Effect of Climate Change on Maple Syrup Producers

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The material in this article was initially gathered and summarized by the Climate Change Committee of the Ontario Maple Syrup Producers Association. In compiling this information, we were careful to only include results for which there was widespread scientific consensus. There have been additional research findings (such as the effect of climate change on Brix levels) that have not yet been substantiated by other researchers and hence are excluded for the time being. The author wishes to acknowledge Jenny Liu and Brodie Berrigan for their contribution to the research and synthesis of the findings reported in this article.

While there are both good and bad impacts on maple syrup producers due to climate change, overall, the effects will be negative. On the plus side, longer summers mean longer growing seasons for maple trees. However, regionally this longer growing season will increasingly be accompanied by periods of extended drought – particularly in more southern latitudes. This in turn may hinder root growth and performance. As maple syrup producers we are aware that anything which negatively effects maple tree roots is a concern because the roots are the origin for sap movement in the spring.

Longer, hotter summers also increase the opportunity for greater impact from invasive species, native and invasive insects, as well as diseases. While these negative factors impact existing maple trees, the longer, hotter summers also have the potential to increase seedling mortality rates. Younger trees must also increasingly compete with invasive tree and undergrowth species better suited for hotter and dryer climates.

The combined effect of greater premature tree death of established mature trees and the diminished replacement rates from younger trees will cause the viable range for sugar maple habitat to shift northward over time. While this may be good news for producers in central Quebec and northern Ontario, it is of long-term concern for producers in Southern Ontario and most of the USA. Fortunately, as maple trees can have a lifetime of over 100 years, the falling level of replacement will take several decades to reduce many sugarbushes to uneconomic levels of tree density.

Of far greater short-term concern is the impact of severe weather events, particularly windstorms. In 2022 both the hurricane event that hit Nova Scotia as their sugaring season was starting, and the derecho event that tore across Ontario and Quebec, demonstrated that the risk of widespread loss of pipeline infrastructure and healthy, productive mature trees is also more likely as wind events continue to increase in both frequency and severity. Increasingly, tornado-scale events are occurring both spring and fall in eastern North America.

Many producers lost over 1/3 of their tappable trees in 2022. Unlike other agricultural harvests that can be easily ensured against annual climate-related losses, maple syrup producers are keenly aware that the loss of a healthy mature tree means the loss of up to 40 years of harvest until a replacement tree can replace it. Currently there is no crop insurance scheme available to deal with this magnitude of productive loss.

As we progress from summer and fall into winter, we can expect to see more precipitation falling as rain which will reduce snowpack that typically insulates fine roots from damage. And as the variability of temperature change increases in spring, maple syrup producers can expect more spring frost events occurring during the vulnerable budbreak period, making both the prediction of buddy sap development more difficult as well as causing leaf dieback. Trees will need to apply more of their energy to leaf replacement which will tend to hinder both tree growth and canopy development.

The same sudden changes in spring temperatures can result in shorter seasons and all regions have seen end-of-season spring dates occurring earlier in the year over time. Similarly, the end-of season fall dates are occurring later and later over time. Long term forecasts suggest that over a period of several decades these two sap movement seasons may merge if climate change continues unabated, meaning that maple syrup may become a winter harvest in some regions. In the shorter-term, shorter seasons in southern regions will make maple syrup production uneconomic for smaller scale producers.

Other economic impacts that accompany climate change include greater difficulty in predicting labour needs (as seasons fluctuate more each year) as well as increasing costs for fuel employed in boiling sap and managing the sugarbush. Labour costs are also likely to increase due to the increasing effort to recover from severe wind events.

The demand for maple syrup may also be affected as consumers increasingly shift their preference towards climate-friendly products. Maple syrup producers who are demonstrably climate-friendly will have an advantage over those who are not. This trend will likely grow much in the same way as the organic trend overtook the industry in the past.

Maple syrup producers can take several actions to mitigate the impact of climate change, even if we cannot individually prevent or adapt to it:

- Biodiversity in the sugarbush is the best mitigation for invasive species/insects/disease. Any monoculture is a fertile ground for any invasive threat that can thrive in it and monoculture maple sugarbushes are no exception. Biodiverse tree species slow the advance of these invaders and give maple trees more opportunity to recover should they become afflicted. Biodiverse wildlife also acts as natural predators for invasive insects.

- Depending on the configuration

and topology of your sugarbush, coniferous tree wind breaks planted/encouraged at the periphery of the compartments in your sugarbush can help limit damage from many wind events.

- Thinning practices need to be revisited as tighter packing of trees helps canopy trees support each other during windstorms. Unfortunately, we also know that tighter canopies may mean less sap production per tree. Finding the right balance is an area for greater research and study.

- Ensuring that recovery trees are "pre-positioned" should mature trees be lost prematurely can shorten the recovery time to regrow the replacement by several decades. A "recovery" tree is an immature adult tree approximately 10-20 feet in height that is waiting for a break in the canopy to shoot up. While it still may take 5-10 years for an immature recovery tree to replace a lost mature tree, it is better than waiting 40 years.

- Maple syrup producers in southern regions can start planting Red Maple to supplant Sugar Maples as they ultimately die off. Red Maples can also be harvested for sap and are more heat tolerant. In regions where there is a risk of greater flooding, Silver Maples can be planted as they are more tolerant of wet growing areas.

- Maple syrup producers who are not using pipelines to increase the scale of their operations can consider doing so. With appropriate sanitation practice, pipelines enable trees to be tapped during winter, reducing the need to try to guess when the spring thaws will start as seasons get more variable over time.

- Single-year production losses due to climate events can be insured using crop insurance in many jurisdictions. While this may not mitigate against multi-year losses, it can soften the blow and help mitigate losses from smaller-scale events. Infrastructure insurance can also be purchased for pipelines and pump houses located in the sugarbush.

Maple syrup producers can also contribute by lowering their own emissions in producing syrup. 90% of producer emissions are from heat energy used to evaporate sap into syrup. It does not matter what the fuel used is (wood, pellets, biomass, oil, propane, etc.), they all emit CO2. Renewable fuels are just as much a part of the short-term problem as fossil fuels as they are only carbon-neutral over the lifetime of a tree. This is longer than the scientific consensus that requires emission reduction within 20 years to prevent greater climate impacts.

There are several strategies maple syrup producers can consider for reducing emissions:

- Reducing the volume of sap to be evaporated via reverse osmosis provides the greatest "bang for the buck." The indirect emissions from using electricity are 100x less compared to direct and indirect emissions from any other fuel source. While quality of syrup is affected by high levels of brix re-

duction prior to boiling, there is no scientific evidence that quality or chemistry of syrup is affected by reducing sap to a low level of 6-8 Brix – a 50% reduction in total volume of sap.

- Increasing the heat efficiency of the evaporation process is important. Oil and propane-fueled evaporators are generally 90% efficient due to employing the use of condensing heat as part of their operation. Most wood evaporators are less than 50% efficient out-of-the-box because they do not employ all the heat available from secondary combustion of gases released by burning wood. Fortunately, it is relatively easy to modify most wood evaporators to employ secondary combustion. Older evaporators over time can be replaced by the emerging electric evaporators that use compressed steam to accelerate evaporation.
- Keeping the heat in the evaporator and not in the chimney is essential. If your chimney temperature is over 450°F you are losing too much heat up your chimney. The best way to reduce the rate of air movement up the chimney varies based on the type of evaporator. Non-forced air evaporators can employ a draft control on the stack and fan speeds in a forced air evaporator can be better balanced.

Maple syrup producers can also transition their own operation to be net-zero. This will be the topic of a subsequent article.