



Planted forests and carbon

Trees, forests and using wood products are some of the best immediate responses to climate change.



Planting trees and forests is one of the best immediate responses to climate change. Sustainably grown trees capture carbon dioxide from the atmosphere to grow and the carbon is stored in the forest biomass. Wood products and buildings continue to store carbon for their lifetime.

Trees also provide energy alternatives that can substitute for fossil fuels. And timber and other wood products are low carbon-footprint materials compared with concrete and steel.

The carbon uptake by forests can also be used to offset emissions from other sources.

Society needs sustainable sources of energy and raw materials. Trees are a sound, sustainable option that we can put into service right now.



Storing carbon in forests

Planting trees in non-forested landscapes increases the carbon stock in that landscape. Trees absorb CO₂ from the air as they grow and use the carbon to form wood, foliage and roots, a new carbon reservoir. Planting initiatives such as the One Billion Tree Programme will help New Zealand meet our target of a 30% reduction in emissions from 2005 levels by 2030, under the 2015 Paris Agreement.

The rate at which CO_2 is absorbed from the atmosphere depends on the growth rate of the trees. Growth rates vary with temperature, rainfall and soil nutrients. Tree species such as radiata pine, coast redwood and eucalypts generally grow faster than native species, storing more carbon in a shorter time.



Rates of carbon sequestration by a range of exotic tree species planted in New Zealand.

The carbon storage potential for radiata pine across New Zealand is directly related to forest productivity. Scion research shows the highest productivity and carbon storage potential in the North island and lowest in the South Island.

With sustainable planted forest management, where harvesting is followed by replanting, the reservoir of stored carbon is maintained on average as carbon dioxide from the atmosphere is captured as the new trees grow.



Potential for Pinus radiata to store carbon across New Zealand.

Storing carbon in wood products

When the trees are cut down the wood can be used in buildings or other products, which will continue to store carbon. Worldwide, some timber buildings have been standing and storing carbon for more than 1000 years.

At its end of life, the wood can be recycled or used for energy production.



Scion Innovation Hub under construction, 2019.

Low carbon footprint building materials

Wood is the only construction material that absorbs CO_2 from the atmosphere. Other materials are net emitters. One tonne of wood absorbs 1.7 tonnes of CO_2 , In contrast, per tonne, concrete emits 159 kg, steel 1.24 tonnes, and aluminium 9.3 tonnes of CO_2 into the atmosphere.

There is increasing interest in modern engineered timber construction using laminated veneer lumber, cross laminated timber and Glulam to reduce emissions. For example, New Zealand district councils, such as Rotorua Lakes and Gisborne, have a wood preference policy to increase use of timber in construction.

Worldwide, Japanese timber company Sumitomo Forestry plans to build a 350-metre, 90% wooden skyscraper in Tokyo. In Canada, an 18-story mass timber residence hall has been built at the University of British Columbia in Vancouver.



Plastics

Sustainably grown wood is increasingly being combined with plastics made from fossil fuels or plant sources to form biocomposite materials. The addition of wood can increase material properties like strength and elasticity. In many cases, products made from wood plastic composites are lighter in weight. Used as components in vehicles, the lighter overall weight components reduce fuel consumption for example. Wood plastic composites can also be recycled repeatedly storing carbon for longer and be burnt for energy at end of life.

Substituting for fossil fuels

Wood is used as a solid fuel and can be converted into liquid fuels such as renewable diesel and bioethanol. The New Zealand Biofuels Roadmap has explored the potential for a plant based liquid biofuel industry to significantly reduce fossil-based fuels for transport. Under one scenario, 523,000 hectares of forest could produce biofuels to replace 30% of New Zealand's liquid transport fuel requirements and reduce fossil fuel emissions by five million tonnes per year.

Forestry sector greenhouse gas emissions

Forestry is a net benefit to New Zealand's emissions profile. The industry does emit some CO_2 (0.51 Mt CO_2 -e), mainly from harvesting, transport and processing, which is less than 1% of New Zealand's total annual emissions. Forestry also has very low emissions of nitrous oxide and methane compared with other primary sector land uses.

New Zealand wood processors are around 90% self-sufficient for their energy use. They use biomass residues, such as sawdust, bark, shavings and forest residues for heat generation in their mills and other plants. Some of the larger mills have combined heat and power plants and produce some, or all, of their electricity as well. This makes the wood processing industry the largest user of solid biofuels for energy generation in New Zealand. The production of 56.6 petajoules per year of energy (equal to about 60% of the energy generated by hydropower) reduces potential fossil fuel emissions by up to 5.6 million tonnes per year.

Offsetting agricultural emissions

Carbon uptake by forests planted in New Zealand since 1989 has offset about 30% of New Zealand's total emissions between 2008 and 2017. The Billion Trees Programme is calculated to contribute around 20% of the net emissions reductions needed for New Zealand to reach its Paris target by 2030. Agriculture contributes around half of New Zealand's greenhouse gas emissions mainly from sheep and cattle, which emit methane as they digest. While efforts are underway to reduce these emissions through feed- and animal-based solutions, new, effective solutions are not widely available.

The most effective means of reducing a farm's net emissions in the meantime is to plant trees to capture and store carbon to offset livestock emissions. Trees will only grow and sequester carbon until they are fully grown and reach a steady state. After this, further trees must be planted on new land to continue the offsetting.

Key links and references

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About Scion

Scion is the Crown research institute that specialises in research, science and technology development for forestry, wood and wood-derived materials, and other bio-material sectors.

Scion's purpose is to create economic value across the entire forestry value chain, and contribute to beneficial environmental and social outcomes for New Zealand.

