



THE STATE OF THE ART OF

# NATURAL INFRASTRUCTURE FOR WATER

Examples and results from  
five metropolitan regions  
in Southeast Brazil





# INFRASTRUCTURE THAT COME FROM NATURE

Ensuring access to quality water is one of the greatest challenges for cities and metropolitan regions in Brazil. Over the past decade, the country's largest cities have faced severe water crises, and the increase in average temperatures caused by climate change could make droughts even more frequent.

One way to face these crises is to turn to nature itself: Nature-Based Solutions (NBS) are important tools to improve the adaptation of our cities. Natural Infrastructure is one of these solutions and can bring lasting effects to the improvement of water quality in cities.

Natural infrastructure for water is nothing more than the conservation, management and restoration of forests, landscapes and ecosystems. Investments in Natural Infrastructure must complement traditional infrastructure - such as reservoirs and supply systems -, thus making it more effective.

But how can a forest help with water supply? In a degraded landscape, a large load of sediments - soil and dirt, for example - ends up in rivers and reservoirs. This generates more costs in water treatment operations, including greater use of chemicals.

By restoring forests in degraded landscapes and in priority areas for water supply, such as around reservoirs, trees prevent much of the sediment from reaching the waterways, functioning as natural barriers.



# HOW FORESTS IMPROVE WATER QUALITY



## REGULATE THE WATER SUPPLY

Trees release water vapor, helping to regulate the periodicity of rainfall, and thus maintain the health of reservoirs.

## CONSERVE SOILS

Forests help in the absorption of nutrients and protect the soil from erosion and storms that could cause landslides.

## REDUCE COSTS

Keeping forests healthy reduces the use of chemicals and electricity, leading to lower water treatment costs to supply urban populations.

Estação de Tratamento de Água Rio das Velhas  
Bela Fama (MG)  
Photo credit: Bruno Figueiredo / WRI Brasil



## FIVE STUDIES ON NATURAL INFRASTRUCTURE

Since 2017, WRI Brasil has been developing studies on the benefits of natural water infrastructure and engaging decision makers to promote and scale up the conservation and restoration of forests surrounding water reservoirs and springs.

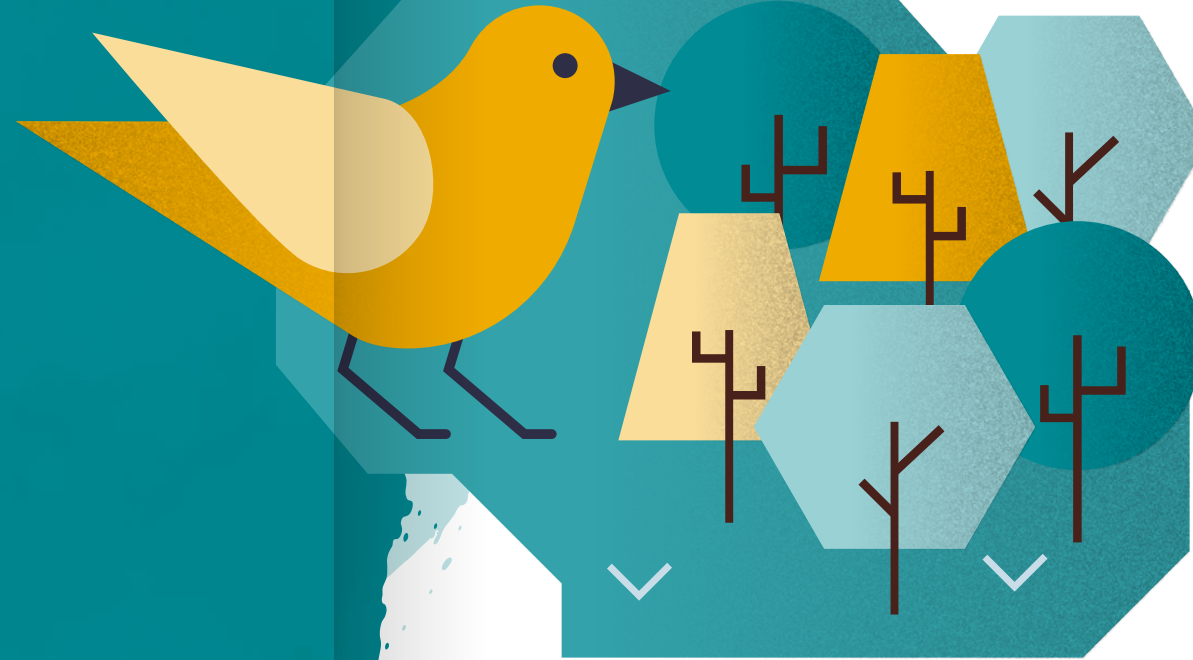
Over the years, WRI Brasil has published, together with partners, analyses of the impact of natural infrastructure on supply systems serving five metropolitan regions in the country:

The assessments were based on methodologies such as the Green-Gray Assessment (GGA/WRI), the InVEST tool (Integrated Valuation of Ecosystem Services and Trade-offs) and the Restoration Opportunities Assessment Methodology (ROAM). With these tools, it is possible to identify priority areas for forest restoration, calculate the financial return on investments in natural infrastructure, map social actors involved in restoration and diagnose the status of key factors necessary to motivate, facilitate and implement natural infrastructure actions in different landscapes.





# THE BENEFITS OF NATURAL INFRASTRUCTURE IN NUMBERS



Would the recovery of pastures surrounding the reservoirs in the Cantareira System improve water supply in São Paulo? Would forests help the largest water treatment plant in the world, Water Treatment Plant Guandu in Rio de Janeiro, save on chemical costs? And what models can small producers adopt to restore forests, improve water and achieve financial returns in Minas Gerais?

The answers to these questions are just a few examples of the positive impact that investments in natural water infrastructure can generate in large Brazilian cities.

In the following pages, we present the main results of five studies on natural infrastructure for water developed by WRI Brasil and partners. The numbers show the importance of forests for water, and the fundamental role that restoration can play in tackling water crises in large Brazilian cities.



# FORESTS GENERATING SAVINGS FOR SÃO PAULO

The restoration of 4 thousand hectares of forests in priority areas in the Cantareira basin, which supplies the metropolitan region of São Paulo, reduces the discharge of sediments into water reservoirs, improving water quality and reducing water treatment costs.



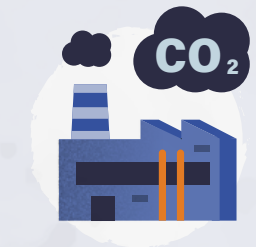
## THE POWER OF FORESTS

By restoring 4 thousand hectares in priority areas, forests reduce **18.160 tons** of sediments entering reservoirs per year.

This means:



Fewer chemicals needed for water treatment



Opportunities to offset emissions

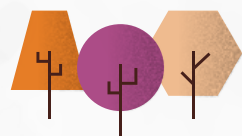


Fewer dredging operations



Lower energy costs in water treatment

## MAIN RESULTS



Investments of around

**119 BRL million**



Over 30 years, forest restoration generates savings of

**338 BRL million**



A return on investment of

**28%**

compatible with traditional infrastructure works in the sector.

## AN INNOVATIVE APPROACH

The report "Natural Infrastructure for Water in the Cantareira System, São Paulo" introduced the innovative approach of applying to forest restoration the same calculations that sanitation companies use to estimate the return on their investments in conventional infrastructure works.

The study considered a 30-year horizon, the same used for works such as reservoir construction, applied discount rates to calculate inflation and financial risk, and evaluated costs, expenses and profits, as required by any conventional project.

## PARTNERS

The work was developed by WRI Brasil and the WRI international office, in partnership with Fundação Grupo Boticário de Proteção à Natureza, The Nature Conservancy (TNC), Fundação FEMSA, International Union for Conservation of Nature (IUCN), Instituto BioAtlântica (IBio) and Natural Capital Coalition.

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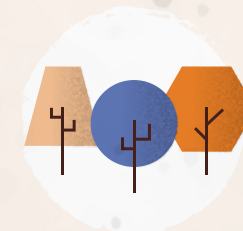


# REDUCING IMPACTS IN WATER TREATMENT IN RIO DE JANEIRO

The Guandu Water Treatment Plant supplies 92% of the population in the metropolitan region of Rio de Janeiro. **Restoring the Guandu watershed reduces impacts in water treatment and generates benefits for the population of Rio de Janeiro.**



By reducing the use of chemicals and energy at WTP Guandu, forest restoration **saves taxpayers' money**



Investments of around **103 BRL million** are required



**A return on investment of 13%**, compatible with traditional infrastructure works in the sector

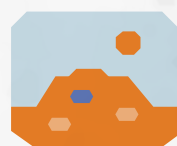


Over 30 years, forest restoration generates savings of **156 BRL million**

## MAIN RESULTS

The restoration of **3 thousand hectares** in priority areas results in:

In **30 years**, this prevents the use of:



**33%** reduction in sediments



**4 million** tons of chemicals



**260 thousand MWh** in electricity



## UNACCOUNTED BENEFITS

In addition to the financial results, restoration generates benefits that were not included in the study's calculations, such as carbon sequestration, refuge for fauna, among others.

## THE VITAL INCENTIVE

The study "Natural Infrastructure for Water in the Guandu System" encourages decision makers to see the forest as an economic investment in infrastructure. From this perspective, managers and governments can connect restoration with existing initiatives.

There are restoration incentive programs already in place in the landscape, such as the Produtores de Água e Floresta program, the Payment for Environmental Services program (PSA-Guandu) and the Pacto das Águas project. These programs can boost the scale of restoration initiatives, with positive results for the water supply.

## PARTNERS

The study was developed by WRI Brasil, in partnership with Fundação Grupo Boticário de Proteção à Natureza, The Nature Conservancy (TNC), Fundação FEMSA, International Union for Conservation of Nature (IUCN), Instituto BioAtlântica (IBio) and Natural Capital Coalition.

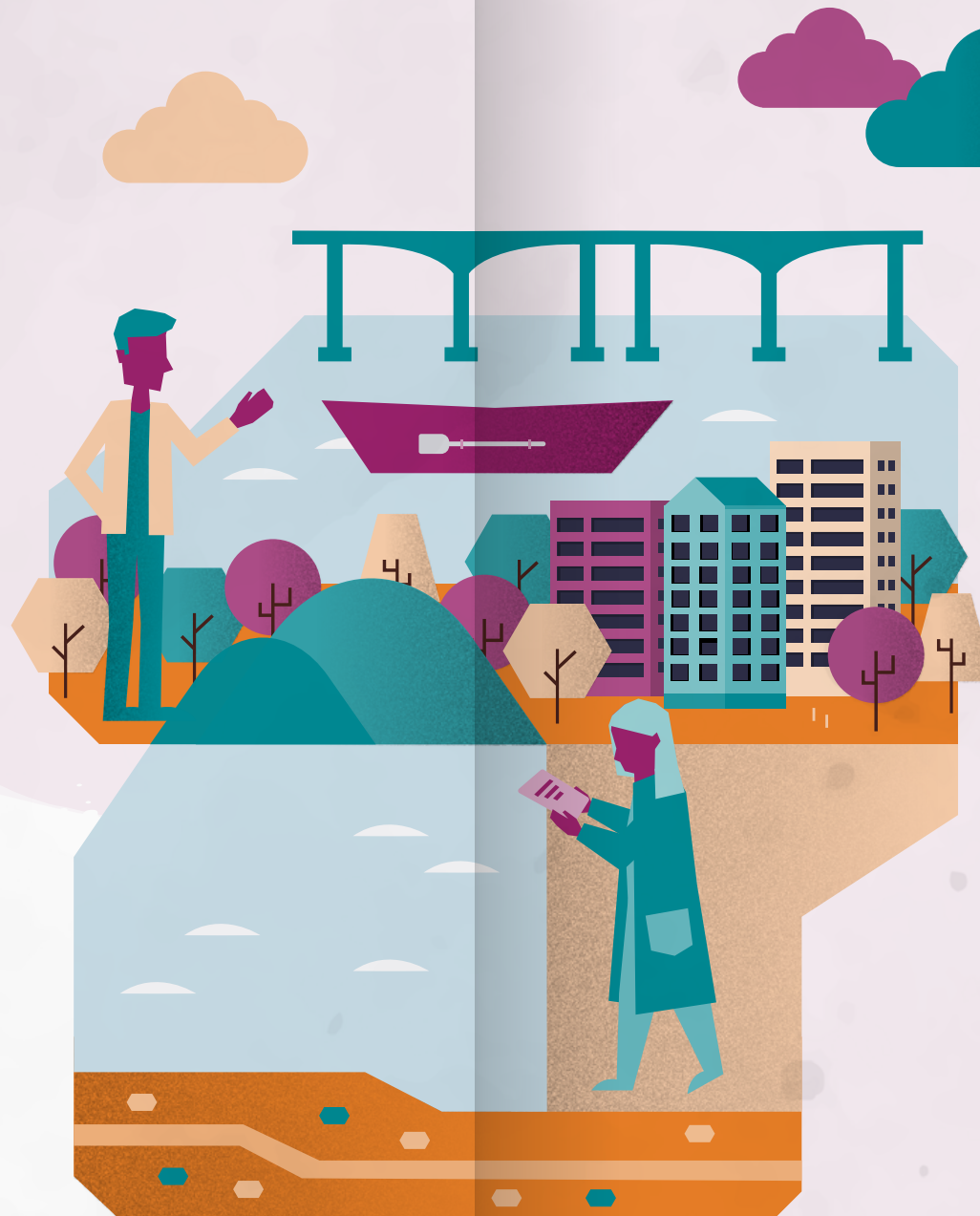
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# FIGHTING WATER SCARCITY IN VITÓRIA

In a landscape threatened by severe droughts and dry seasons in recent years, **the restoration of priority areas in the Jucu and Santa Maria da Vitória basins** can guarantee better water security for state of Espírito Santo and the entire state.



In addition to the financial return, **the benefits connected with reductions in pollution and energy use** are also relevant:



It would avoid the equivalent of dumping the load of **40 dump trucks** into rivers every year



It would save enough energy to light **130 thousand homes**

## MAIN RESULTS

Combining natural and conventional infrastructure generates **50% higher economic benefits** than investing in traditional infrastructure only.



Over **20 years**



the restoration of **2.500** hectares of forests



generates savings of **93 BRL million**

## BETTING ON NATURAL

In a reality with increasingly higher systemic water risks, investments focused solely in conventional infrastructure, such as reservoirs and water treatment plants, which are important for supply management, do not alter the capacity of the water sources in which they are installed. Therefore, investments in natural infrastructure have become increasingly important.

The report "Natural Infrastructure for Water in the Metropolitan Region of Vitória" shows that restoration actions are already underway in the landscape, with important initiatives such as Fundágua (State Fund for Water and Forest Resources), the Reflorestar program and the Florestas para a Vida project.

## PARTNERS

The study was developed by a partnership between WRI Brasil, through the Cities 4 Forests project, Grupo Boticário de Proteção à Natureza, The Nature Conservancy (TNC), Fundação FEMSA, International Union for Conservation of Nature (IUCN), Instituto BioAtlântica (IBio) and Natural Capital Coalition.

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# THE POWER OF FOREST CONSERVATION IN CAMPINAS

Beyond restoration, what is the economic importance of the forests that already protect the water supply areas in the Campinas metropolitan region? The report shows that the impact of **potential deforestation would be very damaging to the water supply.**



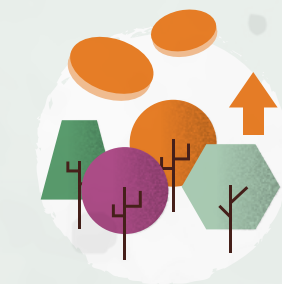
Restoration in Campinas and surrounding region has already begun, through **connection with existing public policies**, such as:



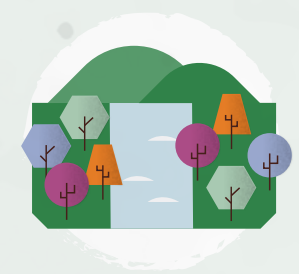
Plan for biodiversity corridors



Traditional infrastructure compensation

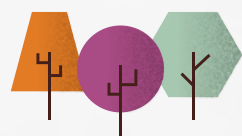


Payment for Environmental Services Program



Mantiqueira Conservation Plan

## MAIN RESULTS



There are already **78,000** hectares of native vegetation in priority areas for water



Conserving these areas guarantees savings of **6,6 BRL** million/year



There are **14 thousand hectares** of degraded land. The restoration of this area would result in savings of **1,7 BRL** million/year



In other words, the conservation and restoration of forests generates savings of **8,3 BRL** million/year

## THE VALUE OF THE STANDING FOREST

In addition to calculating the benefits of restoration for water, the "Natural Infrastructure for Water in Campinas (SP) and surrounding region" expanded the study area to assess the role of already existing conserved forests in the landscape.

It also included an assessment of priority areas that connect with the Action Plan for Implementation of the Connectivity Area in the Metropolitan Region of Campinas, of the Reconecta RMC Program, a municipal government initiative.

## PARTNERS

The study was produced by the Ação Integrada sobre a Biodiversidade - INTERACT-Bio project, led by ICLEI South America - Local Governments for Sustainability, in partnership with WRI Brasil.

READ THE FULL REPORT HERE





# RESTORATION GENERATES INCOME FOR AGRICULTURE IN THE METROPOLITAN REGION OF BELO HORIZONTE

## The benefits of restoration are not limited to the water supply system.

If carried out in priority areas and based on integrated models, such as Agroforestry Systems, it can generate income and guarantee food security in the Belo Horizonte metropolitan region.



## MAIN RESULTS

The restoration of **900 hectares** of priority areas results in:



Prevention of the discharge of **200 tons/day** of sediment into rivers



**26,5%** reduction in the use of chemicals for water treatment



Savings of **2 BRL million/year** in the water supply system



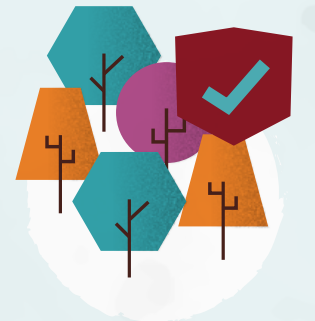
## THE ADVANTAGES OF AGROFORESTRY

Agroforestry Systems (AFS) can **increase income by up to 28%** for small farmers.

**They also:**



Meet the motivations of local producers



Improve resilience and adaptation



Ensure food security for families

## SOCIAL PERSPECTIVE

The report "Natural Infrastructure for Water in the Metropolitan Region of Belo Horizonte (MG)" made progress by including a social perspective in the assessments. The study included economic restoration models - agroforestry systems - focusing on portions of the territory with a larger presence of low-income smallholdings. It also applied the ROAM tool, which evaluates restoration opportunities in the

territory. Thus, the study took a step further in showing the heterogeneity within the watersheds in addition to their biophysical aspects, presenting recommendations for the allocation of resources with a view to promoting social benefits that go beyond water management aspects.

## PARTNERS

The study was produced by WRI Brasil in partnership with Companhia de Saneamento de Minas Gerais (COPASA MG), through the Pró-Mananciais program (Socio-environmental Program for the Protection and Recovery of Water Sources).

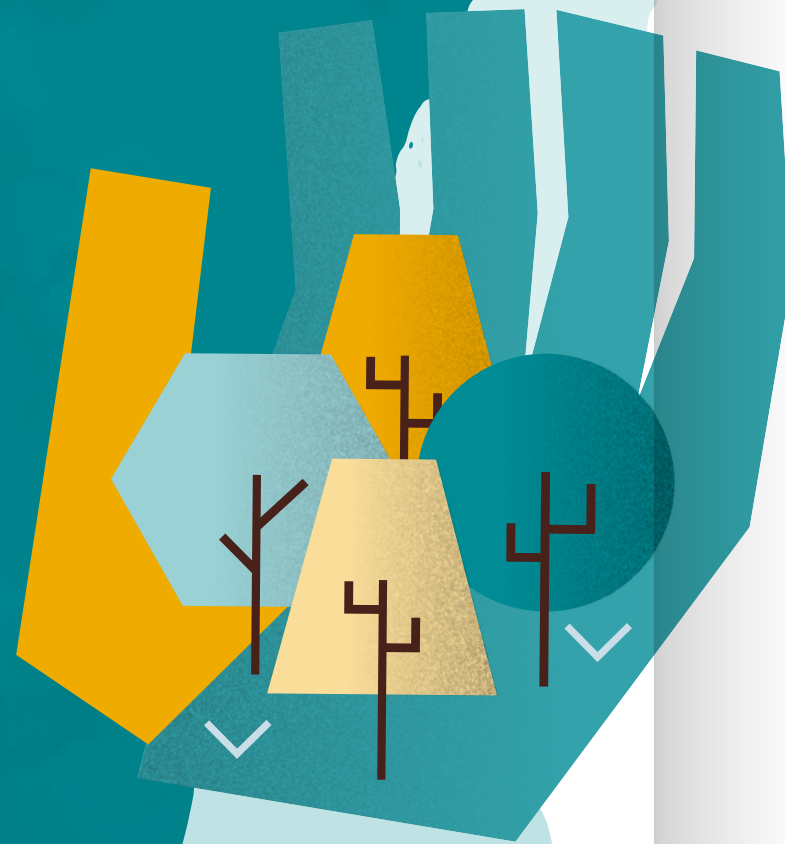
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# RESTORATION IN PROGRESS

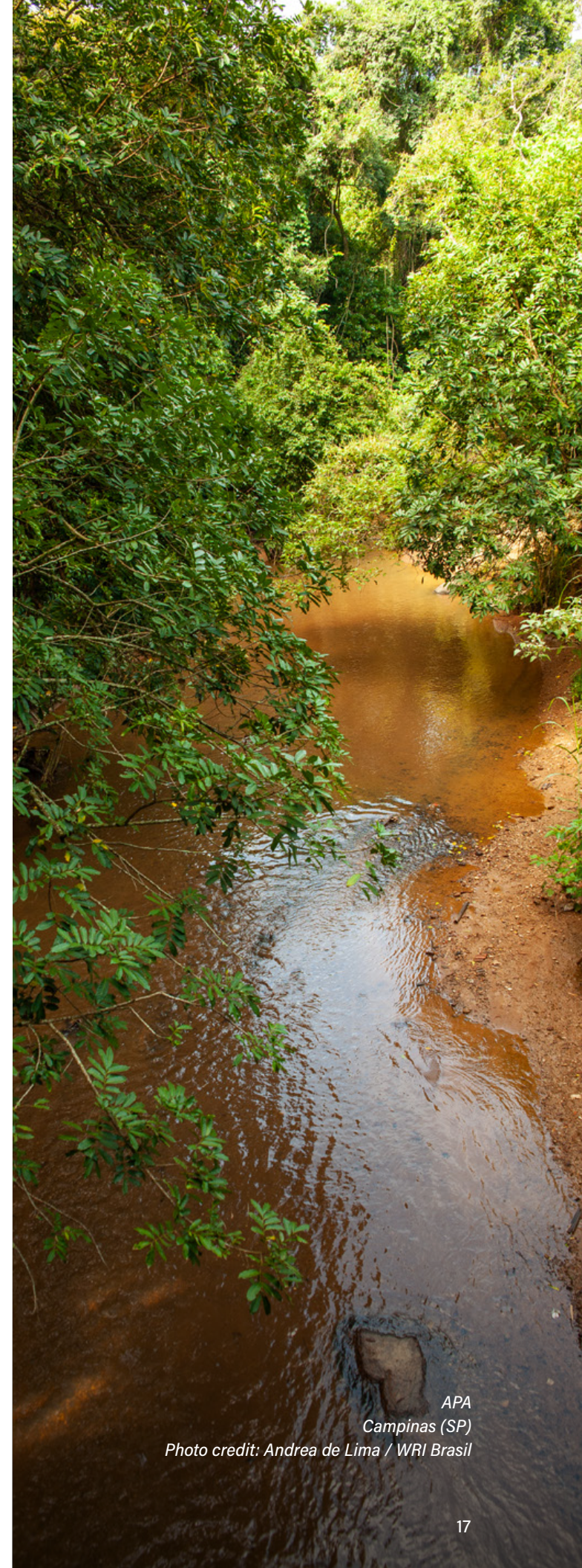
Since the first assessment of the benefits of Natural Infrastructure carried out by WRI Brasil and partners published in 2018, important advances have been made in the landscapes. Actors, governments and companies have made relevant efforts to restore forests and invest in natural infrastructure.



In a series of workshops held in 2023, the landscape actors themselves shared news about the ongoing restoration actions and the impact generated by the studies. According to them, the studies helped to increase the relevance of the topic and strengthen existing programs, increase the capacity to convince managers and local actors to adopt sustainable practices, and create demand for continuous and increasingly precise monitoring of priority areas to confirm benefits and, if necessary, promote possible adjustments.

Participants also made important contributions on how to guarantee the implementation of natural infrastructure, mainly through two proposals:

- **Establish partnerships between the Public Prosecutor's Office and River Basin Committees to consider natural infrastructure beyond jurisdictional limits;**
- **Develop an implementation strategy at the federal level, but one that can be replicated in different contexts.**



APA  
Campinas (SP)  
Photo credit: Andrea de Lima / WRI Brasil



Estação de Tratamento de Água do Guandu  
Nova Iguaçu (RJ)  
Photo credit: Marizilda Cruppe / WRI-Brasil



Nevertheless, the actual implementation of restoration actions has common challenges. The issue of restoration financing is perhaps the main challenge. There is consensus among actors in landscapes regarding the need to seek more economical and accessible alternatives for natural infrastructure. The implementation of more targeted restoration in priority areas and the strengthening of incentives such as Payments for Environmental Services (PES) could be ways to facilitate the materialization of these initiatives.

Furthermore, for many players in public management, restoration is still considered a cost, not an investment. Such findings highlight the need to better communicate the importance of Nature-Based Solutions (NBS) and the restoration of landscapes and forests across different areas of the public sector. But not just this sector: it is essential that messages are improved to ensure engagement and communication with the various groups involved (such as rural producers and decision makers), facilitating the identification of the beneficiaries of natural infrastructure in addition to sanitation companies and making interventions more inclusive.

By generating information, prioritizing areas and mobilizing actors, the natural infrastructure studies left a legacy and influenced decision-making in the landscapes. See below some examples of this legacy for each territory.



### SÃO PAULO/SP

The study has become a reference for policies on Payments for Environmental Services and Nature-Based Solutions.



### RIO DE JANEIRO/RJ

The study supported the implementation of the forest master plan, which prioritizes natural infrastructure.



### VITÓRIA/ES

The study's methodology was replicated by the state in other watersheds and the work supported a restoration monitoring plan.



### CAMPINAS/SP

The study connected the restoration agenda with other public policies, such as urban development, biodiversity and water.



### BELO HORIZONTE/MG

The study allowed articulations with local players for the implementation of Agroforestry Systems and has been supporting the improvement of state and municipal public policies.



# LESSONS LEARNED AND RECOMMENDATIONS

The main objective of the five natural water infrastructure studies was always the same: to provide data that could drive actions to improve water management in its different interfaces. However, each territory faces different challenges, as well as different mobilization capabilities, which depend on aspects associated with financial resources, capacity for social mobilization, available human resources, political issues, among others.

Data is important to support actions, defining regulations and planning, but it is not enough to change local strategy.

After the application of the methodology in five territories, the mobilization of hundreds of people and various developments, the main lesson learned is that local **governance around the topic and clear communication between different sectors of society are key elements for the success of natural infrastructure** as a solution to climate and water challenges.

The benefits generated by natural infrastructure must cover environmental, social and economic aspects, so that the solutions generated are multifunctional. The active participation of society is essential for the implementation of projects, which must guarantee sustainable jobs, inclusion and respect for local cultures. Generating savings beyond avoided costs in water treatment is the preponderant factor in ensuring inclusion and representative governance.

In order to maximize the positive impact of natural infrastructure, these different dimensions need to be considered, ensuring a healthy balance between the environmental, social and economic spheres.





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