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Logging or carbon credits

Comparing the financial returns from forest-based activities in NSW's Southern Forestry Region

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Executive Summary

Background

For several decades, the alternative commercial and economic uses and management of Australia's native forests have generated considerable debate. In the past five years, this debate has sharpened as the native forest sector has contracted in response to increased competition in international and domestic wood product markets. New carbon markets are also emerging that could enable the Australian government and native forest owners, including state governments, to earn carbon credits from altering management practices in native forests. In particular, reducing or stopping harvesting in Australia's native forests will now result in Forest Management (FM) credits being recorded in Australia's greenhouse accounts under the Kyoto Protocol. The preservation of native forests could also lead to the generation of Australian carbon credit units (ACCUs) under the Carbon Farming Initiative.

The native forest sector's decline and emergence of these carbon credit opportunities have raised questions about the financial returns of forest conservation versus commercial harvest. To explore this issue, we conducted a financial analysis of the Southern Forestry Region (SFR) of New South Wales comparing the net financial benefits (revenues minus expenses) from harvesting and processing native forest logs in the region to the net financial benefits that could be derived by using these forests to generate carbon credits (FM credits and ACCUs). Due to the absence of reliable data on non-market items — e.g. biodiversity and heritage values — the analysis was confined to financial flows and did not consider net economic benefits. In other words, it was a financial rather than economic analysis.

New South Wales' Southern Forestry Region (SFR) was employed in this comparative analysis because the structure of its native forest sector is broadly representative of that found in many other parts of Australia. In recent years, the SFR processed approximately 450,000 m^3 to 500,000 m^3 of broadleaved native logs per annum (predominantly Eucalyptus and Corymbia spp.). About 70 per cent of these were pulplogs, which were chipped at the region's major woodchip mill, South East Fibre Exports (SEFE) in Eden, before being exported to Japan to make paper products. Until late 2012, the SFR also supported four medium-sized native hardwood sawmills and a collection of smaller mills that processed approximately 100,000 m^3 of native sawlogs per annum.

Methods

Core scenarios

To compare the net financial benefits from harvesting the SFR's native forests with those produced by conserving the forests and generating carbon credits, two core scenarios were devised: Harvest Scenario 1 (H1) and Carbon Credit Scenario 1 (CC1). The H1 scenario assumed that harvesting and processing in the SFR remain at 2011-2012 levels over the period 2014-2033 (the 'projection period'). The net financial benefit was calculated on the basis of the projected revenues and expenses of the Forestry Corporation of NSW and the SFR's native forest hardwood processors.

The CC1 scenario assumed that all harvesting in the public native estate in the SFR ceases in 2014 and that these forests are used to generate carbon credits (FM credits and Kyoto ACCUs). The carbon credits were calculated by subtracting an estimate of net emissions in the absence of harvesting from an estimate of net emissions under a baseline scenario that included harvesting. Net emissions were estimated on the basis of projected changes in the above- and below-ground live biomass, debris (litter and deadwood) and harvested wood products (HWP) carbon pools using a replica of the Australian government's FM method (method 1). The net financial benefits under this scenario were calculated on the basis of the

projected revenues and expenses of the New South Wales government, which was assumed to be the proponent of the Carbon Farming Initiative project and beneficiary of the associated ACCUs.

Both scenarios included a projection of the net financial benefits received by the Australian government, which was calculated on the basis of the estimated company tax receipts from the native forest hardwood processors and the value of the residual FM credits generated in the scenario. These results are reported separately from the net financial benefits generated by the New South Wales government, Forestry Corporation of NSW and the SFR hardwood processors.

Sensitivity analysis scenarios

Sensitivity analysis scenarios were devised to address four major uncertainties associated with the analysis: baselines, carbon credit methods, carbon prices and discount rates.

To account for uncertainties concerning the future output of the sector and the baseline that should be used to calculate the ACCUs under the Carbon Farming Initiative, a second harvest scenario was devised (Harvest Scenario 2, H2). The H2 scenario's projection of net financial benefits is based on two key assumptions — that woodchip production is one-third lower than the levels assumed in the H1 scenario and that Boral Ltd's Batemans Bay mill, which was closed in late 2012, does not reopen. A matching carbon credit scenario (CC2) was also devised, under which all harvesting in the SFR ceases in 2014 and scenario H2's log removals provide the baseline for the calculation of the ACCUs.

To evaluate the consequences of the closure of the Eden woodchip mill, a third harvest scenario (Harvest Scenario 3, H3) was developed that assumes only sawlogs are harvested and processed in the SFR over the projection period, meaning that SEFE ceases its native woodchip operations and there are no pulplog removals. No corresponding carbon credit scenario was prepared in relation to the H3 scenario. This is because, if the woodchip mill closes, the industry in the SFR would contract substantially, or could even collapse entirely. In effect, scenario H3 is a worst-case scenario for the New South Wales government that illustrates what could happen if the native forest sector in the SFR collapses prior to the initiation of an offset project.

To account for uncertainties concerning methods, a second method (method 2) was developed and applied to estimate the Kyoto ACCUs under the CC1 and CC2 scenarios. The primary aim of method 2 was to adjust the Australian government's FM model to account for age class and silvicultural practice uncertainties associated with the native forests of the SFR.

Three carbon price paths and three discount rates were used to assess the robustness of the results from the harvest (H1, H2 and H3) and no-harvest (CC1 and CC2) scenarios to carbon price and discount rate uncertainties.

Major findings

The analysis in this paper suggests that, in the absence of a rebound in relevant wood product prices (especially the export woodchip price), continued harvesting in the SFR is likely to generate substantial aggregate net losses over the next 20 years. In the core harvest scenario (H1), the combined net financial benefits generated by the Forestry Corporation of NSW and the SFR's private hardwood processors over the period 2014-2033 were estimated at between -$40 million and -$77 million. These losses would be borne by the Forestry Corporation of NSW and SEFE; the sawmills are projected to produce a small positive net

financial benefit over the projection period. This is mainly because the Forestry Corporation of NSW and SEFE's operations subsidise SFR hardwood sawmilling.

Stopping harvesting and using the native forests of the SFR to generate carbon credits offers a viable alternative to commercial forestry. In the core no-harvest scenario (CC1, method 1), it was estimated that the New South Wales government could earn 33.8 million ACCUs over the period 2014-2033 (an average of 1.7 million per year). The net financial benefits that could be generated through the sale of these credits (accounting for transaction and management costs) were estimated at $222 million. The Australian government would also receive the benefit of 12.8 million residual FM credits from the cessation of harvesting in the SFR over the period 2014-2033. However, if the New South Wales government receives ACCUs, the financial benefits to the Australian government are likely to be relatively small as lost company tax revenues associated with ceasing harvesting would largely cancel out the financial benefits received from the residual FM credits.

Overall, the analysis supports two general conclusions:

- under current and likely future market conditions, the harvesting and processing of native logs in the SFR is likely to generate substantial losses; and
- the aggregate net financial benefits are likely to be significantly higher if commercial harvesting is stopped and the native forests of the SFR are used to generate carbon credits.

At least four main uncertainties are associated with these conclusions. First, conditions in relevant domestic and international wood product markets could improve, or new markets might emerge for biomass feedstocks, including wood energy and biofuels, reviving the fortunes of native forest operators in the SFR. This is possible, but the available evidence suggests it is unlikely.

Secondly, avoided public native forest harvesting projects are not currently eligible to participate in the CFI. Amendments to the relevant legislation and regulations are currently being considered by the Australian government. Until these changes are made, the New South Wales government will not be able to generate ACCUs by stopping harvesting in the SFR.

Thirdly, the international accounting rules for forest management are only set for the duration of the Kyoto Protocol's second commitment period, 2013 to 2020, and may not be the same under any post-2020 agreement that might emerge from the Durban Platform negotiations. It was assumed in the analysis that the second commitment period FM accounting rules remain unchanged over the entire projection period.

Fourthly, even if avoided public native forest harvesting projects are made eligible to participate in the CFI and the second commitment period accounting rules are carried over into the post-2020 agreement, there are uncertainties regarding what baseline should be used in the project, what method should be used to calculate the ACCUs, what price ACCUs will attract in relevant markets and what discount rate should be applied when evaluating the financial merits of the project. The analysis here suggests that the conclusions on the merits of using the forests to generate carbon credits are relatively robust to these sources of uncertainty.

The two most significant sources of uncertainty identified in the analysis are baselines and carbon prices. Given the precarious state of the sector, it could collapse before an offset project has been approved under the CFI. If this occurred, it is unlikely that any ACCUs could be generated by 'stopping harvesting' as harvesting would have already ceased. Even if the

sector does not collapse, it could continue to contract, which could potentially lead to lower baselines being set for any CFI project that is initiated. Lower baselines reduce the number of ACCUs that could be generated by stopping harvesting and protecting the forests. Low future carbon prices are the other major threat to the financial viability of a carbon credit project. A combination of low carbon prices and a low baseline could result in an avoided native forest harvesting project producing zero or even negative net financial benefits. Yet the analysis suggests that, even if these factors eventuate, using the forests to generate carbon credits will generate greater aggregate net benefits than harvesting.

Introduction

For several decades, there has been a divisive debate about the management of Australia's native forests and the native forest sector.[1] Conservationists have claimed that the sector is inherently unsustainable and that the harvesting of native forests has significant adverse environmental impacts, including loss of biodiversity, degradation of natural and cultural heritage values, and disruption of local and regional hydrologic cycles.[2] The social concerns surrounding native forestry have been heightened by the fact that the financial returns from the sector have traditionally been relatively limited and that it experiences regular downturns due to local and international market dynamics.[3] Federal and state governments have often provided assistance during these downturns, generating further debate about the long-term financial and economic value of the sector.

Two factors have emerged in the past five years that have intensified interest in the future of the native forest sector. Firstly, since 2008, the native forest sector has experienced a significant contraction. Native roundwood removals over the period 2009-2011 were almost 30 per cent below the average from the previous decade.[4] This decline has been most acute in the private native forest sector but production from public native forests has also fallen significantly in the five native forestry states (Tasmania, Victoria, NSW, Western Australia and Queensland).[5]

The second factor that has increased interest in the sector is the prospect that the Australian government and native forest owners, including state governments, could earn carbon credits from altering management practices in native forests. Several different types of carbon credits could be generated by reducing or stopping harvesting in Australia's native forests, the two most relevant being forest management (FM) credits and Australian carbon credit units (ACCUs). FM credits are the credits that will be recorded in Australia's international greenhouse compliance accounts in the post-2012 era as a result of changes in net emissions from forest management lands.[6] Reductions in native forest harvesting reduce net forest management emissions, thereby 'automatically' leading to the recording of FM credits in Australia's accounts.[7] Conversely, increases in harvesting increase net forest management emissions and lead to the creation of FM debits.

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[1] Ajani, J (2007). *The Forest Wars*.

[2] Ajani (2007)

[3] Marsden Jacob Associates (2001). *Forestry and National Competition Policy*; URS (2007). *Australia's forest industry in the year 2020*; Ajani (2007); New South Wales Auditor-General (2009). *Sustaining Native Forest Operations: Forests NSW*; URS (2010). *VicForests Review 2010*; Tasmanian Auditor-General (2011). *Financial and economic performance of Forestry Tasmania*; Macintosh, A (2013). *The Australian native forest sector: causes of the decline and prospects for the future*.

[4] Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) (2012). *Australian Forest and Wood Products Statistics*.

[5] Macintosh (2013). *The Australian native forest sector*.

[6] United Nations Framework Convention on Climate Change (UNFCCC) Secretariat (2012). *Report of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol on its seventh session, held in Durban from 28 November to 11 December 2011. Decision 2/CMP.7*; UNFCCC Secretariat (2013). *Report of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol on its eight session, held in Doha from 26 November to 8 December 2012. Decision 2/CMP 8.*

[7] FM accounting is done on a national basis. Therefore, whether Australia records net FM credits or debits will depend on FM practices on all FM lands. For simplicity, it is assumed here that actions taken to reduce harvesting lead to the creation of FM credits. In reality, they could either lead to the recording of FM credits or avoidance of FM debits. Although the accounting entry may be different, the financial implications of these credits or avoided debits will be the same.

ACCUs are offset credits issued under the Australian government's *Carbon Credits (Carbon Farming Initiative) Act 2011* (CFI Act).[8] At present, projects involving the cessation or reduction of harvesting in public native forests are not eligible to participate in the Carbon Farming Initiative (CFI). However, amendments are expected to be made in the near future to the CFI Act and regulations to make such projects eligible. If this occurs, the owners of public native forests who hold the requisite carbon sequestration rights could generate ACCUs by altering management practices. These ACCUs could then be sold into compliance or voluntary markets.

To assist in the deliberations on the future of the native forest sector, this paper presents the results from a financial analysis on the Southern Forestry Region (SFR) of New South Wales in which the net financial benefits from harvesting and processing native forest logs in the region were compared to the net financial benefits that could be derived by using these forests to generate carbon credits (FM credits and ACCUs). Due to the absence of reliable data on non-market items – for example, biodiversity and heritage values – the analysis was confined to financial flows and did not consider net economic benefits. The region is ideal for this comparative analysis because the structure of its native forest sector is broadly representative of that found in many other regions in Australia. In recent years, the region has processed approximately 900,000 m^3 to 1,000,000 m^3 of broadleaved native logs per annum (predominantly Eucalyptus and Corymbia spp.) from New South Wales' Southern Forest Region (SFR) and East Gippsland in Victoria. Approximately 70 per cent of these are pulplogs, which are chipped at the South East Fibre Exports (SEFE) woodchip mill in Eden, before being exported to Japan to make printing and writing paper. Until late 2012, the region also supported four medium-sized native hardwood sawmills and a collection of smaller mills that processed approximately 100,000 m^3 of native sawlogs per annum.

The paper is set out as follows. The next section provides an overview of FM accounting and the CFI. After that, the paper describes the native forest sector in southern New South Wales, before detailing the method used to conduct the financial analysis. Finally, there is an explanation and discussion of the results of the analysis, followed by a conclusion.

Forest management and carbon credits

FM credits

Under the Kyoto Protocol's accounting rules, all emissions are recorded in one of six reporting sectors: energy; industrial processes; solvent and other product use; agriculture; waste; and land use, land-use change and forestry (LULUCF). Removals (the drawdown of CO_2 from the atmosphere by sinks) are also recorded but only in the LULUCF sector. Because of the nature of the fluxes associated with LULUCF activities, particularly the fact that they can be influenced by indirect human-induced and natural factors (major natural disturbances, inter-annual variability, CO_2 fertilisation and nitrogen deposition), separate and distinct accounting principles and rules were devised for the LULUCF sector.[9] Most notably, all LULUCF activities, with the exception of deforestation, are excluded from the base year emissions estimate for the purposes of determining the assigned amounts of Annex B parties.[10] Due to this, LULUCF is typically only accounted for during the commitment period

[8] Macintosh, A and Waugh, L (2012). *An Introduction to the Carbon Farming Initiative: Key Concepts and Principles*.

[9] Schlamadinger, B et al. (2007). *A synopsis of land use, land-use change and forestry (LULUCF) under the Kyoto Protocol and Marrakech Accords*; Höhne N et al. (2007). *The rules for land use, land use change and forestry under the Kyoto Protocol – lessons learned for the future climate negotiations*.

[10] Annex B countries are industrialised countries and economies in transition (i.e. those listed in Annex I to the UNFCCC), with the exception of Belarus and Turkey.

through the recording of credits and debits against the assigned amounts of relevant parties. In addition, during the first commitment period of the Protocol (2008 to 2012), LULUCF accounting was activity-based (meaning it seeks to account for carbon stock changes attributable to specific activities on land units subject to the activities)[11] and involved two groups of activities: Article 3.3 activities (reforestation, afforestation and deforestation) and Article 3.4 activities (FM, grazing land management, cropland management and revegetation). Annex B countries were required to account for Article 3.3 activities, while accounting for Article 3.4 activities was optional. Due to concerns about major natural disturbances such as droughts and bushfires, Australia did not account for any Article 3.4 activities in the first commitment period.[12]

The second commitment period of the Kyoto Protocol will run from 1 January 2013 to 31 December 2020.[13] Although this commitment period is yet to formally come into force, Australia has announced its intention to participate, along with Europe (EU-27) and possibly a number of other countries. Several new accounting rules will apply to LULUCF activities in this commitment period, the most relevant of which are as follows.[14]

- FM accounting is compulsory.
- FM accounting will be based on a reference level (or baseline-and-credit) system. Under this approach, FM reference levels are supposed to be set for each participating country, representing an estimate of net FM emissions over the commitment period in the absence of policy changes from 31 December 2009.[15] The credits and debits recorded during the commitment period will be calculated by subtracting the reference level from the actual reported net emissions. Parties whose emissions are higher than the reference level will incur FM debits and those whose emissions are below the reference level will receive FM credits.
- Generally, parties are required to account for six carbon pools on forest lands: above-ground biomass, below-ground biomass, litter, dead wood, soil organic carbon and harvested wood products (HWP) (the HWP pool was not accounted for in the first commitment period, leading to the adoption of the assumption that all carbon in HWPs was instantly oxidised). With the exception of the HWP pool, parties can choose to exclude a carbon pool provided "transparent and verifiable information is provided that demonstrates that the pool is not a source".[16]
- FM credits, and credits associated with FM project activities undertaken through the joint implementation (JI) mechanism, are subject to a combined cap of 3.5 per cent of total base year emissions excluding LULUCF. For Australia, the 3.5 per cent cap is likely to equate to a limit of approximately 15.4 Mt CO_2-e yr^{-1} over the commitment period.[17]

[11] Watson et al. (2000). *Land Use, Land-use Change and Forestry*.

[12] Australian Government (2008*). Carbon Pollution Reduction Scheme: Australia's Low Pollution Future: White Paper*; Australian Government (2008*). Land Use, Land-Use Change and Forestry (LULUCF) Sector: Submission to the AWG-KP and AWG-LCA*.

[13] UNFCCC Secretariat (2013). Decision 1/CMP 8.

[14] UNFCCC Secretariat (2012).

[15] UNFCCC Secretariat (2012). A number of countries have submitted reference levels that do not accord with this principle. Macintosh, A (2011). *Are forest management reference levels incompatible with robust climate outcomes? A case study on Australia*.

[16] UNFCCC Secretariat (2012).

[17] Australia's 1990 base year estimate (excluding LULUCF) under the Kyoto Protocol is 416.2 Mt CO_2-e (see UNFCCC Secretariat (2009). *Report of the review of the initial report of Australia*). However, it is likely to be adjusted upwards to around 440 Mt CO_2-e when new accounting rules come into effect in 2015.

FM is defined as "a system of practices for stewardship and use of forest land aimed at fulfilling relevant ecological (including biological diversity), economic and social functions of the forest in a sustainable manner".[18] This definition allows for two approaches to be used when identifying FM lands.[19] Under the first (the narrow approach), the party can define a set of specific practices (e.g. harvesting, thinning, fertilisation and fire suppression) and the FM lands are those subject to these practices since 1990. The second approach (the broad approach) requires the party to define a system of FM practices and identify the area subject to these practices in the commitment period. Parties can use a mix of these approaches, which is what Australia's FM approach involves.[20]

Under the Australian approach, FM lands will include:

- all multiple use public native forests – forests on Crown land that are managed for multiple purposes, including commercial harvesting – that were available for harvest at December 2009 (broad approach);
- pre-1990 plantations (broad approach);
- private native forests subject to harvesting since 1990 (narrow approach);
- public native forest reserves as at December 2009 that have been, or are, subject to harvesting after 1990 (narrow approach); and
- any forests (public or private) subject to restorative actions after December 2009 (narrow approach).

The adoption of this definition will mean that the public native forests in the SFR and East Gippsland that supply native hardwood logs to processors in southern New South Wales will fall within Australia's FM lands.

The harvesting of Australian native forests typically generates significant carbon emissions. This can be illustrated using one of the Australian government's representative one-hectare medium-dense eucalyptus forest (*FullCAM*) plots. For current purposes, it is assumed that the forest is even age and that, at the time of harvest, the average age of the trees on site is 100 years (consistent with the Australian Government's FM accounting method, both the understorey and soil organic carbon are excluded). Immediately prior to harvest, the live biomass (above and below ground live biomass) carbon pools contain 216 tonnes of carbon (tC), while the debris (litter and dead wood) pools contain 58 tC. Based on averages derived from Australian government and Forests NSW data,[21] it is assumed that all trees on the plot are harvested and that 31 per cent of the stem biomass goes to pulplogs, 36 per cent to saw and other logs (poles, fencing, sleepers etc.), and the remainder is left onsite as deadwood.[22] All remaining biomass is left on the forest floor and there is a regeneration burn within a year of the harvest, after which the forest regrows. The carbon stock in the HWP pool from the

[18] UNFCCC Secretariat (2006). *Report of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol on its first session, held at Montreal from 28 November to 10 December 2005. Addendum – Part Two: Action taken by the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol at its first session. Decision 16/CMP 1*.

[19] Penman, J et al. (2003). *Good Practice Guidance for Land Use, Land-use Change and Forestry*.

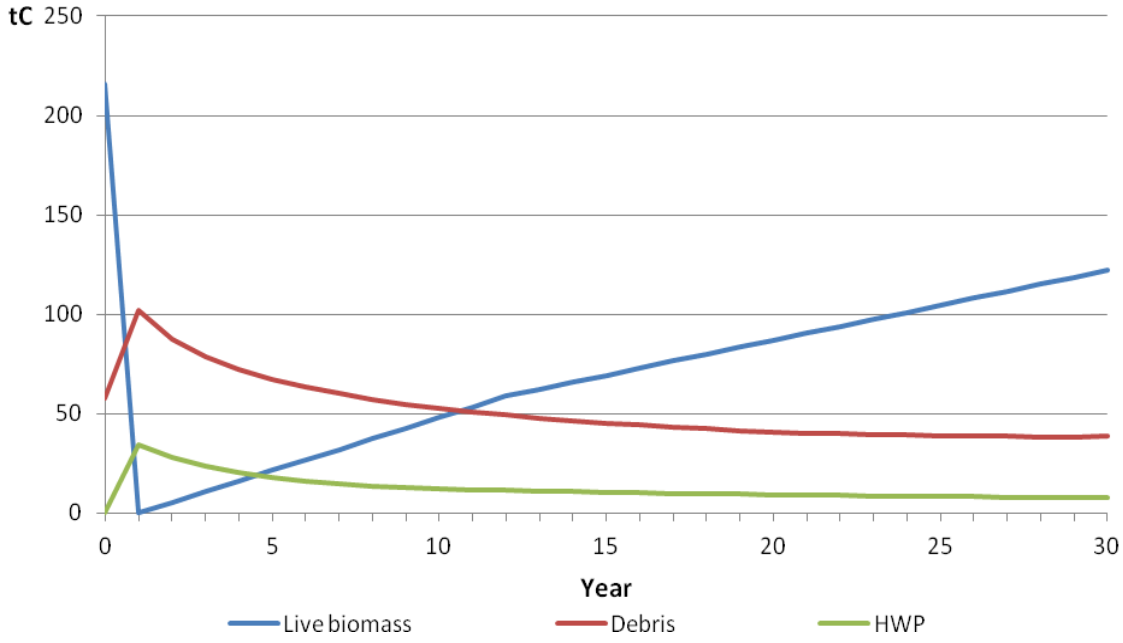
[20] Australian Government (2011). *Submission to the AWG-KP: September 2011 — Forest Management Reference Level Submission*.

[21] The proportion of stems allocated to deadwood (which implicitly includes some firewood) was based on data from the Australian Government's FM model. The division between pulplogs and saw and other logs was based on the proportions from NSW public native forests (hardwood only) over the past decade (2003 to 2012). Australian Government (2013). *National Inventory Report 2011*; State Forests of NSW (2000-2003). *Social, environmental and economic reports*. Forests NSW (2004-2008). *Social, environmental and economic reports*; Forests NSW (2004-2012). *Annual Reports*.

[22] The stems allocated to deadwood implicitly include some firewood, which is burnt offsite.

harvest was estimated using a wood flow model derived from the Australian government's HWP model[23] and other sources[24] and the IPCC first-order decay function,[25] assuming half-lives of two years for paper, 25 years for wood panels and 35 years for sawn wood. The impact of the harvest event on the live biomass, debris and HWP pools is shown in Figure 1. Figure 2 shows the carbon stock changes in the individual pools and the net carbon stock change.

Figure 1 Representative medium dense eucalyptus forest harvest event – carbon stocks in live biomass, debris and HWP pools

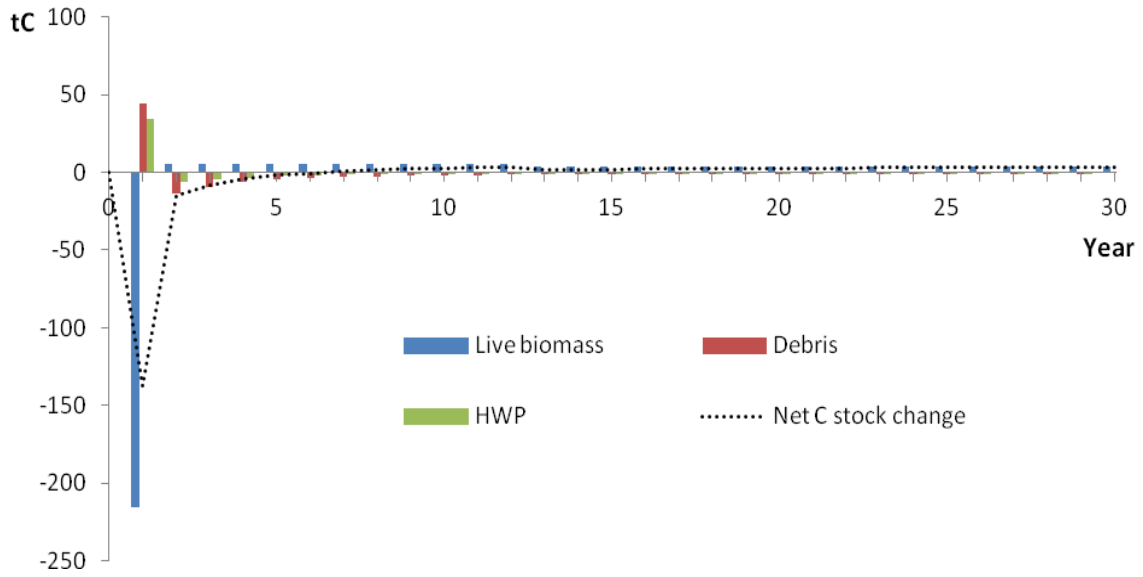


[23] Jaakko Pöyry Consulting (Asia-Pacific) Pty Ltd (1999). *Usage and Life Cycle of Wood Products*; Richards, G et al. (2007). *Developing a carbon stocks and flows model for Australian wood products*; Australian Government (2013).

[24] Burns, K et al. (2009). *ABARE 2007 sawmill survey report;* Tucker, S et al. (2009). *Life Cycle Inventory of Australian Forestry and Wood Products.*

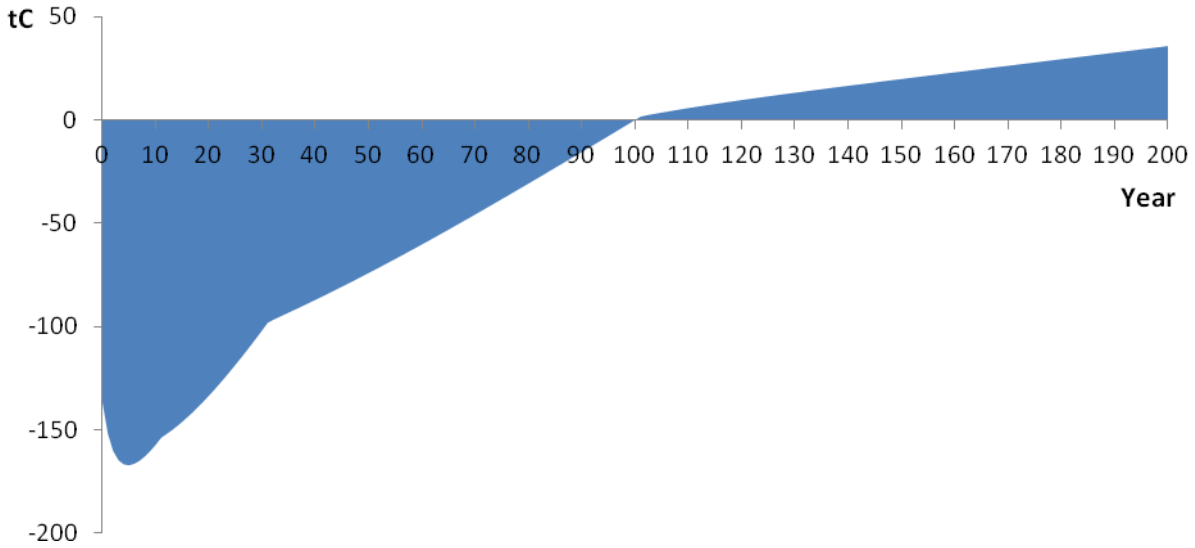
[25] Eggleston, S et al. (2006), *2006 IPCC Guidelines for National Greenhouse Gas Inventories*.

Figure 2 Representative medium dense eucalyptus forest harvest event – carbon stock changes in live biomass, debris and HWP pools and net carbon stock change



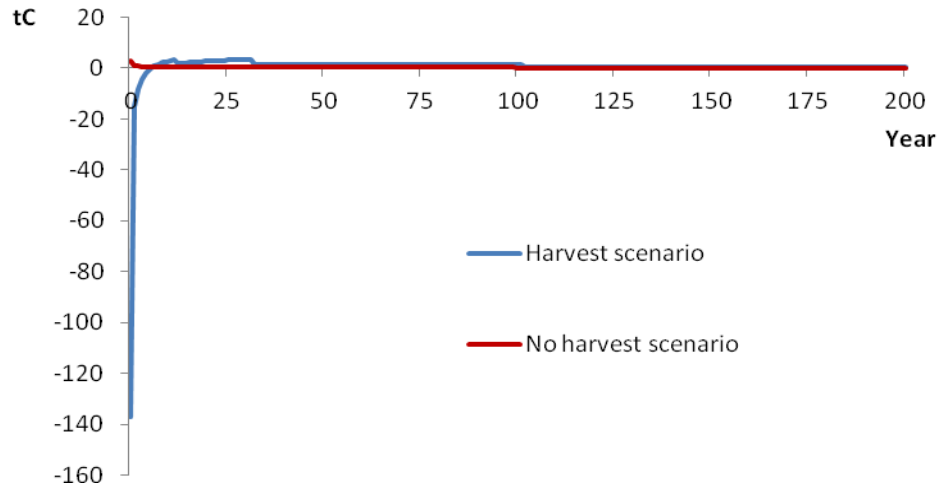
The harvest event results in a large and immediate drop in the live biomass carbon pool, which is partly offset by increases in the debris and HWP pools (i.e. biomass is transferred to the debris and HWP pools). In the six years following the harvest event, the forest begins to regrow, thereby increasing the live biomass carbon pool. However, during this period, the increases in live biomass are wholly offset by the decay of the carbon initially transferred to the debris and HWP pools. Over this initial period, the harvesting of one hectare of forest results in a cumulative net carbon stock change of -167 tC (613 tCO_2). After this, the trends in net carbon stock change are dominated by the gradual increases in live biomass. There is a relatively small annual increase in the net carbon stock, which continues until the next harvest or natural disturbance event. Under this scenario – assuming there is no intervening harvest or other disturbance event – it takes just over a century before the initial forest 'carbon debt' is repaid (Figure 3).

Figure 3 Representative medium dense eucalyptus forest harvest event – cumulative net C stock change



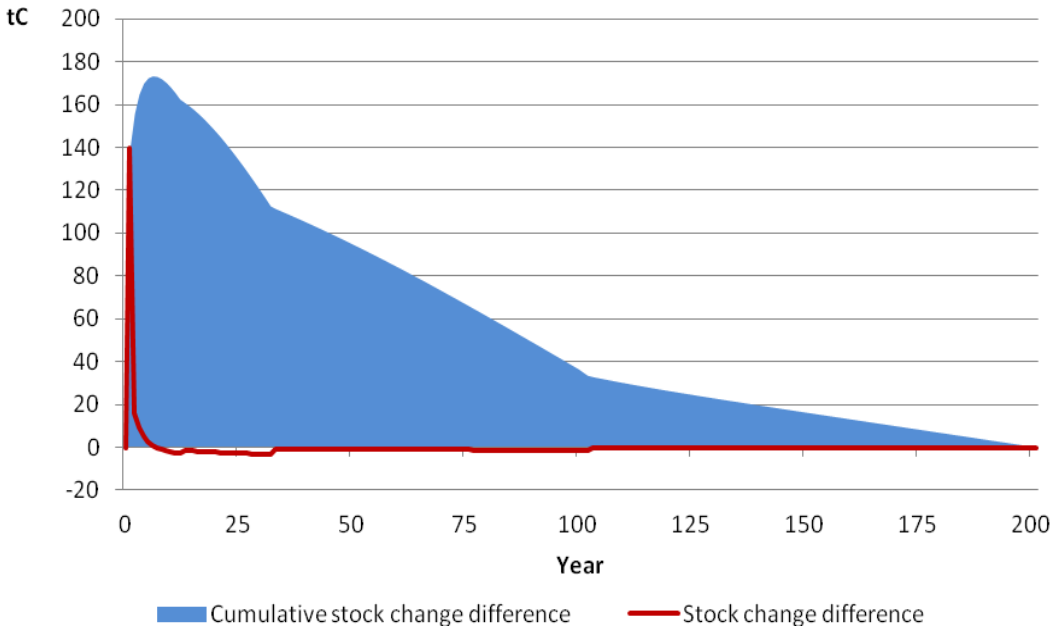
Leaving forests standing can avoid harvest-related emissions and thereby lead to the generation of FM credits in Australia's greenhouse accounts. Moreover, because FM accounting is based on reference levels, additional credits can be derived through the ongoing growth in the standing forest. That is, with reference-level accounting, the FM credits that are generated by not harvesting are calculated by subtracting the actual net carbon stock change from the net carbon stock change under the counterfactual reference scenario where harvesting is assumed to occur. If the forest is still growing when the harvest event would have occurred in the reference scenario, the actual carbon stock change will be positive, ensuring a greater number of credits than if the forest had ceased growing (senescence). This effect can again be illustrated using the representative medium-dense eucalyptus forest plot described above and removing the harvest, regeneration and replanting events in *FullCAM*. Figure 4 shows the net carbon stock change in the harvest and no-harvest scenarios.

Figure 4 Representative medium dense eucalyptus forest harvest event – net carbon stock change in harvest and no-harvest scenarios



While the growth rate in the mature forest in the no-harvest scenario is low, it has a significant impact on the stock change difference between the scenarios (Figure 5). In the first six years after the harvest event, the cumulative net difference is 173 tC (635 tCO_2) – net emissions in the harvest scenario are 173 tC higher than in the no-harvest scenario. Further, it takes more than 200 years for the cumulative stock change difference – the *effective* forest carbon debt – to be reduced to zero.

Figure 5 Representative medium dense eucalyptus forest harvest event – net carbon stock change difference between harvest and no-harvest scenarios and cumulative carbon stock change difference



The nature of the stock change differences means that, when harvesting is avoided on a single native forest plot, the Australian government will usually receive a relatively large quantity of FM credits over a five to ten year period, after which it will record a small number of annual FM debits for an extended period (200 years in the hypothetical presented in Figures 4 and 5). Where harvesting is avoided across a large estate and across time, it can lead to the generation of a substantial number of FM credits for decades. The concentrated upfront profile of FM credits from avoided native forest harvesting projects means that they have an economic advantage over reforestation projects, where the carbon stock changes are characterised by small incremental gains over an extended period of time.

While stopping or reducing harvesting in public native forests will generate FM credits, it should not result in a reduction in recorded national or global emissions. This is because Australia's mitigation commitments involve the setting of a cap on net national emissions for the period 2013-2020, and ultimately through to 2050. Due to the existence of this net emissions limit, abatement actions in sectors that count towards the national total will not usually result in overall national emissions reductions; they merely determine where the abatement comes from.[26] Reductions in absolute emissions should only occur if the abatement actions lead directly to the lowering of the national target (e.g. cancellation of assigned amount units or other equivalent units) or, in the event that national emissions end up being below the target in one accounting period, the Australian Government decides not to carry over the surplus into the next period.

[26] Macintosh and Waugh (2012).

Due to the nature of the international accounting rules, the major benefits associated with reducing harvesting are environmental and financial. The main environmental benefits are those typically associated with the conservation of native forests – improved biodiversity, hydrological, cultural and natural heritage outcomes. The financial benefits stem from the operation of the international greenhouse accounting rules and domestic policy instruments. While the Australian carbon pricing scheme remains in force — and assuming there is no related CFI project — reducing harvesting in native forests should lead to a relative increase in the carbon pollution cap under the *Clean Energy Act 2011* (Cth) (CE Act).[27] This is a product of the fact that the generation of FM credits will lead to a relative decrease in the emissions in the sectors not covered by the CE Act, known as 'uncovered sector emissions'. The carbon pollution cap under the CE Act is likely to be derived by subtracting an estimate of the total uncovered emissions from the national target. Therefore, by reducing the uncovered sector emissions, avoiding native forest harvest events should allow for an increase in the carbon pollution cap. Any increase in the carbon pollution cap allows the Australian government to auction more carbon units, thereby increasing its revenues from the carbon pricing scheme. For example, if due to changes in forest management practices Australia received one million FM credits per year, the Commonwealth would be able to sell an additional million carbon units to liable entities under the CE Act. If the carbon price was $10 per tonne, the Commonwealth would gain an additional $10 million per year from permit sales.

During the current fixed charge period of the carbon pricing scheme, in place from 1 July 2012 to 30 June 2015, there is no carbon pollution cap. Covered sector emissions face a set carbon price but there is no absolute limit on emissions from these sectors under the CE Act. Despite this, a reduction in native forest harvesting over this period should still affect the revenues from the carbon pricing scheme. This is because Australia's mitigation commitments are likely to be cumulative – that is, there will be a national target, or national emissions limit, for the entire accounting period (2013 to 2020) rather than a single year (2020) and the targets will be transferrable within the period. Reductions in uncovered sector emissions in the fixed charge years should therefore allow for higher relative national targets in the flexible charge years, leading to higher carbon pollution caps and greater scheme revenues.

The other notable direct economic benefit associated with reducing native forest harvesting is that, by increasing the carbon pollution cap and availability of domestic carbon units, it will reduce reliance on international permits. Reducing capital outflows associated with imported carbon units should increase domestic economic growth.

If the carbon pricing scheme is repealed, and the Coalition's 'Direct Action Plan' is introduced,[28] reducing native forest harvesting will still produce carbon-related financial benefits. Under the Direct Action Plan, the CE Act's cap-and-trade scheme would be replaced with a baseline-and-credit scheme and other complementary instruments under which the Australian government would be the primary purchaser of abatement. With this approach, the financial benefit that stems from stopping harvesting is the reduction in the quantity of abatement that the Australian government would have to acquire to meet its mitigation commitments. Conversely, increased or continued harvesting would add to the abatement task that must be purchased by the government.

[27] The CE Act is the main statute supporting the Australian carbon pricing scheme.
[28] Liberal Party of Australia and National Party of Australia (2010). *The Coalition's Direct Action Plan*.

ACCUs

The FM credits generated by not harvesting public native forests only provide direct financial benefits to the Australian government. Owners of the relevant forests (public or private) can only derive a direct financial benefit from the FM credits if:

- the Australian government agrees to make a payment to the forest owner that represents the value of the FM credits; or
- the avoided forest harvesting is approved as an eligible offsets project under the CFI Act and ACCUs are issued to the forest owner that correspond to the FM credits recorded in the national greenhouse accounts.

As discussed, ACCUs are offset credits issued under the CFI; a project-based, baseline-and-credit offset scheme. Under the CFI, approved offset projects are able to generate ACCUs from the LULUCF, agriculture and waste sectors. Where the removals and/or avoided emissions count towards Australia's mitigation targets, the ACCUs (called Kyoto ACCUs) can be used to meet liabilities under the carbon pricing scheme or exchanged for Kyoto units (Assigned Amount Units (AAUs), Emission Reduction Units (ERUs) or Removal Units (RMUs)) and sold into overseas compliance markets.[29] If the removals or avoided emissions do not count towards Australia's targets, the project is known as a non-Kyoto offset project and receives non-Kyoto ACCUs, which can only be used in voluntary markets.

In order to be eligible to participate in the CFI, a project must pass the CFI Act's additionality test. This requires a project to satisfy two requirements:

- it must be included on the so-called 'positive list' in the *Carbon Credits (Carbon Farming Initiative) Regulations 2011* (Cth) (CFI Regulations); and
- it must not be required under a law of the Commonwealth, or a law of a state or territory.[30]

The positive list is intended to include activities that are not 'common practice' within an industry or region[31] – if the practice is not common, it is presumed that it would not have been undertaken without the incentive provided by the CFI. At the time of writing, the list consisted of 15 broad project types, including the establishment of permanent plantings (reforestation), avoided regrowth clearing (deforestation), capture and combustion of CH_4 from legacy waste (waste), and early dry season burning of savannah areas and reduction of emissions from ruminants by manipulation of their digestive processes (agriculture).[32]

Despite their abatement potential, the positive list does not currently include avoided public native forest harvesting projects. The CFI Act also excludes projects involving the clearing of native forest or use of material obtained by clearing or harvesting a native forest. This prohibition blocks delayed native forest harvesting projects and prevents any FM project from including part of a forest estate that remains available for harvest. In addition, the legislation limits native forest protection projects to a single crediting period with a default length of 20 years (for other project types, crediting periods can be renewed and have a default length of seven years). These rules appear to have been based on the abatement characteristics of avoided deforestation projects, where the avoided emissions are initially large but then follow an exponential decay function that approaches zero after ~20 years. Although well suited to

[29] They can also be sold into voluntary markets or voluntarily retired.
[30] CFI Act, s 41(1).
[31] CFI Act, s 41(3).
[32] *Carbon Credits (Carbon Farming Initiative) Regulations 2011* (CFI Regulations), reg 3.28.

avoided deforestation projects, it is inconsistent with the abatement profile of avoided native forest harvesting projects.[33]

The Australian government has signalled that it may amend the CFI Act and CFI Regulations to enable avoided public native forest harvesting projects to participate in the scheme. Once included, the opportunity to generate and sell ACCUs by conserving public native forests has the potential to alter the economics of the native forest harvesting industry. As discussed, the returns from harvesting native forests have always been modest. Native forestry is also cyclical and has undergone significant downturns in the past, although arguably not of the same magnitude as that experienced post-2008.[34] Usually, the industry has been sustained during the downturns, and over the longer-term, by a combination of direct and indirect government subsidies.[35] Using commercial native forests to generate carbon credits could potentially provide more sustainable financial returns to state governments and their communities.

Background on the southern NSW forestry sector

For the purposes of the analysis, the southern NSW native forest sector was defined as the sub-component of the domestic forestry industry that is reliant on native logs supplied from the Forestry Corporation of NSW's Southern Forestry Region (SFR). The SFR stretches from Nowra to the Victorian border and inland to Tumut, and includes the Eden and Southern Regional Forest Agreement areas (see map in Appendix A). The native forests of the SFR cover approximately 432,757 ha, or 24 per cent of the Forestry Corporation of NSW's total native forest estate (1,813,465 ha).[36] For management purposes, the SFR is broken into three sub-regions: South Coast, Eden Regional Forest Agreement and Tumut. Details of the gross area and net harvestable area of native forests in these management regions are provided in Table 1 below.[37] The forests in these management areas comprise a mix of forest types including spotted gum, yellow stringybark, silvertop ash, coastal moist, coastal dry and brown barrel forests.[38]

[33] Macintosh, A (2013). *The Carbon Farming Initiative: removing the obstacles to its success*.

[34] Marsden Jacob Associates (2001); URS (2007); Ajani (2007); New South Wales Auditor-General (2009); URS (2010); Tasmanian Auditor-General (2011); Macintosh (2013). *The Australian native forest sector*.

[35] Byron, R and Douglas, J (1981). *Log Pricing in Australia: Policies, Practices and Consequences*; Ajani (2007); Australian National Audit Office (2008). *Tasmanian Forest Industry Development and Assistance Programs*; Productivity Commission (2012). *Trade and Assistance Review 2010-11*.

[36] Forestry Corporation of NSW's native forest operations area includes 50,660 ha of hardwood plantations; when the plantations are excluded, the native forests cover 1,762,805 ha. Forests NSW (2012). *Annual Report*.

[37] The 'gross area' is the total area of multiple use public native forest managed by the Forestry Corporation of NSW. The 'net harvestable area' is the gross area less areas in which harvesting is excluded because of the nature of the terrain (i.e. steep slopes), desire to protect riparian zones and water quality (i.e. drainage lines), or presence of threatened species, heritage sites and other important environmental values (e.g. reserves, rainforest and old-growth forest).

[38] Ximenes, F et al. (2012). *Greenhouse Gas Balance of Native Forests in New South Wales, Australia*; Ximenes, F et al. (2012). *Harvested forests provide the greatest ongoing greenhouse gas benefits: Does current Australian policy support optimal greenhouse gas mitigation outcomes?*

Table 1 Gross and net harvestable areas, South Coast, Eden RFA and Tumut

	Gross area (ha)	Net harvestable area (ha)
South Coast	199,093	96,513
Eden	164,200	88,018
Tumut	64,715	43,333
Total	**428,008**	**227,864**

Source: Forests NSW (2011). *Yield Forecasts — Southern Regional Forest Agreement, South Coast sub-region*; Forests NSW (2012). *Yield Forecasts — Southern Regional Forest Agreement, Tumut sub-region*; Forests NSW (2012). *Yield Forecasts — Eden Regional Forest Agreement*.

In 2011, 98,241 m^3 of sawlogs and 364,718 green tonnes (gt) of pulplogs were produced from the native forests of the SFR and supplied to the mills of southern New South Wales.[39] East Gippsland provided a further 374,506 gt of pulplogs to these processing facilities. For the majority of the period 2008-2012, the processors comprised:

- the SEFE woodchip mill, which processes both native hardwoods and plantation softwoods;
- four medium-sized sawmills, three owned by Boral Ltd (Boral) and a fourth owned by Blue Ridge Hardwoods (Eden) Pty Ltd (Blue Ridge); and
- a collection of small sawmills that collectively process approximately 11 per cent of the sawlogs in the SFR.

In late 2012, Boral closed its sawmill at Batemans Bay and SEFE cut back from two production shifts to one and shed 26 employees, about a third of its production workforce. At the end of 2012, the southern New South Wales native forest sector (comprising forest management, logging, transport and processing) directly employed approximately 325 people, including 75 in the Forestry Corporation of NSW (Table 2).

[39] New South Wales Legislative Council (2012). *Questions and Answers No. 78, Tuesday 1 May 2012 — No. 1183*.

Table 2 Direct employment in SFR native forest sector, forest management, logging, transport and processing, 2011 and end 2012

	2011	End 2012
Wood processing		
SEFE (SFR hardwood processing)	31	20
Boral Timber	85	70
Blue Ridge	55	55
Other small SFR sawmills	17	14
Total hardwood processing	188	159
Logging and haulage		
Eden RFA region logging	40	26
Southern RFA region logging	44	29
Log truck drivers	55	36
Total logging and haulage	139	91
Forest management		
Forestry Corporation NSW SFR	79	75
Total direct employment	**406**	**325**

Source: Interviews with industry CEOs, logging and haulage companies, 2011-12.

Methodology

Overview

To compare the net financial benefits of harvesting native forests and processing them in southern New South Wales to those associated with using the resource to generate carbon credits, we analysed data from the Forestry Corporation of NSW (it harvests logs in the north of the SFR and receives royalties and mill door sales revenue) and native forest hardwood processors in the SFR (SEFE, the four medium-sized sawmills and remaining small local sawmills) over the period 2008 to 2012. These data were then used to project future aggregate net financial benefits from these entities over the period 2014-2033 (the 'projection period') on the assumption that harvesting and processing remain at 2011-2012 levels (Harvest Scenario 1 (H1)). Data for this scenario were obtained from four main sources:

- the annual reports of the Forestry Corporation of NSW for the period 2008-2012;[40]
- SEFE's annual submissions to the Australian Securities and Investments Commission for the period 2008-2011;[41]
- interviews with the processing firms' CEOs (conducted during 2011 and 2012);[42] and
- answers to questions on notice to the New South Wales Legislative Council regarding the Forestry Corporation of NSW (then known as Forests NSW).[43]

Scenario H1 was then compared to a no-harvest scenario in which the native forests of the SFR were used to generate carbon credits (Carbon Credit Scenario 1, CC1). In this scenario, it was assumed that all harvesting in the public native estate in the SFR ceases in 2014 and

[40] Forests NSW (2004-2012; 2004-2008).
[41] South East Fibre Exports Pty Ltd (2008-2011). *Financial Reports*.
[42] Conducted by F Perkins.
[43] New South Wales Legislative Council (2012).

that the forests are used to generate carbon credits (FM credits and Kyoto ACCUs) and for other non-extractive purposes. The carbon credits under the CC1 scenario were calculated by subtracting an estimate of net emissions in the absence of harvesting from an estimate of net emissions under a baseline scenario, with the carbon pools being confined to above- and below-ground live biomass, debris (litter and deadwood) and HWP. Consistent with the method used to devise Australia's FM reference level, soil carbon was excluded.[44]

The value of the carbon credits was estimated using a carbon price path (called the 'central carbon price path') that follows the fixed statutory price under the CE Act until 30 June 2015, falls to $9.06 (2012 AU$) in 2015-16 and then increases by 2.5 per cent real per year over the period 2017-2020.[45] In 2021, the price is assumed to increase to $22.44 (2012 AU$) with the commencement of the post-2020 international climate agreement. From then on, the price is assumed to increase by just above 4 per cent real per year until 2033, consistent with the Hotelling rule.[46] This price path is unlikely to be sufficient to achieve the international objective of ensuring the increase in the global average surface temperature does not exceed 2°C on pre-industrial levels.[47] However, given the current state of relevant carbon markets and the international negotiations, it was considered the most likely scenario. The central carbon price path is illustrated in Figure 8 below.

The FM credits generated under the CC1 scenario over the projection period were estimated using a modified version of the methods and datasets that were used to devise Australia's FM reference level.[48] The Kyoto ACCUs were then assumed to be 'carved out' of the FM credits generated under the corresponding scenario. A leakage deduction of 5 per cent was applied in calculating the number of FM credits and ACCUs in the mitigation scenarios. A 5 per cent risk of reverse buffer was also applied in estimating the ACCUs.[49] The New South Wales government was assumed to be the beneficiary of the Kyoto ACCUs generated from the cessation of harvesting, while the Australian government obtained the financial benefit of the residual FM credits. The residual FM credits were calculated as:

$$RFM = TFM - ACCUs \quad (1)$$

Where:

RFM is the residual number of FM credits;

TFM is the total number of FM credits generated under the relevant scenario; and

ACCUs is the number of Kyoto ACCUs allocated to the Forests Corporation of NSW as a result of the project (i.e. the cessation of harvesting).

All scenarios included a projection of the net financial benefits received by the Australian government, which was calculated on the basis of the estimated company tax receipts from the four native forest hardwood processors and the value of the residual FM credits generated in the scenario. For simplicity, no costs were assigned to either the collection of company tax revenues or the Australian government's receipt of financial benefits from the

[44] The Australian Government has signalled its intent to revise the FM accounting methods, with the ultimate aim being to move from the current Tier 2 to a spatially explicit Tier 3 method. However, it is likely to be several years before these changes are implemented. Australian Government (2011; 2013).
[45] CE Act, s 100.
[46] Hotelling, H (1931). *The Economics of Exhaustible Resources*.
[47] Australian Treasury (2008). *Australia's Low Pollution Future: The Economics of Climate Change Mitigation*; Australian Treasury (2011). *Strong Growth, Low Pollution: Modelling a Carbon Price*.
[48] Australian Government (2011; 2013).
[49] CFI Act, s 17.

residual FM credits. Similarly, personal income taxes were excluded from the scope of the analysis – it was effectively assumed that the returns from the offset project are re-invested in the community, ensuring no net job losses or reductions in net employee compensation. As a state government agency, the Forestry Corporation of NSW was assumed to be exempt from company tax. The value of the residual FM credits was estimated using the central carbon price path. To avoid confusion, the net financial benefits – the company tax or carbon revenues – the Australian government is projected to receive are reported separately from the aggregate net benefits generated by the New South Wales government, Forestry Corporation of NSW and the SFR hardwood processors.

H1 scenario

As discussed, the H1 scenario was based on the assumption that harvesting and processing remain at 2011-2012 levels over the projection period (i.e. the levels seen immediately prior to the closure of the Batemans Bay sawmill and production cutbacks at SEFE). The analysis was also confined to the wood flows, and associated net financial benefit, derived from the native forests of the SFR, meaning plantation logs from New South Wales and native logs from East Gippsland that are processed at SEFE were excluded. The main assumptions adopted in the H1 scenario are summarised in Table 3 below. Further details are provided in Appendix B.

Table 3 Main assumptions in H1 scenario

Issue	Assumption
Projection period	2014 to 2033
Discount rate	7%
Pulplog conversion factor (green density)	1 m^3 = 1.17 gt
Pulplog supply from SFR (gt yr^{-1})	338,542
Sawlog supply from SFR (m^3 yr^{-1})	98,241
Other log supply from SFR (m^3 yr^{-1})	16,150
Average sawlog stumpage in 2014 (AU$ per m^3)	$51.62
Average pulplog stumpage in 2014 (AU$ per gt)	$13.20
Woodchip price in 2014 (AU$ per gt): Low price High price	 $80 $90
Real rate of increase of woodchip price	0%
Sawn timber average sale price in 2014 (AU$ per m^3)	$653-$884
Real rate of increase of sawn timber price	1%

Carbon credit scenarios — FM credits

The Australian government's FM reference level is a projection of net FM emissions over the period 2013-2020 assuming no change in policies from December 2009.[50] In making this projection, two key assumptions were adopted:

- for the purpose of estimating harvest slash emissions over the Kyoto Protocol's second commitment period, the annual intensity, distribution and type of harvesting would be the same as the mean from the period 2002-2009;

[50] Australian Government (2011; 2013).

- for the purpose of estimating carbon stock changes in the HWP pool over the second commitment period, log production would equal the levels from 2008.

Here, the FM reference scenario was confined to a projection of net emissions from the harvesting of native forests in the SFR. The projection period was also extended to 2033 to provide a more complete picture of the carbon credit implications of stopping harvesting. The 20 year period was adopted because this is the default crediting period for native forest protection projects under the CFI Act.[51]

Consistent with the Australian government's FM method, the calculation of the reference level was split into two parts on the basis of the accounted carbon pools – carbon stock changes in the live biomass and debris pools, and carbon stock changes in the HWP pool. The projected carbon stock changes in the live biomass and debris pools were modelled using the non-spatially explicit Tier 2 capabilities of *FullCAM* and 54 representative harvest plot files taken from the Australian government's FM model.[52] The harvest plot files represent three broad forest types (tall dense eucalypt forest, medium dense eucalypt forest and medium sparse eucalypt forest), ten silvicultural systems (involving pulpwood and no pulpwood, different percentages of trees being felled in harvest events and different percentages of stems being left on the forest floor) and six age classes (juvenile, immature, mature, senescent, multi-aged, and unknown age). In constructing the reference scenario, it was assumed that, over the projection period, the 54 harvest plots were subject to the same harvest rate on a national basis as they were over the period 2002-2009 (96,958 ha per year). To assign a harvest area to the SFR forests, the national area was reduced on a pro rata basis using broadleaved native roundwood removals (average broadleaved roundwood removals from public native forests in the SFR over the period 2002-2009 (508,018 m^3 per year) as a proportion of total national roundwood removals from all multiple use public native forests and Tasmanian private native forests over the same period (8,350,984 m^3 per year)).[53] This method resulted in a total assumed harvest area of 5,898 ha per year. The plots were assumed to form part of a single estate and the carbon stock changes on the estate were modelled using an estate simulation start date of 1960 and an end date of 2033.

Carbon stock changes on the parts of SFR estate that are not subject to harvest over the projection period were not modelled. This is due to the fact that carbon stock changes in these areas are the same in all scenarios, thereby cancelling each other out under the FM reference level accounting system. For the same reason, the impacts of wildfires were excluded from all scenarios. Similarly, non-harvest related fuelwood removals were assumed to be the same in all scenarios, and were therefore not modelled.

Carbon stock changes in the HWP pool were estimated using the wood flow model and IPCC first-order decay function discussed above. As in the Australian government's FM reference level, it was assumed for the purposes of the reference scenario that wood production from the SFR remained constant at 2008 levels over the projection period (474,075 m^3 per year, split 67:33 between pulplogs and saw and other logs).[54]

[51] CFI Act, s 69.

[52] Richards, G and Evans, D (2004). *Development of a carbon accounting model (FullCAM vers. 1.0) for the Australian continent*; Richards, G and Brack, C (2004). *A modelled carbon account for Australia's post-1990 plantation estate*; Brack, C et al. (2006). *Integrated and comprehensive emissions estimation for greenhouse gases*.

[53] State Forests of NSW (2000-2003); Forests NSW (2008-2012; 2004-2008); Forests NSW (2001-2011). *Annual report on logging operations, Eden RFA area*; Forests NSW (2005-2011). *Annual report on logging operations, Southern RFA area*; NSW Legislative Council (2012).

[54] Forests NSW (2004-2012; 2004-2008; 2001-2011; 2005-2011).

For the CC1 scenario, where harvesting in the native forests of the SFR is assumed to cease, the FM credits were calculated using the same method as described above, with adjusted harvest and wood production projections. To estimate the carbon stock changes in the live biomass and debris pools, the 54 representative harvest plots used in the reference scenario were replicated and the harvest events removed. The areas allocated to each representative no-harvest plot were the same as those allocated to the corresponding harvest plot – that is, the modelled estate covered the same area in the reference and no-harvest scenarios. Carbon stock changes in the HWP pool were modelled using the simplified wood flow model and IPCC first-order decay function. Over the projection period, it was assumed that log production from the SFR was zero. The residual credits received by the Australian Government were calculated using equation (1).

To estimate the number of FM credits generated under the H1 scenario, the method described above was also applied. In this case, the plots subject to harvest were derived using the projection of roundwood removals contained in Table 3 (an aggregate of 403,743 m^3 per year). No leakage deduction was applied in this case as the H1 scenario is a baseline scenario and other regions in Australia were assumed to be subject to similar market conditions.

Carbon credit scenarios — ACCUs

The method used to estimate the number of Kyoto ACCUs was the same as that which was used to calculate the FM credits. The only difference was that alternative harvest area and log production assumptions were used. Under the CFI, the baseline should represent the net emissions from the project area in the absence of the project. Scenario H1 was used as the baseline (harvest) scenario for these purposes. The assumed harvest area over the projection period was 4,510 ha per year, which was derived using the projection of roundwood removals contained in Table 3.

In estimating the financial value of the ACCUs, the following key assumptions were adopted.[55]

- The reporting period for the CFI project is one year, meaning ACCUs are generated annually.
- All of the ACCUs are sold into domestic or international compliance markets in the year of generation – they are not banked, nor are they affected by the 5 per cent cap on ACCUs under the CE Act over the period 2013-2015.[56]
- The Kyoto or non-Kyoto status of the ACCUs issued in relation to the project is not affected by the 3.5 per cent cap on FM credits under the Kyoto Protocol.
- The Kyoto ACCU price follows the central carbon price path.

The costs associated with the creation of the CFI project were divided into management and transaction costs. Based on data from Gilligan (2006),[57] the Senate Standing Committee on Environment, Communications, Information Technology and the Arts (2007),[58] and state

[55] These assumptions were also applied in calculating the value of the residual FM credits.
[56] CE Act, ss 125(7) and 128(7).
[57] Gilligan, B (2006). *The National Reserve System Programme: 2006 Evaluation*.
[58] Senate Standing Committee on Environment, Communications, Information Technology and the Arts (2007). *Conserving Australia: Australia's national parks, conservation reserves and marine protected areas*.

forest agencies,[59] management costs were assumed to start at $32 (2012 AU$) per hectare in 2014 across the entire native forest estate in the SFR (432,757 ha), and rise by 1 per cent real over the projection period. This is at the higher end of the management cost range across Australia for national parks and state forests, although it is similar to the amount spent by the Forests Corporation of NSW in the SFR (excluding harvest and haulage costs).[60]

The transaction costs associated with the CFI project were broken down into four categories: methodology development, legal and contracting, auditing, and brokerage and incidentals. Details of these transaction costs are provided in Table 4. Again, these cost assumptions are relatively high, and reflect a desire to ensure conservative estimates.

Table 4 Transaction cost assumptions (real 2012 AU$)

Transaction cost category	Cost details
Methodology development	Upfront cost of $150,000 in 2014. No recurrent cost.
Legal and contracting	Upfront cost of $250,000 in 2014. Recurrent cost of $25,000 in 2015, rising by 1 per cent real per annum over period 2016-2033.
Auditing	$20,000 in 2014, rising by 1 per cent real per annum over period 2015-2033.
Brokerage and incidentals	$20,000 in 2014, rising by 0.5 per cent real per annum over period 2015-2033.

Sensitivity analysis

There are four major sources of uncertainty associated with the comparative financial analysis:

- the baseline — whether the H1 scenario provides the best estimate of the likely rate of harvesting and roundwood removals in the absence of the incentive provided via the CFI;
- carbon credit methods — whether the Australian government's FM methods are the most appropriate basis on which to estimate the FM credits and ACCUs that could be generated by stopping harvesting;
- carbon price scenarios — whether the central carbon price path provides the best projection of likely future carbon prices; and
- discounting — whether a discount rate of 7 per cent is appropriate in these circumstances.

[59] State Forests of NSW (2000-2003); Forests NSW (2004-2012; 2004-2008); Forestry Tasmania (2001-2008). *Annual Reports*; Forestry Tasmania (2009-2012). *Stewardship Reports*; Forestry Tasmania (2007-2008). *Sustainable Forest Management Reports*; VicForests (2006-2012). *Annual Reports*; VicForests (2007-2012). *Sustainability Reports*; Victorian Department of Sustainability and Environment (2005). *Victoria's State of the Forests Report 2003*; Victorian Department of Sustainability and Environment (2009). *Victoria's State of the Forests Report 2008*; Forest Products Commission Western Australia (2002-2012). *Annual Reports*.

[60] Forests NSW SFR expenses (including head office costs but excluding harvest and haulage costs) in 2011 were $13.7 million, or $31.73 per hectare (2012 AU$). New South Wales Legislative Council (2012).

The baseline

Given the conditions in relevant domestic and international wood product markets, there is a significant risk that the native forest sector in the SFR will fail to recover from the downturn seen in late 2012.[61] If this occurs, scenario H1 would overestimate the net financial benefit from commercial harvesting over the projection period. The use of scenario H1 would also lead to the overestimation of the Kyoto ACCUs that could be generated by stopping harvesting in the public native forests of the SFR.

To account for this risk, an additional harvest scenario was devised (Harvest Scenario 2, H2), which assumes SEFE's native woodchip production is one third lower than the levels assumed in the H1 scenario and that Boral Ltd's Batemans Bay mill does not reopen.[62] A matching carbon credit scenario (CC2) was also devised, which used the same method to calculate the ACCUs and residual FM credits as in CC1, only with scenario H2's roundwood removals as the baseline.

Japanese demand for Australian broadleaved native woodchips for paper production has fallen sharply since the onset of the global financial crisis and is unlikely to recover to the levels seen prior to 2009.[63] This is a product of several factors. Since at least the mid-2000s, the Japanese pulp and paper industry has signalled its desire to reduce reliance on native woodchips for reasons of sustainability and improved yields.[64] The Japanese industry also appears to be in decline, a trend caused by falling paper and paperboard consumption in Japan and increased competition from imports. It is possible it could recover by reorientating itself toward growing markets in Asia.[65] However, the structure of the industry and that of its foreign competitors makes this unlikely.[66]

Due to the trajectory of the Japanese pulp and paper industry, it is possible that SEFE could close the Eden woodchip mill. To evaluate the consequences of this, a third harvest scenario (Harvest Scenario 3, H3) was developed that assumes that only sawlogs are harvested and processed in the SFR over the projection period, meaning that SEFE ceases its native woodchip operations and there are no pulplog removals. Sawlog harvesting and processing was assumed to be the same as in scenario H2 throughout the projection period. No corresponding carbon credit scenario was prepared in relation to the H3 scenario. This is due to the fact that, if the woodchip mill closes, the industry in the SFR would contract substantially, or could even collapse entirely. If this occurred, few, if any, ACCUs would be generated by 'protecting' the native forests in the SFR (i.e. the CFI baseline would be reduced to account for the contraction in production). The primary beneficiary from this outcome would be the Australian government, as it would receive most or all of the associated carbon credits in the form of FM credits. In effect, scenario H3 is a worst case scenario for the New South Wales government that illustrates what could happen if the native forest sector in the SFR collapses prior to an offset project being initiated.

The main assumptions adopted in the H2 and H3 scenarios are summarised in Table 5 below. Further details are provided in Appendix B.

[61] Macintosh (2013). *The Australian native forest sector*.
[62] Production was assumed to fall in proportion to the reduction in employees.
[63] Macintosh (2013). *The Australian native forest sector*.
[64] URS (2007). *Australia's forest industry in the year 2020*; Nippon Paper Group (2012). *Annual Report 2012 — 2012: Renewing our path toward the future*; URS (2012). *Strategic Review of Forestry Tasmania: Extract from Stage 1 Report (Redacted)*.
[65] URS (2012); Macintosh (2013). *The Australian native forest sector*.
[66] Macintosh (2013). *The Australian native forest sector*.

Table 5 Main assumptions in H2 and H3 scenarios

Issue	Assumption	
Scenario	**H2**	**H3**
Pulplog supply from SFR (gt yr^{-1})	192,901	0
Sawlog supply from SFR (m^3 yr^{-1})	88,706	88,706
Other log supply from SFR (m^3 yr^{-1})	11,734	11,734
Average sawlog stumpage in 2014 (AU$ per m^3)	$51.62	$51.62
Average pulplog stumpage in 2014 (AU$ per gt)	$13.20	NA
Woodchip price in 2014 (AU$ per gt): Low price High price	 $80 $90	 NA NA
Real rate of increase of woodchip price	0%	NA
Sawn timber average sale price in 2014 (AU$ per m^3)	$653-$884	$653-$884
Real rate of increase of sawn timber price	1%	1%

It is important to emphasise that the H1 and H2 scenarios are the preferred harvest scenarios and provide the best estimate of the likely level of harvesting, and removals, in the absence of the initiation of a CFI project. This is due to the fact that SEFE has indicated that it intends to continue to operate and that, historically, where the native forest sector has experienced financial difficulties, federal and state governments have intervened to ensure their ongoing viability.[67] Consistent with this, in the wake of the announcement that SEFE was laying off workers in 2012, federal Labor member for Eden-Monaro, Mike Kelly, indicated that the government would provide assistance if it looked like the chip mill would close, stating:

> There was no indication that closure was imminent and that they are continuing to work through the new economic circumstances they find themselves in. … We'll look to act if there's a need to in the future.[68]

Methods

There is considerable uncertainty surrounding the removals and emissions from native forests and harvest events, and questions concerning whether the Australian Government's FM model accurately reflects 'what the atmosphere sees'. This is a product of a number of factors, including a lack of data on carbon stocks and fluxes in native forests, data gaps concerning the age-class distribution of native forests and the silviculture practices used in them, and the counter-factual nature of reference levels.[69] With improved data and models, it may be possible to devise a more accurate method, a fact acknowledged by the government.[70]

Arguably, the weaknesses in the government's FM model justify the development and application of an alternative method, as other studies have done.[71] However, the object of

[67] ABC News (2012). *MPs say chip mill will remain open*; ABC News (2012). *Anti-forestry campaigner disappointed about chip mill future*.
[68] Kelly, M cited in ABC News (2012). *MPs say chip mill will remain open*.
[69] Macintosh, A (2012). *Tasmanian Forests Intergovernmental Agreement: An assessment of its carbon value*.
[70] Australian Government (2011; 2013); Australian Government (2012). *National Inventory Report 2010*.
[71] Ximenes et al. (2012). *Greenhouse Gas Balance of Native Forests in New South* Wales; Ximenes et al. (2012). *Harvested forests provide the greatest ongoing greenhouse gas benefits*; CO_2 Australia (2012). *Forest Carbon Study Final Report – 18 May 2012*.

the current analysis was not to estimate 'what the atmosphere sees', but rather how many carbon credits might be generated by the cessation of harvesting. Until the Australian government updates its methods, its FM model provides the best estimate of the FM entries that are likely to be recorded in Australia's greenhouse accounts.

Similarly, until a methodological determination is made for avoided public native forest harvesting projects under the CFI Act, the FM model also provides the most reliable basis on which to estimate the number of ACCUs from these types of offset projects. This is because the CFI Act specifies that methodologies 'must not be inconsistent with the methods set out in the National Inventory Report'.[72] This requirement is a jurisdiction fact, meaning the validity of any methodology is contingent on it 'not being inconsistent' with the National Inventory Report. Whether it is inconsistent is a matter of law – the opinions of the minister and Domestic Offset Integrity Committee are not determinative and a court will not give them any special deference.[73] The extent to which methods could deviate from those outlined in the National Inventory Report while still satisfying this requirement is uncertain. Similar phrases have been interpreted by courts in other contexts but these decisions do not provide clear guidance as to how it might be interpreted here.[74] The general legal principle is that courts will interpret this requirement in the broader legislative context in which it appears and seek to give effect to the purpose and language of the requirement 'while maintaining the unity of all the statutory provisions'.[75] Established rules of statutory interpretation also dictate that 'no clause, sentence, or word shall prove superfluous, void, or insignificant, if by any other construction they may all be made useful and pertinent'.[76] Hence, the courts will strive to ensure that this requirement serves a material limit on the content of CFI methodologies, and that there is a coherent relationship between the FM methods in the National Inventory Report and the CFI methodologies.

Although this requirement will act as a limit on differences in the methods, the methodology that is set for avoided public native forest harvesting projects could seek to address some of the deficiencies of the Australian government's FM model. To account for this contingency, an alternative method was developed and applied to estimate the Kyoto ACCUs under the CC1 and CC2 scenarios (hereafter called 'method 2').[77] The primary aim of method 2 was to adjust the Australian government's FM model to account for age class and silvicultural practice uncertainties associated with the native forests of the SFR.

Consistent with the first method described above (hereafter called 'method 1'), carbon stock changes in the live biomass and debris pools, and the HWP pool, were calculated separately. The HWP method was the same as that used in method 1. To estimate carbon stock changes in the live biomass and debris pools, the Tier 2 capabilities of *FullCAM* were again utilised. However, alternative representative plots and estate assumptions were adopted. To devise these, the net harvest area used in method 1 was converted to a logged area equivalent using the assumptions on the proportion of the forest affected by harvest events in the 54 Australian representative harvest plot files.[78] This revised harvest area

[72] CFI Act, s 133(1)(c).
[73] *Minister for Immigration and Citizenship v SZMDS* [2010] HCA 16; *Corporation of the City of Enfield v Development Assessment Commission* [2000] HCA 5; *Australian Heritage Commission v Mount Isa Mines Ltd* [1997] HCA 10.
[74] *Re Septu Brahim; Len Colbung; Spencer Riley and William Yarran v the Commonwealth Electoral Commissioner* [1991] FCA 381; *Minister of Resources; Glen Edward Martin and David Cox v Dover Fisheries Pty Limited* [1993] FCA 366; *De Rose v State of South Australia (No 2)* [2005] FCAFC 110; *Gregory v Commonwealth Railways Commissioner* [1941] HCA 43; *Plaintiff M47-2012 v Director General of Security* [2012] HCA 46.
[75] *Project Blue Sky v ABA* [1998] HCA 28 at [70].
[76] *Commonwealth v Baume* (1905) 2 CLR 405 at 414; *Project Blue Sky v ABA* [1998] HCA 28 at [71].
[77] This second method was not applied to the estimation of FM credits under the relevant scenarios.
[78] Australian Government (2011; 2013).

(2,490 ha per year) was then assigned to the three SFR subregions on the basis of historical proportional contribution to roundwood removals from the SFR: South Coast (35 per cent), Eden RFA (56 per cent) and Tumut (9 per cent).[79] Within each subregion, the harvest areas were assigned to representative forest types (tall-dense eucalypt forest (23 per cent), medium-dense eucalypt forest (71 per cent) and medium-sparse eucalypt forest (6 per cent)) and silvicultural practice combinations.

In the Australian government's FM method, it is assumed that no harvesting occurs in native forests younger than 30 years of age. In the SFR, it is common for commercial and non-commercial thinning to be undertaken in juvenile forests (aged 18-30 years) in order to improve yields. To account for this, it was assumed that a proportion of the harvest area assigned to each SFR subregion represented thinning events that occurred at an average age of 25 years. Based on data published by the Forests Corporation of NSW, the thin proportions were assumed to be 12 per cent, 30 per cent and 5 per cent for the South Coast, Eden RFA and Tumut subregions respectively. Thinning was assumed only to occur in tall-dense and medium-dense forests. Details of the representative forest type/silvicultural practice plots are provided in Table 6.

Table 6 Representative forest type/silvicultural practice plot assumptions in method 2

Forest type*	Plot subject to thin	Pulp/non-pulp in non-thin harvest events	% of stems left as deadwood at harvest
MDEF	No thin	No pulpwood	50%
MDEF	Thin at 25 years	No pulpwood	30% in thin, 40-60% in non-thin
MDEF	No thin	Pulpwood	30%
MDEF	Thin at 25 years	Pulpwood	30% thin, 20-30% in non-thin
MSEF	No thin	No pulpwood	50%
TDEF	No thin	No pulpwood	50%
TDEF	Thin at 25 years	No pulpwood	30% in thin, 40-60% in non-thin
TDEF	No thin	Pulpwood	30%
TDEF	Thin at 25 years	Pulpwood	30% thin, 20-30% in non-thin

* MDEF means medium-dense eucalypt forest. TDEF means tall-dense eucalypt forest. MSEF means medium-sparse eucalypt forest.

The age class distribution of the forests subject to non-thinning harvest events was determined using the probability density functions shown in Figures 6 and 7. As Figure 6 shows, two thirds of the harvesting in tall-dense and medium-dense forests was assumed to occur in forests aged between 60 and 100 years. The age class of medium sparse eucalypt forests subject to harvesting was assumed to be normally distributed, with an average age of 140 years and a standard deviation of 20.

[79] Forests NSW (2004-2012; 2004-2008; 2001-2011; 2005-2011).

Figure 6 Age class of tall dense and medium dense eucalypt forests subject to non-thinning harvest events

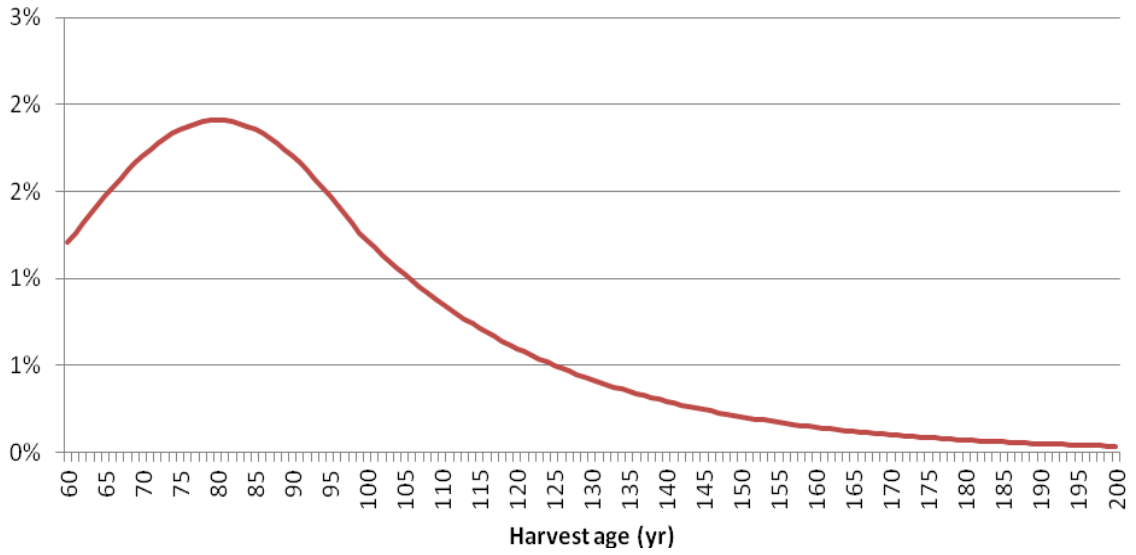
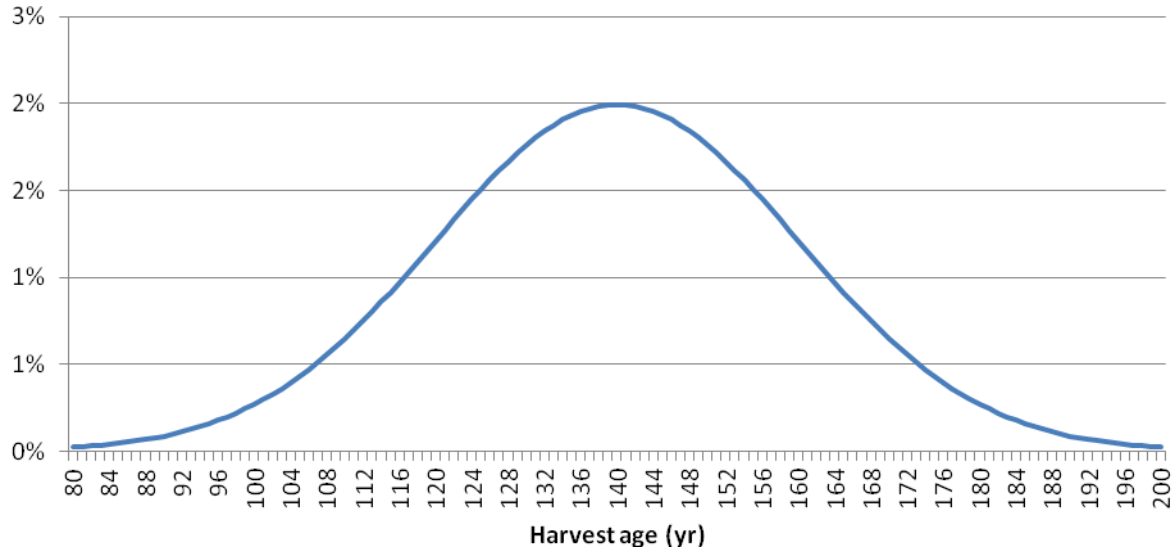


Figure 7 Age class of medium sparse eucalypt forests subject to non-thinning harvest events



Altogether, there were 1,249 plots in method 2, representing different forest type, silviculture and age class combinations. With the exception of the age class and silviculture practice assumptions, the plots were based on the same underlying assumptions as those applied in the Australian government's FM model, including in relation to forest growth rates, turnover rates, carbon fraction of biomass and decomposition rates.[80] Soil-organic carbon was again excluded. In contrast to the Australian government's FM model, the age class of the forests subject to harvest was assumed to remain constant over the projection period. Carbon stock changes on the parts of SFR forests that are not subject to harvest over the projection period were not modelled, nor were the impacts of wildfires and non-harvest fuelwood removals. As in method 1, carbon stock changes in the live biomass and debris pools in the no-harvest

[80] Australian Government (2013).

scenario were modelled using the same representative plot files and estate assumptions as in the harvest scenario, only with the harvest events removed.

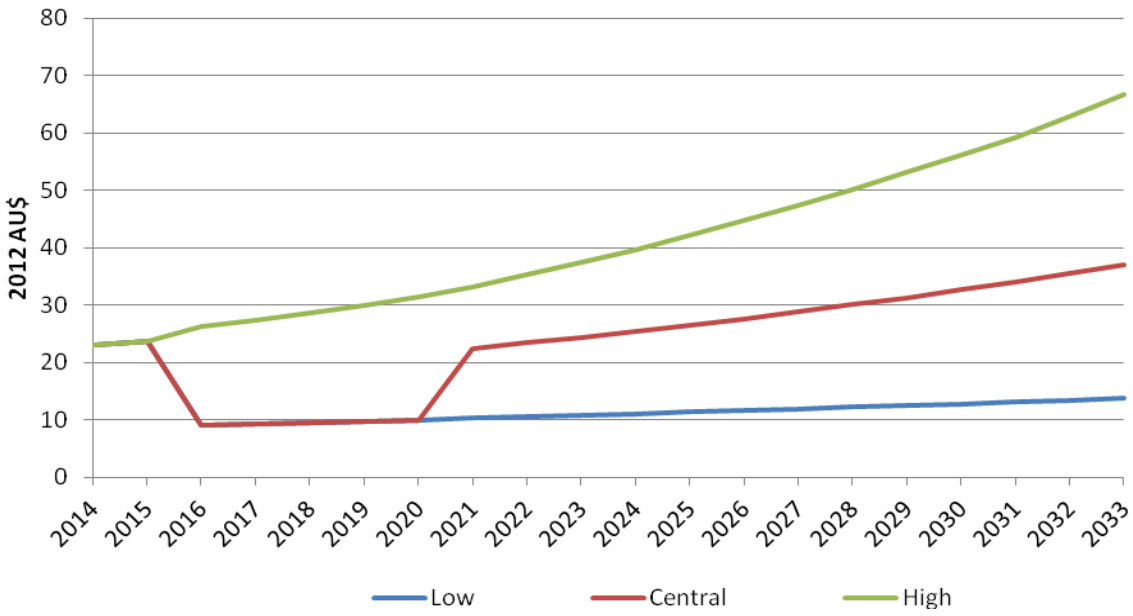
Carbon price paths

There is currently a high degree of uncertainty surrounding future carbon prices and possible sources of demand for Kyoto ACCUs. This was accounted for through the use of two additional carbon price paths:

- a low price path, where the carbon price follows the statutory price under the CE Act until 30 June 2015, falls to a nominal price of $10 in 2015-16 and then grows at 2.5 per cent real through to 2033;[81] and
- a high price path, where the carbon price follows the statutory price until 30 June 2015 and then tracks the Clean Energy Future price path from the Australian Treasury's *Strong Growth, Low Pollution* report for the remainder of the projection period.[82]

The three carbon price paths are shown in Figure 8.

Figure 8 Central, low and high carbon price paths, 2014 to 2033 (real 2012 AU$ per t CO_2-e)



Discount rate

As a financial analysis, future financial flows under the harvest and no-harvest scenarios should be discounted using the real opportunity cost of capital.[83] For Commonwealth projects, the Australian government's Office of Best Practice Regulation recommends the

[81] The 2.5% real growth rate was an arbitrary choice based on the assumption that there is ongoing uncertainty in domestic and international policy settings.
[82] Australian Treasury (2011).
[83] Perkins, F (1994). *Practical Cost Benefit Analysis*; Nas, T (1996). *Cost-Benefit Analysis: Theory and Application*; Harrison, M (2010). *Valuing the Future: the social discount rate in cost-benefit analysis*; Boardman et al. (2011). *Cost-Benefit Analysis: Concepts and Practice (4th ed.)*.

use of a real discount rate of 7 per cent for these purposes, with sensitivity analysis using rates of 3 per cent and 10 per cent.[84] The New South Wales Treasury recommends the NSW government employ a central real discount rate of 7 per cent, with sensitivity analysis using 4 per cent and 10 per cent.[85] Given the nature of the CFI project, and the fact that it offers dual benefits for both the federal and state governments, the rates recommended by the Office of Best Practice Regulation were used for current purposes. Ideally, the real after-tax average weighted cost of capital of the forestry industry should be used to discount its future returns.[86] Due to data limitations, however, the central 7 per cent real discount rate with sensitivity analyses of 3 per cent and 10 per cent were used for both the public and private sector financial flows assessed in this analysis.

Results and discussion

Carbon credits and who gets them

The Kyoto ACCUs and residual FM credits generated under the core (H1 and CC1) and sensitivity analysis (H2 and CC2) scenarios are presented in Table 7. There are several notable aspects of these results. First, the Australian government receives a significant number of residual FM credits in the harvest scenarios, even though no direct measures have been taken to reduce harvesting or net FM emissions. In the H1, H2 and H3 scenarios, the Australian government receives an average of between 0.6 million and 1.1 million FM credits each year over the projection period. This is a product of the methodology that was used to produce Australia's FM reference level. As discussed, the FM reference level is an extrapolation based on the average national harvest rate over the period 2002-2009, and the rate of roundwood removals in 2008. Harvesting in the SFR has fallen since the early 2000s and is likely to remain below the 2002-2009 levels for an extended period. This is reflected in the assumptions regarding log removals in the harvest scenarios. In the FM reference scenario, it was assumed that average native hardwood removals over the projection period were 508,018 m^3 per year. In contrast, in the H1 and H2 scenarios, removals were assumed to be 403,743 m^3 per year and 293,341 m^3 per year respectively. Due to this, even if the New South Wales government does not take steps to end native forest harvesting, the Australian government is likely to receive FM credits.

[84] Australian Government (2010). *Best Practice Regulation Handbook*.
[85] New South Wales Treasury (2007). *New South Wales Government Guidelines for Economic Appraisal*.
[86] Perkins (1994); Nas (1996).

Table 7 Total and average number of Kyoto ACCUs and residual FM credits generated over the projection period, scenarios H1, H2, H3, CC1 and CC2, methods 1 and 2, 2014 to 2033 (million)

Scenario	Aggregate (2014 to 2033)			Average (2014 to 2033)		
	Kyoto ACCUs	Residual FM credits	Total carbon credits	Kyoto ACCUs	Residual FM credits	Total carbon credits
H1	0.0	11.6	11.6	0.0	0.6	0.6
H2	0.0	21.8	21.8	0.0	1.1	1.1
H3	0.0	21.8	21.8	0.0	1.1	1.1
CC1 - method 1	33.8	12.8	46.6	1.7	0.6	2.3
CC1 - method 2	27.7	18.9	46.6	1.4	0.9	2.3
CC2 - method 1	24.6	22.0	46.6	1.2	1.1	2.3
CC2 - method 2	20.2	26.4	46.6	1.0	1.3	2.3

Secondly, the cessation of harvesting in the SFR generates a substantial number of carbon credits; 46.6 million over the projection period, or 2.3 million per year. In the second commitment period of the Kyoto Protocol, the aggregate number of credits generated is 14.1 million. Assuming Australia retains its current mitigation target of a 5 per cent emission reduction by 2020 on 2000 levels, the credits from the cessation of native harvesting in the SFR would equate to at least 2 per cent of the cumulative abatement task over this period. Whether the cessation of harvesting in the SFR will generate FM credits beyond 2020 is uncertain and will depend on the outcomes of the Durban Platform negotiations. Here it has been assumed that the accounting rules for the post-2020 era are the same as those in the second commitment period, which would result in the project generating a further 32.5 million credits over the period 2021-2033.

Thirdly, by ending native harvesting in the SFR, the New South Wales government could generate a total of between 27.7 million and 33.8 million Kyoto ACCUs over the projection period (an average of 1.4-1.7 million per year). With the lower baseline under CC2, the number of ACCUs is reduced to between 20.2 million and 24.6 million (1.0-1.2 million per year). Stopping harvesting in the SFR would generate abatement beyond 2033. However, whether the New South Wales government could receive the associated ACCUs will depend on the length of the crediting periods that are set for avoided public native forest harvesting projects under the CFI.

Finally, the methodology that is applied under the CFI Act merely determines the distribution of credits between the Australian and New South Wales governments. This is shown in both the CC1 and CC2 scenarios. Irrespective of what baseline is used for the CFI project, and what method is applied in determining the relevant net emissions, the total number of credits is the same (46.6 million). However, the different scenarios and different methods determine who receives the credits and in what form. The number of Kyoto ACCUs received by the New South Wales government is highest in the CC1 scenario, which has the highest CFI baseline, when method 1 is applied – the method that most closely resembles that applied by the Australian government when accounting for FM. The Kyoto ACCUs are lowest in the CC2 scenario, which has the lowest CFI baseline, when method 2 is applied. The reverse is the case for the Australian government; it receives the most residual FM credits in the CC2 scenario with method 2.

Net financial benefit under core harvest and no-harvest scenarios

Table 8a shows the aggregate net financial benefit generated by the New South Wales government, Forestry Corporation of NSW and the SFR's hardwood processors under the core scenarios (H1 and CC1) with a 7 per cent discount rate and using method 1 to calculate the carbon credits. Table 8b shows the net financial benefit received by the Australian government under the same scenarios.

Table 8a Net financial benefit generated by the New South Wales government, Forestry Corporation of NSW and the SFR's hardwood processors under the core (H1 and CC1) scenarios, method 1 (real 2012 AU$ million)

	Time period	
	2014 to 2020	**2014 to 2033**
Scenario H1: Net financial benefit generated by the Forestry Corporation of NSW and SFR hardwood processors from harvesting for chips and sawlogs at 2011-12 levels		
Low chip price ($80 per gt fob)	-$37.9	-$76.7
High chip price ($90 per gt fob)	-$19.2	-$39.9
Scenario CC1: Net financial benefit generated by New South Wales government by stopping harvesting and selling ACCUs, with ACCU prices following the central carbon price path		
Net financial benefit	$26.6	$222.0

Table 8b Net financial benefit received by the Australian government under the core (H1 and CC1) scenarios, method 1 (real 2012 AU$ million)

	Time period	
	2014 to 2020	**2014 to 2033**
Scenario H1: Net financial benefit received by Australian government under H1 scenario, with FM credit value determined using the central carbon price path		
Low chip price ($80 per gt fob)	$40.8	$140.7
High chip price ($90 per gt fob)	$40.8	$140.7
Scenario CC1: Net financial benefit received by Australian government under CC1 scenario, with FM credit value determined using the central carbon price path		
Net financial benefit	$42.6	$149.2

The two most significant results from the core scenarios are that:

- the net financial benefit generated from harvesting by the Forestry Corporation of NSW and the SFR's hardwood processors is negative under both the low and high woodchip price paths; and
- the net financial benefit generated by the New South Wales government from the CFI project exceeds the equivalent returns to the Forestry Corporation of NSW and the SFR's hardwood processors under the core harvest scenario by a considerable margin.

The net financial benefit from the CFI project over the period 2014-2020 is estimated at $27 million, and $222 million over the entire 20 year projection period. In comparison, the aggregate net financial benefit generated by the Forestry Corporation of NSW and the SFR's hardwood processors under the H1 scenario over the projection period is estimated at between -$40 million and -$77 million. These losses are attributable to SEFE and the Forestry Corporation of NSW. The estimated net financial benefit generated by these entities over the projection period is between -$53 million and -$89 million. These losses are partially offset by positive returns generated by the sawmills; their combined net financial benefit over the period 2014-2033 is estimated at $13 million.

The other notable aspect of the results is the net financial benefit received by the Australian government, which is similar in both the H1 and CC1 scenarios – the present value of the net benefits received over the period 2014-2033 in the H1 scenario is $141 million, compared to $149 million in the CC1 scenario. The similar result is attributable to the fact that the Australian government receives a large number of FM credits in the H1 scenario and that, under the CC1 scenario, the lost company tax revenue is effectively replaced by the revenue received via the residual FM credits.

Sensitivity analysis scenarios

As discussed, the sensitivity analysis scenarios were designed to address the four major uncertainties associated with the CFI project: baselines, carbon credit methods, carbon prices and the discount rate. Scenarios H2 and CC2 deal with the first of these issues by using a lower estimate of production, which is based on the assumption that the Batemans Bay mill is permanently closed and SEFE reduces production by one third compared to the levels seen in 2011-12. The results from these scenarios, assuming a 7 per cent discount rate and using method 1 to estimate the carbon credits, are set out in Tables 9a and 9b.

Table 9a Net financial benefit generated by the New South Wales government, Forestry Corporation of NSW and the SFR's hardwood processors under the H2 and CC2 scenarios, method 1 (real 2012 AU$ million)

	Time period	
	2014 to 2020	**2014 to 2033**
Scenario H2: Net financial benefit generated by the Forestry Corporation of NSW and SFR hardwood processors from harvesting for chips and sawlogs at reduced levels		
Low chip price ($80 per gt fob)	-$36.7	-$73.9
High chip price ($90 per gt fob)	-$24.2	-$49.4
Scenario CC2: Net financial benefit generated by New South Wales government by stopping harvesting and selling ACCUs, with ACCU prices following the central carbon price path		
Net financial benefit	-$2.3	$115.5

Table 9b Net financial benefit received by the Australian government under the H2 and CC2 scenarios, method 1 (real 2012 AU$ million)

	Time period	
	2014 to 2020	**2014 to 2033**
Scenario H2: Net financial benefit received by Australian government under H2 scenario, with FM credit value determined using the central carbon price path		
Low chip price ($80 per gt fob)	$72.6	$258.2
High chip price ($90 per gt fob)	$72.6	$258.2
Scenario CC2: Net financial benefit received by Australian government under CC2 scenario, with FM credit value determined using the central carbon price path		
Net financial benefit	$71.4	$255.7

The H2 and CC2 scenarios highlight the importance of the baseline to the financial outcomes from the CFI project. Under the CC2 scenario, and assuming the Kyoto ACCU price follows the central carbon price path, the net financial benefit generated by the New South Wales government from the sale of ACCUs over the projection period is estimated at $116 million; 48 per cent lower than in the corresponding CC1 scenario. Over the period 2014-2020, the net present value of the CFI project is negative (-$2 million). This is a product of the low carbon prices projected over the period 2016-2020. However, these losses are smaller than those under the corresponding harvest scenario – the combined net financial benefit generated by the Forestry Corporation of NSW and the hardwood processors in the H2 scenario is estimated at between -$24 million and -$37 million. The initial losses incurred via the CFI project are also recouped over the period 2021-2033.

Due to the reduction in ACCUs received by the New South Wales government in the CC2 scenario compared to the CC1 scenario, the Australian government receives a corresponding increase in its residual FM credits. This results in the net financial benefit received by the Australian government rising from $149 million to $256 million (Table 9b).

In both the H1 and H2 scenarios, the combined net financial benefit generated by the Forestry Corporation of NSW and the SFR's hardwood processors is negative under the two assumed woodchip price paths. This suggests that, if the prices received for woodchip exports do not rebound to the levels seen prior to the global financial crisis (which were above $100 per gt free on board (fob)), there is a risk that SEFE will no longer be financially viable. If SEFE closes, it could result in the collapse of the native forest sector in the SFR. This is consistent with the outcomes of scenario H3, which are presented in Table 10.

Table 10 Net financial benefit generated by the Forestry Corporation of NSW and the SFR's hardwood processors under the H3 scenario (real 2012 AU$ million)

	Time period	
	2014 to 2020	**2014 to 2033**
Scenario H3: Net financial benefit generated by the Forestry Corporation of NSW and sawmills from harvesting for sawlogs only at reduced levels		
Forestry Corporation of NSW	-$46.6	-$95.7
Sawmills	-$15.3	-$27.7
Total	**-$62.0**	**-$123.4**

Without SEFE, the estimated net financial benefit generated by the Forestry Corporation of NSW and the remaining SFR hardwood processors over the projection period is -$123 million. Further, in contrast to the situation under the H1 and H2 scenarios, the sawmills suffer losses in the H3 scenario. Their combined net financial benefit over the projection period is -$28 million. This illustrates the extent to which the profitability of the sawmills is contingent on the continued operation of SEFE and subsidised wood supply provided by the Forestry Corporation of NSW.

The uncertainty surrounding the methods that might be adopted for avoided native forest harvesting projects under the CFI was addressed through the application of method 2 to the CC1 and CC2 scenarios. The results from these scenarios, again with a 7 per cent discount rate, are shown in Tables 11a and 11b.

Table 11a Net financial benefit generated by the New South Wales Government under the CC1 and CC2 scenarios, method 2 (real 2012 AU$ million)

	Time period	
	2014 to 2020	**2014 to 2033**
Scenario CC1: Net financial benefit generated by New South Wales Government by stopping harvesting and selling ACCUs, with ACCU prices following the central carbon price path		
Net financial benefit	$22.6	$154.9
Scenario CC2: Net financial benefit generated by New South Wales government by stopping harvesting and selling ACCUs, with ACCU prices following the central carbon price path		
Net financial benefit	-$5.2	$66.7

Table 11b Net financial benefit received by the Australian government under the CC1 and CC2 scenarios, method 2 (real 2012 AU$ million)

	Time period	
	2014 to 2020	**2014 to 2033**
Scenario CC1: Net financial benefit received by Australian government under CC1 scenario, with FM credit value determined using the central carbon price path		
Net financial benefit	$46.6	$216.3
Scenario CC2: Net financial benefit received by Australian government under CC2 scenario, with FM credit value determined using the central carbon price path		
Net financial benefit	$74.4	$304.5

The key result from the application of method 2 is that it lowers the number of ACCUs received by the New South Wales government compared to method 1 (Table 7). As a result, the net financial benefit generated by the New South Wales government under the no-harvest scenarios also falls. For example, the net financial benefit under the CC1 scenario drops from $222 million to $155 million with the use of method 2. Notwithstanding this, the net benefits under the no-harvest scenarios still exceed those from the harvest scenarios. For example, the net financial benefit under the CC2 scenario over the projection period is estimated at $67 million, compared to between -$49 million and -$74 million in the corresponding H2 scenario.

To explore the implications of different carbon prices, two additional carbon price paths were applied to the no-harvest scenarios. The net financial benefit generated by the New South Wales government over the projection period under the CC1 and CC2 scenarios, using methods 1 and 2 and the three carbon price paths, are shown in Table 12a. Table 12b shows the net financial benefit received by the Australian government under the same scenarios.

Table 12a Net financial benefit generated by the New South Wales government under the CC1 and CC2 scenarios, methods 1 and 2, all carbon price paths, 2014 to 2033 (real 2012 AU$ million)

	ACCU method	
	Method 1	**Method 2**
Scenario CC1: Net financial benefit generated by New South Wales government by stopping harvesting and selling ACCUs, all carbon price paths		
Low	$56.6	$26.7
Central	$222.0	$154.9
High	$515.4	$396.0
Scenario CC2: Net financial benefit generated by New South Wales government by stopping harvesting and selling ACCUs, all carbon price paths		
Low	-$4.5	-$26.2
Central	$115.5	$66.7
High	$328.8	$242.0

Table 12b Net financial benefit received by the Australian government under the CC1 and CC2 scenarios, methods 1 and 2, all carbon price paths, 2014 to 2033 (real 2012 AU$ million)

	ACCU method	
	Method 1	**Method 2**
Scenario CC1: Net financial benefit received by Australian government under CC1 scenario, all carbon price paths		
Low	$86.8	$116.7
Central	$149.2	$216.3
High	$260.3	$379.7
Scenario CC2: Net financial benefit received by Australian government under CC2 scenario, all carbon price paths		
Low	$147.9	$169.7
Central	$255.7	$304.5
High	$446.9	$533.7

The results in Table 12a highlight the sensitivity of the returns from the CFI project to the projected carbon price. Under the high carbon price path, the net financial benefit generated by the New South Wales government under the CC1 scenario over the period 2014-2032 is

estimated at between $396 million and $515 million, depending on the carbon credit method that is applied. Under the low carbon price path, the equivalent range is between $27 million and $57 million.

Notably, scenario CC2 under a low carbon price path is the only no-harvest scenario in which the estimated net financial benefit received by the New South Wales government over the entire projection period is negative. The losses are greatest in the CC2 scenario with a low carbon price path, where method 2 is used to determine the ACCUs – the net financial benefit is -$26 million. Even in this instance, however, the returns to the New South Wales government from the CFI project are greater than the equivalent returns to the Forestry Corporation of NSW and the SFR's hardwood processors under the corresponding harvest scenario (H2, see Table 9a). In addition, these results do not account for the revenues received by the Australian government. In the CC2 scenario under a low carbon price path, where method 2 is used to determine the ACCUs, the estimated net financial benefit received by the Australian government over the projection period is $170 million. In the H2 scenario, the net financial benefit received by the Australian government is $151 million, again assuming the low carbon price path is followed. This suggests that, even if carbon prices are low throughout the projection period and woodchip export prices stabilise at around $90 per gt fob, the protection of the native forests of the SFR is likely to generate greater aggregate returns than those available through harvesting.

The final uncertainty addressed in the sensitivity analysis concerned the appropriate discount rate. Two additional rates were applied: 3 per cent and 10 per cent. The results suggest that changing the discount rate alters the magnitude of the benefits associated with the no-harvest scenarios but not the sign. This is illustrated in Table 13, which compares the net financial benefits over the period 2014-2033 under scenarios H1 and CC1 with the three discount rates.

Table 13 Net financial benefit generated by the Forestry Corporation of NSW, SFR hardwood processors, New South Wales government, and Australian government under the core (H1 and CC1) scenarios, method 1, with discount rates of 3 per cent, 7 per cent and 10 per cent, 2014 to 2033 (real 2012 AU$ million)

Recipient entity	Chip or carbon price	Discount rate		
		3%	7%	10%
Scenario H1: Net financial benefit generated by the Forestry Corporation of NSW, SFR hardwood processors and the Australian government under H1 scenario				
Forestry Corporation of NSW and SFR processors	Low chip price	-$104.5	-$76.7	-$63.1
	High chip price	-$54.7	-$39.9	-$32.6
Australian government	Low carbon price	$115.4	$84.2	$69.2
	Central carbon price	$208.8	$140.7	$108.9
	High carbon price	$357.8	$241.4	$186.8
Scenario CC1: Net financial benefit generated by New South Wales government and Australian government under CC1 scenario				
New South Wales government	Low carbon price	$78.3	$56.6	$46.7
	Central carbon price	$351.8	$222.0	$163.0
	High carbon price	$786.4	$515.4	$389.6
Australian government	Low carbon price	$118.6	$86.8	$71.5
	Central carbon price	$221.7	$149.2	$115.3
	High carbon price	$386.2	$260.3	$201.3

The use of the range of discount rates does not alter the main results of the analysis; namely, continued harvesting results in negative returns over the projection period and significantly higher returns could be generated by stopping harvesting and using the native forests to generate carbon credits. Although not shown in Table 13, the use of an alternative discount rate does not change the nature of the risks associated with a low carbon price in the no-harvest scenarios. With a 3 per cent, 7 per cent or 10 per cent discount rate, the CC2 scenario under the low carbon price path remains the only no-harvest scenario in which the estimated net financial benefit received by the New South Wales government is negative. All that is changed is the magnitude of the losses – the higher the discount rate, the lower the present value of the losses and *vice versa*. Further, under all three discount rates, the net financial benefit received by the New South Wales government in the CC2 scenario is greater than the equivalent returns generated by the Forestry Corporation of NSW and the SFR's hardwood processors under the corresponding H2 scenario.

Conclusion

The emergence of new carbon markets and decline of the native forest sector have raised questions about the economics of forest conservation versus commercial harvest. The analysis in this paper suggests that, in the absence of a rebound in relevant wood product prices (especially the export woodchip price), continued harvesting in the SFR is likely to lead to substantial aggregate financial losses. In the core harvest scenario (H1), the aggregate net financial benefits generated by the Forestry Corporation of NSW and the

SFR's hardwood processors over the period 2014-2033 was estimated at between -$40 million and -$77 million. These losses are borne by the Forestry Corporation of NSW and SEFE; the sawmills are projected to have positive net financial benefits over the projection period. This is mainly due to the fact that the Forestry Corporation of NSW and SEFE effectively cross-subsidise sawmilling. If SEFE closes, the analysis suggests that sawmilling in the SFR will not be financially viable.

Stopping harvesting and using the native forests of the SFR to generate carbon credits offers a viable alternative to commercial forestry. In the core no-harvest scenario (CC1, method 1), it was estimated that the New South Wales government could earn 33.8 million Kyoto ACCUs over the period 2014-2033 (an average of 1.7 million per year). The net financial benefit that could be generated through the sale of these credits (accounting for transaction and management costs) was estimated at $222 million. The Australian government would also receive the benefit of 12.8 million residual FM credits from the cessation of harvesting in the SFR over the period 2014-2033. However, if the New South Wales government receives ACCUs, the financial benefits to the Australian government are likely to be relatively small – the financial benefits received from the residual FM credits would be largely cancelled out by the lost company tax revenues associated with the cessation of harvesting.

Overall, the analysis supports two general conclusions:

- under current and likely future market conditions, the harvesting and processing of native logs in the SFR is likely to generate substantial losses; and
- the aggregate net financial benefits are likely to be significantly higher if commercial harvesting is stopped and the native forests of the SFR are used to generate carbon credits.

There are four main uncertainties associated with these conclusions. First, conditions in relevant domestic and international wood product markets could improve, or new markets may emerge for biomass feedstocks, including wood energy and biofuels.[87] This could revive the fortunes of native forest operators in the SFR. While possible, this seems unlikely. The Japanese pulp and paper industry is in long-term decline and is facing growing competition from other producers, particularly China. The Chinese woodchip market is competitive and becoming more so with the emergence of Vietnam and Thailand as major woodchip exporters. There is also a strong market preference for plantation-sourced chips. A biomass-driven recovery is also unlikely because of current domestic policy settings, social opposition to the use of native forests as feedstocks, excess capacity in key wood pellet markets and competition from other low-emission energy sources. Due to these factors, it is unlikely that commercial harvesting in the SFR will significantly exceed the levels forecast in the H1 scenario, at least in the short- to medium-term.

Secondly, avoided public native forest harvesting projects are not currently eligible to participate in the CFI. Amendments to the CFI Act and Regulations are currently being considered by the Australian government. Until these changes are made, the New South Wales government will not be able to generate ACCUs by stopping harvesting in the SFR.

Thirdly, the international accounting rules for forest management are only set for the duration of the Kyoto Protocol's second commitment period (2013-2020) and may not be the same under any post-2020 agreement that might emerge from the Durban Platform negotiations.[88] It was assumed in the analysis that the second commitment period FM accounting rules remain unchanged over the entire projection period (2014-2033).

[87] URS (2012); Macintosh (2013). *The Australian native forest sector*.
[88] UNFCCC Secretariat (2012).

Fourthly, even if avoided public native forest harvesting projects are made eligible to participate in the CFI and the second commitment period accounting rules are carried over into the post-2020 agreement, there are uncertainties regarding what baseline should be used in the project, what method should be used to calculate the ACCUs, what price ACCUs will attract in relevant markets and what discount rate should be applied when evaluating the financial merits of the project. The analysis here suggests that the conclusions on the merits of using the forests to generate carbon credits are relatively robust to these sources of uncertainty.

The two biggest sources of uncertainty identified in the analysis that could influence results were baselines and carbon prices. Given the precarious state of the sector, there is the potential for it to collapse before an offset project has been approved under the CFI. If this occurred, it is unlikely that any ACCUs could be generated by 'stopping harvesting' – harvesting would have already ceased. Even if the sector does not collapse, it could continue to contract, which could potentially lead to lower baselines being set for any CFI project that is initiated. Lower baselines reduce the number of ACCUs that could be generated by stopping harvesting and protecting the forests. Low future carbon prices are the other major threat to the financial viability of a carbon credit project. A combination of low carbon prices and a low baseline could result in an avoided native forest harvesting project producing negative returns. However, the analysis suggests that, even if these factors eventuate, using the forests to generate carbon credits is likely to generate greater aggregate net financial benefits than the returns available through harvesting.

A potential solution to the uncertainties surrounding the CFI and future carbon prices is for the Australian government to reach a financial agreement with the New South Wales government over the cessation of native forest harvesting in the SFR. Using this approach, there would be no CFI project and no ACCUs; the Australian government would simply pay the New South Wales government to end native forest harvesting. The benefits of a direct payment approach include:

- it reduces transaction costs;
- it allows for an upfront payment to be made to the New South Wales government that could be used to assist forest operators and employees to adjust to the policy change;
- it minimises the New South Wales government's exposure to the risks associated with the CFI rules, international accounting rules, and carbon prices;
- it places the project risks in the hands of the Australian government, which is better placed to manage the majority of the relevant uncertainties (e.g. through international climate negotiations and accounting practices); and
- it is broadly consistent with the federal Opposition's 'Direct Action Plan' approach.

The last of these issues is of particular importance. In the event of a change of federal government in 2013, the carbon pricing scheme that currently provides the major source of demand for ACCUs is likely to be abolished. As discussed, the federal Opposition has undertaken to replace the carbon pricing scheme with a baseline-and-credit scheme and other complementary measures, where the Australian government will be the primary purchaser of abatement. A direct payment approach for the SFR fits within the broad framework of the Opposition's approach and is likely to provide a relatively cost-effective source of abatement.

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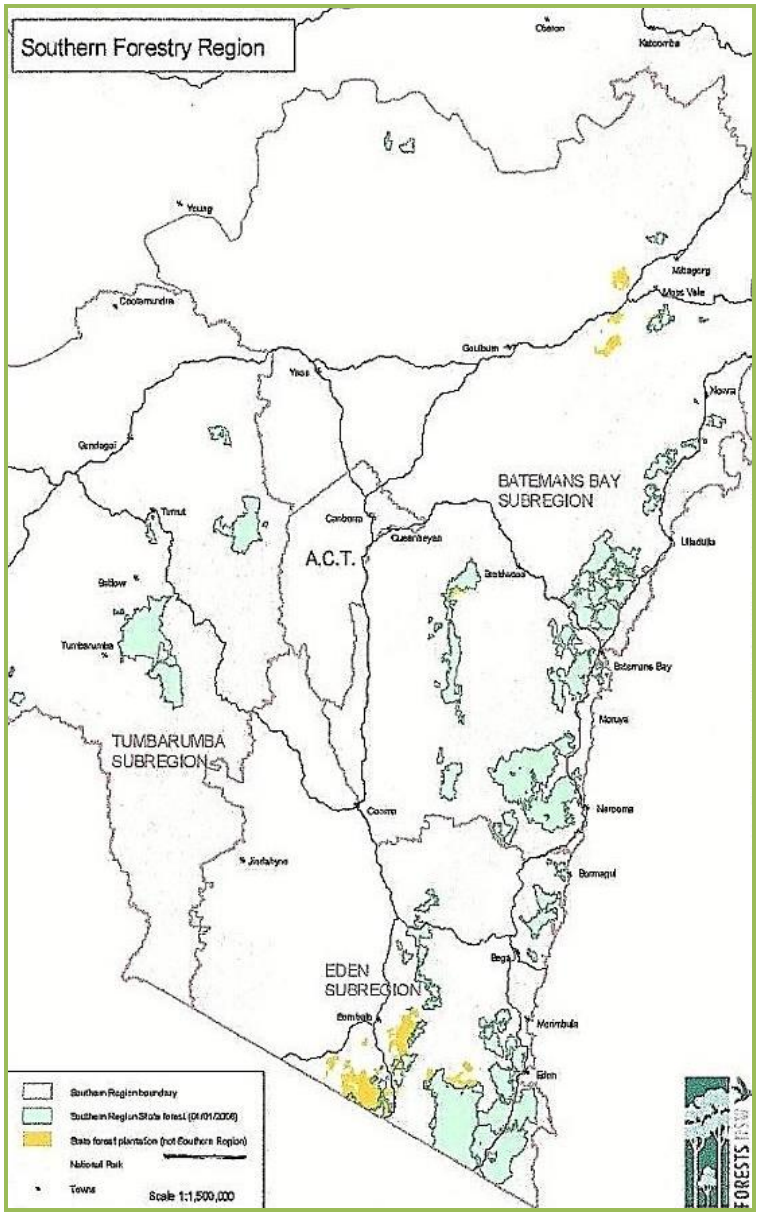
Appendix A: NSW's State Owned Southern Forestry Region, SFR



Source: Forests NSW.

Appendix B Harvest scenario assumptions

Table B1 Global harvest scenario assumptions

Issue	Assumption
Currency value	All values are reported in real 2012 Australian dollars.
Projection period	2014 to 2033
Discount rate	7%
Pulplog conversion factor (green density)	1 m^3 = 1.17 gt

Table B2 Harvest scenario assumptions – pulplogs and woodchips

Issue	Assumption		
Scenario	**H1**	**H2**	**H3**
Native pulplogs sourced from NSW SFR (gt yr^{-1})	338,542	225,694	NA
Pulplog processing waste %	4%	4%	NA
Hardwood chip exports (gt)	650,000	433,333	NA
Pulplog price (mill door) in 2014 (AU$ per gt)	$77.86	$77.86	NA
Real rate of increase of major expense items:			
Pulplog price	0%	0%	NA
Labour	1%	1%	NA
Electricity	2%	2%	NA
Repairs and maintenance	0%	0%	NA
Deprecation and financing costs	0%	0%	NA
Plantation costs	0%	0%	NA
Other operating expenses	0%	0%	NA
Woodchip price (AU$ per gt):			
Low price	$80	$80	NA
High price	$90	$90	NA

Table B3 Harvest scenario assumptions – sawmills

Scenario	H1	H2	H3
Sawlogs processed (m^3 yr^{-1})	98,241	88,706	88,706
Average sawlog stumpage in 2014 (AU$ per m^3)	$51.62	$51.62	$51.62
Log harvest and haulage cost in 2014 (AU$ per m^3)	$53-$64	$53-$64	$85-$95
Real rate of increase of major expense items:			
Sawlog price	0%	0%	0%
Log harvest and haulage costs	1%	1%	1%
Transport (sawn timber products)	1%	1%	1%
Labour	1%	1%	1%
Electricity	2%	2%	2%
Repairs and maintenance	0%	0%	0%
Deprecation and financing costs	0%	0%	0%
Inventories*	0%	0%	0%
Other operating expenses	0%	0%	0%
Average sawn timber sale price in 2014 (AU$ per m^3)	$653-$884	$653-$884	$653-$884
Real rate of increase of sawn timber price	1%	1%	1%

* Boral mills only.

Table B4 Forests Corporation of NSW harvest scenario assumptions

	Assumption		
Scenario	**H1**	**H2**	**H3**
Sawlogs supplied to SFR (m^3 yr^{-1})	98,241	88,706	88,706
Pulplogs supplied to SEFE (gt yr^{-1})	338,542	225,694	0
Average sawlog stumpage in 2014 (AU$ per m^3)	$51.62	$51.62	$51.62
Real rate of increase of sawlog stumpage	0%	0%	0%
Average pulplog stumpage in 2014 (AU$ per m^3)	$13.20	$13.20	NA
Real rate of increase of pulplog stumpage	0%	0%	0%
Revenue from other products and services in 2014	$1.4 million	$1.2 million	1.2 million
Real rate of increase of other revenue	0%	0%	0%
Pre-harvest preparation cost in 2014	$3.0 million	$2.7 million	$2.7 million
Log harvest and haulage cost in 2014	$9.1 million	$7.4 million	$5.2 million
Labour costs in 2014	$6.0 million	$5.4 million	$5.4 million
Head office costs attributed to SFR in 2014	$3.4 million	$3.1 million	$3.1 million
Other operating expenses in 2014	$1.6 million	$1.4 million	$1.4 million
Real rate of increase of major expense items:			
Pre-harvest preparation costs	0%	0%	0%
Log harvest and haulage costs	1%	1%	1%
Labour	1%	1%	1%
Head office	0%	0%	0%
Other operating expenses	0.5%	0.5%	0.5%