GLOBAL DAIRY PLATFORM

Briefing note

What does Modeling with GWP* mean for the global cattle sector?

Introduction and Summary

The cattle sector (dairy, beef and buffalo) produces milk and meat that provide high-quality nutrition to a growing global population. As is the case with all agricultural sectors, greenhouse gas (GHG) emissions are emitted during the production process. For cattle, the majority of these emissions are in the form of methane. Methodologies that accurately assess the warming (or temperature) impacts of GHGs are critical for informing the sector's mitigation pathways.

Modeling research was recently completed by BC3Research (Spain) to better understand GWP*, a relatively new metric developed by the University of Oxford (UK), Victoria University (NZ) and a number of global experts to measure the warming-equivalent emissions of methane.

This document summarizes recently conducted modeling research to better understand GWP*. The modeling confirmed previous studies that found GWP* provides a more accurate evaluation of the global warming impact of methane than does GWP_{100}. GWP* clearly shows that net zero warming[1] from cattle can be achieved by 2050 (against a 2020 baseline) by consistently reducing global cattle methane emissions by 0.3% annually (9% over the period 2020-2050). GWP* has proven to be an excellent planning and forecasting model for identifying appropriate mitigation actions and should be considered an enhancement to GWP_{100} when assessing mitigation pathways for methane. However, there are limits to its applicability and any potential use as a benchmarking or target-setting instrument at any level less than a global perspective, which is explained later.

1 net zero warming defined as the situation where there will be no additional warming from methane, which is equivalent to ceasing carbon dioxide emissions.

Background

The most commonly used and recommended methodology to measure warming is the Global Warming Potential using a 100-year perspective (GWP_{100}), which assesses the warming effect of a ton of a specific GHG compared to a ton of carbon dioxide, based on the energy added to the climate system over 100 years. GWP_{100} has been in use since 1990, but it's shortcomings in quantifying the warming effect of short-lived climate pollutants (SLCP) such as methane are now being recognized and acknowledged (IPCC *https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_TS.pdf*, page 101).

Carbon dioxide, a long-lived climate pollutant (LLCP), remains in the atmosphere for thousands of years, whereas methane has an atmospheric lifetime of approximately 12 years. GWP* quantifies the warming of current (or projected) methane emissions relative to the change in emissions over the previous 20 years. This serves as the basis for future warming calculations, i.e., the approach takes into account actual methane emissions change over the 20 years, which allows a more accurate warming quantification compared with the static GWP_{100} metric which considers just one year. This means that GWP* is better able measure the dynamic nature of SLCPs like methane.

The metric used to assess the mitigation pathways for different GHGs must be able to accurately asses the temperature impact of those options. Using GWP_{100} to quantify the warming effect of SLCPs can lead to incorrect conclusions regarding emission mitigation options for the livestock sector (which has a mix of SLCPs and LLCPs) and potentially misguided policies.

As detailed in a *literature review* of peer-reviewed research and subsequent modeling detailed in this brief, GWP* has been found to be a better metric to GWP_{100} in predicting future temperature change caused by biogenic methane emissions from the cattle sector.

This document builds on the original literature review by exploring modeling scenarios to better understand GWP*. Topics addressed include:

1) What are the warming contributions from methane emissions from beef and milk production prior to 2020, and what further warming could occur from different future emissions pathways at the global level?
2) How applicable is the methodology in assessing the warming effect from methane at the global level down to the individual farm level, and what are the implications that sector stakeholders should be aware of?
3) Can the methodology help answer questions such as: *What reduction in methane is equal to net zero warming from a global warming perspective?*

Research Findings

Modeling found that there are strengths and limitations with regards to GWP*.

Potential Strengths:

- Cattle's historic contribution to global warming is considerably less than currently reported with GWP_{100}. Since 1981, cumulative cattle methane warming-equivalent emissions are 28-44% lower than if quantified using the GWP_{100} methodology and reporting as carbon equivalents.
- For methane, GWP* demonstrates that globally, net zero warming (no additional warming from cattle production) can be achieved by 2050 (against a base year of 2020) by reducing methane emissions from cattle production at a sustained rate of 0.3% per year. This is equivalent to approximately 9% total reduction in methane emissions from the cattle sector in that period. From this knowledge, it is possible to construct hypothetical scenarios where the cattle sector can even go beyond net zero warming (i.e., declining temperatures) over a range of timelines. Achieving similar outcomes from long-lived gas mitigation would require an active removal of long-lived gases from the atmosphere (also know as negative emissions).
- The methodology can determine historic, current, and near-term methane emission performance of production systems.
- GWP* offers a favorable approach for constructing global pathways that reflect the impacts methane emissions have on temperature over time.
- It's a useful metric to explore "what if?" scenarios and to establish warming equivalency of pathway planning between methane and carbon dioxide and other long-lived GHGs.
- Applying GWP* means that it is possible to express the aggregated global warming effect of SLCPs: "net zero warming" is comparable to "net zero carbon."

Potential Limitations:

- Applying GWP* to quantify the warming effect of current biogenic methane emissions largely reflects emissions from the previous 20 years, since the methodology is based on past emission trends. At a regional or individual producer level, this can cause a "grandparenting effect" in that the results are strongly affected by historical emission trends. This means producers with higher emissions per unit of production may be assessed with a more favorable emissions performance and producers in less developed areas may be constrained from developing their production.

  For example, three farmers with the same methane emissions intensity (CH_4/kg of milk or meat) today who take the same emissions reduction actions towards 2050 can have completely different warming contributions from their methane emissions using GWP*. This is a result of the GWP* approach being reliant on whether the farms historically had growing, stable or decreasing emissions. As a result, the methodology is not appropriate as a benchmarking tool at less than a global level.

Other Points for Consideration

- Based on FAO statistics from 1961-2019, aggregated global methane emissions from the cattle sector has increased, with the highest increases coming from the beef and buffalo sectors, whereas dairy has remained largely constant. It is important to note that during that same time period, meat and milk production increased significantly.
- The global cattle sector is diverse. It is imperative that policy makers understand and consider the different characteristics and implications of GWP_{100} and GWP* in order to make informed decisions (i.e., it is important to use the right metric for the policy question that is being addressed).
- Singling out the cattle sector as the way to quickly reduce both future and previous warming from all atmospheric methane could potentially hinder positive developments of the cattle sector and negatively impact millions of livelihoods and nutritional security across the globe.
- Based on this current assessment, GWP_{100} continues to be best fit for quantifying the carbon footprint of products, while recognizing that it tends to overstate the warming effect of biogenic methane. GWP* adds valuable perspectives on the historic warming effect of biogenic methane from the cattle sector and offers more accurate assessments of pathways towards net zero warming.
- The results of this modeling research are currently being documented for peer review publication.

Funding Partners

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Global Dairy Platform
10255 W. Higgins Road, Suite 820
Rosemont, Illinois, 60018-5616
United States
Phone: +1 847 627 3388
Fax: +1 847 627 3380

Info@GlobalDairyPlatform.com
GlobalDairyPlatform.com

GLOBAL DAIRY PLATFORM