Production: Sugarbush Management

Managing for a Healthy Sugarbush in a Changing Climate

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Severe and "wonky" weather is becoming the new normal. It is common to hear the word "new record extreme" used by meteorologists as you listen to the weather report. A recent study conducted by Yale University and George Mason University found that 85% of Americans reported experiencing extreme weather in 2012 and 2013 (Leiserowitz et al., 2013). In Vermont, over the last 50 years we have experienced a 2 degree F temperature increase in the summer months, and a 4.5 degree F temperature increase during the winter months (Betts, 2010). Temperature is only one of numerous changes we are witnessing. As seen in Figure 1, data from the Vermont Department of Forests, Parks & Recreation (FPR) documented both spring bud break (initial leaf emergence) and full leaf-out occurring earlier than historic averages. Earlier bud break increases the length of the growing season, but may make buds vulnerable to frost damage.

Documented earlier bud break than the previous 20 years has been coupled with a later end to the sugar maple growing season over the last decade (Figure 2).

Beyond changes in the amount of time a deciduous tree such as sugar maple is actively growing during the summer months, we are also seeing changes that can impact these trees while they are dormant during winter months. In the last five years in Vermont we have seen a reduction of more than 50% in the number of days with greater than one inch of snow cover on the ground. Deep snow provides a thermal blanket, protecting roots from sub-zero temperatures that can negatively impact delicate roots buried beneath the forest floor.

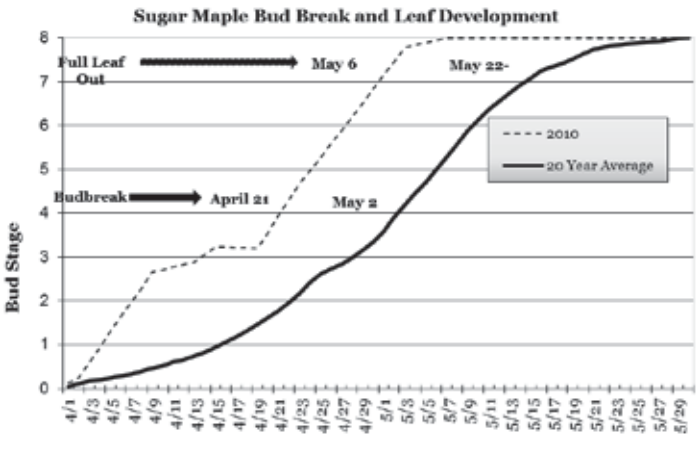

Figure 1: Data from the Vermont Department of Forests, Parks and Recreation, Forest Insect and Disease Conditions in Vermont, 2010, showing sugar maple bud break compared to the 20-year historic average.

These are just a few of the numerous changes we are experiencing today. Climate scientists use his-

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toric data combined with predictive climate models to better understand what we might expect in years to come. These climate projections provide us with invaluable insight into what we should expect, and how we can prepare for future changes. Continued increase in the average/mean global temperature doesn't necessarily mean it will be warmer in all places. What we can expect is more extreme weather in the form of more frequent and intense weather events. Last summer northern Vermont experienced wind damage, heavy rains, and drought conditions. In addition, this region experienced damage from heavy snow and ice during the previous two winters. These are the types of events predicted to be more regular in the Northeastern US in the years to come, so we should expect and prepare for them.

What does this all mean for your sugarbush, and what can you do as a manager? A great start is to read Peter Smallidge's article in the October 2016 *Maple Syrup Digest* titled "Maintaining a Healthy Sugarbush." The word "healthy" could be substituted for "resilient," which is a term often used by foresters and land managers to describe management strategies in a changing climate. Resilience is the ability of a sugarbush to be stressed, respond, and recover from the disturbance – like stretching out a rubber band and then letting it return to the original shape. Vigorous trees, and a diversity of both forest species and structure (see below) create resilience.

Maples did not evolve in a monoculture of only maple groves, and so when they exist in this condition they

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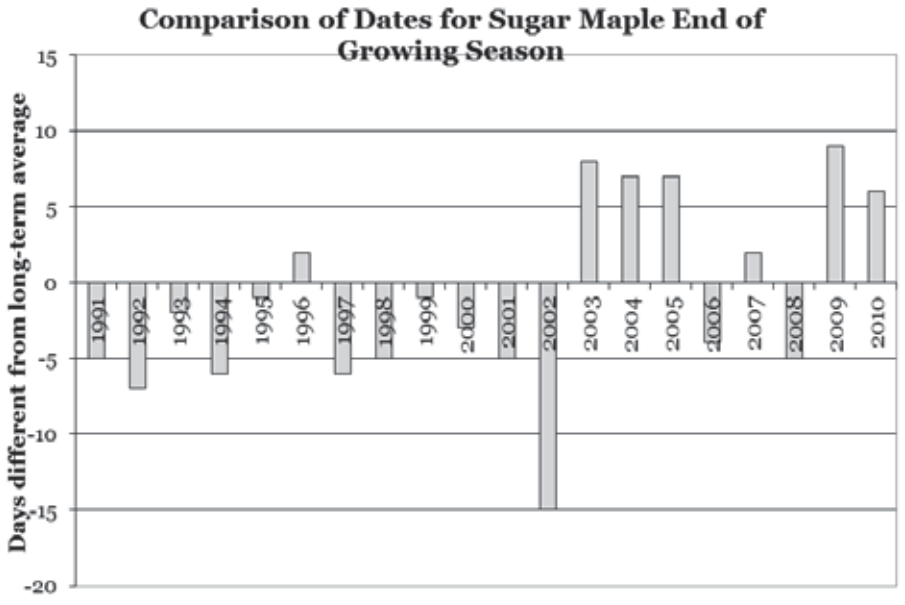

Figure 2: Data from the Vermont Department of Forests, Parks and Recreation, Forest Insect and Disease Conditions in Vermont, 2010, showing the relative end of the sugar maple growing season to the long-term average end of season date. Positive difference correspondence to later end of the growing season.

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are more vulnerable and less resilient. This vulnerability is primarily to pests and pathogens, as monocultures are essentially all-you-can-eat buffets for the pests and pathogens that negatively impact maple trees. Research has shown that maintaining at least 25% stocking (number of mature trees) in non-sugar maple can decrease the impact of pear thrips. During last summer, in northern Vermont we experienced the first year of likely a multi-year outbreak of forest tent caterpillar, a native defoliator of hardwoods, especially sugar maple. Observations from anyone who walked through those sugarbushes that were defoliated will validate the greater the proportion of sugar maple in the sugarbush, the greater the proportion of canopy defoliated. The defoliation event last summer was coupled with a moderate drought, creating a compounding stress on the defoliated trees, and further decreasing their resilience.

The proverbial camel's back was never broken by only one straw, but rather the cumulative weight of many straws combined. The same is true for trees; short of a chainsaw it is rarely one thing that causes a tree to die. We start to see mortality when stressors are compounded such as repeated defoliations and drought conditions. One of the greatest impacts a manager can have on creating a resilient forest is through maintaining tree vigor. This is achieved through regular thinning, and culling structurally weak trees (i.e. weak notches, sugar maple borer impacted trees, etc.). When thinning in a sugarbush, allocating sunlight to the most vigorous and healthy trees assures that these trees are more likely to respond to whatever mother nature throws at them. Further, keeping a diverse mix of species in your sugarbush will not only decrease the "all-you-can-eat buffet" effect, but also provide habitat for beneficial predators such as cuckoos, which feed on the forest tent caterpillar. Diversity is not limited to species, but also is true for the structure within your sugarbush.

Forests (and sugarbushes are a forest) have architecture just like our houses. Some are simple, are some are incredibly complex (think of the work of Solomon Guggenheim and Frank Lloyd Wright). Structural diversity in a forest means gaps in the canopy that allow sunlight to penetrate to the forest floor, establishing young seedlings and creating a sub-canopy of less than five feet high – a perfect place for nesting insectivores such as black-throated blue warblers and invertebrate eating wood thrush that every maple producer should be happy to see in their sugarbush. Structural diversity also includes standing dead trees which attract cavity creators (think woodpeckers in search of insect larvae that are impacting your trees), which in turn attracts cavity nesters (think insect eating birds). Structural diversity also includes having some dead trees on the forest floor, which cycle nutrients back to the soil and retain soil moisture, providing refugia for invertebrates especially during dry summer months. By creating a diverse structure, you are essentially installing a security system for your sugarbush, on call 24/7, providing surveillance and protection from a variety of tree pests and weather extremes.

Beyond resilience, maple producers must also be prepared to adapt. Learning how to adapt starts with monitoring, and there are no better monitors than maple producers. While working in your sugarbush in the spring time,

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watch the leaves as they emerge. Are the leaves misshaped (signs of frost damage or pear thrips)? During the growing season keep an eye out for telltale signs of defoliating insects (circular holes of maple leaf cutter or tiny shards of leaves on the forest floor from forest tent caterpillar feeding). If a defoliation occurs during the summer, pay attention to the weather. If defoliation occurs early in the growing season, the trees will likely leaf out again. If you notice that stressors are starting to compound (defoliation and drought stress on portions of the sugarbush with thin, vulnerable soils), you can respond by delaying any thinning in these areas for at least two years following the end of the defoliation event, and conservatively tapping (one tap per tree, no trees tapped smaller than 10" in diameter at 4.5 feet high off the ground) or not tapping at all those trees that are most stressed the spring following the compounded stress events.

Finally, access in a working sugarbush is critical, and this is achieved through woods roads. Getting back to the sage advice of our climate scientists, in the Northeastern US we are likely to experience more deluges during the summer months, where we receive a tremendous amount of rain in a short period. Having proper drainage on all woods roads is not only good for the streams that any runoff might drain into, but good drainage also keeps your roads in place, prevents washouts and the formation of impassible areas preventing access to your sugarbush. Well-designed roads shed water at regular intervals to prevent erosion before it can happen. Numerous cost share and technical assistance programs are available in many areas for landowners interested in improving their woods roads. Contacting your consulting forester or an extension forester (County Forester in Vermont) is a great first step in understanding the wealth of resources available to help you as a landowner.

We are living in a rapidly changing climate. Given everything described above, it is now more important than ever to be thinking first and foremost about the health of your sugarbush. The next time you walk in your woods, stop and look around. How does the canopy look? What does the forest floor look like, do you see the seedlings that your descendants will be tapping some day? What do you hear, can you hear the bird calls of your security system at work? What species of trees do you see – do you need to diversify an all-you-can-eat buffet? How do your roads look, will they hold up to the next five inches-in-an-hour rain storm? Slowing down and asking these questions is the first step in creating a resilient sugarbush.

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