

Sustainable Canadian Dairy: Why it is Important and How it is Being Achieved

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■ Take Home Messages

- ▶ Implementing practices and infrastructure that increase farm sustainability is necessary in today's ever-changing climate and price market.
- ▶ Canadian dairy farmers need to tell their story to consumers about all the great things they do to protect and enhance our land.
- ▶ We hear a lot about methane reduction. Methane has a much shorter life in the atmosphere than carbon but is much more potent, which is why methane reduction is important.
- ▶ Cattle create methane through enteric fermentation of food digestion, part of the natural process called the biogenic carbon cycle. This cycle sees plants sequester carbon from the atmosphere and turn it into plant cellulose. The plant is in turn eaten by the cow, the byproduct of digestion exits the cow as methane, and then the methane is broken down in the atmosphere over 10 to 12 years and returned to the plant in the form of carbon.
- ▶ Methane emissions can be effectively reduced through genetic selection, feed additives and manure storage and application.
- ▶ Fossil fuels are not part of the biogenic carbon cycle and take thousands of years to break down in the atmosphere. Reduction of methane will decrease emissions, while reduction of carbon will plateau emissions because of the differing atmospheric life spans.
- ▶ In April 2023 Canada became the first country to offer methane efficiency values in genetic evaluations. Selecting bulls for feed and methane efficiency can effectively reduce emissions.
- ▶ When investing in new infrastructure or equipment, dairy farmers must make informed choices about energy efficient and water reducing products and technologies.
- ▶ Land based sustainable practices can have big positive effects, not only on greenhouse gas emissions but also on protecting the land against weather extremes and enhancing the land for the future without increasing inputs or sacrificing outputs.
- ▶ Sustainable practices can protect soil against erosion, decrease compaction, increase nutrient and organic matter, increase water holding capacity and store carbon.
- ▶ Management of wetlands and riparian areas can protect land against flooding and drought and provide important habitat.
- ▶ Stopping land conversion protects habitats for wildlife and pollinators that are integral for food production through plant pollination. Trees sequester carbon and protect land against wind erosion and extreme weather.
- ▶ Canadian dairy farmers are stewards of the land who need to protect and enhance the land for a sustainable dairy future.

▪ Introduction

What is the definition of sustainability? Sustainability is the ability to persist continuously overtime. Canadian dairy farmers are a prime example of sustainability, with the majority being 3rd generation or more. Properly caring for soil, water, and habitat, plus making sustainable herd and infrastructure choices, ensures a healthy farm that can continue to be passed down through the generations. The importance of implementing sustainable practices on Canadian dairy farms has become ever more increasingly evident. As extreme weather patterns become more frequent and land-based challenges continue to increase, finding ways to safeguard agricultural land against these changes is necessary. Increasing sustainability is not only important for protecting land, but also for ensuring a positive public image. In a public survey, Canadian dairy farmers were found to be as trusted as doctors; that's an image we want to preserve and protect. The sustainable practices that farmers have been carrying out for years have always been their best kept secret, but this is changing because consumers are ever increasingly aware and curious about how their food is made. Producers need to let the public in on all the great things they are doing and have been doing for years. They need to define themselves, not be defined by others.

When we hear the word sustainability often we think of the land. While land management and cropping practices are a big part of being sustainable, there are also other factors that contribute. Herd management plays a big role in dairy sustainability; making informed decisions about breeding, culling, replacement animals and herd health practices can increase farm sustainability. Infrastructure choices also can be pertinent in increased sustainability through decreased energy use and cost, improved animal comfort leading to longer life spans, and efficient manure management that decreases methane emissions and improves overall efficiency.

▪ Carbon versus Methane

We hear a lot about carbon and methane. There is a large push for the dairy industry to reduce methane emissions. Methane is 28% more potent than carbon dioxide for trapping heat in the atmosphere but has a shorter lifespan (United States Environmental Protection Agency, 2023). Methane has a life span of about 12 years in the atmosphere; carbon dioxide can last hundreds of years.

Methane levels have more than doubled over the last 200 years, coming from both natural and manmade sources, with man-made making up about 60% of today's atmospheric carbon (NASA, 2023). Methane is naturally destroyed by biological and chemical processes. This can happen by a reaction with atmospheric hydroxyl and chlorine or by bacteria that consume methane in soil and water (Nisbet-Jones et al., 2021). The potency and lifespan of methane versus carbon is one of the main reasons for a greater push on lowering methane emissions rather than carbon emissions. Reducing methane emissions will reduce warming, whereas reducing carbon emissions will just result in a plateau of warming (Figure 1, Allen et al., 2022).

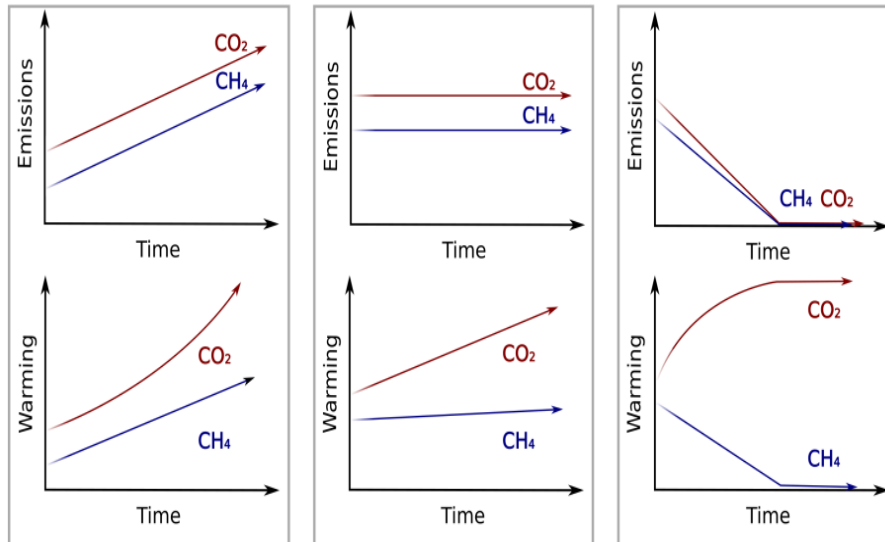


Figure 1. Reduction of carbon versus methane (Allen et al., 2022)

Ruminant animals create methane through enteric fermentation in the rumen and through the anaerobic decomposition of their manure. Even though ruminant methane production and breakdown are part of the natural carbon cycle, methane's potency in the atmosphere makes methane a large contributor to global warming.

▪ Biogenic Carbon Cycle

Methane created by cattle is part of an important natural cycle called the biogenic carbon cycle (Figure 2). This cycle centres around plant photosynthesis and the plant's ability to take carbon from the atmosphere and turn it into oxygen. When plants photosynthesize, a large percentage of the carbon is converted into cellulose. Two thirds of the world's agricultural lands are marginal lands that are not good for growing high input crops but can grow cellulose-dense grasses that are not edible for humans but highly edible for cattle. Cattle digest the carbon in plants and turn it into energy for growth, milk production and other metabolic processes. The methane that cows emit is a by-product of the plant carbon; this returns the carbon that had been sequestered by the plants back to the atmosphere. Methane emitted by cattle is not a new gas emission into the atmosphere, but a gas that had already been there, just transformed into a new element. After 10 to 12 years the methane emitted by the cow is converted back into carbon dioxide, which can then again be sequestered by plants, completing the biogenic carbon cycle (Werth, 2020).

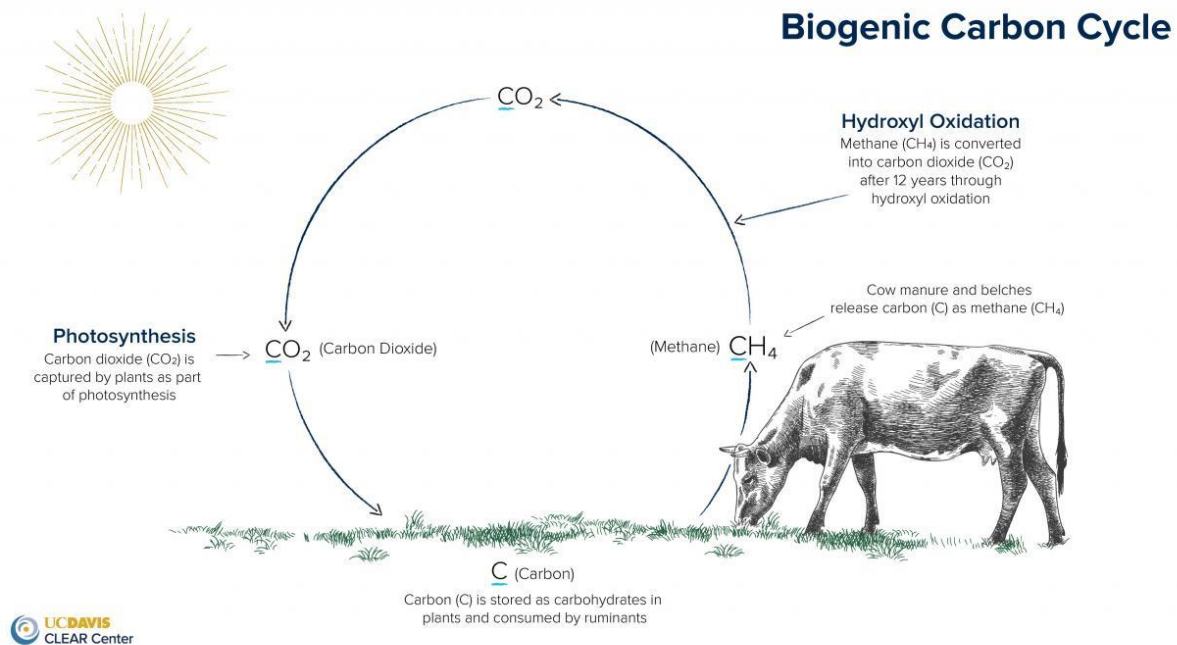


Figure 2. Biogenic carbon cycle (Werth, 2020)

Fossil fuels are not part of the biogenic carbon cycle. Burning fossil fuels has a much greater impact on the atmosphere because the carbon exchange between the atmosphere and geological reserves (deep ocean, rocks, deep soil) takes thousands of years. The biogenic carbon cycle is quite fast, taking a few years to a few decades between plants and the atmosphere and about ten years between cattle and the atmosphere. Therefore, the thousands of years it takes to return carbon dioxide from burning fossil fuels back into geological reserves is ten-fold the amount of time methane belched by cattle takes to return to plants. The carbon dioxide released while driving a car will last in the atmosphere longer than the lifetime of our grandchildren, creating a much more longstanding impact on our climate than does the methane emitted from cattle (Werth, 2020).

▪ How and Why Sustainable Practices can be Easily Implemented

As previously mentioned, Canadian dairy farmers are already incorporating sustainable practices in their farm management. As weather patterns change and profit margins decrease, producers have no choice but to find the most effective ways to produce milk.

In April 2023, Canada became the first country to publish methane efficiency in genetic evaluations. Selecting for the methane efficiency gene can reduce methane emissions by 20-30% per year and has no negative effects on milk production and a slight positive correlation with health and fertility and metabolic disease resistance. Canadian dairy farmers are also offered the feed efficiency trait in genetic evaluations. Using this, in conjunction with the methane reduction gene when choosing sires, can help contribute to environmental sustainability and cost efficiency within a herd. It is a fairly easy, yet effective way to decrease methane emissions (Sweett and Van Doormaal, 2023).

Infrastructure choices are another way to reduce emissions and costs on farm. When investing in new equipment, barns, technology, etc., producers should become informed of the choices that will increase on-farm sustainability. Incorporating systems to reduce water use or recycle water, and lowering energy use through solar panels, wind energy and efficient lighting can all have positive effects, not only on emissions, but also on the farm's bottom line. Proper manure storage and handling can have enormous effects on

decreasing methane emissions. Some investments, such as biodigesters, covered manure storage and injection equipment, while very efficient at emissions reductions, can be very costly. There are ways to decrease methane emissions on farm without a large investment through decreased storage time and proper nutrient management (Dairy Farmers of Canada, 2023)

Land-based practices are also a big way to have a positive impact on the environment without large investment (Figure 3). Besides lowering emissions, implementing sustainable land management programs can safeguard the farm against changing weather patterns and decrease inputs and increase outputs, thus increasing profit and ensuring a prosperous future for the farm. There are many practices that producers may already incorporate into their farm management or could easily be added. Examples include reduced tillage, using cover crops, managing nutrients properly, growing more forage and perennials, using rotational grazing, protecting wetlands and riparian areas, and protecting forest and habitat by decreased land conversion. These practices can have large positive impacts not only on the environment as a whole, but at the farm level. Implementing practices such as the ones listed above while show positive impacts in three main categories: soil, water, and biodiversity. Let's take a closer look at why these three things are so important to the future of individual farms and the Canadian dairy industry.

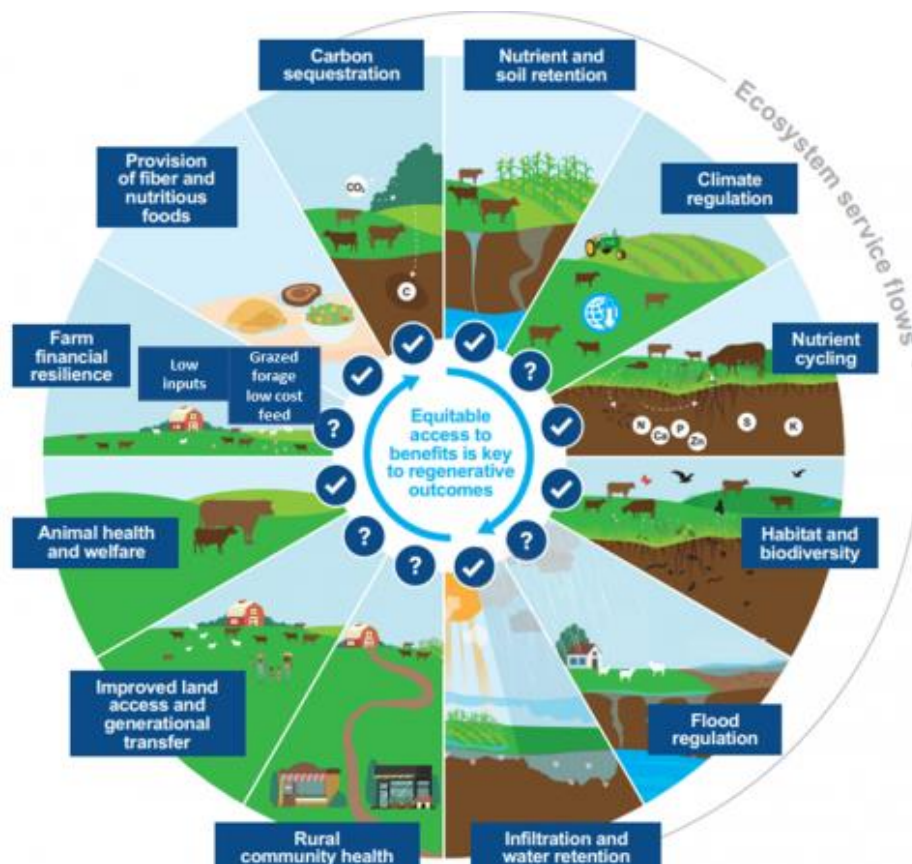


Figure 3. A healthy ecosystem (Cutress, 2021)

■ Soil

Healthy soil is imperative for a profitable farm. Using sustainable practices to enhance soil health can improve soil to the point that less costly inputs are needed, thus saving the farmer time and money while continuing to have profitable yields. We know that the soil is a living thing, full of bacteria, fungi, and insects that help keep the soil healthy for our use, so in turn we must protect them. Reduced tillage not only lowers greenhouse gas emissions but also reduces compaction, which allows water to better filtrate the soil and plant roots to spread more easily and deeper. Reduced tillage or cover crops also protects soil against wind

and water erosion, increases soil organic matter, and improves water retention capacity of the soil. Planting more perennial plants not only provides habitat for pollinator species which are integral to the yield of crops but ensures a constant root structure in the soil to decrease compaction and fight erosion while sequestering carbon. Proper crop rotation and the planting of legumes also aid in soil health by not depleting the soil of a certain nutrient in high demand by a particular crop. Why are these benefits so important? With the ever-increasing frequency of extreme weather, having healthy soil can save crops. During a drought healthy uncompacted soil can hold more water and roots can travel deeper to access that water. If flooding occurs, a healthy soil has a great water holding capacity and stronger soil aggregates to decrease the amount of topsoil lost. The same principles apply to soil with constant vegetative cover versus being barren. Fields with cover crops are more productive than those without; in addition to the above-mentioned benefits, they also promote mycorrhizal growth, suppress weeds, and minimize soil evaporation. Costs for synthetic fertilizer, sprays and diesel continue to increase; having a soil high in organic matter and use of green fertilizers can reduce these input costs. Everything works as a cycle, starting with soil. Healthy bacteria and fungi create healthy soil, creating healthy plants, creating healthy animals and pollinators, and creating high quality products for our consumption.

▪ **Water**

Water is great, until there is too little or too much. Water quantity and quality are becoming more popular topics in farming as drought and flooding events increase and water quality decreases. Protecting water that naturally occurs on the landscape is an important factor in protecting agricultural land for the future. Protecting or enhancing naturally occurring wet areas or wetlands can greatly reduce flood effects and these areas can be used as a water source for crop irrigation or cattle watering during droughts. If the area is too wet to be used for cropping, it is better served as a constructed wetland for water control. When there is not a naturally occurring wetland but there are issues with flooding, a wetland could be created to help deal with the problem. Capturing and storing water will become crucial for sustainable agriculture. Rainwater, runoff or even treated wastewater can be stored and later used for irrigation. The creation of riparian areas and buffer zones around water ways on agricultural land increases water quality through decreased runoff by trapping excessive nutrients and sediments and creates wildlife habitat. Efficient water use in agriculture must continue to increase in the future, not only in cropping, but in the barn as well with adaptations to milking and washing systems to reduce water use or recycle water.

▪ **Biodiversity**

Biodiversity is a newer, but ever-growing topic in agriculture. It refers to all living organisms in an area. Biodiversity makes the earth liveable, from filtering air we breathe and water we drink, to regenerating soil and providing pollination for crops and plants, which in turn creates a food chain from which we eat. Other important aspects also include fungi, which are used in medicine, and animals, which keep disease vectors, like ticks, in check. Protecting and enhancing biodiversity has a compounding positive effect on agricultural land. A goal not only the Canadian dairy industry should be striving for, but all sectors of agriculture, is to stop land conversion. By implementing the above-mentioned practices, we can make existing agricultural soils more productive and increase yields without bringing more land into production. Keeping intact grasslands, forests and other habitats is pertinent to the protection and future of our planet. Intact habitat, tree lines, rock piles, buffer strips, etc., not only sequester carbon and provide a home and nourishment for thousands of different species, but they also protect and enhance our agricultural land by acting as windbreaks, water control, pollination sources, increased soil organic matter and much more. Keeping buffer strips, tree rows or 'unfarmed' areas around fields also decreases pest and crop disease instances. Farms with high levels of biodiversity benefit from healthier soils requiring less inputs, higher yields through increased pollination, higher quality soil through organic matter levels and decreased erosion, lower input costs, decreased pests and disease, increased water control and quality, and long-term soil sustainability.

Canadian dairy farmers must continue to put sustainability at the forefront of their operations to decrease costs while increasing yields, to protect and enhance the land and biodiversity, all to guarantee a great farming future for the next generations.

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