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Territorial governance as a transforming asset for permanent preservation areas along riverbanks

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Abstract: Anthropization process and climatic changes, mainly deforestation and sea level rise, are factors significantly contributing to the loss of mangrove ecosystems. The aim of our study is to analyze the effects of the dynamics of human activities closely associated with these ecosystems' degradation. We identify and compare soil use and occupation variations based on information provided by 140 randomly chosen participants at the Caracol County - Haiti. The results analyzed through multivariate regression tests, the most significant exploratory variable for the mangroves' degradation process was "mangrove occupation", regardless of age, gender, schooling, time in the same residence, profession, home distance from the mangrove, landslide events, and risk of floods. We have concluded that distance from home, ecological function, intervention in biodiversity conservation, as well as water-climatic and geo-physical threats are factors closely correlated to mangroves' environmental conservation and management.

Keywords: Preservation areas; Riverbank; Amazon; Territorial governance; Planning and management; Urban-environmental conflict.

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Introduction

The complex issue of artificializing urban Permanent Preservation Areas (APPs) on riverbanks, with the removal of riparian forests, due to the vast degradation and negative urban-environmental impacts it produces, constitutes a challenge to be faced by public authorities and civil society, requiring active territorial governance to make urban space balanced and sustainable.

Given the growth of cities, this situation of continuous degradation contributes to worsening several socio-environmental problems such as urban flooding, which has been exacerbated by climate change, affecting buildings and populations in a comprehensive and frequent manner, revealing the fragility of public policies and territorial governance.

The World Cities Report (2020) recommends as a political strategy, based on the assertion that urbanization is an irreversible global phenomenon (UN, 2019), that national and local governments, the private sector and civil society accelerate their efforts to face the challenge of making urban space balanced and sustainable, moving towards the new global paradigm of sustainable urbanism, that is, ensuring quality of life while preserving nature in the growth of cities.

In the case of flood disasters, targets are set out in the UN's 2030 Agenda for Sustainable Development Goals (SDGs) for the period 2015-2030, especially SDGs 11 and 13.

In SDG 11, which focuses on making cities sustainable, the goals include adopting and implementing policies to mitigate and adapt to climate change, and resilience to disasters such as floods, as well as increasing the capacity for participatory planning and management. In SDG 13, which focuses on taking urgent measures to combat climate change and its impacts, Brazil adapted[1] the UN target by defining the goal of increasing resilience and adaptive capacity to risks and impacts resulting from climate change and disasters in cities and communities.

The UN guides the essentiality of good governance in efforts to achieve sustainable urbanism. Following this vision, the New Urban Agenda (NAU, p.23) emphasizes the importance of multilevel governance carried out through partnerships, and the World Cities Report (2020, p.44), by stating that effective governance is required as a truly transformative asset to achieve the new urbanism paradigm. Governance conceptually has several meanings and there is great ambiguity between its different uses (Hirst, 2000), with the interest for the present study being governance in the public sphere.

On this topic, Ckagnazaroff *et al.* (2018, p.629) when analyzing academic productions over the last 20 years, even with different emphases and numerous nomenclatures (public governance, network governance, governance network, democratic governance, good governance, among others), noted that the attention of the various authors researched was focused on paradigm shifts, thus compiled:

1 - The justification for Brazil's adaptation to the target established by the UN can be found at https://www.ipea.gov.br/ods/index.html, including concepts related to the target, such as natural disasters and risks.

> - from a bureaucratic to a democratic rationality (Peters, 2005; Brugué, 2011; Speer, 2012);
>
> - from a managerial State (hierarchical, bureaucratic, controlling), to a cooperative State (which acts together with a network of partners or collaborators) (Mayntz, 2000; Kissler; Heidemann, 2006; Bevir, 2011a; Pires, 2015);
>
> - from a society that consumes public policies to a protagonist in the construction of collective projects (Mayntz, 2000; Peters, 2005; Schneider, 2005; Milani, 2008; Brugué, 2011).

Thus, given the city's growth process and the irreversibility of urbanization aiming at sustainable urbanism, it is essential to establish in public governance focused on the issue of riverbank APPs, an active territorial governance with a leading society to achieve a sustainable city, understood as one "capable of avoiding degradation and maintaining the health of its environmental system, reducing social inequality and providing its inhabitants with a healthy built environment" (Ferreira, 2013).

It is reinforced that territorial governance, defined by Cançado (2013, apud Boullosa and Peres, 2020, p.54), is "a process based on an innovative perspective, focused on planning, intervention and management of the territory", or even, "an innovative and collaborative process of planning and territorial management, with the capacity to promote interactions and articulations between different organizations, groups and territorial interests".

In the legal field, public governance is considered by the Brazilian government, through Decree 9,203 of November 23, 2017, as a set of mechanisms aimed at conducting public policies, having among its guidelines, maintaining a decision-making process guided by legal compliance and support for society's participation.

Thus, the legal framework acts as an important driver in the territorial governance process, with society's participation being fundamental from the formulation of standards to their changes, since in the complex issue of APPs and their basins, these instruments can contribute to aggravating or mitigating floods.

A study by MapBiomas Brasil shows that from 1986 to 2020 there was a 102% increase in urbanized areas in the 30m marginal strips of urban water bodies in Brazil (Santos Jr. *et al.*, 2022, p.2). Since this is the minimum strip of preservation of native vegetation along rivers according to the law on the protection of native forests (Brazilian Forest Code of 2012), the proven urban growth that reduces APPs may be endorsed by legislation, promoting the continuation of this conflict scenario, increasing urban and environmental vulnerabilities, and the risk of flooding.

The city of Rio Branco, capital of Acre, located in the Southwestern Amazon region, is experiencing this conflict in its most important urban drainage basin, the São Francisco Stream Basin (BHISF). The basin and its urban APPs on riverbanks suffer from

human occupation and environmental degradation in the greedy process of urbanization and urban expansion, favoring the conditions for the worsening of floods.

Such events in the current times of the so-called Anthropocene era, responsible for the climate crisis, require geostrategic actions to confront them, that is, they are articulated in spatiality.

In this vein, geostrategic action comes, in the understanding of Costa (2017, p.23), in the face of dominant spatialities, as an essential element in the organizing and management context to, among other objectives, achieve the prevention of impacts in the face of risks and vulnerabilities.

Thus, it is important for territorial governance to take into account the essentiality of geostrategic action in preventing impacts, corroborating the theory of Healey (2012, p.199), placing governance with a planning orientation, including in relation to normative issues, as it is a guide to the future. Considering the BHISF, the empirical object of the research, the following is shown, on the one hand, a geostrategic action of (and for) territorial governance that enabled and regulated the environmental protection of a vast area in the basin through the creation of an APA, and on the other hand, an inadequate institutional action that relaxed the metrics of the APPs on the banks of the São Francisco stream in the city's master plan, increasing the risks of flooding.

Object of empirical research and methodology

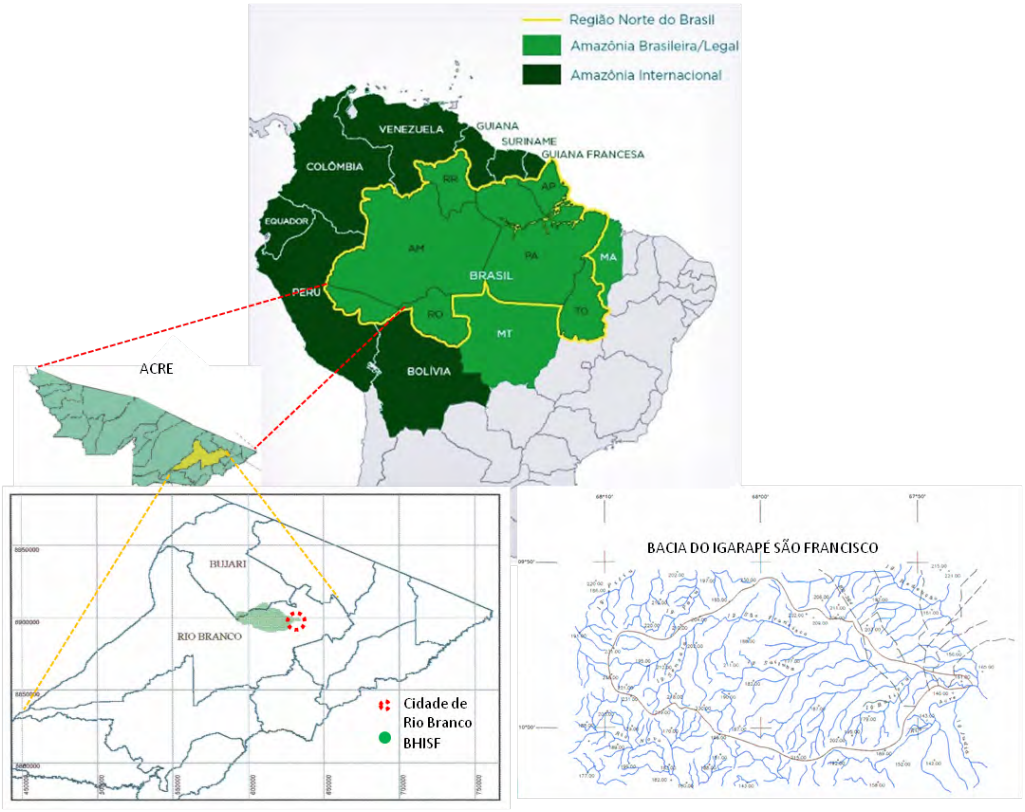
The São Francisco Stream Basin (BHISF) and its urban water APPs are the object of investigation of this research. Most of this 454.403 km² basin is in the municipality of Rio Branco (87.05%), while the remainder is in the municipality of Bujari (12.95%) (Hid, 2000, p.81). These municipalities are part of the state of Acre, located in the North Region of the country, in the South-Western Legal Brazilian Amazon.

The São Francisco Stream, a tributary of the Acre River, is of great importance to the urban site of Rio Branco, since, after the Acre River, it is the city's main collector, responsible for approximately 50% of the natural drainage (Hid, 2000, p.84).

The BHISF is asymmetrical, with the area on the right bank of the stream being flat and considerably higher than the other, and where the extensive tributaries are located.

The geographic locations and shape of the basin with the main course of the stream and its tributaries are illustrated in figure 1.

Figure 1 – Geographical location of Acre, Rio Branco and BHISF



Source: Author's archive.

This exploratory-descriptive research was carried out based on historical bibliographic and documentary research, and on spatial analysis using remote sensing techniques and satellite image processing.

To this end, two stages were developed: a) bibliographic and documentary survey of urban expansion in BHISF, with urban-environmental conflict in riverbank APPs and flooding events, intertwined with the legal framework; b) preparation of land use and occupation maps, carrying out a comparative analysis of occupation for BHISF for 20 years (years 2001 and 2021), and for the São Francisco Environmental Protection Area (APA) section, the analysis for 15 years (years 2005 and 2020).

Relevance of APAs and APPs in BHISF

With the confirmation of the climate crisis by the Intergovernmental Panel on Climate Change (IPCC) and the socio-environmental problem of urban flooding, green areas have become more relevant for cities in their urban-environmental policy, due to the natural ecosystem services of rainwater infiltration and flood mitigation.

Thus, both APAs created by government act and APPs regulated by the Federal Law for the protection of native vegetation are important in the hydrological process in basins with increasing urbanization.

APAs differ from APPs according to the following understanding:

> APAs (...) Conservation Units (UCs) for sustainable use, generally extensive, with a certain degree of human occupation, with biotic, abiotic, aesthetic or cultural attributes that are important for the quality of life and well-being of human populations. They differ from permanent preservation areas (APPs) that are defined by the geographical conditions of the terrain, such as the marginal strip of rivers (ICMBio, 2011).

As the main instrument of urban policy for municipalities, the 1988 Federal Constitution established the Master Plan, with its provisions regulated by the City Statute (Law No. 10,257/2001). The guide for preparing the Participatory Master Plan, published two decades ago, recommends that "the river basin is the appropriate spatial scale for assessing the impacts resulting from current urban occupation and new urbanization projects on hydrological processes" (Brazil, 2004, p.103).

City of Rio Branco and urban expansion in BHISF

The demographic growth of the Amazonian city of Rio Branco, with 364,756 inhabitants (IBGE, 2022), accounts for more than 90% of the city's population and almost 45% of the population of Acre and acts on the expansion of urban spatiality, mainly impacting the BHISF, responsible for approximately half of the city's natural drainage.

The trajectory to reach this urban population scenario dates back to the beginning of the last century, when "Acre, unlike the rest of the Amazon, had extractivism as the economic basis of its occupation" (Franca, 2009, p.70), but which was gradually transformed, mainly from the model of occupation of the Amazon between 1964 and 1985, the period of the military dictatorship in Brazil. This model caused important changes in the economy and society of Acre, intensifying the flow of migration from the countryside to the cities and the destructuring of traditional forms of extractivism (Diniz *et al.*, 2022, p.26). For these authors, the immediate consequences of these two processes were the formation of slums among the populations expelled from the rubber plantations, the increase in deforestation and the destructuring of several traditional communities.

The fragility of urban public policies favored urban-environmental conflict, leading to the proliferation of population density in floodplains and riverbanks, especially among low-income populations who, excluded from the housing market, formed numerous areas vulnerable to flood risks.

Geostrategic action of territorial governance for the creation of APA in the face of urban-environmental conflict

The vulnerability of the urban population living on the banks of rivers in the BHISF to flooding has been sending out warning signs.

The initial alert occurred on February 19, 1997, with the first major overflow of the waters of the São Francisco creek and its tributaries. On that day, during the rainy season in the region, several neighborhoods were partially flooded and 300 families were affected, a fact reported by local media.

The recurrence of this situation, which began in the late 1990s, and the total lack of knowledge about the reality of human occupations in the BHISF, motivated the development of a study at the Federal University of Acre.

In this study, Hid (2000) presents thematic maps showing the temporal evolution of the expansion of the urban area of the city of Rio Branco in the BHISF, from 1955 to 1999, revealing that the city already occupied 7% of the basin area and that almost 50% of its area was drained by it, making this physiographic unit the most relevant in the urban context of drainage. In addition, it showed that the vectors of urban expansion were directed upstream of the rivers, and their banks suffered degradation due to human occupation.

Although the evidence from this investigation warned of the consequences of this situation in relation to the natural drainage of the stream and the possibility of intensified flooding, no concrete measures were taken by successive local governments.

The continuation of this situation contributed to a second major flood on March 23, 2004, of much greater proportions, with an increase in the impacted area, affecting 2,000 families.

The flooding scenario and the warnings generated by the evidence from the investigation motivated the mobilization of civil society, pressuring the government to address this worrying situation.

The first reactions in society began in July 2004, with the mobilization of teachers, technicians and specialists in the environment and the affected community, who founded the NGO Friends Network St. Francis stream of Acre (Raisfa), which was soon transformed into a Civil Society Organization of Public Interest (OSCIP).

The interactions between the various social actors formed a political arrangement, in a successful experience of territorial governance, within the scope of public governance, which resulted in the implementation of important urban-environmental management actions to mitigate the problem, highlighting among them the geostrategic action of creating the Environmental Protection Area (APA) São Francisco.

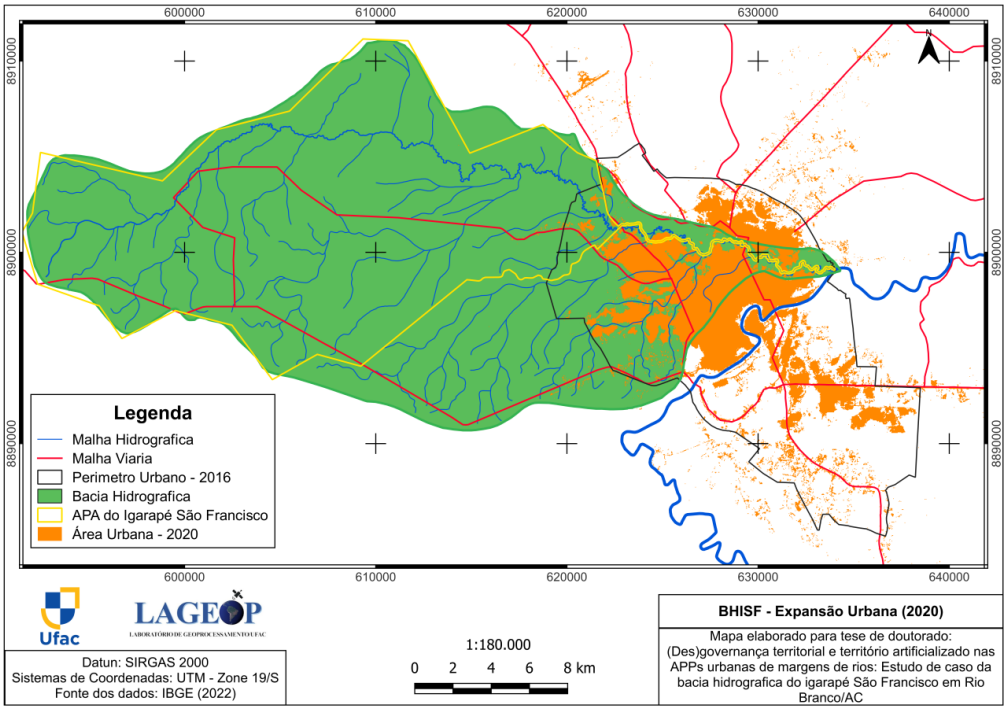
Based on studies by the Federal University of Acre, in May 2005, the creation of the APA was finalized and the government issued the State Decree creating it. Among its objectives was to "order the occupation of the areas of influence of the São Francisco stream", with the creation document emphasizing its social importance and participatory management:

> - The Government of Acre decrees an APA in the area of the São Francisco stream basin, for reasons of social necessity, environmental responsibility and technical and scientific basis;
>
> - The social importance of the APA is evident, emphasizing that the maintenance of environmental services provided by natural systems for the quality of life of the population, in itself, justifies the creation of a Sustainable Use Unit, which does not completely immobilize the area and provides for its parsimonious use based on principles of sustainability and participatory management (Acre, 2005).

The APA of the São Francisco stream located upstream from the city of Rio Branco, shown in Figure 2 with the city's footprint in 2020, covers a significant area of 30,004 ha, approximately two-thirds of the total area of the BHISF. This unit represents, in relation to the future, an important geostrategic action in the sense of providing the maintenance of environmental (ecosystem) services, vital to the quality of life and human well-being, among them, the natural services of infiltration of rainwater and flood mitigation.

Figure 2 – Geographical location of the APA São Francisco in the BHISF

Source: Hid, 2024.



This action, undertaken in an Amazonian city in 2005, has contributed to one of

the sustainable development goals, established years later, in 2015, SDG13 - Take urgent action to combat climate change and its impacts.

New mobilizations are led by civil society pressuring the government to institutionalize the management of the APA. Thus, on October 28, 2009, the State Secretariat for the Environment instituted Ordinance No. 074 creating the Management Council, formed by 22 institutions, including government departments, institutes, a federal university, the Raisfa OSCIP, and associations of rural producers and residents. This council, among its objectives, should promote articulations and establish forms of cooperation between government agencies and civil society for the management of the APA, stimulating the participatory process.

The creation of this Council complies with the conceptual models that guide governance, promoting changes in urban bureaucracy by implementing mechanisms for social participation provided for in the 1988 Federal Constitution and reinforced by the City Statute (Federal Law No. 10,257/2001), which represents for cities "very important milestone in urban territorial governance, as it seeks to address, through a holistic approach, in a single text, several aspects related to democratic governance, urban justice and environmental protection" (Pinheiro et al., 2019, p.35).

Society must therefore interact in the process of territorial governance using its knowledge, while always remaining vigilant to avoid changes that could alter the objectives achieved, as shown in the following item.

Inadequate institutional action for BHISF APPs in a scenario of urban-environmental conflict

The relevance of APPs can be related to their standards, which have evolved from simple environmental protection of certain locations to something more comprehensive, which highlights the interrelationship between man and the environment (Borges *et al.*, 2011, p. 1204). In this sense, the importance of these areas for urban and rural environments is associated with economic, ecological, landscape, physical and psychological aspects (Fisher and Sá, 2007 *apud* Borges *et al.*, 2011, p. 1204), highlighting that ecologically, urban APPs can act preventively in the control of landslides and floods when there is vegetation that, if removed, would imply a risk.

This warning resonates even more in the current times of irreversible urbanization with population growth in cities, and the climate extremes proven by the Sixth Analysis Report of the Intergovernmental Panel on Climate Change (IPCC). This, released in August 2021, highlighted that climate and meteorological events in the world are becoming more common and severe, as recorded in the Human Cost of Disaster Report issued in 2020 by the Centre for Research on the Epidemiology of Disasters (CRED) and The UN Office for Disaster Risk Reduction (UNDRR). In the case of floods, they increased from 1,389 occurrences in the period from 1980 to 1999, affecting 3.25 billion people, to 3,254 occurrences in the period from 2000 to 2019, affecting 4.03 billion people.

Based on this finding, it is no longer possible to ignore the fact that urban APPs,

particularly those categorized as water-based (river banks), and their existence/permanence, are increasingly necessary.

Only in 2001 the APPs were conceptualized as areas protected in the Brazilian legal framework, being ratified by Law No. 12,651, of May 25, 2012 (Native Vegetation Protection Law-LPVN) and their changes, having among their purposes to ensure the well-being of human populations, and precisely because they would be protected, contributing to a safer, resilient and sustainable city.

They reinforce this thought, Medeiros *et al* (2021, p. 8) when they refer to "the tragedies resulting from extreme climate events, registered every year in various regions of the country, point out that the protection conferred by the APPs is of utmost importance and relevance". For these authors, "urban lowlands and floodplains must be treated as special spaces of cities, implementing uses that can live with the dynamics of the waters, giving room for the rivers." In addition, these same authors continue, requires broad knowledge and participation of society, especially universities and research institutions and non-governmental organizations that work with this theme.

In the Amazonian city of Rio Branco, Acre, knowledge of water dynamics was considered more than fifty years ago in urban planning instruments. In the proposal of the city's first territorial physical organization, POFT - Law No.149, 1972, together with the Urban Development Master Plan, PDDU - Law No. 155, 1972, the so -called "protection gardens" were defined for the Acre River banks to constitute "a barrier of natural protection and pleasant to the continuous floods of the river, protect the housing zones and contribute positively to the urban landscape".

The dynamics of the city and its market model, making the land a merchandise, they left the protective gardens on paper. These planning instruments, elaborated to a ten -year horizon, so until 1982, they predicted nothing about the protection of the streams, such as BHISF, conforming only to the 1965 Forest Code.

With the Assumption in 1986 of the Rio Branco Urban Development Master Plan, PDDU (Law No. 611) and the Territorial Physical Organization Plan of the Municipality of Rio Branco (Law No. 612), The theme of the protection of streams has an important advance by reference to watersheds, including the Acre River and São Francisco stream, relating them to population growth and projections of urban perimeters.

In the current scenario of climatic extremes, it is clear the relevance of considering in the Master Plans of the municipalities the physiographic units of the watersheds, due to the severity and unpredictability of the effects that urban floods are taking, resulting from causal factors and causes, including those associated with extreme rainfall in a compromised natural drainage system and their "interactions with infrastructure associated with growing urban population, as well as with economic activities "(Nogueira *et al.*, 2021, p.17).

Thus, the 1986 Master Plan translated the perception of planners of the time into the Amazonian reality about the natural drainage system, where Amazonian rivers have a considerable breadth between water levels that occur at the apex of summer and rain periods, and this dynamic of water in city growth should be taken into account.

Thus, more than thirty years ago, this Master Plan predicted metrics more appropriate to the amazonian reality regarding water urban APPs than the Brazilian_Forest Code of 1965 provided for. Particularly, in the case of São Francisco stream, with 40 meters gutter, a 150-meter preservation range was established for each side of the rio course, and the creation of the Green Zone was defined with the reserve of 80 meters in the valleys, with the function among other rainwater flow.

This perception was also aligned with international work, sought years later by Metzger (2010), focusing on what the author considers the most demanding function of APPs: the conservation of biodiversity for the definition of minimal widths, with emphasis on riparian forests. In this respect, for the case of the Amazon, they pointed out these works, regarding the river margin APPs, which:

> - The widths from 140 to 190 m are necessary to be some similarity between the communities of small mammals and amphibians of serapequeira between linear forest elements and a continuous forest control area (Lima and Gascon, 1999 *apud* Metzger, 2010, p.2);
>
> - Throughout rivers they should maintain at least 200 m of forested area on each side of the river so that there is full conservation of biodiversity, necessary for species accumulation such as poultry and mammals (Lee and Peres, 2008 *apud* Metzger, 2010, p.2).

The motivation at the time for the São Francisco stream metrics was also because the city lacked large leisure and recreational areas. This plan included the need to create the Green Zone, with the reservation of a strip of 80 meters in the background backgrounds, with the function beyond the runoff of rainwater, enable the settlement of leisure, education, safety, care and community centers, as well as implementation of public leisure equipment.

The São Francisco stream flood, which took place on March 23, 2004, and the mobilizations in society, which culminated in the creation of APA São Francisco in 2005, functioned as motivators for the permanence of the stream preservation range metrics, then planned in the 1986 plan, in the one that succeeded it, the 2006 Master Plan (Law No. 1,611), approved on October 27.

This plan, built in the participatory model, for the purposes of territorial governance, was influenced by Law No. 7.803 of 1989, which amended the 1965 Forest Code, establishing the measurement of the permanent preservation range from the highest level of the river, most appropriate to the region.

Making the territorial cut for the São Francisco stream, with a width of 40 meters in its regular bed within the city, the 2006 Plan established that the *non aedificandi* strips along the rivers would coincide with the APPs of the Forest Code (concept introduced by MP 2.166-67/2001), and that the *non aedificandi* marginal strips along the São Francisco stream would be 150 meters on each side, until the preparation of the Environmental Recovery Plan (§ 2 of item II, Art. 78).

The aforementioned paragraph came to standardize the guidelines of the 1986 Master Plan, but establishing the *non aedificandi* marginal strips along the São Francisco stream this time with strong justification due to the flooding situation. The 2006 Plan pointed out the need for an environmental recovery plan due to the continuous degradation of the APPs and the flooding situation.

A flood control plan in a city or metropolitan region "must take into account the watersheds over which urbanization is developing" (Tucci and Genz, 1995, p.278). Tucci (1995, p.22) warned that the areas most affected by the construction of new housing upstream are the oldest ones, located downstream.

The municipality of Rio Branco, disregarding the advances made in its legislation and scientific warnings, backtracked on the rule in 2014 by enacting Law No. 2,100, of December 29, which relaxed the protection regime for native forests in the streams. Based on the 2012 Forest Code, it changed the metrics for water-based APPs, measuring them based on the regular riverbed, influencing the process of territorial governance. The situation was further aggravated by the removal from the text of the expression referring to the 150-meter *non aedificandi* marginal strips along the São Francisco stream, which became 50 meters.

This institutional action took place one year before discussions to begin reviewing the 2006 Master Plan, in which the mandatory 2014 municipal law, based on the controversial 2012 Forest Code, changed the protection regime for urban APPs on the banks of the São Francisco stream. By drastically reducing the size of water APPs, which was out of place in the Amazonian reality, it disregarded the fundamental role of these areas in protecting the climate, nature and the well-being of the population.

On January 2, 2015, the municipality issued Decree No. 002, instituting the review of the 2006 Plan. The preamble of this decree, different from the law imposed in 2014, called for the need to ensure a broad participatory process for the review of the Master Plan, effectively guaranteeing the democratic management of the city.

The participatory planning process was of little use, as Municipal Law No. 2,222, of December 26, 2016, was ratified, approving the new Master Plan for the Municipality of Rio Branco, endorsing the provisions of the 2014 Law.

It was established in the 2016 Plan that the *non aedificandi* strips along the watercourses will coincide with the APPs, in accordance with the 2012 Forest Code, that is, for the São Francisco stream, this strip would be 50 meters, reducing the dimension previously stipulated at 150 meters by the 2006 Master Plan. In this relationship between the environment and society, there is a worrying setback, given the unpredictability of the consequences due to the considerable loss of APPs, estimated at 5.6 km^2 in the urban part of the basin.

The complexity of the challenges posed by urban expansion and urban-environmental conflict, which local communities affected by floods continue to face, can be seen in the territorial reduction of riverbank APPs. While the 1989 Federal Law, which established the measurement of APP from the highest level of the river, positively influenced the 2006 Master Plan, the 2012 Brazilian Forest Code, which established the

measurement of APP from the regular riverbed, negatively influenced the 2016 Master Plan, demonstrating the sensitivity of the municipality to national decisions, even if they are contrary to local reality.

This controversy leads to territorial misgovernance and causes environmental setbacks, which can be explained locally by factors produced by society, such as institutional changes, changes in the legal framework and, above all, by pressure from interested sectors. In addition, years after the last flood in 2004, the scenario contributed to institutionalizing, in the 2016 Master Plan, the reduction of the protection zone of the native forest of the São Francisco stream, and carrying out its measurement in accordance with the 2012 Forest Code.

According to Tucci (2006, p.121), the Master Plan generally does not contain any restrictions on the occupation of areas at risk of flooding, and a sequence of years without flooding is sufficient reason for entrepreneurs to separate these areas for urban occupation.

The result of this setback in legislation contributed to increasing the losses caused by flooding events that occurred later.

Actions and their consequences for the city

Actions have future consequences for the city, in terms of habitability and sustainability of the urban environment and the well-being of the population, and also, according to the thinking of philosopher Hannah Arendt, of the unpredictability that arises directly from history which, as a result of the action, begins and is established as soon as the fleeting moment of the act passes (Hannat, 2007 *apud* Vicente and Martins Filho, 2015, p.139).

For seventeen years, from the summer of 2004 to the end of 2020, there were no urban flooding events in the São Francisco stream. The São Francisco APA area, created in 2005, which occupies around two-thirds of the basin, played an important role in this regard, both in terms of environmental preservation and flood mitigation, as well as in containing the city's expansion.

On the other hand, the growth of Rio Branco in the BHISF and outside the APA, the reduction of the limits of the APPs on riverbanks and the great challenge for humanity that climate change represents today, increased the greatest flooding of the São Francisco stream on March 23, 2023, two years after the 2021 event of much smaller proportions.

On this day, according to data from the Federal University of Acre's meteorological station, 173 mm of rain fell in just 12 hours, generating a flood that quickly affected 23 neighborhoods (the government estimated that 1,600 properties were affected). This volume of rain represented almost 62% of the average of 280 mm for the month of March, recorded over 20 years of measurement (from 2002 to 2021), or almost 40% of the 447 mm of rain that fell in March 2023. A query to the RBGeo digital registry system of the municipality of Rio Branco shows that the flooding in some neighborhoods reached a distance of 440 meters measured from the regular edge of the São Francisco stream.

In this scenario, there is growing concern about the risk of flooding and flash floods in urban areas in floodplains and areas bordering the stream, given the change in

the rainfall pattern. Extreme rainfall associated with urban occupation conditions in the BHISF are important factors in determining flooding events.

With respect to precipitation, it is necessary to analyze the volume and interval of precipitation. With respect to occupation, it is essential to analyze land use in hydrographic basins, on their most varied scales.

Heavy rain factor

The change in the pattern of heavy rain in BHISF and the flood of March 23, 2023, causing damage and losses to the population, prompted civil society to pressure the government to find a solution.

In this sense, the Government of Acre, in partnership with institutions,

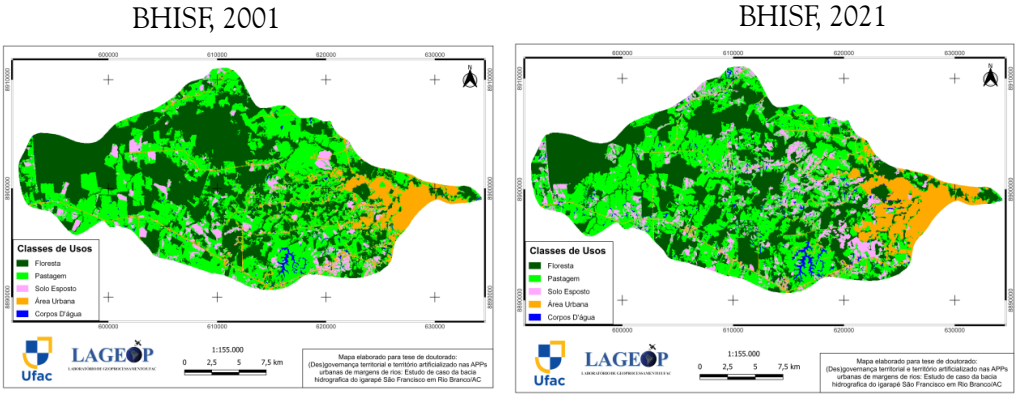
sent a Consultation Letter to the Ministry of the Environment in April 2023, entitled "Action Plan for Environmental Resilience, Risk Confrontation and Social Protection of Communities Living in the Igarapé São Francisco Hydrographic Basin in the State of Acre". This plan aims to restore the physical and environmental conditions of the BHISF, strengthening its resilience and capacity to perform ecosystem services, with actions to protect communities, families and urban and rural enterprises impacted by extreme events in the area covered by the Igarapé. With an estimated value of approximately R$780 million, it foresees the execution of actions, within a period of six years, articulated in three basic intervention components (environmental, urban and infrastructure, and economic and social), in addition to the fourth component that proposes the adoption of a robust governance system. In this, a Multi-institutional Governance Commission will be established to coordinate the plan, involving government, institutions and social representation of communities and organizations.

Occupation factor in the basin

Analyzing the changes in land use in BHISF in space and time, over the twenty-year period from 2001 to 2021, it can be seen that there was a 6.28% reduction in forest cover and a 2.42% growth in the city in the basin.

Figure 3 shows the image of land use and occupation in BHISF in 2002 and in 2021, produced at a scale of 1:155,000, and Table 1 records the differences that occurred. The city, which in 2001 occupied 7.06% of the basin, now occupies 9.48% in 2021.

Figure 3 – Map of land use and occupation in BHISF, in 2001 and 2021



Source: LABGEOP/Ufac, prepared for the author.

Table 1 – Land use and occupation by classes in BHISF, in 2001 and 2021

Class	Nomenclature	Area (ha) 2001	% Total area 2001	Area (ha) 2021	% Total area 2021	Difference
1	Forest	19.317,31	42,49%	16.460,83	36,21%	-6,28%
2	Pasture	19.219,71	42,28%	18.688,09	41,11%	-1,17%
3	Exposed Soil	3.196,90	7,03%	5.111,42	11,24%	4,21%
4	Urban Area	3.210,52	7,06%	4.308,88	9,48%	2,42%
5	Bodies of Water	517,20	1,14%	892,41	1,96%	0,83%
	Total		100,00%	45.461,64	100,00%	

Source: Elaborated by author.

With the creation of the APA in 2005, which has two thirds of the area of the BHISF, and making a cut of it for analysis of land use and occupation, in the period from 2005 to 2020, it was found that there was a reduction of 5.73% in forest cover and a growth of the city in the APA of 0.52%.

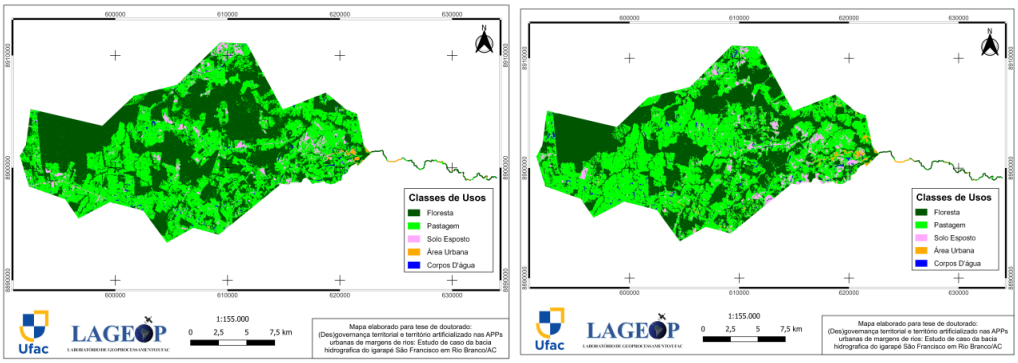
These data demonstrate greater preservation in the APA compared to the basin as a whole.

Figure 4 shows a cross-section of the image of land use and occupation in the APA in 2005 and 2020, produced at a scale of 1:155,000, and Table 2 records the differences that occurred.

These numbers demonstrate that the geostrategic action of creating the São Francisco APA favored environmental preservation and, consequently, the containment of

urban expansion.

Figure 4 – Map of land use and occupation in the APA, in 2005 and 2020



Source: LABGEOP/Ufac, prepared for the author.

Table 2 – Land use and occupation by classes in BHISF, in 2005 and 2020

Class	Nomenclature	Area (ha) 2005	% Total area 2005	Area (ha) 2020	% Total area 2020	Difference
1	Forest		49,41%	13.113,62	43,68%	-5,73%
2	Pasture	13.562,42	45,18%	14.984,59	49,92%	4,74%
3	Exposed Soil	1.298,48	4,33%	1.385,84	4,62%	0,29%
4	Urban Area	111,05	0,37%	265,80	0,89%	0,52%
5	Bodies of Water	215,54	0,72%	269,90	0,90%	0,18%
	Total	30.019,75	100,00%	30.019,75	100,00%	

Source: Elaborated by author.

According to information from the Government of Acre in 2022, the APA Management Council operates with 28 councilors, and one of the vectors of expansion in Rio Branco threatens and puts strong pressure on the area, such as the high-end Terras Alphaville development, started in 2020, which entered the APA.

Conclusion

Unlike the local geostrategic action of creating the APA São Francisco, which is essential, among other purposes, for the conservation of natural services of rainwater infiltration and flood mitigation in the urban part of the BHISF, the action of making the metrics of the APPs of the São Francisco stream more flexible, with a change in the

measurement regime - imposed by municipal law in 2014 and approved by the Participatory Master Plan of 2016, contributed to a disaster situation in the city of Rio Branco with the floods that occurred in 2021 and, especially, in 2023.

This flexibility, influenced by the 2012 Brazilian Forest Code, represented a setback for the riverbank APPs provided for in previous Master Plans, demonstrating the mistake made by disregarding the need and relevance of these areas for environmental and urban protection and the well-being of the population. The 2016 Master Plan, although carried out using a participatory model, was not innovative in and for the process of territorial governance.

Facing the challenge of the degradation of urban APPs on riverbanks requires local territorial governance that actively works to make urban space balanced and sustainable, given the controversial national legal framework for protecting native forests, which is out of place for the Amazon.

In the governance process, knowledge of the territory must advance, providing information to reinforce the need for a paradigm shift towards sustainable urbanism, and to achieve strategic goals for mitigating and adapting cities, especially due to the unpredictable scenario of disaster risks such as floods exacerbated by climate change.

In this way, the protagonism of civil society and the active participation of public authorities can result in active territorial governance, given the controversial legal framework for protecting native forests, implementing actions to prevent impacts in the face of risks and vulnerability, whether from flooding or environmental degradation in the basin.

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AMBIENTE & SOCIEDADE 25 anos 25 años 25 years

SciELO

Governança Territorial como Ativo Transformador para Áreas de Preservação Permanente de Margens de Rios

Alexandre Ricardo Hid

Resumo: A complexa questão da degradação das Áreas de Preservação Permanente (APPs) de margens de rios em bacias hidrográficas urbanas, sujeitas a inundações potencializadas pela mudança climática, deve ser enfrentada por uma governança territorial atuante. Este estudo objetiva mostrar que o arcabouço legal, como importante indutor no processo da governança territorial, pode influir na preservação ambiental da bacia frente ao crescimento urbano, mitigando a degradação e as inundações, contribuindo para o bem-estar das populações. Adotando-se como objeto empírico a bacia do igarapé São Francisco, na cidade Amazônica de Rio Branco/Acre, por meio de pesquisa documental histórica e análise espacial, mostra-se ação de preservação na bacia com a criação de uma APA, mas também ação contrária reduzindo as APPs, ambas com amparo legal. Conclui-se que é necessária uma governança territorial local atuante para tornar o espaço urbano equilibrado e sustentável, diante do controverso arcabouço legal de proteção da mata nativa.

Palavras-chave: Preservação ambiental; Bacia urbana; Amazônia; Planejamento e governança; Conflito urbano-ambiental.

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Tema em destaque: Amazônia

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SciELO

La Gobernanza Territorial como Activo Transformador de las Áreas de Preservación Permanente en las Riberas de los Ríos

Alexandre Ricardo Hid

Resumen: El complejo problema de la degradación de las Áreas de Preservación Permanente (APP) a lo largo de las riberas de los ríos en las cuencas urbanas, sujetas a inundaciones exacerbadas por el cambio climático, debe ser abordado por una gobernanza territorial activa. Este estudio tiene como objetivo demostrar que el marco legal, como un importante impulsor de la gobernanza territorial, puede influir en la preservación ambiental de la cuenca frente al crecimiento urbano, mitigando la degradación y las inundaciones, y contribuyendo al bienestar de la población. Utilizando la cuenca del arroyo São Francisco en la ciudad amazónica de Rio Branco, Acre, como objeto empírico, la investigación documental histórica y el análisis espacial demuestran tanto los esfuerzos de preservación en la cuenca con la creación de una APA, pero también contramedidas, como la reducción de APP, ambas con respaldo legal. La conclusión es que la gobernanza territorial local activa es necesaria para que el espacio urbano sea equilibrado y sostenible, dado el controvertido marco legal para la protección de los bosques nativos.

Palabras-clave: Áreas de preservación. Orilla del río. Amazonas. Gobernanza territorial. Planificación y gestión. Conflicto urbano-ambiental.

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