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Climate Change and Livestock Production: The Uneasy Relationship Between Our Plates and the Planet

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Abstract:

When people picture the causes of climate change, they usually imagine smokestacks, tailpipes, and power plants. Few thinks of a grazing cow or a herd of goats. Yet livestock farming — the raising of cattle, buffalo, sheep, goats, pigs, and poultry for meat, milk, eggs, wool, and leather — has quietly become one of the most significant and most debated contributors to global greenhouse gas emissions. Understanding this relationship is essential, not because livestock farming should be vilified, but because it sits at the crossroads of two urgent global needs: feeding a growing population and protecting a warming planet.

How Livestock Contributes to Climate Change:

Estimates of livestock's exact share of global emissions vary depending on the methodology used, but most credible assessments place the figure somewhere between 12 and 20 percent of total human-caused greenhouse gas emissions. The UN Food and Agriculture Organization's widely cited GLEAM model puts livestock supply chains at roughly 14.5 percent of anthropogenic emissions, while other peer-reviewed studies using different accounting methods have estimated figures as high as 16.5 to nearly 20 percent. Regardless of which number one uses, the conclusion is the same: livestock production is a major piece of the climate puzzle, and cattle alone are responsible for close to two-thirds of that footprint.

The emissions come from several distinct sources. The most talked-about is enteric fermentation — the digestive process in cattle, sheep, and other ruminants that produces methane as microbes in their stomachs break down fibrous plant material.

Methane is a far more potent greenhouse gas than carbon dioxide over a short time horizon, which is why even modest reductions in methane output can have an outsized effect on near-term warming.

Beyond digestion, manure management releases both methane and nitrous oxide, land conversion for pasture and feed crops eliminates carbon-storing forests and grasslands, and the fertilizers, machinery, and transportation involved in growing animal feed add their own layer of emissions.

Food Security Meets Environmental Pressure:

It would be a mistake to frame livestock purely as a problem to be eliminated. Animal-sourced foods supply roughly a third of the protein humans consume worldwide, along with micronutrients such as vitamin B12, iron, zinc, and calcium that are harder to obtain from plant sources alone. For hundreds of millions of smallholder farmers and pastoralist communities, particularly across sub-Saharan Africa, South Asia, and parts of Latin America, livestock are not a luxury — they are a primary source of income, nutrition, and resilience against unpredictable weather. Livestock can graze on marginal land unsuitable for crops, convert agricultural byproducts into food, and provide draft power and manure for fertilizer, making them deeply woven into rural economies.

This is why global institutions increasingly frame the challenge not as “eliminating livestock” but as “decoupling growth in production from growth in emissions.”

With global demand for animal products projected to rise significantly by mid-century as populations grow and incomes rise in developing economies, the real policy question becomes how to produce more food from livestock while shrinking its environmental footprint.

The Feedback Loop: How Climate Change Affects Livestock

The relationship runs in both directions. Just as livestock production contributes to climate change, a warming climate is making livestock farming harder. Rising temperatures cause heat stress in animals, reducing milk yields, weight gain, and fertility. Changing rainfall patterns disrupt pasture growth and water availability, while more frequent droughts and floods threaten feed supplies and can trigger mass die-offs. Warmer, wetter conditions in some regions are also expanding the range of livestock diseases and parasites. In this sense, farmers are not just contributors to the problem but among its earliest and most vulnerable victims, caught in a feedback loop where the very system that sustains their livelihood is being destabilized by the changes it helps produce.

Pathways Toward Lower-Emission Livestock Systems:

The encouraging news is that solutions already exist, and many do not require abandoning animal agriculture altogether. Improving the efficiency of production is one of the most powerful levers available: animals that grow faster, produce more milk, or reproduce more reliably generate fewer emissions per kilogram of meat or litre of milk produced, because fewer animals and less feed are needed to meet the same demand. Better veterinary care, improved breeding, and higher-quality feed can all narrow the large productivity gaps that still exist between livestock systems in different parts of the world.

Feed additives are another promising avenue. Certain seaweed-based and synthetic compounds

added to cattle feed have been shown in trials to suppress the microbes responsible for methane production in the rumen, cutting enteric methane emissions substantially without harming the animal. Improved manure management — capturing methane through biodigesters or altering storage conditions — can convert what was once a pure emissions source into a source of renewable biogas energy. On the land side, better grazing management, agroforestry, and rotational pasture systems can help grasslands sequester more carbon in soil, partially offsetting emissions from the animals themselves.

Diet and consumption patterns matter too, though this remains a genuinely contested area among researchers and policymakers. Shifting a portion of global protein consumption toward plant-based or alternative sources in regions where meat consumption is already high could meaningfully reduce demand-driven emissions, while some experts caution that a wholesale shift away from livestock could compromise nutrition security in places where animal-based foods remain irreplaceable.

A Balanced Path Forward:

Climate change and livestock production are not a simple story of villain and victim; they are two systems locked in a complicated, mutually reinforcing relationship. Livestock farming feeds and sustains billions of people, yet it also ranks among the more significant contributors to the emissions driving global warming — a warming that, in turn, threatens the very animals and farmers at the heart of the system. The most realistic path forward blends smarter genetics and breeding, improved feed and health management, better manure and pasture practices, and thoughtful shifts in consumption, rather than relying on any single solution. Getting this balance right will determine whether livestock farming remains a resilient pillar of global food security or becomes an increasingly fragile one in a hotter world.