


**Greenhouse Gas Emission #s:  
Trends, Truths & Tricks**

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**What does the data really say?**

- **Measurements**
  - Involve error
- **Estimates**
  - Involve assumptions
- **Interpretations**
  - Involve assumptions and bias



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**GHG Inventory Numbers**  
**Reporting Agencies and Sources of Data**

- **U.S. Environmental Protection Agency**  
([www.epa.gov/climatechange](http://www.epa.gov/climatechange))  
Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2008, April 2010  
U.S. EPA # 430-R-10-006  
Tier 2 methods [for Ag] – Models use global equations and coefficients
- **Environment Canada** ([www.ec.gc.ca](http://www.ec.gc.ca))  
National Inventory Report: Greenhouse Gas Sources and Sinks in Canada, 1990-2008  
Tier 2 and 3 methods [for Ag] – More-detailed models, using local information and data



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## Units of Measure for GHG

- **Reported Units**

US: Reporting unit is teragram (Tg)

Canada: Reporting unit is megatonne (Mt)

– Different units adds confusion

- **These units are equivalent**

1 Tg = 1 Mt = 1 billion kilograms (kg)  
= 1 million metric tons

1 kg ~ 2.2 lb and 1 metric ton ~ 2,200 lb



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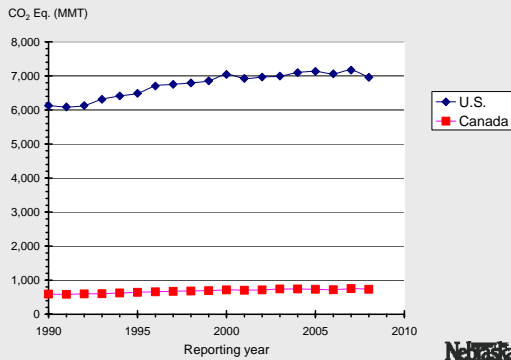
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## Annual Total GHG Emissions



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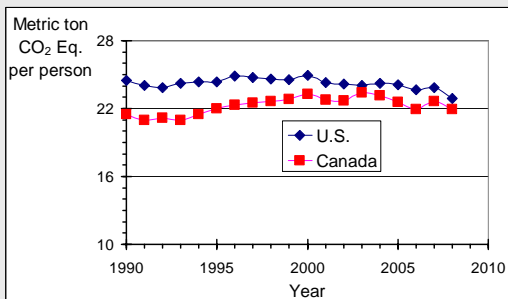
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## Per Capita GHG Emissions



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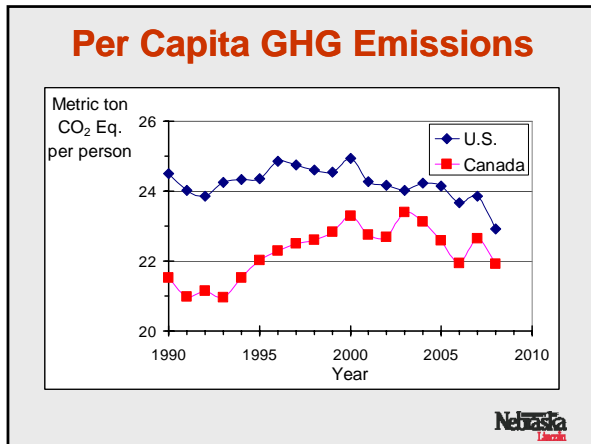
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### 2008 Greenhouse Gas Emissions: Trends Overall

United States

- Up 14% since 1990
- Down 2.9% from prior year (and peak) in '07
  - Lower demand for transportation fuels (high fuel cost)
  - Cool year (less AC)

Canada

- Up 24% since 1990
- Down from peaks
  - 0.8% since 2003
  - 2.1% since 2007
    - Economic slowdown
    - Greater use of hydroelectric power

In both countries, per capita emissions peak in 2000, with a recent trend downward

**Nebraska**  
Lincoln

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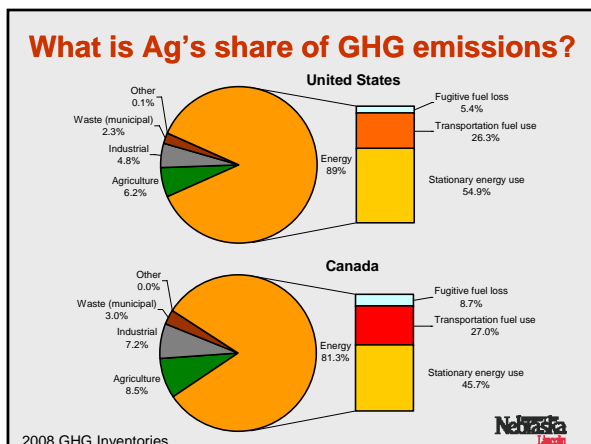
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### 'Agricultural' GHG Emissions: Trends

United States:

- Up 10% since 1990
- Contribution to total emissions is down a bit  
 6.33% in 1990  
 6.14% in 2008
- Probable factors\*
  - + Synthetic nitrogen fertilizer use up with higher yields
  - + Pig and poultry #s up ~ 30%
  - Much smaller beef herd (down 35 million hd from '75)
  - Fewer dairy cows (milk production is up)

Canada:

- Up 28% since 1990
- Contribution to total emissions is slowly rising  
 8.11% in 1990  
 8.45% in 2008
- Contributing factors
  - + Expanded beef cattle and pig herds
  - + Synthetic nitrogen fertilizer use on Prairies
  - Somewhat offset by reduction in dairy cows (same milk production)

\* From sources other than EPA




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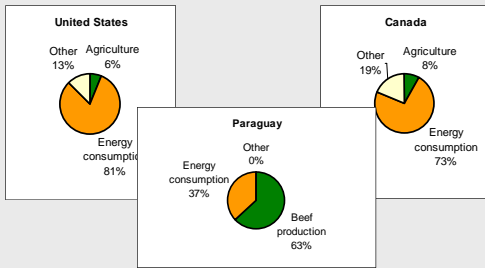
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### Let's extend this comparison...



Reference: Symposium on Mitigating Greenhouse Gas Emissions from Animal Production: A Policy Agenda, Asunción, Paraguay, 6-7 May 2009

What message do you think could be conveyed?  
 Which statistics are applicable for general use?




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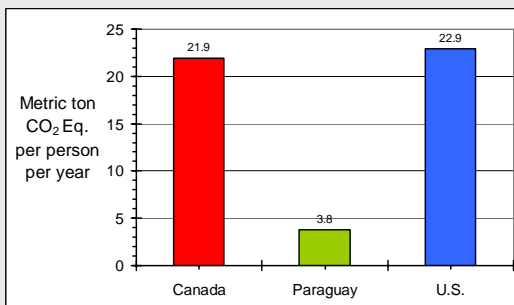
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### Consider total per capita emissions



World average: 4.5 metric tons CO<sub>2</sub> Eq.




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### What is 'Agriculture'?

- In GHG inventories, it is whatever fits in a unique, mutually exclusive box...
  - ❑ Enteric CH<sub>4</sub> emissions from rumination
  - ❑ N<sub>2</sub>O emissions from fertilizing crops and pastures
  - ❑ CH<sub>4</sub> and N<sub>2</sub>O emissions from manure decomposition

Clearly, this is not a complete picture of agriculture nor of agricultural emissions.



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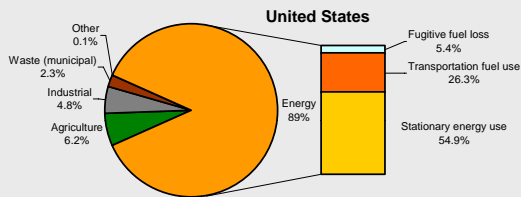
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### What is agriculture's real share of GHG emissions?



2008 GHG Inventory



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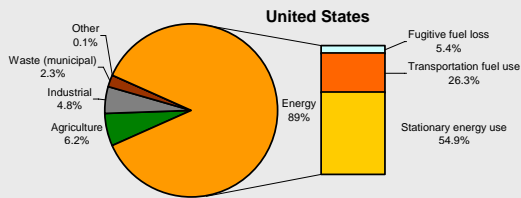
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### How to divvy up the energy GHG?



Environment Canada lists Ag's stationary energy use emissions at 2.2 metric tons out of 335 in the category...  
Could estimate farm tractors' share of off-road diesel use...  
But, the problem is... *"What's missing from the pie?"*

2008 GHG Inventory



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### What about the sinks?!

- GHG inventory emission numbers dwell on source emissions
  - Under Kyoto Protocol, countries are to report GHG emissions in their inventory reports
- Easy to overlook carbon sequestration
  - Significant removal of CO<sub>2</sub> from the atmosphere by plants
- U.S. and Canada also report net emissions; 'Land Use, Land Use Change, and Forestry'
  - Afforestation and deforestation
  - Cropland management



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### Making Fair Comparisons

- Can be challenging, but it is essential
- It's why life-cycle assessments must be critiqued for their assumptions and selection of boundaries



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### Take-Home Points

- Useful data can be abused
  - Lose sight of the context of the data
- Major challenges exist in making good GHG assessments and comparisons
  - Completeness vs. difficulty (assumptions)
  - Apples-to-apples comparison ↔ complete Eval.
- Trends in data help show that agriculture can capitalize on improved efficiencies
  - Should be true across production systems



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