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LANDSCAPES OF LONG DURATION: ETHNOBOTANICAL KNOWLEDGE, PALYNOLOGICAL RECORDS, AND HUMAN OCCUPATION IN THE CERRADO MATO GROSSO

PAISAGENS DE LONGA DURAÇÃO: CONHECIMENTO ETNOBOTÂNICO, REGISTROS PALINOLÓGICOS E OCUPAÇÃO HUMANA NO CERRADO DE MATO GROSSO

PAISAJES DE LARGA DURACIÓN: CONOCIMIENTO ETNOBOTÁNICO, REGISTROS PALINOLÓGICOS Y OCUPACIÓN HUMANA EN EL CERRADO DE MATO GROSSO

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ABSTRACT

This study investigated plant use and management in two traditional communities in Mato Grosso — Vale da Promissão and Passagem da Conceição — integrating ethnobotanical and palynological data to understand the relationship between local flora, cultural practices, and human occupation in the Cerrado. The methodology combined semi-structured interviews, direct observation, soil sampling, and palynological analysis. Results showed that agriculture and extractivism remain central productive activities, with knowledge transmission occurring primarily among the elderly through orality. Palynological analysis revealed environmental differences, with a higher number of palynomorphs in Passagem da Conceição, associated with gallery and transitional forests. The integrated data indicate that traditional knowledge and paleoenvironmental records express a historical continuity of human-Cerrado interaction, shaping the biome as a cultural landscape resulting from prolonged adaptive management. It is concluded that combining ethnobotanical knowledge and palynological remains allows for a partial reconstruction of human occupation processes and the permanence of symbolic botanical links. This interdisciplinary approach highlights the importance of traditional practices in the historical construction of the Mato Grosso territory.

KEYWORDS: *Ethnobotany. Palynology. Cerrado. Traditional communities. Biodiversity.*

RESUMO

Este estudo investigou o uso e manejo de plantas em duas comunidades tradicionais de Mato Grosso — Vale da Promissão e Passagem da Conceição — integrando dados etnobotânicos e palinológicos com o objetivo de compreender a relação entre a flora local, as práticas culturais e a ocupação humana no Cerrado. A metodologia combinou entrevistas semiestruturadas, observação direta, amostragem de solo e análise palinológica. Os resultados indicaram que a agricultura e o extrativismo permanecem como atividades produtivas centrais, com a transmissão do conhecimento ocorrendo principalmente entre os indivíduos mais idosos, por meio da oralidade. A análise palinológica revelou diferenças ambientais entre as áreas, com maior número

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de palinomorfos na Passagem da Conceição, associado à presença de matas de galeria e formações de transição. Os dados integrados indicam que o conhecimento tradicional e os registros paleoambientais expressam uma continuidade histórica da interação entre as populações humanas e o Cerrado, configurando o bioma como uma paisagem cultural resultante de processos prolongados de manejo adaptativo. Conclui-se que a combinação entre o conhecimento etnobotânico e os vestígios palinológicos permite a reconstrução parcial dos processos de ocupação humana e da permanência de vínculos simbólicos com a flora. Essa abordagem interdisciplinar evidencia a importância das práticas tradicionais na construção histórica do território mato-grossense.

PALAVRAS-CHAVE: Etnobotânica. Palinologia. Cerrado. Comunidades tradicionais. Biodiversidade.

RESUMEN

Este estudio investigó el uso y manejo de plantas en dos comunidades tradicionales de Mato Grosso — Vale da Promissão y Passagem da Conceição — integrando datos etnobotánicos y palinológicos con el fin de comprender la relación entre la flora local, las prácticas culturales y la ocupación humana en el Cerrado. La metodología combinó entrevistas semiestructuradas, observación directa, muestreo de suelo y análisis palinológico. Los resultados mostraron que la agricultura y el extractivismo continúan siendo actividades productivas centrales, con la transmisión del conocimiento ocurriendo principalmente entre los adultos mayores a través de la oralidad. El análisis palinológico evidenció diferencias ambientales, con un mayor número de palinomorfos en Passagem da Conceição, asociado a bosques de galería y formaciones de transición. Los datos integrados indican que el conocimiento tradicional y los registros paleoambientales expresan una continuidad histórica de la interacción entre el ser humano y el Cerrado, configurando el bioma como un paisaje cultural resultado de un manejo adaptativo prolongado. Se concluye que la combinación del conocimiento etnobotánico y los restos palinológicos permite una reconstrucción parcial de los procesos de ocupación humana y la permanencia de vínculos simbólicos con las plantas. Este enfoque interdisciplinario resalta la importancia de las prácticas tradicionales en la construcción histórica del territorio de Mato Grosso.

PALABRAS CLAVE: *Etnobotánica. Palinología. Cerrado. Comunidades tradicionales. Biodiversidad.*

INTRODUCTION

The interaction between human societies and the natural environment constitutes one of the central themes of the human and biological sciences, representing a point of convergence among disciplines such as ethnobotany, palynology, archaeobotany, and archaeology. Although these fields employ distinct methodological approaches, they share a common objective: to understand how societies, across time and space, appropriate, transform, and symbolically construct plant resources (Caballero, 1979; Posey et al., 1984; Albuquerque; Lucena, 2004). This interdisciplinary perspective has demonstrated that plant use extends beyond purely utilitarian dimensions, being deeply embedded in cultural practices, cosmologies, and ecological adaptation strategies that structure human–landscape relationships (Alexiades, 1996; Amorozo; Gély, 1988).

In the South American context, archaeological, paleoenvironmental, and ethnobotanical studies have shown that human occupation of the continent was marked by intensive processes

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of ecological adaptation and intentional management of plant resources. Since the beginning of the Holocene, hunter-gatherer and horticultural groups systematically exploited tropical environments, developing practices of domestication, dispersal, and cultivation of native species (Clement, 1998; Salgado-Labouriau, 1973; Arnold, 1947). These interactions resulted in complex cultural landscapes, in which present-day vegetation still reflects the legacy of millennia of human management (Ceccantini; Fernandez, 2003; Pasa *et al.*, 2019). The concept of “anthropic forests” or “cultural forests” synthesizes this process, highlighting how knowledge of flora and natural resource use became a structuring element of traditional South American societies (Vieira *et al.*, 2015; Clement, 1998).

The territory of Mato Grosso occupies a singular position within this continental framework. Located in a transitional zone between the Cerrado, Pantanal, and Amazon biomes, Mato Grosso encompasses one of the oldest and most diverse histories of human occupation in Central Brazil. Archaeological research conducted at sites such as Santa Elina, Serra das Araras, and other transitional areas reveals continuous human presence since the Middle Holocene, with records of plant use, fibers, and other vegetal remains indicating the management of gallery forests and savanna environments (Schmitz, 2002; Vialou; Vialou, 2019; Ceccantini; Gusella, 2001). These findings demonstrate that the current landscape of the Mato Grosso Cerrado is largely the result of a long history of interaction between human groups and the environment, combining practices of gathering, cultivation, and controlled burning to shape local vegetation.

With the advance of colonial frontiers and the establishment of mining and cattle-ranching routes from the eighteenth century onward, new forms of land occupation and resource use began to coexist with traditional management systems. Subsistence agriculture, extractivism, and the medicinal use of plants persisted as axes of cultural continuity, particularly within rural and riverine communities formed over successive generations (Guarim Neto, 1984; Nunes da Cunha; Junk, 1999; Pasa; Guarim Neto, 2006; Pasa, 2007; Pasa, 2011). These groups maintain practices grounded in empirical and symbolic knowledge of flora, transmitted orally across generations—especially by women and elders, who play a central role in the preservation of local knowledge systems (Albuquerque, 2004; Amorozo, 2002; Hanazaki; Oliveira; Silva, 2010).

Ethnobotany, in examining these practices, goes beyond the mere description of species and their uses. It seeks to understand the cultural, religious, and ecological meanings attributed to plants and how these meanings are embedded within processes of landscape occupation and transformation. In the context of Mato Grosso, this perspective reveals how traditional communities have integrated inherited knowledge with the specific environmental conditions of Cerrado savannas and floodplain systems, constructing complex systems of management and conservation (Albuquerque; Hanazaki, 2006; Pasa, 2013). Such practices express a syncretism

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of Indigenous, Afro-descendant, and caboclo knowledge, shaping a distinctive relationship with the environment and ensuring the continuity of cultural repertoires associated with plant use (Guarim Neto; Carniello, 2007).

In parallel, palynology and archaeobotany have contributed significantly to reconstructing the environmental and cultural trajectories of these interactions. The analysis of pollen grains, spores, and plant macroremains preserved in soils reveals successive changes in vegetation, climatic conditions, and land-use practices over time (Salgado-Labouriau, 1973; Furquim *et al.*, 2018). These records reinforce the hypothesis that the Mato Grosso Cerrado has long been—and continues to be—a space of intense interaction between natural and human factors, in which biodiversity management reflects both ecological adaptations and culturally mediated choices.

Within this framework, understanding the relationship between ethnobotanical knowledge and palynological records also entails recognizing the history of human occupation that shaped the territory of Mato Grosso. The communities of Vale da Promissão, in Rosário do Oeste, and Passagem da Conceição, in Várzea Grande, represent contemporary expressions of this long and multifaceted history. Their agricultural, extractivist, and medicinal practices reflect ways of life that combine tradition and adaptation, maintaining symbolic and ecological ties to the Cerrado.

Thus, this study aims to integrate ethnobotanical and palynological data to understand how these communities use and reinterpret local flora. By relating present-day practices to historical processes of landscape occupation and management, the research demonstrates that biodiversity and traditional knowledge constitute complementary dimensions of a shared trajectory of coexistence between human societies and the environment in the Cerrado of Mato Grosso.

2. METHODOLOGY

Data were compiled from two regions within the state of Mato Grosso. The first corresponds to the Upper Paraguay Basin, in the rural traditional community of Vale da Promissão, located in the municipality of Rosário Oeste (UTM: 21L 522617/8325291). The second study site is Passagem da Conceição (UTM: 21L 591094/8279322), situated in the mesoregion known as the Baixada Cuiabana (IBGE, 2010). Both areas are inserted within the Mato Grosso Cerrado biome (Figure 1).

Figure 1. Location of the study areas

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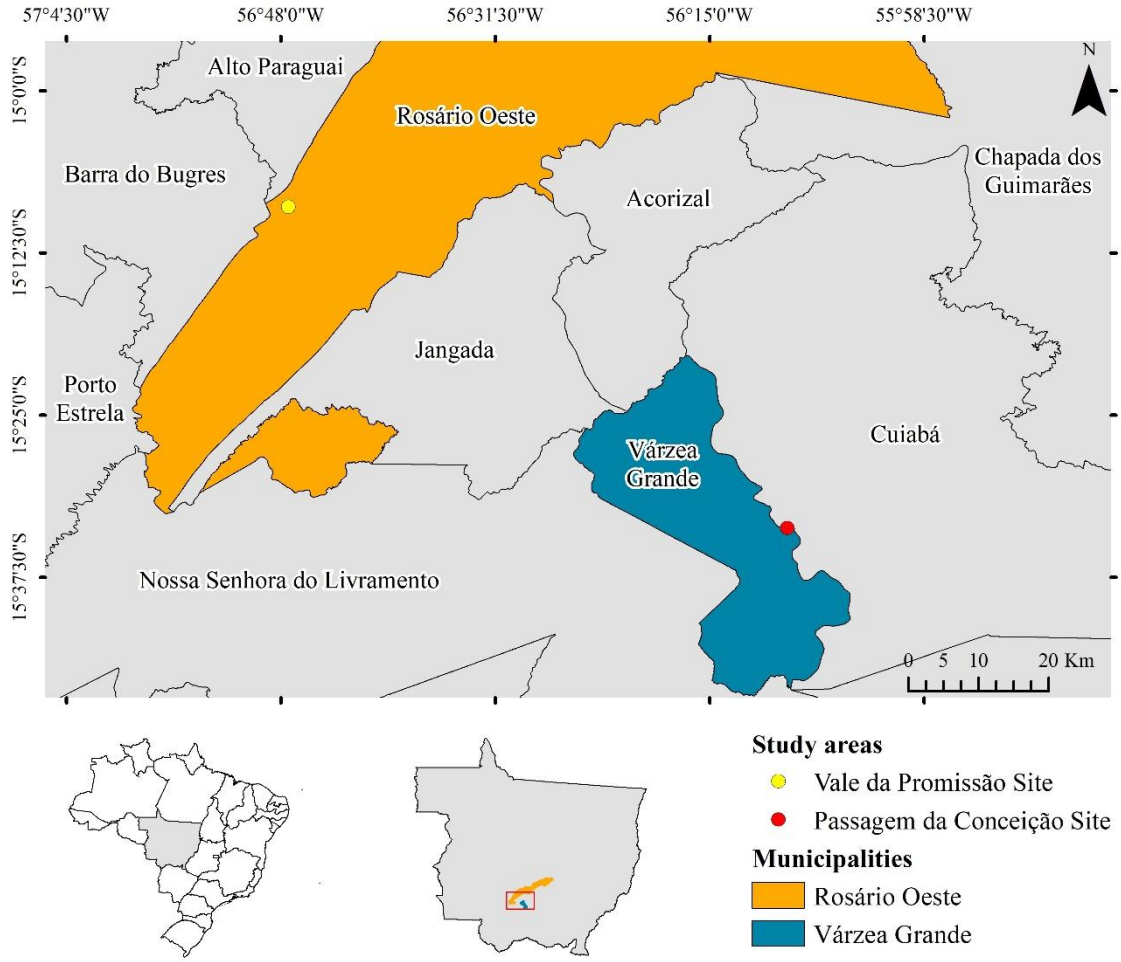

Source: Data compiled by the author. Municipal boundaries: IBGE (2024), scale 1:250,000.

In the Vale da Promissão community, the presence of grass–woody savanna associated with riparian forests indicates a landscape characterized by open formations interspersed with linear forest fragments that follow smaller watercourses. This configuration is directly related to climatic seasonality, marked by alternating dry and rainy periods, which create favorable conditions for herbaceous and shrubby vegetation (Hirooka, 1997), as illustrated in Figure 2.

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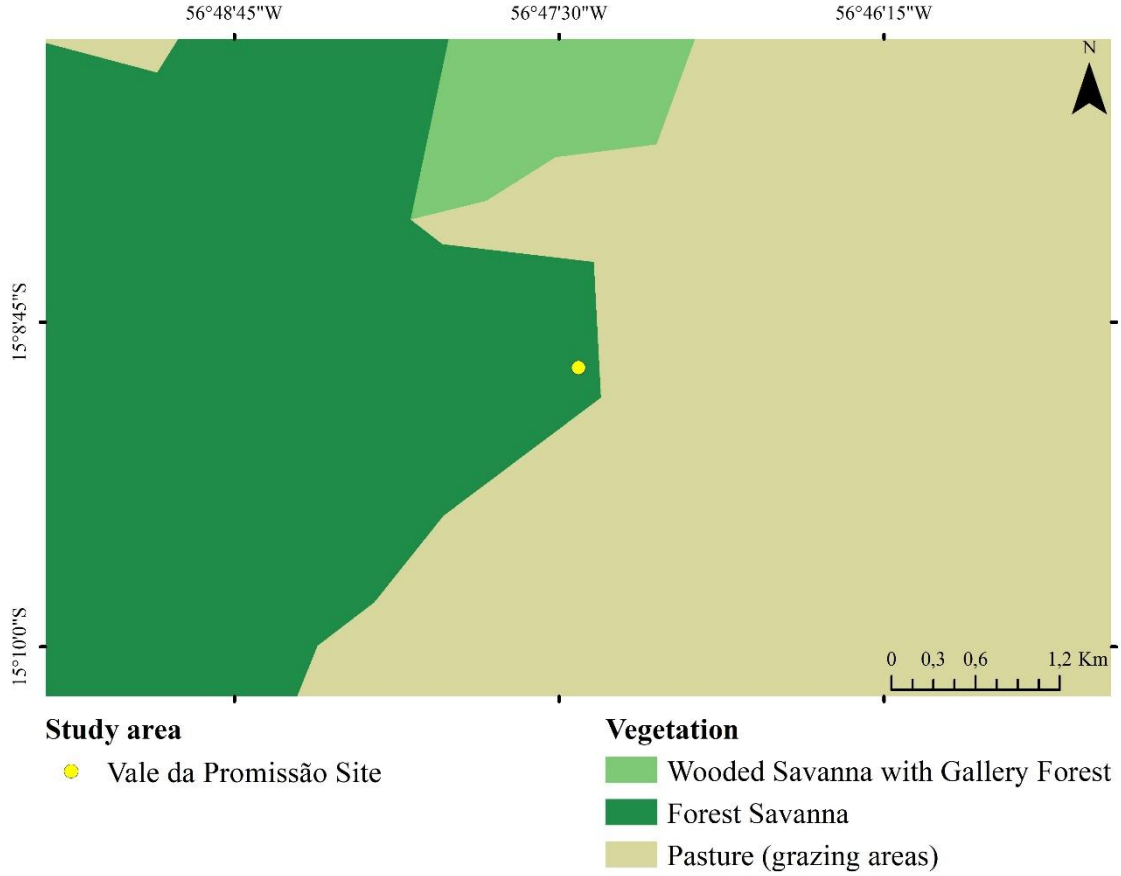
Figure 2. Vegetation map of the Vale da Promissão study site. Mato Grosso. Brazil



Source: Data compiled by the author. Vegetation: IBGE (2023), scale 1:250,000.

In the Upper Paraguay region, hydrography constitutes a decisive factor in shaping the ecological configuration of the area. The presence of the Currupira River creates moisture patches within a savanna mosaic, supporting plant species adapted to sandy soils and to the alternation between dry and flood periods (Hirooka, 1997), as shown in Figure 3.

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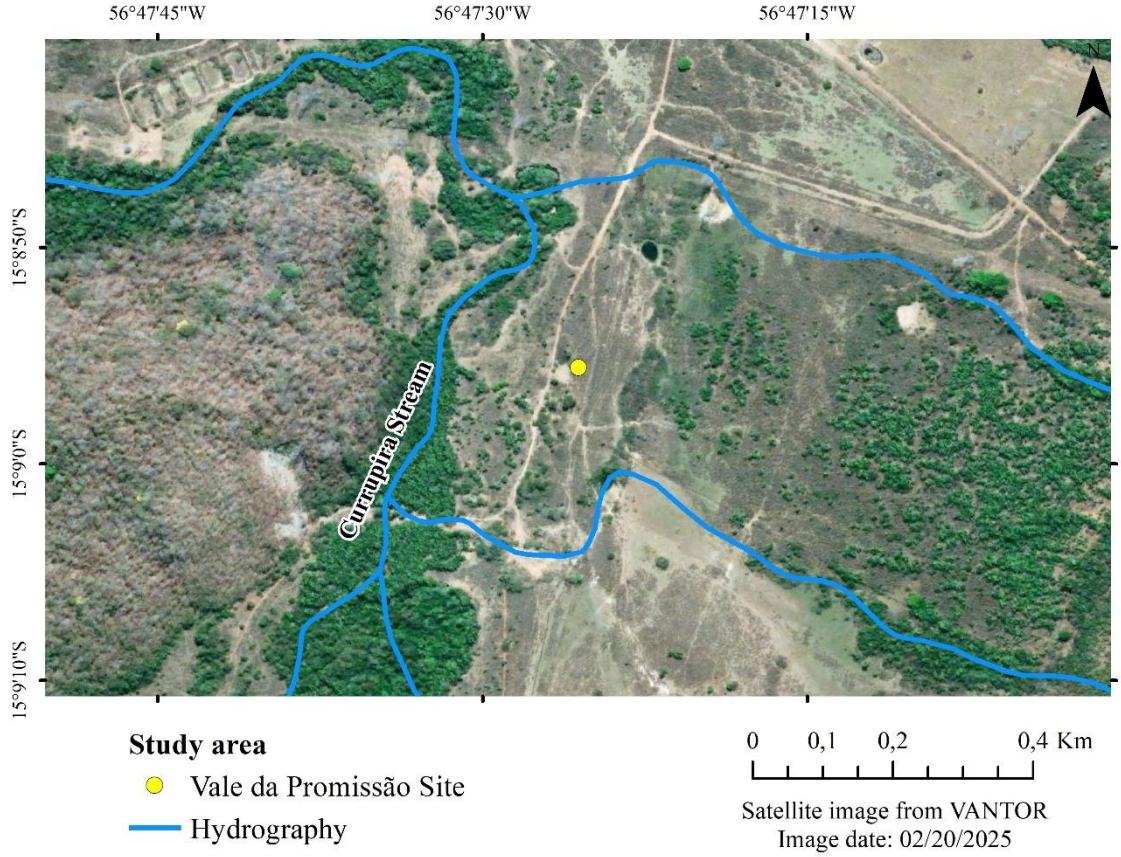
Figure 3. Currupira River. Valley of the Promise. Mato Grosso, Brazil



Source: Data compiled by the author. Hydrography data from the IBGE, scale 1:25,000.

In Passagem da Conceição, characterized by denser formations, the presence of gallery forests and transitional vegetation results from the interaction between the Cerrado biome, riparian environments, and the Cuiabá River. According to Nunes da Cunha and Junk (1999; 2001), these phytophysiognomic variations arise from the interaction between the hydrological regime and geomorphology, creating specific conditions for the availability of local plant resources (Figure 4).

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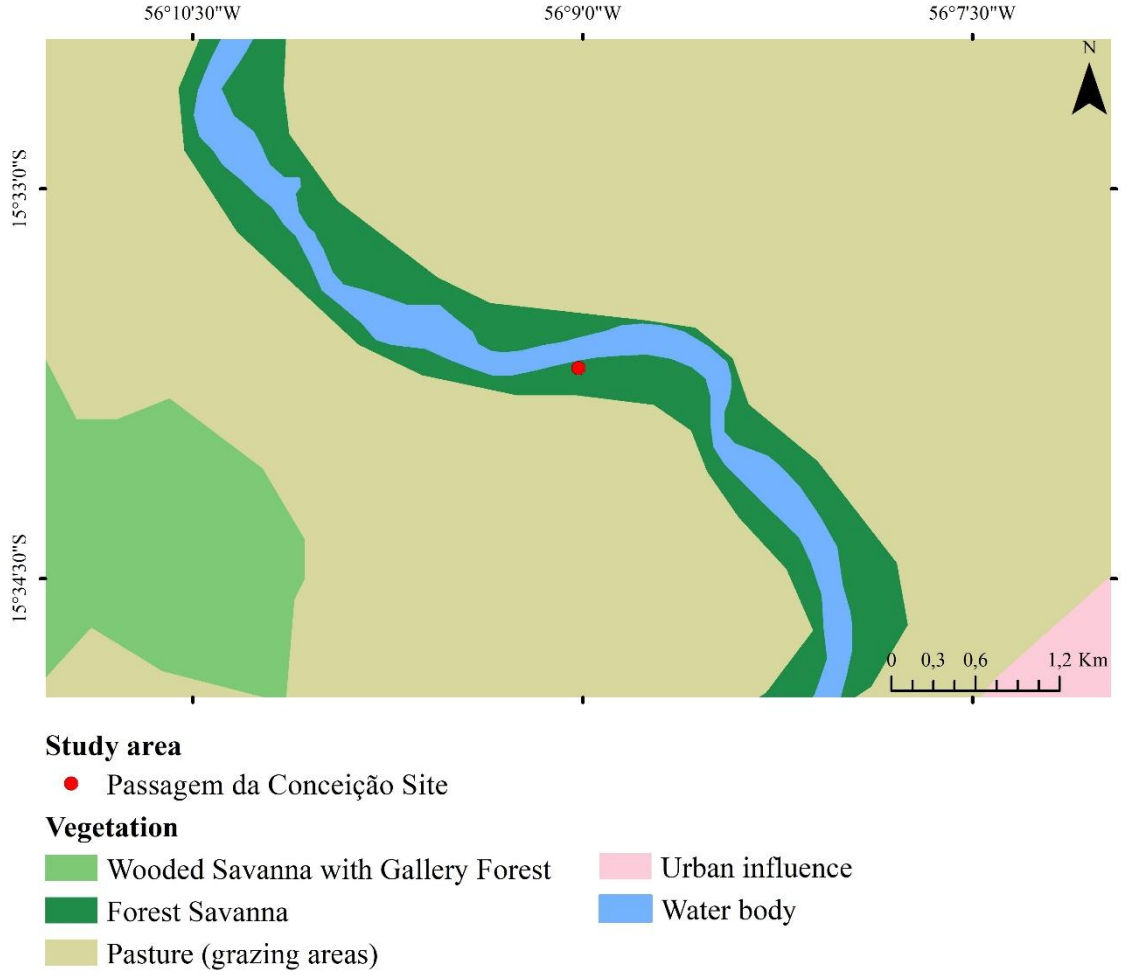
Figure 4. Vegetation map of the Passagem da Conceição study site. Mato Grosso, Brazil



Source: Data compiled by the author. Vegetation: IBGE (2023), scale 1:250,000.

Passagem da Conceição, which is influenced by the Cuiabá River, presents broader and more continuous ecological corridors, typical of gallery forest environments. According to Vieira *et al.* (2015), proximity to large rivers in Mato Grosso not only ensures greater floristic diversity but also provides a wider availability of plant resources (Figure 5).

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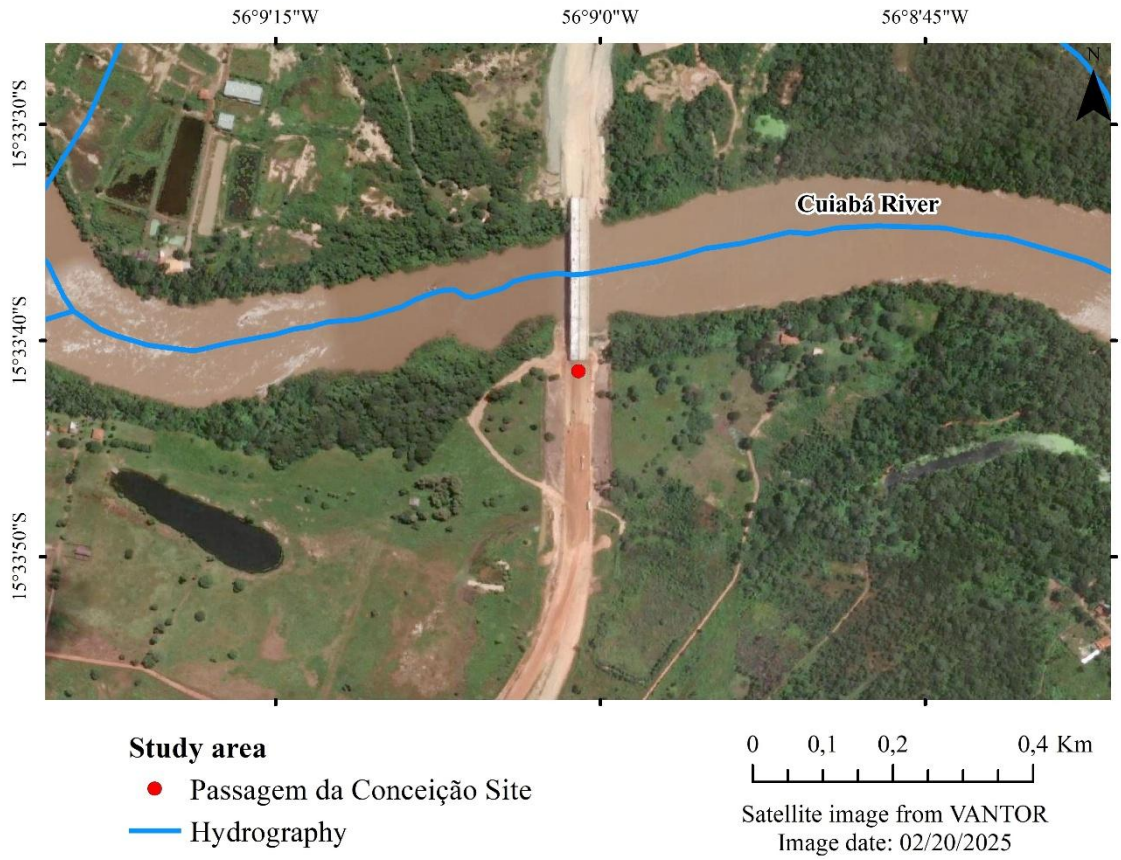
Figure 5. Cuiabá River at Passagem da Conceição. Mato Grosso, Brazil



Source: Data compiled by the author. Hydrography data from the IBGE, scale 1:25,000.

Secondary data were compiled from materials originally obtained through the application of ethnobotanical techniques, including semi-structured and open interviews (Tongco, 2007; Minayo, 1994, 2007), participant observation, guided walks, and oral histories (Meihy, 1996). These data were complemented by bibliographic information and by the collection of plant specimens for subsequent botanical identification.

Botanical identification followed the manuals by Lorenzi and Matos (2008) and Lorenzi (2013), as well as the APG IV classification system (APG IV, 2016). Scientific nomenclature was verified using the Flora do Brasil database (floradobrasil.jbrj.gov.br) and the Missouri Botanical Garden database (http://mobot.mobot.org/W3T/Search/vast.html). Voucher specimens were deposited in the Herbarium of the Federal University of Mato Grosso (UFMT).

Plant use categories, including parts used, preparation methods, dosages, and categories related to health (medicinal use, supplements, food), religious-mystical practices, ornamental use, and other forms of utilization, were defined based on the specialized literature

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(Hanazaki, 2010; Klein *et al.*, 2020; Pasa, 2021). Data varied between localities, as did sampling effort and population characteristics, particularly regarding the presence of key informants such as elders, healers, and traditional blessing practitioners.

Sampling across different environments is relevant because communities may express similar cultural traits depending on historical circumstances and on the botanical repertoire available in their surroundings, including both native and introduced species. The therapeutic indications of plants used in local traditional medicine were grouped according to the disease classification proposed by the International Classification of Diseases (ICD-10) of the World Health Organization (WHO, 2019), as presented in Table 5. This is a cross-sectional qualitative-quantitative study involving the application of the Informed Consent Form (ICF), the Post-informed Consent Form, and semi-structured and open interviews. The study was conducted in accordance with the Declaration of Helsinki and approved by the Research Ethics Committee (CEP – Health) of the Federal University of Mato Grosso (UFMT), under authorization CAAE No. 78947824.2.0000.8124 and approval number 7,160,593.

3. RESULTS AND DISCUSSION

The regional characteristics of the study areas record primary data related to the recognition and identification of vegetation, biome, phytophysiognomy, as well as relief, soil, hypsometry, climate, and hydrological influence. These environmental and anthropological attributes are summarized in Table 1.

Table 1. Environmental and anthropological characteristics of the study areas. 2025

Parameter	Vale da Promissão (Rosário Oeste) – Upper Paraguay	Passagem da Conceição (Várzea Grande) – Lower Paraguay
Predominant biome	Cerrado	Cerrado
Local phytophysiognomy	Grass–woody savanna, riparian forest	Gallery forest, transitional vegetation
Proximity to water	Currupira River, humid areas	Cuiabá River, Cerrado–river transition zones
Mean altitude	300 m	250 m
Local plant use	Folk medicine, food, rituals	Folk medicine, food, rituals
Presence of traditional communities	Rural community with ancestral practices	Community with strong ties to local knowledge
Seasonal variation	Well-defined dry and rainy seasons	Periods of drought and intense rainfall

Source: Souza, 2025.

Sociocultural characteristics

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A total of 84 individuals participated in the study, of whom 53% were women residing in the communities and primarily engaged in household activities and childcare. Men were mainly involved in family farming or in labor activities within the surrounding areas, particularly in rural contexts. The age of the interviewees ranged from 40 to 100 years. Sociodemographic data from the Vale da Promissão community included 24 participants, and the local economy is based on subsistence agriculture, forest extractivism, and fishing, all primarily directed toward family consumption (Table 2).

Table 2. Sociodemographic profile of the Vale da Promissão community, Rosário Oeste, Mato Grosso

Category	Classes	Frequency (n)	Percentage (%)
Gender	Female	14	58.3
	Male	10	41.7
Age group	30–40 years	1	4.2
	41–51 years	1	4.2
	52–61 years	5	20.8
	62–71 years	12	50.0
	72–81 years	1	4.2
	82–100 years	4	16.7
Education	Literate	16	66.7
Main activity	Agriculture/extractivism	24	100.0
Religion	Catholic	24	100.0

Source: Souza, 2025.

In Passagem da Conceição, sociodemographic data comprised 60 participants. The local economy is based on forest extractivism, subsistence agriculture, and fishing, with particular emphasis on Mato Grosso regional gastronomy, including traditional dishes and fish-based foods (Table 3).

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Table 3. Sociodemographic profile of the Passagem da Conceição community, Várzea Grande, Mato Grosso

Category	Subcategory	Frequency (n)	Percentage (%)
Gender	Female	30	50.0
	Male	30	50.0
Age group	18–45 years	21	35.0
	46–65 years	23	38.3
	> 65 years	16	26.7
Education	No formal schooling	3	5.0
	Primary education (complete/incomplete)	28	46.7
	Complete secondary education	22	36.7
	Higher education	6	10.0
	Postgraduate education	1	1.7
Religion	Catholic	53	88.3
	Evangelical	6	10.0

Source: Souza, 2025.

In the studied communities, knowledge about plants is widespread among both men and women; however, knowledge specifically related to medicinal plants is predominantly held by women and elderly individuals. On average, most participants have incomplete primary education. Catholicism is the predominant religion, followed by religious practices influenced by African traditions, which are widely present and actively practiced within these communities.

Economic activities are primarily based on small land plots (ranging from approximately 100 to 400 m²), embedded within an agroforestry landscape that includes the cultivation of *Manihot esculenta Crantz, Musa sp., Carica papaya L., Cucurbita sp., Punica sp., Zea mays L., Ipomoea batatas (L.) Lam, Saccharum sp., Senna occidentalis (L.) Link., Gossypium sp., Citrus sp.*, among other species, mainly for family subsistence. Collective labor practices known as *mutirão*[4] were recorded in both communities, involving the sharing of rural work among neighbors, friends, and relatives based on cooperation and solidarity. These practices represent a common anthropological and social event in Brazilian rural communities.

In general, the plants used are obtained from a variety of environments, including natural forested areas and *Cerradão* formations, where native species are collectively accessed by the population. Anthropogenic areas—defined as zones with intense human intervention—are characterized by cultivated and/or domesticated species, such as home gardens and backyard

[4] **Mutirão** refers to collective and collaborative actions involving the management, cultivation, harvesting, and conservation of plants with cultural, medicinal, food-related, or artisanal significance. These practices are based on mutual aid, solidarity, and the exchange of knowledge—both traditional and technical—aimed at strengthening local empowerment and promoting the appreciation of sociobiodiversity.

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plots located near residences. These spaces contain medicinal and food plants, especially herbaceous species, facilitating food preparation and medicinal practices, activities largely managed by women.

Additionally, areas under regeneration, locally known as *capoeiras*, were identified at different stages of ecological succession within the studied communities. These areas include both exotic and native species and constitute important transitional environments that contribute to the diversity of plant resources available for subsistence, medicinal use, and cultural practices.

Ethnobotanical knowledge

A total of 160 native and exotic plant species were recorded for different uses by local populations, most of them belonging to the botanical families Fabaceae, Asteraceae, Lamiaceae, Malvaceae, and Rutaceae (Table 4).

Table 4. Botanical and ethnobotanical data from the study areas. 2025

Botanical family	Species	Food use	Medicinal use
Fabaceae	*Copaifera langsdorfii*	Not recorded	Oil with anti-inflammatory and healing properties
Fabaceae	*Hymenaea stigonocarpa*	Edible fruit rich in carbohydrates	Expectorant and antifungal
Asteraceae	*Baccharis trimera*	Not recorded	Treatment of gastrointestinal disorders
Amaryllidaceae	*Allium sativum*	Food seasoning	Blood pressure reduction; antimicrobial properties
Myrtaceae	*Psidium guajava*	Widely consumed fruits	Control of diarrhea and gastrointestinal infections
Moraceae	*Dorstenia brasiliensis*	Not recorded	Ritual use and wound-healing processes
Calophyllaceae	*Kielmeyera angustifolia*	Not recorded	Antimicrobial and healing action
Magnoliaceae	*Talauma ovata*	Potential seed use	Treatment of inflammation and wounds

Source: Souza, 2025.

In general, the plants used exhibit multiple functions, with medicinal plants being particularly expressive and presenting a wide range of uses. In many cases, they represent the only available therapy for common ailments such as influenza, headaches, *arca caída* (cultural illness), diabetes, hypertension, toothache, depression, envy, and *evil eye*, among others. The number of citations varied according to community size; on average, each participant cited five species used in traditional Mato Grosso medicine.

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Among food plants, the most frequently cited species were *Musa parasidiaca* L., *Carica papaya* L., *Citrus limon* (L.) Osbeck, *Anacardium occidentale* L., *Psidium guajava* L., and *Citrus sinensis* L. Osbeck, among others. For mystic-religious use, particularly for bodily protection, species such as *Zingiber officinale* L., *Ruta graveolens* L. *Melissa officinalis* L., *Gossypium hirsutum* L., *Petiveria alliacea* L., *Rosmarinus officinalis* L., *Aloe vera* (L.) Burm. F., *Sansevieria trifasciata* Prain., *Vernonia polyanthes* (Spreng.) Less., *Mikania glomerata* Spreng., *Matricaria chamomilla* L., *Justicia pectoralis* Jacq, *Echinodorus macrophyllus* (Kunt) Micheli, *Alternanthera brasiliana* (L.) Kuntze, *Cymbopogon citratus* (DC.) Stapf, *Allium fistulosum* L., *Dieffenbachia amoena* Bull., *Matricaria recutita* L., *Mikania glomerata* Spreng., *Artemisia absinthium* L., and *Vernonia polyanthes* (Spreng.) Less were reported.

Religious uses occur through blessings and prayers, performed individually or collectively, aimed at treating conditions such as *evil eye*, sadness, weakness, envy, and bad luck. Herbaceous species predominate among medicinal plants, and the most frequently used plant part is the leaf, followed by bark and fruits. Preparations are mainly in the form of teas, followed by infusions, macerations, and topical applications (compresses).

Medicinal species were classified according to the World Health Organization (WHO, 2019). Most citations of use were associated with the circulatory system, followed by the digestive system, genitourinary system, respiratory system, nutritional and metabolic disorders, nervous system, and personal or magical-religious protection. Overall, the most frequent health treatments included stomach pain, hypertension, blood purification, bronchitis, intestinal worms, hemorrhoids, osteoporosis, diuresis, anemia, high cholesterol, tumors, cancer, dengue, malaria, postpartum care, heart problems, kidney stones, ulcers, rheumatism, malaise, liver disorders, cough, vomiting, wounds, and burns (Table 5).

Table 5. Number of citations of uses: M = Medicinal; Al = Food; Pr = Protection (mystic-religious)

Category	Passagem da Conceição community	Vale da Promissão community	Total
M	278	124	402
M; Al	56	29	85
M; Pr	44	22	66
Number of interviews	60	24	84

Source: Souza, 2025.

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Secondary data were originally obtained through the application of ethnobotanical techniques, including semi-structured and open interviews (Tongco, 2007; Minayo, 1994, 2007), participant observation, guided walks, and oral histories (Meihy, 1996). These data were complemented with bibliographic information and the collection of plant specimens for subsequent botanical identification. Botanical identification followed Lorenzi and Matos (2008), Lorenzi (2013), and the APG IV classification system (APG IV, 2016). Scientific names were verified using the Flora do Brasil database (floradobrasil.jbrj.gov.br) and the Missouri Botanical Garden database (http://mobot.mobot.org/W3T/Search/vast.html), as presented in Table 4. Voucher specimens were deposited in the Herbarium of the Federal University of Mato Grosso (UFMT).

Categories of plant use, plant parts utilized, dosages, and use categories related to health (medicinal use, supplements), food, mystic-religious practices, ornamental purposes, and other forms of use were defined based on the specialized literature (Hanazaki, 2010; Pasa, 2021; Klein *et al.*, 2020). Data varied between localities, as did sampling effort and population characteristics, particularly regarding the presence of key informants such as elders, healers, and traditional blessing practitioners (benzedeiros and benzedeiras).

Sampling across different environments is relevant because communities may express similar cultural traits depending on historical circumstances and on the botanical repertoire available in their surroundings, including both native and introduced species. Therapeutic indications of plants used in local traditional medicine were grouped according to the disease classification proposed by the International Classification of Diseases (ICD-10) of the World Health Organization (WHO, 2019), with selected species presented in Table 6.

Table 6. Medicinal species and correspondence with ICD-10 categories (WHO, 2019)

Species	Medicinal use	Nosological category (ICD-10)	ICD
Cymbopogon citratus	Calming, digestive	Anxiety disorders and functional dyspepsia	F41 / K30
Lippia alba	Sedative, headache	Sleep disorders and headaches	G43 / G47
Mentha sp.	Cold, fever	Upper respiratory tract infections	J00–J06
Aloe vera	Burns, wounds, skin care	Skin lesions and burns	L00–L99 / T20
Schinus terebinthifolius	Inflammation, intestinal worms	Nonspecific inflammation / intestinal helminthiasis	K52 / B65
Mikania glomerata	Expectorant, cough	Bronchitis and lower respiratory tract disorders	J20–J22

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Species	Medicinal use	Nosological category (ICD-10)	ICD
Carica papaya	Digestive, vermifuge	Digestive disorders and helminthiasis	K31 / B65
Psidium guajava	Diarrhea, gastrointestinal infections	Bacterial intestinal infections	A09 / K59

Source: Souza, 2025. ***Vouchers:*** For plants collected in Mato Grosso, voucher numbers range from UFMT 41495 to 41712 and from 42344 to 42408.

Table 7 presents the results of palynological records, while Figure 6 illustrates the hypsometric data of the soil, indicating a possible relationship between depth and the presence of palynomorphs.

Table 7. Soil depth records and presence of local palynomorphs

Sampling / Depth (cm)	Pollen (n)	Spores (n)	Fungi (n)	Total (n)
SD1 – 60 cm	1	1	5	7
SD2 – 70 cm	0	1	6	7
Overall total	**1**	**2**	**11**	**14**

Source: Souza, 2025.

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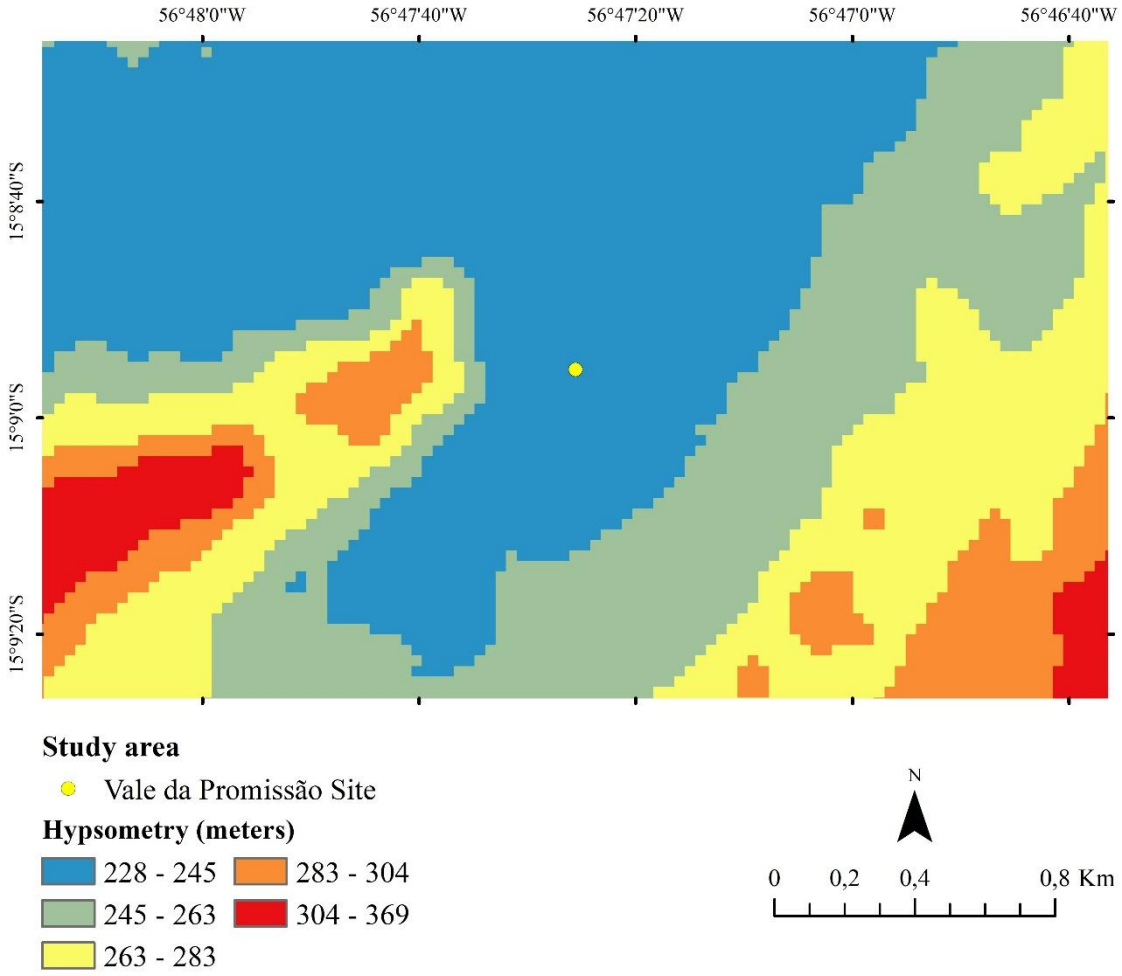
Figure 6. Hypsometric map of the Vale da Promissão. Mato Grosso, Brazil



Source: Adapted by the author, National Water and Basic Sanitation Agency (ANA): https://metadados.snirh.gov.br/geonetwork/srv/api/records/93664c15-1ff8-4e87-bbed-2bb69d321309

Table 8 presents the results regarding the number and relative distribution of palynomorphs identified at each study site, while Figure 7 illustrates the hypsometric data of the soil, indicating a possible relationship between depth and the presence of palynomorphs.

Table 8. Percentage distribution of palynomorphs in the study areas

Study area	Pollen (%)	Spores (%)	Fungi (%)	Total palynomorphs (n)
Vale da Promissão	7.1	14.3	78.6	14
Passagem da Conceição	20.7	17.2	62.1	29

Source: Souza, 2025.

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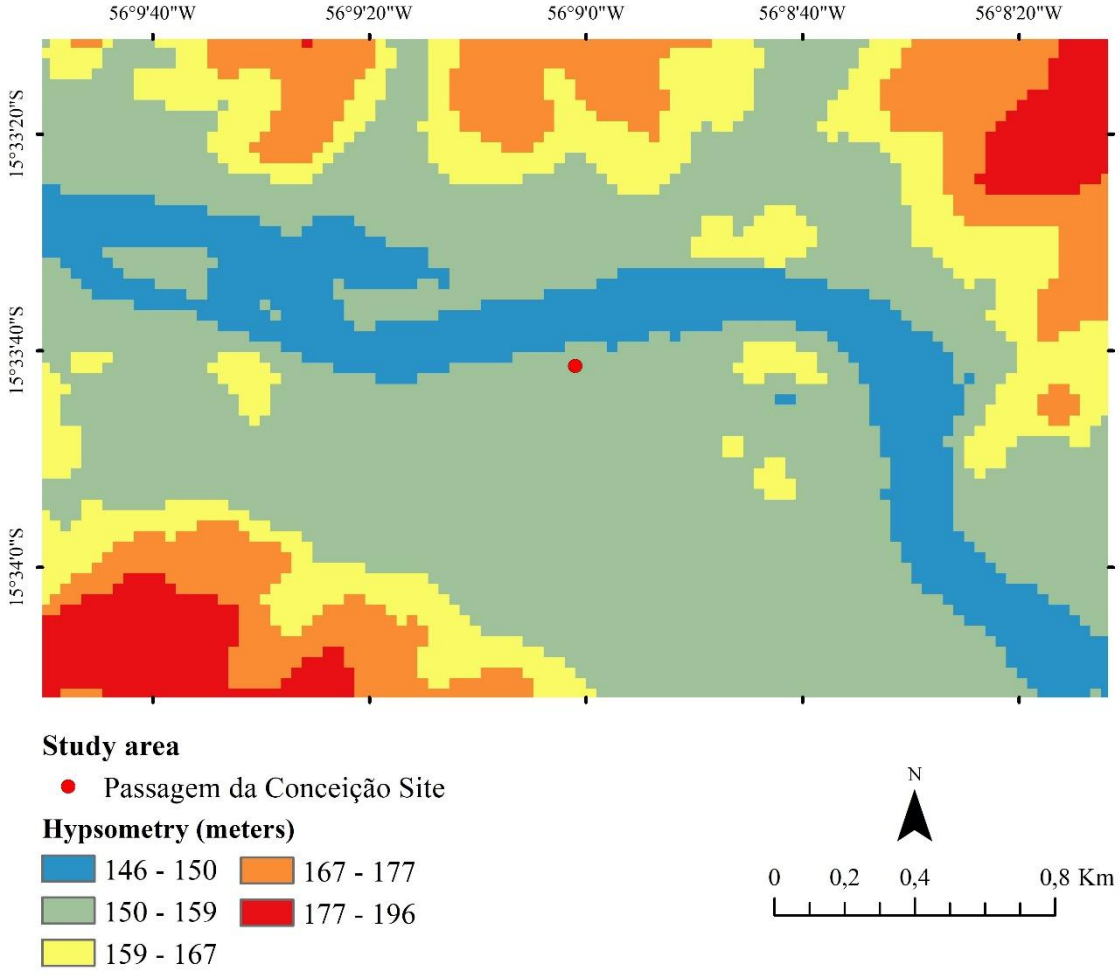
Figure 7. Hypsometric map of the Passagem da Conceição study site. Mato Grosso, Brazil



Source: Adapted by the author. ANADEM Digital Elevation Model (DEM), spatial scale 30 meters.

Landscapes, always permeated by the past, can be understood as "legacies of successive relationships between humans and nature," and may be viewed either as products of the coevolution between human societies and the natural environment or as territorial expressions of the relationship that a given society maintains with the natural system that sustains it (Naveh; Lieberman, 1994). By integrating ethnobotanical data with palynological records, this study reveals scientific evidence of plant use and possible forms of use that are historically constructed and transmitted over time. Ethnobotany, by interpreting these landscape units and the diversity of plants used by populations throughout history, allows for the description of plant use by South American societies, providing specific insights into the processes of human occupation in the Cerrado of Mato Grosso (Clement *et al.*, 2015).

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Conde *et al*. (2017) reported similar results regarding the predominance of older individuals among interviewed specialists, particularly when documenting ethnobotanical knowledge related to traditional medicine. Posey *et al.* (1984), in their analysis of Indigenous peoples and traditional communities in the Amazon, emphasized that the absence of written records does not prevent the construction of sophisticated systems of classification and use of flora. Therefore, in the communities studied here, oral transmission may be interpreted as a strategy of cultural resistance, maintaining practices and categories of use that would be difficult to preserve through formal documentation alone.

The importance of knowledge held by women—especially regarding medicinal plants in rural traditional communities—reflects the social distribution of labor within these societies, as observed by Voeks (2007). Women's knowledge of nature is generally associated with anthropogenic or cultural landscapes, such as home gardens, kitchen gardens, and backyards, which are accessible and practical spaces where domestic responsibilities and childcare can be reconciled with plant management (Amorozo, 2002). In the Vale da Promissão community, women represented 58.3% of participants, a pattern consistent with the observations of Guarim Neto and Carniello (2007), who describe women in rural contexts of the Cerrado and Amazon as guardians of local cultural and biological biodiversity. Men, in contrast, generally work in areas farther from residences or in less accessible forested environments, acquiring knowledge and management skills related to forest species, while women tend to be more proficient in medicinal herbs. As a result, women and men clearly possess different bodies of knowledge regarding their local floras, a pattern especially pronounced in tropical medicinal floras (Voeks, 2007; Lezan; Ribeiro; Pasa, 2024).

The predominance of Catholicism reflects the historical characteristics of these regions of Mato Grosso, where there is a convergence between caboclo, Afro-descendant, and Indigenous belief systems when compared with Catholic traditions in syncretic religious contexts. These dynamics became particularly evident after the African Diaspora, when traditional Catholic communities incorporated plants such as *Ruta graveolens* and *Rosmarinus officinalis* into ritual practices of blessing and spiritual protection, illustrating a close interaction between plants and religion (Klein *et al.*, 2020). The Catholic homogeneity observed in the communities studied here suggests the persistence of ritual practices linked to plant use, reinforcing the connection between religiosity, symbolism, and ethnobotanical knowledge.

These communities interact with a wide range of plants revealed through ethnobotanical investigation, presenting similar uses when knowledge is shared. This pattern may represent a legacy among so-called traditional communities, united by cultural ties, in which plant use reflects the interdependence between biological, social, and cultural dimensions of human life. However,

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the set of shared species may also have been influenced by historical factors related to Portuguese expansion, which contributed to the homogenization of plant use across different regions of the Cerrado (Crosby, 1993). Given that the state of Mato Grosso was historically occupied by Indigenous, caboclo, and Afro-descendant populations, it is possible to suggest that similarities between the studied communities are influenced by their geographic location in tropical regions, sharing a Neotropical environment in Mato Grosso and an Afro-tropical component for introduced African plants. In other words, distinct biogeographic histories may favor the establishment of similar sets of introduced plants in these communities.

Among the most representative botanical families used by these human populations today are Asteraceae and Lamiaceae. Asteraceae is one of the largest families of angiosperms worldwide and is well represented in Brazil, particularly in open environments such as the Cerrado (Hattori; Nakajima, 2008; Souza *et al.*, 2018). Lamiaceae, in turn, occurs across all Brazilian biomes (Lewis *et al.*, 2005; Souza *et al.*, 2018). Both families include several introduced species originating from the Mediterranean region, especially aromatic plants, among which the most frequently cited are *Rosmarinus officinalis*, *Ocimum* sp., *Mentha* × *villosa*, and *Mentha pulegium*. These species possess remarkable medicinal potential and are widely used in Mato Grosso regional gastronomy.

When historicizing the process of South American occupation in the state, it is essential to consider that the movement of plants from tropical Africa to the Americas occurred over many years, either intentionally or unintentionally. As part of this botanical trajectory, domesticated floras from distant regions were introduced (Voeks, 2017). Crosby (1993) termed this process the “Columbian Exchange,” as it contributed to global botanical homogenization and facilitated African transculturation through the diffusion of food and magical-religious plants among Afro-descendant populations in the New World. Through these processes, communities were able to assert a degree of cultural sovereignty in relation to European and American hegemonies (Voeks; Rashford, 2013). This dynamic is evidenced by the mixture of plants of different origins—such as *Anacardium occidentale*, *Musa paradisiaca*, *Jatropha gossypiifolia*, *Senna occidentalis*, *Gossypium hirsutum*, *Citrus sinensis*, and *Zingiber officinale*—recorded in the ethnobotanical repertoires of these communities in Mato Grosso.

Studies by Parsons (1970) on Indigenous and diasporic peoples consider these groups as “repositories of botanical and ethnobotanical knowledge,” emphasizing that the colonization of the Americas promoted inadvertent and intentional biological exchanges on an unprecedented scale, accelerating biogeographic exchange processes between the Old and the New Worlds. Pre-Columbian communities in the New World relied on staple foods such as maize, cassava, squash, beans, peanuts, and sweet potatoes, while populations of the Old World incorporated

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native American fruits into their diets, including passion fruit, guava, cashew, and papaya, among others (Parsons, 1970). Indigenous food systems were subsequently expanded and blended with plant products introduced from the Old World, such as wheat, white rice, vegetables, and bananas, many of which became naturalized and incorporated into local diets (Voeks; Greene, 2018).

In managing environmental resources for survival and plant resilience, African populations developed diverse ethnobotanical traditions that sustained rural Black cultures throughout the Americas. African knowledge applied to the Neotropical landscape “enabled cultural and environmental readaptation in the New World, new relationships with wild and domesticated nature, and genetic exchange of plants between continents” (Voeks, 2017). The diversity of plants used by the communities studied here reflects both the floristic potential of the Cerrado and their availability in natural habitats or culturally structured environments. Several introduced species are cultivated in anthropogenic spaces such as home gardens and backyards. These gardens and yards, as human-created spaces, may be considered cultural or domesticated landscapes and often represent a mixture of native and exotic species (Ávila, 2015).

Aceituno and Loaiza (2015) emphasize that paleoethnobotanical studies from the early Holocene reveal food production systems based on fruit trees and tuberous plants, with plant use, management, and control progressively increasing since the Pleistocene–Holocene transition, thereby altering plant diversity and distribution across landscapes. Clement *et al.* (2015) argue that archaeological, botanical, ecological, anthropological, genetic, and historical evidence demonstrates that early populations constructed their living spaces within local ecosystems, modifying them to meet survival needs. In South America, floristic archaeological remains have been documented since the Pleistocene–Holocene transition, often as charred remains, including jatobá (*Hymenaea*), burnt palm nuts, and guariroba (*Syagrus oleracea*) (Resende; Cardoso, 2009). Morcote-Ríos and Bernal (2001) recorded the use of 29 palm genera across several archaeological sites in the Americas—including *Acrocomia*, *Astrocaryum*, *Attalea*, *Mauritia*, and *Oenocarpus*—with evidence dating back to the early Holocene.

4. FINAL CONSIDERATIONS

The colonization process of the tropical savannas of Mato Grosso occurred through inland expansion routes associated with different population pulses, evidenced by archaeological sites located in Central-Western Brazil. These routes crossed transitional zones between tropical savannas and tropical forests, particularly along headwaters of rivers draining both toward the Amazon Basin and toward the Central Plateau and southeastern Brazil. At the Santa Elina site, although no dates are available for the Pleistocene–Holocene transition, Late Pleistocene dates

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ranging from approximately 13,000 to 27,000 years BP have been documented and are associated with lithic remains. Despite still being poorly understood, the site is situated along early settlement routes, and its artifact assemblage may represent a possible connection between the western highlands and the eastern lowlands of South America.

The integration of ethnobotanical and palynological data allows the Cerrado landscape of Mato Grosso to be understood as the product of a long-term history of human use and occupation. Palynological evidence indicates that present-day environmental variation and floristic composition result from continuous interactions between human populations and their surroundings. This reinforces the perspective that the Cerrado should not be interpreted as an isolated “natural” biome, but rather as a culturally constructed landscape shaped over time by human practices.

This ethno-paleobotanical study, based on an integrated methodological approach, confirms that ethnobotany and palynology are complementary fields. Together, they reveal both the symbolic and cultural dimensions of plant use and the material traces left by these practices in sedimentary records. This integration makes it possible to visualize connections between past and present, demonstrating that traditional knowledge is part of a broader process of landscape occupation and transformation. Thus, the long-term human presence in the Cerrado of Mato Grosso is expressed not only through land use patterns, but also through the memory and persistence of practices that continue to rely on local flora for subsistence, health, and cultural identity.

This study does not provide an exhaustive ethnobotanical and palynological documentation for the state of Mato Grosso. Such comprehensive efforts remain necessary and would open avenues for future ethno-paleobotanical research, offering greater detail on ancient Indigenous occupation processes and incorporating richer archaeological datasets.

We therefore recommend that future studies address the taxonomic and phylogenetic relationships among plant species composing the local flora used by human populations during past occupation processes in Mato Grosso. Finally, documenting and disseminating information on plant diversity and use—both in the past and present—contributes to strengthening botanical and cultural heritage in these regions, supporting biodiversity conservation in the face of ongoing sociocultural transformations.

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