Food and Agriculture Organization of the United Nations

METHANE EMISSIONS IN LIVESTOCK AND RICE SYSTEMS: SOURCES, QUANTIFICATION, MITIGATION AND METRICS

SUMMARY OF THE FAO LEAP REPORT

OVERVIEW

Methane is a short-lived gas with an atmospheric lifespan of roughly a decade. According to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, anthropogenic activities currently contribute approximately 0.5 °C to the observed global warming through methane emissions. In agrifood systems, most of these emissions result from microbial processes that occur during the enteric fermentation of ruminant livestock and the anaerobic digestion of animal manure and other organic wastes. Tackling methane levels has been recognized as a pivotal step toward mitigating global warming, and doing so within a relatively short timeframe is of utmost importance.

Efforts to mitigate methane emissions from livestock and rice systems constitute a vital contribution to achieving the objectives of the Global Methane Pledge, an international non-binding initiative signed by over 150 countries. Methane mitigation also stands as an integral part of strategic efforts to cap the global temperature rise below 2 °C and preferably to 1.5 °C above the preindustrial level, aligning with the Paris Agreement and the Sustainable Development Goal 13 on climate action.

CHALLENGES AND SOLUTIONS

The report is produced by the FAO Livestock Environmental Assessment and Performance (LEAP) Partnership. It analyses the sources and sinks of methane in livestock and rice production systems. It also outlines the current technical and innovative approaches for mitigating methane emissions and examines state-of-the-art mitigation strategies across various ruminant systems. The report emphasizes the pressing requirement for further research to identify economically viable methane mitigation solutions. Furthermore, it delves into management practices that enhance the redox potential of soil, effectively curbing methane production and subsequently leading to a reduction in emissions from rice fields.

The reduction of methane emissions is a pivotal element in the FAO Strategy on Climate Change and the FAO Strategic Framework 2022– 2031 founded on better production, better nutrition, a better environment, and a better life. This report contributes to a better environment and supports FAO Member Nations in integrating specific methane mitigation interventions and targets into national climate actions as requested at the First Session of the Sub-Committee on Livestock of the FAO's Committee on Agriculture (COAG). The report has been crafted through a systematic analysis of scientific research worldwide. This report provides valuable insights that policymakers and stakeholders can deploy as a valuable resource to address methane emission challenges and to establish sustainable futures for agrifood systems

FINDINGS AND KEY MESSAGES

The report highlights that:

- Microbial-mediated enteric fermentative processes in ruminant livestock produce about 30 percent of the total anthropogenic methane emissions, while animal manure digestion and rice paddies contribute 4.5 and 8 percent, respectively.
- The majority (90-96 percent) of global methane is degraded by hydroxyl and chlorine radicals in the atmosphere. The soil contributes 4-10 percent to methane degradation and the ocean acts as a minor methane sink.
- Multiple techniques are used to estimate methane emissions in livestock systems, such as gas exchange techniques, headstalls, tracer gas techniques, micrometeorological methods, and measurements collected from aircraft, drones, and satellites.
- Multiple soil management practices can enhance the redox potential of soil, hence suppressing methane production and reducing emissions from rice fields.
- Thirty enteric methane mitigation strategies are evaluated with considerations of their effectiveness, safety, impact on other greenhouse gases, and their economic, regulatory, and societal implications.
- Sustained research and development are essential for devising enteric methane mitigation strategies tailored to local contexts.
- Greenhouse gas emission metrics serve as tools for quantifying the climate impact of emissions. Each metric captures a different quantification of impacts from the emissions, underscoring the importance of precisely formulating the goal to select the most fitting metric or combination of metrics.
- Pulse-emission metrics provide insights into future climate impacts of emission units, referred to as the 'marginal' impacts. In contrast, step-pulse metrics highlight additional information about the 'additional' impacts relative to a specified date.
- As metrics are tools for policymakers, it is vital to use them within the wider context of the Paris Agreement, definitions of climate neutrality, sustainable agriculture and equity considerations.

LIVESTOCK ENVIRONMENTAL ASSESSMENT AND PERFORMANCE (LEAP) PARTNERSHIP

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