



Panorama of the Ecological Restoration in Matopiba & Public Policy Benchmarking





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1. INTRODUCTION

In recent decades, technological advances in soil preparation, seeds and harvesting have caused an agricultural revolution in Brazil and taken the country to technological leadership in terms of harvesting soybeans and other crops. The agro-industrial advance expanded rapidly in the Cerrado biome's areas, including the Maranhão, Tocantins, Piauí and Bahia states. This region has already been named the "new Brazilian agricultural frontier" and is known as Matopiba, an acronym that comes from the first two letters of the states' names.

One of the most important positive impacts of agricultural expansion refers to the economic effects. However, without control measures, negative social impacts can occur regarding local communities, such as increased social inequality and negative environmental effects, such as loss of native vegetation, loss of biodiversity and degradation of Permanent Preservation Areas (APPs), especially on the banks of water bodies, harming the basins' sustainability. These negative environmental impacts can considerably reduce or even cancel positive economic effects in the medium and long term.

Ecological restoration on farms becomes an important foundation for deforestation-free and sustainable production chains. Compliance with the Forest Code is decisive for containing deforestation, which reached almost 500 thousand hectares (ha) in 2020 in Matopiba.

Matopiba has liabilities of approximately 364 thousand hectares of Permanent Preservation Areas (APP) and 1 million hectares of Legal Reserves (RL), which must be recovered in compliance with the Forest Code. A positive ecological restoration agenda, in addition to the environmental benefits, can also have important synergies with social inclusion and fighting poverty, another challenge for the region's states.

The soy supply chain can provide more direct socioeconomic benefits to the local population. One of the ways to do this is by inserting more products and services into this production chain that can generate work and income for the local population – and the ecological restoration service represents this, bringing not only environmental benefits, but also socioeconomic benefits.

This study aims to support the development of new public policies and projects for ecological restoration, presenting an overview of restoration in Matopiba with important information about the current situation in the region and its bottlenecks. A benchmarking of government initiatives on restoration is also presented, which can be used as references of good practices to solve the identified problems and bottlenecks. These surveys were developed based on surveys, interviews, and consultations with experts from public agencies, Non-Governmental Organizations (NGOs), associations and private organizations that work with restoration.

The study illustrates how clarity and good regulations on recovering native vegetation in Brazil are still lacking for rural landowners to comply with their legal obligations. Existing regulations are not implemented and many of them are confusing, with different terms from one state to another, and no pre-established indicators, causing great legal uncertainty, which makes restoration on the ground difficult. On the other hand, there are also successful public policies that have been implemented in some of the country's regions and that can be used as references in proposing solutions. It is hoped that this study will contribute to the ecological restoration

agenda in Brazil, sharing knowledge and experiences with policymakers and other interested parties in the topic.

The study is the result of the project “Public policies for restoring native vegetation in Matopiba” developed by Agroicone with the support of the Land Innovation Fund (LIF), and it aims to create public policies regarding restoration that facilitate project implementation by rural producers. Furthermore, the project seeks to develop a permanent learning and collaboration environment for policymakers in Matopiba, aiming to establish a basis for continuity of the actions developed in favor of restoration.

2. THE CERRADO: IMPORTANCE, CONSERVATION AND USES

The Cerrado is the second largest biome in Brazil, second only to the Amazon. It continuously covers 11 states as well as the Federal Capital District, in addition to enclaves in 3 other states, and covers close to 203 million hectares, which represents approximately 24% of the Brazilian territory^{1,2,3}. The Brazilian Cerrado contains the world’s richest savanna and is one of the global biodiversity hotspots. 11,627 species of native plants have already been cataloged in its territory². Even so, the Cerrado has only 8.21% of its area protected by Conservation Units (UCs), making it the biome with the lowest percentage of areas under full protection². As a result, the Cerrado's biodiversity is under much strong pressure and risks of extinction. At least 137 species of animals are threatened and approximately 20% of native and endemic species are no longer present in protected areas².

Expansion of the Brazilian agricultural frontier, which took place as of the 1970s, significantly advanced over the Cerrado, making it the second most altered biome in Brazil due to human occupation, second only to the Atlantic Forest². In the Cerrado, in 2019, 105 million hectares were covered by natural forest and non-forest formations, representing 51.7% of the total area of the biome; 86 million hectares were used by agriculture, the equivalent to 42.4% of the total area of the Cerrado; and 12 million hectares (5.9%) were occupied by other uses, such as urban infrastructure, hydrography, planted forest and unmapped areas⁴. Therefore, about half of the biome is already anthropized.

¹ Romeiro, M; Costa, K.; Carneiro Filho, A.; Oliveira, M.; Alves, I. “Cerrado: expansão da área de soja”. São Paulo: INPUT Brasil, 2018.7.

² Ministério do Meio Ambiente (MMA). "O Bioma Cerrado". Available at <https://antigo.mma.gov.br/biomas/cerrado.html>. Accessed on February 10, 2021.

³ Instituto Brasileiro de Geografia e Estatística. "Informações Territoriais - Mapa dos biomas brasileiros". 2004. Available at <https://bit.ly/3ssGQEI>. Accessed on February 10, 2021.

⁴ Projeto MapBiomas – Coleção 5.0 da Série Anual de Mapas de Cobertura e Uso de Solo do Brasil. "Uso e Cobertura Estado & Município (V2)". Accessed on February 22, 2021 on: <https://plataforma.brasil.mapbiomas.org/>.

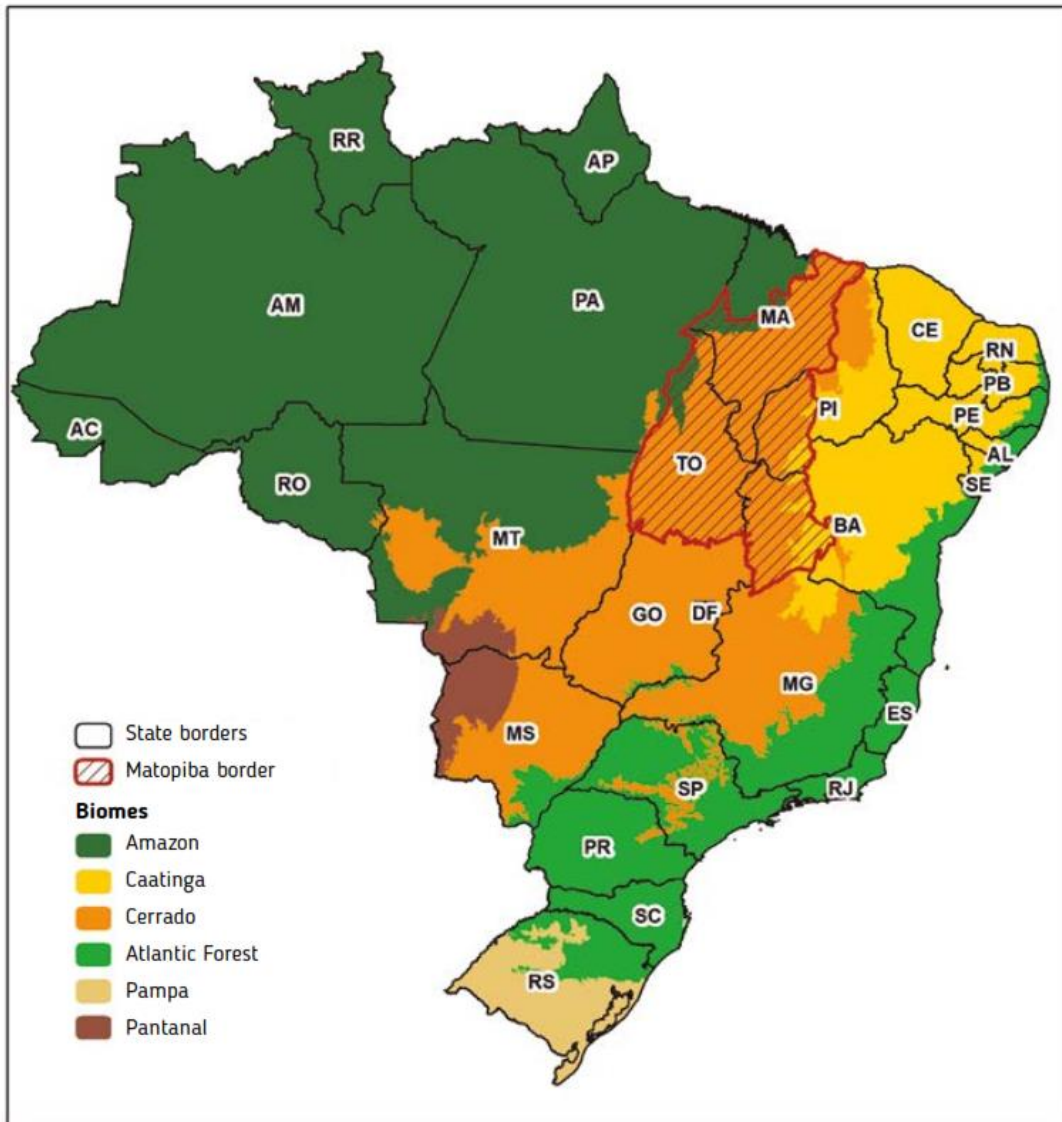


Figure 1. Map of Brazil with indication of biomes, where the Cerrado is represented in orange and the Matopiba region is highlighted in red. Source: Agroicone - prepared in-house with Environment Ministry (MMA, 2019)⁵ data.

According to data published by the National Space Research Institute (INPE)⁶, from 2001 to 2020, 29 million hectares were deforested in the Cerrado. As shown in Figure 2, in the last 20 years it has been possible to verify a downward trend, from approximately 3 million hectares deforested in 2001 to about 700 thousand hectares in 2020, representing a 75% reduction. Despite this trend, since 2016, deforestation has been on a plateau, with 691,000 hectares deforested per year on average. However, in 2020, until early December, 734 thousand hectares were deforested, representing a 13% increase when compared to the previous year⁷.

⁵ Ministério do Meio Ambiente. "Dados biomas". 2019. Available at <https://www.gov.br/mma/pt-br>. Accessed on February 09, 2021.

⁶ Instituto Nacional de Pesquisas Espaciais (INPE). Cerrado - OBT, INPE. "Monitoramento do desmatamento no cerrado brasileiro por satélite". [s.d]. Available at <http://bit.ly/3uBkYJ6>. Accessed on February 26, 2021.

⁷ Assis, L. F. F. G.; Ferreira, K. R.; Vinhas, L.; Maurano, L.; Almeida, C.; Carvalho, A.; Rodrigues, J.; Maciel, A.; Camargo, C. TerraBrasilis: A Spatial Data Analytics Infrastructure for Large-Scale Thematic Mapping. ISPRS International Journal of Geo-Information. 8, 513, 2019. DOI: 10.3390/ijgi8110513.

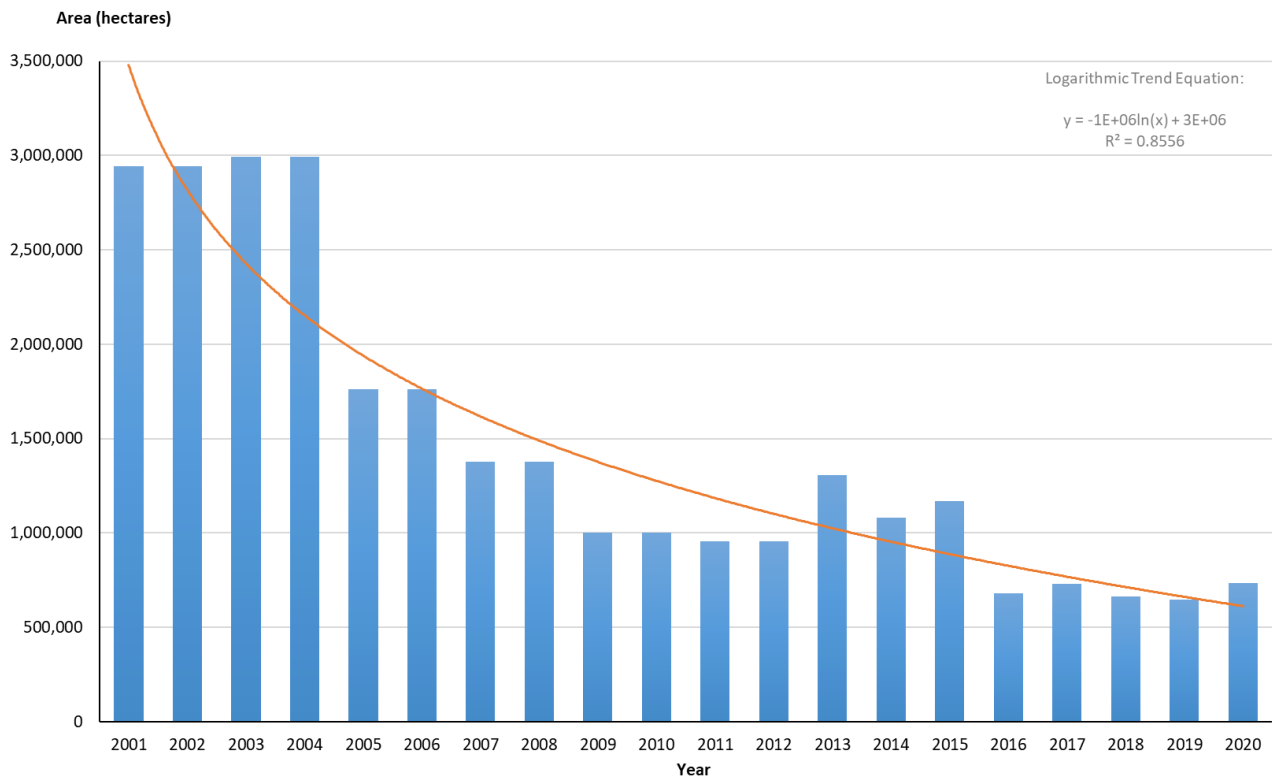


Figure 2. Deforestation rate in the Cerrado in the last 20 years, with logarithmic trend line. Source: Agroicone - prepared in-house with INPE (2020)⁶ data.

It is worth mentioning that a large part of this deforestation is legal, authorized by environmental agencies, given that the legislation allows clearing 65% or 80% of the Cerrado area, whether the area is outside or inside the Legal Amazon, respectively.

Box 1: Methodologies for calculating the deforestation rate in the Cerrado

For mapping the deforested areas in the Cerrado, a base map was prepared for 2000 with the anthropic, water and unobserved classes, with the anthropic class corresponding to the entire area with total or partial removal of the native cover until 2000. For generating the 2002 data, this base map was used as a mask, and the anthropic area increments were mapped. For 2004, the 2002 mapping was used in turn as a base, and so on. Therefore, it is an incremental mapping where the anthropic class is not revised, only added. The unobserved class is the only one that is revised, as it corresponds to bad images or with clouds that render analysis impossible. The same methodology is used for all years and the frequency of disclosures may vary (annual, biannual, etc.) depending on the investment made available by each project's funder. The Cerrado-Jalapão Project was responsible for obtaining data for the 2000-2013 period and, in this case, the rates were published biannually based on the simple average of the values obtained in those two years. From 2013 to 2015, data were collected through the "Mapping and Estimating CO₂ Emissions from Deforestation in the Cerrado Biome for Years 2012 and 2014" and "Thematic mapping of deforestation in digital format for the Cerrado biome in 1:250.000 scale for the 2013-2015 period" projects through a contract signed with The World Bank.

As of 2016, mapping was performed during the “Project for Developing Systems for Preventing Forest Fires and Monitoring Vegetation Coverage in the Brazilian Cerrado”, coordinated by the Ministry of Science, Technology, Innovation and Communications (MCTIC) and financed by the World Bank with support from the Forest Investment Program (FIP)^{8, 6}.

Pasture is the most prominent human use in the Cerrado with 61 million hectares (30% of the Cerrado's total area). Annual and perennial crops combined cover 25 million hectares (12.3%), 18 million hectares (8.9%) of which are used for soybeans, which means that the country's main crop covers almost 9% of the Cerrado territory (Figure 3)⁴.

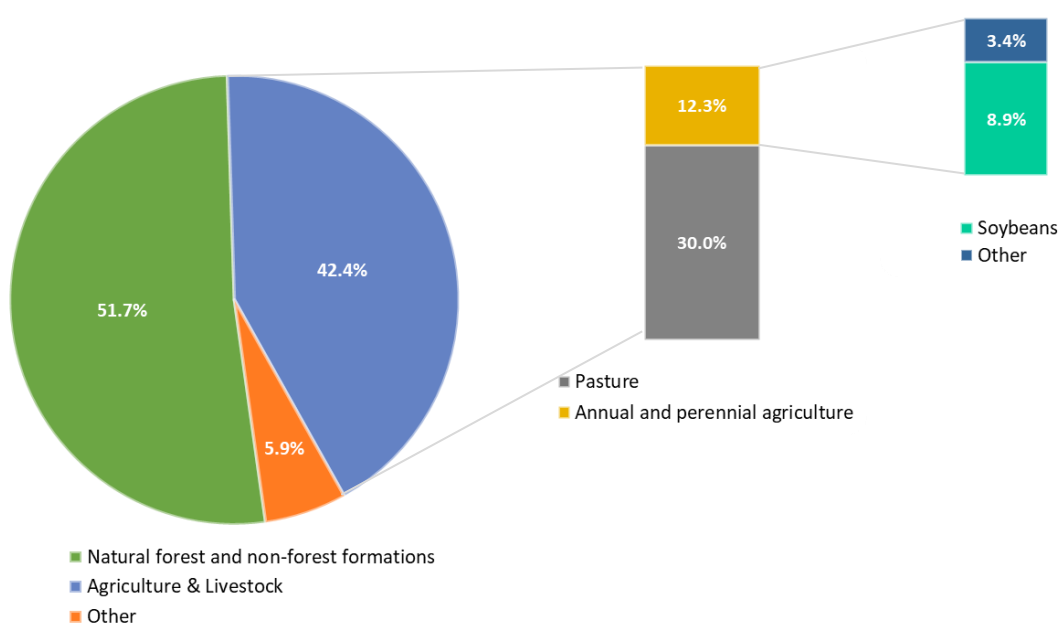


Figure 3. Soil use and occupation in the Cerrado (percentage of the 203-million-hectare area).
Source: Agroicone - prepared in-house with MapBiomias – Coleção 5.0 (2019)⁴ data.

Changes in the Cerrado landscape were accompanied by significant regional socioeconomic changes. Expansion of agriculture in the region significantly increased the Gross Domestic Product (GDP) of the Cerrado, which was 708 billion reais in 2010 and rose to 1.3 trillion reais in 2018, according to data from the Brazilian Geography and Statistics Institute (IBGE). In 2018, the Cerrado's GDP corresponded to 19% of Brazilian GDP (7 trillion reais)⁹.

⁸ Brito, Allan de; Valeriano, Dalton de Morrison; Ferri, Clotilde; Scolastici, Adriana; Sestini, Marcelo. "Metodologia da detecção do desmatamento no bioma cerrado: Mapeamento de Áreas Antropizadas com Imagens de Média Resolução Espacial". Fundação de Ciência, Aplicações e Tecnologias Espaciais, São José dos Campos: Junho de 2018. 1p. Available at <https://bit.ly/3aUupLJ>. Accessed on February 26, 2021.

⁹ Instituto Brasileiro de Geografia e Estatística (IBGE). "Produto Interno Bruto dos Municípios". 2018. Available at <https://bit.ly/3knNqJV>. Accessed on February 23, 2021.

The region has contributed to Brazil's leadership position in the agricultural sector, which in 2018 alone, led the Cerrado to contribute R\$ 109 billion, at current prices, to the Brazilian GDP. This number represented 35% of the country's total gross value added in the Agriculture sector (R\$ 309 billion)⁹.

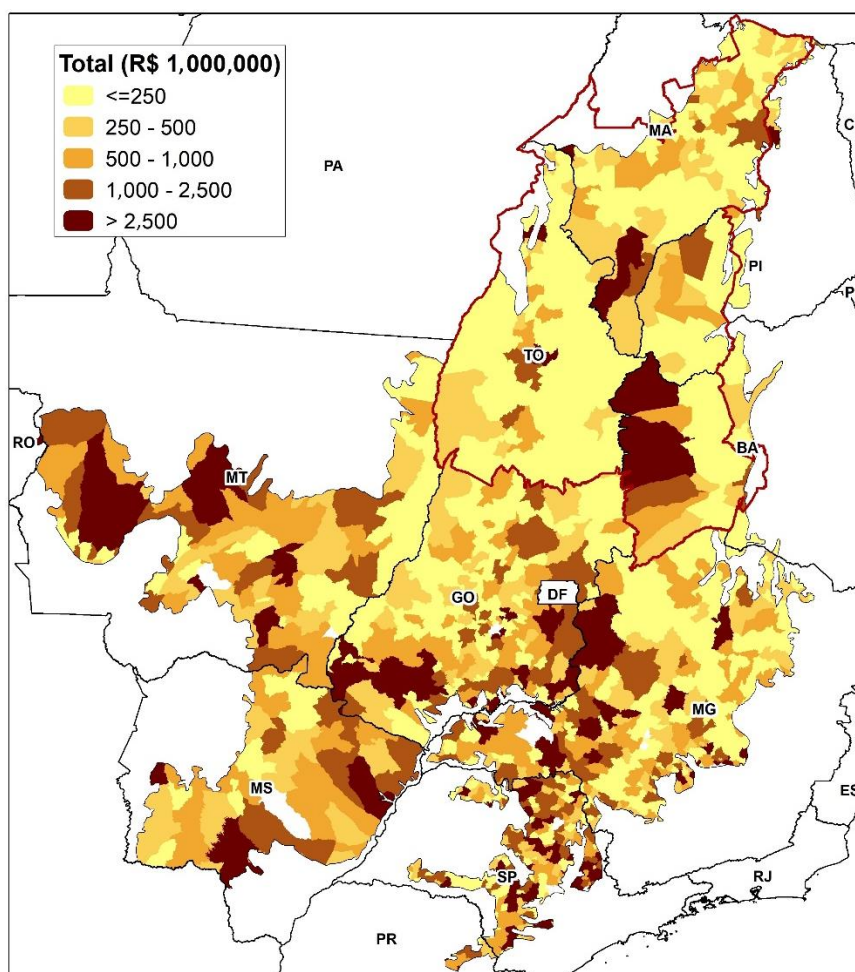


Figure 4. Gross Domestic Product (GDP) of Cerrado municipalities in 2018.
Source: Agroicone - prepared in-house with IBGE (2018)⁹ data.

3. THE MATOPIBA REGION

Matopiba is a 73.1-million-hectare region in the Maranhão (32.77% of the total area of this region), Tocantins (37.95%), Piauí (11.21%) and Bahia (18, 07%) states and 91% of its area contains the Cerrado, 7.3% of the Amazon, and 1.7% of the Caatinga¹⁰. Matopiba comprises 337 municipalities in 31 microregions, with a 6.2 million population^{10, 11, 12}.

¹⁰ Miranda, Evaristo Eduardo. "Caracterização territorial estratégica do MATOPIBA". Versão 2.3, Campinas: Fevereiro de 2015. Available at <https://bit.ly/3aSsGXA>. Accessed on February 10, 2021.

¹¹ Ministério da Agricultura Pecuária e Abastecimento (MAPA). "Projeções do Agronegócio: Brasil 2019/2020 a 2029/30 - Projeções de Longo Prazo". Secretaria de Política Agrícola, Brasília: 2020. Available at <http://bit.ly/3kkM6Y4>. Accessed on February 16, 2021.

¹² Pereira, Caroline Nascimento; Castro, Cesar Nundes de; Porcionato, Gabriel Lanza. "Dinâmica Econômica, Infraestrutura e Logística no MATOPIBA". IPEA: Texto para discussão, Rio de Janeiro: 2018. Available at <https://bit.ly/2ZTfd3>. Accessed on February 11, 2021.

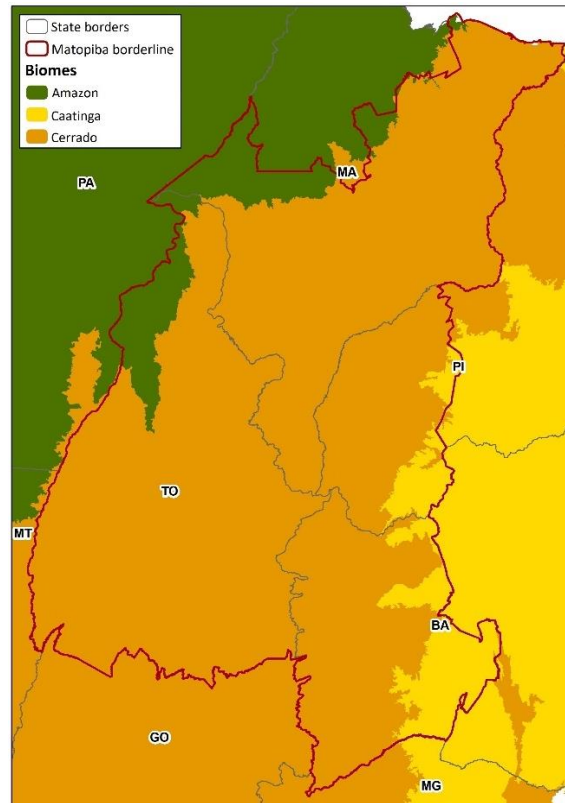


Figure 5. The Matopiba region, bordered in red, with its 3 biomes: 91% of the Cerrado; 7.3% of the Amazon; and 1.7% of the Caatinga. Source: Agroicone - prepared in-house with MMA (2019)⁵ data.

The Matopiba region was delimited by the Territorial Intelligence Group (GITE) of the Brazilian Agricultural Research Corporation (Embrapa) considering agrarian, agricultural, infrastructure, socioeconomic and natural framework criteria, with one of the main criteria being the Cerrado's presence in the states. Delimiting Matopiba aimed to provide technical and scientific support on governance and strategic territorial intelligence issues¹⁰ and, after that, it has been surveyed as a focus and a cutout for public and private policies.

The creation of the Matopiba development agency in 2015 by the Ministry of Agriculture made the region official for directing public policies, but there was discontinuity in the federal government's actions for the region¹³. As Matopiba does not cover the entire area of the four states and because federal policies have not advanced, there are difficulties in aligning with state policies and with the other regions in which the states (Northeast and North Regions and Legal Amazon) are inserted. The Matopiba area in Maranhão comprises 23.9 million hectares (73% of the state), in Tocantins it is 27.7 million hectares (100% of the state), while in Piauí it is 8.2 million hectares (33% of the state). state) and in Bahia there are 13.2 million hectares (23% of the state)^{10, 14, 15}.

¹³ Ministério da Agricultura Pecuária e Abastecimento (MAPA); 2016. Dilma e Kátia Abreu anunciam criação da Agência de Desenvolvimento do Matopiba. Available at: <https://www.gov.br/agricultura/pt-br/assuntos/noticias/dilma-e-katia-abreu-anunciam-criacao-da-agencia-de-desenvolvimento-do-matopiba>. Accessed on July 28, 2021.

¹⁴ Instituto Brasileiro de Geografia e Estatística (IBGE). "IBGE Cidades". 2020. Available at: <https://cidades.ibge.gov.br/brasil/panorama>. Accessed on February 23, 2021.

¹⁵ Embrapa. "Desenvolvimento Territorial Estratégico para região do MATOPIBA - Parceria INCRA e Embrapa (MDA e MAPA)". GITE - Grupo de Inteligência Territorial Estratégica. Campinas: 2015. Available at <http://bit.ly/2NDRkqK>. Accessed on February 15, 2021.

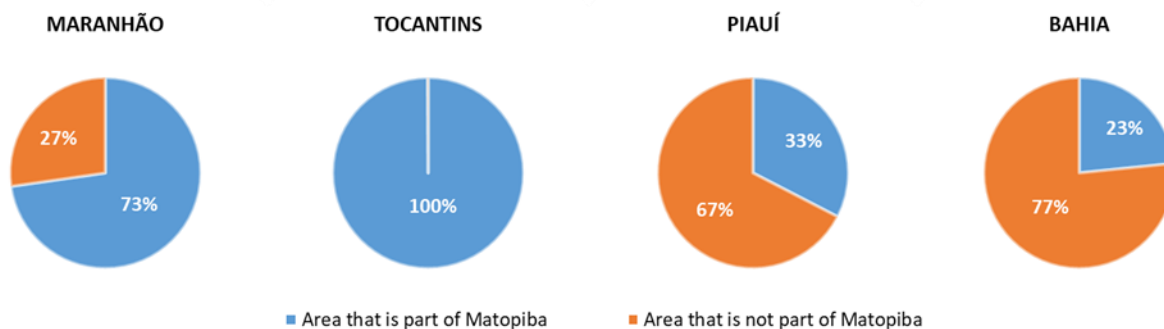


Figure 6. Each state's percentage in the Matopiba region. Source: Agroicone - prepared in-house with Embrapa (2015)¹⁵ and IBGE (2020)¹⁴ data.

Watersheds that are of great importance for the country's water supply are present in this territory. They are the Tocantins-Araguaia basin that covers 42.1% of the region (30 million hectares), the Parnaíba basin that covers 20.16% of the total area (14.7 million hectares), the Western Northeast Atlantic that extends over 19.61% of the region (14.3 million hectares), and the São Francisco basin that covers 18.11% of Matopiba (14.3 million hectares)¹⁰.

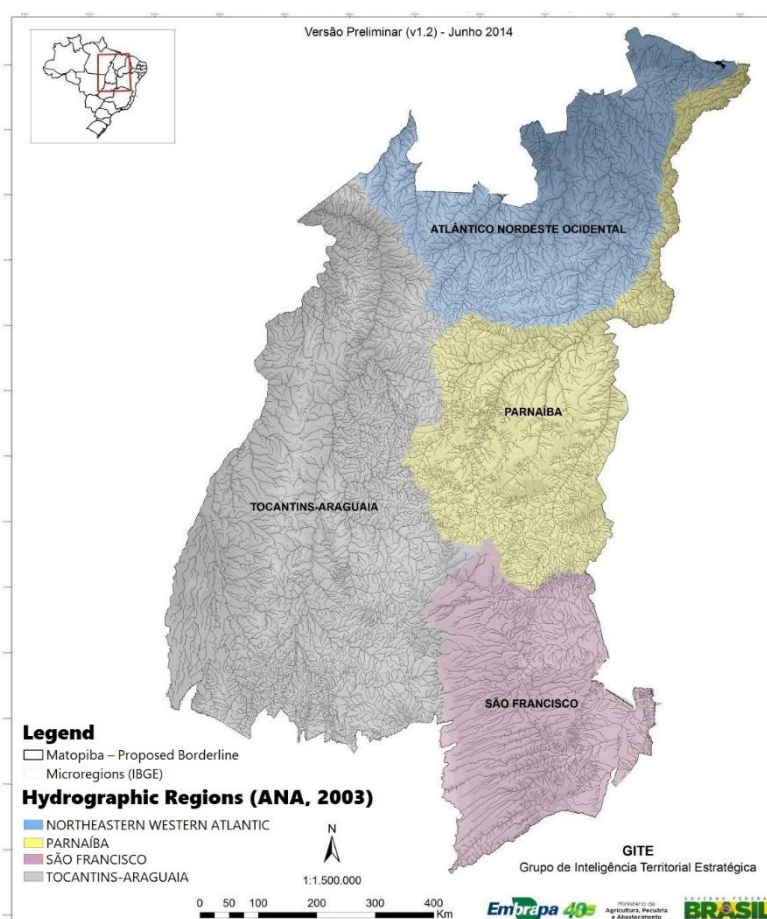


Figure 7. Map of Matopiba with indication of watershed and drainage networks. Source: Embrapa/GITE (2014)¹⁰.

¹⁶ Miranda, Evaristo Eduardo, Magalhães, Lucíola Alvez; Carvalho, Carlos Alberto de. "Proposta de Delimitação Territorial do MATOPIBA". EMBRAPA, Nota Técnica nº 1, Campinas: 2014.

The region is characterized by the expansion of the agricultural frontier based on high-productivity technologies. Changes in land use and land tenure were relevant for agricultural activity expansion. Annual crops, stimulated by new production technologies, including irrigation, replaced extensive and traditional native pastures in fields and savannah areas. Despite the lack of infrastructure, the characteristics of the soil, favorable rainfall, and especially the price of land favored the advance of the agricultural frontier ^{15, 16, 17}.

3.1. Soil use and conservation

According to Ministry of the Environment (MMA, 2020)¹⁸ data, Matopiba has 55 Conservation Units (UCs) for Full Protection and Sustainable Use, covering 8.6 million hectares, representing 11.8% of the total area of the region. In addition to UCs, indigenous territories and quilombola areas are also considered protected areas. Based on Fundação Nacional do Índio (FUNAI, 2019)¹⁹ data, there are 21 indigenous territories in Matopiba covering 3.6 million hectares (4.9% of the total area). Regarding quilombola areas, according to the National Colonization and Agrarian Reform Institute (INCRA, 2020)²⁰ data, there are 44 quilombola areas in 247 thousand hectares.

Still regarding the agrarian situation in Matopiba, there are 1,053 settlements covering 4.4 million hectares (6% of the total area of the region), according to INCRA. Based on 2017 IBGE Agricultural Census²¹ data, there are 324 thousand agricultural establishments in Matopiba covering a 33-million-hectare (ha) area, or 45% of the region.

¹⁷ Miranda, Evaristo Eduardo. "MATOPIBA: Caracterização, agendas e agências". Versão 8.1, março de 2015. Available at <https://bit.ly/2NAV3k4>. Accessed on February 10, 2021.

¹⁸ Ministério do Meio Ambiente (MMA). "Download de mapas geográficos". 2020. Available at <http://mapas.mma.gov.br/i3geo/datadownload.htm>. Accessed on February 9, 2021.

¹⁹ Fundação Nacional do Índio (FUNAI). "Terras indígenas". [s.d]. Available at <http://www.funai.gov.br/index.php/shape>. Accessed on February 9, 2021.

²⁰ Instituto Nacional de Colonização e Reforma Agrária (INCRA). "Quilombolas". Ministério da Agricultura, Pecuária e Abastecimento (MAPA), Brasília: 2020. Available at <http://certificacao.incra.gov.br/>. Accessed on February 9, 2021.

²¹ Instituto Brasileiro de Geografia e Estatística (IBGE). Censo Agropecuário de 2017: resultados consolidados. Rio de Janeiro: IBGE, 2019. Available at <http://bit.ly/2MrtFo8>. Accessed on February 24, 2021.

PROTECTED MATOPIBA AREA

55
Conservation
Units

Full Protection & Sustainable Use (8.6-million-hectare area that represents 11.8% of the total Matopiba area)

21
Indigenous
territories

in Matopiba (3.6-million-hectare area that represents 4.9% of the total Matopiba area)

44
Quilombola
areas

in 247 thousand hectares (representing 0.34% of the total Matopiba area)

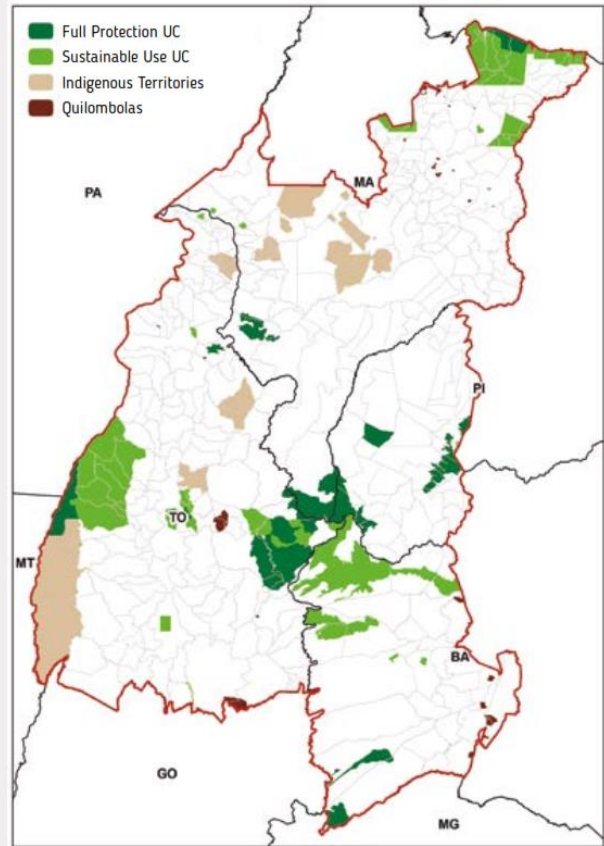


Figure 8. Protected Matopiba areas. Source: Agroicone - prepared in-house with MMA (2020)¹⁸, FUNAI (2019)¹⁹ and INCRA (2020)²⁰ data.

According to MapBiomas – Coleção 5.0 (2019)⁴ data, 51 million hectares were covered by natural forest and non-forest formations, representing 71% of the total Matopiba area, and 20 million hectares were used by agriculture, which is equivalent to 27.5 % of the region’s total area.

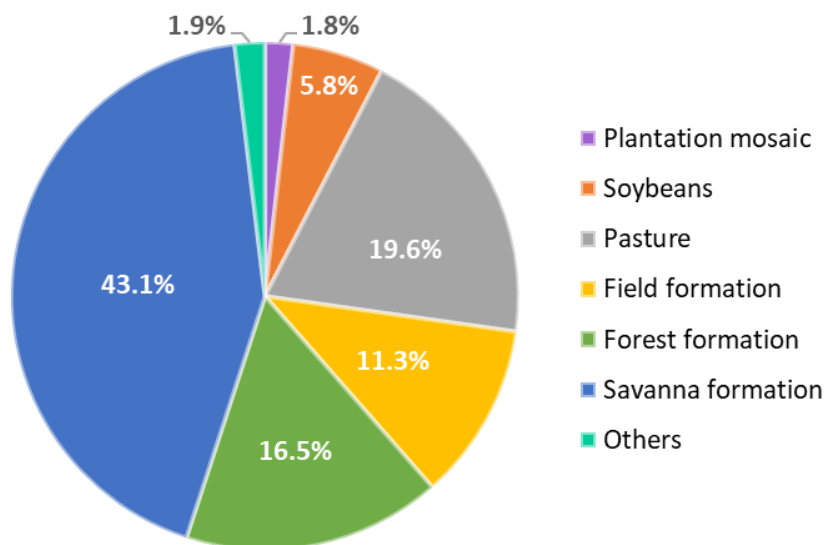


Figure 9. Soil use and conservation in Matopiba in 2019. Source: Agroicone - prepared in-house with MapBiomas – Coleção 5.0 (2019)⁴ data.

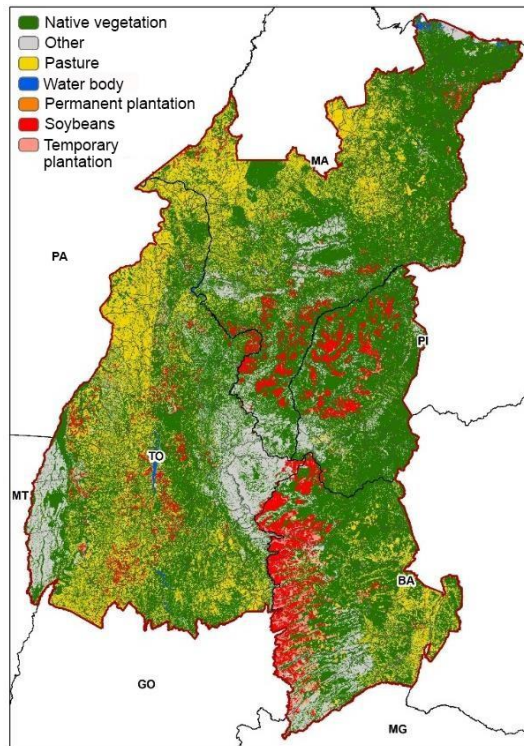


Figure 10. Soil use and conservation in Matopiba. Source: Agroicone - prepared in-house with MapBiomas – Coleção 5.0 (2019)⁴ data.

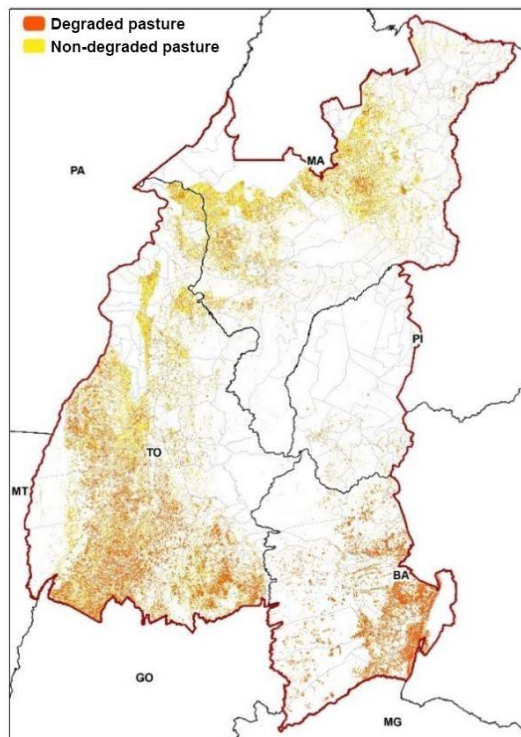


Figure 11. Degraded and non-degraded pastures in Matopiba. Source: Agroicone - prepared in-house with LAPIG (2017) and LAPIG (2018)²² data.

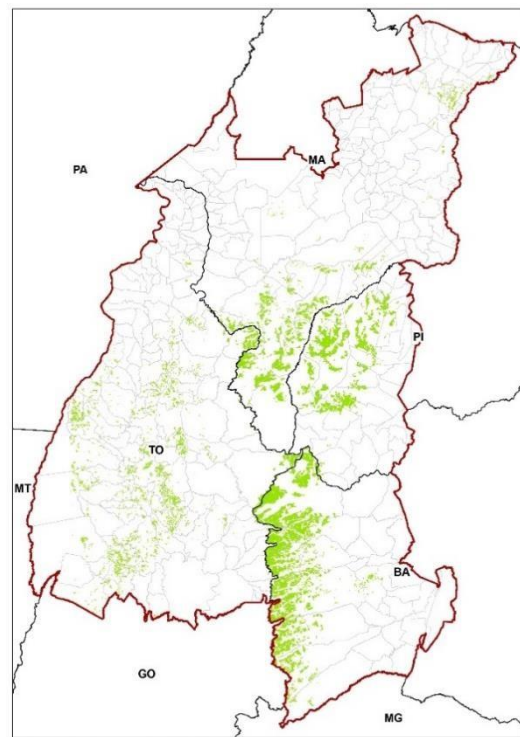


Figure 12. Soybean areas in Matopiba. Source: Agroicone - prepared in-house with MapBiomas – Coleção 5.0 (2019)⁴ data.

²² Laboratório de Processamento de Imagens e Georreferenciamento (LAPIG). "Atlas das pastagens brasileiras". Available at <https://pastagem.org/map>. Accessed on February 10, 2021.

Pasture is the most prominent human use, with 14 million hectares (19.6%), followed by soybean plantation, with 4 million hectares (5.8%)⁴. According to the Image Processing and Georeferencing Laboratory (LAPIG), in 2017, 48% of the Matopiba pasture area consisted of degraded pasture (6 million hectares)²².

In Matopiba, Tocantins is the state with the largest number of pasture areas compared to the other states. However, Maranhão is the state with the lowest percentage of degraded pasture area when compared to total pasture area. In the same sense, practically half of the pasture areas in Piauí and Bahia are degraded, and the area is very small in Piauí.

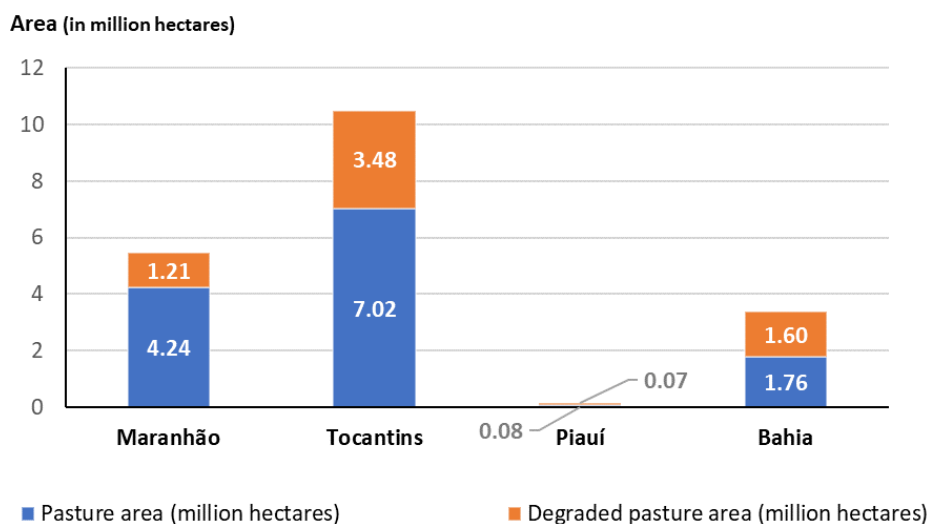


Figure 13. Total pasture area and degraded pasture area by state, in millions of hectares. Source: Agroicone - prepared in-house with LAPIG (2017) and LAPIG (2018)²² data.

3.2. Deforestation

As already explained in the Introduction, the areas that have been legally suppressed are also included within the deforestation rates indicated here, that is, clearing new areas with proper Vegetation Suppression Authorization. However, despite being a legal suppression of vegetation, it can generate negative environmental impacts, such as loss of biodiversity and other ecosystem services, especially if done in sensitive regions, such as water sources or with endemic species.

From 2001 to 2020, 13 million hectares were deforested in Matopiba⁶. This figure corresponds to 44.8% of the deforested area in the entire Cerrado (29 million hectares) in the same period. As shown in Figure 14, in the last 20 years it was possible to see a slight downward trend, as in the Cerrado, but in the Matopiba region this trend was much lower than what was seen in the Cerrado. Still, despite this reduction, deforestation in Matopiba increased by 20% in 2020 when compared to the previous year, while in the Cerrado this increase was 13%. It is possible to state that the Matopiba region has a significant impact on deforestation rates in the Cerrado.

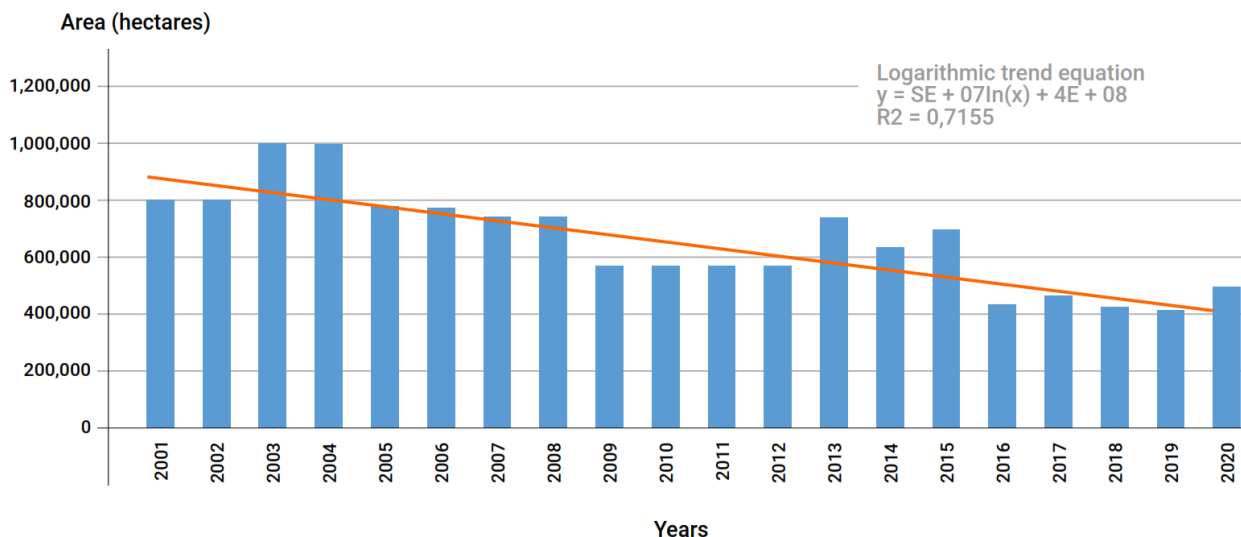


Figure 14. Deforestation rate in Matopiba in the last 20 years, with a logarithmic trend line. Source: Agroicone - prepared in-house with INPE (2020)⁶ data.

According to INPE data, the states that contributed the most to the accumulated deforestation in Matopiba from 2001 to 2020 were Maranhão and Tocantins, with an increase in Tocantins' participation in 2011-2020 (Figure 15). These states also have a significantly larger area within Matopiba, which in part explains this leadership. Likewise, Bahia has the second smallest area of Matopiba and is ranked third in terms of deforestation share, having declined significantly from 2 to 1.1 million hectares between the first and second analyzed decades. And finally, Piauí, with the smallest area of Matopiba, deforested approximately 800 thousand hectares in each decade.

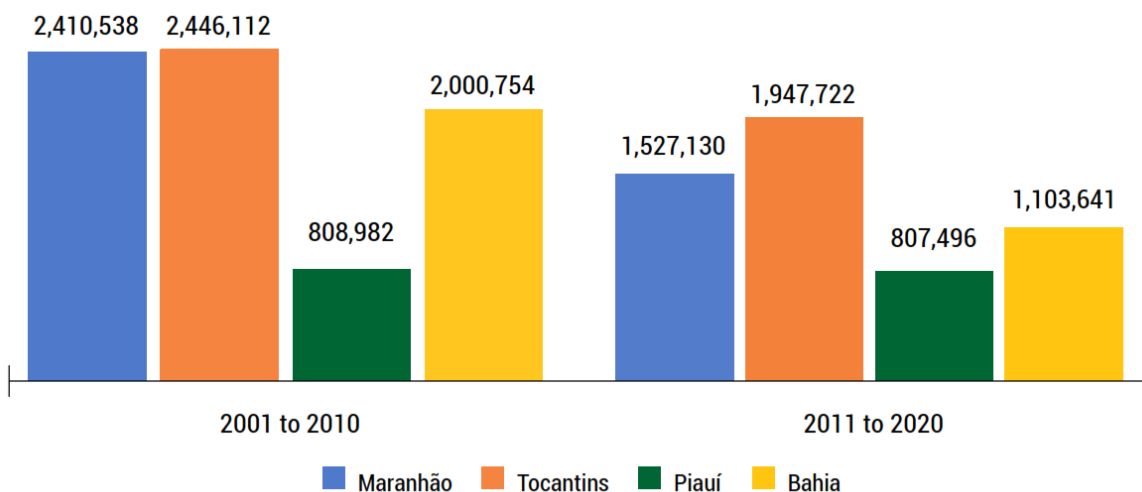


Figure 15. Areas that were deforested in the last two decades (2001-2010 and 2011-2020) in the Matopiba states (in hectares). Source: Agroicone - prepared in-house with INPE (2020) data.

Although 71% of Matopiba's area is covered by natural forest and non-forest formations, the region is one of the main responsible parties for loss of Cerrado biodiversity and, therefore, concern for environmental impacts of soybean expansion in the region has gained evidence.

3.3. Economic aspects

According to IBGE data, the 2018 gross domestic product (GDP) in the Matopiba region was R\$ 116 billion, corresponding to 1.7% of Brazilian GDP (R\$ 7 trillion). The GDP per capita in the same year in Matopiba region was R\$ 18,029.35, about half of the Brazilian per capita GDP (R\$ 33,593.82), which indicates low local development in the region⁹.

When analyzing gross added value in Matopiba at current prices, the industrial sector had the lowest share at 14% compared to the total figure, followed by agriculture with a 21% share, and the one that contributed the most was the service sector (including Administration, Defense, Education, Public Health, and Social Security), with 65%. It is important to emphasize that service sector-related activities are strongly linked to the agricultural sector, such as transportation, storage, logistics, trade, technical assistance, among others, which justifies the significant figure for the service sector^{9, 12}.

The agricultural sector's influence in the region's economy is evident when we compare Matopiba maps of Municipal GDP (Figure 16), per capita municipal GDP (Figure 18), and soybean plantation area (figure 17). Most of the municipalities where the biggest number of soybean-planted areas are, have the highest GDP and GDP per capita figures. This shows the sector's relevance in the region's economic development. Another point to be highlighted is that, although per capita GDP is higher in those municipalities, it does not mean that there was income distribution and improvement in quality of life of the entire local population. This point generates much controversy and criticism regarding the development model, including the argument that soybean crops have worsened the region's income distribution, reduced rural residents' access to water, decreased the livelihood of small producers who are based on agriculture, resulting in a reduction of food self-sufficiency²³. There is also the argument that soybean expansion generates no significant demand for rural labor, favors violent expropriation processes, and does not generate any space for small producers' inclusion²³. Income concentration is due to growth of modern agriculture with intensive capital, which uses little labor and focuses on multinational groups and large landowners¹². More research is needed on socioeconomic impacts of soybean production in the Matopiba region, using robust methodologies for considering negative and positive aspects and advance factor causality.

²³ Russo Lopes, Gabriela & Bastos Lima, Mairon & Reis, Tiago. (2021). Revisitando o conceito de mau desenvolvimento: Inclusão e impactos sociais da expansão da soja no Cerrado do Matopiba. *World Development*. 139. 105316. Available at <https://bit.ly/3dNKvbU>. Accessed on February 26, 2021.

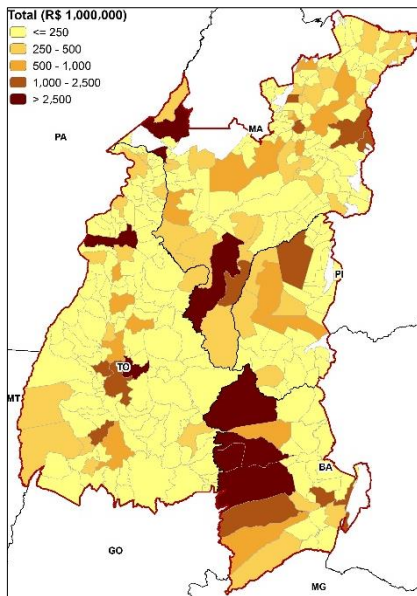


Figure 16. GDP by municipality in Matopiba. Source: Agroicone-prepared in-house with IBGE (2018)⁹ data.

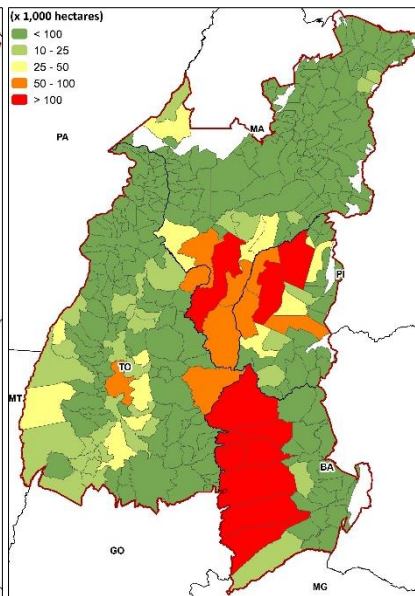


Figure 17. Soybean planted areas by municipality in Matopiba. Source: Agroicone - prepared in-house with MapBiomás – Coleção 5.0 (2019)⁴ data.

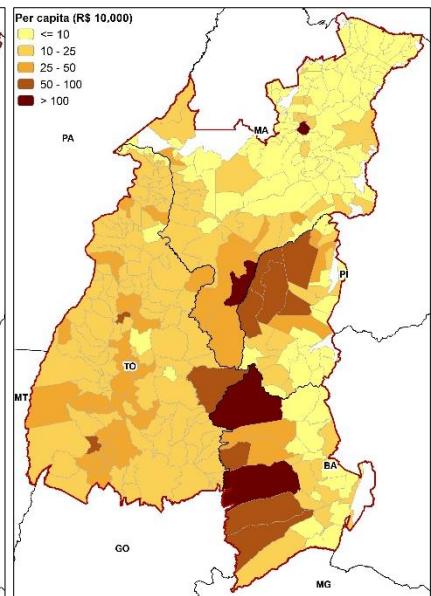


Figure 18. Per capita GDP by municipality in Matopiba PIB. Source: Agroicone - prepared in-house with IBGE (2018)⁹ data.

Concern for sustainable expansion of agriculture in the region is of great relevance, considering that production in Matopiba tends to grow even more. According to Ministry of Agriculture, Livestock and Supply (Mapa) projections¹¹, the region is expected to produce 32.7 million tons of grain until the 2029/30 crop, covering an 8.9-million-hectare planted area. Considering that projections for Brazil are 318.3 million tons of grain produced in 76.4 million hectares, Matopiba will account for 10.3% of the amount of grain to be produced and 11.6% of the area to be used in the country.

Therefore, so that the biodiversity of the region is not severely impaired by increasing grain production, regardless of the economic development generated, it is of utmost importance that public policies, and its developments in programs and projects, are adopted for avoiding as much as possible Conversion (deforestation) of new native vegetation areas – advancing soybean expansion in areas already legally cleared. Along with deforestation control, deforested native areas need to be recovered, especially those that have a legal recovery obligation – such as APPs and legal reserves (RLs) – or in environmentally friendly areas. It is still possible to take advantage of the restoration agenda for leveraging income, employment, and development, both in restoration for productive purposes and for exclusively ecological purposes.

4. ECOLOGICAL RESTORATION VALUE CHAIN

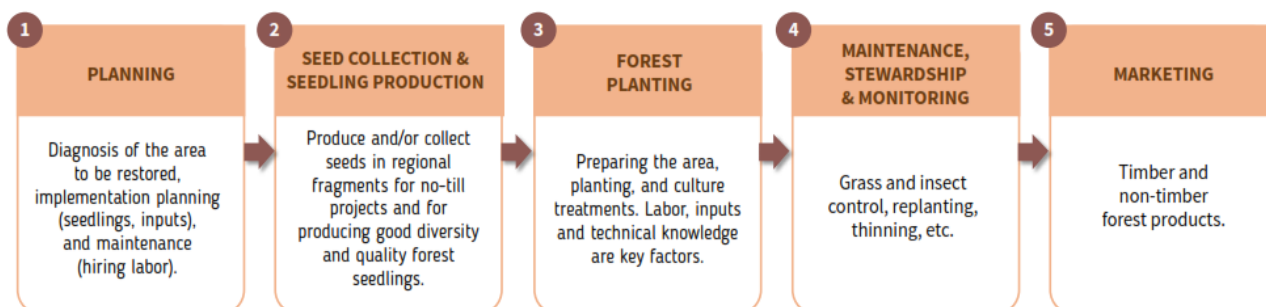
It is very important to understand what is now called the ecological restoration value chain, the term that considers the perspective of explaining and encouraging its economic importance, such as the jobs, taxes and businesses generated by the number of restoration-related activities. It also makes sense to assess the restoration value chain to find bottlenecks and types of intervention seeking to support and encourage, as well as increase their efficiency, similarly to what is done in other chains.

There are the basic links in the chain, which are defined by the nature of the restoration activity and the surrounding environment, with those steps that indirectly interfere in the chain. The basic native vegetation restoration chain is formed by planning, seed collection and seedling production, planting, stewardship, and monitoring, as well as marketing. Research & Development (R&D), regulatory bodies, other inputs, financing, and markets are part of the surrounding environment. As in any analysis of value chains, coordination among agents is very important and can be developed and improved in different ways, through specific organizations, such as associations and pre-competitive entities. Coordination can also be made by the chain's agents/links themselves (Figure 19).

AGENTS



STAGES



SURROUNDING ENVIRONMENT

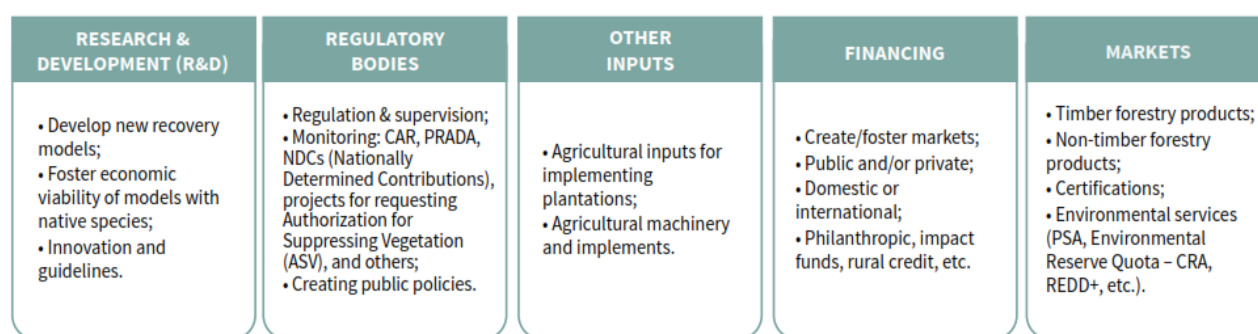


Figure 19. Simplified scheme for representing the ecological restoration chain, agents, and surrounding environment. Source: Agroicone prepared in house.

As currently the main motivations for restoration are legal obligations, the importance of public bodies, especially the environmental ones is key. Several analyzes of the restoration chain indicate points of improvement, but the **crucial bottleneck is low demand for restoration**, which therefore depends on law enforcement. Market incentives can also be important levers, as is the case with private certifications. Some of the actions and levers that can motivate and stimulate each link in the chain are described in Figure 20.

Labor qualification is an important aspect along the chain, and it is generally the action that needs to be continually performed, preferably combined with other actions.

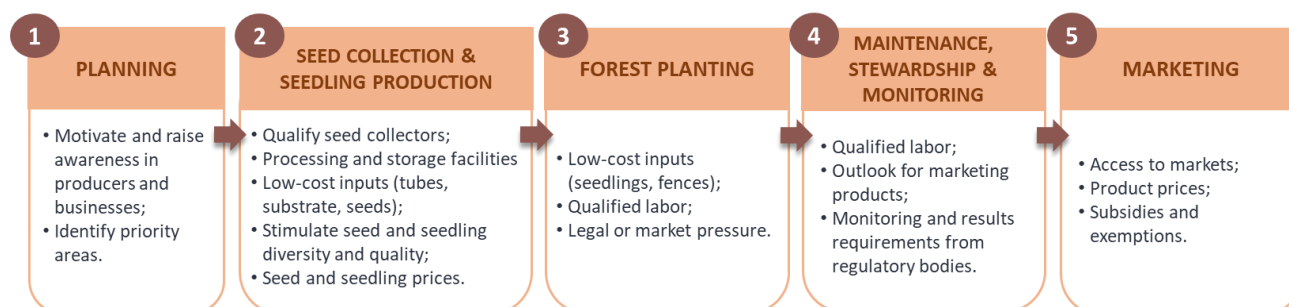


Figure 20. Motivations and incentives at each link in the ecological restoration chain. Source: Agroicone prepared in-house.

The Cerrado has ecological particularities as it contains a diversity of non-forest ecosystems (technically also called Phyto physiognomies), with vegetation that includes forest, savanna, and grassland formations. Forest represents areas with a predominance of tree species. Savanna refers to areas with scattered trees and shrubs under grassy soil, without forming a continuous canopy. In grassland formations, herbaceous and shrub species predominate, with few trees in the landscape. The most common classification of the Cerrado – developed by Embrapa²⁴ – defines the following typical ecosystems:

1. Forest formations: riparian forest, gallery forest, dry forest and *cerradão*;
2. Savanna formations: cerrado in the strict sense, cerrado park, palm grove, and pathway;
3. Grassland formations: dirty field, rupestrian field, and clean field.

All the accumulated knowledge regarding ecological restoration developed by research organizations in the Southeast was designed for the Atlantic Forest, for forest formations. Part of this knowledge was even based on exotic forestry, mixed with knowledge of the ecology of native forests – ecosystems of the Atlantic Forest and also of the Amazon. Thus, specific knowledge of Cerrado ecosystems is much more recent and is still being developed and disseminated.

In research & development (R&D) and training for restoration, producing and organizing knowledge on Cerrado ecosystem restoration, and translating it into practical support material for restoration agents in practical terms, are important work fronts for boosting the chain. Consideration should also be given to adapting practices and methods made for other regions and ecosystems, in order to accelerate learning.

²⁴ Ribeiro, J. F. e Walter, B. M. T. Fitofisionomias do Bioma Cerrado. In: Sano, S. M.; Almeida, S. P de. Cerrado: ambiente e flora. Planaltina: Empresa Brasileira de Pesquisa Agropecuária – EMBRAPA, 1998.

In this sense, precisely knowing restoration methods and techniques is important both for supporting projects on the ground and for planning and supporting large-scale programs, such as those implemented by governmental public policies.

According to the Native Vegetation Protection Law (LPVN), better known as the New Forest Code, restoration of areas consolidated in APPs and RLs can be made using the following techniques:

- Conducting natural regeneration of native species;
- Planting native species;
- Planting native species combined with conducting natural regeneration of native species;
- Interspersed planting of woody, perennial or long-cycle species, exotic species with regional occurrence native species, in up to 50% (fifty percent) of the total area to be recomposed (depending on the size of the property).

In practice, restoration techniques are diverse and can be combined and modified to meet the particularities of the area and the actors involved. Some of the restoration actions must be carried out irrespective of which technique is used, while other activities are specific to the use of such techniques. Simplifying techniques into categories is important for estimating costs and other resources for restoration programs. The “Forest Restoration in Agricultural Chains for Adapting to the New Forest Code” study made by Agroicone, considered three restoration techniques - conducting natural (active and passive) regeneration, no-till, and planting seedlings (only with native species; with exotic species; with and without economic use) – to estimate operational costs for implementing the restoration. The study did not consider fixed costs for preparing the area (fences and firebreaks) and the costs of managing the restoration (technical assistance, management, and monitoring).

Active natural regeneration technique is the cheapest in all regions, with an average cost of R\$ 874/ha for the Matopiba region. However, this technique can only be applied where there is some potential for natural regeneration, where invasive grasses are controlled to favor development of native species that are in the seed bank of the area or surrounding areas. When potential for natural regeneration is low, but amenable to mechanization, the cheapest technique is no-till, with a R\$ 3,302/ha average cost. The cost of planting seedlings of native species with no economic return varies from R\$ 8,036/ha to R\$ 13,092/ha²⁵. More than defining the exact figure, these numbers provide an important indication that there is a wide variation in costs depending on the technique used. Thus, advancing knowledge about cheaper techniques that can be applied in the region can significantly contribute to stimulating restoration in Matopiba.

No-till has emerged as an efficient method, especially for grassland and savannah vegetation, with several additional benefits, such as ease of implantation – and therefore has a significantly lower cost than planting seedlings – and income generation for seed collectors.

²⁵ Antoniazzi, Laura; Sartorelli, Paolo; Costa, Karine; Basso, Iara. "Restauração florestal em cadeias agropecuárias para adequação ao código florestal: análise econômica de oito estados brasileiros". Agroicone: INPUT Brasil. São Paulo: 2016.

Consolidated experiences in restoration with the no-till method are found in Goiás, Mato Grosso and Mato Grosso do Sul and there is great potential for expanding the use of the method in Matopiba.

Each restoration method must be applied considering rural property characteristics, such as vegetation type, landscape situation, level of ecosystem degradation and the area's resilience. In addition, the socioeconomic profile must be considered before defining the objectives and motivations for the restoration. In general, for large and medium-sized landowners, the focus is usually on environmental compliance, and ecological restoration only for environmental conservation purposes. For small landowners, income generation must be integrated with conservation, such as adopting Agroforestry Systems (AFS)²⁶. The legislation itself – New Forest Code and state regulations – differentiate small properties, allowing more use of species for productive purposes. Anyway, even for large properties, ecological restoration can be established with economic use in RLs, using exotic species along with native ones.

Economic use in RL or APP areas is still a challenge, both from the technical side – planting and stewardship for obtaining good production and having access to markets – as well as from a legal standpoint. In the case of wood, while using exotic species (especially eucalyptus) is allowed and there already are established markets, there are restrictions for native species. In order to prevent native vegetation deforestation for selling wood, there is stricter control of native wood, which causes more uncertainty and insecurity for these products. Thus, much progress is still needed to establish legal and safe native wood markets that value sustainable production.

In addition to the legal issue, technical knowledge is also a gap for fostering economically profitable restoration systems in Brazil in general and particularly in the Cerrado. Some experiences and initiatives are taking place and organizing and disseminating them can contribute to spreading the generated knowledge and stimulate restoration with economic use. It is important to emphasize the difference in scale, as models and experiences for small properties cannot be transported to large ones, and vice versa – at least without making certain adaptations.

Tocantins State published the “Native Vegetation Restoration Manual for Environmental Compliance of Rural Properties in Tocantins State” in 2019, which presents several experiences in the state, with guidelines for ecological restoration projects and a section dedicated to socio-productive arrangement models. The Manual provides information on species indicated for economic purposes and socio-productive arrangements indicated for Tocantins state, in addition to a decision key for choosing the restoration model and a description of operational activities. The Manual also provides details on how to monitor restoration, with an explanation of indicators and the type of report that must be filed with the environmental agency.

²⁶ FARAH, Fabiano; RODRIGUES, Ricardo; MESQUITA, Carlos; NAVE, André. (2020). Alternativas para o fortalecimento da cadeia da restauração no Matopiba, Caderno de Notas Técnicas do Programa Parceria para o Bom Desenvolvimento (GGP/ PNUD). Rio de Janeiro: Conservação Internacional Brasil, 2020.

There is no quantitative information at this time regarding the size and extent of restoration in Matopiba, a problem that occurs across the country due to the fact that there is no source of data on restored areas or areas undergoing restoration. Some state environmental agencies have systems that come close to providing this information, but this is an exception. This is therefore a significant information gap that could be filled by public policy. Even without a source of precise information, it is known through information obtained informally from local actors that restoration in the Matopiba region is not as developed as in the Atlantic Forest or in the Midwest Cerrado. There are few infrastructure projects, such as roads, railways, hydroelectric plants, and industrial complexes, which are important restoration vectors due to the licensing process.

The states have an important presence in the ongoing restoration projects and initiatives surveyed, especially Bahia and Tocantins. In Bahia, in addition to active participation of the State Environment Secretariat (SEMA) and the Environment and Water Resources Institute (INEMA), the Luís Eduardo Magalhães municipality also supports a restoration project, with a focus on APPs. The rural producer associations, Bahia state farmers' and irrigants' association (AIBA) and the Irineu Alcides Bays foundation for supporting the Northern export corridor (FAPCEN), have restoration projects, as well as some local NGOs (Lina Galvani institute, Água Doce association, Mundo Lindo foundation, Vida Cerrado Park). The Federal University of Western Bahia (UFOB) acts as a Reference Center for Degraded Area Recovery (CRAD) for Bahia's Cerrado in partnership with AIBA, SEMA and Bahia state farmers' and irrigants' association (AIBA) and the Irineu Alcides Bays foundation for supporting the Northern export corridor (FAPCEN).

Some large and medium-sized international NGOs also work with restoration in Matopiba. The Nature Conservancy (TNC) has a history of supporting public policies with the Bahia state government and AIBA, and today Conservation International (CI-Brazil), through the "Partnerships for Good Development" project, is working with restoration in Bahia and Tocantins. Black Jaguar, which is headquartered in the Netherlands and focused on restoring the Araguaia river, operates in Tocantins.

The work of NGOs and funders operating in the Cerrado in general and particularly in Matopiba, for protecting and supporting traditional people and communities deserves to be highlighted. The Society, Population and Nature Institute (ISPN) has a program focused on the Cerrado in general and another one specifically on Maranhão, financing projects for supporting traditional communities and socio-biodiversity products such as jatobá, cagaita, licuri and others. Despite the projects supporting these products being focused on small farmers and traditional communities, having an exchange of practices and knowledge with restoration projects on large properties could be interesting.

5. ECOLOGICAL RESTORATION IN MATOPIBA

It is important that ecological restoration be no longer a problem for producers but understood as the provision of important ecosystem services and as an opportunity to generate income to improve the quality of life of producers and surrounding communities. This way, with greater people engagement, the number of areas restored or conserved will increase, contributing to conserving biodiversity.

Defining priority areas for restoration must consider ecological and socioeconomic aspects. From a legal standpoint, priority areas should be those where there are environmental liabilities, such as Permanent

Preservation Areas (APPs) and Legal Reserves (RLs) that have been deforested and degraded, especially APPs, as they cannot be offset. Implementing the Rural Environmental Registry (CAR) is a great ally for identifying these deficits in APPs and RLs and establish ways to restore these liabilities and make them compliant.

There is no doubt about how beneficial and relevant restoration is in the ecological aspect, especially regarding ecosystem services such as soil, water source, and biodiversity protection. Furthermore, the Cerrado serves for regulating

According to estimates by Guidotti et al. (2017)²⁸, there is a deficit of 364 thousand hectares of APPs and 1 million hectares of RLs in the Matopiba region that must be recovered. The (active) surplus native vegetation in the region totals 24 million hectares. The amount of surplus native vegetation is much greater when compared to the deficits – almost 24 times greater than the RL deficit. This indicates how important it is to create mechanisms for encouraging conservation of existing native vegetation, in addition to restoring areas with environmental liabilities.

Table 1. RL and APP deficit and surplus native vegetation in the Matopiba region, by state.

Estado	RL Deficit	APP Deficit	Surplus native vegetation
Maranhão	416,869	97,218	7,385,553
Tocantins	418,514	183,302	7,448,770
Piauí	34,961	21,747	3,393,881
Bahia	159,496	62,085	5,908,545
Total	1,029,840	364,351	24,136,748

Source: Agroicone - prepared in-house with Guidotti et al. (2017)²⁸ data.

The surplus native vegetation areas are relatively distributed among the four states (Figure 21). APP and RL deficits are more concentrated in Tocantins State. Piauí is the state with the lowest RL and APP deficits, accounting for only 3% and 6% of Matopiba, respectively.

²⁷ SEMA-DF, 2017. Plano Recupera Cerrado – Uma avaliação das oportunidades de recomposição para o Distrito Federal. 99p.

²⁸ Guidotti, V. Freitas, F. L. M. Sparovek, G. Pinto, L. F. G. Hamamura, C. Carvalho, T. Cerignoni, F.(2017) Números Detalhados do Novo Código Florestal e suas Implicações para os PRAs. Sustentabilidade em debate, Número 5 - Piracicaba, SP: Imaflora. 10 p.

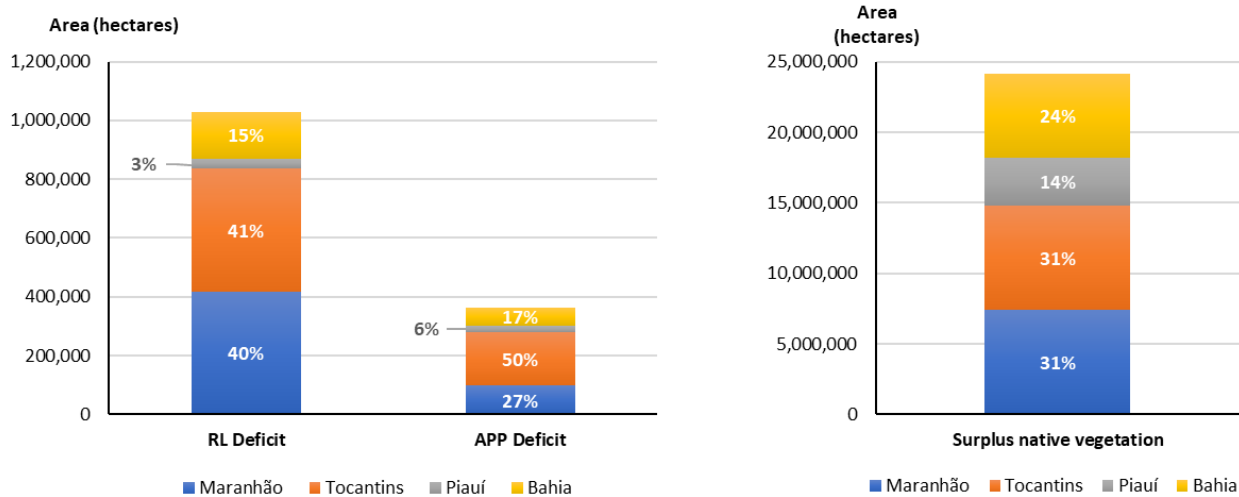


Figure 21. State percentages referring to the deficit of RL and APP and surplus native vegetation in the Matopiba region. The scale between the graphs has been changed to facilitate comparison. Source: Agroicone - prepared in house with Guidotti et al. (2017)²⁸ data.

The areas that need to be recovered in the RLs are 3 times larger than in the APPs and are concentrated in the municipalities where soybean planting is greater. What is striking is that in these same municipalities there is a lot of surplus native vegetation, which would facilitate legalizing RLs with offsets in other properties, such as with the Environmental Reserve Quota (CRA) or other ways.

Despite the smaller APP deficit, it is important to prioritize restoring these areas due to their ecological relevance, in addition to the fact that they cannot be offset. APPs protect water resources, prevent erosion and silting and form ecological corridors, allowing for biodiversity conservation and protection.

It is worth noting that these deficit and surplus native vegetation figures are estimates published in 2017 and may differ slightly from current reality, and CAR validation data or other analysis tools are required for more accurate numbers. Even so, these are figures that illustrate the number of areas that need to be restored and that can be prioritized in restoration actions. Furthermore, the concentration of liabilities spatially follows the areas covered by soybeans (Figure 22).

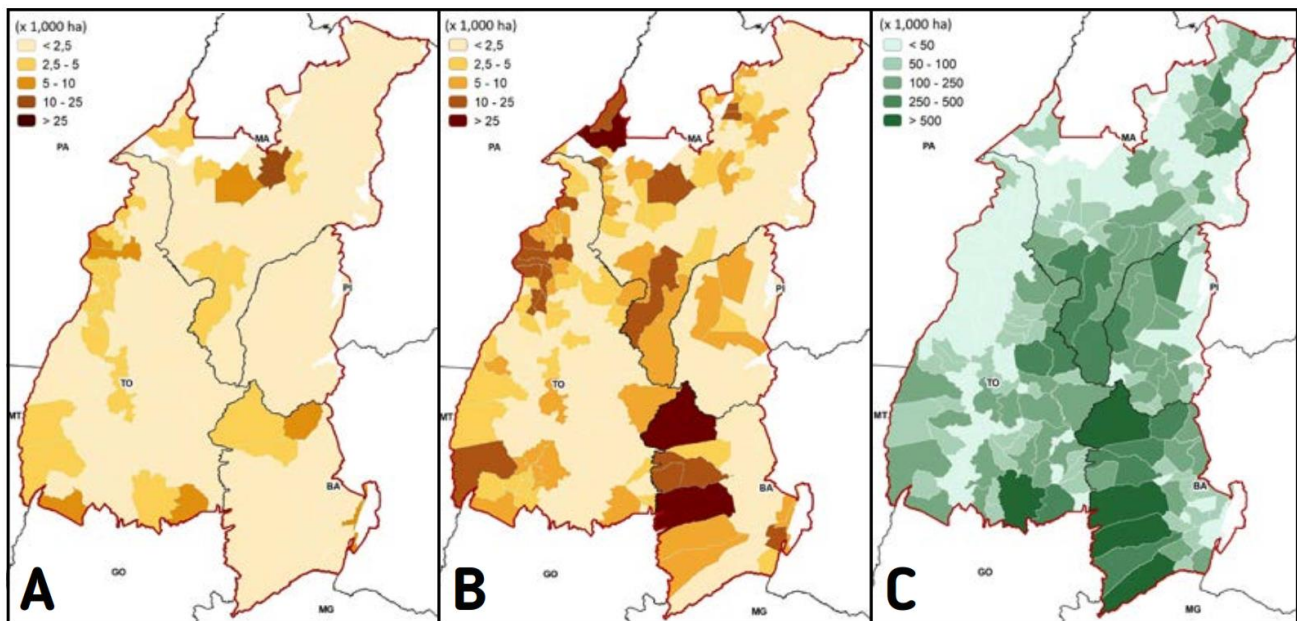


Figure 22. APP deficit (image A), RL deficit (image B) and surplus native vegetation (image C) by municipality in Matopiba. Source: Agroicone - prepared in-house with Guidotti et al. (2017)²⁸ data.

5.1. Difficulties for restoring native vegetation

Based on interviews and workshops held with Matopiba states' environmental secretariats, it was possible to identify problems and bottlenecks that each state faces for fostering ecological restoration, which will be represented in two different ways: through problem trees and a descriptive table (Table 2).

The problem tree is a graphical representation of a problem situation, its main causes, and the negative effects it has on the project's beneficiaries. Focusing on the consequences of the problem only masks its resolution. Hence the importance of applying the "Problem Tree" methodology for helping, and its principle is in defining what the cause is and what the consequences of a problem are ²⁹.

The problem tree model is presented below, followed by problem trees related to the ecological restoration agenda prepared for each of the four states.

²⁹ SOUZA, B. C. C. Gestão da mudança e da inovação: árvore de problemas como ferramenta para avaliação do impacto da mudança. Revista de Ciências Gerenciais. São Paulo, v. 14, n.19, p.1-18, 2010.

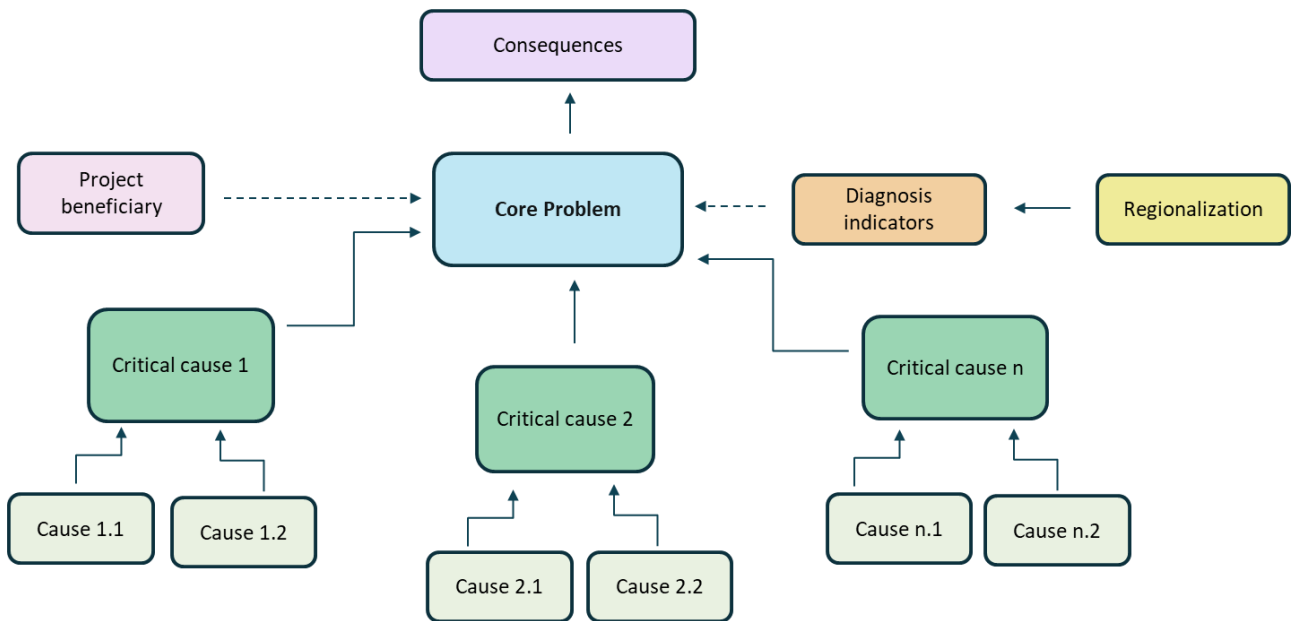
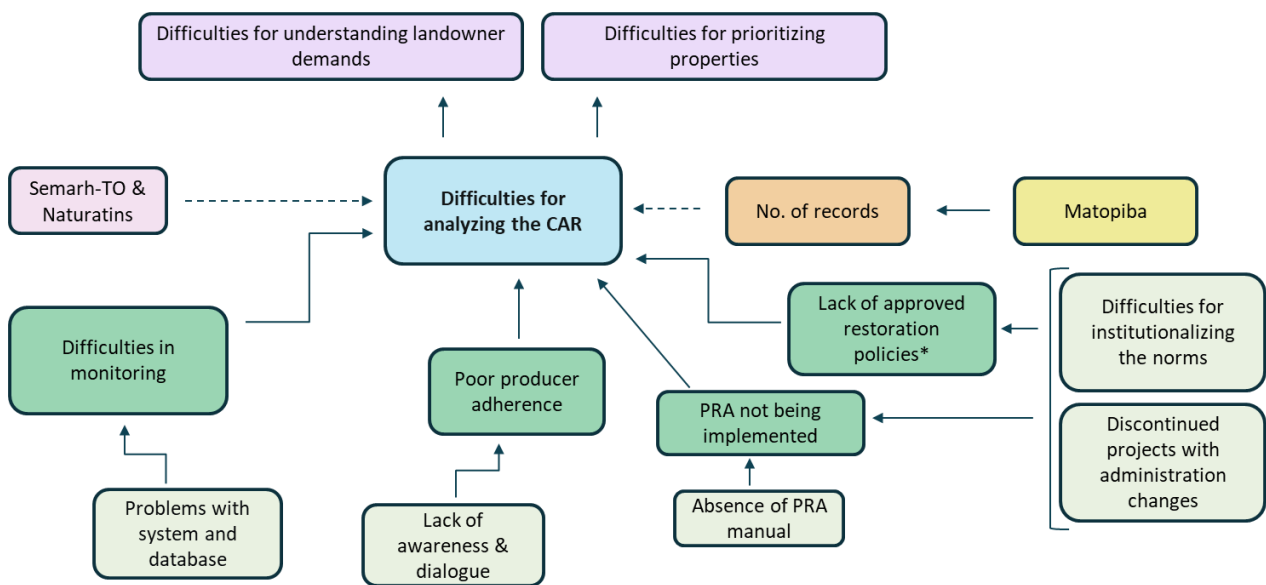


Figure 23. Problem tree model. Source: Agroicone - prepared in-house with Rio Grande do Sul (2019)³⁰ data.



*There is a draft law that provides for native vegetation protection and creates the Restaurar fund. This draft is being analyzed since 2017, and is to be revised this year

Legend:

- Core problem
- Diagnosis indicator
- Critical causes
- Consequences
- Regionalization
- Project beneficiary
- Causes

Figure 24. Tocantins: Simplified initial version of the problem tree for implementing policies native vegetation recovery. Source: Agroicone prepared in-house.

³⁰RIO GRANDE DO SUL. Secretaria de Planejamento, Orçamento e Gestão. Marco Metodológico do PPA 2020-2023. Seplag, 2019. Available at <https://planejamento.rs.gov.br/upload/arquivos/201906/06172548-marco-ppa-2020-2023-05062019-site.pdf>. Accessed on March 17, 2021.

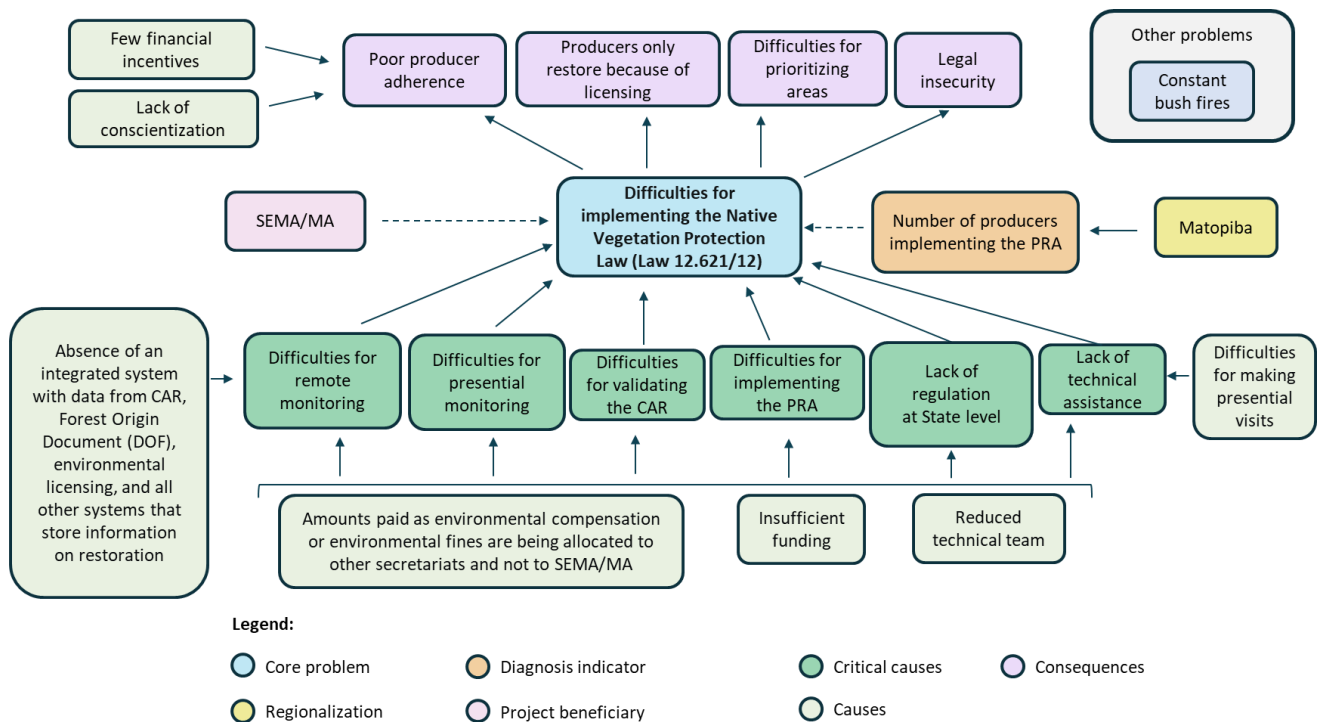


Figure 25. Maranhão: Simplified initial version of the problem tree for implementing native vegetation recovery. Source: Agroicone prepared in-house.

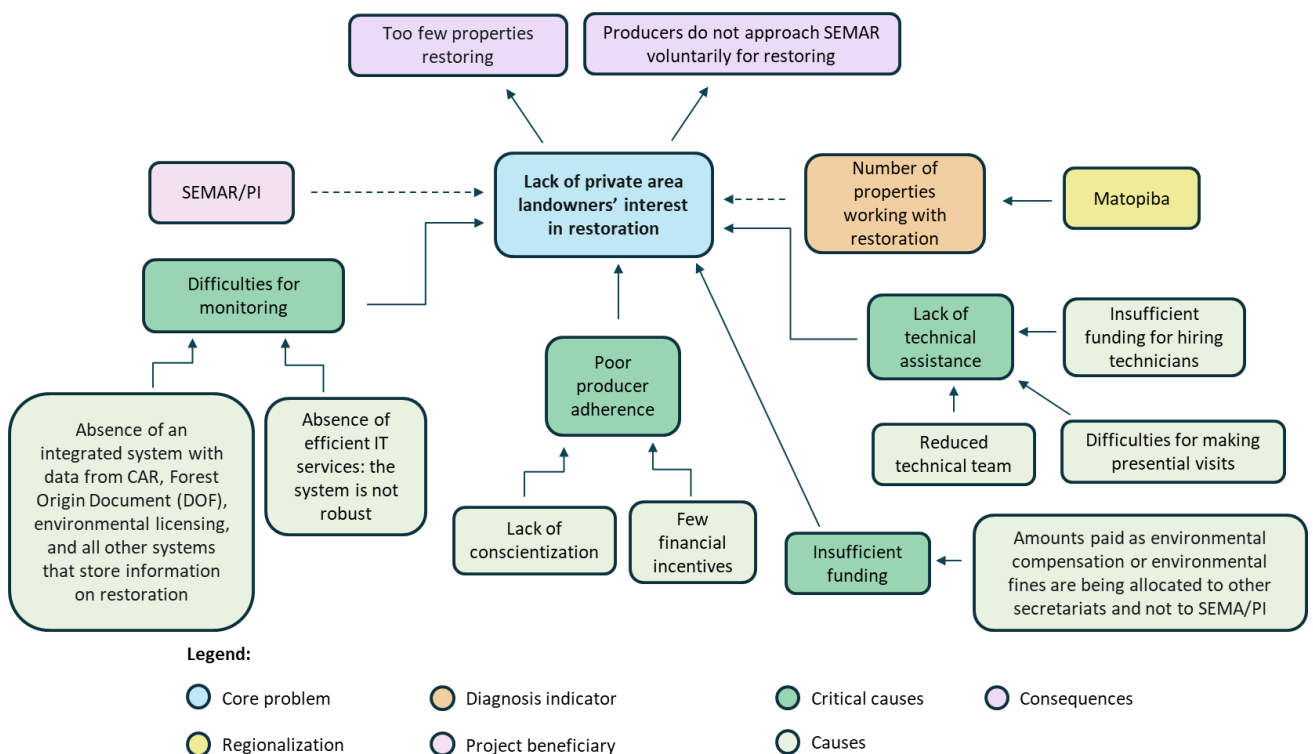


Figure 26. Piauí: Simplified initial version of the problem tree for implementing native vegetation recovery. Source: Agroicone prepared in-house.

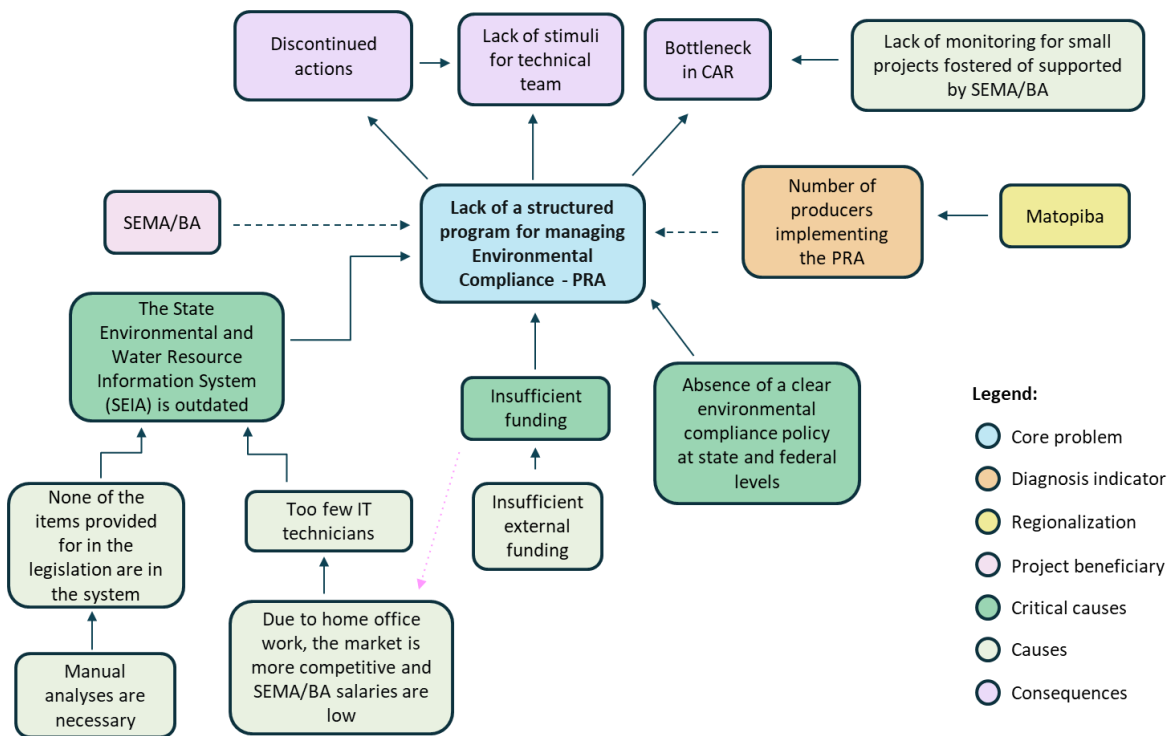


Figure 27. Bahia: Simplified initial version of the problem tree for implementing native vegetation recovery. Source: Agroicone prepared in-house.

In a summarized way, figure 28 presents a problem tree for implementing ecological restoration in the Matopiba states.

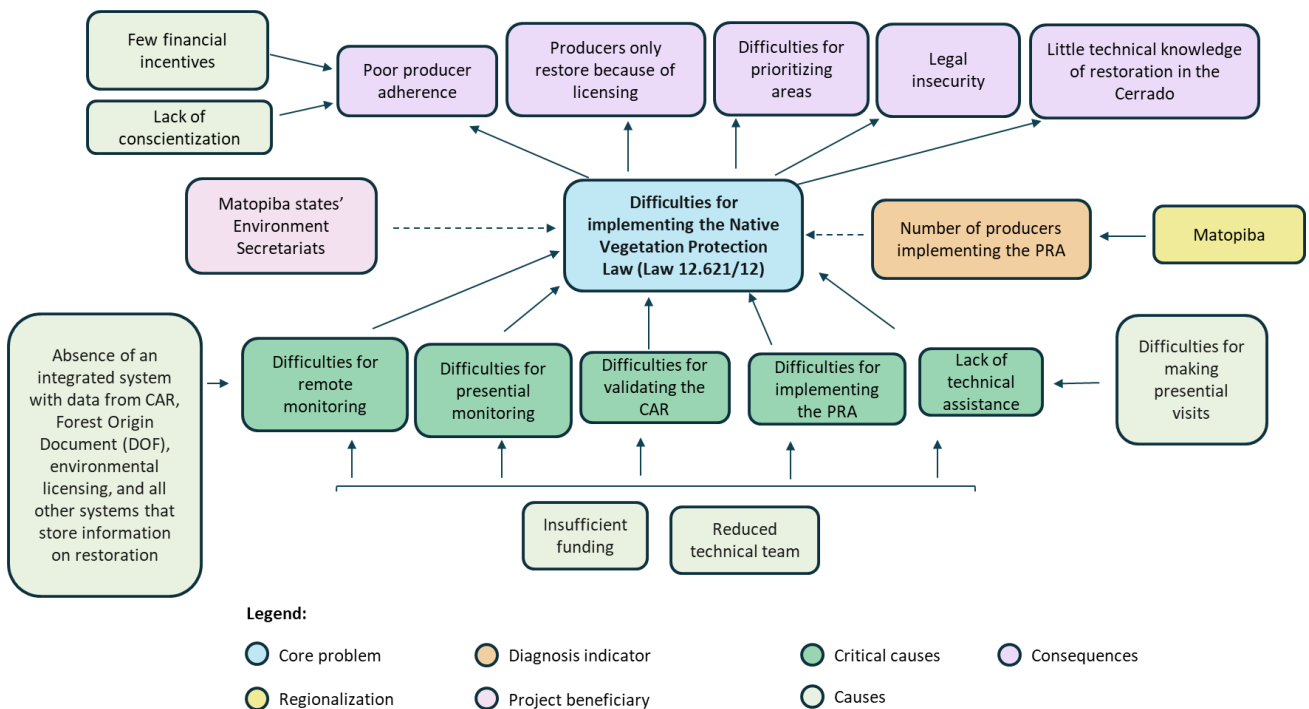


Figure 28. Problem tree for implementing ecological recovery in Matopiba states. Source: Agroicone - prepared in-house.

The problems and bottlenecks that each state faces for advancing ecological restoration can encompass the different restoration stages established in this study: planning; Implementation; monitoring and evaluating results; and financing and markets. These steps will be explained later in this report. Considering these problems and bottlenecks, opportunities were identified for contributing to this work, that is, actions to be developed that can be carried out in favor of restoration.

Table 2. Description of the problems and bottlenecks for restoration, respective impacted steps, and opportunities for contributing to the study that were identified in meetings with Matopiba state environment secretariats.

Maranhão	
Problems & bottlenecks	<ul style="list-style-type: none"> • The State Environment and Natural Resources Secretariat (SEMA/MA) has a very small team for analyzing the processes. • There are no proper mechanisms for monitoring restoration, making it very flawed. • There is not enough money for developing a system integrating data of the Rural Environmental Registry (CAR), Forest Origin Document (DOF), Integrated Environmental Licensing and Authorization Management System (SIGLA), and other systems that store information on ecological restoration. This system would streamline process analysis. • SEMA/MA depends on the Federal Police to have access to Planet's satellite images, which are used in process analysis. • The state intends to have its own deforestation and fire alert system. Constant fires are a big problem for restoration. • CAR validation is a problem. But in early April/2021, SEMA/MA obtained financial resources for hiring 15 expert analysts in geoprocessing, for 1 year, who will work on CAR validation. • The Environmental Compliance Program (PRA) has not yet been implemented. • Due to difficulties faced by the State, the amounts paid for environmental compensation or environmental fines end up being allocated to other secretariats and not to SEMA/MA. • Ecological restoration is required by SEMA/MA only through the environmental licensing process. • SEMA/MA does not give consent, technical assistance or guidance to producers who want to restore their areas on their own volition. • In the state, there are difficulties with inputs for restoration, such as seeds.
Restoration stages	<ul style="list-style-type: none"> • The major bottlenecks are in the planning stage (CAR and PRA) and in the restoration monitoring stage.
Opportunities for contributing	<ul style="list-style-type: none"> • Provide technical and legal support for regulating the PRA. • Develop projects aimed at raising funds for obtaining technologies that speed up monitoring, integrating information distributed across different systems.
Tocantins	
Problems & bottlenecks	<ul style="list-style-type: none"> • The major bottleneck is in the CAR analysis. • The PRA is not yet being implemented. The Instituto Natureza do Tocantins (Naturatins) is in the process of hiring a consultancy to prepare the PRA manual. • There are no approved policies on restoration. • There is a draft law that provides for the protection of native vegetation and creates Fundo Restaurar. This draft has been under analysis since 2017 and will be revised this year.

	<ul style="list-style-type: none"> • The Environment and Water Resources Secretariat (Semarh/TO) is not willing to do anything different from what is already being done. And it suggests that something be done that will help them to follow up and monitor the plantations being made out by Semarh/TO, or that help in engaging producers so that they use the PRA manual.
Restoration stages	<ul style="list-style-type: none"> • The major bottlenecks are in the planning stage (CAR validation) and in the restoration monitoring stage.
Opportunities for contributing	<ul style="list-style-type: none"> • Provide technical and legal support in revising the Draft Law that provides for the protection of native vegetation, creates Fundo Restaurar, revokes some laws, and takes other measures. • Develop work aimed at following up and monitoring the implemented plantations. • Develop engagement work with rural producers for them to use the PRA manual.
Piauí	
Problems & bottlenecks	<ul style="list-style-type: none"> • The PRA is in the creation phase and a study is being performed. And there is strong interest in the PRA being implemented. • The Piauí State Environment and Water Resources Secretariat (SEMAR/PI) does not have any project related to voluntary restoration on private properties. • If an entrepreneur approaches SEMAR/PI to deploy a voluntary restoration project, they will analyze it. But this situation never happened. • Producers with environmental liabilities do not request SEMAR's consent to voluntarily recover their areas, only when they depend on the license. In the latter case, owners present a restoration plan and file it with SEMAR/PI. • SEMAR/PI has difficulties for engaging producers to restore their areas.
Restoration stages	<ul style="list-style-type: none"> • The major bottleneck is in the planning stage (PRA regulation and farmers' awareness of the importance of restoring degraded areas).
Opportunities for contributing	<ul style="list-style-type: none"> • Provide technical and legal support for regulating the PRA. • Develop work for engaging producers in ecological restoration.
Bahia	
Problems & bottlenecks	<ul style="list-style-type: none"> • There is no monitoring for small projects fostered or supported by the State Environment Secretariat (SEMA/BA). • Liability of family farmer registrations in the state is still a bottleneck. External financial resources are essential for solving this problem, but due to the current political situation, it is now more difficult to secure financing for restoration. • The "Technical Guide for Restoring Vegetation in Rural Properties in the State of Bahia" was prepared in 2017 by SEMA/BA, in partnership with The Nature Conservancy (TNC) Brasil, and is a tool that, due to changes in administrations, was not prepared with due attention and ended up receiving criticism. Therefore, the manual has not yet become a regulation. • The State Environmental and Water Resources Information System (SEIA) needs many improvements related to Information Technology (IT). But SEMA/BA is losing many IT technicians because due to home office work, the job market is more competitive and the salaries paid by SEMA/BA are no longer attractive.
Restoration stages	<ul style="list-style-type: none"> • The major bottlenecks are in the planning stage (registration of family farmers in the CAR) and in the restoration monitoring stage.
Opportunities for contributing	<ul style="list-style-type: none"> • Provide technical and legal support to review and regulate the "Technical Guide for Restoring Vegetation in Rural Properties in the State of Bahia". • Develop projects aimed at raising funds for IT-related improvements at SEIA

Source: Agroicone- prepared in-house.

In addition to the opportunities seen specifically for each state, two issues were widely discussed: implementing the CAR and/or regulating the PRA and monitoring restored or preserved areas.

All states have bottlenecks related to CAR and/or PRA implementation. The vast majority of registrations in the CAR are being made, with Bahia reporting the need to increase the number of registrations of family farmers. Validation is still a bottleneck for Tocantins and Maranhão (although Maranhão took an important step in 2021). Implementing the PRA, on the other hand, is still a problem for everyone, with Bahia being the most advanced state, needing only to review and regulate the technical guide for restoration.

With the exception of Piauí, who managed to set up a geoprocessing center in partnership with the state land compliance agency and informs that there were no problems related to this matter; the other states indicated the need for improvements in the integrated system and/or in monitoring the areas. In Tocantins and Maranhão, this improvement would be achieved with the use of advanced technologies that make it possible to identify the recovery of degraded areas or the maintenance of preserved areas without the need to spend resources (time and money) on travel for on-site visits. In Bahia, however, IT (Information Technology) related improvements need to be made in the State Environmental and Water Resources Information System (SEIA).

In addition to interviews with the secretariats, the “Workshop on Public Policies for Restoring the Cerrado: challenges and benchmarking for Matopiba” was also organized. In this event it was possible to obtain more information about the restoration panorama in Matopiba and in Brazil as a whole.

In Brazil, one of the main challenges for restoration is low demand for restoration, which makes it difficult to advance the restoration chain, resulting in several other problems. Little technical knowledge about native species, especially those for economic use; difficulties with norms established by MAPA for producing native seeds; absence of financial incentives or other economic counterparts are some of these problems. Implementing the New Forest Code is of great importance for developing the restoration chain, but it continues to advance at a slow pace.

Slow implementation of the New Forest Code brings a lot of legal uncertainty. In Brazil there are good regulations, but they are not put into practice for several reasons, such as lack of resources for inspection and lack of political support. This legal uncertainty does not only bring problems regarding norms and regulations, but also affects producers’ behavior, as it signals that they can wait to carry out restoration, possibly because they have more lenient rules or other type of support in the future.

Economic incentives, such as Payment for Environmental Services (PSA), are very important for fostering native vegetation protection in priority areas for biodiversity conservation. But the amount paid as PSA will hardly compete with the income generated by soybeans.

There are foreign investors with funds, but they lack good projects for them to invest in. These projects need to be impactful in order to have scale, and for that, thinking about species that generate economic return is essential. Furthermore, the credit approval process for restoration is quite long and complicated. Banks are concerned about the economic return that producers will get.

When talking about Cerrado, there are other specific problems, such as lack of knowledge, techniques, and methodology for restoring the biome – for example, it is not known how to perform restoration in humid fields. Still, diversity and the number of native seeds produced is low. And for that, it would be interesting for small producers to form a seeds and seedlings network, and they will sell them to large producers so they may carry out restoration, bringing both types of producers closer.

In the environmental secretariats, the reduced number of technicians responsible for the high demand assigned to them ends up being a challenge for streamlining restoration.

In summary, one of the main challenges for restoration is low demand and adherence for the process, which makes it difficult to advance the restoration chain and has several repercussions. We can point out the little technical knowledge about native species, especially those that are typical in the Cerrado, on how to obtain economic benefit, in addition to absence of financial incentives or other economic counterparts. Implementing of the New Forest Code, which is progressing slowly, is essential for generating demand for restoration and developing the restoration chain. The environment departments lack civil servants and this has a direct impact on the restoration agenda.

These problems and bottlenecks affect different restoration stages: planning, implementing, monitoring, and evaluating results, and financing and markets – these stages will be explained later in this report. From these bottlenecks, it is possible to identify successful initiatives deployed in Brazil to be used as references, in order to develop new actions to stimulate ecological restoration and environmental compliance.

The contribution opportunities presented in Table 2 can, in a number of ways, become legal instruments, such as “*erga omnes*” norms (a law “for all”, which contains more general provisions) or public tender notices for financing specific projects – in this case, after a company wins a public tender, the rules of the notice become binding, so they are also a legal instrument of the “*inter parte*” type (between parties). Due to the contribution opportunities mapped in this study, the best ways to make them effective would be:

1. Creating an “*erga omnes*” law (any kind of law, according to the normative pyramid presented in Figure 29) that enables, for example, a private individual to comply with a legal obligation (such as paying an environmental fee or fine) by financing of a recovery project made by a private company, without having to pay this fee or fine to the State, only proving that they spent the same or greater amount in recovering some extra area to the one they should have recovered.
2. Creating, whether through public or private funding, funding tender notices for specific recovery projects or monitoring projects.
3. Creating a term of agreement, a service provision contract or other instrument between the government and private institutions (companies, foundations, or private associations, for example), so that these may provide more qualified technical people for working in the environment secretariats, relieving forest licensing sectors and also helping other environmental-recovery related sectors. Basically, the secretariats’ HR departments will need to grow, but it will be much better if this is done through a contract or agreement with a private entity that supplies the workforce.

6. LEGAL ASPECTS THAT IMPACT RESTORATION IN BRAZIL AND IN THE MATOPIBA

6.1. Comprehensive sectoral policies

In order to understand public policies for restoration in Brazil and Matopiba, first it is necessary to understand, with an overview, the structure of the legal system and its respective normative types, that is, the types of laws – because it is through laws that public policies are written and established. Therefore, it is essential that the form and content of the laws are in accordance with the purpose of what is desired with a particular public policy, at the risk of that policy not being able to get off the ground or generating below-expectation results.

Firstly, it is important to remember that the legal system consists of the set of laws of a country – but not laws taken individually, but laws that are interrelated within an organized system. Thus, we could say that the entire organization of the state and of life in society is governed by norms that, in turn, obey the norms of the system's organization, so that a norm that does not obey the system is illegal and/or unconstitutional, must be extracted from the legal system.

The first characteristic of this system is the hierarchy of norms, which became visually known as the “normative pyramid”, as it has the shape of a pyramid. Within this pyramid, rules are organized into “higher laws” and “lower laws”, and the ones below must be in accordance with all those above.

At the top of the pyramid, which would be the highest law, is the Federal Constitution – therefore, all the country's rules must obey the Constitution – currently, the 1988 Constitution. There are theories that claim that international treaties would be above the Constitution, even if to be implemented in the country, they would depend on being accepted and entering the Constitution through constitutional amendments. But there is no such discussion here.

The article of the Constitution that underlies this entire work and the other laws quoted here is article 225, which deals with an ecologically balanced environment, for the benefit of present and future generations.

Below the Constitution there are complementary laws (such as Law 140/2011, which divides the powers for environmental licensing) and below them are the ordinary laws, such as the National Environmental Policy and the New Forest Code. Both complementary laws and ordinary laws are what is generally called “law” because they are created and instituted by the legislative power (whether federal, state, or municipal) - but in reality, they are just one of the normative types that appear in the normative pyramid.

Below them (or, depending on the interpretation, at the same normative force level), we have laws initiated by the head of the executive power (the president of the Republic, the governors, and the mayors), such as decrees and provisional measures – the latter only enter into force for a certain period of time and must then be approved by the legislature and converted into laws to remain in force.

Further down, we arrive at the so-called “infra-legal” normative types, in the sense that they were not created by the legislature, but by executive bodies or other entities. These are the resolutions, ordinances, and

normative instructions, such as the resolutions created by Environment Councils (for example, National Environment Council – CONAMA resolutions) and ordinances and normative instructions of environmental agencies and municipalities. These are the norms that regulate in detail what the complementary and ordinary laws have provided for in a more generic manner – although an ordinary law does not necessarily need a resolution or ordinance to be implemented. However, if it does not exist, it is more difficult, since both individuals and the public power may not know how to achieve a certain purpose laid down in the more general law. Metaphorically, the infra-legal norms show “the obvious path”, regulating the purposes that have already been arranged by the upper laws.

And even within this “step” of the normative pyramid there are sub-steps. A resolution created by an Environmental Council, for example, has more force than an ordinance and a normative instruction created by an Environment Secretariat.

The logic of the normative pyramid is that of hierarchy: each law must be created without contradicting those located above in the pyramid, and a law can only be revoked or modified by another norm of the same normative type or of a higher normative type. Therefore, a “strong” regulation will preferably be made through ordinary law (which is approved by the federal, state, or municipal Legislative Power) or, at least, an Environment Council Resolution (it can also be the federal, state or municipal Council). On the other hand, an “easy” regulation is one that is made through an ordinance or normative instruction, since in this case it is the environmental agency itself or another entity that prepares and approves the standard. Thus, “normative force” and “ease/speed” in creation are opposite choices. For some cases, it may be more interesting to have an ordinance made quickly and easily (but with precarious force), and for others it may be more necessary to face the entire difficult and time-consuming process of creating and approving an ordinary law (with greater normative force). The “half-way” choice, for regulatory purposes, would be a resolution created by the (Federal) Environment Council – CONAMA or the State Councils or even the Municipal Councils.

Figure 29 below shows an example of the regulatory pyramid and its hierarchical character, highlighting the main ordinary laws that guide the environmental preservation and recovery objectives.

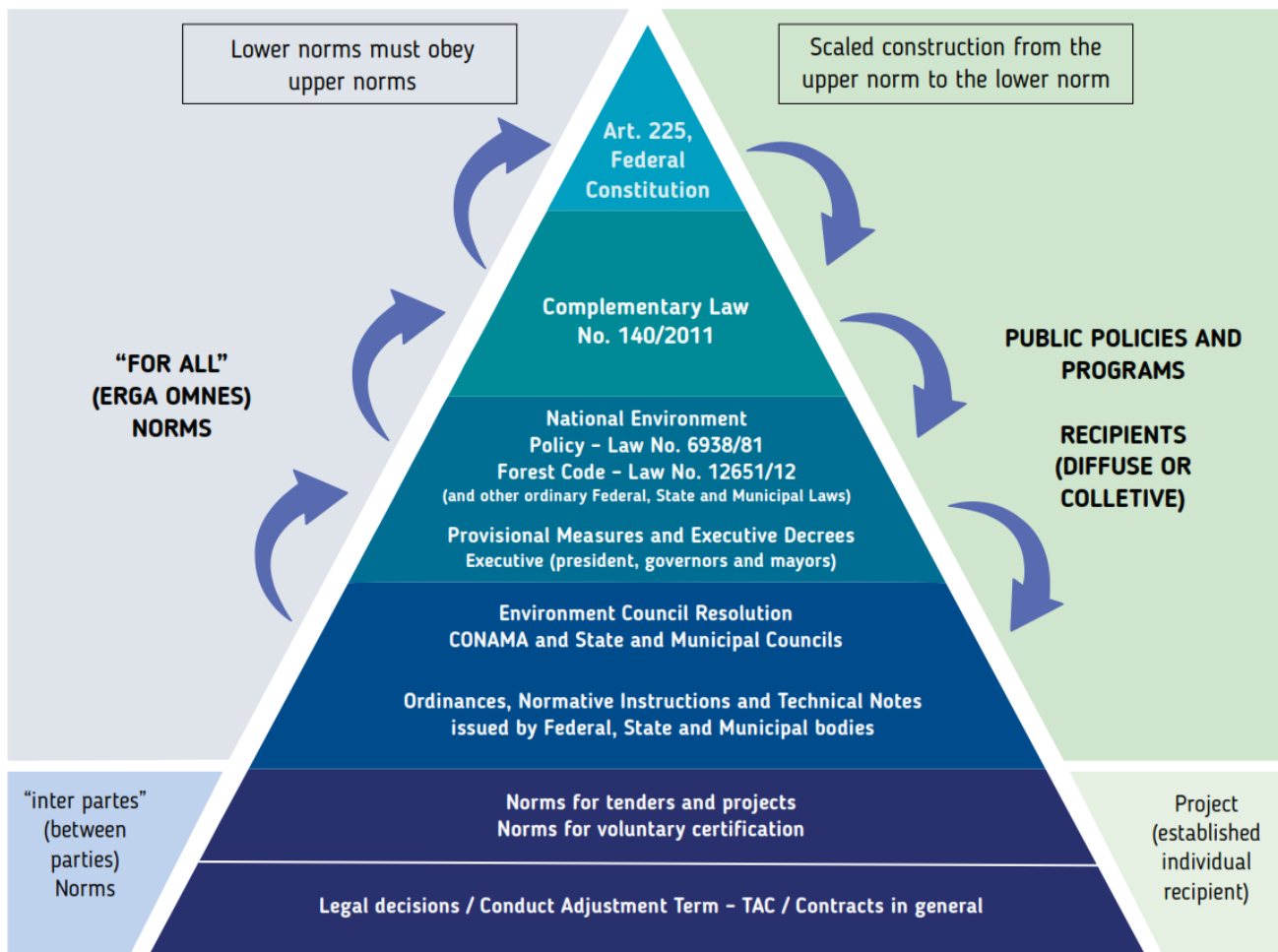


Figure 29. Example of the normative pyramid and its hierarchical character, with the main ordinary laws on environmental preservation and recovery. Source: Agroicone prepared in-house.

It is necessary to explain that the fact that there are federal, state, and municipal laws in Brazil is also related to the hierarchical character of the normative system, but not as directly as the one that affects normative types. The federative entities (municipality, state, and union) are autonomous and can legislate freely in the matters they have authority for. However, each one's authority is provided for in the Federal Constitution (for example, the three entities can legislate on environmental matters), while there is also need for laws to obey the higher normative types – and the normative types at the top of the pyramid are the Constitutions of the States and the Federal Constitution. Thus, it is expected that state norms are in accordance with the federal ones, and the municipal ones are in accordance with the ones of the states.

Another characteristic that governs the system is specialty, which is used when there is an apparent conflict of norms between one that is more generic/general and another that is more specific. This means that sometimes, two norms can belong to the same normative type (that is, to the same area in the pyramid) and also both be created by the same federative entity. For example, two ordinary federal or state laws. It may happen that the two bring apparently contrary provisions – however, one law is more general, and the other is more specific. In that case, the more specific law shall apply.

For this reason, the expression “general laws and specific laws” was popularly born – although every law has the pretension of generality, in the sense of affecting all people and not just an individual case, and precisely

for this reason there are laws called “*erga omnes*” rules, that is, they apply to everyone, while there are other rules that apply only to certain parties, such as the rules of a contract for a specific project, which are called “*inter partes*” rules.

However, even in the “*erga omnes*” norms category, that is, what we normally call “laws”, the classification of “general laws and special laws” serves to indicate that there are laws that deal with more general topics (for example, “environmental protection”), and laws that become specialty-oriented (e.g., “environmental recovery”). However, such categories only exist in a comparative form, because to say that a law is “special”, it must be compared with a more general one. But that same law that was called “special” can become “general”, in the face of an even more specific law. Therefore, laws on “environmental recovery” can be “general or special”, depending on which other laws it is being compared with. If we take the New Forest Code and compare it with specific laws on Cerrado ecosystem restoration, then the New Forest Code is a “general” law and the Cerrado restoration laws are “special” laws.

Having completed this overview of the normative system, it is now time to analyze the laws and their respective public policies that, in a more direct manner, are related to the environmental recovery subject (there are general environmental protection laws and also special laws on recovery).

Policies for supporting ecological restoration are related to a number of types of norms. Several state public policies focus on ecological restoration, to different degrees depending on state rules, as well as land use dynamics, economic activity, biome, among other legal issues. Considering the federative structure, states must follow federal guidelines, so it is pertinent to briefly understand the legal frameworks on the subject.

The legal framework for regulating and encouraging ecological restoration is present in federal legislation since the Federal Constitution of 1988, through comprehensive policies such as the National Environmental Policy (PNMA) of 1981, and the National Conservation Unit System (SNUC) – Law no. 9,985 of July 18, 2000. The latter guides the fully protected areas in the country, such as parks and ecological reserves, and those of sustainable use, such as Extractive Reserves (RESEX) and Environmental Protection Areas (APA). Most of these Conservation Unit (UC) categories are public areas and, therefore, are outside the focus of this report. The New Forest Code is the main legislation that interferes with ecological restoration on private properties, defining the rules for APPs, RLs and other important concepts and mechanisms for environmental compliance. The New Forest Code was followed by some normative instruments for its implementation, with emphasis on the norms for the Environmental Compliance Programs (PRA) of the States and the Federal District (established by Decree no. 8,235/2014).

The New Forest Code will be further detailed in the next item and, for now, it is worth commenting a little more on the environmental recovery objective provided for in the Constitution and in the National Environmental Policy.

The Federal Constitution of 1988, the highest law of the country, states in its art. 225 that:

Art. 225. Everyone has the right to an ecologically balanced environment, an asset for common use by the population and essential to a healthy quality of life, imposing on the

public power and the community the duty to defend and preserve it for present and future generations.

The heading of art. 225 brings the right to an ecologically balanced environment and is the basis for supporting national environmental legislation. But on the topic of recovery, the same article 225 has one more provision in its 3rd paragraph, when it speaks of “obligation to repair damages”:

§3 Conducts and activities that are considered harmful to the environment will subject violators, individuals, or legal entities, to criminal and administrative sanctions, regardless of the obligation to repair the damage caused.

This article provides for the three possible types of liability for damage: administrative, civil, and criminal. However, the concrete circumstances of each case will indicate the need to impose the three types of liability or only one or two. Liability for recovering the area is a measure that, regardless of who was the agent that caused the deforestation, is mandatory for APP and RL areas, as indicated in the New Forest Code, which will be detailed later.

It is also important to mention the National Emissions Reduction Strategy for Deforestation and Forest Degradation, Conservation of Forest Carbon Stocks, Sustainable Forest Stewardship, and Forest Carbon Increase and Stocks (ENREDD+) instituted in 2016.

It is also worth mentioning the National Plan for Recovering Native Vegetation (PLANAVEG) which was published in 2017 as the main instrument for implementing the National Policy for Recovering Native Vegetation (PROVEG) – Decree no. 8.972, of January 23, 2017. This is the country's main regulation on the native vegetation recovery and the rule that would guide state policies on the subject, but part of its regulations either have not yet been implemented or are paralyzed. PLANAVEG guidelines cover: I) raising society's awareness about the benefits of recovering native vegetation; II) fostering the chain of inputs and services linked to recovering native vegetation; III) improving the regulatory environment and the increase of legal certainty for recovering native vegetation with economic use; IV) expanding technical assistance and rural extension services aimed at recovering native vegetation; V) structuring a spatial planning and monitoring system that supports decision-making aimed at recovering native vegetation; and VI) fostering research, development and innovation of techniques related to recovering native vegetation. Thus, these six themes are important components for policies for supporting restoration at state level as well.

The National Commission for Recovering Native Vegetation (Conaveg) that had been originally established by PROVEG, with the participation of several public bodies and civil society representatives, was revoked in 2019, and replaced by the Executive Commission for Controlling Illegal Deforestation and Native Vegetation Recovery, with government representatives only. In addition to these changes and setbacks, there is the fact that these different regulations at the federal level do not have a consistent definition of concepts on ecological restoration and experts in the science of ecological restoration indicate that this inconsistency hinders and brings legal uncertainty³¹. This inconsistency of concepts together with the gaps in implementing the New Forest Code and PROVEG makes the legal framework on ecological restoration fragile in Brazil, not collaborating, of course, for efficient and safe state legislation.

6.1.1. The New Forest Code in Matopiba

The Law for Protecting Native Vegetation – LPVN (Law 12.651/12), better known as the New Forest Code, with the general objective of preserving environmental balance, establishes both the obligation and the percentages of Legal Reserve (RL) for rural properties in its art. 12, as well as establishes the so-called Permanent Preservation Areas (APPs), which must be preserved both in rural and urban areas, regardless of who owns the area, whether an individual or legal entity, under public or private law.

If RL or APP areas are deforested, their recovery is mandatory, as stated in article 7, §1 of the New Forest Code, regarding APPs, and art. 12 and subsequent articles regarding RLs. It is worth transcribing:

Art. 7 The vegetation located in a Permanent Preservation Area must be maintained by the owner of the area, possessor, or occupant in any capacity, whether an individual or legal entity, of public or private law.

§1 In the event of suppression of vegetation located in a Permanent Preservation Area, the owner of the area, possessor or occupant in any capacity is obliged to recompose the vegetation, except for the authorized uses provided for in this Law.

Some highlights deserve to be pointed out. The first is that the recovery obligation falls on the area, and not necessarily on the agent who deforested it. In other words, it does not matter if the owner, tenant, or previous owner was the one who deforested the area. If the area remains cleared, the current one must recover it – and, if they wish to charge the costs of this recovery from the deforesting agent, they must do so on their own through proper legal procedures.

The second highlight is that the RL, instead of being recovered, can be offset in another property with surplus native vegetation compared to the RL. But if the RL was deforested after July 22, 2008, even if the owner offsets the RL in another property, they must still pay the fine, since they did it after the aforementioned date, which was established in the New Forest Code as a “blank slate” for non-incidence of the fine, as will be explained further on in this study.

The third highlight is that there are exceptions provided for in art. 8 of the New Forest Code that allow suppressing vegetation in APPs: in cases of public utility, social interest, or low environmental impact. However, such cases are rarely present in activities related to the soy supply chain, so it is unlikely to use these exceptions - and for the first two cases, it is necessary to have a formal document from the executive branch (for example, a Declaration of Public Utility) to ensure that the said area is covered by this exception

³¹ BERGAMASCHINE, Livia Carvalho. Políticas públicas e as contribuições potenciais do cerrado para o cumprimento das metas brasileiras de redução das emissões de gases do efeito estufa. Dissertação (Mestrado), Universidade de Brasília, Programa de Pós-Graduação em Ecologia, 2017.

In addition to these articles that generally establish environmental recovery as a principle and also an objective, the New Forest Code effectively brings instruments with the power to transform environmental recovery into reality, based on three pillars: the Rural Environmental Registry (CAR) of rural properties; the State Environmental Compliance Programs (PRAs), which will guide the compliance process – where producers must present a Project for Recovering Degraded or Altered Areas (PRADA); and the Terms of Commitment (TCs) that will encompass each producer's commitments³².

The CAR aims to unify environmental information of rural properties and possessions, building a basis for control, monitoring, environmental and economic planning on land use and, therefore, combating deforestation. All rural properties must be registered in the CAR and are subject to fines and administrative sanctions in case of non-compliance with the law. Registrations made until December 31, 2020 – the last valid period – could rectify the environmental liabilities in the areas consolidated in Permanent Preservation Areas (APPs) and Legal Reserves (RLs) considering the more flexible rules of the New Forest Code through adherence to the Environmental Recovery Program (PRA). Consolidated areas are those that were deforested before July 22, 2008³³.

Since February 2021, Bill 36/2021 is being processed in the Lower House of Congress, which aims to extend the deadline for small rural producers to register in CAR and access PRA benefits with a December 31, 2022 deadline. As informed by Agência Câmara de Notícias, the extension is justified due to pandemic-related challenges caused by Covid-19, which made it difficult, especially for small producers, to voluntarily provide formation about their properties for the CAR³⁴.

The PRA is a set of rules for the compliance process in accordance with the New Forest Code. It is based on the CAR, which will define the liabilities of APPs and RLs to be rectified, and requests that producers propose a Project for Recovering Degraded or Altered Areas (PRADA) which, if approved by the environmental agency, will be the basis of the Term of Commitment to be signed by the producers. The PRAs must be clear about compliance of deforested areas before and after July 22, 2008³², since, if the area was deforested before that date, despite rural owners still having the obligation to recover APP and RL areas, the imposition of a fine will not be levied on them. For this reason, it was said, at the time of the approval of the New Forest Code, that it was giving “amnesty” to those who deforested illegally. The logic of the law, however, is that this “amnesty” serves as a blank slate and encourages rural landowners to rectify their respective areas, restoring native vegetation in illegally deforested areas.

³² Lima, Rodrigo C. A; Munhoz, Leonardo. "Programas de regularização ambiental (PRAs) Um guia para orientar e impulsionar o processo de regulamentação dos PRAs nos estados brasileiros". Agroicone: INPUT Brasil; São Paulo: 2016.

³³ Chiavari, Joana; Cristina L. Lopes; Julia N. de Araujo. Onde Estamos na Implementação do Código Florestal? Radiografia do CAR e do PRA nos Estados Brasileiros. Edição 2020. Rio de Janeiro: Climate Policy Initiative, 2020.

³⁴ Souza, Murilo; Doederlein, Natalia. "Projeto prorroga prazo de adesão de pequenos produtores a Programa de Regularização Ambiental". Agência Câmara de Notícias; 08 de fevereiro de 2020. Available at <http://bit.ly/3qVPtHk>. Accessed on February 23, 2021.

The PRADA to be submitted by the owner or possessor, is the technical project that explains how APPs and RLs deforested before July 22, 2008 will be rectified and informs the restoration, revegetation and/or compensation methods in the case of RLs, where permitted, scheduled for deployment. Therefore, for landowners to develop their projects assertively, avoiding filing for rectifications by environmental agencies, it is crucial that the states establish a basic model with mandatory formal criteria and schedule worksheets. In addition, states need to regulate the need for PRADA for liabilities after July 22, 2008³².

The Term of Commitment (TC) binds producers to fulfill the required obligations for legalizing their APPs and/or RL areas and must be signed after the application for joining the PRA and approval of the PRADA.



Figure 30. Simplified scheme for rural property compliance under the New Forest Code. Source: Agroicone - prepared in-house with information extracted from Lima e Munhoz (2016).

BOX 2: Difference in meaning in the acronyms used by federal and state environmental agencies

It is important to highlight that, not infrequently, an infra-legal norm of a state (such as an ordinance or normative instruction) regulates a topic by instituting an acronym similar to one already used in another federal norm, but with a different concept. And if such acronyms, although referring to different concepts, are related to the same topic, then the probability of confusion is high – and for this reason it is always good to check the entire content of the acronym, to understand if it is actually referring to what is imagined.

An example of this is the acronym PRA itself, which in the New Forest Code and for the purposes of this work means "Environmental Compliance Program", but it is the same acronym also used in Ordinance no. 13/2013/SEMA/MA with the meaning of "Environmental Compliance Plan", which is an individualized study for a specific case of environmental compliance of agro-silvopastoral activity implemented in more than 1,000 hectares of rural properties, a study that may or may not involve environmental recovery for that case, but if deforestation in an APP or Legal Reserve has occurred, then it will be necessary to recover them.

It is important to mention that the aforementioned SEMA/MA ordinance "*Sets the procedures for approving the location of a Legal Reserve, for granting an Environmental License for Agro-silvopastoral Activities and Environmental Authorizations for Alternative Land Use in Rural Properties in the State of Maranhão*", while regulating, within the same standard, the granting of licenses for areas that have not yet been deforested and also environmental compliance for areas that have already been deforested without the proper license and now it is necessary to rectify them.

It is also opportune to differentiate this Environmental Compliance Plan – PRA, mentioned in the SEMA ordinance, from the PRADA that has already been mentioned in the present work. PRADA refers to the project for recovering the degraded area, while the Environmental Compliance Plan – PRA is a broader study for the purpose of legalizing the license, with content comparable to that of an Environmental Impact Study, but relative to an area that has already been deforested without the proper environmental license.

It is important to remember that this deforested area without the environmental license, if it does not enter the APP and RL areas, does not necessarily need recovery – but it still needs the license, and therefore SEMA in Maranhão requests the aforementioned Environmental Compliance Plan – PRA, which is the study comparable to what would have been requested if the licensing had been done in advance, before deforestation.

What occurs is that rural landowners often deforest without a permit the areas that, in principle, are precisely those available for planting (therefore, without entering the APPs and RL) and, only after deforesting it, do they start the environmental licensing process for legalizing such area and rule out the likeliness of a possible embargo on it – and in this case, a licensing rectification process is initiated, with the incidence of a fine if the area has been deforested after July 22, 2008 (the fine applies as a penalty for having been deforested without the Vegetation Suppression Authorization – ASV/license).

The example mentioned, as it is an acronym with closely related themes and involves one of the target states of this study – Maranhão –, deserved a more in-depth explanation. There are still other acronyms that can also cause some confusion, so it is highly recommended that the content of the acronyms be checked in detail.

Although the legislation is federal, it is up to the states to validate the CAR registries and regulate and implement the PRA. However, after almost nine years of the enactment of the New Forest Code, most states are late in its implementation. This lack of regulation of PRAs hampers the compliance process, creates insecurity for the entire production chain, generates confusion, and can motivate legal discussions that tend to further delay their implementation process^{32,33}.

Given the slowness of the states, the federal government, through Law no. 13.887/2019, establishes that the owner or possessor of rural property may adhere to the PRA implemented by the Union in the states that did not implement the PRA until December 31, 2020. However, instead of accelerating the implementation of the New Forest Code, the law brought more legal uncertainty due to the lack of regulation of the PRA implemented by the Union and the absence of details and explanations about this paragraph of the law, such as: what is the impact on the non-compliant states? What is the deadline for states to adapt? And what is considered an implemented PRA?³³.

The delay in implementing the New Forest Code by the states generates legal uncertainty and causes demand for restoration to be discouraged. Another relevant point to be noted is that, by leaving it up to each state to regulate its own PRA and other norms that interfere with restoration without technical guidelines (such as the definition of ecological indicators) and standardizing the terms used, confusion and uncertainties are generated in interpreting the legislation, increasing legal uncertainty. Of course, national legislation needs to

have the flexibility to allow adjustments according to the specifics of each region, however general guidelines could facilitate state regulation.

With a broad understanding of the main points and difficulties of the New Forest Code at federal level, it is important to analyze the status of its implementation in the states that make up the Matopiba region.

Along these lines, the Climate Policy Initiative (CPI) and the Land Use Initiative (INPUT), through the “Where are we in implementing the Forest Code?” report published in 2020, defined steps for assessing the evolution of states regarding the implementation of the law. These steps are 1st) CAR registration; 2nd) analyzing and validating registries; 3rd) regulating the PRA; 4th) human, technical and operational resources for implementing the PRA; 5th) PRA is already implemented; and 6th) executing and monitoring APP and RL compliance projects³³.

All Matopiba states have already reached the second stage, which is analyzing and validating registries (Figure 31). Maranhão reached this stage in 2020. Bahia is the most advanced state and is in the last stage regarding the executing and monitoring projects for rectifying Permanent Preservation Areas (APPs) and Legal Reserves (RL), that is, it has already passed all stages³³ despite necessary improvements in previous ones.



Figure 31. CAR and PRA implementation stages and status of Matopiba states, 2020.
Source: Agroicone - prepared in-house with Climate Policy Initiative (2020) data.

Analyzing and validating CARs is done reactively or actively, depending on the state. The reactive analysis takes place when the CAR validation is demanded by judicial implication or during environmental licensing and inspection, whereas the active analysis is made by a specific team for implementing the CAR. In the case of Tocantins and Bahia, these analyzes and validations are made reactively through environmental licensing. As in those states, Piauí also analyzes in a reactive way. In contrast, Maranhão analyzes and validates its CARs through an active routine, in addition to the reactive way. This active analysis was implemented in 2020 and the Maranhão State Environment Secretariat (SEMA/MA) had only three technicians dedicated to CAR³³, however, in early April 2021 SEMA/MA managed to obtain resources for hiring 15 analysts specialized in geoprocessing, for one year, who will work in this stage.

With regard to regulating and implementing the PRA, a study is being made in Piauí for creating the PRA. The state is still discussing a draft regulation of the PRA and expected it to be published in 2021. However, Piauí could still be greatly impacted by the PRA implemented by the Union³³.

In Maranhão, despite having already enacted a state law for implementing the PRA in 2015, the program still needs to be regulated. This law is considered inapplicable due to lack of procedures for adhering to the PRA and rules on environmental compliance. Therefore, a forest policy bill that addresses the state PRA in one of its chapters is currently being discussed in the state's legislature. Therefore, Maranhão has not yet regulated the PRA but already has a draft that was ready to be published in 2021³³.

In general, for the PRA to be implemented, the states must at least establish regulations regarding rectifying liabilities in APP and RL, environmental compensation for RL and rectification of liabilities after July 22, 2008. Bahia it is the only state in Matopiba that has sufficient regulations and has already implemented the PRA – despite necessary improvements. Maranhão and Tocantins only have regulations regarding compliance of areas consolidated in RL, where they define the deadline for restoring the RL and have approved Ecological-Economic Zoning (ZEE) – which is necessary for states located in the Legal Amazon. But there are still many gaps that need to be cleared, leading these two states to not have enough regulations for implementing the PRA. Piauí is way behind, as it does not yet have the necessary regulations for implementing the PRA³³.

Table 3. Existing regulations in 2020 in the Matopiba states on APP and RL liability compliance.

	Maranhão	Tocantins	Piauí	Bahia
Compliance in areas consolidated in APP	None	None	None	Defines deadline for restoring APP
				Defines modalities and parameters for compliance in areas consolidated in APP
				Establishes detailed rules for preparing, executing, and monitoring APP restoration projects
Compliance in areas consolidated in RL	Defines deadline for restoring RL	Defines deadline for restoring RL	None	Defines deadline for restoring RL
				Defines the possibility of economic use of plots not covered by the RL restoration schedule

	Maranhão	Tocantins	Piauí	Bahia
	Has ZEE approved for the state's area within the Legal Amazon	Has ZEE approved (Legal Amazon States)		Defines modalities and parameters for compliance in areas consolidated in RL Establishes detailed rules for preparing, executing, and monitoring RL restoration
RL offset	None	None	None	Defines ground rules for RL offset Own procedure for offsetting RL in Public Domain Conservation Units (UC) Own procedure for RL offset through leasing of environmental easement or RL Own procedure for offsetting via Environmental Reserve Quota (CRA)
Liability compliance after 2008	Determines which study will be submitted for liability compliance after 2008 within the compliance scope regularization licensing	None	None	Defines rules for compliance of liabilities in APPs and RLs after 2008
Status of state regulation for compliance of APP and RL liabilities	Status: late, no regulation	Status: late, no regulation	Status: late, no regulation	Advanced status - sufficient regulation

Source: Agroicone - prepared in-house with Climate Policy Initiative (2020).

It is important to note the different deadlines that each state defines for restoring areas consolidated in RL. In Maranhão and Tocantins states, restoration should be made at a much higher speed than in Bahia, which established the same deadline set forth in the New Forest Code. In addition, Maranhão and Tocantins differentiate deadlines by property size, allowing small producers to have more time to mobilize and allocate necessary resources for restoration.

Table 4. Deadlines for restoring areas consolidated in APP and RL in the Matopiba states.

	Total deadline for restoring areas consolidated in APP	Total deadline for restoring areas consolidated in RL
Maranhão	None	3 years: properties with more than 3k ha 4 years: properties with 500 to 3k ha 5 years: properties with up to 500 ha
Tocantins	None	3 years: properties with more than 3k ha 4 years: properties with 500 to 3k ha 5 years: properties with up to 500 ha
Piauí	None	None
Bahia	20 years: restore 1/10 of area every 2 years	20 years: restore 1/10 of area every 2 years

Source: Agroicone - prepared in-house with Climate Policy Initiative (2020) data.

The legal uncertainty caused by the lack of regulations and guidelines regarding compliance with the New Forest Code confuses and discourages producers from engaging in the ecological restoration process. This ends up contributing to environmental problems, such as reducing biodiversity and accelerating climate change, as well as social problems, such as difficulty in obtaining rural credit to leverage production and consequently increase income and improve the quality of life of producers and their surroundings.

6.1.2. Dados do Cadastro Ambiental Rural (CAR)

Regarding the states that make up the Matopiba region, the number of properties registered in the CAR can be seen in Figure 32. It can be seen that the state that registered the biggest number of properties was Bahia, with a significant difference from the other states. Tocantins, with the lowest number, registered 10 times fewer properties than Bahia.

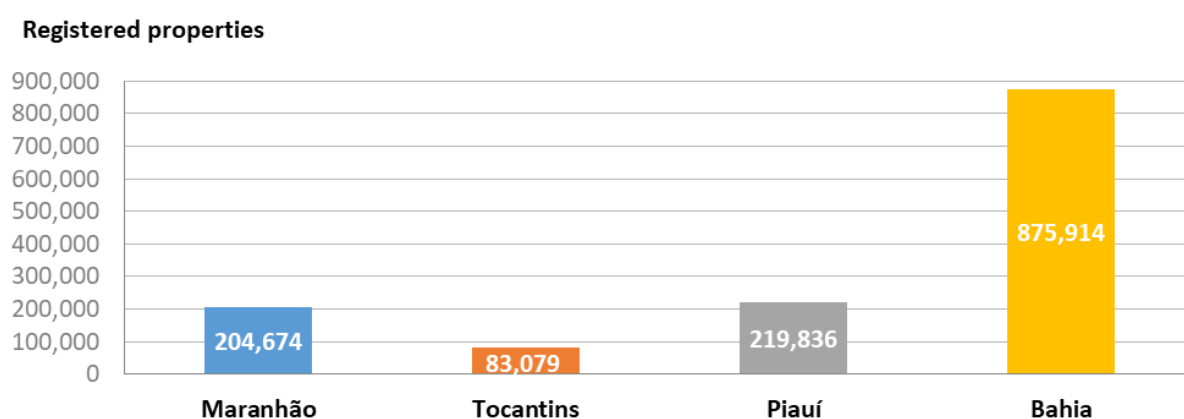


Figure 32. Number of properties registered in the CAR, considering the total area of the states that make up the Matopiba region. Source: Agroicone - prepared in-house with Sistema Nacional de Cadastro Ambiental Rural (SICAR, 2021)³⁵ data.

Table 5 shows the number of properties and areas registered in the CAR to date in the Matopiba states.

Table 5. CAR data considering the total area of the states that make up the Matopiba region and percentage of properties registered in the CAR compared to the number of establishments surveyed in the 2017 Agricultural Census.

States	Registered area (ha) Until 08/FEB/2021	Registered properties Until 08/FEB/2021	No. of establishments (2017 Agricultural Census)	% of registered properties
Maranhão	31,494,956.12	204,674	219,765	93%
Tocantins	25,478,199.53	83,079	63,808	130%
Piauí	17,348,920.34	219,836	245,601	90%
Bahia	32,009,850.94	875,914	762,848	115%

Source: Agroicone - prepared in-house with SICAR (2021)³⁵ e IBGE (2019)²¹ data

³⁵ Sistema Nacional de Cadastro Ambiental Rural (Sicar-CAR). "Número e área do CAR por estados". Serviço Florestal Brasileiro, Versão 1.0:2021. Available at <https://www.car.gov.br/publico/imoveis/index>. Accessed on February 24, 2021.

In order to understand the general context, the percentage of properties already registered in the CAR (see Table 5) was calculated based on the number of rural properties surveyed by the IBGE during the 2017 Agricultural Census – so far, these are the most up-to-date data. These percentages show that although Bahia has the highest absolute number of registered properties and Tocantins the lowest, this does not mean that Tocantins is further behind than Bahia in this regard. In other words, the number of rural establishments in Bahia is 12 times greater than in Tocantins, explaining why Tocantins has about 10 times less registered properties. Furthermore, it is possible to see that the vast majority of rural properties have already been registered.

It is worth mentioning that the percentages of registered properties are only useful for a macro understanding of the situation, as there is a 4-year lag in relation to the number of existing establishments and rural properties. However, the dynamics of establishments does not change very quickly over time and can go in either direction, increasing or decreasing in number of establishments. Also, it is important to highlight that an establishment (farm) considered in the Agricultural Census can be divided into more than one rural property and, therefore, there will be more than one CAR, that is, even if there were a more updated Agricultural Census, it would not be possible to quantify the percentage of establishments already registered in the CAR against the total number. Therefore, this remains the best way to analyze registration progress.

From the data provided by municipalities through the National Rural Environmental Registry System (SICAR)³⁵, it was possible to extract the information from Table 6 regarding the Matopiba region. In November 2020, Maranhão had around 72,000 properties registered in the CAR in the Matopiba region alone, only 1.7% of which were pending validation – the other properties already had their CARs valid and active. This proportion of active and pending CARs is similar in Tocantins, where only 1.2% of registered properties were still awaiting validation. Due to operational problems with the adopted tool, information on the region in Piauí and Bahia was not obtained, hampering the analysis of Matopiba’s CAR-related data.

Table 6. CAR data only considering each state’s Matopiba region.

States	Properties registered in November 2020	Active CARs in November 2020	Pending CARs in November 2020
Maranhão	72,026	70,801	1,225
Tocantins	68,342	67,546	796
Piauí & Bahia	-	-	-

Source: Agroicone - prepared in-house with SICAR (2021)³⁵ data.

Regarding the scope of the Rural Environmental Registry (CAR) in areas with soybeans, this information is not accurate, but inferences can be made from the share of soybean cultivation in the total number of establishments and their areas. This analysis can be done for the entire territory of the states that make up Matopiba (Table 7) and only for the portion within Matopiba (Table 8). In both cases, the share of establishments with soybeans is very small in all states and as this crop is concentrated in Matopiba, it is a little higher than when we analyze the entire states. For Maranhão, for example, only 421 of the 202,276 properties have soybean cultivation (0.21%), with 399 (0.30%) of them within Matopiba, which represents a greater share compared to the 134,042 properties in Maranhão in the Matopiba region.

Table 7. Area and number of total establishments with soybean cultivation in the states that make up the Matopiba, by state.

State	No. of establishments	No. of establishments with soybeans	Share of establishments with soybean crops out of total number of establishments	Total area (ha) of the establishments	Area (ha) of establishments with soybean crops	Share of area of establishments with soybean crops out of the total area of establishments
MA	202,276	421	0.21%	12,238,489	1,362,820	11.14%
TO	63,039	977	1.55%	15,180,162	1,526,123	10.05%
PI	237,272	226	0.10%	10,009,858	1,566,661	15.65%
BA	756,822	643	0.08%	28,020,859	2,359,470	8.42%
TOTAL	1,259,409	2,267	0.18%	65,449,368	6,815,074	10.41%

Source: Agroicone - prepared in-house with Censo Agropecuário de 2017 (IBGE, 2019)²¹data.

Considering that all in four states there are 2,227 soybean establishments, which represents 0.81% of the total number of establishments (Table 8). In terms of area, however, the share is much higher, representing 12.46% of the total area of the establishments (36.21 million hectares), which indicates that the properties with soybeans are much larger than the others. In Bahia, the share of establishments with soybeans out of the total area of the establishments is the most significant among the states: 30.22%, followed by Piauí (13.25%), Maranhão (7.74%) and Tocantins (6.36 %).

Table 8. Area and number of total establishments with soybean cultivation in the states that make up the Matopiba, by state.

State	No. of establishments	No. of establishments with soybeans	Share of establishments with soybean crops out of total number of establishments	Total area (ha) of the establishments	Area (ha) of establishments with soybean crops	Share of area of establishments with soybean crops out of the total area of establishments
MA	134,042	399	0.30%	9,723,007	752,673	7.74%
TO	63,039	977	1.55%	15,180,162	965,331	6.36%
PI	22,012	216	0.98%	3,679,152	487,454	13.25%
BA	56,288	635	1.13%	7,631,468	2,306,109	30.22%
TOTAL	275,381	2,227	0.81%	36,213,789	4,511,567	12.46%

Source: Agroicone - prepared in-house with Censo Agropecuário de 2017 (IBGE, 2019)²¹ data

6.1.3. Specific Restoration Policies

A survey of policies and regulations related to ecological restoration was made in the four Matopiba states. The information was obtained through research on the state secretariats' websites and through interviews with the environment secretariats' teams.

The Rural Environmental Registry (CAR), the Environmental Compliance Program (PRA) and the Ecological-Economic Zoning (ZEE) are specific policies and regulations for restoration. Other more extremely important technical standards for supporting and providing legal certainty for ecological restoration are ecological

indicators (or other types of result indicators), restoration manuals (which indicate methodologies and step-by-step implementation), in addition to projects for defining theoretical or practical models via Demonstration Units (UDs) using different restoration techniques.

Table 9. Survey of specific restoration policies in Maranhão.

Specific Restoration Policies	
Maranhão	
PRA	<ul style="list-style-type: none"> • The PRA has not yet been implemented. • SEMA/MA Ordinance no. 13/2013: Regulation on environmental compliance of agro-pastoral activities, which includes brief provisions on cases that require environmental recovery.
CAR	<ul style="list-style-type: none"> • State Law no. 10.276, of 07/JUN/2015: Establishes the Environmental Compliance Program for Rural Property and Activity and adopts other measures. • State Decree 32.361, of 09/NOV/2016: Delegates powers to the State Family Agriculture Secretariat (SAF) related to CAR actions. • SEMA/MA Ordinance no. 55, of 12/JUN/2017: Establishes the procedures for requesting cancellation, issuing CAR registration receipts, and updating registration data in the National Rural Environmental Registration System (SICAR), within the SEMA/BAD scope. • Decree no. 33,662, of 27/NOV/2017: Provides for creating a monitoring committee for the CAR implementation process in Maranhão State, and other measures. • SEMA/MA Ordinance no. 18, of 31/JAN/2020: Establishes analysis and validation procedures for the CAR, referring to rural properties with more than 4 fiscal modules included in the SICAR.
Ecologic indicators and ZEE	<ul style="list-style-type: none"> • Law no. 10.316, of 17/SEP/2015: Establishes the Ecological-Economic Macro-zoning of Maranhão State and other measures. • Law no. 11.269, of 28/MAY/2020 - Establishes the ZEE for the Amazon Biome in Maranhão State and makes other provisions. • The Cerrado Maranhense Biome ZEE is expected to be delivered by the end of 2021.
Restoration Manual	<ul style="list-style-type: none"> • Not found
Models & Uds	<ul style="list-style-type: none"> • Not found

Source: Agroicone - prepared in-house.

Table 10. Survey of specific restoration policies in Tocantins.

Specific Restoration Policies	
Tocantins	
PRA	<ul style="list-style-type: none"> • The PRA is not yet being implemented. • The Nature Institute of Tocantins (Naturatins) is contracting a consultancy for preparing the PRA manuals. • A draft law is being discussed that provides for protecting native vegetation and creates the Restaurar fund, revoking Laws no. 771, of 07/JUL/1995 (on the Tocantins State Forest Policy), Law 1,445 of 02/APR/2004 (instituting compensation instruments and ways of recomposing Legal Reserve areas), Law 1939 of 24/JUN/2008 (on exceptional cases of public utility, social interest or low environmental impact that allow intervention or suppression of vegetation in APPs , and adopts other measures) and 2,713, of 09/MAY/2013 (establishes the Rural Property and Activity Environmental Compliance Program – TO-LEGAL, and adopts other measures); and makes other measures.

CAR	<ul style="list-style-type: none"> • Naturatins Normative Instruction no. 04, of 03/JUL/2012: Establishes technical standards for the CAR and adopts other measures. • COEMA (State Environmental Council) Resolution no. 61, of 02/OCT/2015: Provides for Registration of Rural Properties for Donation in Conservation Units (CIDUC) and other measures
Ecologic indicators and ZEE	<ul style="list-style-type: none"> • Law no. 2.656, of 06/DEC/2012: Establishes the Tocantins State Ecological-Economic Zoning (ZEE), e adopts other measures. • The indicators are presented in the Native Vegetation Restoration Manual.
Restoration Manual	<ul style="list-style-type: none"> • In 2020, Naturatins published the Native Vegetation Restoration Booklet, and, in 2019, the Native Vegetation Restoration Manual. • Guide for savanna and forest restorers in the Cerrado biome of Tocantins, prepared through the RESTAURA-TO Project.
Models & Uds	<ul style="list-style-type: none"> • Not found

Source: Agroicone - prepared in-house.

Table 11. Survey of specific restoration policies in Piauí.

Specific Restoration Policies	
Piauí	
PRA	<ul style="list-style-type: none"> • The PRA has not yet been implemented.
CAR	<ul style="list-style-type: none"> • They are well advanced in the CAR certification stage. • Ordinary State Law no. 6,132, of 28/NOV/2011: Institutes the Environmental Regularization Program for Rural Properties in the State of Piauí, creates the Rural Environmental Registry (CAR), and takes other measures. • Law no. 7193 of 08/APR/2019: Provides for the consumption of forest raw materials and the modalities of compliance with mandatory forest replacement in the State of Piauí, provided for in art. 33, §1, of Federal Law no. 12.651, of May 25, 2012. • SEMAR Normative Instruction no. 5 of 01/JUN/2020: Establishes, within the ambit of the State Secretariat for the Environment and Water Resources (SEMAR/PI), the technical guidelines and procedures regarding the authorization of suppression of native vegetation and other authorizations forestry, mandatory forest replacement, concession of forest replacement credits and forestry activities.
Ecologic indicators and ZEE	<ul style="list-style-type: none"> • Decree no. 14.504 of 02/JUN/2011: Establishes the Inter-institutional Coordinating Commission for Ecological-Economic Zoning of the State of Piauí (CICZEEPI) and makes other provisions.
Restoration Manual	<ul style="list-style-type: none"> • Not found
Models & Uds	<ul style="list-style-type: none"> • Not found

Source: Agroicone - prepared in-house.

Table 12. Survey of specific restoration policies in Bahia.

Specific Restoration Policies	
Bahia	
PRA	<ul style="list-style-type: none"> • Decree no. 15.180 of 02/JUN/2014: Regulates management of forests and other vegetation forms in Bahia State, conservation of native vegetation, the State Forest Registry of Rural Properties (CEFIR) and provides for the Environmental Compliance Program for Rural Properties in Bahia State and other provisions.

CAR	<ul style="list-style-type: none"> • Law no. 10.431 of 20/DEC/2006: Provides for the Environmental Policy and Biodiversity Protection in Bahia State and other measures. • Law no. 13.597 of 14/DEC/2016: Establishes the Rural Property Environmental Compliance Program. • Law no. 13.223 of 12/JAN/2015: Establishes the state policy for Payment for Environmental Services, the State Program for Payment for Environmental Services, and other provisions. • Decree no. 18.140, of 04/JAN/2018: Amends Decree no. 15.180, of 02/JUN/2014, and makes other provisions. • Decree no. 14.024 of 06/JUN/2012: Approves the Regulation of Law no. 10.431, of 20/DEC/2006, and of Law no. 11.612, of 08/OCT/2009 (on Water Resources). • Inema Ordinance no. 22.078 of 08/JAN/2021: Provides for approving the location of Legal Reserve in Bahia State.
Ecologic indicators and ZEE	<ul style="list-style-type: none"> • State Decree no. 14.530, of 04/JUN/2013: Amends Decree no. 14.024, of 06/JUN/2011, and Decree no. 9.091, of 04/MAY/2004, regulating the implementation of Bahia State's Ecological-Economic Zoning (ZEE/BA) and other measures. • The indicators are presented in the Technical Guide for Recovering Vegetation in Rural Properties in Bahia State prepared by SEMA/BA.
Restoration Manual	<ul style="list-style-type: none"> • Ecological Restoration Manual - Rural Technicians and Producers in Bahia State's Extreme South (2016) • Technical Guide for Recovering Vegetation in Rural Properties in Bahia State prepared by SEMA/BA in partnership with TNC, 2017. • Booklet on Environmental Compliance of Rural Properties in Bahia prepared by the Bahia state farmers' and irrigants' association (AIBA) in 2015 and revised in 2019.
Models & Uds	<ul style="list-style-type: none"> • In 2019, Correntina/BA and Lauro de Freitas/BA received the Outstanding Award in Municipal Environmental Management during the II Brazil Forum on Environmental Management (FBGA), held in Campinas, in São Paulo State. • Reference Centers for Forest Restoration (CRRFs) in Bahia. • There are model initiatives in smaller areas, but not on a large scale. Many small projects are organized or fostered by SEMA/BA. • Parque Vida Cerrado.

Source: Agroicone - prepared in-house.

The general Ecological-Economic Zoning (ZEE) is already regulated in almost all Matopiba states. They are working on preparing specific zoning for the biomes considered in each state, highlighting the Cerrado, which is the main target of this report.

There are restoration manuals in Tocantins and Bahia and there is still room for improvement at this point, especially with regard to regulating these manuals. Another subject that lacks actions and policies are models and Demonstration Units (UDs) for restoration, with a focus on learning the most assertive techniques for different area characteristics. Only Bahia has demonstrative areas aimed at applied knowledge of restoration techniques.

7. PUBLIC POLICIES THAT MAKE RESTORATION ADVANCE IN BRAZIL

7.1. Benchmarking for enhancing public policies

Considering the entire panorama of the current situation in the Matopiba region with regard to ecological restoration, including technical and legal aspects, a survey of governmental ecological restoration initiatives

that can serve as references for developing new solutions to the problems was performed and bottlenecks were identified.

Thus, this survey of initiatives was made by means of a benchmarking of ecological restoration policies – considering that benchmarking is the process of seeking and analyzing best practices for implementing them, with adaptations as necessary. In the current context of valuing “management for results in public administration”, the benchmarking tool can contribute to improving public administration performance and the results of actions and policies. Benchmarking is a systematic management tool that involves a process of searching and analyzing best practices and referenced experiences, to implement or adapt them, aiming at continuous organizational performance improvement. There are several types of benchmarking (processes, products) and generic benchmarking will be used here, which refers to searching for best practices, regardless of where and by whom. The objective is to compare with the best³⁶.

Benchmarking is a first step towards improving performance, which must be followed by assimilation and application. Despite little use in Brazilian public administration, benchmarking is a good government management tool that is widely used in other countries. Unlike the use in companies, there is no secrecy of information in governments – on the contrary, transparency is valued. We can summarize the relevance of benchmarking with the following quotes: “in short, benchmarking is largely an opportunity for a company to learn from the experience of others” and “benchmarking can be used to significantly improve organizational performance in the public sector”³⁷.

For benchmarking to have the desired effect by the body that applies it, Magd and Curry (2003)³⁸ point out some critical factors that should be considered in the next stages of the project:

- Willingness to change processes and improve their results, added to a willingness to seek external experiences within the public body in question;
- That the body knows itself, thus allowing comparison with better-performing organizations;
- The importance of committing to continuous performance improvement, as a motivating factor so that the search for best practices never ceases;
- There still needs to be a qualified team that supports the process and is able to detect and solve problems;
- It is necessary to know and have access to partners, precisely with whom information is exchanged about experiences that are considered successful.

In view of the creation of state public policies for ecological restoration in Matopiba, especially in soybean-growing regions, it is worth understanding each necessary step for achieving this objective. Figure 33 summarizes the public policy design stages and the respective types of indicators to be used. According to

³⁶ CAMP, R. C. Benchmarking: o caminho da qualidade total. Pioneira. São Paulo, 1998.

³⁷ JARDIM, Cláudio Rafael Armijos. Benchmarking no setor público – o processo e as contribuições: uma pesquisa-ação em um governo estadual. Monografia (bacharelado) – Universidade de Brasília, Departamento de Administração, 2012.

³⁸ MAGD, H.; CURRY, A. Benchmarking: achieving best value in public sector organizations. Benchmarking: An International Journal, v. 10, n. 3, p. 261-286, 2003.

Figure 33, benchmarking preparation contributes to the “agenda definition” and “formulation” public policy stages, as it enables understanding the context in question and the problems involved, and also points out possible alternatives and innovative solutions inspired by existing initiatives, which is essential to advance decision-making.

Situational diagnosis and benchmarking actions took place almost simultaneously, generating information and guidance between both. The comparative analysis (public policies and local context versus best practices and identified references) followed, seeking more direct and specific answers in possible contributions of other initiatives to the problems and bottlenecks identified for restoration in the Matopiba states.

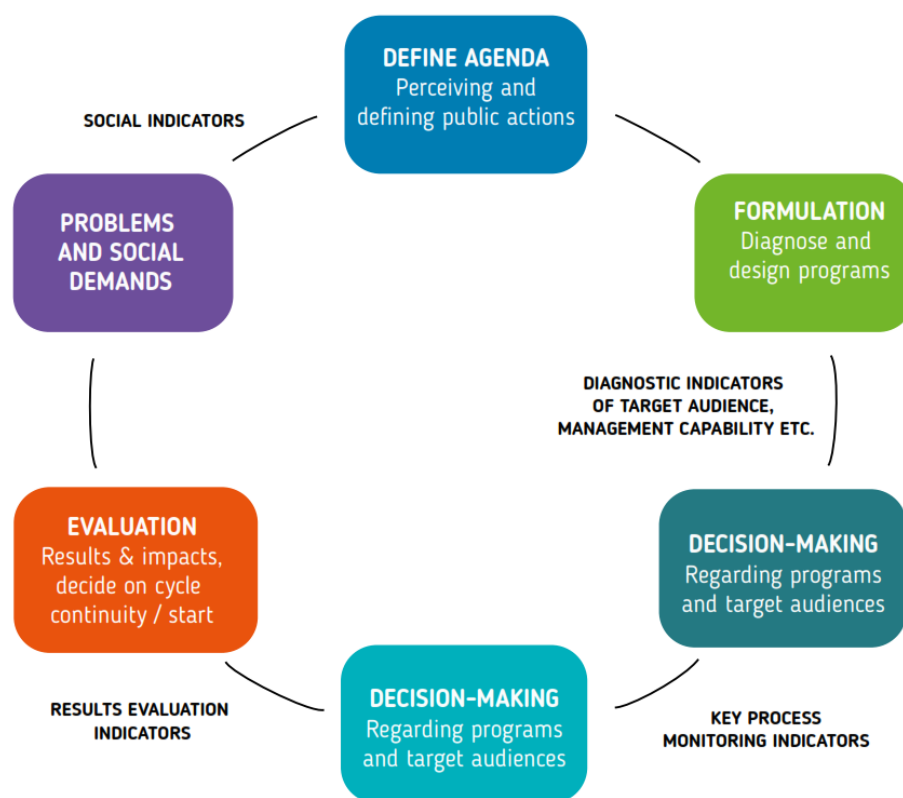


Figure 33. Stages for creating a public policy and the respective indicators for developing each one of them Source: Jannuzzi (2017: 151)³⁹.

Policies for supporting ecological restoration can focus on different stages or actors in the restoration chain (Figure 34). This is a way for categorizing the theme's policies.

³⁹ JANNUZZI, Paulo de Martino. Indicadores Sociais no Brasil. Conceitos, Sources de dados e aplicações. 6 ed. São Paulo: Alínea, 2017.

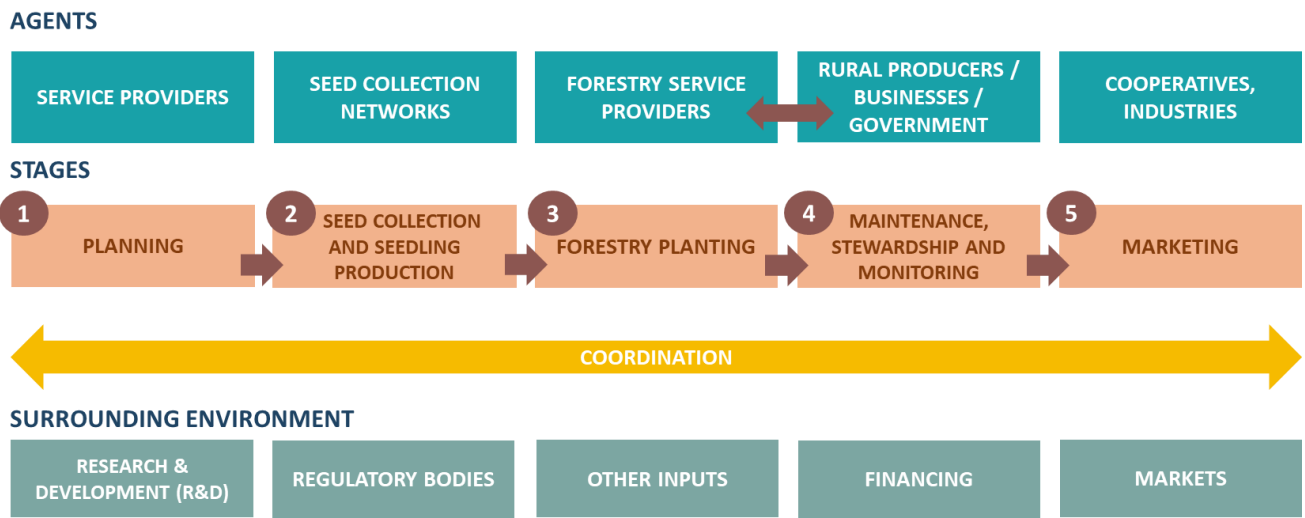


Figure 34. Simplified scheme for representing the native vegetation chain, agents, and surrounding environment
 Source: Agroicone - prepared in-house.

It is noteworthy that the analysis of policies on restoration presented here is unprecedented and is not exhaustive. In this study, all public policies surveyed in the benchmarking process were considered “initiatives”, ranging from comprehensive policies to specific projects and regulations. The collected information did not exist in a systematic manner and here they are presented and analyzed. It was not simple to gather the information and it was challenging to organize it in a way that collaborated with the country’s ecological restoration agenda. In addition, this study advanced in developing an analytical model, allowing more content to be compiled and analysis expanded according to different usage objectives, as the information is dynamic, and analysis can be continuously improved. In any case, this benchmarking contributes significantly to supporting public policies for restoration in Brazil.

7.1.1. Methodology

To improve the initiatives in the Brazilian public agenda, it is essential that there is good management of its services, from formulation to implementation and monitoring. In this sense, it is essential that management and planning tools are used for advising public bodies regarding the processes and deployment.

Among the existing mechanisms, there is the so-called benchmarking, which is a continuous learning and improvement process of based on comparison and observation, therefore it is also important that those bodies exchange experiences and learn from each other, disseminating best practices and creative solutions for common problems³⁷.

Some steps were followed in preparing the benchmarking for this study,

1. Survey bottlenecks and challenges of the environment secretariats of Matopiba’s four states through interviews, literature review and analyzing secondary data from the secretariats.
2. Survey initiatives (programs, projects, and public policies) linked to ecological restoration in several Brazilian states that present interesting results or innovative practices.

3. Define analysis categories and criteria, that is, quantitative and qualitative indicators to be used for comparison and analysis metrics for identifying the best practices and their relevance to the project.
4. Create a strategic action plan. At this stage, a survey and analysis of the problem situation identified in the secretariats was made, thinking about the action focus based on each secretariat's central problems.

7.1.2. Surveyed Initiatives

A survey was made of 58 initiatives related to ecological restoration in all Brazil's regions by public and private, national, and international organizations. In all, initiatives from 15 states plus the Federal District were surveyed, and they were presented in Figure 35.

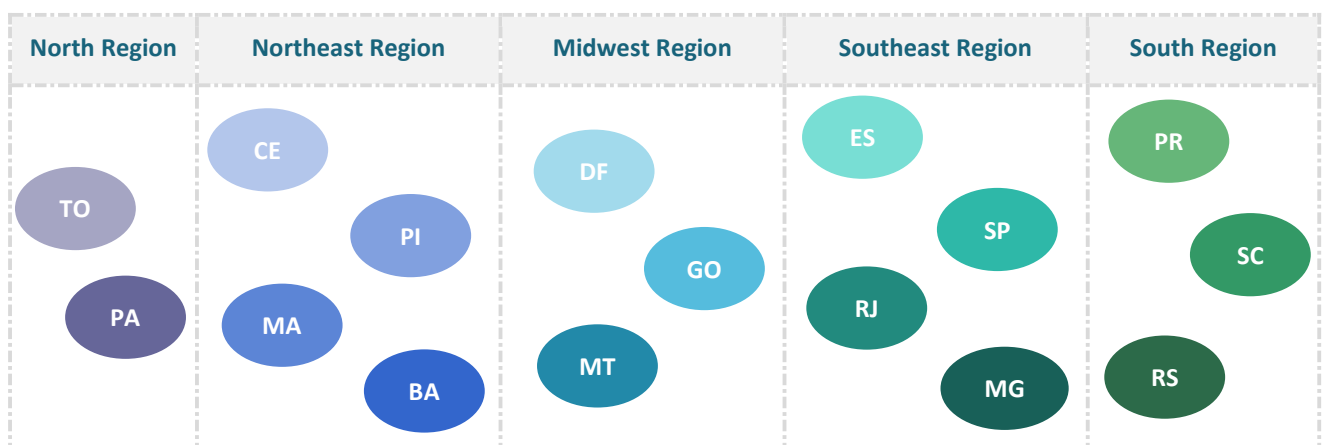


Figure 35. States with surveyed initiatives. Source: Agroicone - prepared in-house.

The surveyed initiatives are presented in an Excel file, in the spreadsheet named "Benchmarking of public policies on ecological restoration" available on the Agroicone⁴⁰ website. Elements were added regarding general information of each initiative, elements for analysis, areas of activity and other information as detailed in Table 13.

⁴⁰ The spreadsheet is part of this study and is available on the Agroicone website: <https://www.agroicone.com.br/portfolio/panorama-matopiba>.

Table 13. Information regarding surveyed initiatives.

Surveyed information	
General information about the Initiative	Number
	Name of the initiative
	Location
	Nature of the initiative
	General objective
	History
	Description
	Initiative's source of funding
	Initiative's partners and/or other institutions involved
Elements for analysis	Scale (ha)
	Jurisdictional scale
	Amount invested
	Legal instrument for creating the initiative
	Differentials, notes and/or comments
	Category
	Coverage
	Relevance
Action areas	Environmental education
	Technical assistance for restoration
	Technical training for restoration
	Restoration Techniques Guide/Manual
	Priority area planning
	Monitoring of recovered and conserved areas
	Fund creation
	Funding
	Payment for Environmental Services - PSA
	Environmental tax
	Link with CAR
	Link with PRA (recovery of APP, RL, or restricted use areas)
	Productive recovery (market access - ex.: SAF)
Other information	Number of "operation areas" covered
	Questions
	Contacts
	Sources

Source: Agroicone - prepared in-house.

The nature of the initiatives was also classified as:

- **Public policy:** these are initiatives that are generally linked to the State based on society demands. It is a broader concept that, in the administrative context, can encompass a set of projects, programs and activities carried out by the government.
- **Program:** a set of projects or actions managed in an integrated manner, so that they generate benefits that would not exist if the projects were not jointly managed.

- **Project:** a set of activities undertaken to achieve a specific objective, it is temporary and, normally, unique, and exclusive. When the project’s objective is reached, it ceases to exist. As it is temporary, usually, after reaching the objective, the project work team also ceases to exist.

23 of the 58 initiatives refer to projects, 23 to programs and only 12 were classified as public policies.

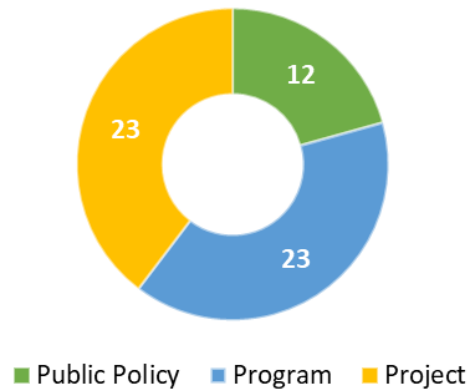


Figure 36. Number of initiatives classified according to their nature. Source: Agroicone - prepared in-house.

In all, 13 action areas were presented, and each initiative may include more than one. The number of initiatives that cover each action area is shown in Figure 37.

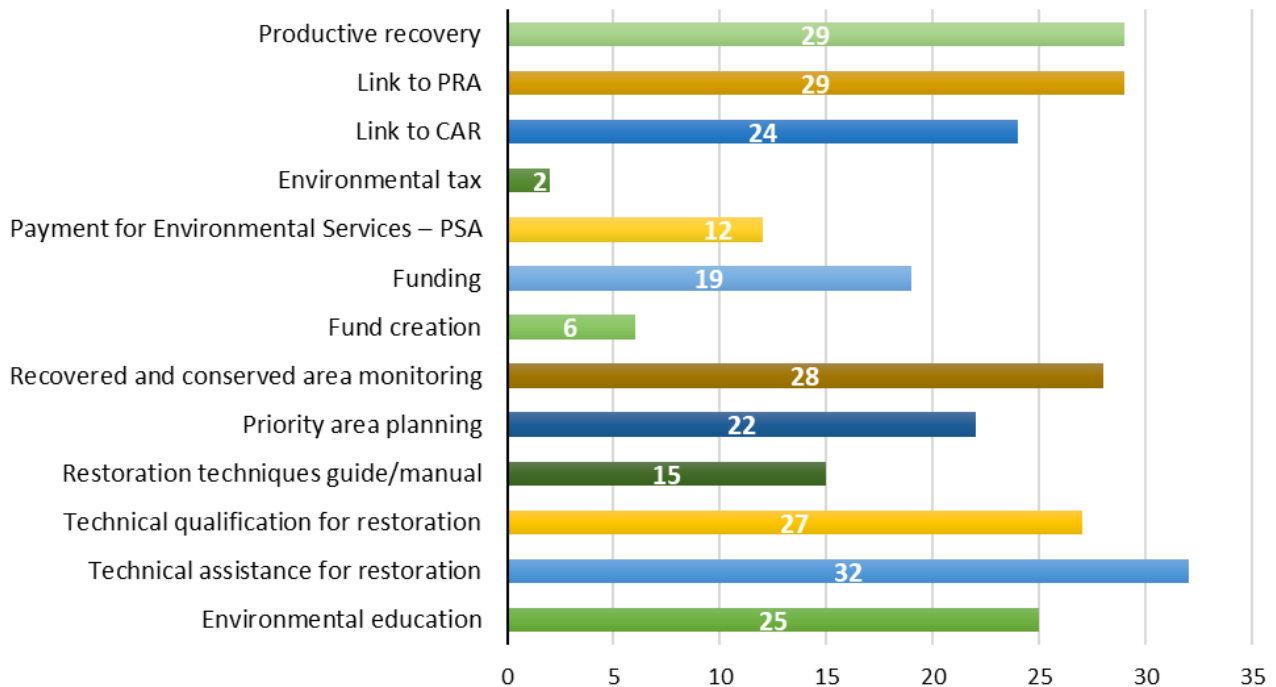


Figure 37. Number of initiatives considered in each action area. Source: Agroicone - prepared in-house.

Regarding the elements of analysis, the scope was defined as “high” and “low”. Initiatives that covered 6 or more operation areas were considered “high” and initiatives that covered 5 or fewer operation areas were considered “low”. In all, there were 23 high-range and 35 low-range initiatives, as shown in Figure 38.

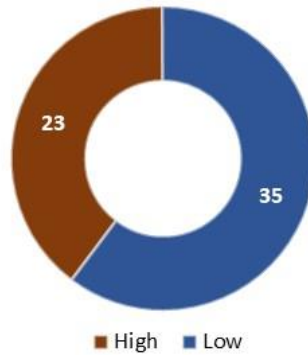


Figure 38. Number of initiatives in each coverage level. Source: Agroicone - prepared in-house.

Level of relevance considers the importance that each initiative has for the project or for the analysis being carried out based on benchmarking. Relevance can be high, medium, or low. Most of the initiatives surveyed, 32, have high relevance, 16 initiatives are medium relevance and only 10 are low relevance.

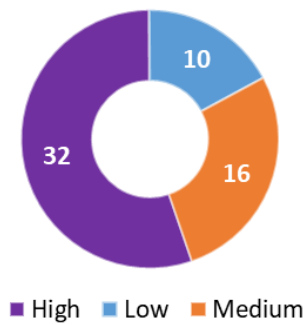


Figure 39. Number of initiatives in each relevance level. Source: Agroicone - prepared in-house.

Still regarding the elements of analysis, the surveyed initiatives were classified in 4 categories according to the stages of ecological restoration and the action areas that were pre-established in this work – except for the “environmental education” action area, which is transversal to the restoration phases –, as described below.

Table 14. Description of the categories defined in this report.

Categories	Description	Action areas considered	Example of identified initiative
Planning	Initiatives related to the planning phase of ecological restoration and conservation, such as defining priority areas.	Priority area planning; Link with CAR	Programa Nascentes - SP

Categories	Description	Action areas considered	Example of identified initiative
Implementation	Initiatives related to the implementation phase of ecological restoration, such as defining methodologies and input donations.	Technical assistance for restoration; Technical training for restoration; Link with PRA (recovery of APPs, RLs or restricted use areas); Productive recovery (market access – e.g.: SAF)	Programa Maranhão Verde - MA
Results monitoring and evaluation	Initiatives related to the monitoring and evaluation phase of ecological restoration and conservation results, such as creating monitoring guides and defining indicators.	Monitoring recovered and conserved areas; restoration techniques guide/manual	Reflorestar - ES
Funding and markets	Initiatives that fund ecological restoration and conservation. For example, Payment for Environmental Services (PSA), Ecological ICMS, certifications.	Fund creation; Funding; Payment for Environmental Services - PSA; environmental tax	Estratégia: Produzir, Conservar e Incluir (PCI) - MT

Source: Agroicone - prepared in-house.

37 of the surveyed initiatives are related to the planning phase of ecological restoration, 46 to the implementation phase, 32 to the monitoring and results evaluation phase, and 24 initiatives involve funding capturing and markets.

In some cases, the same initiative encompasses more than one category, depending on the size, scope, and investment of the initiatives.



Figure 40. Number of initiatives classified by category. Source: Agroicone - prepared in-house.

Considering that lack of financial resources is core problem for restoration, it would be interesting to make an immersion in the initiatives regarding the funding and markets category. In this sense, the economic, political, and technical aspects can be evaluated to understand what best applies in the Matopiba region.

7.1.3. Impact and relevance analysis

From the meetings held with the environmental secretariats of each Matopiba state, the main bottlenecks that hinder ecological restoration at scale in the region were identified. In Table 15, these bottlenecks were summarized together with possible improvement actions and initiatives raised in the benchmarking. This way, it is possible to select initiatives that are relevant to the states, that is, that address their current problems.

Table 15. Main restoration problems identified in Matopiba states, suggestions for possible improvement actions, and reference initiatives.

Main identified problems	Possible improvement actions	Reference initiatives
Lack of monitoring mechanisms (integrated system, satellite images, own database)	Information Technology (IT) Improvements: create integrated system, use satellite images, and own database. This type of improvement can be interesting to offset the decrease in teams of technicians in the secretariats	Programa Nascentes, Sistema Informatizado de Apoio à Restauração Ecológica (SARE) and Indicadores ecológicos (SP)
Absence of PRA regulation and manual	Prepare manual and regulations for PRA and other development tools	PRA (MG)
Absence of technical assistance and regular monitoring	Regular technical visits increase government team or outsource), digital resources	Reflorestar (ES)
Absence of restoration projects for private properties	Contacts with landowners to understand demands and possible incentives	Reflorestar (ES)
Poor producer engagement and awareness regarding restoration	Understand demands and possible incentives, productive restoration	Reflorestar (ES), Conectando Florestas (SP/RJ)
Difficulties in CAR analysis and validation	Hire or allocate a technical team to dedicate themselves exclusively to CAR analysis and validation	PCI (MT)
Lack of financial resources for restoration	External resources and fine offsetting	Sistema Estadual de REDD+, PCI (MT) and Programa Nascentes (SP)

Source: Agroicone - prepared in house.

In addition to relevance, considering the bottlenecks identified in the 4 states, it is also possible to perform an impact analysis of the initiatives surveyed in benchmarking. In this study, two analysis variables were selected, which were combined in the graph in Figure 41. The first variable was territorial scale, which indicates the jurisdiction (municipality, state, watershed, etc.) or the number of hectares (ha) to which the initiative applies. Large scale (G) indicates being statewide or above hundreds of thousands of hectares, while small scale (P) is below that. The scope variable indicates the number of activity areas to which the initiative applies, with “high” meaning equal to or greater than 6 areas (including the following: environmental education, technical

assistance, technical training, restoration techniques guide/manual, priority area planning, monitoring recovered and conserved areas, creating a fund, funding, Payment for Environmental Services (PSA), environmental tax, link with CAR, link with PRA, productive recovery), and “lower” refers to less than 6 areas.

Figure 41 presents an initial analysis for 12 initiatives, with 7 highly comprehensive and large-scale initiatives being indicated: Riparian Forest Recovery Project (PRMC), Nascentes Program – SP; State REDD+ System, Estratégia: Produzir, Conservar e Incluir (Strategy: Produce, Conserve and Include - PCI) – MT; Paraná Biodiversity Project – PR; RS Biodiversity Project – RS; Amazon Now State Plan (PEAA) – PA. Therefore, these 7 initiatives can be analyzed in more detail, instead of spending time on in-depth analysis of the 58 surveyed initiatives.

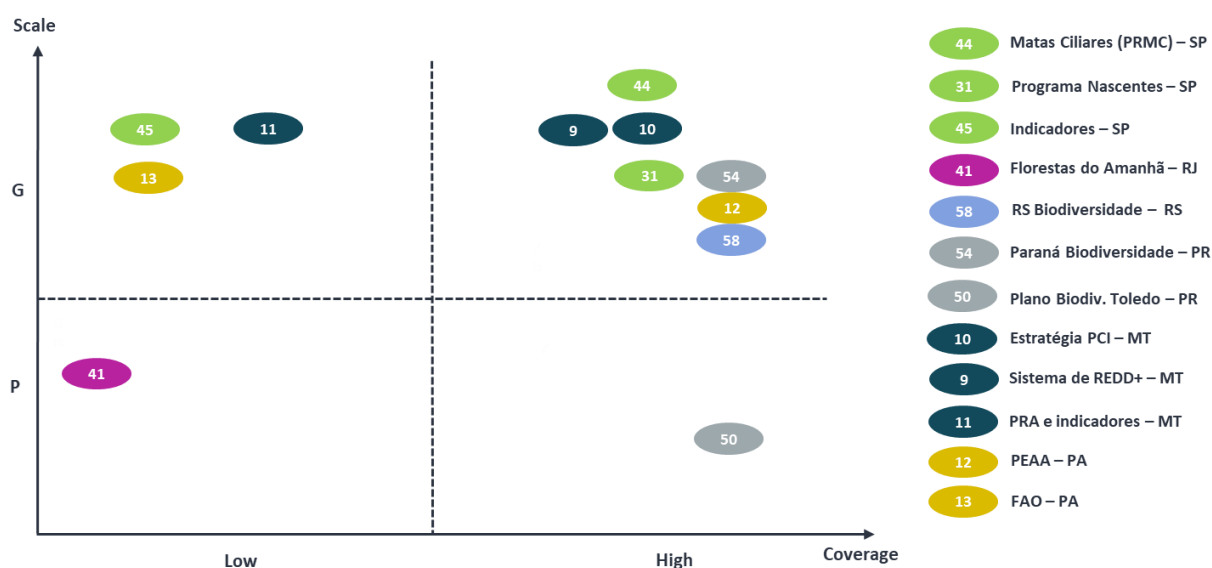


Figure 41. Impact analysis of the selected initiatives. Source: Agroicone - prepared in-house.

7.1.4. Details of two initiatives selected during benchmarking

Two successful initiatives that stimulate, encourage and support ecological restoration are presented in the boxes below: the Nascentes Program (SP) and Estratégia Produzir, Conservar e Incluir – PCI (MT).

- **Programa Nascentes – São Paulo**

Programa Nascentes (Sources Program) was created in June 2014 as the Programa Mata Ciliar (Riparian Forest Program), for fostering ecological restoration in priority areas aimed at protecting and conserving water resources and biodiversity, as provided for by Decree no. 60.521. Its objective is to fulfill legal obligations for environmental compensation, offsetting carbon emissions, water footprint reduction, or even implementing voluntary restoration projects.

In 2015, with the creation of the Management Committee, made up of 12 state administration bodies, the program was expanded (Decrees no. 61.137 and 61.183). In June 2015 it was renamed Programa Nascentes

(Decree no. 61.296) and it was reorganized in 2017 by Decree no. 62.91441.

The Program involves the participation of different entities, including 12 São Paulo State secretariats and other public bodies, private companies, civil society representatives, landowners, and restorers.

Investments are especially geared at protecting and recovering riparian forest areas, springs, and waterholes, but also working to increase native vegetation coverage in springs, in addition to planting native trees and improving stewardship of productive areas in watershed-forming basins⁴².

Nascentes has three main tools. One is the so-called *Prateleira de Projetos* (Project Shelf), a list of ecological restoration initiatives approved by an Internal Commission. The list presents the defined restoration location and strategy that are generally proposed by Non-Governmental Organizations (NGOs) and companies in the environmental sector. Another tool is the *Banco de Áreas Disponíveis para Restauração* (Bank of Available Areas for Restoration), which brings together APPs devoid of vegetation in public and private areas available for restoration. These locations were made available through a declaration made in the Rural Environmental Registry (CAR) or directly by the body responsible for them. There are areas available in state Conservation Units (UCs) and agrarian reform settlements. As a result of the partnership between the Nascentes Program and the São Paulo State Land Institute Foundation (ITESP), ecological restoration of 796.64 hectares has already been authorized⁴³. There is also the Conversion of Fines into Environmental Services, which allows administrative fines to be converted into environmental services through the Program's restoration projects. In addition, the Nascentes Program has a certificate and seal for allowing active brands to publicly associate themselves with the Program.

The goal established at the beginning of the Program – 20,000 hectares under restoration for 2020 - was exceeded, and April 2021 figures indicate that there are currently 22,710 hectares under restoration monitored by the Program⁴³.

- **Estratégia: Produzir, Conservar e Incluir (PCI) – Mato Grosso**

The Strategy: Produce, Conserve and Include (PCI) initiative aims to raise funds for Mato Grosso State in order to expand and increase agricultural and forestry production efficiency, conservation of remnants of native vegetation, restoration of environmental liabilities, socioeconomic inclusion of family farming, and reducing emissions and sequestering carbon by controlling deforestation and developing a low carbon economy⁴⁴.

⁴¹ Nascentes; 2021. Available at <http://www.programanascentes.sp.gov.br/#institucional>. Accessed on June 10, 2021.

⁴² São Paulo, Programa Nascentes; 2021. Available at: <https://www.infraestruturameioambiente.sp.gov.br/programanascentes/>. Accessed on June 10, 2021.

⁴³ São Paulo; 2020. Programa Nascentes bate meta com 20 mil hectares em restauração. Available at: <https://www.saopaulo.sp.gov.br/ultimas-noticias/programa-nascentes-bate-meta-com-20-mil-hectares-em-restauracao/>. Accessed on June 10, 2021.

⁴⁴ Estratégia PCI; 2021. Available at: <http://pci.mt.gov.br/>. Accessed on June 14, 2021.

The initiative establishes a set of goals to help achieve its objectives. In the “Produce” axis, the following goals were stipulated: recover 2.5 million hectares of low-productivity pasture areas by 2030; increase productivity from 50 to 95 kgcw/ha/year by 2030; expand grain crops in degraded pasture areas from 9.5 to 12.5 million hectares by 2030; and increase grain production from 50 to 92 million tons by 2030; expand the area under sustainable forest stewardship from 2.8 to 6 million hectares by 2030; expand the area of planted forests in already cleared areas from 317,000 to 800,000 hectares by 2030; and increase the production of planted wood from 4.9 to 11.75 million cubic meters by 2030.

In the “Conserve” axis, the goals were: to keep 60% of the native vegetation coverage in Mato Grosso State; reduce deforestation by 90% in the forest with reference to the baseline: 2001-2010 (PRODES) of 5,714 sq.km, reaching 571 sq.km/year by 2030; reduce deforestation in the cerrado by 95% using the (SEMA/MT) 3,016 sq.km baseline as a reference, reaching 150 sq.km/year by 2030; eliminate illegal deforestation by 2020; offset 1 million hectares of areas subject to legal deforestation; register 90% of rural properties (CAR) by 2016; validate 100% of CARs by 2018; restore one million hectares (100%) of degraded APPs by 2030; and rectify 5.8 million hectares (100%) of Legal Reserves, 1.9 million hectares of which will be recomposed by 2030. And in the “Include” axis, the following goals were defined: expand Technical Assistance and Rural Extension (ATER) services to family farming from 30% to 100% of families by 2030; increase the share of family farming in the domestic market from 20% to 70% by 2030; increase the share of family farming products in institutional markets from 15% to 30% by 2030; increase access to credit from R\$ 41 million to R\$ 1.3 billion/year by 2030; and perform land tenure rectification of 70% of the family farming lots by 2030⁴⁴.

The strategy emerged from a collective and participatory construction involving the public sector, the private sector, and the third sector. Aiming at implementing the strategy through Decree no. 468 of 31/MAR/2016, the *Estratégia: Produzir, Conservar e Incluir* State Committee (CEEPCI) was created, and its organizational structure was established. The CEEPCI is also a way for the government to monitor the strategy⁴⁴.

The coordinating secretariats for each thematic axis are: the Chief of Staff’s Office, which is responsible for the general coordination of the PCI strategy; the State Economic Development Secretariat (SEDEC), which operates in the “Produce” axis; State Environment Secretariat (SEMA/MT), which operates in the “Conserve” axis; the State Family Agriculture Secretariat (SEAF), which works on the “Include” axis; and the State Planning and Management Secretariat (SEPLAG), which is responsible for planning⁴⁴.

In 2019, *Estratégia PCI* was restructured, and a new phase began. Through Decree no. 46 of 27/FEB/2019, it was defined that implementing the strategy would take place in partnership with a private non-profit entity called Instituto PCI. This way, it was possible to offer Mato Grosso State an instrument for public-private articulation and fundraising and management, which would be transparent and efficient in implementing programs and projects⁴⁴.

8. FINAL CONSIDERATIONS: BOTTLENECKS AND OPPORTUNITIES FOR RESTORAION IN MATOPIBA

Ecological restoration in Matopiba faces many problems that make it difficult, and often unfeasible, to be done on a landscape scale. Restoration is a little-implemented activity due to numerous bottlenecks and high costs²⁵.

One of these bottlenecks for ecological restoration in the country is major misalignment and a great number of gaps in public policies, and especially the delay in fully implementing the new Forest Code. To face this, it is necessary to clarify the legislation and support the monitoring and inspection work. This requires technical staff and other resources at environmental agencies, which are essential for environmental compliance.

There are other bottlenecks in the ecological restoration chain, such as lack of engagement, low demand for restoration, low diversity and number of native seeds produced, little dissemination of technical knowledge, lack of information on regional native species' silvicultural behavior, little-skilled labor, lack of genetic improvement in native species with economic use, and absence of financial incentives or other economic counterparts geared to restoration²⁵.

Strengthening the restoration production chain and implementing the New Forest Code are crucial factors for the growth of the activity. For this, some actions need to be taken and encouraged with the help of different actors (government, producers, NGOs, cooperatives, technical consultancies, teaching and research institutions, and others). Such actions include disseminating technical knowledge, incentives for producing seedlings and seed collection, encouraging plantations for economic purposes, developing communication strategies for fostering the restoration sector, and developing new credit and advancing existing lines²⁵.

In the Matopiba region, there are deficits in Permanent Preservation Areas (APPs) and Legal Reserves (RLs), as well as low-production areas that can be used for recovering native vegetation. Recovering the 364,000 hectares of APPs is a good way to begin a comprehensive restoration program. The restoration chain that would be developed by this demand would even help to lower restoration costs in other areas. If restoration is focused on APPs that are on soybean cultivation properties, it would add even more action focus, as it is a very small universe compared to all the properties and areas in Matopiba.

Analyzing public policies, especially benchmarking, was a very enriching exercise for understanding the situations in each Matopiba state's environmental secretariat and good experiences in other states. Bottlenecks were also identified at both federal and regional levels (Matopiba region) that make ecological restoration at scale difficult, which represents a challenge that new projects will have to address.

As already pointed out, this broad analysis of restoration policies has been a gap, so it is believed that the content presented here will be useful for several organizations that can make use of use and contribute to this study, making benchmarking a dynamic tool when receiving new contributions.

It was found that major advances in public restoration policies were achieved through projects funded with external financial resources, such as the *Mata Ciliar de São Paulo* and *Paraná Biodiversidade* projects. These projects, in addition to concrete interventions in ground restoration, contributed to creating regulations and

capacities in public bodies, leaving an important legacy. However, it indicates that public budget resources are not enough to work on the restoration agenda, even in the country's richest states.

This lack of budgetary resources for restoration indicates that the agenda has not been a priority for governments, but it can be offset with private or mixed financial mechanisms, including international financial resources, given the importance of the topic globally. In this sense, alternatives such as those developed by Mato Grosso (PCI Strategy) and Pará (Amazonas Agora State Plan – PEAA) can bring important lessons to Matopiba.

Preserving vegetation in the region has a direct impact on water resources and, consequently, on agricultural production, in addition to being a legal obligation in the case of APPs. Thus, it makes perfect sense for the productive sector to invest in the scale restoration agenda and supporting public policies are a fundamental part. A region in ecological imbalance is harmful to the wellbeing of the population and to local economic development, and pressure for sustainable production is growing. Matopiba states can and should significantly support the sustainable production agenda, including ecological restoration.

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