

Sustainable Intensification in Brazil: Advancing Resilient and Regenerative Agri-Food Systems

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CHAPTER 1

Background and Purpose

Held at the Mosaic Company offices in São Paulo just days before the official start of COP30, the IFA roundtable brought together Brazilian and international experts to explore how Brazil's experience with sustainable intensification (SI) can inform a more integrated global climate and food systems agenda. The event examined the opportunities and trade-offs of Brazil's agricultural trajectory, the enabling roles of policy, innovation, and finance, and the conditions needed to embed sustainable land use, nature protection, and inclusive rural development into COP30 outcomes and future climate negotiations, building on insights from IFA's high-level SI dialogue at Climate Week NYC 2025.

Participants

Participants included the two co-hosts, **Eduardo Monteiro** (Country Manager Brazil, The Mosaic Company) and **Alzbeta Klein** (CEO/Director General, International Fertilizer Association) who also moderated the event; keynote speaker **Marcos Jank** (Senior Professor of Global Agribusiness, INSPER); **José Carlos Polidoro** (Strategic Programs Advisor, Ministério da Agricultura), **André Guimarães** (President, IPAM – Amazon Environmental Research Institute), **Mirela Sandrini** (Interim Executive Director, WRI Brazil) and **Guilherme Bastos Filho** (Coordinator, FGV Agro); **Eduardo Monteiro**, **Marcio Santos** (CEO, Bayer Brasil), **Marcelo Altieri** (President, Yara Brasil), **Mario Ferreira** (Head of Wholesale, Rabobank Brasil) **Laura Antoniazzi** (Agriculture & Sustainability Specialist, Agroicone); and concluding remarks by **Marcelo Brito** (Special Envoy to COP30 for Amazon subnational governments and Executive Secretary of the Brazilian Amazonian States Consortium).

CHAPTER 2

Outcomes

The Technology Adoption Advantage

Brazilian agriculture is characterized by an exceptional propensity to adopt new technologies. Multiple cropping seasons, with often two and, in some irrigated systems, three harvests per year, allow farmers to test them, learn, and iterate at a pace that is not feasible in most temperate regions. Often operating in high-risk environments with limited safety nets, farmers have strong incentives to professionalize and rapidly adopt innovations that reduce uncertainty and increase efficiency. This dynamic is reinforced by cooperatives, private extension services, and an increasingly mature ag-tech ecosystem that together facilitate the uptake of precision agriculture, digital tools, bio-inputs, and climate-smart practices well beyond the largest operations.

Public R&D as a Foundation

Brazil's agricultural transformation was repeatedly attributed to sustained public investment in research and development, notably through Embrapa, as well as through universities and public extension systems. This public science system provides the technological foundation for modern tropical agriculture. At the same time, a persistent "valley of innovation" was acknowledged between research outputs and market-ready solutions that achieve scale. New institutional models, including Embrapa's Center of Excellence in Fertilizer and Plant Nutrition, are being designed to bridge this gap by strengthening public-private collaboration, accelerating technology transfer, and focusing innovation on critical bottlenecks such as soil health, optimized nutrient management, and integrated production systems.

The Soil Health Imperative

Brazil's productivity gains in the Cerrado and other regions have depended on correcting naturally poor, acidic soils through large-scale liming and the use of fertilizers. However, the emphasis to date has been overwhelmingly on the added value of mineral fertilizer-based fertility, with biological and structural aspects of the soils receiving comparatively little attention. With roughly 165 million hectares under pasture, a significant share of which is degraded or underutilized, soil restoration is now seen as central to both productivity and climate objectives. Bio-inputs are also emerging as a strategic solution, supported by regulatory frameworks and national initiatives that promote biological products, more efficient fertilizer use, and the conversion of degraded pastures into diversified, low-carbon crop-livestock-forest systems.

Geopolitics of Inputs

Brazil's heavy reliance on imported fertilizers, which cover around 85 percent of domestic demand and are sourced largely from Russia and China, has been identified as a strategic vulnerability with geopolitical implications. Inputs move from Eurasian suppliers to Brazil's interior, enabling high-yield commodity production that is then exported back to global markets, especially in Asia, creating a tightly interconnected supply chain. This configuration

exposes Brazil to external shocks, including sanctions and supply disruptions, particularly in key nutrients such as potash. In response, the “National Fertilizer Plan” and associated industrial policies aim to gradually expand domestic fertilizer production capacity, diversify suppliers, and address logistical constraints in ports and internal transport systems to safeguard the sector’s long-term resilience.

Nature as Infrastructure

Nature is recognized as a productive asset. Evidence presented during the discussions shows that proximity to native vegetation can generate measurable yield gains, primarily through improved moisture regulation, pollination, natural pest control, and microclimate moderation, particularly in rain-fed systems. At the same time, rising temperatures and changing rainfall patterns are already eroding yields in key producing regions. The Brazilian Forest Code, which mandates the conservation of significant portions of private land as native vegetation, positions the country uniquely but also creates substantial restoration obligations on properties that exceed legal clearing limits. Delivering on these obligations at scale will require robust payment for environmental services, credible valuation of carbon, water, and biodiversity benefits, and financial mechanisms that recognize native vegetation as an indispensable element of sustainable productivity.

The Climate - Agriculture Nexus

Brazilian agriculture stands at the center of the climate challenge, as both a major greenhouse gas emitter and a potential solution provider. The expansion of agricultural land, as well as methane and nitrous oxide emissions from agriculture, contribute to Brazil’s mitigation burden. At the same time, climate impacts, including temperature increases, altered rainfall patterns, and heightened climate variability, are already affecting production. To address these challenges, Brazil has deployed over 30 million hectares of low-carbon systems, including no-till, integrated crop–livestock systems and permanent soil cover, and is rapidly scaling the use of biological inputs. These efforts are directly linked to the country’s climate commitments and underscore Brazil’s potential to act as a global reference for climate-smart intensification and large-scale carbon sequestration in soils and landscapes.

Finance as Enabler and Barrier

Financial flows are emerging as a decisive factor in determining whether sustainable intensification remains marginal or becomes mainstream. Emerging financial instruments in Brazil, such as credit lines with preferential rates for farmers who commit to avoiding further legal deforestation and long-tenor loans of up to twenty years for restoration or pasture conversion, demonstrate the potential to realign incentives. Scaling these approaches will require closer integration of innovative finance with public policies, and more systematic incorporation of environmental performance into risk assessment.

The Smallholder Challenge

Brazil’s global leadership in agricultural productivity and innovation is rooted mainly in large-scale, capital-intensive farming systems. Small farmers often face challenges related to water access, infrastructure, technology, mechanization, and market access. Enabling these producers

to engage in sustainable intensification will require dedicated strategies, including technologies adapted to small-scale contexts, appropriate mechanization solutions, and differentiated extension models. Emerging programs address these issues, but a more systematic effort is needed to ensure that Brazil's transition is both high-performing and inclusive.

Sustainable Intensification in the Tropics: Brazil's Blueprint for Global Action

Brazil's agriculture demonstrates how science-based, input-intensive, and integrated systems in the tropics can deliver high productivity, significant bioenergy supply, and substantial mitigation potential on a largely fixed land base. While elements of the Brazilian model are being replicated in other Latin American countries with similar biophysical and structural conditions, many countries in Sub-Saharan Africa and South Asia face more complex constraints, including small farm sizes, weak infrastructure, and institutional challenges. Nevertheless, the principle of sustainable intensification in tropical regions, producing more food and energy while halting deforestation and restoring degraded land, is indispensable for meeting future food and energy demand. Brazil is well-positioned to help articulate and demonstrate this vision, showcasing tropical agriculture as a source of food, energy, and climate security.

Recommendations

1. Consolidate Brazil's technology adoption advantage

Brazil should intentionally leverage farmers' strong appetite for innovation by investing in the "last mile" of technology deployment: high-quality technical assistance, digital advisory tools and cooperative-based extension that can serve both large commercial operations and emerging small and medium farmers. Building on Brazil's multi-cropping advantage and farmers' focus on risk reduction, public and private actors should co-design structured demonstration programs (e.g., on degraded pastures) that shorten the learning cycle from research to on-farm practice.

2. Bridge the "valley of innovation" in public R&D

To fully realize the value of decades of public investment in agricultural research, Brazil should prioritize institutional innovations that connect Embrapa, universities, and state agencies more directly with investors, agtech companies, and producer organizations. Embrapa's Center of Excellence in fertilizer and plant nutrition can serve as a model for public-private platforms that co-finance applied research, incubate market-ready technologies, and provide risk-sharing mechanisms for early adoption at scale.

3. Put soil health at the center of climate and productivity strategies

Given that poor, acidic soils remain a structural weak point in Brazilian agriculture, future policies and investment programs should prioritize soil health as a core national asset. This includes scaling bio-inputs under the new regulatory framework, aligning the National Fertilizer Plan with a clear soil-restoration agenda, and directing public credit and technical assistance toward converting degraded and underused pastures into high-productivity systems.

4. Accelerating regulatory approvals of new technologies in plant nutrition

To mitigate high fertilizer import dependence, Brazil should accelerate the implementation of the National Fertilizer Plan, with an emphasis on domestic production, supply diversification, and logistics upgrades in ports and internal corridors. In parallel, regulators and industry should fast-track the development, registration and dissemination of biologicals, ensuring that Brazil's regulatory environment no longer delays access to innovations already available in other markets.

5. Operationalize nature as productive infrastructure

Recognizing that native vegetation delivers measurable yield, resilience, and climate benefits, Brazil should develop robust methodologies and markets that value environmental services at the farm level. Priority actions include strengthening payment for ecological services schemes, improving carbon and biodiversity measurement tools, and enabling farmers to monetize conservation in ways that complement, rather than compete with, agricultural income. Particular attention is needed for farmers in the Amazon biome who are required to maintain up to 80 percent of their properties under native vegetation.

6. Align financial flows with sustainable intensification

The financial sector should systematically integrate climate and nature criteria into agribusiness lending. Discounted loans linked to zero-conversion commitments, long-tenor credit for restoration, and facilities focused on degraded pasture conversion can function as templates for scaling nature-positive finance. Regulators and banks can reinforce this shift by embedding environmental performance into risk assessment, expanding low-carbon agriculture credit lines.

7. Make smallholder inclusion a strategic pillar

Brazil should elevate the integration of smallholders by tailoring technologies, mechanization, financial products, and extension models to low-capital, risk-exposed farmers and scaling programs that link restoration, family farming, and food security. Lessons from these efforts can inform cooperation with countries in Sub-Saharan Africa and South Asia that face similar structural constraints, positioning Brazilian institutions as partners in inclusive tropical intensification.

8. Position Brazil's tropical agricultural model as a global climate solution

Brazil presents a clear narrative that presents tropical agriculture as a pillar of global food, and energy security, backed by concrete evidence of low-carbon systems, bioenergy contributions, and large-scale restoration potential. This narrative should emphasize that Brazil's model is not a simple "copy-paste" but a toolbox of policies, technologies, and financial instruments that can be adapted to different tropical contexts, while also acknowledging and addressing the remaining challenges of deforestation and inequality.

9. Improve policy coherence and cross-ministerial coordination

Brazil should strengthen coordination across ministries, credit systems, and innovation programs to align them around a shared sustainability vision that combines productivity, nature, and social inclusion. Existing instruments, such as the “Agricultura de Baixo Carbono” plan (Low Carbon Agriculture plan), pasture recovery programs, and initiatives that link restoration with family farming, would benefit from a more integrated governance framework with clear accountability for outcomes.

CHAPTER 3

Priority Actions for National Governments in Tropical Regions

Policy coherence, regulatory clarity, and targeted public investment decide whether innovation reaches farmers and whether conservation becomes economically viable. Therefore, it is recommended that governments:

- Create strong policy coherence across agriculture, environment, climate, finance, and infrastructure portfolios, using inter-ministerial coordination with clear mandates and accountability.
- Invest consistently in agricultural R&D and extension for tropical conditions, prioritizing soil health, climate-resilient systems, integrated crop–livestock–forest approaches, and biological and precision ag solutions.
- Accelerate the development of science-based regulatory frameworks for emerging technologies, especially bio-inputs, so that private investment can follow.
- Continue to include conservation and production at the property and landscape level through clear land-use rules, restoration of degraded land, and practical compliance support.
- Align national strategies and incentive systems, including credit, subsidies, infrastructure, and fiscal policy, around a coherent, sustainable intensification plan that treats ecosystem services as productive infrastructure and contributes to compensating farmers for the public goods they provide.

Priority Actions for Investors and Financial Institutions

By redirecting capital toward sustainable intensification and restoration, the financial sector can transform climate and nature objectives into core business conditions. It is recommended that financial institutions:

- Integrate climate and nature risk into mainstream credit analysis, collateral assessment and pricing, treating deforestation, soil degradation and climate vulnerability as material financial risks.
- Develop products that match transformation horizons, including long-tenor and sustainability-linked instruments that support restoration, pasture recovery, and integrated systems, with tailored structures for smallholders.
- Embed no-deforestation policies, aligned with national laws and global standards, in due diligence and covenants, supported by geospatial and ESG data collection and monitoring.
- Rebalance portfolios toward nature-positive production systems, set explicit portfolio targets for sustainable intensification, and move from niche green products to making environmental performance a standard expectation across agrifood finance.

Priority Actions for Agribusiness, Cooperatives, and Value Chain Companies

Agribusinesses, cooperatives, traders, processors, and retailers connect farmers to inputs, knowledge, finance, and markets, and design sourcing models, contracts, and service offers that

determine whether sustainable intensification becomes the competitive norm. It is recommended that businesses:

- Consider farmers as long-term partners in transformation, combining technical assistance, tailored input packages, and access to finance to support the adoption of soil-friendly practices as well as new technologies and improved fertilizer management practices.
- Embed sustainability in sourcing and procurement policies through precise supplier requirements regarding legal compliance and good agricultural practices, backed by traceability and monitoring systems.
- Strengthen cooperatives and producer organization hubs for technology transfer, aggregation of sustainable products, and delivery of services, with specific approaches designed for smallholders and emerging farmers.
- Use their market power to create demand and recognition for sustainably produced commodities through pricing, long-term contracts, and transparent claims, positioning tropical value chains as part of the global food-climate solution.