



PLANTED TREES
AND THEIR
MULTIPLE USES

THERE ARE **3.7 BILLION HECTARES** OF FORESTS IN THE WORLD (FAO, 2015)
93% of this area is composed of natural forests and 7% is planted for productive purposes.
The intensification of planted forest production, along with sustainable management of natural forests, plays a significant role in the protection and conservation of natural ecosystems.

THERE ARE **278 MILLION HECTARES** OF PLANTED FORESTS WORLDWIDE
These forests, only 7% of the world's, provide 50% of all wood for industrial purposes.



1 HECTARE is the size of a soccer field; in Brazil, it produces approximately **36 M³/YEAR** of wood.



In a scenario with incentives to use bioenergy and renewable energies, global consumption of wood from natural and planted forests may reach **8 BILLION M³/YEAR IN 2050...**



... to meet this demand, in addition to sustainable management of natural and semi-natural forests, **250 MILLION ADDITIONAL HECTARES** will be needed. This is the equivalent of Germany, Finland, Norway, Spain, France, and Italy combined.

7.8 MILLION HECTARES IN BRAZIL

Forests occupy less than 1% of the country's territory but are important in the economic scenario, accounting for 6% of the country's industrial GDP.

THE VALUE OF FORESTS IN A FUTURE SCENARIO

Planted forests play a significant role in supplying wood to industry. Although they take up less than 7% of the planet's total forest area, they provide about 50% of this raw material for industrial purposes! Projections indicate that if the current pattern of population growth is maintained, **the world's population will reach 9.1 billion by 2050.**

This growth, combined with changes in purchasing power, will boost demand for commodities, **and the total use of energy from biomass may double or even triple by 2050,** depending on the policies and mechanisms that encourage a low-carbon economy and use of renewable energy.

To meet this demand amid a scenario of low carbon, renewable energy, and net zero deforestation, studies show that **an additional 250 million hectares of planted forests will be needed around the world.**

This is because investments in technology and innovation will open the doors to a broader market beyond conventional uses, **incorporating other industries such as automotive, pharmaceutical, chemical, cosmetic, aeronautics, textiles and food into the forest production chain.**

The Brazilian planted tree industry invests heavily in innovation to increase competitiveness in this scenario of increased demand.

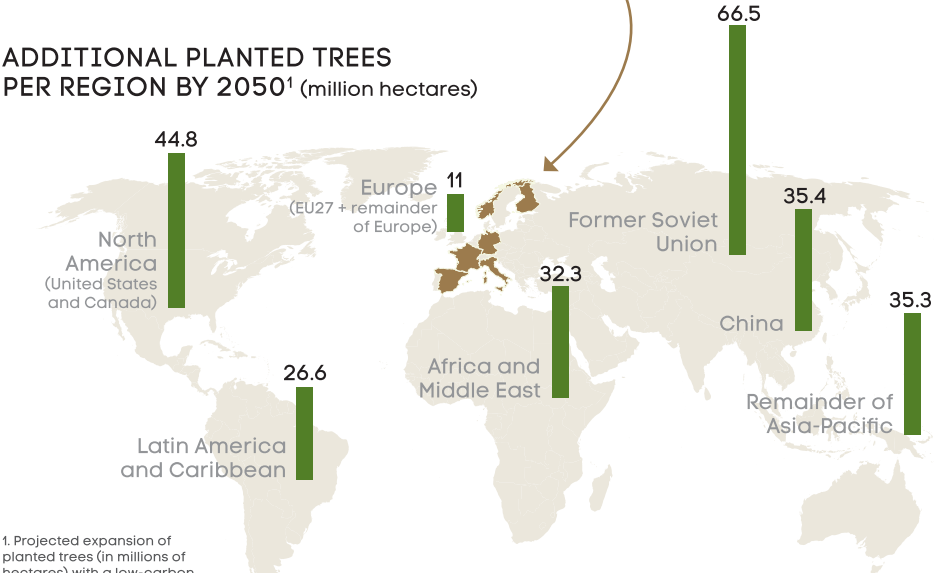
Besides innovations in products and processes, the Brazilian forestry sector is a pioneer in sustainability; it is able to intensify production while maintaining commitments to the highest environmental and social standards. It also leads the way in diversifying production by developing the concept of biorefineries, where the by-products of conventional uses are utilized and reach new markets.

This brochure explains how the planted tree industry supplies different industrial sectors and how continuous investments in innovation are moving the industry into a prominent position for the various uses and services that planted trees can provide.

Natural and planted forests occupy less than 30% of the Earth's surface and play a key role in supplying various products; they generate a market of approximately \$372 billion worldwide and more than 60 million direct and indirect jobs.

They also provide non-timber products and environmental services like regulation of water cycles, erosion control and soil quality; they also conserve biodiversity, provide 40% of the planet's oxygen and store 66% of the carbon on earth, which is fundamental to reduce the effects of climate change in the world.

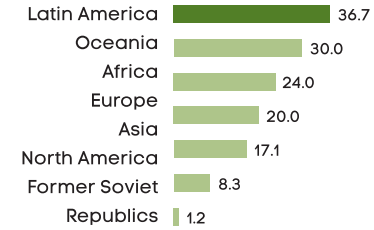
ADDITIONAL PLANTED TREES PER REGION BY 2050¹ (million hectares)



1. Projected expansion of planted trees (in millions of hectares) with a low-carbon economy and assuming zero loss of natural forest after 2020. Combination of the Target and Pro-Nature scenarios featured in the Floresta Viva model from 2010 to 2050. Source: IIASA Report, Florestas Vivas (Living Forests).

2. Considering current production plus additional expansion areas proposed in the low-carbon scenario. Source: Indufor and Russian Federation.

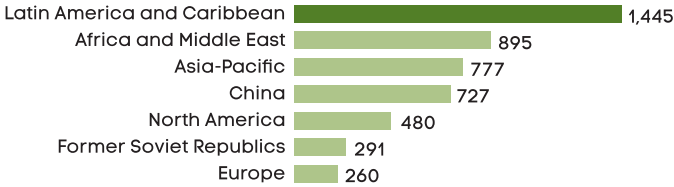
FOREST PRODUCTIVITY (m³/hectares per year)



Sources: Indufor and Russian Federation

The number of hectares of planted trees in Latin America in 2050 (including Brazil) will be less than the area of planted trees on other continents. But if we consider the high productivity of these forests, which are the result of significant investments in genetic breeding and intensification using sustainable management practices, **LATIN AMERICA WILL PLAY AN IMPORTANT ROLE** in supplying fiber, wood, and energy.

PRODUCTION IN 2050² (million m³)



THE PLANTED TREE INDUSTRY HAS INVESTED HEAVILY IN INNOVATION, BOTH IN ITS FOREST BASE AND IN INDUSTRY. THESE PRODUCTS, WHICH ARE DERIVED FROM CUTTING-EDGE TECHNOLOGY, WILL SOON BE PART OF OUR DAILY LIVES.



LIGNIN

This product can replace petroleum derivatives (styrene) to produce thermoplastic. This is a hybrid, moldable, and fusible renewable plastic 10 times more resistant than the product which is most commonly used in the market today, ABS (Acrylonitrile, Butadiene, and Styrene).



ETHANOL

Second-generation ethanol is a molecule equivalent to common ethanol, but is produced from sugar cane, straw, or sawdust and wood waste, almost all of which are discarded. Some refineries already produce this type of ethanol. The challenge is to produce it more efficiently and economically.



BIOPLASTICS

The new generation of renewable and biodegradable plastics is lighter and more resistant than conventional polymers. They can be used by the auto industry in injection-molded polypropylene parts.



NANOFIBERS

These fibers are obtained from the breakdown of cellulose fibers into nanocrystals. They can be used in the production of food supplements, edible packaging, high-performance cement, and in the automotive industry.



TALL OIL

A by-product of long-fiber pulp manufacturing. Some uses of this product include surface coatings, asphalt products, disinfectants, detergents, additives for drilling fluid, and paper glues.

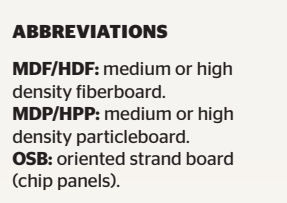


BIO-OILS

When wood fragments are heated in an oxygen-free atmosphere; the process releases a gas that is condensed into bio-oil and chemically treated. These oils can be used as a substitute for diesel.

1. Source: FAO

Brazil is a global reference in the planting of trees for industrial purposes which are used to produce wood panels, laminate flooring, pulp, paper, charcoal and biomass – items that are present in our homes and our daily lives. The planted tree industry has invested in technology to turn the waste and by-products of these processes into innovative, renewable products that are essential for the development of a low-carbon economy. Many of these products are still in the research and development stage, or are being produced on an incipient scale. As investments are made in innovative technologies, the products from this industry will move out of the laboratories toward new markets and different segments, providing additional benefits to society as a whole.



ENVIRONMENTAL SERVICES

Environmental or ecosystem services are the benefits we obtain directly or indirectly from nature through ecosystems in order to sustain life on the planet.

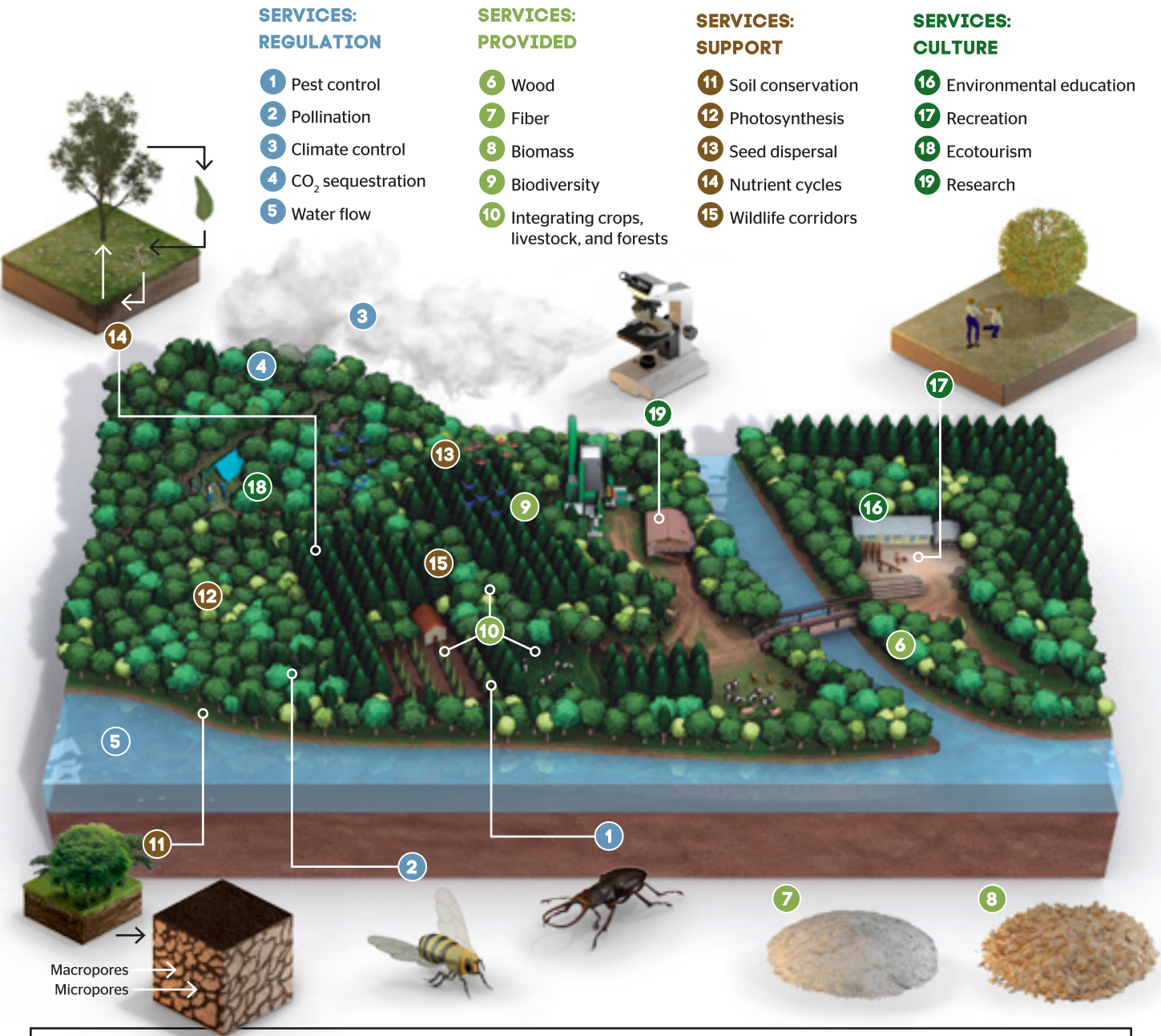
Planted forests are established to meet market demands for wood, fiber, and energy. Many researchers, however, believe that planted forests

can help to conserve natural forests by reducing pressure on these environments, and also conserve biodiversity and provide a number of ecosystem services which are vital to human life.

Studies have shown that planted forests help address environmental challenges, including the demand for

renewable energy, climate regulation, biodiversity conservation, and regulation of water flows.

According to Food and Agriculture Organization of the United Nations (UNFAO), planted forests offer a variety of products and ecosystem services, which are shown in the diagram below:



GLOSSARY

Black liquor: a substance resulting from the wood cooking process, mainly composed of organic and inorganic materials and

remaining dissolved wood (lignin).

Calander: this series of rollers reduces irregularities on the paper surface using pressure and temperature.

Causticizing: process that recovers the main chemical used in the wood cooking

process, lye (sodium hydroxide). This is done by adding lime to the black liquor.

Lignin: residues of dissolved wood.

Net zero deforestation: this means halting the net loss of forests, in other

words, for each hectare of forest lost one hectare must be reforested.

Screen section: part of the papermaking process where water is removed from the pulp through a screen.

Waste paper: the name given to paper waste and

packaging collected after it is used (excludes paper used for sanitary purposes).

White liquor: solution used in cooking wood, responsible for separating the cellulose fibers from the lignin.