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DIAGNÓSTICO PARTICIPATIVO DO SISTEMA SOCIOECOLÓGICO DA BACIA HIDROGRÁFICA DO RIO MARAPANIM, NO PARÁ

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ABSTRACT

The objective of this article is to produce a participative diagnosis of the socio-ecological system of the Marapanim River Basin (MRB), based on the analysis of the implementation of water resources management by a river basin committee in the Amazon of the state of Pará and the creation and performance of the Marapanim River Basin Committee (MRBC). The analysis was guided by the interdisciplinary epistemological approach, with theoretical support from the commons, Socio-Ecological Systems (SES), and the concept of Integrated Water Resources Management (IWRM). The methodological procedures of the case study and content analysis were used, with the aid of IRAMUTEQ. The results demonstrated the emergence of 6 classes of words, which were grouped into four categories: ecological, symbolizing the Marapanim River basin; actors, relating to the interests of the public authorities, water users, and civil entities; governance system, represented by the creation of the MRBC; and interactions and results, which demonstrated the performance of MRBC as a new institution of participation in water management. The diagnosis demonstrated that the collective construction of MRB as a socio-ecological system involves the sharing of common thinking about the needs of water resources management, aiming at local development. It was concluded that the social actors of the MRB self-organized with the interest of favoring the creation of the MRBC, which has limited decision-making power, reduced scope, results restricted to institutional formalization, the need to mature the understanding of its competencies and expand its knowledge about the variables of the socio-ecological system of the MRB, involving public actors.

Keywords: Water resources management. River basin committee. Marapanim river. Socio-ecological system. IRAMUTEQ.

RESUMO

O objetivo do artigo é produzir um diagnóstico participativo do sistema socioecológico da Bacia Hidrográfica do rio Marapanim (BHRM), a partir da análise da implementação da gestão de recursos hídricos por comitê de bacia hidrográfica na Amazônia paraense e a criação e atuação do Comitê da Bacia Hidrográfica do rio Marapanim (CBHRM). A análise foi orientada pela abordagem epistemológica interdisciplinar, com aporte teórico dos comuns, dos sistemas socioecológicos (SES) e do conceito de Gestão Integrada de Recursos Hídricos (GIRH). Utilizou-se os procedimentos metodológicos do estudo de caso e da análise de conteúdo, com o auxílio do IRAMUTEQ. Os resultados demonstraram a emergência de 6 classes de palavras, que foram agrupadas em quatro categorias: ecológica, simbolizando a bacia do rio Marapanim; atores, relacionando-se aos interesses do poder público, usuários de água e entidades civis; sistema de governança, representado pela criação do CBHRM; e interações e resultados, que demonstrou a atuação do CBHRM como uma nova instituição de participação na gestão da água. O diagnóstico demonstrou que a construção coletiva da BHRM como um sistema socioecológico perpassa pelo compartilhamento do pensamento comum acerca das necessidades de gestão de recursos hídricos, visando o desenvolvimento local. Concluiu-se que os atores sociais da BHRM se auto-organizaram com o interesse de favorecer a criação do CBHRM, o qual apresenta limitado poder decisório, abrangência reduzida, resultados restritos à formalização institucional, necessidade de amadurecer o entendimento de suas competências e ampliar o seu conhecimento sobre as variáveis do sistema socioecológico da BHRM, envolvendo os atores públicos.

Palavras-chave: Gestão de recursos hídricos. Comitê de bacia hidrográfica. Rio Marapanim. Sistema socioecológico. IRAMUTEQ.

INTRODUCTION

The analysis framework proposed by McGinnis and Ostrom (2014) offers the possibility of drawing up Socio-Ecological Systems (SES) diagnoses. This framework can be adapted to understand the reality of river basins and the relationships between their social actors. The framework proposed by these authors for diagnosing SES is a methodology based on a survey of variables for analyzing the ecological system, the social structure, and their interactions, which can make up a detailed set of conditions in the watershed in terms of the interdisciplinary relationship between the actors and the water.

The participatory diagnosis followed the following stages, in which the categories analyzed in the research were interrelated in an interdisciplinary way: identification of the socio-ecological variables of a biophysical nature; analysis of the interests of the social and public actors for the organization of the water governance system; analysis of the interactions between the ecological and social variables for the structuring of the basin committee; description of the situation of the socio-ecological and water management problems; recommendations for improving the integrated management of water resources.

This elaboration was based on the data collected from interviews and direct observations from the doctoral research entitled "*Gestão Integrada de Recursos Hídricos por Comitês de Bacia Hidrográfica na Amazônia: o caso do Comitê da Bacia Hidrográfica do Rio Marapanim, no Pará*"(Integrated Water Resources Management by River Basin Committees in the Amazon: the Case of the Marapanim River Basin Committee in Pará), which had significant participation from local actors who presented their thoughts and interests about the river basin in which they live their own experiences of dealing with the region's water resources on a daily basis.

LITERATURE REVIEW

Recognizing the environment and its natural resources as common resources is a learning practice in which knowledge is accumulated throughout the history of people's transformation and development, in certain social and ecological arrangements, which systemically influence and are influenced by the context in which they exist. For this reason, the legitimization of the common is broader than the availability and demand for a resource and its form of ownership by a group of individuals (Dardot; Laval, 2015).

The common is plural, universal, and immaterial. The production of the commons is a human behavior that borders on solidarity and generosity, goes beyond individual benefit, and has an ethical and moral dimension, almost philosophical, located at the level of thought, where ideas, values, and interests are born. The common presupposes that there is a dominant thought among people, an underlying discourse, a predominant idea, a higher order that makes them special, that specifies and differentiates them (Dardot; Laval, 2015).

This definition of common evolved from the more concrete and operational notion of common resources, established mainly by Elinor Ostrom, who established her theory on social organization based on the neo-institutionalist approach of rational choice, which considers that human behavior is shaped by their interests, which are materialized through the structure available to them, which is often uncertain and contingent (Ostrom, 1990; Ostrom, 1991).

To study common resource governance situations, a first theoretical-methodological model was created called the IAD Framework (Institutional Analysis and Development Framework), which dealt with the analysis of the creation, operation, and modification of institutions over time. In

her analyses of social organization, Ostrom emphasized the study of the conditions that favor this process of critical construction and institutional change for the governance of common resources, based on community priorities, local knowledge, and social interactions based on trust and cooperation, virtuously bringing together actors and instruments for managing common needs, through polycentric governance (Ostrom, 1999; Ostrom et al., 1999).

Following criticism of the IAD Framework model, Ostrom presented a new framework for analyzing Socio-Ecological Systems (SES) in 2007, which she refined until the definitive reformulation of the model published in 2014, which was used as a reference for this study. The SES concept addresses the relationships between the ecological, socio-economic, and political-institutional environments, considering the dynamics influenced by this interaction, especially with regard to the actions of actors in the management of common natural resources (Ostrom, 2009; McGinnis; Ostrom, 2014).

The recent model proposes a list of variables that are combined according to the researcher's objective. It consists of two levels of variables, with the first level having 8 variables: Resource Systems (RS); Resource Units (RU); Governance Systems (GS); Actors (A); Interactions (I); Outcomes (O); Political, Economic, And Social Variables (S); And Ecosystem-Related Variables (ECO) (McGinnis; Ostrom, 2014).

When dealing specifically with water resources, they are seen as a necessary source for living beings and are directly linked to the preservation of natural systems and the development of environmental and social well-being. The availability of water resources, in quantity and quality, is essential to promote the life of the human population, for energy production activities, industry, agriculture, etc. This availability is related to Integrated Water Resources Management (IWRM), which is materialized through the structure of the National Water Resources Management System (NWRMS) responsible for integrated decisions on water, in accordance with the Water Law, which is considered advanced for territorial planning, characterized by the decentralization of actions (Brasil, 2014).

According to Machado (2004), IWRM should encompass the following dimensions: the hydrological cycle; multiple uses of water; the interrelationship between water and other natural elements in ecosystems; cooperation between managers, users, and the local community; and society's needs in relation to economic development and environmental preservation from the perspective of local development.

The principles and practices of IWRM stand out, as they consider water to be a unique resource that serves a multiplicity of uses, including economic activities that, along with human consumption, depend on this resource for their development, highlighting the ambivalence between common heritage and economic good (Hellier et al, 2012).

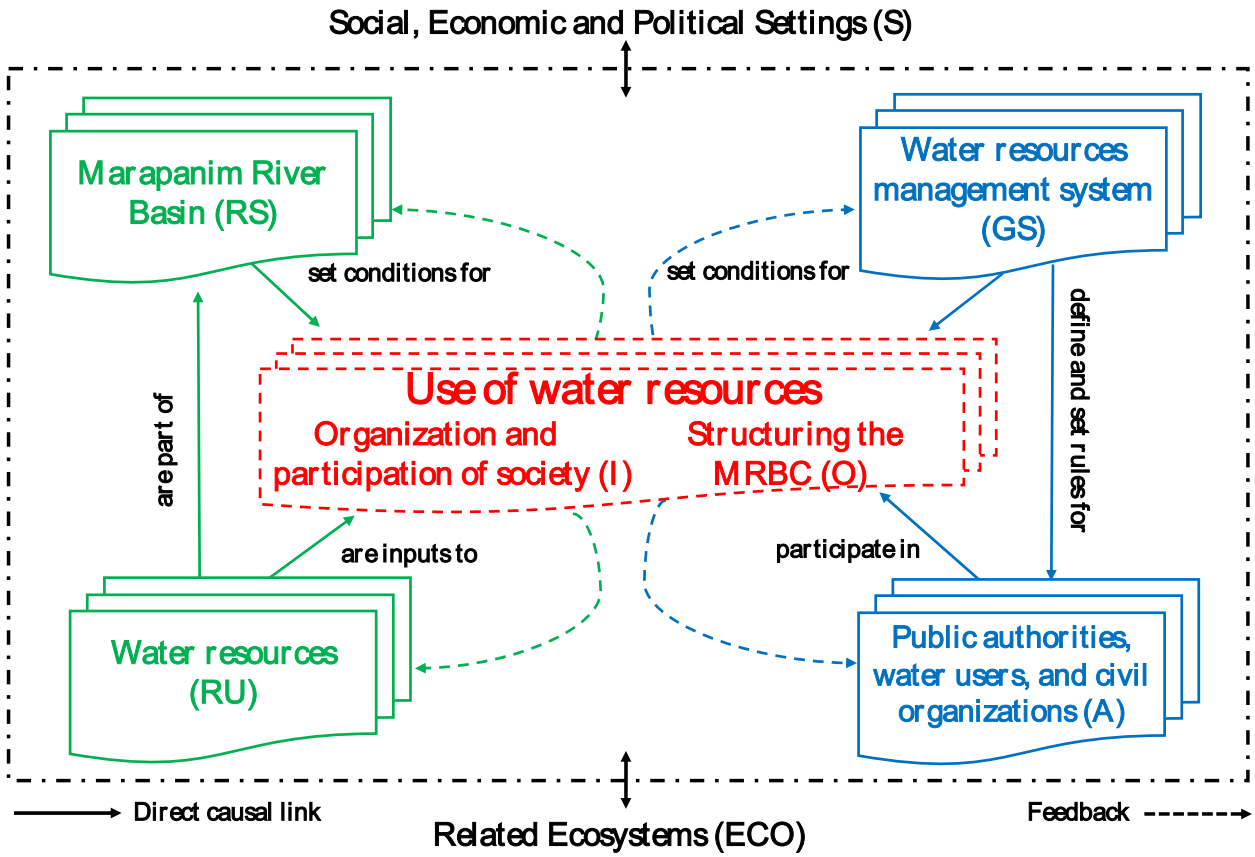
In short, IWRM is a process that promotes the development and management of water resources and other related resources, in a coordinated manner, to maximize economic and social well-being, equitably, and without compromising the sustainability of ecosystems (UN, 2021).

Among the institutions that make up the NWRMS is the basin committee, which focuses its actions on a river basin as a planning unit. Each basin can create its own committee, which will be made up of representatives of water users, public authorities, and organized civil society. The committee's main duties are to negotiate water use conflicts, approve the river basin plan, and establish the mechanisms and amounts to be charged for water use (Brasil, 2014; Silva Junior et al., 2023).

Considering the initiative to bring together the theory of the commons, socio-ecological systems, and integrated water resources management, it was assumed that an indication of the realization of a river basin committee is its action and scope in the respective basin, where there are a variety of actors, with their own interests and needs, sometimes contradictory, but common in terms of organization and collective construction, recognizing the river basin as a socio-ecological system.

A theoretical-methodological scheme was drawn up to represent the articulation of the theories and concepts mobilized with the empirical phenomenon being studied, as shown in Figure 1, based on the SES Framework model (McGinnis; Ostrom, 2014).

Figure 1 | Theoretical-methodological framework and its relationship with the empirical object.



Source: Adapted from McGinnis and Ostrom (2014).

METHODOLOGICAL PROCEDURES

The interdisciplinary method was used to draw up the participatory diagnosis, as it dealt with issues of water resource management by river basin committees in specific socio-ecological systems and has the intrinsic articulation of diverse scientific knowledge, giving rise to a field of research in which there is an interrelation of arguments, knowledge, and objects, unlike the compartmentalized study structure. The article is qualitative in nature, as it focuses on the intersubjective aspects of its object of study for the preparation of the diagnosis. A descriptive approach was adopted to understand the interest and organization of the actors in the process of managing the socio-ecological system of the river basin (Leff, 2001).

We chose to conduct the research using the case study methodology, which aims to understand social phenomena from a broad and meaningful view of real-life events and their transformation processes. This study was carried out in three stages: in the first stage, planning the case study, the theory, the case, and the case study research protocol were defined; in the second stage, preparation, collection, and analysis, the case study was conducted; and in the third stage, analysis and conclusion of the case, the analysis, discussion, and preparation of the diagnosis were carried out (Yin, 2005).

The research protocol for the case study was designed taking into account its theoretical-conceptual underpinning and the framework of the socio-ecological system. The research site covered the twelve municipalities that are part of the MRB, which includes the municipalities of the Salgado micro-region: Castanhal, Curuçá, Igarapé-Açu, Magalhães Barata, Maracanã, Marapanim, Santa Isabel do Pará, Santo Antônio do Tauá, São Caetano de Odivelas, São Francisco do Pará, Terra Alta and Vigia de Nazaré, located in the Atlantic Coast-Northeast Hydrographic Unit, in the state of Pará.

The study period covered the year 2019, which marked the establishment of the MRBC, when secondary data collection began, concurrently with the narrative literature review. November 2023 was set as the end date for the research protocol after all the primary data had been collected from direct non-participant observations and interviews. All the primary and secondary data collected converged to investigate and understand the MRB's socio-ecological system and demonstrated the use of various sources of evidence in the case study. The research participants were divided into three groups: water resource users, public authorities, and organized civil society. The starting point was the total number of MRBC members: 57, of which 12 were representatives of public authorities, 23 of civil society, and 22 of water resource users.

For the semi-structured interview, we used a data collection instrument with a guide containing open-ended questions. In the first part of the script, general information, the aim was to outline the profile of the participants and obtain information on the segment and municipality of the institution the member represents, their position, gender, color or race/ethnicity, age, education,

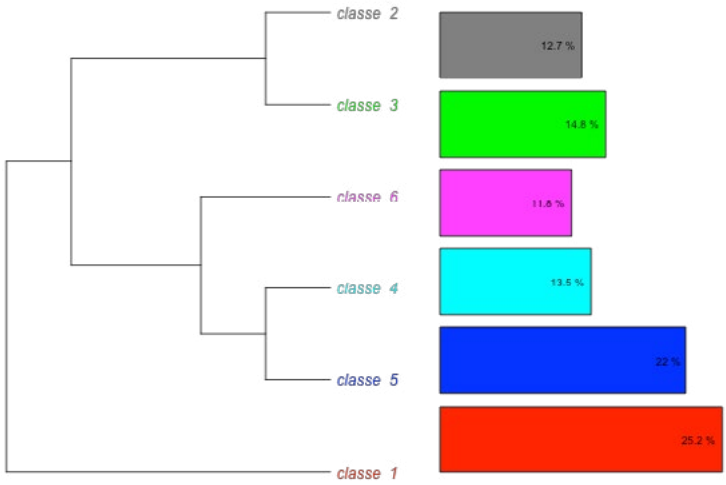
and income. The second part of the questions was intended to survey the participants' prior knowledge about the creation of the MRBC, their role as a member, and the MRBC's performance in its first term. The audios of the interviews were transcribed using Transcribe software to create a text corpus that was analyzed using the *Interface de R pour les Analyses Multidimensionnelles de Textes et de Questionnaire* (IRAMUTEQ) program. Those who agreed to take part in the research, 23 members of the MRBC's total number, were presented with, explained to, and subsequently signed the Free and Informed Consent Term (FICT). Of the 23 members interviewed, 8 are representatives of users, 5 of public authorities, and 10 of civil society.

The research complied with the criteria established by Resolution 466/12 of the National Health Council, which was appraised by the Research Ethics Committee (REC) of the Federal University of Pará (UFPA) and approved by Opinion 6.504.324, dated November 13, 2023.

The transcripts of the interviews were analyzed using the methodological procedures of content analysis, which aims to find the essence of the information contained in diverse discourses, through the frequency and inference found in the subjectivity of the words spoken by the actors, helping to describe, understand and interpret the text from the data collected (Bardin, 2016).

IRAMUTEQ was used to carry out the analysis using Reinert's method to create the Descending Hierarchical Classification (DHC), which distinguishes text segments (TS) that are similar to each other and at the same time different from other segments into classes, producing a hierarchical structure of classes that exposes statistically notable, expressive and relevant ideas, as shown in Figure 2 (Camargo; Justo, 2013).

Figure 2 | DHC phylogram dendrogram.



Source: Prepared by the author, based on the results of IRAMUTEQ (2023).

It was evident that class 1 refers to two variables of the socio-ecological system: resource system and resource unit, creating, according to Bardin (2016), the first category is called the ecological category. Unlike class 1, there are two classes making up a socio-ecological system variable: classes 2 and 3 make up the actors variable and form the second category called the actors category, while class 4 alone describes the governance system variable of the socio-ecological system, structuring the third category called the governance system category. The fourth category was called the interactions and results category, including class 5 identified by the interactions of the socio-ecological system, and class 6 characterized by the results of the socio-ecological system.

The classes derived from Reinert's method considered the profile of the classes generated by the DHC, in which the words, forms, or vocabularies that were most related to the theoretical variables of the model adopted in the study and adapted from McGinnis and Ostrom (2014) were highlighted, demonstrating the link between the theory of the commons, socio-ecological systems and empirics related to the management of water resources by basin committee in the Pará Amazon.

RESULTS AND DISCUSSIONS

The MRB has its main drainage and its own tributaries located entirely in the northeast of the state of Pará, approximately 75 km from Belém, which makes it the domain of that state. It has a territorial area of 2,464.70 km² and more than 187,000 residents. Its main river is the Marapanim River, which is 127.96 km long and whose main sources are located in the municipalities of Castanhal and São Francisco do Pará. This basin covers 12 (twelve) municipalities in the Salgado do Pará micro-region (Mendes; Sombra; Quintairos, 2022).

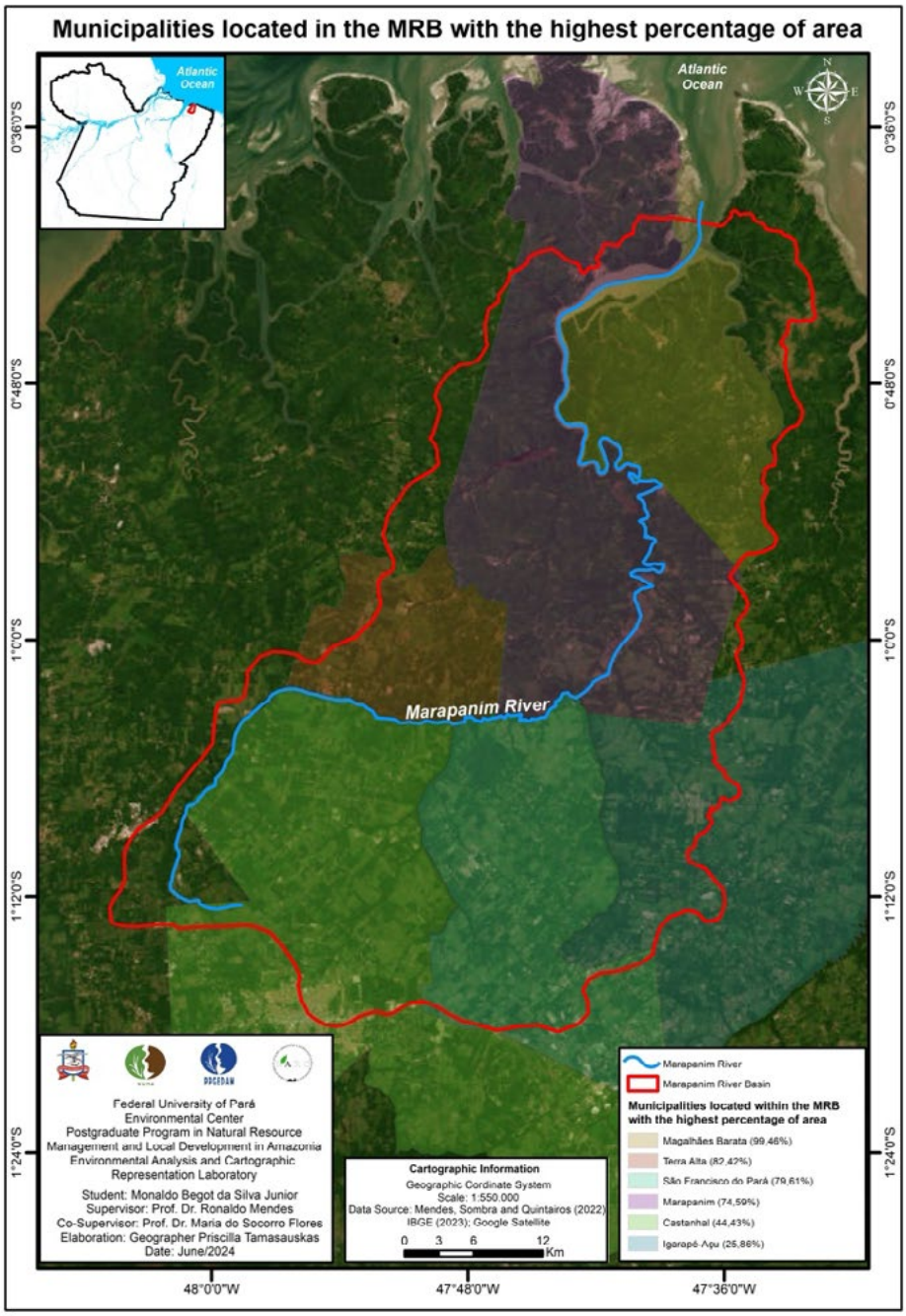
Castanhal, São Francisco do Pará, Magalhães Barata, Marapanim, Terra Alta and Igarapé-Açu are the municipalities with the highest percentages of their areas located within the MRB (Map 1). These municipalities have more than 90% of the estimated population living in the basin and only their headquarters are within the boundaries of the MRB, noting their importance in local dynamics (Mendes; Sombra; Quintairos, 2022).

The MRB is part of the Atlantic Coast State Planning Hydrographic Unit (CAT), which is part of the Atlantic Coast-Northeast Hydrographic Macroregion. This hydrographic macro-region, in which the MRB is located, is the most densely populated and economically developed, with environmental impacts from disorderly occupation (Pará, 2022; Dutra et al., 2023).

According to Pará (2021), this hydrographic macro-region where the MRB is located is characterized as a region with a relative quantitative abundance of water resources. Regarding the qualitative availability of surface water, this is considered good in regions where there is no anthropogenic occupation, but in urbanized areas surface water is more susceptible to pollution.

The MRB is part of the hydrogeological domain of Cenozoic formations and is supplied more directly by the Barreiras aquifer system, which has a high degree of vulnerability and is aggravated by the lack of sewage networks in its areas. This aquifer system is mostly used for domestic supply (Pará, 2021; Pará, 2022).

Map 1 | Municipalities located in the MRB with the highest percentage of area.



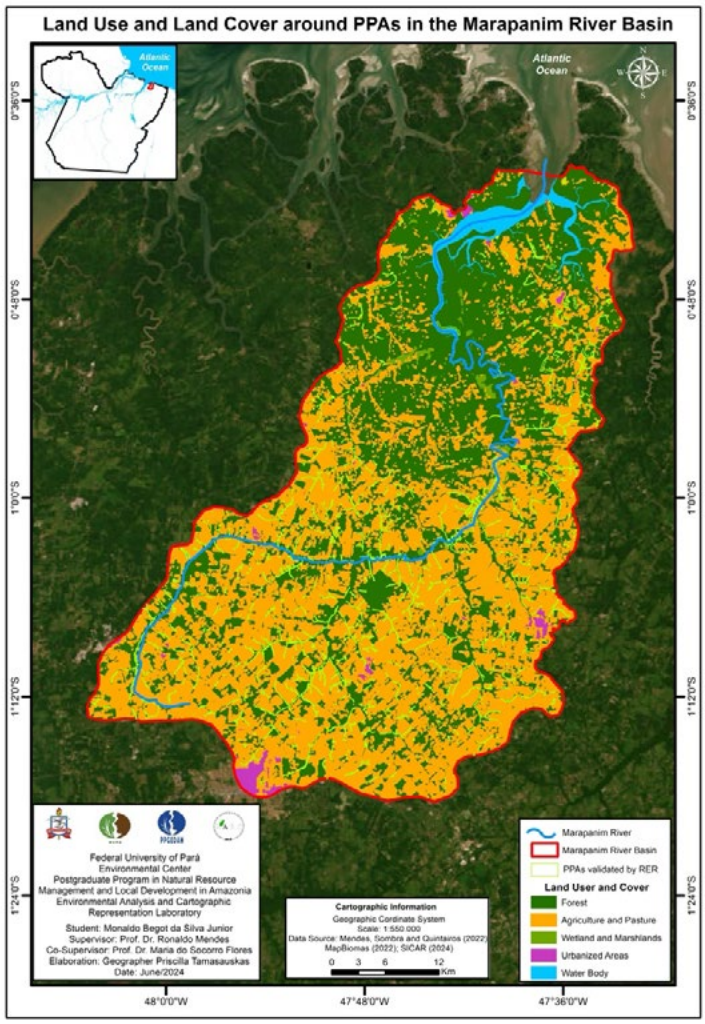
Source: Laboratory of Environmental Analysis and Cartographic Representation - LARC, 2024.

When considering water demand and availability, it was found that the quantitative water balance of the hydrographic region in which the MRB is located indicates a worrying situation and that management is essential, requiring investments in this area (Pará, 2021).

The vegetation in the Marapanim River basin is in a severely degraded state, due to the expansion of anthropogenic activities, be they urban development or agriculture, which leads to a reduction in vegetation cover, as well as pressure on permanent preservation areas (HOMMA et al., 2021; Dutra et al., 2023).

Map 2 illustrates land use and cover around PPAs, which impacts on the deforested area of the MRB, which totals 1,681.30 km². Of this total, the majority is represented by the six municipalities mentioned above, which are responsible for more than 72% of the deforested area in the basin, equivalent to 1,515 km², with the municipality that deforests the most being Castanhal (Santos, 2018; Andrade et al., 2020; Bentes; Alves; Cunha, 2021).

Map 2 | Land use and cover around APPs in the Marapanim River Basin.



Source: Environmental Analysis and Cartographic Representation Laboratory - LARC, 2024.

A total of 638 springs were identified in all the municipalities, which are directly related to their Permanent Preservation Areas (PPAs) which, over the years, have suffered the impacts of the region's economic growth, increasing irregular occupation in these PPAs by 46.57% (Gutierrez, 2017; Andrade et al., 2020; Andrade et al., 2021; Mendes; Sombra; Quintairos, 2022).

From the analysis of the vector files generated by Mendes, Sombra, and Quintairos (2022), the number of springs per municipality was obtained, with Marapanim, Magalhães Barata, Castanhal, São Francisco do Pará, Igarapé-Açu and Terra Alta totaling 548 springs and together representing 85% of the total springs in the MRB.

Public policies in the area of water resources in Pará were only improved at the turn of the 21st century, after the publication of Federal Law No. 9.433/1997, when a new state law had to be drawn up to make it compatible with the federal law. The Pará State Water Resources Policy (PERH/PA) and the Pará State Environment and Water Resources System (SISEMA/PA) were established by State Law No. 6381, of July 25, 2001 (Pará, 2001; Pará, 2022).

Based on SISEMA, SEGRH/PA was created, which is made up of the State Water Resources Council (CERH/PA); the water resources management body (SEMAS/PA); the river basin committees; the basin agencies; and the federal, state and municipal bodies whose competencies relate to water resources management (Pará, 2022).

The implementation of the state's water policy instruments, especially concerning information and mechanisms for monitoring and sanctioning offending users, is not efficient due to the institutional incapacity to manage water resources, demonstrating a notorious delay in the PERH/PA (Silva Junior, 2008; Cirilo, 2019).

In 2019, Pará's first water parliament, the MRBC, was established as a collegiate body with normative, deliberative, and consultative powers within the jurisdiction of the respective river basin. The creation of the committee represents a decades-long history of defending the interests of the local communities that survive on the region's rivers. These mobilizations began in 2003 with the official record of the organization of the first joint effort to clean up the Marapanim River, carried out by the community with the support of the town hall, in the municipality of Terra Alta (CPCGBHRM, 2016; Cirilo, 2019; Silva, 2019; Pará, 2019a; Brasil et al., 2022).

This common problem brought together the actors who were interested in the ideas of preserving water through decentralized and participatory management processes, forming the embryo of what would become the MRBC, starting the coordination of the actions of a movement that unified in the municipality of Castanhal, as the center of the periodic meetings promoted by this still incipient network of actors.

In partnership with the Environment Center (NUMA) of the Federal University of Pará (UFPA), a commission was set up in 2015 called the "Pro-Committee for the Management of the Marapanim River Basin", with the aim of coordinating the actors by encouraging meetings, seminars and workshops in the 12 municipalities of the basin.

In March 2016, the 1st Intermunicipal Conference of the Marapanim River Basin was held in the town of Marapanim, attended by 259 delegates from all the municipalities in the basin. For two days there was a debate on the water crisis and the role of river basin committees, the protection and recovery of springs, and the challenges facing the MRBC. It was decided to create the MRBC, as well as the respective work plan and the members to make it up (CPCGBHRM, 2016; Cirilo, 2019; Silva, 2019; Brasil et al., 2022).

From the conference report, it was possible to grasp the need for local actors to resist the way in which capital expansion is planned for the Amazon, which pushed them to organize and react to take responsibility and have representation in the management of their own water resources (CPCGBHRM, 2016).

The pro-committee movement dates back almost two decades to the creation of the MRBC in 2019, demonstrating "the slowness of the state government to recognize the need to establish a river basin committee in the region, where there are few public administration initiatives that encourage sustainable development" (Bentes; Alves; Cunha, 2021, p. 125).

It can be deduced that the institutionalization of the MRBC is not the result of a political programme or project by the state of Pará designed for this purpose in itself, leaving local collective action with the role of mobilizing its peers in order to find solutions to problems related to the use of water as a common resource, problems which are of relevance to local society.

A series of actions were carried out that demonstrated the performance, firstly, of the provisional board and, later, of the permanent board in its first elective term. The MRBC's provisional board took office on October 3, 2019. The board would have six months to coordinate the organization and installation of the committee, by drafting the internal regulations, appointing full and alternate members, and electing the permanent board (Pará, 2019b).

However, it wasn't until the second half of 2020 that the provisional board drew up the draft of its internal regulations, after a series of trips to the 12 municipalities to discuss suggestions for improving the document, which was built with everyone's participation. The final text was approved, according to CBH do Rio Marapanim Normative Deliberation No. 01, dated April 28, 2021 (Brasil et al., 2022).

The MRBC's provisional board, with the support of SEMAS, created an electoral commission to hold the election of the permanent board, in accordance with Marapanim River CBH Normative Deliberation No. 02, of June 11, 2021. The election took place on August 18, 2021, at IFPA, on the Castanhal campus, and also virtually via Google Forms, electing the only slate registered. On September 15, 2021, the permanent board took office, as recorded in the minutes of the 13th Extraordinary Meeting of CERH/PA, held on November 17, 2021.

This committee is characterized by being a new instance of power in the state's water resources management structure, which shifts decisions towards the river basin, considering that until recently there was a concentration at the level of CERH/PA and SEMAS.

Between 2022 and 2023, the MRBC's first meetings were held, at which the following issues were discussed: terms of reference for hiring a company to draw up the Marapanim River basin plan; formation of the technical chambers; exhibition of the first volume of the Marapanim River Basin Map Booklet, prepared by NUMA/UFPA; terms of reference for structuring the committee; and formation of the coordination of the electoral commission for the election of the new board of directors for the 2023/2025 biennium.

In May 2023, the MRBC board of directors, in partnership with SEMAS/PA, visited the 12 municipalities in the respective basin, with the aim of locating, mobilizing and meeting with each of the members to reinforce their role in the collegiate body and to demand the municipality's priorities for continuing the committee's activities.

The MRBC has been consolidated based on the interests, ideas and values of the collegiate body that makes it up, among which the following stand out: strengthening local production and encouraging economic activities; MRBC must impose itself as a political articulator to give visibility to municipal needs; defense of the peoples of the waters; multiple uses of water; integration between water, soil and forest; mediation of conflicts over the use of water existing in the basin; land regularization; the MRBC represents part of local society; strengthening relations between committee members; investment in the committee's activities through the use of its own financial resources; building identity and belonging to the MRB; prioritizing education in water resources; the MRB's work goes beyond water management from a global and holistic view of the environment; valuing water from the carimbó culture present throughout the MRB; water is related to all productive activities; developing the MRB means developing all human dimensions; water as a natural wealth; the need to change the way land is used; establishing common objectives to overcome particular interests; collective experience and learning, as everyone lives in a common environment; the Marapanim River as the center of development for the watershed; reforestation of water source areas; support for family farming; and sometimes personal interests are greater than collective interests.

Based on the ideas of each of the actors who took part in the research about changes in the environment around them, socio-ecological and water management problems emerged in the Marapanim river basin, which are divided into water scarcity; water pollution; inefficient use; and poor management.

The problems related to water scarcity that were mentioned by the participants in the survey were: groundwater is lower than in previous years; water springs are dying; there are tributaries of the Marapanim River that have already dried up; some areas are already suffering from drought problems; silting up of rivers is reducing the depth of these bodies of water; and global climate change affects the climate of the basin and interferes with rainfall and the level of rivers and wells.

The problems related to water pollution cited were: accelerated deforestation of riparian forests; contamination of the Marapanim River and its tributaries due to the disposal of untreated sanitary sewage; inadequate disposal of solid waste in dumps near water sources (a common problem

in all municipalities); livestock farming degrades river banks and pollutes their waters; the paving of the Transmaú highway (PA-220) did not preserve the streams and rivers that the community used on a daily basis, which suffered environmental damage, a reduction in their water flow and the disappearance of aquatic fauna; pollution of the Maçaranduba river, a tributary of the Marapanim river, in the Santa Terezinha community; pollution of rivers from palm oil companies; and pollution of the Defunto stream (a tributary of the Marapanim river) from slaughterhouses.

The problems related to inefficient use pointed out by the survey participants were: privatized use of the igarapés; predatory fishing with dynamite causes the death of river fauna; impacts caused by sand and stone mining; the region's seaside resorts are causing major negative impacts on the region's igarapés; industrial fishing is reducing fish stocks; construction of residential condominiums in areas with water sources; and scarcity of fish for subsistence.

The related mismanagement problems are as follows: political obstacles for the MRBC to move forward; the committee is delegitimized by the other management bodies; communication failures between the board and committee members; difficulty in integrated management between surface and groundwater resources; the state does not provide the necessary support to the committee; the centrality of decision-making power remains; SEMAS/PA does not encourage the creation of new basin committees; the committee's purpose, mission, vision, objectives and goals are undefined; there is a lack of financial resources for the committee to move forward; lack of knowledge of the committee's attributions, generating demands that don't depend on this collegiate body; MRBC members have limited knowledge of their own attributions; there are committee members who have never spoken or taken part in assemblies; the committee's work is more political and less technical; lack of inter-institutional coordination of the MRBC; discreditability of the committee in the face of so many meetings and little progress in the recovery of water bodies; and lack of availability of technology to produce basin data.

The COVID-19 health crisis has made it difficult for the MRBC to act after the collegiate body was created, mainly due to the impossibility of holding face-to-face meetings, which has distanced committee members, demonstrating a setback in the participation of local actors who had already

been building their own dynamics in the region, with regard to dialogue and collective deliberation on planning and managing the use of water in an integrated and decentralized manner.

In this process of structuring the MRBC, which is the result of the interactions of its social and public actors, it is considered that the committee will contribute to greater integration between water user sectors and water policy; to the effective participation of local society; to the development of shared and innovative solutions; to fostering education and awareness of water as a common resource; and to improving the efficiency of water resource management. However, analyzing the stage of development that this collegiate body is at, it was inferred that the MRBC does not yet have an adequate structure and, therefore, has not been able to express itself in terms of consolidating its performance as a new space for water management in Pará.

It was noted that a number of steps need to be taken for the MRBC to consolidate its actions and facilitate the provision of the socio-ecological demands of the river basin, such as: structuring the MRBC with physical space and hiring staff; hiring a company to draw up the basin plan and provide administrative advice to the committee; gathering data and information from the basin in a participatory manner; establishing priorities for the MRBC's management; drawing up a communication and marketing plan for the committee suitable for the various levels of language, as well as a strategic plan of actions with clear work goals and objectives; capillarization of the committee's actions in the municipalities; surveying and publicizing all the activities carried out and being carried out by the committee; holding a new conference in the MRB, in parallel with a seminar with more technical content; effective practice of the committee's thematic commissions to propose solutions to the basin's problems; expanding partnerships with local organizations; bringing the committee together through training activities; delegating tasks to committee members so that everyone is focused on the same objective; improving communication between SEMAS/PA and the MRBC; integrating the actions of the MRB municipalities to create a common agenda; permanent training on water resources; requesting a public hearing in the Pará State Legislative Assembly (ALEPA) to debate the MRBC and give visibility to the issue; committee members must take responsibility for mobilizing municipal players; and rescuing the demands proposed at the pre-conferences and the inter-municipal conference so as not to disregard what has already been consolidated.

It is worth noting the emphasis of the survey participants on issues related to the economic development of the basin, especially the demands for infrastructure for agricultural production. In the areas where açaí cultivation is expanding, due to the gradual abandonment of cassava cultivation, there is a growing demand for water, due to the need for irrigation of this type of plantation. There is interest in cocoa production in the MRB region and in promoting sustainable community-based tourism, indicating the possibility of the emergence of Agroforestry Systems (AFS). The need to make credits, investments, and funding available for rural production was also emphasized, with the MRBC as a reference for attracting financial resources, given that it should not only deal with water resource issues but also organize local production. In addition, land regularization was another recurring issue, along with the Rural Environmental Registry (RER) for the environmental regularization of rural properties, sometimes making water resource management secondary.

Although the interests and ideas of the social and public actors need to be redirected towards prioritizing the management and use of water as a common resource, they have established recommendations for structurally improving the water conditions of the Marapanim river basin, such as: recovery of areas of riparian forest and recovery of the Paramaú river spring and Lago da Pirapema, with the creation of a seedling nursery to cater for forest restoration in the region; prioritization of the preparation of the basin plan, which should have the identity of the MRB and should take into account the basic sanitation plan, the plans of the conservation units, the coastal zoning plan, the fishing agreements and the other municipal and state plans; creation of a register of water sources and their state of conservation; coordination of water management monitoring actions with the Public Prosecutor's Office; creation of a database and water information system for the MRB; revision of the state water resources policy; creation of a state water resources fund; creation of a day of march for the Marapanim River, as the MRBC is still little recognized in practice by the general population, who still maintain the same attitudes; integration of water resources management with the municipal master plan; improvement of the basic sanitation system, including rainwater supply systems; the creation of consortia between municipalities for the proper treatment of solid waste and the installation of a treatment plant, as individual municipalities are

unable to succeed; encouraging the creation of new committees in the region so that together they can request the formation of a water agency that will manage financial revenues: creation of the subcommittee in the Igarapé-Açu river basin, the Cuinarana river basin, the Curuçá river basin, the Mojuim river basin.

It was found that it is necessary to professionalize the MRBC's work, bearing in mind that this is an occupation that requires a qualified commitment and, at the same time, a willingness to work that is necessary to strengthen the committee, so the members who make up its board are required to carry out this improved exercise, which is often hampered due to the lack of qualified technical support staff, is hampered by the absence of qualified technical support staff who could be from the committee itself, or transferred from municipal and state public bodies, or hired specifically to dedicate themselves exclusively to this purpose, highlighting the need to structure the MRBC which, despite being created by decree, has yet to fulfill its function. This is why it is time for the MRBC to unite with the other stakeholders to help it move towards a new stage of action, given that so far people's lives have not improved and that is why they are discredited and distrustful.

The conclusion is that the effectiveness of a river basin organization needs to go beyond the application of regulations, but must take into account the capacity of its members to understand their socio-ecological system, to work collectively to build solutions in different dimensions, to understand the systemic view of the world and the need for a continuous dialogue of knowledge. It is clear that an active state is needed to stimulate and mobilize actors to build a differentiated, polycentric mode of productive organization that values their common resources, which should be linked to their current use, but also to their future use, as a form of innovation in the face of competitive global markets.

FINAL CONSIDERATIONS

This diagnosis has positioned itself at the heart of the debate on natural resource management and local development in the Amazon, as it addresses water resource management, given that it is a shared resource that meets diverse social demands, with a view to developing river basins as decentralized planning units, based on the organization and participation of local society, which can enable actions to be adapted to Amazonian realities, taking into account specific socio-ecological conditions to meet the needs of promoting economic activities that use natural resources, but which face the challenges of conserving ecosystems.

It proved that the MRBC is being structured as a new institution for participation in water management, which could lead to an improvement in the socio-ecological conditions of its river basin, even though it still has limited decision-making power, reduced scope, and results restricted to institutional formalization. Thus, the effectiveness of this committee will still depend on its own maturation over time, as well as an understanding of its powers to act in the socio-ecological system of the respective basin and the variables that make it up, which involve the involvement of social and public actors.

It has emerged that the common thinking around water is limited to a few actors who have developed a sense of cooperation and leadership in water resource management, and it is therefore hoped that this initiative will induce the expansion of these ideas to those who are still restricted to their own domains.

Thus, it is considered that the diagnosis provides information that can help in the management of multiple water use practices, especially those in which there are situations of conflict identified by users and which can be arbitrated by the respective basin committee. Although the approaches adopted proved to be sufficient for the proposed objectives, it is suggested that further research be carried out in the context of adaptive governance in river basin committees in the Amazon, considering the possibilities of adapting to a water management model that is more appropriate to their local development.

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