP was initiated to answer many questions, which could be summed up as: what is the current health of sugar maple in these various regions, and is it getting better, worse, or staying the same? Over 200 plot "clusters," each containing 25 to 50 mature maples, were established in a diverse array of sites, approximately half in sugarbushes and half in non-sugarbushes. The project relied primarily on annual assessments of the crown conditions of each of the thousands of maples in the plots, with scores given for the amount of branch dieback, the density of the foliage, and the apparent overall vigor of the tree. The monitoring was performed by teams of foresters, botanists, and other natural resource professionals.

NAMP plots were monitored for 10 successive years in most states and provinces (longer in Vermont and a few other states) and the project yielded results that were sometimes unexciting, sometimes surprising, and mostly reassuring. Perhaps most reassuring was the statement made in a major report: "after seven years of monitoring the crown condition of sugar maple, we have identified no evidence of sugar maple decline in NAMP plot clusters. What appear at this point to be temporary, short-term changes in crown condition are associated with a variety of biotic and abiotic stresses." In other words, events such as insect defoliation, drought, and root freezing could explain the decline in the condition of the affected trees, but these changes were not permanent. Most of these changes involved thinning of the foliage after the stress event. The data showed that branch dieback was worst in Quebec, least in the Lake States, and generally improved yearly between 1988 and 1994 when the first major data summary was made. Significant improvements in tree condition in many areas were ascribed to decreased insect damage, primarily less Thrips and Forest Tent Caterpillars. Sites were grouped according to the amount of air pollution and acid rain they received. Although the data did show that maple crowns were thinner in some areas of higher

deposition, branch dieback was not connected to the different levels of deposition seen at these sites. These conclusions did not mean that air pollution caused no harm to trees, only that it was not causing a region-wide maple decline. Air pollution and resulting acid rain remain a continuing threat to trees in some areas.

One of the most important findings to sugarmakers was that there was no meaningful difference in the health of tapped and untapped sugar maples. As this conclusion was derived from a massive data set, this has proved to be one of the most convincing of all arguments that sugarmaking is sustainable in the long haul. It is worth noting, however, that in some regions there exist important differences between sugaring practices during the period of monitoring and those of today. These include both the fact that most trees in the early days of NAMP were tapped with 7/16" spouts (and many were tapped more aggressively using older tapping guidelines), and that vacuum, if used in the 80's, was generally no greater than 15 inches of mercury.

One of the important questions facing the researchers was whether the amount of tree death in the plots during the monitoring period was "normal" or greater than normal. The data collected by NAMP showed that the current mortality of sugar maples was similar to mortality reported in many studies of Eastern forests, and that mortality was not greater in sugarbushes than in non-sugarbushes. Under normal circumstances, a certain number of trees die annually in a maple forest; the data showed that mortality occurred yearly in about 1% of the upper canopy trees, and in about 2% of intermediate or suppressed trees. NAMP data also showed that there was a fairly predictable relationship between the amount of dieback in a tree and its likelihood of dying in the next few years. Trees with 40% or more branch dieback were likely to be in poor condition or dead within five years, while trees with 20-30% dieback were much more likely to improve. Data from Vermont, which is one of the few states that has continued monitoring NAMP plots after the program officially ended, showed an interesting relationship between catastrophic damage (caused by a 1998 ice storm) and the probability of tree recovery. Although most landowners would have given them up for lost, many trees with up to 90% limb breakage recovered within a few years. Much of this recovery occurred at sites with good soil fertility.

The NAMP study should not be used to conclude that all maples are in good health, or that the species is not threatened by reoccurring or new threats. Air pollution, drought, insect defoliation, and other stresses, particularly in combination, are quite capable of dealing a damaging blow to an area. Sites that are less than ideally suited for maple, such those with soils that are wet, thin, or particularly infertile, are much more susceptible to a significant decline after stress events. Maples are also subject to potential harm from agents not recorded in the NAMP data, such as attack by Asian Longhorned Beetle, replacement of native species by invasive plants, or long-term climate change with resulting changes in rainfall. Natural regeneration of maples was not recorded in most NAMP plots, but remains a subject of some concern to

land managers, as seedling and sapling maples are scarce in many maple forests. Nevertheless, the huge effort that went into establishing and monitoring thousands of maples across its range has provided us with assurance that in many cases, what can appear to be a maple disaster in the making is probably a short-term episode of limited scope that will be followed by a return to healthy conditions.

For more information about the NAMP program and its conclusions, see the following publications:

Allen, D.C., Molloy, A.W., Cook, R.R., Lachance, D. and Barnett, C. 1995. North American Maple Project: Seven Year Report. USDA Forest Service, Radnor, PA.

Allen, D.C, Molloy, A.W., Cooke R.R and Pendrel, B.A. 1999. A ten-year regional assessment of sugar maple mortality *In*: Horsley, S. B. and Long, R. P., eds. Sugar maple ecology and health: proceedings of an international symposium; 1998 June 2-4; Warren, PA. USDA Gen. Tech. Rep. NE-261. Radnor, PA.

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