Forests under the Southern Cross: The forest environmental frontier in Australia and New Zealand

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Abstract Australia and New Zealand share many historical and contemporary commonalities. These define five contemporary forest environmental frontiers—for First Nations peoples, between agriculture and forestry, in forest management, in urban and peri-urban environments, and in relation to climate change. In both countries, the First Nations frontier is expanding in scale and significance with those peoples’ rights to land and forests. Frontiers with agriculture and in forest management are longstanding but dynamic and as yet little realised in relation to the need for forest and landscape restoration. Both countries are highly urbanised, elevating the significance of the urban and peri-urban frontier, particularly in the context of climate change. In both countries, forests will be profoundly impacted by climate change and are central to mitigation and adaptation strategies. Experience within and intersections between the frontiers offer encouraging prospects for synergies and for learning between the two countries and more widely.

Keywords Australia · First Nations · Forest conflict · Forest environmental frontier · Forest governance · New Zealand

INTRODUCTION

Australia and New Zealand (Aotearoa) each have the Southern Cross on their national flag, reflecting their southern hemisphere geography; but each is also within the Global North, economically and politically. The contemporary forest environmental frontier in these two countries of Australasia reflects this duality, and is multifaceted, shaped by many commonalities but also some important differences in their histories and societies. The concept of the “frontier”, from which the papers in this Special Issue draw, has long been applied and critiqued in geography and political science (Barney 2009; Rasmussen and Lund 2018). Here, we interpret a “frontier perspective” in the terms outlined by Seijger et al. (2021, pp. 1–2; this Special Issue), in their exploration of water in agricultural-forest frontiers. We note, as they do, that this perspective understands “a frontier [as] a transition space, diffuse and dynamic both in time and extent”, one which “embeds human-driven changes, interests and conflict around forests” in specific geographical contexts, and “draws attention to exploration and exploitation of … [forest] landscapes and the conflicts that emerge over who obtains the benefits of natural resources”.

Contestation and conflict, of ideas as well as of practice, are thus central elements of a frontier perspective. We therefore follow Bonsu et al. (2019), who drew on Walker and Daniels (1997), to outline a framework for analysing conflict through three key, interacting dimensions: substance—what issues, visible and tangible aspects contribute to the conflict; procedure—how conflicts are managed, including relevant discourses, policies and rules; and relationships—the ongoing, conflicting relationships between actors and their interests. We identify five evolving and intersecting forest environmental frontiers common to Australia and New Zealand—for First Nations peoples, between agriculture and forestry, in forest management, in urban and peri-urban environments, and in relation to climate change—and discuss each in terms of this framework. We conclude by reflecting on what we might learn from this analysis, both within and between each country and more widely.
HISTORICAL CONTEXTS

Both Australia and New Zealand’s flora and fauna have their origins in the ancient Gondwanan continent; each is globally distinctive, with high levels of endemism (Australia State of Environment Committee 2016; Ministry for the Environment/Stats NZ 2019). Australia’s Aboriginal peoples arrived on the Australian continent c. 60 000 years ago, their lives and their management of landscapes were shaped by, and shaped, the unique ecosystems of the world’s driest inhabited continent (Baker et al. 2001). Some 250 language groups (‘clans’) exercised their rights and responsibilities for their ‘Country’ at the time of British colonisation in 1788 (AIATSIS 1996); their use of fire profoundly shaped the landscapes and ecosystems that the settlers found (e.g. Flannery 1994).

Amongst the many consequences of the dispossession and displacement of Australia’s First Nations peoples in a series of ‘frontier wars’ (Reynolds 2013) was the loss of the traditional management of Country; and with it the loss of much traditional knowledge and of fire and management regimes that sustained landscapes and ecosystems. In the world’s most fire-prone continent, bushfires (syn. wildﬁres) soon became established in the Australian settler psyche as more of a ‘feral’ natural disaster than the ‘tamed’ land management tool that they had been under Indigenous management (Bowman 2003).

New Zealand’s First Peoples, the Māori, migrated from Polynesia some 700 years ago (Wilson 2005). They used fire extensively to clear forests, both for cultivation and to expand tussock grasslands for the hunting of the now-extinct Moa (Ewers et al. 2006; Fetzel et al. 2014). Approximately 30% of the New Zealand’s land area was cleared by Maori in the 500 years between their arrival and that of Europeans (Ewers et al. 2006). The 1840 Treaty of Waitangi, between Māori chiefs and the British Government, guaranteed Māori “the full exclusive and undisputed possession of their Lands and Estates Forests Fisheries and other properties which they may collectively or individually possess”. However, it was followed by 30 years of frontier wars, and a series of Acts of Parliament and legal decisions, which dispossessed Māori of all but c. 7% of their land by 1900 (Litchfield 1995; Boast 2008).

In both countries, extensive deforestation followed British colonisation; in each, c. 40% of pre-colonial forests were converted to agriculture (Australia State of Environment Committee 1996; Ministry of Primary Industries 2015), a process which continues in some parts of Australia (Blanch and Taylor 2019). Australia’s native forests became important sources of wood and other forest products for the British Empire (Dargavel 1995), and the farms of both countries became similarly important for supplying food and fibre (Fetzel et al. 2014). The introduction of exotic animals and plants, and of European farming practices, impacted profoundly on landscapes, biodiversity and ecosystem services, catalysing an ongoing need for sustainable management and restoration of landscapes (Goldson et al. 2015). In each country, the majority of public native forests are now in conservation reserves; and tree plantations, established in both countries on a large scale in the twentieth century, are now of comparable extent in each (Australia 1.9 M ha; New Zealand 1.7 M ha), and supply c. 90% of Australia’s and all of New Zealand’s industrial wood (ABARES 2019; Forest Owners Association and Ministry for Primary Industries 2019).

Both countries are active members of the United Nations Forum on Forests, signatories to the United Nations Conventions on Biodiversity and Climate Change, and both report on the sustainability of their forest management under the Montreal Process (Ministry of Primary Industries 2015; MPIG and NFISC 2018). In the last two decades of the twentieth century, each country embraced the global free trade agenda, leading to significant structural economic reform and to export-oriented and trade-exposed primary industries. Agricultural exports comprise c. 12% of New Zealand’s GDP, and forestry c. 3% (Forest Owners Association and Ministry for Primary Industries 2019); for Australia, the comparable proportions are 2% and 0.5% (ABARES 2019; Jackson et al. 2020). Despite the strength of rural identity in their post-colonisation histories, the populations of both countries are now predominantly urban, with c. 70% of each living in the countries’ major cities (Stats NZ 2018; Australian Institute of Health and Welfare 2019). Nevertheless, the natural and rural environments remain strong elements of national identity in each (e.g. for Australia, “the bush”—Watson 2014; for New Zealand, Phillips 2008), and for national branding for lifestyle and tourism [e.g. ‘pure (viz. ‘clean and green’) New Zealand’; Morgan et al. 2002] and ‘Outback’ Australia (Pew Trusts 2014).

These historical trajectories of First Nations occupation and displacement, colonial settlement and agricultural development, forest and landscape transformation, and environmental and climate change, are parallel in many respects in each country, but also divergent in some important elements. They set the contexts for the five key contemporary forest environmental frontiers across both countries, which we discuss below in the terms of our analytical framework.
FOREST ENVIRONMENTAL FRONTIERS IN AUSTRALIA AND NEW ZEALAND

The First Nations frontier

First Nations peoples now comprise c. 3% and 16% of Australia’s and Aotearoa New Zealand’s populations, respectively, and experience substantially poorer life expectancies and wellbeing than their non-Indigenous counterparts (OECD 2019). These socially and economically entrenched differences between First Nations and other peoples in both countries reflect histories of dispossession and marginalisation, and are an underlying substantive issue in themselves. Because of the intimate and inseparable attachment of each country’s First Nations peoples to their lands and waters, restoration of rights over these lands and waters is a second substantive issue.

The procedural issue of recognition of First Nations peoples is fundamental in addressing their aspirations for justice and empowerment, and as a basis for the restoration of rights over traditional lands and waters. This process is more advanced in New Zealand than Australia, largely as a consequence of the legal basis afforded by the 1840 Treaty of Waitangi. A succession of legal and parliamentary decisions progressively restored Māori rights, including through a series of treaty settlements. Now, Māori “history, language and traditions are central to New Zealand’s identity” (Hill 2012). In Australia, which was colonised without any treaty process, First Nations Australians and their supporters have repeatedly called for both ‘symbolic and practical’ reconciliation, most recently in the Uluru Statement from the Heart (Referendum Council, 2017). They argue for this as the basis of “establishing a new relationship between First Nations and the Australian nation based on justice and self-determination where Indigenous cultures and peoples can flourish” (ibid). However, this proposition has so far been rejected by the Australian Government.

The key relationships in the First Nations frontier in each country are those between First Nations peoples, their representative organisations, and the dominant majorities; mediated by governments and influential social actors—notably, in the market-oriented economies of both counties, business. In the case of forests, shared interests between First Nations peoples and forest land managers have emerged and matured in the contexts of the latter’s recognition of cultural values and of joint interests in the economic and social values of forest management for a wide range of products and services (see, e.g. Criterion 6.4: Ministry of Primary Industries 2015; MPIG and NFISC 2018).

Consequently, in various respects, forests are at the forefront of the intersection of the dimensions of substance, procedure and relationships in the First Nations frontier in Australia and New Zealand. In Australia, the forested ‘Indigenous Estate’ (lands over which some form of First Nations’ rights have been formalised; see Altman 2012; MPIG and NFISC 2018; Jacobsen et al. 2020) comprises 70 M ha, corresponding to 9% of Australia’s land area and 50% of its forests (Jacobsen et al. 2020); the majority is savanna woodland in Australia’s tropics (Meadows et al. 2020). Around 30% (22 M ha) of the current forested Indigenous Estate is under exclusive First Nations ownership and management; another 40% is managed or co-managed by traditional owners; various lesser forms of rights exist over the remainder (MPIG and NFISC 2018; Jacobsen et al. 2020). The extent of the Indigenous Estate nationally is expected to increase as further native title claims are determined (Jordan et al. 2020).

In New Zealand, Māori leaders speak of three interdependent elements of their responsibilities to their land and people: Kia mau ki te whenua (secure control of the land), Kia whakamahia te whenua (undertake enterprises upon the land), and Hei painga mo nga whakatupuranga (for the generations to come). Legally recognised ‘Māori land’ currently totals c 1.5 M ha (c. 5% of New Zealand; Māori Land Court 2019), of which around a third is native forest (McDermott et al. 2010, Chap. 8). Much of this land has been transferred as a result of treaty settlements catalysed by deregulation and the disposal of state assets initiated in the 1980s, when Māori entities took legal action to halt the sale of Crown forests in order to protect Māori interests, until ownership could be determined through the Treaty of Waitangi settlement process (Crown Forestry Assets Act, 1989). Treaty settlements usually involve a mix of cash reparation and the return of Crown-owned land; most of that returned to Māori is forested. Despite agreement of a set of principles to underpin the contemporary treaty process (partnership, mutual benefit, active protection and redress; Te Puni Kokiri 2002), a number of tensions remain between government and Māori interests, including the mismatch between traditional communal ownership and land and Western tenure models (Kingi 2008), and Māori preferences for native tree species (for food, shelter, building materials and medicine), notwithstanding recognition of the merits of exotic forests in protecting land and generating employment and income (Miller et al. 2007).

Globally, ‘place-based’ approaches to economic development (viz. those that capitalise on local assets through culturally and locally appropriate development activities) are receiving increasing attention (OECD 2019). These approaches offer a means of empowering First Nations landowners, in terms that encompass both their spiritual connection to and responsibilities for their lands, and their desire to participate more fully in the mainstream economy to the benefit of their communities (OECD 2019, 2020).
In Australia, these approaches are most commonly manifested in management of forests for conservation, environmental services and tourism, and have been developed primarily by and through Indigenous Land and Sea Management Organisations, typically drawing on ‘Indigenous Ranger Groups’ (see Indigenous Land and Sea Corporation 2019; Pert et al. 2020). Whilst the majority of these Organisations and Groups are funded primarily through Australian Government programs, some—such as those delivering the longstanding Arnhem Land Fire Abatement (ALFA) Project (Russell-Smith et al. 2013) generate substantial income from environmental services markets. In 2017, ALFA Project income from abating 700 000 t CO₂ equivalent, by applying planned fire during the early dry season to mitigate the risk of late dry season wildfires, was AUD$6.8 M (Jordan et al. 2020).

More traditional commercial forestry enterprises under First Nations Australians’ ownership and management are generally small and fragmented (MPIG and NFSIC 2018). They comprise small-scale sawmills in remote communities, salvage logging ahead of land clearing for mining, small-scale harvesting for art and craft products, and some plantation forestry enterprises (Feary et al. 2010; Meadows et al. 2020). As Feary et al. (2010) observe, there are “a myriad of opportunities for a broadly defined forests sector [on the Indigenous Estate], but this requires improved relationships between Aboriginal people and the dominant society and much deeper understanding of diverse Aboriginal aspirations at the local level.”

In New Zealand, within the Māori land estate, Māori ownership of and rights over forests comprise a complicated mix of ownership of native and plantation forestland; and, in the plantation forestry sector, ownership of plantations transferred under treaty settlements, investments in established or new plantations, forestry land rental income, stumpage shares, and management arrangements. Some 25% (0.4 M ha) of New Zealand’s commercial plantations are established on Māori land, defined as above, a proportion expected to increase to c. 40% as treaty processes conclude. Around a fifth of these are Māori-owned, a proportion that is also expected to increase, because plantation forestry can fit well with the core elements of Māori responsibility for land and people identified above (Forman 2014; Thorp 2014).

The forest-agriculture frontier

Agricultural-based settlement was the foundation of the British colonisation of Australia and New Zealand, and the rationale for much of the displacement of First Nations peoples. A number of waves of agricultural expansion characterise the post-colonisation history of both countries, each also generating social and political reactions in favour of conservation of forests from ‘wanton destruction’ (Carron 1985; Dargavel 1995; Roche 2002, 2017). Agricultural land uses, including extensive pastoralism, now extend over nearly 60% of Australia’s and 50% of New Zealand’s land area (Edwards et al. 2018; Jackson et al. 2020).

There are a number of substantive issues in the forest-agriculture frontier, reflecting both contemporary practices and the legacies of those past. Extensive conversion of forests to agriculture continues in some Australian regions, principally the northern and central east, with the scale of deforestation remaining amongst the top dozen nations globally (Blanch and Taylor 2019), and consequent impacts on ecosystem services at a range of scales. In areas longer converted to farming, biodiversity and other ecosystem services are generally continuing to decline, because of habitat loss and fragmentation, the deterioration of landscape quality, and the unsustainability of many farming systems (Australia State of Environment Committee 2016; Ministry for the Environment/Stats NZ 2019). Regulation and management of forests on private lands remains a contested issue in some Australian states, though less so in others and in New Zealand (McDermott et al. 2010; Kanowski 2017).

Procedurally, public policy governing deforestation and management of forests on private land in Australia is determined primarily at the sub-national level of states (Evans 2016; Simmons et al. 2018). Conversion of native forest to farmland in New Zealand was effectively ended by the New Zealand Forest Accord of 1991 (Roche 2017). In both countries, changes in agricultural land use are relatively permissive and market-driven, subject to operational (e.g. land quality and slope) and environmental constraints. Amongst the most significant of the latter is competition for water use and maintenance of water quality, one dimension of the forest-water frontier explored by Seijger et al. (2021); for example, regulations limiting tree plantation expansion on farmland in some regions of Australia were enacted to minimise competition for water use (Clean Energy Regulator 2020a); irrigated dairying, one of the major areas of growth in New Zealand farming, can have major implications for both water availability and quality (Edgar forthcoming).

Key relationships in the forest-agriculture frontier have historically been those between farmers and agricultural interests, foresters, and conservationists; unlike the forest management frontier, discussed subsequently, foresters and conservationists have shared interests in this frontier, usually at odds with those interests seeking to expand the extent of agriculture. For both historical and contemporary political reasons, the political influence of farming interests is disproportionate to both the economic contribution of agriculture and its electoral size (Liepins and Bradshaw
Where constructive rather than antagonistic relationships have been forged across these historical divides, as in the case of Landcare discussed below, powerful alliances for more sustainable land use have emerged; unfortunately, in both countries, recent relationships between agricultural and forestry have been more competitive than cooperative.

Two important strands of intersections of substance, procedure and relationships in the forest—agriculture frontier are ‘Landcare’ for landscape restoration, and farm forestry. The Landcare movement and related initiatives emerged in Australia in the 1980s in response to the loss of ecosystem function, productivity and value consequent to land clearing. It was catalysed at a grassroots level and catapulted to nation pre-eminence by a coalition of farmers and conservationists; within 5 years of its national launch in 1989, Landcare involved around a third of Australian farmers (Curtis et al. 2014; Robins 2018). Although the early ambitions for Landcare have not been realised at the landscape scale, and early momentum has not been maintained as result of policy oscillations, over-bureaucratization, and volunteer fatigue (Robins and Kanowski 2011; Tennent and Lockie 2013; Robins 2018), the Landcare ethic of ‘the way people live in the landscape while caring for the land’ (Robins 2018, p. 2) remains foundational for the sustainable management of Australian landscapes. A Landcare movement developed similarly and essentially in parallel in New Zealand, informed by the Australian experience and working in partnership with farmers and community groups (Edgar forthcoming; Ross 2009), and becoming institutionally embedded as both an NGO (NZ Landcare Trust) and a public research agency (Manaaki Whenua—Landcare Research).

A second example is that of farm forestry, the potential of which is still largely realised in both countries. In the Australian case, both the Landcare movement and strategic reviews of the national response to climate change (e.g. Garnaut 2008) envisaged substantial restoration of Australian landscapes, for multiple goals. Despite a substantial body of research demonstrating the potential carbon, biodiversity and other economic benefits of targeted reforestation with little if any adverse consequence for agricultural production (e.g. Paul et al. 2016), and a similar body of research and demonstration-scale practice about various agroforestry systems (e.g. O’Grady and Mitchell 2018), there has as yet been only very limited adoption of more integrated land uses, on a scale too limited for landscape-level impact (Campbell et al. 2017).

There are a number of reasons for this. The first is the inconsistency and lack of ambition of Australia’s climate policies under successive conservative governments (Wilcox 2017; Climate Council 2019b, a), and the consequent uncertainty for farmers seeking to make decisions with long-term implications (Evans 2018). A second set of reasons at the farmer level reflect established attitudes that see tree-growing as incompatible with productive farming, concerns about loss of flexibility in land use, and poor information for decision-making (Schirmer and Bull 2014; Evans 2016). These constraints to landscape restoration have been amplified by a national policy and program vacuum in relation to farm forestry for much of this century, a more general lack of policy imagination and integration across agriculture and forestry sectors, and rural community opposition to plantation establishment on farmland associated with the impacts of a tax-driven national program in the decade to 2010 (Kanowski 2017). Thus, while there are now ambitious philanthropic and NGO goals for landscape restoration in Australia, corresponding to c. 10% of current native forest extent (e.g. 25 million trees and 13 M ha land in 5 years—Evergreening 2020; 2 billion trees and 10 M ha by 2030—Blanch and Taylor 2019), formal national policy ambitions remain limited to episodic support for biodiversity plantings (e.g. ‘20 Million Trees’; Landcare Australia 2019, p. 14) and establishment of an additional 400 000 ha of commercial plantations, primarily exotic softwoods (an increase of c. 40% in the extent of these plantations; Australian Government 2018).

In New Zealand, the intersection of substance, procedure and relationships in restoration and farm forestry has many parallels to the Australian case. From the 1990s through to the present, the New Zealand Government has introduced a series of programs to encourage tree planting, especially on marginal and erosion-prone agricultural land (Bayne et al. 2020). Whilst earlier measures, such as the Afforestation Grant or Hill Country Erosion Control Schemes, focussed on planting commercial exotic species, the current 1 Billion Trees Programme (1BT; NZ Ministry of Primary Industries 2021) supports establishment of both exotic commercial and native species, as well as the replanting of current plantations, over the decade to 2027. Two-thirds of the new plantings are intended be native species, for ecosystem services (principally biodiversity, carbon sequestration, and catchment protection) and as a resource for non-timber and timber products, and through these goods and services, to contribute towards Māori realising their cultural, economic, environmental and social aspirations (Te Uru Rakau 2020).

However, similarly to the Australian case, ambitions for greater integration of agriculture and forestry production and land use systems have yet to be realised. The reasons are similar in both countries, reflecting policy frameworks that favour agriculture, explicitly or implicitly; and market-led intensification of farming systems, increasingly by agribusinesses rather than family farmers, and with a framing of sustainability as a collateral obligation rather
than a central tenet of land use (e.g. Swaffield 2014; Massey 2017). Counterarguments for development and land use strategies that decouple economic growth and environmental pressures have been advanced (e.g. Hatfield-Dodds et al. 2015), but have so far had little impact, although they have been received more favourably at the political level in New Zealand than in Australia (e.g. Ministry for the Environment 2005).

The forest management frontier

From the early 1970s, the Australian forest management frontier in both Australia and New Zealand was dominated by conflict over the harvesting and conversion of native forests; this issue was resolved in New Zealand in the 1990s, but continues in Australia as a long-running series of ‘forest wars’ (Ajani 1987; Dargavel 2018). In Australia, management of wildfire in native forests has emerged as another substantive issue, both independent of (e.g. Russell-Smith et al. 2020) and linked to (e.g. Lindenmayer et al. 2020) forest harvesting; and in both countries, a range of environmental and social issues are associated with plantation afforestation and management.

National, and in the Australian case also sub-national, procedural responses to conflicts and issues in the forest management frontier have been a dominant element of forest policy in both countries for some 50 years. The emergence of the environmental movement in the early 1970s catalysed a series of processes and agreements that progressively restricted the harvesting of native forests and their conversion to plantations or other land uses, and strengthened forest management regulations (McDermott et al. 2010, Chap. 8). In New Zealand, concerns about the sustainability of native forest management intersected with the adoption of neo-liberal economic policies; together, these catalysed the New Zealand Forest Accord in 1991 and the cessation of public native forest harvesting in 2002 (Roche 2017). In Australia, where forest management is constitutionally the responsibility of sub-national state governments, a series of policy and legal responses culminated in the initiation of the Regional Forest Agreement (RFA) process in 1995; some dozen agreements, including variants of the original Commonwealth State model, were reached in the following decade (Ajani 2007; Kanowski 2017). Some of these have been substantially modified by subsequent processes (e.g. Tasmania—Schirmer et al. 2016; Victoria—Department of Jobs, Precincts and Regions 2021), and others have been extended for a second 20-year term (Australian Government 2020).

Relationships central to the forest management frontier have predominantly and stereotypically been those between the ‘forestry sector’ and ‘environmentalists’: the former comprising the forest industries and workers, many professional foresters, rural communities and government agencies responsible for forestry; and the latter, environmental NGOs and community groups, many ecologists, and government agencies responsible for the environment. Other actors, including First Nations peoples and those engaged in non-wood products and services businesses, and other local community interests, were largely excluded until the 1990s, when the New Zealand Forest Accord and Australian RFA processes created space for their voices. Relationships and alliances, between and within actor groups have varied with the focal issue; for example, rural communities may be in favour of active native forest management, such as timber harvesting or fuel reduction burning, but be concerned about the economic and social impacts of expanded plantations (Schirmer 2007); First Nations peoples may identify shared interests with both forest conservationists and forest managers (Feary et al. 2010). Given the predominantly urban populations of both countries, tensions in the relationships between the urban majority and rural communities have often been expressed in the political arena (e.g. Chan 2018; Groundswell NZ 2021).

Intersections between the dimensions of conflict in the forest management frontier are evident for both native and plantation forests. For the former, following Australia’s ‘Black Summer’ wildfires of 2019–2020, and expectations of more frequent and severe wildfires under a warming climate (e.g. Boer et al. 2020), the relationship between forest management and wildfire, and how best to manage forests to minimise risk to life, property and environmental assets, has become even more strongly contested. Debate about each of fuel management strategies (Morgan et al. 2020; Russell-Smith et al. 2020) and the role of timber harvesting (Lindenmayer et al. 2020; Bowman et al. 2021) replays established conflicts, but also introduces new dimensions such as the potential of First Nations’ traditional burning practices to reduce wildfire risk (e.g. Neale et al. 2019; Steffensen 2020).

In the New Zealand case, although some debate continues about the very limited extent of native forest harvesting (e.g. of windthrown trees—Wilson and Ali Memon 2005), the key focus of concern is management of multiple pest species which have an adverse impact on New Zealand’s highly endemic, and threatened and vulnerable, native biodiversity (Ministry for the Environment/Stats NZ 2019). The main concerns about forest management practices are associated with plantation forests: downstream sedimentation, and storm-induced flood, landslides and debris flow, have elevated debate about appropriate forest management practices (Bayne et al. 2019), in the context of the National Environmental Standard for Plantation Forestry (Fowler and Buddle 2020).
In both countries, there has been only limited progress in developing management regimes to deliver ecosystem services from commercial tree plantations (see Bauhus et al. 2010), beyond those of carbon sequestration (discussed subsequently) and, in some cases, water catchment protection. In Australia, concerns about the impacts of tree plantations on catchment water yield led to a national policy that effectively precluded the expansion of commercial plantations on productive agricultural land (defined as areas of > 600 mm annual rainfall) for the past two decades, although some of these restrictions have recently been eased (Clean Energy Regulator 2020a). Stronger partnerships between commercial forestry and farming are an obvious pathway for delivering a wider suite of benefits and services from the former, and enhancing the sustainability of both production systems (Keenan et al. 2019).

New Zealand’s progress in developing management regimes for commercial tree plantations to deliver ecosystem services has been constrained by the perceived risk of moving away from radiata pine plantations to alternative species (Smail et al. 2014). Some exotic plantations are managed in part to deliver ecosystem services, particularly recreation and biodiversity, but these management practices are not widespread (Turner et al. 2011). Recent legislative changes, which focus on the impacts of land uses, including forestry, on fresh water quality and biodiversity, may variously constrain and favour tree plantations (Fowler and Buddle 2020). While there is increasing interest in plantations of native species, these are currently and prospectively of only limited scale (Steward and McKinley 2019).

The urban and peri-urban forest frontier

The dominant urban character of both Australia and New Zealand’s populations has only recently been matched by a focus on urban forests and the consequences of peri-urban expansion. One substantive issue at this frontier in both countries is the impact on biodiversity and other ecosystem services of the rapid growth of major cities and, in some locations, ‘sea change’ (coastal) and ‘tree change’ (rural) residential development (Australia State of Environment Committee 2011; Ministry for the Environment 2019). In Australia, peri-urban and tree change development may also elevate wildfire risks, and management of landscapes to mitigate this risk can further impact biodiversity and ecosystem services (Gibbons et al. 2018; Russell-Smith et al. 2020).

A second substantive issue is increasing recognition of the health and wellbeing benefits of well-planned and managed urban forests (e.g. Endreny et al. 2017; Wood et al. 2017), an awareness has been enhanced by the COVID-19 pandemic (Breed et al. 2020; Berdejo-Espinola et al. 2021). These are part of the wide array of ecosystem, economic, cultural and social benefits of urban forests (Salbaitano et al. 2016; Frantzkeskaki 2019), amongst which is now a renewed focus on the role of urban forests in moderating urban temperatures (Norton et al. 2015).

Unlike that for the other frontiers we discuss, responsibility for the procedural dimension of the urban and peri-urban forest frontier rests primarily with city councils, which are the lowest tier of government in Australia and New Zealand. Many cities in both countries have developed progressive and innovative strategies for renewing, expanding and enhancing the resilience of their urban forests, and increasing the benefits they deliver. They have done so through developing green infrastructure and urban forest strategies that recognise and enhance the diverse values of urban forests as nature-based solutions to both environmental and social challenges (Escobedo et al. 2019; Frantzkeskaki and Bush 2021), and engaging communities in realising these solutions (e.g. for Auckland: Auckland Council 2019b, a; for Melbourne: Hartigan et al. 2021). However, city-level governance mechanisms in both countries have generally been less successful in retaining urban trees on private lands as cities both expand and densify (e.g. for Brisbane: Daniel et al. 2016; for Christchurch: Guo et al. 2019).

Relationships between urban residents, the city councils they elect, and the diversity of actor groups with interests in urban forests—particularly community groups and developers—are central to this frontier. Residents in Australia and New Zealand have diverse and sometimes complex relationships with urban trees; whilst most Australian urban residents appreciate and value urban trees, many residents are also concerned about risk, some very strongly so (Kirkpatrick et al. 2012). Urban New Zealanders similarly recognise the benefits of urban trees, but some also see them as a barrier to desirable redevelopment (Guo et al. 2019). Cities in both countries have become more culturally diverse, necessitating more nuanced strategies for engaging communities and designing and managing urban forests (Saldarriaga et al. 2020). Councils typically have to balance the interests of established residents and community groups concerned about the loss of trees with the goals of densification strategies and with developers seeking to maximise returns on property footprints; these relationships are often adversarial, and not well-served by disconnected and inconsistently applied regulatory mechanisms (Daniel et al. 2016; Clark et al. 2020).

A number of issues are at the forefront of interactions between these dimensions in the urban and peri-urban forest frontier. The first is the inherently political nature of ‘urban greening’, and the implications of different strategies and priorities for different actors and interests (Cooke
A second is the locally specific challenge of designing and developing urban forests as a nature-based solution to climate change, and other urban issues (e.g. Frantzeskaki 2019); this includes both technical challenges, such as adapting tree species, their configuration and management (e.g. Zhang and Brack 2021); social challenges, such as those in engaging and empowering residents (Jones 2020), accounting for multiple dimensions of diversity (e.g. de Kleyn et al. 2020; Saldarriaga et al. 2020); and strengthening governance (Daniel et al. 2016; Frantzeskaki and Bush 2021). A third challenge, already evident in many cities, is that of adequately resourcing the management and renewal of urban forests; explicit valuation of their ecosystem services (e.g. Tapsuwan et al. 2021) can help bolster more qualitative arguments in favour of urban forests (e.g. Australian Capital Territory Government 2019).

In peri-urban contexts, transitions away from traditional agriculture are creating opportunities for more forested landscapes with greater biodiversity and ecosystem service values (Beilin et al. 2014). The opportunities are often constrained by fragmented character of these landscapes and of their ownership, the challenges of managing pest plants and animals, and—particularly in Australia—wildfire (Australia State of Environment Committee 2011; Ministry for the Environment/Stats NZ 2019). Community-based organisations such as Landcare, discussed previously, have become important agents for cooperation and coordination in these contexts.

**The forest–climate frontier**

As is the case globally, the impact of climate change on forests and people in both countries is expected to be profound, and so the forest–climate frontier is assuming pre-eminence in the forest environmental frontier in both Australia and New Zealand. There are many substantive issues: for native forests, modelling suggests high levels of change in Australian native vegetation assemblages across the continent, consequent to both temperature and rainfall changes and flow-on effects for wildfire regimes, with unprecedented impacts on ecosystems and biodiversity (Australia State of Environment Committee 2011, pp. 318–319); in New Zealand, drought impacts, and those of pest plants and animals and changed fire regimes, are expected to alter native forests (Ministry for the Environment/Stats NZ 2019). In most of Australia’s major tree plantation regions, environments will be less suited to and more risky for plantation forestry production (Australia State of Environment Committee 2011, pp. 318–319). In New Zealand, commercial plantation forestry may benefit from increased productivity, but this gain is countered by increased risks associated with wind susceptibility, wildfire and pest and disease incursions (Watt et al. 2019). As discussed previously, wildfire frequency, intensity and risk will increase, especially in Australia, with impacts for both forests and people; and the climate mitigation role of urban forests will become more important for human health and wellbeing in cities.

Procedurally, forests are an important element of each country’s international emissions reductions commitments and national change mitigation strategies, despite differences in national emissions profiles. Agriculture, forestry and land use comprise only a modest component (c 15%—Australia State of Environment Committee 2016) of Australia’s emissions, but are a large proportion (c. 48%—Ministry for the Environment/Stats NZ 2019) of New Zealand’s. Australia’s strategy emphasizes broad-scale land management to increase carbon stocks and reduce emissions (Merzian and Hemming 2021); New Zealand’s strategy emphasizes the role of planted forests, including commercial plantations, in achieving these goals (Ministry for the Environment/Stats NZ 2019; Parliamentary Commissioner for the Environment 2019). The pathways by which these goals are being pursued differs between the countries; in Australia, which only briefly had a price on carbon (2012–2013; Crowley 2017), a publicly funded Emissions Reduction Scheme and the voluntary carbon market fund relevant forestry activities; these include revegetation, changed native forest management, savanna fire management and plantation forestry (Clean Energy Regulator 2020b). While forests overall are a net sink, deforestation continues to be a substantial contributor to emissions (Climate Action Tracker 2020). In contrast, New Zealand introduced an Emissions Trading Scheme in 2008, under which carbon stored by existing forests—including commercial plantations—was ‘nationalised’ to contribute to national emissions reduction targets (Hughes and Molloy 2020). Forests have been a major sink since 1990, providing offsets averaging 40% of national emissions to 2017, but this contribution is expected to decline substantially, if temporarily, as maturing post-1990 plantations are harvested (Ministry for the Environment/Stats NZ 2019).

Relationships associated with the forest–climate frontier are embedded in the climate and land use politics of each country. In the eyes of most, Australia remains a laggard on climate action (Climate Council 2021; Merzian and Hemming 2021); successive Australian conservative governments have effectively resisted meaningful climate action (Wilcox 2017; Baxter et al. 2020). In contrast, the New Zealand Government has taken a much more proactive position and declared a climate emergency (Radio NZ 2020). Forest sector actors on both countries have been proponents of important contributions forests and forest products can make to emissions reductions and climate change adaptation (e.g. Ausseil et al. 2013; Jackson et al.
2021; Ximenes 2021), but there is sometimes strong disagreement about strategies with other actors: for example, with farmers in both countries about the extent of carbon plantings on farms (e.g. Cooper and Rosin 2014; Schirmer and Bull 2014); and, as discussed previously, with many conservation actors in Australia about appropriate native forest management.

These dimensions intersect in each country in relation to climate change mitigation and adaptation strategies. In both countries, there is vigorous debate about the role that forests should play in climate change mitigation. In Australia, the focus has been largely about the lack of a carbon pricing and trading scheme, as envisaged in a 2008 national climate change strategy (Garnaut 2008), and the consequent modest public funding available for forest-related mitigation; the constraints on plantation forestry expansion in relation to agriculture that have been embedded in the Emissions Reduction Fund; and issues of permanence associated with increasing wildfire frequency and severity as a result of climate change. In New Zealand, debate has focussed on the reliance of the national climate change strategy on forests as sinks (Parliamentary Commissioner for the Environment 2019); and on the impacts of the Emissions Trading Scheme on commercial forestry activities, given the liabilities of forest owners for emissions when forests are harvested, and the potentially distorting effects on competition with agriculture (Hughes and Molloy 2020).

There is more agreement about the role of forests in climate change adaptation. As discussed in previous sections, the potential for the integration of trees into agricultural production systems to support more climate-adapted farming is recognised, if relatively little-enacted as yet; in cities, increasing tree canopy cover is a core priority to minimise the adverse effects of warmer temperatures on urban residents.

DISCUSSION

Imagining a more harmonious and inclusive forest environmental frontier

The five elements of the forest environmental frontier that we have discussed in the preceding sections emerged and are expressed in the contexts of each Australasian country’s First Nations, colonial and post-colonial settlement history; their evolving political economies and international contexts and relationships; their trajectories of economic and rural development; and their progression from British colonies to multicultural societies more respectful and inclusive, albeit imperfectly so, of their First Nations peoples. In both countries, the current COVID-19 pandemic and the growing sense of a climate emergency are catalysing discussion of economic and social resets to address structural constraints to more sustainable futures (e.g. Garnaut 2021 for Australia; Gluckman and Bardsley 2020 for New Zealand). In that spirit and context, we reflect in this section on what we might learn from the experience of these distinct but interacting frontiers, in imagining a future characterised by a more harmonious and inclusive forest environment frontier in each of Australia and New Zealand.¹

The substantive issues identified in each of the five Australasian forest environmental frontiers are likely to persist over the decades ahead; some, such as those impacted by climate change, may be amplified; others, such as those associated with empowerment of First Nations peoples, may be moderated. Regardless, as Jackson et al. (2021) have argued for Australia’s forests, and Gluckman and Bardsley (2020) suggest for New Zealand, sustainable responses to the major challenges faced by each country will need to be predicated on governance processes that are more integrated and inclusive, founded on relationships that build community cohesion and resilience.

In best case scenarios, such as those that have been imagined for each country (e.g. Australia—Rapauch et al. 2012; New Zealand—Gluckman and Bardsley 2020), a series of synergies would emerge from the issues and relationships that have shaped historical and contemporary frontiers, and be enabled by leadership and procedures that integrate policies across sectors and time horizons (e.g. Dovers and Hussey 2013; Carney 2020). Strategies to mitigate and adapt to climate change would support the forest and landscape restoration that is fundamental to the sustainability of primary production systems in both countries, and foster the sustainable intensification (sensu Pretty et al. 2018) of both agricultural and forestry systems in that context. The contributions these restored landscapes make to climate change mitigation would complement, not substitute for, those made in other sectors of the economy (Parliamentary Commissioner for the Environment 2019; Garnaut 2021); similarly, their contributions to biodiversity conservation and other ecosystem services would complement and amplify the role of remnant native forests, especially those embedded in predominantly agricultural landscapes.

Native forest landscapes would be managed under various forms of collaboration with their First Nations custodians, as a fundamental component of ‘nature-based solutions to global challenges’ (Jackson et al. 2021). The

¹We acknowledge the prior work of others who have likewise envisioned a ‘better’ future for forests and people in each country, including, but not limited to: for Australia, Campbell et al. (2017), Feary et al. (2010), Jackson et al. (2021), Yool (2002); for New Zealand, Jones (2018), Pure Advantage (2021), Te Uru Rakau (2021).
stewardship of First Nations peoples would be expressed in forest management practices that draw from both their and scientific knowledge (e.g. Ens 2012; Lyver et al. 2017), to deliver a wide array of ecosystem goods and services, including but not limited to those valued by markets. The rights and interests of First Nations peoples in relation to forests would be expressed through reconciliation and legal recognition, and through place-based enterprises that deliver both economic and social benefits (see Thorp 2014; Lee et al. 2020) and help ‘close the gap’ (sensu Australian Human Rights Commission 2021) between First Nations and other Australians and New Zealanders. The physical and mental health of the many urban Australians and New Zealanders would benefit from more forested cities, with urban environments and temperatures mediated by trees and other living infrastructure more resilient to climate change. Together, these landscape, lifestyle and production system measures would facilitate a transformation towards a more circular bioeconomy (MacRae and Harnett 2019; Ximenes 2021).

Realising the transformative change required to realise these scenarios will require both community and political leadership that builds collaborative relationships across diverse actors, interests and sectors, and across the five frontiers. There are encouraging examples of these in both countries: they include the development of diverse forest-based enterprises that give effect to First Nations’ aspirations and interests (e.g. savanna burning in Australia—Whitehead et al. 2003; plantation forestry businesses in New Zealand—Lake Taupo Forest Trust 2020); the emergence in the 1980s of Landcare from entrenched positions in the forest–agriculture frontier (Campbell et al. 2017; Edgar forthcoming); political agreements that addressed long-running conflicts in the forest management frontier, such as the NZ Forest Accord (Salmon 2013) or the ‘Tasmanian peace process’ (Schirmer et al. 2016); and the ambitious and innovative urban forest strategies of many Australasian cities. Each of these responses, amongst others, offers platforms and learning for engaging constructively with the challenges of each frontier. They can also contribute to both the familiar and novel challenges presented by the forest–climate frontier: in New Zealand’s case, these challenges are amplified by its unique emissions profile and reliance on forest-based sinks (Ministry for the Environment/Stats NZ 2019); in Australia’s case, they are exacerbated by a ‘lost decade of climate inaction’ (Climate Council 2019b, a) which has failed, amongst other things, to capitalise on the potential role of forests and the forestry and wood products sector. In both countries, greater policy foresight and coherence across the five frontiers would facilitate synergies and help identify and resolve tradeoffs (Dovers and Hussey 2013; Kanowski 2017; Bardsley et al. 2020).

CONCLUSIONS

This review of forest environmental frontiers in Australia and New Zealand illustrates Seijger et al.’s (2021) conceptualisation of forest frontiers as “diffuse and dynamic in both time and space”, and Bonsu et al.’s (2019) characterisation of the intersecting dimensions of conflict. In each country, the First Nations frontier predates British colonisation, was profoundly changed by that colonisation, the dispossession it brought, and its expression in the forest–agriculture frontier. The re-emergence of First Nations peoples’ rights over their forests in both countries since the 1980s was catalysed by both economic and social forces, has progressed steadily rather than dramatically, and with different emphases and outcomes in Australia and New Zealand. The forest management frontier emerged in each country in the early twentieth century as a reaction to the forest–agriculture frontier, which remained the primary focus of conflict until that over forest management regimes became dominant in the 1970s. As public policy processes progressively addressed native forest harvesting conflicts, the focus of tensions in the forest management frontier shifted to management of fire and of plantations. In this century, the forest management and First Nations frontiers began to interact more strongly as the convergence of their interests became more apparent. The accelerating growth of major Australian and New Zealand cities over the past half-century prompted increasing attention on the urban and peri-urban frontier, now defined as much by conflict prompted by densification as by expansion. This frontier has been at the forefront of interaction with the forest–climate frontier, as city councils seek nature-based solutions to climate change and other urban challenges. As the forest–climate frontier evolves and assumes an increasing significance, both mitigation and adaptation strategies are stimulating interactions with each of the other frontiers, and between them—for example, in the exploration of more integrated farming and forestry production systems, or of the role of cultural practices in mitigating risk and sustaining environmental services.

It is common for political leaders in each of Australia and New Zealand to reference both the commonalities and the differences between the two countries, and the role each has as a bridge between nations of the Global North and those of Asia and the Pacific (e.g. Prime Ministers of Australian and New Zealand 2021). This framing is also relevant to the learnings that might be drawn from this review of forest environmental frontiers in the two countries. The many commonalities in these frontiers suggest good prospects for similar, if locally adapted, responses to challenges; Landcare is one such example in the forest–agriculture frontier, as is the development of highly productive tree plantations in the forest management frontier.
Differences are also instructive: for example, New Zealand’s Māori peoples are more fully engaged in commercial elements of the forest management frontier than are Australia’s Aboriginal and Torres Strait Islander peoples, in part because of the Treaty settlement processes that are open to them but not to their Australian counterparts. Differences in the treatment of forest carbon stocks under each country’s carbon accounting regime may have significant consequences across forest management, forest–agriculture and forest–climate frontiers. In each case, there are opportunities for both countries to learn from these differences in shared frontiers.

The same principle of reciprocal learning applies in both the regional and wider international contexts, and across the frontiers identified here. Many elements of the First Nations frontier resonate with experiences of forest-dependent people in Asia and the Pacific, including in the contexts of community forestry and of smallholder value chains (e.g. Cruzado Melendez and Kanowski forthcoming; Jenkin et al. 2019; Nuberg et al. 2019); correspondingly, the experiences of First Nations communities elsewhere (e.g. Canada—Nelson et al. 2019) are instructive for those in Australasia. In the forest–agriculture frontier, both Landcare and Australian approaches to building farmers’ capacity for tree-growing have been adopted in countries of the region (Dale et al. forthcoming; Reid 2017); and Australasian forest restoration initiatives are drawing inspiration and knowledge from those elsewhere (e.g. Hall 2018; EverGreening 2021). In the forest management frontier, each country’s development of and reliance on tree plantations for wood production offers elements to emulate and to avoid (e.g. Edwards et al. 2019; Keenan et al. 2019); and suggests opportunities for learning from elsewhere (e.g. Schirmer 2007; Ranachar et al. 2020). In the urban and peri-urban frontier, ambitious urban forest strategies cognisant of social diversity (e.g. Saldarriaga et al. 2020; Hartigan et al. 2021) offer examples for cities elsewhere, and have themselves been stimulated and informed by those of cities in the region (e.g. Singapore; Newman 2013; Pierce et al. 2020) and globally (e.g. Frantzeskaki 2019). In the forest–climate frontier, the reliance of both countries on forest-based sinks is variously instructive (e.g. Hughes and Molloy 2020; Merzian and Hemming 2021); reciprocally, so is experience elsewhere of ambitions to transition to a forest-based circular bio-economy (e.g. Toppinen et al. 2020).

In conclusion, the geographic location of Australia and New Zealand, their First Nations and subsequent settlement histories and their similar economic and political orientations have resulted in globally distinctive forested (and deforested) landscapes and a particular suite of forest environmental frontiers. While these frontiers—for First Nations peoples, with agriculture, in forest management, in urban and peri-urban contexts and in relation to climate change—are not unique to Australia and New Zealand, they are expressed in locally specific elements and terms. This in turn suggests that a frontiers perspective, such as that we have adopted here, offers insights relevant to the challenges and opportunities that these frontiers present, for both Australia and New Zealand and more widely.

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