URBAN FLOOD MITIGATION USING NATURE-BASED SOLUTIONS: THE TIETÊ RIVER IN SÃO PAULO CITY

UNIVERSITY OF GEORGIA
Compound Inundation Team for Resilient Applications

Luciana Iannone Tarcha[1], Felix L. Santiago-Collazo[1]
[1]School of Environmental, Civil, Agricultural and Mechanical Engineering
University of Georgia, Athens, GA
IRIS Industry Summit, 11/08/2023, Athens GA, Contact: litarcha@uga.edu

Institute for Resilient Infrastructure Systems
UNIVERSITY OF GEORGIA

Motivation

Personal Motivation:

- The biggest and most important river of São Paulo State is the Tietê River, which crosses the whole state from southeast to northwest. It also crosses São Paulo City, making its marginals, nowadays, the main transportation routes for its entire Metropolitan Region.
- My family has lived in São Paulo City since the late 19th century. Since then, they have been living in the Tatuapé district, located at the Tietê margins, where they were part of swimming and rowing clubs.
- I lived in São Paulo for 5 years. Every summer day, flooding was always the main concern, since this season's storms are usually high-intensity rainfall within only a few minutes.


Figure 1: My grandfather Affonso Iannone and his sister at the river banks in 1948

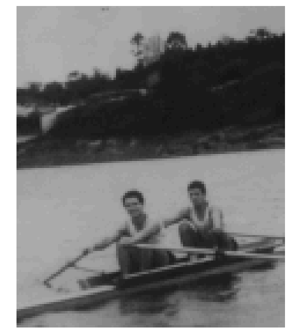


Figure 2: Rowing in Tiete River at the Corinthians Club in the Tatuapé District


Figure 3: Flooded Tietê River between the years 1960 and 1970

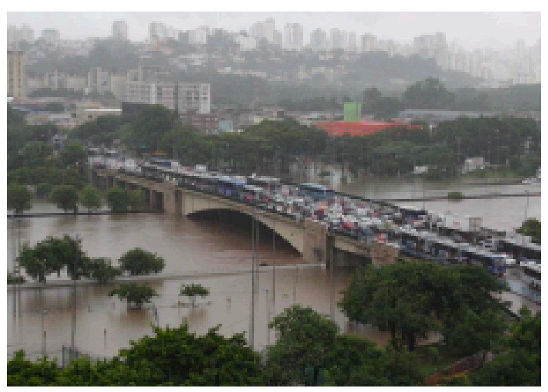


Figure 4: Casa Verde Bridge crossing the flooded Marginal Tietê in 2020

Problems:

- Flood events have been part of São Paulo City dynamics since the early changes on the Tietê River and its tributaries.
- The 1929 flood is considered the greatest that has ever hit the city.
- São Paulo still suffers from the consequences of intense and disordered urbanization.

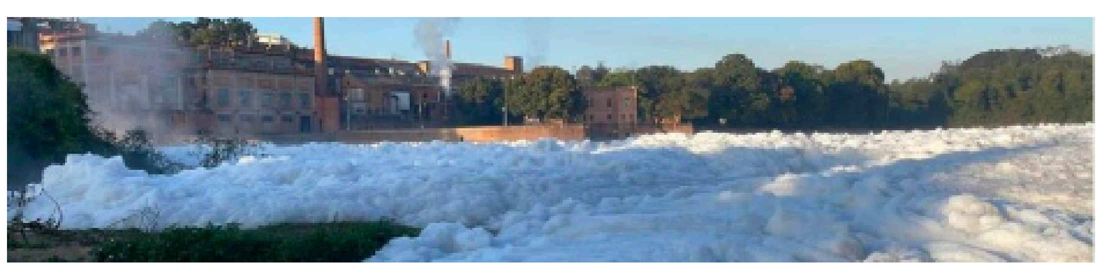


Figure 5: Toxic foam on Tietê River, 100 km downstream of São Paulo, 2023

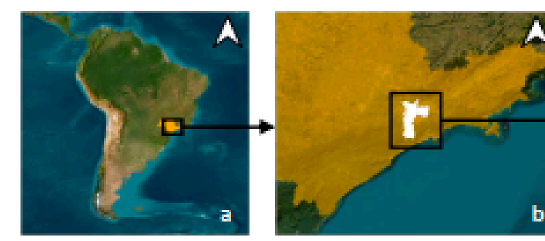
- Another issue is water pollution, which has a major impact on the local ecosystem and to all downstream areas.

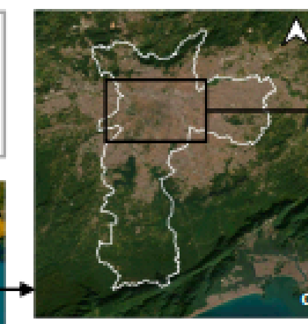
Study Area

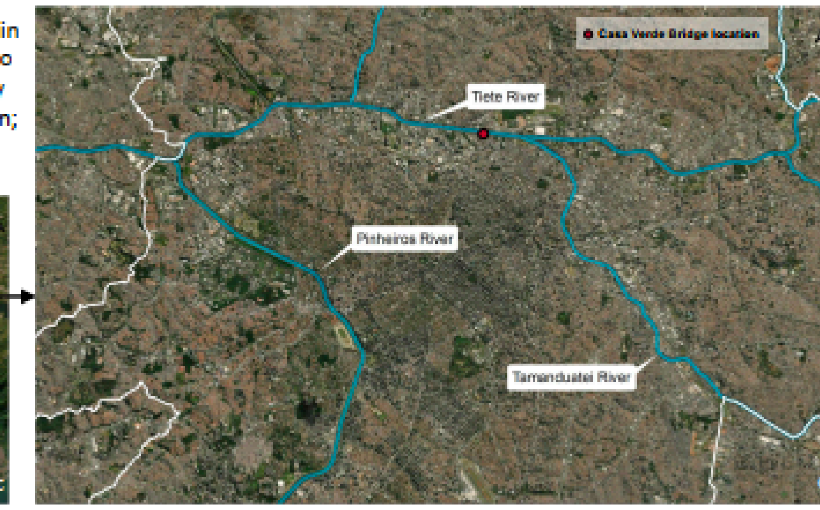
South America
- Brazil
  - São Paulo State
    - São Paulo City

Population = 11.45 million
Pop. Density = 7,528 / km²*
#1 GDP of all cities in Brazil

Figure 6: (a) São Paulo State in South America; (b) São Paulo City in the state; (c) the city and the urban agglomeration; (d) main rivers in densely urbanized areas







*For comparison purposes, NYC's Pop. Density is 29,303 km² and Tokyo's 6,158 km².

The Tietê River in the city nowadays:
- Concrete channeled river
- Straightened river
- Roads, houses, businesses and industries covering the floodplain

Figure 7: Casa Verde Bridge crossing Marginal Tietê (2023)

Figure 8: (a) Tietê River as a tributary of Paraná River; (b) Alto Tietê Watershed, the upper sub-basin of Tietê River

Background

Gap:
- A variety of projects and initiatives were made to manage the flood risk of the Tietê River at the Marginal roads.
- Apart from gray infrastructure and superficial green approaches, the concept of Natural and Nature-Based Solutions (NNBS) has not yet been studied nor applied.

NNBS:
- These solutions rely on the ecosystem's processes, structures, and functions, in order to provide a safe, sustainable, and resilient environment.

Research questions:
- Is it possible to apply NNBS to high population-density areas with urbanized river margins?
  - Which NNB Features can be implemented in these areas without causing major social intervention?
    - What is the best combination of features (NNBS or hybrid) to predict, manage, and prevent flood events?
      - Is it possible to also tackle water quality and environment restoration, public health and well-being, safety and resilience?

Objective:
The aim of this study is to determine how NNBS can be applied to the Tietê River to develop a resilient, comprehensive, and efficient system.

Methods

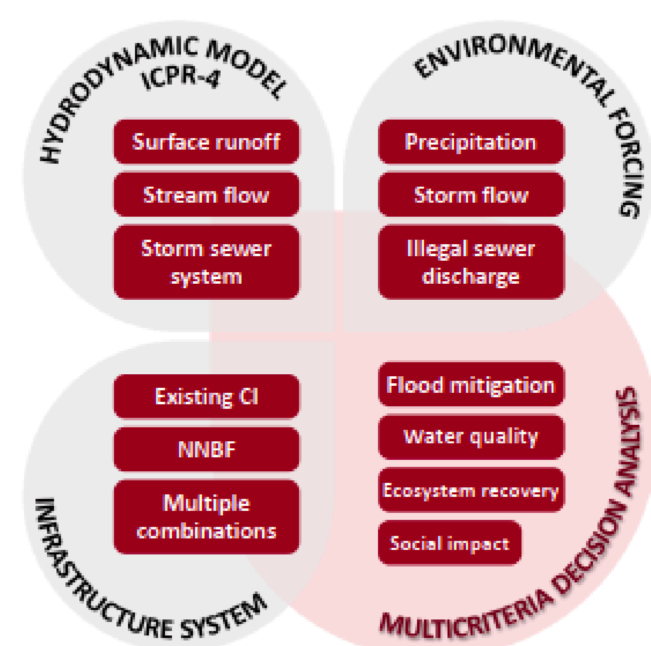


Figure 9: Modeling framework

Acknowledgements / Selected References

- *This work has been carried out in collaboration with the University of São Paulo (USP), Brazil.*

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vi. *Figures: [2] Arquivo Corinthians, São Paulo, Brazil. [3] Revista Veja, Abril, Brazil. [4] Romerito Pontes, Futura Press, Estadão Conteúdo. [5] Diogo Nolasco, Reproducao TV Tem.*