



# LESSONS LEARNED

from Environmental Programs  
and Projects Implemented in the  
Guariroba Stream Basin/MS





# HIGHLIGHTS

**PRACTICAL TRAINING AND IMPLEMENTATION OF DEMONSTRATION UNITS MUST BE TAKEN INTO ACCOUNT TO EXPAND LOCAL ADHERENCE**



**INCLUSION AND PARTICIPATION OF LOCAL ACTORS IN ALL STAGES OF THE PROJECTS TO INCREASE IMPLEMENTATIONS ENGAGEMENT AND SUCCESS**

**CONNECTION, WHENEVER POSSIBLE, BETWEEN ACTIONS OF PROJECTS AND PROGRAMS TO BE IMPLEMENTED TO OBTAIN BETTER RESULTS**

**CONTINUITY OF PROJECTS INCREASES THE COMMITMENT OF RURAL PRODUCERS**



**EVALUATION OF THE PROFILE AND APTITUDE OF THE REGION DURING PROJECT PLANNING AND FOR DEFINITION OF TECHNIQUES TO BE IMPLEMENTED SHOULD BE ONE OF THE FIRST STEPS**



**SHARING LESSONS LEARNED, WHETHER OF SUCCESS OR NOT, HELPS GUIDE FUTURE PROJECTS**

**INCLUSION OF MAINTENANCE AND MONITORING ACTIONS IN THE PROJECTS, CONTAINING RESOURCES FOR REPLANTING DUE TO BAD WEATHER**

**SUPPORT FOR THE BASIC INFRASTRUCTURE OF THE REGION NEEDS TO BE CONSIDERED, PRIOR TO OR CONCOMITANTLY WITH RESTORATION IMPLEMENTATIONS**



**PLANNING AND IMPLEMENTATION ACTIONS SHOULD BE BASED ON SCIENTIFIC DATA**



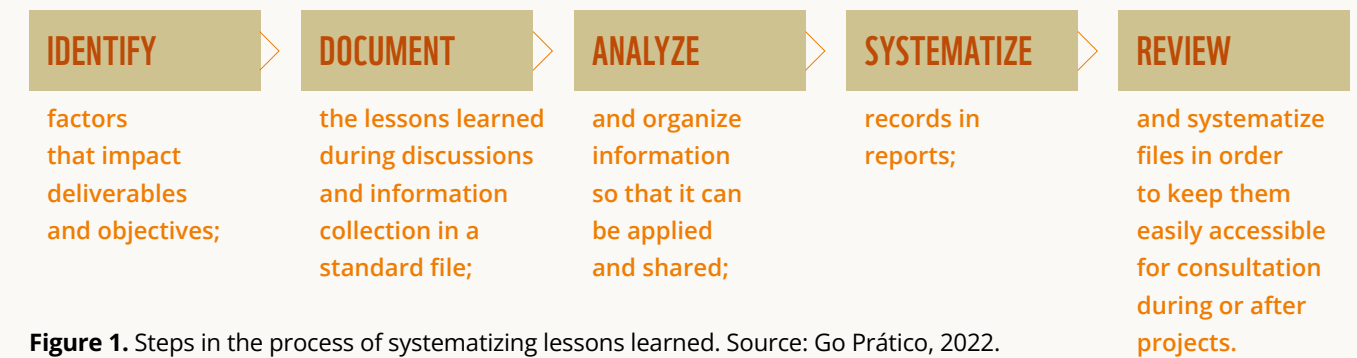
1.

# EXECUTIVE SUMMARY

The Guariroba stream watershed region in Campo Grande, Mato Grosso do Sul (MS), has been the subject of studies and environmental conservation projects since 2010. From this history, the initiative emerged to raise and systematize the results of different programs and projects already carried out, analyzing the lessons learned (with a focus on governance and technologies) - which can be replicated in other places, such as the Pantanal Headwaters landscape.

**Lessons learned are knowledge acquired through the analysis of past positive and/or negative experiences, in order to maintain or expand the quality of future actions, promoting continuous improvement, replicating successful actions or avoiding the recurrence of errors.**

Focused on projects and initiatives, the process of systematizing lessons learned covers five steps (Go Prático, 2022) to:



**Figure 1.** Steps in the process of systematizing lessons learned. Source: Go Prático, 2022.

Secondary surveys, analysis of programs, projects and activities developed in Guariroba, as well as remote meetings with key actors (WWF-Brazil, **ARCP**, **SEMADUR** and **UFMS**) were carried out to prepare this document. The results are systematized below.

**ARCP** Association for the Recovery, Conservation and Preservation of the Guariroba EPA  
**SEMADUR** Municipal Secretary of Environmental and Urban Development  
**UFMS** Federal University of Mato Grosso do Sul



2.

# SCOPE: The Pantanal Headwaters and the Guariroba basin

The landscape known as Pantanal Headwaters encompasses part of the states of Mato Grosso (MT) and Mato Grosso do Sul (MS), being composed of 85 municipalities and 16 sub-basins (figure 2). Most of the Headwaters is inserted in the Cerrado Biome (84%), although a part of it, located in Mato Grosso, is in the Amazon Biome (16%). **Both biomes are under intense anthropogenic pressure and ecological risk due to changes in land use and deforestation.** The plateau where the Headwaters are located provides 80% of the water that supplies the Pantanal plain, and analyses from 2022 show that from 2012 to 2022 there was a reduction of about 20% of the water bodies in the Headwaters (Mapbiomas, 2022). These data reinforce the urgency of restoring the debits of degraded (210,000 hectares) permanent preservation areas (PPAs), mainly in riparian forests and springs, in addition to legal reserves (LRs) (942,717 hectares), which need to be recomposed in compliance with the Brazilian Forest Code (Law 12,727/2012).

The Pantanal Headwaters are a priority landscape for the work of WWF-Brazil, which selected three sub-basins of great water importance to start the restoration of native vegetation and pasture rehabilitation, namely the Miranda, Jauru and Guariroba sub-basins (figure 2). The Guariroba region, even though technically outside of the Headwaters, was selected due to its history of good agricultural and environmental practices, and because it is the main source that supplies the city of Campo Grande (MS). The Guariroba basin is an Environmental Protection Area (EPA) located in the Cerrado biome, with an area of approximately 36,200 hectares, comprising 65 rural properties ranging from 48 to 5,480 hectares (table 1).

## PANTANAL HEADWATERS

85 municipalities

16 sub-basins

Amazon Biome



Cerrado Biome

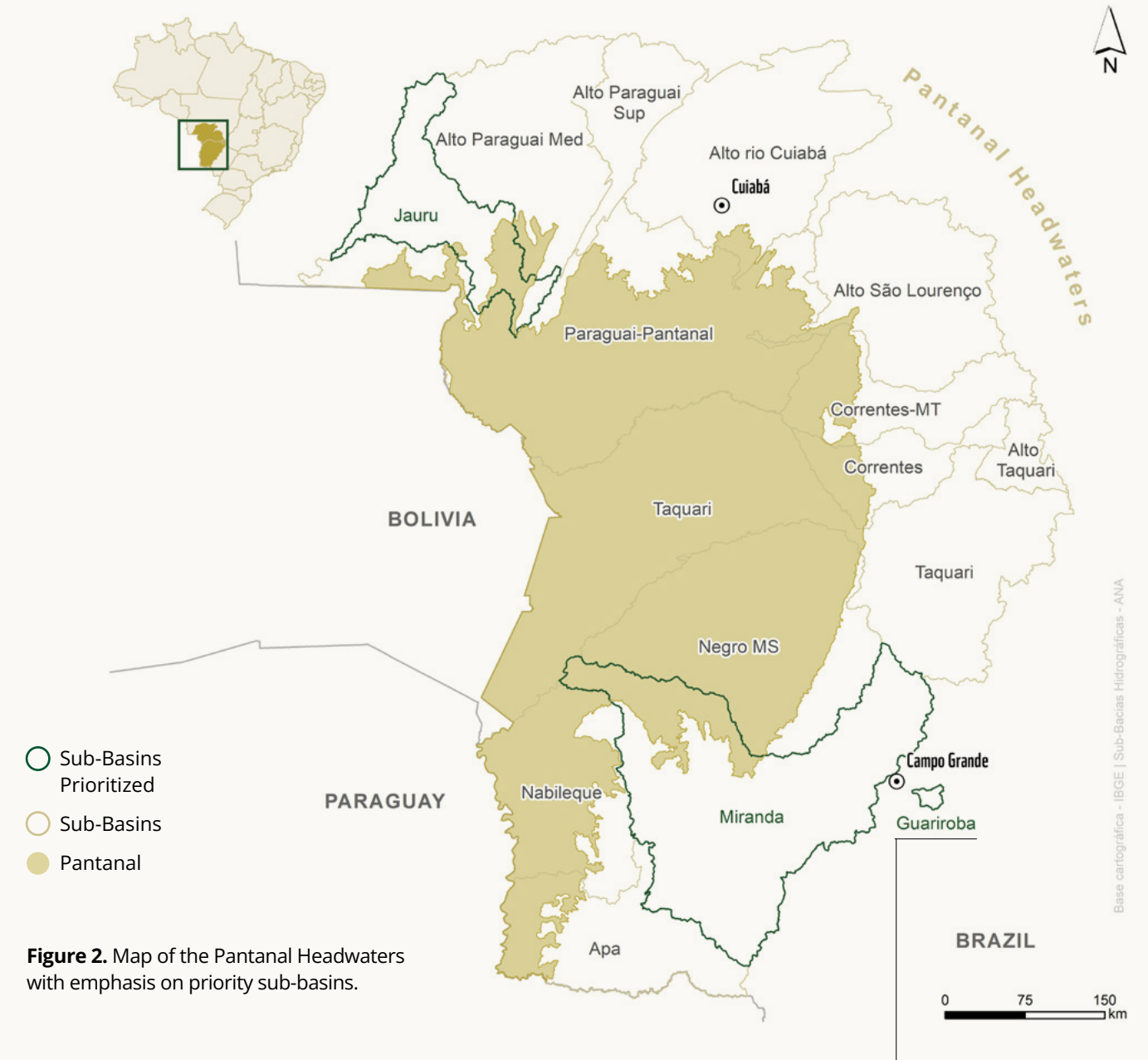


Figure 2. Map of the Pantanal Headwaters with emphasis on priority sub-basins.

## GUARIROBA BASIN

Area (ha)	Soil	Vegetation	PPA	Land use	Land structure	Characteristics of the productive area
36,200	Dystrophic Red Latosol and Quartz Neosol (Ortic RQ)	Savanna	Preserved = 1644 (ha) To recover = 709 (ha)	<p>72% de pastures 14% de native vegetation 8,5% de forestry 5,5% others</p>	65 rural properties (between 48 and 5,480 hectares)	Predominance of extensive beef cattle ranching and forestry

Table 1. Summary table with the main characteristics of the Guariroba EPA.



3.

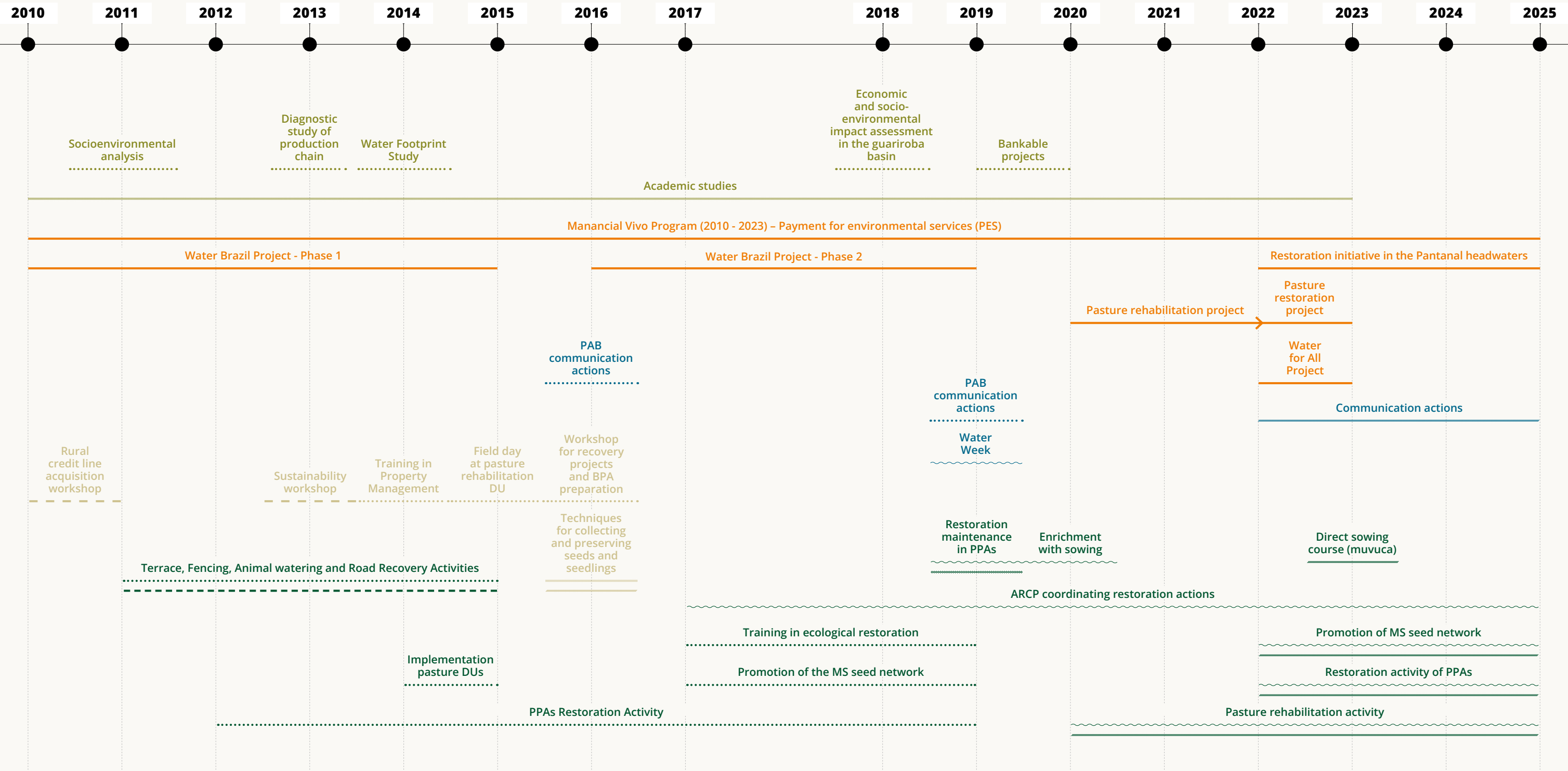
# WHAT HAS ALREADY BEEN DONE IN THE GUARIROBA BASIN

Between 2010 and 2022, seven umbrella programs and projects were identified (**table 2**) that encompass actions in the Guariroba basin, with their main focuses presented in **figure 3**. In this survey, 27 activities carried out in the field were identified, in addition to 21 studies, ten workshops and four communication events, although other actions may exist. The programs and main activities for the landscape are highlighted in a timeline (**figure 3**). For more details on the programs, activities and studies, access the QR Code at the end of this document.



**Figure 3.** Main focuses of action of the analyzed projects in the Guariroba basin.





- Activities
- Projects
- Studies
- Workshops
- Communication
- UFMS, UCDB, Embrapa Gado de Corte, Uniderp-Anhanguera
- ..... PAB
- - PMV
- ~ ARCP
- WWF-Brazil
- ..... Public Prosecutor

**Figure 4.** Timeline of projects, activities, studies and workshops developed in the Guariroba Basin. (Source: WWF-Brazil and Agroicone, 2022)..

**Table 2.** Description of the seven main umbrella projects and programs identified in the surveys carried out.

Projects/ Programs	Formal partners	Financers	Value of projects	Period	Main focuses	Scope of action
<b>Manancial Vivo (Living Spring) Program (PMV)</b>	Management Unit of the Manancial Vivo Program (UGP/PVM).*	National Water Agency, Campo Grande City Hall, Municipal Environment Fund, and rural producers	R\$ 800 thousand for interventions (Guariroba sub-basin) and R\$ 700 thousand for PES	2010 - now	Payment for environmental services for actions of water and soil conservation, ecological restoration and conservation of forest fragments.  Field implementations related to fencing and recovery of PPAs; water and soil conservation practices; and adaptation of vicinal roads.	Guariroba Basin
<b>Water Brazil Program (PAB) - Phase I</b>	Banco do Brasil, Banco do Brasil Foundation, National Water and Basic Sanitation Agency and WWF-Brazil.	Banco do Brasil and Banco do Brasil Foundation	R\$ 62.7 million	2010 - 2015	Governance development; soil conservation and pasture rehabilitation actions; PPA restoration; and training.	National
<b>Water Brazil Program (PAB) - Phase II</b>	Banco do Brasil, Banco do Brasil Foundation, National Water and Basic Sanitation Agency and WWF-Brazil.	Banco do Brasil and Banco do Brasil Foundation	R\$ 13 million	2017 - 2019	Development of governance; restoration of PPA; training and promotion of the seed network.	National
<b>Rehabilitation of Degraded Pastures Project</b>	WWF-Brazil, Guariroba Basin Recovery, Conservation and Preservation Association (ARCP) and rural producers	European Union and rural producers	R\$ 514 thousand	2020 - 2023	Promotion of technical assistance for rehabilitation of degraded pastures.	Guariroba Basin
<b>Technical Assistance Project and Good Livestock Production Practices</b>	ARCP, AGRAER, SENAR/MS, Embrapa Gado de Corte and rural producers	SENAR/MS and rural producers	Not available	2021 - 2022	Promotion of technical assistance in good livestock production practices.	Guariroba Basin

\* Unit formed by several institutions, divided between technical commission and judging commission. The members of committees are appointed every 2 years, and may be reappointed due to the interest of each participating institution.

Projects/ Programs	Formal partners	Financers	Value of projects	Period	Main focuses	Scope of action
<b>Water for All Project</b>	Aegea Saneamento e Participações S.A., WWF-Brazil and ARCP	Aegea	R\$ 2.86 million	2022-2023	Water modeling and definition of priority areas for restoration; socioeconomic assessment of land use change; mapping of actors; systematization and replication of lessons learned; action plan aimed at sustainable water use, and implementation of restoration.	Pantanal Headwaters and Guariroba basin
<b>Restoration Initiative in the Pantanal headwaters</b>	WWF-Brazil, WWF-Japan, WWF-USA, Tapestry Foundation, ARCP and Serra da Bodoquena Waters Institute (IASB)	WWF-Japan	R\$ 1.5 million	2022-2024	Creation of enabling conditions for the restoration chain (training, engagement and seed network); implementation and monitoring of restoration and rehabilitation of pastures; and communication actions.	Pantanal Headwaters and Guariroba basin
		Tapestry Foundation	R\$ 2.0 million	2022-2025		



4.

# DESCRIPTION OF LESSONS LEARNED

## 4.1 GOVERNANCE



### LESSON 1

**Establish a technical and independent management group to increase efficiency and agility in project planning and execution.**

Initially, the Guariroba EPA\* Steering Committee was responsible for forwarding actions related to the Manancial Vivo Program (PMV). However, these actions were only part of one more agenda in the management of the EPA and often had no direct relation with the actors and organizations present at the Steering Committee meeting. With the beginning of the Water Brazil Program (PAB), an independent Participatory Management Unit (UGP) was established, which became responsible for managing the activities and resources of both the PMV and the PAB itself. **This UGP was formed by technical actors directly involved with the activities in the field, and it managed to direct practical actions within an effective, fluid and dynamic management structure**, which had not previously happened.



### LESSON 2

**Presence of local actors at all times of the projects to promote engagement and establish trusting relationships.**

The PAB started its actions in the Guariroba basin in 2010, but the first activities of the program were carried out by outsourced companies that did not know the local actors and reality, which resulted in difficulties to engage rural producers and, consequently, hindered the implementation of field actions. There were also delays in the schedule of activities until a local person was hired who could be at the forefront of the execution of the PAB, which occurred in 2012. **According to the ARCP, the partnership established with the Federal University of Mato Grosso do Sul (UFMS) and Embrapa Gado de Corte (Beef Cattle) was important to give credibility to the actions of ARCP and generate confidence in the producer.** It is therefore suggested that local actors be involved in the planning, coordination and monitoring of programs and projects and that, whenever possible, there be a local institution or actor leading the implementation to facilitate engagement in the region.

\* EPA Environmental Protection Area



### LESSON 3

**Align the planning and execution schedule between local programs and projects so that activities fit and complement each other, considering the execution ability and capacity of local organizations.**

The PMV and PAB worked in Guariroba simultaneously with complementary activities. While the PMV focused on the enclosure of the PPAs and on water and soil conservation practices, with the implementation of terraces and small dams, the PAB focused on the restoration of PPAs, studies and training for producers. At the beginning of the partnership between the programs, there were difficulties in reconciling the execution schedule of each one. The PAB, for example, provided for the recovery of a certain PPA on a date that preceded the fencing and implementation of water and soil conservation practices to be carried out by the PMV, which should happen before the planting. To integrate the action schedules, a lot of dialogue between the projects and adjustment in the actions implementation dates were necessary.

Another important action was the independence of the administrative procedures for hiring third parties who would carry out the implementation of the actions. In their contracts, the techniques and number of hectares to be contemplated were determined so that the selection of the properties itself would be carried out according to the logical order of actions execution. For example: **the PMV hired 1,000 meters of fencing for the PPAs, and the PAB 10 hectares for restoration, but the definition of the properties was jointly made a posteriori**, so that the PAB would only restore in areas already fenced by the PMV.

The interviewees also highlighted a partnership with the Public Prosecutor (MP) to align the execution deadlines of the Conduct Adjustment Terms (TACs) and the Payment for Environmental Services (PES) contracts, creating synergy between the actions. They also reported receiving support from the MP to finance and implement restoration under the PMV.



### LESSON 4

**Strengthen strategic governance within the landscape, with the establishment of a common database for management and dissemination, enabling interaction between key actors in the territory.**

One of the bottlenecks to scale restoration is the absence of strategic planning and shared places where data can be made available and information exchanged between local actors. Although there was dialogue between the partners active in the projects and programs in the Guariroba EPA, **the interviewees felt the need for strategic governance within the landscape, with the establishment of a common database that could store and transmit historical data and facts.** This, according to them, would facilitate the transition processes between programs/projects in the landscape and between managers of the institutions involved, as well as the continuity of actions in the long term. WWF-Brazil, along with several institutions that operate in the Cerrado, has supported the Articulation for the Restoration of the Cerrado (Araticum) to leverage restoration in the biome focusing on intelligence, training and governance, and could assist in the demand for integrated bases and interaction between actors.





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## LESSON 5

**Decision making within the landscape based on scientific data, built in a participatory way with multiple local partners, expanding knowledge and directing implementations in the field, and also contributing to the training of human resources.**

The studies and research developed by universities and research centers can support and direct the actions of the programs in the field. For example, the "evaluation of the use of legumes in the establishment of native species in the Guariroba EPA", carried out by Embrapa Gado de Corte, and "*Which spatial arrangement of green manure is able to reduce herbivory and invasion of exotic grasses in native species?*", carried out by UFMS, pointed out systems that use green manure to favor the establishment of the assessed tree species. The PMV partnership with UFMS and PAB made it possible to use satellite images to define the best place for terrace allocation, which generated greater efficiency and cost reduction. Hydrological, sedimentological and hydrochemical studies carried out by UFMS and the utility company Águas Guariroba generate information on the impacts of field interventions, and allow monitoring the quality and quantity of water available in the watershed.

**The involvement of universities with environmental conservation projects has also contributed to the training of skilled labor in the region, which can contribute to the advancement of knowledge in the field.** In addition, the experimental areas implemented are used as field classes in various courses, as well as demonstrations to local actors of good practices that can be expanded in the region.



## LESSON 6

**Involve local institutions in the planning of projects/ programs, prior to execution, considering the local reality for producer engagement, adherence and continuity of actions in the territory.**

Actions implemented in the Guariroba basin, as well as in other locations, are focused almost exclusively on private properties. In many projects and programs, there is prior planning and identification of priority areas for implementation of interventions. However, in practice, the owners of the prioritized areas are not always sensitized, engaged and willing to receive and collaborate with the proposed interventions. Thus, it is preferable to consult and align planning with local producers and/or institutions prior to implementations, so that local actors can participate in the decision-making process, thus expanding the chances of work success. A practical example: at the beginning of the execution of the PMV and PAB, an environmental spatial diagnosis was carried out within the basin, defining priority sub-basins. However, in the case of private areas, the execution of practical activities depended on the approval of the rural producer. There was, therefore, an adaptation in the selection of areas for intervention with eliminatory and classification criteria, some of them being the interest and commitment of the rural producer.

For this reason, **it was essential to involve the ARCP (which has existed since 1996 in the Guariroba basin) in the projects for greater articulation and involvement of rural producers, communities and local organizations in the programs and projects developed.** Initially, the ARCP was not involved in the inaugural programs, a fact that was remedied in the following projects, generating more engagement and appreciation of the actions carried out in the field.



## 4.2 TECHNIQUES IMPLEMENTED



### LESSON 7

**Plan the field actions by property in order to explain what will be done and where, expanding local engagement.**

Many interventions in the field are complex and invariably include the application of various techniques, concurrently or at varying times. Thus, **it is suggested that planning by property be carried out, with the participation of the producer, in order to facilitate the understanding of the practices and their environmental repercussions**, as well as to favor the monitoring and sustainability of the actions in the long term.

An example of activity carried out in the Guariroba basin during the PMV and PAB was the development of the Property Individual Project (PIP). The PIP allowed the rural producer to have access to a detailed diagnosis of their property in order to assist in making decisions regarding the improvements necessary for their environmental adaptation and improvement of rural production. In addition, the PAB developed a customized portfolio of good agricultural practices, including ways of doing, benefits and indicators of improvement, as well as costs of implementation, with evaluation criteria that were used in the PES program. This portfolio allowed to guide the producer, in practice, on actions of soil conservation, recovery and management of pastures, Integrated Crop-Livestock-Forest (ICLF) systems, and ecological restoration. With the PIP, the producer identifies "what" to do and "where" to carry out the actions in the field, and the customized portfolio presents the "how".



### LESSON 8

**Actions aimed at the basic infrastructure of the landscape helped with the adherence of producers to good environmental practices.**

The definition of priority actions and their degrees of importance vary according to the perception of the actor. While projects and programs can focus more on ecological and landscape restoration aspects, landowners can focus on the basic infrastructure that affects their daily lives. In this sense, the precarious conditions of the roads in the Guariroba EPA hindered and sometimes prevented the passage of large loads, in addition to causing erosion and transport of sediments into rural properties and rivers at their margins, and this discouraged the adoption of best practices by the owners. Thus, actions aimed at basic infrastructure that encompassed the entire river basin, such as **the maintenance of rural roads, gave visibility to the programs and motivated producers to adopt better agricultural and environmental practices in their properties**, for example, the recovery of pastures and the restoration of PPAs. Upon seeing the maintenance of the roads, the producers realized the commitment of the programs to carry out water and soil conservation practices in the region, which expanded the engagement and practical actions within the properties.



### LESSON 9

**Only theoretical training is not enough for the engagement of producers - it is necessary to combine theory with practice.**

The need for training local actors is notorious regarding the adoption of good agricultural and environmental practices. However, many projects focus on theoretical knowledge, in the classroom, not including local skills and realities in the trainings. **At the Guariroba EPA, it was observed that pasture rehabilitation and ecological restoration projects including practical activities generate greater interest in owners/producers regarding the topics addressed.** The implementation of demonstration units also expanded the engagement of both owners/producers and the community in general in the actions of the PAB. The same happened with the adoption of terracing, for which theoretical and practical courses were carried out in the beginning of the PMV, demonstrating the importance of producers knowing and adopting the soil conservation technique. In addition, success stories lead to an awareness effect on owners/producers close to the regions covered by the programs/projects.



### LESSON 10

**Technical assistance (TA) must be continuous in all phases of restoration programs/projects, including monitoring and maintenance costs to avoid losses and failure.**

Some of the major bottlenecks to scale landscape restoration are knowledge of techniques and the availability of skilled labor for implementation. Thus, TA plays a key role in all stages of restoration, namely planning, implementation, maintenance and monitoring, and must be maintained to increase the chances of project success. Such TA may come from government agencies, local institutions or contracted third parties, provided that they have quality information in an accessible language and that they take into account local profiles and aptitudes. **In many projects, the monitoring and maintenance of implemented areas is not included, either due to lack of knowledge of their importance, or because they increase the financial cost of the project. However, the inclusion of these factors can guarantee the success of the intervention and avoid future expenses with new plantings.** In native vegetation restoration activities carried out by the ARCP in the PAB, in partnership with WWF-Brazil, it was possible to observe that at least two monitorings/year were sufficient to guide the maintenance to be performed in each area, which ranged from 2-4/year. Maintenance was important to curb the growth of invasive species (such as brachiaria), prevent pests and ensure the growth of native seedlings.

It is important to note that the plantings of the restored areas must follow the state legislation of Mato Grosso do Sul (Decree No. 13.977/2014 and Law No. 3.628/2008) as well as follow the parameters of the Protocol for Monitoring the Recomposition of Native Vegetation in the Federal District (SOUSA, A.P., VIEIRA, D.L.M. 2017), related to IBRAM Instruction No. 723/2017.



**LESSON 11**

**It is necessary to provide for, in project planning, the availability of resources for possible replanting due to bad weather.**

Periods of drought or extreme rainfall, as well as frost, are becoming increasingly frequent and have a direct impact on landscape restoration activities. Plantations in open areas are directly affected by natural disturbances, from pests to weather events. Thus, it is suggested that climate change be considered a risk in the planning stage of native vegetation restoration projects. At the Guariroba EPA, such events included water scarcity (with long periods of drought and summer), as well as frost. Thus, irrigation costs should become a reality for producers, as well as the provision for species replanting, or even the application of mixed techniques (direct sowing, mulching, green manure, etc.) in order to reduce risks of losses. **Support for the creation of public credit or financing policies for producers to deal with losses related to extreme events or climate change should be reinforced.**

**LESSON 12**

**The establishment of a local/regional seed network and partnerships with local nurseries are important both to ensure seeds and native seedlings suitable for the region and to generate local income.**

The availability, quantity and diversity of inputs (species, seeds, seedlings, etc.) are bottlenecks to scale landscape restoration. At the Guariroba EPA, it is no different. Due to the low availability of seedlings (quantity and species) from local nurseries, in the first years of planting Phase 1 of the PAB, a low diversity of native species of the Cerrado biome was used, not always suitable for the phytophysiology of the areas to be restored. For example, dense Cerrado species were used in riparian forest areas or paths, which, in addition to decharacterizing these wetlands, are not adapted to water flows and have a lower chance of survival.

**In addition to the shortage of seedlings, there was also no availability of local native seeds for planting via direct sowing (muvuca), as it was carried out in the PAB, nor skilled labor for seed collection.** Thus, it was necessary to acquire them from the Xingu Seed Network, in Mato Grosso. The demand for restoration driven by the PAB provided conditions for the mobilization of local seed collectors, predominantly women, who joined the opportunity to increase their income. However, with the end of the program, such actors were demobilized.

**LESSON 13**

**The nucleário using cardboard boxes brought positive results, with similar effects and at a lower cost than the plastic nucleário.**

One of the great difficulties in practical restoration projects, especially in areas of consolidated pasture, is the control of invasive alien species. These species are usually well adapted to the sites, have rapid growth and can prevent the growth and success of plantings. Several techniques can be used to control invasive species, many of them aiming at the shading of the invasive species (e.g. green manure, species consortium, seedling densification, etc.), but a creative and low-cost research carried out by UFMS in the Guariroba basin is noteworthy: The use of seedlings nucleários made of cardboard, reusing pizza boxes. In this technique, the seedlings are planted in the center of the box, with the surroundings shading the alien grasses in the place. **This allows the seedlings to grow without the grasses competition and, over time, the cardboard is absorbed by the soil, leaving no residue.** According to the research, this was a cheaper option and with the same positive results of planting seedlings using the plastic nucleário, which generates waste and has a higher production cost.

**LESSON 14**

**Direct sowing proved to be an efficient technique for establishing native species, controlling invasive ones, and presenting low implementation cost.**

Several planting techniques can be used in landscape restoration, the combination of them being possible and even indicated in some cases. The direct sowing technique has been used in several regions of the Cerrado with great success (Agroicone, 2020). In the PAB, this technique was used in the form of a pilot project in PPA areas and proved to be viable for the planting of native species, presenting approximately 45% lower costs when compared to planting with seedlings (Agroicone, 2019)<sup>1</sup>. **This is due to the absence of structure, irrigation, inputs and time for the development of the seedling in the nurseries, in addition to the planting being carried out faster, and with less labor** (broadcast seeding or with the aid of machinery, depending on the land). In addition, the direct sowing technique also allows greater involvement of local communities in the collection and processing of seeds, generating an extra income for many families.

**LESSON 15**

**Use native species that occur in the region for restoration actions in the landscape.**

While this lesson may seem obvious to some, obtaining local inputs or even having a list of local native species remains a bottleneck in restoration actions. Prior to planting, **it is recommended that an evaluation of the region to be restored be carried out to verify the type of vegetation to be recomposed and the species that can be used.** However, many projects do not provide for said action. Although the importance of these diagnoses for the planting success and greater

<sup>1</sup> Although the values refer to those used in 2019, the cost relationship between the techniques is maintained over time.



adaptability of species is highlighted here, there are other actions that can guide plantings when such diagnoses are not provided in the projects. One possibility is to use scientific studies of floristics or phytosociology carried out by universities in nearby areas, or that are included in management plans of the region (if any), or even check the availability of the species in herbariums of the region. For the first planting of the PAB, for example, a list of species was prepared based on previous experiences in the region (EPA Management Plan, UFMS herbarium, list of species of botanists that were on site). In subsequent plantings, individual projects by property were developed in which the floristic survey was carried out and, from it, the indication of species was made for each area to be restored in alignment with the knowledge of the producer. This was actually the action that brought the most positive results in the restoration.

## LESSON 16

**The model tested with the best results was planting green manure with native species in the same line.**

Several techniques and consortia can be used to restore landscape, which is especially interesting in places with consolidated pasture and the presence of invasive species, such as brachiaria. Studies and research developed by UFMS (2019) and Embrapa (2018) in the Guariroba basin tested several arrangements and restoration models, namely i) green manure and separate native species, ii) fertilizer strips, iii) only native species without green manure, and iv) green manure and native species in the same line. **The last arrangement was the one that brought better results, with green manure being important to improve the condition of the soil by fixing nitrogen and, thanks to its rapid growth, help curb the growth of brachiaria, improving the development of the native species planted.** The planting of species in a consortium using, for example, jack beans, crotalaria and sesame, in addition to conserving the soil, serves as food for ants and termites, diverting the attention of these animals from the seedlings and seeds planted in the restoration and, therefore, reducing or eliminating the use of chemicals.

## LESSON 17

**The baru proved to be a species with great potential for restoration in Guariroba properties.**

Landscape restoration can be productive, in the sense that planted species can be financially useful, through the trade of non-timber products such as fruits, nuts and saps, in addition to the seeds themselves that can be sold for other restoration projects. There are several possible models to be applied, from ICLFs to agroforestry systems (SAFs). One species that has stood out for its resilience in plantations, high growth rate and for already having a consolidated market for its chestnut, is the baru or cumbaru (*Dipteryx alata*).

## LESSON 18

**Organize the schedule to carry out soil conservation actions during droughts, and planting actions in the rainy season.**

The baru restoration models tested by UFMS (2021) presented good results, mainly for planting seedlings in areas of water stress. In addition, **the baru is a very well-known species used by traditional and local communities, it's part of their culture, and has presented increasing demand in the domestic and foreign markets**, which can increase the income of the landowners and collectors of the fruit.

Restoration projects must take into account the periods of drought and rainfall in each region. **The schedule of activities must be organized to contemplate soil conservation activities** (e.g., terracing, small dams and adaptation of rural roads) in the dry season, avoiding that the exposed soil is carried to the rivers, and planting actions must be carried out at the beginning of the rainy season.

In the case of terraces, it is important to provide for two execution moments, with soil revolving done in the dry period and sowing (grasses or green manure) in the rainy period, since the use of the vegetation cover helps in fixing the soil, decreasing its leaching. In the first terracing actions by the PMV, the execution occurred completely during the drought period. This way, the vegetation cover did not settle and the terraces were left with their soil exposed, being easily carried by the rains, causing erosion and sedimentation in rivers and streams.

## LESSON 19

**It is important to adapt the restoration techniques indicated for each area according to the reality of each rural producer.**

With the diversity of techniques possible to be implemented in landscape restoration, the local aptitude and culture must be taken into account when choosing the technique(s) to be used. In project planning, it is suggested that information be collected on the land use and prevailing productive activity in the region (e.g. agriculture or livestock), followed by consultation with rural producers in order to evaluate their technical knowledge, materials available on the property, as well as define which techniques will be used. **In the first plantings of the PAB, the techniques were defined only within the scope of the UGP, without local consultation, and with agroforestry implementation, for example.** And the Guariroba EPA has aptitude for livestock, and the producers were not familiar nor had much interest in agriculture. By indicating agroforestry systems or crop-forest integration to a predominantly livestock region, without agricultural aptitude, the chance of non-engagement and non-adoption of the suggested techniques increases.



## LESSON 20

The definition of criteria for selecting the rural producer who will receive the interventions in the field and the signing of a term of responsibility are important elements to mitigate risks.

The engagement and commitment of the local producer is essential to ensure restoration long-term success. To this end, **it is necessary that the producer is sensitized and involved in the decision-making of the projects, understands the project and the actions to be implemented, as well as the positive impacts arising from their implementations** (e.g., water quality and quantity, soil conservation, etc.), and is committed to maintaining the actions, being followed by a specialized technician. A study by UFMS in the areas under restoration in Guariroba concluded that a factor for restoration lack of success was related to the non-commitment of the producer, who would allow the entry of animals in the restored areas or not perform the proper maintenance of the implemented areas. The same happened in the implementation of the PAB in the crop-livestock-forest integration demonstration unit, which was not successful due to the entry of cattle at an undue time, allowed by the beneficiary producer.

It is suggested that criteria be developed to help in selecting producers, such as the analysis of their participation history and maintenance of interventions in other projects. In the current restoration initiatives of WWF-Brazil in Guariroba, in addition to consultation with local institutions, terms of responsibility were developed to be signed by the producers who receive TA and the implementations, and a greater concern was observed regarding compliance with the activities developed.

## LESSON 21







Highlight the importance and complementarity of studies (theoretical x practical) and monitoring at different levels (landscape x property) and at different times (pre-implementation x post-implementation), providing a better understanding of the territories and implemented practices.

Studies and predictive models contribute to territorial and spatial planning, prioritization of implementation areas, as well as assist in estimating the cost of actions and evaluating impacts and results after interventions. However, it is important to associate theoretical studies with practical local studies, both of implementation and monitoring, whose data can corroborate the predictive models or not, assisting with their acuity, and directing improvements for interventions in the field. **The combination of theoretical and practical studies also assists with the engagement and reliability of local producers and in the replicability of actions in other areas with similar characteristics.** It is always suggested that the area be evaluated in two moments so as to analyze the implementation “before and after”, analyzing whether or not the implemented activity was successful. Depending on the type of intervention and impact analyzed, there must be medium or long term monitoring in order to capture environmental variations. For example, quality improvements can take years to be noticed in soil analyses.



**Table 3.** Summaries of lessons learned according to the programs and projects analyzed for the Guariroba EPA.

### GOVERNANCE

-  Establish a technical and independent management group to increase efficiency and agility in project planning and execution;
-  Presence of local actors at all times of the projects to promote engagement and establish trusting relationships;
-  Align the planning and execution schedule between local programs and projects so that activities fit and complement each other, considering the execution ability and capacity of local organizations;
-  Strengthen strategic governance within the landscape, with the establishment of a common database for management and dissemination, enabling interaction between key actors in the territory;
-  Decision making within the landscape based on scientific data, built in a participatory way with multiple local partners, expanding knowledge and directing implementations in the field, and also contributing to the training of human resources;
-  Involve local institutions in the planning of projects/programs, prior to execution, considering the local reality for producer engagement, adherence and continuity of actions in the territory.



**TECHNIQUES IMPLEMENTED**

	Plan the field actions by property in order to explain what will be done and where, expanding local engagement;
	Actions aimed at the basic infrastructure of the landscape helped with the adherence of producers to good environmental practices;
	Only theoretical training is not enough for the engagement of producers - it is necessary to combine theory with practice;
	Technical assistance (TA) must be continuous in all phases of restoration programs/ projects, including monitoring and maintenance costs to avoid losses and failure;
	It is necessary to provide for, in project planning, the availability of resources for possible replanting due to bad weather;
	The establishment of a local/regional seed network and partnerships with local nurseries are important both to ensure seeds and native seedlings suitable for the region and to generate local income;
	The nucleário using cardboard boxes brought positive results, with similar effects and at a lower cost than the plastic nucleário;
	Direct sowing proved to be an efficient technique for establishing native species, controlling invasive ones, and presenting low implementation cost;
	Use native species that occur in the region for restoration actions in the landscape;
	The model tested with the best results was planting green manure with native species in the same line;
	The baru proved to be a species with great potential for restoration in Guariroba properties;
	Organize the schedule to carry out soil conservation actions during droughts, and planting actions in the rainy season;
	It is important to adapt the restoration techniques indicated for each area according to the reality of each rural producer;
	The definition of criteria for selecting the rural producer who will receive the interventions in the field and the signing of a term of responsibility are important elements to mitigate risks;
	Highlight the importance and complementarity of studies (theoretical x practical) and monitoring at different levels (landscape x property) and at different times (pre-implementation x post-implementation), providing a better understanding of the territories and implemented practices.

The SWOT analysis (Strengths, Weaknesses, Opportunities and Threats) (Figure 4) was carried out with a focus on the projects analyzed and consists of the identification of positive and negative factors, internal and external to the projects. This type of analysis helps with the knowledge and subsequent direction of the lessons learned in the programs/projects in the Guariroba Basin, both those favorable to replicability and those that were not successful, in addition to pointing out possible factors that must be addressed for successful future actions in the landscape.

Figure 4. SWOT matrix (strengths, weaknesses, opportunities and threats) identified for the Guariroba EPA.

	Positive	Negative
Endogenous	<p><b>STRENGTHS</b></p> <ul style="list-style-type: none"> <li>• Association of local producers with strong representation and engagement;</li> <li>• Partnership with universities and research centers;</li> <li>• Existence of EPA management committee with presence of local organizations;</li> <li>• Work of organizations with complementary competencies;</li> <li>• Continuity of projects in restoration and recovery of pastures for 10 years;</li> <li>• Guariroba Region as reference in restoration and pasture recovery projects.</li> </ul>	<p><b>WEAKNESSES</b></p> <ul style="list-style-type: none"> <li>• Lack of skilled labor;</li> <li>• Difficult access to areas to be worked on;</li> <li>• Lack of local governance with focus on restoration;</li> <li>• Difficulty in ensuring that technical recommendations are properly followed;</li> <li>• Absence of a unified record/ database of experiments already carried out in the region;</li> <li>• Lack of communication plan in programs/projects.</li> </ul>
	<p><b>OPPORTUNITIES</b></p> <ul style="list-style-type: none"> <li>• Partnership and strengthening of local nurseries;</li> <li>• Creation of seed network with training and income generation for local collectors;</li> <li>• Partnership with universities and research centers to generate knowledge and skilled labor;</li> <li>• Producers interested in replicating positive experiences and success stories;</li> <li>• Potential market for restoration products with local native species such as Baru.</li> </ul>	<p><b>THREATS</b></p> <ul style="list-style-type: none"> <li>• Seed supply higher than demand;</li> <li>• Low availability in local nurseries of native species seedlings;</li> <li>• Contracted companies with low technical capacity;</li> <li>• Incidence of bad weather, such as frost and water scarcity;</li> <li>• Resistance to the adoption of Technical Assistance;</li> <li>• Restoration with high costs and low investment capacity of producers;</li> <li>• Change of local government focal point and priority.</li> </ul>
Exogenous		



## TECHNICAL INFORMATION

**“Water for all” project –  
restoration and water benefits  
in the Pantanal Headwaters**

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