



LAMBARI RIVER BASIN

IMPROVING WATER SECURITY AND ADAPTING TO CLIMATE CHANGE IN THE ATLANTIC FOREST WITH NATURE-BASED SOLUTIONS

The Lambari Basin is one of the basins identified in a study conducted by WWF on key river basins in the Atlantic Forest that urgently require Nature-based Solutions (NbS) to bolster water security and climate resilience. Compared to conventional interventions, NbS offer long-term affordable and sustainable solutions to major water-related societal challenges, and have multiple co-benefits. The objective is to – together with partners – scale these solutions to generate significant positive impact on biodiversity, water security, and climate resilience.

The Lambari Basin, a tributary of the Pardo and the Rio Grande, spans approximately 52,000 hectares and

serves as a crucial water source for Poços de Caldas (170,000 people), the regional capital of southern Minas Gerais. The basin also plays a crucial role in power generation, delivering 35% of the city's electricity consumption.

Poços de Caldas, once a tourist hotspot for its mineral-rich thermal waters, evolved into an industrial hub for bauxite mining, aluminum production, and dairy products in the 1970s. **Industrial activities now drive nearly 60% of the local economy.** Significant new investments in mining, such as the exploration of rare earths are expected to elevate the economic significance of this region even further. Furthermore, the basin houses approximately 7,300 hectares of coffee plantations.

The substantial industrial activity impacts the region's water demand. **In times of water scarcity, conflicts inevitably arise over its allocation.** The years 2020–

BE ONE WITH NATURE

2021 marked the most severe water crisis to afflict the region in the past 90 years, prompting curtailments on hydropower production.

Addressing the pressing issues of water scarcity in the region necessitates working towards a stable flow of clean water all year round. This goal can be achieved by stimulating groundwater recharge through NbS that enhance water infiltration and by the ecological restoration of riparian buffers. Although nearly the entire basin has been designated as a Priority Area for Biodiversity Conservation, less than 18% of the basin retains native vegetation. This underscores the need for restoration efforts. **Moreover, although the sewage of Poços de Caldas is being fully treated, which is unique in Brazil, water quality can be further improved by restoring riparian zones to mitigate the impacts of diffuse pollution.**



RELEVANCE FOR NBS

The Lambari River Basin is a priority basin for NbS due to the following key attributes:

- **Essential water source** for the downstream regional capital.
- **Increased flood and landslide risk**, and this vulnerability is amplified by the effects of climate change. Over the last 15 years, more than 4,000

people have been affected by floods and financial losses of over US\$2.1 million were reported.

- **Escalating drought threat**, with more extreme droughts further exacerbated by climate change.
- **Classified as critical basin** by the National Water Agency (ANA), signifying the urgency to act.
- **Low Compliance with Forest Regulations:** The basin displays a substantial deficiency in adhering to the Brazilian Forest Code – 2,700 to 7,200 hectares in permanent preservation areas and 1,000 to 1,900 hectares in legal reserves – particularly concerning the degradation of riparian zones.

MAIN BENEFICIARIES OF NBS

- **Local population:** Experience enhanced water supply security and reduced exposure to flood risks.
- **Water supply company:** Benefit from more consistent river flow and lower water treatment costs due to cleaner water.
- **Industries:** Enjoy improved water quality and a decreased likelihood of water withdrawal restrictions.
- **Farmers and ranchers:** Witness improved soil conditions and experience less erosion.
- **Ecosystems:** Improved environmental flow and biodiversity protection, leading to higher connectivity and ecosystem resilience.

POTENTIAL PARTNERS FOR NBS

- Watershed Committees (Mogi-Guaçu, Pardo Rivers' tributaries, Rio Grande)
- Municipal Water Supply Company
- Municipal governments engaged in the Conservador da Mantiqueira Program
- Private sector companies impacting local water resources
- Local farmers and cattle ranchers

NATURE-BASED SOLUTIONS:

WHAT IS POSSIBLE?

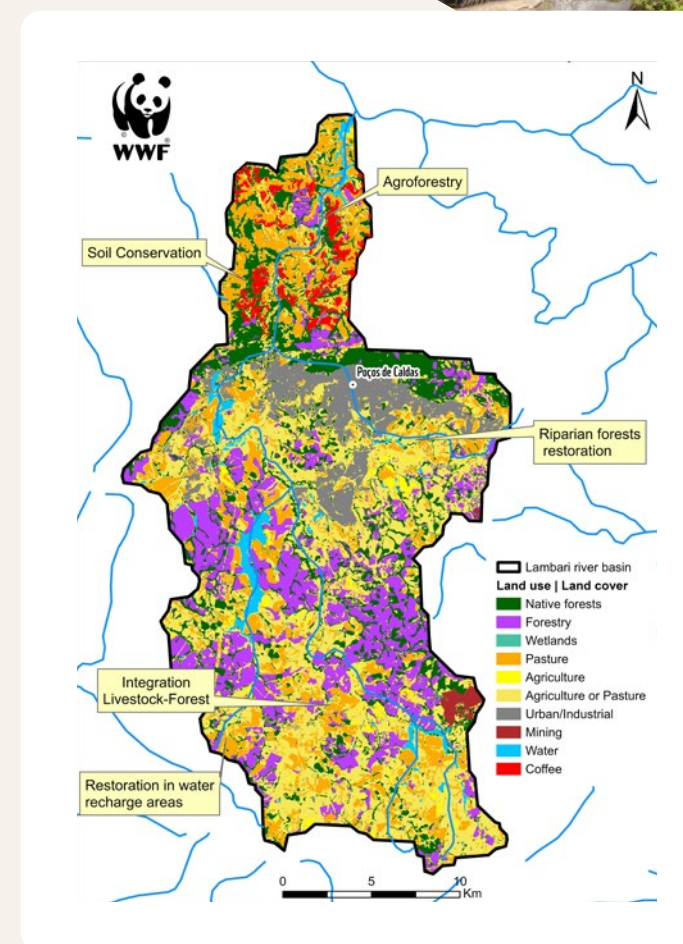


Figure 1: Land use and land cover in the Lambari River Basin, with the suggested NbS.

PROTECTION AND RESTORATION OF WATER RECHARGE AREAS

Groundwater recharge can be stimulated by protecting and restoring natural vegetation in areas that have enabling infiltration conditions, such as flatter slopes or better permeable soils and geology. These activities can lead to improved infiltration capacity in former pastures and agricultural areas by 182% and 291%, respectively. Ultimately, NbS enhance groundwater input, which is crucial in regulating water supply.

PROTECTION AND RESTORATION OF RIPARIAN FORESTS

Riparian forests act as a buffer and natural water filter, reducing the sediment input to the river by 33% to 95%. By restoring and protecting these forests, sediment and other pollutants are trapped before they reach the river, thereby improving the river's water quality.

INTEGRATION LIVESTOCK-FOREST

Integration Livestock-Forest (or silvopastoral) systems combine cattle raising with the recovery of biodiversity and ecosystem services. By introducing native trees into pastoral landscapes, this NbS enhances animal well-being, reduces erosion and sedimentation, and provides extra income through non-wood goods like fruits and honey.

AGRICULTURAL SOIL CONSERVATION

Fostering good practices in agricultural soil management increases water ecosystem services as infiltration, humidity regulation, and retention of sediments, nutrients, and chemicals. Examples of NbS approaches include creating terraces on steep slopes to decrease the erosion potential of coffee plantations by as much as 90%.

AGROFORESTRY

Agroforestry is an agricultural practice that includes biodiversity and ecosystem services recovery, increasing infiltration rates and reducing erosion and sedimentation. Coffee, a very important commodity to this region, is very suitable for the agroforestry approach.

ENABLING CONDITIONS FOR NBS

Socio-economic relevance: Industries such as the mining sector (bauxite and rare earths) and metallurgy (aluminum) greatly contribute to the local economy, yet they also impact the basin's water resources. Investments in NbS could be made to (partly) offset their environmental impacts.

Availability of financing sources: The Watershed Committee recently implemented water use fees, which are a potential source of NbS funding.

Presence of programs and initiatives facilitating NbS:

There are already initiatives in place that promote the use of green infrastructure for improving water security, biodiversity, and/or climate change adaptation. The presence of the following initiatives enhances the success of NbS adoption in the basin.

- **Conservador da Mantiqueira¹:** This collective initiative by municipal governments, non-profit organizations, and the private sector, aims to restore 1.5 million hectares of forest in 425 municipalities in the Mantiqueira mountain region. Around 5,000 hectares have been restored since its start in 2016, with over 150 municipalities involved. Next to using financial mechanisms like Payments for Ecosystem Services, restoration efforts are financed through environmental budgets of municipalities and watershed committees. The initiative is coordinated by The Nature Conservancy, and partnered by WWF Brazil, IUCN, WRI Brazil, Conservation International, SOS Mata Atlântica, National Water Agency, and local municipalities, among others.
- **Projeto Flora²:** This project by Danone aims to implement the use of Integration Livestock-Forest

systems to pastures they work with. Since its start in 2019, 1,400 hectares of pastures on 33 properties have been transformed into Livestock-Forest systems. This has resulted in a 35% reduction of CO2 emissions per kg of milk produced, while pasture productivity has increased by a factor of two to three. Total investments account for about US\$ 200,000 a year.

THE WAY FORWARD

1. **Focused feasibility study on NbS implementation.** Outputs include the identification of priority areas and activities considering water security and biodiversity needs, the integration of climate scenarios with socio-economic and cost-benefit analyses, and the design of a NbS implementation plan.
2. **Strengthen existing coalitions** – such as Conservador da Mantiqueira – for NbS implementation in the region, collaborating with main actors, supporting existing commitments, and discussing suitable strategies to accelerate implementation.
3. **Development of a proposition for large-scale NbS implementation,** further engagement of key partners, and integration with ongoing programs (such as Conservador da Mantiqueira) where possible.
4. **Large-scale implementation** of the selected NbS.

Criteria

The Lambari basin was selected as 'priority basin' from a selection of 87 basins in total, based on three criteria as outlined in a policy brief of WWF Brazil (WWF Brasil, 2024). These criteria are: 1) importance in providing water ecosystem services, 2) vulnerability to water security risks, and 3) suitability for developing or enhancing NbS.

WWF Netherlands. (2024). Improving water security and adapting to climate change in the Atlantic Forest, Brazil, with Nature-based Solutions – Lambari River Basin [Fact sheet].

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1. https://wwfint.awsassets.panda.org/downloads/fr_field_series_atlantic_forest.pdf

2. <https://corporate.danone.com.br/Danone-ultrapassa-meta-de-agricultura-regenerativa-e-expande-modelo-mais-sustentavel-de-producao-de-leite>