Degraded Pastures in Small Properties in **Pará** State:

Diagnosis, challenges and pathways to a sustainable transition

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AGROICONE
conhecimento para uma nova economia

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SUMMARY

Pasture degradation is a multifaceted problem with negative environmental, economic, and social effects that impact communities and producers' livelihoods. In light of the serious problems caused by degradation, it has become necessary over the years to develop agronomic strategies for soil correction and stewardship, with a view to reversing undesirable livestock production trends. In this context, pasture recovery and conversion practices have emerged, encompassing a number of sustainable production processes and systems. With a growing awareness of the problem and Brazil's commitment to global agendas for combating climate change, several public policy initiatives have been implemented in recent years regarding this issue. The most recent one, in 2023, was the National Program for Converting Degraded Pastures into Sustainable Agricultural and Forestry Production Systems (PNCPD), which was renamed Caminho Verde Brasil (Brazil Green Way), which aims to provide new arrangements for financing degraded pasture recovery, in synergy with other policies. The program gave rise to a Plan for Prioritizing Areas and Estimating Investments for Pasture Conversion (Brazil, 2024). The study quantified and located the problem, defined the amount of financial resources required for addressing it, and classified the properties where degradation is widespread. It also opened up the opportunity for an approach focused on family farming – outside the initial focus of the PNCPD – and for a specific look at the subnational context, which is the context of this study. The study's objective was to analyze the degraded pasture scenario in Pará State, focusing on small rural properties (up to four fiscal modules), from a holistic perspective, assessing the socioeconomic context, integration into agricultural policy (especially rural credit), and suitability for pasture recovery and conversion into sustainable production systems. Pará State was chosen for its importance in terms of agricultural production, as well as being ranked second among nine priority states for pasture intensification/conversion detailed in Brazil (2024). The number of findings of this study include the delimitation of a group of 203.8 thousand properties to be targeted by the policy, totaling a 2.7 million hectares (ha) pasture area with some level of degradation (low or medium severity). By combining pasture degradation, socioeconomic context, and inclusion in rural credit policy, it was possible to segment groups and outline a plan

for integrated actions in the territory. Considering properties with a history of rural credit contracts, there is an opportunity in the short and medium term to respond to the problem, with the potential to reach 23.5% of the focused properties' degraded area; the remaining area (76.5%) depends on combined actions in the medium and long term, creating conditions for a fair climate transition.

INTRODUCTION

Cattle ranching (for beef and dairy) is one of the most important productive activities in rural areas, and is present in around 2.5 million agricultural establishments in Brazil (IBGE, 2017). This activity is responsible for an important food and nutritional security segment, supplying protein through meat, milk, and dairy products. These foods are essential and are widely used in the food industry in products that are part of the population's diet. In 2024, beef and dairy cattle ranching totaled R$ 237.4 billion in Gross Production Value (GPV), representing 55% of livestock GPV and 18.8% of total agricultural GPV (MAPA, 2025), with significant importance for both the export industry and producers' income.

Cattle ranching is divided into the breeding, rearing, and fattening phares, which are based on the animal development process through feeding, whether for milk production or slaughter. In this process, which is mostly extensive (Landau et al., 2020), pasture, that is, using land for forage production, is the central element that conditions livestock productivity, both in terms of time and the quality of animal fattening. Therefore, ensuring soil quality and, consequently, its productive strength is a fundamental aspect for the activity's good performance.

Despite the well-known need to maintain soil fertility as a production asset, many producers, whether due to lack of knowledge, guidance, or financial resources, find themselves on productive trajectories that lead to degrading their pastures. This phenomenon, which is characterized by a decrease in the pasture's vitality, productivity, and productive resilience around its production levels, occurs mainly because of poor stewardship (Balbino et al., 2011; Macedo et al., 2013) and is a multifaceted problem.

From an economic standpoint, pasture degradation compromises the capability to support animal nutrition, reducing the yield per area[1], which, depending on the cost of production, can make the activity unfeasible. For smaller producers with fewer means and who are more dependent on

[1]Macedo et al. (2013) provide evidence that, during the fattening phase, a pasture with good stewardship can produce six times more meat than degraded pasture; Almeida et al. (2011) quote studies that identified an eightfold increase in performance.

livestock, this situation can turn into serious social problems, compromising income[2], and leading to situations of vulnerability. Furthermore, from an environmental perspective, decline in soil quality has a direct impact on climate change. Successive grazing cycles with no maintenance can lead to a reduction in soil nutrients and a loss of organic matter, which is essential for carbon retention in the soil (Almeida et al., 2011). Releasing this element, in turn, contributes to the greenhouse effect, causing global warming and affecting ecosystem services in general.

In view of the serious problems caused by degradation, over the years it has become necessary to develop agronomic strategies for soil correction and stewardship, aiming at reversing undesirable livestock production trajectories. In this context, pasture recovery and renewal practices have emerged (Macedo et al., 2013); the former involves reestablishing coverage with the same forage, and the latter involves introducing a new species for replacing the degraded coverage. These processes can be implemented directly, without cultivating other plants or agricultural crops, using only mechanical and chemical processes; or indirectly, by cultivating crops. In practice, the solution depends on soil analyses which identify aspects such as the stage of degradation, the presence of invasive plants, the degree of exposure and/or soil compaction, the existence of erosive processes, soil fertility and acidity, and others. This analysis helps to define the appropriate techniques, as well as to plan the costs of the intervention, involving decisions such as the need to destroy existing vegetation, using soil correctors and fertilizers, intercropping with other forages or agricultural crops, and adjustments to animal stocking rates (Townsend et al., 2010).

Indirect recovery solutions include the so-called ILPF (Integração Lavoura, Pecuária e Floresta - Crop-Livestock-Forestry Integration) systems, also known as agrosilvopastoral systems, stand out. These systems encompass the different combinations among these three components. Such systems aim to create environmental and economic benefits from the synergy between agricultural crops, cattle raising, and forestry production, managing the same area through techniques such as intercropping, succession, and crop rotation (Kichel et al., 2014). A number of system configurations are available and under study, varying in procedures, the timing of component introduction and removal, the species composition of legumes and forage, among other variables.

The results are concrete in terms of improving soil properties, with greater nutrient cycling, reducing pests and weeds, reversing degradation, and

[2]A study by GPP/USP/Esalq (TEEB, 2023), analyzing social and human impacts in degraded pasture recovery, provides evidence of higher real income for families in recovery scenarios compared to that of degradation scenarios. On the other hand, possible negative impacts on employment are detected, given the intensification of livestock activity.

improving animal carrying capacity (Almeida et al., 2011; Vilela et al., 2011; Balbino and Almeida, 2012). Macedo et al. (2013) highlight the role of leguminous plants in pastures, assisting in biological nitrogen fixation and plant root system growth, eliminating the need for directly applying this element.

Balbino et al. (2011) also emphasize the possibility of combining integrated systems with other sustainable practices, such as no-till farming, especially in the case of grain crops, which, together with the commercial opportunities generated by forestry, help to provide greater income for producers, including faster amortization of the system's implementation. It is worth adding that, from an environmental perspective, these practices are also more beneficial, given the greater carbon retention in the soil in the arboreal component and in shortening the fattening process, which leads to a reduction in methane emissions from the animals' enteric fermentation, among other benefits (Almeida et al., 2011).

With growing awareness of the problem and Brazil's commitment to global agendas for combating climate change, a number of public policy initiatives have been implemented in recent years with efforts focused on adopting good agricultural practices. *Plano ABC* (2011-2020) and *Plano ABC+* (2021-2030), which are aimed at supporting Low Carbon Agriculture (ABC), have emerged as the main drivers for encouraging practices for recovering degraded pastures, as well as other technologies, systems, and practices aimed at greater sustainability and resilience in agriculture (Lima, Harfuch, and Palauro, 2020; MAPA, 2021). *Plano ABC+*, for example, estimated a reduction potential of 113.70 million Mg CO2eq in a recovery scenario of 30 million ha of degraded pastures, which illustrates these practices' major potential in the context of the climate agenda (MAPA, 2021).

The rural credit policy, as an instrument for this process, also gained labeled lines (Programa *ABC/ABC+*, now RenovAgro, and Pronaf subprograms, such as Bioeconomy, Agroecology, Forest, and Semi-Arid), channeling financing for the transition. Another milestone at the end of 2023 was the creation of the National Program for Converting Degraded Pastures into Sustainable Agricultural and Forestry Production Systems (PNCPD) (Decree No. 11.815/2023), aimed at providing new arrangements for financing pasture recovery, in synergy with other policies.

In 2024, aiming to diagnose pasture degradation in Brazil and provide inputs for decision-making in the context of the PNCPD, the Agriculture, and Livestock Ministry (MAPA), together with the Climate and Society Institute (iCS), the Public Policy Group (GPP/Esalq/USP), Agroicone, CITE (Intelligence Center for Land Governance and Sustainable Development), and Imaflora, a Plan for Prioritizing Areas and Estimating Investments for Pasture Conversion (Brazil, 2024).

The study quantified and located the problem, defined the amount of financial resources required for addressing it, and classified the properties where degradation is distributed according to their size, eligibility for the program, economic suitability (market insertion), and biophysical suitability for recovery (practices and systems suitable for recovery). In all, an estimated 107.6 million ha of low and medium-vigor pastureland were identified in Brazil, 27.7 million (25.7%) of which were distributed across 1.02 million properties, do not present environmental non-conformities (including deforestation after 2008, whether legal or illegal) and have a potential for conversion based on economic and biophysical criteria, meeting the PNCPD requirements.

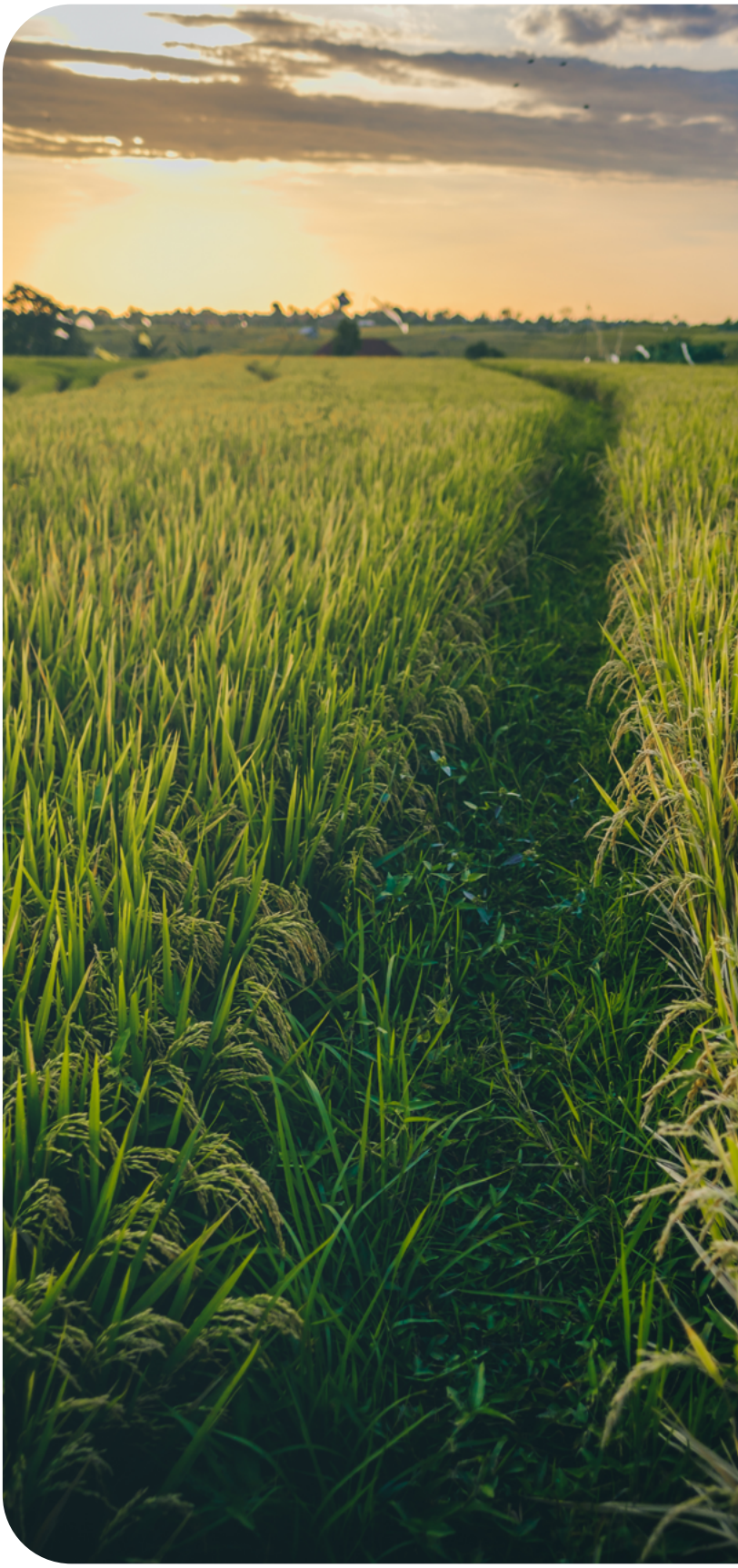
The Plan also highlighted the land dynamics of pasture degradation, since 66% of this area is located on small and medium-sized properties (up to 500 ha total area), mostly linked to Family Farming (AF), while 97% of properties with this problem are of this size (Brazil, 2024). The Plan also found that nine states account for 79% of the situation - Minas Gerais, Mato Grosso, Mato Grosso do Sul, Bahia, Goiás, Pará, Tocantins, Rondônia, and São Paulo - and should therefore feature centrally in the prioritization strategy.

The mapping carried out in the Prioritization Plan highlighted the importance of looking at smaller properties, which together represent a significant share of the degradation problem (66%). This importance is further accentuated by the fact that the financing strategy adopted by the PNCPD — based on calls for proposals and a greater number of eligibility requirements — will tend to produce higher-value loans with higher transaction costs, which are therefore less suited to small producers' profiles. Thus, efforts to find ways to restore pastures for this audience are still necessary, especially due to these producers' vulnerability and worse socioeconomic conditions, which lead to greater difficulties in obtaining financing and access to technical guidance, requiring public policies that act in an integrated manner to solve the problem.

Another opportunity that was opened up by the Prioritization Plan is the focus on key states for the recovery agenda. Pará state, which is studied in this report, accounts for 6.6 million hectares of degraded pastureland on rural properties (out of a total of 107 million hectares in Brazil), being among the nine priority states. The Gross Production Value (GPV) of beef and dairy cattle farming totaled R$ 14.4 billion in 2024 (6.1% of the country's total). In addition, cattle ranching is also highly significant, accounting for 37.3% of the state's total agricultural Gross Production Value and 93.1% of the livestock GPV (MAPA, 2025). These figures underscore this activity's importance for the state's economy and, consequently, the need to carefully examine its productive aspects.

Given this context, this study aims to analyze the degraded pasture scenario in Pará state, focusing on small rural properties (up to four fiscal modules) from

a holistic perspective that takes into account the socioeconomic context of rural properties, their inclusion in agricultural policy (especially rural credit), and their suitability for pasture recovery and conversion using sustainable production systems. We hope to quantify and locate the problem within the state, thoroughly analyze the financing situation, and outline a strategy for better coordinating actions aimed at resolution.



GENERAL ASPECTS

In all, Pará has around 276,700 rural properties (registered in the Rural Environmental Registry - CAR in 2023), covering a 55.3 million ha total area, with 17.8 million ha of pastureland within the properties and 6.6 million ha of low and medium vigor pastureland, i.e., with some degradation. 255,600 (92.3%) of these properties, have up to four fiscal modules (MF), potentially linked to family production[3], accounting for a total area of 13.3 million ha, a pasture area of 7.8 million ha, 2.7 million ha of which show low or medium vigor.

Of the approximately 255,600 properties in the group of up to 4 MF, 25,600 (10%) CARs have no pasture area, 26,200 (10.3%) have an area greater than zero and less than one hectare, and 203,800 (79.7%) have an area equal to or greater than one hectare of pasture. The latter portion was chosen as the group of **focused properties** in this study, given the allocation of at least 1 ha for cattle grazing, thus constituting a potential regularity in performing the activity. This subgroup is representative in the context of small properties, accounting for 99.9% of the degraded pasture area in the group of up to 4 MF.

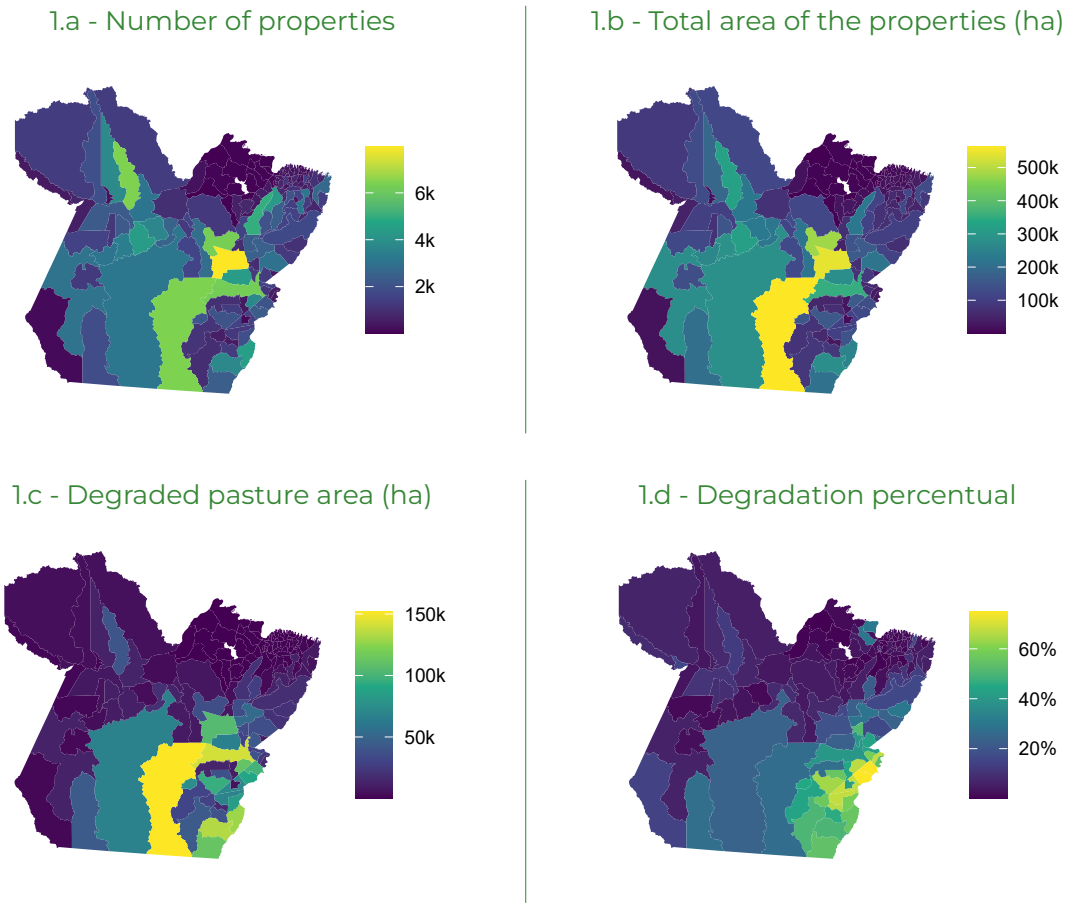
Figure 1 shows the general scenario of the focused properties. There is a differentiated distribution across the territory (Figure 1a), concentrating in a few municipalities, especially in the eastern part of the state. The total area covered by these properties (Figure 1b) largely follows the spatial distribution of this producer profile. The degraded pasture area (Figure 1c), in turn, shows a higher concentration, with properties in 12[4] municipalities accounting for 50% of the degradation in the focused group, across the entire state. In turn, an analysis of the proportional degradation (Figure 1d), verifying the

[3] The 4 MF limit is only one of the criteria for classifying a producer as a family farmer, according to Law No. 11.326/2006, which defines, in summary, the following criteria: i) a 4 MF limit; ii) predominant use of family labor; iii) a minimum percentage of family income originating from economic activities on their property (50% according to Decree No. 9.064/2017); iv) family management of the property or enterprise. The analysis is therefore potential, given that, through the CAR registration code, only the territorial dimension can be inferred, and even then with some degree of uncertainty.

[4] The municipalities are: São Félix do Xingu (151,900 ha), Marabá (141,200 ha), Santa Maria das Barreiras (133,500 ha), Conceição do Araguaia (128,800 ha), Santana do Araguaia (112,400 ha), Eldorado do Carajás (111,500 ha), Novo Repartimento (104,800 ha), São Geraldo do Araguaia (98,900 ha), Água Azul do Norte (95,500 ha), Piçarra (89,700 ha), Floresta do Araguaia (83,500 ha), Tucumã (74,900 ha).

average percentage of degraded pasture area compared to the CAR area, by municipality, shows higher overall levels of relative degradation in the southeastern region of the state. 39,200 (19.2%) of all the CARs focused on in the state have more than 50% of the CAR area with pasture in some level of degradation. Municipalities such as São Geraldo do Araguaia e Piçarra stand out with average percentages above 70%.

Figure 1 - Mapping of the total number of focused rural properties (CARs), total area, degraded pasture area, and percentage of degradation in the state's municipalities



Source: prepared by Agroicone based on Brasil (2024)

The statistics that were found already point to where efforts should be focused in terms of pasture recovery/conversion, showing the regions and municipalities that are most in need of intervention for addressing the problem. Holistically, it is useful to add an understanding of the socioeconomic reality to this layer of information in the context of such properties, moving towards a socio-environmental analysis of the degradation phenomenon.

This advance is relevant because this study is based on the premise that socioeconomic conditions — in this case, in the rural world — are determining factors in individual decisions, while also being determined by them.

Specifically, it is presumed that producers' perception of pasture degradation and their ability to act to solve the problem are conditioned by attributes such as education, the environment in which they live, and the funds they have. For example, it is not expected that rural families, with all or most of their income committed to meeting their basic needs, will invest in pasture recovery, nor that such interventions will come from producers in contexts of low literacy rates or who are still low on their scale of needs.

These understandings are corroborated by some studies that aimed to assess the influence of socioeconomic factors on adopting agricultural practices. Diaz et al. (2021), for example, developed a study analyzing small farmers in northern Colombia, applying Multiple Correspondence Analysis (MCA) and Principal Component Analysis (PCA) techniques to investigate socioeconomic determinants of agricultural practices, such as household characteristics and demographic aspects, and others. The authors found that education, income from agriculture, access to credit, and participation in cooperatives influence the adoption of more sustainable techniques. One of the findings, for example, is that establishments with higher educational levels tend to apply more biofertilizers.

Olsen and Lund (2009) investigated the hypothesis of the effect of socioeconomic factors on investment decisions for a sample of pig farmers in Denmark. The predictor variables income (on and off the property), producer size, debt size, management capacity, interest rate, producer age, and length of activity were used as inputs in a logistic regression for analyzing their effect on investment decisions in land, animal facilities, and machinery. Other findings and revealed results include the impact of income and producer age on the likelihood of making improvements in production.

On this topic, Taveira et al. (2019) add further considerations on the prospects for technological diffusion in rural areas, pointing out that each context has different socioeconomic and cultural conditions, which may present a greater or lesser possibility of adherence to sustainable production practices. Acting to create basic conditions may be a requirement in certain contexts.

In order to study the prospects for progress in the practices of recovering degraded pastures among small farms in Pará state, the living conditions of the focused producers were therefore taken into account. In order to conduct a comprehensive mapping of these dimensions, data from the Rural Development Index for the CAR (IDR-CAR) were used, according to

the methodology developed by Vicari, Lobo, and Harfuch (2025)[5]. This effort is relevant for monitoring the boundary conditions[6] required for a proper functioning of agricultural policy instruments, especially financing.

In the general socioeconomic framework indicators selected for analysis (Figure 2), different patterns can be seen between the dimensions. In terms of education (Figure 2a), which assesses the literacy level of the context in which the properties are located, high values stand out in the vast majority of municipalities in the state, with lower average values in the northern and northeastern portions. Despite a high overall average for the indicator (0.83), it is important to note that this assesses basic literacy (ability to read/write), thus pointing out that several properties are in contexts where basic education is still lacking.

This situation may be expected to cause harm to the families behind these properties in terms of information, awareness of the consequences of certain productive practices, and the effectiveness of public policy interventions, such as ATER (technical assistance and rural extension), for example. In this context, Suela et al. (2021), following the findings of Meyer (2015) and Hyland (2015) regarding the impact of educational level on perceptions and pro-environmental behaviors, obtained statistical evidence regarding the influence of schooling and knowledge obtained through technical guidance on adopting practices for recovering of degraded pastures in a case study. This is, therefore, a relevant dimension in mapping the problem to be considered when defining actions in the territory.

In the Collective Infrastructure dimension (Figure 2b), which measures the context of properties in terms of providing basic conditions — adequate access to water, waste disposal, and sewage disposal — a generally low pattern is seen (average of 0.39) among the focused properties, with 113 municipalities (out of 143) with values below 0.5 on the indicator. This highlights the still inefficient situation of rural infrastructure, which has potential impacts on rural residents, indicating that there is still a long way to go in terms of public policy, as was also pointed out by studies on the subject (Santos and Silva, 2016; Sales, 2018). In terms of the impacts of this situation, Silva et al. (2014) warn of the risks associated with lack of sanitation in rural areas, with families being more exposed to diseases such as typhoid fever, dysentery, diarrhea, leptospirosis, and others.

[5] The IDR-CAR is a rural development index proposed by Vicari, Lobo, and Harfuch (2025), which aims to measure socioeconomic development in the context of rural properties (CARs), based on a methodology based on the Sustainable Development Goals (SDGs) and using data from the Demographic Census in a strategy of overlapping census sectors and CAR grids.

[6] In this work, boundary conditions are understood as a broad concept that involves the socioeconomic context in which rural producers operate. Such conditions would appear as structural requirements for adopting a behavior, for example, taking out credit, and may be expressed in previous stages, such as the documentation being in order, access to technical guidance, supply of basic needs, and others.

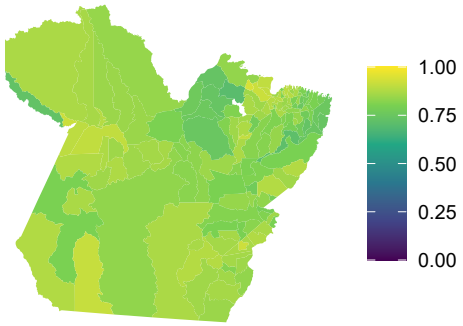
On the other hand, regarding the home infrastructure of the focused properties (Figure 2c) – adequacy of the housing structure, level of access to piped water, and existence of a bathroom – Although a high overall average is observed in the state (average of 0.9), lower values of the indicator can be noted in the northern region, with 20 municipalities having an average below 0.8. From the perspective adopted in this analysis, this result highlights a contrast between patterns of human development among the municipalities, considering the rural households in this group of properties. Therefore, there is a need to advance in meeting basic life needs, which could be an important step towards new levels of needs and greater productive development.

Finally, in terms of income, two patterns are also observed across the state (Figure 2d), with higher values for municipalities in the south, in contrast to the north of the state. The indicator measures 1 as an estimated value for providing human needs, based on income distribution in Brazil, and 0 as the extreme poverty threshold. The indicator shows a medium to low pattern (average of 0.58) among the properties surveyed, with 39 municipalities having an indicator below 0.5 and, therefore, potentially requiring greater targeting for public policies due to lower income conditions.

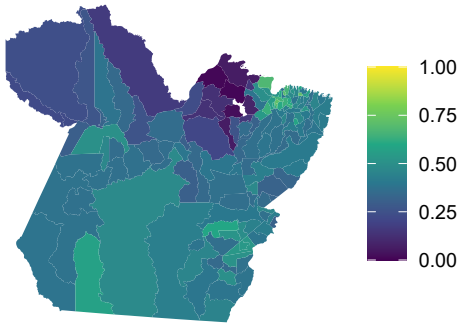
In addition to the aforementioned evidence of the influence of income on investments in production improvement, other studies highlight the relationship between income and adopting good agricultural practices. Sithole and Olorunfemi (2024), when investigating producers in northern South Africa, found that income inside and outside the property tends to be a determining factor in using sustainable practices. Similarly, Foguesatto and Machado (2021) found that income was a significant variable associated with using sustainable production practices by producers in Rio Grande do Sul state.

Figure 2 - Selected socioeconomic indicators for the rural focused properties (average), by municipality

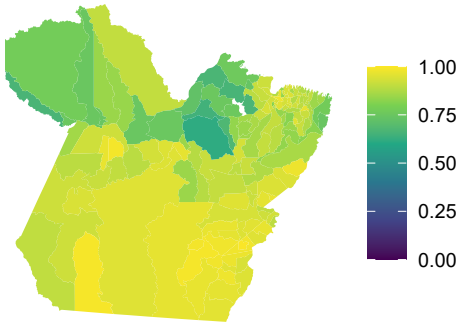
2.a - Education



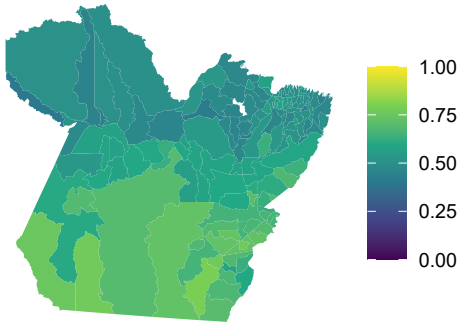
2.b - Collective infrastructure



2.c - Household infrastructure



2.d - Income



Source: prepared by Agroicone based on the IDR-CAR methodology developed by Vicari, Lobo & Harfuch (2025)

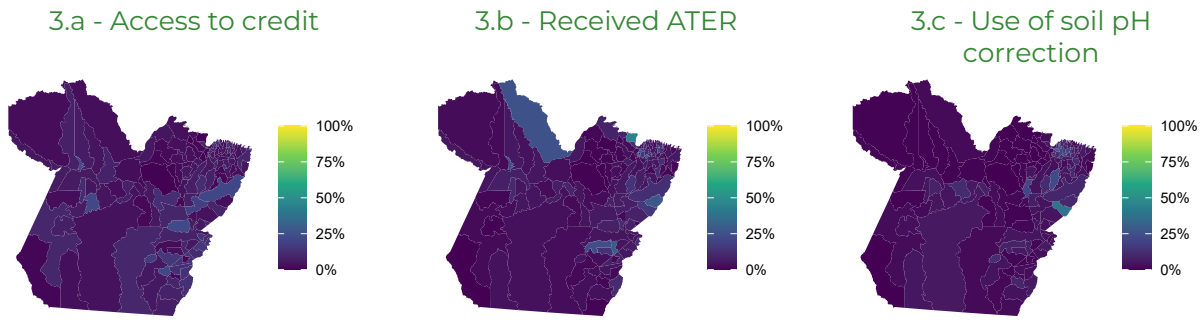
The socioeconomic scenario of the focused properties in the state shows varied characteristics in the analyzed dimensions. A sharp contrast emerges between the northern and southern regions, especially regarding household infrastructure and income. The poor provision of basic living conditions, coupled with still low education levels, suggests a broad context of vulnerabilities in the state's rural areas, indicating a significant demand for public policies. Such characteristics, taken together, therefore tend to variably influence the prospects for adopting sustainable practices among this population. For this reason, it also becomes useful to understand the territory through the lens of efforts and pathways towards solving the problem of pasture degradation. Thus, it is important to examine how producers are using the available agricultural policy instruments to address the problem.

Among these instruments, financing is one of the main means for adapting production systems to climate change, providing the required liquidity to make investments that help increase production resilience. The potential of credit in the transition grows even more due to subsidy policies, which seek to reduce the cost of loans, encouraging producers to adapt their production systems. Although it is a fundamental part of this process, it is noteworthy that credit does not play a definitive role in the process of incorporating good agricultural practices, given that its misguided use may not result in positive environmental effects and may even contribute to degradation processes. Thus, another important instrument, technical assistance and rural extension (ATER), plays a fundamental role, providing producers with guidance that ensures more efficient and effective results in implementing their projects.

Based on data from the Agricultural Census (2017), Figure 3 shows the percentages of family farming establishments with a history of access to credit (Figure 3a) and receiving technical guidance by municipality (Figure 3b). Of the 239,700 family farming establishments registered in the census, around

14,500 (6.1%) reported a history of access to credit and 11,300 (4.7%) reported receiving technical guidance. From a spatial perspective, the maps show low overall levels of access to these policy instruments, with a slight emphasis on the state's central region, which is characterized by greater dynamism in terms of agriculture and livestock activities. Figure 3c also provides an overview of producers' behavior regarding soil recovery, using data from establishments that applied limestone and other soil pH correctives. In all, only 9,695 (4%) properties had a history of this practice.

Figure 3 - Percentage of rural establishments with access to credit; access to ATER, and use of soil pH correctives, by municipality



Source: prepared by Agroicone based on data from the 2017 Agricultural Census (IBGE)

The presented data therefore suggest a gap in agricultural policy in the context of family farmers (AF) in the state, as well as low incorporation of more basic soil recovery techniques. This scenario is a challenge, but also an opportunity for public policy to change these producers' trajectory. Strengthening access to credit, geared toward transforming production toward sustainability and resilience, is a fundamental step.

FOCUSED PROPERTIES' TRAJECTORY IN RURAL CREDIT

The overall analyzed picture helps to understand the macro-territorial characteristics of the focused properties, aggregated by municipality. This view is particularly relevant, given that decision-making and strategies for solving problems, such as pasture degradation, are part of a political-administrative perspective, which helps to define more assertive actions. On the other hand, a better qualification of rural properties and understanding the problem at the micro level is also important, as it enables detecting the focused audience's trajectories and profiles by forming groups.

An important first step in understanding the perspectives of the producers of the focused properties[7] in the pasture recovery and conversion process in the state is to analyze their inclusion in rural credit policy, which can be done using Sicor/BCB[8] data. Figure 4 provides this information, showing, within the focused properties, their number with access to credit by segment (familiar - AF, through the National Program of Strengthening Family Farmers – Pronaf, and Non-family or Non-Pronaf) over the harvests[9]. It should be noted that the peak of loan origination was in the 2021/22 harvest, with 11,000 CARs (Rural Environmental Registry) contracting credit, which accounts for only 5.4% of the total, followed by a downward trend in subsequent harvests. Considering the entire period, approximately 30,700 (15.1%) targeted properties took out

[7] Since a rural property may have several CAR registrations, i.e., its area may be divided into several CARs, for credit analysis purposes, it is useful to track the land structure of the focused properties. Of the 31,897 CPF/CNPJ registered in the Sicor/BCB database for the credit contracts of the focused properties (CARs), 30,125 CPF/CNPJs, or 94.4%, have only one associated CAR. Of those with more than one associated CAR, 506, or 1.6%, have a total area greater than 4 MF. This result, albeit potential, given the impossibility of ensuring the relationship between CPFs/CNPJs and CARs, shows little fragmentation of producers in CARs, indicating a secure land profile for analysis.

[8] The granular analysis of rural properties (CAR) can be done using Sicor/BCB microdata. However, this is a potential analysis, given that not all credit agreements have a CAR reported. In Pará's case, in the 2019/20 to 2024/25 harvests, 67.5% of all credit agreements had a declared CAR. Considering only Pronaf agreements, this percentage rises to 76.5%. These results indicate that, even though there is a volume of contracts for which producer information cannot be traced, there is a significant safety margin in the analyses. It should also be noted that these are the best public data available. For the sake of simplification, throughout the analyses, it is assumed that CARs not identified in the credit database have no financing history.

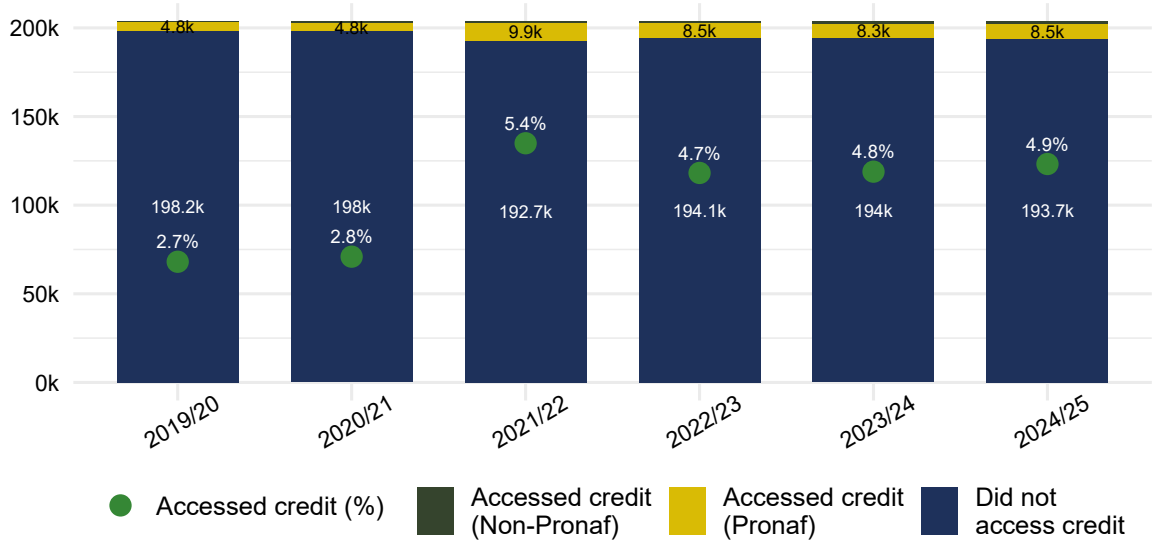
[9] It is assumed that all focused properties, whose data were recorded in 12/2024, had been registered in the CAR since 2019.

credit at least once, with 26,300 (85.4%) properties contracting with Pronaf and 4,500 (14.6%) non- Pronaf.

This situation shows that only a small portion of these producers take out credit at each harvest and that the trajectory is not positive over time, which represents a challenge, but also an opportunity for agricultural policy. Although some properties can be financed by other sources outside the official rural credit policy (Plano Safra), it is also possible to expect a group that does not access credit due to default problems (which hinders or prevents contracting new loans), lack of necessary documentation, failure to meet the policy's socio-environmental requirements, as well as risk aversion. It should be clear, however, that all these situations, each with its own complexity, represent obstacles to the decision to make improvements in their production system, such as recovering/converting degraded pastures, and should therefore be addressed by the policy.

Another relevant point to note in planning actions is that, while the number of borrowers outside Pronaf increased in the analyzed period, the total number of properties linked to AF (Pronaf) shows a downward trend in recent harvests. As this is the segment of agriculture that is generally most vulnerable from a socioeconomic standpoint and is most exposed to environmental and climate risks, a change of course is necessary, identifying and correcting the bottlenecks that have been preventing such producers from obtaining credit.

Figure 4 - Focused properties by credit contracting profile, by harvest

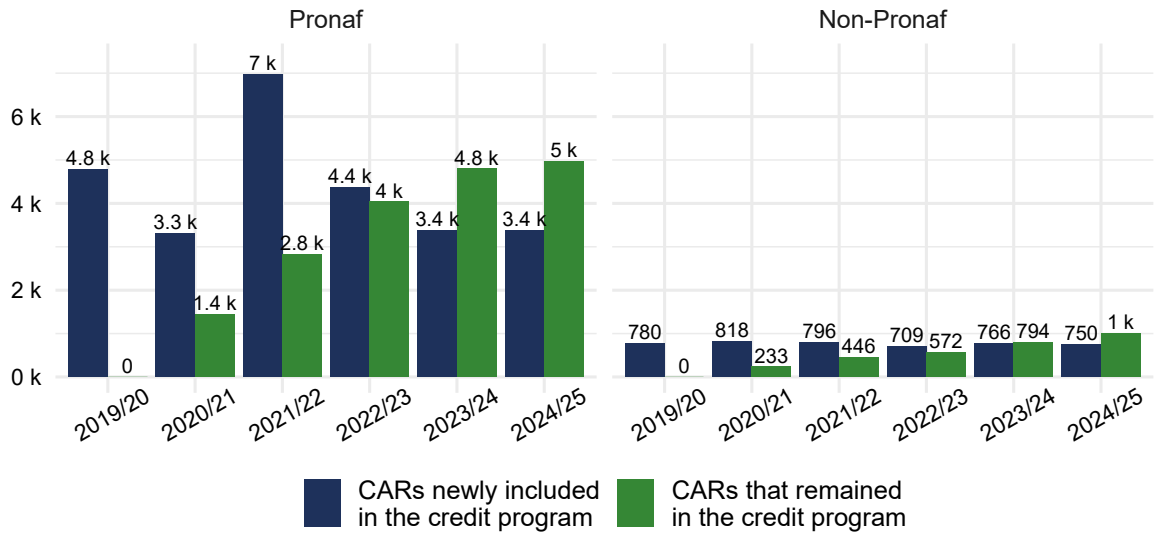


Source: prepared by Agroicone based on data from the PNCPD Prioritization Plan (Brazil, 2024) and Sicor/BCB. Updated on September 30, 2025

To understand the situation more dynamically, it is also useful to assess the movement of the focused properties throughout the harvests. Figure 5 helps to understand the scenario, highlighting the following distinct patterns in the segments: regarding Pronaf, there was a decrease and stabilization in the entry of new properties into the credit policy, accompanied by growth in the number of producers who remained in the policy; among non-Pronaf beneficiaries, there was stability in the entrant rate and an increase in the number of CARs that remained in the policy.

The situation described can be considered positive, even though it demonstrates a slowdown in the pace of incorporating new producers into Pronaf. Nevertheless, the low percentage of properties with any credit history suggests that there is still a long way to go for the state's targeted properties, making it necessary to address the bottlenecks that prevent contracting, such as debit default, land tenure irregularities, lack of documentation, risk aversion, among others.

Figure 5 - Number of focused properties that entered into and remained in the rural credit policy, by audience (Pronaf and Non-Pronaf) and harvest

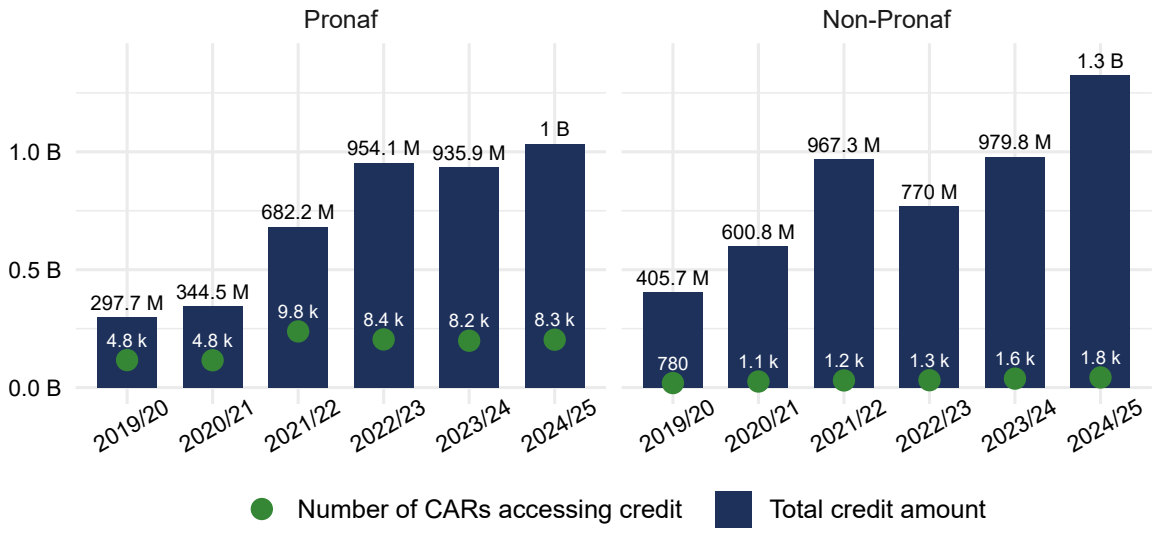


Source: prepared by Agroicone based on Sicor/BCB data. Updated on September 30, 2025

When examining the volume of credit contracted by the focused audience, between the 2019/20 and 2024/25 harvests, the amount of R$ 9.3 billion was identified, R$ 4.2 billion (45.7%) of which was in Pronaf and R$ 5 billion (54.3%) in other programs. Furthermore, similar trajectories can be noticed between Pronaf and non-Pronaf properties (Figure 6). The AF profile, however, is marked by a relatively larger number of contracting producers, evidencing a lower average contracted value per property. In the 2024/2025 harvest, while in the Pronaf program the average was R$ 120,400 per property, in the group

of non-Pronaf producers, the value reached R$ 555,600. Although, in general, the total amounts are similar, the pattern highlights the heterogeneity among small properties.

Figure 6 - Amount of contracted rural credit (financing and investment) and total number of contracting properties among the focused properties, by audience (Pronaf and Non-Pronaf) and harvest



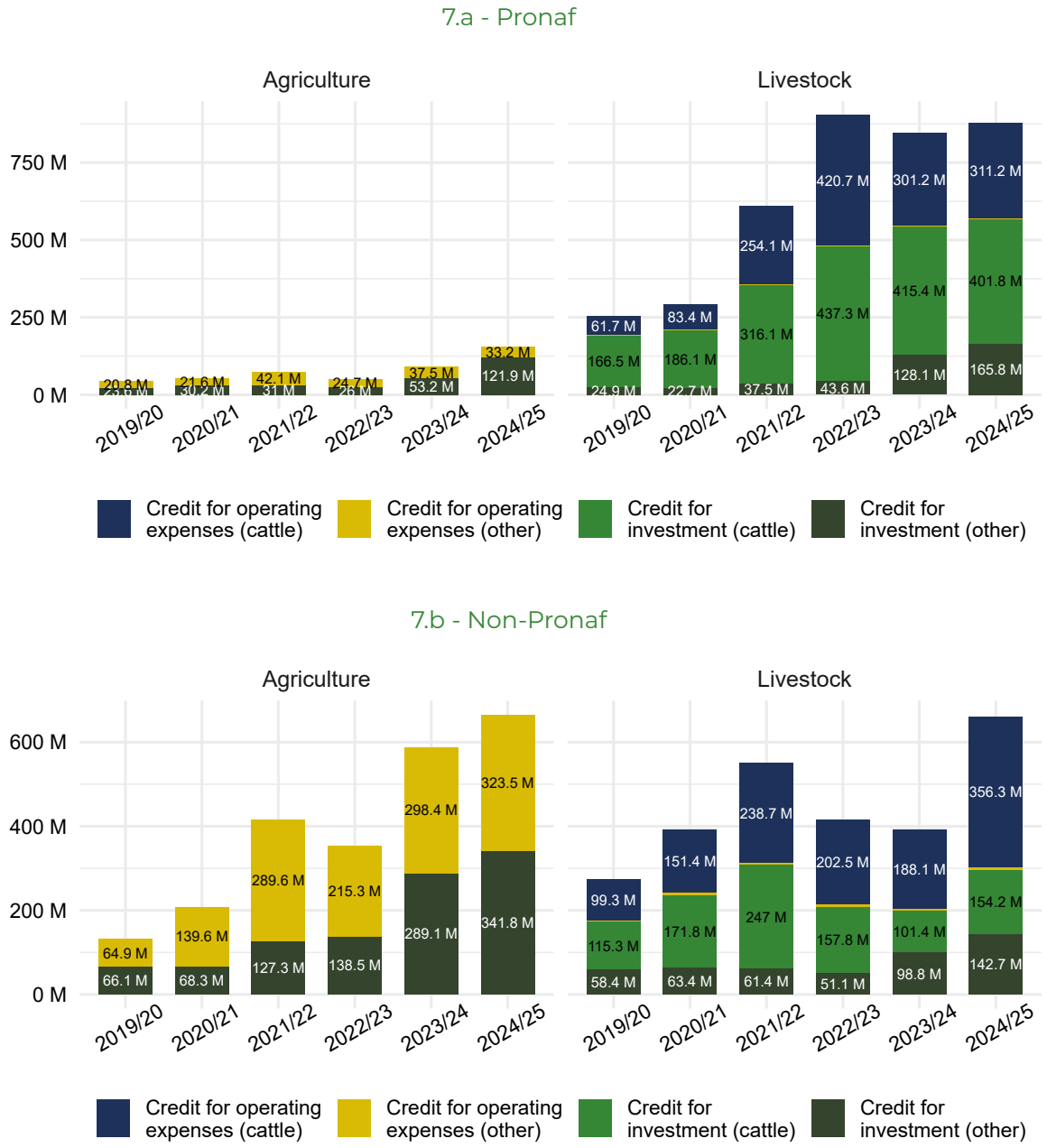
Source: prepared by Agroicone based on Sicor/BCB data. Updated on 30/09/2025

With regard to the contracted activity in the focused properties, Pronaf is geared almost exclusively toward livestock farming (89%), as can be seen in Figure 7. In all the harvests analyzed, R$ 3.3 billion (89.1%) of the R$ 3.7 billion allocated to this activity, was used for purchasing cattle, leaving a small fraction (10.9%) for investments in improving production systems. This raises an important warning: rural credit playing a role in intensifying pasture degradation processes, given the emphasis on purchasing animals for successive production cycles, without investments in soil correction and maintenance, is a scenario evidenced by the data. The almost non-existent contracting of AF for agriculture demonstrates, to date, an obstacle to the possibilities of converting degraded pastures into agriculture, one of the sustainable systems suggested in the nationwide policy. It is, therefore, an issue that needs to be addressed strategically.

In the group of non-Pronaf producers with up to four fiscal modules, there is a more balanced use of credit on agriculture and livestock, with percentages of 46.8% and 53.2% throughout the period, respectively. R$ 2.1 billion (89.7%) of the R$ 2.6 billion allocated to livestock was used for purchasing cattle, which represents a real 11.2% investment rate in farm improvements over the period.

This audience, therefore, demonstrates a productive trajectory similar to those of PRONAF beneficiaries, with a high concentration in cattle and a small portion destined for the maintenance and expansion of production assets. The presence of investments in agriculture also suggests the group's potential for converting pastureland to agriculture or for implementing integrated systems.

Figure 7 - Amount of rural credit contracted (financing and investment) in the focused properties, by activity (Agriculture and Livestock) and audience (Pronaf and Non-Pronaf), and harvest.



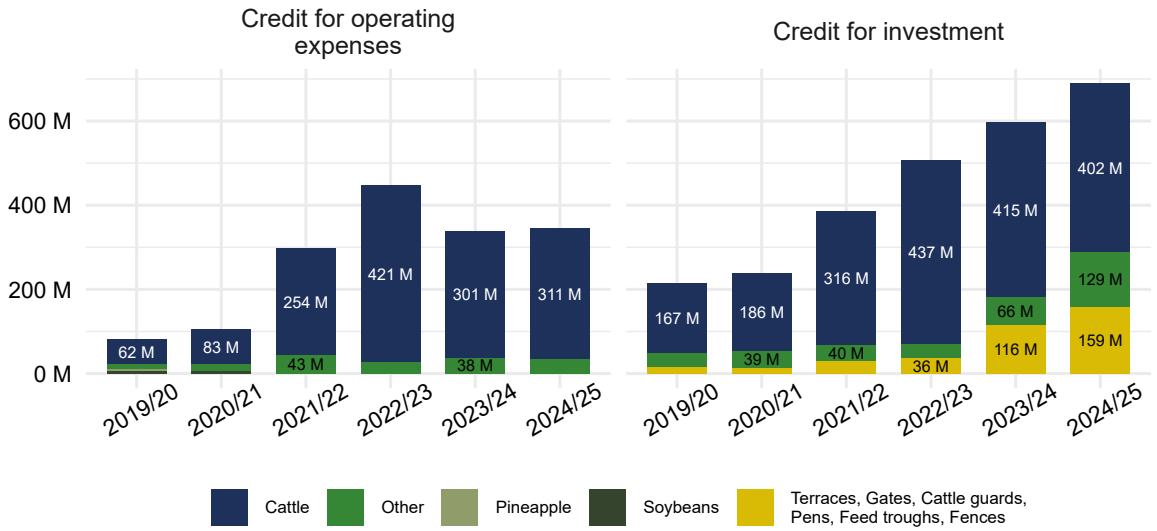
Source: prepared by Agroicone based on Sicor/BCB data. Updated on September 30, 2025

To better understand how credit is allocated by producers, it is important to examine the amounts per contracted product, as provided by SICOR/BCB and shown in Figure 8. In the case of Pronaf, the majority of credit is allocated to purchasing cattle, while a small amount is allocated to other investment products. Only the "Terraces, gates, cattle guards, corrals, troughs, and fences" product stands out from the rest; even so, it accounts for only R$ 369.8 million (8.7%) over the entire period. Products such as "Intensive Soil Correction" and "Intensive Soil Fertilization" – which are essential in pasture recovery processes – totaled only R$ 4.3 million, representing a tiny portion of the investment via Pronaf.

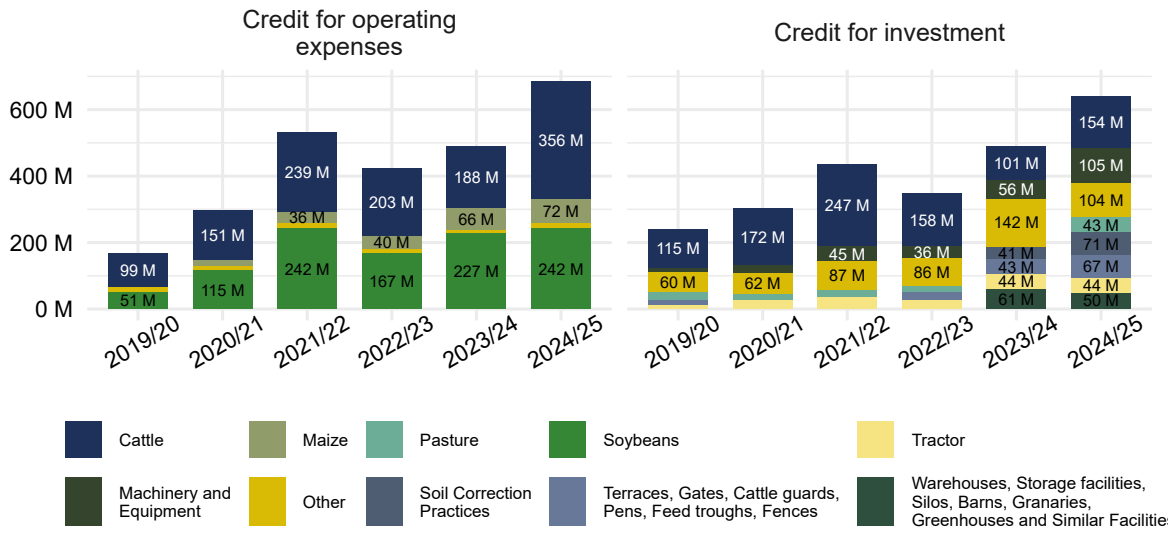
In the non-Pronaf focused producers, the distribution by product is more diversified. Although cattle is also predominant, other ventures such as soybeans and corn stand out in terms of costing, while capital goods such as tractors, harvesters, and other machinery and implements are featured in terms of investment. Investment in "Intensive Soil Correction" also appears, totaling R$ 153.5 million over the entire period, which represents 6.2% of the contracted investment resources. Therefore, it can be said that there is a significant difference in the diversification of productive interventions between those Pronaf beneficiaries and non-Pronaf beneficiaries, with non-family farmers being more dynamic compared to those family properties. Even so, there is still room for both groups to intensify this diversification.

Figure 8 - Amount of rural credit contracted in the focused properties, by purpose (Cost and Investment), product, audience (Pronaf and Non-Pronaf), and harvest.

8.a - Pronaf



8.b - Non-Pronaf



Source: prepared by Agroicone based on Sicor/BCB data. Updated on September 30, 2025

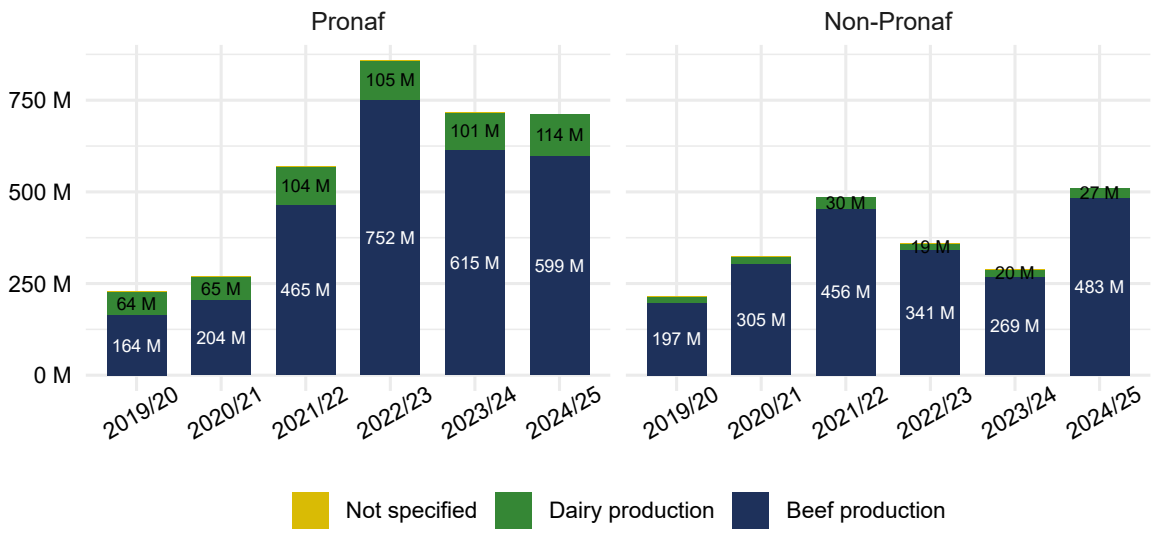
Furthermore, in the recovering and converting pasture process, it is important to analyze the producers' profile regarding the type of cattle ranching performed through credit. Figure 9 shows this picture, segmenting the contracted financial resource in cattle, by producer profile and dairy and beef cattle ranching. It should be noted that acquiring animals for dairy production is done significantly only by AF, which, among the focused properties, allocated R$ 553.2 million (16.5% of the funds for purchasing cattle) of the funds in the period.

This analysis shows that, in the state's case, an advantageous path to pasture recovery lies mainly in intensifying beef cattle ranching, for both audiences. Therefore, it is important to foster practices such as feedlots and other types of animal supplementation. In the case of family farmers, there are opportunities for adopting intensification practices in dairy ranching, investments that can be boosted by rural credit.

Finally, in analyzing credit aggregates, it is possible to note the contracting profile according to the financial resource's alignment with the sustainability journey. The sustainability journey concept stems from the work of Lobo, Vicari, and Harfuch (2024), who demonstrate the potential of rural credit data (Sicor/BCB) to highlight the adoption of practices with the potential to mitigate negative environmental externalities in agricultural activity, indicating the extent to which financing via credit policy is consistent with sustainability

and productive resilience in the face of climate change. Therefore, when a producer takes out a loan for an intervention that potentially mitigates such externalities, they are on a sustainability journey.

Figure 9 - Amount of rural credit contracted by focused properties, by type of cattle ranching (dairy and beef) and harvest



Source: prepared by Agroicone based on Sicor/BCB data. Updated on September 30, 2025

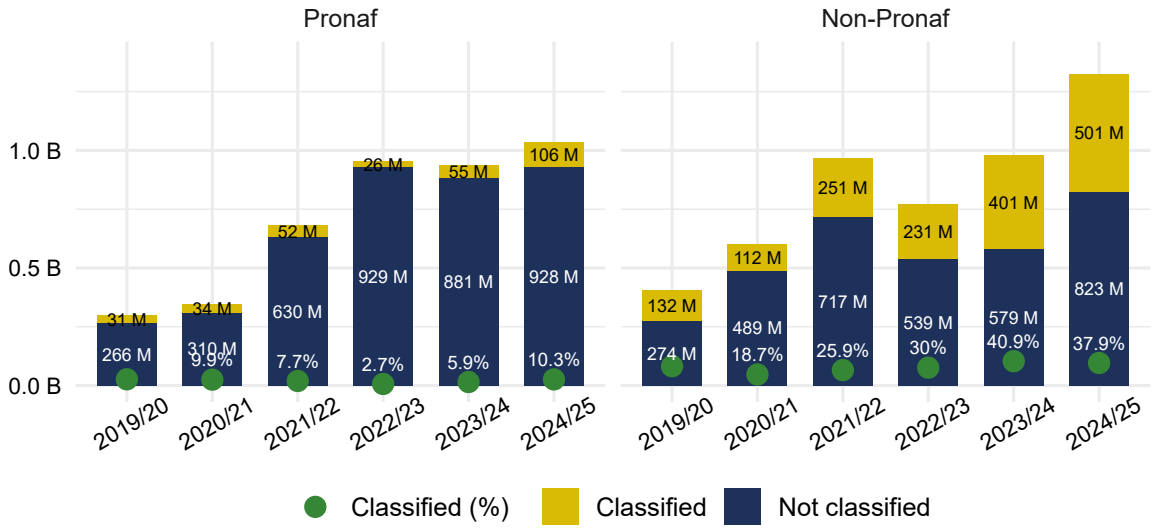
Figure 10 shows the breakdown of producers by amount of contracted credit, per harvest, whether classified or not in sustainability journey. The contrast between the Pronaf and non-Pronaf beneficiaries is remarkable. Despite the growth in the last two harvests, the amount allocated aligned with the sustainability journey in Pronaf is still low, reaching only 10.3% of the costing and investment credit in 2024/2025. Meanwhile, among non-Pronaf beneficiaries, this share reached 37.9%, which can be considered significant and indicates a better qualification of these producers in the interventions carried out with rural credit resources.

Given the above scenario, where groups with similar land structures (up to 4 MF) that are potentially engaged in cattle ranching (as they have at least 1 ha of pasture) were compared, what we see are differences between the group of family farmers and small non-family farmers. It is therefore essential to examine the reasons for this difference.

The analyses enable us to conclude that the focused rural properties' credit trajectory is still not very consistent with productive practices for recovering

and converting degraded pastures in the context of Pronaf. The focus on financial resources for purchasing animals is another warning sign, which may even represent a risk of intensifying degradation. More worryingly, family farmers appear to be less involved in sustainability initiatives in terms of credit and are therefore potentially more vulnerable to the various aspects of pasture degradation. A holistic view will be discussed in the next section, incorporating socioeconomic aspects in the context of rural properties, in order to define target audiences for intervention purposes.

Figure 10 - Amount of rural credit contracted by focused properties, by sustainability journey classification (Classified and Not Classified) and harvest[10]



Source: prepared by Agroicone based on Sicor/BCB data and the methodology developed by Lobo, Vicari & Harfuch (2024).. Updated on September 30, 2025

[10] Note: breaking down financial resources by sustainability level follows the method developed by Lobo, Vicari, and Harfuch (2024), using Level 5 of the analysis, which looks at the total amount of credit taken out with some potential to foster sustainability in agricultural production. Level 5 takes into account programs and subprograms with a sustainable purpose, as well as products, practices, and financial resources associated with Sicor/BCB credit contracts that have the potential for driving a reduction in negative environmental externalities.

A HOLISTIC VIEW

The understanding adopted in this analysis, as previously stated, is based on a more comprehensive view of the rural world and the complex dynamics that permeate it. It is understood that decisions in the rural properties' productive sphere and their economic, social, and environmental implications are conditioned by the socioeconomic realities in which rural populations are embedded. Understanding these realities is a complex task, and transforming them, in all their diversity, by adjusting individual and collective trajectories, requires equally varied solutions.

The issue of rural credit is emblematic. Although credit is one of the main instruments in agricultural policy for helping producers to solve the pasture degradation problem, in many contexts it tends to be insufficient on its own. Producers' lack of knowledge and awareness of soil degradation can mean that credit contracts do not include financial resources for pasture maintenance. In some cases, as mentioned above, the credit trajectory can even lead to further degradation, given the successive cycles of livestock ranching based solely on purchasing animals, without incorporating good practices.

Another factor to be evaluated in this process is the degree of knowledge that producers have about the different lines and practices fostered in credit policy, connected to pasture recovery and conversion: especially Pronaf Bioeconomia (Pronaf Bioeconomy) and the RenovAgro subprograms (Intensification; Recovery and Conversion; Soil Management). Producers may often lack information about the existence of these lines, and financial institutions may also lack sufficient experience or interest in operating them, thus leading to shortcomings in channeling financial resources for such purposes. Even when these lines are contracted, producers may have doubts about the best ways to implement the intended interventions, leading to risk of ineffective processes and wasted resources.

In the aforementioned scenario, we can see the importance of another fundamental agricultural policy instrument, ATER, which has the potential to reduce knowledge gaps both at the activity level and from a management

perspective, involving aspects of feasibility and using credit itself. For pasture recovery, technical guidance is especially relevant, given the use of inputs such as soil correctors and fertilizers, as well as in cases of implementing more complex systems, such as integrated and agroforestry systems, whose techniques involve several variables, such as choice of species, order and combination of components, time of introduction and removal, and other factors. ATER's importance is also corroborated by previously cited evidence (Suela et al., 2021).

In certain situations, other policy fronts may be important in helping to meet needs and create the conditions for rural development for producers. Institutional procurement policies, such as the National School Feeding Program (PNAE) and the Food Acquisition Program (PAA), which generate income for family farmers, have the potential to positively impact farmers' living conditions, generating surpluses for investment in production improvements. Furthermore, in locations with lower levels of economic and human development, more structural measures are necessary, both in terms of production — conditions of access to markets, transportation infrastructure, formalizing the activity, and so on — and in terms of social aspects — investments in education and health for rural families. In the case of transportation, developing solutions for producers' access to inputs, as well as for the distribution channels for their products, is a central step to unlock sustainable pathways. Although they are highly complex and involve intersectoral policies and different levels of federal jurisdiction, these conditions should not be ignored in planning actions aimed at developing sustainable agriculture.

Based on the analysis of the focused properties' profile for rural credit, it is appropriate to analyze the degraded pasture area by dividing the properties into three groups:

1) Producers with a credit history who are on a sustainability journey;

2) Producers with a credit history who are not on a sustainability journey; and

3) Producers with no rural credit history.

Table 1 summarizes these results, showing that only 3.2% of properties have a history of contracting credit with the potential for reducing negative environmental externalities in agricultural activity, a group whose degraded pasture area totals 80,490 ha, only 3% of the degraded pasture area on the focused properties. In other words, in a short-term scenario in which the properties in Group 1, which are more inclined to adopt good practices, were to restore their pasture areas, it would be possible to expect a small portion of the problem to be solved.

Table 1 - Focused properties distributed in groups by credit profile

Group	Descrição	Number of CARs	Degraded area (ha)
Group 1	Producers with a credit history who are classified as being on a path to sustainability	6,492 (3.2%)	80,490.1 (3%)
Group 2	Producers with a credit history who are classified as not being on a path to sustainability	24,256 (11.9%)	548,201.3 (20.5%)
Group 3	No history of contracting credit	173,012 (84.9%)	2,039,715.3 (76.4%)

Source: prepared by Agroicone based on Sicor/BCB data and on the methodology developed by Lobo, Vicari & Harfuch (2024). Updated on September 30, 2025

Group 2, which contains 11.9% of the focused properties, totals 548,201 ha of degraded pasture, accounting for 20.5% of the total. Reflecting on this group's role and capabilities in the pasture recovery process, one can consider the positive aspect that these properties are already part of the credit market,

having broken down entry barriers such as documentation, knowledge of the process, and risk aversion. These properties offer short- to medium-term potential, varying according to the producers' propensity to incorporate pasture recovery practices. To achieve this goal, it is essential to connect ATER with these producers. Thus, Groups 1 and 2, combined, allow for a more agile response to the problem, generating an outlook for correcting 23.5% of the degraded area.

Group 3, in turn, is the largest and most challenging one on the agenda, given the number of properties (173,012; 84.9%), degraded pasture area (2 million ha; 76.4%), dispersion of properties across the territory, and the fact that these producers are not integrated with rural credit[11]. The outlook for incorporating credit into this group tends to be medium to long term, requiring other enabling conditions, which involve the coordinated action of agricultural policy instruments (credit, ATER, institutional procurement, etc.) and other structural public policies.

In order to understand the groups, distributing the properties by degradation range, socioeconomic profile, and public, Figure 11 can be examined. It is noteworthy that most properties are in the lowest degradation range (percentage of degraded pasture area compared to the CAR area lower than 25%), with uniform distribution consistent with the increase in the other ranges. Regarding socioeconomic conditions, two patterns are observed across the IDR-CAR quartiles: in the group with low degradation, a decreasing distribution among the quartiles; and in the other ranges, an increasing distribution, with more producers concentrating in ranges with a higher level of rural development.

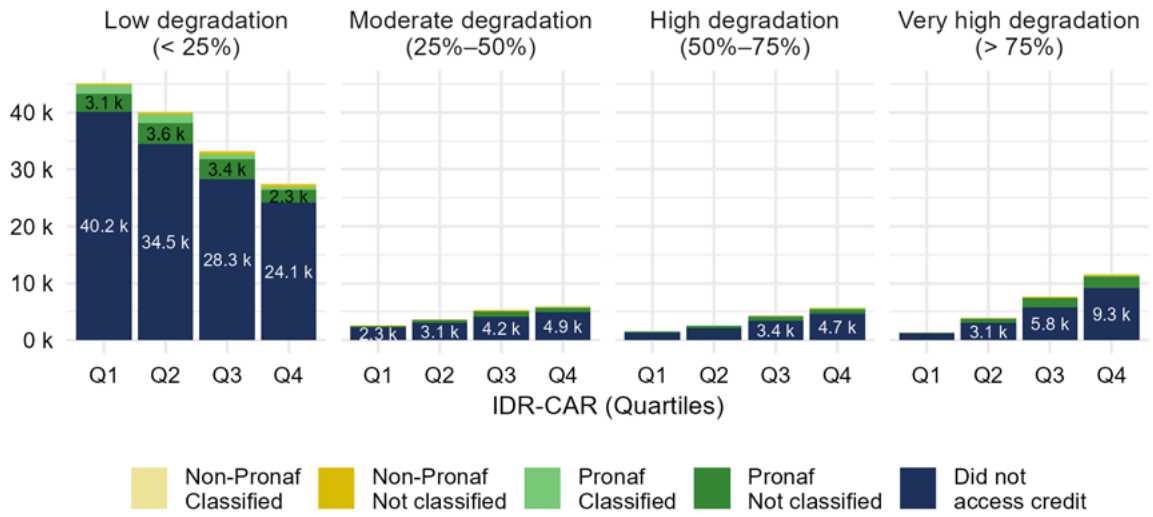
In the credit contracting profile, two nuances are observed across the groupings: i) in the segment of producers with low degradation, there is a relatively homogeneous distribution among credit applicants, with the fact that most of the Pronaf beneficiaries on a sustainability journey are concentrated in the lower quartiles of rural development being noteworthy; ii) in the other degradation levels, credit applicants (mostly not classified as aligned with sustainability journey) appear in the upper quartiles of the IDR-CAR.

The findings demonstrate that producers in the most severe situation regarding degradation are less engaged in sustainable practices via financing. This should be viewed with concern, given the environmental and socioeconomic risks involved in the maintenance and continuation of degradation processes. Furthermore, within these groups, properties in the lower development quartiles—and, in general, those with no history of contracting rural credit—

[11]It is important to note that this conclusion is based on data available from Sicor/BCB and that certain sources of funds do not have CAR records in the system, meaning that CARs in this group may have credit contracts and provide private credit financing (databases that are not publicly available).

are a cause for concern. This indicates a potential high social vulnerability and a lack of access to instruments for sustainable productive development.

Figure 11 - Number of focused properties by percentage of degradation, rural development range (IDR-CAR), and rural credit profile, by audience (Pronaf vs. Non-Pronaf)



Source: prepared by Agroicone based on data from Sicor/BCB, the PNCPD Prioritization Plan (Brazil, 2024), and the methodologies for credit ranking in terms of sustainability (Lobo, Vicari, and Harfuch, 2024) and IDR-CAR (Vicari, Lobo, and Harfuch, 2025). Updated on September 30, 2025

Even though 6,492 properties were surveyed in Group 1, not all of these properties had specific credit lines, products, or practices aimed at restoring degraded pastures. Of the total number of properties in this group, it was found that around 2,100 properties (32.8%) fell into this latter category, with a 22.6% in Pronaf and 68.8% in non-Pronaf properties. These figures suggest that there is still room for improvement within this group, which represents opportunities for ATER measures to support credit channeling.

With regard to Group 2, it is worth analyzing the properties' profiles in terms of their biophysical suitability for degraded pasture recovery/conversion, in accordance with the Prioritization Plan (Brazil, 2024). Figure 12 shows the distribution of the number of properties by potential production practice/system, segmented by percentage of degradation ranges and rural development, according to the IDR-CAR.

It is noticeable that in all combinations, Agroforestry Systems, intensification of beef cattle farming, and intensification of dairy farming predominate as the most suitable systems/activities for pasture recovery/conversion. Conversion to agriculture (soybeans), integrated systems, and commercial

forestry, in turn, appear as less suitable systems for this group, most likely because these are smaller properties (up to 4 MF). The high number of indications in the group of properties with the highest degradation range suggests that these properties have greater potential and can benefit from various systems/practices to promote recovery/conversion.

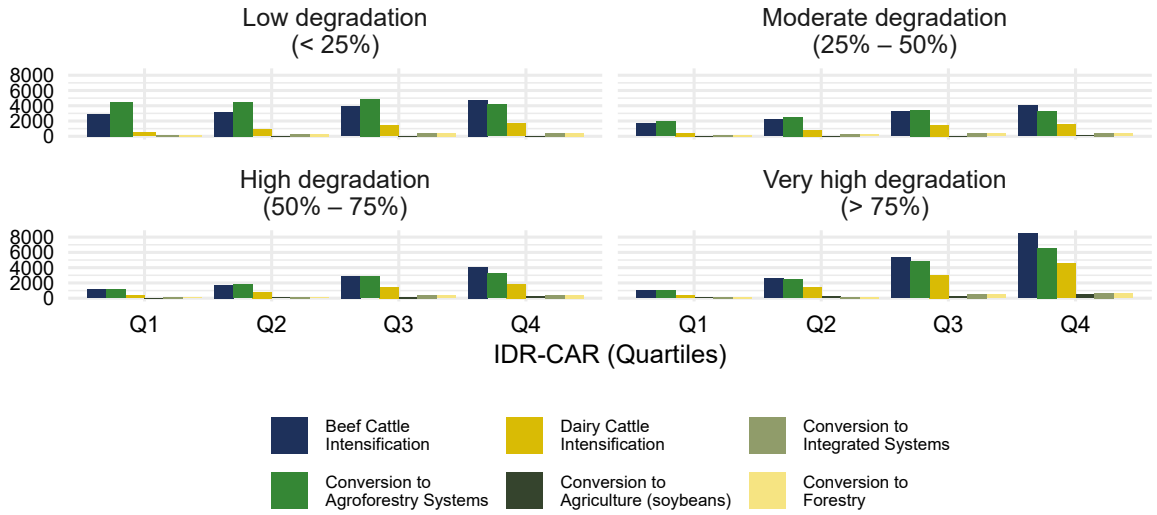
Figure 12 - Number of focused properties with a history of rural credit not included in the sustainability journey, by degradation range, rural development range (IDR-CAR), by production system suitable for conversion, and audience (Pronaf x Non-Pronaf)

Source: prepared by Agroicone based on data from Sicor/BCB, the PNCPD Prioritization Plan (Brazil, 2024), and the methodologies for credit ranking in terms of sustainability (Lobo, Vicari, and Harfuch, 2024) and IDR-CAR (Vicari, Lobo, and Harfuch, 2025). Updated on September 30, 2025

It should be noted, however, that these practices/systems become more frequently indicated as the degraded area increases compared to the CAR area, suggesting their potential in more complex situations. A comparison between the Pronaf and non-Pronaf groups also reveals a greater concentration in the potential for intensifying beef cattle ranching, as well as greater prominence of conversion to agriculture (soybeans) and the ILP system for the non-Pronaf group, also likely reflecting the relatively larger size of the properties (even though they have up to 4 MF).

Finally, in Group 3, with no history of credit contracting, the pattern shown in Figure 13 is noted, with no nuances regarding distribution of potential aptitudes in Group 2. As previously stated, this group should be worked with in the medium to long term for integrating it into the agricultural policy. Even so, mapping productive potential for pasture recovery is an important tool, which is useful for guiding efforts to direct credit and ATER in interventions for productive transition.

Figure 13 - Number of focused properties without a history of rural credit, by degradation range, rural development range (IDR-CAR), and by production system suitable for conversion



Source: prepared by Agroicone based on data from Sicor/BCB, the PNCPD Prioritization Plan (Brazil, 2024), and the methodologies for credit ranking in terms of sustainability (Lobo, Vicari, and Harfuch, 2024) and IDR-CAR (Vicari, Lobo, and Harfuch, 2025). Updated on September 30, 2025

MAIN FINDINGS AND STRATEGY

The performed analyses resulted in findings that are relevant for designing strategies that can guide federal, state, and municipal public policies, as well as private policies, third sector policies, and partnership arrangements in Pará State. Some findings can be summarized as follows:

- Small rural properties, mostly linked to family farming, account for a significant portion of pasture degradation in Pará state and play a strategic role in solving the environmental problems of cattle ranching: the degraded pasture area totaled 6.6 million ha in the state's 276.7 thousand CARs (2022). In the 203.8 thousand properties with up to 4 MF and at least one hectare of pasture (focused property group), the degradation area reaches 2.7 million ha, or 40,7% of the total;

- Mapping the territory is essential for diagnosing the situation, helping to understand the overall picture and the priority regions for the recovery agenda: on the focused properties, 50% of the degraded pasture area is distributed across 12 municipalities, concentrated in the southeastern portion of the state: São Félix do Xingu (151,900 ha), Marabá (141,200 ha), Santa Maria das Barreiras (133,500 ha), Conceição do Araguaia (128,800 ha), Santana do Araguaia (112,400 ha), Eldorado do Carajás (111,500 ha), Novo Repartimento (104,800 ha), São Geraldo do Araguaia (98,900 ha), Água Azul do Norte (95,500 ha), Piçarra (89,700 ha), Floresta do Araguaia (83,500 ha), Tucumã (74,900 ha);

- In family farming, reduced availability of land is an issue that demands greater attention, given that degradation processes tend to expose producers to greater productive, environmental, and socioeconomic risks: 39,200 (19.2%) of all focused CARs in the state have more than 50% of the CAR area with pasture in some degree of degradation. Municipalities such as São Geraldo do Araguaia and Piçarra stand out with average percentages above 70%;

- A more holistic analysis of the pasture degradation scenario, considering socioeconomic dimensions, is essential for defining more effective strategies for solving the problem. Certain vulnerabilities persist in the

state in the context of the focused properties, which gives rise to the need to guide other agricultural policy instruments, as well as other public policies, in the pursuit of sustainable rural development: with regard to the socioeconomic characteristics analyzed in the context of the focused properties, based on the IDR-CAR, the profile is generally marked by shortcomings in the literacy of the rural population (Education dimension, with an average of 0.83 in the indicator, a value considered low, given that it only measures the ability to read/write); deficient access to water, as well as to waste and sewage disposal equipment (collective infrastructure dimension, with an average of 0.39); regions with still low adequacy of dwellings, with access to bathrooms, and access to piped water (infrastructure dimension, with an average of 0.9) and income at a medium to low level (income dimension, with an average of 0.58);

• The outlook for family farmers in Pará in terms of access to key public policies for sustainable transition causes concern, as is the extent of pasture recovery and conversion practices in this group: analyzing farmers' access to the main agricultural policy instruments for production system transitions, the situation for family farming establishments in the state causes concern, given that only 6.1% declared access to credit and 4.7% responded that they had received technical guidance (Agricultural Census/IBGE, 2017). Furthermore, only 4% declared the use of pasture recovery practices, such as limestone and other soil correctors. In an analysis of the focused properties alone, 30,700 (15.1%) properties took out credit at least once. The peak was in the 2022/23 harvest, with 11,000 CARs taking out credit, which accounts for only 5.4% of the total, followed by a downward trend in subsequent harvests.

• The trajectory of the still small group of targeted properties included in the credit policy presents important nuances for the policy. Both Pronaf and other credit programs showed a growing trajectory in the volume contracted, with an increase in non-Pronaf beneficiaries over the harvests and an oscillating trajectory among Pronaf beneficiaries: of the 30,700 properties with a credit history, 26,300 (85.4%) are beneficiaries of the Pronaf and 4,500 (14.6%) are not, demonstrating that, within the same land tenure structure (up to 4 MF), there are different producer profiles (family and non-family). This distinction is also reflected in contracting profiles and reveals important patterns to be considered in the agenda for the recovery of degraded pastures.

  o The volume of credit contracted by the target audience between 2019/20 and 2024/25 harvests was R$ 9.3 billion, with R$ 4.2 billion (45.7%) in Pronaf and R$ 5 billion (54.3%) in other programs. In both groups, the trend is upward;

- While in the non-Pronaf group there was growth in the number of properties contracting credit over the harvests in Pronaf, an oscillating trend was observed. Also regarding the entry and retention of properties within the credit policy, the pattern in Pronaf is one of increased property retention, coupled with a decrease in the rate of new producers entering the program; among non-Pronaf beneficiaries, there is stability in the entry of new producers and an increase in the retention of existing producers.

- In the focused properties, Pronaf is targeted almost entirely on livestock, with 89.1% of the funds going to purchasing cattle and 10.9% to real investments in improvements for production systems;

- Among non-Pronaf beneficiaries, a more balanced use of credit was noted between agriculture and livestock, with percentages of 46.8% and 53.2% throughout the period, respectively. R$ 2.1 billion (89.7%) of the R$ 2.6 billion allocated to livestock farming was used for purchasing cattle, which represents a real investment rate (improvements in farms) of 11.2% for the period.

- Within the contracted credit, family farmers are less involved in the journey towards sustainable agriculture and livestock ranching than non-Pronaf beneficiaries. In the 2024/25 harvest, the proportion of credit with the potential for mitigating negative environmental externalities in Pronaf was 10.3%, while it was 37.9% in non-Pronaf beneficiaries.

• **Considering properties with a history of credit contracts, there is an opportunity for responding to the problem in the short and medium term, with the potential to reach 23.5% of the focused properties' degraded area; the remaining area (76.5%) depends on combined medium- to long-term actions, creating conditions for a fair climate transition:** 6,400 (3.2%) producers with a history of credit for interventions with sustainable potential, totaling 80,400 ha (3%) of degraded pasture area; ii) 24,200 (11.9%) producers with a history of credit, but not classified as having sustainable potential, totaling a degraded area of 548,200 ha (20.5%); and iii) 173,000 producers (84.9%) without a history of rural credit, concentrating the largest area of degraded pasture, 2 million ha.

In order to leverage the mapping effort and the findings of the study, a public policy plan was also drawn up to coordinate actions in the territory, with a view to accelerating the degraded pasture recovery process n small properties. The planning is based on the defined groups, as well as the segmentation into subgroups, based on the degradation profile and socioeconomic conditions.

This plan sought to prioritize regions and municipalities with a minimum number of properties in the subgroup (100 properties) and a minimum area of degraded pasture for intervention, in order to address the problem of high territorial dispersion and enable the coordination of focused actions. For each group and subgroup, actions related to agricultural policy instruments were listed, as well as other ancillary public policies that address the conditions surrounding the development of family farming and small rural properties, as discussed throughout the study. The result of this planning can be found in Table 1 in the Appendix.

Finally, this study concludes that it is important to make efforts to correct the cattle ranching trajectory, especially in the context of small properties, given the negative environmental, economic, and social effects resulting from pasture degradation. It is known that this activity is well established and relevant to this segment of the Brazilian countryside, as evidenced by its capillarity in family farming, the occupied area, and its role in generating income for families. This study emphasizes the importance of understanding the degradation problem from a holistic perspective, considering socioeconomic aspects for defining strategies to support producers. It is based on the understanding, corroborated by several findings in this study, that producers' heterogeneity must be taken into account in designing such strategies, given that not all policy instruments, such as rural credit, tend to work or have the expected effectiveness in all contexts. Therefore, coordinating actions in an intersectoral and territorial manner becomes a fundamental requirement for family farming to advance toward a fair transition, aiming at sustainable development.

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Strategies for recovering/converting pastures in small properties (CARs up to 4 MF) in Pará

Group 1 – Properties with a history of contracting credit in a sustainability journey			
Number of properties	Degraded pasture area	General characteristics	Priority objectives
6,492 (3.2%)	80.4 thousand ha (3%)	Group with a low number of properties, not justifying further divisions for planning purposes. Low percentage of the focused audience's total degraded area	1. Keep producers on the path to sustainability by providing credit for interventions with sustainable potential 2. For producers who do not carry out interventions for pasture recovery and conversion via credit, encourage contracting subprograms and products for this purpose

Territorial Planning				
Group	Integration Region	Priority Municipalities (number of properties)	Strategies for agricultural policy	Strategies for other public policies
	Guamá	São Domingos do Capim (261)	1. Encouraging continued credit contracting in subprograms and products with sustainable potential 2. Especially in the Acará, Capanema, Dom Eliseu, Garrafão do Norte, Medicilândia, Moju, Novo Repartimento, Placas, São Domingos do Capim, Tailândia, Tomé-Açu, Uruará municipalities, ATER should be directed to channel credit contracts for the specific purpose of pasture recovery and conversion, given that in these municipalities there is still several producers with no history of such practices (<50%)	1. Strengthening public policies in all municipalities, focusing on education, infrastructure, and income
	Lago Tucuruí	Goianésia do Pará (108); Novo Repartimento (108)		
	Rio Caeté	Viseu (141); Capanema (124); Santa Luzia do Pará (114)		

Territorial Planning				
	Rio Capim	Dom Eliseu (116); Rondon do Pará (140); Capitão Poço (120); Tomé-Açu (438); Garrafão do Norte (130); Irituia (100)	3. General suitability for intensification of beef cattle farming and agroforestry systems; in the municipalities of Dom Eliseu and Rondon do Pará, suitability for intensification of dairy ranching; 4. In all municipalities, strengthening other programs related to agricultural policy, such as food acquisition programs (PAA and PNAE);	
	Tocantins	Moju (434); Tailândia (184); Acará (800)		
	Xingu	Uruará (234); Placas (103); Medicilândia (220)		
	Guamá	São Domingos do Capim (261)		

Group 2 – Properties with a history of credit contracting, but not classified as sustainable			
Number of properties	Degraded pasture area	General characteristics	Priority objectives
24,256 (11.9%)	548.2 thousand ha (20.5%)	Group with a significant area of degraded pasture and a concentrated pattern in the territory.	1. Include producers in the journey towards sustainability in rural credit, with a focus on recovering degraded pastures; 2. For producers in the High/Very High Degradation subgroups (2.1 and 2.2 below), urgency in the recovery process, in order to avoid further environmental, economic, and social damage; 3. For producers in the Medium/Low Degradation subgroups (2.3 and 2.4 below), intervention for preventing the progression of pasture degradation;

APPENDIX

Territorial Planning					
Sub Group	Integration Region	Priority Municipalities (number of properties)	Degraded pasture area	Strategies for agricultural policy	Strategies for other public policies
2.1 High/ Very high Degradation and Medium/ Low IDR-CAR	Araguaia	Conceição do Araguaia (255); Floresta do Araguaia (182)	21.3 thousand ha	**Transversal actions** 1. Encouraging more properties to be included in rural credit programs; 2. ATER for assisting producers, providing guidance throughout the process, contracting investment credit for the purpose of recovering and converting degraded pastures, as well as for implementing the intervention itself; **Specific actions** 3. General suitability for intensification of beef cattle farming, dairy farming, and agroforestry systems, especially in the Carajás, Araguaia, and Lago Tucuruí regions; 4. Strengthening institutional purchasing policies (PAA and PNAE) aimed at improving producers' income in subgroups 2.1 and 2.3;	**Transversal actions** 1. Strengthening of public policies related to rural collective infrastructure (low level throughout the state); 2. Investments in logistic infrastructure to enable, in the medium and long term, the acquisition of supplies and access to markets; **Specific actions** 2. Public policies for strengthening producer education, such as Youth and Adult Education (EJA) in rural areas, especially in municipallities such as Água Azul do Norte, Santa Maria das Barreiras, Santana do Araguaia, São Felix do Xingu, Eldorado dos Carajás, Marabá, Piçarra, Itupiranga, Novo Repartimento; 3. Complementary public policies to strengthen income and income transfers in all municipalities;
2.2 High/ Very high Degradation and High/Very high IDR-CAR	Araguaia	Santa Maria das Barreiras (295); Santana do Araguaia (254); Água Azul do Norte (257); Xinguara (260); São Felix do Xingu (212); Rio Maria (233); Floresta do Araguaia (254); Tucumã (190); Conceição do Araguaia (237); Bannach (103)	16.1 thousand ha		
	Carajás	Eldorado dos Carajás (684); São Geraldo do Araguaia (368); Piçarra (456); Marabá (512); Canaã dos Carajás (105)	100.6 thousand ha		
	Lago Tucuruí	Itupiranga (182); Novo Repartimento (136)	15.7 thousand ha		
2.3 Medium/ Low Degradation and Medium/ Low IDR-CAR	Araguaia	São Felix do Xingu (477); Santa Maria das Barreiras (238); Santana do Araguaia (188); Tucumã (114); Floresta do Araguaia (113); Conceição do Araguaia (113); Xinguara (100)	24.3 thousand ha		

Group 3 – Properties with no history of credit contracting			
Number of properties	Degraded pasture area	General characteristics	Priority objectives
173,012 (84.9%)	2 million ha (76.4%)	A Group with a large number of properties and a significant degraded pasture area. A Group with heterogeneous characteristics and high dispersion across the territory. Producers not included in the credit policy.	1. Identify producer profiles and possible reasons for pasture degradation processes; 2. Work in an integrated manner on agricultural policies and other public policies, aiming to include producers in more sustainable cattle ranching; 3. Encourage producers to access credit, combined with Technical Assistance;

Territorial Planning					
Sub Group	Integration Region	Priority Municipalities (number of properties)	Degraded pasture area	Strategies for agricultural policy	Strategies for other public policies
3.1 High/ Very High Degradation and Medium/ Low IDR-CAR	Araguaia	Conceição do Araguaia (1180); Floresta do Araguaia (286); Água Azul do Norte (257); Santana do Araguaia (160); São Felix do Xingu (104); Pau D'Arco (188)	89.3 thousand ha	Transversal actions 1. Provide the required conditions for accessing credit, working on actions related to land and environmental compliance, access to documentation, production management, risk aversion, and others.	Transversal actions 1. Strengthening of public policies related to rural collective infrastructure (low level throughout the state);
	Lago Tucuruí	Novo Repartimento (377); Goianésia do Pará (306); Breu Branco (262); Itupiranga (163); Jacundá (144); Nova Ipixuna (165)	65.2 thousand ha		
	Carajás	Marabá (421); São Domingos do Araguaia (303); Palestina do Pará (155); Eldorado dos Carajás (127); São João do Araguaia (120)	45.9 thousand ha		

Territorial Planning					
3.2 High/ Very High Degradation and High/ Very High IDR-CAR	Araguaia	Santa Maria das Barreiras (1534); São Felix do Xingu (1178); Santana do Araguaia (884); Água Azul do Norte (844); Xinguara (832); Rio Maria (658); Tucumã (718); Conceição do Araguaia (926); Floresta do Araguaia (486); Cumaru do Norte (392); Redenção (599); Ourilândia do Norte (410); Bannach (239)	541.3 thousand ha	2. Activate credit for producers, combining it with ATER actions throughout the process, directing the contracting of investment credit for the purpose of recovering and converting degraded pastures, as well as for implementing the intervention itself; Specific actions 3. Strengthen institutional procurement policies (PAA and PNAE), especially for regions such as Araguaia, Lago Tucuruí, Carajás, Baixo Amazonas e Xingu;	2. Investments in transportation infrastructure, to enable, in the medium and long term, the acquisition of inputs and access to markets; Specific actions 3. Public policies for strengthening producers' education, such as Youth and Adult Education (EJA) in rural areas, especially in regions such as de Araguaia, Lago Tucuruí, Carajás, Baixo Amazonas e Xingu; 4. Complementary public policies for strengthening income and income transfers in regions such as Araguaia, Lago Tucuruí, Carajás, Baixo Amazonas e Xingu;
	Carajás	Eldorado dos Carajás (1675); São Geraldo do Araguaia (1191); Marabá (1393); Piçarra (1307); Canaã dos Carajás (683); Bom Jesus do Tocantins (370); São João do Araguaia (435); Brejo Grande do Araguaia (256); São Domingos do Araguaia (248); Parauapebas (230); Curionópolis (135)	339.5 thousand ha		
	Lago Tucuruí	Novo Repartimento (558); Itupiranga (471); Jacundá (237); Nova Ipixuna (267); Goianésia do Pará (202); Breu Branco (130)	85.3 thousand ha		
	Xingu	Altamira (648); Pacajá (138)	46 thousand ha		
	Rio Capim	Rondon do Pará (200); Ulianópolis (216); Paragominas (148); Dom Eliseu (151)	30.2 thousand ha		
3.3 Medium/ Low Degradation and Medium/ Low IDR-CAR	Baixo Amazonas	Monte Alegre (4767); Prainha (2837); Alenquer (2120); Almerim (1278); Mojuí dos Campos (792); Óbidos (1836); Terra Santa (574); Oriximiná (1238); Santarém (693); Juruti (486); Faro (428); Belterra (261); Curuá (271)	51.5 thousand ha		

Territorial Planning					
3.3 Medium/ Low Degradation and Medium/ Low IDR-CAR	Lago Tucuruí	Novo Repartimento (2517); Breu Branco (1189); Itupiranga (1147); Goianésia do Pará (816); Tucuruí (422); Nova Ipixuna (262); Jacundá (102)	44.8 thousand ha		
	Xingu	Pacajá (2553); Senador José Porfírio (1361); Anapu (2053); Uruará (2490); Vitória do Xingu (290); Brasil Novo (693); Placas (1337); Altamira (589); Porto de Moz (765); Medicilândia (1672)	32.1 thousand ha		
3.4 Medium/ Low Degradation and High/ Very High IDR-CAR	Araguaia	São Felix do Xingu (4039); Santa Maria das Barreiras (1446); Santana do Araguaia (686); Conceição do Araguaia (1007); Tucumã (939); Água Azul do Norte (440); Floresta do Araguaia (387); Redenção (583); Xinguara (339); Ourilândia do Norte (503); Cumaru do Norte (375); Rio Maria (286); Bannach (190); Pau D'Arco (109)	144 thousand ha		
	Lago Tucuruí	Novo Repartimento (3144); Itupiranga (1482); Goianésia do Pará (696); Nova Ipixuna (428); Breu Branco (528); Jacundá (273); Tucuruí (295)	54.4 thousand ha		
	Carajás	Marabá (2309); Eldorado dos Carajás (707); São Geraldo do Araguaia (314); Canaã dos Carajás (495); Parauapebas (669); Piçarra (350); Bom Jesus do Tocantins (241); São João do Araguaia (478); São Domingos do Araguaia (182); Curionópolis (121)	53.7 thousand ha		
	Xingu	Altamira (1659); Pacajá (2139); Brasil Novo (1374); Vitória do Xingu (851); Uruará (1257); Placas (1231); Anapu (355); Medicilândia (1521)	48.1 thousand ha		

Degraded Pastures on Small Properties in **Pará** State

Pasture degradation is a multifaceted problem with negative environmental, economic, and social effects that impact the community and the producers' lives. The study analyzed the degraded pasture scenario in Pará State, focusing on small rural properties from a holistic perspective, assessing the socioeconomic context, integration into agricultural policy, and suitability for pasture recovery and conversion using sustainable production systems.

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