Agricultural Land and Ecosystem-Based Disaster Risk Reduction for Flooding in Rio Grande do Sul, Brazil

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Rio Grande do Sul,
September 2025



Introduction

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Spotlight | 13 May 2025

Brazil - Floods in Rio Grande do Sul trigger record displacement

The souther
April and mi
displacemer
capital of Po

BBC

Brazil floods: Hundreds of Rio Grande do Sul towns under water

7 May 2024

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Left: This photo provided by the Sao Paulo Government shows vehicles fallen from an elevated area along the beach in Sao Sebastiao, east of Sao Paulo, Brazil, Sunday, Feb. 19, 2023, after it was damaged by a severe weather system went through the area. (Sao Paulo Government via AP)

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By — Mauricio Savarese, Associated Press

Heavy rain and landslides kill at least 36 in Brazil, inundated cities cancel Carnival festivities

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CLIMATE CHANGE

Floods in Rio Grande do Sul exposed the climate crisis

A year ago, extreme rainfall caused the worst flood in southern Brasil, affecting 2.3 million people. Combining climate change, irregular urbanization, and inadequate infrastructure, the 2024 floods underscored the urgent need for global action. Experts highlight COP30 as a critical forum for debates and solutions to prevent future catastrophes. Reconstruction demands radical changes, they warn.

The Guardian

US

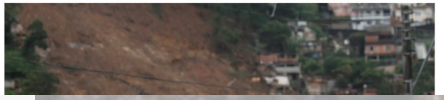
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Southern frontlines: Latin America and the Caribbean Brazil

Three disasters in three years: Brazil's deadly floods show women are 'the first to die' when extreme weather hits

The climate crisis is accelerating the frequency of devastating events across the world, displacing millions and disproportionately affecting women

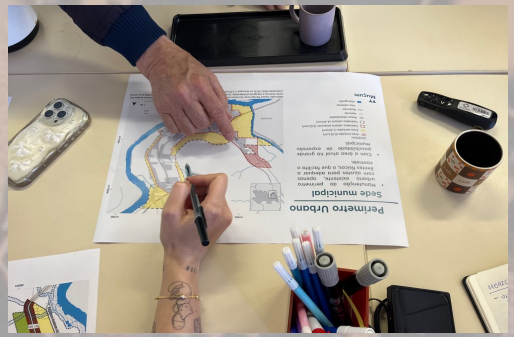


Introduction

Hazard Response Timeline







1- Rescues & emergency response

2- Structural reconstruction and recovery

3- Climate adaptation and resilience planning

3- Climate adaptation and resilience planning

Ecosystem-based disaster risk reduction (Eco-DRR)

Nature-based solutions that use natural systems as main actors in reducing vulnerability to hazards.



Environmental health



Community health



Climate resilience

PLURAL
consultoria em planejamento territorial

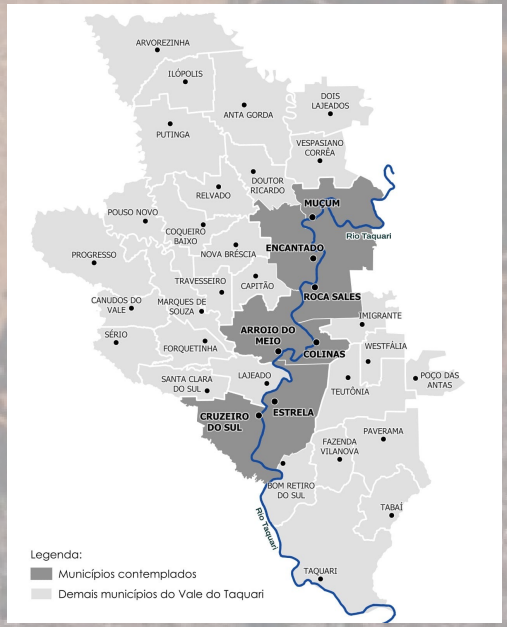
What are the priority implementation areas for flood management nature-based solutions in the Taquari River Valley?

Taquari River Valley

A region in Rio Grande do Sul undergoing post-flood redevelopment.

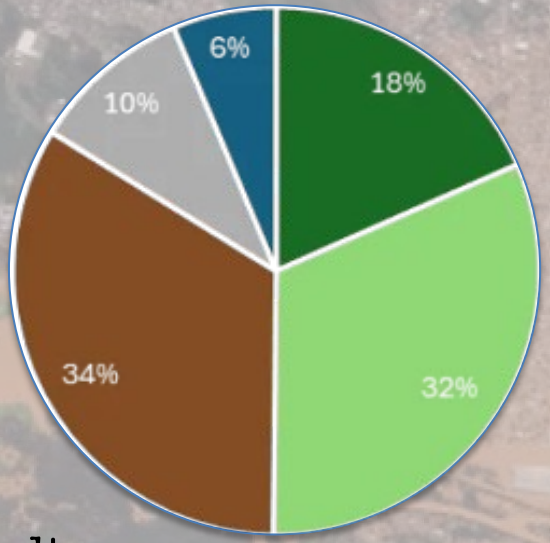


Plural's redevelopment proposal presentation for municipality representatives.

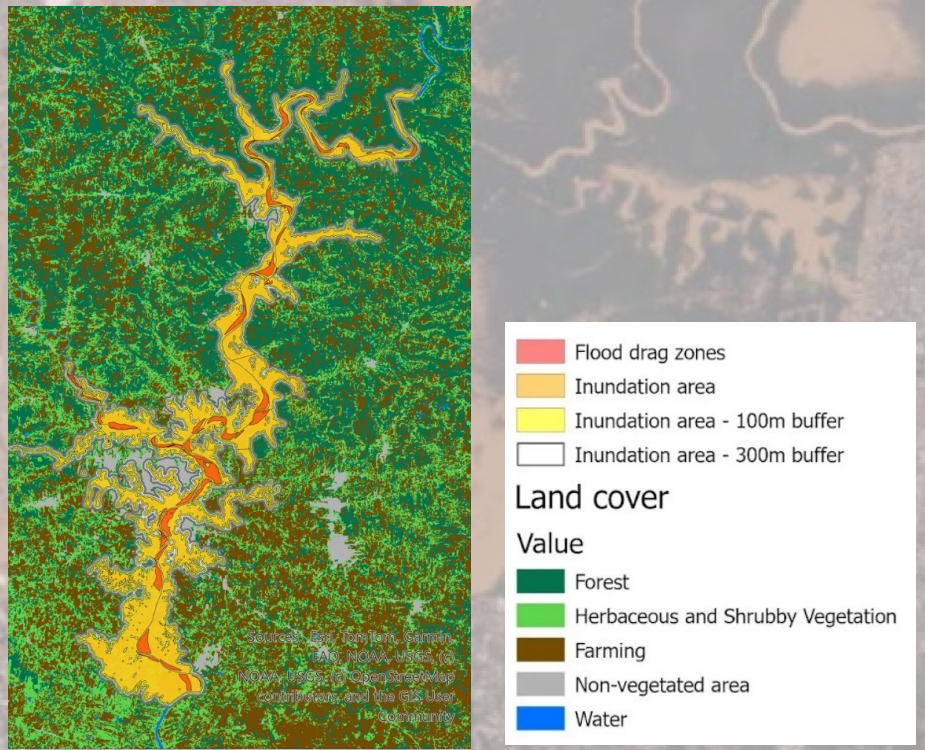


Especially affected because of the municipalities' proximity to the river...

Land Cover in the Valley's Flood Zone



34%
Agriculture
32% Herbaceous and
shrubby vegetation



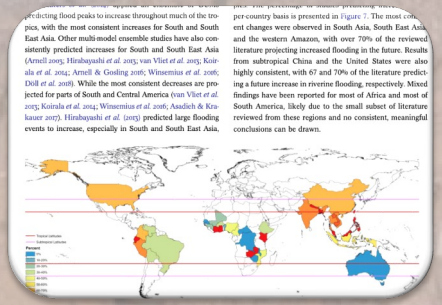
One Step Ahead: Sustainable Mitigation



Background research



Case studies



predicting flood peaks to increase throughout much of the tropics, with the most consistent increases for South and South East Asia. Other multi-model ensemble studies have also consistently predicted increases for South and South East Asia (Arnell 2003, Hirabayashi *et al.* 2013, van Vliet *et al.* 2013, Koirala *et al.* 2014, Arnell & Gosling 2016, Winsemius *et al.* 2016, Döll *et al.* 2018). While the most consistent decreases are projected for parts of South and Central America (van Vliet *et al.* 2013, Koirala *et al.* 2014, Winsemius *et al.* 2016, Asadieh & Krakauer 2017). Hirabayashi *et al.* (2013) predicted large flooding events to increase, especially in South and South East Asia,

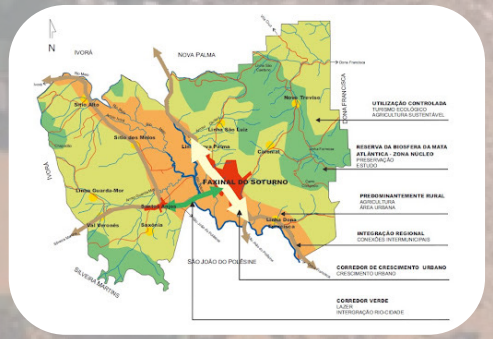
per-country basis is presented in Figure 7. The most consistent changes were observed in South Asia, South East Asia and the western Amazon, with over 70% of the reviewed literature projecting increased flooding in the future. Results from subtropical China and the United States were also highly consistent, with 67 and 70% of the literature predicting a future increase in riverine flooding, respectively. Mixed findings have been reported for most of Africa and most of South America, likely due to the small subset of literature reviewed from these regions and no consistent, meaningful conclusions can be drawn.

Literature review

Federal Emergency Management Agency (FEMA) Guidelines

International Hazard Mitigation Frameworks

Data and Materials



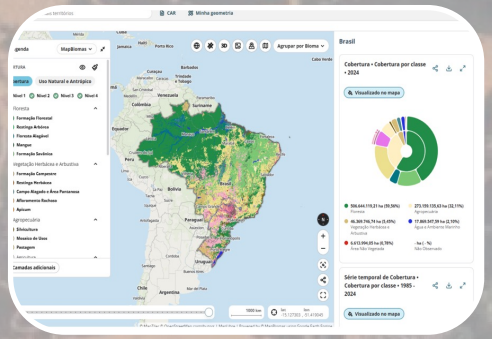
Geography and risk assessment

- Plural



Regional nature-based solution guide

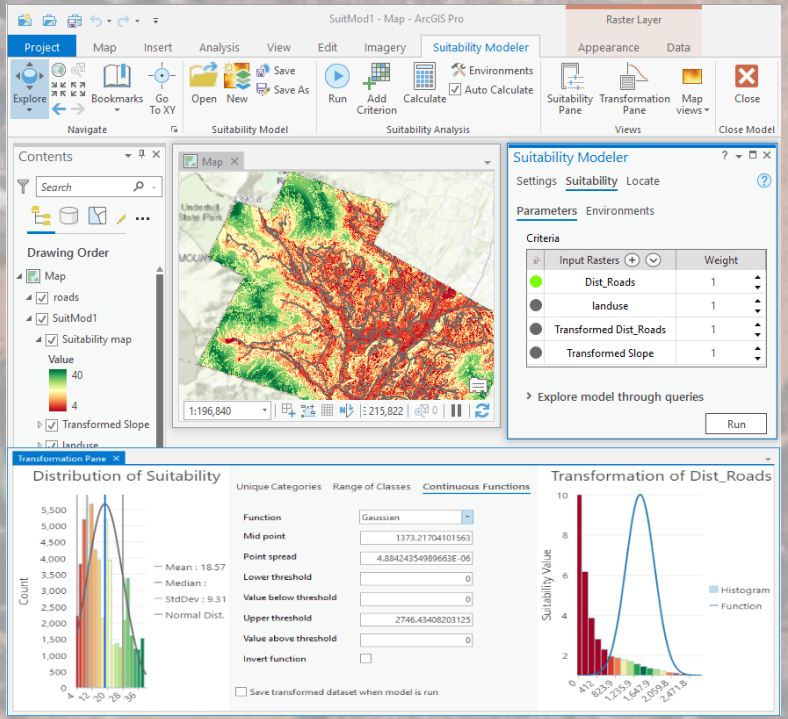
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Land cover data

- MapBiomas

ArcGIS Pro Suitability Modeling



Range of classes

Binary classification:
1 = suitable, 0= unsuitable

1: Riparian Restoration

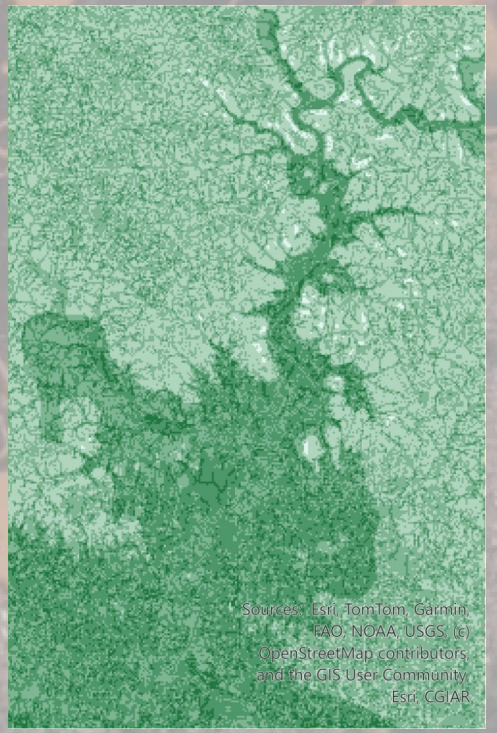
1- Riparian ecosystem restoration with native vegetation
2- Reduction of vulnerabilities in occupations in risk areas;
3- Vegetation helps retain soil erosion
4- Avoids sudden change in water courses.



Suitability Score

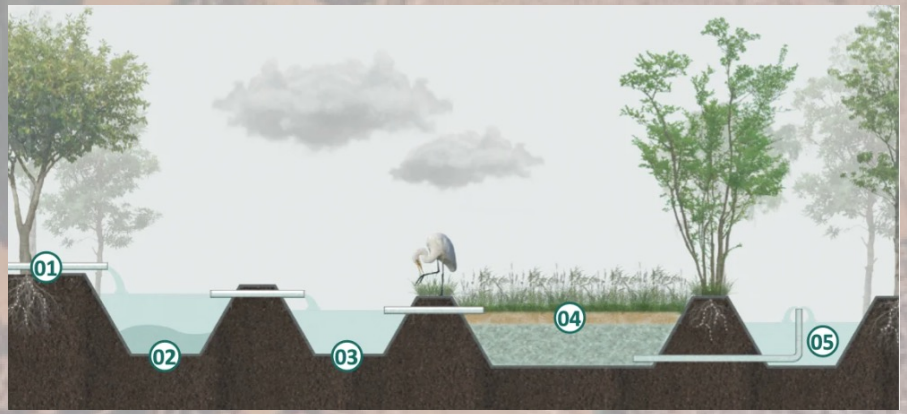
4

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2: Constructed Wetlands

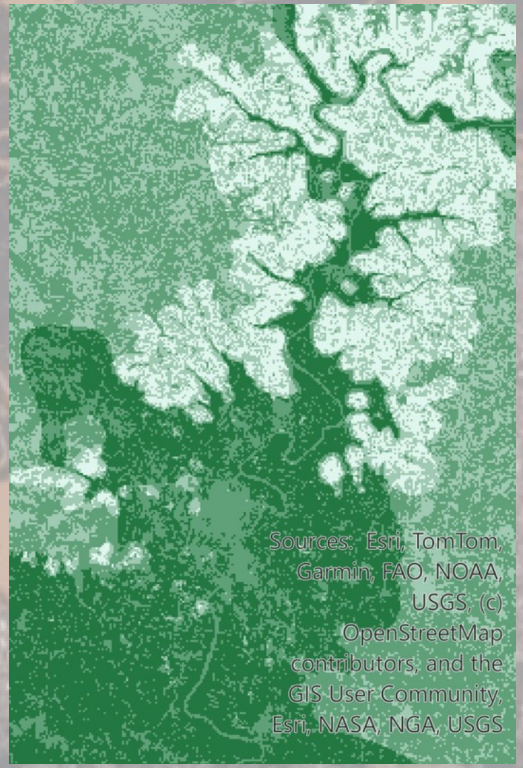
1- Unclean water enters the system
2- Spillway receives and maintains minimum level of water
3- Sediments retained by gravity
4- Plants and soil layers filter the water
5- Treated water leaves the system.



Suitability Score

4

0



3: Retention Basins

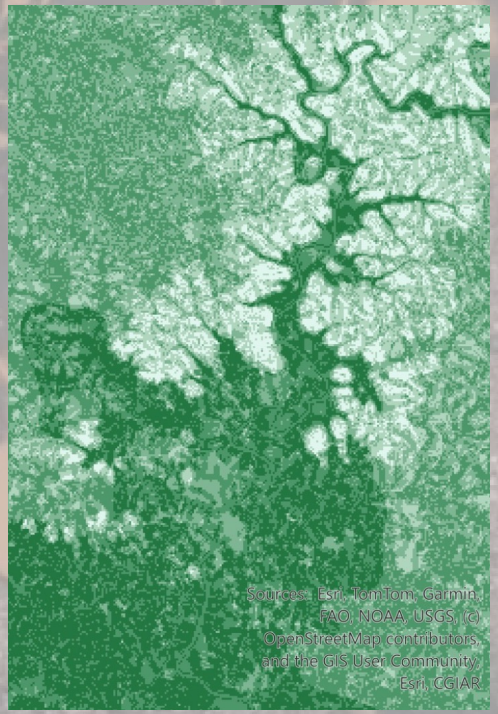
1- Receives stormwater and runoff
2- Retains water for slow infiltration in the soil
3- Vegetation helps filter pollutants in the water
4- Water is slowly released, avoiding or minimizing flooding



Suitability Score

4

0



The Opportunity

Agricultural landscapes can help enhance ecosystem functions





Riparian restoration:
filters runoff,
stabilizes banks



Wetlands and
basins store water,
reduce peak flows



Soil health and infiltration:
improves soil structure and
water retention

Thank you!

PROGRAM ON THE ENVIRONMENT

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