brazilian tree industry

PLANTED TREES AND WATER RESOURCES

www.iba.org

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The Brazilian Tree Industry (Ibá) is the association responsible for institutional and political representation in the planted tree sector. There are almost 8 million hectares of planted trees in Brazil, supplying for a variety of industries 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 using limited natural resources (land, water, and nutrients).

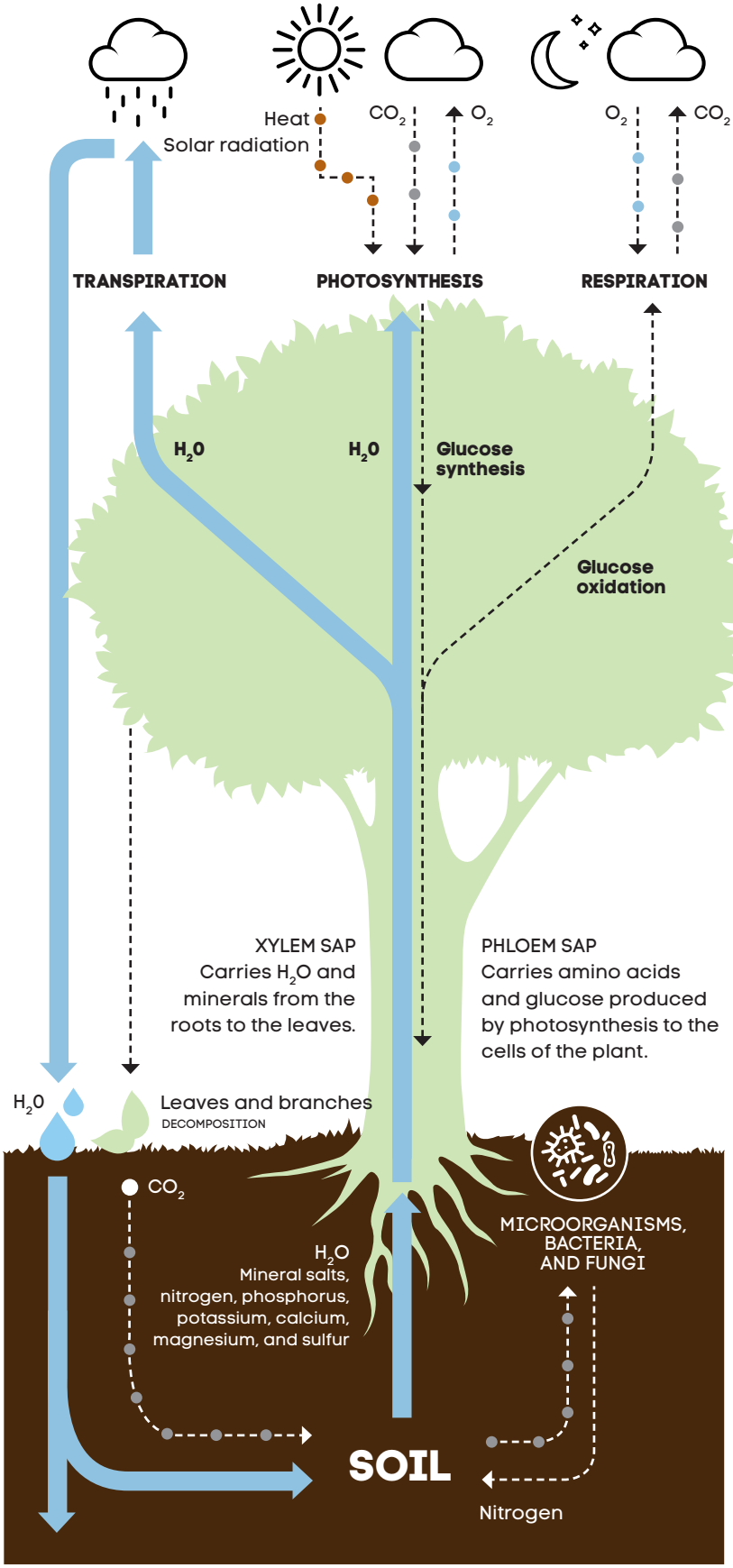
On a planet where exponential population growth is expected, along with climate change and growing demand for food, fiber, energy, bio-products, and increasingly scarce resources, the Brazilian planted tree industry recognizes the need for signicant changes in our patterns of consumption and production.

This infographic shows the industry's commitment to water resource management: integrated landscape management (producing planted trees that produce wood 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 within 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 in details the dynamics of water use in the trees, plantations, and in the landscape.

HOW TREES WORK

Native 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.



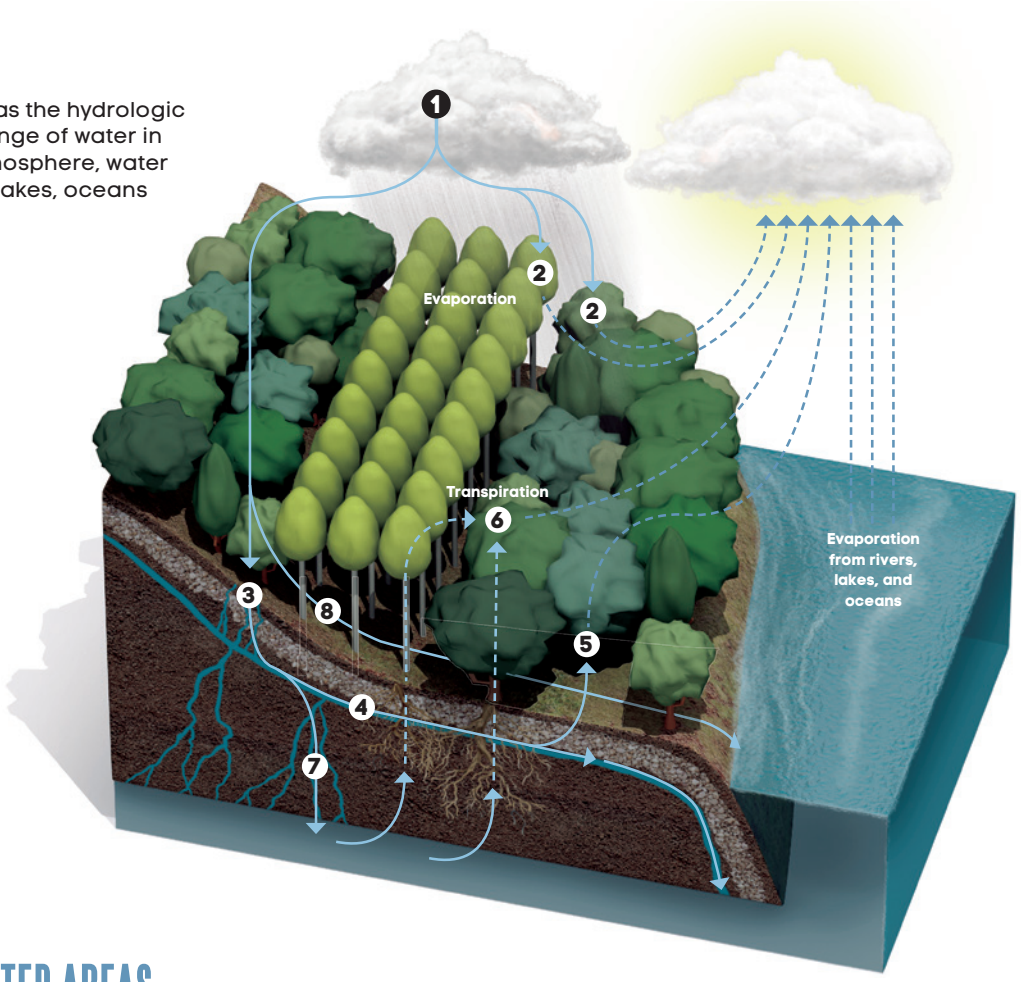
THE WATER CYCLE IN PLANTED FORESTS

Planted forests (like any vegetation) use 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, i.e, between the atmosphere, water in the soil, plants and water in rivers, lakes, oceans and water tables.

When water vapor accumulates in the atmosphere, it provokes precipitation in the form of rain **(1)**, hail, or 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

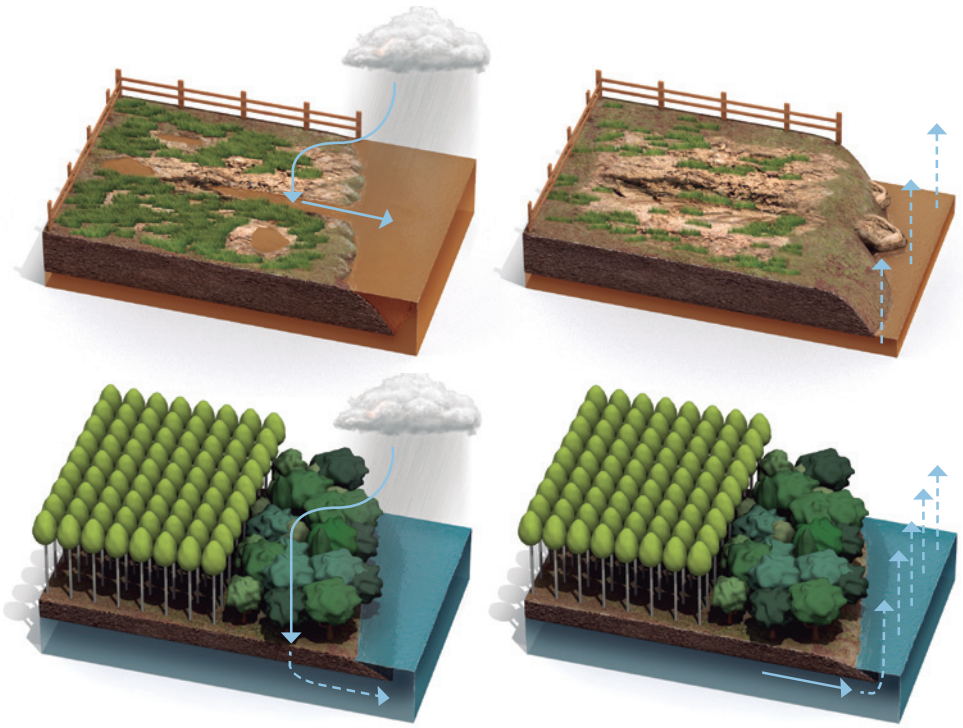
Planted forests act as water regulators

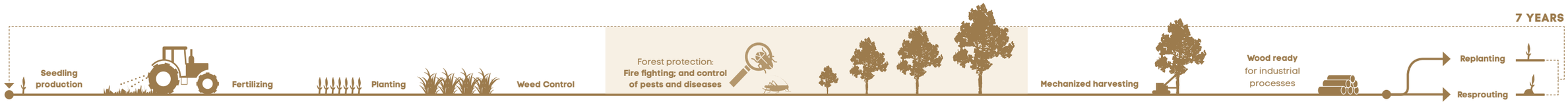
DEGRADED AREA

The degraded land – unstable in terms of structure and lacking vegetal covering, is impermeable and likely to suffer of erosion. During the rainy season this land gets soaked (flooded) resulting in the rain to flow straight to the river (surface runoff) without time to refill the water table. Thus, the river gets more likely to dry or lower its water levels. The surface runoff pulls down lots of sediments and nutrients to the river (leaching), reducing the soil fertility and increasing the riverbanks, causing them to be prone to overflow.

FORESTED AREA

Forests, both natural and planted, work as a shock absorber to the soil. Part of the rain is intercepted by the canopy and stems, reaching the soil with less impact and infiltrating a higher volume. This infiltration is due to better soil structure and roots that allow water to enter into the soil and refill the water table, rather than going straight to the river. When water tables are refilled, the rivers water-level keep stable during the dry season. That is the way forests act as water flow regulators.





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, allowing for soil conservation and maintaining the quality of surface water.

3. MANAGEMENT

Investments in technology and breeding program 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 promoting sustainable natural cycles and maintenance of water resources.

Progress in producing
1 million tons of pulp

1970 170,000 hectares

2000 100,000 hectares

1 hectare
equals 1 football field

4. SPILLWAY

The spillway is the base structure for micro-watershed monitoring. It enables the conduction of more accurate studies of the water resources and nutrient cycling during the development of the plantations cycles, evaluating the effects of the management practices on the environmental health of the 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 PROGRAMS

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 help 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 planted forests improve the physical structure and porosity of soils, allowing for better water infiltration and better refilling of the water table.

C. Micro-watersheds

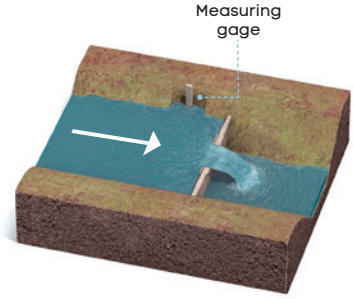
Agricultural and forestry management activities should focus on protecting critical areas of the micro-watersheds in order to promote their resilience. Maintaining riparian forests (those alongside water bodies) is keen for maintaining watersheds integrity.

D. Rivers

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

PERMANENT PRESERVATION AREAS (PPA'S) AND LEGAL RESERVES (LR'S)

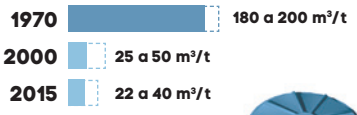
PPAs are protected areas that may or may not be covered with natural vegetation. Their role is to preserve water resources , the landscape and biodiversity, to protect the soil, and ensure the well-being of populations. In PPAs, the following areas are to be preserved: riverbanks, areas surrounding water springs, hilltops, and areas with slopes greater than 45 degrees.
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 regulations 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.
In Brazil, almost 8 millions of hectares are certified through international programs.



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



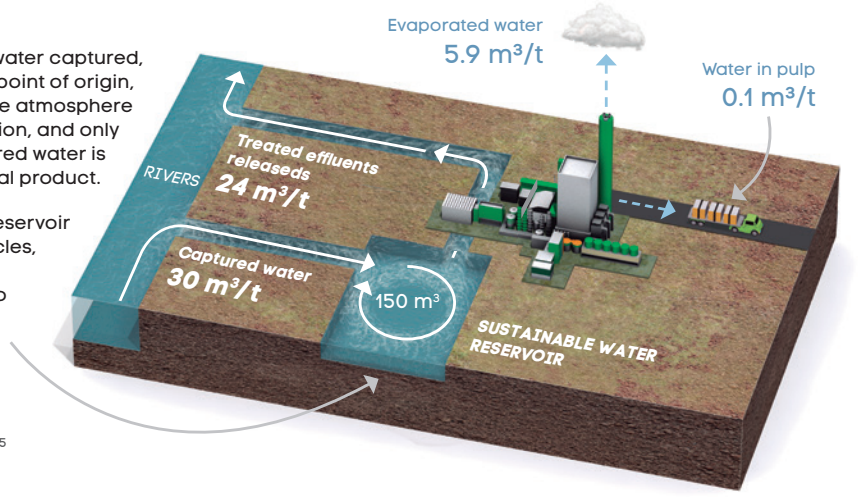
1 m³ is equivalent to a 1000 liter water tank

Source: ABTCP, 2015

WATER BALANCE IN THE PULP INDUSTRY (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 is retained in the final product.

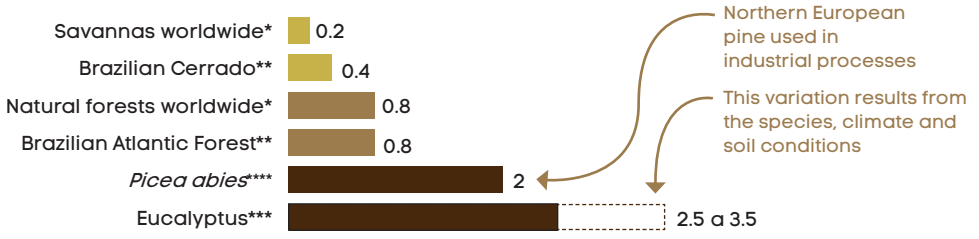
The water in the reservoir is used for five cycles, and then treated before it returns to rivers.



Source: Ibá and Pöyry, 2015

EFFICIENCY IN BIOMASS PRODUCTION

kilograms of wood produced vs. m³ of water captured

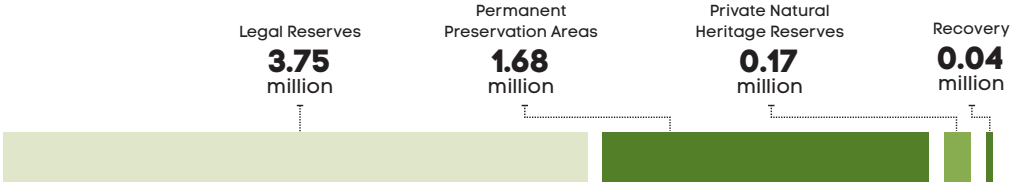


Sources: *Schimel, **Novais, **BEPP, ****Water Footprint

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

AREAS CONSERVED AND RECOVERED BY THE INDUSTRY IN 2016

In millions of hectares



Additional to compliance with legal requirements, The Brazilian Tree Industry, voluntarily recovery and maintains natural areas, further increasing the size of conserved areas.

Conserved area per area planted for commertial purpose →

Source: Ibá

CONCEPTS

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.

RETENTION
In industry: retention 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: retention is the water that stays in the biomass, the difference between the amount of water captured from the soil, used 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, respiration and transpiration.

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

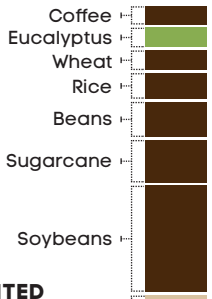
SILTING
Deposit of sediments in a river channel, eventually restraining its flow.

FOREST MANAGEMENT AND MICRO-WATERSHEDS

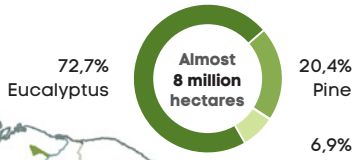
The Brazilian planted tree sector has monitored micro-watersheds through experiments across the country, some of which have been ongoing for more than 20 years. This monitoring allows us to understand the water conditions in specific regions and how forest management and human actions in the landscape affect quantity and quality of this resource. Assessments and monitoring these results can define whether the management practices allow water availability for forest production and surrounding communities, or if they need to be adapted to do so. Water use by planted trees is only part of the issue. Pluviometric conditions besides climate change effects, as well as other land use and landscape management, must be taken into account when discussing water management.

LAND USED

Compare the area planted with eucalyptus to other land uses.



COMPOSITION OF PLANTED FORESTS IN BRAZIL



Source: Ibá

MONITORED MICRO-WATERSHEDS

EUCALYPTUS
40 MONITORED MICRO-WATERSHEDS
Água Clara - MS
Aguaí - SP
Alegrete - RS*
Anhembi - SP*
Araçás - BA*
Aracruz - ES (3)
Brasilândia - MS
Capão Bonito - SP*
Eldorado do Sul - RS (2)
Felixlândia - MG**
Getardo - MG
Guaratinga - BA*
Igaratá - SP*
Imperatriz - MA*
Inocência - MS*
Itacambira - MG**
Itatinga - SP (3)*
Jaguaraíva - PR*
Luís Antonio - SP
Mucuri - BA
Nova Almeida - ES
Sta. Cruz Cabrália - BA*
Sta. Rita do Passa Quatro - SP
São Gabriel - RS (2)
São Mateus - ES
Selvíria - MS
Tacuarembó - URU*
Teixeira de Freitas - BA
Três Lagoas - MS (4)
Vila Gabriel - MG
Vila Valério - ES

NATIVE VEGETATION
12 MONITORED MICRO-WATERSHEDS
Alegrete - RS*
Antônio Olinto - PR*
Eldorado do Sul - RS
Guaratinga - BA*
Imperatriz - MA*
Itatinga - SP*
Ponte Alta - SC*
São Gabriel - RS
Sta Cruz Cabrália - BA*
Tacuarembó - URU*
Telêmaco Borba - PR*
Viçosa - MG**

PINE
3 MONITORED MICRO-WATERSHEDS
Mafra - SC*
Ponte Alta - SC*
Telêmaco Borba - PR*

PASTURE
1 MONITORED MICRO-WATERSHED
Aracruz - ES

TEAK
1 MONITORED MICRO-WATERSHED
Santa Maria das Barreiras - PA*

LEGEND

- Producing municipalities
- 100 largest municipalities
- Rivers and lakes

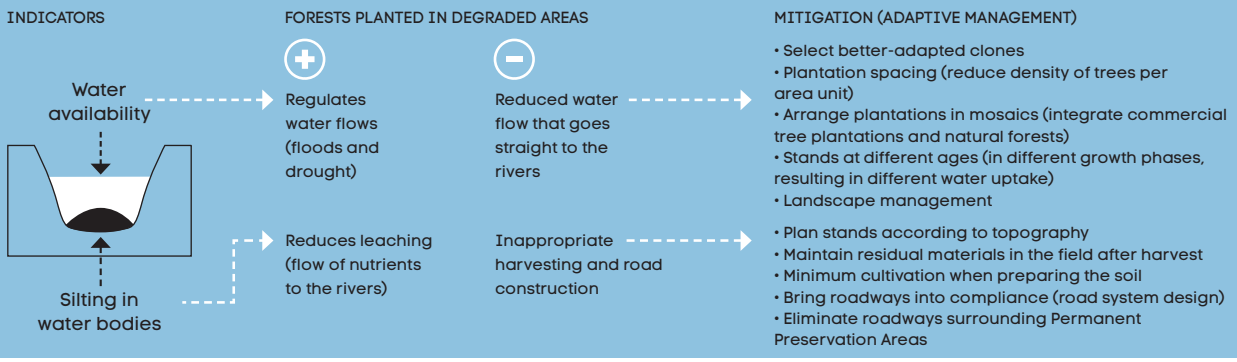
SCALE

0	375	575 km
0	200	375Miles

Source: Ibá, *Promab/Ipef and **UFV/SIF

IMPORTANCE OF MICRO-WATERSHEDS MONITORING

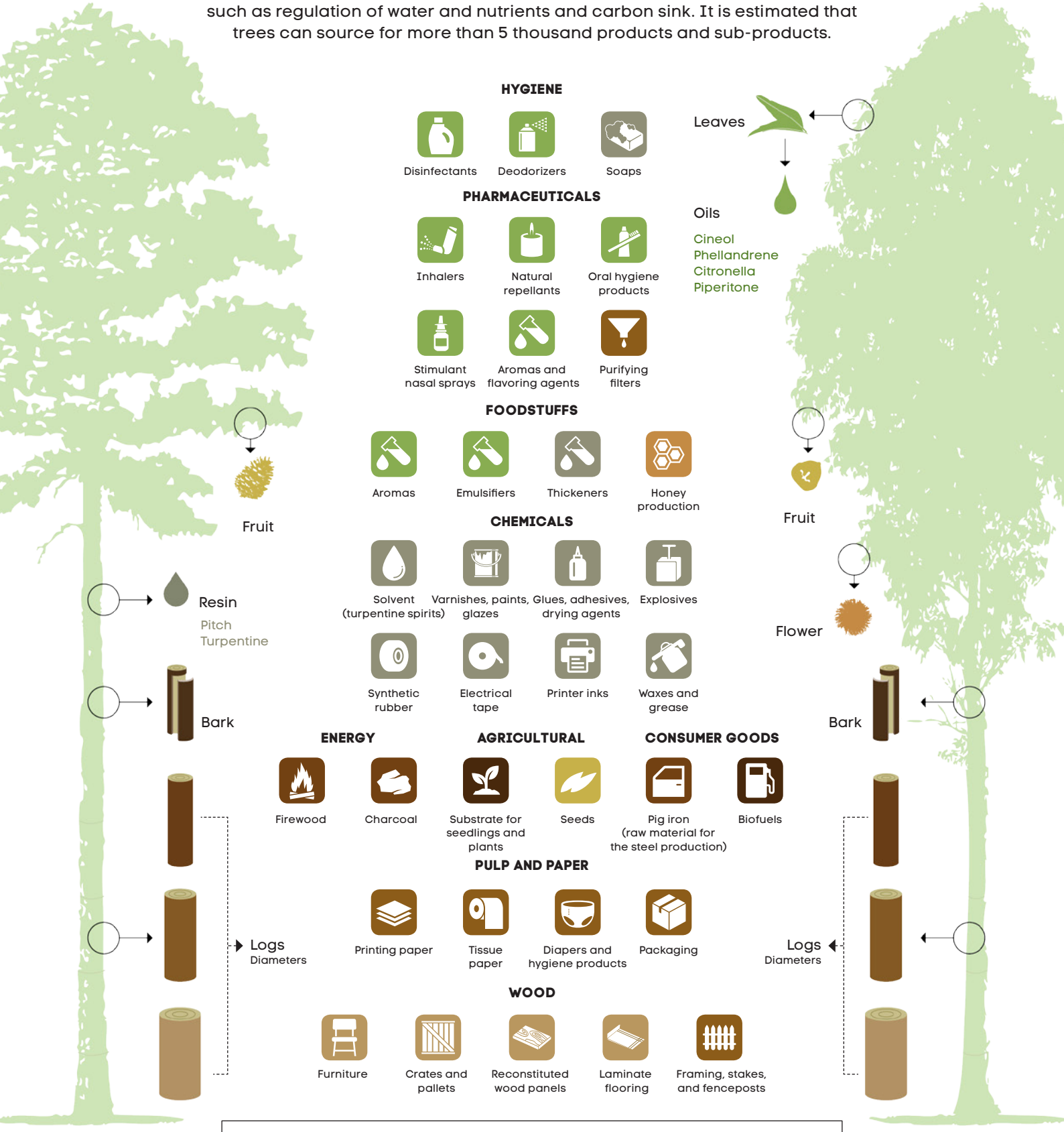
Indicators of the effects of planted forests help the establishment of mitigating measures.



Source: Brazilian Forest Dialogue

WOOD IN EVERYDAY LIFE

Planted trees generate a variety of services related to culture, recreation, tourism and research; as well as environmental services and climate benefits, such as regulation of water and nutrients and carbon sink. It is estimated that trees can source for more than 5 thousand products and sub-products.



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.

PINE

EUCALYPTUS