

**Climate change in Canada:
Adaptation and Mitigation**

**A brief to the Standing Senate Committee
on Agriculture and Forestry**

By the National Farmers Union

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1. Introduction

We have constructed the most energy-inefficient food production and distribution system in human history. And each year, we increase the energy usage in, and greenhouse gas emissions from, our food system. Its energy-inefficiency (and inefficiencies in every other sectors of our economy and society) now threatens to destabilize the natural systems upon which food production is based and to dramatically reduce the amount of food available to Canadians and to people around the world.

Further, food production uncertainties resulting from human-induced climate change will manifest themselves at exactly the same time that humanity adds another three billion to its number. This combination of human-induced climate change, destabilized food production, water shortages, human population growth, and potential economic instability will strain, not only our ability to feed ourselves, but the very foundations of our civilizations. Climate change is a huge threat to Canada and other nations.

Human-induced climate change also raises profound ethical issues: the most damaging effects of climate change—famine and economic collapse—will fall predominantly on the poorest nations, while it is predominantly the richest ones that created the problem.

Finally, human-induced climate change threatens to unleash eco-system loss and species extinction unparalleled in millennia.

It is impossible to overstate the importance of taking swift action to deal with human-induced climate change.

2. Mitigation versus adaptation

“Mitigation”, in the context of climate change, means taking actions to reduce greenhouse gas emissions—initially, slowing the rate of the increase of those emissions, then stabilizing those emissions, and finally reducing them. There is a significant delay between the time that we reduce our emission of greenhouse gases and the time that these reductions are reflected in first, a slowing of human-induced climate change, and then a stabilization of climate. For this reason, immediate action to reduce greenhouse gas emissions and mitigate climate change is critical. Mitigation can take several forms: more fuel-efficient transportation, solar and wind power, and reduction in chemical fertilizer use.

“Adaptation”, in the context of climate change and food production, means changing the way we produce food to account for human-induced changes in the weather. Adaptation can include more efficient water use, switching crops, finding drought-tolerant varieties, substituting livestock for crop production, etc.

NFU members hesitate to engage in discussions with government and industry on adaptation. Human-induced climate change is a calamity—threatening to extinguish farms and species, communities and children. And it is a calamity built in equal parts from human ignorance and from technological recklessness. Most distressing, while we discuss adaptation, we have taken few steps to reduce greenhouse gas emissions, or even to slow the rate of their increase. Farmers’ interest in discussing adaptation would be greater if we thought that the critical actions on mitigation were well underway. To put it another way, it is unsettling to talk about how to use technology and information to try to adapt agriculture to climate change while people in many nations line up to buy larger sport utility vehicles and while we continue to tear up rail lines and replace rail transport with trucks and jets.

Despite the preceding, the NFU will, in Section 3 of this brief, offer recommendations on climate change adaptation. But our organization urges all levels of government to take immediate and extraordinary efforts to slow and reverse climate change.

Further thoughts on mitigation and adaptation

It is impossible to disentangle adaptation from mitigation. Without aggressive mitigation, our adaptation efforts will be unending and probably unsuccessful—constantly aiming at an erratically-moving target. Worse still, as climate change proceeds, the direction of those changes may become increasingly unpredictable and the rate of change may accelerate. Over time, climate change trends in a particular area may suddenly reverse—areas may become wetter for a while and then, as climate change continues, become suddenly dry. Lack of effective mitigation will undo our best efforts at adaptation.

Further, even if Canada can use technology and information to partially adapt its food production system to climate change, developing nations will find adaptation much harder, perhaps impossible. Some nations may lose their ability to produce food altogether. At its worst, climate change will cause increases in ocean levels that will erase some island nations from the globe. As a rich nation and as one of the planet's largest per-capita users of fossil fuels, Canada has a responsibility, not just to adapt its own food system, but to dramatically reduce (mitigate) its greenhouse gas emissions to prevent the destruction of food production systems around the world.

And the adaptation of Canadian agriculture will be cold comfort if climate change leads to the destruction of eco-systems, extinction of species, alterations in ocean currents, and the loss of lakes and rivers.

Human-induced climate change is a profound ethical and cultural problem—perhaps the greatest problem humanity may ever need to solve. While technical adaptation measures are important, climate change must not be reduced to a technical problem for engineers and scientists to “solve.” Adaptation *must proceed along side* our most energetic possible efforts to halt human-induced climate change. Sadly, there is no sign of those efforts in Canada.

3. Agricultural adaptation in Canada

The situation

The Intergovernmental Panel on Climate Change (IPCC) has concluded that the global average surface temperature on the earth has increased 0.6°C over the past 100 years.ⁱ After remaining stable for 10,000 years at about 280 parts per million, global CO₂ levels are today 30% higher than pre-20th Century levels.ⁱⁱ While global temperature is up 0.6°C, the average temperature in Canada is up 1.0°C overall, with larger increases in the north.

Experts agree that atmospheric CO₂ levels will probably double in this centuryⁱⁱⁱ and that global average temperatures will rise by 1.4°C to 5.8°C.^{iv} Because climate change effects are magnified in northern and southern areas—relative to equatorial areas—temperatures in some Canadian regions may rise by two to three times the global average.

It is important to understand the magnitude of these increases. Over the past 10,000 years, the Earth's average temperature has not varied by more than 1.0°C.^v During the Ice Age, global temperatures were 2.8°C to 5°C colder than today, and Canada was under 3,000 feet of ice.^{vi}

The magnitude and effects of climate change will vary across the country and they will vary over time. Most of Canada will acquire a longer growing season. In some places, like the southern prairies, warmer weather may increase evaporation, leaving that area drier, even if rainfall and snowfall do not decline.

Central Canada can expect warmer, dryer winters and, when they come, more intense rains. Farmers will simultaneously struggle to deal with dryer weather and also to install tile drainage systems to deal with occasional intense precipitation.

The Maritimes will see warmer winters and an increase in extreme weather events and will also suffer from higher sea levels and increased storm surges.

Nearly all regions of Canada are experiencing, and will continue to experience, more extreme and unpredictable weather. It is impossible to know for certain how any given area may be affected by climate change. But it seems certain that all areas will experience a range of negative effects including:

- More frequent and intense droughts and floods;
- Soil erosion from wind;
- Over-wet soils and the need for drainage systems;
- Soil erosion from more intense rains;
- New insect species in crops, stored grain, and on livestock;
- Larger insect populations;
- New weeds;
- New diseases, fungi, and blights;

- Loss of surface water and groundwater for livestock;
- Water allocation conflicts between cities, farms, industrial, and recreational users;
- Acreage loss from sea level rise and more energetic storms; and
- Shifting the natural ranges and habitats of all forms of life.

Adaptation actions

Canadian agriculture can do a great deal to adapt to climate change. It can use ground- and surface-water more efficiently—something it should do in any case. It can alter its practices to conserve rainfall and to maximize production in dry areas—a project that farmers in many parts of Canada have undertaken for over one hundred years. And we can use new technology and public policy to maintain production in the face of more variable and less hospitable weather. The NFU offers the following examples of potential agricultural adaptation.

a. Soil health

Soils are the foundation of life on earth. Despite technological advances, humans remain dependent on the biological processes within our soils. There are countless organisms that live in healthy soils. Scientists admit that we only understand a small fraction of the complex processes that take place within the soil. Throughout history, civilizations have declined as a result of soil degradation and resulting crop failures.

In many parts of Canada, climate change may mean less precipitation and unpredictable rains. When rainfall becomes erratic, the soil's ability to store and hold water between rainfalls becomes more important. Extended droughts like what is occurring in western Canada can be self-perpetuating: as soil becomes less productive because of drought, the ability of soil to hold moisture declines.

Agriculture practices can deplete soil organic matter and humus. Improper rotations and too much tillage can reduce organic matter and, thus, reduce the soil's ability to absorb and hold water. Healthy soils hold more moisture and can help tide crops over to the next rain.

Preventing soil erosion is the most important soil management issue. Soil erosion can dramatically and quickly destroy soil productivity. There are many ways to conserve soil and manage moisture. Organic agriculture focuses on using proper rotations, nourishing the soil, and building nutrients and organic matter using on-farm resources. In a Pennsylvania study^{vii}, organic rotations with forage and green manure legumes increased soil organic matter to levels 3 to 5.5 times higher than levels found in commonly-used conventional corn and soybean rotations. Many other studies show that organic agriculture can increase soil organic matter dramatically. Organic agriculture can help increase the health of the soil and its moisture-holding capacity. Some types of conventional agriculture, using minimum-tillage and direct seeding, can also help build soil organic matter and help retain scarce moisture.

In western Canada the majority of farmers are choosing direct seeding methods to reduce tillage. These methods are beneficial in reducing soil erosion and preserving soil moisture. Direct seeding, however, is very dependent upon the increased use of pesticides which have many direct and indirect costs to human health and the environment. Most relevant to the discussion of climate change, conventional and direct-seeding methods are also very dependent upon fossil fuel energy, especially in the form of chemical fertilizers. These systems, overly reliant on chemical fertilizer and fossil fuels, will not be sustainable in the medium- and long-term. Higher energy costs will make these systems uneconomic unless there are dramatic increases in efficiency.

Farming systems that use less fossil fuel energy and more renewable energy will have to be adopted. Organic agricultural systems and direct-seeding systems have both made significant technological advances in this area. But more research is needed to make these systems truly sustainable. The key to developing sustainable agriculture will be knowledge. Reducing greenhouse gas emission from agriculture will require replacing off-farm inputs with more knowledge-based, on-farm management. A good example of increasing productivity in agriculture with knowledge-based management is rotational grazing. Rotational grazing improves the soil and increases feed production with no increase in off-farm inputs. The result is we can feed more cows on less land.

The National Farmers Union recommends that the government of Canada invest in research to further develop knowledge-based sustainable agriculture systems such as organic farming and other low-input farming systems. This strategy should also include training to help farmers understand the importance of soil organic matter and soil health in dealing with climate change.

b. Hog mega-barns

Despite the clear and looming threat, some sectors are moving quickly to dis-adapt to climate change—they are moving from low-water-use systems to extremely high-use systems. One example is the hog mega-barn sector.

Across Canada, corporate hog producers are replicating the industrial production methods pioneered in the U.S. In so doing, they are pushing family farm producers out of business and, most importantly, they are shifting hog production from the traditional dry-straw methods to water-intensive slurry systems.

These mega-barn complexes, often producing up to 50,000 hogs per year, use tens-of-millions of gallons of water per year. These mega-barn producers are, in effect, installing a wasteful flush toilet for each pig.

The alternative to this water-based system is to raise pigs on family farms using the dry straw method. Further, farmers could be encouraged to aerate and compost manure—reducing the emissions of methane and other greenhouse gases (liquid manure handling increases emissions of methane gas. Methane's heat-trapping effects are 21 times larger than the effects from CO₂).

Hogs can waste water another way, by polluting surface and groundwater. As climate change makes sources of fresh water increasingly precious, the pollution threat posed by hog mega-barns will grow increasingly untenable. Moving hog production to a dry straw method not only reduces water use within the barns, it lowers the likelihood that these industrial facilities will foul precious rivers and groundwater.

The National Farmers Union recommends that the government of Canada induce and require hog producers to adapt to climate change and increasingly-scarce water supplies by moving to a dry straw production system.

c. Production and processing of other livestock

Livestock production has the potential to allow farmers to utilize land that, as a result of climate change, may become too dry to produce crops. Such shifts are not a panacea, however, as the capacity of the markets to absorb more livestock production is limited.

For related information on this topic, please see item d. under section 4, “Mitigation.”

d. safety nets

If farmers are to survive financially as the weather becomes more severe and unpredictable, then farmers need better safety net programs. Increasingly unreliable weather resulting from the emissions of greenhouse gasses is a problem created by all Canadians and by citizens in other nations, and by other sectors of the global economy. Unfortunately, when crops fail, most of that cost falls on farmers. Thus, it is appropriate that a larger portion of the cost of farm safety net programs be shared by all Canadians.

The NFU recommends that the federal government increase funding to farm safety net programs to reflect the increased risks that farmers are facing and to reflect the shared source of those increased risks.

Safety net programs are also the most effective tool that government has in shaping the future structure of Canadian agriculture. Currently, those safety net programs give the most money to the largest farmers and drive the expansion and consolidation of Canadian farms.^{viii} As farms get very large, they become locked into production systems that are heavily reliant on purchased inputs (see Section 4 c, below, for a discussion of the relative energy efficiency of small, organic farms versus large, conventional farms). Current safety net programs are driving farmers away from sustainability and away from practices that can minimize greenhouse gas emissions in the long term.

The NFU recommends that Canada’s safety net programs help move farmers toward more sustainable and energy-efficient production.

e. Price

Over the past century, Canadian farmers have eagerly adapted to a range of new technologies and practices. Anyone who has farmed or visited a farm regularly knows how much has changed from one decade to the next. Increasingly, however, financial pressures are preventing farmers from making certain changes on their farms that would be good, not only for their operations, but for the environment.

To adapt to any changes, farmers need prices high enough to give a farm family long-term stability and give it capital to invest. Fair and adequate commodity prices are *essential* if our farms are to adapt to climate change.

One of the ways that the federal government could increase grain prices is by working with the four other major exporters—U.S., EU, Australia, and Argentina—to take a small portion of cropland in each country/bloc out of production. Because world grain stocks/use ratios are near 25-year lows and population is climbing, a small decrease in production could trigger large price increases (a recent federal government study confirmed that a modest 10% acreage set-aside among the five major exporters would trigger 20% to 30% increases in world prices^{ix}).

Land set-aside programs would help increase world prices, thus giving farmers capital and stability to undertake other changes needed to adapt to and mitigate climate change. And by taking marginal land out of production, a set-aside program could help reduce greenhouse gas emissions directly.

The National Farmers Union recommends that the federal government work with the governments of the other major grain exporters to take grain land out of production so as to stabilize world prices at significantly higher levels.

f. research

Canadian farm families have suffered as our publicly-funded research system has been dismantled and replaced by a corporate system subsidized with public money. Farmers have seen their costs rise as new crop varieties are patented and sold for whatever the market will bear.

Further, there is little reason to believe that a profit-driven system will undertake the research needed to adapt to or mitigate climate change. Our corporate system is focused on research that develops new products to sell. Who within this system will do the research on how to reduce fertilizer use? Who will do the research on creating low-input, local (and thus, low emission) food systems?

The NFU recommends that Canada restore the independent, publicly-funded research system that made Canada a world leader in food production.

g. Irrigation

If climate change in some Canadian regions will mean less rainfall or more erratic rainfall, then irrigation would seem the most obvious adaptation measure. However, there is a danger in putting too much faith in irrigation. Lower rainfall and snowfall amounts will mean lower river flow volumes. This will limit the amount of irrigation that is sustainable. We cannot use ground- and surface-water faster than its recharge rate—to do so would simply be mining our water sources. Further, irrigation volumes should not be “sized” to the maximum amount of water available annually, or even to the average amount, but must take a realistic account of the *minimum* amount available in dry years.

Further, as water becomes scarcer, the fees that farmers will be asked to pay will rise. Irrigation projects that seem financially-viable for farmers at today’s water fee levels may become uneconomic.

In light of the potential of climate change to dramatically alter Canada’s supplies of ground- and surface-water, the NFU recommends that Canada develop a long-term national water use policy and allocation plan.

The NFU further recommends that new irrigation projects and expansions of existing projects be evaluated within that long-term national plan.

h. Tile drainage

In many parts of Canada moisture levels are decreasing overall, but rainfall and snowfall, when it comes, can be very heavy. Many farmers are simultaneously adapting to dryer land, but also installing tile drainage systems to deal with occasional wet springs and heavy rainfalls.

There is a need to improve and rethink drainage systems. Often, the water from such systems is lost to the crop, rather than being held for future use. Perhaps farming practices or drainage systems could be altered to retain as much water as possible in the land or in reservoirs, where appropriate.

The NFU recommends more research into drainage systems and water trapping and into helping farmers deal with dryer conditions punctuated by increasingly concentrated rainfall.

i. Water use, allocation, privatization, and exports

Currently, industry is allowed to use water for very questionable purposes: oil companies are pumping fresh water down oil-wells to force out every last drop of oil. This water is lost. Other industries are polluting surface- and ground-water.

The NFU recommends that in order to adapt to climate change, Canada must stop the industrial waste of our increasingly-precious water.

One way to rein in water waste is to increase the fees charged for water. But, at the same time, water must not be turned into a commodity. Price alone will not ensure proper water allocation. Farmers and rural residents cannot compete for increasingly scarce water if it is turned into a commodity. Finally, water must continue to be a public good distributed by public utilities: it must not be privatized or exported.

The NFU recommends that water must remain a public good, must not be commodified or privatized, and it must not be exported or traded.

j. Shelter belts and woodlots

Planting trees in shelterbelts helps mitigate climate change (trees absorb and sequester carbon) and it helps in adaptation (trees catch snowfall and buffer drying winds).

More intense rainfall will mean increased soil runoff into watercourses. Planting trees in riparian areas can protect rivers, streams, and lakes from soil and chemical runoff.

The National Farmers Union recommends that the federal government increase its financial support of the excellent Prairie Farm Rehabilitation Administration; that it make the PFRA national; and that the federal government provide tax incentives to farmers who establish or maintain shelterbelts or woodlots and who reforest riparian areas.

k. Support family farms and mixed farms

If, because of climate change, we don't know what the relative economics of grain production versus livestock production will be in a given area of the country, does it make sense to replace adaptable, mixed-production, family farms with corporate specialized producers? To put it differently, if we transfer hog production to corporate mega-barns and if climate change makes that industrial hog production impossible in the future—either through restrictions on water use or feed shortages—will those corporate producers adapt and begin growing crops or raising dairy cows? Most probably, those corporations will simply leave.

Small and medium-sized family farms are adaptable, resilient, and committed to their location. Over the past generation, most have adapted to market forces by shifting production between a wide range of crops and livestock. Many have made large transitions—moving from grain farming to forage production or moving from dairy farming to beef production. As variability and uncertainty grows, the existence of adaptable, family farm agriculture becomes increasingly important.

The NFU recommends that protecting and nourishing the family farm is the single most important thing that Canada can do to ensure that it can adapt its food system to climate change.

Adaptation: Conclusions

So what is our future? Will it be huge, corporate mega-barns that maximize the use of water in hog production and threaten to pollute the water they don't use? Will it be these same producers that sweep into a community, produce for fifteen years and then leave when the water runs out or the grain crops fail? Or will it be smaller, family farm production that adapts itself to change and clings tenaciously to the land?

Will we take steps to end the farm income crisis and, thus, give farmers the economic stability that they need in order to cope with increasing climate instability? Or will we tolerate the status quo and add a climate crisis to the income crisis?

Climate change can smash Canada's food system. And it will do so if that system is brittle—as a result of overlarge, overspecialized operations and lack of diversity—or if that food system is fragile and drained by constantly working to deal with a grinding farm income crisis. In evaluating Canadian agriculture's potential for adapting to climate change we must not take an over-technical or narrow view (will or will not Monsanto develop a genetically-engineered wheat that will grow in a desert?), for that is the view that brought us to this crisis. Rather, we must look at our food system as a complex web of interconnected human and natural systems. The economic health of our family farms and the structure of our food system will play a decisive role in determining whether Canada grows and prospers during the next 50 years or whether it declines under the onslaught of inhospitable and unpredictable weather.

4. Mitigation

To use a metaphor: adaptation is like putting on your seatbelt before you drive, and mitigation is the ongoing attempt to avert a crash. As important as adaptation is, mitigation is far more important; especially if a “crash” can wreck the entire eco-system of the planet. There is no seatbelt that can save you in a crash of that magnitude.

The NFU offers the following recommendations on Canadian agriculture’s role in mitigating climate change.

a. The Kyoto accord

At their most recent Convention (November 2002), members of the National Farmers Union passed the following resolution in support of the Kyoto agreement.

WHEREAS it is desirable for all Canadians to achieve the maximum efficiencies in energy use possible, and

WHEREAS the environmental and health effects that are the consequences of greenhouse gas emissions affect farm families, and

WHEREAS agricultural activity in Canada is a significant contributor of greenhouse gasses, and

WHEREAS the Kyoto Agreement exists as a mechanism to ensure greenhouse gas emissions are curbed and reduced globally, and

WHEREAS the Federal Government of Canada has expressed intent to enter into the Kyoto Agreement with many other nations,

THEREFORE BE IT RESOLVED that the National Farmers Union express support for the Kyoto Agreement and work to ensure that all provincial governments support the Federal Government ratifying the Kyoto Agreement.

NFU members understand, however, that Kyoto does not stop climate change, or even slow it significantly. Kyoto is a beginning, but a long-delayed and modest beginning. It took a decade to agree to the modest Kyoto goals, and we haven’t yet even begun to implement action plans to reach those goals. To the contrary, energy use and emissions continue to rise. It’s not just that we are failing to pour water on the flames of climate change: we continue to pour on gas—both metaphorically and literally.

Slowing and stopping human-induced climate change will require more than just tweaking our economy and culture: it will require a major shift in attitudes and a reconstitution of our civilization similar in magnitude and impact to the industrial revolution.

Fortunately, this shift can be part of a positive wave of change that can also help us deal with other problems within our society—environmental pollution, habitat loss, and species extinction as well as unemployment, inequality, over-consumption, and unsustainable production.

The Earth has a finite ability to absorb humanity's excess carbon. We have hit that limit. It is an absolute limit. For the first time in generations, humanity and its economies will be forced to work within absolute limits. This can be a positive change. But it must be a change directed by forward-looking citizens and governments, not by reactive companies and markets. Kyoto is a tentative step. We encourage the government to move quickly to implement it, and to negotiate its successor. All citizens look forward to creating a more-sustainable Canadian economy.

The NFU recommends that the Canadian government swiftly implement the Kyoto Accord and move on to negotiate and implement new agreements that will more quickly bring greenhouse gas emissions into balance with the global ecosystem.

b. Food transportation and trade

Canadian grain transportation policies—tearing up branchlines and moving grain and food onto trucks—are increasing emissions of CO₂ and other climate change gases. International trade agreements that globalize markets and stimulate needless food trade have similar effects.

Trains are two to three times more fuel efficient than trucks.^x Thus, train emissions are 1/3 to 1/2 of those for trucks over comparable distances and carrying comparable loads. The ongoing destruction of Canada's rail system is perhaps the most shortsighted and wasteful policy in Canadian history. It is impossible to justify in 2003—6 years after the adoption of the Kyoto Accord—tearing up and melting railway tracks.

The NFU has been emphasizing the linkages between Kyoto and the benefits of rail transportation since 1997. At the first Saskatchewan meeting of Judge Estey's consultation process, the NFU asked that he include in his deliberations the question of increased CO₂ levels resulting from branch-line abandonment and longer trucking distances. His response was that he did not have the time, the mandate, or the money to include this important parameter.

Then, a few weeks before the Federal government embarked on the Kroeger implementation process of transportation reform, the NFU told Transportation Minister Collonette (in a face-to-face meeting in his office) that it would be irresponsible for his Department to fundamentally change grain transportation policies without projecting the increase in CO₂ emissions. Minister Collonette ignored this advice and moved ahead with reforms which moved grain off of rails and on to trucks and, thus, increased Canada's greenhouse gas emissions.

We are again on the verge of new transportation reforms. And this round of reforms seems likely to repeat past mistakes and to again ignore climate change implications of Canadian transportation policy. Any new transportation policy must increase the use of railways for grain transportation. One way to attain this goal is for the government to protect existing sidings and protect access to those sidings for farmers who want to load producer cars. Short line railways, such as the Prairie Alliance for the Future, should receive credit for emission reductions that result from their operations.

The NFU recommends that the federal government alter its transportation policies to maximize rail use and minimize greenhouse gas emissions. To these ends it should:

- ***Stop branch-line abandonment and the destruction of elevators;***
- ***Protect sidings and farmers' access to sidings and producer cars; and***
- ***Foster short-line railways as a way of reducing emissions.***

Another factor that is increasing the energy use is that Canada, the U.S., and others are pushing trade agreements that globalize the world food system, industrialize production, and increase the distance that food is shipped. In North America, food travels an average distance of 2,500 to 4,000 kms from farm to plate. This distance is up 25% since 1980. In the U.K. food transport distances are up 50% since 1980.^{xi} World agricultural trade doubled since 1980. We are using jets to fly lobsters and strawberries across continents and oceans. It will be impossible to slow or reverse climate change until we reduce food travel and localize markets. Unfortunately, the World Trade Organization (WTO) agreement that the Canadian government is now negotiating will increase food travel and related greenhouse gas emissions. The globalization of our food system is on a collision course with human-induced climate change.

Food travel distances are also a function of concentration in the processing and retail sectors. Canadian meat processing is dominated by fewer than six companies. Canada is increasingly dominated by a handful of powerful food retailers.^{xii} These corporations centralize their production and distribution facilities, adding miles to the journey of a steak or a box of cereal. As corporate concentration increases, so will these negative effects.

The government policies that effects our food system—branchline abandonment and elevator closures, free trade and corporate globalization, deregulated markets and increased corporate concentration, the industrialization of agriculture—are increasing the greenhouse gas emissions from every mouthful of our food. Canadian government policies are driving us away from our Kyoto commitments and away from effective attempts to deal with climate change. It is not useful to urge farmers to adapt to climate change when Canadian government food policies are accelerating that climate change.

The NFU recommends that the federal government alter its food and trade policies to localize food production. To these ends it should:

- ***Take agriculture out of the WTO agreement;***
- ***Work with countries around the world toward food sovereignty^{xiii};***
- ***Reverse corporate concentration within the food system; and***
- ***Stop the industrialization of agriculture and the destruction of family farms.***

c. farming strategies to lower greenhouse gas emissions and maximize carbon sequestration

There are two major sources of greenhouse gas emissions in crop production agriculture: emissions from the fossil fuel content in production inputs; and emissions from the soil that are affected by crop rotation and soil management.

Many policymakers are talking about the soil carbon sequestration that can result from direct seeding and reduced tillage within conventional agriculture. This benefit, however, should be carefully measured against the greenhouse gas emissions from this type of agriculture.

Conventional agriculture—using chemical fertilizers and pesticides—is heavily dependant on fossil fuels and, thus, emits large quantities of greenhouse gases. For instance, we have become increasingly dependant on fossil fuel energy for the fertility of our soils. If you visit a production plant that makes nitrogen fertilizer, you will see the equivalent of a large natural gas pipe going in one side of the plant and a large nitrogen (anhydrous ammonia) pipe coming out the other side. We literally turn natural gas into nitrogen for our crops. When evaluating the carbon sequestration potential of conventional and direct seeding production, this energy use must be taken into account.

Organic agriculture can dramatically reduce energy inputs into agriculture thereby reducing greenhouse gas emissions. A recent study from the University of Manitoba^{xiv} provides evidence that organic systems can be much more efficient at using fossil fuel energy to produce crops than conventional agriculture. The study compared energy use in conventional rotations with organic rotations and found: in a wheat-pea-wheat-flax rotation and in a wheat-alfalfa-alfalfa-flax rotation that organic production used only 35% and 41% (respectively) of the energy of conventional production. While organic yields can be lower, when measuring food output versus energy input, the organic system was nearly twice as efficient as the conventional system.

In the long term, emission reductions will depend more upon gains from increased energy efficiency because soils will reach their maximum carbon levels, at which point there will be no further gains from using soils as sinks. At this point the input/output energy efficiency of farming systems will be the most important factor in determining which farming system produces the least greenhouse gases. Currently, organic farming systems are in the lead in terms of energy efficiency. Seen another way, credit for increasing soil carbon sequestration can, for the short term, mask the high energy use in, and high emissions from, conventional agriculture. Once carbon sequestration limits are reached, however, the high energy use of conventional agriculture will again become clear. Like minimum-tillage conventional agriculture, organic agriculture builds soil carbon. But organic agriculture also offers long-term energy efficiency (and low emissions) unmatched by conventional agriculture.

The issue of greenhouse gas emissions in agriculture is a complex scientific question. Key pieces of research are still needed, especially research on the effects of rotations and soil management in conventional, minimum-tillage, and organic systems in the different soil and climatic zones. Unfortunately minimum-tillage is often seen as the only way to reduce greenhouse gas emissions even when there is increasing evidence that organic farming has as much or more potential to reduce greenhouse gases. There is also evidence that organic farmers can use direct seeding. This can combine the benefits of organic farming with some of the benefits of zero tillage seeding methods.

The National Farmers Union recommends that governments support organic agriculture and other forms of lower input agriculture as a way of reducing energy use and greenhouse gas emissions.

d. Livestock production

As noted in section 3, livestock production has the potential to allow farmers to utilize land that, as a result of climate change, may become too dry for crop production. Livestock production can have the additional benefit of lower per-acre emissions of greenhouse gases, compared to crop production. But this is only true if livestock is allowed to graze in the summer and is fed with local forage in the winter (and, where necessary, given grain only for short-term finishing). Today, too many of our herds are confined year round and fed on grain.

Allowing livestock to distribute their own manure and move to their feed cuts down fossil fuel use for manure and feed transportation. Confining livestock year-round and feeding them grain not only requires fuel to transport the feed and manure, but also fuel to produce the grain. Further, as climate change destabilizes and reduces global food production, feeding grain to livestock will become both unjustifiable and unaffordable.

Grass-fed livestock also emit less methane than grain-fed livestock (methane's heat-trapping effects are much larger than the effects from CO₂)

Producing livestock with minimum total greenhouse gas emissions also requires access to local processing facilities. Currently, many Canadian cattle and pigs are shipped to the U.S. At the same time, meat and livestock are being shipped into Canada *from* the U.S. Part of the problem is a North American beef packing sector dominated by a duopoly of companies (Cargill and IBP) and a hog packing sector increasingly controlled by one company, Smithfield. Another part of the problem is the closure of small, local abattoirs.

The NFU recommends that the government of Canada:

- ***regulate livestock production to encourage decentralized, grass-based production;***
- ***regulate competition to increase the number of firms in the meat processing sector in Canada and to increase the number of facilities they operate; and***
- ***regulate meat processing in a way that protects the health of all Canadians but that fosters the prosperity of the maximum number of small, community abattoirs.***

5. Conclusions

Localizing food production systems and moving toward sustainable agriculture can reduce energy use and CO₂ emissions. Rationalizing our transportation systems—using existing rails—can have a similar effect. Thus, these policies can simultaneously help reduce climate instability, cut government costs, help Canada meet its Kyoto commitments, and increase the net incomes of farm families. Unfortunately, our national policies are driving us in the opposite direction.

If our nations and cultures are to survive climate change, it will take all of our cleverness and technology to adapt. But far more important, it will take our wisdom, it will take courage and wisdom to fundamentally alter the bases of our economies and cultures. Adaptation may buy us a little time for this transition, but regardless, time is short.

Climate change presents all Canadians with a danger. But it also forces us to grasp certain opportunities—for a more sane and sustainable economy. Farmers are eager to work with government and all Canadians to tackle this great challenge.

Respectfully submitted by the National Farmers Union

ⁱ Intergovernmental Panel on Climate Change, *Climate Change 2001: The Scientific Basis*, Summary for Policymakers.

ⁱⁱ Government of Canada, *Climate Change Plan for Canada*, November 2002. p. 5.

ⁱⁱⁱ Government of Canada, *Climate Change Plan for Canada*, November 2002. p. 5.

^{iv} Government of Canada, *Climate Change Plan for Canada*, November 2002. p. 5.

^v Union of Concerned Scientists, *Frequently Asked Questions about Global Warming*, www.ucsusa.org/global_environment/global_warming/page.cfm?pageID=497

^{vi} Union of Concerned Scientists, *Frequently Asked Questions about Global Warming*, www.ucsusa.org/global_environment/global_warming/page.cfm?pageID=497

^{vii} Drinkwater, L. E., Wagoner, P. and Sarrantonio, M., *Legume-based cropping systems have reduced carbon and nitrogen losses*, 1998, *Nature* 396: p. 262-265.

^{viii} See the National Farmers Union's *Safety Nets and the Future of the Family Farm in Canada*, January 23, 2003.

^{ix} Agriculture and Agri-Food Canada, *A Market Analysis of a Set-aside Program by the Five Major Grain and Oilseed Exporting Countries*.

^x Roberts, Sloane, and Associates, *Environmental Implications of Increased Trucking Due to Branch Line Abandonment in Western Canada*, November, 1992, p. 10.

^{xi} All numbers in this paragraph are from: Brain Halweil, *Home Grown: The Case for Local Food in a Global Market*, *Worldwatch* Paper 163, November 2002, p. 6

^{xii} See the National Farmers Union's *The Farm Crisis, EU Subsidies, and Agribusiness Market Power*, Feb. 17, 2000.

^{xiii} A people or a nation has food sovereignty if it has the right to define its agricultural and food policy. Food sovereignty includes:

- Prioritizing local agricultural production in order to feed people;
- Maximizing access to land, water, seeds, and credit;
- The right of farmers and peasants to produce food and the right of consumers to be able to decide what they consume, and how and by whom it is produced;
- The right of countries to protect themselves from low-priced agricultural and food imports;
- Agricultural prices linked to production costs;
- The recognition of the rights of the women farmers who play a major role in food production.

Food sovereignty does not oppose trade, but opposes the priority given to exports and trade. It allows countries to guarantee food security for their people, while trading with other regions for specific products which make up diversity on our planet.

^{xiv} Hoepfner, J. W., *The Effects of legume green manures, perennial forages, and cover crops on non-renewable energy use in western Canadian cropping systems*, 2001, Masters Thesis, Department of Plant Science, College of Agriculture, University of Manitoba.