Ag and Greenhouse Gas Emissions

Key Takeaways

- The Environmental Protection Agency (EPA) provides annual estimates of man-made greenhouse gas (GHG) emissions in the U.S. by emissions source – with agriculture's contribution at just 10% – as well as estimates of the amount of carbon trapped in forest and vegetation soil.
- The largest GHG emission sources by sector are transportation (28%), electric power generation (25%), industrial sector such as iron/steel production or cement production (23%).
- The largest source of U.S. agricultural emissions was agricultural soil management (5% of total US GHG emissions) followed by livestock-related emissions from enteric fermentation and manure management (4% of total US GHG emissions).
- U.S. farmers are producing more food, fibers and renewable fuels for more people while using less land and conserving more natural resources. Per capita agricultural emissions have declined by 15% since 1990, and when agricultural emissions are adjusted by productivity gains, it is estimated aggregate agricultural per-unit emissions have declined by more than 20%.

Background

Over many years, as the international community has sought to learn more about carbon emissions, their sources and impact, agriculture has been part of the conversation — not only in regard to its emissions but in its potential to serve as a "carbon sink." Recent policy discussions on Capitol Hill have renewed interest in this topic. This paper seeks to provide clarity on agriculture's contribution to greenhouse gas emissions and demonstrate how productivity trends and technology adoption are reducing the footprint of agricultural greenhouse gas emissions and increasing sustainability.

The Environmental Protection Agency (EPA) provides annual estimates of man-made greenhouse gas emissions in the U.S. by emissions source, as well as estimates of the amount of carbon trapped in forest and vegetation soil. It is important to highlight U.S. agriculture's minimal contribution to total U.S. emissions is just 10% and to emphasize how productivity gains in crop and livestock production help agriculture reduce per-unit emissions. An equally key takeaway is the impact increased investment in agricultural research can have in helping farmers play a direct role in capturing more carbon in the soils with voluntary and incentive-based practices and markets.

A recent EPA report expressed during 2019, total U.S. emissions from all man-made sources totaled 6.6 billion metric tons in CO2 equivalents. Emissions in 2019 were down 1.7%, or 166 million metric tons, from 2018. Land use, land-use changes and forestry trapped 789 million metric tons of carbon in the soils, representing 12% of total U.S. emissions. Combined, the net greenhouse gas emissions in 2019 totaled 5.8 billion metric tons, down 1.8% from 2018. These estimates put both emissions and net emissions at the third-lowest level in the last 25 years.

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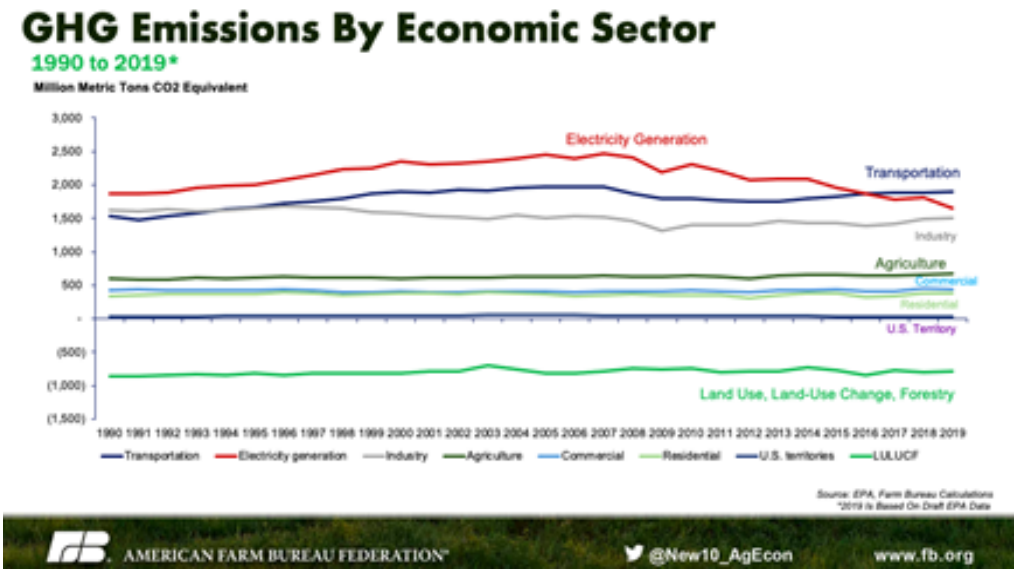
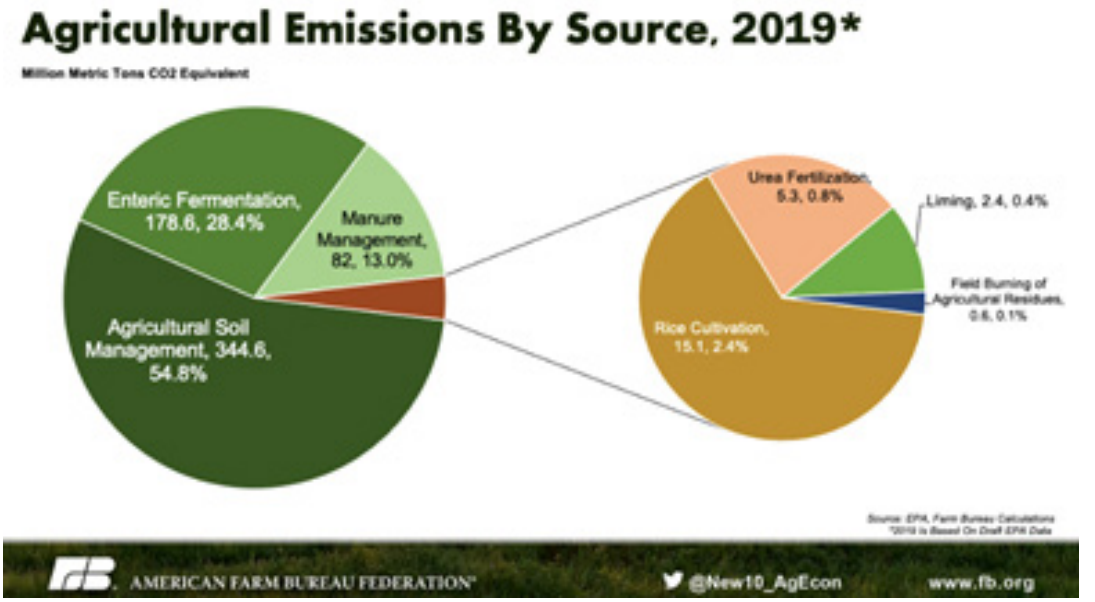


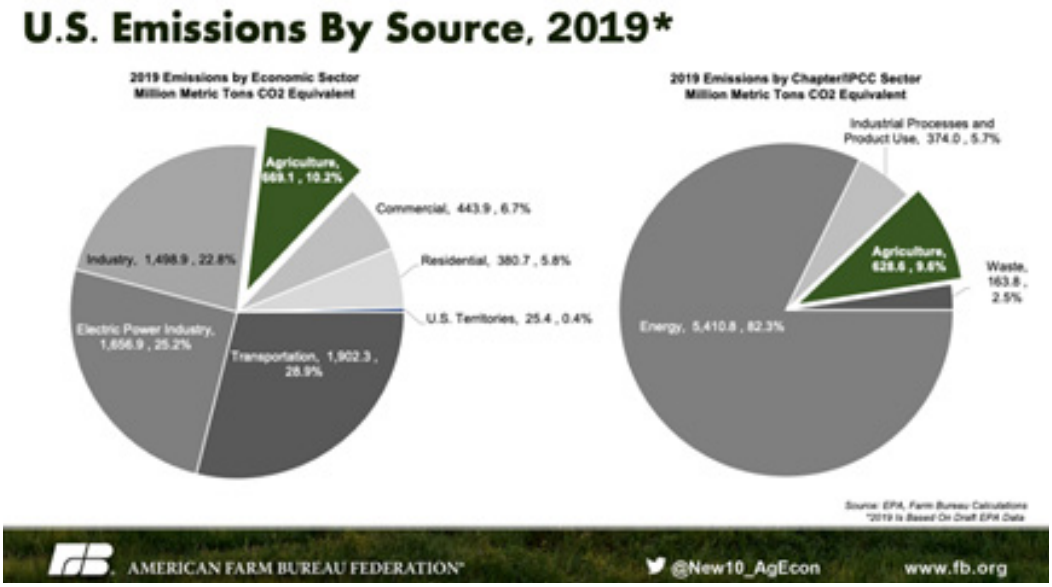
Agricultural Emissions in 2019

The largest source of U.S. agricultural emissions was soil management at 345 million metric tons, only 5% of total U.S. emissions.

Emissions from agriculture totaled 669 million metric tons in CO2 equivalents during 2019, up 1.1%, or 7.5 million metric tons, from the previous year. Based on methodology consistent with the Intergovernmental Panel on Climate Change, U.S. agricultural emissions totaled 629 million metric tons, up 1.2% from 2018. **The largest source of U.S. agricultural emissions was agricultural soil management, e.g., fertilizer applications or tillage practices, at 345 million metric tons, approximately 55% of all agricultural emissions and only 5% of total U.S. emissions.**



Following agricultural soil management, livestock-related emissions from enteric fermentation and manure management contributed 179 million metric tons and 82 million metric tons, respectively, to total U.S. emissions. These two emission sources represented 41% of agricultural emissions, but only 4% of total U.S. emissions. Other agricultural emissions sources include rice cultivation at 15 million metric tons, urea fertilization at 5.3 million metric tons, liming at 2.4 million metric tons and field burning at 0.6 million metric tons. Combined, these categories represented less than 4% of agricultural emissions and 0.4% of U.S. emissions. As a percent of total U.S. emissions, and depending on the estimation methodology, U.S. agriculture represents approximately 10% of total U.S. emissions.



Agricultural Productivity and Emission Trends

Since 1990, U.S. agricultural emissions have increased by 12%. However, when considering agricultural emissions, productivity gains provide an important perspective. For example, through improvements in crop yields, animal nutrition and breeding, compared to 1990, the U.S. is producing 80% more pork (12-billion-pound increase), 79% more corn (6-billion-bushel increase), 51% more milk (75-billion-pound increase) and 20% more beef (4.5 -billion-pound increase).

USDA's Economic Research Service estimates indices of farm output, input and total factor productivity (Agricultural Productivity in the U.S.). Compared to 1990, the U.S. is producing 43% more food and agricultural products, while largely using the same amount of inputs, like fertilizer. During the same time, the United States lost more than 30 million acres of cropland. Moreover, when you consider the U.S. population has increased by 31%, or 79 million people, U.S. agriculture has more mouths to feed than ever before. **Put simply, U.S. farmers are producing more food, fibers and renewable fuels for more people while using less land and conserving more natural resources.**

When taking these productivity trends into consideration, we flip the 12% increase in total U.S. agricultural emissions since 1990 on its head. Per capita agricultural emissions have declined by 15% since 1990, and when agricultural emissions are adjusted by productivity gains, it is estimated aggregate agricultural per-unit emissions have declined by more than 20%.

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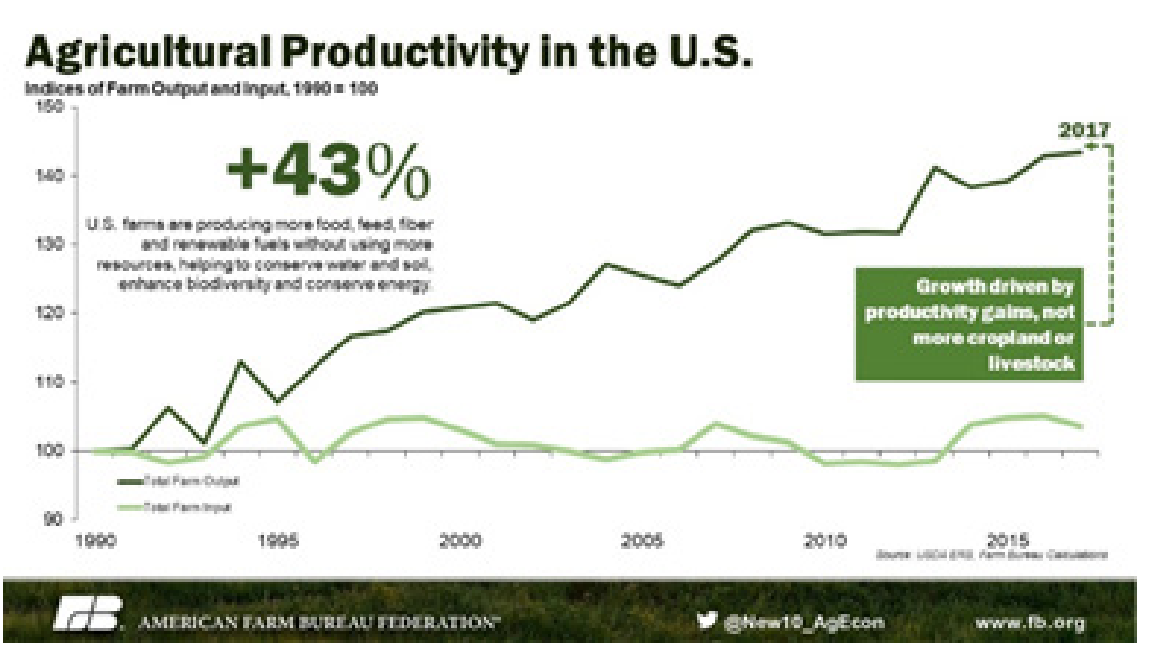


There are two primary sources of agricultural-related greenhouse gas emissions: crop cultivation and livestock production. Since 1990, crop cultivation has represented 50 percent of agriculture-related greenhouse gas emissions while livestock production has represented approximately 42 percent of agriculture-related greenhouse gas emissions. Of livestock-related emissions, in recent years approximately two-thirds of emissions have been related to methane emissions from enteric fermentation.

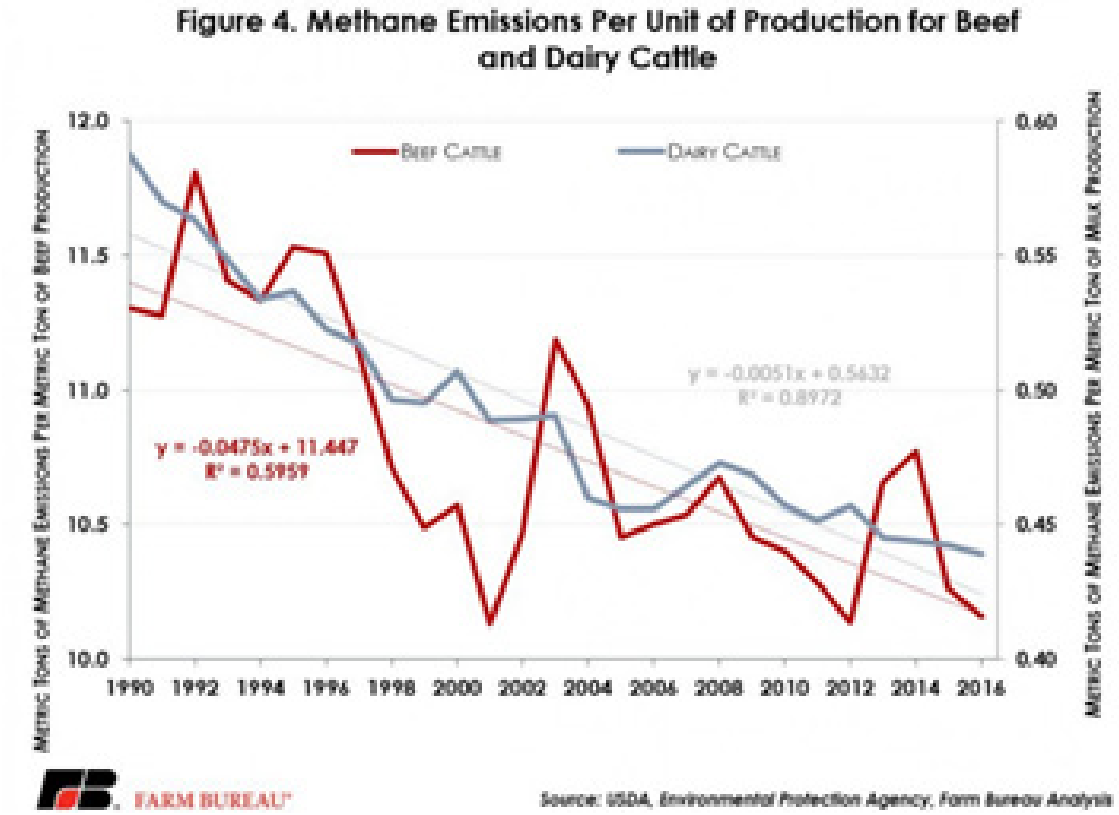
As a percent of total U.S. greenhouse gas emissions, methane emissions represent approximately 10 percent of all emissions and are dwarfed by carbon dioxide, which represents more than 80 percent of all greenhouse gas emissions. Methane does have a larger impact on global warming potential than carbon dioxide, but the half-life in the atmosphere is also significantly lower.

from 1990 to 2016, total methane emissions per unit of beef and milk production declined by 10 percent and 25 percent, respectively.

Methane emissions from ruminant animals, principally cattle and sheep, represent only a quarter of all methane emissions and gross livestock emissions have a very small footprint, representing approximately 3.5 percent of greenhouse gas emissions since 1990. Furthermore, methane from livestock can be turned into an energy source through methane digesters – avoiding the emissions into the atmosphere and producing a renewable energy source.

While emissions from crop and livestock production have remained relatively flat since 1990, once the productivity gains are counted, agriculture has been on a long path to sustainability. **As an example, from 1990 to 2016, total methane emissions per unit of beef and milk production declined by 10 percent and 25 percent, respectively.**

A linear regression of methane emissions per unit of beef and milk production reveals a statistically significant trend demonstrating how the productivity improvements in livestock production are contributing to a lower greenhouse gas intensity footprint, Figure 4.



Summary

During 2019, U.S. emissions from all man-made sources totaled 6.6 billion metric tons in CO2 equivalents, down 1.7% from 2018. When taking into consideration carbon trapped in the soils through forestry, grasslands, wetlands and cropland, U.S. greenhouse gas emissions were reduced by 12% to a net emissions level of 5.8 billion metric tons, down 1.8% from 2018.

Emissions related to agriculture totaled 669 million metric tons during 2019, up 1.1% from the previous year. U.S. agricultural emissions totaled 629 million metric tons in 2019, also up slightly from the prior year. As a percentage of total U.S. emissions, U.S. agriculture represents approximately 10% of emissions, with livestock-related emissions at only 4%.

When factoring in productivity and population gains, however, both per-unit and per capita agricultural emissions are declining. This means U.S. agriculture is producing more food, fibers and renewable fuels for more people while using fewer resources and emitting less carbon.

Increased investment in agricultural research can help develop new cutting-edge plant and animal technologies to capture more carbon in the soil and reduce livestock-related emissions. Voluntary and incentive-based tools will complement these research efforts to ensure while farmers help to achieve climate goals, they also remain economically sustainable.

This paper was adopted from AFBF Market Intel articles which can be found here:
https://www.fb.org/market-intel/previewing-2019-agricultural-emissions
https://www.fb.org/market-intel/agriculture-and-greenhouse-gas-emissions

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