

**VOLUNTARY PRESERVATION ON PRIVATE LAND IN BRAZIL:
CHARACTERISATION AND ASSESSMENT OF THE EFFECTIVENESS OF
MANAGING PRIVATE RESERVES OF NATURAL HERITAGE**

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KEYWORDS:

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ABSTRACT:

Private reserves complement public efforts to preserve biodiversity. Brazil already has about 1100 private reserves, but there is still a need to gather accurate information on their integrity and management. This study characterises and analyses the effectiveness of managing a set of 34 areas in the state of Mato Grosso do Sul. The results show that preservation and research are the main objectives for managing these areas, followed by tourism and environmental education. For the group of reserves that were analysed, a rating of 57.6% was obtained. The scopes with the highest ratings were current political and legal uses, and the worst were planning and knowledge. The results showed the importance and comprehensiveness of this initiative in Brazil, but they also reinforced the fact that better management is needed in many of the reserves so that they can adequately meet their initial objectives.

**CONSERVAÇÃO EM TERRAS PRIVADAS NO BRASIL: CARACTERIZAÇÃO E AVALIAÇÃO DA
EFETIVIDADE DE MANEJO DAS RESERVAS PARTICULARES DO PATRIMÔNIO NATURAL**

RESUMO:

As reservas privadas complementam os esforços públicos para a conservação da biodiversidade. No Brasil, apesar de já existirem aproximadamente 1.100 reservas privadas, ainda faltam informações precisas sobre sua integridade e gestão. Esse estudo caracteriza e analisa a eficácia da gestão de um conjunto de 34 áreas do estado do Mato Grosso do Sul. Os resultados demonstram que a conservação e a pesquisa são os principais objetivos de manejo destas áreas, seguidos pelo turismo e educação ambiental. O conjunto de reservas analisado obteve classificação de 57,6%. Os âmbitos mais bem avaliados foram usos atuais e político e legal, e os piores foram o planejamento e ordenamento e o conhecimento. Os resultados demonstram a importância e abrangência dessa iniciativa no estado do Mato Grosso do Sul, mas também reforçam que muitas precisam melhorar sua gestão para que possam cumprir adequadamente seus objetivos de criação.

PALAVRAS-CHAVE:

Áreas protegidas
Reservas privadas
Eficácia do manejo

**CONSERVACIÓN EN TIERRAS PRIVADAS NO BRASIL: CARACTERIZACIÓN Y AVALIACIÓN
DE LA EFECTIVIDAD DE MANEJO DE LAS RESERVAS PRIVADAS DEL PATRIMONIO
NATURAL**

PALABRAS CLAVE:

Áreas protegidas
Reservas privadas
Eficacia de la
administración

RESUMEN:

Las reservas privadas complementan los esfuerzos públicos para la conservación de la biodiversidad. En Brasil, a pesar de que ya hay cerca de 1.100 reservas privadas, aún carecen de información precisa sobre su integridad y gestión. Este estudio describe y analiza la eficacia de la gestión de un conjunto de 34 áreas de Mato Grosso do Sul. Los resultados muestran que la conservación y la investigación son los principales objetivos de la gestión de estas áreas, seguido por el turismo y la educación ambiental. El sistema de reservas obtuvo 57,6% de calificación. Las áreas más valoradas fueron los usos actuales y políticos y legales, y las peores fueron planificación y conocimiento. Los resultados demuestran la importancia y el alcance de esta iniciativa en Mato Grosso do Sul, pero también refuerzan que muchas reservas necesitan mejorar su gestión de manera que puedan cumplir adecuadamente sus objetivos de creación.

INTRODUCTION

Preservation of private land by voluntarily establishing protected areas is a phenomenon that, although not recent, has been spreading rapidly around the world in the past few years (LANGHOLZ; LASSOIE, 2001; LANGHOLZ; KRUG, 2004; BRENT, 2005; IUCN, 2005). The importance of these initiatives is further reinforced by the fact that there are not enough public areas to ensure the preservation of biodiversity (LANGHOLZ; LASSOIE, 2001), and also because many countries depend on the majority of their territory being occupied by private properties (ELI 2003).

Amongst the positive aspects of nature preservation on private land, the following stand out: the reinforcement of systems for protected public areas, the support of scientific research, the possibility of creating environmental education and recreation activities, the increase in the connection between natural landscapes and the protection of key areas along biomes, and prevention against the implementation of potentially harmful uses in areas that are in good condition (LANGHOLZ, 1996; MESQUITA, 1999; LANGHOLZ, 2002; HOLMES, 2013).

However, these initiatives have not been thoroughly studied (UPHOFF; LANGHOLZ, 1998; LANGHOLZ; LASSOIE; SCHELHAS, 2000; KRAMER; LANGHOLZ; SALAFSKY, 2000; QUINTANA; MORSE, 2005; GALLO et al., 2009; HOLMES, 2013; KAMAL; GRODZINSKA-JURCZAK; BROWN, 2014; STOLTON; REDFORD; DUDLEY, 2014), and there have not been enough management assessments or monitoring projects in private reserves (ALDERMAN, 1994; LANGHOLZ, 1996; MESQUITA, 1999; PELLIN, 2010; STOLTON; REDFORD; DUDLEY, 2014). According to Asociación Conservación de la Naturaleza (2007), performing periodic management assessments in these areas would be even more relevant in countries where these are part of the official system of protected areas. This is the case in Brazil, where they are known as private reserves of natural heritage (PRNHs).

Some of the benefits that these management effectiveness assessments can provide to protected areas are as follows: (i) verifying whether initial objectives are met; (ii) identifying their main issues and their causes; (iii) characterising the nature, severity, and distribution of pressure in these areas; (iv) emphasising the positive and negative aspects of the management action, a source of feedback that allows the administrator to make the action better; (v) verifying whether the activities developed are compatible with the objectives of a specific area; (vi) using the results to raise awareness amongst society; and (vii) influencing policies, helping decision makers in the definition of strategies for preservation, and directing the application of resources to solve the main issues and enhance the strengths of these areas (IUCN, 1994; CIFUENTES; IZURIETA; FARIA, 2000; HOCKINGS; STOLTON; DUDLEY, 2000; ERVIN, 2003; HOCKINGS, 2003).

The first formal discussions regarding the need to evaluate the management of these protected areas occurred during the III World Parks Congress in 1982 (IUCN, 1990). During the following years, several methodologies were developed, always with an emphasis on the public protected areas (HOCKINGS; STOLTON; DUDLEY, 2000). A few years later, a survey performed by Leverington; Hockings; Costa (2008) noted that the most used methodologies were as follows: (i) RAPPAM (ERVIN, 2003), applied mainly by initiatives from environmentalist non-governmental organisations (NGOs); (ii) “Tracking Tool” (STOLTON et al., 2003), a requirement of the World Bank, “Forest Alliance,” and a global environment facility (GEF) for protected areas, which received resources from those institutions; and (iii) PROARCA—“The Site Consolidation Scorecard” (COURRAU, 1999). The first two were mostly used in Asian, African, and European countries, and the last one in countries in Latin America (LEVERINGTON; HOCKINGS; COSTA, 2008).

In Brazil, management assessments have been performed since the mid-1990s (PELLIN, 2010). The first studies were based on the methodology proposed by Cifuentes; Izurieta; Faria (2000), such as Faria (1997), Brito (2000), Faria (2002), Uchoa Neto; Silva (2002), Queiroz et al. (2002), Mesquita (2002), Padovan; Lederman (2004), and Faria (2004). Since 2000, broader studies have been performed using the RAPPAM methodology, such as WWF/Brasil (2004), IBAMA; WWF/Brasil (2007), WWF/Brasil; SEMA/MT; ICMBio (2009), WWF/Brasil; SEMA/AC; ICMBio (2009), WWF/Brasil et al. (2009), and WWF; ICMBio (2012). However, these studies have emphasised public protected areas, with rare cases of evaluations including private reserves (PELLIN, 2010).

Considering the integration of PRNHs in the National System of Protected Areas—Brazilian SNUC (Federal Law 9985/2000) and the importance of voluntary preservation initiatives in the country, the aim of this study is to contribute to the expansion of knowledge regarding the characteristics of private reserves in Brazil and the effectiveness of the management of these areas, using as a case study a set of PRNHs located in the state of Mato Grosso do Sul, Brazil.

CONTEXTUALIZATION OF PRIVATE RESERVES IN BRAZIL

In Brazil, private protected areas are known as Private Reserves of Natural Heritage (PRNHs). Their primary goal is conservation of biological diversity. PRNHs are created in perpetuity on the initiative of landowners and are recognized by public authorities. Activities

allowed in these areas include: scientific research and visitations for tourism, recreation and education, as long as such activities are not incompatible with the protection of the resources in the protected area. Thus, a PRNH corresponds to IUCN categories I, II, III and IV depending on the objectives set by its owner.

Currently, the federal legislation governing PRNHs is Federal Law 9985 (2000), which includes these areas within the National System of Officially Protected Areas. Since their emergence in 1990, 1094 PRNHs have been created, protecting approximately 703 740 ha. These are distributed in all Brazilian 27 states and 571 different municipalities. Therefore, PRNHs occur in 10.26% of Brazilian municipalities and corresponds to 0.33% of the total area protected by protected areas (Table 1; CNRPPN, 2013; CNUC, 2013).

Biome	Number of PRNHs	Area (ha)	Mean Area (ha)	% of reserves	% of Area
Caatinga	54	80 507	1491	4.9%	11.4%
Pantanal	24	267 871	11 161	2.2%	38.1%
Pampa (Southern Plains)	8	3170	396	0.7%	0.5%
Amazonia	50	42 586	852	4.6%	6.1%
Cerrado	193	166 406	862	17.6%	23.7%
Atlantic Forest	755	141 468	187	69%	20.1%
Coastal	10	1345	134	0.9%	0.2%
Total	1094	703 353	643	100%	100%

Table 1 - Distribution and average area of PRNHs in different biomes.

Source: CNRPPN, 2013.

Although the largest number of PRNHs is concentrated in the Atlantic Forest (69% of the total), due to the small size of RPPNs here, this biome represents only 20.1% of the total protected area nationally. The opposite is true in the Pantanal, where PRNHs comprise only 2.2% in number, but whose area equals 38.1% of the total protected area by the category.

The average area of private reserves in Brazil is 643 ha. However, there is substantial variation among biomes, with the average in the Pantanal being 11 161 ha and areas in the Atlantic Forest and Coastal biomes of 187 and 134 ha, respectively (Table 1).

According to National Confederation of PRNHs, the vast majority of PRNH owners is comprised of individuals (74%). Of the remaining 23%, which are legal entities, no information exists regarding whether these are Non-Governmental Organizations (NGO) or businesses. A small percentage (2.7%) have undefined property status (CNPRNH 2013).

According to federal law, owners have legal obligations subsequent to the creation of PRNHs, such as ensuring the maintenance of their environmental attributes, marking their boundaries, preparing and submitting a management plan to the responsible agency, and informing annually, or whenever requested, a status report of the PRNH and its activities (Federal Decree 5746/2006). However, both federal and state jurisdictions are lenient regarding the fulfilment of these obligations, likely because of the difficulty these agencies have in tracking and monitoring the management of these areas.

Owners of PRNHs face many challenges: i) excessive bureaucracy that hinders the creation of such areas, ii) lack of public policies to encourage their creation and management, and lack of societal recognition about the benefits associated with these PAs and iii) management inexperience of owners. Despite the large number of private reserves already established, these issues might discourage the creation of future reserves (COSTA, 2006; PELLIN; RANIERI, 2009).

According to Pellin; Ranieri (2009), the main motivations to create PRNHs are conservation of species and ecosystems and the personal satisfaction of contributing to the conservation of natural environments, and of knowing that their descendants would have the opportunity of knowing and enjoying the place they turned into a PNHR. Despite the conservation reasons, the economic incentive variable, is sometimes, also mentioned as decision factor in the creation of PNHRs. In these cases the reasons are obtaining exemption on the Rural Property Tax, economic alternative – tourism, protection against their land being possessed by the government, and to add economic value – marketing (PELLIN; RANIERI, 2009).

METHODS

Study area

The state of Mato Grosso do Sul has an area of approximately 35 713 900 ha, which corresponds to about 4% of Brazil's territory. It is divided into two large river basins: Paraná's, which occupies 47% of its area and is inhabited by 78% of the population, and the basin in Alto Paraguai, which occupies 53% of its area and whose population is widely scattered due to its geological and geographical configuration (MATO GROSSO DO SUL, 2009). The basin in Alto Paraguai is divided into a plateau area (64%) and a plain area (36%), which is known as Pantanal.

In 2009, only 310 000 ha of Mato Grosso do Sul's surface was covered by protected areas from the full protection group, which are integrated into categories I, II, III, and IV of IUCN. This area, when added to the set of 36 existing PRNHs, expanded the protection area to 438 000 ha, showing the importance of private reserves in this state (Figure 1).

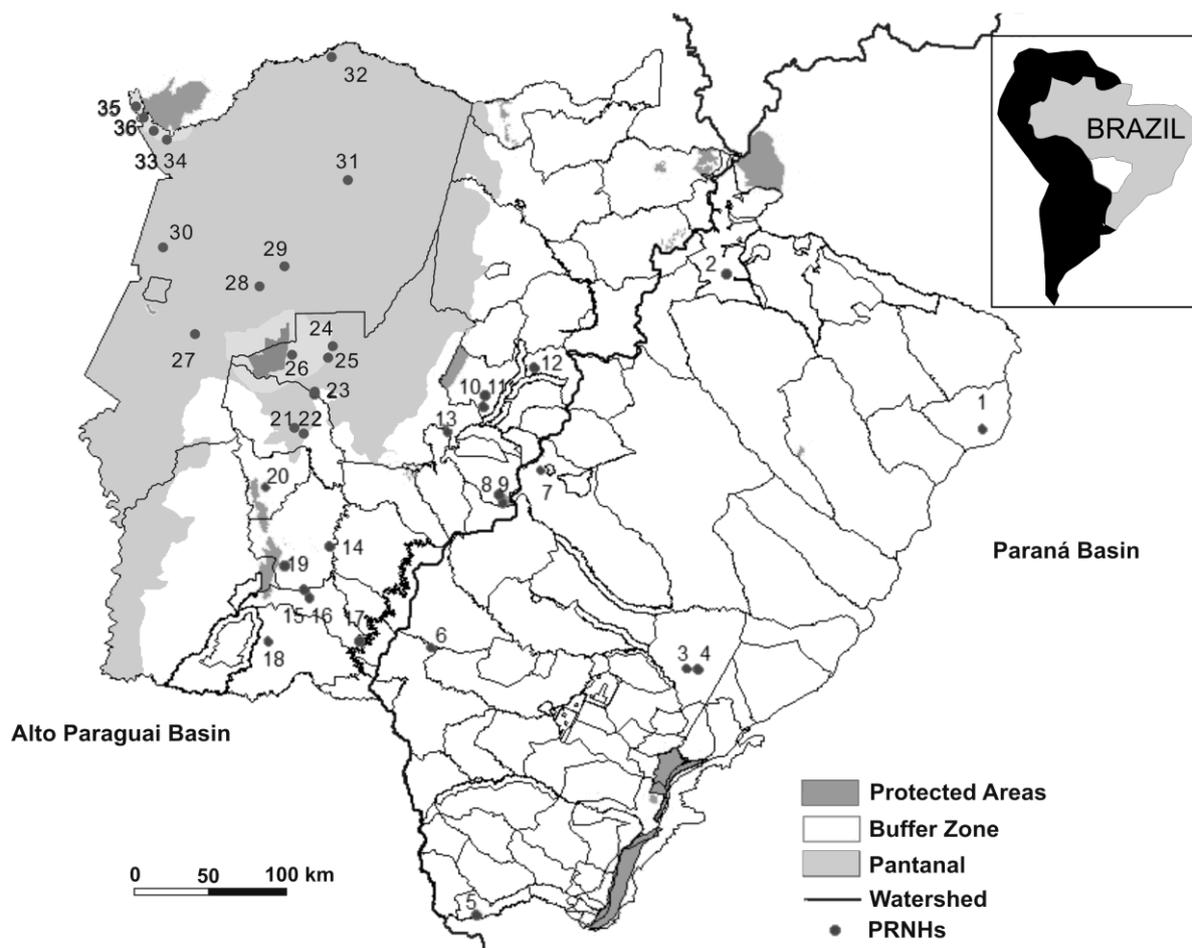


Figure 11 - Mato Grosso do Sul State presenting its division by municipalities and large basins (highlighting the Pantanal), protected areas and its buffer zones and the location of PRNHs officially recognized in the State. **Figure note:** The PRNHs Blongalé, Duas Pedras, Vale do Anhanduí e Engenheiro Eliezer Batista are not with the exact locations because there were no accurate geo-referenced information. 1. Reserva Sabiá; 2. Ponte de Pedra; 3. Cabeceira do Mimoso; 4. Vale do Anhanduí; 5. Blongalé; 6. Morro da Peroba; 7. UFMS; 8. Gavião de Penacho; 9. Vale do Bugio; 10. Nova Querência I; 11. Nova Querência II; 12. Duas Pedras; 13. Lageado; 14. Fazenda da Barra; 15. Cabeceira do Prata; 16. Buraco das Araras; 17. Xodó do Vô Ruy; 18. Fazenda Margarida; 19. São Geraldo; 20. Cara da Onça; 21. Portal do Pantanal Sul I; 22. Portal do Pantanal Sul II; 23. Caiman; 24. Fazenda Rio Negro; 25. Fazenda Santa Sophia; 26. Fazendinha; 27. Paculândia; 28. Fazenda Alegria; 29. Fazenda Nhumirin; 30. Arara Azul; 31. Santa Cecília II; 32. Poleiro Grande; 33. Penha; 34. Engenheiro Eliezer Batista; 35. Acurizal; 36. Rumo ao Oeste. Source: information obtained from the Interactive System Database Support Environmental Licensing/MS.

Assessment of PRNH management effectiveness

The methodology used to assess PRNH management effectiveness in the state of Mato Grosso do Sul was proposed by Pellin (2010). It is an adaptation of the methodologies of Cifuentes; Izurieta; Faria (2000) and Faria (2004), and it assumes the use of indicators, the construction of optimum and current scenarios for each indicator, and their association to a standard scale.

The results are synthesised in a double-entry matrix, whose sum of the highest possible scores of each indicator results in a value called the “optimum total” (which is equivalent to 100% of the reachable total); in turn, the sum of the scores obtained from the analysis of the current situation of the indicators results in a value called the “reached total.” Comparing these two magnitudes in proportion results in a percent value, which, correlated to a valuation scale, defines the effectiveness level of the management process, according to Table 2.

% of the optimum total	Level of management quality	Description of Quality Standard
≤ 40.99	Much Lower Standard	Basic elements are missing from the management and preservation of the PRNH; in the long run, it can be compromised. With these conditions, the management objectives may not be met.
41 – 54.99	Lower Standard	The area is vulnerable to external and/or internal factors, having only minimal elements required for its management. These conditions may prevent some of the primary objectives from being met in this area.
55 – 69.99	Average Standard	The PRNH has very specific deficiencies, which interfere with the creation of a solid basis for effective management. Some of the secondary objectives may not be met.
70 – 84.99	High Standard	Essential activities are regularly developed, driving this set toward meeting the objectives of this unit. The most important program actions are performed.
≥ 85%	Gold Standard	The area has all or almost all key components for its effective management, which means it is able to absorb future demands and requirements without compromising the preservation of protected resources. Compliance with objectives is assured.

Table 2 - Qualification scale of effectiveness regarding protected area management.

Source: adapted from Faria (2004).

The indicators proposed in the methodologies previously quoted were also adapted for higher suitability with the characteristics of private reserves in the country. Therefore, a total of 6 scopes and 27 variants (Table 3) was obtained, which are subdivided into a series of sub-variants that compose the given scenarios. More information on the methodology can be obtained by referring to Pellin’s work (2010), where all scopes, variants, and respective scenarios are described in detail.

Scope	Variant
Political and Legal	Legal recognition of the PRNH Standard application and compliance Relationship with the residents of the surrounding areas

	Support and/or inter-institutional relationship
	Exchange
Planning and Development	Management plan Management programs Zoning
	Administrator Professional staff
Administrative	Organisation chart, standards and management procedures Infrastructure and equipment Financial sustainability Physical demarcation
Knowledge	Biophysical information Cartographic information Socioeconomic information Research and projects Monitoring and feedback
	Size Form Isolation
Quality of the Natural Resources	% of the modified area in its interior Activities developed in surrounding areas Pressure on the natural resources
Current Uses	Permitted uses Non-permitted uses

Table 3 - Indicators used for the assessment of private reserve management proposed by Pellin (2010).

Based on the selected indicators, an interview script was developed addressing several aspects of the characteristics of the PRNHs and their management. All 36 PRNH owners in the state of Mato Grosso do Sul were invited to participate in this research, with 34 of them expressing interest. The interviews were carried out with the owners of the reserves in 67.6% of the cases, and with a manager or employee of the property in the rest of the cases; the interviews took place between March 2008 and December 2009. Whenever possible, visits to the PRNHs were carried out to check information *in loco* (this occurred in 67.6% of the cases). Additionally, data were also collected in relation to the creation processes of the PRNHs in the federal or state environmental entities, and their management plans and other materials supplied by the owners were also verified, such as property registrations and maps of the area.

The answers were used to complete the matrices with the scenarios for evaluating the management process. The data obtained were tabulated in a spreadsheet in order to calculate optimum totals, reached totals, and percent values for each analysed scope, for each sample unit, for the indicators, and for the system as a whole.

RESULTS AND DISCUSSION

Characterisation of PRNHs in the state of Mato Grosso do Sul

Until 2009, the 36 PRNHs in the state of Mato Grosso do Sul accounted for a total area of 128 164 ha. The average area of these reserves is 3 560 ha; however, it varies depending on the region where the reserves are located, which means only 16 reserves located in the Pantanal plateau region account for 108 143 ha. This is probably related to the lower potential for economic activities in the region, which reduces the monetary value of the land. According to the 34 interviewees, the main management goal of the PRNHs, quoted for all areas, is the preservation of species or ecosystems, a result that is similar to the one obtained by Mesquita (1999) for a set of private reserves in Latin America. The second most quoted management goal, mentioned as primary or secondary for all areas, is scientific research (Figure 2).

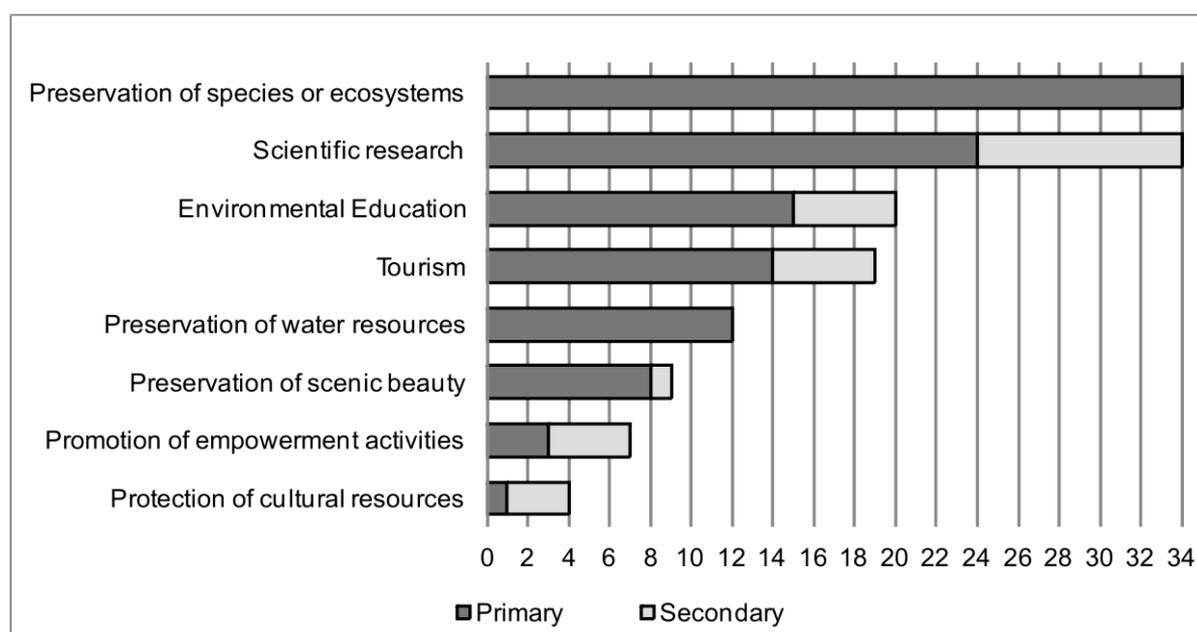


Figure 2 - Primary and secondary management objectives of the PRNHs in the state of Mato Grosso do Sul.

Environmental education and tourism were quoted as a primary goal by 15 and 14 interviewees, respectively, and as a secondary goal by five. Other quoted objectives were the preservation of water resources, the preservation of scenic beauty, the promotion of empowerment activities, and the protection of cultural resources.

Table 4 presents a comparison of the activities developed on the PRNHs of this study with the results found by the following: Alderman (1994), who analysed 48 private reserves, and Langholz (1996), who evaluated 22 private reserves, both in Latin America and Africa; Mesquita (1999), who analysed 118 reserves in Latin America; and Oltremari; Martinez (2000), who analysed 37 private reserves in Chile.

Activity	Alderman		Langholz		Mesquita		Oltremari and Martinez		Present study	
	No.	%	No.	%	No.	%	No.	%	No.	%
Visitation	41	85.4	13	59.1	70	59.3	16	43.2	8	24
Agriculture and Livestock	13	27.1	3	13.6	51	43.2	-	-	-	-
Research	23	47.9	15	68.2	68	57.6	19	51.4	21	62
Environmental education	7	14.6	19	86.4	71	60.2	19	51.4	5	15
Only preservation	-	-	-	-	-	-	-	-	13	38

Table 4 - Comparison of the activities developed on the private reserves from studies carried out by Alderman (1994), Langholz (1996), Mesquita (1999), Oltremari; Martinez (2000), and in this study. Percentages refer to the total number of reserves presented by the activity.

As noted in Table 4, research was quoted as a frequent activity in all the studies, and in the state of Mato Grosso do Sul it occurs or has occurred in 62% of the PRNHs. With regard to visiting, it was verified in only 24% of the PRNHs in this study, which is a lower value than those found by Alderman (1994), Langholz (1996) and Mesquita (1999), and closer to the one found by Oltremari; Martinez (2000). With regard to environmental education, the PRNHs in Mato Grosso do Sul obtained a result similar to the one observed by Alderman (1994), which, however, was lower than those obtained by Mesquita (1999), Langholz (1996), and Oltremari; Martinez (2000). It is important to highlight that, in this study, there were a large number of reserves where no activity is developed (38%).

The majority of the PRNHs in this state (61%) belong to a private individual, followed by companies (27%), NGOs (26%), and two areas belonging to public institution foundations.

Effectiveness of PRNH management in the state of Mato Grosso do Sul

Table 5 summarises the results obtained through the effectiveness assessment of the PRNH management in the state of Mato Grosso do Sul. According to the classification scale adopted, only 29.4% achieved a high or gold standard in terms of management; the remaining were classified to be of average, lower, or much lower standard.

% of the optimum total	Level of management quality	Quantity of CUs	Percentage
≤ 40.99	Much Lower Standard	7	20.6
41 – 54.99	Lower Standard	11	32.4
55 – 69.99	Average Standard	6	17.6
70 – 84.99	High Standard	6	17.6
≥ 85%	Gold Standard	4	11.8

Table 5 - Quality standard of PRNH management in the state of Mato Grosso do Sul.

The set of PRNHs analysed achieved a classification of 57.6% of the optimum level, which leads to the inclusion of the system at a level that requires attention. The number of PRNHs assessed ranged from 30.21% to 87.71% of the optimum level (Figure 3). These results may be compared with those obtained by Tacón et al. (2012), who analysed 35 preservation initiatives on private land in Chile. They obtained a slightly lower assessment,

with 49% of the optimum level for the set of areas that were analysed, with a variation of 17%–61%.

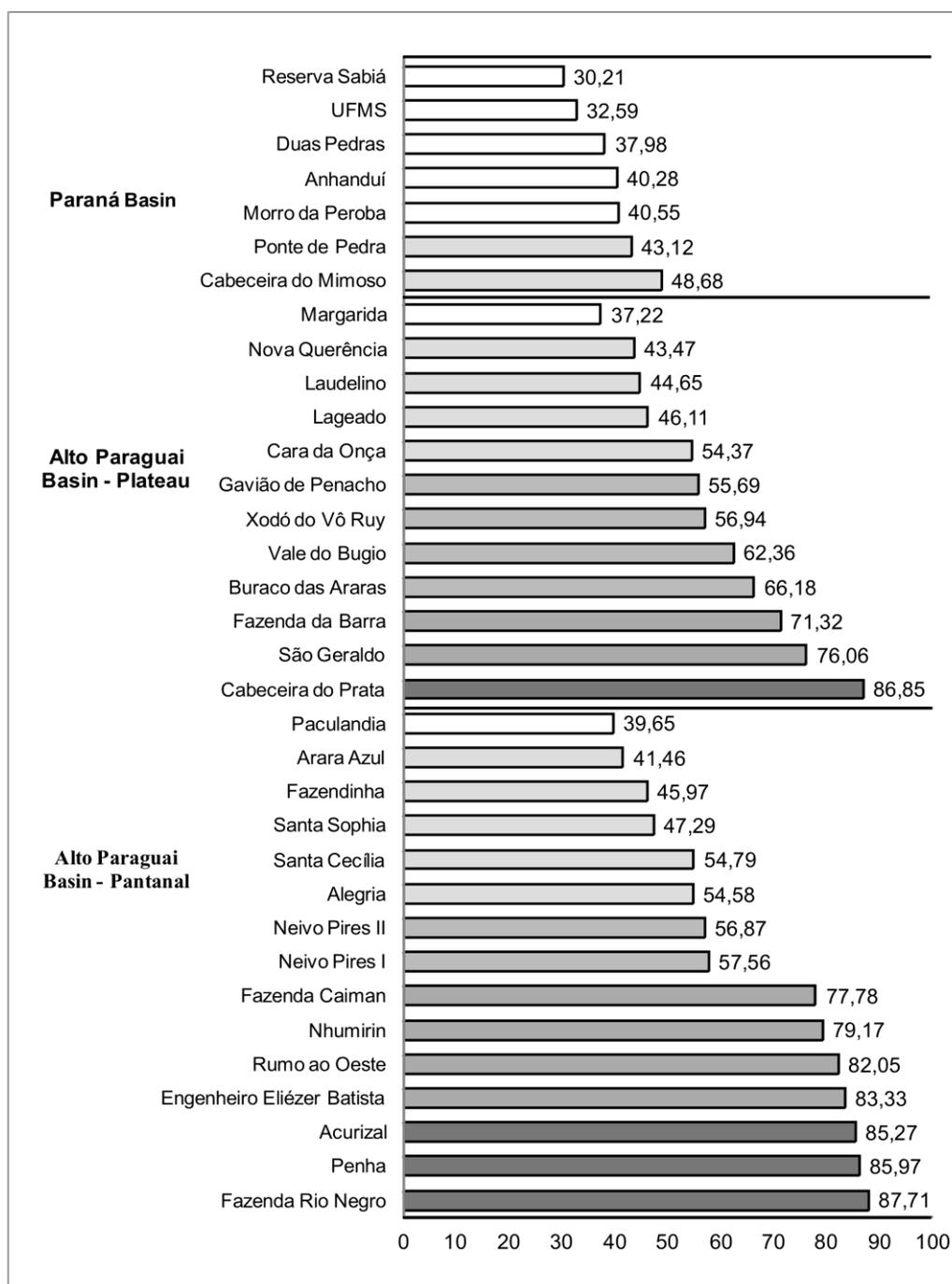


Figure 3 - Classification of PRNH management in the state of Mato Grosso do Sul according to the respective state region and management classes: much lower standard, lower standard, average standard, high standard, gold standard.

This result suggests that there are a large number of private reserves with management weaknesses, which may compromise the achievement of the management objectives in the long term. However, this result was even more positive than the result

obtained by the most recent assessment of federal protected areas of the country, which obtained an average of management effectiveness of 48% for the 292 areas assessed (WWF; ICMBio, 2012).

The results of this study suggest a significant difference in the classification of the PRNHs when analysed per state region. The reserves situated in the region of the Paraná Basin present the worst results, with all the areas being classified with a lower or much lower management standard. In the region of the plateau of the Alto Paraguai Basin, 41.7% of the areas have a lower or much lower management standard, 33.3% have an average standard, and 25% have a high or gold standard. The best situation was observed in the Pantanal, with 40% of the areas presenting a lower or much lower management standard, 13.3% an average standard, and the majority, with 46.7%, a high or gold standard (Figure 3).

This result seems to be influenced by two main factors: I) the region of the Paraná Basin has a highly fragmented and anthropised landscape, which leads to smaller PRNHs under higher pressures coming from the occupation of the surrounding areas; II) the lack of programs supporting the owners in the region of the Paraná Basin. In this regard, Pellin; Ranieri (2009) concluded that only 14% of the owners in this region received support for reserve creation and 28.6 for management. In the Alto Paraguai Basin, this percentage increases to 63% of owners receiving support for reserve creation and 74% for management, thanks to incentive programs that were developed by the Association of Owners of the State in partnership with NGOs.

In relation to the scope and variants analysed through the assessment, it was concluded that “Current Uses” obtained the best classification, with 89.7% on the optimum total (Table 6). This scope assesses whether the allowed uses that exist in the area are being appropriately carried out, and if there are non-permitted uses that go against the area management objectives and standards, or if they are being practiced beyond the pre-established boundaries or zones. As mentioned before, the current uses allowed, as identified, were as follows: environmental research, tourism, and education. The non-permitted uses identified were extraction of resources such as hunting, fishing, or lumber.

Variant	Total obtained	Optimum total	% according to the optimum total
POLITICAL AND LEGAL			
Legal recognition of the PRNH	121.0	136.0	89.0
Standard application and compliance	121.0	136.0	89.0
Relationship with the residents of the surrounding areas	69.0	136.0	50.7
Support and/or inter-institutional relationship	64.0	136.0	47.1
Exchange	76.0	136.0	55.9
SUBTOTAL	451.0	680.0	66.3
PLANNING AND DEVELOPMENT			
Management plan	48.7	136.0	40.5
Management programs	58.0	136.0	35.8
Zoning	161.8	408.0	42.6

SUBTOTAL	268.5	680.0	39.6
ADMINISTRATIVE			
Administrator	69.0	136.0	50.7
Professional staff	56.0	136.0	41.2
Organisation chart, standards, and management procedures	57.0	136.0	41.9
Infrastructure and equipment	66.5	136.0	48.9
Financial sustainability	72.0	136.0	52.9
Physical demarcation	116.0	136.0	85.3
SUBTOTAL	436.5	816.0	53.5
KNOWLEDGE			
Biophysical information	53.0	136.0	39.0
Cartographic information	53.0	136.0	39.0
Socioeconomic information	53.0	136.0	39.0
Research and projects	67.0	136.0	49.3
Monitoring and feedback	25.0	136.0	18.4
SUBTOTAL	251.0	680.0	36.9
QUALITY OF THE NATURAL RESOURCES			
Size	27.0	136.0	19.9
Form	59.0	124.0	47.6
Isolation	84.0	124.0	67.7
% of the modified area in its interior	120.0	136.0	88.2
Activities developed in surrounding areas	82.0	128.0	64.1
Pressure on the natural resources	93.0	136.0	68.4
SUBTOTAL	465.0	784.0	59.3
CURRENT USES			
Non-permitted uses	111.0	136.0	81.6
Permitted uses	133.0	136.0	97.8
SUBTOTAL	244.0	272.0	89.7
SYSTEM EFFECTIVENESS	600	345.3	57.6

Table 6 - Results of the scopes and variants analysed for PRNHs in Mato Grosso do Sul.

The second scope obtaining the best classification was “Political and Legal” with 66.3% of the optimum level. This scope assesses the legal situation of the areas and their compatibility with the guidelines and standards that regulate their creation and management, and their capacity to cooperate with the surrounding areas, other institutions, or even other PRNHs. The variants associated with legal questions were well evaluated; however, the political issues obtained 47.1%–55.9% of the optimum level. The results suggested that the relationship of the PRNHs with the surrounding areas is not always peaceful, and that non-permitted activities are usually carried out in these regions. It was also possible to conclude that, with some exceptions, the exchange is not a common practice, and there are few PRNHs with a network of partners. On the other hand, a large number of owners (66.7%) are part of the Association of Owners of PRNHs of the state. According to Kamal; Grodzinska-Jurczak; Brown (2014), the associations play an important role in

spreading information and improving the connection between reserve owners and environment bodies, which was also observed in this study.

The scope “Quality of the Natural Resources” obtained 59.3% of the optimum level, and it analyses the ecological aspects or the protection-related aspects that may impact the maintenance of the PRNHs in the long term. In relation to the size, it was decided that the surface of a PRNH would ideally be 15 000 ha. This variant received the worst assessment among all variants, with only 19.9% of the optimum situation. As far as form is concerned, the index proposed by MacGarigal; Barbara (1995) was used with a classification of 47.6% of the optimum level for the reserves that were analysed. The existence of areas contiguous to the perimeter of the PRNHs was also analysed, considering as an ideal scenario the existence of areas contiguous to the reserve in at least 70% of its perimeter, and, thus, a result of 67.7% of the optimum level was obtained. This result suggested that, in general, the PRNHs are not isolated in the landscape.

The variant “activities developed in surrounding areas” analyses the adequacy and interference of these activities with the preservation of the area, and it obtained 64.1% of the optimum level. This result was positively impacted by the high-quality performance of the PRNHs located in the Pantanal plateau, which are not under high pressure from the activities developed in the surrounding areas. The percentage of the area modified in its interior achieved 88.2% of the optimum level, which shows that, in general, these areas are mainly intact. The variant “pressure on the natural resources” aims at understanding the intensity and comprehensiveness of the pressures on the area and if there are actions aimed at minimising the negative effects; it obtained 68.4% of the optimum level. In this study, the main external pressures identified were hunting and the presence of exotic species in 50% of the areas, fire in 35%, trespassing in 23%, and fishing in 17%. Protection and inspection actions are essential for guaranteeing the integrity of those reserves, mainly in areas where the natural resources are under pressure. However, for the PRNHs assessed, it was observed that only 21% are frequently inspected; in 56% of the cases, inspection is occasionally performed; and in 23% of the areas, there is no inspection.

The scope “Administrative” was 53.5% of the optimum level and is related to the presence of inputs for management, such as natural resources, equipment, infrastructure, administrative and organisational procedures, and financial resources that guarantee the financial sustainability of the area.

The variant “physical demarcation” obtained the best result among all the variants analysed, with 85.3% of the optimum level, thus demonstrating that this issue is not a problem. The variant “financial sustainability” is aimed at analysing the current situation of the PRNHs in relation to the sufficiency of financial resources allocated to management. It obtained 52.9% of the optimum level, which means that, in general, the resources invested in these areas have only been sufficient to satisfy the most basic needs. It is worth noting that, among the PRNHs analysed, only three meet their financial needs with resources from activities performed within them.

The variant “infrastructure and equipment” obtained a total of 48.9% of the optimum level. The infrastructure more frequently identified is trails and decks. Signs informing about the existence of the PRNHs and the prohibition of illegal activities inside occur in 50% of the reserves. It is worth noting that, in some cases, there are structures such as reception desks, lodges and housing, research centres, and environment education centres constructed outside the boundaries of the PRNHs, but these structures provide support to the reserves.

With regard to basic equipment, it was observed that 58% have communication equipment, 47% have transport equipment, and 26% have protection and fire-fighting equipment.

The variants “administrator” and “professional staff” obtained results of 50.7% and 41.2% of the optimum level, respectively. The survey showed that 64.7% of the areas are managed by the owners themselves and only 32% have employees.

The scope “Planning and Development” assesses the existence of planning instruments that provide guidelines for achieving the management objectives of the PRNHs and the development mechanisms of the developed activities. This scope obtained a classification of 39.6%, the second-worst result overall.

The variant “management plan” obtained 40.5% of the optimum level, with 29.4% of the PRNHs having a management plan (there are six being prepared). The variant 'zoning', which was associated with the presence of the management plan in all cases, obtained 42.6% of the optimum level. The assessment of the documents suggested that all but one presented information, compatible zoning, and transparent guidelines for management. The low implementation of the management plan programs, when applicable, and the nonexistence of other planning instruments were key factors in the low classification of the variant 'management programs'. The interviewees that did not have management plans justified this situation by saying they were not aware that the document was needed and that it was too expensive.

As to this result, it is worth noting that planning weaknesses are also observed in public protected areas of the country. According to Gonçalves (2007), among 288 federal protected areas in 2007, only 28% had management plans. In that same year, Scardua (2007) identified that among 476 protected areas of the state, only 13.8% had a management plan and 22.4% were preparing or reviewing the plan.

The scope “Knowledge” obtained a classification of 36.9%, the worst classification among all the scopes analysed. This scope analysed the availability and organisation of information on the PRNHs and the regions that might contribute to better management. It also addresses the preparation of information for research and the existence of monitoring systems in the PRNHs. The variants 'biophysical information', 'cartographic information', and 'socioeconomic information' obtained 39% of the optimum level. As previously mentioned, research was an activity reported for 62% of the PRNHs; however, this variant obtained a punctuation as low as 49.3%, since the majority of the interviewees did not receive reports or copies of the works with research results, and only 20% of the PRNHs used the results to support management decisions.

Among all the variants analysed, “monitoring and feedback” obtained the lowest score, with only 18.4%. This variant determines whether the PRNHs monitor natural, social, and administrative phenomena that enable the identification of changes in their standards and decision-making processes suitable for management. The existence of monitoring on the impact of public use was reported for three areas, and the monitoring of biologic aspects was reported for two. Some areas reported the development of monitoring aimed at protecting the area against fires. The results obtained by Tacón et al. (2012) also indicate that monitoring was the worst variant among all the variants analysed in this study. This result may reflect the low capacity of this area to monitor and adapt to changes, and to define more efficient management strategies.

CONCLUSIONS

This was a pioneering study in Brazil, because it entailed the first assessment of a high number of PRNHs. The study encompassed an analysis of the characteristics and management of 94% of the reserves in the state of Mato Grosso do Sul, which currently has the second largest protected area for this category.

The main management objectives of these areas are species and ecosystem preservation and research, but many of them also mention tourism and environmental education. However, not all the PRNHs have been developing activities related to these objectives, with 38% exclusively dedicated to self-preservation. Among the reserves that develop other activities, we should mention that research occurs in 62%, while tourism and environmental education occur in only 24% and 9%, respectively.

The subsystem of the PRNHs assessed obtained a classification of 57.6% of the optimum level, with individual results ranging from 30.21% to 87.71%. This result shows that management of many of these areas needs to be enhanced, but it can be considered more positive than the one obtained recently for federally protected areas.

It is important to highlight that a marked difference in management quality was noted when the areas were analysed based upon the region where they are located within the state, with PRNHs from the Basin of Paraná presenting a management standard much lower than those located in the Alto Paraguai Basin. This result seems to be influenced by the landscape characteristics of the region where they are located, by the existence or non-existence of incentive programs in the region, and by the owner's profile, with areas managed by NGOs reaching, in general, higher scores.

The management aspects that obtained the best classification were those related to current uses, compatibility with standards, and political and legal aspects. On the other hand, the most fragile aspect was the planning of these areas and the existence and use of knowledge generated by monitoring projects and research in this region for management of this area.

From the characterisation of this set of PRNHs and the assessment of their management, we can better understand the contribution of these areas, as well as their weaknesses and potential. The results may help to enhance governmental or non-governmental management support programs, with prioritisation of aspects representing the main shortcoming of the system. Moreover, they allow for an individual analysis of the PRNHs, contributing toward the adaptive management of these areas and the fulfilment of their creation objectives.

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