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Climate change and its Mitigation Strategies in Livestock Production

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Summary:

Livestock is one of the vital components of global food security. Its contribution is particularly significant for marginal landholders, for whom livestock is a specific source of micronutrients, protein, and energy. Ecosystems and the natural resources, where the livestock depends on are significantly impacted by climate change. However, livestock plays a significant contribution to the greenhouse gas emissions. The output of livestock is seriously threatened by climate change. It is anticipated that rising temperatures, changes in the distribution of rainfall, a rise in the frequency of extreme weather events, and the resulting increased heat stress and decreased water availability will have a direct and indirect impact on livestock output and productivity worldwide.

Keywords: Livestock, climate change, greenhouse gas, mitigation strategies.

Climate Change and its Mitigation Strategies:

Climate mitigation strategies in livestock are essential for reducing greenhouse gas (GHG) emissions and adapting to climate change. Extreme weather events like heat waves, droughts, floods, and tropical cyclones are occurring more frequently and with greater intensity due to climate change. It is also making water management issues worse, decreasing agricultural output and food security, raising health risks, destroying vital infrastructure, and disrupting the delivery of essential services like energy, transportation, education, and water and sanitation.

The Climate change impact on livestock production:

Methane and nitrous oxide are the two most significant greenhouse gases produced by animal agriculture. Methane is a gas that contributes to global warming 28 times more than carbon dioxide and is primarily produced by enteric fermentation and storage of manure. The storage of manure and the usage of organic and inorganic fertilizers release nitrous oxide, that has a 265-fold greater potential to cause global warming than carbon dioxide. One common unit used to account for the possibility of global

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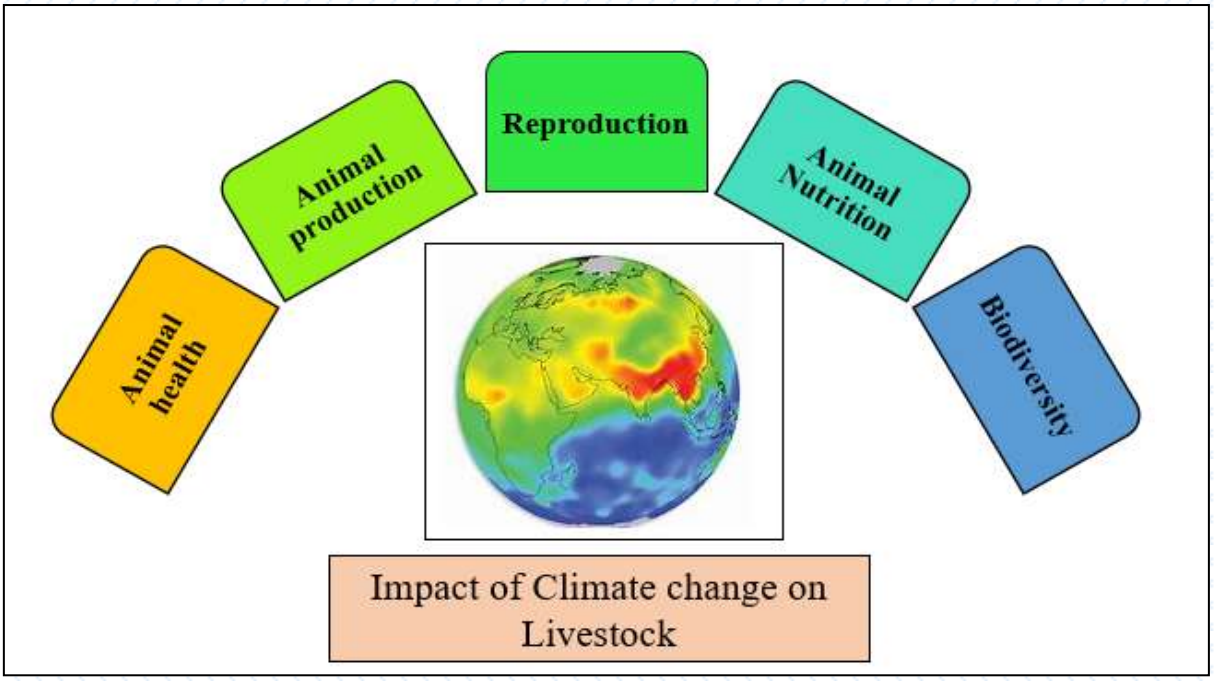
warming is the carbon dioxide equivalent (IPCC, 2013).

- ✓ Grazing systems will encounter the greatest impact due to their dependence on the natural resource base and climate, as well as their limited capacity for adaptability. (Aydinalp and Cresser, 2008).
- ✓ Higher temperatures and altered rainfall patterns can influence the quantity, distribution, and transmission of animal pathogens. Climate change may have major consequences for the increased appearance of livestock diseases. (Baylis and Githeko, 2006).



Both the strategies have frequently been used to deal with climate change:

- Adaptation efforts to modify systems and societies to resist its effects
- Mitigation efforts to reduce or eliminate greenhouse gas emissions from the atmosphere.

Some climate change adaptation and mitigation strategies in livestock are:

1. Improving Productivity and Efficiency:

- ***Better Nutrition:*** Enhancing the nutritional quality of feed can lead to improved livestock health and productivity, thereby reducing methane emissions per unit of product.
- ***Genetic Improvements:*** Selecting for breeds that are more efficient in converting feed into meat or milk can significantly lower emissions. This includes focusing on high-performing animals and considering cross-breeding with heat and disease-resistant breeds.

2. Genetic Markers and Climate Resilience in Livestock:

- Genetic markers play a crucial role in enhancing climate resilience in livestock by enabling the identification and selection of animals that possess traits conducive to surviving and thriving in changing environmental conditions. Genomic selection utilizes genome-wide markers to predict breeding values for complex traits, such as heat tolerance and disease resistance.

3. Manure Management:

- Implementing effective manure management practices can reduce methane emissions from waste. This includes composting and anaerobic digestion, which can also produce biogas as a renewable energy source.
- Implementing anaerobic manure management systems can capture biogas for energy while reducing methane emissions from manure decomposition. This method not only mitigates GHGs but also recovers nutrients such as nitrogen and phosphorus.

4. Adjusting Herd Composition and Size:

- ***Herd Reduction:*** Reducing herd sizes while increasing the productivity of remaining animals can decrease overall emissions. This approach not only mitigates GHG emissions but also enhances economic resilience during adverse conditions like droughts.
- ***Species Diversification:*** Transitioning from traditional cattle to other species that are better adapted to local climates, such as goats or camels, can help maintain productivity while reducing environmental impact.

5. Land Use Management:

- ***Grazing Practices:*** Altering grazing patterns and intensity can improve land health and reduce emissions. Practices such as rotational grazing can enhance soil carbon sequestration and improve pasture quality.
- ***Integration with Crop Production:*** Combining livestock with crop farming (agroecology) can optimize resource use, reduce waste, and enhance ecosystem services.

6. Reducing greenhouse gas (GHG) emissions:

- Incorporating feed additives, such as specific oils and methane inhibitors (e.g., 3-NOP and seaweed), can significantly reduce enteric methane emissions. These additives have shown potential to lower emissions by 20% to 98% without harming animal health or productivity.
- Improving the digestibility of feed, particularly low-quality forage, can decrease the fermentation process that produces methane. Concentrate feeds and high-quality forage can lead to better nutrient absorption and lower emissions per unit of production.
- Utilizing by-products and improving forage quality can also contribute to lower emissions by enhancing the energy efficiency of feed conversion.

7. Resilience to Climate Variability:

- Healthier livestock are better equipped to withstand climate-related stresses such as heat and disease outbreaks exacerbated by climate change. This resilience ensures consistent production levels, which is vital for food security and can help stabilize emissions over time.
- Indigenous livestock breeds have developed over generations to cope with harsh environmental

conditions through various genetic, physiological, and behavioral adaptations. Research is increasingly focused on identifying genetic markers associated with these resilience traits to enhance selective breeding programs aimed at developing livestock better suited for future climate challenges.

8. Climate-Smart Practices:

- ***Precision Feeding:*** Tailoring feed formulations to meet the specific nutritional needs of animals can enhance feed efficiency and reduce methane emissions per unit of product. This approach ensures that livestock receive the right nutrients at the right time, optimizing growth and milk production while minimizing waste.
- ***Water and Shade Provision:*** Providing adequate water and shade for livestock helps mitigate heat stress, improving animal welfare and productivity while reducing the need for more intensive production systems.
- ***Emergency Grazing Areas:*** Maintaining emergency grazing areas can provide critical resources during droughts, helping to sustain livestock without overexploiting pastures.

9. Animal Health and Husbandry Improvements:

- Enhancing overall animal health through better veterinary care and management practices leads to improved productivity and reduced emissions. Healthier animals tend to produce more milk or meat with lower associated methane emissions per unit of product.
- Integrating animal health with environmental and human health through the One Health framework fosters collaboration across sectors. This holistic approach helps address zoonotic diseases and reduces the risk of disease outbreaks that can be exacerbated by climate change.

10. Policy and Economic Incentives:

- Developing policies that promote sustainable livestock practices is crucial for encouraging the adoption of mitigation strategies. These may include financial incentives for farmers who implement environmentally friendly practices or invest in technology that reduces emissions.
- Training in agroecological practices can improve resilience and reduce emissions. Education and capacity building for livestock producers are essential to equip them with the knowledge and skills necessary to adapt to climate change effectively.

Conclusions:

Mitigating climate change in the livestock sector is not only essential for reducing greenhouse gas emissions but also crucial for ensuring food security, enhancing animal welfare, and promoting sustainable agricultural practices. As the global demand for animal products continues to rise, it is imperative to adopt innovative and sustainable approaches that address the challenges posed by climate change while supporting rural livelihoods and enhancing resilience in agricultural communities. Ultimately, a concerted

effort towards sustainable livestock management will contribute to a healthier planet and a more secure future for all.

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