



PERMEATING SOCIO -
ECOLOGICAL WALLS

Permeating

S O C I O - E C O L O G I C A L

Walls.

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

Larissa Muller

5465664

01. ■

PROBLEM ANALYSIS

Multi-dimensional Inequality

02. ■

FRAMEWORK

Concepts and Theories

03. ■

STRATEGIES

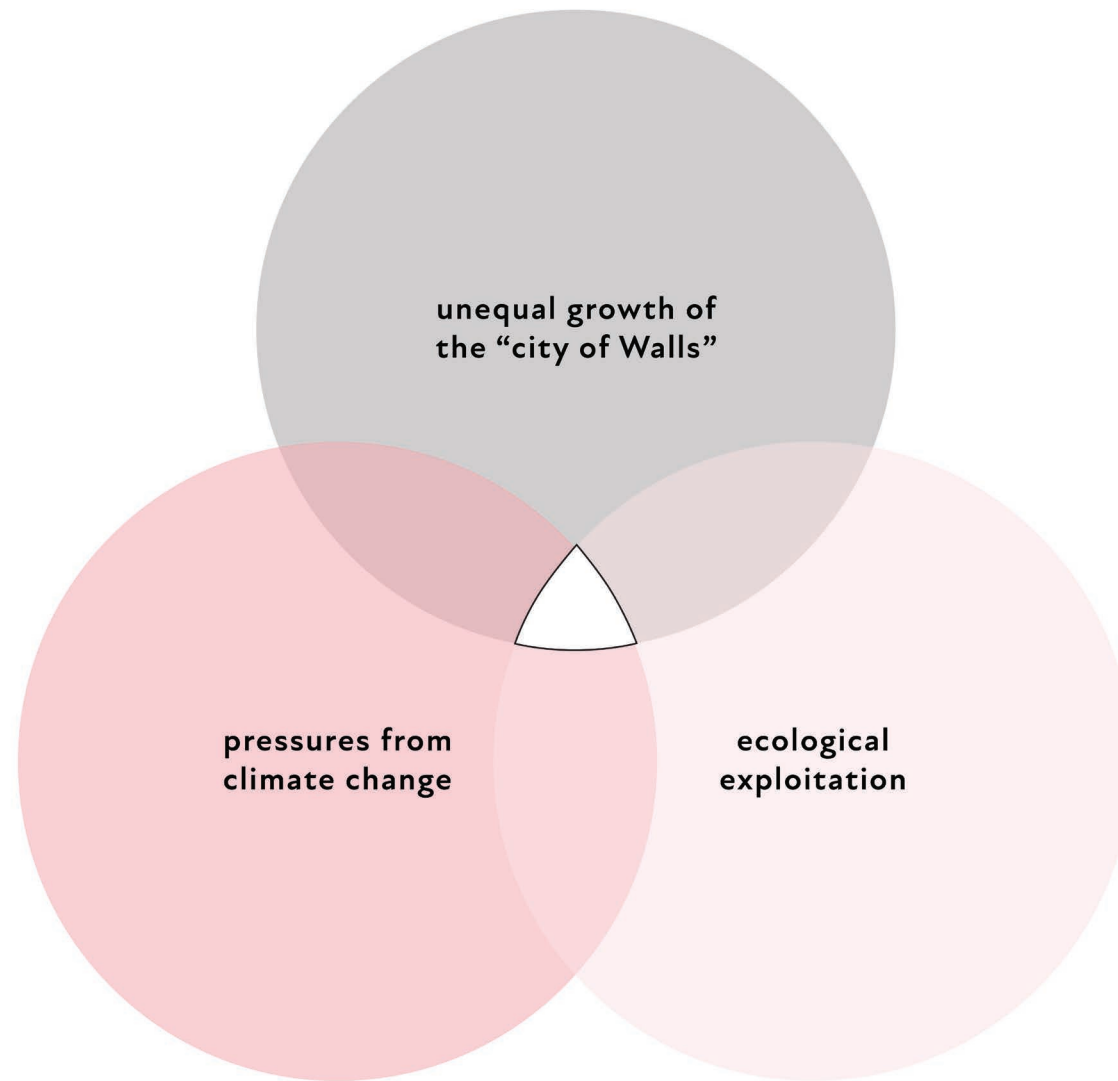
Inclusive Climate Adaptation

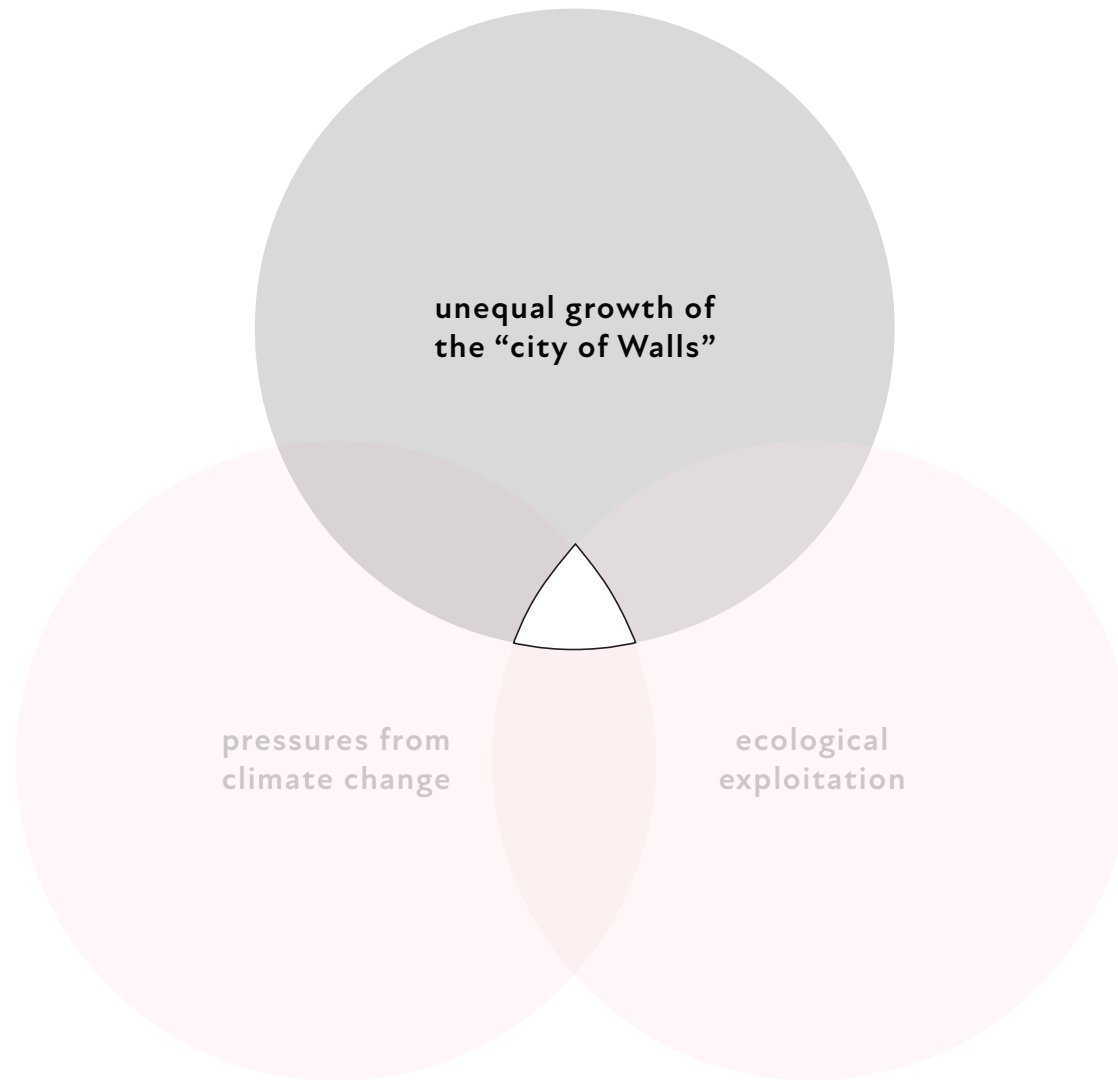
04. ■

CONCLUSIONS

Local Implementation







“THE CITY OF WALLS”

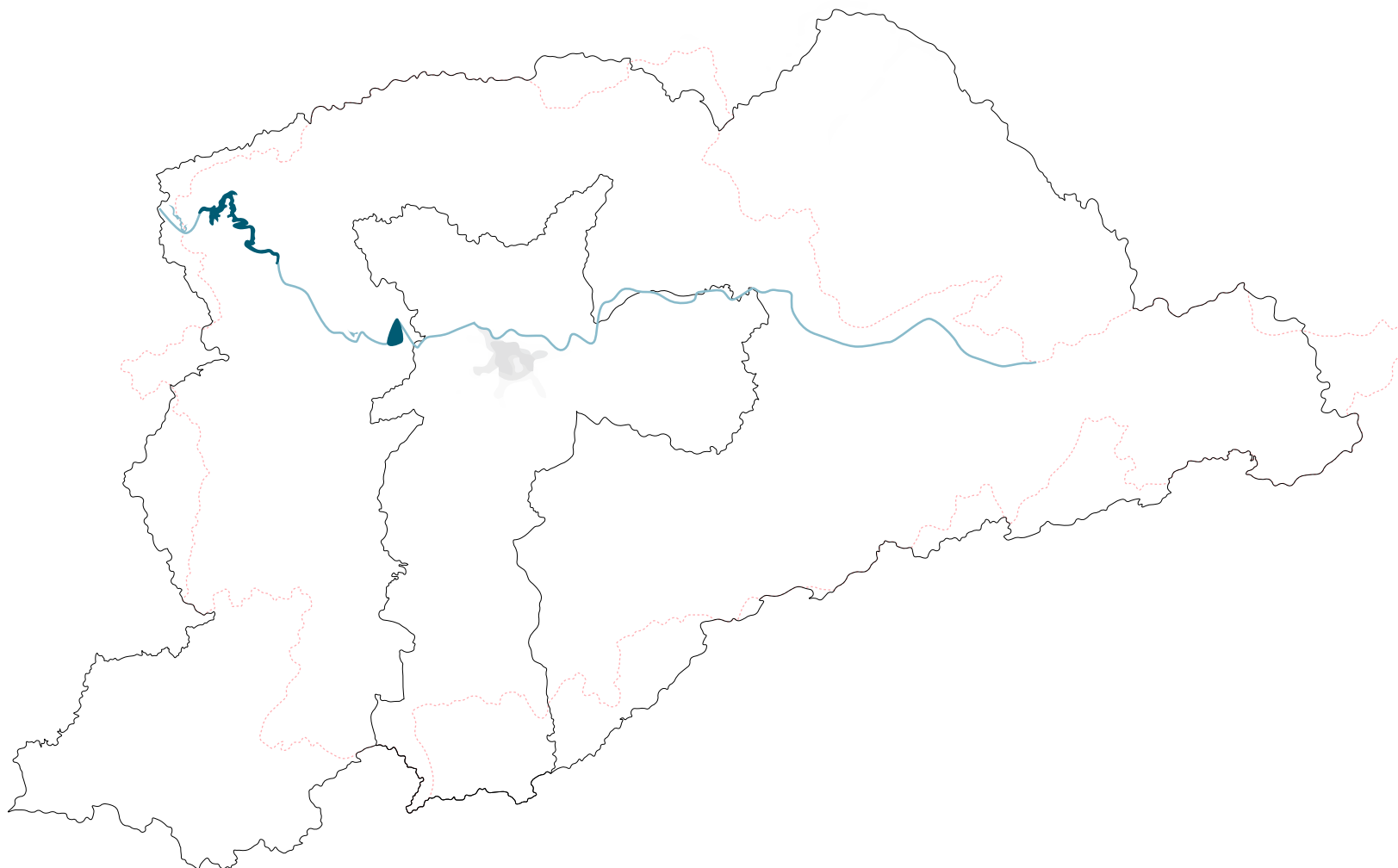
patterns of segregation that were formed from
underlying socio-political structures



1905

urban expansion 
existing reservoir 
reservoir under construction 
alto tietê basin 

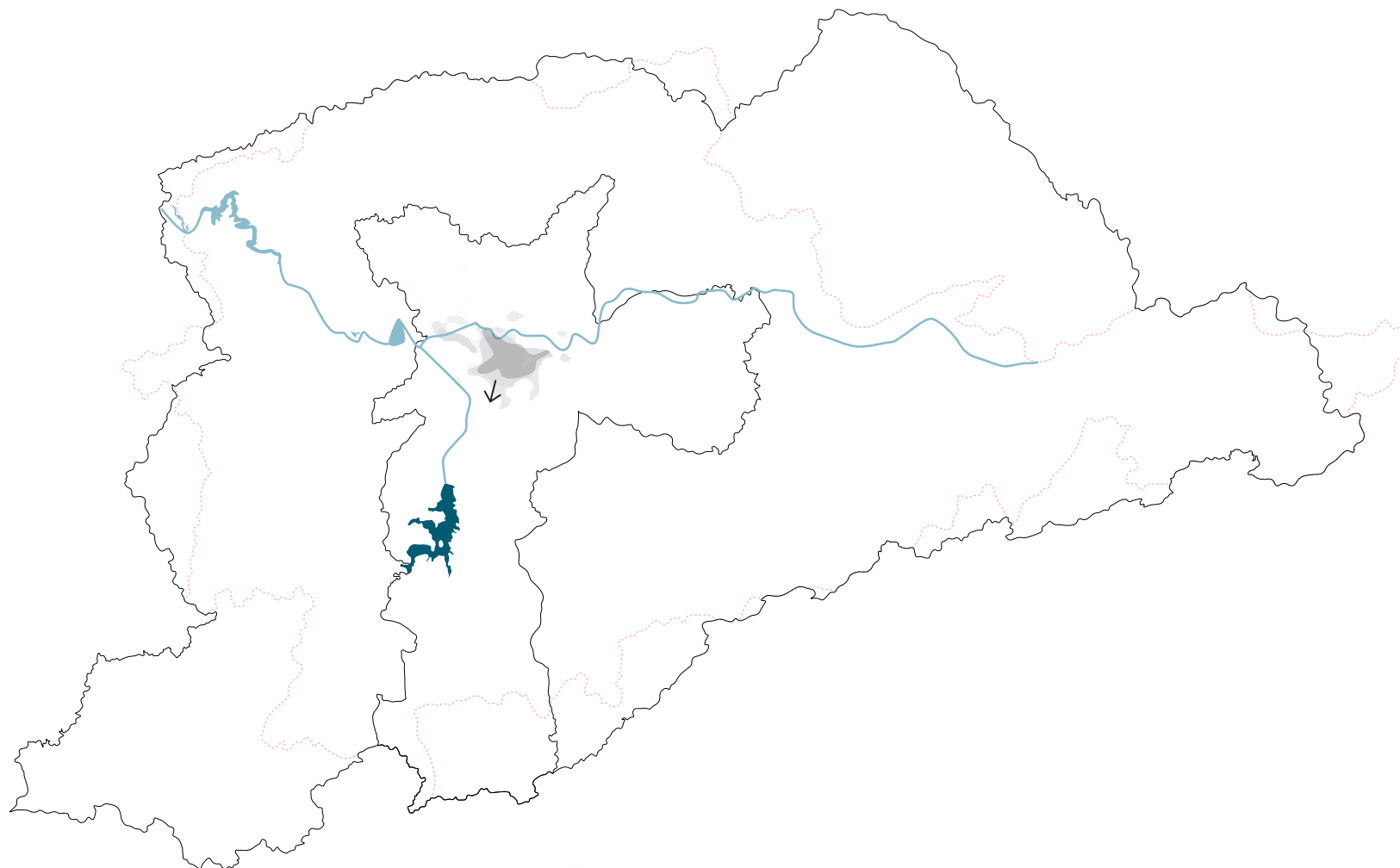
0 20 40 km

1914

urban expansion 
existing reservoir 
reservoir under construction 
alto tietê basin 

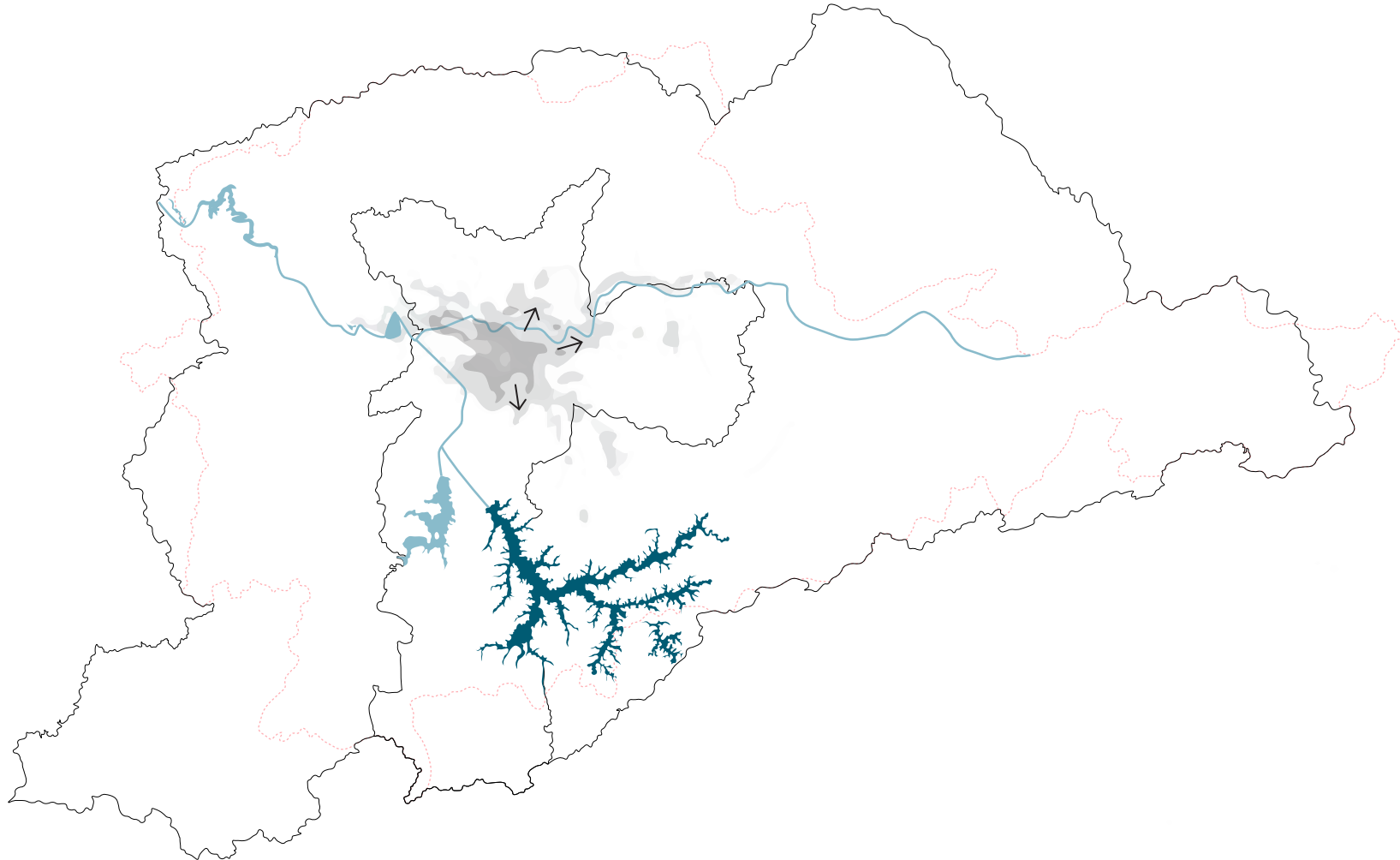
0 20 40 km

1930

urban expansion 
existing reservoir 
reservoir under construction 
alto tietê basin 

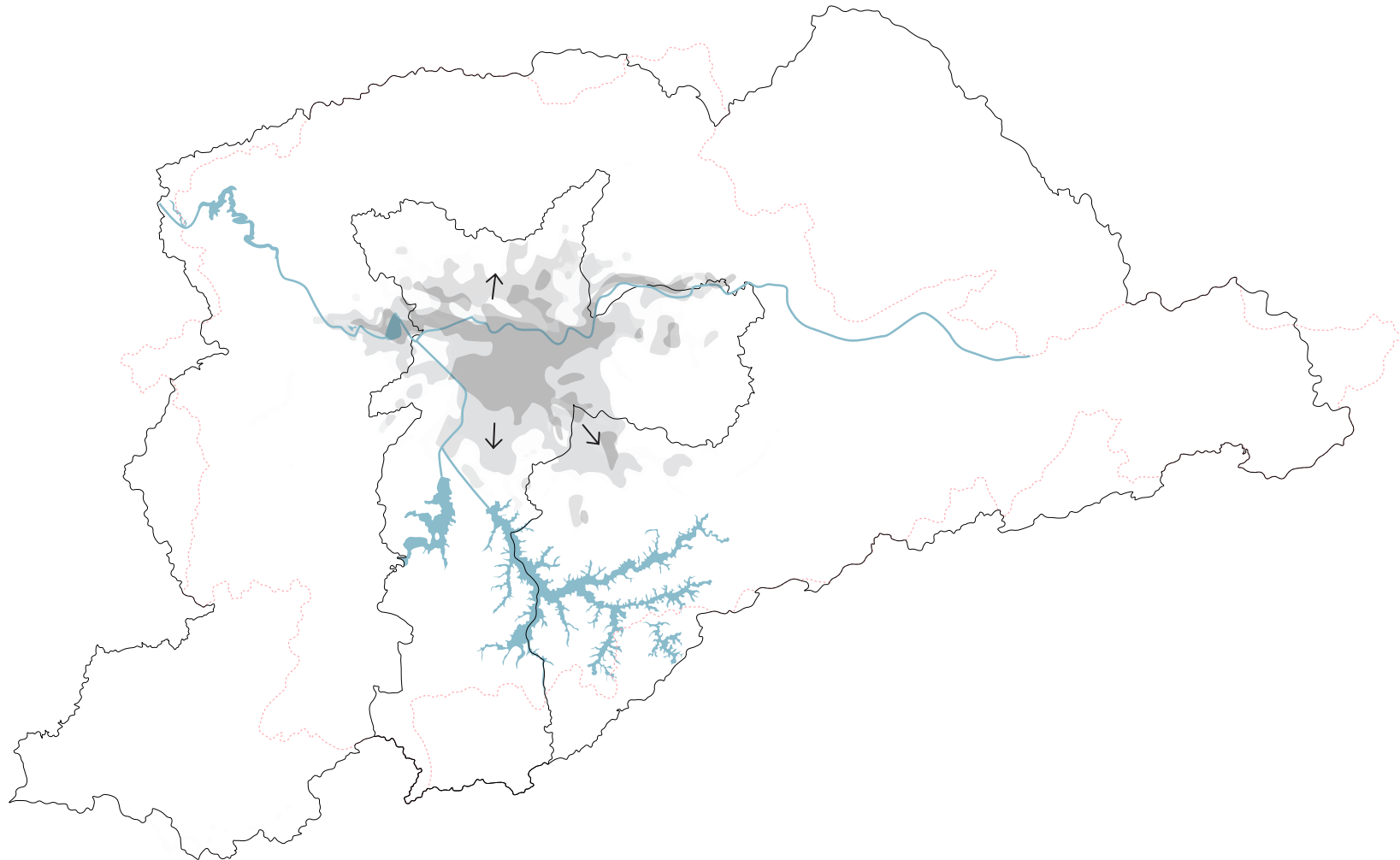
0 20 40 km

1952

urban expansion 
existing reservoir 
reservoir under construction 
alto tietê basin 

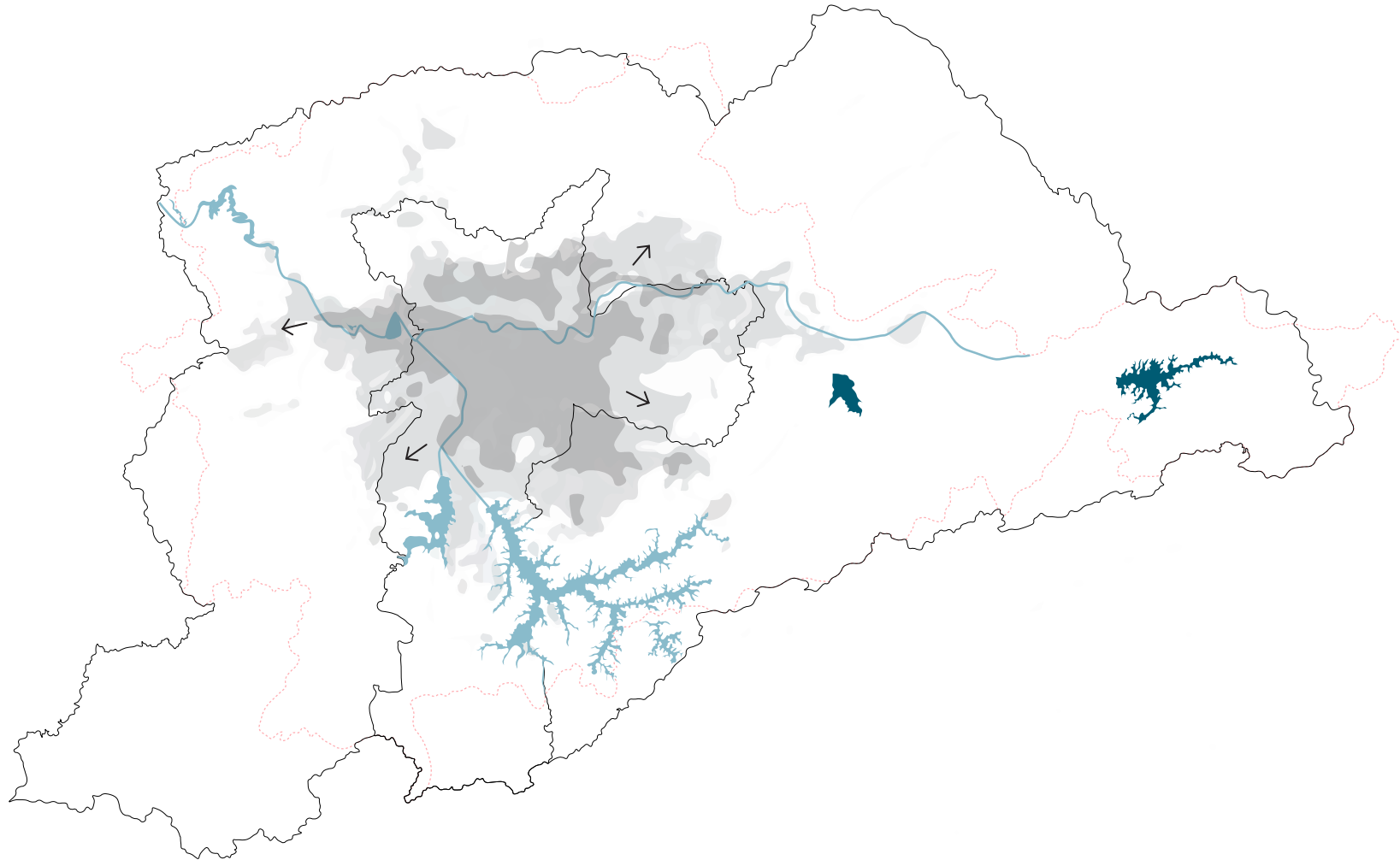
0 20 40 km

1983

urban expansion 
existing reservoir 
reservoir under construction 
alto tietê basin 

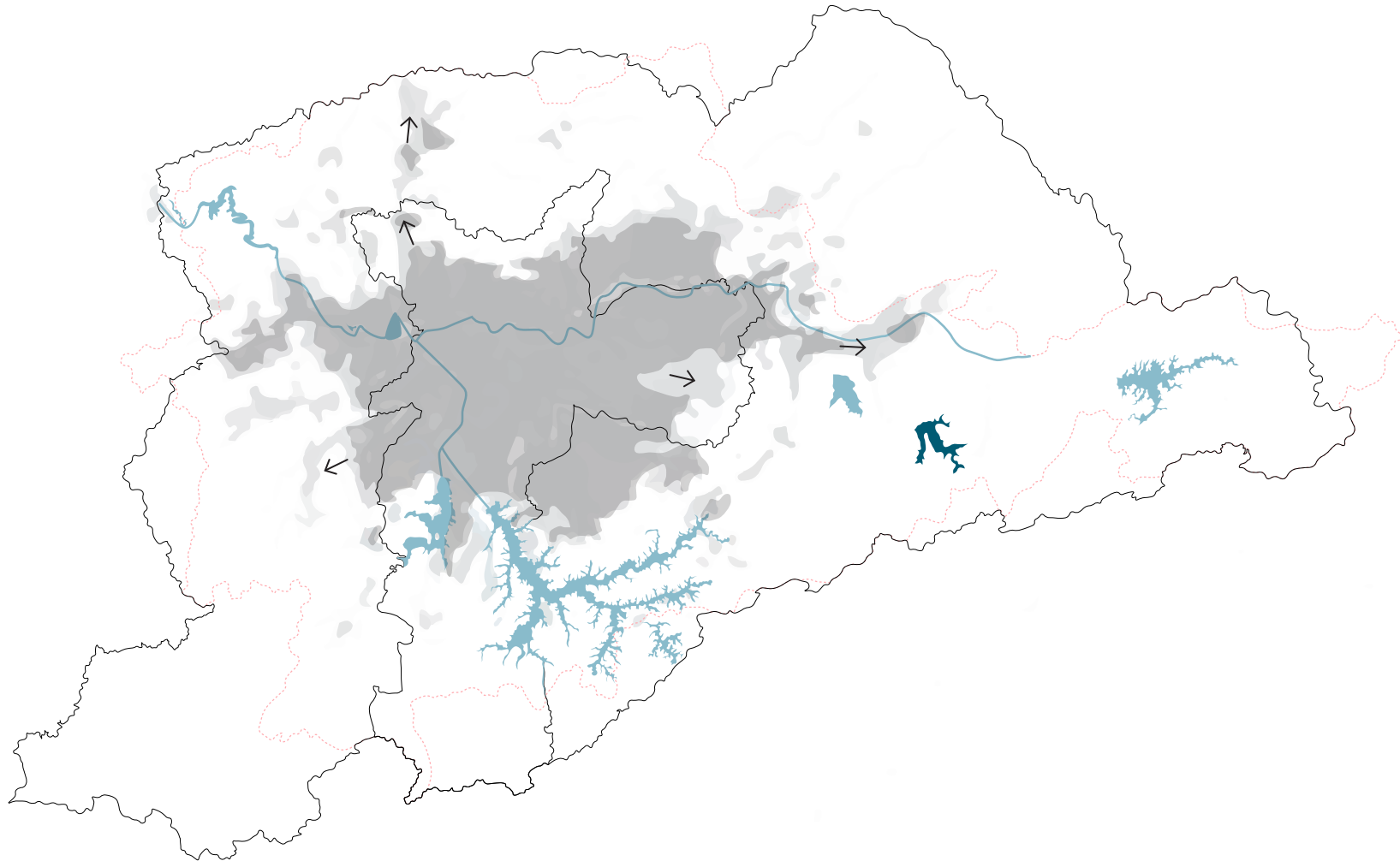
0 20 40 km

1995

urban expansion 
existing reservoir 
reservoir under construction 
alto tietê basin 

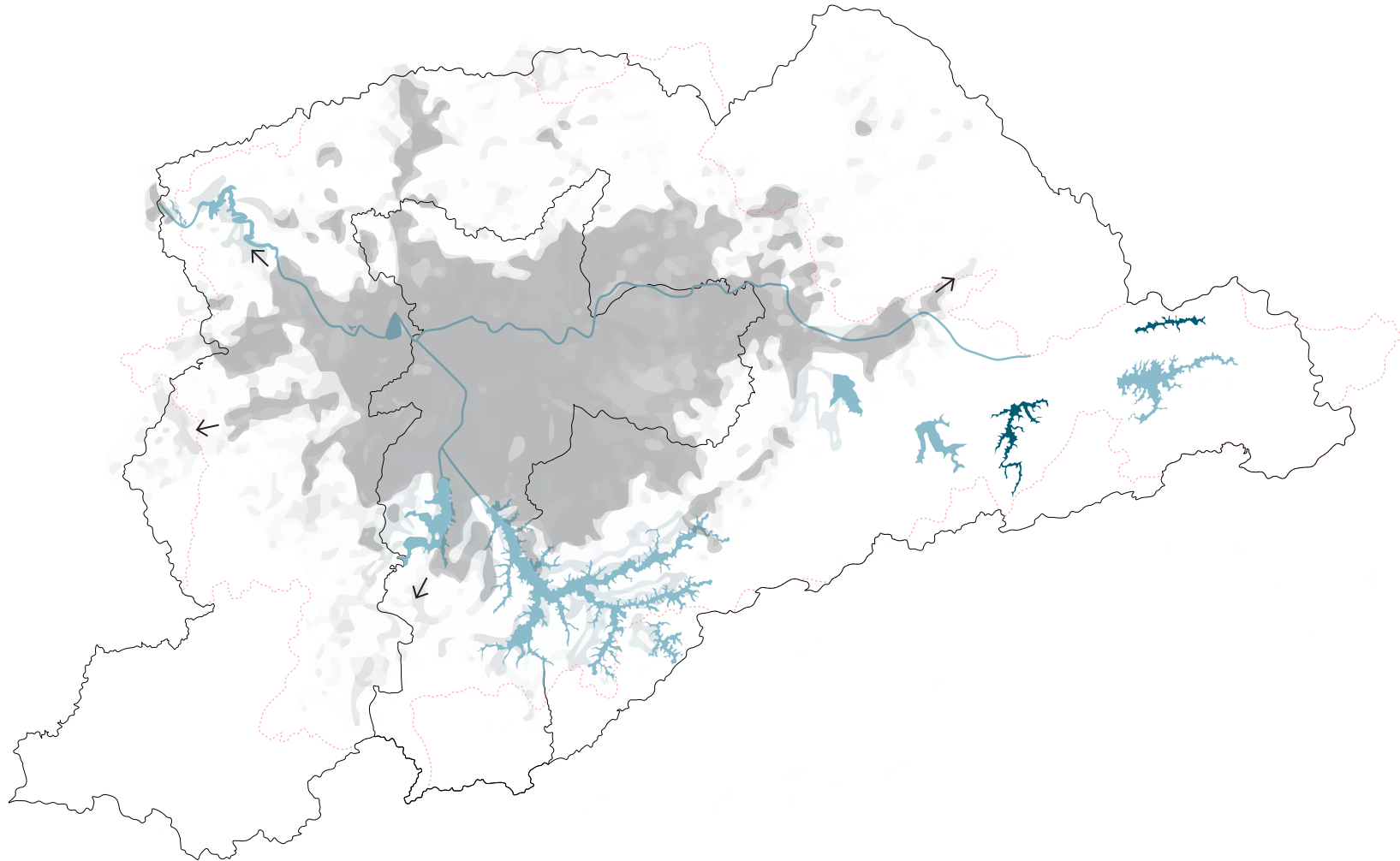
0 20 40 km

2010

urban expansion 
existing reservoir 
reservoir under construction 
alto tietê basin 

0 20 40 km

TODAY

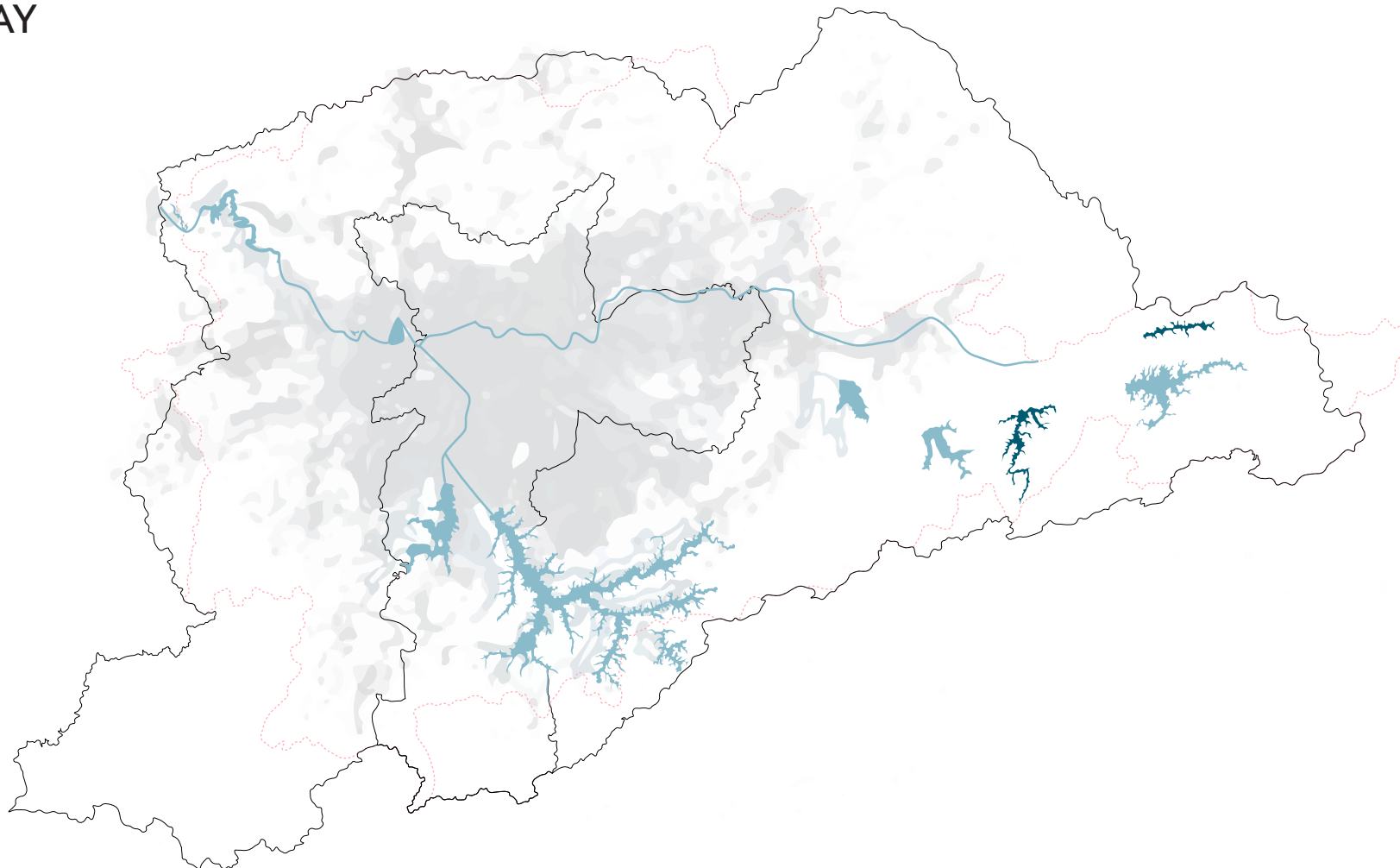
urban expansion 

existing reservoir 

reservoir under construction 

alto tietê basin 

0 20 40 km

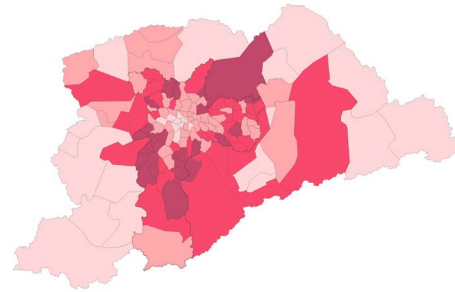




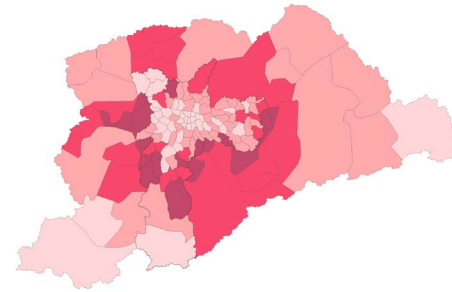
01 02 03 04

SOCIO-ECONOMIC VULNERABILITY

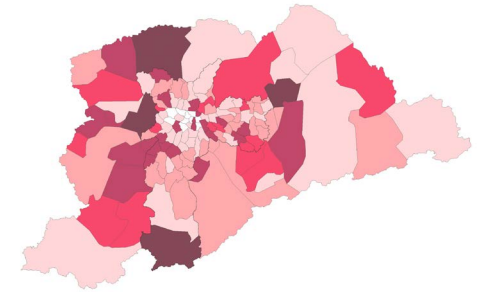
Households in Favelas



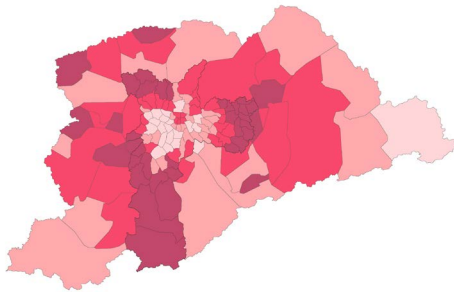
Population density



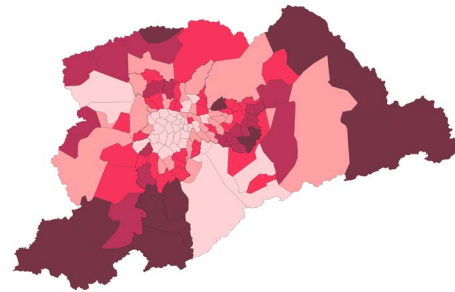
Rate of students that dropped out of schooling



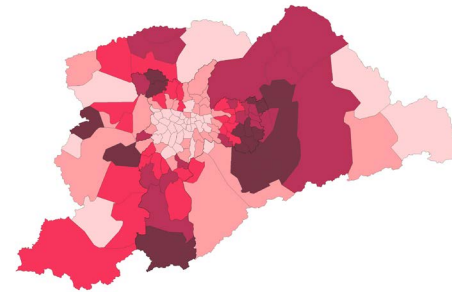
Proportion of minorities
preta e parda



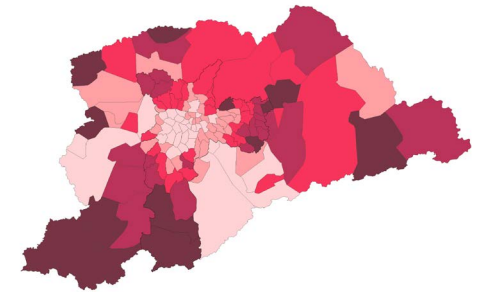
Percentage of population
in informal occupations



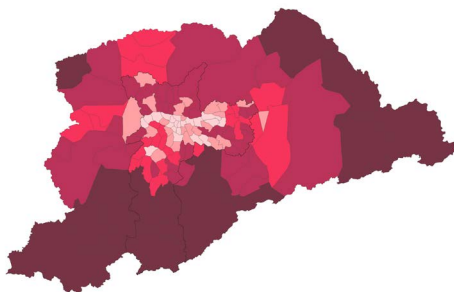
Unemployment rate
over 18 years old



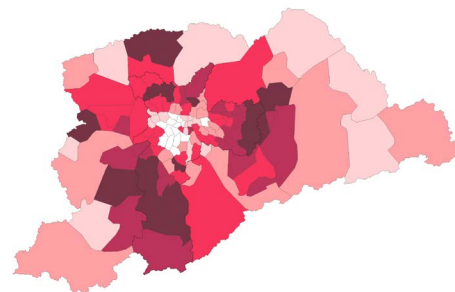
Proportion of people with
low per capita income



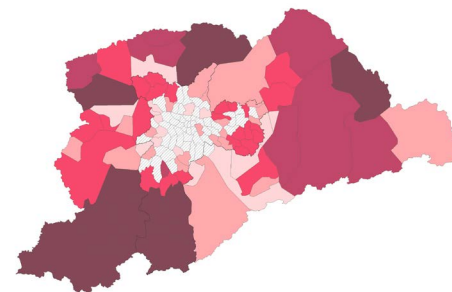
Access to mass transit



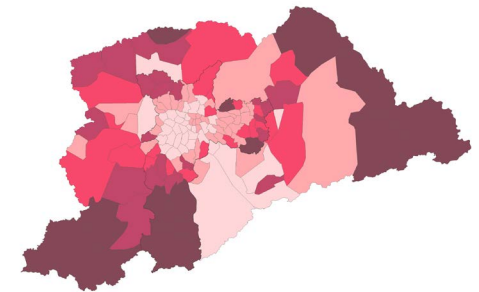
Percentage of low income
households with long commutes



Households with
inadequate water



Illiteracy rate
over 15 years old



0 20 40 km

SOURCES

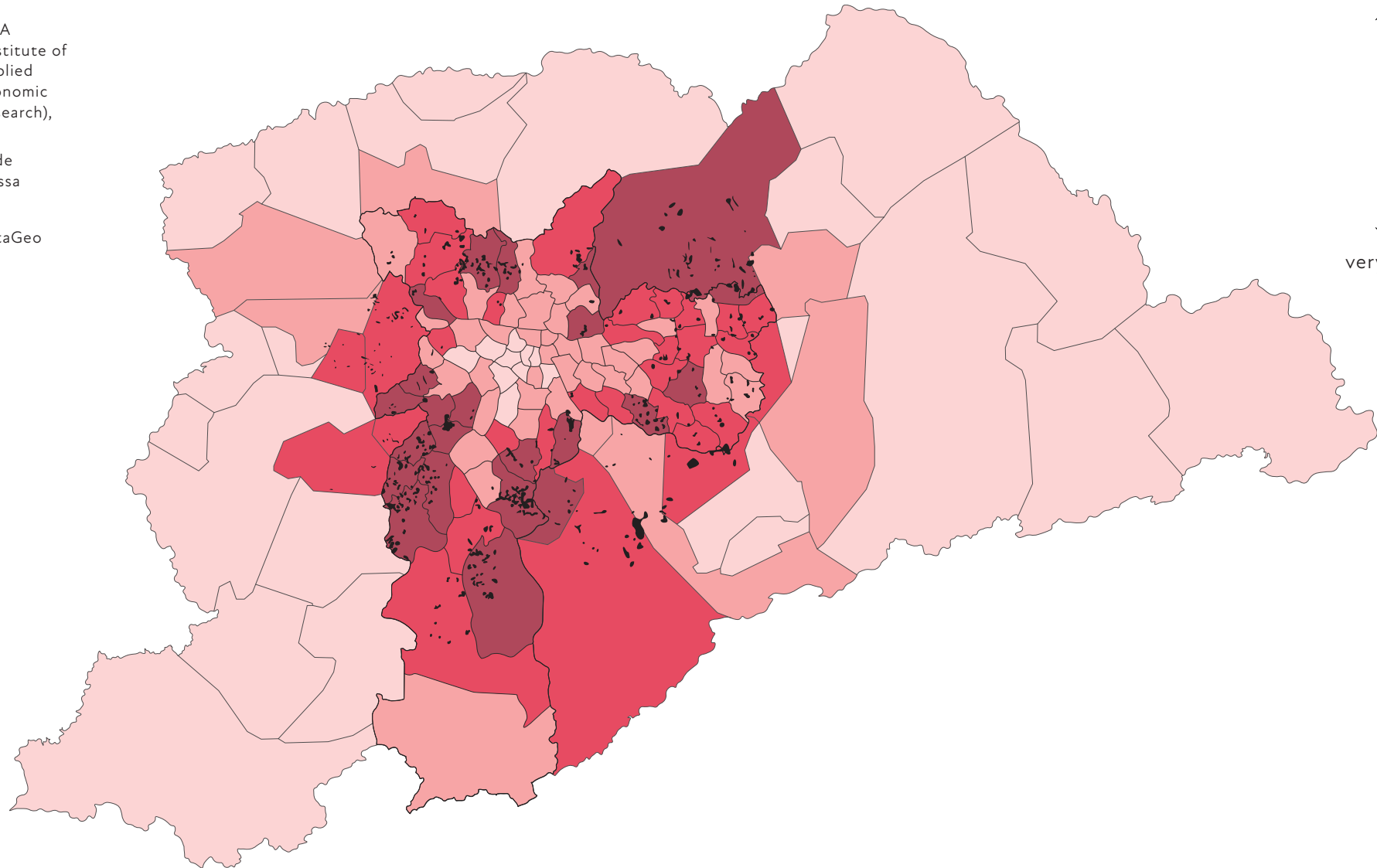
- IPEA
(Institute of
Applied
Economic
Research),
- Rede
Nossa
- DataGeo

favelas

very high



very low





Favelas: an informal settlement typology characteristic of Brazilian cities

Source: Roberto Rocco

0 20 40 km

favelas

socio-economic vulnerable municipalities

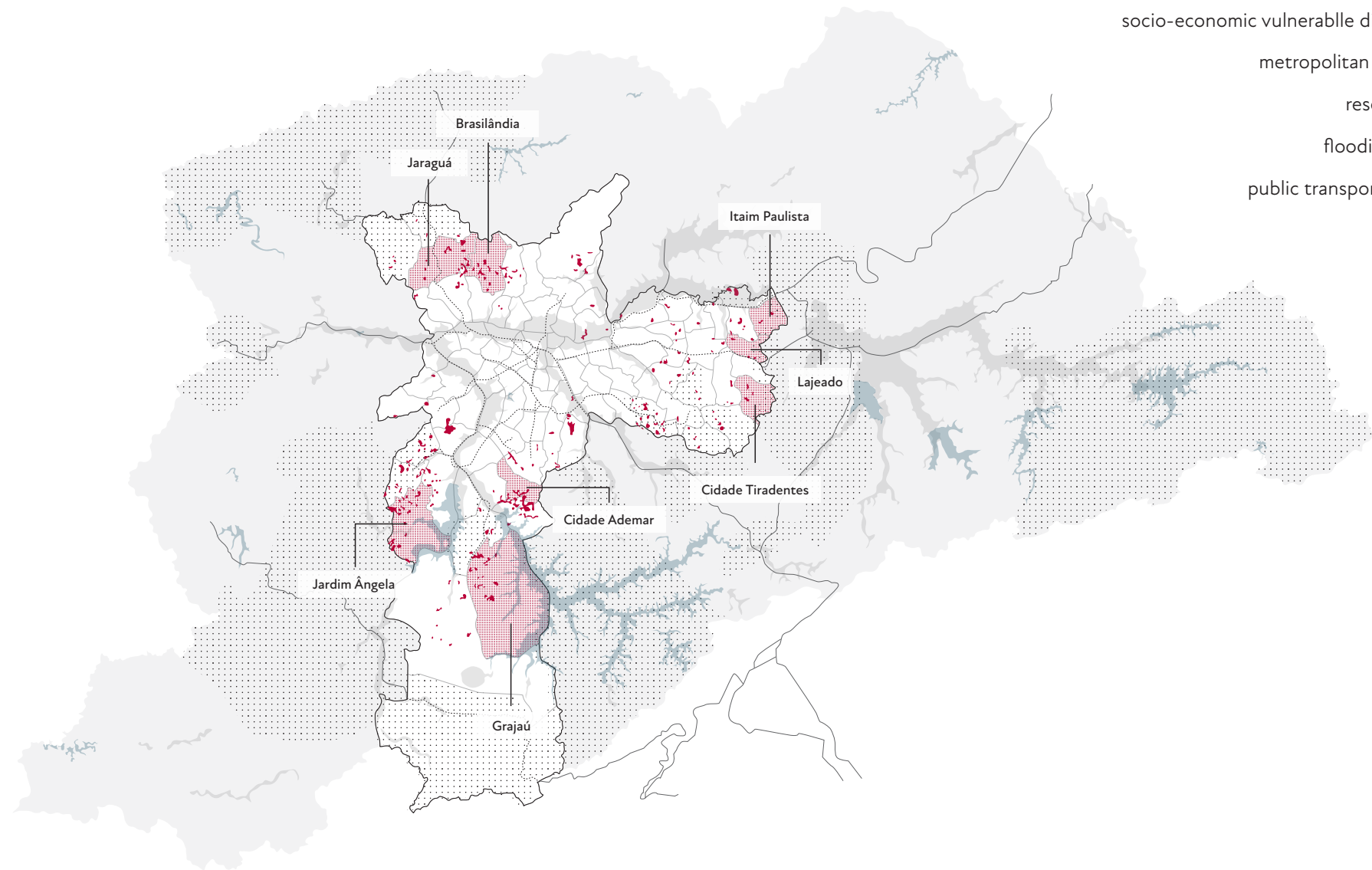
socio-economic vulnerable districts

metropolitan region

reservoirs

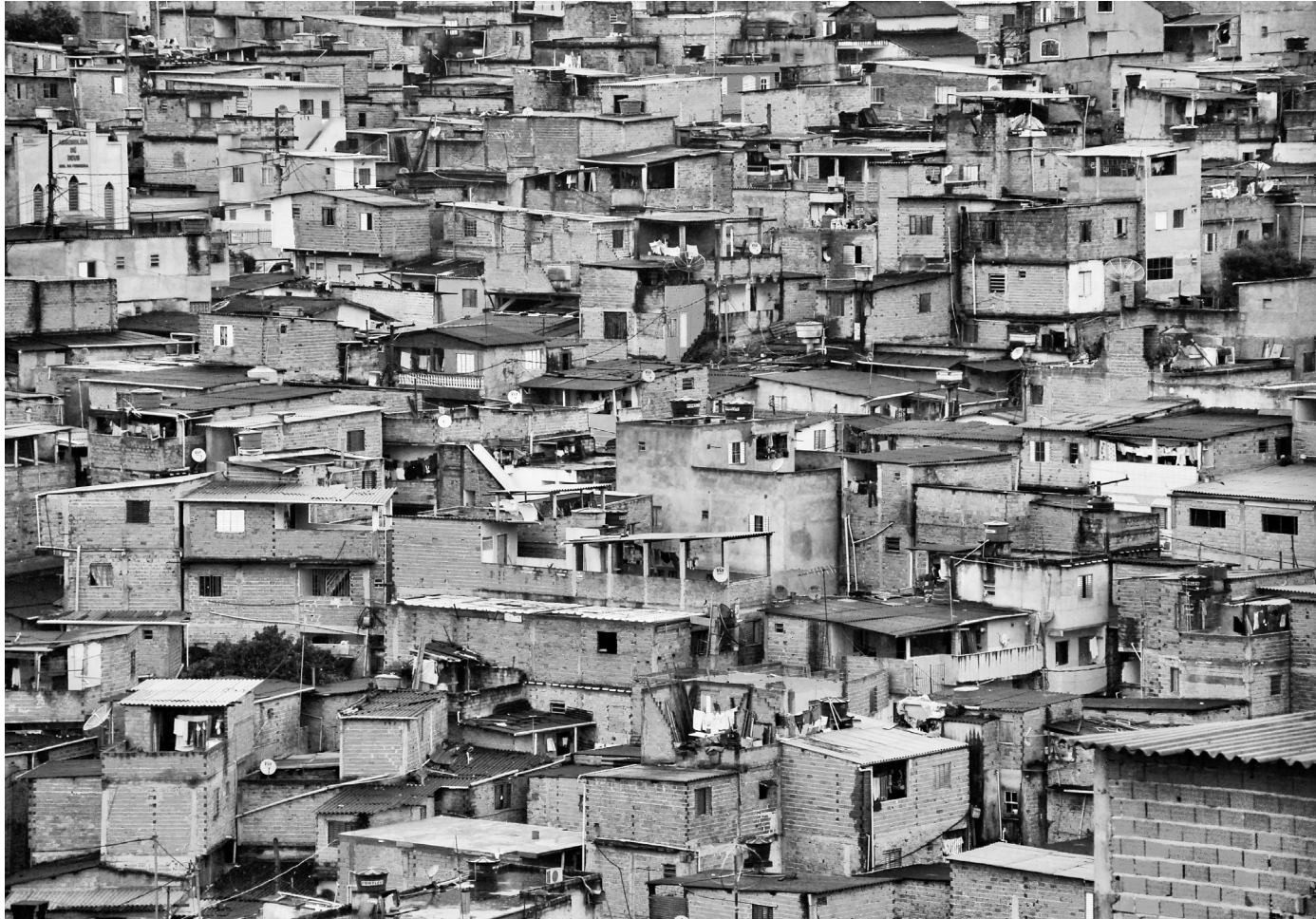
flooding risk

public transportation ---

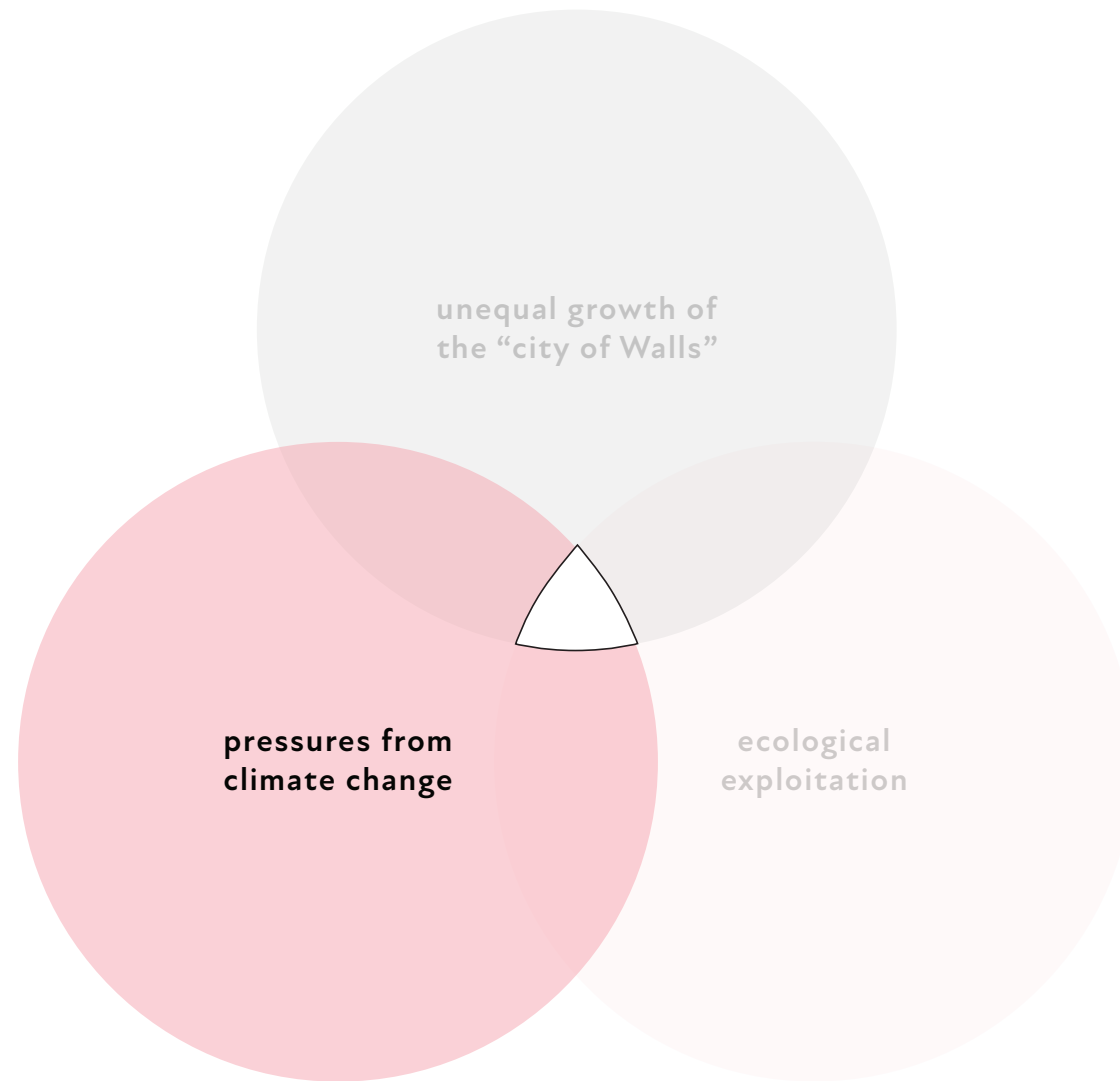


“THE CITY OF WALLS”

- Caldeira, 1999



Source: Roberto Rocco





INTENSIVE RIVER AND URBAN FLOODING

0 10 20 km

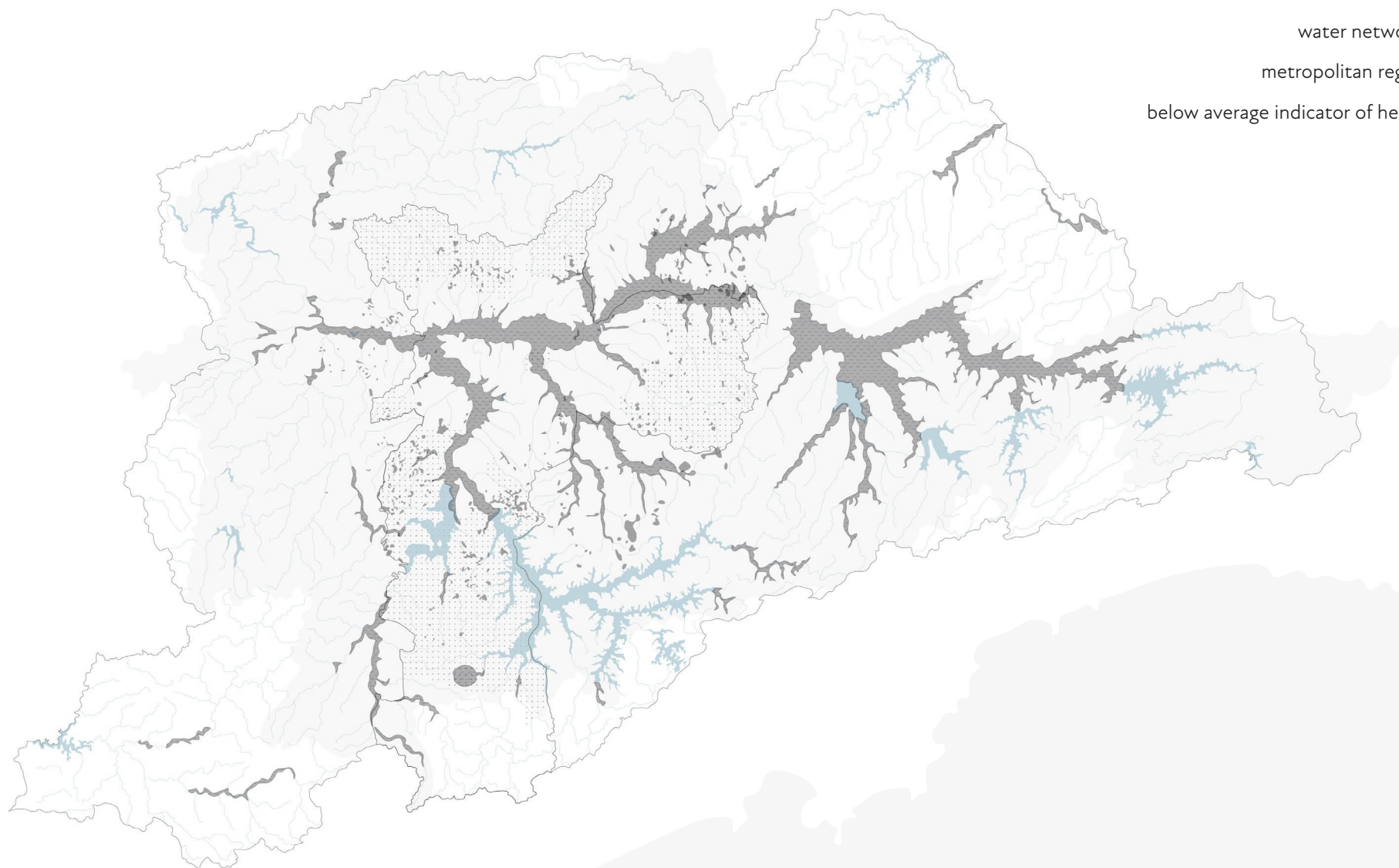
flooding risk

alto tietê basin

water networks

metropolitan region

below average indicator of health





The combination of the effects of global warming as the problems of urban displacement

Source: Floodlist, 2019

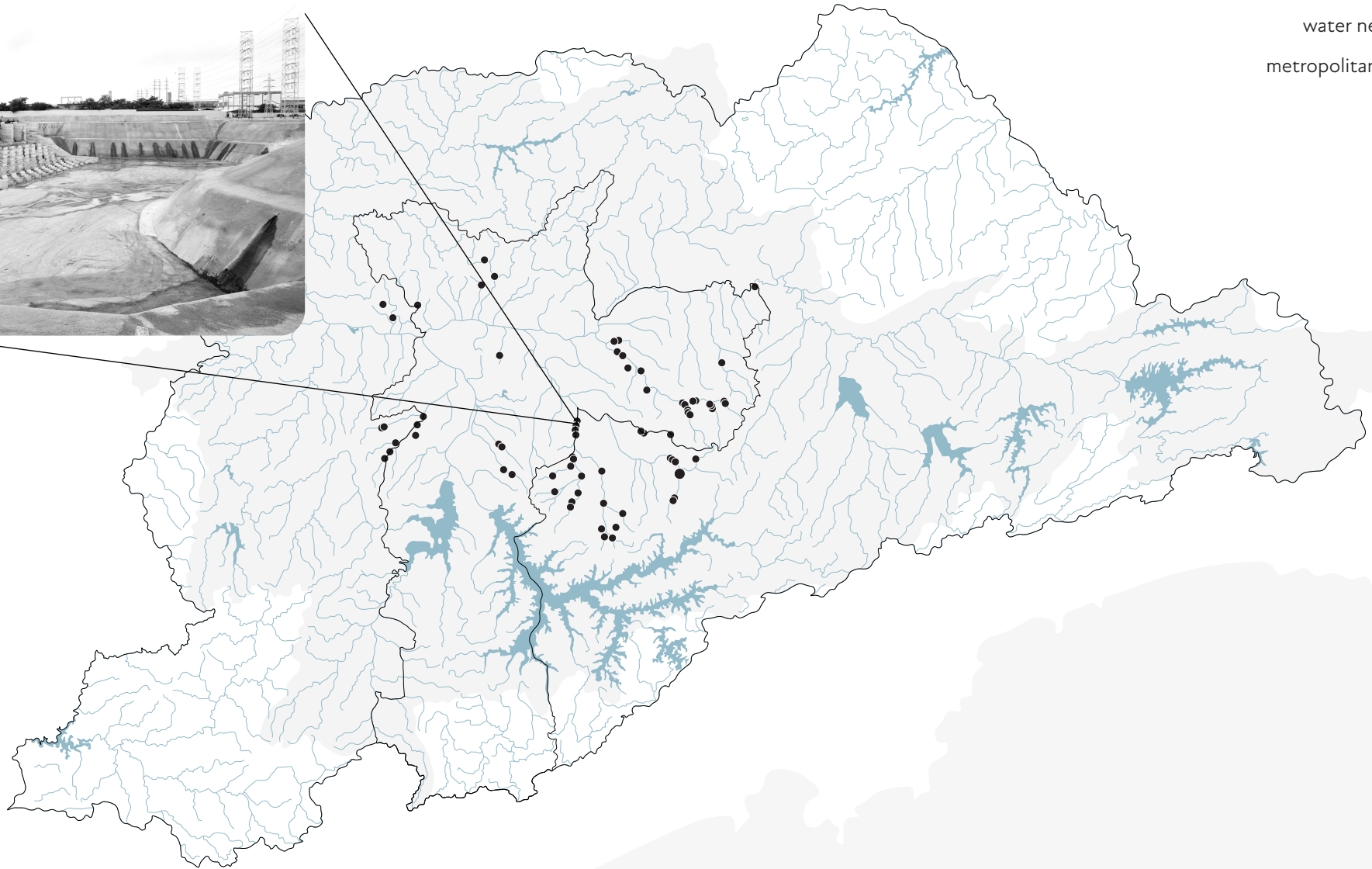


Leading to areas of higher disaster-susceptibility

Source: ABC News 2019

0 10 20 km

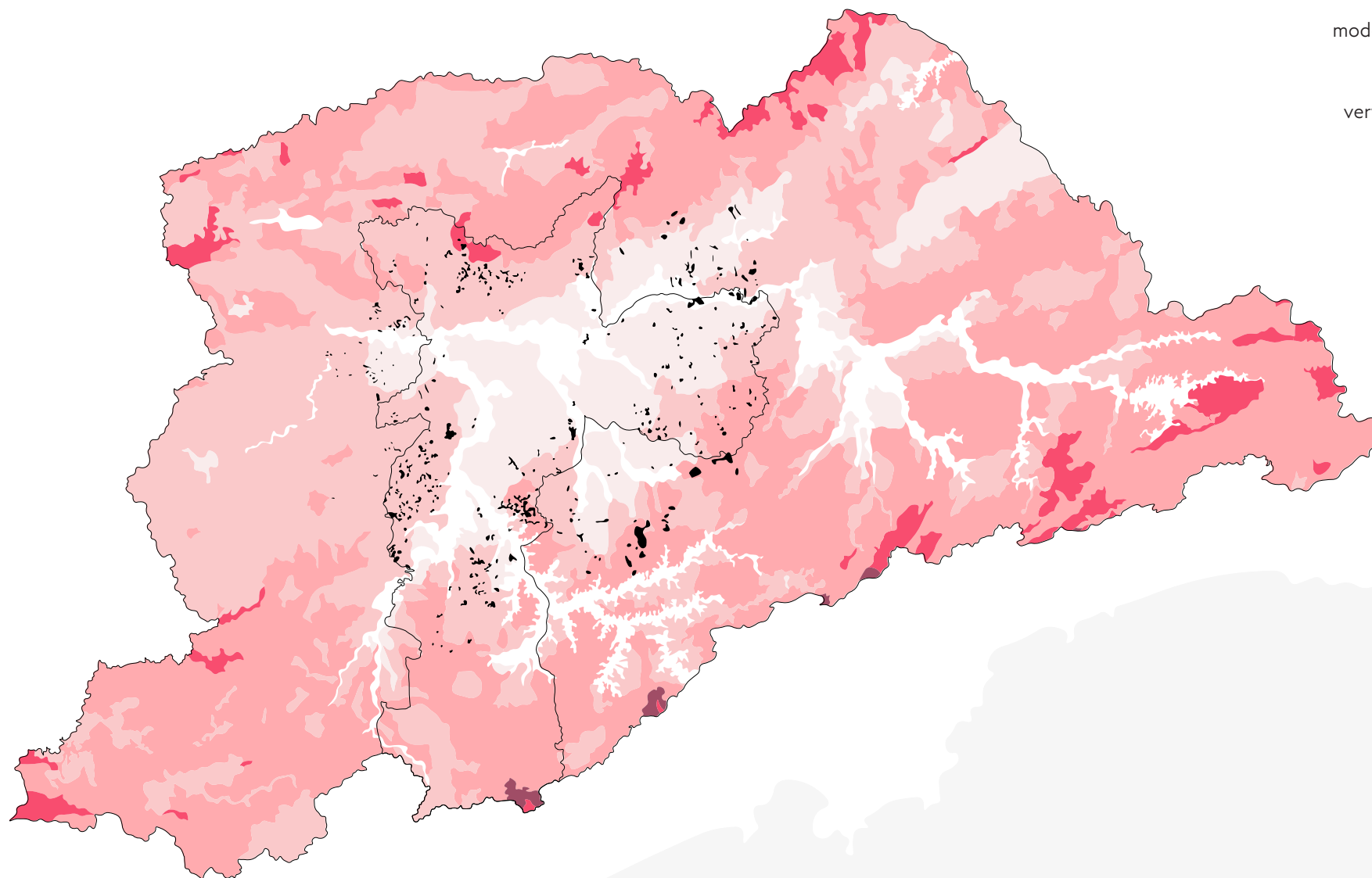
piscinões ●
alto tietê basin ■
water networks ■
metropolitan region □





0 10 20 km

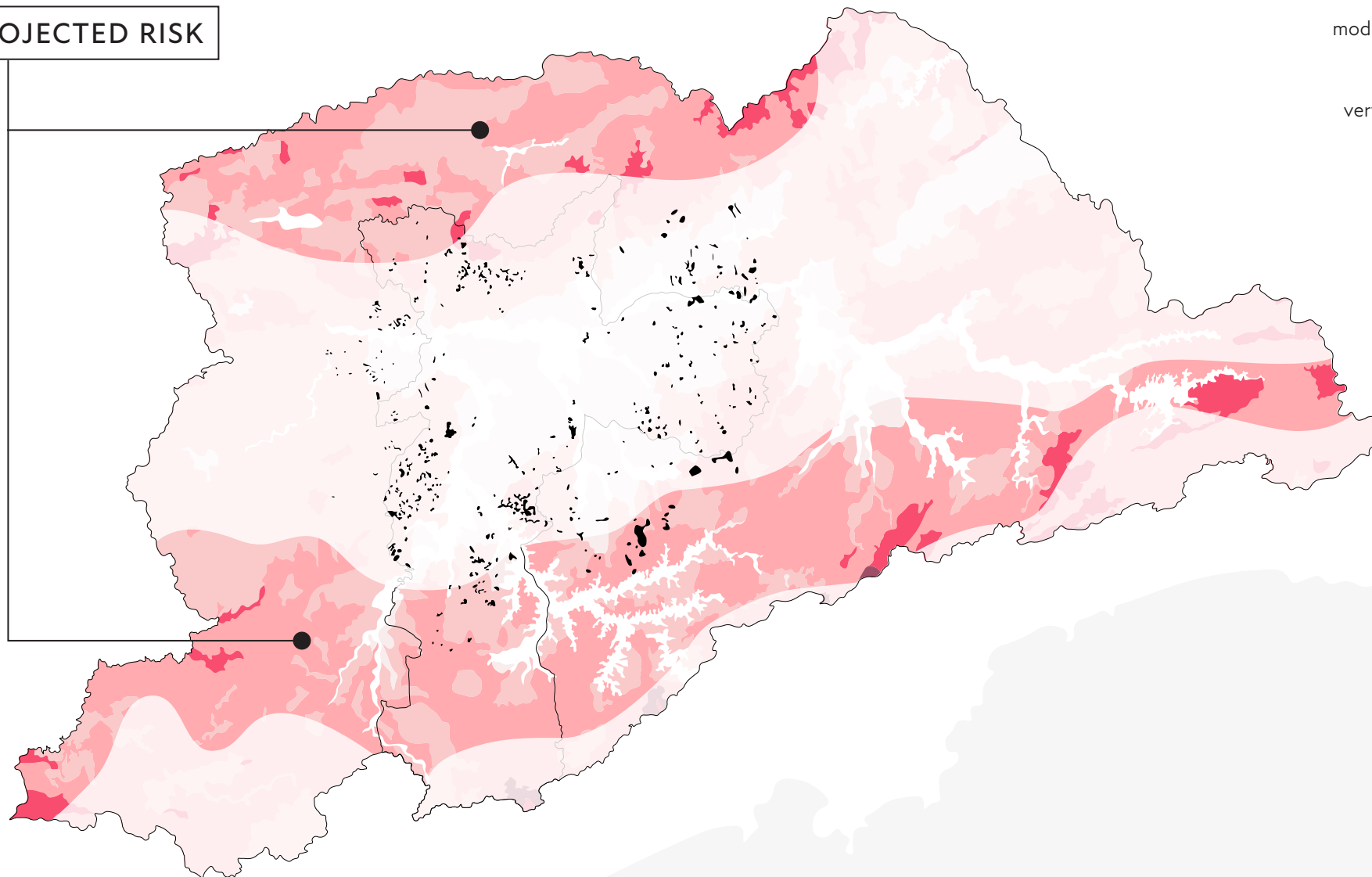
- very high risk
- high risk
- moderate risk
- low risk
- very low risk
- favelas



0 10 20 km

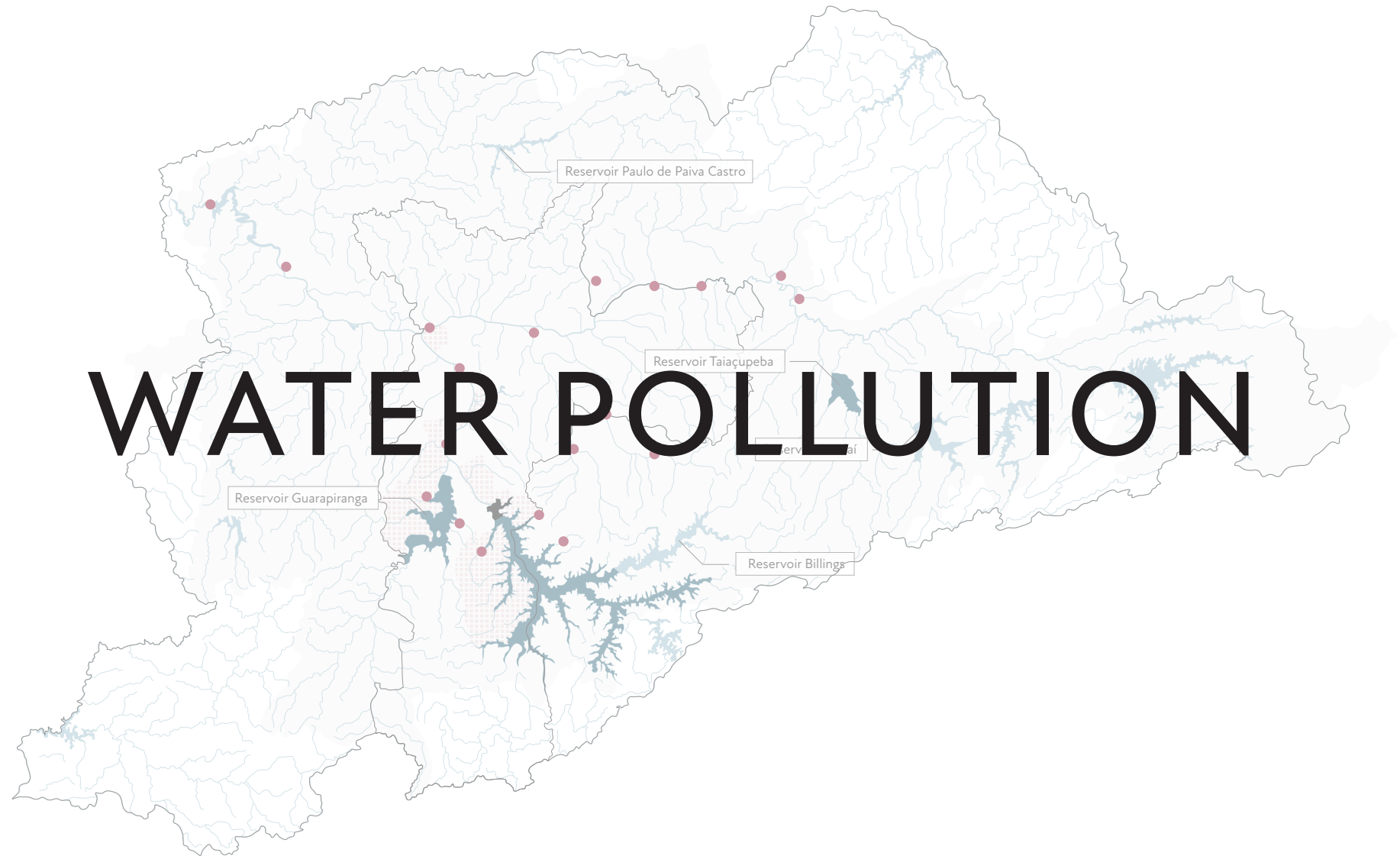
PROJECTED RISK

- very high risk
- high risk
- moderate risk
- low risk
- very low risk
- favelas





Source: ABS-CBN, 2023



0 10 20 km

Reservoir
Guarapiranga

Reservoir Paulo de Paiva Castro

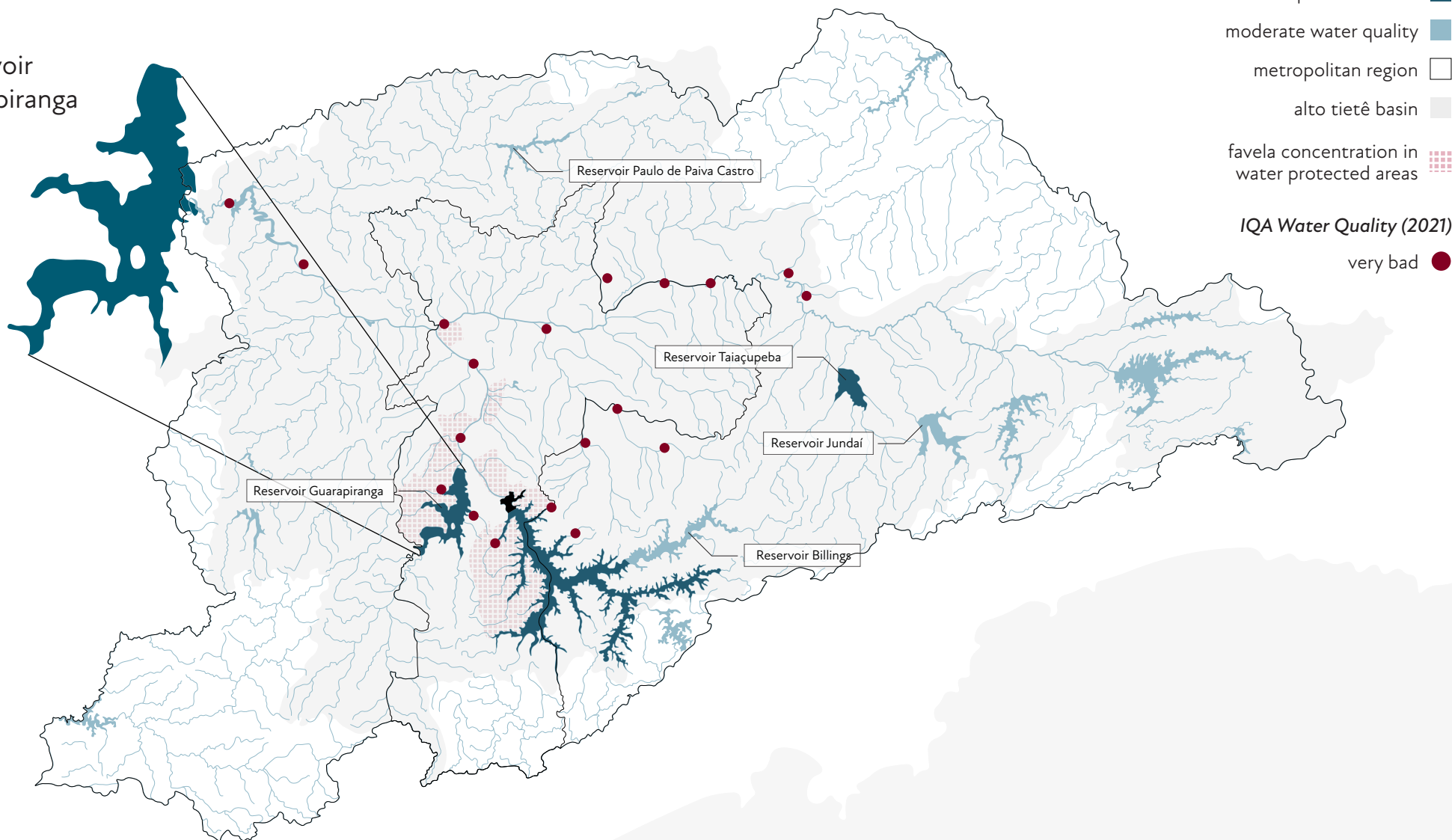
Reservoir Taiacupeba

Reservoir Jundai

Reservoir Guarapiranga

Reservoir Billings

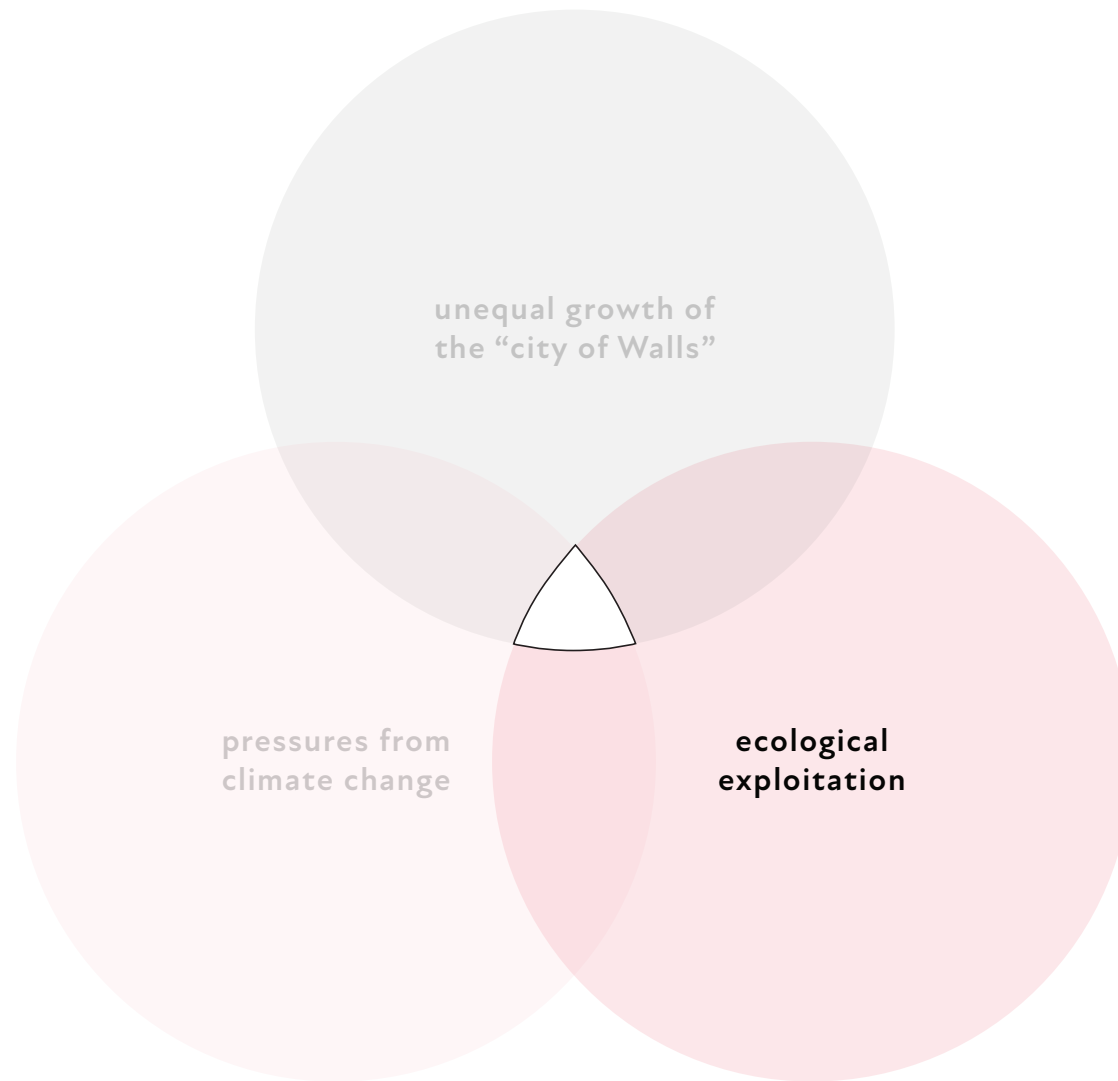
- highly polluted water
- polluted water
- moderate water quality
- metropolitan region
- alto tietê basin
- favela concentration in water protected areas
- IQA Water Quality (2021)*
- very bad



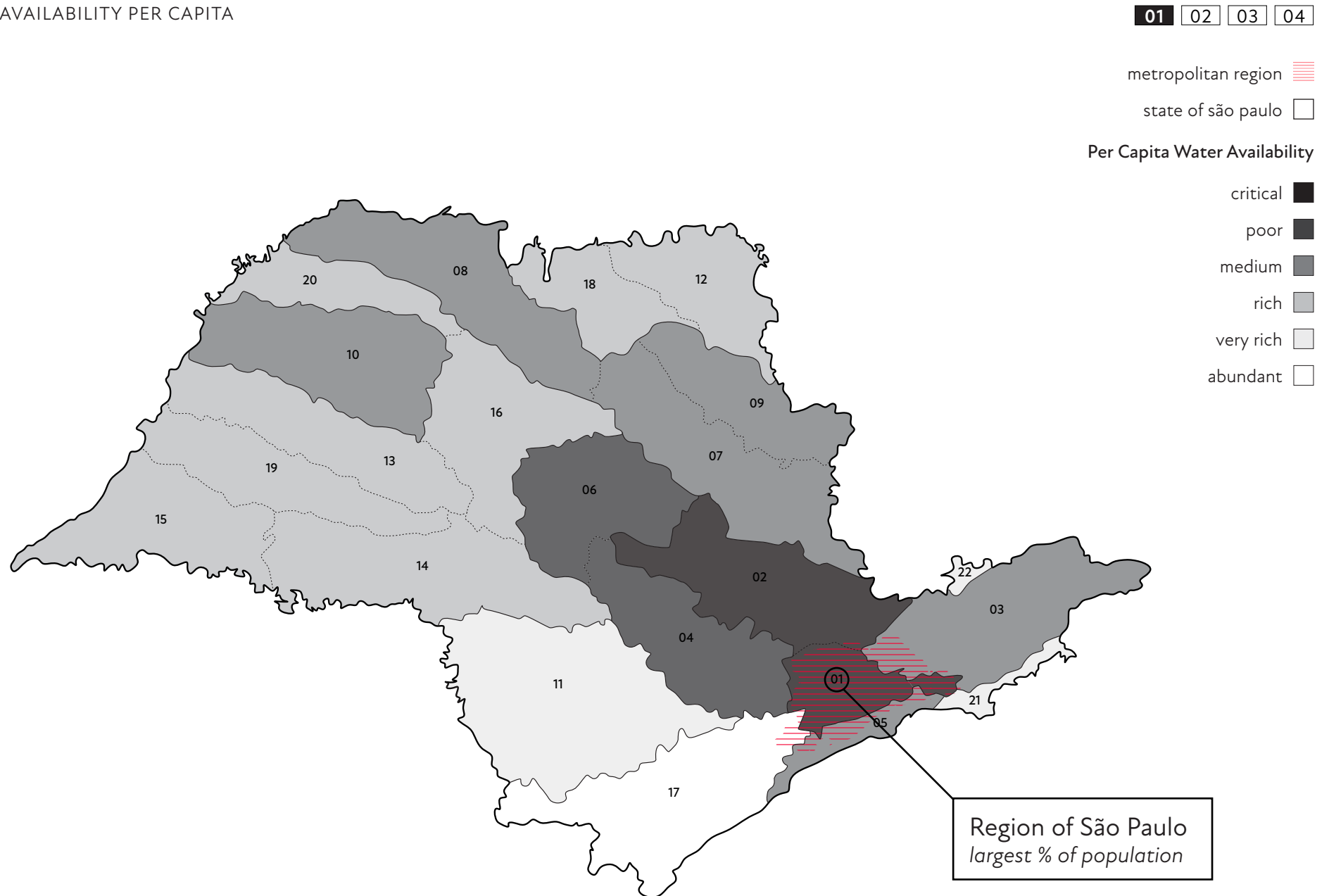
PRESSURES FROM CLIMATE CHANGE



Source: Floodlist





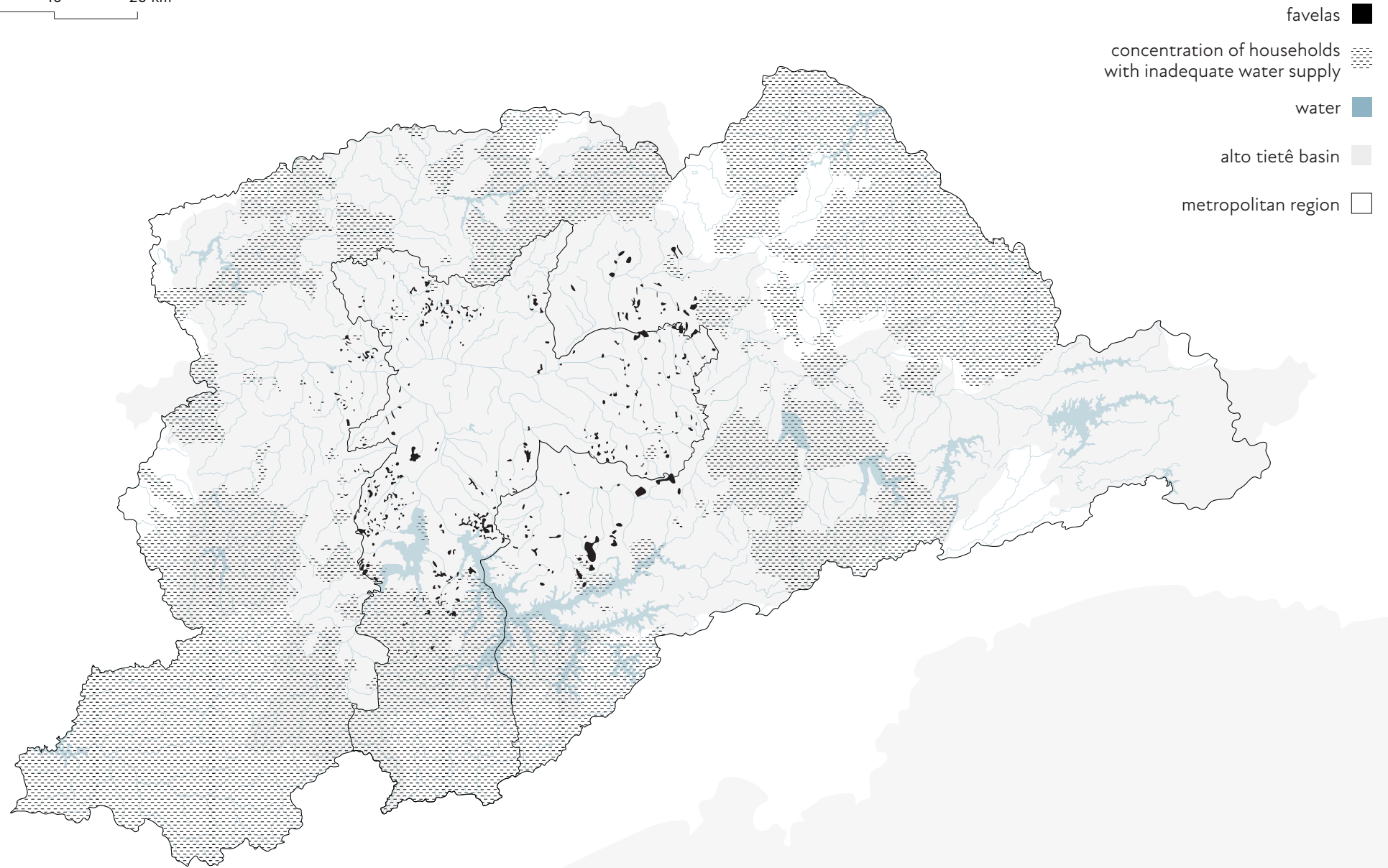




Effects of climate change, increased water consumption, and the mismanagement of water resources

Source: CNBC, 2015

0 10 20 km



0 10 20 km

favelas

concentration of households
with inadequate water supply

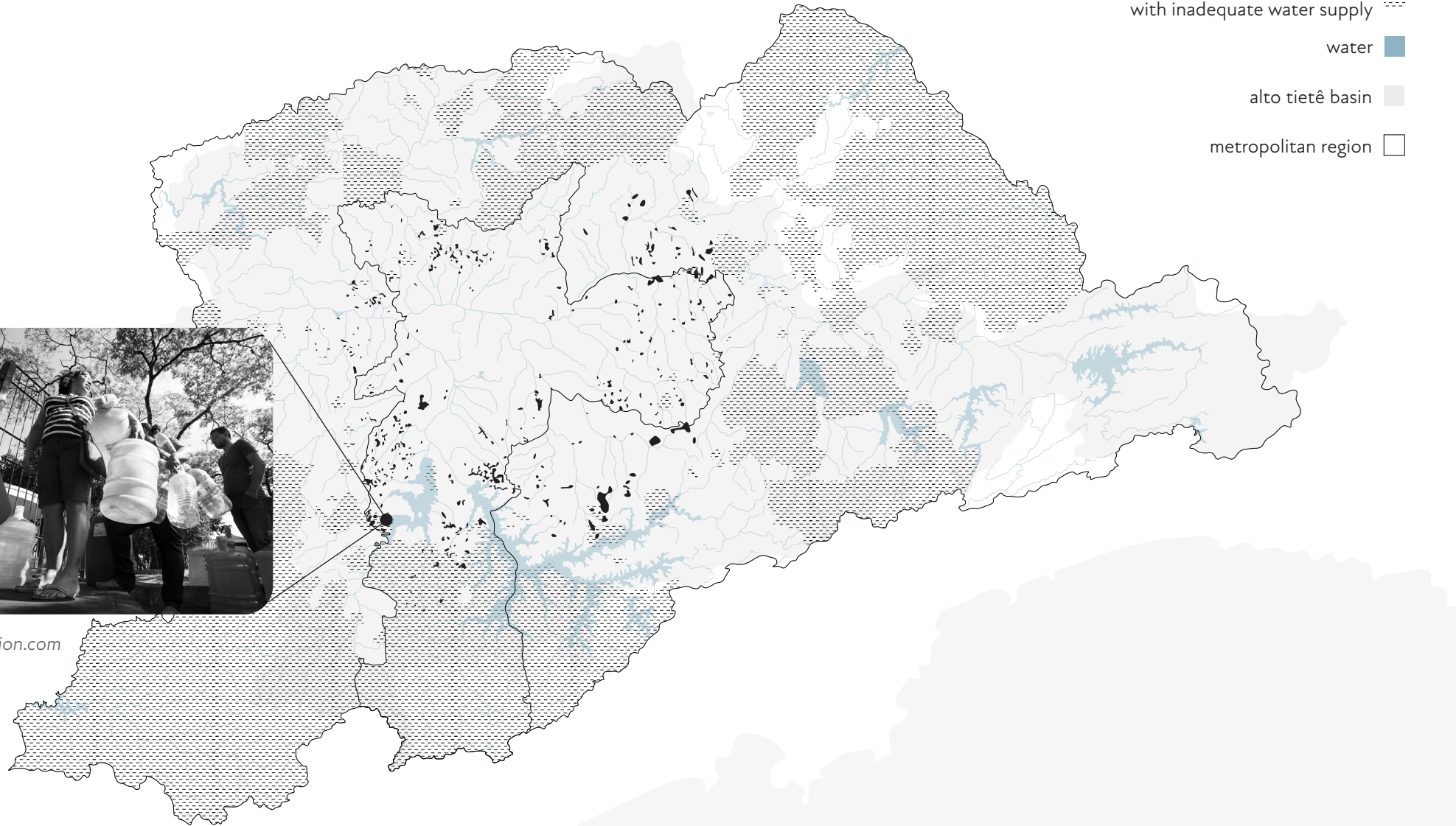
water

alto tietê basin

metropolitan region

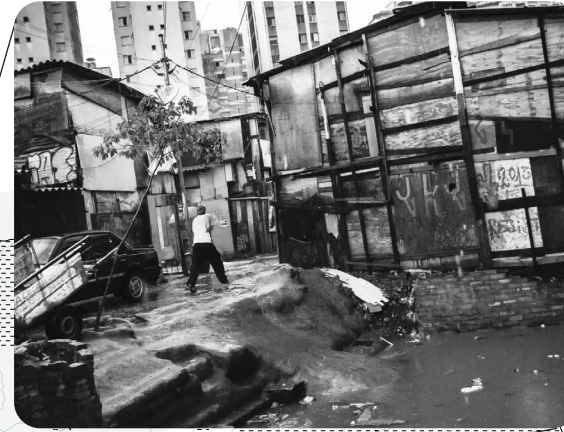


theconversation.com



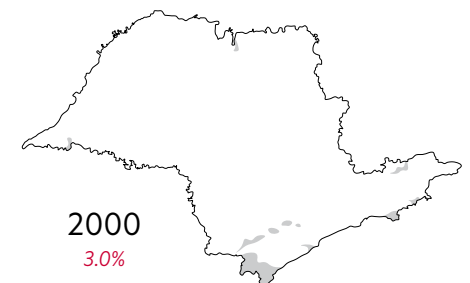
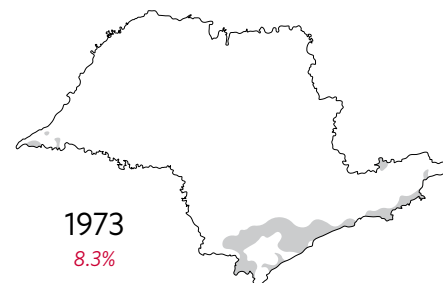
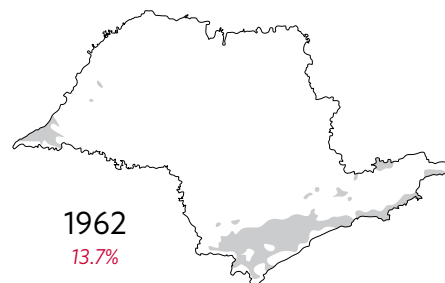
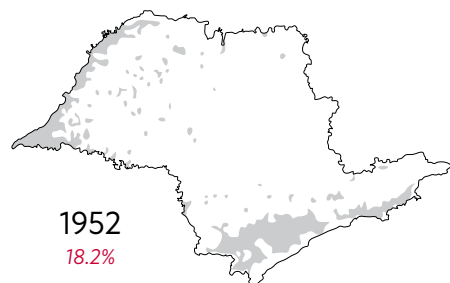
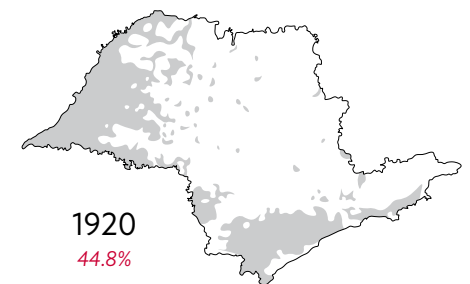
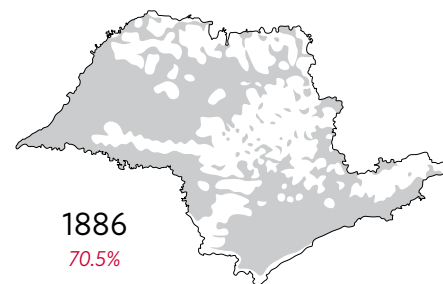
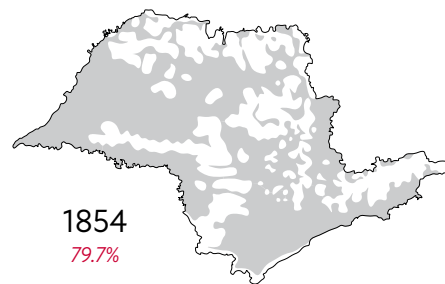
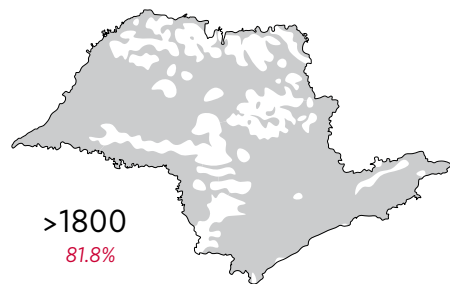
0 10 20 km

- favelas ■
- concentration of households with inadequate water supply ▨
- water ■
- alto tietê basin ■
- metropolitan region □





DEFORESTATION



Source: [AmazonConservation.org](https://www.amazonconservation.org/)

LEADING DRIVERS OF DEFORESTATION



unchecked agricultural
expansion



illegal logging



lack of sufficient
governance

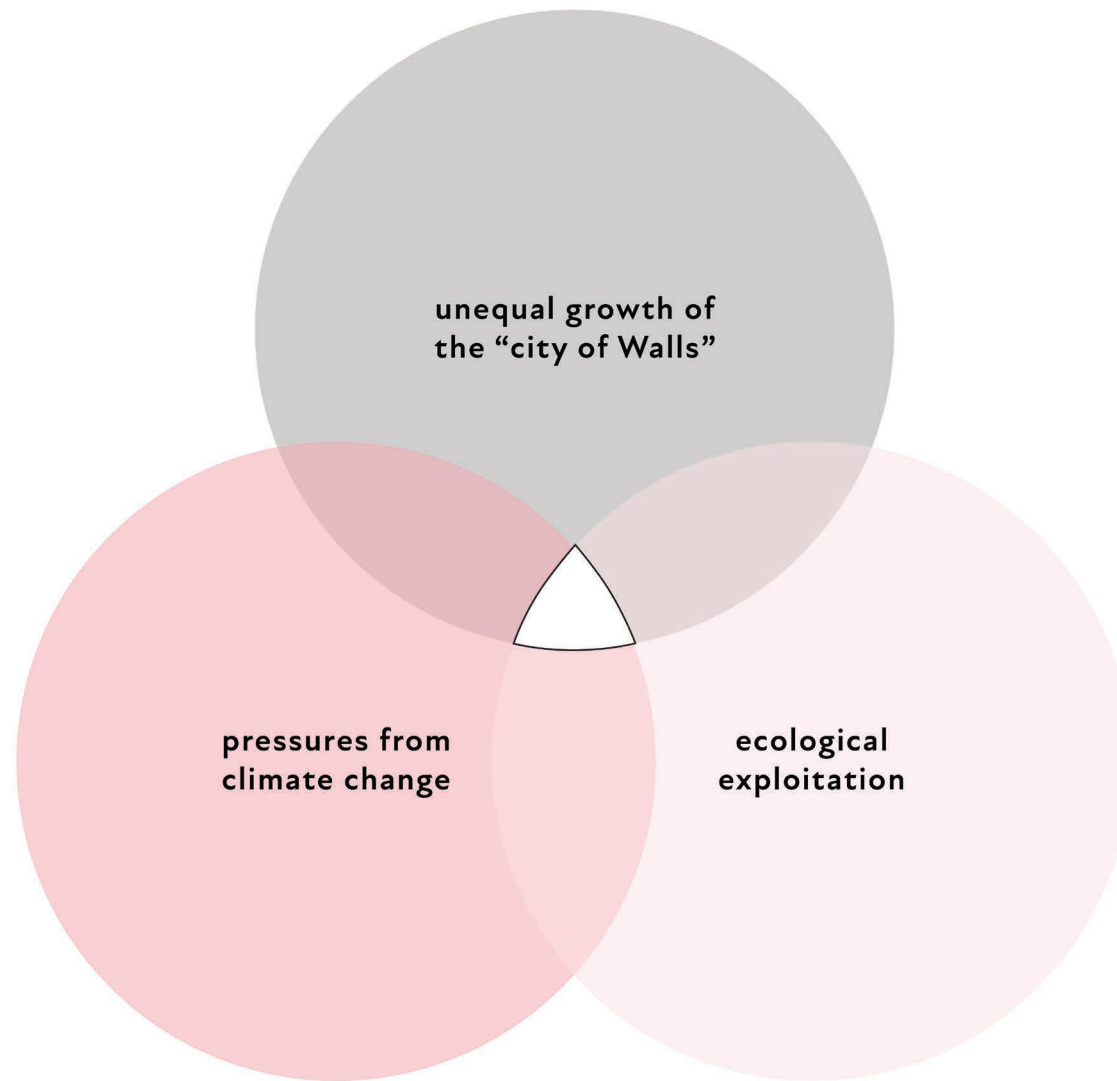


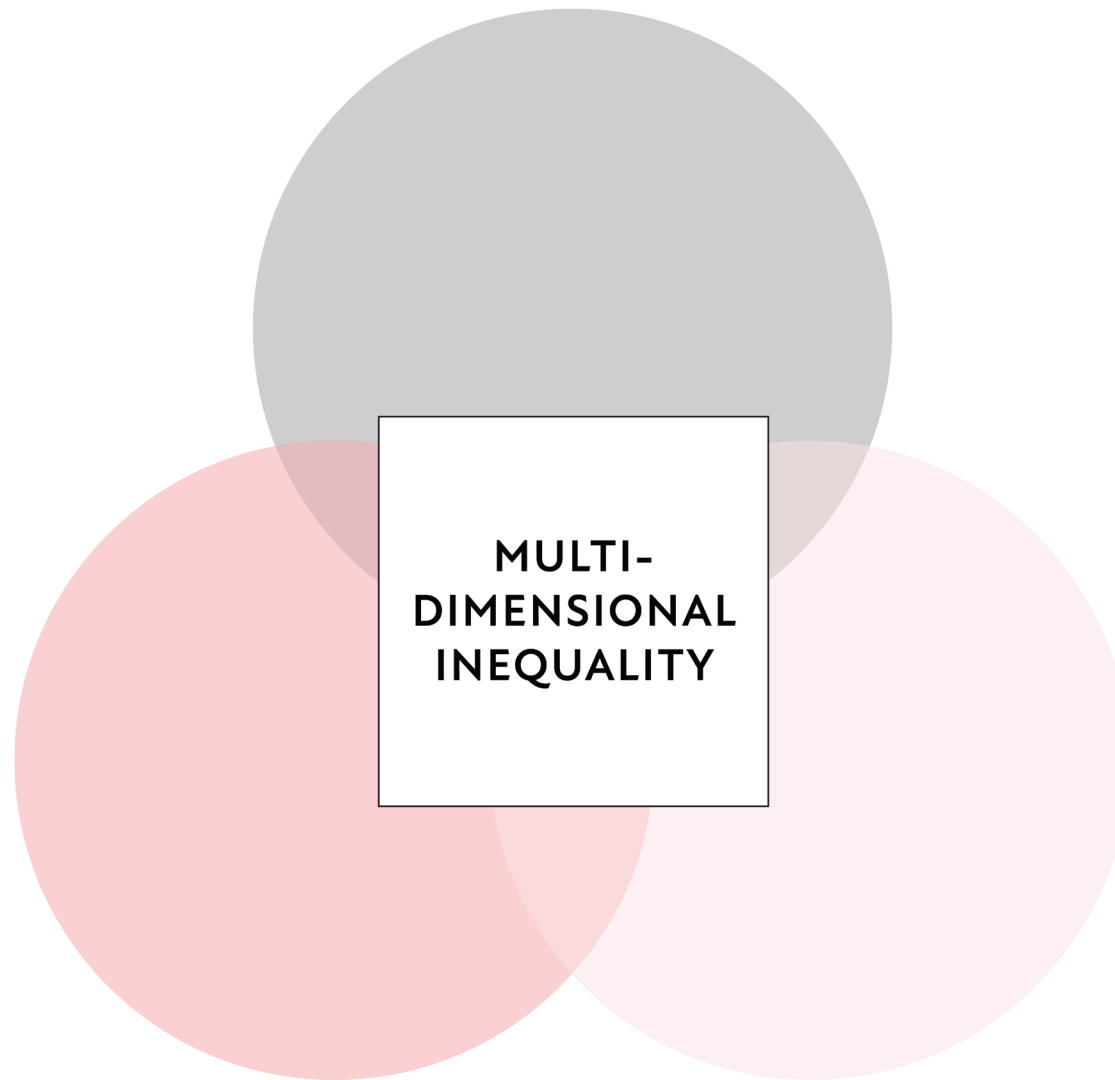
poorly-planned
infrastructure

ECOLOGICAL EXPLOITATION

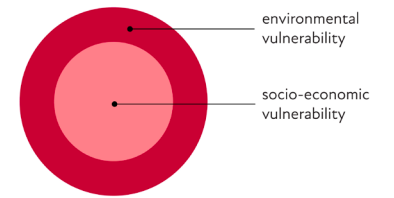
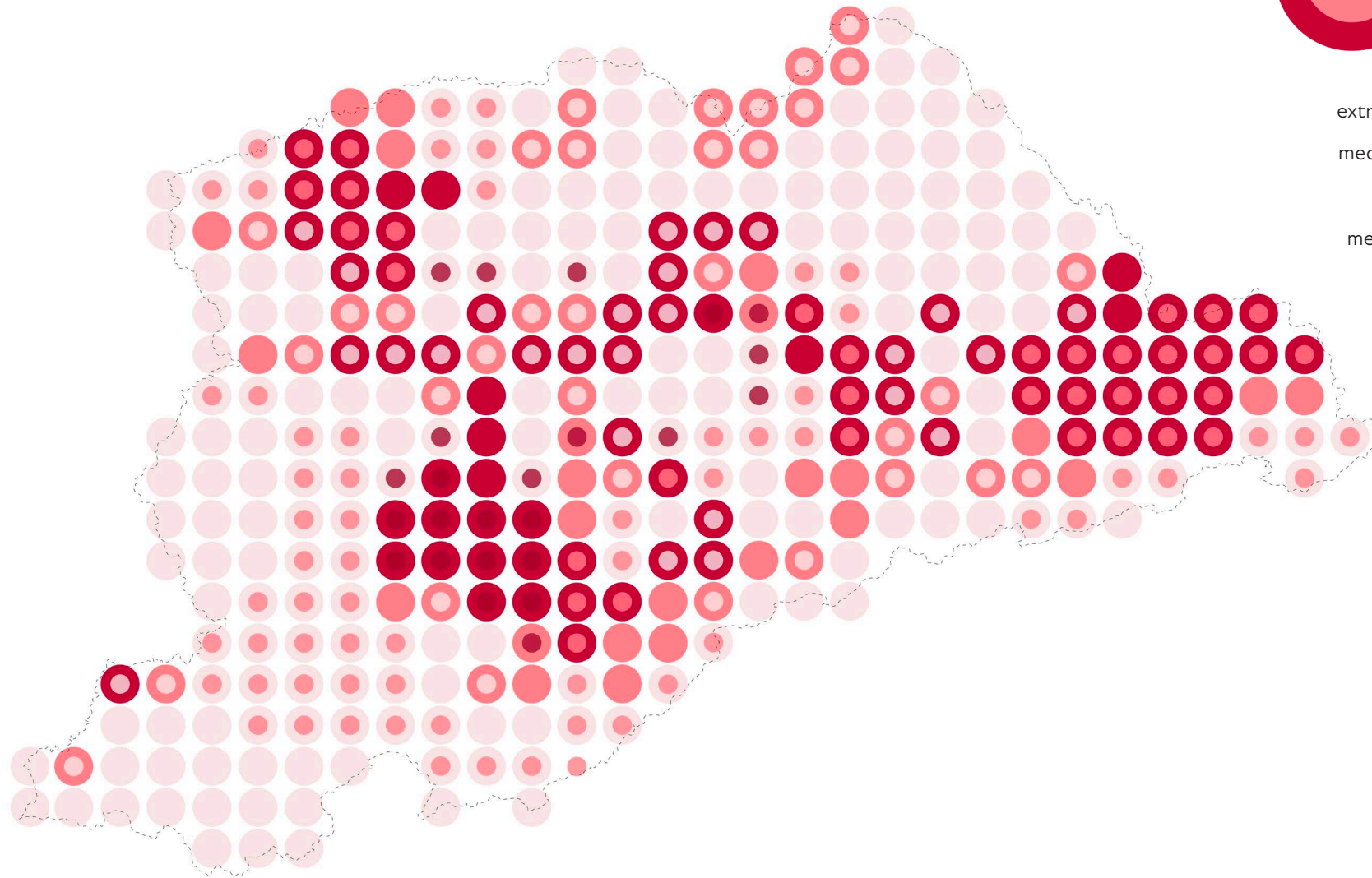


Source: *The Times*



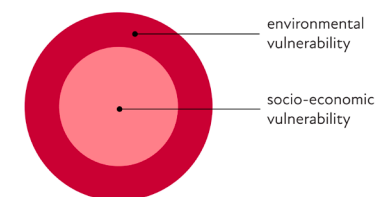


0 10 20 km



- extreme vulnerability
- medium vulnerability
- low vulnerability
- metropolitan region ---

0 10 20 km



extreme vulnerability ●

medium vulnerability ●

low vulnerability ●

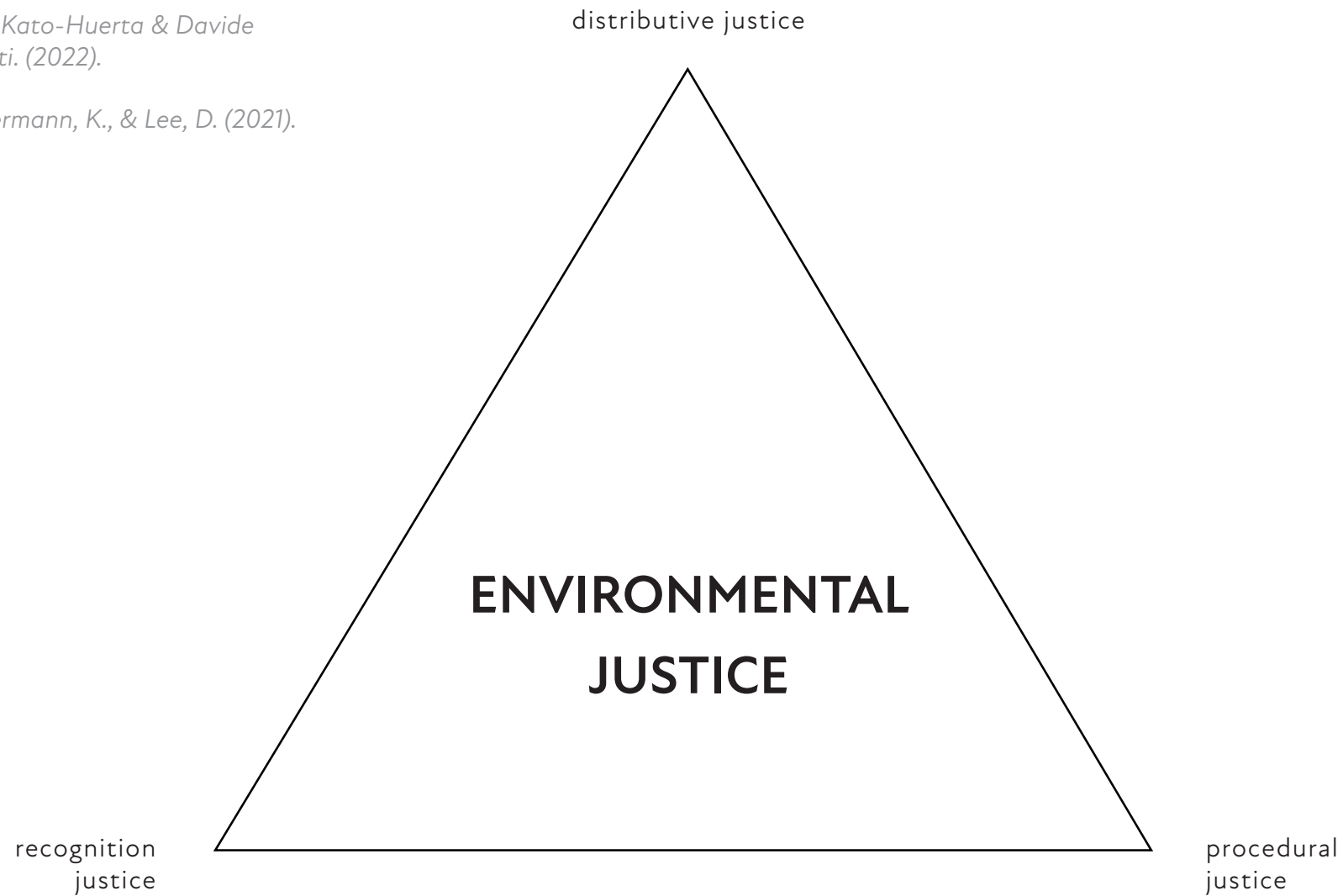
metropolitan region ---



Academic Literature Source:

- Jarum Kato-Huerta & Davide Geneletti. (2022).

- Zimmermann, K., & Lee, D. (2021).



DISTRIBUTIVE JUSTICE

acknowledges the
notion of a fair and equal
spatial distribution,
more commonly known
as the distribution of
burdens and benefits

RECOGNITION JUSTICE

refers to discussions
on who's interest is
at stake and how to
recognize interests
that are typically not
acknowledged and not
taken into consideration

PROCEDURAL JUSTICE

the process of decision-
making; how do you
come to these solutions
and how fair are they

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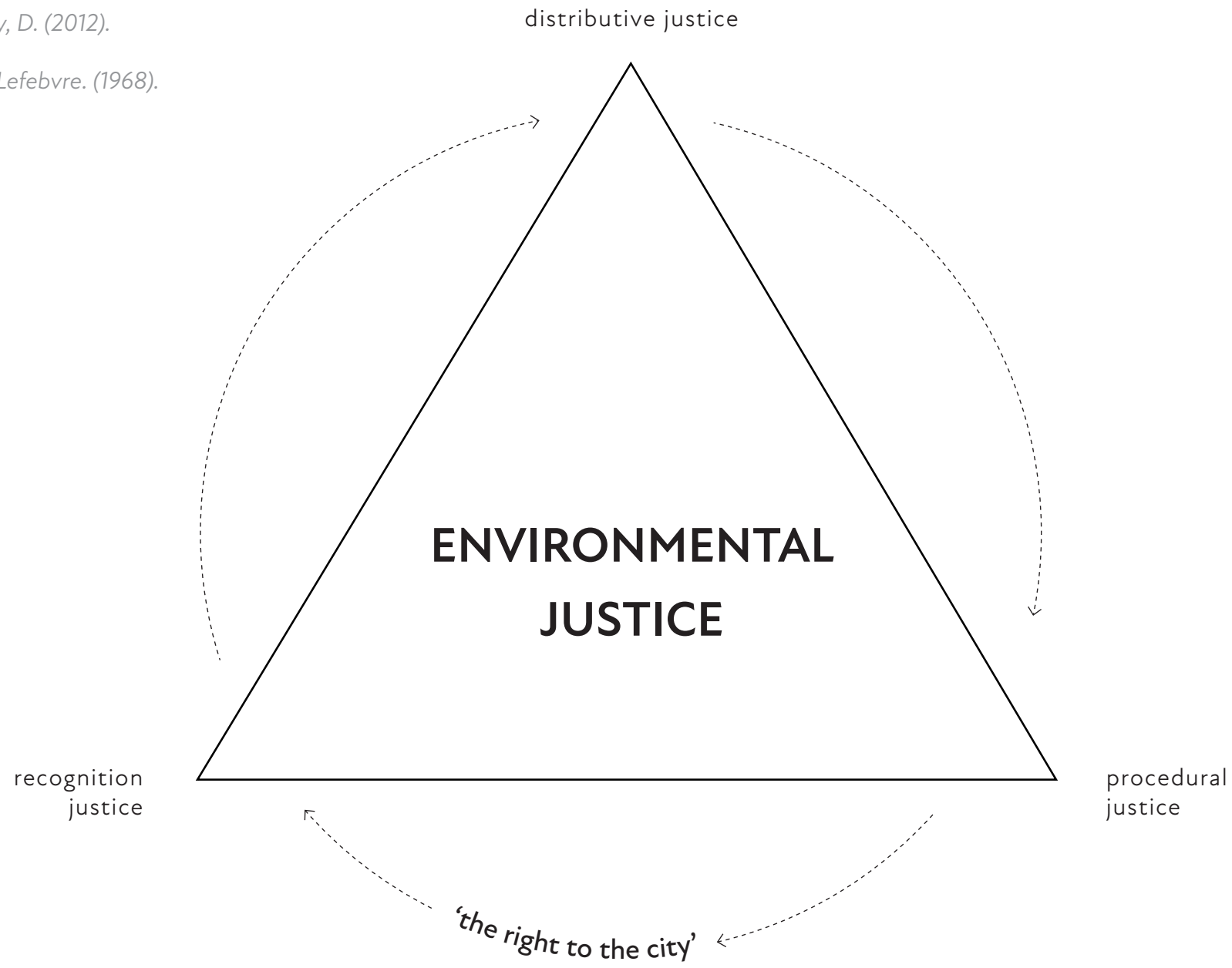
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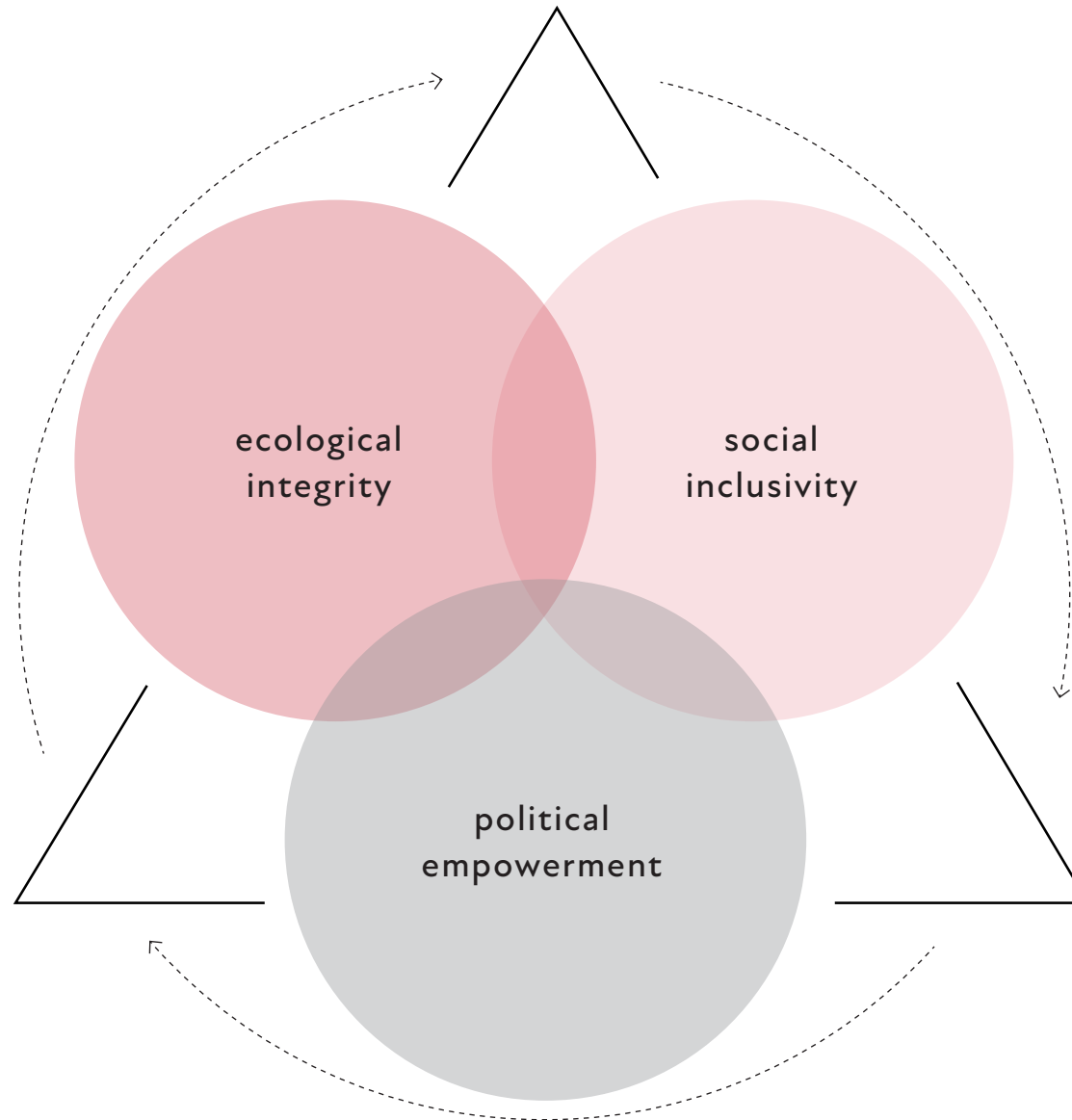
PROCEDURAL JUSTICE

the process of decision-
making; how do you
come to these solutions
and how fair are they

Academic Literature Source:

- Harvey, D. (2012).
- Henri Lefebvre. (1968).





MAIN RESEARCH QUESTION.

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



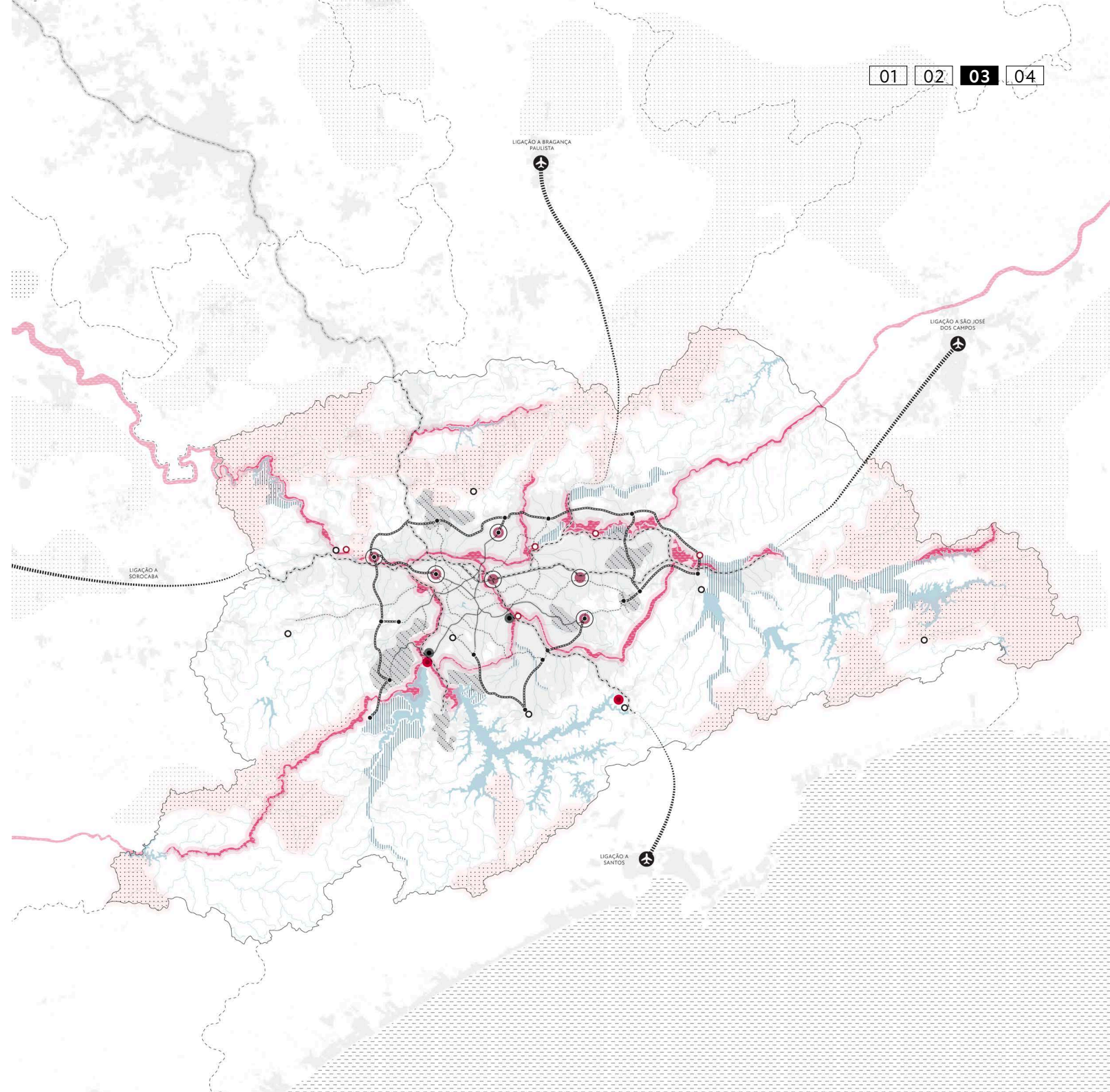
“ Climate change is the single greatest threat to a sustainable future but, at the same time, addressing the climate challenge presents a golden opportunity to promote prosperity, security and a brighter future for all. ”

Ban Ki-Moon

0 10 20 km

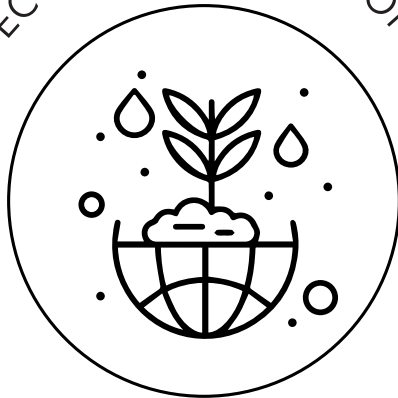
STRATEGIC VISION FOR ENVIRONMENTAL JUSTICE

-  Oceano Atlântico
-  Water
-  Urban area
-  Metropolitan Regions
-  Metropolitan Region of São Paulo
-  Train line
-  Metro line
-  Metro line (under construction)
-  Existing water treatment facilities
-  Existing sanitation facilities
-  Forest rehabilitation
-  Vegetation corridor
-  Water restoration
-  Upgrading precarious settlements
-  Extension of metro
-  Train connections
-  New urban centralities
-  New sanitation facilities
-  New water treatment facilities

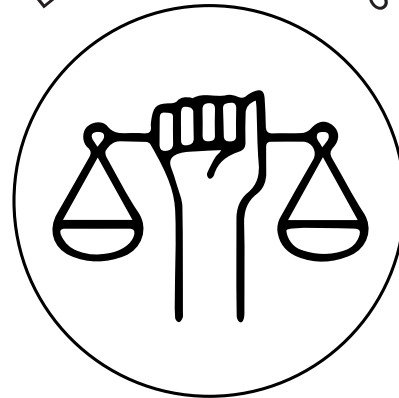


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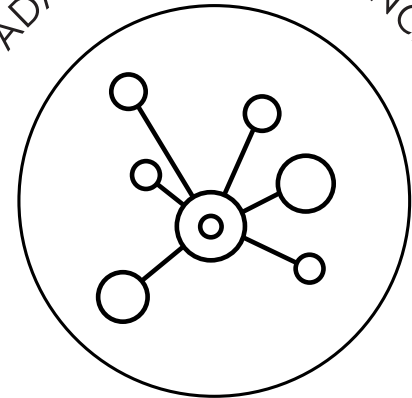
ECOLOGICAL BACKBONE



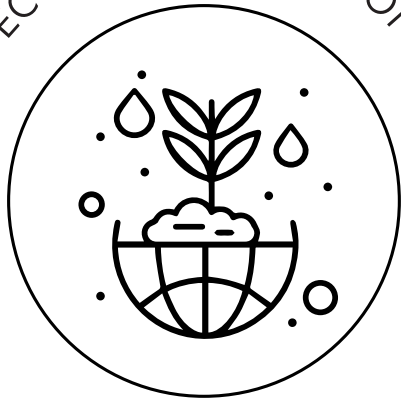
EQUITABLE ACCESS



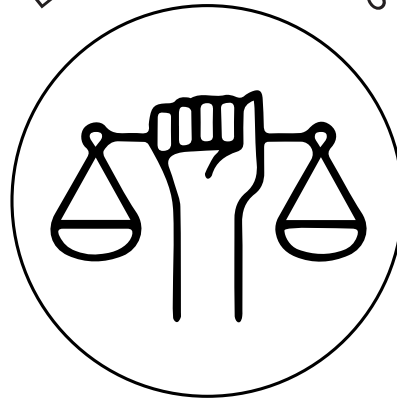
ADAPTIVE GOVERNANCE



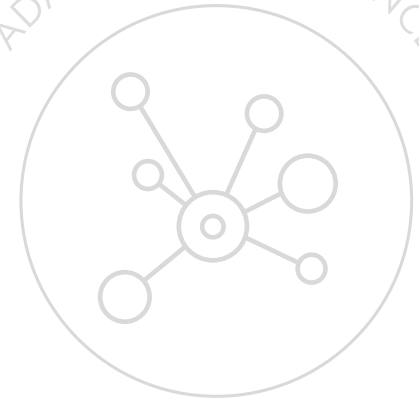
ECOLOGICAL BACKBONE



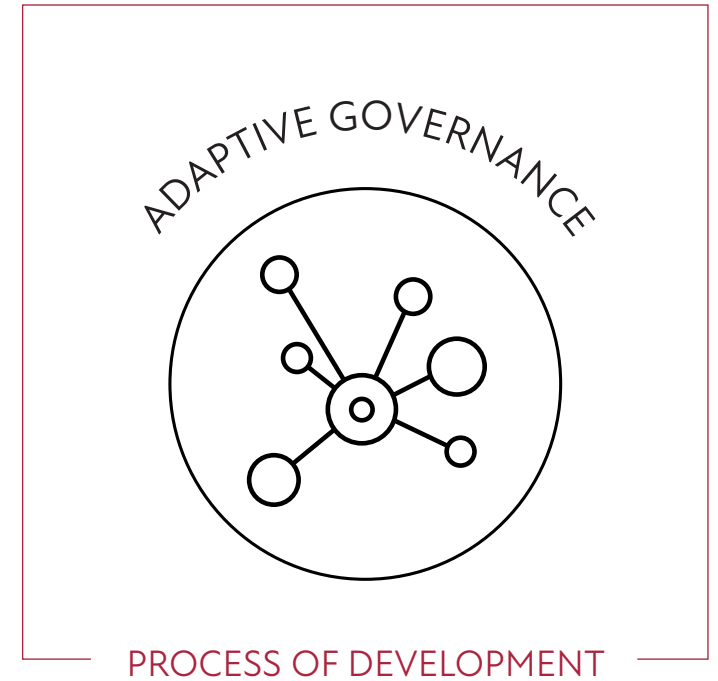
EQUITABLE ACCESS



ADAPTIVE GOVERNANCE



SPATIAL FRAMEWORK



PROCESS OF DEVELOPMENT

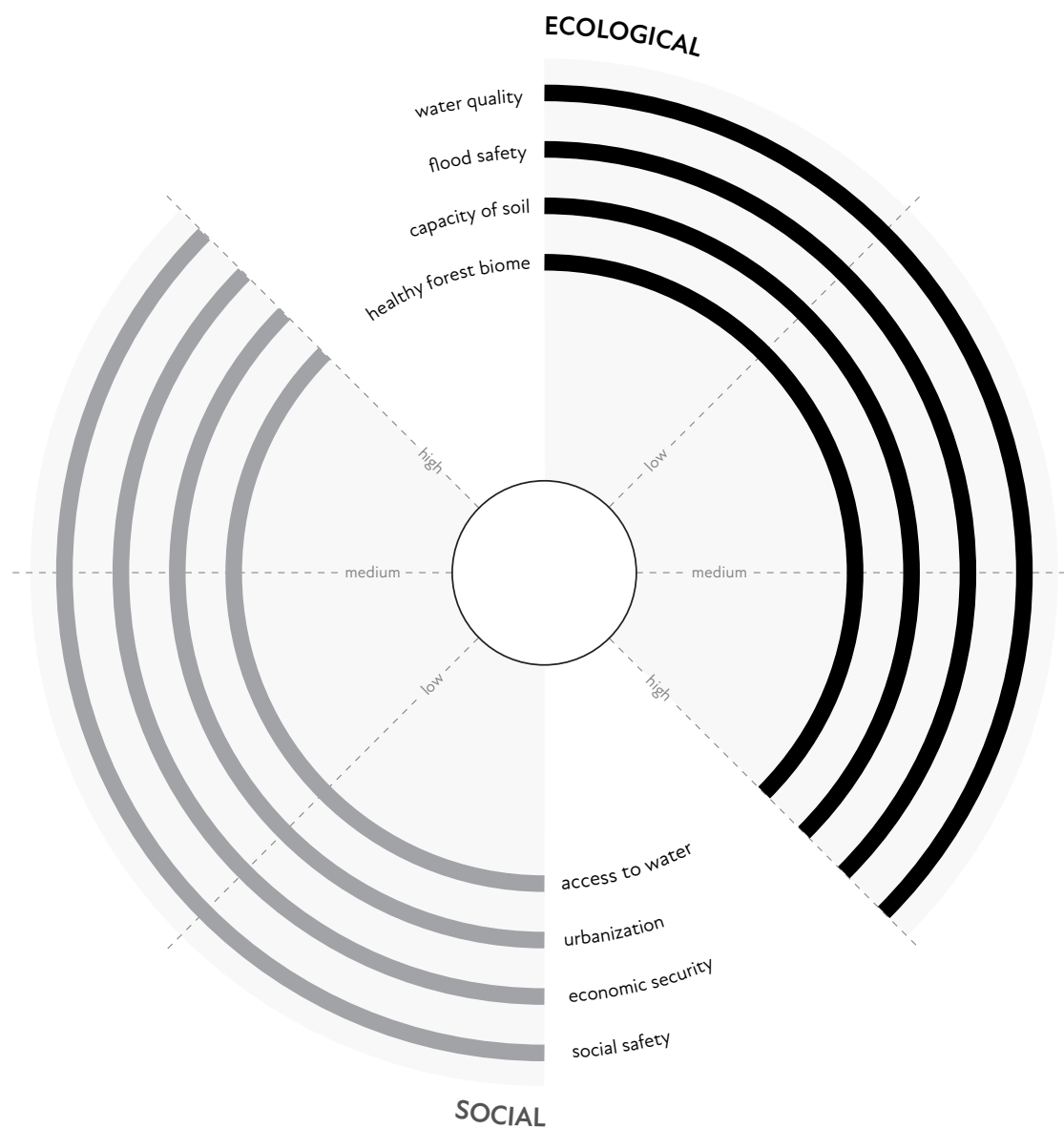
ASSESSMENT TOOL

Ecological Category:

- water quality
- flood safety
- capacity of soil
- healthy forest biome

Social Category:

- access to water
- urbanization
- economic security
- social safety



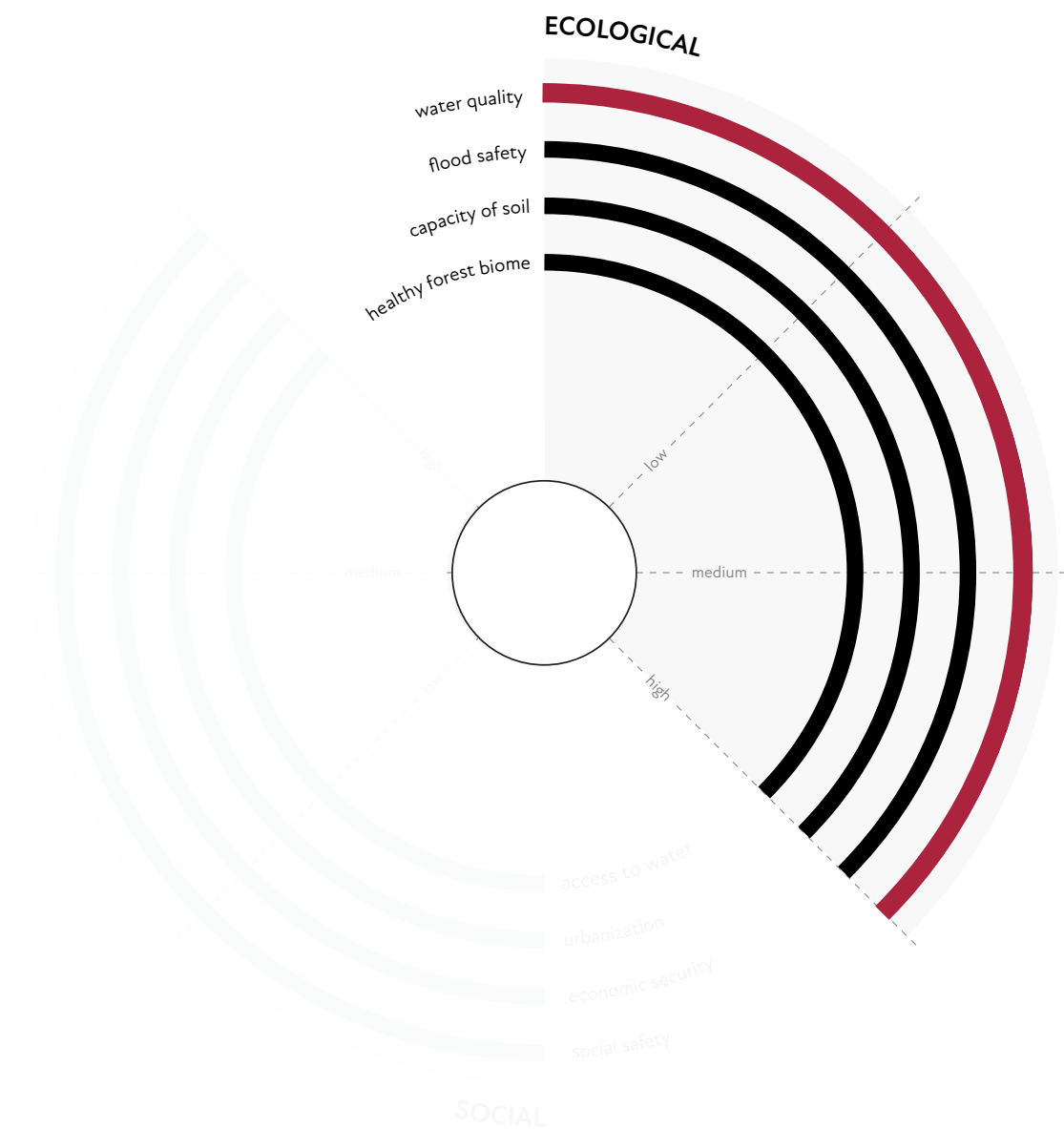
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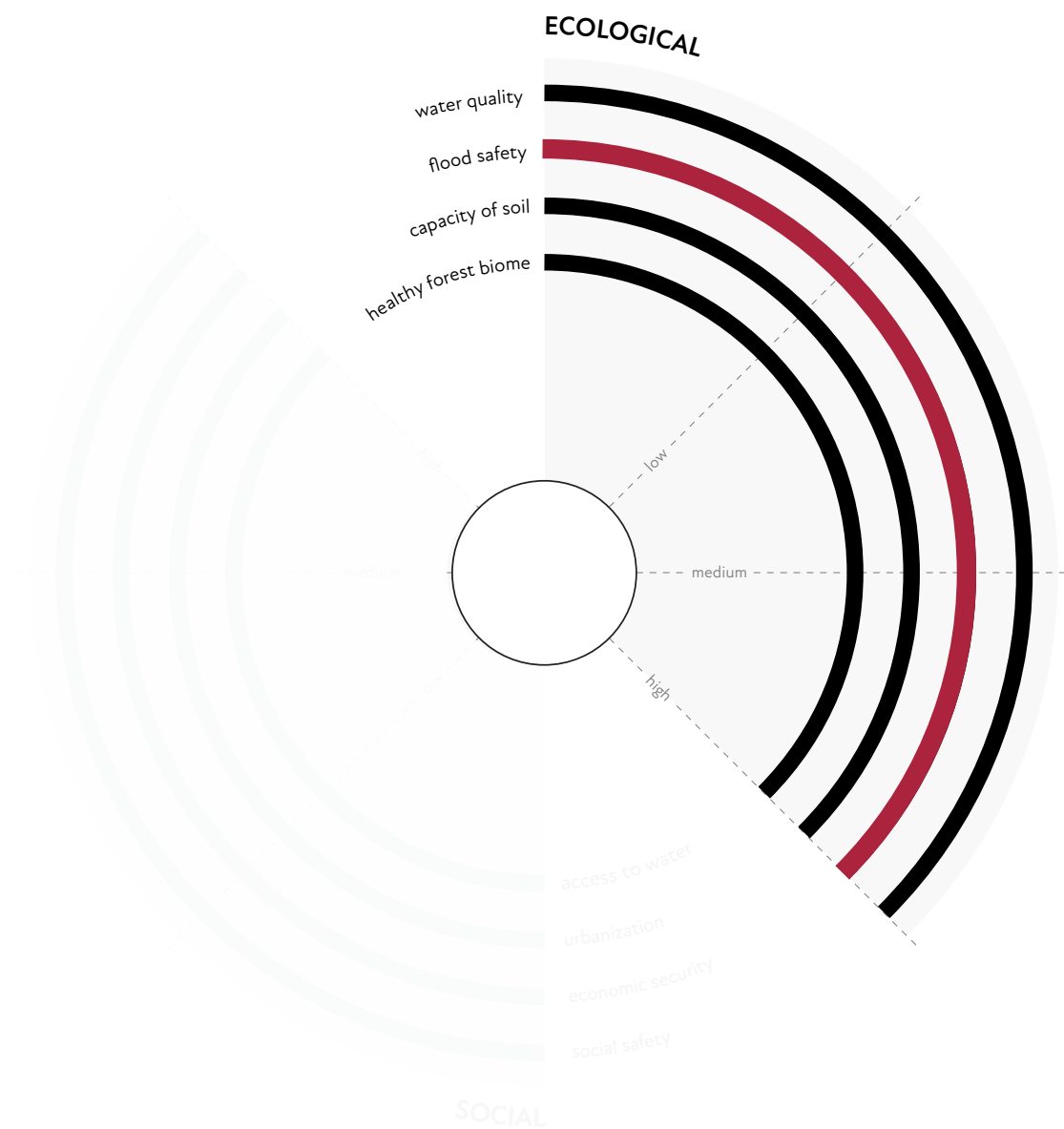
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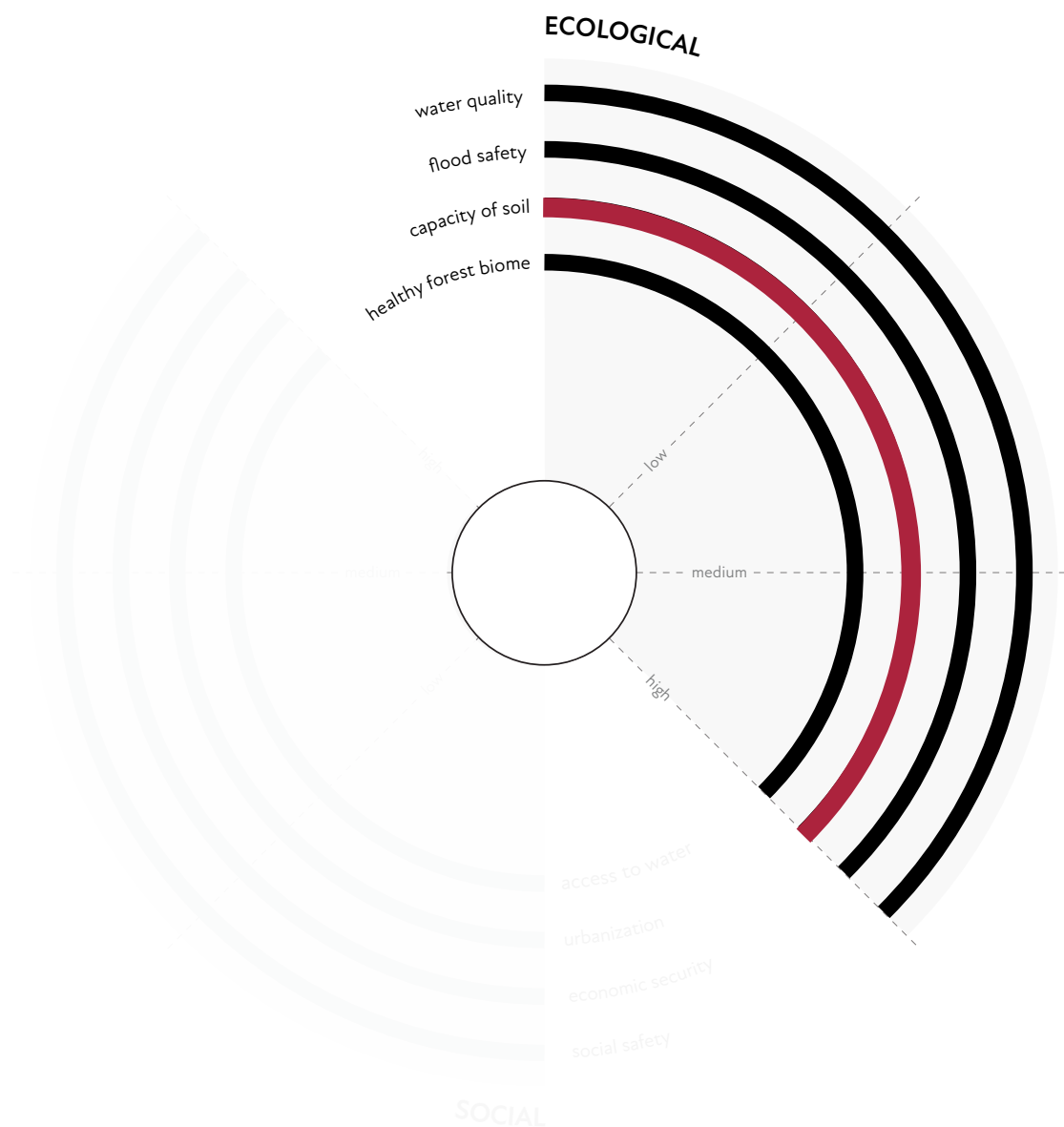
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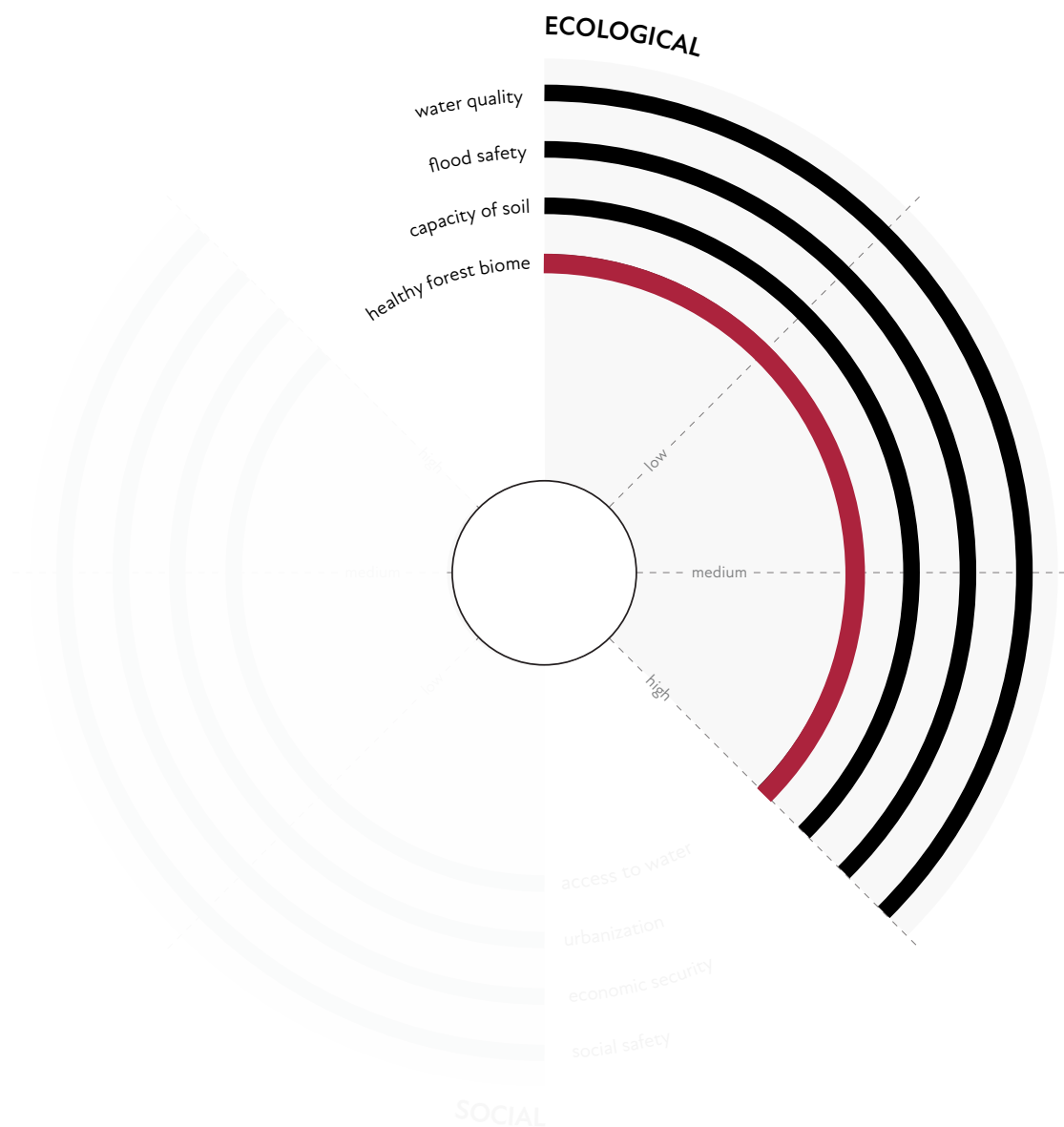
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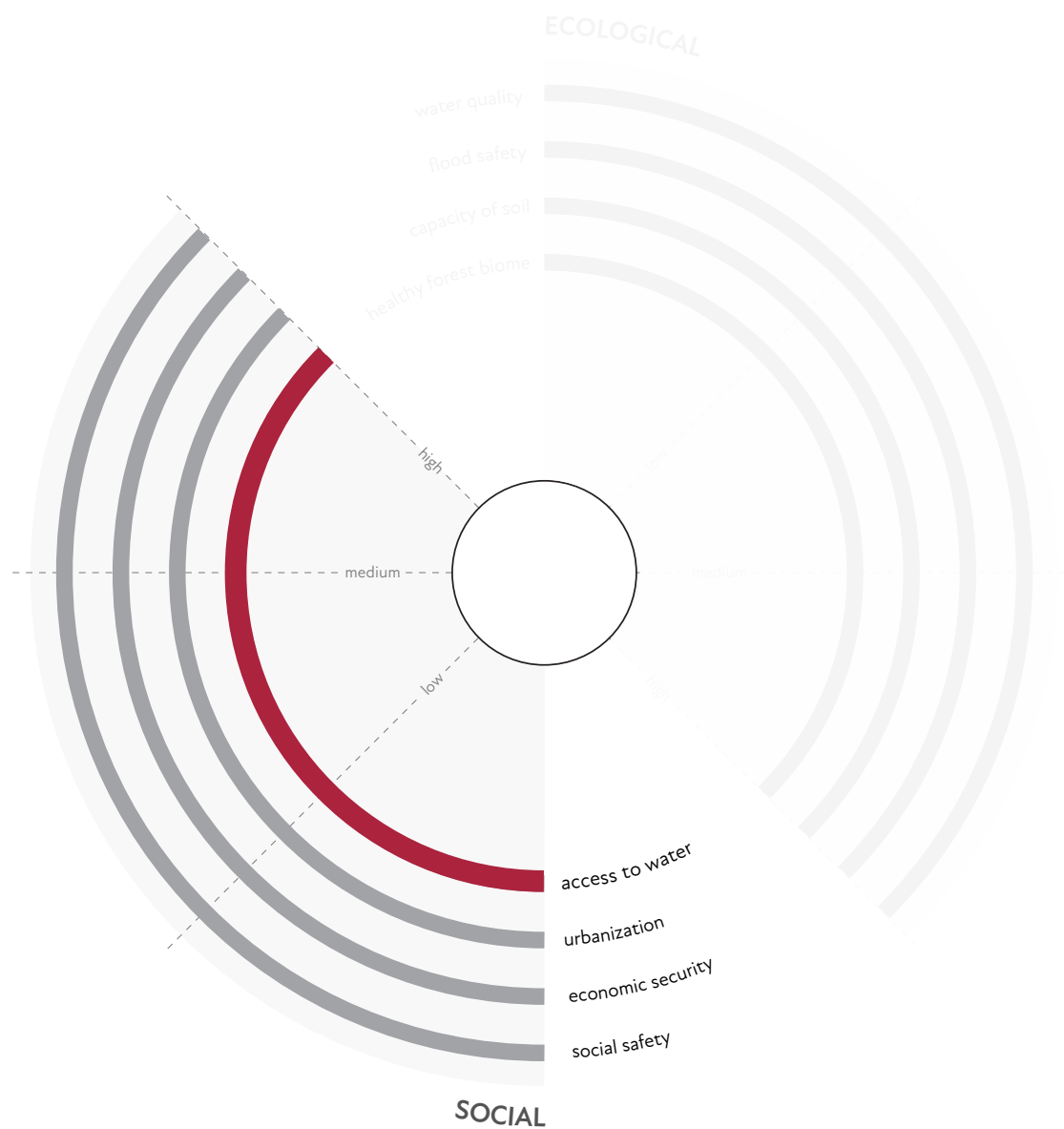
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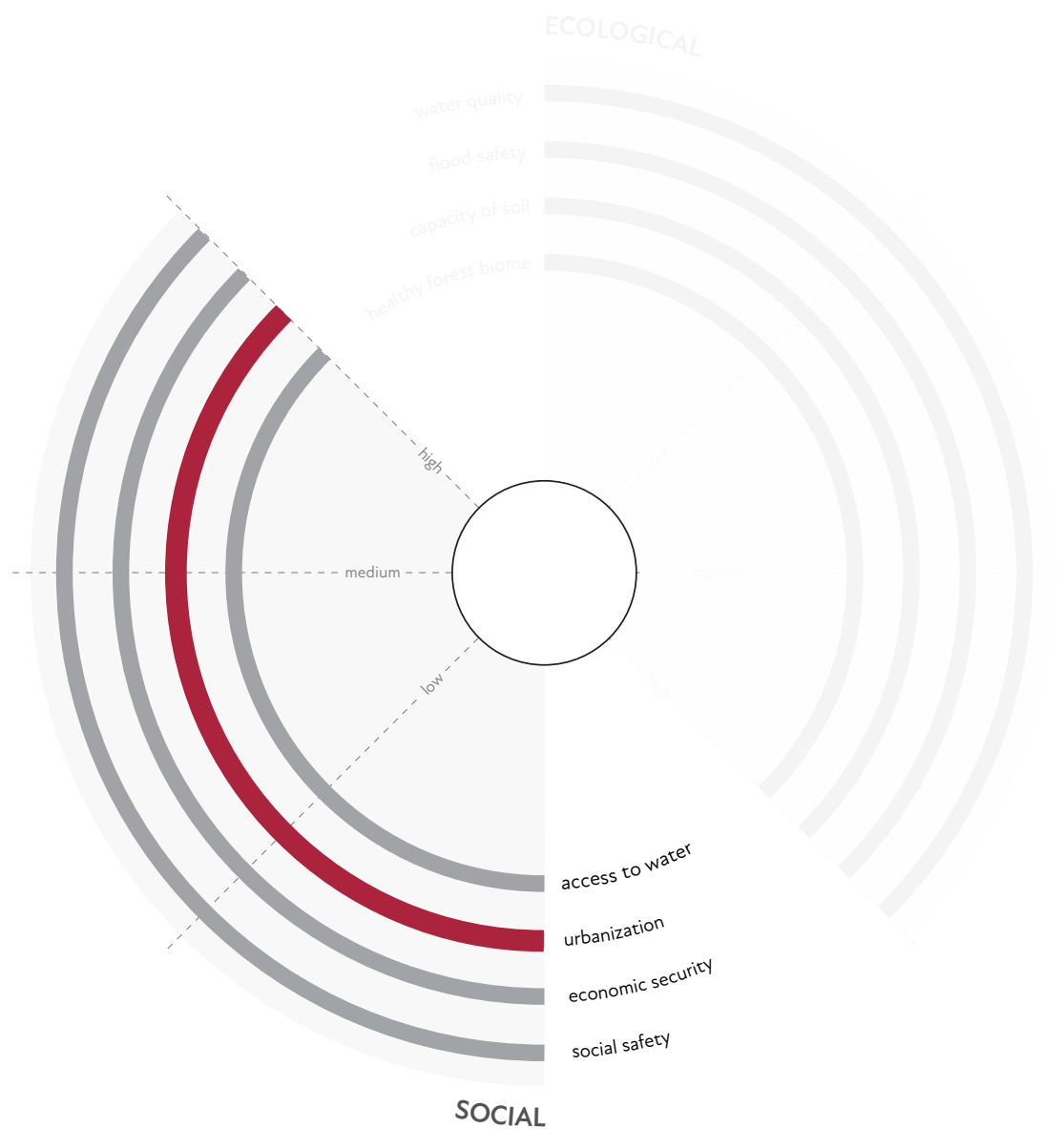
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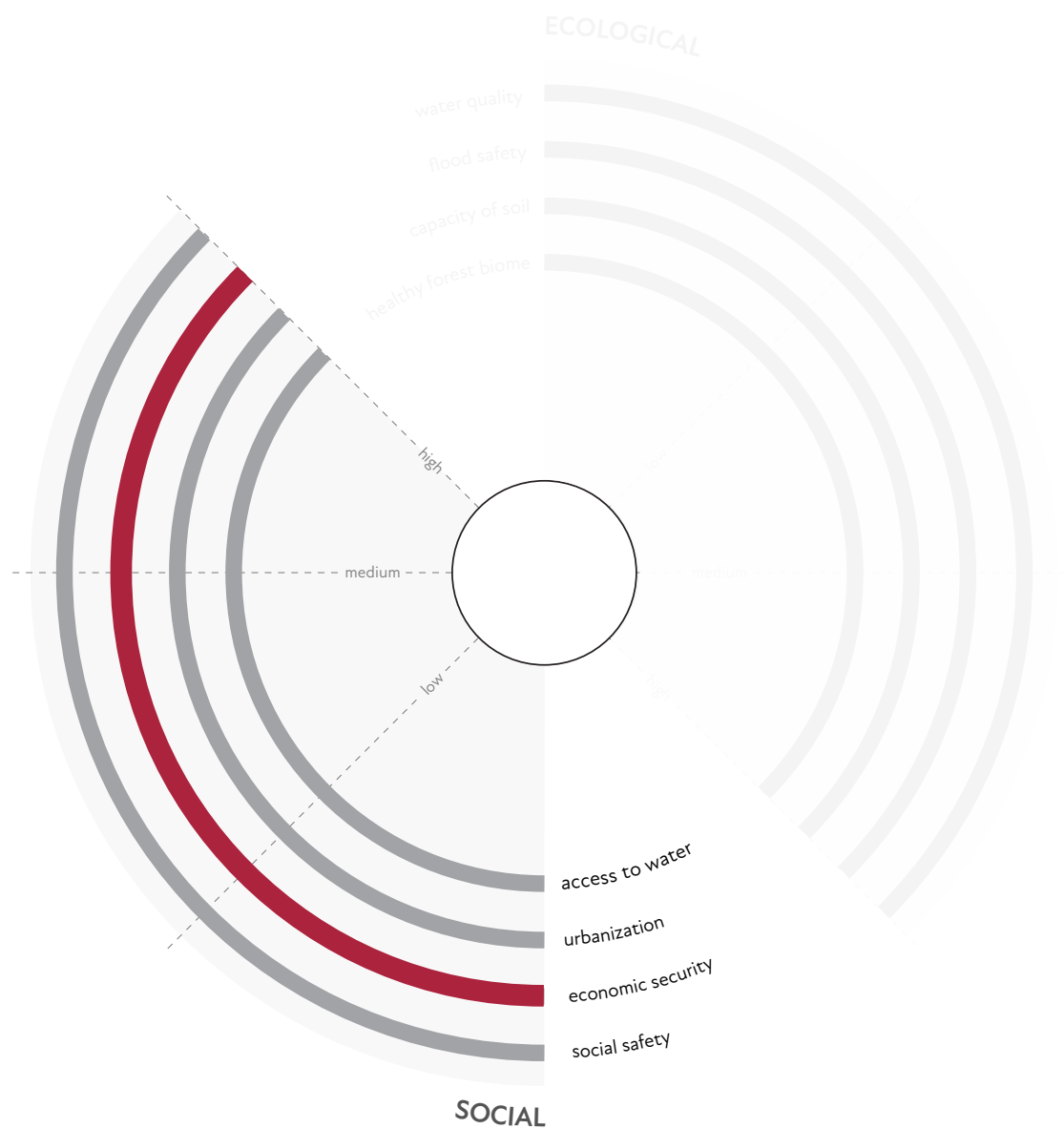
ASSESSMENT TOOL

Ecological Category:

- water quality
- flood safety
- capacity of soil
- healthy forest biome

Social Category:

- access to water
- urbanization
- economic security
- social safety



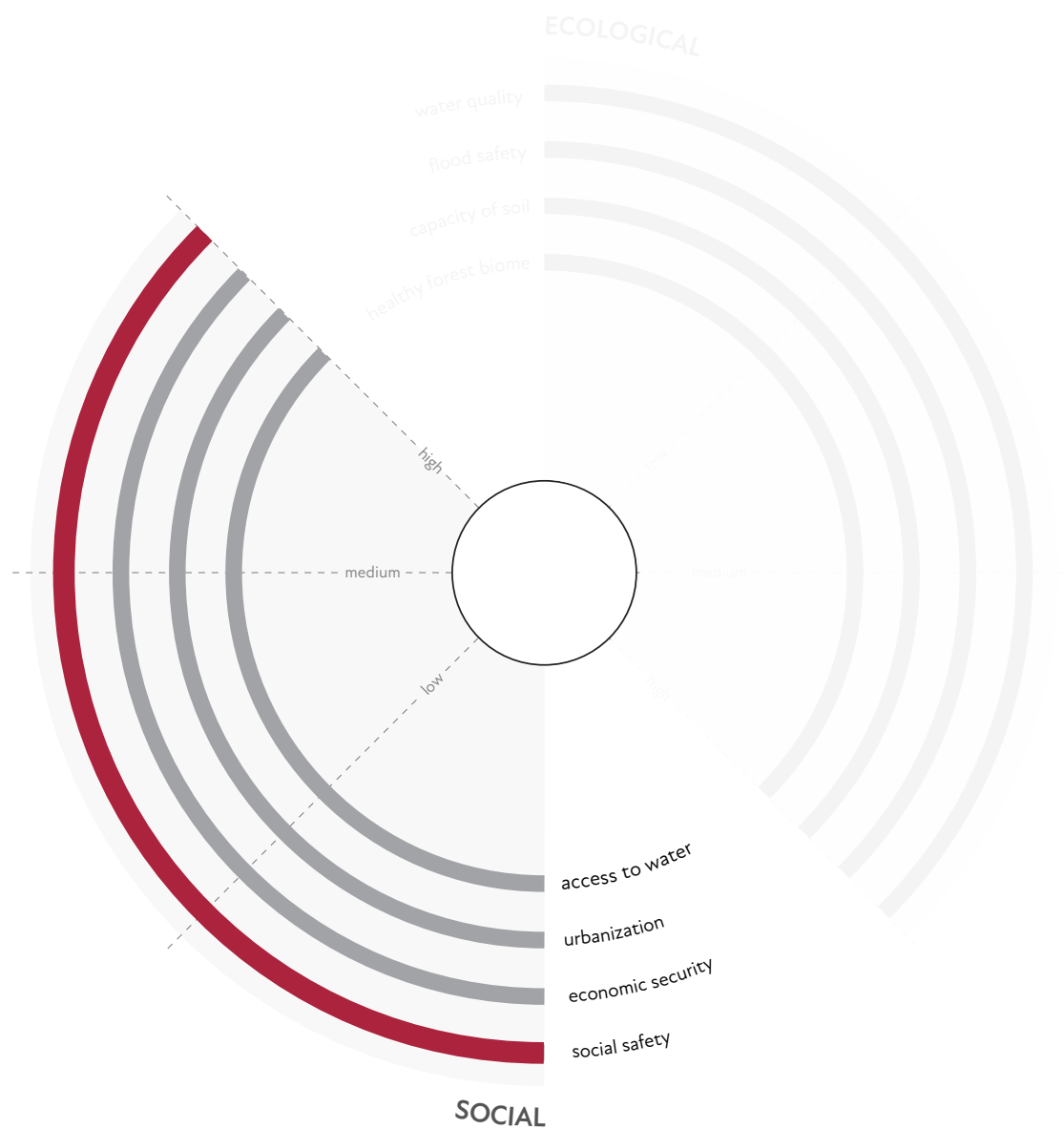
ASSESSMENT TOOL

Ecological Category:

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Social Category:

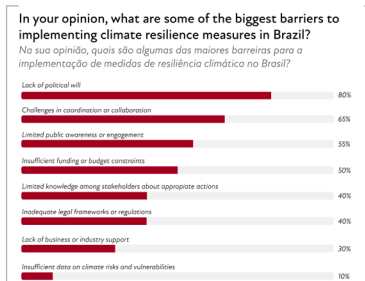
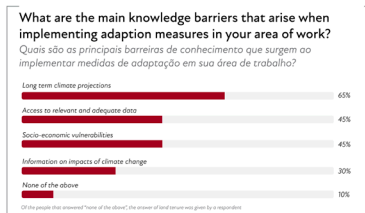
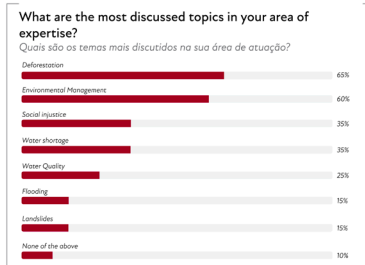
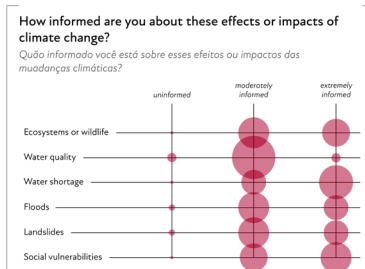
- access to water
- urbanization
- economic security
- social safety



Online Survey Questionnaire.

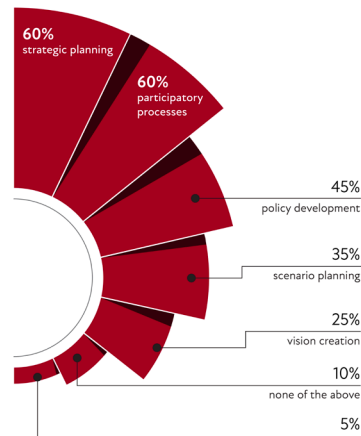
100%

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



Main Techniques Used:

Principais Técnicas Utilizadas:



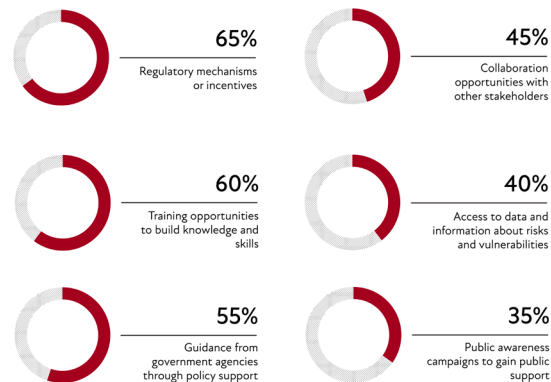
Most important solutions for environmental problems:

soluções mais importantes para os problemas ambientais:



Most helpful types of support to organizations for implementing inclusive adaptation measures:

tipos de apoio mais úteis para as organizações na implementação de medidas de adaptação inclusivas:



As of 26.06.2023:
there have been
22 respondents



01.

São Paulo should be focused on supporting vulnerable communities as well as encouraging nature-based urbanism or green infrastructures.

02.

That providing more incentives and more training opportunities to build capacity and knowledge are the most helpful types of support.

03.

One of the key limitations was that there lacks adequate collaboration or coordination in the implementation of solutions.

04.

The public still lacks sufficient awareness and understanding on the importance of implementing climate resilience solutions.

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04.

The public still lacks sufficient awareness and understanding on the importance of implementing climate resilience solutions.



ECOLOGICAL BACKBONE

APPLIED SDGS:



APPLIED THEORIES:

SOCIO-ECOLOGICAL RESILIENCE

- DAKOS, V., & KEFI, S. (2022).
- DAVOUDI, S., BROOKS, E., & MEHMOOD, A. (2013).

ECO-SYSTEM BASED ADAPTATION

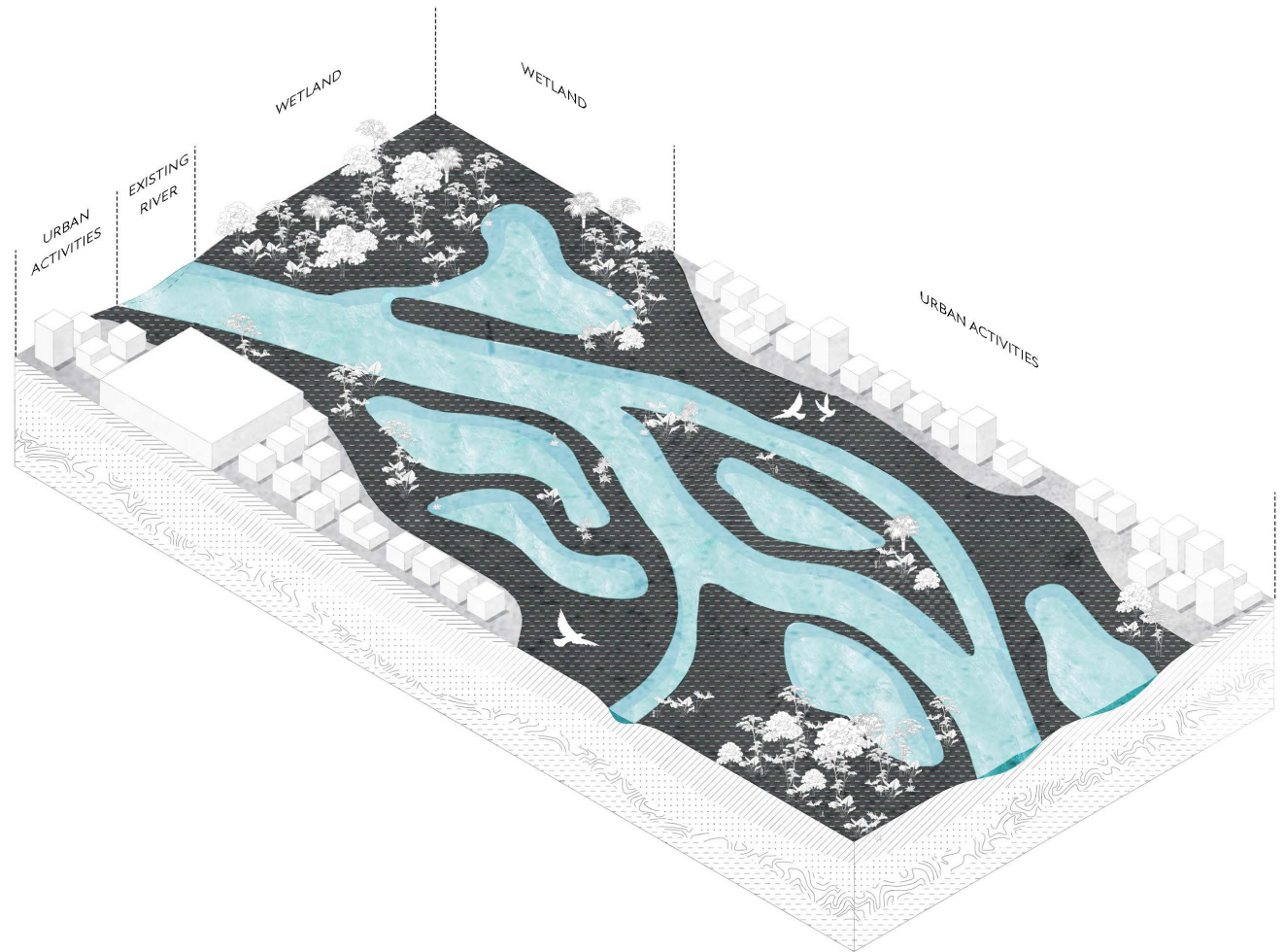
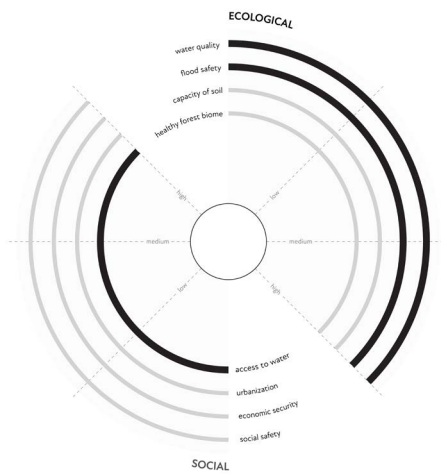
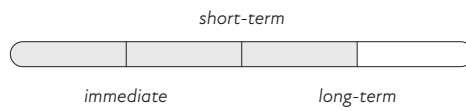
- JONES, H., HOLE, D., & ZAVALETA, E. (2012).
- MANES, S., ET AL. (2022).



Wetland Creation

■ THORSLUND ET AL., 2017

Phase Timeline

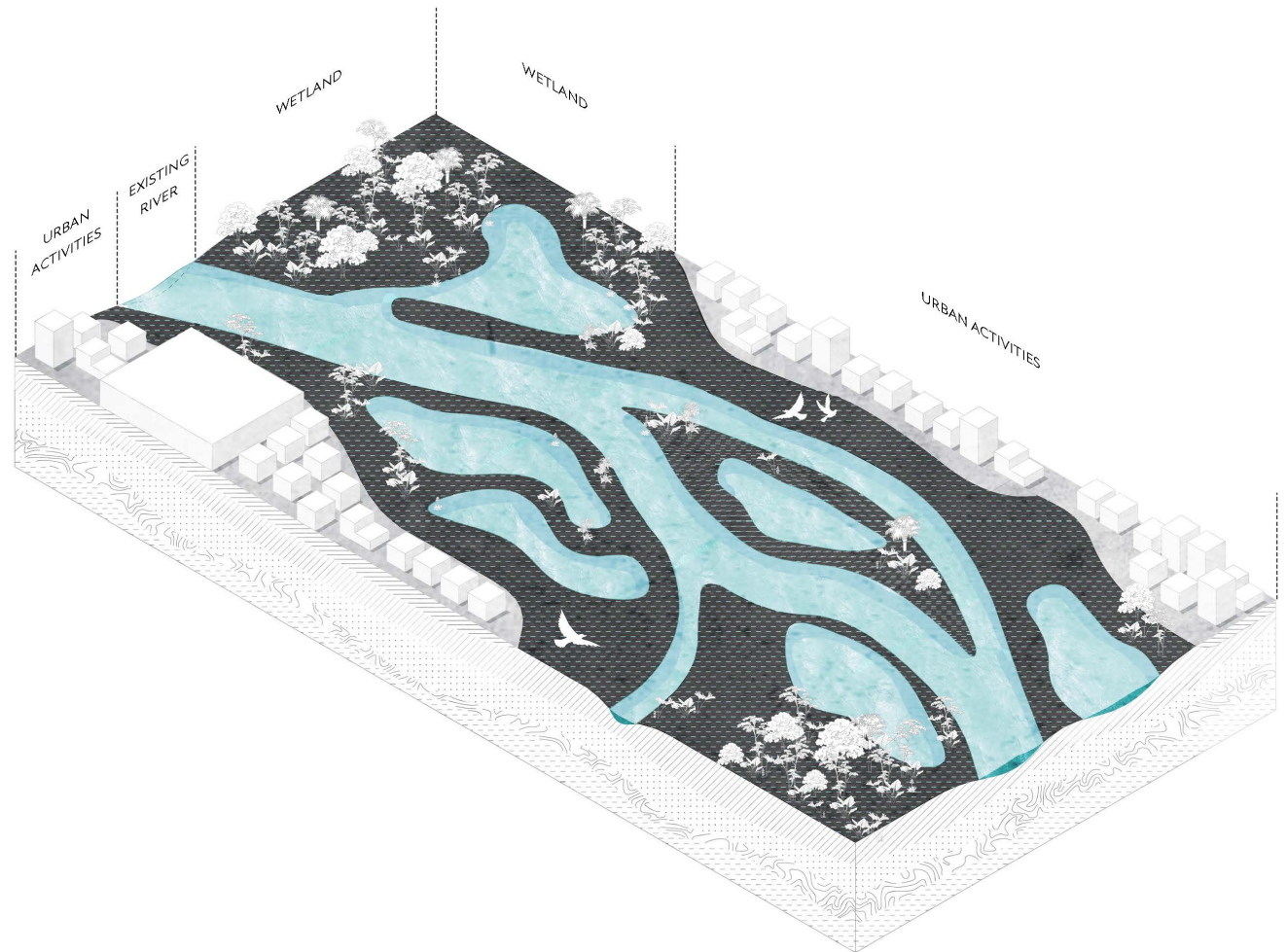
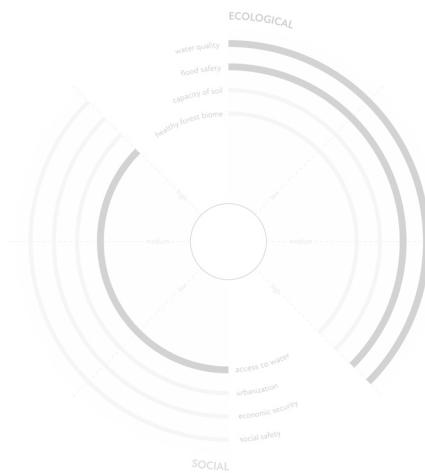




Wetland Creation

■ THORSLUND ET AL., 2017

Phase Timeline

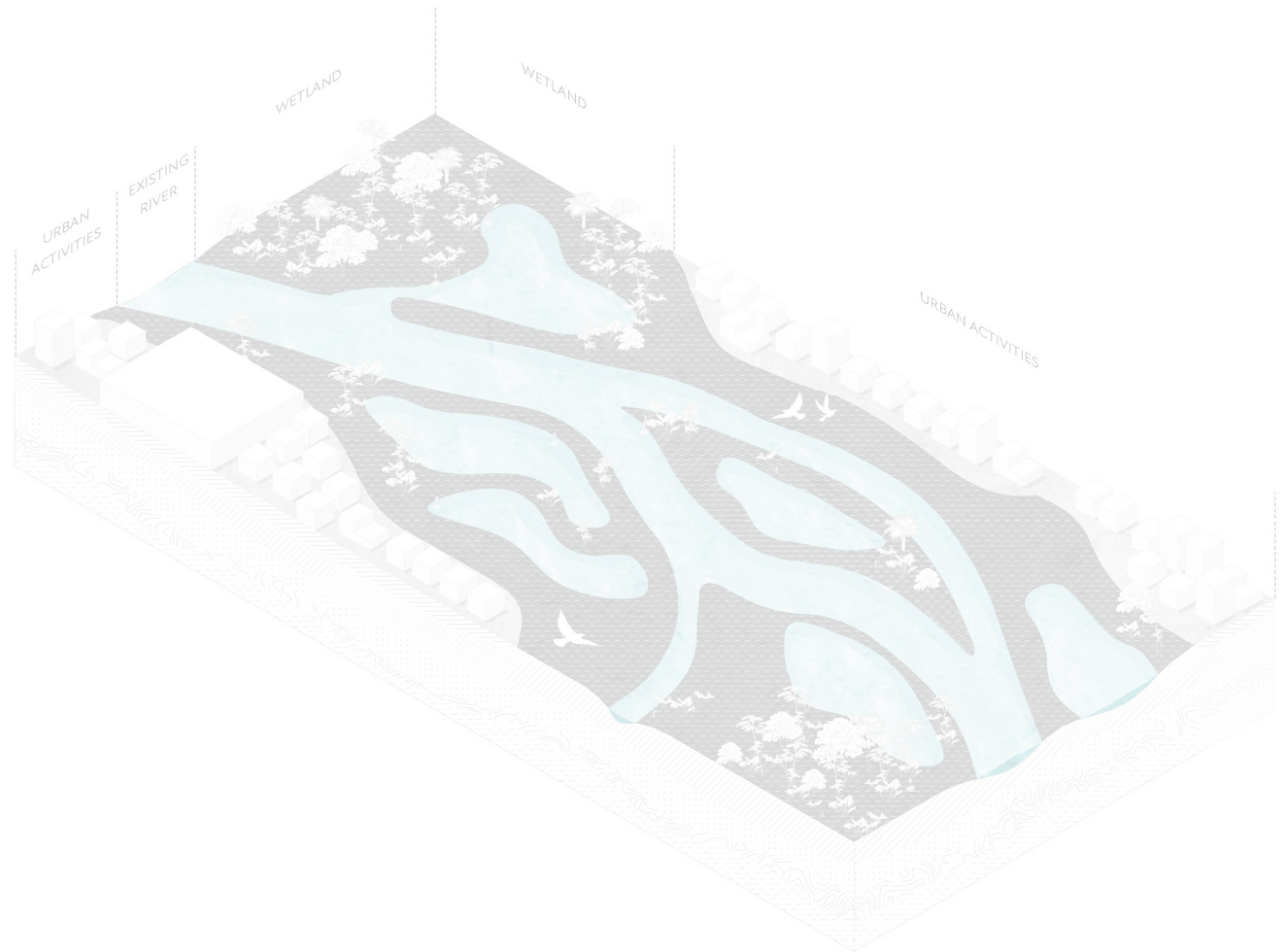
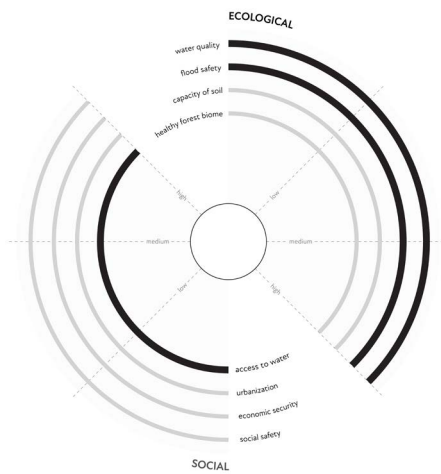




Wetland Creation

■ THORSLUND ET AL., 2017

Phase Timeline

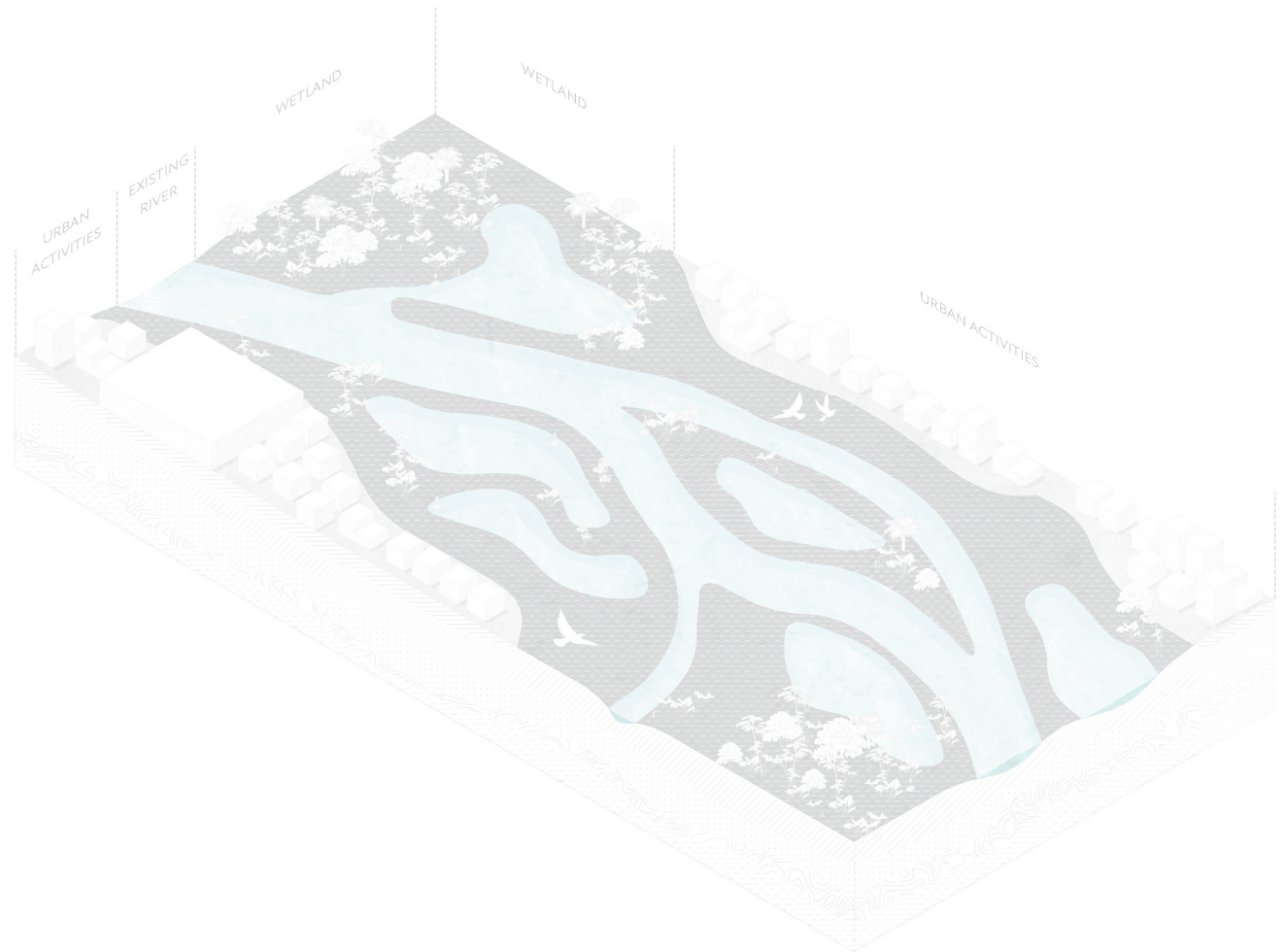
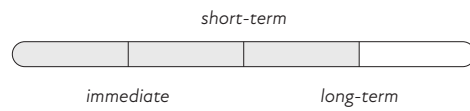




Wetland Creation

■ THORSLUND ET AL., 2017

Phase Timeline

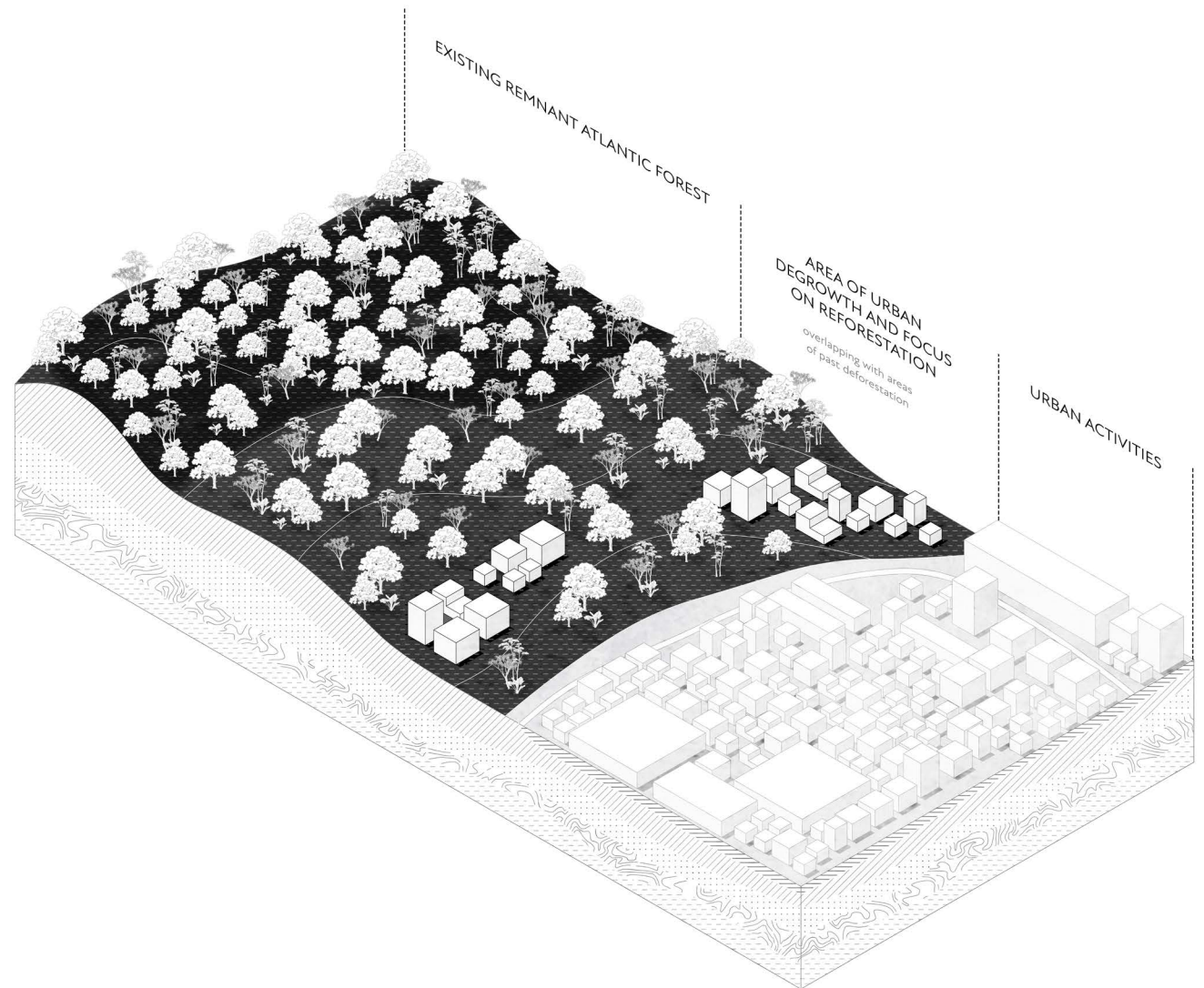
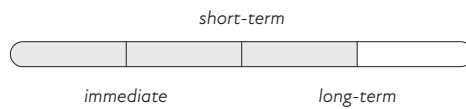




Rehabilitate Atlantic Forest

■ IPCC, 2022 AND GLOBAL FOREST WATCH, 2022

Phase Timeline

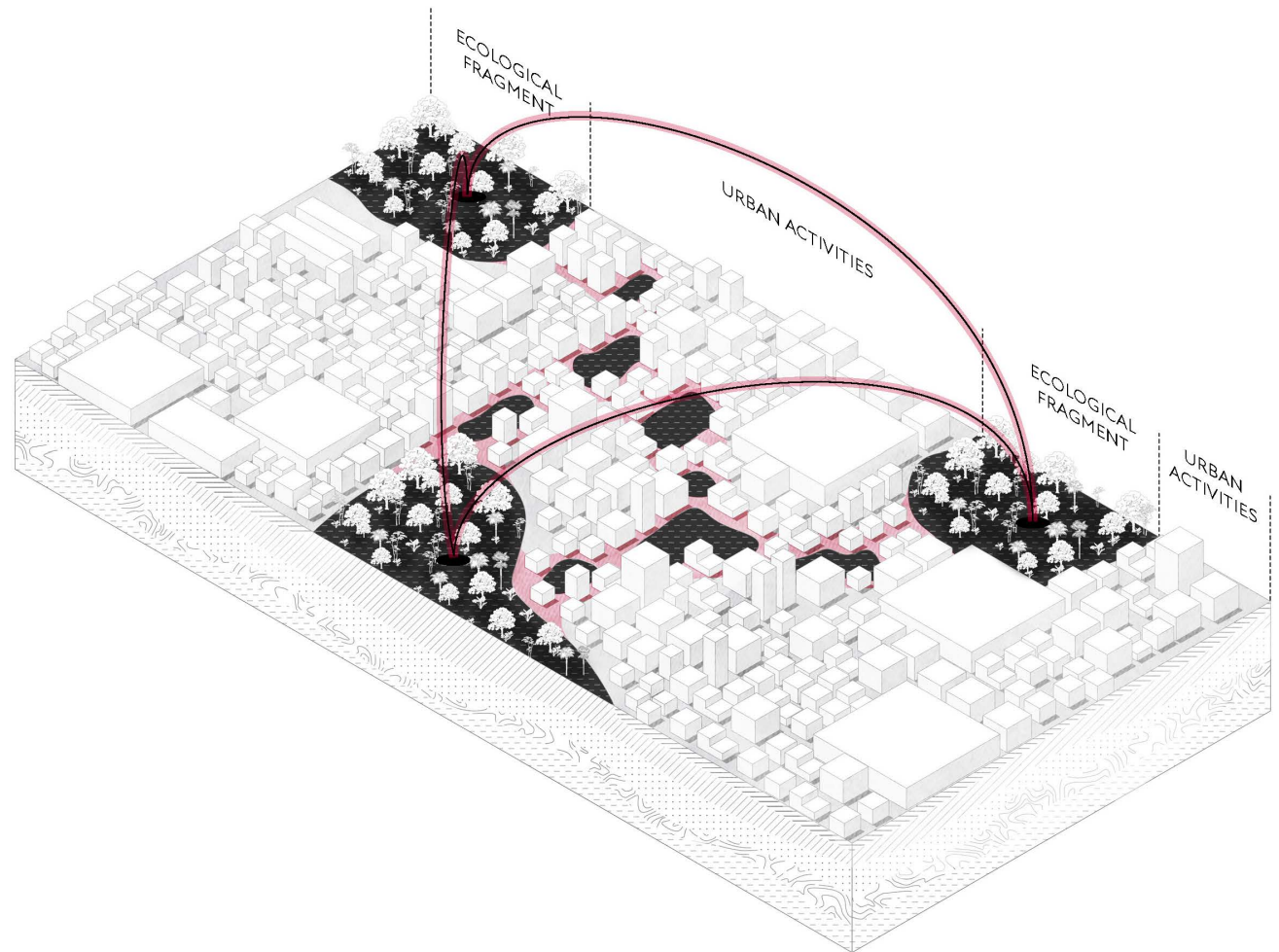
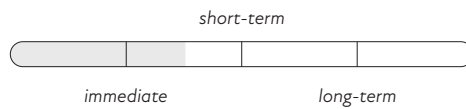




Ecological Connectivity

■ JODI HILTY, 2022 AND JAMES D. OLSON ET AL., 2013

Phase Timeline

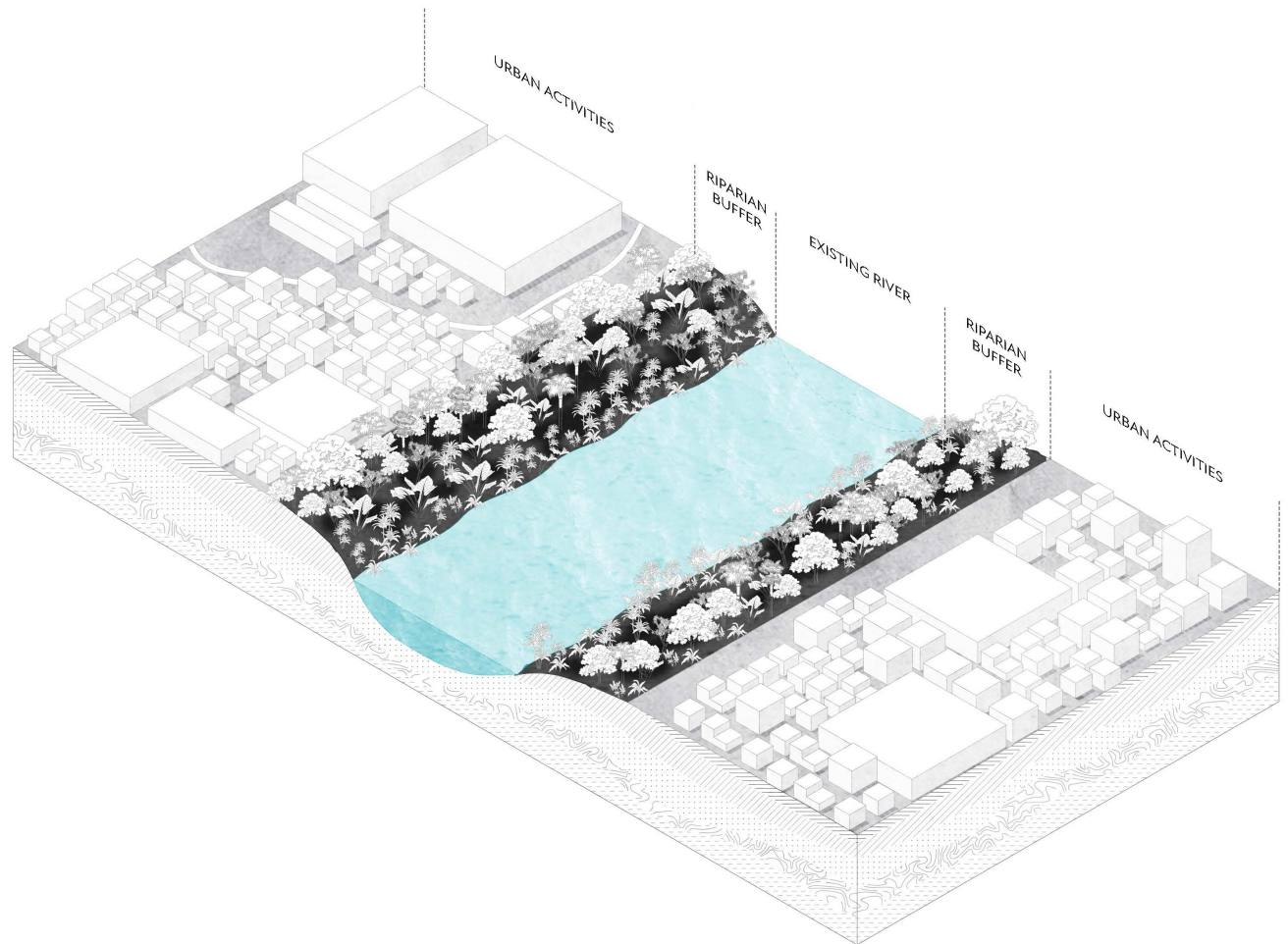
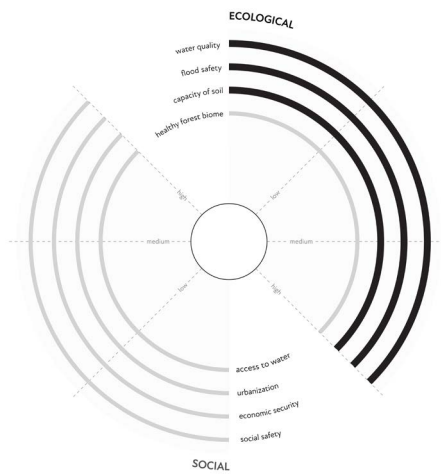
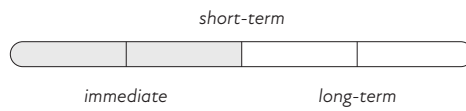




Riparian Vegetation

■ KAHN, ET AL., 2022

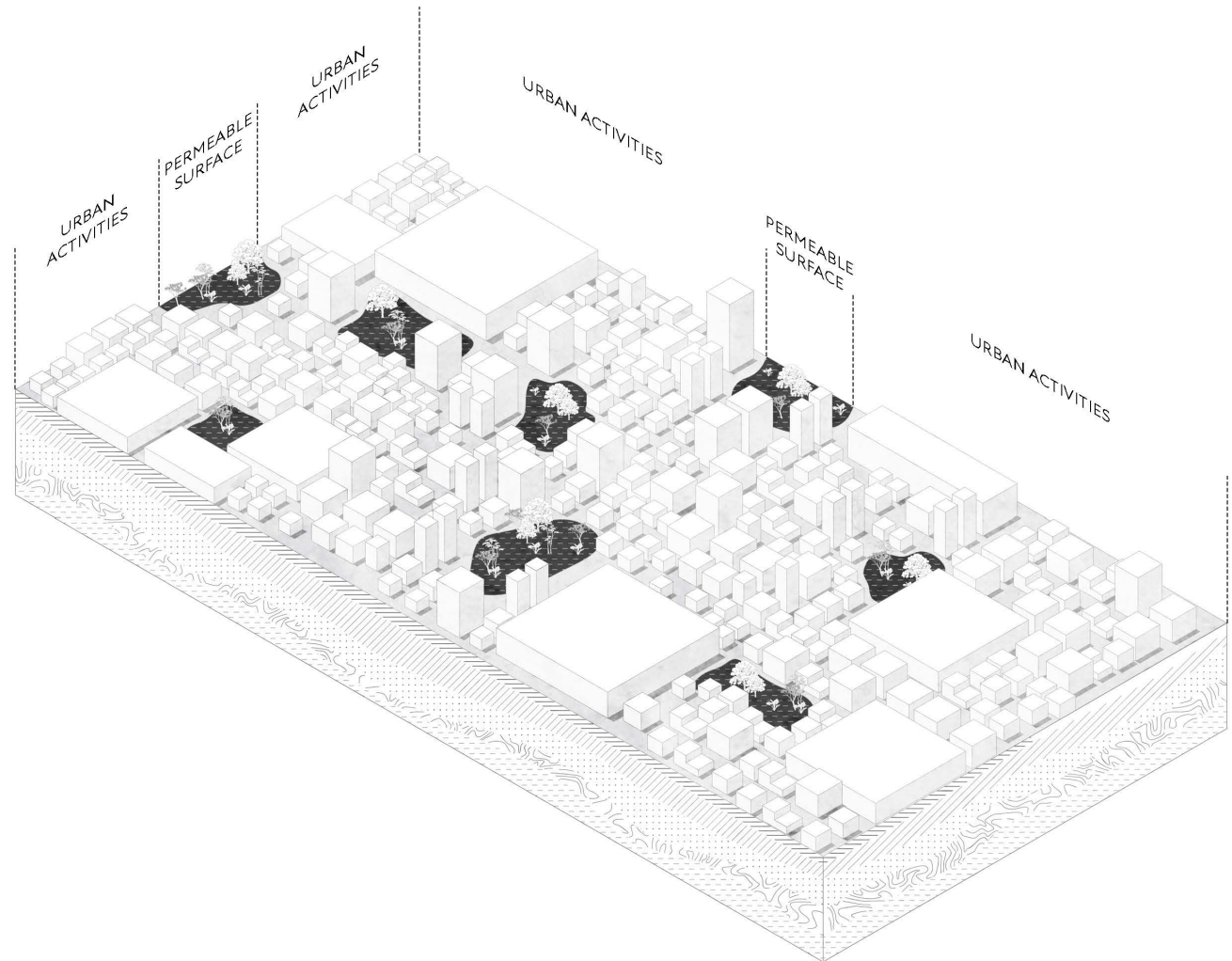
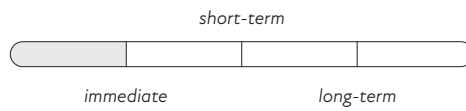
Phase Timeline





Permeable Surfaces

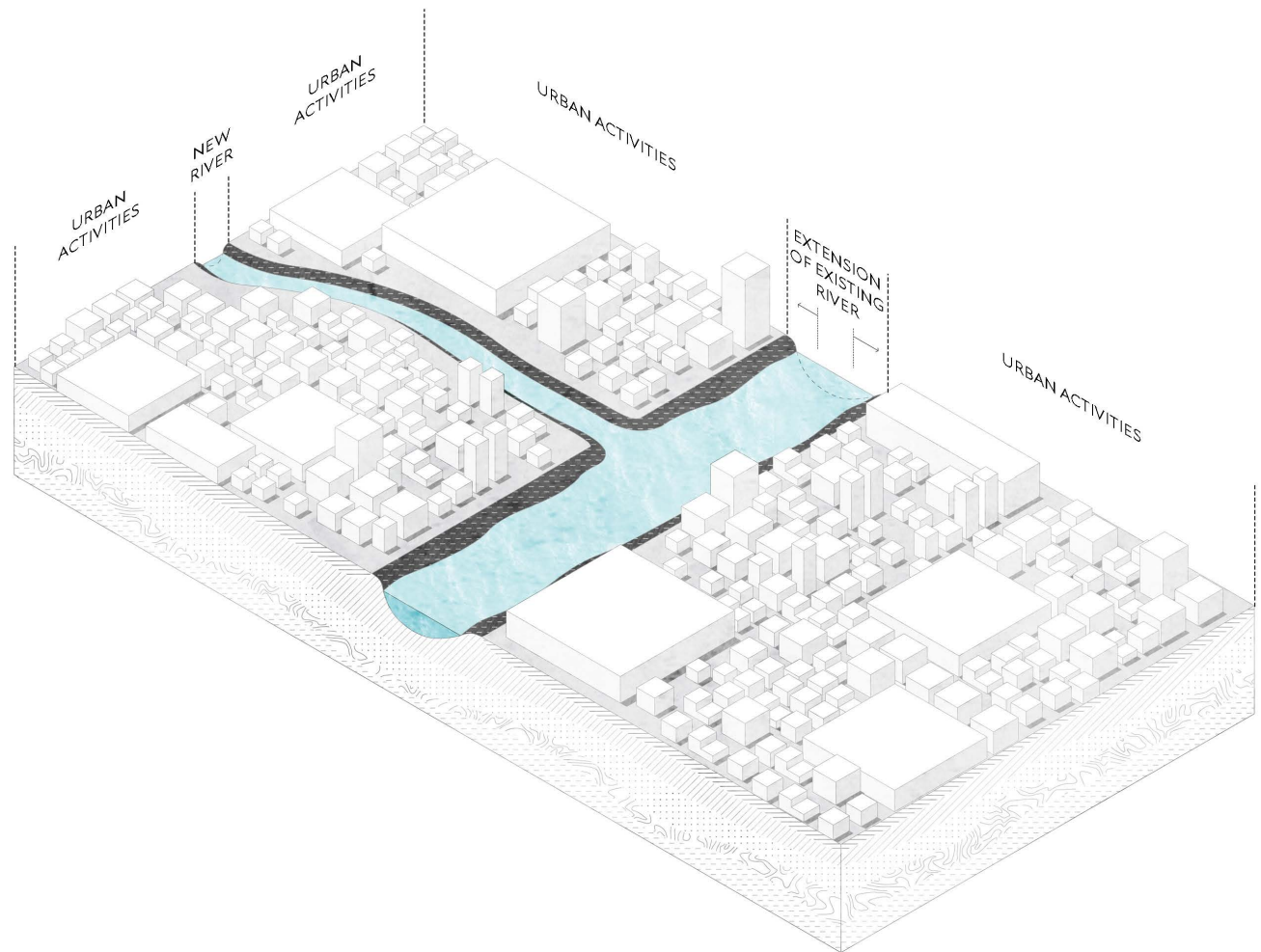
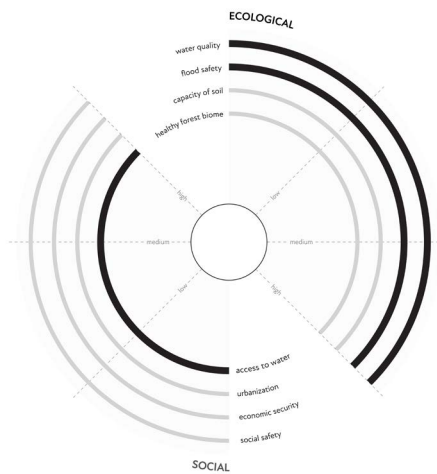
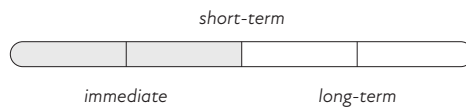
Phase Timeline





Expansion of Water Networks

Phase Timeline





Thus, improving the resilience of vulnerable communities in São Paulo through the revival of neglected and exploited ecological systems.



Source: Floodlist



EQUITABLE ACCESS

APPLIED SDGS:



APPLIED THEORIES:

SOCIO-ECOLOGICAL RESILIENCE

- DAKOS, V., & KEFI, S. (2022).
- DAVOUDI, S., BROOKS, E., & MEHMOOD, A. (2013).

URBAN POLITICAL ECOLOGY

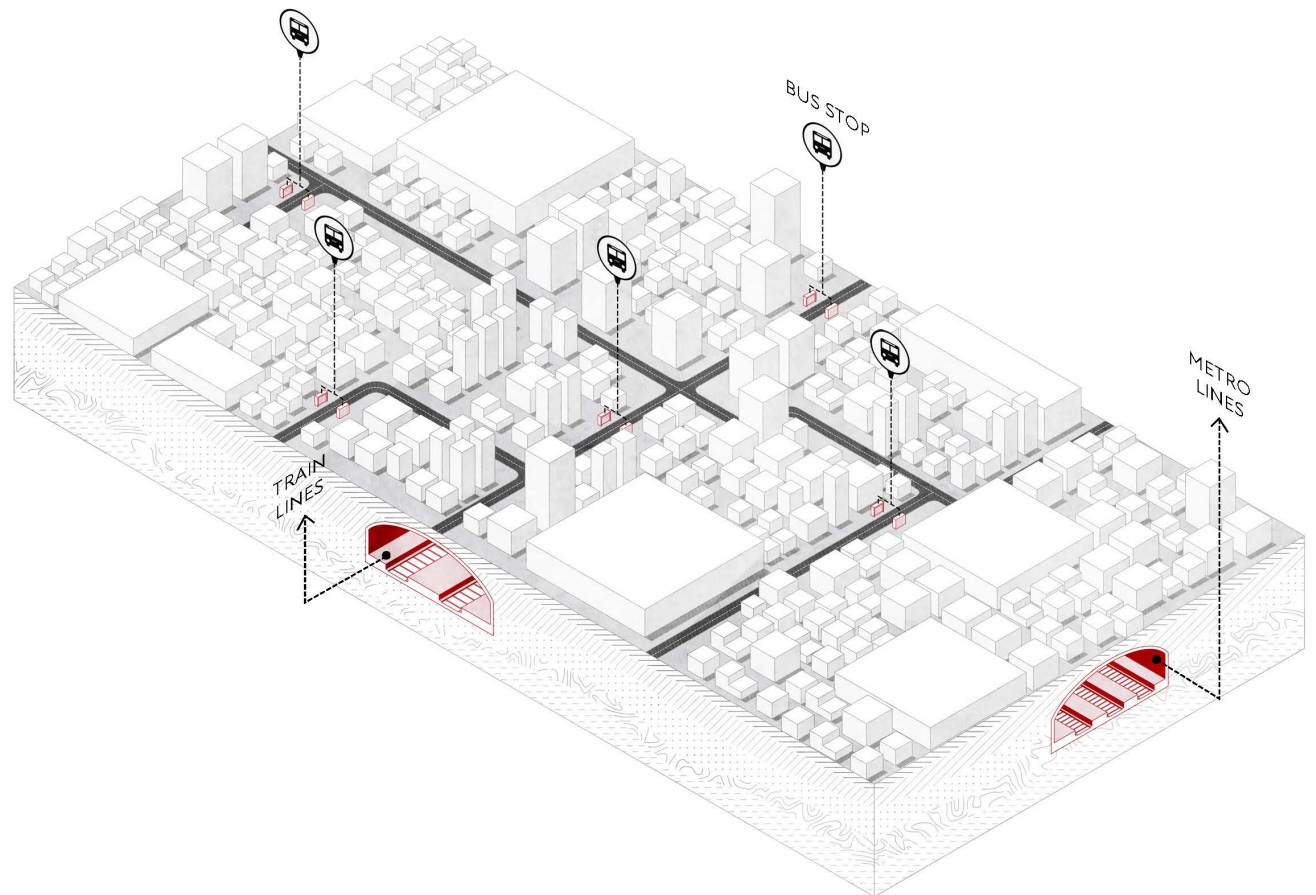
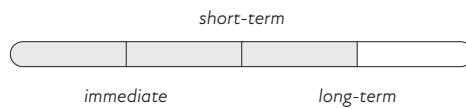
- HEYNEN, N., KAIKA, M., & SWYNEDGOUW. (2006).
- NIK HEYNEN. (2014).



Expansion of Transportation

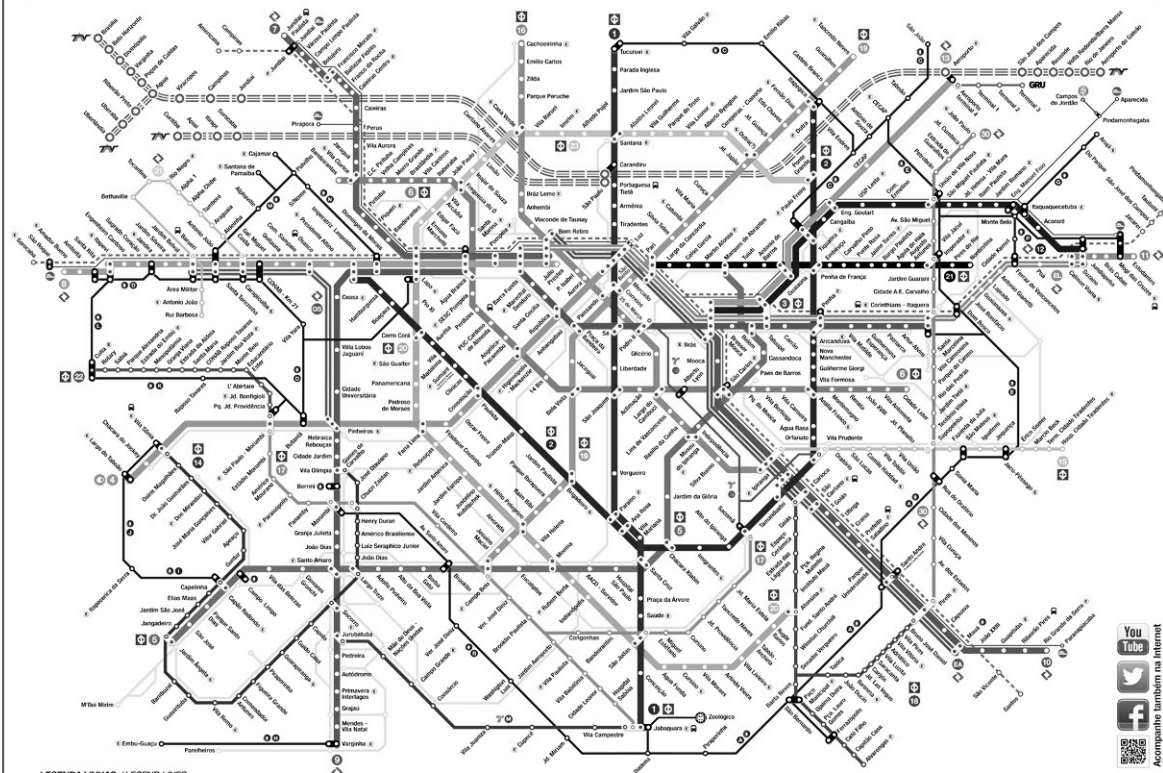
■ A TALE OF TWO CITIES, UN-HABITAT, 2010

Phase Timeline





Mapa do Transporte Metropolitano - 2034 / Metropolitan Transport Network - 2034



LEGENDA LINHAS / LEGEND LINES

- Linha 1 - Azul / Blue - Linha 2 - Verde / Green - Linha 3 - Vermelha / Red - Linha 4 - Amarela / Yellow - Linha 5 - Lilás / Lilac - Linha 6 - Laranja / Orange - Linha 7 - Rubi / Ruby - Linha 8 - Diamante / Diamond - Linha 9 - Esmeralda / Emerald - Expresso Oeste-Sul-Esmeralda / South West Express-Emerald - Linha 10 - Turquesa / Turquoise - Expresso ABC - Turquesa / ABC Express - Turquoise - Linha 11 - Coral / Coral - Expresso Leste - Coral / East Express - Coral - Linha 12 - Safira / Sapphire - Linha 13 - Jade / Jade - Linha 14 - Musgo - Monotrilho / Moss - Monorail	- Linha 15 - Prata - Monotrilho / Silver - Monorail - Linha 16 - Púrpura / Purple - Linha 17 - Ouro - Monotrilho / Gold - Monorail - Linha 18 - Bronze - Monotrilho / Bronze - Monorail - Linha 19 - Celeste / Light Blue - Linha 20 - Rosa / Pink - Linha 21 - Ônix (Preta) / Onyx (Black) - Linha 22 - Cobre - Monotrilho / Copper - Monorail - Linha 23 - Quik / Quik - Linha 30 - Vinho - VLT / Wine - Light Rail Vehicle - Linha 31 - Bego - VLT / Bego - Light Rail Vehicle - Linha M - Oliva - Light Rail Vehicle - Expresso Tiradentes / BRT Tiradentes Express - Corredores Municipais / BRT Bus Corridor - ABD - São Mateus/Jabaquara - Diadema/Morumbi	- Guarulhos/Tucuruvi - Itapevi/Butantã - Guarulhos/São Mateus - BRT Perimetral Alto Tietê - Embu-Guaçu/Vargem - Itapeverica da Serra/Capão Redondo - Itapeverica da Serra/Vila Sônia - Raposo Tavares - Itapevi/Cotia - Alphaville/Cajamar - Anhanguera - Leste - Trem Regional - Interdistâncias / Regional Train - Interdistances - Expresso Turístico - Juruatê Express - Expresso Turístico - Campos do Jordão / Touristic Express - GRU Transporte Aeroporto / Airport Shuttle Service - TAV - Trem de Alta Velocidade / High Speed Train	- Ponte Orc / Ore Shuttle Service - Estação/Terminal do Trem/Monotrilho/VR / Station - Estação TAV / High Speed Train Station - Estação de Integração - gratuita / Integration - Free Interchange - Estação de Integração - tarifada / Integration - Paid Interchange - Estacionamento de Veículos Integrado / Integrated Car Parking - Terminal Rodoviário / Bus Terminal
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INFORMAÇÕES / USEFUL INFORMATION

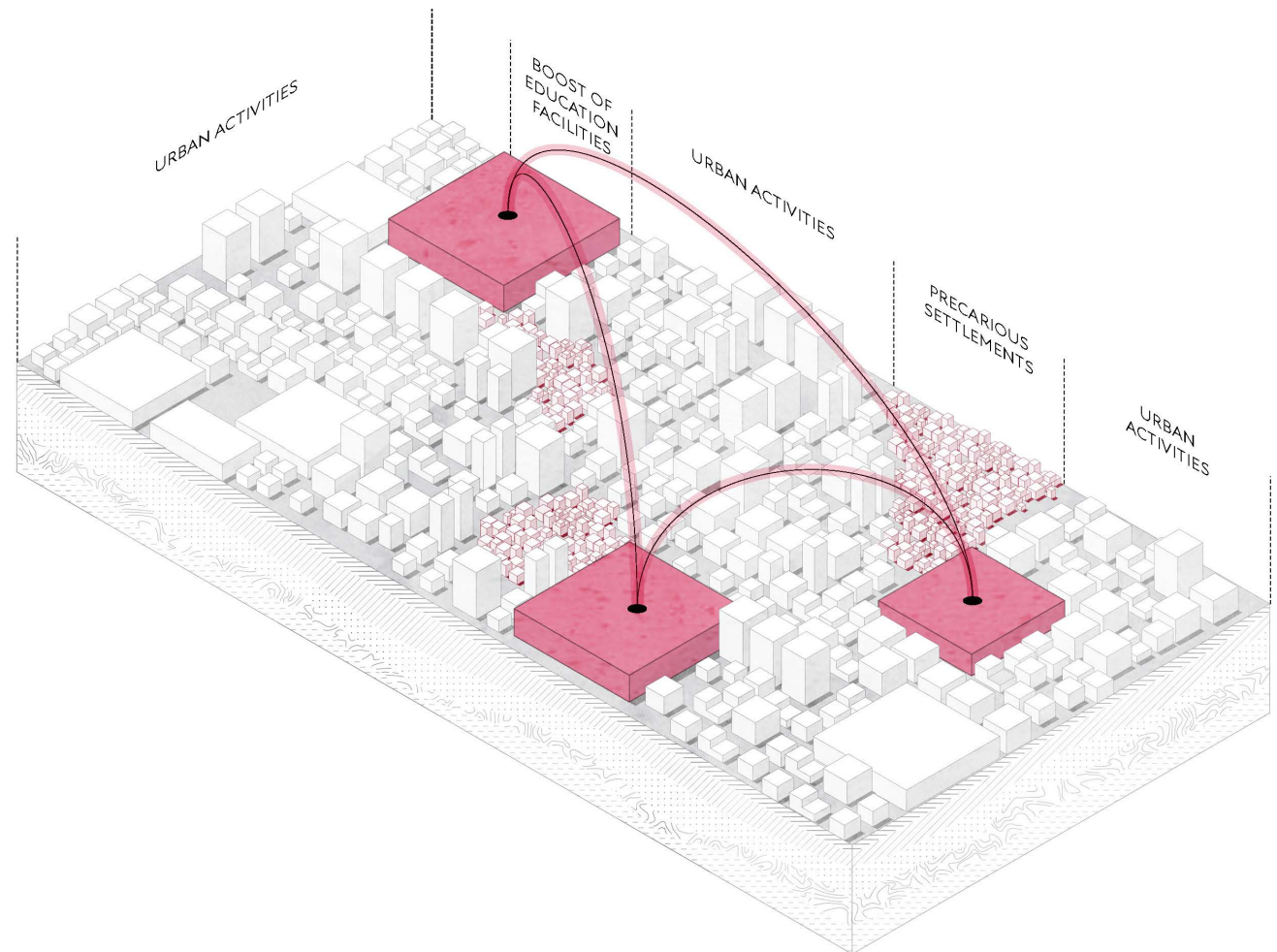
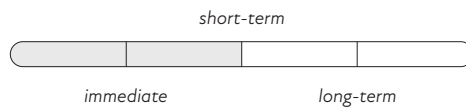
- www.metro.sp.gov.br - www.cptm.sp.gov.br - www.viaquatro.com.br - www.emtu.sp.gov.br - www.sptm.sp.gov.br - www.etcf.sp.gov.br - www.anti.gov.br - www.gru.com.br	0800 770 7722 0800 055 0121 0800 770 7100 0800 724 0555 156 (12) 3644 7400/3644 7409 - XXX XXX XXXX (11) 2445 2945/2445 3173
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Reinforcement of Education

■ A TALE OF TWO CITIES, UN-HABITAT, 2010

Phase Timeline





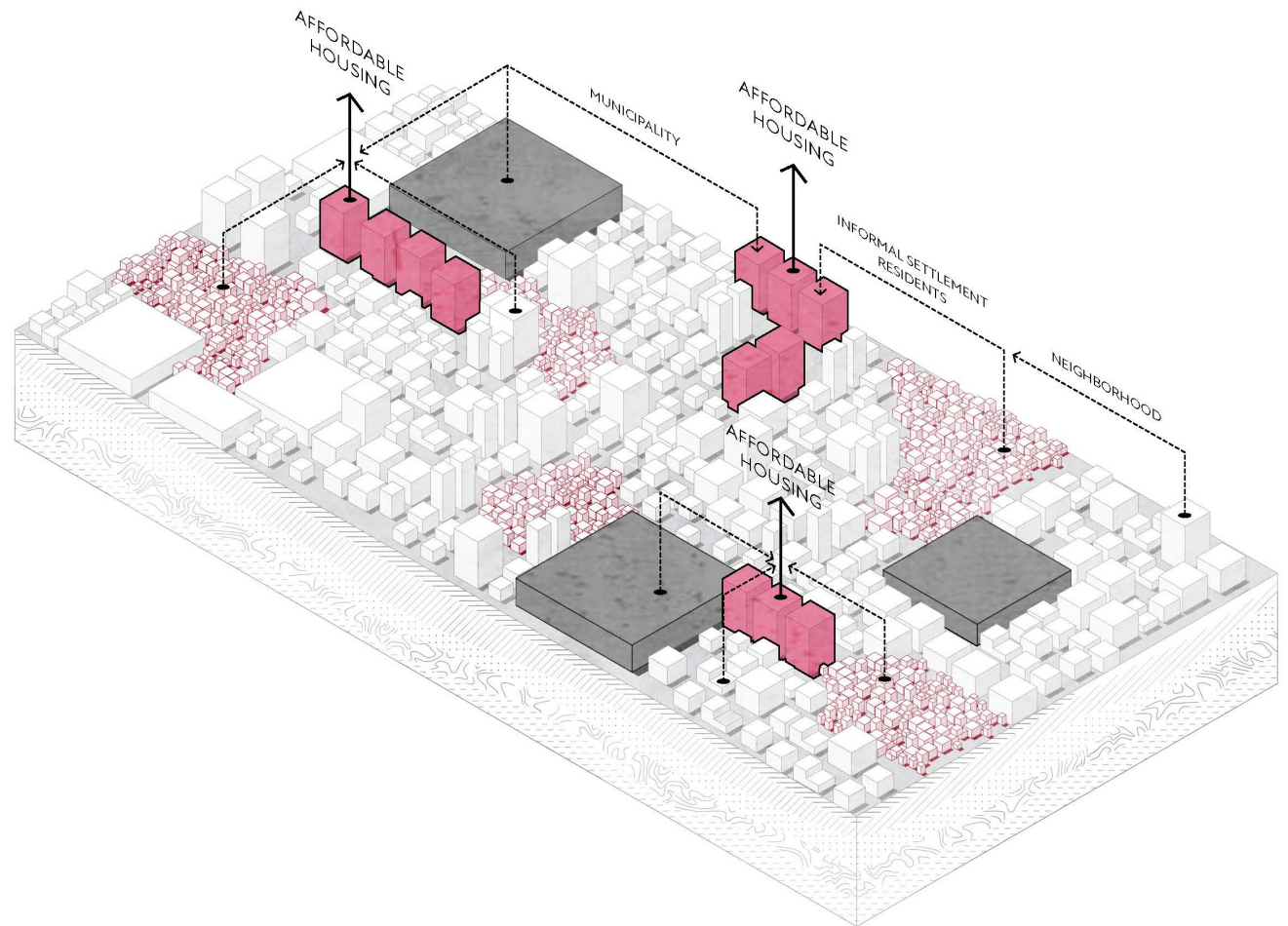
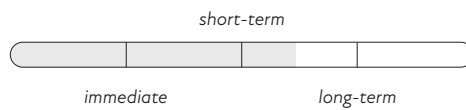
Source: ceappedreira.org.br



Increase Access to Affordable Housing

■ A TALE OF TWO CITIES, UN-HABITAT, 2010 AND CATALYTIC COMMUNITIES, N.D.

Phase Timeline

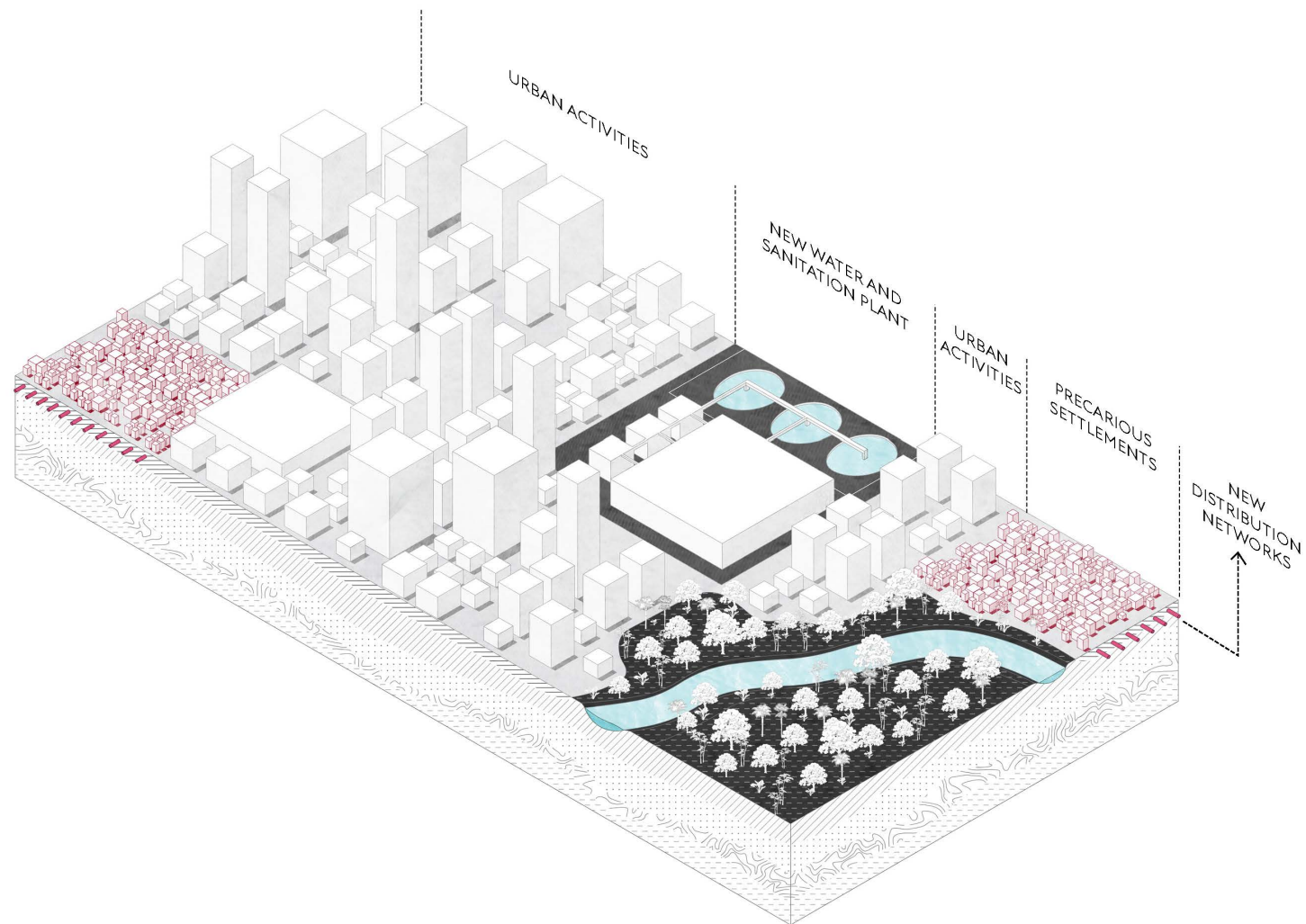
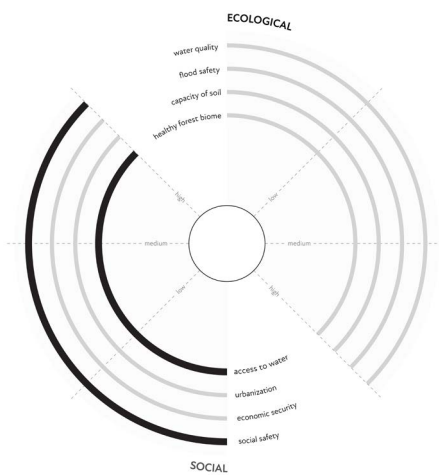
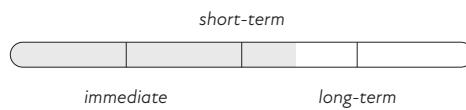




Development of Water + Sanitation Infrastructure

■ A TALE OF TWO CITIES, UN-HABITAT, 2010

Phase Timeline

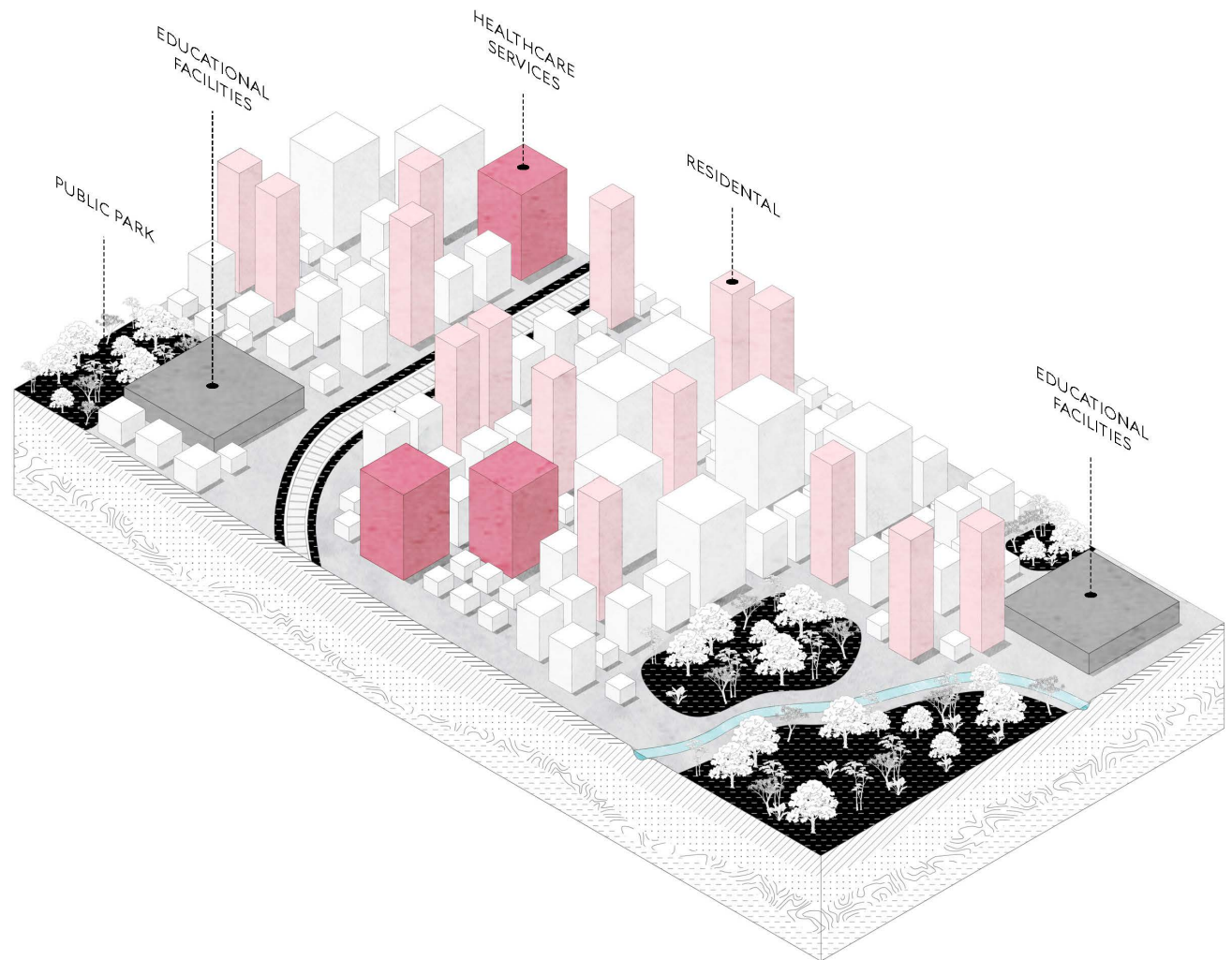
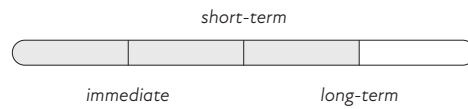




Employ a Compact City Model

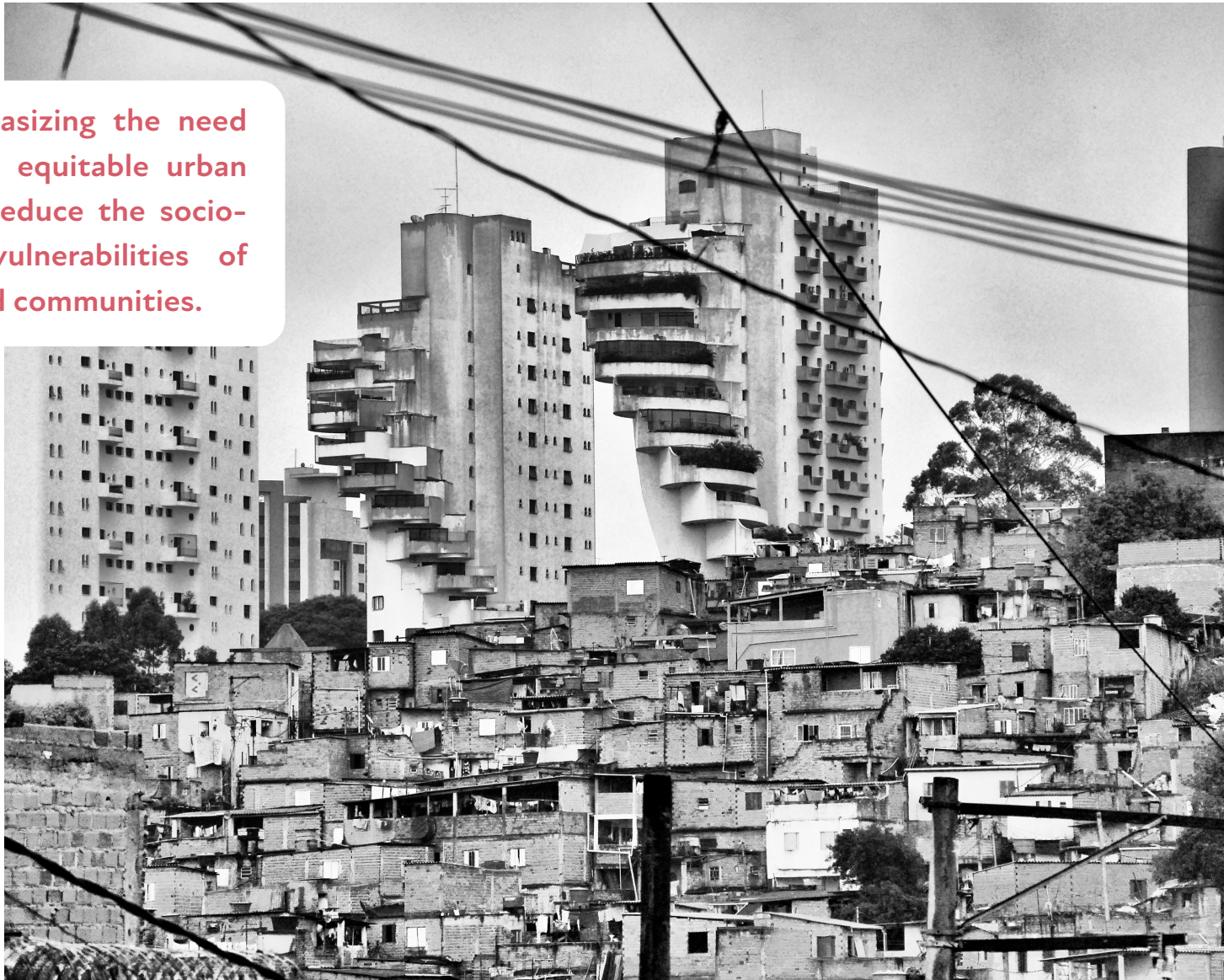
■ A TALE OF TWO CITIES, UN-HABITAT, 2010 AND OECD, 2012

Phase Timeline

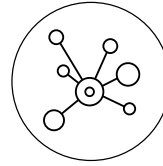




Thus, emphasizing the need for fair and equitable urban growth to reduce the socio-economic vulnerabilities of marginalized communities.



Source: Roberto Rocco



ADAPTIVE GOVERNANCE

APPLIED SDGS:



APPLIED THEORIES:

ADAPTIVE GOVERNANCE

- CHAFFIN, B.C., & GUNDERSON, L.H. (2016)
- PEDRO HENRIQUE CAMPELLO TORRES, ET AL. (2021).

CO-PRODUCTION OF KNOWLEDGE

- MILLER, C.A., & WYBORN, C. (2020)
- PEDRO HENRIQUE CAMPELLO TORRES, ET AL. (2021).

URBAN POLITICAL ECOLOGY

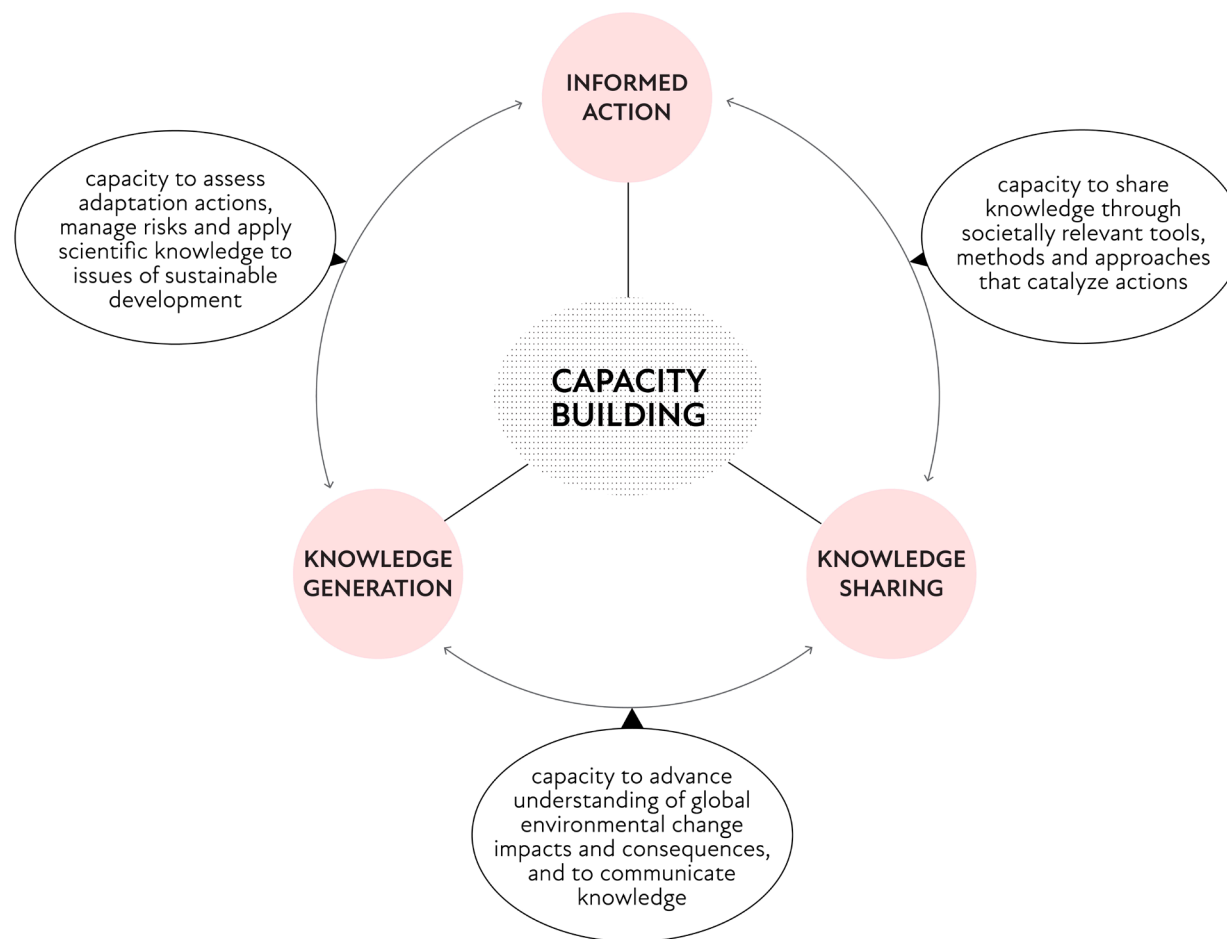
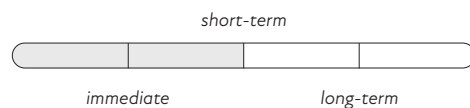
- HEYNEN, ET AL. (2006)
- NIK HEYNEN. (2014)



Support Capacity Building Programs

■ VIRJI ET AL., 2012

Phase Timeline

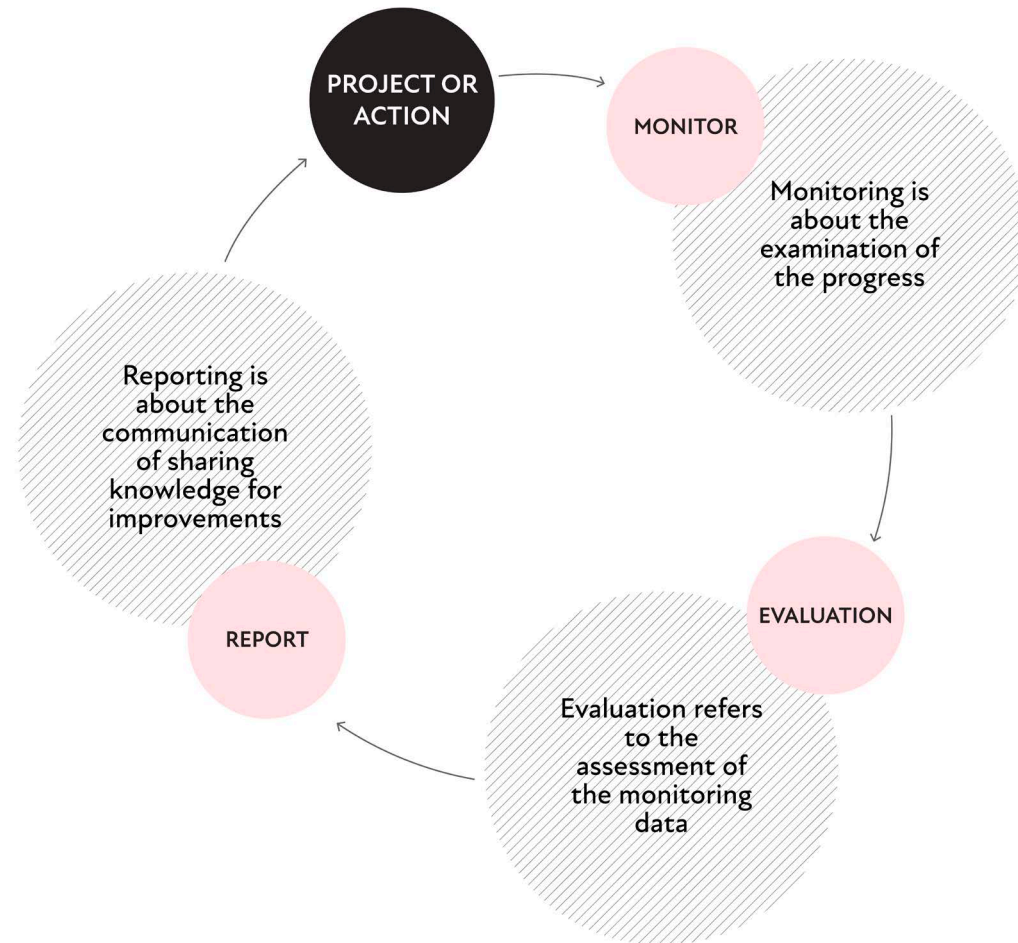
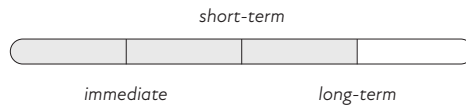




Develop Monitor, Report, and Evaluation Systems

■ EUROPEAN ENVIRONMENT AGENCY, 2015

Phase Timeline

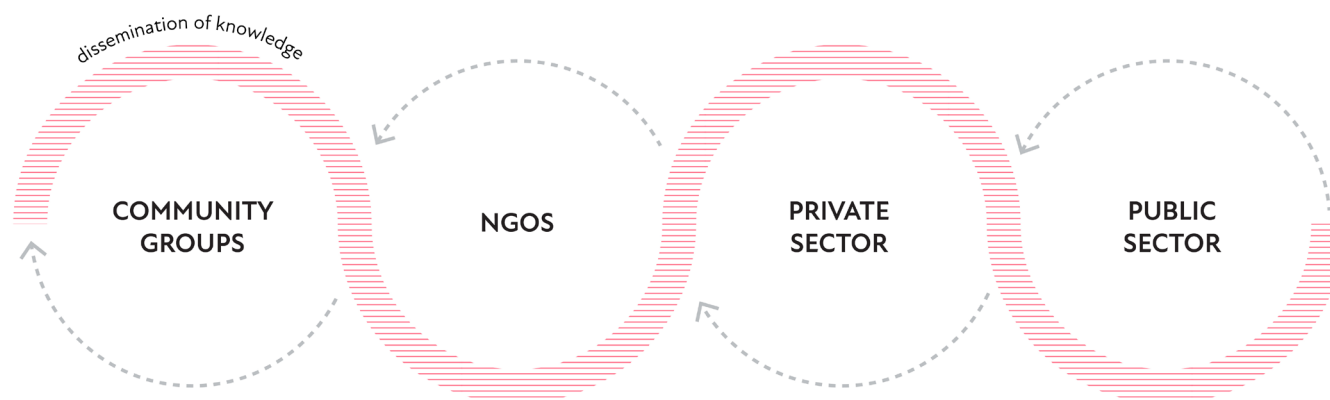
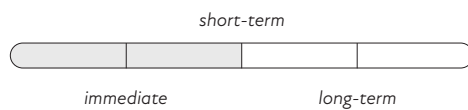




Promotion of Social Learning and Education

■ ISON ET AL., 2015

Phase Timeline

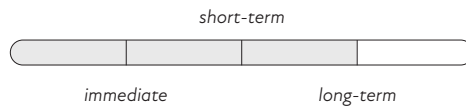




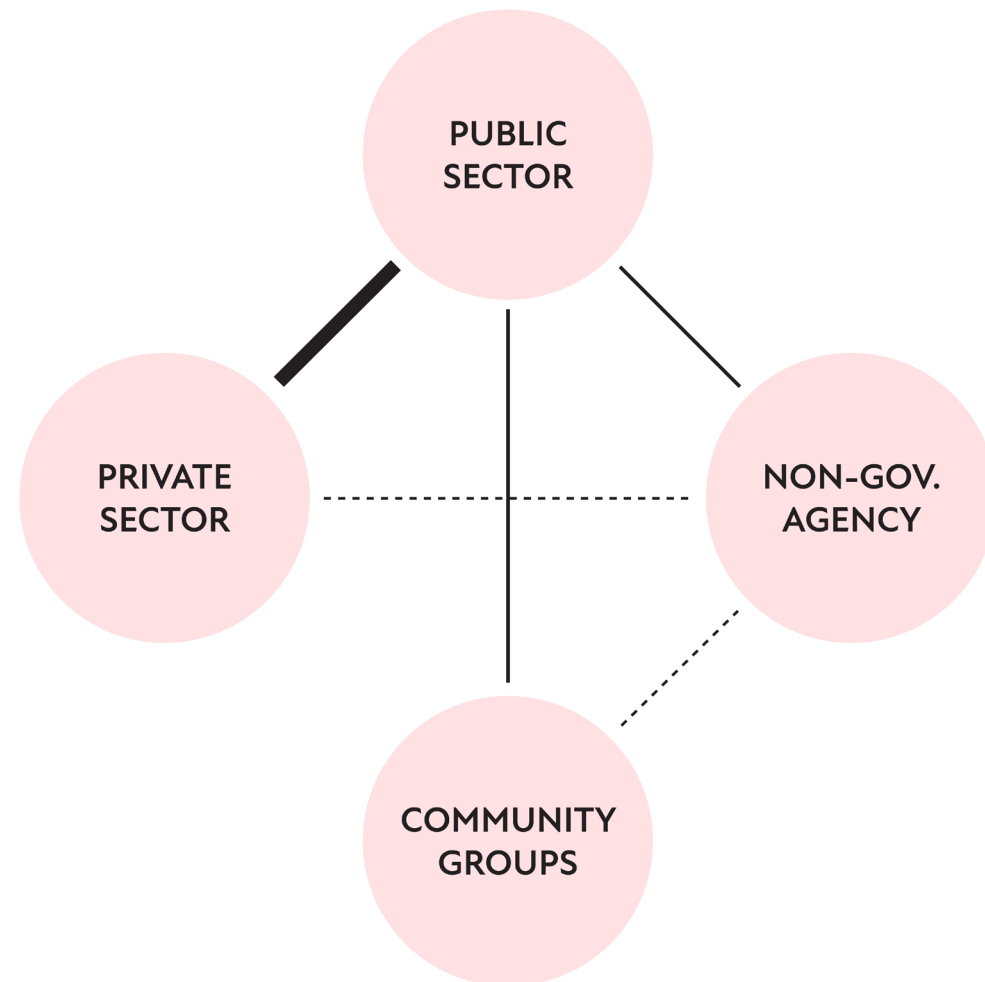
Promotion of Collaboration and Partnerships

■ VIRAPONSGE ET AL., 2016

Phase Timeline



- regulate + manage**
- collaborate + execute
- monitor + consultate



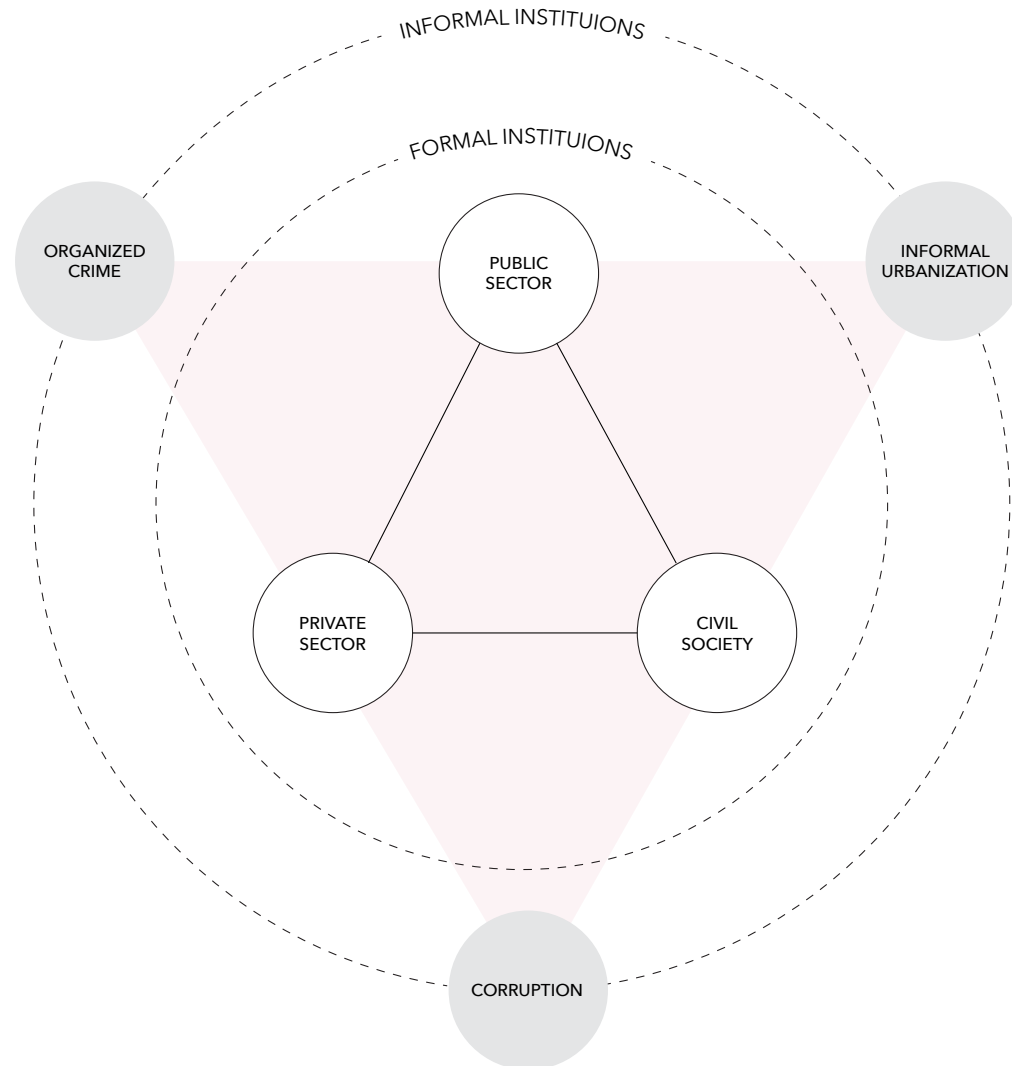


Thus, to ensure transparency and inclusivity in decision-making processes in the relevant governance and management systems.



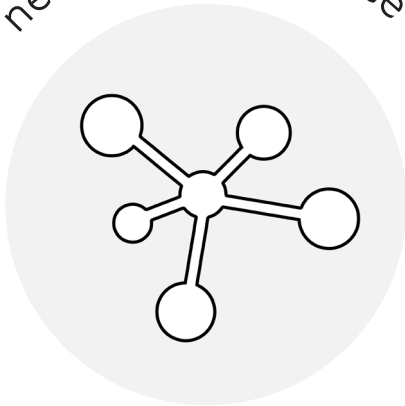
Source: Rede Nossa Sao Paulo, 2023

INFORMAL INSTITUTIONS

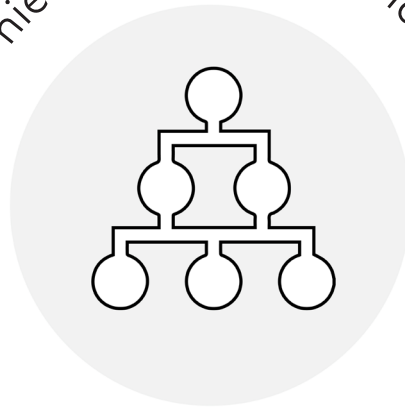


META - GOVERNANCE

network governance



hierarchical governance



market governance



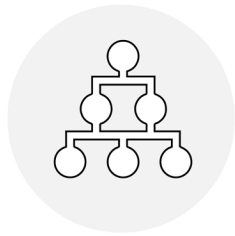


NETWORK GOVERNANCE

LEVELS OF GOVERNANCE

RESPONSIBILITIES

NATIONAL	FINANCE	•
STATE	FINANCE, COORDINATE, IMPLEMENT	•
CITY	COORDINATE, IMPLEMENT, REGULATE, MONITOR	•
MUNICIPAL	IMPLEMENT, REGULATE, MONITOR	•
LOCAL (non-governmental)	MONITOR, CONSULT, IMPLEMENT	•



HIERARCHICAL GOVERNANCE

CITY STATUTE, 2001

(Estatuto da Cidade)

Article 7

**Urban Land and Property Tax
(IPTU) Progressive over time**

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

Article 25

Right of Preemption

(Direito de preempção)

Article 5

**Compulsory Parcelling,
Building, or Utilization (PEUC)**

*(Parcelamento, Edificação ou
Utilização Compulsórios)*

Article 9

**Special Urban Real Estate
Possession**

(Usucapião especial de imóvel urbano)

Article 35

**Transfer of the Right to Build
(TDC)**

(Transferência do Direito de Construir)



MARKET GOVERNANCE

Public Infrastructure Subsidy

Forest Reforestation Grants

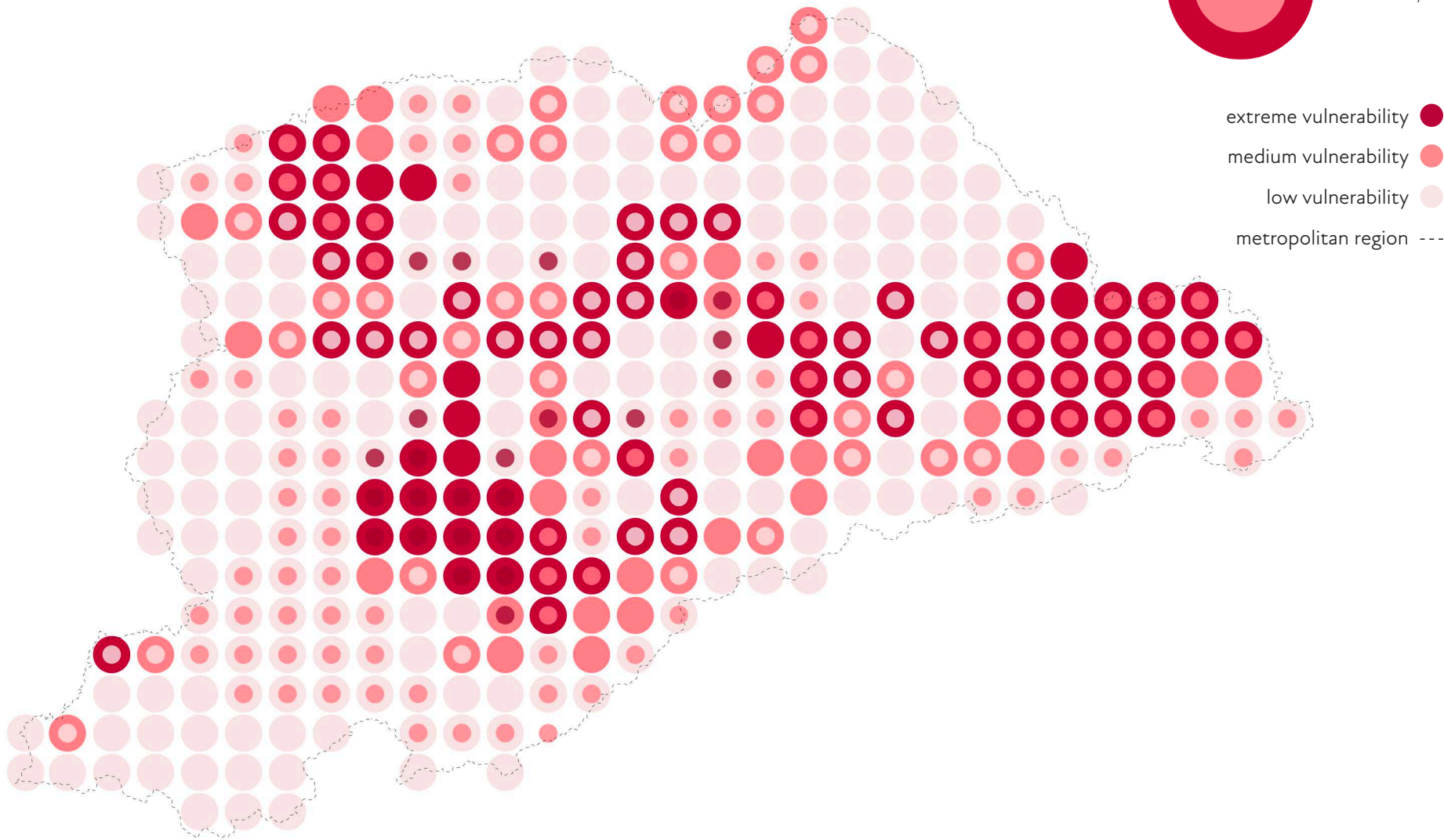
Affordable Housing Grants for CLT's

Biodiversity Offsets

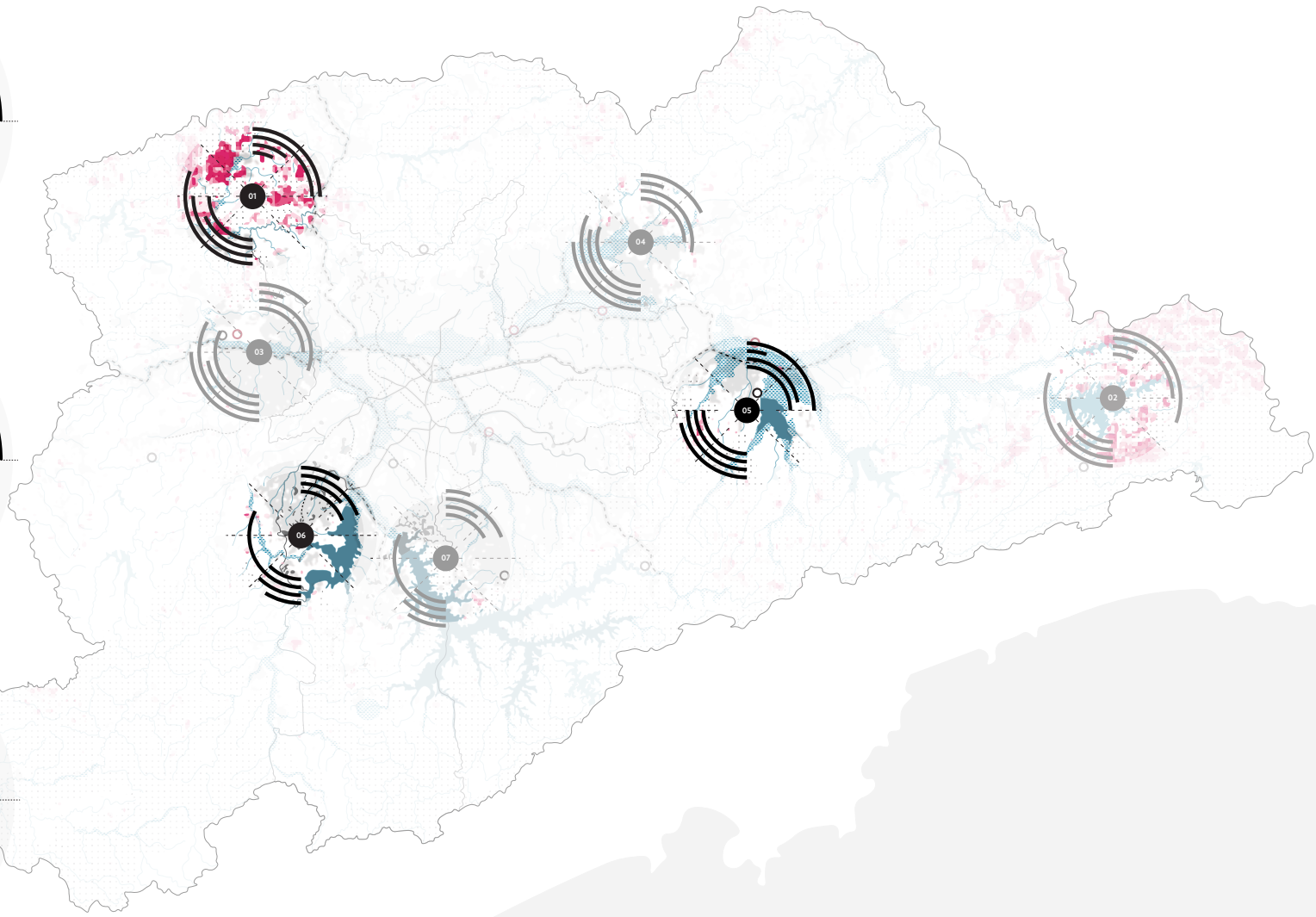
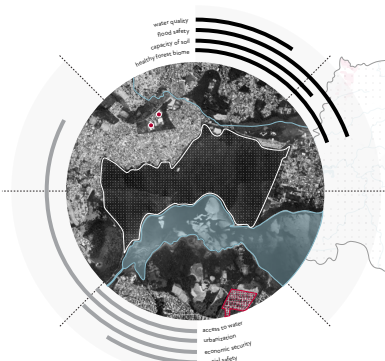
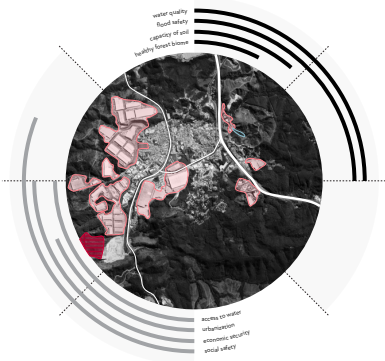
Construction Incentives

Protection Incentives

0 10 20 km

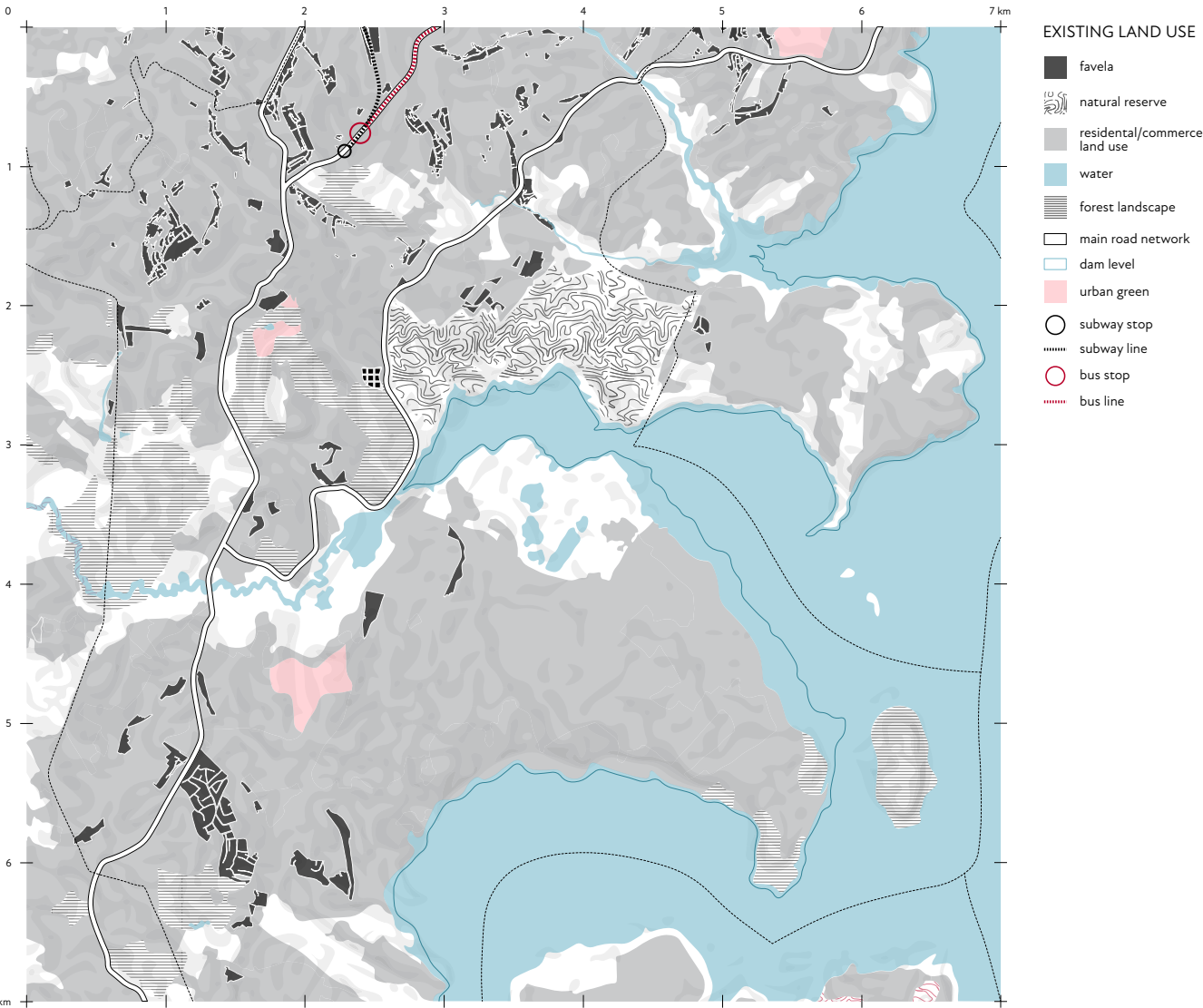
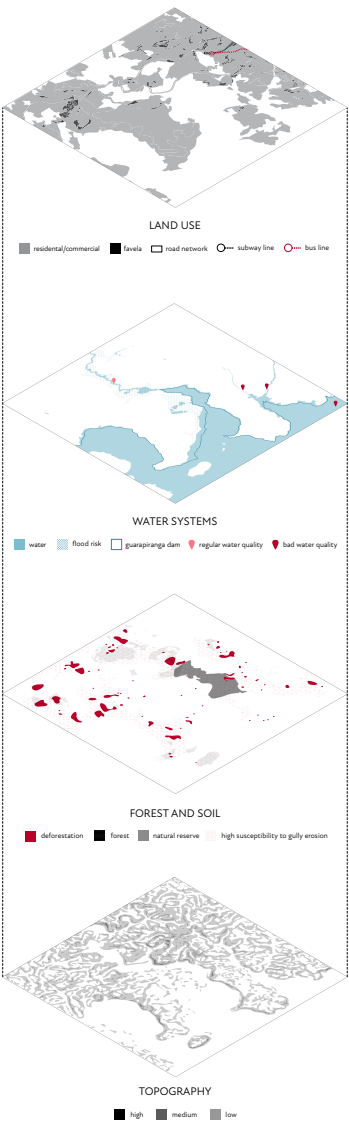


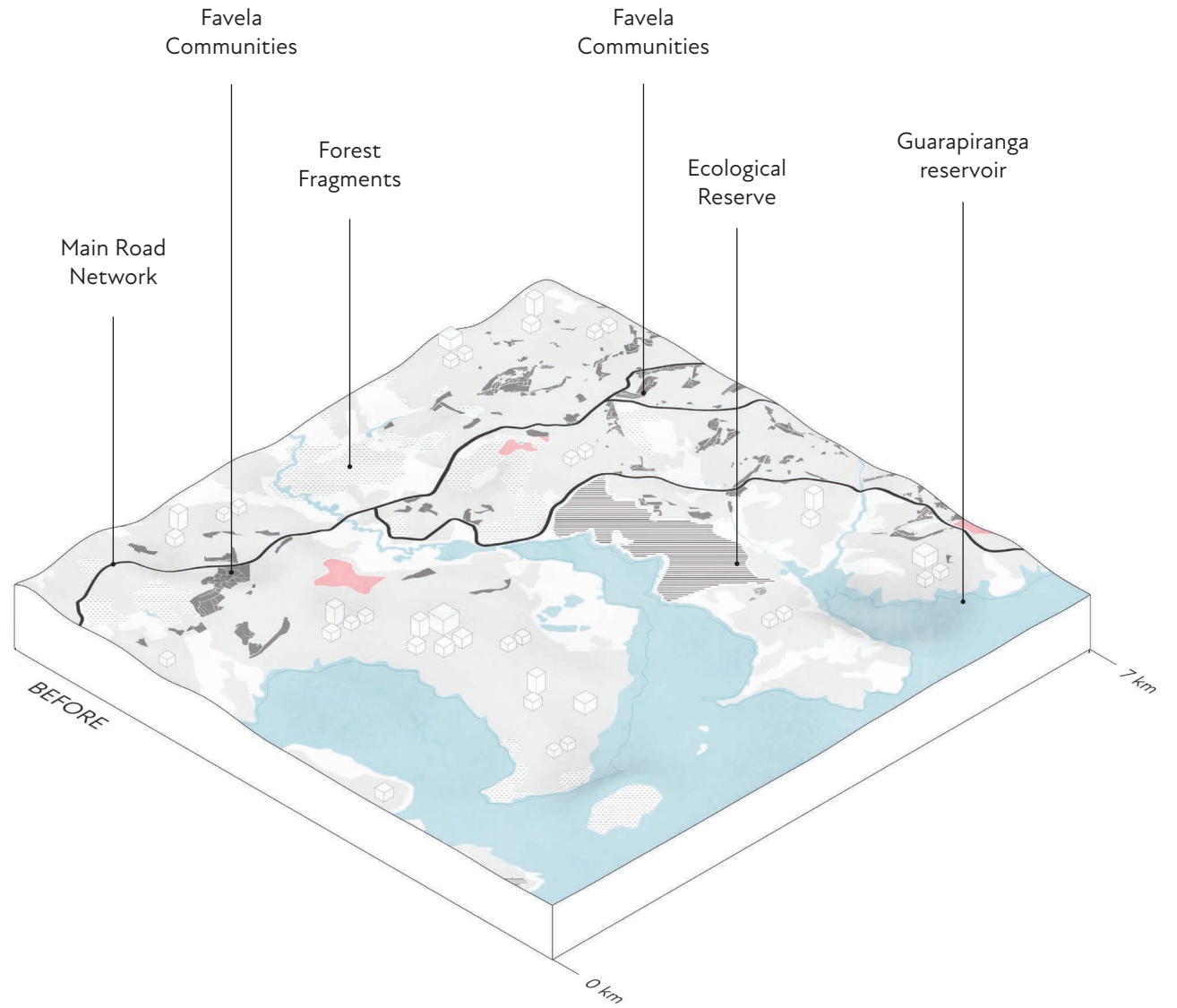
0 10 20 km

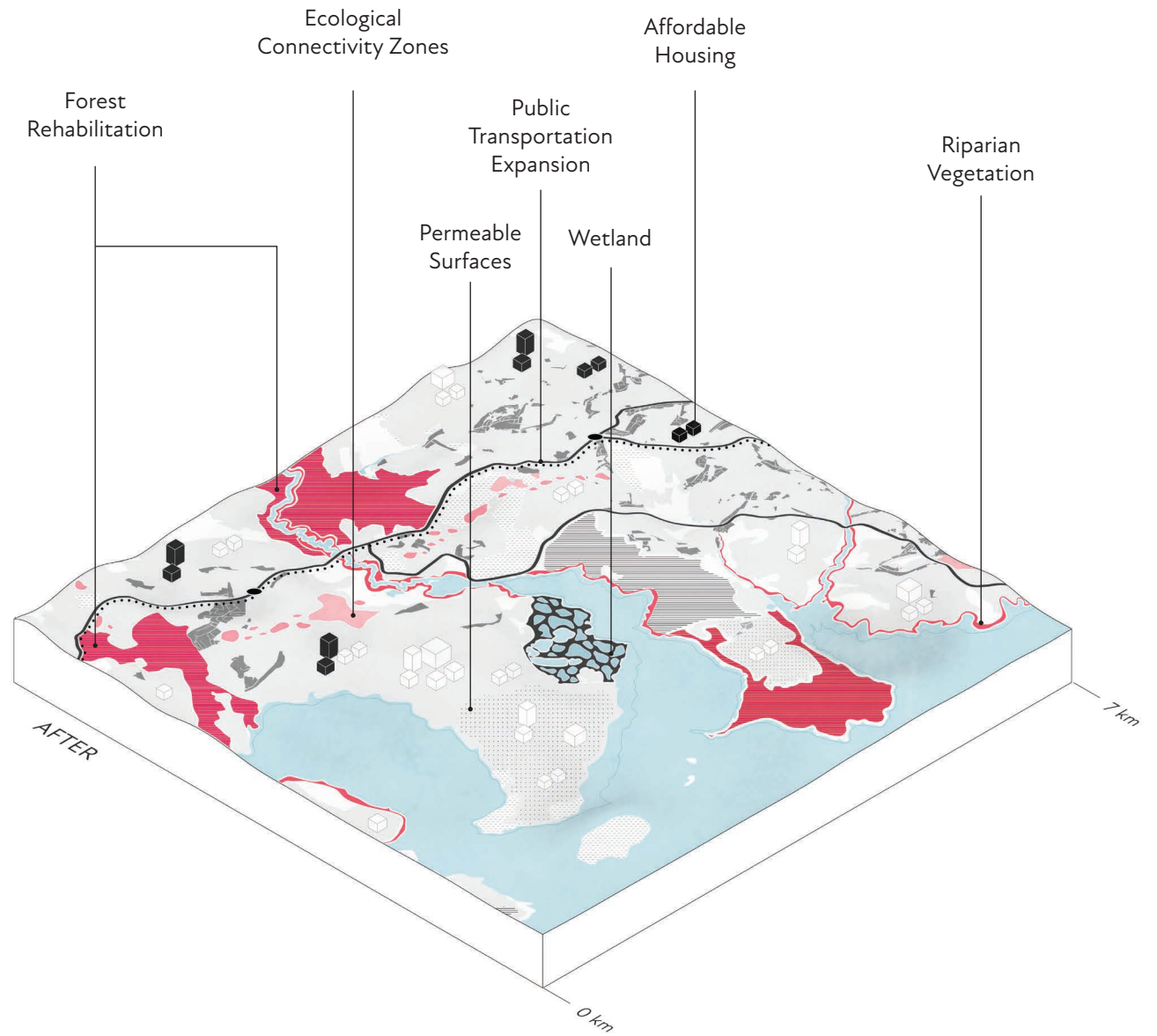


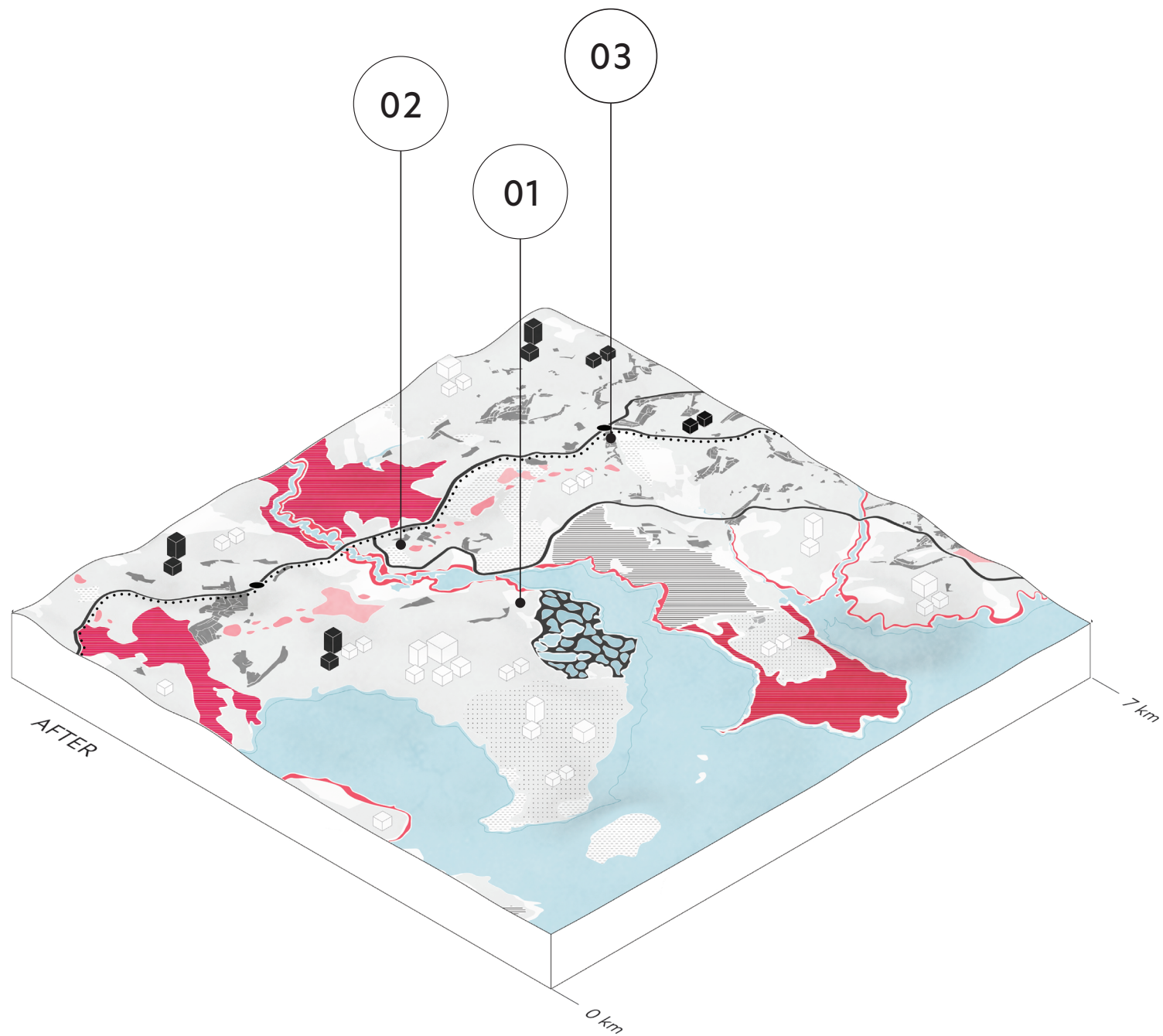
LOCAL DESIGN ADAPTATION

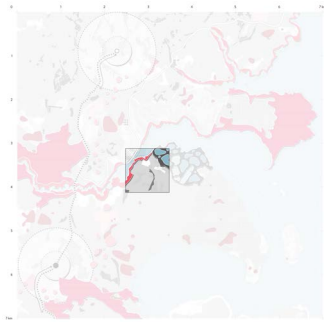


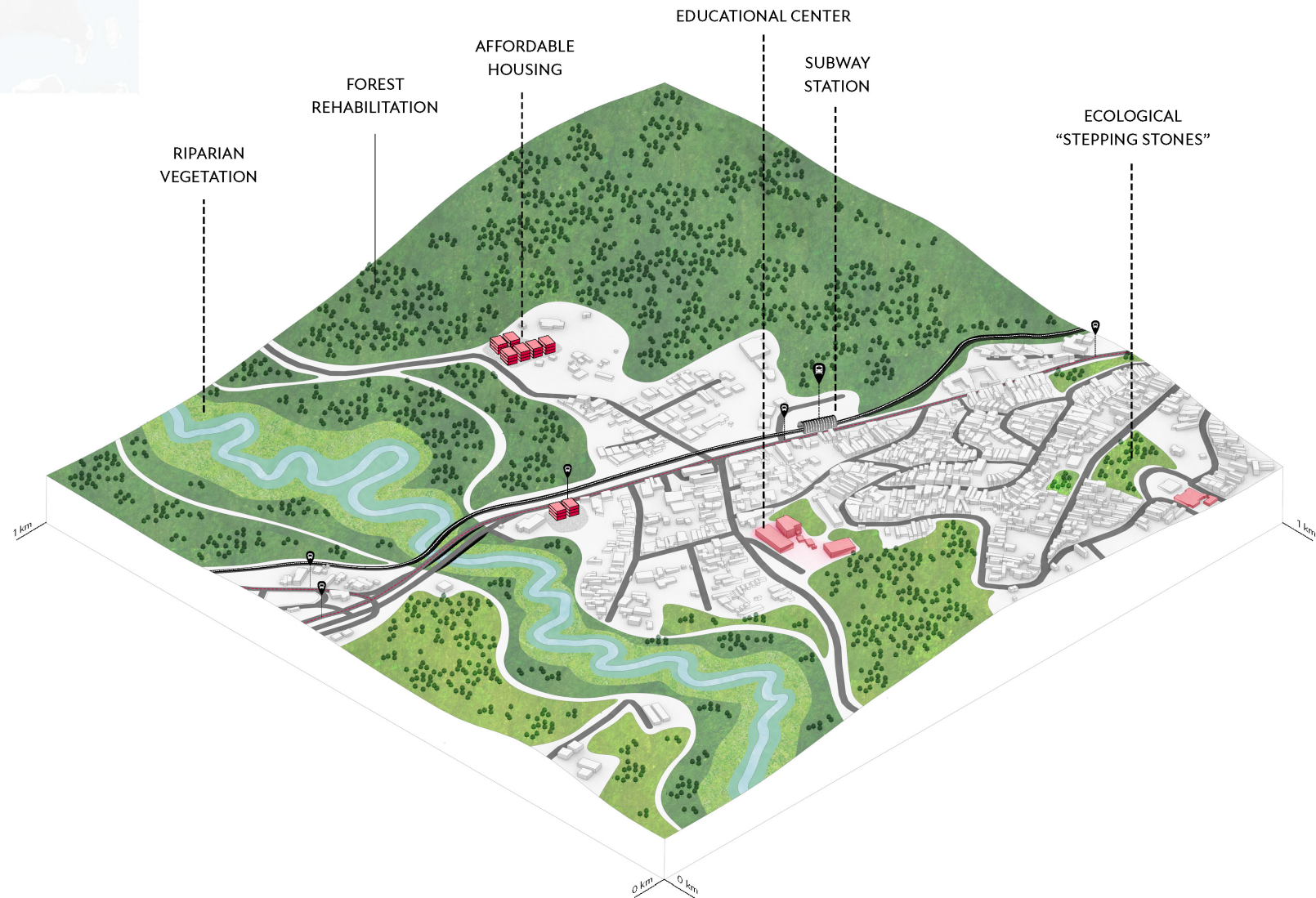


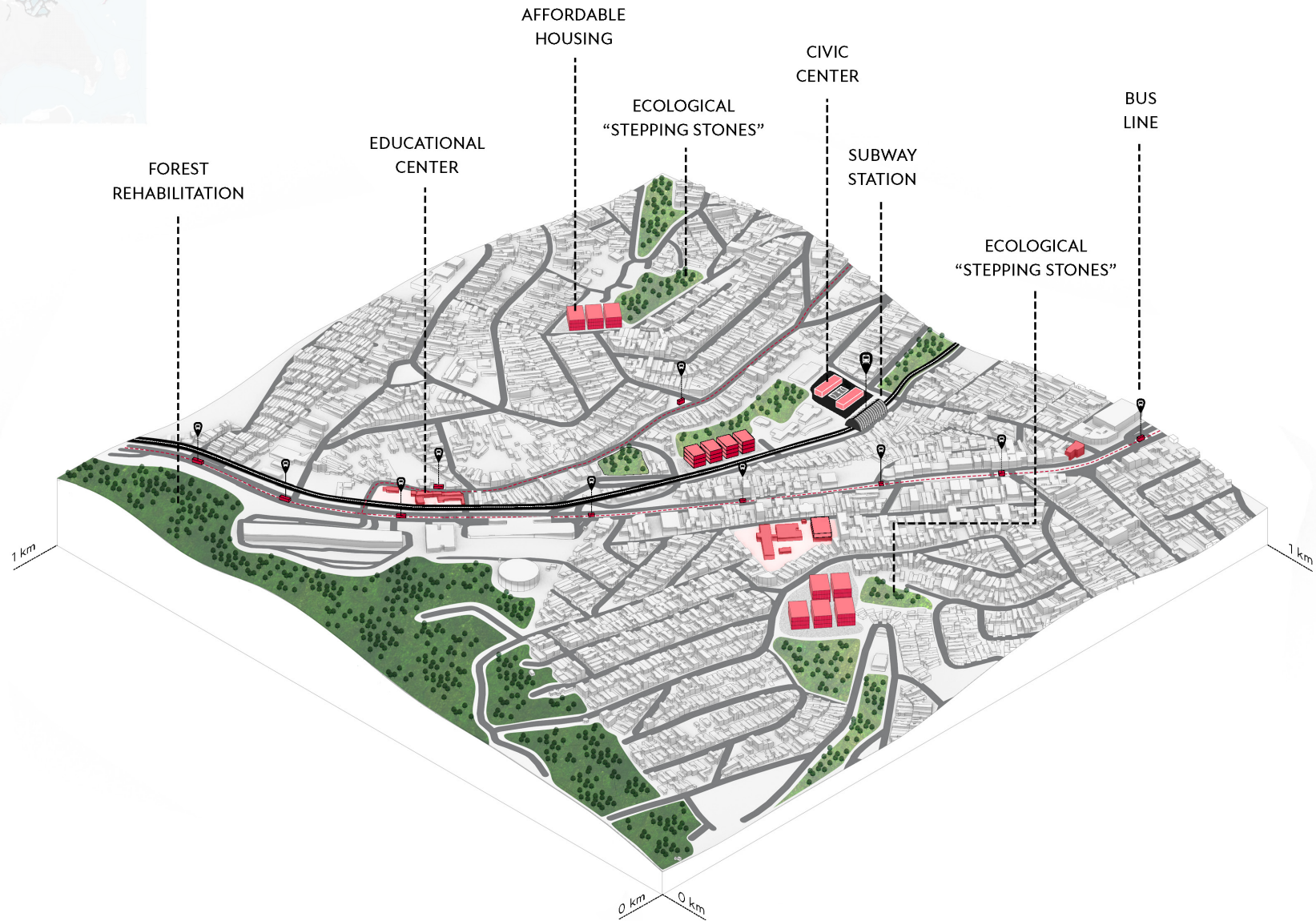












Chapters of the Booklet

01 o que está acontecendo agora?
what is happening right now?

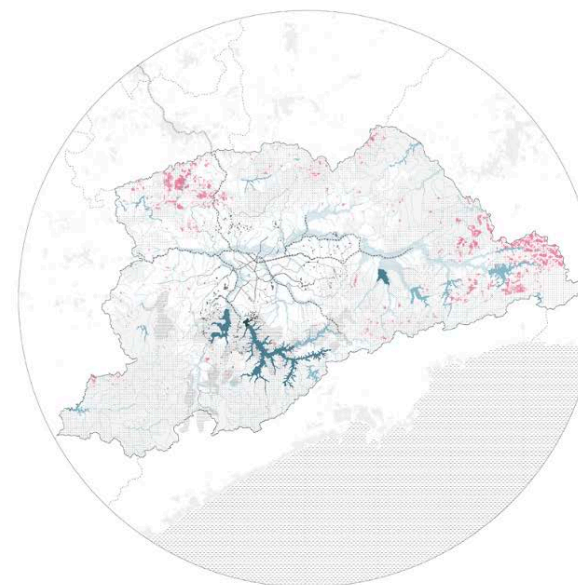
02 O que pode ser feito?
what can be done?

03 Como você pode participar?
how can you participate?

Permeando os Muros.

SÓCIO-ECOLÓGICO

(PERMEATING SOCIO-ECOLOGICAL WALLS)



abordar a desigualdade
multidimensional na
"cidade das muralhas"
através da justiça ambiental

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

autor author

Larissa Müller

4 ○ QUE ESTÁ ACONTECENDO AGORA? / WHAT IS HAPPENING RIGHT NOW?

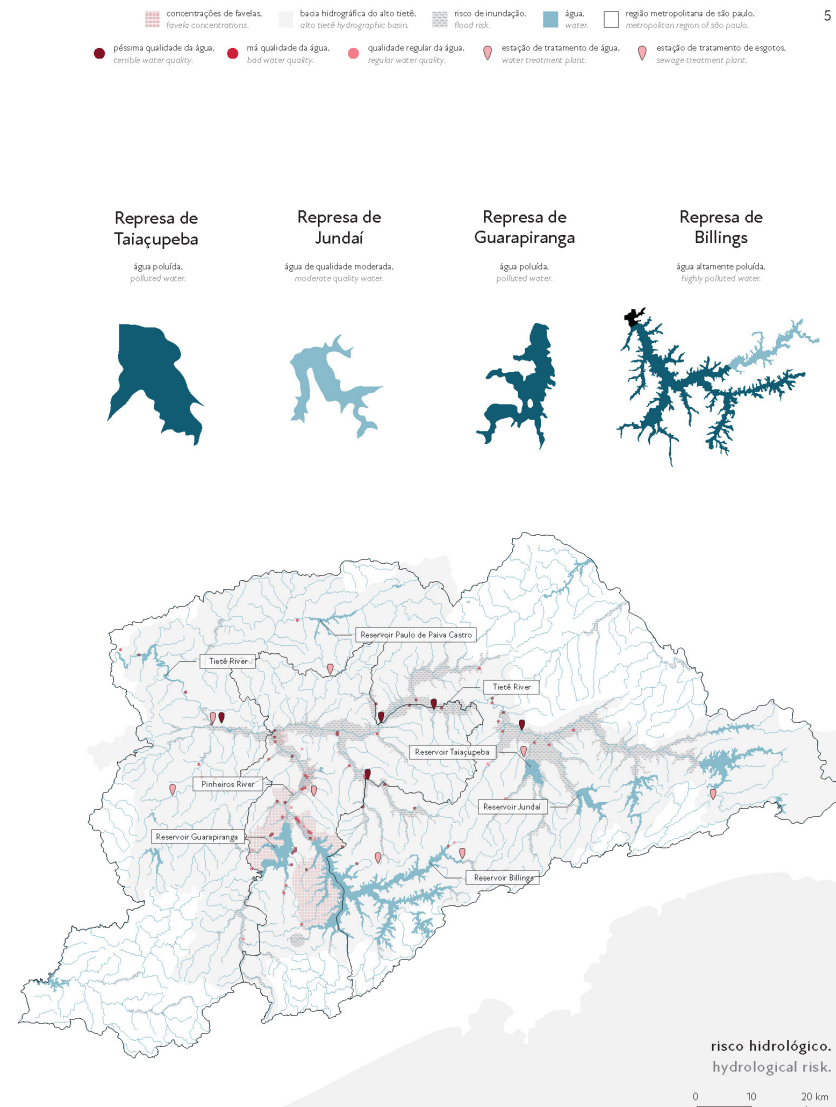
o que está acontecendo agora? what is happening right now?

A cidade de São Paulo experimentou um dos mais rápidos crescimentos populacionais e econômicos do mundo durante a década de 1900, tendo-se transformado numa megacidade com mais de 12 milhões de habitantes. No entanto, os impactos desse crescimento urbano também moldaram a paisagem e, consequentemente, o meio ambiente. À medida que a cidade se transformava, com disparidades crescentes entre as populações ricas e pobres, desastres ambientais frequentes começaram a ocorrer. Estas catástrofes ambientais, que afetam toda a vida urbana circundante, têm muitas vezes um impacto desproporcionado nas zonas vulneráveis existentes, frequentemente zonas de povoações informais e grupos historicamente marginalizados. Os padrões de desenvolvimento urbano insustentável, a degradação ecológica e as pressões das alterações climáticas continuam a afetar a paisagem natural, causando graves consequências como poluição e falta de água, inundações, deslizamentos de terras, e desflorestação.

POLUIÇÃO DAS ÁGUAS: Os reservatórios construídos na bacia hidrográfica fornecem água à grande maioria das pessoas que vivem na Região Metropolitana. No entanto, esses sistemas enfrentam riscos crescentes de poluição da água devido à expansão de assentamentos informais em áreas adjacentes a fontes de água e práticas insustentáveis de uso da terra. A poluição da água é um problema recorrente na Região Metropolitana desde a década de 1950, quando a expansão informal da cidade se estendeu para a periferia, em áreas que estavam dentro dos limites das zonas protegidas pela água. Como a maior parte dessas expansões urbanas descontroladas em áreas protegidas eram, em grande parte, assentamentos informais, o município não conseguiu dotar essas áreas de desenvolvimento de infraestruturas de saneamento devido a obstáculos políticos e econômicos. Assim, com a falta de investimento em infraestruturas e gestão de serviços de saneamento, as fontes de água do município ficaram poluídas com grandes quantidades de resíduos

The city of São Paulo experienced one of the world's most rapid population and economic growths during the 1900's, transforming into a megapolis with currently over 12 million inhabitants. However, the impact of this urban growth also shaped the landscape and hence, the environment. As the city transformed, with increasing disparities between the wealthy and the poor populations, frequent environmental disasters began to occur. These environmental disasters, which affect all surrounding urban life, are often disproportionately impactful to existing vulnerable areas, typically areas of informal settlements and historically marginalized groups. Patterns of unsustainable urban development, ecological degradation, and pressures from climate change continue to berate the natural landscape, causing severe consequences, such as water pollution and shortages, flooding, landslides, and deforestation.

WATER POLLUTION: Existing reservoirs within the hydrographic basin supply water to most people living within the Metropolitan Region. However, these systems face an increasing risk of water pollution due to the expansion of informal settlements into areas adjacent to water sources and unsustainable land use practices. Water pollution was a recurring problem in the Metropolitan Region since the 1950s, when the informal expansion of the city spread to the periphery, in areas that were within the bounds of water-protected zones. As most of these uncontrolled urban expansions into protected areas were largely informal settlements, the municipality was unable to provide these areas with sanitation infrastructure due to political and economic hurdles. 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



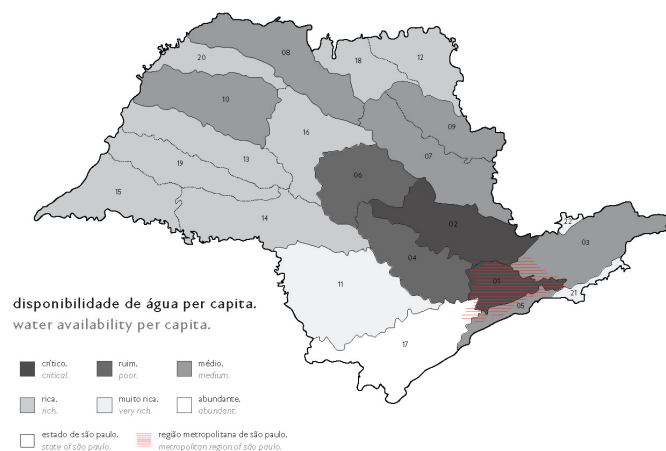
8 O QUE ESTÁ ACONTECENDO AGORA? / WHAT IS HAPPENING RIGHT NOW?

pressão climática devido à sua topografia (inclinação), falta de capacidade do solo, aumento da precipitação e urbanização. Como se espera que a mudança climática piore os riscos de deslizamentos de terra, o que já é um fardo ambiental pesado para as populações da periferia da cidade, a piora das condições socioeconômicas continua a forçar as populações mais pobres a irem para essas áreas de risco ambiental.

ESCASSEZ DE ÁGUA: Nos últimos anos, houve um aumento na escassez de água, o que levou a região metropolitana a ser listada como uma das áreas mais críticas do estado em termos de água. A demanda conflitante de recursos hídricos, a deterioração da qualidade da água, a extração excessiva de água e a demanda crescentes de setores industriais levaram a uma pressão acelerada sobre a infraestrutura hídrica. Em 2014, essas práticas levaram São Paulo à pior crise hídrica registrada na cidade. Durante esse período, os níveis dos reservatórios caíram para níveis historicamente baixos e a implementação de um racionamento secreto de fato do abastecimento de água ampliou ainda mais a natureza desigual do sistema de distribuição de água urbana da cidade. Devido às

increase 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 of the city, worsening socio-economic conditions continue to force poorer populations into these environmentally at-risk areas.

WATER SCARCITY: In recent years, there has been an increase in water shortages, leading to the metropolitan region being listed as one of the state's most water-critical areas. Conflicting demand on water resources, deterioration of water quality, excessive water extraction, and increasing demand from industrial sectors have led to an accelerating pressure on water infrastructure. In 2014, these practices brought São Paulo to the worst water crisis reported in the city. During this time, reservoir levels declined to historically low levels and the implementation of a secretive de facto rationing of water supplies further amplified the unequal nature of the city's urban water distribution. Due to the existing inequalities embedded within the



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desigualdades existentes na paisagem da cidade, as populações vulneráveis na periferia urbana e nas áreas urbanizadas informais sentiram desproporcionalmente o ônus, pois muitas vezes ficavam sem abastecimento de água por dias. Embora os reservatórios da cidade tenham se recuperado com o aumento das chuvas em 2015, essa crise hídrica criou uma gama de questões políticas na governança da água em São Paulo. Na época, essa crise aumentou a conscientização sobre a necessidade de agir de forma preventiva, dar prioridade às populações vulneráveis e implementar um sistema de gerenciamento de água mais transparente e responsável. No entanto, as promessas logo desapareceram da agenda da cidade. Agora, a cidade está começando a sentir os efeitos iniciais de sua crise hídrica de 2021 com novos alertas de emergência emitidos em resposta a reservatórios que começaram a atingir status críticos mais uma vez.

DESMATAMENTO: As florestas tropicais são ecossistemas vibrantes, desempenhando um papel fundamental na manutenção do clima, na estabilização das chuvas e na proteção de outras funções ecológicas. Apesar do conhecimento da importância das florestas para a estabilidade dos sistemas ecológicos, a Mata Atlântica que cobria o Estado de São Paulo sofreu um desmatamento maciço no último século. De acordo com o Global Forest Watch, somente o município de São Paulo perdeu 138 ha de floresta natural em 2021. Hoje, os remanescentes da Mata Atlântica estão, em sua maioria, consolidados na periferia da região metropolitana e ainda permanecem sob ameaça significativa devido à expansão urbana descontrolada, práticas agrícolas insustentáveis, infraestrutura mal planejada, falta de gestão e governança suficientes e mudanças climáticas. Como essa prática continua a degradar as florestas primárias, os ecossistemas florestais de São Paulo não são mais capazes de filtrar a água, reduzir a erosão, regular as chuvas e agir como um amortecedor contra os riscos ambientais, levando ao aumento das vulnerabilidades de poluição da água, inundações, deslizamentos de terra e escassez de água. Assim, colocando os sistemas socioecológicos de São Paulo sob imensa pressão e levando a região metropolitana a um estado de vulnerabilidade mais elevado.

city's landscape, the vulnerable populations in the urban periphery and in informal urbanized areas disproportionately felt the burden as they were often left without water supply for days. Although the city's reservoirs recovered with the increase in rainfall in 2015, this water crisis created a range of political issues in São Paulo's water governance. At the time, this crisis raised awareness of the need to act preventively, give priority to the already vulnerable populations, and implement a more transparent and accountable water management system. However, promises soon faded from the city's agenda. Now, the city is starting to feel the early effects of its 2021 water crisis with newly issued water emergency alerts as reservoirs began to reach critical statuses once again.

DEFORESTATION: Rainforests are vibrant ecosystems, playing a fundamental role in maintaining the climate, stabilizing rainfall, and protecting other ecological functions. Despite knowledge of the importance of forests for the stability of ecological systems, the Atlantic Rainforest that covered the state of São Paulo underwent massive deforestation in the last century. According to the Global Forest Watch, the municipality of São Paulo alone lost 138ha of natural forest in the year 2021. Today, the remnants of the Atlantic forest are mostly consolidated to the periphery of the metropolitan region and still remain under significant threat from unchecked urban expansion, unsustainable agricultural practices, poorly planned infrastructure, lack of sufficient management and governance, and climate change. As these practices continue to degrade primary forests, the forest ecosystem of São Paulo is no longer able to filter water, reduce erosion, regulate rainfall, and act as a buffer against environmental risks, leading to the increasing vulnerabilities of water pollution, flooding, landslides, and water scarcity. Thus, placing the socio-ecological systems of São Paulo under immense pressure and leading the metropolitan region into a heightened state of vulnerability.

12 O QUE PODE SER FEITO? / WHAT CAN BE DONE?

O que pode ser feito?

what can be done?



ESPINHA DORSAL
ECOLÓGICA
ECOLOGICAL
BACKBONE



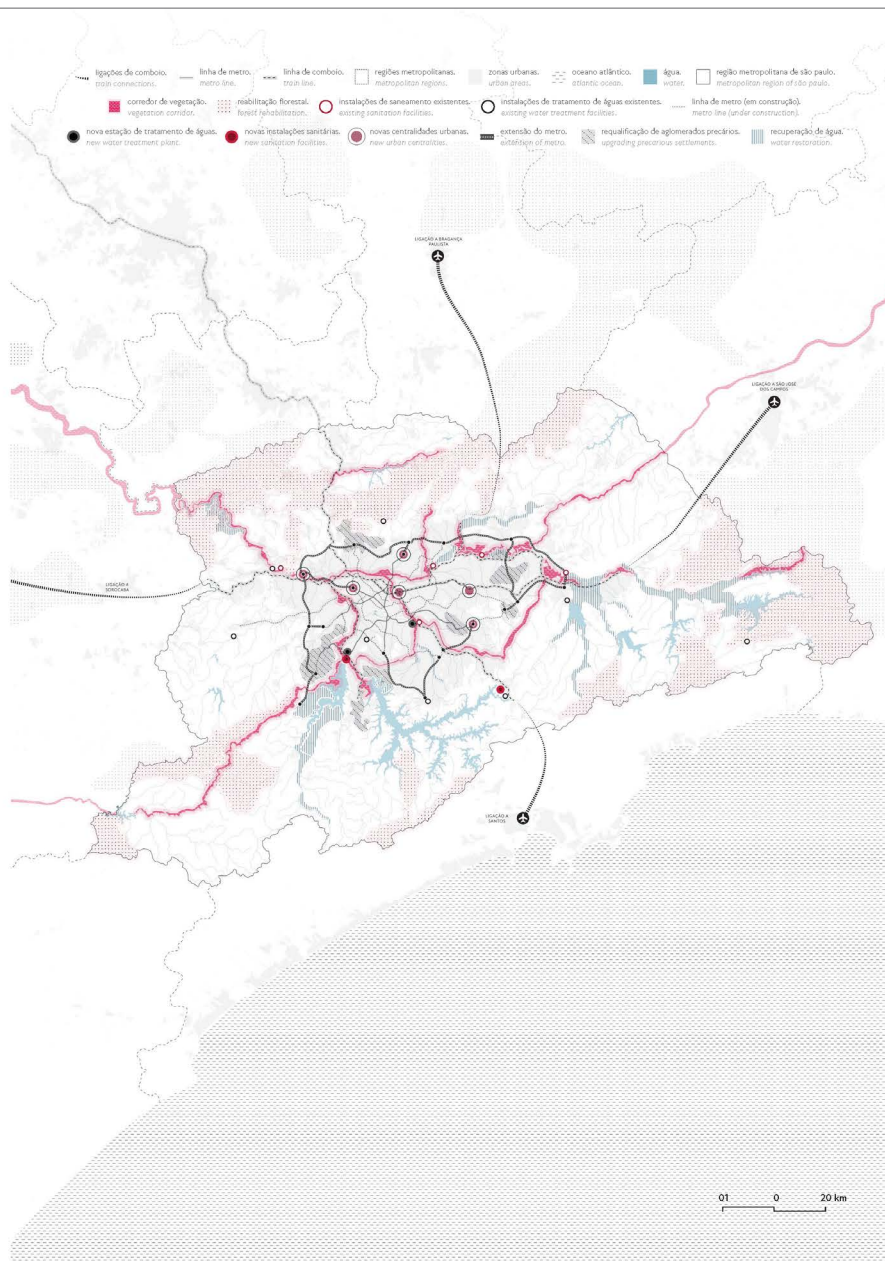
ACESSO
EQUITATIVO
EQUITABLE
ACCESS



GOVERNAÇÃO
ADAPTATIVA
ADAPTIVE
GOVERNANCE

Com os riscos crescentes das mudanças climáticas e a crescente divisão da desigualdade na sociedade brasileira, os sistemas ecológicos de São Paulo e as comunidades marginalizadas se tornam cada vez mais exacerbados. Portanto, a ideia de criar um ambiente mais resiliente e inclusivo segue a teoria mais ampla da Justiça Ambiental, centrada nos princípios de integridade ecológica, inclusão social e capacitação política. Para concretizar essa visão para a Região Metropolitana de São Paulo, esses princípios são construídos por meio das estratégias de desenvolvimento de uma base ecológica, acesso equitativo e governança adaptativa. A compreensão dos sistemas naturais críticos está diretamente ligada ao uso de soluções baseadas na natureza por meio da espinha dorsal ecológica, com o objetivo de proteger e restaurar os sistemas ecológicos para restabelecer a integridade ecológica em toda a região metropolitana. Além disso, as ações urbanas buscam a promoção de políticas e desenvolvimentos urbanos socialmente inclusivos para garantir o acesso justo e igualitário aos serviços urbanos e ecossistêmicos para todos os membros da sociedade, principalmente para as comunidades marginalizadas da sociedade. Por fim, uma base de governança adaptativa prioriza o envolvimento de diversas partes interessadas e soluções co-produzidas para uma rede de conhecimento compartilhado por meio do processo de desenvolvimento. Assim, o resultado é uma Região Metropolitana de São Paulo resiliente, adaptável e inclusiva, capaz de atender com eficácia às necessidades e aos desafios em constante mudança de nosso ambiente e sociedade.

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.



14 O QUE PODE SER FEITO? / WHAT CAN BE DONE?



ESPINHA DORSAL ECOLÓGICA ECOLOGICAL BACKBONE

A estratégia de uma espinha dorsal ecológica pode servir como base para o desenvolvimento da Região Metropolitana para o restabelecimento da integridade ecológica. As ações elaboradas nessa estratégia concentram-se na preservação e restauração de sistemas naturais que abordam questões ambientais urgentes, como inundações, diminuição da qualidade da água, deslizamentos de terra, permeabilidade do solo, entre outros. Com o uso de soluções de adaptação climática, essa estratégia visa melhorar a resiliência das comunidades vulneráveis em São Paulo por meio da revitalização de sistemas ecológicos negligenciados e explorados. Assim, a criação de uma espinha dorsal ecológica para a Região Metropolitana de São Paulo está centrada em ações estratégicas de reabilitação da Mata Atlântica, criação de paisagens de áreas úmidas, construção de zonas de conectividade ecológica, criação de vegetação ciliar ao longo dos rios, promoção de superfícies permeáveis em áreas urbanas e expansão de redes de água.

Essa estratégia se opõe às ações brasileiras existentes, centradas em infraestrutura rígida, e defende soluções baseadas na natureza com metas de reabilitação da paisagem natural, expansão da rede verde e revitalização das redes de água estabelecidas nas planícies de inundação de São Paulo.

The strategy of an ecological backbone can serve 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. Thus, creating an ecological backbone for the Metropolitan Region of São Paulo centered around strategic actions of rehabilitating the Atlantic forest, creating wetland landscapes, constructing ecological connectivity zones, creating riparian vegetation along rivers, promoting permeable surfaces in urban areas, and expanding water networks.

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 preset in the floodplains of São Paulo.

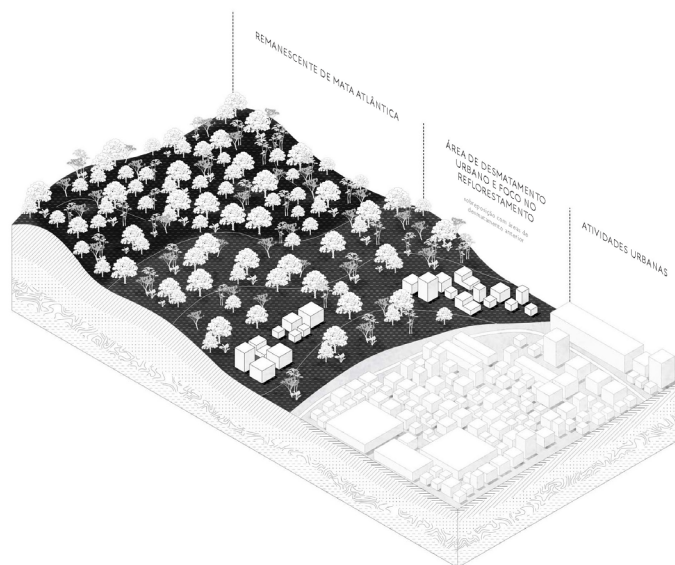


01 Reabilitar a Mata Atlântica / Rehabilitate Atlantic Forest

Calendário das Fases	imediato	curto prazo	longo prazo
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A reabilitação de florestas representa uma solução crítica e negligenciada para a ampla variedade de riscos de mudanças climáticas em São Paulo. Especialmente porque a redução das taxas de desmatamento e degradação florestal é uma das principais e mais eficazes opções para mitigar as mudanças climáticas. Embora as soluções atuais para os riscos ambientais estejam alinhadas com soluções de infraestrutura rígidas, a reabilitação de florestas é uma “maneira natural e econômica” de proteger as populações contra uma variedade de desastres, como enchentes e secas. Portanto, essa ação estratégica refere-se ao processo de restauração das áreas remanescentes do bioma florestal que foram afetadas pelo desmatamento, pela urbanização e pela expansão agrícola para um estado mais saudável.

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. 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. 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.

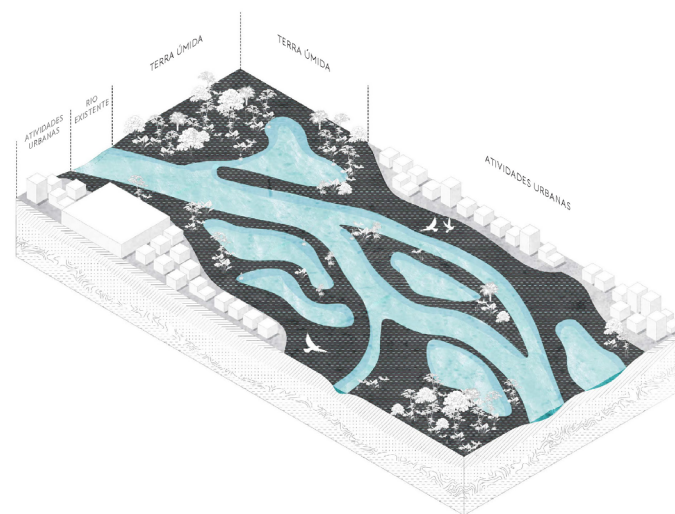


02 Criação de Zonas Úmidas / Creation of Wetlands

Calendário das Fases	imediato	curto prazo	longo prazo
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A criação de áreas úmidas é considerada uma solução baseada na natureza que se refere ao processo de construção ou restauração de ecossistemas de áreas úmidas caracterizadas por áreas de transição de ambientes aquáticos e terrestres. Essa ação, portanto, aborda desafios ambientais como a mudança climática e o gerenciamento de água, fornecendo uma abordagem eficaz para reduzir o risco de inundações, armazenando e absorvendo quantidades excessivas de água, aumentando o suporte à biodiversidade e apoiando os níveis de água subterrânea. Além disso, a construção de áreas úmidas é diretamente atribuída à melhoria da qualidade da água das fontes de água adjacentes por meio da filtragem de poluentes. De modo geral, a criação de ecossistemas de áreas úmidas em toda a região metropolitana é uma solução importante que representa um papel fundamental no desenvolvimento sustentável e na adaptação ambiental.

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. Additionally, the construction of wetlands is directly attributed to improving the water quality of adjacent water sources by filtering pollutants. 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.



como você pode participar how can you participate?

QUEM É VOCÊ? / WHO ARE YOU?



UMA EMPRESA PRIVADA A PRIVATE COMPANY

Você é uma entidade com fins lucrativos que opera em vários setores e é administrada por indivíduos ou por um grupo de acionistas?

Are you a profit-driven entity that operates in various industries and is run by individuals or a group of shareholders?

Em seguida, vá até a página 38.

Then go to page 38.



UMA AGÊNCIA GOVERNAMENTAL A GOVERNMENTAL AGENCY

Você é uma entidade do setor público responsável pela implementação e aplicação de leis, regulamentos e políticas em nível local, regional ou nacional?

Are you a public sector entity responsible for implementing and enforcing laws, regulations, and policies at either the local, regional, or national level?

Em seguida, vá até a página 39.

Then go to page 39.

3

UMA ORGANIZAÇÃO DA SOCIEDADE CIVIL A CIVIL SOCIETY ORGANIZATION

Você é uma organização independente, sem fins lucrativos, um grupo comunitário, um grupo de defesa de direitos ou uma associação profissional, orientada por uma missão específica?

Are you an independent organization, either a non-profit organization, a community group, an advocacy group, or a professional association, driven by a specific mission?

Em seguida, vá até a página 40.

Then go to page 40.



4

UMA INSTITUIÇÃO DE INVESTIGAÇÃO A RESEARCH INSTITUTION

Você é uma instituição de pesquisa, um centro de pesquisa ou um think tank dedicado à pesquisa científica, à criação de conhecimento e à educação?

Are you a research institution, research center, or think tank that is dedicated to scientific research, knowledge creation, and education?

Em seguida, vá até a página 41.

Then go to page 41.



5

UM INDIVÍDUO AN INDIVIDUAL

Você é um membro individual da sociedade que vive no Brasil?

Are you an individual member of society living in Brazil?

Em seguida, vá até a página 42.

Then go to page 42.



38

(PARTICIPANTE / STAKEHOLDER)

Uma Empresa Privada / A Private Company

(AÇÕES CONTRIBUTIVAS / CONTRIBUTING ACTIONS)



Fornecer suporte financeiro

Provide financial support



Colaborar com organizações

Collaborate with organizations



Aumentar a transparência

Enhance transparency



Defender políticas

Advocate for policies

As empresas privadas podem desempenhar um papel fundamental na implementação das soluções ilustradas, contribuindo com seus recursos, experiência e apoio. Elas podem fornecer apoio financeiro por meio de vários métodos de investimentos, subsídios ou fundos para iniciativas ou fundações dedicadas ao esforço de implementar essas ações inclusivas de adaptação climática. Além disso, as empresas podem colaborar com várias organizações ou agências da sociedade civil ou do setor público para desenvolver soluções em conjunto, fornecendo sua experiência, conhecimento e tecnologias de adaptação climática. As empresas privadas também podem apoiar a implementação de estratégias de adaptação climática usando sua influência e poder de defesa para promover mudanças nas políticas que apoiem esses esforços. Por fim, as empresas podem aumentar a transparência corporativa e, assim, permitir que as partes interessadas responsabilizem as entidades privadas por suas ações.

Private companies can play a crucial role in implementing the illustrated solutions by contributing their resources, expertise, and support. They can provide financial support through various methods of investments, grants, or funds for initiatives or foundations that are dedicated to the effort of implementing these inclusive climate adaptation actions. In addition, companies can collaborate with various organizations or agencies within civil society or the public sector to jointly develop solutions by providing their expertise, knowledge, and climate adaptation technologies. Private companies can also support the implementation of climate adaptation strategies through using their influence and advocacy power to push for policy changes that support these efforts. Lastly, companies can enhance corporate transparency and thus allow stakeholders to hold private entities accountable for their actions.

39

(PARTICIPANTE / STAKEHOLDER)

Uma Agência Governamental / A Governmental Agency

(AÇÕES CONTRIBUTIVAS / CONTRIBUTING ACTIONS)



Fornecer fundos ou incentivos

Provide funding or incentives



Colaborar com organizações

Collaborate with organizations



Monitorar e avaliar projetos

Monitor and Evaluate projects



Conduzir pesquisas

Conduct research



Desenvolver políticas

Develop policies

Os órgãos governamentais têm a autoridade, os recursos e a capacidade de desenvolver e executar a implementação de ações inclusivas de adaptação climática. Esses órgãos do setor público podem fornecer financiamento ou apoio financeiro para incentivar empresas privadas, proprietários de terras e comunidades a viabilizar a implementação de projetos. Além disso, você pode investir em pesquisas e esforços de coleta de dados para entender melhor os impactos e as soluções relevantes. Os órgãos governamentais também desempenham um papel fundamental na coordenação dos esforços entre as partes interessadas e podem promover uma maior colaboração entre os diferentes setores. Além disso, um sistema de monitoramento e avaliação pode ser estabelecido pelo setor público para acompanhar o progresso, avaliar os resultados e ajustar as ações. Por fim, os órgãos governamentais têm autoridade para desenvolver políticas e normas que estabeleçam diretrizes e garantam a execução dessas ações.

Governmental agencies have the authority, resources, and capacity to develop and execute the implementation of inclusive climate adaptation actions. These agencies within the public sector can provide funding or financial support to incentivize private companies, landowners, and communities to enable the implementation of projects. As well as invest in research and data collection efforts to better understand the impacts and relevant solutions. Governmental agencies also play a crucial role in coordinating efforts among stakeholders and can foster further collaboration between different sectors. Additionally, a monitoring and evaluation system can be established by the public sector to track progress, evaluate outcomes, and adjust actions. Lastly, governmental agencies have the authority to develop policies and regulations that establish guidelines and ensure the execution of these actions.



“ Climate change is the single greatest threat to a sustainable future but, at the same time, addressing the climate challenge presents a golden opportunity to promote prosperity, security and a brighter future for all. ”

Ban Ki-Moon

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 QUESTION.**Q1**

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

Q2

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

Q3

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

Q4

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

ANALYTICAL FRAMEWORK

DESIGN FRAMEWORK

TRANSCALAR MAPPING

Q1 Q2 Q3

MAIN DATA SOURCES

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

ONLINE SURVEY QUESTIONNAIRE

Q2 Q4

KEY PLAYERS

- *NGOs*
- *Public Authorities*
- *Research Institutions*
- *Private Companies*
- *Community Groups*

LITERATURE + POLICY REVIEW

Q3 Q4

MAIN SOURCES

- *City Statue*
- *Research Gate*
- *Science Direct*
- *Google Scholar*
- *Gestão Urbana*

STAKEHOLDER ANALYSIS

Q2 Q4

KEY PLAYERS

- *NGOs*
- *Public Authorities*
- *Research Institutions*
- *Private Companies*
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VULNERABILITY FRAMEWORK

Q1

MAIN SOURCES

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

DATA ANALYSIS

Q1 Q2 Q3

MAIN DATA SOURCES

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

SOURCES

- IPEA
(Institute of Applied Economic Research),
- Rede Nossa
- DataGeo

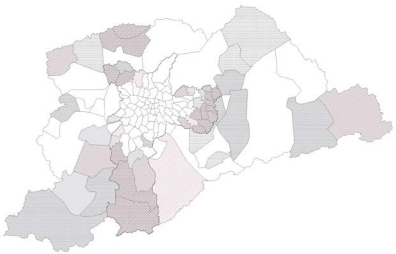
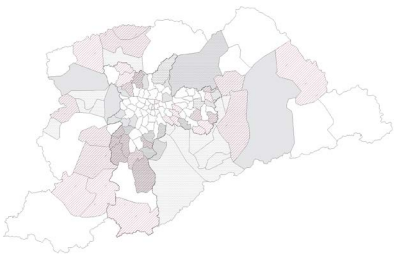
ECONOMIC VULNERABILITY

- *analytical criteria #1*
- *analytical criteria #2*
- *analytical criteria #3*
- *analytical criteria #4*

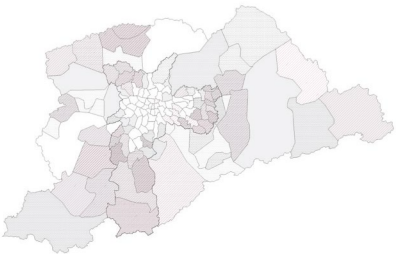
SOCIAL VULNERABILITY

- *analytical criteria #1*
- *analytical criteria #2*
- *analytical criteria #3*
- *analytical criteria #4*
- *analytical criteria #5*

Socio-Economic Vulnerability



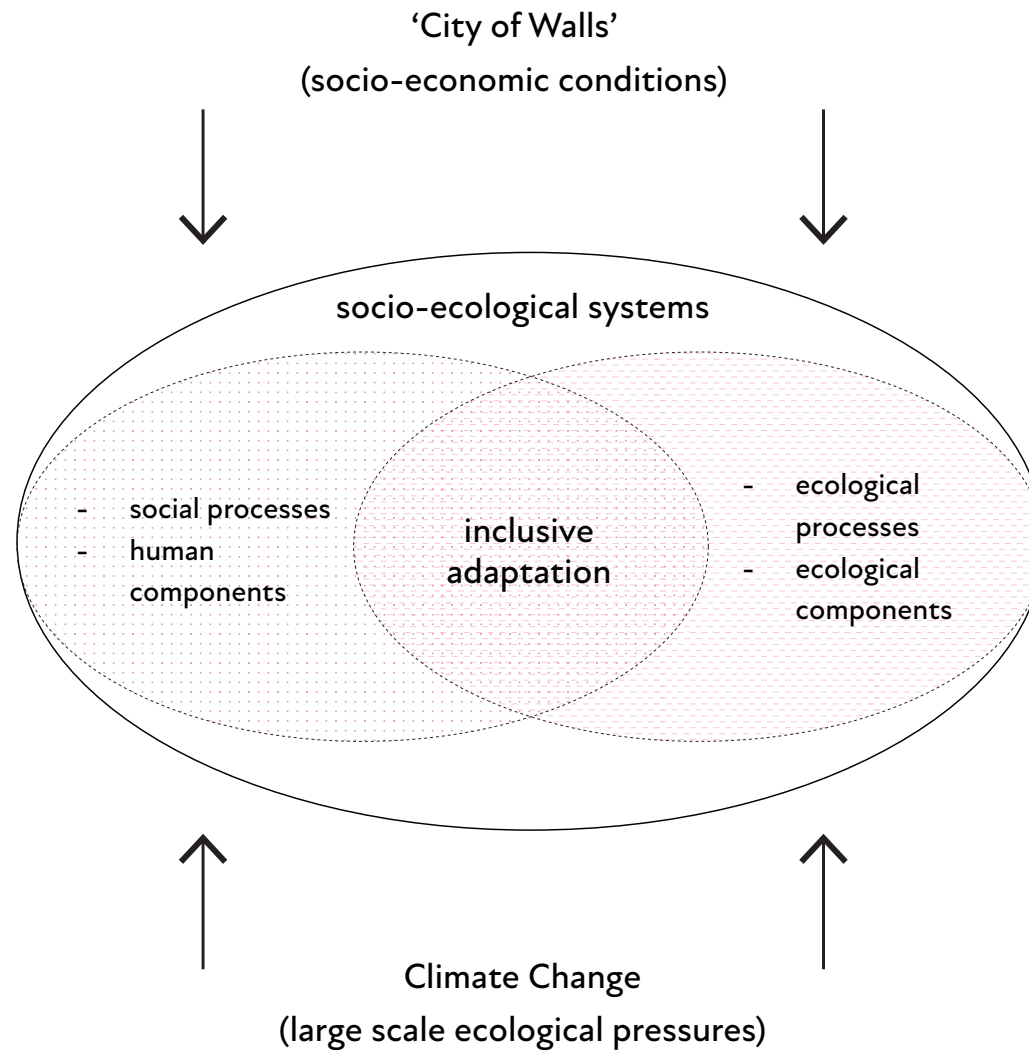
Highest Vulnerability



■ SOCIO-ECOLOGICAL SYSTEMS APPROACH.
MADE BY AUTHOR
SOURCED: VIRAPONGSE, ET AL., 2016

SOCIO-ECOLOGICAL SYSTEMS

Frames the relationships between human and ecological components as part of a complex interdependent system.



CO-PRODUCTION OF KNOWLEDGE

■ Miller, C. A., & Wyborn, C. (2020).
■ Pedro Henrique Campello Torres, Pedro Roberto Jacobi, Sandra Momm, & Ana Lia Leonel. (2021).

ADAPTIVE GOVERNANCE

■ Chaffin, B. C., & Gunderson, L. H. (2016).
■ Pedro Henrique Campello Torres, Pedro Roberto Jacobi, Sandra Momm, & Ana Lia Leonel. (2021).

SOCIO-ECOLOGICAL RESILIENCE

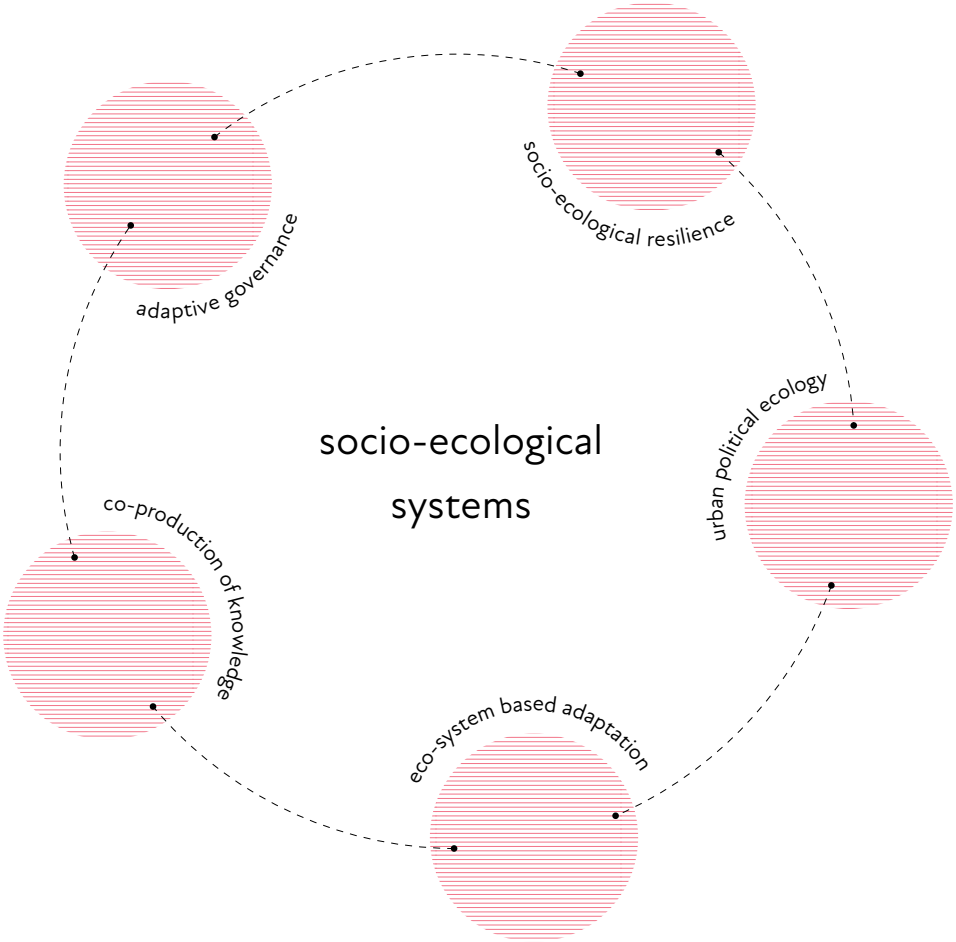
■ Dakos, V., & Kéfi, S. (2022).
■ Davoudi, S., Brooks, E., & Mehmood, A. (2013).

URBAN POLITICAL ECOLOGY

■ Heynen, N., Kaika, M., & Swyngedouw, E. (2006).
■ Nik Heynen. (2014).

ECO-SYSTEM ADAPTATION

■ Jones, H., Hole, D., & Zavaleta, E. (2012).
■ Manes, S., Vale, M. M., Malecha, A., & Pires, A. P. F. (2022).



ECOLOGICAL CATEGORY

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).

SOCIAL CATEGORY

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:

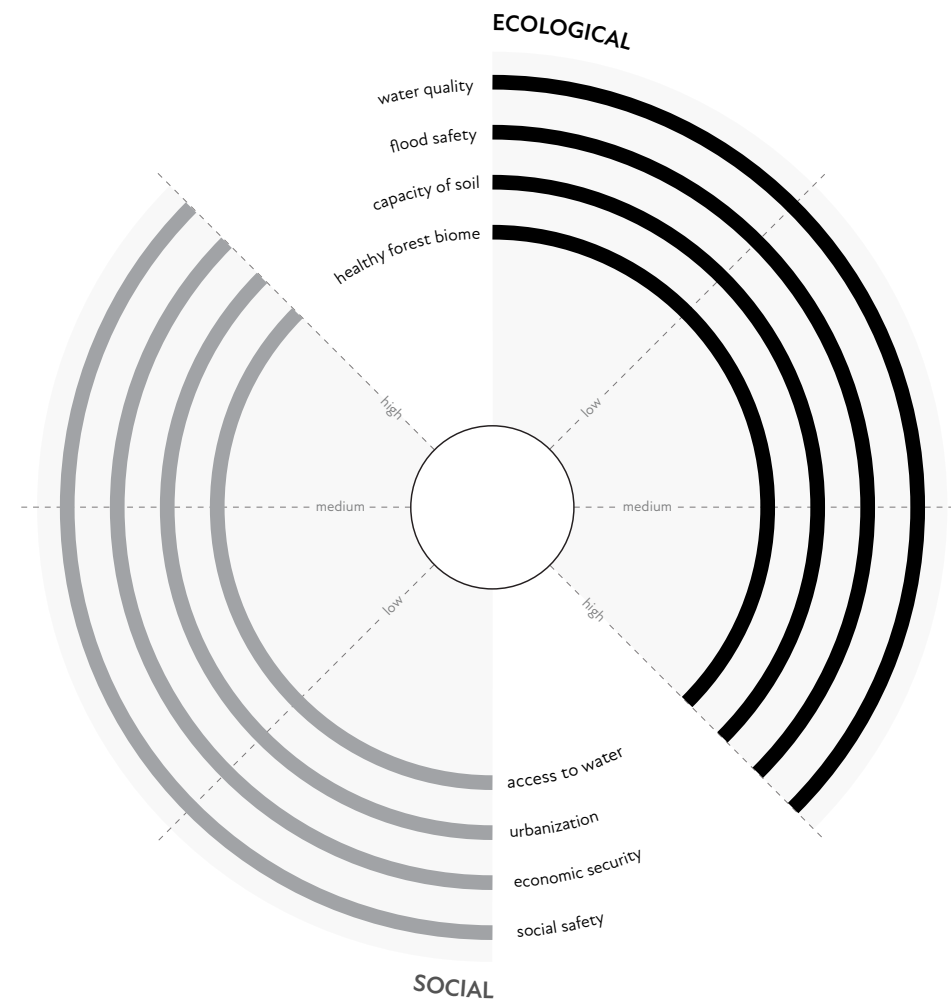
This Indicator refers to the condition of financial security and having resources to support a adequate standard of living, regardless of external stressors. Therefore, measuring factors related to formal employment opportunities, levels of household income, and access to public transportation services.

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.





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