

Growing Trees in a Machine

A Pioneering Technological Revolution
in Sustainable Timber Production





CRAFTED
HARDWOODS

Blackbutt

INTRODUCTION

As a renewable, low-carbon, non-toxic and recyclable material, timber plays an important role in sustainable architecture. Compared to steel or concrete, the manufacture of wood products produces significantly fewer carbon emissions.¹ In addition, sustainably-sourced wood acts as a carbon sink, allowing timber buildings to store vast amounts of carbon.

Not only are they good for the environment, but timber is easy to build with. With the right design and specifications, timber can be used to produce high-performing, safe and beautiful structures. Sustainable timber construction also creates jobs, boosts the economy and contributes to healthier living and working environments.²

However, specifying timber in a project carries more risk due to supply uncertainty and price volatility in today's current economic landscape. Given recent shortages and price increases,³ the design and construction industry, as well as the general public, are starting to recognise that timber may be a finite resource.

In order to address major issues such as pollution, waste, carbon emissions, and climate change, we must embrace new timber technologies. According to reports, Australia generates about two million tonnes of timber waste annually.⁴ The solution is not to give up on wood use; rather, we must learn to use our resources more wisely.

Below, we explore the role of new technologies in maximising the utilisation of forest resources and expanding the potential of timber in design and construction.

An aerial photograph showing a dense green forest at the top, transitioning to a cleared area below. In the cleared area, there are two large stacks of cut timber logs. The ground is covered with dry, brownish vegetation and some scattered branches.

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DEFORESTATION AND CLIMATE CHANGE

The built environment is responsible for almost half of the world's annual CO₂ emissions.⁵ Building operations account for 27% of those total emissions each year, while construction and building materials (such as timber) account for an additional 20%.⁶

While the carbon footprint of buildings is well known, its impact on natural resources, the ingredients used to make building materials, should not be overlooked. The quantity of natural resources used for building and transportation infrastructure increased 23-fold between 1900 and 2010.⁷ Currently, 800 billion tonnes of natural resources are bound up in these structures globally.⁸

This trend is set to continue.⁹ Seventy percent of the infrastructure and structures that Australia will require in 2050 have not yet been constructed. Future construction will strain the planet's natural resources

even further and have a major negative impact on climate change and the environment.¹⁰

Timber is a renewable resource, but that does not mean it is an infinite resource. The World Bank reports that we have lost 1.3 million square kilometers of forests since 1990.¹¹ A yearly average of 28 million hectares have been cleared of forest since 2016, a rate that amounts to a football pitch of forest lost every second.¹²

The loss of forests and forested areas has serious negative effects on the environment. These effects include loss of biodiversity, reduced water quality,¹³ and broader social and economic impacts, including displacement of forest communities, loss of cultural heritage, and poor worker conditions.

According to the Food and Agriculture Organization of the United Nations, deforestation ranks as the second most significant contributor to climate change.¹⁴

TIMBER DEMAND OUTSTRIPPING SUPPLY

The amount of native forest that can be used to produce commercial timber has decreased. There is increased pressure on governments to protect old growth and native forests, which has resulted in the end of native logging in Victoria and Western Australia. Additionally, there is legal action to halt logging in Tasmania and New South Wales.

The slow, organic growth of trees combined with these recent legal developments adds to the uncertainty surrounding timber supply and prices across the country.

The constraints placed on native timber supply will make it difficult to meet current and future demand. Over the next few decades, with a growing population requiring housing and infrastructure, the need for timber is predicted to rise substantially.¹⁵ Timber also plays a huge part in achieving the net zero carbon goal and it

is quickly becoming the “eco-friendly” building material of choice, replacing steel, aluminium and concrete. Reports estimate that global demand for timber is set to quadruple by 2050.¹⁶

At the same time, there is a vast amount of wood that is underutilised. The Australian forest industry produces large amounts of wood waste or by-products, some of which could be better utilised for alternative technologies. Less than 40% of the input log volume is recovered by the majority of Australian sawmills as saleable product.¹⁷

In addition, nearly half of all trees logged in Australian forests get classed as low-value pulp logs. As a country, we produce on average 16 million cubic meters of pulpwood every year, with most of it being turned into woodchips and exported.¹⁸

ROLE OF NEW TIMBER TECHNOLOGIES

Establishing a hardwood plantation involves extensive preparation prior to being suitable for timber production. Typically, a hardwood tree requires 75 years or more to mature to the quality needed for the construction industry and furniture manufacturing.

Victoria had initially planned to cease native forestry by 2030, a timeline already considered stringent by many in the timber industry. Advancing this deadline to 2023 has undeniably affected supply.

Given these considerations, are we adequately preparing to meet the anticipated growth in timber demand within the Australian market?

If we do not rethink the supply chain and find a way to produce timber in large quantities, sustainably, and with consideration for future generations, it will cease to be a viable core building material. Our best hope is to optimise the utilisation of forest resources using new technologies to produce hardwood alternatives.





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DOING MORE WITH LESS—USING BYPRODUCTS TO CREATE MORE VALUABLE RESOURCES

Crafted Hardwoods is an Australian manufacturer using 3RT's advanced technology to supply their world-first hardwood innovation to the commercial and residential construction markets. The company is converting sustainably sourced, low-value pulp grade resources into premium hardwoods with the look, feel and properties of 100-year-old trees. In one day.

Through science and engineering, Crafted Hardwoods uses pulp-grade logs that are destined for wood chips and export, upvaluing them to suit a wide array of applications. At the heart of this technology, developed by 3RT in partnership with Flinders University, Henkel and Bosch, is a patented process using a water-based "nano glue" that biomimics the properties of wood's natural lignin, a complex organic compound produced by trees. This gives the new hardwood timber the same structure and properties as mature trees. To achieve nature's precision, this process is managed by robots and the power of artificial intelligence.

The process was also designed to increase yield and minimise waste; the wood fibres are obtained by rotary peeling each log, using as much of the tree as possible. The result is a 75% yield from a log compared to an average of only 33% using traditional methods.

Growing square trees

Crafted Hardwood produces "square logs", which are dimensionally consistent at 2500mm x 500mm x 250mm. Those billets are then cut and finished as required. The dimensions of the billets have been carefully chosen to enable maximum output and minimal waste. To achieve longer lengths, the timber can be joined, just like traditional wood.

Every single block Crafted Hardwoods produces using this innovative technology is unique and highlights the beauty and characteristics of natural wood. The end product is healthy, sustainable, natural, recyclable and free of harmful chemicals and toxins. It is available in a range of Australian native and imported species.

A SUSTAINABLE TIMBER LIKE NO OTHER

Unlike traditional hardwood timber, which take on average 75 years to reach the required size and density to be harvested as sawn hardwood, the resources that are used by Crafted Hardwoods are 12-20 years old. This means that an area of plantation forest has the potential to be cycled 4-5 times within the same timeframe it takes for a single traditional growth and harvesting cycle. More importantly, this also removes the need to rely solely on resources from native or old-growth forests to meet the demand for hardwood timbers.

Using juvenile trees also has a positive impact on carbon sequestration, as research suggests that young, growing trees are more efficient at sequestering carbon. According to the National Council for Air and Stream Improvement, young forests grow rapidly, removing much more CO₂ each year from the atmosphere than an older forest covering the same area.¹⁹

Juvenile pulpwood is an abundant material with immense untapped potential. By transforming these underutilised and low-value resources into premium hardwoods, Crafted Hardwoods is revolutionising sustainable timber production, bringing to the market a unique product that can be used for architecture and interior design.



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