Climate Change Impact on Maple Syrup

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Increasing evidence on effects of climate change – 1 of 2

Sugarbush Health

- Warmer and longer growing seasons can potentially **benefit tree growth** if properly managed
- **Higher frequency and increased severity of wind** storms
- Higher frequency of native **pest outbreaks** and exotic pest invasion
- **Increased drought frequency and severity** can cause widespread seedling mortality, hinder root performance and growth
- **More frequent spring frosts** coincide with vulnerable budbreak period, causing leaf dieback, delaying canopy development
- **Reduced winter snowpack** with more winter precipitation falling as rain, causing fine root damage

Maple Season Timing

- **Tapping seasons are beginning earlier** and becoming more unpredictable
- The **timing of last boils** is being more affected more than timing of first boils
- **Buddy sap will appear earlier** and more unpredictably
- **Very short syrup production seasons** will likely become more frequent
- Shifting and unpredictable tapping seasons has **implications for labour availability**

Increasing evidence on effects of climate change – 2 of 2

Geography

- **Sugar maple habitat will shrink in its southern range** while potentially growing in northern regions
- **Southerly latitudes will experience fewer days favourable for maple syrup production**, while northerly latitudes will experience more
- The rate of tree migration may not keep pace with climate change, but it **may take decades for currently existing trees to decline and be replaced**.

Market Effects

- **Carbon taxes will increase the cost of fuel**; you may need to invest in new technologies to stay competitive
- **Consumers are more likely to choose eco-friendly products** which means organic or environmentally sustainable labelling will be increasingly popular

Many producers are already reporting the effects

Key takeaways from producer surveys

- Most producers believe that quantity and quality of sap is decreasing due to climate change
- 1/3 of producers missed the first sap flow of the season several years in a row
- 40% of producers believe that severe weather events will have a negative impact on syrup production

Legault S, Houle D, Plouffe A, Ameztegui A, Kuehn D, Chase L, et al. (2019) Perceptions of U.S. and Canadian maple syrup producers toward climate change, its impacts, and potential adaptation measures. PLoS ONE 14(4): e0215511

Things producers can do today

Reduce fuel consumption, carbon footprint, and costs by:

- ✓ Improving heat management in your evaporator, keep the heat in the arch – not your chimney
  - ✓ Wood: exploit secondary combustion, dry your wood for over a year, put a thermostat in your stack
  - ✓ Oil: use a draft control, lower your fan speeds

- ✓ Reducing amount of sap needed to boil by employing reverse osmosis (RO) to reduce volume by 50%
- ✓ Use electric powered UTVs, chainsaws, etc. to reduce use of secondary fuels

Minimize risk and improve carbon sequestration by:

- ✓ Implementing best practices for sugarbush management including promoting biodiversity which can mitigate risk of wind damage (e.g. conifer wind breaks) and invasive species.
- ✓ Plant and nurture at-the-ready replacement trees. Don't thin them out.
- ✓ Allow crowns to support each other during windstorms.
- ✓ Use crop insurance to protect against increasing risk of catastrophic loss
- ✓ Use pipelines with improved sanitation to avoid missing the start of the season by tapping earlier
- ✓ Harvest only dead, diseased, or downed trees for firewood where possible while allowing healthy trees to continue to grow and sequester carbon

A collective strategy for mitigating climate change

Recognize that climate change is due to human activities being out of balance with nature

- Operating on a net-zero basis each year brings us back into balance and is a good thing

If you disagree with the above:

- “You can argue with me, but you cannot argue with physics” …. Greta Thunberg

If you agree with the above:

- We can estimate the CO2 sequestered annually in our sugarbushes and use this as a carbon budget

- We can ensure that our annual emissions are within that carbon budget
  - Scope 1: Evaporator emissions, sugarbush management (pumps, tractors, chainsaws, …)
  - Scope 2: Indirect emissions from electrical consumption
  - Scope 3: Bottling, Shipping / Delivery of products, Lifecycle emissions from use of fossil fuels

Maple Syrup Producers Have An Advantage

Sequestration

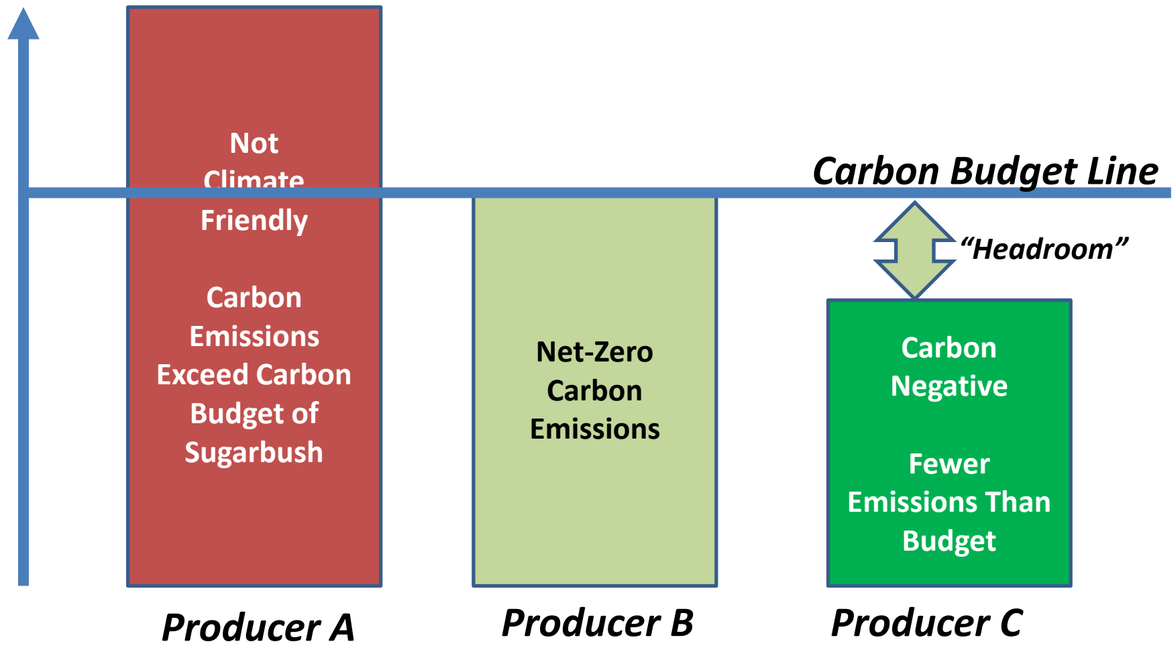
- **Sugar bushes capture carbon naturally**
  - A maple tree that is big enough to be tapped has already stored 1 metric tonne of CO2 to reach that size
  - And is continuing to grow, sequestering approx. 20 kg per mature tree per year

- 100 tappable, maple trees sequester over 1 metric tonne of CO2 per year

- To-date we've benchmarked over a dozen net-zero or better maple syrup producers
  - Ranging from 100 – 19,000 taps in size
  - Totaling 52,000 taps
  - Using different types of evaporators (wood, oil, pellet, steam)

1 Tonne = 1 Mg = 1,000 kg or 2200 lbs

Carbon Storage naturally occurring increases with the number of trees In the Sugarbush



Carbon Emissions Vary By Producer

Evaporator Efficiency is Key to Becoming Net-Zero

Emissions

- 80 - 90% of maple syrup producer emissions come from evaporating sap
  - RO is carbon-friendly because it reduces sap volume without using heat
  - Electric power is much lower emission than any fuel used in an evaporator (3 g / kwhr vs 4 Kg/L for oil, vs 2800 Kg/cord)
- The more efficient your evaporator is, the less fuel you need & the less carbon emissions you have
  - The less efficient your evaporator is, the more you may need to use RO to reduce carbon footprint

Evaporator Efficiency		Output: L Syrup (@ 66 Brix) / Cord												
		50	80	100	200	300	400	500	600	700	800	1000	1500	2000
Input Brix	2.5	19%	30%	37%	74%									
	6	8%	12%	15%	31%	46%	61%	77%				*Unattainable*		
	8	5%	9%	11%	22%	33%	44%	54%	65%	76%	87%			
	10	4%	7%	8%	17%	25%	33%	41%	50%	58%	66%	83%		
	12	3%	5%	7%	13%	20%	26%	33%	40%	46%	53%	66%		
	16	2%	4%	5%	9%	14%	18%	23%	27%	32%	36%	45%	68%	
	18	2%	3%	4%	8%	12%	15%	19%	23%	27%	31%	39%	58%	77%
	20	2%	3%	3%	7%	10%	13%	17%	20%	23%	27%	33%	50%	66%
Colour Legend		Unacceptable					Not Good				Good		Very Good	

Can Oil Evaporators be Climate Friendly?

All CO2 Emissions Count, regardless of whether they come from Fossil Fuel or Renewable Fuels

- If you consumed less litres of oil than the litres of maple syrup you produced, you are will have net-negative emissions

- Sequestration by a single maple tree @ minimum tapping diameter of 10” dbh:
  - @ 1 L maple syrup per tap: 32.41 Kg CO2e / L of syrup
  - @ 800 ml per tap: 25.93 Kg CO2e / L of syrup

- Emission from burning 1 Litre of Oil: 4.266 Kg CO2e / L [Includes both direct & indirect emissions]

- If litres of Oil consumed < litres of syrup produced, you will be net-negative after evaporation by 6x, leaving a lot of headroom for your other emissions

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Emissions from burning a cord of firewood: 2800 Kg CO2e / Cord
- @ 1 L maple syrup per tap: 100 L of maple syrup => 100 trees
- 100 trees x 32.41 Kg CO2e per tree = 3241 Kg CO2e sequestered
- If you produce > 100 L of syrup per cord used, you are likely to be net-negative

- Actual emissions and ratios depend on mix of firewood and dryness in addition to quantity

So Why Bother?

“I’m just a small producer, how does becoming net-zero even matter against global emissions?”

- Collectively, our actions add up

If every maple tap in Canada were as net-negative as the producers in these case studies:

- The amount of sequestration would be equivalent to all the transportation emissions in any of the largest regions in the Greater Toronto Area (e.g. Burlington/Halton, or York Regions)

If, with some encouragement, we could do better (e.g. with government incentives):

- The sequestration opportunity would offset the entire emissions of the City of Winnipeg or of Quebec City
- I.E. a city of over 500.000 people

Top 3 Reasons For Becoming Provably Net-Zero

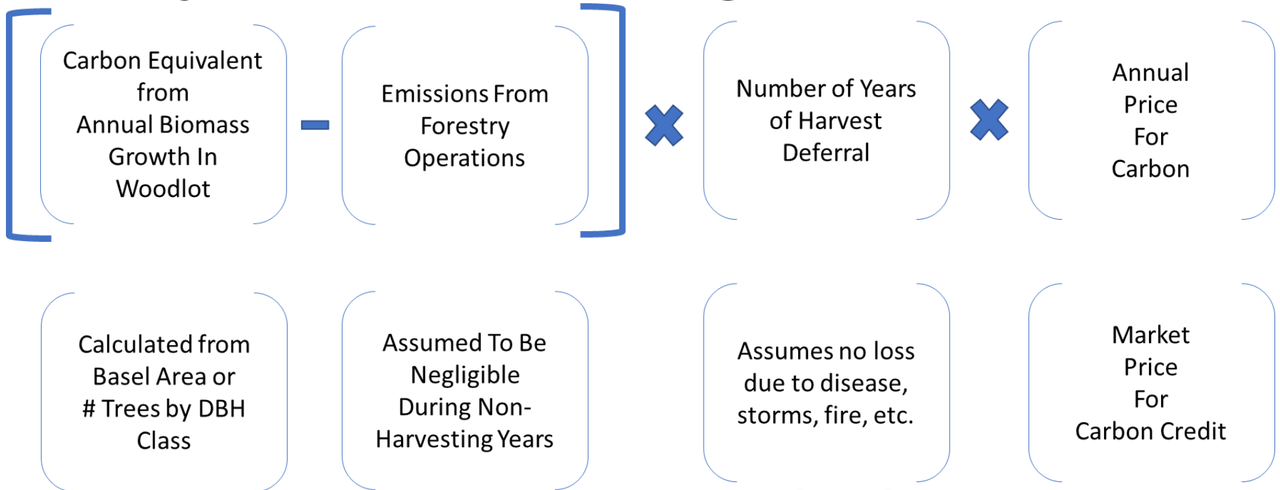
1. **Good for the environment**
   - Ethically responsible
   - Enables immediate action on fighting climate change instead of waiting for others

2. **Increases efficiency if you are not already as efficient as you can be**
   - Don’t like cutting wood, buying so much fuel, …
   - Lowers costs
   - Speeds up boiling

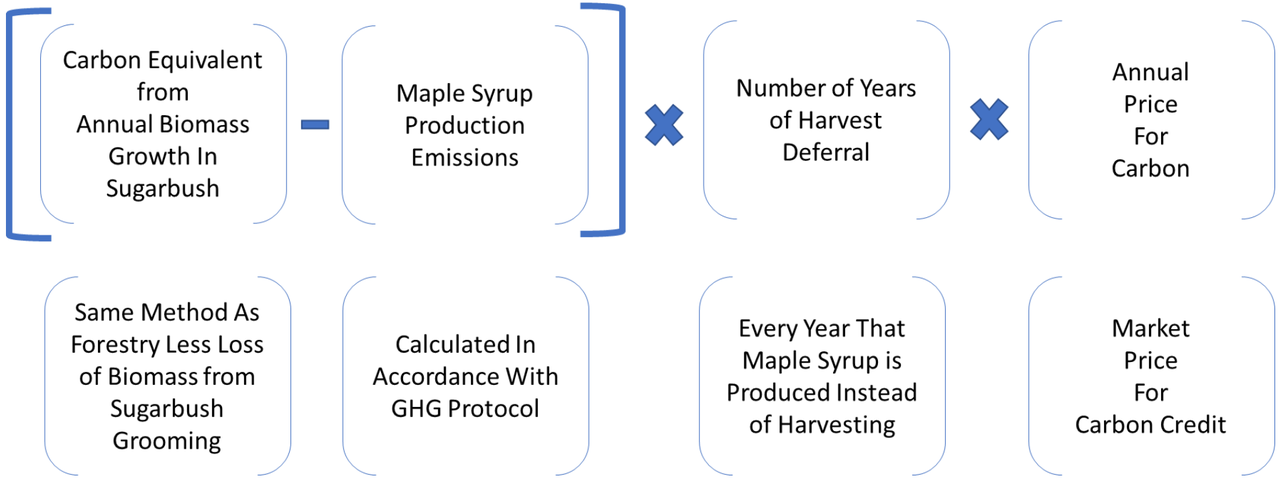
3. **Financial benefits**
   - Increased sales to climate-conscious customers
   - Opportunity to differentiate in a crowded market
   - Potential for downstream incentives or carbon credits in future

What about Carbon Credits?

Currently there is no approved methodology for calculating carbon credits for maple syrup, but there is one for forestry based on harvesting trees less often



A case could be made to extend the methodology for forestry to encompass any forest-based product



But Carbon Credits Require

Additionality

- Current “wisdom”: if a producer is already making maple syrup there is no additionality

- This presumes there would be no change in land use over time
  - Yet the IPCC highlights change in land use as a major risk factor in mitigating climate change

- There are many examples of unfavorable changes in land use in maple forests:
  - Annual disputes about leasing of Crown land for maple syrup or forestry harvesting
  - Producers going out of business as negative effects of climate change get worse every year due to:
    - Storms damaging trees and equipment
    - Reduction in harvest season length due to increasingly warmer winters and hotter summers
    - Invasive species, disease and drought damaging or impairing growth of maple trees
    - Increasingly unfavorable maple growing conditions making it difficult to replace trees

Audits

- Expensive to periodically measure that sequestration occurred as forecast and that any emissions were in the range forecasted

Carbon As A Cash Crop

Additionality

- Only applies when you sell carbon credits to someone who is using them to offset their emissions
- Additionality is not required if you are in balance on your own emissions

Why not Incentives for being Net-Zero Emission Agricultural Producer?

- Net-zero means “Total Sequestration = Total Emissions”
  - Whenever Total Sequestration > Total Emissions, excess sequestration is produced
- Governments could offer incentive for generating “excess sequestration” beyond net-zero
- Producer Associations could “certify” producers via a lighter-weight process than carbon-credit audits
  - Certification would need to show chain of custody from forest to table
- Based on cost of carbon in Canada, would increase maple syrup producer revenue by 3% in 2030 and 5% by 2050

Questions?

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See also the Net-Zero page on the website
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