Contribution of the Brazilian Academy of Agronomic Science (ABCA) to the 30th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP30)

August, 2025

Presentation

The Brazilian Academy of Agronomic Science (ABCA) is a private, non-profit legal entity composed of Agronomists dedicated to research that generates new fundamental knowledge for agricultural innovation, as well as those who competently transfer knowledge and technologies to producers. ABCA is headquartered in Brasília (DF) and is composed of 100 Full Academicians, trained in Agronomy across various fields of knowledge and specializations, coming from different regions of the country.

ABCA's mission is to stimulate and safeguard the advancement of Agronomic Science in Brazil, with the social responsibility of contributing to development in line with the basic principles of tropical and subtropical agriculture, for the sustainable production of food, fiber, and energy. It also seeks to uphold the prestige of institutions, promote public well-being, and raise society's awareness of the economic, social, and environmental relevance of Agronomic Science.

With this spirit, the Brazilian Academy of Agronomic Science presents its contribution to COP30. The document is structured in two complementary parts: Part I expresses ABCA's institutional vision, positioning agronomic science and the bioeconomy of connections as strategic pillars of a new cycle of tropical, sustainable, and inclusive development; Part II provides a reflection on the Legal Amazon, a synthesis territory of major transformations, to concretely illustrate how this vision can be applied at a territorial scale, articulating science, culture, innovation, and social inclusion.

It is with great satisfaction that we share this document as ABCA's contribution to the discussions that will take place at COP30. The Committee, composed of renowned academicians Alfredo Kingo Homma, José Oswaldo Siqueira, and Maurício Antônio Lopes, worked with great dedication to present something worthy of an Academy of Science, focused on the country's development through knowledge. To them, as well as to the Full Academicians of ABCA who, in Assembly, contributed to and approved the document, we express our recognition for the collective effort in building an Agronomic Science Academy that deeply honors us as it advances along the paths of sustainability, global food security, and, at the same time, consolidates understanding and respect for territorial boundaries.

This document, along with its English version, will be personally delivered, in a solemn session, to Academician Roberto Rodrigues, a member of the COP30 Organizing Committee, for appropriate follow-up.

Evaldo Ferreira Vilela

President of the Brazilian Academy of Agronomic Science – ABCA

XECUTIVE SUMMARY

The 30th United Nations Conference on Climate Change (COP30), to be held in Belém, represents a geopolitical and symbolic milestone of enormous relevance. The Conference is a complex space for international negotiation, intertwining dimensions such as climate, energy, biodiversity, food security, trade, and social development. The integrated analysis of these agendas is essential for the formulation of consistent solutions. In this context, it becomes evident that none of these dimensions can be addressed in isolation: it is necessary to understand their interdependencies in order to build systemic and lasting solutions.

In this spirit, the Brazilian Academy of Agronomic Science (ABCA) presents its contribution to COP30. The document is structured in two complementary parts:

Part I: expresses ABCA's institutional vision, positioning agronomic science and the bioeconomy of connections as strategic pillars of a new cycle of tropical, sustainable, and inclusive development.

Part II: presents a reflective essay on the Legal Amazon, a synthesis territory of major transformations, to concretely illustrate how this vision can be applied on a territorial scale, articulating science, culture, innovation, and social inclusion.

PART I – ABCA'S INSTITUTIONAL VISION

The first part of the document reaffirms agronomic science as critical infrastructure for the future. Its role goes beyond productivity gains; it involves the ability to connect traditional knowledge and advanced technologies, to guide strategic choices in food, energy, and environmental security, and to strengthen Brazil's position in international debates. Key recommendations include:

- Recognize agronomic science as infrastructure for sovereignty and development, supporting stable investments in research and innovation.
- Promote regenerative production systems, with certification, traceability, and inclusion of small producers.
- Strengthen productive sovereignty and global integration, combining science, market intelligence, and scientific diplomacy.
- Implement tropical innovation ecosystems, connecting universities, research centers, companies, and local communities.

The central message is that Brazil must reposition its tropical agriculture as a global strategic asset, capable of proposing integrated solutions for climate, biodiversity, energy, and food.

PART II – THE AMAZON AS A SYNTHESIS TERRITORY

The second part translates this vision into an essay on the Legal Amazon, understood as a testing ground for the major scientific, productive, and social transformations required. The text advocates the construction of a *"Third Nature"* that overcomes the dichotomy between untouched forest and predatory agriculture, creating arrangements that combine environmental restoration, productive inclusion, and economic dynamism. In this context, the Amazon is called upon to play a strategic role in:

- Global climate stability;
- Biodiversity preservation;
- Sustainable production of food, bioenergy, and bio-inputs;

Building new models of development based on innovation, knowledge, and social justice.
At the same time, the document warns that Amazonian challenges—such as deforestation pressure, rural population decline, and labor shortages—demand innovative solutions in mechanization, territorial governance, and social inclusion.

A VIEW ACROSS ALL BIOMES

Although the Amazon is emphasized for its symbolism at COP30, the document highlights that a new cycle of sustainable development must encompass all Brazilian biomes:
Cerrado: essential for water security and food and energy production.
Caatinga: a frontier of innovations for coexistence with semi-arid conditions and desertification risks.
Atlantic Forest: a global reference in ecological restoration and payment for environmental services.
Pantanal: a biodiversity heritage with livestock systems adapted to wetlands.
Pampa: a livestock tradition that can consolidate as a low-carbon model.

Together with the Amazon, these biomes form a diverse and complementary tropical heritage capable of inspiring global solutions for sustainability, food security, and climate resilience.

THE BIOECONOMY OF CONNECTIONS: OVERCOMING REDUCTIONISM

Brazil built its position as an agro-environmental power supported by agronomic science and innovative public policies. This trajectory ensured food security, international competitiveness, and vast areas of preserved native vegetation. However, the challenges of the 21st century—climate crisis, biodiversity loss, territorial inequalities, food insecurity, and geopolitical risks—demand overcoming fragmented and reductionist approaches.

The bioeconomy of connections is proposed as a guiding paradigm, among dozens of existing concepts. It recognizes that development does not arise from isolated production chains, but from the interactions between science, territory, and innovation. This concept values the biological and cultural diversity of the tropics as a strategic asset, capable of structuring productive arrangements that reconcile productivity, conservation, and social inclusion.

The bioeconomy of connections goes beyond replacing fossil inputs or opening specific markets. The challenge is to redesign agri-food and agro-industrial systems so that they are regenerative, circular, and resilient—compatible with today's complexity.

CALL TO ACTION

Brazil has unique conditions to lead a new agenda of tropical development. To do so, it must:

- Consolidate agronomic science as critical innovation infrastructure;

- Activate the bioeconomy of connections as a central axis for public policies, investments, and international cooperation;

Articulate all national biomes as an integrated mosaic of regenerative solutions.

COP30 should be remembered not only as the conference hosted in the Amazon but as the moment when Brazil proposed to the world a new pact between society and nature—founded on science, diversity, and innovation.

PART I

AGRONOMIC SCIENCE AND THE BIOECONOMY OF CONNECTIONS DRIVING A NEW CYCLE OF RESILIENT DEVELOPMENT

The hosting of COP30 in the Brazilian Amazon is both a symbolic milestone and a strategic opportunity. Climate Conferences are, by nature, complex negotiation spaces, shaped by the nexuses that link climate, energy, biodiversity, food security, trade, and social development. In this scenario, it becomes evident that no issue can be addressed in isolation: it is necessary to understand the interdependencies that shape challenges and, from them, build systemic and lasting solutions.

In this context, agronomic science assumes a central role. More than a producer of sectoral knowledge, it emerges as critical infrastructure to help overcome the verticality and reductionism still present in policies and production practices. By integrating diverse knowledge, connecting territories, and incorporating innovation, science provides the necessary elements to guide choices consistent with the magnitude and complexity of contemporary challenges and opportunities.

Thus, Part I of this document presents ABCA's institutional vision for COP30, highlighting how tropical agriculture, founded on science, can contribute to addressing the climate crisis, strengthening biodiversity, ensuring food and energy security, and promoting social inclusion. It is an invitation to reposition Brazilian agriculture as a strategic asset not only for the country but for the world, demonstrating that science and the bioeconomy of connections are keys to transforming global dilemmas into regenerative solutions.

1. INTRODUCTION

The 30th United Nations Conference on Climate Change (COP30) in the Brazilian Amazon represents a geopolitical and symbolic milestone of enormous relevance, placing the tropics at the center of discussions about humanity's future. It is recognition that overcoming global challenges—such as climate change, biodiversity loss, and socioeconomic inequality—requires solutions aligned with the potential of tropical regions (Beardsworth, 2025; Bidone *et al.*, 2025; Leal-Arcas, 2025).

COP30 offers Brazil a historic opportunity to lead a new narrative of development, articulating conservation and productivity, innovation and inclusion, nature and society. To achieve this, it will be necessary to go beyond environmental credentials and present a strategic vision capable of transforming the diversity of Brazilian tropical biomes into platforms of innovation, sustainability, and shared prosperity (Martha & Lopes, 2023).

Although the Amazon symbolizes the centrality of COP30, it is important to recognize that other Brazilian biomes—Cerrado, Atlantic Forest, Caatinga, Pantanal, and Pampa—also represent strategic assets in the climate and biodiversity agenda. Each carries ecological and productive specificities that offer unique solutions for mitigation, adaptation, and regeneration, composing a truly national vision of sustainable development.

In this context, agronomic science assumes a central role as critical infrastructure for building resilient futures. Its integrative nature—connecting traditional knowledge and advanced technologies, science and society, ecosystems and production systems—makes it fundamental to the development of solutions adapted to tropical realities. This potential is reinforced by the ecological and productive diversity of the national biomes, which provide unique conditions for innovation and regeneration.

Tropical agriculture, in turn, must be recognized not merely as an economic sector, but as a vital link between nature and society, responsible for ensuring food security, conserving natural resources, and promoting socioeconomic inclusion. The advance of agriculture throughout the 20th century, though remarkable in terms of productivity, was shaped by a reductionist and linear paradigm that is now insufficient to face the interdependent challenges of the 21st century (Kiers *et al.*, 2008; Rockström *et al.*, 2017; Fearnside & Filho, 2025).

Overcoming these limitations requires a strategic reorientation that positions agronomic science and tropical agriculture as levers of systemic transformation, capable of reorganizing production systems around diversity and resilience in the face of the climate crisis.

2. OVERCOMING PARADIGMS: FROM REDUCTIONISM TO THE BIOECONOMY OF CONNECTIONS

Throughout the 20th century, tropical agriculture advanced based on a reductionist paradigm, characterized by specialization of production systems, linear value chains, and homogenization of practices. This model was decisive in overcoming production deficits and consolidating Brazil as an agricultural power (Conway, 1997; Pingali, 2012; Vieira Filho & Fishlow, 2019; Gasques *et al.*, 2020; Buainain *et al.*, 2024).

However, the challenges of the 21st century—climate change, accelerated biodiversity loss, territorial inequalities, and food insecurity—highlight the limitations of this model. Productive intensification disconnected from regenerative strategies increases the vulnerability of agri-food systems and compromises their ecological and social foundations (HLPE, 2019; Willett et al., 2019; Rockström *et al.*, 2020; John & Babu, 2021; Artaxo, 2020, 2022).

Overcoming such limitations requires abandoning fragmented approaches and adopting a systemic vision, attentive to the interrelationships among ecological, productive, and social dimensions (Folke, 2006; IPBES, 2019; IPCC, 2022). It is from this perspective that the *Bioeconomy of Connections* emerges, among dozens of existing concepts, as a framework that views development as the result of interactions among science, territory, and innovation, rather than the sum of isolated parts (Costa *et al.*, 2022; Amazonia Bioeconomy Connections, 2025).

This approach values the biological and cultural diversity of the tropics as strategic assets, fostering value networks that integrate local knowledge, frontier science, and technological innovation. Beyond replacing fossil inputs or exploring niche markets, the goal is to redesign production chains according to the vocations of biomes and territories, activating synergies among production, conservation, and regeneration (European Commission, 2018; IICA, 2020; Carraresi, 2024; Rao, 2025; Srivastav *et al.*, 2025).

Resilience thus emerges as the central objective of this new paradigm. It is not only about resisting shocks, but about building agri-food and territorial systems capable of learning, adapting, and evolving in the face of uncertainties, balancing productivity, conservation, and social inclusion (OECD, 2025; HLPE-FSN Report, 2025; Libert-Amico & Koloffon, 2025).

3. FROM COMPARATIVE ADVANTAGE TO STRATEGIC ADVANTAGE

The success of Brazilian agribusiness, based on the abundance of natural resources and applied agricultural science, ensured a strong presence in global markets and significant surpluses (Ferreira *et al.*, 2024). However, dependence on low value-added commodities exposes the country to structural vulnerabilities, including geopolitical risks, trade barriers, and environmental pressures (Andrade, 2018; United Nations, 2023; Piegas *et al.*, 2024; Li *et al.*, 2024; Silva & Oliveira, 2025). This configuration limits the generation of value in territories and increases social and regional inequalities (Nkurunziza, 2021; Cardoso *et al.*, 2023).

Overcoming this condition requires repositioning agribusiness as a strategic asset of sovereignty and national security, aligned with the agendas of sustainability, decarbonization, the bioeconomy of connections, and the energy transition (CEBRI, 2022; Lacerda, 2023; Toplicean & Datcu, 2024). Competitiveness can no longer rely only on low costs, but must be grounded in science, technology, territorial governance, and innovation. This repositioning implies:

- Strengthening production chains with decentralized value addition, connected to local bioindustries and differentiated markets (Zhou *et al.*, 2024; Raveloaritiana & Wanger, 2024).

- Encouraging local and cooperative production arrangements, with a focus on including small and medium producers (Dhillon & Moncur, 2023).

- Investing in logistics and digital infrastructure to increase territorial competitiveness (König *et al.*, 2022; Cruz *et al.*, 2024).

- Market intelligence must anticipate trends, identify opportunities, and mitigate risks in a dynamic international environment, supported by scenario observatories and strategic platforms (Hernández-Cruz *et al.*, 2023; Adegbola, 2025; HLPE-FSN Report, 2025; OECD, 2025).

- Commercial diplomacy, in turn, must act assertively in multilateral forums, defending the specificities of sustainable tropical production and preventing unfair trade barriers, while expanding international cooperation in science and technology (Soler, 2021; Han & Si-Si, 2025).

More than isolated competencies, it is from the convergence of science, intelligence, and diplomacy that a systemic strategic advantage can emerge, capable of consolidating Brazil as a proactive leader in sustainable development, productive sovereignty, and geopolitical influence.

4. AMAZON: A KEY BIOME FOR GLOBAL SOLUTIONS

The hosting of COP30 in the Amazon creates a historic opportunity to reposition Brazil as a global leader in sustainability and innovation, with the bioeconomy of connections as its central axis (Beardsworth, 2025; Bidone *et al.*, 2025; Leal-Arcas, 2025). More than a challenge, the Amazon must be recognized as a strategic asset—a territory of extraordinary biological, sociocultural, and climatic diversity, with unique potential to generate transformative solutions in climate security, energy transition, biodiversity valorization, and productive inclusion (ABC, 2008; Nobre & Nobre, 2019; Lopes & Hunt, 2021; Lopes *et al.*, 2023;).

To achieve this, it is essential to overcome views that oppose production and conservation. The real progress lies in activating nexuses between forest, population, science, culture, and economy, structuring sustainable production systems, forest-based value chains, and new models of territorial governance (Homma, 2021, 2022; Garrett *et al.*, 2024).

Amazonian protagonism in the 21st century will not depend on exploiting more resources, but on the ability to inspire new paradigms of coexistence with the forest. Regional biodiversity offers platforms for foods, bio-inputs, pharmaceuticals, cosmetics, and other high value-added sectors (Torres & Cruz, 2023; de Almada-Vilhena, 2024). Rational use of these resources requires robust research, technological innovation, and strengthening of local communities (Nobre & Nobre, 2019; Lopes & Hunt, 2021).

Sustainable intensification of agricultural and livestock production is equally necessary. Extensive cattle ranching must be replaced by more efficient, integrated systems, freeing areas for ecological regeneration and reforestation with fruit species, raw material producers, and timber species of ecological and economic value (Homma, 2022b, 2024; Borges *et al.*, 2025).

Another challenge is the reduction of the rural population and labor shortages, which demand technologies adapted to small producers and simple mechanization solutions with high social impact (Homma, 2022a, 2024).

In this new context, the Amazon should not be seen as an obstacle to development, but as the foundation of a tropical economy of the future, based on knowledge, diversity, and innovation. The articulation between agronomic science, the bioeconomy of connections, and integrated public policies can transform the biome into a central vector of a national project of resilient, inclusive, and genuinely tropical development (Nobre & Nobre, 2019; Lopes & Hunt, 2021).

Although the Amazon concentrates international attention and is the symbolic stage of COP30, it is essential to reaffirm that Brazil's solutions for climate and sustainability are not limited to this biome. The Cerrado, Caatinga, Atlantic Forest, Pantanal, and Pampa are also strategic: each, in its own way, composes a mosaic of opportunities for innovation, conservation, and productive inclusion, whose articulation strengthens Brazil's leadership in the global climate agenda.

5. GREEN REINDUSTRIALIZATION FROM THE TERRITORIES

Brazil needs a new industrial agenda, suited to the uniqueness of a tropical country, capable of translating its biological and cultural diversity into high value-added solutions (Altenburg & Rodrik, 2017; Feijó *et al.*, 2024). This transformation requires more than technology: it requires systemic vision, territorial intelligence, and integration among science, innovation, and public policies (Lacerda, 2023; De Toni & Hitner, 2024).

The bioeconomy of connections provides the conceptual and operational architecture for this reindustrialization. It enables the structuring of new clean, circular, decentralized, and socially inclusive industrial models, grounded in strategic nexuses such as production–conservation–regeneration and science–territory–innovation (Vilela *et al.*, 2019; Cardoso *et al.*, 2023; ISC, 2024).

To reindustrialize in this new cycle means overcoming the historical condition of being a raw material supplier and building tropical production chains with greater technological complexity and value addition. For this, regulatory frameworks, consistent public policies, and innovative financial instruments are needed to connect and expand initiatives already underway in the territories.

This arrangement not only qualifies and makes products more sustainable but also strengthens fairer and more resilient economic relations between producing and consuming countries. In Brazil's case, the biodiversity of the Amazon and other tropical biomes offers concrete points of connection for the development of differentiated production chains with impact across multiple sectors (Strand *et al.*, 2018; Nobre & Nobre, 2019; Lopes & Hunt, 2021).

Transforming this potential into tangible wealth requires a cooperative and systemic approach, ensuring that countries possessing natural resources play a central role in generating the economic, social, and environmental benefits derived from the intelligent management of the connections between human systems and nature.

6. AGRONOMIC SCIENCE AT THE CORE OF THE BIOECONOMY OF CONNECTIONS

Agronomic science was decisive in transforming Brazil into an agro-environmental power. Investment in research, technological innovation, and strategic public policies enabled significant productivity gains, ensured food security, and consolidated competitive chains in the global scenario (Martha Jr. *et al.*, 2012; Vieira Filho & Fishlow, 2019; Gasques *et al.*, 2020; Buainain *et al.*, 2024).

Today, new challenges—climate change, biodiversity loss, food insecurity, and social vulnerabilities—demand that agronomy move beyond productivity and incorporate the systemic resilience of territories as the structural axis of development (Rockström *et al.*, 2020; IPCC, 2022; Sader & Engelke, 2024). The goal is to promote a conservationist, competitive, and knowledge-intensive agriculture, capable of reducing pressure on soil, water, and biodiversity, while strengthening inclusion and prosperity (Lopes, 2022; Chauhan, 2024).

In this process, agronomic science must be consolidated as critical infrastructure for the bioeconomy of connections. This means expanding its scope, integrating environmental regeneration, circularity, digital connectivity, productive inclusion, and climate adaptation, in strong dialogue with traditional knowledge and other fields of science (Lopes, 2019).

The ongoing transition points to the emergence of new profiles of producers, more integrated with digital technologies, attentive to sustainability, and connected to global markets. This shift increases competitiveness and strengthens Brazil's international integration. These producers

combine tradition and modernity, managing bioenergy, food, fibers, and bio-inputs in regenerative ways, while meeting growing demands for decarbonization, traceability, and circularity (Bolfe *et al.*, 2020; Mendes & Viola, 2023).

Demographic renewal in rural areas reinforces this scenario. The greater engagement of young people and new profiles of producers, with technological affinity and socio-environmental commitment, enhances dynamism and strengthens agriculture as a vector of economic and social transformation. This movement indicates that tropical agriculture, historically viewed as a commodity supplier, can become a hub of innovation, entrepreneurship, and territorial regeneration (Lopes, 2019).

To consolidate this new cycle, ABCA understands that agronomic science must advance along three strategic fronts:

- **Proximity to territories** – intensify the co-production of knowledge with farmers, local communities, and traditional peoples, transforming their realities into living laboratories of innovation.

- **Full integration of the bioeconomy of connections** – incorporate principles of sustainability, circularity, and socio-environmental justice into production systems, promoting regenerative models.

- **Scientific and diplomatic protagonism** – position Brazilian tropical agriculture and agronomic science in national and international debates on climate, biodiversity, food, and the energy transition.

By embracing this agenda, agronomic science becomes more than a scientific and technological field; it becomes a strategic pillar of national development. With this vision, ABCA reaffirms its commitment to strengthening agricultural research, supporting the training of new generations of scientists, and consolidating innovation networks anchored in tropical biomes.

Ultimately, this means valuing agronomic science as essential infrastructure, capable of sustaining a national project that is competitive, regenerative, and inclusive. On this basis, Brazil can consolidate itself as a global reference in creating sustainable solutions, rooted in its territories and oriented toward the challenges of the 21st century.

7. CONVERGENCE FOR TRANSFORMATION: ABCA'S RECOMMENDATIONS FOR COP30

Given the magnitude of global challenges and the strategic relevance of the tropics, the Brazilian Academy of Agronomic Science (ABCA) proposes a set of recommendations that reflect its institutional mission: to strengthen agronomic science, enhance tropical agriculture, and promote the bioeconomy of connections as the axis of a new pact for sustainable, inclusive, and regenerative development.

These recommendations, organized into four dimensions, aim to guide public policies, investments, and international cooperation, offering COP30 a concrete, science-based agenda.

7.1. SCIENTIFIC AND TECHNOLOGICAL INFRASTRUCTURE

Recognize agronomic science as critical infrastructure: integrate science and innovation into food, energy, environmental, and economic security strategies.

Ensure stable and long-term investments in R&D: secure continuous funding for tropical research, reducing vulnerabilities and external dependencies.

Strengthen scientific institutions in tropical regions: expand research networks, train qualified human resources, and foster international exchanges.

7.2. TERRITORIAL AND PRODUCTIVE TRANSFORMATION

Position the bioeconomy of connections as a strategic pillar: align biodiversity, science, and culture in territorial production arrangements capable of guiding investments and incentives.

Promote regenerative production systems: support practices that reconcile efficiency, conservation, and inclusion, with financing mechanisms, certification, and traceability.

Create enabling institutional environments: improve regulatory frameworks, expand innovative financial instruments, and strengthen territorial governance.

Implement tropical innovation ecosystems: establish innovation hubs in the biomes, connecting universities, research centers, entrepreneurs, and local communities.

7.3. SOCIAL INCLUSION AND GENERATIONAL RENEWAL

Engage youth and new producer profiles: expand training and access to technologies, strengthening the leadership of new generations in innovation and territorial regeneration.

Reconnect urban populations with tropical agriculture: promote education, communication, and responsible consumption, highlighting the origin of food and sustainable production systems.

7.4. GLOBAL INTEGRATION AND PRODUCTIVE SOVEREIGNTY

Reinforce the resilience of Brazilian agribusiness: diversify markets, reduce dependence on critical inputs, and expand risk and market intelligence.

Broaden the presence of tropical agriculture in international forums: project tropical solutions as global assets, influencing sustainability standards and norms.

Democratize access to and sustainable use of biodiversity: ensure fair benefit-sharing and respect for the rights of traditional communities.

By presenting these recommendations, ABCA reaffirms that Brazil can and must exercise proactive leadership in the global climate debate. COP30 is an opportunity to propose to the world a new pact between society and nature, grounded in science, territorial intelligence, and the regenerative power of life.

As guardian of agronomic scientific thought in Brazil, ABCA assumes the commitment to mobilize research networks, foster the training of new generations of scientists, and articulate science, public policy, and the productive sector. The goal is to transform tropical agriculture into an international reference for regenerative, inclusive, and competitive development.

8. CONCLUSION AND CALL TO ACTION

By hosting COP30 in the Amazon, Brazil has the opportunity to inaugurate a new cycle of sustainable development that must encompass all national biomes. The Cerrado, essential for water security and for food and energy production; the Caatinga, a frontier of innovation for life under semi-arid conditions; the Atlantic Forest, a global reference in ecological restoration and payment for environmental services; the Pantanal, with its unique biodiversity and livestock systems adapted to wetlands; and the Pampa, with its tradition of low-carbon livestock production. Together with the Amazon, these biomes form a diverse and complementary tropical heritage, capable of inspiring global solutions.

Tropical agriculture must be repositioned as a strategic asset of sovereignty and sustainable transformation, no longer seen merely as a commodity supplier. Building the bioeconomy of connections, rooted in territories, can help valorize biodiversity, incorporate cultural diversity as an asset, foster accessible innovation for different productive sectors, and strengthen the nation's capacity to address the climate crisis, food insecurity, and social inequalities.

In this process, agronomic science is the invisible but essential infrastructure that connects traditional knowledge and cutting-edge technologies, nature and society, territories and markets. It is through agronomic science that Brazil can consolidate new productive paradigms and transform its biological and cultural wealth into regenerative, competitive, and inclusive solutions.

In presenting this contribution, ABCA calls on governments, businesses, scientific institutions, local communities, farmers, youth, and civil society to converge efforts to transform proposals into robust public policies, consistent investments, and transformative partnerships.

COP30 must mark the beginning of a national and tropical pact, capable of inspiring other tropical belt countries and positively influencing the global agenda on climate, biodiversity, food security, and energy transition.

Brazil has unique conditions to lead this agenda. It is time to mobilize all territorial intelligence and the creative power of science. ABCA reaffirms its conviction that regenerative and inclusive development is not only possible but inevitable — and that it is up to Brazil to offer the world a new paradigm of coexistence between humanity and nature.

PART II

APPLYING A SYSTEMIC VISION TO THE TERRITORY *BUILDING THE THIRD NATURE OF THE AMAZON*

To give concreteness to the recommendations presented in the first part of this document, ABCA chose to include this reflective and propositional essay on the Legal Amazon. It complements the institutional vision by adding territorial density, thematic diversity, and conceptual provocations that directly resonate with the spirit of COP30. It demonstrates agronomic science's commitment not only to the transformation of production systems but also to the reinvention of ways of living, producing, caring for, and coevolving with nature.

By treating the Legal Amazon as a testing ground for the major scientific, productive, environmental, and social transformations ahead, this text proposes an integrated reading of nature, culture, and innovation. It seeks to translate, into a concrete territory rich with important symbolism, the new paradigm of tropical development sustained by science, territorial intelligence, and the bioeconomy of connections.

It is, therefore, a call to the international community to recognize the Amazon's strategic role in climate stability, in preserving global biodiversity, and in building new development models. At the same time, the vision proposed here should be understood as a paradigm to be extended to all Brazilian biomes, which—with their different challenges, specificities, and opportunities—share historical and ecological nexuses. Articulated within a common strategy, they can support a national project of regenerative, resilient, and inclusive development.

1. INTRODUCTION

The Amazon rainforest, in its plenitude, represents what is conventionally called "First Nature." The areas converted by human action constitute "Second Nature." The current challenge—and civilizational opportunity—lies in building a "Third Nature": a new territorial arrangement that reconciles environmental recovery with productive inclusion and economic dynamism (Vesentini, 1996; Homma, 2024). This transition requires new approaches to the use of already deforested areas, which total about 82 million hectares, or 18% of the Legal Amazon—an area larger than the sum of Brazil's southern states and comparable to countries such as Germany and Japan.

The Third Nature proposal is an invitation to overcome paralyzing dichotomies between conserving and producing, between untouched forest and predatory or illegal agriculture (Instituto..., 2022). It begins with the recognition that the future of the Legal Amazon largely depends on systemic solutions that integrate biodiversity, local knowledge, modern science, and territorial justice. In this sense, it expands the scope of conventional bioeconomy beyond the efficient exploitation of natural resources, incorporating strategies for environmental regeneration, strengthening local capacities, and reconfiguring agri-food and agro-industrial systems (Preiss & Schneider, 2020; Clement *et al.*, 2024).

2. POPULATION DYNAMICS AND INEQUALITIES

The demographic explosion in the Legal Amazon—from 7.8 million inhabitants in 1970 to more than 27 million in 2022—reveals a complex social reality. While some urban regions grow rapidly, rural areas shrink: between 2010 and 2022, the rural population of the Legal Amazon decreased by almost 1 million people. This depopulation is associated with persistent poverty, lack of opportunities, and precarious basic infrastructure (Pobreza..., 2023).

In this context, the Third Nature emerges as a viable alternative to transform part of the Second Nature into more sustainable, resilient, and inclusive productive territories. To achieve this, a new model of Amazonian rural development is required—one that surpasses both rudimentary extractivism and extensive cattle ranching, and opens space for integrated systems, restoration of environmental liabilities, agroforestry, and bio-industrial arrangements rooted in knowledge, innovation, and territorial intelligence (Acemoglu & Robinson, 2012; Hannusch, 2023).

3. CONNECTING KNOWLEDGE: INDIGENOUS LEGACY AND TROPICAL SCIENCE

The Legal Amazon is a living repository of traditional knowledge. Cassava planting techniques, hunting and fishing practices, the medicinal and nutritional use of native plants, and even regional toponymy are direct legacies of Indigenous civilizations that have inhabited the region for millennia. Revaluing this knowledge—not as ethnographic curiosity but as a strategic part of building contemporary solutions—is essential for a more effective, rooted, and innovative tropical science (The Amazon..., 2025).

At the same time, it is urgent to consolidate scientific infrastructure in the Legal Amazon capable of dialoguing with this diversity. This means training local human resources, establishing modern laboratories, and integrating agronomic science, biotechnology, public health, and social sciences into Amazonian realities (Alvim, 1982).

4. PRODUCTIVE AND TECHNOLOGICAL TRANSFORMATIONS

The Third Nature also requires a reconfiguration of productive foundations. Technological mastery of aquaculture with native species, for example, opens promising paths for a value-added chain with lower environmental impact, similar to Brazil's poultry revolution. In addition, the progressive conversion of extensive pastures into areas for integrated systems, forestry, productive forests, and restoration with economic value (açaí, cocoa, Brazil nut, bacuri, paricá, Brazilian mahogany, bacaba, cumaru, etc.) should guide the redesign of land use (Homma, 2024).

Adapted mechanization, aimed at smallholders and perennial crops, represents another pillar. Technological innovations specific to the Amazonian context—such as equipment for harvesting and processing native fruits and adding value at the origin—are essential to increase productivity, reduce labor hardship, and generate dignified opportunities.

Agriculture in the Legal Amazon has an ambiguous position: it can be a carbon emitter (deforestation, burning, etc.) or a carbon sink via photosynthesis (reforestation, bioenergy, etc.). The world must recognize Brazil's capacity to produce bioenergy on a large scale (sugarcane, soy, maize, oil palm—with oil productivity ten times higher than soy, etc.) for vehicles, agricultural machinery, and Sustainable Aviation Fuel (SAF), complementing electricity generation from solar, wind, and hydro sources. 22

5. HARVESTING WITHOUT PLANTING – THE NEXUS OF PLANT AND ANIMAL EXTRACTIVISM

Two important plants of the Legal Amazon—the rubber tree and the cocoa tree—respectively the second and third perennial crops with the largest planted areas worldwide, became important crops in new locations. Even in Brazil, plants such as cassava, rubber, cocoa, guaraná, and peach palm generated wealth in states outside the Legal Amazon and abroad. The opposite occurred for the vast majority of plant and animal products in the country (coffee, soy, orange, banana, cattle, buffalo, poultry, etc.) (Homma, 2020).

For many extractive products of the Legal Amazon, conflicts already exist between supply and demand, as with Brazil nut, açaí, rubber, rosewood, bacuri, and uxi. For these, management and cultivation, along with vertical integration, are essential. Through managed extraction and cultivation of extractive resources, pressure on natural extraction can be reduced, along with poverty.

Many proposals have been put forward to save the Amazon rainforest and generate income and employment. One internationally recognized proposal was the creation of extractive reserves, which gained visibility especially after the assassination of Chico Mendes (1944–1988). Extractivism is viable while markets remain small, but when demand grows, producers are driven to establish plantations—causing the collapse of extractivist activity. This has occurred with more than 3,000 cultivated plants and hundreds of animals worldwide. The first apple that Adam and Eve tasted in Paradise was extractive, but today no one hunts pigs or chickens, as all have been domesticated (Homma, 2018).

Another solution is the implementation of agroforestry systems (AFS), combining perennial crops, based on the experience of Japanese immigrants in Tomé-Açu, Pará (Barros et al., 2009). These systems are suitable for degraded areas, but their success depends on the markets for component plants such as cocoa, rubber, Brazil nut, cupuaçu, açaí, timber trees, bacuri, cumaru, uxi, etc. Other factors influencing the success of AFS include competition among plants for water, nutrients, and light, as well as labor needs.

Brazil imported 50.13% of its rubber (2022), spending more than US$ 541 million; 38.65% of palm oil and 62.87% of palm kernel oil, spending US$ 728 million; and 12.76% of cocoa

consumed (2023), among others. Bahia produced 64.8% of guaraná (2022); São Paulo, Santa Catarina, Bahia, Paraná, Espírito Santo, and Goiás accounted for 94% of peach palm area (2022). Extractive rubber represents only 0.25% of all natural rubber produced in Brazil. In São Paulo state alone, 70 municipalities produce more than 1,000 tons of rubber annually, and 3 municipalities produce more than the entire North region. It is necessary to plant açaí, Brazil nut, rosewood, bacuri, and dozens of other species. The açaí price in Belém reached R$ 60.00 per liter (2025), signaling the need to plant at least 50,000 hectares in suitable areas.

6. CROPS FOR FOOD SECURITY AND FOREIGN EXCHANGE GENERATION

Annual and perennial crops—the former with larger land coverage and the latter occupying smaller areas, as seen in Brazil and globally—are important for ensuring food security, raw material production, and generating jobs, income, and foreign exchange (Belik, 2020). Some states or countries specialize in annual crops, perennials, or livestock.

Despite Brazil's macroeconomic food self-sufficiency, the Legal Amazon still suffers from chronic food shortages, caused by poverty, lack of technology, and dependence on imports from other Brazilian regions or abroad (sugar, coffee, milk, rice, poultry, pork, wheat, beans, fruits, and vegetables) (Homma *et al.*, 2007; Baiardi, 2009; Homma, 2022c).

It can be said that the sustainable period of the Legal Amazon lasted until the arrival of Portuguese colonizers in 1612, with the founding of present-day Belém. At that time, the small population relied on hunting and fishing for protein, cassava for carbohydrates, and native fruits, maintaining balance with nature. Population growth expanded food and raw material needs, exports, discovery of new products and precious metals, leading to increasing subtraction from First Nature (Homma, 2015).

Expansion of crop areas must occur through productivity increases and pastureland reduction in the Legal Amazon. Land and labor productivity growth must not be incentives for continuous incorporation of new productive areas, especially from First Nature.

Deforestation and burning (legal and illegal) will not be abruptly halted. Addressing the problem first requires neutralization—through reforestation, planting perennials, and assigning economic purpose to environmental liabilities represented by Permanent Preservation Areas (PPAs) and Legal Reserve Areas (LRAs) (Saraiva *et al.*, 2020).

The most viable challenge lies in producers increasing the productivity of their activities, freeing up pasture areas, including those in good condition, and utilizing more than 100,000 km² of degraded pastures. Producers in the Legal Amazon (small to large) have always responded positively to prices and markets—whether in extractivism, planting, or commercial livestock. Environmental and social issues, long treated as secondary, must be incorporated into productive activities.

In the Legal Amazon, Manaus and the Belém Metropolitan Region each have over 2 million inhabitants; São Luís has more than 1 million; Cuiabá exceeds 650,000; Porto Velho, Macapá, and Boa Vista surpass 413,000; and Rio Branco, Santarém, Palmas, Parauapebas, and Marabá each range from 266,000 to 400,000. To supply these urban populations, part of the vegetables—especially leafy greens like kale, lettuce, jambu, coriander, parsley, and chicory—are produced in peri-urban areas, while much of the produce consumed nationally is imported from Brazil's South and Southeast. At the Ceasa-Pará wholesale market in Belém (2019–2022), 81% of fruits and vegetables (by weight) came from other states, 18% from Pará, and 1% from abroad.

Jute and black pepper crops, introduced by Japanese immigrants, were exotic to the region in both cultivation and processing practices but were quickly adopted by small farmers (Homma *et al.*, 2021). This demonstrates that producers in the Legal Amazon are not resistant to innovation—when profitable and with markets, they rapidly adopt new crops. The same type of solution must be developed for environmental challenges and slash-and-burn agriculture in the Legal Amazon, with technological and economic alternatives, instead of diffuse or artificial markets such as selling carbon credits to small producers. People need food and raw materials with lower environmental impact.

7. LOW-CARBON LIVESTOCK

Humans and animals appear capable of surviving in polar regions, deserts, swamps, jungles, and mountains, among other environments. Over the past 50 years, Embrapa has acclimatized soybeans to tropical regions, domesticated several Amazonian plants, and adapted other crops and livestock species introduced by Portuguese colonizers, immigrants, research institutions, scientists, farmers, and pioneers—shifting the global center of gravity in food production.

The Legal Amazon holds more than 107 million head of cattle (44.91% of Brazil's total) in 2023, with Mato Grosso having the largest state herd (14.25%), Pará second (10.49%), and Rondônia sixth (7.61%). Regarding water buffalo, the Legal Amazon concentrates 76.15% of the national herd, estimated at 1,672,956 head, with Pará and Amapá leading. Notably, Pará holds the second largest equine herd in Brazil, and the Legal Amazon as a whole accounts for 30.79% (2023) of the national total. It is possible to reduce both pasture area and cattle herds by half within a decade—without loss of production—through productivity gains and greater sustainability (Caitano *et al.*, 2023; Caitano & Homma, 2025).

This livestock sector (beef and dairy) is marked by great technological heterogeneity, ranging from high-standard herds showcased at fairs and expositions to smallholder dairy operations producing as little as one liter of milk per cow per day. The United States, with 37.2% (2023) of Brazil's herd size, produces 1.25 times Brazil's beef output. In beef production, the U.S. and Brazil rank first and second, respectively, while in exports they rank fourth and first. Positively, productivity has been rising thanks to the recovery of degraded pastures and herd improvement by more efficient producers (Caitano *et al.*, 2025).

Five decades ago, poultry consumption was limited to rural populations and urban patients or women in postpartum recovery, later becoming a Sunday option, and only democratizing in the 1980s. Today, chicken from Santa Catarina travels across more than half the country and is sold in Amazonian cities cheaper than fish or beef. Given the availability of soy and maize, poultry and swine production should be encouraged in the Legal Amazon, moving toward regional self-sufficiency. Globally, Brazil is the largest exporter and second-largest producer of poultry meat, the second-largest producer and largest exporter of beef, and the fourth-largest producer and exporter of pork (Beef..., 2025; Relatório..., 2025). Brazil's global leadership in poultry, beef, and pork exports comes from allocating 35.37% (2024), 27.36% (2023), and 25.50% (2024), respectively, of national production.

8. FORESTRY ABSORBING CARBON

In the Legal Amazon, only 9.2% of Brazil's reforested area is found—873,000 hectares (2022) of eucalyptus, pine, paricá, acacia mangium, Brazilian and African mahogany, teak, and others. This is less than the reforested areas of Santa Catarina, São Paulo, Paraná, or Rio Grande do Sul. In Amapá, eucalyptus plantations by Companhia do Jari (1967) and AMCEL (1976) cover 59,000

ha; Maranhão has 252,000 ha; Mato Grosso, 227,000 ha; and Pará, 199,000 ha (2022). At the very least, this area could be doubled, ensuring supply of wood, fuelwood, and pulp—collapsed by extractive logging, now reduced to one-fifth of its peak—while promoting sector verticalization and the establishment of a furniture industry.

There is significant demand for fuelwood to dry grains, toast cassava flour for smallholders, supply kilns, and power slaughterhouses. Major river basins in the Legal Amazon host the 5th and 8th largest hydroelectric plants in the world; their banks need reforestation, suppression of deforestation and burning, and engagement of medium and large landholdings in this effort. Giving economic meaning to this recovery requires planting timber, fruit, and other species, whether native or exotic.

9. AQUACULTURE TO REDUCE PASTURE AREA

The Amazon Basin's potential, for instance, can be harnessed for fish farming, mirroring the poultry sector's success: in 2007, chicken production surpassed beef production, making Brazil the world's largest exporter of both products.

Brazilian fish production is reducing dependence on extractive fishing (51.40%), with 48.60% (2023) now coming from aquaculture, while globally the balance is approaching 51% extractive and 49% aquaculture (FAO, 2022). In Brazil, fish production equals only 12.35% of poultry and 13.83% of beef production in 2022. Rondônia, Maranhão, Mato Grosso, Pará, Amazonas, Roraima, and Tocantins have made significant advances in aquaculture (Anuário 2025; Beef..., 2025).

Whereas beef cattle require 2–3 years to yield 300–500 kg of live weight per hectare, the same area in water could yield 10–15 tons of fish per hectare per year under commercial conditions.

In summary, these are some of the proposals for making agriculture more sustainable in the Legal Amazon. Moving beyond the Neolithic slash-and-burn system is the best way to reduce deforestation in the region.

10. CONCLUSION: FROM VISION TO TRANSFORMATION

The Third Nature of the Legal Amazon is not just a technical proposal: it is a vision of the future. By repositioning the territory as a source of solutions—rather than as a problem—Brazil can make a unique contribution to the climate agenda and the global debate on development models.

This proposal echoes and deepens the principles set out in the first part of this document: science as infrastructure for the future; the bioeconomy of connections as a vector for regeneration, the replacement of illegal agriculture, and social justice; and more sustainable tropical agriculture as a platform for innovation. In this horizon, the Legal Amazon ceases to be merely a symbol of urgency and becomes a reference of possibility.

The future of the Legal Amazon will, in many ways, be a decisive test for the success of a new paradigm of tropical development. If Brazil can harmonize conservation and production, respect local knowledge, and activate its scientific creativity in favor of regeneration and inclusion, it will demonstrate to the world that it is possible to build a new relationship between society and nature. The Amazon's trajectory could then inspire global solutions—and agronomic science will, once again, be at the center of this transformation.

The technological limitations of the Legal Amazon are well known. Scientists are motivated to promote this change, and it is possible. The Brazilian Agricultural Research Corporation (Embrapa), for example, spearheaded technological revolutions such as large-scale bioenergy production, enabling agriculture in the Cerrado, and making Brazil one of the world's largest food producers. These are examples of Brazil's capacity to promote a technological revolution in the Legal Amazon, developing tropical agriculture rooted in its flora and fauna. Producers are eager for more technology, technical assistance, appropriate rural credit, cooperativism, improved infrastructure, and land and property security.

Finally, it must be emphasized: there is no magic solution for the Legal Amazon. Change takes time, is often costly, and requires patience and dedication. 28

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