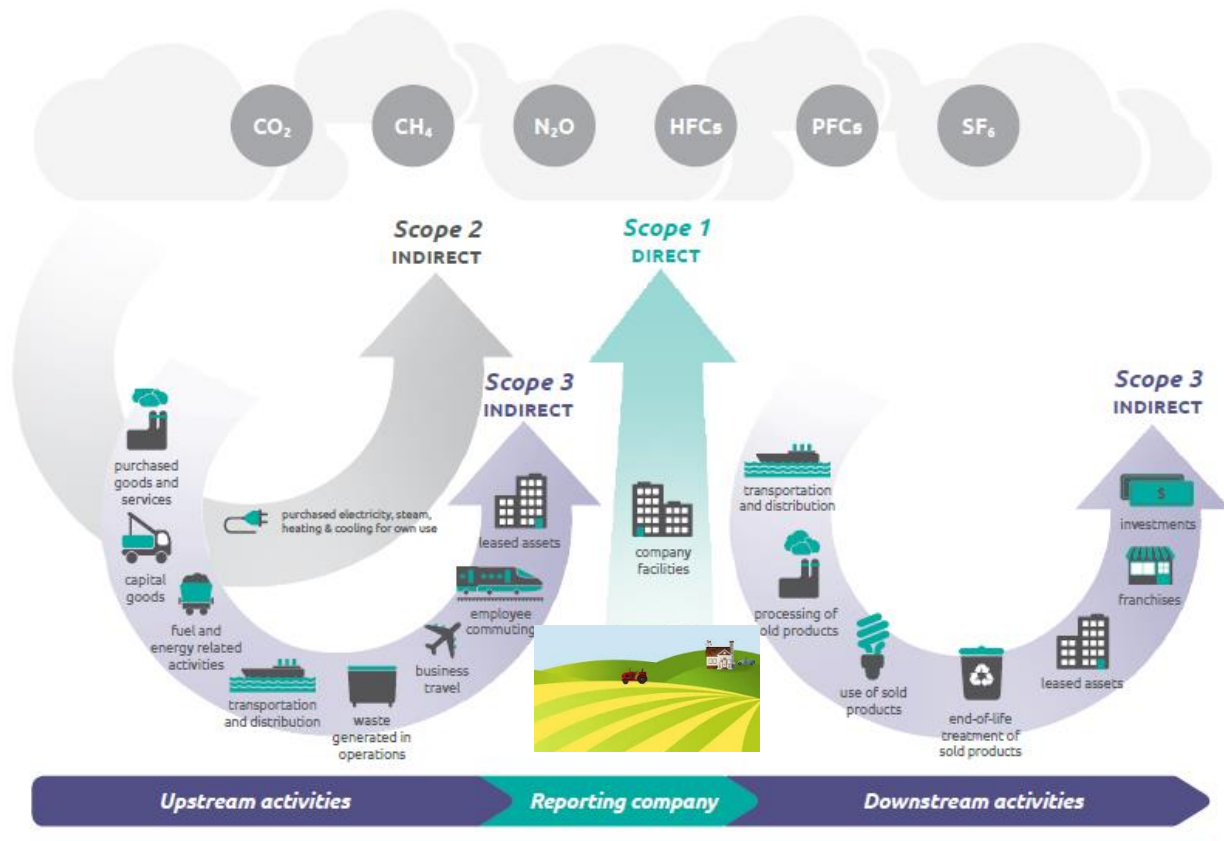




A Guide to Calculate a Farm and Ranch Emissions Footprint

June 1, 2024



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 _____			
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			Sum
Total CO2e Enteric Emissions			Sum x 28 = A (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			Sum
Total CO2e Manure Emissions			Sum x 28 = B (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			Sum
Total Co2e Manure Emissions			Sum x 265 = C (C) kg

¹ Based on 2022 ECCC IPCC Background Tables

Yearly Farm Operations			
Source	(A) Amounts	(B) Emission Factor²	(A x B) Estimated Emissions per year
Operations	As Applied		
Inorganic Fertilizer (kg of nitrogen)	kg of N	0.01 kg of N ₂ O	kg
Organic Fertilizer (kg of nitrogen)	kg of N	0.01 kg of N ₂ O	kg
Animal Manure Applied (kg of nitrogen)	kg of N	0.01 kg of N ₂ O	kg
Organic Fertilizer (kg of nitrogen)	kg of N	0.01 kg of N ₂ O	kg
Burning of Annual Crops	Tonnes of Dry Matter	0.06 kg per 1000 tonnes of N ₂ O	kg
Total N₂O			(a) kg
Burning of Annual Crops	Tonnes of Dry Matter	2.5 kg per 1000 tonnes of CH ₄	kg
Total CH₄			(b) kg
Limestone	kg	0.000125 kg of CO ₂	kg
Urea	kg	0.0002 kg of CO ₂	kg
Total CO₂			(c) kg
(a)		(a) x 265	kg
(b)		(b) x 28	kg
(c)		(c) x 1	kg
Total CO₂e Emissions from Fertilizers and Other Sources			(a+b+c) (D) kg

² Based on 2021 ECCC IPCC Background Tables

Yearly Farm Energy and Fuels			
Source	(A) Amounts	(B) Emission Factor³	(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 Factor⁴	(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 <small>This number will be negative.</small>
Management of Tame Forage		(zero ¹⁰) -110 kg ¹¹¹²¹³	kg <small>This number will be negative.</small>
Management of Intensive Grazing		-340 ¹⁴ kg	kg <small>This number will be negative.</small>
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			Sum (F) kg

⁴ Based on 2022 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 carrying 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	(A)	↻		kg CO2e
Total CH4 Manure Emissions	(B)	↻		kg CO2e
Total N2O Manure Emissions	(C)	↻		kg CO2e
Total CO2e Fertilizer Emissions and Other Sources	(D)	↻		kg CO2e
Total CO2e Energy Emissions	(E)	↻		kg CO2e
Total CO2e Net Land Emissions	(F)	↻		kg CO2e
Total GHG Footprint CO2e	Sum			kg CO2e

Ecozone Sink Tables

Ecozone	Cropland remaining kg/ha	Forest converted to Croplands kg/ha
Boreal Plains	-108.103	33.73003
Subhumid prairies	-669.682	-37.0625
Semiarid prairies	-862.807	0
Taiga Plain	1126.667	0
Montane Cordillera	235.6604	66.10711
Pacific Maritime	944.125	-302.449
Boreal Shield East	295.8199	-143.588
Atlantic Maritime	213.5527	234.2269
Mixed-wood Plains	332.8179	-164.632
Boreal Shield West	-85.551	-10.8379

Electricity Table¹⁵

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

