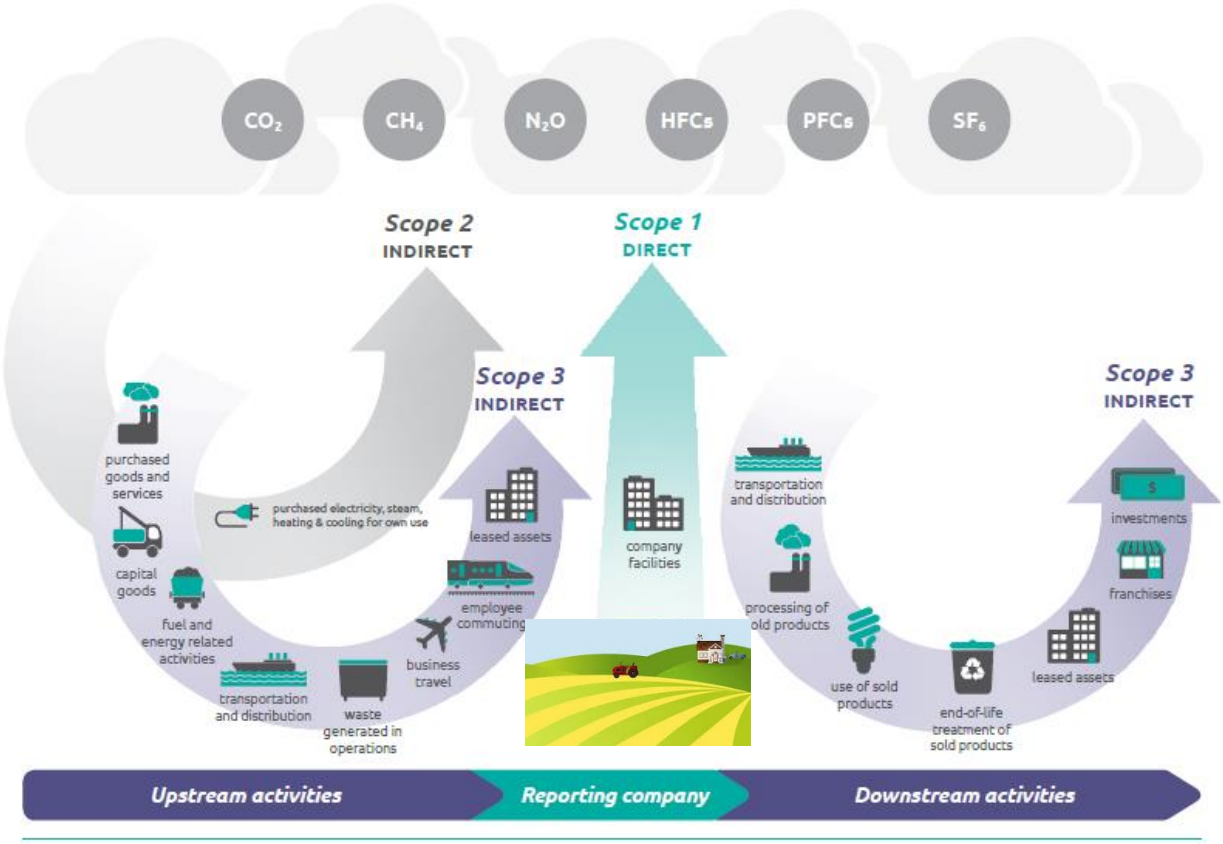
A Guide to Calculate a Farm's Scope One and Two Emission

October 2, 2023



Scope One Emissions

Scope 1 emissions are direct greenhouse (GHG) emissions from sources controlled or owned by the farm.

Scope Two Emissions

Scope 2 emissions are indirect GHG emissions associated with purchasing electricity, steam, heat, or cooling. Scope 2 emissions physically occur at the facility. The emissions are accounted for in the farm's GHG inventory due to the farm's energy consumption.

Farm Scope Manual Calculator

Instructions

The calculator below asks for total numbers. Start the process by locating all the following records from your on-farm data.

- Livestock should include all animals at a specific date.
- Record fertilizers as the actual nitrogen applied.
- Burning requires an estimate of the total dry matter consumed.
- Fuels required a record of all fuels (liters and gigajoules) consumed.
- Soil sequestration requires hectares under management, new croplands added, and lands sold for development in the year assessed.
- Farm data should be a yearly total.

Multiply the amount by the emission factor. Once done, add all the emissions together at the bottom.

Farm Name _____ Greenhouse Gas Scope One and Two Net Emissions Report For the Year Ending (Month, Day, Year)			
Source	**(A) Amounts**	**(B) Emission Factor[1]**	**(A x B) Estimated Emissions per year**
Livestock Ch4 Enteric			
Dairy Cattle	#	145.26 kg	kg
Non-Dairy Cattle	#	71.49 kg	kg
Sheep	#	8 kg	kg
Swine	#	1.5 kg	kg
Poultry	#	NE (0)	0
Horses	#	18 kg	kg
Not Listed Animals	#	Consult Background Tables	kg
Total CH4 (Enteric) Emissions from Livestock			(A) kg
Livestock Ch4 Manure			
Dairy Cattle	#	39.46 kg	kg
Non-Dairy Cattle	#	3.61 kg	kg
Sheep	#	0.28 kg	kg
Swine	#	4.86 kg	kg
Poultry	#	0.05 kg	kg
Horses	#	2.6 kg	kg
Not Listed Animals	#	Consult Background Tables	kg
Total CH4 Emissions (Manure) from Livestock			(B) kg
Livestock N2O Manure			
Dairy Cattle	#	0.93 kg	kg
Non-Dairy Cattle	#	0.71 kg	kg
Sheep	#	0.04 kg	kg
Swine	#	0.01 kg	kg
Poultry	#	0.01 kg	kg
Horses	#	0.49 kg	kg
Not Listed Animals	#	Consult Background Tables	kg
Total N2O Emissions (Manure) from Livestock			(C) kg

[1] Based on 2021 ECCC IPCC Background Tables

Yearly Farm Operations			
Source	**(A) Amounts**	**(B) Emission Factor[2]**	**(A x B) Estimated Emissions per year**
Operations	As Applied		
Inorganic Fertilizer (kg of nitrogen)	kg	0.01 kg of N2O	kg
Organic Fertilizer (kg of nitrogen)	kg	0.01 kg of N2O	kg
Animal Manure Applied (kg of nitrogen)	kg	0.01 kg of N2O	kg
Organic Fertilizer (kg of nitrogen)	kg	0.01 kg of N2O	kg
Burning of Annual Crops	Tonnes of Dry Matter	2.5 kg per 1000 tonnes of CH4	kg
Burning of Annual Crops	Tonnes of Dry Matter	0.06 kg per 1000 tonnes of N2O	kg
Limestone	kg	0.000125 kg of CO2	kg
Urea	kg	0.0002 kg of CO2	kg
Total CO2e Emissions from Fertilizers and Other Sources			(D) kg

[2] Based on 2021 ECCC IPCC Background Tables

Yearly Farm Energy and Fuels			
Source	**(A) Amounts**	**(B) Emission Factor[3]**	**(A x B) Estimated Emissions per year**
Farm Diesel		2.89 kg per liter	kg
Farm Gasoline		2.23 kg per liter	kg
Farm Natural Gas		52.6 kg per Gj	kg
Farm Propane		1.565 kg per liter	kg
Farm Electricity		Per Kwh see Table	kg
Total CO2e Emissions from Energy Consumption			(E) kg

[3] Amended June 22, 2022

Land and Soil Sinks			
Source	**(A) Amounts**	**(B) Emission Factor[4]**	**(A x B) Estimated Emissions per year**
Lands	# Hectares		
Management[5] Annual Cropland		See Ecozone Table	kg
Management of Native Grasslands		(zero[6]) -26 kg[789]	(kg) This number will be negative.
Management of Tame Forage		(zero[10]) -110 kg[111213]	(kg) This number will be negative.
Management of Intensive Grazing		-340[14] kg	kg This number will be negative.
Conversion of Forrest to Cropland	New Hectares Added	See Ecozone Table	kg
Conversion of Grassland to Cropland	New Hectares Added	3696 kg	kg
Conversion of Cropland to Urban		10256 kg	kg
Conversion of Grassland to Urban		21400 kg	kg
Total CO2e Net Emissions from Land Sources			(F) kg

[4] Based on 2021 ECCC IPCC Background Tables
[5] Identified with no-till practices. Maximum 2 passes at seeding. Maximum disturbance 46%. No tillage post harvest.
[6] The ECCC Background tables report annual changes to carbon stocks as negligible or NE.
[7] Background information Grassland Protocol, assuming carring capacity at optimum. Drop by 50% when under drought.
[8] RAQUEL GARCÍA-ÁLVAREZ, Linking prairie carbon sequestration and other co-benefits to the voluntary carbon market. Pilot Project: Midewin National Tallgrass Prairie
[9] D. H. Lynch, R. D. H. Cohen, A. Fredeen, G. Patterson, and R. C. Martin, Management of Canadian prairie region grazed grasslands: Soil C sequestration, livestock productivity and profitability, Canadian Journal of Soil Science May 2005
[10] The ECCC Background tables report annual changes to carbon stocks as negligible or NE.
[11] Viresco Solutions, Grassland Protocol background data.
[12] Vern Baron, Forage Physiologist, Western Forage/Beef Group and AAFC, Can Pastures Slow Down Global Warming?
[13] D H Lynch
[14] Aklilu W. Alemu, Roland Kröbel, Brian G. McConkey, and Alan D. Iwaasa, Effect of Increasing Species Diversity and Grazing Management on Pasture Productivity, Animal Performance, and Soil Carbon Sequestration of Re-Established Pasture in Canadian Prairie, Animals (Basel). 2019 Apr; 9(4): 127.

			Summary of Emissions	
Total CH4 (Enteric) Emissions from Livestock	**(A)**	**x 25**		**kg CO2e**
Total CH4 Emissions (Manure) from Livestock	**(B)**	**x 25**		**kg CO2e**
Total N2O Emissions (Manure) from Livestock	**(C)**	**x 298**		**kg CO2e**
Total CO2e Emissions from Fertilizers and Other Sources	**(D)**	➲		**kg CO2e**
Total CO2e Emissions from Energy Consumption	**(E)**	➲		**kg CO2e**
Total CO2e Net Emissions from Land Sources	**(F)**	➲		**kg CO2e**
Total GHG Footprint	**Sum**			**kg CO2e**

Ecozone Sink Tables

Ecozone	Cropland remaining cropland kg/ha	Forest converted to Croplands Kg/ha
RZ10 Boreal Plains	-108.103	33.73003
RZ11 Subhumid prairies	-669.682	-37.0625
RZ12 Semiarid prairies	-862.807	0
RZ13 Taiga Plain	1126.667	0
RZ14 Montane Cordillera	235.6604	66.10711
RZ15 Pacific Maritime	944.125	-302.449
RZ5 Boreal Shield East	295.8199	-143.588
RZ6 Atlantic Maritime	213.5527	234.2269
RZ7 Mixedwood Plains	332.8179	-164.632
RZ9 Boreal Shield West	-85.551	-10.8379

Electricity Table[15]

Province	Factor per kwh[16]	Province	Factor per kwh
BC	0.054 kg	PQ	0.029 kg
AB	0.479 kg	NB	0.244 kg
SK	0.461 kg	PEI	0.222 kg
MB	0.105 kg	NS	0.477 kg
ON	0.105 kg	NL/NWT/NUN	No Data
YK	0.073 kg		

[15] https://app.electricitymap.org/zone/CA-QC
[16] May 12, 2022 data

2005 Baseline

Repeat this exercise with your 2005 data. Why 2005? The emissions from 2005 are your baseline.

Compare the two to establish what changes may need to be made to reach 2030 targets or 2050 net-zero aspirations.

Factors and Coefficients

BCC is aware of many good discussions and debates on the coefficients used to identify and measure greenhouse gas emissions and sinks. Therefore, this worksheet uses the ECCC coefficients. For the grasslands and forage, we recognize better soil management does increase soil carbon. The coefficients used are conservative.

An example of this debate is switching to a coated fertilizer product. There is good science, and a protocol exists to capture that reduction in emissions. However, these changes in emissions are not reflected in the coefficients used by ECCC. Mainly, the practice is insufficient across annual cropping agriculture to date effectively.

For Membership and Other Extension Information

Biological Carbon Canada

www.biologicalcarbon.ca

Appendix

Ecozone Maps