



LOWER PARDO RIVER BASIN

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

The Lower Pardo 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.

This basin constitutes the lower section of the Pardo River watershed, situated just before its confluence

with its main tributary, the Mogi-Guaçu River. **The local economy is predominantly driven by the agricultural sector, with a strong focus on sugarcane cultivation for sugar and alcohol production and citrus farming. The high level of agricultural activity results in a substantial demand for freshwater, with 45% of the total water demand originating from agriculture. Additionally, the basin has a very low natural vegetation coverage, with native forests and wetlands accounting for a mere 10% of its total area. To provide context, 60% of the basin's area is covered by agricultural lands.**

The high water demand, in combination with climate change induced drought, has led to several severe water crises. During the water crisis of 2015, for example, the Pardo River's flow dropped to 10% of its average flow. The high demand for water is especially critical for the basin's groundwater sources, as currently **the withdrawal rates are seven times higher than the recommended maximum.** Groundwater is also being

BE ONE WITH NATURE

contaminated by nitrogen, sourced from agricultural inputs. These conditions highlight a pressing concern for the future water supply of the city of Ribeirão Preto, which **relies on groundwater for 80% of its urban demand**.

Although the city of Ribeirão Preto has a fully functioning sewage treatment system, the persistence of surface water pollution raises concerns about the influence of diffuse source pollution on water quality. **Nature-based Solutions, such as river renaturation, offer options to substantially enhance natural filtering of non-point source pollutants. Additionally, the restoration of groundwater recharge areas could promote groundwater replenishment.**



RELEVANCE FOR NBS

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

- **Essential groundwater source** for downstream urban areas.
- **Increased flood and landslide risk**, and this vulnerability is amplified by the effects of climate change.
- **Escalating drought threat**, with more extreme droughts further exacerbated by climate change. From 2013 until 2023, droughts led to material losses of over US\$300,000.

- **Negative water balance.** The current water demand exceeds the water supply of the Pardo River by 60%, leading to water stress. Even with restrictions on drilling groundwater wells as formulated in 2006, the groundwater level has shown a significant drop of 60 meters in recent years. The per capita water availability for the city of Ribeirão Preto is the lowest in the basin with 481 m³/person/year, far below the UN-threshold of 1,500 m³/person/year.
- **Low Compliance with Forest Regulations:** The basin displays a substantial deficiency in adhering to the Brazilian Forest Code – 5,800 hectares in permanent preservation areas and 17,100 hectares in legal reserves – particularly concerning the degradation of riparian zones.

MAIN BENEFICIARIES OF NBS

- **Local population:** Experience enhanced water supply security by increased recharge and reduced exposure to long periods of drought.
- **Water supply company (SAERP):** Benefit from more reliable groundwater sources and less contamination risks.
- **Industries:** Enjoy a decreased likelihood of water withdrawal restrictions.
- **Farmers:** Witness improved soil and water conditions and have the opportunity for diversified crop cultivation.
- **Ecosystems:** Improved environmental flow and biodiversity protection, leading to higher connectivity and ecosystem resilience.

POTENTIAL PARTNERS FOR NBS

- SAERP (Ribeirão Preto's Water Sanitation Company)
- Pardo Watershed Committee
- Sugarcane producers' associations (Orplana, Canaeste)
- Sugarcane-based industry association (Unica)
- WWF-Brazil's partner companies and organizations
- Local municipalities
- Local farmers

NATURE-BASED SOLUTIONS: WHAT IS POSSIBLE?

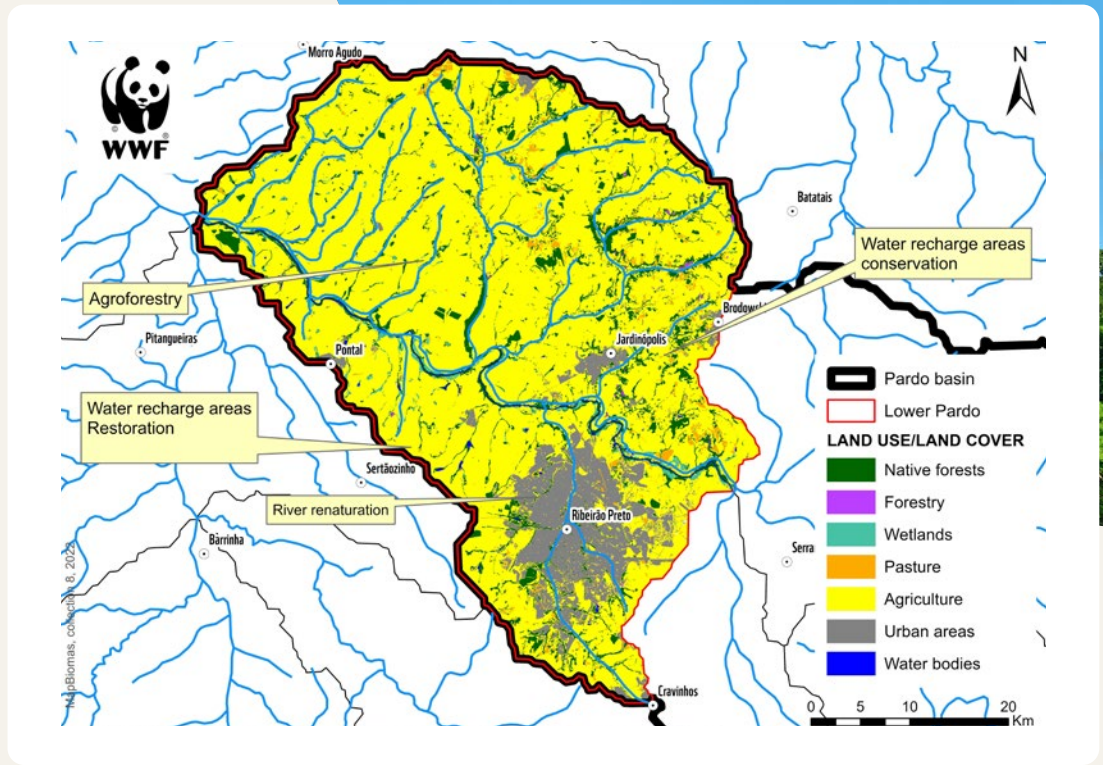


Figure 1: Land use and land cover in the Lower Pardo River Basin, with the suggested NbS.

RIVER RENATURATION

By reestablishing the original course of the river and reintroducing natural riverbanks, the natural dynamics of the river system are being restored. This way, ecosystem services that were previously lost due to the use of artificial structures are recovered. These include flood mitigation, erosion control, water filtering properties, and an increase in biodiversity by making the river an ecological corridor.

AGROFORESTRY

Agroforestry is an agricultural practice that includes biodiversity and ecosystem services recovery, increasing infiltration rates and reducing erosion and sedimentation. Massive water withdrawal for agricultural production in this basin can be attenuated with diversification brought by agroforestry, offering a less water demanding production system.

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.



ENABLING CONDITIONS FOR NBS

Importance for public water supply: Being a strategic water source for Ribeirão Preto (regional capital), the basin receives special attention from the state and municipal governments, economic sectors as sugarcane agroindustry, and society in general.

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 climate change adaptation. The presence of the following initiatives enhances the success potential of NbS adoption in the basin.

- **Greener Ethanol State Program¹:** In 2017, secretaries of the State of São Paulo agreed with the sugar and energy sector (UNICA and ORPLANA) to implement best practices for a sustainable production chain. This includes starting on full restoration of riparian forests in sugarcane production areas by 2025. UNICA is linked to 91% of all sugarcane produced in the State of São Paulo, meaning that this agreement can generate a huge impact with 250 thousand hectares of riparian forests restored or protected. There is potential to expand this agreement towards the protection and restoration of groundwater recharge areas given the major importance of groundwater for sugarcane production in the Pardo Basin.
- **Ribeirão Preto's Region Agroforestry Network²:** Smallholder farmers in the region of Ribeirão Preto have united themselves in a regional agroforestry

network in 2019, with the goal to develop a larger-scale agroforestry system. Thereto, they have partnered with Fazenda da Toca, an experienced agroforestry organization in Brazil with whom they can expand their agroforestry practices as an alternative to sugarcane cultivation in monocultures.

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. **Build or strengthen multi stakeholder coalitions** for NbS implementation in the region, identifying main actors and commitments needed.
3. **Development of a proposition for large-scale NbS implementation,** further engagement of key partners, and integration with ongoing programs (such as the Greener Ethanol State Program) where possible.
4. **Large-scale implementation** of the selected NbS.

Criteria

The Lower Pardo 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 – Lower Pardo River Basin [Fact sheet].

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1. <https://semil.sp.gov.br/sma/etanolverde/>

2. <https://www.instagram.com/redeagroforestalrp/>