# Regeneration of Ecological Integrity in the Tietê River Basin

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## Acknowledgements

I still remember the first time that I entered BK, back in 2016, when I was still an undergrad student at my Alma-mater, the University of São Paulo. I and two friends were visiting the Netherlands and we decided to pay a visit to the faculty building, which at the time seemed very intimidating to us. It was in awe that we wandered through the corridors of the amazing Bouwkunde as I thought to myself: How lucky are these people? To be able to study here. It must be amazing.

Today I graduate from this very incredible place, alongside with some of the most intelligent, competent, and kind minds I have ever had the opportunity to cross paths with. Coming here and moving the center of my life to this lovely, but very peculiar country amid a pandemic was a challenge that can not be overstated. Looking in retrospect, I still do not know how I made it. I am only sure that nothing of this would have been possible without:

The support of my dear family, my parents Ana and Luiz, and my three sisters Fabiana, Vanessa, and Daniela, always watching me and rooting for me, even from a distance. I miss you all.

My dear in-laws Izabel and Edson, who have supported our move to The Netherlands and have always rooted for us. I am sure you will continue to do so, it does not matter where from.

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My partner, Luiz, who has accompanied me along every step of the way and did everything that was in his power, and even what was not, to help me achieve this dream of mine. Without you, none of this would have been possible. Thank you so much for always believing in me, supporting me, and showing me nothing but love and affection. Concluding this Master's is such a great achievement, and I share it wholeheartedly with you.

# Contents

# 1 Introduction

*Vuelvo al Sur**
*Original lyrics in Spanish*
*1988*

*Composer*
*Astor Piazzola*

*Lyricist*
*Pino Solanas*

**I return to the South*

Vuelvo al Sur
Como se vuelve siempre al amor
Vuelvo a vos
Con mi deseo, con mi temor

Llego el Sur
Como un destino del corazón
Soy del Sur
Como los aires del bandoneón

Sueño el Sur
Inmensa luna, cielo al revés
Busco el Sur
El tiempo abierto, y su después

Quiero el Sur
Su buena gente, su dignidad
Siento el Sur
Como tu cuerpo en la intimidad

Vuelvo al Sur
Llego al sur
Te quiero

Sueño el Sur
Inmensa luna, cielo al revés
Busco el Sur
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Quiero el Sur
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Vuelvo al Sur
Llego al sur
Te quiero

# Abstract



The Tietê River Basin, in the State of São Paulo, Brazil, has been shaped throughout centuries into a highly-industrialized agriculture landscape. Originally almost entirely covered by the Atlantic Rainforest, a rich tropical biome that stretches through most of the Brazilian eastern coast, the basin is now mostly covered by urbanized landscapes, associated with spaces of intense production.
First heavily altered by the coffee economic cycles during the 19 and 20th centuries, the Basin has since then been deprived of most of its natural ecological conditions and has lost its ability to regulate and support ecological cycles in this region of southeastern Brazil.
Since the 2000s the basin has been going through a process of specialization in the plantation of sugar-cane by extensive monocultures, mostly for biofuels production (alongside the rest of the hinterland of the State of São Paulo). The sterilization of the land and changes in land-use patterns across the region and other neighboring areas by industrial agriculture (such as the Amazon and Atlantic forests) are disrupting to micro and macroclimates, and the effect of such intense exploitation of the soil is already clearly noted in the form of catastrophes. Some of the countless externalities observed in the region are shifting rainfall patterns across the continent, heatwaves, cold spells, wildfires, and issues directly related to health, cause by, among other reasons, the intensive use of pesticides in the latifundia.
As the new climate conditions increasingly become a reality, conventional land use patterns must be challenged. Natural resources and the capacity of natural systems to bounce back must be protected. Looking for possibilities of economic stability, in synch with the environment and welfare through the creation of new production systems, distributing the gains and burdens of climate change are among the goals of the project.
A literature review, a series of cartographies, and research through design are some of the methods chosen as an attempt to research ways in which the peri-urban landscape of the State of São Paulo can change during the upcoming decades. This project arguments for the necessity of revaluation of the current pivots of the *Paulista** economy, currently based on the accumulation of wealth by extractive industries and agriculture, and what changes to the urban and peri-urban fabric would be necessary to accommodate this shift.

Keywords: Tietê Basin; Landscape ecology; Landscape urbanism; Ecological Integrity.

# Thesis positioning





A LONG HISTORY OF EXTRACTION

This thesis intends to look at the Upper-Tietê Basin, in the hinterland of the State of São Paulo, putting forward alternative modes of land use, which are more in sync with the natural processes and temporalities of the site, as well as taking advantage of the immense potential of the Basin from the point of view of ecosystem services.
The Basin, and to a larger extent, the entire South-American Continent, has been shaped following demands from the industrialized demands of the global north, to detriment of the local potentialities and benefits. Traditional and local knowledge have, and continue to, be disregarded in favor of employing technologies that have been designed for very different landscapes, cultures, and environments.
Consumption of goods by the urban developed centers in an exploitative relationship, incompatible with sustainable development (Escobar, 2011), forces the hinterland to constantly adapt to global systems of production, at the expense of the well-being of nature and local populations. Urban and peri-urban regions have always been in dialogue in a scheme of co-dependency since whatever occurs in the marginal spaces between field and forest, land and water, is also experienced in the city; benefits, but also burdens.
The design proposes to question the identified urban and peri-urban land-use patterns found in the region of the Tietê basin in the Paulista countryside. Ultimately, the result is of a landscape that is more in synch with the localities, peoples, and economic drivers that aim to share the prosperity embedded in the land, through a process of re-territorialization.

REGENERATION OF THE ECOLOGICAL INTEGRITY

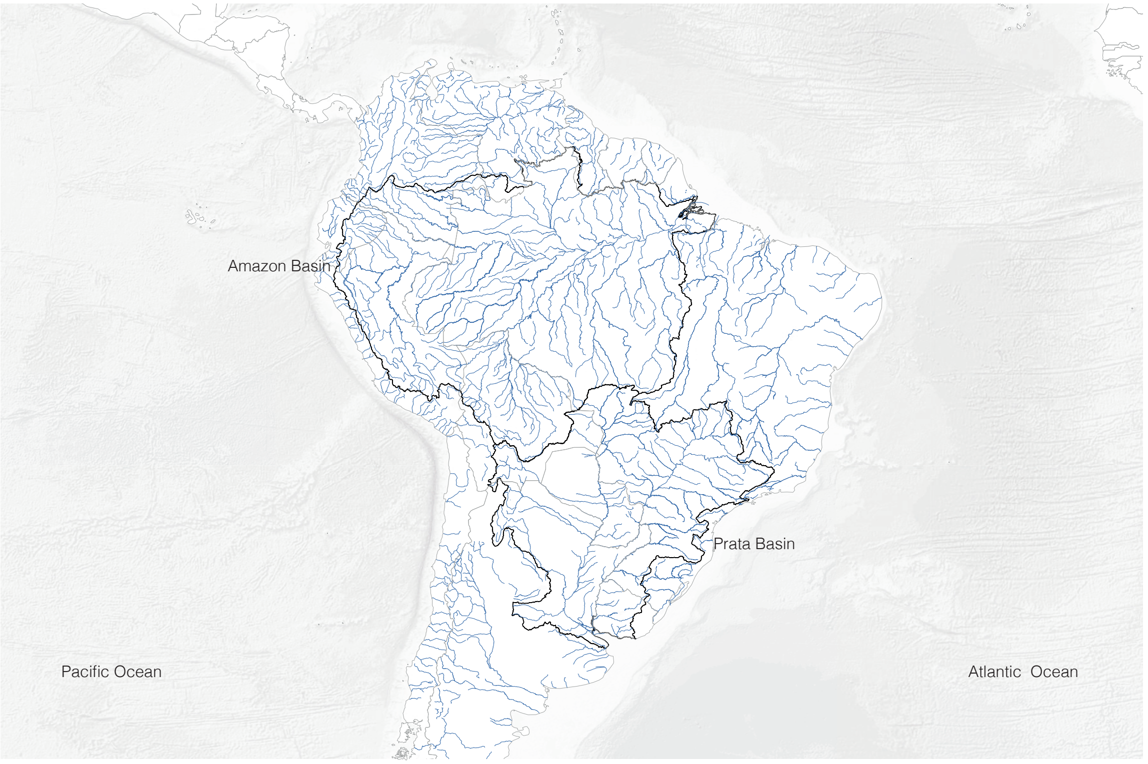
Ecological Integrity is seen as a material layer, as an appropriate framework for measuring and communicating progress towards conservation and restoration goals (Wurtzebach & Schultz, 2016). Action has to be taken to regenerate the Ecological Integrity of the Basin, halting the destruction of the tropical biome, which is still a place of abundance and incomparable biodiversity. Not only for the sake of perpetuating the provision of ecosystem services but by nature's right to exist. Hinterlands' extraction landscapes that have been exhausted by different forms of urbanization and industrial agriculture must be at the core of regeneration efforts via multifunctional landscape design, regenerative agriculture, and ecosystems restoration in a new cooperation contract.
It can be observed that the ecological conditions of the site are severely compromised while detecting trends in how the conditions might continue to deteriorate in case an extensive project of ecosystem restoration on the scale of the entire biome (Atlantic Forest) is not put forward during the next decades.
A desired new contract between subjects part of an ecology is one where humankind repositions itself and takes a humbling step: from being "in charge" of natural worlds by pastoral care (Bellacasa, 2010) to contributing to the return of the surplus of production and biotic processes to nature, via the ground. Taking care of the earth (both soil and our homeland), and scaling up practices that have been overlooked by modern agriculture (such as minimal tilling, inter-cropping, and crop-rotating), along with new ways of working with the land as a manner of giving back to nature the surplus of its cycles are some of the ways through which soil can be regenerated.

# Identity

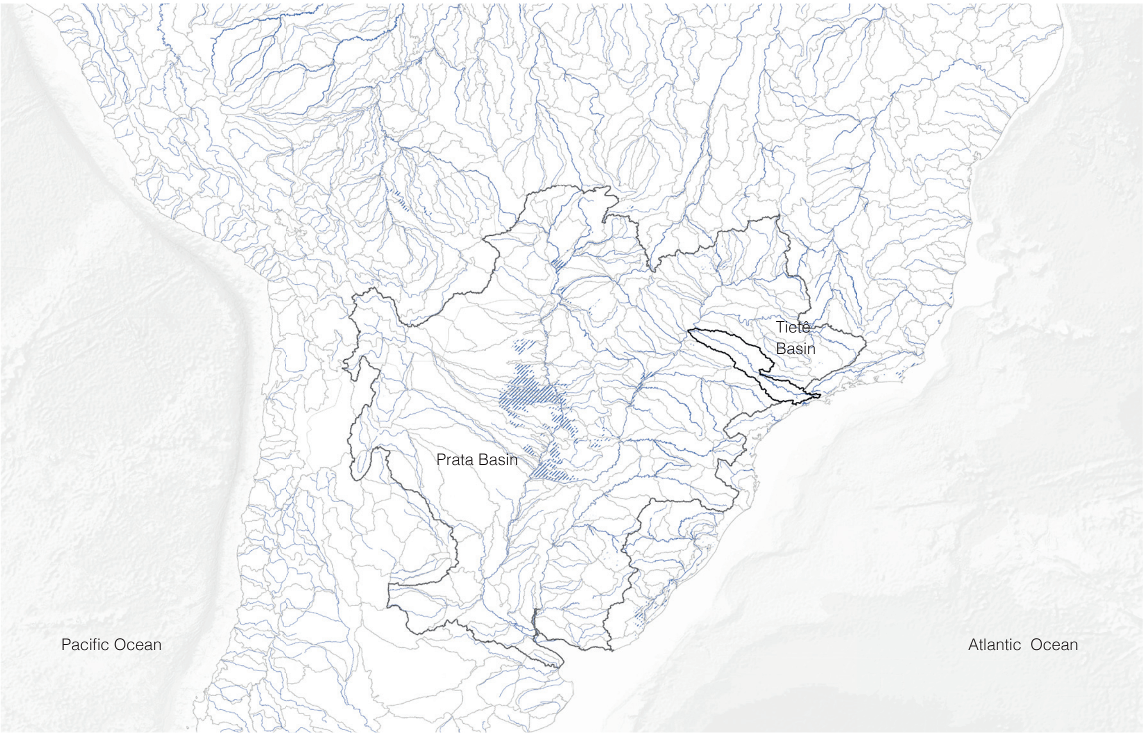


## The Tietê River Basin

> The two main basins of South America: Amazon and Prata
The Author, 2021

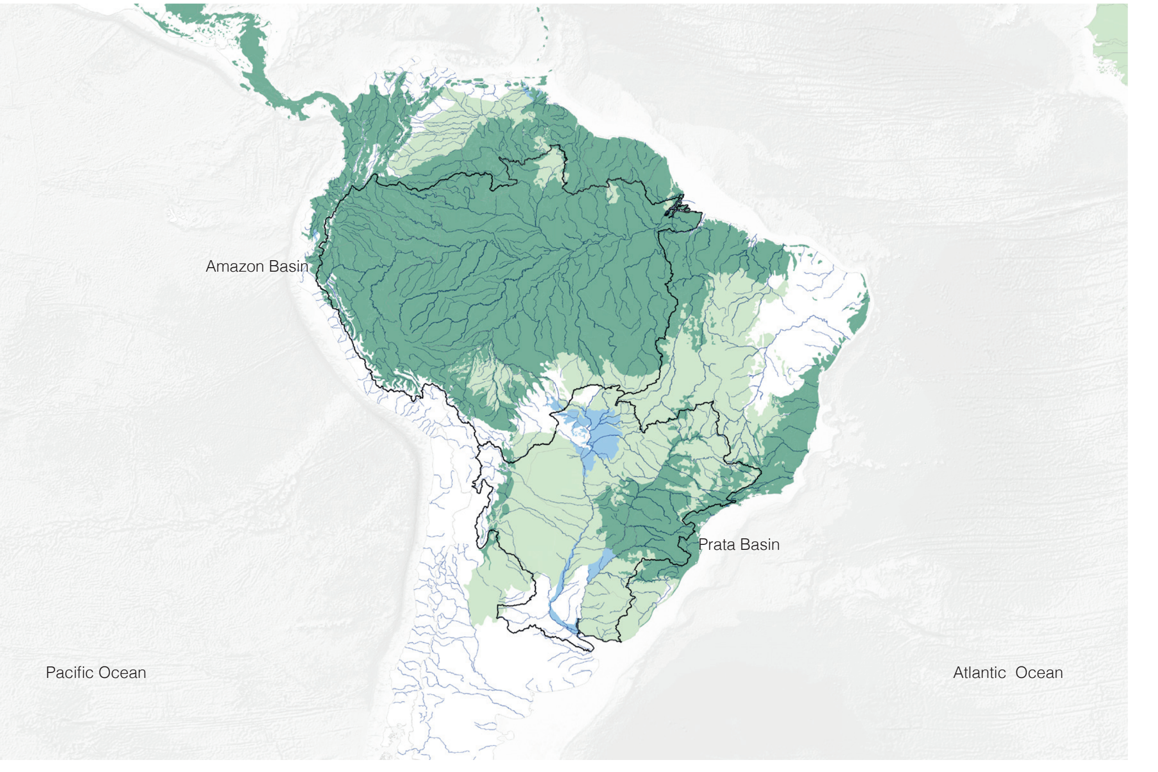



> Location of the Tietê River Basin within the Prata Basin
The Author, 2021




Two of the largest basins in the world, the Amazon and the Prata Basin cover most of the South-American continent. These are both enormous in extension, but also in water discharge volumes and in relevance to the lives of hundreds of millions of people that live within the basins. Whereas the Amazon basin is sourced by rivers and streams that run down from the Andes mountain range, as well as from the rain that travels inland from the Atlantic, The Prata Basin finds its strength in the rainfall coming from the Ocean towards the eastern coast of Brazil, as well as from the Pantanal, the largest wetland natural system in the world. In the Prata Basin, three different larger biomes are found. The already mentioned Pantanal, the Cerrado (a semi-dry biome that flourishes during the rainy months), and the Atlantic Forest, or *Mata Atlântica*, a luxurious biome covering most of southeastern Brazil, home to the Tietê River. The River is located at the intersection between ocean and continent, stretching through the mountains and plateaus of São Paulo's state, in a coastal belt where moisture travels inland from the sea and has its sources in the coastal mountain range, amid natural landscapes formed by luxurious tropical vegetation and steep topography. Once covered almost entirely by the Atlantic Forest, the River Basin is now mostly barren land, used by agricultural production, especially middle and downstream. The river then descends towards the capital city, the City of São Paulo, in an unusual maneuver. Instead of running from the mountains directly to its mouth on the coast, the waters run towards the hinterland, cutting through the entire State of São Paulo on a diagonal axis. Until it reaches its mouth on the Paraná River (which in turn will find its mouth further south in the *Río de la Plata*, the Prata River, close to the city of Buenos Aires, Argentina), the Tietê's margins are occupied by a series of very distinct landscapes, both of relative preservation of its natural conditions and heavily altered by anthropic intervention.

> Biomes within the Prata Basin on a continental scale
The Author, 2021

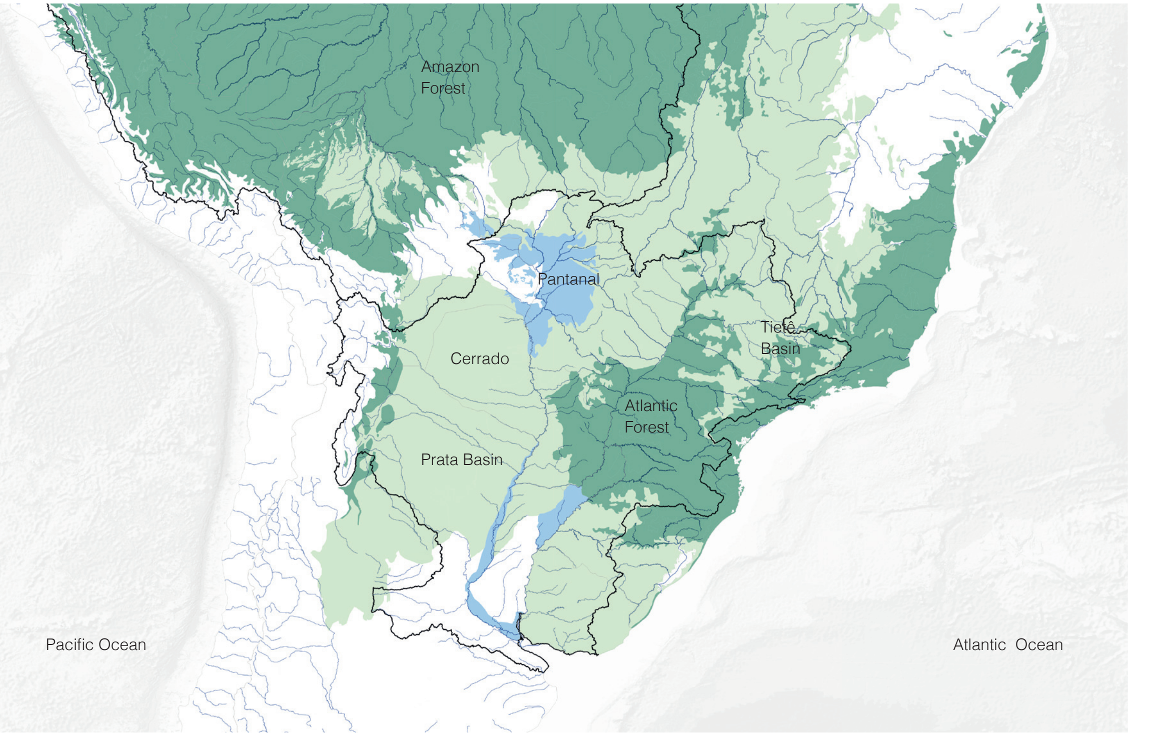



Upstream, within the perimeter of the capital metropolis, the river is heavily polluted by all sorts of industrial and residential waste, tragically impacting the entire river downstream. Within the boundaries of the City, the waters of the River are kept at the furthest distance possible from the inhabitants. Confined between two very heavily used freeways, the River is left unnoticed by most citizens, apart from the inescapable bad smell coming from the water during a warm day. During the rainy season, year after year, immense river floods expose the fragility of the infrastructures built to contain the power of the River, as well as the lack of synch between the urban model built around the many rivers of the City, among them the Tietê.

The river continues its descent towards the heart of the continent, through some smaller riverine cities, a few with high historical value dating back to the economic cycle of coffee from the 19th century, followed by a large sequence of reservoirs, dams, and powerplants, which were built in the sixties to meet the demand of the exploding capital city. The prominence of the River to the development of the State goes back to the times of Portuguese colonization when the course of the water was used as guiding compass for reaching the inner corners of the hinterland, towards the deep forest of the Amazon. Since then, the River Basin has continued to serve as an important axis of transport of goods and people, with several highways, railways, and waterways being constructed following its course.

Hence the many natural and anthropic systems that overlap each other within the basin. As all these networks were formed with a certain natural condition in mind, these long-lasting structures are at a turning point. Systems that were built on conditions that are seizing to exist will collapse unless adaptation or transformation schemes are proposed.

> Biomes within the Prata Basin: Pantanal, Cerrado, and Atlantic Forest
The Author, 2021



## Extractive urbanization

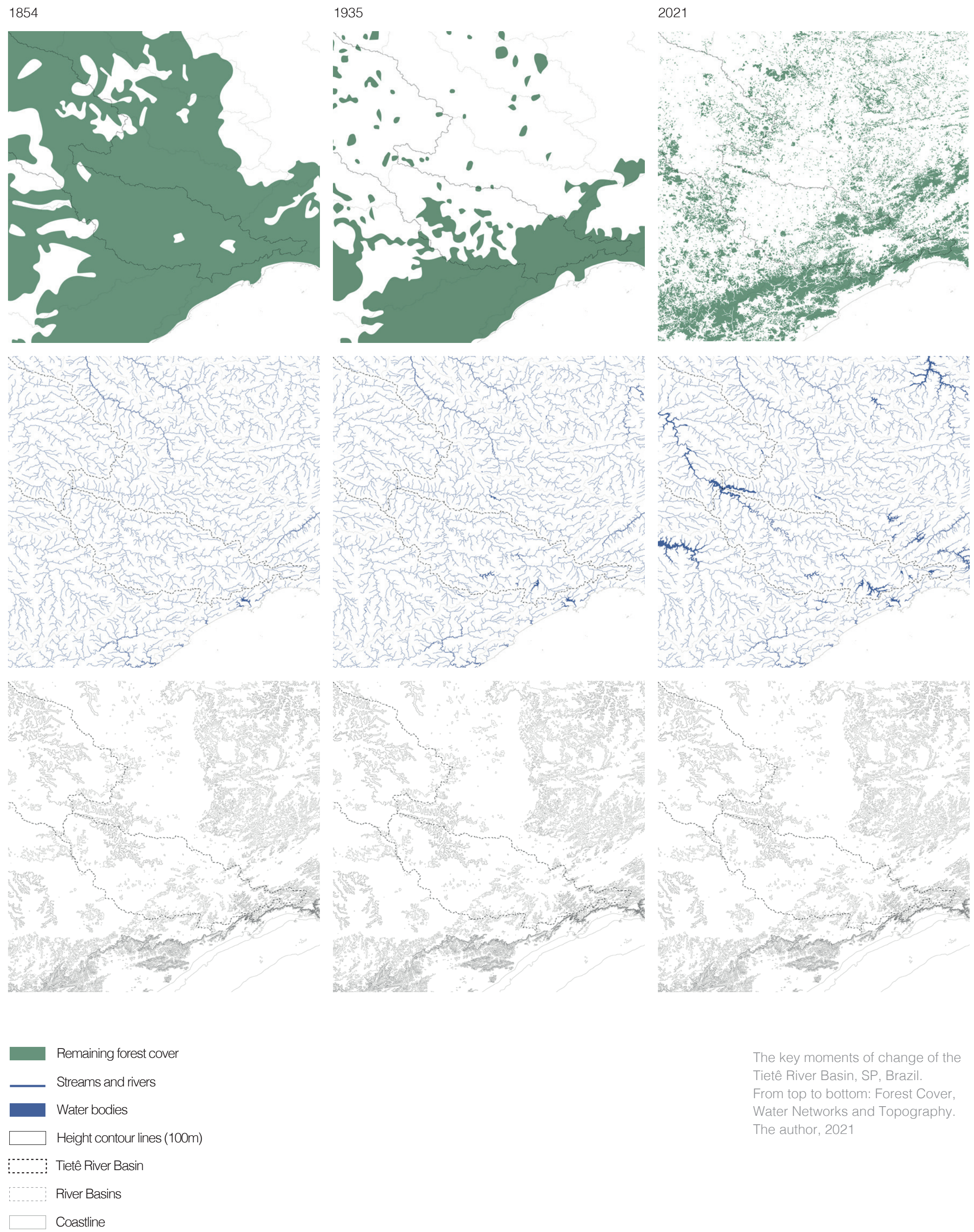
Devastation of the jungle, Johann Moritz Rugendas, 1820-1825
Source: Centro de Documentação D. João VI

The history of land transformations in the Tietê Basin and São Paulo's State follows a complex sequence of economic cycles of expansion and decay of several types of crops and commodities. Starting with the colonization and further continuation of extractive practices, the landscape of the Tietê has been severely altered by a series of economic cycles that took place throughout the continent. Large-scale manipulation of the land begins in the mid 19th century, with the expansion of coffee plantations throughout the region. Before this date, the Atlantic forest in the hinterland was left still mostly untouched, except for small patches along with the existing cities at the time, like São Paulo and Santana de Parnaíba.

However still beautiful and impressive, the Atlantic Coast of southeastern Brazil used to be almost enterelly covered by the Atlantic Forest Biome, as well as parts of the hinterland of São Paulo's, stretching almost 700 km inland within the country. Therefore, formerly the Tietê River Basin was almost entirely covered by this biome, from the highlands of the Coastal Mountain Range, descending through the steep waterfalls and plateaus, today located at the heart of the State of São Paulo. Most of the remaining forest overlaps with the Coastal Mountain Range, along the Atlantic Ocean, and the Cantareira/ Mantiqueira mountain ranges, to the north of the City of São Paulo. After almost 200 years of intense occupation and manipulation of the land, few parts of the basin still present pristine nature, with the persistent forest being limited to protected areas that have been traced after the establishment of the Forest Protection act, in 1934 (Victor et al, 2015).

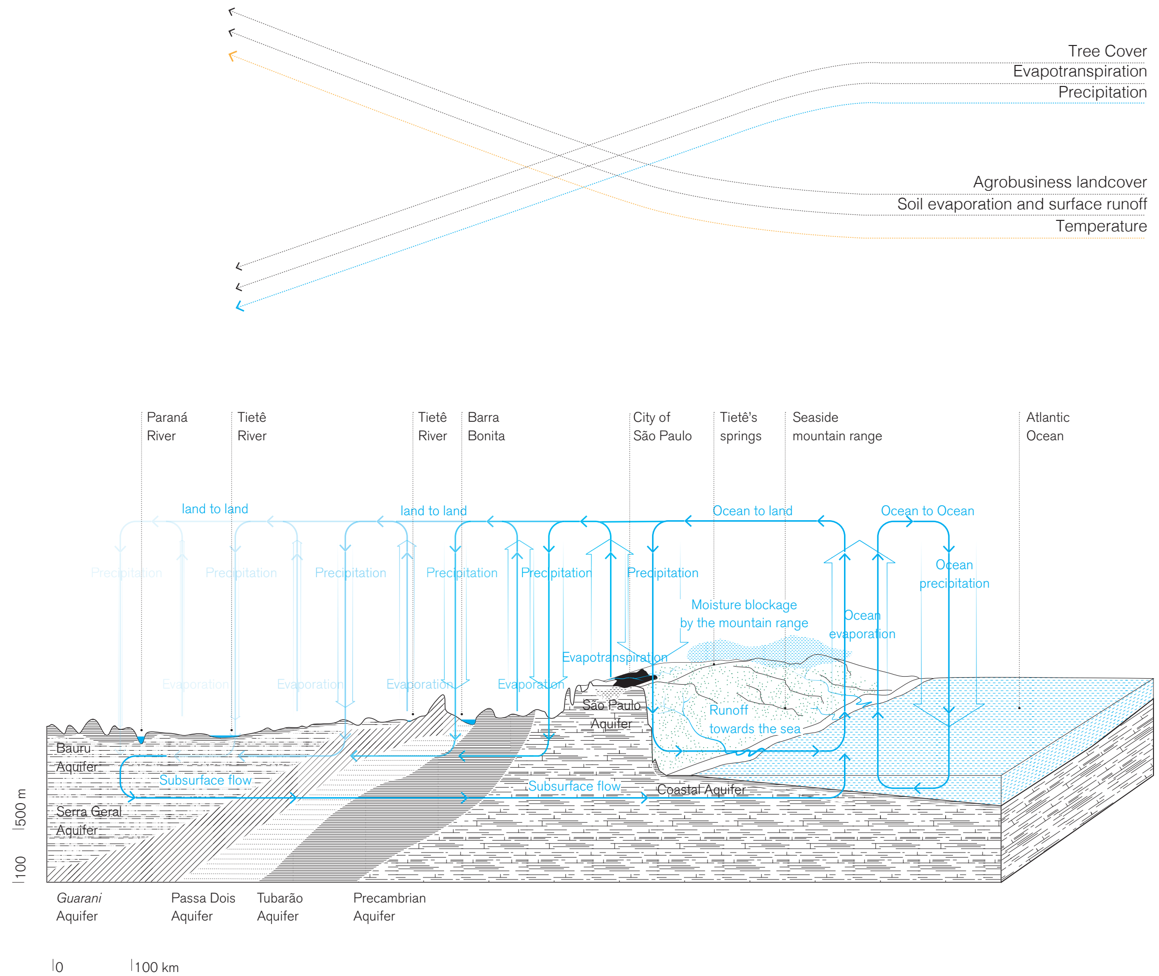
Apart from the conservation efforts and establishment of natural state parks in the area, the steep topography arguably is the main reason why these forested zones have persisted to exist after almost 200

years of intense occupation of the region, forming an intricate mix of sugar cane plantations, cattle ranching, and mineral extraction.
For almost a century the forest was seen as an impediment to economic development, and trees were simply cut to open room for coffee monocultures; the precious wood of tropical trees was not even used for other purposes (Victor et al, 2005).
Following the international crisis of 1929, the coffee economy starts to fall into decay. However, even after the stock market crash and with it a sharp decrease in demand for coffee, internationally, farmers still were pushing the limits of production, with an increasing amount of coffee yielded. In 1933, coffee plantations reached their maximal extension, with almost 1,5 billion planted coffee plants (Victor et al, 2005). During the same period, the former natural forest of the State reaches an extension of merely 26,2% of its total area, in comparison to the original 81,8% before 1854 (Victor et al, 2005).
The persistent nature is mainly concentrated along with the coastal bands of the mountain ranges. Thanks to contemporary digital tracing techniques it is possible to notice that the hinterland of the state presents many scattered patches of vegetation.
However, not all of these patches present remains of natural forest. Some are reforestation areas using very poor techniques, such as the massive plantation of eucalyptus trees, which are famous for drying up the soil. All of these scattered patches leave hints for the elaboration of a new spatial framework, based on Landscape Urbanism and Landscape Ecology premisses of reconnecting the fragmented patches, corridors, and matrix. In summary, the landscape of the Basin has been shaped into a highly-urbanized environment, serving mainly the purposes of production and accumulation of wealth by extraction, as well as supporting systems of logistics and energy production.




The key moments of change of the Tietê River Basin, SP, Brazil.
From top to bottom: Forest Cover, Water Networks and Topography.
The author, 2021

# A particular geophysical composition




Hydrology and soil dynamics in the Tietê Basin
The author, 2021

TOPOGRAPHY AND WATER AT PLAY

Besides being a site of pristine natural beauty, providing ecosystem services for the capital city of São Paulo and the seaside urban areas, the coastal zone of São Paulo plays a very important role in the maintenance of life in the hinterland. The Atlantic Forest's evapotranspiration facilitates the exchange of moisture between water and land, which brings rain to the countryside. At its present state, with the severe deforestation and bareness of the land in the countryside areas, the amount of rainfall and humidity decreases as one enters the continent. The hydrological flows lose strength by the inability of the soil to store water, which is not transferred back to the atmosphere via evaporation and evapotranspiration in a small water cycle.
Moisture and humidity that are formed by the evaporation of the ocean are transported to the hinterland via a biotic pump, facilitated by the existence of dense forests in tropical Brazil. Despite being a region that has been severely urbanized, the hinterland of São Paulo is key to the maintenance of the biotic pump. It stretches 600 km from the coast to the hinterland, which also is the estimated maximum distance that moisture travels inland without the help of a biotic pump (Makarieva & Gorshkov, 2007). Hence the relevance of ecological regeneration and conditions of the soil and surface of the Tietê Basin for the restoration of hydrological cycles.
The steepness of the Coastal Mountain Range contrasts with the relative flatness of the main plateau of the state, descending from the higher altitudes of the City of São Paulo towards the Paraná River valley, through the basin of the Tietê. A composition of topography + humidity brought by the ocean that descends to the ground in the form of rain along the coastal band is what allows the intricate network of rivers of the area to be persistent. Despite severe alterations of the

natural processes, rain that falls on the coast feeds the river springs and allows for moisture recycling by precipitation, infiltration, and evapotranspiration.

Southeastern Brazil is an area with a dense system of natural waterways that have been severely altered by the construction of dams for flood management and hydropower plants, but also by the construction of the Tietê-Paraná Hydroway, one of the most important of the country in terms of the number of goods transported.

A remarkable amount of dams and reservoirs were built upstream, close to the City of São Paulo, to meet the demand for energy by the fast-growing city (the urban growth was fueled by coffee money), setting precedent for extensive works of water management during the following decades. The system of dams and reservoirs, which was largely expanded during the 1970s seems very robust and was supposed to meet the demand for energy and water of the metropolis. Nevertheless, the dams and hydropower plants middle stream compromised the discharge of water downstream (associated with low rainfall statistics during the last couple of years). As of 2022, Southeastern Brazil as a whole is under severe stress for the lack of water for domestic consumption and production of hydropower.

A complex system of several aquifers is found along the Basin in the subsoil. Some of the most important aquifers of the continent e.g. the *Guarani* has its recharge zone (where rock present at the surface allows for the infiltration of water to the deeper layers of the subsoil) overlapping areas of industrial agricultural production and reservoirs of water made for hydropower generation.The fragility and importance of the site to the recharge of aquifers and maintenance of the biotic pump bringing moisture and rain from the Atlantic coast on the east to the hinterland of the country, to the west, is severely harmed by industrial

A family of farmers in Estrela D'Oeste, São Paulo, standing on dry soil on what used to be a weir.
Source: Lela Beltrão, El País Brasil

João, Davi, Marcelo, and José. All papaya fruit harvesters, who have been affected by the severe drought in the Paulista countryside in 2021.
Source: Lela Beltrão, El País Brasil

Streets flooded by rain in São Paulo
Source: Paulo Pinto / El País Brasil

agriculture uses in the region. Among other reasons, by the heavy usage of pesticides and chemical fertilizers, soil degradation and eutrophication of water bodies, desertification by intensive agriculture, and impermeabilization of the soil by urbanized areas.

# 2 Problem Field

# Problem

## Statement and Proposition

PROBLEM STATEMENT

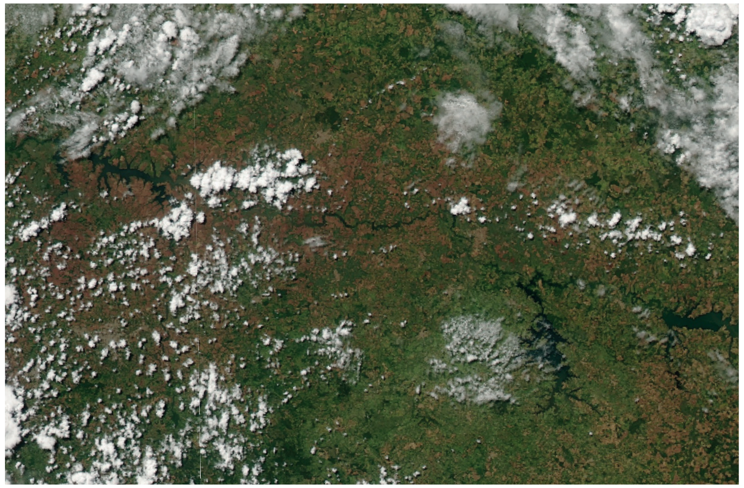
An affluent of the Paraná River, the Tietê River shapes the homonym basin that runs almost 700 km inland, from the Atlantic coast towards the countryside. From its source, in the highlands of the Coastal Mountain Range, to its mouth on the Paraná, the river runs through several different types of natural and highly-urbanized areas which have altered and shaped watercourses in many different ways. Within the Basin, the natural environment and its processes have been severely altered from their original state throughout almost two centuries. A process of predatorial exploration of the land by different urban forms going back to the time of colonization. This transformation increasingly depleted the soil by tearing down the forest, followed by intensively extractive agricultural practices aligned with a series of distinct economic cycles. To meet the demands of the economic and populational growth of the region, the water network and water bodies have been disrupted by the construction of several infrastructures for the production of energy by hydropower plants and flood control. During the past decade, environmental problems such as extreme droughts, floods, forest fires, and dust clouds have exposed the fragility of the ecological integrity and the economic model behind the use and production of space in the State of São Paulo, Brazil. The transformation of the hinterland, from tropical forest to extensive monocultures affected the climate and the natural environment by, amongst many factors, the intensive use of industrial agriculture techniques and subsequent degradation of soil and water infiltration capacity, compromising groundwater levels, recharge of aquifers, and recycling of moisture from the Atlantic Ocean towards the hinterland. Within the Basin, almost 80% of the former forest now has been destroyed, compromising the biotic pump of the Atlantic Coast, altering the rainfall regimes and temperatures, increasing the probability of environmental disasters, and compromising the economic cycle continuity.

PROPOSITION

Possibilities of restoring the ecological integrity of the basin, as a model of regeneration for the entire biome; an alternative occupation, and positions of care for the land is proposed, in synch with the environment, and the ambition of a fairer country.
Contemporary agriculture systems of production and consumption are complex, sustaining animals and humans, as well as yielding crops for commodities and energy. Approaches towards regenerative agriculture can provide a glimpse into solutions for the problem caused by monocultures and industrial agriculture but are incapable of keeping with demand and expressing a position of care towards the earth simultaneously. Hence the need for negotiation between interests of the financial and natural orders, given that the ingenuity of presuming that some forms of extraction, e.g. plantation of soy and sugarcane, will be halted in the name of earth's well-being.
Renegotiating the countryside space offers a window of opportunity to perform other forms of control of the land while improving biodiversity through the restoration of the earth by an approach to farming that uses soil conservation as the entry point to enhance environmental, social, and economic dimensions of production (Schreefel, Schulte, de Boer, Pas Schrijver & van Zanten, 2020). Ultimately, regenerating the soil also means regenerating hydrological cycles, quality of all kinds of life, and guaranteeing our existence together.

Dust cloud in Guararapes, 2021
São Paulo, Brazil
Source: G1

Dust storm in Castilho, São Paulo, in 2021.
Source: El País Brasil



Exposed barren land prone to erosion in the countryside of São Paulo in February of 2022. Satellite Image.
Source: INPE, 2022

# 3 Framework

# Methodology



## Theoretical framework

The proposed Theoretical framework puts forward the relations between theories and domains of knowledge used for the development of this work until the moment.

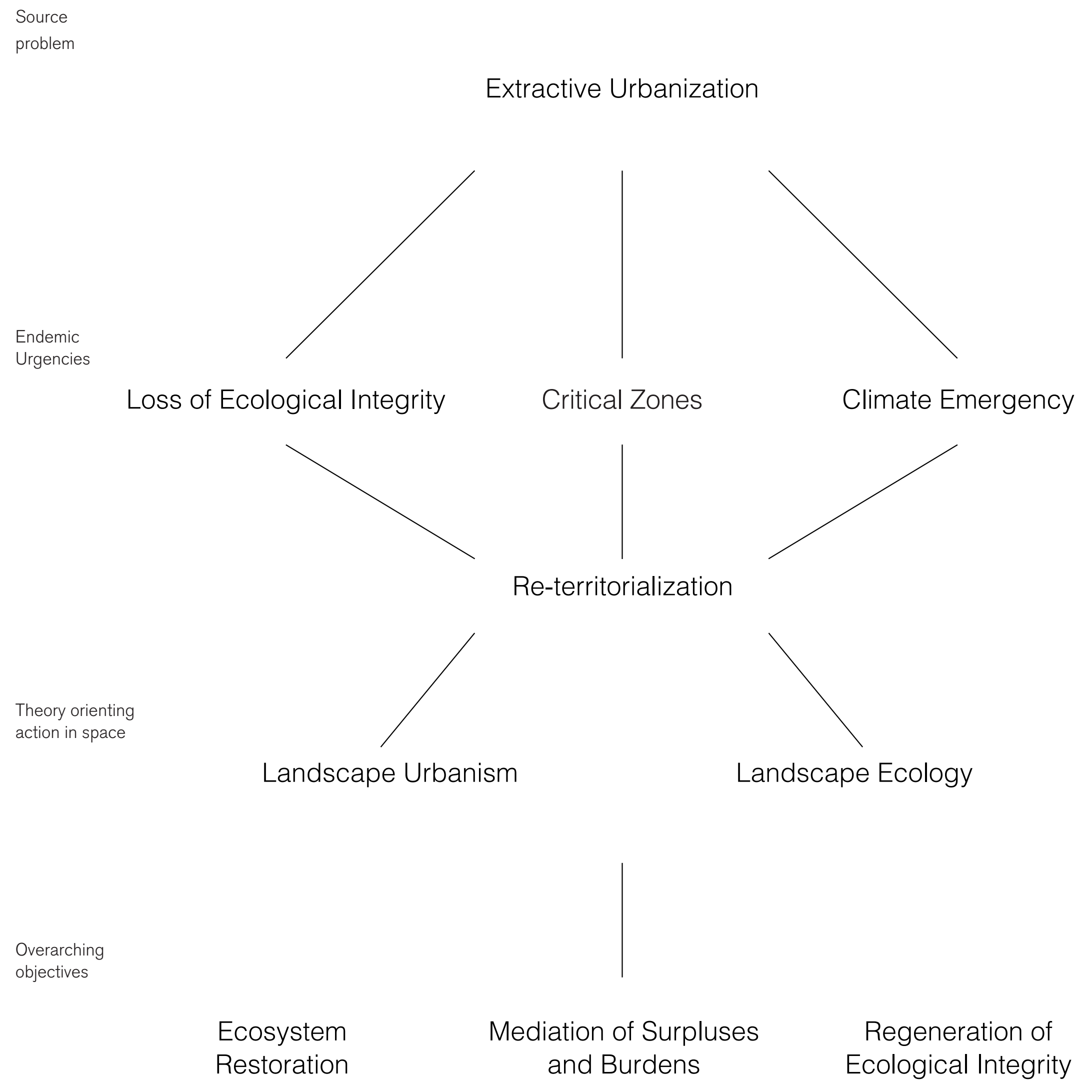
The starting condition, identified as a Source Problem, is Extractive Urbanization, or how international capital manifests itself in space through the accumulation of wealth extracted from the Earth. Extraction entails a lot of different activities, such as mining, extraction of fossil fuels, and wood from natural forests, but in this case, it refers to the extraction of nutrients from the soil and ecosystem services by industrial agriculture, through extensive monoculture landscapes found along the Basin.

Three endemic urgencies are presented, related to the impacts of Extractive Urbanization on the Tietê River Basin, namely: Loss of Ecological Integrity, Critical Zones, and Climate Emergency. Ecological Integrity is used as a holistic concept that entails the conservation of native biodiversity, promoting resilience, or the capacity to reorganize while changing and bouncing back to the same function and structure following an event of chock (Wurtzebach & Schultz, 2016); Critical Zones highlights transcalar influences of the natural and anthropic systems in place on Site, expanding the boundary of a territory to that of the entire Planet (Latour, 2018); and Climate Emergency, entailing all the natural disasters occurring within the Basin, which seem to be increasing in quantity, frequency, and severeness.

The urgencies are translated to Re-territorialization, in a holistic attempt to re-synchronize land uses with the capacity of the site. It entails the adaptation of techniques and ways of occupying the land by reading the local potentialities and limits. Re-territorialization is then expressed and organized in space using principles of Landscape Urbanism and Landscape Ecology framing urban and rural spatial form.

Finally, Ecosystem Restoration and Regeneration of Ecological Integrity are posed as overarching objectives embedded within the homonymous theories. By analyzing a series of available practices of Landscape Ecology by regenerative landscape and urban designs, forming a complex new landscape mosaic constituted by corridors, patches, and a parcelled matrix, for instance, the project is informed on how to better address the issues of the site whilst improving the state of the local biomes, ecosystems and natural processes. As to the Regeneration of Ecological Integrity, the theory should provide the designer with practical criteria to measure and restore ecological integrity (Wurtzebach & Schultz, 2016).





## Research Questions and Framework

MAIN RESEARCH QUESTION

What is the new territorial form capable of synchronizing environmental, social, and economic interests in an exemplary zone for the regeneration of ecological integrity within the Tietê River Basin?

SECONDARY RESEARCH QUESTIONS

SQ1. What constitutes the urban form of the Tietê River Basin?

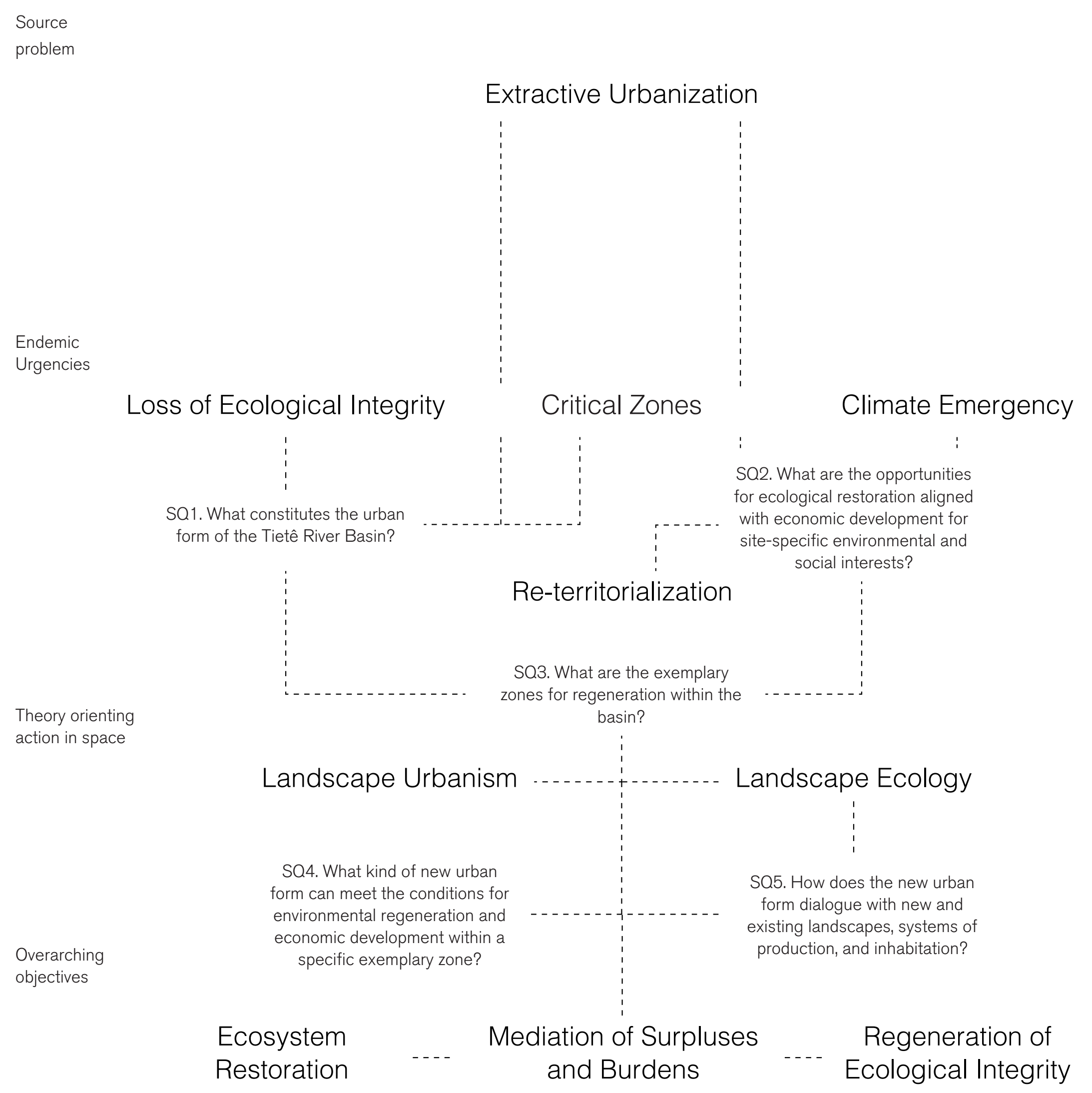
SQ2. What are the opportunities for ecological restoration aligned with economic development for site-specific environmental and social interests?

SQ3. What are the exemplary zones for regeneration within the basin?

SQ4. What kind of new urban form can meet the conditions for environmental regeneration and economic development within a specific exemplary zone?

SQ5. How does the new urban form dialogue with new and existing landscapes, systems of production, and inhabitation?






**What is the new territorial form capable of synchronizing environmental, social, and economic interests in an exemplary zone for the regeneration of ecological integrity within the Tietê River Basin?**

## Approach and Research Framework

The research is enriched by a literature review, supporting the drafting of the drawings and providing sufficient knowledge about the different domains of expertise which seem to be necessary at this point. For the definition of criteria of the assessment of ecological integrity, specific literature will be evaluated, transforming general concepts into an assessment criteria which is responsive to the conditions of the site. These criteria would then be applied to selected exemplary zones within the Basin, which should be aligned with economic and environmental regeneration goals, as well as having enough data available for the continuation of more in-depth research.
Analytic maps should be produced to help in better understanding the potentials for the re-generation of ecological integrity within the specific exemplary zone, which then would lead to the construction of the spatial framework.
The design develops into a series of smaller-scale interventions, responding to local conditions of the landscape, culture, and climate, as well as pre-existing networks and usages of the land.
All of the above-mentioned steps undertake a design thinking process, which should be one of the base methods of this graduation work. It allows the designer to create different possibilities of choice during its analysis process, with convergent and divergent thinking hand in hand, forming a non-linear path forward. Focusing on the interrelations between seemingly disconnected concepts and subjects, design thinking frames and traces ties between different parts of the problem. This process is supported by the analysis elaborated during the Monograph Series, as well as by the analytic maps which should be prepared for the evaluation of potentials and limits within the exemplary zones. These acts of mapping reveal the agency of creating possibilities for the research and design, followed by an unfolding of different projects, at varied scales, based on choices informed by the cartographies.
In other words, the Design Thinking process in this scale should be as follows: Analysis (Composition), or the creation of possibilities; Synthesis (Alteration and Limits), or the making of choices; and Projection (concrete design interventions proposed for the chosen zones).
As to the theories applied to the designs of the project deliverables, Landscape Ecology and Landscape Urbanism are at the base of the new extended urban landscape matrix, which will be applied to exemplary zones, following the principles put forward by Richard Forman, with his publication “Land mosaics: the ecology of landscapes and regions”, where the basic elements of a mosaic are presented, namely patches, corridors, and matrix. These principles and vocabulary will be used to draft the new urban matrix of the site, while the different patches, matrix, and corridors shall provide the specific, smaller scale, objects of urban and landscape design.
The distinct landscapes and exemplary zones should be connected by a network of relations between different systems, scales, and subjects. This constitutes an urban/peri-urban/rural transect of interventions, which should expose the fundamental trans scalar value of this graduation work.

Personal Motivation and Urgency

Problem Field

Extractive urbanization on the Tietê River Basin and externaties on the Ecological Integrity of the Site

Problem Statement

Environmental problems such as extreme droughts, floods, forest fires, and dust clouds have exposed the fragility of the ecological integrity and the economic model behind the use and production of space in the State of São Paulo, Brazil. The transformation of the hinterland, from tropical forest to extensive monocultures affected the climate and the natural environment by, amongst many factors, the intensive use of industrial agriculture techniques and subsequent degradation of soil and water infiltration capacity, compromising groundwater levels, recharge of aquifers, and recycling of moisture from the Atlantic Ocean towards the hinterland.

Proposition

Possibilities of restoring the ecological integrity of the basin, as a model of regeneration for the entire biome, an alternative occupation, and care for the land is proposed, in synch with the environment, and the ambition of a fairer country is sought after.

Theoretical Framework

Research Question

What is the new territorial form capable of synchronizing environmental, social, and economic interests in an exemplary zone for the regeneration of ecological integrity within the Tietê River Basin?

Approach

Projection

Objectives

Adaptation of methods according to Objectives...

Target Territory and Site

...and sites

Tietê River Basin | Exemplary Zones

Scales

Land | Landscape | Ensemble | Object

Conclusion

Reflection | Evaluation

Evaluation according to evolving propostion

# 4 Monographs

MONOGRAPHS



# Lines of inquiry



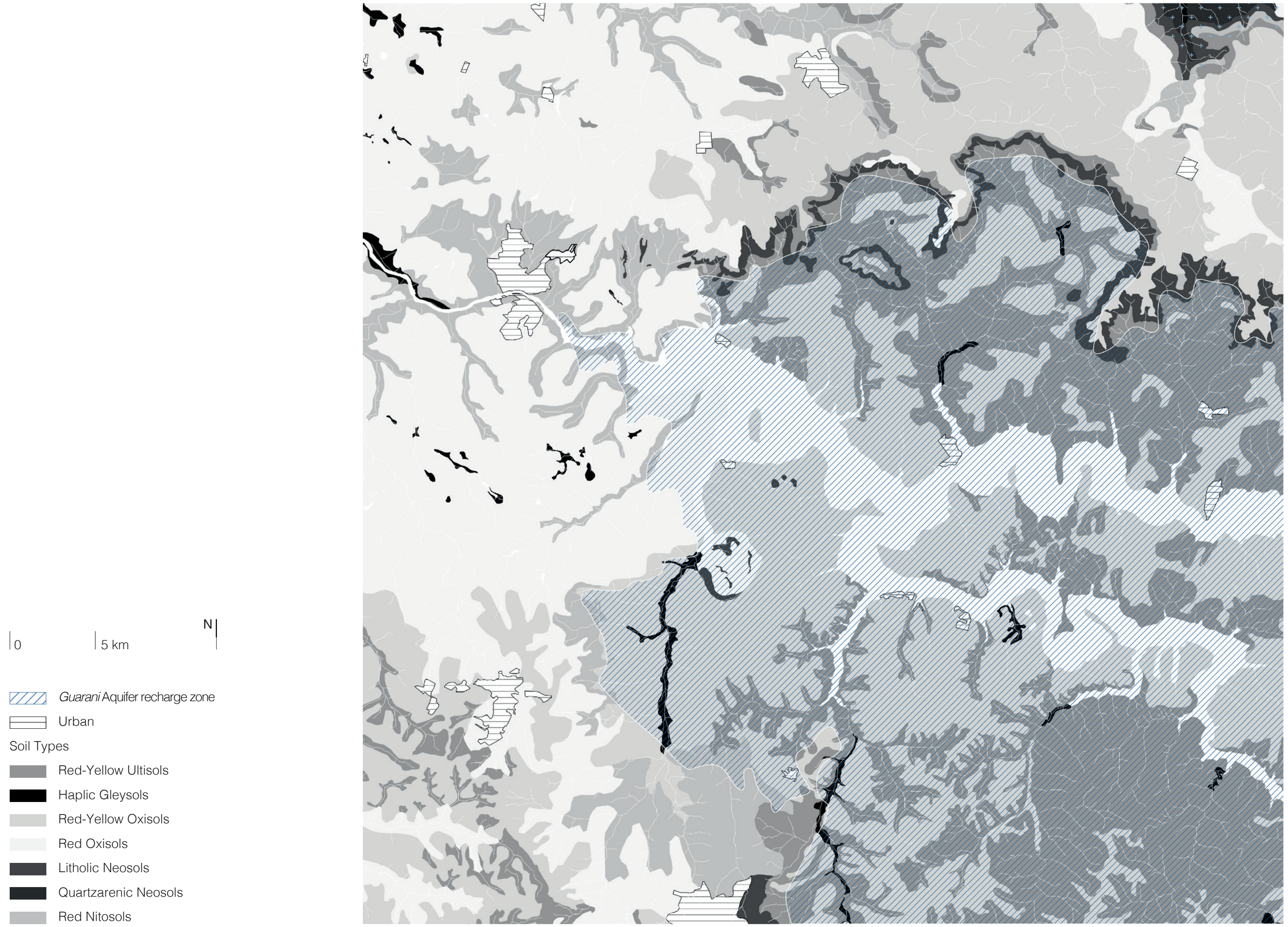
To obtain the necessary base knowledge of the site and its dynamics, the Monograph Series of the Transitional Territories Studio will be the starting point. The Series is divided into four sets on the present states of Matter, Topos, Habitat, and Geopolitics, providing a sufficient amount of entry-points to guide the process of development of the thesis, with further room for development after the conclusion of this phase.

Differing per line of inquiry, the methods of research and representation are various. Each line of inquiry presents three drawings, namely Composition, Alteration, and Limits, depict-ing the baseline of a specific subject of interest, related to the set and the site. The cartographies are not limited to the elaboration of maps, but graphs, drawing sections, and any other kind of exploratory drawings as well.

## Composition

GEOLOGICAL COMPOSTION OF THE SOIL AND WATER NETWORK IN BARRA BONITA

Most of the area around the City of Barra Bonita is covered by two types of Oxisols: Red-Yellow and Red Oxisols. These soils present vibrant and reddish colors due to the high volumes of iron oxides in the original organic matter of the earth. Mainly found in regions of moderate topography, the soils are most commonly used for farming cereals and sugarcane in Southeastern Brazil. The gentle slopes allow for the usage of heavy machinery for harvesting - justifying the existence of few, but enormous properties occupied by monocultures throughout the region. Furthermore, the surroundings of Barra Bonita are of extreme relevance for the maintenance of quality and levels of underground water, due to its location on top of the recharge zone of the *Guarani* Aquifer, one of the largest in the World.



# Matter

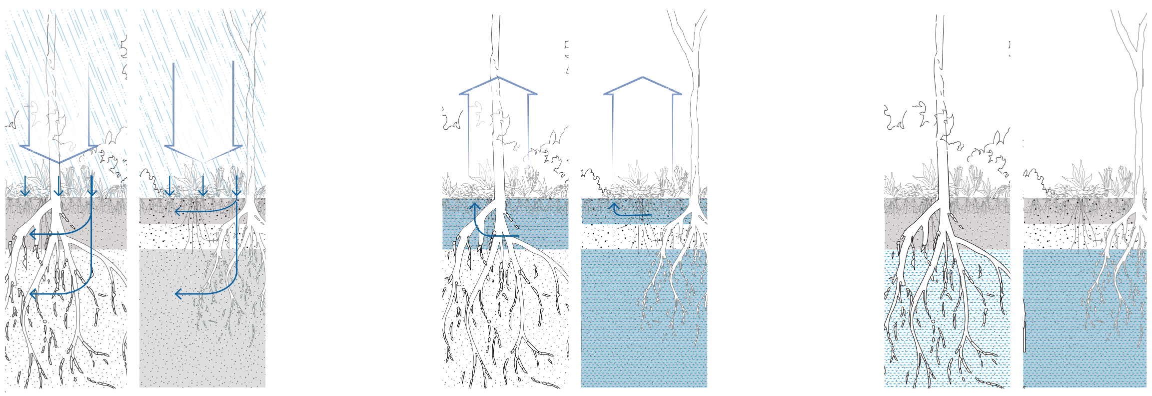


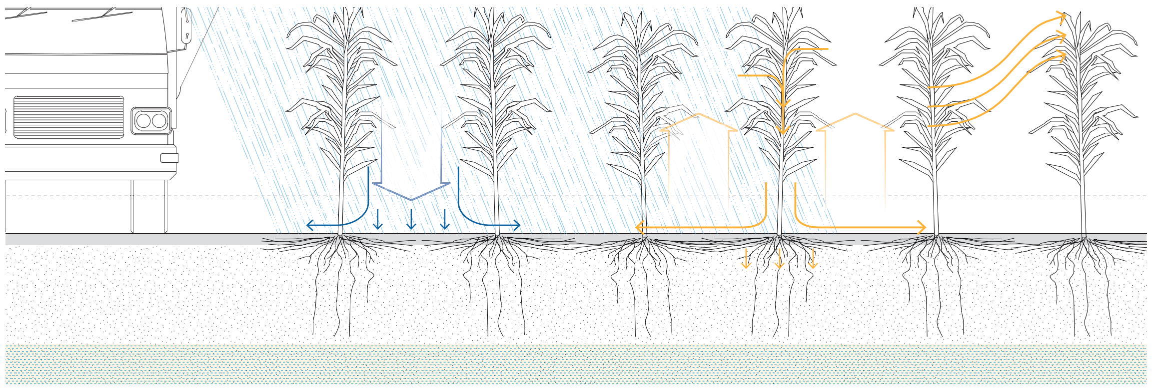
## Alteration

EVOLUTION OF SUPERFICIAL SUBSOIL + SOIL EMPOVERISHMENT CAUSED BY INDUSTRIAL AGRICULTURE

A challenge for oxisols refers to the low amount of water available to plants and their susceptibility to compaction. This is commonly found in Red Oxisols with a clayey or very clayey texture, also occurring in Red Latosols if the fine sand content is high (EMBRAPA). During rain or irrigation, the soil stores water in macro and micropores. The Ultisols with second horizons starting at a depth of 40 cm present greater availability of water than the other Latosols.
As oxisols are prone to compaction, the intensive exploration of the soil by extractive agriculture uses is harmful to these landscapes. The top layer of soil is most often either compacted or washed away due to the frequency and long periods in which the soil is left exposed between two harvesting periods. Because of their overlap with the recharge zones of the *Guarani* Aquifer, the areas destined for the plantation of Sugarcane provoke yet another environmental issue. The Infiltration of pesticides into the subsoil occurs in different manners, but mostly when heavy rainfall occurs after a long period of drought.

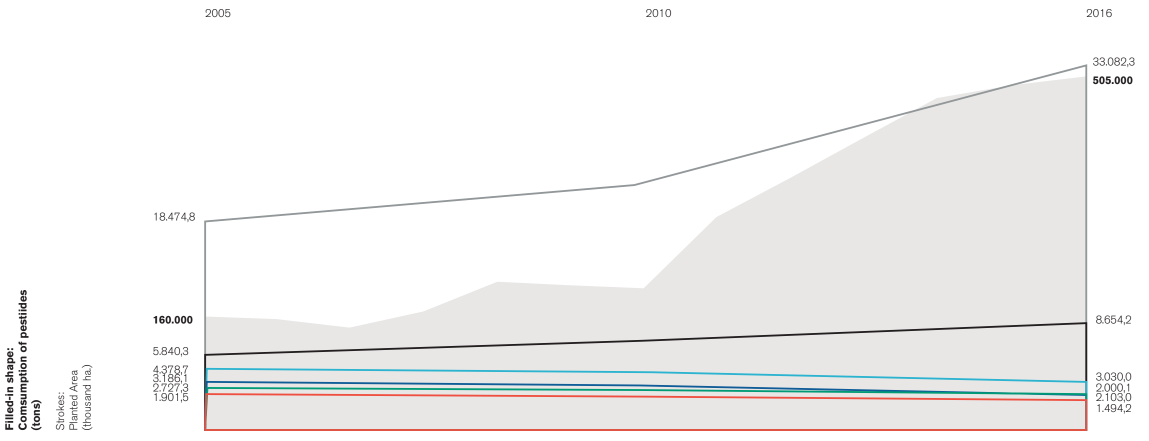
Furthermore, the pesticides (sugarcane plantations are mostly pulverized with the use of small airplanes) can easily be transported by the wind towards neighboring communities, bodies of water, and farms producing food products. Due to the compaction and subdue impermeabilization of the soil, the pesticides are washed away by runoff water, polluting the rivers and springs of the Basin.

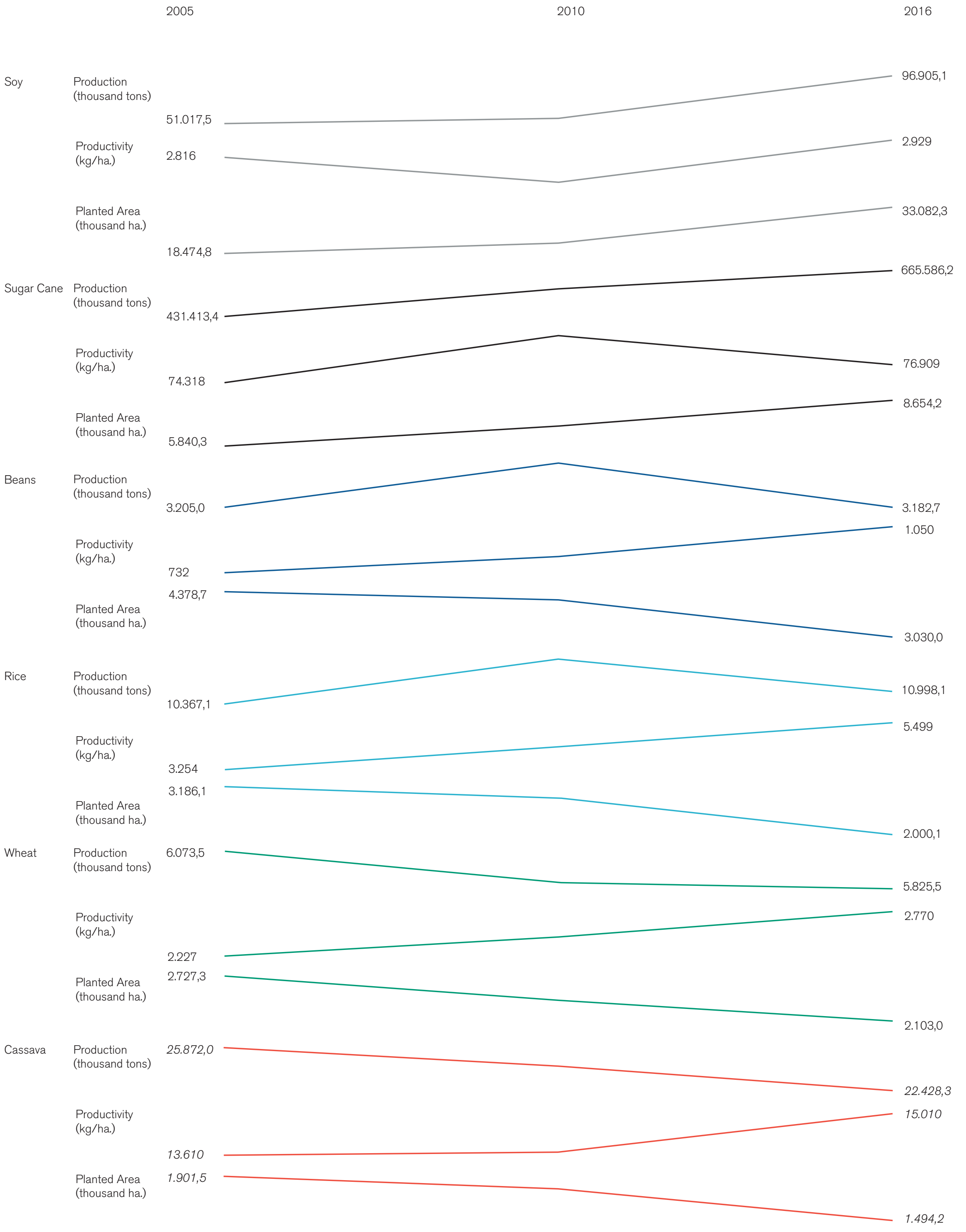




### DEPENDENCY ON PESTICIDES FOR AGRICULTURAL PRODUCTION X TYPE OF PRODUCTION

The amount of land available for the production of food is increasingly diminishing throughout the country. As observed in the graph, apart from rice all other food products have had their production decrease in the period from 2005 to 2016. Crops of commodities, on the other hand, such as soy and sugarcane are seeing a considerable increase in production, productivity, and are destined for the crop. On a National basis, the Ministry of Agriculture predicts two million hectares less for rice, beans, and cassava until 2030. Soybean and corn should increase by 27% in production and reach 70 million ha. This process follows the tendency clearly seen on the graph at the bottom part of the page. The area destined for the plantation of soy is nowhere close to other crops, with its closest competitor being sugarcane. Furthermore, these crops are heavily dependent on pesticides for increasing their productivity.



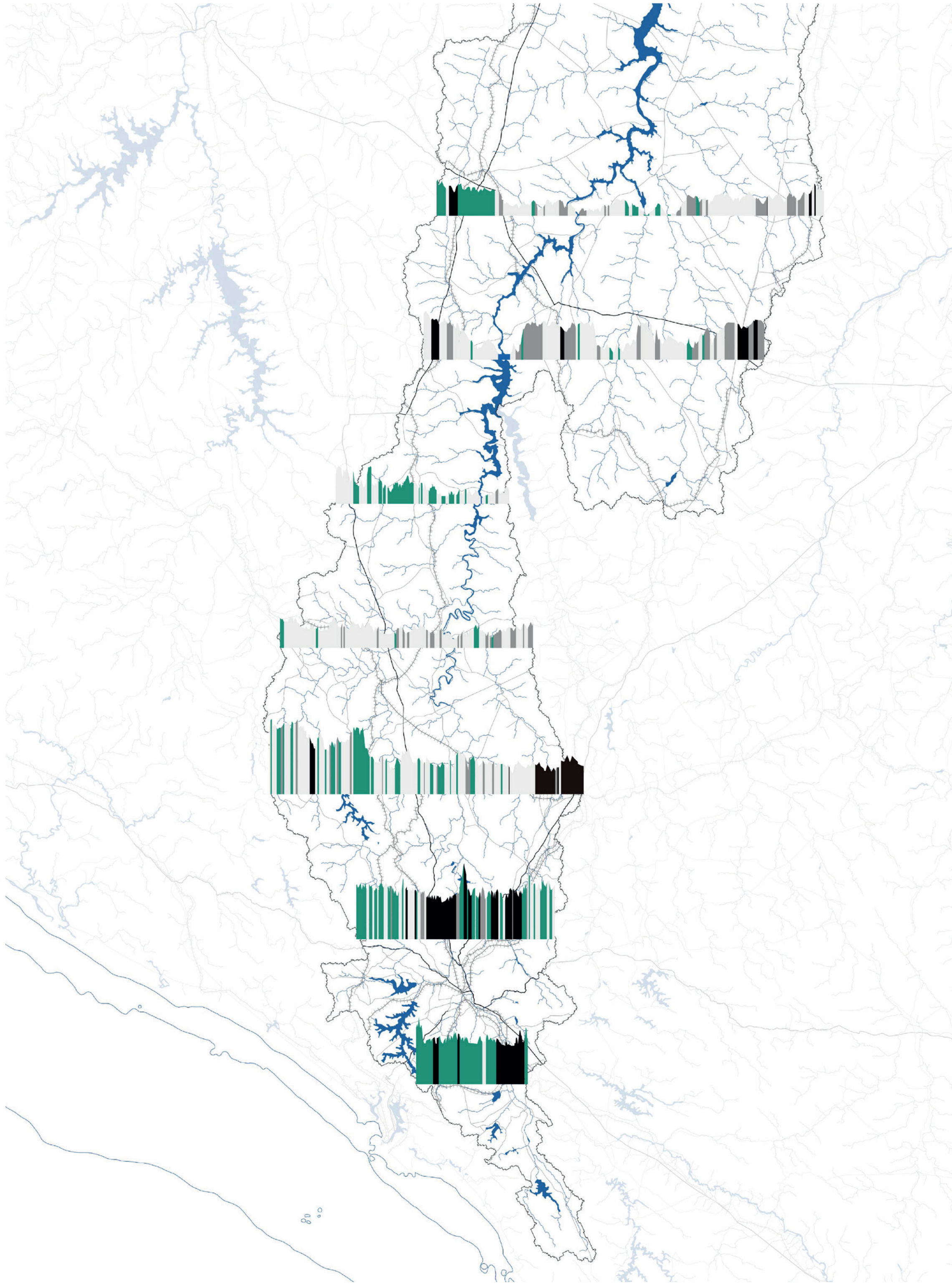



## Composition

DIVERSITY OF LAND USES ALONG THE BASIN + HYDROGRAPHY AND TOPOGRAPHY

Following the course of the Tietê, from its source on the Coastal Mountain range until its mouth in the Paraná, several landscapes are found. These distinct scenarios have been built throughout the centuries by processes of urbanization with the extraction of resources as a goal. Hence the enormous amount of land destined for agriculture and cattle farming middle and downstream, in former areas of forest which have been torn down for the plantations of coffee during the 19th and 20th centuries. The remains of the forest are found at the steepest areas of the Mountain Range and have been preserved by the difficulty in accessing these pieces of land due to the harsh topography, but also by conservation efforts and the establishment of several nature reserves and State Nature Parks. Furthermore, one type of land cover - or the lack of it- commonly found along the basin is enormous plots of barren land, left unused for months in a row.
Due to the low levels of rainfall during the past couple of years, some plantations of sugarcane were torn down due to their low levels of productivity.

The unfortunate combination of exposed soils, lack of natural vegetation, and wind storms propitiate the formation of dust clouds across the Basin.



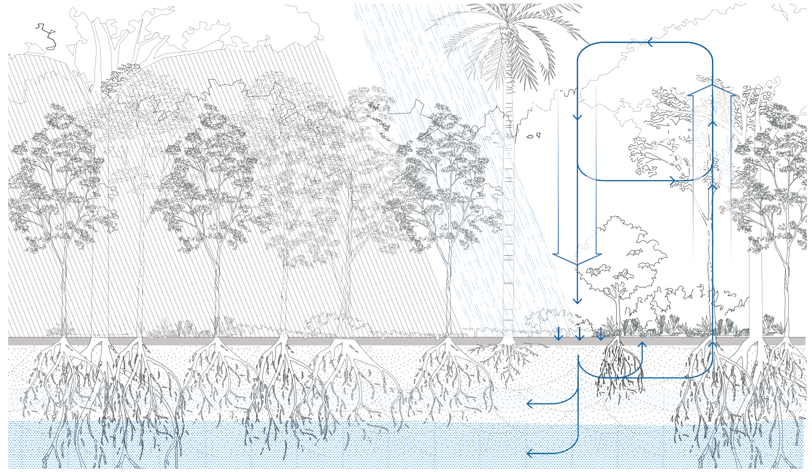
## Alteration

CHANGES IN THE LANDSCAPE OF THE BASIN BY AGRICULTURE ACTIVITY

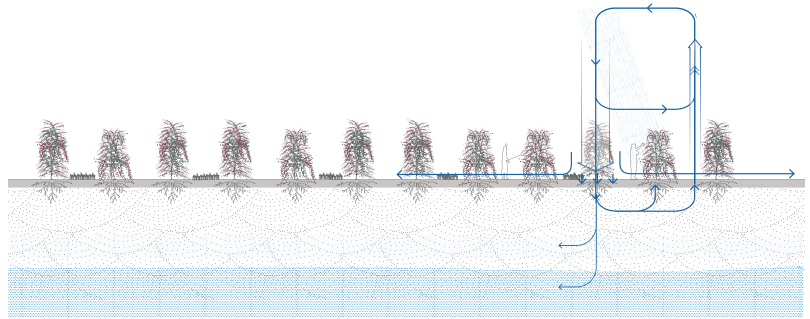
The formation of the vast areas dedicated to agriculture production along the Basin is a very complex and non-linear process. Before the arrival of colonizers and farmers opening the way for the expansion of coffee plantations, most of the Basin was covered by luxurious Atlantic Rainforest, one of the Brazilian biomes home to exuberant fauna and flora. The existence of the forest is what made the soils of the region extremely rich, very suitable for the plantation of coffee.
With the tearing down of the woods for the plantation of coffee, many of the ecosystem services seized to exist, with the amount of rain and episodes of frost being severely impacted by the change in land cover ever since the 19th century (Victor et al, 2005).
When the coffee crops showed the first symptoms of exhaustion, new areas of forests were sacrificed to make way for the implantation of coffee plantations. The former crops, now abandoned and subject to strong erosion, were then transformed into cotton land and cereal lands and finally, as a last resort, on pasture lands.

With the green revolution, areas that had been abandoned due to the impoverishment and erosion of the soils find a second purpose with the plantation of commodities, such as sugar cane, corn, and soy. Dependent on the heavy usage of pesticides and machinery, these crops provoke an ecology of environmental, social, and economical crises,

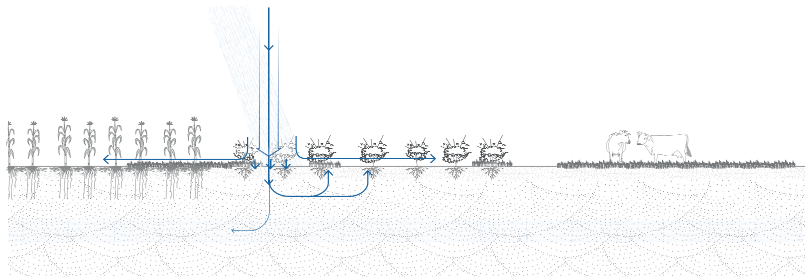
Pristine Atlantic Forest
Prior to 1850



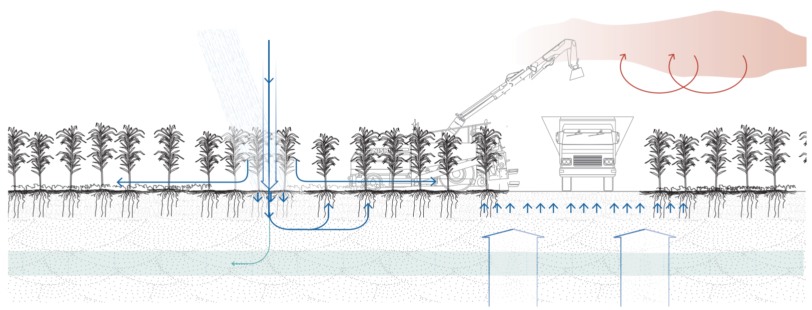
Coffee plantations
1850s



Ceral, cotton and cattle
1950s

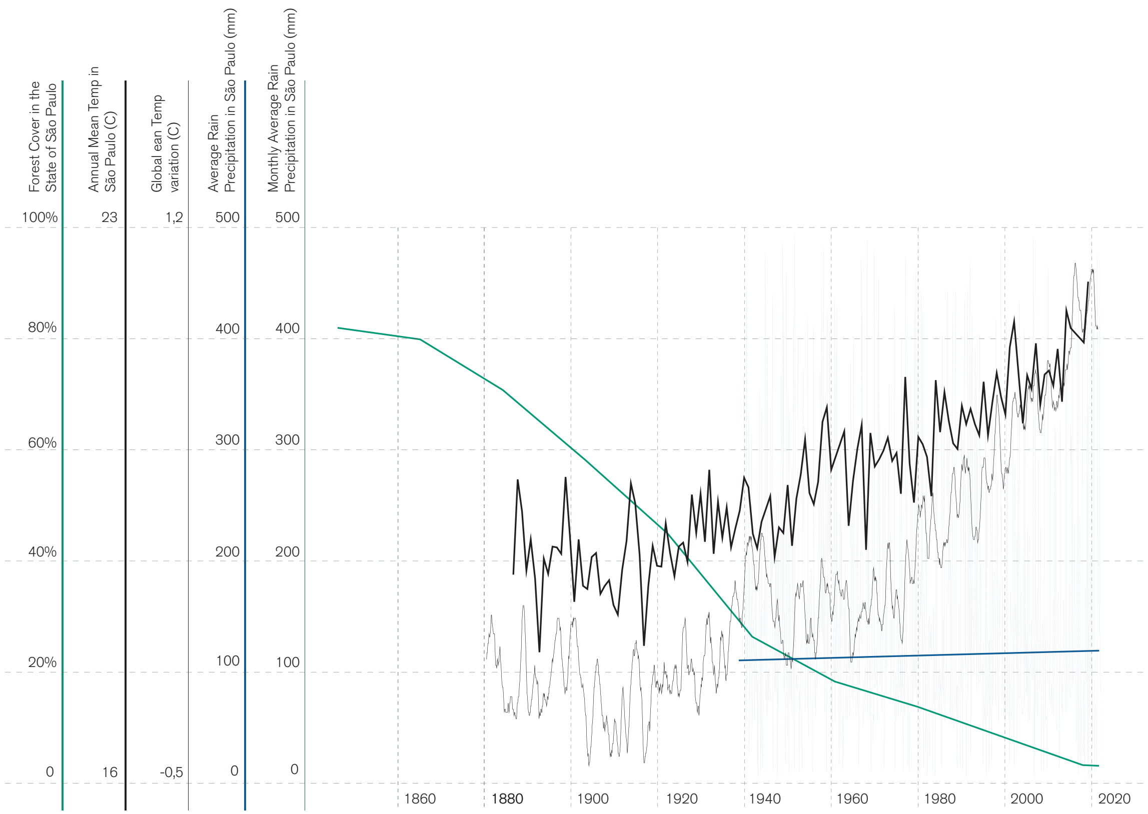


Sugarcane monocultures
2020s



DEFORESTATION, RISING TEMPERATURES
AND RAINFALL

The urbanization process of the State was heavily dependent on deforestation. Either for opening the way for the coffee plantations or acquiring wood for the construction and operationalization of the first railways, very little is left of the former forest.
The decrease in the area covered by the Atlantic forest corresponds to the clear increase in average temperature in the City of São Paulo (although apparently in synch with global average temperature rises).
Due to its location on the Basin, close to the Ocean and, therefore, humidity going from the Atlantic towards the hinterland, the amount of rainfall in the city has not changed too much, contrary to initial expectations. Instead, it appears that the heavy rainfall occurring every summer seems to be getting more intense and higher in volume.
This phenomena is clearly explained by Makarieva and Gorshkov (2007): *"Thus, in the absence of biotic control the transport of moisture to land would only be able to ensure normal life functioning in a narrow band near the ocean of a width not exceeding several hundred kilometers; the much more extensive inner parts of the continents would have invariably remained arid."*



# Habitat



## Composition

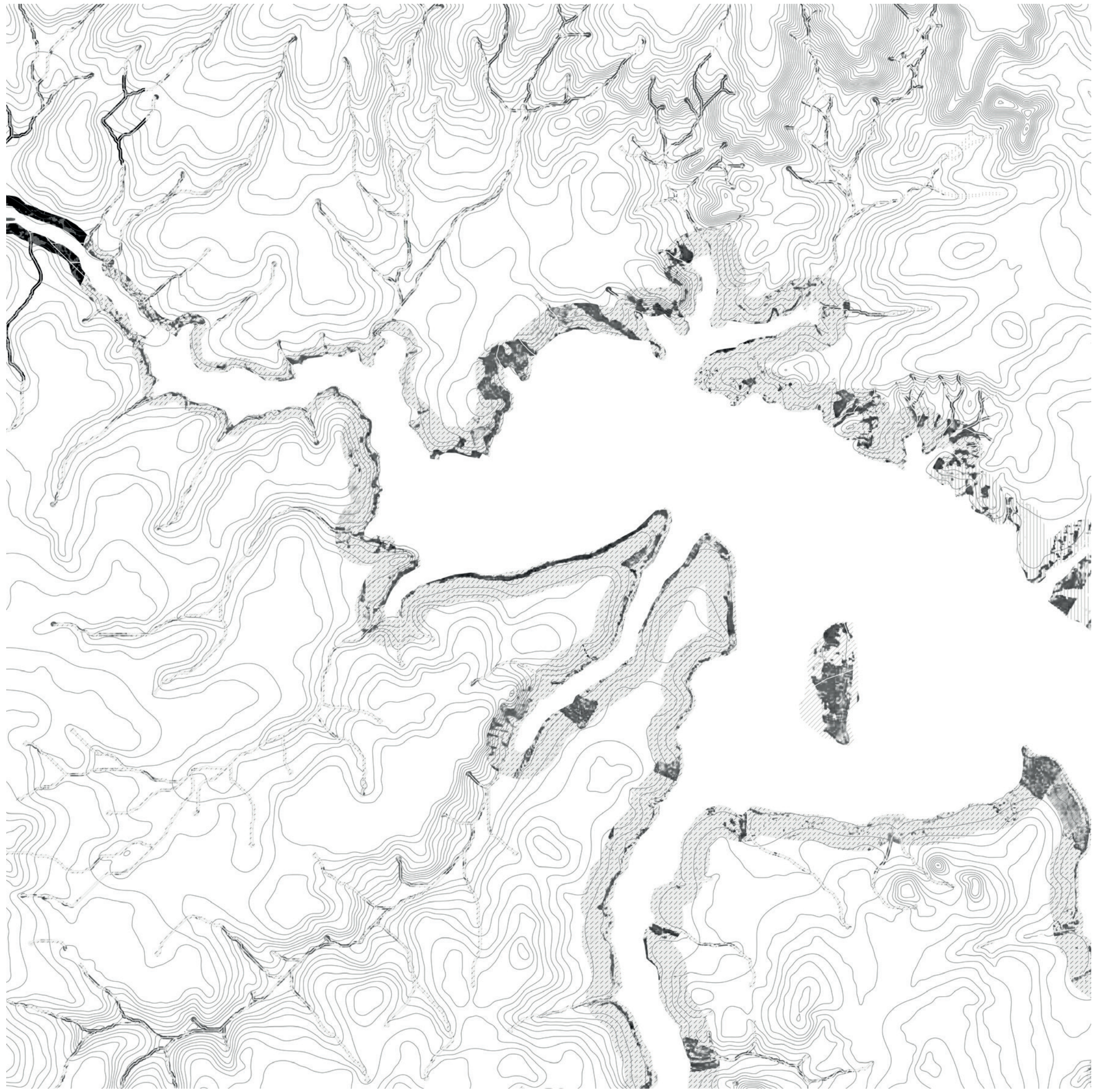
CONDITION OF THE INTEGRITY OF THE RIPARIAN FOREST

According to the Brazilian Code of Forestry (Federal Law #12.651/2012), riparian zones bandwidths are bound to the width of the body of water which they aim to protect.
In the case of large reservoirs, as depicted on the right, close to the City of Barra Bonita, the width of the riparian zone should be 500m. Although small compared to the dimensions of the reservoirs, the band is hardly any help in preventing the pesticides and other industrial agricultural "by-products" from reaching the water. Most of the zones which should be covered by riparian vegetation are left exposed or are covered by agriculture/urban fabrics. Only a few zones of the northern margin of the reservoirs are relatively well-covered by vegetation - a fact that can be explained by the unsuitability of the terrain to accommodate monocultures, due to its steep topography and south-facing slopes (in São Paulo, the preferred orientation for sun-catching is North; this is essential for sugarcane, which requires a lot of sunlight to grow).

*Note: Further along with the development of the research, it was noted that according to the Brazilian code of forestry, the actual vegetation preservation bandwidth along dam reservoirs should be determined for every specific endeavor. Therefore, in the case of the construction of the Barra Bonita Hydropower plant and the adjacent reservoir, the bandwidth of the reservoir's edges vegetation preservation differs from that presented in the drawing. According to the empirical observation of satellite images of the site, along the limited stretches presenting a well-defined vegetation band, the actual width stipulated for the endeavor is, approximately, 100 meters.*
*However, this contradiction does not make the critique presented in the drawing invalid. It seems rather insufficient that a vegetation band of 100m would be capable of securing the erosion of the shores of a reservoir that, in some locations, reaches almosts 6km of width. Furthermore, the large extensions of the adjacent fields occupied by industrial agriculture call for a much more extensive buffer zone between land and water. According to Forman (1995) the vegetation bands between agricultural land and water bodies (to withhold the excess fertilizers, pesticides, and other industrial agricultural toxic runoffs from reaching the reservoirs) should be very wide, acting as the only defense against sources of dissolved substances in runoff water.*

0 5 km N

Agriculture
Agriculture with crop rotation
Agriculture with perm. crops
Farming
Cattle farming
Urban
Tree cover
Contour line (10m)



# Habitat

## Alteration

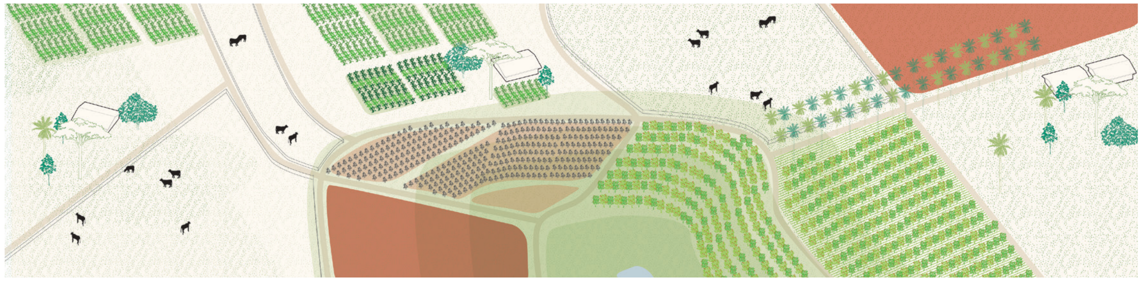
CHANGE IN LAND TENURE MANAGEMENT AND SPATIAL PATTERNS

Keeping up with changes in land cover, land tenure, and spatial patterns also have adapted over almost two centuries within the Basin. The first settlers of farmers exploring coffee developed the crops by opening way through the forest, with complete disregard by the potential of its fauna or without any interest in the commercial value of tropical wood. On top of the very rich land by the organic matter left behind by the forest, the plantations thrived for a few decades, until the unescapable exhaustion of land showed its first signs. The forest continued to be devasted, as the plantations marched upper northwest, following the course of the river. As mentioned before, pieces of land that were unsuitable for plantations of any kind of crop started being used for animal grazing and cattle farming. Already during the 19th century, it was evident that the replacement of the forest by monocultures of coffee affected the climate, bringing less rain to the countryside and raising temperatures. With the international financial crises of 1929, coffee seizes to be as lucrative as it was and many plantations begin a process of decadence.

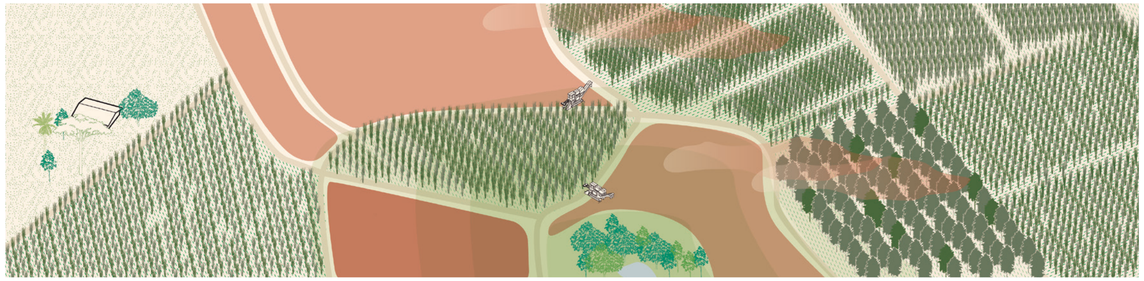
Pristine Nature
Prior to 1850

Coffee boom
1850 to 1930s

Decadence and resettlement
1930s to 1970s



Cane boom
1970s to present day



The land spatial structure, which until the 1930s, was occupied by large estates, is now subdivided. With the abolishment of slavery and the arrival of European workers, companies specialized in accomodating the colonos (settlers) are founded. This contributes to the laceration of the remnants of forests that stiltl exist in these areas. Many of the former owners of the latifundia saw in the forest an opportunity for leisure, as they used to do hunting in it, a custom also imported from Europe (Victor et. al., 2005). From 1970 onwards the countryside witnessed the rebirth of the monocultures, this time by sugarcane farms. The landscape is profoundly sterilized and any sign of former tropical vegetation is hard to be found. The areas destined for nature preservation or reforestation are often planted using very poor techniques and rely on the plantation of eucalyptus. The landscape of the hinterland of the Basin is nowadays a patchwork of exposed barren land, never-ending monocultures, and green patches of reforested eucalyptus. Temperatures are much higher than they were in the past and rainfall is a lot less well-distributed. More recently, a new climatic phenomenon began to be customary: the formation of giant dust clouds that travels from the exposed erored fields towards the cities of the hinterland.

Félix-Émile Taunay
Forest Reduced to Coal, 1830
Oil on canvas
Source: Itaú Cultural/
Walter Morgenthaler

Cândido Portinari
Café, 1935
Oil on canvas
Source: Google Art Project/
Museu Nacional de Belas Artes

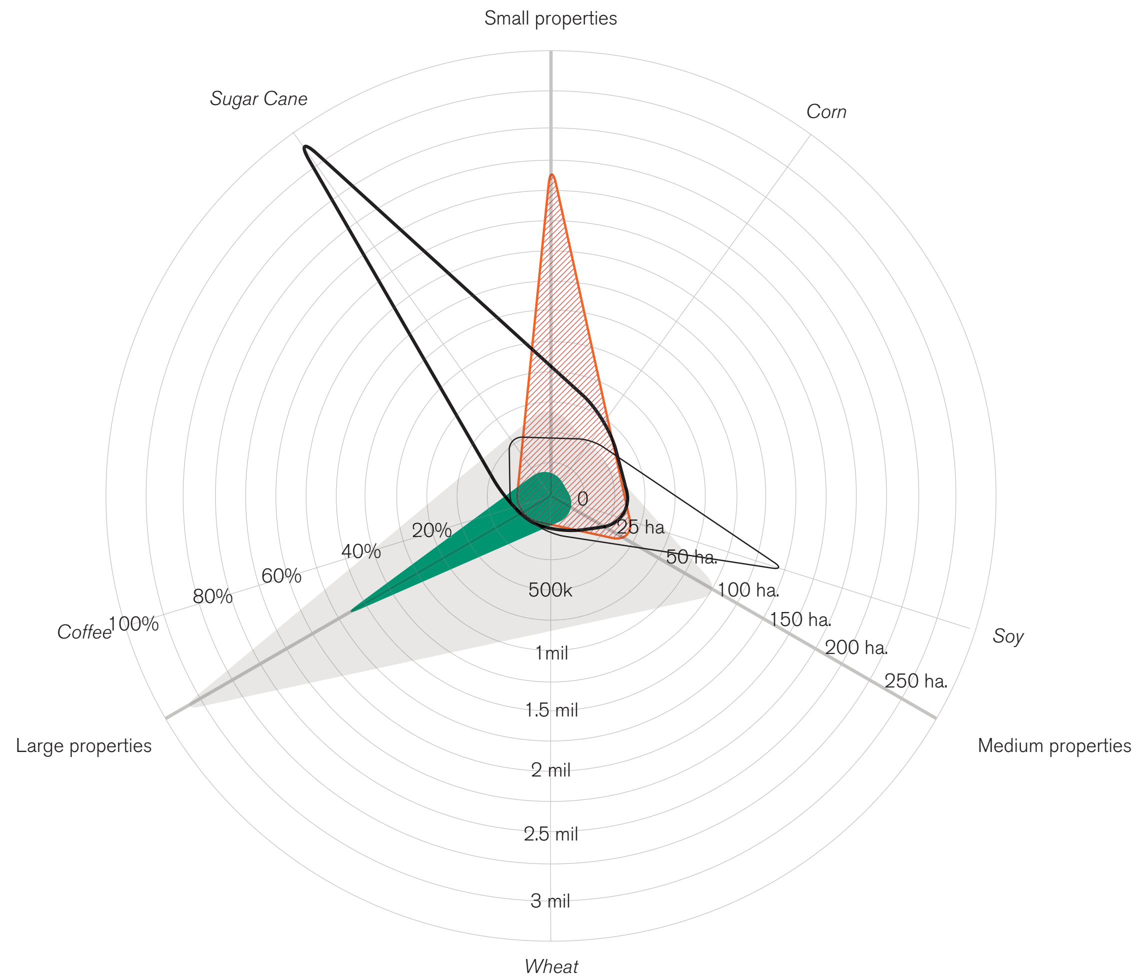
Tarsila do Amaral
Landscape with Taurus, 1925
Oil on canvas
Source: Itaú Cultural/Romulo Fialdini

Mechanized Harvest of cane in Chapadão do Céu, in the State of Goiás.
Fieldwork: Marcelo Luiz Delizio Araujo, 2017.

## Limits

SIZE OF RURAL PROPERTIES, USE OF PESTICIDES, AGRICULTURE PRODUCTION AND CONSERVATION AREAS WITHIN PROPERTIES

The large size of the properties along the Basin, especially those destined for monocultures of commodities makes it hard for conservation and reforestation goals to be reached. It is estimated that 54% of all shortages of land destined for reforestation and nature preservation within the State of São Paulo are located within large farm properties (Alisson, E., 2020).
In Barra Bonita alone, large properties count almost 300 ha. of riparian zones deficit, while zones dedicated for nature reserve by large properties are lacking almost 150 ha.
On the contrary of what might be found by the large number of smaller and medium-sized properties in São Paulo, it is within the few, but extremely large properties that environmental problems are exacerbated.
The size of properties, associated with the ever-increasing percentage of land used for harvesting commodities - and all the pesticide usage that comes with it - constitute a spatial program for environmental disaster.




Shortage of zones dedicated for riparian protection, within the municipality of Barra Bonita, SP, Brazil - according to the Brazilian Forestry code, Federal Law #12.651/2012 (in ha.) Source: Geolab, ESALQ

Shortage of zones dedicated for legal natural reserves, within the municipality of Barra Bonita, SP, Brazil - according to the Brazilian Forestry code, Federal Law #12.651/2012 (in ha.) Source: Geolab, ESALQ

Number of properties in the State of São Paulo, divided per size of property - according to Federal Law #8629/1993 Source: IBGE(2017)

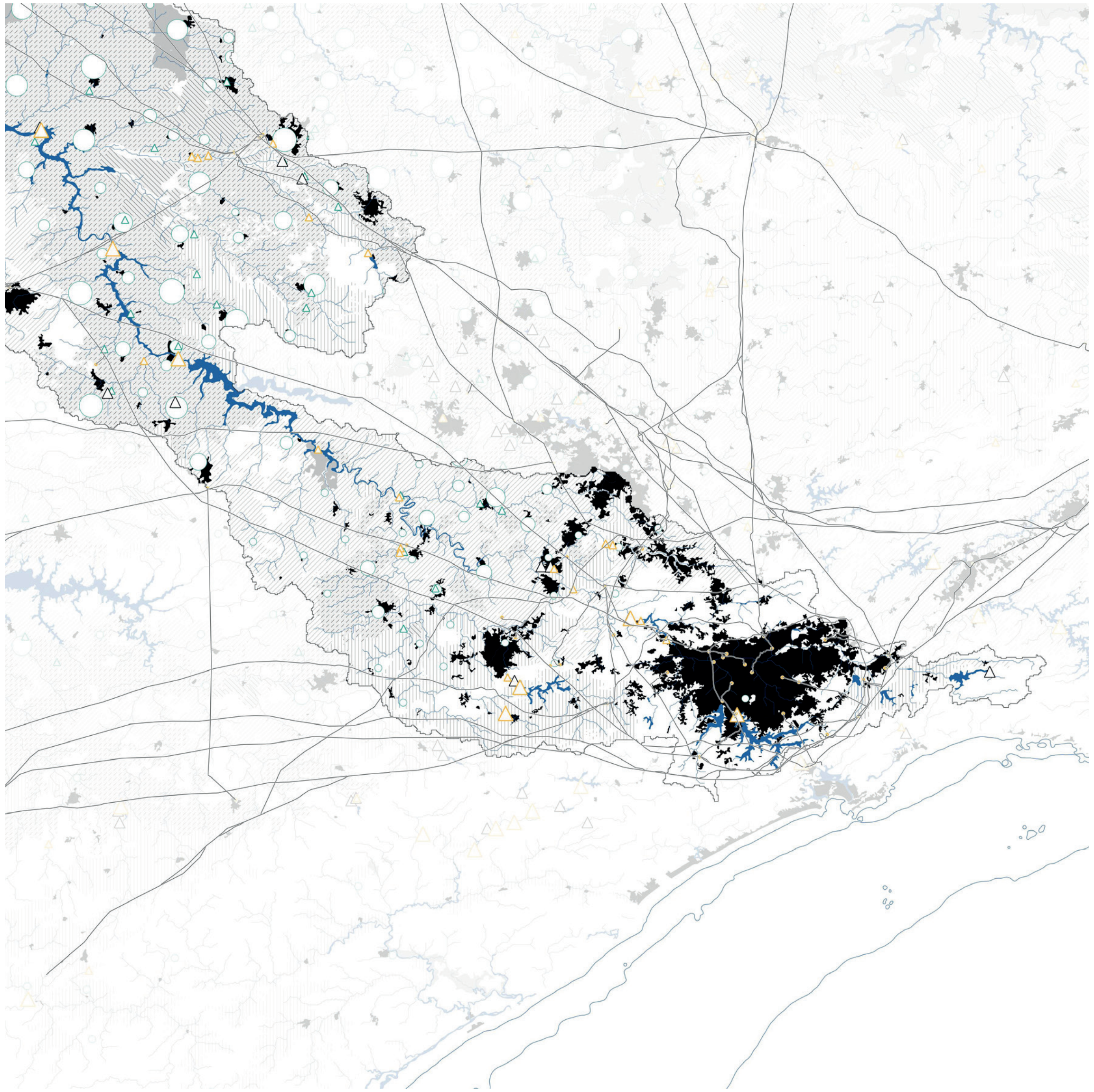
Planted area per type of crop in the State of São Paulo, 2006. (in ha.) Source: IBGE(2017)

Percentage of pesticides in specific types of crops in Brazil, 2015 (in %). Source: Bombardi, L. (2017)

## Composition

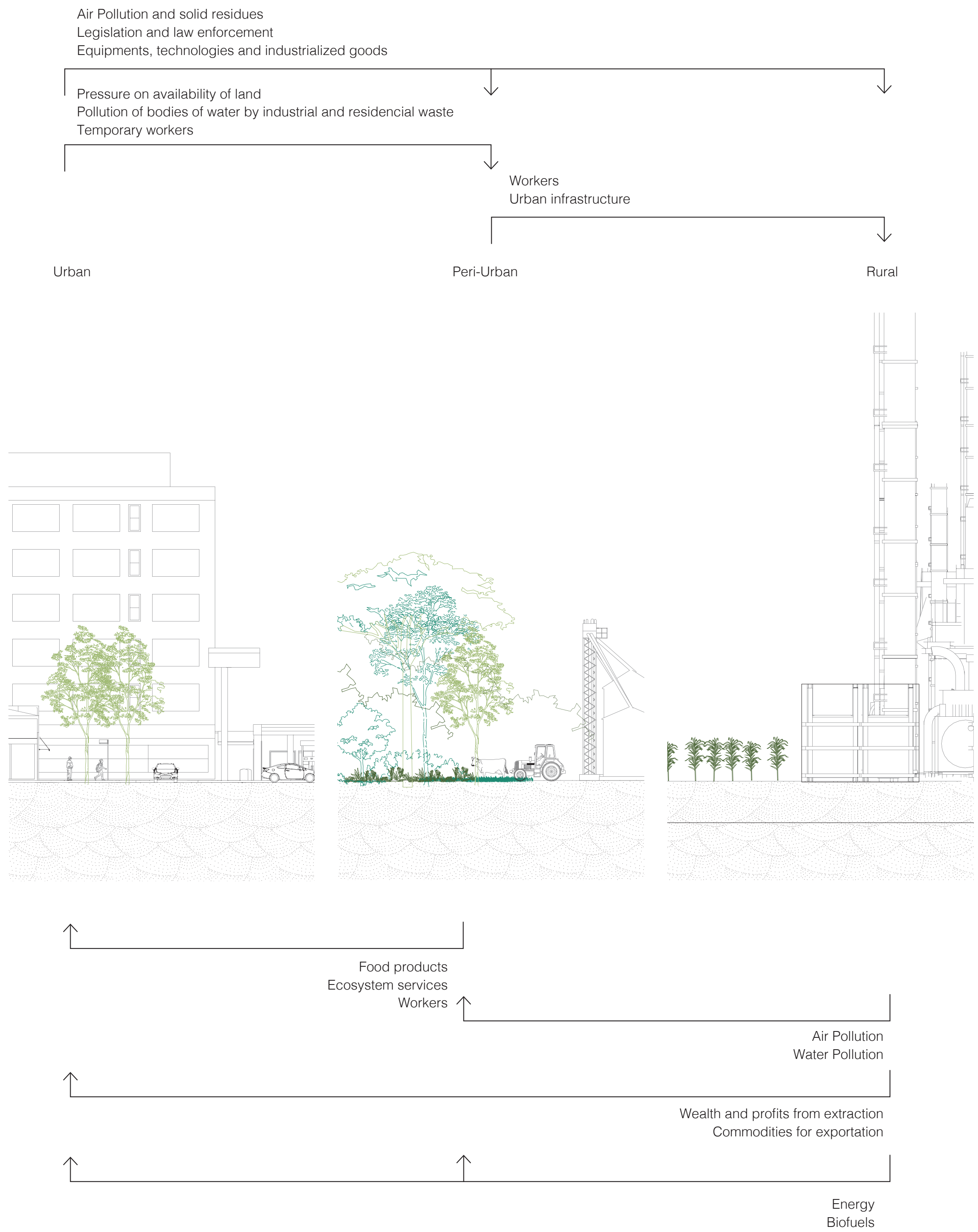
### PRODUCTIVE/ ENERGETIC/ INHABITED LANDSCAPES

The highly urbanized Basin presents conflicts of overlapping interests. Within the landscape of the river valley, three main operational landscapes can be noticed: energetic landscape, productive landscape, and landscape of inhabitation. Due do its position regarding the Basin (upstream), the City of São Paulo's regard for the river determines much of what goes on downstream.
Apart from being the Capital City, São Paulo has always exercised influence on the countryside. Either by concentrating the accumulated wealth generated by extractive activities in the hinterland or by generating demand for food, agricultural products, and more recently cheap biofuels.
The enormous size of the city and the lack of a mobility system based on public transportation creates an enormous demand for biofuels, which are commonly used in Brazil. Part of this demand is met by the inner peri-urban areas of the Basin, which has specialized in the production of sugarcane and presents an impressive amount of biofuel plants.
Furthermore, the Middle and Upper-Basin have been shaped for the production of energy from many hydropower plants, as well as for navigation towards the Tietê-Paraná Waterway. Acting as a route towards the hinterland since pre-colonial times, the River Basin continues to be very relevant for the logistics of the region, as along the centuries many highways and rails have been built following the shape of its valleys.



# Geopolitics

## Alteration




### TRANSCALAR RELATIONS BETWEEN LANDSCAPES

The Capital City of São Paulo and the hinterland of the Tietê Basin have, since colonial times, grown in a synchronized manner. As the coffee fields expanded and wealth was accumulated based on enslaved work, cheap nature, and natural resources, the City grew richer. This led to the great expansion of what today is one of the largest urban areas in the world, now responsible for exercising great pressure on the adjacent peri-urban and rural areas of the Basin.

As a mandatory stopping point between the fields and the Port of Santos, much of the agricultural production of the State still passes through the city on its way down to the Ocean. As previously mentioned, a great deal of the harvested sugarcane in the Basin is destined for the production of biofuels, which are used by the City's inhabitants due to the excessive dependency on private motor vehicles for transportation.

Around the large city, a peri-urban belt of small food produces nourishes the population of almost 20 million people, despite the lack of economic incentives and appropriate infrastructure.

On the other side, the peri-urban areas adjacent to the city face pressure from the countryside as it has been transformed into an empire of Biofuels corporations.

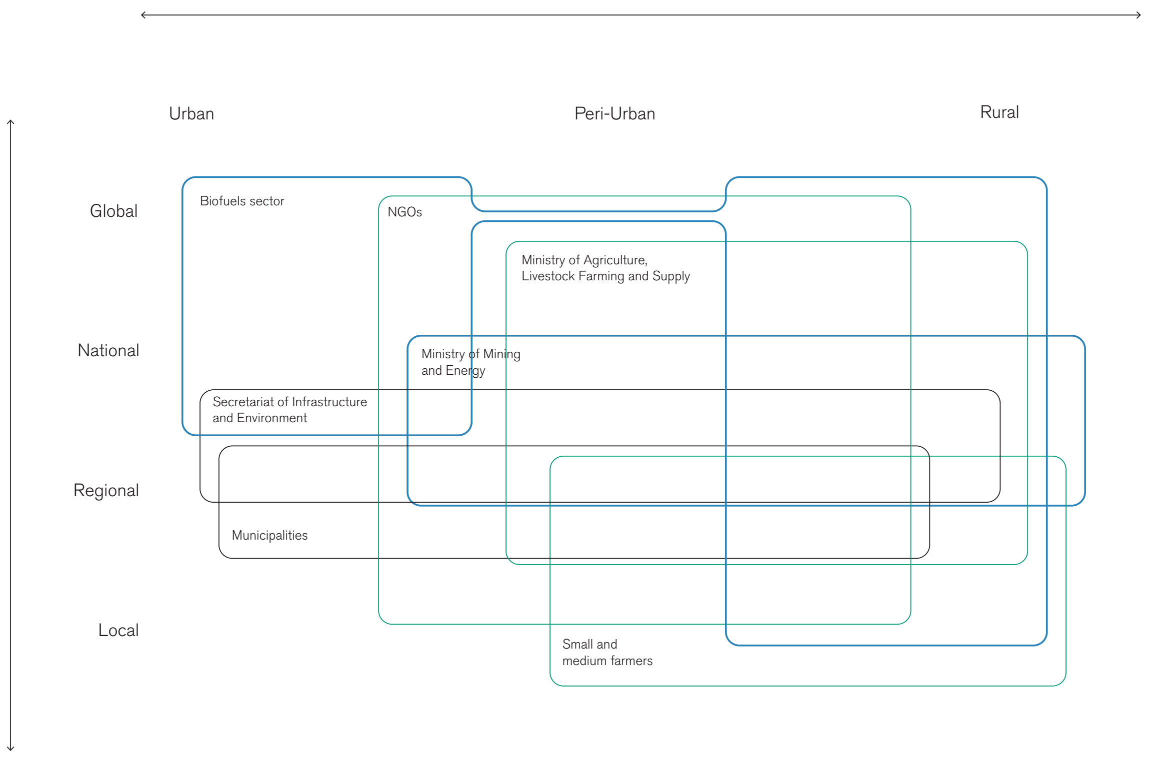
# Geopolitics



## Limits

DIFFERENT INSTANCES OF GOVERNANCE AND LANDSCAPES

Many private and public institutions overlap their interests and agencies within the Basin, as it is a highly disputed space by nature, citizens, farmers, biofuel companies, and energy companies. It is clear that the interests of International capital have been given preference for the past centuries, by the total disregard of environmental and social well-being within the Basin.
Any attempt of going against these interests seems to border on the impossible and utopian, but a large number of NGOs, especially related to nature conservancy and regeneration, within the Basin provide a glimpse of an alternative future. Due to the high value of the Atlantic Rainforest, these NGOs are compromised with exposing environmental issues and demanding action from governmental institutions.



# 5 Research-by-design

# Objectives of the project



The thesis project is linked to the main subtitle of this year's studio "Inland, Seaward" as it focuses on the transition from water to land, on several different scales, levels, and forms. From ocean to river basin, from basin to stream, how water and its territory are shaped and have been disrupted along the course of almost 200 years of occupation in the Tietê Basin presents challenges to the future conditions of urban projects in the riverine areas.

One of the ultimate goals of the thesis, a landscape urbanism design proposal, addresses the interrelations between urban and rural, natural and anthropic, political and societal. Building on the leading hypothesis from the studio "the territory is a shared project – independently from scale – wherein the urban always co-constructs with nature" the design would benefit from in-depth research of the natural conditions of the site, following the Q6 joint research phase of the studio.

Responding to the main and secondary research questions, the outcome of the graduation work will reflect the role of landscape and urban designers in addressing social and environmental challenges through spatial expression. Some of the prospected outcomes which derive from the proposed questions are as follow:

Secondary questions 1, 2, and 3:
Documentation of the conditions of the basin and existing spatial networks of greenspaces, infrastructures, and economy, through the Monograph Series proposed by the Transitional Territories Studio;

Secondary questions 2, 3, and 4:
Definition of criteria for the assessment of ecological integrity and key characteristics sought in exemplary zones;

Secondary questions 3, 4, and 5:
Definition of exemplary zones for ecosystem integrity regeneration within the region;

Secondary questions 4 and 5:
Development of the chosen zone as a pilot, establishing a new territorial framework capable of synchronizing environmental and economic interests;

Secondary questions 4 and 5:
Design of a set of spatial interventions related to the new territorial framework, on a multi-scalar basis (from the scale of the basin to the scale of the architectonic object);

# Projection



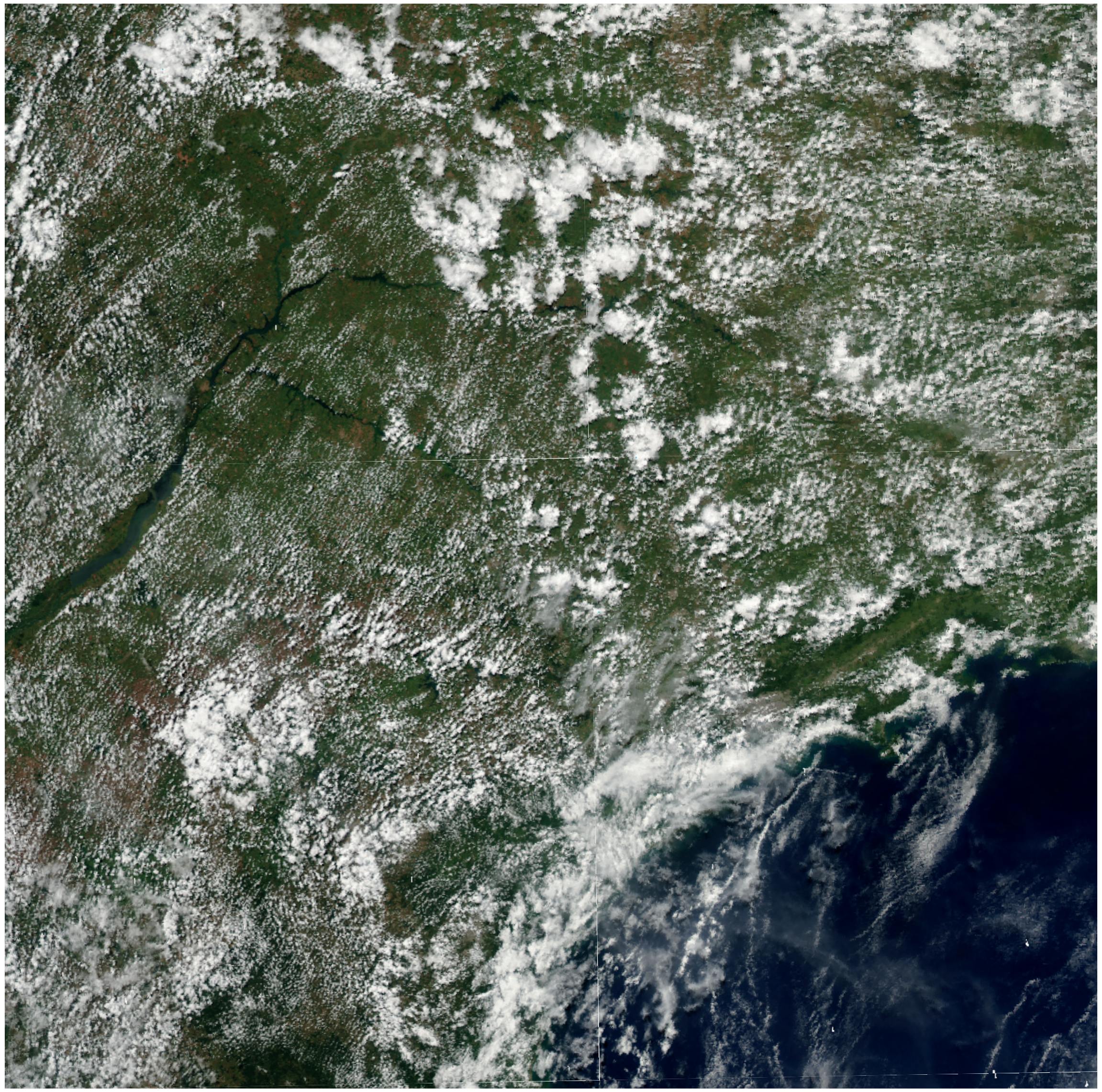
## Role of the Project

The urbanized areas of the Basin were developed through the course of almost two centuries from a place of agriculture extraction, followed by a period of intensive production and transformation of riverscapes by the construction of hydropower plants, and now presents an increasing economic and energetic dependency on extraction. The graduation work aims at handling these issues in proposing alternative land-uses and the landscapes that are formed by them, supporting alternative methods of production.

Another important aspect which would be tackled by the work is the ever-shrinking availability of land for food production by small farmers, who are responsible for really feeding the country. Due to the increasing dependency on commodities, hence the expansion of land occupied by monocultures, the Brazilian government expects that the plantation of rice, beans, and cassava (which form the basis of the Brazilian diet) should lose 2 million ha. until 2030, making room for the expansion of soy, corn, and sugar cane. This is a threat to the wellbeing of our country as a whole, as healthy and nutritious food would become ever more scarce and expensive, while the country is headed back towards a scenario of hunger and misery for the benefit of huge agribusiness corporations. Therefore, the societal gains of implementing alternative patterns of land-use, associated with less-harmful agricultural practices could be enormous.

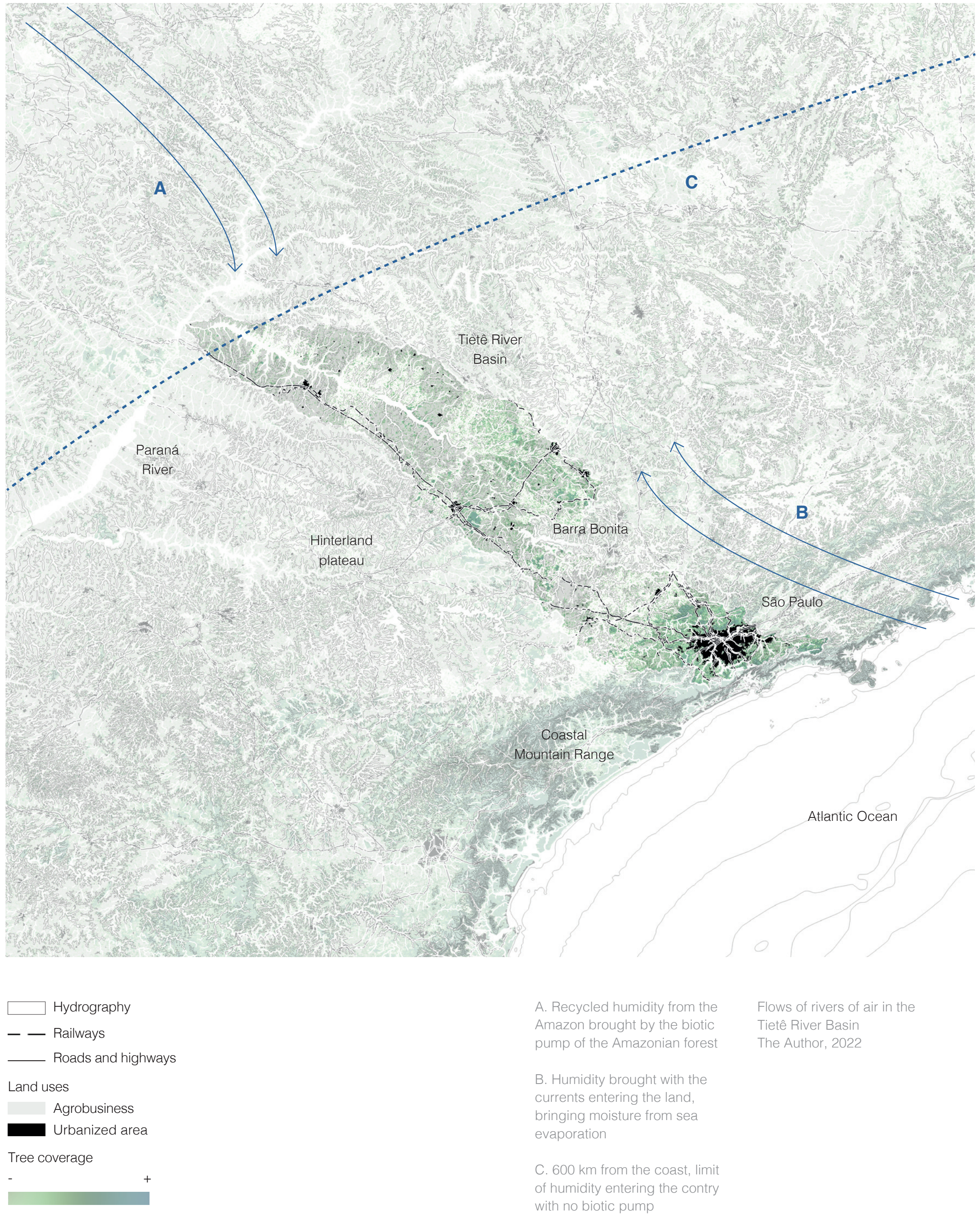
As the new climate of extremes increasingly becomes a reality, spatial patterns of production and inhabitation must be adapted to better use natural resources and respond to extreme disruptive events, but also be innovative in exploring ways of maintaining and distributing economic prosperity, diminishing social and climatic injustices.

The graduation work looks for possibilities of designing for economic stability, in synch with the environment and welfare by reinterpreting



Satellite image of portions of Southeasrtern Brazil and the Atlantic Coast.
At the center, the Tietê River Basin.
Source: INPE, 2021

the land-use patterns in the region. In the case of this project, this is translated to a multi-scalar landscape urbanism proposal capable of providing insights into an alternative future for a land that has been shaped in form and content by the exploitative use of soil. This would be a valid addition to the professional field of Landscape Urbanism, as it explores different ways of occupying the land, responding to a multitude of challenges by the establishment of multi-functional landscapes. Lastly, the relevance to the scientific framework is clear by applying already existing methods and concepts to a large area of the Basin, with all the associated social and economic benefits. The proposal could help in demonstrating that solutions that rely on green and blue infrastructures considering endemic conditions could easily be an economic alternative to monocultures. Besides, the additional benefit of once sterile, monofunctional landscapes performing as green and blue infrastructures could help mitigate climate extremes and regenerate the ecological integrity of the Basin, avoiding a worst-case scenario of climatic disaster.




A. Recycled humidity from the Amazon brought by the biotic pump of the Amazonian forest

B. Humidity brought with the currents entering the land, bringing moisture from sea evaporation

C. 600 km from the coast, limit of humidity entering the contry with no biotic pump

Flows of rivers of air in the Tietê River Basin
The Author, 2022

## Target Territory

As stated previously, the coastal zone of São Paulo plays a very important role in the maintenance of life in the hinterland, at the transition between the South-American Continent and the Atlantic Ocean. Formerly an ecotone between the Cerrado and Atlantic Forest biomes, the hinterland of São Paulo's State around the Tietê River is now barren land, taken by industrial agriculture usages (mostly sugarcane plantations), water reservoirs built for hydropower plants, and heavy road systems. Analyzing the coastline, the Capital, and the hinterland it is striking how much of the former forest has been transformed into agricultural land throughout the last centuries since the expansion of coffee plantations during the late 19th century. The little nature which is left is confined to a disconnected bunch of patches, while reforestation areas are planted using very impoverishing techniques regarding biodiversity, soil, and hydrology restoration.
The lasting ties between the capital City of São Paulo and the neighboring rural areas form the strongest lasting systemic relation identified within this Territory. The persistence of rivers and the basin as a whole, functional network of waterways despite the changing rainfall patterns inland is facilitated by the geographical composition of the site: humidity from the Atlantic Ocean being intercepted by the Coastal Mountain Range, with rain charging soils and providing the streams with water. However, this continuity is at stake, should the surface of the Basin continue to be mostly used by intensive agricultural practices, which keep the soil from keeping the water that falls with rain and transferring it back to the atmosphere by vegetation.
Furthermore, the co-dependency between city and hinterland suggests that the Project must present solutions both to urban, peri-urban, and rural landscapes. The City of São Paulo has historically benefited from its position between hinterland and coast, as an interceptor of goods,

Longue durée and places of change within the Tietê River Basin. The author, 2021

where wealth has been accumulated throughout the centuries. On the other hand, the countryside depends on the capital city for agricultural inputs, as well as pieces of equipment and technology, and is shaped to meet the demands of the large metropolis.
With the aim of not ignoring this intrinsic relationship between city and rural, the design intends to explore, within this extensive piece of land, pin-pointed smaller locations, within an exemplary zone, which could be situated in urban, peri-urban, or rural contexts. Therefore, following the same logic of mirroring of wealth and spatial expression of welfare, economic development, and manipulation of nature that has been manifested in the Basin.

<< Coffee harvesting, 1882
Source: Marc Ferrez/
Colección Gilberto Ferrez/
Acervo Instituto Moreira Salles

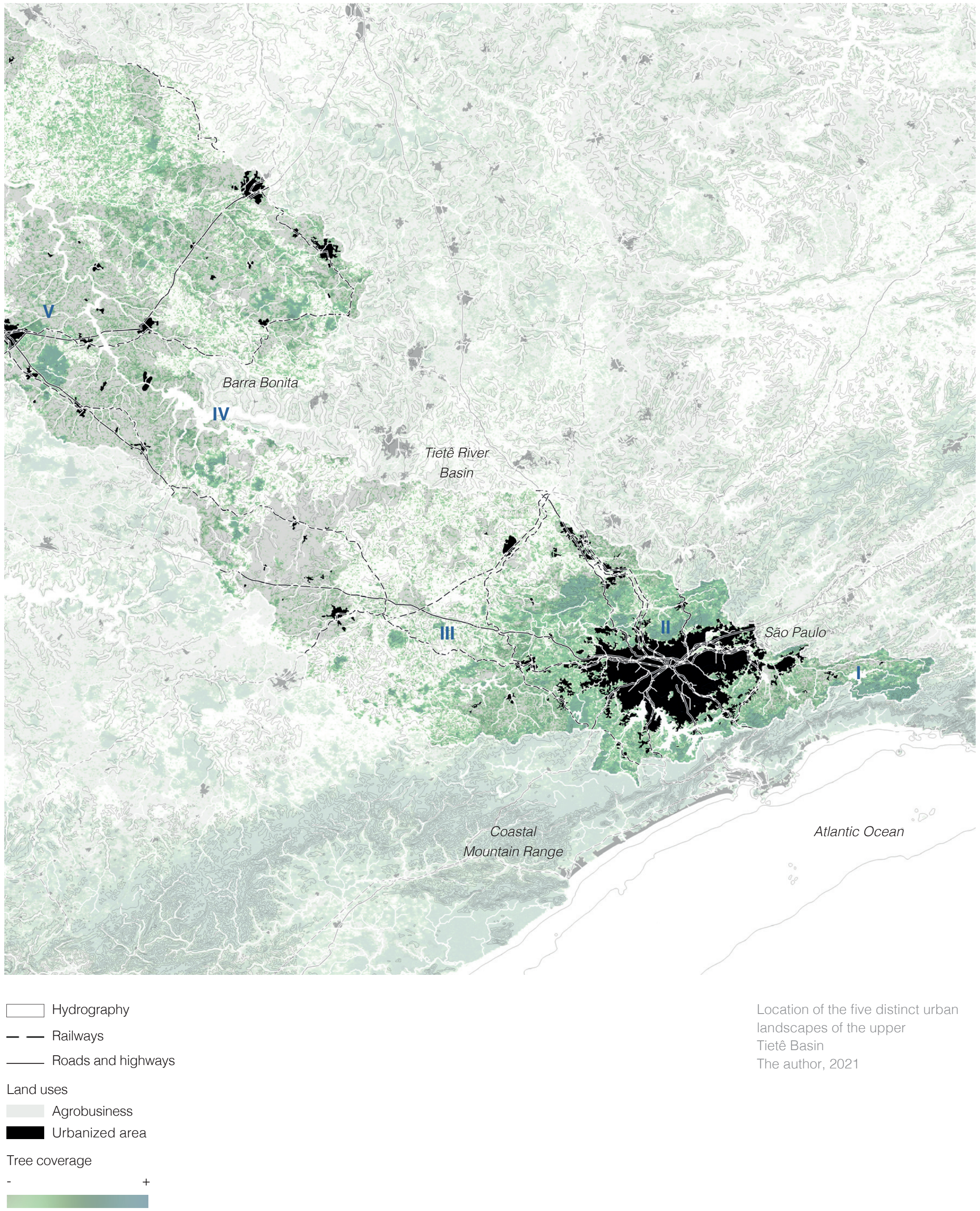
< Coffee berry pickers, probably in São Paulo state inland, Brazil. 1900-1923
Source: Library of Congress

View of the Anhangabaú valley, in the city center of São Paulo
Source: Museum of Immigration

Paulista Avenue in 1902
Source: Guilherme Gaensly/
National Library of Brazil

## Target Site

The different types of landscapes found along the Basin provide interesting opportunities for various designs responsive to local settings. Among the five identified landscapes (I. River springs on the Coastal Mountain Range, II. The channeled urban section of the River, III. Smaller riverine cities between greenspaces, IV. Large reservoirs, dams and hydropower plants, and finally V. Industrial agriculture landscapes and hydroway), one seemed to be more relevant for deeper analysis and further serve as a subject of design intervention: V. Industrial agriculture landscapes and hydroway.
Within the larger Territory of study, the project intends to further explore smaller locations in more detail, in the form of an exemplary zone. These zones have been selected based upon the overlapping of interesting features related to the ultimate goal of the project, proposing a new spatial framework guided by Landscape Urbanism and Ecology. Within the exemplary zones, the smaller objects submitted to the design interventions are selected from the identified elements of the Landscape Ecology, namely: green corridors, patches, or matrix. Furthermore, as the design operates on a transcalar dimension (from urban to peri-urban and rural), the distinct design proposals should form a projective transect.
In other words, the design forms a collection of smaller spatial interventions varying in landscape and function, but part of the same transformation: a re-territorialized landscape that operates following the timings, potentials, and limits of the land, whilst promoting the restoration of Ecological Integrity by different design strategies associated to specific land-uses found along the Basin.




Location of the five distinct urban landscapes of the upper Tietê Basin
The author, 2021

# Designing with various systems, landscapes, and water trends

The final design proposal forms a transect of different spatial interventions. Embedded within the larger spatial framework to be designed for the selected exemplary zone, the transect contains a range of proposals varying in scale.
The proposal challenges the traditional scales (Macro to Meso, Micro, and Nano), and works instead with the notions of the Lands, Landscape, the Ensemble, and the Object.

## Land

The general urbanized landscape of extraction, present throughout the Basin. Goals are proposed to orient future projects, guaranteeing coherence and prescribing overarching goals, related to the effects that a series of projects spread throughout the Basin could have on the Continuum.

## Landscape

A selected exemplary zone, of approximately 50 x 50 km, containing distinct features of unique value, forming a well-defined and singular landscape. A new spatial framework is proposed, to orient future development and detach the territory’s main elements from the constant change put forward by the highly-dynamic agricultural lands.

## Ensemble

Zones within the general urbanized landscape, which are characterized by predominant land uses, presenting, nevertheless, other land uses that present conflicts between each other. Transformed by the implementation of the new spatial and infrastructure framework.

## Object

Points in space where a specific goal should be achieved, overall in sites in decay, with poor environmental conditions and urgent need for regeneration. The designs take form on the scale of the architectonic object, mostly through the drafting of landscape design proposals.



**IV. Object**
Geo-physical | Cultural

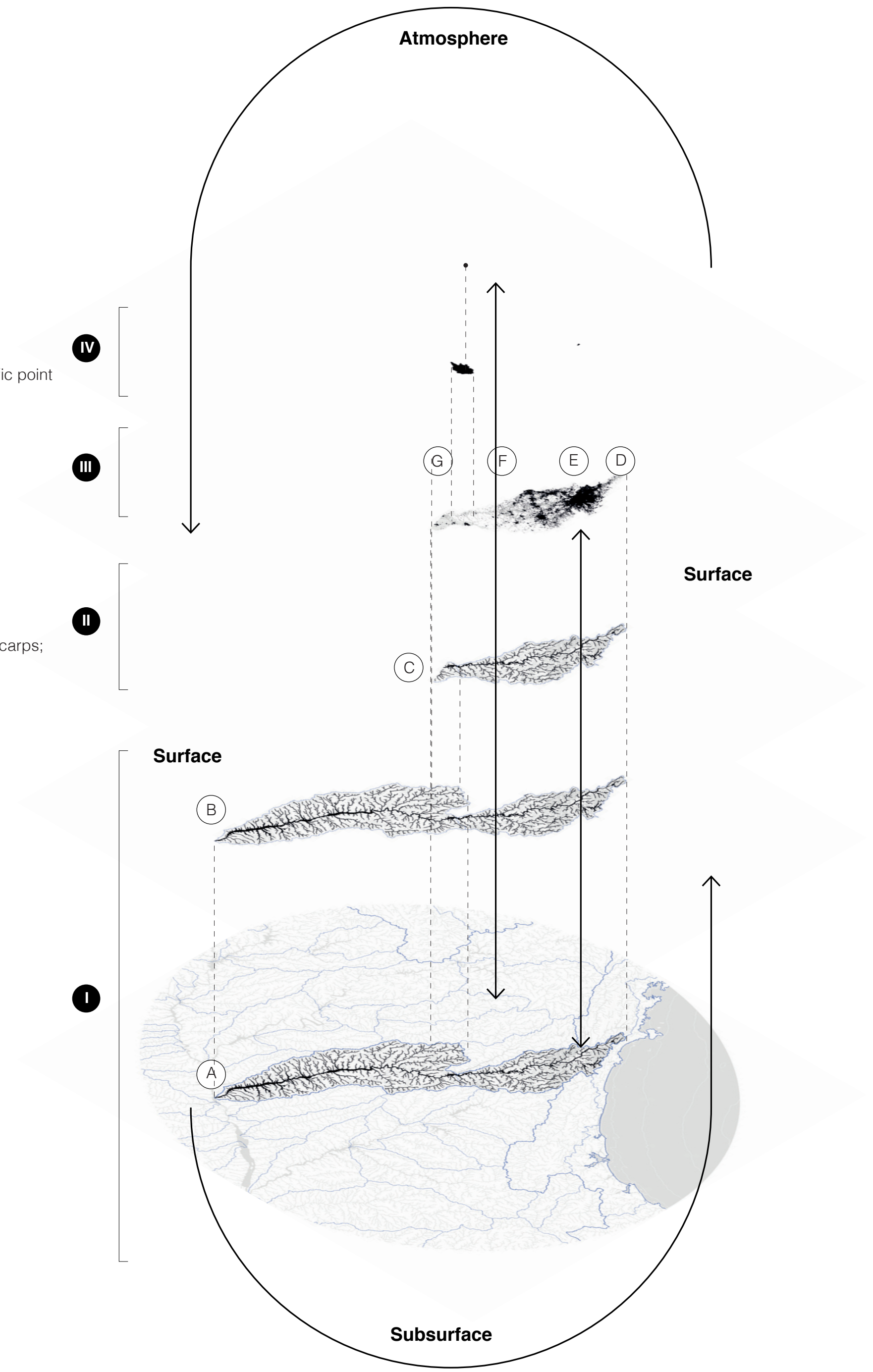
Manifestation of a process at a specific point

**III. Ensemble**
Geo-physical | Cultural | Political

Areas of influence of a given process

**II. Landscapes**
Geo-physical | Cultural | Political

D. Coastal mountain range;
E. Metropolitan region;
F.Hills of the peripherical valley and scarps;
G. Paulista Plateau;




**I. Land**
Geo-physical

A. Coastal zones of the continent
B. Tietê River Basin
C. Upper Tietê River Basin

## Conceiving the design

The design derives from different theories, from the fields of landscape urbanism, geology, and landscape architecture.
In a zone of friction between ocean and land, facilitated by the existence of the mountain ranges on the seaside, where the river springs of the Tietê, and many other tributaries of the Paraná, the design should dialogue with the conditions of topography, climate, and geology.
Such a reading of the landscape is possible by the works of Aziz Ab'Saber, especially from the writings of A Terra Paulista, from 1956 and Geomorfologia do Sítio Urbano de São Paulo, also from 1956. Both works describe the singularity of the site and the straight ties between soil composition, topography, climate, and landscape.
The interpretation of the landscape conditions informs the design on a larger scale, using the concepts put forward by Ian McHarg in Designing with Nature (1969), such as suitabilities of the land, understanding and identifying values in the landscape, as well as gradients between land and water, lowlands and highlands.
The examined landscape then is the subject of a design proposal, with the ultimate goal of establishing basic conditions for the increase of biodiversity, enhancement of water quality, infiltration and runoff control, as well as improvements on the micro and macroclimates.
This requires a framework, that is oriented by the works of Richard T. Forman, especially with Land Mosaics, from 1995.
The complexities of dealing with time and moving subjects, such as the agricultural fields of the region, which are highly adaptable to market trends are challenging to the framework. In the plan Stork (Lodewijk van Nieuwenhuijze, Dirk Sijmons, and Dick Hamhuis, 1985), inspiration and ways of dealing with water systems, nature, and agriculture development are found. The landscape then is divided between two different sets of interventions and subjects: those which operate with

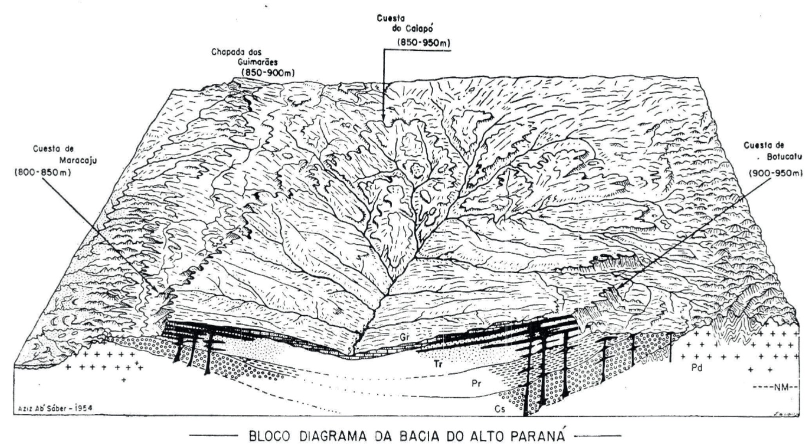



Diagram of the upper Paraná Basin
Drawing by Aziz Ab'Saber, 1954

Land use | Landscape variation in forest restoration sucess | Persitence of the forest | Soil exhaustion | Barren or abandoned land

Selection of exemplary zone

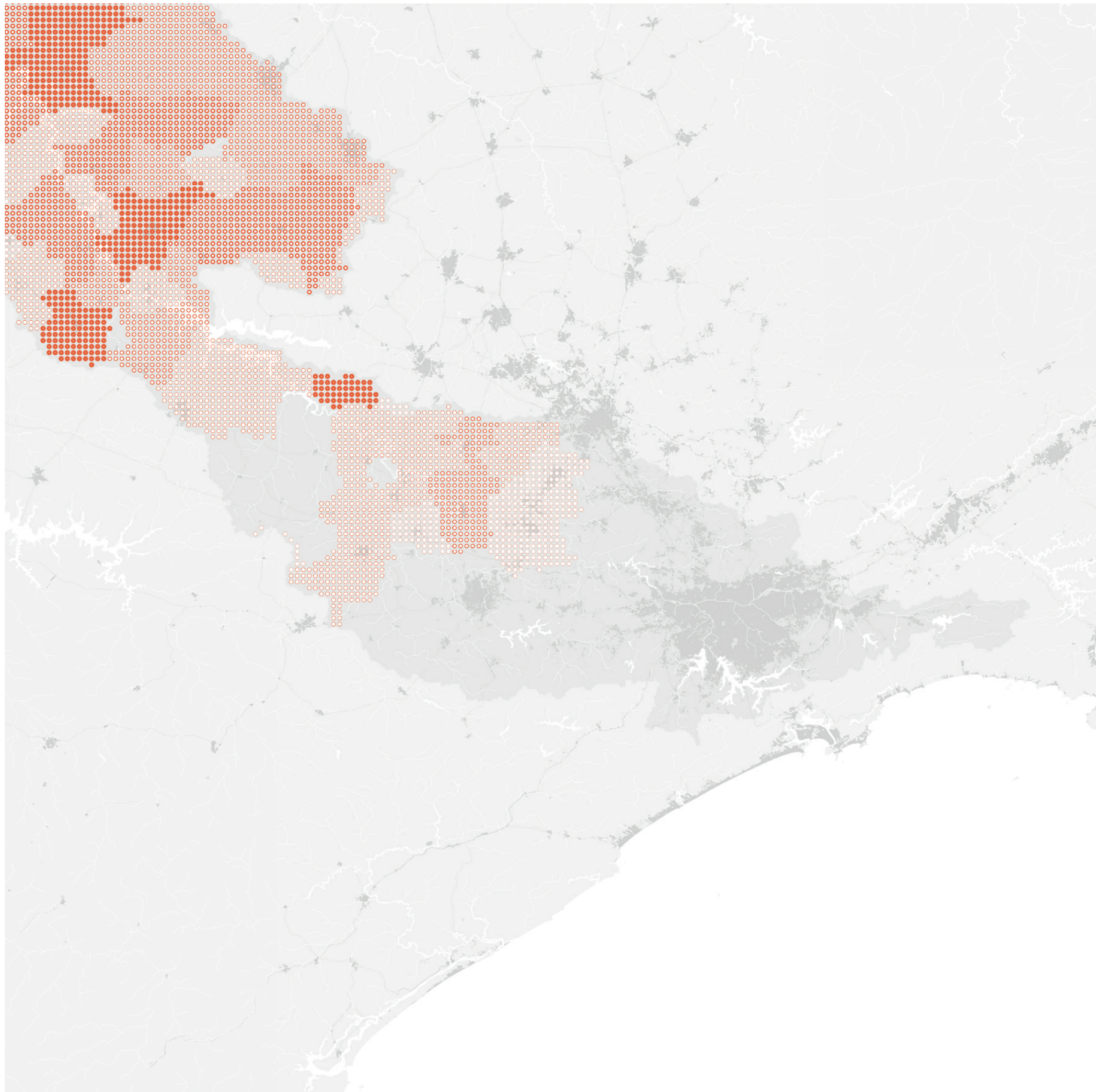
low dynamicity, such as the vegetation corridors and patches that are bound to succession periods and are conceived with the long-term in mind, and those which operate with high dynamicity, such as the agricultural fields.
Lastly, as a way of making sense of the added complexity of questions, subjects, issues, and potentials, the project by Rosa Kliass for the Pioneer Environmental Protection Area for Barra Bonita and adjacent areas (1975), offers, its singular ways of dealing with environmental and cultural problems through the proposition of a landscape-oriented conservation plan.
Before the drafting of the initial proposals, secondary research was carried through, to confirm the capabilities of the site of Barra Bonita to receive the prototype interventions.
A criterion was established for the confirmation of the site as suitable, and it is reflected in the cartographies gathered on the small atlas presented next in this report.

# Selection of an exemplary zone



Sugar Cane
Sales value of yielded production

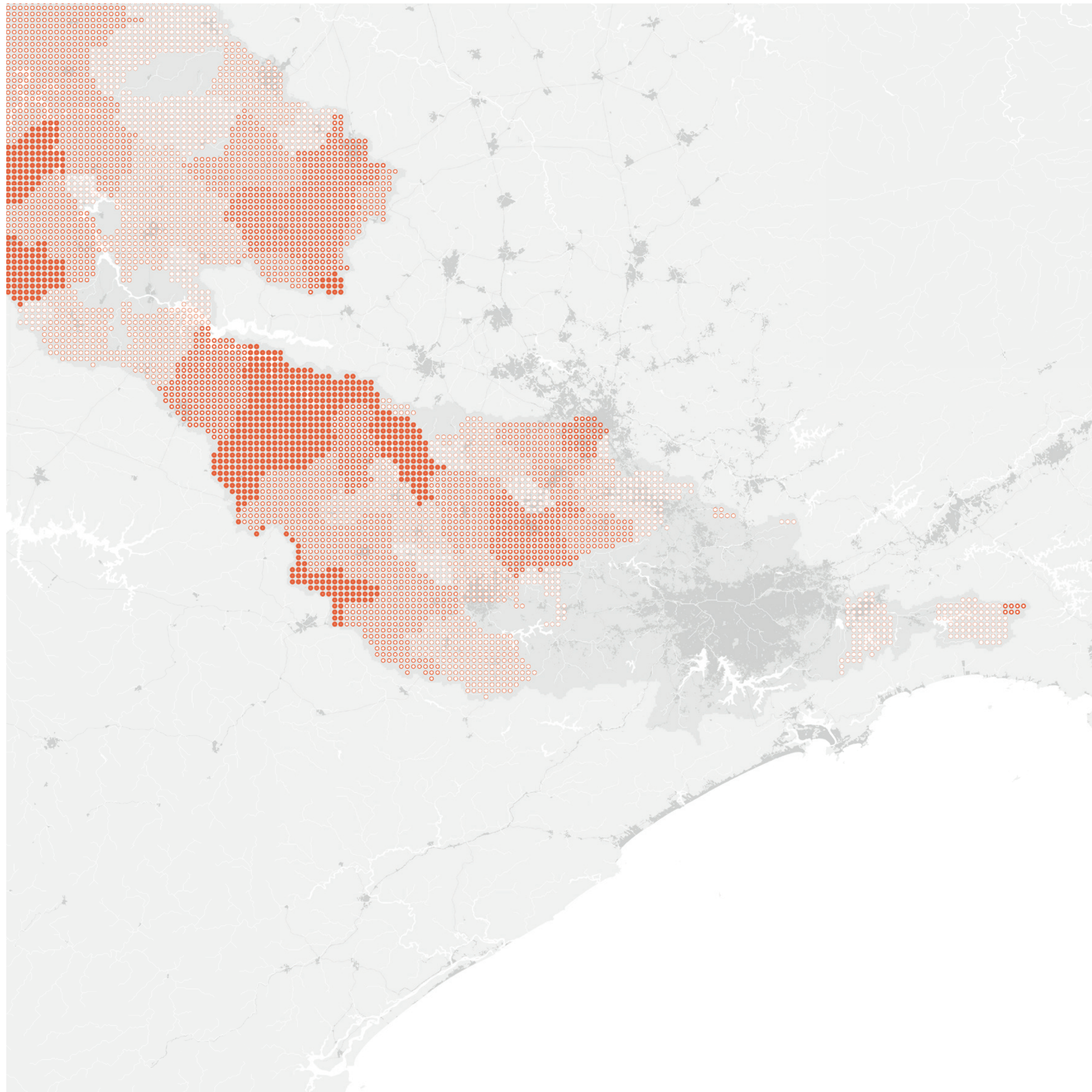
- 5.000 - 10.000
- 10.000 - 50.000
- 50.000 - 100.000
- 100.000 - 150.000
- >150.000






Livestock in numbers

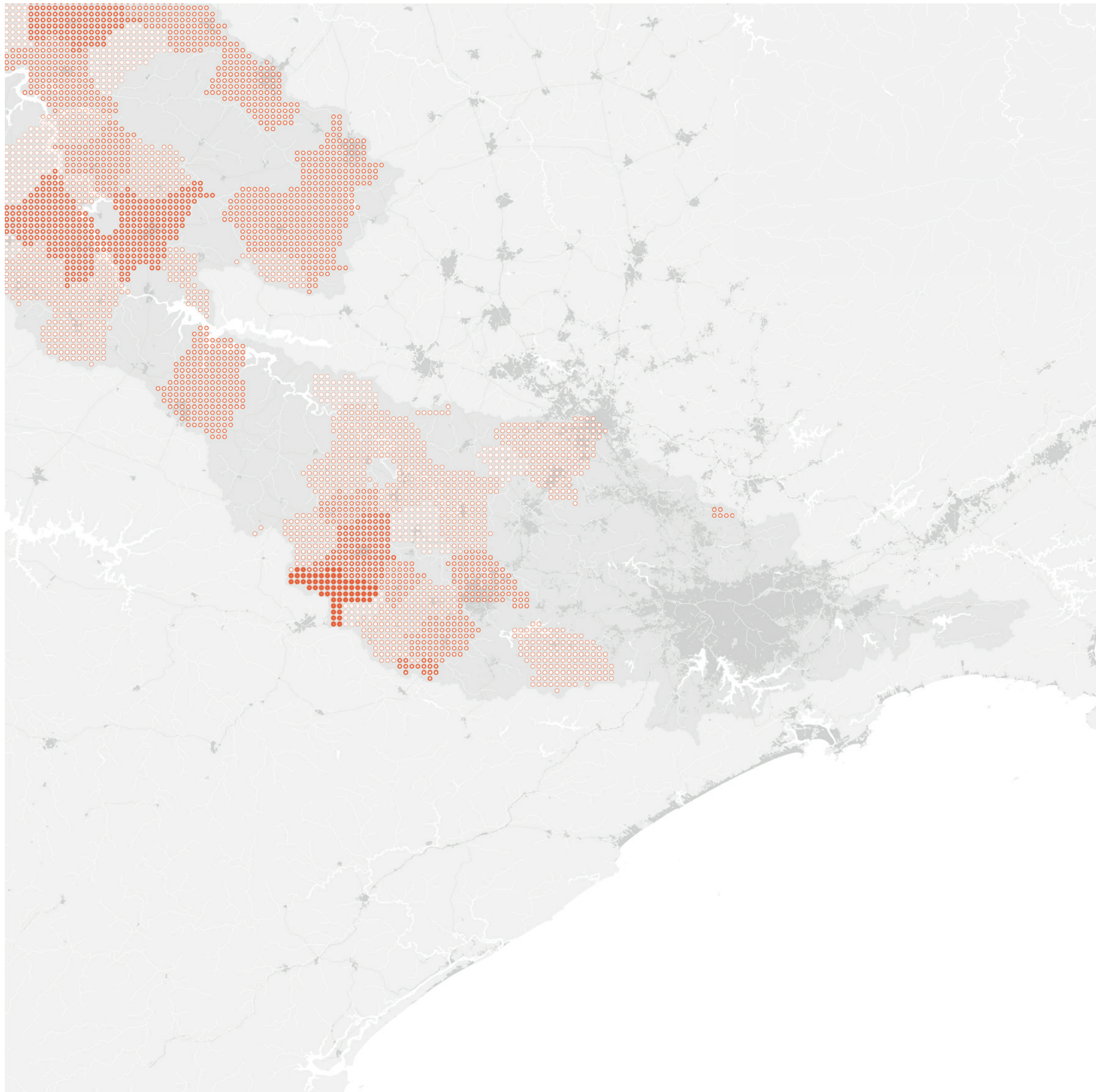
- 1.000 - 2.500
- 2.500 - 5.000
- 5.000 - 15.000
- 15.000 - 20.000
- >20.000



Soybeans
Sales value of yielded production

- 0 - 1.000
- 1.000 - 2.500
- 2.500 - 7.500
- 7.500 - 15.000
- >20.000

0 50 km N

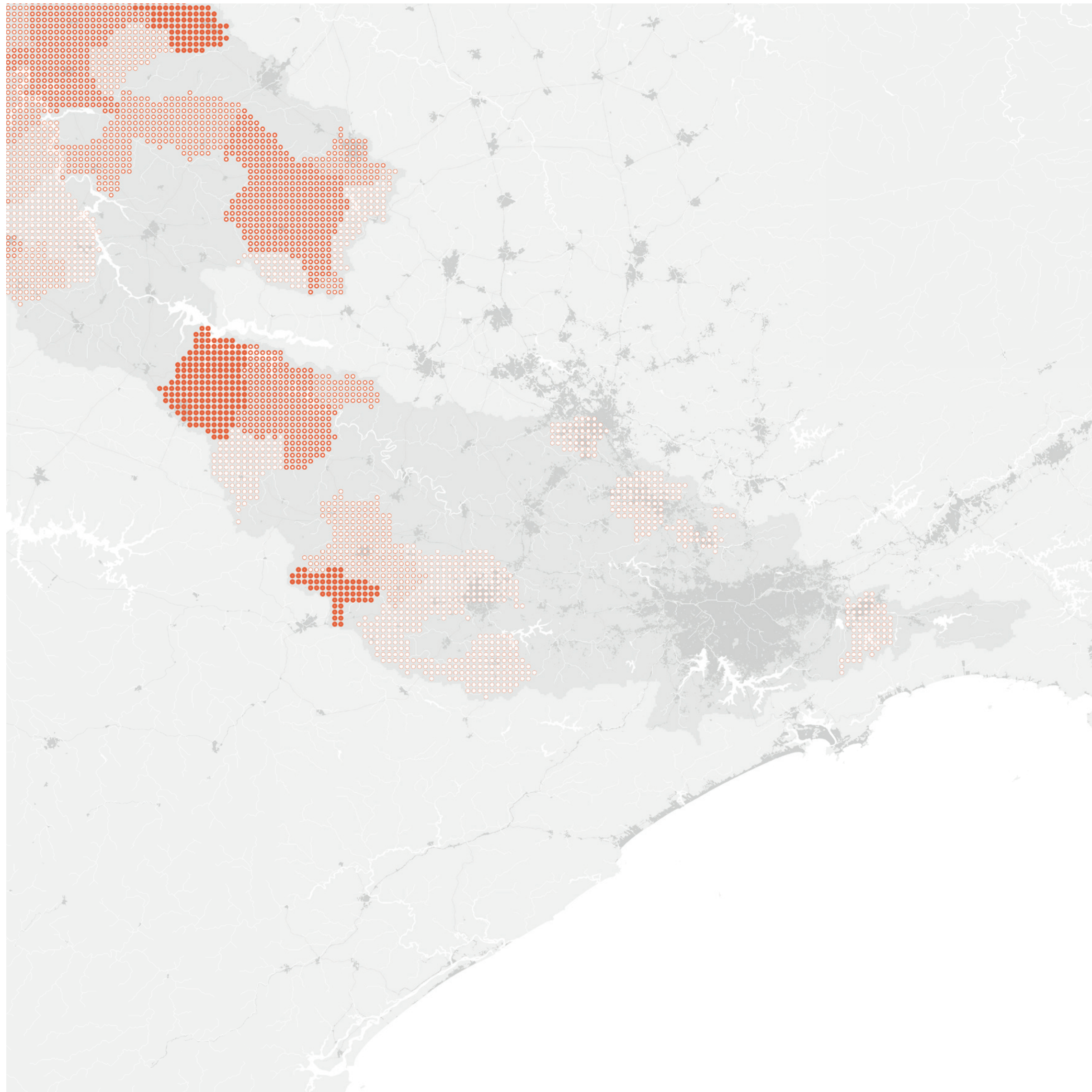




Orange
Sales value of yielded production

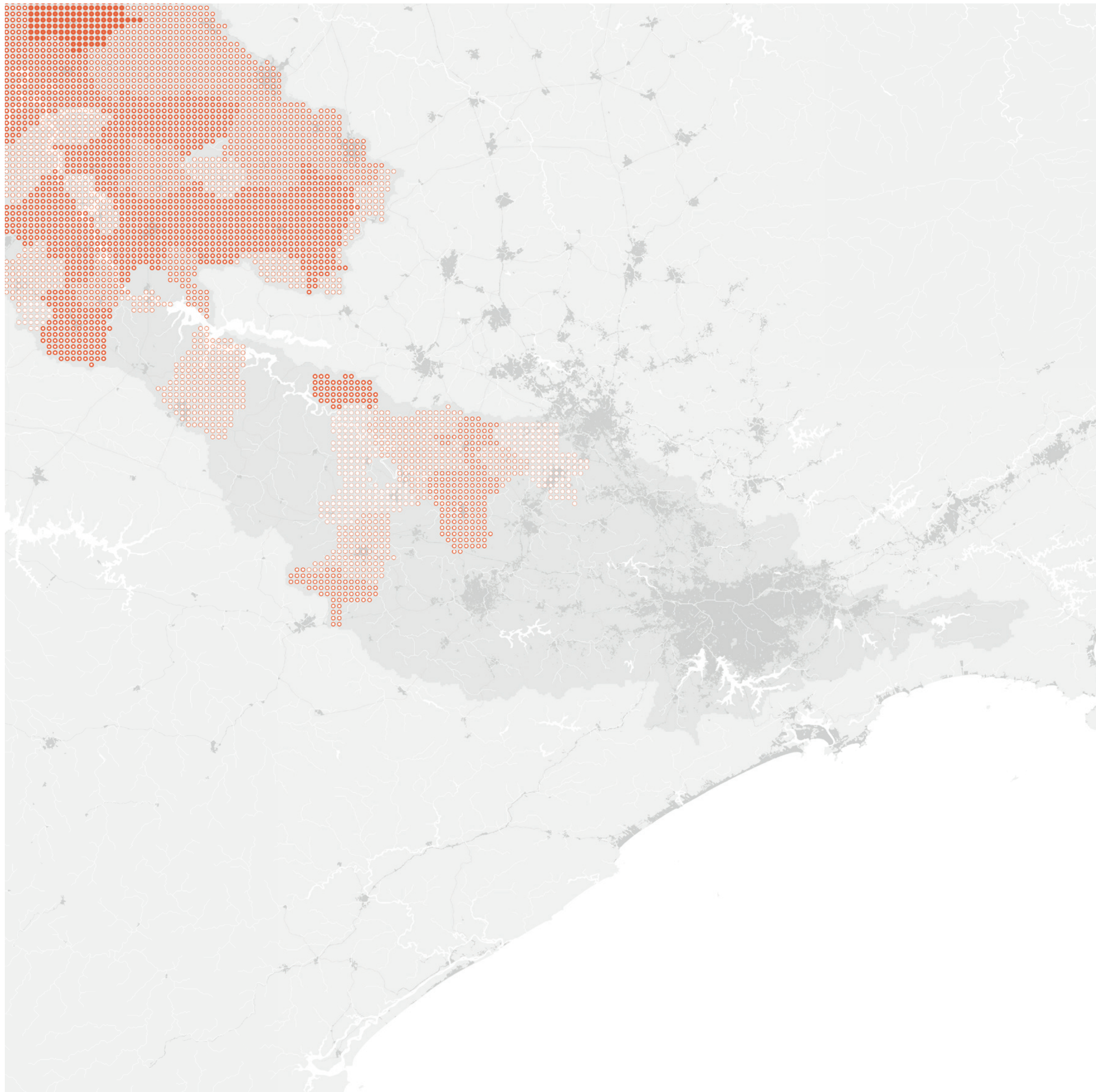
- 0 - 6.000
- 6.000 - 12.000
- 12.000 - 30.000
- 30.000 - 60.000
- >60.000

0 50 km N



Corn
Sales value of yielded production

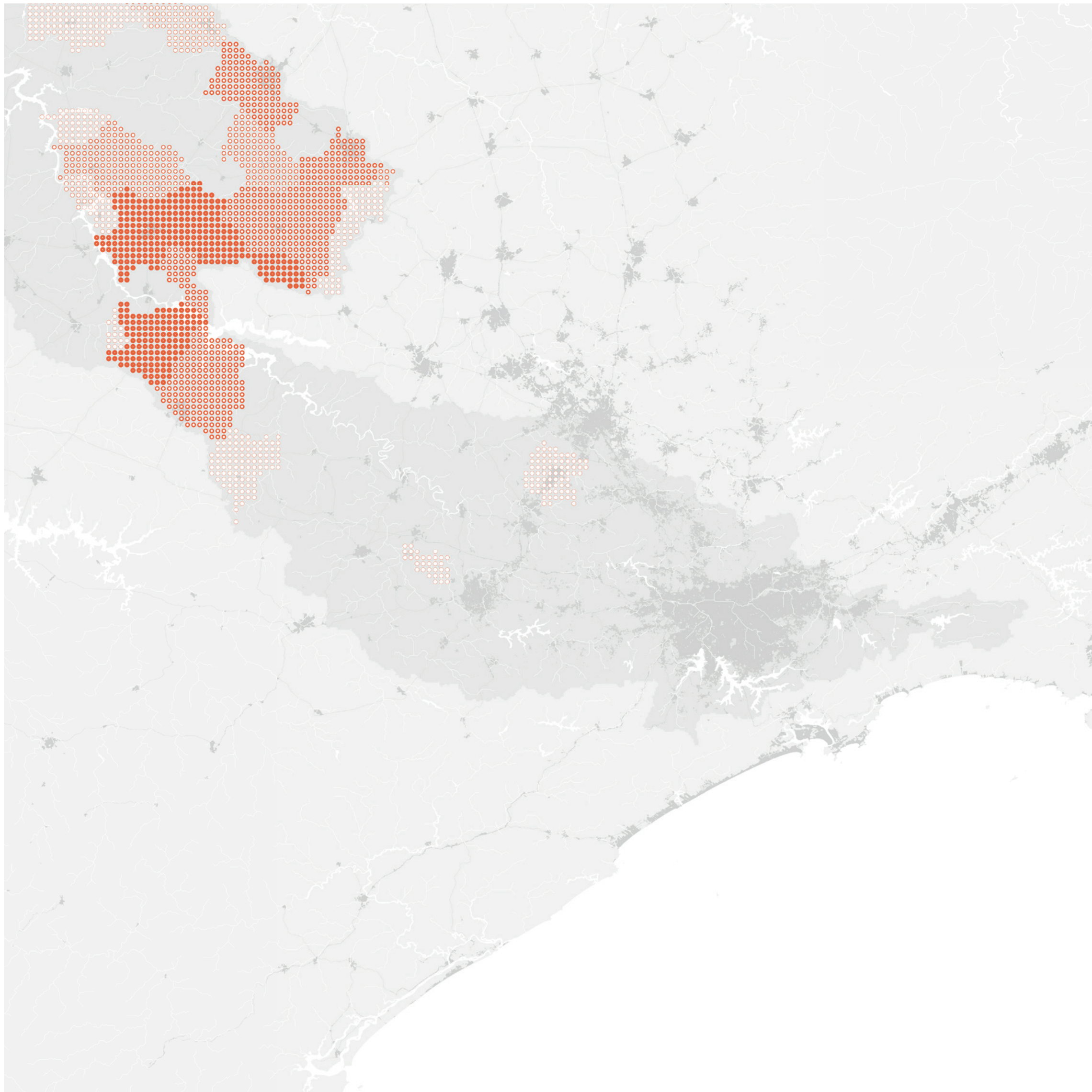
10.000 - 20.000
20.000 - 50.000
50.000 - 100.000
100.000- 200.000
>200.000



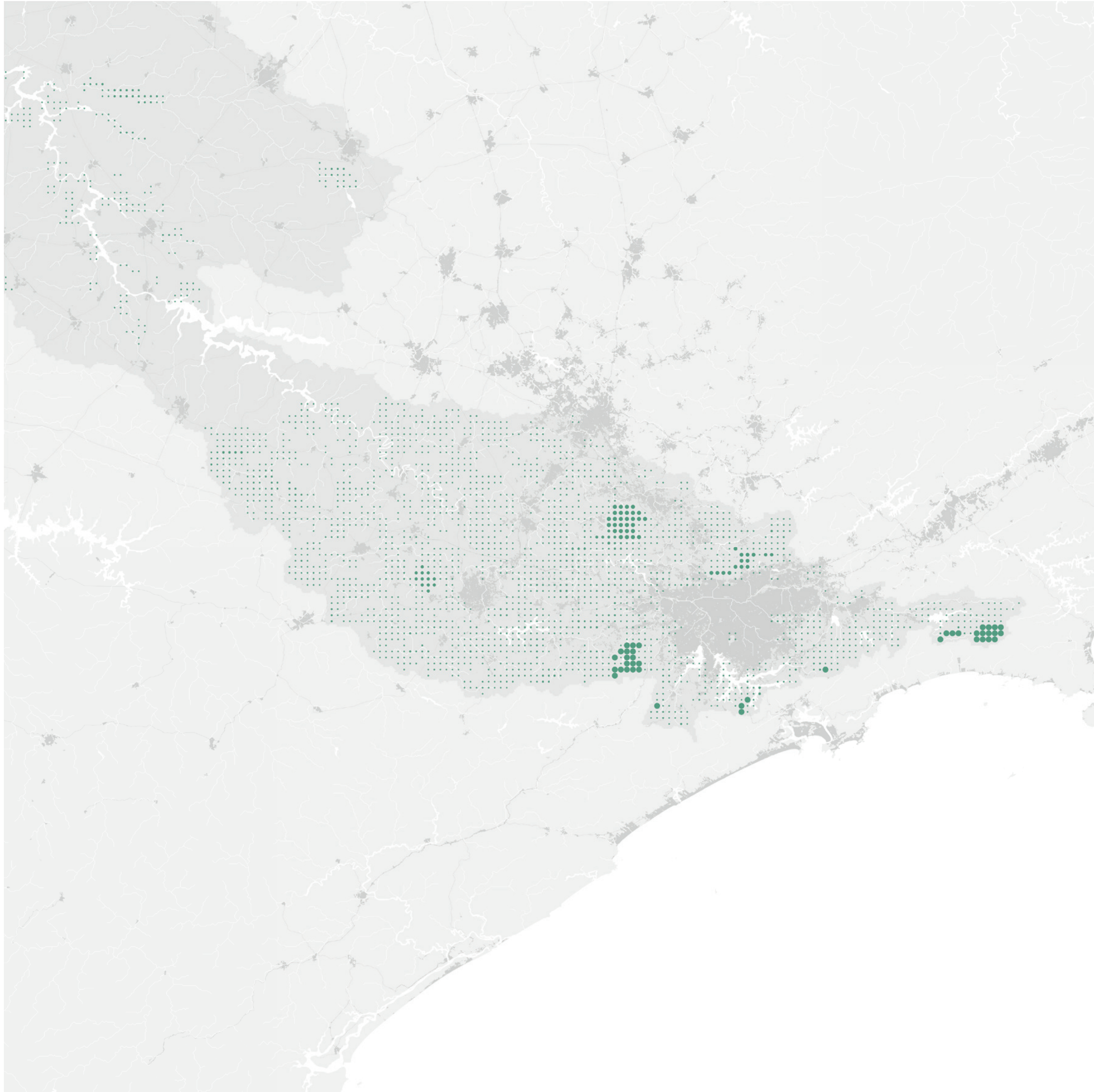



Coffee
Sales value of yielded production

0 -150
150 - 300
300 - 1.000
1.000 - 5.000
>5.000

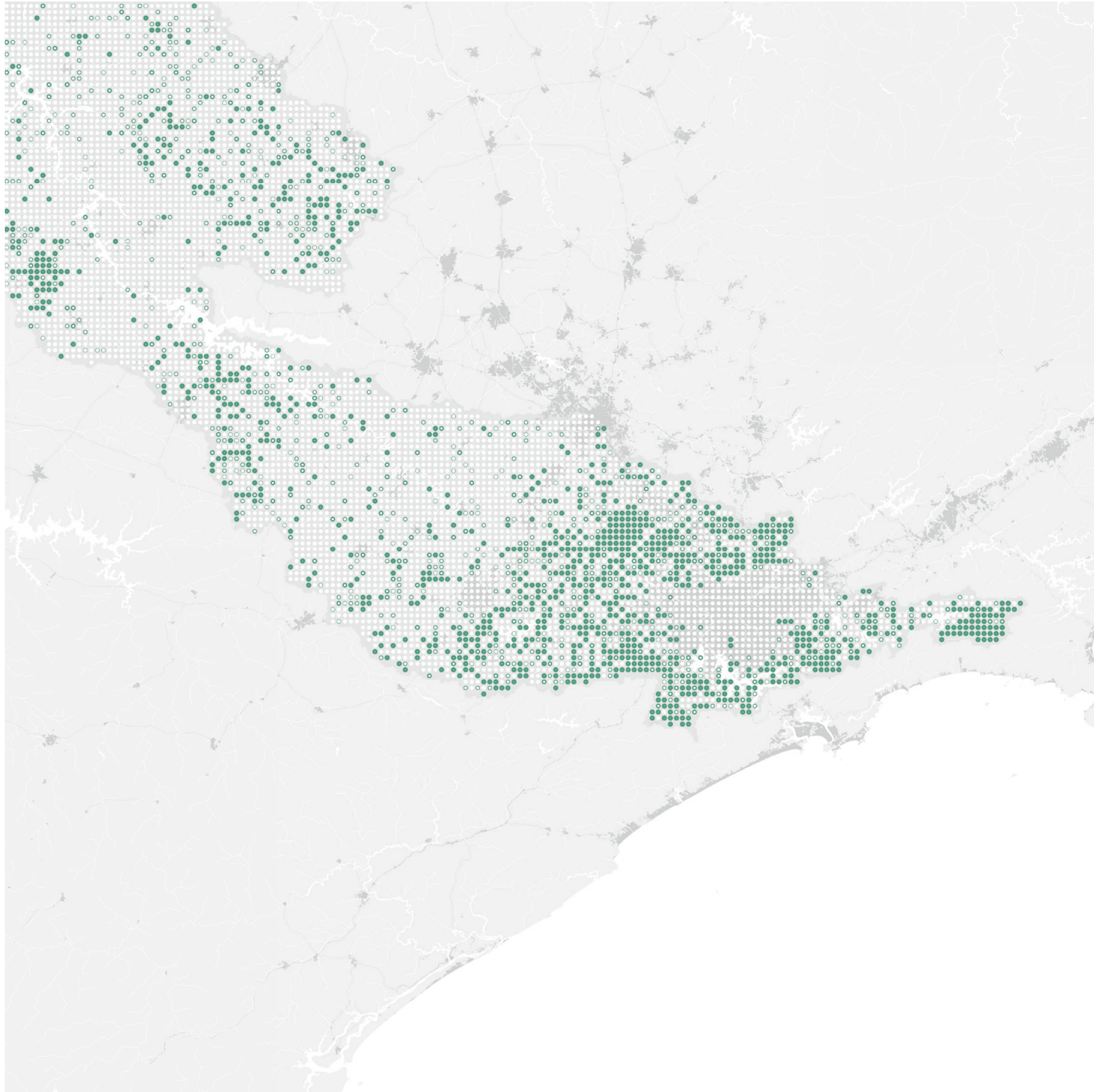


Permanent forest

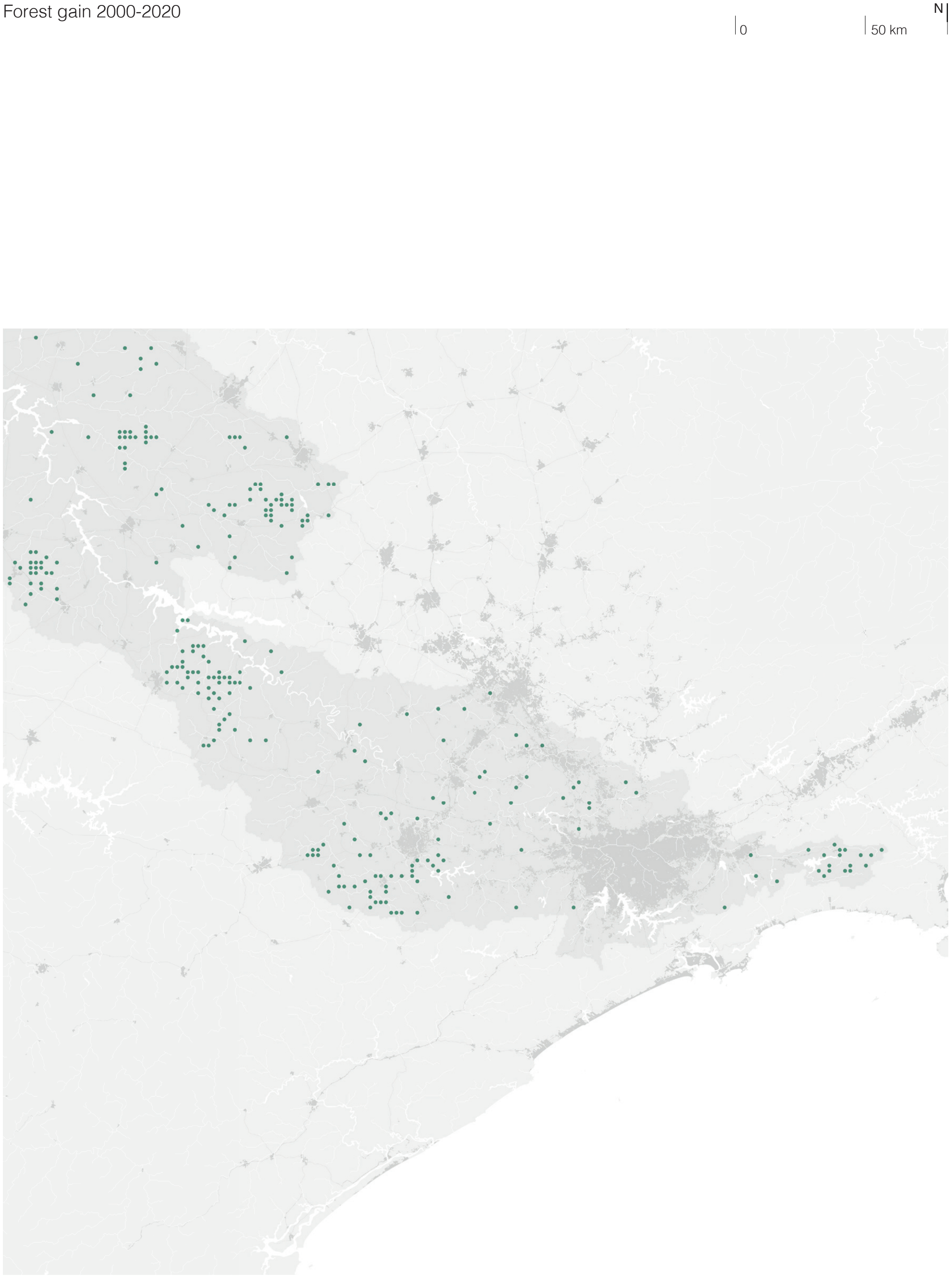



Persistant forest

Tree cover percentage

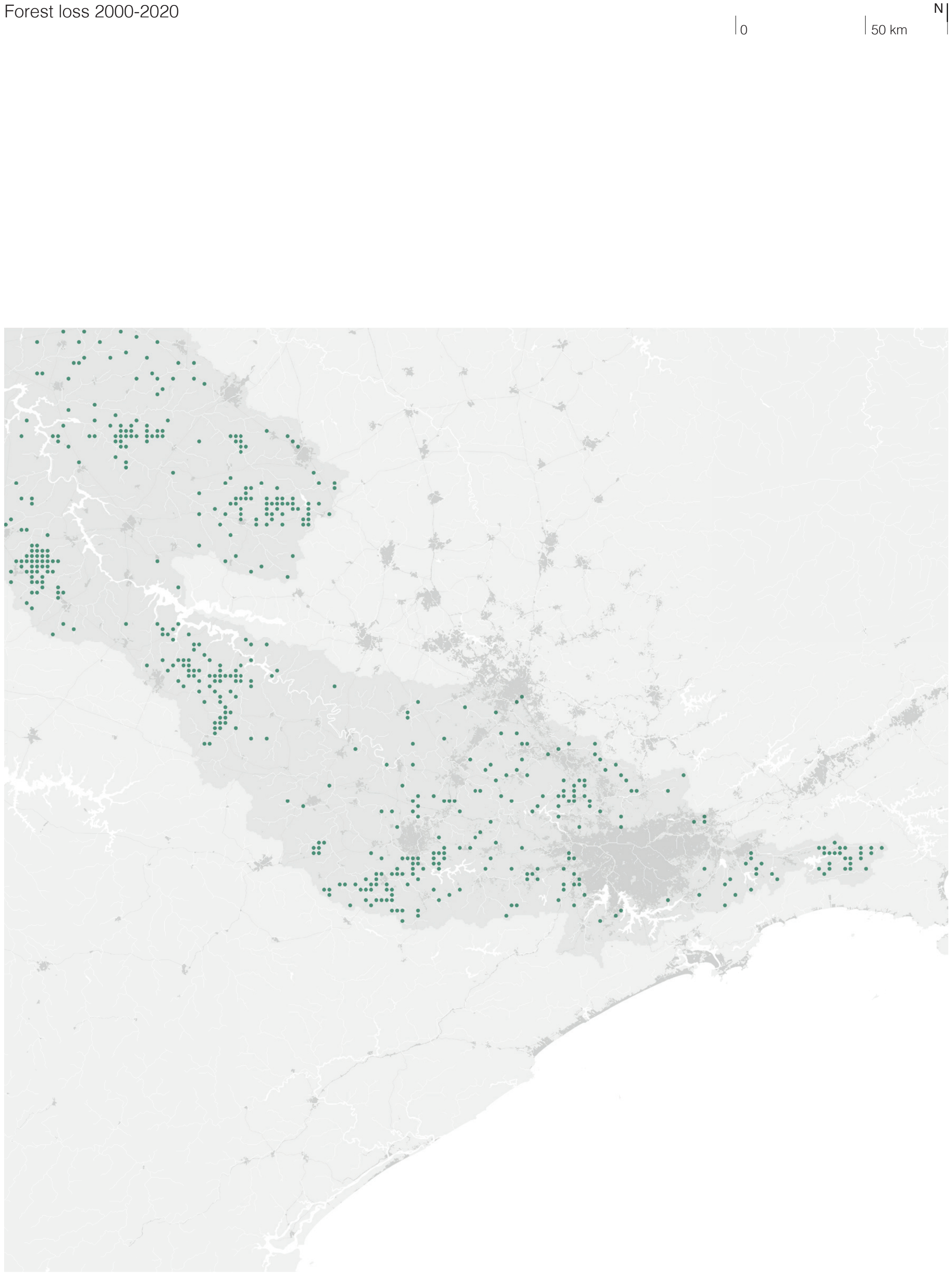


Forest gain 2000-2020



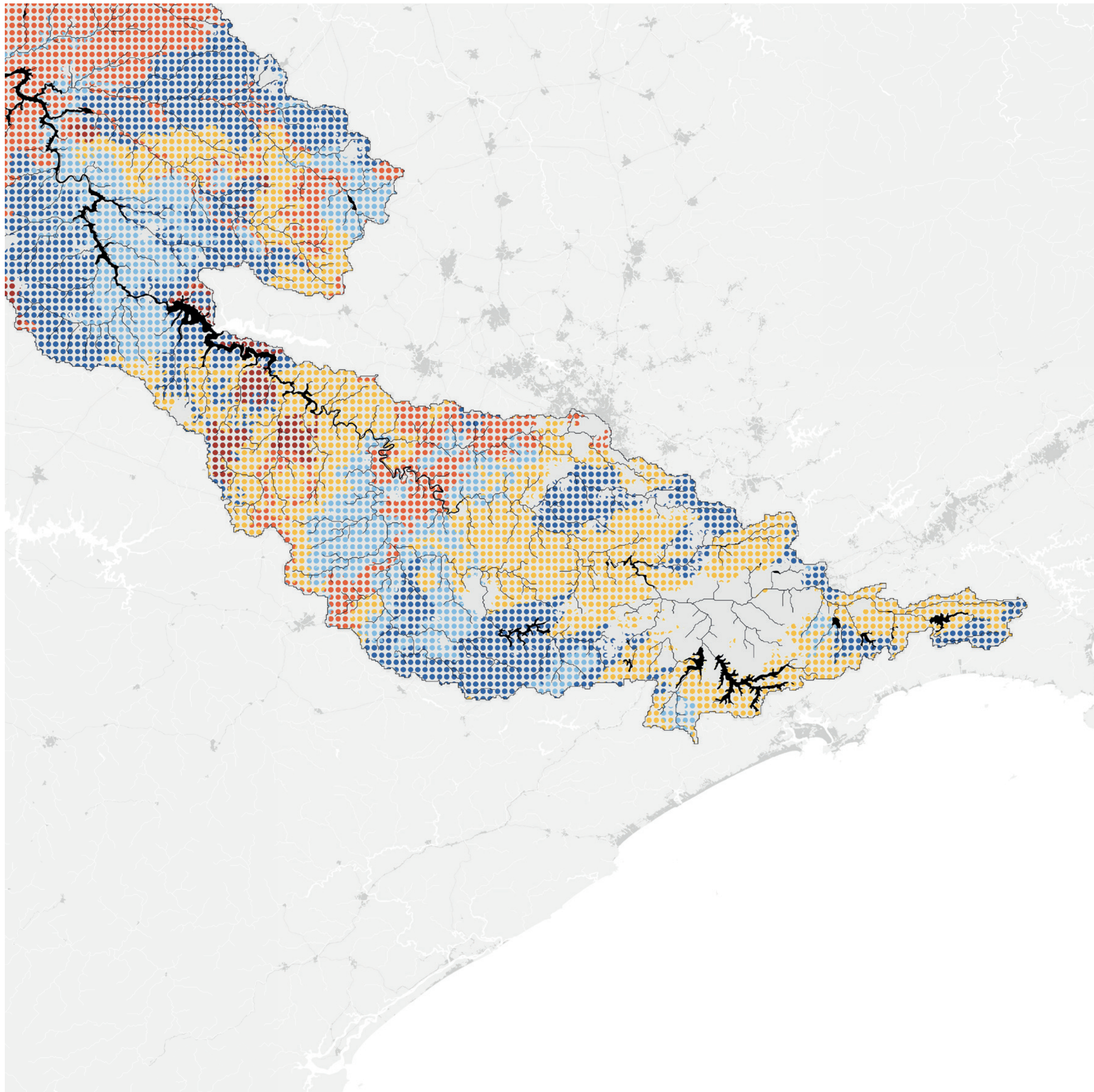



Forest loss 2000-2020



Soil erodibility

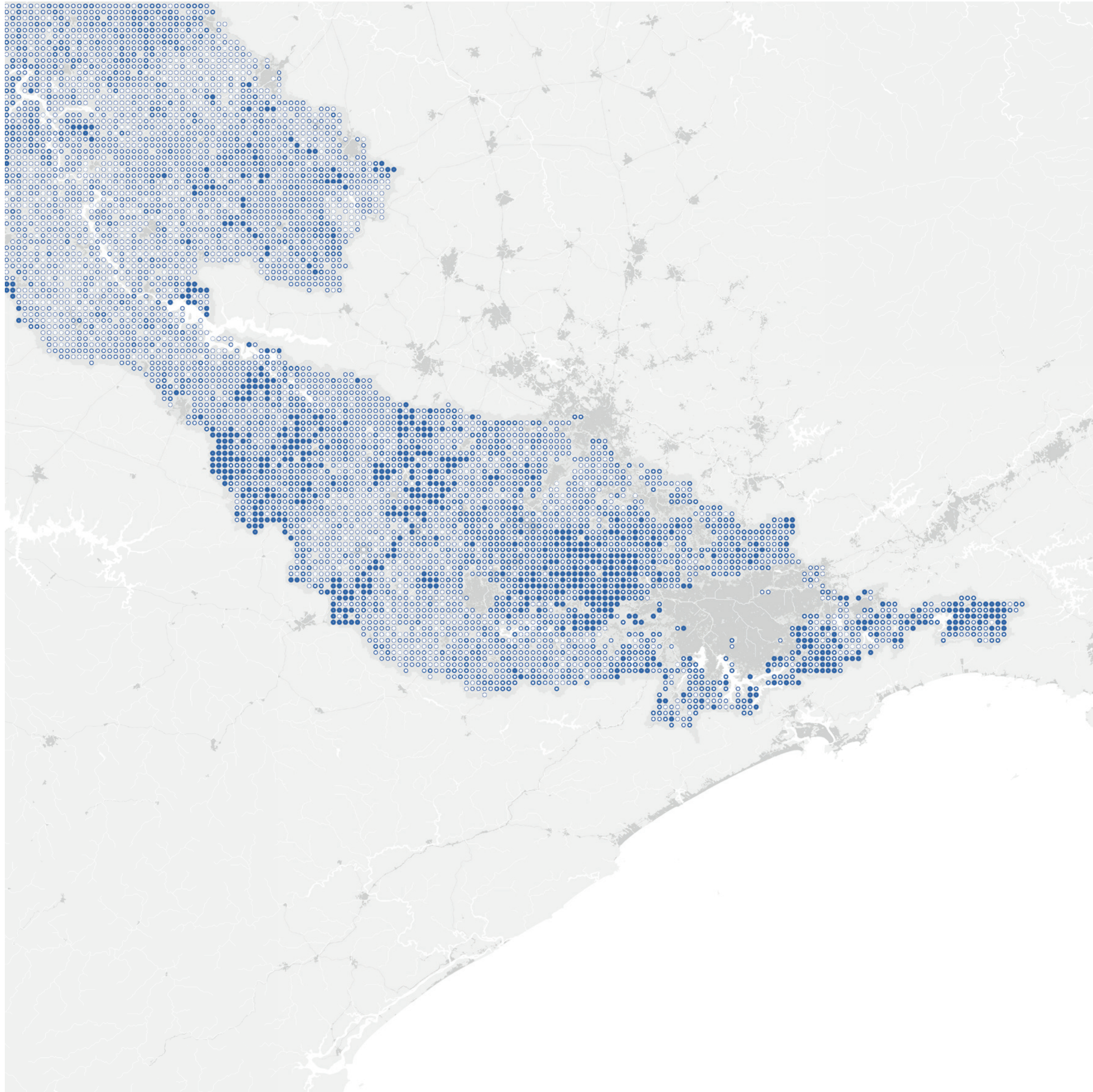
- Very High
- High
- Medium
- Low
- Very Low



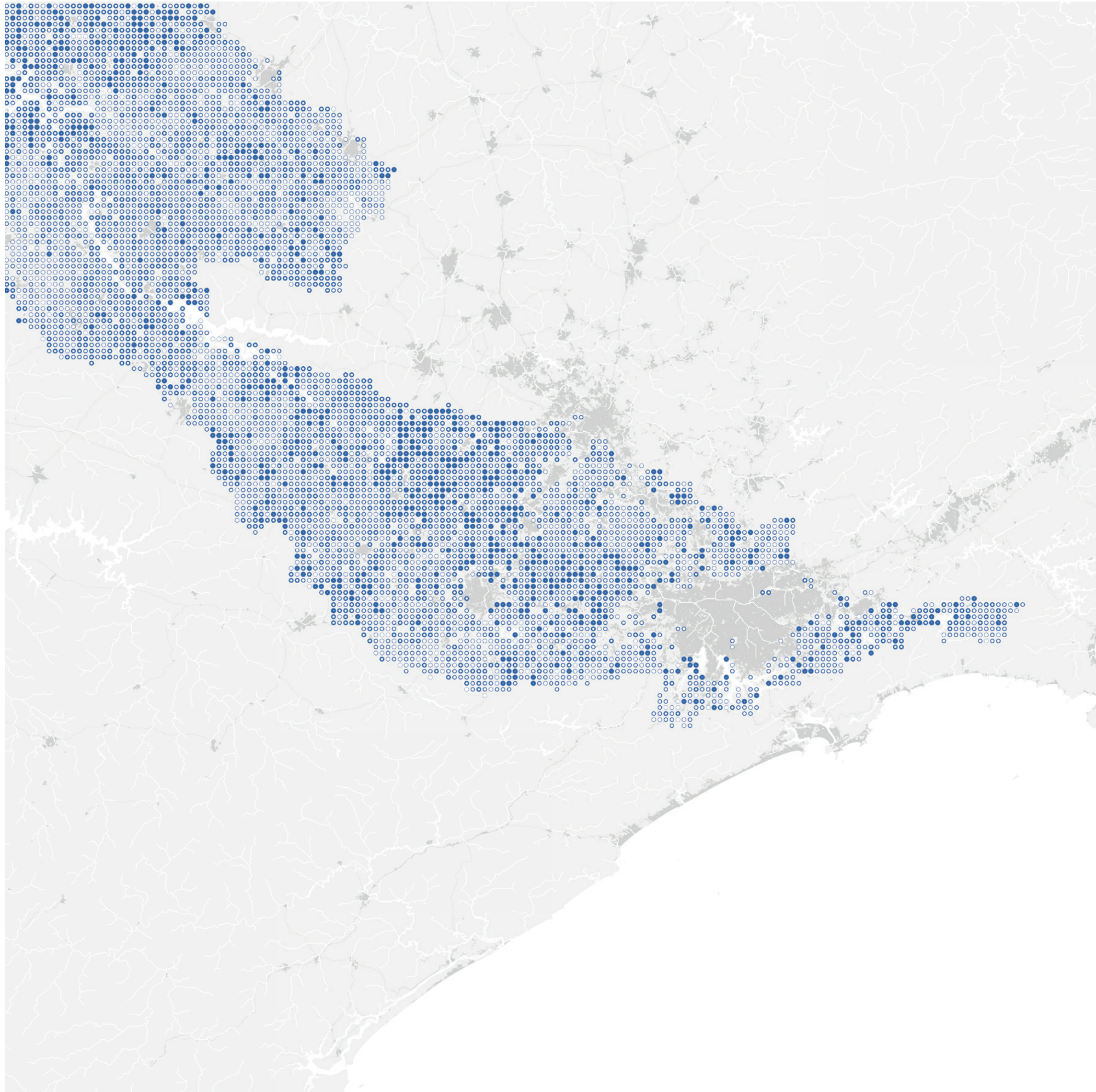



Soil Susceptibility to erosion

- Very Low
- Low
- Moderate
- High
- Very High

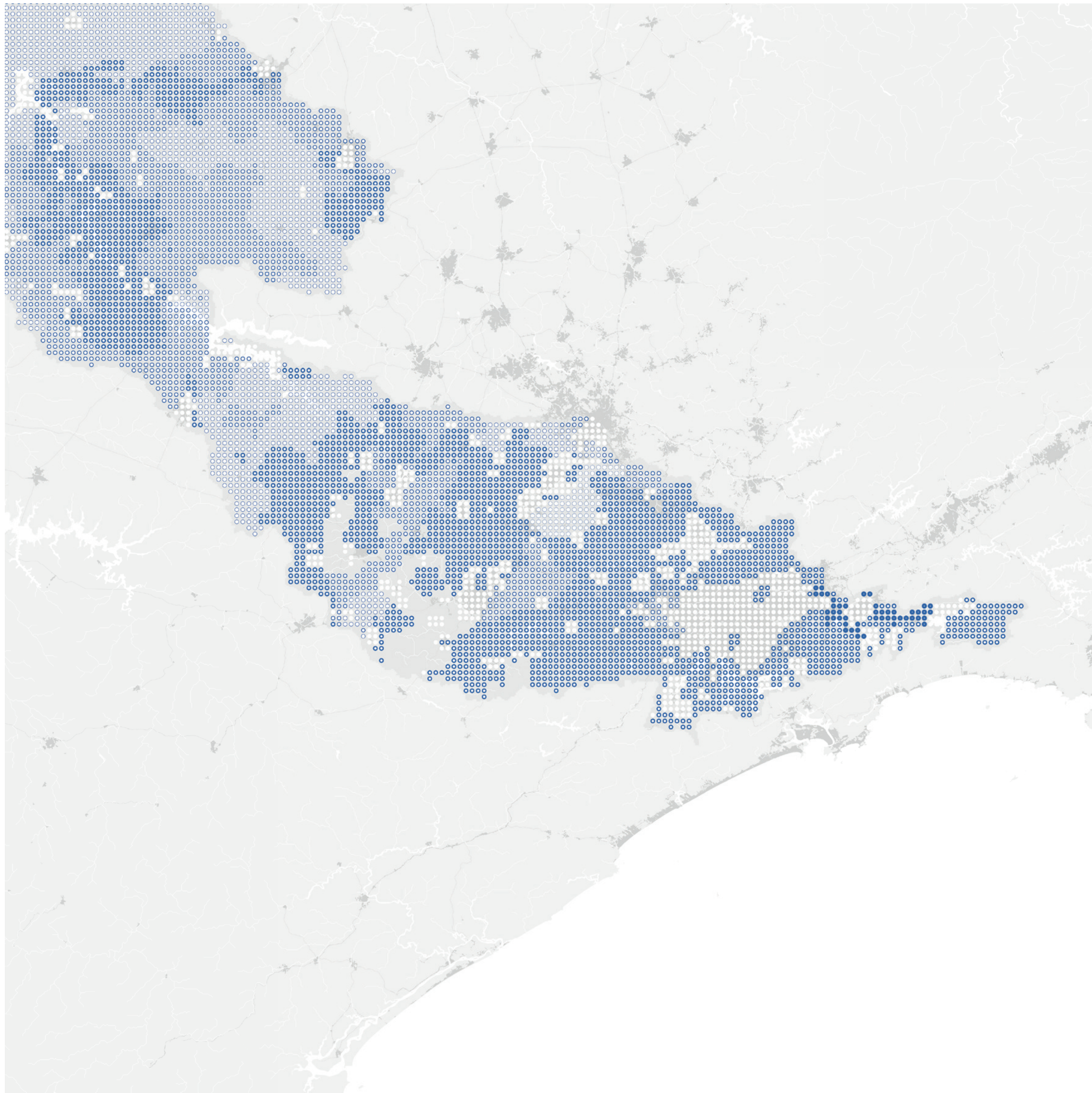


Vulnerability to soil erosion

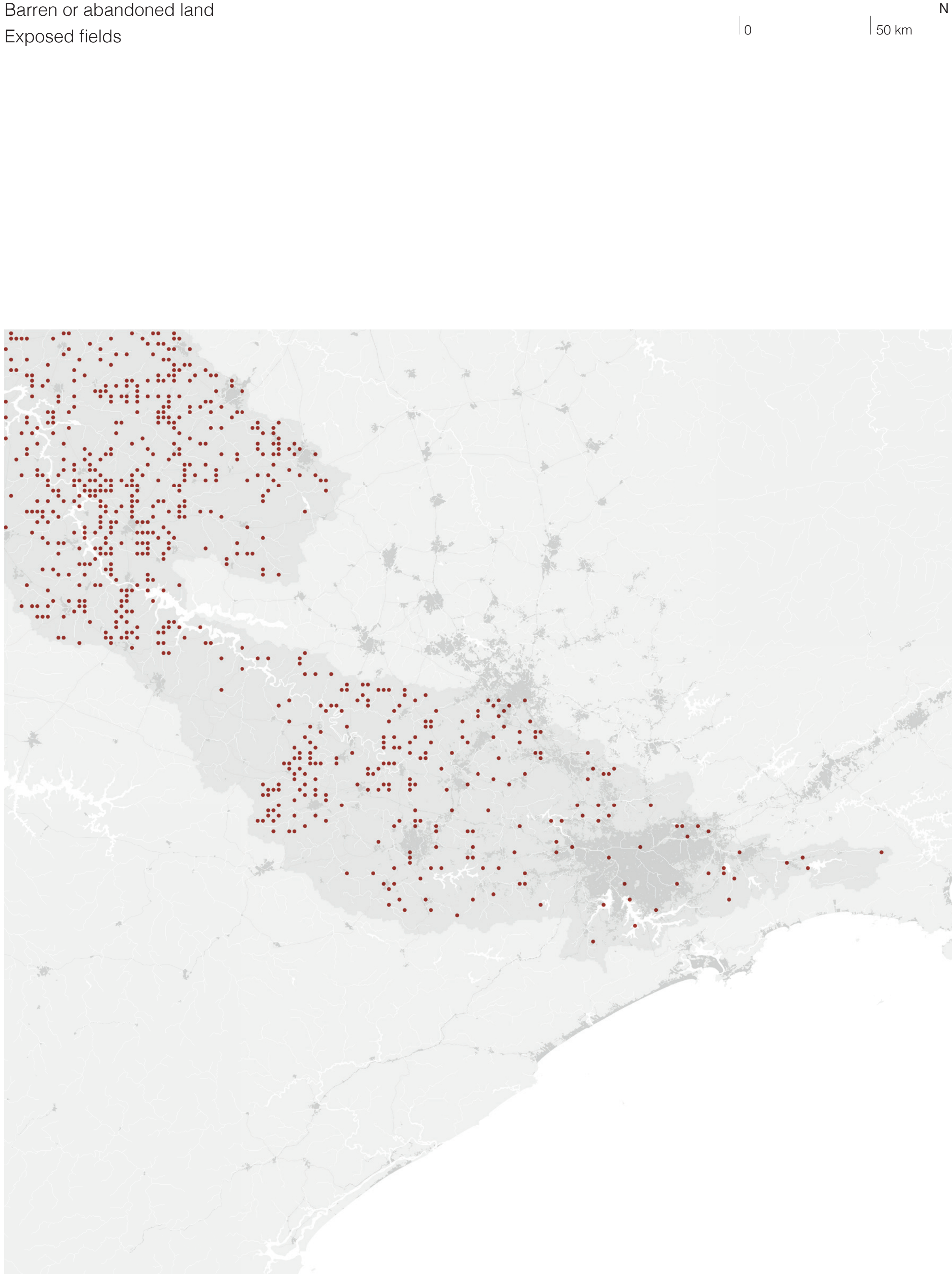





Estimation of availability of water in soil



Barren or abandoned land
Exposed fields



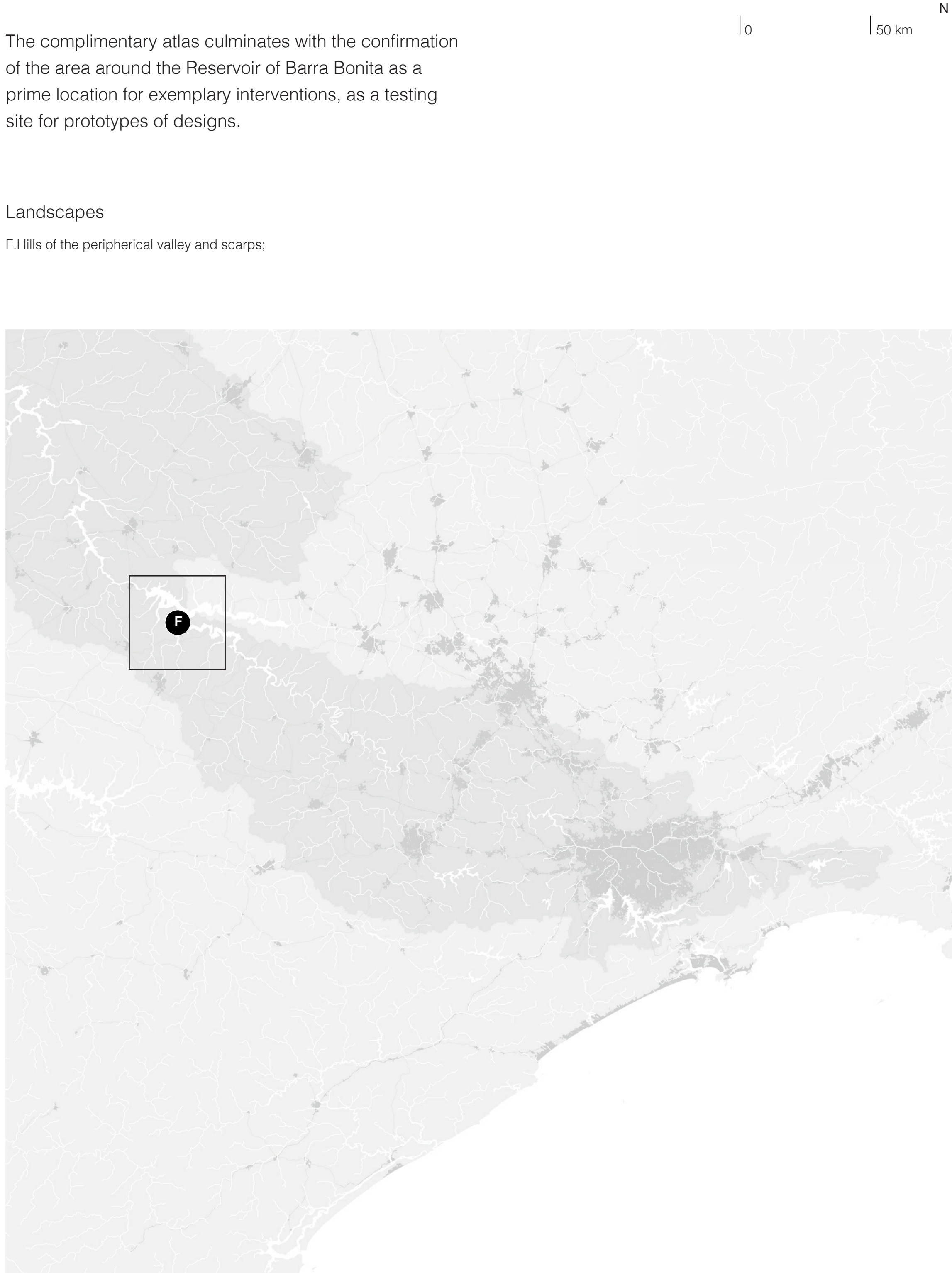


## Selection of specific sites

The complimentary atlas culminates with the confirmation of the area around the Reservoir of Barra Bonita as a prime location for exemplary interventions, as a testing site for prototypes of designs.

Landscapes

F.Hills of the peripherical valley and scarps;



# Intervention on the Continuum

## Drafting goals and strategies for the Basin

The research carried through for the development of the monographs, as well as the literature review and the elaboration of the small atlas for confirmation of the exemplary zone, provide the design with enough input to inform the selection of problems and opportunities across the Basin.
The readings have been compiled in a synchronization table, that qualifies ecological factors into a criteria ranking, then relates these qualities to systems in which they operate (Atmosphere, Surface, or Subsurface), their influence on water trends, and, lastly, the type of landscape in which they occur. The outcome of the synchronization table is a clear understanding of which are the urgencies and potentials for each scale, and type of landscape, and which are their effects on the continuum.
Prior to the deepening into the design phase, a few goals are set for the entire basin, with the idea that interventions that are carried out on the scale of the entire Basin, or a set of interventions aligned by the same goals, could actually provoke an effect on the continuum, changing the macroclimate of the region and improving resilience to climate events.
These goals and related strategies should inform specific commissions and design interventions, which ideally should be carried out by distinct design agencies, dialoguing with various stakeholders within the governmental, civil society, and private spheres.

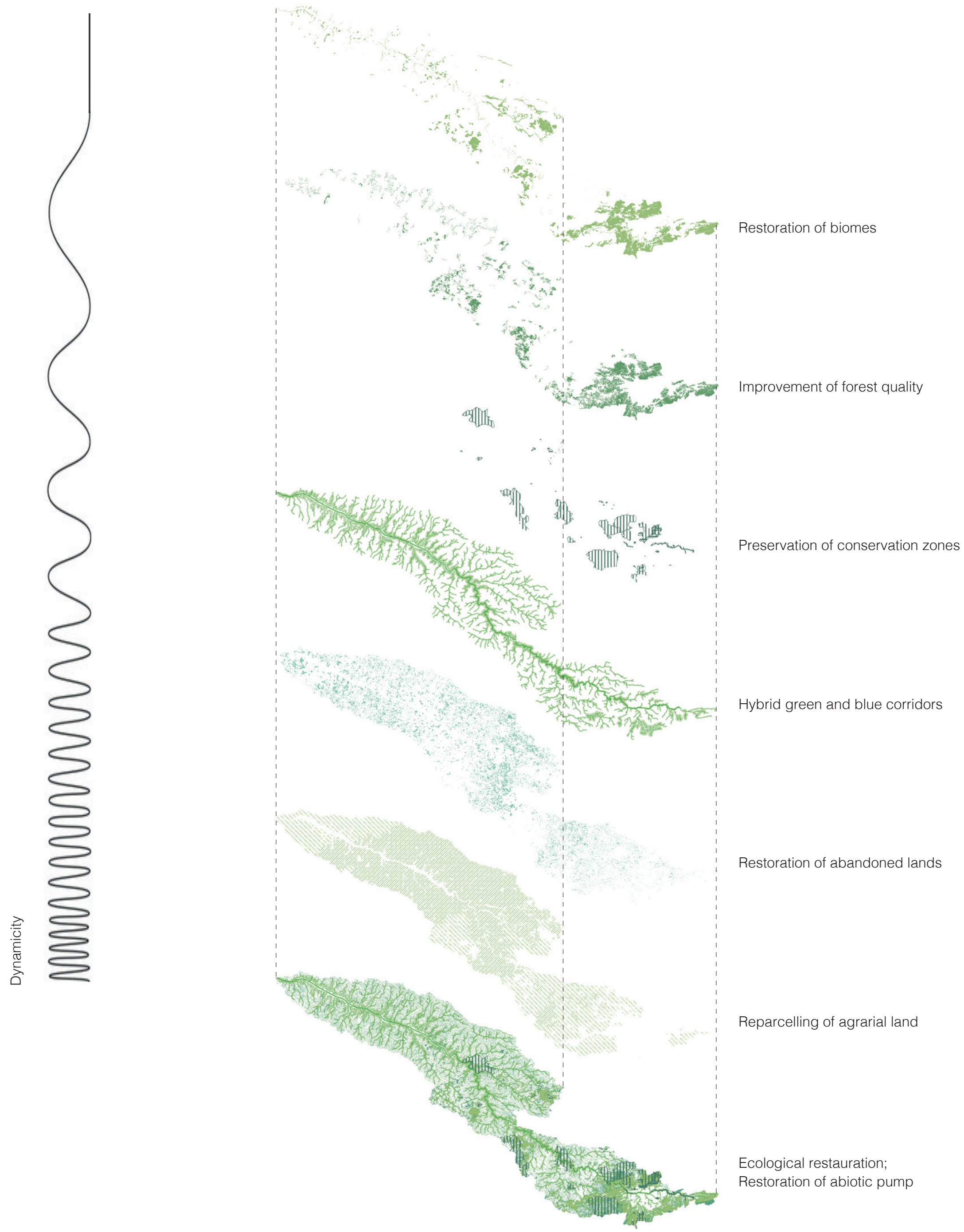


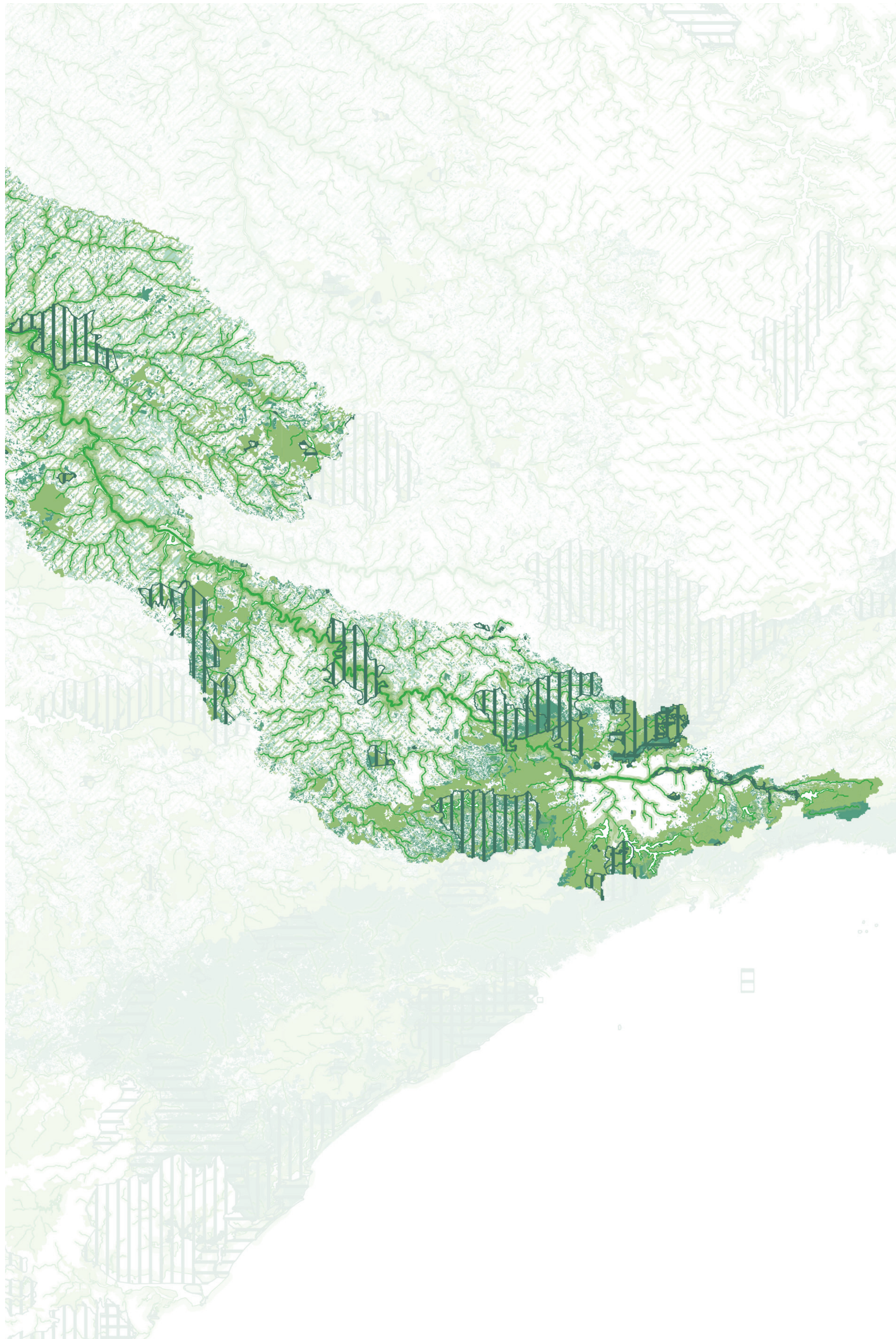
| Atmosphere | Surface | Subsurface |
|---|---|---|
| Ecological restauration, restauration of the abiotic pump | Runoff control, runoff water contamination control and infiltration enhancement | Recharge of aquifers and improvement of water quality |
| Pedology<br>Soil Drainage;<br>Erosion;<br><br>Hydrology<br>Groundwater availability;<br>Aquifers;<br>Aquifer recharge zones;<br>Flooding;<br>Flow and connectivity; | Land use<br>Barreness of land;<br>Intensity of land imperviousness;<br>Productivity of land;<br>Potential Usage Capacity;<br>Water discharge ;<br><br>Vegetation<br>Existing rainforest;<br>Existing shrubland;<br>Forest type;<br>Forest persistance; | Pollution<br>Water pollution;<br>Groundwater pollution;<br>Topsoil pollution;<br>Probability of soil pollution;<br><br>Landscape<br>Existing and potential recreation resources;<br>Features of unique educational and historical value;<br>Features of scenic value;<br><br>Wildlife<br>Existing Habitats. |

# Drafting programs from research

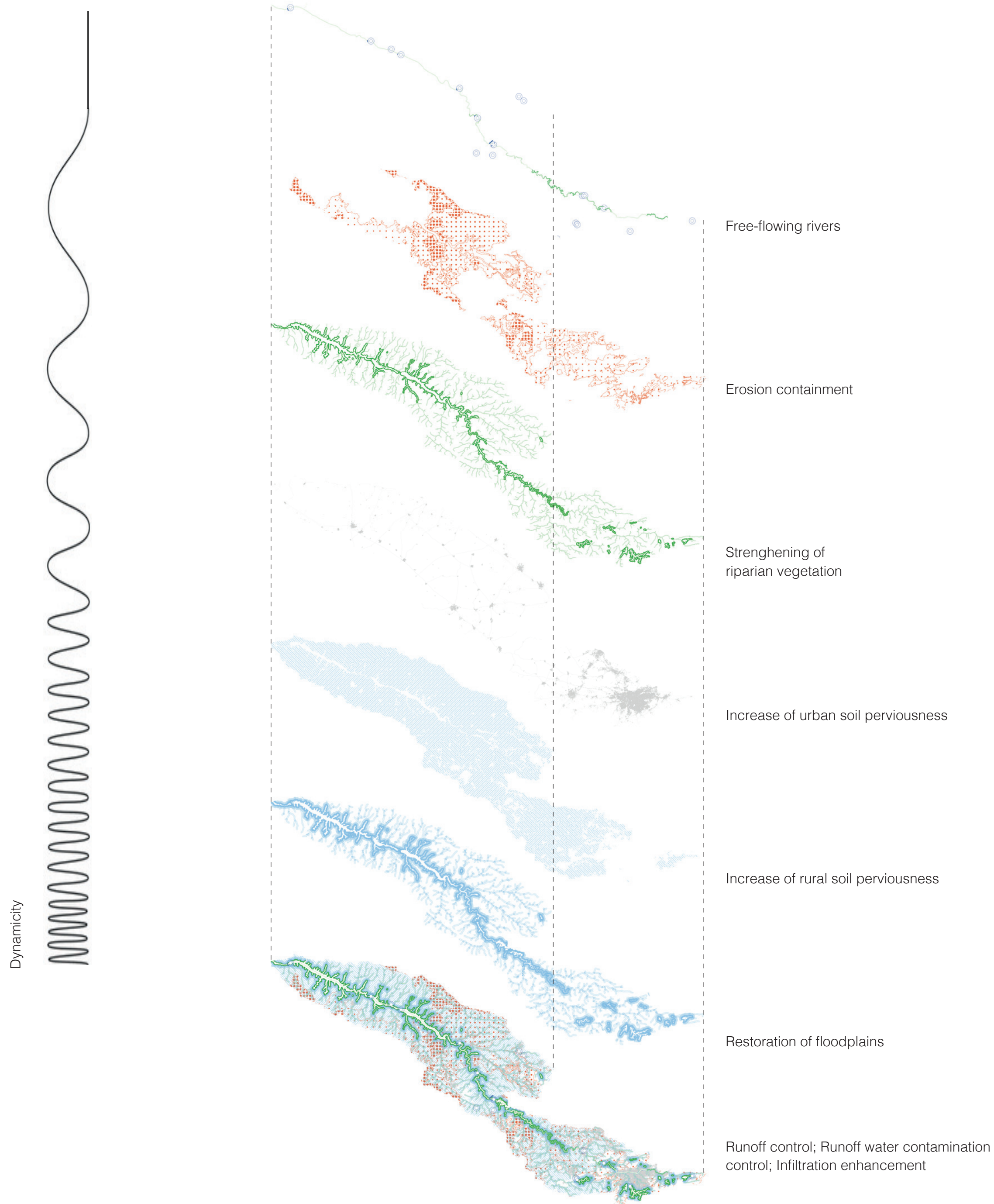
| Ecological factor | Ranking criteria | | Phenomena Rank | | | | | System | Influence on water trends | | | Landscape | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Pedology** | | | I | II | III | IV | V | | Too much | Too little | Too dirty | M | V | P | C |
| Soil Drainage | Permeability | Most > Least | Excellent | Good Fair | Fair good | Poor | Nul | Surface | X | X | | V | IV | III | I |
| | Susceptibility to water erosion | Most > Least | Very High | High | Moderate | Low | Very low | Surface | X | X | | | III | V | IV |
| Erosion | Vulnerability to soil erosion | Most > Least | Very High | High | Moderate | Low | Very low | Surface | X | X | | | II | IV | III |
| | Erodibility of soil | Most > Least | Very High | High | Medium | Low | Very low | Surface | X | X | | III | III | IV | III |
| **Hydrology** | | | | | | | | | | | | | | | |
| Groundwater availability | Yield | Highest > Lowest | Very High | High | Moderate | Low | Very low | Subsurface | | X | | V | III | II | I |
| Aquifers | Potential yield | Highest > Lowest | Very High | High | Moderate | Low | Very low | Subsurface | | X | | IV | III | I | II |
| Aquifer recharge zones | Importance of aquifers | Most > Least | Sedimentary | | Magmatic | | Crystalline | Subsurface | | X | | IV | III | I | II |
| Flooding | Incidence | Maximum > Minimum | Highest | | Medium | | None | Surface | X | | X | I | II | IV | |
| Flow and connectivity | Degree of human-made changes | Highest > Lowest | Very High | High | Moderate | Low | Very low | Surface | X | X | | I | II | II | IV |
| **Land use** | | | | | | | | | | | | | | | |
| Barreness of land | Exposure of land fields | Most > Least | Very High | High | Moderate | Low | Very low | Surface | X | X | X | | III | II | V |
| Intensity of land imperviousness | Gradient of urbanization | Most > Least | Very High | High | Moderate | Low | Very low | Surface | X | | X | I | II | III | IV |
| Productivity of land | Value of Yielded production | Highest > Lowest | Very High | High | Moderate | Low | Very low | Atmosphere, Surface | | X | X | | II | I | IV |
| Potential Usage Capacity | Limitation | Highest > Lowest | Very High | High | Moderate | Low | Very low | Surface | X | X | | | II | IV | V |
| Water discharge | Limitation | Highest > Lowest | Very High | High | Moderate | Low | Very low | Surface | X | | | I | II | II | V |
| **Vegetation** | | | | | | | | | | | | | | | |
| Existing rainforest | Quality of the forest | Best > Poorest | Excellent | Good Fair | Poor | Disturbed | Nul | Atmosphere | | X | | II | III | IV | II |
| Existing shrubland | Quality of the vegetation | Best > Poorest | Excellent | Good Fair | Poor | Disturbed | Nul | Surface | | X | | | III | IV | III |
| Forest type | Type of vegetation | Most > Least | Humid tropical forest | | Semi-dry | | Absense | Atmosphere, Surface | | X | | I | III | V | II |
| Forest persistance | Abundance of forest | Most > Least | Plentiful | Mass | Moderate | Few | Very few | Atmosphere | | X | | IV | IV | V | II |
| **Pollution** | | | | | | | | | | | | | | | |
| Water pollution | Quality of water | Best > Poorest | Great | Good | Regular | Bad | Terrible | Surface | | | X | V | III | III | II |
| Groundwater pollution | Vulnerability to contamination | Highest > Lowest | Very High | High | Moderate | Low | Very low | Surface, Subsurface | | | X | II | II | I | II |
| Topsoil pollution | Abundance of contaminated areas | Most > Least | Plentiful | Mass | Moderate | Few | Very few | Surface, Subsurface | | | X | I | III | III | |
| Probability of soil pollution | Degree of exposure to contaminants | Highest > Lowest | Very High | High | Moderate | Low | Very low | Surface, Subsurface | | | X | I | II | II | |

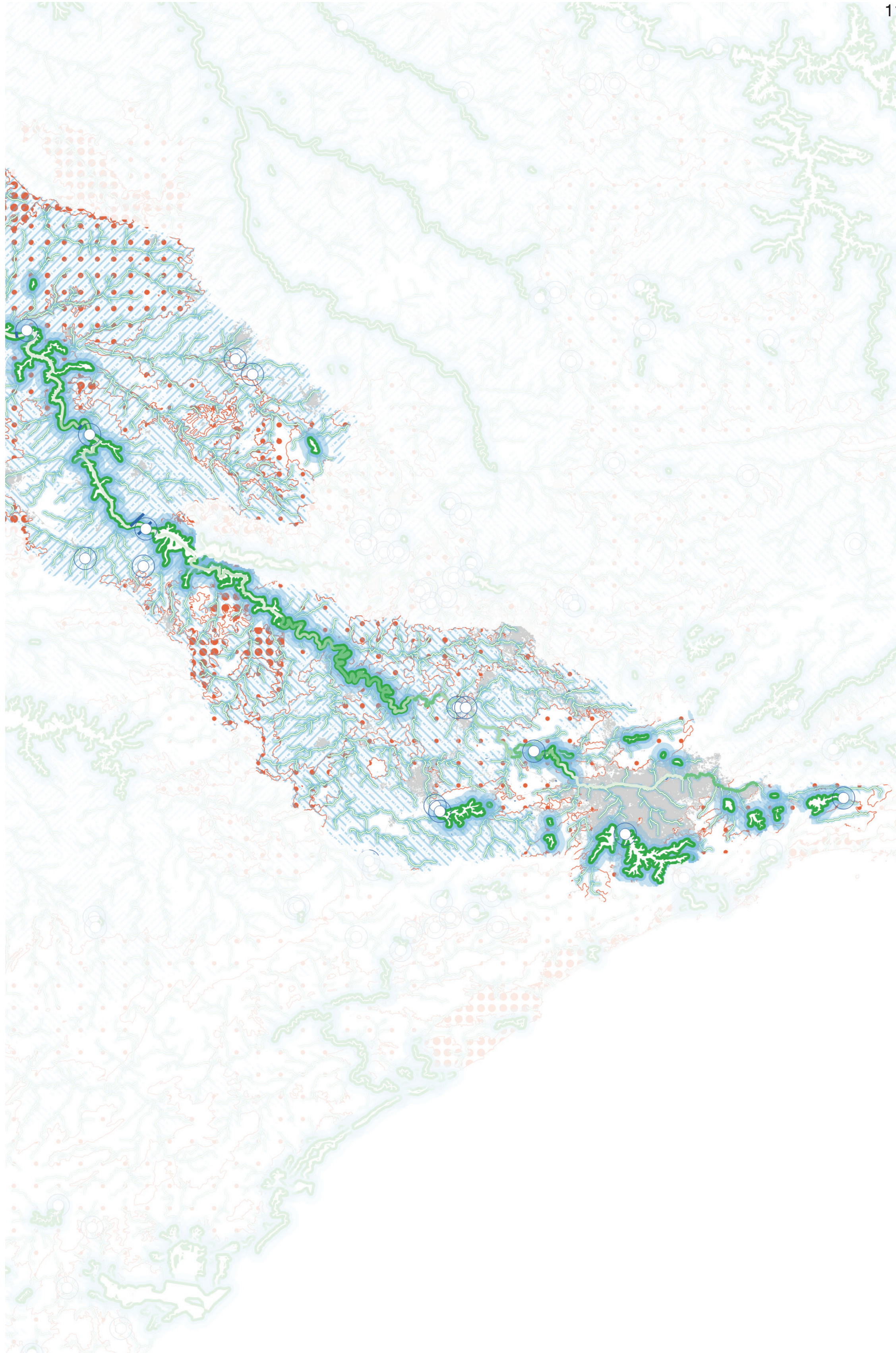
## Intervening on the Atmosphere



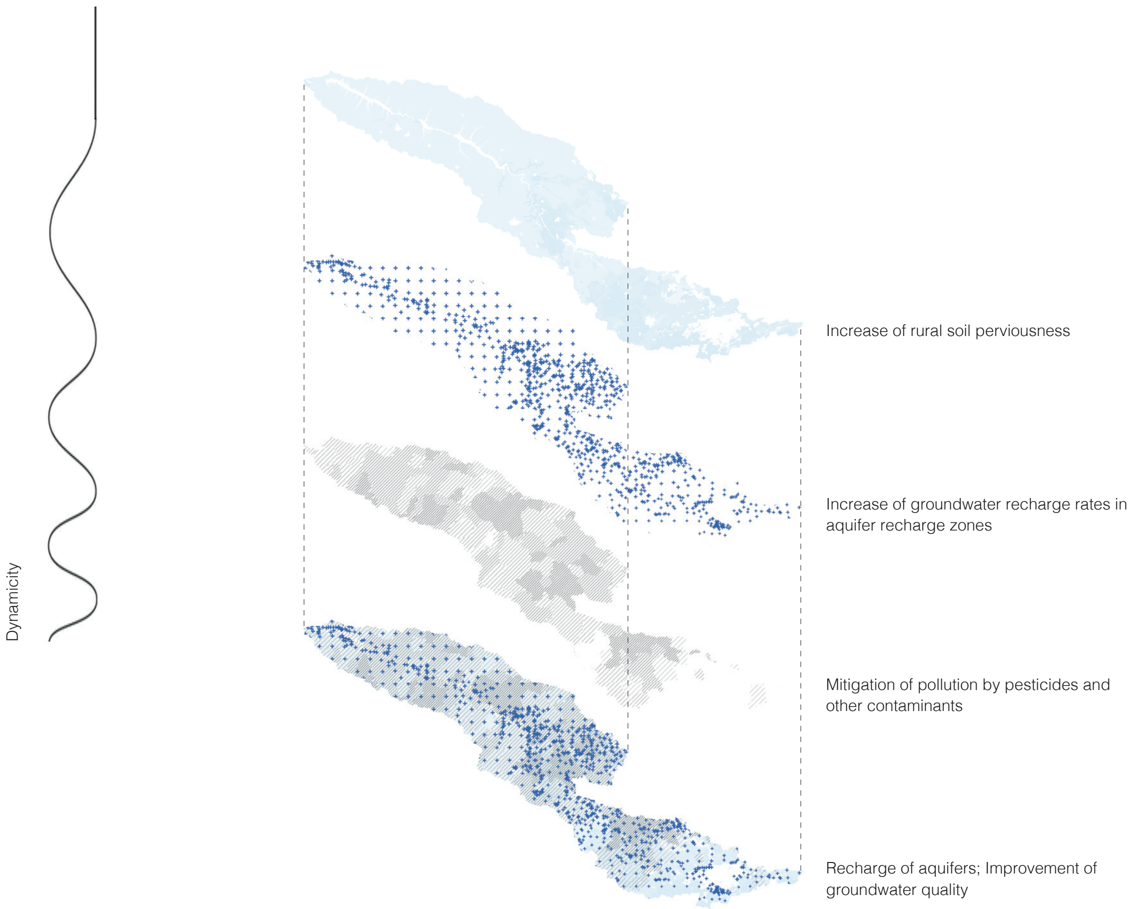



## Intervening on the Surface



## Intervening on the Subsurface




# 6 Intermission

As much as the graduation thesis has been carried through following the scientific methods and processes, keeping in mind the academic character of the work, once the further stages of the work are reached, entering the design phases, subjectivity and arbitrariness are inescapable qualities that are embedded to the process.

Following the research phase results, there might be enough reasons why it should be decided to carry on with intervention one or intervention two, according to the most appropriate and suitable options for each type of site, each need, governmental and institutional scenarios, and so on. However, exactly how the design takes form in space (not by which means, but the actual shape, form, size, orientation, and materiality) is oftentimes bound to the personal choices of the designer, influenced by its trajectory.

It is the result of a trace that defines how a proposal is superimposed on the territory, especially being an urban landscape design proposal; there are always abstract inputs that exert great influence on the outcome. Aspects of composition, cultural perceptions and values are attributed by locals or foreigners, by those at the top of the social pyramid, or by those at the bottom. It becomes clear that oftentimes already from the start there are intentions behind the design proposal, either informed by the commissioner or other agents exerting influence in the choice between different possibilities and answering in different manners questions such as: What to highlight, what to cover? What to create, what to abolish? What to leave behind and what to recover?

Working with the landscape is always a task filled with subjectiveness. Rather than denying this subjectivity for the sake of the academic value of the work or the scientific rigor, arbitrariness and subjectivity should be embraced and exposed, since a designer is, all the time, making decisions, preferably informed by data and previous scientific results.

Prior to the development of this graduation work, two possible positions that could be taken by the designer when presented with a new proposal challenge were known to the author. The actual direction of the work, however, presented a third one, a result of the research-by-design method.

The first position takes the angle of an experienced reader, with a trained eye, and previously acquainted with a certain landscape. Pieces of information and readings that might escape the eye of others are, in this case, immediately exposed. Fundamental aspects come to the surface, the landscape is read in a rather effortless and agile manner, and a conclusion is reached in no time, followed up by the evident design proposal; in the case of this work, pre-conceptions about the type of landscape, demographics, and values that were still intrinsic to the landscape seemed evident to the author and were worthy of attention from the start.

The second position is of someone new both to the site and the subject of intervention. They still possess the gift of naivety and a fresh gaze, by not being bound to pre-conceptions and biases. From this angle, if an effort should be made to extensively uncover and comprehend the composition of the surrounding landscape, and if the designer acts with simplicity, care, and above all, respect for what was there before, the final design outcome might be delightful. Or, on the opposite end, disastrous, if the chosen approach is one of creating deliberate disruption, breaking ties with the past, and denying pre-existence in favor of the writing of a new narrative.

Surprisingly, along with the development of the work, a third position has been found (and adopted). That of a designer who is fairly familiar with the landscape, its composition, and founding events and elements, but that allows itself to be influenced by the subjectivity and beauty of aspects that have been unveiled throughout the work.

There is still so much beauty, value, and pristine nature to the site of the Tietê, that it could pitiful how, at the first stage, these aspects had been neglected in favor of a more technical, straightforward reading of the landscape. Moreover, it was easier to be convinced by the image put forward by agribusiness, the great power changing and influencing the transformation of the image of the country's hinterland for centuries. That of a country taken over by never-ending fields producing commodities in favor of progress and economic accumulation.

At first, it seemed like all had been lost, as if there was nothing else to be saved and celebrated. All the original and pristine qualities of the site had been erased in favor of extraction, and whatever effort to try and recover some of these aspects was doomed to be interpreted as romantic.

As more and more objects of enormous value came to the surface with the research, this third position concerning the design was embraced. It became evident that one of the main goals of the work should be to illustrate the rediscovering of the landscape, (besides the ones exposed by the research questions, which were evident since the start of the work). Exposing that there is, still after centuries of extraction, a lot to be valued in the hinterlands landscape of south-eastern Brazil. That soy, sugar cane, cattle, and corn are not all there is. That in all of Latin America but Brazil, founding traces of Pre-Columbian civilizations which could rewrite the story of occupation and human evolution on the continent would be celebrated, to the detriment of keeping the land cheap for the harvesting of cane for the production of biofuels. Thus, trying to make justice to the relevance of the site to our history and our native peoples.

Furthermore, the researcher has been informed by a careful reading of the past, through the series of exercises in search of the Longue-Durée. Ultimately three main aspects that have always (or at least for a long time) shaped the site were found: <u>the unique physiographic conditions, the close ties between the capital city of São Paulo and the development of the hinterland, and the extractive character of agriculture.</u>



It seemed hard to reconcile all this subjectivity and willingness to put forward this "rediscovering" of the landscape with the previously established, more technical goals of the research.

During the reading of an interview with the Dutch landscape architect Dirk Sijmons in 2019 to the Foreground, an Australian website published in partnership with the Australian Institute of Landscape Architects, a way out of this dilemma was perceived. In the interview, Dirk Sijmons builds on ideas exposed during a lecture given a couple of years back at the University of Massachusetts, claiming that a landscape designer turns problems into parks, ultimately creating public space. Although however important and however beautiful, this act does not solve global problems. So, once again, the issue of reconciliation between tangible and intangible, real and abstract is there. As a solution to this paradigm, Dirk Sijmons defines the three roles, or rather the fields in which an urban landscape designer should work, with its attention equally divided between the delivery of well-designed public spaces, research and design visualization, and activism.

Therefore, it became clear that the graduation work could, too, navigate these three avenues, each complementing the other. First, scientific relevance was sought with extensive technical research during the construction of the monographs and complementary studies. Second, a willingness to design a new landscape spatial framework, capable of guiding the transformation of the ravaged hinterland into a multi-functional landscape. To be remotely realistic, this new landscape framework would still be tied to the inescapable sorrow of extraction that dooms the underdeveloped world. Nevertheless, the vast hinterlands of Brazil can not be kept at the disposition of only agribusiness. There are too, other functions and vocations that should be addressed, in this case, the regeneration of the ecological integrity of the basin, ultimately (and hopefully) resulting in the regeneration of the hydrological cycles as well. Not to mention the dependence, from an economic perspective, on commodities exportation, putting in jeopardy the welfare and sovereignty of the country and its people.

Finally, the third field of the urban landscape designer role, activism, is expressed in the manner by which aspects that supposably have no economical value to decision-makers and landowners are brought forward and given protagonism in this work.

However, the question of how to select and find value in what had been lost, amid an infinite extension of land and diverse landscapes ravaged by centuries of extraction remained. At this stage of understanding the attributions and scope of the graduation work, the beautiful book of the German writer Judith Schalansky comes into play. The book, entitled An Inventory of Losses, describes the most varied collection of objects, places, and practices that have been lost by humankind. Either forgotten, fallen into decay, or purposely erased from history, the rediscovery of this inventory triggers the imagination. What world would we be living in if some of these objects were to be recovered? Not only the materiality of these objects but the paradigms, world views, and values that come with them.

It was from this moment of reflection that an idea emerged: to think about the values of what has been lost, of course in the case of the landscapes of the Tietê. Rather than cataloging and romanticizing the past, the idea was to uncover the values, the benefits, and the impact that the absence of this inventory of lost conditions has on the present.

For instance, what has really been lost when the Atlantic Forest and the Cerrado were torn down for the establishment of coffee monocultures in the 1800s?

Ever since the disappearance of the forest as the main element of the landscape, environmental conditions have changed drastically. Currently, there is a clear inflection point, where the circumstances are very hostile and completely different from those found not so long ago (approximately 150 years, in the case of the Tietê River Basin, which was covered in natural vegetation until the expansion of coffee plantations during the late 19th century; Victor et al, 2015). Was it just a landscape, and our contemporary romantic idea of the forest and its colorful plants and animals living in harmony, that has been lost? Or would it be more beneficial, at least for the designer, to reflect on the vital relevance of the natural and ecological processes that were regulated by the vegetation cover?



In this way, a cataloging process of some conditions and objects of the landscape was followed. Most probably, the choice of the cataloged objects came from personal fascination. Some were already known, and some have been presented to the author during the research phase. However, it would be naive to say that defining the acts of research and design (following the newly-found third position of the designer, addressing research, aesthetic values, and activism relevance, and carefully constructing the inventory of losses) was not, still, determined by subjectivity and arbitrarity. Therefore, by personal choice, it was decided that it would be very important to place this research within this personal condition.

First, of a passionate designer, enchanted by the natural beauty and complexity of the former biomes of the region. Second, of a designer respectful of Brazil’s native peoples, and ravaged by the lack of historical prominence given to them. And third, of a designer confronted with the fact that its agency seems minimal given the complexities, wickedness, and strength of pre-established paths, aligned with very powerful economic powers, but that, nevertheless, understands the relevance and the beauty of its role in reinterpreting current conditions and offering a vision of another possible future.

Lastly, it is hoped that this intermission chapter did not distract the reader too much from the overall narrative of the thesis work, but rather present a reflection that would not have the same relevance if placed on the very last pages of the thesis report. Understanding that these are very dear questions to the researcher is fundamental, and it might help to understand why the design has gone in one direction and not the other.

## The beauty and depth of southeastern riverine landscapes

< A stretch of the Paraná River, along the border between the states of São Paulo and Mato Grosso do Sul, in South-eastern Brazil.
Despite the expressive number of large hydropower plants and the usage of the river as a hydroway, the river still presents locations where the former wilderness that was present in the entire Basin can be observed. A beautiful composition of different types of vegetation (considering that this is an area between two distinct biomes, the Atlantic Forest and the Cerrado), and different water depths create ephemeral sandbanks, powered by the varying water flows that come down from the hinterlands of Brazil towards the Paraná Delta, between Uruguay and Argentina.

V Two locations along the Paraná Basin. The reservoir formed by the Itaipu Dam, one of the largest in the world. and the reservoir of Barra Bonita Dam.
Along the entire Tietê River, and most of the Paraná, the normalization caused by the heavy-engineering works of the hydropower plants and endeavors to make the rivers navigable have stripped the riversides from the former variety of landscapes, types of vegetation, and habitats. The vegetated bands observed on the Itaipu reservoir most probably were required as environmental compensation measures for the construction of the dam. The same should have applied to the borders of the Barra Bonita reservoir, whereas the same enforcement is not observed. A great deal of the shores of the reservoir is covered in grass, or occupied by conglomerates of houses, country clubs, or industrial agriculture cropland, leaving no room for habitats of biodiversity.

## The ambiguity of the *Várzeas*

< An area of Várzea, along the floodplains of the Piracica-ba River, a tributary of the Tietê.

V The normalized channel of the Tietê River, upstream from the Barra Bonita Reservoir.

## The *Paulista* countryside historical juncture

< Paintings by Antonio Ferrigno Monjolo, from the late 1800s. The paintings were commissioned by the Count of Serra Negra to depict the family's coffee farm, Fazenda Vitória, one of the most important in the history of agricultural development in the region.

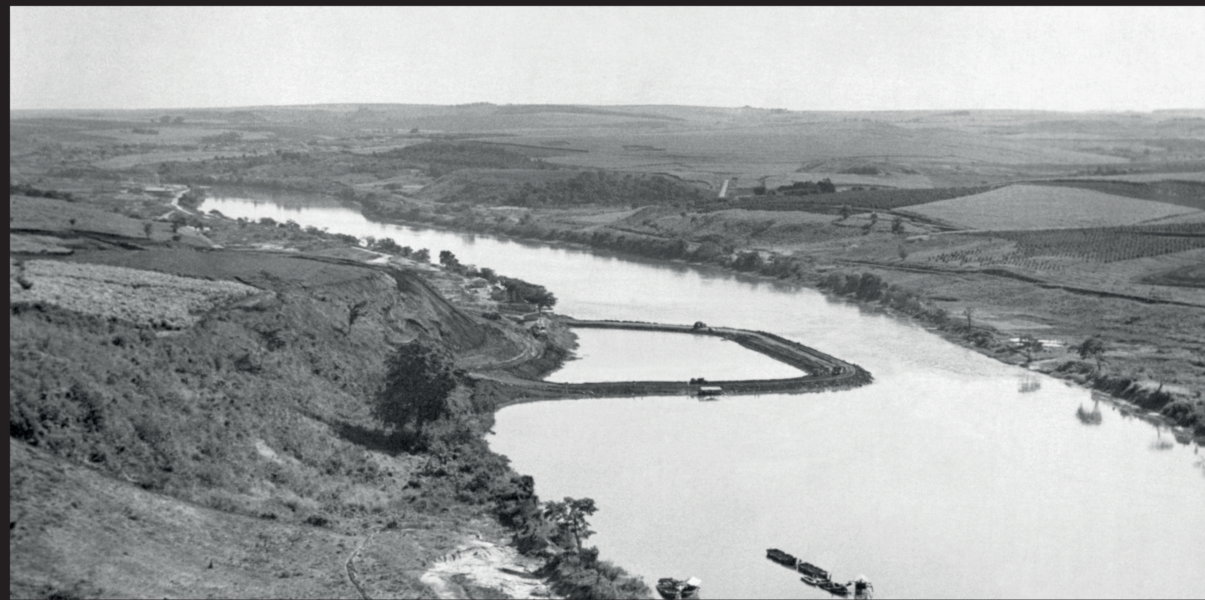
**V** Heavy machinery on the croplands of the São Manoel Sugar Mill, in the outskirts of São Manuel. Most of the agricultural land in the region has been acquired by the plant, leaving little room for the production of other crops, as well as jeopardizing the historical conjuncture of the site by the standardization of the landscape.

## The footprints of native peoples



< Numerous archeological sites have been found close to the hillsides of the region of Barra Bonita and Botucatu. In Pre-Colombian times, the region was served by the Peabiru route and indigenous pathway that was supposed to connect communities living in Southern Brazil with those in the Andes, across the continent.

V Photographs of the construction of the Barra Bonita Dam and Reservoir, during the 1960s. The amount of earth and matter displaced for the construction of the infrastructure is striking. It raises questions as to the amount of other archeological sites of great value that has already been lost by the severe transformation of the site.



## The complexity of the *Mata*

< Satellite images of areas covered in vegetation typical of the Atlantic forest, close to the springs of the River Tletê, in Salesópolis (top) and Cerrado, in Minas Gerais (bottom). The Region of Barra Bonita, and also the capital City of São Paulo are former regions of ecotones, in-between areas of the two biomes. The landscapes varied according to the altitude, as well as the degree of contact with the water of the rivers.

V A great deal of the vegetation patches found in the region are plantations of eucalyptus - either for the production of cellulose for paper manufacturing, or for complying with reforestation efforts required by law.

IMAGES REFERENCES

1. A stretch of the Paraná River, along the border between the states of São Paulo and Mato Grosso do Sul, in Southeastern Brazil.
Source: Google Maps
2. Two locations along the Paraná Basin. The reservoir formed by the Itaipu Dam, one of the largest in the world. and the reservoir of Barra Bonita Dam.
Source: Google Maps
3. An area of *Várzea*, along the floodplains of the Piracicaba River, a tributary of the Tietê.
Source: Google Maps
4. The normalized channel of the Tietê River, upstream from the Barra Bonita Reservoir.
Source: Google Maps
5. *Monjolo, Fazenda Victória*, Antonio Ferrigno, Circa 1890, Oil on canvas
Source: Coleção Manoel Ernesto Serra Negra - São Paulo/ Enciclopédia Itaú Cultural de Artes Visuais
6. *Colonos indo ao trabalho, Fazenda Victória*, Antonio Ferrigno, 1898, Oil on canvas
Source: Private Colection/ Enciclopédia Itaú Cultural de Artes Visuais
7. *A Colheita*, Antonio Ferrigno, 1903, Oil on canvas
Source: Museu Paulista da USP
8. A sugarcane field of the São Manoel plant, in São Paulo, Brazil
Source: Usina São Manoel
9. Serrito Hill, close to the Reservoir of Barra Bonita, in São Paulo, Brazil
Source: Mapio/ Photograph: Gabriel Marcuss
10. Rock carvingss in São Manuel, in the Serrito II Archeological Site.
Source: Zanettini Arqueologia
11. *Mirante da Pedra do Índio*, in Botucatu
Source: G1
12. Construction of the Barra Bonita Hydropower Dam, in 1958
Source: Projeto Eletromemória FFLCH USP
13. Construction of the Barra Bonita Hydropower Dam, in 1958
Source: Projeto Eletromemória FFLCH USP
Photograph: Oswaldo Grossi Jaú.
14. Areas covered in vegetation typical of the Atlantic forest, close to the springs of the River TIetê, in Salesópolis.
Source: Google Maps
15. Areas covered in vegetation typical of the Cerrado in Minas Gerais, Brazil
Source: Google Maps
16. Eucalyptus plantation close to the Reservoir of Barra Bonita, in São Paulo, Brazil
Source: Google Maps

# 7 Projection

# Three acts of design



The projection operates on several different scales and conditions of the urban, therefore calling for different strategies on how to deal with highly complex environments. The three scales of design, Landscape, Ensemble, and Object are informed and influenced by one another but have different general aims.

| Landscape | Ensemble | Object |
|---|---|---|
| Re-structuring of the territory | Reterritorialization of land cover and land use | Caring for the environment |
| Establishment of a landscape ecological framework, re-interpreting the existing land mosaic | Establishment of a landscape ecological framework, re-interpreting the existing land mosaic<br><br>Site-specific gradients, operating with conflicts and lack of synchronism between adjance land uses | Regeneration of specific sites and landscapes, increasing the amount of vegetation cover, ofering new habitats for biodiveristy<br><br>Commemoration of unique historical values of the landscape<br><br>Enhancement of the scenic and aesthetic potentials of the sites |

## Design methodology

The design interventions, on all scales, are proposed using a few simple rules of composition and founding elements and unrestrained variants.

Founding elements

I. Earthworks
Earth movements from one site to the other, creating variations in the topography to create distinct conditions for distinct habitats

II. Light-engineering works
Masonry elements, such as an underwater dyke, a retaining wall, an infiltration ditch, or light bridges over the water, establish the conditions for further treatment of the landscape with vegetation and appropriation by users

III. Vegetation
Coverage of the newly-modified topography, increasing vegetation coverage and offering spaces for biodiversity, all while affecting the microclimate of the site

Variants

1. Time
Organization of the linearity of the interventions, defining what comes before and what comes later, the succession of plant species, different dynamicity in the process of adaptation and transformation of a landscape

2. Uncertainty
Acceptance of the unpredictable in terms of the evolution of the conditions on-site, such as vegetation succession, change in land-use patterns and requirements



# First act

## Defining the Landscape

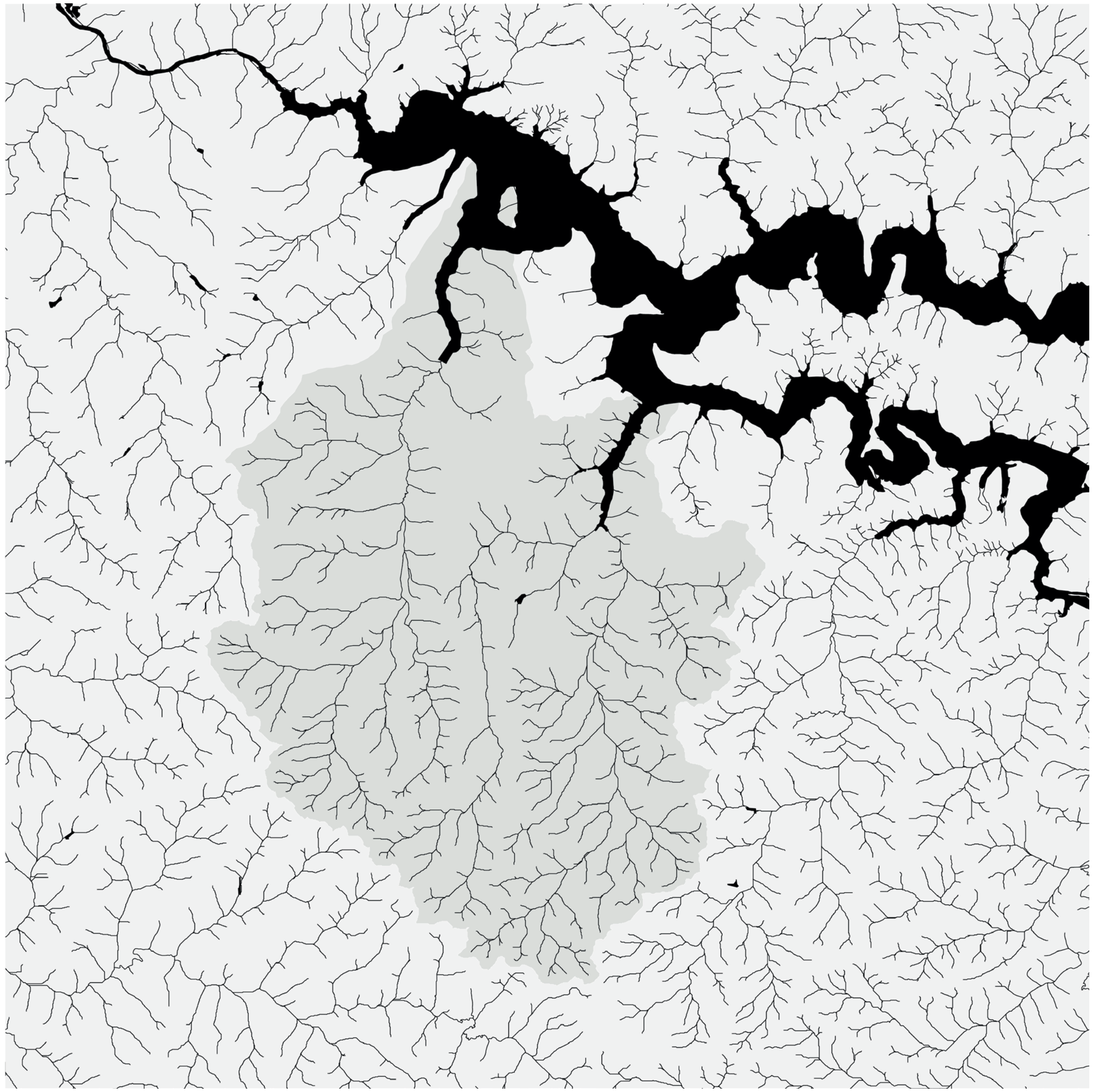
The Landscape is the first testing ground of ideas and spatial interventions for site-specific designs. Deriving from some of the main goals prescribed for the entire Basin, it is within the scale of the landscape that a new spatial framework is put forward.
This new framework should allow for the re-structuring of the territory, establishing a series of corridors of various widths, connecting patches, and serving as habitats for biodiversity themselves. Another set of interventions are those related to the improvement of patch environments and border conditions, especially those adjacent to industrial agriculture croplands.
As the first act of projective reading, a small atlas of the landscape is presented, using an approach of elementarism. The focus is given to one element at a time, eventually culminating in the drafting of a Landscape Synthesis Plan, serving as the basis for projection drawings.
These steps are also repeated for the scale of the Ensemble.

# Elementarism



## Analyzing the components of the Landscape

Hydrography






Topography

Road and Rail transportation

Selected River Basins

Water bodies

0 5 km N



Administrative boundaries

Selected River Basins

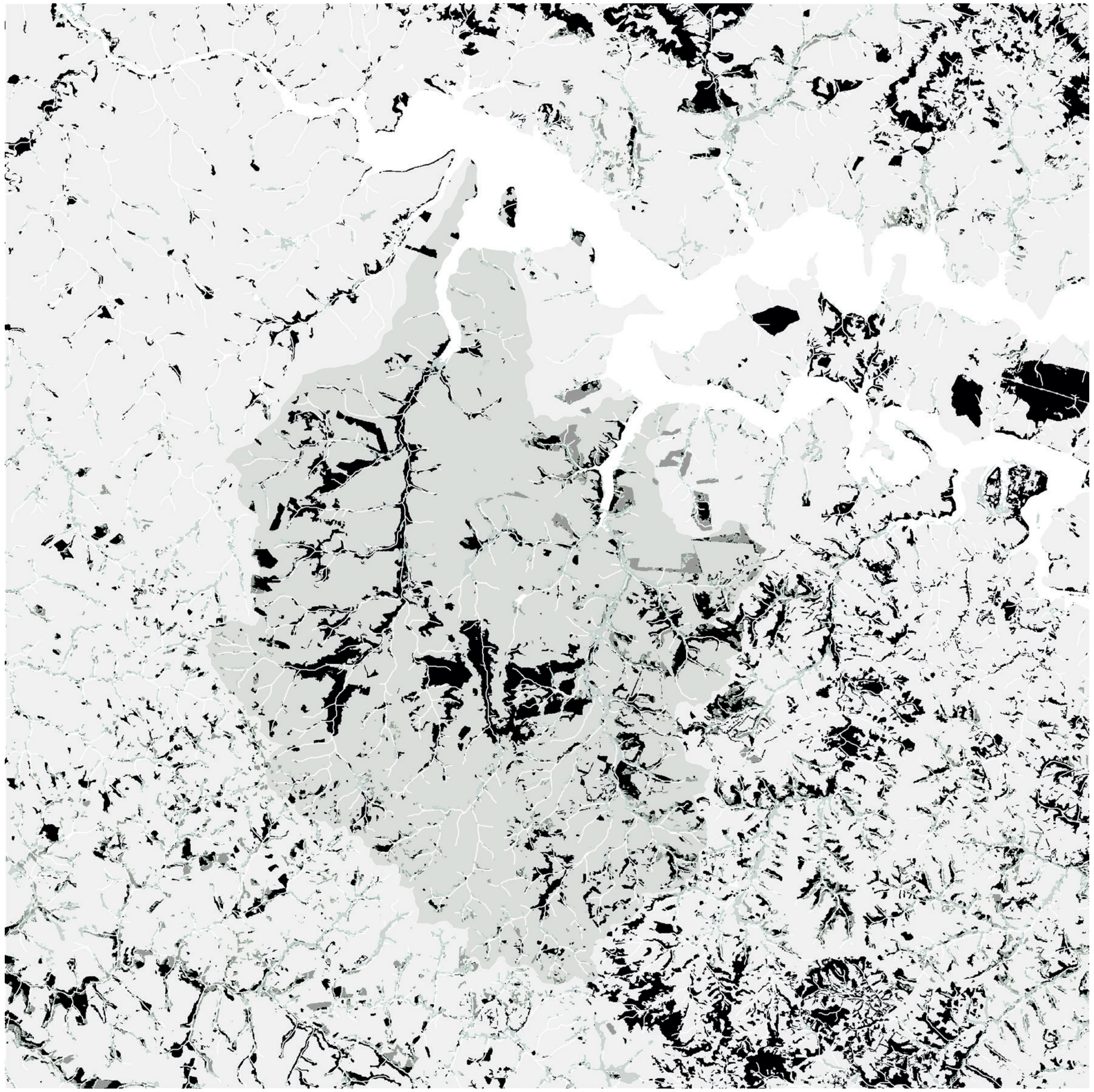
Municipal subdivisions

0 5 km N

Original vegetation remainings

- Selected River Basins
- Natural tropical forest remnants
- Bushes and grasslands
- Riparian vegetation

0 5 km N

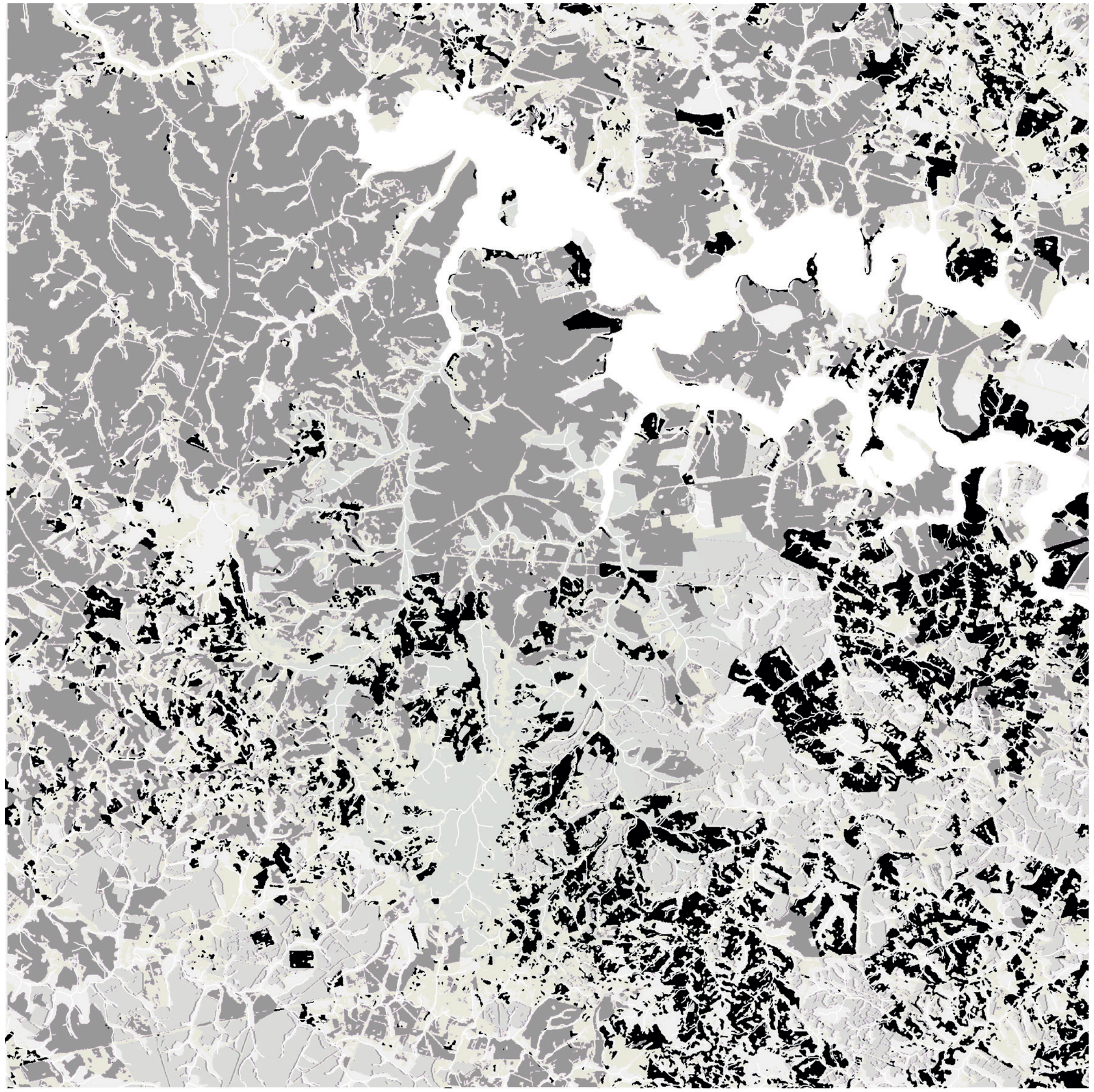




Agriculture land cover

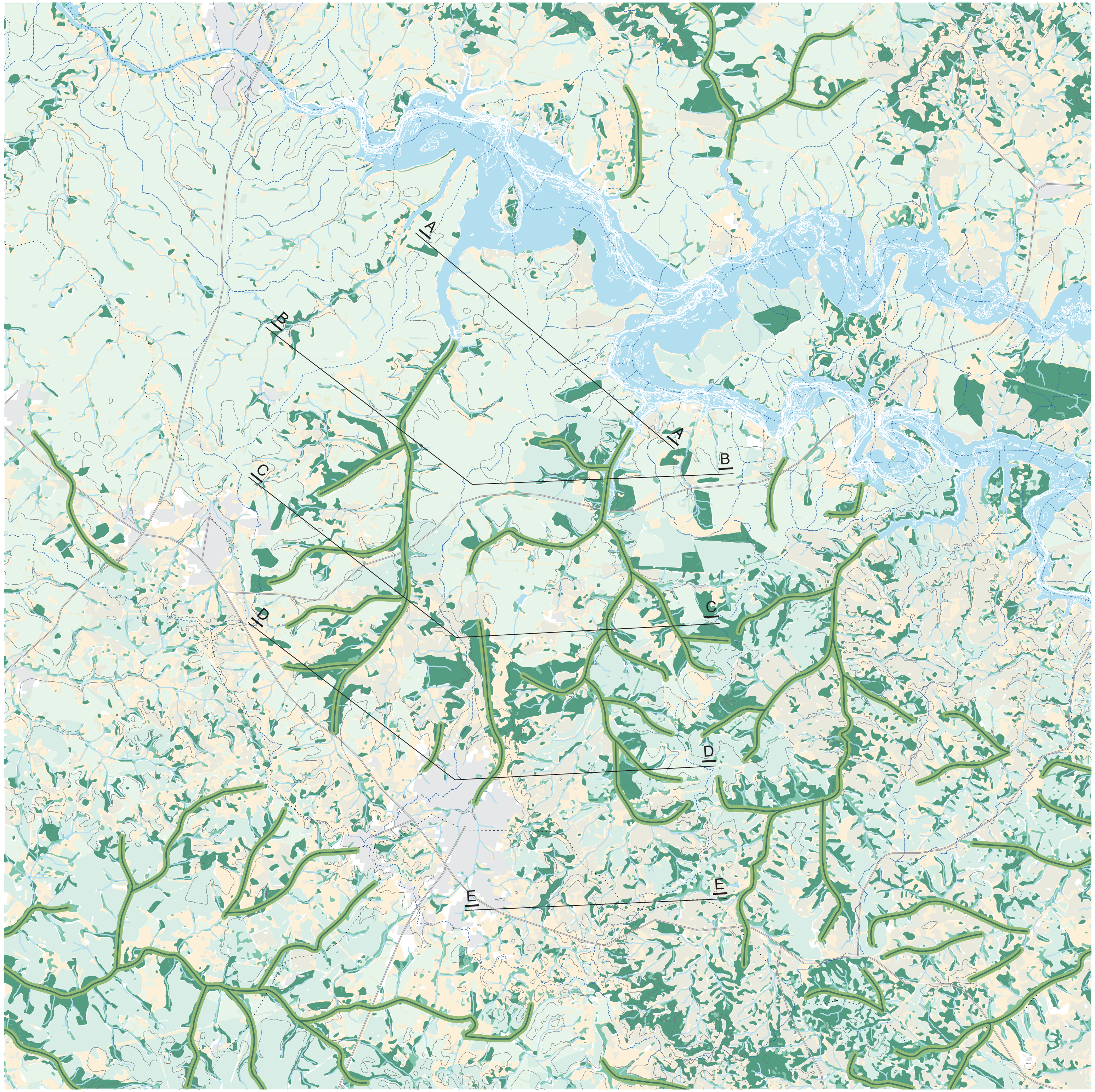
- Selected River Basins
- Tree farming
- Sugarcane
- Cattle ranching
- Other

0 5 km N

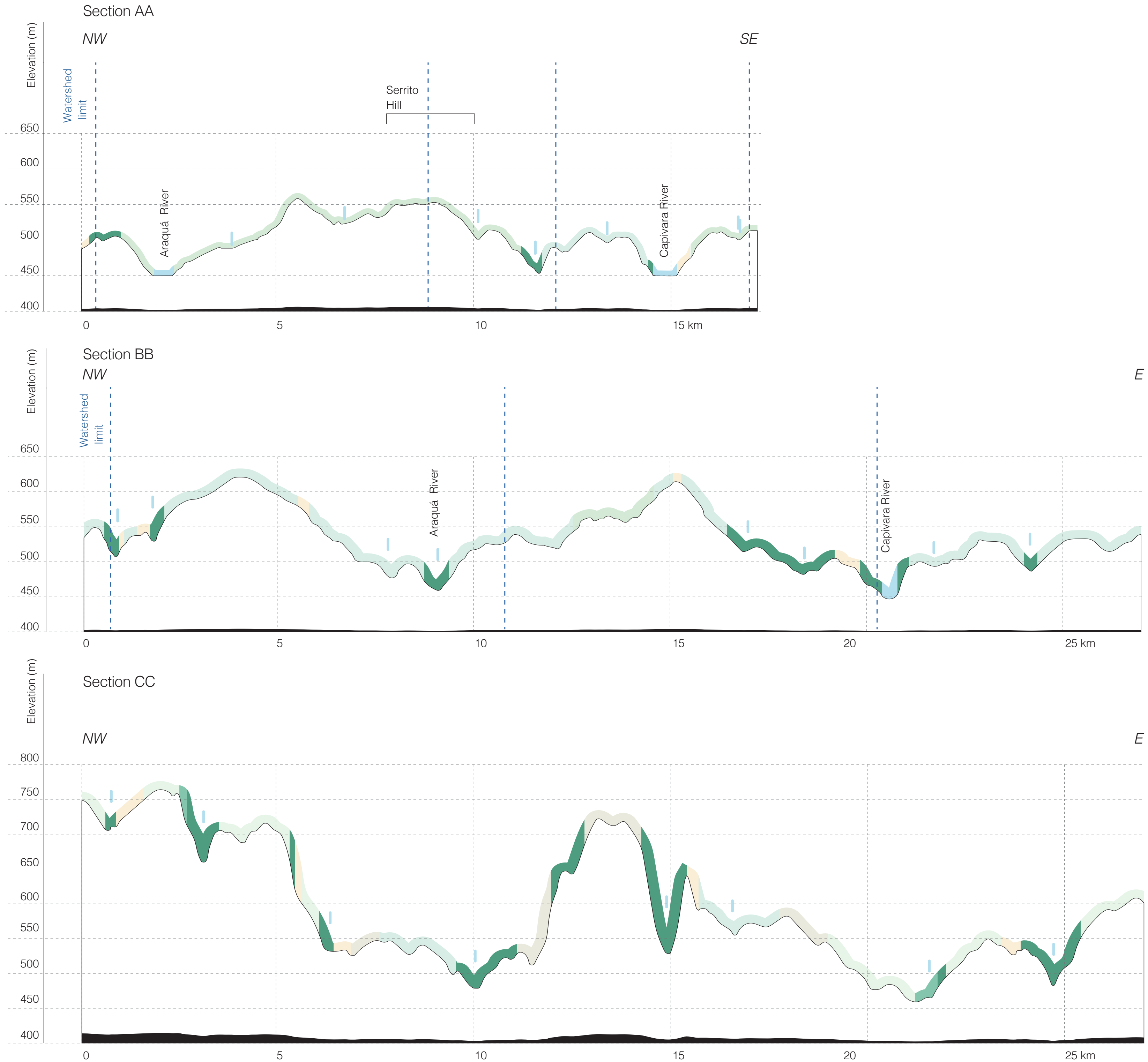


# Landscape Synthesis

## Ecological Landscape

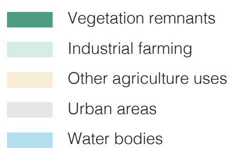


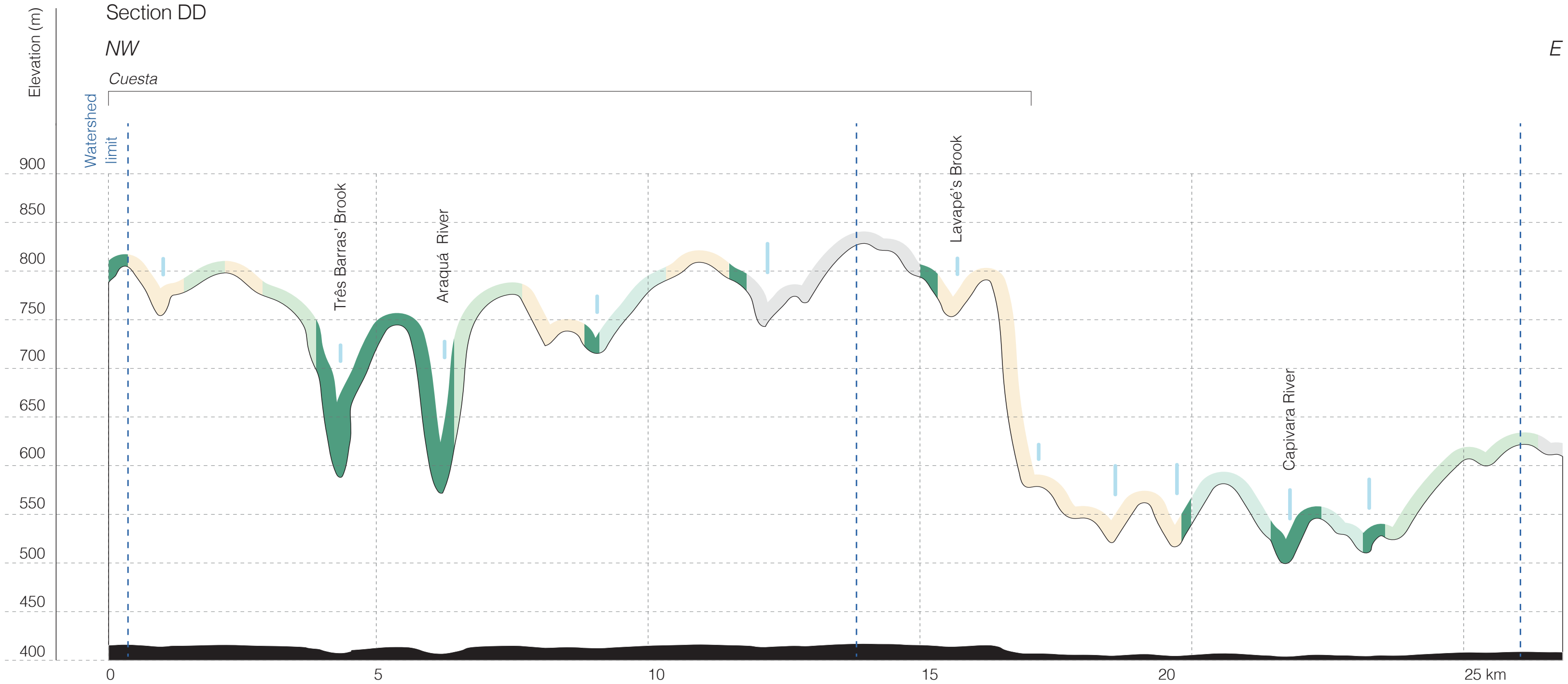

The landscape around the Barra Bonita Reservoir, right at the center of the São Paulo State, and also of the Tietê River Basin is representative of a great deal of the hinterlands of Brazil. An area formerly occupied by a beautiful mix of vegetation of the Atlantic Forest and the Cerrado, the area now is mostly covered in endless sugarcane plantations. The croplands are organized around a few sugar and alcohol plants, forming what might seem like a contemporary feud. As the plants expand their areas of influence by acquiring more land for the harvesting of cane, less and less room for food production, other crops, and biodiversity is left available. Apart from the standardization of the landscape provoked by the expansion of the sugarcane fields since the early 2000s, the construction of the Barra Bonita Dam, in the 1960s, has profoundly altered the water regimes of the water and extinguished a great part of the landscape's uniqueness, the Várzeas, of floodplains, formed along the Tietê River.
Furthermore, the region can be seen as an entryway towards the hinterlands of Brazil, taken over by agribusiness and covered in croplands producing commodities as far as the eye can see.

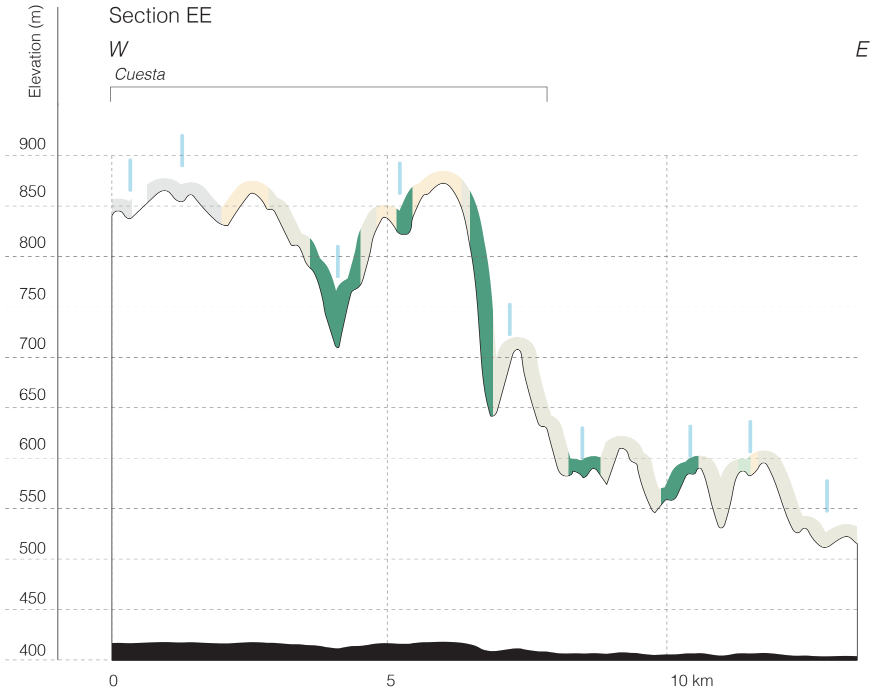


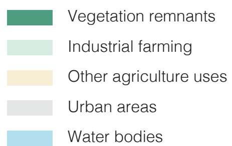



The physiographic conditions of the region are, even after all these severe transformations, still breathtaking. The Botucatu geological formation has it's efflorescence along the *Cuestas* of Botucatu. The *cuestas* are very steep hillslopes separating the lowland from the higher plateaus and mark the areas where the *Guarani* Aquifer comes to the surface, presenting its very limited recharge zone. Therefore, the preservation and regeneration of the landscape are essential not only for scenic purposes and to increase biodiversity, but also to guarantee the water-supply safety of a large part of the state, which uses groundwater from the aquifer for supply.
It is quite striking that very few spots of the remnant of vegetation can be noticed around the area, even less as one goes further north, from the southeastern corner of the map. Most of the preserved patches of vegetation are, however, of dense tropical forest, and not of the bush formations of the Cerrado.
Due to the complex phisiographic omposition of the landscape, alongside with the drafting of the landscape synthesis plan, a set of sections has been drafted, in an attempt to understand if correlations between land use and geographical conditions can be seen.
The land cover of the region has, seemingly, no ordering structure, apart from places of highly-steep terrain and within marked preservation zones, where the vegetation remnants can be found. Overall, it is the single use of the land - crops of sugarcane - that covers the vast majority of the landscape.




Elevation (m)
Section DD
NW
E
Cuesta
Watershed limit
900
850
800
750
700
650
600
550
500
450
400
Três Barras' Brook
Araquá River
Lavapé's Brook
Capivara River
0
5
10
15
20
25 km


Elevation (m)
Section EE
W
E
Cuesta
900
850
800
750
700
650
600
550
500
450
400
0
5
10 km


Vegetation remnants
Industrial farming
Other agriculture uses
Urban areas
Water bodies

# Establishing a new framework





## Components of the new mosaic

The proposed spatial framework has the ultimate aim of orienting the adaptation and transformation of land cover and land-uses, by re-establishing components of the landscape mosaic that have been lost. Using a set of different types of corridors - such as roads, highways, powerlines, rivers, streams, the embankments of the reservoirs, remnant ecological corridors, and so on, it intends to organize the landscape around these lines. The corridors are constructed with the long-term evolution of the place in mind. While the matrix is supposed to keep changing at a fast pace, as industrial agriculture follows global market trends, the corridors should bring continuity to the mosaic.
Furthermore, the patches are enriched by edge zones, or more complex borders, that should allow for the enriching of edge species and improve flows between different patches, therefore improving the conditions for biodiversity too.
Lastly, a few “non-negotiable” areas are proposed. These are areas of exceptional value to the landscape, either by their scenic, cultural or environmental relevance. Examples of these areas are the friction zones between rivers descending the mountains and the reservoir’s flooded areas, which are key spots for biodiversity due to the complexity of these sites, as well as due to the fluctuations in water levels caused by the dam reservoir and periods of rainfall. The hillsides of the *Cuesta* are also protected, not only by their scenic values but also because these are key zones for the recharging of water to the *Guarani* Aquifer. Apart from the slopes of the *cuestas*, all areas with more than 30% of steepness are also marked as special areas for vegetation regeneration, due to their exposure to erosion. Lastly, a large area is proposed to function as an archeological special zone, divided between two different park cores, and adjacent croplands. This area is traced around places where a high number of archeological findings have been made and intend to safe keep this valuable heritage, unique to the region.

Design principles for the Corridors

I. Increase the flow of species between different patches, offering new connections for biodiversity between patches of the same type

II. Create numerous and distinct environments for edge species that are adapted to thin corridors of vegetation

III. Establish the general “lines” of the framework, securing continuity in the urban tissue of the landscape, in contrast with the highly-dynamic matrix covered by agricultural land uses

IV. Add visual depth to the landscape, establishing routes for human flows - tourists and locals - that would use the new, improved pathways.

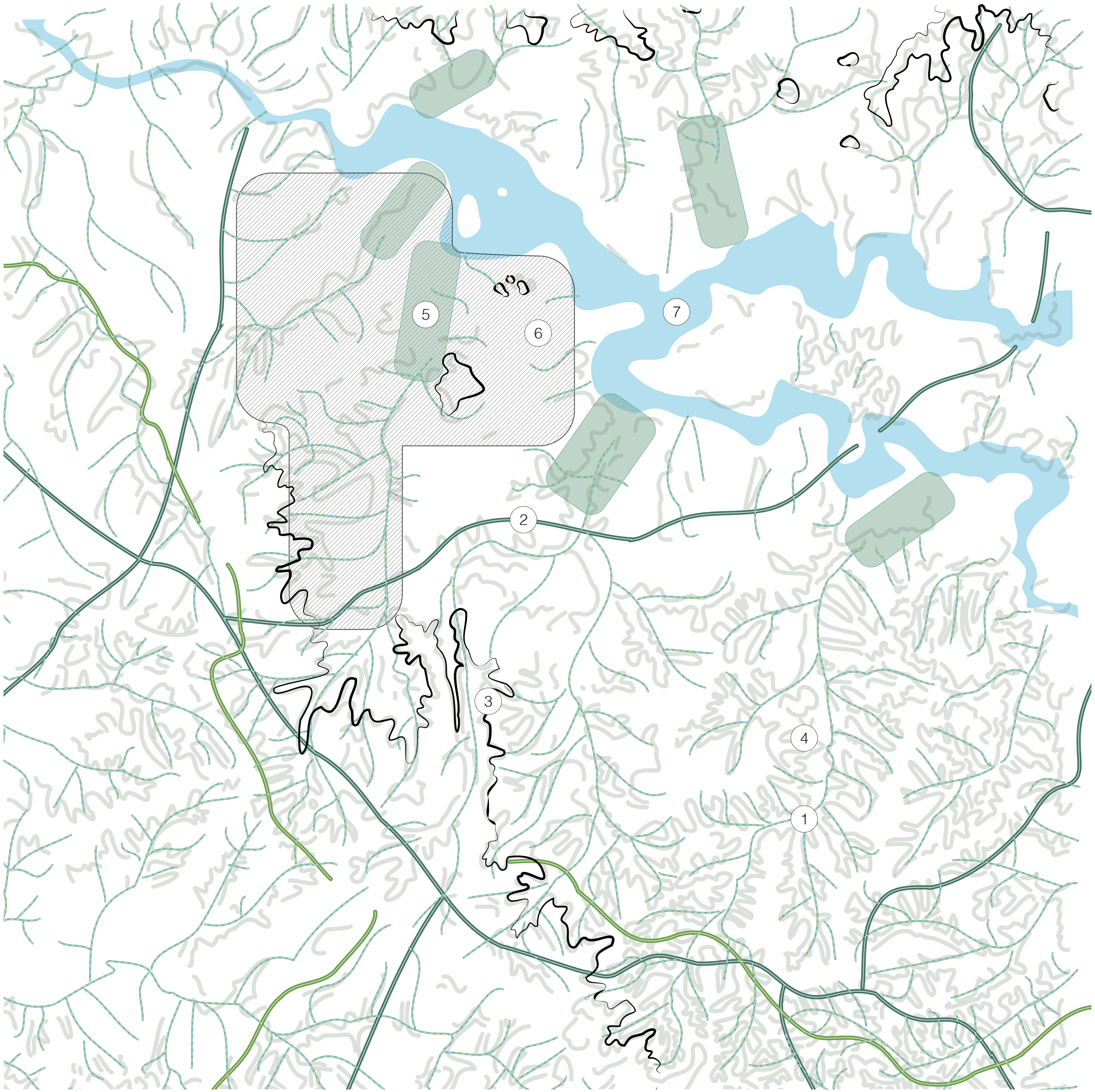
Design intentions for the Patches

I. Preserving existing remnants of natural vegetation found in the landscape, both of Atlantic Forest and Cerrado formations

II. Increase the biodiversity and resiliency of species within the area, by establishing connections between patches of the same type

III. Increase the amount of vegetation cover in the area, helping in water infiltration and groundwater recharge, erosion control and influencing the micro and macroclimates through the atmosphere.

## Intervention on the Mosaic



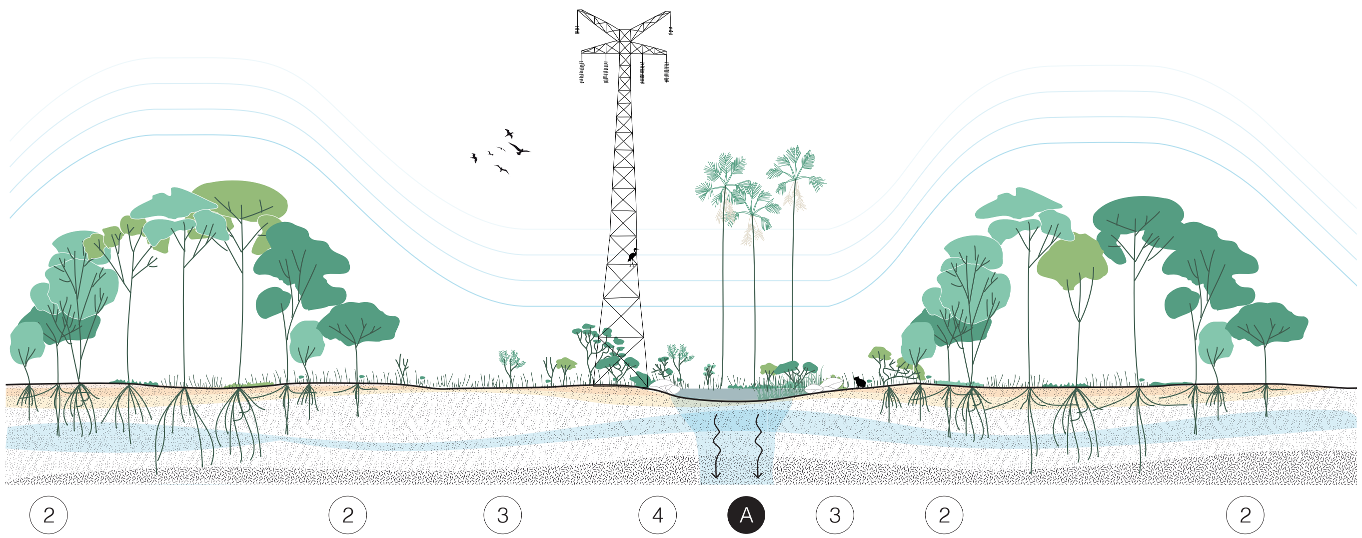

Strategic Site Interventions

1. Establishment of new corridors along rivers and streams
2. Establishment of new corridors along infrastructure
3. Increase vegetation cover along the edges of the *Cuesta*
4. Increase vegetation cover along steep areas
5. Regeneration of tidal-zones
6. Establishment of an area of special interest for safekeeping the archeological findings and history of the place
7. Special treatment for scenic features

# Intervention on Corridors

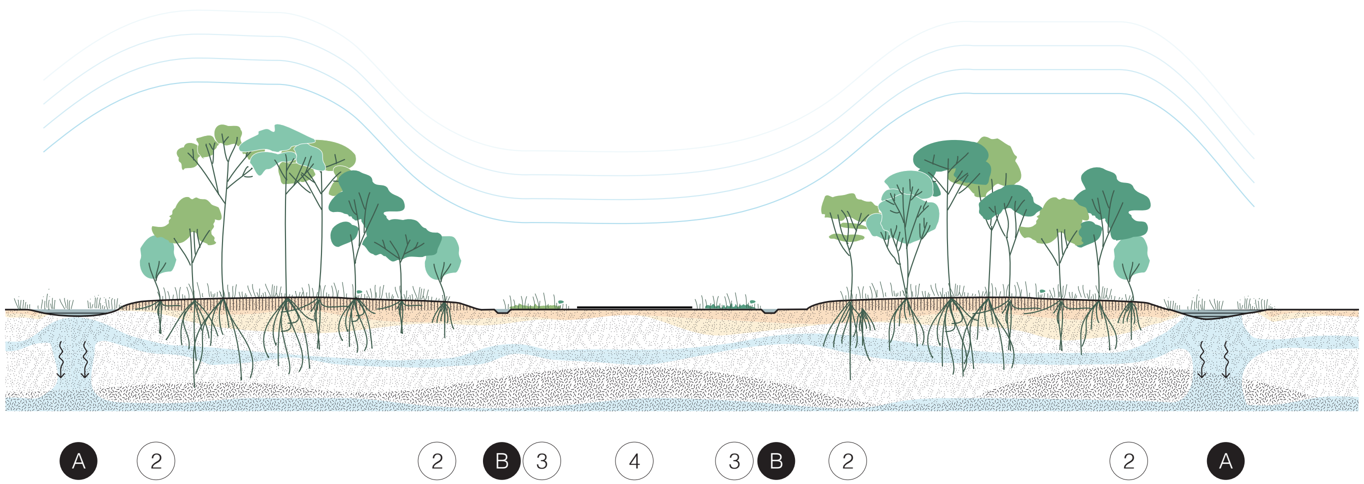
**A. Ecological corridor along powerlines**
Disturbance Corridor/ Introduced Corridor

- Line corridor, wide enough to serve as habitat for edge species
- Compound corridor, with clear Edge, Verge, Internal entity, Verge, and Edge.




**B. Ecological corridor along roads**
Disturbance Corridor

- Line corridor, wide enough to serve as habitat for edge species
- Compound corridor, with clear Edge, Small Verge, Internal entity, Small Verge, and Edge.




1. Interior
2. Edge
3. Verge
4. Internal Entity
5.Veil
6. Mantel
7. Cropland

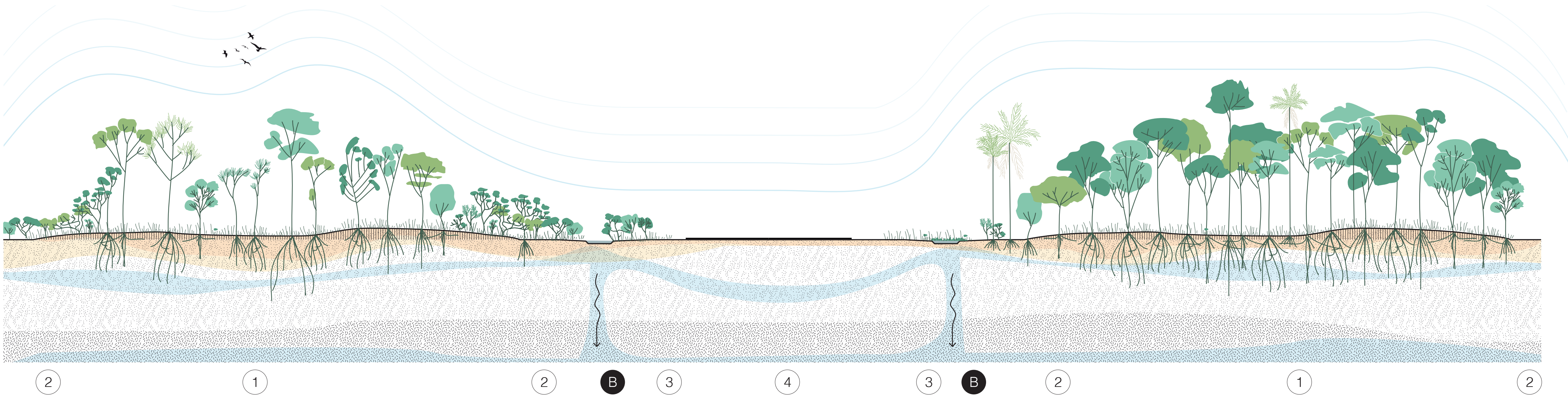
A. Infiltration Pond
B. Ditch
C. Constructed Wetlands
D. Wooden Piling

0 10 20 m

**C. Ecological corridor along highways**

Disturbance Corridor

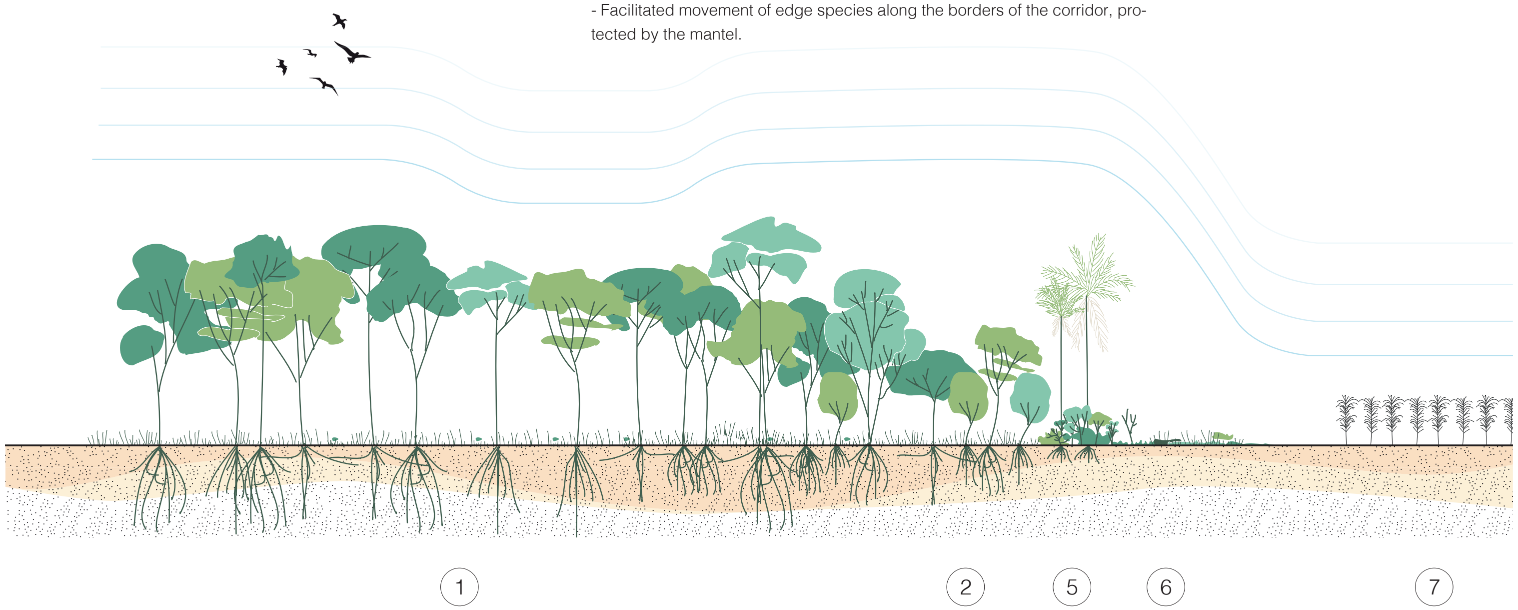
- Strip corridor, wide enough to serve as habitat for edge and interior species
- Compound corridor, with clear Edge, Interior, Edge, Large Verge, Internal entity, Large Verge, Edge, Interior and Edge.




**D. Remnant green corridors**

Environmental Corridor/ Regenerated Corridor

- Strip corridor, wide enough to serve as habitat for edge and interior species
- Adjacent areas freed-up to further development of the corridor's edges, adding a mantel and veil to the woods.
- Facilitated movement of edge species along the borders of the corridor, protected by the mantel.




1. Interior
2. Edge
3. Verge
4. Internal Entity
5. Veil
6. Mantel
7. Cropland

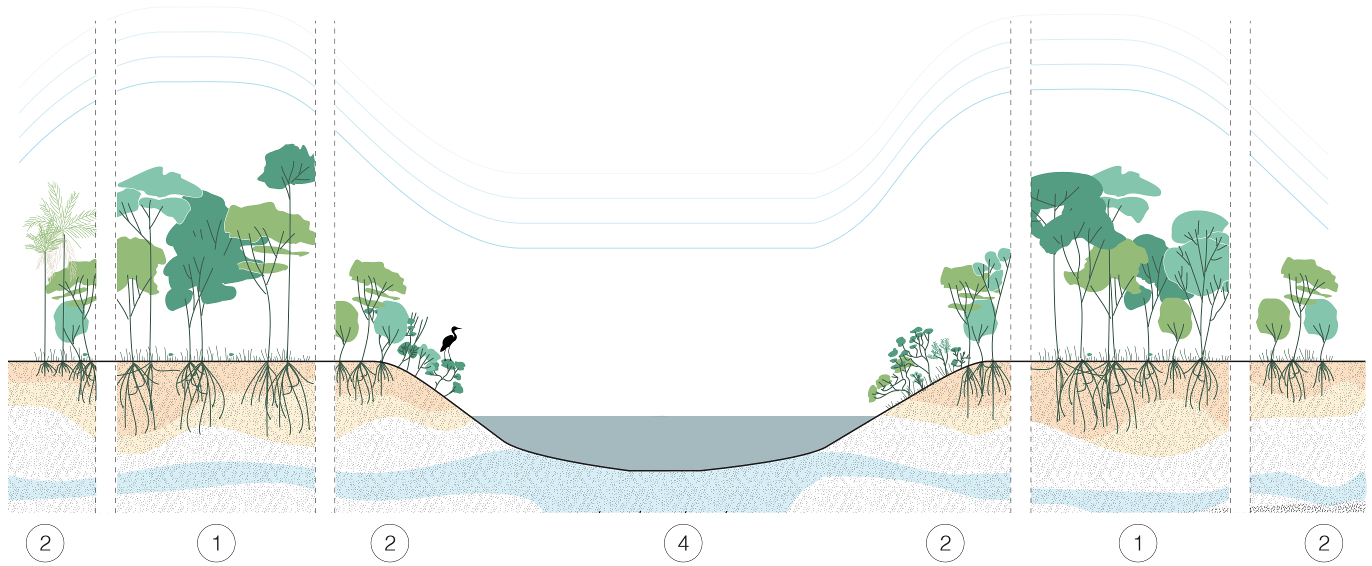
A. Infiltration Pond
B. Ditch
C. Constructed Wetlands
D. Wooden Piling

0 | 10 | 20 m

**E. River Corridor**

Environmental corridor

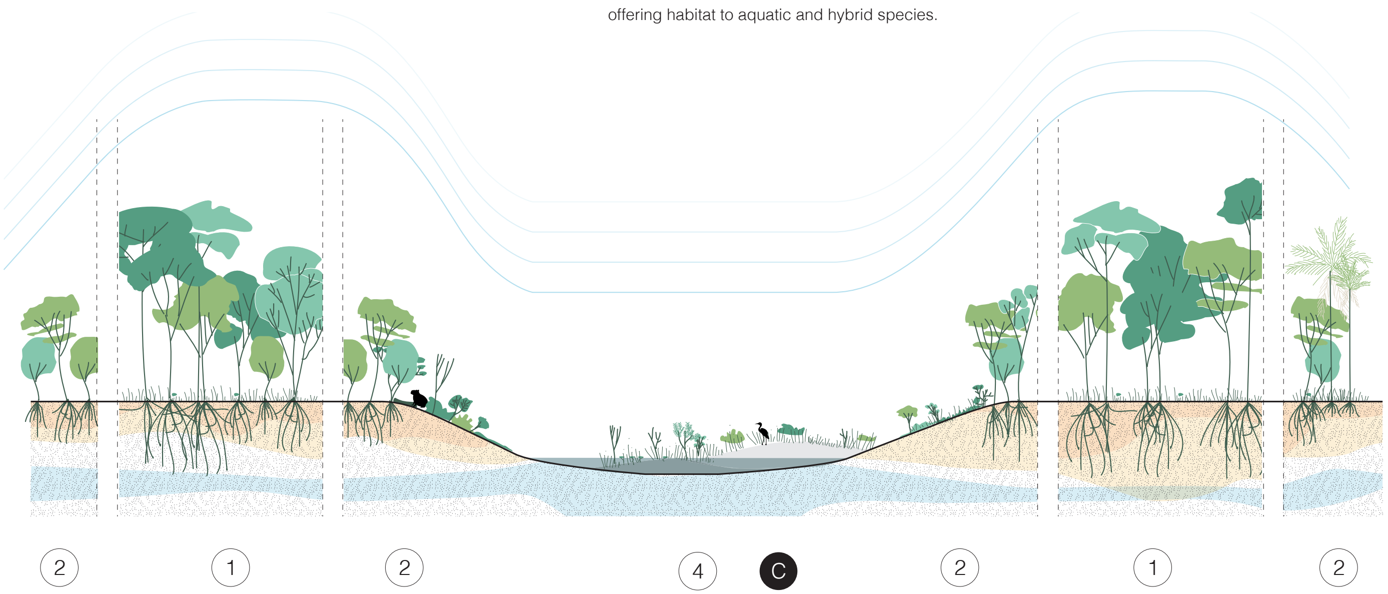
- Strip corridor, wide enough to serve as habitat for edge and interior species
- Compound corridor, with clear Edge, Interior, Edge, Internal Entity, Edge, Interior, and Edge.




**F. Floodplain Corridor**

Environmental corridor

- Strip corridor, wide enough to serve as habitat for edge and interior species
- Compound corridor, with clear Edge, Interior, Edge, Internal Entity, Edge, Interior, and Edge.
- Complex Internal Entity, with plantings on riverine islands or sandbanks, offering habitat to aquatic and hybrid species.




1. Interior
2. Edge
3. Verge
4. Internal Entity
5.Veil
6. Mantel
7. Cropland

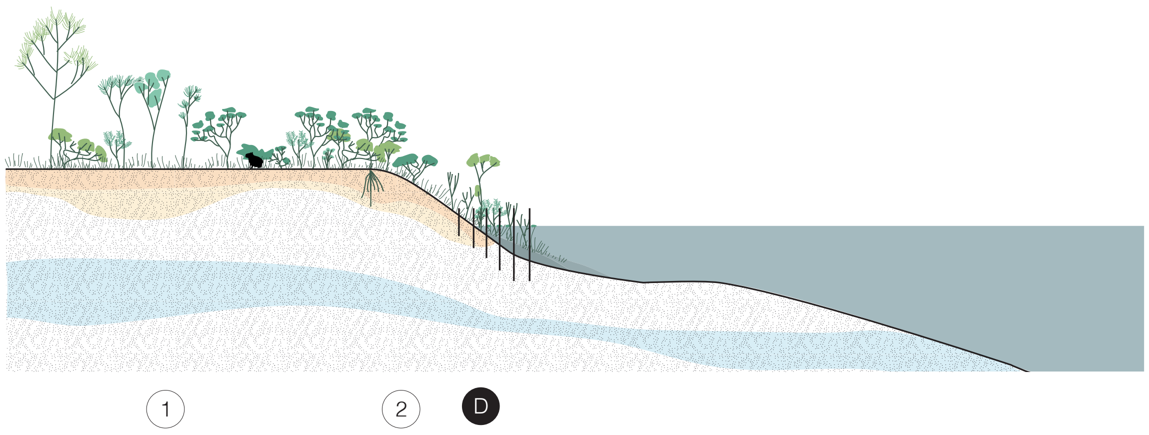
A. Infiltration Pond
B. Ditch
C. Constructed Wetlands
D. Wooden Piling

0 10 20 m

**G. Reservoir Corridors**

Regenerated Corridor

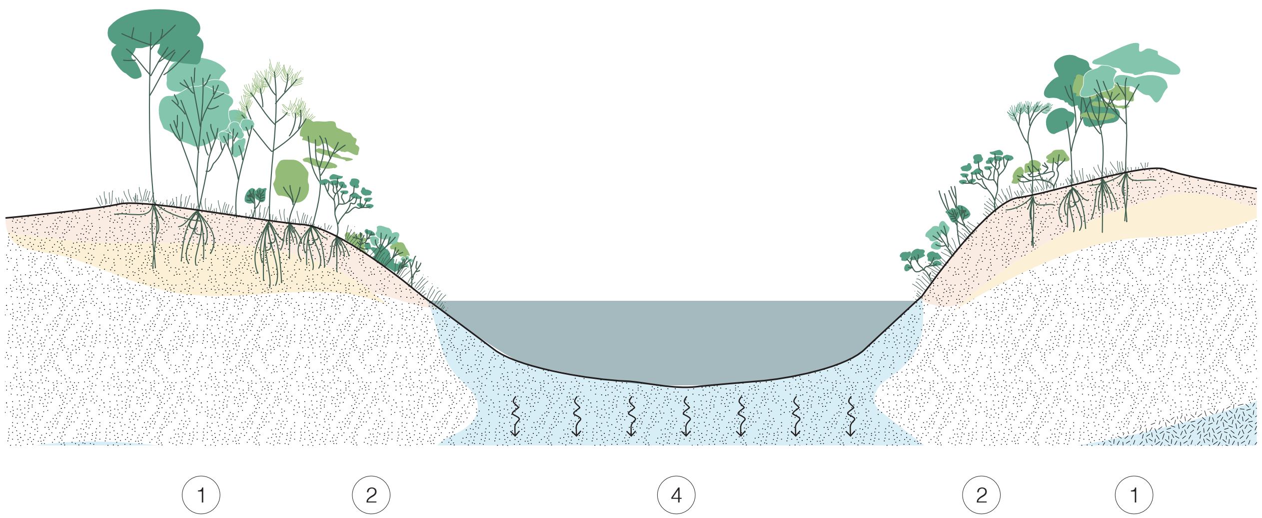
- Strip corridor, wide enough to serve as habitat for edge and interior species
- Compound corridor, with clear Edge, Interior, and Edge
- Vegetated strip extended until the top of the hillslope, guaranteeing freedom of movement for biodiversity




**H. Flooded Areas from Hillslope to Hillslope Corridor**

Regenerated Corridor

- Strip corridor, wide enough to serve as habitat for edge and interior species
- Compound corridor, with clear Edge, Interior, and Edge
- Vegetated strip extended until the top of the hillslope, guaranteeing freedom of movement for biodiversity




1. Interior
2. Edge
3. Verge
4. Internal Entity
5.Veil
6. Mantel
7. Cropland

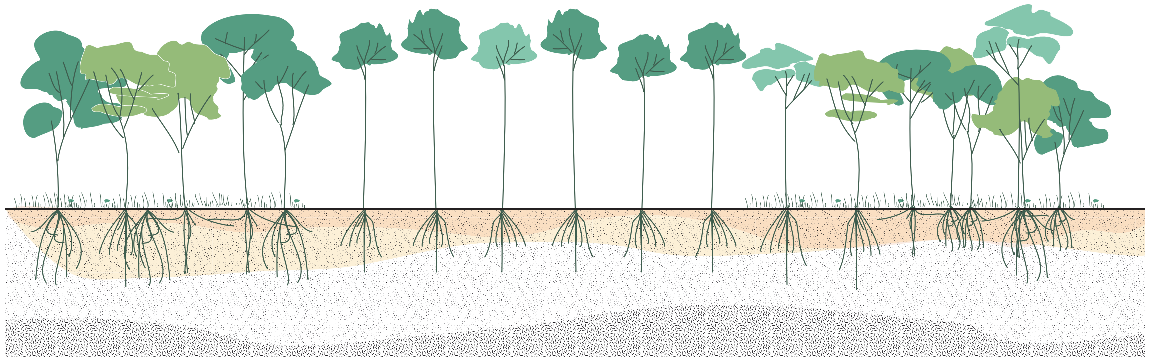
A. Infiltration Pond
B. Ditch
C. Constructed Wetlands
D. Wooden Piling

0 10 20 m

## Intervention on Patches

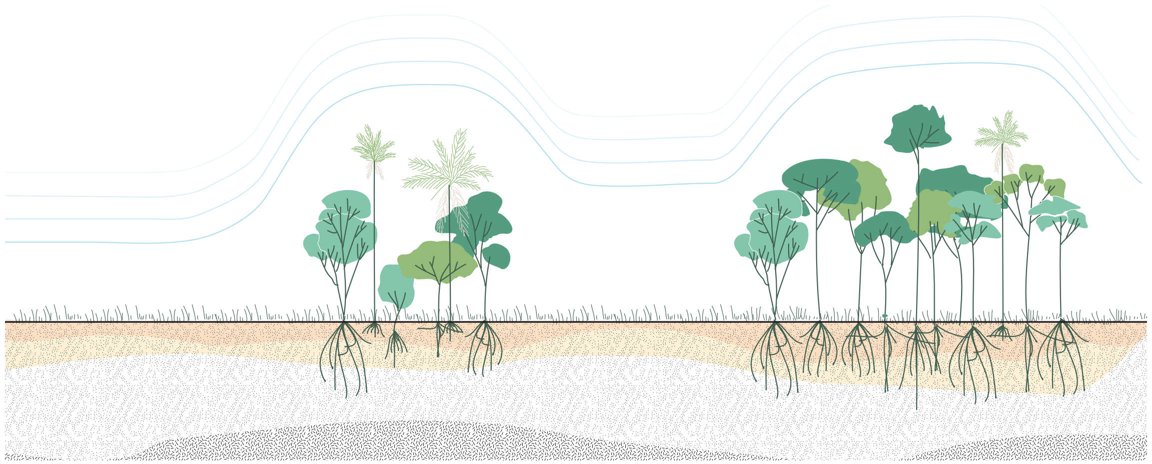
**A. Bond Areas**
Between two separate, relatively close enough patches

- Controlled usage, with recommend land uses that do not interfere too much with movements of species between the distinct patches;
- Recommended usages such as Agroforestry, Orchards and Nurseries;
- Criterious selection of species, dialoguing with the neighboring patches;

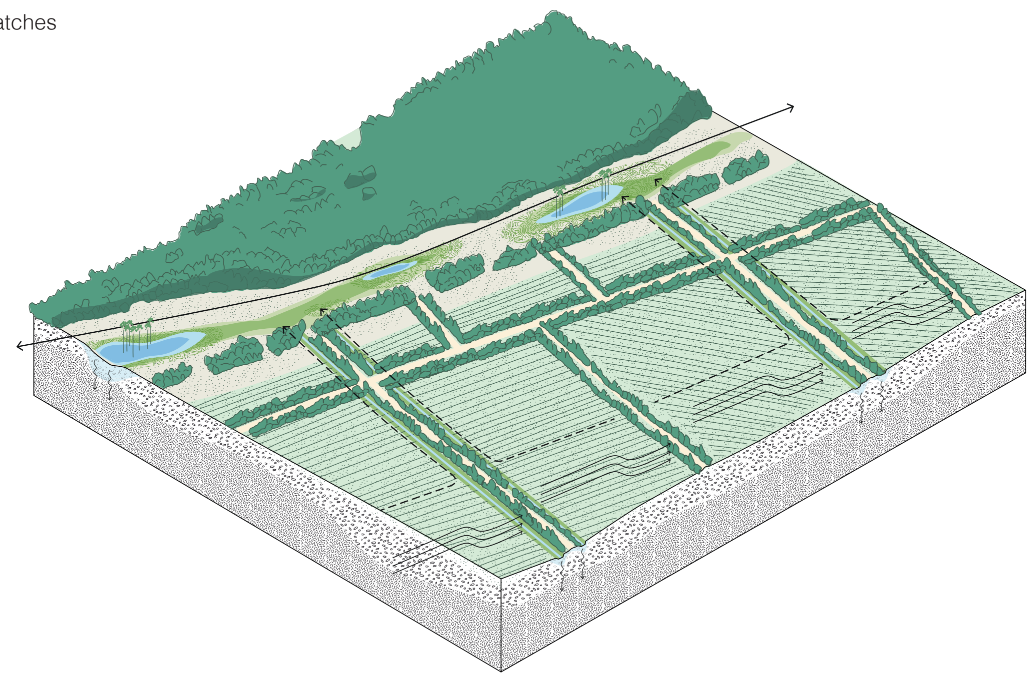


**B. Edge Patches**
Tiny patches along boundaries of larger patches

- Line corridor, wide enough to serve as habitat for edge species;
- Preserved areas, including the field areas between the tiny patches and remnant patches;
- Creation of areas of field-vegetation landscapes of the Cerrado;



Edge Patches



# Second act





## Intervention on the Ensemble

The Ensemble forms the intermediate scale between the Landscape (50 km) and the 1-5km scale of the architectonic objects. It better translates how the open space is felt and perceived on the ground. In this intermediate scale the relations and exchanges between different elements composing a landscape become evident, but also conflicts and disputes between different land uses and associated cultures.
The juxtaposition of industrial agriculture with small-scale food farming, for instance, can be disastrous. With the loosely regulated practices adopted by the monocultures present in the area - such as the application of pesticides and fertilizers using small airplanes - the integrity and safety of local farmers could be jeopardized. With the idea of reprogramming a piece of the countryside as a prototype for changing land-cover patterns and fine-graining the ecological mosaic, an area around the Reservoir of Barra Bonita has been selected to serve as the Ensemble site. An interesting mix of different types of crops, and their associated land patterns, together with relevant remnants of natural vegetation, the existence of transportation infrastructure, and proximity to the waters of the reservoir make this Ensemble area a prime spot for testing ideas and solutions for improvement of the ecological conditions on the countryside.

Aerial photograph of the Ensemble area, along the Barra Bonita Reservoir.
Source: Google maps, 2022

Photographs of the Barra Bonita reservoir and the Capivara River Tidal zone.

Source: Mapio, 2022

A tributary of the Capivara River

Source: Mapio, 2022

A rural road of *terra roxa*, or red ground
Source: Mapio, 2022

# Elementarism

## Analyzing the components of the Ensemble

Hydrography


Topography

Road and Rail transportation




Land parcelling

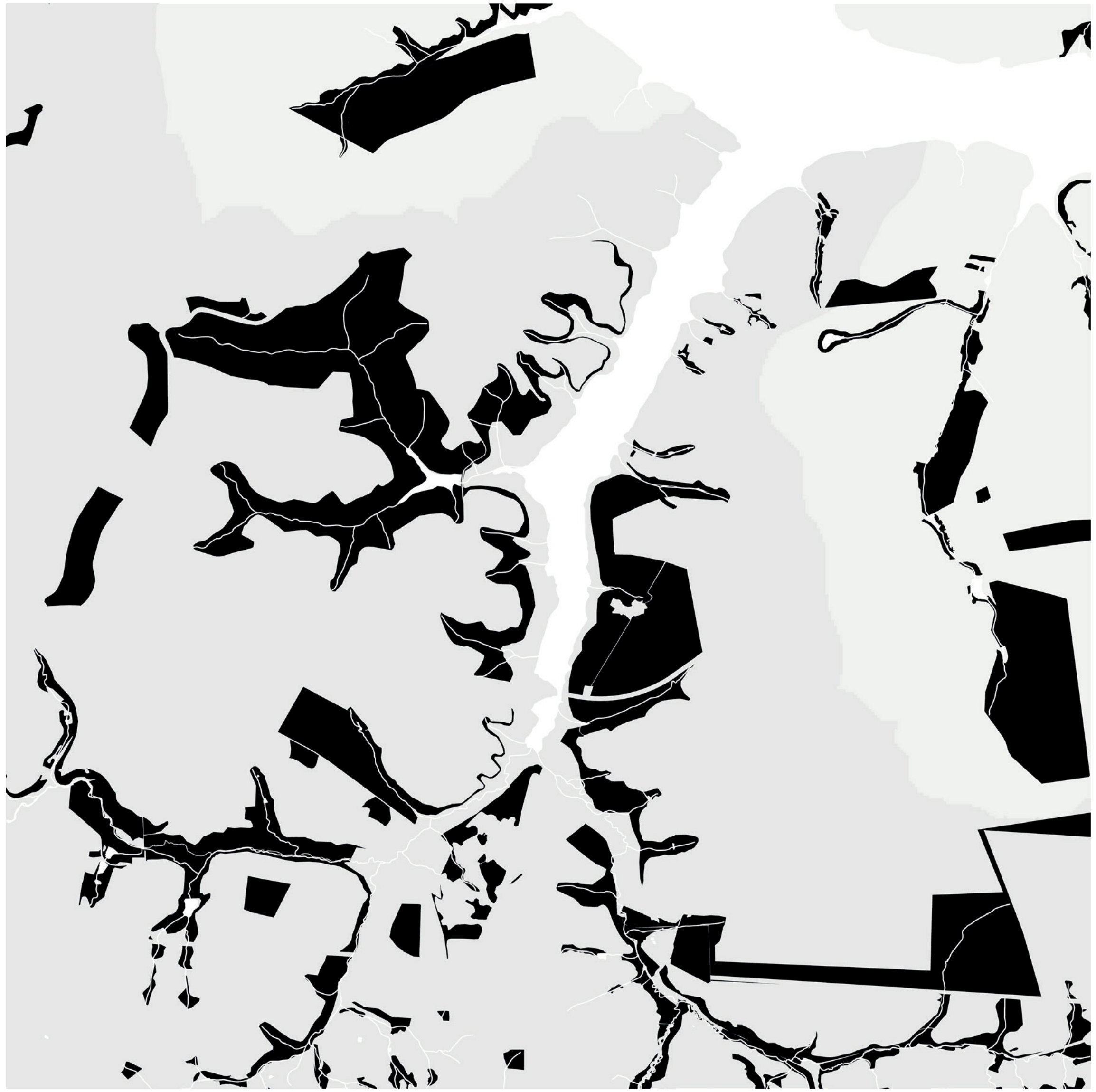
Conservation areas enforced by law





Original vegetation remnants

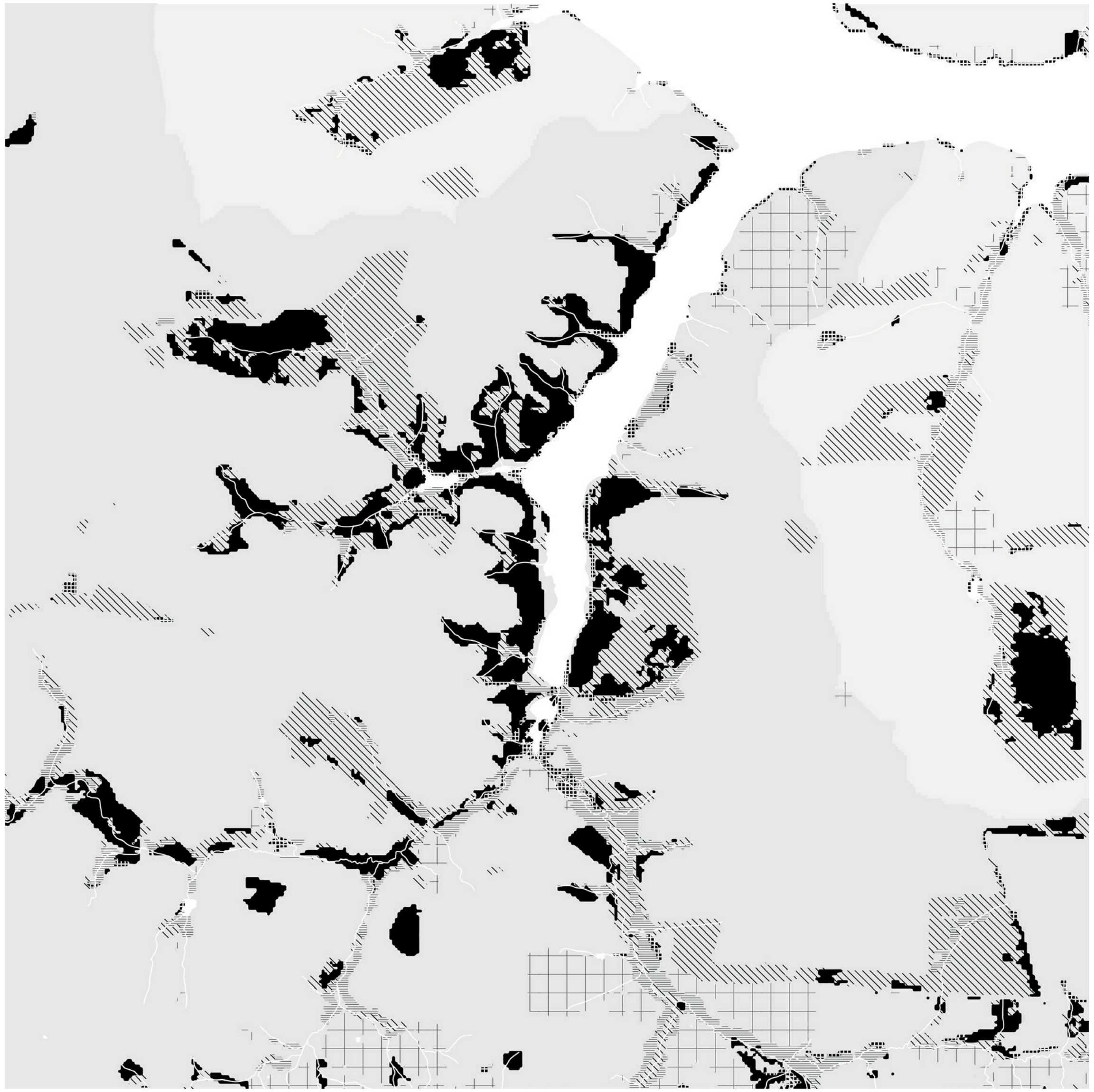




Type of remnant vegetation

- Selected River Basins
- Tropical vegetation
- Bushes and shrublands
- Riparian vegetation
- Grasslands

0 1 km N





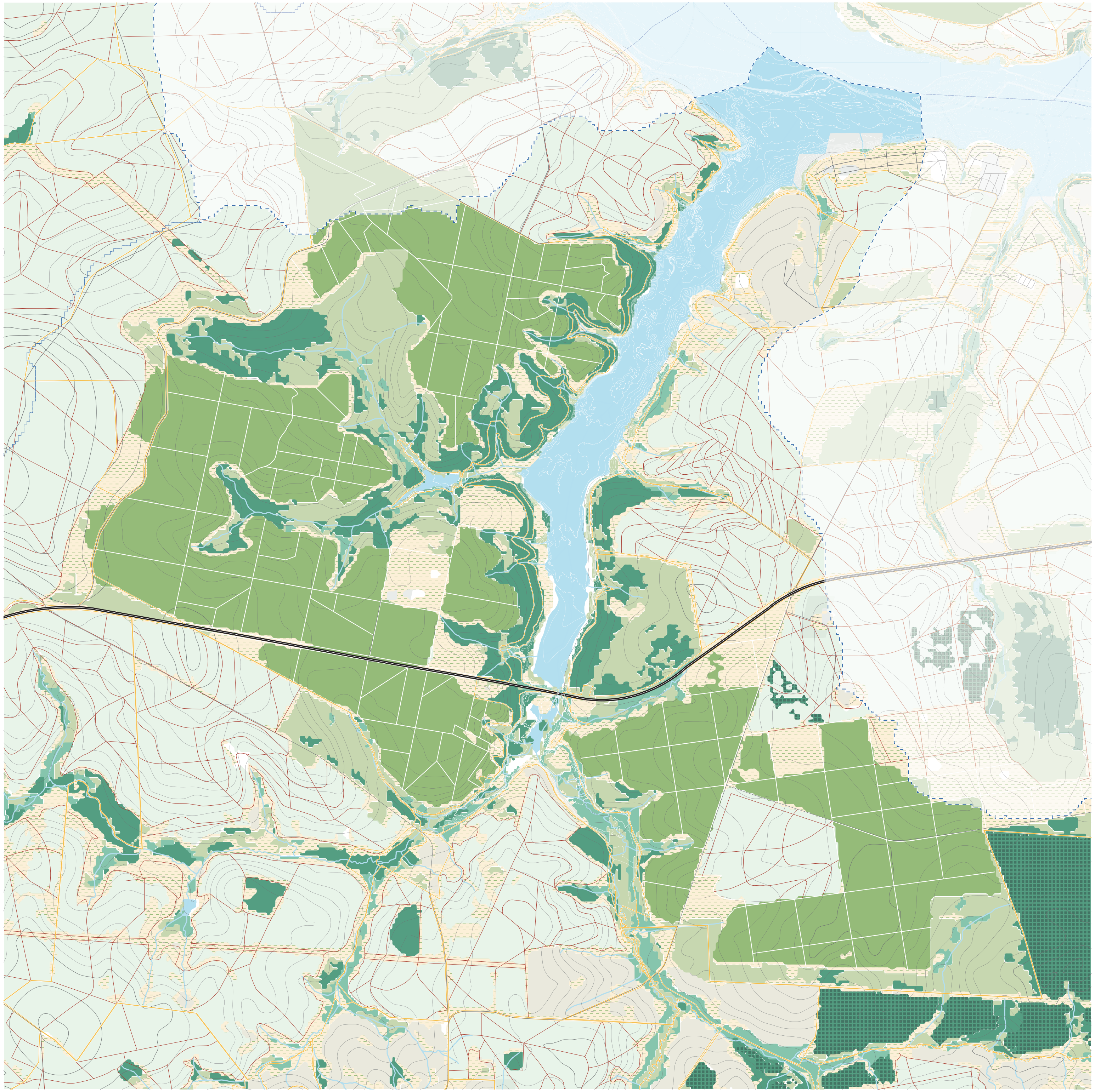
Type of land use

- Selected River Basins
- Urban
- Bushes and shrublands
- Sugarcane crops
- Orange orchard
- Cattle ranching
- Agroforestry

0 1 km N

# Synthesis of the Ensemble

## Ecological Landscape



The ensemble is where the spatial relations between different elements constituting a landscape are better expressed. In this case, the few remnants of vegetation are tied to the water edges, within the riparian zones protected by law. The reasons why some streams have wider riparian zones around them are unclear. However, considering that these patches of vegetation are - according to the databases and analysis of satellite images - remnants of the original Atlantic Forest, they could have been kept by former landlords for the purpose of gaming and recreation.

The matrix is mostly covered in croplands of sugarcane and orange groves. These are two of the most important agricultural products of the State, and the ways of occupying the land that they determine are very representative. Orange groves' grids are not so tied to the natural contour of the land and are planted in a tight grid structure, of about 1x1km. On the other hand, sugarcane fields are usually planted following the natural terrain contour lines, as the heavy machinery used for the harvesting of cane runs parallel to the height lines to avoid sliding.

It can be observed that there are no clear intentions behind the ecological structure of the site, with the vegetation patches aligned to the riverine areas, and a few scattered pockets of vegetation within the vast fields. The proposal calls for a fine-graining of the ecological structure - adding thin and wider corridors along highways, local roads, and power lines - as well as windbreakers in the large industrial agriculture fields to prevent wind erosion. As to the slowing down of water runoff, in the case of a cloudburst event during the summer months, the riparian zones along the reservoir should offer better protection against the pollution of water by agricultural runoffs.

0 1 km N

- Riparian vegetation
- Woodlands
- Crop land
- Pasture land
- Crop and pasture land
- Urban areas
- Property division lines
- Pathways
- Highways
- Railways
- Height contour lines (100m)
- Sub basin contours
- Hydrography

# Reading of form in time

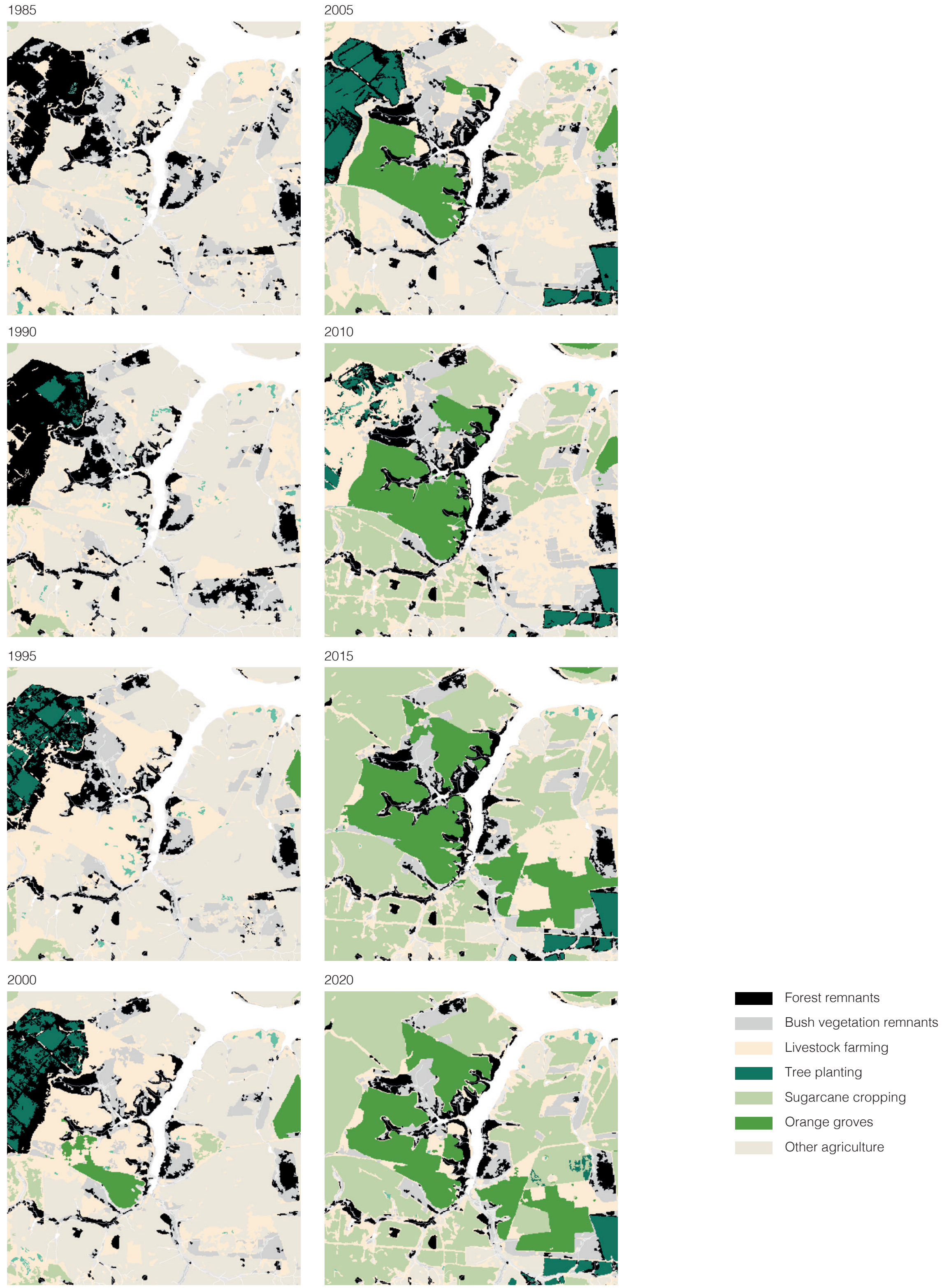
## Finding the *Longue-Durée*

With its urbanization starting in the 19th century with the expansion of coffee farms towards the interior of the State, the area around the present Barra Bonita Reservoir has seen its land cover change several times

By observing the evolution of land use and land cover in the area of the Ensemble, it becomes clear that, along with the main findings of the Longue-Durée from the early stages of the research (the physiographic composition of the site and the ties between the development of the capital City of São Paulo and the hinterland of the Basin), another long-lasting character of the site is the presence of extractive agricultural practices.

During the last 40 years, the site has seen the presence of natural vegetation diminish considerably, while the expansion of industrial agriculture has accompanied the surge in commodities production and production of sugar cane for the production of biofuels in Brazil.

It can be inferred that even if limits to the extraction have to be imposed, especially considering the climatic, food, and social crises that the country faces, extractive agriculture will continue to be part of the composition of the landscape. Part of the design's aim should be, therefore, to accommodate areas for this type of production, having in mind the suitability insights gathered during the elaboration of the general framework and conflicts between different uses, such as small farming practices and large monocultures that use pesticides and fertilizers heavily, harming the harvesting and quality of food produced by local farmers.

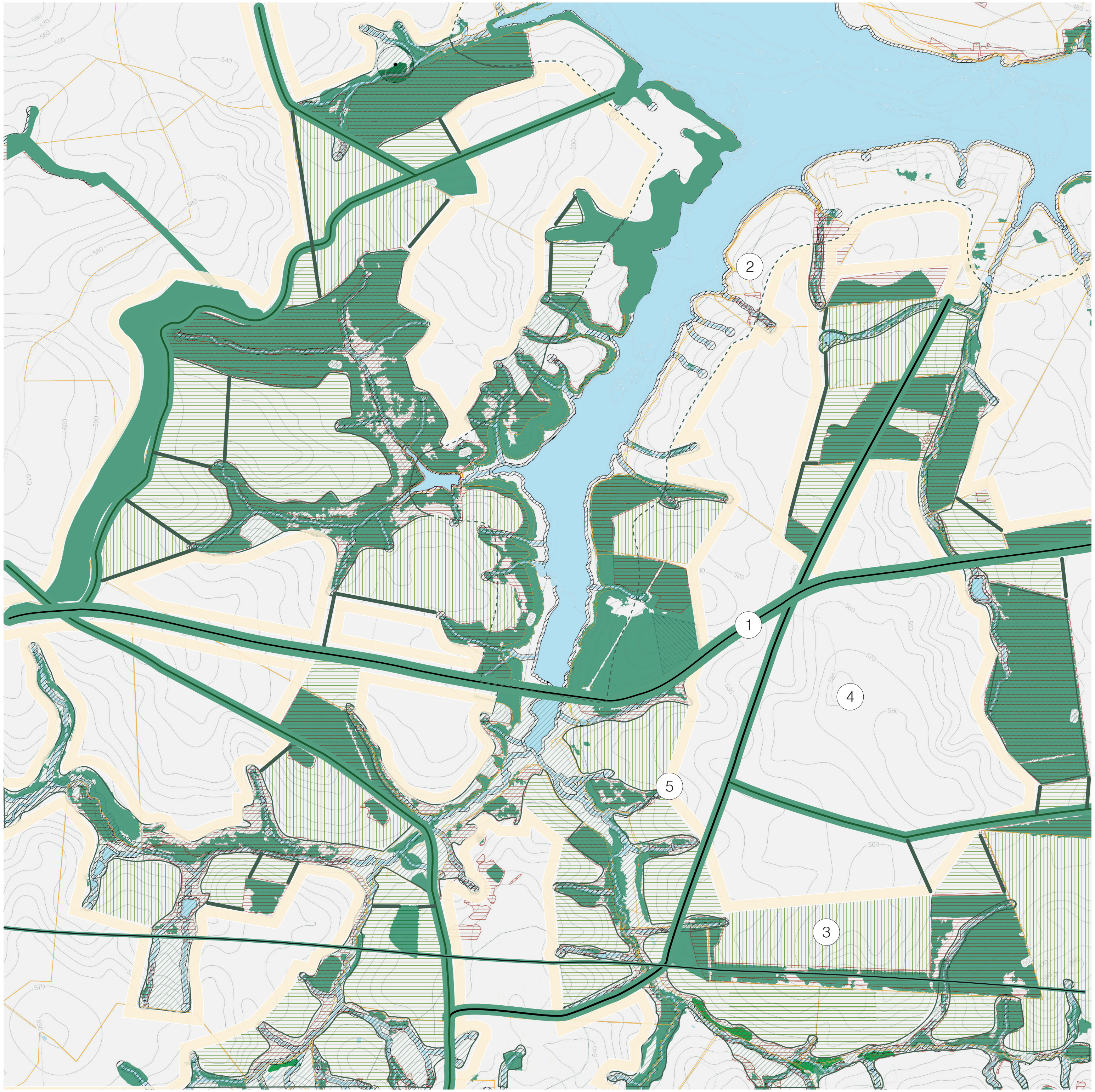


# Fine-graining the Framework





## Getting specific with corridors, patches and matrix




At the scale of the Ensemble, the framework prescribed at the scale of the Landscape gains more detail and depth. The different typologies of corridors and patch-edge treatments are applied to local contexts, forming a new land mosaic on this intermediate scale between the landscape and the very local architectonic object.
As a way of synchronizing the different spheres of protection of land and remaining vegetation, as well as extending the perimeter of the riparian zones to better suit the vastness of the water bodies, as well as offering connections between different patches, Integral Zones of Regeneration are proposed as a new spatial element to the mosaic.
These integral zones encompass the larger river and stream corridors, as well as adjacent patches and water spring areas.
Another new type of zone, the Edges, are proposed for areas in-between remnants of vegetation, large-scale industrial farming, small-scale farming, and water features.

Strategic Site Interventions

Re-structuring
1. Creation of new corridors and strengthening of existing ones
2. Definition of Integral Zones of Regeneration

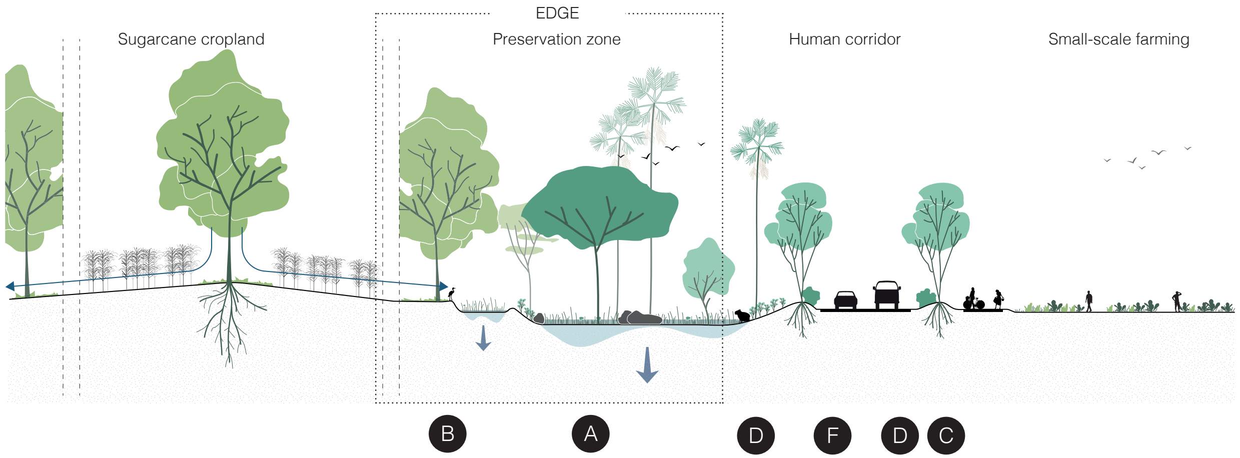
Re-territorializing
3. Definition of areas with limited occupation and land use patterns
4. Definition of areas that are more suitable for industrial farming, away from inhabitation and food production areas, or protected by Edge zones
5. Definition of Edge Zones, acting as borders between conflicting land uses

0 1 km N

## Establishing a new gradient

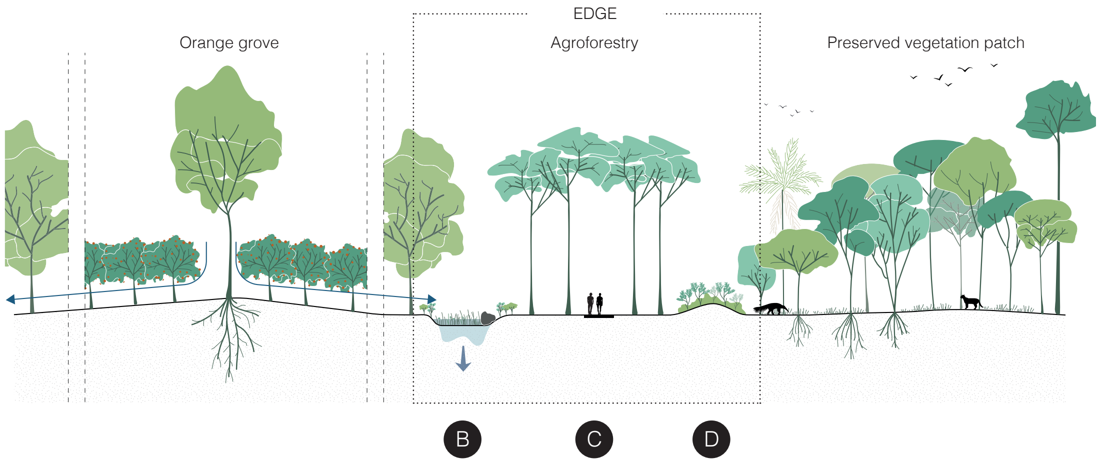
**Composition A**

Industrial agriculture | Edge | Small scale farming



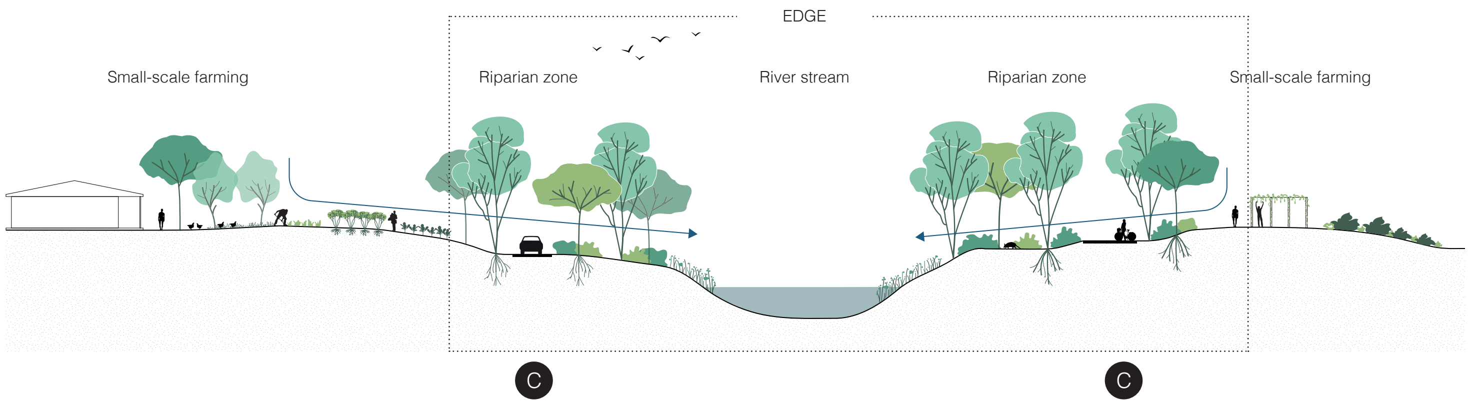

**Composition B**

Industrial agriculture | Edge | Vegetation remnant




**Composition C**

Small scale farming | Hybrid corridor | Small scale farming




The gradient mediates conflicts between areas destined for intense industrial agricultural production, remnants of vegetation, areas for small-scale farming, and water bodies.

The edge zones, in a free translation from the french *lisière*, as described by Michel Desvignes (2021), join different land uses, associated with different cultures and ways of cultivating the land, creating a very particular type of space that defines a permeable border between different land-uses.

Edge areas are either used for alternative agriculture practices - such as agroforestry and silviculture - or as infiltration zones for water management and recharging of groundwater while offering wild species different environments in the form of ecological corridors.

The limits of the edges are not determined by fencing - as they should be permeable to passersby, acting as a leisure and recreation zone for the locals and tourists - but rather by gentle markings on the landscape, put forward by small earthworks. Small ditches and gentle slopes determine the edge's boundaries, which are lined with trees, bushes, and public-access pathways.

The maintenance and care necessary for the edge should be split between municipal governments, local farmers, large farming conglomerates, and tourism institutions.

A. Infiltration Pond
B. Ditch
C. Public pathway
D. Mound of earth
E. Wind-breaks
F. Alleys

0 10 20 m

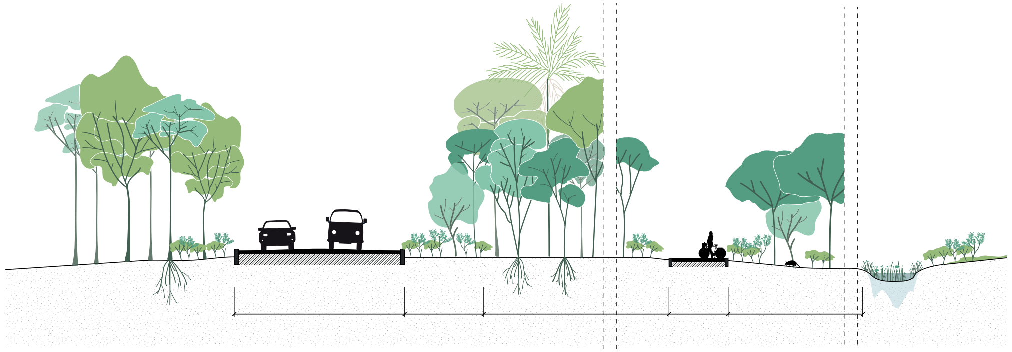
## Working with land, water, and vegetation

**Alleys**
Disturbance corridor

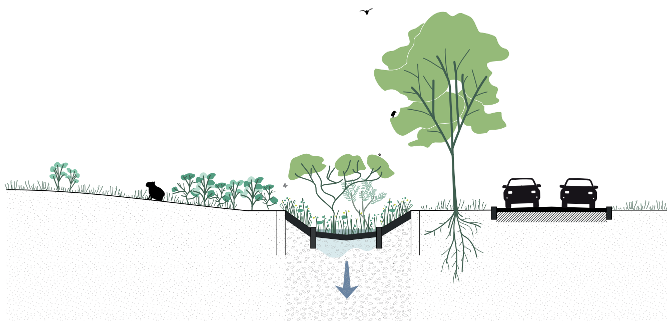
The gradients are formed by site-specific, smaller-scale interventions that are designed using an inventory of landscape architecture techniques. These interventions intend to synchronize technical-oriented goals (such as water infiltration, runoff control, and purification, wind erosion control, and wind-gust speed control) with aesthetic and environmental improvements, by careful consideration and treatment of the local landscapes.

Interventions such as Alleys intend to make it possible for tourists to wander through the edges of the fields, but also for local workers going from farm to farm, using a bicycle, or children going to rural schools, sheltered from the sun under the canopy of the trees. Furthermore, the corridors should have positive impacts on biodiversity and movement of species, not to mention the creation of singular habitats for species of fields and flooded landscapes.

**Local Roads Corridor**
Disturbance corridor



**Ditches**
Regenerated corridor



**Infiltration Strip I Pond**
Regenerated corridor

**Wind breaker**
Introduced corridor

### Occuppying the edge zones, or spaces in-between

# Third Act



## Rediscovering a cultural landscape

SELECTING OBJECTS, FINDING VALUE IN WHAT HAS BEEN LOST

The third scale of design, the scale of the object, elaborates site-specific interventions, operating with the framework proposed by the interventions on the scale of the landscape and the ensemble, adding depth to the apparently-barren landscape covered in industrial-agriculture fields.

Drawing inspiration from the sets of values observed in the Inventory of losses (see Intermission chapter), the objects aim to recover some of the lost qualities of the landscape of the Tietê. Each intervention has its unique goals and inventory of actions, offering five new destinations for leisure and tourism in the region while commemorating the history and the complex process of occupation and urbanization of the area.

As a result, the route between the 5 different design locations offers the possibility of rediscovery part of the history of the place, as well as the splendor and variety in the types of landscapes of this former ecotone.

From a pragmatic point of view, the set of interventions could be framed as a cultural landscape - which since 1992, has been adopted by UNESCO as a new typology for recognizing cultural assets within a specific landscape. In Brazil, the Institute of National Artistic and Historic Heritage, IPHAN, also determines the safekeeping of relevant landscapes as cultural landscapes as an instrument for the preservation of Brazilian cultural heritage.

Furthermore, the interventions rely on natural processes of sedimentation, erosion, water fluctuations, and vegetation - making use of the same simple rationale of designing with earthworks, water, vegetation, and light-engineering works.

Route through the interventions

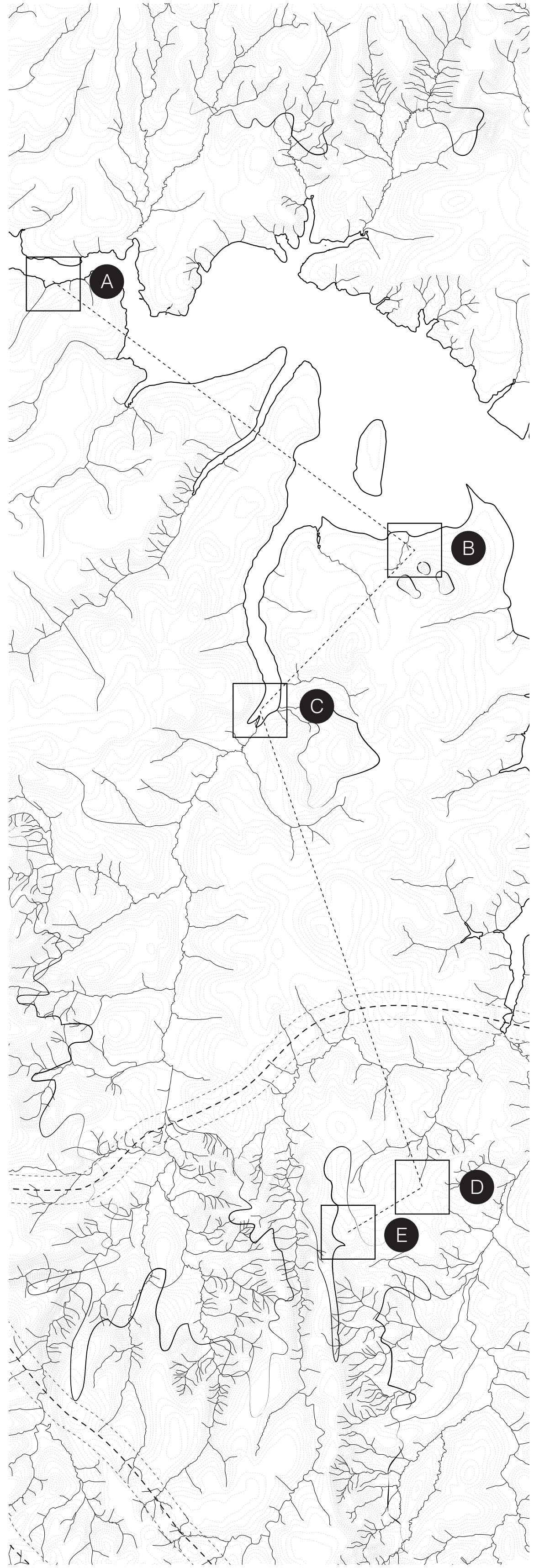
A. Farmer's port of Igaraçu do Tietê

B. Archeological Park of Barra Bonita

C. Várzea Park

D. *Guarani* Water Battery

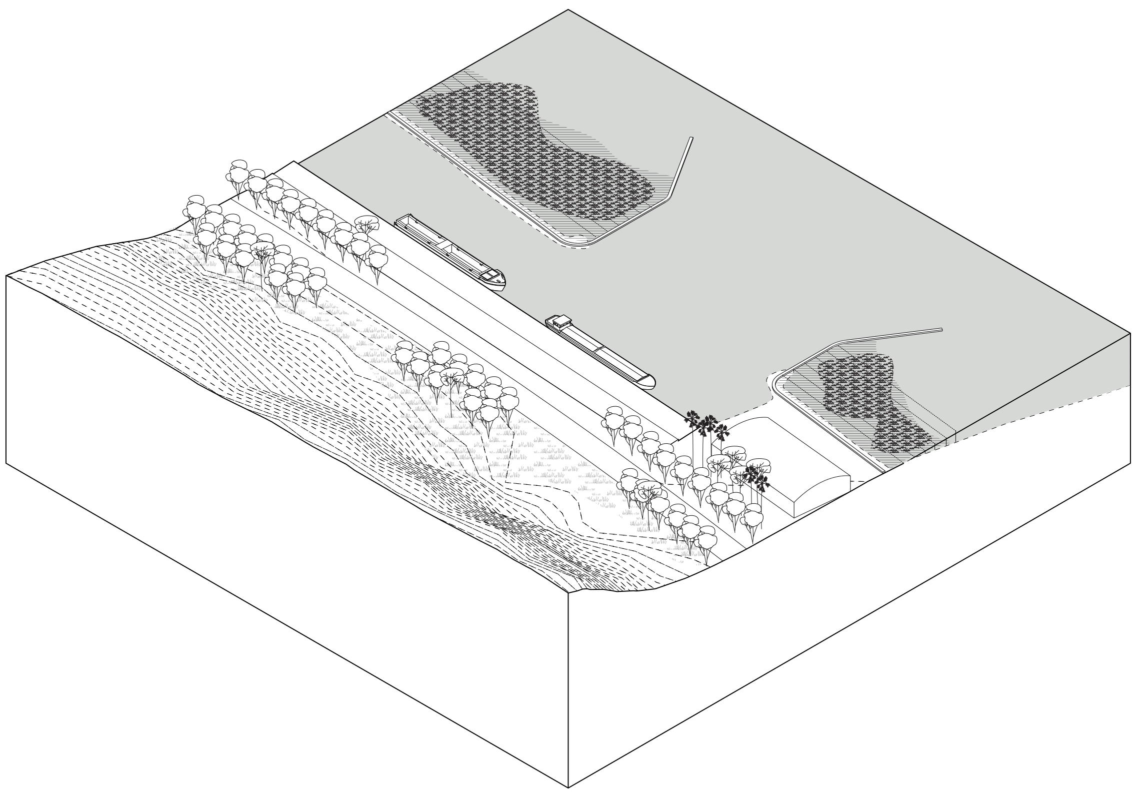
E. *Cuesta*'s hillslopes conservation and infiltration plan



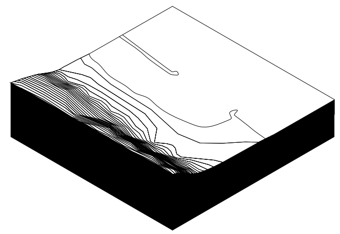
# Objects

## A. Farmer’s port of Igaraçu do Tietê

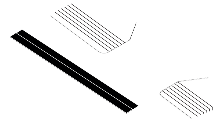
The small riverine town of Igaraçu do Tietê is one among several small urban areas that have developed around key points of intersection between infrastructure, water, transport axes, and productive landscapes.
Sitting at the shores of the Tietê, downstream from the Barra Bonita power dam, the city presents a distinctly urban feel and environment along the river banks, as well as the neighbor city of Barra Bonita (on the right bank). As a prototype that could be applied to many riverine cities along the Tietê, connecting smaller municipalities, as well as to the larger urban centers, the idea of a Farmer’s port emerges from the necessity of rapidly shipping fresh produces to other parts of the Basin, to diminish the dependence on motor transportation in the region. As the overarching landscape mosaic is implemented, the amount of land available for small farmers increases, facilitated by the creation of the edge zones and the establishment of areas with limited land-use patterns.
As put forward by the Grupo Metrópole Fluvial at the University of São Paulo, this kind of facility has the power not only to serve as an important piece of infrastructure for logistics but also as a gathering spot for locals. Barges load and unload fresh produce coming or going to the neighboring riverine cities, while inhabitants of Igaraçu gather around the docks, in an open-air produce market.
The docks aim to secure the barges and smaller ships from small waves and fluctuations on the water, but also hold the sediments that could accumulate along the shore. Instead, the sand and earth that comes with the water are secured by wooden piles and concrete slabs, forming embankments where aquatic vegetation can grow on top.



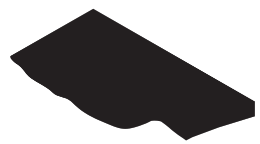




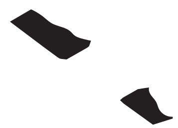
Topography
The chosen area is a naturally good spot for docking boats, secured from the tidal waves by two natural sand and gravel banks.



Implementation of light-engineering works
- Docks
- Docking pier
- Wooden piles

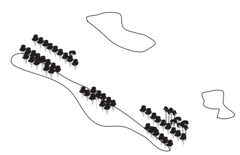


Water
The Docks and the created riverbanks form an area safe for docking.



Earth movement
The docks and wooden piles facilitate the sedimentation, forming small riverbanks.

Time



Vegetation
Plants adapted to aquatic environments grow on top of the riverbanks and trees are planted along the small port, creating a waterfront promenade.

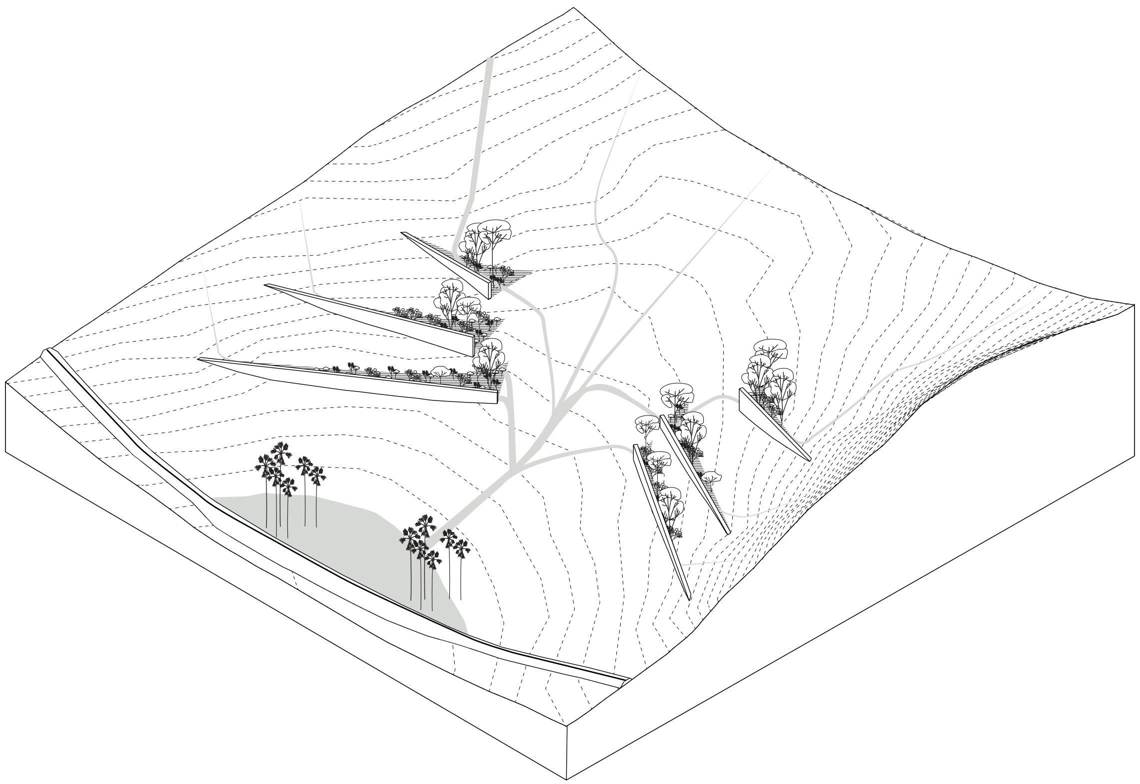
The former Porto Martins Station, in 1948. Nowadays flooded by the Barra Bonita Reservoir.

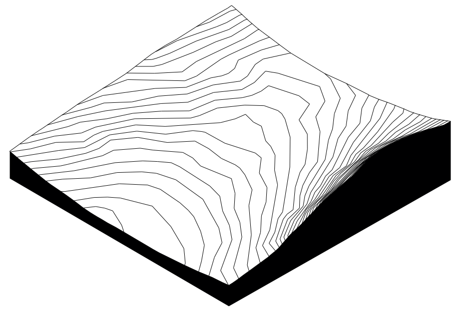
Photograph: Luiz Simonetti

## B. Archeological Park of Barra Bonita

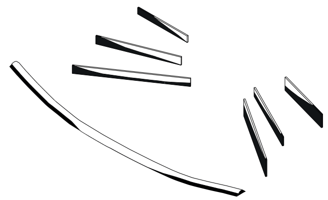
The incredible amount of archeological sites found in such a small area, not to mention the unique historical value of these findings call for special protection of the outskirts, and also of the general landscape that was chosen by these ancient peoples to serve as their habitat.
It is clear, by the concentration of archeological findings along the hillslopes of the rock formations, and also along some hillslopes facing the water, that these singular geographical conditions were attractive to the settling of the indians.
Put very simply, the park has the goal of safekeeping the landscape, and possible future archeological findings, from destruction by the rampant exploitation of the land by industrial agriculture.

Taking inspiration from the Peabiru way, a Pre-Colombian indigenous pathway that used to run through the region, and connected both sides of the continent, the park proposes two promenades, one along the water, and one through the fields.
Along the promenade, visitors are exposed to the beauty of the rock formations, of the enormous body of water of the reservoir, further below, and to a carefully-picked set of plantings that aim to present the variety of landscapes and plant types that covered the region, before the expansion of the plantations in the 19th century.

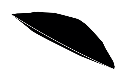




Topography
The concave area formed by several waterstreams converging to this spot creates a natural gentle slope suitable for the establishment of terraces.



Implementation of light-engineering works
Concrete walls frame views and direct runoff water towards the main drainage line. The pathway is slightly elevated, creating a natural water retention terrace.



Water
The runoff water coming down from the hills is trapped by the retention terrace and forms small ponds.

Earth movement
Sediments coming down from the hills are held by the concrete walls, creating zones of enriched soil, with higher availabliity of water.

Time

Vegetation
Trees grow on top of the collected sediments, taking advantage of the better soil and the increase in the presence of water. Buritis grow within the retention ponds.


Around the region of Barra Bonita and Botucatu, before the invasion of European settlers during the 16th century, there used to be an indigenous pathway, connecting peoples from the seaside of Brazil, to the highlands of the Andes, in Cusco, Peru. As the narrative goes, this was an unpaved pathway frequently used by the indigenous, that was kept uncovered by the erosion provoked by the constant movement of people, but also by an ingenious planting scheme of grasses that prevented trees and other plant species from growing on top of the pathway, therefore erasing it.
Coincidentally or not, many archeological sites have been found around the same region, in the outskirts of Barra Bonita. Some archeological sites date as far as 11 thousand years ago and present traces of the occupation of the region that could rewrite the story of the entire continent. However, the land in which these archeological sites have been found is mostly owned by major corporations from the biofuel sector, and the findings have been made during archeological works that, by law, should be carried out before the expansion of the sugarcane plantations in the region.

A. West Core of the Park
Regeneration of riparian vegetation and construction of a pathway along the water

B. East Core of the Park
Creation of an archeological park, dotted with different gardens, mimetizing landscapes formerly found in the site

C. Várzea Park

1. Waterfront pathway
2. Interior pathway
3. Araucárias Grove
4. Hills and rock formations
5. Contour cropping - contour planting
6. Jetty overlooking the reservoir and the dam
7. Buriti gardens
8. Fields of the Cerrado

**Waterfront Pathway**
A promenade overlooking the water, under the shadow of the trees.

The tree patches are planted in such a way that as one walks from east to west or from west to east, the views of the inner park are not concealed by the tree leaves. The groups of planting are dense and should form a closed canopy over the heads of those who wander through the path. This is a gesture inspired by the Matas de Galeria, or gallery forests, tree formations of the Cerrado along with inundated areas or smaller streams. Due to the abundance of water year-round, trees of the gallery forests are able to grow more than species endemic to the Cerrado's fields, where water usually is scarce. Adjacent to the reservoir, earth movements should create varied conditions for the planting and spontaneous growth of floodplain species, recreating a type of habitat that used to be dominant along the river, but rarely exist anymore, due to the normalization of the river channel, but also the flooding from hillslope to hillslope provoked by the water dam.

Waterfront pathway

***Araucárias* Grove**
An entrance to the park is marked by the iconic majestic trees of Southeastern Brazil.

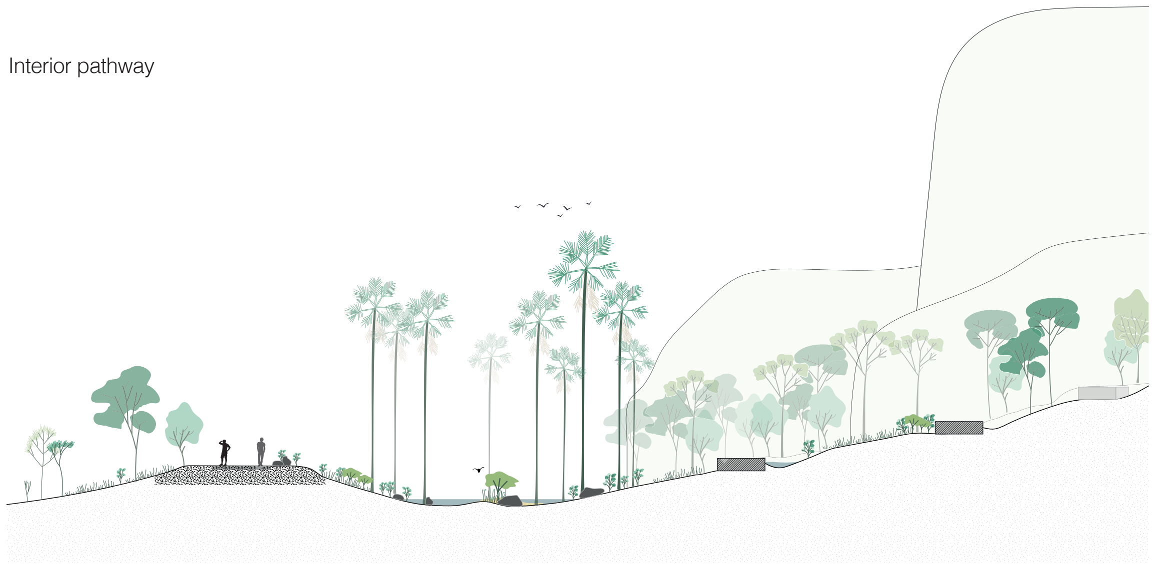
Commemorating the former Peabiru way, that linked the lowlands of the Paulista seashore with the highlands of the Andes, and passed through the region of Barra Bonita and Botucatu, the *Araucárias* Grove pays hommage to the route of the Peabiru that passed through the highland forests of Southern Brazil, which are home to the Araucárias, a type of pine tree endemic to the region. As their canopies are very high, they offer shadow, while not obstructing the views over the entire park. The Grove marks the entry of the park for those coming from the east and is the first type of vegetation experienced by the visitor, followed by the Buriti Gardens, the Cerrado fields, and the remanent Atlantic Forest vegetation on the slopes of the iconic hills.

**Interior Pathway**
A journey through some exemplary landscapes, commemorating the pre-Colombian Peabiru way.

On one side, the pathway offers visitors views over the Archeological Park and, in the background, the Barra Bonita Reservoir. On the other side, visitors are presented with views over the iconic hills and rock formations (where many archeological sites have been found) and the Buriti gardens.
The Buritis are palm trees from the Cerrado biome that typically grow in areas where the water table is close to the surface. These plants are resistant to flood and drought, and usually pinpoint the areas of the Cerrado where water can be found as if marking the location of an oasis in the middle of the desert, due to its great heights, that contrast with the flatness of the hinterland plains.

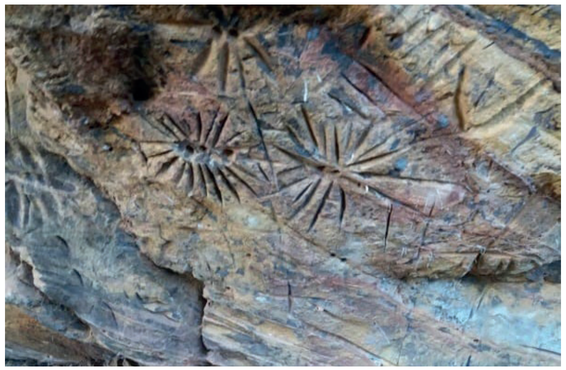
*Araucárias* Grove

Interior pathway



The Cerrito Rock, partially underwater, standing in the middle of the Barra Bonita Reservoir.

Photograph: Viotto

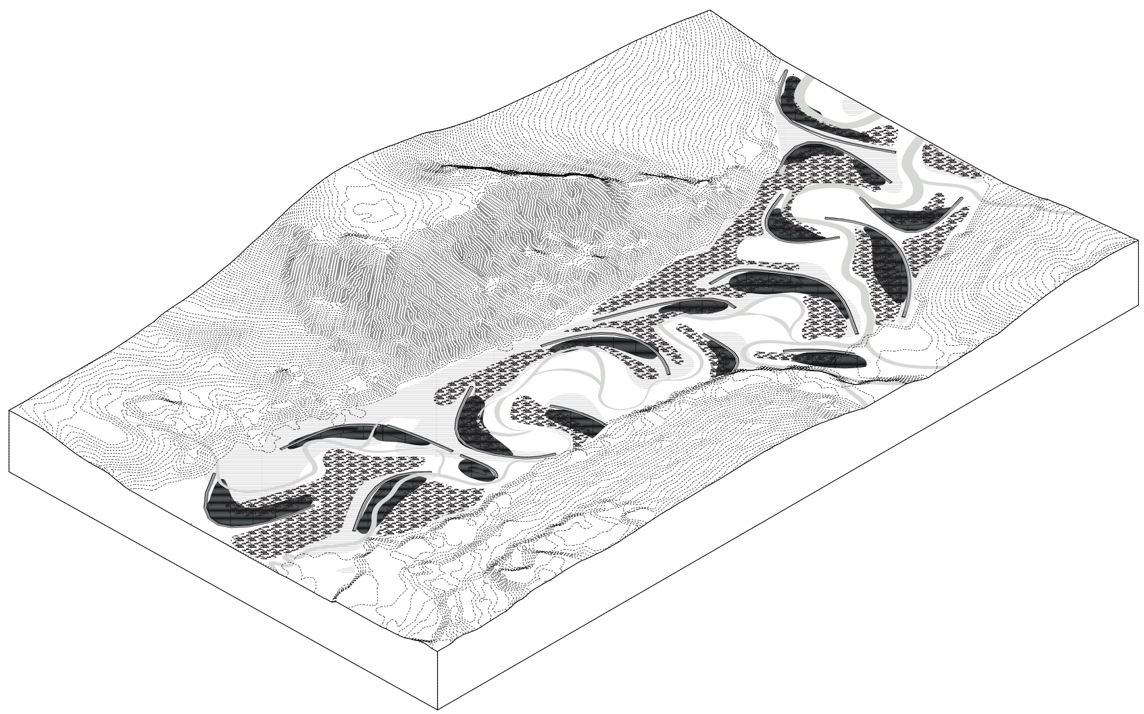


Rock carvingss in São Manuel, in the Serrito II Archeological Site.

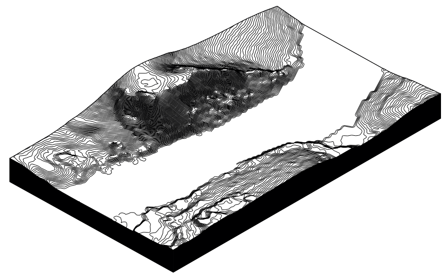
Photograph: Zanettini Arqueologia

## C. *Várzea* Park

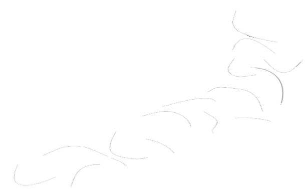
One of the first object-type of interventions to be implemented, the constructed wetland park recuperates a type of habitat that is no longer seen in the region, or at least not in its former splendor: the Várzeas. These are areas along floodplains, that experience constant fluctuations in the water levels, and, therefore, allow for the existence of numerous flood-proof plants and serve as habitats for singular species. With the help of gravity, a series of implemented underwater dykes block the flow of sediments downstream, creating the small islands of sand and earth along the river bed. The path that the water should go through, from the point when it enters the wetland until it reaches the waters of the reservoirs is, thus, extended. This offers the possibility of slowing down the flow of water, while, with the help of specific plant species planted on top of the riverine islands, the water is cleaned of agricultural runoff and pollutants.



Time

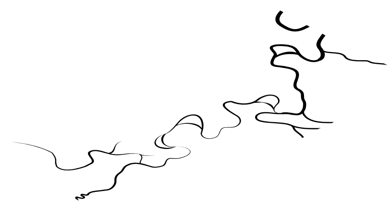


Topography
The fluctuations in water level, associated with the low-laying wide branch of the Barra Bonita Reservoir form a natural area for the construction of wetlands.



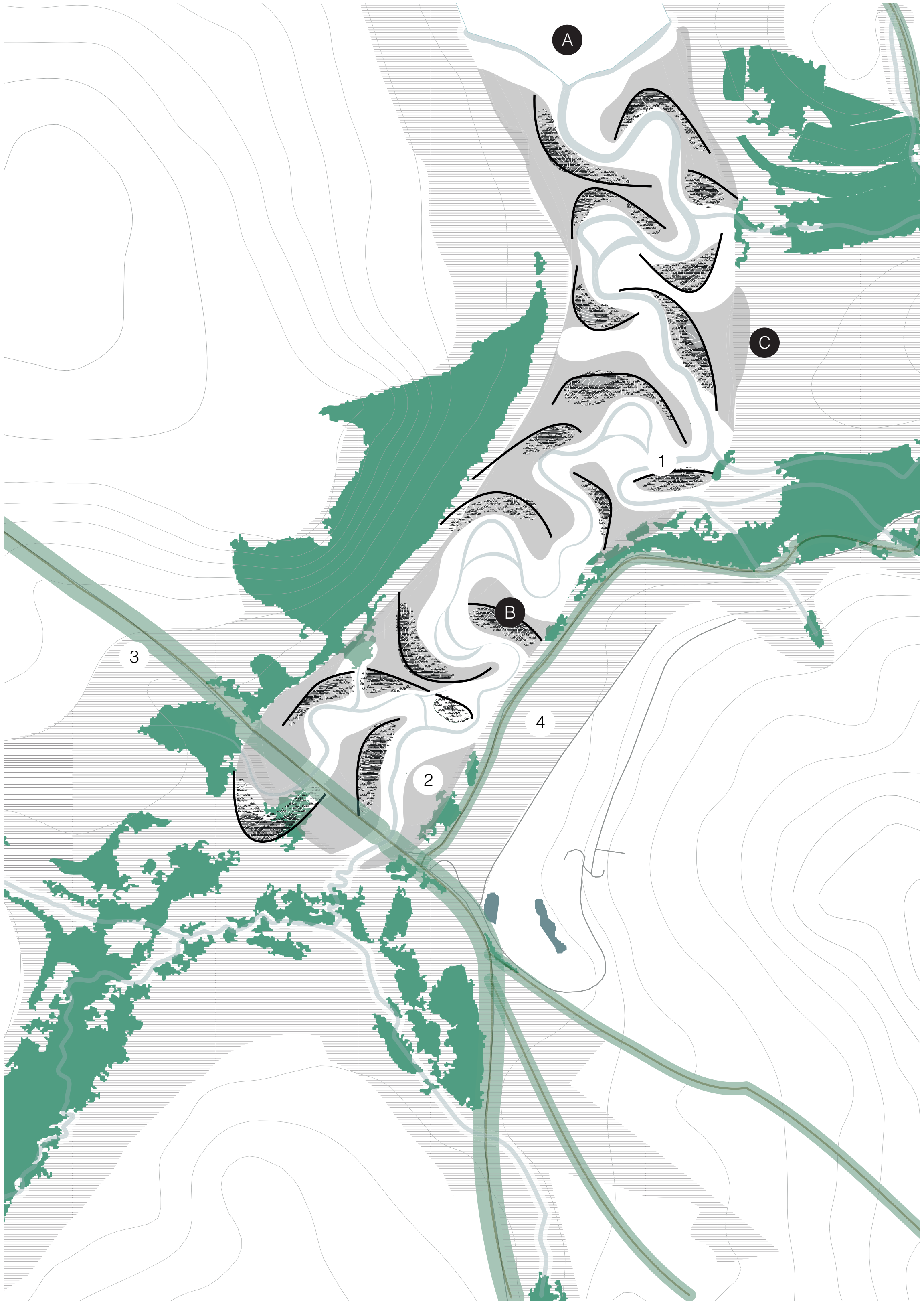
Implementation of light-engineering works
Submerged dykes made out of gabion or concrete hold the sediments coming downstream from the highlands of the *cuesta*.

Earth movement
The sediments held by the submerged dykes form meandering sand and ear-thbanks.



Water
The water line is restricted by the differenc-ces of depth cause by the newly-formed sandbanks, resulting in a meandering stream.

Vegetation
Vegetation adapted to flooding grows on top of the sandbanks, creating habitats for species of the Várzea, which are very rare nowadays.



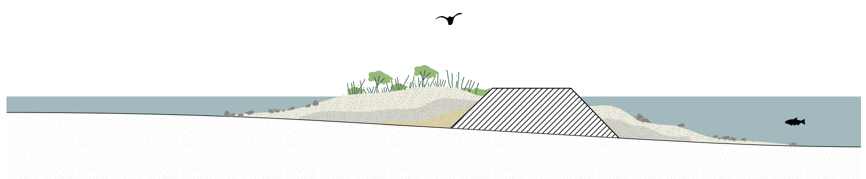

## Submerged Dykes

The dykes are built using gabion blocks and are positioned in such a way that sediments coming downstream from the highlands of the Botucatu mountains are naturally deposited against its walls.
The idea is that these would be one of the first interventions to be implemented, as, with time, the number of sediments coming downstream would diminish. This would be an outcome of the renaturalization of the riverbanks and increase in the riparian vegetation covering (along with other measures, such as the implementation of windbreaks, increase in vegetation cover, construction of ditches and so on).
After a fair amount of time, once the substratum is deep enough to allow for the growth of vegetation, flood-proof species would cover the small ephemerous islands of the newly-emerged wetland. The plant species would be selected having in mind their ability to filter agriculture runoff that could cause eutrophication, aiding in cleaning the water before it reaches the reservoir.

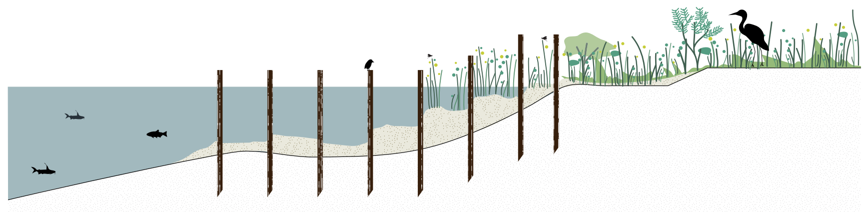
## Constructed Sandbanks

The positioning of a grid of wooden piles helps in the deposition of sediments along the river banks, forming areas of shallower water that allow for the planting or natural growth of flood-proof species. These areas are key for the survival of endangered floodplain species of birds, mammals, and so on. Together with the sandbanks formed by the underwater dykes, the pile grids compose the new landscape of the wetland.

Submerged Dykes



Constructed Sandbanks



A. Barra Bonita Reservoir

B. Constructed wetlands

C. Regenerated riparian zones

1. Underwater dykes

2. Sandbanks secured by wooden pilling

3. Highway corridor

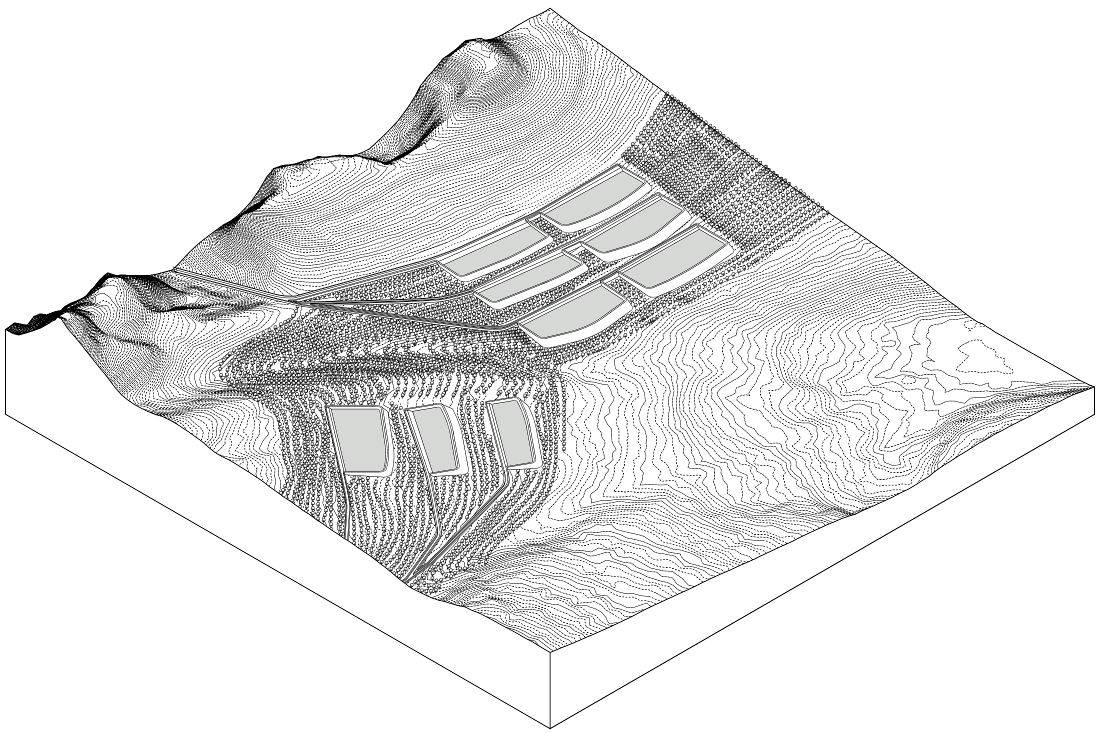
4. Local road corridor

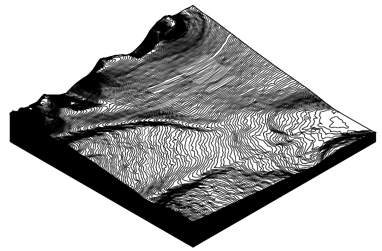
*Várzeas* of the *Tanquã*, along the Piracicaba River.

Photograph: Christiano Diehl Neto

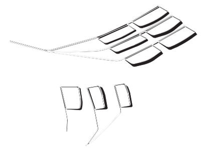
## D. *Guarani* water battery

The *Guarani* Aquifer, one of the largest in the world, covers an enormous portion of the south-American continent but has a limited area for recharge of its waters. Being a confined aquifer, the *Guarani* depends on the infiltration of water along its borders, in areas such as the *Cuesta* of Botucatu, and most of the landscape analyzed during the thesis work.
Already facing severe drought, municipalities in the deep countryside of São Paulo, further downstream along the Tietê, depend heavily on the subterranean water of the aquifer for its water supply. As of 2022, the land uses and land cover overlapping with the recharge zones of the aquifer is not very suitable for the recharging of the subsurface with water. Therefore, this object puts forward the necessity of actively recharging the subsurface, through the construction of a system of infiltration ponds, taking advantage of the natural slope formed on the northern side of the *Cuesta*. As a giant toboggan, water that is captured by the rural ditches (see Object E) is directed towards the infiltration ponds.
This geo-engineering endeavor doubles as a landscape design proposal, with the treatment of the margins of the *bassins*, as well as the neighboring hillslopes.
To mimic the former coffee plantations of the Victória Estate, trees are planted in rows, following the contour lines of the site. At first, the planting seems too straight and unnatural, but with time, some trees give room to larger, secondary trees, and the sharp lines disappear, leaving behind a reforested and secured slope against erosion.



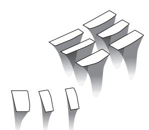


Topography
The natural slope formed by the north-facing side of the *Cuesta* directs water towards the lower lands of the former Victória Estate.

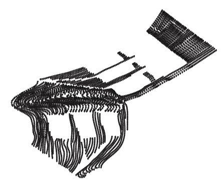


Implementation of light-engineering works
A system of ditches direct the excess runoff water coming down from the *Cuesta* towards the infiltration ponds, constructed against the gentle slopes of the front of the *Cuesta*.

Water
The water directed towards the bassins is slowly infiltrated into the soil, helping with the recharge of the Aquifer down bellow.



Time
Considering the vastness of the Aquifer, the small size of the intervention and the time necessary to actually bring water to the subsurface, time is an important aspect of the implementation of the design. This is an intervantion with a timespan of a 1000 years .

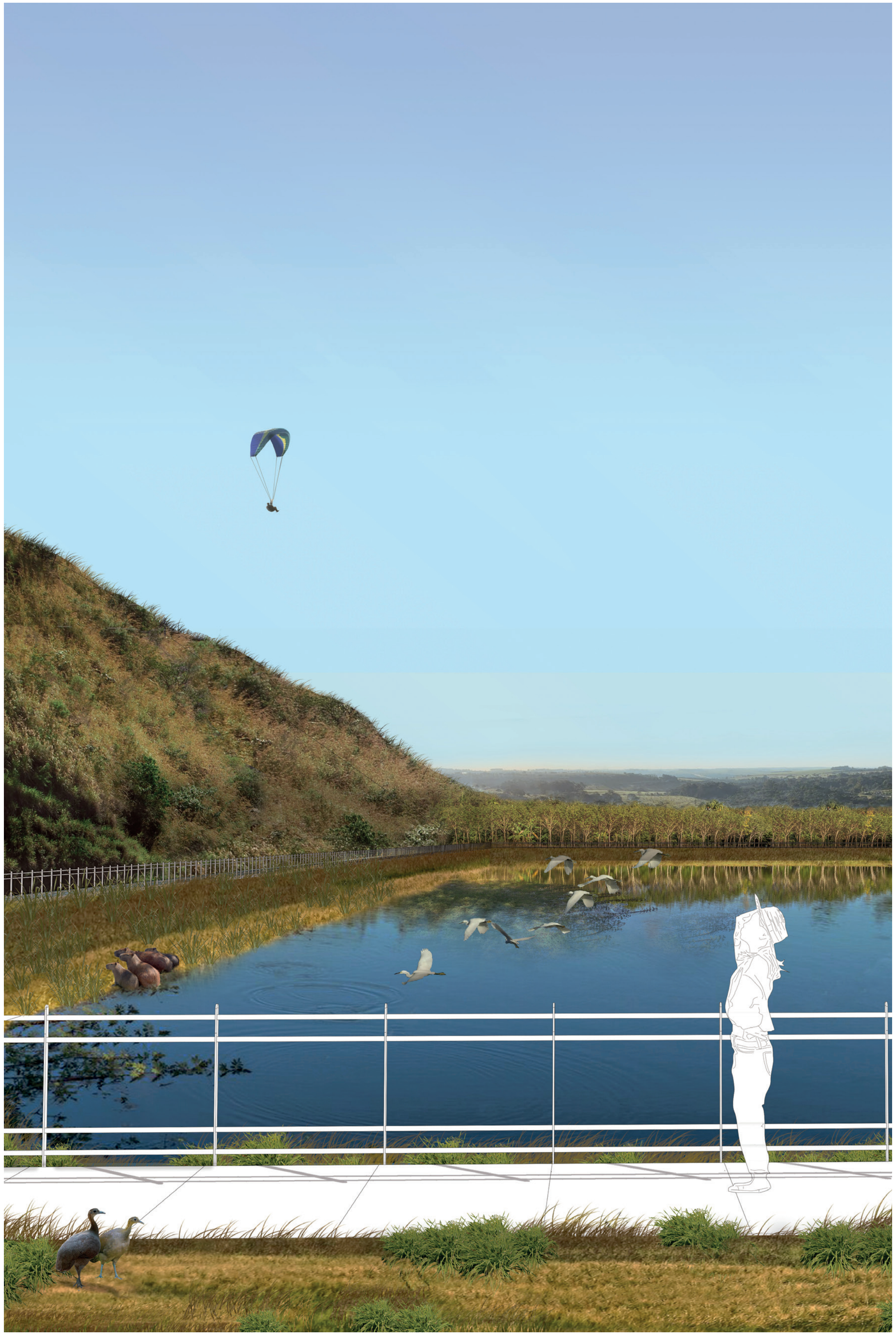


Vegetation
Rows of trees are planted along the fronts of the formation, naturally turning into a more natural-looking vegetated slope with time. Grasslands and shrubs grow inside of the bassins, which, whenever the water is low, ressembles a wetland.

Time

*Fazenda Victória, dos Condes de Serra Negra.*
Victoria Farm, of the Serra Negra Earl.
Antonio Ferrigno, Circa 1900
Oil on canvas

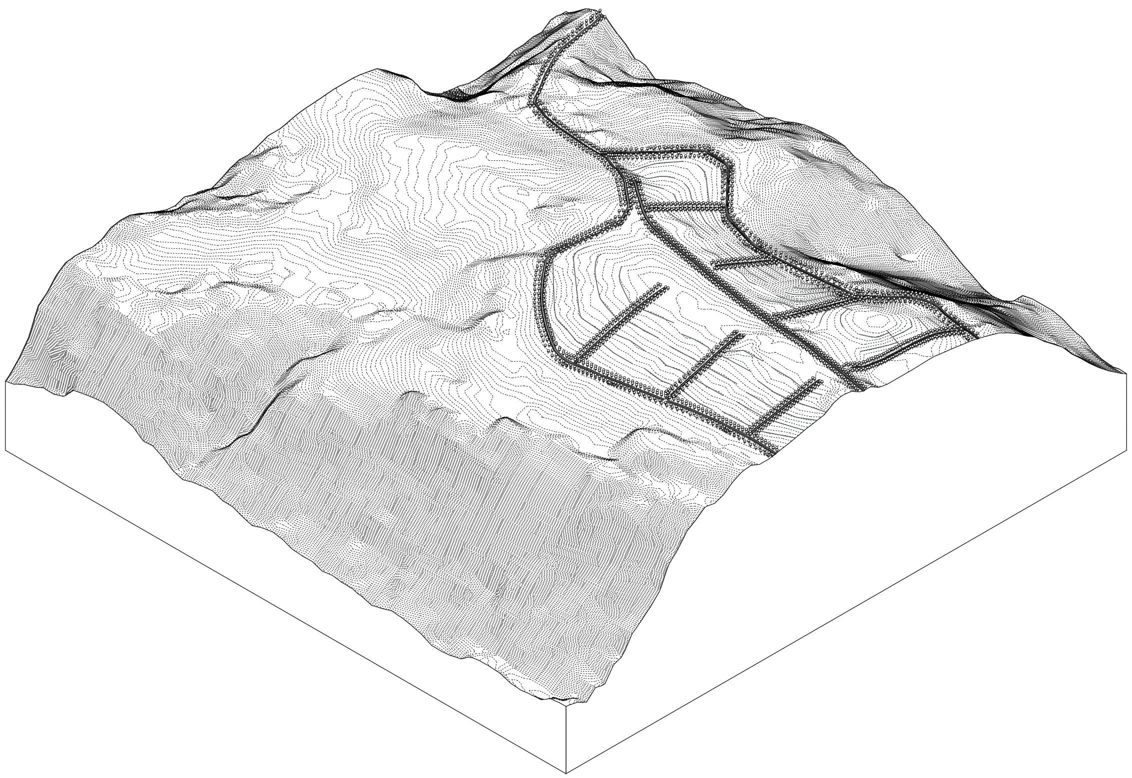
Source: Coleção família Francisco José da Conceição Serra Negra/ Enciclopédia Itaú Cultural de Artes Visuais

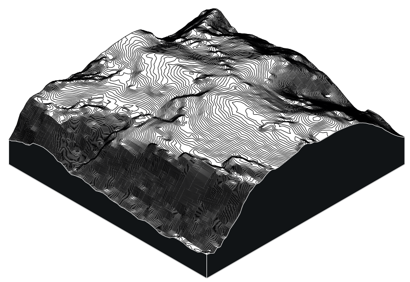


## E. *Cuesta's* hillslopes conservation and infiltration plan

The top parts of the Cuesta of Botucatu, despite its exquisite natural beauty, and scenic potential for tourism and leisure, have been mostly occupied by the same sugarcane monocultures that can be found elsewhere along the landscape. These crops are terrible for soil erosion, as farmers usually leave the barren land exposed for months in a row, not to mention the lack of natural vegetation to retain sediments and block wind gusts. The Cuesta's hillslopes conservation and infiltration plan is a modest, but extremely relevant proposal for the maintenance of the Cuesta and the downstream lands dependent on the water that descends from the Cuesta towards the Tietê and Paranapanema Rivers.

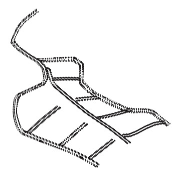
A simple system of ditches is carved on the ground, to collect excess runoff water from the crops. The ditches then lead the water to the infiltration ponds (see Object D), and excess water is released into the natural water network. Along the ditches, pathways are marked. These can be used for hikers or cyclists, and also provide water for the neighboring vegetation. With the implementation of ditches and restrainments for the land-use of the adjacent areas, small farmers can make use of the increased availability of water for the harvesting of produce, which can then be distributed throughout the region (see Object A).





Topography
The hilltop of the Cuesta is surrounded by sharp slopes that descent towards the valley of the Tietê.

Implementation of light-engineering works
Around the edges of the hilltop, a system of small ditches is implemented to manage the excess rainwater and prevent erosion by water. The captured water is then led to the infiltration ponds of the *Guarani* water battery.



Vegetation
Along the ditches rows of varied trees are planted, creating narrow ecological corridors. The trees and bushes can thrive due to the proximity to the water.

Time

Botucatu, Tejupá and Corumbataí
Environmental Protection Areas

Source: Momentum

# Design Synthesis





## A vision acting on multiple scales


Strategic Site Interventions

1. Establishment of new corridors along rivers and streams
2. Establishment of new corridors along infrastructure
3. Increase vegetation cover along the edges of the Cuesta
4. Increase vegetation cover along steep areas
5. Regeneration of tidal-zones
6. Establishment of an area of special interest for safekeeping the archeological findings and history of the place
7. Special treatment for scenic features

Objects

A. Farmer's port of Igaraçu do Tietê
B. Archeological Park of Barra Bonita
C. Várzea Park
D. Guarani Water Battery
E. Cuesta's hillslopes conservation and infiltration plan

# 9 Conclusions

# Reflection



1. THE RELATIONSHIP BETWEEN RESEARCH AND DESIGN.

The thesis builds upon the idea of addressing spatial and urban problems present in the region using a framework for the spatial development and transformation of the area. The work proposes to tackle issues that would otherwise be dealt with by other fields (such as agrarian sciences, water management, hydraulic engineering, and forestry management) from a spatial perspective. Admitting the limitations of the strategy, as one professional could not account for all the other aforementioned fields of expertise in the same level of depth and precision, the research relevance and application to the design lies in the innovative way in which space is reinterpreted, making room the establishment of a plurality of practices other than the industrial monocultures present in the region. New spatial patterns that could accommodate small-scale farming destined for the production of real food, associated and in synch with the capabilities of the land are proposed. The research culminates in the drafting of a landscape structuring framework, that aims to guide the development of the region and adapt it to future change. Divided between proposals that act on the global and local scales, on the general and the specific, the rationale of the intervention builds upon other previous works, mainly:
I.The learnings of Ian McHarg in Design with Nature (1969), on the finding of suitable practices and landform in synch with the natural conditions of the site;
II. Richard T. Forman in Land mosaics: The Ecology of Landscapes and Regions (1995), on the understanding of the structure of a land mosaic, its systems, and the composition between patches of vegetation, water bodies, areas of production, and ecological corridors;
III. Dirk Sijmons, with the Plan Stork (1986) and the way in which land

cover transformations are aligned with ecological regeneration and the multiplicity of temporalities embedded in such a transformation;
IV. Rosa Kliass with the Pioneer Environmental Protection Area for Barra Bonita and adjacent areas (1975), and its unique way of dealing with environmental and landscape issues with the drafting of areas for different gradients of preservation, agricultural exploitation, and tourism development, all framed by a project of landscape planning;
V. Michel Desvignes and its numerous designs taking form on the edge between urban and peri-urban areas, on various scales, from the landscape to the object, and its inseparable linkage to landscape theory and principles of composition.
All these theories and methods together constitute the backbone of the research, which translates many foreign concepts and strategies to the local reality of the site. Not only adapting strategies for the constitution of a new land mosaic (converting conceptions put forward by Richard Forman for temperate-climate landscapes of North America, for instance, for the diverse vegetation and composition of the Atlantic Forest and the Cerrado) but also taking into account the limitations in funding, maintenance and lack of political will that the implementation of such a project would face.
The thesis puts forward a method for the understating of a landscape (through extensive research using cartographies, sections, photographs, historical analysis, and literature) that is followed by the drafting of general guidelines for the entire Basin. These guidelines inform the more in-depth spatial framework applied to the landscape scale, which, in its turn, briefs the drafting of a finer-grained proposal for the scale of the ensemble. The elements composing the landscape are different according to the scale, so this distinction between scales and methods is important.

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

The relations between the studio and the graduation work were straightforward from the start, as the project intended to analyze the urbanized landscape of the Tietê River Basin, and how specific forms of urbanization in the area (intensive agriculture and highly-urbanized areas) affected water cycles and the ecological integrity of the region.
After centuries of transformation of the natural landscape, the region is deeply exposed to climate-related crises, and yet, has its economical and urbanization trends tied to extractive practices that aggravate the problem.
The 2021-2022 academic year within the Transitional Territories Studio has been focused on the understanding of the composition of singular areas, exposed to the influence of water bodies, oceans, and rivers. The relations between political, physiographic, and ecological spheres have always been the subject of attention, and throughout the graduation year, students were invited to study and reflect on their graduation subjects oriented to this perspective.
From the beginning of the graduation year, it was clear that the work would be focused on the Tietê River Basin, it was possible to apply the exercises and utilize the research developed during the early stages of the graduation year (with the set of three intensives) to enrich the main proposal of the project and better refine the areas of interest. For the thesis topic, it was key to understand the urbanization dynamics that have been mainly responsible for the deforestation of the area, and modification of natural watercourses, resulting in severe damage to the ecological integrity of the site. The drafting of this clear evolutionary line, passing through the first processes of extraction, resulting in the transformation of the land cover, and having drastic effects on the soil, water, and ultimately atmosphere has only been possible thanks to the brilliant method put forward by the studio, using the notions of accumulation and clearance. Looking at the systems and cycles of accumulation, its externalities, and impacts on the urbanized landscape, it was possible to understand where the core of the problem was, and after that, with the help and guidance of the Studio mentors, focus on components of the problem that form the scope of the urban landscape designer.
Moreover, the relation between the work and the master track/program is evidenced by the manner in which a very complex issue, such as the transformation of land cover by agribusiness, and its impacts on the climate, people, and ecology, can be interpreted from a spatial perspective. The proposal results in a spatial framework and strategic plan to mitigate some of the issues previously described. Although sometimes it seemed like the agency of the designer was too small compared to the broadness and wickedness of the matter, it is clear

that the field has an important role in the drafting of an alternative vision for the occupation, vocation, and development of the region.
At several moments during the development of the thesis, the mentors have challenged, in a constructive manner, the relevance and position of the thesis within the field of urbanism. In a few words, the project is a work of urbanism (and not of landscape architecture, or any other field) by the dimension in which the landscape is analyzed and proposed to be transformed. More than a proposal for the regeneration, reterritorialization, and care for the site, it has embedded the idea of reconstruction of a territory by the manipulation of the landscape, making evident the urban character of the work.

## 3. ELABORATION ON THE RESEARCH METHOD AND APPROACH CHOSEN BY THE STUDENT CONCERNING THE GRADUATION STUDIO METHODICAL LINE OF INQUIRY, REFLECTING THEREBY UPON THE SCIENTIFIC RELEVANCE OF THE WORK.

Taking advantage of the method proposed by the studio, of constructing and deconstructing the territory through a series of cartographies and drawings, was a fundamental part of the methodology proposed for the thesis. This has allowed the research to obtain a sufficient amount of information on several topics of interest, also clearly showcasing fields of research that should be analyzed more in-depth, or that should be dismissed. The method seemed very appropriate for the initial phase of the research, not only in the matter of knowledge acquired but also by the way in which information was synthesized and translated into drawing pieces. With this not only did the report start to take form and acquire content but also the graphic language and style began to take shape. Considering the design-oriented character of the thesis and the importance of graphic expression, this was also a very clear advantage of the method.
On a less positive note, the extensive phase of writing and drafting the monographs, with the pre-established table of content drafted still at the early stages of the research, narrowed the research in such a way that topics such as agriculture, agribusiness, and the particularities of these fields seemed like they would be of higher prominence to the research than they turned out to. By focusing on single parts of the research during the elaboration of the monographs, it took some time before the core of the design proposal came to the surface. Only then was the testing of initial ideas and further confirmation of the direction in which the research possible.
After the initial research phase was concluded, it became clear that the role of the proposal did not lie in discussing more sustainable, less harmful ways of dealing with agriculture (for instance by exploring alternative, more sustainable farming practices, permaculture, extensive usage of pesticides and so on). Not because these are not of crucial relevance for the improvement of environmental and urban conditions of the site, but because it was understood that I, as a designer who is interested in the scales of the landscape, the architectonic object, and intermediate scales in between, with special attention to aspects of composition, aesthetics and cultural value, should focus on the spatial configuration and transformation aspects rather than going too deep into these other fields.
This movement resulted in some reflections on the role of the urban and landscape designer in relation to such enormous complex and seemingly irresolvable questions. Lingering uncertainties were: What is the role of an urban/landscape design within this context? Would a territorial proposal make a difference? Could the existing stakeholders (especially those present in the current far-right government, and in charge of large agribusiness economic conglomerates) be involved without profoundly altering the direction and the ultimate goal of the envisioned spatial transformation?
While many of these interrogations are still far from answered, it is with more clarity about my role and the field's role that I arrive at the end of this journey. Nevertheless, the agency of the designer seems minuscule faced with the wickedness of peripherical capitalism in Latin America, there is power in being able to envision alternative realities and the spaces that could host these realities. There is meaning in shifting the lenses of progress and establishing limits, although theoretically, to the so-called economic development put forward by agribusiness. And there is potential in working with the local landscapes, discussing the use of local species, and reinterpreting natural compositions between vegetated patches, fields, and productive areas, eventually culminating in the construction of a land-use pattern that is more suitable to the specificities of the landscape.

4. ELABORATION ON THE RELATIONSHIP BETWEEN THE GRADUATION PROJECT AND THE WIDER SOCIAL, PROFESSIONAL AND SCIENTIFIC FRAMEWORK, TOUCHING UPON THE TRANSFERABILITY OF THE PROJECT RESULTS.

The region of the Tietê River Basin, and to a larger extent, the entire country, is already suffering from severe impacts of climate change, in the form of extended periods of drought, followed by devastating cloudbursts, wildfires, dustbowls, and water insecurity. However complex and impossible to fully grasp in the one-year period in which the thesis has been developed, some of the conflicts between extractive practices and society have been understood adequately.
The ecology of crises in which the area is found requires a much broader and more powerful set of actions than what has been prescribed and achieved with the thesis, however, the innovative spatial interventions put forward by the work present viable pathways for the achievement of the main goal of the research: the regeneration of the ecological integrity of the region, ultimately resulting in the regeneration of the hydrological cycles, reflecting on the level of exposure of citizens and more-than-human communities to climate change.
Other side-effects could also be expected, should a project of the sort be implemented in the region, such as the increase in the availability of land for real food production (to the detriment of the dominance of monocultures for the production of commodities, that year by year take more space from the production of beans, rice, corn and cassava, some of the key components of the traditional Brazilian diet), the increase of biodiversity (with the expansion of vegetated areas, creating habitats for the one-of-a-kind fauna of the Atlantic Forest and the Cerrado) and increase in resilience of the animal populations (with the increased connectivity between patches of vegetation that are currently isolated, therefore increasing too the genetic variation within species).
Brazil desperately needs to reassess its land cover patterns and the externalities that come with such an oppressive dependence on agribusiness, and there is relevance in the very kind of the proposed project. As should be expected, making this type of project work would not be so simple. The actors, interests, and the type of economy necessary for the implementation of such a project do not exist. The relevance, therefore, lies in the manner in which this landscape-oriented proposal can synchronize the multiple needs of the site and provide a vision for possible solutions.
The solutions put forward for each scale and site are, overall, not immediately transferrable to other scales and places, what is the transferrable is the strategy and the shift between scales followed by complimentary readings of the conditions of the site. Furthermore, the rather simple manner in which the interventions are proposed, following fundamental acts of the establishment of new conditions (by dealing with earthworks, concrete constructions, vegetation, water, and water) allows for the replication of the method. Either in other areas of the country where agribusiness continues to devastate the landscape, and also elsewhere in the continent where the apparent vocation of provisioner of commodities to detriment of the local richness of fauna and flora is present.

5. DISCUSS THE ETHICAL ISSUES AND DILEMMAS ENCOUNTERED IN DOING THE RESEARCH, ELABORATING THE DESIGN, AND POTENTIAL APPLICATIONS OF THE RESULTS IN PRACTICE.

An evident dilemma, right from the start of the graduation year, regarded the limitations of developing a master thesis concerning a subject of study located on the other side of the globe, with very limited access to data and local sources. On several occasions, it seemed unclear if the problems of the thesis could not be better explored by a researcher with easier access to the site, and above all, easier access to relevant data. This issue was partially overcome with the extensive gathering of digital data, available on various public open-access data platforms, both of the Brazilian and São Paulo's State governments, as well as accessing local news sources. Also, with the help and support of the helpful library and archives sections of the Faculty of Architecture of the University of São Paulo, access was granted to some files that seemed relevant to the research. Furthermore, the lack of precise data (on elements such as topography, borders and management of properties, types of vegetation and animal species, and so on) shifted the proposal in another direction than previously anticipated, which was also beneficial to the final design. Alternately to developing a proposal that is fundamentally bound to a place, or a fraction of a place, and that

arrives at a design on a very small scale, the thesis focuses on drafting strategies and developing typologies for interventions of this sort.
Furthermore, during the elaboration of the design and several Studio meetings, the necessity to discuss and propose governance schemes, economical models, and changes in legislation became clear. As much as the thesis work presents valuable findings and pathways to tackling the problems of the site, it would be necessary to elaborate a much broader, and more robust framework, concerning aspects of land ownership, funding, governance, and so on. As time is a constraint, some of these topics have been not developed to their fullest. Also having the idea in mind that, in the case of the potential application of the results in practice, an interdisciplinary team of researchers should be involved, covering all the aforementioned indispensable lines of action.

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