brazilian tree industry

PLANTED TREES AND WATER RESOURCES

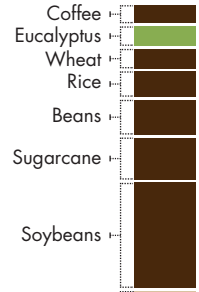
www.iba.org

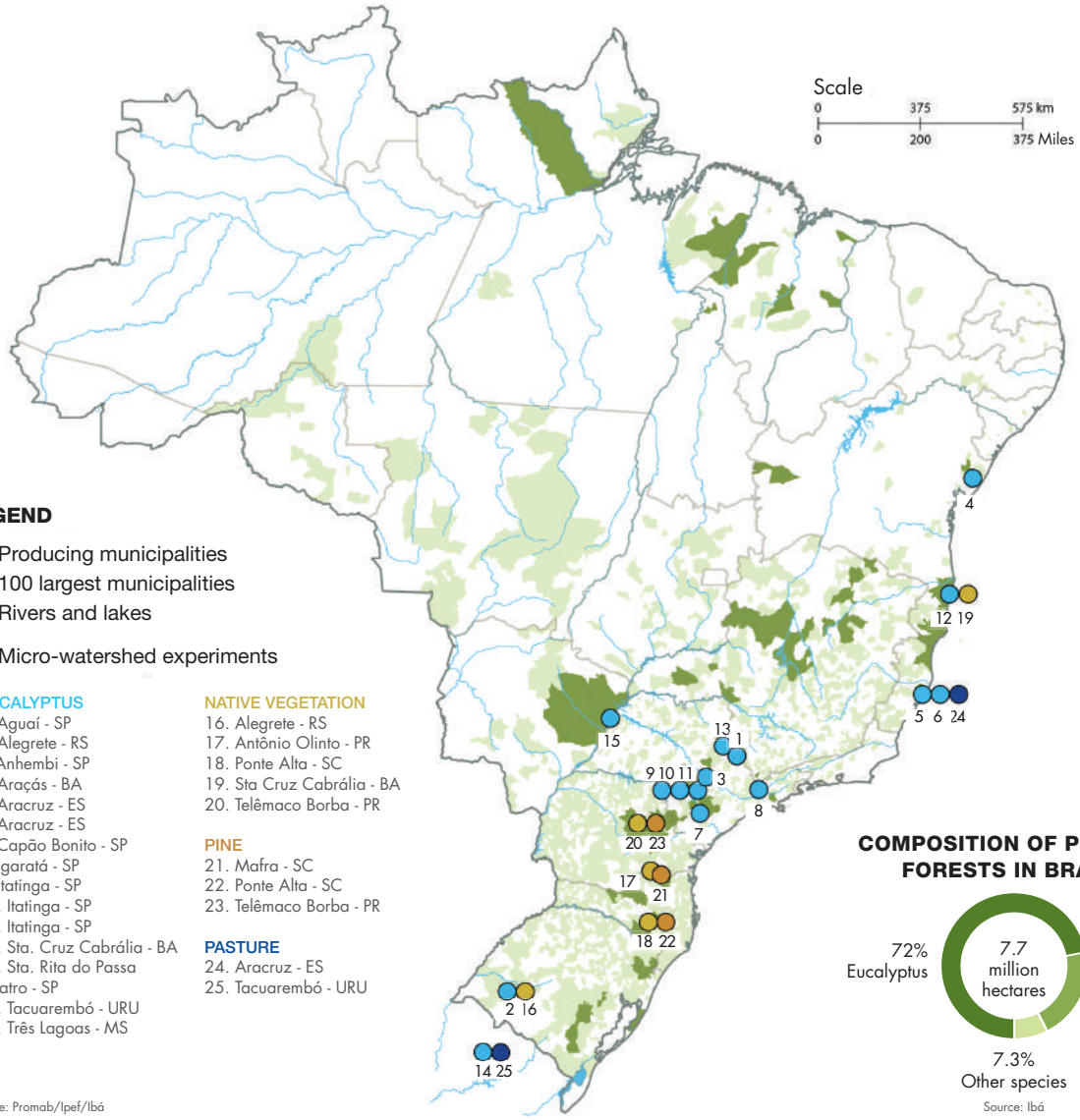
FOREST MANAGEMENT AND MICRO-WATERSHEDS

Analysis and management of micro-watersheds allow us to understand the water conditions in specific regions, and how human actions in the landscape affect quantity and quality of these resources. Assessments of environmental indicators within a micro-watershed, demonstrates whether forest management practices ensure water availability for forest production not hindering the supply for surrounding communities. Water uptake by planted trees is only part of the issue. Climate conditions of the region must be taken into account. Other land use and landscape management also play a role in the water flow. The sector has monitored micro-watersheds across the country through experiments, some of which have been ongoing for more than 20 years. The goal of watershed monitoring is to understand the effects of forest management and to adjust practices to ensure water availability for other uses.

LAND USED

Compare the area planted with eucalyptus to other land uses.





LEGEND

- Producing municipalities
- 100 largest municipalities
- Rivers and lakes
- Micro-watershed experiments

EUCALYPTUS
1. Aguaí - SP
2. Alegrete - RS
3. Anhembi - SP
4. Araçás - BA
5. Aracruz - ES
6. Aracruz - ES
7. Capão Bonito - SP
8. Igaratá - SP
9. Itatinga - SP
10. Itatinga - SP
11. Itatinga - SP
12. Sta. Cruz Cabrália - BA
13. Sta. Rita do Passa Quatro - SP
14. Tacuarembó - URU
15. Três Lagoas - MS

NATIVE VEGETATION
16. Alegrete - RS
17. Antônio Olinto - PR
18. Ponte Alta - SC
19. Sta Cruz Cabrália - BA
20. Telêmaco Borba - PR

PINE
21. Mafra - SC
22. Ponte Alta - SC
23. Telêmaco Borba - PR

PASTURE
24. Aracruz - ES
25. Tacuarembó - URU

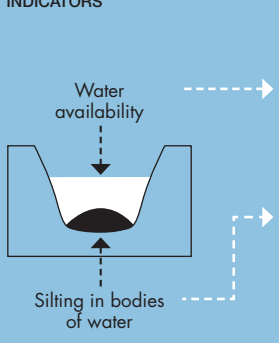
Fonte: Promab/Ipef/Ibá

COMPOSITION OF PLANTED FORESTS IN BRAZIL

Source: Ibá

IMPORTANCE OF WATERSHEDS MONITORING

Indicators of the impact of planted forests help the establishment of mitigating measures.

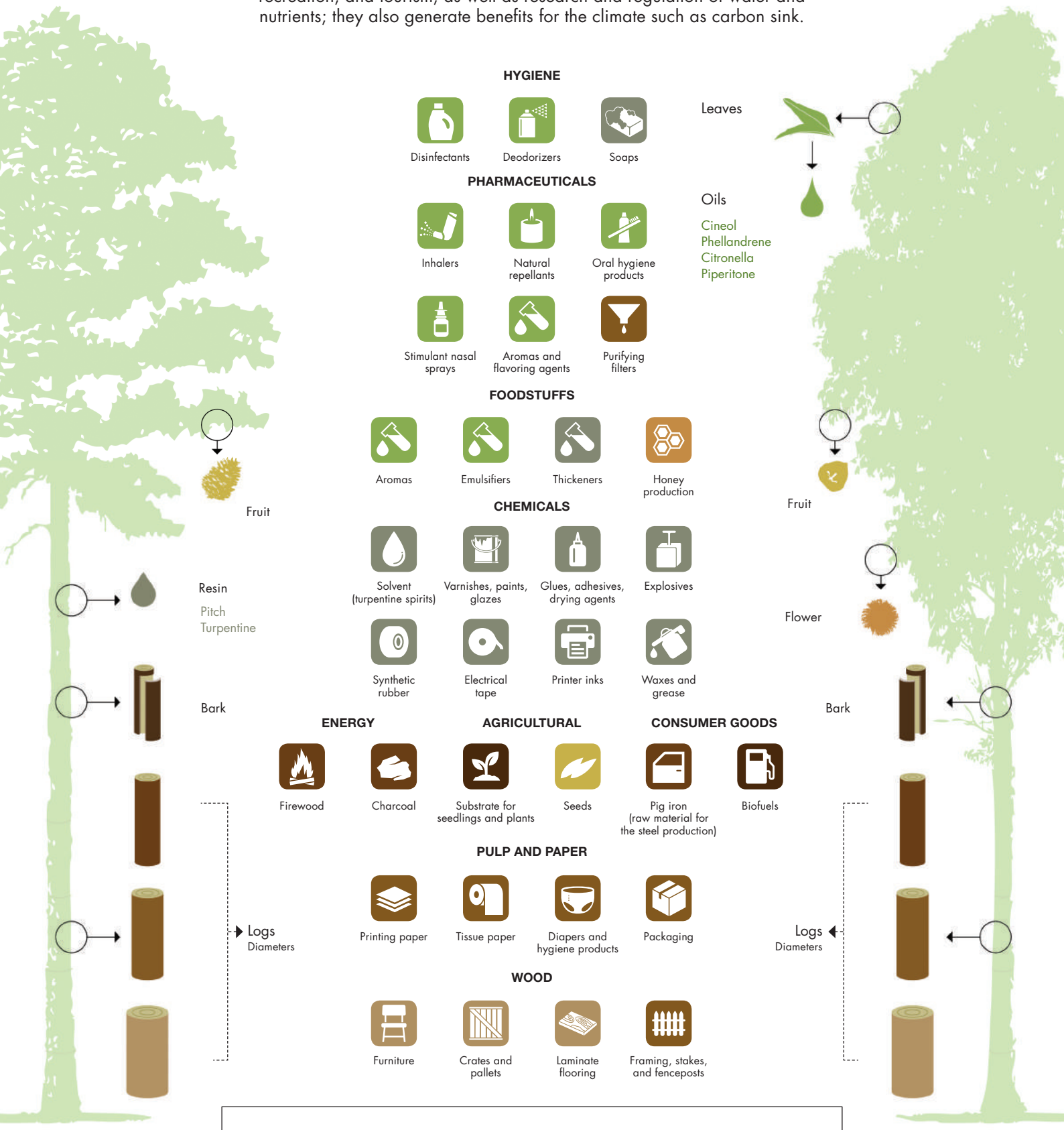


INDICATORS	FORESTS PLANTED IN DEGRADED AREAS		MITIGATION (ADAPTIVE MANAGEMENT)
Water availability	Regulates water flows (floods and drought)	Reduces surface water runoff	• Select better-adapted clones (in dry regions) • Plantation spacing (reduce density of trees per area unit) • Arrange plantations in mosaics (integrate commercial tree plantations and natural forests) • Stands at different ages (in different growth phases, resulting in different water uptake) • Landscape management
Silting in bodies of water	Reduces the load of sediment released; Reduces leaching (percolation of nutrients through the soil)	Harvesting and inappropriate road construction	• Plan stands according to topography • Maintain residual materials in the field after harvest • Minimum cultivation when preparing the soil • Bring roadways into compliance (road system design) • Eliminate roadways surrounding • Permanent Preservation Areas • Distance between roadways and water courses

Source: Brazilian Forest Dialogue

WOOD IN EVERYDAY LIFE

Today, planted trees are the raw material for more than 5,000 products and subproducts. They generate a variety of services related to culture, recreation, and tourism, as well as research and regulation of water and nutrients; they also generate benefits for the climate such as carbon sink.



PINE

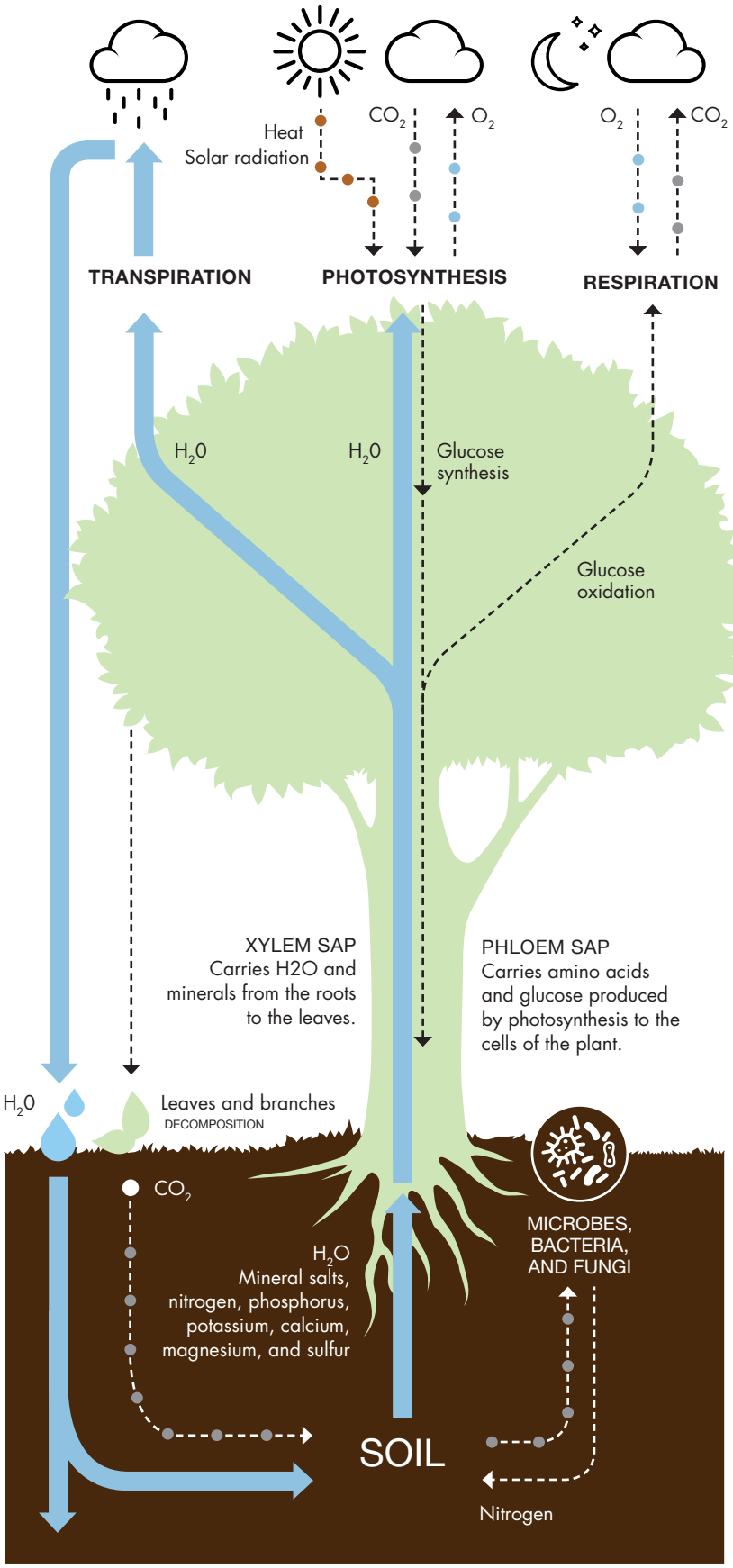
EUCALYPTUS

IMPROVEMENTS FOR THE FUTURE

When combined with other products, trees produce lighter and more resistant materials. Today, studies and research show that the use of materials such as nanocellulose, fibers, and crystals will significantly increase within ten years' time for the commercial-scale.

HOW TREES WORK

Natural and planted trees develop according to the same physiological mechanisms. They capture water through their roots and return it to the atmosphere in the form of vapor, in a process known as transpiration. This water cycle is necessary for photosynthesis to occur.



The Brazilian Tree Industry (Ibá) is the association responsible for institutional representation in the planted tree sector. There are 7.74 million hectares of planted trees in Brazil, supplying a variety of industrial areas including pulp & paper, wood panels, laminate flooring, and charcoal for iron and steel production.

This industry has historically made efforts to improve forest management practices and landscape management to encourage efficient operations and to produce more while using less of our natural resources (land, water, and nutrients).

On a planet where exponential population growth is expected, along with climate change and growing demand for food, fiber, energy, bio-products, and increasingly scarce resources, the Brazilian planted tree industry recognizes the need for significant changes in our patterns of consumption and production.

Here we show the industry's commitment to water resource management: integrated landscape management (producing planted trees that produce biomass efficiently), mosaic systems integrated with natural forests, watershed monitoring, and improving management practices to mitigate any potential impacts. This infographic shows the different aspects of the relationship between forestry and water resources. It shows the dynamics of the water cycle in the trees, forest, landscape, industry, and also compares the use of water by different types of forests. It demonstrates that planted forests, if they are well managed, uses water to generate significant benefits for society, through the production of daily-life products and services. They also bring benefits for the surrounding community by creating employment and income, as well as benefits for the environment, through integrated landscape management and the planted trees.

The following pages explain detailed the dynamics of water use in the trees, plantations, and in the landscape.

THE WATER CYCLE IN PLANTED FORESTS

Planted forests (like any vegetation) consume water as part of growth and survival. Because of the importance of this resource in maintaining life and human activities, is necessary to understand its dynamics. This illustration explains the water cycle between the atmosphere and the soil.

THE HYDROLOGIC CYCLE

The water cycle, known scientifically as the hydrologic cycle, refers to the continuous exchange of water in the hydrosphere between the atmosphere, water in the soil, water in superficial bodies of water, underground bodies of water, and plants.

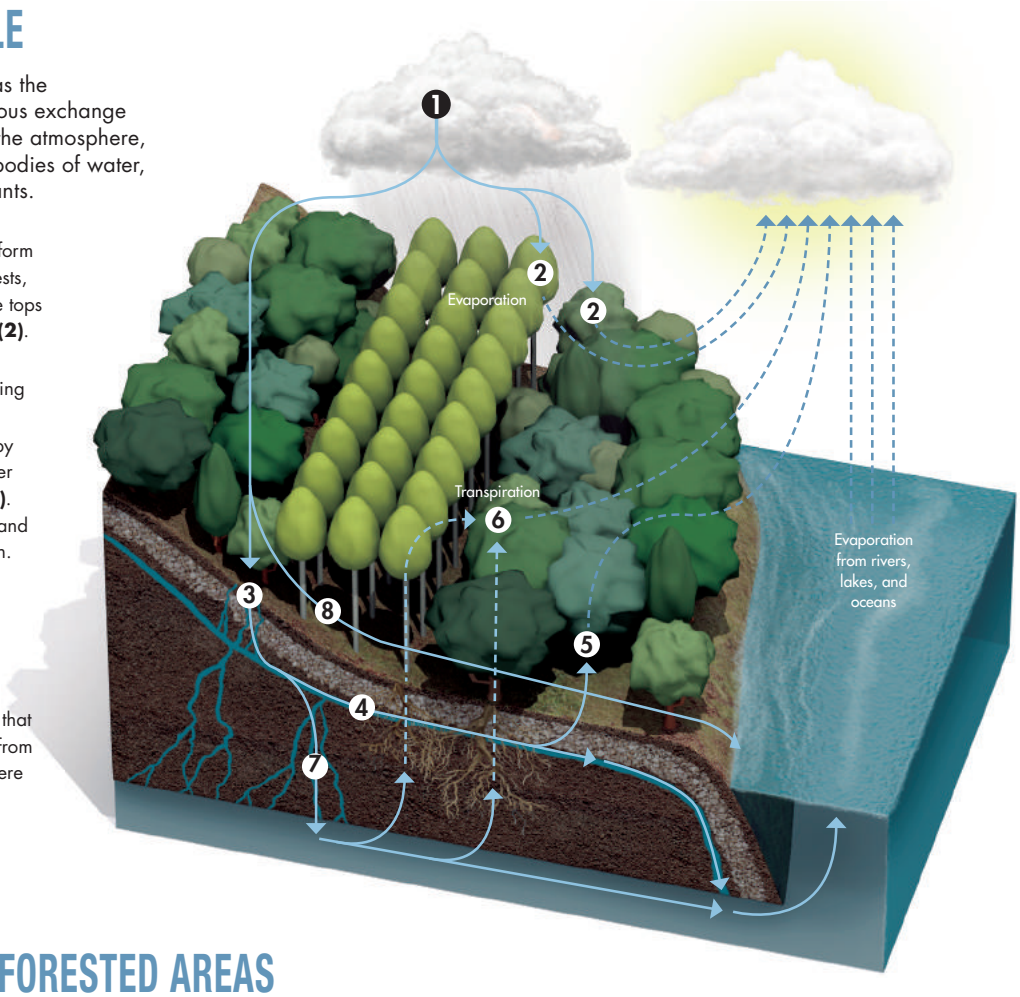
When water vapor accumulates in the atmosphere, it provokes precipitation in the form of rain **(1)**, hail, and dew. In areas with forests, part of this precipitation is intercepted by the tops of the trees – forest canopy and evaporates **(2)**.

The water flow infiltrates into the ground **(3)** and passes slowly through the soil **(4)**, keeping the surface moist, where it evaporates. **(5)**.

Part of this underground water is absorbed by the plants. The plants in turn release the water into the atmosphere through transpiration **(6)**. This combination of processes (evaporation and transpiration) is known as evapotranspiration.

Part of the water that infiltrates into the ground, flows between the particles and into the empty spaces between soil and rocks, and is stored for a period that can vary widely, forming aquifers **(7)**.

If precipitation exceeds the amount of water that can infiltrate into the soil, the water runs off from the surface **(8)** to nearby rivers or lakes, where it evaporates, returning to the atmosphere.

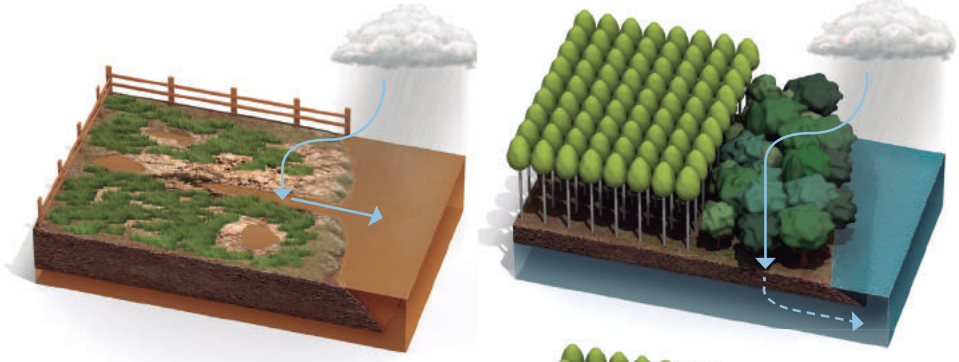


DEGRADED AREAS VS. FORESTED AREAS

Planted forests act as water regulators

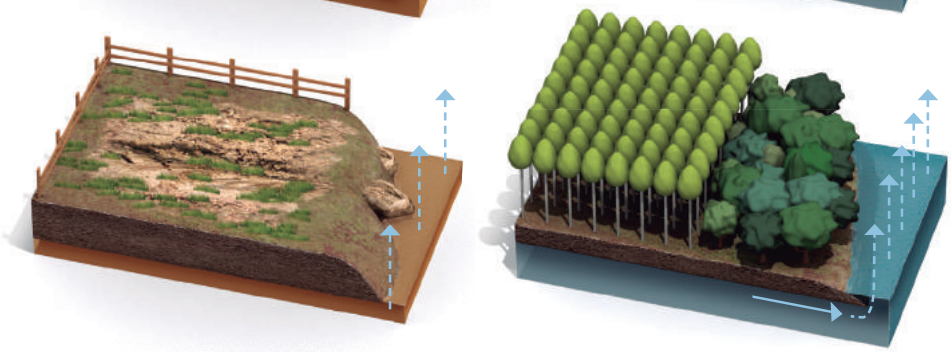
THE RAINY SEASON

During this season, the high volume of water can generate floods in degraded areas because of soil impermeability; consequently, surface runoff increases raising the water level in rivers and increasing the amount of sediment that is deposited. In planted forests, part of the water is intercepted by the treetops and part is absorbed by better-structured soil. Besides reducing surface runoff, silting is also reduced, allowing rivers to maintain their normal levels.



THE DRY SEASON

The degraded areas with impermeable soil that were flooded did not contribute to the underground bodies of water that feed the rivers at this season; river levels fall with the accumulated sediments. Planted forests act as regulators and guarantee supply of water in the dry season due to underground water (known as the water table) that was refilled during the rainy season.

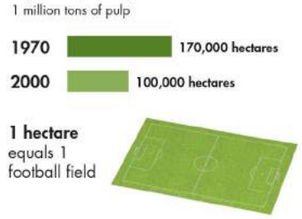


THE CYCLE OF PLANTED FORESTS

1. MOSAIC
Planted trees for industrial purposes are integrated with the natural vegetation, forming mosaics and ecological corridors. This integration, combined with other land uses, comprises the landscape. Integrated management of this landscape allows availability and regularity of water resources.

2. HARVEST
Mechanized forest harvesting leaves a large volume of residue in the field, such as bark, leaves, and branches. Besides contributing to nutrient cycling, this layer of residue retains moisture and sediments, protecting the soil from the raindrops impact during the rainy season, ensuring soil conservation and maintaining the quality of surface water.

3. MANAGEMENT
Investments in technology and genetic improvement combined with modern forestry management practices have allowed producers to triple forest yields and also maintain numerous rotations for a period of over 50 years in the same area, thus ensuring sustainable natural cycles and maintenance of water resources.



4. SPILLWAY
The spillway is the basic component in watersheds monitoring. This tool allows us to study the cycles in the forest such as the water, carbon, and nutrient cycles, which connect the dynamics of forest management practices to the environmental health of micro-watersheds.

LANDSCAPE INTEGRATION
The volume and quality of water resources depend on management practices throughout the watershed. The integration between land use sectors to allow for landscape management has happened through associations and organizations that promote: educational programs, water use in irrigation monitoring, water reuse and recycling in different industries, and conservation of areas that have high potential for water production.

OUTGROWERS
Integration between forest industries and smallholders through outgrower programs promotes technology transfer, technical assistance, compliance with landownership and environmental regulation, as well as socioeconomic development, conservation of water resources, and recovery of degraded soils.

WATER RESOURCES

A. Surface runoff
Planted forests interspersed with natural forests ensure the regulation of water flows. Consequently, preservation of the areas surrounding springs and waterways is essential, along with soil conservation.

B. Water table
The dense network of roots in areas planted with eucalyptus improves the physical structure and porosity of soils, allowing for better water infiltration and better refilling of the water table.

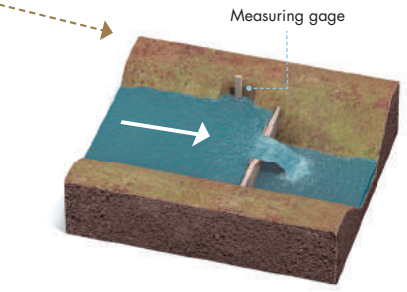
C. Micro-watersheds
Agricultural and forestry management activities should focus on protecting critical areas of the micro-watersheds in order to ensure their resilience. Maintaining riparian forests (those alongside water bodies) is keen for maintaining watersheds integrity.

D. Rivers
The mulch formed by leaves and branches that fall to the ground and are maintained during harvesting contributes to water retention, and decreases the amount of sediment that is carried to water bodies, preserving water flow and quality.

AREAS OF PERMANENT PROTECTION (APPS) AND LEGAL RESERVES (LR)

APPs are protected areas that may or may not be covered with native vegetation; their role is to preserve water resources, the landscape and biodiversity, to protect the soil, and ensure the well-being of populations. In APPs, the following areas are to be preserved: riverbanks, areas surrounding water springs, hilltops, and areas with slopes greater than 100% (45 degrees). LR areas are set aside for sustainable use and conservation of water bodies and biodiversity. The planted tree industry has been working together with smallholders (through outgrowers programs) to achieve compliance with land use regulations. Besides enforcement and monitoring of land use regulation by environmental agencies, forest management also comply with voluntary international certifications schemes, such as FSC and PEFC. Forest certification extrapolates national regulations and are considered exemplary. More than 60% of the area with planted trees is certified through international programs.

170,000 hectares



5. INDUSTRY

As a result of the technologies deployed by this industry, 3/4 of the volume of water used for the manufacturing process in the past is no longer needed, and can be made available for other uses.

Water captured by industry to produce one ton of pulp.

1970	180 to 200 m³/t
2000	25 to 50 m³/t
2015	22 to 40 m³/t

1 m³ is equivalent to a 1000 liter water tank

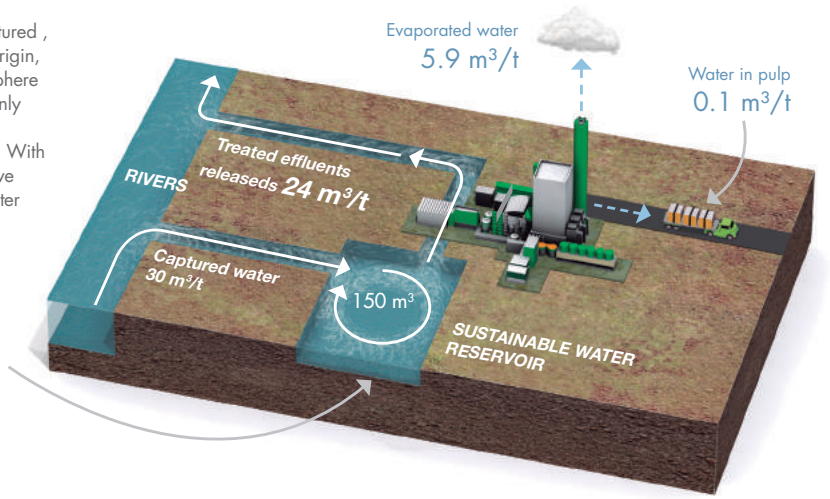
Source: ABTCP, 2015

WATER BALANCE IN THE PULP INDUSTRY (em m³/t)

Of the volume of water captured , 80% returns to its point of origin, 19.7% returns to the atmosphere through evaporation, and only 0.3% of this captured water remains in the final product. With water reuse technologies, five times the total volume of water that would have been used in the industrial process is available for other uses.

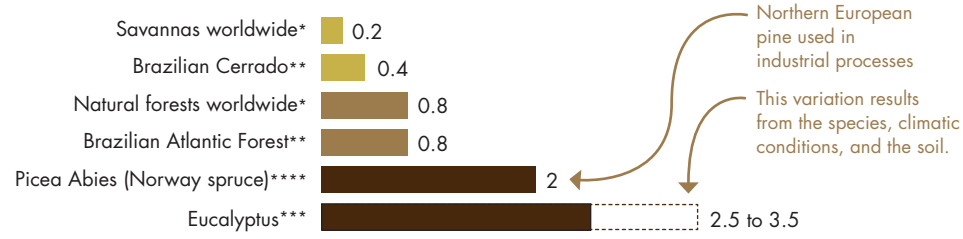
The water in the reservoir is used for five cycles, and then is treated before it returns to rivers.

Source: Ibá and Pöyry, 2015



EFFICIENCY IN BIOMASS PRODUCTION

kilograms of wood produced vs. m3 of water captured

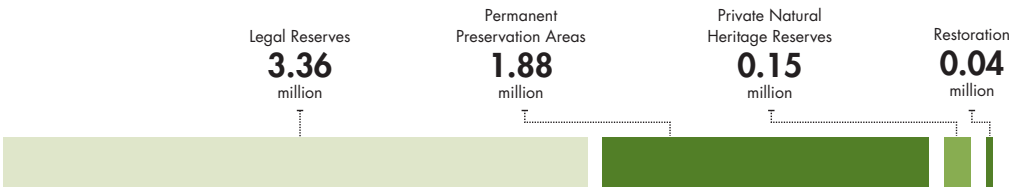


Sources: *Schimel, **Novais, **BEPP, ****Water Footprint

Eucalyptus is highly efficient in teerms of biomss production when compared with other tree species. With increased demand for wood-based products, planted forests can reduce pressure on natural forests.

AREAS PRESERVED AND RESTORED BY THE INDUSTRY IN 2014

In millions of hectares



Additional to compliance with legal requirements, The Brazilian planted tree industry, voluntarily restores and maintains natural areas , further increasing the size of protected areas.

Protected area per planted hectare →

Source: Ibá

GLOSSARY

BIOMASS
Organic plant matter originated by the photosynthetic conversion of solar energy.

CLIMATIC CONDITIONS
These characteristics are defined by climatic factors such as precipitation, humidity, terrain, temperature, solar radiation, and the physical and chemical characteristics of the soil, among others.

CONSUMPTION VS CAPTURE
In industry: Consumption is the water that effectively stays in the final product, which is equivalente to the difference between captured water and the amounts of released effluents, evaporated water, and reused water.
In the forest: Consumption is the water that stays in the biomass, the difference between the amount of water captured from the soil and the amount that returns to the atmosphere through evapotranspiration.

EVAPOTRANSPIRATION
The process of returning water to the atmosphere by evaporation from the soil and plants via transpiration from the leaves.

PHYSIOLOGY
The branch of botanical sciences that studies the biochemical functions and processes of plants, such as water uptake, water use, and transpiration.

RESILIENCE
An organism or environment's ability to return to its original natural state after some kind of disturbance.

SILTING
Deposit and accumulation of sediments in a river channel, eventually restraining its flow.