



AMAZON TRANSITION - CERRADO: AGRICULTURAL FRONTIER AND SUSTAINABILITY IN THE STATE OF MATO GROSSO, BRAZIL

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ABSTRACT

Objective: The present study aimed to demonstrate the relevance of agribusiness and highlight sustainable development actions in the Amazon-Cerrado transition zone, in the center-north of the state of Mato Grosso, in line with the Sustainable Development Goals of the United Nations.

Theoretical framework: This topic sought to contemplate the aspects of sustainable food production, in a holistic view that minimizes environmental impacts, in order to stimulate sustainable management, efficient use of resources and inputs in the various sustainable economic activities.

Method: Theoretical framework on the subject, research based on Web of Science and Google scholar, tabulation of data and elaboration of a table with sustainable initiatives and a map of the location of the Amazon-Cerrado transition zone.

Results and conclusion: In parallel to the large-scale agro-export production mode, several initiatives of agroecological production, natural extractivism, integration between forest, crops and livestock were identified in the research using techniques that seek environmental sustainability and sustainable local development in the region of the study.

Implications of the research: In line with the environmental theme, the study presents and discusses relevant initiatives in society associating agribusiness and sustainable development.

Originality/value: Preparation of an unprecedented map of the municipalities of Mato Grosso that are located in the transition zone of the Amazon - Cerrado biomes and a table with organizations, activities and sustainable actions developed in the transition area and respective associations with the Sustainable Development Goals of the United Nations, with a discussion on proactive activities aimed at developing the region in focus.

Keywords: Amazon, Savannah, Agribusiness, Sustainability, SDG/UN.

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TRANSIÇÃO AMAZÔNIA - CERRADO: FRONTEIRA AGRÍCOLA E SUSTENTABILIDADE NO ESTADO DE MATO GROSSO, BRASIL

RESUMO

Objetivo: O presente estudo objetivou demonstrar a relevância do agronegócio e evidenciar ações de desenvolvimento sustentável na zona de transição Amazônia-Cerrado, no centro-norte do estado de Mato Grosso, em linha com os Objetivos do Desenvolvimento Sustentável da Organização das Nações Unidas.

Referencial teórico: Buscou-se neste tópico contemplar os aspectos da produção sustentável de alimentos, em uma visão holística que minimize os impactos ambientais, no sentido de estimular a gestão sustentável, uso eficiente dos recursos e insumos nas diversas atividades econômicas sustentáveis.

Método: Referencial teórico sobre o tema, pesquisa baseada na Web of Science e Google acadêmico, tabulação dos dados e elaboração de um quadro com as iniciativas sustentáveis e um mapa de localização da zona de transição Amazônia-Cerrado.

Resultados e conclusão: Em paralelo ao modo produtivo agroexportador de larga escala, identificou-se na pesquisa diversas iniciativas de produção agroecológica, extrativismo natural, integração entre floresta, lavoura e pecuária utilizando técnicas em que buscam a sustentabilidade ambiental e o desenvolvimento local sustentável na região do estudo.

Implicações da pesquisa: Em linha com a temática ambiental, o estudo apresenta e discute iniciativas relevantes na sociedade associando o agronegócio e desenvolvimento sustentável.

Originalidade/valor: Elaboração de um mapa inédito dos municípios de Mato Grosso que estão inseridos na zona de transição dos biomas Amazônia - Cerrado e um quadro com organizações, atividades e ações sustentáveis desenvolvidas na área de transição e respectivas associações com os Objetivos do Desenvolvimento Sustentável da Organização das Nações Unidas, com uma discussão sobre as atividades pró-ativas visando o desenvolvimento da região em foco.

Palavras-chave: Amazônia, Cerrado, Agronegócio, Sustentabilidade, ODS/ONU.

TRANSICIÓN AMAZÓNICA - CERRADO: FRONTERA AGRÍCOLA Y SOSTENIBILIDAD EN EL ESTADO DE MATO GROSSO, BRASIL

RESUMEN

Objetivo: El presente estudio tuvo como objetivo demostrar la relevancia de los agronegocios y resaltar acciones de desarrollo sostenible en la zona de transición Amazonas-Cerrado, en el centro-norte del estado de Mato Grosso, en línea con los Objetivos de Desarrollo Sostenible de las Naciones Unidas.

Marco teórico: Este tema buscó contemplar los aspectos de la producción sostenible de alimentos, en una visión holística que minimice los impactos ambientales, con el fin de estimular el manejo sostenible, el uso eficiente de los recursos e insumos en las diversas actividades económicas sostenibles.

Método: Marco teórico sobre el tema, investigación basada en Web of Science y Google Scholar, tabulación de datos y elaboración de una tabla con iniciativas sostenibles y un mapa de la ubicación de la zona de transición Amazonas-Cerrado.

Resultados y conclusión: En paralelo a la modalidad de producción agroexportadora a gran escala, se identificaron en la investigación varias iniciativas de producción agroecológica, extractivismo natural, integración entre bosques, cultivos y ganadería utilizando técnicas que buscan la sostenibilidad ambiental y el desarrollo local sostenible en la región de estudio.

Implicaciones de la investigación: En línea con el tema ambiental, el estudio presenta y discute iniciativas relevantes en la sociedad asociando el agronegocio y el desarrollo sostenible.

Originalidad/valor: Elaboración de un mapa inédito de los municipios de Mato Grosso que se ubican en la zona de transición de los biomas Amazonía - Cerrado y una tabla con organizaciones, actividades y acciones sostenibles



desarrolladas en la zona de transición y respectivas asociaciones con los Objetivos de Desarrollo Sostenible de la Organización Naciones Unidas, con un debate sobre las actividades proactivas destinadas a desarrollar la región en el centro de atención.

Palabras clave: Amazonía, Grueso, Agronegocios, Sostenibilidad, ODS/ONU.

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1 INTRODUCTION

The technical aspects of public policy related to the environment have been discussed with more emphasis since the 1970s, focusing on ways of exploitation around the world, considering the economy from the perspective of sustainability. In this sense, the arguments necessarily went through guiding guidelines and actions that could mitigate the impacts generated by progress at the global level.

It is estimated that the world population will be 9.8 billion, 29% more than the current number and in developing countries the growth will be higher (UN, 2019). In this scenario, 70% of the population will be urban and income levels will be higher than the current ones, "to feed this larger, urban and rich population, food production should increase by 70% and Brazil will become the main supplier to respond to the increase in global demand for *commodity* imports" (FAO, 2017).

In food production, the use of tropical forests and climate issues are closely linked. From this perspective, research, studies and institutions in the world are trying to understand the risks to the affected ecosystems and to present more sustainable alternatives. Foley *et al.* (2011), among other authors, emphasize that agriculture is significantly increasing CO₂ emissions from deforestation, reducing biodiversity and ecosystem services.

Farming accounted for about 74% of total greenhouse gas (GHG) emissions in 2020 in Brazil, according to data from the System of Estimates of Emissions and Removals of Greenhouse Gases (SEEG, 2023). Consequently, it is necessary to create an index to measure the benefits of reducing these emissions (Searchinger *et al.*, 2018). The constant increase in these gases can dramatically change the climate, according to a recent report by the IPCC - Intergovernmental Panel on Climate Change that assesses the possibility of profound climate change (Ditlevsen & Ditlevsen, 2023).

The advance in the use of tropical forests and the increase in emissions may bring humanity closer to undesirable limits to our planet. By the year 2050 estimates have *shown that*



environmental effects could increase by 50-90%, making it necessary to mitigate these externalities (Springmann et al., 2018). Therefore, technological innovations should be used to generate efficient systems related to planting, more heat-resistant crops, efficiency of collection, recycling and irrigation systems as has been happening in the United States (Ausubel, 1991).

Food demand tends to increase due to the increase in population and income in the world (Searchinger *et al.*, 2018). Food availability will need to double in the next 25 years, so it is necessary to resort to more than 1,700 gene banks, plant breeding, and creole seeds that are more resilient and help reduce food insecurity with environmental sustainability (McCouch *et al.*, 2013).

Sustainable development is a prerequisite for food production. In the Amazon forest, despite the income for local communities being relatively low, the environmental gains are considerable (Silva *et al.*, 2016). It is possible to impact the local and global economy with actions with some technological limitation, such as the exploitation of babassu, cupuassu and Brazil nuts (Nobre *et al.*, 2016). Along these lines, an initiative that takes place in Africa (Ghana), shows that agriculture provides 60% of the average rural family income, forest 38% and activities outside the farm only 2% (Appiah *et al.*, 2009).

Climate variability from land use changes can cause irreversible damage to local and continental climate (Marengo *et al.*, 2018). In the eastern Amazon region, it has already observed a decrease in land cover, an increase in local air temperature and other factors linked to agricultural expansion (Sampaio *et al.*, 2007). However, some measures can contribute to the preservation of the Amazon forest: abandon the use of fire, invest in fire prevention, respect environmental laws and restrict agricultural expansion (Nepstad *et al.*, 2008).

From this perspective, the objective of the present study was to demonstrate the relevance of agribusiness and evidence sustainable development actions in the Amazon-Cerrado transition zone, in the north-central state of Mato Grosso, in line with the Sustainable Development Goals (SDG/UN).

The theme discussed in this research encompasses from the spheres of public and private institutions, as well as community actions that develop sustainable activities. In this sense, highlight the magnitude of agribusiness and ways to alleviate the impact caused to the environment of the study area.



2 THEORETICAL FRAME

The analysis of the conditions for preserving ecosystems is of fundamental importance to humanity. Producing food is essential, as is the maintenance of biomes and their transition zones that constitute the unique biodiversity of the planet, such as the biomes of the Amazon and Cerrado. Sustainable development in these regions is necessary for Brazil, other nations around the world and local communities to enjoy production and extraction according to the capacity of the environment.

2.1 AGRIBUSINESS IN MATO GROSSO STATE

The state of Mato Grosso, which since colonial times was considered an exotic territory, being isolated from the coastal regions of Brazil, began to undergo socio-economic transformations from the 1930s with state policies of territorial integration (Ioris, 2017). This process intensifies with the period of military governments between the years 1964 to 1985 with actions that took agriculture to the Midwest and the Amazon region.

For the success of the model of occupation, both national and international companies were attracted to the state, as well as small farmers from the states of the southern region of Brazil, who saw an opportunity for economic recovery. Thus, the state of Mato Grosso has become a haven for private colonization enterprises, which culminated in the origin of the cities in the north of the state, which today dominate the production and export of agricultural commodities (Ioris, 2017).

Agricultural activity is the main driver of the economy of the state of Mato Grosso. To this end, the financing of production is of fundamental importance, as a function of the high levels of productivity required and the proportion of the sector's technological scale (Vieira Filho; Gasques, 2023).

The financing of agribusiness in Mato Grosso can be divided into three periods, as follows: i) 1970 to 1980 characterized by strong state participation; ii) 1980 to 1990 characterized by instability due to the transition of macroeconomic policy; iii) involved greater financial complexity due to the growing Brazilian neoliberalization from the 1990s that is the new globalized model of agricultural capitalism (Ioris, 2016).

The agribusiness consolidated itself in the region and established a complex agroindustrial chain that permeates the development of a large part of the municipalities of the state of Mato Grosso. Exports of commodities such as soybeans, cotton and corn virtually



monopolize state funding resources. In addition, the state is a major producer and exporter of beef, poultry meat, soybean oil and other agricultural products.

The state's largest trading partner is the Republic of China. Wilkinson (2016) described the progressive relevance of the Brazil-China relationship in the economic and diplomatic fields. Between 1970 and 1980 Brazil exported mainly manufactured from the steel and petrochemical industries.

In this context, in 1991, about 56% of our exports to the Chinese were iron ore and soybean oil, imported from that country low-trade-value final consumer goods, initiating a new pattern of trade between these nations. Between 2004 and 2013 there was an expansion of trade flows from \$9 billion to \$80 billion.

Our Chinese imports came to be mainly of electronic products, and 75% of exports were of iron ore, soybeans, cellulose and petroleum (Wilkinson *et al.*, 2016). In this way, we have become important suppliers of food and raw material for the industrial growth of China, and the agribusiness of Mato Grosso is positioned as the largest national producer and exporter, reflecting in the solid local socio-economic development from the 2000s onwards.

2.2 SUSTAINABLE DEVELOPMENT AND SUSTAINABILITY

The concept of sustainable development is dynamic and always needs to be under discussion, especially in academic circles, to overcome difficulties in its interpretation. New terms emerge, such as the Circular Economy, which relates more to questions of economic prosperity (Kirchherr *et al.*, 2017). Also the definition on sustainability of restoration or environmental degradation processes needs better interpretation (Ostrom, 2009). Discussion on the topic is essential, since the world increasingly needs to combine environmental preservation and reduction of food insecurity (Godfray *et al.*, 2010).

In the context of sustainable development, the Stockholm Conference in 1972 is an important milestone in the discussion, and in 1987 the Brundtland Report brought the most used definition of the term, as the "ability to meet present needs without harming future generations", constituting a vast and complex set of challenges for society (Geissdoerfer *et al.*, 2016). The corporate management literature focuses on ecological sustainability and the issue of social and environmental responsibility (Carter & Rogers, 2008).

For the success of sustainable actions, Sachs (2009) considers it essential that modern biotechnology be available to all the tips of the 5 Fs: food, supplies (*feed*), fuels (*fuel*), fertilizers



(fertilizers) and industrialized animal feed (feed). This is an issue of the utmost importance for humanity in the quest for sustainability.

The Brundtland Report focused on the dichotomy between development and the environment, restricting the debates to these two aspects. Subsequently, the UN developed a broader understanding that sustainability consists of the interaction and interdependence between three main dimensions: social development, economic development and the environment, which need to be considered as a whole to achieve the established goals of preservation and conservation (Kuhlman & Farrington, 2010).

The concept of sustainability should be understood as a set of dynamic objectives measuring causes and effects in the environmental, economic and social spheres, such as the production, distribution and use of biofuels worldwide (Efroymson *et al.*, 2012). In this perspective, the SDG initiative should be applicable guidelines in the public and private spheres, so that sustainability can really get off the ground by innovating technologies that leverage natural resources with less impact on the environment.

2.3 SUSTAINABLE DEVELOPMENT GOALS

The UN held the meeting of key Member States in September 2015, where the 2030 Agenda for Sustainable Development was established. This document reflects the concern to reduce poverty and improve living conditions for all on the planet, benefiting current generations without harming future generations.

At the same time, national economies were being affected by climate change caused mainly by increased GHG emissions around the world. Ending hunger, improving living conditions, reducing GHG emissions and saving the planet were the main motivations for developing the SDGs (UN, 2023).

The SDGs are a set of 17 topics subdivided into 167 goals, created by the United Nations in 2015. This document was part of the action plan "Transforming Our World: The 2030 Agenda for Sustainable Development" which was a response to global challenges of climate, social inequality and environmental degradation (Van der Waal & Thijssens, 2020).

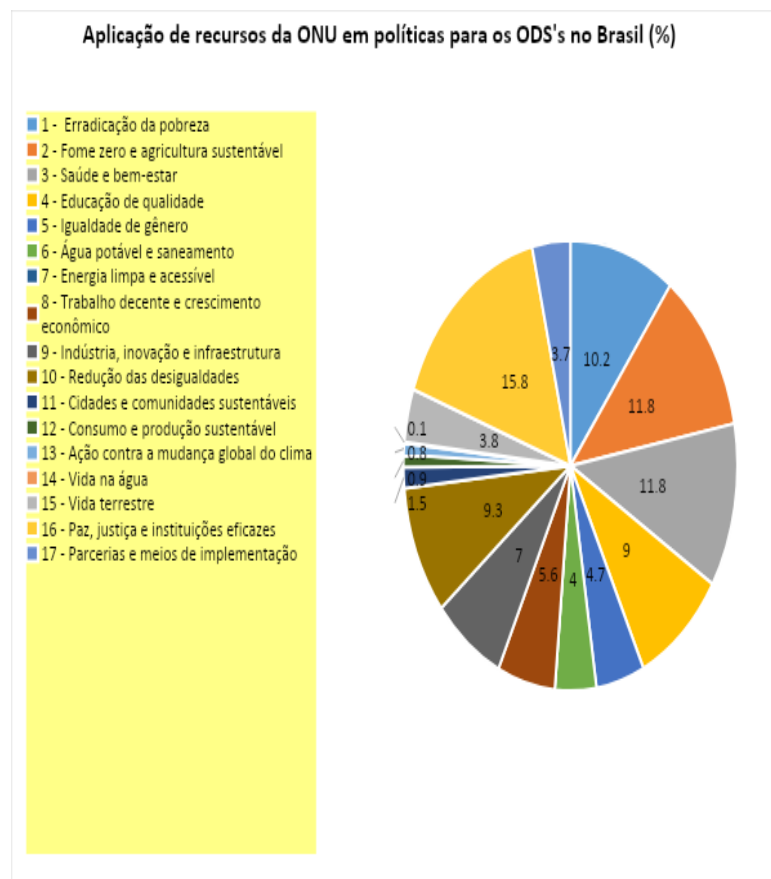
In Brazil, the UN carries out about 274 activities with investments of around 191 million dollars to reach the 17 SDGs (UN, 2023). The actions are organized in the United Nations Sustainable Development Partnership Framework formed by all UN agencies, funds and programs in each nation (UNSDPF, 2023).



The *International Fund for Agricultural Development* (IFDA), Ministry of Agriculture, Livestock and Supply (MAPA), *The Green Climate Fund* (GCF), National Council of Justice (CNJ), Brazilian Agency for Cooperation (ABC), UN Agency for Refugees (UNHCR), UN Agency for Refugees - Multi Donors (UNHCR MD), United Nations Children's Fund (UNICEF), Department of Population, Refugees and Migration (PRM - U.S. DEPARTMENT OF STATES) participate. Besides international bodies, Brazilian institutions participate, such as (BNDES, Amazon Fund) and international (World Bank). Therefore, there are several institutions working in partnerships for the implementation and execution of the SDGs in the country. Resources are allocated according to the needs of each objective, as shown in Figure 1.

Figure 1

Graph on the distribution of resources of the UN and its partners for the SDGs in Brazil.



Source: Prepared by the authors from the UN (2023).

The graph presents, in percentage terms, the amounts set aside by UN Brazil and its partners for SDG programs and actions. Highlights are Goal 17 - Peace, justice and effective



institutions - which receives the highest percentage (15.8%). While goal 07 - Clean and affordable energy - does not receive values (0%).

The concern with environmental and climatic issues, the emissions of GHGs, give an impulse to investments in research into the ecosystems, qualification and awareness of the people who live in these places. They are business groups and diverse communities, rural settlements, family farmers who receive technical and financial assistance from national organizations such as the BNDES (Amazon Fund) and international (World Bank).

Agricultural expansion may be more effective in the Mato Grosso Amazon, due to an unprecedented global demand for food and biofuels pushing for the conversion of the tropical forest to agriculture (Macedo *et al.*, 2012). Deforestation has a direct relationship with the price of soybeans, which defines a high standard of forest loss in Mato Grosso (Morton *et al.*, 2006). The transition zone of the Amazon-Cerrado biomes in which most of the commodities production takes place, needs better planning of public policies aimed at preserving their biodiversity (Marques *et al.*, 2020).

There is a trend of expansion of cultivated area as already cited in Macedo (2012). Most of the cities that produced the most agricultural commodities in 2020 are located in the area under study (SEPLAG, 2020). It is one of the most extensive and complex transition areas in the world, where the rates of rotation of most vegetation are exceptionally high (Oliveira *et al.*, 2017).

Therefore, it is necessary that indices of economic, social and environmental efficiency be developed to monitor the use of these biomes and propose more efficient public policies (Araújo *et al.*, 2021).

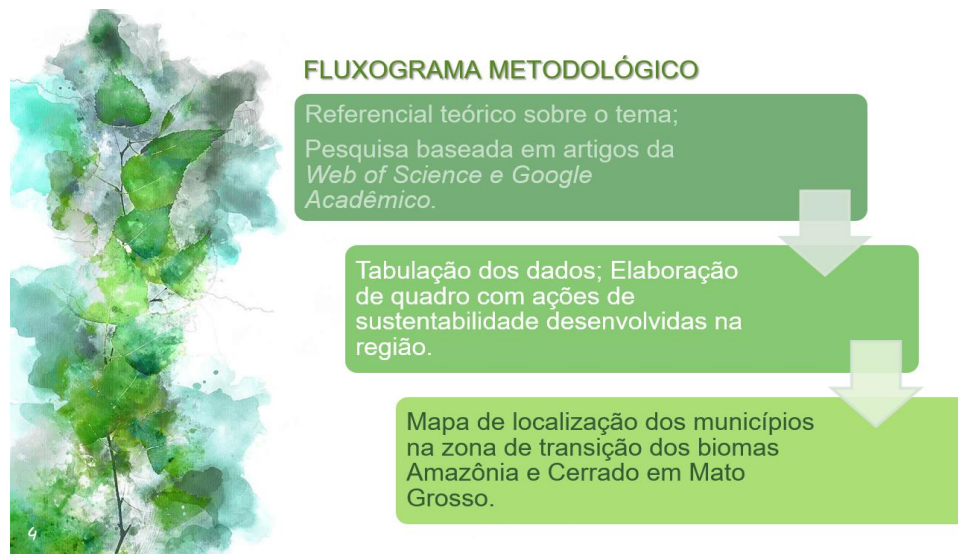
3 METHODOLOGY

The methodology and procedures used in the work followed the steps described in Figure 2 methodological flowchart:



Figure 2

Methodological flowchart.



The geographical area of the Amazon-Cerrado transition zone and the corresponding municipalities were defined by a mapping of the types of vegetation that characterize the region (Parreira Lúcio, 2020). The *software* ArcGis 10.6 was used to draw up the thematic map of the location of these localities in the transition zone of the Amazon and Cerrado biomes in the state of Mato Grosso. The *shapefile* vector data (Limit of Brazil and Biomas) were obtained from the website of the Brazilian Institute of Geography and Statistics (IBGE).

First, there was the cutting out of the biomes of the Amazon and Cerrado, a state limit, after the municipal limits inserted into the transition zone. These procedures were developed with the help of the *geoprocessing-clip* tools. After the *shapefile* cut out, the *symbolology-categories-unique values* tool applied the *classification of the names of municipalities and biomes according to the corresponding colors*.

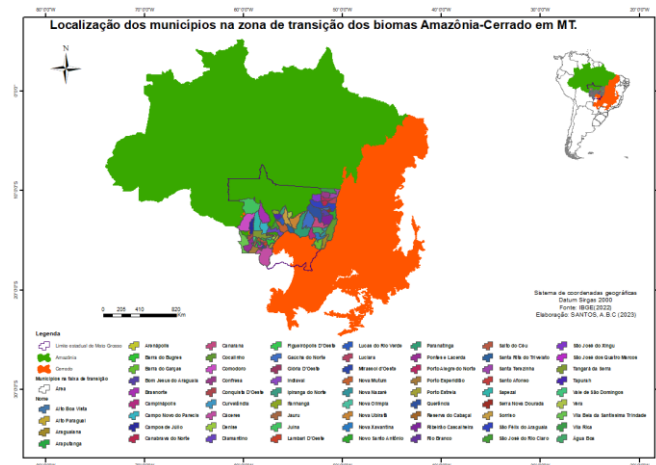
3.1 CHARACTERIZATION AND LOCATION OF THE STUDY AREA

The state of Mato Grosso (MT) is located in the Midwest Region of the country, it is the third largest in Brazil with territorial area of 903,208,361 km². In 2021 its estimated population was 3,567,234 people, and the population density was 3.36 inhab/km². Its capital is Cuiabá with approximately 623,614 inhabitants in 2021 (IBGE, 2023). Figure (3) shows the map of location of the state of Mato Grosso and the municipalities that are inserted in the transition zone of the Amazon and Cerrado biomes.



Figure 3

Map of the location of the municipalities in the transition zone of the Amazon- Cerrado biomes in Mato Grosso.



Source: IBGE (2022), with specific elaboration for the transition zone of the Amazon and Cerrado biomes carried out by the authors.

From this perspective, present productive and extractive activities in the Amazon biomes and the Amazon-Cerrado transition zone in Mato Grosso, Brazil. According to the IBGE, the Amazon biome is the largest in the country, occupies about 49% of the territory, is the largest humid tropical forest on the planet and contains 20% of all fresh water in the world, besides large mineral reserves and enormous biodiversity.

The Cerrado is the second largest biome in the country, occupying about 24% of the national territory, being recognized as the savanna with the highest biodiversity on the planet (Educa IBGE, 2023). In the biome it is common to have more spaced trees and smaller statures, but they are more efficient and resistant to the changes that are occurring in ambient and foliar temperatures (Araújo *et al.*, 2021).

The Amazon-Cerrado transition zone is the largest ecotone (contact area between two biomes) savanna-forest in the world with a total length of 6,000km (Oliveira *et al* (2017). In the territory of Mato Grosso, it occupies approximately 414,007 km² of dry forests that normally occur in places distant from the permanent waterways (World Wildlife Fund Brazil, 2023). The Amazon-Cerrado transition zone may be the first region of the planet affected by the changes resulting from extreme climatic effects and from the advance of deforestation (Marques *et al.*, 2020).

The study focused on the actions, projects and programs for production and extraction developed in these regions by non-governmental organizations, companies, international



institutions, state and federal governments. They are activities involving local communities of family farmers, native peoples, organized in associations and cooperatives.

The research was based on scientific articles from the *Web of Science*, Scielo, Google Academic *databases*, as well as on the sites of institutions, besides the official sites of the cities of Alta Floresta and Cotriguaçu, both of the state of Mato Grosso.

4 RESULTS AND DISCUSSIONS

Brazil is finalizing a period of strong GDP drop since 2015, according to data from SEPLAG MT - Secretary of State for Planning and Management, 2023 - the country's GDP turned negative in 2015 and 2016. More recently, the forecast for 2022 was to grow 0.3%, however, the result was 3% growth of national GDP, in this scenario, the state of Mato Grosso has important participation.

In this context, the economy of the state of Mato Grosso is driven by agribusiness, which is the main factor of generation of employment and regional income. Some commercial results prove the strength of the agro-exporting sector. The trade balance showed in the 4th quarter of 2022 an expansion of export value of around 77% compared to the same period of 2021 (SEPLAG, 2020). This performance confirms the productive and commercial vocation of the state.

In the year 2020 the state GDP was 178,65 mi of real motivated mainly by the performance of the farming sector. The municipalities of the Amazon-Cerrado transition zone, about 63 localities, had a participation in this result of 78.89 mi of reals, that is, practically 44% of all of the state's wealth.

Then, the average GDP of these cities was 1.25 mi, and the average GDP per capita was 60.85 thousand reais (SEPLAG, 2023). The municipalities that stood out the most in 2020 were Sorriso with 9.1 mi of reais, and Sinop with 8.07 mi and real of GDP. In addition, Nova Mutum, Campo Novo do Parecis and Diamantino can be highlighted as major producers of commodities for export (SEPLAG, 2023).

In the first quarter of 2023: The state GDP grew by 11% while Brazil's GDP increased by 4% in that period. The sector of the local economy with the best result was agriculture with an increase of 30%, which demonstrates the importance of this sector for the national economy. In the period from 2002 to 2020, Mato Grosso presented the highest average of the country's growth with 4.7% a year, besides obtaining the highest GDP per capita with approximately 50.6



thousand reais (2023). Most of this production comes from the municipalities located in the Amazon-Cerrado transition zone.

The current external demand for food produced in Brazil raises concerns about environmental conservation and preservation, which is becoming a challenge for the State. Research indicates a possible increase in this volume as a function of the population growth and of the greater consumption of food in the whole world. If this forecast is confirmed, the agricultural frontier will tend to expand in the direction of the Amazon-Cerrado transition zone and to the tropical forest itself.

These concerns are in line with the above-mentioned document, the 2030 Agenda of the SDGs to be incorporated by all nations. Since then, numerous actions have been taken to achieve the 17 U.N. goals and eliminate hunger, reduce GHG emissions and climate impacts, ensuring the availability of natural resources for future generations.

In parallel to the large scale agroexporter production system, the research identified several initiatives of agroecological production, natural extraction, integration between forest, farming and livestock using techniques in which they seek environmental sustainability and local development. Figure three (3) contains important initiatives organized by national and international institutions in the north and middle-north region of the state of Mato Grosso.

Figure 3

Sustainable organizations, activities and actions developed in the transition area of the Amazon - Cerrado biomes and their relations with the SDGs/UN.

Organization	Activity	Sustainable action
Association of Brazil Nut Collectors of Pará Juruena - Municipality of Cotriguaçu - MT.	Sustainable extraction of Brazil nuts. SDG/UN: 1, 2 and 12	Plan for Sustainable Forest Management of Brazil Nut. Average annual production of 16 tons of chestnuts. Tree mapping, cleansing access roads, choosing the least extensive trails. Territorial Intelligence Portal (2023).
AJOPAM - Juinense Association Organized For Mutual Aid - Municipality of Juína, north of Mato Grosso	It works on the educational issue SDG/UN: 4 and 12	Educational and environmental development for timber workers and prospectors. Improving socio-environmental integration Recovery of degraded areas by mining. (Riscarolli, 2002)
COMOV - Mixed Agricultural Cooperative Green Gold in the city of Alta Floresta - Alta Floresta Municipality - MT.	Production and marketing of milk and milk products. SDG/UN: 1, 2, 11 and 12	Technical support from the Center for Life Institute through the Socio-Productive Networks project. Funding from the Amazon Fund/BNDES. Associations, cooperatives and small farmers. It operates in 6 municipalities: Alta Floresta, Nova Monte Verde, Cotriguaçu, Colniza, Nova Bandeirante and Paranaíta. (Centro de Vida Institute, 2023).



Project Juruena Carbon Well - ADERJUR - Juruena Rural Development Association - Municipality of Juruena - MT	SAFs - Agroforestry Systems, the production of Non-Timber Forest Products - PFMN. SDG/UN: 1, 2 and 12	Conservation of biodiversity. Biomass production (carbon sequestration). Generation of ecosystem services. Four indigenous associations. Four women's associations, one of them being indigenous women. A family farmers' cooperative. Support from Petrobras Socio-Environmental Program. (Juruena Rural Development Association - Juruena Municipality - MT, 2023)
Project Mato Grosso Sustentável - State of Mato Grosso - Area: 09 Conservation Units (UCs) and 40 municipalities of the state in the Amazon biome.	Support to the Protected Areas system. SDG/UN: 4 and 12	Strengthen forest enforcement and licensing through digital innovation. Expansion and strengthening of surveillance activities in the region. Deconcentration and decentralization of activities. Funding from the Amazon Fund with resources in the order of 35 million reais. (Amazon Fund, 2023)
Organic Production Network of the Amazon Mato Grosso - Repoama - Alta Floresta, Paranaíta, Nova Monte Verde, Nova Bandeirantes, Cotriguaçu and Colniza, in the north and northwest regions of Mato Grosso	Organic food production. SDG/UN: 1, 2, 11 and 12	Project of the ICV - Center of Life Institute. Funding from the Amazon Fund/BNDES, the Global REDD Early Movers (REM) Program and the European Union. Accredited as a Participatory Guarantee System (GSP) by the Ministry of Agriculture, Livestock and Supply (Map). (Centro de Vida Institute - News, 2023)
Program for Reducing Emissions from Deforestation and Degradation REDD+ Early Movers of Mato Grosso - Leadership of the 43 original peoples of the state - Participants: all 43 indigenous peoples of the territory of the state of Mato Grosso.	Conservation of forests, reduction of deforestation and CO2 emissions. SDG/UN: 1, 2, 10 and 12	Sustainable development for farmers, indigenous communities and extractive communities. Participation of the Federation of Indigenous Peoples and Organizations of Mato Grosso (FEPOIMT) and the Center of Life Institute (ICV), with the support of the German Technical Cooperation (GIZ - <i>Deutsche Gesellschaft für Internationale Zusammenarbeit</i>), the project of Window A of the GCF Valorizando as Florestas de Mato Grosso, the National Indian Foundation (Funai) and the Superintendence of Indigenous Affairs (SAI/MT). (REM/MT Life Center Institute, 2023)
Forest Restoration in degraded APPs in Alta Floresta - SAF for Agroecological Corridors - Municipality of Alta Floresta - MT.	Agreement with the Ministry of Justice. SDG/UN: 2, 8, 11, 12 and 13	To conserve and improve the production and supply of water on family farm properties in Alta Floresta/MT. Maintenance of areas with periodic management. Restore degraded Permanent Preservation Area (APPs) through the use of Agroforestry Systems (SAFs). Formation of ecological corridors for landscape connectivity and the production and sustainable use of forest and water resources. (Instituto Centro de Vida Sistemas Agroforestry (SAFs, 2023).
Project Forest Carbon Well of Peugeot-ONF - Municipality of Cotriguaçu - MT.	Reforestation project for carbon sequestration. SDG/UN 7, 8, 12 and 13	Capture of atmospheric CO2 by reforestation of 2,000 hectares of degraded pastures. To analyze the efficiency of the planted forest in the reduction of atmospheric CO2 concentrations. Show that ecosystem protection and local development are not incompatible (Peugeot-ONF, 2023)



Embrapa Western Amazon - Recovery of degraded or altered areas in the Amazon.	Environmental recovery and development through forest restoration actions in all Brazilian biomes. SDG/UN 1, 6, 7, 12 and 13, 14, 15.	Forest recovery actions in 52 municipalities located in the states of Pará, Mato Grosso, Rondônia and Sul do Amazonas. Use of agroforestry systems, Integration of Livestock and Forest, planting of forests. Benefits for society and the Amazon biome according to the SDGs, with adaptation to climate change, water and food security, poverty reduction, economic growth and biodiversity conservation (EMBRAPA, 2022)
Farm Group Brunette New Field of the Parecis	Sustainable production on a large scale through integration of livestock and forest integration systems - IPF and crop and livestock integration - ILP SDG/UN 2, 4, 6, 7, 12 and 13	Livestock-forest and crop-livestock integration; Income generation; Use of rainwater for production; Diversified planting of soybeans, corn, brachiaria; Increased profitability with area conservation. 12 families and more than 100 employees Internal environmental actions: Socio-environmental system brunette group Earth Sentinels Harvesting more than perfect Open field academy https://grupomorena.com.br/ssgm/
Itamarati Farm New Field of the Parecis	Conservation of native vegetation SDG/UN: 2, 7, 12 and 13	CONSERV Project Funding of the Environmental Research Institute of Amazonia - IPAM. Payment for the conservation of 2200 hectares of native forest https://www.amaggi.com.br/ipam-e-amaggi-firmam-parceria-para-conservacao-de-vegetacao-nativa/
TerraClass Project	Planning and infrastructure for satellite area monitoring. SDG/UN: 9, 13 and 16	Deforestation analysis service in the Amazon Legal. It feeds data to EMBRAPA and INPE. It guides government actions towards sustainable agricultural production, preservation of biodiversity and environmental services. (TerraClass, 2023)
REDD Early Movers Program - REM MT	Projects that aim to reduce CO2 emissions on the planet. SDG/UN: 1, 2, 11 and 12	They work in the three biomes of Mato Grosso - Amazônia, Cerrado and Pantanal, the program benefits those who contribute with actions for the conservation of the forest, such as family farmers, traditional communities, rural producers and the indigenous peoples, encouraging initiatives that stimulate low carbon agriculture and the reduction of deforestation

It can be seen that there is convergence between the SDGs and sustainable activities, mainly in the mid-north region of the state of Mato Grosso, which includes the major part of the Amazon-Cerrado transition area.



The main SDGs considered in the sustainable production initiatives in the scope of this study were: 1 - Eradication of poverty; 2 - Zero hunger and sustainable agriculture; 8 - Decent work and economic growth; 10 - Reduction of inequalities; 11 - Sustainable cities and communities and 12 - Sustainable consumption and production.

In addition to these activities, under the 2030 Agenda the UN develops 274 other programs funded by the body and its institutional partners to provide a sustainable future and greater food security in Brazil (UN, 2023).

The UN develops 18 of these sustainable projects in Mato Grosso, in partnership with institutions such as UNICEF (UNSDPF, 2023). These programs include SDGs 1, 3, 4, 6, 8, 10, 13, 14, 15, 16, 17 as part of the actions related to the green economy with the perspective of eradicating poverty, job creation and income in the region.

Even with several positive initiatives in the sense of preserving biomes and the Amazon-Cerrado transition zone, there is a tendency for an increase in the demand for food and biofuels. This economic factor, which is difficult to mitigate, may put pressure on the use of new agricultural land, particularly in the tropical forests such as the Amazon and the Cerrado biome. In Mato Grosso, the largest agricultural productions occur in regions with biodiversities that are more sensitive to human actions.

In municipalities such as Lucas do Rio Verde, Juína and Alta Floresta that are located in the center and north of the state, occurs at the same time the large scale production and activities of small family producers to meet the local and regional market. Dairy activity, non-timber product extraction, agro-ecological production and other forms that include some of the presented SDGs are developed.

According to the SEMA-MT Environment Secretariat, since 2019 regional actions are implemented in Mato Grosso through the Global *REDD Early Movers Program* (REM) which also finances the Institute Produce, Conserve and Include (PCI), promoting practices to increase the efficiency of agricultural and forestry production, the conservation of remnants of native vegetation and the recomposition of environmental liabilities (REM-MT, 2019). Initiatives that add to the international efforts of the UN, institutional partners and other nations to minimize the effects of climate change.

In recent years, the state has developed in the agribusiness sector through new production technologies, research and rural development, which have allowed the advance of the planted area, increased agricultural productivity and the formation of an extensive agro-industrial chain. In this segment, the main export vectors are soybeans, corn, cotton, beef cattle raising, milk production, poultry raising and pig farming. The state has the largest cattle herd



in the country and the largest soybean production in the world. These results demonstrate the full strength and relevance of the export agribusiness in generating jobs and income for the population (SEPLAG, 2023).

The above-mentioned companies, institutions and communities develop alternatives for more sustainable production in line with the proposal of the UN 2030 Agenda to eliminate hunger and protect our rivers and forests. South America, especially Brazil, concentrates the most extensive and diverse tropical forests in the world (Bennett *et al.*, 2023).

For many years these forests act as carbon sinks for humanity. At the same time, they are ecosystems that are extremely sensitive to changes in soil temperature and humidity, and from the 1990s these sinks began to decrease and could cease completely by 2040 (Bennett *et al.*, 2023).

This possibility reinforces the relevance and urgency of the initiatives in Mato Grosso in the preservation, environmental conservation and reduction of food insecurity according to the SDGs. They are initiatives in the sense of human awareness for a new relationship with nature, agroecology, ecological corridors, recovery of degraded areas, reforestation and research for carbon sequestration, among others.

The main climate research organs in the world point to the risks of anthropic actions as the dynamo of these transformations (Sampaio *et al.*, 2007). Observational and modeling analyzes have proven that alterations in the soil cover of Amazonia can have a significant impact on the global climate.

However, every possible effort must be engendered in the struggle for the preservation of biodiversity. Studies in Finland have concluded that protected areas may contribute partially to preservation, but alone will not be sufficient to reduce biodiversity losses, and that there is a need to improve the coverage and management of areas (Santangeli *et al.*, 2023).

Within the framework of sustainable activities presented, most of them are in the context of small farmers, cooperatives, communities of original peoples, who need permanent technical assistance in addition to financial resources. To address climate issues, it is necessary to change production practices, have access to storage structures, and especially to choose varieties of crops that are more climate-resistant (Acevedo *et al.*, 2020).

The combination of financial support plus technical infrastructure is essential for the longevity and success of these initiatives, as well as the implementation of environmental public policies (Saarikoski *et al.*, 2018). In this context, some actions related to the SDGs work with reduced resources available (Figure 1) presented in the graph, referring to SDG 7 - Clean and accessible energy is not destined for any value.



According to the initiatives mentioned above, integration between economic actors and the community is essential for local development. According to the IBGE, "Sustainable development seeks to integrate and harmonize ideas and concepts related to economic growth, justice and social welfare, environmental conservation and the rational use of natural resources" (IBGE, 2004).

Based on this assumption, environmental issues are highlighted because we know that, without the natural resources available, there is a shortage that can lead to various extinctions. These sustainable actions and projects are relevant to society, which through environmental education can implement alternatives of behavioral changes for the common good.

Nature already rewards us with its resources that are available and finite that subsidize life on the planet in such a way that its value is indispensable, on this aspect that is analyzed the quality of life. In this way, these projects and actions aim not only to preserve, but also to compensate for the damage caused (McKenney; Kiesecker, 2010).

Along these lines of thinking, of conservation and preservation, the concept of sustainable development has been attributed from the 1970s onwards. When the world began to observe the urgency of worrying about the environment, due to the environmental impacts that occurred frequently.

Amongst the actors that aim to integrate the environment and the themes of environmental education, the Non-Governmental Organizations (NGOs) are fundamental with the integrated actions, in which the information and research are aimed at collaborating with projects that aim at differentiation. Acting with environmental actions, whether for a group, local community or even on larger scales (Charleton-Hug; Hug, 2010).

5 CONCLUSION

Brazilian agribusiness is an indispensable sector for the country's economy, being significant for its significant share in regional and national GDP. Thus, the transition region Amazon - Cerrado in the State of Mato Grosso stands out for the performance in volume of national production associated with the modern technology used by this segment, resulting in relevant participation of *commodity* exports.

On the other hand, continuous monitoring of the impacts caused by anthropic action becomes important, in order to recover and restore the natural environment that is degraded. This can be achieved by collective actions promoting projects to mitigate the damage caused, especially in areas of biodiversity that are more sensitive to human actions.



In this sense, several important productive and conservation initiatives implemented by sustainable organizations, activities and actions developed in the area under focus and their relations with the SDGs/UN have been demonstrated, with desirable results for municipalities in the transition zone. Therefore, it becomes crucial to discuss, support and implement public policies and projects that empower the local economy in a sustainable way.

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