Temperatures in the Sugarbush

Tim Wilmot, University of Vermont Extension Maple Specialist
Proctor Maple Research Center

Reprinted with permission from the Maple Syrup Digest, June 2006

Most maple producers are keenly aware of the weather during the spring, with temperature the most frequently observed parameter. One major limitation to the sap-run forecasting ability of many producers is that measurement of air temperature in one location does not capture the wide variation in air temperature throughout the sugarbush; nor does it accurately reflect the temperature of the diverse parts of trees, or of the soil. A study of the range of temperatures in the forest during sugaring time is helpful in understanding some of the influences of weather on sap flow. This article briefly summarizes a large set of data collected over the past years which includes many sugarbush temperatures, and will give a few examples of the sometimes unexpected variation in temperatures which occur during the spring.

The temperature data referenced in this article were all collected at the Univeristy of Vermont Proctor Maple Research Center in Underhill Center, Vermont, over the past decade. Temperature measurement is part of an ongoing effort to describe sap pressure and flow in sugar maple in relation to weather. Some of the data can be seen live during the spring at http://www.uvm.edu/~pmrc --- click on TREEMET. Measurements were made with copper/constantan thermocouples, which provide a high degree of accuracy, and were recorded every 15 minutes around the clock by remote dataloggers.

The sap flow mechanism of sugar maple requires periods of freezing and thawing; freezing temperatures produce negative pressure in the tree and result in water uptake from the soil, while thawing results in positive pressure that causes flow from tapholes. Large limbs and tree trunks respond slowly to changes in temperature, so that when alternating cold nights and warm days lead to periods of sap flow, this is caused primarily by temperatures low and sustained enough to freeze small branches, and warm enough to thaw them. Predicting when branches will freeze is not always easy, because air temperature measured close to the ground may not be a good indication of

On April 3, wind speeds had diminished to less than 2 mph, and a temperature gradient of about 8 degrees from the ground surface to mid-canopy at 54’ was present, as the heavier cold air sank to the lowest point. Puddles on the ground froze, but the temperatures above this were too warm to freeze the branches. Still nights during the spring were more common than windy nights; for example, during the sugaring seasons of 2005 and 2006, about 60% of the nights were calm enough to establish a vertical temperature gradient similar to April 3. Additionally, still nights allow cold air to move downslope and pool in low spots, so that higher parts of the sugarbush might not receive frosts that occur in hollows.

Another sugarbush incongruity is the temperature of small branches and twigs: they are rarely the same as the air surrounding them

snow, soils would freeze with