Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

# Species Selection for Cerradão Restoration Based on Ecological and Socioeconomic Criteria

**João Victor de Lima Pereira**
joaovictor-lp@hotmail.com
Universidade Federal da Grande Dourados
**Lorelai Ribeiro Dourado de Figueiredo**
Universidade Federal da Grande Dourados
**Alanis Rodrigues Ramalho**
Universidade Federal da Grande Dourados
**Gabrielli Duarte dos Santos**
Universidade Federal da Grande Dourados
**Joab Doria Domingos**
Universidade Federal da Grande Dourados
**Luciana Cruz Cortes**
Universidade Federal da Grande Dourados
**Luciana Maria Bulcão Michelon**
Universidade Federal da Grande Dourados
**Zefa Valdivina Pereira**
Universidade Federal da Grande Dourados

**Research Article**

**Keywords:** Cerrado, ecological restoration, native species, restoration potential

**Posted Date:** October 12th, 2026

**DOI:** https://doi.org/10.21203/rs.3.rs-11097347/v1

**License:** This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

**Additional Declarations:** No competing interests reported.

# Abstract

The Cerrado is a biome of great ecological, hydrological, and socioeconomic importance; however, it has undergone extensive conversion of its native vegetation. In this context, this study aimed to select native Cerradão species with high Restoration Potential (RP), considering ecological and socioeconomic attributes. The research was conducted in the Legal Reserve of the Teijin Settlement, in Nova Casa Verde, Mato Grosso do Sul, Brazil. Seventy 100 m² plots were sampled, in which trees with a circumference at breast height equal to or greater than 10 cm were recorded. Ecological Potential (EP) was assessed based on pollination and seed-dispersal syndromes, basal area, leaf phenology, and fire tolerance. Use Potential (UP) considered 12 socioeconomic categories, including food, medicinal, timber, ornamental, and apicultural uses. A total of 63 species were recorded, distributed among 24 families and 51 genera. Most species presented animal-mediated pollination (98%), zoochorous seed dispersal (59%), and fire tolerance (75%). All species had at least one use category, with ornamental, timber, and medicinal uses being the most prominent. Thirty-eight species were identified as having high RP, including *Caryocar brasiliense*, *Copaifera langsdorffii*, *Curatella americana*, and *Dipteryx alata*. The results demonstrate that the RP index is a promising tool for guiding ecological restoration by integrating biodiversity conservation, the recovery of ecosystem services, and the generation of social and economic benefits.


# INTRODUCTION

The Brazilian Cerrado is the largest savanna in South America, covering approximately 2 million km². It encompasses three of the continent's largest river basins and accounts for 43% of Brazil's surface water outside the Amazon (Strassburg et al. 2020). In addition, it functions as an important carbon sink, contributing to climate change mitigation and the maintenance of ecosystem services (Sano et al. 2019; Weichert et al. 2024). Although it is recognized as a global biodiversity hotspot (Damasco et al., 2018), approximately 45% of its native vegetation has been converted to different land uses, twice the proportion observed in the Amazon (Alencar et al. 2020).

Despite this degradation, the Cerrado exhibits remarkable diversity in vegetation formations. Ribeiro and Walter (2008) describe three main groups comprising 11 physiognomies: forest formations (Gallery Forests, Riparian Forests, Dry Forests, and Cerradão), savanna formations (Cerrado sensu stricto, Cerrado Parkland, Palm Grove, and Vereda), and grassland formations (Shrubby Grassland, Open Grassland, and Rocky Grassland). These physiognomies are determined by factors such as climate, topography, fire, groundwater depth, and soil characteristics.

Among these physiognomies, Cerradão (CD) is characterized by xeromorphic features, a continuous canopy (50%–90%), and an average tree height of 8–15 m, in addition to shrub, herbaceous, and some grass species. Its soil is well drained, slightly acidic, and of medium to low fertility (Ribeiro and Walter 2008). Due to its ecological and structural characteristics, CD has undergone intense landscape changes, mainly as a result of advancing deforestation and recurrent fires. These disturbances cause

significant losses of vegetation cover and compromise essential ecosystem functions, such as water regulation and climate balance, highlighting the importance of ecological restoration as a mitigating action (Carvalho et al. 2025).

As a strategy for recovering these degraded ecosystems, restoration efforts seek to reestablish biological diversity and restore the balance of ecological processes and functions (SER 2004). In this process, the ecological attributes of species may be used as selection criteria, including their ability to attract seed-dispersing fauna, functional diversity, and associated ecosystem services (Piaia et al. 2023). In addition, the potential uses of species may be considered, including food, medicinal, ethnobotanical, cultural, and symbolic aspects (Espinosa et al. 2020). In this context, integrating these two criteria, as proposed by Albuquerque et al. (2025), is important to ensure that restoration not only recovers natural ecosystem processes but also generates social and economic benefits, thereby increasing the long-term feasibility and sustainability of restoration initiatives.

Therefore, this study aimed to select native Cerradão species with high Restoration Potential, considering ecological and socioeconomic attributes, in order to guide ecological restoration actions and promote sustainable use.

## MATERIALS AND METHODS

# Study area

The study was conducted in the Legal Reserve of the Teijin Settlement, located in Nova Casa Verde, a district of Nova Andradina, Mato Grosso do Sul, Brazil (Fig. 1). The area is surrounded by agricultural crops, including soybean, corn, and sugarcane, as well as pasturelands.

The vegetation in the study area is classified as Cerradão (Ribeiro and Walter 2008). Annual precipitation ranges from 1,230 to 1,390 mm, while the mean temperature is 19.5°C in the coldest month and 25.6°C in the warmest month (Alvares et al. 2013). The region has an average elevation of 476 m and is underlain by fine- to medium-grained quartzose to subarkosic sandstone belonging to the Undivided Caiuá Group, from the Cretaceous period (Theodoroviz & Theodoroviz 2010). The predominant soil is Dystrophic Red Latosol, characterized by low fertility and high iron content (IBGE 2021).

## Floristic and phytisicuikigucak survey

For the floristic and phytosociological survey, data were collected from January to December 2018. Seventy 100 m² plots (10 × 10 m) were established in the Cerradão (CD) physiognomy, covering a total area of 0.7 ha. All trees with a circumference at breast height (CBH) ≥ 10 cm within the plots were measured. Tree height was estimated, and circumference was recorded using a measuring tape. Basal area was calculated from the CBH data. Taxonomic identification was based on analytical keys, comparison with specimens in the herbarium collection of the Federal University of Grande Dourados

(UFGD), and consultation with specialists. Current nomenclature was verified using the REFLORA database (Flora e Funga do Brasil 2025).

# Data analysis

*2.3.1 Ecological Potential*

The Ecological Potential (EP) was calculated based on five attributes, adapted from Albuquerque et al. (2025): pollination syndrome, dispersal syndrome, basal area, leaf phenology and fire tolerance. Except for basal area, for which data were obtained directly in the field, the other attributes were compiled through a literature review. A hierarchy of importance for restoration was established among these attributes as follows: pollination syndrome > dispersal syndrome > basal area > leaf phenology > fire tolerance. In addition, hierarchical levels of ecological relevance were defined within each attribute, as detailed below.

For pollination syndrome, two main categories were considered and organized according to their importance: yes > no. The “yes” category included species pollinated by animals, such as insects, bats, and birds (zoophily), whereas the “no” category included species not pollinated by animals, such as wind-pollinated species (anemophily). Pollination was prioritized because it represents the starting point for fruit and seed formation, directly influencing reproductive success, genetic variability, and the resilience of plant communities (Sousa 2002).

Dispersal was then considered and similarly organized into two categories: yes > no. The “yes” category referred to species attractive to animals (zoochory), whereas the “no” category included species whose dispersal does not depend on animals, including wind dispersal (anemochory) and dispersal by plant-specific mechanisms (autochory). Dispersal is directly related to the natural regeneration of species and the spatial extent of their distribution (Pijl 1982).

For basal area, the mean values for each species were classified into three categories: low (0 to 0.005), medium (> 0.005 to 0.01), and high (> 0.01), using R software, version 4.3.1 (R Core Team 2023). Basal area was used as an indicator of the degree of spatial occupation by each species, reflecting its contribution to community biomass. Therefore, species with higher basal-area values were considered ecologically more relevant, following the hierarchy: high > medium > low.

Leaf phenology regulates light availability; therefore, species were classified as deciduous or evergreen. Evergreen species retain their foliage throughout the year, providing greater structural stability, whereas deciduous species undergo seasonal leaf loss, temporarily opening the canopy and increasing light availability and material deposition (Vale 2013). Accordingly, deciduousness > evergreen habit was adopted in the attribute hierarchy because deciduousness favors litter deposition and nutrient cycling.

Finally, fire tolerance was assigned the lowest priority, considering the low frequency of fires in managed areas. Species were classified according to fire tolerance at two levels: yes or no. Fire-tolerant species

have a greater capacity to withstand disturbances caused by burning, favoring their persistence in the area (Chiminazzo et al. 2023). This attribute is also related to leaf phenology, as deciduous species tend to be less vulnerable to fire because they lose their leaves during the dry season (Lucena et al. 2015).

To calculate EP, a table was developed based on the hierarchy of the five attributes considered. Each species received a score ranging from 1 to 48; the higher the EP value, the greater the species' capacity to contribute ecologically to the restoration process.

*2.3.2 Use Potential*

Use Potential (UP) represented the socioeconomic value of the species. Cerrado species have diverse socioeconomic values. The biome contains a wide variety of edible species; native fruits contain phytochemicals with medicinal and biochemical potential; several species provide high-quality, resistant, and durable timber; and the biome is home to approximately 35% of tropical bee species, reinforcing its apicultural potential (Weichert et al. 2024).

For the calculation of UP, the presence or absence (1/0) of each species was recorded across 12 use categories: apicultural resource; food; fibers; pulpwood; firewood; furniture timber; medicinal use; handicrafts; forage; ornamental use; biochemical use; and other uses, adapted from Albuquerque et al. (2025). The data were obtained through a literature review. Each species received a score corresponding to the sum of the categories. Thus, higher UP values indicate a greater capacity to contribute socioeconomic benefits to the restoration process.

*2.3.3 Restoration Potential*

Restoration Potential (RP) represents the capacity of each species to contribute to ecological restoration by combining its ecological (EP) and socioeconomic (UP) characteristics, as adapted from Albuquerque et al. (2025). The higher the RP, the more suitable the species is for restoration, according to the following equation:

$$PR = PE + PU$$

where: RP – Restoration Potential; EP – Ecological Potential; UP – Use Potential. Subsequently, RP was classified into three categories: low (1–24), medium (25–39) and high (≥ 40).

# RESULTS AND DISCUSSION

A total of 63 woody species were recorded, distributed among 24 families and 51 genera. Fabaceae was the most representative family, with 18 species, followed by Myrtaceae, with six species, and Vochysiaceae, with five species (Table S4).

## Ecological potential

The attributes evaluated to calculate EP—pollination syndrome, dispersal syndrome, basal area, leaf phenology, and fire tolerance—indicate that the studied community has high functional value and reflects typical adaptations of Cerrado species (Fig. 2). The tabulated values with their respective scores can be observed in Table S1.

Most species exhibited animal-mediated pollination (98%), reflecting the wide diversity of pollinators found in the Cerrado, which consists mainly of native and exotic bees, beetles, moths, birds, and bats. This pattern is associated with floral traits adapted to attract pollinators, such as vibrant colors, nectar, and the release of specific odors (Martins and Batalha 2006).

The only species that did not exhibit animal-mediated pollination were *Roupala montana* Aubl. and *Dimorphandra mollis* Benth. The latter has pollen containing toxic compounds, such as astilbin, which may cause mortality in *Apis mellifera* L., 1758 bees (Cintra et al. 2002). This pattern reinforces the predominance of zoophilous pollination in the Cerrado, particularly insect pollination, which is essential for reproductive success and the genetic variability of populations (Gottsberger and Guttemberger 1988).

Regarding seed dispersal, approximately 59% of the species depended on fauna for seed dispersal, indicating the predominance of animal-attractive fruits, a common characteristic of woody Cerrado formations (Vasconcelos et al. 2020). The coexistence of biotic and abiotic dispersal strategies increases the potential for regeneration and connectivity among vegetation fragments, favoring the persistence of plant communities in fragmented landscapes (Peres 2016).

Basal area showed a higher proportion of species with medium values (48%), followed by high (31%) and low values (21%), suggesting a balanced contribution to biomass and litter formation. Leaf phenology showed equal proportions of deciduous and evergreen species, simultaneously favoring nutrient cycling and structural canopy stability (Kilca et al. 2009; Pirani 2009).

Finally, 75% of the species were classified as fire-tolerant, indicating a good capacity to persist under disturbances typical of the Cerrado (Coutinho 1990). Overall, the evaluated attributes revealed high ecological potential, reinforcing the suitability of the plant community for restoration activities.

# Use potenial

All sampled species presented at least one use category, demonstrating the high socioeconomic value of the Cerradão. The most frequent categories were ornamental use (50 species), followed by timber use (49 species) and medicinal use (40 species) (Fig. 3). The tabulated values with their respective scores can be observed in Table S2.

These results are consistent with patterns observed in other Cerrado formations. Albuquerque et al. (2025) reported a predominance of timber and medicinal uses, whereas Santos et al. (2020) and Sano et

al. (2019) highlighted the association between diversity of uses, ecological adaptability, and socioeconomic value.

The diversity of uses observed reflects the strong integration between conservation and sustainable development. Categories such as medicinal, food, and timber uses combine ecological and economic benefits, reinforcing the potential of Cerradão species for productive restoration programs. The medicinal use, widely documented in the biome (Santos et al. 2020; Sano et al. 2019), demonstrates the continuity of traditional knowledge and the presence of bioactive compounds of pharmacological interest, reinforcing the scientific and cultural relevance of these species.

In the food context, species such as *Dipteryx alata* Vogel stand out for their nutritional and cultural value (Ribeiro and Walter 2008). According to information available in the supplementary material (Table S5), Cerrado fruits contain significant levels of nutrients and functional compounds, making them important resources for dietary diversification and local income generation. Some species are also relevant to apiculture, contributing to the maintenance of pollinators.

Timber use stands out because of the durability and strength of species such as *D. alata*, *Plathymenia reticulata* Benth., and *Copaifera langsdorffii* Desf., which are used in civil construction and furniture making when managed sustainably (Ribeiro & Walter, 2008; Longui et al., 2014; Carvalho, 2009). The ornamental group highlights the aesthetic and cultural value of species such as *Lafoensia pacari* A.St.-Hil., recognized for its hardiness, attractive flowers, and high landscaping potential (Carvalho 2003), and *Tabebuia aurea* Benth. & Hook.f. ex S.Moore, which is widely used in urban forestry because of its adaptability to different environments and ease of management. In addition to its landscaping potential, *T. aurea* is culturally recognized for its medicinal properties, which have earned it the popular name “paratudo” because of its wide variety of therapeutic uses (Lima et al. 2018).

The high UP recorded indicates that Cerradão restoration can go beyond environmental recovery and also become an opportunity to generate social and economic benefits. Multifunctional species expand the possibilities for sustainable management and community engagement, adding symbolic and economic value to native vegetation (Albuquerque et al. 2025). Thus, this study expands this perspective by demonstrating the potential of Cerradão, a poorly studied physiognomy, to be incorporated into productive restoration strategies.

## Restoration potential

Thirty-eight species with high RP were identified, including *Caryocar brasiliense* Cambess., *C. langsdorffii*, *Curatella americana* L., *Plathymenia reticulata* Benth., *Allophylus edulis* (A.St.-Hil. et al.) Hieron. ex Niederl., *Pouteria torta* (Mart.) Radlk., *Hymenaea stigonocarpa* Mart. ex Hayne, *Byrsonima coccolobifolia* Kunth, *D. alata*, and *Mimosa laticifera* Rizzini & A.Mattos (Fig. 4). The tabulated values with their respective scores can be observed in Table S3.

Among the species with high RP, all exhibited animal-mediated pollination, and most were zoochorous, except *T. aurea*, *L. pacari*, *Enterolobium gummiferum* (Mart.) J.F.Macbr., *Qualea grandiflora* Mart., and *Qualea parviflora* Mart. These biotic interactions play a fundamental role in the restoration potential of Cerradão, as fauna and flora maintain an interdependent relationship resulting from their adaptation to the biome's seasonality. During the dry season, many plants flower and provide flowers as the main food resources, whereas during the rainy season, fruit production by these species supports fauna, which disperses seeds and contributes to natural regeneration (Malheiros 2016).

The high restoration potential of these species may also be explained by their high ecological plasticity (Howe and Smallwood 1982; Jordano 2000). Species with high ecological plasticity are capable of tolerating more extreme conditions, such as degraded environments and water deficits, and may exhibit fire resistance, thereby functioning as structural and facilitating species in restoration initiatives (Chazdon 2008; Durigan and Engel 2012).

*C. americana* and *C. langsdorffii* are examples of species with these characteristics. In addition to having high restoration potential, they exhibit high ecological plasticity and fire resistance and resilience, as they can develop in both drier and wetter environments (Ribeiro and Walter 2008; Silva and Batalha 2011). They also have a high capacity for resprouting after fire, thereby contributing to the recovery of vegetation cover and the reestablishment of ecosystem processes in impacted areas (Hoffmann et al. 2009; Medeiros and Miranda 2005; Durigan and Ratter 2006; Chazdon 2008).

*C. brasiliense* is a widely distributed melliferous species in the Cerrado biome and has high economic potential. Its fruit can be consumed fresh or used to produce various culinary products, timber products, medicinal oils, and biofuels (Epifânio and de Souza 2018). In addition to providing ecosystem services, the species is part of the traditions and culture of local populations (da Silva et al. 2021). It is therefore recommended for restoration initiatives because it combines ecological, economic, and sociocultural aspects.

On the other hand, *D. mollis* and *R. montana* were the only species with low RP due to ecological and socioeconomic limitations. *D. mollis* exhibits seed-coat dormancy, resulting in low seedling emergence without scarification (Oliveira et al. 2008). Controlled burning does not break this dormancy, increasing mortality and restricting natural regeneration (Borghetti et al. 2019). In addition, the species is not recommended as an apicultural resource because of the toxicity of its pollen to *A. mellifera* (Cintra et al. 2002). *R. montana*, due to its anemochorous dispersal syndrome (winged seeds), reduces the participation of vertebrates in seed dispersal, hindering faunal nucleation in fragmented areas (Carvalho 2009). In environments subject to frequent fires, the species resprouts but shows low population increase (Neri et al. 2023). Thus, the low EP of these species, combined with poorly established use chains (UP), resulted in low RP under the methodology adopted (Carvalho 2009).

However, low RP does not imply that these species should be excluded; rather, it indicates that they should be used strategically to capture their ecological and functional value within restoration designs. For *D. mollis*, the active planting of seedlings obtained from scarified seeds is recommended, together

with fire protection during the first two to three years. These seedlings should be associated with consortia of zoochorous and melittophilous species that increase seed rain and pollination services (Bizerril et al. 2005; Oliveira et al. 2008; Borghetti et al. 2019). For *R. montana*, the introduction of seedlings, the absence of fire during establishment, and functional combinations with species that promote zoochory and melittophily may increase nucleation and consortium stability (Carvalho 2009; Neri et al. 2023). Thus, despite their low RP, both species contribute to functional diversity and to medium- and long-term gains in Cerradão restoration projects.

In the present study, the use of RP proved to be an effective tool for selecting native Cerradão species. However, the criteria used to calculate this index should be adjusted according to the objectives and ecosystem under analysis. For EP, the hierarchy of importance among the criteria may be reorganized by assigning greater weight to fire tolerance in areas with a higher fire frequency, or it may be modified according to the type of ecosystem, as proposed by Albuquerque et al. (2025), who included successional categories when evaluating riparian forests.

For UP, different categories may be incorporated to make restoration more attractive to various sectors, including the participation of local communities in the selection process. Sacande and Berrahmouni (2016) integrated community needs and preferences with ecological criteria when selecting native species for restoration, whereas Meli et al. (2014) considered five criteria based on ecological, social, and technical information to develop a list of species for riparian-zone recovery.

Therefore, further research is needed in different types of ecosystems to integrate ecological and socioeconomic criteria into species selection for restoration. Additional studies should also expand knowledge about these species, since the scarcity of information was a limitation of the present study.

# CONCLUSION

This study demonstrates that the Restoration Potential index is an effective tool for guiding ecological restoration projects in the Cerrado. Through its indicators, species can be selected not only according to their ecological functions but also based on their economic and social value, resulting in more efficient, diverse, and sustainable restoration strategies.

The analysis showed that species with the highest RP values, such as *C. brasiliense*, *C. langsdorffii*, and *C. americana*, combine relevant ecological attributes with multiple economic and cultural uses. The index also makes it possible to identify species with different functional roles within the ecosystem, contributing to the design of more balanced and resilient restoration arrangements.

Thus, the application of RP represents a promising approach for recovering biodiversity and ecosystem services, while valuing the productive potential of native species and strengthening the integration between conservation and sustainable development. Future studies should test and improve the index in other physiognomies and socioenvironmental contexts, exploring its integration with additional

ecological variables and ecosystem services in order to expand its applicability and accuracy across different biomes.

# Declarations

### Ethics approval and consent to participate

Not applicable.

### Consent for publication

Not applicable.

### Availability of data and materials

All data supporting the findings of this study are available within the paper and its Supplementary Information.

### Competing interests

The authors declare no conflicts of interest among researchers and institutions.


### Funding

Not applicable.


### Authors' contributions

JVLP, LRDF, ARR, GDS, JDD, LCC, and LMBM contributed to the conception, design, data acquisition, and drafting. ZVP contributed to supervision, validation and revision.


### Acknowledgments

We appreciate the cooperation and support of the members of the Environmental Restoration Laboratory (LABRA) and the support provided by the Federal University of Grande Dourados.


### Authors' information (optional)

Not applicable.

# References


1. Albuquerque LB, Gomes WB, Pompermaier VT, de Melo AC, Leite JB. (2025) Restorability and Use Potential (RUP) of native riparian forest species as a tool for ecological restoration in the Cerrado. *Restoration Ecology*, e70156.

2. Alencar A, Shimbo JZ, Lenti F, Marques CM, Zimbres B, Rosa M, Arruda V, Castro I, Ribeiro JPFM, Varela V, Alencar I, Piontekowski V, Ribeiro V, Bustamente MMC, Sano EE, Barroso M. Mapeando três décadas de mudanças na vegetação nativa do cerrado brasileiro usando dados do Landsat processados na plataforma Google Earth Engine. Sensoriamento Remoto. 2020;12(6):924.
3. Alvares CA, Stape JL, Sentelhas PC, Gonçalves JDM, Sparovek G. Mapa de classificação climática de Köppen para o Brasil. Meteorol Z. 2013;22(6):711–28.
4. Bizerril MXA, Rodrigues FHG, Hass A. Fruit consumption and seed dispersal of Dimorphandra mollis Benth. (Leguminosae) by the lowland tapir in the cerrado of Central Brazil. Brazilian J Biology. 2005;65(3):407–13.
5. Borghetti F, Barbosa E, Ribeiro L, Ribeiro JF, Walter BMT. In: Scogings PF, Sankaran M, editors. South American Savannas. Savanna Woody Plants and Large Herbivores. Wiley; 2019.
6. Carvalho PER. (2009) *Carvalho-do-Cerrado: Roupala montana*. Embrapa Florestas Comunicado Técnico – 223.
7. Carvalho SGD, Trevisan DMDQ, Prata D, Rodrigues D, Rodrigues W, Carneiro LDA, Barbos G, Lisboa M, Pires AFM. (2025) Governança Ambiental e Degradação no Cerrado: Evidências Empíricas do Estado do Tocantins. Sociedade Natureza, 37(1).
8. Chazdon RL. Beyond deforestation: restoring forests and ecosystem services on degraded lands. Sci v. 2008;320:1458–60.
9. Chiminazzo MA, Bombo AB, Charles-Dominique T, Fidelis A. (2023) To protect or to hide: Why not both? An investigation of fire-related strategies in Cerrado woody species. Flora, 306.
10. Cintra P, Malaspina O, Petacci F, Fernandes JB, Bueno OC, Vieira PC, Silva MFGF. Toxicity of Dimorphandra mollis to workers of Apis mellifera. J Braz Chem Soc. 2002;13:115–8.
11. Coutinho LM. (1990) Fire in the Ecology of the Brazilian Cerrado. In: Goldammer, J. G. Fire in the Tropical Biota. *Ecological Studies*, 84.
12. DA SILVA JP, Tejerina GRL, Barreira S, Souza CB. Aspectos da comercialização do pequi (Caryocar brasiliense Camb.) no Estado de Goiás, Brasil. Enciclopédia Biosfera - Centro Científico Conhecer. 2021;18(37):61–75.
13. Damasco G, Fontes C, Françoso R, Haidar R. (2018) O bioma Cerrado: um hotspot de biodiversidade esquecido. Fronteiras para Mentes Jovens, 6.
14. Durigan G, Engel VL. Restauração de ecossistemas no Brasil: desafios e oportunidades. Natureza Conservação. 2012;10(2):83–6.
15. Durigan G, Ratter JA. Cerrado vegetation of Brazil: structure and dynamics. In: Oliveira PS, Marquis RJ, editors. The Cerrados of Brazil: ecology and natural history of a neotropical savanna. Columbia University; 2006. pp. 91–120.
16. Epifânio MLFG, DE SOUZA PB. As potencialidades do Caryocar brasiliense Cambess. (Pequi) para a recuperação da biodiversidade em áreas de cerrado: um estudo bibliográfico. Élisée-Revista de Geografia da UEG. 2018;7(1):179–91.

17. Espinosa UR, Caicedo JCR, Castillo DVC, Díaz HC. Plantas útiles del páramo y su potencial en la sostenibilidad ambiental: caracterización etnobotánica, Sumapaz Colombia. Revista Iberoamericana Ambiente Sustentabilidad. 2020;3(2):125–37.
18. Flora e Funga do Brasil. Reflora. Jardim Botânico do Rio de Janeiro; 2025.
19. Gottsberger IS, Gottsberger G. A polinização de plantas do cerrado. Rev Bras Biol. 1988;48(4):651–63.
20. Hoffmann WA, Adasme R, Haridasan M, Carvalho MT, Geiger EL, Pereira MAB, Gotsch SG, Franco AC. Tree topkill, not mortality, governs the dynamics of savanna–forest boundaries under fire exclusion. Ecology. 2009;90(5):1326–37.
21. Howe HF, Smallwood J. Ecology of seed dispersal. Annu Rev Ecol Syst. 1982;13:201–28.
22. IBGE - Instituto Brasileiro de Geografia e Estatistica. Pedologia 1:250.000. IBGE, Base de dados digital; 2021.
23. Jordano P. (2000) Fruits and frugivory. In: Fenner M, editor Seeds: The ecology of regeneration in plant communities. *CABI Publishing*, 125–166.
24. Kilca RV, Schiavini I, Araújo GM, Fagg JMF. Diferenças edáficas e estruturais entre duas florestas estacionais no bioma Cerrado. Neotropical Biology Conserv. 2009;4(3):150–63.
25. Lima JR, Pareyn FGC, Drumond MA. Tabebuia aurea: Craibeira. In: Coradin L, Camillo J, Pareyn FGC, editors. Espécies nativas da flora brasileira de valor econômico atual ou potencial: plantas para o futuro: região Nordeste. Brasília, DF: MMA; 2018.
26. Lonhui EL, Costa NO, Cielo-Filho R, Marcati CR, Romeiro D, Rajiput KS, Lima IL, Florshein S. (2014) Wood and Leaf Anatomy of Copaifera langsdorffii Dwarf Trees. IAWA J 35 (2).
27. Lucena IC, Leite MB, Matos DMS. A deciduidade foliar indica a vulnerabilidade de espécies lenhosas ao fogo. Revista Árvore. 2015;39(1):59–68.
28. Malheiros R. (2016) A influência da sazonalidade na dinâmica da vida no bioma Cerrado. Revista Brasileira de Climatologia, 19.
29. Martins FQ, Batalha MA. Pollination systems and floral traits in cerrado woody species of the Upper Taquari region (central Brazil). Brazilian J Biology. 2006;66(2a):543–52.
30. Medeiros MB, Miranda HS. Post-fire resprouting and mortality in cerrado woody plant species over a three-year period. Acta Bot Brasilica. 2005;19(4):493–500.
31. Meli P, Martinez-Ramos M, Rey-Benayas JM, Carabias J. Combining ecological, social and technical criteria to select species for forest restoration. Appl Veg Sci. 2014;17(4):744–53.
32. Neri SCM, Bomfim B, Pereira RS, Santos PV, Tetto AF. Decadal fire effects on the structure, composition, diversity, and aboveground carbon stocks of a Neotropical savanna. Forests. 2023;14:12.
33. Oliveira DA, Nunes YRF, Rocha EA, Braga RF, Pimenta MAS, Veloso MDM. Potencial germinativo de sementes de fava-d'anta (*Dimorphandra mollis* Benth. – Fabaceae: Mimosoideae) sob diferentes procedências, datas de coleta e tratamentos de escarificação. Revista Árvore. 2008;32(6):1001–9.

34. Peres MK, ESTRATÉGIAS DE DISPERSÃO DE SEMENTES NO BIOMA CERRADO. (2016) : CONSIDERAÇÕES ECOLÓGICAS E FILOGENÉTICAS. Universidade de Brasília, Instituto de Ciências Biológicas.
35. Piaia BB, Rovedder APM, Procknow D, Fockink GD, Camargo B. Diversidade taxonômica e funcional da nucleação aplicada à restauração ecológica. Ecologia Vegetal. 2023;224(10):855–64.
36. Pijl LVD. Principles of dispersal in higher plants. Springer; 1982.
37. Pirani FR, Sanchez M, Pedroni F. Fenologia de uma comunidade arbórea em cerrado sentido restrito, Barra do Garças, MT, Brasil. Acta Bot Brasilica. 2009;23:1096–110.
38. R CORE TEAM. R: A Language and Environment for Statistical Computing. R Foundation for Statistical Computing; 2023.
39. Ribeiro JF, Walter BMT. (2008) As principais fitofisionomias do bioma Cerrado. In: Sano SM, Almeida SP, Ribeiro JF, editors *Cerrado: ecologia e flora. Brasília: Embrapa*. 151–212.
40. Sacande M, Berrahmouni N. Community participation and ecological criteria for selecting species and restoring natural capital with native species in the Sahel. Restor Ecol. 2016;24(4):479–88.
41. Sano EE, Rodrigues AA, Martins ES, Bettiol GM, Bustamante MMC, Bezerra AS, Couto AF, Vasconcelos V, Schüler J, Bolfe EL. Cerrado Ecoregions: A Spatial Framework to Assess and Prioritize Brazilian Savanna Environmental Diversity for Conservation. J Environ Manage. 2019;232:818–28.
42. Santos LAC, Miranda SC, Silva-Neto CM. (2020) Fitofisionomias do Cerrado: definições e tendências. Élisée - Revista De Geografia Da UEG, 9(2).
43. SER - Society for Ecological Restoration International. The SER International primer on ecological restoration (Version 2). Society for Ecological Restoration International; 2004.
44. Silva IA, Batalha MA. Floristic and functional patterns across a gradient of woodiness in a cerrado vegetation. Flora. 2011;206(8):819–27.
45. Sousa VR. (2002) BIOLOGIA FLORAL DO CERRADO: POLINIZAÇÃO E FLORAÇÃO. Monografia—UniCEUB, Brasília: 2002.
46. Strassburg BB, Iribarrem A, Beyer HL, Cordeiro CL, Crouzeilles R, Jakovac CC, Junqueira AB, Lacerda E, Latawiec AE, Balmford A, Brooks TM, Butchart SHM, Chazdon RL, Herb K-H, Brancalion P, Buchanan G, Cooper D, Días S, Donald PF, Kapos V, Leclère D, Miles L, Obersteiner M, Plutzar C, Scaramuzza CAM, Scarano FR, Visconti P. Global priority areas for ecosystem restoration. Nature. 2020;586(7831):724–9.
47. Theodoroviz AMG, Theodoroviz A. Geodiversidade do estado de Mato Grosso do Sul. CPRM; 2010.
48. Vale VS, Schiavini I, Lopes SF, Oliveira AP, Neto OCD, Gusson AE. Functional groups in a semideciduous seasonal forest in Southeastern Brazil. Biotemas. 2013;26(2):45–58.
49. Vasconcelos WA, Miranda SC, Neto CMS, Souza PB. (2020) Caracterização florístico-estrutural e síndromes de dispersão de espécies lenhosas de remanescente de Cerradão. *Nativa*, 8 (4).

50. Weichert RF, Mazzinghy ACC, Costa B, Nunes B, Lopes L, Garcia L, Reis M, Parreiras V, Reina L, Melo J. (2024) Cerrado em destaque: o papel vital do cerrado na biodiversidade do planeta. Árvores, Plantas e Frutos do Cerrado: aplicações e possibilidades. Editora Científica, 1.

# Figures

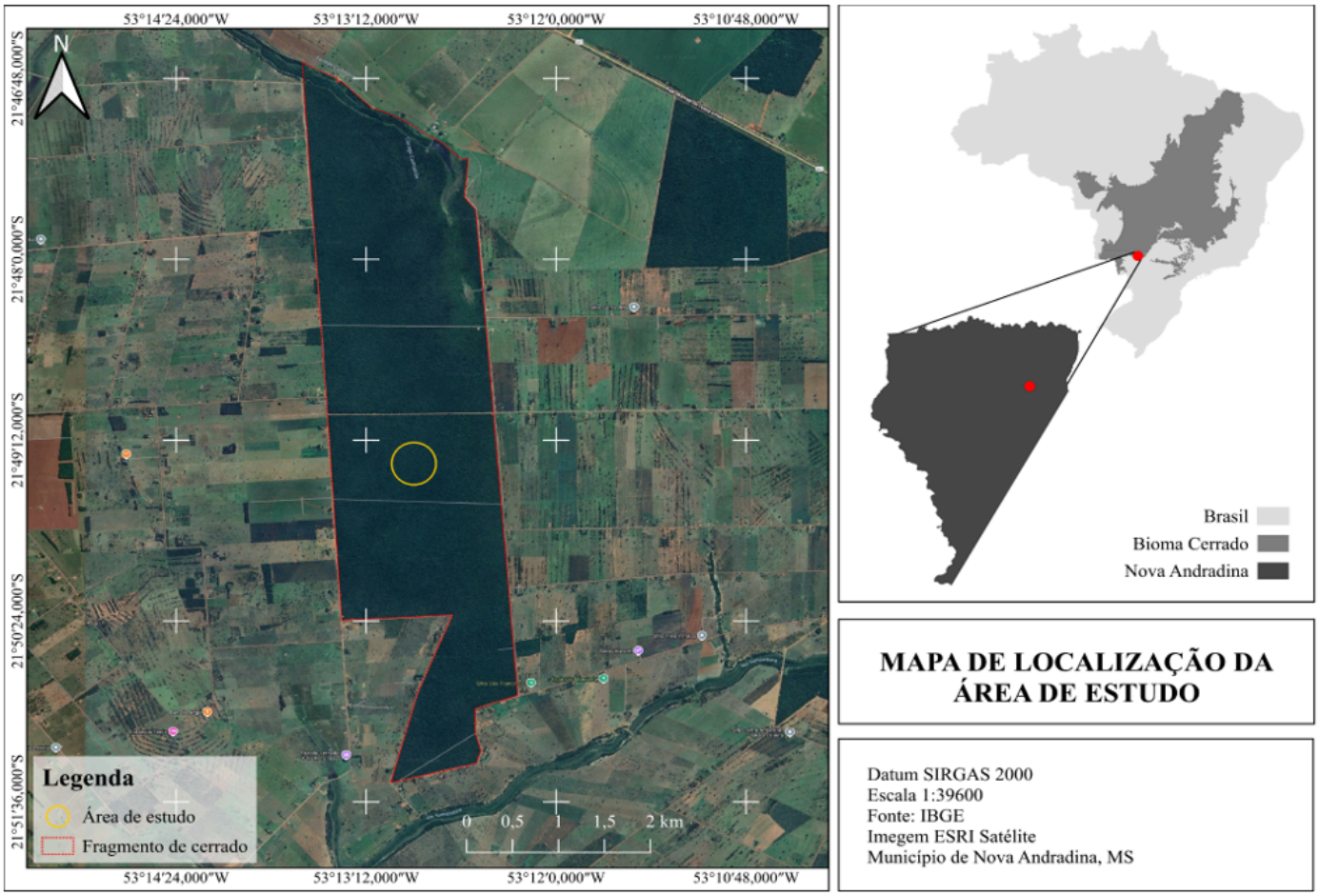



**Figure 1**

Location of the study area within the Cerradão physiognomy in the municipality of Nova Andradina, Mato Grosso do Sul, Brazil.

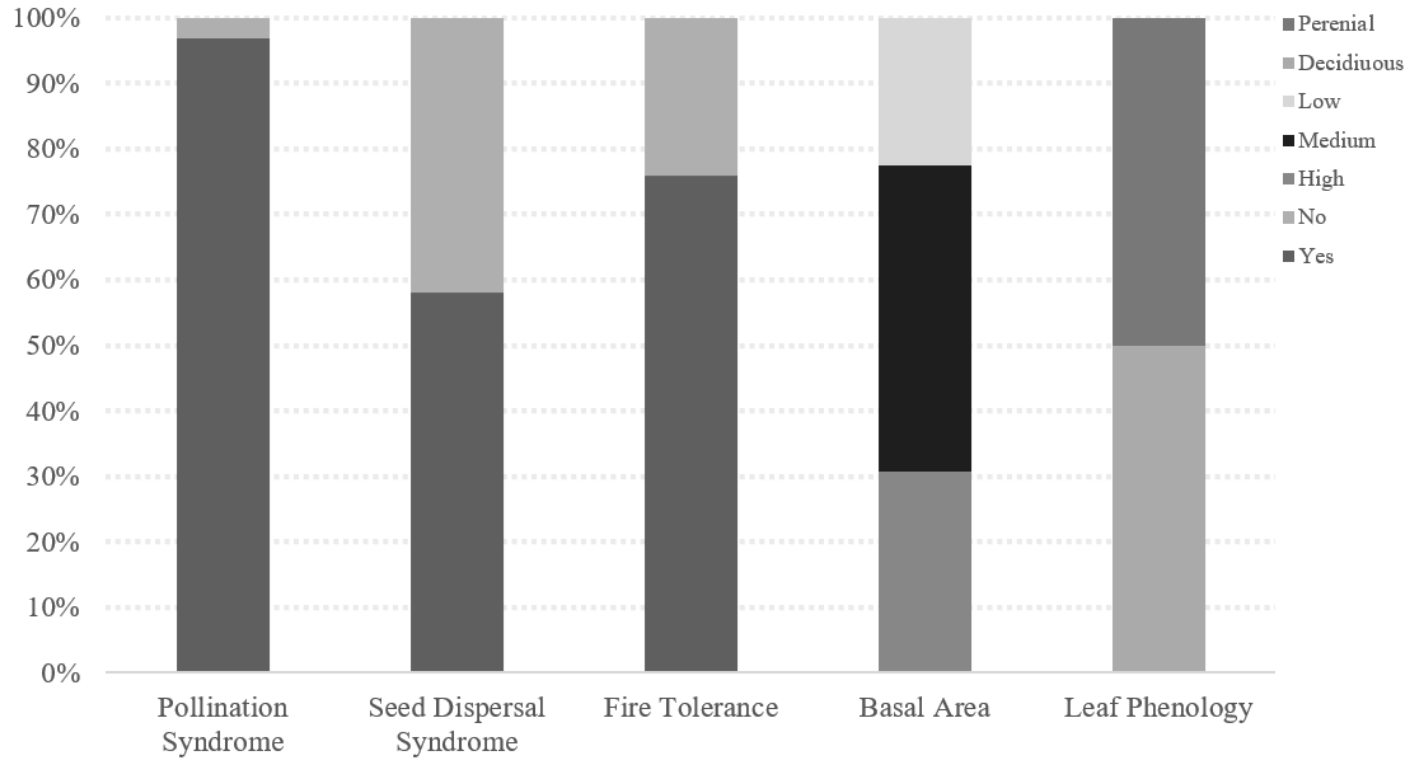



**Figure 2**

Graphical representation of the values obtained for Ecological Potential

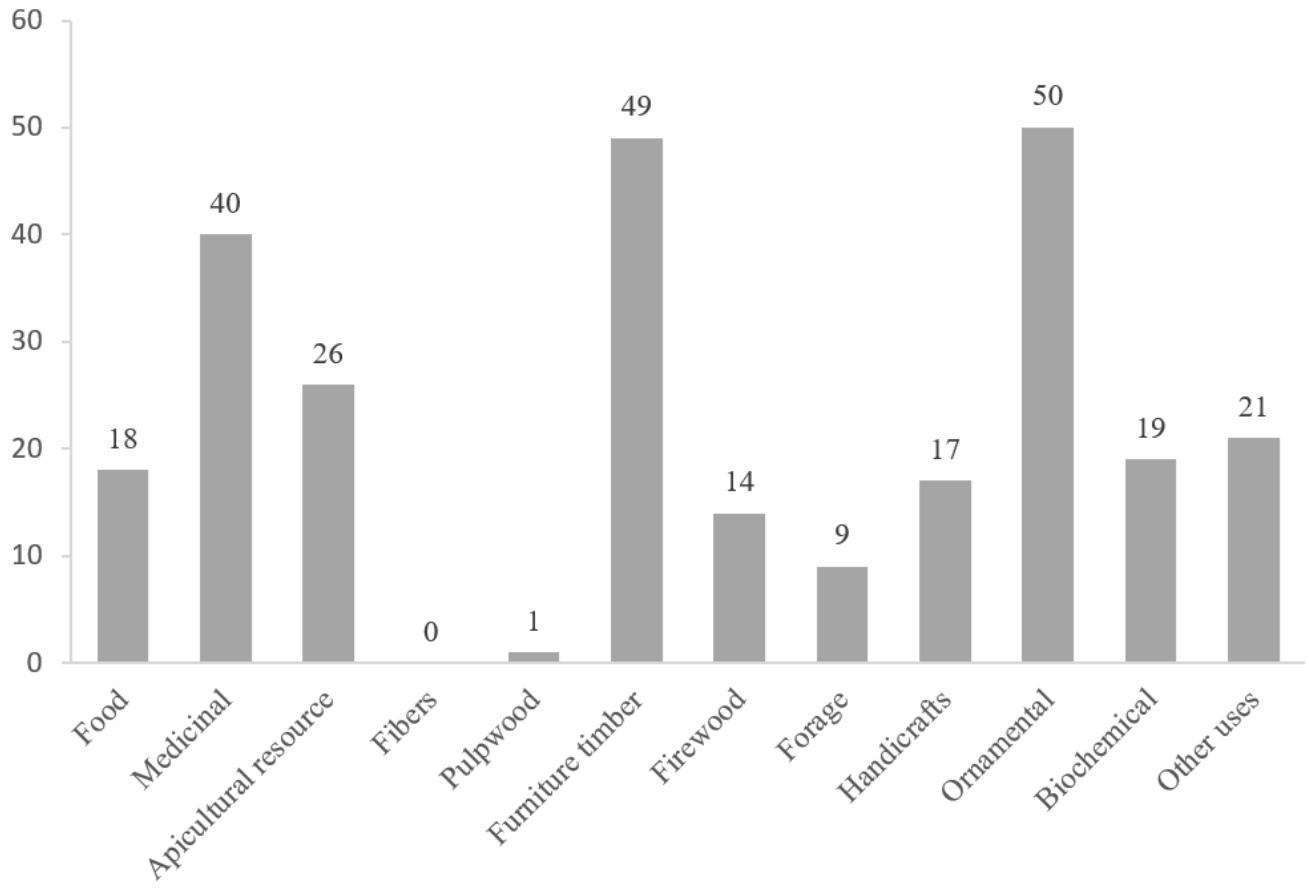



**Figure 3**

Graphical representation of the values obtained for the use categories.

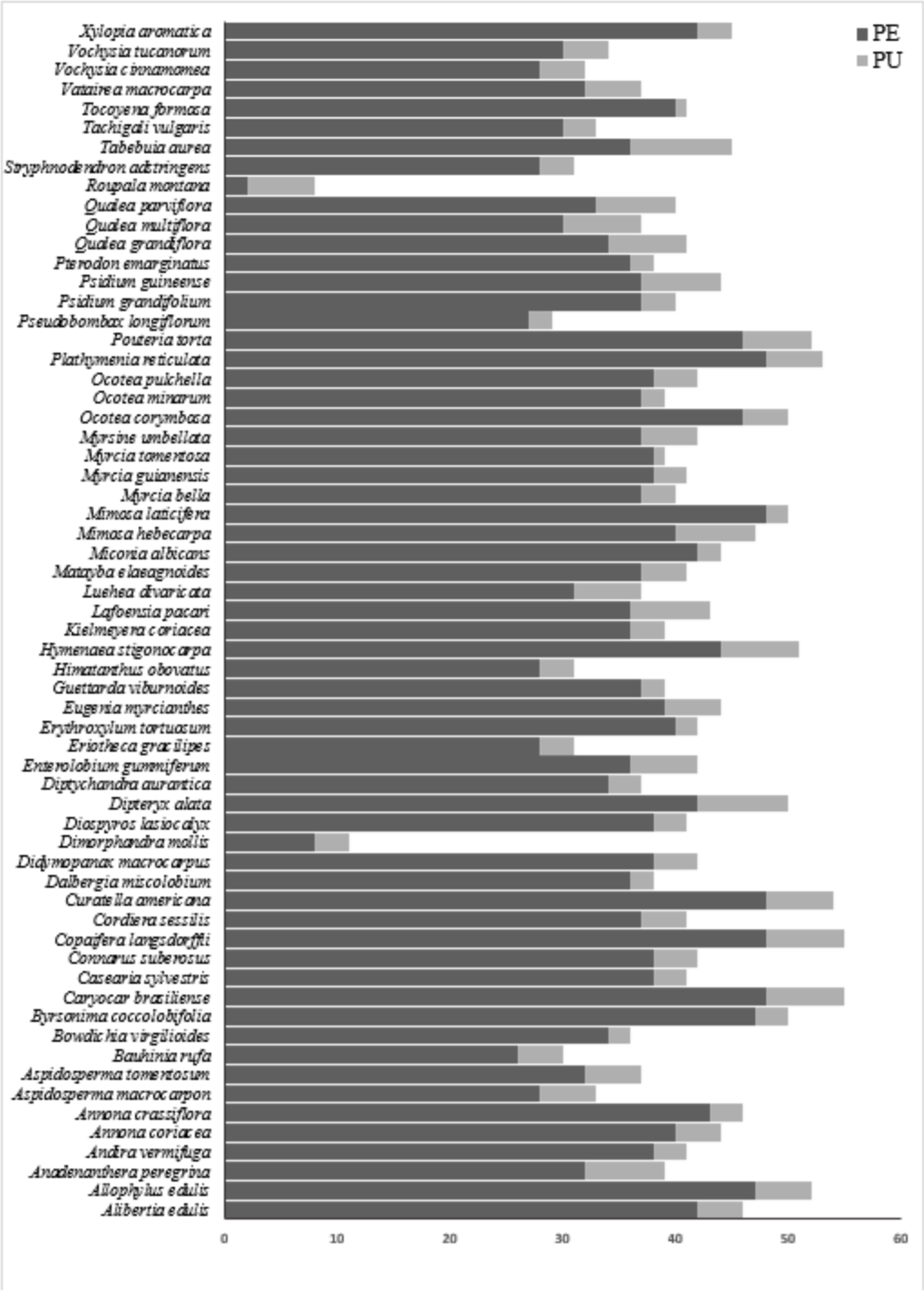



**Figure 4**

Graphical representation of the values obtained for Restoration Potential.

# Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- SUPLEMENTAR.docx