# Net-Zero Maple Syrup

*Paul Renaud*

In the previous issue, the article *Effect of Climate Change on Maple Syrup Producers* summarized the short and long-term impacts of climate change on the maple syrup industry. The most imminent impact is the increased frequency and severity of wind and ice storms which can destroy the trees in your sugarbush. As it takes at least 40 years to replace a maple tree, every tree lost represents a significant loss of income until a replacement tree can be grown. And as the viable zone for sugar maple is moving northward at a rate of approximately 25 km per year, being able to grow replacement trees is increasingly uncertain. While the warmer climate impacts the ability to regrow sugar maples, it does not kill the existing mature trees which can continue to live on another 100 – 200 years. However, wind and ice storms can and even an annual loss of 3% mature trees due to storms eliminates over half of the established trees within 20 years.

The previous article also reviewed the mitigation measures that producers can take and several ways that producers can reduce their own emissions. As every challenge usually brings an opportunity, this article will focus on how producers can transition their own operations to a net-zero carbon footprint (or better) and be seen to be part of the solution instead of part of the problem.

There are three reasons why most maple syrup producers consider becoming carbon neutral:

**1. They believe it is the right thing to do** and they are tired of waiting for slow-moving politicians to take effective climate action. By taking the initiative to become carbon-neutral they feel that they can collectively make a difference, as even though the contribution from any given producer may seem small by comparison to the emissions in other industries, collectively even small changes add up to become a significant improvement. For example, if every maple tap in Canada were carbon neutral, the improvement will offset the emissions of a medium-sized city the size of Quebec City or Winnipeg.

**2. They want lower costs and improve productivity**. Even producers who are skeptical about climate change see the benefit of consuming less wood or oil because it lowers costs and saves labour. These improvements can be dramatic. For example, improving the heat management within your wood evaporator from 8% to 80% can reduce the wood consumed for boiling the same quantity of maple syrup from four bush cords to less than a face cord (I demonstrated this in my own operation). So, unless you like chopping wood, there are advantages to becoming carbon neutral. In fact, there is no trade-off between being carbon neutral and being more efficient. If you reduce your fuel consumption because of better heat management, you will reduce costs as well as reduce your emissions.

**3. They want to re-position their maple syrup, so it appeals to an in-**

**creasingly sustainably minded consumer**. Many people believe that "Carbon Neutral" is the next "Organic" in terms of impact on a large part of their client base. We have already seen beef consumers' buying patterns shift towards products such as "Beyond Meat" because many consumers perceive (rightly or wrongly) that it is more sustainable than traditional meat. Being carbon neutral (or better) also helps differentiates their product from other maple syrups, as well as from other sweeteners such as corn syrup, etc.

Whether you are righteous, lazy, or greedy, or any combination of the above, there are many good reasons to consider becoming carbon neutral. So how is this possible?

The first step is to examine and quantify your emissions. The Greenhouse Gas Protocol provides a good framework for doing this:

Scope 1 emissions are your direct emissions. For maple syrup producers, the major direct emissions are from:

- the combustion of fuel in your evaporator and your use of fossil fuels to manage your sugarbush (e.g. chainsaws, clearing saws, skidders/log loaders, tractors)
- the transport the sap from your bush to your sugar shack (ATV, Tractors)
- the transport of your syrup to market (stores, bulk buyers, etc)

Scope 2 emissions are your indirect emissions from using electricity:

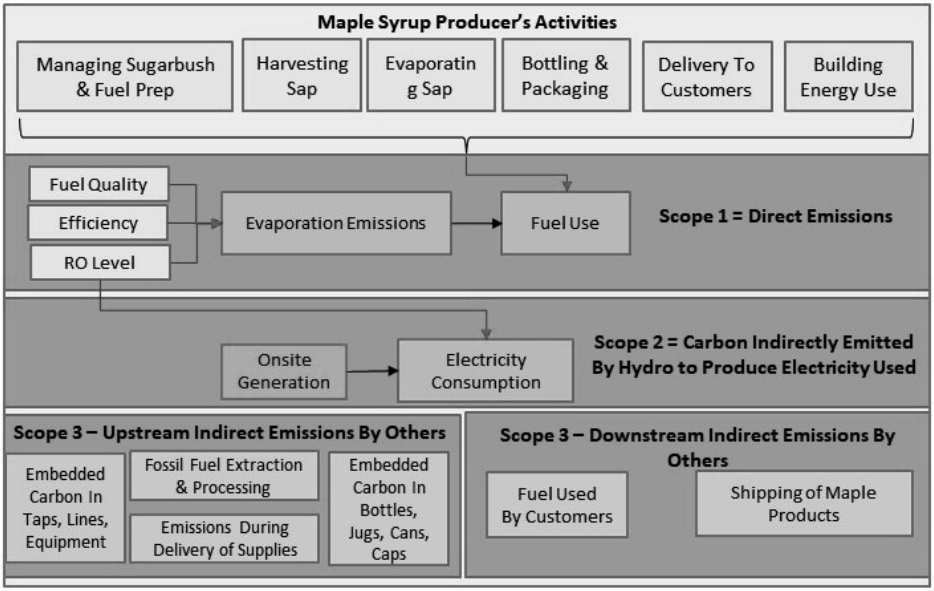
- Pumps, sap lifters, separators
- Reverse osmosis
- Lighting

Scope 3 upstream emissions are the indirect emissions embedded in the products that you use. While this can seem to be a long list (e.g., evaporator, taps, pipeline, bottles, etc.), you only need to focus on the consumables in your operation, because the carbon embedded in the use of major items such as evaporators and pumps is amortized over the many years of use that you will get from those products. For most producers, the amount of carbon embedded in small consumable items such as taps and tees is small compared to the carbon embedded in the bottles that they package their syrup in. The other major source for upstream indirect emissions is from the shipment of supplies to your farm.

Scope 3 downstream emissions are the indirect emissions associated with the sale of your maple syrup and maple products. For example, if you sell via farmgate sales your Scope 3 emissions include the gasoline consumed by your customers driving from their home to your farm gate. Although you may not know the milage driven by every customer, generally most producers know that they sell 80% of their products to customers from within a certain radius of their operation. You can use the average emissions from a car over that distance to figure out your scope 3 emissions.

These emissions are illustrated on the following page.

Once you have identified your emis-




sions, the next step is to see how you can reduce the major ones. For example, is it possible to establish a drop-off or distribution point closer to your repeat customers who otherwise would drive to your farmgate? Is it possible to use less fuel in your evaporator, optimize your use of shipping, etc.?

One of the easiest ways to reduce evaporator-related emissions is to use reverse osmosis (RO). Even using an RO to raise the Brix of your sap from 2 to 5 will reduce the amount you have to boil by 50%. Although an RO uses electricity, the indirect emissions from electricity are far lower than the direct emissions from burning fuel in your evaporator. For example, in Ontario electric power has a carbon footprint of only 25 g CO2e per Kwhr or 0.085 g / BTU as compared to 0.1 g/BTU of oil burned, or 0.087 -0 0.14 g/BTU when wood consumed (varies on the dryness of the wood). Although indirect power emissions vary by state/province (eg., Vermont in 2020 was 9 g CO2e/kwhr, compared to Quebec at 1.5 g/kwhr), electricity is always lower in emissions, even if you live in an area such as Nova Scotia where most power is generated from fossil fuels (670 g CO2e / kwhr).

It is important to appreciate that although wood is a biofuel (i.e., the emissions from burning wood were produced from carbon already in the atmosphere that was photosynthesized by the trees that contributed the wood that was burned) and does not contribute long-term to climate change, it is carbon neutral only over the 100+ year lifecycle of a tree. However, on an annual basis, the emissions from burning wood are just as impactful as the emissions from burning a fossil fuel in your evaporator – and we do not have 100 years to mitigate climate change.

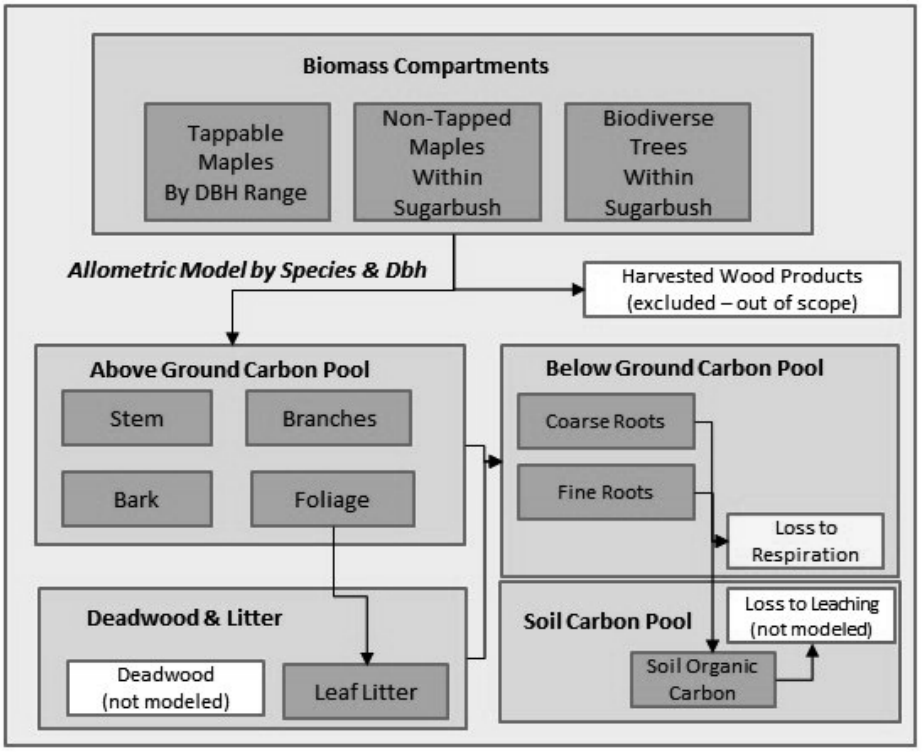
Knowing your emissions is only the half of the net-zero equation. The other

half comes from understanding the sequestration of trees in your sugarbush. Your trees are incredibly effective in removing carbon dioxide from the atmosphere (via photosynthesis) and converting it to carbon as they grow. A maple tree is approximately 50% carbon and a 10-inch DBH tree (the minimum size that is tapped) has already sequestered a metric tonne of CO2 (1,000 kg) to reach that size. As your trees are growing each year, they are sequestering CO2 each year and it turns out that every 100 tappable trees sequester a metric tonne of CO2 per year.

Trees also contribute to carbon in the soil when they shed their leaves that ultimately decompose on the ground (not all the carbon in the leaf litter decomposes into soil, some of it goes back to the atmosphere due to the respiration from the microbes that decompose the organic matter from the leaves).

As most sugarbushes are bio-diverse, non-maples also contribute to the sequestration of CO2 as do the smaller maple trees that are not yet ready to be tapped. The full scope of sequestration is illustrated below.

In the illustration below, we show the harvesting of saw lumber as out-of-scope because we are focusing solely on maple syrup related activities. If you also have a woodlot that produces saw timber, you might include or exclude it depending on whether you just want to know the carbon footprint of your maple syrup business or of your entire farm. We also exclude the carbon



| Carbon Footprint High Level Readout | | | Relevé de haut niveau de l'empreinte carbone |
|---|---|---|---|
| Total Trees | 2,666 | | Totale des arbes |
| Total Taps | 1,335 | | Entailles totale |
| Expected Syrup Yield per Tap | 2.22 | L | Montant de sirop anticipée par entaille |
| Total Syrup | 2,967 | L | Totale de sirop |
| | | | |
| Overall Carbon Budget | 24,395 | kg CO2/yr | Bilan de carbone |
| Evaporator Emissions | 9,454 | | Émissions d'évaporateur |
| Other Scope 1 Emissions | 945 | | Autres émissions de portée 1 |
| Scope 2 Emissions | 80 | | Émissions de portée 2 |
| Scope 3 Packaging | 401 | | Portée 3 émissions d'emballage |
| Scope 3 Customer | 2,095 | | Portée 3 émissions des clients |
| Lifecycle Fuel Emissions | 1,970 | | Émissions du cycle de vie du combustible |
| Other Scope 3 Allocation | 200 | | Autres émissions de portée 3 |
| Total Emissions Estimate | 15,146 | kg CO2/yr | Totale d'émissions |
| Excess Sequestration | 9 | T CO2/yr | Marge de manœuvre dans le bilan carbone |
| Per Tree | 3.47 | kg CO2/yr | Par Arbre |
| Per Tap | 6.93 | kg CO2/yr | Par Entaille |
| Per L Syrup | 3.12 | kg CO2/yr | Par L de Sirop |

accumulating in deadwood because in an actively managed sugarbush, the effect of tree mortality is small because the sugarbush is being managed to promote growth. We also exclude leaching of carbon via groundwater as it is relatively minor in most sugarbushes.

Above is a typical carbon footprint analysis from a 1300-tap maple syrup producer. As you can see, not all emissions are equal, and the evaporator usually dominates all other emissions. This producer relied heavily on farmgate sales, so Scope 3 fuel emissions from his customers were significant. Nonetheless, this producer is better than carbon neutral as his emissions do not exceed the annual carbon budget established by the sequestration in his sugarbush.

While it may seem daunting to do all these calculations, it is possible to do so and there are a variety of sources available online to help you along. Increasingly, sustainability advisory firms such as The Lanigan Group have off-the-shelf models to facilitate these calculations.

On the following page are some results from other producers using wood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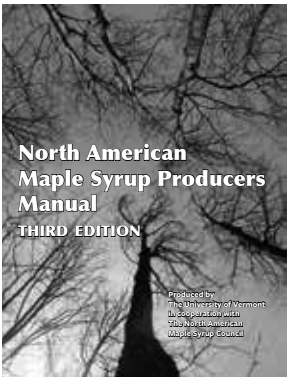

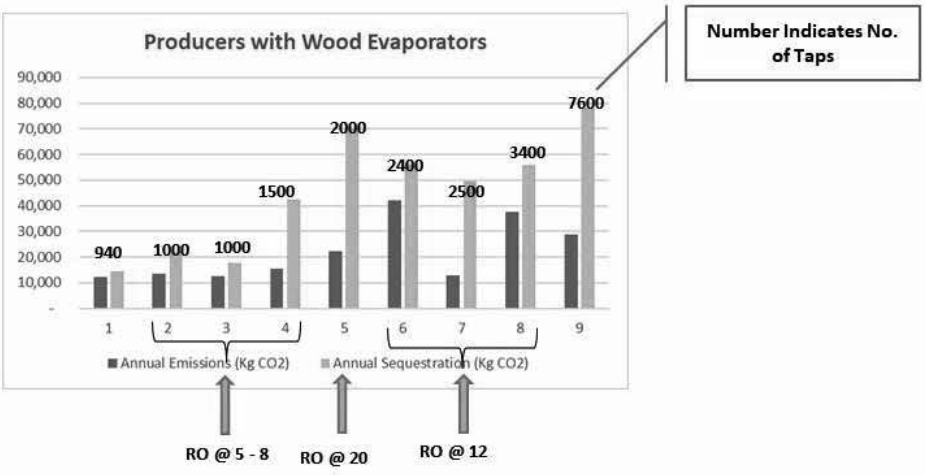


evaporators who were better than carbon neutral that were modeled recently by the Lanigan Group. As you can see, the carbon footprint of producers varies based on their level of efficiency and extent of RO target level. The larger the maple syrup operation, the more efficient the producer needs to become to control costs. This efficiency is also evident when you look at the difference between the amounts sequestered vs emitted as the scale of the producer increases (i.e. the amount by which the light bar exceeds the darker bar).

So, the good news is that it is very possible for maple syrup producers to become provably carbon neutral if they choose to do so. Several maple syrup associations are starting to investigate proving that their entire sector is carbon neutral. Because we do not destroy our trees when we harvest our product, maple syrup has the potential to become the world's first carbon neutral agricultural product and all the bragging rights that come with that prize.


# Quality from Tree to Table

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