



MIDDLE IVAÍ RIVER BASIN

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

The Middle Ivaí 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 middle stretch of the Ivaí River Basin spans 341,000 hectares and encompasses Maringá, the third-largest

city in Paraná with 400,000 residents. **The region is increasingly impacted by hydroclimatic disasters, witnessing a stark rise from 39 events affecting 9,000 individuals between 1997 and 2009 to 58 events impacting nearly 53,000 people since 2010.** Recent severe droughts alone resulted in significant financial losses of approximately US\$180 million in 2021 and 2022.

Agriculture and pastures dominate the landscape, covering 43% and 42% of the area respectively. Historically, coffee production drove significant deforestation. Today, the region stands as a primary sugarcane production hub, fueling the sugar and alcohol industries. While integral to the local economy, **the agro-industry bears a heavy water footprint, polluting and consuming substantial water resources.**

Intensive agricultural practices, coupled with minimal natural vegetation cover (only 11%), and the

BE ONE WITH NATURE

predominance of Caiuá sandstone soils render the region highly susceptible to widespread erosion.

Annually, the Ivaí River carries approximately 4.2 million tons of sediment, earning it the dubious distinction of having Paraná's highest erosion rate and being the most environmentally degraded stretch in the state.

Addressing this challenge involves restoring riparian buffers to curb sediment and pollutant inflow into the river system. Furthermore, agricultural and industrial activities pose risks to groundwater quality, threatening aquifers with contamination from pesticides. The middle stretch of the Ivaí boasts the second-largest groundwater potential in Paraná, with around 80% of the population living above the Caiuá aquifer relying on this source. **Enhancing natural filtration in water recharge areas becomes crucial to safeguarding future groundwater use.** The revitalization of water recharge zones offers promise in preserving groundwater quality, ensuring a sustainable resource for the area's population.

RELEVANCE FOR NBS

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

- **Essential water source** for downstream urban areas.
- **Increased flood risk**, and this vulnerability is amplified by the effects of climate change.
- **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 – 8,800 hectares in permanent preservation areas and 10,100 hectares in legal reserves – particularly concerning the degradation of riparian zones.

MAIN BENEFICIARIES OF NBS

- **Local population:** Experience enhanced water supply security and reduced vulnerability to drought.
- **Water supply company:** Benefit from improved groundwater supply security.
- **Industries:** Enjoy improved water quality and a decreased likelihood of water withdrawal restrictions.
- **Farmers:** Witness improved soil 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

- Lower Ivaí and Paraná Watershed Committee
- SANEPAR (Paraná State water supply company)
- Agribusiness companies and cooperatives
- Local municipalities
- Local farmers
- Private sector

NATURE-BASED SOLUTIONS:

WHAT IS POSSIBLE?

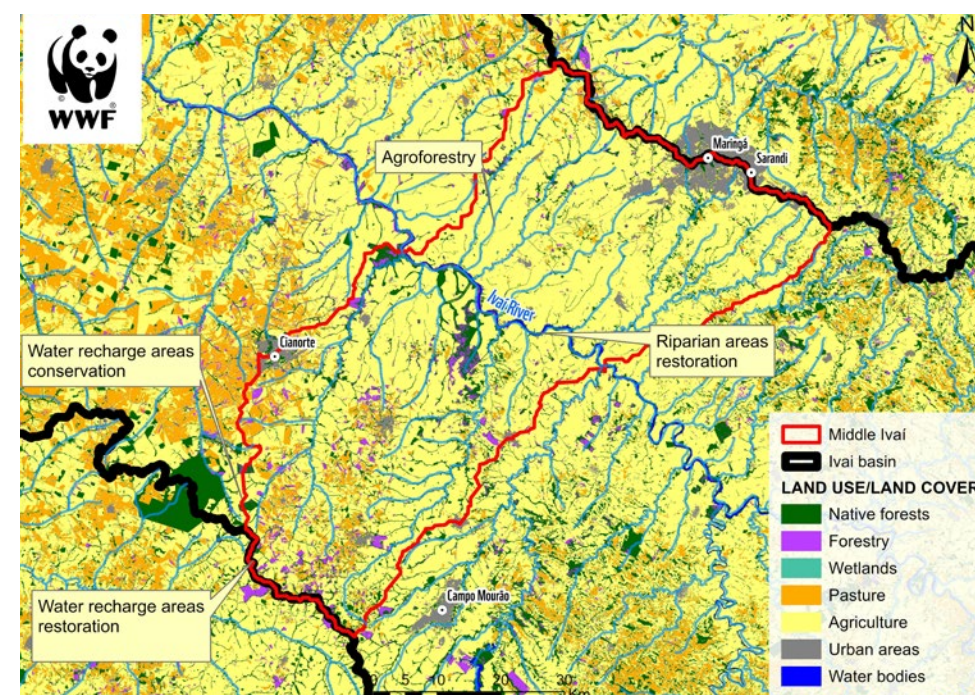


Figure 1: Land use and land cover in the Middle Ivaí River Basin, with the suggested NbS.



RESTORATION AND PROTECTION OF RIPARIAN FORESTS

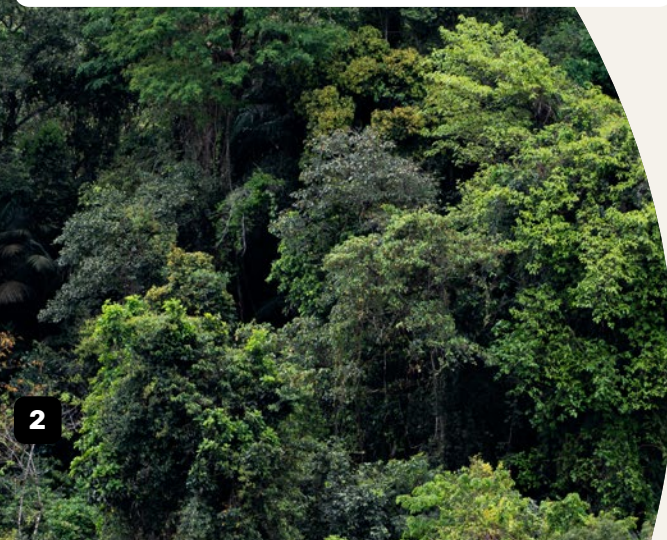
Riparian forests act as a buffer and natural water filter, reducing the sediment input to the river by 33% to 95%. By restoring and protecting these forests, sediment and other pollutants are trapped before they reach the river, thereby improving the river's water quality.

AGROFORESTRY

Agroforestry is an agricultural practice that includes biodiversity and ecosystem services recovery, increasing infiltration rates and reducing erosion and sedimentation. Areas degraded by overgrazing can be transformed into areas of regenerative agriculture, especially using an agroforestry approach. In cattle ranching areas, livestock-forest integration (with native trees) is a fitting NbS option.

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

Relevance for agroindustry: A large share of the local GDP generation is due to the presence of some of Brazil's largest agricultural cooperatives in the region. Given the sector's heavy reliance on water, it is to their benefit to be actively engaged in NbS for water security as a strategic partner for scaling NbS implementation in agricultural production systems. Thereby, it contributes to meeting the environmental compliance standards, as increasingly requested by major traders and buyers.

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 initiative enhances the success of NbS adoption in the basin.

Trinational Network for the Restoration of the Atlantic Forest of the Upper Paraná Ecoregion¹:

The Trinational Network (Brazil, Argentina, and Paraguay) aims to unite multisectoral and multidimensional conservation efforts in the Upper Paraná Ecoregion, which the Ivaí basin is part of. Since 2006, WWF has been involved in various notable projects such as "Biodiversity Corridors" and ongoing projects like "Restoration of the Atlantic Forest: Biodiversity and Water Supply Corridors" and "Reconecta Alto Paraná". In collaboration with Mater Natura, WWF-Brazil has recently formulated a strategic restoration plan, identifying 700 hectares for restoration within the region, with a target of restoring 200 hectares by 2024. In 2022, the United Nations recognized the Trinational Atlantic Forest

Pact restoration work as one of the most promising and globally relevant efforts, declaring it one of the 10 World Restoration Flagships of the UN Decade of Ecosystem Restoration.

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 the Trinational Network for the Restoration of the Atlantic Forest of the Upper Paraná Ecoregion – 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 Reconecta Alto Paraná) where possible.
- 4. Large-scale implementation** of the selected NbS.

Criteria

The Middle Ivaí 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 – Middle Ivaí River Basin [Fact sheet].

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