



## **Brazilian Livestock as Part of the Solution to Climate Change**

**Embrapa's position on the strategic role of tropical livestock in the transition toward sustainable and low-carbon agrifood systems**

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Cattle production is simultaneously the greatest challenge and the main opportunity to reconcile food security with the fulfilment of national commitments to reduce greenhouse gas (GHG) emissions. Meat and milk are healthy, nutritious, and essential foods for human development. Without them, the goal of eradicating hunger worldwide would hardly be achieved (SDG 2). Co-products are equally important for the pharmaceutical and cosmetics industries, clothing, pet nutrition, and many others. Tropical cattle farming can be part of the solution in combating climate change through sustainable, inclusive, and strategic production systems. In Brazil, cattle production is pasture-based, often carried out in areas unsuitable for agriculture, and relies on forages and agro-industrial residues not consumed by humans. Although cattle emit GHGs, tropical pasture-based production systems promote carbon sequestration through the incorporation of organic matter into the soil, mitigating these emissions. They also provide greater efficiency in water use, mostly derived from rainfall. Tropical science has made technologies available, which, combined with the adoption of good agricultural practices, allow balancing agricultural production with social and environmental demands, ensuring income, jobs, and food security for millions of people in Brazil and around the world.

### **Call to Action**

An integrated, strategic, and multilevel approach is essential to consolidate tropical cattle farming as a pillar of environmental sustainability, socioeconomic development, and food security. In this context, we propose:

- Continued technical assistance and impact monitoring to ensure the effectiveness of the Caminho Verde Program (“Green Path” Program), which aims to recover degraded pasture areas or reclaim them to other production purposes. Initiatives that contribute to maintaining pasture productivity after recovery are also crucial to prevent degradation from recurring.
- The expansion of financing for a just transition through public policies and innovative models that facilitate farmers’ access to credit.
- The increase of both the level and predictability of investments in science, technology, and innovation to ensure the long-term sustainable transformation of tropical agriculture, whose contribution to global production of food, fibre, and energy is vital.
- The measurement and recognition of ecosystem services provided by tropical cattle farming within the context of the circular economy, such as increased soil carbon stocks, water regulation, biodiversity maintenance in anthropic areas, landscape value, animal recycling (rendering), the use of manure as organic fertilizer and its potential for biogas production, and many others.
- The promotion of assertive and proactive communication with consumers and “thought leaders”, emphasizing Brazil’s commitment to fight against illegal deforestation and produce low GHG beef and milk through production systems that promote animal welfare, socio-productive inclusion, and the responsible use of natural resources.

## Livestock in the Face of the Climate Emergency

Cattle farming is directly linked to climate change, being both a cause and a victim of its effects. In 2020, agricultural sector emissions accounted for 28.5% of total Brazilian GHG emissions, of which enteric methane represented 57%, with beef production responsible for 89% and dairy for 11% of that total. Furthermore, land-use change (LUC), the country's main emission source (38%), is often associated with the conversion of native vegetation into pastureland. On the other hand, farmers are the most vulnerable to extreme events such as droughts, floods, and changes in rainfall patterns, which directly affect the productivity of crops, pastures, and animals, posing risks to food security, income, and livelihoods.

Nonetheless, cattle farming can play a strategic role in climate change mitigation and adaptation, contributing to UN SDG 13. Studies show that over the past 30 years, new technologies in cattle production have saved the equivalent of 200 million hectares in Brazil. Technologies such as crop-livestock-forest integration (CLFi), the use of cultivars and cattle breeds better adapted to tropical conditions, efficient soil, pasture, and feed management, as well as genetic and reproductive improvements, enable higher productivity, adaptation to climate change, and GHG mitigation. Increasing the average weaning rate, still low in Brazil, could reduce the number of breeding cows required to produce the same number of calves, thus reducing methane emissions and environmental impact.

Therefore, the sustainable transformation of cattle farming necessarily involves the use of science-based practices and technologies, adapted to local realities and aligned with global environmental demands, with participation and support from various actors in the innovation system.

## Brazilian Cattle Farming Can Combine Economic Development With Mitigating Climate Change

Cattle production has great socioeconomic importance and the potential to contribute to achieving national commitments to reduce GHG emissions. Of the more than five million rural properties in Brazil, at least 50% have cattle, occupying an area of approximately 160 million hectares of pasture (20% of the territory), in the six Brazilian biomes. Considering the difference between the current performance (150 kg live weight/ha/year and 6 kg of milk/animal/day) and potential (600 kg live weight/ha/year and 21 kg of milk/animal/day), there is a great opportunity to increase productive efficiency and production without the need to increase the herd. This contributes to reducing the intensity of GHG emissions, i.e., kg CO<sub>2</sub> eq. per kilogram of product produced.

Therefore, it is necessary to accelerate the transition to more efficient systems, with reduced GHG emissions that reconcile employment and income generation, socio-productive inclusion, and the competitiveness of meat and dairy, while respecting cultural distinctions and the specificities of cattle farming practices in Brazil. That is the challenge!

## Pathways to a Sustainable Transition in Brazilian Cattle Farming

The sustainable intensification of cattle farming is essential to reduce its environmental impact. The adoption of good agricultural practices and the use of climate-smart technologies are the basis for achieving this goal, leading to a decrease in production cycles and GHG emissions. Among the recommended practices and technologies, the following stands out: use of bio-inputs in pastures; superior genetics aimed at increasing animal production of meat and milk; diversification of pastures, intercropping of grasses and legumes, and ICLF (Integrated Crop-Livestock-Forestry Systems); use of strategic supplementation and intensive finishing, which can reduce the intensity of methane emissions by 20% to 47%; sanitary practices indicated for each region, within a One Health perspective; reproductive management with particular attention to the cow-calf phase. The cow-calf production phase is responsible for a large part of cattle emissions and for the consumption of almost  $\frac{2}{3}$  of the total energy needed until maturity. Reducing categories that produce GHGs without corresponding productivity is strategic for reducing total herd emissions, including: non-pregnant cows, heifers that are late to reproduce, animals losing weight, and animals with unsatisfactory feed conversion.

Proper pasture management, following guidelines to ideal grazing heights and nutrient needs, is crucial for reducing emission intensity and increasing soil carbon stocks. Well-managed pastures, especially in integrated systems, also exhibit greater water use efficiency for meat production compared to extensive systems, potentially reducing the water footprint of meat by up to 69%. Almost all water consumption in these systems corresponds to so-called "green water," derived exclusively from rainfall. Another strategy is the intercropping of grasses with forage legumes, which, in addition to improving the quality of the animal diet, naturally fixes nitrogen in the soil. This reduces the demand for nitrogen fertilizers and, consequently, the emission of nitrous oxide (N<sub>2</sub>O), an important GHG.

Brazil has approximately 40 million hectares of pastureland with moderate to severe degradation, whose recovery and maintenance are essential to regenerate the soil and increase biomass production, which aligns with UN SDG 15. In addition, they can free up areas for agriculture and forestry, directly contributing to the country's food and energy security, and potentially generating carbon credits. Thus, they strengthen the circular economy and reduce the need for clearing native vegetation, allowing the restoration of environmental liabilities in Legal Reserve and Permanent Preservation areas. With increasing adoption throughout the country, ICLF systems are among the alternatives for recovering degraded pasture areas. These systems exploit synergistic effects between their components, allowing the production of two to three harvests in the same area in a single year. Given this, they promote an increase in soil carbon stock, expand water retention capacity, and strengthen the climate resilience of Brazilian pasture-based cattle farming.

To guide farmers in adopting sustainable practices and low carbon livestock farming, Embrapa has a long history of developing production protocols. The Good Agricultural Practices® (GAP) Program and, more recently, the Low Carbon Beef® (LCB) brand protocol seek to align beef farming with global decarbonization goals.

Despite the numerous practices, technologies, and protocols already available, the transition to low-carbon farming requires strengthening the conditions that facilitate the large-scale adoption of sustainable practices recommended by science. Alignment between legislation and planning instruments of federal, state, and municipal governments is necessary, ensuring coherence between internationally assumed commitments, public policies, and productive reality. The structuring of certification and traceability mechanisms, as well as green credits, based on the new Brazilian Sustainable Taxonomy, should ensure transparency and credibility for the production chain, increasing the competitiveness of Brazilian cattle farming in international markets. These mechanisms can be organized through multi-level alliances, involving farmers associations and representatives, the private sector, financial institutions, research centres, and civil society organizations.

Access to public policies is also fundamental to modernizing the sector, promoting the inclusion of small and medium-sized farmers, and fostering sustainable practices. Key actions include: granting differentiated rural credit; flexibility in the requirements for financial and capital guarantees (e.g. collateral) for granting financing; stimulating the implementation of a rural microcredit policy with an increasing loan ceiling based on repayment history; investments in research, green infrastructure, and nature-based solutions; regulation of the carbon market; and incentives such as payment for ecosystem services.

Continuous and high-quality education and technical assistance through rural extension are essential for the sustainable transition of cattle farming, allowing farmers to have their actions recognized and valued. Communication is also fundamental for a qualified debate and democratization of information, both in rural areas and in cities, where most consumers and those responsible for public policies live.

Finally, the challenges associated with characterizing tropical production systems in different biomes are multiple and stem both from the limitations of IPCC methodologies and the inherent complexity of the Brazilian context, which are still poorly equipped to capture the peculiarities of these systems, especially carbon removal in integrated crop-livestock-forestry systems (ICLFS). In the last decade, investments in research and development aimed at expanding and improving the impacts of policies, such as the ABC+ Plan, have not had the volume and consistency to ensure permanent advances in accurate modelling of local climate scenarios. The lack of updated official data also imposes limitations on science to support the planning and implementation of strategies that lead to the fulfilment of Brazil's Nationally Determined Contributions (NDCs). Therefore, it is necessary to prioritize actions to support scientific research, which ultimately informs decision-makers at various levels, from farmers to public policy makers.

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## **Our Invitation to Reflection**

Tropical cattle farming is diverse and complex. There is no one-fits-all solution. Thus, simplifications of its nature will lead to partial, hasty solutions that lack relevance to the reality faced by the majority of Brazilian farmers. It needs to be addressed systemically, based on scientific evidence, differentiating production systems in terms of carbon balance, and considering their socioeconomic importance and their role in global food security. More than a challenge, tropical cattle farming represents a great opportunity to make Brazil a leader in the sustainable and low-carbon transition. The time to act is now!

Note: To consult the supporting bibliography and data cited in this Position Paper, access the QR code to the side.

