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Greenhouse Gases and Agriculture

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Greenhouse gases (GHG) include an array of naturally occurring and human-synthesized chemical compounds. On a mass basis, each GHG traps a different amount of heat in the atmosphere. Global warming potential (GWP) is a relative measure that standardizes comparisons of heat trapping capacity among different GHGs. GWP compares the amount of heat trapped by a given mass of a specific GHG to an equivalent mass of carbon dioxide (mass CO_2 Eq) over a set period of time, typically 100 years. For example, because nitrous oxide (N_2O) has a GWP of roughly 300, an emission of one metric ton of N_2O has a heat trapping capacity equivalent to an emission of roughly 300 metric tons of CO_2 (1 Mt N_2O = 298 Mt CO_2 Eq) over a period of 100 years.

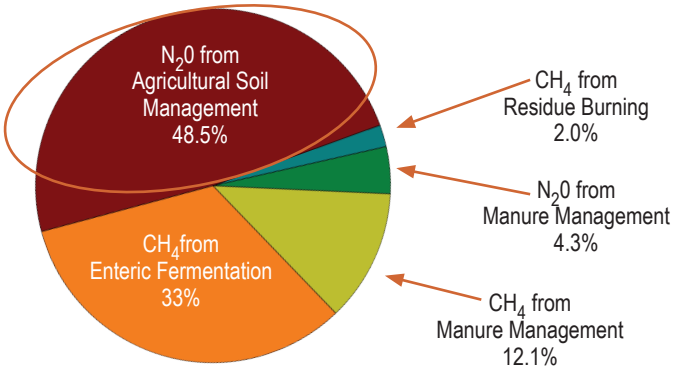
Anthropogenic (human-caused) GHG emissions are dominated by CO_2, N_2O and methane (CH_4). Based on CO_2 Eq, these gases account for approximately 97% of all U.S. anthropogenic GHG emissions. Biological systems dominate CO_2, CH_4, and N_2O production. Agricultural systems, which cover 40-50% of Earth's land surface, are biological and affect production of these gases.

Globally, agriculture directly accounts for 10-12% of total global anthropogenic GHG emissions. However, if land use change associated with agriculture is added to this proportion, agriculture accounts for 17-30% of total global anthropogenic GHG emissions. In the U.S., agricultural GHG emissions account for approximately 8% of total anthropogenic GHG emissions and land use change is neither a significant sink nor source of GHG. N_2O production from agricultural soil management is the major GHG source, which accounts for approximately 50% of total U.S. agricultural GHG emissions.

The Intergovernmental Panel on Climate Change has identified improved agricultural soil management as the most prominent option for technically and economically feasible agricultural GHG mitigation. Recent research has determined that high yields (mass/area) coupled with high nitrogen fertilizer use efficiency (mass crop N uptake/mass N applied) achieve the lowest GHG emissions per unit yield. Management practices and technologies that simultaneously enhance crop yield and nitrogen fertilizer use efficiency will be the most effective mitigation strategies. Accordingly, cropland GHG mitigation objectives are typically cost-effective and consistent with financial goals.

GHG measurement locations

Measuring N_20 at the soil surface



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This presentation was given at the Climate and Corn-based Cropping Systems Coordinated Agricultural Project (CSCAP) 2012 Annual Meeting and updated in 2015. This handout and supplemental video are approved for use in research, education, and extension outlets.

USDA United States Department of Agriculture National Institute of Food and Agriculture

This publication is produced as part of a regional collaborative project supported by the USDA-NIFA, Award No. 2011-68002-30190 "Cropping Systems Coordinated Agricultural Project: Climate Change, Mitigation, and Adaptation in Corn-based Cropping Systems." The 11 institutions comprising the project team include: Iowa State University, Lincoln University, Michigan State University, The Ohio State University, Purdue University, South Dakota State University, University of Illinois, University of Minnesota, University of Missouri, University of Wisconsin, and USDA-ARS Columbus, Ohio.
CSCAP-0113-2012