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Comparative analysis between two conservation units in Piauí using the principles of good governance

Análise comparativa entre duas unidades de conservação no Piauí utilizando os princípios de boa governança

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Abstract: The creation of conservation units has been an important strategy for effectively reducing deforestation and increasing environmental preservation. In this sense, this article aims at carrying out a comparative analysis between the management strategies developed by two different conservation units in the state of Piauí, the Sete Cidades National Park and the Palmares National Forest. To this end, field research was carried out with qualitative interviews with the two managements, using the principles of good governance to analyse these two units. Therefore, it can be seen that, especially due to the time of existence, there is greater maturity of management devices. It was also noticed that despite the singularities, there is a permanent effort to optimize the results linked to the protection of biodiversity, as well as concern with social issues and the resolution of conflicts of use.

Keywords: Conservation; Logging; Management; Biodiversity.

Resumo: A criação de unidades de conservação vem sendo uma importante estratégia para a efetiva redução do desmatamento e preservação ambiental. Nesse sentido, o presente artigo tem como objetivo realizar uma análise comparativa entre as estratégias de gestão desenvolvidas por duas unidades de conservação distintas no estado do Piauí, o Parque Nacional de Sete Cidades e a Floresta Nacional de Palmares. Para isso, foi realizada uma pesquisa de campo com entrevista qualitativa com as duas gestões, utilizando os princípios de boa governança para analisar estas duas unidades. Sendo assim, percebe-se uma, especialmente em função do tempo de existência, apresenta maior maturidade dos dispositivos de gestão. Percebeu-se ainda, que apesar das singularidades, há um permanente esforço em otimizar os resultados ligados à proteção da biodiversidade, bem como, a preocupação com as questões sociais e a solução de conflitos de uso.

Palavras-chave: Conservação; Desmatamento; Gestão; Biodiversidade.

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1. Introduction

During the historical course of the human race, man went from a passive subject in nature to a motivator of it, using the most varied forms of exploitation of the environment (FONSECA *et al.*, 2019). In their quest for development, human beings sought to extract the maximum from nature's finite resources, affecting the environment across the planet for years (SANTOS; ARAÚJO, 2019). In this context, unrestrained consumption and production have become the main aggravating factors of the environmental issue, triggering an alert to the entire society (D'AMICO; AGOGLIA, 2019).

Therefore, to protect the planet's biodiversity, protected areas or conservation units (CUs) were created around the world, one of the most important strategies currently in this regard (MAMMIDES, 2022). These are designated areas with natural characteristics relevant to nature conservation and biological diversity (BRASIL, 2011). In Brazil, conservation units are legally established by the Public Power and managed under a special regime, with guidelines defined by the National System of Conservation Units (SNUC).

Due to their decisive role in biodiversity conservation, these protected areas have been gaining prominence in academia, being studied around the world, such as in China (ZHANG *et al.*, 2022), South America (SCHLEICHER *et al.*, 2019), Brazil (SALVIO *et al.*, 2020), among others (GOULD *et al.*, 2021; STACHOWIAK *et al.*, 2021). In the national territory, there has been an increasing number of articles on the topic since 2016, highlighting unexplored opportunities and gaps, as well as the increased interest of the topic for society (ROCHA *et al.*, 2020).

The creation of UCs are being praised as important contributors to the effective reduction of deforestation and environmental preservation, (TREVIZAN; OLIVEIRA, 2022). But despite this, more and more natural resources and wild species are being exploited to meet the demands of globalization (ZHANG *et al.*, 2022).

Another existing problem observed in the literature is the lack of resources for the proper functioning of these places (CUs), or even the inefficient use of available resources, making their functioning difficult (RODRIGUES, 2014; SCHLEICHER *et al.*, 2019).

In this sense, in view of the need to contribute to the improvement of the management of conservation units, this article seeks to carry out a comparative analysis of the management strategies developed by two different conservation units in the state of Piauí, the Sete Cidades National Park and the Palmares National Forest, considering the stages of maturity and the specific pressures inherent to them. To this end, its limitations and potential were identified. Thus, this study used the principles of good governance defined by Dudley (2008), principles coined to serve as a guide for good governance practices in conservation units. The two units chosen in Piauí are representative of different contexts, the first, the Sete Cidades National Park, is much older and more mature, in addition to suffering less from urban and human infrastructure pressures. The second, Palmares National Forest, is a recently created unit, located close to the state capital and has been suffering more urban and demographic pressures.

2. Theoretical Framework

The environmental issue gained strength from the 1960s and 1970s, in a socio-historical context marked by intense social movement (D'AMICO; AGOGLIA, 2019). In Brazil, however, it was in 1930 that debates began around the environmental issue, with the promulgation of the Hunting and Fishing Code and other legal provisions, but only with the federal constitution of 1988, there was effective demarcation and conservation of protected areas (FONSECA *et al.*, 2019). In 2007, with the dismemberment of the Brazilian Institute of the Environment and Renewable Natural Resources (IBAMA), the Chico Mendes Institute for Biodiversity Conservation (ICMBIO) was created, being responsible for proposing, implementing, managing, inspecting and monitoring the Biodiversity Conservation Units (BRAZIL, 2007). Therefore, conservation units are territorial spaces that have natural characteristics relevant to the conservation of nature and biological diversity, legally established by the Public Power and administered under a special regime (BRASIL, 2011).

Worldwide, there is an expansion of protected area networks in an effort to address the growing rates of global biodiversity loss (MAMMIDES, 2022). The creation of conservation units is currently the main means of ensuring the conservation of biodiversity and ecosystem services in the world (CHEN *et al.*, 2022). These environmental conservation areas are well-defined geographic spaces, with legal recognition and managed through legal or other effective means, with the aim of achieving long-term conservation (JONES *et al.*, 2022). However, socio-economic activities threaten biodiversity and ecosystem services, reducing the effectiveness of the present UCs and a third of these units are under intense human pressure (CHEN *et al.*, 2022).

The effectiveness of protected area management can be assessed by how well it manages to achieve its objectives, using limited personnel and infrastructure resources (MCNEELY, 2020). In their study in China's protected areas, the findings of Chen *et al.* (2022) point to a gradual expansion of the natural reserve protection system through the creation of UCs. However, there was also an increase in socio-economic activities in these regions, showing the need for real-time monitoring to ensure nature conservation. In many UCs there is still the issue of agroindustry, which threatens these locations, potentially causing a reduction in territorial limits and re-categorization of units (OLIVEIRA, 2021). Along the same lines, for Mcneely (2020), humanity will still face environmental problems in the coming years, and this will require a joint and strong response from government agencies, civil society, the private sector and academia.

In a study in Mato Grosso, Trevizan and Oliveira (2022), observed that UCs play an important mitigation role in relation to climate change in that state, which may reflect on the availability of water resources and other ecosystem services in the region. Furthermore, UCs are still capable of boosting science, in the areas that allow controlled human impacts also provide opportunities for researchers to study the biodiversity of that location (MCNEELY, 2020). This being one of the great challenges of conservation units, the management of these shared-use spaces in a way that still guarantees the fulfilment of their objective of preserving biodiversity (SANTOS *et al.*, 2021).

The International Union for Conservation of Nature (IUCN) defines six categories of protected areas (PA), namely: Ia) Strict Natural Reserve; Ib) Wildlife Area; II) National Park; III) Natural Monument; IV) Habitat/species management area; V) Protected Landscapes; and, VI) Protected area with sustainable use of natural resources. Each category has a well-defined purpose, reflecting the management objectives for each area, with the first three categories having well-controlled human intervention, while the last three categories are more permissive to human intervention (DUDLEY, 2008).

In Brazil, there is the National System of Conservation Units (SNUC), a set of official standards and procedures that allow government spheres and organized civil society to create, implement and manage conservation units in the country (BRASIL, 2011). The SNUC also has a similar system of categories for UCs, which are defined in two groups: Full Protection Units and Sustainable Use Units. In the first group there are five categories: i) Ecological Station; ii) Biological Reserve; iii) National Park; iv) Natural Monument; and, v) Wildlife Refuge. This group's basic objective is to preserve nature. For this reason, they have more restricted human intervention, similar to the first three categories of the IUCN. The second group has seven categories: i) Environmental Protection Area; ii) Area of Relevant Ecological Interest; iii) National Forest; iv) Extractive Reserve; v) Fauna Reserve; vi) Sustainable Development Reserve; and, vii) Private Natural Heritage Reserve. Thus, this group seeks to reconcile the conservation of protected nature with the use of these available resources (BRASIL, 2011).

For good governance of protected areas and conservation units, Dudley (2008) suggests nine principles of good governance: Legitimacy and Voice; Subsidiarity; Justice; Do no harm; Direction; Performance; Accountability; Transparency; Human rights. These principles encompass general aspects that all conservation units must have to meet IUCN good governance criteria (DUDLEY, 2008).

The term "governance" is old and complex, different from the concept of government or governability, and may have different meanings in different scenarios (CARDOZO *et al.*, 2019). With this in mind, Cardozo *et al.* (2019) argue that good governance and sustainable development are correlated concepts, with the presence of good governance not *per se* guaranteeing sustainable development, but its absence can obstruct it.

Table 1 – Principles of good governance of protected areas according to Dudley (2008).

Principles	Description
Legitimacy and Voice	It consists of social and collective dialogue between the various actors involved in the management of a conservation unit, facilitating association among members without discrimination based on gender, ethnicity, lifestyles, cultural values or other characteristics.
Subsidiarity	It refers to the attribution of authority and management responsibility to those institutions that are closest to the resources under protection.
Justice	The principle of justice is premised on equitably sharing the costs and benefits generated by the conservation unit, as well as offering impartial judgement in the event of conflicts.
Do no harm	It proposes to ensure that the costs involved with the conservation unit do not create or worsen poverty and vulnerability.
Direction	It consists of disseminating an inspiring and consistent long-term vision to achieve the objectives of the conservation unit.
Performance	Performance concerns the effective conservation of biodiversity, responding to <i>stakeholder concerns</i> and using existing resources intelligently.
Accountability	Have management with clear lines of responsibility in order to ensure adequate accountability to all interested parties.
Transparency	The management of conservation units must ensure that all relevant information is available and easily accessible to <i>stakeholders</i> .
Human rights	It consists of respecting the human rights of current and future generations in the context of managing a conservation unit.

Source: Adapted from Dudley (2008).

The first principle to be debated is that of legitimacy and voice. This principle values the existence of clearly defined, legitimate, equitable and functional governance agreements, representing society's interests fairly (IUCN; WCPA, 2017). For Dudley (2008), this principle consists of social and collective dialogue between the various stakeholders, employees, the surrounding community and managers, allowing easy interaction between these social actors without any type of discrimination. This is one of the most present principles in UCs, perceived mainly by consultative or deliberative councils (CARDOZO *et al.*, 2019). Furthermore, the connection created with the surrounding community can create partnerships in order to solve problems arising from a lack of resources, such as the use of volunteers in monitoring in the UC area (LIMA JÚNIOR *et al.*, 2019). The article by Gould *et al.* (2021) addresses this issue well in that the protected area under study underwent practices and initiatives led by local indigenous people, collaborating with the management of the UC, and thus, raising important questions regarding local conservation and indigenous rights. Local communities can and should carry out conservation activities in UCs, thus helping to achieve large-scale conservation goals if their efforts are well integrated with the activities of the UC itself (STACHOWIAK *et al.*, 2021).

The principle of subsidiarity is related to the attribution of authority and responsibility, and this attribution is indicated for institutions that are closest to the resources chosen for conservation (DUDLEY, 2008). The decentralization of environmental protection is considered one of the most efficient alternatives for effective participation of the local community and civil society, integrating these social actors in the management of UCs (FONSECA *et al.*, 2019). However, Salvio *et al.* (2020) argues that this decentralization of environmental conservation management is important to raise globally the involvement and communication between the different administrative levels connecting the UCs and allowing for the effective protection of biodiversity. In this sense, this principle values decentralized management, in which organizations that are effectively under the management of the UC must have full authority and responsibility over it.

The principle of justice seeks to equitably share the costs and benefits generated by the UC, that is, management must maintain a sense of impartial justice to judge existing conflicts between interested parties (DUDLEY, 2008). In this principle, it is considered that social impacts can affect both positively and negatively a UC, and thus, include the costs and benefits perceived and shared by the entire protected area, such as quality of life, personal income, mental health, landscape and local recreational activities (JONES *et al.*, 2022).

Even though they present numerous benefits to global biodiversity, protected areas still face criticism for possibly affecting the livelihoods of the local community, particularly those in developing countries (MAMMIDES, 2022). In view of this, the premise of the do no harm principle is to ensure that the costs involved with UC do not create or worsen poverty and vulnerability in that location (DUDLEY, 2008). This translates into thinking about the community involved with UC and ensuring that the existence and maintenance of the protected area does not impact in any way the source of income or vulnerability of the location. Furthermore, urban expansion must always be considered by UC management, as this changes the existing relationship between the environment and people, potentially harming local biodiversity (CHEN *et al.*, 2022).

In relation to the principle of direction, the key aspect is the long-term vision, in which it is expected that this vision will be disseminated in inspiring and consistent terms so that the UC achieves its conservation objectives (DUDLEY, 2008). UCs are important areas to support change and transformation, whether in terrestrial or marine environments, sharing benefits with the entire local community, and for this reason, management must consider this type of vision in its decision-making, considering long-term aspects (MCNEELY, 2020). Furthermore, protected areas with a high administrative level demonstrated greater effectiveness in protecting biodiversity, thus indicating that the management of a UC is a relevant element for long-term nature conservation (ZHANG *et al.*, 2022).

The performance principle relates to the effective conservation of biodiversity, since the objective of a conservation unit is the protection of local biodiversity (DUDLEY, 2008). Therefore, this principle seeks to respond to existing concerns of stakeholders, as well as use available resources in the most intelligent way possible. Furthermore, Jones *et al.* (2022) highlights that effective UC management includes the attitude and support of the local community, mainly through voluntary activities. This idea is corroborated by Lima Júnior *et al.* (2019), in which volunteering from the surrounding community was relevant for the maintenance of the studied UC, especially due to issues related to the low budget, which is an interesting alternative for the management and protection of local biodiversity.

The Principle of accountability supports the idea that the management of a UC has clear and well-defined lines of responsibility to ensure efficient and adequate accountability, serving all interested parties (DUDLEY, 2008). International literature has recently highlighted the role of stakeholders in protected areas, mainly because they are areas prone to conflicts between local communities, visitors and management (JONES *et al.*, 2022). Even more so, UC's bring economic, social and environmental contributions to the entire extent of their reach through their ecosystem services,

from fishermen to researchers and government agencies (MCNEELY, 2020). For this reason, accountability with all these interested parties becomes essential for good management.

Regarding the principle of transparency, the focus is to ensure that all pertinent information is made available to interested parties, thus ensuring transparency between management and civil society (DUDLEY, 2008). UCs at the federal, state and municipal levels must listen to the community in their management plan and collegial meetings, which allows everyone to actively participate in the decisions made in the management of these areas (FONSECA *et al.*, 2019). Therefore, this principle is linked to the understanding of participatory governance, which seeks to improve the quality of decisions taken, within the scope of public management, through the incorporation of knowledge from interested parties, facilitating the implementation and acceptance of decisions taken (CARDOZO *et al.*, 2019).

The last principle is human rights. This is one of the principles that is linked to the concept of sustainable development, especially with regard to conservation for future generations (DUDLEY, 2008). Therefore, this principle requires respect for human rights on the part of management and employees in the context of the UC. One of the key aspects of good governance of conservation units is being able to convey respect for human rights and the importance of the place to visitors. This type of environmental education directly contributes to the protected area by sowing a critical perspective and integrated world-view with different social agents (MACHADO; SORRENTINO, 2021).

3. Methodology

3.1 Characterization of study areas

The research was carried out in two Conservation Units at the Federal administrative level. The first is the Sete Cidades National Park (PNSC), located in the north of the state of Piauí, occupying an area of 6,221.48 ha in the municipalities of Piracuruca and Brasileira, covering 76.78% and 26.27% of its area in each municipality, respectively. It was created in 1961, through Federal Decree No. 50,744. Its biome is characterized by a transition from the caatinga to the cerrado and its area covers around 6,304 hectares. The climate regime present in the region is intermediate between the typically tropical regime of the Plateau and the Mediterranean regime of the eastern coast.

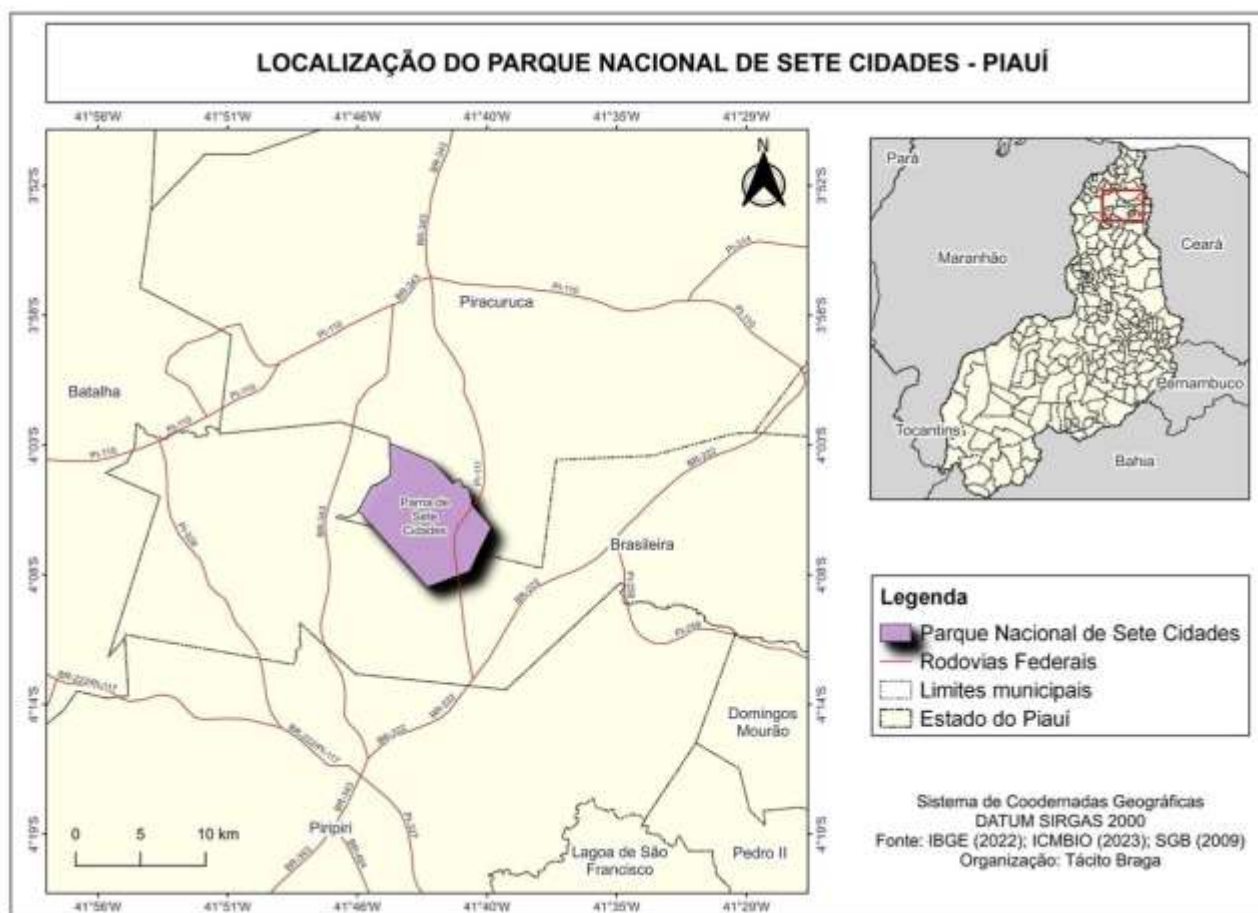


Figure 1 – Location of Sete Cidades National Park.
 Source: Authors (2023) based on IBGE (2022); ICMBIO(2023); SGB (2009).

Regarding geological factors, the PNSC is located in the Parnaíba sedimentary basin, located in the northeast region of Brazil and occupies an area of approximately 600 km². The most common rocks in this geological context are sandstones. Its unity is given by a cementing material that can be silica, iron oxide, or calcium carbonate (Gary *et al.*, 1972).

The other unit is the Palmares National Forest (Flona dos Palmares) created in 2005 through a presidential decree S/N^o, with the objective of promoting the management of multiple use of forest resources, and an important reserve of animal and plant species native to the Cerrado and Caatinga biomes (LOPES, 2007). It is located in a rural area in the state of Piauí, more precisely in the municipality of Altos, whose geographic coordinates are located between the quadrants 5° 2' 59" S and 42° 35' 45" W. Its area is approximately 170 hectares, which in turn is managed by the Chico Mendes Institute for Biodiversity Conservation (ICMBio). Regarding vegetation, 87 different species of trees are catalogued according to SOUSA *et al.* (2018). According to phytosociological inventories already conducted at Flona (ICMBIO, 2022), there are individuals, distributed among 63 (sixty-three) plant species and 26 (twenty-six) botanical families, of which the most representative in the area are from the Fabaceae family (ICMBIO, 2022). According to the Köppen and Geiger classification, the predominant climate is tropical, with an average annual temperature of 28°C.

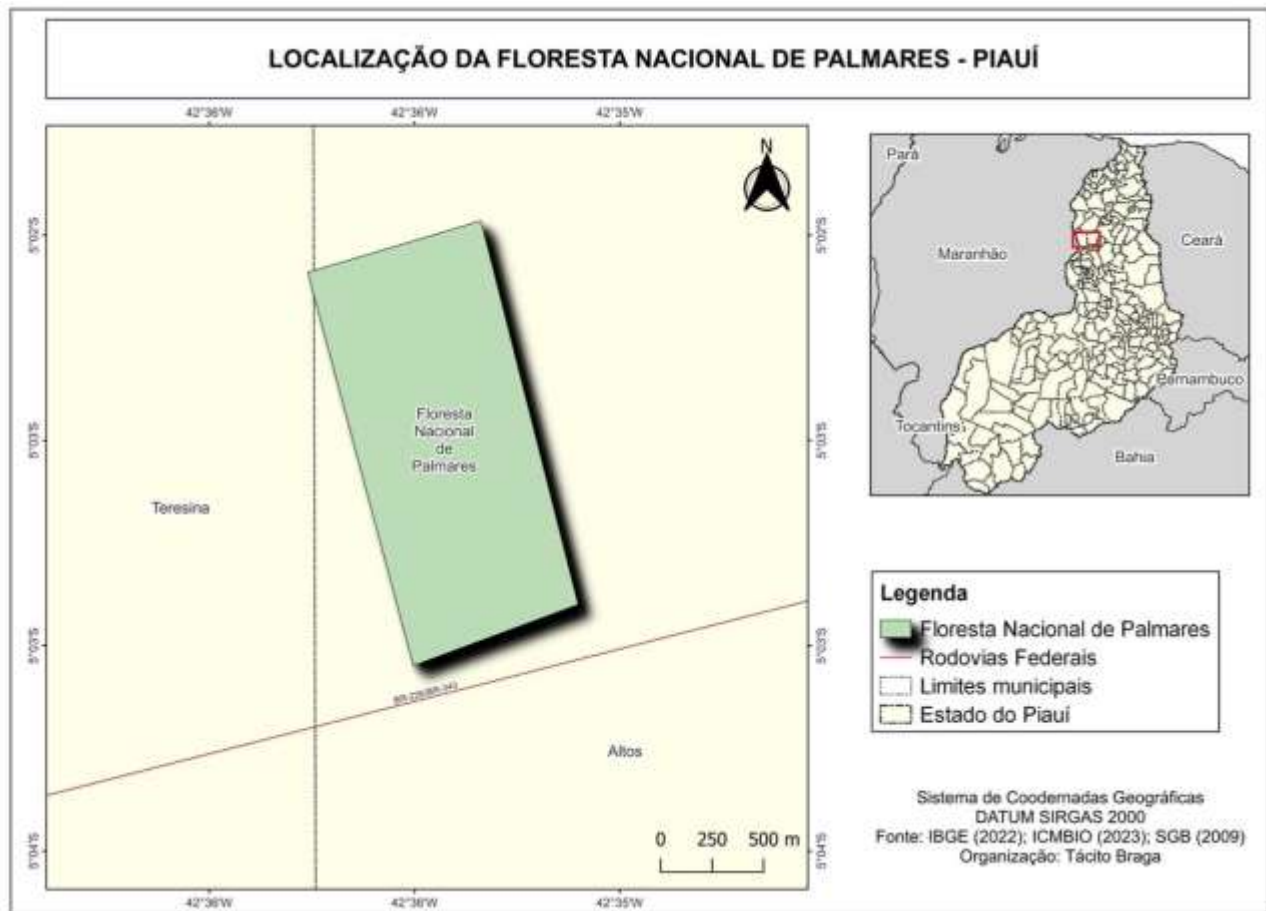


Figure 2 – Location of the Palmares National Forest.
 Source: Authors (2023). Based on IBGE (2022); ICMBIO(2023); SGB (2009).

In relation to geological issues, Flona dos Palmares is also part of the Paleozoic Sedimentary Basin of Parnaíba, under the control of the Pedra de Fogo Formation, composed of sandstones, siltstones and shales interspersed with beds of flint and limestone, gypsum lenses, with an age corresponding to the Carboniferous Period (IBAMA, 2004).

3.2 Methodological procedures

With the objective of this article in mind, qualitative research was developed in the two study locations: Sete Cidades National Park and Palmares National Forest. Qualitative research addresses the subjective aspects of the world, seeking to delve deeper into the subject in question to propose a possible answer to the topic (GONZÁLEZ, 2020). Therefore, it is the ideal approach to interpret and understand the scenarios with social and managerial aspects, such as that of conservation units.

In the data collection stage, this study used semi-structured interviews with the management of both locations, in addition to field observation (GIL, 2008; GASKELL, 2012). The semi-structured interview was used with the managers of the conservation units, which were later transcribed to analyze the results. The field observation was carried out in order to validate what was presented by the managers in the interview, and the observation data were described during the visit to both UCs, and then transcribed and compared with the information from the interviews. Below are the questions prepared as a basis for the semi-structured interview carried out.

Table 2 – Basic questions for the interview.

Principles	Questions
Legitimation	How is the communication (relationship) between park management and the local community?
	Does management understand the culture and history of the local community?
	How management considers it important to respect diversity in the communities involved with the conservation unit (ethnicity, color, race, gender)?
Subsidiarity	Is park management centralized or decentralized?
	What is management autonomy like in the park?
	Is the park responsible for its entire management or does it just represent ICMBIO in this matter?
Justice	Is the park management clear and participatory?
	Does the park fairly share the costs and benefits of establishing and managing protected areas?
	Impartial judgment in case of conflict (do you listen to everyone collectively?)
Do no harm	What are management precautions regarding the vulnerability of natural resources?
	Do employees understand the importance and vulnerability of the park?
	Were there any post-implementation consequences of the park?
Direction	Does the park have its own mission, vision and values?
	Do employees understand the park's objectives and their importance?

	What do you think in the short, medium and long term? Are there goals in this regard?
Performance	Does management record and control information about the unit's fauna and flora?
	Does management consider it important to respond to stakeholders?
	How is the park's financial management?
Accountability	Do employees understand their responsibilities?
	Is there a manual or code of conduct?
	How is responsibility conveyed to employees, management, customers and local communities?
Transparency	How transparent is the park?
	Are the park conservation results open to the public?
	Do the community and interested parties have easy access to information about the unit?
Human rights	Do the laws and regulations that govern the park consider current and future human rights?
	How does management view respect human rights within the conservation unit?
	Do employees and management understand their responsibility to current and future generations?

Source: Prepared by the authors (2023).

Data analysis was conducted using the content analysis technique. This type of analysis fragments the information obtained in the data collection phase into sections with similar themes to then be categorized into a specific thematic category (BARDIN, 2002). Following the criteria of Batista et al. (2021) initially, a floating reading was carried out in the transcription of the interviews, then the material was explored by categorizing the interview excerpts into the established categories, and finally, the results were interpreted. In this way, the interview transcripts were read and re-

read to be framed in accordance with Dudley's (2008) nine principles of good governance: Legitimacy and Voice; Subsidiarity; Justice; Do no harm; Direction; Performance; Accountability; Transparency; Human rights. In the results and discussion section, excerpts cut from the interview transcripts are marked with "PNSC" for the statements about the management of the Sete Cidades National Park and "FLONA" for the Palmares National Forest.

4. Results and discussion

The results made it possible to analyze and discuss governance based on 9 (nine) principles, starting with the legitimacy of voice. The Principle of legitimacy and voice refers to the communication relationship between society and the UC. In this aspect, it was observed that both parks have councils, thus enabling more effective participation of the surrounding communities. In relation to Flona dos Palmares there is less participation from this public, according to the manager the reason is related to more specific themes focused on the management of the park, which arouse little interest among the public. In the PNSC, this interaction between residents and the park is more constructive, since one of the council's functions is to mitigate conflicts within communities, thus providing a friendlier environment conducive to cooperation.

Often those who participate most in decisions in terms of supporting the forest are the parents of the children in the project, even more so than the surrounding councilors, because parents, they perceive development in children in a way like this, in their day-to-day life, probably different from the representative of the association, the settlement or the residents' association. So they participate too (FLONA).

The communities had a lot of conflicts, so they asked us to hold our meetings in the communities, and so we did, each meeting we held in a different community [...] Now that we are renewing, we are thinking about a new model, because we cannot just resolve community conflicts, we also have our own internal problems (PNSC).

In the excerpts above, in Flona de Palmares it can be seen that there is less involvement of councilors, compared to the PNSC, but the manager highlights the participation of parents in the conservation unit's projects as a positive point. In the extractive reserve studied by Cardozo *et al.* (2019) a similar participation was observed in council meetings, in which there was participation from the surrounding communities, but still timidly, and little participation from public authorities. Furthermore, Gould *et al.* (2021) also highlights the importance of UCs in cultural conservation, which is as relevant as biodiversity conservation, hence the value of including surrounding communities in the UC decision-making process.

In relation to the principle of subsidiarity, that is, in relation to centralization and decentralization as a form of decision-making, it was observed that in the PNSC, choices are discussed jointly through an advisory council, which has the participation of governmental and civil institutions. At Flona dos Palmares there is also an advisory board, but not all decision-making goes through it, some decisions are taken by the manager himself together with ICMBio. Despite this finding, there is an effort by both units to promote a more decentralized and participatory management model.

I would say I'm the helper. Even for the collaborators here. So we work with a decentralization philosophy (FLONA).

Yes, management has autonomy, it has a certain autonomy, because like, when you decentralize and when you make it participatory, you make it stronger and it is a democratic way of managing [...] (PNSC).

Based on the principle of doing no harm, UCs must act so that they do not promote vulnerability and poverty in their actions. Regarding these practices in the PNSC, the manager states that since the implementation of the park, the population residing in that territory has not been harmed, but rather, joined together, becoming partners of the unit. This is also seen when we look at the benefits brought after the implementation of the UC, one of which is the opportunity to generate income, for example, through the sale of handicrafts, or the visitation itself, anchored in ecotourism. These types of actions are also encouraged by the management of Flona dos Palmares. In relation to this, the unit has an association that offers training courses to train guides, and what's more, it is seen in their attitudes that management strives to encourage communities to develop wealth generation practices. However, there is need for greater interaction among residents. Thus, it is evident in both PNSC and Flona dos Palmares that they work consciously, as they know the importance that the community has for the unit, so both UCs have this commitment to developing practices and activities aimed at non-harmful commitment.

I usually say the following, that the systematic monitoring work that was developed, with the adoption of the environmental socio-educational project, we created a barrier that I call invisible and more visible, which is the participation of the community in the management process (FLONA).

It's like I told you, we try our best to get these communities to be our partners because we can't be there in the area monitoring every day, so we try to get the communities that are there to be our partners, our eyes and our feet. So much so that when someone there who is our partner sees that something is wrong, they call or come here to talk to the agent, there is this partnership. (PNSC).

In the excerpts above, the managers exemplify how they practiced this principle. On the part of Flona dos Palmares management, the projects established with the aim of maintaining the preservation and protection of the site are mentioned. At the PNSC, the manager demonstrates that from the beginning the park sought to include the surrounding communities, and today they are an essential part of the maintenance and preservation of the UC. Along the same lines, for Mammides (2022), UCs must protect local nature, but without disproportionately worsening the environment of the local population. The results of SCHLEICHER *et al.* (2019) corroborate this idea, in which the PAs studied in the Amazon demonstrate a reduction in forest degradation and deforestation, while vulnerability and poverty were not worsened.

In relation to the performance principle, biodiversity conservation must be observed, as well as responding to the concerns of interested parties and making efficient use of resources (DUDLEY, 2008). Another important point of the performance principle is the medium and long-term vision, which are essential elements to guarantee the efficiency of nature conservation (the main objective of a UC). In Flona dos Palmares, according to the manager, the act of hunting was part of the communities' culture, but through an inspection methodology used they managed to reduce this practice. Furthermore, the UC suffers from being located close to a penitentiary, where inmates escape into its extension, which can cause damage to the UC's assets. Therefore, Flona management must also consider these cases to fulfill conservation performance.

When you talk about the medium and long term, for example, in the medium term what we hope is that the damage caused by inmates entering Flona, making trails and damaging property (FLONA) will cease.

In this sense, the manager cites as a medium-term objective the containment of damage caused by escaping inmates, in addition to the damage caused by the visitors' trail itself. In the PNSC, this practice of monitoring is commonly used, but as the unit is large, the cooperation of guides and surrounding residents is essential to maintain control of this action. For Stachowiak *et al.* (2021) surrounding communities can contribute to monitoring biodiversity, protecting the environment and helping with site management. It is observed that a common factor between the two units is the existing partnership with residents, who help in this process of inspection and preservation of the unit.

Still on the principle of performance, managers were asked about the management of fauna and flora biodiversity. The PNSC management highlighted the importance of managing research within the park, another key aspect of this principle, in which scientific research carried out at the site must follow a specific protocol to be carried out. This research must be included in medium to long-term management planning, as it can also generate impacts, even if small and controlled, on local biodiversity.

We have this control over all fauna and flora research, so we need to authorize it. Researchers only come to do research if we give a positive or favorable opinion, so we do have a whole database, as I said, SISBIO has all the information (PNSC).

The principle of accountability is directly linked to the communication of results to *stakeholders*, as well as the fulfilment of the park's responsibilities (DUDLEY, 2008). Regarding this issue, the PNSC takes place through meetings held annually, in which all costs incurred during the year are presented. In the Flona dos Palmares park, this provision occurs through reports, also annually, of all activities carried out within the unit, which in turn is made available to all council participants and communities, as well as informative announcements on bulletin boards.

I do an accounting, today I'm not putting it on the wall anymore, but I've already put it on the wall several times, where the den is. [...] (FLONA).

Every project we want to do, it has to be presented, because if they don't give the approval we can't go ahead, so if they give the approval we will have to be accountable. Once the hotel renovation project is approved, after everything is finished, you

have to come here and present everything that has been done, everything in detail so that the council can approve it, have the minutes, sign everything correctly. (PNSC).

The effort of both units can be seen in the process of accounting for the financial resources used in the unit's actions. Managements undertake different but effective strategies to provide administrative transparency to the allocation of financial resources. Accountability is a key factor for conservation units, as they promote trust among *stakeholders*, influencing both the attitude and active support of the community in these places (JONES *et al.*, 2022). Another aspect of accountability highlighted by the Flona dos Palmares manager is the responsibility of employees, in which they are aware of their responsibilities and the importance of conserving the conservation unit in which they are located.

“They already understand (the importance of the conservation unit), because the youngest person here joined in 2017, there are people here who have been working with us for almost a decade, there are people here who joined in 2008, stayed away for a while, but came back (FLONA)”.

Regarding the principle of transparency, it must be ensured that all relevant information is available to all interested parties (DUDLEY, 2008). At PNSC, this principle is implemented through advisory councils that take place quarterly, with the participation of various institutions and some communities. Furthermore, they leave that information displayed on bulletin boards inside the unit. In the Flona dos Palmares park, all of its activities, such as research, contracts and the entire history of resources, are available for access. With these practices, it is observed that this principle is adequately developed in both UCs, as the information is available to all interested parties.

“So I believe that we have this very clear concept of transparency for those who pass through here (FLONA).

It is our duty to guide because many people do wrong things due to lack of clarification, they do it because they don't know how, so our role is not just to monitor, there is the area of socio-environmental management [...] Socio-environmental management is conflict management, environmental education, management council (PNSC)”.

Furthermore, transparency is present in the day-to-day activities of the two conservation units, where employees are instructed in this regard, and management is notably transparent with them and *stakeholders*. For Jones *et al.* (2022), social values cultivated through transparency and accountability help to better understand local social values, building a relationship of trust that contributes to effective management. These values are well observed in both units, where they count on the support of employees and the community to remain fully operational.

The principle of direction translates mainly into the existence of governance instruments and the ability to manage it. According to the manager of Flona dos Palmares, before the creation of the unit's management plan, the general objectives were based on their lived and academic experiences. In addition to this, they also had the help of small written works. In the PNSC, in relation to the goals, it was observed that they are individualized by sector, that is, each department has its own goals to be achieved.

The mission is to protect the Germplasm Bank and native species from the Cerrado, Caatinga, Amazon and Atlantic Forest and promote environmental education, research and management (FLONA).

Yes, we work [with goals], because ICMBIO itself has its goals, each macroprocess has its goals, I'll give you an example: SISBIO, which is the Biodiversity Monitoring System, is all the research that is carried out within the park, we have a deadline to respond, to authorize these researches, even researchers who want to carry out research, which involve botanical and zoological collections, we have to give authorization and there is a deadline, there are deadlines, so these Deadlines make our goals, if I have ten surveys in a month, if I don't complete these surveys within the deadline, it will come back in my evaluation, we have an evaluation every year if I don't meet my goals (PNSC).

The management of Flona dos Palmares recently established a well-defined mission, vision and values, which are management elements that directly help with this principle. While in the PNSC, these elements were gradually forgotten over time, but still, management maintains well-defined macro processes, such as: people management, assets, fleet management, administration, communication, judiciary, monitoring, research, socio-environmental protection and management.

In the principle of justice, UCs must seek to fairly share costs and benefits and resort to an impartial judgment in case of conflict (DUDLEY, 2008). In relation to this, in the PNSC it was quite common for internal conflicts to exist in the surrounding communities, the solution found by the management was to hold council meetings within these communities, thus enabling fairer decision-making, as they allow us to better understand the possible causes of usage

conflicts. In Flona dos Palmares, the manager reports that there are not many conflicts between the communities, the most notable in the manager's view, is related to a condominium, which apparently was having problems with the inadequate disposal of garbage, but according to the manager, management actions were taken.

Now, the benefits of this cost are an exponential counterpart, which the forest returns to society in terms of management, protection, education and research value (FLONA).

It is our duty to guide because many people do wrong things due to lack of clarification, they do it because they don't know how, so it is our role not only to monitor, but there is an area that is socio-environmental management (PNSC).

Both conservation units studied practice the principle of justice well, not only resolving conflicts, but also seeking to educate and raise awareness so that the costs and benefits are in fact equitably perceived and shared. Not only does the ecosystem benefit from the establishment of UCs, but also the people living in the surrounding area benefit from the ecosystem services of UCs (MCNEELY, 2020).

The principle of human rights is related to the respect that UCs have for the human rights of present and future generations (DUDLEY, 2008). Based on this, the concern with preserving resources is observed in the speech of both unit managers. Regarding this, at Flona dos Palmares the management exalts the importance of environmental education aimed at young people, as they cannot envision a future without environmental awareness. It is no different at PNSC. For managers, preserving the resources present in the park is fundamental and essential to guarantee access to resources for future generations.

I will repeat, the issue of detainees, when they are captured here, we advise agents not to use greater force than necessary, within the unit (FLONA).

[...] anyone who works with the environment never works for themselves, we can never say that we are working for ourselves, we are working for future generations and we really believe that this issue of Human Rights is about leaving what we have today for future generations. (PNSC).

The issue of human rights at Flona dos Palmares is present when dealing with escaped inmates within the park area. Being close to a penitentiary, the conservation unit is also concerned with the practice of human rights in situations like this. The PNSC management also complements this by discussing the problems faced by the region and how this affects future generations. UCs have the ability to increase the feeling of well-being in the people who attend them, especially children, who are able to interact with the environment in a healthy and balanced way (MCNEELY, 2020).

Table 3 – Summary of research results.

Principle	Sete Cidades National Park	Palmares National Forest
legitimacy of voice	The interaction between residents takes place through the council, thus providing greater popular participation.	Low popular interest in specific unit management issues.
Subsidiarity	Existence of an advisory council, which has the participation of government and civil institutions, with the aim of promoting a more decentralized and participatory management model.	Existence of an advisory council, which has the participation of government and civil institutions, with the aim of promoting a more decentralized and participatory management model.
Do no harm	Integration of the surrounding community into non-predatory productive activities. opportunity to generate employment and income, for example, through the sale of handicrafts, or the visitation itself, anchored in ecotourism.	Existence of an association to offer training and guide training courses.
Performance	Monitoring is one of the main strategies used to ensure conservation. Due to the large size of the unit, the cooperation of guides and surrounding residents is necessary to ensure the effectiveness of this action.	Application of inspection strategies are used to prevent the practice of hunting carried out by members of the public.
Accountability	Publicity and transparency of accounts is carried out through annual meetings.	Publicity and transparency of accounts is carried out through annual reports, made available to all council participants, the community and displayed on bulletin boards.
Transparency	The information is made available to the advisory councils that take place quarterly and are available on bulletin boards within the unit.	Activities , contracts and all resource history are available for access on the walls.
Steering _	Individualized goals by sector. well-defined macroprocesses, such as: people management, assets, fleet management, administration, communication, judiciary, monitoring, research, protection and socio-environmental management.	Before the unit's management plan (2022), the general objectives were based on its experiences and academic work. It recently established a well-defined mission, vision and values, which are management elements that directly help with this principle.
Justice	Holding council meetings within communities in order to mitigate internal conflicts in surrounding communities. The strategy enabled participatory decision-making, and allowed diagnosing the possible	Problems with inappropriate dumping of waste in the surrounding area mitigated by management actions.

	causes of conflicts of use.	
Human rights	Strategies for preserving park resources are essential to guarantee access to resources for future generations.	Environmental education aimed at young people is the main strategy for the future in relation to the human rights of present and future generations.

Source: Prepared by the authors (2023).

The percentage of protected lands is growing continuously over the years, this is mainly due to the effectiveness of UCs in conserving biodiversity around the world (MAMMIDES, 2022). Zhang *et al.* (2022) noted that in the last two decades there has been a significant increase in protected areas in Sichuan, China, making it a global phenomenon and not just a local one. Therefore, it is clear that the principles of good governance (DUDLEY, 2008) are relevant for the maintenance of these areas, especially with regard to the participation of the local community in nature protection. In a scenario where resources are scarce, this partnership between the community and UC management serves to mitigate the problems encountered and fill existing gaps.

5. Final considerations

The global trend points to a progressive increase in the number of conservation units spread across the world. This is mainly due to the conservation capacity offered by UCs, which are also relevant for maintaining the planet's biodiversity, covering a wide variety of plant and animal species. With this in mind, UCs in the state of Piauí, with their great diversity of ecosystems, play a fundamental role in conserving local biodiversity. In this sense, the objective of this article was to comparatively analyze the challenges faced by the management of two conservation units in Piauí.

In general, after carrying out the analysis between the two units, it was possible to verify that there are more similarities than differences. However, an interesting aspect to highlight concerns the management profile. At PNSC, governance methodologies are more mature. This factor is entirely related to the implementation period of the unit, which is 44 years older, compared to Flona dos Palmares. With this, the development of their actions becomes noticeable. However, it is worth highlighting that due to the short time since the creation of the Palmares National Forest, the commitment that management has in relation to its practices is evident, demonstrating considerable responsibility.

As a theoretical contribution, this article provides practical insights into the principles of good governance in two conservation units in Piauí, advancing this literature. It is clear that certain principles stand out more than others, such as, for example, the principle of legitimacy and voice and the principle of performance. However, they present an interdependence that favours the maintenance of UCs and the conservation of biodiversity. In this sense, the principles of good governance appear together in the day-to-day activities of UCs, but each has its own relevance.

Furthermore, despite the scarcity of resources to manage the conservation units, both administrations use community participation and partnerships to keep them functioning properly. Therefore, as a managerial contribution to UCs in general, the use of good governance principles stands out, especially with regard to social participation, to fill the gaps left by the lack of resources. Therefore, conservation unit managers can increasingly integrate the community in decision-making, making them feel part of the UC and, therefore, contributing to its maintenance and conservation of the environment.

As for limitations, this article only observed the qualitative aspects of the two administrations, not focusing on conservation numbers and statistics. Furthermore, due to the number of principles observed, it was not possible to analyze each principle at a specific and more in-depth level just with the chosen approach. Another point of limitation is observation only at the managerial level, where studies involving surrounding communities and employees could offer a different perspective on the topic.

For future research agendas, it is first suggested that the methodology be replicated in different contexts and conservation units so that the principles of good governance are observed and studied in other scenarios. Different methodological approaches are also encouraged to study this topic, thus being able to acquire new perspectives that contribute to the literature.

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