Motu Working Paper 20-11

Decision trees: Forestry in the New Zealand Emissions Trading Scheme post-2020

Motu economic & public policy research

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October 2020 (updated in October 2021)

Document information

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Acknowledgements

We would like to thank New Forests for commissioning this project and providing the core funding for the work to proceed. We also appreciate and thank Suzi Kerr, Ollie Belton, and Sophie Hale for early input. We further appreciate and thank a peer reviewer for critically reading the document and suggesting substantial improvements.

Disclaimer

Naturally, all errors, omissions and opinions expressed are the responsibility of the authors. This paper was re-issued in October 2021 with a corrigendum detailing changes since it was first published in October 2020.

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New Zealand

 ISSN 1176-2667 (Print), ISSN 1177-9047 (Online).

Abstract

In June 2020, the New Zealand Government passed the Climate Change Response (Emissions Trading Reform) Amendment Act 2020 (ETR Act) to reform the architecture of the New Zealand Emissions Trading Scheme (NZ ETS). As a result of the ETR Act, from 1 January 2023, post-1989 forest land will be classified either as standard post-1989 forest (stock change), standard post-1989 forest (averaging) or permanent post-1989 forest. This paper collates information for obtaining New Zealand Units from these three forestry activities via the NZ ETS and summarises the most recent decisions regarding forestry-related accounting methods and operational changes to the NZ ETS.

JEL codes

H23, Q54

Keywords

Forestry, emissions trading scheme, climate change, environment, New Zealand, indigenous forest, exotic forest

Summary haiku

Forest accounting
varies like the seasons, but
remains essential

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1 Introduction

New Zealand is in a crucial period of transitioning to a low-emissions economy.[1] This transition is part of the country's international commitments, most recently under the 2015 Paris Agreement, to address the impacts of climate change and to limit the rise in global temperature (New Zealand Government, 2015).

In November 2019, the New Zealand Government passed the Climate Change Response (Zero Carbon) Amendment Act 2019 (hereafter Zero Carbon Act), which established a new overarching framework for reducing net Greenhouse Gas (GHG) emissions.[2] First, the Zero Carbon Act includes the definition of a 2050 target and a requirement for the Government to prepare five-year emissions budgets as stepping stones to reach the 2050 target.[3] Second, it includes associated emissions reduction plans and a requirement for national assessment and planning for adaptation. Third, it establishes an independent Climate Change Commission to provide technical advice and monitor New Zealand's progress with both mitigation and adaptation.

Important foundational work has already been conducted on decarbonisation pathways for New Zealand. In 2017, for example, the Government tasked the New Zealand Productivity Commission with identifying options to facilitate the transition to a low-emission economy while supporting growth in income and wellbeing. As a result, the Productivity Commission (2018) recommended three fundamental changes:

- a transition from fossil fuels to electricity and other low-emission fuels across the economy;
- changes to the structure and methods of agricultural production;
- substantial levels of afforestation to offset New Zealand's remaining emissions.

[1] A low-emissions economy aims to reduce the output of Greenhouse Gas (GHG) emissions while at the same time continuing to grow incomes and wellbeing.

[2] Net emissions represent the amount of GHGs contributing to atmospheric concentration of GHGs from the energy, Industrial Processes and Product Use (IPPU), agriculture and waste sectors, together with GHG emissions and removals from the Land Use, Land-Use Change and Forestry (LULUCF) sector (Ministry for the Environment, 2020a).

[3] The 2050 target takes an innovative split-gas approach. For biogenic methane, the target is to reduce emissions at least 10 per cent below 2017 levels by 2030 and 24–47 per cent below 2017 levels by 2050. For all other GHGs, the target is to reach net zero emissions by 2050.

The Productivity Commission also proposed several actions for a stable and credible policy environment. These include the development of a new architecture for the domestic climate change legislation with stable and enduring laws, and a reform of the New Zealand Emissions Trading Scheme (NZ ETS).[4]

In June 2020, the Government passed the Climate Change Response (Emissions Trading Reform) Amendment Act 2020 (hereafter ETR Act) to reform the architecture of the NZ ETS. Starting in 2021, the Government will introduce auctioning of emission units under an absolute cap that aligns with the emissions budgets and targets established under the Zero Carbon Act.[5] The ETR Act changes emission price safeguards by phasing out the $25 fixed-price option operating since 2010 (with a transitional increase to $35 per tonne[6]) and introducing a volume-limited cost containment reserve and reserve price operationalised through auctioning.

The ETR Act also incentivises greater uptake of afforestation by introducing a new "averaging accounting" regime for new post-1989 forests, creating a new permanent forestry activity for post-1989 forest land,[7] and making other operational improvements to forestry provisions. The new measures for managing unit supply and emission prices will assist the NZ ETS in helping New Zealand achieve its broader climate change goals (Ministry for the Environment & Ministry for Primary Industries, 2020).

Forestry is one of New Zealand's most affordable means of net emissions reduction, and a significant domestic component of mitigation (Karpas & Kerr, 2011; Ministry for the Environment, 2020b). The expansion of forest land is considered central to achieving New

[4] Emissions trading is a market-based instrument to limit GHG emissions from covered sectors. Under these systems, a government sets a regulatory limit on emissions, which translates into a market price creating an economic incentive to reduce emissions and enhance removals. Participants from covered sectors are required to surrender a tradable emission unit (or allowance) for each tonne of emissions for which they are liable. Emission units can be allocated for free, bought from other participants (through domestic or international trading), purchased at government auction, or earned by removal activities such as forestry (Leining & Kerr, 2018).

[5] The ETR Act enables a cap on GHG emissions covered by the NZ ETS. It will decline over time as emissions budgets are reduced in line with achieving New Zealand's 2050 target. For further commentary, see Ministry for the Environment (2020d).

[6] Assuming that auctioning starts in 2021, the $35 fixed price option will be available for unit surrenders in 2021 in respect of emissions in 2020.

[7] Permanent forests are restricted from deforestation and clear-fell harvesting for at least 50 years. Additionally, the forest land under this activity must remain registered in the NZ ETS for at least 50 years as permanent forestry.

Zealand's international and domestic targets for net GHG emissions alongside significant reductions in gross emissions from other sectors. However, for forestry to constitute a valid offset for emissions from other sectors, attributed forest carbon benefits must be maintained. This requires accounting for any subsequent reversal of those benefits over time (e.g. from harvesting, deforestation or adverse events) so it is factored into the achievement of emission reduction targets.[8] In this regard, permanent forestry offers advantages relative to plantation regimes.

Based on the amendment legislation and supporting policy documentation, we have prepared this paper to help inform landowners, NZ ETS market participants, and other stakeholders about the significant changes to NZ ETS forestry rules under the ETR Act. We concentrate on the choices facing landowners as they consider registering new post-1989 forests in the NZ ETS and the factors that could influence them to choose between standard and permanent forestry activities. This paper does not consider broader strategic policy issues about the potential scale of forestry removals that should apply toward meeting New Zealand's Nationally Determined Contribution under the 2015 Paris Agreement or New Zealand's future emissions budgets pursuant to the Zero Carbon Act 2019.

We begin with a brief overview of the main features of the NZ ETS and the role of forestry to provide context for the discussion. This is followed by a more detailed discussion of the accounting rules for post-1989 forest land. We conclude with a section covering key trade-offs to consider when registering post-1989 forest land in the NZ ETS as standard or permanent forest.

2 General features of the NZ ETS

The NZ ETS was established in 2008 by an amendment to the Climate Change Response Act 2002 and has undergone subsequent rounds of amendments. The NZ ETS supports and encourages global efforts to reduce GHG emissions by assisting New Zealand to meet (i) its international obligations under the United Nations Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol and the Paris Agreement; and (ii) its 2050 target and emissions budgets established under the Zero Carbon Act.

The NZ ETS was designed as a cap-and-trade system, but from 2008 through 2020 it has operated without a cap limiting domestic net emissions. The ETR Act introduces a cap – referred

[8] Different forestry accounting rules for the reversal of attributed forest carbon benefits may apply under New Zealand's international and domestic emission reduction targets. Differences in accounting at the international and domestic levels may have fiscal implications for the Government.

to as an "overall limit" – guided by emissions budgets. The cap structure includes an individual limit on the number of New Zealand Units (NZUs) supplied to the market through auctions, and an individual limit on any future use of approved overseas units by Emissions Trading Scheme (ETS) participants should this become possible in the future.[9] The cap does not place a limit on NZUs from forestry, nor does it limit free allocation to the industrial and agriculture sectors.[10]

The NZ ETS was designed to cover the major sources of GHG emissions as well as removals from all economic sectors, but has applied a phase-in period with sectors entering at different stages.[11] The NZ ETS regulates emissions of carbon dioxide (CO_2), methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride, while removals can result from both forestry and industrial activities.

Table 1 summarises the general features of the NZ ETS.

[9] The NZ ETS has not accepted overseas units since mid-2015.

[10] Under the Climate Change Response Act 2002, free allocation to the industrial and agriculture sectors is provided annually on an output basis. This is calculated as the product of an allocative baseline (emissions per unit of output), actual annual output, and a level of assistance which varies by activity (starting at 90/60 per cent for highly/moderately emissions-intensive and trade-exposed industrial producers and 95 per cent for agricultural producers). Allocative baselines are defined in regulation. Free allocation to the agriculture sector will begin when participants face unit surrender obligations.

[11] As of 2020, the forestry, stationary energy (electricity and heat), transport, industrial processes, synthetic GHGs and waste sectors carry obligations to both report emissions and surrender emission units, while biological emissions from agriculture (animal production and nitrogen fertilisers) carry reporting obligations only.

Table 1. General features of the NZ ETS

Feature	Details
Participants	Participants carry out a specified type of activity defined in the Climate Change Response Act 2002 and are required to report a defined set of GHG information. Participants carry an obligation to surrender emission units or have an opportunity to earn units for removal activities (from forestry, for instance). Depending on the type of activity carried out, participation in the NZ ETS can either be mandatory or voluntary (Climate Change Response Act 2002, Schedules 3 and 4).[12]
Obligations	Participants have three core obligations: (i) collect and record information on emissions or removals of GHGs that resulted from their activities, (ii) report this information to the Environmental Protection Authority (EPA) by periodically filing an emissions return; and (iii) surrender emission units to cover reported emissions or claim units for removals (Climate Change Response Act 2002, s 62-63).
Unit of trade	The primary unit of trade in the NZ ETS is NZU. One NZU represents one tonne of carbon dioxide equivalent (CO_2eq) and can cover both emissions and removals.
Registry	The New Zealand Emissions Trading Register (the Register) is the national registry for emission units, including those owned by the Crown. The EPA operates the Register. Anyone who wants to receive, own or trade NZUs or other emission units in the country must hold an account in the Register.
Allocation of NZUs	As of 2020, NZUs are issued in the form of free allocation to eligible emissions-intensive and trade-exposed industrial producers and for forestry and industrial removals.[13] The Government will begin auctioning NZUs in 2021.

[12] The mandatory activities fall into the categories of liquid fossil fuels, stationary energy (e.g. importing coal), industrial processes (e.g. producing gold or aluminium), agriculture (e.g. fertiliser and animals), waste, and deforestation of pre-1990 or pre-1990 offsetting land (Climate Change Response Act 2002, Schedule 3).

[13] An industrial removal involves a product that contains a substance that would result in emissions if not embedded and (i) is permanently embedded in the product, or (ii) is temporarily embedded in the product, and the product is exported with the substance embedded (Climate Change Response Act 2002, Schedule 4, Part 2).

Feature	Details
Price management	As of 2020, the NZ ETS operates with a fixed-price mechanism enabling participants to purchase unlimited NZUs from the Government for immediate surrender (i.e. not for banking or trading). The Fixed Price Option (FPO) is set at $25 per tonne for 2019 emissions (surrender date of May 2020) and will increase to $35 for 2020 emissions (surrender date of May 2021).[14] The ETR Act will introduce a volume-limited Cost Containment Reserve (CCR) with a trigger price as well as a reserve price operationalised at auction (anticipated to start in 2021). Unit prices in the secondary market could be above the CCR trigger price or below the reserve price.
Linking	Since mid-2015, the NZ ETS has operated as a domestic-only system. In the future, the Minister could use regulations to approve overseas units eligible for use in the NZ ETS.[15] Under the ETR Act, any future use of approved overseas units by ETS participants would be subject to a quantity limit defined in regulation.
Non-compliance	There are both civil and criminal penalties for non-compliance by participants. In the ETR Act, from 1 January 2021, the penalty for failure to surrender NZUs consists of a make-good requirement plus payment of three times the market price.[16] Other penalties apply for failure to comply with data collection, record-keeping, reporting, registration, or notification requirements or knowingly providing false information about surrender NZUs.

[14] The FPO will be extended in respect of emissions in years beyond 2020 to the extent that the introduction of auctioning is delayed beyond 2021. Participants with post-1989 forests registered in the NZ ETS, who submit an emissions return that covers multiple years, will have access to the FPO on a pro-rata basis. The pro-rata FPO gives the option to pay money instead of surrendering, repaying, or reimbursing NZUs in respect of those emissions that occurred as follows: (i) for emissions attributed to 2019 or earlier, the fixed price is $25; or (ii) for emissions attributed to 2020 or later, but before the start of the calendar year when auctioning begins, the fixed price is $35. For more information see the ETR Act, s 153 (2)(b)(i) and s 155.

[15] The government has articulated a framework for international carbon market cooperation which identifies objectives and principles for ensuring the environmental integrity of overseas units used to help meet New Zealand's international targets and support effective operation of the NZ ETS (Ministry for the Environment, 2019).

[16] Reduced penalties apply to transactions relating to forestry activities conducted before 2023 and involving less than 25,000 units. For further information see the ETR Act, s 232(2) at [17].

3 Forestry in the NZ ETS

Since the beginning of its operations, the NZ ETS has included forestry as an obligated sector for deforestation emissions, representing the first and only scheme in the world to do so. The forestry sector was the first sector included in the NZ ETS because of its significant role in removing CO_2 from the atmosphere through forest growth and contributing emissions from deforestation (Carver et al., 2017; Karpas & Kerr, 2011; Lough & Cameron, 2018).

The NZ ETS treats forests differently depending on the date of their establishment, regardless of the predominant forest species on the land.[17] This treatment reflects the activity-based rules applicable to the country's targets as introduced under the Kyoto Protocol,[18] under which the reference year for accounting for eligible changes in emissions and removals from the Land Use, Land-Use Change and Forestry (LULUCF) sector is 1990.[19] Before describing the differences between the treatment of forest established pre-1990 and post-1989, we note the definition of forest land in the NZ ETS.

Eligible forest (or forest land) is an area of land of at least 1 hectare that has (or is likely to have) tree crown cover from tree species (or forest species) of more than 30 per cent in each hectare. The tree species must be capable of reaching at least 5 metres in height at maturity in

[17] In New Zealand, forest species can be indigenous or exotic. The Climate Change Response Act 2002 defines (i) indigenous forest species as forest species that occur naturally or have arrived in New Zealand without human assistance, and (ii) exotic forest species as forest species that are not an indigenous forest species. Exotic species were introduced by human activity, typically for commercial interests, which are planted and managed with the intention of producing wood or wood fibre (Ministry for Primary Industries, 2019). The predominant exotic species are *Pinus radiata*, Douglas fir, exotic softwood, or exotic hardwood. *Pinus radiata*, given its relatively fast growth cycle, accounts for 90 per cent of New Zealand's planted production forests (Scion, 2017).

[18] The Kyoto Protocol's activity-based forestry accounting rules for Annex B (industrialised) countries took effect from 2008. New Zealand has applied these rules to its international targets from 2008 to 2012, when it took its target under the Kyoto Protocol, and from 2013 to 2020, when it took its target under the UNFCCC. In some cases, NZ ETS forestry rules have diverged from Kyoto Protocol rules. In its annual GHG inventory, New Zealand also continues to report forestry emissions and removals following the carbon-stock-change accounting conventions prescribed under the UNFCCC.

[19] This convention was first adopted in relation to Article 3.3 of the Kyoto Protocol for 2008-2012 and New Zealand has applied it to subsequent targets taken under the UNFCCC and the Paris. This convention differs from the rules used for national GHG inventory accounting from the Intergovernmental Panel on Climate Change.

the place where they are located. Tree species grown primarily for fruits or nuts are excluded. Forest land does not include shelter belt where the tree crown cover has (or is likely to have) an average width of less than 30 metres, or an area of land where the forest species have (or are likely to have) a tree crown cover of an average width of less than 30 metres unless the area is contiguous with land that meets the previous requirements (see Figure 1).

In the NZ ETS, the distinction between pre-1990 and post-1989 forest land determines participants' responsibilities regarding harvest and deforestation, and their eligibility to earn NZUs. Table 2 provides more details about the forest land classification and its obligations.

The NZ ETS regulates pre-1990 forest land with primarily exotic species.[20] Participants must surrender NZUs equivalent to the loss of carbon if pre-1990 forest land is deforested (referred to as a deforestation liability), but do not bear an emissions liability for harvesting followed by replanting and cannot earn NZUs for activities that increase carbon stocks on that land (e.g. pest management). However, participants who deforest pre-1990 forest land can avoid the deforestation liability by establishing a carbon-equivalent forest elsewhere – a practice called "forest offsetting".[21] Other specific exemptions also apply.[22]

On the other hand, registration of post-1989 forest land in the NZ ETS is voluntary. Participants earn NZUs for the carbon sequestered as their registered forest grows, and those using carbon stock-change accounting (rather than averaging accounting) face liabilities when the forest is harvested (referred to as a harvest liability); we discuss the harvest liability further

[20] Indigenous forest established before 1 January 1990, which is land wholly or predominantly under the cover of indigenous species, has special protections under the Forest Act 1949 and the Resource Management Act 1991. These protections include the harvesting, milling and exporting of indigenous timber in order to maintain forest cover and ecological balance (Karpas & Kerr, 2011).

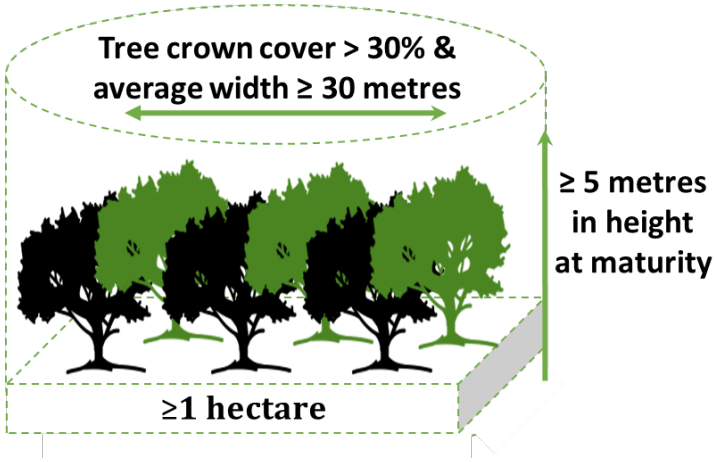
[21] Deforestation does not carry an NZ ETS emissions liability if it: (i) is contiguous with the edge of pre-1990 forest land that existed on 31 December 2007; and (ii) is an area that is less than 1 hectare or that is less than 30 metres wide at its widest point; and (iii) is required to be or remain cleared to implement New Zealand's best-practice forest management; and (iv) is used only for the purpose of implementing New Zealand's best-practice forest management (Climate Change Response Act 2002, s 179A).

[22] Exemptions from deforestation obligations apply in the following cases: (i) forest clearance was due to a natural event that prevents re-establishing a forest; (ii) less than 2 hectares of pre-1990 forest is deforested in any 5-year period commencing from 1 January 2008; (iii) the area of forest has been granted an exemption for tree weeds; (iv) the landowner has less than 50 hectares of forest; or (v) minor clearing occurs on forest edges below a threshold and in line with best practice for forest management. Additionally, the ETR Act 2020 s 160 provides exemptions for some Māori land or land with 10 or more owners.

in the following section.[23] Moreover, if a registered post-1989 forest is deforested, then all NZUs earned must be repaid to the Crown (a deforestation liability). Post-1989 forest land can comprise indigenous or exotic species. The predominant tree species in a hectare determines the type of species used for calculating the NZUs associated with the registered land.

Participants calculate the carbon stored in their registered post-1989 forest land when filing an emissions return with the Government. An emissions return reports the changes in the carbon stocks in each Carbon Accounting Area (CAA) during a specified period (Ministry for Primary Industries, 2020).[24] For registered post-1989 forest, participants must submit an emissions return to the Ministry for Primary Industries within six months after the end of every five-year Mandatory Emissions Return Period (MERP) (for example, ending in 2012, 2017 and 2022).[25] They can also submit voluntary emissions returns in each year when a MERP is not required.

Figure 1. Forest land in the NZ ETS



[23] Regardless of the accounting method used, the ETR Act introduces, from 1 January 2023, a regime to allow participants with registered post-1989 forest land to suspend their liability to surrender, and entitlement to receive, NZUs if the land is subject to an event that temporarily adversely affects the land (Climate Change Response Act 2002, s 193).

[24] A CAA is the area of registered post-1989 forest land for which participants are required to report changes in the carbon stock over time (Ministry for Primary Industries, 2018).

[25] A "mini-MERP" has been introduced to align mandatory emissions reporting in the NZ ETS to the country's international reporting on the 2030 target under the Paris Agreement. This mini-MERP is a three-year period starting on 1 January 2023 and ending on 31 December 2025. After this period, MERPs will continue being five-year periods consecutively.

Table 2. Forest land classification in the NZ ETS and its obligations

	Pre-1990 forest land	**Post-1989 forest land**
Tree species considered	Predominantly exotic species.	Indigenous and exotic species.
Participation in the NZ ETS	Mandatory if either pre-1990 forest land or pre-1990 offsetting forest land is deforested.	Voluntary.
Participants	Owners of pre-1990 forest land. When a third party has a deforestation right and landowners have no control over the decision, the third party becomes the participant.	Three options are: (i) owners of post-1989 forest land that is not subject to a forest sink covenant; (ii) holders of a registered forestry right or leaseholders, under the registered forestry right leased; or (iii) those who are part of a Crown conservation contract in respect of the land.
Emissions returns	Yes – Required when pre-1990 forest land is deforested.	Yes – Required within six months of the end of every five-year MERP, regardless of whether participants submitted voluntary emissions returns during the period. Voluntary emissions returns can be submitted each year to claim NZUs.
Accounting methods	Carbon stock-change accounting is the method used for calculating reductions in the carbon stocks when pre-1990 forest land or pre-1990 offsetting forest land is deforested.	Two methods are carbon stock-change accounting and averaging accounting. See Table 3.
Categories	Pre-1990 forest land.	The categories are: (i) permanent post-1989 forest, (ii) standard post-1989 forest (stock change), and (iii) standard post-1989 forest (averaging). See Table 4.

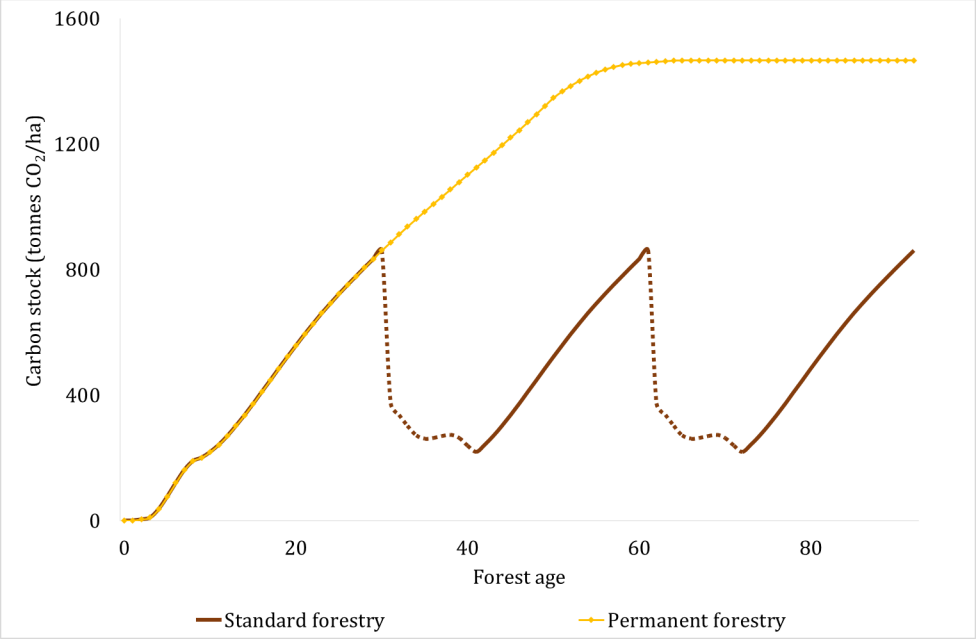
	Pre-1990 forest land	Post-1989 forest land
Harvest liability	No – Participants can harvest and replant their pre-1990 forest land without needing to pay NZUs back to the Crown.	Yes – When carbon stock-change accounting applies. No – When averaging accounting applies. See Table 4.
Deforestation liability	Yes – When pre-1990 forest land or pre-1990 offsetting forest land is deforested, equivalent NZUs must be paid back to the Crown (note some exceptions apply).	Yes – When registered post-1989 forest land is deforested, equivalent NZUs must be paid back to the Crown (note some exceptions apply).
Forest offsetting	Yes – Participants can apply to offset the deforestation of pre-1990 forest land by establishing an equivalent forest. This forest is known as pre-1990 offsetting forest land.	Yes – When averaging accounting applies. See Table 4. No – When carbon stock-change accounting applies.
Definition	Forest land that (i) was forest land on 31 December 1989; and (ii) remained as forest land on 31 December 2007; and (iii) where the forest species on the forest land on 31 December 2007 consisted predominantly of exotic forest species. Also included as pre-1990 forest land is any exempt land or pre-1990 forest land deforested, even if the deforestation liabilities have been paid back to the Crown. Exempt land is either (i) pre-1990 forest land with an area less than 50 hectares, some Māori freehold land or land with ten or more landowners, or land with tree weed (Climate Change Response Act 2002, s 183 – s 184).	Forest land that was either: (i) not forest land on 31 December 1989; (ii) forest land on 31 December 1989, but was deforested between 1 January 1990 and 31 December 2007; (iii) pre-1990 forest land, other than exempt land, that was deforested on or after 1 January 2008 and the deforestation liabilities have been paid back to the Crown; (iv) pre-1990 forest land, other than exempt land, that was deforested on or after 1 January 2003 inclusive and offset by pre-1990 offsetting forest land; (v) pre-1990 offsetting forest land that was deforested after 1 January 2013 and the deforestation liabilities have been paid back to the Crown; (vi) exempt land that has been deforested, and the deforestation liabilities have been paid back to the Crown; or (vii) exempt land that has been deforested more than eight years ago; and is not pre-1990 offsetting forest land.

4 NZ ETS accounting rules for post-1989 forest land

Under the ETR Act, post-1989 forest land registered in the NZ ETS from 1 January 2023 will be categorised as standard or permanent forest. One of the main differences between these two forestry activities is that permanent forests will be restricted from deforestation and clear-fell harvesting for at least 50 years.[26] These restrictions seek to increase and maintain carbon or stocks over time.

Figure 2 shows an example of the carbon stocks in permanent forests (see the yellow line) and changes in carbon stocks in a standard forest managed as a plantation regime with two rotations (see the brown line). The solid brown line shows carbon stocks in standard forests, whereas the dotted brown line shows carbon released back to the atmosphere. It is useful to note that permanent and standard forests follow the same profile until the first harvest.

Figure 2. Carbon stock in standard and permanent forests



Note: Based on look-up tables for post-1989 forest land. Carbon stock per hectare reported for *Pinus radiata*, Gisborne (Ministry for Primary Industries, 2017). The values for permanent forestry after age 50 are indicative. Currently, the regulation states that if the age of the forest extends beyond the last age in the yield table, the last value for the carbon stock applies indefinitely. However, this statement might be subject to further amendments.

[26] Under the Climate Change Response Act 2002, an area of land is considered to be clear-felled when at least in one hectare, any trees are cleared or killed by any form of human activity, including felling, harvesting, burning, removing by mechanical means, or spraying with a herbicide intended to kill the tree; and after that type of clearing or killing, the tree crown cover is less than 30 per cent in each hectare.

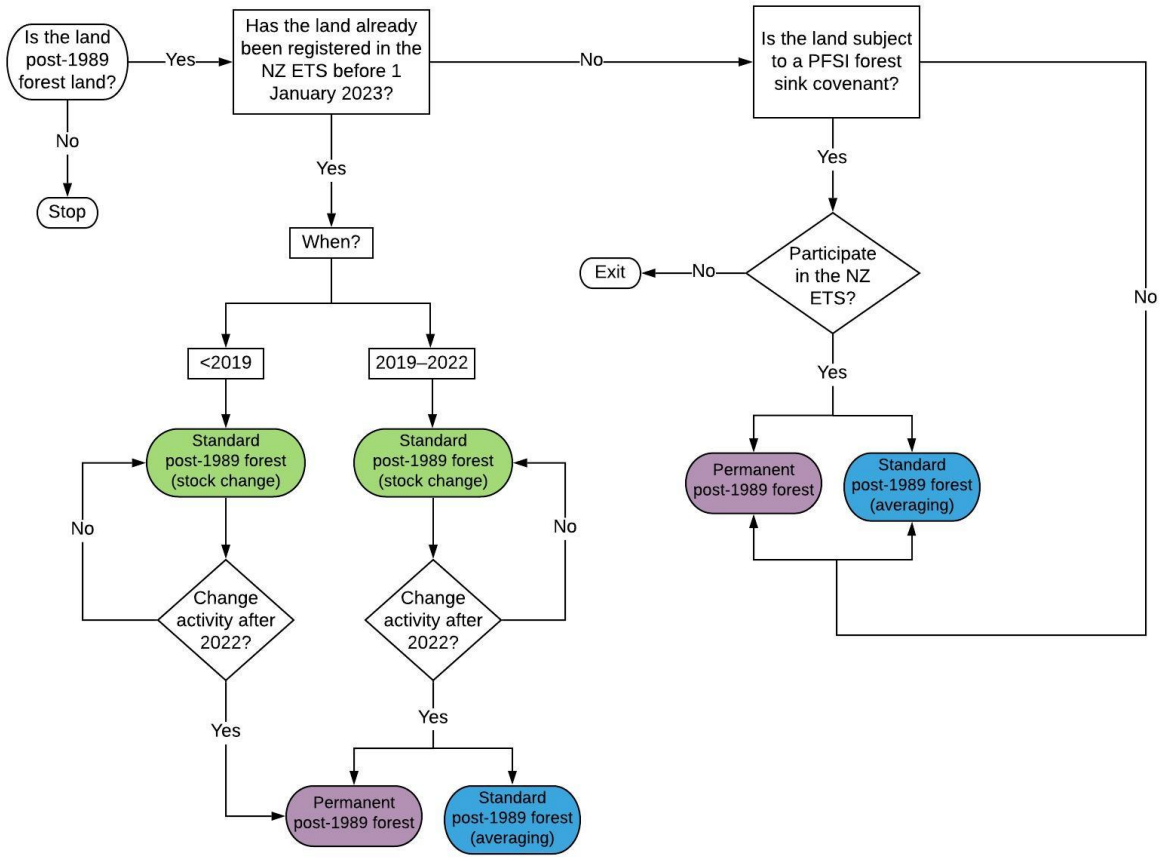
From 1 January 2023, two accounting methods will apply for calculating the changes in carbon stock in post-1989 forest land: carbon stock-change and averaging accounting. The main difference between these two accounting methods is that participants using carbon stock-change accounting calculate carbon sequestered as their forest grows. In contrast, participants who use averaging accounting can calculate carbon sequestered as their forest grows up to a pre-determined average level of long-term carbon storage. For standard forests, the choice between both accounting methods is dictated by when the forest is registered in the NZ ETS, as shown in Table 3. Permanent forests will use carbon stock-change accounting.

Table 3. Accounting methods for standard post-1989 forest by registration year

Year of registration	Accounting methods
Before 2019	Carbon stock-change accounting.
2019–2022	Forest land is initially registered under carbon stock-change accounting. In 2023, this forest land can be changed to averaging in the first six months of 2023 (i.e. participant's choice).
Post 2022	Averaging.

As a result of these changes introduced by the ETR Act, after 2022, post-1989 forest land will be classified either as standard post-1989 forest (stock change), standard post-1989 forest (averaging) or permanent post-1989 forest. Figure 3 shows a decision tree for registering post-1989 forest land in the NZ ETS under any of these categories. Note that participants with post-1989 forest (stock change) registered between 2019 and 2022 will only have one opportunity to change the activity to post-1989 forest (averaging), while the change to permanent post-1989 forest can happen at any time after 2022.

Figure 3. Decision tree for registering post-1989 forest land in the NZ ETS



Note: In the case of land subject to a Permanent Forest Sink Initiative (PFSI) forest covenant, the decision on whether to participate in the NZ ETS can be made between 1 January 2023 and 31 December 2023.

4.1 Standard post-1989 forest (stock change)

The standard post-1989 forest (stock change) activity is essentially the same as the existing post-1989 forest land voluntarily registered in the NZ ETS, for which carbon stock-change accounting has been the methodology used since the inception of the NZ ETS. Under carbon stock-change accounting, participants earn NZUs as trees grow and need to surrender NZUs upon harvesting or deforestation. Participants face unit liabilities at harvest, and they must replant after harvesting to avoid facing deforestation liabilities (Ministry for the Environment & Ministry for Primary Industries, 2020). It is possible to earn NZUs on the subsequent rotations of the registered forest, but participants need to surrender NZUs with each harvest. Participants earn and pay NZUs based on changes in carbon stock in CAAs (Ministry for Primary Industries, 2018).

Depending on the size of the forest, participants can determine the change in carbon stock in their forest over the reporting period by either using default look-up tables or generating

participant-specific carbon stock tables.[27] Participants with small areas of post-1989 forest – less than 100 hectares – must use the default carbon stock look-up tables (Ministry for Primary Industries, 2020). Default values vary by age and forest type. For *Pinus radiata*, the look-up tables vary by region. Indigenous forests have their own look-up tables that are not region specific. Participants with larger forest area – 100 hectares or more – must gather information and apply participant-specific carbon stock tables that are generated using the Field Measurement Approach (FMA) (Te Uru Rākau, 2020).

Figure 4 shows an example of changes in carbon stock in a standard forest managed as plantation regime with two rotations. Figure 4 also illustrates a potential amount of NZUs that participants can trade when using any of the two accounting methods – carbon stock-change and averaging. As mentioned before, participants using carbon stock-change accounting earn NZUs as their forest grows (as shown by the solid green line) but need to surrender NZUs upon harvesting (as shown by the dotted green line). Note that timing of forest registration in relation to its age influences how many NZUs can be earned. As an example, a participant who registers a first-rotation, 20-year-old forest at a given point in a MERP typically will earn NZUs for that MERP reflecting the carbon stock change between the start and end of that MERP given the forest's age class and any harvesting. Some exceptions apply (e.g., if a Mandatory Emissions Return has previously been filed in respect of that forest or if the forest is transitioning to averaging). Moreover, the harvest liability is capped at the number of NZUs received for the CAAs.

In Figure 4, the amount of NZUs associated with carbon stocks within range A can be characterised as "low-risk" NZUs for sale in the market when using carbon stock-change accounting. This is because these carbon stocks will never face future harvesting liabilities. In other words, range A reflects the margin of the carbon stocks which remain intact after harvesting and hence do not face a harvest liability. A participant who chooses to sell, rather than bank, NZUs associated with carbon stocks above range A will need to surrender replacement NZUs at the time of harvest. Purchasing replacement NZUs could come at a net cost to the participant if market prices have risen since the sale of the original NZUs.

Participants with post-1989 forests registered in the NZ ETS between 1 January 2019 and 31 December 2022 will have one option to transition from the stock change accounting to averaging accounting.

[27] The default look-up tables are pre-calculated average values of carbon stocks in forests per hectare over 50 years. These values express the amount of the CO_2 removed from the atmosphere and stored in the forest, as well as the carbon that would be released back into the atmosphere due to harvesting.

4.2 Standard post-1989 forest (averaging)[28]

As noted earlier, the ETS Act introduces averaging accounting. Under this new accounting methodology, participants receive NZUs as their forest grows up to a pre-determined average level of long-term carbon storage over several rotations of growth and harvest. As long as the forest is replanted, participants face no liabilities at harvest, but do not earn extra NZUs for any subsequent rotations, unless they significantly extend the rotation period or replant different forest species (Te Uru Rākau, 2019). Details on how averaging accounting will operate will be prescribed in regulations that sit under the Climate Change Response Act 2002.

Participants using averaging accounting are not required to repay equivalent NZUs when harvesting, so the amount of low risk NZUs available for sale in the market is higher than when using carbon stock-change accounting. Participants do not face harvest liabilities if the forest is planted with the same forest species and harvested at the same average harvest age. Additionally, they must replant it to avoid facing deforestation liabilities.

Figure 4 illustrates the potential NZUs earned when using averaging accounting (see the double solid blue line). Relative to carbon-stock change accounting, averaging accounting will increase the potential return for participants who register a newly established forest or have a young forest that is in its first rotation (see range B). Once the forest reaches the average harvest age band or is in its second (or subsequent rotation), participants will only earn additional NZUs if they significantly extend rotation length or change to other forest species with higher carbon stocks (see range C).

Post-1989 forest land registered before 2019 cannot use averaging,[29] nor can the forest shift to averaging unless the forest is deregistered from the NZ ETS, which requires that all NZUs previously earned must be surrendered before the forest can be registered again (Ministry for the Environment, 2020c). Note that the same conditions apply once the forest reaches the average harvest age band or is in any subsequent rotation.

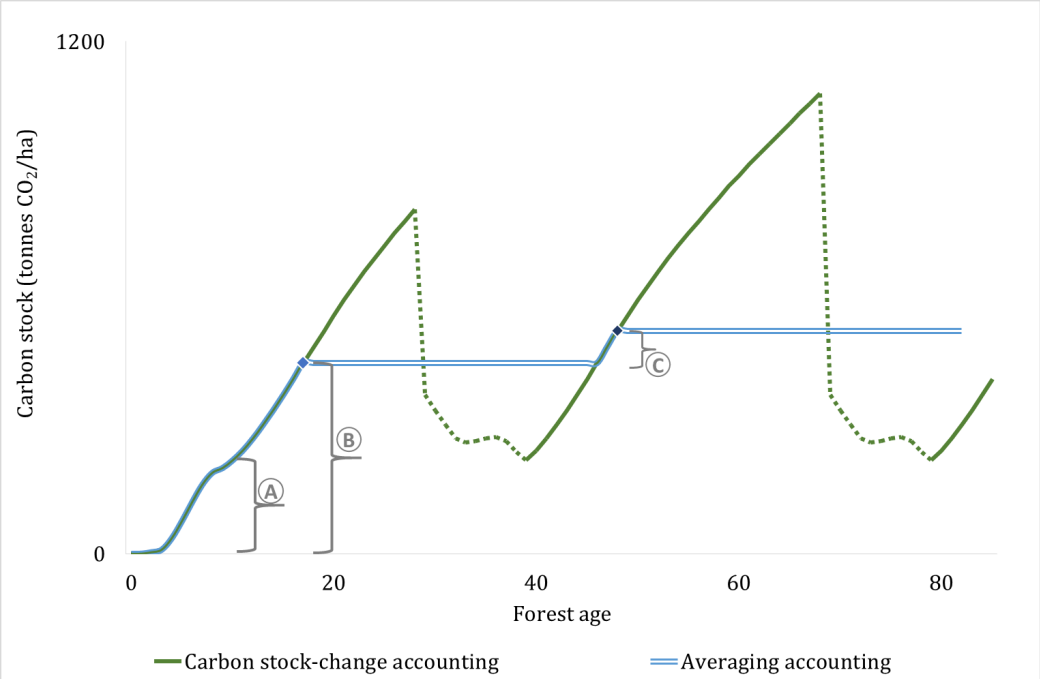
[28] This paper provides an overview of averaging accounting as currently understood. Detailed accounting rules (e.g. regarding the definition of harvest age bands and treatment of different forest species) will be defined in regulations that were under development at the time of writing this paper. In 2019, Te Uru Rākau provided a discussion paper when consulting on the regulations to explain and seek feedback on different accounting options (Te Uru Rākau, 2019).

[29] As shown in Table 3, averaging accounting can be used voluntarily for post-1989 forest land registered between 1 January 2019 and 31 December 2022 and will be mandatory for post-1989 forest land registered in the NZ ETS from 1 January 2023.

In summary, Figure 4 shows a comparison between the two accounting methods for standard forestry. The ranges illustrate different NZUs that can be earned:

- range A refers to low-risk NZUs using carbon stock-change accounting,
- range B refers to low-risk NZUs using averaging accounting, assuming a 28-year harvest scenario; and
- range C refers to additional low-risk NZUs using averaging with an extended length of the second rotation, assuming a 40-year harvest scenario.

Figure 4. A comparison between accounting methods for standard post-1989 forest land



Source: Based on look-up tables for post-1989 forest land assuming carbon stocks per hectare for *Pinus radiata* in Gisborne (Ministry for Primary Industries, 2017). The value for the increased average carbon stock in the second rotation is indicative.

4.3 Permanent post-1989 forest

The ETR Act introduces a new permanent forestry activity for post-1989 forest land. The crucial point of difference from the standard post-1989 forestry activity in the NZ ETS is that land registered as permanent post-1989 forest will: (i) need to maintain a minimum of 30 per cent of tree crown cover per hectare, (ii) be subject to a restriction that precludes clear-fell harvesting within 50 years from the date the forest land is first registered, and (iii) be in the NZ ETS for 50 years as permanent post-1989 forest.

The permanent post-1989 forestry activity replaces the Permanent Forest Sink Initiative (PFSI).[30] The PFSI was the first programme to offer a market-based approach to increasing carbon sinks in the country. However, after being reviewed twice, the PFSI will be discontinued by 2023, mainly because the programme was underperforming and it was inefficient for the Crown to maintain a dual system to reward carbon stored in New Zealand's forests (Te Uru Rākau, 2018).

Unlike the PFSI, under permanent post-1989 forestry, legal covenants are not a requirement for registering forest land in this new activity. From 1 January 2023, the option to participate in permanent post-1989 forestry will be available for (i) land subject to a PFSI forest sink covenant,[31] (ii) land already registered in the NZ ETS as standard post-1989 forest (stock change), or (iii) post-1989 forest land eligible to be registered in the NZ ETS (Ministry for the Environment & Ministry for Primary Industries, 2020).[32]

Permanent post-1989 forestry will use carbon stock-change accounting and the NZUs from these forests will be identified and tagged as coming from a permanent forestry. Participants will earn NZUs as their permanent post-1989 forest grows, so it is expected that they will have a strong financial incentive to maintain a higher canopy or tree crown cover. Furthermore, the possibility of tracing NZUs from permanent forests, as they were in the PFSI, is a way of highlighting the environmental co-benefits from purchasing these specific NZUs and may

[30] The PFSI offered owners of eligible forests established from 1990 the opportunity to earn tradable emission units which were eligible in the NZ ETS. To be eligible under the PFSI, the forest must: (i) be permanent, (ii) be established on or after 1 January 1990, (iii) be directly human induced by planting, seeding, or promotion of natural seed sources, and (iv) not consist of more than 5 hectares of land that were cleared on or after 1 December 2007. Forests may be either exotic or indigenous species, including indigenous forests naturally regenerated since 1990. PFSI participants entered a covenant with the Crown, which was registered against their land title. After 50 years, PFSI participants had the right to terminate, and repay to the Crown, the full balance of NZUs earned (Te Uru Rākau, 2018).

[31] Land subject to a PFSI forest sink covenant will be automatically registered as permanent post-1989 forest and the period for which clear-fell harvesting is restricted will start from the date when the land was initially registered in the PFSI. However, between 1 January 2023 and 31 December 2023, owners of land under the PFSI will have the option to join the NZ ETS as standard post-1989 (averaging) or exit the NZ ETS, in which case they might need to surrender NZUs down to the averaging level or pay all NZUs earned back to the Crown, respectively.

[32] Participants with standard post-1989 forest (averaging) will have the opportunity to change to permanent post-1989 forest, but this change will be observed after several years as averaging accounting will be available from 1 January 2023.

command a price premium in the carbon market (Ministry for the Environment & Ministry for Primary Industries, 2020; Te Uru Rākau, 2019).

Participants are expected to face a harvest liability if the canopy is reduced by a significant degree, so they will likely need to surrender equivalent NZUs.[33] In the event of deliberate and premature clear-fell harvesting (i.e. the tree crown cover drops below 30 per cent in any hectare), participants will need to surrender the corresponding amount of NZUs and re-establish the forest for the remainder of the 50-year period.[34] Additionally, participants will need to pay a clear-fell penalty based on the market value of the timber. Furthermore, if the land is deliberately deforested, participants will need to deregister the CAA that is no longer forest land, surrender the unit balance for that CAA, and pay a deforestation penalty (based on the current carbon price). Note that the Courts will determine the final amount for the clear-fell or deforestation penalty, the maximum value of which is defined in regulations (Ministry for the Environment & Ministry for Primary Industries, 2020).

Based on the experience from the PFSI, the ETR Act sets conditions that allow a degree of flexibility for participants to exit from permanent forestry. After the 50-year period and at the end of the Mandatory Emission Reporting Period, participants will have the option to: (i) extend participation for another 25-year period; (ii) transition to standard post-1989 forest (averaging) and repay the differential amount of NZUs,[35] or (iii) exit the scheme and repay the NZUs earned since registration.

In summary, the ETR Act creates three categories for post-1989 forest land voluntary registered in the NZ ETS. Table 4 shows the general features and obligations for each of these categories, as previously described.

[33] The area size for calculating a potential harvest liability will be prescribed in regulations that sit under the Climate Change Response Act 2002.

[34] Participants can ask the Minister for Climate Change for permission to remove a specific area of land registered as permanent post-1989 forest. If the area is small and its removal does not undermine the integrity of the permanent forestry activity (or the NZ ETS), it may be allowed to be deregistered from the NZ ETS after surrendering equivalent NZUs.

[35] The equivalent NZUs to be surrendered will be calculated as the difference between the current carbon stock in the forest and the nominal average carbon stock for a forest of equivalent age. The current carbon stock depends on the age of the forest and its type.

Table 4. General features and obligations by categories of post-1989 forest land

	Standard post-1989 forest (stock change)	**Standard post-1989 forest (averaging)**	**Permanent post-1989 forest**
Accounting methods	Carbon stock-change accounting	Averaging accounting	Carbon stock-change accounting.
Type of harvesting allowed	Unlimited	Unlimited	Selective harvesting – 30 per cent of the canopy, per hectare, must remain.
Minimum period without clear-fell harvesting	None	None	50 years.
Harvest liability	Yes – Registered forest must account for changes in carbon stock.	No – Forest can be replanted without needing to pay NZUs. Change in the average harvest age or forest species may result in a liability.	Yes – Registered forest must account for changes in carbon stock. An additional clear-fell harvest penalty applies if the canopy drops below 30 per cent.
Deforestation liability	Yes	Yes	Yes. An additional deforestation penalty applies if the land is deliberately deforested.
Forest offsetting	No	Yes – Participants can apply to offset their deforestation liability by planting an equivalent forest elsewhere. This forest is known as post-1990 offsetting forest land.	No

5 Considerations for registering post-1989 forest land in the NZ ETS

As a result of the ETR Act, from 1 January 2023, post-1989 forest land will be classified either as standard post-1989 forest (stock change), standard post-1989 forest (averaging) or permanent post-1989 forest. These classifications can be translated into different levels of NZU gains. Participants using carbon stock-change accounting earn more NZUs as the forest grows and more carbon is sequestered. However, given the harvest liability that participants with standard post-1989 forest (stock change) face, the amount of low-risk NZUs, relative to averaging accounting, is lower. Averaging accounting also creates a further marginal incentive to extend harvest rotations and earn NZUs at a higher average level.

Why might participants consider permanent forestry when they are foregoing market returns from harvesting their forest? Permanent forests can offer greater environmental, social and cultural value than plantation regimes. Moreover, the new policy framework for permanent forestry is fully integrated with the NZ ETS and has clear rules about harvesting as well as transition options after 50 years. A covenant is no longer required. Furthermore, under the permanent post-1989 forestry activity in the NZ ETS, selective harvesting will be permitted, so participants will have the flexibility to balance revenues from carbon and timber provided they maintain a minimum of 30 per cent tree crown cover per hectare. Note that higher tree crown cover translates to extra NZUs and participants will likely face a harvest liability when the canopy is reduced. The NZUs from permanent forestry will be tagged and identified. It is expected that these NZUs may attract a premium market price for being NZUs associated with permanent forestry.

Landowners could achieve longer-term commercial returns from permanent forestry by choosing species with harvest rotations beyond 50 years, whether indigenous or exotic species. If a landowner does not anticipate clear-fell harvesting on post-1989 land, the comparative value propositions for choosing standard forestry with averaging versus permanent forestry will depend on the net present value of anticipated unit flows under the two activities and the additional opportunity costs from the relative constraints on land use applied for the two different activities under the NZ ETS.[36]

[36] Participants with permanent post-1989 forest land must remain in the NZ ETS for 50 years and will need to surrender NZUs when they deregister the land from the NZ ETS. Participants with standard post-1989 forest

Why might participants consider indigenous species for their permanent forest? By rewarding forest carbon stock increases as they accrue, the NZ ETS generally can be expected to provide stronger economic incentives for exotic species with faster growth rates than indigenous species for both standard and permanent forestry.[37] The overall economic case for choosing between indigenous and exotic species will depend on further considerations, such as the landowner's time horizon for calculating the return on investment, the relative cost of forest establishment,[38] harvesting intentions, the relative market value of timber from indigenous versus exotic species, and the potential to monetise the value of co-benefits from indigenous forestry. On some land, the difference in long-term economic returns between exotic and indigenous species will be much smaller (e.g. when clear-fell harvesting is not possible) and some landowners will prefer indigenous species because of amenity values.[39] Partial reforestation in indigenous species may provide co-benefits to the wider community through biodiversity, freshwater management, and sediment control (Daigneault et al., 2017). Sometimes these co-benefits translate into grant funding from groups such as Regional Councils or other forms of community support. Broadly, the benefits of indigenous species can be categorised as economic, environmental, social, and cultural (Carver & Kerr, 2017).

In the case of permanent forests, the combination of carbon payments, landowner preferences, and support for co-benefits can make indigenous species more attractive than exotics if the streams of benefit can be combined, especially over a longer time horizon. There is also a potential incentive for indigenous species that may attract an even higher premium market price for the NZUs associated with this type of forestry. To maximise the long-term value of forests registered in the NZ ETS, it will be important for landowners to evaluate the full range of costs and benefits that will be associated with their forestry choices.

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land (stock change or averaging) can deregister their land at any time but will need to surrender NZUs when they exit.

[37] Some exotic species such as *Pinus radiata* outcompete indigenous species in terms of carbon sequestration over 50 years because the former grows faster. Over 50 years, exotic species are likely to achieve higher carbon stocks even if the exotic forest is intended for rotation forestry and the indigenous species are intended to be permanent (Ministry for Primary Industries, 2017).

[38] The costs of planting forest are typically higher for indigenous species than exotic; however, enabling regeneration of indigenous forest, while much slower, can substantially reduce establishment costs (Carver & Kerr, 2017).

[39] The New Zealand Resource Management Act 1991 defines amenity values as "those natural or physical qualities and characteristics of an area that contribute to people's appreciation of its pleasantness, aesthetic coherence, and cultural and recreational attributes."

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Glossary of acronyms

CAA	Carbon accounting area
CCR	Cost containment reserve
CO_2	Carbon dioxide
CO_2eq	Carbon dioxide equivalent
EPA	Environmental Protection Authority
ETR Act	The Climate Change Response (Emissions Trading Reform) Amendment Act 2020
ETS	Emissions Trading Scheme
FMA	Field Measurement Approach
FPO	Fixed price option
GHGs	Greenhouse gases
IPPU	Industrial processes and product use
LULUCF	Land use, land-use change and forestry
MERP	Mandatory Emissions Return Period
NZ ETS	New Zealand Emissions Trading Scheme
NZU	New Zealand Unit
PFSI	Permanent Forest Sink Initiative
UNFCCC	United Nations Framework Convention on Climate Change
Zero Carbon Act	The Climate Change Response (Zero Carbon) Amendment Act 2019