Metrics Fact Sheet

February 2022

The livestock sector's measurement and reporting of climate impacts occur within a larger policy context relating to climate action and sustainable development. The draft FAO LEAP report on methane[1] provides broad based guidance on this topic.

Important context to the key takeaways from the draft FAO LEAP report are the global trends in methane emissions from bovines in the world (Figure 1). From 1961 to 2017, global cattle and buffalo meat production grew by 144% (UN FAOSTAT, 2022), and methane emissions from both manure and enteric sources grew 71% from 1961 to 2019.

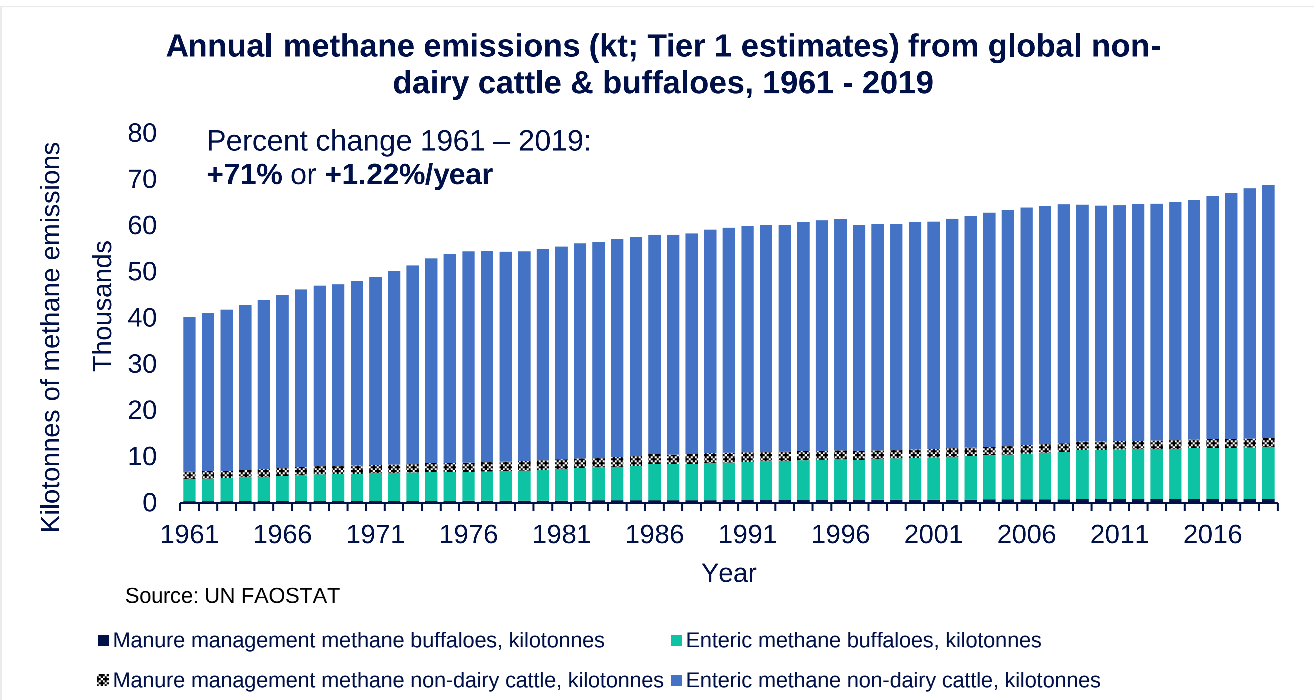

Figure 1. Methane emissions trends from global non-dairy cattle and buffaloes. While reducing methane emissions can help reduce the warming impacts of the global cattle industry, current trends suggest the industry must make significant departures from business-as-usual trends to achieve stable and declining methane emissions in the coming decade.

One of the key objectives of the cattle industry is to produce nutrient dense beef while reducing our environmental impact, particularly with respect to GHG emissions. The aim is to decouple total beef production from total GHG emissions, so that total GHG emissions do not continue to increase as total beef production increases. The higher incremental increase in bovine meat production relative to bovine

[1] **FAO.** 2022. *Methane Emissions in Agriculture – sources, quantification, mitigation and metrics*. Food and Agriculture Organization of the United Nations (FAO), Rome, Italy.

methane emissions of the past several decades highlights that the global beef sector has achieved some decoupling. **However, the sector is not yet able to claim that the warming impacts of the industry are not increasing.** To achieve no additional warming from global beef production, the methane emissions intensity of beef cattle production must lower enough to offset any increases in production. This may be achieved by reducing emissions per head (e.g., increased digestibility of cattle diets, methane inhibitors, etc.), reducing the total cattle required to produce beef via increased efficiency, or a combination of both.

<u>FAO LEAP Recommendations</u>:

- Report greenhouse gas emissions for *individual gases* where possible in addition to any emissions aggregation with a chosen metric (p. 181)
- Distinguish between methane derived from *fossil fuel and biogenic sources* (p. 181)
- The choice of a metric, including its time horizon, should reflect the policy objectives for which the metric is applied (Section 6.2.1; p. 158 -159).

<u>Metric selection process</u> (section 6.5, p.187). Define the following:

- *Your* objective. Appropriate metrics cannot be identified unless the objective (end goal) is clear
- *Existing requirements about metrics* – Does your country have a stated GHG reduction goal? If not, consider completing a sensitivity analysis with several different GHG metrics to understand how different targets and timeframes could impact the beef sector in your country.
- *Timeframe* - When assessing methane, use a pair of metrics, one with a short time horizon (e.g., GWP20 or GWP* with a 20 year horizon) with and one with a long-time horizon (e.g., GWP100) to show the different impacts. This improves transparency as no single-term metric can effectively capture the time-dependency of the impacts. We want to know if any intervention contributes to lower temperatures in the space of a decade. But also want to know if using that metric will inadvertently warm the climate at any point after that.
- *Context and Baseline counterfactual* - Are you interested in the total impacts of a particular emissions scenario, potentially including the impacts of past emissions with current emissions' impacts, and how these combined impacts might relate to an overall climate objective? Or do you only want to assess the potentially avoidable future impacts that will occur due to current emissions? For example, comparing a 'business as usual' scenario with a 'feed additive' scenario.
- *Comparability and transparency* - If other metrics are chosen (e.g., GWP*), also reporting the more common GWP100 metric can improve comparability and transparency, as it is the most commonly used metric.
- *Other considerations* - Any metric that is time sensitive and driven by inventories, such as GWP*, has limited application at a sub-national level and should not be used at an individual farm level because shifts in inventories from one supply chain to another can negate those reduced emissions when viewed from the national or global level. Therefore, system boundaries are an important consideration when selecting a metric to avoid carbon or in this case, leakage of methane's warming impacts.

System Boundaries

For example, if a ranch decides to sell cattle, and lowering its cattle inventory levels and maintains that lower inventory going forward, the individual ranch could potentially claim "climate neutrality" compared to an emissions baseline of twenty years ago depending upon the degree of methane emissions reductions relative to other greenhouse gas emissions emitted from the ranch's activities.

However, if the cattle sold from the ranch were not slaughtered, but rather sold to another ranch, overall methane emissions coming from that country's cattle industry were unlikely to be affected. Indeed, the ranch where the cattle have moved to likely increased its warming impacts if its herd inventory increased leading to no net change in temperature impacts arising from the country's cattle system activities. As this example illustrates, consideration of system boundaries is critical.

System boundaries and leakage of emissions as the example highlights are important whether the choice of metric for methane is GWP*, GWP100, GWP20, CGTP, or any other alternative. But, special consideration should be paid to step-pulse metrics such as GWP* to avoid a potential future state where individual farms or supply chains are simply offloading warming, rather than affecting permanent emissions reductions that can help to hold steady or bring down atmospheric methane concentrations.

Bottom line: Using GWP* for individual farms without accounting for changes within a supply chain can provide misleading conclusions about warming impacts of cattle production at the national or international scale and is not recommended.

Types of Goals and Metrics

The choice of metric should reflect the policy objective or goal set. As the GRSB membership have set several different types of goals the below table provides select examples of appropriate metrics for different goals.

Goal	**Methane Metric**
Emissions Intensity Reduction	GWP100 to calculate CO2e per unit of production (e.g., kg of carcass weight)
Climate Neutrality ƚ	GWP* to calculate an absolute emission total CO2we
Carbon Neutral	N/A to methane (CO_2 only) CO_2 emissions less removals
Net Zero	Metric-weighted anthropogenic GHG emissions less removals[2]
Individual gas reduction target for methane emissions	Monitor individual gas emissions directly, no metric needed

ƚ A climate neutrality goal is applicable at a national or global level but is not suitable to the individual farm level as reductions in inventories on one farm can be offset on a neighboring farm.

Monitoring how we get there

GWP* has a role even for goals that use a different metric, to monitor how we get there. Achieving a target in the future can be done in many ways, but how we get there impacts the climate conversation as it is about cumulative warming over time. This is shown by the area under the curve by using a step-pulse metric like GWP*. Therefore, it may make sense for an emissions intensity reduction goal reporting against GWP100 to be monitored on an annual basis using GWP*.

When using a step-pulse metric like GWP* it is recommended not to use a single year value, but a longer timeseries (e.g., 20 years) to account for historical emissions (p.199).

Net Zero

Cumulative global efforts may be able to achieve net zero warming in the future, but there will always be net emissions associated with food production. It is likely impossible for agriculture achieve net zero when expressed as CO_2e using GWP100, and indeed, most future climate scenarios assume agricultural

[2] Depending on the weighted metric one chooses (e.g., GWP*), Net Zero can = climate neutrality.

GHG emissions do not go to zero. This is reflected in the IPCC Special Report on Global Warming of 1.5°C, where non-CO_2 GHG emissions flatten but continue.[3] To reach this 1.5°C target, net carbon dioxide must go to zero. The non-CO_2 gases are also reduced, but they do not reach zero globally.

A reduction in methane emissions (either from reduced intensity or inventories) where new emissions are balanced by the decay of methane from recent historical emissions, can result in methane-caused climate stabilization.

Reaching and sustaining net zero GHG emissions typically leads to a peak and decline in temperatures when reporting with GWP100 (IPCC, 2021). When organisations make commitments to reduce and/or offset GHG emissions using GWP100, it is unclear what the impact on future radiative forcing and temperatures will be; these will vary over time depending on the specific combination of GHGs emitted.

Net zero GHG emissions defined by CGTP or GWP* imply net zero CO_2 and N_2O emissions and constant (CGTP) or gradually declining (GWP*) emissions of CH_4. The warming resulting from net zero GHG emissions defined with a step-pulse metric approximately corresponds (in terms of radiative forcing and temperature) to reaching net zero CO_2 emissions. As a result, these metrics do not lead to declining temperatures after net zero GHG emissions are achieved, but to an approximate temperature stabilization (p.184).

Cautions:

- A metric that establishes equivalence regarding one key measure of the climate system response to emissions does not imply equivalence regarding other key measures.
- The large difference in lifetimes for CO_2 and CH_4 mean that the pulse emission metrics vary considerably with the **time horizon chosen** {2.3}. Step-pulse metrics (comparing a change in rate of CH_4 emissions with a one-off emission of CO_2) show much less variation with time horizon {6.2.4}.
- A step-pulse metric (GWP*) can be used to calculate an equivalent CO_2 emission time-series which gives a good approximation of the temperature time-series that would result from the original CH_4 emissions time-series {6.2.4}.
- There is no solely scientific basis to determine a time horizon. However certain policy goals such as temperature limits may implicitly suggest specific time horizon ranges are more relevant than others {6.2.6}.
- Climate metrics for CH_4 include the radiative effects of the resulting increases in ozone (and stratospheric water vapour) but not the human health and crop yield effects. These could double the social cost of CH_4 {6.2.8}.[4]

[3] https://www.ipcc.ch/sr15/chapter/spm/spm-c/spm3a/

[4] References are to sections in **FAO.** 2022. *Methane Emissions in Agriculture – sources, quantification, mitigation and metrics*. Food and Agriculture Organization of the United Nations (FAO), Rome, Italy.