



Research article

# Plants of place: justice through (re)planting Aotearoa New Zealand's urban natural heritage

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## Abstract

Climate change has led to urgent calls for environmental action and justice, which is likely to include increased urban vegetation. The benefits of this planting could go beyond ecological and climate benefits to contribute to decolonisation and environmental and spatial justice and build on the well-documented links between ecological and human wellbeing. In Aotearoa New Zealand, past and ongoing injustices resulting from colonisation have disconnected Māori (the Indigenous people) from their land. Māori see themselves reflected in the landscape and te taiao (the natural world). The process of colonisation has mostly erased natural heritage, intrinsic to Māori identity, from urban areas. Many plants in urban areas represent colonial identity rather than

this natural heritage, and many of the native plants that have been planted originate from other parts of the country. Through reviewing the literature, this article argues for research that determines the benefits of urban planting design prioritising plants that naturally occurred in the past, termed here 'plants of place', in public places. In settler colonial countries, where it is an accepted practice to acknowledge built and predominantly colonial heritage, making pre-colonial natural heritage visible can have many co-benefits. It has the potential to contribute to climate change mitigation and adaptation, decolonisation efforts, spatial justice and environmental justice. Celebrating natural heritage and planting 'plants of place' can contribute in some part to righting past injustices and preparing for a changing future.

**Keywords:** Aotearoa New Zealand; Indigenous; Treaty of Waitangi – Te Tiriti o Waitangi; urban design; landscape architecture; plants; decolonisation; climate justice; environmental justice; place identity

## Introduction

The 2022 Intergovernmental Panel on Climate Change (IPCC) concluded that climate change is unavoidable and planning for just adaptation and mitigation is vital.<sup>1</sup> The ongoing and future impacts of climate change have led to calls for urgent action in cities. Of the many solutions available, expanding the space allocated to urban vegetation offers an opportunity to contribute not only to ecological climate objectives, but also to positive outcomes relating to human wellbeing.<sup>2</sup> In settler colonial countries such as Aotearoa New Zealand (hereafter Aotearoa), these positive outcomes expand to include addressing the sociocultural impacts of colonisation as well as encouraging environmental and spatial justice, especially if urban greening initiatives centre on endemic and/or native species.

Mason Durie, a prominent Māori academic, sees the fundamental feature of indigeneity as 'a long-standing bond with the land and the natural environment'.<sup>3</sup> In te ao Māori (the Māori world), 'land is not merely a resource, but a fundamental and intrinsic aspect of one's being'.<sup>4</sup> This is lived out in many ways, including through te reo Māori (Māori language).<sup>5</sup> Māori call themselves tangata whenua (people of the land). The word for land and placenta is the same: whenua. Natural heritage being part of Māori identity is expressed in pepeha (formal personal introductions), which link 'land and people into a whole in such a way as to make them inseparable'.<sup>6</sup> Pepeha include elements of the landscape, such as mountains, rivers and forests, that the individual connects to and has a genealogical connection to, and these are privileged over a person's name.<sup>7</sup>

Past and ongoing injustices have disconnected many Māori from their tūrangawaewae (homelands). Eighty-five per cent of Māori live in urban areas.<sup>8</sup> Natural heritage has mostly been erased from urban areas through the process of colonisation.<sup>9</sup> Many plants growing in the urban public realm in Aotearoa are non-native or exotic, and therefore continue to represent colonial heritage rather than pre-colonial flora. While restoration planting focuses on plants that naturally occurred in the past, in urban areas other factors, such as the colonial legacy and the desire for deciduous trees that lose their leaves in winter to let light into buildings, dominate. This is the case in the central business district (CBD) of Wellington (hereafter, Te Whanganui-a-Tara, the te reo Māori name) (Figure 1). Very few native trees and shrubs in Aotearoa are deciduous. Additionally, many native plants purposefully planted in urban areas are from other parts of the country and did not naturally occur where they grow now. The natural heritage of a place, of which plants are a part, is a taonga (treasure) whose mana (prestige) is not a part of urban areas. Making these taonga more visible moves city design towards just outcomes for Māori.

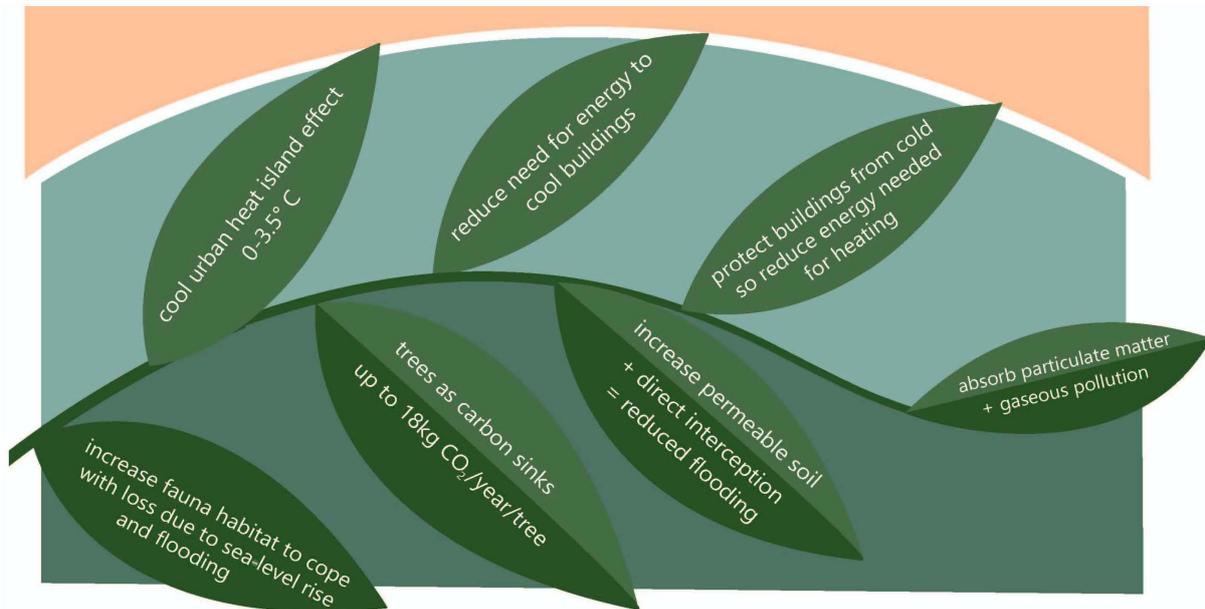
**Figure 1. An *Ulmus procera*, English elm, in the centre of the image, with other exotic deciduous street trees, Te Whanganui-a-Tara**



Urban justice for Indigenous Peoples is intimately connected with climate justice and approaches that adapt and mitigate the impacts of climate change. In Aotearoa, as in other countries, climate change will bring increases in temperatures and in the magnitude and frequency of extreme weather events.<sup>10</sup> Excessive urbanisation will increase the urban heat island effect (where an urban area is warmer than the surrounding area due to high concentrations of concrete and asphalt), which is further exacerbated by climate change.<sup>11</sup> As most cities in Aotearoa are coastal, they will be subject to rising sea levels. Climate change will contribute to habitat degradation and decreases in the distribution of native species not adapted to heat and drought.<sup>12</sup> Furthermore, it will impact biodiversity, with invasive weeds and pests increasing due to less frost-prone winters.<sup>13</sup>

Urban vegetation can contribute to both climate change adaptation and mitigation.<sup>14</sup> Increasing vegetation achieves this in a number of interconnected ways (Figure 2). Urban vegetation can reduce the urban heat island effect, cooling streets and façades by up to a 3.5 °C temperature drop through shading, and the need to use energy to cool buildings.<sup>15</sup> Vegetation typically increases permeable soil surface, direct interception and water infiltration, slowing stormwater flows, reducing flooding and filtering, altering or removing pollutants and particulate matter.<sup>16</sup> Plants sequester and store carbon, with a single tree storing up to 18 kilograms of CO<sub>2</sub>/year.<sup>17</sup> Trees used as windbreaks protect buildings from cold winds, reducing energy consumption for heating.<sup>18</sup>

Responding justly to ongoing climate change and the related need to decolonise in settler colonial countries requires place-specific responses. Planting design in urban public spaces should celebrate the specific natural heritage of the place. The planting of 'plants of place' (plants that were naturally occurring in the past) can contribute to righting injustices of the past.

**Figure 2. How plants can contribute to climate change mitigation and adaptation**

## Colonisation of Aotearoa

Colonisation in Aotearoa began in the sixteenth century: ‘With the arrival of the Dutch explorer Abel Tasman in 1642, and subsequently the British explorer James Cook in 1769, the European world made its entry into tribal New Zealand.’<sup>19</sup> Cook’s landfall led to the country being colonised by Britain.<sup>20</sup> By 1840, Māori decided the British had to take responsibility for lawless British immigrants.<sup>21</sup> The British government considered ‘that annexing the country could protect Māori, regulate British subjects and secure commercial interests’.<sup>22</sup> The Treaty of Waitangi, Te Tiriti o Waitangi, was signed in 1840: ‘New Zealand’s founding document was meant to be a partnership between Māori and the British Crown.’<sup>23</sup> However, there are marked differences in meaning in the two versions (one is the English-language version and one is in te reo Māori). Beausoleil, a political theorist, states that the English version ‘claims rangatira [leaders] ceded their authority to the Crown’,<sup>24</sup> but the te reo Māori version ‘was signed by all but 39 of 540 Māori rangatira, and is given precedence by international law (*contra preferentem*) . . . [and] says something altogether different’.<sup>25</sup> (‘The *contra proferentem* rule [is] that in the event of ambiguity such a provision should be construed against the party which drafted or proposed that provision (in this case the Crown) applies.’)<sup>26</sup> Tapsell writes, ‘we never ever knowingly agreed to ceding our rights of sovereignty over our tangata [people], our whenua [land], our taonga [treasures].’<sup>27</sup> For many years, the understanding of the document by government and Pākehā (New Zealanders of European descent) focused on the English version, called ‘The Treaty’ but recently there has been a shift in focus to ‘Te Tiriti’, the te reo Māori version.<sup>28</sup>

Early Pākehā colonial settlers were hungry for land and Māori chiefs would often allow Pākehā to settle on land in exchange for goods.<sup>29</sup> Māori saw this as a transfer of temporary rights rather than granting Pākehā ownership.<sup>30</sup> This situation, the signing of Te Tiriti and the breaches that followed, plus a multitude of unjust laws, led to a significant loss of land and resources for Māori and disconnection from their whenua (land).<sup>31</sup> The breaches were many and widespread, and include the government ignoring protections Te Tiriti promised Māori and land being taken by the government for public works.<sup>32</sup> In addition, the Native Land Court ‘enabled the conversion of traditional communal landholdings into individual titles, making it much easier for Pākehā to purchase Māori land’.<sup>33</sup> Hēnare states, ‘Māori are tangata whenua, the people of the land, and the people who are the land, of Aotearoa.’<sup>34</sup> However, many Māori today are people without land. The removal, by force or otherwise, of Māori from their

homelands has caused severe negative impacts and ongoing disconnection from identity and culture as well as whenua.<sup>35</sup>

## Impacts of colonisation on flora

In addition to having severe negative impacts on Māori, colonisation had a devastating impact on both flora and fauna in Aotearoa. Plants and animals in Aotearoa evolved for millions of years without predators and so they were vulnerable when people and other predators arrived.<sup>36</sup> The first people, whose descendants are Māori, arrived from East Polynesia in the late thirteenth century.<sup>37</sup> They cleared forest to grow food and there was a change to flora and fauna.<sup>38</sup> The impact of Pākehā, however, was catastrophic. While Māori came to see themselves as kaitiaki (guardians) of the environment with land held communally, Pākehā saw the environment as there to be exploited, and land as there to be divided and owned individually.<sup>39</sup> Between 1860 and 1910, 'New Zealand underwent possibly the most rapid landscape transformation of any nation.'<sup>40</sup> Huge areas of forest were rapidly cut for timber or simply burnt and converted to exotic grass for farming (Figure 3).<sup>41</sup>

**Figure 3. Motuara Island, Tataranui (Queen Charlotte Sound), 1902. The image shows the aftermath of the forest being burned off so the land could be used for sheep farming (Source: Archives New Zealand, licensed under CC BY 2.0)**



The ancestors of Māori brought about a dozen plant species with them to Aotearoa.<sup>42</sup> These plants were from warmer climates so did not become naturalised or invasive, in contrast to those that Europeans brought.<sup>43</sup> There are currently 2,522 Indigenous vascular plants in Aotearoa that have been formally named.<sup>44</sup> (Vascular plants have vessels for the transport of water and nutrients and include flowering plants, conifers and ferns.) Pākehā introduced over 25,000 species and about 10 per cent have naturalised, meaning they reproduce and grow in the wild, with some becoming irrepressible weeds, such as old man's beard, *Clematis vitalba*.<sup>45</sup>

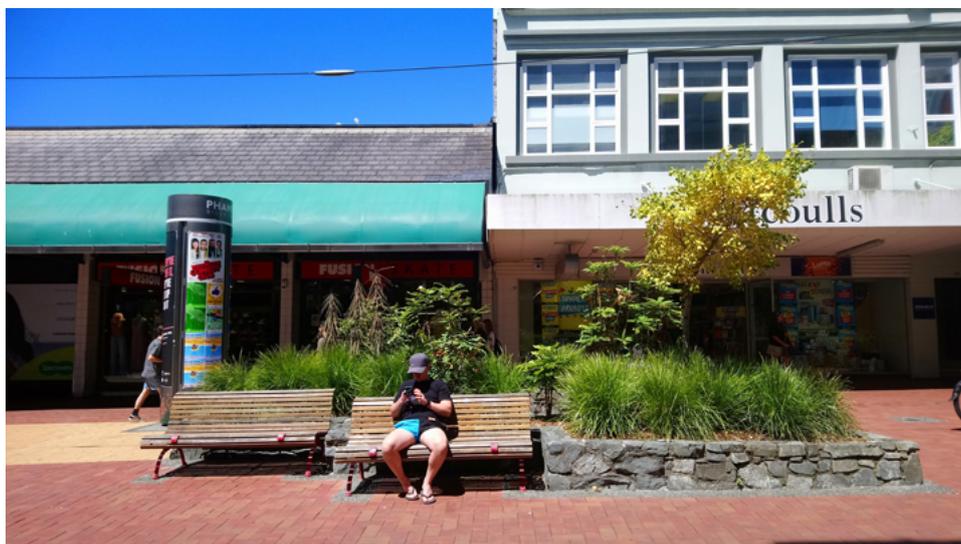
Botanical colonisation was carried out in both urban and rural contexts with native species cleared and replaced by exotic food and timber crops. Non-native pest animals are widely known to threaten native birds in Aotearoa. However, most New Zealanders are unaware how serious a problem plant invasions are, with weeds threatening over half of the critically endangered ecosystems.<sup>46</sup> It is considered that 'if left to their own devices, these weeds will transform our ecosystems beyond recognition'.<sup>47</sup> This will further disconnect tangata from whenua and therefore Māori from their natural heritage and identity and it follows, from a sense of wellbeing.

Another example of botanical colonisation is that many streets in New Zealand's urban areas were lined with trees from the settlers' European homelands. While there have been more native plants planted in the urban realm in recent times, urban planting design in public space in Aotearoa continues to consist mostly of native plants that are not 'plants of place' as well as non-native or exotic plants. For

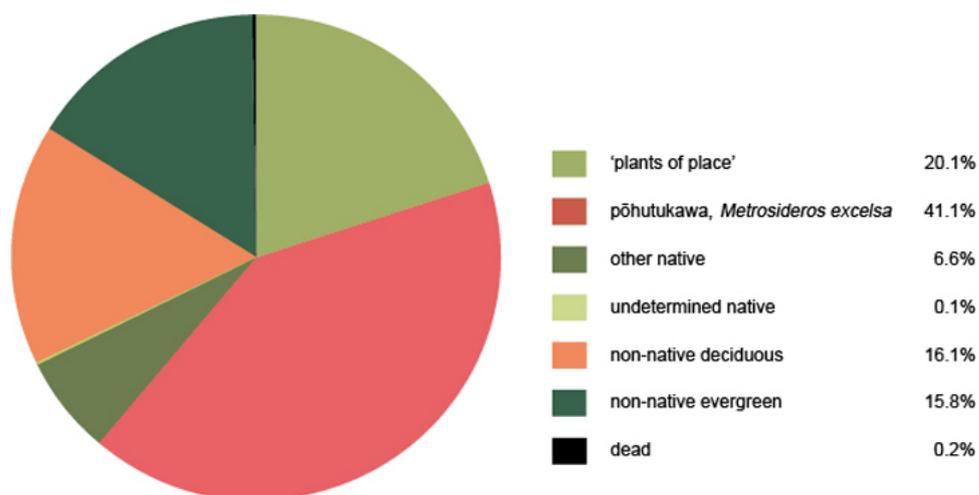
example, in Te Whanganui-a-Tara the Australian *Lomandra* species is becoming ubiquitous due to the ease of its propagation and hardiness (Figure 4).

Analysis of the Wellington City Council GIS Tree Data 2022 shows that only 20 per cent of the city's 13,500 street trees are 'plants of place' (Figure 5). Approximately one-third of the street trees are non-native or exotic. Of the street trees in the CBD and two adjoining inner-city areas, the proportion of exotic species is greater, 43 per cent, with 86 per cent of these being deciduous (Figure 6). Interestingly, in these areas there is a greater proportion of 'plants of place' than in the city as a whole, 26 per cent compared to 20 per cent. The proportion of the trees in the inner city which are pōhutukawa, *Metrosideros excelsa*, native to the northern half of the North Island and not a 'plant of place' is 28 per cent compared to 41 per cent over the whole city.

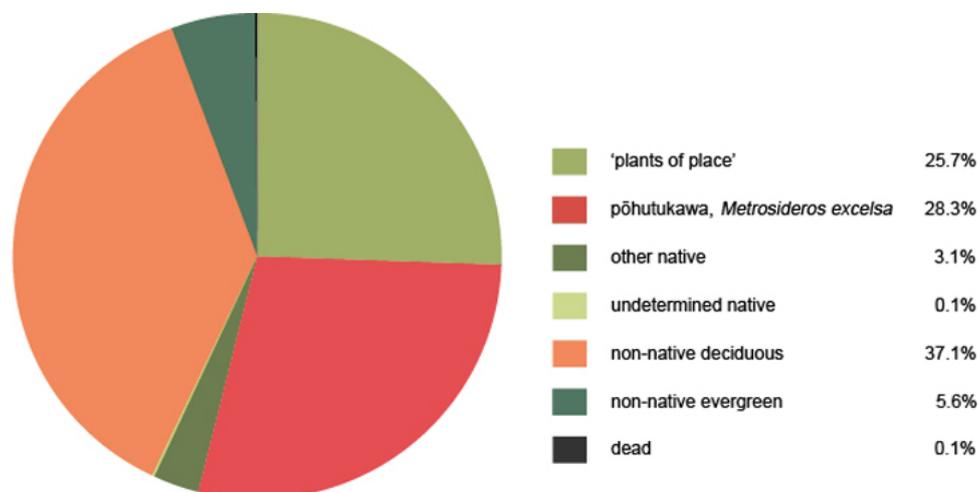
**Figure 4. *Lomandra* species, the Australian grass growing with other exotic plants, Cuba Mall, Te Whanganui-a-Tara**



**Figure 5. Street trees of Te Whanganui-a-Tara, created from Wellington City Council Tree Data 2022**



**Figure 6. Street trees of the Central Business District, Pipitea and Te Aro, Te Whanganui-a-Tara, created from Wellington City Council Tree Data 2022**



## Predicted impacts of climate change on flora

Aotearoa will be subject to different climate change impacts when compared to large land masses due to isolation, the influence of oceanic climates, high rates of endemism and extinction and the threat of invasive species.<sup>48</sup> Macinnis-Ng et al. consider that due to Aotearoa being an island ecosystem, 'interactions between climate change and other threatening processes, such as biological invasions and habitat fragmentation, will drive reductions in biodiversity'.<sup>49</sup> Lundquist et al. expect that native forests will change in distribution and composition due to increased temperature, changes in rainfall and increasing westerly winds.<sup>50</sup> McGlone et al. foresee that the destructive impact of weeds will be exacerbated as plant ranges move southwards and to higher altitudes.<sup>51</sup> An IPCC working group noted that in Aotearoa some plants have already increased in abundance, plant ranges have shifted due to the recession of glaciers and a shorter snow season, and the risk of functional extinction of species adapted to colder temperatures has increased.<sup>52</sup>

In warmer areas, climate change is also influencing native and exotic plant distribution; for example, Hawkes Bay is 'becoming more suitable for the establishment and spread of subtropical species'.<sup>53</sup> Native plant species are also becoming invasive outside their natural range. An example of this is karo, *Pittosporum crassifolium*, native to the northern half of the North Island, which now dominates areas of the south coast of Te Whanganui-a-Tara creating a monoculture that excludes the mosaic of plants native to the area.<sup>54</sup>

The 2022 IPCC report considers that some keystone cultural flora may be impacted by climate change with the obstruction of access to them 'expected to adversely impact customary practice, cultural identity and well-being'.<sup>55</sup> Garibaldi and Turner see the term 'cultural keystone species' as 'a metaphorical parallel with ecological keystone species',<sup>56</sup> and that they are a key feature of a community's identity which is 'reflected in the fundamental roles these species have in diet, materials, medicine, and/or spiritual practices'.<sup>57</sup> More research is needed to determine the cultural impacts of climate change on taonga species and build on work such as Bond et al.'s research on the potential climate change effects on kūmarahou, *Pomaderris kumeraho* and kuta, *Eleocharis sphacelata*, used for medicine and weaving.<sup>58</sup> As part of a just response to colonisation and climate change it is vital to determine the ongoing and potential cultural impacts of the loss of biocultural heritage and what can be done to safeguard and reinstate taonga, treasure, plants and 'plants of place' in urban areas, where most people live. This research seeks to determine the benefits of prioritising these plants in urban areas, hereafter referred to collectively as 'plants of place'.

## Benefits of planting 'plants of place' in the urban realm

The ecological benefits of the restoration of natural heritage, part of which is plants that naturally occurred in the past, are widely accepted. Natural heritage is 'mainly valued for its contribution to ecological, biological and geological processes'.<sup>59</sup> Ecological restoration, largely shaped by Western scientific ideas, does not always consider restoring biocultural relationships to identity.<sup>60</sup> However, in writing about restoring Aotearoa New Zealand's biological heritage by 2050, Norton et al. argue 'that restoration must be as much about people as about the natural environment'.<sup>61</sup> Matunga considers that urban ecological restoration can celebrate Māori histories and reinclude Māori in the urban environment they have been excluded from.<sup>62</sup>

An increase in urban vegetation is likely to be a common response to adapting to climate change because vegetation can contribute to both adaptation and mitigation.<sup>63</sup> This has the potential to have positive cultural benefits for Māori. Alongside the ecological benefits of prioritising plants that were naturally occurring in the past, the literature review that follows confirms the potential cultural benefits of prioritising 'plants of place' and taonga plants that relate to Māori values and aspirations. These have been synthesised below and are expanded upon in the following sections:

1. an opportunity to honour Te Tiriti o Waitangi, the te reo Māori version of the Treaty of Waitangi and protect taonga, treasures
2. a contribution to decolonisation efforts and spatial justice
3. a contribution to environmental and climate justice
4. an expression of cultural heritage as well as natural heritage
5. a support for place identity
6. the restoration of wellbeing through restoring the environment.

## Honouring Te Tiriti o Waitangi

The Waitangi Tribunal asserts that honouring Te Tiriti requires that taonga are protected so they can be passed on from generation to generation.<sup>64</sup> The tribunal 'is a permanent commission of inquiry that makes recommendations on claims brought by Māori relating to Crown actions which breach the promises made in the Treaty of Waitangi' or Te Tiriti o Waitangi.<sup>65</sup> However, as Matunga states, native vegetation is treasured by tangata whenua and has often been replaced by exotic, colonial vegetation with the biota of cities now radically different to pre-colonial times except for rare remnants.<sup>66</sup> This lack of respect for Te Tiriti is shown in the central city of Te Whanganui-a-Tara where most trees in public spaces are not 'plants of place' (Figures 1 and 5, Figures 6–8).

**Figure 7. *Fraxinus excelsior* 'Aurea', golden ash, from Europe and *Magnolia grandiflora*, southern magnolia, native to the south-eastern USA, in central Te Whanganui-a-Tara**



**Figure 8. These trees in Te Whanganui-a-Tara are a cultivar of pōhutukawa, *Metrosideros excelsa*, native to areas more than 250 km to the north**



Street trees not only have multiple benefits in cities, adapting to climate change and increasing biodiversity as discussed, but also provide a connection to nature. Beatley and Newman consider that the concept of biophilia is based on the understanding that humans have an innate need to connect to nature.<sup>67</sup> For Beatley and Newman, and Pedersen Zari, biophilic design stresses the importance of designing to emphasise and leverage human–nature relationships in the built environment to increase wellbeing.<sup>68</sup> While this global concept could be seen to align with Māori values, for justice in Aotearoa honouring Te Tiriti must guide all of our actions, including designing urban landscapes, and designers must be guided by concepts rooted in Aotearoa. In 2006, Māori involved in areas such as architecture, landscape architecture, planning, local and central government and iwi (tribal) development, met to discuss and formulate a draft National Māori Cultural Landscape Strategy.<sup>69</sup> The resulting strategy, Te Aranga Māori Design Principles, was named after Te Aranga Marae where the hui (gathering) took place.<sup>70</sup> The principles form a cultural landscape approach to design which incorporates a series of Māori cultural values and principles.<sup>71</sup> A member of the Nisga'a and Kwakwak'awak Nations in Canada, Gosnell-Myers considers that the principles 'set the standard for what Indigenous design in the built form should strive to understand and reflect locally.'<sup>72</sup> The principles are about connection with all of te ao Māori, past, present and future, as well as connections to te taiao that biophilic design theory espouses.<sup>73</sup> The principle of Taiao asserts that the natural environment is protected, restored or enhanced and that local flora and fauna significant to mana whenua (people Indigenous to a specific place in Aotearoa) be key elements in the design of urban areas.<sup>74</sup> This prioritising of 'plants of place' honours Te Tiriti.

## Contributing to decolonisation efforts and spatial justice

Prioritising 'plants of place' acknowledges the importance of a place's context. Kiddle considers that 'to design without a deep appreciation of the context and particularities of that place supports . . . ongoing colonisation of these very spaces'.<sup>75</sup> Decolonisation has come to mean more than simply the colonisers leaving. Mercier writes that in Aotearoa and many other settler countries, decolonising instead means 'a fundamental shift in the ideas, knowledges and value sets that underpin the systems which shape our country', restoring power to the colonised and affirming 'a non-colonial identity'.<sup>76</sup> For Soja, the decolonising of urban public space is a form of spatial justice that 'involves the fair and equitable distribution in space of socially valued resources and the opportunities to use them'.<sup>77</sup>

Despite a very high proportion of Māori living in urban areas, Matunga states that cities reinforce a colonial past and negate pre-colonial origins (Figure 9).<sup>78</sup> Kiddle concurs, asserting that colonial norms privilege built heritage and that natural heritage relating to Māori identity is usually erased or hidden.<sup>79</sup> Therefore, ongoing colonisation and spatial injustice are physically manifest in the public realm.

**Figure 9. Queen Victoria statue, Cambridge Terrace, Te Whanganui-a-Tara**

Matunga states that a critical issue for Māori in cities has been finding a place to be at home, in a place originally their home, but now appearing to be foreign territory.<sup>80</sup> Thompson-Fawcett and Riddle believe that for Māori, 'being able to recognise your identity in the city is critical'.<sup>81</sup> The inextricable links of Māori to whenua mean that enabling connection to 'plants of place' may enable mana whenua to see their particular identity in urban areas. The native vegetation of Aotearoa varies greatly due to the nature of its geography: 'The three main islands stretch 1,500 km between latitudes 34° and 47° south.'<sup>82</sup> Ecosystems range from warm temperate forest in the north to alpine in the mountainous areas located mainly in the South Island.<sup>83</sup> Each iwi (tribe) has a rohe (territory) so that the 'plants of place' of Ngā Puhī, whose rohe is close to the top of the North Island differ greatly from the 'plants of place' of Ngāi Tahu, whose rohe covers most of the South Island.

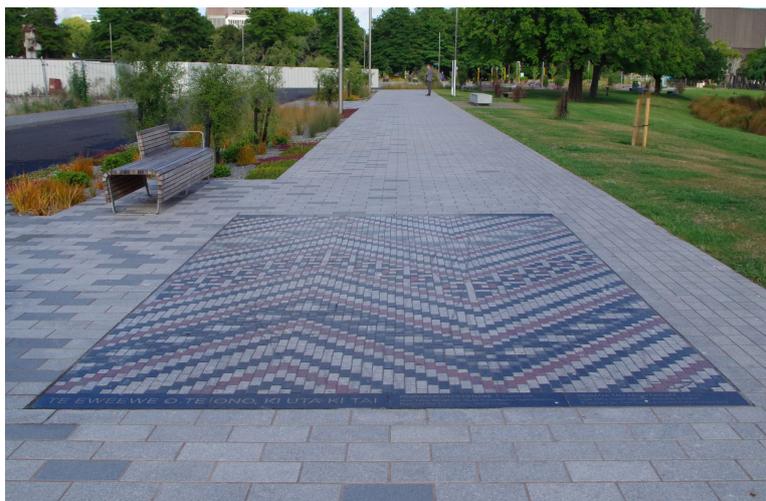
As discussed, some native vegetation other than these 'plants of place' may also contribute to decolonisation efforts and spatial justice. Plants that are cultural keystone species are taonga and although possibly not 'plants of place', they may also enable mana whenua to recognise their identity in their city. An example of the re-insertion of a cultural keystone species is the Anthropocene Grove, designed by Wraight + Associates, in Te Whanganui-a-Tara. The grove is a grid of karaka, *Corynocarpus laevigatus*, situated on the waterfront close to Te Raukura, the Wharewaka (canoe house) (Figure 10). While these trees were not naturally occurring in the past in that place, their presence represents past plantings of karaka as a food source around kāinga (settlements) and pā (fortified settlements), therefore karaka is a cultural keystone species. Reintroducing and prioritising cultural keystone species as well as 'plants of place' in public spaces, may be a way to reassert and celebrate the identity of the people of place, of mana whenua.

The Canterbury earthquakes in Aotearoa in 2010 and 2011 damaged large parts of the city of Ōtautahi, Christchurch. While tragic in terms of loss of life, this created room to reimagine Christchurch as a city in Aotearoa, not as an outpost of Great Britain, with a multitude of references to the settlers' 'home', such as avenues of European trees. Raerino et al. see that the rebuild 'has entailed a "cultural recovery" that is reliant on a working partnership with Ngāi Tūāhuriri', the local iwi.<sup>84</sup> Thompson-Fawcett et al. write that some of the positive outcomes for mana whenua include, 'reinstating native fauna and flora valued by local Māori [and] ... introducing a locally specific Māori symbolism and design ethic'.<sup>85</sup> Thompson-Fawcett et al. illustrate this with the example of Ngā Whāriki Manaaki (Woven Mats of Welcome), in which weaving designs have been adapted for a sequence of paving patterns (Figure 11).<sup>86</sup> The new planting alongside Ngā Whāriki Manaaki could have further contributed to Māori identity and decolonisation by being 'plants of place' rather than predominantly exotic.

**Figure 10. The Anthropocene Grove, Te Whanganui-a-Tara, designed by Wraight + Associates**



**Figure 11. Ngā Whāriki Manaaki, Woven Mats of Welcome, Reihana Parata and Morehu Flutey-Henare; part of Ōtākaro Avon Arts Trail designed by LandLAB, Ōtautahi, Christchurch**



McGregor et al. write that climate change is seen by some Indigenous scholars as an “intensification of colonialism”, and thus decolonisation is required if any viable and sustainable path forward is to be envisioned<sup>.87</sup> Gosnell-Myers states that in responding to climate change, ‘if Indigenous knowledge isn’t reflected in those plans, I fear we will reinforce colonisation through new forms of erasure of Indigenous People’s roles as stewards and key knowledge holders of these lands and waters’.<sup>88</sup> Barnett considers decolonisation and the climate emergency to be the central issues for landscape architects, who design much public space, with connections between the two becoming clearer all the time.<sup>89</sup> Mercier states, ‘Public spaces are important sites for decolonising acts’.<sup>90</sup> To contribute to decolonisation efforts and spatial justice, public space planting design needs to reaffirm pre-colonial identity and prioritise ‘plants of place’.

## Contributing to environmental and climate justice

Environmental injustice is manifest in the cities of Aotearoa. Harmsworth identifies the loss of and damage to Indigenous ecosystems, habitats and taonga species as a key issue of concern for Māori in the

urban realm.<sup>91</sup> He writes that, 'From a Māori values perspective urban ecosystems seem very much out of balance and require new approaches to design and development that link the urban physical, social, and cultural environment intimately to human wellbeing, values, and human existence.'<sup>92</sup> To enhance Māori values, and in turn contribute to environmental justice, Harmsworth proposes measures including 'promotion of the planting of indigenous flora, and increase [of] native faunal habitats within urban areas', as well as introducing native vegetation to culturally significant areas.<sup>93</sup>

The impacts of climate change will not be distributed equally. Indigenous Peoples' wellbeing is threatened the most and they are the most likely to suffer climate injustice; for example, Jones et al. consider that as Māori have significantly higher rates of major diseases and poorer access to health care, their vulnerability to the health effects of climate change will increase.<sup>94</sup>

A just response to climate change concerns and to the need to decolonise requires place-specific and people-of-place specific responses, that is, responses specific to *mana whenua*. As well as being detrimental to biodiversity, a lack of prioritisation of 'plants of place' in urban areas when adapting to climate change is likely to contribute to environmental and climate injustice. However, Mata et al. show that when choosing plants for climate change mitigation and adaptation, their indigeneity is often not a factor.<sup>95</sup> Leuzinger, Vogt and Körner found that of 10 trees tested, a North American deciduous tree with the smallest leaves was found to remain relatively cooler at high temperatures, potentially meaning that trees with these characteristics could be most effective for countering the urban heat island effect.<sup>96</sup> There is some research being undertaken in Aotearoa to determine how native plants can help with climate change mitigation and adaptation, such as which native wetland plants best sequester carbon. More research is needed in Aotearoa. For example, work must be done to determine which native trees are best for climate change mitigation and adaptation and could be planted more in urban areas to contribute to environmental and spatial justice.

## An expression of cultural heritage as well as natural heritage

In the past, natural heritage was 'mainly valued for its contribution to ecological, biological and geological processes' with the value for people overlooked.<sup>97</sup> Mallarach and Verschuuren state that recently there has been a shift from the European notion that natural and cultural heritage are separate and divided towards Indigenous thinking, where natural and cultural heritage are inextricably linked.<sup>98</sup> Prioritising 'plants of place' in urban areas may be an expression of a holistic, biocultural approach to heritage. Yletyinen et al. write that, 'Specific ecosystem elements (e.g. culturally significant species or particular types of forest) are commonly associated with cultural identity, connection to place, stories, language, knowledge and practices, and provide environmental and communal experiences shared across generations.'<sup>99</sup> Hikuroa states that in *te ao Māori* humans exist in a kinship-based relationship with *te taiao*; cultural and natural heritage are inseparable.<sup>100</sup> Matunga considers that, 'Precolonial and colonial Maori histories in the city need to be celebrated, commemorated and interpreted.'<sup>101</sup> For this to happen, Māori place names need to be reinstated, special natural landscapes, sites, events and ancestors identified, ecological surveys undertaken and native plants and ecosystems reintroduced.<sup>102</sup>

Recently, there has been a revitalisation of many traditional Māori practices such as *rongoā rākau* (plant-based medicinal remedies) and *raranga* (Māori weaving). The availability of plant material in urban areas for these practices could further strengthen connections to *whenua* and cultural practice, both of which connect to celebrating identity and therefore reinforce wellbeing. One of the 2025 goals in *Te Mana o te Taiao – Aotearoa New Zealand Biodiversity Strategy*, is that planting Indigenous vegetation be standard practice in urban areas.<sup>103</sup> We suggest taking this a step further and aiming for a focus on Indigenous 'plants of place' embracing biocultural heritage (Figure 12). The notion of 'plants of place' is in line with the notion of 'past presencing', which Macdonald defines as 'the empirical phenomenon of how people variously experience, understand and produce the past in the present'.<sup>104</sup> The Anthropocene Grove is an example of that which Goldsmith sees 'can be read as 'past-presented' representations' (Figure 10).<sup>105</sup> Waitangi Park is another example, with new plantings of native plants that would have naturally grown in the area in the past (Figure 13).<sup>106</sup>

**Figure 12. Rātā, *Metrosideros robusta*, a 'plant of place', which the buildings were designed around, central Te Whanganui-a-Tara**



**Figure 13. Waitangi Park, designed by Wraight Athfield Landscape + Architecture, Te Whanganui-a-Tara**



Kermath considers that if natural heritage is not intricately woven into cultural fabric, passing on this legacy is likely to fail.<sup>107</sup> This would be unjust. To embrace biocultural heritage and for mana whenua identity to be intrinsic to urban areas, place-specific natural heritage including 'plants of place' must be woven into urban and cultural fabric. How this is specifically achieved should be up to mana whenua, because in Te Tiriti, 'Māori were guaranteed "te tino rangatiratanga" or the unqualified exercise of their chieftainship over their lands, villages, and all their property and treasures'.<sup>108</sup>

## Place identity

'Plants of place' will contribute to place identity. Meurk and Swaffield write that during the first century or so of Pākehā settlement, colonial values, the phenomenal growth rates of exotic plants, 'nostalgia for "home"', and a sense of horticultural aesthetics derived from Europe' influenced urban planting.<sup>109</sup>

White, Professor of Environmental Planning at the University of Waikato, who grew up in England, 'is struck by how similar our urban green spaces are to those in England . . . and how many New Zealand cities lack native vegetation and are Victorian ideals of beauty and amenity'.<sup>110</sup>

The Waitangi Tribunal stated in the Wai 262 claim that the unique flora and fauna of Aotearoa 'deserve protection as an element of national identity'.<sup>111</sup> Syrbe et al. have shown that green elements characteristic of a place tend to be valued by those who inhabit it.<sup>112</sup> Beatley and Newman consider that plants can help make a place distinctive, nurturing place identity or a sense of place for all, not just Māori, such as the pōhutukawa fringing Tāmaki Drive in Tāmaki Makaurau Auckland.<sup>113</sup> Sadly, not all plants that have become part of a place's identity are 'plants of place'; for example, the much-photographed line of *Araucaria heterophylla*, Norfolk Island pine, that fringe Oriental Bay in Te Whanganui-a-Tara are not native.

Meurk and Swaffield, citing Rossi, write that cities are 'complex systems of symbols. They physically represent the values embodied within urban society and culture, both past and present and these messages are "read" by the inhabitants and by visitors'.<sup>114</sup> As previously stated, 40 per cent of the street trees in Te Whanganui-a-Tara are pōhutukawa, not native to place, and nearly a third are exotic. Currently, in the CBD of Te Whanganui-a-Tara cars and roads tend to dominate. In winter, most trees within the area are leafless and grey, blending with the concrete and asphalt, as they are deciduous. The valuing of our relationship with our local natural heritage, our local biodiversity, should be seen throughout our urban areas, in our street trees, our pocket parks and our large civic spaces, not just on the fringes or in fenced sanctuaries, such as Zealandia Te Māra a Tāne.

Meurk and Swaffield write that in cities in Aotearoa, city councils own and administer public space and the decisions they make 'about the design and management of these areas are central to the evolution of public values concerning indigenous biodiversity'.<sup>115</sup> A long-term Wellington City Council (WCC) plan set out in 1995 to remove exotic conifers from the Town Belt, the swathe of green space that surrounds the inner-city suburbs and CBD and replace them with natives.<sup>116</sup> While this is desirable, more could be done so that trees in the CBD are also 'plants of place'. WCC recently installed non-native Chinese elm, *Ulmus parvifolia*, as street trees in the inner-city Te Niho Park and in late 2022, exotic alders were planted in nearby Cuba Street. Meurk and Swaffield state that street trees need to cope with stressful conditions, that they must have particular qualities and that many of our native trees are from forest ecosystems and so do not do well planted as individuals.<sup>117</sup> While this limits the choice of possible natives, Meurk and Swaffield suggest a range of Indigenous plants as street trees for cities in Aotearoa that includes 'plants of place' of Te Whanganui-a-Tara.<sup>118</sup> How trees are planted could improve native street tree health. Planting trees with larger root plates and in groups with root-shading low plants could improve their ability to cope with stress.

In 2017, Meurk and Swaffield proposed an urban biodiversity strategy for Aotearoa which would build place identity. The strategy has a three-layered approach: 'strategic interventions to create a resilient deep landscape structure'; 'targeted public design interventions to enhance the indigenous legibility of focal public spaces'; and 'planning policies and educational programmes to cultivate the residential/industrial matrix'.<sup>119</sup> They explain that the strategy must operate at all levels from home gardens and public spaces to long-term strategic commitments to be successful.<sup>120</sup> Council-wide strategies to increase urban biodiversity and 'plants of place' must be actioned at all levels and scales so that our public spaces physically represent the value of local biodiversity and 'plants of place'.

Rastendeh et al. state that biodiversity loss occurs due to urban growth and the increasing demand for land for housing in Aotearoa; invasion of exotic species and further biodiversity loss could be triggered by rising temperatures.<sup>121</sup> Andreucci et al. assert that sense of place may be encouraged by our daily lives being linked to biodiversity.<sup>122</sup> We assert that 'biodiversity of place', that which naturally occurred in the past, will create a stronger sense of place. Shanahan, the chief executive of Zealandia Te Māra a Tāne in Te Whanganui-a-Tara, states 'cities tend to fall victim to "biotic homogenisation", the process by which two or more spatially separate ecological communities become increasingly similar over time'.<sup>123</sup> If cities lose biodiversity, they lose not just ecosystem health, but also place identity. By welcoming back 'plants of place' to our cities we can welcome back biodiversity of place and grow place identity.

## Restoring nature, restoring wellbeing

Planting 'plants of place' in cities, though not of course to the scale or extent of pre-development ecosystems, is likely to restore wellbeing. The restoration of physical, psychological and cultural wellbeing can occur through elevating the importance and interconnectedness of living ecosystems, social wellbeing and health or socio-ecological systems. The links between urban vegetation, urban green space and human wellbeing are well documented.<sup>124</sup> Santamouris et al. state that the benefits of urban green space include improved physical health and recovery, higher self-esteem and decreased anxiety.<sup>125</sup> Lehmann asserts that urban green space can reduce stress and mental illness.<sup>126</sup> It can also provide physical and mental health benefits through exercise and stronger immune systems.<sup>127</sup> Urban green space can lead to the creation of social bonds with others who share the same space.<sup>128</sup>

Urban living tends to reduce people's exposure to nature. Because most Māori live in urban areas, they are at risk of having a diminished connection to whenua and te taiao. Hikuroa states that 'rekindling the relationship with whenua is the first step in achieving better health and wellbeing, improved ecological and environmental outcomes and contributing to climate change mitigation'.<sup>129</sup>

Cumpston, an Indigenous Barkandji researcher, in her booklet on the plants of the Kulin nation of south-central Victoria, Australia, says of growing Indigenous plants: 'They tell stories about the cultural belonging of Indigenous Peoples and allow a portal into the rich cultural and ecological knowledges'; they 'illuminate the specific identity and history of landscapes'; and they assert the place of the Aboriginal people in the present.<sup>130</sup> Growing these plants can also improve wellbeing and has 'healing potential for Aboriginal community members'.<sup>131</sup> Raerino et al. consider that there are 'wellbeing benefits of recognising and promoting the Indigenous cultural identity of neighbourhoods as a contributing factor to more equitable and healthier communities'.<sup>132</sup> 'Plants of place' may help reconnect tangata with whenua and therefore increase wellbeing.

## Co-benefits of a whole systems approach

There is synergy between te ao Māori and a whole systems or socio-ecological approach. Te ao Māori acknowledges the interconnectedness and interrelationship of all living and non-living things.<sup>133</sup> Arnold and Wade state that a whole systems approach also sees the world in a holistic way, looking at the relationships and interactions between parts and seeking integrative solutions.<sup>134</sup> McGaw advocates that those who design built environments consider them as 'places that are at once social, political, economic and environmental'.<sup>135</sup>

Imminent climate change is a threat that should be considered holistically. In Aotearoa, a whole systems approach using 'plants of place' for climate change adaptation and mitigation can have multiple benefits, as discussed. The choice of plants for our cities should be governed by more than just aesthetic, economic, logistical or practical issues. It should embrace links between 'plants of place' and climate change mitigation and adaptation, to maximise socio-ecological co-benefits in a just and whole systems approach.

## Conclusion

Increased urban vegetation will be part of climate change mitigation and adaptation. Establishing the importance in planting design of going beyond prioritising 'all of country' native plants to focusing on 'plants of place', as well as cultural keystone species, is a significant shift in approach that will have important implications for current practice. The increase in vegetation could have a multitude of other beneficial impacts. Prioritising 'plants of place' is likely to contribute to a just response to climate change and to honouring Te Tiriti o Waitangi. It is likely to connect both Māori and Pākehā and Tauiwi, non-Pākehā residents in Aotearoa to pre-colonial natural heritage in urban realms. It has the potential to increase how much non-Indigenous landscape architects and planting designers contribute to decolonisation efforts. It may encourage the cultural benefits of 'plants of place' to be part of a holistic, whole systems or socio-ecological approach to climate change and grow the perceived value and knowledge of the benefits of 'plants of place'. Further research will be undertaken with mana whenua of Te Whanganui-a-Tara to understand what they see as the benefits of celebrating natural heritage through planting 'plants of place' in urban areas.

Prioritising 'plants of place' in urban public space has the potential to enable all people living in that place to grow deeper connections to the whenua, to contribute to righting past injustice and increasing resilience in both physical and social ways. Establishing the impacts and benefits of honouring 'plants of place' will contribute to a commitment to celebrating natural heritage in urban areas, so that 'first nature' will become second nature.

## Notes

<sup>1</sup>IPCC, *Climate Change 2022*.

<sup>2</sup>McDonald and Beatley, *Biophilic Cities*.

<sup>3</sup>Durie, 'Race and ethnicity', 2.

<sup>4</sup>Puketapu-Dentice et al., 'Towards integrating Indigenous culture', 10.

<sup>5</sup>In Aotearoa New Zealand the use of words and phrases in te reo Māori, the Māori language, in both everyday conversation and academic writing in English, is commonplace. It is now not standard practice for te reo words to be italicised in printed text and often a translation is not given as the meaning is widely known. As this article is for readers beyond Aotearoa, a translation of te reo Māori words and phrases follows them to aid understanding. Regarding macrons, if the original source does not use macrons they have not been used in the quoted text.

<sup>6</sup>Murton, 'Being in the place world', 96.

<sup>7</sup>Hikuroa, 'Pūniu river care'; Kiddle, 'Indigenous ecological design'.

<sup>8</sup>Ryks, Pearson and Waa, 'Mapping urban Māori', 28.

<sup>9</sup>Kiddle, 'Whose heritage?'.

<sup>10</sup>McGlone et al., *Climate Change*, 83; Ministry for the Environment & Stats NZ, *New Zealand's Environmental Reporting Series*.

<sup>11</sup>Ferrini et al., 'Role of vegetation', 10.

<sup>12</sup>Schröter et al., 'Ecosystem service supply'; Knapp et al., 'Changes in the functional composition'; EEA, *Climate Change* as cited in Kabisch et al., 'Nature-based solutions', 1.

<sup>13</sup>McGlone et al., *Climate Change*, 83–4.

<sup>14</sup>Mathey et al., 'Urban green spaces', 480.

<sup>15</sup>Santamouris et al., 'Progress in urban greenery mitigation', 648.

<sup>16</sup>Xiao and McPherson, 'Surface water storage', as cited in Ferrini et al., 'Role of vegetation', 9; Ferrini et al., 'Role of vegetation', 1.

<sup>17</sup>Farrugia, Hudson and McCulloch, 'An evaluation of flood control' as cited in Ferrini et al., 'Role of vegetation', 1–2.

<sup>18</sup>Ferrini et al., 'Role of vegetation', 12.

<sup>19</sup>'Māori – The arrival of Europeans'.

<sup>20</sup>'History – Europeans to 1840'.

<sup>21</sup>Mutu, "'To honour the treaty'", 6, 7.

<sup>22</sup>'The Treaty in brief', Ministry for Culture and Heritage.

<sup>23</sup>'Treaty of Waitangi', Te Ara – the Encyclopedia of New Zealand.

<sup>24</sup>Beausoleil, 'A more just'.

<sup>25</sup>Beausoleil, 'A more just'.

<sup>26</sup>'Meaning of the Treaty', New Zealand Government.

<sup>27</sup>Tapsell, *Kāinga People*, 33.

<sup>28</sup>Huygens, 'Developing a decolonisation practice', 57.

<sup>29</sup>'Land ownership – Māori and land ownership'.

<sup>30</sup>'Land ownership – Māori and land ownership'.

<sup>31</sup>Take, 'Spatial justice', 125.

<sup>32</sup>'Treaty of Waitangi'.

<sup>33</sup>'Native Land Court created'.

<sup>34</sup>Hēnare, 'In search of harmony', 126.

<sup>35</sup>Moewaka Barnes and McCreanor, 'Colonisation', 19; Take, 'Spatial justice', 125.

<sup>36</sup>'Human effects on the environment'.

<sup>37</sup>'History – Māori arrival and settlement'.

<sup>38</sup>Waitangi Tribunal – Te Rōpū Whakamana i te Tiriti O Waitangi, 238.

- <sup>39</sup>Waitangi Tribunal – Te Rōpū Whakamana i te Tiriti O Waitangi, 239.
- <sup>40</sup>Molloy, *Soils in the New Zealand Landscape*, 226, cited in Waitangi Tribunal – Te Rōpū Whakamana i te Tiriti O Waitangi, 239, 241.
- <sup>41</sup>Came et al., 'From gorse to ngahere', 105.
- <sup>42</sup>Mitchell, 'The silent invasion'.
- <sup>43</sup>'Human effects on the environment – Early human impact'.
- <sup>44</sup>'FAQs – New Zealand plants'.
- <sup>45</sup>Brandt et al., 'Naturalised plants', 353.
- <sup>46</sup>Wiser et al., 'New Zealand's naturally uncommon ecosystems', cited in Hulme, 'Plant invasions', 1540.
- <sup>47</sup>Parliamentary Commissioner for the Environment, 'Turning back a silent invasion'.
- <sup>48</sup>Whittaker et al., 'Island biogeography', cited in Macinnis-Ng et al., 'Climate-change impacts', 222.
- <sup>49</sup>Macinnis-Ng et al., 'Climate-change impacts', 216.
- <sup>50</sup>Hennessy et al., 'Climate change 2007'; Whitehead et al., 'How will New Zealand's forests', cited in Lundquist et al., 'Predicted impacts of climate change', 184.
- <sup>51</sup>McGlone et al., *Climate Change*.
- <sup>52</sup>Lawrence et al., 'Australasia', 1587.
- <sup>53</sup>Sheppard et al., 'Predicting plant invasions', cited in Stanley and Bassett, 'Environmental weeds', 151.
- <sup>54</sup>T. Mayo, personal communication, conversation, 1 October 2021.
- <sup>55</sup>Royal Society of New Zealand, *Climate Change Implications*; Bond et al., 'Effects of climatically shifting species distributions'; Egan, Woolley and Williams, *Climate Change Vulnerability*; Jones et al., 'Climate change'; Jones et al., 'Climate change', cited in Lawrence et al., 'Australasia', 1631.
- <sup>56</sup>Garibaldi and Turner, 'Cultural keystone species', 1.
- <sup>57</sup>Garibaldi and Turner, 'Cultural keystone species', 4.
- <sup>58</sup>Bond et al., 'Effects of climatically shifting species distributions'.
- <sup>59</sup>Batista et al., 'Assessing vegetation heritage value', 1.
- <sup>60</sup>Black, 'Te Koko ki Ōhiwa', cited in Hall et al., 'Promoting social and environmental justice', 1.
- <sup>61</sup>Norton et al., 'How do we restore', 171
- <sup>62</sup>Matunga, 'Urban ecology'.
- <sup>63</sup>Pedersen Zari et al., 'Regenerative living cities'.
- <sup>64</sup>Waitangi Tribunal, *A Guide to the Principles of the Treaty of Waitangi*.
- <sup>65</sup>'Waitangi Tribunal', Ministry of Justice.
- <sup>66</sup>Matunga, 'Urban ecology', 67.
- <sup>67</sup>Beatley and Newman, 'Biophilic cities are sustainable'.
- <sup>68</sup>Beatley and Newman, 'Biophilic cities are sustainable'; Pedersen Zari, 'Understanding and designing nature'.
- <sup>69</sup>'Te Aranga Principles', Auckland Council.
- <sup>70</sup>Hoskins et al., 'Te Aranga Maori cultural landscapes strategy'.
- <sup>71</sup>Paul, 'Exploring Te Aranga design principles', 2.
- <sup>72</sup>Gosnell-Myers, 'Co-creating the cities', 89.
- <sup>73</sup>Hoskins et al., 'Te Aranga Maori cultural landscapes strategy'.
- <sup>74</sup>'Taiao', Auckland Council.
- <sup>75</sup>Kiddle, 'Indigenous ecological design', 210.
- <sup>76</sup>Mercier, 'What is decolonisation?', 51, 79.
- <sup>77</sup>Soja, 'The city and spatial justice', 2.
- <sup>78</sup>Matunga, 'Urban ecology', 65.
- <sup>79</sup>Kiddle, 'Whose heritage?'.
- <sup>80</sup>Matunga, 'Urban ecology', 67.
- <sup>81</sup>Thompson-Fawcett and Riddle, 'Being ourselves', 664.
- <sup>82</sup>'Natural environment – geography and geology'.
- <sup>83</sup>Singers and Rogers, *A Classification of New Zealand's Terrestrial Ecosystems*.
- <sup>84</sup>Raerino et al., 'Local-Indigenous autonomy', 2.
- <sup>85</sup>Thompson-Fawcett et al., 'Enhancing cultural aspirations', 272.
- <sup>86</sup>Thompson-Fawcett, 'Fluid stories', 1.
- <sup>87</sup>Hoover, *The River Is in Us*; Whyte, 'The Dakota Access Pipeline'; Reo and Ogden, 'Anishnaabe Aki', cited in McGregor et al., 'Indigenous environmental justice and sustainability', 36
- <sup>88</sup>Gosnell-Myers, 'Co-creating the cities', 90.

- <sup>89</sup>Barnett, 'Decoloniality'.
- <sup>90</sup>Mercier, 'What is decolonisation?', 65–6.
- <sup>91</sup>Harmsworth, 'The role of Maori values', 10.
- <sup>92</sup>Harmsworth, 'The role of Maori values', 8.
- <sup>93</sup>Harmsworth, 'The role of Maori values', 12.
- <sup>94</sup>Jones et al., 'Climate change', 54; Whyte, 'Settler colonialism', 139–40.
- <sup>95</sup>Mata et al., 'Bringing nature back into cities', 352.
- <sup>96</sup>Leuzinger, Vogt and Körner, 'Tree surface temperature'.
- <sup>97</sup>Batista et al., 'Assessing vegetation heritage value', 1.
- <sup>98</sup>Mallarach and Verschuuren, *Changing Concepts and Values*, 141.
- <sup>99</sup>Yletyinen et al., 'Potential for cascading impacts', 1110–11.
- <sup>100</sup>Hikuroa, 'Pūniu river care'.
- <sup>101</sup>Matunga, 'Urban ecology', 70.
- <sup>102</sup>Matunga, 'Urban ecology', 70.
- <sup>103</sup>DOC, Te Mana o Te Taiao, 54.
- <sup>104</sup>Macdonald, *Memorylands*, cited in Goldsmith, 'Natural monuments', 28.
- <sup>105</sup>Goldsmith, 'Natural monuments', 109.
- <sup>106</sup>Goldsmith, 'Natural monuments', 109.
- <sup>107</sup>Kermath, 'Why go native?', 212.
- <sup>108</sup>'Differences between the texts', Ministry for Culture and Heritage.
- <sup>109</sup>Meurk and Swaffield, 'Cities as complex landscapes', 11–12.
- <sup>110</sup>Graves, 'Greening our lives', 25.
- <sup>111</sup>Waitangi Tribunal – Te Rōpū Whakamana i te Tiriti O Waitangi, 197.
- <sup>112</sup>Syrbe et al., 'The value of urban nature', 22.
- <sup>113</sup>Beatley and Newman, 'Biophilic cities are sustainable', 3335.
- <sup>114</sup>Rossi, *The Architecture of the City*, cited in Meurk and Swaffield, 'Cities as complex landscapes', 13.
- <sup>115</sup>Meurk and Swaffield, 'Cities as complex landscapes', 13.
- <sup>116</sup>Wellington City Council, *Town Belt Management Plan*, Appendix 6.
- <sup>117</sup>Meurk and Swaffield, 'Cities as complex landscapes', 13.
- <sup>118</sup>Meurk and Swaffield, 'Cities as complex landscapes', 16.
- <sup>119</sup>Meurk and Swaffield, 'Cities as complex landscapes', 14, 15.
- <sup>120</sup>Meurk and Swaffield, 'Cities as complex landscapes', 18.
- <sup>121</sup>Rastandeh, Brown and Pedersen Zari, 'Site selection'.
- <sup>122</sup>Andreucci et al., 'Exploring challenges and opportunities', 1.
- <sup>123</sup>'Reaching beyond the fence'.
- <sup>124</sup>Andreucci et al., 'Exploring challenges and opportunities'; McDonald and Beatley, *Biophilic Cities*; Syrbe et al., 'The value of urban nature'; Barron et al., 'Greening blocks'.
- <sup>125</sup>Santamouris et al., 'Progress in urban greenery mitigation', 650.
- <sup>126</sup>Lehmann, 'Growing biodiverse urban futures', 18.
- <sup>127</sup>Kuo, 'Parks and other green environments', cited in Ministry for the Environment & Stats NZ, *New Zealand's Environmental Reporting Series*, 40.
- <sup>128</sup>DOC, Te Mana o Te Taiao, 24.
- <sup>129</sup>Hikuroa, 'Pūniu river care'.
- <sup>130</sup>Cumpston, *Indigenous Plant Use*, 6–7.
- <sup>131</sup>Cumpston, 'Personal perspectives', 12–13.
- <sup>132</sup>Raerino et al., 'Local-Indigenous autonomy', 1.
- <sup>133</sup>'Te Ao Māori', National Science Challenges.
- <sup>134</sup>Arnold and Wade, 'A definition of systems thinking'.
- <sup>135</sup>McGaw, 'Imagining Portland's future past', 203.

## Declarations and conflicts of interest

### Research ethics statement

Not applicable to this article.

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The authors declare no conflict of interests with this work. All efforts to sufficiently anonymise the authors during peer review of this article have been made. The authors declare no further conflicts with this article.

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