

## ACKNOWLEDGEMENTS

Climate Change Connection sincerely thanks the following people and organizations who provided their knowledge, experience, and energy to make this guide relevant and useful to Manitoban agricultural producers:

- Juanita Kopp, Manitoba Agriculture, Food and Rural Initiatives (MAFRI)
- John Popp, (MAFRI)
- Curtis Cavers, (MAFRI)
- Van Doan, (MAFRI)
- Tony Szumigalski, (MAFRI)
- Esther Salvano, (MAFRI)
- Blair Geisel, Gaia Consulting Ltd
- Allen Tyrchniewicz, Tyrchniewicz Consulting Inc
- Carol Thiessen, Writer
- Cheri Frazer, Editor

Climate Change Connection is a multi-stakeholder project, managed by the Manitoba Eco Network.

Our vision is for a future in which:

***Manitobans will be aware of climate change facts related to Manitoba and will take action to reduce their greenhouse gas (GHG) emissions, both individually and as a community***

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## CAN YOU MAKE A DIFFERENCE?

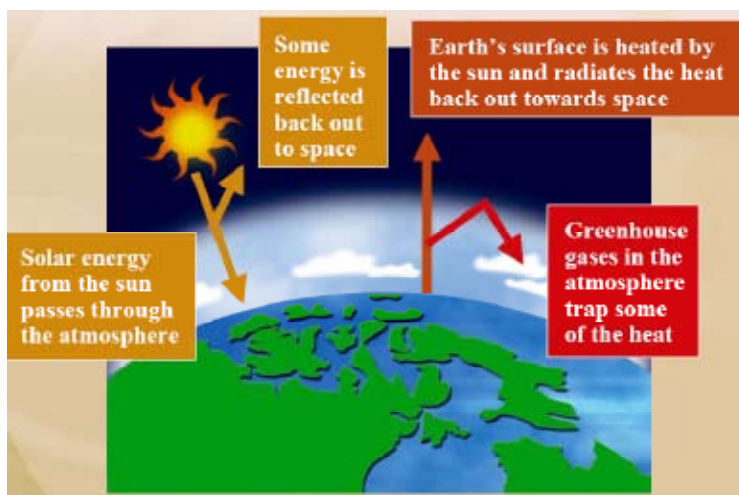
Farming activities account for 36 percent of Manitoba's total greenhouse gas emissions. The good news is that farming practices can be modified to become part of the solution. You can make a difference.

This guide sets out to help you, as a Manitoba farmer, to adopt climate-friendly practices without hurting your wallet. In fact, many of the recommendations can result in higher yields and fewer inputs. And whether you've already incorporated climate-friendly practices into your farming operation or are interested in making changes now, you'll be part of a positive movement to pass on a healthier environment to future generations.

In this guide you'll find the causes and effects of climate change, and suggested actions that you can take to reduce greenhouse gas emissions, specifically on livestock production. It includes:

- A brief introduction to climate change
- Predicted changes for Manitoba's climate
- The impact of climate change on Manitoba livestock production
- Farm contributions to climate change
- Recommendations on how to reduce greenhouse gas emissions from livestock production
- Resource list

## WHAT CAUSES CLIMATE CHANGE?



*“Warming of the climate system is unequivocal, as it is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level.”*

-Intergovernmental Panel on Climate Change, 2007

## In Manitoba...

Agriculture plays a significant role in contributing emissions.

It accounts for 36 percent of Manitoba's greenhouse gas emissions, excluding vehicle fuel and commercial heat.

Manitoba's agricultural emissions increased 42 percent between 1990 and 2006.

Of Manitoba's agricultural emissions in 2006, 55 percent came from agricultural soils, 33 percent from enteric fermentation and 12 percent from manure management. <sup>(1)</sup>

In Canada, agriculture-related emissions contributed 8.6 percent of total emissions in 2006, an increase of 25 percent from 1990 levels. <sup>(2)</sup>

The earth has always had a greenhouse system, ensuring that not all energy arriving from the sun escapes directly back into space. Most greenhouse gases, including carbon dioxide, methane and nitrous oxide, are found naturally in the earth's atmosphere. This natural greenhouse effect keeps the earth a balmy 30°C warmer than it would otherwise be. This is necessary for life on earth.

Since the onset of the Industrial Revolution around 1750, however, humans have been contributing to the amount of greenhouse gases in the atmosphere by introducing new sources (mainly by burning fossil fuels) or by removing existing sinks, such as forests, which absorb greenhouse gases. Scientists estimate that levels of greenhouse gas emissions have risen by 31 percent since the start of the Industrial Revolution. <sup>(3)</sup>

The increase in greenhouse gas emissions means a thicker blanket of greenhouse gases in the atmosphere. And that means more heat is trapped, leading to global warming.

- Temperatures have increased by approximately 0.74°C during the 20th century (4)
- Eleven of the last 12 years (1995–2006) rank among the warmest years on record (5)
- A further rise of between 1.4–5.8°C is expected by the year 2100 (6)

This global warming, in turn, affects other aspects of the earth's climate, such as:

- Changing rainfall patterns
- Melting polar ice cover, snow and permafrost
- Rising sea levels
- Increasing numbers of extreme weather events

These phenomena are all part of climate change. (7)

Carbon dioxide (CO<sub>2</sub>) makes up 60 percent of greenhouse gas emissions, followed by methane (CH<sub>4</sub>) at 20 percent, while nitrous oxide (N<sub>2</sub>O), industrial gases and ozone contribute the remaining 20 percent. (8)

## WHAT CHANGES ARE PREDICTED FOR MANITOBA?

As every farmer knows, it's difficult to predict weather for any given day. So how can scientists possibly predict how climate change will affect overall temperature in Manitoba? First of all, climate change and weather are two very different things. Weather is the specific condition of the atmosphere at a particular place and time. Climate, in contrast, is much less specific. It refers to weather patterns averaged over a long period of time. (9)

That doesn't mean it's easy to predict climate changes, but scientists do have an increasingly clear picture of what to expect. There will still be plenty of variability in Manitoba's daily weather, but the overall climate for Manitoba is expected to change noticeably. In fact, Manitoba's central location in North America, with its northerly latitude, means climate change is likely to occur earlier and more severely than in other parts of the world. (10)

Predicted changes for Manitoba's agricultural regions include: (11)

- Above-normal spring temperatures
- An increase in summer temperatures of 3–4°C
- An increase in fall temperatures of 2–3°C
- An increase in winter temperatures of 5–8°C
- An increase in springtime precipitation of 5–10 percent
- A decline in summer precipitation of 10–20 percent

- A decrease in fall precipitation in the south, and an increase of fall precipitation in the north
- More extreme heat spells and less extreme cold spells
- More extreme weather, including droughts, heavy precipitation and heat waves
- More intense winter storms

Source: Manitoba government

## HOW WILL CLIMATE CHANGE AFFECT MANITOBA LIVESTOCK PRODUCTION?

As you already know, a changed climate will significantly impact agriculture in Manitoba. Higher levels of carbon dioxide, changing rain patterns, higher temperatures and greater occurrence of extreme weather events will all significantly affect livestock production in Manitoba. That's the easy part.

However, making more detailed predictions about how livestock production will be affected is an inexact science at best. Generally, climate change models predict an uncertain future for agriculture in Manitoba, with potential benefits likely offset by major drawbacks.

The following summary will clarify both these potential benefits and drawbacks for livestock production in Manitoba.

### How Higher Temperatures Might Affect Your Farming

#### Heat Stress

With summer temperatures 3–4°C warmer than now, livestock will be more vulnerable to heat stress during the warmest months, resulting in decreased productivity and reproduction. (12) Hogs and poultry are especially susceptible to heat-related injury and death because they have no sweat glands. The demand—and cost—for water and cooling systems will grow. (13)

Cattle over-wintered outside, however, will face less stress from harsh cold, and will likely gain more over winter. (14)

#### Insects and Pathogens

The exact impacts of climate change on insects and pathogens is somewhat uncertain—some changes may be favourable to insects and pathogens while others may be negative. Most evidence, however, indicates an overall increase in the number of outbreaks of a wider variety of insects and pathogens. (15)

#### Soil Quality

Warmer temperatures increase soil microbial activity, speeding the natural breakdown of organic matter and other processes that affect fertility. (16) But a longer growing season with more vegetative mass produced may offset the increased breakdown of organic matter.



## How Changing Precipitation Patterns Can Affect Your Livestock

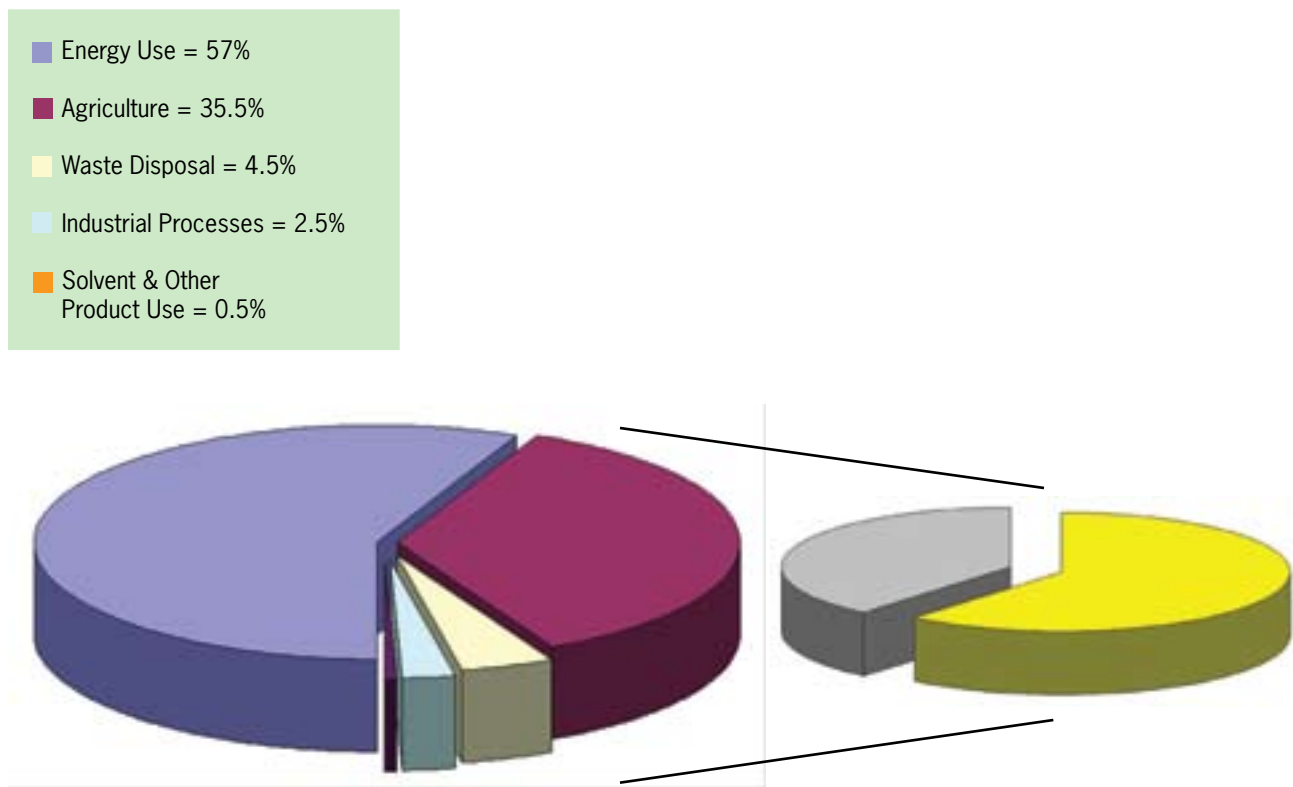
### Water Availability

Of the total rainfall expected, more will fall in intense events, so the length of dry periods between rains will likely increase. Together with warmer temperatures (causing more water loss), the result will likely be increased drought frequency and severity. (17)

Water quality for livestock could also be an issue because of warmer temperatures and increased water loss, resulting in decreased water supplies in summer.

Less available surface water means less dilution of pollutants, resulting in poorer water quality. Increased spring rains could also result in more pollution from such sources as flooded lands (18)

Overall, the availability of water for livestock is likely to become a major issue.



## HOW AGRICULTURE CONTRIBUTES TO CLIMATE CHANGE IN MANITOBA

Farming activities in Manitoba account for 32 percent of Manitoba’s total greenhouse gas emissions, as shown in the pie chart.

The emissions from agricultural sources are 61 percent nitrous oxide and 39 percent methane. (19)

**Note:** This figure does not include the use of fossil fuels for heating homes or operating machinery. Nor does it include indirect greenhouse gas emissions from fertilizer production.

The following chart gives a handy breakdown of greenhouse gases and their agricultural sources. (It includes home heating and farm machinery as sources of CO<sub>2</sub> emissions from fossil fuel burning. Although Canada categorizes these separately from agricultural emissions, they are still sources of CO<sub>2</sub>.)

Greenhouse Gas	Global Warming Potential	Agricultural Source	Causes
Carbon dioxide (CO <sub>2</sub> )	1:1 (CO <sub>2</sub> equivalent)	<ul style="list-style-type: none"> <li>- Soils</li> <li>- Fossil fuel combustion</li> </ul>	<ul style="list-style-type: none"> <li>- Tillage, which accelerates organic matter decomposition</li> <li>- Clearing woodlots and soil drainage</li> <li>- Operating farm machinery</li> <li>- Heating farm buildings</li> <li>- Crop residue burning</li> </ul>
Methane (CH <sub>4</sub> )	21:1 (21 times more potent than CO <sub>2</sub> )	<ul style="list-style-type: none"> <li>- Ruminant livestock (the major source)</li> <li>- Manure</li> <li>- Soils</li> </ul>	<ul style="list-style-type: none"> <li>- Digestion of feeds by ruminants</li> <li>- Decomposition of manure during storage and application</li> <li>- Methane production by bacteria in poorly drained soils</li> </ul>
Nitrous oxide (N <sub>2</sub> O)	310:1 (310 times more potent than CO <sub>2</sub> )	<ul style="list-style-type: none"> <li>- Manure storage</li> <li>- Nitrification (oxidation of ammonia)</li> <li>- Denitrification (conversion of plant-available nitrate-nitrogen to gases) in the soil</li> </ul>	<ul style="list-style-type: none"> <li>- Saturated soil conditions with warm soil temperatures and the presence of carbon</li> <li>- Production of N<sub>2</sub>O during manure storage</li> <li>- Immediate loss to atmosphere shortly after fertilizer application</li> <li>- Use of excess amounts of nitrogen fertilizers</li> <li>- No or delayed incorporation of manure</li> </ul>

(Source: Ontario Ministry of Agriculture, Food and Rural Affairs) (20)



# RECOMMENDATIONS ON HOW TO REDUCE GREENHOUSE GAS EMISSIONS FROM LIVESTOCK PRODUCTION

Carrying such a heavy load of Manitoba's greenhouse gas emissions may seem overwhelming for the agricultural sector, but there is good news. As already stated, there are practical on-farm measures that reduce these emissions. And most are simply good management practices that will also optimize livestock production and decrease input costs.

This section includes suggestions on how you can:

- Manage your grassland and pasture in healthy ways
- Manage livestock feed efficiently
- Manage manure to reduce greenhouse gas emissions
- Use agroforestry to make your farm more climate-friendly
- Cut greenhouse gas emissions from vehicles and equipment
- Increase energy efficiency in farm buildings

## Manage Grassland and Pasture in Healthy Ways

Cattle are the primary source of methane emissions in Canadian agriculture. In Manitoba, enteric fermentation, or methane emissions, from ruminant livestock (primarily cattle) produced about 33 percent of the agricultural emissions in 2006.

Methane is produced in the rumen as microbial fermentation takes place. Up to 12 percent of the energy in the feed may be emitted as methane. (21) In addition to the production of greenhouse gases, this loss of feed energy as methane also represents lost profit for producers, since a significant portion of the feed consumed is not being converted to animal protein.

The best way to reduce methane emissions is by improving feed efficiency. And using high quality forage is one of the most effective ways to do this.

Research in Manitoba, for instance, showed that methane emissions from grazing steers on high quality pastures were 50 percent lower than emissions from those grazing on poor quality pastures. (22)

Rate of consumption by cattle is improved with abundant high quality forage, thus reducing time spent grazing and making the digestion process more efficient. Grazing time could drop from 10–13 hours per day to five hours per day, meaning significantly lower methane emissions. The faster the digestion, the less methane that is produced per unit of feed consumed. (23)

Healthy forage stands can also increase carbon stored in the soil, prevent soil erosion and protect water quality. (24)



Here are some key ways to ensure high quality forage, while also protecting the land.

### Adopt Rotational Grazing Patterns

Rotational grazing—alternating periods of grazing and time for plant recovery—helps ensure even pasture growth, resulting in less weed encroachment and a healthier forage stand. (25)

If a pasture is grazed unevenly, cattle end up expending a lot of energy trying to get what they like to eat from the regrowth. Uneven growth can lead to lower pasture productivity and more energy expended by cattle when grazing. (26)

### Practise Intensive Grazing

Intensive grazing on grass-legume pastures is another way to increase pasture productivity. This practice of using rotational grazing with multiple small paddocks and careful, often daily, management can increase profits while also benefiting the soil. Most practitioners can increase the pasture's carrying capacity by 30 to 60 percent in the first five years. However, intensive grazing requires more time and knowledge for it to work effectively. (27)

Intensive grazing, however, can result in more nitrous oxide emissions from the increased amounts of manure and urine left behind. So intensive grazing on a pasture should be followed by a significant rest period for the plants to recover adequately. This will allow the pasture to utilize any excess soil nitrogen that could be lost as ammonia or nitrous oxide. (28)

### Avoid Overgrazing Pastures

Overgrazing occurs when a plant that has been grazed is grazed again before it has regrown and replenished its root reserves. If regrazing continues, the plant may eventually die. Short grazing periods will ensure regrazing does not occur. (29)

Putting cattle out to pasture too early in spring and leaving them out too late in fall is another way that overgrazing happens. This can degrade pasture quality bit by bit every year. (30)

### Increase Use of Legumes

Adding some legume forages such as alfalfa or clover to the pasture mix will ensure there is adequate nitrogen in the diet to aid digestion of plant fibres, resulting in less methane production. (31)

## Brian Harper – Intensive Rotational Grazing

It may seem counter-intuitive that increasing the density of cows on a pasture can lead to healthier pastures and environmental benefits, but that's just what Brian Harper has learned in his Brandon cow-calf operation.

Over the last 10 years he has gradually divided his 360 acres of pasture into 8–15-acre paddocks. He puts his cows into each paddock for short intensive amounts of grazing—the length dependent on stock density.

"I usually try to be out of a paddock within five days," he explains. "And if it's especially high density we're out after a day. We've only really gone that intensive in the last couple of years and we're seeing the benefits."

He says new growth on the pasture is noticeably abundant. Wean weights on his animals stay the same, but he's carrying more animals per acre. "As your carrying capacity goes up you get better return per acre. We're just starting to get into that. It definitely pays off," he says.

Harper wasn't thinking about environmental benefits when he adopted intensive rotational grazing. But he does now. "My new philosophy is to take care of the soil and it will take care of the calves."

Legume forages also provide pasture grasses with adequate nitrogen, and reduce the need for synthetic nitrogen fertilizer, which in turn reduces the greenhouse gas emissions associated with its production. (32)

Even having as little as 25 percent legume in forages can result in significantly higher feed efficiency, leading to substantial decreases in methane. (33)

### Increase Perennial Forages

Forages provide a sink for carbon in the plant itself, while also increasing the organic matter content in the soil. Perennial forages reduce the frequency of soil tillage, prevent soil erosion and help protect water quality. (34)

### Fertilize Tame Pastures

Fertilization with synthetic fertilizer, manure or compost, encourages more vegetative growth and improves pasture productivity. This will also encourage more carbon sequestration in the soil. (35)

## Barry Lowes – Increased Legume Use

Barry Lowes loves the way his pasture grass grows with a healthy mix of legumes added to it. “You get good growth in spring. You get good growth late into the summer. And you don’t have to use commercial fertilizer because the legumes supply the nitrogen for the grass,” he marvels.

In the last four years, each time he’s sown down a pasture he’s put alfalfa into it. Usually about 15 percent of the grass mix he seeds is alfalfa, working out to about 25 percent alfalfa actually growing in the pasture.

Barry runs an 800 cow-calf operation on 6000 acres near McAuley, Manitoba, and the majority of that is pasture.

He knows legumes are good for pasture health and good for the environment. But he also suspects it’s doing his cows good. “I would say it probably helps quite a bit in terms of weight gain, because there’s higher protein in legumes.”

However, the use of synthetic fertilizers on pastures needs to be considered on the basis of economic benefit, potential environmental impacts and the energy requirements of synthetic fertilizer production, which uses significant quantities of fossil fuels.

## Manage Livestock Feed Efficiently

Proper grassland and pasture management are not the only ways to reduce methane emissions from livestock. Further options for improving animal nutrition and feed efficiency will also cut greenhouse gas emissions. Most of these suggestions relate specifically to enteric fermentation by cattle.

However, employing good feed management may also reduce greenhouse gas emissions produced from all types of livestock manure.

### Improve Production Efficiencies (All Livestock)

Any practice that reduces the number of livestock needed to meet demand will reduce overall emissions. Such steps include accelerated growth, improved reproduction, selective breeding, and improved herd health. (36) Emissions per pound of liveweight gain are reduced as production efficiencies increase. (37)

### Improve Feed Efficiency (Cattle and Hogs)

Avoid feeding more nutrients than required. Feeding excessive nutrients results in more nutrients excreted in manure. For cattle it also increases rumen methane emissions and wastes money on additional feed. (38)

Animal nutritionists can analyze the nutrient content of feed and formulate diets with the ideal mix of proteins, minerals and other essential nutrients. (39)

### Add Vegetable Oil to Diet (Cattle and Hogs)

Provide a low level of vegetable oil to the diet. The added oils—such as canola oil—reduce methane emissions by gathering hydrogen in the rumen that might otherwise be converted to methane. They also add energy to the diet. (40)

Vegetable oils should be added at a rate of no more than 5–6 percent of ration, as any higher rates will depress fibre digestion. (41)

A recent trial in Manitoba found cattle fed small amounts of whole sunflower seeds emitted 25–30 percent less methane than without the added vegetable oil. (42) However, so far this approach hasn’t been economically attractive for cattle.

There is some evidence that methane released from hogs by enteric fermentation can also be reduced by adding edible oils to their diet. (43) Raw canola oil is already routinely used in swine diets as an energy source. Edible oils are also beneficial for dust control.

### Introduce Higher Quality Feeds (Cattle)

Low quality feeds produce elevated levels of methane. Limiting straw intake and incrementally increasing higher quality feeds will reduce methane emissions.

For instance, straw intake could be cut from 24 lbs to 18 lbs, with an additional 1 lb of barley added to an 8 lb/day barley ration. That small addition of higher quality feed is all that is needed to replace the lost straw. The cow would then be fed 18 lbs straw and 9 lbs barley daily. This reduces methane emissions without compromising nutrition. (44) And while there could be some increase in feed costs, the added benefit of energy and better utilization could outweigh the added cost of grain.

## Feed Balanced Diet to Wintering Cattle

Many producers do not test their winter rations for nutrients, instead feeding whatever is available. A balanced winter diet of energy, protein, minerals and vitamins, however, could cut greenhouse gas emissions by 15 percent. (45)

## Reduce Dietary Protein (Hogs)

Reducing protein levels and including a proper balance of amino acids in the diet is a cost-effective means to reduce greenhouse gas emissions from hogs. This could be done without impacting performance and at little or no cost to the producer. (46)

In one study, low protein diets, with supplementary synthetic amino acids, cut greenhouse gas emissions from growing pigs by 25–30 percent and from sows by 10–15 percent. (47) This change could lead to significant cuts in nitrous oxide and methane emissions when slurry is later applied to fields. (48)

This is particularly important in barley-based diets, which result in greater methane emissions than corn-based diets. (49)

## Aid Digestion (Hogs)

Pigs struggle to digest phytate in cereal grains. Adding phytase to the feed helps break down the phytate. The main benefit of this strategy is reduced phosphorus excretion, but it also increases feed use efficiency, which could lead to a decrease in nitrogen output in the manure. (50)

Another option is to give pigs a more easily digestible food supply. A University of Manitoba study showed that feeding a diet including raw or micronized peas cut manure production by 25–33 percent, with similar reductions in total nitrogen excretion. (51) This tactic is not widely adopted yet because of the cost.

## Manage Manure to Reduce Greenhouse Gas Emissions

Approximately 12 percent of Manitoba's agricultural emissions are attributed to manure. (52)

Emissions from manure come in the form of methane (decomposition of manure during storage and application) and nitrous oxide (manure storage and application).

Greenhouse gas emissions from manure are influenced by a variety of factors, such as temperature, oxygen level (aeration), moisture and sources of nutrients. These factors are in turn affected by manure type, diet, storage and handling of manure, and manure application. (53) Determining how best to reduce these emissions is complicated and problematic.



Changing storage systems is an expensive step that produces only moderate emissions reductions and it is not yet clear which system is the best for managing manure emissions. (54)

However, this section will give some suggestions on manure handling, storage and application practices that should also have positive environmental effects.

### Manure Handling Systems in Barn

Ensure that manure is quickly removed from the barn and into proper storage areas. This will cut emissions from the barn itself. Manure kept in the barn will tend to be warmer than manure stored outdoors, and will produce more methane. (55) Barn scraper systems can provide regular manure removal from the barn. (56)

In solid manure management systems, where poultry and livestock are housed on dry bedded manure packs of straw, sawdust, etc., lower methane emissions have been noted. (57)

### Develop Proper Manure Storage Systems

What to do with manure once it has been removed from the barn is a more complicated question. More research is needed to determine the best storage systems and methods, but there are some good starting points.

- Avoid liquid or slurry handling systems. Methane production takes place when manure decomposes in the absence of oxygen (anaerobic conditions). Therefore, methane production is higher in liquid manure.
- Manure storage covers—roofs for solid, covered tanks for liquid, etc.—can be used to trap manure gases. In liquid systems covers may reduce methane emissions by up to 95 percent. (58) They also have the added benefit of controlling odour. (59)
- If you use a liquid or slurry system, ensure that it is covered and the gases flared. Flaring the gas converts the methane to carbon dioxide. Methane is about 21 times more powerful as a greenhouse gas than carbon dioxide.
- Avoid straw covers. Using a straw cover may be an effective odour barrier, but when the straw sinks into liquid manure storage—as often happens during wind or rain—it adds carbon, which can increase methane production substantially. (60)
- Avoid stockpiling manure for long periods. It can lead to anaerobic decomposition, resulting in both methane and nitrous oxide emissions. (61)



## Consider Composting Manure

Composting has a number of environmental benefits. It breaks down manure into a more stable organic form and is rich in carbon, free of most pathogens and weed seeds, and enhances soil. It also has benefits related to surface and groundwater quality and ammonia emissions. (62) As well, since manure volume is significantly reduced, less fossil fuel is needed for field applications. (63)

However, more research is needed to determine whether composting manure results in a net greenhouse gas benefit.

## Consider Anaerobic Digesters

Digesters or other technology for recycling methane from manure to generate energy have good potential to harness methane gas produced on the farm while also displacing fossil fuel energy sources.

Anaerobic digesters process liquid manure by heating and mixing it continuously, in the absence of oxygen, to produce high levels of methane gas (biogas). The biogas can then be used as a fuel in power generators, engines, boilers and burners. The remaining effluent from the digester has some nutrient value but fewer odours than stored manure and can be applied on fields as a fertilizer.

These systems have traditionally been much too expensive for most farmers to consider, but they could hold potential in the future under the right policy and economic conditions. (64) In December 2006 the Manitoba government committed \$300,000 for biogas research on Manitoba hog farms.

### Larry Schweitzer – Composting Manure

At the Hamiota Feedlot, home to upwards of 13,000 head of beef feeder cattle, manure is in plentiful supply. In summer and winter, when that manure can't be spread on fields, composting becomes the best way to store it.

Larry Schweitzer says they pile the manure in pens and roll it over two or three times a summer, based on the manure's temperature. "It's pretty much compost by the time we put it on the field," he says. "It cuts down on the volume we have to take out on the field too, meaning we're spending less on diesel fuel."

## Apply Manure Properly

Manure application has been extensively covered in the companion Creating Climate-Friendly Farms guide to crop production. These suggestions should be useful for livestock operations as well.

- Apply manure to soil as soon as possible after it is collected. Storing manure for long periods can encourage anaerobic decomposition and lead to increased methane emissions. (65)
- Inject or incorporate manure as soon as possible after application to reduce nitrogen loss. (66)
- Avoid applying manure in areas where the soil can become saturated, as this also leads to anaerobic decomposition and increased nitrous oxide emissions. (67)
- Eliminate winter applications (now restricted under Manitoba's Livestock Manure and Mortalities Management Regulation) to reduce the risk of run-off, and reduce the amount of nitrate-nitrogen in soils during spring snowmelt when the risk of nitrous oxide losses are the greatest. (68)
- Spread manure uniformly around pasture to reduce nitrogen losses. (69)
- Move winter feeding and bedding areas around pastures so manure is more evenly distributed. This will result in better decomposition. (70)
- Station winter feeding areas on level ground away from riparian areas. This will reduce the risk of manure run-off entering surface watercourses. (71)

## Sieg Peters – Manure Injection

As far as Sieg Peters is concerned, manure is a precious commodity. “We have a lot of land, so we want to get as much coverage out of our manure as possible,” he says. “We need the nitrogen so there’s no point losing half of it. That’s why we directly inject it into the ground.”

Sieg, who farms with his brother and their sons near Steinbach, was never that impressed with sprinkler systems. There was too much nitrogen loss. And the odours and view weren’t pleasant. So seven years ago he started hiring a custom applicator to come in and inject the manure directly—some of which is pumped through hoses from his storage lagoon three to four miles away.

As part of a large farm—they crop about 3000 acres, and have a 12,000 feeder hog operation—they use all the manure they produce. That means they’re reluctant to see any go to waste.

But the environment ranks high on their priorities too. “We know if we put it in the ground it’s less likely to leach off, to run off the field. That’s a huge consideration.”

## Use Agroforestry to Make your Farm More Climate-Friendly

Agroforestry refers to combinations of trees, crops and livestock that are intentionally designed and managed as a whole unit.

The benefits include improved soil and water quality, added shelter and increased biodiversity, as well as cuts in greenhouse gases and increased carbon sequestration. (72)

### Plant Shelterbelts

Shelterbelts consist of one or more rows of trees strategically planted on the farm. They are an effective tool for fighting climate change because they remove carbon dioxide from the atmosphere and can moderate the microclimate around the shelterbelt.

Studies at Agri-Food Canada’s Shelterbelt Centre show that the above-ground portion of a mature poplar tree in a shelterbelt stores about 970 kg of carbon dioxide, white spruce about 520 kg and green ash trees about 230 kg. There is also carbon stored in the roots—about 50–75 percent of the carbon stored above ground. (73)

For livestock, the benefits of shelter include reduced stock losses during breeding, lower winter feed requirements, and faster growth to target weight. Shelterbelts further help to disperse barnyard odours. (74)

Shelterbelts also reduce wind, cut soil erosion and nutrient loss, conserve water, control blowing snow, and may provide diversification opportunities, such as fruit production.

The potential drawbacks are increased shade and competition for water and nutrients. (75)

### Plant Riparian Buffers

Riparian buffers consist of trees and/or grasses planted between cultivated crop land and a watercourse. The main benefits of these buffers are to filter surface runoff, which may contain sediments, nutrients and/or pesticides, protect stream banks and shorelines from erosion, and sequester carbon. (76)

### Consider Silvopastures

Silvopastures refers to planted trees, livestock and forage production all combined in one pasture. While this is not currently practised in Manitoba, silvopastures can increase net carbon storage when both trees and forages are properly managed. (77)

Trees perform a further service by providing shade and shelter for livestock during extreme weather. (78)

### Diversify into Agro Woodlots

Fast growing woody crops, such as hybrid poplar trees, provide environmental benefits with high rates of nutrient uptake and large amounts of carbon storage over rotation lengths as short as 15 years. (79)

Biomass from trees can also be used as an alternative fuel (bioenergy). Carbon dioxide emissions from a unit of electricity generated from bioenergy are 10 to 20 times lower than from fossil fuel-based electricity production. (80)

## Cut Greenhouse Gas Emissions from Vehicles and Equipment

Any farm practices that reduce the need for equipment and vehicles, without productivity losses, have benefits for both farm budgets and the environment. When vehicles or equipment do need to be started,

making fuel-efficient choices will lower greenhouse gas emissions and also help the bank balance.

Here are some suggestions to cut carbon dioxide emissions from farm vehicles:

- Use bio-diesel fuel to reduce emissions. Using petroleum based diesel (petro-diesel) puts about 2.7 kg of carbon dioxide per litre into the atmosphere, while 100 percent bio-diesel may reduce those emissions by more than 75 percent. Using a blend of 20 percent bio-diesel reduces carbon dioxide emissions by 15 percent.

A blended fuel can contain up to 20% bio-diesel without problems. Use only bio-diesel that is approved for use by the engine manufacturer; otherwise, warranties could be voided. (81)

- Adopt fuel-saving strategies for farm machinery. For example, choose fuel-efficient engines when buying new machinery, do regular maintenance on machinery and vehicles, make sure tire pressure is optimal, and practice 'gear up, throttle down' operations. (82)
- Reduce idling times. Diesels do not need to be kept running, except in extremely cold temperatures (if not equipped with additional heaters).

## Increase Energy Efficiency in Farm Buildings

Energy efficiency in farm homes and other buildings can reduce demand for fossil fuels, lower carbon dioxide emissions, and save money. Consider using alternative energy sources such as geothermal, solar, wind, biomass energy and waste heat to heat farm buildings.

Windbreaks around farm buildings can significantly increase energy efficiency, reducing heating bills by as much as 25 percent. (83)

Suggestions for increasing energy efficiency in barns include: (84)

- Regular maintenance of fans and heating systems in barns to ensure good barn air quality and energy efficiency.
- Efficient heating sources, such as solar power, hot water heating pads and new highly efficient bulb systems for farrowing crates will save energy for hog producers.
- Climate control systems that automatically reduce barn temperatures slightly at night can provide further savings and reduce carbon dioxide emissions.

For more ways to boost energy efficiency in farm homes and other buildings, please consult Manitoba Hydro's new 'Power Smart for Farm Owners' brochure. This brochure is available at MAFRI 'GO' offices.



## MORE INFORMATION

For more information on climate change and sustainable farming practices in Manitoba, please check out the following Web sites:

### Government of Manitoba Web Sites

#### **Beyond Kyoto - Province of Manitoba Climate Change Action Plan**

[http://www.gov.mb.ca/beyond\\_kyoto/index.html](http://www.gov.mb.ca/beyond_kyoto/index.html)

#### **Climate and Green Initiatives**

<http://www.gov.mb.ca/est/climate/index.html>

For information about the Manitoba government's climate and ecological programs and initiatives.

#### **Energy Development Initiative**

<http://www.gov.mb.ca/est/energy/index.html>

Manitoba Energy, Science and Technology's guide to alternative energy, such as agri-energy, ethanol, and wind energy.

#### **Environmental Farm Plan Program**

<http://www.gov.mb.ca/agriculture/soilwater/farmplan/fpp00s01.html>

Environmental farm planning is a voluntary, self-assessment process designed to help farm managers identify the environmental strengths and weaknesses of their operations.

#### **Manitoba Agriculture, Food and Rural Initiatives**

<http://www.gov.mb.ca/agriculture/index.shtml>

For all things agricultural in Manitoba.

#### **Manitoba Agricultural Sustainability Initiative**

<http://www.gov.mb.ca/agriculture/research/asi/index.html>

The program provides funding to Manitoba producer groups and provincial commodity organizations to carry out sustainable agriculture demonstration or technology transfer projects throughout the province.

#### **Manitoba Conservation – Livestock Manure and Mortalities Management Regulation**

[http://www.gov.mb.ca/conservation/envprograms/livestock/pdf/livestock\\_manure\\_and\\_mortality\\_management\\_mr04298.pdf](http://www.gov.mb.ca/conservation/envprograms/livestock/pdf/livestock_manure_and_mortality_management_mr04298.pdf)



## Other Useful Sites

### **Agriculture and the Environment**

[http://www.agr.gc.ca/policy/environment/air\\_03\\_e.phtml](http://www.agr.gc.ca/policy/environment/air_03_e.phtml)

Agriculture and Agri-Food Canada's guide to farming and climate change.

### **An Introduction to Biogas**

<http://www.ees.adelaide.edu.au/pharris/biogas/beginners.html>

A useful guide to all things biogas from the University of Adelaide, Australia.

### **Canadian Cattlemen's Association**

<http://www.jpcs.on.ca/biodiversity/ghg/index.html>

The Canadian Cattlemen's Association guide to greenhouse gases.

### **C-CIARN Agriculture**

<http://www.c-ciarn.uoguelph.ca>

Clearinghouse of current information on climate change risks and adaptation for the Canadian agri-food sector.

### **Climate and Farming**

<http://www.climateandfarming.org/index.php>

Resource materials to help farmers make practical and profitable responses to climate changes.

### **Climate Change and Agriculture**

[http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/cl9706](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/cl9706)

Alberta's guide to farming and climate change.

### **Climate Change Central**

<http://www.climatechangecentral.com>

A public-private partnership based in Alberta that promotes the development of innovative responses to global climate change and its impacts.

### **Climate Change Connection**

<http://www.climatechangeconnection.org>

Public education and outreach on climate change issues for Manitoba.

### **Manitoba Hydro**

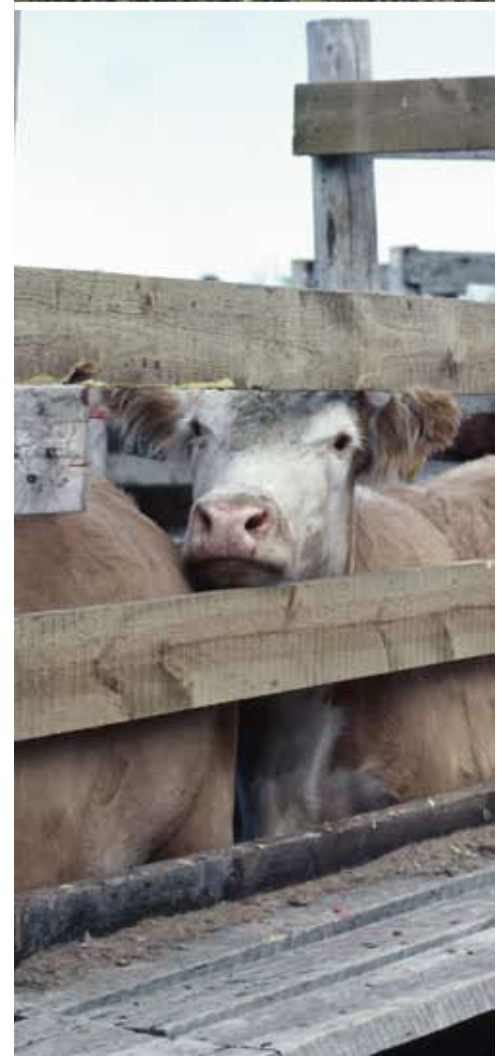
[www.hydro.mb.ca](http://www.hydro.mb.ca)

Information on energy efficiency for farm owners.

### **Manitoba Zero Tillage Research Association**

<http://www.mbzerotill.com>

Farmer-directed research information on zero tillage production systems.



### **National Centre for Livestock and the Environment**

<http://www.umanitoba.ca/afs/ncl/index.html>

Research furthering the economic and environmental sustainability of integrated livestock and crop production systems

### **Prairie Farm Rehabilitation Administration (PFRA)**

[http://www.agr.gc.ca/pfra/main\\_e.htm](http://www.agr.gc.ca/pfra/main_e.htm)

Guides to clean air, clean water, healthy soils and biodiversity.

### **PFRA Shelterbelt Centre**

[http://www.agr.gc.ca/pfra/shelterbelt\\_e.htm](http://www.agr.gc.ca/pfra/shelterbelt_e.htm)

Shelterbelt research, programs and numerous resources.

### **PAMI (Prairie Agricultural Machinery Institute)**

<http://www.pami.ca>

An applied research, development, and testing organization serving manufacturers and farmers.

### **Resource Conservation Manitoba**

<http://www.resourceconservation.mb.ca>

Information on the principles of composting.

### **Soil Conservation Council of Canada**

<http://www.soilcc.ca>

Wide-ranging producer information from the Greenhouse Gas Mitigation Program for Canadian agriculture, as well as soil conservation knowledge.

### **University of Manitoba - Natural Systems Agriculture**

<http://www.umanitoba.ca/outreach/naturalagriculture/index.html>

Information on cropping systems based on processes found in nature - specifically the natural grassland ecosystem of prairie Canada.



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