



THE ROLE OF THE VETERINARIAN IN MITIGATING ENVIRONMENTAL IMPACTS IN SUSTAINABLE LIVESTOCK PRODUCTION

O PAPEL DO VETERINÁRIO NA MITIGAÇÃO DOS IMPACTOS AMBIENTAIS NA PRODUÇÃO PECUÁRIA SUSTENTÁVEL

EL PAPEL DEL VETERINARIO EN LA MITIGACIÓN DE LOS IMPACTOS AMBIENTALES EN LA PRODUCCIÓN GANADERA SOSTENIBLE



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ABSTRACT

Livestock production plays a strategic role in global food security; however, it is associated with significant environmental impacts, particularly greenhouse gas (GHG) emissions, intensive use of natural resources, and ecosystem degradation. In this context, the veterinarian's role is essential in promoting sustainable animal production by integrating animal health, productive efficiency, and environmental responsibility. This study consists of a qualitative literature review with a descriptive approach, based on scientific articles and institutional reports. A critical analysis was conducted regarding the relationship between productive efficiency, environmental mitigation, and veterinary professional performance. Evidence indicates that interventions in animal health, nutrition, reproductive management, and animal welfare reduce emission intensity per unit of product, improve feed conversion efficiency, and minimize production losses. It is concluded that veterinarians play a strategic and multidisciplinary role in mitigating the environmental impacts of livestock production,

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acting as key agents in the transition toward more efficient and sustainable production systems.

Keywords: Greenhouse Gases. Environmental Impact. Sustainability.

RESUMO

A produção pecuária desempenha um papel estratégico na segurança alimentar global; no entanto, está associada a impactos ambientais significativos, particularmente emissões de gases de efeito estufa (GEE), uso intensivo de recursos naturais e degradação de ecossistemas. Nesse contexto, o papel do médico veterinário é essencial na promoção da produção animal sustentável, integrando saúde animal, eficiência produtiva e responsabilidade ambiental. Este estudo consiste em uma revisão qualitativa da literatura com abordagem descritiva, baseada em artigos científicos e relatórios institucionais. Foi realizada uma análise crítica da relação entre eficiência produtiva, mitigação ambiental e desempenho profissional veterinário. As evidências indicam que intervenções em saúde animal, nutrição, manejo reprodutivo e bem-estar animal reduzem a intensidade de emissões por unidade de produto, melhoram a eficiência de conversão alimentar e minimizam as perdas de produção. Conclui-se que os médicos veterinários desempenham um papel estratégico e multidisciplinar na mitigação dos impactos ambientais da produção pecuária, atuando como agentes-chave na transição para sistemas de produção mais eficientes e sustentáveis.

Palavras-chave: Gases de Efeito Estufa. Impacto Ambiental. Sustentabilidade.

RESUMEN

La producción ganadera desempeña un papel estratégico en la seguridad alimentaria mundial; sin embargo, está asociada a importantes impactos ambientales, en particular las emisiones de gases de efecto invernadero (GEI), el uso intensivo de recursos naturales y la degradación de los ecosistemas. En este contexto, el rol del veterinario es esencial para promover la producción animal sostenible mediante la integración de la salud animal, la eficiencia productiva y la responsabilidad ambiental. Este estudio consiste en una revisión bibliográfica cualitativa con un enfoque descriptivo, basada en artículos científicos e informes institucionales. Se realizó un análisis crítico sobre la relación entre la eficiencia productiva, la mitigación ambiental y el desempeño profesional veterinario. La evidencia indica que las intervenciones en salud animal, nutrición, manejo reproductivo y bienestar animal reducen la intensidad de las emisiones por unidad de producto, mejoran la eficiencia de conversión alimenticia y minimizan las pérdidas de producción. Se concluye que los veterinarios desempeñan un papel estratégico y multidisciplinario en la mitigación de los impactos ambientales de la producción ganadera, actuando como agentes clave en la transición hacia sistemas de producción más eficientes y sostenibles.

Palabras clave: Gases de Efecto Invernadero. Impacto Ambiental. Sostenibilidad.



1 INTRODUCTION

Animal production constitutes one of the pillars of global food security, supplying high biological value protein to billions of people. However, the livestock sector is also associated with significant environmental impacts, including enteric methane emissions, nitrous oxide derived from manure, and intensive land and water use. Agriculture represents a substantial share of global greenhouse gas (GHG) emissions, with livestock production being one of the main contributors within the sector (IPCC, 2022).

The Food and Agriculture Organization of the United Nations (FAO, 2026) estimates that livestock accounts for approximately 14.5% of global anthropogenic GHG emissions. Nevertheless, these impacts vary considerably according to production system, technological level, feed efficiency, and sanitary conditions. More efficient systems exhibit lower emission intensity per unit of product (Herrero *et al.*, 2016).

Qualified technical performance is decisive in this context, as veterinarians professionals responsible for animal health, production management, and sanitary safety play a central role in implementing strategies aimed at reducing the environmental intensity of livestock production. Improvements in productive efficiency can substantially reduce the environmental footprint of animal-derived products (Poore; Nemecek, 2018).

Therefore, understanding the contribution of Veterinary Medicine to livestock sustainability is essential for advancing environmentally responsible production models.

2 METHODOLOGY

This is a literature review, with a qualitative character and a descriptive approach, where scientific articles published between 2008 and 2026 indexed in national and international databases such as SciELO, PubMed, Google Scholar and Capes Journals were considered, in addition to institutional technical reports of internationally recognized organizations, using the following descriptors: "greenhouse gas emissions in livestock", "environmental mitigation strategies", "productive efficiency and sustainability" and the "technical-professional role of the veterinarian in animal production". Articles published in journals were included, as well as official reports from the FAO and the IPCC. Works without peer review and materials without scientific foundation were excluded.

3 DEVELOPMENT

3.1 PRODUCTIVE EFFICIENCY AND EMISSION REDUCTION

Productive efficiency is one of the main determinants of livestock environmental intensity. Systems with improved feed conversion, lower mortality rates, and higher



productivity per animal tend to emit fewer GHGs per unit of product. Improvements in sanitary and nutritional management can significantly reduce global emissions from the sector (Herrero *et al.*, 2016). In extensive and low-technology farms still common in developing countries financial limitations and reduced access to technical assistance may hinder the adoption of more efficient practices. In these contexts, veterinarians act not only as protocol executors but also as technical advisors and agents of innovation diffusion.

The variability among producers is substantial, indicating that targeted technical interventions can significantly reduce environmental footprints without necessarily decreasing production levels (Poore; Nemecek, 2018). In this framework, veterinarians directly contribute to diet formulation, disease control, and improvement of reproductive efficiency.

3.2 NUTRITION AND ENTERIC METHANE MITIGATION

Enteric fermentation is the primary source of methane emissions in ruminant livestock. Nutritional strategies, such as dietary adjustments and the use of feed additives, have been identified as effective mitigation measures. Nutritional interventions can significantly reduce methane emissions without compromising productive performance (Beauchemin *et al.*, 2008). Veterinary involvement in proper nutritional guidance, combined with rumen health monitoring, represents a strategic tool for reducing environmental impact. However, adoption must consider producers' economic realities. Therefore, technical monitoring is essential to evaluate cost-effectiveness and ensure alignment between environmental mitigation and economic viability.

3.3 MANURE MANAGEMENT AND BIOSECURITY

Manure management is an important source of nitrous oxide (N₂O) emissions and may cause soil and water contamination when inadequately handled. Composting and anaerobic biodigestion reduce emissions and enable waste reuse as biofertilizer or renewable energy sources (Symeon *et al.*, 2025). Nevertheless, biodigester implementation faces structural barriers, including high initial investment, maintenance requirements, and limited public incentives in certain regions. Integrated public policies and rural financing programs are therefore decisive for expanding adoption. Veterinarians may also act as technical intermediaries between producers and institutional bodies.

3.4 SUSTAINABLE INTENSIFICATION

Sustainable intensification aims to increase productivity without expanding agricultural land. Optimizing resource use in animal feeding can reduce pressure on natural ecosystems



(Mottet *et al.*, 2017). Veterinarians directly participate in this process through reproductive management, sanitary control, and monitoring of zootechnical indicators. However, intensification must be conducted cautiously to avoid negative externalities, such as increased water demand or compromised animal welfare. Sustainable intensification requires balance among efficiency, environmental responsibility, and economic viability.

3.5 MULTIDISCIPLINARY DIMENSION

Climate solutions in the agricultural sector require integration among science, policy, and productive practice. Veterinary Medicine operates as a technical link between animal production, public health, and environmental sustainability, aligning with the One Health concept (IPCC, 2022).

4 CONCLUSION

Reducing the environmental impact of livestock production does not depend exclusively on large-scale structural changes but also on qualified technical performance within production systems. Veterinarians play a strategic role in emission mitigation, improvement of productive efficiency, and implementation of sustainable practices. The integration of animal health, nutrition, management, and environmental responsibility positions Veterinary Medicine as a central profession in the transition toward more sustainable livestock models. Strengthening this technical role is essential to meet contemporary environmental demands without compromising food security.

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