

# Best Practices for Greenhouse Gas Management

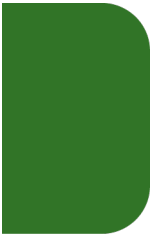
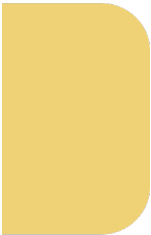
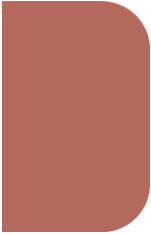

OSCIA Annual Meeting  
February 2, 2010

Adam Hayes, OMAFRFA  
Alan Kruszel, OSCIA



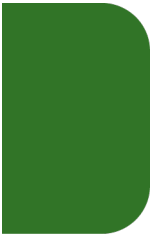
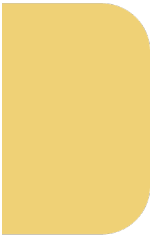
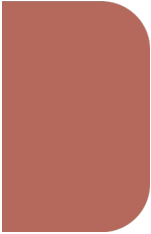

# Provincial Responses

## Alberta

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- legislation in effect requiring an intensity based reduction of 12% starting July 1, 2007 by firms emitting more than 100,000 tonnes of GHG's/yr
  - compliance by internal reductions, \$15/MT to tech fund, and offsets
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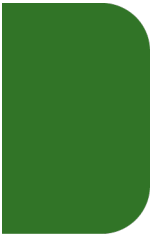
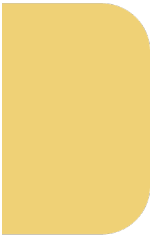
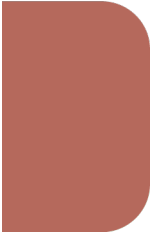



## Alberta Offsets

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- credit from January 1, 2002
  - real, demonstrable, quantifiable
  - verification by third party
  - occur in Alberta
  - action to produce offset was not required by law
  - clear ownership
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## Alberta Protocols

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- A protocol is a defined method ensuring a credit is created meeting the criteria listed before.
  - Types available (afforestation, beef feeding, beef lifecycle, biofuels, compost, energy efficiency, landfill gas, pork, tillage, waste heat recovery)
  - future protocols possible (N use efficiency, wetlands mgt., conversion to perennial forages, rangeland mgt.)
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## Offset Credits

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- Make a change to reduce GHG emissions
  - Create a credit
  - Sell the credit
  - Trading system operates under protocols (rules)
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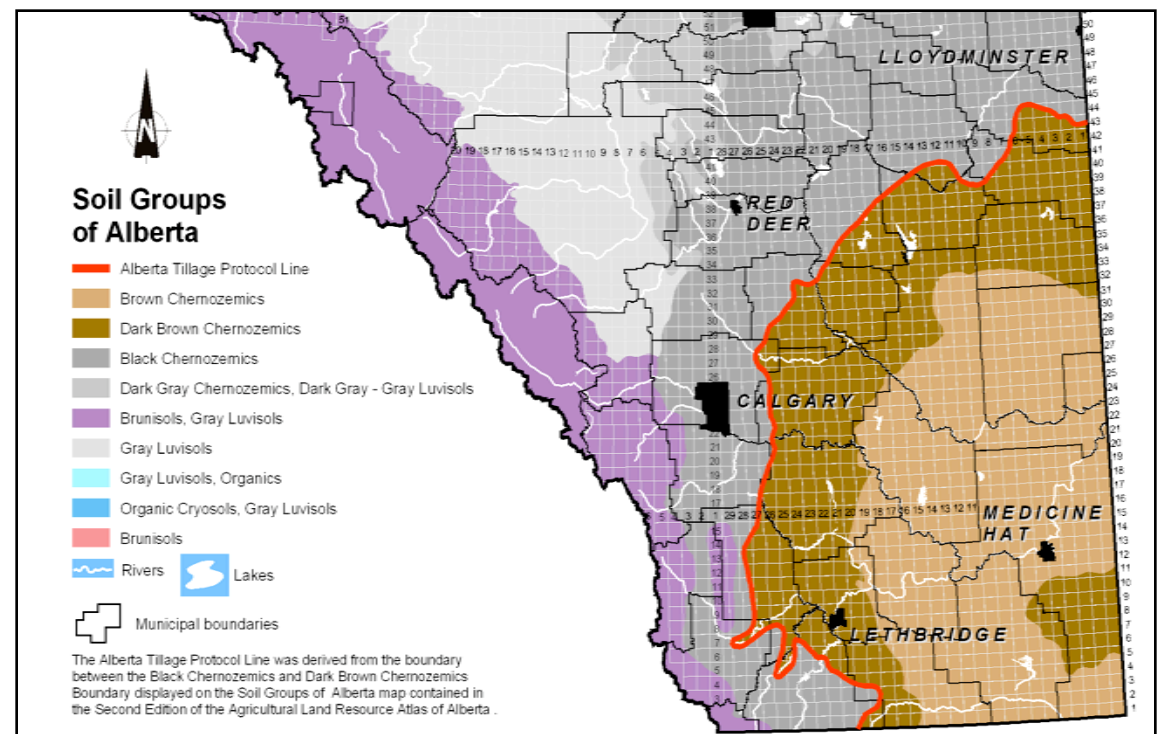
## Offset Credits

- Tillage
  - CT to NT = 0.51 T CO<sub>2</sub>/ha/yr
  - CT to RT = 0.26 T CO<sub>2</sub>/ha/yr
  - RT to NT = 0.36 T CO<sub>2</sub>/ha/yr
  - Inventory CT to NT = 0.1 T CO<sub>2</sub>/ha/yr
    - Increase in perennials = 0.74 T CO<sub>2</sub>/ha/yr
- Nitrogen
  - More complex 0.0125 kg N<sub>2</sub>O-N/kg
  - Inventory 0.017 kg N<sub>2</sub>O-N/kg

# Tillage Protocol Example

- For Alberta, soil tillage credits were 47% of the compliance under the offsets option.

- Soil Carbon changes and fuel consumption changes and N2O changes with tillage were derived as well and scaled to similar units



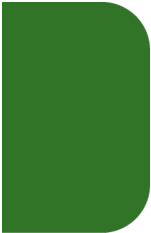
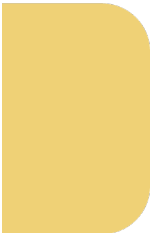

# Ontario's Commitment to Address Climate Change

- Climate Change Action Plan <http://www.ene.gov.on.ca/publications/7286e.pdf>
  - Released in 2007, includes both mitigation and adaptation actions
  - Second annual progress report released on Dec. 2, 2009, (featuring current and emerging adaptation initiatives -e.g. Animal Health Strategy)
- Expert Panel on Climate Change Adaptation
  - Appointed in Dec. 2007 to provide advice on how to best plan and prepare for the impacts of climate change
  - Panel's Report released on Nov. 25, 2009  
<http://www.ene.gov.on.ca/publications/7300e.pdf>
  - Panel's appointment extended to Spring 2010
  - Co-Chair in attendance at COP 15; profiling Panel's process/report



# Expert Panel on Climate Change Adaptation



## Report recommendations: Overview

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- Over 50 recommendations - focusing on five key pillars
    1. Develop a Climate Change Adaptation Strategy and Action Plan
    2. Build capacity within government
    3. Maintain continued access to experts
    4. Enhance climate change science and modelling capacity
    5. Ensure dedicated adaptation funding
  - Adaptation Strategy's strategic goals:
    - Enhance government leadership
    - Integrate adaptation
    - Support communities
    - Develop and disseminate tools to manage risk
    - Collaborate with other governments
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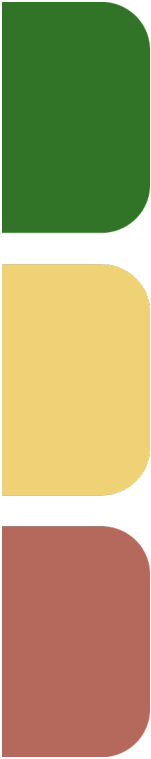

# Expert Panel on Climate Change Adaptation

A number of the panel's recommendations, whether ministry-specific or strategic, have implications for OMAFRA's areas of mandate:

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- Mainstreaming adaptation at all levels of decision-making
  - Enhancement of climate change modelling capacity
  - Working with rural communities to increase their resilience
  - Supporting the agriculture and agri-food sectors and rural communities by:
    - Examining opportunities to incent producer behaviour through business risk management programming
    - Undertaking risk assessment and engaging agricultural/rural clients in discussion on climate change adaptation
    - Enhancing our ability to anticipate, prepare for and prevent new or expanded plant, livestock and zoonotic diseases and pests
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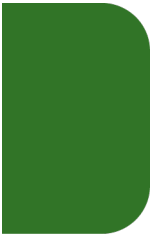
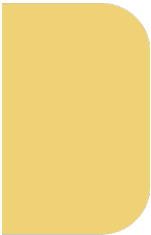
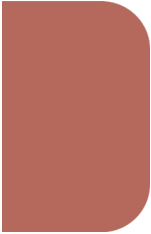



## Ontario Approach

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- Ministry of the Environment is the lead ministry
  - August 2007 – Ontario’s Action Plan On Climate Change
    - Emission targets:
      - 6% below 1990 by 2014
      - 15% below 1990 by 2020
      - 80% below 1990 by 2050
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## Ontario

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- Ontario supports the development of a cap and trade system for greenhouse gases
  - MOU with Quebec
  - Develop a program compatible with the WCI and future Canadian and U.S. systems
  - Uncertainty in U.S. so also Canada
- 

# Eligible Offset Project Types

## Agricultural

- Beef Feeding – Edible Oils
- Beef – Days on Feed
- Beef – Age at Slaughter
- Anaerobic Digestors
- Pork – Manure and Feeding
- Tillage

## Energy Efficiency

- Energy Efficiency
- Waste Heat Recovery
- Buildings (Residential and Industrial/Commercial)

## Forestry

- Afforestation
- Forest Management (CCAR)

## Fossil Fuel Based Energy

- Fuel Switching

## Geological Sequestration

- Acid Gas Injection
- Enhanced Oil Recovery

## Methane Management

- Landfill Gas
- Coal Bed/Mine/Ventilation Methane
- Composting
- Aerobic Landfill Bioreactor
- Wastewater Treatment

## Renewable Energy

- Wind, Solar, Small Hydro
- Biomass to Energy
- District Heating

## Transportation

- Road Rehabilitation
- Modal Shifting

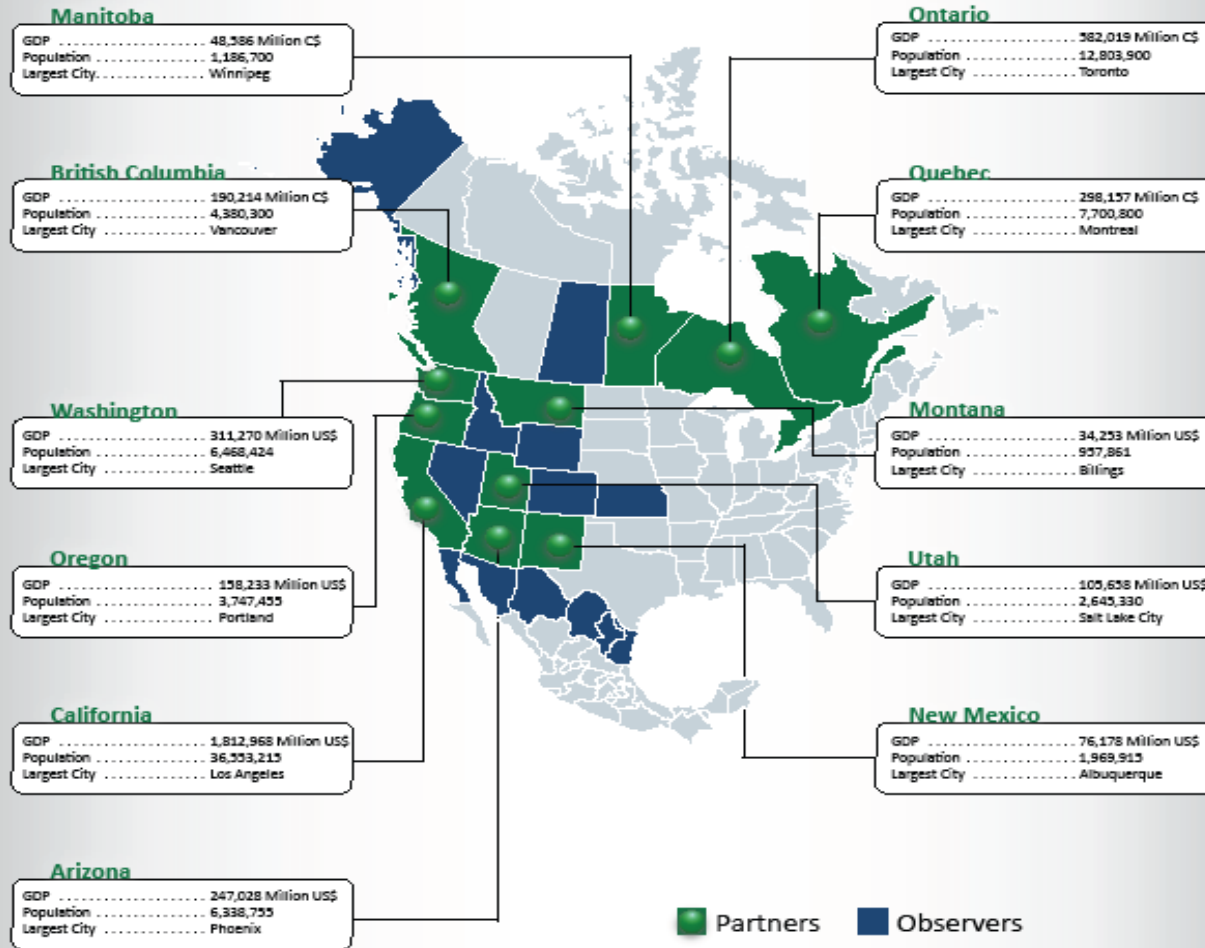
## Waste Management

- Reusing flared well gas
- Non-incineration thermal waste management

## Other

- N<sub>2</sub>O abatement
- Biofuels

# Western Climate Initiative

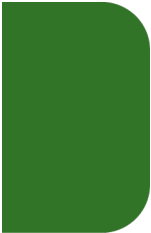
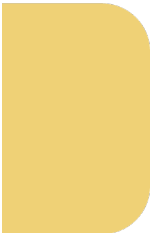
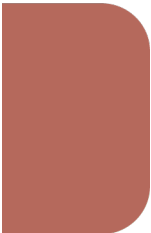



WCI OBSERVERS	
<b>CANADA</b>	<b>UNITED STATES</b>
Saskatchewan	Alaska
	Colorado
	Idaho
	Kansas
	Nevada
	Wyoming
	<b>MEXICO</b>
	Baja California
	Chihuahua
	Coahuila
	Nuevo Leon
	Sonora
	Tamaulipas

All figures for 2007  
 Source for US data: US Census Bureau and US Bureau of Economic Analysis  
 Source for Canadian data: Statistics Canada






## Western Climate Initiative

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- Working on a regional based cap and trade system
  - Evaluating offset protocols to identify opportunities
    - Includes projects types in agriculture, forestry and waste management
  - Midwestern Greenhouse Gas Reduction Accord (several mid-western states)
  - Regional Greenhouse Gas Initiative (several north-eastern states)
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# What are the impacts of climate change?

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- Altered annual temperature
  - Changes in precipitation patterns (flooding, drought)
  - Increased frequency of severe weather events
  - Elevated CO<sub>2</sub>
  - Possible shifts in pests and diseases





# Holos

*A tool to estimate and  
reduce GHGs from farms*

Adapted from a presentation created by Shannan Little





## Purpose

- 
- Whole-systems approach
    - All GHGs from entire, integrated farm
    - Ensures effects of changes are transferred through entire system
    - Emphasizes interactions
  - Envision and test possible way of reducing GHG emissions before implementation
  - “What if?” not “What were?”
  - Learning and communication tool
- 



## GHG emissions & sources

- 
- CH<sub>4</sub> from enteric fermentation
  - CH<sub>4</sub> from manure management
  - N<sub>2</sub>O from manure management – direct and indirect
  - N<sub>2</sub>O from soils and cropping – direct and indirect
  - CO<sub>2</sub> from energy use
  - Carbon storage and removals from soils and trees
- 





## Farm components or operations

- Crops/grassland/land use change
  - Beef cow-calf
  - Beef feedlot
  - Beef stocker/grasser
  - Dairy
  - Swine
  - Sheep-market lamb
  - Sheep feedlot
  - Poultry
  - Other animals
  - Lineal tree plantings/shelterbelts
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In Holos, carbon storage and emissions are based on:

1. change in management practice

- 
- 
- change in tillage intensity
  - change in the amount of perennial crops
  - change in the amount of permanent grassland



2. time since the change

3. the area involved





Select general farm location and values for soil, climate and topography data are automatically entered.

# Enter Crop and Livestock Information

Holos 1.1.2 - Brown Farm - [Crops and Grassland]

Load Farm | New Farm | Copy Farm | Delete Farm | Preferences | Français | Exit |

Save | Close

Enter the most common yearly crop rotation  
Grassland is not considered a part of the rotation

Add Crop/Grassland | Delete Crop/Grassland

Land use type: Cereal

Crop / Grassland: Grain corn (shelled)

Area: 81 ha = 200 acre \*

Yield: 8246 - 9700 kg / ha = 133 - 155 bushels / acre \*

Irrigated:  (checked = Yes)

Herbicide:  (checked = Yes)

Synthetic Nitrogen Fertilizer: 157 kg N / ha = 140 lbs N / acre \*

Synthetic Phosphorus Fertilizer: 40 kg P2O5 / ha = 36 lbs P2O5 / acre \*

Select a row in the table to edit a crop Total Area (hectares) = 206

Land Use Type	Crop/ Grassland	Area (ha)
Annual Legume	Soybeans	61
Cereal	Grain corn (shelled)	81
Cereal	Winter wheat	40
Perennial Forage	Hay - legume	24

\* Enter a value for any unit; the other will be entered in automatically. Non-metric units may change due to rounding.



Farm Information

Lineal Tree Plantings

Crops/Grassland

Land Use

Cow - Calf

Beef Feedlots

Stockers/Grassers

Dairy

Market Lambs

Sheep Feedlots

Swine

Poultry

Other Animals

Results

Reports

Mitigation Options

# Results

Presented as a -

# Report

**Emission Details**  
 2008-09-17

Export Report | Print Report | Previous Page | Next Page | Zoom | Preferences

**EMISSION DETAILS**  
 2008-09-17

**Mixed farm** Units = Mg CO2 Eq (1 Mg = 1 Tonne)

Subtotals

Lineal Tree Plantings CO2					
Lineal Tree Plantings		0.0			0.0

	Soil CO2	Direct N2O	Indirect N2O	
Soils	-325.8	78.4	11.1	-236.3

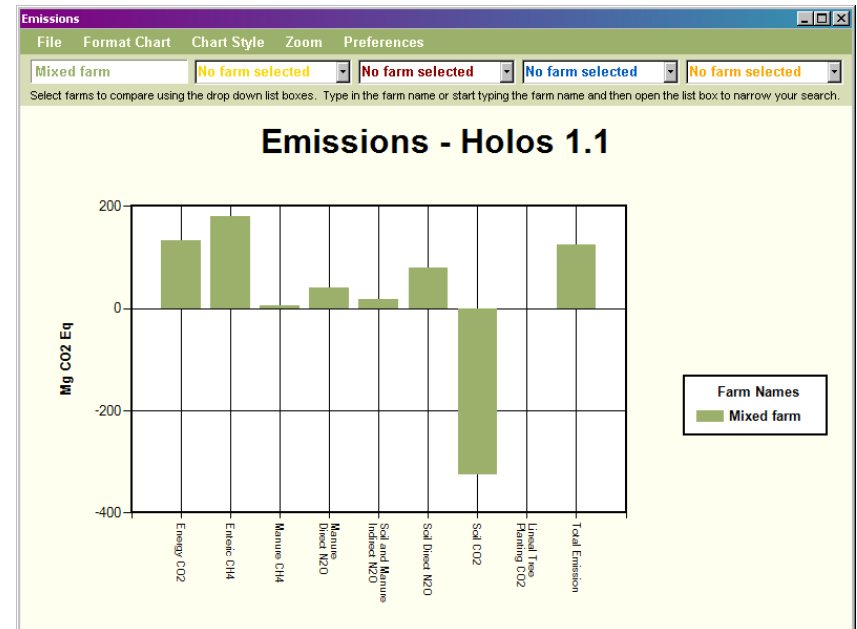
	Enteric CH4	Manure CH4	Direct N2O	Indirect N2O	
Cow-calf	178.8	4.4	40.5	5.8	229.5
Beef Feedlot	0.0	0.0	0.0	0.0	0.0
Stokers/Grassers	0.0	0.0	0.0	0.0	0.0
Dairy	0.0	0.0	0.0	0.0	0.0
Market Lamb	0.0	0.0	0.0	0.0	0.0
Sheep Feedlot	0.0	0.0	0.0	0.0	0.0
Swine	0.0	0.0	0.0	0.0	0.0
Poultry	0.0	0.0	0.0	0.0	0.0
Other Animals	0.0	0.0	0.0	0.0	0.0
<b>Livestock</b>	<b>178.8</b>	<b>4.4</b>	<b>40.5</b>	<b>5.8</b>	<b>229.5</b>

Cropping Energy CO2		Livestock Energy CO2		
Energy	131.5	0.0		131.5
<b>Total Emissions</b>				<b>124.7</b>

Negative values indicate carbon storage.  
 Positive values indicate greenhouse gas emissions.

Current Page No.: 1 | Total Page No.: 1 | Zoom Factor: 75%

# Chart



# Mitigation

**Mitigation**

Choose mitigation options listed below, then click Run Mitigation button.  
Multiple options may be selected.

Run Mitigation    Do it yourself mitigation (PDF)

✓ Unselect Plant trees

Reduce tillage

Eliminate fallow

Add perennial crops

Select Add grassland

✓ Unselect Reduce synthetic nitrogen fertilizer by 25%.

Select Include feed additives in cattle diets

Feed dairy a reduced protein diet

Select Feed dairy higher energy / digestible feed

More

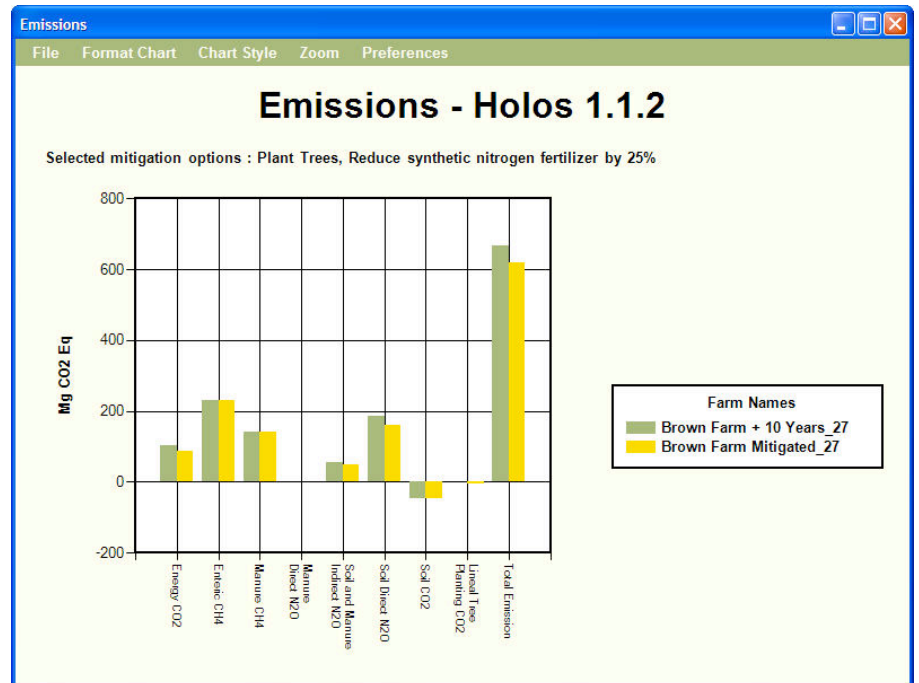
**Mitigation options are not recommended practices, but are listed to demonstrate changing practices, changes emissions !!!**

**Reduce synthetic nitrogen fertilizer by 25%**

Reducing nitrogen fertilizer decreases soil N<sub>2</sub>O and energy CO<sub>2</sub> emissions. Improving the efficiency of nitrogen use and reducing nitrogen fertilizer rates can be accomplished by adjusting rates to coincide with plant needs, by placing fertilizer near the roots, by using slow-release forms, or by replacing synthetic fertilizer nitrogen with organic nitrogen (e.g., manure).

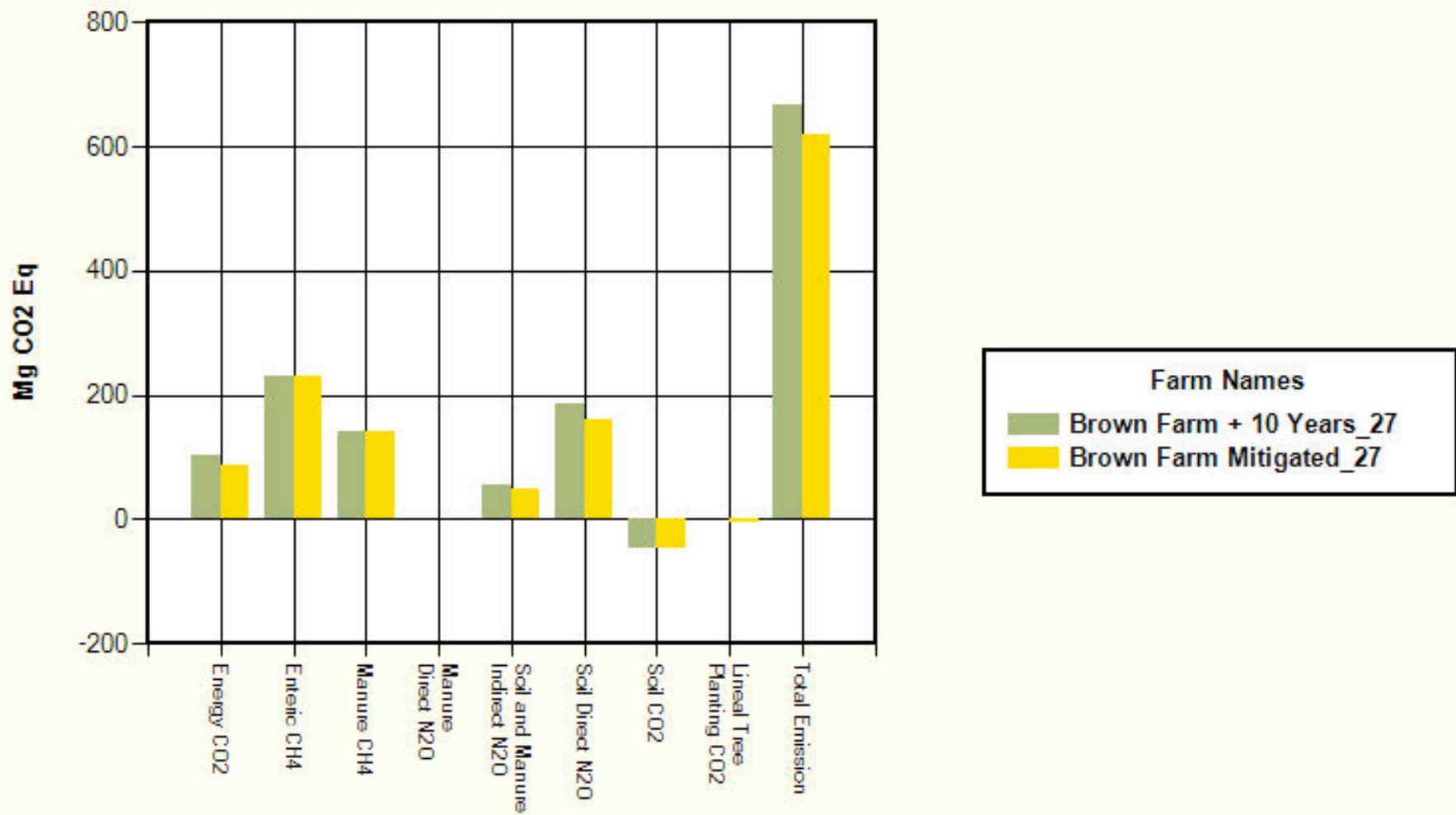
**Co-benefits**  
Reducing nitrogen fertilizer cuts crop production costs and lessens the amounts of nitrates, ammonia and other nitrogen pollutants entering the environment.

**What Holos is doing**  
All synthetic nitrogen fertilizer rates are reduced by 25 percent.



# Emissions - Holos 1.1.2

Selected mitigation options : Plant Trees, Reduce synthetic nitrogen fertilizer by 25%



# Do-it-yourself Mitigation

Mitigation

Choose mitigation options listed below, then click Run Mitigation. Multiple options may be selected.

[Plant trees](#)

[Reduce tillage](#)

[Eliminate fallow](#)

[Add perennial crops](#)

[Add grassland](#)

[Reduce synthetic nitrogen fertilizer b](#)

[Include feed additives in cattle diets](#)

[Feed dairy a reduced protein diet](#)

[Feed dairy higher energy / digestible](#)

[Feed yourself good quality feedin](#)

Holos 1.1.2 - trial2 - [Land Use]

Load Farm | New Farm | Copy Farm | Delete Farm | Preferences | Français | Exit |

Save | Close

Enter the most recent changes in land management.

**Tillage**

Present tillage intensity  No-till Reduced Intensive

Past tillage intensity  No-Till Reduced Intensive

Year tillage changed

**Perennial Forage**

Present Percent Perennial Forages = 33%

Has there been a change in perennial forages cropping area?  (checked = Yes)

Past percent perennial forage

Year perennial forages changed

**Grassland**

Recently broken grassland area  ha =  acre \*

Year grassland broken

**Organic Soil**

Organic soil area  ha =  acre \*

**Fallow**

Present Percent Fallow = 0%

Was more than 10% of the cropping area fallowed in the past?  (checked = Yes)

Year fallow changed

\* Enter a value for any unit, the other will be entered in automatically. Non-metric units may change due to rounding.