Continuous Cover Forestry Business Models for Aotearoa New Zealand

December 2023

THE CONNECTIVE

Tāne's Tree Trust
NATIVE FORESTS FOR OUR FUTURE
Hereherea te Wao-nui-a-Tāne

Ngā Pou a Tāne

SCION
FORESTS • PRODUCTS • INNOVATION

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About this Report

This report is the result of a project commissioned by the Ministry for Primary Industries (MPI) to develop the foundation for wider adoption of Continuous Cover Forestry (CCF) in Aotearoa New Zealand, and the realisation of its associated environmental, social, and economic benefits. This applies particularly on erosion-prone hill country where woody debris and logging slash have been a problem.

A cross-sector collaborative team was established to deliver the project from May to November 2023. The team consisted of: The Connective (systems change facilitators); Tāne's Tree Trust (Charity promoting indigenous forests for multiple purposes); Ngā Pou a Tāne (National Māori Forestry Association, championing multi-use forests); and Scion (Crown Research Institute for forestry and wood products).

Key objectives of the project were to:

- Identify high-potential and priority CCF business models to pursue from local and international case studies;
- Identify systemic barriers and enablers to realising the benefits of scaling CCF in Aotearoa New Zealand;
- Provide an overarching investment case for CCF; and
- Recommend policies, market settings and initiatives that can support the priority CCF business models.

Executive Summary

Forestry is central to Aotearoa New Zealand. It covers 38% of our land, it is the fourth largest export earner at $6.6bn pa, it employs 35,000-40,000 people, and it is expected to play a major role in our national journey to net zero (Climate Change Commission, 2021).

But our forestry is also characterised by a high reliance on a single species, a small number of export markets, and a relatively narrow range of forest products. This low diversity in the sector renders it vulnerable to climate-related, biological, and economic risks. We also have the suboptimal, from a productivity, resilience, and climate emissions perspective, of exporting 60% of our forestry products as lower-value raw logs and importing $2.6bn pa of processed wood products.

Damage from cyclones Hale and Gabrielle in 2023 highlighted the urgent need to improve land use practices in Aotearoa. Forestry's 'social license to operate' has diminished. Trees are important for erosion control, and there is need to transition in some places from intensive plantation forestry, particularly on highly erodible soils. Additionally, alternative forest management options that avoid clear-fell harvesting, can improve non-timber values, and are more resilient to disturbance common in New Zealand, such as adverse weather, earthquakes, and erosion.

Forestry has a significant role to play in addressing the pressing environmental and climate crises of our times, while also providing local social, cultural, and economic benefits. Continuous Cover Forestry (CCF) seeks to integrate all these values, while tailoring management practices to local context, and is a promising option to get more from New Zealand's forestry sector. Diversifying forest management practices and forest types in this way has potential to build resilience into local landscapes, communities, the forest sector and our economy.

CCF is the most common umbrella term for a collection of forest management approaches, including close-to-nature, ecological forestry, irregular shelterwood, selection systems and small-coupe harvesting. What they all have in common is avoiding large, clear-fell, harvests. Most seek to develop a more natural forest structure and ecology. Typically, this involves mixed species, uneven-aged stands, and management for multiple values – not just timber production. CCF is often described as a blend of art and science, requiring an adaptive management approach, careful monitoring, and responding to the evolving forest (Barton, 2005).

Continuous Cover Forestry requires scale to deliver its associated benefits. Aotearoa NZ currently has circa 2m hectares of productive forestry with significant growth expected over the coming decades, particularly to support mitigation of carbon emissions. Our high-level analysis identifies the potential of circa 2m hectares of CCF forests by 2050, with the right support and enabling environment.

In the short term, the growth of CCF will be through a focus on transitioning existing high erosion-risk exotic plantations to CCF, encouraging CCF in regenerating native stands on farmland and establishing new planted forests of both exotic and native species on farmland. A medium-term horizon includes the transition of existing pine and new pine plantations where CCF is appropriate. Due to more than seventy purchases by Iwi of significant tracts of Crown Forest Land through Treaty settlements beginning in 1990, Māori landowners will be key to directing this transition.

Planting native and exotic forest species, and even mixes of both, brings the opportunity to create new forests designed and managed to realise the potential multiple benefits of CCF forestry.
Expanding CCF in Aotearoa New Zealand is crucial for bolstering resilience across our economy, forestry sector, communities, and land. With the need to significantly expand forestry stocks to meet Paris Commitments, as well as growing demand domestically and globally for wood, we can't only rely on our existing forestry sector model. CCF, proven globally and in local examples, can provide increased

resilience and comparable or superior returns under favourable conditions. Delivered at scale it can also create additional revenue streams and provide economic growth, particularly in rural areas.

The following recommendations to support the growth of CCF and the benefits it can provide were identified through desktop research and engagement with a diverse group of local and international forestry industry leaders, scientists, researchers, Government officials, investors and community groups.

We reviewed international CCF business models from Slovenia, Ireland and the US. And a diverse range of local CCF models: Woodside Forest; Forever Beech; Totara Industry Pilot; and Redwood CCF Model.

A combination of the three focus areas below is required and all three need focus to ensure we can maximise the benefits CCF can bring to our nation:

1. **Market Development.** The following markets offer the greatest potential to support CCF: Voluntary carbon credits with layered nature benefits; Compliance credits with layered natured benefits; Biodiversity credits; Other Payment for Ecosystem Services (PES); Development of timber markets for non-radiata pine and timber products; and Research into priority areas for CCF plant-based products e.g. nutraceuticals.
2. **Societal momentum for change.** Create community and industry momentum for a national cultural value shift around the role of forestry and its ability to integrate conservation, production, and recreation.
3. **Business model enablers.** Support the investment of time and money in to: Clear long-term Policy direction and regulatory changes; People capability; Silviculture management; Harvesting systems; and Science and data.

Next Steps: This report, and the project that produced it, is a small step on a journey that many who have contributed have been leading to date. We hope that this work provides a useful consolidation of what CCF is, what it can deliver for Aotearoa New Zealand and the key areas that can support the acceleration and scaling of CCF here.

Section 2 – Opportunity For New Forestry Approaches In Aotearoa New Zealand

Current status of forestry in NZ

In recent decades, forestry in New Zealand has had several pronounced and remarkable characteristics. These include:

- **Extreme dichotomy between indigenous conservation forests and commercial production forests**: The latter is industrial-scale, and almost exclusively exotic mono-cultural plantations, managed in clear-fell rotations, mostly on private land. Indigenous forests are predominantly on Crown land which are almost entirely protected in parks and reserves.
- **Timber and wood-products industries concentrate in just a few exotics:** Dominated by *Pinus radiata* (90%). Harvesting from indigenous forests is heavily regulated and very limited, and indigenous timber and wood-product markets are underdeveloped.
- **Heavy reliance on export log markets**: Around 60% raw timber is exported annually, mostly to China.
- **Underdeveloped wood products markets:** Local mills struggle to compete with export prices for raw wood, which is a barrier to expanding. Of such, New Zealand presently produces much more wood and wood fibre than it can process.
- **While New Zealand has an industrial scale forestry sector, it still imports a significant amount of wood products:** Forestry is central to Aotearoa New Zealand. It covers 38% of our land, it is the fourth largest export earner at $6.6bn, however we also import around $2.6bn pa annually.
- **Increasing afforestation for carbon-sequestration**: Particularly with quick-growing exotic plantation species to meet climate targets on time.
- **Social licence to operate:** Loss of public support for forestry, particularly for exotic plantations, large clear-fell harvests, and single-purpose forests (i.e., just timber, or just carbon-farming). In contrast, there is an increasing recognition of the wide range of benefits that well managed forestry can deliver, including mitigating climate change, and higher value-added products.
- **Momentum for change:** Clear public preferences for forests that support environmental, aesthetic, and cultural values

The current opportunity

Damage from cyclones Hale and Gabrielle highlighted the urgent need to improve land use practices in Aotearoa. Forestry's 'social license to operate' has diminished, with plantation forestry becoming an increasingly controversial land use (Radio NZ, 2023). There is need to transition from plantation forestry in some places, particularly on highly erodible soils. Alternative forest management options that avoid clear-fell harvesting, improve non-timber values, and are more resilient to disturbance, such as adverse weather, earthquakes, and erosion, are very relevant to many existing and new forests in New Zealand.

CCF requires significant scale to deliver substantial effect and deliver its associated benefits. Aotearoa NZ currently has circa 2m hectares of productive forestry with significant growth expected over the coming decades, particularly to support mitigation of carbon emissions. Our high-level analysis identifies the potential of circa 2m hectares of CCF forests by 2050, with the right support and enabling environment. This is through a focus on transitioning existing high erosion-risk exotic plantations to CCF, encouraging CCF in regenerating native stands on farmland, establishing new planted forests of both exotic and native species on farmland. A medium-term horizon includes the transition of existing pine and new pine plantations where CCF makes sense. Due to more than seventy purchases by Iwi of

significant tracts of Crown Forest Land through enacted Treaty settlements beginning in 1990, Māori landowners will be key to directing this transition.

What is CCF?

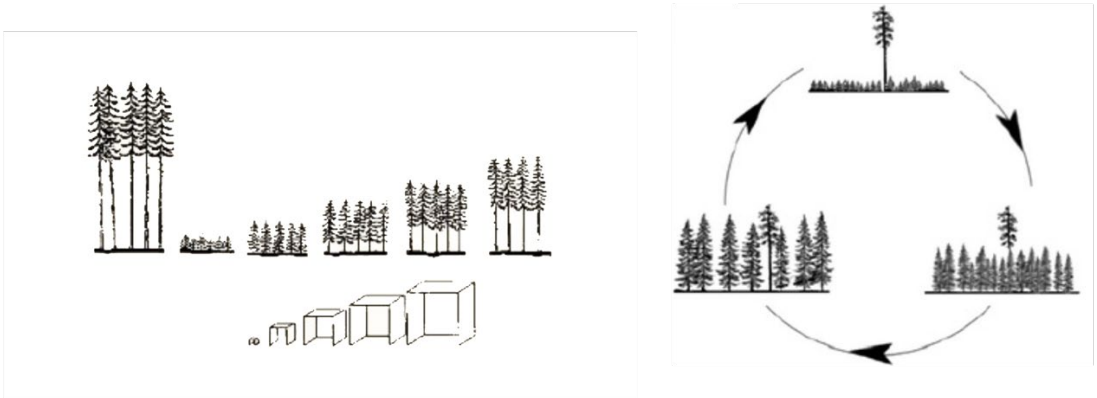
'Continuous Cover Forestry' is the most common umbrella term for a collection of forest management ideas or approaches. Terms such as close-to-nature, ecological forestry, irregular shelterwood' Plenterwald, selection systems, and small-coupe harvesting hint at the necessary variants required to suit differing types of forest ecosystems.

What they all have in common is avoiding large, clear-fell, harvests. Also, most seek to develop more a natural forest structure and ecology. Typically, this involves mixed species, uneven-aged stands, and management for multiple values – not just timber production. CCF is often described as a blend of art and science, requiring an adaptive management approach, careful monitoring, and responding to the evolving forest.

The diagram below contrasts the difference in forest structure between CCF and plantation concepts (Barton, I., 2005; Kuuluvainen T. et al, 2012).

Continuous cover forestry systems - Vertically arranged growing stock

Plantation clearcut system - Horizontally arranged growing stock



Continuous Cover Forestry in Aotearoa New Zealand is adequately defined by the community of practice. For instance, New Zealand Farm Foresters Association define CCF as "the management of forests using ecological principles which are patterned on natural processes so that the forest canopy is always maintained at one or more levels and the forests will largely self-generate. Harvest removals will be undertaken as single tree or small coupe fellings so that biodiversity, soil and water values and the landscape are not compromised (NZFFA, 2009).

However, New Zealand lacks a legislated policy definition and framework for CCF that supports this community of practice. For example, the New Zealand Forests Act 1949 refers to sustainable forest management standards and guidelines for indigenous forests only, in accordance with approved and registered Sustainable Forest Management plans and permits. The requirements in this Act limit the full range of CCF practices and are not optimal for all native tree species (e.g., harvesting restrictions do not allow enough light to enter the canopy to support natural regeneration for some species).

While a CCF meaning in the Forests (Permanent Carbon Sink) Regulations 2007 states it is for "the management of a forest sink where the harvesting of trees retains a minimum of 80% of the pre-harvest basal area on each hectare for the first harvesting operation, and for subsequent harvesting, either a minimum of 80% of the existing pre-harvest basal area on each hectare or 80% of the previous pre-harvesting basal area on each hectare, whichever is the greater". This low harvest requirement significantly restricts what can be done under CCF. Further, it risks putting industry players (many of whom are interested in CCF) off exploring options to build resilience into forestry portfolios.

History of CCF: International

Many traditional cultures globally have managed forests to generate multiple benefits for thousands of years. While CCF as a management practice has its roots in Europe, it is important to highlight that indigenous peoples globally manage forests in an integrated way, for multiple uses and to generate multiple values.

In Europe, German forester Carl von Carlowitz wrote about sustainable forestry in the early-1700s, with the modern concept of CCF being more formalised by Möller in 1923. Switzerland was the first country to prohibit clear-cut forestry in 1902, and Slovenia followed suit in 1949. Pro Silva, established in 1989, leads and promotes close-to-nature forestry throughout Europe, with affiliates globally, including in New Zealand. In the European Union (EU) CCF is growing as a practice particularly due its ability to support the European Union's Forest Strategy for 2030 which aims to improve the quantity and quality of EU forests (European Parliament, 2022). In North America, Ecological Forestry was championed in the 1940's and became widely accepted in the 1980's across the Pacific Northwest.

History of CCF: Aotearoa New Zealand

In New Zealand, as early as 1877, the government was encouraged by forestry advisors to adopt selective felling practices for indigenous forests. Politicians at that time, however, decided upon a different route. Since, with the remarkable performance of exotic plantation forestry in New Zealand, there has been minimal interest or experimentation with CCF. The Forest Service had sections doing some work with native species, including as kauri, beech, and rimu, however, this ceased with the decision to disband the service in 1985.

Other work was undertaken by individual enthusiasts but has not gained traction in mainstream forestry. In 1993, Part 3A of the Forests Act 1949 was amended to allow sustainable harvesting of native forest on private land, with required CCF practices to be used (such as small coupe-felling in beech forests, and single-stem selection harvests in podocarp forests). Such indigenous CCF forestry activities have only occurred at relatively small scales. In recent years, and echoing an international trend, there is a growing appreciation of the need to explore CCF options – including for exotic forestry in Aotearoa New Zealand.

Section 3 – CCF Business Models Project Objectives and Process

This report seeks to develop the foundation for wider adoption of CCF in New Zealand and the realisation of the associated environmental, social, and economic benefits. Especially on erosion-prone hill country where woody debris and logging slash have been a problem.

Key objectives of the project were to:

- Identify high-potential and priority CCF business models to pursue from local and international case studies;
- Identify systemic barriers and enablers to realising the benefits of scaling CCF in Aotearoa New Zealand;
- Provide an overarching investment case for CCF; and
- Recommend policies, market settings and initiatives that can support the priority CCF business models.

These objectives have been delivered though three workstreams:
Wānanga 1: A kaupapa Māori engagement process via a series of wānanga workshops for the purpose of mutual learning and sharing of information between stakeholders in Aotearoa and internationally;
Wānanga 2: Desktop research and conversations with experts from the forestry sector in Aotearoa and internationally; and
Wānanga 3: Analysis of business models, barriers, and enablers, with a focus on market readiness to support CCF to scale.

The CCF wānanga/workshop series, was held over two months, with a diverse group of local and international speakers and attendees invited. The six wānanga had an average of 50+ participants each. The majority were forestry industry participants alongside scientists and researchers, Government officials, investors, and community groups. A wide range of perspectives and experiences were shared.

The following provide an overview of each wānanga.

Wānanga	Key Insights
#1 Opening sessions – introduction to the project and to each other Peter Berg (Chair, Tane's Tree Trust): Past President of the NZ Forest Owners Association and former member of the SCION (NZ Forest Research Institute). Ernest Morton (Ngā Pou a Tāne): 40 years Forestry Professional with whakapapa Māori, and Chairman of Taitokerau Māori Forests Collective. Tim Payn (Scion, Principal Scientists): Chairs the 12 Country Montreal Process Technical Advisory Committee.	Significant interest from diverse stakeholders in scaling CCF, and the business models to support the financial sustainability of this management regime. Stakeholders see CCF is an opportunity to integrate multiple values into forestry – to move beyond the historic division between conservation and business in forestry.
#2 Historical and contemporary context influences on continuous cover forestry Justice Hetaraka: Ngati Wai, Kai Tahu, educator and advocate for Wai262. Roger Dungan (General Manager Strategic Partnerships & Communication, Scion): Supports Forest transition for a prosperous low-carbon future.	High potential for Māori to lead transition to CCF forestry; alignment with their values, desire to exercise Tino rangatiratanga over fauna and flora, and the levels of Māori forestry ownership. CCF has potential to generate high-quality carbon credits (layered with biodiversity values) for carbon markets.

Kit Richards (Fellow of the New Zealand Institute of Forestry): Deep forestry industry involvement for 45 years, including Environmental Manager PF Olsen.	
#3 International practice models and international wider systems enablers for continuous cover Prof Jurij Diaci (Board, Pro Silva Europe; Head of Silviculture Department of Forestry, University of Ljubljana, Slovenia): International expert in CCF Dr Eckart Senitza (University of Natural Resources and Life Sciences Vienna)	CCF internationally is supported by high quality and high-value timber product markets, integrated domestic value chains, and cost saving (e.g., natural regeneration). Cross-cutting is broad demand from civil society for forests to be managed in a way that is multi-use and multi-value.
#4 International wider systems enablers Paddy Purser (Pro Silva, Ireland): International expert in CCF Manus Crowley (Enfor, Ireland): International expert in CCF Alec Giffen and Robert Perschel (New England Forestry, USA): Expert in CCF to unlock carbon potential of forests	Internationally, transition of clear-fell to CCF has been driven by wider demand from civil society to integrate multiple values into forestry. Active government support for forestry industry transition has been an accelerator. Internationally, CCF is being explored to maximise the carbon storage potential of commercial forests.
#5 Enabling continuous cover forestry innovation and excellence in Aotearoa Mark Bloomberg (Canterbury University, Te Kura Ngahere) Jon Dronfield (Tane's Tree Trust, Seymour Forestry, Forever Beech): Practitioner of CCF. Ramona Radford (Ngā Pou a Tāne)	Competing ideologies around the use of forests in NZ (i.e. natives for conservation vs pine for commercial values) has been a key barrier to CCF. Example of viable CCF with Radiata pine (Woodside).
#6 Closing session – identifying priority opportunities for Aotearoa Discussion-based session	Consolidation of learning through the wānanga sessions to identify key opportunities for the growth of CCF in Aotearoa New Zealand, including business models, wider systems enablers and barriers to address, and next steps.

The wānanga outputs and desktop research fed into collaborative workshops with the CCF project team, to identify:

- Business models to support CCF to scale Aotearoa;
- Overarching investment case for CCF;
- Transition scenarios, focusing on: Existing exotic plantation forest cover; regenerated and reverting indigenous vegetation cover; and New planted forests; and
- Key barriers and enablers to be addressed, including market readiness to support CCF.

This report outlines the findings in each of these areas, concluding with recommendations for the Government and industry to shift CCF from a small group of passionate foresters, into a wider national strategy.

Section 4 – The Overarching Investment Case

Expanding CCF in Aotearoa New Zealand is crucial for bolstering resilience across our economy, forestry sector, communities, and land. With the need to significantly expand forestry stocks to meet Paris Commitments, as well as growing demand domestically and globally for wood, we can't only rely on our existing forestry sector model. Characterised by a high reliance on a single species, a small number of export markets, and a relatively narrow range of products – low diversity in the sector renders it vulnerable to climate-related and other risks.

CCF, proven globally and in local examples, can provide increased resilience and comparable or superior returns under favourable conditions. Delivered at scale it can also create additional revenue streams and provide economic growth, particularly in rural areas.

How CCF drives resilience and value

Close to nature forestry aims to put stands in a state of greater responsiveness and better resilience. (Susse, 2011). Countries globally are seeking to scale CCF to help preserve their forestry sectors against climate-related risks, and to deliver the multiple benefits that well managed forests generate. Typically, this is by transitioning clear-fell models, transitioning existing forest stands or planting new forests to be managed in alignment with CCF principles (EU Commission, 2023).

This global trend to scale CCF extends to New Zealand where there is considerable appetite for resilience:

- To learn from the shocks of the cyclones in early 2023, and to diversify our forestry to safeguard against significant future harms and financial costs; and
- To enable the ongoing evolution of forestry to advance economic prosperity, while generating multiple co-benefits for the environment, the climate, and all New Zealanders.

While forestry generated $6bn+ annually, having 90% of our forestry in one species allows for limited alternatives in the face of shocks. This level of concentration in one species poses significant climate, biological and economic risks. In some areas radiata will be vulnerable to a host of climate-related shocks, that are projected to increase in frequency and intensity, including more extreme weather events, stronger winds and disease (Watt et al., 2019). Given New Zealand's limited coverage of climate models to provide understanding of extreme events and the conservative nature of some current climate projects, the inclusion of CCF, should be taken seriously (Truss et al. 2023).

Considering that currently much of the wealth generated by New Zealand forests flow to overseas companies (The Treasury, 2019). CCF is also an opportunity to channel more wealth into New Zealand's regions, to drive economic growth, create new employment opportunities, decrease inequity and grow community resilience. This could occur, for instance, through smaller scale community-owned CCF models or through larger scale CCF, particularly with Māori owned and operated forestry.

Managed well, forestry can enhance community wellbeing and social cohesion. CCF practices can maintain higher natural character and amenity values by creating more natural forest structures and characteristics and by avoiding adverse visual effects associated with large-scale clear-fell harvesting. Such landscape outcomes are experienced both within the forest and outside it from the surrounding visual catchments, with relationships between the visual characteristics of forests and how individuals and communities perceive them. There are many examples internationally of active community involvement in CCF, which fosters ownership and preserves cultural values and practices (Friends of the Earth International, n.d.). This is especially relevant for Māori, many of whom express strong desire

to reclaim control over flora and fauna to be managed in alignment with te ao Māori and local tikanga (Wai 262, 2023).

Māori are well positioned to take a lead in shaping a more resilient and equitable forestry sector for Aotearoa. There is strong alignment between te ao Māori and the underlying principles of resilience, centring on the understanding that humans are part of interconnected socio-ecological systems (Stockholm Resilience Centre, n.d.). With Māori owning a significant percentage of NZ's forestry estate, there is potential for Māori to trial CCF models in a NZ-context at scale that delivers broad and deep resilience.

Prioritising resilience will deliver multiple benefits at multiple scales for our economy, our forestry sector, for communities, and for our environment.

Economic and sector-level resilience

- CCF practices can support the diversification of timber and forest products, services, and markets. International experience shows that diversification into higher value markets has positive back-flow impacts in terms of returns to forest owners and the wider economy.
- The cyclones of early 2023 were a reminder that a forestry sector vulnerable to climate-related risks can cause impacts and costs well beyond the boundaries of the sector. Cyclone Gabrielle, for instance, triggered plantation slash and sediment slides with damage $1 billion+ to public infrastructure, farms and the local communities of Tairāwhiti (Gisborne District Council, 2023).
- Diverse forests managed under site-specific CCF regimes can act as more effective carbon sinks, reducing the costs of meeting our Paris commitments (by lessening the need for buying international offsets) (Kilpeläinen and Peltola, 2022). Further, CCF forests can take advantage of the growing national and international markets for carbon, biodiversity and other ecosystem services.
- In some areas CCF provides an attractive opportunity for new revenue streams, particularly through non-timber products, such as high-value bio extractives, carbon credits and payments for nature benefits. This applies especially to forest owners on erosion prone land, at greater risk to increasing extreme weather events.
- Investors are increasingly drawn to sectors that demonstrate resilience by being equipped to manage and mitigate the risks associated with climate change. This trend is driven by the Task Force on Climate-Related Financial Disclosures (TCFD), which is incentivising investor globally to screen investments against the risks of financial losses associated with a range of climate-related risks.

Community resilience

- CCF is compatible with the maintenance of natural landscape character and amenity values along with biodiversity, and can provide opportunities for outdoor recreation, such as hiking and mountain biking. It is well established that connection to nature reduces stress and improves mental health (Harvard Medical School, 2019). Further, the preservation of scenic landscapes contributes to the cultural identity of communities and supports tourism/NZ brand value. Enhancement of wellbeing and New Zealand's global image is possible within plantations forest that are transitioned to CCF.
- Smaller scale CCF forestry can provide opportunities for community involvement in their sustainable management. This fosters a sense of ownership, empowers residents, and creates economic opportunities, all of which can positively impact human well-being.

- Shared spaces for recreation and sustainable resource use can strengthen community connections to the local landscape and place, providing a sense of belonging, identity, and social inclusion. This is beneficial for mental and emotional well-being.

Land, water and biodiversity resilience

- In allowing for the natural regeneration of trees and avoiding large-scale clear-cutting, CCF, alongside other management systems, can support genetic diversity within tree populations. This genetic diversity enhances the resilience of forests to pests, diseases, and environmental changes (Cavers and Cottrell, 2015).
- Diverse ecosystems are more resilient to disturbance, as they are able to absorb shocks, recover, and adapt to changes over time. CCF can promote the preservation of diverse ecosystems by maintaining a mix of tree species, age classes, and structures. This diversity supports a wide range of plant and animal species that depend on specific habitat conditions.
- CCF has multiple benefits for water. CCF practices involve reduced soil disturbance and minimal use of heavy machinery, which helps to minimise soil erosion, sedimentation, and nutrient runoff into water bodies. Further, maintaining a natural forest structure helps to protect water quality by filtering runoff from pollutants.

Section 5: Local and International Models for CCF

High-level CCF business models

Continuous Cover Forestry is an umbrella term rather than a single approach, model or system. Therefore globally, and within New Zealand, there are multiple unique business models to support CCF management regimes, applicable along the forest value chain and at different scales.

This section focuses on CCF business models for forest owners. Business models have been divided into international examples, that may be applicable in the New Zealand context, and local models that already exist in New Zealand or are emerging. From these specific case studies, alongside our research and wānanga series, key learnings have been identified to support the development of CCF business models in New Zealand.

There are business models internationally and locally that illustrate whilst managing mixed-species, mixed-age forest approaches is more complicated, it is possible to support a viable business. CCF silviculture approaches enable optimisation of growth and value from specific trees, with the benefit of being able to produce high-quality timber. However, usually CCF business models cannot rely solely on the revenue from this wood, and generally rely on a stacked revenue model with revenue from multiple products and sources.

Due to the complexity of managing a Continuous Cover Forest, overseas governments and regional states often provide support to forest owners (particularly to small farm foresters) in developing and managing their forests to CCF principles, through training, support in forest management plan development, as well as grants and incentives. Wider support is also given through 'payment for ecosystem services' (PES), with CCF becoming prominent in wider conversations about how to account for the ecological values generated by biodiverse landscapes. These PES markets are emerging in varying degrees of maturity, with carbon being the most well established (see Section 7 on Financial and Economic markets).

Overall, a forest owners key revenue streams may include:

1. Sale of timber through:
    a) high value wood from selectively harvested trees, for example veneer and sawlog grades (e.g. larger, good-form trees)
    b) lower value wood harvested as a secondary by-product of sustainable CCF to enable the growth and value from larger trees (smaller and poor-form trees)
2. Products utilising the understory of the forest e.g. honey, ginseng, mushrooms
3. Sale of premium real-estate within the forest/property
4. Payment for ecosystem values such as carbon mitigation, biodiversity, recreation services
5. Grants to support CCF based silviculture and forest management that honour the benefits these forests provide to wider society
6. Publicly funded incentives to transition to CCF practices including support for the transition costs

More sophisticated forest management is required with CCF regimes, but enables the realisation of multiple values of the forest. CCF requires increased investment in highly-skilled foresters to work with the living system of the forest in an adaptive approach, particularly across silviculture management and harvesting. These foresters also need to have the expertise to optimise the multiple forest values across timber and non-timber opportunities; and balance profitability in near-term, alongside delivering return in longer-horizons. National and local cultural values have a strong influence on these forestry

management approaches, with momentum for national change being driven by community and industry organisations.

With CCF there is a focus on natural regeneration and working with natural forest processes, which has the benefit of reducing costs. However, harvesting costs are usually higher than other forestry models. Overall these transitions take time – both within the forest, but also in market development for lesser-known species, and integration across the value chain. For New Zealand, whilst our species mix is different, other countries experiences illustrate the potential for transition to CCF, across newly planted forests and mature exotic forest. Locally we also have clear models for collaboration e.g. Forever Beech's model of bringing together forest owners, with existing land and forests, alongside forestry experts with strong capability in sustainable forestry management to lead and manage forestry operations. Woodside Forest shows how Radiata pine can be managed with CCF principles whilst providing comparable financial returns to the landowner as other land uses.

Business Model Structure

To give the CCF business models in this section structure, we've built upon the well-known Business Model Canvas (BMC) (Osterwalder, 2010). The BMC provides a framework for how organisations create, deliver and capture financial value, organised around four core elements:

1. **Value proposition**: The value the organisation provides to its customers.
2. **Infrastructure**: The key partners, key activities and key resources required.
3. **Customers**: The customer segments, relationships and channels.
4. **Finances**: Cost structure and revenue streams.

To this we've added two additional components:

- **Systems enablers**: The system enablers which support a CCF business model such as national and community culture and values, industry and market context, government policy, funding, industry leadership and collaboration.
- **Systems impacts and value creation:** The wider value created by the business model, and other impacts e.g. environmental, community, economic.

The following business model diagram (based on the original BMC and adapted for use here) outlines each components key questions. For each local and international case study we have highlighted key points of interest across these components.

System Enablers

- What are the key cultural perspectives which underpin the business model?
- What is the wider industry and market context that this business model sits within?
- What are the system enablers that support this business model?

Business Model Design

Value Proposition

- How do we create value and what value do we deliver?
- How do we differentiate our products and services?

Key Resources, Activities & Partners

- What key resources and assets are required?
- What people capabilities are required?
- What are the most important activities?
- Who are our key partners and suppliers?

Customer Relationships, Segments & Channels

- Who are our customers? Who are the end customers?
- What are the key customer segments we are providing value to (e.g. building, construction, furniture), and how do we connect to them?
- What are the key sales and delivery channels?

Cost Structure

- Which costs are there for running the business model?
- What are the most expensive investments?

Revenue Streams

- What are our customers paying for and willing to pay for?
- How does each revenue stream contribute to overall revenue?

Systems Impacts & Value

- What are the system impacts and value that result from this business model including environmental, social and economic outcomes?

International models: Examples

Continuous Cover Forestry has a long history with sustainable and ecologically sound approaches to forest management. These can maintain forest cover while promoting biodiversity, ecosystem resilience and multi-use benefits for communities. Countries such as Slovenia, Germany, Ireland, the United States and Canada have been at the forefront of implementing robust CCF systems. In Germany, the concept of Dauerwald, meaning "permanent forest," has been integral to maintaining continuous tree cover, emphasizing natural regeneration and selection harvesting. Similarly, Slovenia's Pro Silva approach has demonstrated the efficacy of managing forests in a way that aligns with ecological processes.

We have focused on key countries and specific models to compare, contrast and learn from for the New Zealand context. The European countries Slovenia and Ireland were identified for deeper research, analysis and discussion, due to their size, landscape, differing forestry history and current CCF scale. In Slovenia ecosystem-based forest management systems have been used for many decades, whilst in Ireland (which had significant loss of forest cover in the previous century) transitioning conifer plantations to close-to-nature forestry, in response to social pressure, has been a focus in recent decades. We have researched the business model for large forestry investment companies in the Lake

States of the USA. These have seen the value of managing their forests through a CCF approach, with the ability to optimise for multiple uses and revenue streams and receive continued returns over a long-term horizon.

Slovenia Close-to-Nature Business model

Slovenia has one of the highest percentages of forest cover in Europe (58% of forest coverage), and a long history of an ecosystem approach to forest management. Clear-cutting was banned in 1947, alongside development of requirements for forest management plans.

System Enablers

- **Culture:** Forests are valued broadly Slovenian society for their provision of multiple-financial values, including recreation, cultural identity and ecosystem services.
- **Wider momentum:** Pro-Silva, the organisation driving CCF practices, started in Slovenia
- **Research**: The Slovenian Forestry Institute (SFI) has undertaken research to better understand biodiversity and functional diversity; below ground complexity; and net ecosystem carbon exchange in time and space
- **Policy**: National ecosystem approach to forest management that imitates the natural cycle in forests, with clearcutting prohibited, and protection of the use of forests for recreation and other values. Forest and ecological approaches are managed alongside each other and Slovenia's National Forest Service partners with all forest owners to support individual forest ecosystems.
- **Funding**: Wider public benefit of forests recognised, with state and EU funds providing financial support through grants to forest owners for silviculture and conservation work
- **Cross-country collaboration**: Partnership at Ministerial level between Slovenia, Austria, Finland and Sweden to share knowledge and expertise

Business Model

Core Value Proposition

- Multi-use, mixed-age native forests with natural regeneration providing high cultural and natural values, as well as high-value logs for building and construction

Key Resources, Activities & Partners

- Existing mature mixed-age forest
- Silviculture, forestry management and harvesting with partnership with national forestry service for management plans and record keeping

Customer Relationships, Segments & Channels

- Strong community relationships to forests with access for gathering forest products, and recreation
- Wood sales through locally based wood markets

Cost Structure

- Utilising natural regeneration
- Land ownership handed down through families, with small forest size (limiting scale benefits)
- Harvesting costs reduced through skill development of forest owners

Revenue Streams

- Regular stream of income from wood harvests, with high value logs that can sell up to 20x more than a standard log
- Financial support for full or partial costs of forestry management work through Forestry Service and EU grants

Systems Impacts & Value

- Now 95% of its forests are afforested through a close-to-nature approach.
- Significant forest regeneration and one of the highest forest covers in Europe
- High levels of biodiversity with ~50% of forests classed as Natura2000 naturally protected areas

(CCF wānanga series, 2023; Slovenia Forest Service)

Key perspectives which can be taken into a New Zealand context are:

- Impact and influence of national and local cultural values to drive forestry management approaches
- Potential for greater support to smaller forest owners to manage their forests with ecological principles from the national forestry service through forest management plans and grants
- Significant impact on forest regeneration and biodiversity through active forest management incorporating these values
- Access to forests for recreation and understory harvesting, enables local communities to build strong relationships with their local forest

Ireland Forest Owner Builder model

Significant deforestation across Ireland had resulted in only 1.5% of forest cover left at the beginning of the 20th Century, largely in inaccessible areas. Policy was developed to re-establish a forest resource as quickly as possible, and following trials, exotic conifers from the Pacific North-West emerged as a suitable species for timber production with Ireland's soils and climate.

The reforestation policy was largely very successful, increasing the forest estate to 10% of land area, supported initially through state owned forest development and later through grant assisted private forest development. However, there was limited planning around biodiversity, heritage, recreation etc., and forestry in Ireland became synonymous with mono-cultural plantations, predominantly Sitka spruce. As Irish society became more educated and affluent, there came a push for forests to provide more than timber, alongside a growing knowledge that other options to forestry management existed, which could support native forest species. With growing concerns at local, national and EU levels over habitat loss, loss of biodiversity, damage to water catchments and scars on the landscape, a growing resistance has built over the last 20 years in Ireland to clear-felling and monocultures.

This public pressure and grassroots efforts from organisations like Pro-Silva Ireland and HomeTree have enabled significant shifts in national policy. CCF is a key part of the recent Ireland National Forest Strategy, which had significant public consultation, resulting in a goal that CCF becomes mainstreamed, and that landowners who decide to establish new forests can do that in accordance with CCF principles. This is supported by funding provided to forest owners utilising CCF practices and supporting native ecosystems. This has also seen an increase in the use of CCF practices by the state-owned commercial forestry company, Coillte, which owns ~50% of Irelands forests. With some forests close to Dublin transitioning from a plantation approach to a mixed-use CCF approach with a key objective to support local recreation and tourism.

System Enablers

- **Culture**: Increasing demand from public for continuing to increase forest cover, and for forests to play a wider role in supporting people and nature
- **Wider Momentum:** National momentum for CCF built over time, and now a part of the national forest strategy
- **Policy**: CCF a key part of the Ireland National Forest Strategy 2023 - 2030
- **Funding**: A mix of grants, incentive schemes and payment for ecosystem services to support multiple different approaches to growing CCF within Ireland, whether transition to CCF from existing forest, develop new forest with CCF principles, and support to a forest owner until revenue is received through timber harvesting

Core Value Proposition

- Multi-use, mixed-age forests (native, exotic and mixed) to reforest the landscape whilst providing high-value logs for building and construction

Key Resources, Activities & Partners

- Utilisation of existing exotic plantations to transition to CCF with a potential mix of exotic and native species
- Training and support from ProSilva, national forestry service, Coillte and other organisations
- Partnership with national forestry service for management plans

Customer Relationships, Segments & Channels

- Initiatives planned to promote Irish wood for Irish homes
- Coillte provides open access to its forests, and provides significant recreational opportunities

Cost Structure

- Significant initial new forest re-planting to rebuild Ireland's forest over
- Existing forests utilising natural regeneration, alongside selected planting where transitioning from an exotic mono-culture to mixed-species with natives
- Higher costs for silviculture management and harvesting
- Training across the value chain

Revenue Streams

- Financial support through government grants and incentive schemes for new and transitioning forests
- Timber sales once forest mature

Systems Impacts & Value

- State-owned forests are now working to CCF targets within their commercial forests, and transitioning some to a core focus on tourism and recreational values, whilst also maintaining timber production

(CCF wānanga series, 2023; Department of Agriculture, Food & the Marine, Ireland, 2023)

Key perspectives which can be taken into a New Zealand context are:

- Power of community and industry organisations to create momentum for national change
- Potential for policy and financial support to forests owners through a wide variety of mechanisms
- Potential for development of forests with both native and exotic species, particularly where starting from a mature exotic plantation forest
- State-owned forests with a multi-use approach across forest production, recreation, tourism and biodiversity development.

USA: Northern Hardwood Forests of Northeastern and Lake States

Real Estate Investment Trusts (REIT) and Timber Investment Management Organizations (TIMO) in the Northeastern and Lake States of the United States, focus on owning and managing land used to grow timber e.g. Lyme Timber. They utilise a wide range of silvicultural systems depending on the forest type to balance their portfolios of forestry investments, including a range of CCF approaches e.g. Northern Hardwood forests.

The choice of silvicultural system is driven by the ecology of each forest type. These companies often operate a complex business within multiple markets, looking to ensure that the company is profitable now, whilst also ensuring a long-term sustainable future. This is supported by strong people capability and expertise in forest management. Their portfolio is likely to include a mix of timber revenue across premium, high-value and low value timber products, alongside trading of non-timber values, sale of real estate and other revenue streams like hunting leases.

Where the forests are managed using CCF, they need both the high value wood and the pulp and paper markets (or other markets for low value wood produced as a by-product) to support a profitable business.

System Enablers

- **Culture**: Shift to CCF principles for particular species and forests in USA's 'Lake States' from the 1940's and 50's due to forest degradation from over harvesting of old-growth forests
- **Research**: The development of CCF techniques was undertaken through research by the US Forest Service, with some in-kind contributions from industry.
- **Industry values:** Now CCF is a culturally ingrained view for management of specific forest types in the Lake States. This is led by professional ethics, rather than regulation
- **Multi-use & Multi-value:** State forest services and US Forest Service mandated to protect conservation, provide recreation, and support regional economies. This results in sale of rights to cut timber within sustainable limits on open market (stumpage sales)

Core Value Proposition

- High value locally grown timber for flooring and furniture
- High volume low-grade wood for pulp and paper processing

Key Resources, Activities & Partners

- Significant company land holdings with risk managed across forest types and land uses
- Well-developed and maintained roading infrastructure within forest
- Strong capability in ecological forestry management and uneven-aged silviculture, to support optimisation of value from trees both now and in the future
- Harvesting with own crew or strong relationships with harvesting contractor
- Key partnerships with next stage processor (sawmill, pulp mill, veneer mill etc)
- Partnerships with environmental groups and state/federal agencies to create conservation easements

Customer Relationships, Segments & Channels

- At harvest trees are separated between species and grades, with clarity on what specific markets each will go to, to optimise value
- Auction for individual very high-value logs e.g. birdseye maple
- Sawlogs for appearance grade timbers such as flooring, furniture, basketball courts
- Bulk of wood volume going to pulp and paper. This lower value wood is a by-product in process of growing high-quality wood.
- Federal and state forest service sales of stumpage
- Trading of mitigation and carbon credits through voluntary and free-market schemes

Cost Structure

- Focus on natural regeneration to drive down costs
- Skilled forestry staff to optimise forest value
- Harvesting stands every ~10-20 years with objective to maintain peak optimum volume, growth rates and potential for particular logs
- Purchase of stumpage from state and national forest services, with bond held until harvest completed to required standard

Revenue Streams

- Primary revenue through timber production – mix of quality and price, with pulp and paper revenue 'keeping the lights on'
- Sale of mitigation credits to other companies, received from state due to restoration and protection of vulnerable land e.g. wetlands (Note: state by state policies will differ)
- Sale of carbon credits through voluntary / free market schemes
- Real estate sale of forest property with high aesthetic values for residential use
- Leasing of hunting rights on designated hunting blocks

Systems Impacts & Value

- Multiple forest values managed simultaneously resulting in environmental protection of wildlife habitat, ecological diversity, and recreational access supported alongside economic and community benefits from forest production

Key perspectives which can be taken into a New Zealand context are:

- Emphasis on working with natural regeneration
- Importance of skilled people with expertise to optimise the multiple forest values across timber and non-timber opportunities; and manage the balance of ensuring profitability in near-term, alongside delivering return in longer-horizons
- Whilst increasing complexity from mixed-species, mixed-age forests, this can be managed effectively with clear financial returns
- Need for markets and use of low-grade log volume produced as process of forest tending for longer-term enhancement of forest structure e.g., improve production of large, higher-grade logs
- Utilisation of auction system to sell high-quality logs
- Possible relevance of real estate opportunities for New Zealand forests – e.g., "forest-park" subdivision concepts with premium residential opportunities within a larger commonly accessible multi-use forest area. Can provide finance for early forest establishment and/or transitions.

New Zealand models: Examples

In New Zealand there are several examples of profitable CCF business models, in which the forest owners have taken a regenerative forestry approach to enable a healthy forest ecosystem whilst maintaining a financial return through forestry production. There are also emerging models with the New Zealand landscape that offer different approaches and alternatives to current forestry management (seen through the Tōtara Industry Pilot and a Redwood CCF business case), and illustrate the potential for greater, more diverse forest landscapes across New Zealand.

Commercial examples

Woodside Forest

Woodside is a 120ha farm-forest property in North Canterbury owned by Rosalie and John Wardle with Black beech (84 ha) and Radiata pine (27 ha) forests. The Wardle's see themselves as forest farmers rather than owners of forest investments, with them living and working on the land, and the forest providing a sustainable livelihood from a small property.

A continuous canopy, selective harvesting management system is utilised across the black beech and pine forests, based on target harvest diameter (where a tree is harvested once it meets a chosen target diameter). This approach enables the development of mixed age stands, and yields a continuous flow of high-quality logs, mostly relying on natural regeneration for replacement (CCF Wānanga series, 2023). Alongside this the Radiata pine stands are currently being transitioned to mixed-aged, mixed-species stands with supplementary planting with other species.

System Enablers

- Utilisation of existing pine value chain for large diameter pine logs enabling high value returns from these logs

Core Value Proposition

- Main value proposition is high value large pine logs for building and construction
- Supported by black beech timber for building and furniture and beech honeydew as a condiment

Key Resources, Activities & Partners

- Land with exiting regenerating beech and planted pine forests
- Forest management including pest control
- Harvesting using a small ground-based contract harvesting crew with skidder extraction
- Partnership with scientists to measure and study forest

Customer Relationships, Segments & Channels

- Large pine log marketing and sales through local forest consulting form
- Development of local market for black beech for furniture, flooring and tools, and channel for lower quality wood for home heating
- German market for honeydew

Cost Structure

- Forest owner expertise in forest management
- Natural regeneration with supplementary planting in pine with redwood and cypress
- Roading to logging truck standard for harvest and transport
- Utilises existing pine value chain for pine harvesting, transport and sales
- On-site beech saw-milling and air-drying

Revenue Streams

- Annual scheduled harvest and windthrow events providing regular cash flows, and similar cash return to pastoral farming (excl. capital gain)
- Pine provides similar investment returns to clear-felling with revenue from large diameter pine logs (high proportion of P and S grades), as well as chipwood or firewood logs (~10% volume)
- Additional revenue from sawn black beech timber and beech honeydew

Systems Impacts & Value

- Key case study for alternative forestry management practices in New Zealand
- Supports wider ecological benefits for Woodside Forest and land

(CCF wānanga series 2023; M. Bloomberg; FAO, 2005)

Key learnings for scaling CCF in New Zealand are:

- Working with a living system to develop effective silviculture and forest management approaches for a particular site and species mix can take time, and is ongoing
- The black beech operation demonstrates application of CCF under the provisions of Part 3A of the Forests Act
- An example of a viable CCF transition of a pine plantation
- Potential for target diameter harvesting for Radiata pine to provide comparable financial returns to the land owner as other land uses, with increased silviculture and harvesting costs offset through increased revenue from higher value logs
- Increasingly a mixed species forest developing with transition to CCF management of Radiata pine (e.g. black beech invading some areas)

Forever Beech Business model

Forever Beech coordinates the management of a beech forest resource in Buller and Tasman in the northern area of the South Island, encompassing 22 landowners and a forested area of 5,600 hectares, with about 80% of this area used for wood production. Individual forest owners did not have the time or expertise themselves in navigating legislation and enabling sustainable forest management. This initiative involved marrying the technical knowledge required to produce management plans and practical harvesting logistics, with a diverse and scattered group of forest owners to form an umbrella organisation that had enough resource under management to attract working capital and investment. Utilisation of pre-existing forest resources, often partially modified, also meant no investment cost in planting or land purchase.

Each forest is managed individually under its own Sustainable Forest Management Plan under Part 3A of Forest's Act (1949). Forever Beech is responsible for the development and implementation of the management plans, and in return received 20-year Forestry Rights with the "first right of refusal" over annual production from the forest owners. This legal mechanism with committed timber resource enabled investment.

Forever Beech's objective is to manage the forests using techniques and practices that mimic what happens in nature and retain the forests' natural structure, whilst producing a sustained annual yield. Whilst it does not have independent certification e.g. Forest Stewardship Council, it has been possible to market timber that is supported by New Zealand legislation and the required technical documents. However, this market for beech needed to be developed within New Zealand, with strong competition from imported wood, and a reduction in local furniture makers and other value-added processing for wood, initially impacting the overall market potential.

System Enablers

- **Regulatory**: The Forest Act Amendments of 1993 allowed for and governs the production of timber from privately owned indigenous forest
- **Expertise:** Large amounts of intellectual property and forest management knowledge gained from earlier work by the New Zealand Forest Service and Timberlands West Coast Limited
- **Funding:** In recognition of the loss of timber production from publicly owned forests following 1999 changes in legislation, government funds were vested in the West Coast Development Trust who provided financial capital of $3m to Forever Beech at initial stages of development

Core Value Proposition

- Red beech timber with strong durability and high performance for exterior and interior use, and silver beech for furniture and building interiors
- Additional benefit that wood is from sustainable harvesting processes that ensures protection of the natural forest state

Key Resources, Activities & Partners

- Existing native beech forests on private land, consolidated to support forest owners with sustainable forestry management and harvesting
- Responsible for forest management, harvesting and saw milling to manage quality, impact on forest, and develop people capability
- Harvesting across the forest with existing size distribution, with key objective of maintaining forest
- Exclusive supply arrangement with Health Based Building who is responsible for marketing, sales and wood machining

Customer Relationships, Segments

- Required market development for beech (took 15+ years to develop) to become a sought-after wood
- Main customer is architects and their specifications for beech in new commercial and residential builds
- Physical product, producer statements, technical information, and high-quality imagery important to support sales

Cost Structure

- High-cost structure particularly due to helicopter harvesting which is expensive but mitigates negative impacts on soil and water, with no roads required
- Only marketable trunks of harvested trees are removed (~60% of total biomass of trees felled)
- Lengthy drying period results in resources tied up in drying stocks

Revenue Streams

- Architect specifications for new builds across exterior cladding, decking, flooring and panelling systems
- Flooring product needs to be price competitive against other wood, as well as compared to other flooring options

Systems Impacts & Value

- Minimal visual change to the forest following harvest, due to helicopter harvesting enabling very small areas to be harvested and an absence of access roads
- Ensures protection of the natural forest state and all the benefits of soil, water and biodiversity protection associated with this
- Forest contiguous with Department of Conservation land, enabling an extension of conservation land and benefits to native biodiversity
- Employment and business activity in an economically depressed region
- A "by locals for locals" approach to producing timbers under well-regulated systems for domestic use enables the shortening of logistics chains, minimises the carbon footprint of timber in the market, and substitutes for use of imported timbers of dubious provenance

(CCF wānanga series 2023; J. Dronfield; FAO, 2005)

Key learnings for scaling CCF in New Zealand are:

- Potential model to build off in bringing together forest owners with existing land and forests. Forestry experts with strong capability in sustainable forestry management to lead and manage forestry operations
- Key enabler of financial capital at early stages of the business

- Demonstrates application of CCF practice in existing indigenous forests under Part 3A of the Forests Act.
- Demonstrates extraction option for high-value logs from steep and inaccessible terrain
- Red beech and white beech have clear marketable characteristics for a range of indoor and outdoor uses
- Highlights the difficulties competing with imported timbers and the important role of specifiers (architects) in choosing to use a local product, often reliant on belief in a credible sustainability and local benefits story
- Market development for timber species by individual companies takes time to build, and more support is required to enable greater scale of native wood production to be utilised in New Zealand
- Due to decrease in local furniture making, and other local value-added wood processing, there is a high reliance on specifications through architects for utilisation for beech in residential and commercial buildings
- Indigenous timber production under the Forest's Act (1949) can be commercially viable, but challenges exist depending on silviculture and harvest accessibility, with helicopter harvesting for remote areas significantly impacting costs

Emerging Models

Tōtara Industry Pilot

The Northland Tōtara Working Group (NTWG) is cross-industry body that was established in 2005 to promote the management and support the research of naturally-regenerating tōtara trees on farms for multiple purposes, including sustainable timber-production and a wide range of environmental benefits.

The Tōtara Industry Pilot was a study that was completed by Tānes Tree Trust, Taitokerau Māori Forests, Scion, Northland Inc., and Te Uru Rākau in 2021. The project is in its pre-commercial stage with six months' worth of work, (on value chain integration, resource stocktake, partnership model), still to be completed.

Tōtara is a prominent feature of the rural Northland pastoral landscape typically regenerating on erosion-prone pastoral hill country as well as along riparian margins. It is fast growing and regenerates prolifically, colonising poor pastures whilst being relatively unpalatable to grazing stock. Over the last century or more, substantial areas of dense second-growth tōtara-dominated stands have developed with the potential to be managed as a sustainable resource to complement existing pastoral farming land use. However fear of regulations and lack of financial incentives often result in clearances of reverting indigenous vegetation even on steep, marginal farmland. The NTWG initiated the Tōtara Industry Pilot project with the aim to test the opportunity for a new industry based on careful management of regenerating tōtara on private land.

System Enablers

- Climate change drivers for native afforestation in New Zealand, alongside the multiple co-benefits including cultural, biodiversity, erosion control and water quality benefits
- Northland Tōtara Working Group as a cross-industry working group driving key initiatives
- Requires conducive regulations which ensure sufficient protection without becoming onerous disincentives

Value Proposition

- Weaving of native forest into the rural production landscape, sustainably managing and enhancing what is already there, with potential for some wood production through continuous cover forestry practices. (Note: further work needed to confirm sustainable yields can be achieved)
- A practical opportunity to integrate native trees into pastoral environments.
- Provision of timber associated with extremely high cultural values

Key Resources, Activities & Partners

- Naturally regenerating tōtara with potential to harvest now
- Northland Tōtara Working Group & Tōtara Industry Pilot projects
- Small scale harvesting and timber sales occurring at present.
- Currently limited knowledge on adaptive management practices
- Potential for local forestry advisors to support landowners with management plans
- Te Taitokerau Māori Forestry Inc. have indicated they wish to be the entity that progresses this opportunity in Northland

Customer Relationships, Segments & Channels

- Key challenge still exists to develop a tōtara timber and non-timber industry and market, and develop key channels to market

Cost Structure

- Utilising natural regeneration
- Potential for tōtara to be a viable land use option for marginal hill country in the region, and in some scenarios tōtara forestry could be more profitable than pastoral farming
- Potential of co-op approach to enable small forest owners to obtain scale advantages for silviculture management, harvesting, processing and marketing

Revenue Streams

- Potential for tōtara to be a key timber species in many places for building interiors and furniture

Systems Impacts & Value

- Tōtara forests can provide the first canopy and forest structure or framework to support an increasing diversity of other indigenous species
- Potential for:
  - native forest to be an ingrained and prominent feature of the rural landscape
  - creating a greater relationship between people and nature, land use and kaitiakitanga
  - Skilled employment opportunities for local people where they do the work, get the benefits and hold the responsibilities

(Quinlan, 2022)

Redwood Continuous Cover Forestry Model

Scion and the Faculty of Forestry in Chile have undertaken initial modelling on the potential for Redwood forests under a CCF approach to support both timber production and offset greenhouse gases in New Zealand (Brown, in prep). It should be noted that this is currently a hypothetical model, and there are still significant unknowns which may strongly influence the productivity and resulting profitability of the model, but it provides the indicative potential for CCF Redwood forests in New Zealand.

Redwood is capable of accumulating very high amounts of carbon in secondary and plantation forests (Sillett et al. 2020), which enables a business model for a planted Redwood forest to utilise carbon revenue through the New Zealand Emissions Trading Scheme whilst the forest is growing, and then

transitioning to revenue from the Redwood timber once the forest is mature. This initial business modelling shows this system is economically feasible, with a potential strong investment return from this regime, particularly for key regions such as Waikato, Taupo and the Bay of Plenty where Redwood is more suited.

System Enablers

- Climate change drivers for afforestation in New Zealand, with increasing price for carbon through the ETS
- Existing Californian market for Redwood and existing Redwood value chain in New Zealand

Core Value Proposition

- High quality appearance grade redwood timber for the Californian building market
- High levels of carbon sequestration to offset atmospheric carbon

Key Resources, Activities & Partners

- Requires land/sites suitable for Redwood, and preparation undertaken
- Planting and silviculture management to maximise high value clear heartwood
- People capabilities and equipment for pruning and harvesting under CCF model
- Key relationships with sawmill and wood processors

Customer Relationships, Segments & Channels

- Existing Californian market for Redwood timber for building
- New Zealand carbon credit system

Cost Structure

- Initially planted followed by natural regeneration after harvest, maintaining >50% forest cover of trees aged 20 years and older
- Pruning at regular intervals, as well as harvesting to improve stand density
- Forest management and harvesting costs higher under CCF than clearfell regime due to increased complexity

Revenue Streams

- Carbon credit as main revenue stream for the first 35 years, from where it drops to zero
- Timber production from smaller harvested trees for stand management
- Main timber revenue from harvest of mature trees for high value clear heartwood with potential for a net price approximately 5x that of Radiata pine, supported by timber sales of other quality levels

Systems Impacts & Value

- Redwood forests have potential for wider recreational use e.g. mountain biking
- Diversification from Radiata pine with a species that has high resiliency

(Brown, H., in prep; M. Watt)

Conclusion

There are strong international business models alongside local examples which can provide learning and inspiration for the scaling of CCF practices in New Zealand. Key learnings are:

- National cultural values can drive forestry approaches, with the power of community and industry momentum for change
- CCF business models can be more complex than other models and are usually supported by multiple revenue streams, operating in multiple markets
- Requires higher investment in silviculture, people capability and harvesting
- Internationally government and state support is often provided to support foresters, particularly small forest owners, across a range of approaches and funding mechanisms to support CCF practices and its wider ecosystem benefits
- Government support in the form of conducive policies, regulations and investment support may be necessary to facilitate CCF development in New Zealand
- There are existing CCF models in New Zealand for Radiata pine and Beech species, with emerging models and potential for both Tōtara and Redwood
- Transitions can take time – but so much can also happen quickly when there is national momentum for change

Section 6: Scaling CCF - What is needed for the transition

While commercially successful business models for CCF exist internationally and locally, this has not been enough to support momentum to scale CCF wider in New Zealand. To understand what would be required to support a transition to CCF within New Zealand, we have investigated what the current systemic barriers are to scaling CCF, the required enablers for change, and the key priorities to focus on in the next five years to start to realise the benefits of CCF.

CCF transition options

Within a CCF approach there are multiple forest management regime options, and many ways to transition to CCF from existing forest cover. Fortunately, there are many subset concepts enabling CCF principles to be applied to suit a range of forest types and situations. Most of these systems have been developed in other countries, so applying them here will need some adaption and translation, and are best used as inspiration. Implementing CCF in Aotearoa will therefore be characterised by practical experimentation and learning by doing, alongside concurrent research and monitoring.

With this large number of different pathways available, this project decided to group options together for analysis into three larger land transition categories. We believe that this higher-level analysis enables identification of core themes of current gaps and strengths across the forest value chain, as well as priority areas at a national level for the next five years to then support localised, practical, pragmatic action.
CCF in Aotearoa could be applicable to several broad categories of forest type or situation. We have focused on the following opportunities to transition to CCF:

1. Existing exotic plantation forest cover
2. Regenerated and reverting indigenous vegetation cover
3. New planted forests

For each category we have looked at a wide range of different areas that make up a successful forestry value chain and business model, across science and data, the processes involved in developing and managing forest, as well as harvesting, processing and extracting value from the wood and non-wood products, supporting key enablers and key outcomes.
We then looked at the existing strength and relative priority of the area, and graded them with levels of high (green), medium (blue) and low (red).

- **Strength** – What is the existing strength of this area to support the uptake of CCF in NZ?
- **Priority** – What is the relative priority of this area for focus over the next five years to support the uptake of CCF in NZ? This was in comparison against the rest of the table and in consideration of other scenarios.

This detailed analysis for each transition category, with the gradings and key notes is included in Appendix 1. From this analysis we have been able to identify clear areas of priority and focus, across the categories; and specific opportunities for further development.

Key scenarios for CCF transition

1. Transition to CCF from existing exotic forests

Transitioning existing exotic forests is a large-scale opportunity for CCF in Aotearoa, with the majority of these Radiata pine forests. There are areas of existing private production forests where clear-fell harvesting is no longer appropriate and alternative managed options would be preferable. Logs and timber from Radiata pine forests already have established markets and product industries that need

supply. Other exotic timber species also have suitable attributes and advantages for CCF regimes, such as local site suitability, reasonable shade tolerance, ability to coppice, quick growth, and or high value timber properties. Increasing ecological values including composition of native species is anticipated by transitioning plantation regimes to CCF. This will bring some regulatory 'fishhooks' e.g. Part 3A of the Forests Act will apply to all naturally regenerated indigenous trees.

High priority areas of focus for the next five years to support scaling CCF for existing exotic forest are:

- Development of new adaptive methods of **silvicultur**e (the art and science of controlling forests to meet the values and needs of its stakeholders) that align with CCF principles as well as reflecting the species and ecosystems relevant to New Zealand
- Development of **people capabilities** to grow the number of people trained to make decisions in the field, as well as specially skilled in harvesting within CCF models
- Development of **harvesting systems** which are cost effective for the harvester and forest owner, and also support the realisation of high-value wood products, to optimise across their overall business model
- Ensure the wider systems enablers for this transition are in place. For a transition from a plantation approach to CCF for existing exotic forests we need:
    - a clear aspirational **vision** and strong storytelling
    - focus on **building industry momentum**
    - growing wider **knowledge and understanding** across communities
    - a foundation of financing models from the public and private sector
- Development of integrated policies and regulation that incorporate the wider CCF approach, with review of the potential regulatory 'fishhooks', restraints and disincentives to ecologically and financially sustainable CCF (e.g. Part 3A of the Forests Act).
- Prioritising multiple value forestry including overall community wellbeing as a key outcome. In some areas, like Tairawhiti and the East Cape there is immediate work required to determine the best land and forestry management practices to limit erosion and risk from forestry slash impacting farms and communities, and CCF could be part of this mix. There are also opportunities for skilled employment, particularly in silviculture and harvesting as forests transition, with development of closer relationships to the land and forest.
- Building out improved **science and data** availability
- Development and realisation of **value for non-wood products** across nature based products from e.g. the forest understory, as well as through nature-based markets which value the wider societal and environmental benefits of forests
- Research and capability for **weed and pest control**, as specific weeds are likely to differ in a CCF model

2. Transition to CCF from Existing Native regeneration

Another significantly-scaled resource of advanced-growth exists in the extensive areas of regenerated (second-growth) native forest on private land. Moreover, further reversion of marginal farmland is likely and encouraged by regional councils. Many of our native beech species are ecologically very well-suited to management under CCF regimes and have reasonable productivity. Similarly, tōtara regrowth on farms in Northland and other regions. Native forests have very high non-timber values and many native trees species also have excellent timber properties.

Legislation is already in place to ensure the compatibility between some sustainable timber production and the maintenance of the full range of a forest's natural values. Such outcomes are stipulated in Forests Act Part 3A and controlled by Te Uru Rākau, The New Zealand Forest Service.

To develop CCF for native regenerating forest at significant scale for effective silviculture, harvesting and wood processing; it will need to be woven in amongst other land uses with a mosaic approach, where a range of land use activities occurs within a landscape.

Continuous Cover Forestry models for native forests generally have lower returns for wood than exotic forests, partially due to longer growth cycles, smaller but more frequent harvests, lower current scale of market availability of wood, and the need for a stacked business model with various revenue sources to be viable. This transition can be supported through natural regeneration, with minimal or no planting, which is done solely as a complement, which has the benefit of reducing costs. However, it will likely require higher additional financial support due to the slower growth rates and ecologies of our indigenous species.

High priority areas of focus for the next five years to support scaling of CCF for existing native regeneration are:

- Develop **wood products** for a range of native timbers, and build value propositions that utilise whole potential tree product range, not just the high value parts
- **Science,** research and development that supports in particular development of example CCF native species regimes, silviculture and associated people expertise and capability in the field; and opportunities to optimise the value of the whole tree as well as non-wood products
- Develop **people capability** to make effective silviculture decisions in the field, and harvesting which retains the full forest values whilst optimising value of the wood harvested and retained
- Support a viable business model for forest owners and other businesses across the value chain, through multiple **non-wood revenue sources** which may involve products grown in the forest understory and/or funding for the value the forest provides e.g., improved biodiversity
- Support in the development, connection and integration of the various parts of the **value chain** to enable scale
- Create an enabling **policy foundation**, as current levels of duplication and disincentives, create insecurity for forest owners to invest. Review and amend the Sustainable Forestry Management Plan and Permit provisions of Part 3A of the Forests Act.
- Recognise the wider value developed through native species CCF models and provide the **financial support** to transition and manage it on an ongoing basis
- **Grow knowledge and understanding** of CCF and close-to-nature models within New Zealand to enable wider cultural support for the transition
- Build **industry momentum** to enable scale of CCF at pace

3. Transition to CCF through planting of new forest

For environmental reasons, including climate-change mitigation and improving resilience, significantly more planting of new forest (afforestation) is likely to be encouraged in sensitive catchments and within farm and forest systems. These new, predominantly privately owned, forests will fulfil multiple purposes, and the inclusion of some productive values such as timber, is an important form of diversification. Planting native and exotic forest species, and even mixes of both, brings the opportunity to create new forests designed and managed to realise the potential multiple benefits of CCF forestry. This can include a range of CCF forest types, from quick-growing exotic mixes, to indigenous forest plantings. Strategic management plans could aim for an increasing indigenous composition of over time.

Overall new planting for CCF should be a lower priority compared to transitioning existing forest. However as industry momentum exists for planting currently, initiated by the One Billion Trees

programme, and carbon incentives through the ETS; this is an opportunity to develop new forests responsive to the land, and the community that surrounds it, and realise wider outcomes from the trees planted through a long term horizon view for the forests.
High priority areas of focus for the next five years to support scaling of CCF through planting of new forest are:

- Development of **people capability** with forest design and establishment, CCF silviculture and weed and pest control skills
- Development of **silviculture** science, knowledge and practical experience in adaptive management that can support the wide variety of land and the design of forests being planted. A specific research challenge is how to develop multi-aged forests as soon as possible. Typically in both plantations and restoration we plant all the trees at one time, but for CCF we want to develop multi-aged forests.
- Exploration of **non-wood revenue sources** particularly those through nature-based markets, as the business model for planting a new forest, with current land prices, will be reliant on multiple revenue streams to be economic
- Building an integrated approach across the **system enablers** of **policy, financial levers**, and wider **knowledge and understanding** of the benefits of CCF across sectors and communities, will be imperative to enable a shift to strategic multi-use forest development

Regulatory barriers and enablers

A supportive regulatory environment that supports sustainable forestry production, bridging the current dichotomy of indigenous conservation forests and commercial production forests (which are predominantly industrial-scale, exotic mono-cultural plantations), will be a key enabler in supporting scaling CCF in New Zealand.
Regulation for native species: A key opportunity for economic growth through forestry in rural communities, is the significant volume of existing and regenerating native bush on private farmland which is an underutilised existing timber resource e.g. Tōtara in Northland. However, the significant current levels of duplication and disincentives (e.g. across the Resource Management Act, local and regional council regulations, and Part 3A of the Forests Act) creates insecurity for forest owners to operate. In addition, Part 3A, Forest Act 1949, currently restricts the full diverse range of CCF management regimes that still support sustainable forestry practices, and is suboptimal for many native species that need high light for natural regeneration to occur.
Recommendation: Review the overall regulatory framework for harvesting of native timber on private land, to support sustainable forestry practices such as CCF, and minimise disincentives for forest owners. In particular review and amend the Sustainable Forestry Management Plan and Permit provisions of Part 3A of the Forests Act.
Regulation for exotic forestry: Current definitions of Continuous Cover Forestry e.g. the National Environmental Standards for Commercial Forestry (NES-CF) do not reflect CCF approaches used internationally or the community of practice in New Zealand. These outline restrictive harvesting regulations for CCF for commercial (exotic) forests, which does not allow for the full spectrum of CCF management regime options.
Recommendation: Review the utilisation and definition of CCF in the NES-CF and other regulations.
Bridging the gap: There is an opportunity to create new forests tailored to New Zealand needs, designed and managed to realise the potential multiple benefits of CCF forestry. Currently there is a policy and regulatory gap in providing for forestry management practices and therefore new business models that bridge the space between conservation and industrial approaches to forestry.
Recommendation: Review the overall regulatory approach to support a wider range of forests and CCF regimes, particularly for CCF that may include both native and exotic species.

Emissions Trading Scheme: When the NZETS is being reviewed it would be good to make sure that the permanent category is designed in a way that incentives carbon removals, standing forest benefits, timber and other broader benefits.

Conclusion

Whilst there are unique characteristics and requirements for each category explored above, there are also key themes which are consistent across them. Overall the key focus areas are:

- Ensuring the wider systems enablers for this transition are in place across integrated policy and regulation, financing of the transition and wider knowledge and understanding to support community and industry momentum
- Enabling economically viable business models through multiple wood and non-wood revenue sources, cost-management through natural regeneration over planting, and optimised harvesting approaches
- Greater investment in science to support CCF models particularly around silviculture
- Development of people capability is imperative to enable them to adaptively make dynamic, complex, site-specific decisions
- Enabling outcomes that support community well-being alongside financial and environmental impacts

Section 7 – Financial / Economic markets

Context:

Continuous Cover Forestry practices deliver a broad range of benefits. Some benefits have mature markets in NZ e.g. exotic wood products, some have emerging markets e.g. biodiversity improvements, and some benefits, often public goods e.g. water quality, are currently only delivered though public or philanthropic funding. Nature has historically been under-valued and over-exploited through markets due to a well known set of "market failures".

In understanding the overarching investment case for expansion of CCF in New Zealand, we focused on two levels:

1. Those areas that markets can or could deliver; and
2. Those that have significant public good that markets are not likely to deliver anytime soon.

The Global Nature Markets Landscaping Study (McKinsey for the Taskforce for Nature Markets 2022) highlights that the future of nature markets will look very different from historical trends. Climate change is driving increased demand for ecosystem services that support climate change mitigation, and consumers preferences are moving to more nature-related products such as organically grown food, or brands with sustainability commitments. Investor preferences are also moving towards financial products with enhanced environmental values and assets that preserve nature with products such as sustainability-linked loans, nature-related bonds and debt-for-nature swaps.

Global and New Zealand markets for CCF-based products

Globally, Continuous Cover Forestry provides a range of financial and economic benefits. In terms of financial benefits, timber and wood products are harvested and often sold for premium returns reflecting the sustainability values within the products. CCF-managed forests provide a range of environmental benefits to economies such as: enhanced water quality; climate regulation; biodiversity; species habitat; storage of carbon in standing vegetation and soil; and flora and fauna.

These forests also provide significant social benefits to economies, supporting community recreation, traditional foraging for food and craft ingredients, and spiritual and cultural value as people enjoy connection to and stewardship of their natural environment. In most instances internationally, these wider economic values are recognised by state and local governments and public funding is available to support the provision of these services within CCF landscapes.

There are a variety of nature markets in New Zealand where CCF forest products can be sold. These markets range in size with the largest being for exotic logs and timber, and carbon payments. Many of the smaller and more sustainability-aligned markets are well established but have failed to move beyond niche or place specific. Barriers to investment-level scale differ across each market, but common themes include difficulty accessing sufficient market demand, uncertain or un-viable rates of investment returns, and challenges in paths to market for CCF-produced products. In some markets the correlation is unclear between growth in the demand and value of end-use products, and returns to foresters for raw ingredients.

In this context, markets for CCF-based products are more limited compared with international operations. Instead, historical investment in exotic monoculture production forestry with clear felling rotational harvesting has embedded sales channels and paths to market set up to support commodity-based sales of wood and timber. As a result, New Zealand lacks many of the market supports for low-volume timber extraction that enables CCF overseas, such as: high-grade timber production and consumption; high-value manufacturing; and non-extractive markets such as

payment for ecosystem services (PES) mechanisms. A notable exception is the New Zealand Emissions Trading Scheme which provides a carbon market. Overall, CFF is not yet practiced at a significant level in New Zealand.

Summary of key New Zealand nature markets for CCF products

Timber and wood products are New Zealand's largest and most established nature markets, and fourth largest export sector. Radiata pine significantly dominates these markets by area planted and volume harvested. New Zealand's current low level of onshore processing represents an opportunity to increase processing and manufacturing and grow value within the sector. However investment barriers are significant, particularly the cost of processing and securing sufficient market demand to support the scale of production required for economic feasibility. Greater uptake of **manufactured and Mass timber,** which is a fast-growing market globally, has many benefits to society and the economy however the degree to which higher prices for end uses and products may be passed down to the forest level is still to be determined.

There are established, small-scale markets for **non-pine exotic and indigenous species**, but variability in yield and growing conditions together with long rotation lengths for indigenous species have prevented these forest types from competing with investments made in Radiata pine, which has significant path dependency in place.

New Zealand's most significant **payment-for-ecosystem-services (PES)** mechanisms is for **carbon** sequestration, established via the New Zealand Emissions Trading Scheme (NZETS) which has facilitated a compliance and voluntary market since 2008. New Zealand's historic investment in low-risk and high-yield Radiata pine growing capability combined with attractive pine harvesting return options, and combined with international climate action urgency prioritising rapid carbon sequestration, means Radiata pine generates greater returns within the scheme and therefore dominates the market.

Outside of carbon sequestration there have been a handful of examples of PES in New Zealand in the past in erosion control and native afforestation. Two live examples are the Land for Life Partnership and the Hill Country Erosion Programme for councils.

The Land for Life Partnership is a collaboration between Hawkes Bay Regional Council and The Nature Conservancy, a global philanthropic with a focus on conservation and sustainable financing. The programme supports farmers to "plant trees in the right places" to slow erosion, improve freshwater quality and build resilient farms, while utilising the NZETS.

The MPI led Bay of Plenty Erosion Programme (2023-2027) works with councils and landowners to implement erosion control programmes, primarily by planting trees to retain productive soils and reduce sediment loss to waterways.

Interest is growing in payments for biodiversity such as biodiversity credits and climate resilience-based payments, however lack of transaction infrastructure and uncertain demand are current barriers to development.

Other low-impact revenue streams includes **recreation and tourism** within CCF forests, of which there are many opportunities.

Harvesting of **non-timber forest products** from the forest understory (e.g. honey, mushrooms) alongside **plant ingredients and bio-extractives** offer opportunities for CCF forestry due to promising consumer growth trends and would benefit from research to identify the highest priority areas for different regions. There may be significant community and social value from non-timber

forest products and harvesting of plant ingredients and bio-extractives from within CCF operations. These may also be provided through permanent afforestation projects.

The New Zealand Investment Environment for nature markets and CCF-produced goods and services

Forestry investment in New Zealand largely focuses on offering a traditional, low-risk investment profile favouring established forestry systems. Investment in New Zealand nature markets is primarily through funds with offerings mirroring the trends observed in carbon and timber markets. Investment is based upon revenue from rotational pine plantations - both timber and carbon streams - and includes significant overseas investment.

There are few incentives or specific mechanisms for investment in supporting production forestry to adopt CCF practices or to move away from the traditional forestry markets focused on exports to Asia. There are limited investment funds focusing on non-pine species. Sustainability-focused bonds have emerged in New Zealand in recent years, however none have focused on production forestry sectors to date. Including forestry production within these investments or creating new bond offerings offers the greatest promise for unlocking potential funding for CCF in the future.

There is a small but growing investment focus on climate positive investments. Investment vehicles such as the Climate Venture Fund, the New Zealand Green Investment Fund, Westpac NZ Government Innovation Fund and Sprout AgriTech appear to include high-value sustainable forestry such as CCF and value chain businesses within their purview.

The emerging Impact Investment sector in New Zealand could offer demand for investment in some CCF applications as the market matures and more impact investment money is available. For example, Foundation North, the largest philanthropic in New Zealand, has established an impact fund with three criteria: social inclusion; increased equity; and regenerative environments ("Enterprises and projects that move us beyond doing less harm to the planet to supporting the restoration and renewal of Earth's living systems").

The fast-growing global funds focused on environmental and social outcomes offer New Zealand projects and businesses investment opportunities as well. For example, the Māori owned and led Hinemoana Halo Ocean Fund, is close to raising $100m for an offset scheme, which empowers indigenous custodians of the land to protect and revitalise coastal and marine diversity in Aotearoa and the Pacific.

Recommended priority markets and market actions to support CCF business cases

Development of these existing **markets** would enable CCF adoption and transitions and recognise the wider ecosystem values provided by CCF can be delivered from a range of mechanisms including:

a) Voluntary carbon credits with layered nature benefits, supported by consistent and affordable monitoring and verification;
b) Compliance carbon credits with layered nature benefits, through amending the current NZETS;
c) Biodiversity credits that can support the growth of native forests in New Zealand, particularly on private land, with implementation through the current mechanisms under government consultation;
d) Other Payment for Ecosystem Services (PES) e.g. water quality, land resilience, pollination. Delivered through public spending, market mechanisms or a mix. Priority areas are support for establishment mechanisms & consistent and affordable monitoring and verification;

e) Development of timber markets for non-pine exotic and indigenous timber products to enable a business model which can optimise value across high and low value wood products;
f) Research into priority areas for CCF to support non-timber forest products and low-volume, high value plant-based products e.g. nutraceuticals.

Section 8 – Summary Recommendations

The following recommendations are based on analysis of the barriers and enablers for CCF in New Zealand and on what areas have been critical in supporting CCF in other countries. A combination of the three focus areas are required and all three need focus to ensure we can maximise the benefits CCF can bring to our nation.

Priority focus areas

1. Market development

a) Development of the following existing **markets** would enable CCF adoption and recognise the wider ecosystem values provided by CCF particularly in restoration of native ecology:
   i. Voluntary carbon credits with layered nature benefits, supported by consistent and affordable monitoring and verification;
   ii. Compliance carbon credits with layered nature benefits, through amending the current NZETS;
   iii. Biodiversity credits that can support the growth of native forests in New Zealand, particularly on private land, with implementation through the current mechanisms under government consultation;
   iv. Other Payment for Ecosystem Services (PES) e.g. water quality, land resilience, pollination. Delivered through public spending, market mechanisms or a mix. Priority areas are support for establishment mechanisms & consistent and affordable monitoring and verification;
   v. Development of timber markets for non-pine exotic and indigenous timber products to enable a business model which can optimise value across high and low value wood products;
   vi. Research into priority areas for CCF to support non-timber forest products and low-volume, high value plant-based products e.g. nutraceuticals.

b) Value chain development and integration for native forestry

Collaboration across the sector to develop and support the integration of key parts of the value chain to enable scale for native forestry with particular focus on:
   i. Silviculture – science, training and development
   ii. Harvesting – capability and approaches for New Zealand situations
   iii. Wood processing – local wood processing to support low and high value wood products

c) **Transition funding** - Provide financial support through grants and / or incentives for forest owners to transition to a CCF model. Focussed financial support for silviculture management whilst the forest is in transition and revenue from wood and non-wood sources are likely to be lower. This could be in the form of grants as seen in the EU, with timed payments over a clear time horizon.

d) CCF pilot funding – Provide support to fill research gaps and increase understanding of what works best in different regions.

2. Societal momentum for change

Create community and industry momentum for a national cultural value shift around the role of forestry and its ability to integrate conservation, production and recreation (as seen in many European countries and some US states)

- Build off wānanga series to build an active community of practice
- Develop network of CCF demonstration sites where field days can be held, and opportunities to meet in the forest for inspiration and technology transfer
- Develop ProSilva Aotearoa with full membership to ProSilva to strengthen global connections and have an industry group that promotes CCF principles, providing research materials, networks, and field days etc.

- Re-build the forestry sectors social licence to operate through a compelling vision and clear storytelling of the potential for a different forestry model, backed up by focussed action in key regions and engagement widely across NZ.

3. Business model enablers

a) Regulatory and policy enablers

- Clear visionary policy that supports scaling of CCF from existing approaches
- Regulations at national and regional levels which reflect a move from a mono-species, plantation approach to a mixed-species, mixed-stand closer to nature approach and remove regulatory 'fish-hooks'
- Reduce the split in New Zealand between conservation and commercial production – providing a greater opportunity for forests which can bridge both
- Review the overall regulatory approach to support a wider range of forests and CCF regimes, particularly for CCF that may include both native and exotic species.
- Review the utilisation and definition of CCF in the National Environmental Standards for Commercial Forestry and other regulations.
- Review the overall regulatory framework for harvesting of native timber on private land, to support sustainable forestry practices such as CCF, and minimise disincentives for forest owners.
    - Remove conflicting and dysfunctional regulations across Forest Act, RMA and regional/local authorities
    - Review and amend the Sustainable Forestry Management Plan and Permit provisions of Part 3A of the Forests Act.
- Supply chain resilience – Consider approaches to support the mitigation of global supply chain risks and to build building economic diversification
- **Emissions Trading Scheme:** When the NZETS is being reviewed it would be good to make sure that the permanent category is designed in a way that incentives carbon removals, standing forest benefits, timber and other broader benefits..

g) People capability is a key priority area, with training and development of skills needed in managing and harvesting forests with CCF approach which will be less prescriptive and more adaptive

h) Silviculture management – integration of development of people capability, insights through field trials and demo sites as well as practical experience in the field

i) Harvesting systems – Pilots to include a range of harvesting systems that enable cost-effective approaches for NZ environment, particularly for existing exotic forests

j) Science and data

a. **Long-term funded** science that supports silviculture management across key species for NZ
b. Establish a series of new **field experiments** focussed on supporting silviculture management for key regimes in NZ across
    - Biophysical (most critical) - shade tolerance, tree physiology, how mixtures interact, physiological process-based models
    - Effect of thinning on understory development for existing exotic and native stands
    - Need for underplanting of crop species vs management of understory
    - Methods for successful establishment after planting for new sites
    - Weed control and succession
c. Identification of **specific land areas** where CCF across a range of regimes could work, and develop pilots in key regions

High level plan for pilots

The value of demonstration examples and trial sites

International recommendations consistently emphasise the value of demonstration sites and field days. This was reiterated during the Wānanga series.

A two-level plan for CCF trials

Inevitably, CCF in this country will need to start off before robustly proven models or management prescriptions are available. Other countries have faced this situation. It necessitates adopting an adaptive management approach, by starting practice, and learning by doing. However, concurrently strategic research plans to model and inform silvicultural practices and industry matters should be established.

Development of regional networks of two different, but complementary, levels is proposed - demonstration sites, and research trials.

1. **Inspirational demonstration sites -** Showcasing exemplary local efforts and practical experiences is extremely important. The purpose is promotion, knowledge sharing and learning, but includes inspiration, including the human stories and *values*. Such sites also function as venues for technology transfer opportunities – e.g., useful for field days, workshops, and perhaps as case studies. These need to be relatively accessible, locally relevant, and have plenty going on i.e., cover a rich array of relevant aspects. Examples include Woodside, some of the Northland tōtara project sites, and many new trials within existing commercial plantation forests will be needed.

2. **Research trials** – These are to provide robust data to enable modelling and research to inform and refine silvicultural practice, industry planning, and policy/regulatory settings. For example, modelling impacts and implications for timber production, income, and carbon storage when transitioning plantation to CCF. These would generate information for academic and sector publications and for technology transfer via field days and events at the demo sites described above. These trials sites may not always be in easily accessible places or be interesting enough on their own for popular field visits etc.

Appendix 1: Analysis of CCF Strengths and Priorities

CCF in Aotearoa could be applicable to several broad categories of forest type or situation. For the purposes of this project we have focused on the following opportunities to transition to CCF:

1. Existing exotic plantation forest cover
2. Regenerated and reverting indigenous vegetation cover
3. New planted forests

For each category we have looked at a wide range of different areas that make up a successful forestry value chain and business model, across science and data, the processes involved in developing and managing forest, as well as harvesting, processing and extracting value from the wood and non-wood products, supporting key enablers and key outcomes.

We then looked at the existing strength and relative priority of the area:

- **Current Strength –** What is the existing strength of this area to support the uptake of CCF in NZ?
- **Priority –** What is the relative priority of this area for focus over the next five years to support the uptake of CCF in NZ? This was in comparison against the rest of the table and in consideration of other scenarios.

We graded them with levels of low (red), medium (blue), high (green), with key insights and requirements noted from the workshops.

Level	Colour
Low	
Medium	
High	

This analysis for each transition category, with the gradings and key notes is included here.

1. Strengths and Priority Analysis for Transition to CCF from Existing Exotic

Area	Detail	Current Strength	Priority	Key notes
Science and Data	**Science**			• Limited science on transition to CCF from pine • Priority to support practical, on the ground action with longer term science trials
	Data			• Low level of data available currently • Priority to collate existing data and set up research trials.
Value Chain	**Land availability**			• Scope to weave into significant areas of existing forest with potential to transition, and afforestation opportunities on private rural land.
	Land preparation			• Land already supporting forestry, so further land preparation likely to be minimal
	Nurseries/ seeds			• Focus on regeneration and supplementary planting
	People capabilities			• High priority to have people trained to make decisions in the field, as well as specially skilled in harvesting

	Weed and pest control			• Significant area of focus to enable regeneration across weed and pest control, but specifically impact of weeds which are likely to differ in a CCF model
	Silviculture			• High priority to experiment and develop different methods of silviculture especially with likely range of forest types that will exist
	Harvesting systems			• High priority to develop CCF harvesting systems cost effective for the harvester and forest owner
	Wood processing			• Strong wood processing models in place for pine to build off
	Transport			• Existing roading and transport in place
	Market demand: Wood			• Strong market demand for wood overall, and importing significant level of overseas timber
	Market demand: Non-Wood			• Successful CCF models rely on realising overall value of the forest through multiple non-wood sources to support a viable business model.
	Value chain integration			• Important, with existing strength for pine value chain but work required to support integration where transitioning to indigenous
Wider systems enablers	**Policy/ regulation**			• Currently focused on plantation forestry, and will need significant change to support CCF models
	Finance			• Supportive financing models required to enable the transition for forest owners
	Knowledge / Understanding			• Low level of current understanding of wider forestry models • Cultural change around philosophy and position of forestry within society is a key enabler for CCF
	Industry momentum			• Key enabler with support required to build industry momentum
Outcomes	**Wood products**			• Strong market and range of pine wood products alongside potential supplementary planting
	Carbon sequestration			• Long term CCF will significantly support carbon sequestration through maintenance of a high level of biomass
	Biodiversity			• Increased biodiversity through understory and tree species mix
	Forestry resilience			• Increased forestry resilience and supports climate change resiliency
	Water			• Supports water quality through reduction of erosion following clearfell
	Erosion control			• Major outcome and strength of CCF to have continual woody vegetation cover
	Nitrate reduction			• High strength from CCF in reduction of nitrate
	Methane reduction			• Little knowledge about methane reduction • Lower benefit from transitioning from pine plantation, and likely to be dependent on multiple land and community factors
	Rongoa			• Focus required to support development of Rongoa as part of diverse forest use

				• May be more difficult in near-term to support when transitioning from exotic
	Community wellbeing			• Community support behind moving away from plantation, clear-fell approach • CCF provides opportunity for more active silviculture and forest management, to support local employment • High priority for CCF to support community development and wellbeing through employment, recreation and other community value, especially in transitioning from exotic plantation to a CCF model

2. Strengths and Priority Analysis for Transition to CCF from existing native regeneration

Area	Detail	Current Strength	Priority	Key notes
Science and Data	**Science**			• Low current strength, priority to focus on supportive science around key areas e.g. silviculture, utilisation of whole tree and non-wood products and ecosystem services alongside supporting building of people capability
	Data			• Low level of data, but need to move forward even if all the data is not available
Value Chain	**Land availability**			• Significant amount of land already regenerating, with need to weave it into the overall landscape
	Land preparation			• Preparation techniques available and track development may be required • Land preparation may not be required at all for some sites
	Nurseries/ seeds			• Not a bottleneck to CCF development • Significant number of native nurseries in NZ • CCF focus on natural regeneration, with planting as a complement
	People capabilities			• Limited existing people capability • High priority to have people trained to make decisions in the field, as well as enable harvest
	Weed and pest control			• Browser, pest and weed management is a critical factor for CCF success with native regenerating forest, however not as high a priority for focus and research as for exotic transition and establishing a new forest
	Silviculture			• High priority to experiment and develop different methods of silviculture
	Harvesting systems			• Significant challenges with small scale harvesting • Need to develop CCF harvesting systems economic for the harvester and forest owner
	Wood processing			• Challenges with kilns for smaller scale and non-pine processing, and lower knowledge base
	Transport			• Lower priority in terms of enabling CCF in near term, with transport infrastructure available

	Market demand: Wood			• Low current strength in market for native logs/timber • Exploration of market opportunity for various native timbers required • Need to develop demand especially for low-grade products that the market may not be aware of yet, and are required to support the business model
	Market demand: Non-Wood			• High priority to support a viable business model for forest owners and other parts of the value chain, through multiple non-wood revenue sources • Potential for research into chemical composition of native timbers for energy and nutraceuticals • Native species CCF in particular needs a stacked business model with various revenue sources e.g. biodiversity credits, carbon, understory products
	Value chain integration			• Currently dysfunctional, and needs conscious cobbling together of the different parts of the value chain • Needs focussed big-picture support to integrate at scale across the value chain
Wider systems enablers	**Policy/ regulation**			• Currently a range of policy and regulations to meet across Forest Act, RMA, district plans, export regulations with duplication, disincentives and resulting in insecurity for forest owners to invest • High priority to create an enabling policy foundation
	Finance			• High priority to recognise the wider value developed through native CCF models and provide the financial support to transition and manage it on an ongoing basis
	Knowledge / Understanding			• Currently some knowledge and understanding to build off, but high priority to develop capability, understanding and knowledge connected to place and NZ native specific needs
	Industry momentum			• Scattered initiatives currently • High priority to develop and support industry momentum to enable scale of CCF at speed
Outcomes	**Wood products**			• High priority to develop wood products for a range of native timbers, and build value propositions that utilise whole potential tree product range (not just high value parts)
	Carbon sequestration			• Reasonable level of understanding about impact for carbon, and existing regeneration to build off
	Biodiversity			• Existing biodiversity strength to extend from
	Forestry resilience			• Existing resiliency in place through native regeneration, and transition to CCF extends this resiliency through active management • Longer term focus for research
	Water			• Existing strength in improved water quality from native forest

	Erosion control			• Existing strength in erosion control from native regeneration would be further supported by transition to CCF
	Nitrate reduction			• High existing strength can be leveraged to CCF model
	Methane reduction			• Little knowledge about methane reduction • Already existing regenerating native vegetation
	Rongoa			• Existing native regeneration enabling greater scope for Rongoa as part of CCF model, and expected to develop organically
	Community wellbeing			• Strong community support for native forest regeneration, providing significant value to communities through natural landscape, spiritual, ecosystem and recreational values

3. Strengths and Priority Analysis for CCF through planting of new forest

Area	Detail	Current Strength	Priority	Key notes
Science and Data	**Science**			• Existing science to build off • Lower priority for science focus than other regimes
	Data			• Opportunity for data collection across the planting that has been done in recent years e.g. One Billion trees initiative
Value Chain	**Land availability**			• Significant level of land availability, but needs to take into consideration overall land potential • Opportunity to support land use viability across mosaic of land uses, particularly for farm forestry
	Land preparation			• Existing knowledge on establishment of forests • Lower priority in near term
	Nurseries/ seeds			• Existing capacity and capability in place
	People capabilities			• Low existing capability across silviculture and forest management particularly at large scale • High priority for training and upskilling including for weed and pest control
	Weed and pest control			• Continue work underway around weed and pest control • Move forward with planting with the knowledge we have, improving and adapting as we go
	Silviculture			• High priority to adaptively manage forests that are being planted, and develop capability and expertise in this area
	Harvesting systems			• Lower priority as if new planting, then will not be harvested in near term
	Wood processing			• Knowledge across a range of species, and lower priority in near term
	Transport			• Existing roading and transport in place, and lower priority in place
	Market demand: Wood			• Strong market demand for wood overall, and importing significant level of overseas timber

				• Lower priority to develop in near term, can build off work for transition from exotic and native regenerating regimes
	Market demand: Non-Wood			• If planting a new forest, with current land prices, the business model will be reliant on other non-wood sources of value e.g. carbon, biodiversity credits, grants and subsidies for planting • Currently these sources of additional value are not integrated and supportive of multi-use forests
	Value chain integration			• Limited integration currently, opportunity to build across value chain
Wider systems enablers	**Policy/ regulation**			• High priority for strong policy foundation to support CCF for new planted forests
	Finance			• High priority to develop financial levers support to forest owners to support a CCF model, in particular for the period whilst the stand is maturing but active silviculture is required
	Knowledge / Understanding			• High priority to grow wider knowledge and understanding of CCF within the forestry sector, as well as the public and private sectors, and local communities
	Industry momentum			• Industry momentum for planting exists, but it will not organically support a shift to CCF without the above enablers
Outcomes	**Wood products**			• Lower priority of focus in short-term due lengthy time until harvest
	Carbon sequestration			• Likely to be slower for this scenario due to the level of natives in this category that take longer to sequester carbon
	Biodiversity			• Will provide biodiversity improvement where planting with CCF principles to develop a mixed-species forest
	Forestry resilience			• Planting and management with CCF principles is likely to develop a more resilient forest ecosystem
	Water			• High current strength in ability for new planting to support water quality
	Erosion control			• High current strength in ability for new planting to support water quality
	Nitrate reduction			• New planting will improve nitrate reduction, but lower priority focus over other outcomes
	Methane reduction			• Limited knowledge around methane reduction, and lower priority focus over other outcomes
	Rongoa			• Opportunity to support rongoa through planting and silviculture approach
	Community wellbeing			• Community wellbeing a key outcome to focus on, alongside the environmental outcomes, but will be slower to realise than from transition from existing forests

References

Barton, I., 2005. *Continuous Cover Forestry: A Handbook for the Management of New Zealand Forests,* Wiley. Image sourced Barton, I. Farm Forestry New Zealand. Continuous cover forestry - an introduction. https://www.nzffa.org.nz/farm-forestry-model/resource-centre/tree-grower-articles/november-2005/continuous-cover-forestry-an-introduction/

Brown, H.E., Watt, M.S. (in prep.) *Continuous cover redwood plantations for timber production and offsetting greenhouse gases in New Zealand Forests.*

Cavers and Cottrell (2015). The basis of resilience in forest tree species and its use in adaptive forest management in Britain. Forestry: An International Journal of Forest Research*, Volume 88, Issue 1, January 2015,*

Climate Change Commission (2021). *Ināia tonu nei: a low emissions future for Aotearoa Advice to the New Zealand Government on its first three emissions budgets and direction for its emissions reduction plan 2022 – 2025.*

CCF wānanga series (2023). https://www.continuouscoverforestry.com/

Department of Agriculture, Food & the Marine, Ireland (2023). *Ireland Forest Strategy Implementation Plan 2023-2030*

European Parliament (2022). *Report on a new EU Forest Strategy for 2030 – Sustainable Forest Management in Europe.*

EU Commission (2023). *Guidelines on closer-to-nature forest management.* Publications Office of the European Union.

Food and Agricultural Organisation of the United Nations (2005) *In Search of Excellence*

Friends of the Earth International, n.d. Community forest management. https://www.foei.org/what-we-do/forests-and-biodiversity/community-forest-management/

Gisborne District Council (2023). *Our road to recovery – Tairawhiti: Following the impact of Cyclone Gabrielle across Tairāwhiti.* https://www.gdc.govt.nz/services/tairawhiti-road-to-recovery

Harvard Medical School (2019). *A 20 minute nature break relieves stress.*

Kilpeläinen and Peltola (2022). Carbon Sequestration and Storage in European Forests

Kuuluvainen T., Tahvonen, O. Aakala, T. (2012) *Even-Aged and Uneven-Aged Forest Management in Boreal Fennoscandia: A Review*. Forest Bioeconomy and Climate Change pp 113–128. https://link.springer.com/chapter/10.1007/978-3-030-99206-4_6#Tab2

McKinsey Taskforce for Nature Markets (2022) https://www.naturemarkets.net/publications/global-nature-markets-landscaping-study

NZFFA (2009). Continuous Cover Forestry. *New Zealand Tree Grower.*

Quinlan, 2022, *The Tōtara Opportunity – A practical guide to managing Tōtara on Private land*. https://www.tanestrees.org.nz/projects/a-practical-guide-to-managing-t-tara-on-private-land/

Radio NZ (2023). Forestry report urges immediate halt on wider-scale felling. https://www.rnz.co.nz/news/political/489748/forestry-report-urges-immediate-halt-on-wide-scale-felling

Slovenia Forest Service, *Caring for Forest to benefit Nature and People,* http://www.zgs.si/fileadmin/zgs/main/img/PDF/PDF_BROSURE/Brosura_ANGL.pdf

Stockholm Resilience Centre (n.d.). *Applying resilience thinking Seven principles for building resilience in social-ecological systems.* https://www.stockholmresilience.org/download/18.10119fc11455d3c557d6928/1459560241272/SRC+Applying+Resilience+final.pdf

Susse, R. et al 2011 edition: *Management of Irregular Forests. Association Futaie Irreguliare*
The Treasury (2019). *Overseas Investment Forestry Information Release.* Release Document. https://www.treasury.govt.nz/sites/default/files/2019-02/forestry-cabinetpaper.pdf

Truss, Joshi, Lenton, Oliver (2023). The Emperor's New Climate Scenarios: Limitations and assumptions of commonly used climate-change scenarios in financial services.

World Integrated Trade Solution https://wits.worldbank.org/CountryProfile/en/Country/NZL/Year/2021/TradeFlow/Import/Partner/all/Product/44-49_Wood