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Watershed as a scale of planning and community governance: the case of the Tiburtino stream in São Paulo

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Bacia hidrográfica como escala de planejamento e governança comunitária: o caso do córrego Tiburtino em São Paulo

RESUMO

A bacia hidrográfica como recorte de planejamento territorial e de governança comunitária é o tema abordado neste artigo. Nele propõe-se uma reflexão sobre o processo de formação e consolidação do Movimento Preserve a Praça São Crispim e do Subgrupo Drenagem Sustentável do Córrego Tiburtino com Soluções Baseadas na Natureza do CADES Lapa, bem como das ações que possibilitaram a construção de um conjunto de diretrizes para o plano de drenagem para a bacia, em elaboração pela prefeitura, a partir de ações técnico-políticas e do conhecimento empírico dos moradores. A metodologia percorre as seguintes etapas: revisão da literatura especializada; caracterização urbanística da bacia do Tiburtino e do histórico dos movimentos sociais atuantes na área; análise da legislação, de planos urbanos e de acordos municipais firmados; sistematização de dados respectivos às ações realizadas pela sociedade civil; sistematização das sugestões para um plano de drenagem sustentável para a bacia do Tiburtino. Como objetivos, este estudo procura traçar uma linha histórica do movimento social de proteção da praça São Crispim e lançar diretrizes de intervenção urbana para a implantação de um sistema de Soluções baseadas na Natureza (SbNs), incluindo Sistemas de Drenagem Sustentável (SuDS). Pretende-se assim, indicar caminhos para a adaptação das cidades e a mitigação dos efeitos das mudanças climáticas no sentido do aumento da resiliência urbana, ambiental e hídrica orientada pelos objetivos de desenvolvimento sustentável.

PALAVRAS-CHAVE: Soluções baseadas na Natureza (SbN). Sistemas de Drenagem Sustentáveis (SuDS). Mudanças Climáticas.

Watershed as a scale of planning and community governance: the case of the Tiburtino stream in São Paulo

ABSTRACT

This paper delves into the integration of watershed management into territorial planning and community governance, focusing on the evolution of the São Crispim Square Preservation Movement and the Subgroup for Sustainable Drainage of the Tiburtino Stream with Nature-Based Solutions within CADES Lapa. It also examines the processes leading to the formulation of guidelines for a prospective drainage plan for the basin, drawing from both technical-political initiatives along with the experiential knowledge of residents and stakeholders. The methodological framework encompasses a literature review, urban characterization of the Tiburtino basin, synthesis of key steps in local social movements, examination of relevant legislation and urban plans, compilation of civil society actions, and categorization of recommendations for the development of a sustainable drainage plan. The outcome offers a historical account of the social movement advocating for São Crispim Square's preservation and introduces possible urban intervention guidelines for implementing Nature-based Solutions (NbSs) in the Tiburtino basin, including Sustainable Drainage Systems (SuDS). This attempt aims to guide cities in adapting to and mitigating the impacts of climate change, promoting urban, environmental, and water resilience in alignment with sustainable development objectives.

KEYWORDS: Nature-based solutions (NbS). Sustainable Drainage Systems (SuDS). Climate Change.

Cuenca hidrográfica como escala de planificación y gobernanza comunitaria: el caso del arroyo Tiburtino en São Paulo

RESUMEN

La cuenca hidrográfica como enfoque para la planificación territorial y la gobernanza comunitaria es el tema abordado en este artículo. Se propone una reflexión sobre el proceso de formación y consolidación del Movimiento Preserve la Plaza São Crispim y del Subgrupo de Drenaje Sostenible del Arroyo Tiburtino con Soluciones Basadas en la Naturaleza del CADES Lapa, así como las acciones que permitieron la construcción de un conjunto de directrices para el plan de drenaje de la cuenca, en elaboración por parte del ayuntamiento, basadas en acciones técnico-políticas y el conocimiento empírico de los residentes. La metodología recorre las siguientes etapas: revisión de la literatura especializada; caracterización urbanística de la cuenca del Tiburtino y del historial de los movimientos

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sociales activos en la zona; análisis de la legislación, de los planes urbanos y de los acuerdos municipales firmados; sistematización de datos relativos a las acciones realizadas por la sociedad civil; sistematización de sugerencias para un plan de drenaje sostenible para la cuenca del Tiburtino. Como objetivos, este estudio busca trazar una línea histórica del movimiento social de protección de la Plaza São Crispim y proponer directrices de intervención urbana para la implementación de un sistema de Soluciones Basadas en la Naturaleza (SbN), incluyendo Sistemas de Drenaje Sostenible (SuDS). Así, se pretende señalar caminos para la adaptación de las ciudades y la mitigación de los efectos del cambio climático con el objetivo de aumentar la resiliencia urbana, ambiental e hídrica, orientada por los objetivos de desarrollo sostenible.

PALABRAS CLAVE: Soluciones Basadas en la Naturaleza (SbN). Sistemas de Drenaje Sostenibles (SuDS). Cambio Climático.

1. INTRODUCTION

This paper addresses the utilization of watershed as a scale for territorial planning and community governance and proposes an examination of the organizational and consolidative processes within the Preserve the São Crispim Square Movement and the Subgroup Sustainable Drainage of the Tiburtino Stream with Nature-Based Solutions of CADES Lapa (Council for the Environment, Sustainable Development and Culture of Peace). Furthermore, it suggests a framework to support a drainage plan for the basin, incorporating the preservation of green areas, grounded in technical-political initiatives and community perspectives.

The inception of the Preserve São Crispim Square Movement emerged in late 2019 following the revelation of a municipal project by the city hall proposing a Rainwater Reservoir (RAP), to be constructed on a century-old square adorned with trees in the Vila Ipojuca neighborhood of Lapa, São Paulo. Subsequently, a popular movement materialized within the neighborhood, bolstered by the engagement of professionals from various fields including architecture, engineering, biology, administration, and law, among others. This coalition, alongside artists, researchers, educators, residents, and local merchants, initiated dialogues concerning alternative drainage initiatives for the area, alongside advocating for the preservation of green spaces and the Tiburtino stream traversing the square. At the time, it was noted the necessity to consider the hydrographic basin as a whole entity and to harness both the technical as well as empirical knowledge of residents to propose alternative solutions beyond the rainwater retention reservoir.

Following a sequence of meetings, the collective advocating for the preservation of the square petitioned the Lapa Subprefecture and CADES LAPA, prompting an extraordinary assembly, where the request was acknowledged. Consequently, the formation of a Working Subgroup (WG) ensued, tasked with deliberating the viability of integrating sustainable drainage systems and other Nature-Based Solutions (NBS) within the Vila Ipojuca locality. This initiative prioritized the conservation of green spaces and watercourses as a counterproposal to the São Crispim Rainwater Reservoir (RAP) project.

Effective rainwater management, particularly amidst the context of climate change, is not just important but also an urgent necessity. In this context, reevaluating the traditional model of urban drainage infrastructure becomes a focal point in urban discourse. The prevalence of impermeable surfaces in urban areas, among other factors, fosters urban heat islands that disrupt the pattern of rainfall, exacerbating the social vulnerability of local

settlements due to the altered intensity, concentration, and frequency of precipitation. While commonly perceived as natural disasters, it is imperative to acknowledge that these events are socially constructed, and can thus be anticipated, planned for, and mitigated (ACOSTA, 2019).

In this context, it is essential to consider the rapid urbanization process experienced by São Paulo, which has resulted in significant levels of watershed impermeability. This phenomenon has led to a rise in both the quantity and speed of surface runoff (CANHOLI, 2005; TUCCI, 2006). Moreover, this issue has been exacerbated by alterations to streambeds, channelization of waterways, diminished vegetation coverage, and modifications to the topography of valleys and floodplains (GUTIERREZ, RAMOS, 2017).

Confronted with these challenges, a paradigm in urban planning emerges, aiming to leverage the attributes of natural drainage systems to alter, adapt, or rehabilitate built environments, termed as Nature-based Solutions (NBS). NBS encompass strategies inspired by or derived from natural ecosystems, such as Green-Blue Infrastructure (GBI) and Sustainable Drainage Systems (SuDS). These approaches aim to intelligently and efficiently integrate natural solutions with conventional methods, capitalizing on existing environmental features, systems, and materials, while also maximizing resource utilization to address environmental, social, and economic challenges. Such practices attempt to concurrently promote human well-being and environmental benefits and can complement traditional solutions (LIMA et al., 2023).

The city of São Paulo presents considerable potential for the implementation of Sustainable Drainage Systems (SuDS), Green-Blue Infrastructure (GBI), and other Nature-based Solutions (NBS), integrating both existing infrastructures and traditional methods. At the municipal level, São Paulo is a signatory to the C40 Pact, which endeavors to tackle the imperative of constructing a resilient city. This entails ensuring equitable access to sustainable water and sanitation management, safeguarding and rehabilitating water-related ecosystems and the urban environment. Moreover, the city commits to implementing sustainable urban drainage systems to safeguard against floodwater inundation.

The utilization of Nature-Based Solutions (NBS) is recommended in strategic documents such as the Municipal Plan for Protected Areas, Green Areas, and Open Spaces (PLANPAVEL 2022), as well as in the revision of São Paulo's Strategic Master Plan (PDE) under Law 17,975/23. The Municipality of São Paulo's Climate Change Policy, as stipulated in Law No. 14,933/2009, mandates the implementation of municipal climate change initiatives with a focus on promoting afforestation of public roads and sidewalks, expansion of permeable surfaces, and preservation and restoration of drainage areas. However, despite these recommendations, their practical implementation remains limited.

Following its endorsement, PlanClima SP - the Climate Action Plan of the Municipality of São Paulo (Decree No. 60,289/2021) was developed, delineating strategies to adapt the city for the future, with a particular focus on augmenting the utilization of Nature-based Solutions (NBS) in drainage infrastructure projects (action 23), as well as overseeing the implementation of the Clean Stream Program (action 26), alongside other initiatives geared towards environmental preservation within the urban landscape. Furthermore, the Municipal Policy for Water Security and Water Management (Law No. 17,104/19) is committed to various aspects of water management, including protection, preservation, conservation, recovery, and provision of public services pertaining to water resources and related areas of interest within the

municipal territory. At the federal level, the Federal Constitution (articles 30 and 225) delineate the responsibilities of both government entities and the broader community in safeguarding the environment for the benefit of present and future generations.

Meanwhile, the sanitation policies and solutions outlined in the maps of the Strategic Master Plan (PDE) revision plan (Map 12) largely mirror the conventional approach of implementing grey infrastructure, such as large underground impermeable rainwater reservoirs, often situated within public squares. Essentially, despite the existence of a robust legal framework, encompassing plans, agreements endorsed by the Municipality of São Paulo, as well as federal and state governments, alongside national policies and international accords, which are the culmination of collective deliberations and efforts aimed at fostering urban resilience, there persists a challenge for public administration to adopt design practices commensurate with the contemporary environmental imperatives. This challenge is underscored by the absence of Nature-based Solutions (NbSs) in the São Crispim reservoir project presented in 2019, and their limited adoption within the city.

Goal number 6, focusing on Drinking Water and Sanitation, is among the SDGs (Sustainable Development Goals) defined by the UN for 2030. These goals function as a framework directing worldwide social, economic, and environmental policies, aims to ensure the availability and sustainable management of water and sanitation for the global population. Additionally, it seeks to enhance water quality by reducing pollution and significantly increasing recycling and safe reuse practices globally. Furthermore, this SDG emphasizes the protection and restoration of water-related ecosystems, such as forests, rivers, aquifers, and lakes, alongside fostering international cooperation and support, as well as strengthening the involvement of local communities to enhance water and sanitation management.

In the case of São Crispim and the Tiburtino basin, popular participation has been attentive and active, leading to significant strides in the formulation of a sustainable urban policy for managing the area's water resources. This level of engagement can be elucidated through the concept of socio-technical transition, as delineated by Travassos and Schult (2013). It refers to profound structural changes in systems that reconfigure technological, political, infrastructure, scientific knowledge, and social and cultural practices. A multilevel perspective, developed in different scales, serves as a framework for comprehending the process of socio-technical transition (GEELS and SCHOT, 2007; GEELS, 2019).

In this scenario, this paper aims to contribute to the discussion on the utilization of the watershed as a space for territorial planning and governance, with the objective of paving new, more sustainable paths for urban drainage infrastructure, thereby aiding in the mitigation of the effects caused by the risk of natural disasters. Consequently, the research endeavors to provide instruments of urban resilience (MERROW; NEWELL, STULTS, 2016), aligning itself with the United Nations Sustainable Development Goals. Specifically, it focuses on sustainable water and sanitation management, the pursuit of a secure, resilient, and sustainable habitat, and concerted efforts in combatting climate change. The aim is for this research to contribute to the formulation of public policies at the watershed scale, underpinned by the belief that the amalgamation of scientific methodologies and social engagement can catalyze genuine transformative processes.

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2. OBJECTIVES

The main objective of this paper is to engage in reflection on the adoption of the watershed as a focus of urban planning and governance, as well as the relevance of community actions in the construction of sociotechnical knowledge for the launch of environmental planning and urban drainage guidelines, with emphasis on the case of the Tiburtino stream basin.

The specific objectives include providing a brief urbanistic characterization of the area, constructing a historical timeline of movements and actions for the preservation of São Crispim Square, analyzing urban plans, laws, and agreements concerning drainage, water resources, and afforestation, systematizing and mapping suggestions for drainage solutions for the Tiburtino basin proposed by social movements as an alternative to the construction of the São Crispim Square Rainwater Reservoir, with the aim of implementing a sustainable drainage system as a complement to traditional infrastructures.

3. METHODOLOGY

For the development of this work, a set of methodological procedures was adopted, which include:

(i). Review of the specialized literature on river basins as a unit of planning and territorial governance;

(ii). Characterization and urban study of the Tiburtino basin, based on on-site visits, photographic documentation, and conversations with community leaders and residents; production and analysis of maps of land use and occupation, system of green areas, hypsometry and water bodies, elaborated from the survey of data such as satellite images, historical maps and official cartographic bases, such as the Geosampa platform, through the use of software such as QGIS and its complements;

(iii). Tracing the historical course of popular involvement in the activities of community and institutional movements;

(iv). Analysis of urban plans such as PLANPAVEL (2022), Strategic Master Plan of the Municipality of São Paulo (2023) and of the project of São Crispim Square RAP (HidroStudio/SIURB/FCTH), as well as other laws and agreements;

(v). Systematization of data regarding the initiatives of the movements advocating for the preservation of the square and the Working Group (WG), which aimed to reinforce a community governance network grounded in interinstitutional collaboration and a spectrum of activities, ranging from clean-up campaigns, breakfast gatherings, mural painting to signify the subterranean presence of rivers, and discussion circles. These initiatives have been ongoing since 2019 (Table 1);

(vii). Systematization of solutions suggested by the community for the development of a sustainable drainage plan for the studied watershed, with a focus on sustainable drainage systems (SuDS) and other Nature-based Solutions (Table 2).

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4. RESULTS

4.1 The watershed as a scale of planning and governance within the Tiburtino stream basin

The watershed constitutes a natural boundary of the topographic relief in relation to the hydrological cycle, delineating the effective area for surface water runoff of both perennial water sources - springs, streams, and rivers, and temporary ones – and rainwater. From the perspective of urban studies, watersheds represent a complex and multifaceted issue that encompasses a multitude of scales observable in the territory (SCHUTZER, 2012; AMÉRICO-PINHEIRO, BENINI, 2019). They are considered within as the fundamental unit of analysis for the development of both structural and non-structural actions and measures aimed at integrating water resources management and environmental management. Therefore, its strategic significance arises from the fact that all water resource management is structured based on this conditioning and delimitation.

In Brazil, this territorial delineation was established by the National Water Resources Policy, enacted through Law No. 9433 on January 8th, 1997, where basins are delineated from watersheds and enable a comprehensive analysis of environmental, social, and economic elements, and interrelationships based on existing demands and resources within their boundaries, as well as external influences (CARVALHO, 2020).

In the Tiburtino stream basin, a tributary of the Tietê River situated in the West Zone of the city of São Paulo, there is a burgeoning social movement advocating for the preservation of São Crispim Square, where the construction of a Rainwater Reservoir (RAP) is planned. This reservoir was initially proposed in a 2007 project by the Secretariat of Urban Infrastructure (SIURB), which was further endorsed by the revision of the 2023 Strategic Master Plan (PDE). Concurrently, this movement is working alongside the development of a Drainage Notebook or Plan by SIURB/FCTH, slated for release this year (see Figure 1).

The Tiburtino stream originates from a collection of approximately seven springs and three tributaries, beginning in the highest part of the Lapa neighborhood, near Cerro Corá Avenue. It flows for 3.5 km before discharging into the Tietê River, with its channeling initiated in 1947. The stream's path is intersected by two railway lines linking the interior of the state to the port of Santos. This intersection is prone to frequent flooding, causing significant inconvenience to public transport users, merchants, and visitors to the Lapa Market. These occurrences highlight the inadequacy of the existing drainage system and the necessity for new interventions. Downstream from the Lapa Market, in the Lapa de Baixo region, the urbanization pattern adheres to a traditional layout. Land usage is mixed, and green spaces are limited. The land occupancy is diverse, with numerous industrial warehouses present. Upstream, in the area surrounding the springs, street layouts follow a more organic pattern, conforming to the pronounced relief and contour lines. This area encompasses the Vila Ipojuca neighborhood, characterized by ample green spaces and well-forested squares, such as São Crispim and Otávio Perez Velasco, constituting a predominantly horizontally developed residential zone (see Figure 2).

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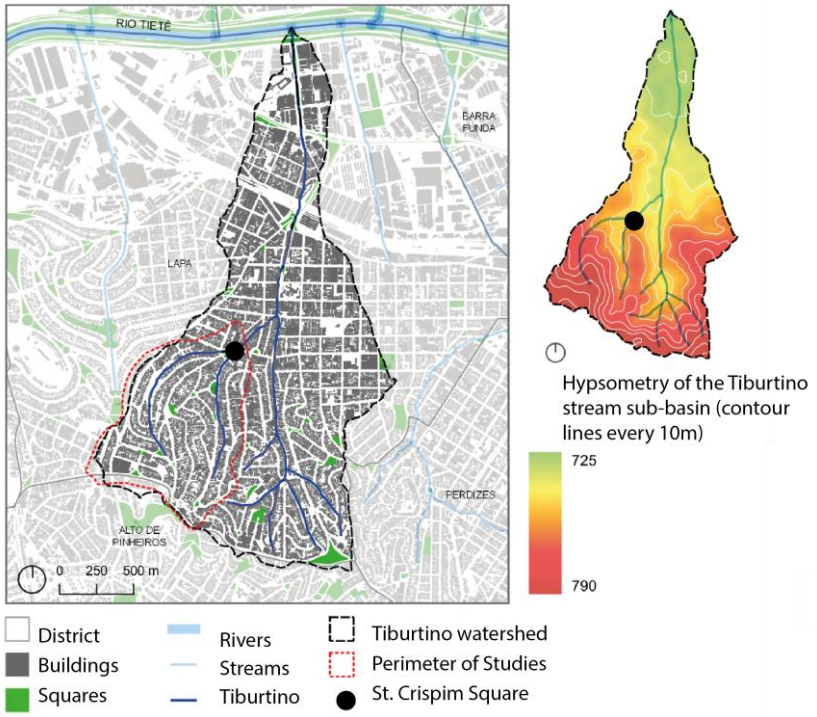
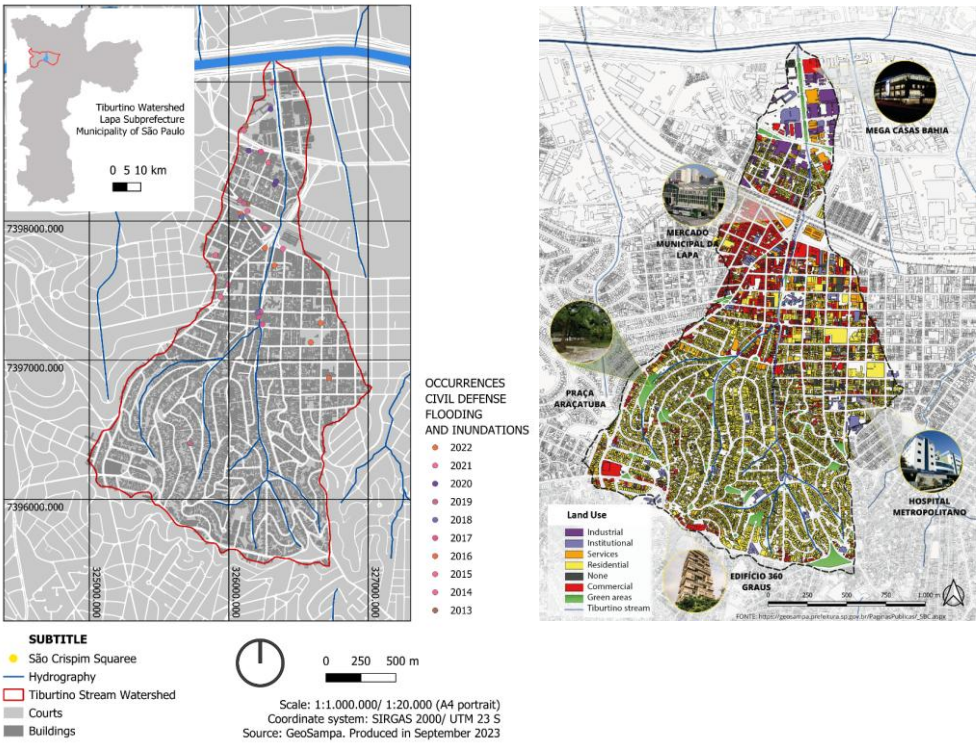
Figure 1 – Study area location



Prepared by the authors based on data from Geosampa (2022)

Figure 2 – Hydrography and Land Use in the Tiburtino Basin Area



Source: Compiled by the authors; and by students Tiago Domingos, Bianca Santos, Patrícia Maziero, Francine Garcia, and Thabata Proença, utilizing data from Geosampa 2023 and information gathered on-site

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São Crispim Square is a green space nestled in the heart of Vila Ipojuca, situated at the confluence of two tributaries of the Tiburtino Stream. Originally conceived as a garden area, it forms part of a network of green spaces within a residential subdivision, serving its social and environmental role as a community gathering spot and hub for civic activities (see Figure 3). However, the square faces a looming threat posed by the proposed construction of a rainwater reservoir. With an estimated volume of approximately 28,000 m³, the implementation of this reservoir is projected to result in significant environmental, landscape, and social impacts. These include the removal of existing vegetation cover, heightened soil waterproofing, and substantial alterations to the natural drainage system.

Another inconsistency of the reservoir project lies in the fact that while it may store a portion of the water volume that could reach the market area, it also poses the risk of accumulating sediments and debris, leading to issues of unsanitary conditions. This has been observed in numerous locations throughout the city where similar reservoirs were implemented, contradicting the desires of the local population.

Figure 3 - São Crispim Square

Source: Google Earth satellite image (2022); Photo by the authors (2020)

The São Crispim Square reservoir project is grounded in the need to address the recurring flooding issue that often affects the region surrounding the Lapa Municipal Market. Despite the severity of the problem, there is a belief in the existence of alternative solutions integrating gray, green, and blue infrastructures. Another approach involves enlarging the cross-sectional area of the culverts that channel the stream beneath the railway tracks, which currently act as a physical barrier to the natural course of the Tiburtino stream and surface waters. While the project anticipates the duplication of culverts, it lacks any innovations that contribute to the capture of greenhouse gases, mitigating water velocity, or facilitating tree planting to establish the desired green corridor.

The failure to recognize the existence of a 400-meter-long sanitary pathway, measuring approximately 5 meters wide, connecting São Crispim Square to Dr. Otávio Perez Velasco Square, highlights the lack of recognition of the environmental potential of the area during the planning of the swimming pool project, as well as the absence of consultation with the local community.

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4.2 The São Crispim Square Preservation Movement and its demands

The São Crispim Square Preservation Movement was initiated in late 2019, following the approval of a decree by the São Paulo City Hall. This decree allowed for the construction of various rainwater reservoirs in city squares, financed and managed by Public-Private Partnerships (PPPs), including one in São Crispim. The project stipulated a 33-year concession of the square to a private entity. The construction of reservoir would necessitate the destruction of 3,000 square meters of green space, including the removal of tree cover and the waterproofing of the subsoil. In response to this, a collective of residents, users, and supporters rallied in defense of preserving the square. They proposed requalification and expansions to the square and established a Whatsapp group and pages on Instagram and Facebook as primary communication channels for the movement. These platforms have since become crucial for the group's coordination and outreach efforts.

The movement initially took shape under the banner of Sustainable Ipojuca. Its primary objective was to foster community-driven, collective actions that would lead to the implementation of sustainable public policies. These policies were grounded in the principles of the Earth Charter, the Sustainable Development Goals, and various municipal, state, and federal laws that were both planned and advocated for by civil society.

Furthermore, the movement aimed to facilitate the establishment of green and blue infrastructures (also known as GBI) in the vicinity of São Crispim Square. The goal of these frameworks was to enhance the infiltration of rainwater, thereby mitigating and preventing flooding in the region. These objectives continue to serve as the guiding principles for the collective's actions.

The inaugural assembly of the movement advocating for the preservation of São Crispim Square was convened on December 7, 2019. The invitation to this gathering was disseminated through verbal communication by residents and via social media platforms. After this initial meeting, the movement has undertaken numerous initiatives, encompassing square clean-up, participation in academic seminars by member of the group, and attendance at public hearings. These endeavors have been systematically documented in chronological sequence in Table 1.

The construction project for the São Crispim RAP experienced a period of stagnation but was revived by SIURB in 2022 and incorporated into the Emergency Flood Control Plan. This occurred notwithstanding the extensive social mobilization that transpired between 2019 and 2020. In response to this development, the movement advocating for the protection of the square sought assistance from CADES Lapa. An extraordinary meeting was convened in November 2022, marking a pivotal juncture as it led to the approval for the formation of a working group to explore sustainable drainage strategies for the Tiburtino watershed, with a focus on Nature-Based Solutions. This initiative facilitated a platform for technical dialogue and knowledge exchange between residents and technicians. The aim was to generate alternative proposals to the reservoir project and to incorporate community suggestions into the Lapa Drainage Booklet, which is currently under preparation by SIURB/FCTH. This approach underscores a commitment to community engagement and the exploration of innovative sustainable solutions.

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Table 1 - WG activity history

DATE	ACTIVITY	CHARACTER
December 7th, 2019.	First Conversation Forum for the preservation São Crispim Square	Communal
December 10th, 2019.	Educational actions for socially vulnerable children in Lapa	Interinstitutional
December 13th, 2019.	Public Hearing for the Preservation of São Crispim Square	Technician
December 17th, 2019.	Second round of conversation for the Preservation of São Crispin Square	Communal
January 11th, 2020.	Conversation circle between residents and guests at São Crispim Square	Communal
January 18th, 2020.	Article published in *Jornal da Gente* edition 897	Interinstitutional
February 1st, 2020.	Community Picnic and maintenance of São Crispim Square	Communal
February 2nd, 2020.	Third round of conversation with the presence of the movements Save the Rio dos Campos Square and Pompeia without Fear	Interinstitutional
February 19th, 2020.	CADES LAPA Ordinary Meeting	Technician
February 22nd, 2020.	Coffee in the square and interview - MPSC - Rede Cidade SP/ Lapamix	Interinstitutional
March 1st, 2020.	Workshop to the protest poster for the event at the Municipality	Communal
March 4th, 2020.	Event at the Municipality of São Paulo	Technician
March 15th, 2020.	Fourth Conversation Circle	Communal
September 20th, 2020.	Collective effort to clean the Square carried out during the Covid-19 pandemic	Communal
September 18th, 2021.	Fifth Conversation Circle	Communal
November 11th, 2021.	Community maintenance of São Crispim Square	Communal
November 29th, 2022.	Meeting of the Movement for the Preservation of São Crispim Square and SIURB - First suggestion for the formation of the WG	Technician
January 18th, 2023.	Date of approval of this WG at the Ordinary Meeting of CADES LAPA	Technician
February 11st, 2023.	Sixth Conversation Circle	Communal
February 13th, 2023.	Whatsapp Group Creation for the WG	Communal
February 18th, 2023.	First Meeting of the WG	Technician
February 25th, 2023.	Second Meeting of the WG	Technician
March 9th, 2023.	Third Meeting of the WG	Technician
March 14th, 2023.	Fourth Meeting of the WG	Technician
March 25th, 2023.	Fifth Meeting of the WG	Technician
April 1st, 2023.	Sixth Meeting of the WG	Technician
April 6th, 2023.	Seventh Meeting of the WG	Technician
April 15th, 2023.	Community café in São Crispim Square	Communal
April 25th, 2023.	Meeting of the WG with SIURB and SVMA	Technician
May 13th, 2023.	Eighth Meeting of the WG	Technician
June 26th, 2023.	Ninth Meeting of the WG	Technician
July 17th, 2023.	Tenth Meeting of the WG	Technician
August 1st, 2023.	Meeting with the SVMA	Technician
September 18th, 2023.	Field visit with FCTH technicians	Technician

Source: prepared by the authors, 2023

The establishment of this WG, affiliated with the Water and Afforestation Working Group (WG), was formally recognized at a CADES Lapa assembly in January 2023. Following a six-month period of comprehensive studies, discussions, research, involvement in seminars, public consultations, internal gatherings, both in-person and virtual meetings, interactions with

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the local community, municipal technicians, and fellow CADES LAPA members, the WG has compiled a series of findings. These discoveries pertain to the urban-environmental facets of the Tiburtino basin and the principles of Nature-based Solutions, specifically in the vicinity of São Crispim Square. These outcomes were the result of a collective effort by the community.

The group's initiatives also encompassed involvement in public hearings, email correspondence, and the drafting of public declarations in relation to the public consultation for the development of the Lapa Drainage Plan. Additionally, they engaged in the creation of a collaborative framework, wherein movement members could highlight significant territorial aspects. They also proposed suggestions for the deployment of sustainable drainage mechanisms and alternative locations for the RAP, should its construction be deemed unavoidable (figures 4 and 5).

Figure 4 – Conversation Circle in São Crispim Square

Source: photo by authors, 2020 and 2023

Figure 5 – Meetings of the working group with technicians with the community, SIURB and SVMA

Source: photo by authors, 2023

4.3. Drainage devices for the Tiburtino basin

The Working Group's (WG) primary accomplishments include the suggestion of alternative drainage mechanisms as a substitute for the rainwater reservoir at São Crispim square. These alternatives were proposed after an urban analysis of the neighborhood, conducting meetings, creating mappings and reports, compiling photographic records, constructing a model, and systematizing the suggestions put forth by the residents of Lapa, Vila Ipojuca, and nearby areas. The proposals were categorized into five groups (as shown in Chart 2), each corresponding to a specific type of drainage solution (Figure 6).

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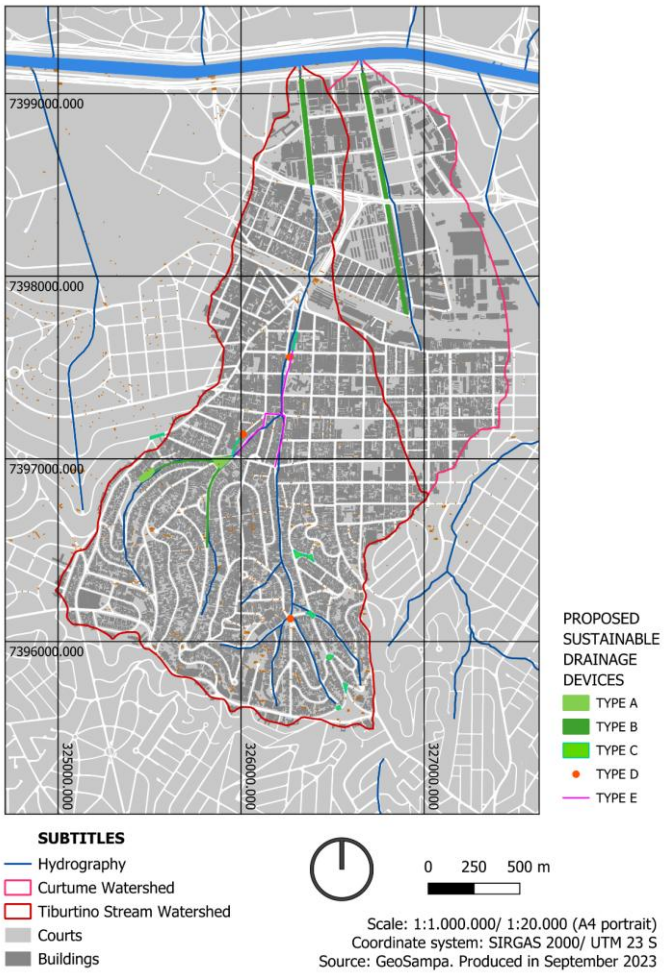
Table 2 – Sustainable drainage devices

GROUP	TYPES	MAIN FEATURE
A	Afforestation and landscaping; rain gardens; Draining floors	Increase in areas with an optimized evapotranspiration (biomass) and infiltration (soil) index
B	Green Corridors and rewilding/decapping of streams	Connection of green areas, which favors the protection of biodiversity and the circulation of wildlife, creating dispersal routes that reduce isolation between fragments
C	Bioswales, trenches, bioretention basins	Increased filtration, retention and treatment at source; reduction of investments in water transport; increased investments in quality retention; not overloading drainage channels in rainy weather. They prevent the contamination of rainwater by urban runoff, reducing the processes of carryover and erosion
D	Rainwater micro-reservoirs	Distribution of retention volumes, constituting more discreet devices with less local environmental impact
E	Stormwater culverts	The new technologies available on the market meet the current ASTM F2787 and NCh 3352 standards, and consist of new solutions for the management and control of stormwater used to infiltrate rainwater, helping to recharge groundwater water resources

Source: prepared by the authors, 2023

Figure 6 – Proposal for sustainable drainage systems for the study area



Source: Prepared by the authors, 2023

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These proposals need to be detailed and submitted to hydrological calculations. However, they were favorably acknowledged during an initial assembly conducted amongst the Working Group members and technicians from SIURB/FCTH.

CONCLUDING REMARKS

The reevaluation of the conventional urban infrastructure paradigm, with a particular emphasis on drainage and sustainable sanitation systems, is increasingly becoming a focal point in urban debate. Within this context, technical knowledge about the possibilities of combining gray infrastructure networks with green and blue infrastructures is expanding. This integration offers a promising prospect for envisioning future urban landscapes that are not only greener and bluer, but also more vibrant and human centric.

Within this framework, the directive for adopting the hydrographic basin as a focal point in urban planning and governance is reinforced. This approach underscores the significance of community involvement in the development of sociotechnical knowledge, which is instrumental in formulating guidelines for environmental planning and urban drainage. This represents an alternative to the traditional government-centric decision-making process. In the case of the Tiburtino basin, this methodology has empowered the community to gain a deeper understanding of the most pertinent environmental and urban elements of the area, such as the dynamics of rainwater and river flows. Furthermore, it has enabled the community to propose alternative solutions to those previously put forth by the municipal government.

The development of the historical narrative of civil society movements in the region has facilitated the understanding that community initiatives have bolstered the process of territorial and environmental governance. These initiatives have gained increased significance and influence by aligning with a participatory council such as CADES Lapa and by establishing a communication channel with the city hall's technical staff. This approach aims to incorporate the empirical knowledge and aspirations of the residents who are most affected by drainage works. It was also discovered that these initiatives serve as a potent supplementary tool for planning alternatives to the conventional model, and they distribute the possibilities and responsibilities of decision-making and the creation of territorial plans. In this study, the WG concluded that the solution proposed by SIURB, if implemented, would not solve the recurrent flooding in the Lapa Market region. It was observed that the proposed reservoir timidly faces the issue of the transposition of the stream over the railroad located on the banks of the market.

Moreover, the examination of plans, statutes, and accords pertaining to drainage systems, water resources, and the conservation of urban ecosystems, endorsed by the Municipality and the Federal and State governments, reveals significant challenges faced by public sector organizations. These challenges are particularly evident in the implementation of public policies that adopt design practices in line with the demands of a paradigm shift towards sustainable drainage projects in the city of São Paulo.

Although Nature-Based Solutions are recognized and advocated by municipal plans, the actual implementation of drainage works in São Paulo has limited engagement with its territorial matrix. This often results in substantial environmental, landscape, and social impacts, and in many instances, does not fully resolve the issue of flooding. This urban culture

necessitates a reevaluation. The removal of tree masses for the construction of reservoirs should not be viewed as a solution, given the city's extensive impermeable areas. Instead, green spaces should be expanded and considered as adjuncts in urban drainage. Other public squares in the city, such as Rio dos Campos in Pompeia neighborhood, have also been selected for the construction of grey reservoirs, which should be reassessed in plans. For the Tiburtino basin, it is recommended that the Nature-Based Solutions (NBS) system be thoroughly examined and validated using calculations and hydrological models.

In conclusion, this study asserts that it is possible to solve the problems of floods by taking advantage of the territorial, environmental natural infrastructures as a support and alternative to traditional gray ones and emphasizes the enhancement of the potential of tree masses, rainwater, and river water. Furthermore, it is necessary to consider the recommendations of the local community. These actions can contribute to strengthening urban, environmental, and water resilience, aligning with the globally established Sustainable Development Goals.

REFERENCES

ACOSTA, V. G. Unnatural Disasters and the Anthropocene: lessons learnt from anthropological and historical perspectives in Latin America. In Gugg, G. and Borriello, D. (Ed.) **Distaster in Popular Culture**. Rende (Italy): Il Sileno Ed, 2019.

AMÉRICO-PINHEIRO, Juliana Heloís Pinê, BENINI, Sandra Medina. **Watersheds: fundamentals and applications**. Tupã: ANAP, 2019.

CANHOLI, Aluísio Pardo. **Urban Drainage and Flood Control**. São Paulo: Oficina de Textos, 2005.

CARVALHO, Andreza Tacyana Felix. Hydrographic basin as a planning unit: discussion on the impacts of social production on water resources management in Brazil. **Caderno Prudentino de Geografia**, Presidente Prudente, n. 42, v. 1, p. 140-161, jan-jun, 2020.

GEELS, F. W. Technological transitions as evolutionary reconfiguration processes: a multilevel perspective and a case study**. Research Policy**, v. 31, pp. 1257-1274, 2002.

GEELS, F. W., & SCHOT, J. Typology of sociotechnical transition pathways. **Research Policy**, 2007 36(3), 399-417. h_ps://doi.org/10.1016/j.respol.2007.01.003

GUTIERREZ, A. I. R & RAMOS, I. C. D. Sustainable urban drainage for the achievement of SDG/UN targets. **ArchDaily** , 2019. Available at <https://www.archdaily.com.br/br/920314/drenagem-urbana-sustentavel-para-a-concretizacao-de-metas-de-ods-onu> ISSN 0719-8906> Accessed 21 Sep 2023.

LIMA, R. P.; ANELLI, R. L. S.; LONGO, M. R.; HARBICH, L. V. A.. **Urban-Environmental Patterns of the Morumbi-Paraisópolis Axis and its Potential for Transformation in the Face of Climate Change**. Annals of the XX ENANPUR -. Belém: UFPA, 2023.

MERROW, S.; NEWELL, J.; STULTS, M. Defining urban resilience: a review. **Landscape and Urban Planning** 147: 38-49, doi: 10.1016/j.landurbplan.2015.11.011, 2016.

SCHUTZER, José Guilherme. **City and Environment: the appropriation of relief in urban environmental design**. São Paulo: Editora Universidade de São Paulo, 2012.

TRAVASSOS, L.. SCHULT, S. I. M. Socio-environmental recovery of urban valley bottoms in the city of São Paulo, between transformations and permanences. **Cadernos da Metrópole**, v. 15, n. 29 (2013). h_ps://revistas.pucsp.br/metropole/article/view/15826

TUCCI, Carlos E. M.. Water in the Urban Environment. In: **Águas Doces no Brasil – Capital Ecológico, Uso e Conservação (Fresh Waters in Brazil – Ecological Capital, Use and Conservation**). p. 399-432. São Paulo: Escrituras Editora, 2006.