



Tāne's Tree Trust

NATIVE FORESTS FOR OUR FUTURE

Hereherea te Wao-nui-a-Tāne

P.O. Box 12094

Hamilton 3248

Phone: 07 858 4404, or 027 900 7853

Email: office@tanestrees.org.nz

**Submission in response to
*Climate Change Commission 2021 Draft Advice for
Consultation***

Details of Tāne's Tree Trust (TTT) relevant to this submission are provided below:

- TTT was established in 2000, with the following aims:
 - Promote best practice establishment of native forests for multiple benefits.
 - Reduce impediments to planting and management of natives.
 - Identify information gaps and priorities for applied research.
 - Increase funding into applied research and information transfer.
- OUR VISION - To see the majority of NZ land-owners successfully establishing and sustainably managing native trees for multiple uses <https://www.tanestrees.org.nz/>
- We are a national organisation with currently 10 trustees who have expertise in forest management, forestry science, ecology and ecological restoration, tech transfer, forestry economics and policy analysis, farm forestry, landscape architecture, kaupapa Maori, conservation and natural resource management, sustainable land use and water quality.
- We are committed to scientific research – as a base for best practise guidelines.
- We have field trials and demonstration sites established throughout NZ; including Permanent Sampling Plots - measuring growth of key native forest species for over 40 years.
- Our publications and research results are freely available to all via our website: <https://www.tanestrees.org.nz/resource-centre/>
- We collaborate with like-minded organisations, where there are good synergies, and have close associations with Trees That Count, the NZ Farm Forestry Association, and the NZ Native Forest Restoration Trust, among others.
- We compete for and receive funding from a variety of central and local government sources, Trusts, NGOs, etc.
- We have a strong interest in integrating native forest into our working lands, working to support landowners in achieving this – to bring back important ecosystem services including carbon sequestration, provision of habitat, erosion control, catchment protection, green infrastructure, nutrient regulation, water quality, aesthetic landscape values, and restoring cultural values and provisioning services associated with natural ecosystems (including mahinga kai and rongoa).
- We also promote planting of native trees in urban areas for multiple benefits.

- We hold workshops throughout the country, covering topics including nursery plant quality, species selection, forest establishment, non-timber values (including carbon sequestration), and silvicultural management and harvesting under continuous cover forestry (CCF) regimes.
- We promote the planting of permanent forests, or forests managed under CCF as opposed to clear-fell harvest regimes – as high-forest values are retained, i.e., CCF minimises impact on environmental, cultural and aesthetic landscape values.
- In NZ, outside of TTT, there is a lack of expertise in CCF and ‘near-natural forestry’ with our native species; yet this form of forestry has been carried out in Europe for centuries.
- TTT has a key role in the multi-agency Northland Totara Industry (TIP) Project: <https://www.totaraindustry.co.nz/>. One of our trustees, Paul Quinlan, is based in Northland and has a lead role in the TIP project. TTT convenes the Northland Tōtara Working Group: <https://www.tanestrees.org.nz/about-us/northland-totara-working-group/>
- We are currently researching methods to reduce the cost of establishing natives; including managing natural reversion, which is a much more cost-effective way of establishing native forest in NZ, eg, the Northland totara example with over 200,000 ha of reverting country may well be representative of many other marginal hill country areas in NZ.
- TTT manages NZ’s only national database on planted natives with over 60 different native tree and shrub species measured throughout NZ from over 100 stands ranging in age from 5 to over 100 years old and is used for growth and yield modelling.
- Tāne’s Tree Trust has recently launched an on-line, free-access, Carbon Calculator: <https://www.tanestrees.org.nz/resource-centre/carbon-calculator/?highlight=carbon+calculator>
- This project was driven by Dr David Bergin (native forestry scientist) and Mark Kimberley (biometrician).
- The Carbon Calculator uses growth models developed from the TTT Plantation Database: <https://www.tanestrees.org.nz/resource-centre/carbon-calculator/carbon-models-for-planted-natives/>.
- Further calculators are about to be published and available free on the TTT website including a Planting and Budgeting Calculator, Growth and Yield Calculator, and a Costs and Benefits Calculator for planted native forest.

In summary, Tāne's Tree Trust is highly committed to increasing the amount of native forest cover in our rural working lands and urban areas, and the promotion of all the benefits associated with native forests, including carbon sequestration and adaption to climate change.

Thanks for the opportunity to submit. We are happy to provide further info and advice if required.

We are best contacted via office@tanestrees.org.nz

GENERAL COMMENTS

Tāne's Tree Trust (TTT) congratulates the Climate Change Commission (CCC) for tackling what has become the greatest existential crisis of our time. The final report is likely to be valued in the post-carbon era as one of New Zealand's seminal documents.

TTT's focus for this submission is on native forestry, which is our *raison d'être*, although we support the overall advice given for the balanced approach of emissions reduction, as well as carbon sequestration from exotic and native forests. This submission provides support for native forests to be a vital part of this country's integrated responses to the climate change crisis, and at the same time addressing the biodiversity and freshwater crises.

We strongly support the following (as per exec summary):

- Existing forests, small blocks of trees, soils and wetlands can all store more carbon. Work is needed to better understand this potential and how to include this in accounting systems.
- Native forests can create a long-term carbon sink while providing a range of other benefits, like improving biodiversity and erosion control.
- Incentives are needed to get more native trees planted.

We strongly support the CCC advice on improving and enforcing measures to reduce deforestation of pre-1990 native forests (Necessary action 12, p. 123).

And we strongly support the recommended policy direction and approaches indicated in 6.1.4, to increase the amount of permanent native forest as a long-term carbon sink. Particularly, we welcome the emphasis on native reforestation as a key component in the mitigation response. We also applaud the recognition of native forests for their wider values.

However, we have two areas of concern for more detailed comment. First, a concern that the draft advice underestimates the capacity of native forests (our *ngahere*) for carbon storage, particularly for planted and managed naturally regenerating native forest. Second, that the current proposed trajectory for new *planted* native forest area maybe too optimistic. As a solution to the latter, we propose a shift in emphasis from planting to a mix of planting and natural regeneration.

To maximise native forest area, we recommend a gradual increase in the amount of forest established, as capability, systems, expertise, land availability, infrastructure, and the necessary incentives are developed – and strategically managing natural regeneration, augmented by targeted planting to assist natural regeneration processes, as described below, as a pragmatic way to achieve the target of at least 300,000 ha of permanent forest.

Currently, there are barriers to rapidly upscaling native forest cover due to a significant lack of infrastructure and expertise, the complexity and diversity of our *ngahere*, and knowledge gaps around indigenous forest restoration and management - due to decades of divestment. This is in contrast with the massive investment in R&D and infrastructure around one species – radiata-pine.

The narrative also needs to be changed, particularly in the forestry industry, local government, and agricultural sector. For example, we are aware of landowners who are being dissuaded by regional council staff from planting native species, although this is the landowners' preference. However, there are some council staff scattered throughout the country who are supporting the planting of native species. So it is patchy.

Currently, charitable organisations, such as TTT, are stretched too thinly trying to fill the gaps, and are only operational due the philanthropic support.

Most importantly, native forest cover needs to become an economically *viable* land-use option for landowners, otherwise native reforestation will not occur with significant scale nor will those forests be managed as well as they could be. This is repeated message in many of the articles posted on the O Tatou Ngahere platform (e.g., <https://pureadvantage.org/valuing-native-forest-on-private-land/>; <https://pureadvantage.org/interwoven-land-use-values-and-principles/>; <https://pureadvantage.org/native-trees-and-professional-foresters/>). Therefore, we agree that a comprehensive and effective package of ETS and non-ETS incentives is required to encourage native forest cover and ensure their ongoing management.

Native forests as carbon sink – changing the narrative

TTT have concerns over the figures quoted for carbon storage in our ngahere. There is a widespread perception that native trees store carbon at much lower rates than exotic tree species such as radiata pine. The look-up tables published by the Ministry for Primary Industries (MPI) for use by small forest growers in the Emissions Trading Scheme (ETS) do a poor job of representing the carbon sequestration of native forest – they are not based on managed planted stands, rather they are based on regenerating shrublands, which have less carbon storage potential than taller forests.

Unfortunately, the look-up tables are often quoted by people wanting to dismiss the potential carbon sequestration by native trees and the call for planting more indigenous forest.

TTT's data is far more extensive, based on several decades of permanent sampling plots - the database represents the most comprehensive set of planted native tree and shrub measurements available. Data is collected across the full gamut of poorly managed through to well-managed stands. Most are on relatively unproductive land.

A sentinel paper has been published by biometrician Mark Kimberley in the O Tatou Ngahere campaign: <https://pureadvantage.org/setting-the-record-straight-on-carbon-sequestration-in-managed-native-forests/>. Mark has developed several widely used forest growth models for both exotic and native tree species and contributed to the design and analysis of NZ's national inventories of exotic and natural forests. Mark was also integral in development of TTT's carbon calculator, which is based on the TTT database for our ngahere. It demonstrates a much greater capacity for carbon storage than the quoted figures from the Ministry for the Environment (MfE) or the look-up tables. The Calculator predicts that a stand of native trees planted at 1,250 trees per hectare has a CO₂ removal rate of only 6 tonnes over the first 30 years after planting, but this increases to 20 tonnes between ages 30 and 60 years, and further increases to 27 tonnes between ages 60 and 90.

This growth pattern, with the CO₂ removal rate steadily increasing over many decades after planting of native trees, contrasts with the pattern of radiata pine where the CO₂ removal rate peaks before age 20 years and then gradually declines. So, for a landowner wanting to invest in carbon forestry, it is a matter of choosing between radiata pine for a quick initial return, or natives as the long-term option.

In 2018, TTT commissioned a report by Motu Economic and Public Policy Research to assist those interested in carbon forestry with native forest plantings. All the native forest species surveyed had higher total carbon stocks in comparison to the default look-up table, suggesting that participants who use the field management approach could earn significantly more carbon units. However, this is not an easy option, creating barriers for landowners obtaining an equitable return.

Direct planting and the current proposed scaling up of native forest cover

We have concerns over the scale of the planting that is proposed by the CCC draft advice, i.e., starting at 12,000 ha per year and building up to 25,000 ha per year. We propose alternative pathways with a more gradual increase of planting, but fully utilising natural regeneration to reach the necessary targets.

We consider the initial CCC targets to be too optimistic and too prescriptive. Although well intentioned it, could result in some unintended consequences. There are many fine examples of native forests established in the traditional way by teams of planters making their way across open hillsides. There have also been some impressive and costly failures. Unfortunately, failures can end up well-publicised and used to discredit well-intentioned programmes (e.g., Kiwi Build).

Pressure to meet ambitious initial targets could lead to poor quality outcomes. Existing resources will be stretched too thin and there are risks if work is contracted to entities that lack the necessary skills and understanding of a highly complex, integrated operation. Establishment of native forests is far more complex than establishing monocultural plantations, and there has been far less research compared with the heavy investment in R&D and infrastructure for radiata-pine forest establishment and silviculture.

With our ngahere, it starts when specialist seed collectors enter natural forests to collect seeds for the nursery, and continues several years later when another team moves into the newly emerging forest to ensure that the plants are released, gaps blanked in, and weeds and predators are controlled. And active management must then be sustained on an ongoing basis. It is a chain in which all the links must be secure, and does not end. A broken link will sabotage the whole operation.

There is also the matter of costs. At the often-quoted rate of \$20,000 per hectare, mass planting is unlikely to be sustainable at large scale. TTT, who have extensive experience in native forest establishment, have examined the costs of establishment and barriers to successful establishment of native forests.

We propose some alternative pathways to help increase native forest cover.

Proposed solution - Assisted natural regeneration augmented by targeted planting

- **We advise a shift in focus from a reliance on mostly planted forests to assisted natural regeneration – where planting is part of the mix**, along with management to limit the factors that inhibit natural regeneration of natives, i.e., control of the most aggressive weeds, elimination of pests including predators of bird populations essential for seed spread.
- We support direct planting, but recommend that it starts on a modest scale, and expands as quickly as capacity permits.
- Concurrent with this is the need to monitor the success or otherwise of planting programmes so that changes in management can be made early on to improve performance with subsequent plantings.
- Fixed annual targets should be used with caution, although we understand there is a need to reach carbon sequestration targets.
- Management of natural regeneration coupled with targeted planting must be well planned, adapted to site, supervised, and the outcome monitored and the management input sustained.
- Start with a survey to identify potential sites for natural regeneration.

- Identify any existing native forest within bird range that will encourage spread of seed of key native tree species.
- Our birds have a good track record, having established forests in Aotearoa over millions of years.
- Our contribution to a partnership with the birds is simple: we will provide them with a convenient seed source, an incentive to visit the site with strategic planting of berry-producing shrub species (along with wind dispersed species), and implement control of bird and seed predators such as rodents, mustelids and possums.
- The birds will do all the rest, although we can assist with enrichment planting of species that are no longer present in the local area.
- Where there are no native forests within bird range, we can prepare a seed source for them by employing a strategy that has been developed and is being evaluated by TTT, i.e., where there are gaps, establish a network of seed islands (see Addendum 1).
- TTT has produced fact sheets on assisted natural regeneration and the seed island approach. These will soon be published on our website.
- Assisted natural regeneration could be done at large scale as resources permit, and there should be no need for delay in getting this under way.
- Monitoring systems are vital as practitioners can act promptly to protect their ngahere, and also learn what does, and doesn't work, and adapt accordingly. This is particularly important in an era of climate change.
- This need not be delayed. Some of the human and financial resources available for direct planting should be diverted towards establishing a framework that supports natural regeneration – including sustainable management of the large area of existing natural regeneration, some of which is being routinely sprayed, cut back or burnt to keep marginal farmland in pasture.

Much of this is described in more detail in an article by Dr David Bergin – *The ten golden rules for establishing native forest at scale*, published as part of the O Tatou Ngahere campaign <https://pureadvantage.org/ten-golden-rules-for-large-scale-establishment-of-native-forest/>.

Pros and cons of assisted natural regeneration

Advantages

- Scale - significant areas already exist (hundreds of thousands of hectares), that are in the process of regeneration to forest cover, and much more could be encouraged to regenerate.
- Low cost. Nature and time, assisted by the wind and birds, do the greatest share of the work.
- Less pressure. There are no fixed annual targets to be met.
- Flexibility. It is suited to a range of sites, large and small; and a range of different scenarios can be employed. There is scope here for site-specific and creative solutions.
- Plants that germinate naturally have been, by definition, ecosourced, and are therefore adapted to site.
- Planting can be leveraged for maximum cost/benefit.
- Lower risk of dramatic failure.

Disadvantages

- Forest establishment will take longer. On the other hand, as it is low cost, it can start sooner and at a larger scale (and is already happening over large areas).
- We cannot assume that available open space will be colonised by native species alone. Over time we have introduced too many impediments for that to occur.

- We have introduced a range of weeds, some of which will be better adapted to the changing conditions of a warming climate – these can preclude natural regeneration on some sites, if there is no intervention. And then there are the introduced pests that must be controlled.
- Our remaining forests have been degraded and fragmented, and natural pathways for colonisation have been intercepted by cities, farms and roads.
- Natural regeneration will need our assistance - weed and pest control is vital.
- All forests require ongoing and active management. There is presently insufficient financial incentive or income potential to encourage and support native forest management on private land – especially regarding regenerating native forest cover.

In summary – working with nature for cost-effective, large-scale expansion of our ngahere

Successful large-scale establishment of native forest will depend on working with nature and better integration of those involved. Encouraging natural regeneration can only be done in tandem with pest animal control to prevent damage of establishing seedlings, working with Predator Free NZ, neighbouring landowners, iwi and local communities to boost bird populations and seed production for a diverse forest ecosystems, selective weed control to remove or reduce the most aggressive and persistent exotic species, and undertaking targeted supplementary planting to bring back once abundant species now locally extinct or scarce.

There are significant and ongoing costs associated with establishing and managing native forests. Nevertheless, we strongly support the potential value and roles for native forest within the integrated climate response strategy.

Our recommendations:

- Enable naturally regenerated native cover that predates 1990, but that still has significant potential to sequester more carbon, to be eligible and become part of the target area.
- For afforestation by planting alone, start with modest targets and build infrastructure, capability and confidence, and ‘iron out problems’; i.e., start with a smaller yearly target, upscaling gradually as capacity and competence improve.
- Look at the easiest options first - ‘nature-based solutions’ - assisted regeneration, building on the natural regeneration that is already happening in many hill country sites.
- Establishing seed islands amongst shrub pioneers, to help the natural succession to high-forest – let the birds do the work of spreading the seed.
- Management of transition from exotic to natives where native forest is already regenerating under an exotic canopy (see Addendum 2).
- Ensure that nursery plant quality standards and infrastructure are in place to deliver quality, fit-for-purpose planting stock.
- Monitoring systems are vital and need to be a requirement of any funding for afforestation.
- Planters – are there sufficient well-trained planting gangs who know how to plant native species (as opposed to radiata-pine, which is quite different to plant)?

Nursery infrastructure and systems are critical to success of planting programmes

Planting programmes like The One Billion Trees fund present opportunities for the native nursery industry. However, they also present challenges that will need to be carefully considered by all who are involved in the industry, be they producers, specifiers or users of plant material (<https://pureadvantage.org/the-state-of-the-native-plant-nursery-industry-in-2021/>).

Targeted planting will be required under assisted natural regeneration. However, some issues urgently need to be resolved regarding the nursery industry capacity and plant quality standards:

- The Billion Trees programme has put considerable pressure on the native plant industry to produce plants in volumes that have never been done in this country before. NZ has a very small native nursery industry. There are only a handful of large plant producers alongside many small nurseries employing less than 5 people.
- Most native nurseries have been riding a fine line of profitability. They are often undermined by community-based nurseries that can produce plants more cheaply due to local and central government funding and volunteer labour.
- In the decade prior to the Billion Trees programme, the industry was struck hard by the GFC, collapse of the carbon market, and lack of government initiatives supporting ecosystem restoration. Several excellent major native plant nurseries closed, and others retrenched. Surviving nurseries have been reluctant to risk investing in infrastructure to upscale due to the vagaries of funding for native plantings.
- NZ is one of the few countries in the world without a common set of nursery standards. Until there is a required set of standards, particularly for plant quality, ecosourcing and biosecurity measures, there will be wide variations in standards, which will have an impact on planting projects, e.g., biosecurity measures may not be appropriately undertaken, which is critical due to the threats of kauri dieback and myrtle rust.
- Planting ill-adapted species is a recipe for disaster. See Tāne's Tree Trust guidelines on species selection and ecosourcing (<https://www.tanestrees.org.nz/news-events/articles/t-nes-tree-trust-guidelines-to-species-selection-ecosourcing-and-seed-collection/?highlight=ecosourcing>).
- One of our major concerns is the use of large-scale cuttings propagation - as promoted and practised by one CRI and several major native nurseries. This can dramatically decrease genetic diversity and lead to inbreeding in permanent native forest. It is an example of inappropriately applying plantation forestry deployment systems (for short-rotation forests) which is counter to what we need for permanent forests in an era of climate change and increased biosecurity risk (<https://pureadvantage.org/future-proofing-our-ngahere/>).
- Biosecurity measures must be upheld in nursery and planting operations. This is particularly important for myrtle rust (<https://nzppi.co.nz/CURRENT-THREATS/19727-s119533/>) and kauri dieback (https://www.kauridieback.co.nz/media/1864/bpg-kauri-propagation-and-planting_v1_finalpdf.pdf).
- These issues could be addressed by nursery standards being a requirement of government or private funding.

Recognising the wider value of native forests

We are delighted that the CCC while maintaining a focus on carbon are strongly supportive of native forests for the wider values that they represent. They define our unique landscapes, link us to our natural world, offer pleasure and solace, cultural values such as tūrangawaewae, and play a major part in protecting our fragile ecosystems, our biodiversity and our water quality.

While many non-timber values (NTVs) can be attributed to forests irrespective of whether they are native or exotic, in most cases the aggregated NTVs of native forests would likely exceed that for exotic plantation regimes – particularly for cultural and spiritual values, conservation of indigenous biodiversity, and protection of erodible land, water quality, and downstream infrastructure and ecosystems. Permanent native forests managed solely for NTVs or sustainably managed under continuous cover regimes, are likely to have the highest aggregated NTVs, which could potentially exceed timber values (<https://pureadvantage.org/valuing-native-forest-on-private-land/>).

It is appropriate and desirable for native forests to play a significant role in our country's future including its strategic response to the climate, biodiversity and freshwater crises. Native forests offer

a comprehensive suite of benefits befitting the complexity of the situation we face. Rather than using climate change policy to solely drive tree planting decisions, this broader perspective helps counter adverse outcomes from well-intended policy. TTT recommends avoiding focus on any single-purpose commodity, e.g., rapid carbon sequestration - to avoid any unintended consequences such as what we have seen with the ETS and high carbon prices leading to 'plant and leave' radiata-pine, which is grown for carbon farming purposes only.

As Gerard Horgan, TTT trustee and forest economist states: *"A conventional business case, as typically used to assist many investment or management decisions, is not the right tool for decisions around the infinitely complex and varied land-use that is like native forests. Aside from the problems of evaluating long-term risks such as climate change and new disease incursions, the most valuable outputs of native forests are the myriad of non-timber values these forests generate. And while putting a figure on non-timber values could encourage more investment in native forests, it is acknowledged that it may not be possible to 'value the invaluable'"* (<https://pureadvantage.org/is-there-business-case-for-native-forestry/>).

Forestation has multiple environmental benefits beyond carbon sequestration (particularly forestation with native species), and we request that policymakers strive to make decisions with the overarching concern for how we look after our environment, i.e., be good kaitiaki.

We also request that the CCC explore potential synergies with other proposed policy, particularly:

- "TE KOIROA O TE KOIORA" - Proposal for a Biodiversity Strategy for Aotearoa NZ.
- "ACTION FOR HEALTHY WATERWAYS" - Proposed National Direction for our Essential Freshwater.

TTT gratefully acknowledge CCC's recommendations to incentivise land-use change on marginal, erodible hill country – this would have multiple environmental benefits and help with climate change adaptation. However, we are concerned that there is a lack of focus on restoration of lowland and coastal native forest.

Role for exotic production forestry

We generally agree with the discussion set out under the heading: *Define a clear role for production forests in the transition to low emissions*. Specifically, we agree that: *'[exotic clear-fell] Production forests are helpful for providing removals over the short to medium term to reduce the climate impact of Aotearoa over the time needed to reduce gross emissions, but they are not a long-term solution'* (page 53).

We confirm the contention that the current NZ ETS settings incentivise large-scale radiata-pine plantations and provide insufficient incentive for native forest establishment and sustainable management. Therefore, we also agree with the need for non-ETS policies the Government could consider to support diverse and resilient production forests, and we strongly support the suggestion to *"Investigate approaches for promoting a native forest industry"*, but only where the regeneration dynamics of indigenous species are amenable to sustainable forest management.

Native forest also needs to be restored to lowland areas

There was no mention of the need for lowland forest to be restored in the CCC draft advice.

Much of NZ's remaining native forest is restricted to upland regions, with intact lowland podocarp-hardwood forest, wetland-forest complexes, and natural coastal ecosystems now scarce in most regions, and largely confined to private land. There is a major under-representation of lowland

ecosystems in the conservation estate and a recognised need to increase indigenous biodiversity conservation on our productive rural lands. There is also increased awareness of water quality issues in waterways in intensively developed urban and agricultural land.

TTT request that the CCC consider the recent Freshwater Reforms (especially the 3 m setbacks), and recent Biodiversity Strategy (Te Mana O Te Taiao Aotearoa New Zealand Biodiversity Strategy 2020).

QUOTE FROM CCC DRAFT ADVICE, p. 6: *“Small areas of trees and vegetation on other land, such as riparian planting along waterways or shelterbelts on farms, also remove carbon dioxide and store carbon, but to a much lesser degree. This is partly due to the small areas planted and partly because they are generally smaller tree species which cannot store large amounts of carbon.”*

TTT disagrees with this.

Riparian plantings are currently not recognised under the ETS for their carbon sequestration, which cumulatively could be substantial, especially farm-wide plantings – this should be rectified. For instance, restoration of kahikatea forest in riparian areas throughout our lowland rural areas would significantly contribute to carbon sequestration and a myriad of other ecosystem services including climate adaptation. Kahikatea is our tallest native tree species; it is a long-lived pioneer species (a rare thing), and is a relatively fast-growing native tree species, therefore, ideal for carbon sequestration!

In 2006 to 2010, Project Kahikatea surveyed 166 of the 3060 Waikato kahikatea remnants and documented their precarious position. Project Kahikatea demonstrated that kahikatea remnants can be successfully restored and managed (<http://www.projectkahikatea.net.nz/>).

TTT and several partner organisations aim to move forward with lessons learnt from Project Kahikatea. We are currently seeking funding to develop an informed, targeted approach to restoration of lowland kahikatea ecosystems throughout the Waikato. Most of these stands are riparian. It is estimated that approximately 100 rural landowners, mostly farmers, would be willing to participate, with some already actively engaged and asking for help with restoring and managing their forest remnants.

Our research on ecosystem services indicates that native forest in riparian areas is likely to have particularly high aggregated non-timber values – especially for water quality, terrestrial and aquatic biodiversity, and moderating flood peak flows – as well as carbon sequestration (<https://pureadvantage.org/valuing-native-forest-on-private-land/>). Riparian zones are often highly fertile sites with fastest growth and hence carbon sequestration for planted and regenerating native forest compared to marginal steep hill country with skeletal soils and greater exposure.

A network of native forest along riparian zones, linking wetlands and remnant forest to provide corridors for indigenous biodiversity, and shade and shelter for grazing stock, are excellent opportunities for providing multiple benefits within even our most highly productive lowland agricultural landscapes. This will enhance existing land uses, not compete with it. Moreover, the collective cumulative effect and scale of riparian plantings and pockets of native bush on farms is potentially significant. (See article by Dr David Norton, on ‘The importance of native trees in agroecosystems’: <https://pureadvantage.org/the-conservation-estate-copy/>).

Also, there will likely be negative consequences of leaving riparian setbacks unplanted, as per the 3 m setbacks under the recent Freshwater Reforms, as waterways are often conduits for weed species

and animal pests. TT request that the CCC recommend incentivising the planting of riparian zones for carbon sequestration and the myriad of significant co-benefits.

Transitioning from radiata pine and other exotic species to native forest

Some members of the forestry industry are promoting 'plant and leave' regimes for radiata-pine forests, capitalising on the currently high carbon values in the ETS. There has been considerable backlash on this, particularly from rural communities and the agricultural sector.

Radiata-pine is a short-lived species, and it is assumed by many in the forestry industry that when these disintegrate they will somehow be automatically replaced by naturally regenerating native forests. We believe that this is unlikely without active intervention, and even then, cannot be assured. Intensive management inputs may be necessary to ensure a successful transition on many sites, but this can be fraught as disintegrating radiata-pine stands are dangerous to work in.

Carbon-farming provides no incentive for the landowner to budget for, or invest in the work required to manage a long-term transition. While TTT does not advocate for 'plant and leave' radiata pine, we are aware that such stands are already being established. We have a proposal that would give native species a competitive advantage over invading armies of exotic weeds. This combines a network of seed islands and green fire breaks – please refer to Addendum 2 in this submission.

Almost one-quarter of NZ's plantation forest estate is on erosion-prone land (high to very high erosion susceptibility classification). High-profile intense weather events in 2018, on the East Coast of the North Island and in the Tasman District in the top of the South Island, have highlighted major issues with logging debris and sediment from clear-fell operations seriously damaging downstream infrastructure. Therefore, social license to operate (community acceptance) has become more of an issue regarding clear-fell regimes and exotic plantation forestry. There have been calls for vulnerable hill country to be established in permanent forest, with natives the obvious choice.

We recommend that incentives are created to transition clear-fell regimes of short-lived exotic species such as radiata-pine, to permanent native forest in sensitive upland catchments.

Utilising native timbers

NZ is fortunate in having a spectacular range of world-class native timbers. They are part of our heritage, and we should have an opportunity to make use of them for decorative and practical purposes. We are pleased to note that this is supported by the CCC. By applying the principles of continuous cover forestry (CCF), selected trees can be harvested without compromising the integrity of the forest and the myriad of ecosystem services it provides

(https://www.tanestrees.org.nz/site/assets/files/1069/continuous_cover_forestry_web.pdf; and <https://pureadvantage.org/nature-based-forestry-regenerative-forestry-models-for-aotearoa/>).

A good example is the management of totara, which has proliferated in most regions due to clearance of the original forest cover and is recolonising on our less productive land. This occurring even in the presence of grazing, despite repeated attempts by landowners to control it. Our Northland Totara Working Group (NTWG) is continuing to demonstrate that farmers have a valuable resource of native timber establishing before their eyes.

The NTWG have established over 60 Permanent Sample Plots in Northland demonstrating the benefits of thinning and pruning this resource as a future high-value specialty species that can be managed under CCF harvesting methods to retain high forest values and benefits. The Totara

Industry Project (<https://www.totaraindustry.co.nz/>) demonstrates the viability of CCF with naturally regenerating totara on marginal hill country. However, a viable native timber industry is required to encourage sustainable native forestry. Government investment could help expedite this.

Native forests require ongoing management and that requires ongoing income streams. These could come from carbon, timber, and payments for ecosystem services. However, effective mechanisms, industries and incentives need to be created to support this. Therefore, we strongly support CCC recommendations to investigate approaches for promoting a native forest industry.

NZ currently imports large amounts of specialty timbers each year (e.g., NZ\$99.6 million worth in 2016), some of which comes from non-sustainable sources. There are published discussions on why we are not producing more of our own specialty timbers, including timber from native species, e.g., sustainably grown tōtara would be an excellent substitute for imported western red cedar in many applications, as well as being a culturally important resource highly valued by Maori.

Incentivising establishment of native forest

The big question is how can the weaving of more ngahere back into our rural working lands be incentivised? This is vital - unless farmers are brought on board in substantial numbers, little will be achieved. The key is to make native forest a viable and comparatively profitable land use option for landowners!

Recognition of the value of regenerating native vegetation is vital, including providing incentives, e.g., government policy and afforestation grants should recognise the importance of naturally regenerating shrublands and the potential for this to be managed to enable succession to mature-phase forest. Incentivising the long-term sustainable management of these areas is critical.

Off-site benefits of native forestation accrue more to downstream landowners and the general public rather than to the original landowner – they should be compensated, or incentives provided for retiring land. Options include:

- Promote the multiple benefits of CCF, as demonstrated by the Totara Industry Project on Northland farmland (<https://www.totaraindustry.co.nz/>). Limited careful harvest of high-value timber in 'near to nature' forestry regimes - permanent forest cover is maintained, along with all the high-forest ecosystem services, and there is a future revenue stream for landowners.
- Funding provided by central government for exploring and developing markets and infrastructure in support of production of high-value native timber from CCF regimes.
- Creating a credit/payment system for environmental services, such as biodiversity, erosion prevention and water quality - to incentivise establishment of native forest - the flipside of the 'polluter-pays' principle.
- Biodiversity values are a central, pivotal ecosystem service, i.e., actions to increase biodiversity values will likely simultaneously increase all or most other non-timber values, particularly environmental and cultural services.
- Nature-based forestry is 'a blend between art, culture, and science', where forests are managed on a continuous cover basis and allowed to reach their full potential in terms of the holistic services they can provide, including timber. Harnessing the power of markets is suggested as an effective way to bring about a shift in land-use towards more natural models of forest management (<https://pureadvantage.org/nature-based-forestry-regenerative-forestry-models-for-aotearoa/>).
- It is likely that multiple potential markets and income streams are required sufficiently incentivise and support native forestry as a viable land use option (e.g., a combination of timber, carbon, and payment for ecosystem services etc.). A comprehensive suite of policies

and mechanisms to facilitate this outcome is required. Integration with other planning and regulatory systems will be important (e.g., RMA, District Plans, ETS, taxation, etc.).

Employment

It is difficult to ascertain figures for employment and training opportunities regarding native forests because the available employment data is not categorised in sufficient detail. However, examples of types of businesses, employment and educational opportunities associated with native forests include:

- Ecotourism, e.g., Canopy Tours, Sanctuary Mountain Maungatautari, ZEALANDIA, Orokonui Ecosanctuary, and Foris Eco-tours, as described above. There are also supporting industries associated with ecotourism ventures, such as local accommodation providers generating revenue for the local economy.
- Industries based on outdoor activities, e.g., hunting, fishing, tramping, mountain biking and horse trekking. Business enterprises involved in hunting of game, management of pests, and trapping possum for fur and pelts have ranged in number from 140 to 170 in recent years. Commercial operators provide guided tours in many wilderness areas, with other enterprises providing provisions and accommodation, generating revenue for the local economy. Native forestation and conservation projects funded by government agencies, local councils, community organisations, and iwi groups. This includes the New Zealand government's 'One Billion Trees Programme', as described below.
- Native plant nurseries are distributed throughout New Zealand. Those that are well-managed can be a significant employer of local people. Commercial and community-based nurseries also provide opportunities for training and skills development. For example, the Minginui Nursery provides employment and training opportunities and contributes to the socioeconomic and cultural values of a local community, as described below.
- The honey industry - the number of registered beekeeping enterprises in New Zealand was 7,814 in 2017 (MPI data). Many of these honey enterprises are solely dependent on native forest species for nectar and pollen, such as mānuka honey production, while other honey industries rely on native forest for part of the season, particularly early season nectar flow.
- Forest-based health products such as nutritional supplements, antibacterial oils and health remedies, e.g., bioactive compounds for pharmaceuticals (e.g., mānuka and kānuka oils). Māori have been significantly involved in businesses and associated research initiatives on these types of products, frequently drawing on customary knowledge.
- Wild food and fibre enterprises have been described above under non-timber provisioning services. While these industries are small-scale, they are important for providing employment and supporting local economic activity, and they are often culturally important. This includes hunting of wild game and trapping for fur, and traditional foraged food for fine dining – as described previously.

Compared with radiata-pine nurseries, native nurseries are generally dealing with multiple species, which often have different propagation requirements, and far less scale and mechanisation. And it takes longer to produce native plants compared with radiata-pine. So it is far more labour-intensive compared with radiata-pine nursery systems.

And there is no 'one size fits all' formula for establishment and management of native forest, as compared with radiata pine, so it is also more labour intensive.

An example of increased employment and an improved socioeconomic situation is demonstrated by the Minginui Nursery, in the Whirinaki region of the central North Island. This nursery specialises in production of native plants, and received a significant boost from the billion-tree programme. Ngāti Whare established the nursery in 2016 to supply plants for the Whirinaki regeneration project and

other regeneration projects in the North Island. This has created employment in an area where there has been high welfare dependency and socioeconomic deprivation since the closure of the timber mill in 1988. About 40 full-time, part-time, and seasonal staff from the local community are currently employed in the native plant nursery and in planting and maintenance of native forest in logged sites as part of the Whirinaki Regeneration Project.

In terms of employment throughout the rotation of native versus exotic forestry – ‘it depends’. The honey industry in New Zealand is significant and this is underpinned by native species, as they provide the early season nectar flow, as well the huge export industry for manuka honey. There are also a multitude of small industries that could be associated with native forests, such as forest-based health and food products e.g., kawakawa, honey, pikopiko, and medicinal plant oils.

Harvesting of nurse crops to create light gaps may also create employment and income, such as manuka oil, kanuka palings, and manuka and kanuka for firewood and smoking food. And sustainable timber production based on CCF regimes will provide jobs and income, starting with production things. There are also opportunities for ecotourism and recreational industries, e.g., mountain biking, which will create jobs and income.

RESPONSES TO QUESTIONS FROM CONSULTATION DOCUMENT

Big issues 4 - role and type of forests

Do you agree with our approach to meet the 2050 target that prioritises growing new native forests to provide a long-term store of carbon?

Strongly agree - Agree - Neutral - Disagree - Strongly disagree - Do not know

Please explain your answer (1000 word limit)

TTT strongly support the CCC's recognition of the importance of native forests, not only for carbon sequestration, but also for the substantial co-benefits including environmental and cultural ecosystem services and economic resilience.

The current forested area in New Zealand represents a reduction of over 70% from the pre-human state circa 800 years ago. This large-scale deforestation has been disastrous for our soils, our water, and our biodiversity and has been a significant source of emissions. Weaving our ngahere back into our landscapes will aid climate change mitigation and adaptation, as well as improving water quality, soil stability, and biodiversity conservation (Aimers et al. 2021).

The World Economic Forum (2021) recently estimated that natural climate solutions, i.e., investment in conservation, and land use that increases carbon sequestration and reduces emissions, can provide one-third (almost 7 Gt CO₂) of the net emissions reductions needed to obtain a 1.5 to 2.0°C pathway by 2030. This would simultaneously address multiple other environmental issues, providing substantial co-benefits for the environment and associated communities.

Please see our main contribution to this submission, above.

Aimers, J., Bergin, D., Horgan, G. (2021). *Review of Non-Timber Values in sustainably-managed native forest in New Zealand*. Tāne's Tree Trust bulletin, Hamilton, New Zealand. 115 pages. Publication pending.

World Economic Forum (2021). Consultation: Nature and Net Zero. Report in Collaboration with McKinsey & Company, January 2021. <https://www.weforum.org/reports/consultation-nature-and-net-zero>

Big issues 5 - policy priorities to reduce emissions

What are the most urgent policy interventions needed to help meet our emissions budgets? (Select all that apply)

Action to address barriers - Pricing to influence investments and choices - Investment to spur innovation and system transformation - None of them - (All of them)

Please explain your answer (1000 word limit)

Please see our main contribution to this submission, above, for information on barriers to increasing native forest cover, and the importance of (i) government investment in incentive schemes for land-owners to encourage appropriate land use change, and support the ongoing sustainable management of land/forest cover; (ii) good policy to avoid perverse outcomes; (iii) investment in infrastructure and R&D to expedite the proposed increase in native forest cover; (iv) facilitating the development of a native timber industry and other markets to make native forest cover a viable land use option.

Big issues 6 - technology and behaviour change

Do you think our proposed emissions budgets and path to 2035 are both ambitious and achievable considering the potential for future behaviour and technology changes in the next 15 years?

Strongly agree - Agree - Neutral - Disagree - Strongly disagree - Do not know

We can only speak to our expertise around forestry and land use. There are barriers to rapidly upscaling native forest cover, as explained in our main contribution to this submission – due to a lack of infrastructure, a lack of experienced practitioners, and knowledge gaps around indigenous forestry, which has had extremely little attention compared with the massive investment in R&D and infrastructure around one species – radiata-pine.

We desperately need more people within the forestry industry who have training and expertise around indigenous management, including near-to-nature forestry regimes.

We also need more infrastructure in the native nursery industry and adoption of national standards, particularly around plant quality and biosecurity.

Finally, there is a need to change the narrative around the value of native forests and forestry with indigenous species.

ADDENDUM 1

Seed Islands

Seed islands provide a cost-effective method for large-scale establishment of native forest. The aim is to plant small and intensively managed groves of selected native trees, and to recruit wind and birds as agents of seed dispersal.

There are a limited number of examples of seed island established that provide insight into this technique. One of the best is in north Canterbury by Te Kohaka o Tuhaitara Trust where over 30 seed islands, or 'biota nodes' as they have termed them, have been established for several years within a coastal lowland with a vision to transition land use from production pines to permanent native forest over several generations.

Similarly, Dame Anne and Jeremy Salmond planted groves at Waikeruru Sanctuary near Gisborne that are now acting like seed islands of established native conifer and hardwood tree species that will assist in regenerating a diverse high forest across adjacent retired hill country pasture. Tane's Tree Trust are currently setting up several trials of seed islands comprising small groups of intensively managed planted diverse range of once commonly present native tree species within a matrix of manuka or kanuka nurse cover.

Advantages

- **Low cost** - There are no large up-front costs, and they can be planted over time as funds, seedlings, and opportunities become available.
- **Diversity** - Species are selected to match the site, offer diversity, and restore species that have been lost to the area.
- **Versatility** - There is no single prescription. The size, shape, and composition of seed islands can be matched to a range of scenarios.
- **Stepping stones** - Each seed island will eventually become a copse of trees along corridors, allowing birds to roost, feed, and fly between groves across a landscape, linking remnants of native forest.

Requirements

- **Accessibility** - Because of the need for regular maintenance, seed islands should be accessible, and weed-free. Ideal sites are adjacent to tracks, or on lower slopes, which are accessible, and where fertility, moisture, and shelter support rapid growth.
- **Geometry** - A practical formula, subject to variations, is as follows:
 - 10 - 30 metres diameter,
 - 1.5 - 2 metres tree spacing within each seed island,
 - Aim for 1 seed island per hectare.
- **Composition** - The aim is to plant later succession high forest species that will seed into the surrounding landscape.

Species should be ecosourced, and as far as possible, matching the original forest composition. In general, plant a matrix of shrubs and tree species, in a ratio of 4:1. The shrubs offer biodiversity, and act as a nurse for the tall forest species.

Site preparation

There are two requirements in preparing the sites that are selected for re-forestation:

- Control, or eliminate competitive weed species,
- Retain, or establish a cover of nurse species that will shelter the interplanted native tree species as well as support germination and development of any naturally regenerating seedlings.

Establishment

Depending on site history, there are different scenarios that will require site-specific solutions. These include the following:

- **Bare pasture** - There may be low cost options for establishing a nurse cover, e.g. manuka planted at low density.
- **Regenerating manuka, or gorse** - Both are excellent nurse crops, and if there is a local seed source of key native tree species, then no action may be needed other than ongoing pest animal control.
- **Exotic weeds** - These should be controlled and replaced by a nurse of native shrub hardwood species with interplanted native trees.

Management

Assisted natural regeneration is not a job for the amateur. It needs an experienced team, with an understanding of native forest ecology, and hands-on skills in forest establishment. The sites should be monitored to assess growth performance, and to control weeds and predators.

The concept of seed islands will seem unfamiliar to some, who will regard it as novel, untested, and reflecting their background in planting trees, somehow "unnatural". It is none of those. It embodies a principle of forest establishment that over millions of years has delivered some of the world's great forests in Aotearoa, by using wind and birds as agents of seed dispersal. Establishing groves of native tree species that once occurred at that site is a practical alternative to the prohibitively expensive option of blanket planting thousands of hectares of erosion-prone marginal hill country with native trees and shrubs. It is an example of working with nature, rather than imposing ourselves on it.

These notes are based on work conducted by Dr David Bergin, and reference a Tane's Tree Trust Fact Sheet "How to establish "seed Islands" of Natives". This will be published shortly on our website.

ADDENDUM 2

Transitioning from radiata pine to native forest

Tane's Tree Trust does not promote 'plant and leave' radiata pine. Instead, we promote the use of fast-growing native pioneers as a nurse, but do not dismiss exotics as a nurse where they already exist and could be utilised in the transition to native forest.

However, there has been strong advocacy within the forestry industry for 'plant and leave' regimes for radiata pine as part of the climate change response. The trees are planted but then left undisturbed to complete their life cycle, and decay over what could be well over a century. As gaps appear in the forest, they are expected to be colonised by native species. This would combine the benefits of carbon capture with eventual conversion to native forest.

This has an appealing logic, especially for establishing forest relatively cheaply at scale on remote erosion-prone pastoral hill country to reduce erosion. However, we have some concerns over the proposal, not least that the prospect of covering expanses of the New Zealand landscape with disintegrating pine forests is hard act to sell to the New Zealand public. Furthermore, there are few examples of radiata pine established at scale on remote hill country as demonstration of what eventually happens to ageing radiata pine forest and if a permanent native forest will eventuate.

More specifically, we have concerns over the health of unmanaged pine forests at a time of climate change, and in particular an associated risk of fire. We also feel that re-colonisation by native species should not be left to chance but would benefit from active intervention to ensure the desired ecosystem service benefits are realised. We will discuss this and propose some simple measures that will mitigate these effects.

Fire

Among the conifers, radiata pine is notable for vigorous growth, but a relatively short life span. As the pines age, they fall victim to a range of fungal diseases, bark beetles, and other pathogens, and there are more yet to make landfall. Their natural populations begin to decline at about 80 years, and they are mostly gone by 120 although some individual trees may persist for longer.

However, in California, their life span is commonly cut short by fire. Radiata pine has a close evolutionary linkage with fire. They are dependent on fires to renew their populations, which expand and contract in response to fire frequency. Core samples of coastal sediments in California have shown an intimate linkage between pine pollen and charcoal deposits. Moreover, isotope studies have linked these deposits to periods of rapid climate warming within the last ice age.

At Monterey, the pines form a mosaic of even-aged forests, a sequel to fires. In a recent example, the Pebble Beach fire of 1987 first appeared in a pine canopy, and fuelled by pines and scrubland, raced uphill, and destroyed over 30 houses. A thicket of pine seedlings appeared in the aftermath.

Closer to home, there is an example on Kawau Island, where Governor George Grey planted radiata pines, among many other species, in the 1860s. A limited scattering of the original trees are still present, although senescent and venerable in age, craggy and open crowned, and with old fire scars around their base. They are embedded in a community of younger pines, their offspring, the product of a fire that swept through the forest in 1935.

Over the years there has been much debate over management of the forest; whether to leave alone, mill, replace with pines, or natives. Nothing has been done because the problem is extremely

difficult and costly to deal with. The forest is in decline and has been declared dangerous to enter, and tracks have been closed. With an accumulating fuel load, the dilemma may be resolved by another fire.

Our radiata forests, well managed on a 28-year rotation, have a good fire record, and with careful management should remain secure. However, 'plant and leave' forests could be at risk as they age and become more flammable, due to accumulating dead wood, and are challenged by heat and drought in a warming climate.

We will suggest a method that could give them some protection, while at the same time encouraging transition to native forest.

Legacy

Whatever "plant and leave" forests might offer in carbon storage, they will not leave behind them a blank slate. As they mature and age they will be host to an increasing burden of pathogens, and these could have consequences: in addition to contributing to the risk of fire, they could shift their attention to managed pine forests.

There is a precedent in the great *Sirex noctilio* epidemic of the late 1940s that targeted pines that had been unthinned and heavily stocked. And in the northern boreal forests, global warming has released plagues of bark beetles, followed by devastating fires.

Moreover, there will be an extensive debris of biomass, which if it does not burn, could be more than problematic on steep slopes.

We suggest that these matters should be considered and researched before a commitment to large scale "plant and leave" forests.

Transitioning to natives

A strategy will be needed to ensure that when gaps appear in the declining forests, they will be occupied by native species, rather than an army of exotic weeds.

Direct planting of natives will not be an option. These forests are likely to be remote and inaccessible, and hazardous to work in.

Again, we will need to rely on wind and birds to bring in seeds from a local source. Unless there is a natural forest within bird range, an alternative seed source will need to be introduced.

Research opportunities

It seems that there are potentially some good strategies to transition from faster growing crops of exotic trees to natives but these need careful thought so that matters like seed sources for the new forest and avoiding some of the potential issues with a moribund and gradually collapsing old forest can be minimised or avoided. It could provide a great win-win for all parties but needs to be backed with better research and information than is presently the case.

Tane's Tree Trust would like to see several avenues of research undertaken before we can safely argue that a 'plant and leave option' for exotics is promoted on a large scale, or indeed other options for using fast growing exotics as a short-term temporary nurse are adopted as a viable option for establishing permanent native forest.

Green firebreaks and seed islands

Although Tane's Tree Trust is not an advocate for 'plant and leave' radiata pine, we are aware that it is already happening. We urge the adoption of two strategies that could go a long way to addressing the issues of wildfire, and forest succession. They are green firebreaks and seed islands. Where pine forests are established on a 'plant and leave' regime, we suggest that both these concepts should be incorporated in the plantation design.

Low flammability natives have been identified for planting in regions where there is increased drought due to climate change and a subsequent increased risk of fire. Planting **green firebreaks** (https://www.tanestrees.org.nz/site/assets/files/1321/green_fire_breaks_corrected_2020.pdf) is a proven technology widely used offshore. Their primary purpose is to contain fires or slow down the spread of fires by providing networks of native species selected for low flammability, that encircle and infiltrate plantation species. These would also provide a secondary function as a seed source for forest succession and serve as corridors for birds and other wildlife.

Similarly, strategically located **seed islands** can also become a seed source, with a wider range of wind and bird-dispersed species than already present in the landscape. The seed island approach is currently being evaluated by Tane's Tree Trust on several sites, and is likely to prove to be a cost-effective method for large scale forest succession particularly in enhancing natural regeneration (see Addendum 1).

Survey of existing stands

While there has been some work on quantifying understorey native in pine plantations, more work is required to quantify the optimum densities and proximity to native seed sources in development of a replacement permanent native forest. Tāne's Tree Trust is currently working on a research proposal that aims to investigate the optimal plant spacing of *Pinus radiata* to gain both high erosion protection and carbon absorption while maximising the opportunity for long-term regeneration of indigenous forest cover.

This work will include surveying existing pines that have failed or have been left long term as they are not economic to log. It is intended the research findings will allow us to then guide the establishment of 'plant and leave' forests on appropriate sites combining optimal pine tree density together with green firebreaks and seed islands to help achieve the long-term benefits from such forests.

Fast growing exotics as a temporary nurse

The role of using pines, eucalypts, acacia, tree lucerne, gorse or other fast-growing exotics has often been promoted with a limited number of examples indicating its potential to establish permanent native forest. The Hinewai Reserve experience by Hugh Wilson of using naturally reverting gorse as a nurse for eventual conversion to native forest is a successful example. And there are other selective brush weeds like broom that could be utilised. However, there are many brush weeds like blackberry and locally dominant old man's beard and banana passionfruit that are not suitable.

There are many operational examples of poisoning or ring barking as methods for gradual removal of overtopping canopies of exotics like pines, such as on hills of the Marlborough Sounds to allow development of permanent native forest. Similarly, there are numerous examples of underplanting natives within canopies of poisoned willows in wetlands.

This also has implications for management of wilding conifers as potential nurse crops for eventual permanent native forests.