Future forests and future foresters – forest management in a changing New Zealand landscape

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Figure 1: Mixed-species forest (exotic and native) Tairāwhiti

Abstract

New Zealand's forest ecosystems are undergoing accelerated transformation, driven by changing climate, periodic disturbance events and biological invasions. Societal expectations of forests are also evolving. These forces and changing attitudes are challenging the current strongly entrenched dichotomies in New Zealand forest management, by both society and forestry practitioners. This paper contends that there is and will be a further increase in the diversity of forest types, and that many future forests in New Zealand will need to be more dynamic and multifunctional than in the past.

Consequently, forestry practice will require a broader spectrum of management regimes and a rapid evolution of the professional forester's role and skills to meet these changes. The New Zealand forestry profession must progress from the current main focus on exotic plantation timber production, to one that also better captures adaptive, integrative and systems-based management, capable of delivering multiple environmental, social and economic outcomes. Forests and forestry will take on many different forms in the future.

Introduction

All forests in New Zealand – whether exotic or indigenous – now exist within a modified and rapidly changing environment, and have done so for some time. The notion of an unchanging pre-human unaltered forest system does not reflect the reality of the world today. Rather, forest structure and species compositions at any given time reflect changes in disturbance regimes and changes in climate (Ogden, 1985; Wyse et al., 2018), both natural- and human-induced, and this is ongoing, gradual or sometimes abrupt.

Collectively, human pressures have been described as 'the Anthropocene', being the most recent geological epoch covering the timespan over which human activity has become the dominant influence transforming Earth's climate, ecosystems and geology. This human influence has accelerated post-1945 (Steffen et al., 2011). Species extinctions, climate change, biodiversity loss, species introductions, land-use intensification and new markets are redefining forest dynamics. This raises fundamental questions about the future composition, structure and management of forests in New Zealand. Navigating these matters will bring both challenges and opportunities for the professional forester (Figure 1).

Ecological change and system instability

New Zealand's forest environments are increasingly characterised by human-induced ongoing ecological change. The effects of human-induced extinctions, such as of the seed-dispersing and seed-predating birds (e.g. Moa species) is likely exerting significant impacts on the relative abundances of forest tree species . The continued introduction and establishment of exotic plants, mammals, insects and pathogens is altering forest species composition and ecosystem relationships. The presence of non-native plant species is one highly visible manifestation of that. Already, by 2008, New Zealand had more exotic plant species naturalised (i.e. reproducing in the wild) than indigenous plant species – 2,390 exotic versus 2,158 native (Howell, 2008).

At that time, the Department of Conservation published a consolidated list of 328 exotic vascular plant species considered to be environmental weeds (Howell, 2008). Up until 2021, just 11 exotic plant species introduced since the start of European settlement are believed to have been eradicated from the whole of Aotearoa New Zealand (PCE, 2021). On top of that, the risk of both new pests and diseases arriving in New Zealand courtesy of increasing volumes of travel and trade continues to grow. The risk of these becoming invasive has grown, and will continue to grow, with climate change.

The prevalence of extended lag phases between the arrival of a new species and it becoming invasive creates a considerable 'invasion debt'. That is, the exotic species currently present will be a potential source of recruitment of invasive species for decades to come (Gillman, 2023). As in other parts of the world, we see ongoing increases in the invasion of non-native forest insect species (Brockerhoff & Liebhold, 2017) and pathogens, such as the difficult-to-track myrtle rust. Mammalian invasive species are well established and are still spreading across Aotearoa.

These historical introductions and the establishment of exotic flora, fauna and pathogens are increasingly altering species mixes and ecosystems. Such changes are further complicated by climate-driven shifts in species natural ranges, site disturbance, and different growth patterns in those changing environments. This is consistent with global observations (e.g. Hobbs et al., 2013). It must be acknowledged, however, that the conservation ethic and desire to minimise invasive species in the conservation estate is an aesthetic one, rather than a scientific one, and it relates to a sense of place that is reinforced by the globally unique nature of the biota in Aotearoa (Gillman, 2023). Nonetheless, there is equally the need to adapt to these changes in the management of both our indigenous and exotics forests.

Traditional forestry models, which assume relatively stable site-species relationships and predictable growth outcomes, are therefore increasingly inadequate or need to be adapted and modified. Future forest systems, managed with specific or multi-purpose aims in mind, will need to accommodate uncertainty as a fundamental condition rather than an exception.

Changing concepts of nature and conservation

Learning from less isolated countries, whose landscapes have experienced longer exposure to human modifications, New Zealand's ecological scientists and conservation discourses may also need to expand their understanding of 'nature'. Ideas and definitions of nature are, of course, human cultural constructs and these can, and do, change over time.

New perspectives are emerging that acknowledge the realities of ongoing ecological change, along with the need for continued human interaction and relationships with the natural environment, especially in 'working' or production landscapes. Often grouped under the term 'New Conservation' (e.g. Kareiva, 2014; Holmes et al., 2017), this thinking encourages a pragmatic focus on ecosystem services and functional ecology (Leuzinger & Rewald, 2021), and an acceptance of novel ecosystems (Hobbs et al., 2013), especially in production landscapes.

Within this framework, forests are understood as dynamic systems shaped by both natural and anthropogenic processes and are taking on forms that possibly have no historical precedent. Exotic production forests have, for example, been shown to contain a considerable complement of indigenous biota and in some instances to provide important

habitat for threatened species such as the karearea (e.g. Ogden et al., 1997; Seaton et al., 2010). This necessitates an expansion of management paradigms, away from simplistic dichotomies, such as 'native good – exotic bad', or production versus conservation. Central to this is a focus on ecological and environmental function, rather than species provenance, targeted toward more flexible, interwoven and adaptive approaches to forest management.

Beyond dichotomies – toward integrated forest landscapes

Historically, as a result of government decisions in the 1980s to prevent the management of public and private indigenous forests for other than conservation uses, forestry in New Zealand has been split between: (a) industrial plantation forestry on the one hand; and (b) conservation-oriented native forest management on the other. However, these two dominant approaches are being challenged, as seen in the 2023 paper 'Transitional Forestry in New Zealand: Re-evaluating the Design and Management of Forest Systems Through the Lens of Forest Purpose':

> '*... forestry within New Zealand is an ongoing process of change from an existing bimodal philosophy of land management, where industrial plantation forestry and conservation forestry sit in apparent opposition, to future sets of forestry systems that blend multiple uses, landscapes and forest types.*'
>
> (Jones et al., 2023)

However, the dichotomy described by Jones et al. is increasingly untenable for private land. Contemporary research suggests a transition toward: integrated landscape models; multifunctional forest systems; and blended approaches combining production and conservation objectives. Future forestry is likely to involve a greater range of systems, including: mixed-species plantations; indigenous-exotic hybrid systems; continuous cover forestry; silvopastoral systems; and permanent forest estates.

These systems blur traditional boundaries and require enhanced conceptual and operational frameworks. Two evolving viewpoints discussed further below are increasingly important in shaping how forests should be managed beyond the dichotomous objectives of production and conservation in New Zealand.

Societal expectations and expanding forest values

The social contract surrounding forests is also evolving with changing needs and demands from society. Forests are increasingly expected to deliver a wide range of ecosystem services and societal benefits beyond timber production or preservation alone, including:

- Biodiversity enhancement
- Soil and water protection
- Carbon sequestration and climate mitigation
- Recreational access and amenity values
- Cultural and identity-based functions
- Local employment opportunities.

While these expectations introduce both opportunities and complexities, forest management must increasingly reconcile multiple and sometimes competing objectives within a single landscape, forest or stand. Most recently, society's expectations have been further honed by the aftermath of multiple extreme weather events in Northland, Tairāwhiti and Nelson, with many communities wanting these wider forest services and values considered alongside or even ahead of production. This need is recognised by many forest owners, who also have to balance those expectations with generating a commercially viable return to retain and attract capital, as well as provide a range of forest services.

Māori perspectives and intergenerational stewardship

Māori perspectives on land and forest stewardship provide an important lens for understanding future forest management paradigms:

> '*Māori forestry is grounded in whakapapa. Forests are not simply resources; they are living systems of relationship connecting Ranginui, Papatūānuku, and all Tangata Whenua. Through this lens, forestry is the expression of intergenerational responsibility – ecological, cultural, and economic.*'
>
> (Ngā Pou a Tāne, 2026).

Māori hold a significant minority share of private native forest. Also, 30% of New Zealand's exotic forest land is under Māori control and more than 190,181 ha of commercial forest is owned and managed by Māori entities (Ngā Pou a Tāne, 2024). Accordingly, Māori are now one of the largest single stakeholder groups in plantation forestry. Māori land and forest stewardship is fundamentally about kaitiakitanga (guardianship) of a living, inherited system where:

- Land is never truly 'owned'
- Forests are part of whakapapa (personal genealogy)
- Decisions must protect future generations
- Economic use must sit alongside cultural and ecological integrity
- Māori worldviews include seeing people and their activities as part of nature (Ngā Pou a Tāne, 2024).

These views and those of other indigenous people (IPBES, 2026) align closely with emerging global notions of sustainability and resilience, as well as with earlier developments of sustainable

multigenerational forestry practices and policies developed in the 1900s in Europe (Pommerening & Murphy, 2004) – see www.waikereru.org/assets/documents/GermanForests.pdf. With Māori being significant forest landowners and stakeholders, this further reinforces the relevance of these perspectives for future forest management systems.

Emerging forest management systems

Evidence of changing forest systems is already visible in a range of contemporary examples in New Zealand. These include: mixed-species exotic forests, designed to increase resilience and diversify production; native forest restoration systems, incorporating active silviculture; hybrid native-exotic systems, reflecting transitional ecological states; and continuous cover forestry, avoiding clearfelling and maintaining permanent canopy structure.

Some examples of different forest types and forest management systems that can and do play a larger role in the New Zealand landscape are detailed below. Some of these have achieved significant scale. For example, Nateva's hybrid native-exotic systems, reflecting a transitional ecological state, as well as being the largest New Zealand owner of planted managed forest (80,000 ha of forest lands). With a rapidly changing world, the opportunity for other forest systems to gain momentum and scale is real. These systems are discussed below:

Mixed-species exotic forests

For example, many on-farm plantings where mixed stands or side-by-side stands of different species occur as a consequence of landowners having multiple goals, including high-quality wood production, shade and shelter for livestock, and amenity value. For instance, Richard Thompson's Papaiti Forest in Whanganui (Horizons, 2019) (Figure 2).

Mixed-species planted native forest

For example, Cassie's Farm, Waikato where 35 ha of steep hill country has been retired from pasture and planted in native forest (Figure 3). It includes silviculture of planted podocarps and their releasing from an overtopping nurse cover (Tānes Tree Trust, 2023).

Mixed-species forest – exotic and native

For example, Nateva's large-scale Permanent Forest Estate, such as the one in Tairāwhiti (Figure 4). A nurse crop of exotic species is actively managed over time to transition to a resilient and productive native forest (Casey et al., 2024).

Continuous cover forestry

For example, the Wardle's 121 ha Woodside Forest, located near Oxford, Canterbury (Figure 5). Here, they practice sustainable 'continuous cover' harvesting within both their black beech (74% of the area) and radiata forests (23% of area) (Tānes Tree Trust, 2016).

Such systems demonstrate a move toward: enhanced integration of ecosystem services and production objectives; a wider range of forest outputs and attributes being valued and monetised; lower-intensity and more selective harvesting approaches; greater structural and compositional diversity; a pragmatic acceptance of ecosystem novelty in modified environments.

Figure 2: Mixed-species exotic forest, Papaiti Forest, Whanganui

Figure 3: Mixed-species planted native forest, Cassie's Farm, Waikato

Figure 4: Mixed-species forest (exotic and native), Nateva permanent forest transitioning from pine to native, Tairāwhiti

Figure 5: Continuous cover forestry – black beech forest, Woodside Forest, Canterbury

Implications for the professional forester

Forests in New Zealand are entering a period of significant transformation. Driven by ecological change, societal expectations and evolving conceptual frameworks, future forests will be more diverse, multifunctional and dynamic than those of today – some in unfamiliar forms.

This transition requires a corresponding evolution in forestry practice. The profession must move beyond narrow, production-focused paradigms toward a more holistic, adaptive and integrative approach. What does this mean in terms of the role of professional foresters and their required knowledge and skill sets? We suggest there is a need for open thinking beyond often overly simplistic 20th century dichotomies and ecological paradigms to better fit the needs of the 21st century, including:

- Recognising the realities of changing ecologies, and the need to better integrate functional ecology, resilience and ecosystem services into production landscapes (as a necessary complement to existing reserves and conservation areas)
- Accepting a much broader range of forest types as being legitimate, including modified forest types in the new 'middle-ground' between conservation and production (e.g. exotic-native mixes). Realising opportunities for more multifunctional, multiple values and variable management objectives/practices applied at much finer spatial resolution and scales than commercial forestry (or farming) have typically done. This will generally be more responsive to micro-sites and a wider range of site-specific values and conditions than a blanket-like application of a single management prescription
- In doing so, optimising practices and management strategies that reflect the current state of the forest and the benefits of a more diverse and integrated species mix. This will be from production to transitioning native forests, to improving forest resilience and realising a wider range of environmental, economic and social benefits, while also focusing on a positive legacy of active forest management.

Ultimately, the professional forester's role will be to design and manage forest systems that: function within, and adapt in response to, a changing environment; realise site-specific opportunities; deliver a broad suite of societal values; and endure across human generations and ecological successional processes.

By doing so, foresters will actively contribute to shaping New Zealand's future landscapes in ways that are more sophisticated, nuanced and interdisciplinary than ever before. So, for all foresters, and in particular our Ngā Kaiwhakahaere Ngahere o Āpōpō (Tomorrow's Forest Managers), the future will bring opportunities to develop, practice and communicate new approaches to forest management in New Zealand.

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