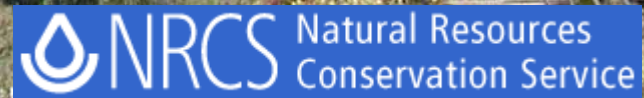


Greenhouse Gases and Carbon Sequestration: Agricultural Connections, and the USDA-NRCS

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Agriculture and Greenhouse Gases

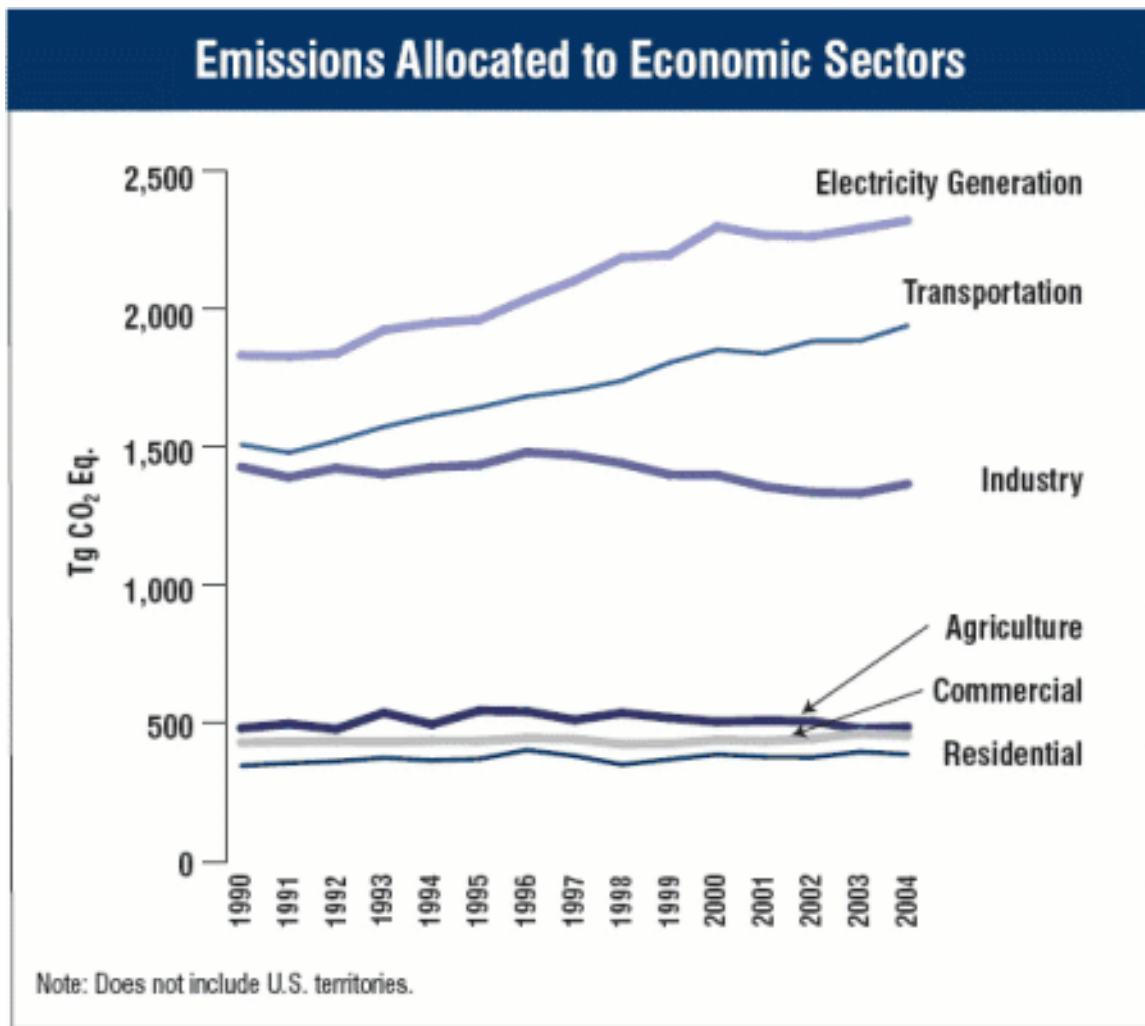
***Part of the Problem, A good part
of the Solution***





Principal Greenhouse Gases (GHGs) with Agricultural Connections

- Water Vapor (up to 70% of total greenhouse effect)
- Carbon Dioxide (CO₂)
- Nitrous Oxide (N₂O)
- Methane (CH₄)

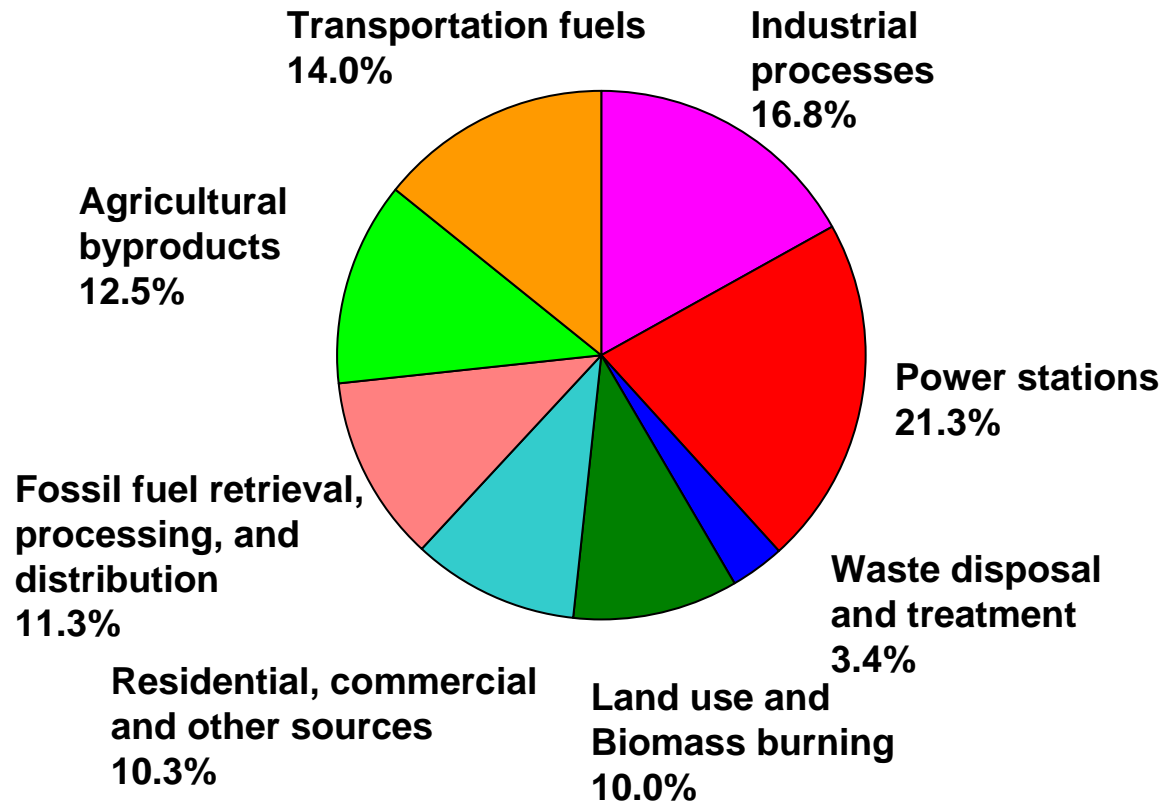


Total U.S. GHG Emissions (2004): 7074 Tg CO₂ Eq.

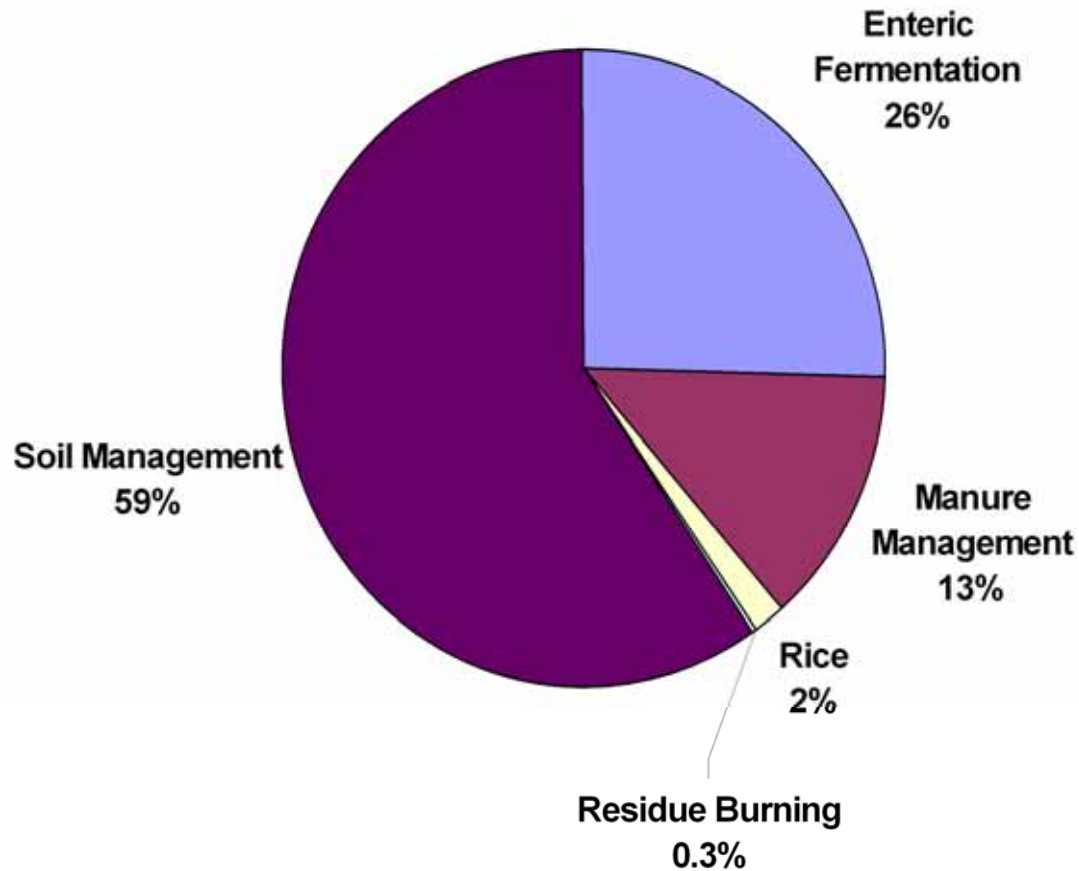
Total U.S. Agricultural GHG Emissions: 440.1 Tg CO₂ Eq.* (6%)

*Note: This value does not include ag-CO₂ emissions, emissions from liming, or residue burning

Annual Greenhouse Gas Emissions by Sector



Agricultural GHG Emissions- Inventory Categories



GHGs: Temporal Changes and Radiative Forcing

- CO₂: 280 (pre-industrial) to 380 ppm now; RF=1
- N₂O: 270 to 320 ppm; RF=296
- CH₄: 715 to 1775 ppm (growth rate declining); RF=23

Trends in Agricultural GHGs

Total U.S. Emissions Up 16% Since 1990

Agricultural Emissions 6% of the U.S. Total; Up 0.1%

CH₄ Up 2%; N₂O Down 1%

- Soil Management
 - N₂O Down 1.7%
- Enteric Fermentation
 - CH₄ Down 4.5%
- Manure Management
 - CH₄ Up 26.4%
 - N₂O Up 8.8%
- Rice
 - CH₄ Up 6.2%
- Residue Burning
 - CH₄ Up 27.2%
 - N₂O Up 38.5%
- Organic Soils:
 - CO₂ Up 1%
- Liming
 - CO₂ Down 15%
- Residue Burning
 - CO₂ Up 27%
- Mineral Soil C Sequestration Rate
 - Down 7%

Greenhouse Gases and Ag

CO₂ (GWP=1)

- Fossil Fuels
- NH₃ Production
- Lime Manufacture
- May be Sequestered in Soils

N₂O (GWP=296)

- Ag Soil Management
- Mobile Sources
- Manure Management
- Residue Burning

CH₄ (GWP=23)

- Landfills
- Enteric Fermentation
- Manure Management
- Rice Cultivation
- Residue Burning



Carbon Sequestration

- The capture and storage of carbon in agricultural soils
- Net carbon buildup in soils and biomass
 - Decreasing C emissions
 - Increasing storage of C

GHG “Atmospheric Fertilization” Effect on Agricultural Production

- Enhanced CO₂ can have an impact on plant growth
- Preferential growth changes in some plants versus others
- Free-Air CO₂ Enrichment (FACE) Experiment discerning how CO₂ and other GHG buildups may impact agriculture

Agricultural GHG Quantification

- The measurement or estimation of GHG emissions and sinks
- *Drivers:*
 - Market need (verify, reproduce)—ag is a potential sink, and partner
 - Voluntary registry of GHG emissions and sinks (DOE-EIA's 1605(b) Program)
 - Local to global accounting of GHGs





Agricultural GHG Tools

- Direct measurement
- Estimation methods
 - Process-based models
 - Empirical equations and estimates

Agricultural GHG Tools

- COMET-VR (Carbon Management Evaluation Tool for Voluntary Reporting)
- Developed by Colorado State Univ. and NRCS
- Web-based interface to Century model
- Decision support for agricultural producers, land managers, and other agricultural interests
- Official USDA tool for 1605(b)



COMET-VR

www.cometvr.colostate.edu

USDA United States Department of Agriculture

Contributors

- ▶ USDA
- ▶ USDA GCPO
- ▶ NRCS
- ▶ ARS
- ▶ CSU NREL

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- Easy to use web interface
- Minimum of inputs required
- Currently for cropland and rangeland
- Expanded version incl. agroforestry in summer '07



COMET-VR

www.cometvr.colostate.edu

■ Outputs:

- Net soil carbon change per year over next 10 years
- Includes an uncertainty estimate
- Estimated on-farm fuel (diesel) and nitrogen fertilizer use



USDA-NRCS Incentives

■ CSP

- COMET-VR on-farm scenario testing in 2006—900 producers, \$500 each
- Possible enhancement payment for C seq. and GHG emissions reductions in future CSP


■ EQIP

- Alternatives being discussed

■ Conservation Plans, Practices & Activities

- Conservation tillage, Agroforestry, Nutrient Management, Feed Management, Manure Management, Combined Operations, Biofuels





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