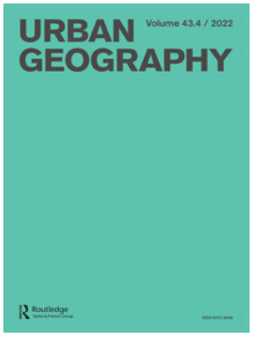

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Problematizing infrastructural "fixes": critical perspectives on technocratic approaches to Green Infrastructure

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ABSTRACT

This paper analyzes the concept of Green Infrastructure (GI) in urban context, challenging the extent to which it can support a transition towards more socially inclusive forms of urban governance. It builds on the argument that the false promise of "win-wins" in the conceptualization of urban greening participates in the creation of blind spots in practice. Using the case of São Paulo, we bring attention to techno-managerial patterns within top-down governance structures. A political ecology lens helps to analyze power relations at play in the context of a linear park project implemented in an informal settlement. It reveals how current urban governance structures create barriers to the practice of GI, notably because projects often remain incomplete, but also because participatory processes often remain limited. The practice of GI normalized as a technical-rational endeavor leaves limited space for "non-expert" knowledge. Complex settings where intertwined socio-environmental issues cause conflicts over space demand equally complex efforts that go beyond infrastructural "fixes". To support the institutionalization of GI, a fuller and grounded "translation" process of the concept needs to be supported by forms of urban expertise centered on communities' needs and local dynamics. We argue that only then will GI support the democratization of urban planning.

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Green Infrastructure; linear parks; urban greening; urban expertise; São Paulo

Introduction

A growing number of policy and planning discourses refer to nature-based approaches as a means of concurrently tackling the multiple challenges faced by cities, ranging from climate change to socio-economic inequalities. Many discourses present nature-based

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approaches as a panacea, while there is a critical need to engage with the complexities of their implementation that shape their efficacy, robustness, and performance (Frantzeskaki et al., 2019; Meerow, 2020). Similarly to other urban greening concepts such as linear parks, green belts, green corridors and the more recent concept of nature-based solutions, Green Infrastructure (GI) seeks to provide arrays of co-benefits and is often ambitiously presented as a win-win solution (Dorst et al., 2019; Nesshöver et al., 2017; Wright, 2011). GI has been conceptualized using the principles of multifunctionality and interconnectedness to move away from mono-functional grey infrastructure, and to address social, economic, and environmental issues simultaneously (Benedict & McMahon, 2002). Its conceptualization has further evolved towards different directions: a greenspace planning concept, an urban ecology concept, a water management concept, as well as a component of the built environment (Matsler et al., 2021). As each of these conceptualizations relate to different types of interventions, with varying metrics to measure success at different scales, they ultimately lead to different forms of benefit provision to different groups (Matsler et al., 2021).

A growing body of literature highlights the need to expand research boundaries towards a more critical scholarship. It raises epistemological questions around power/knowledge relationships and nature-based approaches, such as GI, notably on the way inequalities of access to benefits intersect with socioeconomic factors including those of class and race (e.g. Anguelovski et al., 2020; Finewood et al., 2019; Lennon, 2014; Woroniecki et al., 2020). Among these, Finewood et al. (2019) critically examine the institutionalization of GI. They explore the way complex politics of water and stormwater management in Pittsburgh (United States) have been standardized with engineering foci of optimization and efficiency. Finewood et al. argue this provides an example of depoliticization of GI through "black-boxed" decision-making. We align with the arguments that the promise of "win-wins" in GI discourses and the lack of consensus over its conceptualization can reinforce the creation of blind spots in the practice of GI. Policy discourses on "innovative" urban greening interventions which come with the implied assumption that they will intrinsically lead to inclusive and sustainable outcomes need to be problematized. That is because they have given institutions the flexibility to shape their own narratives and justify decision-making that often result in business-as-usual approaches.

Building on these, this paper challenges the notion that the practice of GI has increased space for the democratization of urban governance. To serve the purpose of overcoming apolitical approaches to GI, we raise the question: "how, and to what extent, can the (re)politicization of GI support a transition towards more inclusive forms of urban planning?". This aims to bring attention to the top-down governance structures that formerly shaped traditional infrastructural system and continue to influence the institutionalization of the GI concept. It considers that the GI language is often integrated into technocratic discourses held by the same powerholders who have collapsed complex issues into technical decisions. Technocratic approaches are defined here as decision-making privileging technical expertise, including through the use of technical language. Political Ecology theories help us explore how power relations in the co-production of nature and society manifest themselves in discursive forms as well as in material struggles (Bryant, 2015). We analyze how GI has been institutionalized within the same power structures entrenched within societal relations of competition

over resources (Neo & Pow, 2015). This helps us understand how some urban greening practices perpetuate exclusionary patterns and risk to affect marginalized populations.

In this paper, we examine the context of São Paulo in Brazil which has seen a rise in urban greening strategies for urban water management since the beginning of the twenty-first century, especially through the institutionalization of the concept of linear parks thereafter integrated under the umbrella term of GI. Part 2 contextualizes the institutionalization of linear parks and GI for river management in São Paulo. Drawing from research on urban policy mobility and knowledge circulation, it explores the role played by experts in the circulation of GI expertise *toward* and *within* São Paulo. Part 3 analyses these concepts in practice by examining the case of the Sapé linear park project implemented in the context of an informal settlement, also known as "favela". Part 4 discusses issues that have emerged through the project, highlighting the complexity of GI implementation in the context of urban informality. Project plans are compared with performance, and particularly in relation to community participation in decision-making. It thereby reflects on challenges of inclusion and further discusses avenues for the (re-)democratization of GI.

Empirical evidence is based on urban policies and plans as well as 19 semi-structured interviews conducted with academics, government representatives, independent consultants, non-governmental organizations, community workers and residents from the case study area. Discourse analyses were conducted to identify the way decisions have been justified, with particular attention to the use of technical language as a power tool (Hajer & Versteeg, 2005; Weiss & Wodak, 2003). This is based on the argument that the broadness of GI's scope leads to multiple interpretations and affects its practice. Paying attention to *who* defines a concept and *how*, therefore, matters as much as the definition itself to understand the way GI functions are enhanced, and to identify who benefits from them. Overall, this study aligns with the literature that problematizes urban greening approaches and the democratization of urban governance. It particularly seeks to contribute to the body of research that explores the links between techno-managerial approaches to ecological sustainability and social inclusion problems, and the (re)production of inequalities in the context of informal settlements.

The circulation of urban greening concepts to, and within, São Paulo

River management: from grey to green

São Paulo's urban development strategies have historically been oriented towards a vision of modernity. This has been reflected in São Paulo's water management models based on the same Promethean project found in other global cities, and particularly in the Global North (Millington, 2018). Such models have been based on the control of nature through engineering approaches (Kaika, 2003, 2005). However, these approaches have been limited since São Paulo has faced increasingly devastating flood and drought events over the past decades. Millington (2021) points out that ways through which large-scale engineering solutions have addressed the socio-political issues that underpin flood problems in the city have been limited (Millington, 2021). In the meantime, there has been a spiralling expansion of informal settlements ("favelas") in the city since the 1970s–1980s. The population living in *favelas* in

proximity to rivers has particularly been exposed to flood risks. The enforcement of river conservation laws and policies preventing the expansion of settlements along rivers has increased conflicts between environmental preservation and social housing urban agendas (Fix et al., 2003). Such conflicts created a need for different river management approaches in the city (Moroz-Caccia Gouveia, 2016).

Urban greening concepts popularized in Brazil shortly after they mainstreamed in the United States and Europe in the 1980–1990s. Among them, linear parks, greenways and green corridors have attracted particular interest due to the way they opened possibilities for the (re-)integration of rivers into the urban fabric, while providing co-benefits to populations living in close proximity to them (Marques, 2020). Linear parks can be traced back to the work of landscape architect Frederik Law Olmsted and urban planner Ebenezer Howard who designed multifunctional and connected green spaces in the United States and the United Kingdom from the 1880s through to the 1900s – including the Emerald Necklace linear park in Massachusetts (Eisenman, 2013). Experts in Brazil saw the potential of the multifunctional role of linear parks, starting with addressing urban drainage issues, and subsequently developed strategies to implement them in cities (Devecchi et al., 2009; Gonçalves & Nagano, 2018; Machado, 2017; Marques, 2020; Soares, 2014; Travassos, 2010).

The concept of linear park was institutionalized in São Paulo with its 2002 Master Plan. Thirty-seven linear park projects were listed in the city's 10-year Program for Streams Recovery which defined them as "urban interventions that aim to re-establish citizens' awareness of the natural environment in which they live, by progressively expanding green areas" (Municipality of São Paulo; in Silva-Sánchez & Jacobi, 2012, p. 124). The 2004 Regional Master Plans nearly quadrupled the number of planned linear parks. In 2008, the 100 Parks Program was created by the Municipal Secretariat for the Environmental to boost the implementation of linear parks in the context of a climate change adaptation strategy (Travassos & Momm Schult, 2013). Linear parks still appeared in the 2014 São Paulo Master Plan, but the concept lost strength as many of the planned projects were only partially or never implemented.

In parallel, in 2007, the municipality and the state water and sanitation utility SABESP jointly launched the "Clean Stream Program", to rehabilitate 300 of São Paulo's urban streams whose majority are tributaries of São Paulo's main rivers: Tietê and Pinheiros. According to SABESP, more than 318 million Brazilian reais[1] would have been invested up to 2020, in 161 streams of the city (SABESP, 2022). The various objectives around which SABESP has presented the program include the conservation of riparian areas through pollution prevention in informal settlements. The expansion of informal settlements has been narrated as the main barriers to the achievement of these objectives. SABESP cites the need to take joint action to "minimize the damage caused by informal land occupation and its consequences" (SABESP, 2020, p. 64). Land regularization was accompanied by the expansion of sanitation service coverage in areas that were not formally connected to the "formal" network. This has participated in increasing public authorities' control over land-use, and in making the utility reach new customers. Displacements have been justified as necessary to protect populations from a range of risks including floods (Butantã Sub-prefecture, 2008). As explored in further details with the case of Sapé, these objectives have been discursively articulated by decision-

makers during elaboration of projects to build a case for multi-beneficial infrastructural interventions.

Green Infrastructure in São Paulo

Similarly to linear parks, the concept of GI has inspired Brazilian cities including São Paulo to formulate new strategies to address intertwined urban issues. GI first developed in Europe and North America among environmental conservationists and planners in the early 2000s (Benedict & McMahon, 2002; Matsler et al., 2021; Mell, 2008). GI became popular in Brazil a few years later. It started to appear in the work of scholars in landscape architecture, urban planning, and civil engineering in the mid-2000s, therefore, around the same time the concept of linear parks started to be institutionalized. This was predominantly in relation to the preservation, restoration and creation of urban green spaces to support biodiversity (Bernardi, 2007; Frischenbruder & Pellegrino, 2006), the design of sustainable urban drainage systems (Cormier & Pellegrino, 2008), and the development of land management strategies at basin scale (Herzog, 2009; Universidade de São Paulo, 2005). Furthermore, Sandeville and Radoll (2010) started discussing the way GI could integrate into land-use dynamics and the meaning of this for public participation in water governance. Various forms of GI were then being explored, from green roofs to raingardens (Marques, 2020).

In relation to rivers more specifically, the period from which the concept was adopted in Brazil also coincides with the change of direction in river and stream management strategies of which linear parks have been part. In São Paulo, experts have been advocating for river re-naturalization as a complementing technique in hydrological control, notably to help reduce dependency on *piscinões* whose cost efficiency and socio-environmental impacts were (and remain) debated (e.g. Brocaneli & Stuermer, 2008). River re-naturalization was presented by urban experts as opportunities for the ecological conservation of rivers, and for stimulating local populations' sense of place and belonging (see for example, Silva-Sánchez & Jacobi, 2012). Such urban experts shaped such argument through GI, presenting it as an opportunity for a paradigm shift that could give new meanings to rivers in cities. This aligned with the objective of altering the perception of rivers as flood risk multipliers and as sanitary threats to eliminate.

Although GI has not yet appeared in the city's Master Plans, it is currently increasingly appearing in a number of municipal planning strategies to guide infrastructure development, including linear parks (e.g. FIPT, 2020; Municipality of São Paulo, 2021). GI for river management has been discussed as a way to create new forms of social and political networks at basin scale, for example with the creation of intermunicipal consortiums of river basins (Marques, 2020; Ribeiro, 2010; Travassos, 2010). It is important to note that at the time of writing of this article, the concept of Nature-Based Solutions (NBS) is also gaining traction in the city's urban development strategies including the Municipal Plan for Protected Areas, Green Areas and Open Spaces (Municipality of São Paulo, 2020).

The role of experts in the circulation of concepts

Urban experts, and particularly those involved in academia, have played an important role in the circulation of urban greening concepts in Brazil. They have supported

knowledge production, the construction of expertise, and the dissemination of ideas with the aim of building epistemic communities around the term. Urban scholars have advocated for linear parks and GI to support the delivery of ecosystem services, for example to tackle flood management while meeting other ecological and social objectives of which sanitation, housing and mobility have been part. Scholars have used GI to analyze existing linear park projects and further justify their benefits. They have thereby helped shape a new narrative on integrated approaches towards river rehabilitation in Brazilian cities. Discourses have subsequently started to develop among decision-makers with influence on São Paulo's development plans, claiming intentions to enact this vision in practice.

International non-governmental organization and corporations have also advocated for the expansion of GI in Brazil as well as other countries in Latin America and the Caribbean (e.g. Davidson et al., 2019; Muñoz Castillo & Crisman, 2019; Quintero, 2012). Since the popularization of the concept of GI, other actors have shown interest in its adoption. NBS has also been advocated for in Brazil by international funding institutions such as the Inter-American Development Bank (Watkins et al., 2019). As a result, initiatives refered to as GI and NBS interventions have multiplied in the city. Besides consolidating existing or stimulated new international coalitions, this has provided incentives for multinational corporations such as Danone and PepsiCo to adapt their agendas, using the language of GI and NBS (Shiao et al., 2020). A growing number of private consultants has also developed services to support such companies and governments to deliver on evolving sustainability agendas. More specifically in São Paulo, a large proportion of these consultants includes individuals who provide services in the sectors of engineering and architecture, while also working in academia.

Urban policy mobility studies have demonstrated the way expert knowledge is articulated to justify decisions in urban development (Jacobs & Lees, 2013; Mccann, 2011; Robin & Nkula-Wenz, 2021). Observing the routes through which growing urban greening concepts have been traveling to, and within, São Paulo shows patterns of influence of the way cities are shaped. The role of academics in this process is central in the articulation of the language to legitimize the institutionalization of concepts. As observed with GI and linear park principles in São Paulo, the circulation of concepts and policies has been accompanied with narratives of modernization through technical solutions. Experts have played a role in the pre-policy localized translation of what is considered as innovative knowledge (Bell et al., 2011; Kotsila et al., 2021). Policies are often framed as "solutions" and "new knowledge". In the context of urban greening, they nevertheless require critical evaluations of attempts to address persisting issues in the achievement of sustainable and inclusive urban development.

Political ecology perspectives help explore knowledge constructions, including around scientific authority, in order to identify underlying power forces at play (Lave, 2011). Marques (2017, 2018) highlights the way institutions in São Paulo, often in partnership with private actors, pursue development ideals. While responding to global economic forces, they fail to translate concepts and thereby (re-)introduce social inequalities at local level, with impacts in informal settlements. Highlighting the influence of the Global North in cities of the Global South reveals issues around the relevance of concepts like NBS and GI in different socio-cultural settings, particularly where instruments that should support their localization are not in place (Souza & Torres, 2021; Zain et al., 2022). Given the power relations at play, this helps question the extent to which promises

of urban transformation are fulfilled. The case of Sapé linear park explored in the next part seeks to illustrate this in context.

Sapé linear park project

Sapé linear park project: an overview of the plans

Sapé stream is a tributary of the Jaguaré River in the West Zone of São Paulo, which itself is a tributary of the Pinheiros River (Figure 1). The basin area of Sapé stream extends over about 1.10 km^2. Sapé stream gave its name to the *favela* that expanded along its margins in the 1960s. Blocks of brick houses and shacks (known as "*barracos*") were built on the riverbanks over the years, while groups of "formal" houses have also grown in different parts of the neighbourhood. This has resulted in a mosaic landscape of juxtaposed groups of "formal" and "informal" houses. Before the linear park project in 2009, it was estimated that between 2,500 and 3,000 families were living in Sapé *favela* (Butantã Sub-prefecture, 2008; Parra, 2017). The Sapé stream was periodically flooding and affecting families living on its banks. It has, on several occasions, severely damaged houses, and even caused loss of life. Sapé waters have long suffered from pollution issues, both due to effluents of untreated wastewater from households, and to large amounts of solid waste, including house debris directly disposed of into the stream (Figure 2). A conjunction of these factors means that Sapé stream has been considered more as a nuisance than an environmental asset by residents of the area. A perception study conducted by local authorities before project implementation found that many residents expressed a desire to "bury" the stream, or "culvert" it (Butantã Sub-prefecture, 2006).

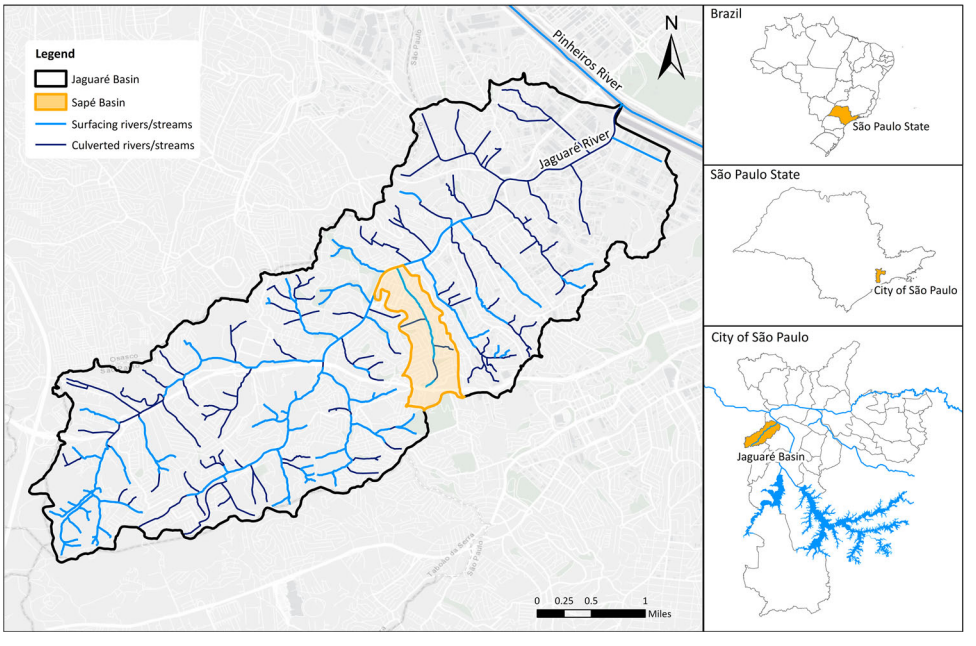

Figure 1. Location of Sapé basin in Jaguaré basin and in the city and state of São Paulo.

Figure 2. Sapé stream and favela in 2010 (Source: Google Earth).

Plans for a linear park project in Sapé were brought forward to address flood and pollution issues through stream canalization, increase local greenspace, but also socio-spatially connect the stream and the *favela* to the wider environment. This could therefore help meet objectives laid down in the 2002 City Master Plan and 2004 Strategic Regional Plan. The Environmental Compensation Law – requiring "grey" projects to be compensated by "green" projects – provided the legal instrument to initiate investment for Sapé. The project's scope increased with time, leading multiple governmental institutions to take part, notably for the integration of a housing strategy. Plans were made for a selected number of households at risk - especially those exposed to flood risks - for in-situ relocation to new condominiums provided by the Municipal Housing Secretariat. The relocation was considered necessary to "depollute" the Sapé stream, "reclaim" the river margins and enable the construction of sanitation infrastructure within legal requirements (SABESP, 2022). For this, the project was integrated into the Clean Stream Program led by the water and sanitation state utility which came with

Figure 3. Digital simulations of Sapé linear park project pre-implementation (Source: https://vitruvius.com.br/index.php/revistas/read/projetos/15.170/5441).

further investment. According to the municipality, a total of R$ 5,187,350[2] were invested into the project from both private and public sources (Butantã Sub-prefecture, 2006; SVMA-DEPLAN, 2013). Figure 3 provides a visual overview of the transformation proposed by experts for the area.

Decision-making processes

The team of architects and urban planners in charge of the design of the linear park, the new condominiums and the wider planning of public spaces faced many challenges throughout decision-making. They proposed a linear park design which would serve the purpose of controlling flood risks based on engineering methods to dimension sufficient depth. They also explained the way they considered that shallower depth would discourage pollution behaviors:

> With a deep and narrow river canalisation, people would not have the same relationship with the river as if it were wide and shallow, which is what we wanted. As such, waste would bother people more, and it would force them to actually take care of it. (Personal interview, June 2, 2020)

In Brazil, multiple laws including the federal Forest Code which delimits non-constructible zones around water bodies restrict room for manoeuvre in the planning of dense urban areas like Sapé. Legal restrictions have thus posed further challenges to the integration of objectives of ecosystems protection with those of equal access to land and housing. The municipality eventually approved a design with a shallower and wider stream section yet leading to the displacement of about 1,500 families. Four condominiums were designed with a total of 960 housing units, indicating that plans for in-situ relocation did no accommodate at least 217 displaced families. Those offered accommodation (or financial compensation) had been selected based on an assessment considering a number of criteria including income, number of children in school, and length of residency in Sapé (i.e. number of years lived in Sapé). Regarding other components of the project, a mobility strategy was developed according to principles of connectivity to allow spatial connections between the *favela* and neighboring "formal" areas. This demonstrated the team of experts' intentions to deliver multiple social and environmental benefits, considering impacts at the scale of the community, but also that of the wider neighborhood and the river basin scale. Once plans were pre-approved by the governmental authorities in charge, they were presented to the population via a management council ("*conselho gestor*") as required by the law for projects conducted in low-income communities (Municipality of São Paulo, 2002).

A range of internal institutional issues were identified as having affected decision-making processes. Although the Municipal Secretariat for the Environment and the sub-prefecture were the two official governmental bodies in charge, they appeared to have less power than other institutions including the Municipal Housing Secretariat and the private companies contracted to lead the construction part of the project (personal communication, June 17, 2021). Similarly, the urban planners hired for the project explained how decision-making processes were limited to only a few actors:

> It was very messy […]. There was an overlap of roles in the hierarchy. Some actors were not responsible for the approval or plans or not, but they were fulfilling this role. And since we

> had to report to them, we were concerned about this. It was a work of persuasion; it was a political work. Going there, going back … Sometimes we had to re-do things. (Personal interview, June 2, 2020)

The contracted team of architects also described how contacts with the community only occurred during management council meetings. A general assumption was that the elected community representatives of favela residents who participated to these meetings were satisfied with the propositions made by the team of experts:

> Our contact with the community was only occurring when we were taking part in the meetings of the management council. The council was for us to present our propositions for them to approve or not. But it is true that [the community] loved everything that we were doing. Not because we were good, but because any type of improvement was already a huge improvement for them. (Personal interview, June 2, 2020)

Yet, further interviews with residents reveal how they felt excluded:

> They came with the project ready for implementation. The council has just been there for them to say they conducted a consultation and that they informed the population. (Personal interview, July 27, 2019)

> We are seen as ignorant. This is why the population here gives value to nothing. (Personal interview, July 27, 2019)

These testimonies reveal important issues with community members' participation to decision-making processes. While the space for community representatives to raise issues remained restricted, their influence on the outcomes of the planning phase of the project was even more limited.

Project implementation and outcomes

The Sapé linear park project was implemented in two stages, the first one being concluded in 2009 near the stream sources, and the second one in the *favela* between 2010 and 2014. The project was long considered a successful example of river restoration in the city (personal communication, June 17, 2021). The sanitation interventions conducted together with the stream canalization (i.e. a type of channelization with a containing and open structure) resulted in improvement of the water quality, monitored by the environmental NGO SOS Mata Atlântica (personal interview, November 19, 2020). The canalization also resulted in flood risk mitigation, with no major flood events being reported since then. The overall aesthetical transformation of the landscape, for example with a cycling lane constructed along the streambanks and the development of football pitches provided amenity space. The construction of new buildings - to which a part of the population was relocated - has been accompanied by the legal formalization of land occupation in this part of Sapé. However, many components of the plans were modified during the course of the project or were never implemented. This includes one of the planned condominiums which has left several hundreds of families[3] waiting for relocation up until the time of writing of this paper. Since the condominiums were not being constructed on the formally assigned land, previously established and new families have since (re-)built their home there.

More specifically related to the ecological achievements of the stream restoration, results indicate differences between plans and outcomes. The few ecological gains

Figure 4. Pollution in Sapé stream and new shacks built on the cycling lane post-project implementation in 2019.

emerging from the project were not sustained over the long-term. Incomplete housing components of the project left many families without accommodation, which has resulted in the building of new shacks by former or new residents (Figure 4). Poor maintenance of the area together with continued wastewater and solid waste disposal issues have also led to the water quality of the stream to deteriorate again over time. Yet, these issues are commonly blamed on newcomers who settle in the Sapé *favela*. For example, the water and sanitation utility in charge stated:

> There used to be sceptic tanks and households were disposing of [wastewater] into the stream. That should no longer be the case. But there might have been new waves of invasion after the regularization. There has been depollution of the stream with implementation of infrastructure on the left margin and right margin to connect households. So, if there is currently any pollution, it comes from the invaders who came after project completion. (Personal interview, August 23, 2019)

> [T]here is also a lack of awareness. There is a part of the population which still does not have such awareness around water resources. They don't. Because of this, we suffer a lot. (Personal interview, August 23, 2019)

An unpublished, "non-technical", internal assessment was prepared by the municipality post-project implementation (SVMA-DEPLAN, 2013). The assessment indicates a range of issues with the long-term performance of the Sapé linear park. Criminal activities in the area are cited as a notable barrier to the maintenance of the park by authorities in charge. The report points out the lack of explicit strategy for active public participation that goes beyond mere consultation or dissemination of information. It states that a

stronger participatory process would contribute to the planning and implementation of the project, but also to its long-term management.

Furthermore, it is important to note that the project did not lead to a re-naturalization of the river per se. As it was previously the case, only a small portion of the stream was, and remained, vegetated. The rest of the stream has either been canalized or remained "buried". The project even led to the development of sports equipment (e.g. football pitches, skate park, playgrounds) *above* the culverted stream. Yet, it is the "re-valorization" of the space that has led to the project to be referred to as a "linear park". Similar observations were made by Pizarro and Lino on the Sapé project and for which they observed that

> linear parks built along water bodies actually follow the same logic as any other public square […] these parks are, in essence, flood designs that mix lawn and semi-permeable areas, on which series of sports and leisure equipment are placed. (2012, p. 101)

Problematizing "cure-all" interventions

Technocratic discourses and hidden governance issues

Challenges emerging from the practice of GI in context start from the way it is conceptualized. Highlighting the influence of the Global North in the global circulation of concepts like GI and linear parks raises issues around their relevance in different socio-cultural settings, particularly where instruments that should support their localization are not in place (Souza & Torres, 2021; Zain et al., 2022). Since rivers and streams are complex ecological systems, their embeddedness in connected layers of social and political urban dynamics in cities like São Paulo means that river restoration in informal settlements requires equally complex approaches between experts, governments, and citizens. However, river restoration projects in São Paulo have largely remained in the hand of restricted circles of decision-makers willing to "import" the concepts of linear parks and GI, and who have faced barriers throughout implementation processes. The case of the Sapé linear park project reveals how technocratic approaches have limited space for integration of "non-expert" knowledge that could have supported the translation of the concepts in practice at community level. Limited inclusion of residents in the making of decisions has restricted the understanding of socio-political local dynamics. As such, unearthing the multi-layered power relations at play shows the currently limited extent to which promises of more inclusivity in urban governance structures can be fulfilled through GI in context.

The lack of achievement of both ecological and social inclusion objectives with Sapé linear park project tightly relates to governance structures privileging disproportionately powerful actors who dictate final outcomes. The case demonstrates that contracted experts have deployed efforts in adapting plans to local dynamics by taking into consideration intertwined issues of housing, mobility, and sanitation. Yet, the case reveals that final decisions remained in the hand of a small group of governmental authorities who limited holistic approaches. Apart from the unpublished assessment prepared by non-technical actors within the municipality, discourses used by this group have been built around the narrative that river restoration is first and foremost a scientific endeavor. From a political ecology perspective on expertise, the language of technical solutions is analyzed as having strategically supported the legitimization of the decisions made through a top-down process (Dryzek, 2013). Such processes have embedded

participatory approaches during the planning phases of the project, notably with communities' poor influence on decisions during management council meetings, further limited the way the project' objectives were negotiated among different actors. Administrative and fiscal constraints that relate to wider urban governance issues in São Paulo have participated in preventing project completion and also affected the achievement of objectives.

Further attention is required on the construction of apolitical arguments that flatten urban politics. Experts involved in decision-making communicated that communities have not had much interests in participating to meetings or were satisfied with plans proposed to them, and therefore, that consensus was reached without conflicts with them. A political ecology perspective here highlights the mechanisms that leave political discourses unchallenged. These mechanisms participate in the legitimization of technocratic governance approaches and their techno-managerial apparatuses, claiming to conduct consensual politics while applying infrastructural fixes to complex issues that require holistic approaches, including "non-infrastructural" measures (Lennon, 2014; Swyngedouw, 2007). This further questions the way GI can be collectively planned between experts, governmental authorities, and the wider society, in a wider context of urban regeneration. There is indeed a need to challenge what has been claimed to represent a shift in river management and wider urban planning in São Paulo. Experts framing urban greening concepts as cure-all solutions are likely to provide the basis through which decisions are legitimized and which reproduce the status quo. Reducing conflicts between GI functions to technical issues and seeking solutions in the face of competing demands hide relations of power among these different actors. The notion of technical rationality affects public engagement, where GI could in fact leverage the democratization of planning processes.

In the case of Sapé, discursive construction of "pollution behaviors" have obscured unaddressed governance issues of integration of informal settlements into the "formal" city. Attention to the land and housing components of the project further reveals more intricacies of discursive constructions. While the planned housing components of the linear park project offered the promise of adequate compensation to those who were displaced, their incompletion prompted new land occupation with informal sanitation connections to the stream. As illustrated by the quote from São Paulo's sanitation utility, this provided an additional argument to authorities discursively articulating communities' responsibilities in project performance. Decision-makers have held a narrative of insuperable tensions between different urban development agendas, here between housing and river conservation agendas. Such narrative is identified as a mechanism that maintains a duality between social and environmental agendas (Souza, 2015). This echoes theories on ecological gentrification that call for attention to "hidden" political projects serving a neoliberal order and fail to address essential community needs (Checker, 2011; Swyngedouw, 2007). That is particularly important considering the amount of resources – including financial resources – budgeted for investments into the Sapé linear park. The community-authority and intercommunity conflicts that have resulted from this further shows the limited achievement of co-benefits.

Limited engagement with local needs

This part provides further context for the limited extent to which urban greening concepts applied to river management have supported a transition towards more inclusive

forms of urban planning. Despite the government of São Paulo's efforts in building an elaborated polynuclear urban governance system, struggles with the integration of multiple urban development objectives are persisting. The fragmented aspect of governance structures directly affects the participation of vulnerable groups in the political sphere. Both the linear parks and GI have been advocated for by experts in São Paulo using the promise of tackling social inclusion concerns. As seen with the city's Master Plans, principles of integration of communities' needs into projects have been retained in the formulation of urban policies and strategies. These principles have been integrated into legal instruments that require the creation of management councils as platforms for negotiations. As indicated above, the space for Sapé residents to negotiate their needs has nevertheless remained restricted in practice. Results have revealed forms of engagements that are more one-directional than representative of a co-production process for decision-making. Policies, plans and assessments put in place for the inclusion of affected populations could, therefore, not guarantee inclusive governance.

Assessments of Sapé population's relationship with the environment – and particularly with their local stream – were conducted during planning phases of the project. However, these considerations were lost in final outcomes. Residents' testimonials also reflect that the systems of dialogue put in place by the municipality with the managementcouncils have been insufficient to guarantee influence over decisions. Community members who took part in meetings appear to have been *informed* about the final plans, instead of being active participants to planning strategies. Technocratic discourses often perpetuate the vision that communities do not have the required knowledge or capacity to support decision-making. This might discourage the population from participating to meetings, a factor that also legitimates the way decisions are made within small circles. In return, participation "fatigue" has also often facilitated authorities' articulation of the argument that engagement with the population has indeed occurred, whereas the participatory aspects of decision-making processes are contested by this same population. Articulating expert knowledge in a way it prevails over that of communities also often leads to the invisibilization of communities' voices.

Stronger participatory approaches should have supported the framing of pollution issues, and therefore, manners to address them collectively. Pre-project assessments have shown that a part of Sapé population's preferences for river culverting demonstrates the existence of a complex relationship between the population and rivers. As analyzed in more details in Diep et al. (2022), demands for river culverting expressed by some individuals does not necessarily reflect a lack of awareness or interest into environmental matters, but rather hide frustrations towards unresolved issues such as that of waste management service provision. Similar arguments were made by Juntti et al. (2019) in a study conducted in peri-urban settlements of Nova Contagem (Minas Gerais), where flood and pollution issues in open streams have increased residents' desires to canalize them. Juntti et al. emphasize that opting for an infrastructural approach of river canalization would not guarantee the mitigation of flooding and pollution issues. Instead, efforts should be made on addressing unwanted relations with ecosystems that emerge from nuisances that their (lack of) management causes. Also referred to as "ecosystem disservices", these can range from bad odors, the proliferation of rats and mosquitoes, but also the added burdens associated to maintenance.

Finewood et al. (2019) argue in the context of GI: "what is sometimes articulated as best for communities, and in turn what happens in communities, ends up coinciding

with a particular urban politics expressed through singular, hegemonic value frameworks". In the case studied here, discourses held by technocrats have similarly flattened complex people-nature relationships – or in this case, river-community relationships – behind the argument that individuals cannot foresee the way urban greening will benefit them. Yet, communities' aspirations towards river culverting directly reflect São Paulo institutions' older historical discourses associating "hard" interventions to rivers with socio-economic development and modernity. Reflective of the social construction of urban issues and dialectical processes, this argument is particularly representative of the impact of the circulation of concepts and the associated articulation of socio-cultural values in river management strategies. Therefore, attention must be given to the way supposedly innovative urban greening practices perpetuate exclusive planning approaches. That is because decisions and their justifications might continue to undermine alternative views and restrict space through which community can express their own values.

(Re-)democratizing Green Infrastructure

Results have highlighted how neither the conceptualization nor the institutionalization of urban greening strategies under principles of social inclusion inherently ensure just outcomes. The case of Sapé particularly illustrates that planners' efforts to create a rapprochement of people and rivers through the implementation of a linear park project have not let to expected outcomes. Lessons can be extended to GI, whose theoretical promise is also to deliver co-benefits, but does not guarantee their emergence in practice. The case emphasizes that systematic issues preventing community empowerment – ranging from barriers to participation, to the integration of local knowledge – need to be better addressed in urban greening practices. This does not discard the potential of the concepts of linear parks, GI – and to a further extent, of NBS. It highlights that structural measures are nevertheless required for a shift in infrastructure politics to allow more democratic urban environmental decision-making processes, where affected populations can better benefit from this type of projects.

GI practitioners sometimes position technical approaches as the (only) answer to complex issues and prevent the integration of alternative "non-expert" perspectives or vernacular knowledge, including that of directly affected citizens. This can demonstrate resistance in having additional political actors participating in decision-making processes. We align with Finewood et al. (2019) to argue that the GI concept should be re-centered on its potential to expose, embrace, and address the messy politics of cities, for example where participatory governance lets residents express diverse desires for urban space and deploys efforts to respond to them. Since Green Infrastructure can "serve" different populations differently, efforts should focus on mobilizing local knowledge for integration in every new context. This process needs to raise understandings of local practices and everyday uses of space, and how they emerge from different social and cultural preferences and needs related to nature. Identifying current caring initiatives will provide insight into relations of attachment between people and their environment.

Working around pre-existing local dynamics is thus necessary for stewardship initiatives to scale up, and thereby make GI the needed mechanism for inclusive urban

planning. Alternative approaches to GI practices would entail better engagement with communities, allowing them direct influence on decision-making processes. Such approaches would, therefore, give attention to the meaning of knowledge and its co-production (Axelsson, 2011; Forsyth, 2008; Matsler, 2019; Pahl-Wostl et al., 2013). For GI, collaboration implies that different constituent groups emerge and express their preferences that also make politics more visible. As GI provide opportunities for communities to negotiate their place and meaning, different approaches can reconcile relationships between people and nature, as opposed to perpetuating narratives of conflicts between the two. Instead of framing GI as a technical project, involving community workers or scholars involved in community planning could be better involved and act as gatekeepers to ensure higher levels of community participation. The increased involvement of these actors in GI partnerships suggests changing the way knowledge would be mobilized and shared, as well as making GI planning more inclusive.

Political ecology perspectives also show that a democratization of GI more fundamentally requires a deconstruction of discourses. They reveal how dominant discourses privileging certain values for the city, and thereby restricting space for alternatives, tend to lead to the normalization of such values. These work as a mechanism that stabilizes and maintains urban politics. Yet, if normative discourses are exposed and contested, space can be made for new discourses that allow communities to better express their concerns and negotiate their own values. More inclusive forms of planning can not only help counter the way in which technocratic approaches impose dominant views on the way ecosystem services should be managed. They can also provide marginalized groups with further negotiating tools to combat urban inequality. GI's principles of interconnectedness and multi-functionality are particularly pertinent to re-think the integration of "informal" settlements into the "formal" city. For this, urban planning processes must support the way GI is negotiated, including to navigate competing demands on urban land. In this sense, GI will truly create change in São Paulo if it manages to open opportunities for new narratives that address the socio-spatial isolation of *favelas*. Where communities can counter the political structures that oppress them, they can use GI projects as channels to raise issues that are pertinent to them.

Conclusion

As more cities turn to GI and other urban greening concepts for solutions to tackle urban challenges, it is crucial to problematize ways in which they are conceptualized and applied in context through understandings of power dynamics. Recently integrated with GI, linear parks serve the purpose of connecting urban rivers and streams to their landscape, and thereby offer a management approach for their ecological preservation as well as the provision of wider social benefits. In this paper, we have critically analyzed GI through the practice of linear park in the city of São Paulo in Brazil. The context of the linear park in the *favela* of Sapé has illustrated the way current urban governance structures limit the application of GI and linear park concepts in practice with regards to the achievement of co-benefits. Despite urban planners' efforts to develop plans that respond to local dynamics so that the river restoration project could be integrated into the socio-environment of the *favela*, they have demonstrated limited performance over the long-term. The analyzes has shown that this lack of performance

relates to the way decisions on the form and functions of GI have been taken, and by whom.

A persisting disconnect between the conceptualization and practice of GI is analyzed as a manifestation of the way dominant views on urban development are enforced by powerholders. This starts with the way linear parks and GI have emerged and developed in the Global North. The circulation of "cure-all" concepts has, however, not been accompanied by adequate translations of these concepts for application in complex socio-cultural urban contexts. In São Paulo, experts that largely include urban scholars have aided the adoption of the concept, but implementation has faced challenges. The way the Sapé linear park plans have been negotiated through participatory processes with local communities has been limited and further affected the performance of the project. Governmental authorities have contracted technical experts to design infrastructural approaches to address complex issues around river restoration that link to wider questions of socio-environmental inequality. Symptomatic of top-down governance, the use of language of expertise to legitimize decisions has restricted opportunities for the affected population to articulate its own values through the maintenance of hierarchical decision-making structures. A political ecological perspective demonstrates how these approaches are characteristic of technocratic approaches underpinned by power relations which can perpetuate patterns of exclusion.

We join the body of researchers on GI that call for an epistemological rupture with dominating expert-led approaches. This has further relevance considering the current rise of the concept of NBS in São Paulo's institutional sphere whose multiple conceptualizations, like for GI, has also led to disagreements over its practice. The (re)politicization of GI requires moving away from technocratic approaches and establish stronger mechanisms to engage with – and integrate – knowledge from different actors, including that of directly affected communities. An emphasis on the integration of local knowledge means that projects could materialize in significantly different ways from those that are shaped by technical experts. Involving actors focused on the integration of community knowledge could result in significantly different plans. Such mechanisms must be accompanied by the construction of new narratives to move away from discourses that exclude the "non-experts". We argue this can help communities better negotiate their own needs and further support the democratization of GI, in both its conceptualization and application.

Notes

1. Equivalent to about US$ 80.6 million in 2019 (https://www.xe.com).
2. Equivalent to about US$ 3 million in 2009 (https://www.xe.com).
3. Sources disagree on this number showing it could be anywhere between 227 and 1,096 families having been evicted and not returned to Sapé. A number of these families keeps receiving financial compensation, but testimonials reveal this is not considered sufficient for them to relocate to Sapé.

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