



Greenhouse Gas 101: **An Overview of Agricultural** **Greenhouse Gases**

Kendall Tupker and Kristian Stephens
Brown Bagger Session

May 5, 2005



Overview

- Introduction
- Science of Climate Change and GHGs
- What role can Agriculture Play?
- Policy Response to Climate Change
- Federal Climate Change Plan
- AAFRD's Activities to Date

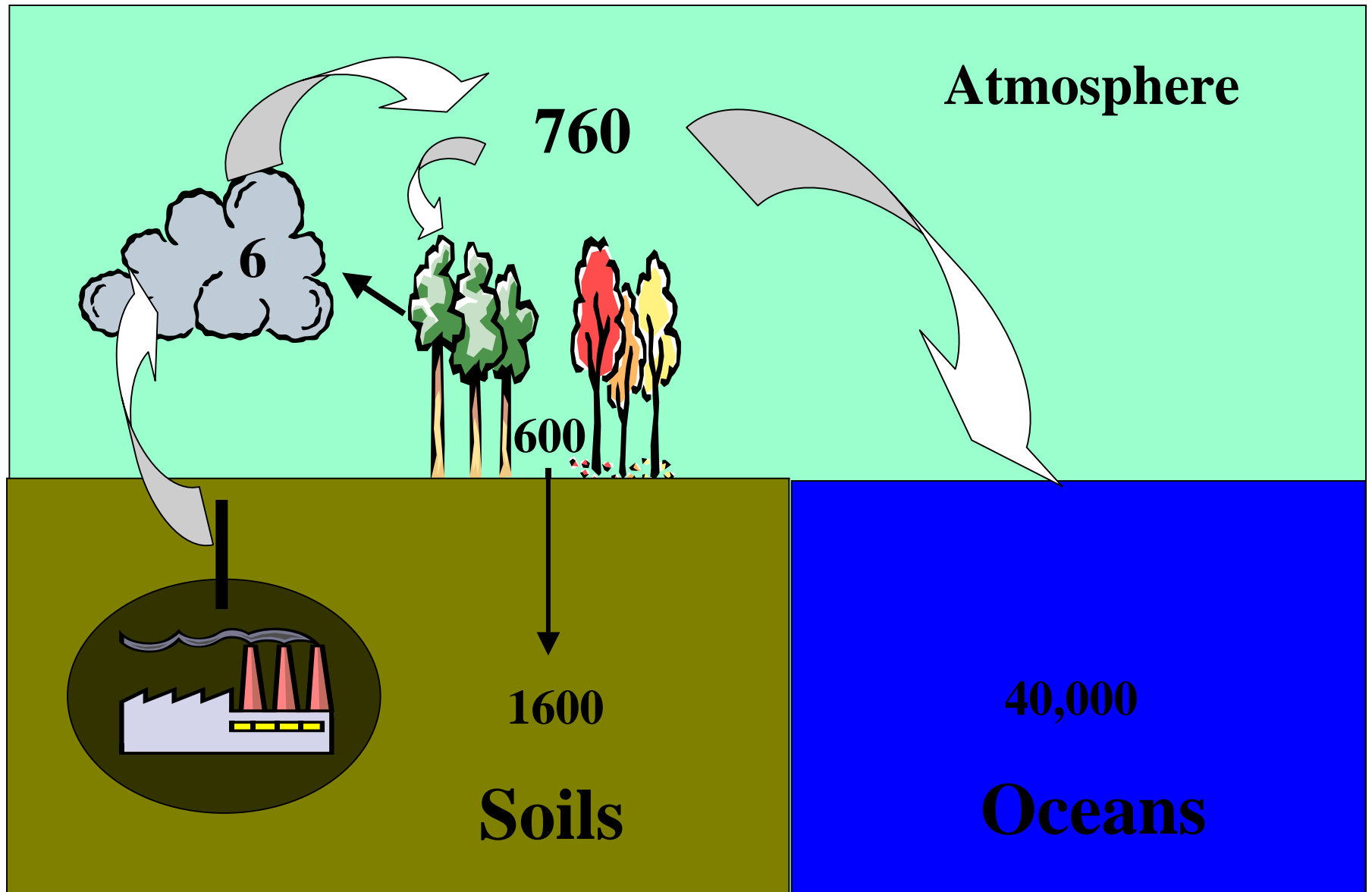


What's the Controversy?

- Anthropogenic GHG emissions are 5% of GHG global emissions
- Canada accounts for only 2% of global GHG emissions
- Kyoto would delay GHG trends by 10 or so years
- Cost and health estimates vary widely
- Regional climate circulation models predict that:
 - Increase in climate variability
 - Greater precipitation will occur in the winter
 - Temperate regions with 'heat' more (5 –10 degrees)
 - Increase in pests and diseases



Global Carbon Cycle – Tipping Point (Gt carbon)



Political Reality

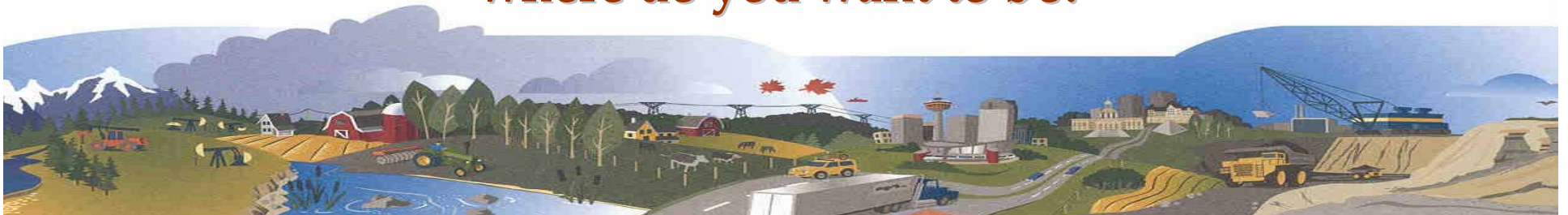
- The world is quickly moving to a carbon-constrained economy
- Governments are taking action and markets are forming fast
- Carbon markets will accelerate:
 - UK and EU markets (\$14-\$16 CAD/tonne)
 - International markets (\$7.75 CAD/tonne)



Political Reality

- The Kyoto Protocol on GHG emissions came into force February 16, 2005
- Canada launched its \$10B Plan
- Alberta has a Climate Change Act and Strategy
- Is AAFRD ready?

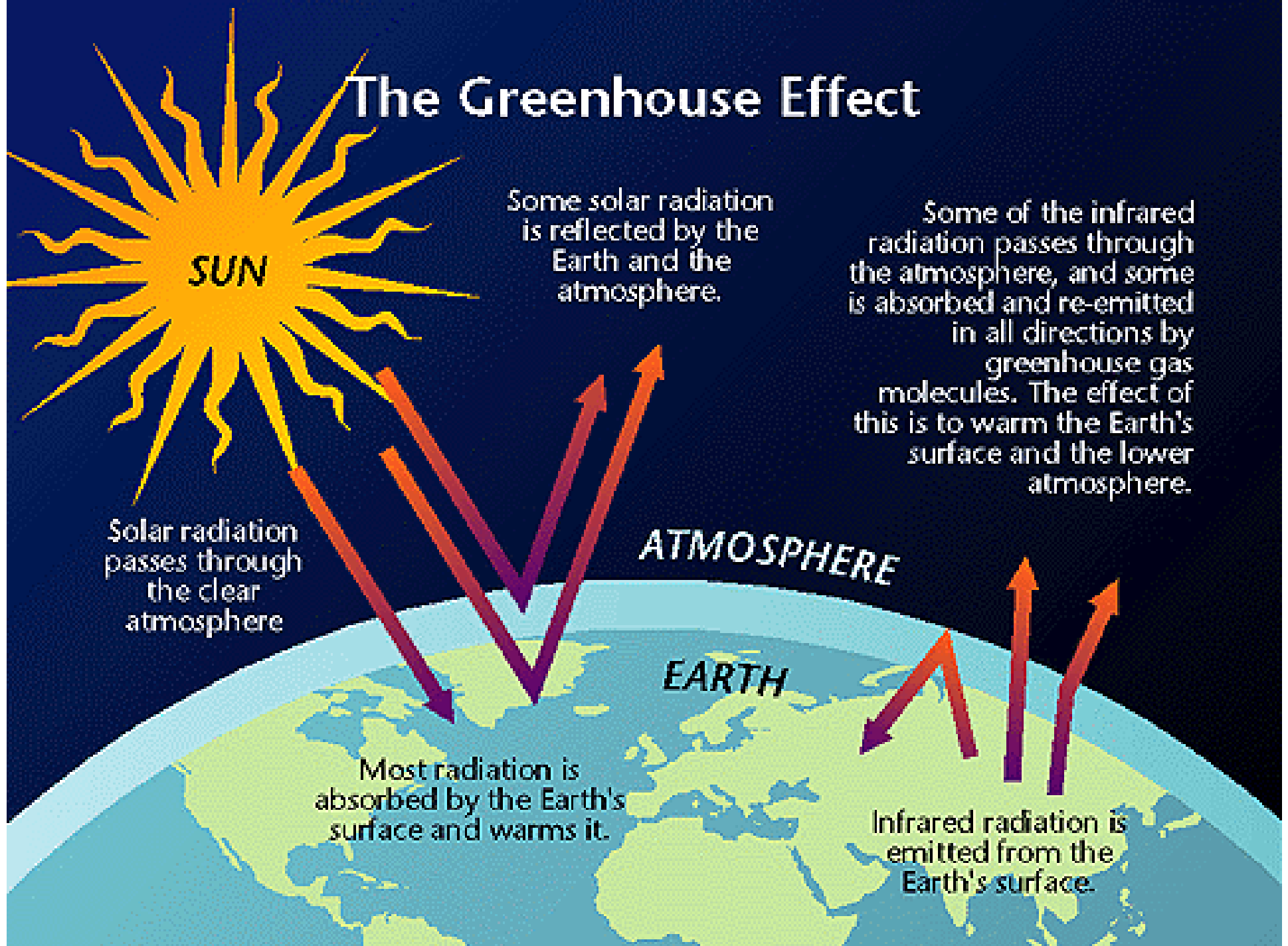
**Make it happen, Watch it Happen or ask “What Happened” –
where do you want to be?**



Science of Climate Change and Greenhouse Gases



The Greenhouse Effect



SUN

Solar radiation passes through the clear atmosphere

Some solar radiation is reflected by the Earth and the atmosphere.

ATMOSPHERE

EARTH

Most radiation is absorbed by the Earth's surface and warms it.

Some of the infrared radiation passes through the atmosphere, and some is absorbed and re-emitted in all directions by greenhouse gas molecules. The effect of this is to warm the Earth's surface and the lower atmosphere.

Infrared radiation is emitted from the Earth's surface.

Global Warming Potentials (GWP) (CO₂ equivalents)

Gas	Relative GWP
-----	--------------

Carbon Dioxide (CO ₂)	1
-----------------------------------	---

Methane (CH ₄)	21 (23)
----------------------------	---------

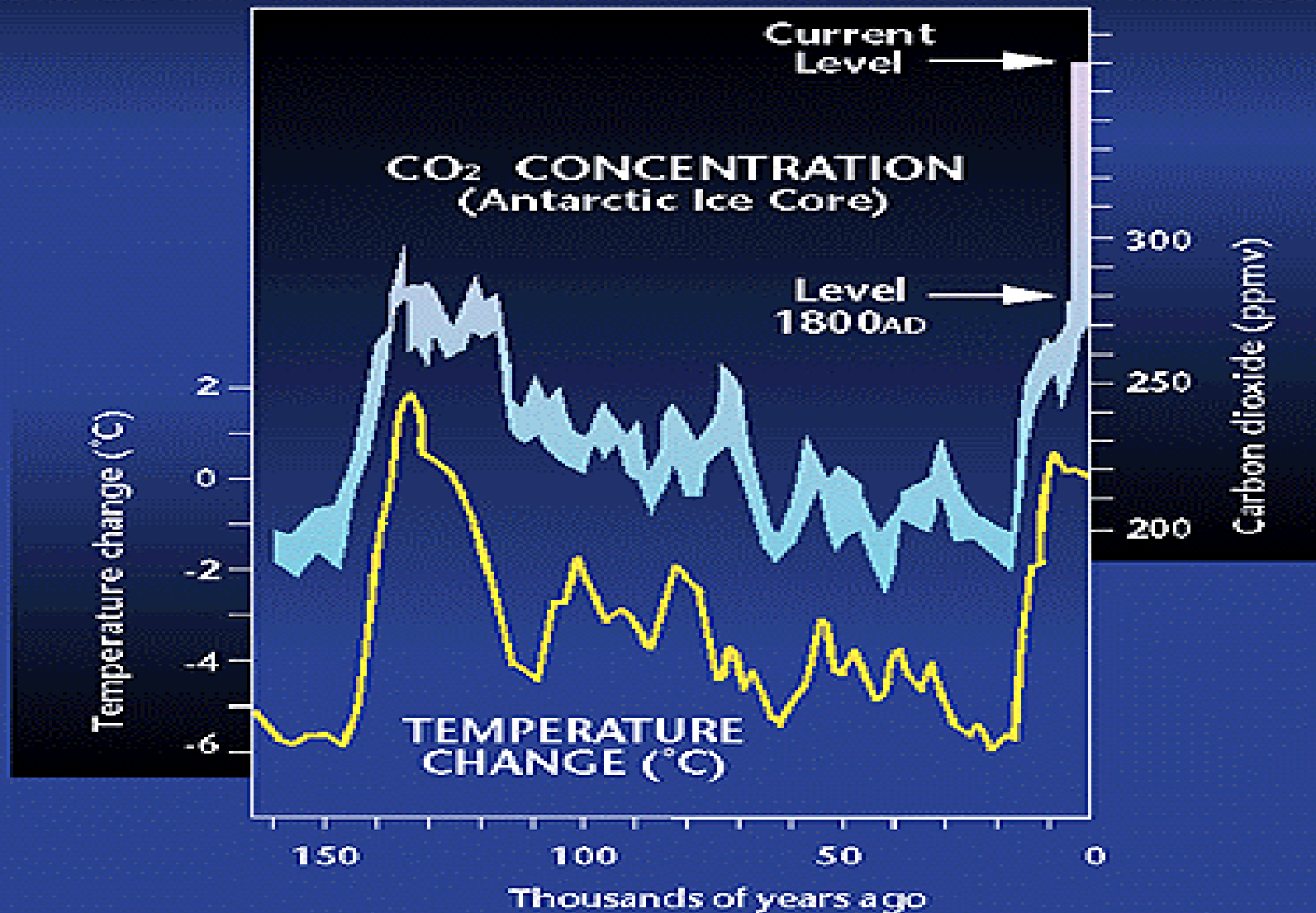
Nitrous Oxide (N ₂ O)	310 (296)
----------------------------------	-----------

(Time Horizon: 100 years)

1 tonne N₂O x 310 (GWP) = 310 tonnes CO₂e



Atmospheric Carbon Dioxide Concentration and Temperature Change



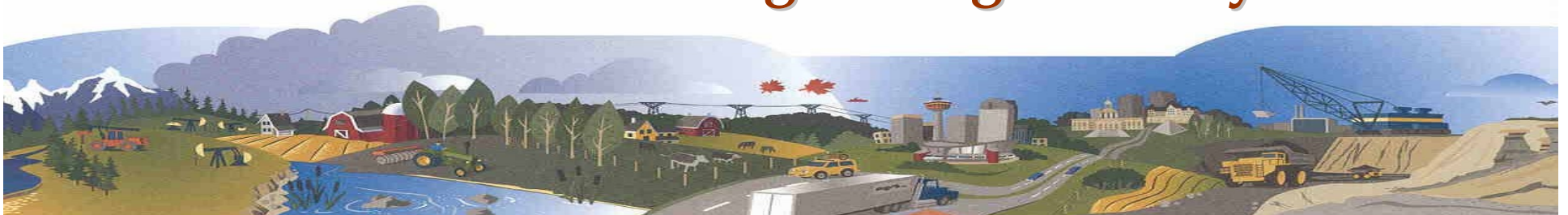
What Role can Agriculture Play?



Agriculture in Canada

- Contributes 8% of total GHG emissions in 2002
- Contribution of each sector to total GHG emissions:
 - soils: 50% (nitrous oxide from N based fertilizers)
 - domestic animals: 32% (methane produced during digestion)
 - manure management: 17% (nitrous oxide)

Greenhouse Gases = Escapees of Leaky Nutrient and Feeding Management Systems



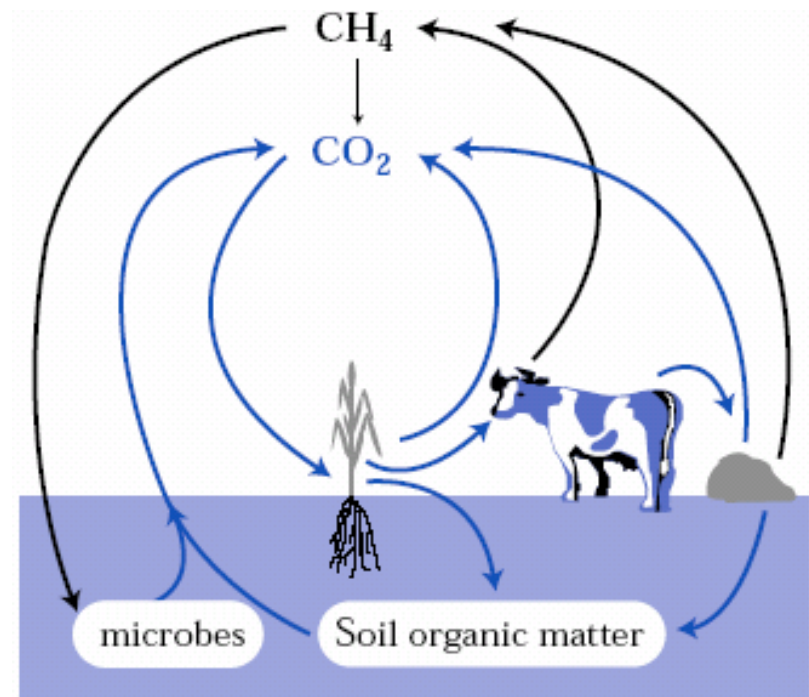
Methane (CH₄)

Sources:

- Enteric fermentation
- Manure

Management Practices:

- Feed higher quality feed and balance rations
- Feed supplements (e.g. edible oils, ionophores)
- Process solid or liquid manure anaerobically



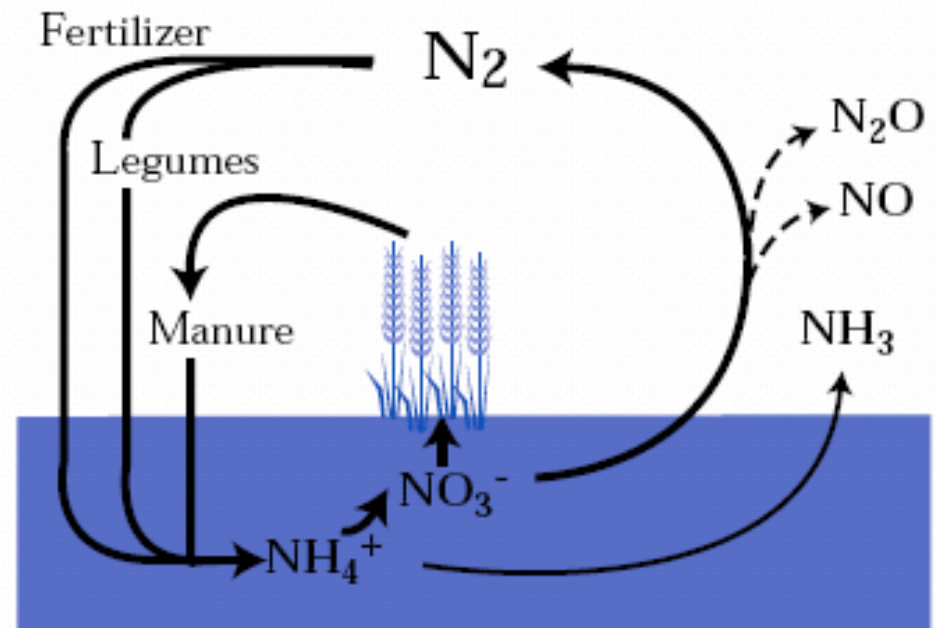
Nitrous Oxide (N₂O)

Sources:

- Soils - manure or fertilizer application
- Manure

Management Practices:

- Apply fertilizer in spring
- Match fertilizer to crop needs
- Avoid over application of fertilizers or manure



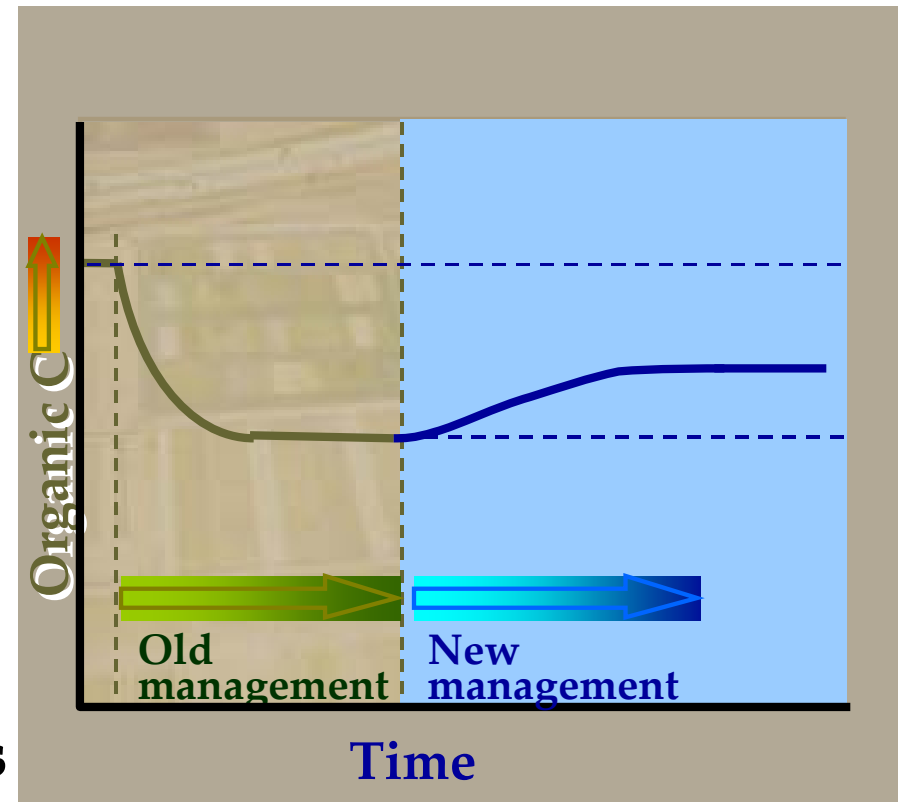
Carbon Dioxide (CO₂)

Sources:

- Fossil fuel combustion
- Soils, Plants, etc

Management Practices to Increase C Storage:

- Reduce tillage, zero tillage
- Include perennial forages
- Improved grazing management
- Decrease summerfallow
- More permanent cover crops



Opportunity for Agriculture

**“Agriculture is 8% of the problem
– but with proper investment it can be 30% of the solution”**

Reduce

Greenhouse gas
emissions

**Agricultural
GHG
Management**

Remove

Atmospheric C to
store in soils and
perennial crops

Replace

Fossil fuels with bio-
based energy,
chemicals and
materials



Potential for Agriculture

More of a Solution than a Problem:

- Removing – about **20** Megatonnes CO₂e/yr
- Reducing – about **12** Megatonnes CO₂e /yr
- Replacing Fossil Fuels – about **40 to 60** Megatonnes CO₂e /yr



Policy Response to Climate Change



What has Been the Global Policy Response?

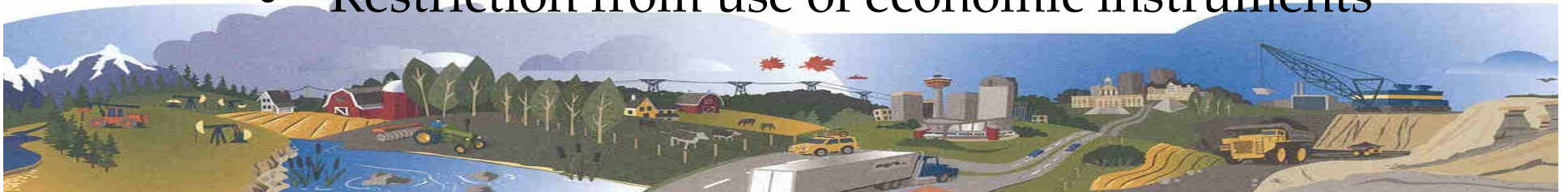
United Nations Framework Convention on Climate Change: Conference of the Parties

- 1992 – Rio
- 1995 – Berlin
- 1997 – Kyoto
- 1998 – Buenos Aires
- 1999 – Bonn
- 2000/1 – Hague/Bonn
- 2001 – Marrakech
- 2002 – New Delhi
- 2003 – Milan
- 2004 – Buenos Aires
- 2005 – Montreal

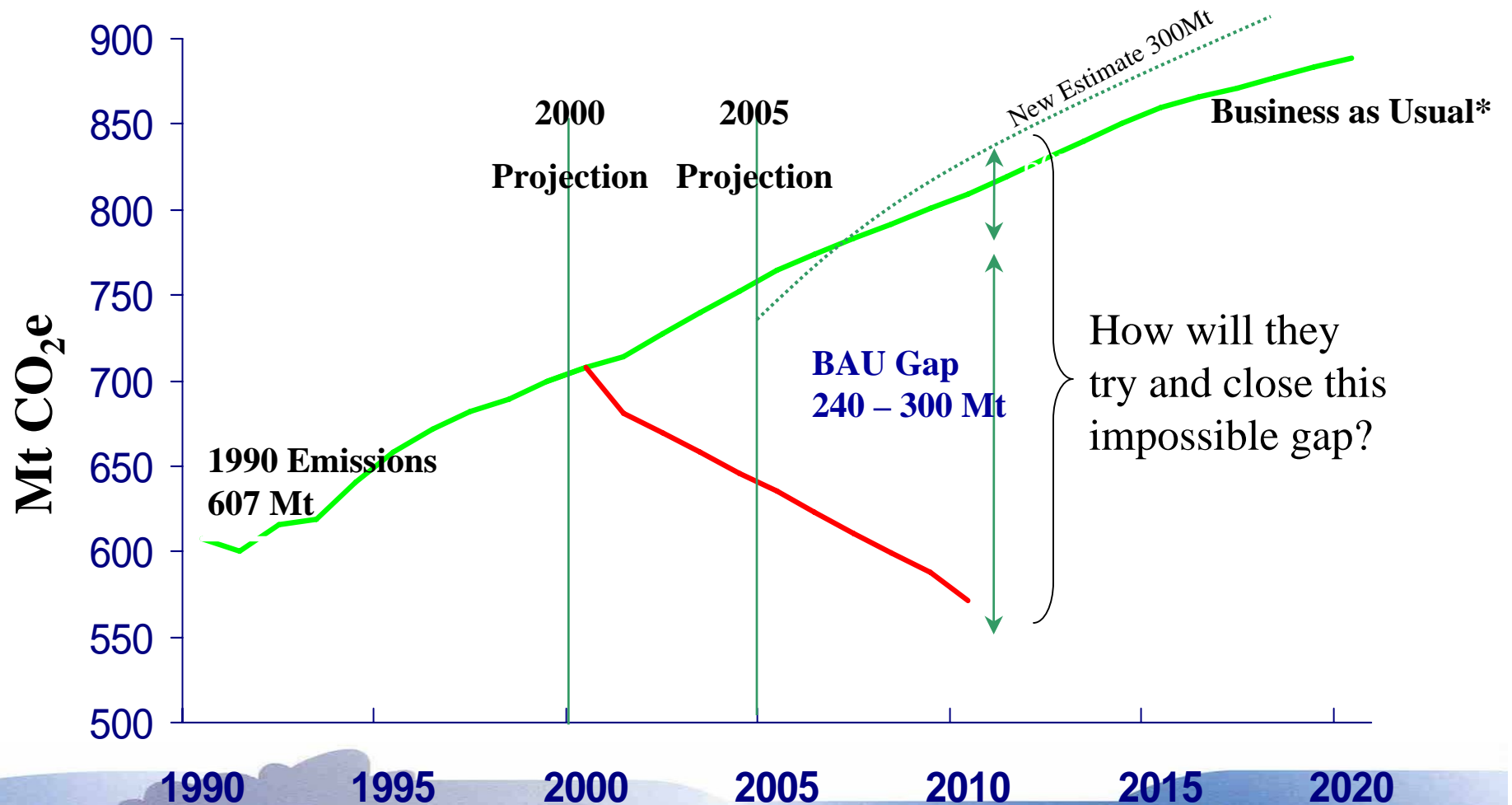


The Kyoto Protocol

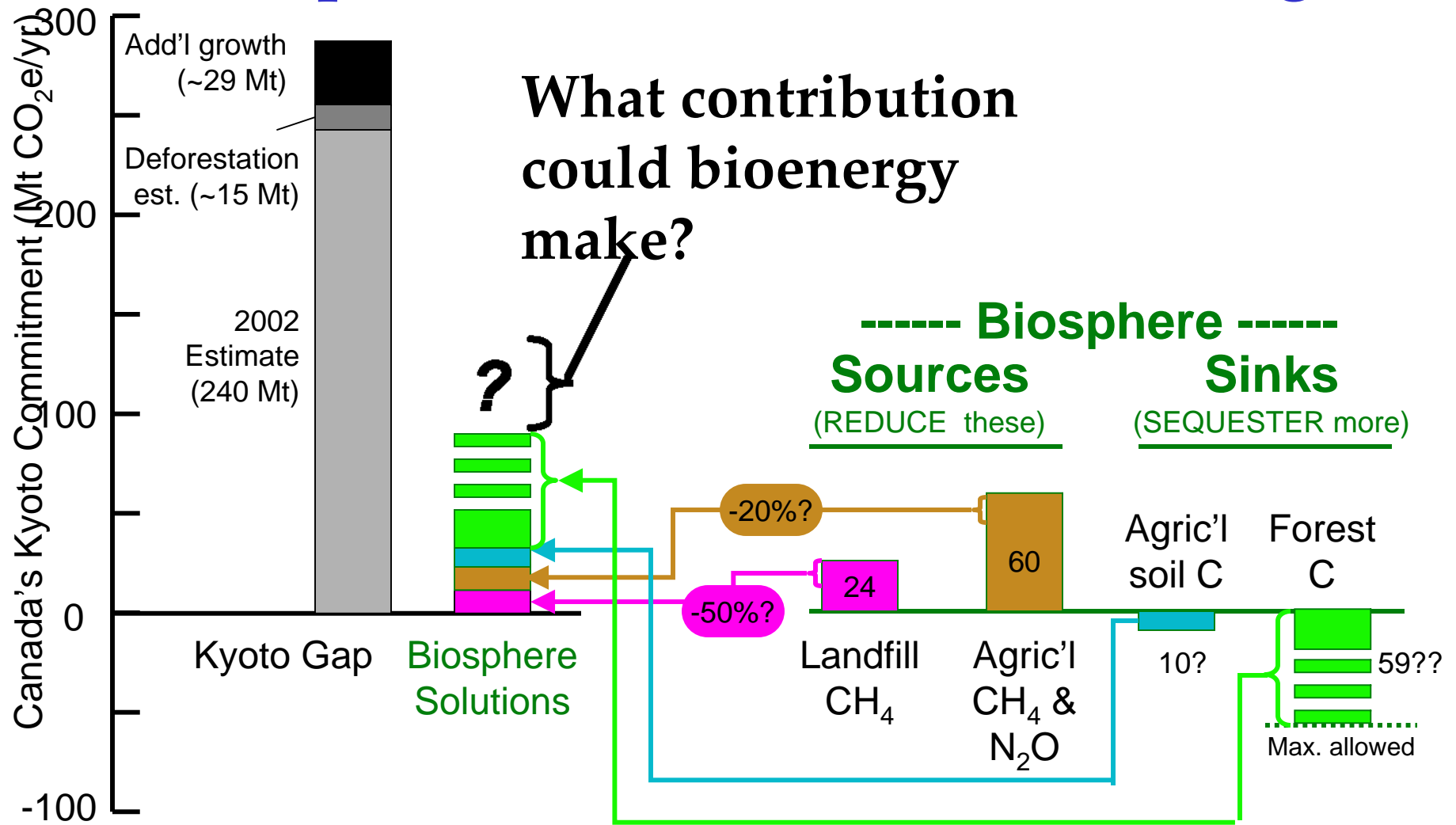
1. Sets targets for reducing GHG emissions from industrialized nations (5.2% below 1990 levels collectively)
2. Allows targets to be met through market-based strategies or economic instruments:
 - ✓ International Emissions Trading
 - ✓ Clean Development Mechanism
 - ✓ Joint Implementation
3. Non-Compliance Consequences
 - 1.3 tonne make-up
 - Restriction from use of economic instruments



The Canadian Kyoto Gap

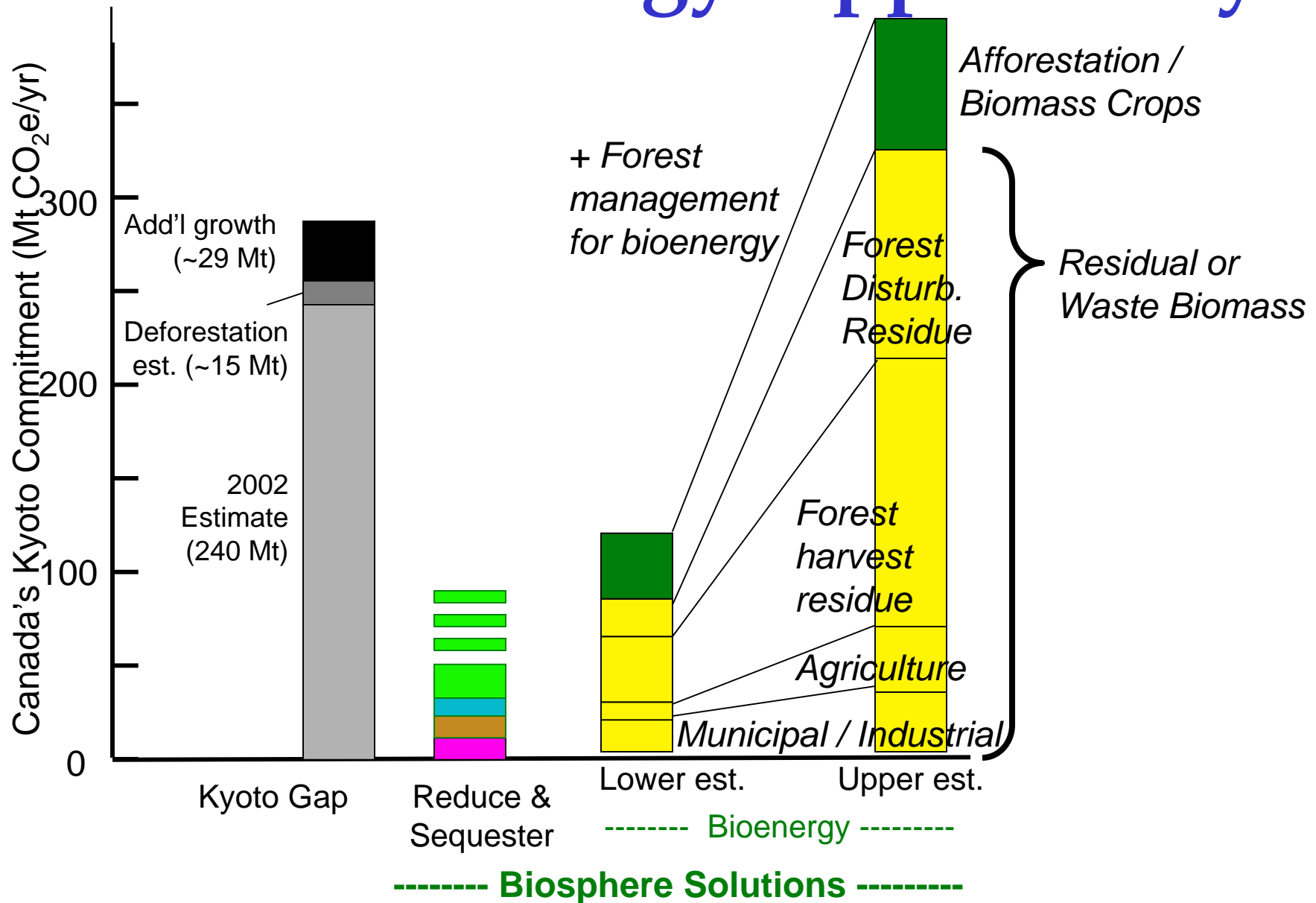


Closing the Kyoto Gap: Biosphere solutions to climate change



C/o David Layzell, BIOCAP 2005 Ottawa Conference.

The Bioenergy Opportunity

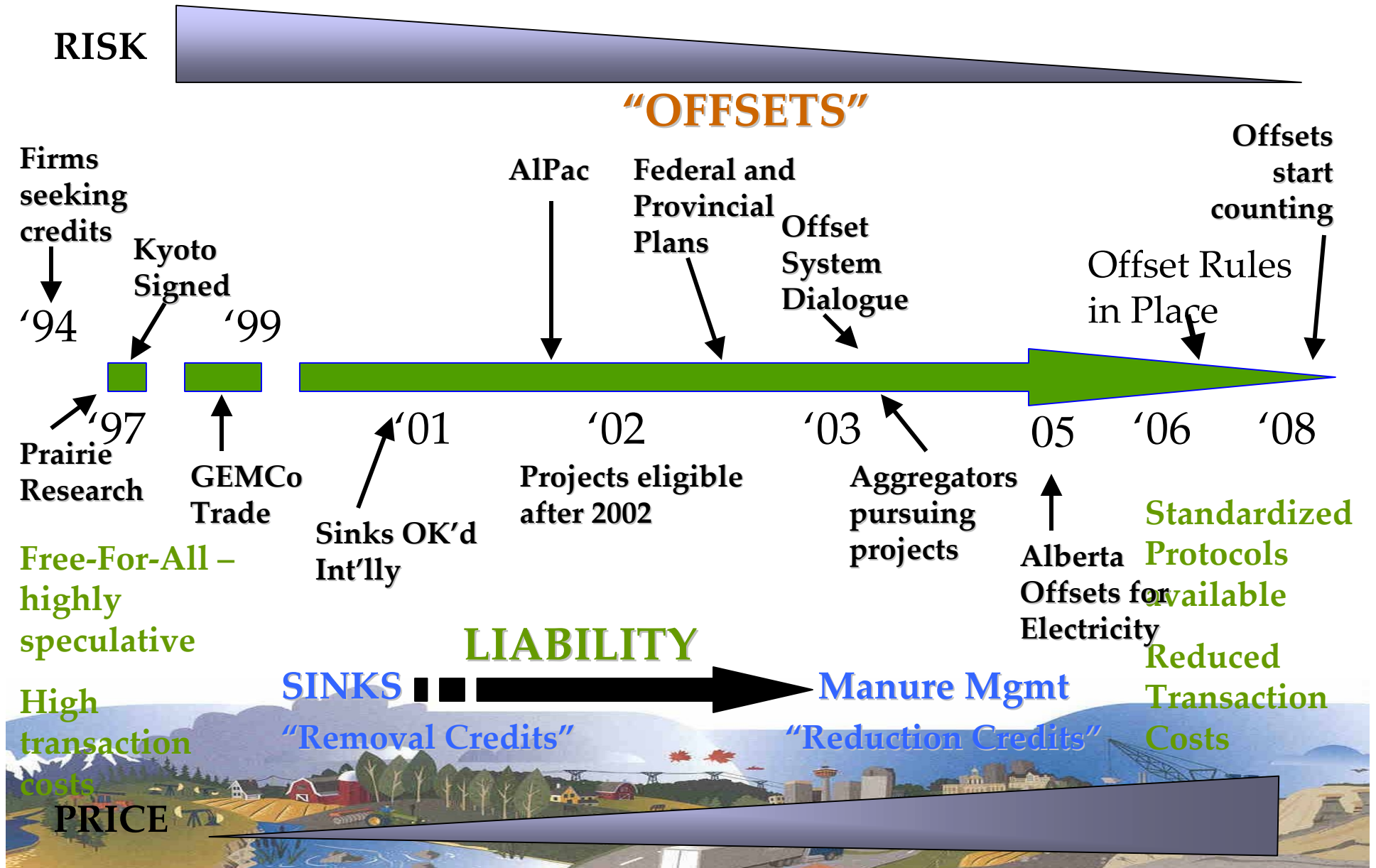


\$10B Federal Climate Plan (8yrs)

1. \$1-5B Climate Fund
2. Emissions Trading System
3. \$2-3B Provincial Partnerships
4. ~\$2B Renewable Energy, C Sinks, Automobiles
5. \$2B One Tonne Challenge/Programs
6. \$.3B Tax Incentives
7. Green Governments



Carbon Market Timeline



Alberta Offset Activity

- AgCert Canada- AB hog farmers; CDM Brazil deal ; marketing Dutch/Japanese
- AgCheck Canada- buying 1 year sink credits in Foothills
- Parkland AgriServices Corp- pilot with EPCOR/TransAlta
- Agri-Trend Agrology- GEMCo partnership
- Carbon Earth- shopping around
- TransAlta Utilities CDM deal
- AlPac – leasing land for timber supply/C credits



Risks of Ignoring the Issue:

- Input costs will go up - if agriculture provides credits, costs will not rise as sharply
- Possible restricted access to export markets
- Future regulations – are we prepared??
 - Precautionary principle
- Civil litigation cases are on the rise
- Increasing market pressures
- Missed opportunities



Challenges

- The energy sector's climate change problem is agriculture's future operating problem
 - Rising prices due to regulation will be passed on to the farmer in increased input costs
- More science and technology is needed:
 - to develop sound estimates of all three GHG emissions on farm
 - to examine adaptation options (e.g. new varieties, water management)
 - to develop new technologies (e.g. biofuels, biogas)



AAFRD's Activities to Date



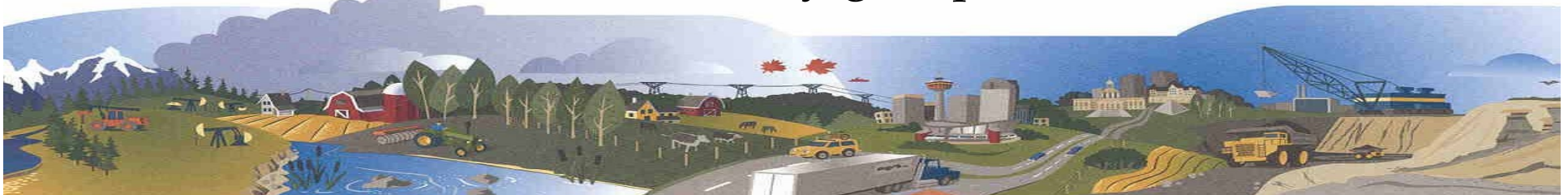
Current AAFRD CC Activities

- **Science and Information:**
 - **GHG Science Plan**
 - Knowledge gaps identified; Recommended research
 - **Strategic Roadmap -**
 - Identified most important management practices that balance production economics with GHG management
 - **Monitoring/Reducing GHGs:**
 - CO₂ wetlands study with Ducks Unlimited
 - N₂O reduction strategies across seasons and cropping systems
 - CH₄ emissions reductions from enteric fermentation from cattle



Current AAFRD CC Activities

- **Science and Information:**
 - **Adaptation:**
 - Report outlining results from 4 focus groups held across Alberta assessing the sectors' ability to adapt to a changing climate
- **Communication and Awareness:**
 - Joint with AESA Council
 - National Agricultural GHG Mitigation Program
 - Hub Sites, Demo Sites, Satellite Sites
 - **GHG Booklets, 11 bulletins, and 4 brochures**
 - Train the trainer/producer workshops
 - Presentations to Industry groups



Current AAFRD CC Activities

- **Policy Coordination/Leadership:**
 - Alberta Leadership on Quantification Protocols (C3, AENV)
 - **National Offset Quantification Team** – interfacing with Federal Government
 - Participating on intergovernmental committees and Taking Action Climate Change Plan



For More Information

- **Ropin' the Web GHG website:**
www.agric.gov.ab.ca/ghg
- **Kendall Tupker** **780-427-3615**
- **Kristian Stephens** **780-427-3347**
- **Karen Haugen-Kozyra** **780-427-3067**

Stay Tuned for the Next Brown Bagger

