Australia's methane budget

A comprehensive assessment of Australia's methane sources and sinks.

The Australian methane budget assessment for 2010-2019 will enhance our understanding of methane's role in Australia's total greenhouse gas emissions and help guide mitigation approaches for policymakers.

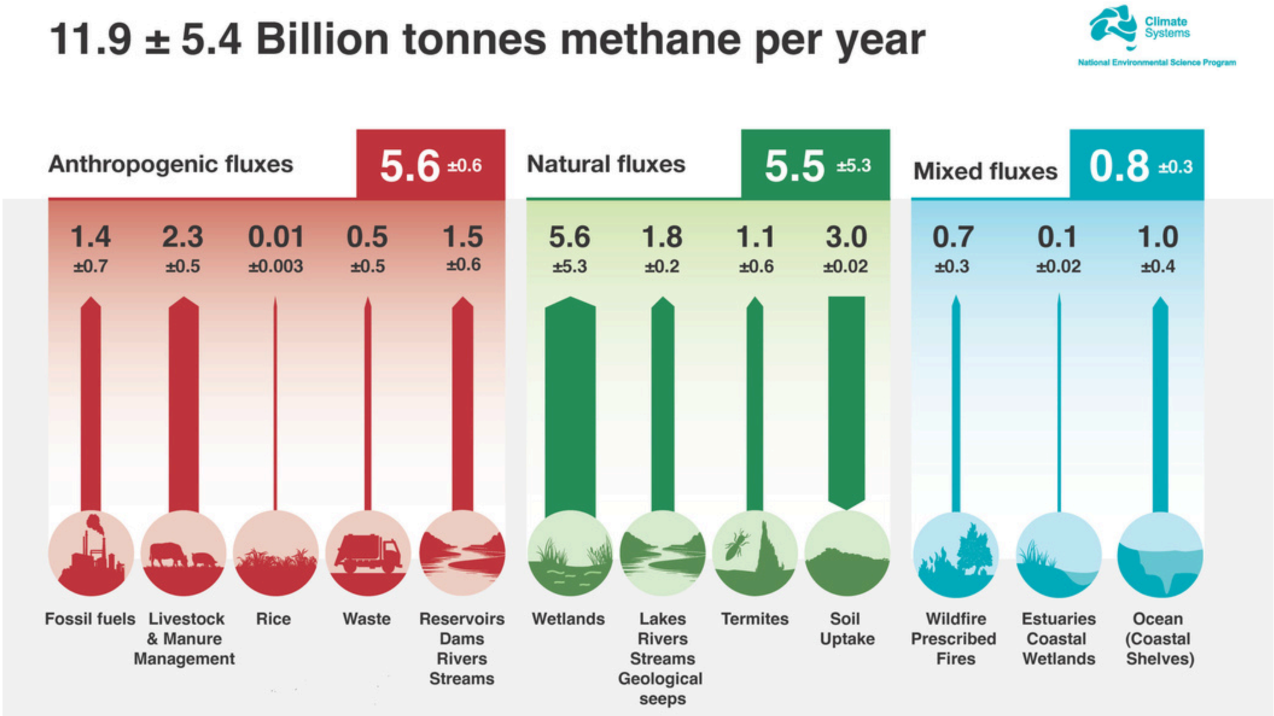

Figure 1: The methane budget for Australia (2010-2019), separated into human-caused and natural sources and sinks. Numbers are the decadal mean annual fluxes with uncertainties based on Villalobos et al. 2025.

Methane, a greenhouse gas more potent than carbon dioxide, is produced both naturally and through human activity. Historically, natural methane emissions have been roughly balanced by the rate at which methane is broken down in the atmosphere. However, over the past 200 years, human activities have significantly increased methane emissions, and climate change is now also affecting natural sources of methane.

Australia's decadal methane budget (2010 – 2019) showed human activities produced the most net methane emissions, contributing 5.6 billion tonnes each year. The largest natural emitters were wetlands, followed by emissions from lakes, rivers, and streams. As the world warms, bacteria-producing methane in wetlands work more efficiently, resulting in a further increase of methane in the atmosphere.

Livestock and manure together is the largest source of human-driven methane into the atmosphere in Australia, followed by reservoirs, dams and streams, and the fossil fuel industry. Soils act as a methane sink due to methane-consuming bacteria in the soil. However, the largest sink is the atmosphere, which, through chemical reactions, converts methane into carbon dioxide.

This research has also shown that there are difficulties in estimating the fluxes of methane from natural sources, particularly wetlands in Australia, which are often temporary and highly dynamic over time. Reducing these uncertainties is essential in understanding the scale of the sources and how they will affect and be affected by climate change.

Why methane matters

Methane is a greenhouse gas that contributes to human-induced climate change. To date, methane emissions from human activities have caused 0.5°C of current warming, which is two-thirds as much as the warming caused by carbon dioxide.

Although methane remains in the atmosphere for a much shorter period compared to carbon dioxide, it has a much higher global warming potential—86 times greater over 20 years. This is because methane absorbs thermal infrared radiation from the sun more efficiently than carbon dioxide, trapping more heat in our atmosphere.

Due to its shorter atmospheric lifespan, methane is highly responsive to changes in emissions. For example, reductions in methane emissions can lower temperatures within a decade. After 30 years, less than 10 percent of methane's warming effect remains, and it mostly disappears within 50 years.

Reducing methane emissions is crucial in lowering the peak temperature at which the climate will stop warming when carbon dioxide reaches net zero. Given methane's high potency in warming and its relatively short atmospheric lifetime, cutting methane emissions is key to quickly reducing the rising global mean temperature.

Warming potential

In the Paris Agreement (under the United Nations Framework Convention on Climate Change), greenhouse gases are compared over a century scale using the Warming Potential 100 (WP100) metric. When evaluating the total warming potential of the three major greenhouse gases—carbon dioxide, methane, and nitrous oxide—methane accounted for 26.4 per cent during the previous full decade (2010-2019).

However, when considering a period of 20 years (WP20) after the release of greenhouse gases, when most warming from methane occurs, methane is responsible for more than half of the total warming potential, making it an even more significant greenhouse gas.

This comparison highlights the distinct roles different greenhouse gases play in stopping global warming. Carbon dioxide must reach net zero emissions, while emissions from other greenhouse gases, particularly methane, need to decrease as much as possible to lower the maximum peak temperature.

While natural methane sources like wetlands can't be reduced, human-driven emissions can. The gas and coal industries can cut fugitive emissions during extraction, processing, and transport, although open coal mines remain a large and difficult source to address. Reduced livestock emissions are possible through food additives and improved manure management, but eliminating them completely is unlikely. Intermittent water flooding of rice paddies reduces emissions while not affecting yields.

References

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