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Papers

Spatial and temporal distribution of Unidades de Conservação in the Cerrado: heterogeneity and structure combined for conservation

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Abstract
Unidades de Conservação - UC (type of Brazilian protected area) corresponds to approximately 18% of the national continental area, resulting from the integration of pressures from organized civil society materialized in public policies, whose selection criteria and distribution have varied over time. By observing the location of these protected areas, issues related to their relevance and Cerrado heterogeneity representativeness are of considerable importance for the conservation of life, since they make it possible to understand this Biome's current situation, perspectives, and challenges for its conservation. Therefore, the objective here is to evaluate the spatial distribution of UC in the Cerrado from the temporal evolution of new units' creation, in administrative spheres and categories, with a period starting in 1949, the year of the first UC creation in the Cerrado, until the end of 2010. The methodological procedures adopted consisted of a bibliographic survey, secondary databases consultation and data processing in a GIS environment. The results show that the distribution of UC is not regular in either space or time. In addition, many units correspond to isolated fragments of vegetation, with no connection to other areas and/or are of smaller dimensions, making it difficult to maintain the ecosystems present in them. In the national scenario, the Cerrado stands out in relation to the number and area of protected ones, which reinforces its important role in Brazilian conservation policies.

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INTRODUCTION

The recognition of the importance of in situ conservation led to an international expansion of protected areas in the 1970s (Watson et al., 2014). This expansion was related in part to an increased concern with environmental protection and the rise of preservationist ideas to ensure the protection of wildlife against agricultural and urban-industrial expansion (DIEGUES, 2008), which materialized with the creation of the first "modern park" (MEDEIROS, 2007), The Yellowstone National Park in the U.S. in 1872.

Protected areas (PA), in general, are classified into categories with different objectives depending on the country and region in which they are located. A PA can be defined as "a geographically defined area that has been designated or regulated and managed to achieve specific conservation objectives" (CBD, 1992, p. 4). These areas have many specificities when one considers the categories and objectives they propose, but consist, according to Jenkins and Joppa (2009), of delimited areas with specific restrictions on human activities.

In 2016, only 19.2% of the world's key biodiversity areas were completely covered by PA (UNEP-WCMC; IUCN, 2016). This means that many species worldwide have a substantial proportion of their populations completely unprotected, as the presence of PA is not always sufficient to ensure population persistence (RODRIGUES et al., 2004). Despite this, protected areas continue to show evidence of their increased contribution to the conservation of diverse terrestrial ecosystems (DUDLEY et al., 2014).

The Tenth Convention on Biological Diversity's (CBD) Strategic Plan for Biodiversity 2011-2020 set the goal that by 2020, 17 percent of terrestrial areas and 10 percent of marine and coastal areas - especially those of particular importance for biodiversity and ecosystem services - would be legally protected (CBD, 2010). However, in 2017 protected areas covered approximately 14.7 percent of the Earth's land surface, according to data from the World Database on Protected Areas (WDPA, 2017).

Based on information made available by UNEP-WCMC/ IUCN (2021), of the seven global regions, the one corresponding to Latin America and the Caribbean has the second highest percentage of land area covered by PAs, with about 24%, second only to the Poles, with more than half of this total area protected in Brazil. According to data from CNUC/MMA (2019) about 18% of Brazil's continental area corresponds to Conservation Units, considering the overlaps, which makes it the country with the largest national network of terrestrial protected areas in the world (UNEP-WCMC; IUCN, 2016).

In Brazil, protected areas are mainly featured as Unidades de Conservação (UC), besides other types, such as Área de Preservação Permanente (APP), which means Permanent Preservation Areas in English, and Reserva Legal (RL), which means Legal Reserves in English. The UC is subdivided into two main categories: Proteção Integral (PI), which means Full Protection in English, that aims at preservation and is more restrictive in relation to the use inside them; and Uso Sustentável (US), which means Sustainable Use in English, that proposes adequate use of the resources in interaction with the present communities (BRASIL, 2000).

Throughout the creation process, these units went through various selection criteria, ranging from scenic to exceptionalism (ARAUJO, 2007) and only later more refined technical-scientific criteria were adopted in this choice. Furthermore, according to Medeiros and Garay (2006), some instruments used for the creation of these areas included social expectations of interested groups, which resulted in the establishment of different modalities of protected areas, with distinct typologies and categories, even susceptible to confusion.

Despite the progress in the creation of protected areas at a national and global level, their distribution is not homogeneous, but rather marked by differences among regions, nations, and terrestrial biomes. While some biomes have more than a third of their extension covered by protected areas (ANDERSON; MAMMIDES, 2020), others have less than 5% (ROSA; GUERRA, 2019). Added to such a discrepancy among protected areas is the level of anthropic pressure (SILVA et al., 2012). Jones et al. (2018) point out that only 10% of PAs in the world are totally free of pressure and about 30% are intensely pressured.

Aware of the complex context in which the Brazilian UC is inserted, we sought to evaluate the spatial and temporal variability of the UC present in the Brazilian Cerrado. We sought to conduct a study of the aspects related to the temporal evolution of the creation, administrative spheres, and categories of these units, with a period from 1949, the year of the first UC in the Cerrado creation, to 2019.

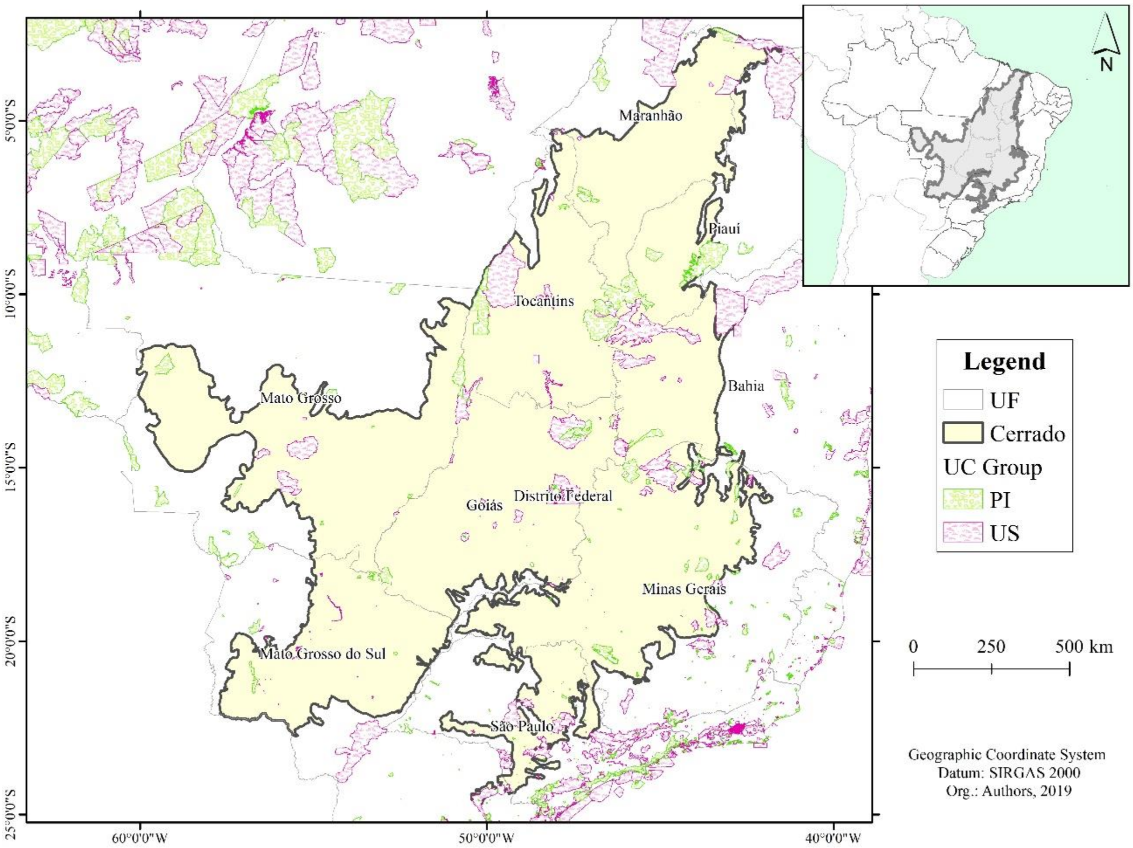
The choice of the Cerrado as a spatial cutout was motivated by the fact that it has the second largest area of UC among Brazilian biomes, 170,017 km² (CNUC/MMA, 2019), the result of a strategy to conserve remnants in the face of the intense process of conversion to other forms of land use and coverage. The Cerrado, diverse and heterogeneous, was and is highly impacted by the expansion of agricultural activities, also called the "Agricultural Frontier". Its degradation causes inestimable loss of biodiversity and affects its role in the (eco)systemic balance.

MATERIAL AND METHODS

Study Area

The Cerrado biome corresponds to about a quarter of the national territory, approximately two million km² (Figure 1).

Figure 1 - UC present in the Cerrado Biome, classified by group: PI and US. UF: Unidade da Federação, which means Federation Unity in English.



Data source: CNUC/MMA (2019) and IBGE (2004; 2013). Elaborated by the authors (2019).

According to Coutinho (1992) and Oliveira (2005), the Cerrado biome is composed of mosaics of physiognomic forms that do not present themselves in an orderly manner, alternating from campo sujo, cerradão, campo cerrado, campo limpo, among others. Such diversity is the result of factors such as the mosaic of soil types present there, the burning regime, and anthropic action.

In 2018, there was still about 54% of the Cerrado natural cover, 30 years ago this percentage was close to 70%, a variation of more than 15%, while other biomes such as the Amazon and the Atlantic Forest, in the same space of time, had variations respectively around 10% and 0.5% (MAPBIOMAS, 2019). From 2002 to 2011, the Cerrado's deforestation rate was 2.5 times higher than that of the Amazon (STRASSBURG et al, 2017).

The Cerrado, one of the world's hotspots (MYERS et al., 2000), is the most diverse tropical savannah in the world, but for a long time, it was underestimated (KLINK; MACHADO, 2005). The rate of conversion that it has been undergoing makes protected areas, especially UC, one of the promising alternatives for the conservation of remnants.

Methodological procedures

As the objective of the work was to carry out a general assessment of the UC present in the Cerrado biome, the main source of data for the proposed analyses was the Cadastro Nacional de

Unidades de Conservação (CNUC), which means National Register of Conservation Units in English. CNUC is a database of the Ministério do Meio Ambiente (MMA), the Brazilian agency responsible for the national environmental policy, where it was possible to obtain data on the UC throughout Brazil in a tabular and vector format, with information regarding the categories, administrative spheres, and year of creation. Furthermore, data were also accessed in vector format made available on the platforms of Instituto Brasileiro de Geografia e Estatística (IBGE), the institute that provides geographic and statistical information in Brazil, and MMA (Chart 1).'

Chart 1 - Characterization of the data used in the research.

Data	**Format**	**Scale**	**Source**	**Processing environment**	**Type of analysis**
UC	Tabular	-	CNUC/ MMA (2016; 2017; 2019)	GIS, spreadsheet editors and programming language environment software	Spatial and temporal distribution by category and administrative sphere
	Shapefile	1:100.000			
Brazilian biomes	Shapefile	1:5.000.000	IBGE (2004)	GIS	General characterization of UC in Biomes
Federation Units	Shapefile	1:250.000	IBGE (2013)	GIS	Cartographic base

Elaborated by the authors (2022).

We opted for the temporal cutout starting from the first year of UC registration in the Cerrado, available in the CNUC/MMA. The first UC in the biome registered at the time the research was developed was dated 1949, so for the evaluation, 1949 was adopted as the first year. Regarding the final year, the date varied according to the period for obtaining the data, since the most current data possible was chosen for each analysis, therefore, it starts with the final year of 2016, reaching 2019. It is understood that, as it is a general analysis, such differences among the final years of the clipping do not significantly influence the results, since the difference between them is not large in view of the adopted temporal scope and does not influence the historical and spatial evaluation proposed.

Firstly, in order to obtain a general visualization of the UC in the Brazilian biomes, a prior evaluation of the units was made at the biome level. To do this, we used data extracted from the CNUC, in a tabular format, which was associated with the table of attributes of the vector file of the biomes, obtained from the MMA portal, in a GIS environment, using clipping and intersection tools. As a result of the processing, maps characterizing the UC in the Brazilian biomes were obtained, with information regarding the number, area, and category per biome.

After this previous contextualization, there was a focus on the Cerrado biome, where we sought to analyze the spatial and temporal distribution of the UC present therein, as well as to compare the existing categories and spheres. The data processing was based on the use of GIS tools, spreadsheet editors, and programming language environment software for graphics and statistical calculations.

The history of The UC creation was evaluated from their geospatial data. Using GIS tools, the polygons were converted into points, and each UC began to correspond to a point, with information referring to its year of creation. From this procedure, the UC was classified by decade of creation, which resulted in 8 classes, starting in the 1940s and ending in 2010, counting up to 2014, the last year with available data during the period in which the data were collected. The classified points of each UC were superimposed on the Cerrado limits, which enabled the visualization of the distribution of UC by biome areas, and by creation period.

To evaluate the UC accumulated creation of the only georeferenced UC, data obtained from the CNUC were used. The area corresponding to each UC was calculated using GIS tools. The data related to the year of creation, area and category of the units were organized in a spreadsheet editor, where it was possible to organize them by decade, number, and area by category over the last eight decades.

Subsequently, to complement the evolution analysis of the UC creation in relation to category, administrative sphere, and area, the data referring to the UC, in this case in a tabular format, obtained from the MMA - Departamento de Áreas Protegidas (2019), were worked on in a programming language environment software for graphics and statistical calculations, the RStudio. Through this, it was possible to analyze the distribution of UC by category, sphere, and area over the past 70 years.

The analysis of the spatial structure distribution of the UC was done using tabular and vector data of the UC, also obtained from the CNUC/MMA platform, with a time frame from 1949 to 2016 first, and later extended to 2017.

Initially, a comparison was made among the total number of units in the biome, described in the tabular data, which is more comprehensive, and the number of georeferenced UC available in the vector data.

Based on these data, the ratio between the total area of UC and the area of each category was calculated. All these analyses were done using spreadsheet editors, with all the units created from 1949 to 2016 in the Cerrado biome.

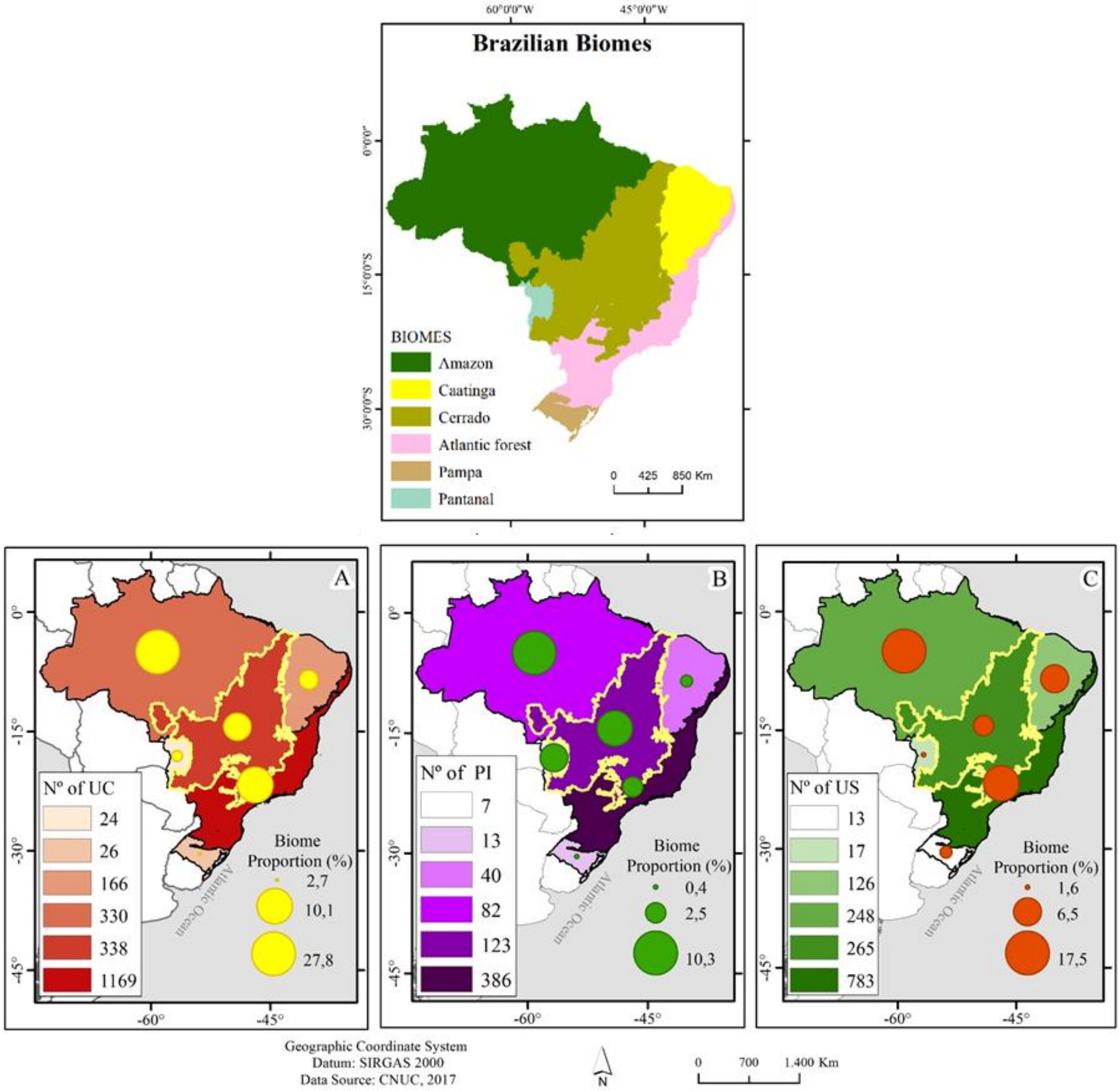
In a second moment, with a temporal scope extended to 2017, the geospatial data of the UC were used to evaluate their spatial distribution by area, category, and administrative sphere. These data were worked in a GIS environment, which resulted in the mapping of the UC grouped according to the above criteria.

RESULTS AND DISCUSSION

The Cerrado UC current status compared to other biomes

The Cerrado is the second biome in area and number of protected areas, 388, however, if we consider the proportion in relation to the biome, the protected areas correspond to only 8.3% of its total area, 3% for PI and 5.1% for US (Figure 2). In the Amazon, the largest and most preserved biome, the protected areas represent more than 27% of its area. The Atlantic Forest has the largest absolute number of units (1,169), corresponding to a little more than 10% of its remaining area. Finally, the Caatinga, Pampa and Pantanal are the Biomes with the smallest proportion of covered area and the lowest total number of units, respectively (Figure 2).

Figure 2 - Distribution of the UC in the Brazilian Biomes: total units (A), PI (B), US (C). Cerrado biome boundary in yellow.



Data source: CNUC/MMA (2017). Elaborated by the authors (2017).

The discrepancy in the arrangement of UC among the Biomes is evident, and such differences are even more accentuated when the distribution by UC category is analyzed. The Amazon concentrates the largest proportion of PI and US UC, while, in relation to numbers, the Atlantic Forest and Cerrado, respectively, have the largest. It is interesting to observe that in the Pampa, for example, there is a greater proportion and number of US, while in the Pantanal the PI predominate.

In the Atlantic Rain Forest, Vieira et al. (2019) observed that the high number of UC did not represent a greater proportion of the protected biome's area, as observed in the present study. Pampa and Pantanal, the Brazilian biomes with the lowest number and proportion of protected areas, are also the ones with the lowest percentage of threatened plant species with occurrence within protected areas, about 10%, while the others have proportions greater than 50% (RIBEIRO et al., 2018). This shows that there is not only a discrepancy in the geographical distribution of the number and area of protected areas among Brazilian biomes, but also in relation to the representation of species that need to be protected. It is possible to see that among the Brazilian biomes there is no relationship between the number of protected areas, the legally protected area, and the quantity of remnants actually protected, since there are significant differences among these classes, as was observed in the case of the Atlantic Rain Forest. The discrepancy between the number and proportion of protected areas follows a global trend (UNEP-WCMC; IUCN, 2021).

The protected areas distribution is also geographically uneven in the various territorial cutouts adopted, whether biomes, states, or municipalities. The Amazon, for example, although it presents a greater quantity of protected areas, these are not homogeneously distributed among its states and municipalities (SALOMÃO et al., 2019). As for the Cerrado, the fact that it is the second in number of protected areas and the third in proportion of area, does not place it in a comfortable situation, since about 50% of its original coverage remains, and less than 15% of these are protected (Table 1).

Table 1 - UC by Biome.

Biome	**Total Nº of UC**	**Area percentage of UC**	**Nº of PI**	**Nº of US**	**Area percentage of PI**	**Area percentage of US**
Amazon	330	27,8	82	248	10,3	17,5
Caatinga	166	7,7	40	126	1,2	6,5
Cerrado	338	8,6	123	265	3,1	5,5
Pampa	26	2,7	13	13	0,4	2,4
Pantanal	24	4,6	7	17	2,9	1,6
Atlantic Forest	1169	10,1	386	783	2,5	7,5

Data source: CNUC/MMA (2016). Elaborated by the authors (2022).

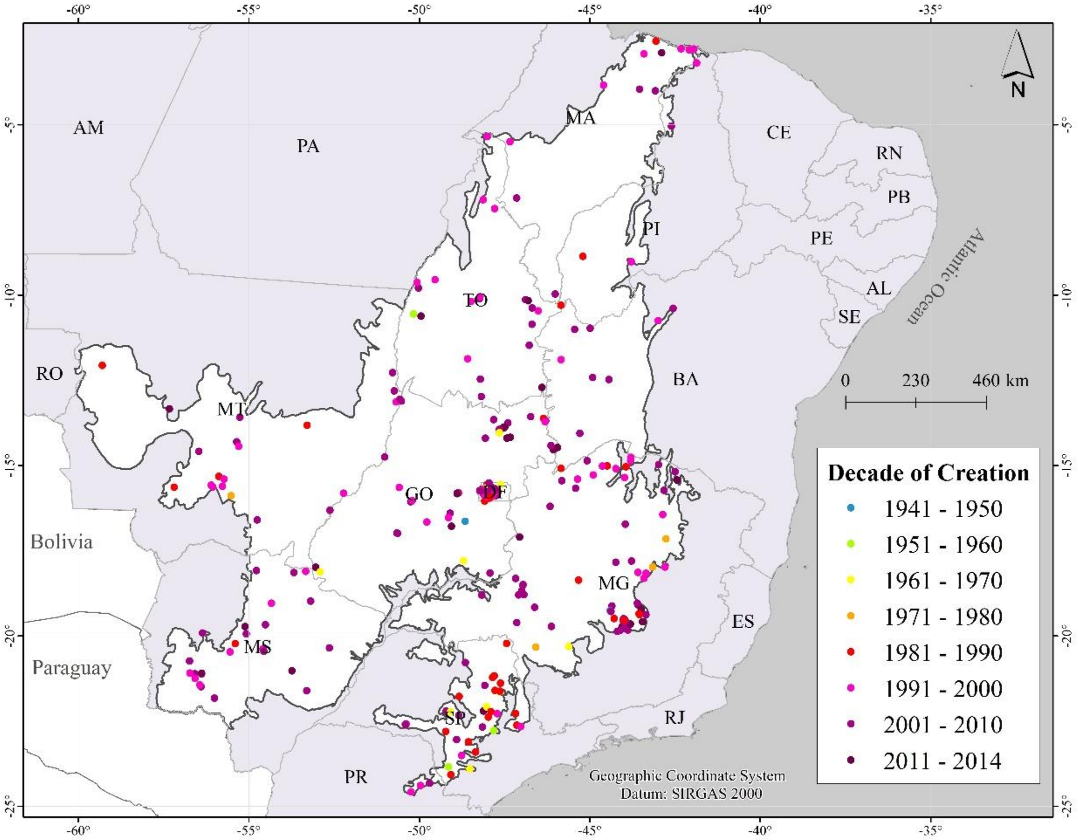
Temporal analysis of the creation of the UC in the Cerrado

The first two UC in Cerrado were created as horto forests, the Horto Floresta de Silvânia-Goiás and the Horto Floresta de Paraopeba - São Paulo, in 1949 by the ordinary law 612, and in 1950 by the ordinary law 1170, respectively. In 2001 these were recategorized as Floresta Nacional (FN), which is National Forests in English. In 1957, a Reserva Florestal (RF), Forest Reserve in English, was created in Itaberá - São Paulo, the 3rd UC in the Cerrado, which in 1987 was recategorized as the Estação Ecológica Itaberá. In the following year, a property in Ibicatu, also in São Paulo, was designated for the defense of flora and fauna, and protection of local landscapes particularly endowed by nature, recategorized in 1987 to Estação Ecológica Ibicatu.

Therefore, the first four protected areas in the Cerrado were established as different categories than the ones they belong to today, which shows a process of adaptation to the evolution of the protected areas designations. The first unit created in this region within modern terminology that did not undergo recategorization was the Parque Nacional do Araguaia in 1959, by decree number 47570, in the state of Tocantins, followed by the creation of the Parque Nacional de Brasília in 1961.

It can be observed that the establishment of UC has not occurred homogeneously in the Biome, and that this process has intensified in recent decades (Figure 3). The units with the longest time of establishment are concentrated in São Paulo, where state US units predominate, especially the Area de Proteção Ambiental (APA), which means Environmental Protection area in English. In recent years, the northern portion of the biome has seen a significant increase in the number and area of UC.

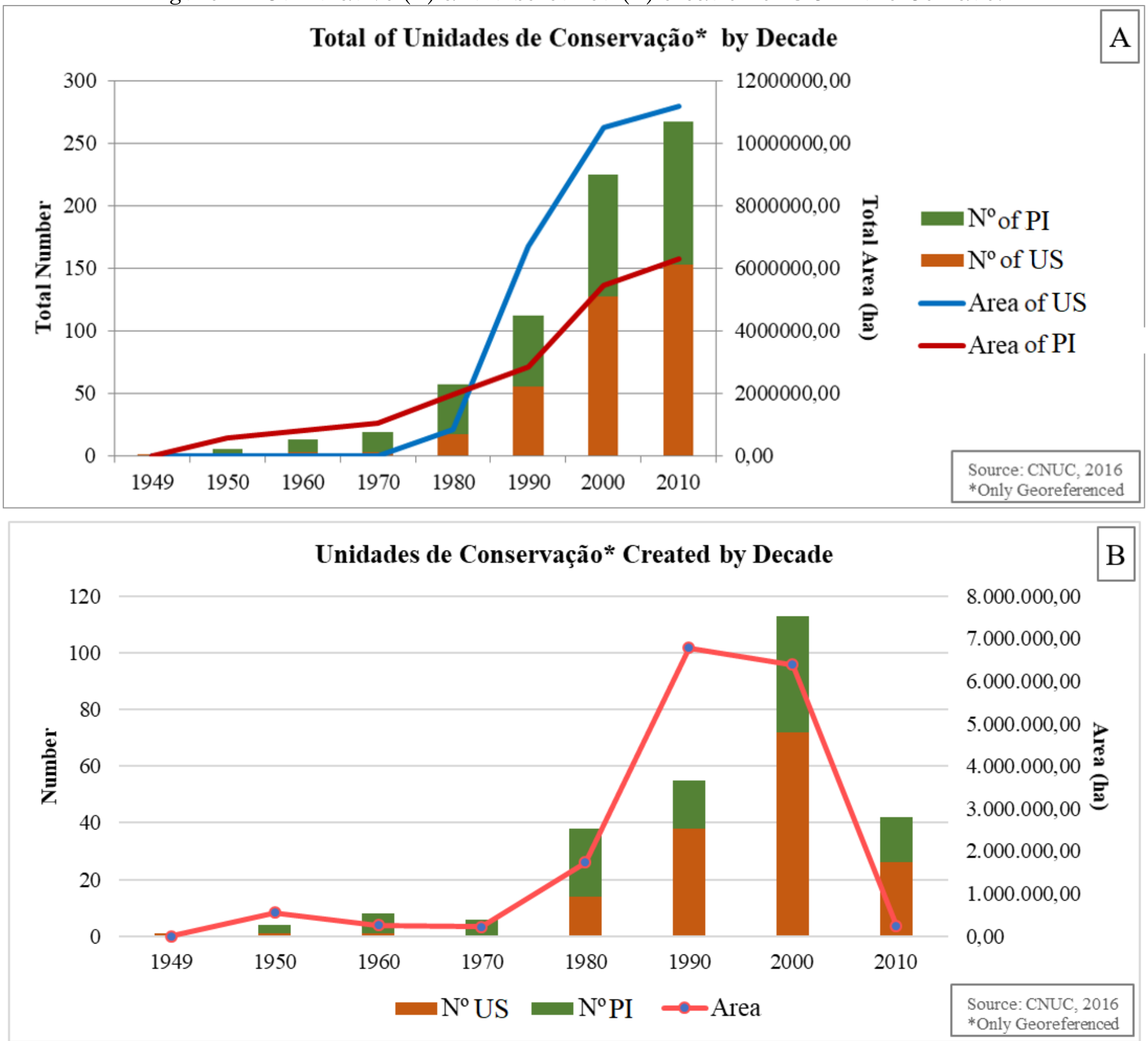
Figure 3 - History of the UC creation in the Cerrado by decades.



Data source: CNUC/MMA (2016) and IBGE (2004; 2013). Elaborated by the authors (2016).

From 1950 to 1970 the process of creating UC in the Cerrado was not very intense, with an average of less than 10 UC per decade. From 1980 onwards this rate increased significantly, reaching its peak in the 2000s (Figure 4), when an average of 11 UC per year were created. It is also possible to observe that until the 1980s the PI predominated, both in number and area. Beginning in 1990 there is an inversion of this picture, with the US predominating in number and in area.

Figure 4 - Cumulative (A) and discretized (B) creation of UC in the Cerrado.

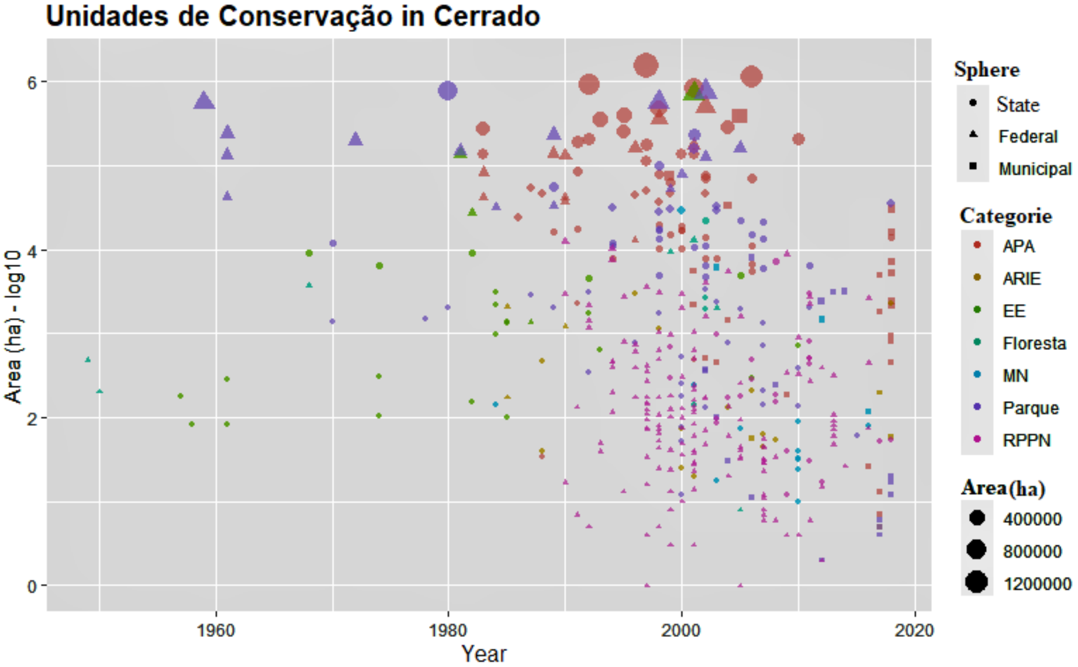


Data source: CNUC (2016). Elaborated by the authors (2016).

The accumulated number of UC by category shows that the US are those with the greatest presence. This tendency shows that there is a preference for the implementation of units where private property is maintained, like Área de Proteção Ambiental (APA) and Reservas Particulares de Patrimônio Natural (RPPN), which mens Private Natural Patrimony Reserves in English, in opposition to the others, especially the PI. Altogether (221), the APA and RPPN are more numerous than the other units, whether of the PI or US type. This shows that the predominant intention has been to balance conservation and protection of natural resources with their use by the population that holds the right to use or own the land.

Currently, there has been a reduction in the process of creating UC, and a tendency to create units with smaller areas (Figure 5), such as RPPN. It is noted that the increase in the creation of various categories of UC between the 1990s and 2000s coincided with the emergence of some policies related to protected spaces. Some of these polices was the Sistema Nacional de Unidades de Conservação (SNUC), National System of Conservation Units in English, in 2000, and Decree Nº 98,914 of 1990, which introduced RPPN into Brazilian legislation. According to Paiva (2017), national and international environmental policies influenced the pace of creation of protected areas, and the UC greatest creation periods coincided as of the establishment of these policies.

Figure 5 - Distribution of the 7 categories of predominant UC in the Cerrado in relation to the area of each and administrative sphere over the past 70 years. APA: Área de Proteção Ambiental; ARIE: Área de Relevante Interesse Ecológico (Relevant Ecological Interest Area); EE: Estação Ecológica (Ecological Station); MN: Monumento Natural (Natural Monument); RPPN: Reserva Particular do Patrimônio Natural.



Data source: MMA - Departamento de Áreas Protegidas (2019). Elaborated by the authors (2020).

After its establishment in the legislation, there was a considerably intense pace of RPPN creation, which lasted until the first half of the 2010s. After this period, there was a reduction in the pace of the creation of Conservation Units in general. From then on, it is the municipalities that take the lead in the creation of protected spaces, represented mainly by the APA and Parks categories. If on one hand they still have a discrete number and area in relation to the other administrative spheres, from 2017 to 2018 alone, 22 new municipal UC were created, which corresponds to almost 47% of their total in 2019.

UC in Cerrado spatial structure analysis

In Cerrado, the US predominate in area (5.5% of the total area of the biome), and number (253). Among these, the APA corresponds to almost the whole totality, representing 5.3% of the total area of the biome, with about 68 units, while the RPPN are the most numerous (161), despite a tiny total area (less than 0.1% of the total area of the Cerrado) (Table 1). In 2016, 120 PI units were registered to protect 3.1% of the biome area, among which, parks (state and federal added together) corresponded to 70 units protecting 2.4% of the total area.

It is observed that not all the UC present in the Biome are georeferenced (Table 2), especially in the case of the US, where of the 265 (CNUC/MMA, 2016), there were only 153; while of the 123 PI, 114. It is noted that the RPPN corresponds to the category with the least mapped units, followed by the APA. This equates to a total of approximately 12,000 km² without vector representation.

Table 2 - Number of UC in the Cerrado by category.

Type	Category	Total Number	Ratio with total area (%)	N° georeferenced
PI	Estação Ecológica (EE) – Ecological Station	28	0,6	28
	Monumento Natural (MN) – Natural Monument	12	< 0,1	11
	Parque Nacional/Parque Estadual (PN/PE) – National Park/State Park	70 (15 – 55)	2,4	67
	Refúgio da Vida Silvestre (RVS) – Wildlife Refuge	5	0,1	4
	Reserva Biológica (RB) – Biological Reserve	5	< 0,1	5
	Floresta Nacional (FLONA) – National Forest	11	< 0,1	11
	TOTAL	131	3,1	126
US	Reserva Extrativista (RE) – Extractive Reserve	6	< 0,1	6
	Reserva de Desenvolvimento Sustentável (RDS) – Sustainable Development Reserve	2	< 0,1	2
	Reserva de Fauna (RF) – Fauna Reserve	0	0	0
	Área de Proteção Ambiental (APA) – Environmental Protection Area	68	5,3	61
	Área de Relevante Interesse Ecológico (ARIE) – Relevant Ecological Interest Area	16	< 0,1	16
	Reserva Particular do Patrimônio Natural (RPPN) - Private Natural Patrimony Reserve	161	0,1	57
	TOTAL	253	5,5	142

Data source: CNUC/MMA (2016). Elaborated by the authors, 2016.

The RPPN is a private UC category, which has been excelling in Brazil, with increasing rates of creation, following a global trend. In 2016 the IUCN World Conservation Congress approved a resolution that supports Private Protected Areas (PPA). In 2014 during the XII *Conferencia de Las Partes en el Convenio sobre la Diversidad biológica* (CBD, 2014) their contribution was recognized, and encouragement was given to the private sector to continue engaging in this practice. Despite gaining support at the international level, the creation policy and legislation related to PPA vary in each country. There is so far no general picture of the areas created in the world, which can hinder the carrying out of conservation plans and their management (BINGHAM et al., 2017). It is emphasized that it is necessary to recognize the existing spaces, and without this, action plans will not achieve the best possible army for biodiversity conservation (BINGHAM et al., 2017).

Regarding Brazil, as mentioned earlier, the RPPN is not always spatially available, which makes their identification and study difficult. In other cases, they have significantly small dimensions. However, they are promising initiatives for conservation, since today they correspond to the most numerous categories in Brazil. According to the CNUC/MMA (2017), there were 844 RPPN in the country, most registered in the federal sphere (672), located predominantly in the Atlantic Rain Forest (525) and Cerrado (161).

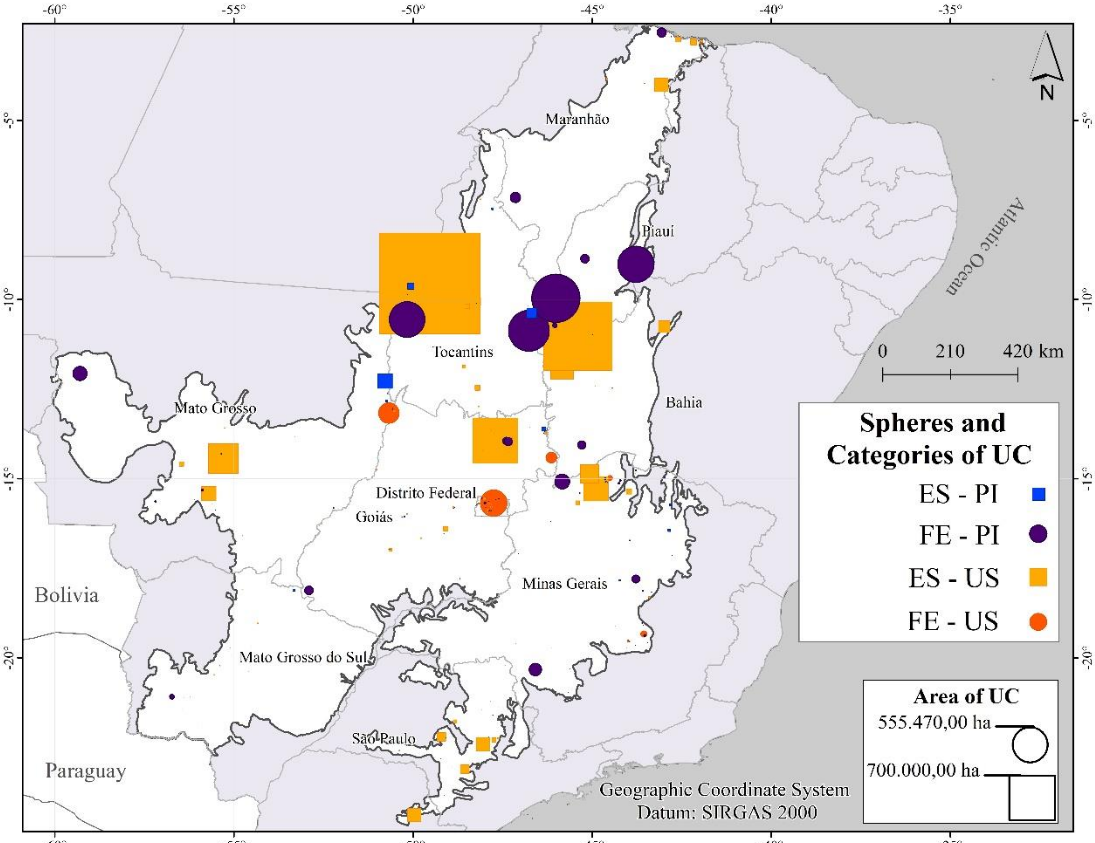
There are significant differences among the administrative spheres and their unit categories. In the Cerrado, the number of federal UC is greater than in other spheres, but almost 75% of this amount corresponds to RPPN. In the state sphere, the number of RPPN is less representative, around 11%, and categories such as *Parques* and APA have a higher number. The growing number of state units is due in part to the fact that, according to Vieira et al (2019), in recent decades there has been greater investment by the state administrative spheres in the UC creation.

Despite the representativeness that the state UC have been conquering, the federal ones represent approximately 40% of the total area of georeferenced UC in the biome. Furthermore, according to a study by Françoso et al. (2015), federal UC have fewer deforested area both inside and around them.

The largest federal US units are in the state of Goiás, while the largest federal PI units are in the states of Tocantins and Piauí, within the borders of Maranhão, Tocantins, Piauí and Bahia (MA-TO-PI-BA). Matopiba refers to the new agricultural frontier of Brazil, characterized by grain production (SANO et al., 2020) and that has been suffering an intense deforestation process (POLIZEL et al., 2021).

Regarding distribution, there is a concentration of units in the Federal District, in the northeastern portion of Goiás, eastern Minas Gerais and along practically the entire Cerrado belt present in São Paulo (Figure 6). These concentrations are due in part to overlapping UC, as in the case of PI and US; establishment of UC mosaics; and the high number of RPPN in the same region, as in the case of Chapada dos Veadeiros, western Minas and southwestern Mato Grosso do Sul, where there are considerable numbers of these reserves. Sano et al. (2019) also observed differences in the concentration of protected areas among the ecoregions present in the Biome, which highlights the fact that the protection of remnants in the biome is not equal.

Figure 6 - UC grouped into: ES-PI (Estaduais de Proteção Integral – State Full Protection); FE-PI (Federais de Proteção Integral - Federal Full Protection); ES-US (Estaduais de Uso Sustentável - State Sustainable Use); FE-US (Federais de Uso Sustentável - Federal Sustainable Use).



Data source: CNUC/MMA (2017) and IBGE (2004; 2013). Elaborated by the authors (2017).

It is also worth noting that both the creation of PA and the connectivity among them, usually with the creation of ecological corridors and mosaics, so that they are not just isolated fragments, have been an agenda among the scientific community and the various sectors involved with environmental conservation (AKASHI JUNIOR; CASTRO, 2010; BRITO, 2012; SANTOS et al., 2013; HILTY et al., 2020). Such an approach is related in part to the current scenario of intense pace of anthropization and fragmentation of ecosystems and can be considered an advance in environmental protection.

FINAL CONSIDERATIONS

In Cerrado, there was an intensification of UC creation in the 2000s, with emphasis on the US, which since the 1990s has outnumbered the PI. In terms of distribution, this does not occur proportionally in the areas of the Biome, while in its southern portion there is a considerable number of smaller UC, in the central-northern portion there is a concentration of larger units, mainly in the Matopiba region. There is a concentration of UC in certain areas, while others are largely empty. This situation is not restricted to the Cerrado scale; among the Brazilian biomes, there is also a significant difference in the number and area of UC.

Private protected areas have been gaining space in the Cerrado, following the global trend to expand the creation of private protected spaces. Although they represent a considerable number, in terms of area proportion, they are still not very significant, and many are not spatially available and/or easily accessible.

It is worth mentioning the milestone that was the creation of the SNUC for the creation and management of UC in Brazil. It standardized the nomenclatures and types of protected areas, which led to a significant increase in the area and number of units. Despite the difficulties, the protected spaces are important mechanisms for environmental protection, especially in regions that suffer intense anthropic pressure, as in the case of Matopiba.

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AUTHORS CONTRIBUTION

The author Sara Alves dos Santos conceived the study, formulated research goals and objectives, analyzed the data and wrote the text. Luis Felipe Soares Cherem conceived the study, formulated research goals and objectives, analyzed the data and wrote the text.