PLANTED TREES AND THEIR MULTIPLE USES
Natural and planted forests occupy less than 30% of the Earth’s surface and play a key 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 all 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 making the industry into a prominent position for the various uses and services that planted trees can provide.

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.
Brazil is a global reference in the planting of trees for industrial purposes which are used to produce wood panel, laminated flooring, pulp, paper, charcoal and biocides – items that are present in our homes and daily lives. The planted tree industry has invested in technological advances to transform 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.

**FOREST-BASED PRODUCTS**

Brazil's forests account for 7.3 of the 7.8 million hectares of planted forests in Brazil. In addition to these species, fruits and nuts are also cultivated.

**SECTORS OF USE**

- Aviation
- Civil construction
- Printing/Publishing
- Food
- Automotive
- Cosmetics and personal hygiene
- Electronics
- Pharmaceutical and medical
- Furniture
- Chemicals
- Textiles
- Tourism

**FOOD**

Cellulose is used as an ingredient in various food products, such as syrups, dairy creams, and boiled food as a stabilizer and provide consistency. It is also added to ground cheeses to prevent moisture absorption and staling. Cellulose is also a source of dietary fiber for many whole food products. Small cellulose fibers serve as a flavoring extracted from browning wood during the process of charcoal making. This extract, pyrolytic acid, is basically condensed smoke. One such fiber, cellulose, has been added to chocolate to improve the use of this flavor for example in a chocolate sauce. Today, even dog food and animal bones contain these products. These uses, pyrolytic acid is also used as a stabilizer in agriculture.

**HEALTHCARE**

Substances derived from cellulose are used in various medical products. This is an excellent alternative for those who cannot consume animal-derived products. Traditional capsules are mainly composed of a capsule derived from the partial hydrolysis of cellulose. These capsules are obtained from the bones and connective tissues of animals. Using cellulose ensures that patients with allergies or cultural constraints can safely use these medications.

**AVIATION**

Cellulose nanocrystals have been examined as important structural components for aircraft. Since the early 1980s, much more research has been done on this topic. Cellulose nanocrystals have been added to materials that have attracted attention from the aviation industry. These applications range from improving the strength and durability of aircraft components to composites which are applied to the exterior of the aircraft to lower the freezing point of water on and below planes to take off more safely in harsh environments.

**ABBREVIATIONS**

- MDF: medium density fiberboard
- HDF: high density fiberboard
- OSB: oriented strand board
- MDP/HPP: medium or high density particleboard
- ABBREVIATIONS

*Products already on the market
Products in the research and development stage or produced on an incipient scale

*Note: This page is an excerpt from a larger infographic. The full infographic can be accessed by visiting the source link.
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 (FAO), planted forests offer a variety of products and ecosystem services, which are shown in the diagram below:

**SERVICES: REGULATION**
1. Pest control
2. Pollination
3. Climate control
4. CO₂ sequestration
5. Water flow

**SERVICES: PROVIDED**
6. Wood
7. Fiber
8. Biomass
9. Biodiversity
10. Integrating crops, livestock, and forests

**SERVICES: SUPPORT**
11. Soil conservation
12. Photosynthesis
13. Seed dispersal
14. Nutrient cycles
15. Wildlife corridors

**SERVICES: CULTURE**
16. Environmental education
17. Recreation
18. Ecotourism
19. Research

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**GLOSSARY**

**Black liquor**: a substance resulting from the wood cooking process, mainly composed of organic and inorganic materials and remaining dissolved wood (lignin).

**Calender**: 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, i.e., 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.