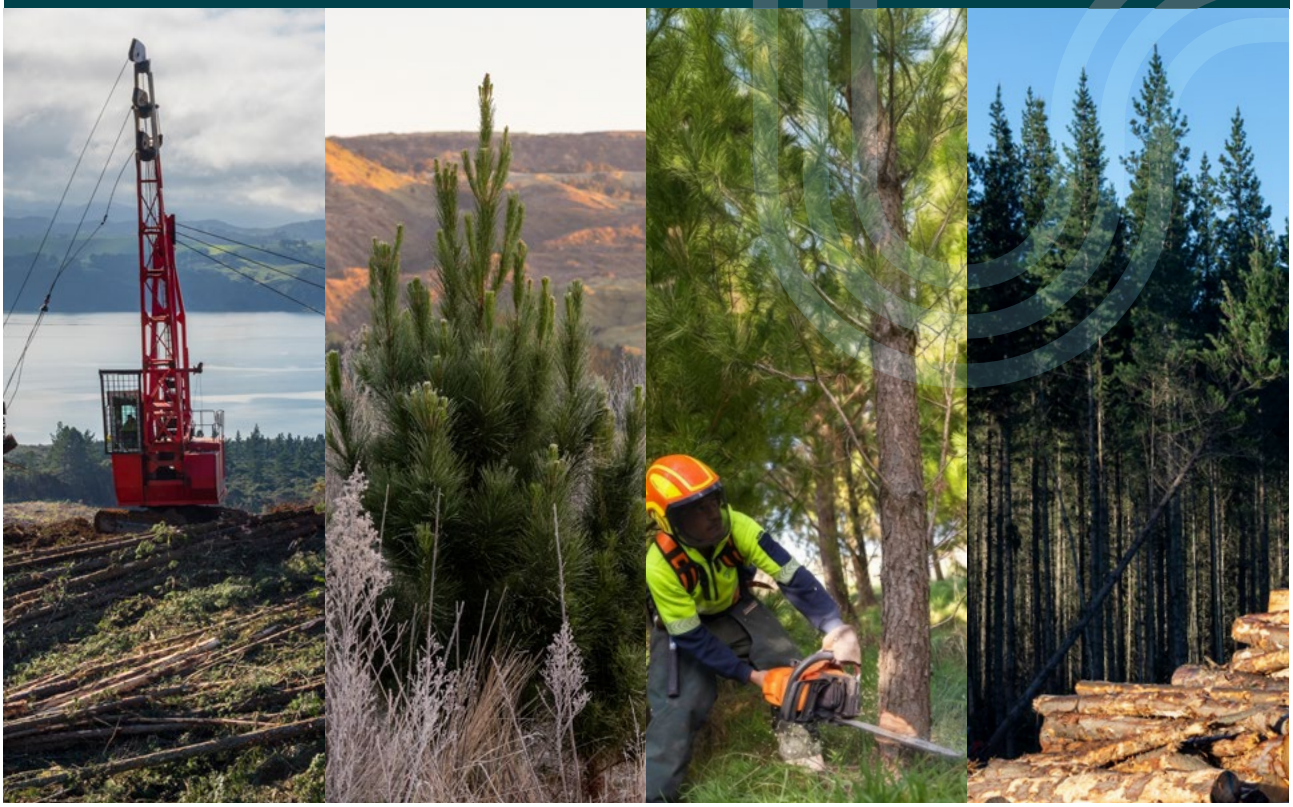
Bioeconomy Science Institute™
Maiangi Taiao

Carbon debt from harvest of woody biomass

How it affects bioenergy from New Zealand's plantation forests



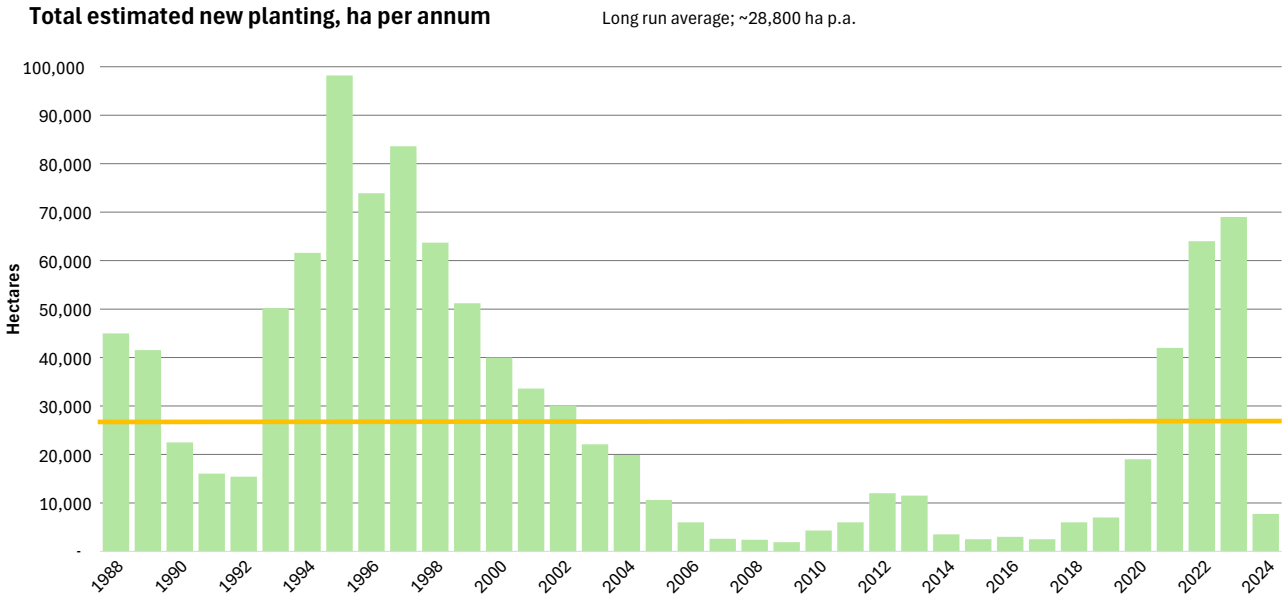
The sustainability credentials of all forms of energy come under scrutiny at some stage. This includes the use of woody biomass for providing heat, electricity and liquid fuels. In the last few years there has been some commentary, mostly coming from Europe, claiming that woody biomass derived from forests takes many decades to pay back the carbon debt (the CO2-e released) when the wood or its derivatives are combusted. This view depends entirely on the assumptions used in the calculations and in many cases these are not applicable to New Zealand's situation.

A critical point is that we are not harvesting native forest – we are harvesting from plantations forests that were planted with the intention of cutting them down in the future. A further point is that these forests grow quickly and are ready for harvest in 28 years or less. Thus, the carbon debt would only be 28 years maximum.

However, even this value is much too high, as it treats each stand as a separate entity with its harvest and re-establishment being in isolation from all the other forests around it. The forest industry does not and cannot work like that. Wood processors need a steady supply of logs over many years, which means having stands of many different ages all growing at the same time, with only some (1/28th) of the area being harvested each year, with the rest remaining to grow, absorb carbon, and provide the logs and or biomass supply in future years. You have to have a period of up to 28 years of growing and planting new areas before the harvest of the mature trees begins. In New Zealand this occurred in the 1920s and 30s.

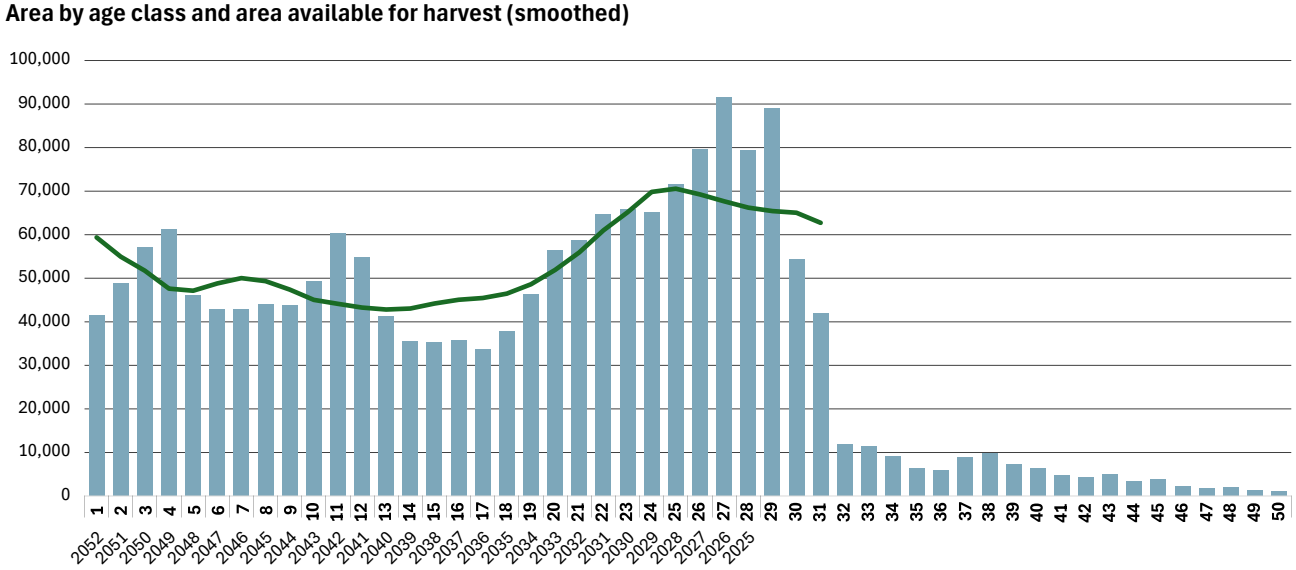
New Zealand's forest estate is a mixture of age classes, with trees that were planted in 1996 now being ready for harvest. Since 1996 we have continued to plant new area of forests at varying rates.

This forest estate provides an ongoing supply of logs, with the volume available over time fluctuating slightly, but less than the new planting graph might suggest as not only is there new planting but replanting of the area harvested each year.



A planting boom in the 1990s is providing an abundant supply of logs

Holmgren P. (2021) The forst carbon debt illusion. Swedish Forest Industries Federation. www.forestindustries.se



Despite the boom in new planting the age class distribution of the plantings from earlier decades means we have a steady supply of area of harvestable age.

Continued new plantings means an expanding area of forest and volume of standing timber increases.

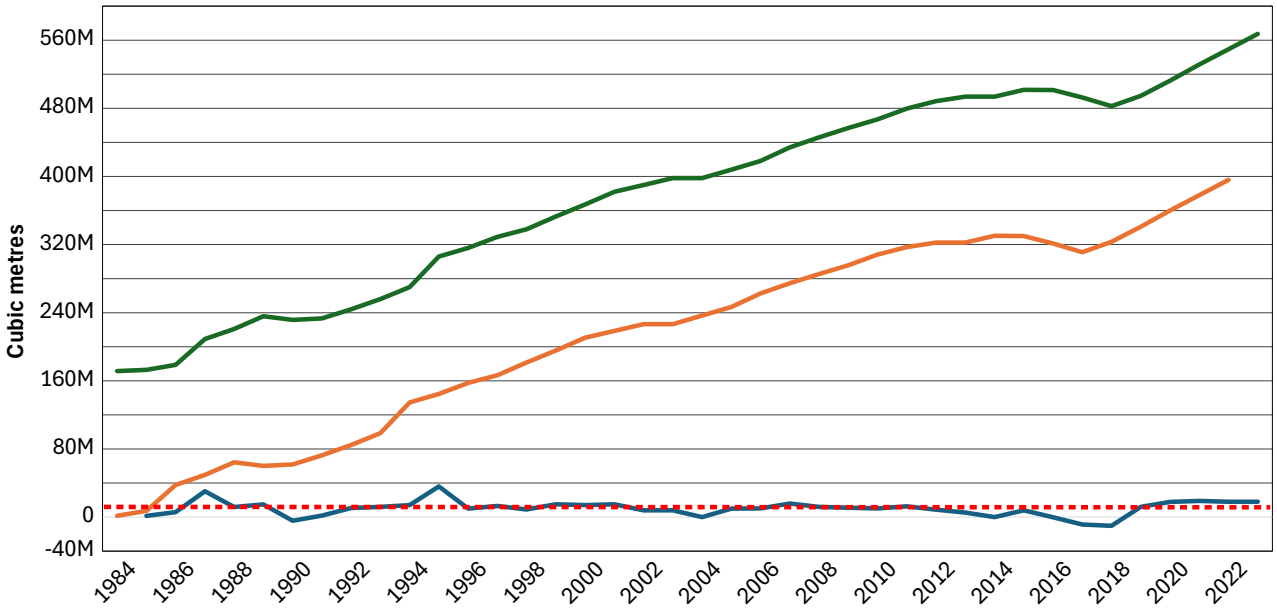
The area that is likely to be available for harvest in any given year, and therefore the volume of wood available, can be predicted based on the forest area and growth rates.

Being able to predict the volume of wood that is likely to be available for harvest allows us to manage our harvest to achieve a crucial goal if we wish to avoid incurring a carbon debt from harvesting our forests – that is: do not harvest more than you have grown.

The history of our plantation forests to date (with data from 1984 to 2023 (MPI)) shows that we have very consistently cut less than we are growing. As the Total Standing Volume (TSV) of wood in our plantation forests has increased year on year, including accounting for the amount harvested.

Based on the gain in TSV we can state that our forests have been and are a net carbon sink and that we do not have any carbon debt even if we assume that all the carbon stored in them is emitted on the day of harvest.

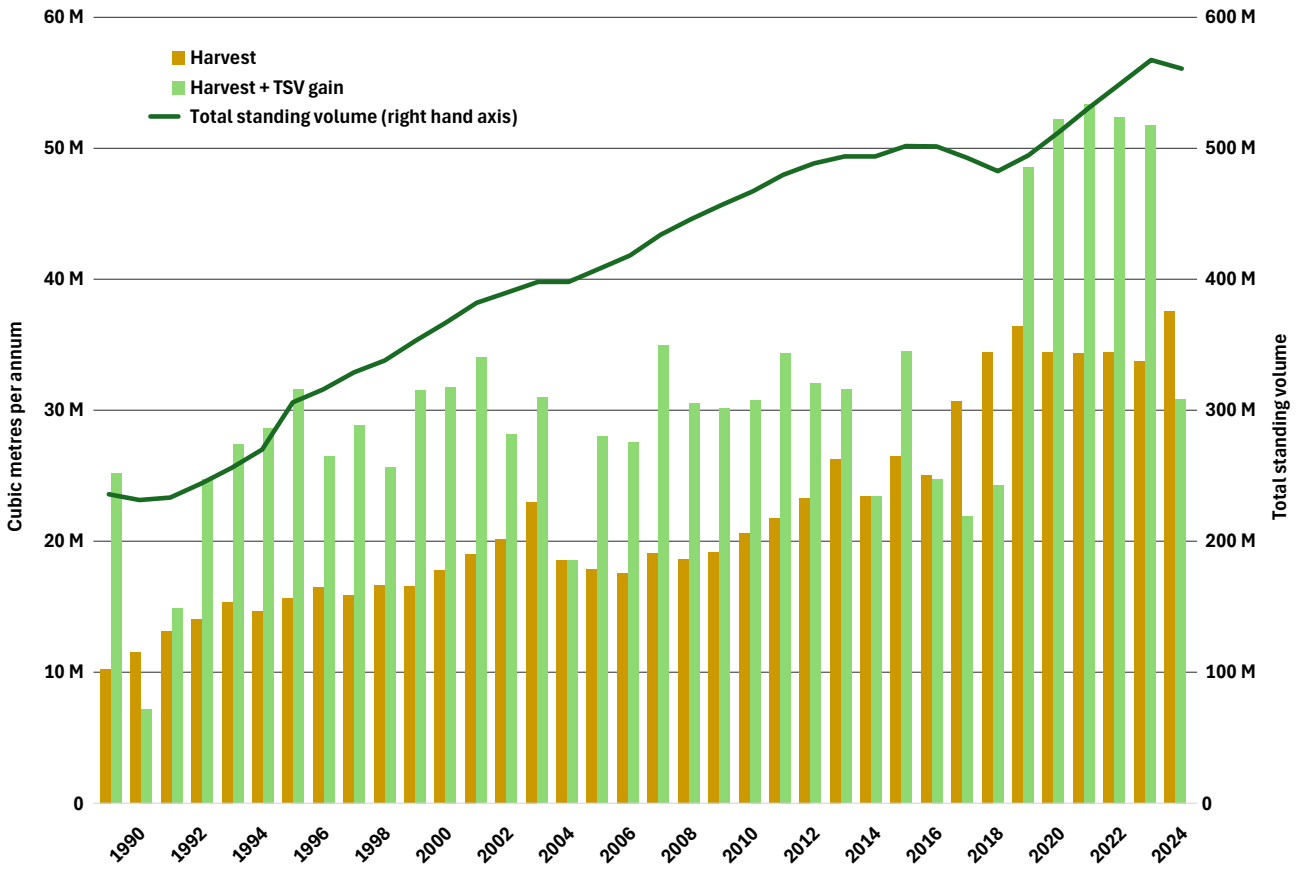
TSV gain and Cummulative TSV in NZ plantation forests 1984 to 2023 (38 years)



In the last 38 years there have been ;

- 2 years where there was no gain in TSV
- 3 years with small drops, & 33 years with gains
- TSV gains have averaged 10.1M m³ per annum over the total 38 years

Annual Harvest & Annual Total Standing Volume increase



We have an accumulation of carbon due to absorption of carbon by the other trees that are still standing and growing.

Avoiding future carbon debt associated with forest harvest is also possible. Whilst we do have a limit on the amount of land available to continue planting trees that is not a limit on our ability to claim that we do not have a carbon debt. Key points are that;

- as long as we do not harvest more than we grow we will not incur any carbon debt.
- If we use some of the harvest to displace fossil fuels (such as coal) we would have a carbon credit. Using 25% of the harvest volume (residues and low-grade logs) could displace at least 150 tonnes of carbon emissions per hectare of forest harvest if the wood is used as fuel displacing coal.

Further, there is still plenty of suitable land available to plant forests (at least 1.0M ha)

Acknowledgements

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HĪKINA WHAKATUTUKI

References

The data in this article was derived from National Exotic Forest Descriptions published by Te Uru Rakau New Zealand Forest Service and its predecessor organisations annually since 1984. Sources are the Te Uru Rakau website and the National Forestry Library.

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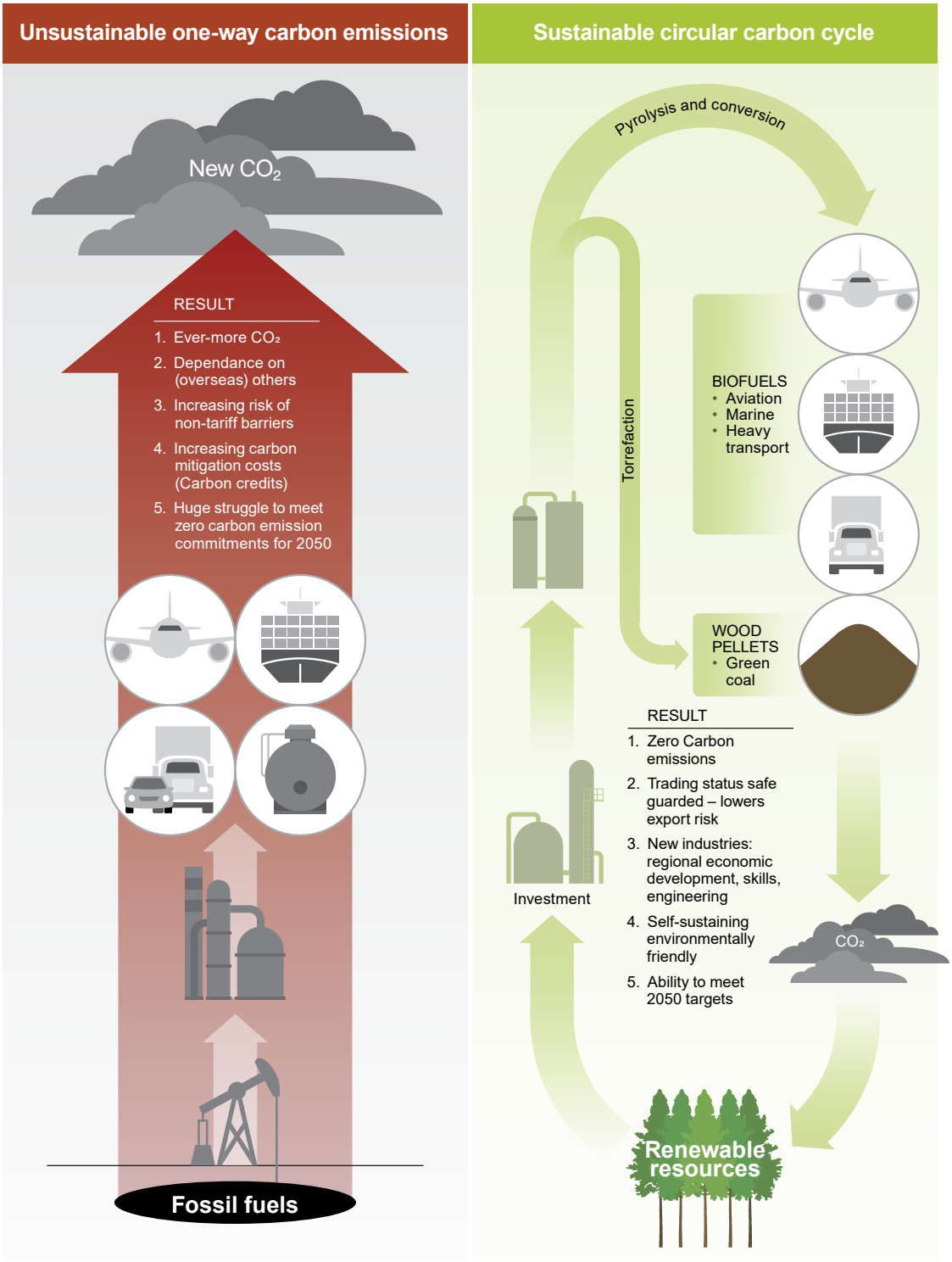

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