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Papers

Conservation Units and their effectiveness in protecting water resources in the Araguaia River Drainage Basin

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Abstract
The Araguaia River basin corresponds to 4.53% of the Brazilian territory and is the target of an intense occupation process and environmental impacts which compromise its socio-environmental integrity. Among the various conservation and environmental preservation strategies instructed by Brazilian environmental policies, conservation units (UCs) can assist in the territorial and environmental management strategies of river basins to preserve the country's natural resources. The aim of this article is to understand the context of creation, quantity, distribution and the effectiveness of conservation units within the Araguaia River basin. We were able to identify 49 conservation units in the basin, which represents only 9.42% of its territory. These units were organized by Category (Fully Protected or Sustainable Use), Area (ha), Decree/Law of creation, presence or not of a Management Council and Management Plan, Municipalities which comprise the conservation units and the Responsible Body for administering and managing the UCs (Federal, State or Municipal). Thus, it was evidenced that the UCs are not evenly distributed in the basin area, and there is no protection - in any conservation unit category - of any of the springs of the main tributaries of the Araguaia River. Accordingly, the effectiveness of the areas is compromised by the absence of management instruments and the historical recurrence of deforestation and fires.

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INTRODUCTION

Conservation Units (UCs – in Portuguese) currently play an important role in reducing deforestation rates and in providing environmental services to Brazil (BRASIL, 2011), but their establishment only took place after many years of clashes between productive sectors, environmentalists and landowners in the country (GUERRA; COELHO NETO, 2012).

UCs are areas legally established by the Public Power, which have the objectives of conservation, preservation, maintenance, recovery, sustainable use and restoration of natural resources, including the conservation of scenic beauty, protection of historical and/or cultural sites, among others (BRASIL, 2000; HASSLER, 2006), in order to meet the needs and aspirations of current and future generations.

Thus, it should be noted that the Sistema Nacional de Unidades de Conservação – SNUC (National System of Conservation Units) is a set of official norms and procedures that enable federal, state and municipal governmental spheres, as well as the private sector, to create, implement and manage conservation units in the country, through Law No. 9,985 of 2000, is that which regulates, establishes criteria and creates norms for implementing and managing protected areas in the Brazilian territory (BRASIL, 2000).

This system of conservation units is divided into two groups of categories: Fully Protected and Sustainable Use. The first is aimed at the basic objective of preserving nature, allowing only indirect use of natural resources, such as environmental education, ecological tourism and scientific research. In turn, the second delegates the responsibility of making the conservation of nature compatible with the sustainable use of natural resources (BRASIL, 2000).

Therefore, the areas destined for full protection now encompass the Full Protection: Estação Ecológica (Ecological Station), Reserva Biológica (Biological Reserve), Parque Nacional (National Park), Monumento Natural (Natural Monument), Refúgio de Vida Silvestre (Wildlife Refuge), and Sustainable Use: Área de Proteção Ambiental – APA (Environmental Protection Area), Área de Relevante Interesse Ecológico - ARIE (Area of Relevant Ecological Interest), Floresta Nacional (National Forest), Reserva Extrativista (Extractive Reserve), Reserva de Fauna (Wildlife Reserve), Reserva de Desenvolvimento Sustentável (Sustainable Development Reserve), Reserva Particular do Patrimônio Natural – RPPN (Private Natural Heritage Reserve) categories (BRASIL, 2000).

These different categories enable planning, controlling and organizing the territory when well-managed, as they are competent for preserving ecosystems, biomes and natural domains in Brazil (MILARÉ, 2007; BRASIL, 2011) due to playing an important role in ensuring environmental/ecosystem services and in the quality of water resources, as well as their integrated management between *SNUC*, the Forest Code and compliance with the Water Law (Law No. 9,433/ 97), which institutes the National Water Resources Policy and the National Basic Sanitation Policy (Law 11.445/2007). Thus, these interventional actions are presented as important strategies for the conservation of drainage basins and consequently of water resources in Brazil (ZAFALON; SILVA, 2012; SOUZA et al., 2018).

However, the creation of these conservation units without technical support for choosing an area with important environmental characteristics, associated with a lack of investment, inspection and/or the effective environmental policy ends up compromising the effectiveness of these areas, becoming a great challenge in managing these units (SOUZA, 2016; SILVA et al., 2017).

The Araguaia River basin, the area for this study, comprises several conservation units of the most varied categories in its territory. The main river in this basin, Araguaia, is characterized by being one of the main watercourses in the Brazilian territory, encompassing the Cerrado biome and the Amazon Forest, two phytogeographic regions of remarkable biodiversity (LOPES et al., 2017). It also has a complex floodplain which comprises the largest wetland area in the Cerrado (Bananal Plain which extends over 100,000 km²) and the Cerrado-Amazon ecotone, in addition to presenting a high endemic rate (DAGOSTA; PINNA, 2017).

The basin is currently identified as one of the priority areas for the conservation of the Cerrado and water resources in Brazil, and as "a primordial area for the country's economic development, with a strengthening perspective for the coming decades due to the national and international demands for the production of commodities" (BAYER et al., 2020). However, the historical land use and occupation processes account for intense siltation and erosion

processes, as well as soil and water contamination by fertilizers and pesticides (CASTRO, 2011), in addition to compromising biodiversity (ALBERNAZ, 2003; MENDES, 2005), as well as negative implications for economic activities which depend on environmental integrity (ANGELO, 2010).

Given this scenario notably marked by an ecosystem crisis, disruption of inspection bodies and socio-environmental preservation, this article has the fundamental purpose to understand the context of creation, quantity, distribution and effectiveness (legal, operational and control of impacts related to deforestation and fires) of the conservation units within the Araguaia River drainage basin.

MATERIALS AND METHODS

The methodological processes of this study involved compiling data available on the platforms of the Brazilian government and environmental NGOs, such as: Protected Areas Monitoring Program, ICMBio, MMA, ISA, Computerized Monitoring System for RPPN (*ICMBio*), Panel of Brazilian Protected Areas and Mato Grosso Protected Areas Yearbook and as well as processing data arising from geographic information.

The Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio), is the Brazilian environmental agency responsible for proposing, implementing, managing, protecting, inspecting and monitoring conservation units, in addition to promoting and executing research, protection, preservation and conservation programs for biodiversity throughout Brazil.

The Ministério do Meio Ambiente (MMA) aims to promote the adoption of principles and strategies for knowledge, protection and restoration of the environment, the sustainable use of natural resources, the enhancement of environmental services and the inclusion of sustainable development in formulation and implementation of public policies, at all levels and instances of government and Society.

The Instituto Socioambiental (ISA) is a non-profit organization of Brazilian civil society, founded in 1994, with the objective of proposing integrated solutions to social and environmental issues based on the defense of social, collective and environmental goods and rights, environment, cultural heritage, human and peoples rights.

The Sistema Informatizado de Monitoria de Reservas Particulares do Patrimônio Natural (SIMRPPN), is a platform that gathers all information about the Reservas Particulares do Patrimônio Natural – RPPN (Private Natural Heritage Reserve) in Brazil, was developed to act as a technological instrument for the creation, management and monitoring of federal RPPN, constituting an important support tool for the management of RPPN, both for the Government and for the owner.

All protected areas were categorized and organized by: Number corresponding to the protected area map (0 – 49); UC Category (Fully Protected or Sustainable Use); Area (ha); Decree/Law of creation; presence or absence of a Management Board and Management Plan; Municipalities comprising conservation units and the Responsible Body for administering and managing these activities (Federal, State or Municipal) (Table 1 - Supplementary Material).

An analysis of deforestation and fire outbreaks in the Araguaia River basin was also conducted, mainly in relation to conservation units. It is worth mentioning that this analytical activity was carried out from January 2012 (the creation year of the last conservation unit in the Araguaia River basin) until the year 2020.

Deforestation data were obtained from the Instituto Nacional de Pesquisas Espaciais (INPE), which is a Brazilian federal institute dedicated to space research and exploration, created in 1961, through the *PRODES* project, which uses LANDSAT satellite images (20 to 30 meters of spatial resolution and 16-day revisit rate) to record and quantify deforestation areas. In addition, data on fire and burning outbreaks were obtained by *INPE*'s fire monitoring program. Thus, the sample set was submitted to Kernel Density estimation (10,000-meter radius and with a raster created based on a 500m pixel resolution) for clustered analysis of the proximity of outbreak recurrence to protected areas.

In view of this, it should be considered that the cartographic maps of this study were carried out in the ArcGis 10.3 software program, with vector bases also acquired from the Sistema Estadual de Geoinformação de Goiás (SIEG), the Ministério do Meio Ambiente (MMA), the Instituto Brasileiro de Geografia e Estatística (IBGE) and Agência Nacional de Águas (ANA).

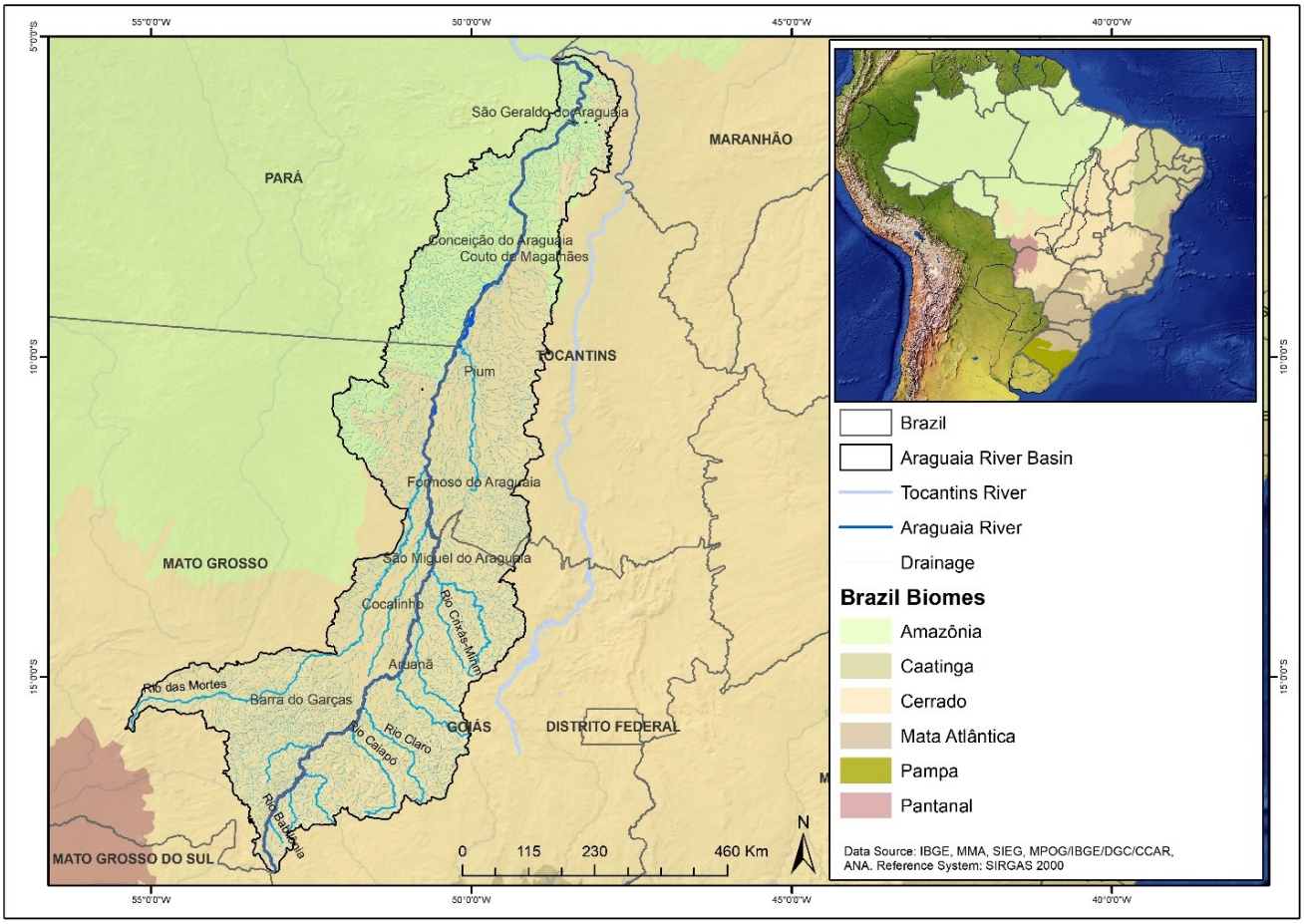
The Sistema Estadual de Geoinformação de Goiás (SIEG), aims to optimize and promote the integration of the geoinformation production areas of state bodies, aiming to support the planning and monitoring of government actions and make information available to society as a whole, the Instituto Brasileiro de Geografia e Estatística (IBGE) is the main provider of geographic information and statistics in Brazil and Agência Nacional de Águas (ANA) is responsible for implementation of water resources management in the Brazilian territory.

STUDY AREA

The Araguaia River drainage basin covers two Brazilian biomes (Cerrado and Amazon), with a territory of more than 386,000 km² (ANA, 2015), in 204 municipalities, which are distributed among the states of Goiás, Mato Grosso, Tocantins and Pará (Figure 1). It also comprises a complex floodplain and the largest wetland area of the Cerrado (Bananal Plain which extends over 100,000 km² and the Cerrado-Amazon ecotone), representing the largest river island in the world (MORAIS, 2006), with the greatest geodiversity of the biome, a wide diversity of fish and a high endemic rate (DAGOSTA; PINNA, 2017; BAYER et al., 2020).

The Araguaia River starts in Serra do Caiapó, in the southwest of the State of Goiás in Brazil, and runs for 2,600 km until it flows into the Tocantins River (ANA, 2015). Its main following tributaries stand out: the rivers Babilônia, Claro, Caiapó, Diamantino, Cristalino, Crixá-Açú, Crixá-Mirim, Javaés, das Mortes, Peixe and Rio Vermelho.

Figure 1 – Araguaia River drainage basin.



Source: The authors (2021).

The altitudes in the Araguaia river basin vary between 850m at the springs and 100m at the mouth (BAYER et al., 2020), and is subdivided into three units: Alto Araguaia with a length of 450 km of channel from the springs in Mineiros, Goiás – Brazil to Registro do Araguaia, Goiás – Brazil, which is characterized by Pre-Cambrian crystalline rocks, as well as Paleozoic and Mesozoic rocks from the Paraná Sedimentary Basin; the Middle Araguaia is 1,160 km long from Registro do Araguaia Goiás – Brazil to Conceição do Araguai, Pará - Brazil and is characterized by the development of an alluvial plain formed by Cenozoic tertiary and quaternary sediments; in addition to the Lower Araguaia which is 500 km in length starting from Conceição do Araguaia, Pará – Brazil to the confluence with the Tocantins River, and this area drains over Pre-Cambrian crystalline rocks of the Brazilian Shield (LATRUBESSE; STEVAUX, 2002).

RESULTS AND DISCUSSION

From the compilation of data available on the Brazilian government and environmental NGO platforms, in addition to the use of the Geographic Information System (*SIG,* in Portuguese), it was possible to identify 49 conservation units (35804.1 km²) in the drainage basin of the Araguaia River, which represents only 9.42% of the basin (Figure 2).

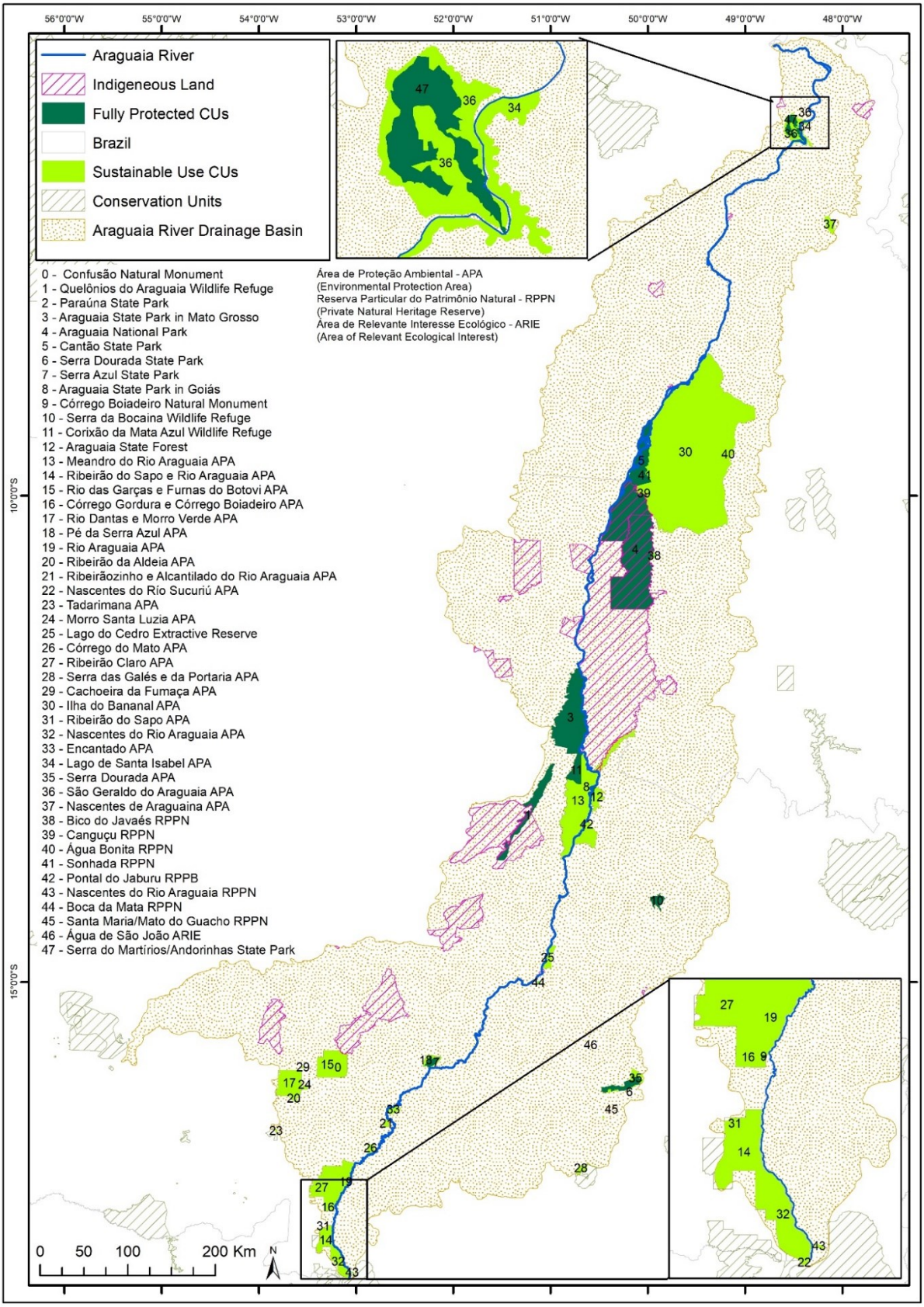
It is observed that the conservation units of the Araguaia River basin are mainly associated with the main channel of the Araguaia river, such as the Nascentes do rio Araguaia APA, Araguaia River APA, Meandro do rio Araguaia APA, Araguaia National Park, Ilha do Bananal APA, Lago de Santa Isabel APA, São Geraldo do Araguaia APA and other UCs with smaller areas.

Although the main sources of the Araguaia River are associated with the upper basin where there are intense erosive processes, silting and sanding (CASTRO, 2011), with more than 5000 large linear erosive features already identified in the upper Araguaia River basin (NUNES, 2015), the important conservation units (in terms of size - hectares) are mainly associated with the middle Araguaia (Araguaia State Park – MT, Araguaia River APA, Araguaia National Park and Ilha do Bananal APA).

The spatialization of the units also indicates that the sources of the main tributaries of the Araguaia River, namely the Babilônia, Claro, Caiapó, Diamantino, Cristalino, Crixá-Açú, Crixá-Mirim, Javaés, das Mortes, Peixe and Vermelho rivers, are not covered by any of the 49 conservation units that exist in the Araguaia River basin. Although this is a very important aspect for managing water resources, not including them as priority areas for conservation presents a major deficit in the analysis and studies which focus on implementing conservation units in the basin.

In this sense, spring areas should be adopted as an important criterion in creating and defining the implementation of conservation units, as the existence of vegetation can help in dampening the impact of rains which act directly on the soil, contributing to greater absorption of rainwater and supply of groundwater in order to favor controlling surface runoff, pollution and silting.

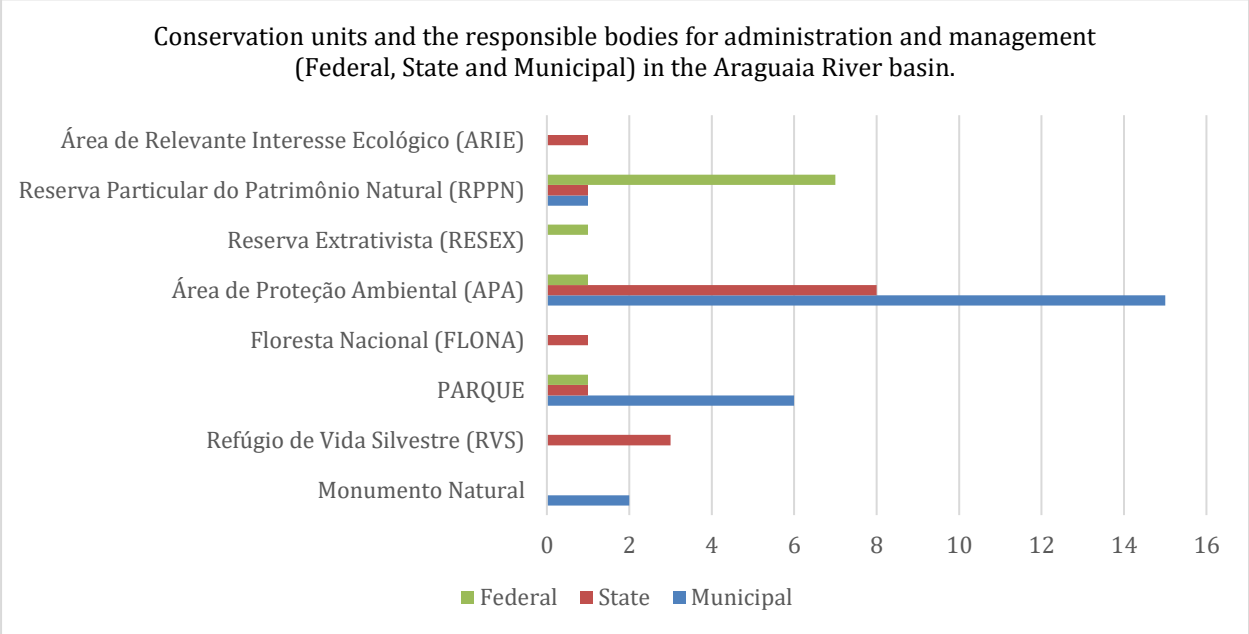
Figure 2 – Conservation Units in the Araguaia River drainage basin.



Source: The authors (2021).

Thus, corroborating a trend for the Brazilian territory in which the sustainable use category represents the largest number and extension of PAs in Brazil (VIEIRA et al., 2019), the Araguaia River basin conservation units are mostly for sustainable use, with 36 for Sustainable Use and 13 for Full Protection. In addition, when considering the responsible bodies, the conservation units are distributed into 10 at the federal level, 21 at the state level and 18 at the municipal level (Figure 3 and Table 01 - Supplementary Material).

Figure 3 – List of conservation units and responsible bodies for administration and management in the Araguaia River basin.



Source: The authors (2021).

According to Art. 50 of Law No. 9,985, of 2000, the Ministry of the Environment is responsible for organizing and maintaining the national registry of conservation units with the collaboration of Brazilian Institute for the Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (Ibama) (BRASIL, 2000), which is the executive body responsible for implementing the national environmental policy in Brazil, and develops various activities for the preservation and conservation of natural heritage, carries out control and inspection of the use of natural resources (water, flora, fauna, soil , etc), as well as granting environmental licenses for undertakings within its competence.

Compliance with this responsibility is linked to the Painel Unidades de Conservação Brasileira, which is an official protected area platform and should contain all categories and data from all existing protected areas in Brazil.

Through an evaluation of the platform, it appears that its role is not effectively met, given that an analysis of the data made available by this portal indicates that not all UCs are registered, and the data for most of them are different from the creation decrees, mainly in relation to the area (ha).

Although an investigation was carried out on the environmental platforms, it was not possible to find informative data related to: Decree of Creation, Management Plan and Management Council of the following Conservation Units: Córrego Boiadeiro Natural Monument (9), Serra da Bocaina RVS (10) and Santa Maria/Mata do Guacho RPPN (45); nor the location/municipality data of the UCs Córrego Boiadeiro Natural Monument (9) and Serra da Bocaina RVS (10); or obtaining the decree for the complete creation of the UCs: Ribeirão do Sapo and Araguaia River APA (14), Córrego Gordura and Boiadeiros APA (16) and Ribeirão Claro APA (27).

The Sistema Informatizado de Monitoria de Reservas Particulares do Patrimônio Natural (*SIMRPPN*), which is the responsibility of *ICMBio*, has more complete data on Private Reserves. Despite this, no data regarding the Santa Maria/Mata do Guacho RPPN (45) is even found on this platform.

Regarding the Rio Vermelho Ecological Reserve RPPN (48), there is an error in the georeferencing, since all the platforms consulted indicate that this UC is located in the municipality of Britânia, in Goiás. However, the georeferenced digital boundaries available in *SIMRPPN* correspond to an area in the state of Minas Gerais. Therefore, in the absence of correct data, this RPPN was excluded from the analysis (Figure 2). Such facts then point to the existence of controversies in the official repositories responsible for making the data available.

The two main instruments defined by Law 9,985/2000 for managing protected areas are guided by the SNUC which correspond to the Management Plan (MP) and the Management Council (MC), also present problems. The Management Plan is a technical document that guides the management and sustainable use of natural resources within a conservation unit and acts as an instrument to assist the owner in managing these UCs, which requires preparation within five years from the date of its creation. However, this is not the reality of most conservation units inserted in the Araguaia River drainage basin.

In turn, the Management Council (MC) aims to assist the head of the UC in management activities within the park and its surroundings (BRASIL, 2000), with the competence to monitor the preparation, implementation and review of management plans of the UC. Such action therefore represents the interests and concerns of society, which ends up avoiding current problems and future conflicts over the protected area (BRASIL, 2000; SANTANA et al., 2020).

In turn, "the management of a protected area, when well defined and executed, directly contributes to achieving its objectives and its desired effectiveness" (BARROS; LEUZINGER, 2018, p. 282). However, a large part of the conservation units in the Brazilian territory present difficulties in elaborating and implementing management plans and management councils. Barros and Leuzinger (2018) point out that the main problems arise from the difficulty of adapting to the parameters provided by the methodological guidelines, the observance of the deadline for elaboration, a lack of guaranteeing effective social participation in creating the document, in determining the dampening zones, the high financial cost, among other challenges to be faced.

When analyzing this scenario for the Araguaia River basin, only 8 protected areas have a management plan among the 49 conservation units and excluding the units for which we were unable to obtain information (Araguaia State Park – MT, Araguaia National Park, Cantão State Park, Serra Azul State Park, Pé da Serra Azul APA, Nascentes do Rio Sucuriú APA, Ilha do Bananal APA and Serra dos Martírios/Andorinhas State Park). Furthermore, it was also identified that 5 conservation units created in the 1990s did not yet have a Management Plan (Meandros do rio Araguaia APA - 1998, Serra Dourada APA -1998, São Geraldo do Araguaia APA - 1996, Nascentes de Araguaína APA - 1999 and Reserva Boca da Mata RPPN - 1998).

Most UC's in the study area correspond to the APA category. Within this bias, it is observed that such areas present greater conflicts and difficulties for implementation and management when compared to other categories, as already verified by researchers (MORAES, 2004; TEIXEIRA, 2005; COZZOLINO; IRVING, 2004; GONÇALVES et al., 2011).

The management plan in the case of RPPNs is the owner's responsibility, which must be analyzed and approved by the responsible environmental agency. However, none of the 9 RPPNs registered in the Araguaia River basin has the management instrument.

For the Management Board of the 49 conservation units, excluding those for which we were unable to obtain the data, only 14 have a MC. In an analysis of the conservation units created in the 1990s, three still do not have a Management Council according to the environmental data platforms, which are: Serra Dourada APA (1998), Nascentes de Araguaína APA (1999) and Reserva Boca da Mata RPPN (1998).

Godoy and Leuzinger (2015) point out that the main problems for implementing and managing protected areas are the lack of financial resources and the inexistence of a management plan. It should also be noted that the management councils are one of the main strategies for managing the protected area, as it encompasses the participation of social segments from the planning process to the evaluation and management, which helps to minimize conflicts with the society of conservation units (FRANCA et al., 2006; ANDRADE; LIMA, 2016).

Given this scenario and the absence of Management Councils, Management Plans, non-

existence and/or misunderstandings of data on environmental platforms, there is a question about the effectiveness of protected areas in the Araguaia River basin. This questioning above all occurs in relation to environmental issues, and mainly in relation to its contribution to the preservation and conservation of water resources in the Araguaia River basin.

The two types of protected area categories have been shown to be effective in comparison to no protection and are presented as important tools to prevent deforestation in Brazil, although PAs with more rigid uses tend to be more effective (CARRANZA et al., 2013; FRANÇOSO et al., 2015; NOLTE et al., 2013; VIEIRA et al., 2019).

Although Nelson and Chomitz (2011) specify that multiple use/sustainable use units are more effective in reducing deforestation and fires, it should be considered that data provided by Mapbiomas (2019) indicate that this category of unit presents a greater recurrence of these processes.

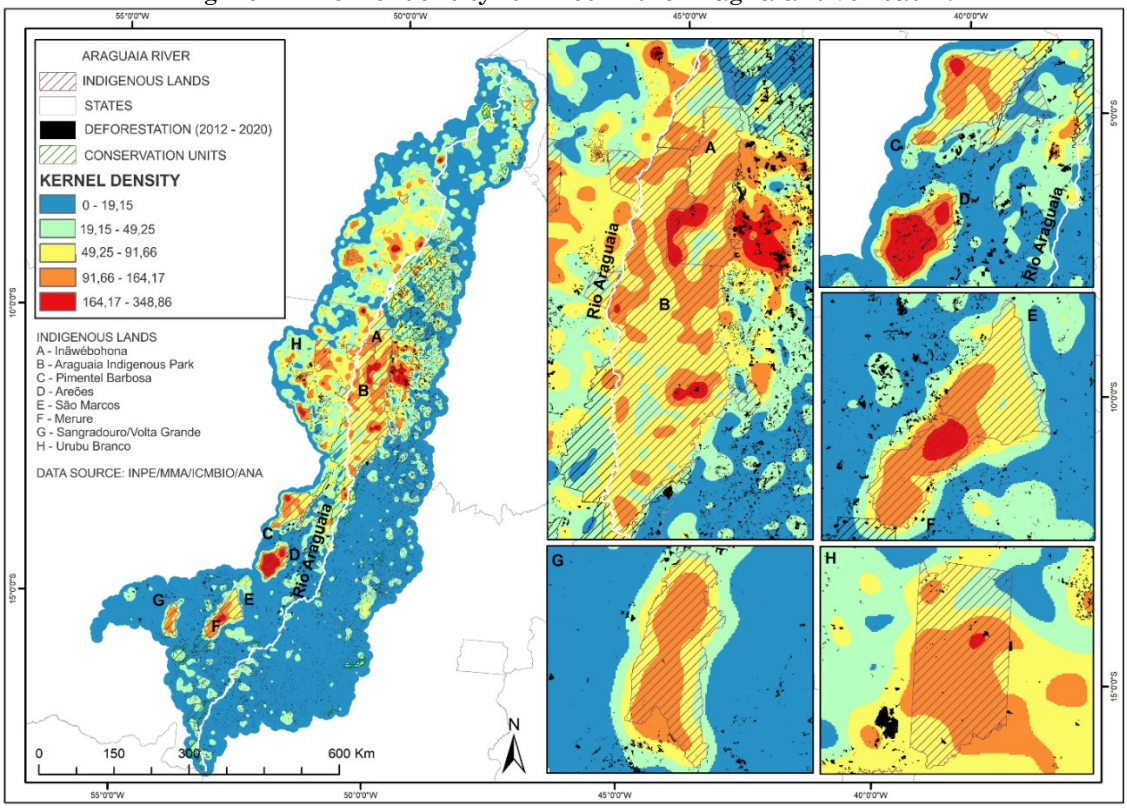
Data collected from *INPE* indicate that there was an accumulated deforestation of 14,472.03 Km² and 114,326 fires and forest fires in the Araguaia River basin between 2012 and 2020, which even occurred in the overlapping with conservation units and indigenous lands.

Using the Kernel Density (Figure 4), it is possible to better understand this distribution and the occurrence of fire and forest fire outbreaks, for example showing that the areas with higher densities of fire and forest fire outbreaks (red tones) are mainly located within conservation units and indigenous lands.

Regarding the conservation units of the Araguaia River basin for the period of analysis (between 2012 and 2020), 15,191 of these fires and forest fires were identified within their limits, which represents about 13.28% of the basin's total outbreaks, indicating that the Araguaia Indigenous Park in the Araguaia National Park in the Ilha do Bananal EPA were the most affected PAs among them.

As can be seen in Figure 4, the indigenous lands most affected (higher density of outbreaks) by fires and forest fires were: the Inãwébohona, Pimentel Barbosa, Sangradouro/Volta Grande, Merure and São Marcos Indigenous Lands.

Figure 4 – Kernel density for fires in the Araguaia River basin.



Source: The authors (2021). The color scales represent a lower or higher density of fire and forest fire outbreaks, ranging from shades of blue (lower density of outbreaks) to red (higher density of outbreaks).

The data analysis on fires and forest fires is of great relevance, as it indicates that areas destined for the conservation of environmental and cultural aspects are not managing to effectively fulfill their role in conservation. It is important to say that these focuses are being induced by human action, especially as a result of activities to change land use and land cover that consequently cause various environmental, social and economic impacts which can be intensely enhanced.

It should therefore be considered that the consequences of the effect from forest fires and fires are numerous and of great proportions for conservation units (BONTEMPO, 2011), including: the destruction of forests, biodiversity loss, atmospheric pollution, decrease in the quality and quantity of water resources, loss of fertility and increase in soil compaction, acceleration of erosion processes and widespread changes in ecosystems (NASCIMENTO, 2001; HOFFMANN; MOREIRA,2002; KLINK; MACHADO, 2005).

They are also largely responsible for CO_2 emissions into the atmosphere in Brazil (IBAMA, 2009), in addition to the development of respiratory diseases, allergies, interruption in electricity supply, drop in agricultural productivity, and an increase in food prices, compromising the functioning of the air and road sectors, among other negative effects (IBAMA, 2009).

Another important aspect to be considered for the effectiveness of conservation units is the lack of connectivity and overlap between the PAs, in most cases becoming "vegetation islands" due to vegetation patches and fragments in the landscape with a high degree of predatory activities, which in turn provide speciation and adaptations, in addition to increasing the edge effect in these isolated areas. These characteristics have also been confirmed by research carried out in other Brazilian regions (FERRETTI, 2019; AKASHI JUNIOR; CASTRO, 2010).

There is also an overlap between conservation units from different government spheres and management categories in the Araguaia River basin, as in the following examples of UCs: Serras dos Martírios/Andorinhas State Park (Full Protection), Lago de Santa Isabel APA and São Geraldo do Araguaia APA (Sustainable Use); Meandros do rio Araguaia APA (Sustainable Use) and Corixão da Mata Azul RVS (Full Protection); Pé da Serra Azul APA (Sustainable Use) and Serra Azul State Park (Full Protection); Serra Dourada APA (Sustainable Use) and Serra Dourada State Park (Full Protection). This aspect ends up interfering in the management of these conservation units, in most cases behaving as mosaics of protected areas.

Although these mosaics are aimed at "the compatibility between biodiversity, sociodiversity and sustainable development in the regional context, and should be managed in an integrated and participatory manner" (SANTOS, 2018, p. 65), they tend to decrease the ability to move fauna and disperse flora, especially in protected areas (AQUINO, 2014).

Thus, when they only represent these vegetation fragments by themselves amidst areas of pasture and agriculture, they are not effective in protecting natural resources, biodiversity or in providing ecosystem services as expected, and lead to characteristics which transform them, in the majority of times, as the main threats to biodiversity conservation in the Cerrado biome (ROCHA et al., 2018).

FINAL CONSIDERATIONS

In view of the reflections raised herein, it can be inferred that although conservation units are under intense attack from the dismantling of environmental policies, they still represent an important tool for preserving natural resources, scenic beauty and the protection of historical and/or cultural sites and biodiversity in Brazil.

The Araguaia River basin, with approximately 380,000 km², has 49 conservation units, which represent only 9.42% of its territory. There are 36 for Sustainable Use and 13 Full Protection, distributed in 10 at the Federal level, 21 at the State level and 18 at the Municipal level.

Among the 49 conservation units and excluding the Córrego Boiadeiro Natural Monument, Serra da Bocaina RVS and Santa Maria/Mata do Guacho RPPN Conservation Units, as it was not possible to obtain information, only 8 have a management plan. It was also observed that even for the 11 conservation units created in the 1990s, meaning more than 20 years after their creation, 5 still do not have a Management Plan and only 14 have a Management Council in total.

Data collected from *INPE* indicates that there was accumulated deforestation of 14,472.03 Km²

and 114,326 outbreaks of fires and forest fires in the Araguaia River basin between 2012 and 2020, which even occurred in the overlapping with conservation units and indigenous lands, so that 15,191 of these fires and forest fires occurred within the limits of conservation units, representing about 13.28% of the total outbreaks in the basin.

On the other hand, although the conservation units represent an important tool for the conservation of water resources in the Araguaia River basin, none of them comprise the source areas of the main tributaries of the Araguaia River.

In view of these reflections, it is observed that the creation of conservation units alone does not guarantee by itself the conservation of natural and social resources, even if the UC's are representative in number and areas. Therefore, there is a need for more technical monitoring by environmental agencies and society from creation to the implementation of Management Councils and Management Plans, etc.

Thus, although the *SNUC* institutes conservation units and defines their norms and objectives, there is a lack of management in activities and inspection in most conservation units in the Araguaia River basin. Therefore, there is an urgent need to apply the Environmental Legislation in these areas because they are an effective tool in the protection and preservation of natural, social and biodiversity resources in the Araguaia River basin when well-managed.

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AUTHORS' CONTRIBUTION

Pâmela Camila Assis was responsible for the theoretical-conceptual development, technical procedures, elaboration of cartographic maps, data acquisition and its interpretations and analysis, and text writing. Karla Maria Silva de Faria analyzed the data and wrote the text and Maximiliano Bayer wrote the text.