

# Challenges of Integrated and Participatory Management of the Lower Rio Negro Mosaic

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**Abstract:** We analyzed the constitution and challenges of integrated management of protected areas through the “Mosaic” model, based on one of the most relevant experiences in Brazilian conservation: the Lower Rio Negro Mosaic (MBRN). Based on fieldwork data collected from 106 traditional communities within MBRN and an analysis of documentation from the 26 meetings held by the Mosaic Advisory Council, we identified the successes and challenges of the proposal. The results indicate a political and institutional maturation of MBRN since its establishment in 2010, especially given the complexity of forming a Council focused on participatory management. However, inequality in the distribution of infrastructure, services, and projects implemented by governmental and non-governmental institutions poses some challenges to be addressed. Such socio-spatial inequality and variations in environmental management attributes affect the recognition of the Mosaic by community leaders and hinder the enhancement of integrated, multilevel management.

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## Introduction

Proposals and actions for conservation of “nature,” “biodiversity,” or—more recently—“sociobiodiversity” have the establishment of protected areas as a favored means for implementation. If we consider its contemporary characteristics, understood here based on the environmental, social, and political frameworks introduced by the discussions that preceded and culminated in the commitments instituted in the Convention of Biodiversity (1992), the fostering and creation of protected areas constitutes a global phenomenon, with the orchestrated establishment of goals, priority areas, multilateral agreements and forms of financing (DIEGUES, 2008).

This orchestration—it is well known—was not conducted in a harmonious and conflict-free manner, both with regard to the preponderance of a “Northern” conservationism under the interests and views on global “Southern” areas and peoples and with regard to types and forms of conservation considered as excluding non-Western peoples and ways of life under the areas of interest for conservation (RODRÍGUEZ et al., 2007). One of the central issues of this debate was the generic, but significant term “human presence”: the actions, forms of occupation, management and mobility of traditional, indigenous, quilombola, and riverine peoples, considered by some as deleterious and by others as beneficial to conservation objectives (DIEGUES, 2008). One of the results of these disputes was the establishment of a significant set of categories for protected areas (DUDLEY, 2008), which Brazilian legislation has grouped into two basic models: Integral Protection units (indirect use of natural resources) and Sustainable Use units (direct use of natural resources) (BRASIL, 2000).

For various reasons, whether from a macro and global perspective (in defining priority conservation areas) or due to the need to address local/regional issues, there was a certain consensus that the establishment of a single protected area, isolated in a broader territory without other environmental restrictions on use, was counterproductive for conservation objectives (ZHANG et al., 2020). This context (of diverse objectives, interests, types, and disputes between economic and non-economic determinants) warrants the pursuit of management instruments aimed at a more integrated nature conservation, such as the so-called “Protected Area Mosaics.” These should be established,

When there is a set of protected areas of different categories or not, close, juxtaposed or overlapping, and other public or private protected areas, constituting a mosaic, the set must be managed in an integrated and participatory manner, considering the distinct conservation goals, in order to reconcile the presence of biodiversity, the valorization of sociodiversity, and sustainable development in the regional context (BRASIL, 2000).

The present description of Mosaic—which constitutes the main foundation of the integrated and participatory management of the set of protected areas—is, in itself, quite interesting because it poses a challenge, much more than a solution, for the efficient management of conservation. This challenge can be summarized in the following ques-

tion: how to combine, in the same management effort, protected areas that, despite their proximity, overlap or juxtaposition, have their own complexities, derived from specific models of regulation and zoning?

Therefore, it is a matter of examining the implementation of forms of governance that address dynamics that impact different scales and involve interactions between the government and civil society, in its various forms, with specific implications as to what is defined as “multi-level governance of forest resources” (MWANGI; WARDELL, 2012), including the perception that decision-making involves the participation of non-governmental actors in complex overlapping networks and not in discrete territorial levels (MWANGI; WARDELL, 2012; BACHE; FLINDERS, 2004). Integration requires the composition of the occupation rules that apply to each type of unit, of the various governmental spheres involved, of the specificities of the NGOs that operate there, and of the rights of people residing in such areas. The participatory dimension requires that these different actors have a voice, that is, that they can defend their interests and positions.

The Lower Rio Negro Mosaic (MBRN) of protected areas constitutes a very significant context for this challenge. Located in the heart of the Amazon, it has 15 Protected Areas (PAs) in an area of approximately 8 million hectares where about 170,000 people live (ALVES; PEREIRA, 2023). The PAs are of different management categories – Sustainable Use (ER, SDR, and EPA) and Integral Protection (National, State and Municipal Parks) – of federal, state or municipal competence. The MBRN includes dryland forests, igapó forests, rivers and streams, *campinas*, *campinaranas*, sandbanks and beaches that arise during the dry periods of the Rio Negro river (DIDIER et al., 2017). Due to the connectivity between the ecosystems and the extensive conserved areas in a context of complex urban-rural arrangements and forest degradation, the MBRN has environmental and social importance.

The management of its constituent units is linked both to the corresponding competent government agencies (Amazonas State Department of the Environment – SEMA; Municipal Department of the Environment and Sustainability of Manaus – SEMAS; Chico Mendes Institute for Biodiversity Conservation - ICMBio; and the Municipal government of Novo Airão) and to a significant and diverse set of Civil Society Organizations, Non-Governmental Organizations and Associations, which make the term “participatory” a pulsating dynamics of political actions with diverse scope and interests. Similarly, the scientific activity and scrutiny is carried out by a number of universities, research institutes, and funding agencies of national and international scope.

This demonstrates—still incipiently—that integrated and participatory management of the MBRN is not a minor challenge. Thus, how to coordinate ecological diversity, the set of actors, institutional and legal diversity, and the myriad of ethnic and socio-cultural configurations toward the same purpose of conservation management?

Considering this issue, we discuss the challenges of integrated management of the Lower Rio Negro Mosaic, addressing its creation process, the need for coordination between levels, actors, and policies, and the dilemmas of multilevel management. To this end, we present (1) a brief history of the constitution of the MBRN and the assemblies

held by the Advisory Council with the participation of residents of traditional communities and representatives of public and private institutions; and, based on this history, (2) a mapping of social and institutional actors present in the management efforts of the Mosaic, of the projects and initiatives in progress, in addition to the main issues addressed in such projects. To this end, we analyzed 26 minutes of Advisory Council assemblies held between 2011 and 2022 in order to trace the issues, actors, and projects found in the assemblies.

Subsequently, (3) we traced advances and challenges in the management of the Mosaic in a discussion that juxtaposes the previously mentioned aspects with the results of the sociodemographic survey carried out in 106 rural communities of the MBRN between February and May 2022. Finally, (4) we present the final considerations, indicating the possible paths for new interdisciplinary research interested in analyzing the role of Mosaics in a more participatory and integrated territory management.

With the work conducted in this article, we hope to provide a general contribution to the discussion on the challenges of integrated territory management, underscoring the importance of creating protected area mosaics for environmental conservation. Furthermore, we seek to open a range of possibilities for addressing specific issues related to the Lower Rio Negro Mosaic, which directly relate to the challenges noted here.

## Materials and methods

We used primary and secondary data from fieldwork carried out in the region and from the analysis of minutes of assemblies of the MBRN Advisory Council. We analyzed 26 minutes of assemblies held between 2011 and 2022, made available by the Council management team. The minutes express the intentions of the different actors that compose the Council's organizational structure, enabling us to trace the issues discussed and the actors' positions in relation to everyday issues. The analysis of the minutes showed recurring issues, which enabled us to classify the main subjects discussed.

The fieldwork was carried out within the scope of the research project "*Traditional populations in protected areas: socio-environmental dynamics and management of Protected areas in the Lower Rio Negro Mosaic, in Amazonas*" (FAPESP/FAPEAM), registered by the Certificate of Presentation of Ethical Appreciation (CAAE) number 52457621.5.0000.5404. The fieldwork was carried out between February and October 2022, a period in which we visited 106 of the approximately 220 traditional communities located in the MBRN PAs. Innovatively for research in the fields of Human and Social Sciences in the Amazon, the surveys were based on the application of geocoded digital instruments, installed on *tablets* and *smartphones* (D'ANTONA; ALVES, 2023).

We applied three types of questionnaires: one for community leaders and two for those responsible for households. The questionnaire for leaders, prioritized in the analyses of this article, focused on capturing the general information of the communities (location, history, infrastructure, health, education, projects, among others). We focus here on the issues and questions that enable us to evaluate everything from the distribution of infrastructures to the perception of community leaders about the existence of the protected

areas and of the Mosaic itself.

### **The constitution of the Lower Rio Negro Mosaic**

The Lower Rio Negro Mosaic region, located between the states of Amazonas and Roraima, is of central importance to global biodiversity conservation efforts. In the 1970s and 1980s, the period of gestation of the contemporary molds of conservationism, the region became one of the priority conservation areas, within a global logic of construction of protected areas (WWF, 2018). That view was adopted both by transnational institutions, such as the International Union for Conservation of Nature (IUCN) and the World Wide Fund for Nature (WWF) and national, regional and local institutions dedicated to the issue.

An indication of the region as a cosmopolitan space for action (BECK, 2008) is the fact that it has been, since 2002, centrally considered in the Amazon Protected Area Program (ARPA), “a Federal Government program that aims at sustainably developing the Amazon region and strengthening the SNUC [Portuguese acronym for Sistema Nacional de Unidades de Conservação da Natureza – National Nature Conservation Unit System] through conservation actions in the Amazon biome” (Almeida, 2014, p. 54, our translation), bringing together institutions such as the Ministry of the Environment, ICMBio, the German Development Bank (KfW), the Global Environment Facility (GEF) through the World Bank, the Gordon and Betty Moore Foundation, AngloAmerican, and WWF.

Thus, these conservation initiatives—with the premise of coordinating protected areas in common objectives, strategies, and practices beyond their specific plans—have special attention and emphasis on the territorial integration of protected areas as recommended in the ARPA (Amazon Protected Areas) Program aiming at expanding the protected area system in the Amazon, creating protected area mosaics in various categories (FUNBIO, 2017).

This powerful historical and political context led to the creation of the Lower Rio Negro Mosaic (MBRN). In 2010, it was recognized through MMA Ordinance No. 483 of December 14, resulting from the activities based on process 01/2005 of the National Environmental Fund (FNMA), which aimed to foster the formation of protected area mosaics throughout the country (BRASIL, 2010). At the federal level, the process would politically reinforce the need for integrated territorial management, allocating investments to develop the necessary bases for the consolidation of mosaics in diverse Brazilian biomes. This integrated model, in addition to connecting the geographical spaces, also had the purpose of integrating their surroundings, since they influence the protected areas, mainly with economic activities. The need to meet the various interests of social groups, such as the resolution of land conflicts, the protection of rights of resident peoples, and empowerment in the political process of territorial management, were also reasons considered for the formation of the MBRN (DIDIER et al., 2017).

Located in the Central Amazon Corridor, in the Central Amazon Biosphere Reserve (RBAC), three of its PAs are natural world heritage sites: Jaú National Park, Anavilhanas

National Park, and Amanã Sustainable Development Reserve. This is an important territory for the conservation of Amazonian biodiversity, including the main rivers of the region (Branco, Cuieiras, Japurá, Jutai, Juruá, Solimões, Tefé, and Negro) and concentrating different aquatic environments with hundreds of floodplains and dry land lakes (JUNK et al., 2020), standing out for the rich biodiversity and ecological interactions in and between terrestrial and aquatic ecosystems (DIDIER et al., 2017).

In its original design, the MBRN consisted of 11 Protected areas, most of them created in 1995 (Almeida, 2014). Over time, new PAs became part of the MBRN, totaling 15 PAs in about 8 million hectares (Chart 1).

**Chart 1 – Protected Areas belonging to the MBRN in 2024**

Protected Area	Management	Year of Creation	Area (ha)
Rio Negro Right Bank EPA - Paduari-Solimões Sector	State	1995	461.740,67
Rio Negro Left Bank EPA - Aturiá-Apuauzinho Sector	State	1995	559.097,79
Rio Negro Left Bank EPA - Tarumã Açu-Tarumã Mirim Sector	State	1995	56.793,00
Tarumã/Ponta Negra EPA	Municipal	2008	22.698,84
Rio Negro North Sector SP	State	1995	146.028,00
Rio Negro South Sector SP	State	1995	77.950,86
Anavilhanas NP	Federal	2008	350.469,79
Jaú NP	Federal	1980	2.367.357,47
Amanã SDR	State	1998	2.313.000,00
Rio Negro SDR	State	2008	102.978,83
Tupé SDR	Municipal	2005	11.973,00
Puranga Conquista SDR	State	2014	86.233,43
Lower Rio Branco-Jauaperi ER	Federal	2018	580.630,92
Rio Unini ER	Federal	2006	849.693,35
Cacimba Municipal Park	Municipal	2020	7,14

Source: MMA, 2023. Prepared by the authors, 2024.

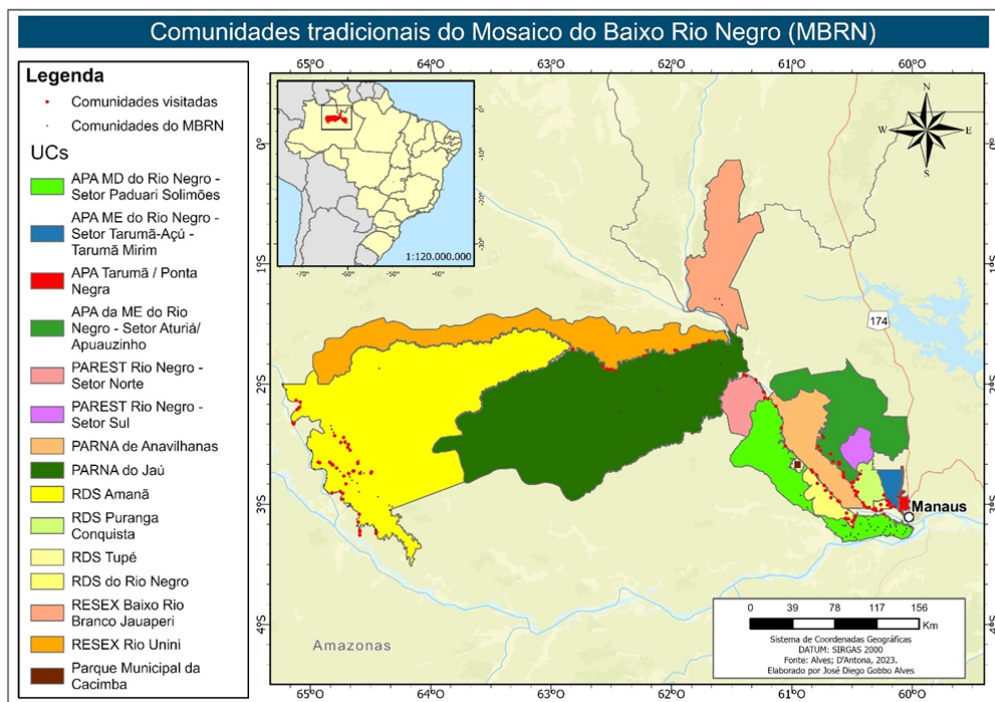
*Note: EPA, Environmental Protection Area; SP, State Park; NP, National Park; SDR, Sustainable Development Reserve; ER, Extractive Reserve*

Currently, the Mosaic encompasses the rural areas of the municipalities of Manaus, Novo Airão, Iranduba, Barcelos, Manacapuru, Coari, Maraã, Codajás, Rorainópolis and Presidente Figueiredo and part of the urban areas of the municipalities of Manaus,

Irlanduba and Manacapuru, totaling a population of 170,000 inhabitants (IBGE, 2025) distributed in about 250 communities (or localities), including those distributed along the PAs and urban districts belonging to Manaus, Irlanduba and Manacapuru (Figure 1).

**Figure 1 - Location of communities of the Lower Rio Negro Mosaic**

Source: ALVES; D'ANTONA, 2023. Prepared by the authors, 2024.



### The advisory council and its assemblies

As provided for in the National Nature Conservation Unit System (SNUC) since 2000, the management councils of PAs and, in this case, of a protected area mosaic, must be composed of representatives of civil society and the government (at federal, state or municipal levels), with the objective of planning, monitoring and discussing the different issues related to the demarcated area and proposing solutions to the socio-environmental issues required within the scope of the council.

Ordinance No. 483/2010 established the creation of the Mosaic Advisory Council with the function of integrated management of the PAs that are part of it, involving management institutions and civil society. It is reinforced that the Mosaic Councils have an advisory and not a deliberative character, which means a more restrictive power of decision-making and control over the territory. The Council is composed of 14 (fourteen)

full councilors and 14 alternates, whose occupied seats must guarantee the plurality of actors who live and produce in the territories that constitute the mosaic. In total, there are seven representatives of the government sector and seven representatives of the non-governmental sector.

The diversity in the representation of entities and actors in the Council aims to encompass the plurality of perspectives on the issues found in the MBRN. In addition to the representatives who occupy a chair as councilors, others participate in the assemblies without voting power, but with freedom of manifestation and debate: members of civil society interested in the issues that relate to the daily management of the community (researchers, artisans, extractivists, representatives of NGOs and the private sector, among other guests) and residents of the communities of the PAs. The Council is responsible for preparing an internal regulation and a work or action plan, conducting administrative activities, and proposing measures and actions to reconcile and integrate the activities in each of the protected areas (use of resources, monitoring of management plans, biodiversity, access and inspection of the units and the execution of scientific research) and the relationship between traditional populations and the environment (BRASIL, 2010). The Council is also responsible for issuing opinion on the discussions on the overlaps between the PAs and when requested by other environmental agencies.

Although the councils are central for integrated and participatory management, Decree No. 9,759, of April 11, 2019 discontinued and established guidelines, rules and limitations for collegiate bodies of the federal public administration, such as the mosaic councils. The impact on the context presented here, however, was minimized because the MBRN Advisory Council remained active despite its formal discontinuation: assemblies and deliberations occurred regularly throughout the period of validity of the decree—which was revoked through Decree 11,371 of January 1, 2023. Not even the COVID-19 pandemic prevented the operation of the Council. During the height of the pandemic in the state of Amazonas, assemblies began to be held virtually. From the second half of 2021, the assemblies were held again in a hybrid format (virtual and face-to-face), headquartered at the Vitória Amazônica Foundation (FVA), in the city of Novo Airão.

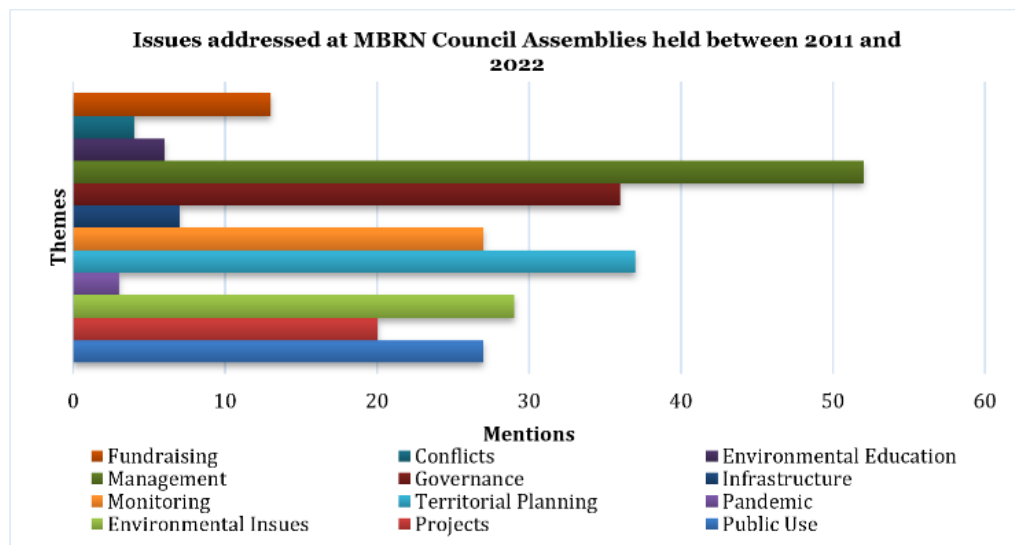
The assemblies are held every six months and last up to three days. They include workshops, capacity-building training, and presentations on various topics related to the Mosaic, providing expanded knowledge on the region and its political-institutional context. It is important to note the effort on the part of the managers to attract as many councilors as possible from the riverside and indigenous communities, residents of the PAs. However, the long distances from the communities are only overcome by raising funds for such activities, which involve: transport, fuel, food, and lodging. In addition, certain political obstacles prevent representatives from attending assemblies, either due to a lack of interest in collaborating or even due to lack of knowledge of their existence.

Analysis of the minutes of the 26 Council assemblies held between 2011 and 2022 indicates changes in the concerns and issues discussed in the meetings over time, reflecting the maturation and structuring of the MBRN as a territorial management level strongly associated with the concept of participatory management. Discussions, proposals, demands,



researches, and projects that involve resources to foster activities focus on environmental conservation, creation of infrastructures, and promotion of domestic economy. Figure 2 presents the main categories of issues discussed during the analyzed assemblies.

Figure 2 – Issues addressed at MBRN Council Assemblies held between 2011 and 2022



Source: Minutes of MBRN assemblies. Prepared by the authors, 2024.

The discussions traced in the assemblies were categorized into 12 themes. We note those themes related to Mosaic Management, especially the administrative and bureaucratic aspects of the Council, such as: Council composition, action planning, technical work chamber structuring and formation. The Territorial Planning theme encompasses the issues of inclusion and recategorization of Protected areas and the planning of actions in the territory. Governance includes the political coordination carried out by the MBRN to incorporate institutions present in the region. For example, the effort to include a public representative of a municipal government of a city that is part of the Mosaic and that was unaware of its existence.

Issues such as deforestation and mining in the Rio Negro River were included in Environmental Issues. In turn, projects in progress or already carried out are in Projects. Monitoring refers to inspection actions in the MBRN that were discussed in the Public Use assemblies in relation to visitation, tourism, leisure and sport fishing. The Fundraising theme is recurrent, especially due to the need for financing for the execution of projects and implementation of actions. Other themes are also discussed, such as Environmental Education (continuing education program – capacity-building training courses), promotion of Infrastructures (electricity and roads), socio-environmental conflicts and, more recently, issues caused by the expanded COVID-19 pandemic in the lower Rio Negro

territory (ALVES; CÔRTEZ, D'ANTONA, 2022).

The mosaic's first assemblies were mainly focused on structuring the Council and the MBRN itself. They featured presentation of experiences of other Brazilian mosaics, preparation of internal regulations, action plan, definition of the actors who occupied the chairs of the council, and creation of technical work chambers, such as those on Integrated Management; Environmental Education; Public Policies; Public Use; Communication; Territorial Planning; Resource Use; and Fundraising.

Other discussions arose in the course of the MBRN's operation and the challenges found in territorial, bureaucratic and administrative management. Over the years, themes emerged such as: integrated protection of the Mosaic, inclusion in projects with investments in various areas, communication plan, biodiversity monitoring, creation of technical chambers, overview of threats, action plan, composition of the Council and others.

The Council's minutes show that there are two groups of institutions and actors that participate in the assemblies: a) fixed institutions and actors and b) transitional institutions and actors (ALVES, 2025). The first group consists of a set of institutions and actors that have been present at most assemblies since the constitution of the MBRN, being part of the Council, either as a full councilor, alternate member, or participating member. It was observed in the minutes that, although the alternates have voting power only in the absence of the holders during the assemblies, they have an active voice in the considerations on the issues that are discussed at the meetings, in view of the history of socio-spatial operation of these institutions and actors.

The main institutions represented in the Council are: Institute for Ecological Research (IPÊ), Chico Mendes Institute for Biodiversity Conservation (ICMBio), Vitória Amazônica Foundation (FVA), Municipal Department of the Environment and Sustainability (SEMMAS), State Department of the Environment (SEMA), Brazilian Micro and Small Enterprise Support Service (SEBRAE), State University of Amazonas (UEA), Permanent Forum for the Defense of Riverside Communities of Manaus (FOPEC), World Wide Fund for Nature (WWF), Wildlife Conservation Society (WCS) and State Department of Economic Development, Science, Technology and Innovation of Amazonas (SEDECTI). In addition to holding Full Councilor positions, government institution representatives work in Technical Chambers focused on specific territorial management issues in partnership with alternate representatives and others interested in the discussions.

In turn, transitional institutions and actors attend assemblies for a specific period, usually because of some project under development or to be developed in the Mosaic area. Their participation seeks to strengthen ties with the Mosaic Council aiming at authorization, enablement of projects, knowledge of the territory and feedback on outcomes after completion of the work. Research institutions and NGOs, with the exception of those listed above, tend to have a temporally more intermittent role in Mosaic assemblies, as they follow the operating schedule provided for in research projects and funding processes. However, these institutions tend to return to Council assemblies or return to operate in the area after new funding. The partner institutions also have a constant presence in the

assemblies and in the debate spaces, even though they do not have voting power.

The funds raised by NGOs coordinate the MBRN with institutions on an international scale. Investments for initiatives are provided by institutions such as the *Gordon and Betty Moore Foundation*, the *World Bank*, *Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)*, the *United States Agency for International Development (USAID)* and *Samsung*, which are interested in the socio-environmental conservation of the Amazon. This coordination situates the Mosaic at the center of the international discussion on biodiversity conservation and the interest of philanthropic institutions and companies from different segments in the Amazon. The scientific actions and projects found in the analyzed minutes refer to the dimensions related to territorial planning, public use, environmental education, infrastructure and biodiversity conservation. The territory covered by these projects varies according to the funding; the time frame is defined in the projects' process and schedules and in the institutions' history of operation and geographical location.

### **The Mosaic from the perspective of its residents**

Having observed how the dialogue and the definition of strategies occur through the central level, which is the Advisory Council, we move to the repercussions of its activities in the scope of the traditional communities located in the Mosaic's Protected areas. That is, to what extent do the resident populations recognize the conducted activities as belonging to the Mosaic? Data collected with the leaders of 106 communities provide elements on three aspects that enable us to compare the impressions of the residents with the information pointed out on the minutes of the assemblies: 1) the (re)knowledge about the PAs and Mosaic; 2) the distribution of infrastructures and services in relation to those who provide them; and 3) operation/presence of institutional actors through their projects and areas of operation.

#### **(Re)knowledge about the PAs and Mosaic**

Knowledge about PAs is disseminated among the community leaders interviewed. When asked about "*What changed with the creation of the PA?*," only nine people said they did not notice changes. Among those who noticed changes, most statements were positive – the statements were spontaneous and not stimulated as to the indication of positive changes and negative changes. The answers showed the understanding of the meanings and implications of living in a conservation unit.

Among the positive responses (n=76) regarding the creation of PAs that belong to the MBRN, it was reported that the institutionalization of the territory enhanced the preservation of natural resources, providing greater political organization within communities and support from governmental and non-governmental entities. In addition, the creation of the PAs was associated with increased infrastructure and better management of natural resources. Concomitantly, part of the interviewed leaders (n=21) consider that the creation of the PAs increased institutional control over the territory and resources, improving the use and occupation rules and bureaucratizing daily activities, such as the

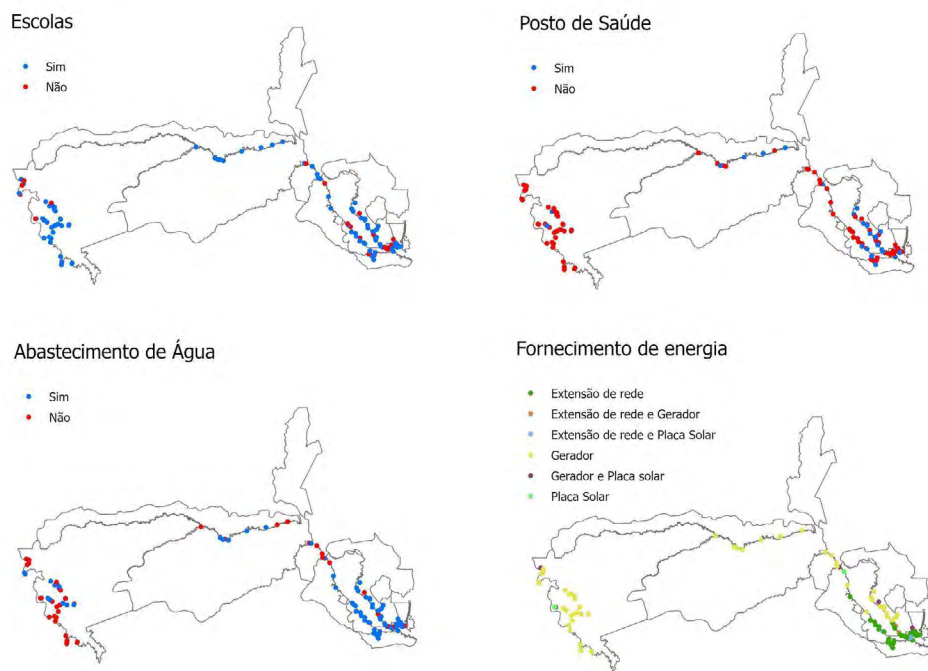
need to create fishing agreements. We interpret that the differences found are due to the diversity of categories of the PAs visited, which implies different restrictions on the use of natural resources and human occupations, reflecting ambivalent and antagonistic perceptions as to the rules established for the different PAs. Relatively close communities coexist in an extensive socio-spatial network, but are subject to different rules and different forms of management, both at the municipal, state and federal levels.

These understandings seem disjointed and potentially restricted to the PA to which the interviewed leader's community belongs, and/or to the scope of an association or cooperative to which it belongs. More than half of the 106 community leaders who answered the question "*Do you know what the Rio Negro Mosaic is?*" said they did not know ( $n=53$ ) or did not know how to explain what the Mosaic is ( $n=29$ ). This unawareness, or vague feeling, extends to those who answered "Yes" laconically, without subsequent explanation ( $n=29$ ). Therefore, it is observed that there is a recognition of the protected areas' role as an important territorial management instrument for forest conservation. Although some consider it an exacerbated control of the territory, it is noted a deficient knowledge of the PAs' role in an expanded context of territory management.

To a certain extent, this finding corresponds to that found mainly in the minutes of the Council assemblies, where the need for greater dissemination of the potential, challenges and actions that are being carried out throughout the territory is reinforced, which indicates the need to advance the process of informing the Mosaic's role and potential impacts on the lives of residents. There should be a joint and planned dissemination of the activities carried out by partner institutions and those resulting from the operation of the MBRN, in order to show a coordination and relation between the different actions.

### **Spatial distribution of Infrastructures and Services**

During our team's travels in the region, we observed an unequal spatial distribution of infrastructures in the MBRN. This perception was corroborated by the responses recorded in the questionnaires, according to the spatial distributions of health care clinics, schools, electricity supply, and water supply (both piped water and artesian wells) shown in Figure 3.

**Figure 3 – Spatial distribution of MBRN infrastructures**

Source: ALVES, 2025.

In addition to the existence of infrastructures in the communities, the responses end up showing that local concerns extend to the quality of the service provided and the physical maintenance of these resources. Among the communities visited, about 80% indicated the existence of schools in the community. However, part of this total does not have a complete education system or the education was considered insufficient by the community leaders. The lack of school in the community or the lack of any school level requires that young people and adolescents commute to other communities or cities to attend school (PEREIRA et al., 2022).

The distribution of health care clinics is more unequal compared to that of schools, leaving significant portions of the territory without coverage – with negative emphasis on the Amanã SDR, where health care clinics are much scarcer in communities (GOMES et al., 2019; GOMES et al., 2022). Ambulance motorboats for the transport of patients were donated to 16 communities; however, leaders reported that they are not always in conditions of use due to lack of maintenance or fuel. This situation results in the travel of patients to urban centers and the travel of multidisciplinary health care teams to communities in actions promoted by the government and at the initiative of NGOs and churches. The service, based on the mobility of the actors, however, does not seem to be sufficient: 26 leaders of communities that have received mobile health care services

in recent years reported that health issues constitute one of the main problems in the community.

Interviews with residents indicated that the provision of medical consultations in health care expeditions does not serve all residents, making travel to cities necessary to receive medical care. Therefore, the alternative created is insufficient to meet the demands of part of the population within the PAs (D'ANTONA, 2023).

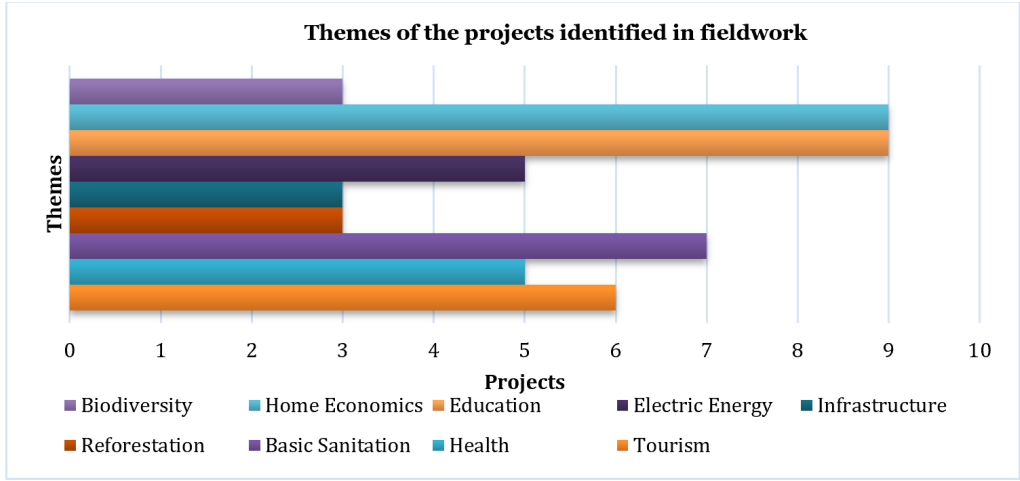
Most communities have some kind of electricity supply. In the vicinity of Manaus, we note the supply by Network Extension, driven by the Federal Government's "Light for Everyone" program. In the middle Solimões region, where the Amanã SDR is located, we note that electricity is supplied by diesel-powered generators. When electricity is supplied by generators, it is usually available from 6pm to 10pm. Problems with equipment maintenance and lack of fuel were reported. The issue of electricity is essential in the daily lives of communities, as instable power supply makes it difficult to store food that requires refrigeration. Most communities visited have water supply, usually from an artesian well with a submerged or manual pump. Part of the residences have a water tank for water storage. As in the case of electricity, water supply in some communities depends on the availability of diesel fuel.

It is important to note that basic utilities such as electricity and water are fundamental achievements for maintaining traditional populations in communities, which helps to understand the efforts of institutional actors (governmental and non-governmental) in the implementation of projects related to these issues. Some of the identified infrastructures were provided by different levels of the government, while others result from projects of non-governmental organizations or even companies. The need to raise funds for new infrastructure and capacity-building training projects is a recurring theme in Council assemblies, which demonstrates that the populations' demands are raised in the different spheres of MBRN management but that, in practice, this has not resulted in a satisfactory spatial distribution of essential services.

### **Operation/Presence of institutional actors (projects and areas of operation of NGOs)**

Analysis of minutes of the MBRN Advisory Council assemblies indicated gaps in the participation and operation of key institutional actors for integrated management of the territory. There were obstacles to the actors' participation in the formation of the MBRN, especially of the public sector and representatives of local governments. There is a greater focus on actors operating in the lower Rio Negro rather than representatives from the far west, in the Amanã SDR region. Regarding the operation of governmental and non-governmental institutions, the results surveyed in 106 communities demonstrate that there is a plurality of projects being carried out in the communities belonging to the MBRN. Based on the questions "*What projects are in effect in the community?*" and "*Which institutions are involved in each of them?*," Figure 4 presents the themes of the main projects mentioned by community leaders that have occurred in the last five years.

Figure 4 - Themes of the projects identified in fieldwork.



Source: Fieldwork data from the project “Traditional populations in protected areas: socio-environmental dynamics and management of Protected areas in the Lower Rio Negro Mosaic, in Amazonas,” 2022.

A total of 51 projects were cited in the last five years. Among the themes, we note those that assist in the domestic economy, such as handicraft training courses or programs for the management of agricultural and fishery products. Basic sanitation projects correspond to infrastructures such as water collection wells and waste collection. Tourism represents projects aimed at encouraging and organizing the practice in communities (trails, sport fishing, visitation). Education represents the infrastructures for schools and libraries, in addition to environmental education courses.

In relation to NGOs that carry out and/or coordinate community actions, according to the respondents, there are spatial *clusters* with predominance of operation, with each of the actors present in defined areas and, in a way, neither overlapping nor being integrated. In the western sector of the MBRN, two NGOs predominate in the territory, while in the eastern sector about five stand out in the operation. There are types of projects and actions that are carried out specifically by an actor in a certain portion of the territory. On the one hand, these islands of operation are present throughout the MBRN and at first indicate the idea of a regional synergy, making all PAs be covered by some action or activity. On the other hand, there is no effective integration of these activities and institutions, which reinforces the perception of a primacy of operation of an actor in a territory.

As for integrated management of the territory, even if this type of organization may seem reasonable in the distribution of tasks in such a large region, the following questions remain: i. how to standardize or guarantee equivalent services and programs performed by different actors? ii. To what extent does this usually informal zoning reproduce the simplified view of discrete territorial levels when the complexity of a Mosaic is best characterized by the overlapping of networks?

## Challenges for integrated and participatory management

As can be understood thus far, the Mosaic has a degree of institutional maturity in which its management mechanisms and instruments are well established. Similarly, it is possible to detect that the collegiate management bodies are susceptible to the participation of political and institutional actors representing civil society and governments involved in the scope of the Mosaic. The Advisory Council's role is virtuous and necessary for governance, as shown by the notes on its operation – even under unfavorable conditions in recent years – and its plural composition.

However, the complex issues to be addressed for the conservation goals of the Mosaic region impose a significant set of achievements yet to be accomplished. These challenges of the MBRN are inherent to contexts characterized by a perspective of “multilevel governance of forest resources” (MWANGI; WARDELL, 2012), and are defined a priori by the purpose of integrated and participatory management in protected area mosaics. Accordingly, two aspects are central to the case under study and, probably, to other Mosaics: a) how to integrate the interests and actions of various actors; b) how to implement actions in protected areas with different missions and restrictions.

These broader issues lead to specific challenges stemming from the socio-environmental characteristics of the MBRN: c) how to plan, execute and supervise actions in such an extensive region with such diverse social, political and environmental demands; d) how to align the presence of urban centers with micro- and macro-regional influence, such as Manaus, to the territorial planning resulting from the different conservation guidelines provided for in the Mosaic. More specifically, such challenges are manifested e) in the difficulties of carrying out environmental monitoring actions, f) in the monitoring and control of human actions; g) in the design and implementation of projects to improve living conditions in communities without losing the dimensions of the environmental legislation; h) in the sharing and management of data, including those necessary for the dissemination of lessons learned and for accountability; i) and, finally, in the design of actions at the level of the Mosaic – and not in some of its Units – that are consistent with what must be carried out in specially protected territorial spaces and with their surroundings.

## Final Considerations

In this article, we trace the main challenges for integrated and shared management of a protected area mosaic, using the Lower Rio Negro Mosaic as a socio-spatial context of analysis. The results indicated an important institutional maturation of the MBRN, consolidating a bureaucratic-administrative system relevant to its functioning, even during the period in which it was in informality when the federal councils were discontinued in 2019.

The results show that there is a biological, historical, and cultural integration between the territories that constitute the Mosaic and that favor integrated management,



as this enables a wide institutional and community support network to deal with the pressures and challenges faced in isolation. In addition to the challenges and conflicts, some demands are permanent and common to all PAs, such as: more investments in education, health care, management, sanitation, and inspection. Despite the efforts of the Council and its members, the operation and perceived operation seem to indicate more a zoning/division of tasks than a systematic and widespread operation through networks at various levels. This distribution can facilitate interinstitutional coexistence, but also limits synergies and large-scale actions, calling into question the degree of integration between the actors involved.

Fieldwork data indicated an uneven distribution of infrastructures in the MBRN. However, the central issue is the quality of the services that the infrastructures provide; thus, one of the challenges is to improve the distribution of facilities and the quality of the service provided. Some community leaders know and recognize the role played by protected areas, although awareness about the existence of the MBRN is significantly lower.

Finally, we have advanced in outlining a set of challenges based on what is defined as integrated and participatory management in protected area Mosaics—considering that the central challenge of the Lower Rio Negro Mosaic is inherent in any multilevel forest resource governance system (MWANGI; WARDELL, 2012).

Despite the Mosaic Advisory Council's positive operation as a communication and dialogue body, we conclude that the actions (projects and interventions) carried out by its members need greater integration. Our recommendation is that, based on the findings of the literature on forest resource governance, local actors seek to integrate their areas of operation, effectively functioning as a multilevel network that discontinues a certain tradition of dividing the territory into specific areas of operation.

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### **Data Availability Statement:**

The authors state that all data used in the research have been made publicly available and can be accessed through the ArcGIS StoryMaps and FigShare platforms:

<https://storymaps.arcgis.com/collections/9a783fc997eb4891ba4940da60f4aa82>

[https://figshare.com/articles/dataset/Mapa\\_Interativo\\_do\\_Mosaico\\_de\\_reas\\_Protegidas\\_do\\_baixo\\_Rio\\_Negro\\_MBRN\\_/22129127](https://figshare.com/articles/dataset/Mapa_Interativo_do_Mosaico_de_reas_Protegidas_do_baixo_Rio_Negro_MBRN_/22129127)

# Desafios da Gestão Integrada e Participativa do Mosaico de Áreas Protegidas do Baixo Rio Negro

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**Resumo:** Analisamos a constituição e os desafios da gestão integrada de áreas protegidas por meio do modelo “Mosaico”, partindo de uma das mais relevantes experiências do conservacionismo brasileiro: o Mosaico do Baixo Rio Negro (MBRN). Baseado em dados de trabalhos de campo realizados em 106 comunidades tradicionais do MBRN e na análise de 26 atas de reuniões do Conselho Consultivo do Mosaico, identificamos os êxitos e desafios da proposta de gestão integrada. Os resultados indicam um amadurecimento político-institucional do MBRN desde a sua criação em 2010, sobretudo diante da complexidade da composição de um Conselho orientado para a gestão participativa. No entanto, a desigualdade na distribuição de infraestruturas, serviços e projetos implementados por instituições governamentais e não-governamentais gera alguns desafios a serem enfrentados. Tal desigualdade socioespacial e de atributos da gestão ambiental afeta o (re)conhecimento do Mosaico por parte das lideranças comunitárias e dificulta o aprimoramento da gestão integrada e multinível.

**Palavras-chave:** Mosaico de Áreas Protegidas; MBRN; Amazônia; Gestão multinível; Gestão da Conservação.

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# Efectos de la dinámica antrópica en la degradación de los ecosistemas de manglar en el Haití

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**Resumen:** Analizamos la constitución y los desafíos de la gestión integrada de áreas protegidas a través del modelo “Mosaico,” basándonos en una de las experiencias más relevantes de la conservación brasileña: el Mosaico del Bajo Río Negro. Basándonos en datos de trabajos de campo realizados en 106 comunidades tradicionales del MBRN y en un análisis de la documentación de las 26 reuniones celebradas por el Consejo Consultivo del Mosaico, identificamos los éxitos y desafíos. Los resultados indican una madurez político-institucional del MBRN desde su creación en 2010, especialmente dada la complejidad de la formación de un Consejo orientado a la gestión participativa. La desigualdad en la distribución de infraestructura, servicios y proyectos implementados por instituciones gubernamentales y no gubernamentales plantea algunos desafíos. Esta desigualdad y las variaciones en los atributos afectan el reconocimiento del Mosaico por parte de los líderes comunitarios y dificultan el mejoramiento de la gestión integrada y multinivel.

**Palabras-clave:** Mosaico de Áreas Protegidas; MBRN; Amazonía; Gestión multinivel; Gestión de la Conservación.

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