



Permeating

SOCIO-ECOLOGICAL

Walls.

addressing the multi-dimensional
inequality in the 'city of walls'
through environmental justice

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mentors.

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Permeating

SOCIO - ECOLOGICAL

Walls.

addressing **multi-dimensional
inequality** in the ‘city of walls’
through **environmental justice**

permeating.

Permeate is defined by the ability to pass through things. Within this research, the definition of permeating is applied to aspects related to the physical and non-physical walls of inequality in the city. This term defines the aim of this research, which is to break multi-dimensional barriers created for the vulnerable communities of the city.

environmental justice.

Environmental Justice is based upon the principle of a fair and equal distribution and involvement in the designs and planning of a healthy environment. This concept opposes the fact that marginalized communities due to socio-economic vulnerability are those that experience the most environmental injustices (Geneletti & Kato-Huerta, 2022).

multi-dimensional inequality.

The complexity of the present multi-dimensional inequality in the city of São Paulo are subsequent conflicts caused by the erection of the ‘city of walls’. In other words, this problem is multifaceted and is present throughout physical, social, economic, political, and ecological spheres, configuring an issue of complexity.

‘city of walls’.

The identity of São Paulo as a ‘city of walls’ was coined by Caldeira in 2001. The walls of the city were erected on a foundation of mistrust and fear, ranging from physical walls of segregated housing typologies to invisible walls of planning.

acknowledgments.

This thesis is a far cry from an individual piece of work and could not have been realized without the contributions of my family, friends, the urbanism staff, and my partner. To my mentors Roberto Rocco and Claudiu Forgaci, I would like to express my deep gratitude for your enthusiasm, patience, and endless encouragement throughout the development of this thesis. This year has been a continuous learning process, enriched by the wealth of knowledge afforded to me by my mentors. To Roberto, thank you for your persistent support and contextual knowledge that grounded this thesis. To Claudiu, thank you for your constant constructive feedback and through-provoking critical insights. Today I graduate with a wealth of incredible experiences and accomplishments that would not have been possible without the foundation of my family. To my parents Luis and Cristina, I owe everything to you. Thank you for your constant emotional and moral support throughout the

linear and non-linear steps in my life. Moving away from my home and to a country of unfamiliar faces was a challenge. However, the friends I made along the way made this journey spectacular and worth every obstacle that I faced. Especially, with my flatmate Kiana, to whom I am so lucky to have met. Kiana, you have made my journey here one that I will never forget and I will carry the treasures from our experiences together for the rest of my life. Thank you to my partner, Julian, who has showed me nothing short than endless love, affection, and unconditional support in the times when I could not put one foot in front of the other. Lastly, I am grateful for this opportunity to explore a context that is both familiar and foreign to me. This possibility to grasp the core and context of this thesis that has been burning in the back of mind of years. Thank you TU Delft, for allowing me this chance and giving me an unforgettable experience.



abstract.

Rapid urbanization, governmental neglect, socio-spatial segregation, and a widening societal gap has led to São Paulo’s nickname as the ‘City of Walls’ (Caldiera, 2000). These processes continue to shape the sprawling city today, contributing to the formation of a society characterized by multi-dimensional inequality and deeply isolated marginalized communities. In addition, global pressures resulting from climate change and the degradation of ecological systems within the region further expose these marginalized communities to increasing risks. Consequently, leading parts of the city to live in the of face extreme exposure, especially as these communities lack the resilience to withstand these socio-ecological pressures.

vulnerable communities, socio-ecological systems, city of walls, socio-spatial segregation, environmental-justice

Addressing these socio-environmental inequalities requires the establishment of a foundation of ecological integrity, ensuring a high standard of live-ability and an environment of inclusivity for marginalized communities. This research proposes the reconfiguration of the Metropolitan Region of São Paulo through socio-ecological strategies aimed at restoring ecological integrity, promoting social inclusivity, and empowering local communities. By examining the vulnerabilities, barriers, and opportunities present in Brazilian society, this project seeks to promote the restructuring of São Paulo for socio-ecological resilience, embracing principles of nature-based urbanism, sustainable urban development, and adaptive governance capacities.

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VOLUME 01

RESEARCH FRAMEWORK

Problem Field (p. 10)

- *global context*
- *problem field*
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Conceptual Framework (p. 36)

- *conceptual diagram*
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- *methods*
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problem field.

OVERVIEW

This following chapter will be focused on the geographical context that this research will be focused on. Firstly, by revealing the global context of Brazil in relation to problems such as social inequality, environmental disasters, and public mistrust. As history of the city of Sao Paulo unfolds, the intensification of urban inequality and the marginalization of communities will be focused on. With particular attention into the development of the city into a ‘City of Walls’ (Caldeira, 2001); further contextualized as socio-physical walls, fragmentational wall, and walls in the planning realms. With the context of the city elaborated on, the problem focus on multi-dimensional inequality will be addressed through the research questions pertaining to environmental justice.

SECTIONS

- *global context*
- *problem field*
- *problem focus*
- *research aim*
- *research questions*

global context.

São Paulo city is the capital of São Paulo State in southeastern Brazil and is the largest city in the country at a population of over 12 million inhabitants (São Paulo Census, 2021).

The municipality is located in the Metropolitan Region of São Paulo, similarly, holding one of the largest urban agglomerations in all of Latin America with a population of over 22 million inhabitants.

Industrialization and high rates of migration in the mid-1900s led to one of the world's fastest growing metropolitan populations, leading to a city sprawling in all directions.

As the city continued to grow, the flood of people coupled with an economic crisis and lack of infrastructure led to the spatial segregation that is still apparent within the urban fabric today;

the poorer class inhabiting the periphery with the richer class occupying the center.

Nowadays, about 99% of the population, Paulistanos as the city inhabitants are called, lives in an urban area (São Paulo Census, 2021).

It is also important to note that Brazil is a relatively new democratic country with the military regime ending only in 1986. The creation of the Constitution in 1988 was the first introduction that guaranteed the rights of the city and created devices for direct participation, as well as the Statute of the City in 2001 that looked at the social function of the city.

However, São Paulo today is a city coupled with an ineffective public transportation system triggering an automobile centric city, lack

FIGURE 01. SÃO PAULO'S WORLD LOCATION. ■
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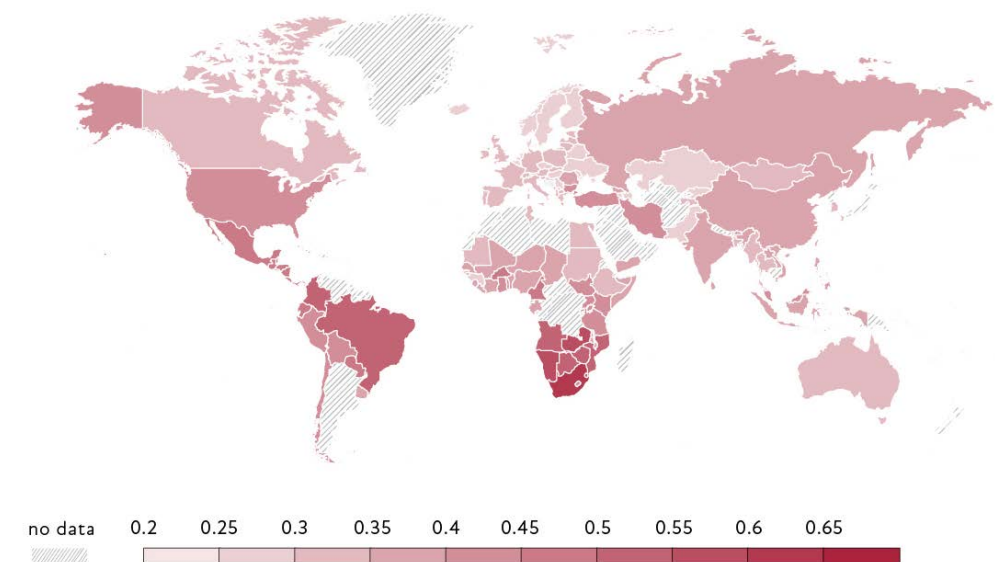
FIGURE 02. BRAZIL'S INCOME INEQUALITY. ■
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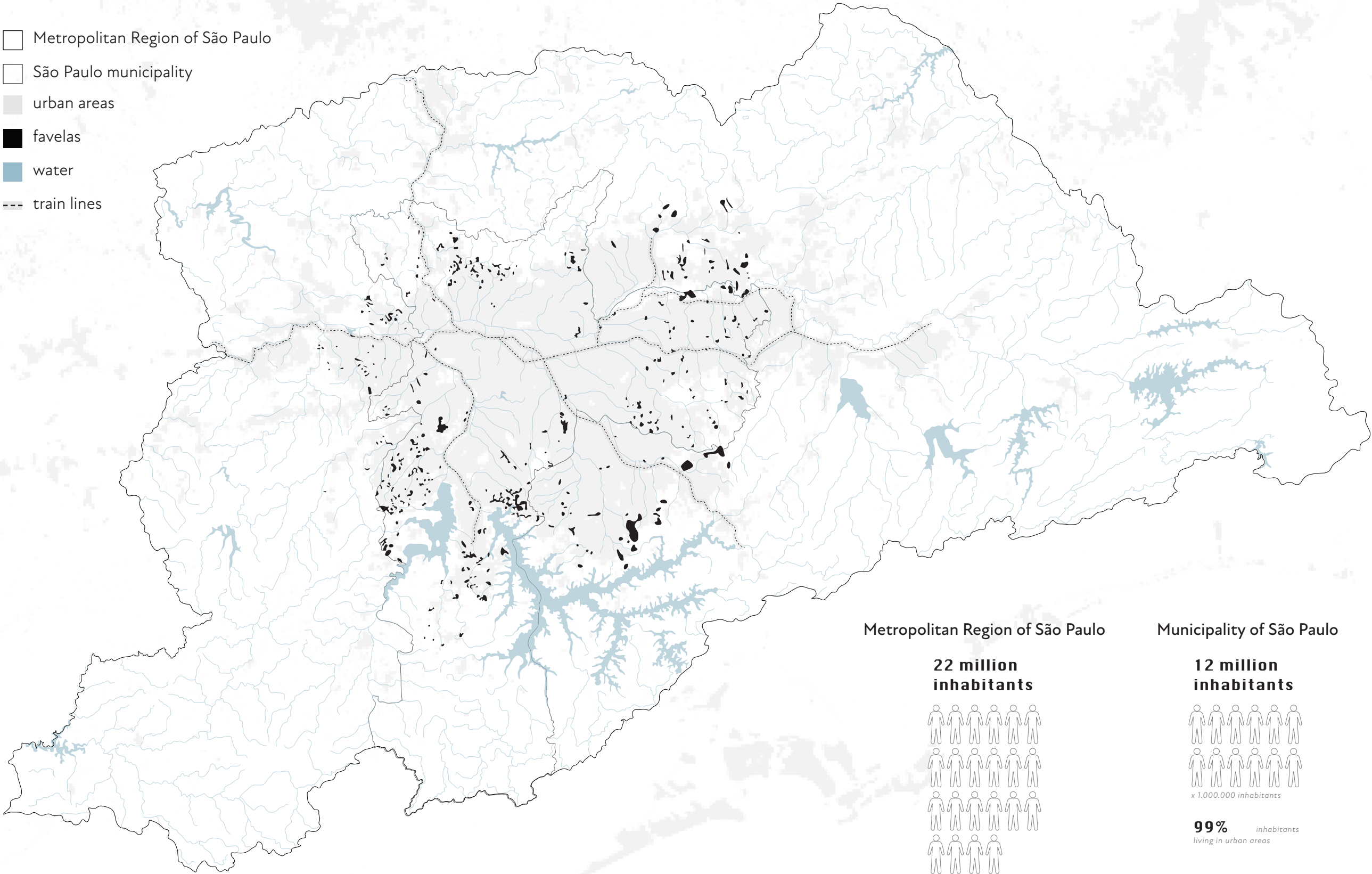
Income Inequality

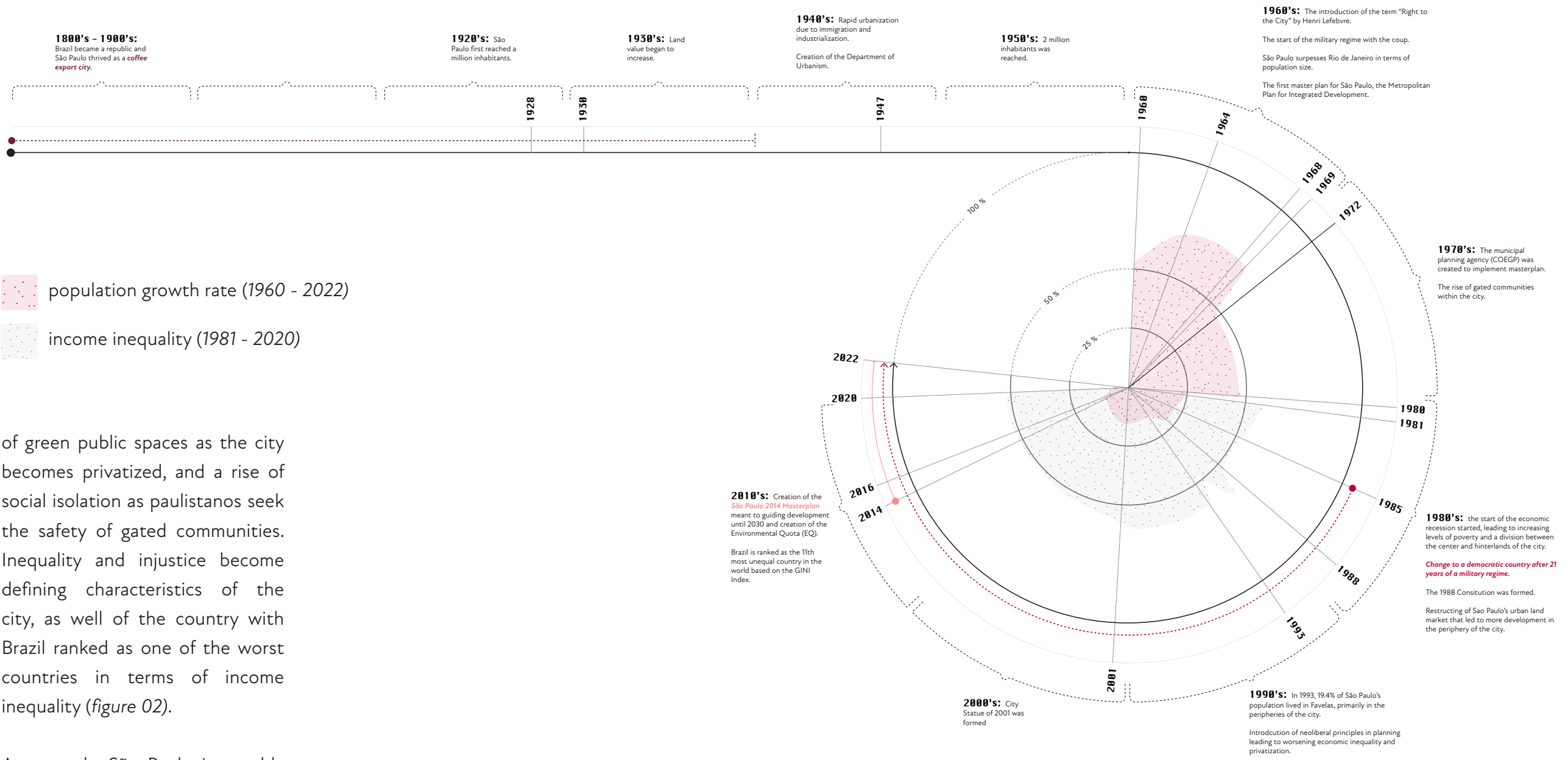
The Gini Coefficient is a measurement of the inequality of income distribution in countries across the world. The higher the

value, the higher the inequality. Brazil is listed as one of the worst countries in the world in terms of income inequality.



- Metropolitan Region of São Paulo
- São Paulo municipality
- urban areas
- favelas
- water
- train lines





of green public spaces as the city becomes privatized, and a rise of social isolation as paulistanos seek the safety of gated communities. Inequality and injustice become defining characteristics of the city, as well of the country with Brazil ranked as one of the worst countries in terms of income inequality (figure 02).

As a result, São Paulo is notably considered a city of tensions and conflicts, often nicknamed the “City of Walls” (Caldeira, 2000).

problem field.

Past urban planning practices and institutions have created the ‘City of Walls’, the nickname of São Paulo (Caldeira, 1999), and in turn, affected the social trust within the city between citizens and institutions.

Segregated Communities

The base for social trust has been on the decline with growing spatial segregation apparent within the city, stemming from the economic recession of the 1980s-1990s when the economic crisis led to increasing levels of poverty. As poverty rapidly increased, different social groups began creating large physical distances between each other; the richer population moved to the center while the poorer population moved to the periphery. In 1993, 19.4% of the population in São Paulo (1,902,000 people) lived in the Favelas when only 20

years prior in 1973, it was only 1.1% of the population (Caldeira, 1999). Over the coming years, with the rise of violence and crime, citizens began to use different strategies to separate each other.

Closed condominiums (*condomínio fechado*) and gated communities are visual consequences of a deepening divide and social segregation within São Paulo. “Privatized, enclosed, and monitored spaces” (Freeman, 2003), these segregated communities were formed for the purpose of creating safe and secure housing, away from violent crime. As media institutions, such as the O Estado de São Paulo Newspaper, began marketing these *condomínios fechados* in the 1970’s as safe and secure areas in the city, surrounded by like-minded people, it began to shape people’s beliefs and behaviors towards other social groups.

Soon, it became the norm for those who could afford it, middle to higher income, to seek out these enclaves, creating a market for the continuous construction

of these communities. As segregational practices continued to be developed, social inequality became evermore present in São Paulo’s society. The rise of neo-liberal principles in the 1990’s, with the ideas of a privatized public sphere, cuts to public spending, and deregulation practices, only heightened the worsening inequality and gave a foundation for wealthier urban dwellers and large real estate companies to control the urban development of the city (Coy, 2006). These “visible islands of wealth” (Coy, 2006) created physical barriers to shut out the exterior world that they conceived as riddled with crime; through walls with barbed wires, private security systems, continuous monitoring systems by security guards and holding no relationship with the exterior environment (Caldeira, 1999).

As wealthier residents turned their lives inwards, the exterior environment of the public domain became characterized by fear and paranoia and social connections began to deteriorate (Caldeira,

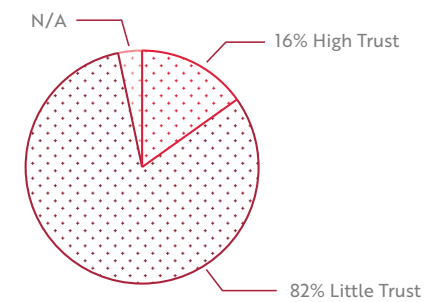
FIGURE 05. ADVERTISEMENT FOR CLOSED COMMUNITIES. ■
SOURCED FROM: O ESTADO DE SÃO PAULO NEWSPAPER, 1952



1999). Through the segregational practices of close communities, public interactions only occurred within homogeneous groups. Mistrust towards the exterior world heightened and the part of the population living beyond their walls were excluded and seen as dangerous. In 2014, 82% of Brazilians reported saying that they have little to no trust in other people not a part of their immediate group (Lee, 2014). Mistrust over the years only grew as according to a 2018 Latinobarómetro opinion survey, only 4 years later, 96% of respondents reported saying they cannot trust most people (Bertelsmann Stiftung BTI, 2022).

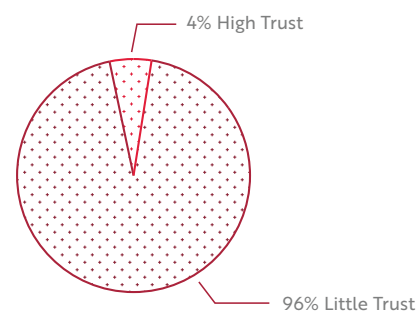
Public Mistrust

Trust has a hand in how successful urban planning is and is vital for having active citizen participation in planning processes. More than that, social trust is an important indicator of the strength of equality and democracy in countries across the world.



2014

2014 study from Brazilian Institute of Public Opinion and Statistics.

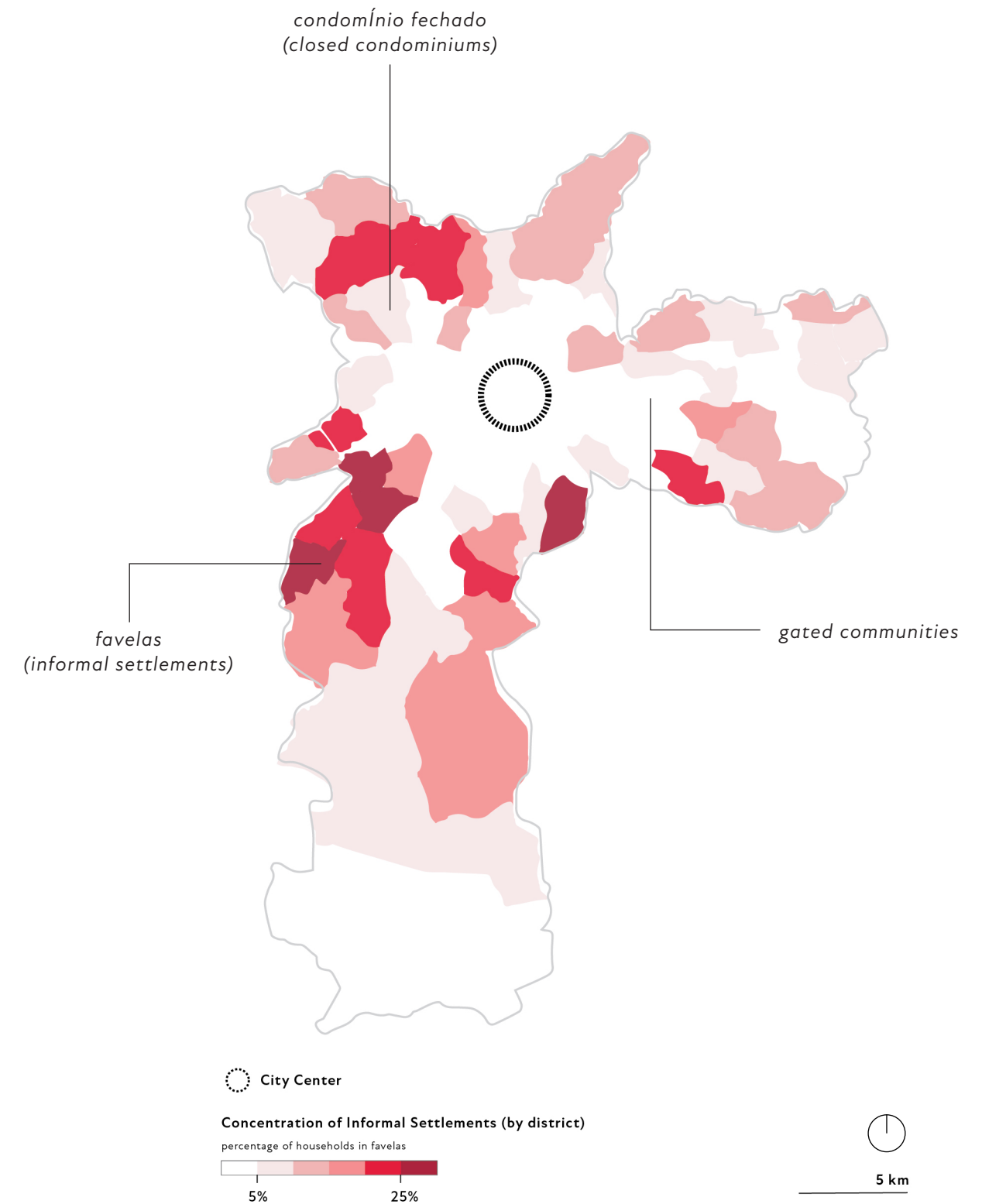


2018

2018 Latinobarómetro opinion survey.

■ FIGURE 06. AVERAGE TRUST IN BRAZIL.
MADE BY AUTHOR.
SOURCE: BERTELSMANN STIFTUNG BTI, 2022 AND LEE, 2014

FIGURE 07. CONCENTRATION OF INFORMAL SETTLEMENTS ■
MADE BY AUTHOR



Good governance and a distribution of opportunities for all is a crucial element in the process of building trust within cities. Thus, incorrupt actions, accountability, and equal opportunities are vital for citizen's trust in their democracy as well as in their neighbors. Without a foundation of trust, cities around the world are unable to tackle pressing societal and environmental risks and push forward to a sustainable future.

In São Paulo, a history of uneven development, colonization, and political and economic neglect has created a city riddled with mistrust.

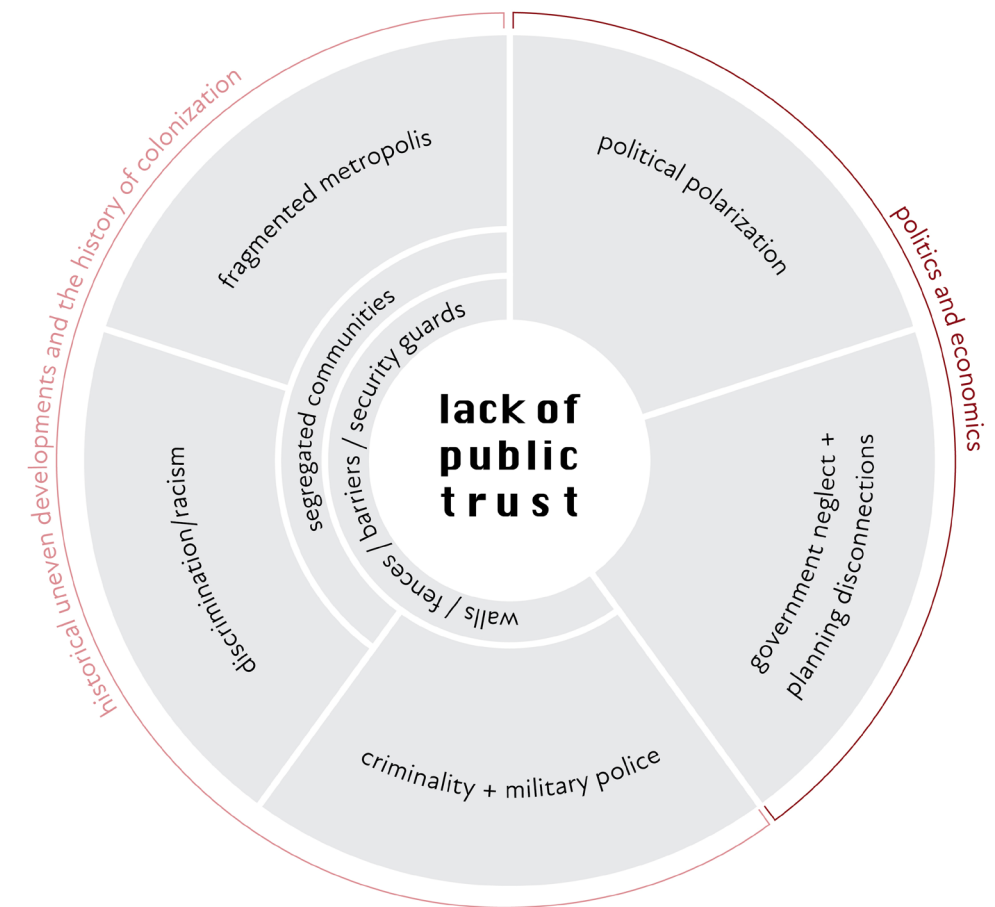
As these trends shaped the city of today, issues of fragmentation, discrimination, criminality, corruption, neglect, and segregation heightened relationships built on mistrust between different social groups and institutions. Low trust implies living in a society where citizens do not feel safe in public spaces, where interactions do not occur outside of immediate groups, and where the foundation of democracy is fractured.

Economic and Environmental Walls

Fragmentation and segregational practices are also reinforced with poorly serviced and at risk hinterlands that contribute to socio-economic inequalities and environmental risks. As marginalized communities were pushed towards the peripheries of the city due to the economic recession in the 1980's and neglected in the planning of the city, these areas are now marked with low economic value and an abundance of environmental risks.

The confinement of employment opportunities remains in the central city, reinforcing inequality and segregation as lower-income populations must commute longer everyday for work. With the sprawl of urbanization, efforts have been made to broaden the transportation network within the city to combat the increasing commute hours, with the average commute time for poorer residents in the periphery accumulating to 2.5 hours per day (WorldBank,

FIGURE 08. LACK OF PUBLIC TRUST DIAGRAM. ■
MADE BY AUTHOR.



2019). However, the services of public transportation still remain limited in these lower-income areas, with a lack of established networks between communities.

As the city struggles with an uneven distribution of services and a lack of employment opportunities within socially vulnerable areas, these communities also struggle with the brunt of environmental risks. While the socio-economic benefits remain in the center of the city with wealthier residents, environmental risks such as air and water pollution and a lack of adequate green spaces are concentrated in lower-income areas. These unevenly distributed risks lead to a higher environmental vulnerability within lower-income communities as they disproportionately feel the burdens of climate change.

Pressures on Ecological Systems

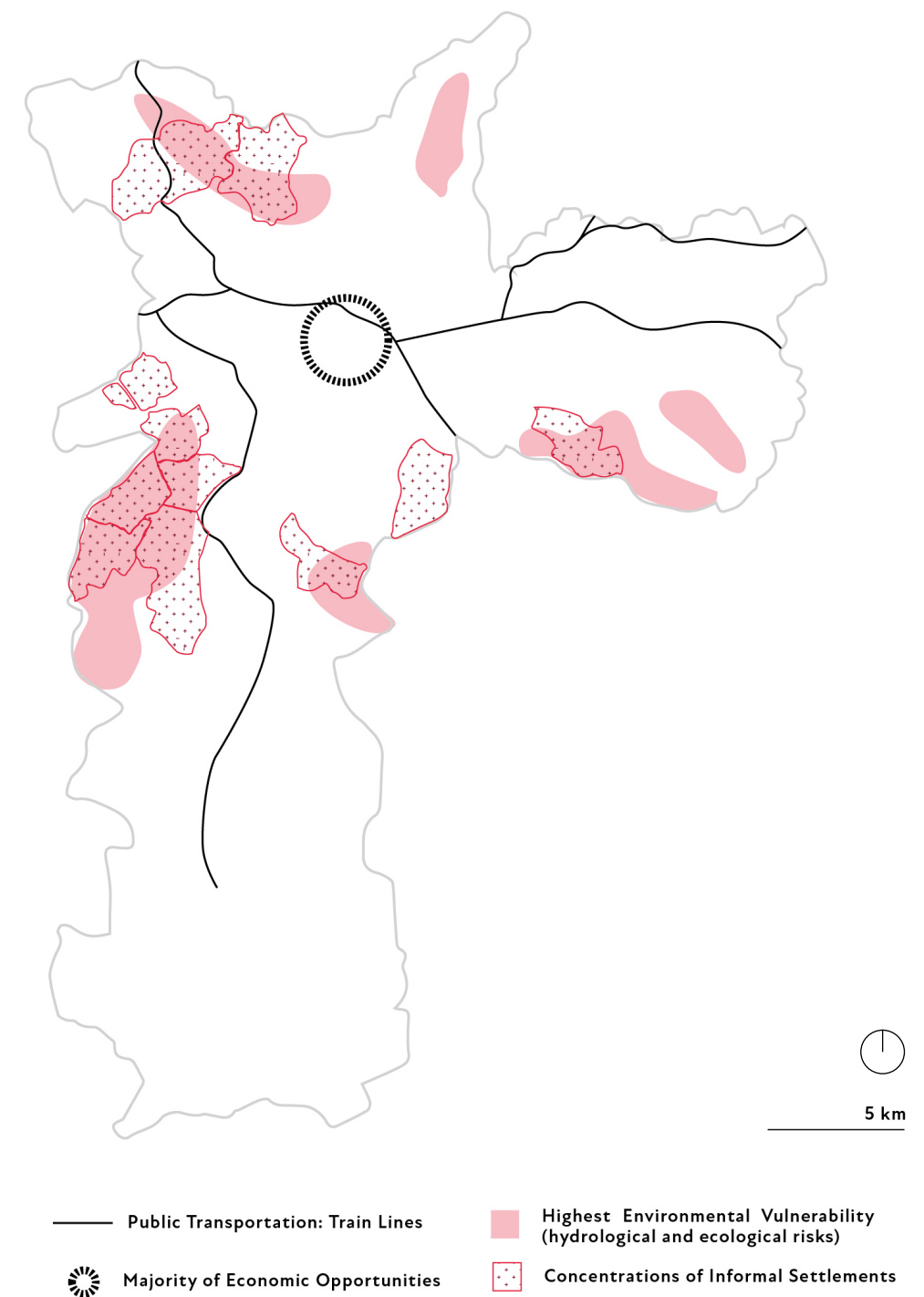
Cities worldwide are continuously being affected by the worsening effects of climate change through

increasing severity and frequency of natural disasters. As urbanized areas continue to over-pressure their ecological systems for ecosystem services such as over extracting water for public supply and cutting down forests for materials, city inhabitants are continuously put at risk.

The city of São Paulo is no exception, with combinations of climatic pressure, degradation of ecological systems, and high rates of urbanization triggering an increase in environmental events such as floods, fires, and landslides. In an urban environment tackled with multidimensional inequality, the groups of people most vulnerable to environmental risks and disasters are those that have been historically marginalized in the development of the city. The urban poor who typically lack the resources to absorb the effects of a rapidly changing environment.

A majority of the most socio-economic vulnerable populations, who often live in favelas, inhabit environmentally hazardous areas

FIGURE 09. ECONOMIC AND ENVIRONMENTAL VULNERABILITY AREAS ■
MADE BY AUTHOR



on the periphery of the city. Their vulnerable locations coupled with poor sanitation infrastructure, degradation of ecological sources, and climate change thus disproportionately intensifies these population's vulnerability.

Thus, the pressures from the unplanned and rapid growth of the city compounded with increasing pressures from climate change intensifies São Paulo's issue of inequality.

Planning Disconnections

As the divide between social groups began to grow, so did the divide between informal actions and formal planning. Informal urbanization was first a reaction in the mid 1900s when there was a lack of a response from the government to provide adequate housing and services tied with the rapid growth of Brazilian cities with immigration and industrialization. This illegality and disconnection from the informal and formal realm disallowed the integration of public services in these areas, promoted

spatial segregation, and created issues with citizenships.

As informality grew, communities like the Favelas in the peripheries of the city, where environmental risks were concentrated, developed through a process of self help construction (*auto-construção*). Due to the illegality of these communities and the prevention of the public sector to provide basic services, the relationship between these marginalized communities and public authorities deteriorated, marred with mistrust.

The informal and formal realms were largely disconnected from each other until the 1988 Constitution, Estatuto da Cidade (City Statute in 2001), and an end to the military regime with the call for democratization among Brazilians. This shift increased efforts for citizens to have a right to the planning of their city. However, the efforts made by institutions of decreasing social segregation and fragmentation largely remain unsuccessful.

Current Planning Practices

Most formal urban planning within the city occurs at the municipality level with the main tool for spatial planning as Master Plans, the latest of São Paulo created in 2014, with the Federal Government level focused on creating policies for regional projects for the integration of the country (Rocco et al., 2019).

There have been steps made to create citizen engagement within urban planning in São Paulo, namely through strategies in the process of their latest Masterplan in 2014. In this design process, planning authorities used two main methods of participation; the workshops and an online draft bill.

Within the participatory workshops, face to face discussion groups discussed the future of urban development in São Paulo. However, the urban planning "experts" only held merely a facilitator role and was not engaged in the exchange of knowledge with citizens, remaining as a hierarchical process. The workshops in this

process was less of a co-creation process and more of an analysis tool.

The second method was through means of an online draft bill where once the masterplan was written, citizens could add comments to sections of the bill. Although an online method of commenting allowed for a wider engagement and a flexibility of citizens to participate regardless of their schedules, this online platform comes with the exclusion of citizens who have access to technology.

These traditional urban planning practices, concentrated in zoning plans and land use regulations, have failed in confronting the spatial fragmentation within São Paulo. Formal institutions have the power for broader spatial changes as well as a large impact range, however, lack the knowledge of mitigating spatial segregation.

Self-organized initiatives and NGOs were born from the fragmented context of São Paulo as a way for citizens to have a positive impact on reducing socio-spatial segregation

and discrimination in a bottom-up approach. These organizations are abundant within the city due to the fact that the government's efforts at creating spatial inclusion have fallen short of creating an impact. The organization 'A Cidade Precisa de Você', meaning the City Needs You, is an example of the self-organized initiatives located throughout the city. As a collective of individuals, this organization aims at rebuilding São Paulo as a democratic and inclusive city through means of activating public spaces. Through the construction of urban furniture, workshops, small-scale interventions, and lectures, this organization creates dialogues between social groups as the first step towards spatial inclusion.

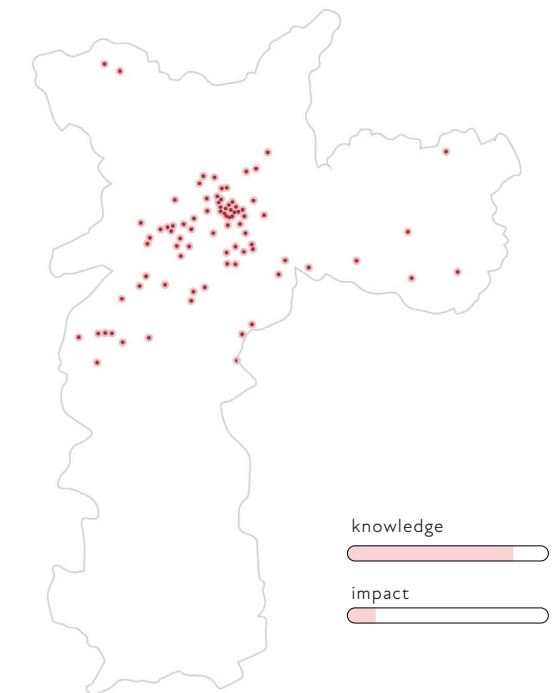
However, although these self-organized initiatives have the knowledge as well as projects that mitigate spatial segregation, these projects remain on a smaller scale and on a short term timeline.

With current planning practices and tools used like Masterplans

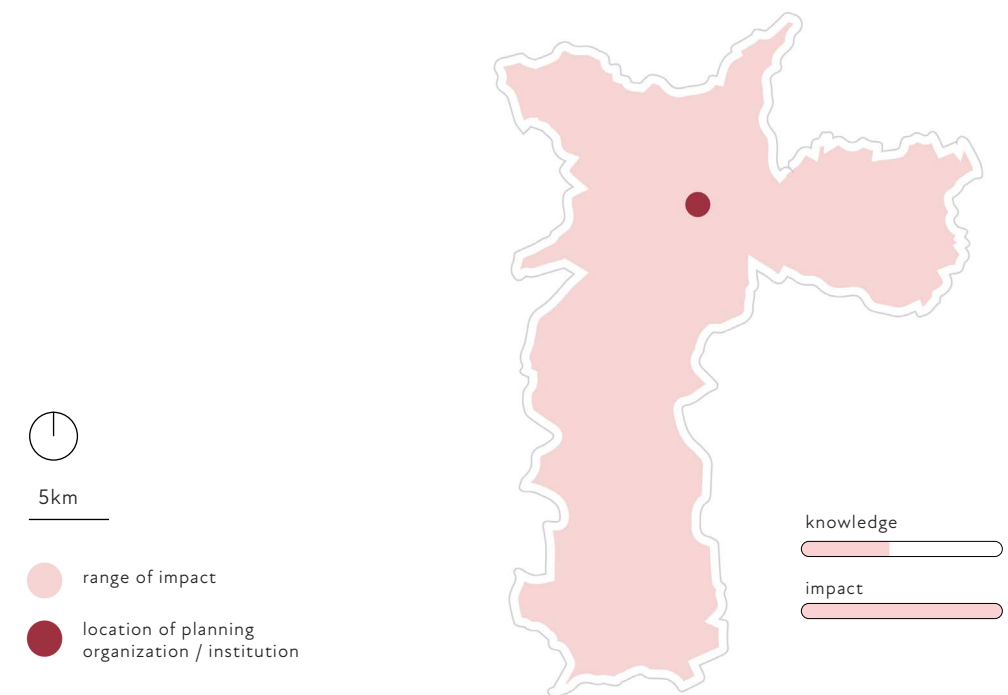
and small-scale public space design, urban plans in Sao Paulo lack a broader strategic vision for the mitigation of a fragmented and segregated metropolis.

FIGURE 10. PLANNING DISCONNECT. ■
DRAWING MADE BY AUTHOR.

SELF-ORGANIZED INITIATIVES



FORMAL PLANNING INSTITUTION



problem statement.

São Paulo's socio-spatial segregation and fragmentation transverse institutional, economic, spatial, social, and environmental levels, granting it the nickname of the 'City of Walls' (Caldiera, 1999). The increase in discrimination and inequality due to a lack of governance and unbalanced urban planning developments in the past has resulted in a society exposed to extreme, multi-dimensional inequality.

Rapid urbanization coupled with market-oriented development, governmental neglect, discrepancies between formal and informal systems within the city, and socio-spatial segregation has widened the gap between social groups within the city. These processes have shaped the multidimensional fragmentation within the city, creating walls transcending the just physical realm

and manifesting as walls in planning processes and in distribution of resources and opportunities.

These vulnerabilities in socio-economic systems of São Paulo are only further exacerbated as pressures from climate change causes extreme disturbances in the socio-ecological systems of the city. In today's globalized world, with rapid urbanization coupled with climate change, cities need to transition to a more sustainable and adaptive future. However, in a society with blatant socio-economic inequality, marginalized communities become disproportionately affected and left behind.



This photograph shows a clear illustration of social inequality in São Paulo with the bleak contrast between Paraisópolis, one of the largest favelas of the city, and the affluent neighborhood of Morumbi.

research aim.

The research aim of this project is to understand the urban patterns, climatic trends and governance practices that have led to a society aggravated with socio-economic inequality and ecological degradation, creating multi-dimensional vulnerability for marginalized communities.

With this research, a framework of socio-ecological strategies for the larger metropolitan region is identified for tackling issues associated with a city of walls to establish ecological integrity, social inclusivity, and political empowerment.

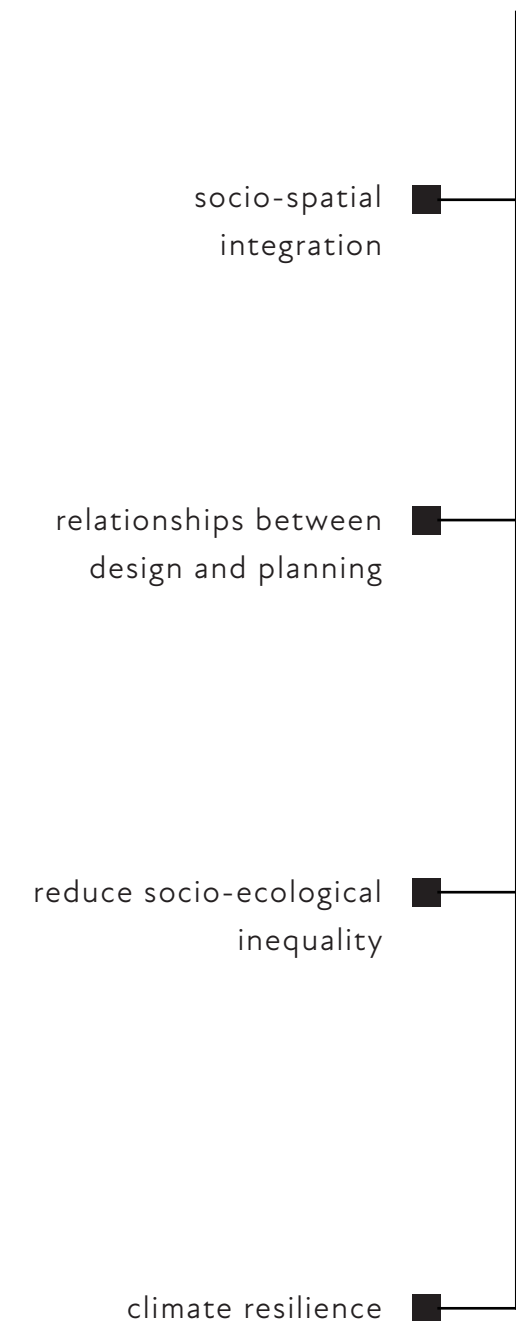
With the support of a vision aimed at distributing environmental justice, this project will also propose strategic actions throughout the metropolis that manifest at a more local scale in vulnerable areas to explore these relationships in a

more grounded and spatialized context. In addition, this research adds to the creation of a shared platform of knowledge around climate adaptation in Brazilian society through a publication of an informational booklet.

Through expanding benefits to all social groups, these outcomes will consequently act as a bridge in the “City of Walls” (Caldiera, 1999) and reverse patterns of vulnerability and inequality in São Paulo.

‘The Good Life’

DESIGN GOALS



research questions.

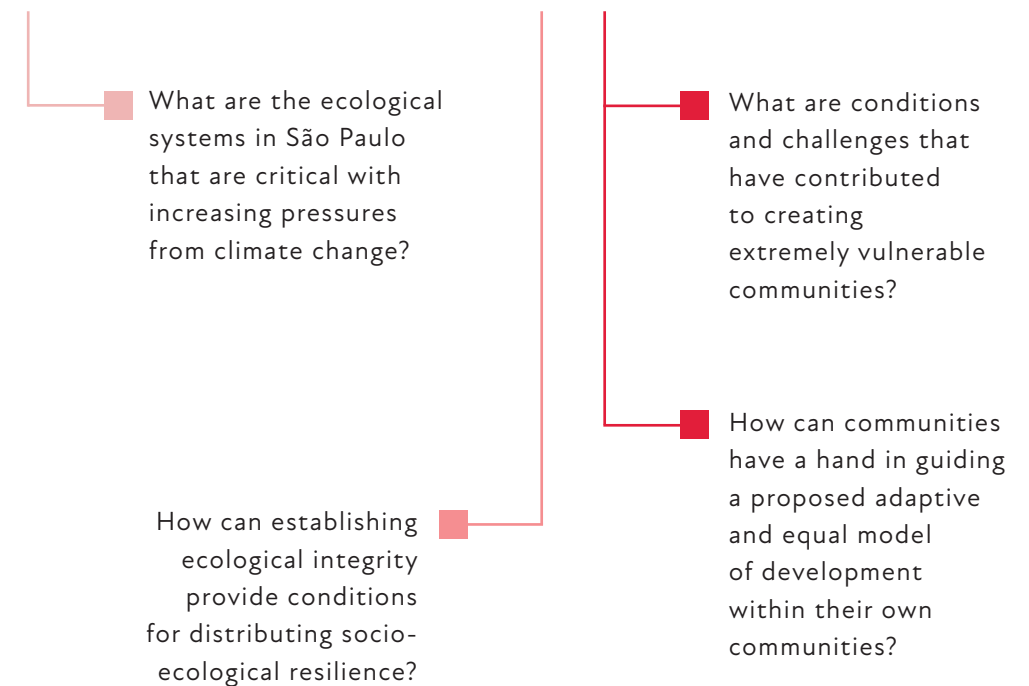
Strategies from the research aim formulate the research questions, which are focused on investigating these four aspects:

- *inclusion of informal settlements*
- *strategies to promote environmental-justice*
- *improve resilience and adaptability of vulnerable areas*
- *mitigate multi-dimensional inequality*
- *developing an accountable and adaptive process of development*

Main Research Question

How can environmental justice principles help boost resilience and bridge existing socio-spatial walls for vulnerable communities in São Paulo?

Sub-Research Questions



conceptual framework.

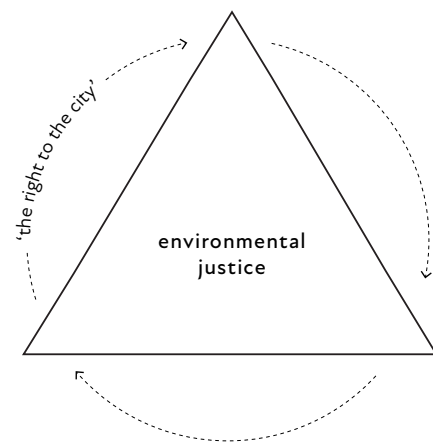
OVERVIEW

This chapter will orient the structure and provide a foundation for this research’s approach and analysis. Further elaborating on critical principles and concepts that are centered in the problem statement, research aims and objectives, and the scope of this research proposal.

SECTIONS

- *conceptual diagram*
- *environmental justice*
- *‘the right to the city’*

CONCEPTUAL DIAGRAM.

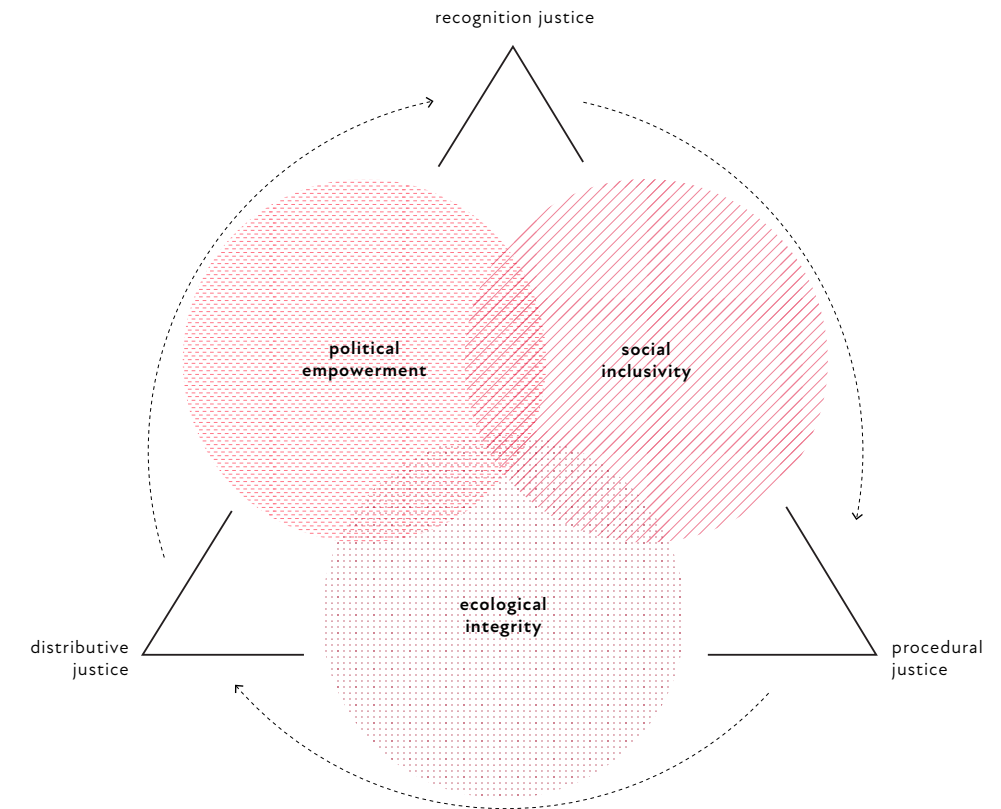


■ FIGURE 12. CONCEPTUAL DIAGRAM
MADE BY AUTHOR

The development of the conceptual framework is built around the principle of environmental justice of a fair and equal distribution and involvement in the designs and planning of a healthy environment (Geneletti & Kato-Huerta, 2022). Further defined through the foundation of the three pillars of recognition justice, distributive justice, and procedural justice. These pillars shape the concept of the 'Right to the City', a term first developed by Henri Lefebvre and later elaborated on by David Harvey, that proposes the idea that

all inhabitants have the right to shape and occupy their city. Thus, formulating a renewed view on collective rights (Henri Lefebvre, 1968).

These concepts aim to increase climate resilience, reduce socio-ecological inequality and promote socio-spatial integration within the Metropolitan Region of São Paulo. These issues of multi-dimensional inequality in São Paulo, heightened by increasing pressures from climate change, have never been adequately addressed by public institutions in the past. These failures are largely due to the over-simplification of the issue at hand. Therefore, this framework in figure 13 intends to address the gaps regarding strategies for the integration and resilience of vulnerable communities within the region. This conceptual framework thus articulates the multi-faceted approach of environmental justice through political empowerment, social inclusivity, and ecological integrity.



Political Empowerment

This concept is for the empowerment of marginalized communities into the construction and planning of their city. Thus raising these communities' opportunities for co-production and empowering disadvantaged communities.

Ecological Integrity

This concept acknowledges that society and ecological systems are interdependent and introduces resilience strategies that reject previously rigid methods of environmental management.

Social Inclusivity

This concept aims to permeate social, planning, and spatial walls to further integrate marginalized communities into the functional and structural systems of the city.

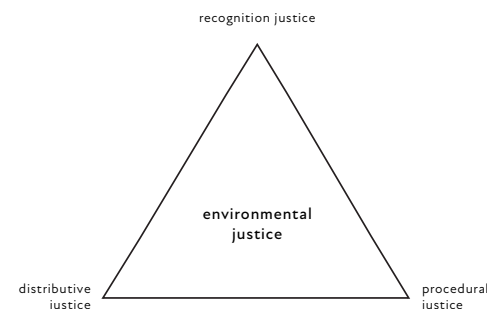
ENVIRONMENTAL JUSTICE.

Extremely marginalized communities due to socio-economic vulnerability are those that experience the most social and environmental injustices. These communities are often more exposed to environmental risks and are the most negatively impacted from larger 'greening strategies' in the urban world (Geneletti & Kato-Huerta, 2022). Environmental justice is based upon the principle of a fair and equal distribution and involvement in the designs and planning of a healthy environment.

In São Paulo, the development of the city of walls created visually present marginalized communities within the fabric of the city. Accordingly, these communities disproportionately feel the burdens from the pressures of climate change through increasing environmental risks associated with these areas. Due to the emergence of these communities as now socio-economic and environmental vulnerable areas, the theory of environmental justice

acts as a bridge between these physical and non-physical walls.

In this research the theory of Environmental Justice is conceptualized through an analysis on nature based solutions. Furthermore, environmental justice has been defined and cataloged in three main notions, as follows: 'distributive justice', 'recognition justice', and 'procedural justice' (Geneletti & Kato-Huerta, 2022).



Distributive justice, a principle of environmental justice, acknowledges the notion of a fair and equal spatial distribution. This conception challenges the unequal distribution of environmental burdens and benefits that are

allocated to areas of either marginalized and lower-income communities or higher-income communities (Geneletti & Kato-Huerta, 2022).

In the more social context, **recognition justice** is the principle based upon the social, political and cultural impacts of the previously stated most common dimension of environmental justice, distribution. Thus, this principle is embedded in the complex socio-economic underpinnings of the context. Therefore acknowledging the local knowledge and societal needs, thus recognizing the vitality of local communities in the construction of design solutions (Geneletti & Kato-Huerta, 2022).

Procedural justice pertains to the importance of co-creating and co-designing within these historically neglected communities (Geneletti & Kato-Huerta, 2022). In this sense, this principle is thus advocating for the acknowledgment of past planning practices that have excluded disadvantaged individuals and communities. These past

practices that, in the case of São Paulo, have led to public mistrust in planning and democratic institutions.

In other words, these concepts of distribution, procedures, and recognition are all bound to the complexity of environmental justice. This approach goes beyond solely the designs of bio-physical systems, but embraces the complexity of vulnerable communities in terms of the social, economic, political, and ecological layers of the metropolitan region.

SOURCES.

Jarum Kato-Huerta & Davide Geneletti. (2022, December). Environmental justice implications of nature-based solutions in urban areas: A systematic review of approaches, indicators, and outcomes. ScienceDirect.

Zimmermann, K., & Lee, D. (2021). Environmental Justice and Green Infrastructure in the Ruhr. From Distributive to Institutional Conceptions of Justice. *Frontiers in Sustainable Cities*, 3.

‘THE RIGHT TO THE CITY’.

‘The right to the city’ is a political idea first coined by Henri Lefebvre in 1968 and later elaborated on by David Harvey that seemingly proposes the need for a renewed view on collective rights. Harvey and Lefebvre dubbed this view on collective rights as ‘the right to the city’; a right that goes beyond an individual’s right to access the city’s resources but the right to shape the city for the collective’s needs (Harvey, 2012).

As Harvey observes, this collective right is at urbanization’s core and yet, is most neglected in today’s globalized societies. Cities around the world, São Paulo included, have historically been shaped by a small group of political and economic elites (Harvey, 2012), who continue the pattern of fragmented and divided cities. As the opportunities and resources are provided for rich elites, the poorer communities of the city are excluded from its resources. All of these results become apparent in our spatial environment as the city becomes

increasingly divided by fortified enclaves, gated communities, and privatized public spaces (Harvey, 2012). As such, in São Paulo, these processes have divided the city. Done so for the interests of the private market and have lent a hand to the cultivation of the city as the ‘City of Walls’.

Large planning proposals that shape the urbanized environment that are for “supposedly public benefit and did so in the name of civic improvement” (Harvey, 2012, p. 16) often results in the removal of the working class and the expulsion of the poorer communities to the periphery. Lefebvre draws parallels between this concept and the urban renewal of Paris’s city center by Haussmann, the French official under Emperor Napoleon’s rule. While Haussmann transformed and beautified Paris’s city center, simultaneously, he also enhanced the social segregation of the classes by removing the working class citizens from the center.

Therefore, as Lefebvre argues, ‘the right to the city’ is a slogan to call for action to bring the conflict between social needs and capital processes to light. As planners and designers move forward, there must be an ideological shift in the processes of the development of cities.

In order to adequately address issues of multi-dimensional inequality, fragmentation, and increasing environmental risks, models of development must include the inhabitants of the city to further shape their own environment and contribute to the integration of collective rights into planning spheres.

SOURCES.

Harvey, D. (2012). *Rebel cities: From the right to the city to the urban revolution*. Verso.

Henri Lefebvre. (1968). *The Right to the City*.

methodology framework.

OVERVIEW

The methods further elaborated on within this chapter aim to collect and analyze data to thus understand the phenomenas present in this research.

Six methods were then chosen to define relationships, the context, and further promote strategies for the expected outcomes. These methods will be explained and reasoned in the following sections.

As well, this chapter will reveal the expected outcomes split between a spatial vision, strategic actions, and an informational booklet.

Lastly, this chapter will present the timeline of this research across the academic year.

SECTIONS

- *methods*
- *outcomes*
- *timeline*

methods.

Q1

What are the conditions and challenges that have contributed to creating extremely vulnerable communities?

METHODS: DATA ANALYSIS, TRANSCALAR MAPPING, AND VULNERABILITY FRAMEWORK

Through methods of data analysis, transcalar mapping and creating a vulnerability framework, I uncovered a deeper understanding about the conditions of development that has led to a society of extreme vulnerability.

The first step was to identify specific conditions that cause social and economic vulnerabilities within the Metropolitan Region of São Paulo. Which will then uncover specific communities that have been marginalized in the development of the city, making these areas thus disproportionately vulnerable to environmental risks. Once the analysis of which areas are most marginalized and vulnerable, these areas will become key areas of interest when proposing inclusive policies and methods.

Q2

What are the ecological systems in São Paulo that are critical with increasing pressures from climate change?

METHODS: DATA ANALYSIS, TRANSCALAR MAPPING AND STAKEHOLDER ANALYSIS

With a deeper literature analysis into the meaning of re-establishing ecological integrity in the context of the Global South, the next step is understanding the ecological systems present in São Paulo. With data analysis, I will gain more of an understanding on the environmental crises that burden the communities of the city, especially the factors that are unevenly distributed to marginalized communities. Transcalar mapping will then further uncover the relationships between different ecological systems. This method proposes mapping through numerous scales as environmental systems and disasters do not respect political and jurisdictional borders. With the analysis on the critical ecological systems of São Paulo, this research will focus upon strategies of re-establishing its integrity for the prevention of further marginalizing communities.

Q3

How can establishing ecological integrity provide conditions for distributing socio-ecological resilience?

METHODS: LITERATURE REVIEW

Through literature research, I will uncover the meaning of the term ‘ecological integrity’ for the purpose of understanding its role in bridging the socio-economic walls in São Paulo. With this question as a guidance, this term will unravel through key pieces of literature on the meaning of ecological systems and the issues against them in the context of Brazil.

The first step is identifying key pieces of literature on ecological systems and the planning and design processes of re-establishing their integrity. With the analysis of these literature pieces, I will conclude the role of establishing ecological integrity in addressing the ‘city of walls’. Furthermore, this question will thus guide the vision design of providing environmental justice to vulnerable groups of this research.

Q4

How can communities have a hand in guiding a proposed adaptive and equitable model of development within their own community?

METHODS: STAKEHOLDER ANALYSIS, INTERVIEWS + SURVEYS, LITERATURE REVIEW

Through methods of stakeholder analysis, surveys, and literature review, I will uncover the power imbalances in current environmental management systems in São Paulo. Thus revealing the conditions of an inflexible system of governance and management that have led to a society of environmental inequality and environmental degradation.

Once an understanding of existing systems is established, the next product of this research will be to experiment with proposals of incorporating communities and organizations within these rigid systems through co-production methods.

LITERATURE REVIEW.

DEFINITION

This method is a collection of information gathered, relative to the topic of the research.

OBJECTIVE

Firstly to research relevant articles and papers related to the problem field and that addresses the topic of multidimensional inequality in São Paulo.

OUTCOME

This will lend into defining the contextual framework of policies and issues present in São Paulo. The overall conclusions from research will define a theoretical framework, with relevant literature, to provide an overview of the strategies and concepts defined through the research.

MAIN DATA SOURCES

- *Science Direct*
- *Places Journal*
- *Google Scholar*
- *Web of Science*
- *Research Gate*

MAIN DATA SOURCES

- World Bank* ▪
- BTI* ▪
- Rede Nossa São Paulo* ▪
- GeoSampa* ▪
- Statista* ▪

DATA ANALYSIS.

DEFINITION

This method involves the use of relevant data with a critical interpretation.

OBJECTIVE

The method intends to analyze how the concept of the ‘city of walls’ in Sao Paulo have led to an unjust society. It will explore the data followed by conclusions.

OUTCOME

Understanding the urban inequalities in the vulnerable areas of the city, as well as the political and environmental systems regarding these areas.

STAKEHOLDER ANALYSIS.

DEFINITION

This method identifies and understands the important stakeholders and actors involved in the context in the problem field.

OBJECTIVE

To identify the stakeholders related to urban inequality and environmental integrity with research to uncover the power and hierarchal relationships. Then to follow, to propose strategies for a collaborative method based upon opportunities.

OUTCOME

Uncovering the stakeholder structures and to understand the opportunities for partnerships and areas for co-creation amongst stakeholder groups.

MAIN DATA SOURCES

- *NGO's*
- *Municipal of São Paulo*
- *SABESP*
- *DAEE*

MAIN DATA SOURCES

- *IVS.IPEA.gov*
- *Rede Nossa São Paulo*

DEFINITION

This method measures vulnerability by looking at the risks and social and economic conditions in districts of the city.

OBJECTIVE

Through the vulnerability framework on social and economic factors, with methods of statistical analysis and spatial analysis, an assessment will made to unfold the highest areas of vulnerability.

OUTCOME

Revealing the areas in Sao Paulo with the highest social and economic vulnerabilities. Thus, uncovering areas of marginalized communities that are most important in planning for an environmentally just society.

TRANSCALAR MAPPING.

DEFINITION

Mapping of relationships reflected in the spatial environment of São Paulo, crossing scales.

OBJECTIVE

To discover the contextual relationships through mapping fragmentational and segregational structures in the built environment. In the case of this research, this method will be elaborated on multiple scales: the macro (metropolitan region of São Paulo), meso (São Paulo municipality), and micro scale (a chosen vulnerable district).

OUTCOME

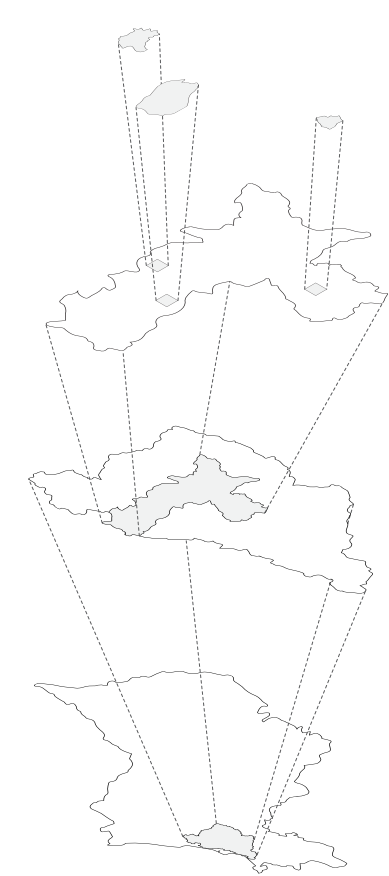
To understand the social, spatial, and ecological conditions of the area and to uncover the relationships between them.

Q1

Q2

MAIN DATA SOURCES

- *GeoSampa*
- *Open Street Map*
- *Rede Nossa São Paulo*
- *dados.prefeitura.sp.gov.br*
- *DataGEO*



SURVEYS.

DEFINITION

An onnline questionnare survey that will provide qualitative data and research on the understanding of the barriers in place in relation to ecological designs and plans in São Paulo.

OBJECTIVE

This method is designed to gather qualitative information from key actors in relation to the political and ecological environment of São Paulo. In order to gain an understanding of the current knowledge gaps and further analyze possibilities.

OUTCOME

An analysis of present political systems and further proceed with opportunities for the incorporation of co-creation methods with vulnerable communities. As well an analysis into the existing knowledge gaps present.

Q2

Q4

outcomes.

“Environmental Justice is a question of scales”

(Zimmermann & Lee, 2021)

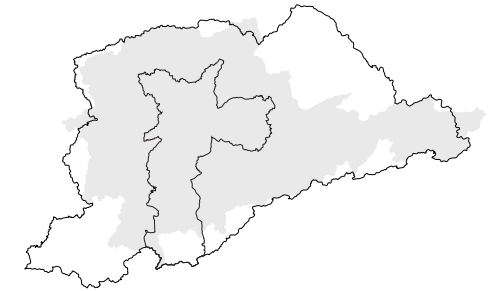
The outcomes of this research are conceived as a reaction to current urban planning practices in São Paulo. Furthermore, the outcomes are elaborated by three productions: a strategic vision of development for the Metropolitan Region, a design exploration of strategic actions on a localized and vulnerable case study, and an informational booklet for the Brazilian society.

Each product of this research is framed as an argumentation for future processes and designs that São Paulo should adopt for establishing ecological resilience, social inclusivity, and political empowerment. While the design outcomes are primarily distributed within the scales of the metropolitan region and the municipality of São Paulo, the design exploration will be within a district scale of a specific vulnerable community.

FIGURE 16. OUTCOMES DIAGRAM ■
MADE BY AUTHOR

Metropolitan Region of São Paulo (*meso*)

strategic vision for the re-establishment of ecological integrity of the environmental systems of the Metropolitan Region, focused around the Alto Tietê Hydrographic Basin, that would promote socio-ecological resilience.



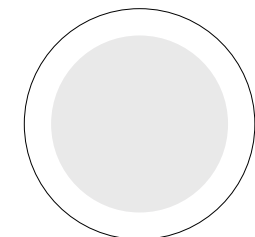
Municipality of São Paulo (*macro*)

Local design experiment for the implementation of the socio-ecological strategies for ecological integrity, social inclusivity, and political empowerment.



Local (*micro*)

An informational booklet for Brazilian society to bridge knowledge gaps present about climate change and propose scenarios of climate adaptation strategies.



strategic vision.

The product of a strategic vision is for the re-establishment of ecological integrity for the promotion of socio-ecological resilience. This outcome of envisioning a future of the region of São Paulo with socio-ecological strategies is a reaction against the current practices in place within the city that attempt to tackle these issues of environmental instability and social inequality.

Current attempts to tackle environmental issues such as flooding remain in the realm of engineering interventions, such as piscinões that solely represent a temporary solution for a disorganized city. This current system of smaller scale engineering solutions and lack of a larger strategic plan for the management of environmental risks within the city highlights the powerful role that the private sector has in shaping the urban fabric.

This design outcome focuses on the theory of eco-system based

approaches, with an emphasis on natural based solutions as a response to São Paulo's previous hard interventions. The strategic vision broadens the scale to the metropolitan region of São Paulo as an acknowledgement of unintended effects of natural based solutions designed in low-income areas that lead to gentrification and displacement. This outcome aims at tackling critical ecological sites in the larger scale of the Metropolitan Region as to advertently increase environmental protection for marginalized communities.

With a strategic vision for the establishment of ecological integrity, social inclusivity, and political empowerment within the scales of the metropolitan region of São Paulo, this outcome will provide an integrated and long-term framework of socio-environmental goals for the desired outcome of São Paulo.

local adaptation design.

This outcome of the research aims to explore the design implementations of the previously elaborated socio-ecological strategies on a specific localized scale. Thus exploring a design experiment in a specific case study with the highest overlap of socio-economic inequality and socio-ecological vulnerabilities.

informational booklet.

In relation to climate change and adaptation strategies, there is an urgent need to bridge existing knowledge gaps that limit adequate interventions and implementations of policies or designs within the Global South. In order for a successful practice of adaptive governance that includes a multitude of diverse stakeholders from the public, private and civil society, there must be a foundation of shared knowledge. Therefore, within environmental planning and design, there is an urgent need for the dissemination of knowledge

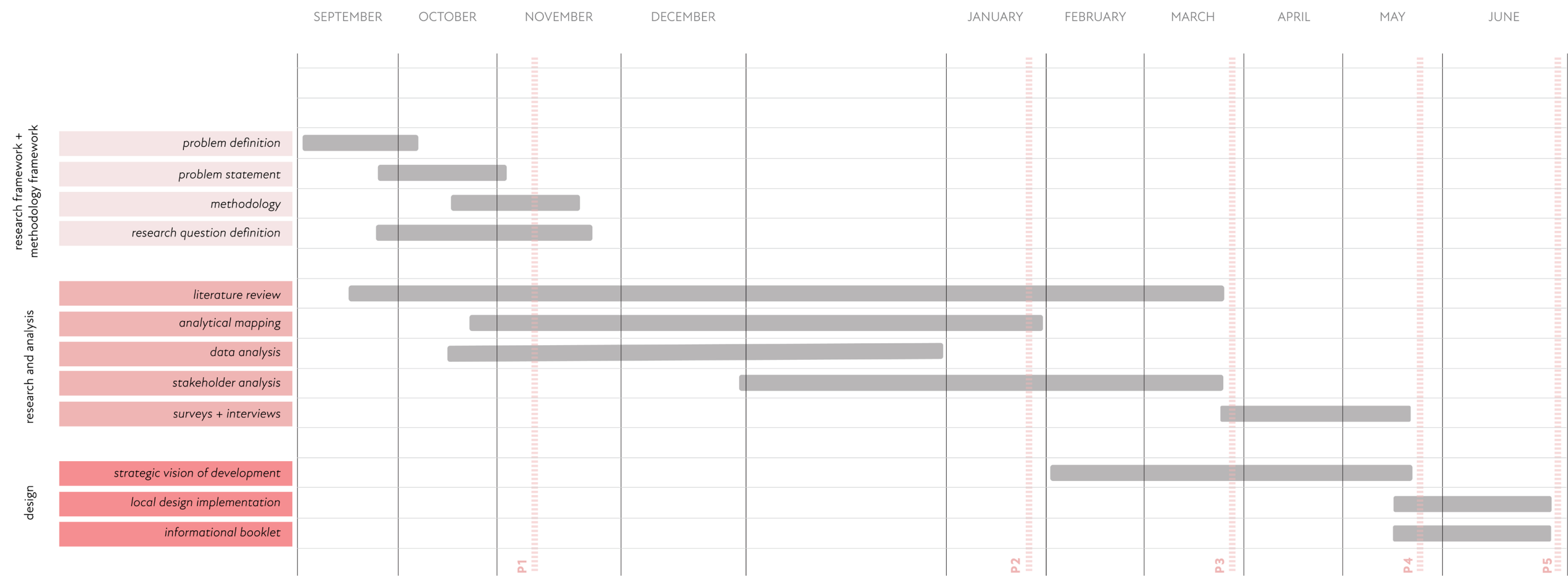
as a way to raise awareness and promote dialogue between stakeholders.

Evidently, in São Paulo, there is a pressing necessity to improve information regarding vulnerability assessments, environmental impacts that arise from climate change, and long-term climate projections and scenarios (Pedro Henrique Campello Torres et al., 2021). Therefore, a product of this research will aim to combine missing information to crucial actors within São Paulo's society as a key ingredient for ensuring a co-production process. All in order to empower marginalized communities and local organizations to engage in solving climatic problems that require a combination of top-down and bottom-up interventions.

FIGURE 17. TIMELINE OF THESIS ■
MADE BY AUTHOR

timeline.

The time schedule shown in figure 17 show the process of this thesis. The first section mainly driven by an analytical approach with literature, theories, and concepts to structure the research topic. Further on, the methods will be focused on the spatial analysis to have an understanding on the areas of conflicts and opportunities. The third section of the time table is aimed at design strategies, followed by periods of evaluation and reflection.



theoretical framework.

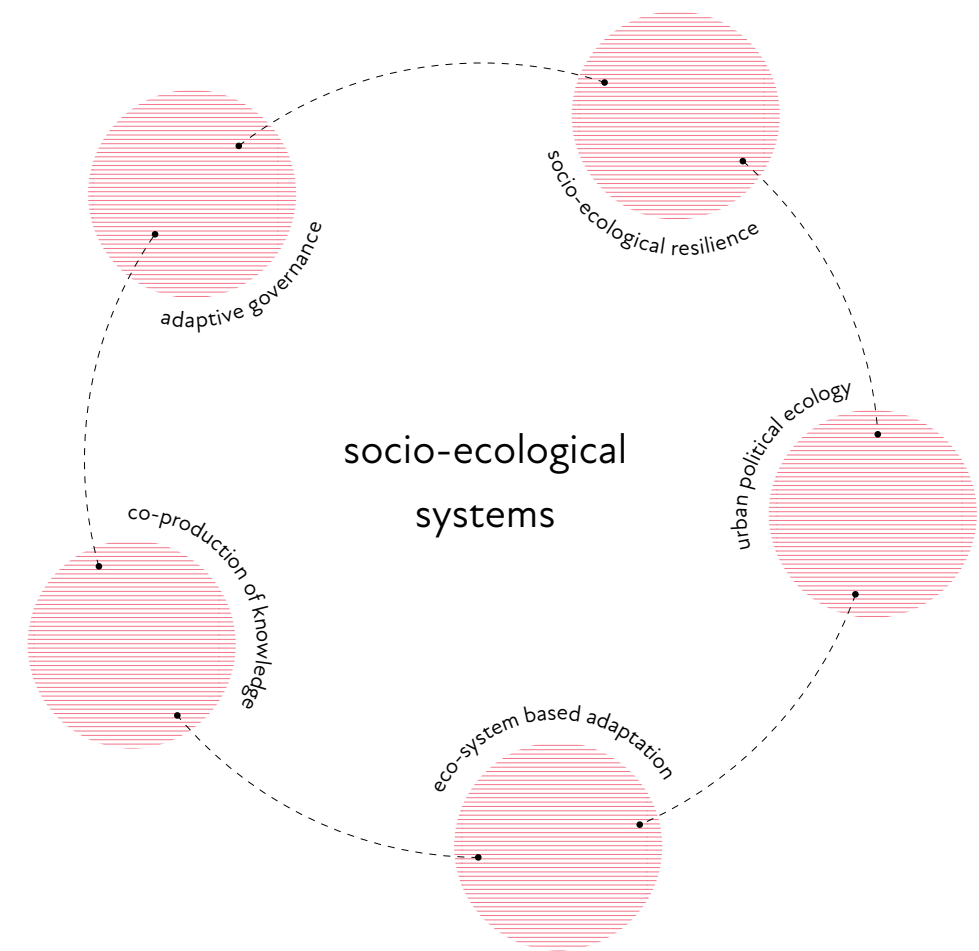
OVERVIEW

This chapter will focus on the theoretical underpinning of the previously stated concepts of political empowerment, social inclusivity, and ecological integrity. The theories presented in this chapter will support and orient the analysis and strategies of this research.

Furthermore, this chapter will introduce the chosen approach and elements of the following volume on analysis, adapted from relevant readings and theories.

SECTIONS

- *theoretical approach*
- *analytical approach*



■ FIGURE 18. THEORETICAL FRAMEWORK
MADE BY AUTHOR

The theoretical framework is constructed around the socio-ecological systems approach, with interconnectable theories: *co-production of knowledge*, *adaptive governance*, *socio-ecological resilience*, *urban political ecology*,

and eco-system based adaptation. These theories support the objectives of this research and further develop the proposals of this thesis for environmental justice.

theoretical approach.

01

CO-PRODUCTION OF KNOWLEDGE

Miller, C. A., & Wyborn, C. (2020). Co-production in global sustainability: Histories and theories. *Environmental Science & Policy*, 113, 88–95. <https://doi.org/10.1016/j.envsci.2018.01.016>

Pedro Henrique Campello Torres, Pedro Roberto Jacobi, Sandra Momm, & Ana Lia Leonel. (2021). Data and knowledge matters: Urban adaptation planning in São Paulo, Brazil | Elsevier Enhanced Reader. <https://doi.org/10.1016/j.uclim.2021.100808>

In this research, the theory of co-production of knowledge elaborated by Miller and Wybron (2020) integrates marginalized communities in the development of plans that affect their communities. Currently, issues of data and knowledge gaps exist in the city of São Paulo that hinders the implementation of plans and actions regarding solutions for climate adaptation. Through a survey conducted in 2021 for actors part of climate adaptation in São Paulo, the main limitations for successful environmental actions stem from information gaps between communities and ‘experts’ (Pedro Henrique Campello Torres et al., 2021).

The term ‘co-production’ was first coined by Elinor and Vincent Ostrom in the 1970s to promote collective goods like environmental protection by governmental agencies through a process of contributions and cooperation between diverse sets of actors (Miller & Wyborn, 2020).

The practice that guides inclusive environmental management implies that the process of the accumulation of applicable knowledge of sustainable actions must be a collaboration with local users, governments and institutions. This involves engagement across scales for a diverse set of knowledge to fully analyze socio-ecological systems and appropriate responses.

Co-production of knowledge has the capacity to act as a bridge in a contested environment between marginalized communities and public authority by creating a

platform of a shared knowledge system, thus rehabilitating a trust. It is crucial to understand that sustainable management of large ecological systems and social standards is inhibited by the sole production of knowledge by a single agency. While cooperation does not “imply harmonious or level power relations between public agencies and communities”, as multiple actors often leads to complex arrangements and shifted power balances, knowledge co-production does aim to increase the capacity to manage future conflicts and crises (Miller & Wyborn, 2020).

Miller and Wybron defines three fundamental elements for a successful process of co-production: the inclusivity in the diverse set of actors involved, awareness of the existing power dynamics, and acknowledgment that co-production of knowledge is a “process of re-configuring... social authority” and is thus intertwined with governance (Miller & Wyborn, 2020).

02

ADAPTIVE GOVERNANCE

Chaffin, B. C., & Gunderson, L. H. (2016). Emergence, institutionalization and renewal: Rhythms of adaptive governance in complex social-ecological systems. *Journal of Environmental Management*, 165, 81–87. <https://doi.org/10.1016/j.jenvman.2015.09.003>

Pedro Henrique Campello Torres, Pedro Roberto Jacobi, Sandra Momm, & Ana Lia Leonel. (2021). Data and knowledge matters: Urban adaptation planning in São Paulo, Brazil | Elsevier Enhanced Reader. <https://doi.org/10.1016/j.uclim.2021.100808>

Adaptive governance is an emergent form of environmental governance. The term is not exclusively applied to socio-ecological systems, but in recent literature, has become more linked to these ideas. This term represents a shift away from the traditional government management processes that remain hierarchical and towards a broader concept that incorporates a variety of diverse stakeholders (Pedro Henrique Campello Torres et al., 2021). In Chaffin and Gunderson’s words (2016), “Adaptive governance provides the capacity for environmental managers and decision makers to confront variable degrees of uncertainty inherent to complex social-ecological systems” (Chaffin & Gunderson, 2016). Therefore, the fundamental understanding of this theory is thus the re-

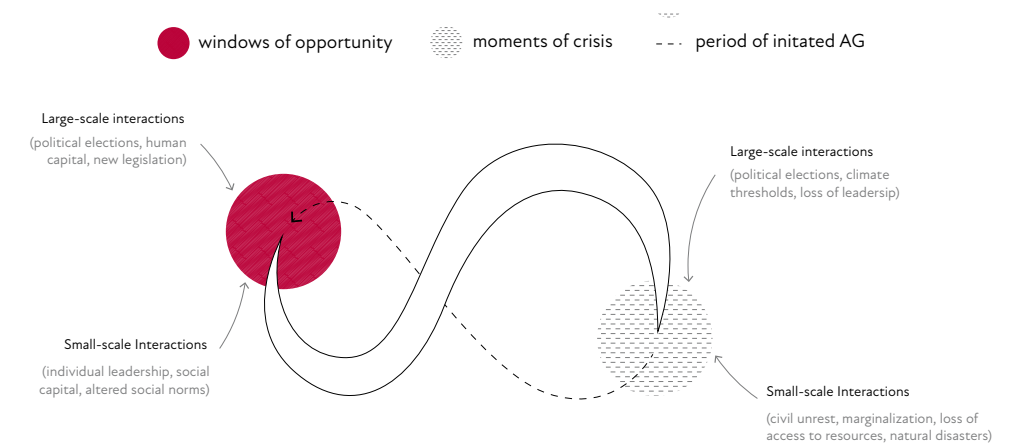
configuration of governmental structures and management systems for adaptivity in times of socio-ecological instability. The formation of the theory of adaptive governance stems from the increasing complexity of interdependent variables within social and ecological systems coupled with difficulties attached to the multi-scalar nature of these environmental issues. Many scholars proposed adaptive governance, also referred to as “resilience-based governance”, due to these complexities and increasing periods of uncertainty arising within these systems (Chaffin & Gunderson, 2016). Therefore, expanding the diversity of actors and feedback loops between different stakeholders encompasses a more inclusive and flexible management system.

Within São Paulo, the environmental management system is primarily based around a single mixed public-private company (SABESP) that is intended to “stabilize ecological systems and meet societal goals of sustainable resource use” (Chaffin

& Gunderson, 2016). However, this existing system is unable to cope with increasing environmental pressures and further degrades ecological systems for the purpose of human consumption. These strains on the systems allow for an opportunity for the theory of adaptive governance (AG) to replace an existing system of incomplete information, uncertainty, conflicts in resource allocation, and disturbances in ecological systems.

Chaffin and Gunderson (2016) represent the process of adaptive governance, in parallel with Panarchy or the adaptive cycle, as ‘emergence’ and ‘institutionalization’. The emergence of adaptive governance is initiated in the transitional period of crisis or collapse, synonymous to Brazil’s current period of political unrest, increasing severity of environmental disasters, and political elections. Through periods of social disruption and ecological crisis, existing governance and management systems are revealed as exhibiting low efficiency,

FIGURE 19. PANARCHY/ADAPTIVE CYCLE DIAGRAM FOR ADAPTIVE GOVERNANCE ■
SOURCE: CHAFFIN & GUNDERSON, 2016. DIAGRAM MADE BY AUTHOR



equity, and stability (Chaffin & Gunderson, 2016). Thus a change of systems is urgently required. The institutionalization relates to the processes of actions that lead to the formalization of networks, new organizations, new management systems, or changes in social norms (Chaffin & Gunderson, 2016). Overall, actions of cross-scalar interactions that facilitate the formal change of existing governance structures.

Chaffin and Gunderson (2016) have bridged a connection between AG and the concept of “good governance”, reflecting principles of fairness, inclusiveness, transparency, and accountability (Chaffin & Gunderson, 2016). Making evident that this

research utilizes this theory for promoting an inclusive and accountable alternative to existing environmental management systems for preventing further marginalization and environmental degradation.

03 SOCIO-ECOLOGICAL RESILIENCE

Dakos, V., & Kéfi, S. (2022). Ecological resilience: What to measure and how. *Environmental Research Letters*, 17. <https://doi.org/10.1088/1748-9326/ac5767>

Davoudi, S., Brooks, E., & Mehmood, A. (2013). Evolutionary Resilience and Strategies for Climate Adaptation. *Planning Practice & Research*, 28(3), 307–322. <https://doi.org/10.1080/02697459.2013.787695>

The concept of resilience has largely been understood from Holling’s 1973 seminal paper that defines it as the ability of a system to cope with disturbances and maintain its functionality (Dakos & Kéfi, 2022).

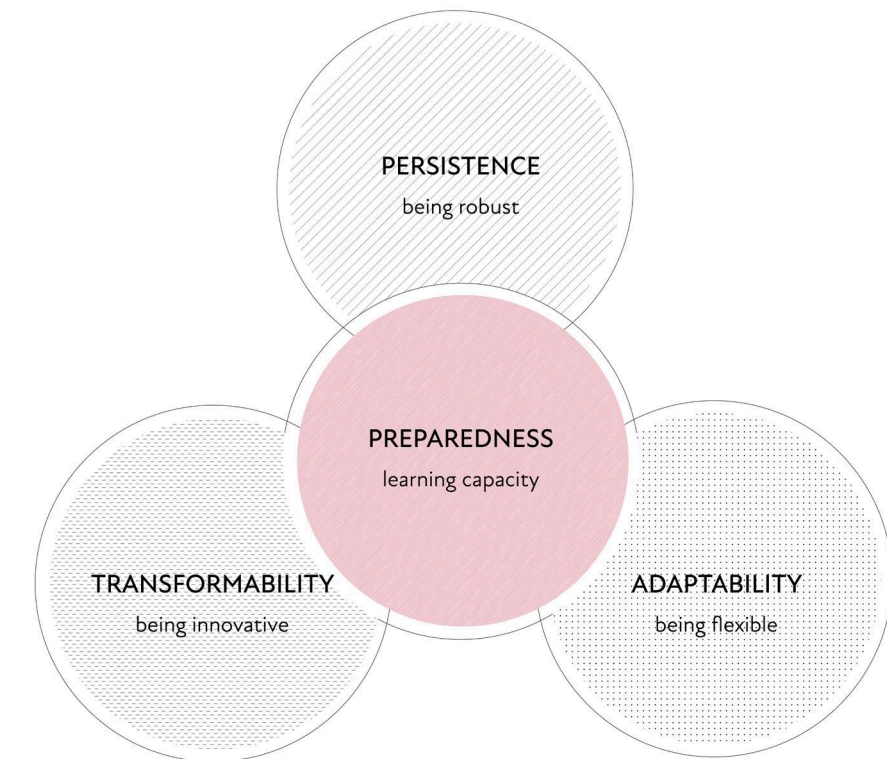
Although the use of resilience in urban planning and design is of the utmost importance in achieving a stable relationship between humans and the natural world, the definition of resilience has lost clarity with its wide usage across multiple disciplines. Furthermore, when evaluating resilience, specific measures and terms must be applied to pervade abstract notions.

In ecological literature, the term resilience has been cataloged into three notions: engineering resilience, ecological resilience, and evolutionary resilience or otherwise known as socio-ecological resilience (Davoudi et al., 2013). Comparatively, socio-ecological resilience challenges the other notions in achieving a more flexible system and emphasizing unpredictability. This theory rejects the idea that there is a single equilibrium in systems and suggests that resilience revolves around the concept of fluctuation with multiple equilibria (Davoudi et al., 2013).

Attributes of evolutionary resilience, according to Davoudi's dimensional framework for resilience building, are largely confined to the components of persistence, preparedness, and adaptability. These elements are allotted towards cooperation across scales for maintaining links among networks for long-term post-disaster responses to achieve adaptability, the heart of ecological resilience (Davoudi et al., 2013). As communities have largely been viewed as passive recipients rather than active participants in establishing resilience, identifying the potential opportunities in the evaluation of vulnerability promotes a learning process and preparedness (Davoudi et al., 2013).

However, in ecology papers that evaluate resilience theory, the primary notion understood has been engineering resilience. In line with this notion, engineering resilience has been the dominant force in achieving sustainability between humans and the environment in practice, especially in São Paulo. Whereas, evolutionary

FIGURE 20. FRAMEWORK FOR RESILIENCE BUILDING ■
SOURCE: DAVOUDI ET AL., 2013. DIAGRAM REDRAWN BY AUTHOR



resilience has been encountered with uncertainty as the discourse of this term revolves mainly around theoretical approaches rather than practical metrics (Dakos & Kéfi, 2022). Although the term resilience is in the makings of becoming a buzzword, the theory of socio-ecological or evolutionary resilience is at the center of establishing a strategic plan for climate adaptation and an effective environmental management system.

04

URBAN POLITICAL ECOLOGY

Heynen, N., Kaika, M., & Swyngedouw, E. (2006). In the Nature of Cities—Urban Political Ecology and The Politics of Urban Metabolism.

Nik Heynen. (2014). Urban political ecology I: The Urban Century. 38(4).

Urban Political Ecology is understood as an approach that understands human and nature to be intertwined with interconnected processes and

both deeply embedded in social, political and economic systems. Thus, this perspective transcends the pre-established dualistic viewpoint of humans and nature or city versus environment, arguing that “this split between humanity and environment ... has long impeded understanding of environmental issues” (Heynen et al., 2006). These systems are better understood in tandem with each other rather than in isolation, as the underpinnings of urban political ecology are composed within the broader understandings of relationships of power that shape the urban landscape and framing cities as a second nature (Heynen et al., 2006).

Furthermore, urban political ecology stems from recognizing the synergies between the political economy and ecology and critiquing uneven power relations that shape inequitable social landscapes (Nik Heynen, 2014). Specifically, emerging from the research into the sociopolitical dynamics that underpin socio-ecological processes that produce uneven

and unjust urban landscapes. This urban political lens has been applied to analytical research into urban greenery, food, waste, and many more systems. However, a central focus of urban political ecology since the first recognition of the term has been tied to water inequality and hydroscares.

In relation to this thesis, this theory has been selected to further support the understanding that environmental risks such as flooding, water quality, landslides, and more as socio-natural processes produced by urbanization. These environmental occurrences are causes of a deeply unjust political society that is simultaneously grappling with the city’s unequal urban form. The theory of urban political ecology serves to rectify this imbalance by uncovering inequalities created by socio-ecological connections. Therefore, this theory is used as a theoretical platform for revealing and critiquing the “complex, interrelated socio-ecological processes that occur” within São Paulo (Heynen et al., 2006).



ECO-SYSTEM ADAPTATION

Jones, H., Hole, D., & Zavaleta, E. (2012). Jones HP, Hole DG, and Zavaleta ES. Harnessing nature to help people adapt to climate change. *Nature Climate Change*. *Nature Climate Change*, 2, 504–509. <https://doi.org/10.1038/nclimate1463>

Manes, S., Vale, M. M., Malecha, A., & Pires, A. P. F. (2022). Nature-based solutions promote climate change adaptation safeguarding ecosystem services. *Ecosystem Services*, 55, 101439. <https://doi.org/10.1016/j.ecoser.2022.101439>

Climate change leading to massive disruption in socio-ecological systems by destroying eco-system services has frequently been a topic of interest in literature over the past years. Eco-system based adaptation was introduced as a form of climate adaptation, that is focused loosely around the idea of harnessing natural infrastructure as a buffer to the impacts of climate change (Jones et al., 2012).

Previous to natural adaptation approaches, local and national governments around the world have primarily focused their adaptation planning approaches on hard infrastructure (i.e. engineered and infrastructure-based interventions). São Paulo is no exception, with their water management approaches revolving

around the construction of reservoirs, dams, and hydraulic interventions like piscinões.

Hard approaches to climate change usually represent interventions that are often mono-functional and inflexible, with unexpected negative impacts on social systems. While eco-system based approaches often provide an adaptable alternative to time of changing ecological systems and uncertainty (Jones et al., 2012). As well as provide a reduction of climate vulnerability while simultaneously providing socio-economic benefits.

Eco-system based approach is fundamentally grounded in the theory of a decelerating world, advocating for a nature centered development that restores ecological integrity (Manes et al., 2022). Rather than planning and designing for the extraction of services and goods for human prosperity and resources, this theory focuses on the circular flow between nature and people for a pathway towards resilience.

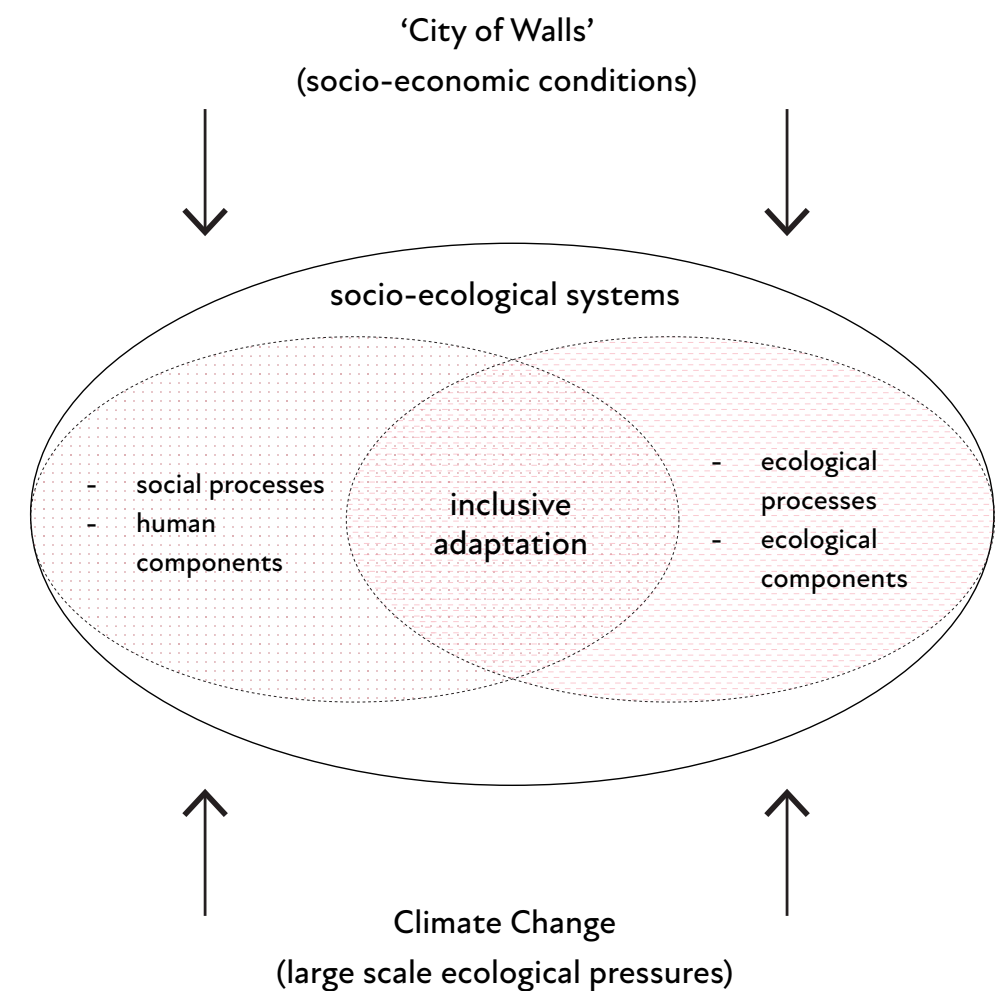
analytical approach.

Virapongse, A., Brooks, S., Metcalf, E. C., Zedalis, M., Gosz, J., Kliskey, A., & Alessa, L. (2016). A social-ecological systems approach for environmental management. *Journal of Environmental Management*, 178, 83–91. <https://doi.org/10.1016/j.jenvman.2016.02.028>

In this research, the socio-ecological systems approach is an important tool for the analysis of ecological systems in relation to social inequalities. This approach calls for an analysis of urgent environmental issues at the intersection of where they lie, between complex natural and social systems. In other words, it frames relationships between human and ecological components as part of a complex and interdependent system (Virapongse et al., 2016). However, as is the case in São Paulo, current environmental management practices still remain conventional and linear by not exploring the complexities of these systems.

This transdisciplinary approach

provides guidance as this research will explore these ideas in order to adequately assess both the ecological and human components as variables to frame the problem. The socio-ecological system conceptualizes these interconnected components as influenced by broader forces of social and ecological processes (Virapongse et al., 2016). In the case of my research, these larger forces are adapted as social-economic conditions, created by the uneven development of the ‘City of Walls’, and large-scale ecological pressures created from climate change. Furthermore, the analysis of this research will provide an understanding of both of these forces on the components of the city, working between scales defined by political boundaries and ecological elements.



VOLUME 02

ANALYTICAL FRAMEWORK

Socio-Ecological Systems (p. 74)

- *environmental risks*
- *socio-ecological systems*
- *conclusion*

Socio-Economic Networks (p. 114)

- *vulnerability framework*
- *scenario a: social vulnerability*
- *scenario b: economic vulnerability*
- *socio-economic vulnerable areas*

Institutionalized Walls (p. 136)

- *governance structure*
- *formal vs. informal institutions*

Analysis Conclusion (p. 146)

socio-ecological systems.

OVERVIEW

The analysis in this chapter expands upon the increasing burdens of climate change as cities around the world continue to urbanize. To understand the critical ecological systems in São Paulo, this research needs to analyze what the biggest environmental problems of the city are and the opinions of the residents of the city on these issues and future solutions.

Therefore, this chapter will focus on critical environmental risks, the socio-ecological systems attributed to these vulnerabilities, and the existing policies and proposals in place in São Paulo that attempt to address these inequalities.

The analysis on the socio-ecological systems will be unrestrained by political boundaries, varying between scales. The concept of the multi-scalar approach will be further elaborated through this chapter as environmental risks do not respect human-made borders.

SECTIONS

- *environmental risks*
- *socio-ecological systems*
- *conclusion*

environmental risks.

Rede Nossa São Paulo, a civil society organization based in the city, collected data from a series of online interviews and household questionnaires with residents of the Municipality of São Paulo, age 16 and up, completed in December 2021. Data gathered from this process uncovers what the communities of the city believe are the increasing environmental problems due to climate change and the role that various stakeholders have in the solutions to these issues.

There has been an upward trend in the severity of environmental risks and disasters in Brazil, attributed to changes in the environment, historical rapid urbanization, and societal changes (Hidalgo Nunes, 2011). The historical unplanned

growth of the city of São Paulo that led to the existing socio-economic conditions and expulsion of poorer populations from the center led to the settlement of these groups in hazard prone areas. Now with increasing pressures from climate change and unsustainable land use practices, environmental risks and disasters occur at a higher frequency and disproportionately affect marginalized communities.

The main environmental problems of the municipality that are the most crucial, pointed out by the residents of São Paulo, are primarily air pollution, river pollution, and

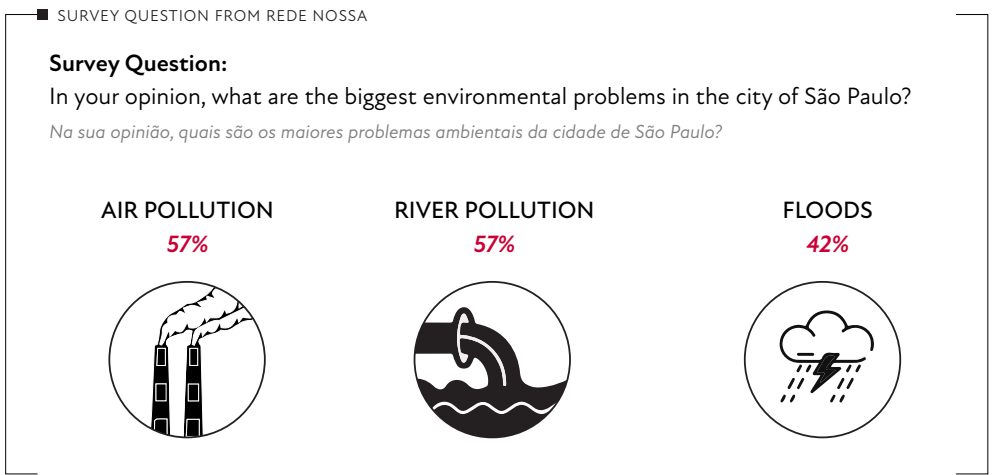


FIGURE 1. Environmental problems in São Paulo, according to residents' opinions. Source: Rede Nossa São Paulo, 2021.



flooding (NossaSaoPaulo, 2022). Furthermore, the growing severity of floods causes disturbances within the soil systems and thus also causes risks of landslides. It is important to note that the problems of air pollution are more attributed to the north region, the problems of river pollution experienced more in the center and west region, and flooding most cited as a problem in the east and south region of the municipality. Despite these environmental issues being largely attributed to specific areas, it is important to understand that these impacts are present throughout the municipality of São Paulo and are all highly rated as an urgent problem regardless of the region.

Although these problems are

complex and are attributed to numerous factors, human actions and land-use patterns are at the core of the previously highlighted environmental issues. According to the residents of São Paulo from the survey conducted by Nossa Sao Paulo in 2022, 69% of surveyors believed that their collective unsustainable actions are the main causes of increasing environmental risks and disasters (NossaSaoPaulo, 2022). Human action in regards to causing these impacts often range from the effects of overpopulation and fast urbanization on the environmental landscape, pollution from industries, deforestation, and more. In the case of São Paulo, worsening urban drainage problems are often linked to increasing levels of human occupation along the Tietê River, ultimately increasing

FIGURE 2. Causes of environmental problems in São Paulo, according to residents' opinions. Source: Rede Nossa São Paulo, 2021.

flood hazards (Eduardo Amaral Haddad & Eliana Teixeira, 2015). These environmental problems linked to a lack of urban planning and rapid patterns of developments along environmental protection zones in megacities like São Paulo are only aggravated by increasing pressures from climate change.

In the face of addressing these environmental issues present in the municipality, there are a multitude of stakeholders with highly rated responsibilities and possibilities of policies, plans and designs. Regardless of where the residents live (north, west, east, south or central zone of São Paulo), most people agree that in order to face

these environmental challenges, it is necessary to involve different forms of government: municipal, state, and federal government (NossaSaoPaulo, 2022). The largest percentage of residents claiming that the municipal government (*Governo Municipal*) holds the highest degree of responsibility in terms of searching for solutions to the environmental problems of the city of São Paulo (NossaSaoPaulo, 2022). However, as the government continues to be ineffective in combating these environmental impacts with insufficient policies and plans, the country of Brazil proceeds to fall behind in the global discussions of climate change.

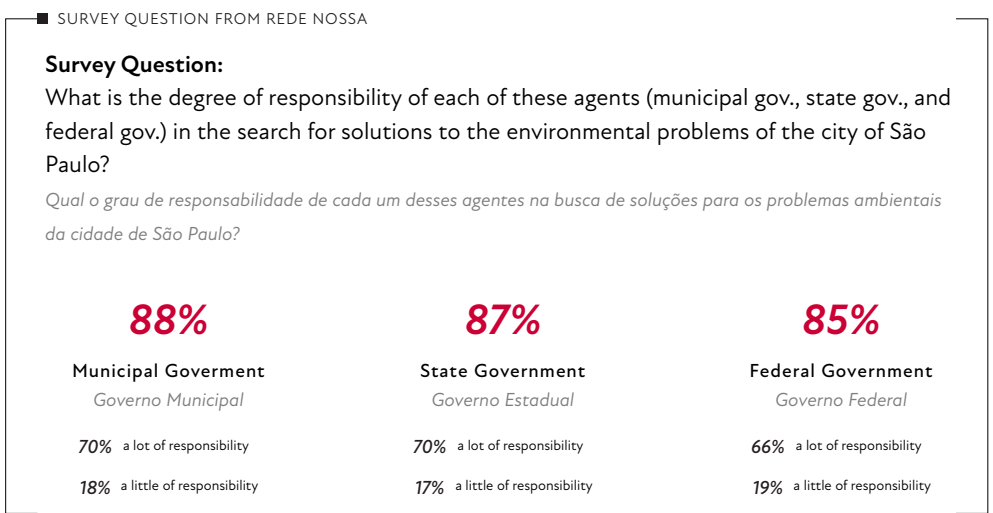


FIGURE 10. Degree of responsibility of each of these agents (municipal gov., state gov., and federal gov.) in the search for solutions to the environmental problems of the city of São Paulo. (NossaSaoPaulo, 2022).

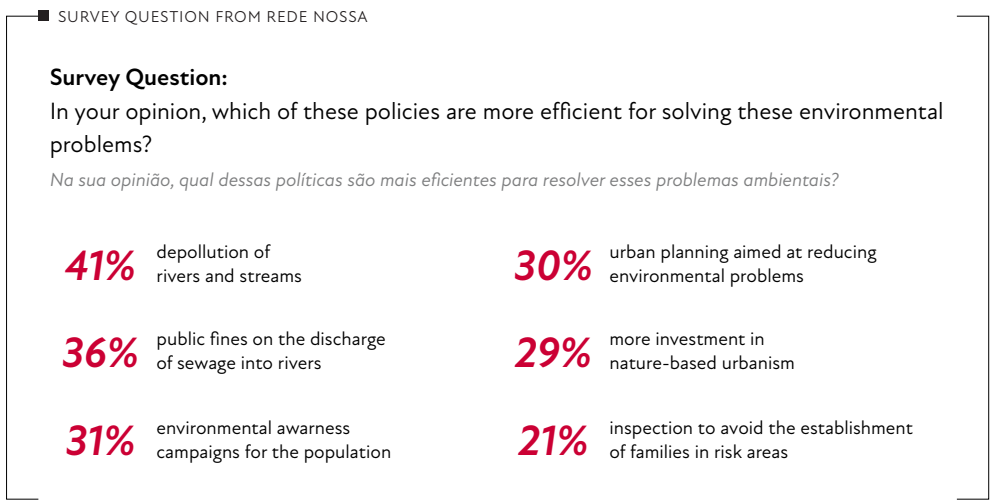


FIGURE 11. Policies considered more efficient for solving environmental problems. (NossaSaoPaulo, 2022).

In terms of adequate solutions that address the impacts of climate change, Red Nossa São Paulo gathered data on what the residents of the municipality believe are the most important next steps. Although the answers within this survey range, the wide variety agreed on three main steps for solutions, ranked based on their efficiency and level of urgency. The primary tool that residents agreed upon for addressing these environmental issues was aimed at the depollution of the municipalities' rivers and streams. One solution of attempting to depollute water sources is by creating public fines on the discharge of sewage into

the rivers (NossaSaoPaulo, 2022). The surveyors also reported that a major attribution to addressing these environmental issues was building awareness for the wider population, as most people are either unaware of these pressing issues or have daily concerns and stresses that prevent the population from thinking about these climatic issues (NossaSaoPaulo, 2022). Consequently, the residents also contributed by saying that urban planning aimed at reducing these environmental problems with more investment in nature based solutions would prove as one of the most efficient and viable options for reducing environmental burdens (NossaSaoPaulo, 2022).

socio-ecological systems.

São Paulo has experienced one of the most rapid population and economic growths in the world during the 1900s. In 2000, the city became a megapolis with intense industrialization that houses over 12 million inhabitants. However, the impacts of this socio-economic growth also shaped the landscape and hence, the environment. As the city transformed, with increasing disparities between the wealthy and the poorer populations, frequent floods, landslides, and pollution began to mark the city. These environmental disasters and risks, which affect all surrounding urban life, are often disproportionately impactful upon existing socio-economic vulnerable areas.

As the critical environmental risks in São Paulo are flooding, landslides, water pollution and air pollution, this subchapter will focus on understanding the

corresponding ecological systems to these risks. Therefore, this analysis will investigate the:

- current hydrological systems
- topographical landscape
- forest ecosystem
- interrelated unsustainable land use practices adjacent to these systems

As environmental risks do not observe political administrative boundaries, the analysis of these ecological systems will be addressed through a multi-scalar approach, with the use of transcalar mapping, data analysis and literature review.

FIGURE 22. ENVIRONMENTAL DISASTERS PHOTOS ■
SOURCED FROM: ABC NEWS AND FLOODLIST



The consequences of insufficient water management, uncontrollable urban expansion, and climate change in the Alto Tietê Hydrographic Basin has led to contamination of urban waters, frequent flooding, and a growing imbalance between water supply and demand. This subchapter analyzes these hydrological systems and their current water issues, while adopting a critical glance on past measures and key stakeholders in the water management of these subsequent systems.

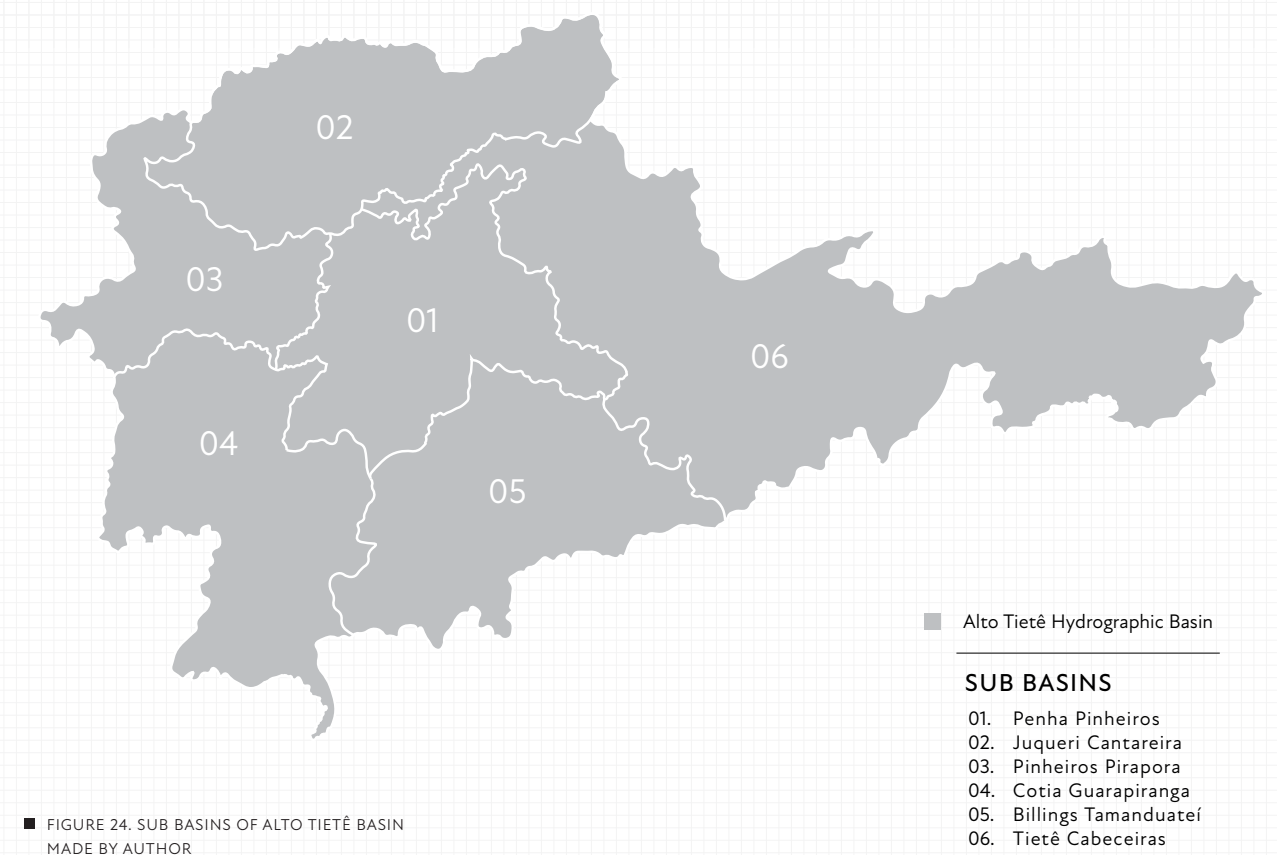
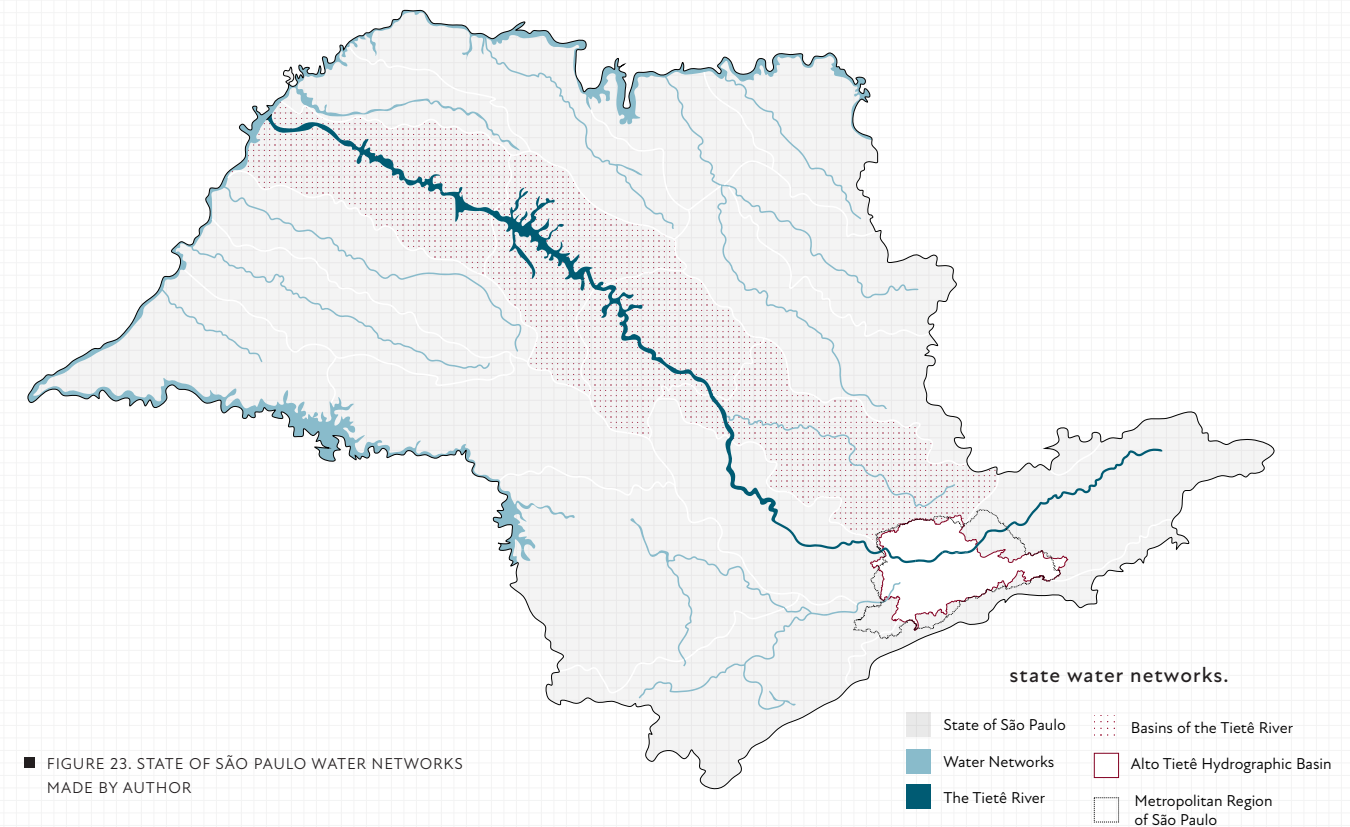
CONTEXT

The Tietê River is the main waterway of the state of São Paulo that runs through six basins (figure 23), one of those basins being the Alto Tietê Hydrographic Basin in the South-Eastern region of the state. The metropolitan region of São Paulo is situated within the Alto Tietê Hydrographic Basin, the main water basin that supplies water to the region's population, with an area of about 5985 km². An extensive network of sub-basins, seen in figure 24, encompass

the Alto Tietê Hydrographic basin: Penha Pinheiros, Juqueri Cantareira, Pinheiros Pirapora, Cotia Guarapiranga, Billings Tamanduateí, and Tietê Cabeceiras.

URBAN EXPANSION

Over the last decades, the influx of immigrants, the rapid industrial growth, and economic recession led to the growth of the population of São Paulo and urban expansion along the waterways. The city's struggle to keep up with the demand of the growing population and increasing demands led to the landscape of reservoirs and river systems that make up the Alto Tietê Hydrographic Basin today (figure 25).



0 20 40 km

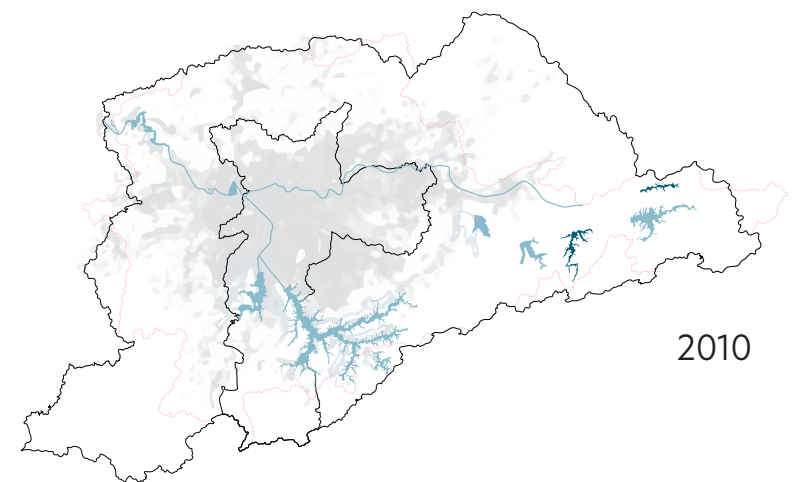
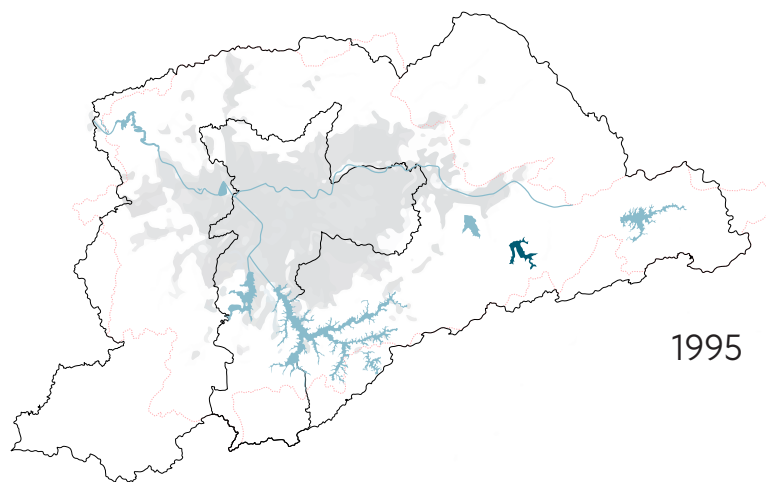
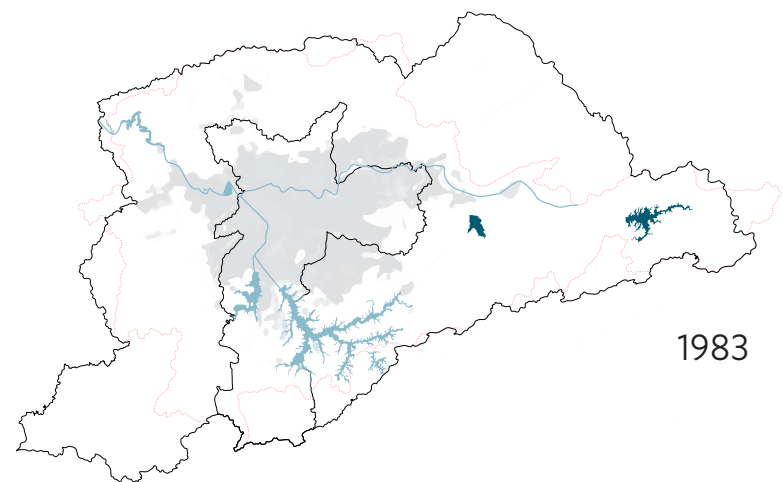
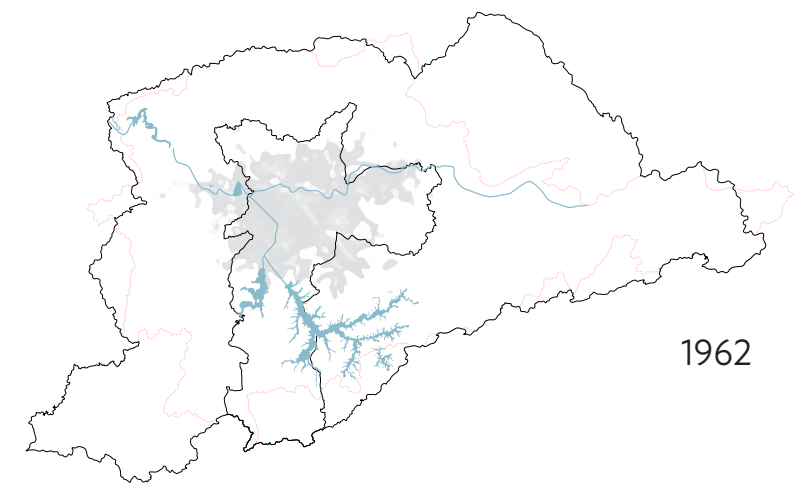
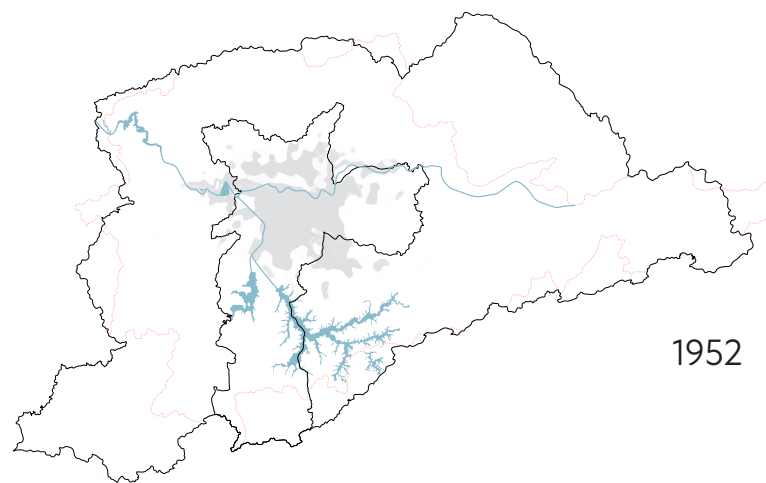
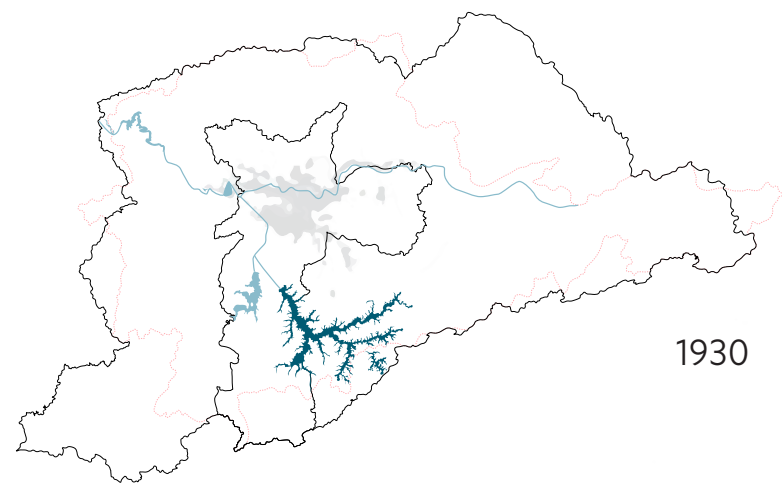
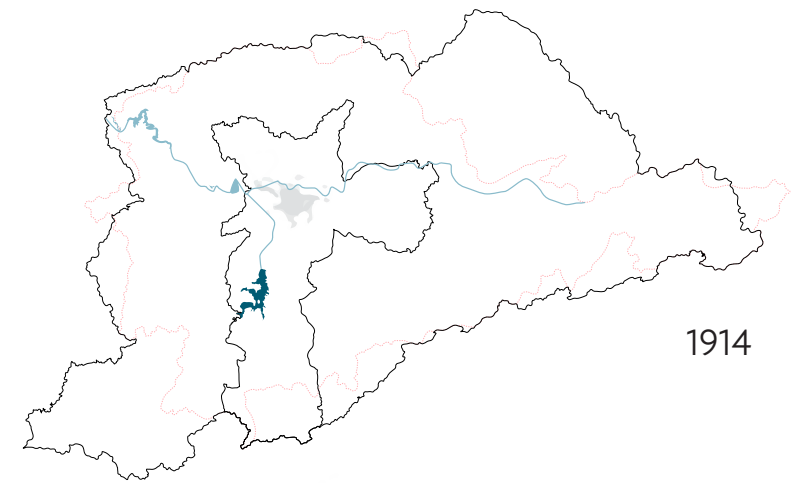
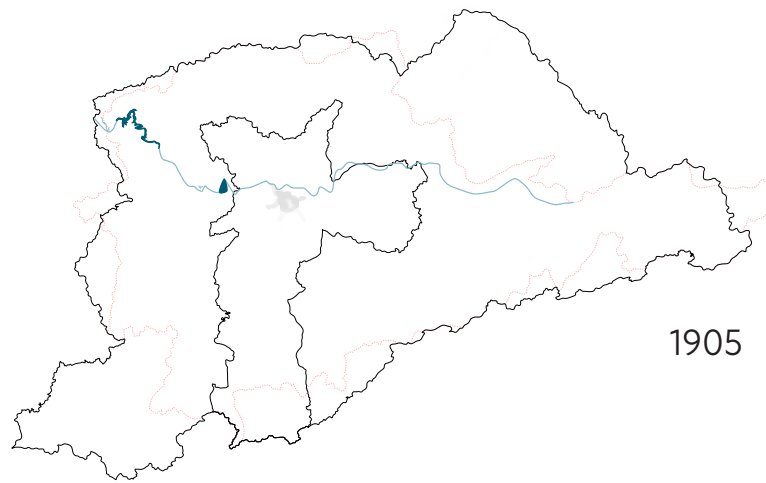
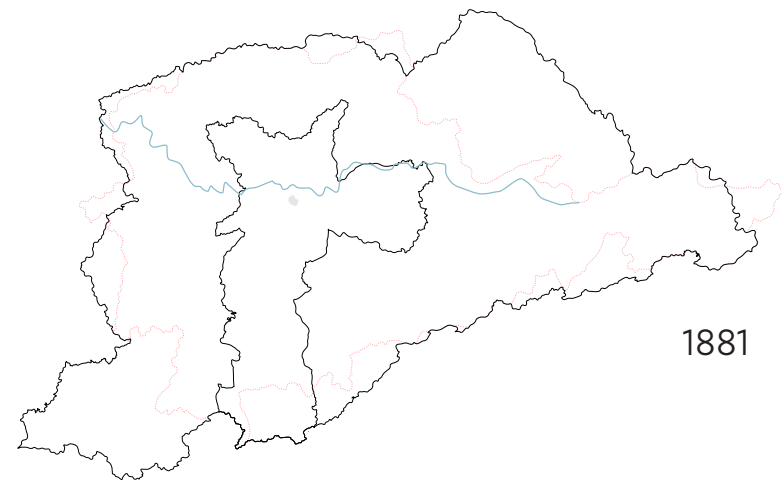
Urban Expansion

Existing Reservoirs

Reservoirs under Construction

Alto Tietê Hydrographic Basin

Municipality of São Paulo

Metropolitan Region
of São PauloFIGURE 25. URBAN EXPANSION DIAGRAM ■
MADE BY AUTHOR

WATER POLLUTION

The three most vital water infrastructures that provides 70% of the water to the population of the Metropolitan region of São Paulo lie within the Cotia Guarapiranga, the Billings Tamanduateí, and the Juqueri Cantareira sub-basins (Milano et al., 2018). Although these river systems supply water to the vast majority of people within the Metropolitan Region, these systems also face increasing risks of water pollution due to the expansion of informal settlements into areas adjacent to water sources and unsustainable land use practices.

Water pollution has been a recurring problem in the Metropolitan Region since the 1950s, when informal expansion of the city spread to the periphery, in areas that were categorized as water source protected areas. As most of these uncontrolled urban expansions into protected areas were largely informal settlements, the government was unable to provide these areas of development

with sanitation infrastructures due to political and economic hurdles. Although the areas surrounding the Guarapiranga watershed have been protected since the 1970s, the laws protecting the water system and prohibiting any occupation proved fruitless as flocks of people began to invade this empty space. Thus, with a lack of investment in infrastructure and management of sanitation services, the water sources of the municipality became polluted with vast amounts of domestic waste from these informal settlement areas, with contaminated substances that pose health risks above the safety limit (Mapa Da Água, n.d.).

In 1992, there was a seven year project enacted by São Paulo to recuperate and maintain the quality of these reservoirs. However, according to the Water Quality Index (IQA) in 2021, the reservoirs of Guarapiranga and Billings, reservoirs that are both important to the city for power generation, water storage and for recreational purposes, are still categorized as polluted water

sources. As well, the rivers of Tietê and its secondary river of Pinheiros running through São Paulo are the most polluted rivers in the Alto

Tietê Hydrographic Basin due to high concentrations of urban and industrial activity bordering these systems (figure 27).

FIGURE 26. WATER POLLUTION OF RESERVOIRS ■
MADE BY AUTHOR

water pollution of reservoirs.

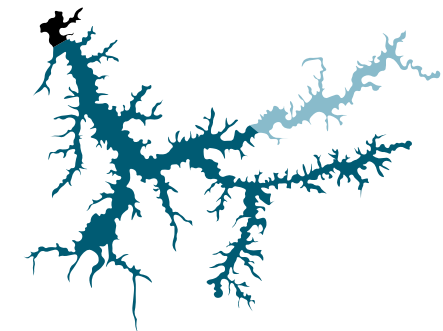
**these diagrams are not to scale and are solely constructed for the visualization of polluted reservoirs.*

■ Highly Polluted Water ■ Polluted Water ■ Moderate Water Quality

Reservoir Taiaçupeba



Reservoir Billings

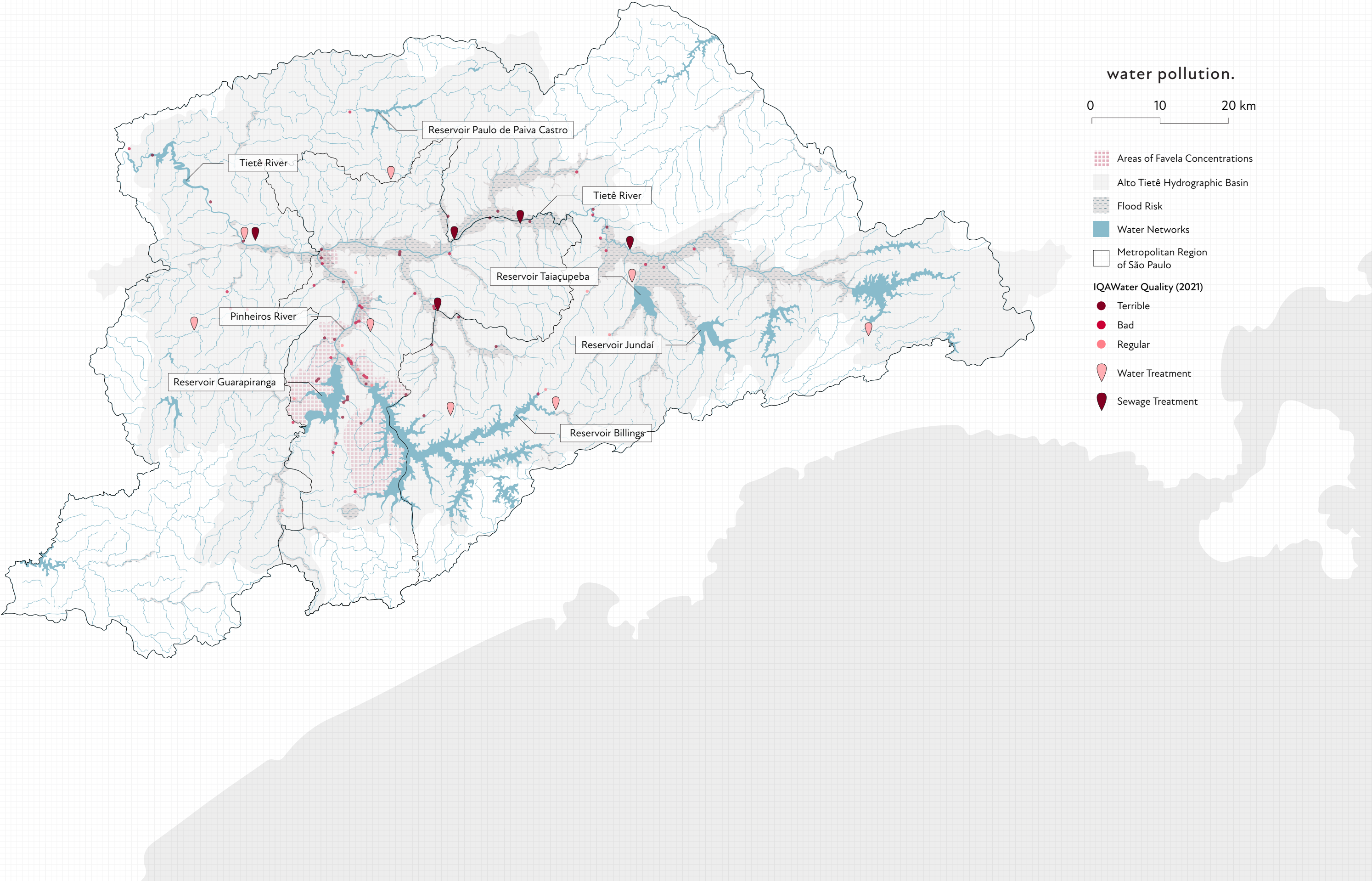


Reservoir Jundaí



Reservoir Guarapiranga





FLOODING

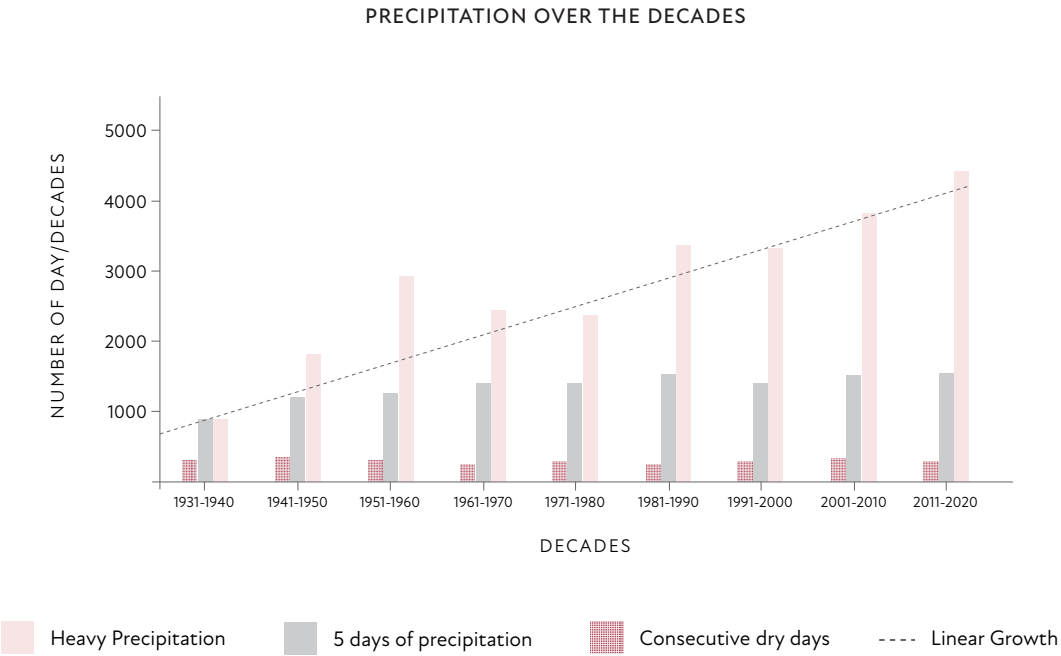
As the metropolitan region of São Paulo is located in a floodplain and is conserved within a subtropical climate, persistent flooding of water systems marks the landscape. Continuous flooding in dense urban areas is noted as São Paulo’s most common natural disaster, with periods of flooding aggravated with increasing pressures from climate change and the growth of unprotected areas. Past urban growth patterns of illegal occupations and alternate land-use settlements in areas bordering water-sheds have led to the continuous destruction of the resilience of these water systems to precipitation pressures. During the 1980s-1990s, there was an estimation that the “urban growth in the Billings watershed was 31.7%”, an area that had severe restrictions in place (Young, 2013).

Problems of flash floods and river flooding continue to exacerbate São Paulo as trends of extreme rainfall increase. Over the years, the total amount of rainfall and

the frequency of periods of flash floods have increased significantly, with precipitation rates from 1930s to 2020s increasing about 400% percent (*figure 28*). These changes in rainfall precipitation, due to growing urbanization and global warming that has accelerated urban heat island effects, have led to increases in hydrological hazards, triggering disasters of flash floods and river flooding. The damages of flooding periods, with increasing severity and length every year, are substantially high, destroying homes, hindering infrastructure, and putting people’s lives at risk.

While dense urban areas that follow the Tietê river are most under flash flood risk, the poorer population that resides within the periphery of the city, usually located on the banks of vital waterways, are continuously the most affected by flooding disasters due to the externalities that these hazards cause. Due to their location and a lack of adequate infrastructure, residents

FIGURE 28. PRECIPITATION OVER DECADES CHART ■
MADE BY AUTHOR
SOURCED FROM: IAG FROM UNIVERSITY OF SÃO PAULO



in these areas are now subjected to constant floods that increase these population’s vulnerabilities. Since their self-made constructions are not in accordance with the building codes, their homes are often built out of a mix of materials that range from a patchwork of scrap wood planks to cardboard. Thus, constant flooding leads to the destruction of their homes and their livelihoods. As times of precipitation lengthen and informal settlement areas become flooded, existing inadequate sewage systems become overflowed that

leads to detrimental health effects like outbreaks of dengue fever.

As the inhabitants of São Paulo suffer substantial losses due to urban and river flooding, the increasing severity of these disasters also affect the economic sectors that transcend political or ecological boundaries. As São Paulo is one of the country’s economic powerhouse cities, contributing a substantial amount to Brazil’s overall GDP, losses in this city are felt throughout the country. Given industrial

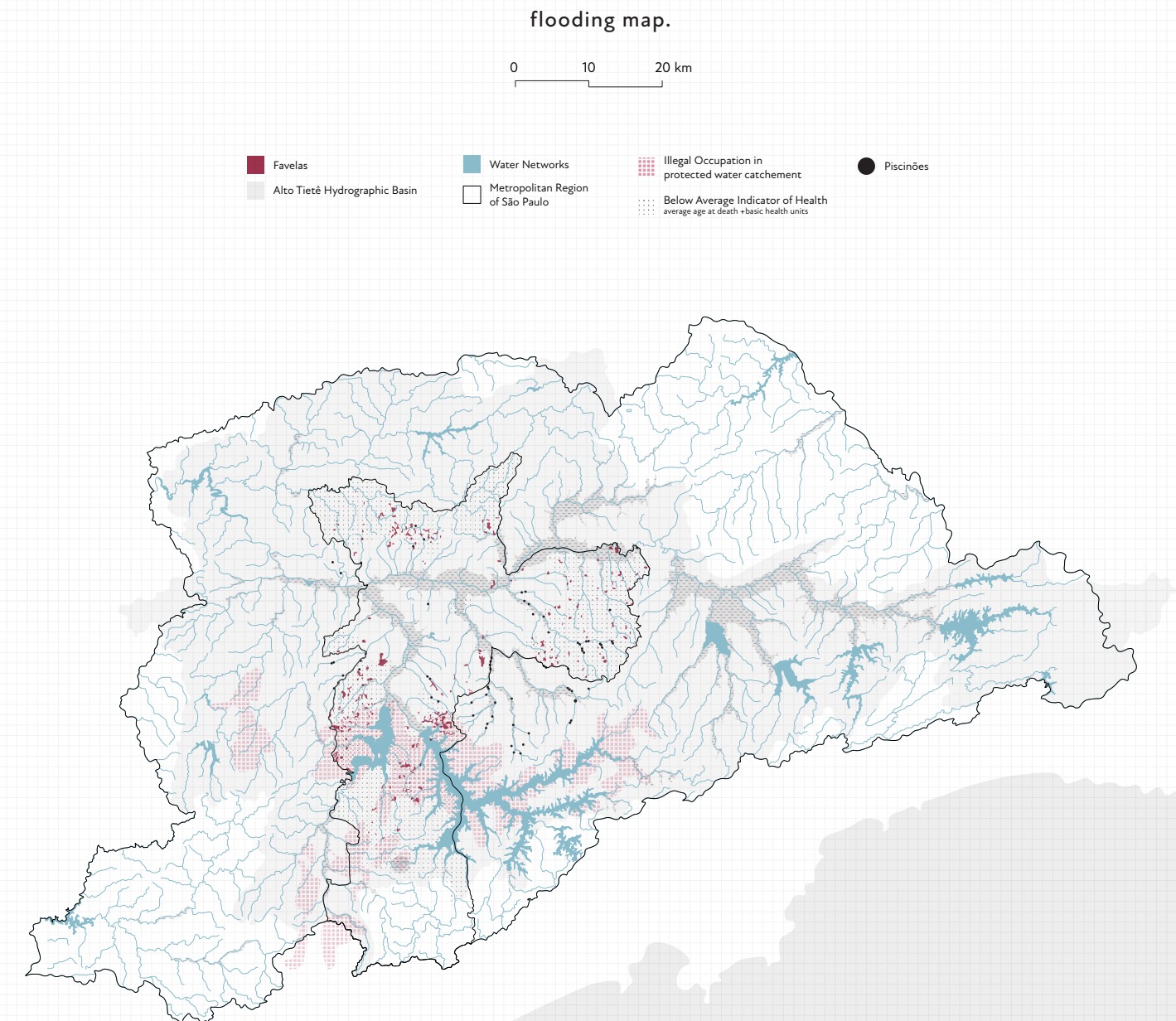
activities and concentrations of populations continue to grow within the municipality, economic losses and impacts on global economic chains due to natural disasters continue to increase. As well, increases in the severity of flooding aggravates already existing economically vulnerable areas by paralyzing activities and hampering transportation such as expressways and public transportation routes along the major rivers of Tietê and Pinheiros.

As a response, São Paulo has enacted interventions along waterways that have presented themselves as unable to cope with increasing water pressures. Current flood governance is oriented towards the construction of piscinões, large scale detention ponds, that aim to delay flooding of water systems through engineering interventions (Millington, 2021). These ponds act as a “stopgap solution” and were seen as a necessary response to a disorganized urban landscape with no appropriate urban planning system that prevents a more sustainable model of

flood management (Millington, 2021). The mono-functional and environmentally problematic nature of piscinões amplifies the existing issue that São Paulo’s water management solely views flooding as an engineering issue rather than a political challenge. These interventions are marked by numerous limitations due to their need for excessive amounts of space, their constant demand for maintenance, and their lack of ability to restore the river morphology from sedimentation issues. As well, often informal settlements are evicted to make space for these large interventions, causing these population’s increase in vulnerability.

All of which highlight “the degree to which the relationship between water and land in São Paulo is fundamentally broken” (Millington, 2021).

FIGURE 29. FLOODING MAP ■
MADE BY AUTHOR



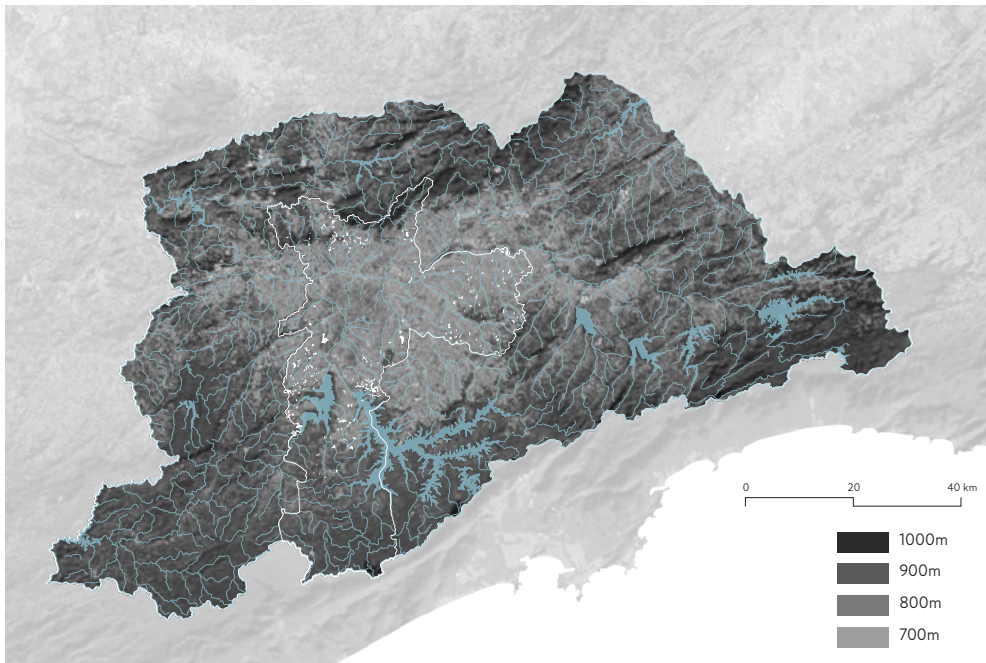
LANDSLIDES

Landslides in the Metropolitan Region of São Paulo are heavily attributed to the relationship between the history of uncontrolled urban expansion of informal settlements, a phenomenon occurring since the early 1900s, and pressure on natural elements. Today, the intensity of landslide disasters have increased with global climatic changes of increasing precipitation rates and the degradation of forests.

As periods of precipitation increase

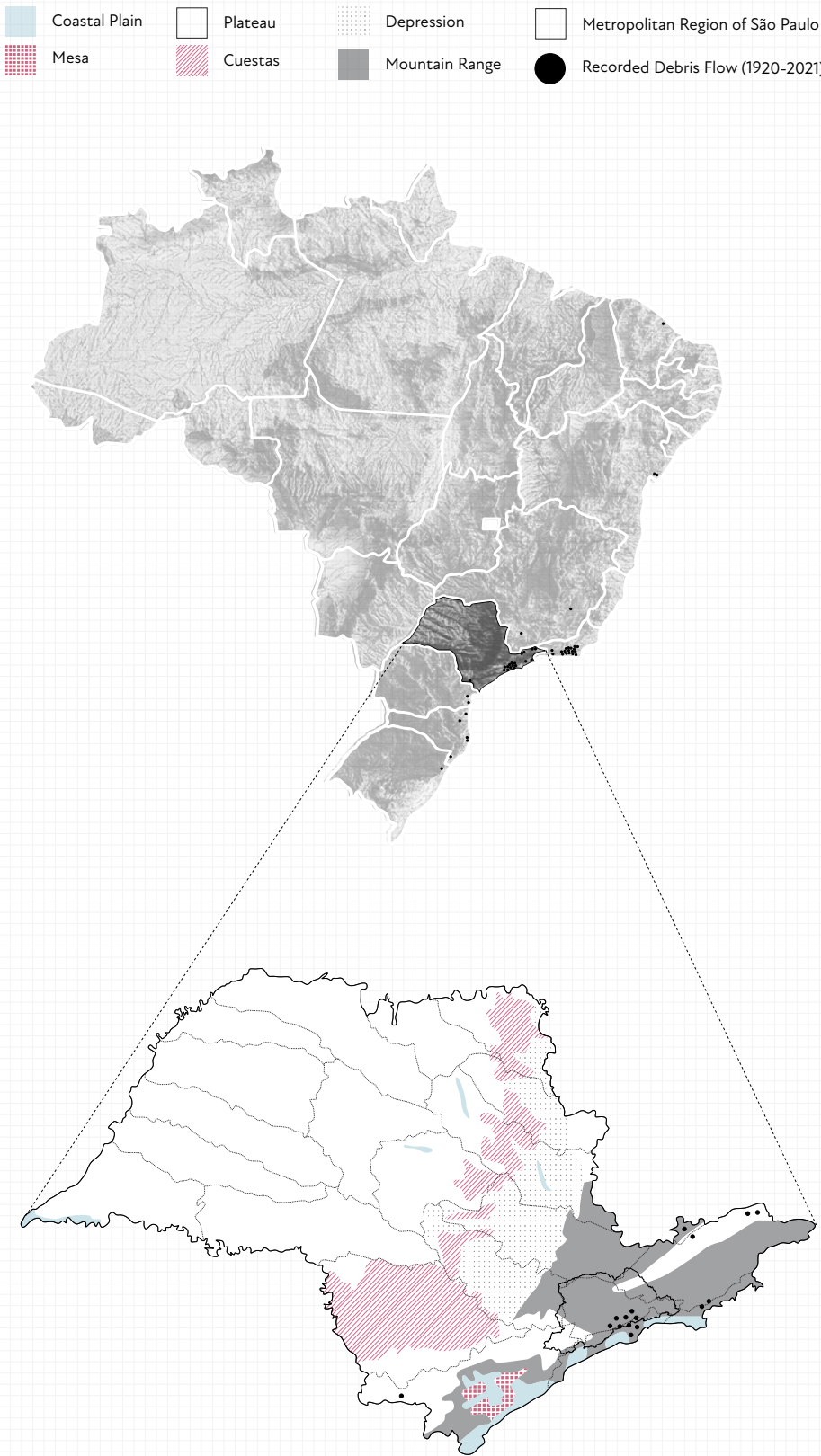
in length and severity, causing an overflow in sewage systems and flooding, soil conditions in higher elevated areas are put under immense pressure. Areas of major environmental instability, such as areas of high slopes and fragile soil, within the metropolitan region are associated with illegal human occupation that provokes the conditions for landslide natural disasters.

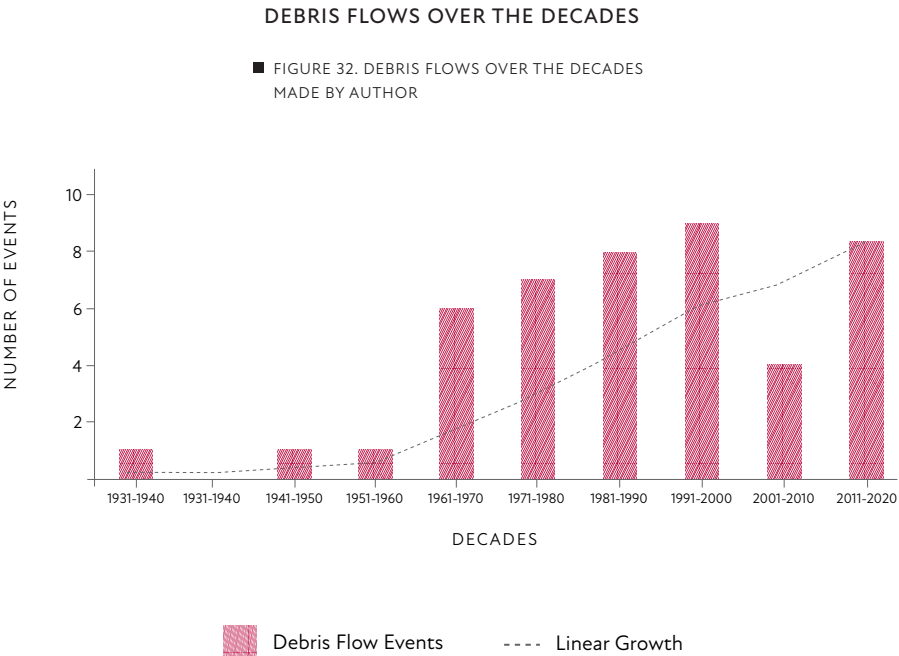
Debris flows, a type of landslide disaster, are a principal problem for Brazil, especially in South Eastern Brazil. Based on a compilation of



■ FIGURE 30. TOPOGRAPHY OF METROPOLITAN REGION
SOURCED FROM: TOPOGRAPHIC-MAP.COM

FIGURE 31. TOPOGRAPHY OF BAZIL ■
MADE BY AUTHOR





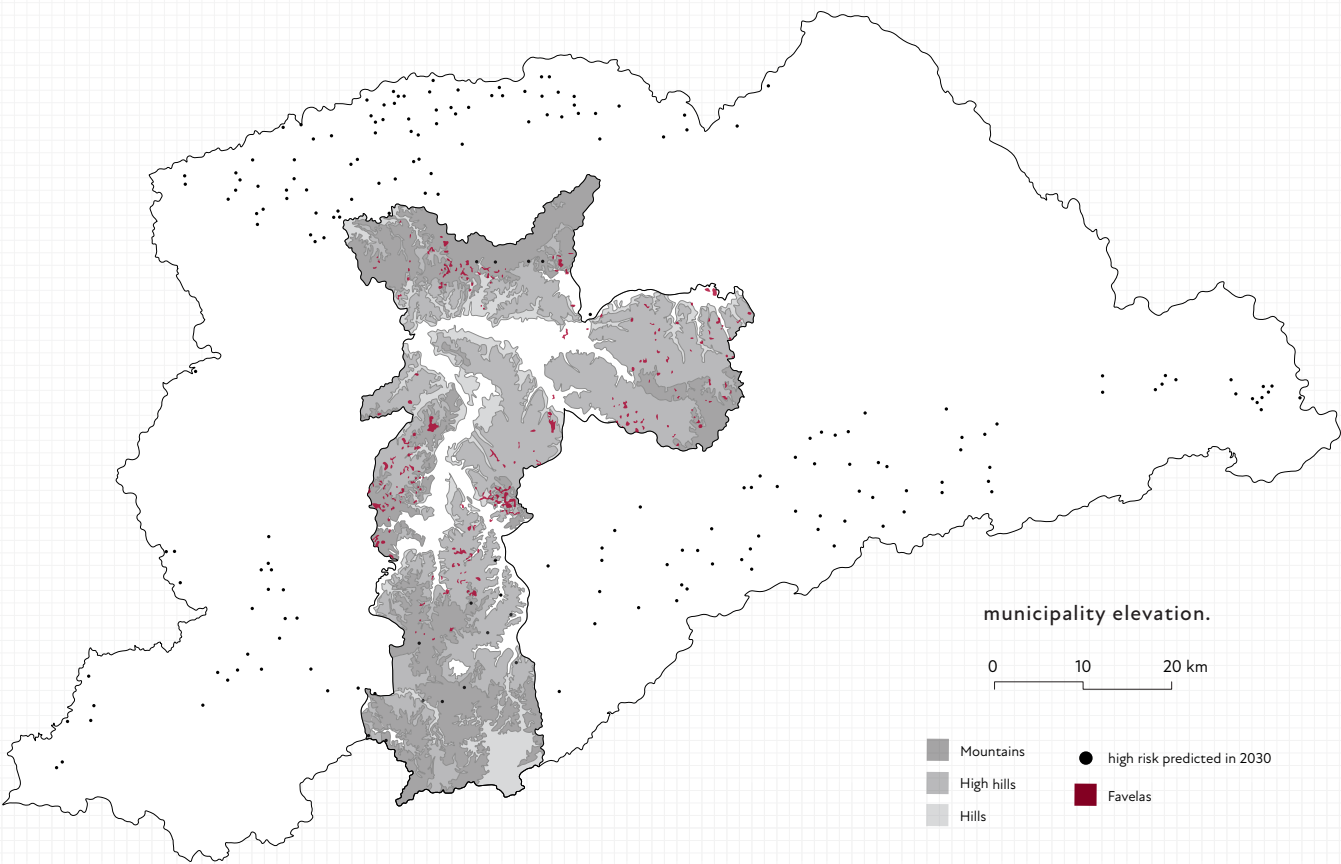
debris flow related disasters from 1920 to 2021, a study was able to identify key areas in Brazil that are most affected with high numbers of fatalities and economic losses (Cabral et al., 2022).

Due to their location in the mountain ranges of the state, proximity to the coast, and influx of informal settlements concentrating in risk areas, the areas surrounding the metropolitan region of São Paulo hold the most recorded landslide disasters. Over the decades, debris

flow events in Brazil have increased with the growth of urban areas and the decline of forest areas with 45 debris flow events recorded since 1920, causing high levels of fatalities and socio-economic losses across the country (Cabral et al., 2022).

Although landslides devastate areas of all incomes, these disasters are often disproportionately affected by communities of poorer populations. Damages in areas of higher-income are often less noticeable as these areas are more

FIGURE 33. MUNICIPALITY ELEVATION ■
MADE BY AUTHOR

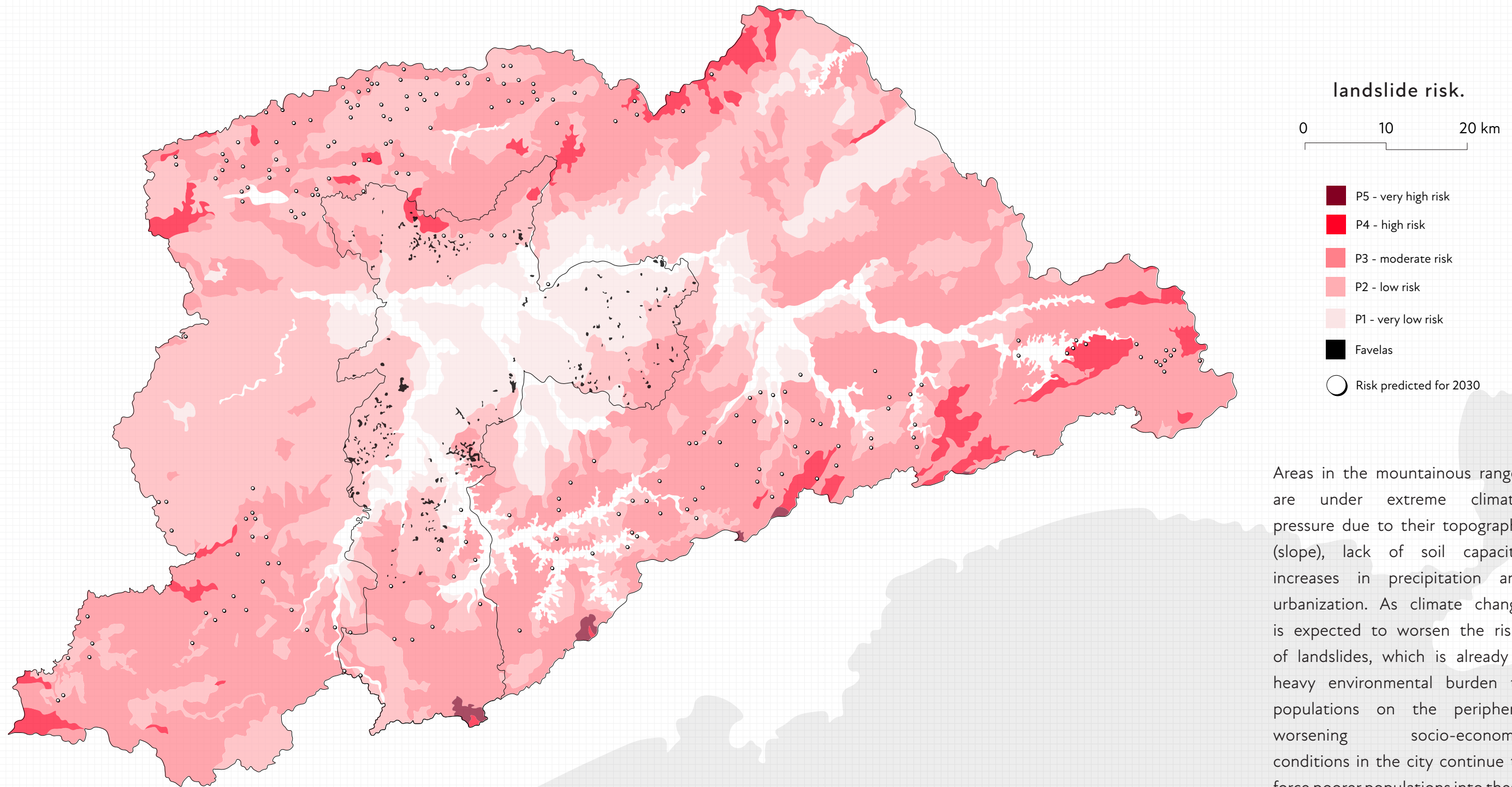


resilient to disasters, i.e. more resistant constructions.

However, in areas that are associated with self-constructed homes, insufficient sewage systems, and non-resilient constructions, similar disasters of the same intensity will generate more damages to these communities. These areas most at-risk generally correspond to low-income housing units, which in the Brazilian context are the informal settlement areas of favelas that are located in higher elevated areas of

the municipality seen in figure 33.

According to the Brazilian risk assessment for landslide disasters, areas of high risk are generally areas of low stability of soil, high conditions of living instability (i.e. garbage and poor drainage), high elevations and areas with little to no vegetation (Luciana Pascarelli et al., 2011). As seen in figure 34, the areas of highest risk (P5, P4, and P3) remain in the peripheries of the city.



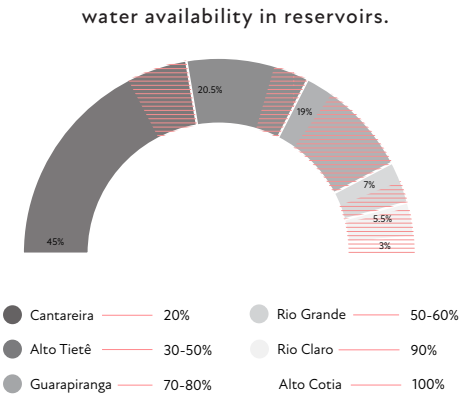
Areas in the mountainous ranges are under extreme climatic pressure due to their topography (slope), lack of soil capacity, increases in precipitation and urbanization. As climate change is expected to worsen the risks of landslides, which is already a heavy environmental burden to populations on the periphery, worsening socio-economic conditions in the city continue to force poorer populations into these environmentally at-risk areas.

■ FIGURE 35. WATER AVAILABILITY IN RESERVOIRS
MADE BY AUTHOR
SOURCED FROM SABESP

WATER SCARCITY

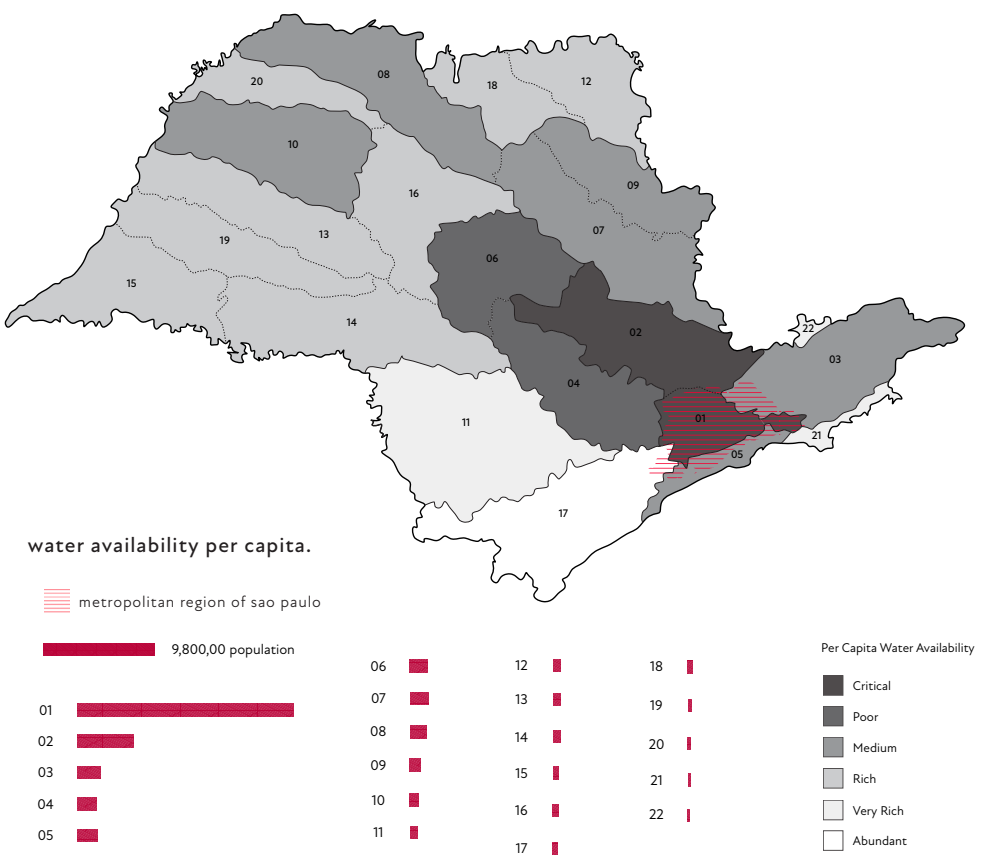
South America is considered the “Continent of Water”, so it is not shocking that water is closely interrelated throughout the urban history of São Paulo (Stevaux et al., 2009). Although problems of flooding and water pollution are evident risks associated with a flood plain, challenges connected with water scarcity are typically associated with arid landscapes. However, in recent years, there has been an increase in water shortages due to the high demand of water supply with increasing urbanization in unexpected regions like São Paulo that have led to the metropolitan region being listed as one of the state’s most water critical areas (*figure 36*).

In 2014 to 2015, the effects of climate change coupled with a pattern of mismanagement of water systems brought the city São Paulo to the brink of the worst water crisis reported for the city. During this time, reservoir levels declined to historically low levels as the effects of water shortage were



felt throughout the city. According to SABESP in 2014, the Cantareira Reservoir supplied 45% of the total amount of the water supply to São Paulo. During the water crisis, the Cantareira Reservoir sunk to less than 20% of its capacity (*figure 35*). The state government and SABESP, the city’s water and sewage utility company, instated a secretive de facto rationing of water supplies that amplified the unequal nature of the city’s urban water political system. Due to the existing inequalities embedded within the city’s landscape, the vulnerable populations in the urban periphery were disproportionately affected as these neighborhoods often live at the end of distribution networks where water fails to reach them in times of water shortages.

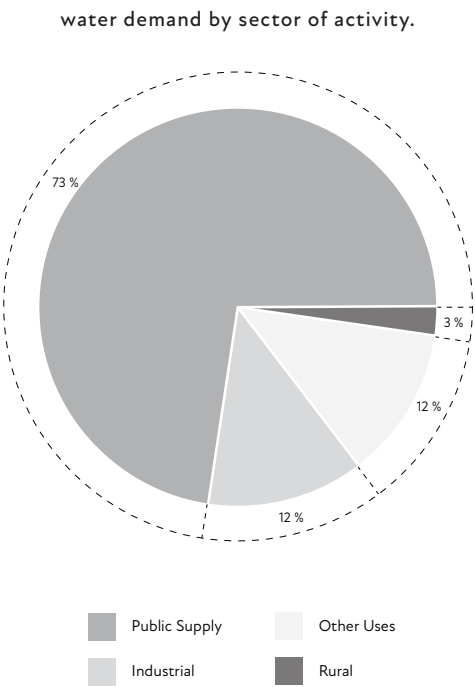
■ FIGURE 36. WATER AVAILABILITY PER CAPITA
MADE BY AUTHOR



Although the reservoirs of the city recovered with the increase in rainfall in 2015, this water crisis implicated the range of political issues existing in relation to São Paulo’s water governance. At the time, this crisis raised awareness in the need for the municipality to act more preventatively, give priority to the already existing vulnerable populations, and that a transparent and accountable

water management system must be implemented. However, these long-term responses and environmental protests soon faded from the city’s agendas and now, the city is starting to feel the beginning effects of their next water crisis as in 2021, the city issued water emergency alerts as reservoirs began to reach critical statuses once again.

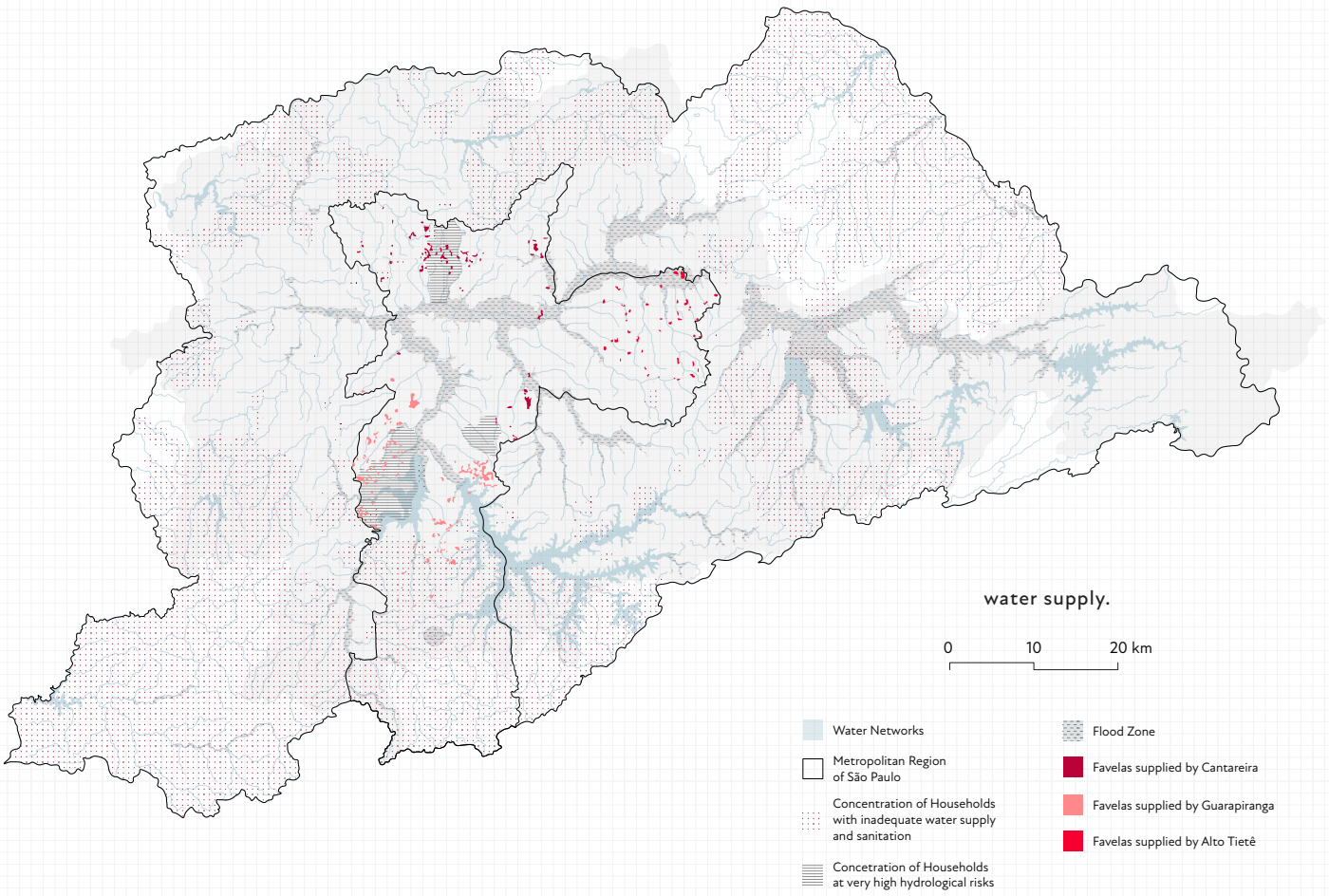
■ FIGURE 37. WATER DEMAND BY SECTOR OF ACTIVITY
MADE BY AUTHOR



The governor and company leaders argued that issues of water scarcity and droughts were largely linked to outside pressure from climate change. Although natural factors have had an impact on water shortages, human factors have significantly “propelled the water supply crisis to unprecedented levels” (Slater, 2019). Conflicting demands on water resources, deterioration of water quality, and increased demands from multiple sectors that require an abundance of water supply have led to an accelerating pressure on

the water systems. According to the Hydrographic Unit for Water Resources of São Paulo, the public supply demands 73% while the industrial economy demands 12% of the water resources (UGRHI, 2021). It has been continuously stated that the city’s water supply system cannot keep up with the region’s growing water demands and population (Daniel Aldana Cohen, 2016). Thus, SABESP, in search for a solution, created measures for extracting water from the city’s hinterlands rather than advocating for a curb in consumption and a better use of local water resources (Water Crisis and Eco-Apartheid in São Paulo, n.d.). Their model of seeking water from already stressed water systems, ignoring untreated local water resources and slashing investments in renewed sewage systems have received backlash from environmentalists that state that these measures only reinforce the existing unequal ecology and urgent case (Daniel Aldana Cohen, 2016). Other responses and plans have simply displaced residents of favelas in areas adjacent to watersheds to boost water quality

■ FIGURE 38. HYDROLOGICAL RISKS
MADE BY AUTHOR



and supply of reservoirs, with no adequate housing plan for these marginalized communities.

The state of the distribution of water supply in São Paulo continues to maintain an era of eco-apartheid, a term coined by Jones in 2007 to describe a situation in which affluent communities reap the benefits of economic-

environmental developments while marginalized communities are further pushed to a status of vulnerability. Poor urban planning, corruption, mismanagement of water resources, environmental degradation, and climate change have all contributed to the water scarcity of the Metropolitan Region of São Paulo.

■ FIGURE 39. TREE COVER LOSS IN THE CITY
MADE BY AUTHOR
SOURCED FROM GLOBAL FOREST WATCH

DEFORESTATION

Rainforests are vibrant ecosystems, playing a fundamental role in maintaining the climate, stabilizing rainfall, and protecting other ecological functions. Despite awareness of the significant importance of forests for ecological systems and urbanized areas, countries around the world have experienced massive deforestation.

As Brazil underwent a rapid urban expansion in the late 1900s, cities across the country faced higher pressures on natural resources and a pattern of unsustainable land use patterns. These impacts of rapid expansion in urban areas are typical in the state of São Paulo, causing a massive pattern of deforestation of

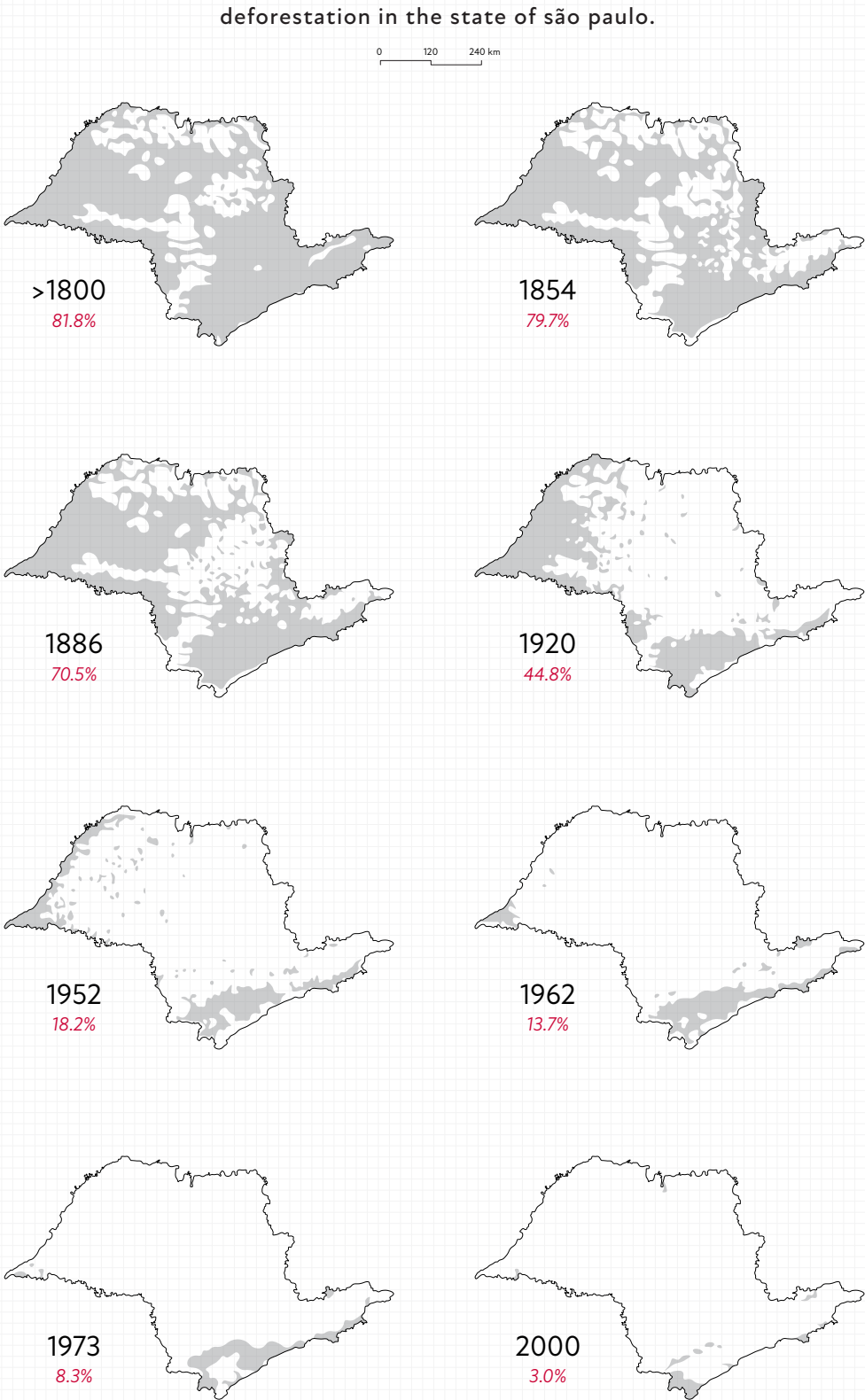
the Atlantic Rainforest with a steep decline from about 80% in 1854 to 3% of forest cover in 2000, seen in figure 40 (Luci Hidalgo Nunes, 2011). According to the Global Forest Watch, the municipality of São Paulo alone in the year 2021 lost 138ha of natural forest, which is equivalent to 67.4kt of CO2 emissions, seen in figure 39 (Exploring New Tree Cover Gain and Net Change Data | GFW, 2022).

The Atlantic forest, second to the Amazon forest in terms of diversity of ecological systems and species, has largely been deforested with remnants of the forest mostly consolidated to the areas surrounding the Metropolitan Region of São Paulo. Today, the majority of the remnants of the

tree cover loss in the city of são paulo.



FIGURE 40. DEFORESTATION IN STATE OF SÃO PAULO ■
MADE BY AUTHOR



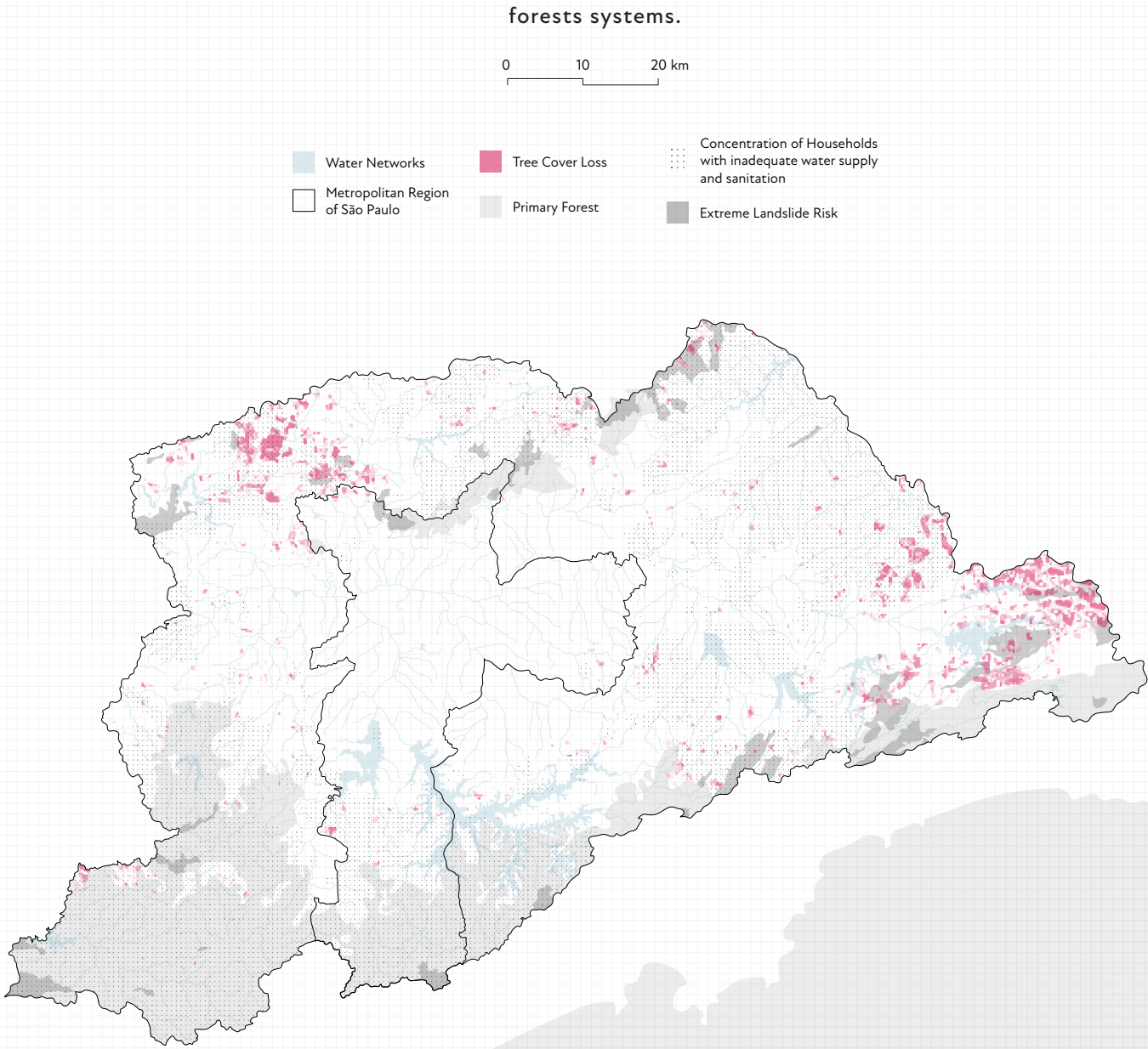
forest are under significant threat from unchecked agricultural expansion, poorly planned infrastructure, lack of sufficient management and governance, and climate change. The deforestation and degradation of forests in the metropolitan region of São Paulo have been a major driver to the increasing water crisis, leading to rising droughts and dry periods.

As these unsustainable practices continue to degrade primary forests, like Atlantic forest biomes in the Metropolitan Region, the forest ecosystems of São Paulo are no longer able to filter water, reduce erosion, regulate rainfall and act as a buffer against environmental risks. As seen in figure 41, the areas of the most tree cover loss are almost synonymous to areas of extreme landslide risks as the lack of forests equate to the lack of ability to hold sediments in place and reduce rain runoff on fragile soil. The trends of deforestation also have a hand in the inadequate water supply and sanitation of water resources in the metropolitan region, as the destruction of forests leads to the

lack of ability to filter water and boost water supply.

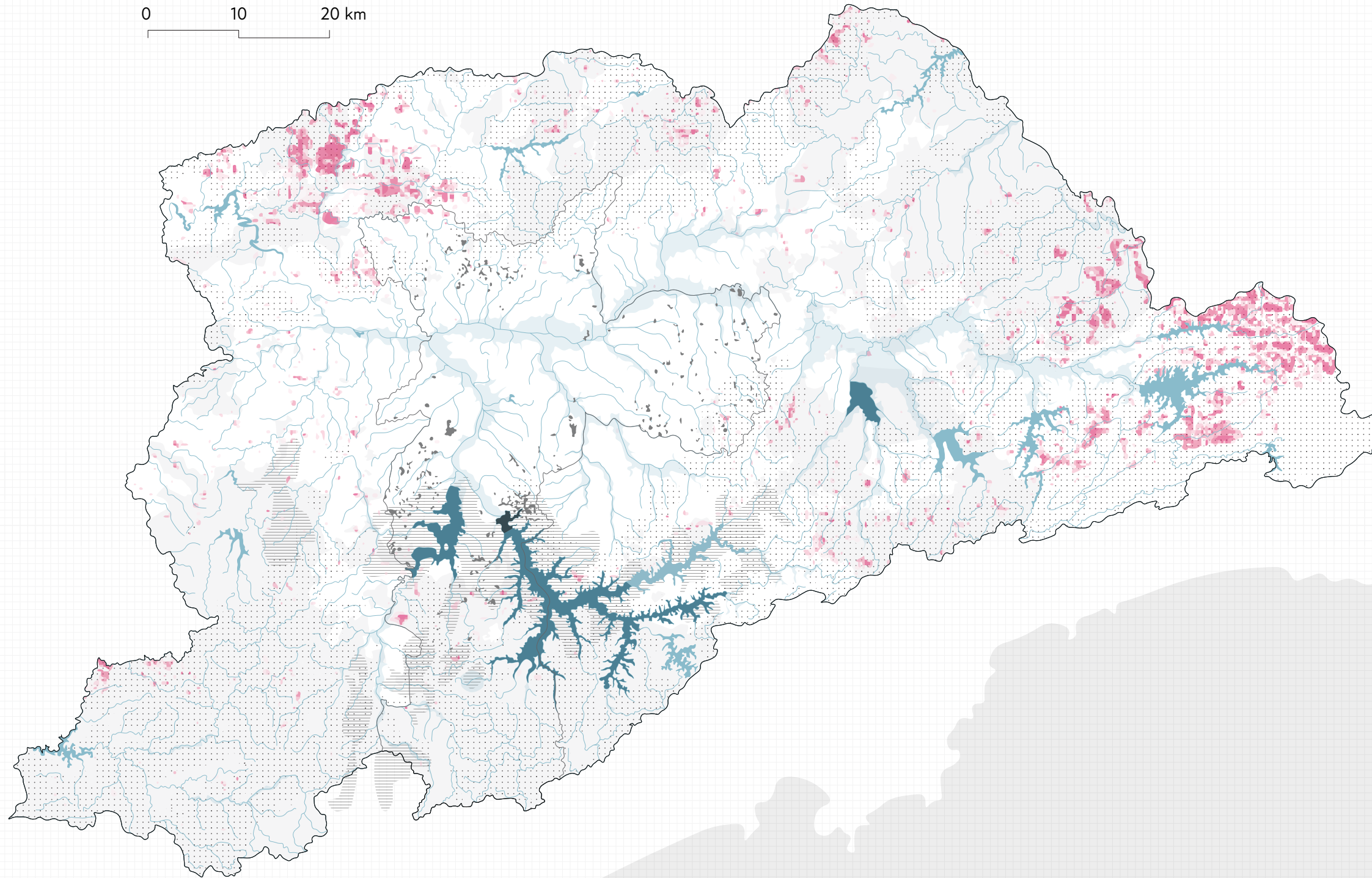
As the amount of forest cover continues to drastically reduce, areas already under socio-economic vulnerability continue to live in a heightened compromised state.

FIGURE 41. FOREST SYSTEMS ■
MADE BY AUTHOR



■ FIGURE 42. CONCLUSION OF SOCIO-ECOLOGICAL SYSTEMS
MADE BY AUTHOR

0 10 20 km



socio- ecological systems conclusion.

The socio-ecological systems analysis of this chapter delved deeper into the burdens of climate change and interlinked critical socio-ecological systems in São Paulo. As pressures from climate change and mismanagement systems continue, environmental events and risks continue to increase, leading to the damage of associated social and ecological systems.

As seen in figure 42, most environmental events and risks are consolidated to the periphery, affecting the poorer and marginalized communities that were expelled to these locations due to the historically unplanned and rapid growth of the city. These hazard prone areas of the city were primarily associated with favela communities that were

built adjacent to water sources in environmentally protected sites. However, due to the lack of proactive measures from the government of São Paulo, construction continued to be built in these protected water catchment areas, leading to the construction of a few luxury condominiums in watershed areas. A large portion of the southern zone along the Billings and Guarapiranga Reservoir are now classified as illegal occupations in protected areas.

Although there is in some cases a mix of low and higher income populations in these areas, the populations in favelas disproportionately feel the burdens of the practices of environmental degradation due to the lack of basic infrastructures provided to them by the government. The concentration of households with inadequate water supply and inadequate sanitation thus remain around the periphery of the metropolitan region, in areas with concentrations of favela communities. Socio-economic conditions induce a large influence over adequate sanitation

infrastructure as it was found that most households with inadequate water supply and sanitation were often those of lower income that were historically marginalized. Poor sanitation in these communities has dangerous consequences that often lead to outbreaks of dengue fever and other diseases as residents linked to poverty are exposed to sewer water and mud. Overall, the lack of sewage and sanitation plants causes a significant impact on the public health system.

The lack of water treatment and sewage plants in areas of illegal occupations in protected areas as well as unsustainable practices from adjacent industries thus leads to the pollution of water sources. Reservoirs adjacent to communities without basic infrastructure in the city of São Paulo, like the Billings and Guarapiranga Reservoir, have been listed as polluted waters by the Water Quality Index (IQA) in 2021 largely due to untreated domestic sewage. Although there have been scholars and organizations calling for investments to broaden

the construction of sewage and sanitation infrastructure to vulnerable areas, the Brazilian government has instead decided to limit the effects of pollution by controlling algae levels in water supplies.

As well, as these water supply systems face rising pollution, reservoirs around São Paulo also suffer from a decreasing water supply. As a result, instead of focusing on the protection of nearby reservoirs, SABESP and DAEE are focusing on extracting water supply from sources from distant systems and drilling additional deep wells. The mismanagement of water systems has led to the critical state of water availability in São Paulo as water demand continues to increase with a growing population. These existing unsustainable practices of water exploitation by companies and government lead to increased periods of droughts and water scarcity. The water scarcity crisis of 2014 in São Paulo that left socio-economic vulnerable populations in the periphery of the city without

water for days was a prime example of the effects that these patterns of unsustainable water usage have on the city. As well as a blatant example of inequality based on how socio-economic vulnerable populations were left completely vulnerable to the extreme lack of water. Although many believe that the last water scarcity crisis of São Paulo in 2014 was a distant event, many scholars and critics claim that another severe water crisis is still possible.

However, as periods of drought increase, similarly periods of extreme rainfall exponentially increase. These areas adjacent to water sources that are simultaneously affected by water scarcity are also strained by rising precipitation rates. Although the primary zones for flooding risks remain in the center of the city due to increased paved surfaces and lower elevations, mostly along the Tietê River and the Pinheiros River, increased precipitation leads to further damage in periphery areas. Heavy rainfall in areas of higher elevations with a lower soil

capacity with concentrations of poorer communities sparks events such as mudslides and landslides. Due to these communities' socio-economic vulnerable state, their self-built constructions typically made out of scrap materials are more susceptible to damages from these events, as well as more vulnerable to the after effects of rebuilding damaged areas. Overall, Leading to the destruction of human life, infrastructures and ecosystems.

As seen in figure 44, areas of high landslide risks also coincide with areas of deforestation. The metropolitan region of São Paulo, once an area abundant with forest landscapes, almost completely lost its primary forest areas in the 2000s. Deforestation has been a consistent issue in Brazilian politics, with Bolsonaro's term from 2019 to 2022 seeing a surge in the deforestation rates. As forest loss continues in areas like São Paulo, environmental disasters and risks become more frequent and extreme as deforestation is linking to compromising watershed areas

and increasing risks of droughts, floods and soil degradation.

In conclusion, the socio-ecological systems of São Paulo are under immense pressure from unsustainable land use practices, inadequate actions from governance and management systems, and increasing burdens from rising climate change. Overall leading São Paulo into a heightened socio-ecological vulnerable state and necessity to re-establish ecological integrity for the stability of social systems. However, providing adequate information and performing a complete socio-ecological evaluation in São Paulo remains a challenge. There are many data sets and relevant information that remain unavailable to the public due to untransparent governance and management entities. All of which continues to highlight the increasing knowledge gap in the city about socio-ecological systems and the need for a shift in information exchange.

socio-economic networks.

OVERVIEW

The analysis of the socio-economic networks will focus on the dimensions elaborated through the creation of the “City of Walls” (Caldeira, 2001) that have created marginalized communities. This chapter will investigate the key aspects of vulnerability and identify the most vulnerable areas within the metropolitian region of São Paulo.

The vulnerability framework will be evaluated through both current social and economic conditions in the municipalities of the metropolitan region, ranging from education status, housing typologies, employment rates, and more. Through defining the municipalities of the highest vulnerability, this chapter will in turn define the areas that are most vulnerable to the increasing pressures of climate change. Finally those areas will be addressed as the main subjects for further investigation.

SECTIONS

- *vulnerability framework*
- *scenario a: social vulnerability*
- *scenario b: economic vulnerability*
- *socio-economic vulnerable areas*

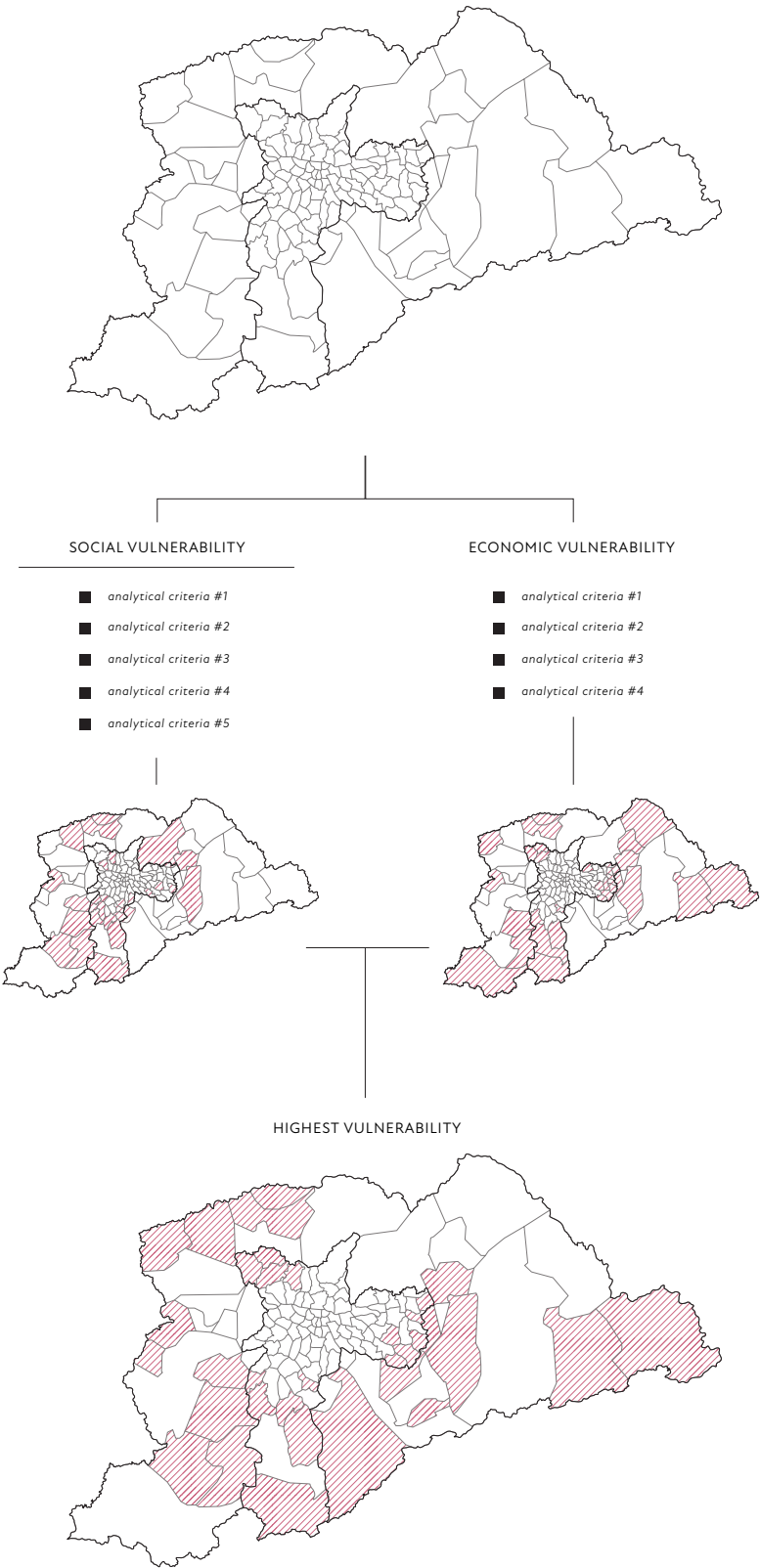
vulnerability framework.

Scenarios of vulnerability in São Paulo investigates the social and economic vulnerability conditions that have been allocated through the construction of the ‘city of walls’. This analysis intends to extract the areas of highest vulnerabilities within the Metropolitan Region of São Paulo. Urban vulnerability has become a key issue for strategic planning as cities around the world face pressures from climate change as well as push towards a globalized future. Vulnerable communities become increasingly marginalized and left behind as they are “unable to cope with adverse effects of climate change, including variability and extremes” (McCarthy et al., 2001).

This investigation is elaborated through a collection of data conducted by IPEA (Institute of Applied Economic Research), a spatial research conducted by Rede

Nossa, and data collected from the DataGeo data source. This analysis thus evaluates the conditions of the different municipalities of the metropolitan region, as well as the districts of the municipality of São Paulo. The framework for each condition starts from the definition of the criteria for each aspect. In other words, the criteria used are defined from previous vulnerability assessments and from relevant literature. With a deep dive into each segment of vulnerability (social and economic), this analysis will inform on the highest vulnerability communities that are most susceptible to environmental risks. The areas of highest vulnerability will determine the subject of future investigations, with design recommendations for re-establishing ecological integrity and promoting social inclusivity to serve as a bridge for these vulnerabilities.

FIGURE 43. VULNERABILITY FRAMEWORK DIAGRAM ■
MADE BY AUTHOR



social vulnerability.

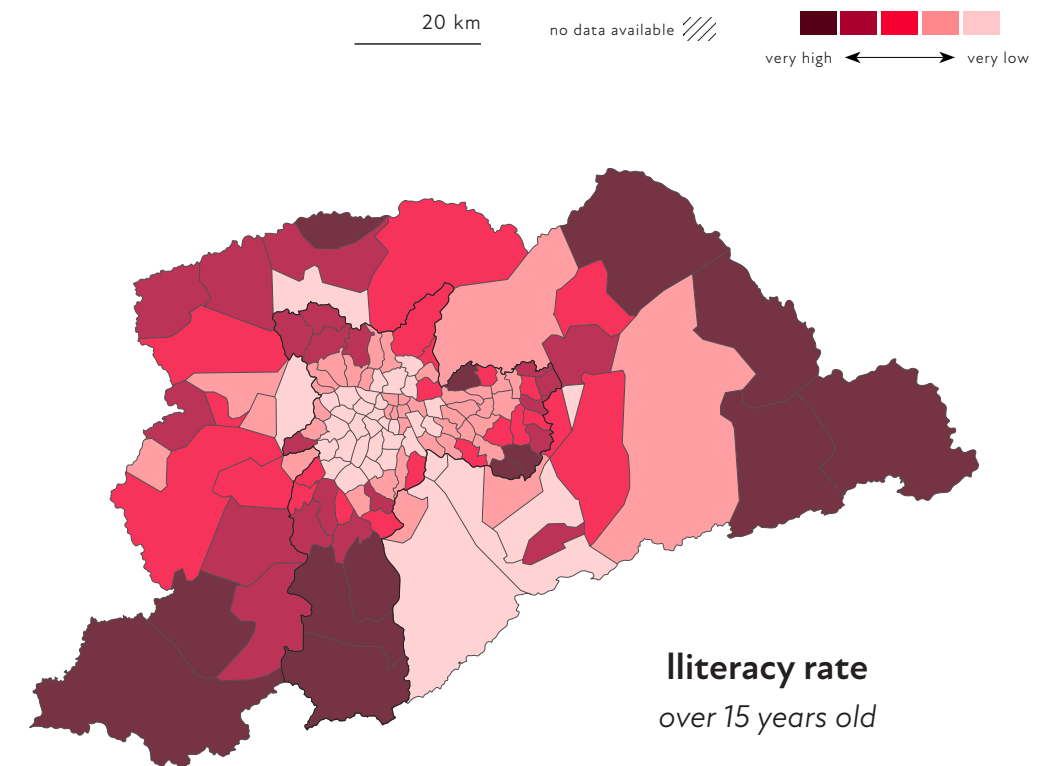
The social vulnerability analysis investigates social variables that influences inequality in the Metropolitan Region of São Paulo.

The main criteria emerges from a spatial study from Rede Nossa São Paulo on inequality, data collected from the Institute of Applied Economic Science (IPEA) on vulnerabilities, and data collected from DataGeo.

This vulnerability analysis will be elaborated through criteria relating to human behavior and societal characteristics, further broken down to educational aspects, housing typologies, population density, and demographics.

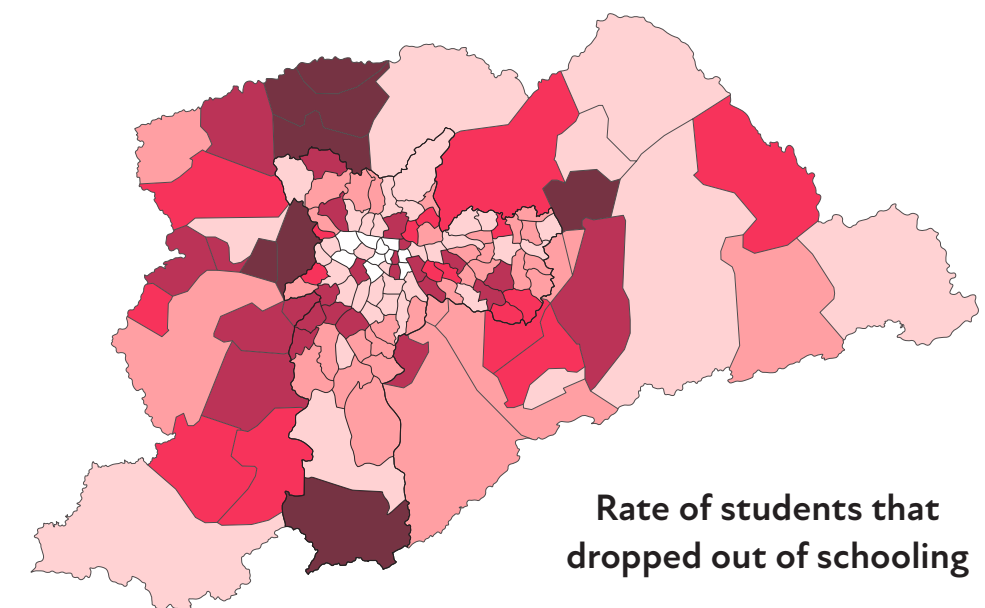
CRITERIA:

- illiteracy rate (population age 15 and over)
- proportion of students who dropped out of schooling
- proportion of households in favelas (informal settlement typology)
- proportion of minorities (*preta e parda*)
- population density



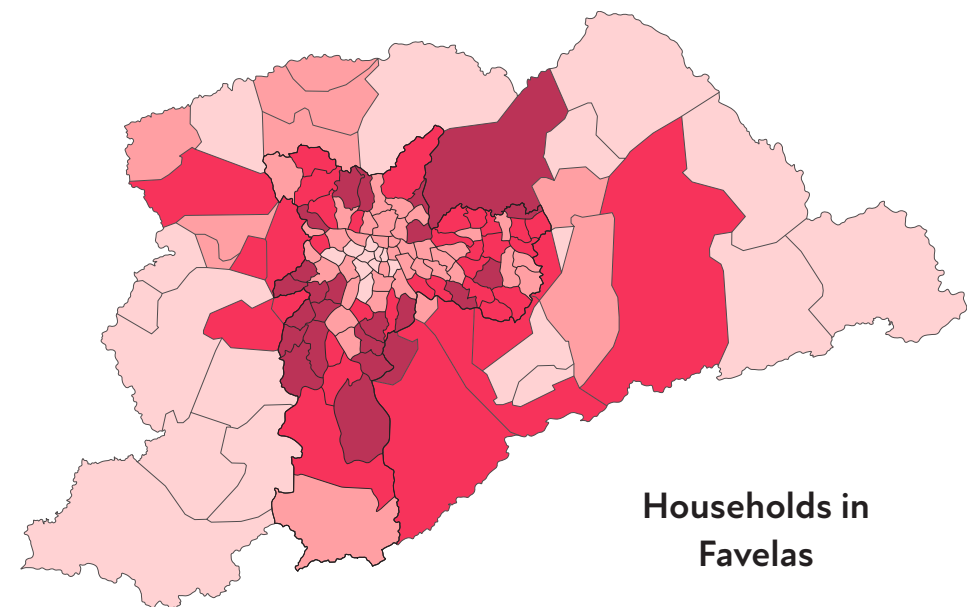
■ FIGURE 44. ILLITERACY RATE MAP
MADE BY AUTHOR

The proportion of residents above the age of 15 years old that are part of the illiterate population.



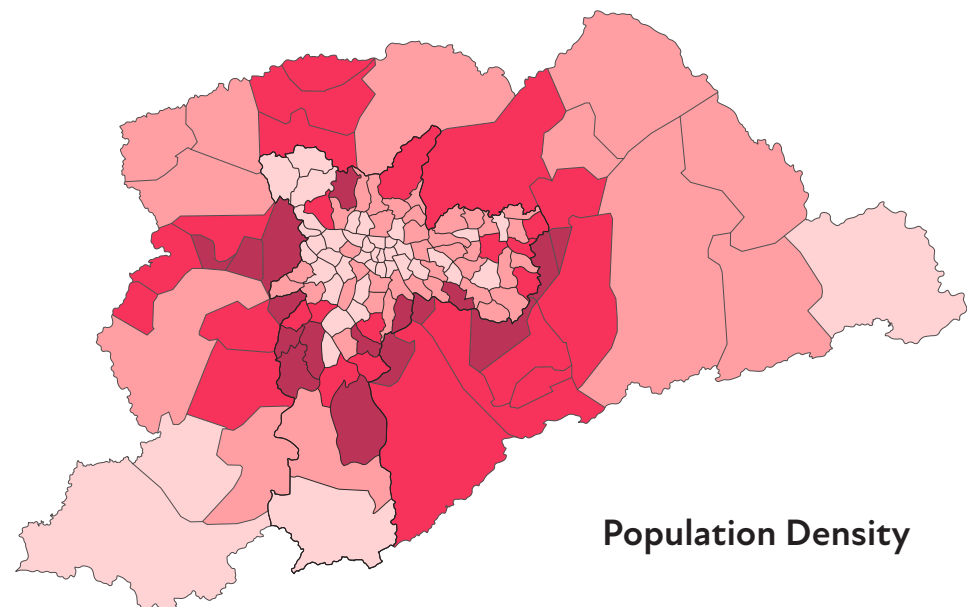
■ FIGURE 45. RATE OF DROP-OUTS MAP
MADE BY AUTHOR

The drop-out rate of people that are not enrolled in school and lack an equivalent to a high school credential.



■ FIGURE 46. HOUSEHOLDS IN FAVELAS MAP
MADE BY AUTHOR

The proportion of households that live in Favelas, a type of informal settlement typology that is characterized as a slum.

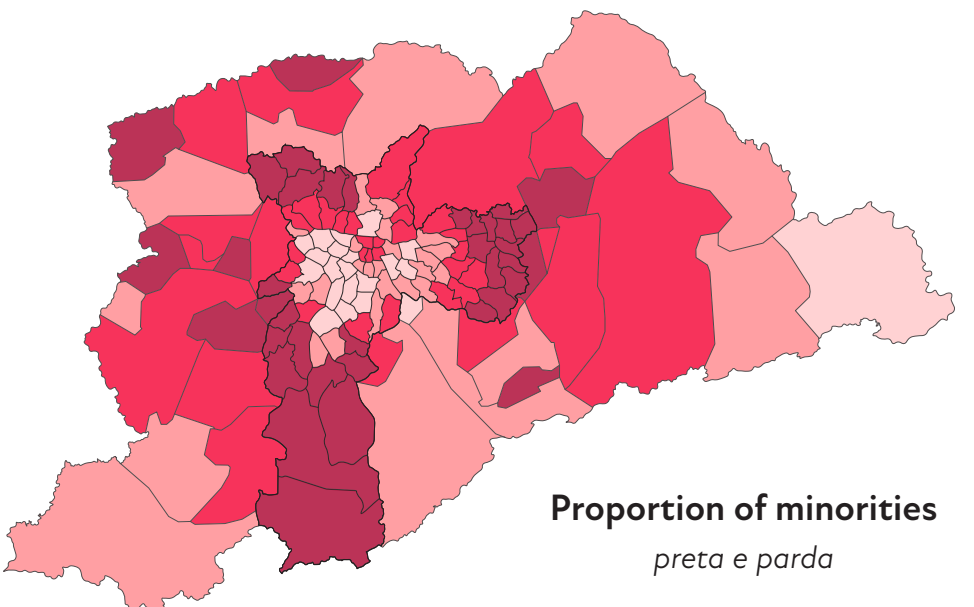


■ FIGURE 47. POPULATION DENSITY MAP
MADE BY AUTHOR

The number of individuals within the district/municipality borders in relation to the size of the area

Households in Favelas

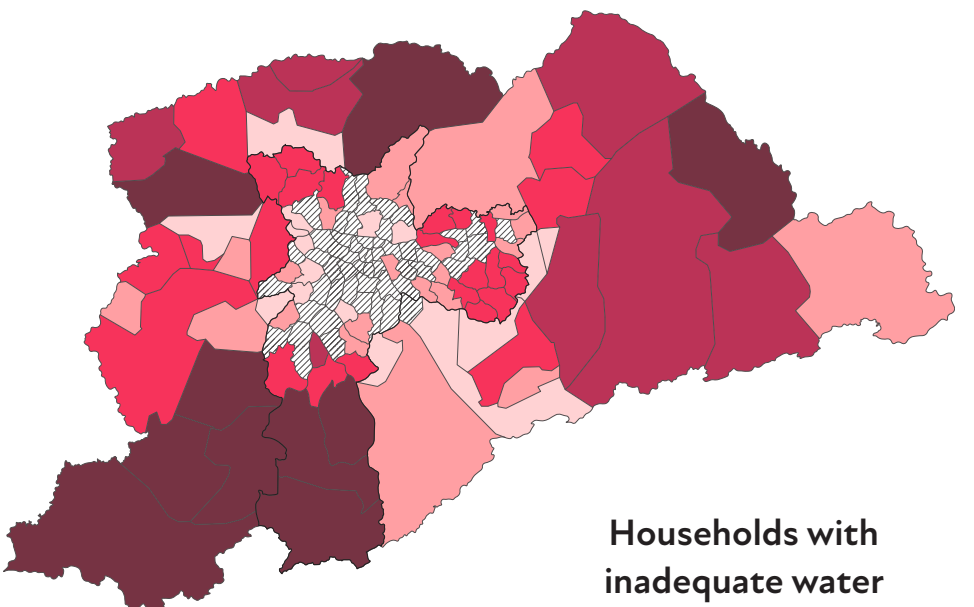
Population Density



■ FIGURE 48. MINORITIES MAP
MADE BY AUTHOR

The proportion of residents who are in the minority groups of *Preta* (meaning black race) and *Parda* (meaning brown or mixed race). This terminology is a racial classification in Brazil and are often historically discriminated against.

Proportion of minorities *preta e parda*



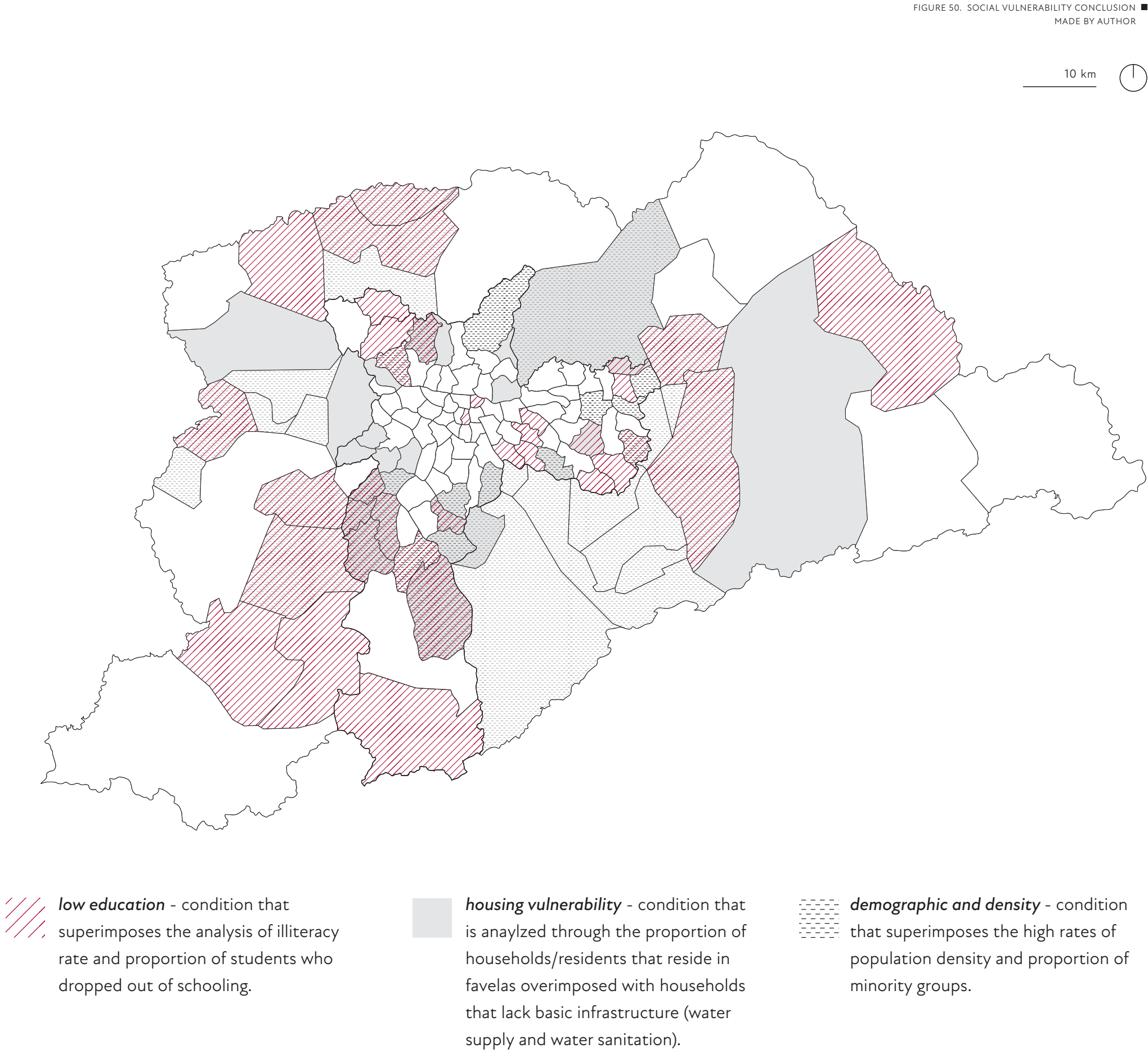
■ FIGURE 49. INADEQUATE WATER MAP
MADE BY AUTHOR

The percentage of households that have inadequate water supply and sanitation infrastructure.

Households with inadequate water

highest social vulnerability.

The results from the social vulnerability framework analysis revealed the districts and municipalities of the Metropolitan Region of São Paulo with the highest vulnerability in regards to social conditions. These communities face, shown in the figure 50, face high social vulnerabilities, meaning that these communities are less resilient and capable to deal with external stressors. Within the entirety of the region, the municipality of São Paulo is regarded as the most socially vulnerable with a majority of the overlapping education, housing, demographic, and density conditions.



economic vulnerability.

The economic vulnerability analysis investigates economic variables that influences inequality in the Metropolitan Region of São Paulo.

The main criteria emerges from a spatial study from Rede Nossa São Paulo on inequality, data collected from the Institute of Applied Economic Science (IPEA) on vulnerabilities, and spatial data collected from DataGeo.

This vulnerability analysis will be elaborated through criteria relating to service and opportunity factors, further broken down to employment opportunities, income distribution, and public services.

CRITERIA:

- unemployment rate (population age 18 and over)
- proportion of people with low per capita income
- percentage of population in informal occupations
- access to mass transit
- percentage of low income households with long commutes

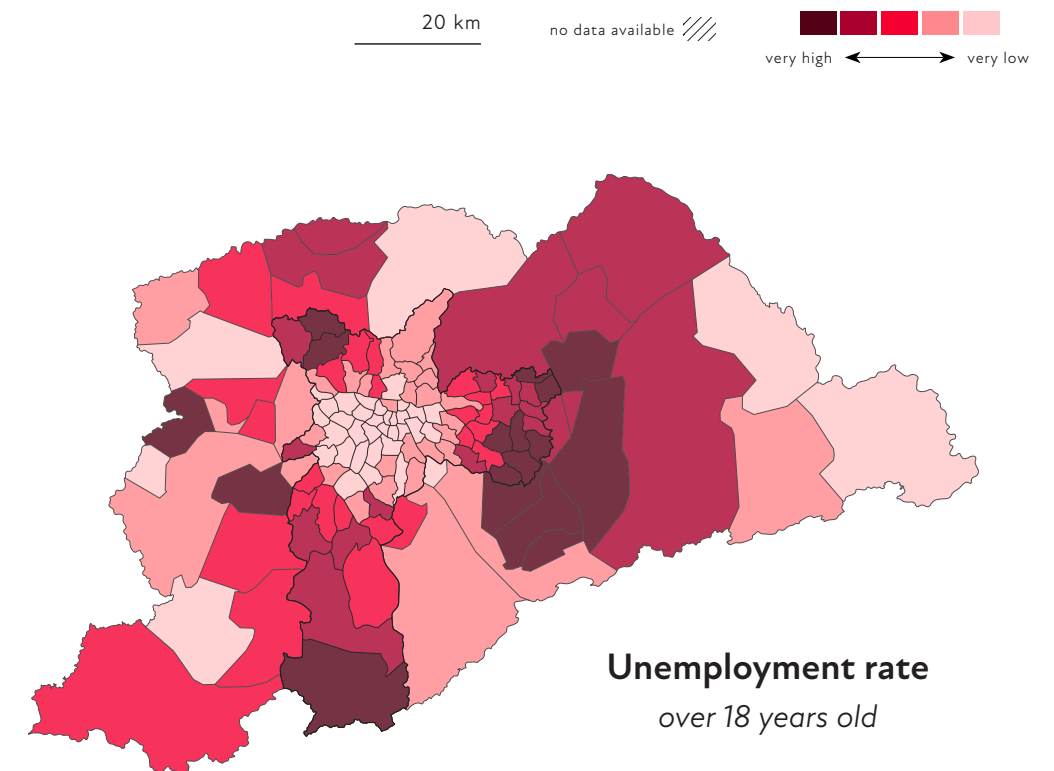


FIGURE 51. UNEMPLOYMENT MAP
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The percentage of the population of the total labor force that is over 18 years old that is currently unemployed.

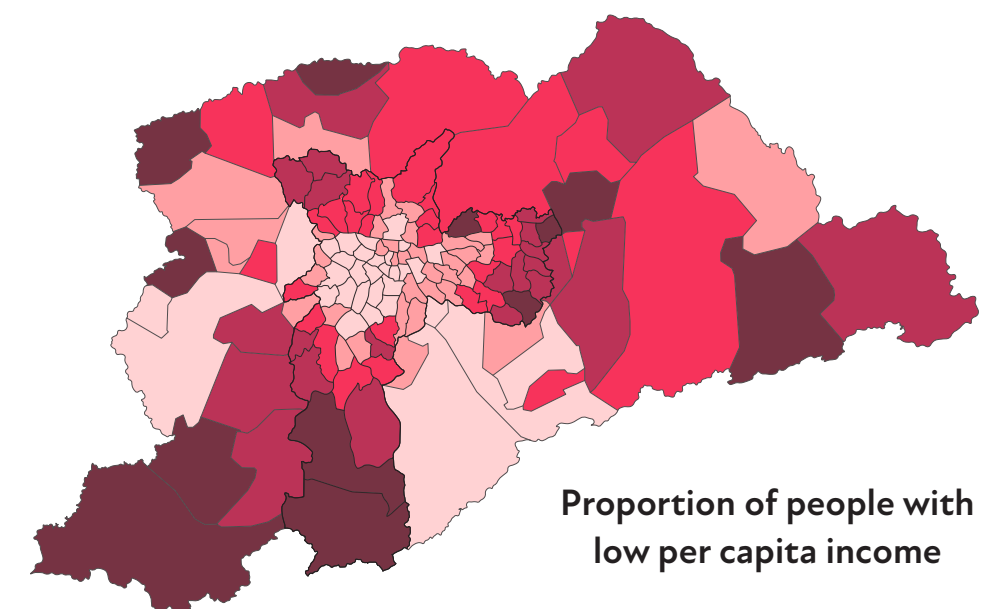
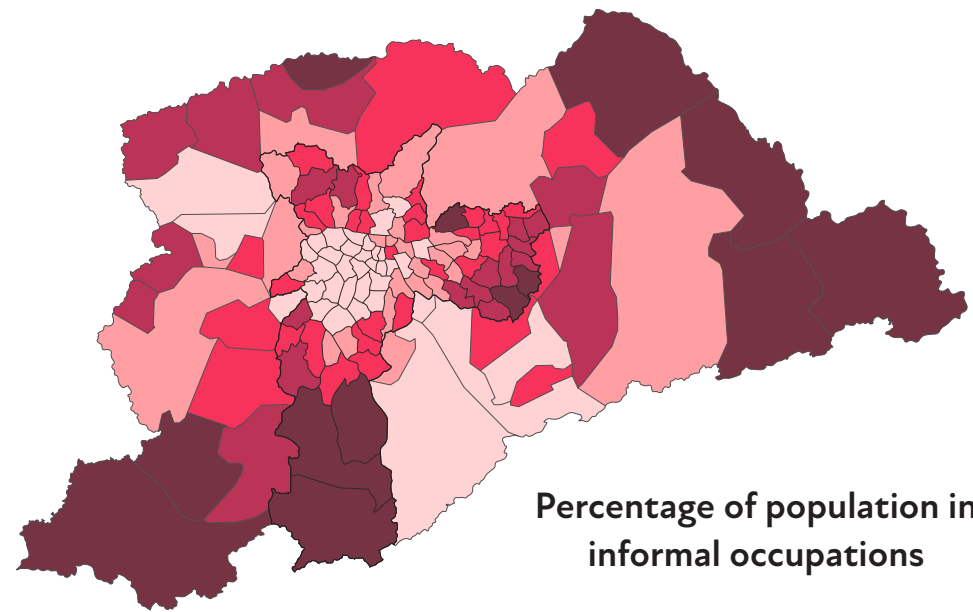


FIGURE 52. LOW INCOME MAP
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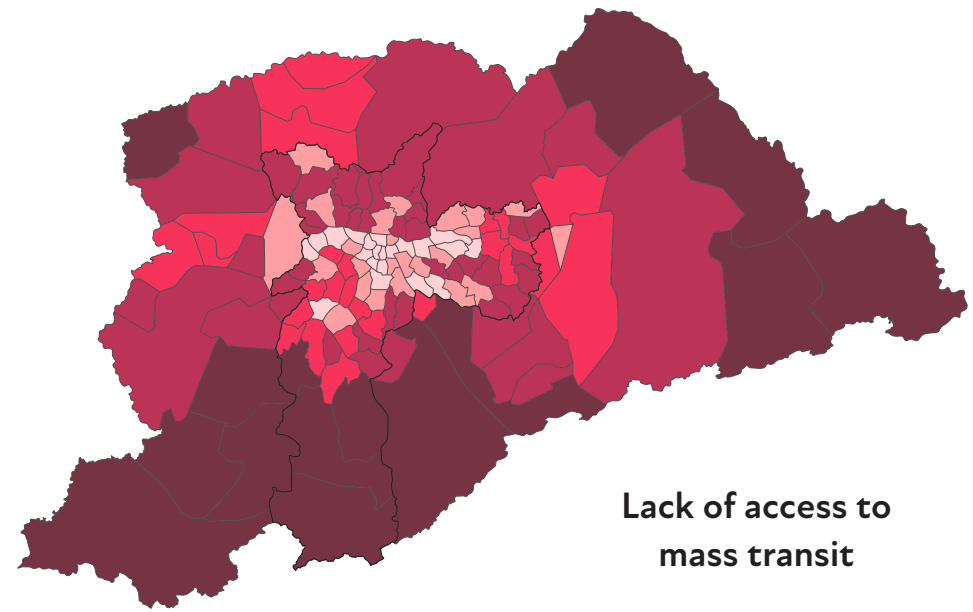
The proportion of people within the district with a per capita household income equal to or less than half of the minimum wage.



■ FIGURE 53. INFORMAL OCCUPATION MAP
MADE BY AUTHOR

Percentage of population in informal occupations

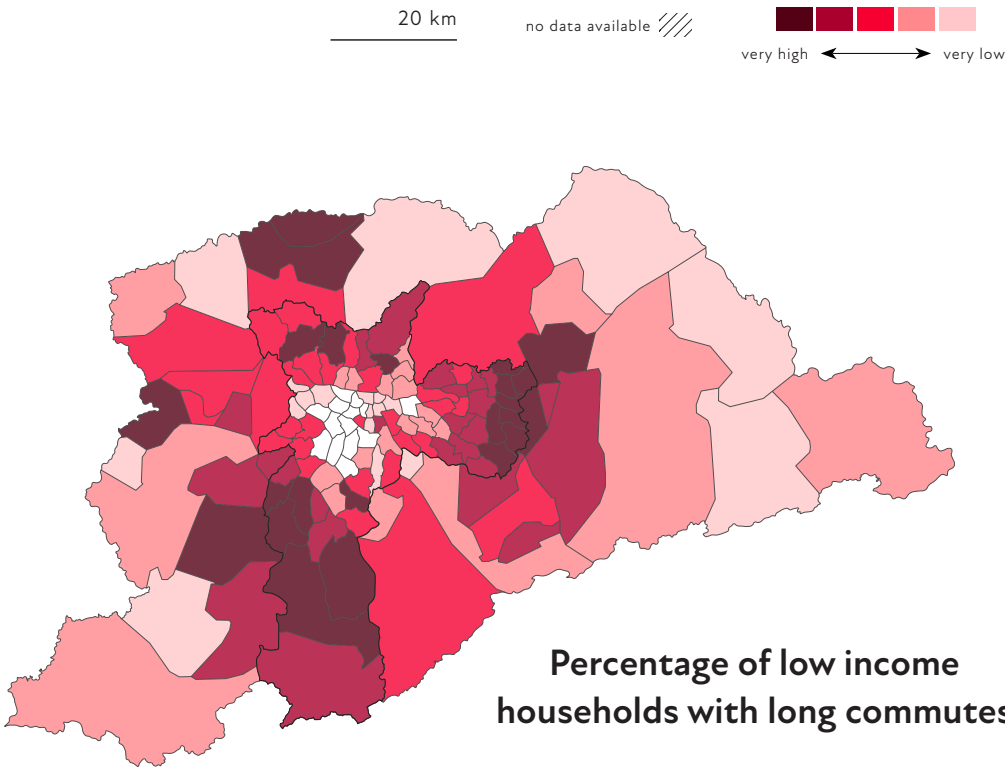
The percentage of the population that works within the informal sector, which constitutes as a job that has little or no job security and does not have a contract.



■ FIGURE 54. ACCESS TO MASS TRANSIT MAP
MADE BY AUTHOR

Lack of access to mass transit

The proportion of the population that does not have easy and convenient access to public transportation (trains, metro, buses, trams, etc.) that would transport them to the majority of employment opportunities in the center.



■ FIGURE 55. LONG COMMUTES FOR LOW
INCOME HOUSEHOLDS MAP
MADE BY AUTHOR

Percentage of low income households with long commutes

The percentage of households with a low per capita income of less than half the minimum wage that requires a commute of more than an hour to their place of employment.



highest economic vulnerability.

The results from the economic framework analysis revealed the districts of the municipality of São Paulo, as well as the municipalities of the Metropolitan Region, with the highest vulnerability in regards to economic conditions. Potential shocks and hazards significantly impacts areas that are currently within the frame of economic vulnerability. The majority of the districts with the highest economic vulnerability lies within São Paulo's southern territory zone: Jardim Ângela, Parelheiros and Marsilac. As well, within the east territory zone: São Rafael, Iguatemi, Parque do Carmo, José Bonifácio, Cidade Tiradentes, Guaianases, Lajeado, Vila Curuçá, and Itaim Paulista. The remaining economic vulnerable district is Jaraguá in the northern territory zone. However, municipalities in the periphery also categorize as economically vulnerable due to their distance from the services of the city center.



access to services - condition that analyzes the proportion of the population that lack basic services such as access to public transportation as well as long commute requirements for the lower income population.



income distribution - condition that analyzes on the current status of poverty dependent on income of households.



employment - condition that superimposes the high rates of unemployment with the percentage of population in the district employed in an informal occupation.

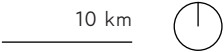
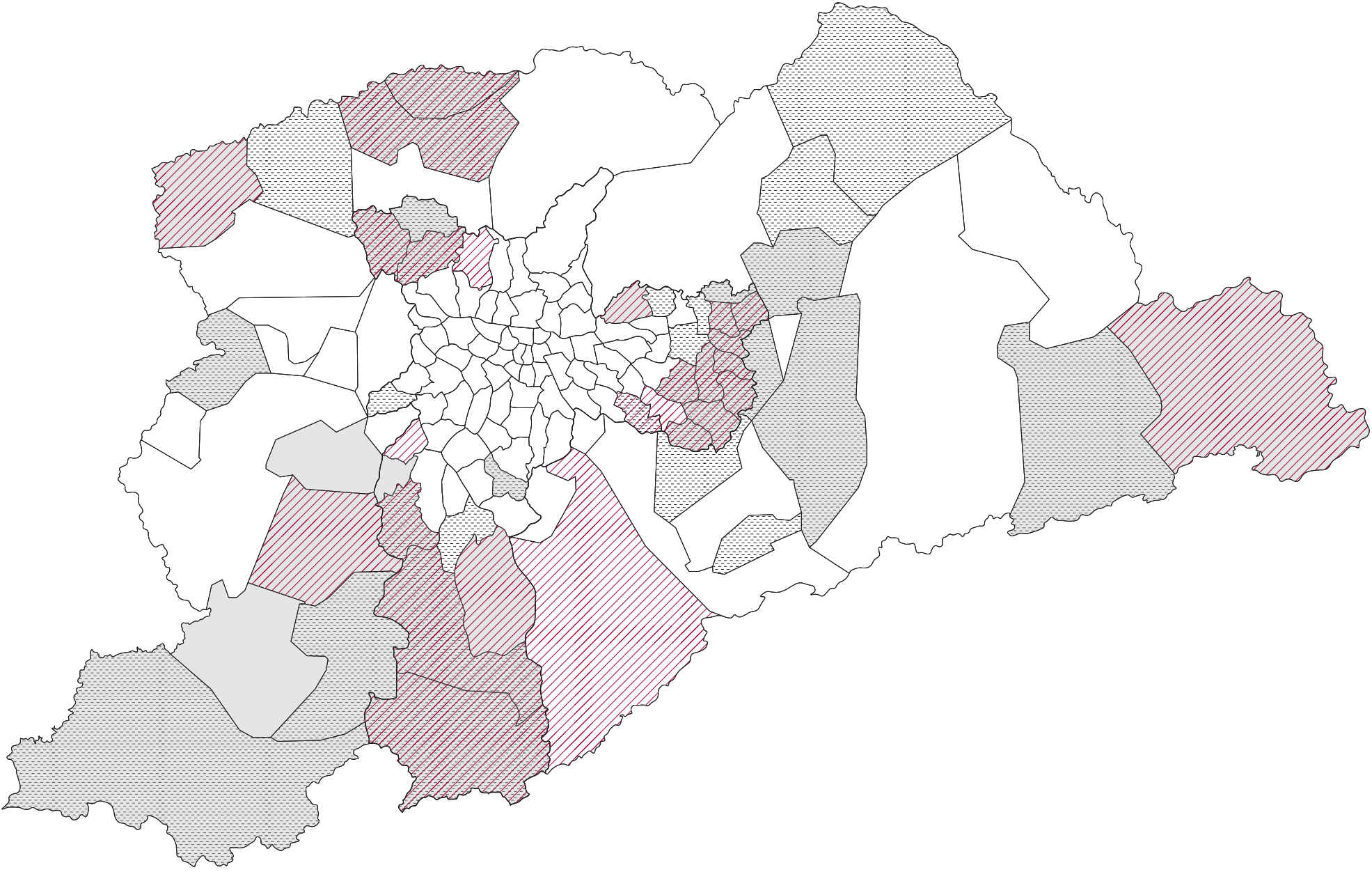
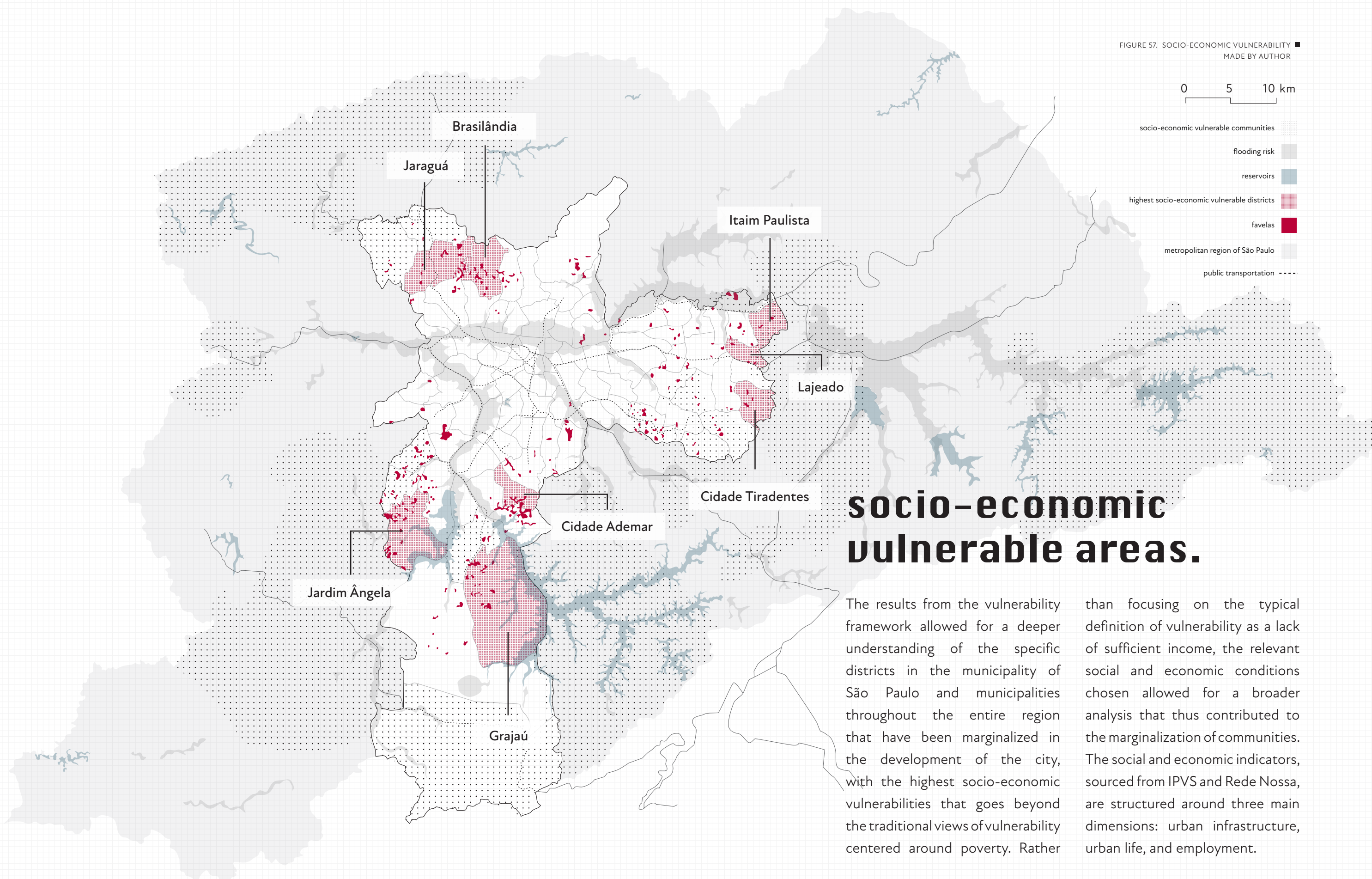


FIGURE 56. ECONOMIC VULNERABILITY CONCLUSION ■
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FIGURE 57. SOCIO-ECONOMIC VULNERABILITY ■
MADE BY AUTHOR



socio-economic vulnerable areas.

The results from the vulnerability framework allowed for a deeper understanding of the specific districts in the municipality of São Paulo and municipalities throughout the entire region that have been marginalized in the development of the city, with the highest socio-economic vulnerabilities that goes beyond the traditional views of vulnerability centered around poverty. Rather

than focusing on the typical definition of vulnerability as a lack of sufficient income, the relevant social and economic conditions chosen allowed for a broader analysis that thus contributed to the marginalization of communities. The social and economic indicators, sourced from IPVS and Rede Nossa, are structured around three main dimensions: urban infrastructure, urban life, and employment.

Dimensions of Vulnerability:

- Urban Life: housing typology, demographics, density, illiteracy, low education
- Employment: informal vs. formal occupation, insufficient income, unemployment
- Urban infrastructure: access to public transit, commute duration, access to water

socio-economic vulnerability

Although many conditions still exist within these three dimensions that equate to vulnerability, data on these information sets are limited in São Paulo.

In the **urban infrastructure dimension** of socio-economic vulnerability, the framework focuses upon access to services, primarily transportation. Although urban infrastructure also relates to

access to garbage infrastructure, access to water, and more, data on these information sets are limited in São Paulo. These areas comprise communities that are most removed from the services of public transportation, such as trains and subway.

These areas, often in the periphery of the city, are “synonymous with neglected infrastructure” and have continuously been excluded from the scope of the public transportation system (Sao Paulo; A Tale of Two Cities by UN-Habitat, 2010). Most of the highlighted areas have no direct connection to a major line of public infrastructure. These communities are consequently disconnected from areas like the city center that contain the concentration of opportunities and services.

Thus, transportation in São Paulo has been a consistent factor in the socio-economic exclusion and increased economic vulnerability of communities in the periphery.

In line with urban infrastructure,

this dimension is also characterized by the duration of commute for low-income populations to reach their place of employment. Specifically focused around the percentage of the population that requires up to or more than an hour to commute daily.

In the **urban life dimension** of socio-economic vulnerability, the framework explores housing typologies, demographics of the population, population density, and education.

The social condition of housing focuses on the proportion of households that reside in favelas, an informal housing typology that consists of self-made constructions built on illegally occupied land. Favelas have become a historic symbol of Brazil’s inequality, with its residents often displayed as living in extreme poverty. Although the reality is often more complicated, with a proportion of informal residents often living in comfort and in a vibrant community, a majority of favela residents can be classified as urban poor.

These communities of increased favela households have historically been excluded from public investments and urban planning in the development of São Paulo. Thus decreasing these area’s accessibility to basic infrastructure like sewer lines, adequate water supply, or water sanitation infrastructure. As well, housing constructions in communities like favelas are often self-constructed homes out of recycled and scrap materials that are susceptible to easy damages from environmental disasters. Therefore, communities in the periphery with higher proportions of households in favelas are often more vulnerable to environmental events that bring upon negative consequences like water scarcity.

Housing conditions as the favelas, coupled with high percentages of the existing population of the city living in these areas, exemplifies these area’s vulnerabilities. As such, these communities also comprise low conditions for adequate education, with high rates of illiteracy in ages 15 and up and high rates of students who

have dropped out of schooling.

In areas characterized by urban poverty in the peripheries of the city, basic education is less present and less evident of equality. Inequalities based on different socio-economic backgrounds, primarily in secondary school, and a lack of adequate facilities have contributed to a decline in educational standards (Sao Paulo; A Tale of Two Cities by UN-Habitat, 2010).

A lack of education directly links to increased levels of vulnerabilities to natural hazards and climate change, hindering societies' ability to be adaptive in responses to environmental disasters.

Racial inequality has played a role in impeding minorities from an adequate education as these groups often face discrimination and racism. Consequently, most of the minorities of '*preto*' and '*parda*' reside in informal settlements, like favelas and cortiços. Factors of urban life like racial inequality, lack of education, and lack of adequate

housing hinder these communities to be adaptive and responsive towards ecological disasters, thus intensifying their vulnerability.

In the **employment dimension** of socio-economic vulnerability, the framework focuses on uncovering districts with conditions of informal occupation, insufficient levels of income and higher percentage rates of unemployment. These areas often face a higher level of economic difficulties, lack of sufficient opportunities, and a more susceptible state to economic recessions.

The communities in these areas thus contain a higher percentage of the population that work in an informal occupation setting. There is often a stigmatization around the idea of the informal economy, that this sector of the economy inherently exploits workers. Although those practices are typical in the agriculture sector, work in the urban informal sector traditionally are run by single owners and range from trade and service to construction jobs

(Sao Paulo; A Tale of Two Cities by UN-Habitat, 2010). Although the informal work sector is not intrinsically linked to vulnerable populations, the jobs within the informal economy are traditionally more unreliable and vulnerable to shifts in the global economy that induce economic recessions.

Furthermore, the populations within these districts consist of higher rates of unemployment in those 18 years and up in relation to other districts in the municipality, associating these areas with poverty. It has been noted that the residents of the periphery, often those living in informal housing like favelas or cortiços, make up a large percentage of the unemployed population in São Paulo as these communities are excluded from work opportunities and services that are available in center areas of the city. (Sao Paulo; A Tale of Two Cities by UN-Habitat, 2010). As such, areas of higher rates of unemployment also coincide with the areas where there are higher rates of insufficient income in households, which equate to a per

capita household income equal to or less than half of the established minimum wage.

Consequently, these communities in São Paulo have been economically marginalized in terms of opportunities and employment and living standards, all of which contribute to a heightened state of vulnerability to shifts in socio-ecological systems.

In conclusion, these areas uncovered through methods of mapping and data analysis within the vulnerability framework have revealed the communities of the metropolitan region that are most socio-economic vulnerable. Equating to the communities that are currently and will be disproportionately affected by increasing environmental risks and disasters.

institutionalized walls.

OVERVIEW

This chapter will analyze the current institutionalized walls present in Sao Paulo and its effects on socio-ecological barriers within the Metropolitan Region. Therefore, this section will analyze the governance system in Brazil and elaborate on the institutions, both formal and informal, that configure the complex governance system. Thus, allowing for a framework of opportunities to reconfigure the system towards a more just and inclusive process.

This chapter acknowledges the intricate nature and complexity of Brazil's governance structure. While it serves as a base for future strategies for environmental justice in São Paulo, this topic of governance and institutions is not extensively explored.

SECTIONS

- *governance structure*
- *formal vs. informal institutions*

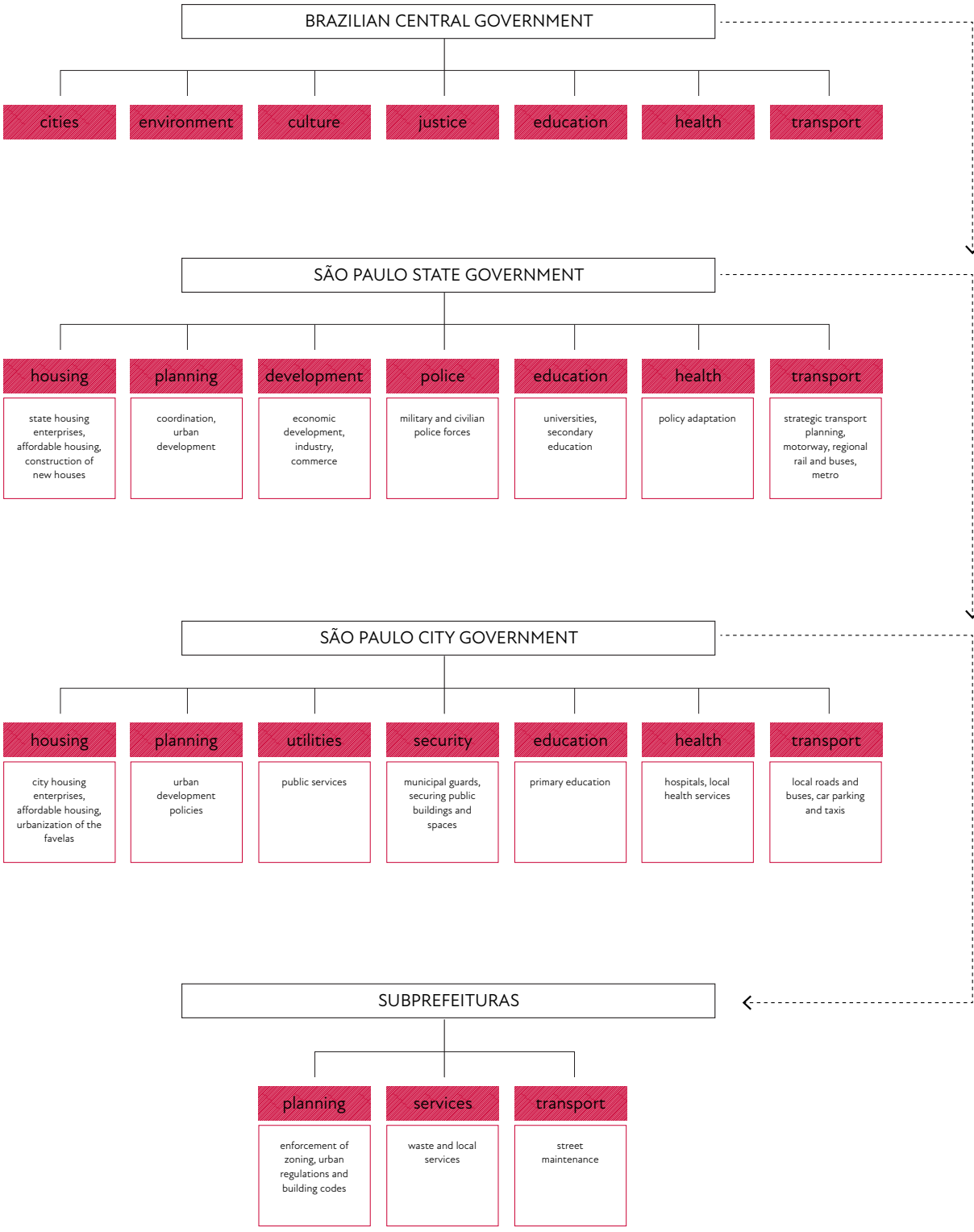
governance structure.

BRAZILIAN GOVERNANCE STRUCTURE

The Brazilian government is categorized as a federal democratic republic and as such, is divided into twenty-six states, each with its own government, which operates under the authority of the federal government. Each state operates in conjunction with the federal government but has separate responsibilities. The state government is ruled by an elected official, the governor of the state, for a four-year term and is responsible for managing the state budget and enforcing state laws. In addition to the state governments, Brazil is also divided into municipalities, each with its own local government. The municipal government is responsible for providing services such as garbage collection, road maintenance, and managing the local budget.

Similarly to the state government, the municipal government is run by an elected official, the mayor, for a four-year term. Under the municipal government, there are administrative units called Subprefeituras with each category headed by a Subprefeito that is appointed by the mayor of the municipality. This system was first introduced in the city of São Paulo in 2002 as a way to decentralize the municipal government and facilitate better relationships between the government and civil society. Due to the success of this system in providing a more efficient and inclusive way for the municipal government to address the needs of the people, this system is now adopted by many other municipalities in Brazil.

FIGURE 58. BRAZIL GOVERNANCE STRUCTURE ■
REDRAWN BY AUTHOR, SOURCED FROM: LSE CITIES (2008)



METROPOLITAN REGION
GOVERNANCE STRUCTURE

Due to the large gap present between most municipal boundaries and the boundaries of urban cities, the two levels of state and municipal government are required to work very closely together. This gap in the governance system was very present in São Paulo’s case, where the extent of the city within the metropolitan region spreads beyond São Paulo’s municipal boundaries.

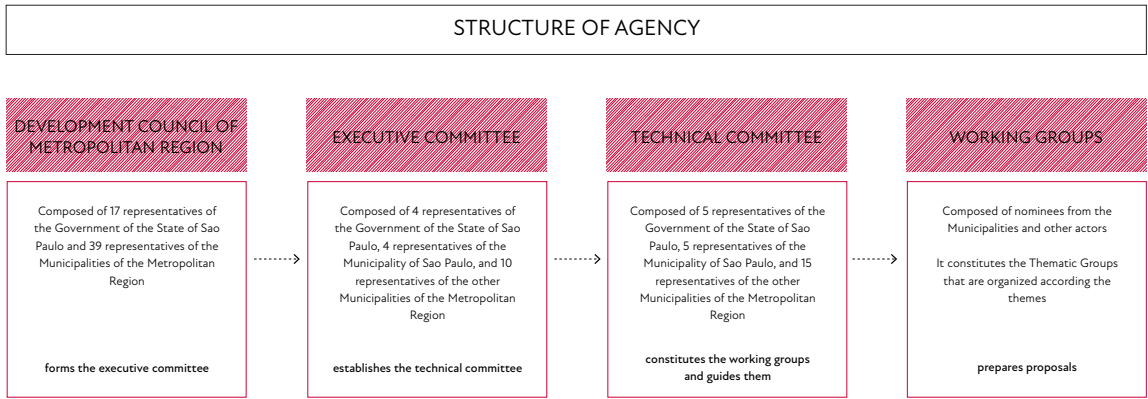
In the case of Brazil, metropolitan regions are governed by a combination of federal, state, and municipal authorities, with each level of government typically responsible for different aspects. In the case of the Metropolitan Region of São Paulo, one of the largest metropolitan regions in the world, the governance of this system is coordinated by the Metropolitan Region of São Paulo Agency (*Agência da Metropolitana de São Paulo*). This agency was created by the São Paulo state government in 2019 as

a response to this noticeable gap between government structures. The agency, which is governed by representatives from each of the thirty-nine municipalities in the Metropolitan Region of São Paulo as well as seventeen representatives from the state government, is responsible for coordinating the planning and implementation of policies and programs across the region.

Most notably, this agency is responsible for developing and implementing the Metropolitan Plan for Sustainable Development (*Plano Metropolitano de Desenvolvimento Sustentável*) that guides the long-term development of the region. This document for the Metropolitan Region of São Paulo (RMSP) was first developed in 2010, with the most recently updated plan released in 2019.

Although the governance system in the metropolitan region continues to evolve and adapt to

FIGURE 59. METROPOLITAN REGION GOVERNANCE STRUCTURE ■
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the changing conditions of the region, there are still criticisms that this agency faces regarding the call to create a more efficient and sustainable governance structure. Coordination among this agency can prove difficult when confronted with many different actors that hold different opinions and interests in the region’s development. In many cases in Brazil, political interference and corruption are still very present in current governance systems. Many decisions made in these structures are often undermined by the private interests of political figures and ‘under-the-table’ deals that lead to criticisms of the legitimacy of these systems. In addition, there are criticisms that these agencies

do not adequately incorporate the voices and needs of the existing marginalized communities with limited participation processes. As such, these communities also face a lack of investments in their areas due to the limited resources and funding available to support development projects.

formal vs. informal institutions.

The governance systems in Brazil, more specifically São Paulo, is marked by complexity. The network of institutions, both informal and formal institutions, is central to understanding the historical patterns of development and political difficulty within the region. Both informal and formal institutions have significant power in how cities in Brazil are ruled and developed.

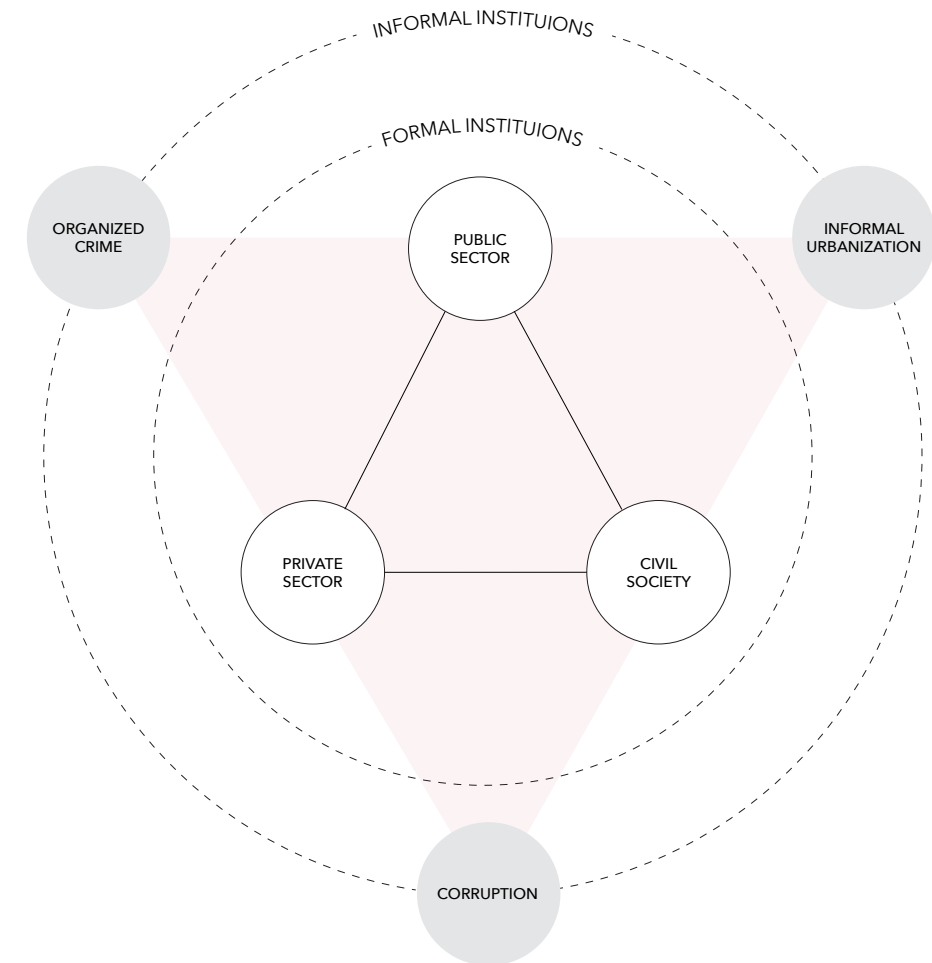
Formal institutions are defined within the legal framework of the country's political, economic, and social system. Thus, articulating the three main institutions of civil society, the private sector, and the public sector. Otherwise, respectively known as community power, capitalist society, and state power.

Informal, otherwise known as non-statutory, institutions are

those that are not regulated and occur outside of formal law. These practices are deeply ingrained in Brazil's society, often influencing how formal institutions function. Thus playing a significant role in shaping political interactions and socio-spatial environments.

ORGANIZED CRIME

Organized crime in Brazil can be understood as an informal institution as it operates outside of the legal framework of the country. This institution can be seen as a parallel system of power in Brazil's institutional system through its exertion of power and influence over the development and governance of cities. The influence of this institution is particularly visible in areas that experience the absence of the public sector and patterns of governmental neglect, for example in areas of informal settlements.

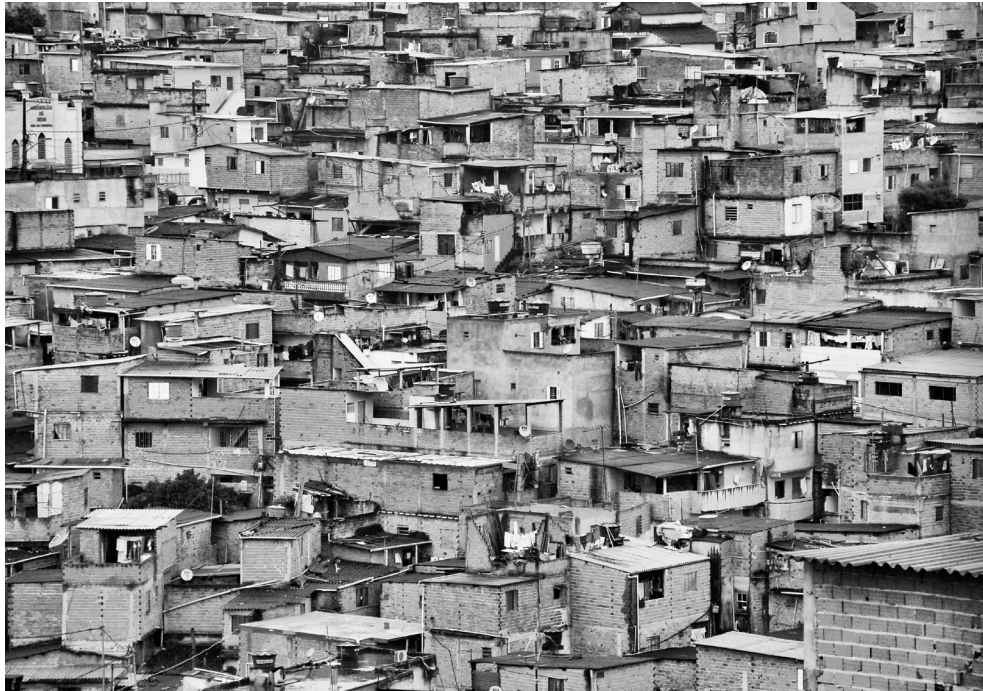


INFORMAL URBANIZATION

Although informal urbanization, such as favelas, has become a key part of the Brazilian urban landscape, its development outside of the formal system marks them as an informal institution. Informal urbanization refers to the process of development where often poor or marginalized communities

were forced to settle in areas that lacked legal authorization. These processes were often triggered by rapid urbanization, lack of governmental intervention, extreme inequality, and lack of affordable housing. The response to these informal institutions varies between states in Brazil and has received much attention in the

INFORMAL URBANIZATION AS AN INFORMAL INSTITUTION

FIGURE 61. INFORMAL URBANIZATION IN SAO PAULO ■
PHOTOGRAPHS FROM ROBERTO ROCCO

past years. São Paulo, like many other Brazilian cities, used to focus their response to these urban agglomerations around policies that removed these residents and relocated these communities to the outskirts of the city. However, these practices often led to the exacerbation of these communities' economic, social, and environmental vulnerability. In recent years, São Paulo has shifted its focus away from displacement and towards the formalization and integration of these communities into the city. Despite many efforts towards the regularization of these communities, many challenges still remain in adequately integrating these institutions into the formal systems of the city.

CORRUPTION

Corruption in Brazil has deeply influenced how formal institutions function and continue to play a significant role in shaping developments, political interactions and social environments in cities across the country. Corruption as an informal institution in Brazil takes many forms, including 'under-

the-table' deals, bribery, nepotism, embezzlement and more. These organized and influential practices occur throughout national, state, and municipal governments and are often facilitated by a lack of transparent and unaccountable systems. As these networks are aided to cater towards the private interests and political gain of individuals, this informal institution continues to undermine the public trust in the government institutions and the rule of law in Brazil.

In São Paulo specifically, the imbalance between these formal and informal institutions that make up the governance structure has had a considerable impact on the way the metropolitan region was historically developed. The inequality in the socio-spatial environments within São Paulo, most notably the formation of favelas in environmentally unstable areas, was caused by the permeability of private interests in Brazilian's public institutions.

analysis conclusion.

OVERVIEW

The multi-scalar analysis, through methods of a literature review, a vulnerability framework, and transcalar mapping, developed through the analytical framework identified the vulnerable areas of the region through the overlap of environmental and socio-economic vulnerability indications. Therefore, showcasing areas of extreme exposure to social and environmental vulnerabilities in the Metropolitan Region of São Paulo. This was therefore used to identify distinct critical areas where communities experience double exposure, meaning that they are confronted both by the impacts of climate change and the burdens of social inequality.



VOLUME 03

EXPLORING POTENTIALITIES

Socio-Ecological Indicator (p. 152)

- *socio-ecological indicator*
- *critical areas of interest*

Design Exploration (p. 162)

- *area 01*
- *area 02*
- *area 03*

Site Recognition (p. 188)

- *existing barriers*
- *the survey questionnaire*

socio-ecological indicator.

OVERVIEW

The Socio-Ecological Indication System that was developed for this thesis was based on the previous segments of analysis on socio-ecological systems and socio-economic conditions of the Metropolitan Region of São Paulo.

Through indexes from ecological and social categories, this chapter will apply this system to the Metropolitan Region. Thus concluding the overall rating of the region in terms of sustainable and resilience of socio-ecological systems.

Furthermore, through the use of this indication system, this chapter will investigate areas of critical interest within the region. These areas of critical interest will be the main subjects for design explorations in socio-ecological imbalanced areas.

SECTIONS

- 
- *socio-ecological indicator*
 - *critical areas of interest*

socio-ecological indicator.

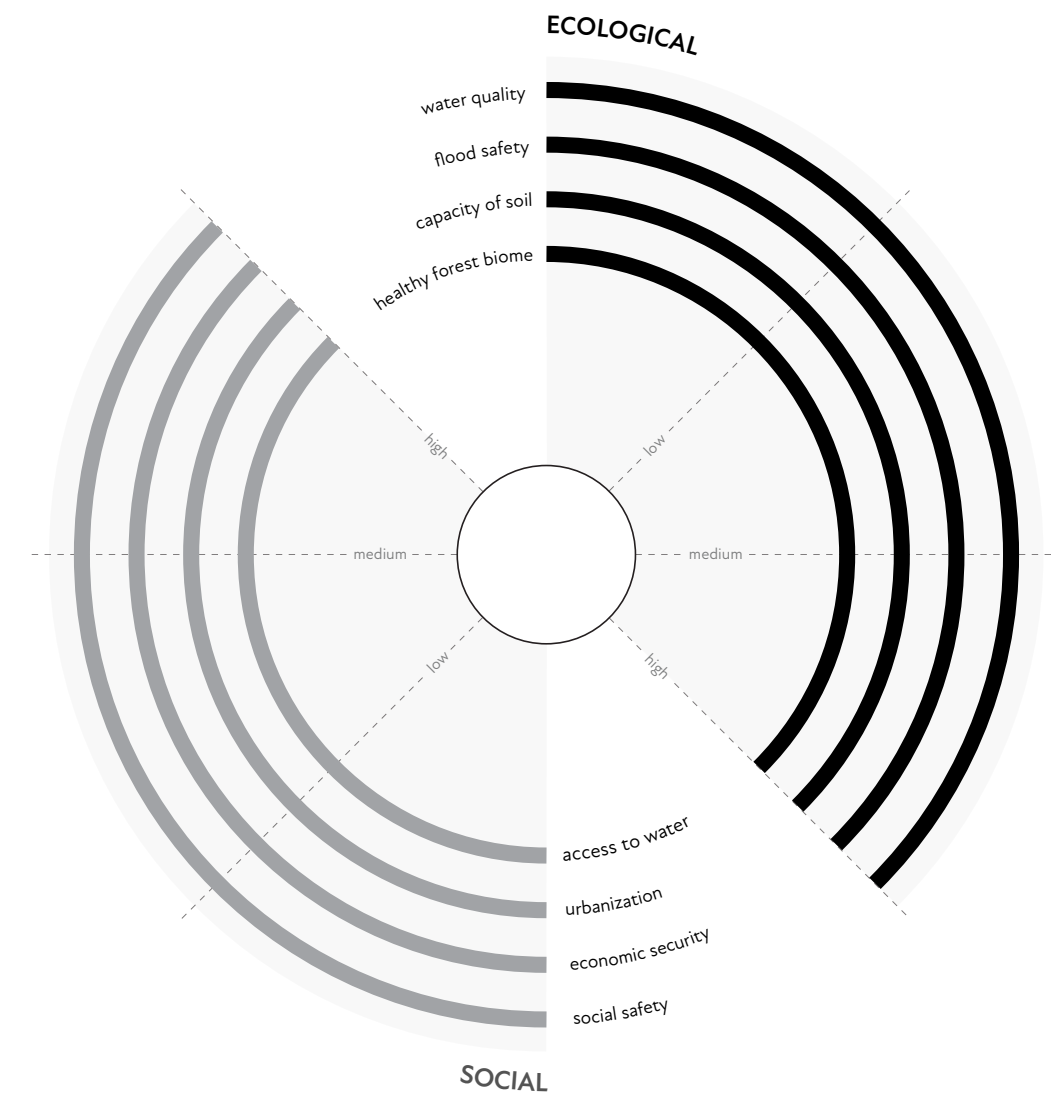
This socio-ecological indicator system developed for this thesis is a framework of indicators that emphasize societal and environmental qualities, with spatial implications, that impact multidimensional inequality and ecological degradation in the Metropolitan Region of São Paulo. In this way, the indicator system serves as a tool in planning and decision-making processes that can be used by various organizations or communities to measure and monitor the health of the socio-ecological system in a given area, identify areas for improvement, and develop strategies to promote a balanced area.

The formulation of the indicators is made concerning both ecological and social categories that measure a healthy, resilient and inclusive system, based on the previous analysis of socio-ecological systems

and socio-economic conditions of the Metropolitan Region of São Paulo. The ecological category deals with topics of water quality, flood safety, the capacity of the soil, and the health of the forest biome. On the other hand, the indicators in the social category measure social safety, economic security, urbanization, and access to water.

Overall, this framework of indicators emphasizes the interdependence of ecological and social systems and the need to address both aspects in planning and decision-making processes. Thus, this developed framework is crucial for evaluating the impacts and progress towards achieving the goals of ecological integrity and social inclusivity.

FIGURE 63. SOCIO-ECOLOGICAL INDICATOR ■
MADE BY AUTHOR



ECOLOGICAL CATEGORY

The ecological category deals with indicators that were established through the socio-ecological systems analysis of this thesis and are thus elaborated as such:

WATER QUALITY:

This Indicator describes the condition of the adjacent water bodies. Taking into account the quality of water drinking and public usage as well as the area’s proximity to a sewage and water treatment facility.

FLOOD SAFETY:

This Indicator describes the ability of the adjacent water bodies to adequately absorb excessive precipitations. Thus, preventing an overflow of these bodies and averting flood hazards.

CAPACITY OF SOIL:

This Indicator represents the soil’s ability to absorb pressures from exterior sources, like abundant amounts of water due to increased precipitation. Thus, to prevent events of soil erosion such as landslides or gully erosions.

HEALTHY FOREST BIOME:

This Indicator reports on the area, density and biodiversity of any adjacent forest landscape within the area. As well, taking into account the area’s past practices of deforestation due to human activity relatively within the last twenty years (2000-2020).

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SOCIAL CATEGORY

The social category deals with indicators that were established through the socio-economic conditions analysis of this thesis and are thus elaborated as such:

SOCIAL SAFETY:

This Indicator reports on the population’s ability to withstand societal impacts and stressors. Thus, measuring the quantity of educated individuals and the proportion of households living in adequate living conditions.

ECONOMIC SECURITY:

This Indicator refers to the condition of financial security and having resources to support a adequate standard of living, regardless of external stressors. Therefore, measuring factors related to formal employment opportunities, levels of household income, and access to public transportation services.

SOCIAL CATEGORY

The social category deals with indicators that were established through the socio-economic conditions analysis of this thesis and are thus elaborated as such:

SOCIAL SAFETY:

This Indicator reports on the population’s ability to withstand societal impacts and stressors. Thus, measuring the quantity of educated individuals and the proportion of households living in adequate living conditions.

URBANIZATION:

This Indicator refers to the concentration of human occupation (residential, commercial, and industrial) within the area. Taking into account the area’s population density and area of human occupation.

ACCESS TO WATER:

This Indicator describes the area’s population ability to access clean and adequate quantities of water throughout the year for private usage.

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■ FIGURE 64. CRITICAL AREAS OF INTERVENTION.
MADE BY AUTHOR

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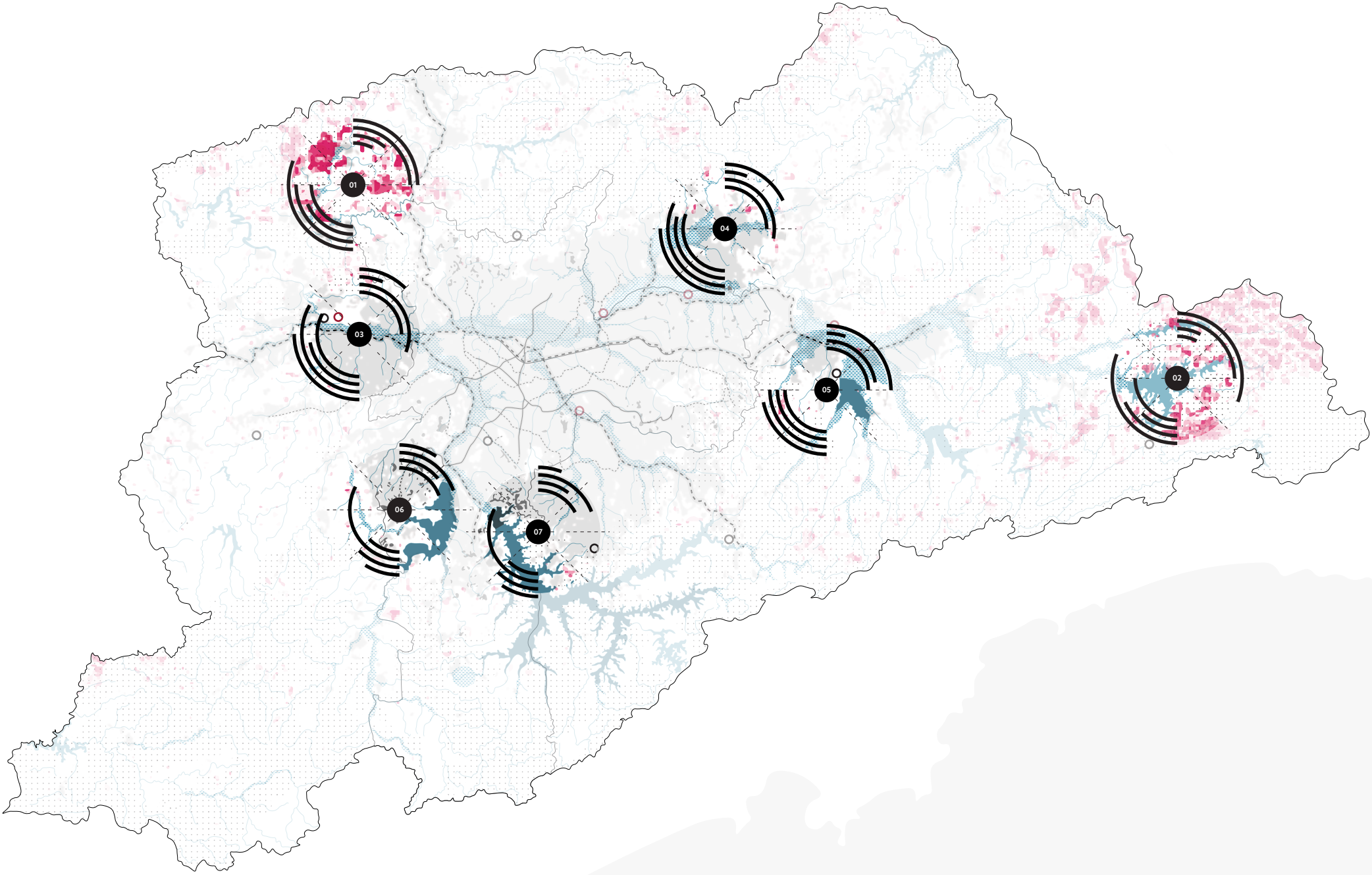
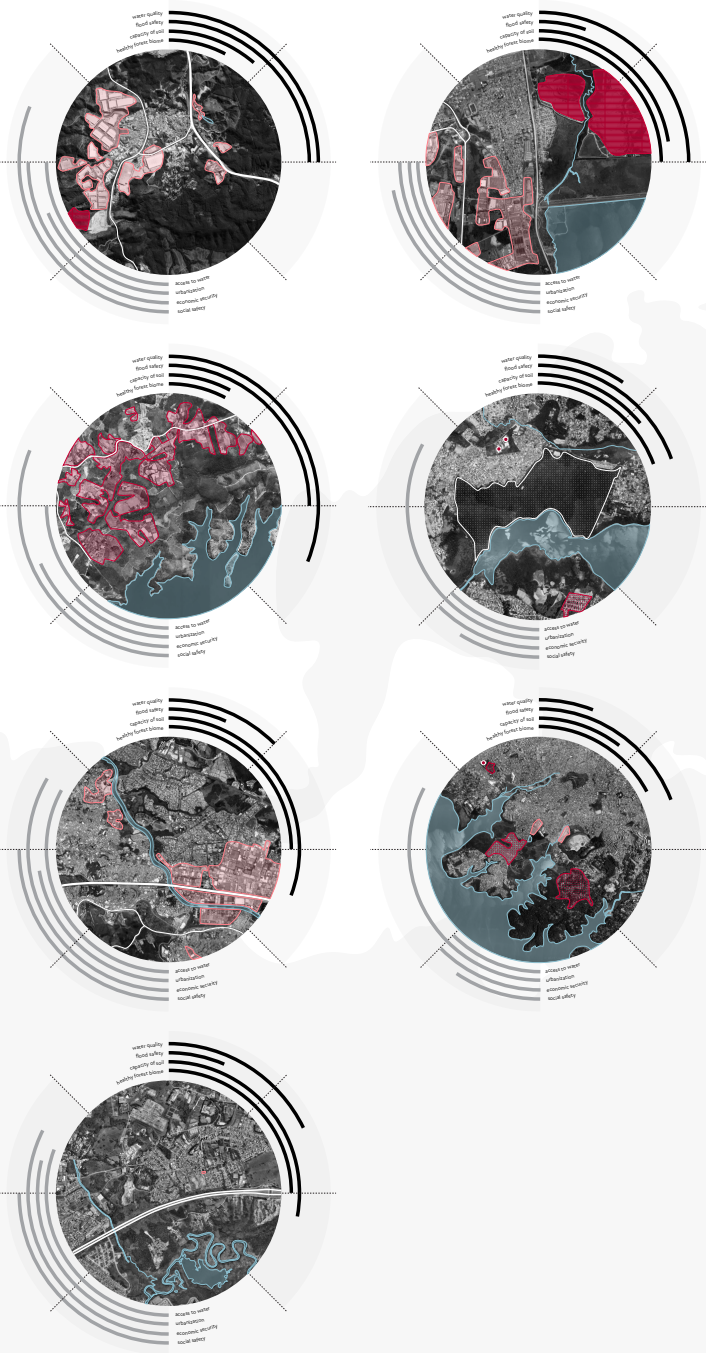
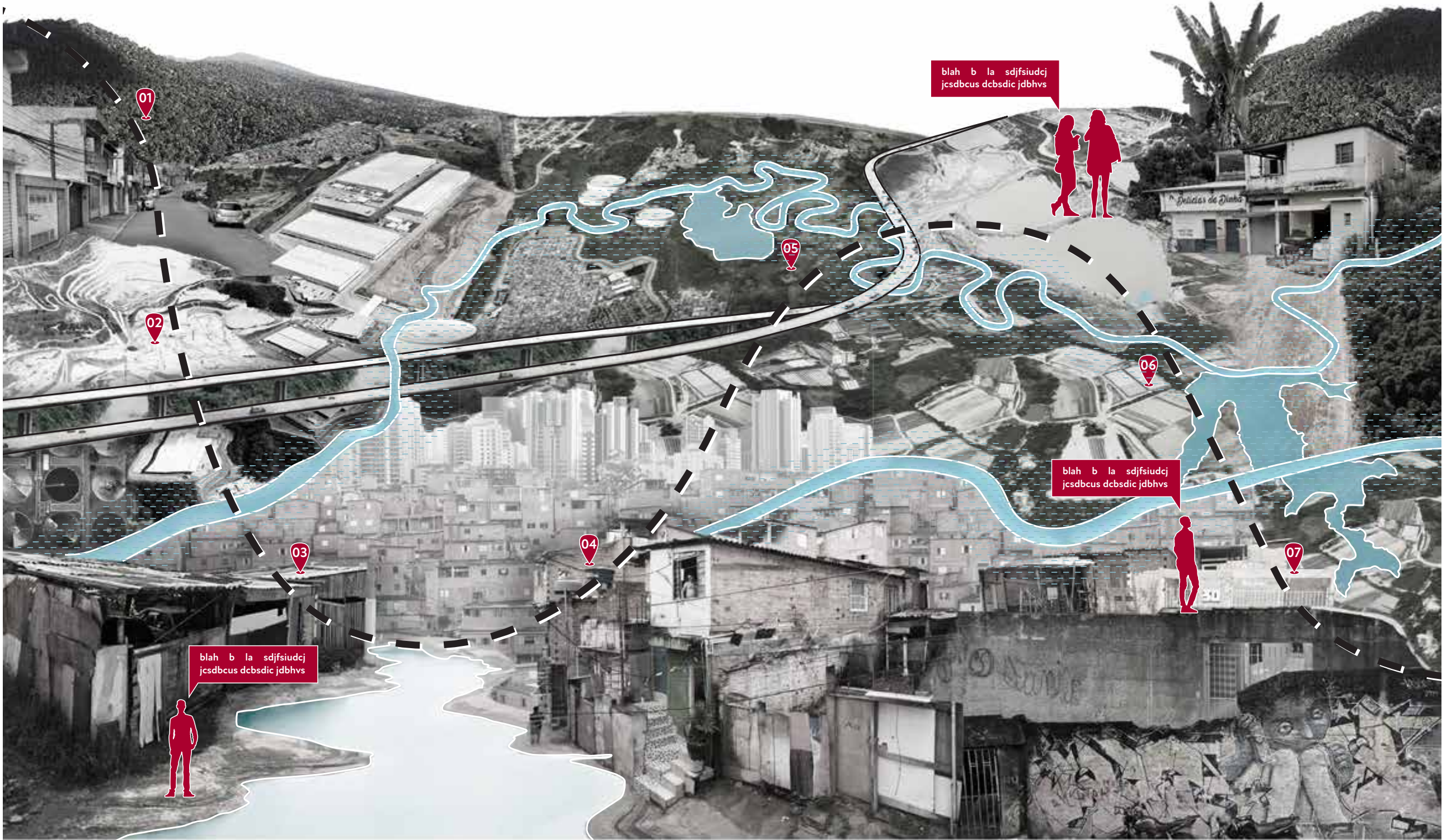


FIGURE 65. CRITICAL AREAS DEEP-DIVE ■
MADE BY AUTHOR

critical areas of interest.





design exploration.

OVERVIEW

This chapter will hone in on three of the critical areas within the Metropolitan Region that were previously highlighted through the socio-ecological indication system. Each of the three areas presents a different type of area with alternate socio-ecological levels on the indication system. Thus, these sections will articulate on the morphological structures, ecological systems, and vulnerability conditions of the three selected areas in an in-depth analysis format. Therefore, to serve as a backdrop to explore the existing potentialities for strategies that promote ecological integrity, social inclusivity, and political empowerment that will be elaborated on in the Design Framework Volume of this thesis.

SECTIONS

- area 01
- area 02
- area 03

area 01.

This area of interest lies on the north-western periphery of the Metropolitan Region at the intersection of the municipality of Cajamar, Caieiras, and Franco da Rocha. Due to its location on the periphery of the metropolitan region, this area is most notable due to its overlap with the biome of the Mata Atlantic Forest.

Nowadays, this area is defined primarily by the practices of ecological degradation with vast deforestation rates, erosion, and substantial soil loss.

This area developed as a small rural community with a predominant focus on agriculture, primarily with the sugarcane plantations and later with the boom of coffee plantations. However, with the rapid urban growth in the metropolitan region in the 19th and 20th centuries, this area soon experienced significant population growth and urbanization.

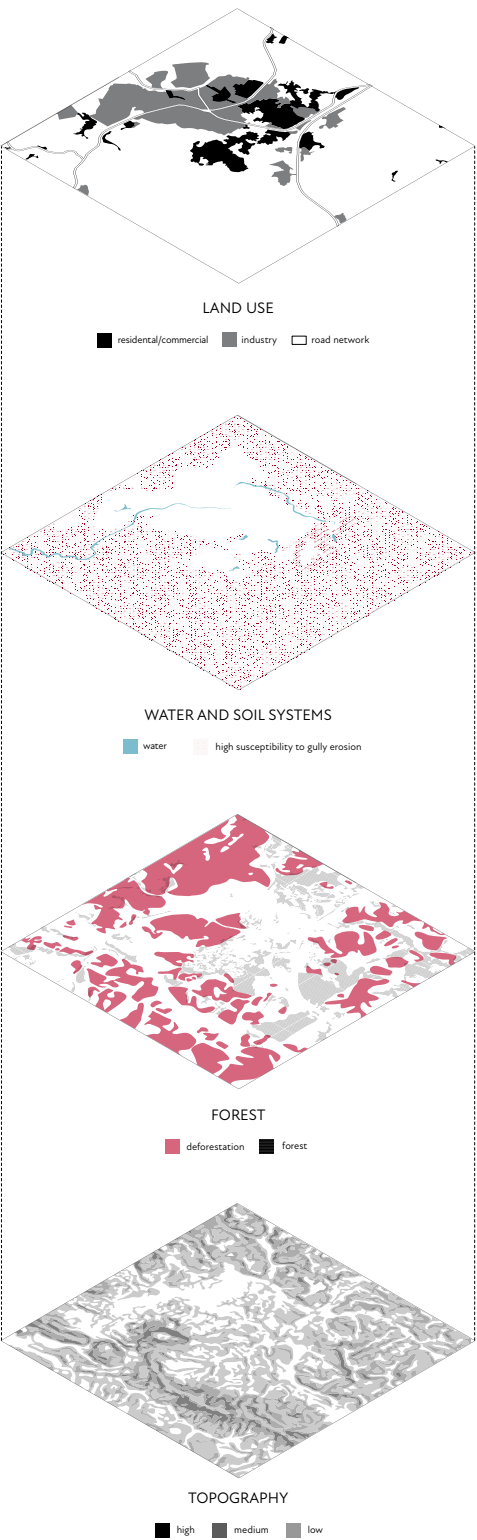
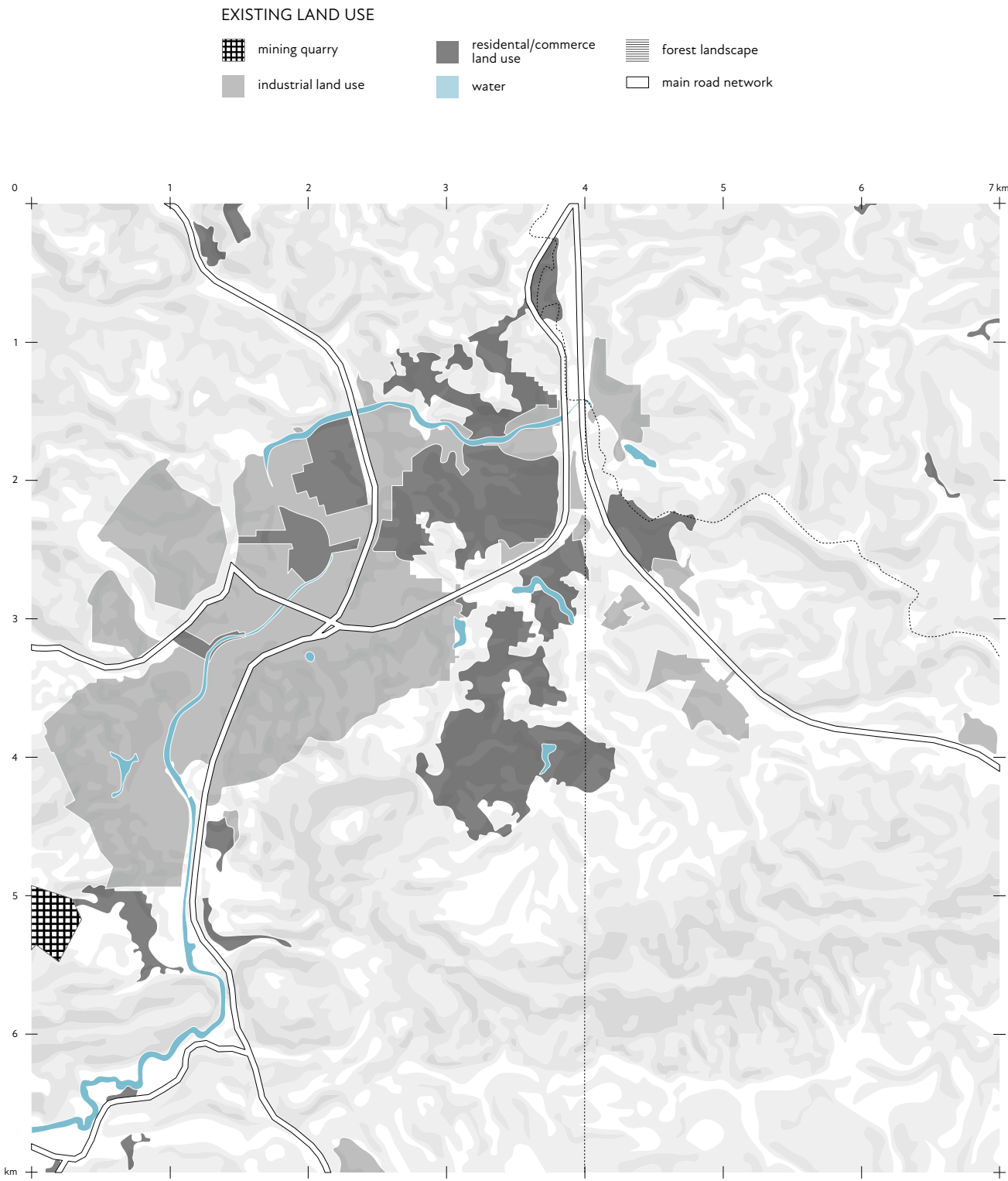


FIGURE 67. AREA 01 AXO AND PLAN ■
MADE BY AUTHOR



With the rise of urbanization, this area’s identity soon began to shift as a variety of industries, primarily manufacturing, logistics, and service industries began to emerge. The development of these industries and warehouses has now contributed to the air and water pollution of the area through the generation and disposal of harmful emissions and hazardous waste.

During the growth of the urban fabric, this area was connected to the remainder of the region through a network of highways. However, the only available public transportation system in this area that currently exists is the bus system that connects to the different cities in the neighboring municipalities. This highlighted area still remains isolated from the reach of São Paulo’s major public transportation networks.

This area originally coincided with the Atlantic Forest biome, which was the predominant and one of the most diverse ecosystems in Brazil. However, the Atlantic Forest has been heavily impacted by human

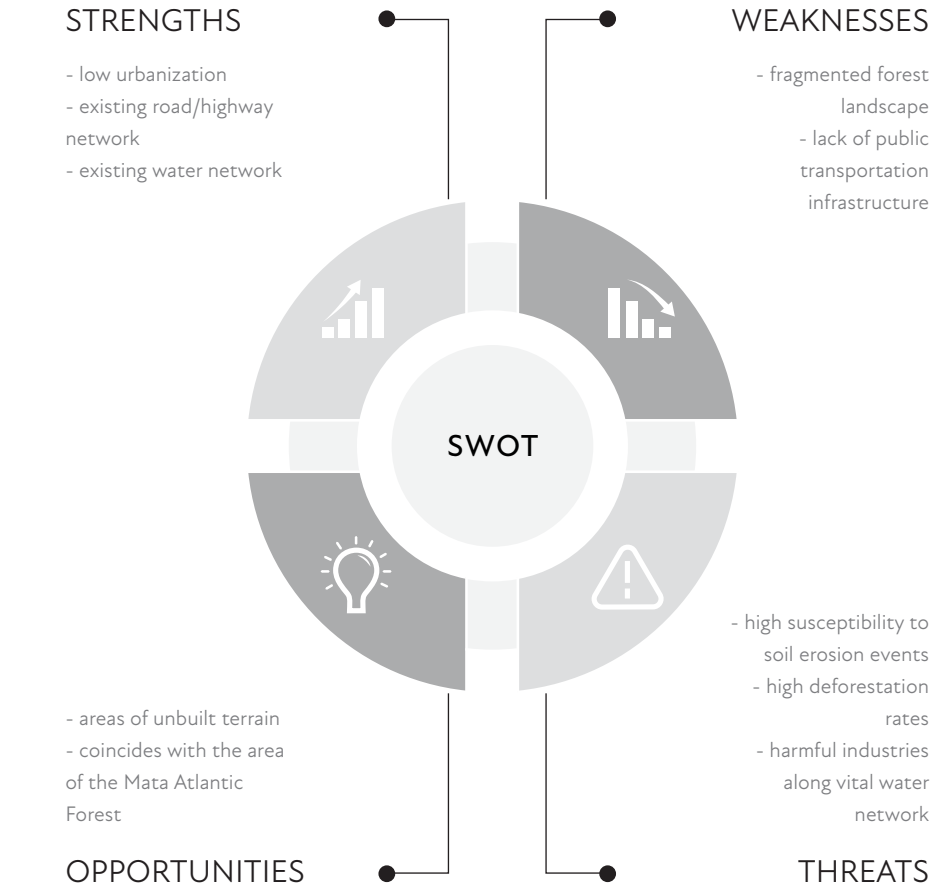
activities, particularly agricultural activities and urbanization, leading to rapid deforestation rates throughout the biome. As a result, this area has lost most of its original forest cover.

Now, the remaining forest landscape is mostly composed of small fragments, scattered throughout the metropolitan region. Attempts to preserve the original forest landscape within the region have been made by many different agencies and organizations.

The most notable effort to preserve the biological diversity of the forest biome of the region is the Green Belt which was part of the Atlantic Biosphere Reserve, in Portuguese the Reserva da Biosfera da Mata Atlântica. The Green Belt, running through this highlighted area, is considered to be an important development for the region that contributes to mitigating the impacts of urbanization on ecological systems.

Their efforts to preserve the

FIGURE 68. AREA 01 SWOT ANALYSIS ■
MADE BY AUTHOR

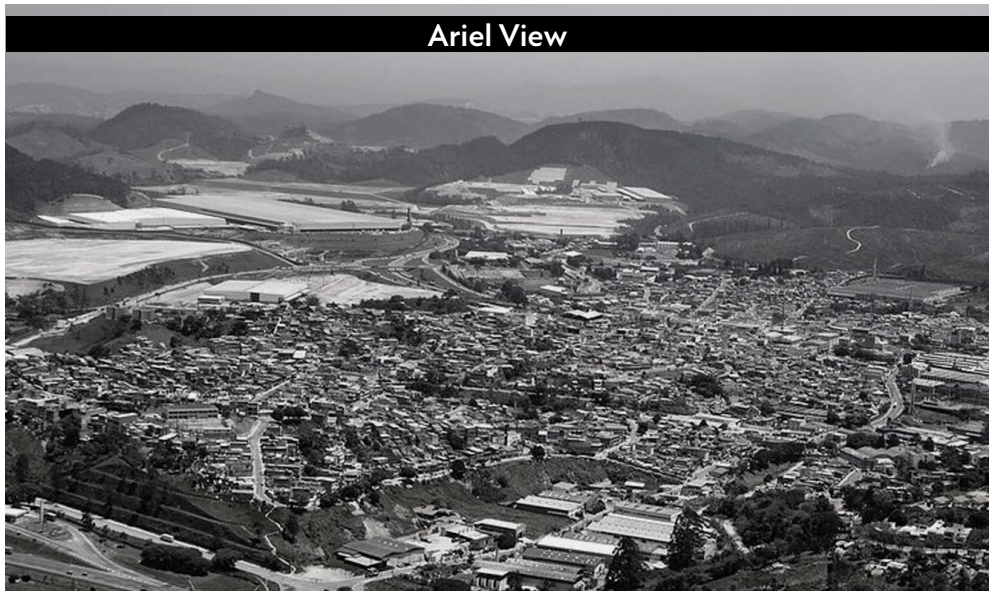
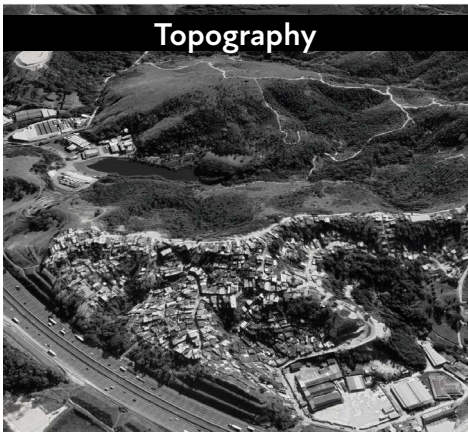
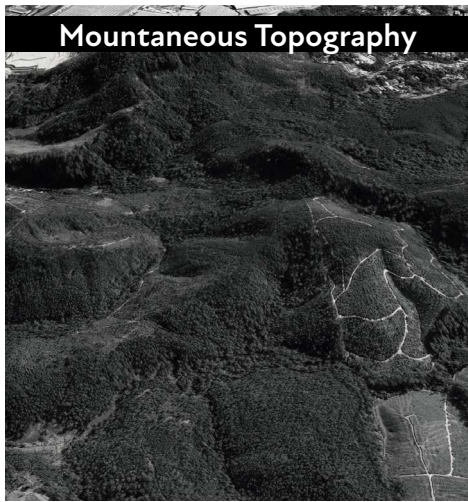
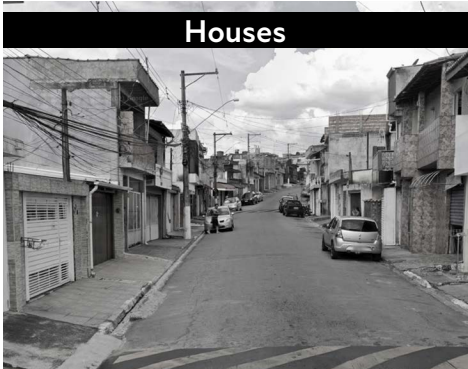


Green Belt are ongoing and focus on measures of reforestation, forest conservation programs, and regulations on urbanized areas to protect natural sources.

However, despite these efforts to protect the remaining Atlantic Forest landscapes, deforestation and forest degradation continue to be an increasing concern in this area. Overall leading to external

environmental impacts, including soil erosion, loss of biodiversity, and loss in water quality.

This area is also closely located near the Tietê River, the most important waterway of the region, with several smaller tributary rivers flowing throughout the site. The most notable is the Ribeirão dos Cristais which runs through the city of Jordânia and is an important



FLICKR ((Fernando Stankuns)

source of water for the agricultural and industrial functions of the area. However, like many waterways in the metropolitan region, the water quality of the Ribeirão dos Cristais

River has been greatly affected by the pollution from the adjacent industrial sources.

Strategic Actions.

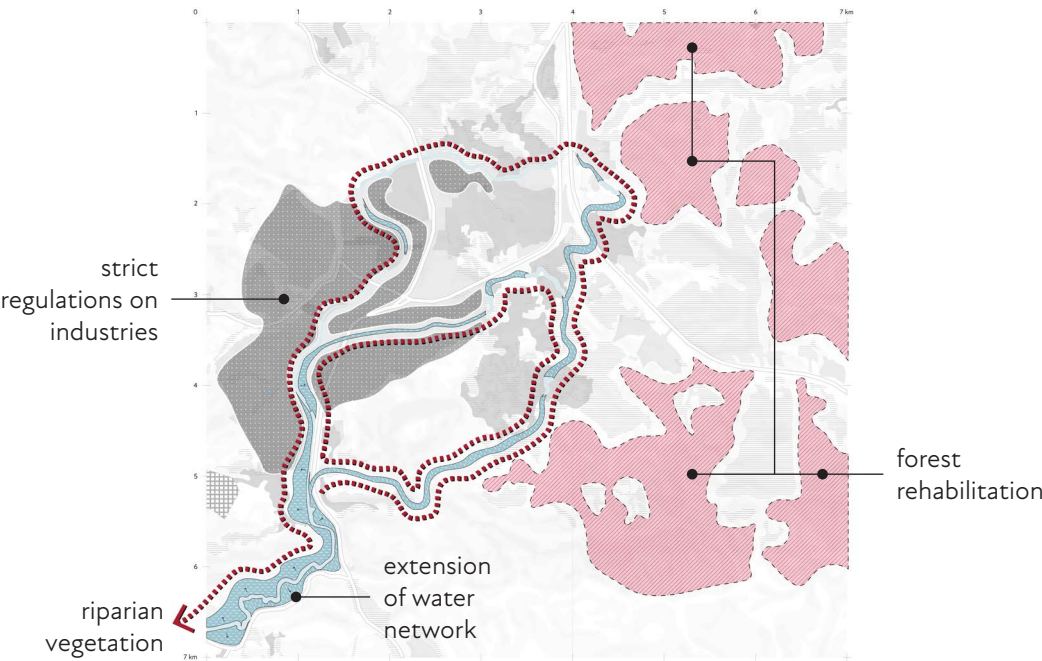
■ FIGURE 70. AREA 01 SOCIO-ECOLOGICAL INDICATOR
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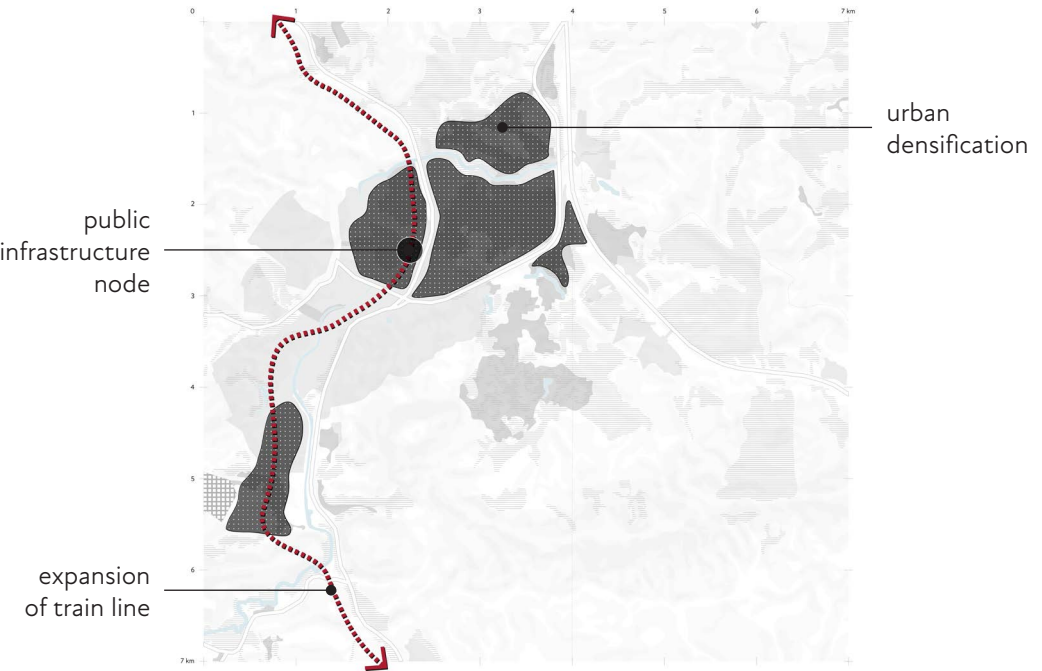
FIGURE 71. AREA 01 SOCIAL INCLUSIVITY ■
MADE BY AUTHOR

FIGURE 72. AREA 01 ECOLOGICAL INTEGRITY ■
MADE BY AUTHOR

OPPORTUNITY FOR ECOLOGICAL INTEGRITY



OPPORTUNITY FOR SOCIAL INCLUSIVITY



area 02.

This area of interest resides on the margins of the municipality of São Paulo, lying at the intersection of several districts and the municipality of Itapeceirica da Serra. Due to its location on the periphery of the urban area, lower-income populations were displaced here, thus creating an urban morphology built from patterns of spatial segregation and a lack of urban planning. Nowadays, this area is defined by its social vulnerability and environmental risks.

The urban morphology of this district is typical of the additional formations of urban environments in the periphery that were expanded due to the city's unplanned growth. During the first formation of the urban fabric in the 1900s, the road network fabricated the configuration of the growth as occupation mainly took place alongside the two main access roads of Estrada do M'Boi Mirim and Estrada da Baronesa. Although the road infrastructure played an

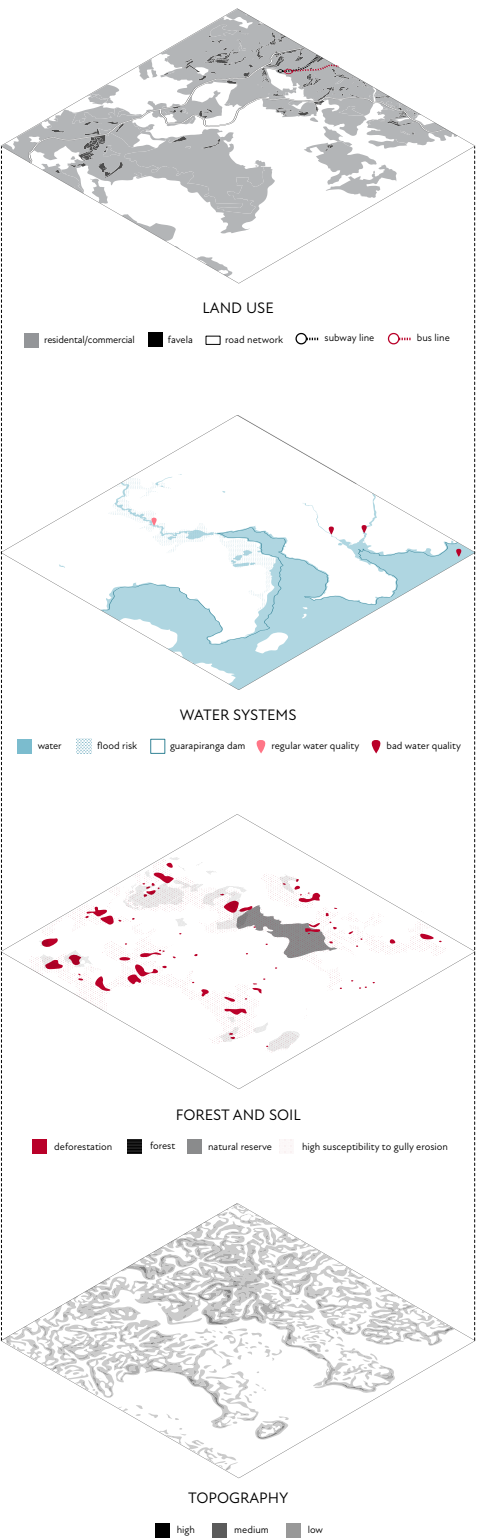
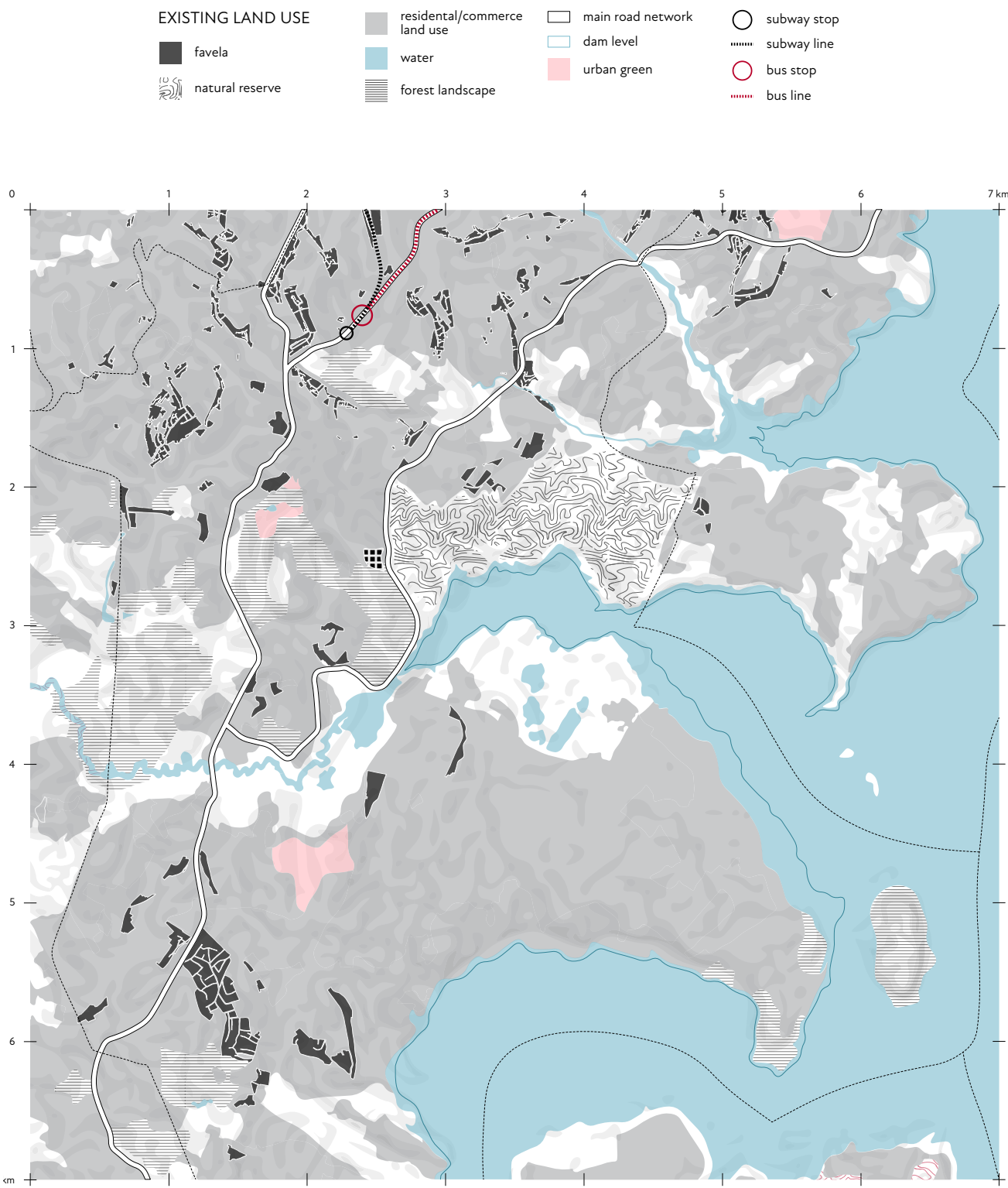


FIGURE 73. AREA 02 AXO AND PLAN ■
MADE BY AUTHOR



important role in the growth of the district, there is little public transportation available today throughout the area.

This area still remains isolated from the public transportation network of the metropolis with the closest metro station about 6000 meters from the center of the district. The only accessible public transportation routes for populations solely consist of bus lines. However, discussions of the extension of the metro line are underway for the area.

The area is also categorized by its close proximity to the Guarapiranga Reservoir, a major source of drinking water for over 3 million inhabitants of the city and an important element of the social, economic, and environmental city of São Paulo. The reservoir first originated with the construction of the dam in the early 1900s with the reservoir soon transforming into a hydrological resource. However, the areas surrounding the reservoir began to become urbanized through the unplanned and rapid growth of

São Paulo around the 1970s. Not long after, the state of São Paulo passed the Spring Protection Law in 1975 that set strict restrictions on urban settlement in designated zones marked as environmentally protected areas.

Although the legislation attempted to prevent further urbanization, the lack of government enforcement and action led to a significant area for illegal occupation with non-existent sanitation and sewer systems. Although guidelines have been set for the encouragement of land use and infrastructural projects based on these sub-areas, this district still remains with a complete lack of sanitation infrastructure, greatly impacting the water quality and services of the reservoir.

Currently, only 53% of households in the northwest sector of the reservoir, including the Jardim Angela district, are served by sewage collection and treatment systems (Semensatto et al., 2021). Many criticize residents of favelas for the degradation

of the Guarapiranga Reservoir, these issues of contamination are rather a result of disorganized and poor urban planning. Although the loss of water quality is mainly associated with urban settlement patterns with inefficient sewage and sanitation systems, the degradation of water is also closely connected to the geomorphology of surrounding areas.

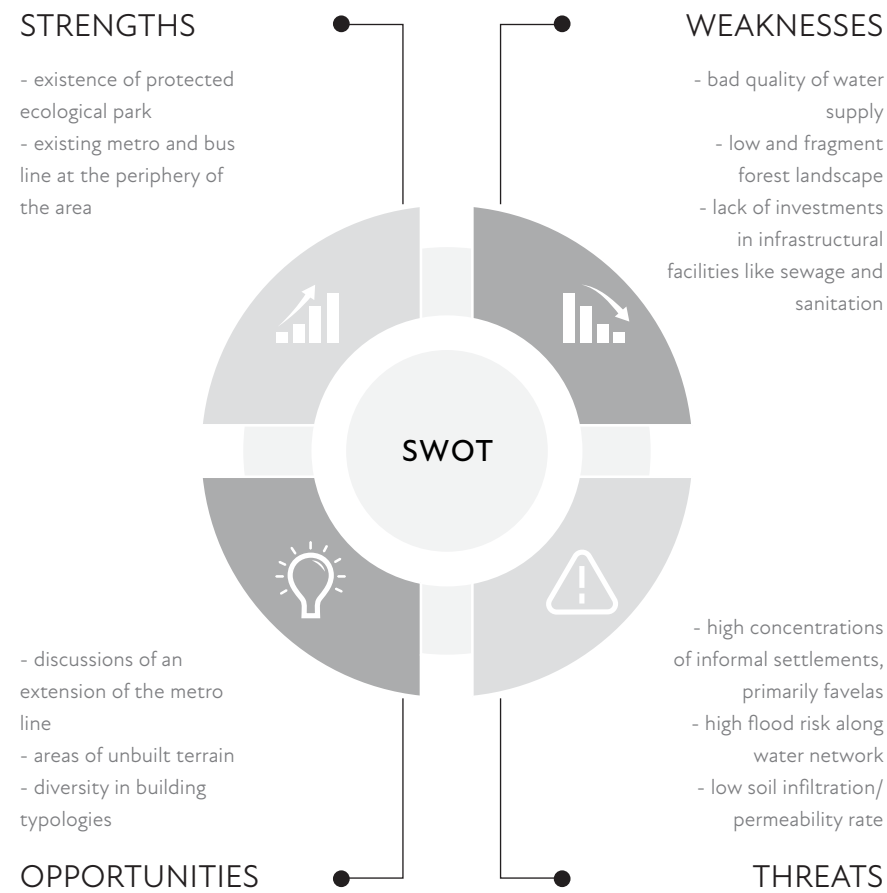
The lack of suitable land for urban settlements within this area can be attributed to the water reservoir location as well as the topographical conditions of the land. Due to its location on the periphery of the municipality of São Paulo, this area is characterized by low mountainous and hilly slopes with altitudes ranging from 700m to 900m.

The rapid growth of urban developments in the residing districts in the late 1900s reshaped the landscape and thus amplified potential environmental risks. Increased urbanization in areas of unsuitable land led to a decrease in soil capacity and a higher risk of

soil erodibility. A combination of land use, climate, and slope causes soil degradation and therefore, impedes the soil's ability to act as a natural drainage system as the soil's capacity to store water decreases.

Patterns of urbanization reshape the landscape to become more susceptible to climatic changes like increases in heavy precipitation periods, thus triggering an increase in environmental risks for erosion and landslide events. Between 2000-2013, there were 28 recorded sliding events solely within the Jardim Angela district that caused damage. These events mainly occurred in zones of higher altitudes, which coincide with areas of favela concentrations.

Due to the socio-economic vulnerability of favela populations and the nature of these typologies as self-built constructions, these populations remain largely defenseless in an era of climate change. As precipitation frequency and intensity increases with climatic changes, environmental events like landslides are suffered

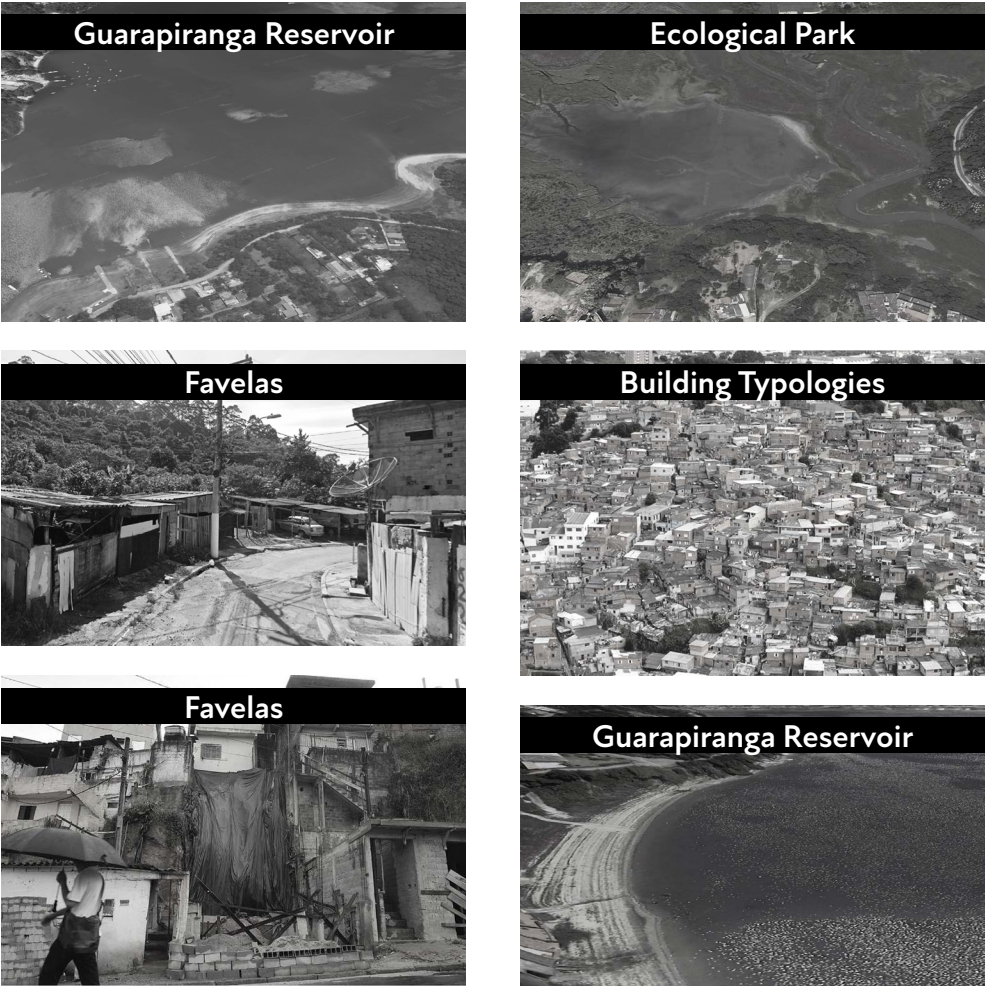


disproportionately by the favelas of Brazil, resulting in greater material damage and destructive secondary effects. In areas of inequality and poverty, increases in sliding events that lead to the destruction of existing infrastructures and constructions also cause an increase in the risk of diseases and health hazards with the lack of

basic sanitation infrastructure. The pattern of rapid deforestation in Brazil also triggers shifts in precipitation rates that induce increases in landslide risks. Forests and vegetation are critical for stabilizing ecological systems, as these ecosystems reduce soil erosion, filter water supplies,

FIGURE 74. AREA 02 SWOT ANALYSIS ■
MADE BY AUTHOR

FIGURE 75. PHOTOGRAPHS AREA 02 ■
SOURCED: GOOGLE EARTH, ESTADAO EXPRESSO, FOTO-
GRAPHIA-UOL



regulate rainfall, and act as a buffer against flooding and drought impacts (globalforestwatch). Significant losses of vegetation in watershed areas are thus attributed to inducing adjacent urbanized areas into a compromised and vulnerable state. Currently, this area can be categorized as with a low amount and spatially fragmented

forest landscape. However, within the boundaries of this area lies the Guarapiranga Ecological Park, created to promote the preservation of the environment adjacent to the Guarapiranga Reservoir that holds the remnants of the Atlantic Forest.

Strategic Actions.

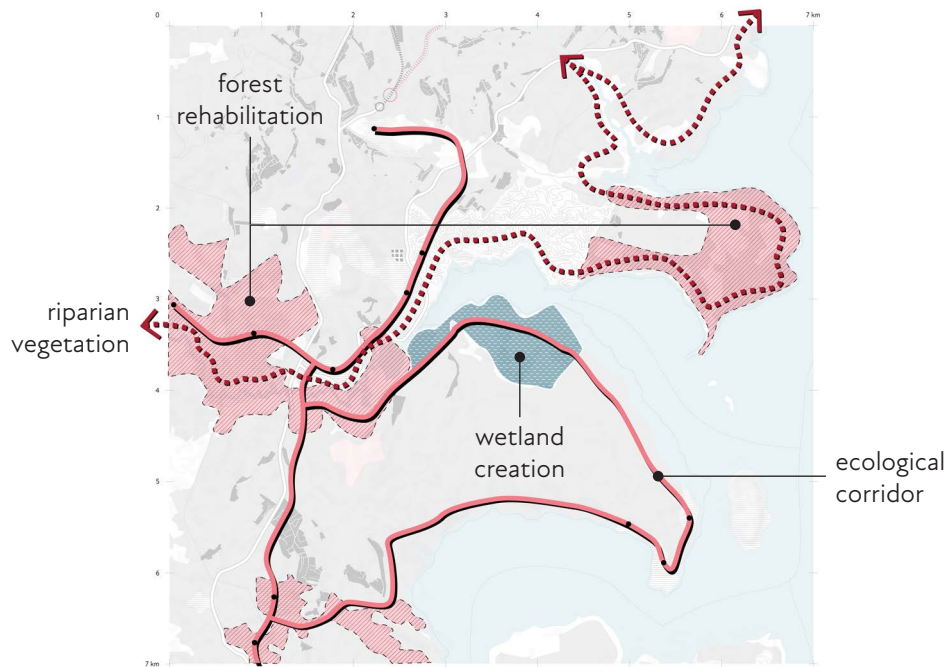
■ FIGURE 76. AREA 02 SOCIO-ECOLOGICAL INDICATOR
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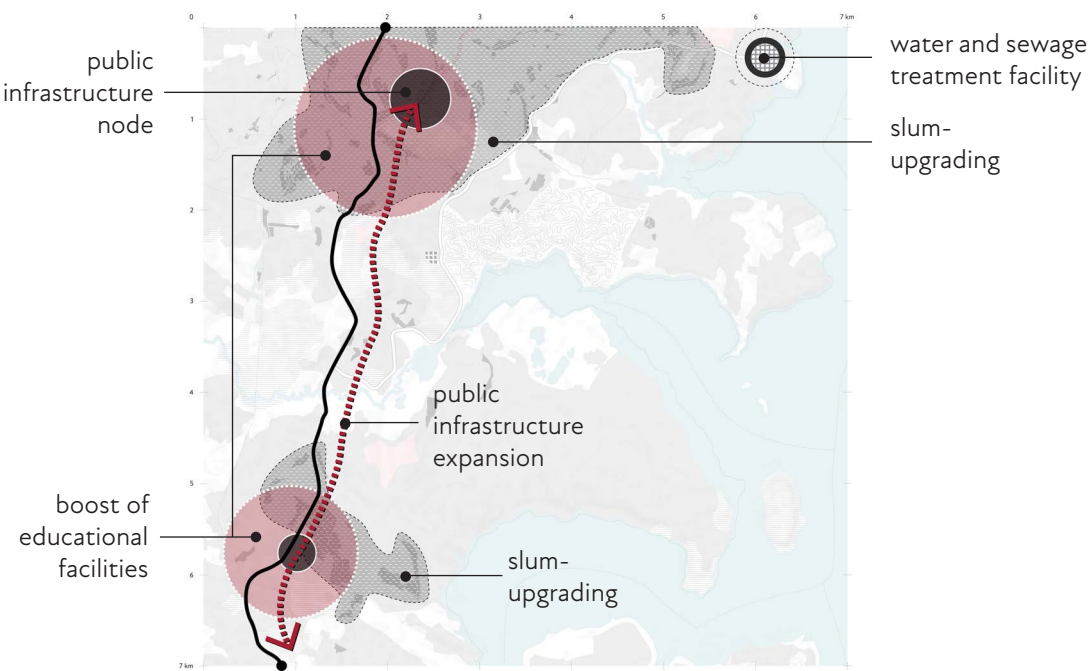
FIGURE 77. AREA 02 SOCIAL INCLUSIVITY ■
MADE BY AUTHOR

FIGURE 78. AREA 02 ECOLOGICAL INTEGRITY ■
MADE BY AUTHOR

OPPORTUNITY FOR ECOLOGICAL INTEGRITY



OPPORTUNITY FOR SOCIAL INCLUSIVITY



area 03.

This area of interest is situated in the northeastern part of the metropolitan region of São Paulo, where the municipalities of Suzano and Mogi das Cruzes intersect. Over the years, the urban landscape of this area has undergone significant transformation in response to larger social, economic, and environmental factors

Like many other areas of the metropolitan region, this area evolved alongside the population growth of the country, initially focusing on agriculture due to its location in the floodplains and on the outskirts of São Paulo's urban sprawl. However, with the burgeoning demand for housing, infrastructure, and services with the rapid growth of São Paulo in the 19th and 20th centuries, this area witnessed a shift from primarily agricultural functions to a dynamic urban morphology featuring a blend of residential, commercial, and industrial activities.

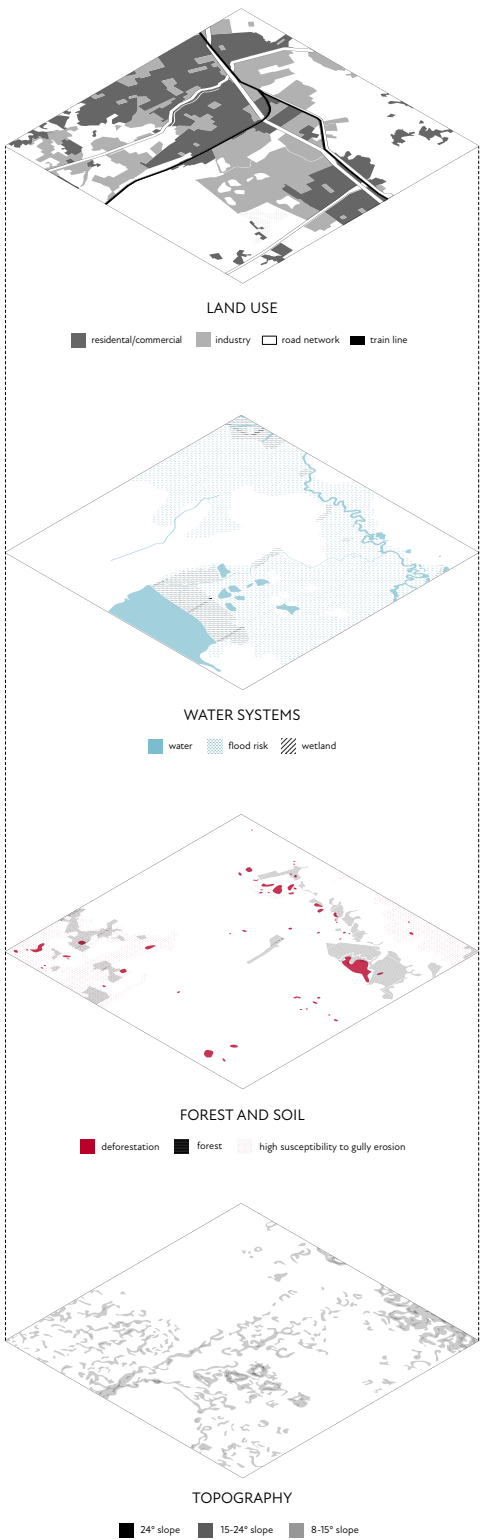
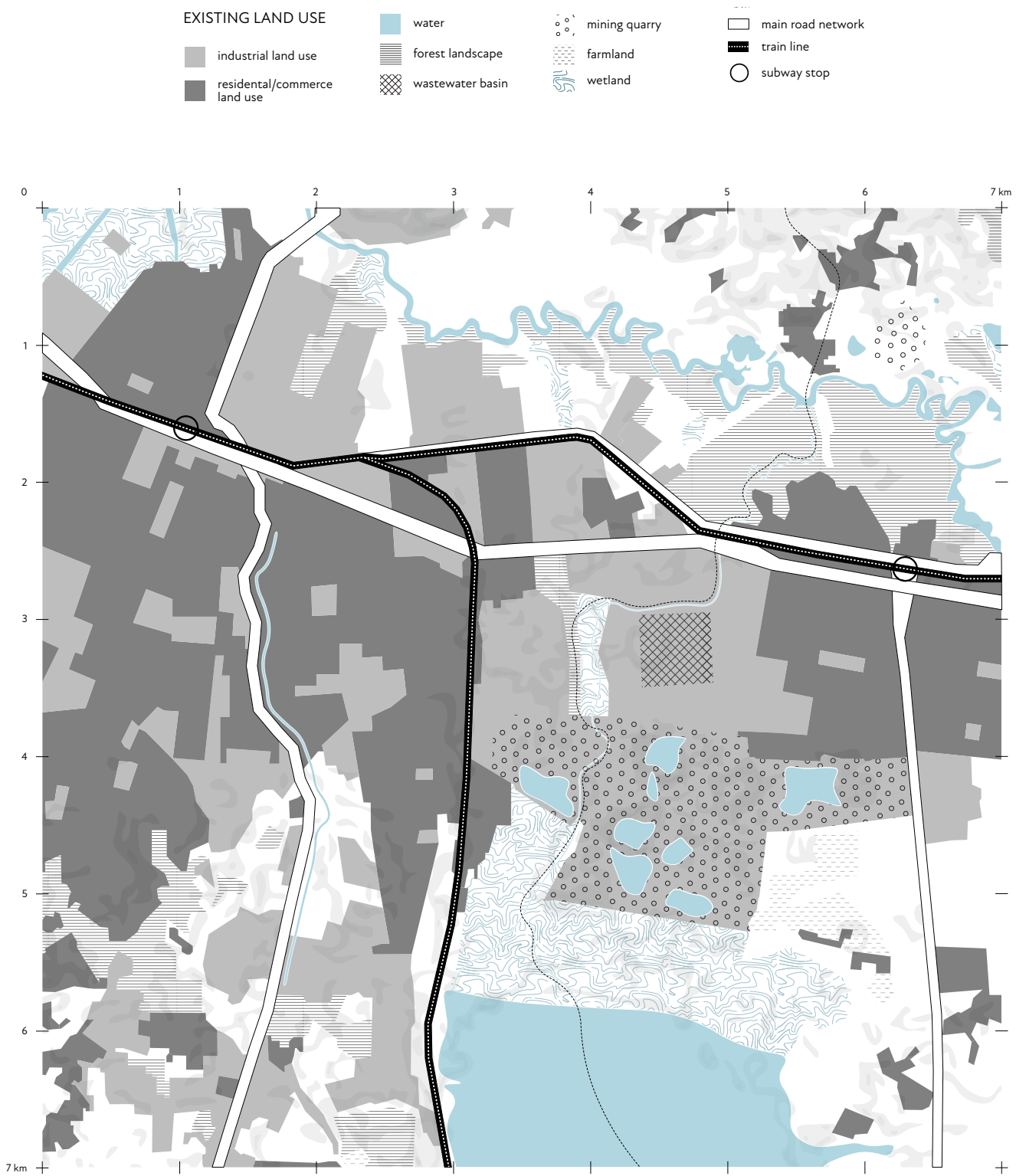


FIGURE 79. AREA 03 AXO AND PLAN ■
MADE BY AUTHOR



Today, it is recognized as a major industrial hub, with a particular emphasis on paper, textiles, and plastics.

Despite its location at the urban fringe of São Paulo, this area boasts a robust transportation network, with numerous highways and roads linking the area to other major urban areas of the metropolitan region. Additionally, the local population within this area also has direct access to public transportation services, including a train station and a line forming part of the CPTM 11 Line located within the area's boundaries.

The highlighted area is also notable for its close proximity to the Taiaçupeba Reservoir, also known as the Suzano Reservoir, which is maintained by the Department of Water and Electric Energy (DAEE) and the Sanitation Company of the State of São Paulo (SABESP). This man-made lake formed by the Taiaçupeba Dam was created in the 1960s to provide water supply to the city of Suzano and the nearby municipalities. The

Taiaçupeba Reservoir still remains an important source of drinking water for the entire region but has faced environmental challenges in recent years.

Industrial sites near the artificial lake, such as the extraction of mineral resources site directly north of the reservoir, lend a hand to the degradation of this water source due to the industrial waste disposal into the aquatic environment. The hazardous disposal from these adjacent industries, coupled with untreated domestic sewage and agricultural runoff, leads to the pollution and decreasing quality of this water source. The deterioration of the water quality within the reservoir represents a significant concern for this area, particularly in light of the fact that the reservoir connects to the Tietê River, the metropolitan region's most critical river.

The Tietê River, the most important river of the metropolitan region, runs through the site and connects to the reservoir through the tributary river of Rio Taiaçupeba.

Like many urban areas in São Paulo, this area, located in a low-lying area, is prone to flooding during periods of heavy rainfall. As rates of precipitation have increased in recent years, the several rivers and streams running through the area have been known to overflow, leading to damage to the surrounding homes, businesses, and infrastructures.

Although the municipalities have implemented measures to mitigate the risks of flooding, the risk of flooding within this area still remains a concern. In addition, the reservoir has previously faced risks related to flooding in the event of heavy rainfall, which eventually led to a partial collapse of the Taiaçupeba dam in 2010.

The municipalities have implemented measures to mitigate the risks of flooding, such as the construction of drainage systems around the urban areas, the implementation of early warning systems, and flood control systems around the dam. However, despite efforts made by public authorities,

this flooding risk still poses a large threat to this area.

Moreover, the rapid urbanization that has characterized this region has led to extensive deforestation, resulting in the loss of one of Brazil's most biodiverse forests, the Atlantic Forest. Although once home to the Atlantic Forest Biome, this area now contains only small and fragmented remnants of the forest, scattered throughout the area.

Extensive deforestation has been driven by a range of factors, including agricultural practices, urbanization, illegal logging, and infrastructure development. As forests are critical for a variety of functions, the loss of forest cover within this area has several negative impacts on the environment and local communities. The practices of deforestation inevitably lead to negative externalities of soil erosion, water pollution, and loss of biodiversity.

The events of soil erosion within this area are particularly more

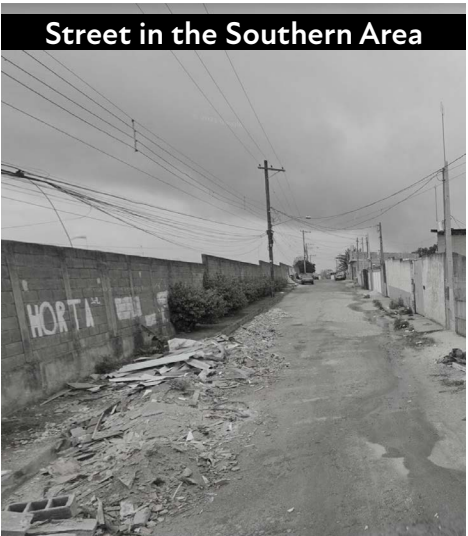
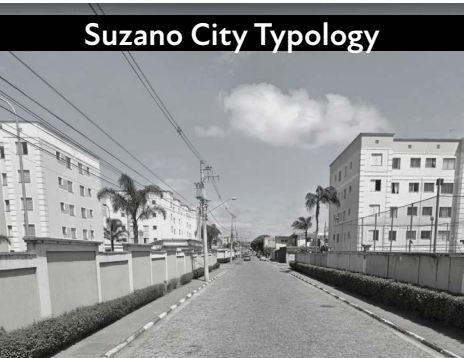
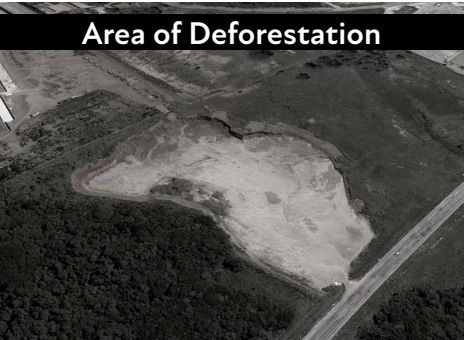


common in the periphery within locations with steeper slopes and less forest cover. These areas also coincide with areas that have been cleared of vegetation due to human activities of deforestation, urbanization, and intensive agriculture that exacerbated the capacity of the soil.

In conclusion, these forests are critical for regulating water, providing protection for biodiversity, increasing the capacity of soil towards pressuring events, and providing important ecosystem services such as carbon sequestration.

FIGURE 80. AREA 03 SWOT ANALYSIS ■
MADE BY AUTHOR

FIGURE 81. PHOTOGRAPHS AREA 03 ■
SOURCED: GOOGLE EARTH, ANDRITZ GROUP,
WIKIMEDIA COMMONS



Strategic Actions.

■ FIGURE 82. AREA 03 SOCIO-ECOLOGICAL INDICATOR
MADE BY AUTHOR

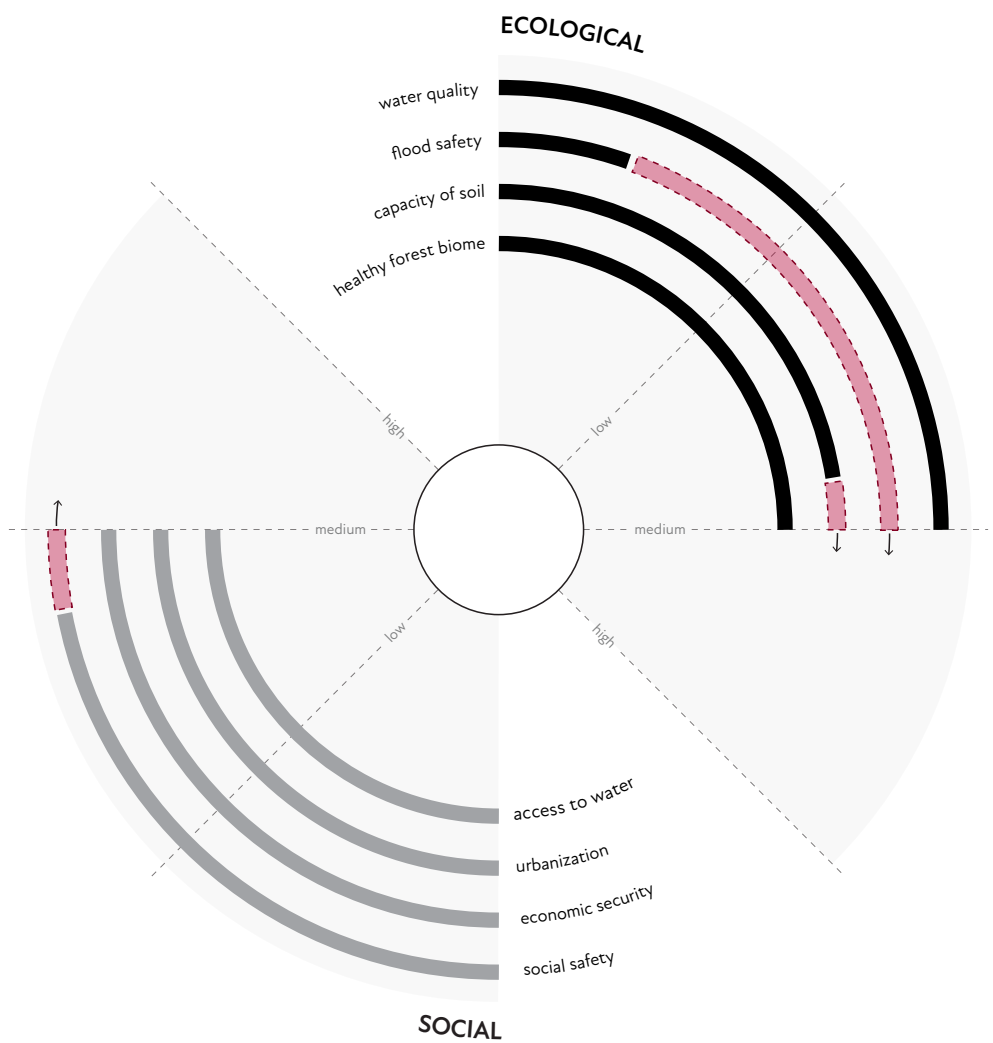
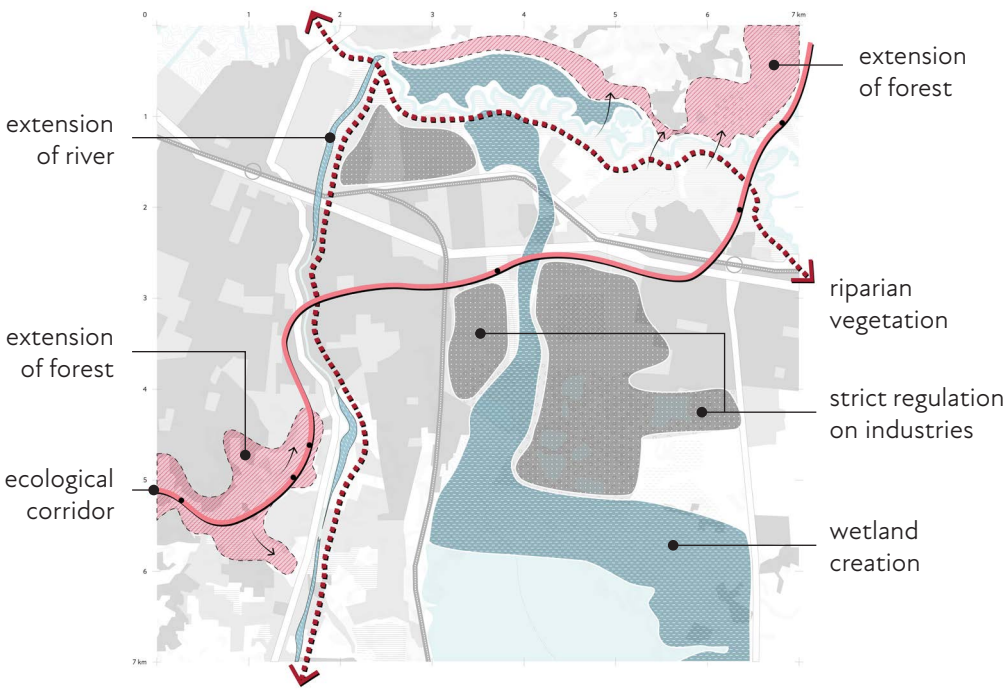


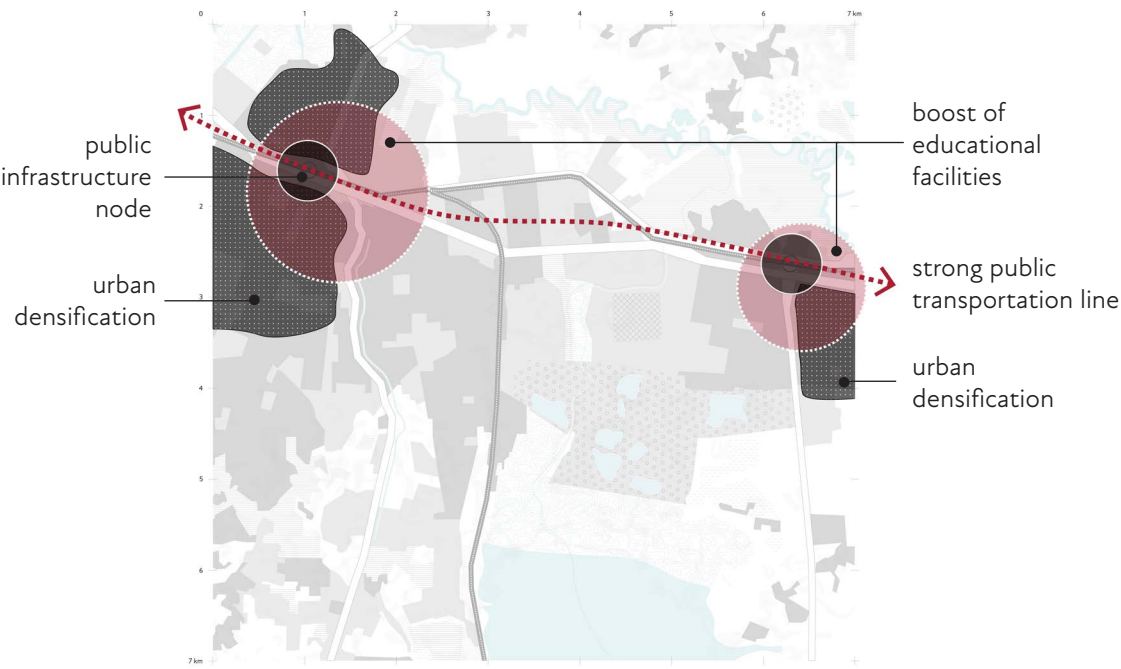
FIGURE 83. AREA 03 SOCIAL INCLUSIVITY ■
MADE BY AUTHOR

FIGURE 84. AREA 03 ECOLOGICAL INTEGRITY ■
MADE BY AUTHOR

OPPORTUNITY FOR ECOLOGICAL INTEGRITY



OPPORTUNITY FOR SOCIAL INCLUSIVITY



site recognition.

OVERVIEW

This chapter will elaborate on previously analyzed constraints in the knowledge and data systems of climate adaptation in the Global South, primarily focusing on São Paulo. Thus, the sections within this chapter report on the process and results of the online survey questionnaire that was distributed to São Paulo’s society. Through the support of the findings from this chapter, the final conclusions will be implemented into the creation of the final outcome of this thesis: the informational manual. Furthermore, to orient the knowledge and recommendations included in the manual that will be distributed to Brazilian society.

SECTIONS

- *existing barriers*
- *the survey questionnaire*

Existing Barriers.

Climate change is already a reality and a pressing issue as its consequences continue to affect countries around the world. Although adapting to the increasing pressures from climate change is a prevalent topic in international agendas, climate adaptation plans continue to face complications. Part of the difficulty in successfully implementing climate adaptation strategies lies in capacity constraints and a disconnected knowledge system, which is especially prevalent in Brazil (AdaptaClima | Sobre a Plataforma, n.d.).

A shared knowledge system and data to support decision-making is essential for people, agencies, and organizations to thus work collaboratively and effectively to mitigate climate risks. Thus, this study puts forth the statement that investing in education and the distribution of knowledge is imperative to support climate adaptation strategies and plans in Brazil (Pedro Henrique Campello

Torres et al., 2021). In order to contribute to overcoming the existing knowledge gap, this study attempts to bridge these issues by first identifying the most prevalent barriers that limit the successful implementation of climate adaptation measures in Brazil, specifically in São Paulo. Therefore, a survey questionnaire was distributed to key identifying players: civil society organizations, planning authorities, and private companies who are involved in climate adaptation within the Metropolitan Region of São Paulo. The results and conclusions from this study thus show the necessary and critical role of overcoming knowledge barriers in São Paulo to ensure the success of the proposed strategies of this thesis.

Materials & Methods.

This study of the main barriers to implementing climate adaptation plans in São Paulo is based on an

online survey questionnaire that was administrated to critical players in civil society organizations, planning authorities, and private companies in Brazil. The online survey, created via typeform.com, was administrated between April 25th and May 31st and consisted of ten (10) closed questions, two (2) open questions, and one (1) voluntary, supplementary open question with the requirements of identifying the participant's specific roles in relation to climate adaptation work. Over forty (40) invitations to answer the questionnaires were sent out via measures of LinkedIn and email, with twenty (20) completed questionnaires obtained at the end of the study.

Conclusion.

The online survey analysis resulted in highlighting a number of urgent mismatches and the need for improvements in implementing inclusive adaptation measures in Brazil. As well, revealed the current informational gaps on social and environmental impacts

that arise from climate change and deficiencies in instruments or techniques that could be utilized.

Regarding the respondent's identifying links to climate adaptation work in Brazil, a majority stated their field of work is either for a private company (40%) or for a non-profit organization (25%) in primarily the city of São Paulo. Others classified their field of work as an alternate option (15%), a research institution (10%), or a governmental agency (10%). In addition, the use of planning techniques was explored through the survey, with a majority of respondents declaring that strategy-making, participatory processes, and policy development are the primary tools employed in their field of work. This supports the evaluation that strategic visioning and scenario building, both critical tools for resiliency planning, are not widely used within the domains of climate adaptation.

Regarding the responses to the survey that listed participatory processes as a major technique

utilized in their fields of work (60%), it was expressed that the major difficulty within co-creation processes was maintaining relationships. Secondary to lost relationships, some respondents of the survey also expressed that in their experiences, communities or critical actors did not participate in these processes. One respondent especially acknowledged this gap in current processes with their supplementary open response, stating that “the wide participation of the communities and the deep work of raising awareness of their role are fundamental”. Thus, advocating for the importance of gaining knowledge on the localized context through effective dialogue to recognize the needs of citizens. In the same thread, it is also worth noting that 100% of the respondents believe that there is not enough understanding and awareness of the importance of climate resilience measures among the public in São Paulo. Representing a key barrier involved in climate adaptation planning and supporting the need for a shared platform of knowledge about climate risks and relevant

adaptation information amongst the public. When confronted with questions regarding the major barriers to the implementation of solutions, respondents presented the belief that knowledge of long-term climatic impacts, a lack of political will, and challenges in coordination served as the most experienced obstacles in their field of work. In addition, regulatory mechanisms or incentives (65%), training opportunities to build knowledge and capacity (60%), and policy support from governmental agencies (55%) were listed as the most supportive ways to help organizations and companies in São Paulo to implement inclusive adaptation measures. Thus, highlighting the urgent need of developing accountability and coordinated measures amongst planning processes for the successful implementation of solutions.

In relation to the topics of this thesis that were explored in the analytical framework, the issue of water quality is the least informed category and one of the least

discussed topics within work on climate adaptation in São Paulo, alongside the risks of flooding and landslides. Lastly, an important finding of this survey questionnaire is that the options of supporting vulnerable communities and encouraging nature-based urbanism were both found to be the solutions that garnered the most support from respondents as ways to develop socio-ecological resiliency strategies. While constructing hard infrastructural solutions, a method that Brazilian management and governance systems continue to employ as a response to climatic effects, was seen as the least effective method in climate adaptation.

The challenges of current climate adaptation in São Paulo present opportunities for this research to effectively participate in the improvement of the distribution of knowledge and tools in Brazilian society. Thus, offering insight into necessary advancements and actions in the socio-ecological systems of São Paulo.

Survey Questionnaire.

■ FIGURE 85. RESPONDENT IDENTIFICATIONS
MADE BY AUTHOR

20 respondents



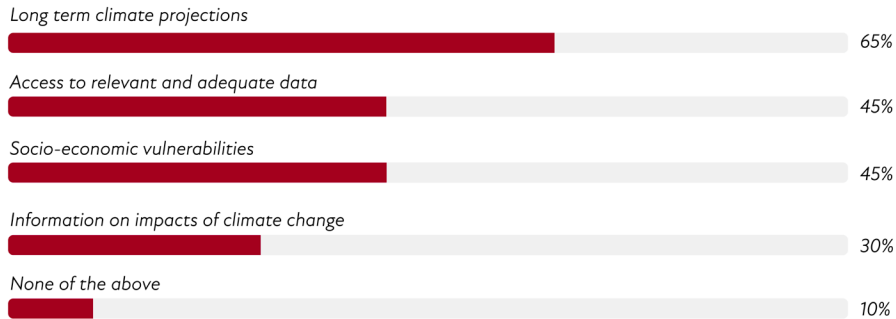
■ FIGURE 86. SURVEY ANSWER DIAGRAMS
MADE BY AUTHOR

100% of respondents believe that there is not enough awareness and understanding of the importance of climate resilience among the public in Sao Paulo.

Survey Question:

What are the main knowledge barriers that arise when implementing adaption measures in your area of work?

Quais são as principais barreiras de conhecimento que surgem ao implementar medidas de adaptação em sua área de trabalho?



Of the people that answered "none of the above", the answer of land tenure was given by a respondent

Survey Question:

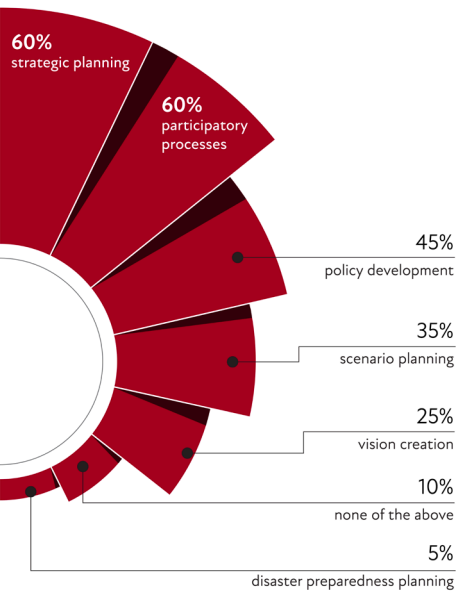
Regarding the process of participation in your field of work, what was the biggest difficulty you faced?

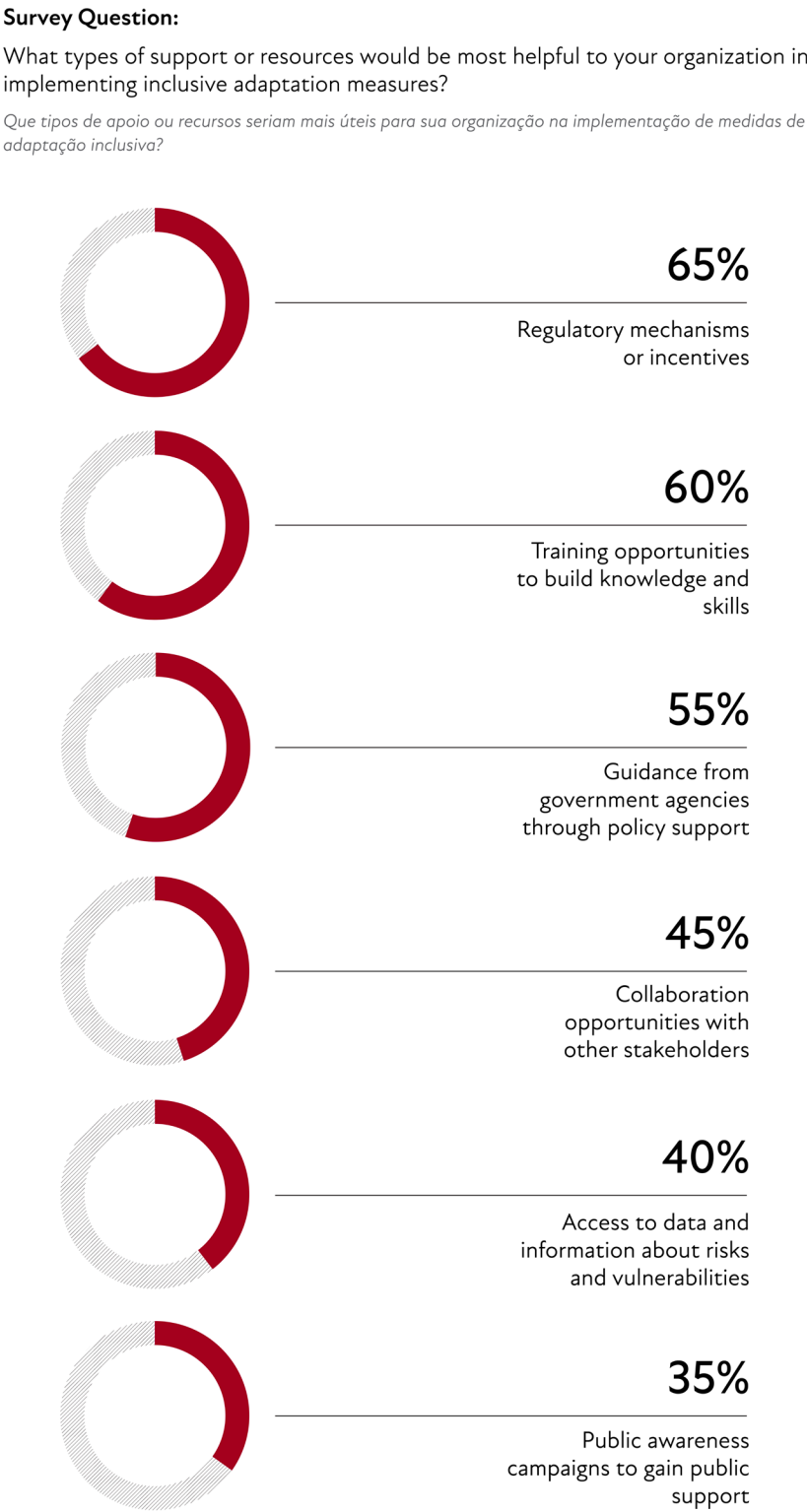
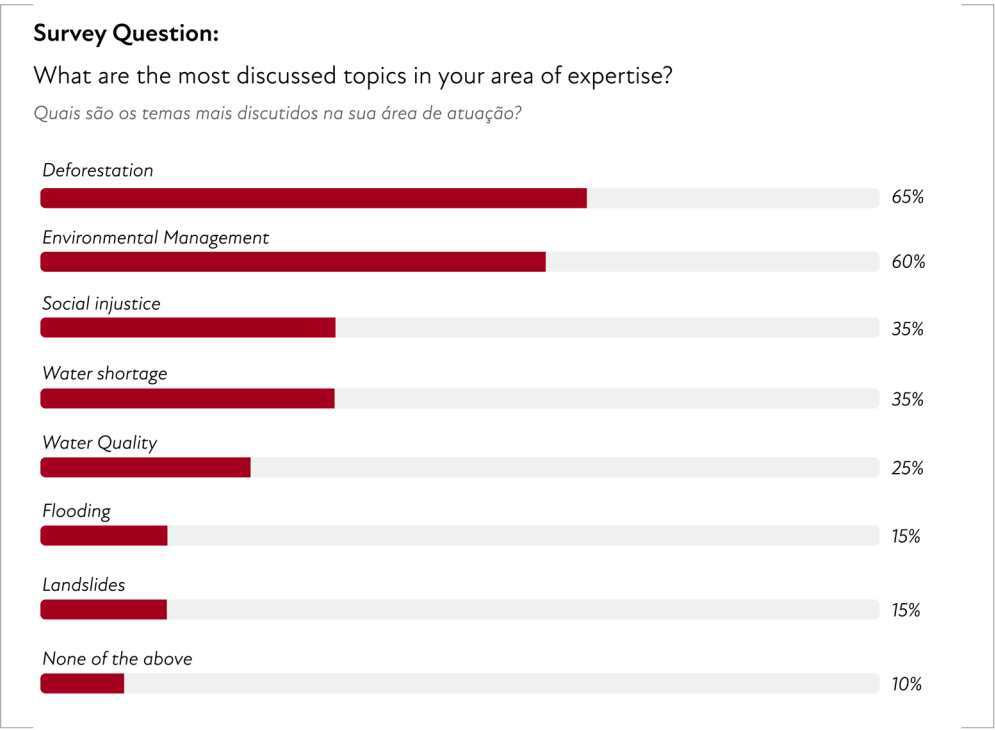
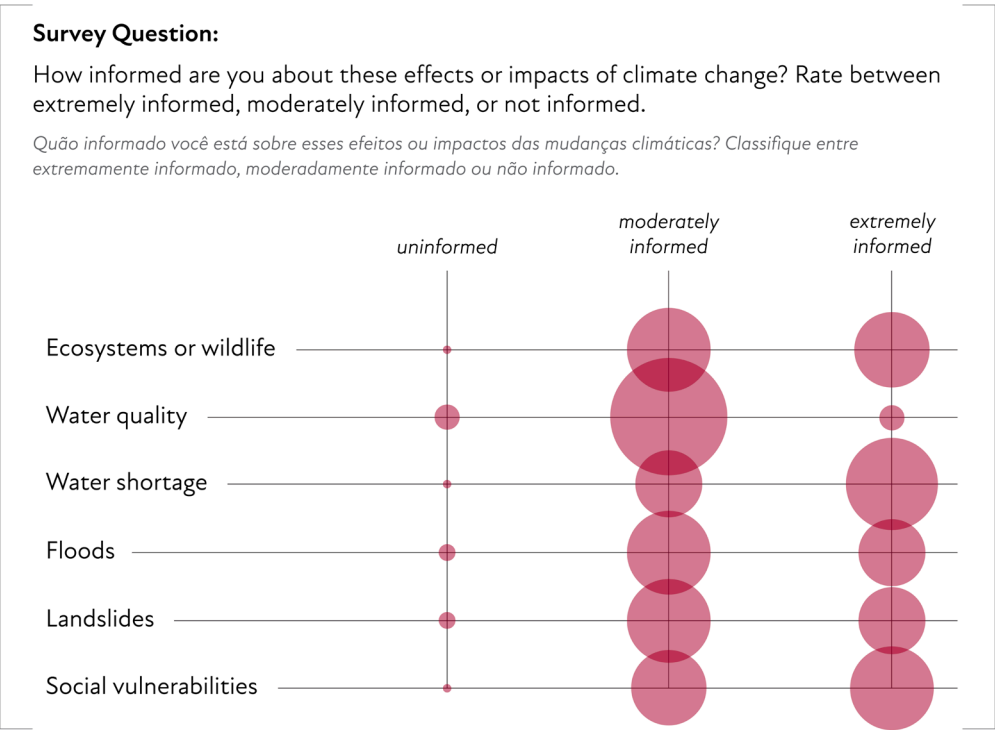
Em relação aos processos de participação em seu campo de trabalho, qual foi a maior dificuldade enfrentada?



Main Techniques Used:

Principais Técnicas Utilizadas:

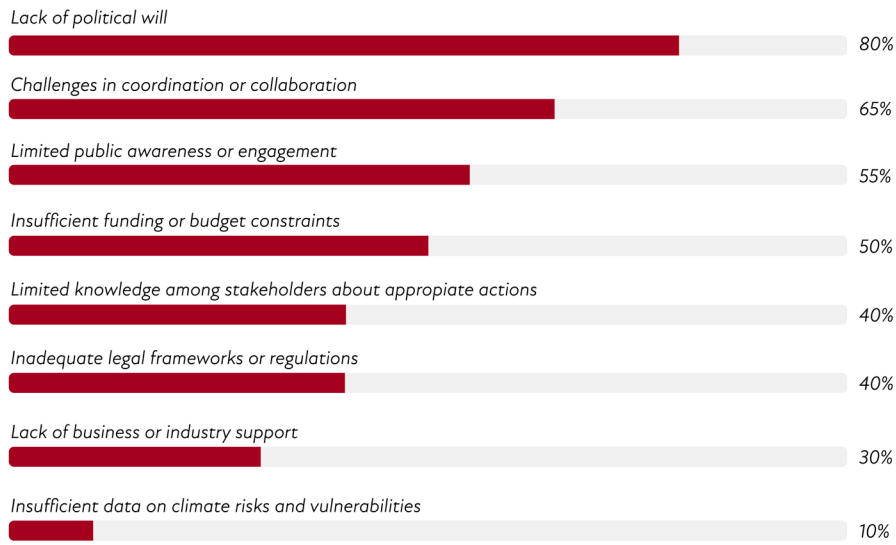




Survey Question:

In your opinion, what are some of the biggest barriers to implementing climate resilience measures in Brazil?

Na sua opinião, quais são algumas das maiores barreiras para a implementação de medidas de resiliência climática no Brasil?



Survey Question:

Please rate which of these solutions is the most effective in solving environmental problems, from 1 (most important) to 5 (least important).

Por favor, classifique qual dessas soluções é a mais eficaz para resolver problemas ambientais, de 1 (mais importante) a 5 (menos importante).



Additional comments on creating an ecologically sustainable and socially inclusive São Paulo from respondents.

6 respondents added an additional comment through the survey.

“The wide participation of the communities and the deep work of raising awareness of their role are fundamental. We cannot propose solutions without real knowledge of everyone’s needs and commitment. It is necessary to partner with the many institutions that already exist for networking.”

“Greater engagement of the Governor and Assembly, as well as the private sector in an effective and efficient manner.”

“Putting existing policies and plans into practice would be a great start. São Paulo is one of the cities that has the most study, research, institutional capacity and resources to put adaptation and injustices at the center.”

“So many challenges with so many characteristics, but also so many opportunities. look at recycling for example - nobody even understands it, few respect it, waste/recycling companies are almost perpetuating the lack of knowledge. On the other hand, there are many individuals who collect separate garbage without government assistance, presents winwins opportunity”

“There is a growing number of studies demonstrating the importance of the resilience of natural environments for sustaining life on the planet. An example of this is the MILLENIUM ECOSYSTEM ASSESSMENT. This, in turn, shows an urgent need for new management models that integrate the continuous development of society and its relationship with natural environments.”

“Maintenance of a permanent multi-actor and multi-level forum with attribution of decision-making, it could be a specific Council on resilience and climate justice, for example, that can dialogue with forums on housing, environment, etc.”

VOLUME 04

DESIGN RECOMMENDATIONS

Vision for Environmental Justice (p. 202)

Socio-Ecological Strategies (p. 208)

- *ecological backbone*
- *equitable access*
- *adaptive governance*

Meta-Governance (p. 232)

- *meta-governance*
- *stakeholder analysis*
- *governance tactics*

Local Adaptation (p. 248)

- *design implementation*

vision for environmental justice.

OVERVIEW

With the increasing risks of climate change and the increasing divide of inequality within Brazilian society, São Paulo's ecological systems and marginalized communities become increasingly exacerbated. Therefore, the idea of creating a more resilient and inclusive environment follows the larger theory of Environmental Justice, centered around the principles of ecological integrity, social inclusivity, and political empowerment.

vision for environmental justice.

■ FIGURE 87. VISION FOR ENVIRONMENTAL JUSTICE
MADE BY AUTHOR

0 10 20 km

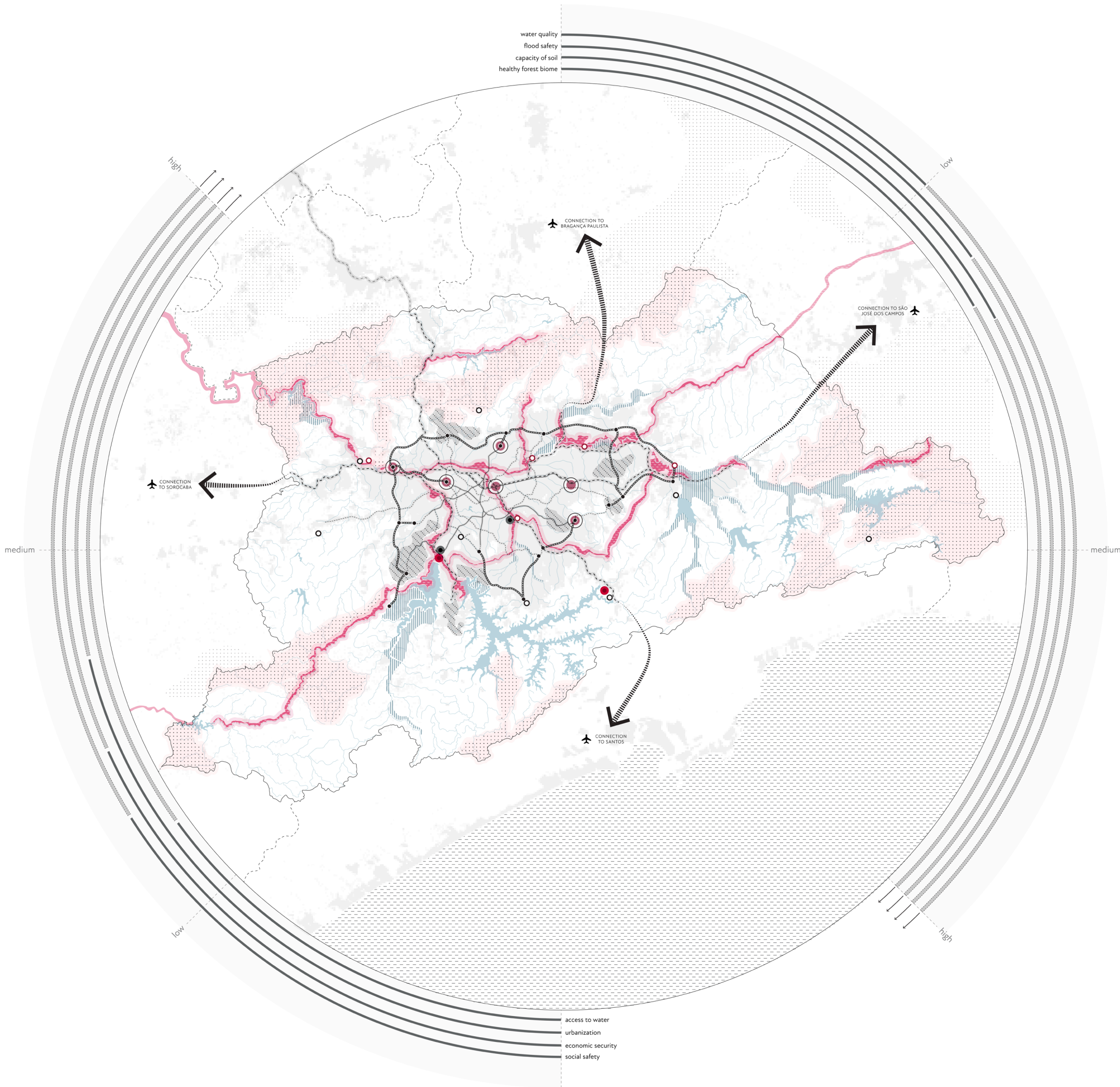
- Oceano Atlantico
- Water
- Urban area
- Metropolitan Regions
- Metropolitan Region of Sao Paulo
- Train line
- Metro line
- Metro line (under construction)
- Existing water treatment facilities
- Existing sanitation facilities

ECOLOGICAL BACKBONE

- Forest rehabilitation
- Vegetation corridor
- Water restoration

EQUITABLE ACCESS

- Upgrading precarious settelments
- Extension of metro
- Train connections
- New urban centralities
- New sanitation facilities
- New water treatment facilities



vision for environmental justice.

With the increasing risks of climate change and the increasing divide of inequality within Brazilian society, São Paulo’s ecological systems and marginalized communities become increasingly exacerbated. Therefore, the idea of creating a more resilient and inclusive environment follows the larger theory of Environmental Justice, centered around the principles of ecological integrity, social inclusivity, and political empowerment.

To realize this vision for the Metropolitan Region of São Paulo, these principles are built up through the strategies of developing an ecological backbone, equitable access, and adaptive governance.

Understanding the critical natural systems directly connects to the use of nature-based solutions through the ecological backbone, aiming to protect and restore ecological systems to re-establish ecological integrity throughout the whole metropolitan region. In

addition, urban actions strive for the promotion of socially inclusive urban developments and policies to ensure fair and equal access to urban and ecosystem services for all members of society, primarily for the marginalized communities of society. Lastly, a foundation of adaptive governance prioritizes the involvement of diverse stakeholders and co-produced solutions for a shared knowledge network through the process of development.

Thus, resulting in a resilient, adaptive, and inclusive Metropolitan Region of São Paulo that is able to effectively address the changing needs and challenges of our environment and society.



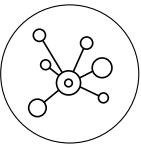
ECOLOGICAL BACKBONE

The goal of the ecological backbone strategy is to rehabilitate natural landscapes, expand green network, and re-vitalize water networks.



EQUITABLE ACCESS

The goal of the equitable access strategy is to reinforce a sustainable model of growth, re-institute urban services throughout the region and increase access to public infrastructure.



ADAPTIVE GOVERNANCE

The goal of the adaptive governance strategy is to strengthen climate adaptation knowledge and develop a multi-sectoral system.

socio-ecological strategies.

OVERVIEW

This chapter elaborates on the chosen socio-ecological strategies that form the objective of environmental justice for the Metropolitan Region of São Paulo. Based on the conclusions of the analysis, this project addresses each of the previously listed problems through ecological backbone, equitable access, and adaptive governance.

This strategic system covers the urban form and process of development through the goals from the conceptual framework of this thesis: ecological integrity, political empowerment, and social inclusivity. Through this chapter, each of these strategies will be defined through the broader framework of environmental justice.

SECTIONS

- *ecological backbone*
- *equitable access*
- *adaptive governance*



ecological backbone.

The strategy of ecological backbone serves as the foundation for the development of the Metropolitan Region for the re-establishment of ecological integrity. Actions elaborated in this strategy focus on the preservation and restoration of natural systems that address urgent environmental issues such as flooding, decreasing water quality, landslides, soil permeability, and more. Through the use of climate adaptation solutions, this strategy aims to improve the resilience of vulnerable communities in São Paulo through the revival of neglected and exploited ecological systems. This strategy argues against the existing Brazilian actions centered around hard infrastructure and advocates for nature-based solutions with goals of rehabilitating the natural landscape, expanding the green network, and re-vitalizing water networks present in the floodplains of São Paulo.

While small-scale initiatives and NGOs have played a key role in implementing localized solutions in these communities, they often do not holistically address the overarching issue. Therefore, this strategy must explore a combination of top-down and bottom-up governance strategies that can promote ecological integrity at a regional level. Thus, creating an ecological backbone for the Metropolitan Region of São Paulo centered around strategies for restoring forest biomes, boosting water resilience, and rejuvenating soil capacity.

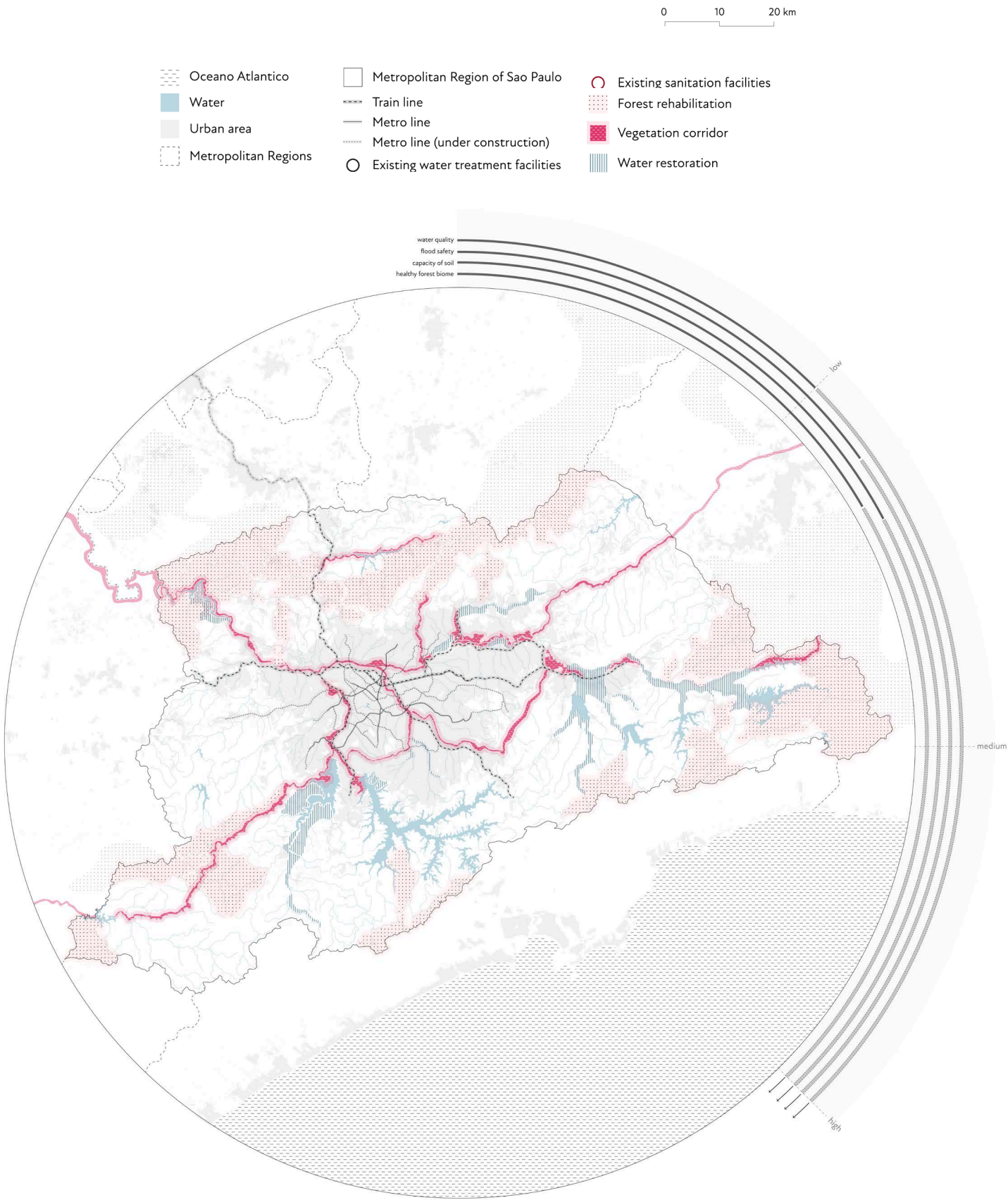
APPLIED SDGS:

6 CLEAN WATER AND SANITATION

11 SUSTAINABLE CITIES AND COMMUNITIES

13 CLIMATE ACTION

FIGURE 88. ECOLOGICAL BACKBONE VISION STRATEGY ■
MADE BY AUTHOR

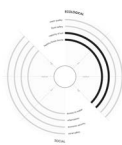


STRATEGIC ACTIONS.

01

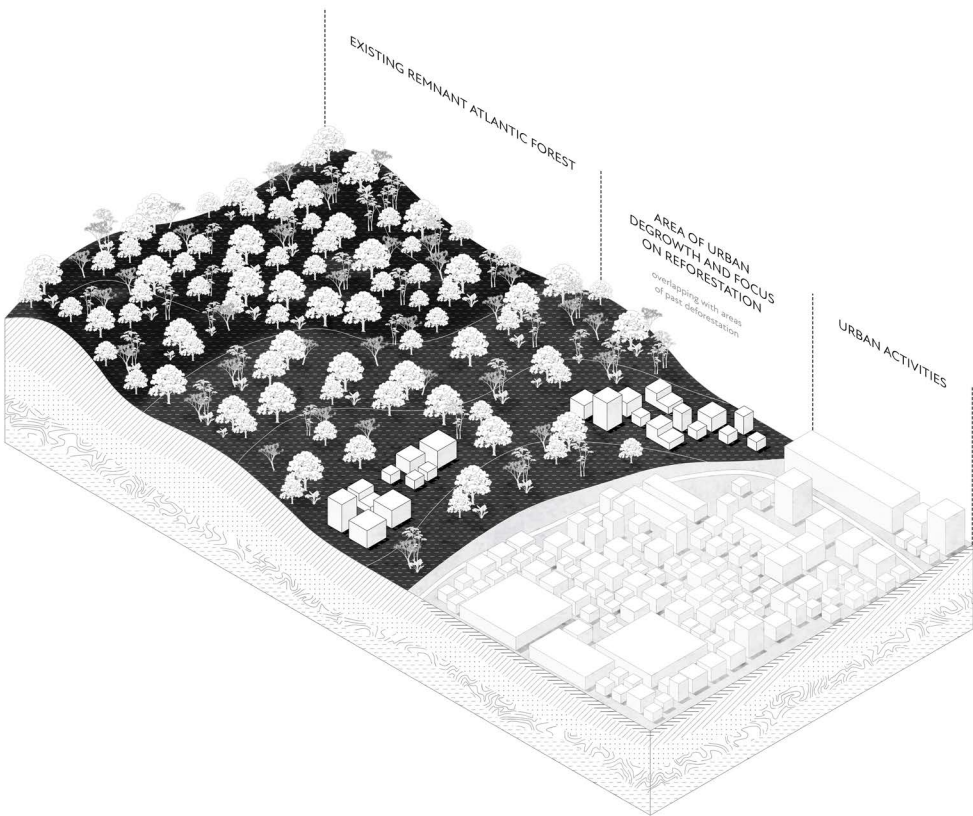
Rehabilitate Atlantic Forest

■ FIGURE 89. REHABILITATE ATLANTIC FOREST
MADE BY AUTHOR



Rehabilitating forests represents itself as an overlooked and critical solution to São Paulo’s wide variety of climate change risks. Especially as reducing rates of deforestation and forest degradation is one of the leading and most effective options for mitigating climate change (IPCC, 2022). Although current solutions to environmental risks are aligned with hard infrastructural solutions, rehabilitating forests is a “natural, cost-effective way” to protect populations against a variety of disasters like floods and droughts (Exploring New Tree Cover Gain and Net

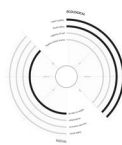
Change Data | GFW, 2022). Thus, this strategic action refers to the process of restoring the remaining areas of the forest biome that has been impacted by deforestation, urbanization, and agricultural expansion to a healthier state. This action occurs through the expansion of the native vegetation and the restoration of the biodiversity of the ecosystem. As forests demonstrate a variety of economic, environmental, and social benefits, this strategic action is essential in re-establishing ecological integrity throughout the Metropolitan Region.



02

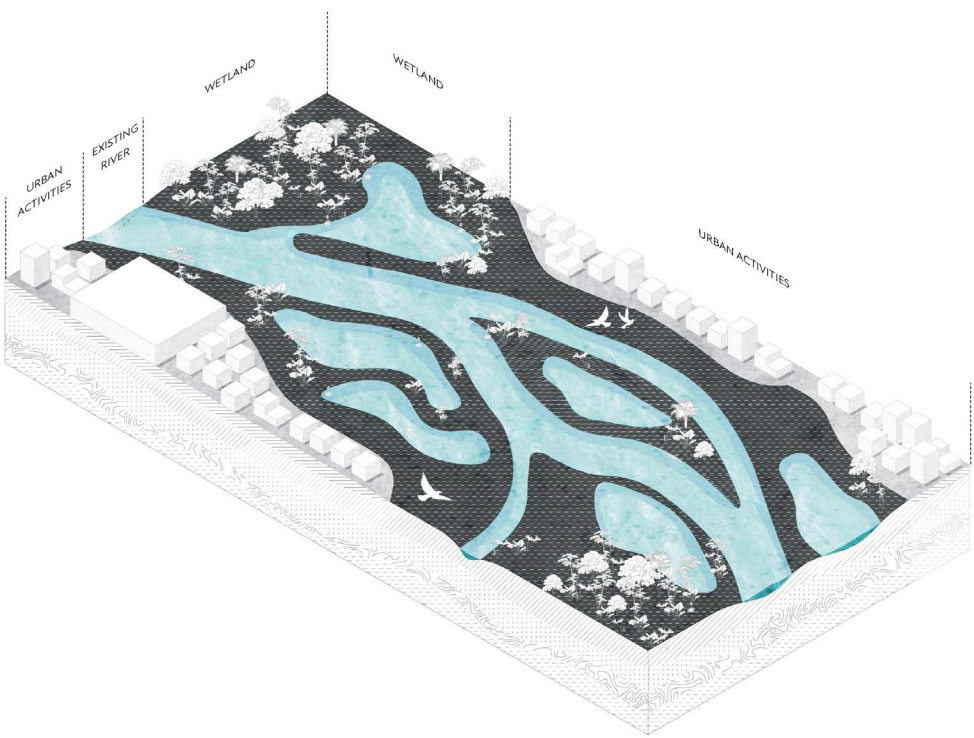
Wetland Creation

■ FIGURE 90. WETLAND CREATION
MADE BY AUTHOR



Wetland creation is considered a nature-based solution that refers to the process of construction or restoration of wetland ecosystems that are characterized by transitional areas of aquatic and terrestrial environments. This action thus addresses environmental challenges such as climate change and water management by providing an effective approach to reducing the risk of flooding by storing and absorbing excess amounts of water, increasing support for biodiversity, and supporting

groundwater levels (Thorslund et al., 2017). Additionally, the construction of wetlands is directly attributed to improving the water quality of adjacent water sources by filtering pollutants (Thorslund et al., 2017). Overall, the creation of wetland ecosystems throughout the Metropolitan region is an important solution that represents itself as a critical role in sustainable development and environmental adaptation.



STRATEGIC ACTIONS.

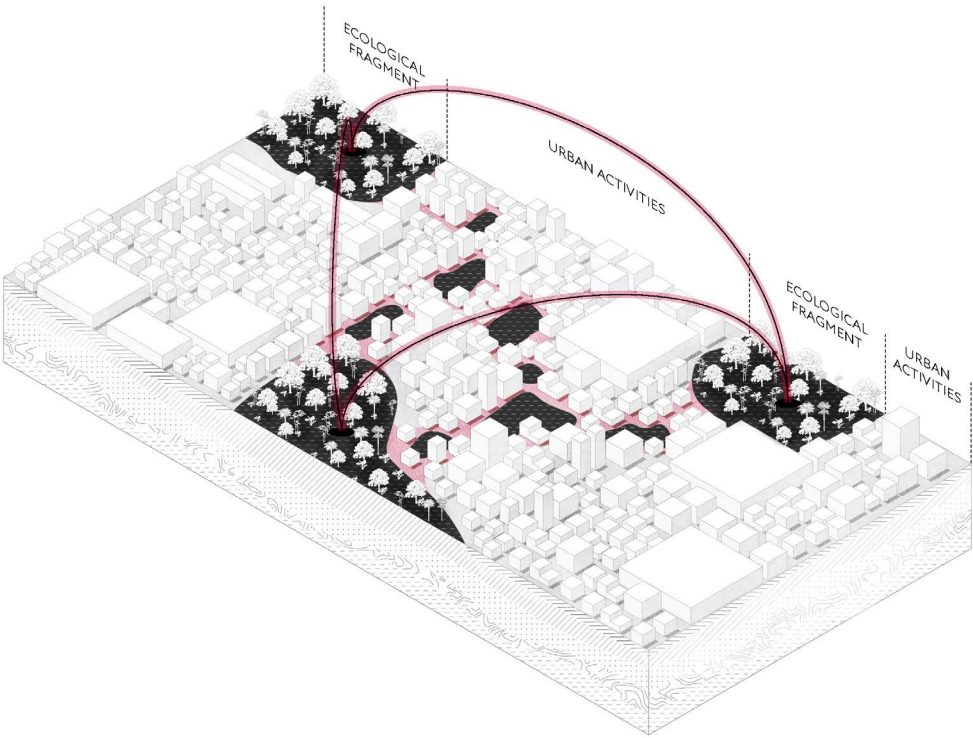
03 Ecological Connectivity

■ FIGURE 91. ECOLOGICAL CONNECTIVITY
MADE BY AUTHOR



Habitat destruction, biodiversity loss, and ecological fragmentation are leading causes of the increase in climate change risks around the world (Jodi Hilty, 2022). Therefore, this strategic action of the creation of ecological connections focuses on the construction of natural networks that connect these fragmented ecological landscapes together. As urbanization and unsustainable agricultural practices continue to decrease the size and quality of ecological zones, connectivity conservation across the Metropolitan Region becomes increasingly critical.

Therefore, the spatial arrangements of clusters of stepping stones between fragments of existing forest landscapes act as ecological connections for the protection and enhancement of biodiversity (James D. Olson et al., 2013). This strategic action thus aims to increase the permeability of urbanized areas, provide a buffer between urban and natural landscapes, and help maintain biodiversity that was lost through human activities by focusing on connectivity conservation.



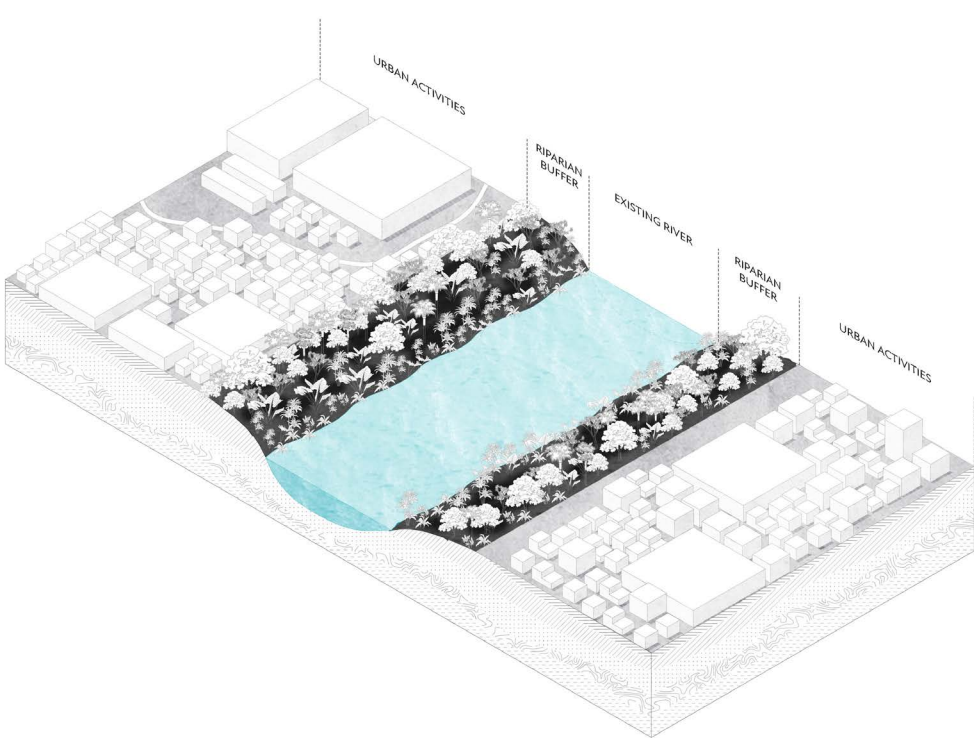
04 Riparian Vegetation

■ FIGURE 92. RIPARIAN VEGETATION
MADE BY AUTHOR



The creation and expansion of riparian vegetation along the banks of rivers and other water bodies presents itself as a vital nature-based solution in dense urban areas that are vulnerable to high flooding risks. Riparian vegetation refers to a diverse ecosystem found adjacent to rivers or streams that act as a buffer between aquatic and terrestrial zones (Khan et al., 2022). As a solution a part of ecosystem-based adaptation strategies, riparian vegetations serve as an important component of ecological

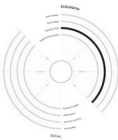
networks through their diversified benefits of stabilizing rivers, reducing flood risks for adjacent urbanized areas, and protecting biodiversity. Additionally, riparian vegetation functions as a soil and water protectant by providing root system support for the soil and filtration system to boost the quality of adjacent water (Khan et al., 2022). Therefore, the creation and conservation of riparian vegetation serve as a vital solution to the sustainable development of urban environments adjacent to water bodies.



STRATEGIC ACTIONS.

05 Permeable Surfaces

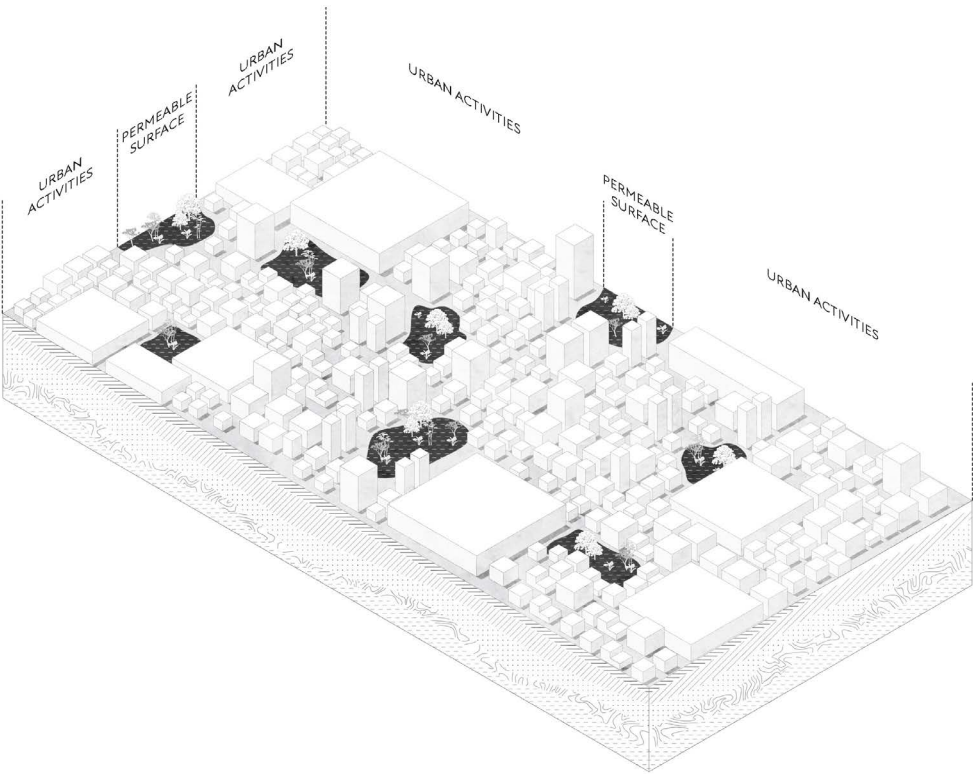
■ FIGURE 93. PERMEABLE SURFACE
MADE BY AUTHOR



Phase Timeline	immediate	short-term	long-term

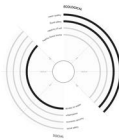
As urbanization rates continue to increase and areas continue to be densified, the hazards of urban flooding continue to maximize the vulnerabilities of populations across the Metropolitan Region. Therefore, the strategic action of permeable surfaces focuses on the introduction of porous surfaces in urban environments. Which consequentially increases the permeability of urban surfaces through

the use of vegetation that allows the soil to filter out pollutants and reduce the risk of urban flooding. Thus, improving the stability of the fragments of soil, increasing the absorption capacity, and boosting the infiltration rate of stormwater. This strategic action presents itself as a smaller-scale nature-based solution that focuses on the participation of more local actors in the alteration of urban landscapes.



06 Expansion of Water Networks

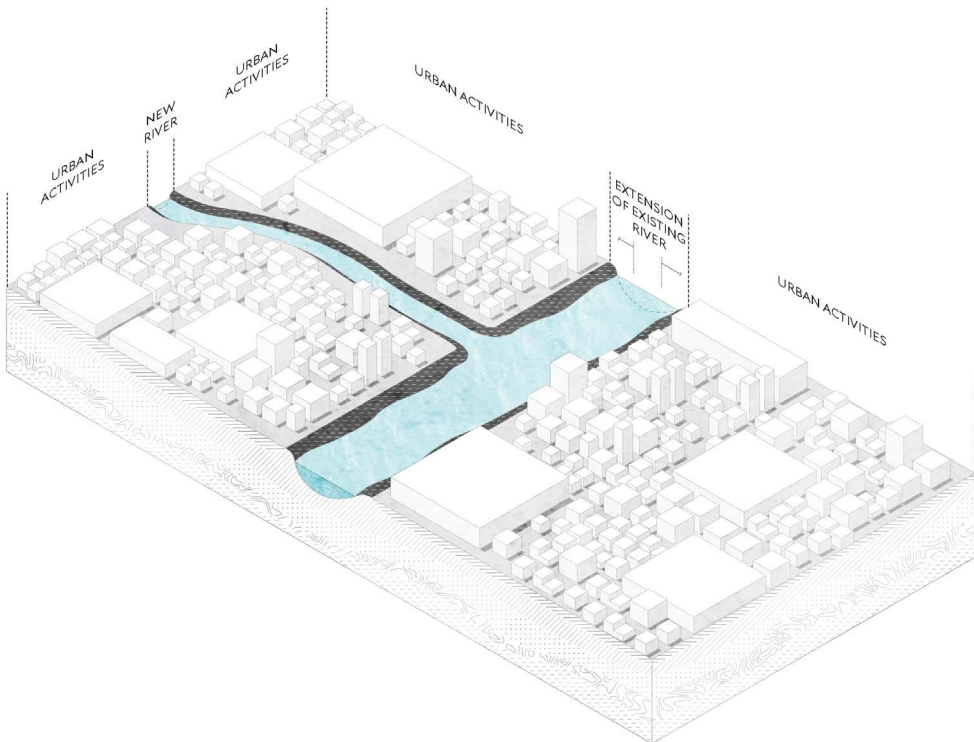
■ FIGURE 94. EXPANSION OF WATER NETWORKS
MADE BY AUTHOR



Phase Timeline	immediate	short-term	long-term

The expansion of water networks revolves around the creation of new blue connections or the expansion of existing river systems. This strategic action acts as a natural system, rather than relying on infrastructure and engineering solutions, to help reduce water scarcity and promote the resilience of river ecosystems. Additionally, the creation of new river

systems or the creation of a connection between existing river systems provides adaptation benefits of preventing flooding for adjacent urban environments by creating new catchment areas. Therefore, the expansion of water networks exemplifies an important solution for the restoration and enhancement of natural riverine ecosystems.





equitable access.

Building off the foundation of the ecological backbone, this strategy of equitable access seeks to address the challenges posed by the rapid urban growth of São Paulo that has led to its widespread inequality and socio-economic vulnerabilities. Thus, this strategy emphasizes the need for fair and equitable urban growth to reduce the socio-economic vulnerabilities of marginalized communities. To achieve this goal, various actions have been identified that elaborate on solutions to rectify the imbalances that exist in São Paulo's society.

By following the social inclusivity and justice core of this project, critical actions of this strategy revolve around the goals of increasing access to public infrastructure, re-instituting urban services for all members of society, and reinforcing a sustainable model

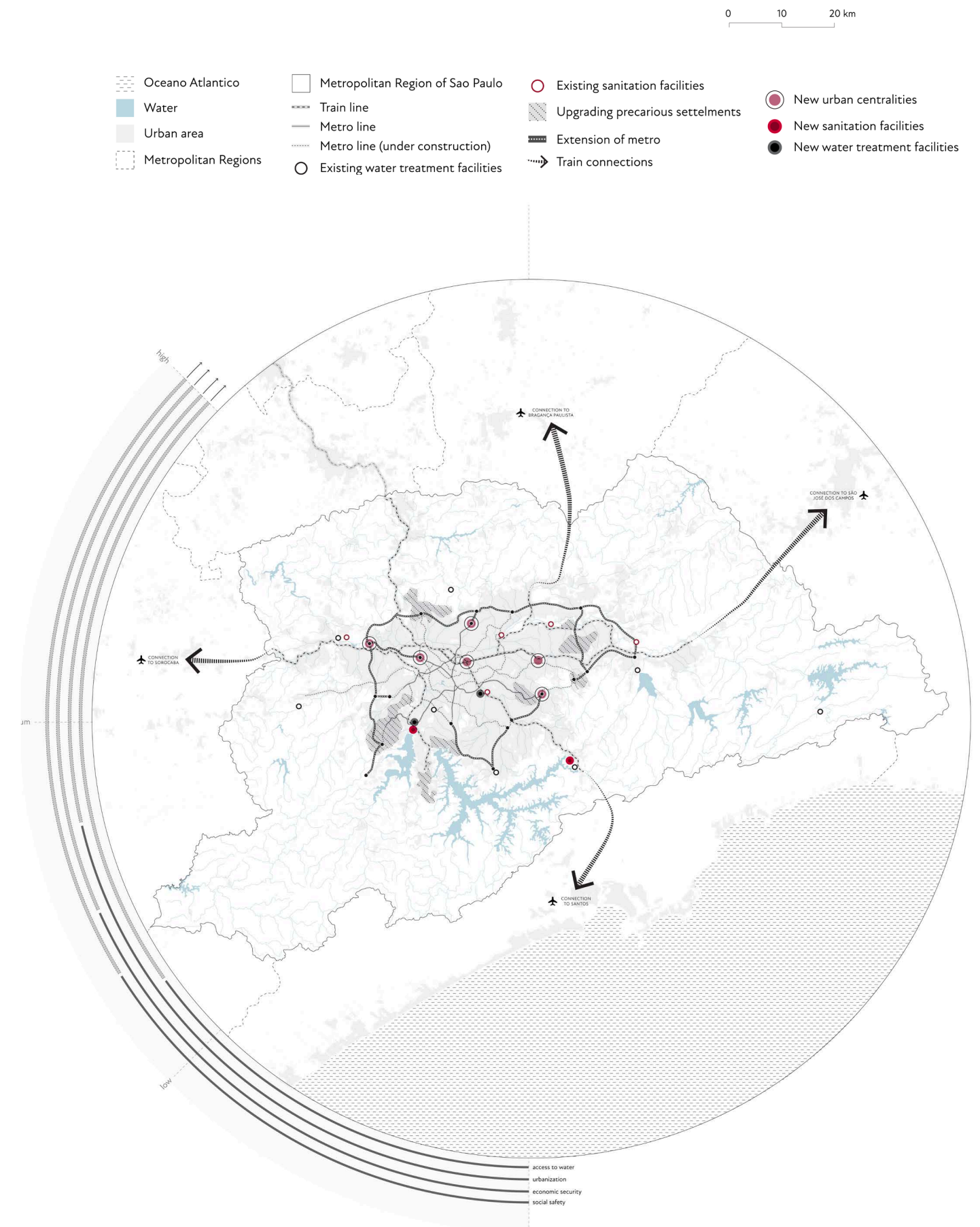
of urban growth through the region. Therefore, increasing access to housing, employment, education, and more opportunities to tackle social and economic inequality present in Brazilian society. Thus, the participation of the relevant citizens and bottom-up initiatives in the implementation of these actions is crucial.

Overall, the strategy of equitable allocation seeks to combat the unequal growth of São Paulo's region that has led to the city's nickname as the 'City of Walls'. Representing as a comprehensive approach to provide a more equitable and just society.

APPLIED SDGS:



FIGURE 95. EQUITABLE ACCESS VISION STRATEGY ■
MADE BY AUTHOR

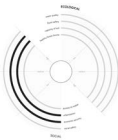


STRATEGIC ACTIONS.

01

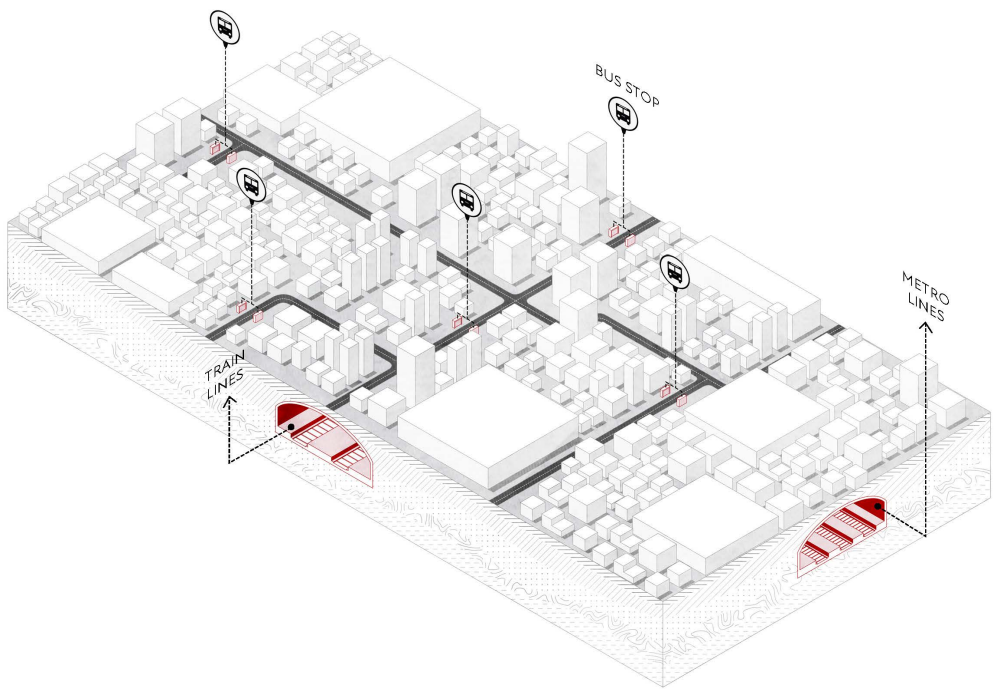
Expansion of Transportation

■ FIGURE 96. EXPANSION OF TRANSPORTATION
MADE BY AUTHOR



The lack of access to public transportation has continually been a factor of socioeconomic exclusion of marginalized communities that lie on the periphery of the city (Sao Paulo; A Tale of Two Cities by UN-Habitat, 2010). Although widely identified as a key to social inclusion, transport services still do not meet the needs of the increasing population, thus separating the amenities and opportunities available in the city's core from vulnerable populations (Sao Paulo; A Tale of Two Cities by UN-Habitat, 2010). Therefore, this strategic action centers

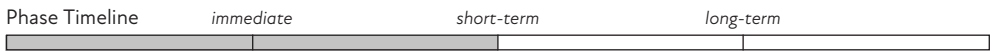
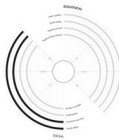
around the expansion of critical public transportation services such as train or metro lines throughout the Metropolitan Region. Thus, to decrease transportation inequality and provide vulnerable communities with key services such as healthcare, education, employment, and other services that are concentrated in the city center. This action promotes the idea that all residents of the region should have equal and fair access to the urban services of public transportation and puts forth transportation as a critical role in socio-economic inclusion.



02

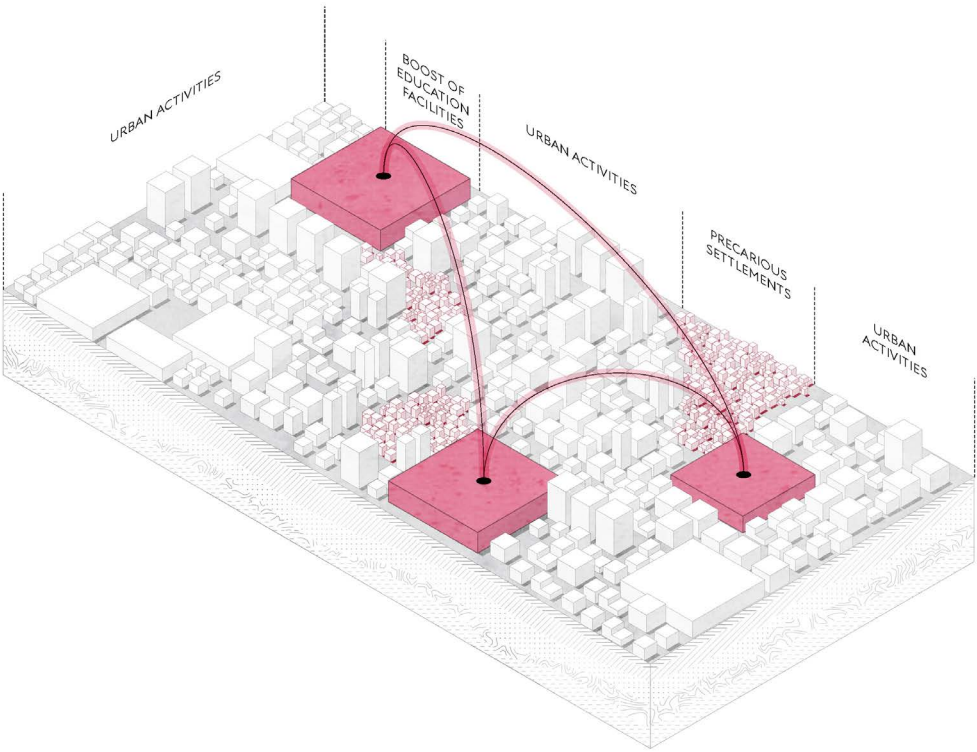
Reinforcement of Education

■ FIGURE 97. REINFORCEMENT OF EDUCATION
MADE BY AUTHOR



Discrepancies in education among populations are a key indicator of socio-economic inequality and exclusion. Although there have been various measures instated to raise the quality of basic education, São Paulo is still challenged by the cycle of poor education and social instability (Sao Paulo; A Tale of Two Cities by UN-Habitat, 2010). Therefore, this strategic action focuses on the reinforcement of education as a key role in establishing resiliency and stability throughout the Metropolitan

Region of São Paulo. The reinforcement of education promotes the strengthening of educational facilities, such as CEAP (Conselho Estadual de Assistência Social) institutions in São Paulo, and focuses on increasing educational programs in areas of socio-economic vulnerability. Thus, to provide more spaces that promote educational benefits to vulnerable communities and provide a framework for the establishment of climate adaption knowledge networks.



STRATEGIC ACTIONS.

03

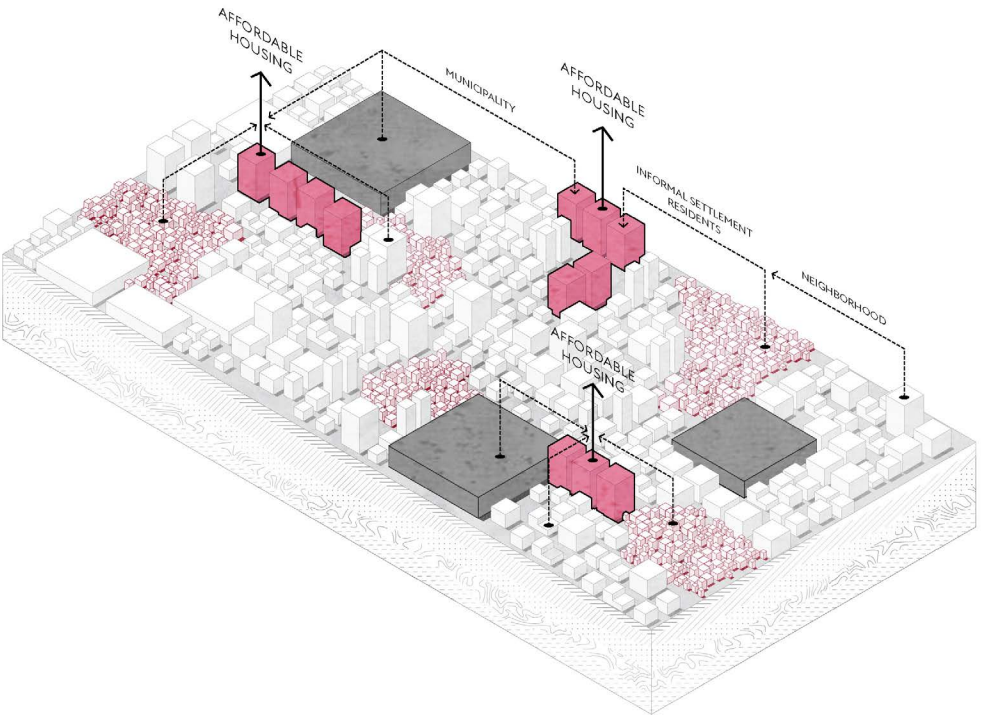
Increase Access to Affordable Housing (CLT)

FIGURE 98. INCREASE AFFORDABLE HOUSING
MADE BY AUTHOR



São Paulo's reputation as a region of tensions can mostly be traced back to the visual signs of inequality in the construction of informal settlements that mark the Brazilian urban landscape (Sao Paulo; A Tale of Two Cities by UN-Habitat, 2010). The promotion of the core ideas of inclusion, equality, and justice is intertwined with the struggle for adequate housing for all individuals in São Paulo. Therefore, this action focuses on improving the living conditions of residents residing in informal settlements by providing better access to basic services such as housing. Increasing access to affordable housing revolves around

reducing multi-dimensional inequality and works with existing initiatives to provide policies and financial support on increasing affordable housing on vacant lands. Primarily through the focus on developing community land trusts (CLTs) in non-regularized settlements that consolidate the commitments of several parties (the municipality, the residents, and the neighborhoods) to manage the land. Thus, offering a mode of a community-based association that provides affordable housing for residents of informal settlements (Catalytic Communities, n.d.).



04

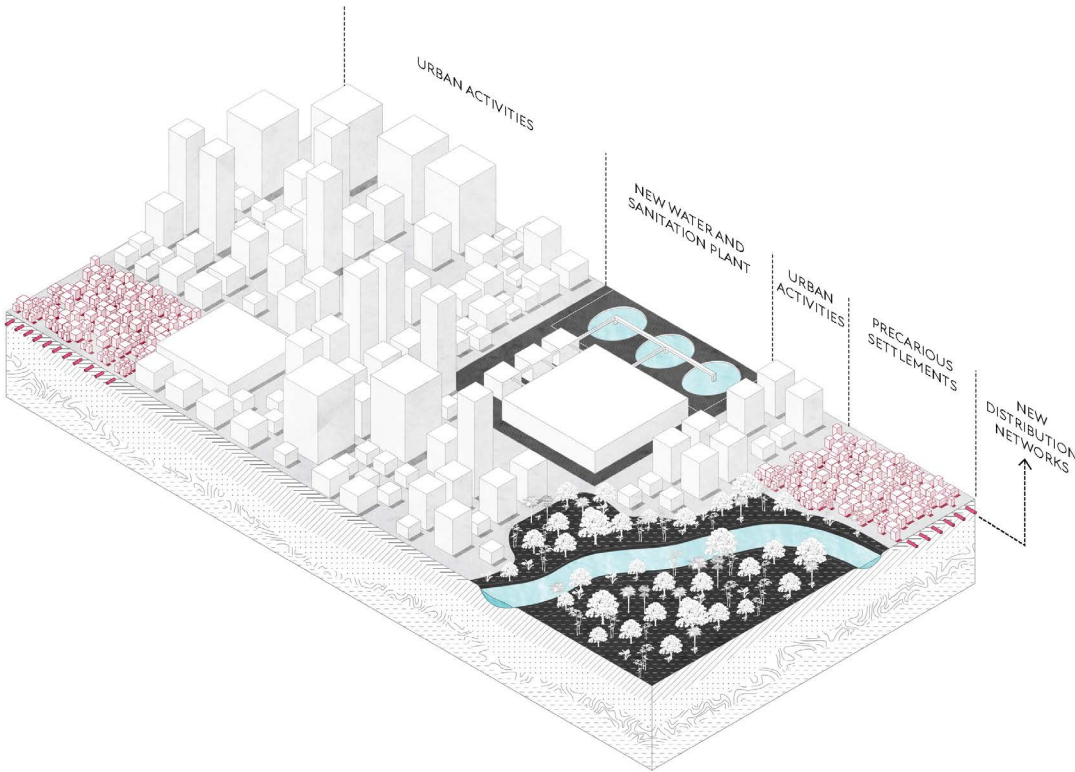
Development of Water and Sanitation Infrastructure

FIGURE 99. DEVELOPMENT OF WATER AND
SANITATION INFRASTRUCTURE
MADE BY AUTHOR



The issues that underpin the divided nature of the region, like the unequal access to resources, underpin the inequalities of adequate drinking water and sanitation infrastructure (Sao Paulo; A Tale of Two Cities by UN-Habitat, 2010). As the broader issues of water and waste management within the region are also inexplicably related to the degradation of ecological systems, the focus on adequate infrastructure is critical for both the re-establishment of ecological integrity and the promotion of equality (Sao Paulo; A Tale of Two Cities by UN-Habitat, 2010).

Therefore, this strategic action involves the development of water and sanitation infrastructure in vulnerable communities or in areas with concentrations of informal urbanization such as water treatment plants, distribution networks, and sanitation facilities, as well as upgrading existing infrastructure. Thus, providing both ecological, health, and equity benefits by improving public health, preventing the spread of waterborne diseases, removing pollutants from water systems to increase the quality of water, and improving access to clean water for vulnerable communities.

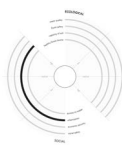


STRATEGIC ACTIONS.

05

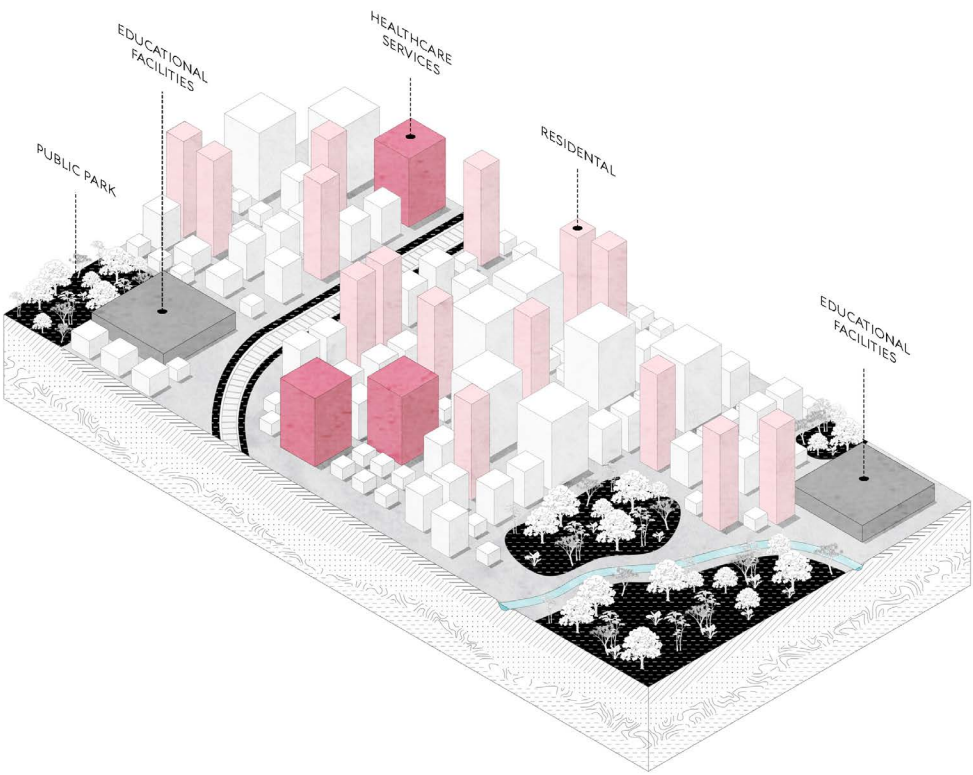
Employ a Compact City Model

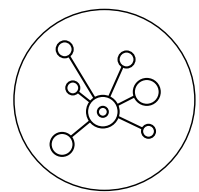
■ FIGURE 100. COMPACT CITY MODEL
MADE BY AUTHOR



The Metropolitan Region of São Paulo, since the urbanization boom in the late 1900s, has been characterized by the ever-sprawling periphery, commonly regarded as a fundamental factor in the socio-economic divide between urban populations (Sao Paulo; A Tale of Two Cities by UN-Habitat, 2010). Therefore, this strategic action focuses on the reconfiguration of the urban development of São Paulo towards a sustainable model of development through a focus on compact cities. The compact city model of development refers to an urban model

that promotes a more sustainable model of living, with densified occupations with overlapping multi-functional uses (OECD, 2012). Primarily, this action focuses on increasing the multi-functionality of existing urban areas to thus increase access to services and amenities as well as reducing urban sprawl and the negative externalities associated with it. As well, this action is focused on the densification of low-populated areas, not associated with vulnerable contexts, to thus fairly distribute the urban growth throughout the region.





adaptive governance.

The strategy of adaptive governance revolves around the combination of principles of adaptive governance and the co-production of knowledge to develop a more flexible and adaptive framework in times of socio-ecological instability. This strategy is grounded in the governance process of developing the vision for environmental justice in the Metropolitan region, focusing on the principles of procedural and recognition justice.

Thus, actions in this strategy aim to increase accountability and transparency in governance systems to ensure inclusive and empowering processes. Thus, referring to creating a more flexible and adaptable framework for decision-making and management. Additionally, this strategy aims to create more interlinked relationships between communities of São Paulo and governance

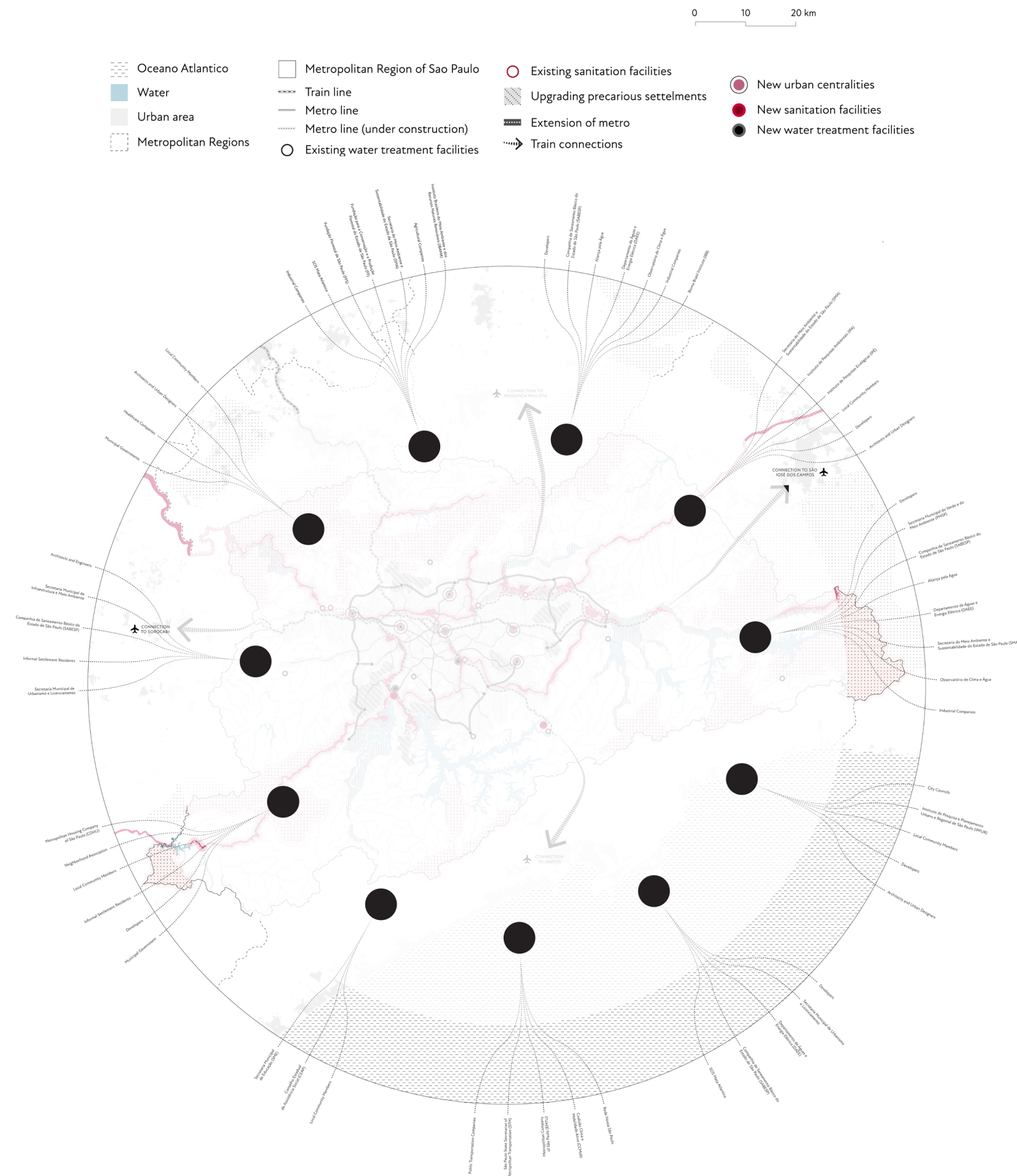
systems through the promotion of a shared knowledge system. By recognizing that knowledge is not created in isolation, actions of this strategy aim to increase public trust between communities and the public sector, incorporate local knowledge, and ensure an equal distribution of relevant education.

Overall, the adaptive governance strategy promotes an adaptive and collaborative process for the spatial creation of the ecological backbone and equitable access strategies in the Metropolitan Region.

APPLIED SDGS:



FIGURE 101. ADAPTIVE GOVERNANCE VISION STRATEGY
MADE BY AUTHOR



PROCESS PRACTICES.

01

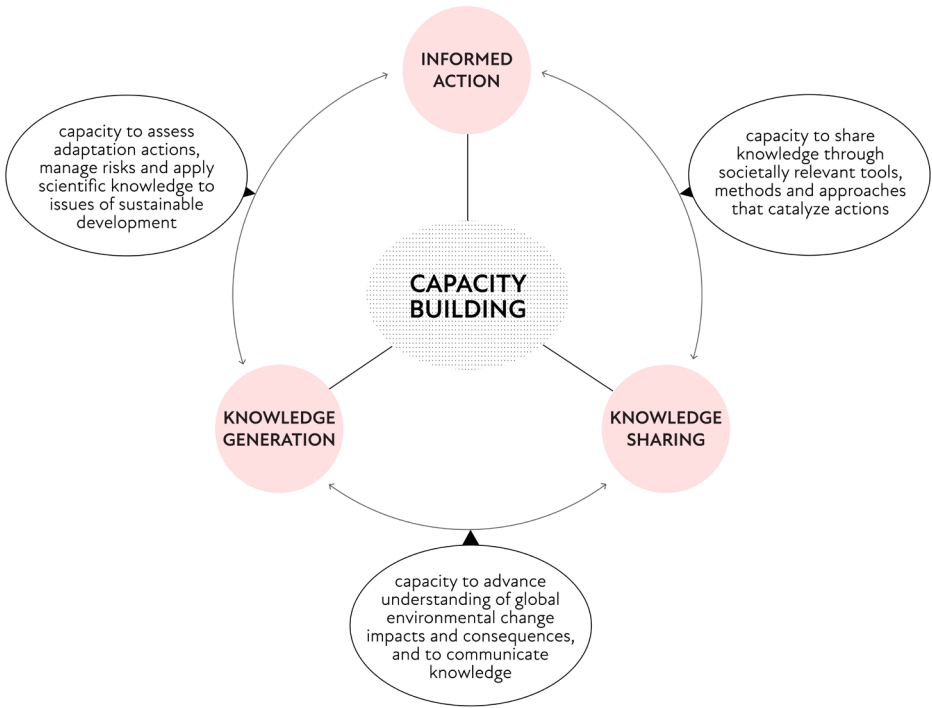
Support Capacity Building Programs

FIGURE 102. CAPACITY BUILDING PROGRAMS
SOURCED FROM VIRJI ET AL., 2012
RE-MADE BY AUTHOR



This strategic action refers to the importance of robust systems of knowledge generation and exchange to deal with socio-ecological changes (Virji et al., 2012). Supporting capacity building efforts entails providing resources and knowledge to individual agents or organizations to thus enable a continual and dynamic process. By supporting these programs, specific stakeholders can become empowered and better equipped to participate in the processes of resilient

development in their communities. These efforts are particularly urgent in contexts like Brazil that are exacerbated by socio-economic issues and ecological degradation. These endeavors of supporting capacity building programs not only strengthens the process of knowledge building and exchange of critical agents, but also “in the processes that catalyze efforts to move from knowledge to action” (Virji et al., 2012).



02

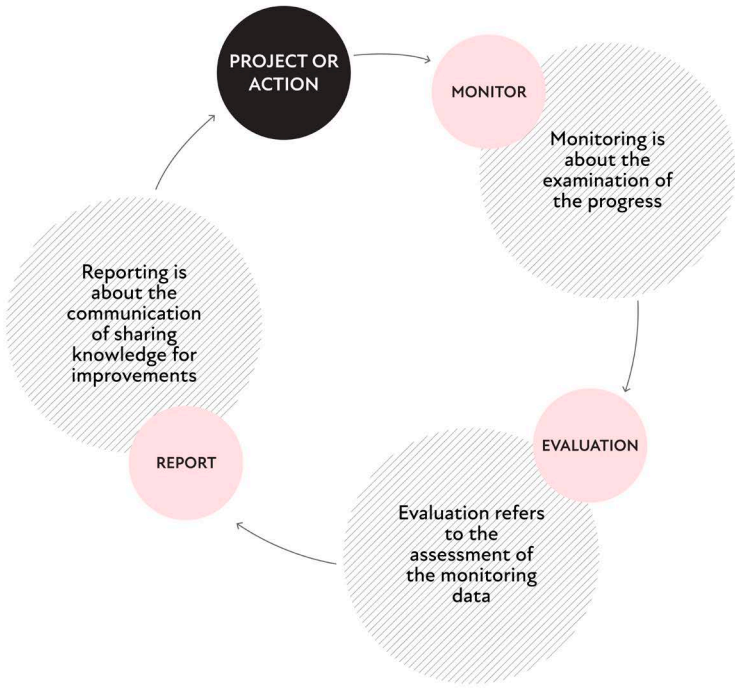
Develop Monitor, Report, and Evaluation Systems

FIGURE 103. MONITORING, REPORTING, AND EVALUATING SYSTEMS
MADE BY AUTHOR



The development of monitoring, reporting, and evaluating systems (MRE) is increasingly becoming recognized as a critical aspect of the process of implementing climate adaptation strategies around the world. MRE refers to the process of continually assessing the changing environmental conditions and progress of the larger coordinated efforts of climate adaptation. Thus, to

create a more flexible and continuous process that is able to effectively adapt to the complexity of climate change. This strategic action designs approaches that therefore improve the understanding of the effectiveness and efficiency of plans, provides accountability, and enhances the generation of knowledge (European Environment Agency, 2015).



PROCESS PRACTICES.

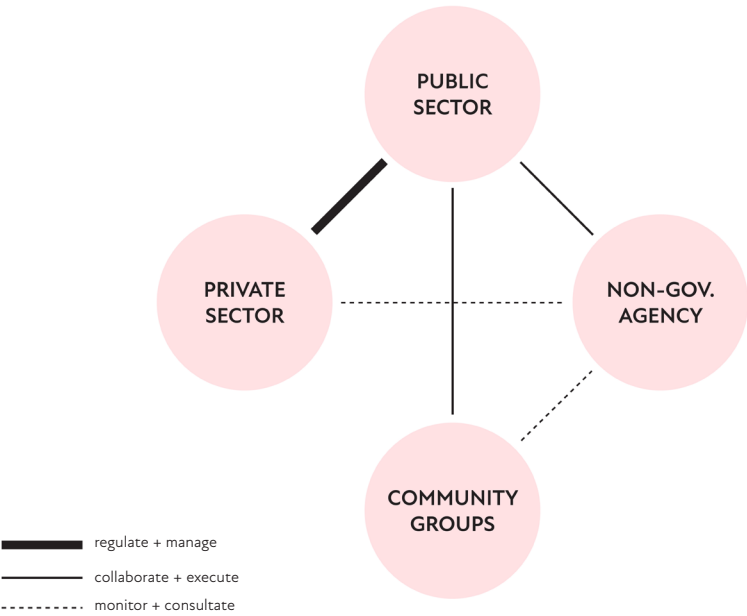
03 Promotion of Collaboration and Partnerships

FIGURE 104. COLLABORATION AND PARTNERSHIPS AMONG STAKEHOLDERS
MADE BY AUTHOR



Building partnerships and relationships between the public sector, private sector, and civil society represents itself as a critical strategic action in improving the adaptivity of environmental management and governance practices. Often, the disconnect between groups of stakeholders undermines the success or achievements of sustainable environmental initiatives. By recognizing that “effective governance of complex environmental systems required the participation and collaboration of diverse stakeholders in environmental decision-making”, this

action aims to overcome existing problems with accountability, power imbalances, miscommunications, and exclusion of vital groups (Virapongse et al., 2016). Thus, to leverage the collective resources, knowledge, and expertise to achieve the shared goal of environmental justice through multi-directional, collaborative strategies between stakeholders. Creating a process built from partnerships provides a more accountable and transparent system of environmental management and governance structure that is reactive and adaptive to changes.



04 Promotion of Social Learning and Education

FIGURE 105. PROMOTION OF SOCIAL LEARNING AND EDUCATION
MADE BY AUTHOR



The strategic action of promoting social learning focuses on disseminating knowledge on the impacts of climate change and solutions as a complementary governance mechanism in a framework of adaptive governance (Ison et al., 2015). Therefore, to effectively adapt to socio-ecological instability, providing awareness and guidance for vulnerable communities to prepare for changing environments. This action promotes a culture of resilience amongst communities and empowers

individuals to take small-scale proactive measures to mitigate the impacts of climate change in their own communities. Additionally, strengthening education and knowledge can empower individuals to participate in decision-making processes and advocate for policies that support climate resilience. Overall, this action can help individuals in vulnerable or marginalized communities become more active and effective agents of change in the face of environmental justice.



meta governance.

OVERVIEW

This next chapter focuses on the governance processes and critical stakeholders that are involved in each strategy of establishing an ecological backbone, promoting equitable access, and creating an adaptive governance system. As well, this section introduces the principles of meta-governance as the foundation for securing an accountable and successful implementation of sustainable developments. Through the creation or identification of existing tools within network, hierarchic, and market governance styles in Brazilian society.

SECTIONS

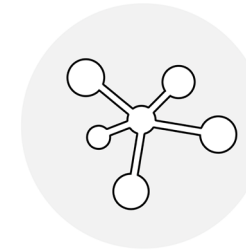
- *meta-governance*
- *stakeholder analysis*
- *governance tactics*

Meta-Governance.

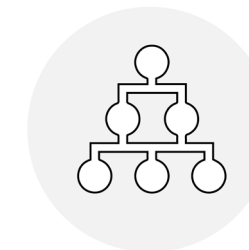
Successful governance for the execution of sustainability and justice solutions in countries around the world often presents hurdles due to a lack of political will, power, or skills. Primarily, the implementation or execution of projects and proposals in Brazilian governance is the most difficult stage of planning, often marred by corruption, crime, and nepotism (Rocco et al., 2019). As such, this thesis promotes the usage of the meta-governance approach, which aims at combining specific tools from different governance styles that range between network, hierarchic, and market governance. Thus enhancing the adaptiveness and accountability of processes of development. Meta-Governance is a practice that has garnered attention in recent governance literature for its framing as a broad solution to past failures in governance (Gjaltema et al., 2020). This practice is highly regarded as a measure to enhance

accountability, transparency, and coherency among governance processes and institutions to thus “increase the democratic legitimacy of governance networks” (Gjaltema et al., 2020). Framed as a governance toolbox, meta-governance draws its principles from the three governance styles of network, hierarchical, and market governance for a stable approach to sustainable development (Hub, 2018). Most countries around the world, including Brazil, often favor a specific model of governance to push for solutions. For example, the Brazilian model often favors a market form of governance that focuses on the use of market-based solutions while the Dutch model prefers network governance through the usage of partnerships. However, the combination of elements from all three styles of governance provides a more effective and comprehensive strategy toward resilient governance approaches.

NETWORK
GOVERNANCE



HIERARCHIC
GOVERNANCE



MARKET
GOVERNANCE



network governance.

Network governance is used as a response to complex, ‘wicked’ problems and is primarily characterized by its usage of tools that support a multi-level governance system (Hub, 2018). This governance structure promotes dialogue through the engagement of actors across all levels of governance and reflects a collaborative system to address the complexity inherent in socio-ecological systems.

hierarchic governance.

Hierarchic governance is characterized by its top-down structure with the power of higher-level governance stakeholders to steer development primarily through the usage of policy mechanisms.

market governance.

Market Governance promotes the usage of market-based or economic tools to employ accountability and efficiency.

Therefore, this thesis proposes using all three governance strategies on the grounds of the principles of meta-governance to introduce a more adaptive, accountable, and successful development process. However, in the context of Brazil, this thesis primarily prioritizes its governance approaches through tools of network governance, while existing market and hierarchic governance tools support inclusive climate adaptation strategies as supplementary measures.

Stakeholder Analysis.

This analysis recognizes the critical stakeholders involved in the development and decision-making processes of the strategies of this thesis. Thus, key stakeholders have been identified for each of the strategic actions of the spatial framework; the ecological backbone and equitable access strategies. The key stakeholders are classified within four categories of society (the public sector, the private sector, non-governmental agencies/organizations, and community groups) and organized within each strategic action.

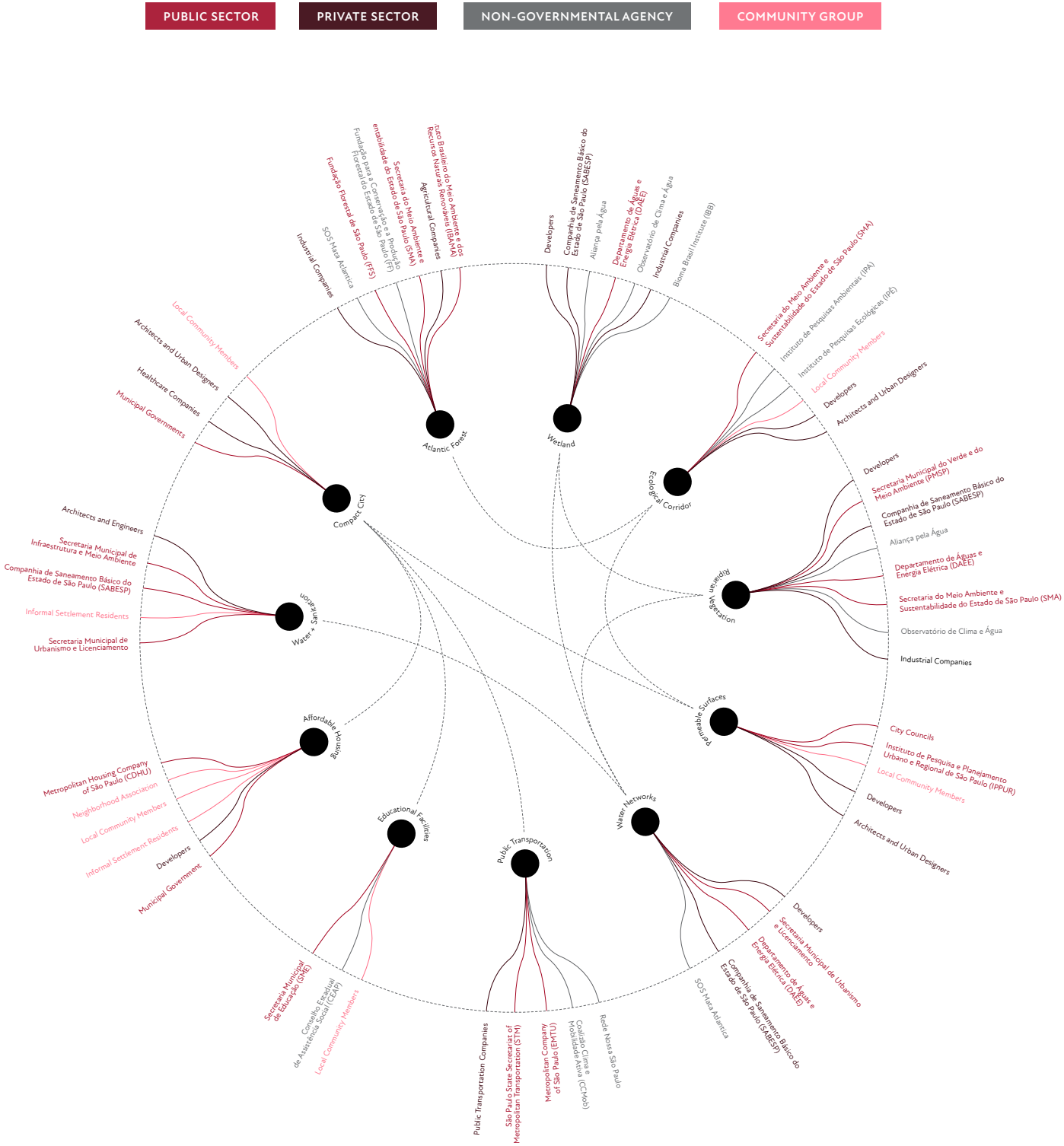
By studying the possible conflicts and power imbalances between these stakeholders, the opportunity to integrate their objectives and roles through the practices of the adaptive governance strategic framework and meta-governance principles can be explored.

As each strategic action balances stakeholders of differing levels

of governance, the practices of capacity-building programs, MRE systems, partnerships, and social learning can act as a bridge between the involvement of all key actors. These practices of adaptive governance framework instigate forms of accountability and coordination. Therefore, cementing principles of good governance throughout the process of development by promoting accountability, transparency, shared responsibility, and responsiveness (Oyeyinka, 2010).

Having identified the key stakeholders of each strategic action, the power-interest analysis reveals the most critical stakeholders involved in the decision-making processes for each spatial strategy. Strategies for climate adaptation, due to their interconnected nature and wide global influence, require the

FIGURE 106. STAKEHOLDER ANALYSIS ■
MADE BY AUTHOR



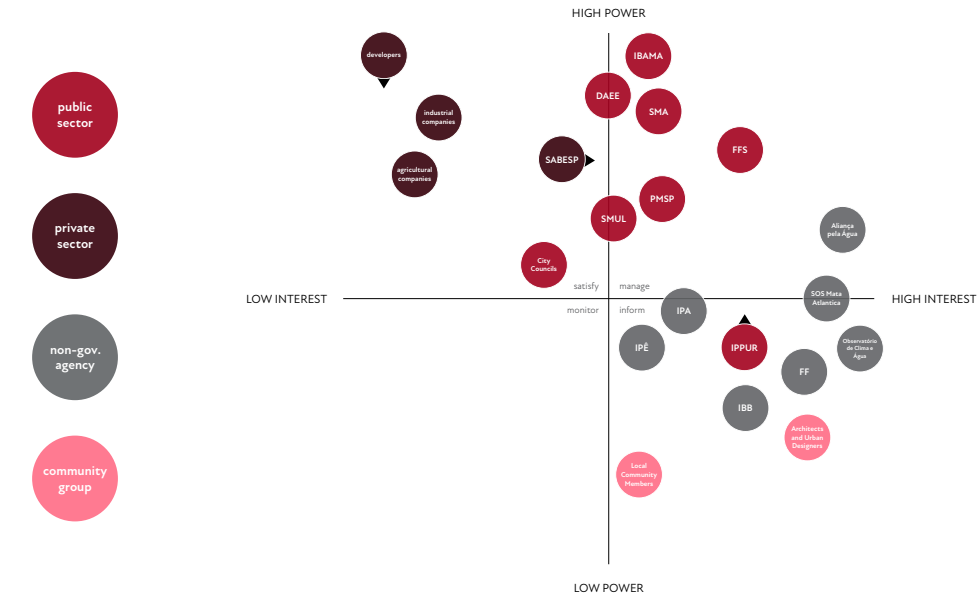
cooperation of a wide range of actors from a variety of different sectors. As climate change spans various fields and scales of society, strategic actions of the ecological backbone strategy necessitates a coordinated and comprehensive response from actors. Therefore, the engagement of national and state-level actors within the public sector is more extensive and of more importance for effective adaptation planning. While creating inclusive and equitable strategies in the urban environment that tackle socio-economic vulnerabilities requires more cooperation from civil society organizations and local communities. Civil society organizations, community-based groups, and local communities are vital in providing their expertise on the local contexts and social dynamics. Thus, providing valuable and effective insight into the challenges experienced by vulnerable populations and ensuring the inclusion of marginalized communities in decision-making processes. Ultimately, collaborating and engaging with bottom-up participation and initiatives

enhances the legitimacy of creating equitable strategies, promoting justice and fostering inclusivity.

Overall, cooperation and coordination among stakeholders from different sectors of society are essential for creating inclusive climate adaptation strategies that effectively address the vulnerabilities of society and ensure a resilient environment.

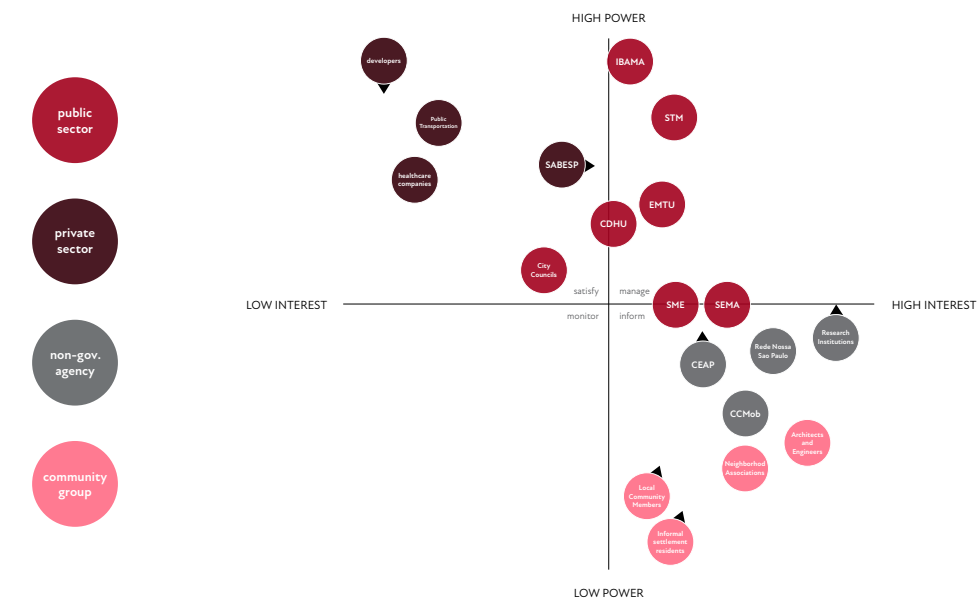
ECOLOGICAL BACKBONE

■ FIGURE 107. POWER + INTEREST MATRIX - ECO BACKBONE
MADE BY AUTHOR



EQUITABLE ACCESS

■ FIGURE 108. POWER + INTEREST MATRIX - EQUITABLE ACCESS
MADE BY AUTHOR



Governance Tactics.

This subchapter will focus on key strategies from meta-governance principles of network, hierarchic, and market governance to provide a framework for effective and inclusive governance. Thus, this section will either identify current practices and tools existing in Brazilian governance that this thesis can utilize or create new governance practices to promote the implementation of inclusive climate adaptation strategies.

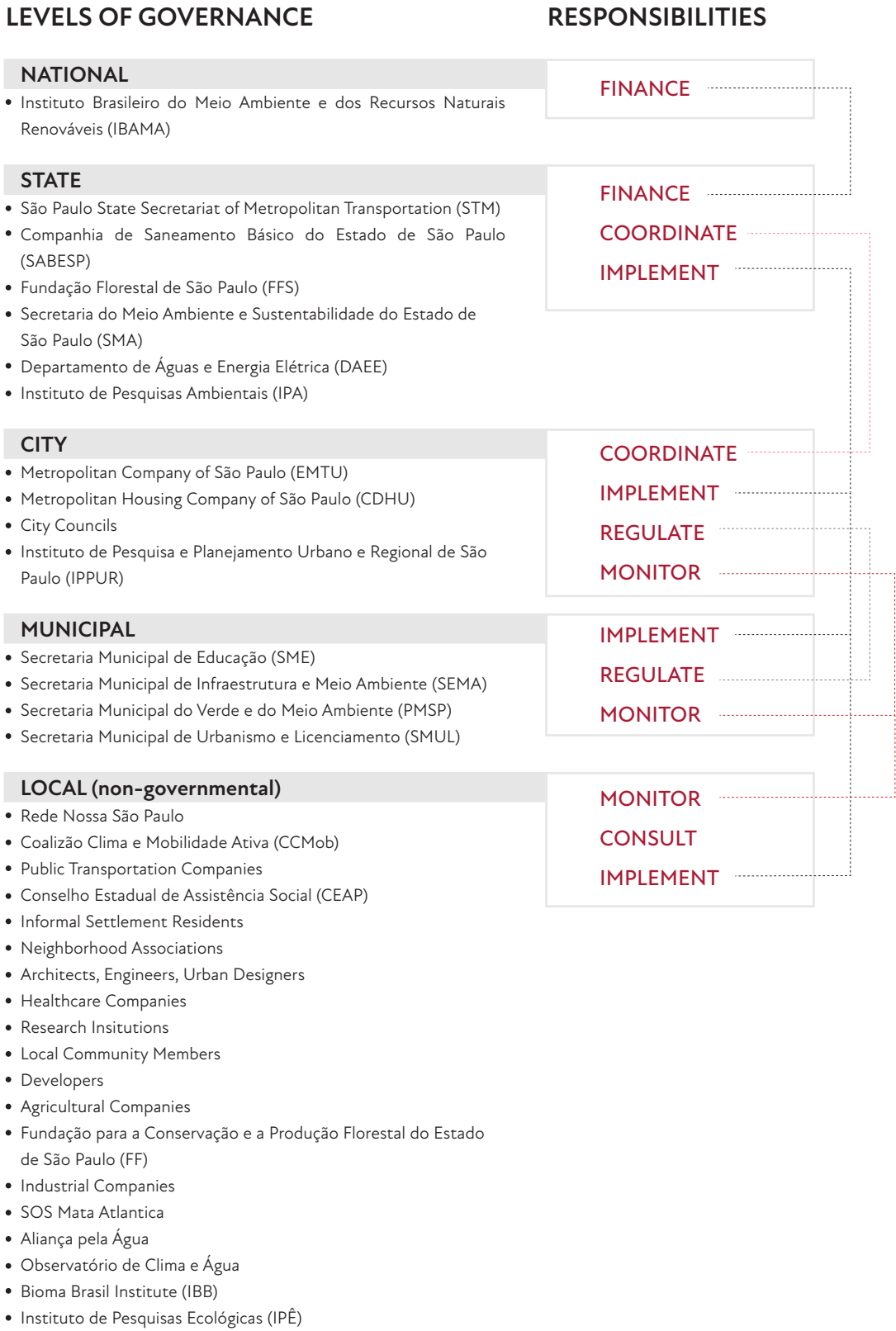


Network Governance.

As previously stated, network governance refers to a type of governance structure within the larger theory of meta-governance that is characterized by the involvement of multiple actors from different sectors. This governance structure is especially vital within this thesis as coordination across spheres of society and levels of governance is crucial

to operationalize the success of inclusive climate adaptation solutions. Therefore, network governance also referred to as multi-level governance, can be used to address the complexities of socio-ecological systems by increasing the sharing power between the public sector, private sector, non-governmental organizations, and community groups. This thesis thus utilizes the principles of network governance to propose a model of partnerships among different levels of governance, such as national, state, city, municipal, and local (non-governmental), as a measure of increasing accountability and transparency in the implementation of the socio-ecological strategies. These partnerships, seen in the figure to the right, involve creating shared responsibilities and distributing various roles of financing, coordinating, implementing, regulating, and monitoring to ensure a coordinated and effective process of implementation.

FIGURE 109. RESPONSIBILITIES OF LEVELS OF GOVERNANCE ■
MADE BY AUTHOR



Shared financial responsibilities involve the allocation of funding between different levels of governance, specifically national and state actors, to support strategic actions. Thus, the role of financing from higher-level actors provides assistance and empowers local and municipal governments to take action and implement adaptation projects. Coordination or collaboration responsibilities refer to establishing mechanisms of creating platforms that facilitate information sharing and allow for effective collaboration between different stakeholders. Therefore, to effectively navigate complex relationships and serve as a liaison between different stakeholders involved in a particular strategic action. Implementation responsibilities involve the execution of specific strategic actions. As the main challenge with planning in Brazil is the execution of projects or policies, the responsibility of implementation is distributed across three levels of state, municipal, and city actors to improve the chances of successful project implementation

(Rocco et al., 2019). Regulatory responsibilities include setting the regulations or guidelines that shape the development of strategic actions. Monitoring responsibilities revolve around assessing the progress and effectiveness of adaptation projects. The distribution of this responsibility amongst different stakeholders facilitates the sharing of data and information throughout levels of governance. Especially including local-level organizations or groups in the process of monitoring systems can empower local communities by providing a sense of ownership and responsibility. Thus, enabling local communities and smaller-scale actors to shape the project's direction and success. Lastly, consulting or capacity building involves the collaboration of different stakeholders to share expertise and knowledge of local contexts to ensure effective decision-making processes. Thus, this shared responsibility enhances the capacity of stakeholders to adequately and inclusively address complex problems through training programs, workshops, and more.

Overall, the breakdown of roles between each level of governance provides a dispersion of responsibilities in the implementation, monitoring, coordinating, financing, and more of the strategic actions. Through network governance principles of decentralizing responsibilities and promoting partnerships, power is distributed throughout levels of governance and equips different groups of stakeholders with accountability measures.



Hierarchic Governance.

Hierarchic Governance refers to a type of governance structure within the larger theory of meta-governance that is primarily characterized by a top-down approach that focuses on the use of authority and public power concentrated in government institutions and regulatory frameworks. Hierarchy governance thus provides policies or regulations that are established by higher-level public authorities or organizations to steer development.

The primary tool of hierarchic governance to implement inclusive adaptation strategies is the existing City Statue (Estatuto da Cidade) that was created in Brazil in 2001. The City Statue, Federal Law No. 10.257, is a landmark legislation in Brazil that focus on embodying the concept of the ‘right to the city’ through policy instruments for urban development (Estatuto da Cidade, 2001). In general terms,

the City Statue primarily focuses on providing guidelines for urban planning, land regularization, and reducing socio-spatial inequalities (Estatuto da Cidade, 2001). Thus, allowing the principles of inclusive adaptation actions to be carried out through the main policy instruments listed on the next pages.

CITY STATUE (ESTATUTO DA CIDADE) INSTRUMENTS AND MECHANISMS:

Article 5: Compulsory Parcelling, Building, or Utilization (PEUC)

(Parcelamento, Edificação ou Utilização Compulsórios)

Combats the agglomeration of underutilized or vacant lands in the urban environment and stipulates the compulsory use or building of urban land defined by the Municipal Master Plan (Estatuto da Cidade 2001).

Support for Strategic Actions: Employ a Compact City Model

Article 7: Urban Land and Property Tax (IPTU) Progressive over time

(Imposto Predial e Territorial Urbano (IPTU) progressivo no tempo)

Provides for the increase of property tax for five consecutive years if this land is not fulfilling its social function (Estatuto da Cidade 2001).

Support Strategic Actions: Employ a Compact City Model, Access to Affordable Housing, Reinforcement of Educational Facilities

Article 25: Right of Preemption

(Direito de preempção)

Allows for the municipal government to purchase real estate property for purposes of housing policies, environmental preservation, or the protection of areas of cultural, historical, or landscape importance (Estatuto da Cidade 2001).

Support Strategic Actions: Increase Access to Affordable Housing, Expansion of Water Networks, Wetland Creation, Ecological Connectivity, Rehabilitate Atlantic Forest

Article 9: Special Urban Real Estate Possession

(Usucapião especial de imóvel urbano)

Provides a legal instrument to regularize informal settlements and occupations by allowing a transfer of possession to the persons that occupy a building or dwelling for five uninterrupted years (Estatuto da Cidade 2001).

Support Strategic Action: Access to Affordable Housing, Development of Water and Sanitation Infrastructure

Article 35: Transfer of the Right to Build (TDC)

(Transferência do Direito de Construir)

Allows for the municipality to authorize an owner of a property to exercise their right to build in an alternate location in cases when the property is considered to be an area of environmental, cultural, or historical interest (Estatuto da Cidade 2001).

Support Strategic Actions: Employ a Compact City Model, Wetland Creation, Rehabilitate Atlantic Forest, Ecological Connectivity



Market Governance.

Market Governance promotes the usage of market-based or economic tools to employ accountability and efficiency. Thus, aligning the economic interests with climate adaptation goals to stimulate development or growth. This thesis utilizes these principles and proposes versus economic recommendations for the stimulation of the previously stated actions from the ecological backbone and equitable access strategies.

EQUITABLE ACCESS

Public Infrastructure Subsidy
financial assistance to fund the development and construction of infrastructural projects <i>Support for Strategic Actions: expansion of public transportation + development of water and sanitation infrastructure</i>
Affordable Housing Grants for Community Land Trusts
grant funding to provide the subsidy that allows community land <i>Support for Strategic Actions: increase access to affordable housing (CLT)</i>
Construction Incentives
encourages the development of mixed use typologies <i>Support for Strategic Actions: employ a compact city model + reinforcement of education</i>

ECOLOGICAL BACKBONE

Forest Reforestation Grants
grants given to land owners, farmers, communities, or organizations involved in various forest restoration practices or efforts <i>Support for Strategic Actions: rehabilitate atlantic forest, ecological connectivity, riparian vegetation</i>
Biodiversity Offsets
programs that require companies to compensate for the environmental impacts of their activities by funding climate projects/actions <i>Support for Strategic Actions: wetland creation, riparian vegetation, ecological connectivity, permeable surfaces, rehabilitate atlantic forest</i>
Protection Incentives
financial incentives to landowners and organizations to shift to ecological protective practices <i>Support for Strategic Actions: riparian vegetation, ecological connectivity, permeable surfaces</i>

local adaptation.

OVERVIEW

This chapter elaborates on the design implementation and the illustration of how the previously layed out socio-ecological strategic actions are integrated into a specific context within the Metropolitan Region of São Paulo. Therefore, providing more emphasis on the spatial configuration and the phasing of these actions in a specific case study with the highest overlap of socio-ecological vulnerabilities, chosen from the previous solution exploration case studies.

SECTIONS

■ *design implementation*

Design Implementation.

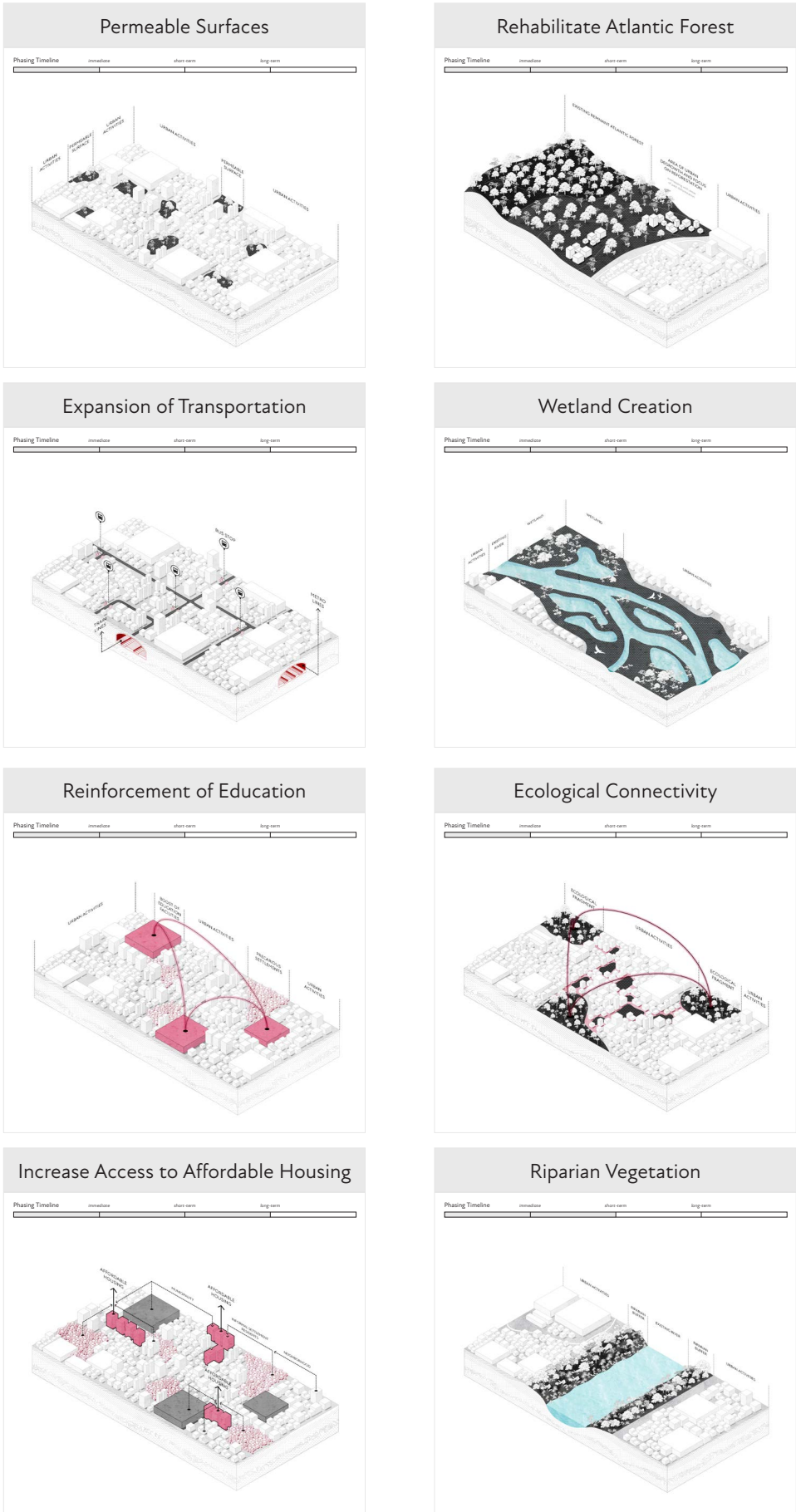


■ FIGURE 110. CASE STUDY
MADE BY AUTHOR

The design implementation focuses on the illustration of how the socio-ecological strategies are integrated into a specific context with the Metropolitan Region that struggles with environmental risks and socio-economic vulnerabilities as

previously established in previous chapters of this thesis. Therefore, the chosen site is located on the margins of the municipality of São Paulo, previously elaborated as area 02 within the exploring potentials chapter.

FIGURE 111. STRATEGIC ACTIONS CHOSEN FOR CASE STUDY ■
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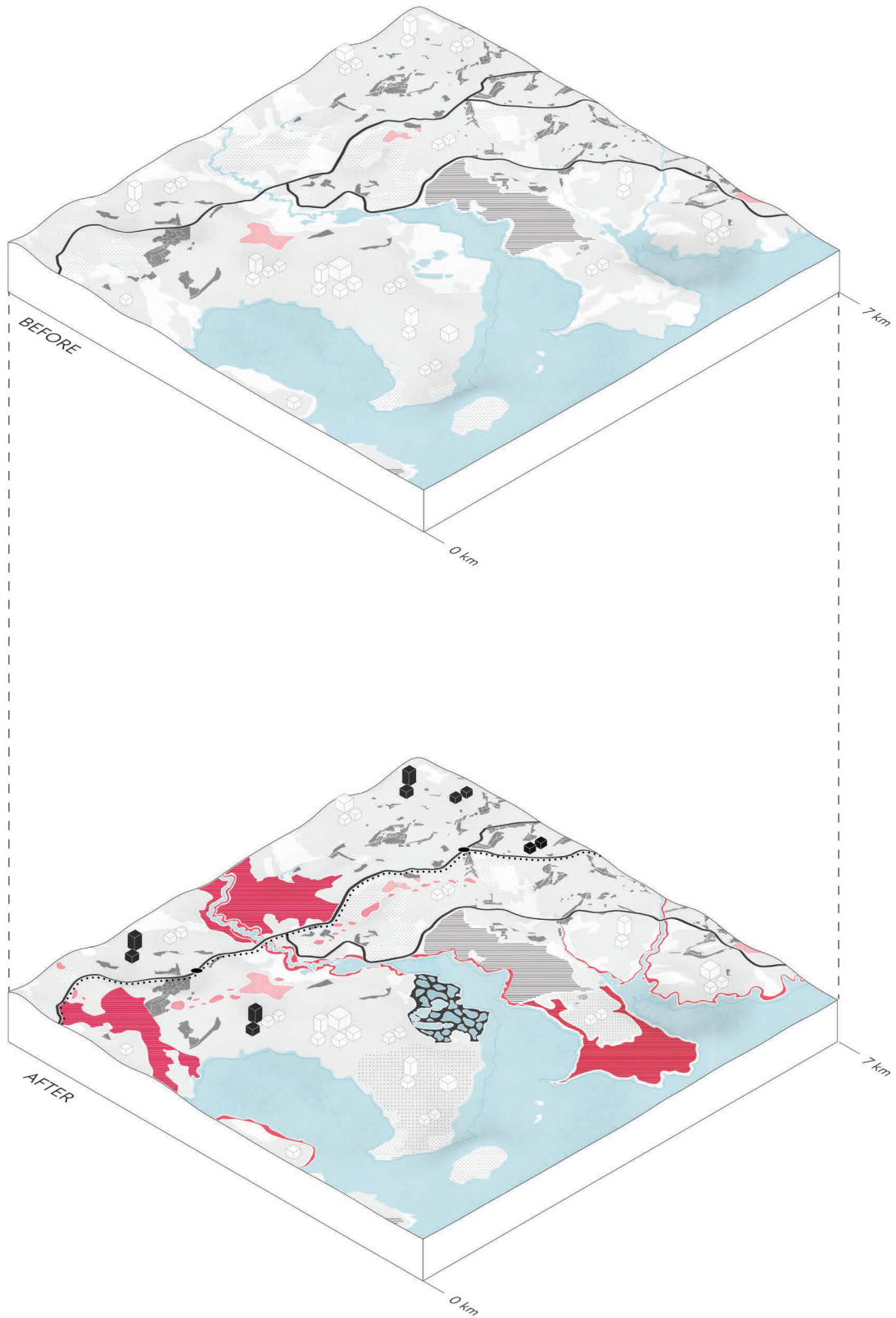


In the case of this area, the overlap of socio-economic and environmental vulnerabilities influence the strategic actions chosen for the design of this area. An exploratory design is elaborated through the lens of establishing an ecological backbone and distributing equitable access to urban services throughout the area. Therefore, this exploration proposes the creation of nature-based solutions to protect the water quality of the nearby Guarapiranga Reservoir, increase the safety of urban environments to

flood hazards, protect the capacity of soil to prevent the events of gully erosion, and promote a healthy forest biome of the remnants of the Atlantic Forest. On the other hand, this proposal supplies the communities residing in this area with actions to assist in promoting socio-economic equality by promoting access to affordable housing through community land trusts, promoting the creation of new educational facilities, and expanding infrastructural networks throughout the area.

FIGURE 112. BEFORE AND AFTER AXO FOR CASE STUDY ■
MADE BY AUTHOR

- forest rehabilitation
- ecological connectivity zones
- riparian vegetation
- wetland
- water
- educational facility
- water
- urban area
- permeable surfaces
- existing irregular settlements
- existing urban green
- affordable housing
- main road network
- expansion of public transportation
- existing ecological reserve
- remaining forest fragments



PHASING

The development of the chosen strategic action for the design exploration demands the implementation process to be broken down into three stages: mobilization of stakeholders, execution and implementation, and evaluation and adjustment. The diagram on the following page (figure 113) thus structures the organization of the strategic actions and practices into a timeline, resulting in a phasing between immediate, short-term, or long-term interventions. In addition, phasing the implementation of specific incentives and subsidies to promote the success of specific strategic actions. Thus, aligning the goals of the research into the development timeline of São Paulo, ensuring an adaptive and inclusive process.

01. Mobilize Stakeholders



Setting up the initial conditions and collaborations between stakeholders to achieve the societal and ecological goals.

02. Implement and Execute



Implementation of key projects and actions. As well as beginning the process of monitoring, reporting, and evaluating.

03. Evaluate and Adjust

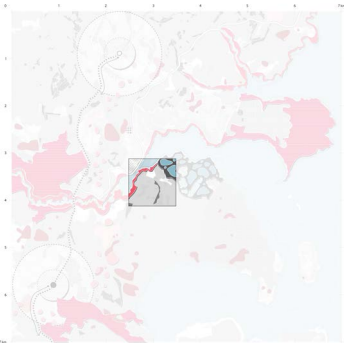


Evaluating of the performance of strategic actions. Followed by periods of adjustment based on the changing conditions. To overall create a responsive and adaptive process.

FIGURE 113. PHASING TIMELINE ■
MADE BY AUTHOR



01. PROPOSED DESIGN SOLUTION



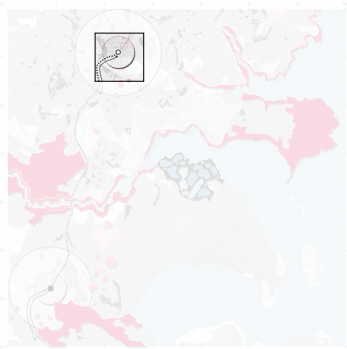
Area of flooding risk, low water quality, and susceptibility to gully erosion events.

The proposed design solution for this localized area focuses on strategic ecological actions by construction of riparian vegetation along the reservoir to mitigate flooding risks and increase the water quality. In addition, this area explores the creation of a wetland and the rehabilitation of an adjacent forest landscape.



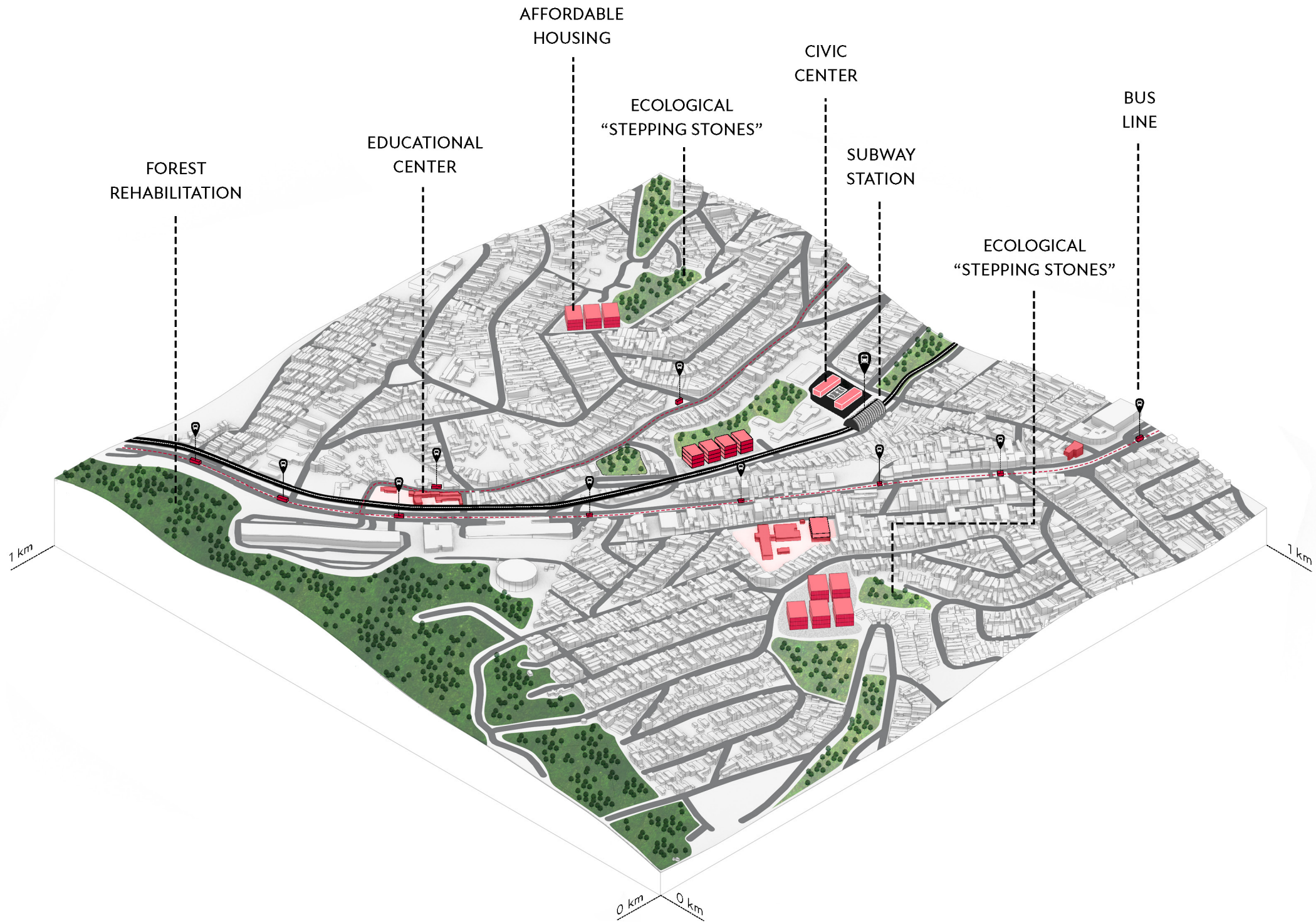
FIGURE 114. ZOOM IN 01 EXPLORATORY DESIGN ■
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02. PROPOSED DESIGN SOLUTION

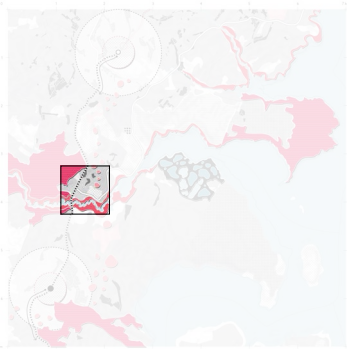


Area of dense urbanization with informal settlements and existing forest fragment.

The proposed design solution for this localized area focuses on strategic equitable actions through developing affordable housing, developing and boosting existing educational facilities within the area, expanding the public transportation networks, and improving community spaces. In addition, ecological actions by developing ecological ‘stepping stones’ adjacent to the forest rehabilitation project.

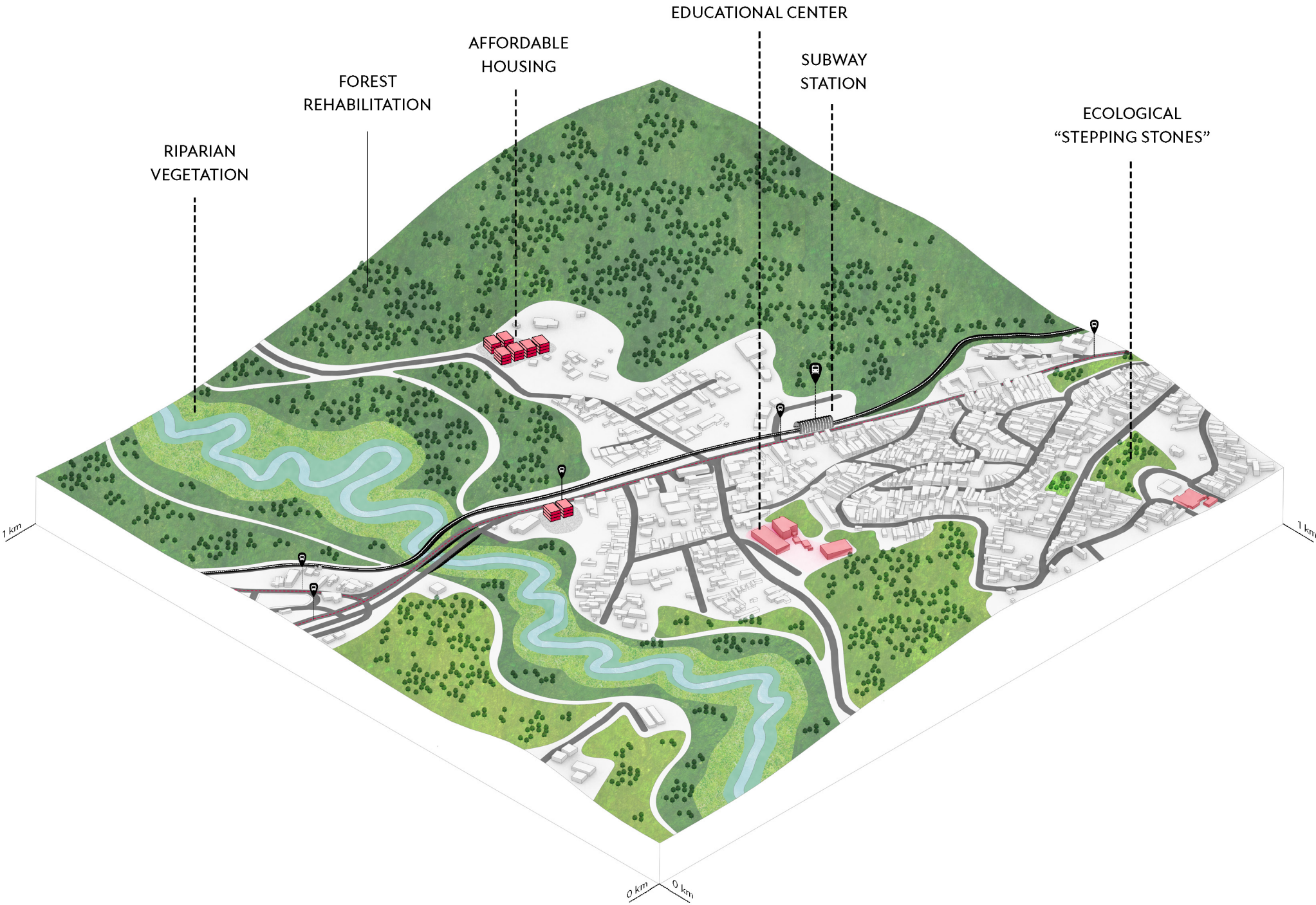


03. PROPOSED DESIGN SOLUTION



Area of flooding risk, low water quality, existing primary forest fragment and presence of informal settlements.

The proposed design solution for this localized area focuses on strategic ecological actions by construction of riparian vegetation along the river to mitigate flooding risks and increase the water quality. In addition, this area explores the focus preserving the forest biome and biodiversity of area through forest rehabilitation efforts and creating of ecological ‘stepping stones’. This design also explores the boosting of existing educational facilities, creating affordable housing, and expanding the public transportation line.



CONCLUSION

Reflection (p. 264)

References (p. 268)

reflection.

THE RELATIONSHIP BETWEEN THE GRADUATION TOPIC, THE URBANISM TRACK, AND THE MSC PROGRAMME.

This graduation project is linked with the Urbanism Track and graduation studio, Planning Complex Cities, through research that focuses on changing the arrangement of spatial development patterns and planning systems in the contested environment of São Paulo. The contribution of this research to the graduation studio involves the exploration of creating a strategic framework for socio-ecological resilience in metropolitan regions riddled with tensions and walls. In regards to the graduation programme, this thesis contributes to the built collection of master research through the exploration of the spatial perspective of complex issues of socio-economic vulnerabilities exacerbated by the rising effects of climate change and ecological degradation in the context of the Global South. A context that is not exposed enough by the international teachings of this master's program.

RESEARCH APPROACH

The approach at the beginning of this research was oriented toward the focus on social vulnerabilities in extremely marginalized communities within the city

of São Paulo. Primarily centering around the spatial polarization of communities and the enactment of both physical and non-physical walls present in Brazilian society. However, as the research continued to formulate into a thesis, I developed further insight into the pressing risks and vulnerabilities that these marginalized communities continue to face every day as a result of historical isolation. Additionally, the lack of published research I found in relation to this topic while on the other side, the abundance of explorative and investigative research into the primary topic of this thesis established a need to adapt to the research gaps. Thereby, this research has been adapted to respond to these pressing issues encountered in the process. This leads to the subjects of socio-ecological resiliency to combat the increasing vulnerabilities and risks that communities, especially historically marginalized neighborhoods, face in the present day.

The impacts of climate change, patterns of ecological degradation, and a historical pattern of social segregation formulate a topic of extreme complexity; one that is impossible to fully grasp in the one-year period of this thesis. Thus, this research focused on the production of outcomes that this thesis found to be necessary for the trajectory of developing solutions to this complex, wicked problem. In line with that, this research does not adhere to a set or traditional urban design solution but rather explores social, ecological, and political opportunities. The outcomes of this thesis were formulated into four final products outlined on different scales: a

vision of development for the metropolitan region, socio-ecological strategic actions or guidelines, local adaptation of the guidelines in a spatialized environment, and an informational manual. Each outcome is framed as a valuable piece that corresponds to gaps found in the Brazilian societal and planning system through the analytical framework.

RESEARCH METHODS

The methods for data collection and analysis that were established in the preliminary stages of this thesis predominately held true. However, towards the end of the research, the methods were partially adapted with the addition of a new technique. As a response to new knowledge found through the analytical framework of socio-ecological systems and socio-economic vulnerabilities, the method of an online survey questionnaire was introduced to this research in later stages. Initially, the method of a survey was not incorporated into this research, with the main approaches on the analytical framework set up as transcalar mapping, stakeholder analysis, data analysis, and more. However, as new barriers present in Brazilian society to implementing climate adaptation solutions were uncovered, it became evident that gathering on-the-ground insight from the employees of the organizations and companies that were under study would become crucial. Although introducing the survey in the earlier stages of this research would have been beneficial to allow an opportunity of receiving more feedback, this method

still had substantial influence over the direction of this research. Regardless of the time constraints, the outcomes of the survey resulted in reflections on the role of urbanism in tackling an enormous and multi-scalar issue.

ACADEMIC AND SOCIETAL VALUE

This thesis project addresses a critical issue in the field of environmental justice by examining the relationship between socio-spatial inequality and environmental degradation in the context of Brazil. The findings of this research have significant implications for addressing the challenges faced by many societies worldwide as they struggle with the effects of historical rapid urbanization, increasing inequality, and a lack of resilience in the face of an uncertain future. The trends of poorly planned urbanization in combination with increasing pressures from climate change on socio-ecological systems reveal the unpreparedness of cities worldwide to face these challenges. Socio-spatial inequality and sustainability are terms widely used in the development of cities. However, often, the effects of plans and designs on already marginalized communities are overlooked. These challenges disproportionately affect lower-income communities, widening the gap between the rich and poor and exacerbating vulnerable communities, pushing them into unprotected environments susceptible to dangerous socio-environmental events and risks. This project aims to expose and raise awareness of the need for ecological action to promote trust and justice within societies

exacerbated by these challenges. Previous planning systems and tools in São Paulo have attempted to mitigate segregation and fragmentation through policy tools and local-scale designs. However, these efforts have been largely ineffective due to a lack of a broader vision for the city’s development. This thesis offers an alternative approach by highlighting the importance of understanding socio-ecological systems and using this knowledge to guide the development of a just and equitable society in the Global South. Furthermore, this research contributes to the knowledge systems of Brazil by providing valuable insights into the shortcomings of current practices and offering new strategic proposals that promote social and environmental justice in vulnerable areas, increase their resilience, and integrate these communities into the formal fabric of the city. Overall, the analytical framework of this thesis can play a valuable role in promoting sustainable and equitable strategies for development in Brazil.

ETHICAL DILEMMAS

The most evident ethical dilemma of this research, which was apparent from the beginning stages, was the limitations of developing a thesis in a context that lies on the other side of the world. On several occasions, concerns were brought up if this research would be possible with these prominent limitations of access to local data and access to the site. Especially as this research was exploring an extremely complex issue in a very contested environment, however, this concern

was addressed throughout the thesis with an extensive and comprehensive analysis of digital data that was available through various data platforms and sources. Although there were barriers to gathering data on small-scale elements (factors on the district scale in terms of topography, housing types, demographics, etc.), it simply restructured this research to focus on a more extensive and holistic dimension rather than developing a thesis proposal that centers on the small-scale. Through alternating the scale of the thesis, it provided a focus on developing strategies and strategic interventions that can be applied to various contexts within the Brazilian landscape. However, with the necessity to elaborate on a broader scale came the importance of incorporating governance and economic models into the research. As time is constrained through the development of this thesis to a one-year period, these subjects were not developed to their fullest potential. Thus, providing an important topic to be further explored by an alternate team of researchers or professionals. On another note, the ethical implications of a researcher’s background and its influence over the thesis subject are vital to consider in any research. Therefore, it becomes crucial to acknowledge that although the research stems from personal ties to Brazil, my background is not grounded in the local context of this thesis. The process of this research prepared for the potential bias arising from a Western background by structuring the selection of mentors towards those that possess local knowledge of the context. As well, mitigating the bias influences by grounding

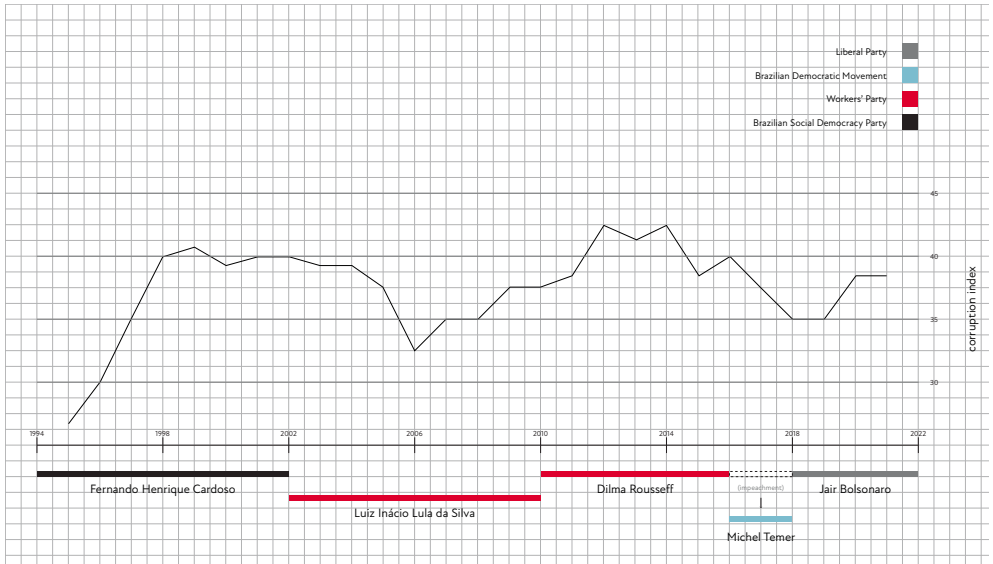
the research in extensive contextual and data-driven analysis. Although our roles as a designer require taking a critical stance and in various instances, applying our background and passionate opinions towards research proposals, continually reflecting on personal biases and engaging in critical discussions contribute to providing a comprehensive response to various ethical concerns.

RESEARCH LIMITATIONS

Lastly, the complexity of issues that involve the adaptation of environmental risks and the alleviation of social inequality have continuously been linked to the limitations bound by political polarization, oppressive

administrations, and corruptive practices in Brazilian governance. As explained briefly through the research, this thesis developed alternate strategies that cover the discourse over the execution of plans or policies by enabling more accountable and transparent systems. However, it is important to stress that although our roles as urban planners or designers are impacted by these political systems and practices, these limitations are present in every aspect of research and are often too complex for a one-year thesis. Thus, additional interdisciplinary research is required within this field of discussion to adequately address these limitations of extreme political polarization and corruption.

FIGURE 117. CORRUPTION INDEX TABLE ■
MADE BY AUTHOR
SOURCED FROM TRADINGECONOMICS.COM



The corruption perception index from Trading Economics ranks countries based on how corrupt their public sector is perceived to be from a scale of 0 (highly corrupt) to 100 (not corrupt). Brazil,

as of December 2021, is ranked with a corruption index of 38. Which is equivalent to countries such as Turkey, Serbia, Argentina, and Indonesia.

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