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Pathways Call for Evidence Submission

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Submission to the NSW Net Zero Commission Call for Evidence - Decarbonisation Pathways

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The University of Melbourne's AFWI-funded Centre for Climate Smart Forestry (CCSF) welcomes the opportunity to provide input to the NSW Government's Net Zero Plan.

The CCSF is a consortium of nine academic, governmental, and non-governmental institutions dedicated to enabling research to transform Australia's forest and wood products sector. Forests produce a broad range of goods and services that society depends on. Climate change is threatening the ability of Australian forests to generate those values. A core focus of the research supported and undertaken by the CCSF is the critical role that forests play in achieving Net Zero and in meeting 50% emission reduction by 2030 targets, and 70% by 2035. The Centre provides expertise on practical strategies for managing forests for long-term carbon sequestration, improved uptake of wood and biomass products, and building capacity for, and encouraging investment in, bio-based industries such as biofuels, biochar, and high-value timber products.

In this submission we emphasise several specific themes on which the CCSF has particular depth of knowledge and expertise. These include **uncertainty in carbon and GHG accounting practises**, the need for **product-level accounting** including Life Cycle Assessments, the **economic feasibility of existing strategies**, and **scoping issues with forest sector decarbonisation strategies**, all of which currently limit our ability to understand the role of forests in reaching emission reduction targets for 2030 and 2035.

In NSW the forests are doing the heavy lifting in respect to decarbonisation of the State, with the total land sector contributing significantly to reducing NSW's emissions and storing carbon from 2005 to the present.

NSW land sector emissions have steadily decreased since 2005 due to a simultaneous reduction in gross annual emissions through reduced deforestation and a steady increase in stored carbon through reforestation, afforestation, and increasing soil carbon stocks (NZC 2024:34[1]). Estimated emissions from deforestation have decreased by 78%, while net carbon storage has increased by 11%.

The annual CO2 emissions due to forest converted is estimated to have declined by 65%, from 12.2 Mt CO_2-e yr^{-1} in 2005 to 5.4 Mt CO_2-e yr^{-1} in 2022. Positively, the total annual area of sustained forest regrowth is estimated to have increased by 76%,

[1] Net Zero Commission. (2024). *2024 annual report: Report to the Minister for Climate Change, Energy and the Environment and the NSW Parliament*. New South Wales Government. nsw.gov.au

resulting in a 65% increase in total carbon stored from -3.0 Mt CO_2-e yr^{-1} to -6.8 Mt CO_2-e yr^{-1} (NZC 2024:34). In 2022, the land sector's net emissions totalled -20.6 Mt CO_2-e yr^{-1}, a 240 per cent decrease from 1990 (NZC 2024:37). Figure 1 illustrates the historical total land sector emissions.

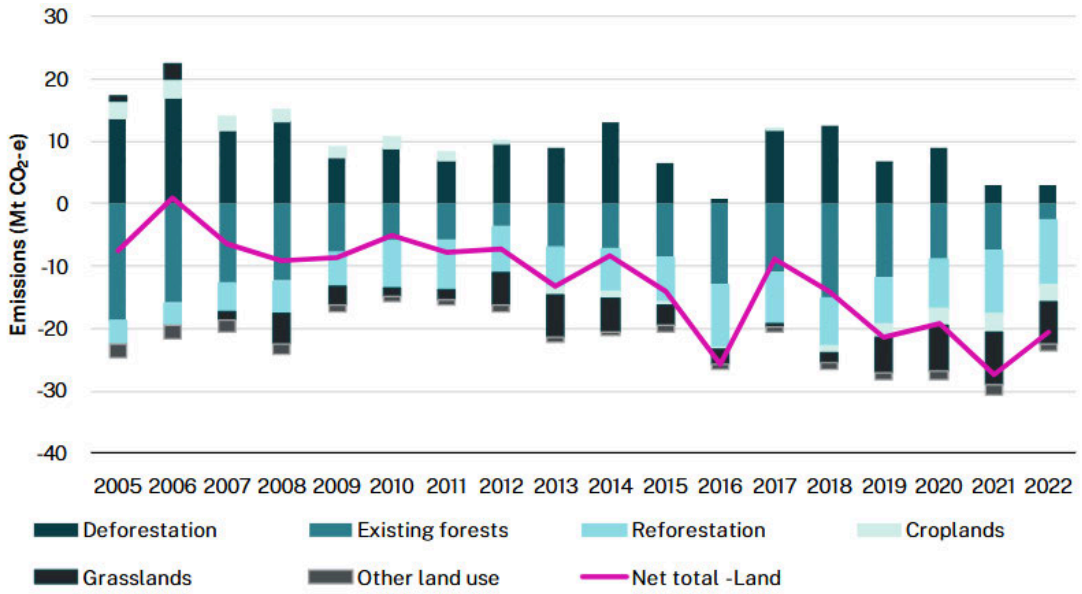

Figure 1: Historical total land sector emissions and carbon storage in carbon flux per year, by subsector category, 2005-22 (NZC 2024:34)

These data show the large contribution that the land sector is already having in reducing NSW state greenhouse gas emissions. Much of our submission's analyses are based on emissions and carbon sequestration data from the 2024 NSW Government Net Zero Commission, which is the most up to date data on land sector emissions and underpins the sectoral structure that this consultation is framed under.

The CCSF supports the statement made in the 2024 Net Zero Commission around uncertainty of estimates, and recalculations of these estimates due to advances in estimation methods.

"However, these reported emissions reductions and their potential to continue over time is subject to significant uncertainty. This is partly because advances in estimation

methods have frequently produced major recalculations of historical emissions in recent years, complicating predictions about future changes in land sector emissions. Further, the scale and degree of permanence of the land sector's contribution will continue to be subject to uncertainty, including in light of an evolving understanding of the impact of climate change on the land sector." (NZC, 2024)

The Centre recognises the government's uncertainty in estimations, and encourages subsequent modelling and reporting to embrace changing estimation methods which improve our understanding of land sector emissions. The following suggestions have been made on the topic:

1. In regard to estimation methods, we note the soil carbon estimates that contribute towards the inventory reporting have undergone significant changes between CSIRO and DCCEEW over recent years, which suggest that the increases stated in the 2024 NSW Government Net Zero Commission may be incorrect. Here, it is worth noting that relying on soil carbon estimates to underpin land sector emission reduction strategies is difficult now and will continue to be without better soil carbon emissions data.
2. Subsequent modelling should seek to integrate the CO2 fertilisation effect on vegetation growth to 2050 and beyond, as well as the impacts of climate change on photosynthesis, heat stress, precipitation, temperature and vapour pressure deficit (VPD), and their extremes. The CO2 fertilisation effect has been modelled for Australian vegetation[2] and has been validated across multiple Free-Air CO_2 Enrichment (FACE) initiatives in Victoria (for agriculture) and NSW[3]. This research suggests that the role of CO2 fertilisation has mitigated the effect of aridity across Australia's woody ecosystems. Accounting for this across managed and unmanaged forests should be carefully structured to recognise the role this anthropogenically-induced effect has on carbon sequestration.

[2] Rifai, S, De Kauwe, M, Ukkola, A, Cernusak, L, Meir, P, Medlyn, B, & Pitman, A. (2022) *Thirty-eight years of CO2 fertilization has outpaced growing aridity to drive greening of Australian woody ecosystems.* Biogeosciences, 19 (2). pp. 491-515.
[3] https://eucface.hieresearch.org/
https://piccc.org.au/research/AGFACE.html

3. UNFCCC inventory reporting fails to account for “unmanaged land”. There is significant evidence to suggest that unmanaged land in NSW’s national parks is not being managed and is in decline.

Ensuring the permanence of carbon stocks requires a consolidated policy approach to land management and carbon accounting. By neglecting the role of bio-based products such as timber, green fuels and biochar, carbon that is stored in vegetation, and that ends up decarbonising other areas of the NSW economy (such as transport and the built environment), is not fully recognised. Managing this resource, and appropriately quantifying its role in decarbonisation, at a local, national and global level is paramount to measuring permanence and managing carbon stocks across all areas measured in the Net Zero Commission’s 2024 Annual Report (such as deforestation, existing forests, soil carbon, grasslands and forests). To do this accurately, a process-based product level account of carbon flows and accounts is required to map and track carbon as it enters and leaves subsectors, and as it is exported outside of state and national accounts, as high-value exports. Subsequent import substitutions such as processed wood products from China and low-carbon liquid fuels (LCLFs) from Southeast Asian forests reduce Australia and the rest of the world's opportunity to decarbonise and to manage our own forests and biomass resources for decarbonisation purposes[4]. How this interacts and overlaps with existing UNFCCC inventory reporting needs to be carefully thought through.

Leakage

[4] Venn, Huang & Lacchwani, (2026) An analysis of Australia’s solid wood timber production and imports . Report commissioned by the North East NSW Forestry Hub. Accessed at: https://nenswforestryhub.com.au/news-reports/reports/report/20-an-analysis-of-australias-solid-wood-timber-production-and-imports
Longbottom, J., Miller, J., Toomey, J., 2026. Victoria ended native forest logging. So where are these trees coming from? 22 June. ABC News, Available at URL: https://www.abc.net.au/news/2026-06-22/victoria-native-forest-logging-ban-enabling-tasmania-industry/106790366. Accessed 23 June 2026
Carron, L.T., 1985. A History of Forestry in Australia. Australian National University Press, Canberra.
Raison, J., Nambiar, S., 2024. Australia should source wood from both plantations and native forests. Australian Forestry 87, 149-150.

To maintain carbon accounting and market integrity, and prevent perverse climate outcomes, the NSW net zero pathways must explicitly accommodate *indirect* (or *market*) carbon leakage to ensure atmospheric integrity of NSW abatement claims. In Australia's open market economy, leakage occurs when policy interventions reduce domestic supply without reducing demand. For example, a 2026 ABC television *Four Corners* episode highlighted timber harvest leakage to Tasmania's native forests caused by Victoria's 2024 shut down of native forest harvesting (Longbottom et al., 2026). In the first econometric analysis of timber harvest leakage in Australia using historic production and trade data (1996 to 2023), Venn et al. (2026) found 80% of reduced domestic native forest hardwood production leaked into imports, particularly to the classifications Builders' Carpentry (e.g., merbau, kwila, meranti and balau decking, flooring, mouldings, joinery and doors), Wood Furniture (e.g., meranti dining suites, and kitchen and bathroom cabinetry), and Engineered Wood Products (EWPs; particularly plywood, which is predominantly hardwood and accounted for 65% of Australia's imported EWPs).

Leakage evaluations should not naively assume Australia's existing plantation softwoods and hardwoods have the spare production capacity and wood properties to facilitate direct substitution for native forest hardwoods. As intended by policymakers (Carron, 1985) and described by industry experts (Raison and Nambiar, 2024; ABARES, 2025b, 2025a; Forestry Australia, 2025)[5], the econometric analysis by Venn et al. (2026) also revealed that Australia's plantation estate produces timber products that are consumed together with domestic native forest and imported hardwoods, rather than acting as a substitute for them (e.g. softwood plantation 'stick' framing of houses and native forest hardwood flooring).

Furthermore, Venn et al. (2026) found that 87% of Australia's international timber harvest leakage over the last 30 years was to countries with elevated risk of illegal logging and trade. Embodied carbon in products from these countries is often much

[5] ABARES, 2025a. Australia's native forests and wood production. ABARES Insights, ABARES, Canberra. Available at URL: https://daff.ent.sirsidynix.net.au/client/en_AU/search/asset/1036960/0/NativeForestsWoodProduction_v1.0.0.pdf. Accessed 12/12/2025.
ABARES, 2025b. Australian wood volumes analysis. ABARES Research Report No. 25.02, ABARES, Canberra. Available at URL: https://daff.ent.sirsidynix.net.au/client/en_AU/search/asset/1036861/0/AusWoodVolumesAnalysis_v1.0.0.pdf. Accessed 18 March 2026.
Forestry Australia, 2025. Plantations for Australia's timber supply. Forestry Australia, Available at URL: https://www.forestry.org.au/wp-content/uploads/2025/08/05-Plantations-for-Australlias-Timber-Supply-July-2025.pdf. Accessed 19 March 2026.

higher than for the same products produced from sustainably managed forests, including Australia's native forest estate (Putz, 2011; Edwards et al., 2014; Brandt et al., 2016; Pearson et al., 2017; Jati et al., 2018; Pendrill et al., 2019a; Pendrill et al., 2019b; Juniyanti et al., 2021; Aryapratama and Pauliuk, 2022)[6].

We recommend that the Commission mandate consumption-based carbon accounting and leakage impact assessments, including tracking displaced demand to timber imports and carbon-intensive structural substitute materials such as steel, concrete, plastic, brick and carpet.

Green Fuel development

NSW has been identified as an existing base for feedstocks and as a hotspot for biofuel feedstock development. These opportunities have been outlined in various feedstock and green fuel reports[7]. The NSW Government has recognised this importance by implementing a biofuel mandate of 2% of diesel-biodiesel volume sales and a 6% petrol-ethanol blend. This is an important first step in creating a demand signal for

[6] Aryapratama, R., Pauliuk, S., 2022. Life cycle carbon emissions of different land conversion and woody biomass utilization scenarios in Indonesia. Sci Total Environ 805, 150226.
Brandt, J.S., Nolte, C., Agrawal, A., 2016. Deforestation and timber production in Congo after implementation of sustainable forest management policy. Land Use Policy 56, 15-22.
Carron, L.T., 1985. A History of Forestry in Australia. Australian National University Press, Canberra.
Edwards, D.P., Tobias, J.A., Sheil, D., Maijaard, E., Laurance, W.F., 2014. Maintaining ecosystem function and services in logged tropical forests. Trends in Ecology and Evolution 29, 511-520.
Jati, A.S., Samejima, H., Fujiki, S., Kurniawan, Y., Aoyagi, R., Kitayama, K., 2018. Effects of logging on wildlife communities in certified tropical rainforests in East Kalimantan, Indonesia. Forest Ecology and Management 427, 124-134.
Juniyanti, L., Purnomo, H., Kartodihardjo, H., Prasetyo, L.B., 2021. Understanding the Driving Forces and Actors of Land Change Due to Forestry and Agricultural Practices in Sumatra and Kalimantan: A Systematic Review. Land 10.
Pearson, T.R.H., Brown, S., Murray, L., Sidman, G., 2017. Greenhouse gas emissions from tropical forest degradation: an underestimated source. Carbon Balance Manag 12, 3.
Pendrill, F., Persson, U.M., Godar, J., Kastner, T., 2019a. Deforestation displaced: trade in forest-risk commodities and the prospects for a global forest transition. Environmental Research Letters 14.
Pendrill, F., Persson, U.M., Godar, J., Kastner, T., Moran, D., Schmidt, S., Wood, R., 2019b. Agricultural and forestry trade drives large share of tropical deforestation emissions. Global Environmental Change 56, 1-10.
Putz, F.E., 2011. Biodiversity Conservation in Tropical Forests Managed for Timber, in: Günter, S., Weber, M., Stimm, B., Mosandl, R. (Eds.), Silviculture in the Tropics. Springer Berlin Heidelberg, Berlin, Heidelberg, pp. 91-101.

[7] Clean Energy Finance Corporation, & Deloitte. (2025). *Refined ambitions: Exploring Australia's low carbon liquid fuel potential*. https://www.cefc.com.au/media/jh3gvm14/refined-ambitions-exploring-australia-s-low-carbon-liquid-fuel-potential.pdf
Commonwealth Scientific and Industrial Research Organisation. (2023). *Sustainable Aviation Fuel Roadmap*. CSIRO
GrainCorp. (2026, July). *From paddock to plane: Sustainable aviation fuel (SAF) feedstock white paper*. https://energy.graincorp.com.au/wp-content/uploads/2026/07/From-Paddock-to-Plane-SAF-Feedstock-White-Paper.pdf

industry. However, without enforcement the mandate for renewable fuels in NSW will fail to recognise - and benefit from - the role of green fuels in decarbonising road transport, and the aviation sector. The recent announcement of LCLFs as part of the Renewable Fuel Scheme is an encouraging sign. These announcements drive demand, and provide investment security to renewable fuel developers seeking to base their production in NSW. NSW is naturally well-endowed with forests and has a strong plantation forestry sector, which has a large capacity to make use of forestry fibre not currently used for timber production and other uses for LCLFs. The potential contribution to Gross State Product (GSP) of this low carbon liquid fuel is large.

More needs to be done for the forestry sector to understand the opportunity forestry fibre represents to this growing and important fuel security need. The CEFC Deloitte report has estimated that the LCLF opportunity out to 2050 is greater than $36 billion in today's dollars. This only represents the existing feedstocks. It does not include expanded feedstock opportunities in NSW's rangelands areas, which are potentially large[8].

Estimates of lignocellulosic feedstocks from the forestry sector in NSW are expected to be underestimated. The Australian Biomass for Bioenergy Assessment (ABBA) and subsequent NSW Biosmart tool concluded that there are ~1.66 million tonnes yr^{-1} available from NSW forests (private and public)[9]. The development of the NSW Biosmart tool aims to account for all residues, including those in the native forest and plantation estate, properly account for changing management practices, and account for the availability of residues and other fibre or low-grade logs that are not currently primary products of forestry and are being undervalued. This supply data informs investors and highlights areas for development of green fuels within NSW. The work of NSW DPIRD on Woody Biomass Crop Trials[10] helps to outline long term, sustainable biomass feedstocks that can expand the existing base of forestry fibre for LCLF development.

Management of NSW forests under a changing climate

[8] Commonwealth Scientific and Industrial Research Organisation. (2024). *Opportunities and priorities for a low-carbon liquid fuel industry in Australia: A technoeconomic assessment*. CSIRO.
[9] https://www.dpird.nsw.gov.au/forestry/science/forest-carbon/abba
[10] https://www.dpird.nsw.gov.au/forestry/science/forest-carbon/biomass-for-bioenergy/biomass-crops

As NSW forests are impacted by a warming and drying climate and more frequent high-intensity fires, they provide both an opportunity and a risk to net zero emissions. They are NSW's largest terrestrial carbon stock (aboveground). Decades of intensive management and recent extreme fire events such as the 2019-20 Black Summer fires have produced large areas that are dominated by dense, young regrowth forest. These forests are particularly vulnerable to future mortality from drought and fire and their slow growth prolongs their exposure to that risk. Active management of the forests through thinning can increase tree-, stand-, and landscape-scale resilience and mitigate potential losses of carbon to mortality. By reducing tree density in overcrowded stands, the retained trees have more space and resources to grow. This increases their vigour, accelerates their growth, and reduces the length of time they are exposed to mortality risk (as bigger trees are more resilient to drought- and fire-induced mortality). Even small reductions in the risk profile of these forests have the potential to reduce carbon emissions directly attributable to climate-related disturbances by large amounts. The Black Summer fires generated 76 Million tonnes of unanticipated CO2 emissions[11]. If active forest management could reduce those losses by 10% it would be a significant contribution to State-level emissions accounts. Continuing to write off major wildfire emissions as purely non-anthropogenic is increasingly difficult to justify from an accounting integrity standpoint, particularly as active forest management clearly demonstrates the capacity to reduce fire severity and carbon losses. Importantly, thinning to improve the resilience of forests typically removes smaller trees that have historically had little commercial value. Advances in the development of SAF, LCLFs, biochar, and engineered wood products (EWPs) have the potential to create a demand signal for this wood that has long been absent. This would be a significant win-win opportunity for NSW – improving the resilience of its forests to carbon losses by increasing the use of wood fibre in sustainable energy and the built environment.

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11 https://task45.ieabioenergy.com/wp-content/uploads/sites/13/2024/06/3.-IEA_Bio_Ximenes_UK_20244032 7.pdf

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We welcome the opportunity to consult further with the Net Zero Commission on these recommendations and forest-related decarbonisation opportunities for NSW.

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