Agribusiness and Climate Change
Strategic Sector Positioning for COP30

Introduction

COP30 - Conference of the Parties of United Nations Framework Convention on Climate Change -, to be held in Belém (PA), represents an outstanding opportunity for Agribusiness to be acknowledged as part of the solution for climate challenges. It is a strategic moment to reinforce, before Brazil and the international community, the convergence between speech and practice in the sector commitment with sustainability.

More than ever, it is deeply relevant that Agribusiness production chain restates its major role within climate change global setting, highlighting Brazil´s protagonism to promote a productive model aligned with environmental preservation and socioeconomic development.

Along the years, the sector has developed towards a more sustainable production, adopting innovative practices that conciliate productivity and environment preservation, and valuing social and economic aspects of communities involved.

With this goal, the forum **"Towards COP30: Agribusiness and Climate Changes"**, held on April 23, 2025, gathered different voices with different points of view around a common goal: building the trail for an increasingly fair and sustainable future.

The meeting was attended by government representatives, companies, sectoral entities, academia members, scientists and researchers, establishing an inclusive and collaborative dialog space.

From the discussions promoted in the Forum, based on contributions of everyone involved in debate panels that approached three major central roles on Agribusiness and Climate, the mentor group - renown experts and technicians that guided panel works - developed this document, which will guide the sector performance at COP30, and be an advocacy instrument before several foreign audiences.

This sectoral stand highlights how agriculture and livestock can be an agent of change within climate change adaptation and mitigation agenda. The text proposes evidence practices that contribute to cut down carbon emissions and promote productive system resilience before climate changes.

What is more, it approaches strategies to unlock funding, vital to the sector, exploring solutions that expand access to financial assets and trigger sustainable innovation.

Finally, the document also approaches Agribusiness role in carbon market, investigating how the sector could integrate efficiently to such credit trade, cooperating to a global low carbon economy.

These topics are essential not only to enhance Agribusiness in Brazil, but also to develop an environmental balance and economically sustainable future all around the world.

1. **How can agriculture and livestock contribute to climate change adaptation and mitigation agenda?**

Initial considerations

Agriculture and livestock is one of Brazilian economy pillars, and it is also one of the activities that is more exposed to climate change impacts. It represents a strategic segment to mitigate greenhouse gas (GHG) emissions in economic sectors, and it is also one of the most vulnerable activities to climate effects. Such vulnerability is particularly stressed in tropic countries (IPCC, 2021) like Brazil, where climate variability has a significant impact to agricultural productivity. Forecasts indicate potential performance reductions to main Brazilian cultures in different climate setting in the next years, threatening food security and economic stability.

In 2024, Agribusiness accounted for 24% of Brazil´s Gross National Product (GNP), highlighting (Brazilian Government, 2024), highlighting its relevance to national economy and global food security. An interruption induced by climate in this sector would have unprecedented consequences. Extreme climate event increasing frequency and severity – including prolonged droughts, heat waves and heavy rains – are already a reality and tend to be intensified.

This scenario evidences the urgency to adopt adaptative and regenerative technologies, capable of increasing Agribusiness resilience. Over the last decade, Brazil has implemented public policies and commitments to mitigate GHG emissions, including the National Climate Change Adaptation Plan (PNAMC, 2016), and Climate Change Mitigation and Adaptation Sectoral Plan for Low Carbon Emission Economy Consolidation in Agriculture (Plan ABC+, 2021).Such public policies propose several agricultural management practices that not only adapt and mitigate GHG emissions, but also promote soil and water conservation, increase agriculture productivity and system resilience to climate change.

It shall be highlighted that Brazilian farmers have already adopted several strategies to deal with climate variability, applying management techniques in different scales and in different production systems. The following sections introduce main agricultural management practices that have been employed successfully as climate adaptation and mitigation strategies. Wide disclosure of such practices, including in international forums like COP30, is fundamental to reinforce agriculture and livestock role to face global climate crisis.

Agrosystem climate change adaptation strategy examples

Climate change agrosystem adaptation is a strategic priority to tropical countries like Brazil, which agriculture and livestock relies strongly on stable climate conditions. Forecasts indicate that, as current land use and agriculture management patterns are kept, sector greenhouse gas (GHG) emissions can rise up to 8.6% by 2050, compromising productive system resilience and global food security.

Within this context, so-called Climate-Smart Agriculture - acknowledged by institutions including FAO, World Bank and Embrapa - aims at increasing productivity, enhancing resilience and cutting down emissions, in synergic and contextualized way. Key strategies to efficient adaptation in tropical ecosystems are detailed as follows:

Land use efficiency increase

Sustainable intensification strategies goal is expanding productivity in areas already converted to agriculture, preventing progress over natural ecosystems, including forests, savannahs and wet areas. It is essential to reduce pressure by deforestation and preserve natural carbon stocks. Adoption of technologies including crop-livestock-forest integration (ILPF), precision agriculture and rational population densification enables achieving higher performance with less space use. What is more, agroecological and climate zoning (ZAE) is an essential tool to guide the territory most efficient use within climate variability increase context.

Water resource and nutrient use efficiency improvement

In an extreme hydrological event scenario - including prolonged droughts and concentrated rains -, efficient water use has become a critical adaptation axis. The implementation of precision irrigation systems, management based on evapotranspiration and remote sensing, as well as rainwater collection and reuse, are examples of good practices. In nutrient field, fertility integrated management plan adoption, based on soil analyses, minimizes losses and increases agronomic efficiency of fertilizers applied. Such practice integration reduces culture vulnerability to water and nutritional stress, sustaining productive stability before climate instability.

More tolerant variety growing to abiotic and biotic stresses

Plant and animal genetic development is crucial to resilience. National research, led by institutions including Embrapa, Instituto Agronômico de Campinas - IAC and universities, has develop cultivar adapted to adverse conditions, including tolerance to draught, heat, soil acidity and salinity, as well as resistance to pests and diseases that expand due to average temperature increase. In livestock, genetic improvement programs have promoted breeds that are more adapted to heat and grazing in tropical conditions. Access to adapted seeds and efficient certification and distribution system is fundamental to expand the reach of different producer profiles to such solutions.

Conservationist soil management

Soil is agricultural resilience base. Practices including no-tillage farming, contour farming, level curves, permanent soil cover, and culture rotation reduce erosion, increase water infiltration and keep fertility through time. These actions mitigate heavy rain effects and compaction by trampling or heavy machines. What is more, they enable soil biological activity, promoting increased nutrient and water cycle stability. Public policies including Plan ABC+ acknowledge such practices as priorities to productive adaptation and natural resource conservation.

Genetic improvement guided by resilience

Genetic improvement programs guided by climate change aim at expanding phenotypic and genotypic plasticity of grown and raised species. It means generating materials with capacity to generate fine productive performance even under adverse environmental conditions. In Brazil, initiatives including Embrapa genetic improvement programs and partnerships with international networks have developed varieties adapted to temperature increase, new pluviometric regimes and soils with lower fertility. Biotechnology, especially by means of genomic edition (e.g.:CRISPR-Cas9), also expands solution range for genetic and phytosanitary adaptation.

Soil health and functionality promotion

Healthy soils act as climate sponge. Increasing Soil Organic Matter (SOM), promoting edaphic biodiversity and improving physical structure are fundamental actions to resilience. That can be achieved with techniques including green fertilization, organic compounds, bio-based product application (growth and biological control promoting micro-organisms) and remineralizer use (rock powder) that also enable gradual nutrient release. Soil health improves water retention, decreasing irrigation need and enabling more efficient input use, enhancing the system concerning water and thermal stress.

Social and territorial inclusion and contextualized solutions

Efficient adaptation requires that solutions are developed based on each territory reality, observing rural producer social, economic, gender and cultural diversity. ATER (Technical Assistance and Rural Extension) public policies, cooperative enhancement, access to climate credit and adaptative rural insurance instruments are fundamental to expand product adaptative capacity. Local knowledge valuing, especially of indigenous peoples and traditional communities, shall be acknowledged as part of solutions. Equity in access to information, technologies and markets is an essential condition so that adaptation is effective, fair and inclusive.

Strategy examples of greenhouse gas emissions mitigation and carbon removal in agrosystems

Brazil is one the world´s leading producers of agricultural and live stock commodities. Modern technology integration with country´s different edaphoclimatic conditions provided a competitive asset to sustainable agricultural development. Nevertheless, there is still potential to improve soil use and management system, particularly through regenerative agricultural and live stock practices that improve soil ecosystem functions and long-term agroenvironmental sustainability. Each strategy enables C sequestration and GHG emission reduction, and it improves soil health and agricultural resilience. Some main strategies for greenhouse gas emissions mitigation and carbon removal in agrosystems in Brazilian agriculture and livestock include:

No-Tillage Farming System

No-Tillage Farming (NTF) system follows three principles:(i) minimum soil disturbance, (ii) permanent soil cover, and (iii) culture rotation, promoting soil sustainable management and resilience to climate variability (Fuentes-Llanillo et al., 2021).Introduced in Brazil in 1970´s to control intensive growing erosion, NTF has proven to be efficient at runoff reduction and soil structure improvement (Amado et al., 2006; Engel et al., 2009).Initially adopted in 1 million hectares in 1992, its benefits, including less field operations, lower fuel spending and earlier farming, lead to wider acceptance.

NTF contributes significantly to soil carbon (C) sequestration. Maia et al.(2022) reported that NTF increased Soil Organic C (SOC) stocks at 22–25% in 0–50 cm layer within 20 years in *Cerrado* and *Mata Atlântica*.In pastures converted to NTF, SOC increased 16% in 0–30 cm layer.NTF also increases nitrous oxide (N_2O) emissions, mainly due to surface residue decomposition and microbial activity changes (Bayer et al., 2015).Even though NTF can lead to slightly higher N_2O emissions, its climate benefits remain positive due to C sequestration increase and fossil fuel use reduction.

A life cycle analysis by Silva et al.(2024) found out that NTF with cover cultures had more favorable C footprint (-0.7 to -0.1 kg CO_2e by kg of corn) compared to standard preparation (1,0 kg CO_2e by kg of corn), with 86.4% lower fuel use. Apart from climate benefits, NFT also improves soil properties, increasing water retention and nutrient availability (Moraes et al., 2014).Despite advantages including productivity increase and resilience to climate extremes (Vignola et al., 2022), challenges remain, including culture rotation, bio-based products and fertilization strategies.

Integrated Agricultural Systems

Brazilian agriculture experienced significant changes, with Integrated Agricultural Systems standing out. These systems aim at increasing productivity, and also increasing ecosystemic services, mainly in degraded pasture areas.Four main integration models include:

- Crop-Livestock Integration (ILP)
- Forest-Crop Integration (ILF)
- Forest-Livestock Integration (IPF)
- Crop-Livestock-Forest Integration (ILPF)

These integrated systems promote soil quality, C sequestration and reduce GHG emissions, and they improve economic and environmental sustainability. Studies show that ILPF systems increase biomass production and microbial activity, leading to significant benefits in C sequestration (Granja et al.2025, Freitas et al., 2020; Torres et al., 2014).Carvalho et al.(2010) found out that standard monoculture transition to ILP increased C stocks at 0.82-2.85 Mg C ha^{-1} $year^{-1}$, depending on culture and soil conditions. Similar trends were seen in ILPF systems, where tree components increased C storage and improved soil structure.

Degraded pasture recovery

Pastures played a fundamental role at livestock production and environmental sustainability, covering around 70% of global agricultural lands and providing habitat to several organisms. Moreover, these agroecosystems have high C sequestration potential in soil, making them climate change mitigation key strategy (Silva et al.2024, Conant et al., 2017).However, pasture degradation due to inadequate management, excessive grazing and insufficient input use can lead to soil fertility loss, compromising productivity and increasing GHG emissions.

Degraded pasture recovery is essential to improve livestock productivity and recover soil quality. Good management practice adoption, including invading plant control, adequate crowding rates, balanced fertilization and integrated systems, have proven to be efficient in soil C stock increase and livestock GHG emission reduction. Studies indicate that pastures well managed can increase soil C stocks at 15% within 30 years. On the other hand, previously degraded and recovered pastures can gain up to 23% more C than non-recovered pastures (Oliveira et al., 2018).

Studies in Brazil also show that fertilizers and soil improvers impact pasture recovery significantly. In Southern Bahia, limestone and fertilizers increased soil C stocks at 0.66

Mg C ha-1 year-1.In Paracatu, Minas Gerais, urea application every three years led to higher C stocks than native vegetation and monoculture eucalyptus plantations or the ones intercropped with Brachiaria (Tonucci et al., 2011).

C national average increase by fertilizer use in pastures is 0.73 Mg C ha-1 year-1.Nevertheless, limited nitrogen (N) availability is a major restriction to pasture recovery and C sequestration. Leguminous fodder plant introduction, that fixate N biologically, has proven to be efficient to overcome such limitation. Pastures intercalated with leguminous presented C buildup rate of 0.72 Mg C ha-1 year-1, contributing to a more productive and resilient system.

Biochar

Biomass conversion into biochar has been widely studied as an alternative to increase soil C sequestration and decrease CO2 atmosphere emissions (Jia et al., 2019). Biochar is produced through pyrolisis, a thermal decomposition process performed in low oxygen conditions. This carbonized material shows high chemical stability and can persist in soil for hundreds to thousands of years, decelerating C cycle significantly. Biochar application in agricultural soils has additional benefits, including soil physical and chemical improvement, like water retention, nutrient availability and Cation Exchange Capacity (CEC).Studies indicate that approximately 90% of C contained in biochar contributes to soil organic matter (SOM) stable fraction, increasing long-term persistence (Tozzi et al., 2019).Despite its climate change mitigation potential, biochar use in Brazil is still incipient, with limited regulation and incentives for large scale adoption. Nevertheless, its multiple agronomic and environmental benefits, including soil fertility improvement and residue management, make biochar a promising technology for sustainable agriculture and C sequestration strategies.

Enhanced Rock Weathering

Enhanced Rock Weathering (ERW) is a promising strategy to capture atmospheric CO_2, applying finely ground rock powers in agricultural soils. Brazil high potential to implement this technique, due to abundant basalt rock deposits and mineral dissolution favorable climate conditions. This technology acts as permanent C sink, promoting mineral reactivity, increasing bicarbonate formation, which can be transported to oceans and precipitated as carbonates.

Large scale ERW application can contribute to CO_2 removal from the atmosphere, and increase soil fertility while providing essential nutrients like Ca, Mg and Si. However, measuring C capture efficiency via ERW remains a challenge, as applied areas not always follow natural landscape dynamic (for instance, hydrographic basins) and several biogeochemical factors influence dissolution rates.

Ongoing researches by companies and universities are exploring methodologies including geochemical modeling, soil solution analysis and acid neutralization assessments to quantity ERW impact in a better way (Larkin et al., 2022; Reershemius et al., 2023; Dietzen & Rosing, 2023).Even though field scale experimentation is still under development, ERW presents high potential as permanent C sequestration strategy and sustainable soil amendment, particularly in tropical agricultural systems.

Technosols

Technosols are anthropogenic soils built from industrial, mining or urban residues, with C sequestration high potential and degraded land recovery. These soils can contain high levels of easily weathering minerals, enabling soil C stabilization through organomineral interactions (Ruiz et al., 2023a).During initial weathering, high dissolution rates of primary minerals increase Si, Al and Fe concentrations, leading to amorphous or little crystalline minerals (Wilson, 1999).

These minerals increase SOM stabilization, forming organomineral associations, reducing microbial decomposition (Kleber et al., 2015; Mikutta et al., 2005).Additionally, polyvalent cation release (Al^{3+}, Ca^{2+}, Mg^{2+}) during technosol weathering promotes cation bridges, stabilizing SOM even further and increasing aggregate formation (Rowley et al., 2018).This structural improvement reduces SOM degradation, increasing soil C persistence (Ruiz et al., 2023b).As annual mining residue production in Brazil is projected to reach 11 billion tons by 2030 (IPEA, 2012), technosol construction is an opportunity to transform environmental liabilities into productive assets, with nature-based solutions to C sequestration and soil recovery. Studies suggest that technosol applications in mining locations can recover up to 60% of C stocks (Ruiz et al., 2023b).

What is more, they can provide support to agricultural production, rationalizing external input usage, including fertilizers, increasing GHG emissions even further. Researches show that technosols created from mining residues can support sugar cane and pasture production successfully, evidencing their agronomic potential, along with C sequestration benefits (Ruiz et al., 2020a; Ruiz et al., 2020b).

Biofuels

Biofuels contribute to greenhouse gas (GHG) emission mitigation, mainly because they emit less carbon dioxide (CO_2) compared to fossil fuels. During its life cycle, carbon released in biofuel burning is partially balanced by CO_2, absorbed by plants used in its production, including sugar cane, corn, among others. This balancing makes the process less carbon-intensive, especially whenever sustainable practices are adopted in growing, processing and end use. Moreover, agricultural and organic residue use to produce biogas and biodiesel prevents methane (CH_4) release in such material decomposition, a gas with global heating potential much higher than CO_2.

Biofuel biomass growing can be planned in order to improve vegetation cover, recover degraded areas and prevent deforestation, factors that contribute to sustain and increase carbon stocks in agricultural ecosystems. Thus, biofuels integrate mitigation strategies and promote sustainability to production systems.

Final Considerations

Expanding adoption of strategies presented herein could intensify agriculture and livestock standing even further, as a key vector to climate change adaptation and mitigation, and to promote more sustainable and resilient production systems. Nevertheless, large scale implementation requires solid public policies, economic incentives, technical qualification and monitoring structures, improved to quantity carbon sequestration and GHG emission reductions.

Public policies, including Plan ABC+, provide a base to sustainable land use, however, more investments in research, infrastructure and education are required to speed up adoption. Integrating carbon markets and payment programs through ecosystemic services can also incentive farmers to perform transmission to Climate-Smart Agriculture. As Brazil´s wide agricultural and livestock potential is triggered, these strategies shall be valued at COP30 agenda, contributing significantly to climate change adaptation and mitigation, food security and ecological recovery, reinforcing the country leadership in sustainable agriculture.

2. How can we unlock funding to agriculture and livestock sector?

Initial considerations

There are 141 Nationally Determined Contributions (NDCs) within 168 NDCs presented/updated by September, 2024, which propose to adopt agriculture and food security climate actions.

Ongoing technology adoption in agriculture and livestock is fundamental to foster productive system adaptation and promote greenhouse gas (GHG) emission reduction, always highlighting agriculture central role to assure food security and its contribution to energy transition and carbon sequestration contribution.

Considering agriculture is especially vulnerable to climate changes and that impacts caused by extreme climate events require responses based on adopting technologies and practices that enable minimizing and reducing losses, the sector needs attention as to maintenance funding and productivity increase, within an acknowledged, verifiable and certifiable sustainable production model.

Enhancing low carbon agriculture and livestock is an inherent condition to the possibility of contributing to global food security. Nevertheless, it shall be noted parameters/criteria are missing which guide banks and investors in low carbon, regenerative agriculture and livestock projects, nature-based solutions and other models that generate co-benefits of adaptation, GHG emission reduction, and environmental service generation.

Missing harmonized metrics to measure mitigation results jeopardize low carbon agriculture and livestock investments. Similarly, missing solid indicators and metrics to assess adaptation hinder climate funding to progress at the scale and speed required to mitigate risks associated to extreme events and losses causes by climate changes.

Agriculture climate funding needs to consider adaptation, mitigation and food and nutritional security elements in its MRV (Measurable, Reportable, Verifiable) criteria. Thus, green taxonomy, traceability and productive chain data management components (including CAR, PRA and another environmental legislation elements) shall be solid and accessible and promote legal security to producer and financial sector, whether public or private.

Essential aspects to raise funding

Expanding climate funding, originated from several sources, is a central challenge to foster climate action implementation. Baku-Belém Roadmap for USD 1.3 trillion target shall generate recommendation to COP30, aiming at expanding and mobilizing financial assets. Agriculture and livestock needs to progress in metrics and indicators as investment opportunity, considering its contributions as part of climate solution and food security.

Funding is a condition that enables agriculture mitigation, adaptation and co-benefit results. To be effective, it shall be driven by scientific and metric evidence, which provides security to investors to achieve results by applying technologies acknowledged as sustainable and climatically beneficial, considering specific contexts of each region and production models.

Funding shall originated from multiple sources, including multilateral development banks, private banks and financial market, national development banks, UNFCCC official mechanisms, including Green Fund for the Climate and Adaptation Fund, philanthropy, developed country donations, among other sources.

Funding source and model diversity is fundamental to cover volume required, and situation diversity in which investments shall be performed, considering different demands within small, medium and large producers. It shall be highlighted that different agriculture model and size coexistence is fundamental to assure food production security and another materials originated from agriculture, to meet different society needs, from commodity production to local and peri-urban food production.

In Brazil, there are more than 5 million rural properties, and around 2.5 million are considered small, with up to 10-hectare area.

It is essential to differentiate public funding, via Harvest Plan and another programs from private funding within national and international scope.

Defining parameters/metrics that guide climate funding to promote low carbon and regenerative agriculture and livestock is an issue required to raise funding.

As objective criteria are defined, which shall be complied with by producers, banks can define climate funding products. Technology and practice application measurement, and mitigation and adaptation result reach requires defining objective criteria and that can be measured.

Thus, setting forth a green taxonomy for agriculture, and traceability and MRV mechanism progress are essential conditions to unlock new climate funding models adapted to agriculture within Brazilian context.

Developing funding products/lines aligned with different production chain requirements, considering return, guarantees and specifics need to be considered. Differences among small, medium and large producers need to be considered.

It is necessary to incorporate climate funding lines and products for agriculture to agribusiness funding culture; training banking agents and market operators is a requirement, so that funding gains scale.

Criteria shall be objective: recover degraded areas, fosters carbon capture in soil and promote soil health, cut down erosion losses, recover native vegetation, and preserve biodiversity in the surroundings, use efficiently nitrogenous fertilizers, cut down fossil fuels, promote environmental services, including spring and waterway preservation, are examples of criteria that can lure investments and new credit lines.

Concerning local scope, taxonomy, programs including EcoInvest and Green CPR can trigger funding.

It is essential to develop Payment for Environmental Services (PES) instruments intended to incorporate carbon and biodiversity co-benefits. How to translate such assets into benefits in funding is challenging and can enable funding expansion. These mechanisms shall promote incentives to RL and APP recovery and maintenance, as well as RL surplus preservation incentives, which can add income to PES and carbon market.

Customized funding instruments for different production chains: blended finance, guarantees, instruments blending non-reimbursable assets intended to technical assets shall be developed. Therefore, legal security and fostering the adoption of sustainable technologies that enable climate benefits are fundamental.

A hindrance to expand climate funding is solving land regularization bottlenecks. It is an essential requirement that needs to be considered in Brazilian climate policy.

Brazil Agro + Sustainable Platform shall act as an instrument to guide access to cheaper funding due to technology and practice adoption.

Within UNFCCC international climate negotiation scope, a more effective participation of Brazilian agribusiness players is required, for instance, to use the tools of Sharm el-Sheikh Joint Work on Agriculture and Food Security (SSJWA), especially the online portal, which promotes project and policy proximity with possible funding sources and Summary Report, which promotes funding flow vision and other actions at global level that can become opportunities for the sector in Brazil.

Brazil needs to be qualified to raise funds in multilateral banks, IFC and investors, having as assets clear policies that stimulate decarbonization. This is an action that relies on government, financial sector and agribusiness production sector joint action, to be prepared and qualified at eligibility criteria concerning such assets.

Carbon market – within the scope of Paris Agreement, Brazilian Emission Trade System (SBCE) and volunteer market - that acknowledges agriculture and livestock methodologies, can stimulate funding as a way to expand projects that generate mitigation results and agriculture and livestock carbon credit emission.

Final considerations

Agriculture and livestock change into an increasingly more sustainable, resilient and competitive sector relies on its full inclusion in climate funding strategies. In order to achieve this goal, it is imperative to set forth clear and objective criteria that guide climate funding, using solid Measurable, Reportable, Verifiable (MRV) metrics. Green taxonomy implementation aligned to advanced traceability practices, along with diversified financial instruments, can unlock significant investments.

These efforts shall be aimed at small and large producers, promoting practices that regenerate and protect the environment, and assuring productivity and profitability. The partnership between government, private sector and international financial institutions shall be crucial to raise funds required, and promote an efficient carbon market that stimulates agricultural and livestock practices aligned with Paris Agreement goals.

In summary, the path to sustainable agriculture and livestock includes local and international effort harmonization in benefit of a more responsible and adaptable production model to current and future climate demands.

3. **How is Agribusiness related to carbon market?**

Initial considerations

Agribusiness Strategic Role in New Low Carbon Economy

Brazilian agribusiness has acted as a strategic player in global climate agenda. The sector plays a central role in international discussions on climate changes. Not only an emitting sector, agribusiness is also part of the solution, thanks to its carbon sequestration and natural resource sustainable use capacity. As it adopts adequate practices, the sector not only cuts down emissions, but also triggers social, economic and environmental development - essential pillars for low carbon economy. This potential makes agribusiness a strategic piece in decarbonization efforts, especially as COP30 is approaching.

Brazil, within the scope of Paris Agreement, is committed to present and report its Nationally Determined Contributions (NDCs) - climate targets that drive national efforts to cut down greenhouse gas emissions.

Brazilian NDCs have a wide scope, covering all economy. It means that all sector emissions count to comply with targets set forth. In this scenario, each decarbonization initiative is essential so that the country evolves within its climate journey.

Even though the global priority is direct emission reduction, an alternative foreseen is using carbon credits as balancing mechanism for emissions that could not be prevented yet. This balancing can be performed by means of carbon markets - pricing instruments that can be volunteer or regulated.

Volunteer market is triggered by targets assumed spontaneously by companies, which are not mandatory. On the other hand, **regulated market** is structured by emission reduction legal obligations, set forth by national or sub-national governments.

As part of its climate strategy, Brazil established, at the end of 2024, through Law no. 15.042/2024, Brazilian Greenhouse Gas Emission Trade System (SBCE).The law sets guidelines to national carbon regulate market development, based on cap-and-trade model - in which specific activities are subject to emission limits.

SBCE adopts an inclusive and sectoral level wide approach, covering all national economy. The only express exception is agriculture and livestock primary production, excluded at this moment, due to technical challenges associated to accurate emission measurement. Considering different existing cultures and each sector part specifics, different indicators and instruments are required (Munhoz & Trennepohl, 2024).

Nevertheless, agribusiness is not completely out of the process. SBCE shall enables operators to use carbon credits generated by sustainable projects as a way to balance part of its emissions.

Due to this scenario, Brazil is integral part of an environment with multiple opportunities - both in volunteer market and regulated market -, and agribusiness stands out as a player with high potential. Not only the sector contributes directly to own emission reduction, but also has the capacity to generate carbon credits through sustainable agricultural practice implementation, being consolidated as a strategic vector to develop new green economy.

In this context, it is fundamental to consider a few key positions on how agribusiness can be included and relate to carbon market, as follows:

1.Environmental Asset Valuing

Environmental preservation goes beyond plain conservation. It connects directly to environmental asset valuing, including standing forest, ecosystemic services and smart soil management. Sustainability logics now also incorporates an economic dimension: by integrating remuneration for environmental services and carbon credits, Brazilian agribusiness identifies new growth opportunities, adding value to products and territory.

This valuing transforms preservation into a concrete opportunity, and not only a legal obligation or a burden. That can trigger not only “economic will”, but also political incentives so that nature sustainable exploration is seen with the same interest - and return potential - as traditional exploration models.

2.Carbon Credit Generation

Thus, it is not surprising that agribusiness sector has a great capacity to develop projects capable of generating carbon credits, whether for sale and marketing in volunteer market, or for future regulated market, including opportunities originated from international carbon credit sale.

Some relevant practices include:

- Degraded area recovery, transforming them into carbon sinks;
- Integrated system adoption like ILPF;
- Biodigester, biogas and biomethane use;
- Technology implementation including biochar and soil remineralizers;
- Biofuel expansion, reducing energy carbon footprint;
- Native vegetation conservation and standing forest valuing as environmental asset.

3.Metric and Methodology Tropicalization

So that opportunities and benefits associated to carbon credit generation are performed effectively, it is essential to consider territory local features where projects shall be implemented. In case of Brazil — a country with continental dimensions, with wide climate diversity and unique biomes — this attention is even more critical.

One of the main hindrances to this market expansion in the country is missing methodologies and metrics that are truly adapted to Brazilian tropical reality. Agriculture and livestock sector emission measurement itself represents a relevant technical challenge (Assad et. al., 2023).Thus, it is essential to develop solid calculation methods, compatible with national agricultural practices, assuring predictability and confidence to producers. What is more, models currently used are mostly based on temperate realities and do not reflect national production system complexity and diversity. That compromises several project eligibility and credibility before international market.

Within this context, strategic priorities include:

- Tropicalized carbon calculator development, adjusted to different regional realities and Brazilian biomes;
- Measurement, monitoring and verification system improvement;
- Reliable and solid database development;
- Interoperability enhancement between volunteer and regulated markets, stimulating sector payer confidence and engagement.

Another relevant challenge face to implement carbon projects is additionality criteria - essential requirement to define whether emission reductions generated by a project would take place only due to its execution. One way to evidencing additionality commonly adopted by international certification bodies is proving that the project does not incur from a pre-existing legal obligation (Munhoz & Vargas, 2022).

Advancing in this agenda, with appropriate methodologies and criteria adjusted to national reality, shall enable Brazil to stand out as carbon credit exported based on science, credibility and alignment with global good practices.

4.Regulatory Milestone and Government Development

SBCE regulation is essential to unlock agribusiness potential in regulated market, as legal uncertainties could mean high risks to sector producers and players. Thus, poor or extremely low regulation of this new market could limit marketing opportunities to producers and decrease credit integrity generated in this sector (Vieira et. al., 2025).

Private sector active participation to develop standards, eligibility criteria and governance processes is fundamental. Assuring legal security, land regularization and social inclusion — especially small and medium producers — is an essential step to make the system functional and reliable.

5.Financial Incentive Adoption

Practice adoption intended to carbon credit generation requires initial investments that often represent a financial challenge to rural producers. Costs include from new agricultural technology implementation to processes like audits and certifications. So that carbon market becomes accessible and scalable, it is essential to develop financial instruments aligned to Brazilian field reality.

Available mechanisms include:

- Green CPR (Decree 10.828/2021): bond that aims at remunerating producer for native forest preservation, recovery and sustainable management, enabling environmental asset marketing linked to conservation;

- Green Bonds: fixed income instruments intended to sustainable project funding, in which, for instance, investor fund raising is aimed at supporting actions intended to climate change mitigation and adaptation;
- Payment for Environmental Services (PES),as per Law 14.119/2021: tool that enables direct remuneration to practices that enable environmental conservation, benefitting mainly rural producers, traditional communities and indigenous peoples;

Such instruments have potential to transform preservation into income source, enabling sustainability to evolve along with field productivity.

6.Producer Qualification

Valuing environmental assets also means acknowledging rural producer strategic role and expanding access to technical knowledge required to operate in carbon market. At present, a relevant gap still remains at understanding credit generation and marketing mechanism, as well as emission mitigation efficient practices (Vieira et. al., 2025).

Contemporary approaches linked to Paris Agreement and latest COP decisions aim not only at climate gains, but also to positive social impact promotion. Initiatives including Cancun Safeguards, applicable to REDD+ projects, and SBCE Law text (art. 28, §1), reinforce action relevance intended to innovation, technical qualification, research and support to sustainable technology implementation.

Knowledge education and dissemination are key elements to solid governance, which reduces risks and enables increasingly inclusive and efficient market development. Due to that, it is fundamental that carbon market development includes:

- Technical qualification programs for sector producers and professionals, promoting local community enhancement;
- Integration between productivity and sustainability, in order to maximize environmental, economic and social benefits;
- Accessible language adoption, which translates market technical aspects to rural product daily activities, democratizing knowledge and expanding engagement.

It is noticed that holding COP30 in Brazil represents a unique opportunity for the country to play a major role in global climate agenda, supported by natural assets and sustainable agribusiness force. Showing to the world Brazil´s potential to generate sound credits is a decisive step to lure investments, consolidate its player reputation and foster this market growth in multiple fronts.

Final considerations

So that this participation is effective, it is essential that discussions progress in topics including governance, structuring and credibility of SBCE. It is required that the country presents concrete results — in regulations, technologies, methodologies and registration systems — ready to be debated and acknowledged internationally.

COP30 strategic recommendations include:

- Acknowledging agribusiness as climate agenda protagonist, with active role in emission reduction and sink generation;
- Consolidating inclusive national regulatory milestone, which enables effective agribusiness participation to provide credits to national carbon market;
- Investing in research, solid methodology tropicalization and scientific infrastructure;
- Setting forth concrete economic incentives, including taxes, so that rural producers adopt low carbon practices;
- Promoting field climate education; democratizing access to carbon market opportunities;
- Placing Brazil at COP30 as low carbon agriculture global benchmark, and agriculture and livestock sector major player.

Conclusion

Initiative **"Towards COP30: Agribusiness and Climate Changes"** goal was contributing to climate agenda through a wide debate among representatives from companies, government, non-profit sector, academia and scientific community.

It was evident, along discussions, that Brazilian Agribusiness plays a crucial role in this global agenda, especially concerning COP30.Not only it is a particularly vulnerable sector to climate change impacts, Agribusiness production chain also stands as solution fundamental part, with great potential to mitigate emissions and promote food security in sustainable way.

So that this potential is fulfilled, it is essential to implement innovative agricultural practices, adapted to Brazilian tropical reality, including efficient natural resource use, tolerant variety growing to climate stresses, and conservationist soil management. Moreover, it is essential to unlock funding to sector, through objective and transparent criteria, which incentive sustainable technology and practice adoption.

Agribusiness active participation in carbon market is also fundamental, valuing environmental assets and generating carbon credits through projects that promote emission reduction and atmosphere carbon removal. Thus, metric and methodology tropicalization is crucial, adapting them to Brazilian reality and assuring project credibility.

COP30 is a unique opportunity for Brazil to stand as a global leadership in low carbon agriculture, showing to the world its potential to generate sound credits and attract investments to the sector. Therefore, it is fundamental that the country presents concrete results — in regulations, technologies, methodologies and registration systems — ready to be debated and acknowledged internationally.

Acknowledging Agribusiness as a climate agenda role player and investing in its capacity to mitigate emissions and generating carbon sinks is a decisive step so that Brazil contributes significantly to a more sustainable, resilient, competitive and balanced future.

Mentors:

For each topic approached in debate panels, two experts performed as mentors.

Adaptation and Mitigation: Carlos Eduardo Cerri, Director of CCARBON/USP - Center for Carbon Research in Tropical Agriculture, and Renato Rodrigues, Head of Agribusiness of Terradot.

Funding: Marcelo A. Boechat Morandi, Head of International Relations Consulting at Embrapa and Rodrigo C. A. Lima, CEO of Agroicone.

Carbon Market:Eduardo Bastos, CEO of Instituto de Estudos do Agronegócio (IEAg) at ABAG and Instituto Equilíbrio, and Natascha Trennepohl, PhD, partner of Carbonn Nature.

This document relied on the collaboration of people that attended debate panels of the Forum **“Towards COP30: Agribusiness and Climate Changes”.** They include:

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