

Climate Neutral Maple Syrup

PAUL RENAUD

THE LANIGAN GROUP

www.spiritintheforest.ca

Pure Maple Syrup

Carbon-Negative Emissions



ESPRIT DANS LA FORÊT

Émissions de Carbone Négatif

Sirup d'Erable Pur

www.espritudanslaforet.ca



Impact of Climate Change on Maple Syrup

- The Climate Change Committee of the Ontario Maple Syrup Association examined all available research on the impact of climate change on maple syrup published in both Canada & the USA
- Since science always evolves, we were careful to include only the findings where every research scientist agreed
 - By excluding “research in progress”, we excluded findings which might possibly be validated in future by other researchers
 - However, we also eliminated any speculation or theories which might not turn out to be validated due to regional or methodological differences
 - Our findings can be viewed as “baseline” information upon which decisions can be made with confidence because we did this work to support Ontario’s strategic planning process

The Obvious Problem: Maple Season Timing & Length



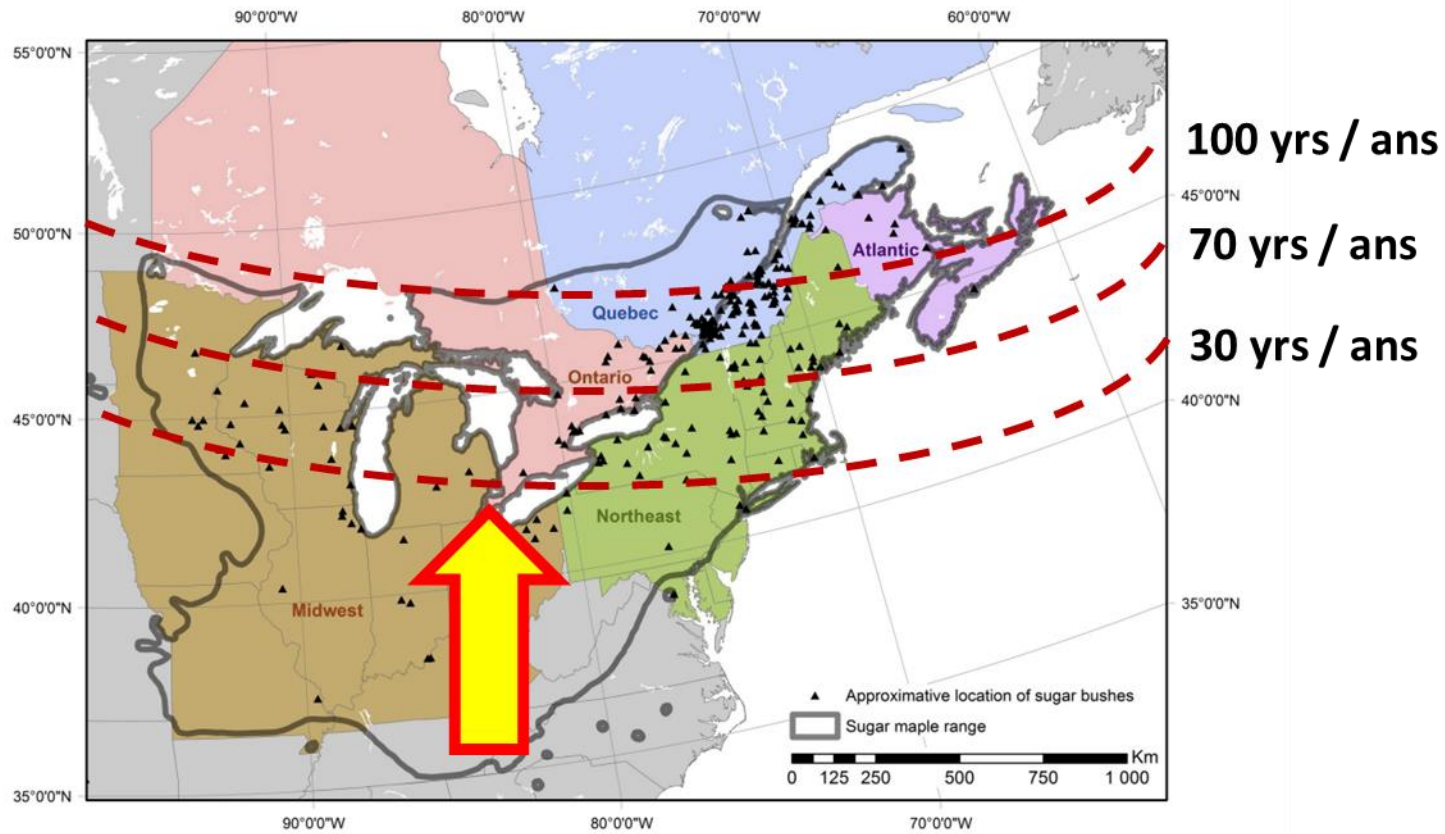
1. Spring sap flows occur earlier each year and more unpredictably
 - Autumn sap flows are later and eventually may merge with spring flows
2. Unpredictability increases risk of the season starting before the sugarbush is tapped
 - Most large producers are already tapping during winter to avoid missing the start of the season
3. Timing of end is affected more than the timing of start
 - Buddy sap will appear earlier & more unpredictably
 - Overall season length will get shorter & shorter
4. Shifting seasons of unpredictable length makes it harder to plan labour availability



The Hidden Problem – Slowly declining Productivity

- Warmer & longer growing seasons can benefit tree growth if properly managed
- Increased drought frequency & severity can cause seedling mortality, hinder root performance, and impact growth
- Higher & more frequent risk of native pest outbreaks and invasive insects
- More frequent spring frosts can coincide with budbreak, causing leaf dieback and delay canopy development
- Reduced winter snowpack with more winter precipitation falling as rain can cause fine root damage

If we do not mitigate climate change



Viable Zone For Sugar Maple is Changing

THE VIABLE REGION FOR SUGAR MAPLE IS MOVING NORTHWARD AT THE RATE OF 25 KM / YEAR



The Imminent Problem : Wind & Ice Storms

- Wind storms are already increasing in both severity & frequency
- Ice storms are occurring more often at both the start & end of winter
- Loss of a tapped maple tree during a wind or ice storm results in > 40 years of lost production
- In 2022:
 - Nova Scotia producers lost their entire season when an ice storm hit them at the start of their season, damaging both trees and infrastructure
 - 3 – 5% of producing maple trees were lost in Ontario due to the derecho wind storm in May
 - Many producers also sustained significant infrastructure damage to pipelines, pumps, etc.
- If 3% of trees are lost each year, the industry may not exist after 20 years
 - Can you afford to lose 60% of your sugarbush?

What You can Do – 1 : Reduce Risk In The Sugarbush

1. Use pipelines with advanced sanitation so that you can tap well in advance of spring
2. Promote at least 20% biodiversity in the sugarbush
 - ✓ Slows invasive species and disease
 - ✓ Conifers act as wind-breaks to protect maples from wind
3. Change thinning practices
 - ✓ Nurture replacement trees
 - ✓ Allow crowns to support each other during windstorms
4. Look for opportunities to improve productivity so that you can make the same income from fewer trees
5. Apply for crop insurance
6. Plant red maple to replace lost sugar maple because it is more tolerant to a warming climate



What You Can Do – 2 : Lower Your Carbon Footprint

1. Maximise sequestration of CO₂
 - ✓ Harvest only dead, diseased, or fallen trees
 - ✓ Allow healthy trees to continue to sequester carbon
2. Improve heat use in your evaporator – keep the heat under the arch and NOT in your chimney
 - ✓ Wood : exploit secondary combustion, dry wood > 1 year
 - ✓ Oil : reduce fan speeds
 - ✓ Install draft control on chimney to reduce speed of air leaving your evaporator by 30 - 50%
 - ✓ Use RO to reduce sap by 50%
3. Reduce use of fossil fuel in chainsaws, UTVs, generators

What You Can Do – 3 : Become Provably Carbon Neutral

Each mature maple tree has sequestered 1 metric tonne of CO₂ to reach 10" DBH

- 100 maple trees sequester over 1,000 kg CO₂ per year
- A producer with 1000 taps has a carbon budget of at least 10 metric tonnes of CO₂ / year

Emit less CO₂ than the amount sequestered in your sugarbush each year

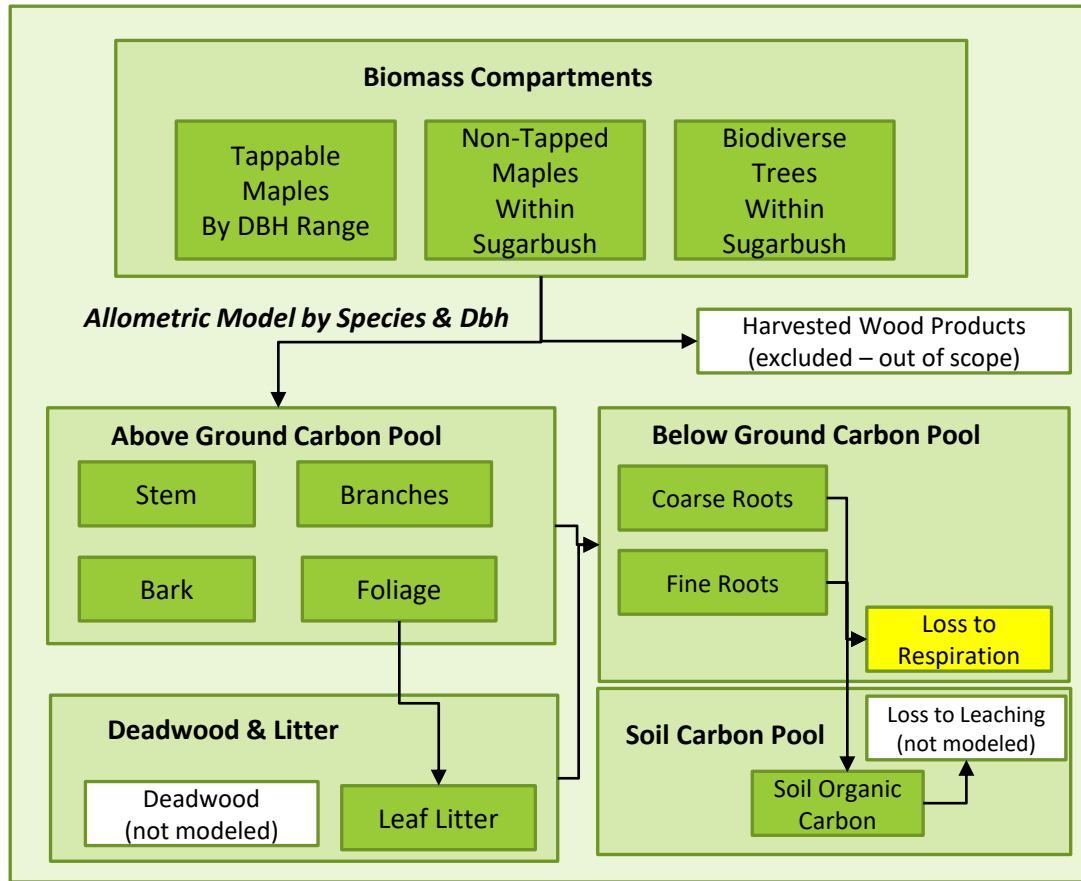
- Scope 1: evaporator fuel emissions, sugarbush management (chainsaws, ATVs / tractors, etc.)
- Scope 2: electricity for RO, pumps, lifts, separators, lights
- Scope 3: transport of supplies & maple syrup, carbon in bottles / cans

Electric power emits only
ON: 0.085 g CO₂e/MBTU
QC: 0.005 g CO₂e/MBTU
Vermont: 0.031 g
CO₂e/MBTU

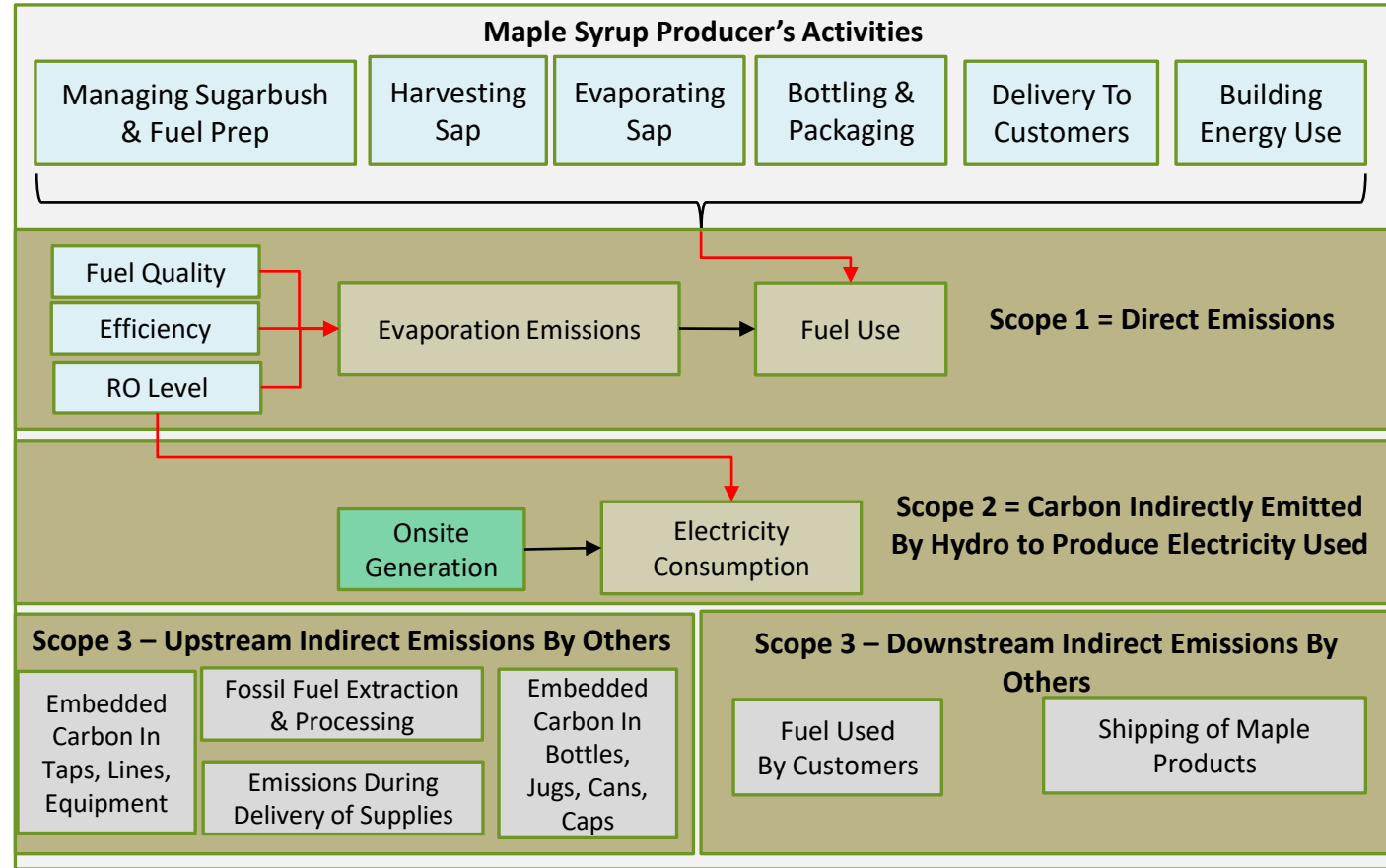
- vs 0.1 g for oil or 0.087 – 0.14 g for wood (depending on dryness of wood)
- Wood emissions are biogenic carbon, so contributes to emissions annually, but not over a 100-year period – however we do not have 100 years to improve our climate

Maple Syrup Producer Carbon Modeling

Annual Sequestration By IPCC-Specified Carbon Pool



Annual Emissions By ISO 14064 Scope of Activity



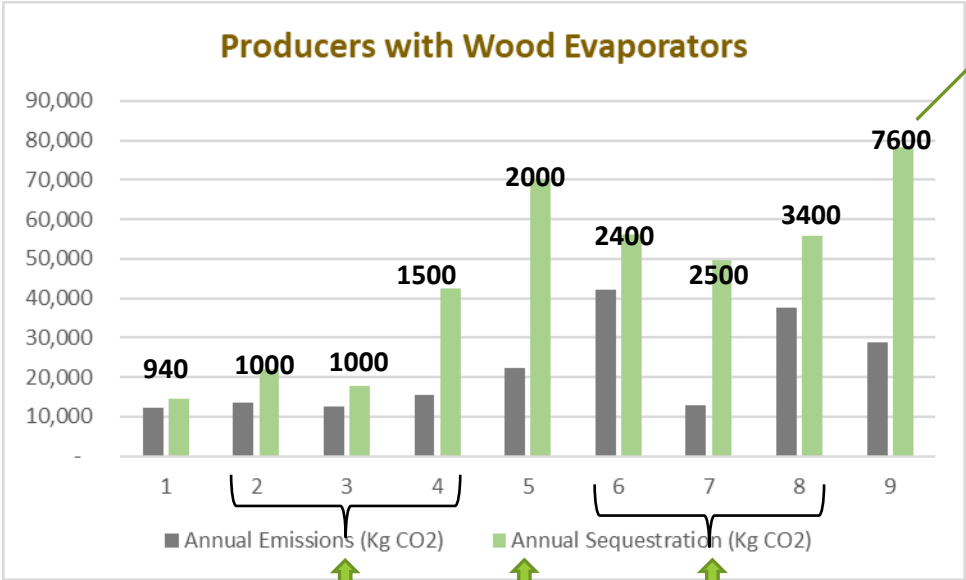
Producer-Level Results Identify Areas of Opportunity for Emissions Reductions – Example taken from a recent case study

Even an Oil-Based Evaporator Running at 80% Efficiency Still Dominates Emissions

2nd largest emission source is direct & indirect fossil fuel emissions

Carbon Footprint High Level Readout		Relevé de haut niveau de l’empreinte carbone	
Total Trees	2,666	Total des arbres	
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	Total 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	Total 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	

Is it Possible For Maple Syrup Producers using wood to be Climate Neutral?



Number Indicates No. of Taps

We've measured that Ontario producers of all sizes can be carbon neutral even using inefficient wood evaporators

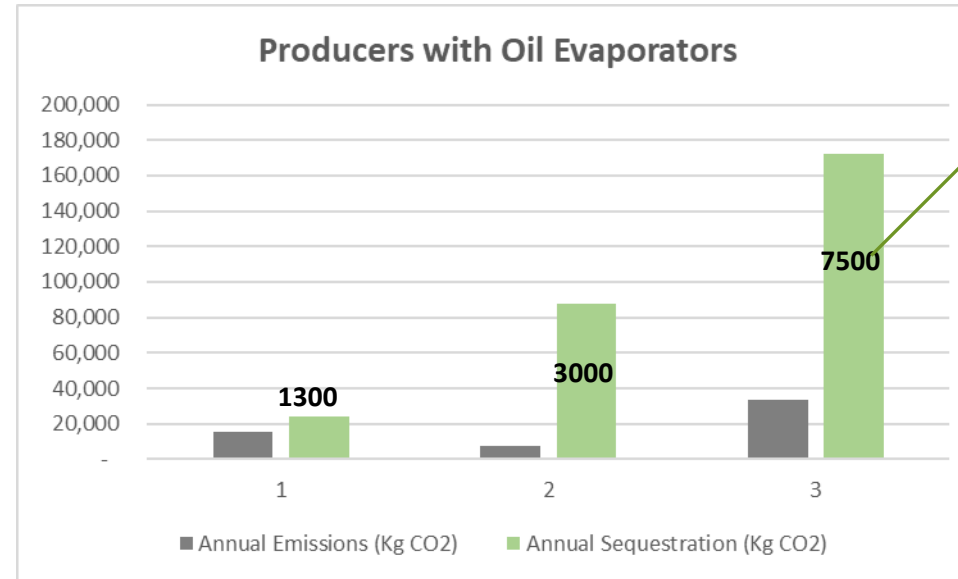
RO @ 5 - 8

RO @ 20

RO @ 12

Is it Possible For Maple Syrup Producers using oil to be Climate Neutral?

- ❖ Oil evaporators are 2x more efficient than wood evaporators due to better heat management
 - ❖ Usually more litres of syrup are produced than litres of oil consumed
- ❖ Average is > 1 L of syrup / tap for large producers and it is the largest producers who use oil evaporators
- ❖ Excess sequestration scales at least 2x faster as the size of the producer grows



Number Indicates No. of Taps

-
- If you consume 1 L of oil / L of maple syrup produced:
 - even if all your other emissions are 10x greater than evaporator emissions
 - Usually evaporator emissions are > 50% of all emissions
 - :

What You Can Do – 4 : Improve Evaporator Fuel Consumption

Assuming 1 L of syrup / tap and 1 tap / tree in an average sugarbush

Oil	Each tap is a tree that sequesters 32.4 kg CO ₂ e / L of syrup produced	If you consume 1 L of oil / L of maple syrup produced: <ul style="list-style-type: none">• Each L of oil emits 4.3 Kg of CO₂e• If you consume less than 1 L of oil for each litre of maple syrup produced, you will be better than carbon neutral
Wood	If you produce > 100 L syrup per cord of wood consumed <ul style="list-style-type: none">• The 100 trees it takes to produce 100 L will sequester 3,241 kg CO₂e	Emissions vary depending on type & age of wood, but an average of 2800 kg CO ₂ e / bush cord is reasonable

Wood Evaporator Efficiency vs RO Brix

Divide your total syrup produced (Litres) by Cord of wood consumed



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%	<i>Unattainable</i>					
	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		

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 good 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 greater Toronto or Montreal

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

- The sequestration opportunity would offset the entire emissions of a city of over 500,000 people

Top 3 Reasons for Becoming Provably Carbon Neutral

1. **Good for the environment – the moral reason**

- Ethically responsible
- Enables immediate action on fighting climate change instead of waiting for others

2. **Increases efficiency – the lazy reason**

- Don't like cutting wood, buying so much fuel, ...
- Lowers costs

3. **Financial benefits – the greedy reason**

- Increased sales to climate-conscious customers
- Opportunity to differentiate in a crowded market
- Potential for downstream tax breaks or incentives

www.spiritintheforest.ca

Pure Maple Syrup

Carbon-Negative Emissions



ESPRIT DANS LA FORÊT

Émissions de Carbone Négatif

Sirop d'Erable Pur

www.espritdanslaforet.ca

Questions?

Paul Renaud

paul@spiritintheforest.ca

613-259-3274 (landline)

613-277-5898 (cell)

See also the Net-Zero page at www.spiritintheforest.ca