

Regeneration of Ecological Integrity in the Tietê River Basin

P5 Presentation
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Mentors

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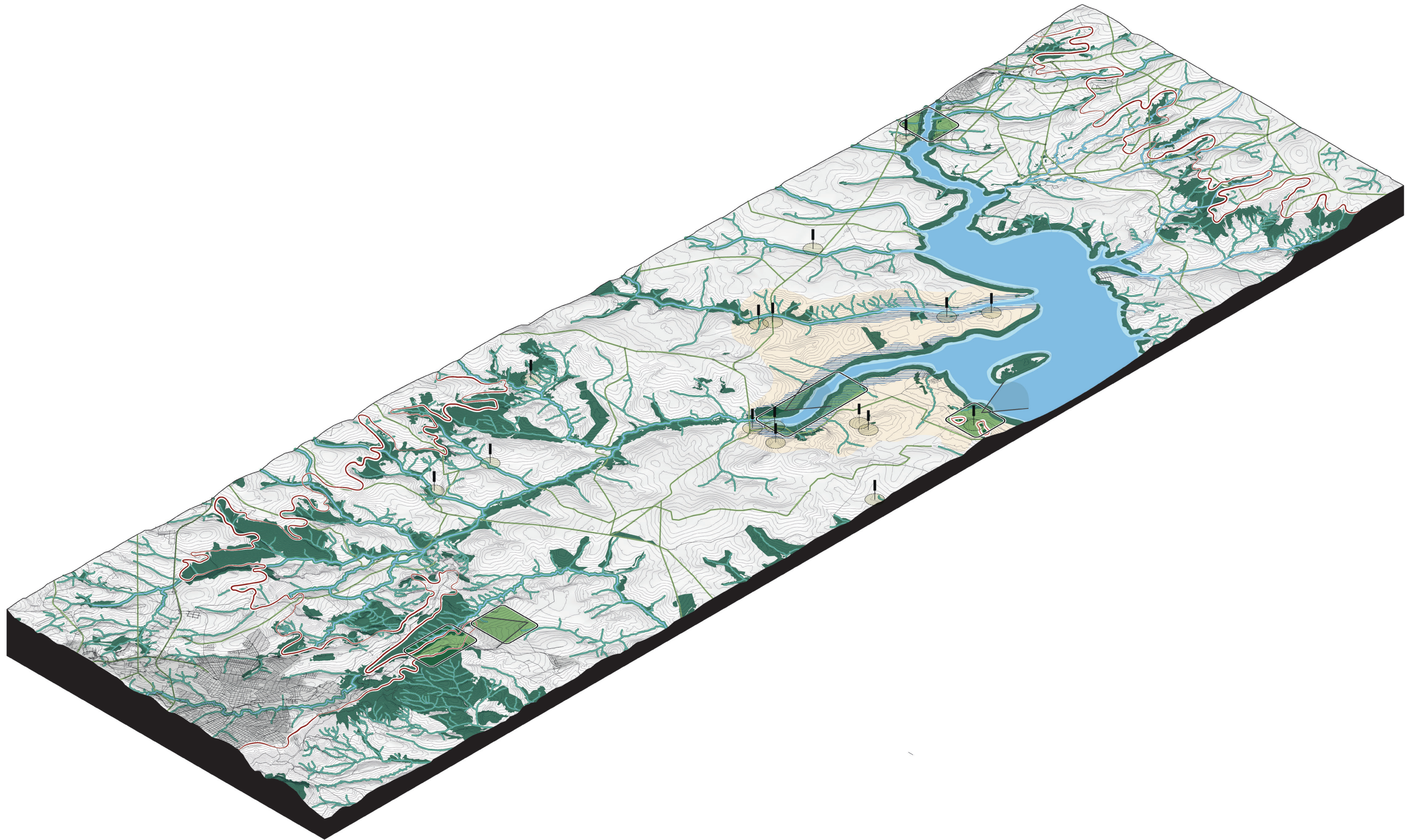
Transitional Territories Studio - Inland-Seaward
MSc Architecture, Urbanism and Building Sciences
Faculty of Architecture and the Built Environment
Delft University of Technology

Content

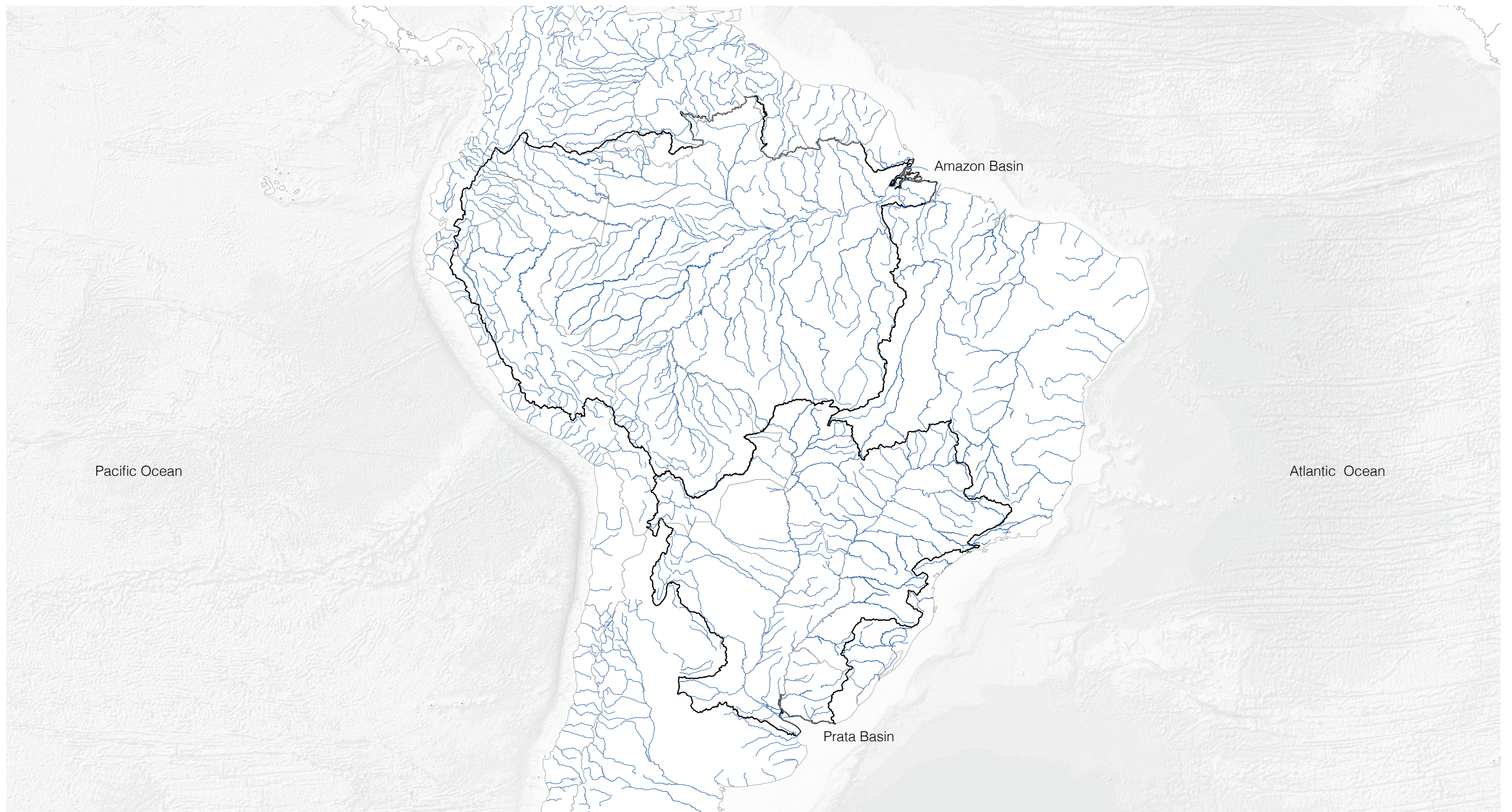
1. Introduction
2. Research statement and Methodology
3. Research-by-Design
4. Intermission
5. Projection
6. Conclusions



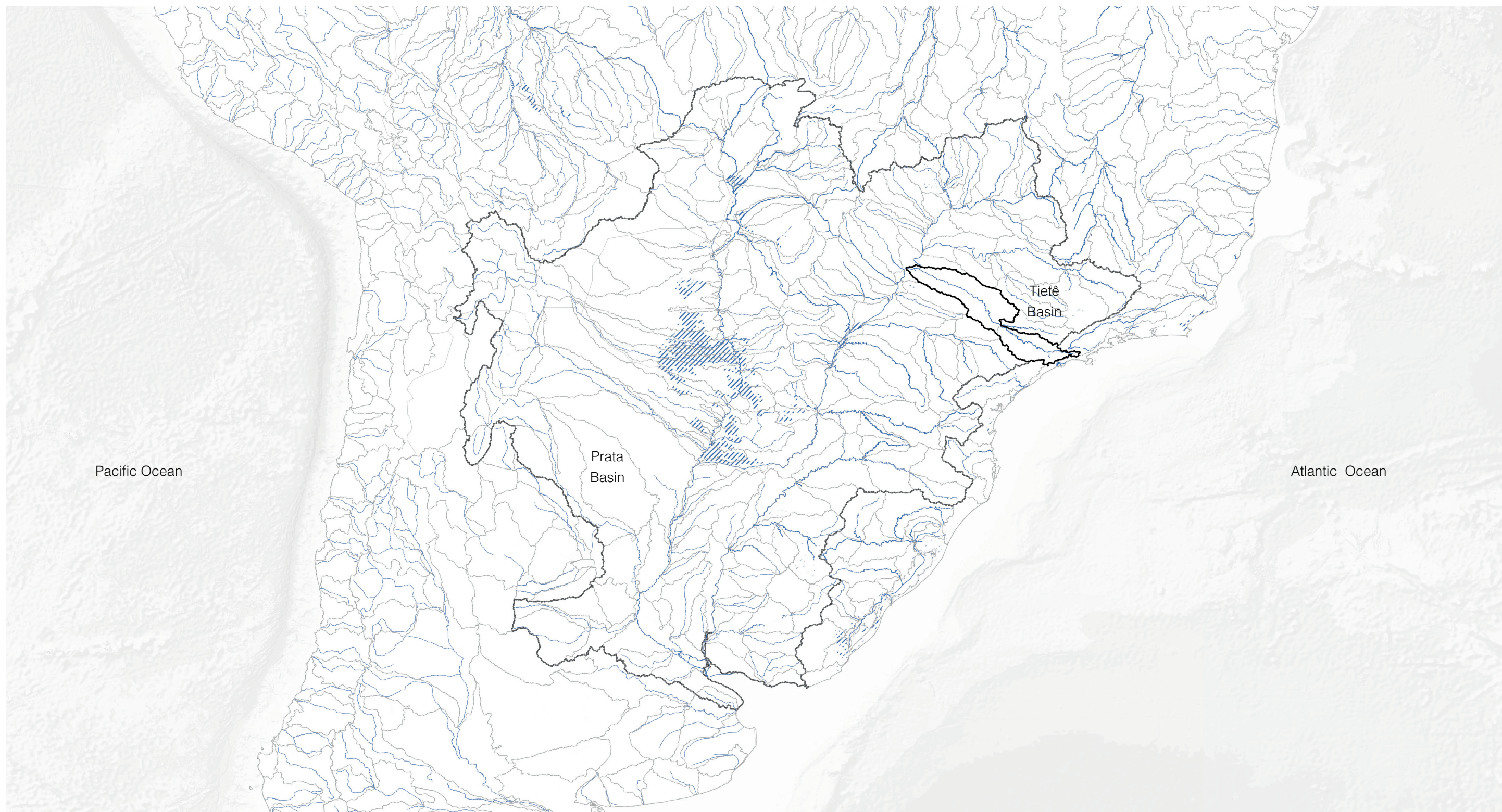
Dust cloud in Guararapes, 2021
São Paulo, Brazil
Source: G1



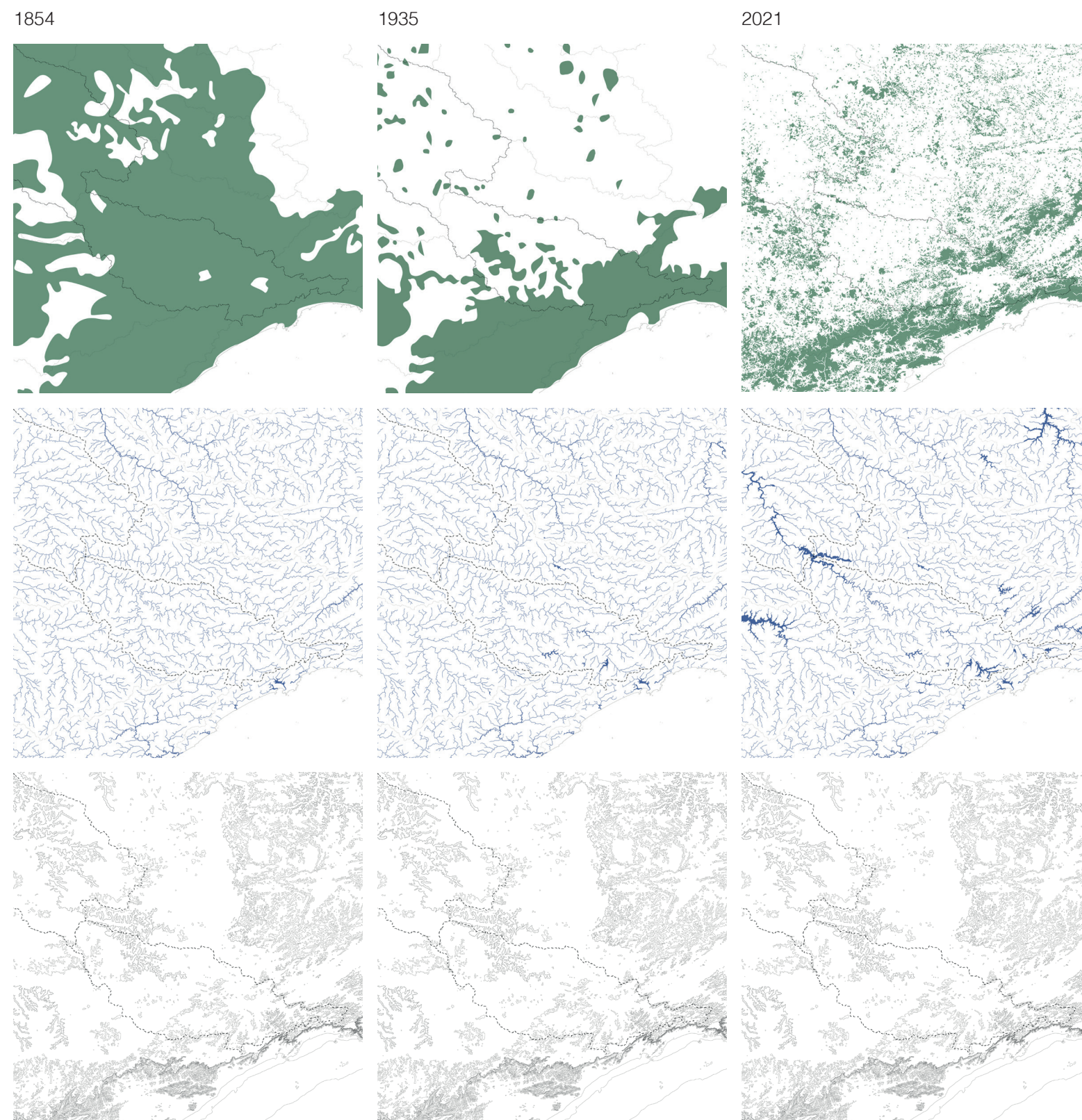
Vision acting on multiple scales



The two main basins of South America: Amazon and Prata



Location of the Tietê River Basin within the Prata Basin



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



Pristine Nature - Prior to 1850



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



Coffee boom - 1850 to 1930s



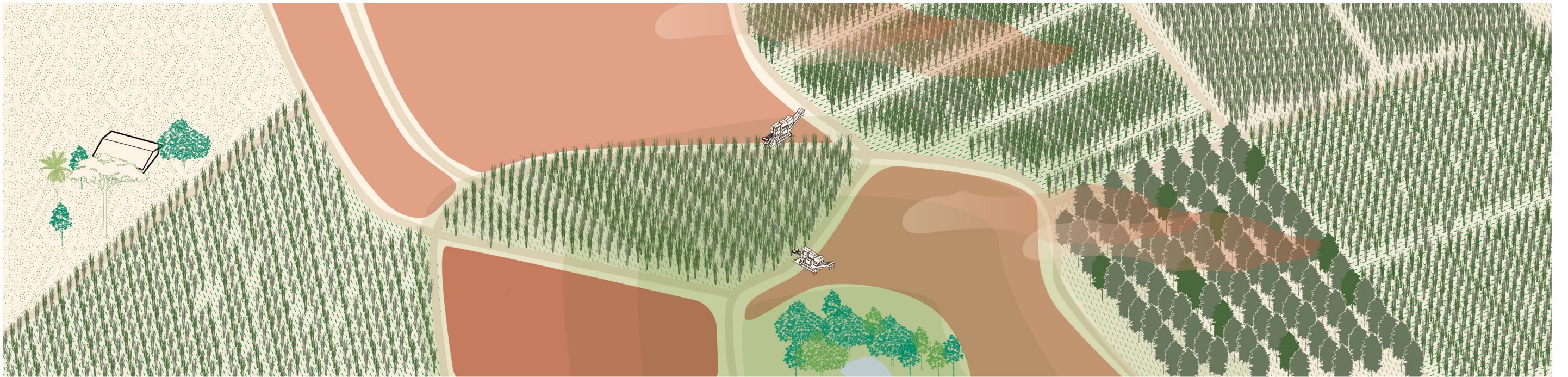
Cândido Portinari
 Café, 1935, Oil on canvas
 Source: Google Art Project/ Museu Nacional de Belas Artes



Decadence and resettlement - 1930s to 1970s



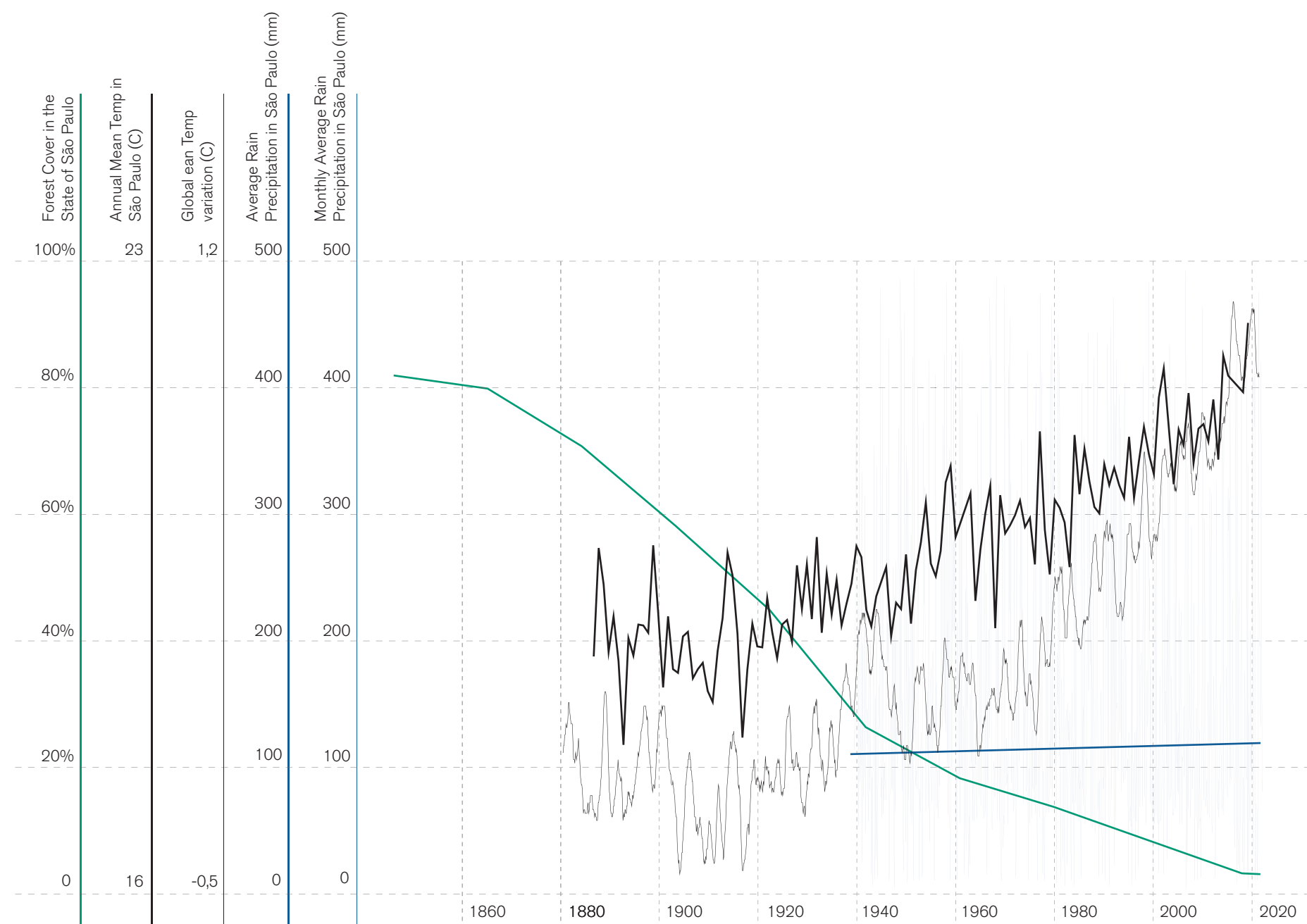
Tarsila do Amaral
Landscape with Taurus, 1925, Oil on canvas
Source: Itaú Cultural/Romulo Fialdini



Cane boom- 1970s to present day



Mechanized Harvest of cane in Chapadão do Céu (GO)
Fieldwork: Marcelo Luiz Delizio Araujo, 2017.



Deforestation, Rising Temperatures and Rainfall



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



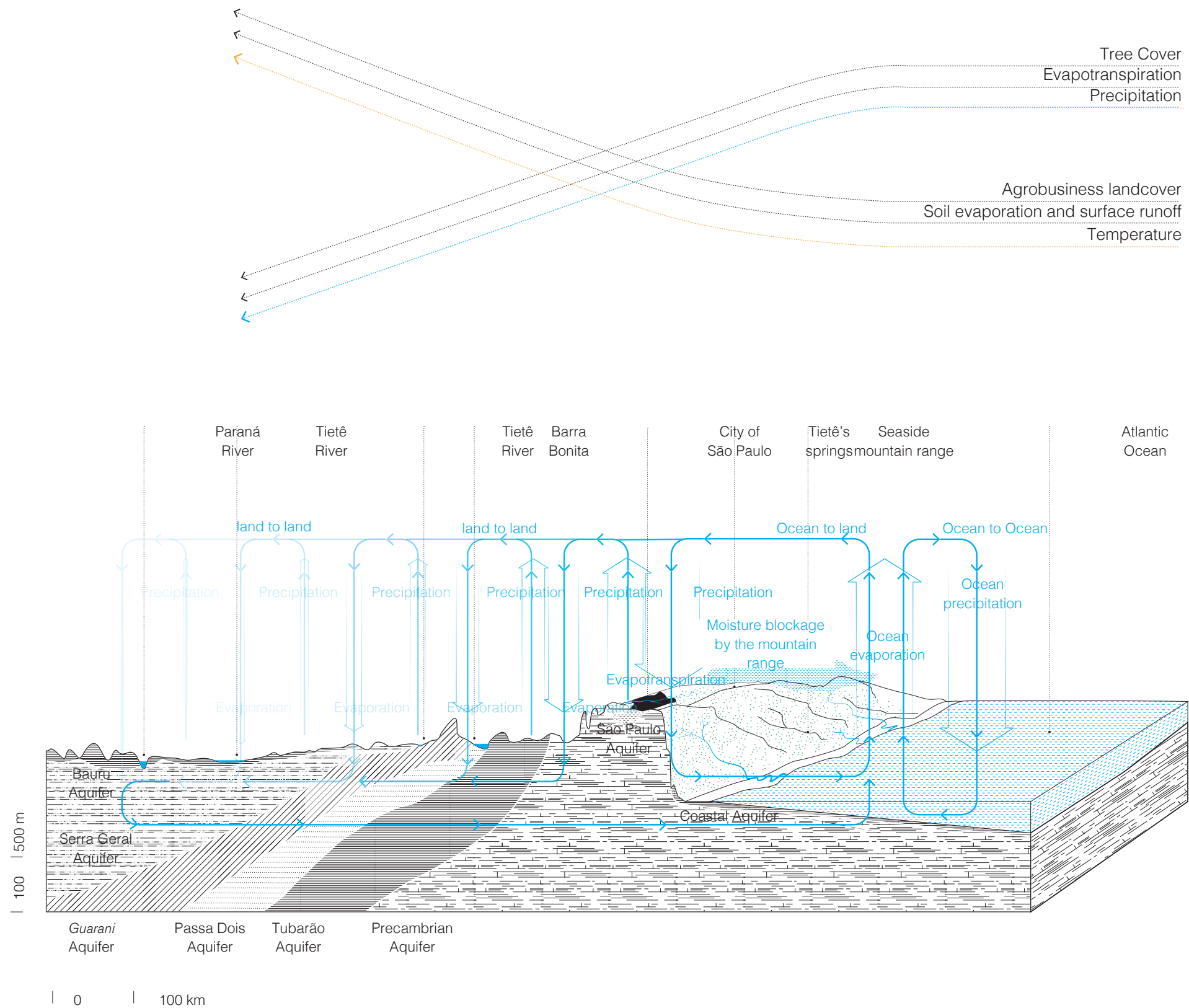
Streets flooded by rain in São Paulo
Source: Paulo Pinto / El País Brasil

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

Possibilities of restoring the ecological integrity of the
basin, as a model of regeneration for the entire biome.

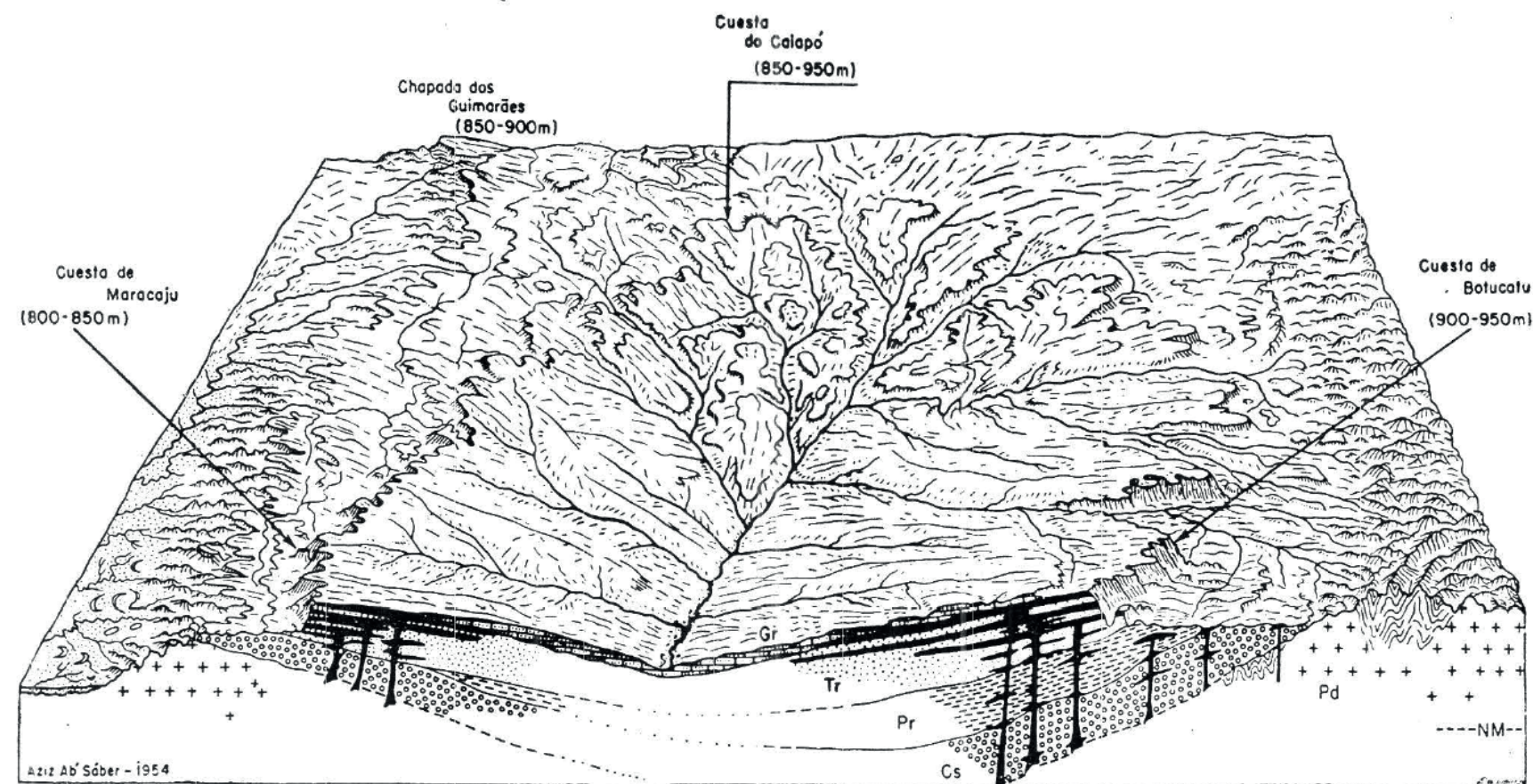
An alternative occupation, and care for the land is
proposed, more in synch with the environment.

Regeneration of hydrological cycles, operating on the continuum of
atmosphere, surface and subsurface, through a multiscale
landscape urbanism proposal



Hydrology and soil dynamics in the Tietê Basin

A Landscape Urbanism design proposal, addressing the interrelations between urban and rural, natural and anthropic, political and societal.



—— BLOCO DIAGRAMA DA BACIA DO ALTO PARANÁ ——

Diagram of the upper Paraná Basin
Aziz Ab'Saber 1954

IV. Object
Geo-physical | Cultural

Manifestation of a process at a specific point

III. Ensemble
Geo-physical | Cultural | Political

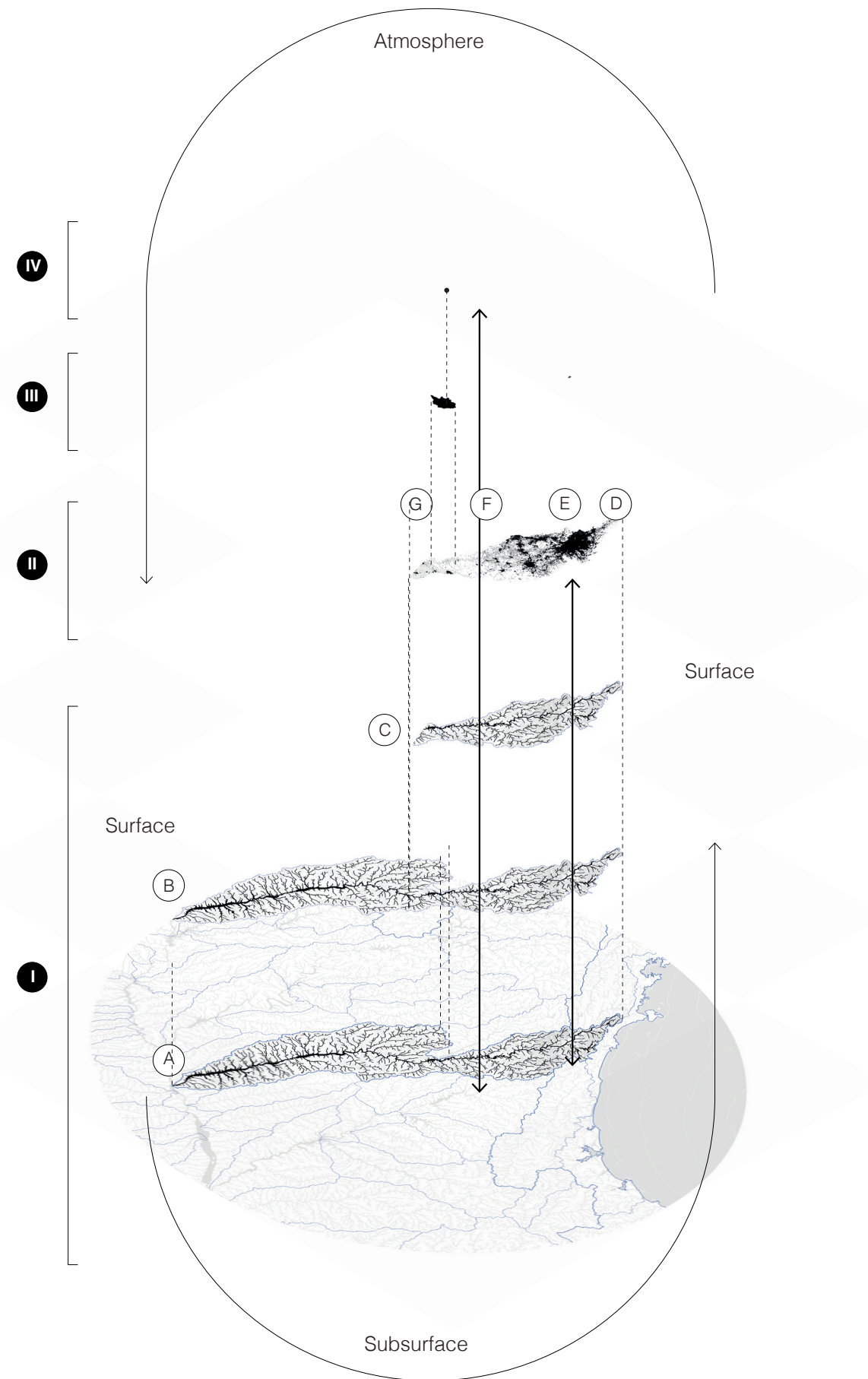
Areas of influence of a given process

II. Landscapes
Geo-physical | Cultural | Political

D. Coastal mountain range;
E. Metropolitan region;
F. Hills of the peripheral 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



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

Soil Drainage;
Erosion;

Hydrology

Groundwater availability;
Aquifers;
Aquifer recharge zones;
Flooding;
Flow and connectivity;

Land use

Barrenness of land;
Intensity of land imperviousness;
Productivity of land;
Potential Usage Capacity;
Water discharge ;

Vegetation

Existing rainforest;
Existing shrubland;
Forest type;
Forest persistance;

Pollution

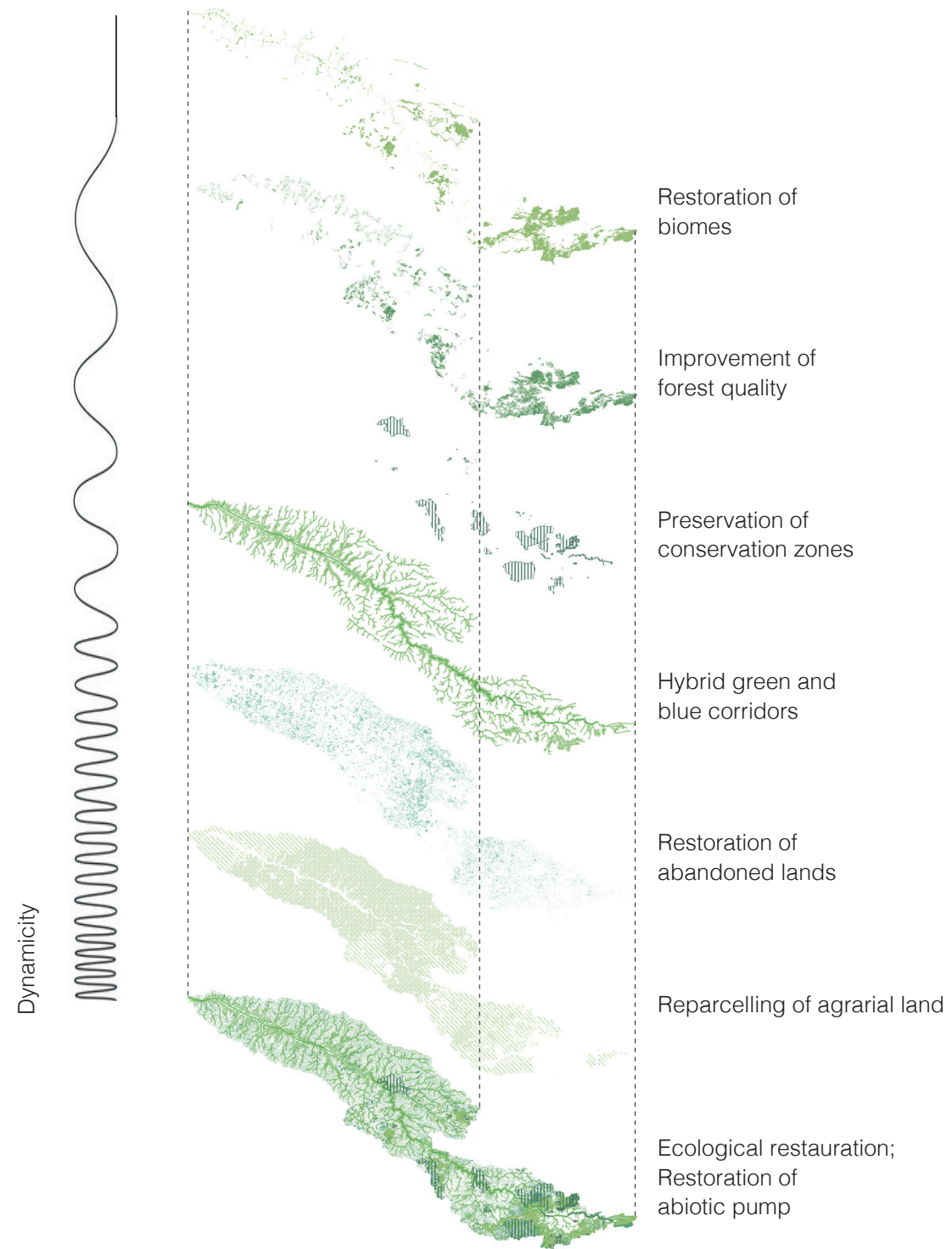
Water pollution;
Groundwater pollution;
Topsoil pollution;
Probability of soil pollution;

Landscape

Existing and potential
recreation resources;
Features of unique educational
and historical value;
Features of scenic value;


Wildlife

Existing Habitats.



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An aerial photograph of a wide, winding river with a muddy brown color. The river is flanked by lush green vegetation. Several large, sandy islands and peninsulas are visible, some with patches of greenery. The river's path is highly irregular, with many meanders and oxbow-like features. The overall scene depicts a complex and dynamic riverine landscape.

The beauty and depth of
southeastern riverine landscapes

A stretch of the Paran River, along the border between the
states of So Paulo and Mato Grosso do Sul, in Southeastern Brazil
Source: Google Maps



Reservoir of the Barra Bonita Dam, in São Paulo, Brazil
Source: Google Maps

An aerial photograph showing a river with multiple meanders flowing through a lush green landscape. The river's path is highly irregular, creating large, rounded loops. The surrounding land is covered in dense green vegetation, with some areas appearing darker, possibly indicating water or wetland. In the upper left, there are some agricultural fields and a small building. The overall scene depicts a natural, undisturbed floodplain environment.

The ambiguity of the *Várzeas*

An area of *Várzea*, along the floodplains of the
Piracicaba River, tributary of the Tietê.
Source: Google Maps



The normalized channel of the Tietê River,
upstream of the Barra Bonita Reservoir.
Source: Google Maps

The *Paulista* countryside
historical juncture



A Colheita, Antonio Ferrigno
1903, Oil on canvas
Source: Museu Paulista da USP



A sugarcane field of the São Manoel plant, in São Paulo, Brazil
Source: Usina São Manoel

The footprints of native peoples



Serrito Hill, close to the Reservoir of Barra Bonita, in São Paulo, Brazil

Source: Mapio

Photograph: Gabriel Marcusso



Construction of the Barra Bonita Hydropower Dam, in 1958
Source: Projeto Eletromemória FFLCH USP
Photograph: Oswaldo Grossi Jaú



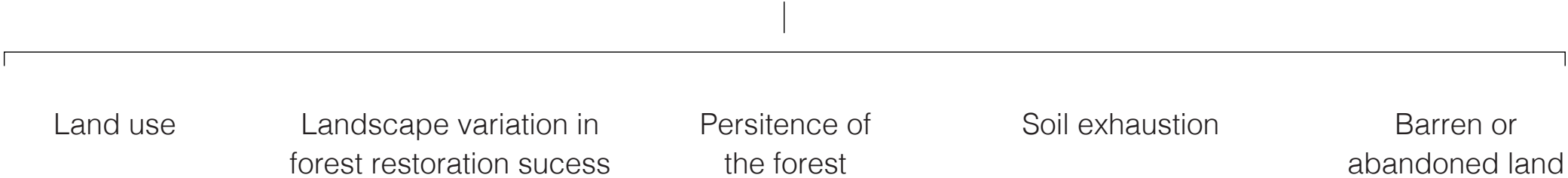
The complexity of the *Mata*

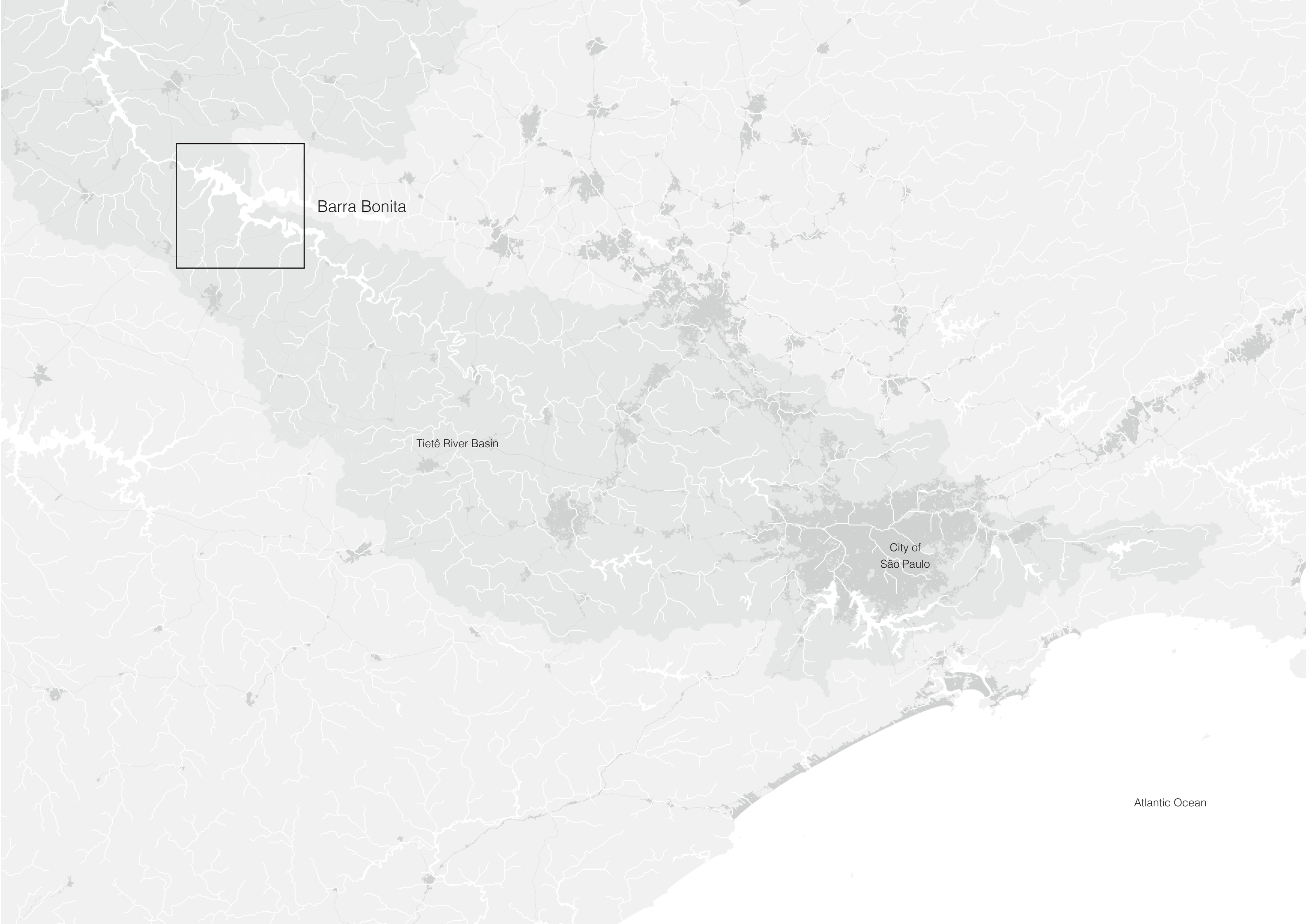
Areas covered in vegetation typical of the
Cerrado in Minas Gerais, Brazil
Source: Google Maps



Eucalyptus plantation close to the
Reservoir of Barra Bonita, in São Paulo, Brazil
Source: Google Maps

Selection of exemplary zone





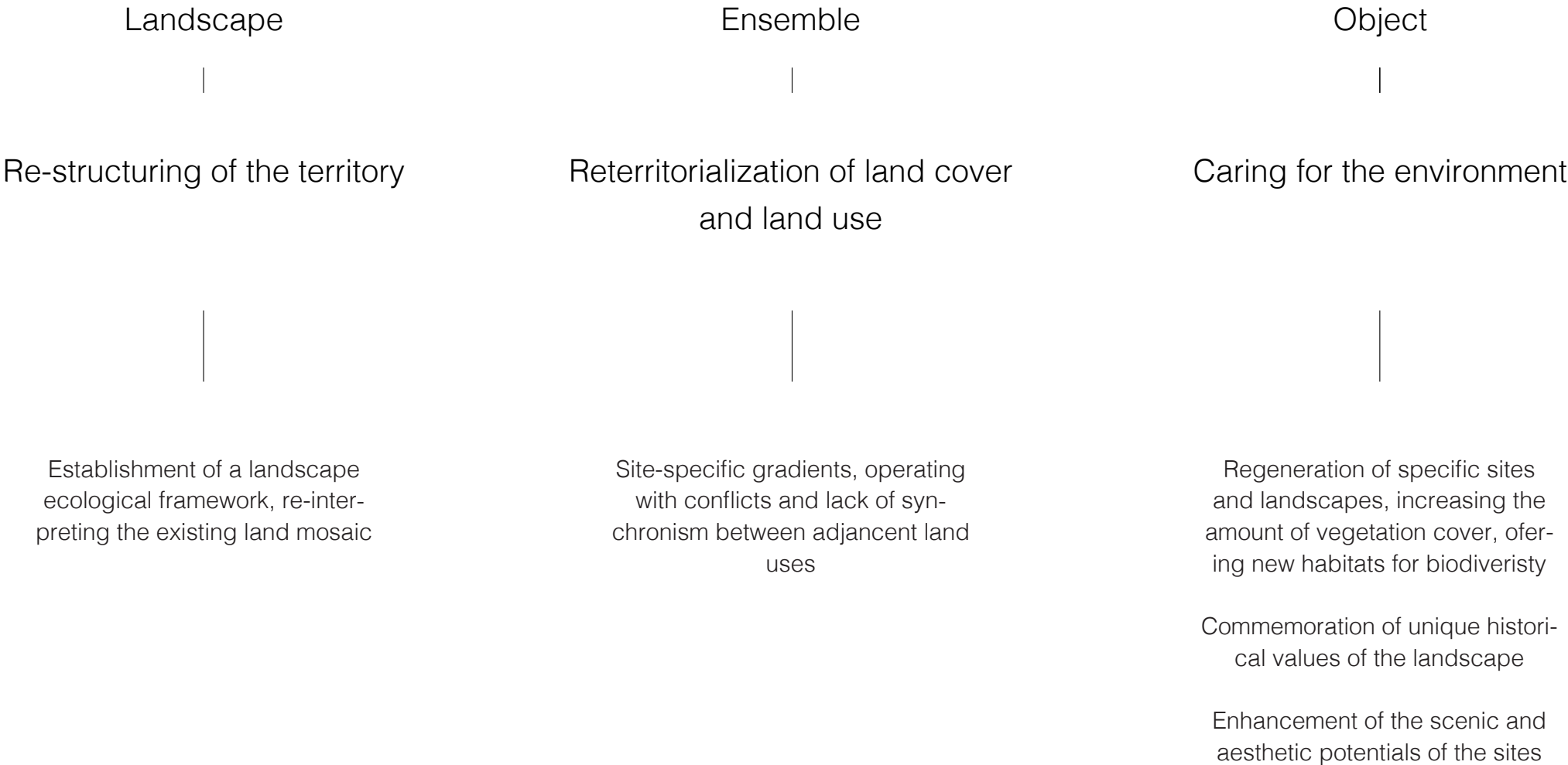
Barra Bonita

Tietê River Basin

City of
São Paulo

Atlantic Ocean

Three acts of design



Design Methodology

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

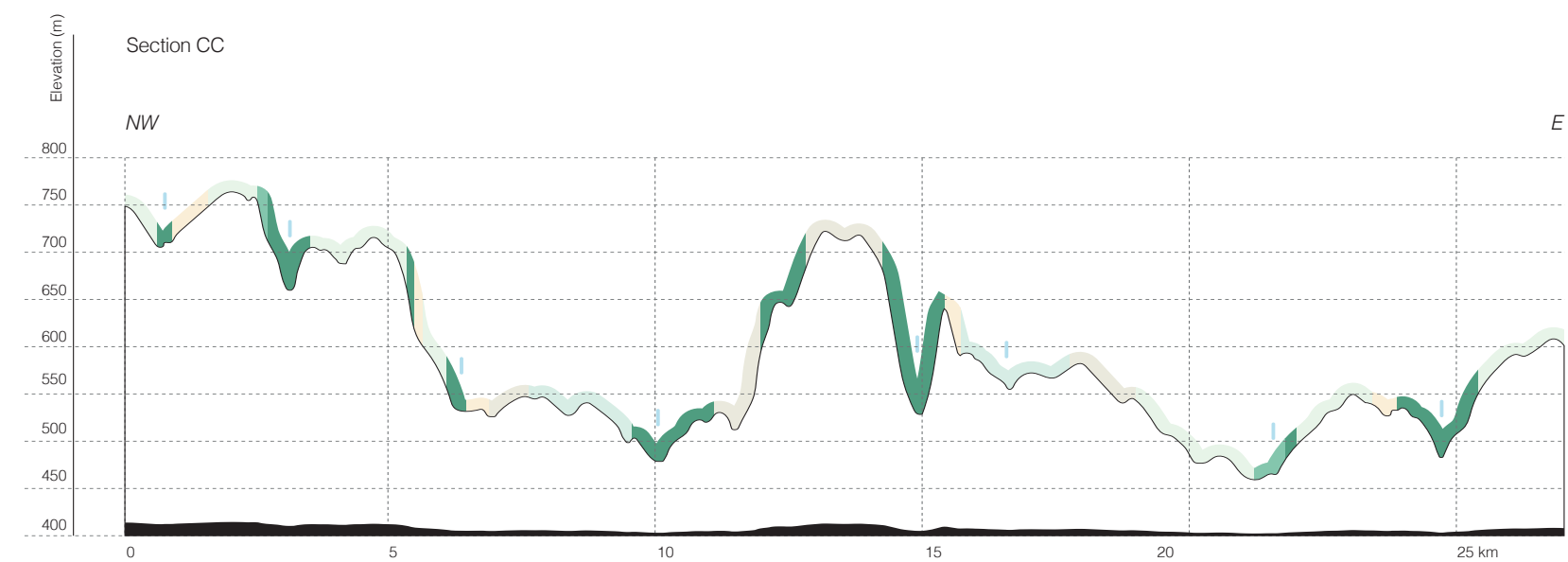
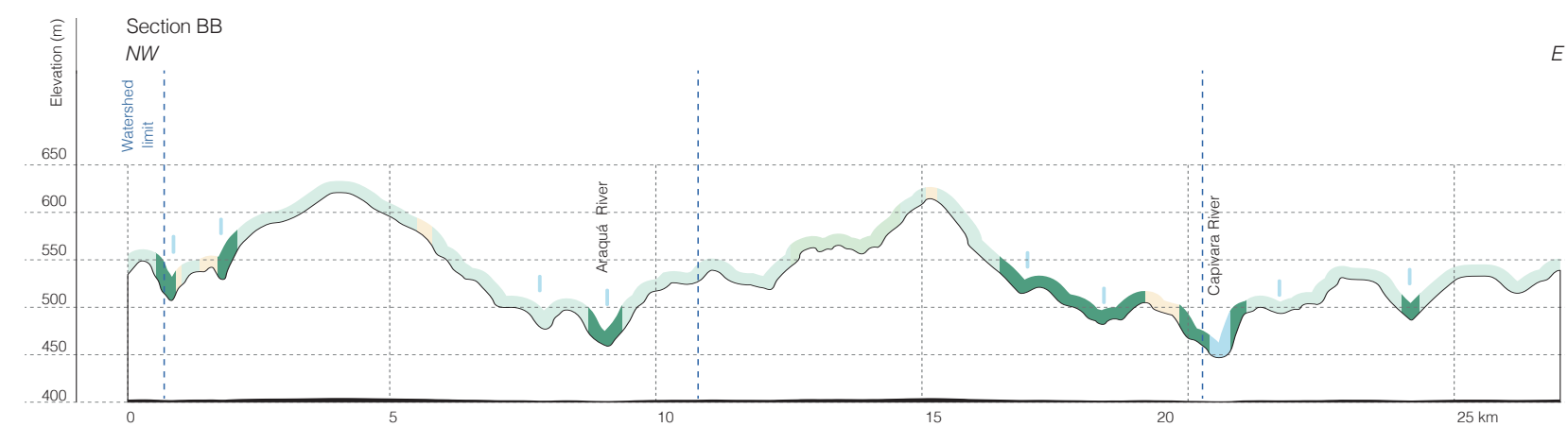
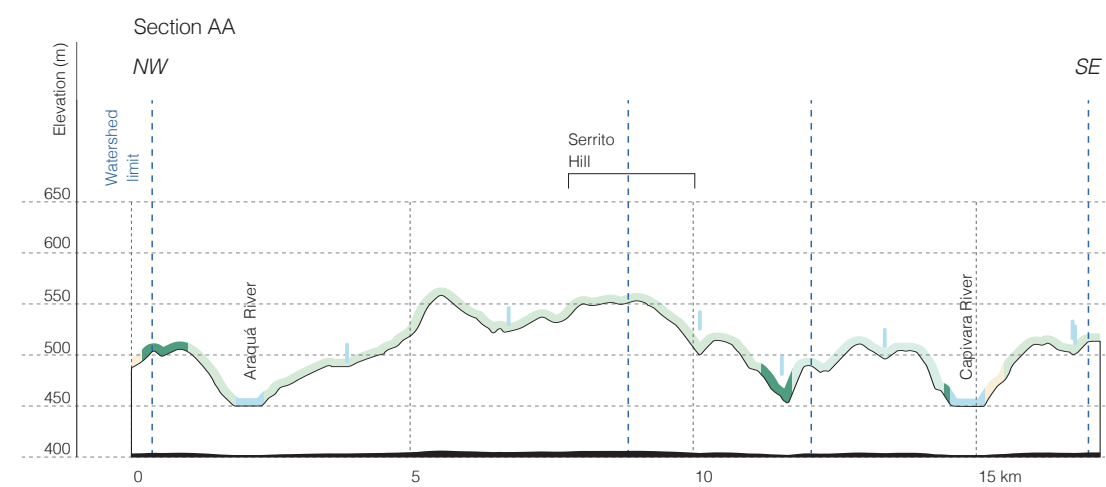
Variants

- 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

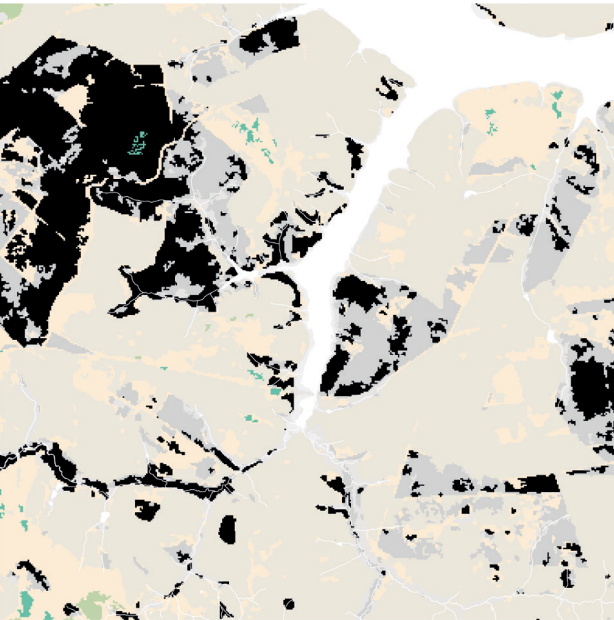


Reservoir of Barra Bonita, in São Paulo, Brazil
Source: CicloVivo
Photograph: José Reynaldo da Fonseca

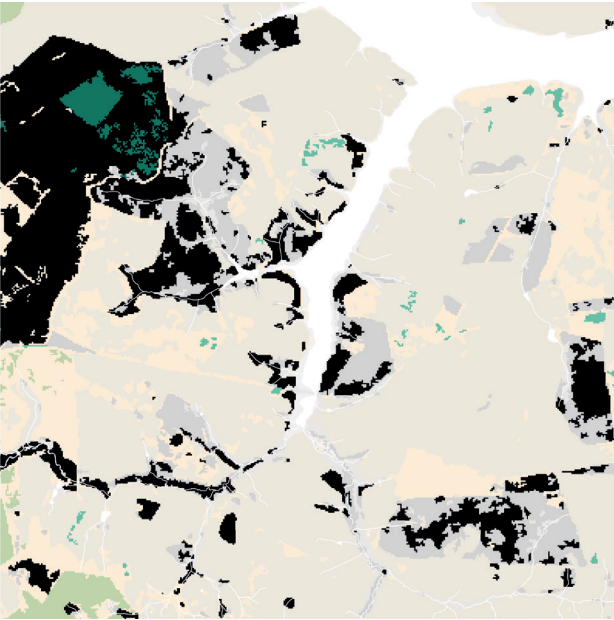


- Vegetation remnants
- Industrial farming
- Other agriculture uses
- Urban areas
- Water bodies

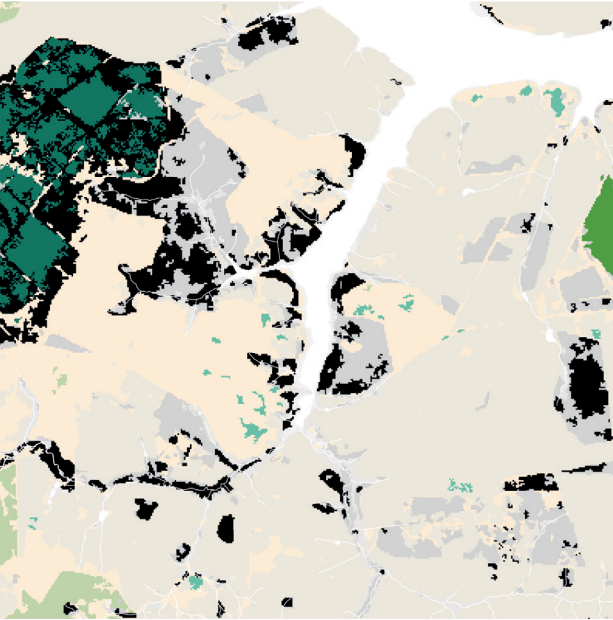
1985



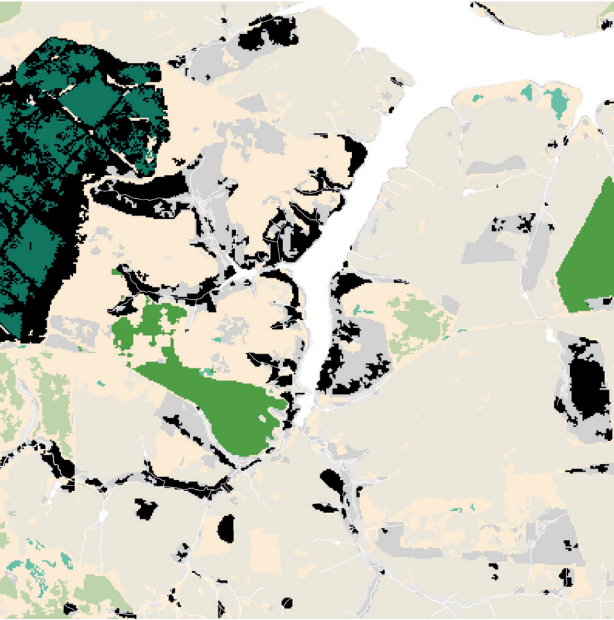
1990



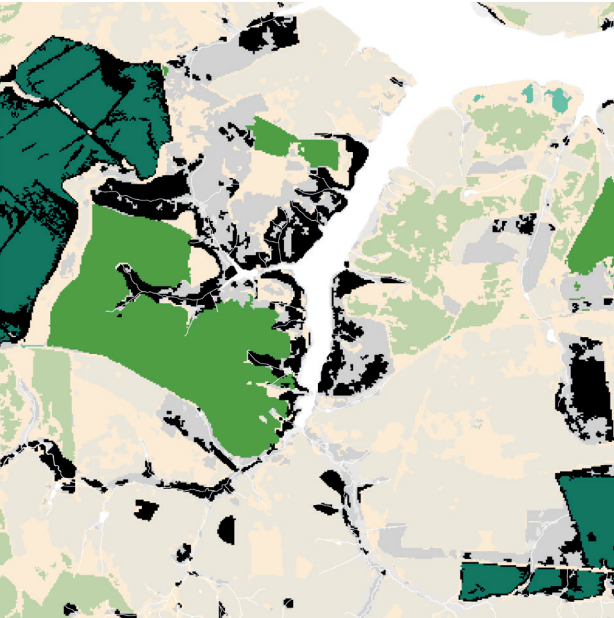
1995



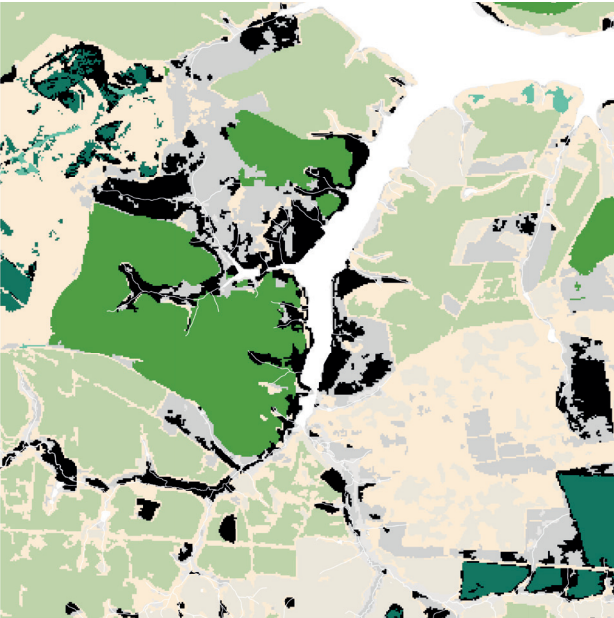
2000



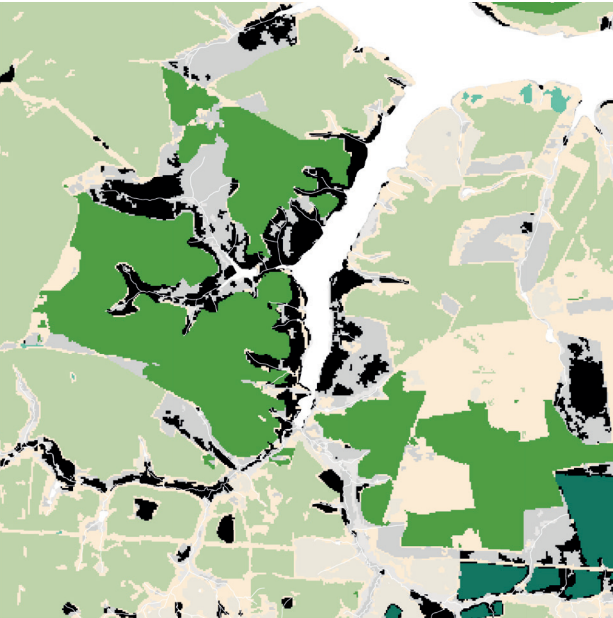
2005



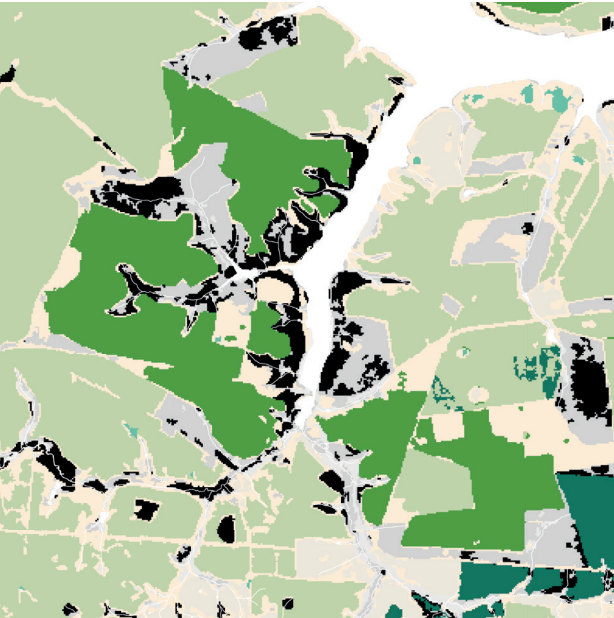
2010



2015



2020



Finding the Longue-Durée

- Natural forest
- Natural shrubland
- Pasture land
- Crop and pasture land
- Sugarcane fields
- Orange fields
- Planted forests
- Other agriculture

First act of design

Landscape

|

Re-structuring of the territory

|

Establishment of a landscape
ecological framework,
re-interpreting the existing land mosaic



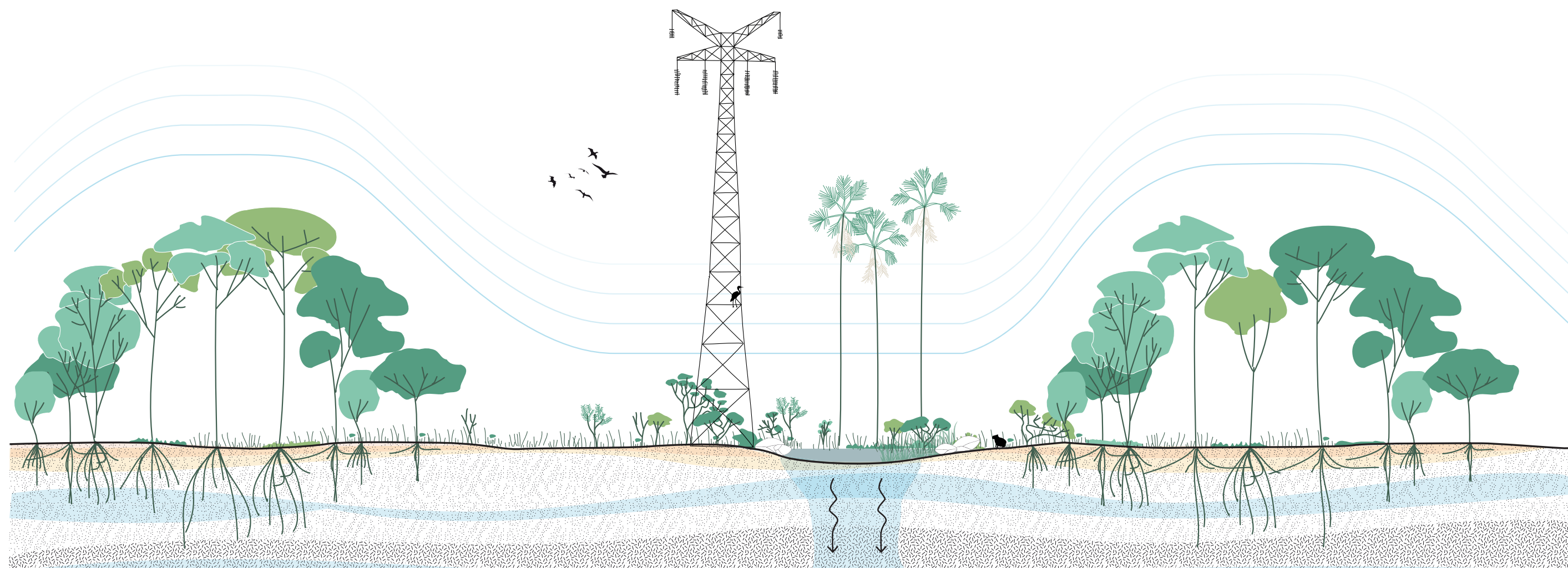
- Strategic Site Interventions
1. Establishment of new corridors along rivers and streams
 2. Establishment of new corridors along infrastructure
 3. Increase vegetation cover along the edges of the *Cuesta*
 4. Increase vegetation cover along steep areas
 5. Regeneration of tidal-zones
 6. Establishment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

Intervention on the Mosaic

0 5 km N



Powerlines inbetween sugarcane fields in Barra Bonita
Source: Google street view



2 2 3 4 A 3 2 2

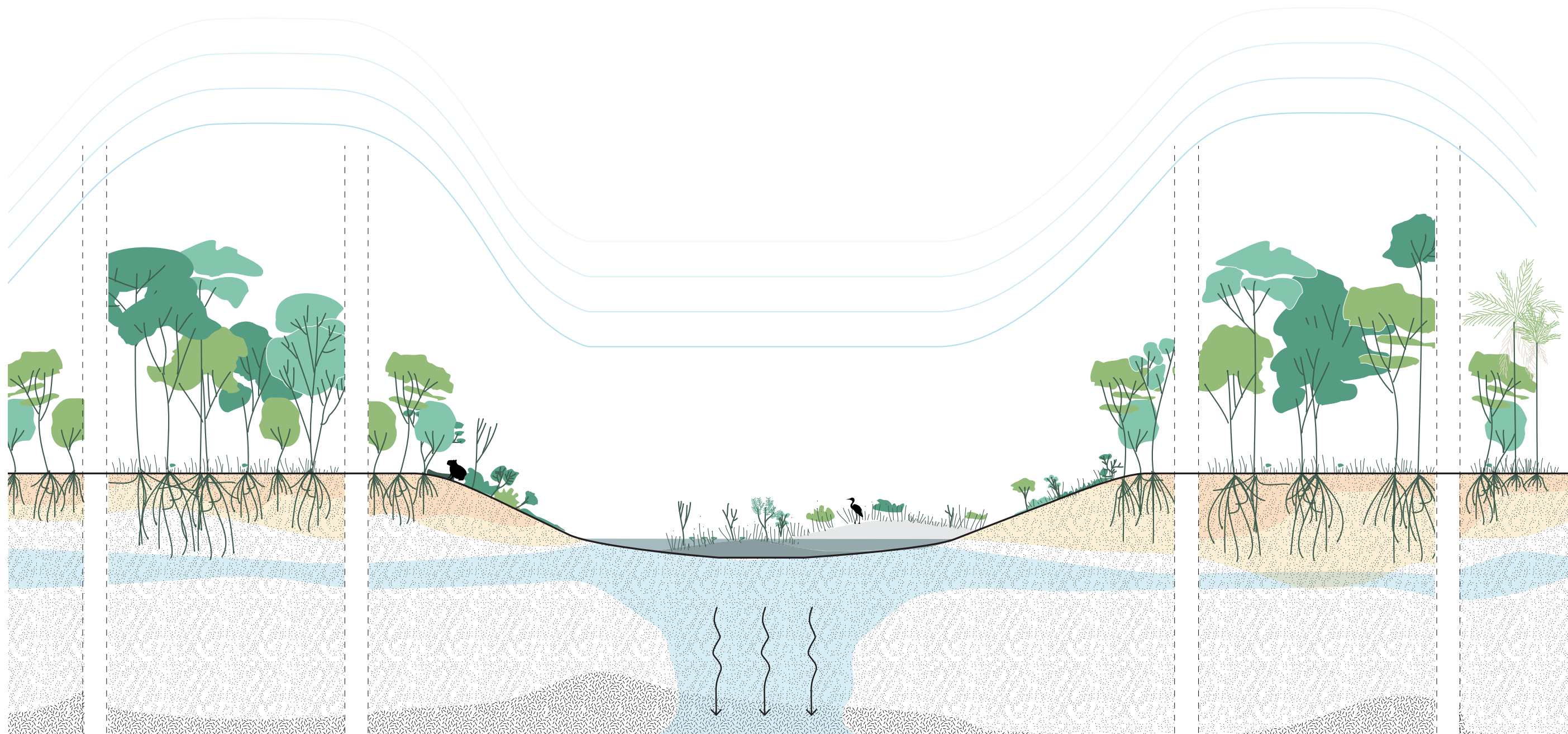
- 1. Interior
- 2. Edge
- 3. Verge
- 4. Internal Entity
- 5. Veil
- 6. Mantel
- 7. Cropland
- A. Infiltration Pond
- B. Ditch
- C. Constructed Wetlands
- D. Wooden Piling

0 10 20 m

Ecological corridor along powerlines
Disturbance Corridor/ Introduced Corridor



Former wetland area, adjacent to the Barra Bonita Reservoir
Source: Google street view



② ① ② ④ C ② ① ②

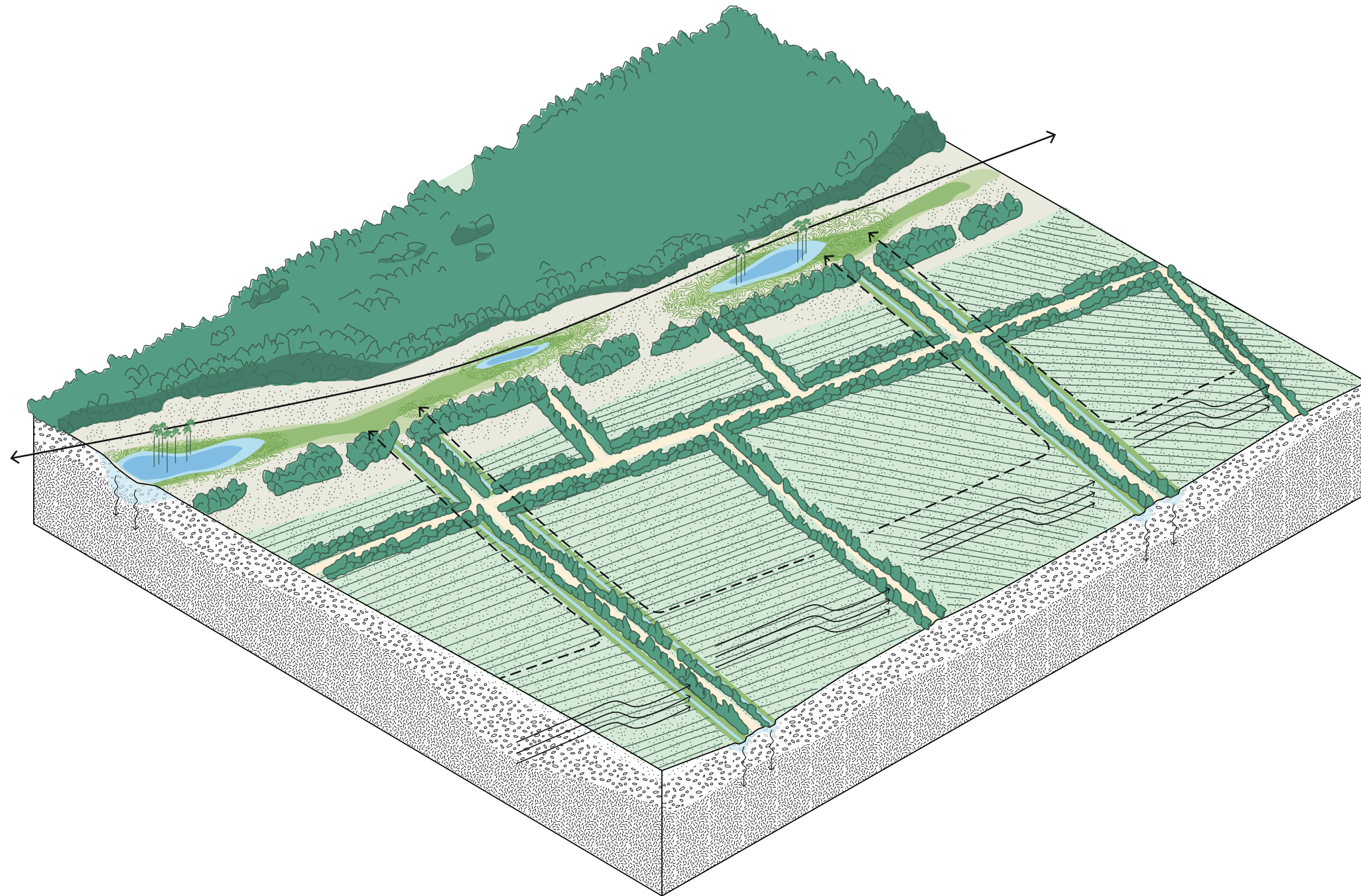
Floodplain Corridor
Environmental corridor

- 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



Remnant vegetation patch adjacent to an exposed field
Source: Google street view



Edge Patches
Tiny patches along boundaries of larger patches

Second Act



A sugarcane field of the São Manoel plant, in São Paulo, Brazil
Source: Usina São Manoel

Second act of design

Ensemble



Reterritorialization of land cover
and land use



Establishment of a landscape
ecological framework, re-inter-
preting the existing land mosaic

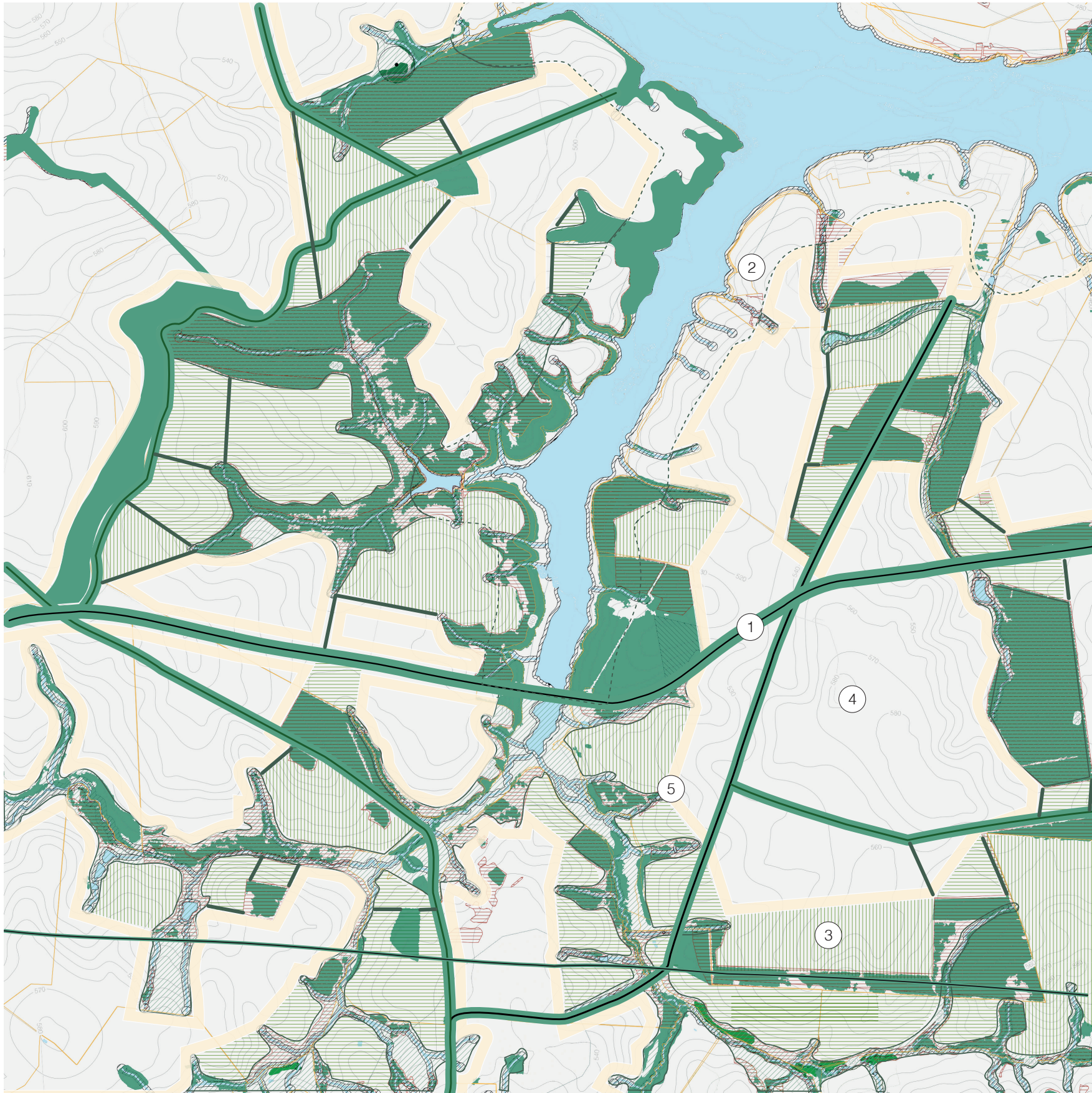
Site-specific gradients, operating
with conflicts and lack of synchro-
nism between adjaance land uses



Photographs of the Barra Bonita reservoir and the
Capivara River Tidal zone.
Source: Mapio, 2022



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



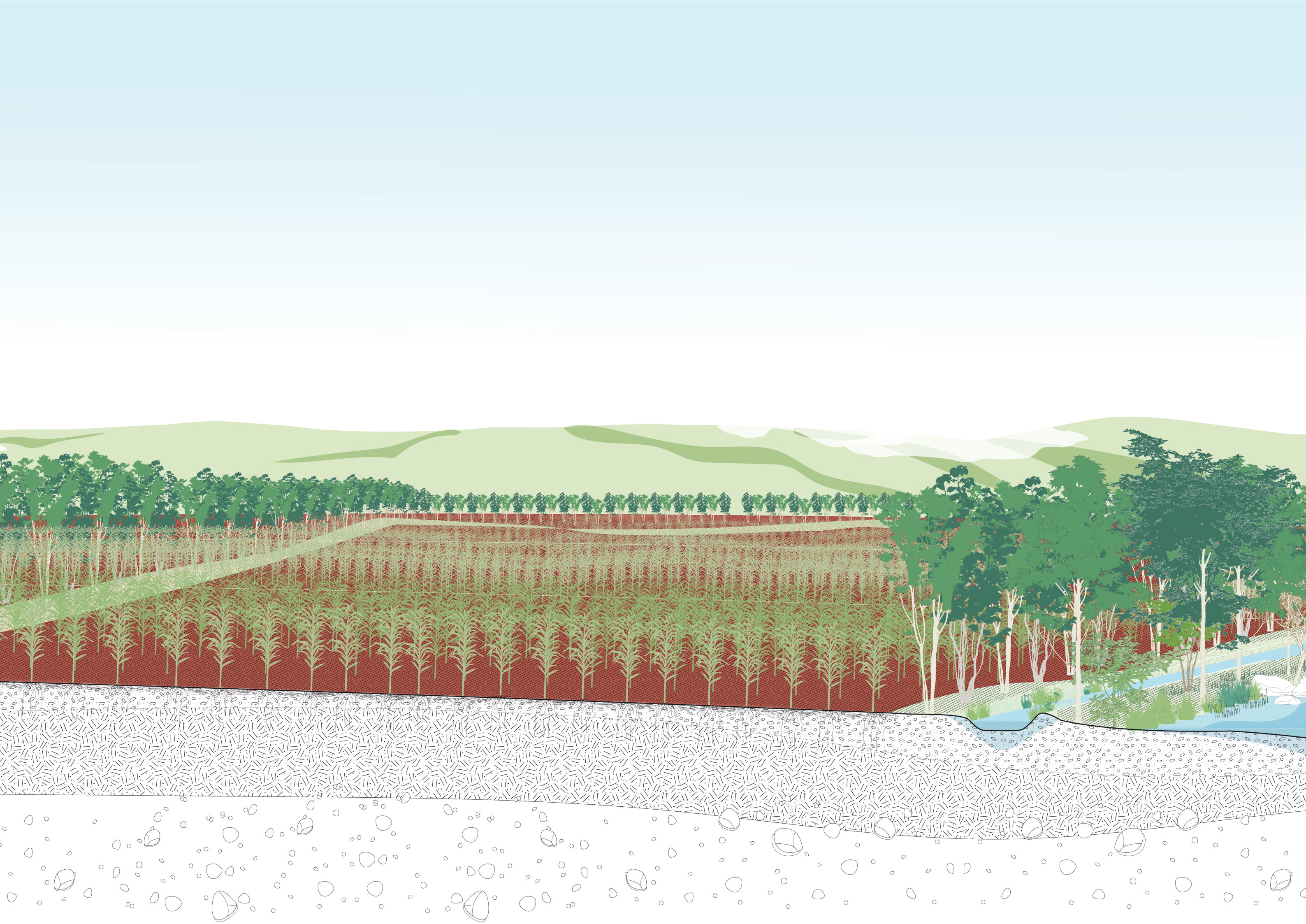
Getting specific with corridors, patches and matrix

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



Occupying the edge zones, or spaces in-between











Third Act

Várzeas of the *Tanquã*, along the Piracicaba River.
Photograph: Christiano Diehl Neto

Third act of design

Object



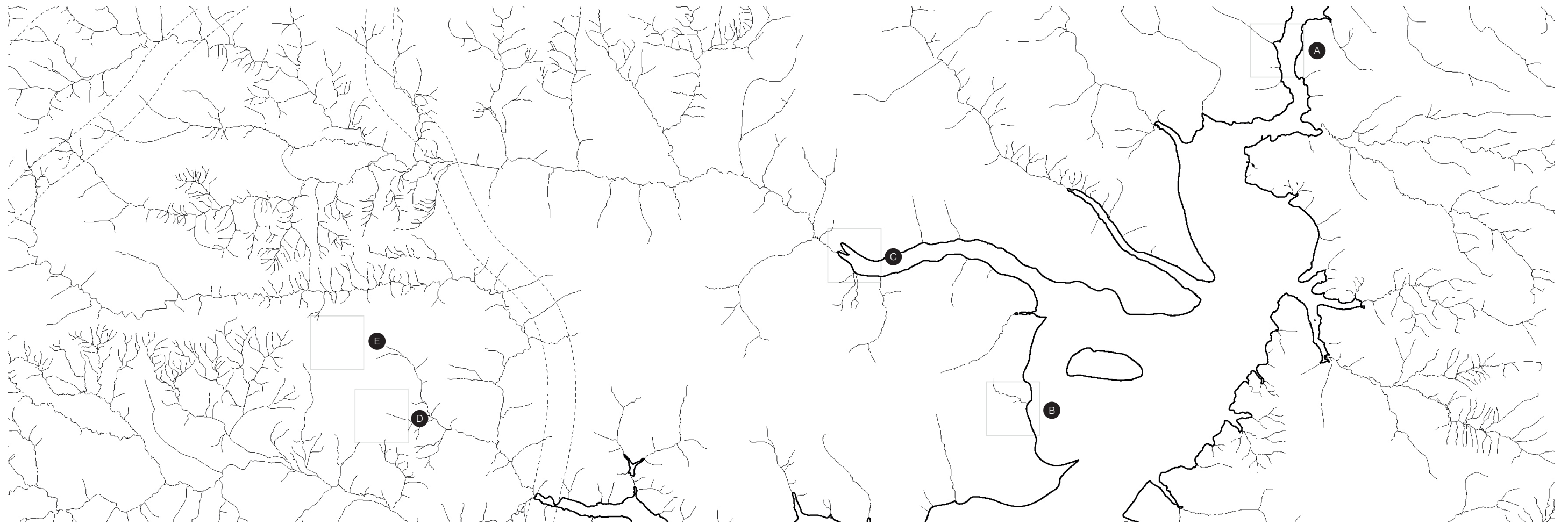
Caring for the environment



Regeneration of specific sites and landscapes, increasing the amount of vegetation cover, offering new habitats for biodiversity

Commemoration of unique historical values of the landscape

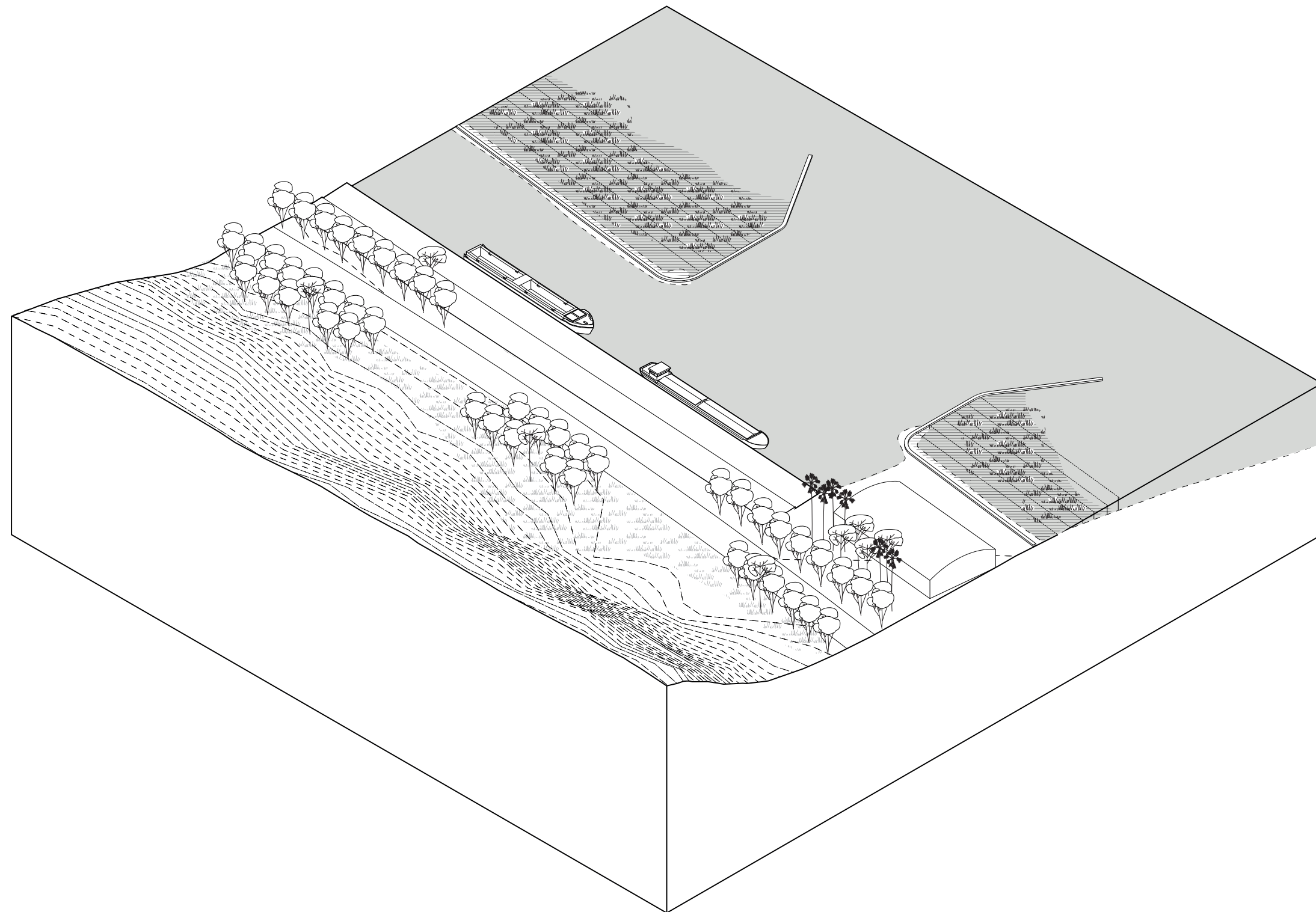
Enhancement of the scenic and aesthetic potentials of the sites



- 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

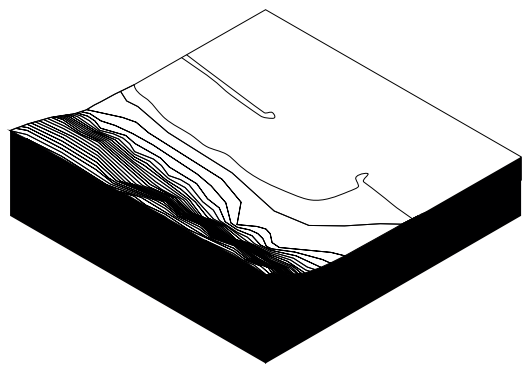


River Cruise along the Tietê River
Source: Revista Viagem e Turismo/Abril
Photograph: André Penner

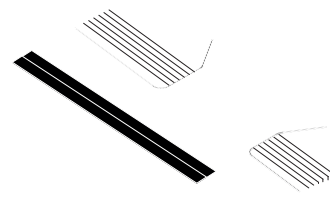


A. Farmer's port of Igarçu do Tietê

Topography



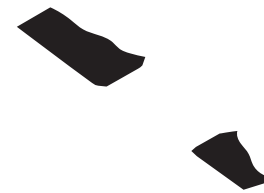
Light-engineering
works



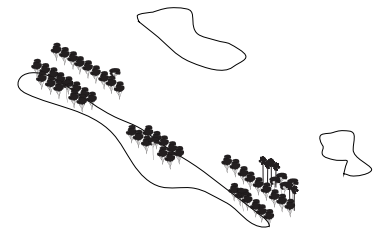
Water

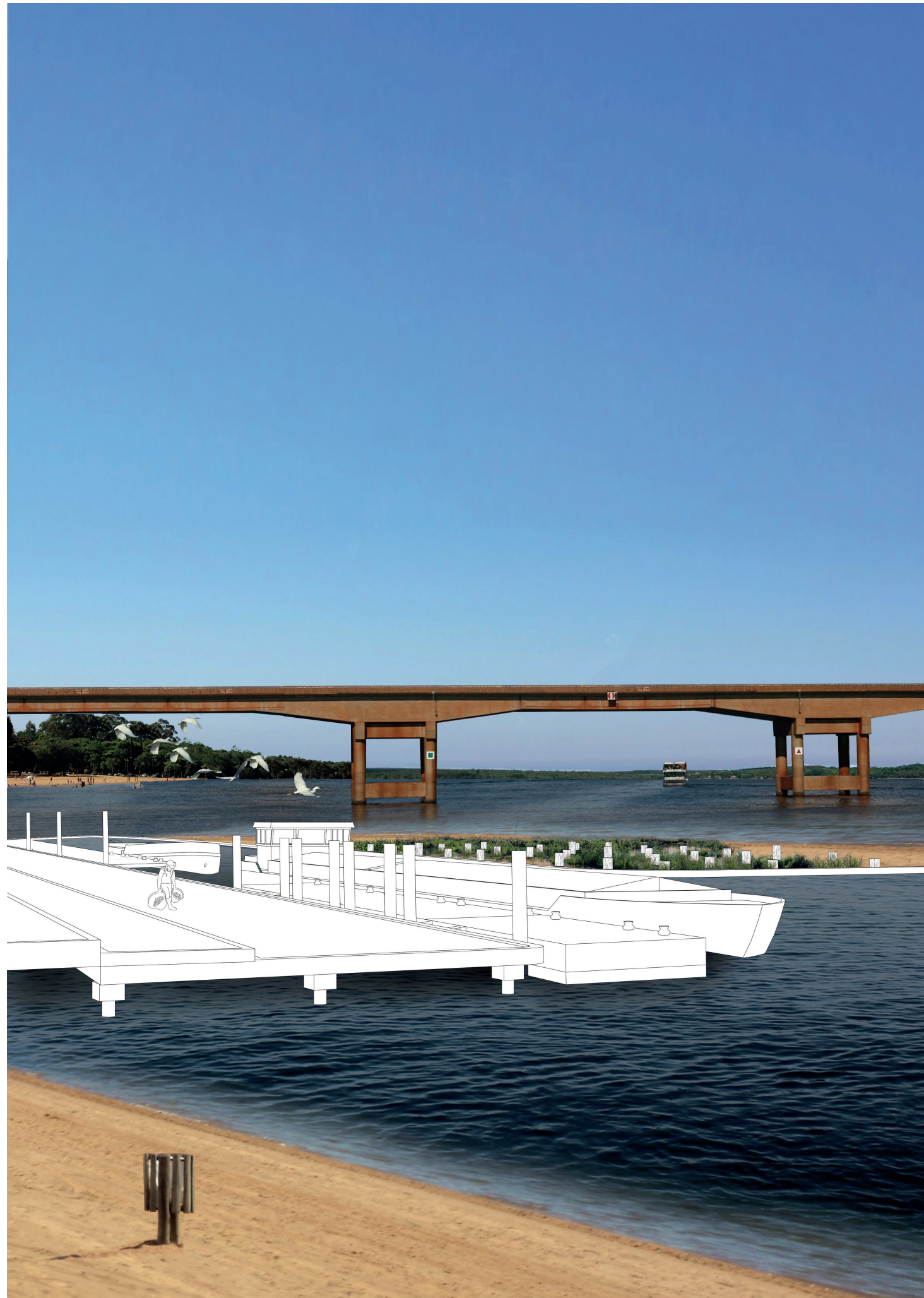


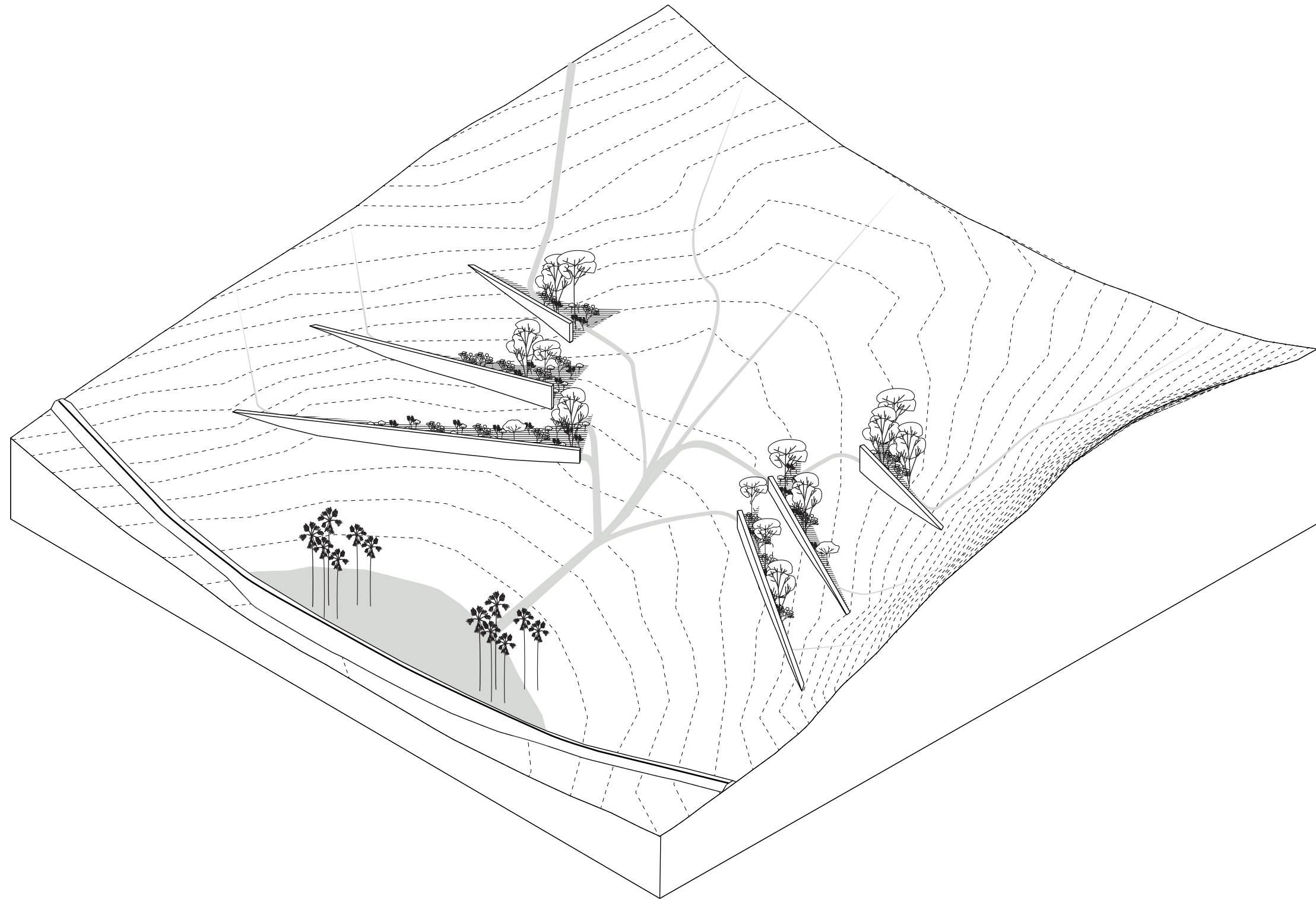
Sedimentation



Vegetation

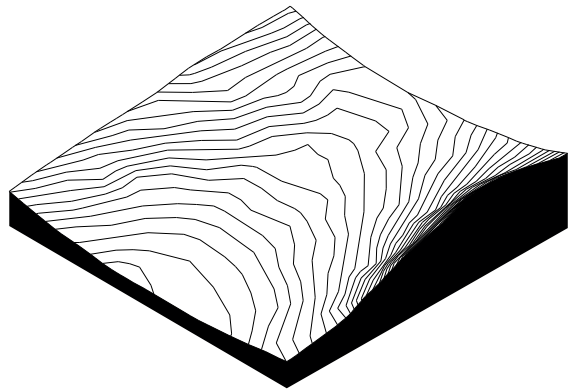




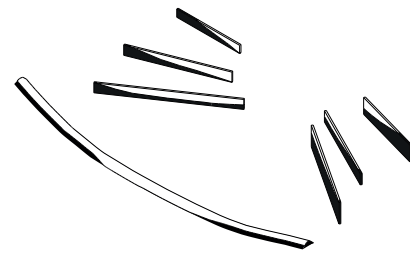


B. Archeological Park of Barra Bonita

Topography



Light-engineering
works



Water



Sedimentation



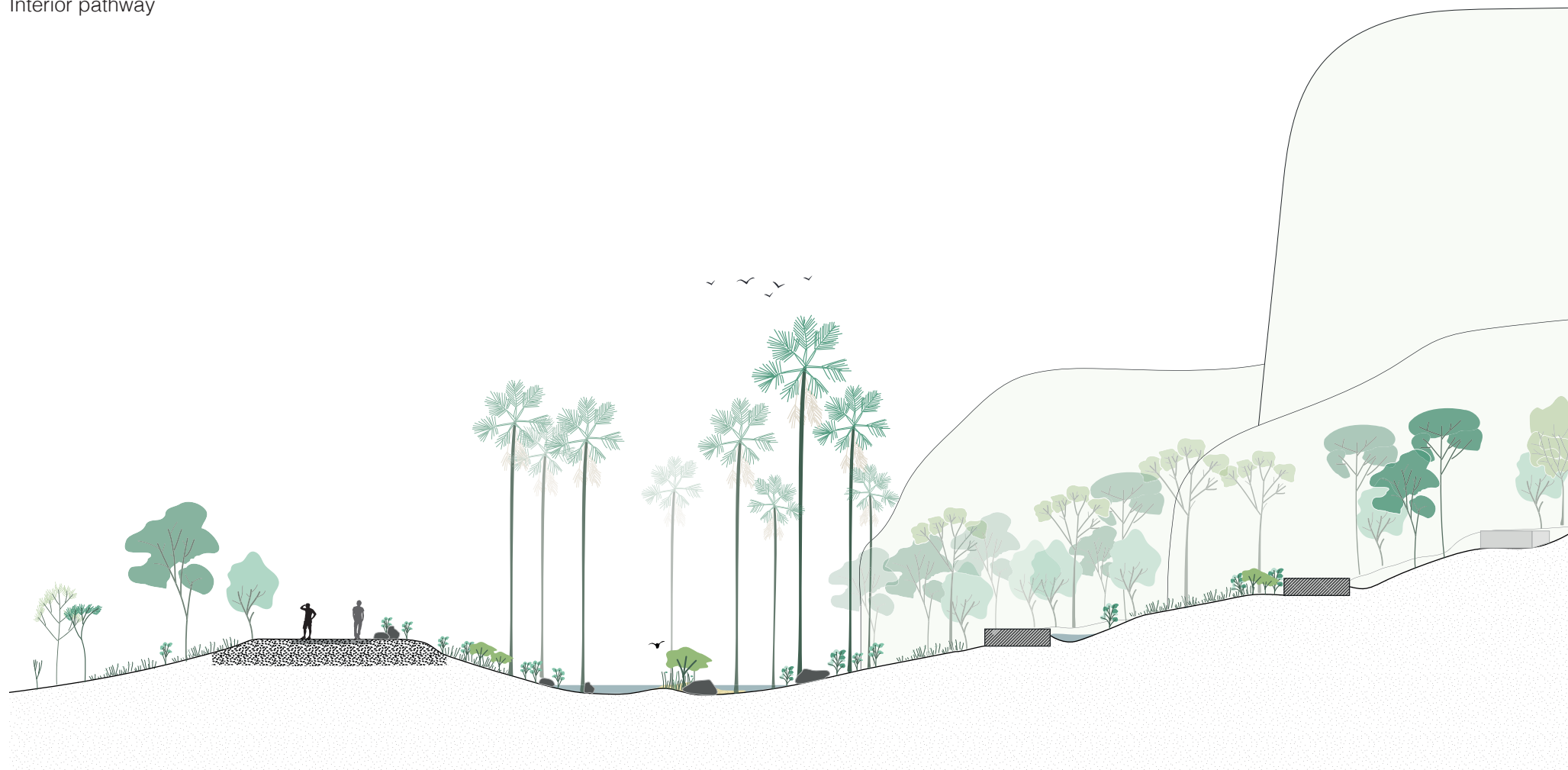
Vegetation



Waterfront pathway



Interior pathway

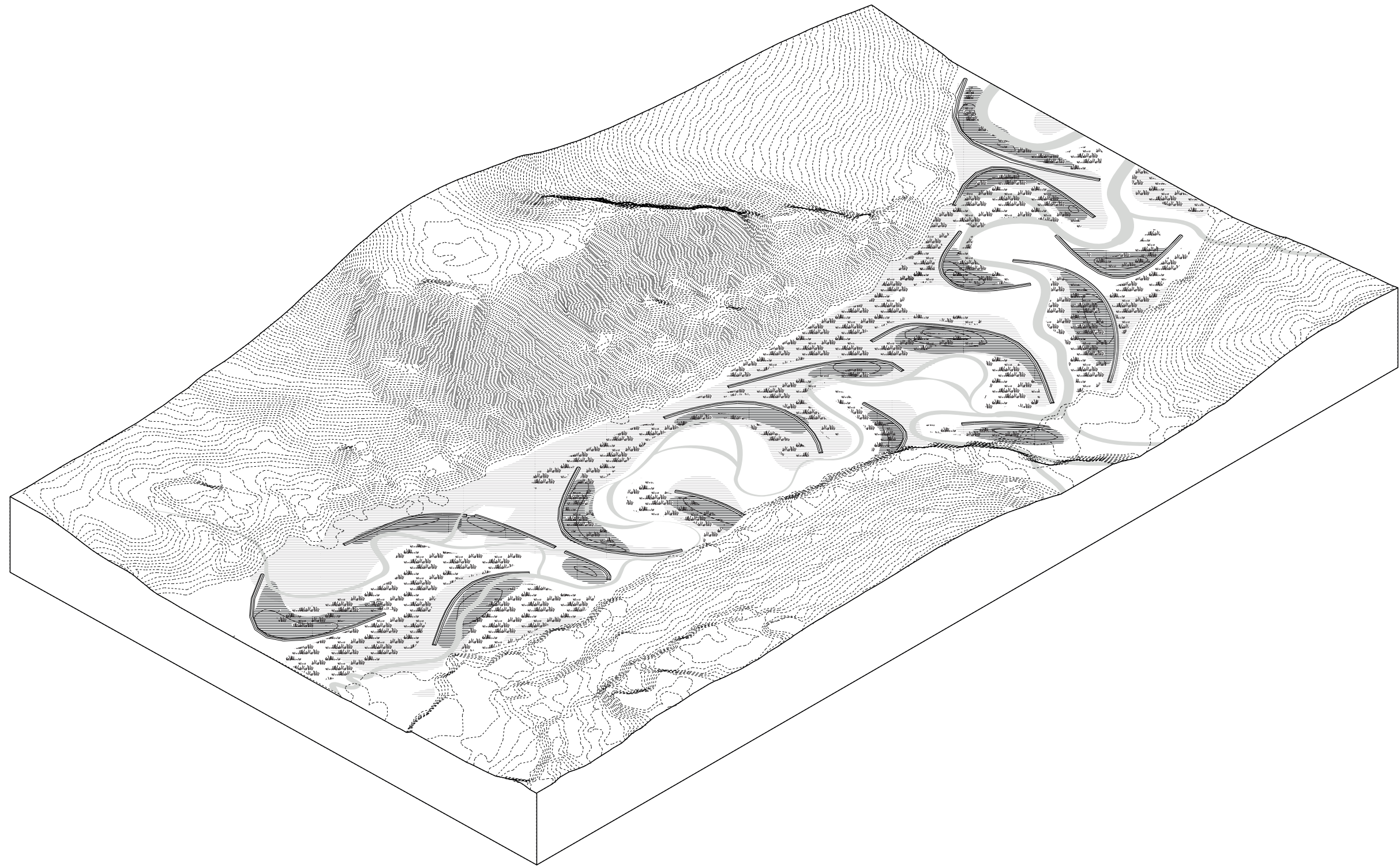


Araucárias Grove



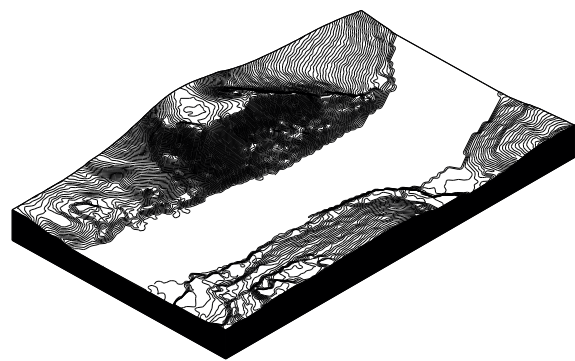






C. Várzea Park

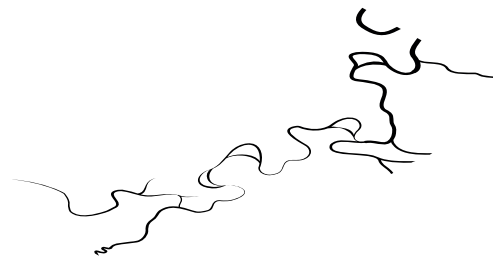
Topography



Light-engineering
works



Water



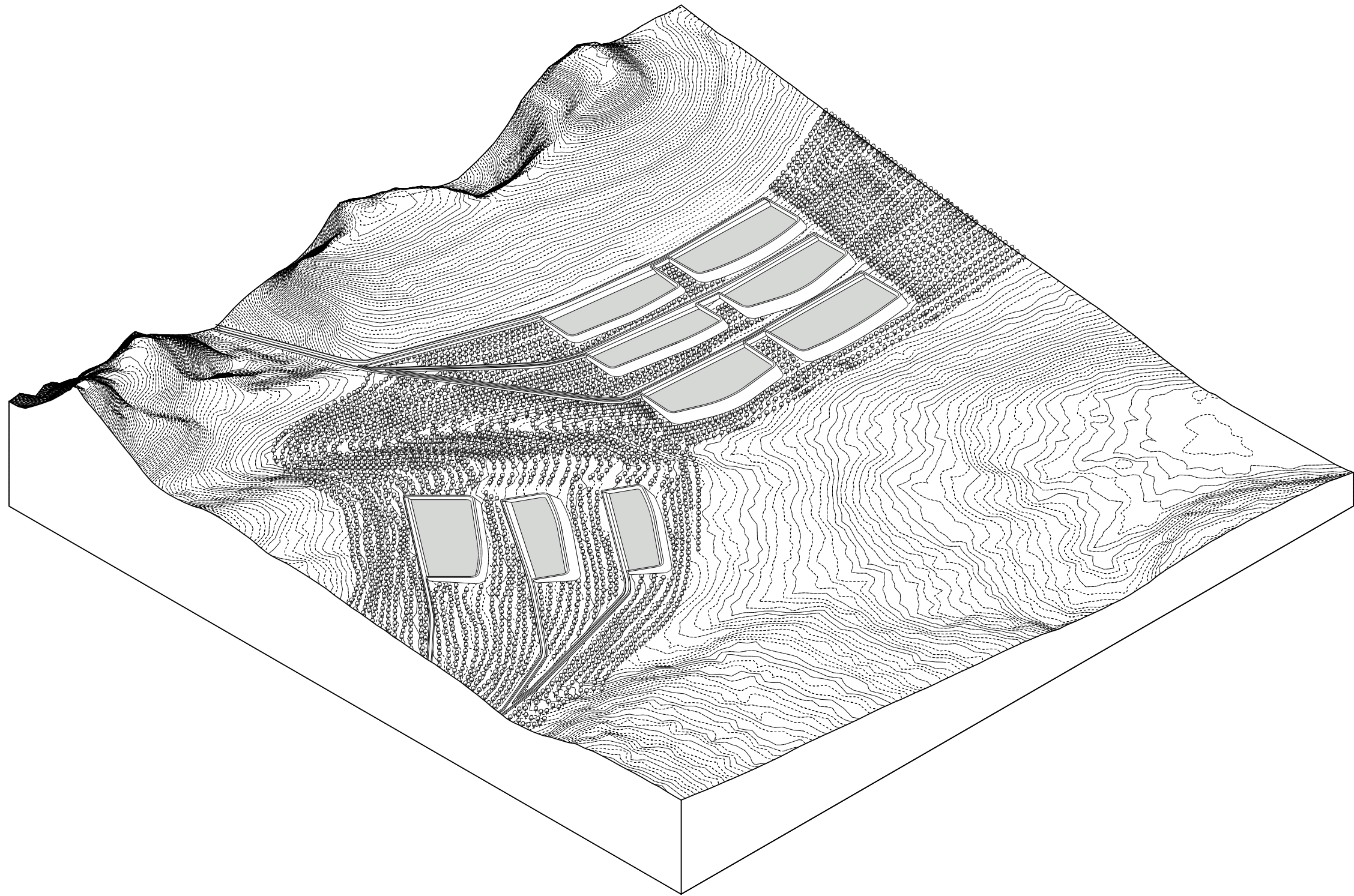
Sedimentation



Vegetation

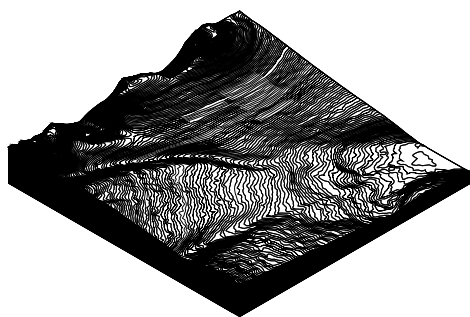




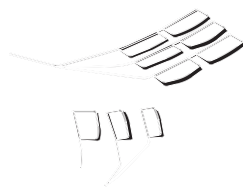


D. Guarani water battery

Topography



Light-engineering
works



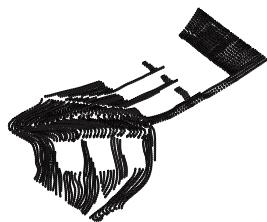
Water

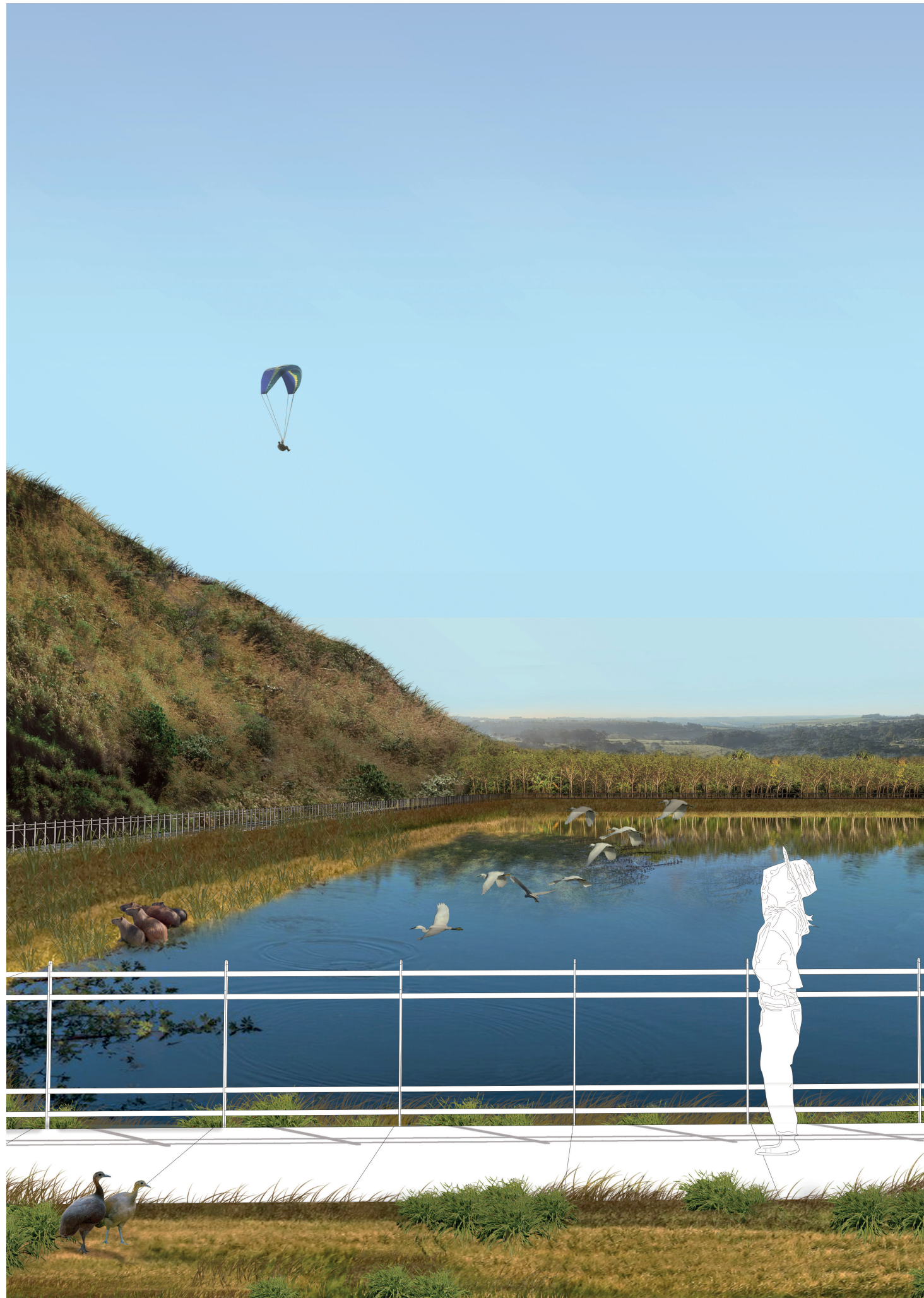


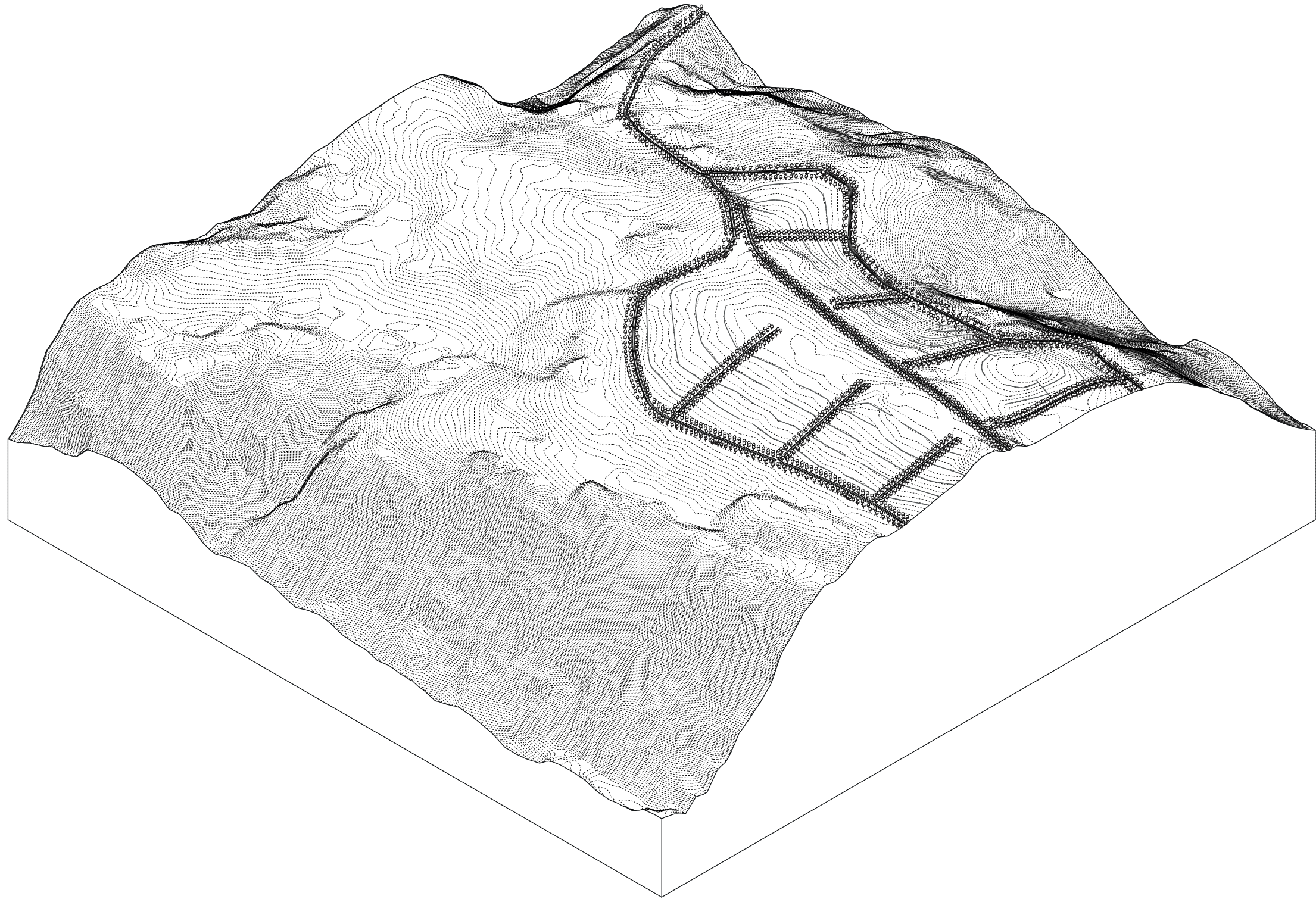
Sedimentation



Vegetation

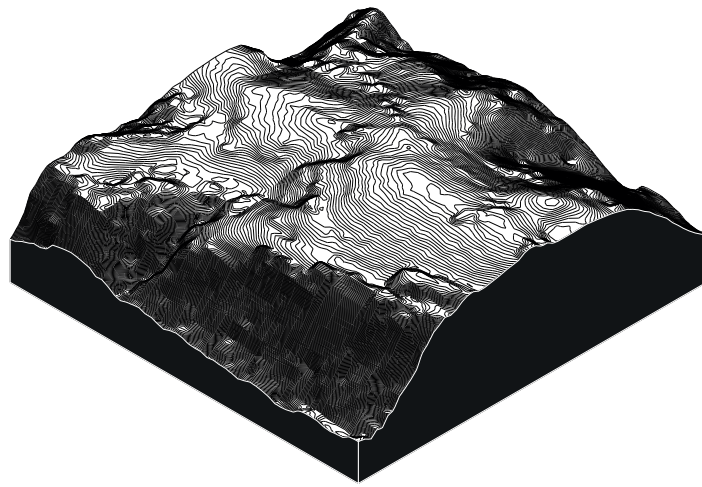






E. Cuesta's hillslopes conservation
and infiltration plan

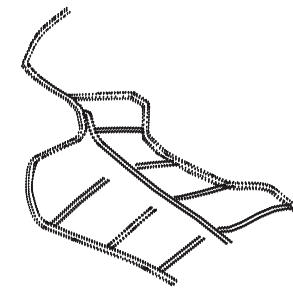
Topography



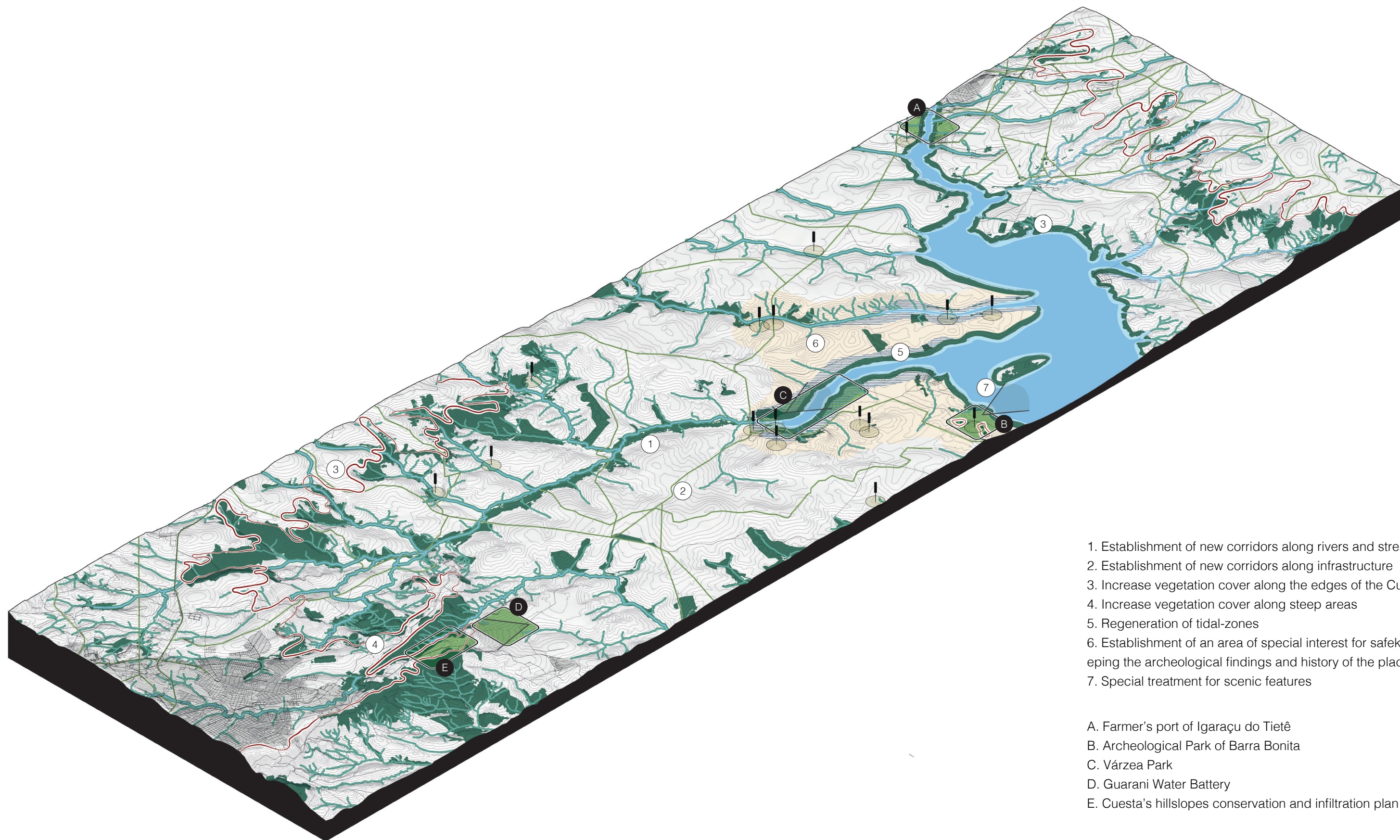
Light-engineering
works



Vegetation







1. Establishment of new corridors along rivers and streams
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Vision acting on multiple scales

Care as a design tool, highlighting the agency of cultural, landscape and historical features as a way of reading the landscape

Transferrability of site-specific solutions to other contexts, maximization of transformation potential

Redesign of the landscape as a model for territorial transformational on a larger scale, across the land

