

Cultural stewardship in urban spaces: Reviving Indigenous knowledge for the restoration of nature

Erana Walker¹  | Tim Jowett²  | Hēmi Whaanga³  | Priscilla M. Wehi^{4,5} 

¹The University of Waikato, Hamilton, New Zealand

²University of Otago, Dunedin, New Zealand

³Massey University, Palmerston North, New Zealand

⁴Te Pūnaha Matatini, and Centre for Sustainability, University of Otago, Dunedin, New Zealand

⁵Manaaki Whenua Landcare Research, Dunedin, New Zealand

Correspondence

Erana Walker

Email: erana.walker@waikato.ac.nz

Funding information

MBIE, Grant/Award Number: UOW1601; Te Aparangi Royal Society of New Zealand, Grant/Award Number: 14-LCR-001

Handling Editor: Emilie Ens

Abstract

1. Relationships to nature are important for the health and well-being of peoples globally and should be actively protected. Indigenous Māori people in Aotearoa New Zealand recognize this important relationship to nature through narratives of lineage and express this through concepts such as kaitiakitanga; a cultural place-based practice of stewardship that intertwines relationships of responsibility between people, nature and culture. However, many Māori now live outside of tribal areas in urban settings, putting relationships with nature into question.
2. We asked how urban Māori people practice kaitiakitanga, and what factors might predict flourishing relationships with nature. We surveyed 214 urban Māori who shared their perceptions of kaitiakitanga, cultural practices and restoration activities. The data were analysed by identifying qualitative themes and using linear mixed effect models.
3. Māori who were exposed to kaitiakitanga as children were more likely to attend marae and family restoration activities, and less likely to attend events led by local councils. Pressingly, young people in urban areas were more at risk of losing cultural knowledge and opportunities to practice cultural practices in urban areas. Age, distance from tribal area and early exposure all affected decision-making and expression of kaitiakitanga in urban areas.
4. Knowledge associated with kaitiakitanga can create inclusive and effective urban restoration activities. We suggest that partnership between Māori groups including local marae, and local councils, may provide accessible, best practice urban restoration models that attract local Māori and act to support cultural knowledge, in turn encouraging diverse pathways to nature restoration to develop in urban areas. Likewise, such partnerships will ensure that Māori in cities are supported to express and maintain cultural knowledge and practice into the future.

KEYWORDS

Indigenous knowledge, Indigenous practice, Indigenous urban restoration, Indigenous urbanism, kaitiakitanga, urban restoration

This is an open access article under the terms of the [Creative Commons Attribution-NonCommercial](https://creativecommons.org/licenses/by-nc/4.0/) License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited and is not used for commercial purposes.

© 2024 The Author(s). *People and Nature* published by John Wiley & Sons Ltd on behalf of British Ecological Society.

1 | INTRODUCTION

Nature provides key physical, spiritual, cultural and emotional sustenance for people, as well as supporting economic wealth amongst communities (Cox & Gaston, 2015; Ives et al., 2017). These benefits range from increased mental wellness, to improving physical ailments (Cox et al., 2017; Davvand et al., 2016; Gagliardi et al., 2020; Ives et al., 2017; Marselle et al., 2020; van Heezik et al., 2021). In many Indigenous perspectives, nature itself is viewed as a part of the community, and as such a relative entitled to care, protection and respect (Arora, 2018; Deluze et al., 2023; Warbrick et al., 2023). Cultural practices in many Indigenous communities are, therefore, physical manifestations of this important relationship, helping to maintain human connection with nature while simultaneously shaping concepts of identity, knowledge and connection to place (Berkes, 2012; Fitzgerald, 2015; Kearney et al., 2018). Conceptualizing plants, animals and other features of nature as kin supports guidelines to enact practices like hunting, harvesting of plants, weaving practices, carving, storytelling and prayer in ways that are informed by place and respect relationships between people and kin (Abas et al., 2022; Gould et al., 2019; Lyver, 2008; Thompson et al., 2020; Whyte, 2013; Wright, 2014). By strengthening long held relationships between Indigenous People and nature, Indigenous practices also play an important role for nature's care into the future (Garnett et al., 2018).

With the acceleration of industrial development, natural resource extraction and fragmentation of landscapes and ecosystems over the last 200 years in particular, human–nature relationships are frequently dissolved, damaged and neglected while urbanization spreads (Allred et al., 2015; Cox et al., 2018; Li et al., 2010; Mao et al., 2018; Soga & Gaston, 2016). Changes in land and sea use continue to drive biodiversity loss and place pressure on communities who are reliant on such sources for sustenance (Foley et al., 2005; Isbell et al., 2023). Added pressure on ecosystem functions through: urban development; pollution; climate change impacts; biodiversity degradation and depletion, has prompted intensified efforts to address challenges to the relationships that exist between humans and the rest of nature (Foley et al., 2005; Grimm et al., 2008; Isbell et al., 2023; Ives et al., 2017).

Indigenous communities, amongst others, have repeatedly called for challenges to nature to be addressed, because Indigenous philosophies frequently embed a symbiotic relationship between humans and nature that is informed by worldview, lineage, cultural narratives and value systems (Arora, 2018; Berkes et al., 2000; Brondízio et al., 2021; Deluze et al., 2023; Harcourt et al., 2021). Māori, the Indigenous people of Aotearoa New Zealand (AoNZ), are one such group, and it is through this perspective that a kinship obligation to nature, known as *kaitiakitanga*, has developed through time, to maintain human–nature relationships whilst also protecting valuable resources, connections and knowledge (Kawharu, 2000; Marsden & Henare, 1992; Roberts et al., 1995;

Walker et al., 2019). *Kaitiakitanga*, together with the concept of *whakapapa* (lineage), reinforces spiritual and relational connections between Māori and nature and acts to generate practices that align with ideas of care, protection and sustainability of nature and people, that ensure balance between the physical and spiritual realms (Roberts, 2013; also see Kawharu, 2000; Marsden & Henare, 1992; Selby et al., 2010).

Indigenous peoples nonetheless are deeply affected by issues such as urbanization which impact long-held connections to place, culture, identity, language and knowledge (Nejad et al., 2020; Wehi et al., 2023; Williams, 2015). Many Māori have migrated from traditional homelands to urban spaces, in search of better living and economic wealth (Haami, 2018; Williams, 2015), and more than 80% of Māori now live in urban areas in AoNZ (Gagné, 2013; Kukutai, 2013). Yet although urban residence by Māori challenges identity, connections to homelands, the longevity of language and culture, and restricts opportunities to maintain tribal histories and knowledge (Haami, 2018; Harris, 2004; Wehi et al., 2023; Williams, 2015), urban spaces can also play a role in revitalizing knowledge, language and practice, and could further support the connections between Māori and nature (Ryks et al., 2016, 2019). For this to occur, examining how key groups such as *Mana Whenua* (those living on their own tribal lands) and *Mātāwaka* (those living on the tribal lands of others) engage with nature, culture and other Māori in urban spaces is critical (Walker et al., 2019).

The loss of biodiversity in urban areas has ignited efforts by local communities to restore remnant, often degraded, patches of urban nature (Clarkson et al., 2007). However, it is also clear that exclusion of Indigenous voices in planning processes, and inequitable access to nature, act as barriers to Māori cultural connection and practice in natural and restored urban spaces (Cuerrier et al., 2015; Hall et al., 2021; Jackson & Ormsby, 2017; Jennings et al., 2012; Nejad et al., 2020; Shochat et al., 2010; Walker et al., 2019). There is growing recognition that cultural knowledge can help enhance ecological restoration in urban spaces while also supporting opportunities to express cultural practice, retain the longevity of knowledge systems, and increase the well-being of both nature and people (Fox et al., 2017; Hall et al., 2021; Henwood et al., 2016; Morishige et al., 2018; Wehi & Lord, 2017). Pressingly, *kaitiakitanga* could support the development of socio-ecological restoration that aligns to biological, cultural and ecological needs of urban communities. Here, we investigate factors that enable *kaitiakitanga* in urban spaces in AoNZ and consider some of the key barriers for urban Māori, including barriers to engagement with ecological restoration activities. We examine some of the ways that *kaitiakitanga* is conceptualized and practiced by urban Māori in AoNZ. Specifically, we examined demographic factors that might be associated with knowledge of *kaitiakitanga*, to better understand how barriers to *kaitiakitanga* vary across age groups and the urban–rural divide, and on the other hand, what factors might support the practice of *kaitiakitanga* in urban spaces.

2 | METHODS

2.1 | Research framework and languaging

The first author of this project is of Māori descent and, therefore, has used Kaupapa Māori theory to guide, construct and implement this research project. This research draws on a Māori lens to interpret and understand the phenomena between urban Māori and relationships to nature. Therefore, we used kaupapa Māori theory to inform our research approach with multiple Māori communities across Aotearoa. Kaupapa Māori theory advocates for the use of Māori knowledge, values, concepts and experiences as foundations for research (Pihama et al., 2015). Kaupapa Māori theory draws on Māori knowledge to create research projects that align with Māori community needs and perspectives (Moewaka-Barnes, 2000; Pihama et al., 2015), thereby shaping, for example, survey design and distribution, data collection and data analysis. Its use emphasizes key cultural prerogatives such as: recognition of and respect for participants; the sacredness of data shared; and care for and protection of data. This approach supports exploration and recognition of important cultural aspects to the research, such as: engagement with participant childhood experiences; tribal knowledge; relationships with home; cultural practices and experiences of kaitiakitanga.

We use some *te reo* Māori (Māori language terms) throughout. Definitions are included to aid reader understanding; however, these definitions often do not capture the full breadth of meaning of words used. We encourage readers to explore *Te Aka Online Māori dictionary*, and writings by Biggs (2013) and Williams (2000) to gain a better appreciation of Māori concepts and definitions.

2.2 | Survey design and distribution

We constructed a 52-question online survey with open and closed ended questions (see Supplementary Materials), using QualtricsXM Software. The survey aimed to gather responses from a diverse range of Māori adults aged between 16 and 75 living in urban areas. Consent from participants to be part of this survey and for their data to be used in research outputs was sought through the online survey itself. Participants who selected the 'next' tab on the survey agreed for their data to be used and their information was anonymized through this process to ensure confidentiality. We tested the survey with a small number of pilot participants to ensure question appropriateness and clarity, and to gather community feedback on design. The survey was distributed through email and social media, and used snowball sampling (see Biernacki & Waldorf, 2016; Cohen & Arieli, 2011) to ensure timely and wide distribution throughout Aotearoa and engage with a vast range of people. In this work, we focused on a small number of the total survey questions (for example, we derived models from questions 5, 22, 28 and 41; see Table S2) and report further data from the study elsewhere. Moreover, to answer the questions of interest around urban kaitiakitanga, we focused solely on responses from Māori participants in this study, who are Mana

Whenua (from the area in which the urban space sits) and Mātāwaka (those from another tribal area and, therefore, live in a tribal boundary that is not their own). Ethical approval was obtained from the University of Waikato, Faculty of Māori and Indigenous Studies Ethics Committee, Te Manu Taiko, on 24 July 2018.

2.3 | Analysis of survey data

We used both qualitative and quantitative methods to identify both important understandings and predictors of kaitiakitanga in urban Māori survey participants. Qualitative methods gather understandings about behaviours, thoughts, beliefs and attitudes towards a subject (Taylor et al., 2015), and provide rich, descriptive data of a phenomena or area of interest, such as, in this case, the expression of kaitiakitanga and factors that encourage or hinder this expression in urban areas (see Tables S1 and S2). In the survey, we gathered qualitative information on participant perceptions of kaitiakitanga and cultural practices, and barriers to engagement in kaitiakitanga and ecological restoration. Thematic analysis was used for qualitative analysis of the data that surfaced through the survey. Data were coded and key themes extracted, defined, and redefined to ensure accuracy (Braun & Clarke, 2021). Initial themes such as: placemaking, the growing challenges in urban areas, and how participants define kaitiakitanga were informed by prior literature review related to kaitiakitanga and urban areas. The data from the survey was then 'matched' to these themes and gaps identified. Themes were redefined as more clarity from the qualitative data emerged. Finally, the qualitative data were grouped into six key themes related to kaitiakitanga knowledge and barriers (Tables 1 and 2).

We also used a selection of statistical models to further investigate the importance of demographic factors on the practice of kaitiakitanga by urban Māori, drawing on the data from survey responses and demographic information provided by survey participants. We first sought to better understand which demographic information might be important to these models (Table S1). Demographic factors collected from participant included: gender; age; living identity (rural/urban); whether they had moved from their tribal area; and whether they were exposed to kaitiakitanga as a child. Models were then fitted to data from a range of survey questions (Table S2). For Likert (rating) questions (Table S2, Q5 and Q28) where the data is ordinal in nature with multiple response categories, the *clmm* function from the *ordinal* package (Christensen, 2019) was used to fit linear mixed effects models to allow for within-subject correlation. All models were fitted using R software, version 4.0.2 (R Core Team, 2020).

The models explored the types of cultural practices associated with kaitiakitanga that participants may have undertaken, such as: working in gardens; rongoā (traditional medicine making); mirimiri (massage); protecting land (including occupation, caring for and management of traditional lands); storytelling; karakia (prayer); waiata (song); whaikōrero (formal speech); and karanga (formal call). For these activities, we measured frequency of occurrence using the categories: *Regularly*; *Sometimes*; and *Never*. As well, levels of

TABLE 1 Key themes about understanding kaitiakitanga, based on survey responses.

Key theme	Understanding about kaitiakitanga shared by survey participants
Obligation to past, present and future	<p>'My duty to look after taonga tuku iho, our natural resources for our tamariki [children] and mokopuna [grandchildren]' (Female, urban location, 26–44 years)</p> <p>'We have a responsibility to look after the environment as they are taonga tuku iho, as are we. Our well-being is reflected in the well-being of all that surrounds us.' (Female, urban location, 16–25 years)</p> <p>'Kaitiakitanga is about looking after what has been passed down from my tupuna for our future generations. Tiaki te taiao e whakaora nei i a koe. Kia marama ai ki nga mauri o te wai, o te whenua, o te rangi, o te hau. Kei enei mea katoa te oranga o te ao e hurihuri nei [Take care of nature as it is critical to your health and well-being. Understand that water, land, the sky and winds all have their own mauri. These aspects are all important in today's modern age].' (Male, urban location, 26–44 years)</p>
Knowledge and nature	<p>'Majority of my knowledge surrounds the Moana [ocean], being a coastie kid and having both parents as ex-navy we grew up knowing about limits, rahui [restrictions], throwing fish back, throwing back undersized fish, karakia' (Female, rural location, 16–25 years)</p> <p>'Understand it as a cultural value and philosophy. At home we try to look after the land and water, not using anything too damaging for the environment.' (Female, urban location, 45–54 years)</p>
Expression through practice	<p>'[I] am a designated Tangata Tiaki, a Kaitiaki Rūnaka [council] member. Active kai [food] Māori gatherer of kai moana / seaweeds/ cultural greens and generally feed myself for 80 percent of the time from my own maara [garden], the rūnaka maara the shoreline/coast and awa [river] estuary.' (Female, rural location, 55+ years)</p> <p>'Practicing kaitiakitanga on a daily basis by recycling and being aware of how we operate on a daily basis by role modeling to our tamariki on how to care for their natural environment.' (Female, rural location, 26–44 years)</p> <p>'I know how to respectfully harvest for the ongoing health of the plant. I do my best to protect and nurture my natural surroundings by reducing household waste. I only take what I need from the environment and try not to upset the natural balance of things.' (Female, urban location, 45–54 years)</p> <p>'My parents were artists, my father was a carver. His work constantly referenced our kaitiaki and we were raised with a representation of our kaitiaki in pride of place in our childhood home.' (Female, urban location, 26–44 years)</p> <p>'Looking after resources, making sure not [to] abuse or take more than you need. Attempting to reseed when you see an area is low in kai. Close off an area if kai is depleted & needs to recover.' (Male, rural location, 45–54 years)</p> <p>'In our new ecotourism business we see kaitiakitanga as the obvious conservation, but also not leaving rubbish behind, taking rubbish out if we see it from others, being respectful of the land and sea. Being respectful of the communities we work within and with. We also see it as a responsibility to share with our guests the what and why.' (Female, urban location, 45–54 years)</p>

Note: Quotes are examples from survey participant data relating to each theme; demographic information from the participant is attached alongside each quote.

confidence were measured through: *Not confident/Do not know*; *Know but do not do*; *Rarely*; *Sometimes*; and *Often/Expert*. We also explored attendance of restoration events, such as: marae (meeting place); river; tribal; local council; department of conservation (DOC); whānau; and church led restoration events. Barriers to enacting kaitiakitanga were also scoped such as: laws; limited knowledge, limited space (lack of adequate space or places to carry out kaitiakitanga) and concerns about neighbours. Multiple response choice data was analysed using a linear mixed effects binary logistic regression model using the *glmmTMB* package (Brooks et al., 2017). Model checking was carried out using the Hosmer and Lemeshow goodness of fit test via the *logitgof* and *lipsitz.test* functions from the *ordinal* package. Further details about models and statistical equations used are in the Supplementary Materials.

3 | RESULTS

Two hundred and forty-four participants took part in the survey, with more than 88% identifying as Māori. Most of the 244 participants

identified as female (74.3% female and 24.7% male, respectively). One participant identified as gender fluid, and one participant preferred not to answer this question. Participant age ranged from 16 to 74 years, with >55% of participants aged between 26 and 44 years (Table S3). Participants were located in urban areas throughout Aotearoa; the most frequent location (28%) was Hamilton, a city of around 160,911 people (Stats NZ, 2018), with 14% in Auckland, a city of around 1.7 million (Stats NZ, 2021a, 2021b; Table S4).

3.1 | Kaitiakitanga

Qualitative survey responses provide a rich foundation for understanding urban kaitiakitanga practices. Participants identified key features such as whenua (land), water and food sources as important components in their understanding of kaitiakitanga (Table 1). Food collection, plant harvesting, artistic expression, environmental sustainability practices, knowledge sharing and the active protection of nature were all important practices in kaitiakitanga for survey participants (Table 1).

TABLE 2 Key barriers to kaitiakitanga practices identified from survey responses.

Key theme	Examples of the barrier for kaitiakitanga
Disconnection	'Not being on our land or in our iwi region. Divided and individualistic ways of living creating a lack of kotahitanga [unity], community effort.' (Female, urban location, 26–44 years) 'Very little. I had limited connection to my marae, my Māori relatives, and te ao Māori growing up.' (Female, urban location, 26–44 years) 'I have trouble establishing whether it is okay for me to harvest from certain places as I am not mana whenua.' (Female, urban location, 45–54 years) 'I know the difference in how kaitiakitanga is practiced from rural to urban areas much of it is lost and not practiced as a normal part of our day in urban places' (Female, urban location, 26–44 years)
Limited knowledge	'Very little [knowledge]- willing to learn more through online resources' (Female, urban location, 26–44 years) 'Other people's ignorance is the major barrier to effective kaitiakitanga' (Male, urban location, 26–44 years)
Modern lifestyle	'Time (physical, emotional, spiritual)—often time can act as a barrier to continued practice of kaitiakitanga' (Female, urban location, 26–44 years) 'Time/work commitments' (Female, urban location, 26–44 years)

Note: Quotes are examples from survey participant data related to each barrier, along with the demographic information of the participant quoted.

Qualitative analysis suggested that participant knowledge varied with recognition of: the importance of hapū (subtribe) and iwi (tribe) knowledge; obligation; cultural practices; and nature. There was extensive recognition of protection and sustainability of these taonga (treasures), including people, in kaitiakitanga. Participants articulated the varying degrees of obligation that exist in their knowledge of kaitiakitanga. Obligations to past, present and future generations informed how the participants undertook kaitiakitanga practices and shaped their priorities for nature protection. Participants also noted diverse practices that capture the concept of kaitiakitanga such as: food collection; plant harvesting; artistic expression; environmental sustainability practices; knowledge sharing; as well as the active protection of nature.

Survey participants shared barriers to their practice of kaitiakitanga, including feelings of disconnection, and limited knowledge and commitment (Table 2). Overall, we identified a range of key themes in participant responses around barriers to kaitiakitanga. These were division; separation from lands; limited connection to te ao Māori (the Māori world), whānau (family) and local hapū (subtribal groups); the role of urbanization; lack of knowledge, time and ignorance of other people. Participants indicated that legal barriers (*laws*) and limited knowledge impacted kaitiakitanga practices most often, although these impacts varied across age groups. Other less frequent barriers were *neighbours*, *space*, and a range of issues grouped as 'other' (Figure 1a,b). *Limited knowledge* was identified most strongly as a barrier for participants under the age of 55, particularly those aged 16–25 and 45–54 years (Figure 1a). Participant responses also varied according to their location, and this was particularly so for *laws* and *limited knowledge*. Rural participants were affected more by *laws* than urban participants (Figure 1b). Although they did not explicitly state which laws were impacting their practices of kaitiakitanga, they identified legal language, as well as laws that provide local councils with the ability to alter the environment (for example, through spraying) as impeding practices. In contrast, urban participants were impacted more by *limited knowledge* compared to rural participants (Figure 1b), particularly through

disconnection from their homelands and a lack of knowledge of the urban area.

Across the range of listed potential cultural practices undertaken to support kaitiakitanga, both frequency and confidence varied with both age and the type of practice (Figure 2). Those aged 45–55 had high responses in the *Often/Expert* category for 7 out of the 9 listed cultural practices compared to other age brackets. That is, older participants were more likely to report that they were an expert in the listed practices. The 16–25 aged survey participants had lower scores in confidence across most cultural practices. However, confidence to carry out practices like waiata, karakia, protecting land and gardening had a large number of survey participants in all age groups rating themselves in the *Often/Expert* category (Figure 2). As one example, participants reported that they practiced waiata often, with most (55.9%) responses in the *Often/Expert* category (Figure 2). In contrast, participants were much less confident practicing rongoā, mirimiri, whaikōrero and karanga, with high responses in the *Not confident/Do not know* and *Know but do not do* categories (Figure 2).

Living identity and cultural practices also showed different levels of confidence (Figure 3). Participants undertook practices like waiata, karakia, protecting land (protect), storytelling (story) and gardening, often. However, across all cultural practices, living identity influenced confidence levels for undertaking cultural practices ($p=0.0059$, Figure 3). Although participants were confident to carry out cultural activities such as waiata, karakia, protecting land, storytelling (story) and gardening, expressed as positive responses in the *Often/Expert* category, differences between rural and urban participants were notable. Rural participants reported more confidence to undertake all cultural practices than urban participants ($p=0.0059$; Figure 3). Likewise, gender was also important for some cultural practices: *male* participants had more confidence to carry out whaikōrero (OR=2.44, medium effect size, $p=0.024$) while *female* participants had more confidence in karanga (OR=0.26, large effect size, $p<0.001$). Childhood exposure to kaitiakitanga was an important predictor of confidence to undertake stated cultural

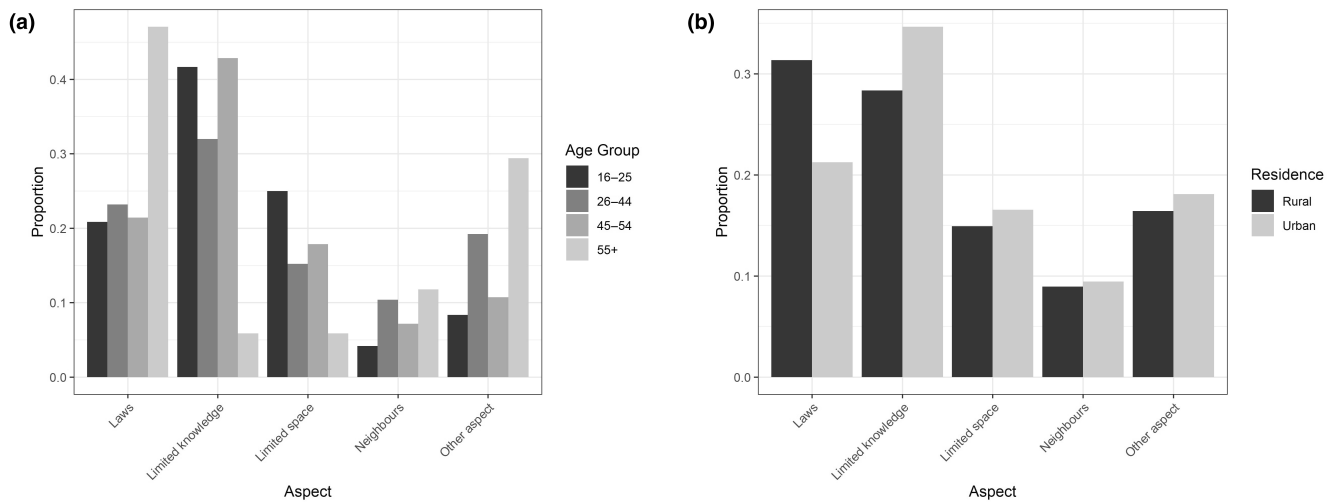


FIGURE 1 (a) Barriers to enacting kaitiakitanga are grouped as legal ('laws'); limited knowledge; limited space; concerns about neighbours ('neighbours'); and other. Barriers varied by age group. $N = 194$. (b) Limited knowledge was a more important barrier for urban Māori than rural Māori in enacting kaitiakitanga; conversely, legal barriers were more important for rural Māori survey participants. Rural and urban Māori had similar experience of some other barriers to enacting kaitiakitanga. $N = 194$.

practices in survey participants ($p < 0.001$, Figure 4), although rongoā, mirimiri, whaikōrero and karanga had a low proportion of survey responses. Nonetheless, there is a close relationship between kaitiakitanga exposure in childhood and the expression of cultural practices in adulthood.

Confidence levels in collecting resources were influenced by rural or urban living identity. Urban and rural participants who had not moved in their childhood showed no difference in proportions in terms of the gathering of natural resources (Figure 5). However, participants who had moved during childhood and were now living in rural areas tended to gather more natural resources than those in urban areas.

3.2 | Restoration of nature

Data analysis of attendance of restoration events shows preference towards cultural spaces and events. For example, participants reported that they would *Sometimes* attend marae restoration events (40.9%). Whānau restoration events had even higher attendance, with over half (69.9%) of participants' responses in the combined *Regularly* and *Sometimes* categories. In contrast, for river restoration events, participants' data presented a low *Regularly* response (9.8%) while local council and DOC restoration events had a very low *Regularly* response (4.7%). In addition, church organized restoration events had a very high response rate in the *Never* category (77.6%).

Attendance at listed restoration events varied with both age and urban or rural living identity (Figures 6 and 7). Survey participants over the age of 45 generally attended restoration events on a regular basis. Marae, tribal and whānau restoration were more likely to be attended regularly than other events, with whānau restoration events more frequented by all age groups. When this data set is aligned with data pertaining to the movements of participants in their childhood, younger participants who moved during their

childhood and are part of the 16–25 age bracket, were more likely to attend restoration events compared to those over 55 years of age who had also moved (OR=0.02, strong effect, $p = 0.0079$). Urban participants were less likely to attend restoration events (OR=13.2, strong effect, $p < 0.001$), with frequency of attendance differing from rural participants. Of note, there were more rural responses in the *Regularly* category compared to urban responses. Although there was no significance between attendance at restoration events as a whole and childhood exposure, there were significant relationships between childhood exposure and individual types of restoration events (Figure 8). Participants with childhood exposure to kaitiakitanga were more likely to attend whānau and marae restoration events ($p = 0.024$; $p = 0.032$), and less likely to attend restoration events that were led by *local councils* (OR=2.66). Highlighted across all categories was the large number of participants who did not attend restoration events regardless of the type. However, restoration events that were more closely connected to tribal groups or family led, seem to garner more interest and attendance by participants.

4 | DISCUSSION

Urban living is a necessity for many Indigenous people globally, many of whom also live outside their territories. Our data show that urban Māori from Aotearoa New Zealand who live outside their tribal boundaries act on obligations to past, present and future generations to practice kaitiakitanga or stewardship in both traditional and novel ways. Participants in our survey commented on challenges to urban kaitiakitanga, noting for example feelings of disconnection to their tribal area, and barriers such as limited knowledge when living in urban areas. Confidence levels in practicing kaitiakitanga varied with their living identity, age, childhood exposure to kaitiakitanga, and the nature of the practice undertaken. In addition, those who had

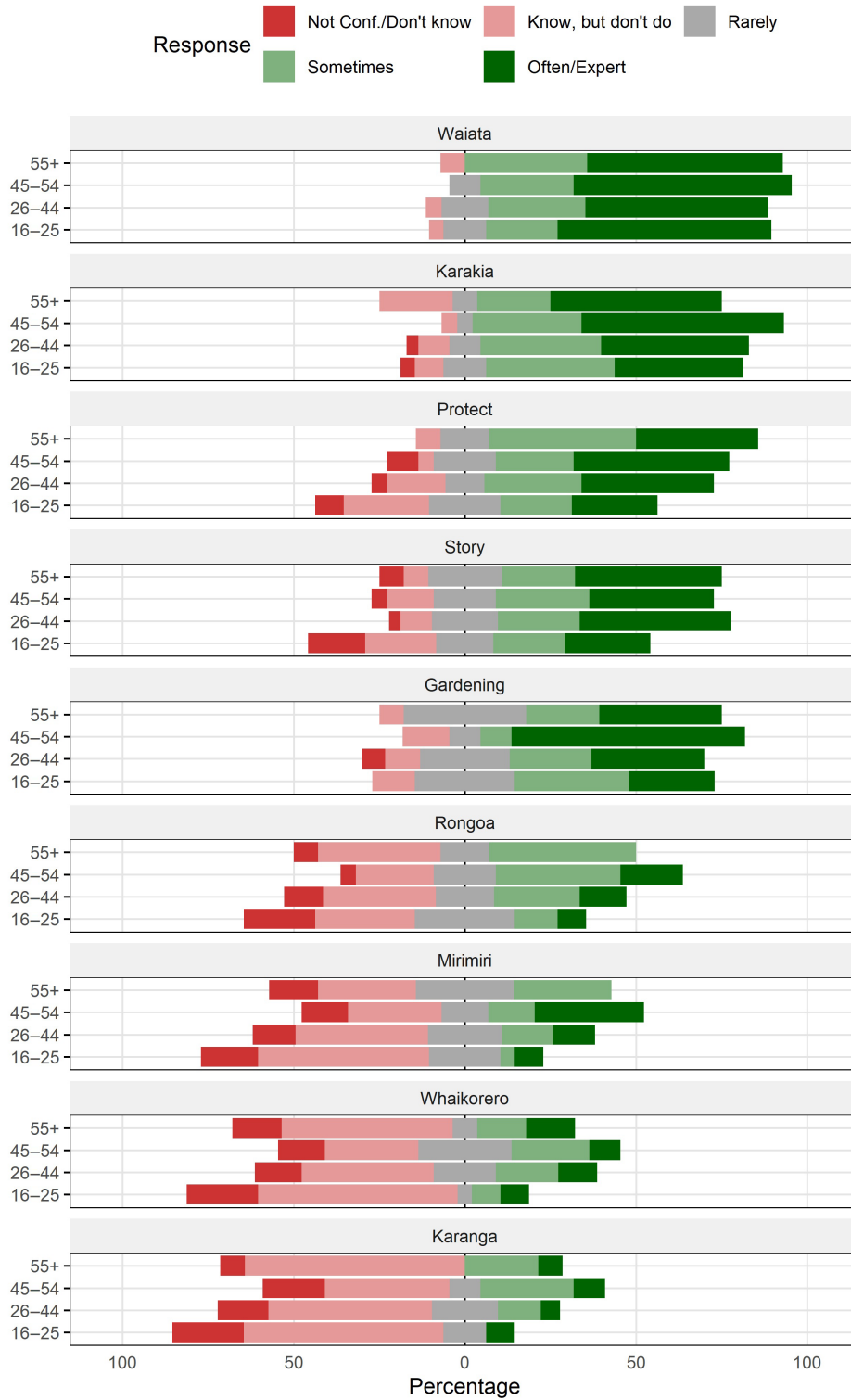


FIGURE 2 Confidence in undertaking cultural practices varies with age. For example, the data indicates that survey participants in the 16–25 age bracket require support across most cultural practices. This trend is more prominent in cultural practices of rongoā, mirimiri, whaikōrero and karanga. *N* = 184.

moved as a child and who now lived in rural areas tended to gather more resources than those who had moved but now lived in urban areas. Finally, there were clear preferences towards participating in ecological restoration events that took place in cultural spaces, such

as those with family or at the marae amongst all age groups, and this was particularly the case amongst those with childhood exposure to kaitiakitanga. Rural living participants and younger participants who had experienced mobility both to urban and rural areas during

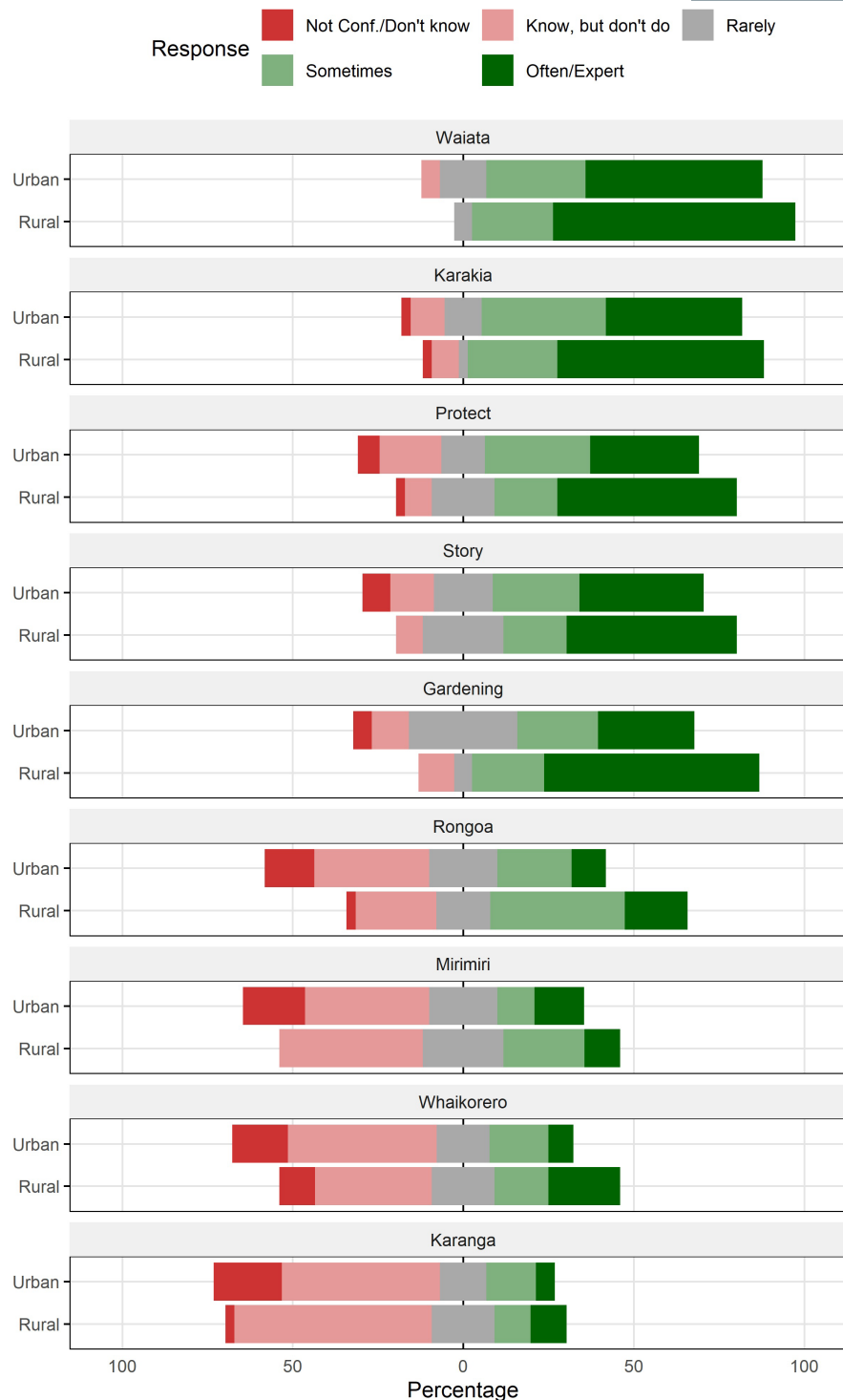


FIGURE 3 Living identity and cultural practices also showed variance related to confidence levels. For more common practices like Waiata; Karakia; Protecting land (Protect); Storytelling (Story) and Gardening, participants undertook these often. However, across all cultural practices, living identity related to location influenced confidence levels for undertaking cultural practices ($p=0.0059$). $N=184$.

their childhoods were also more likely to attend cultural restoration activities than others.

Better understanding of how these groups can, do and would like to enact their kaitiakitanga obligations is critical for equitable urban policy and management. The results shown here demonstrate not only what issues arise for urban Māori who wish to practice

kaitiakitanga, but also where efforts could be targeted to support kaitiakitanga and, potentially, engagement in restoration activities. This in turn requires reflection about the overall goals of ecological restoration activities and if indeed, the lens of indigenous knowledge can open the way to new approaches that connect people to nature and help ensure nature and human well-being into the future.

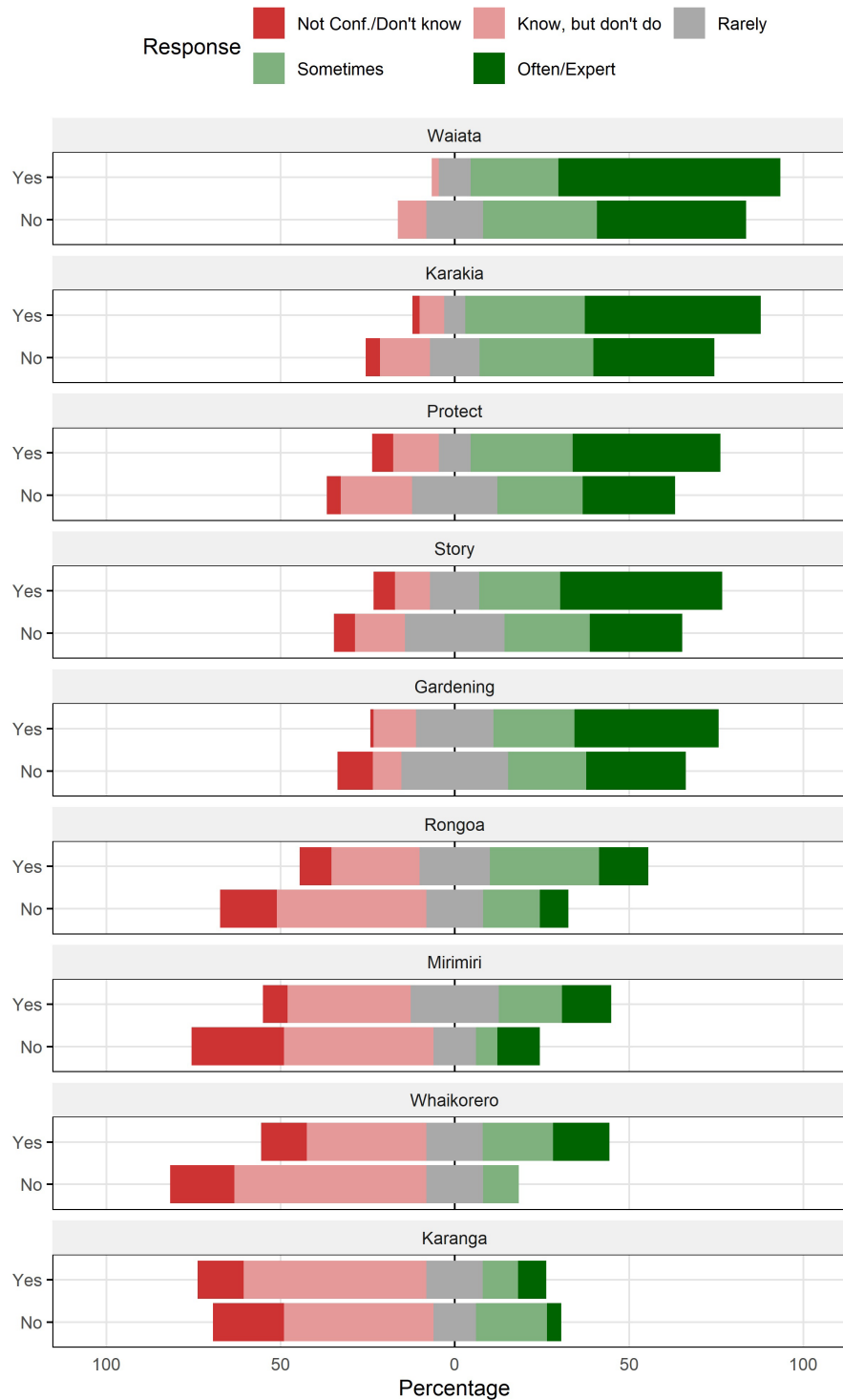


FIGURE 4 Childhood exposure and confidence levels to undertake cultural practices shows that participants who were exposed to kaitiakitanga as a child have more confidence to undertake most of the listed cultural practices. More confidence by the participants is expressed in the waiata, karakia, protecting lands, storytelling and gardening practices. $N = 184$.

4.1 | Kaitiakitanga

The qualitative themes we identified in the study emphasize the stewardship obligations that urban Māori participants feel towards the natural environment (see Kawharu, 2000; Marsden & Henare, 1992; Roberts et al., 1995), even in novel and non-traditional

spaces. Many Indigenous peoples view themselves as part of the natural world and, therefore, feel obliged to care for and protect the natural environment (Arora, 2018; Kawharu, 2000; Marsden & Henare, 1992; Roberts et al., 1995; Watene, 2022). Strong connections to place, knowledge and cultural practices are key determinants of care and protection expressed by Indigenous People for

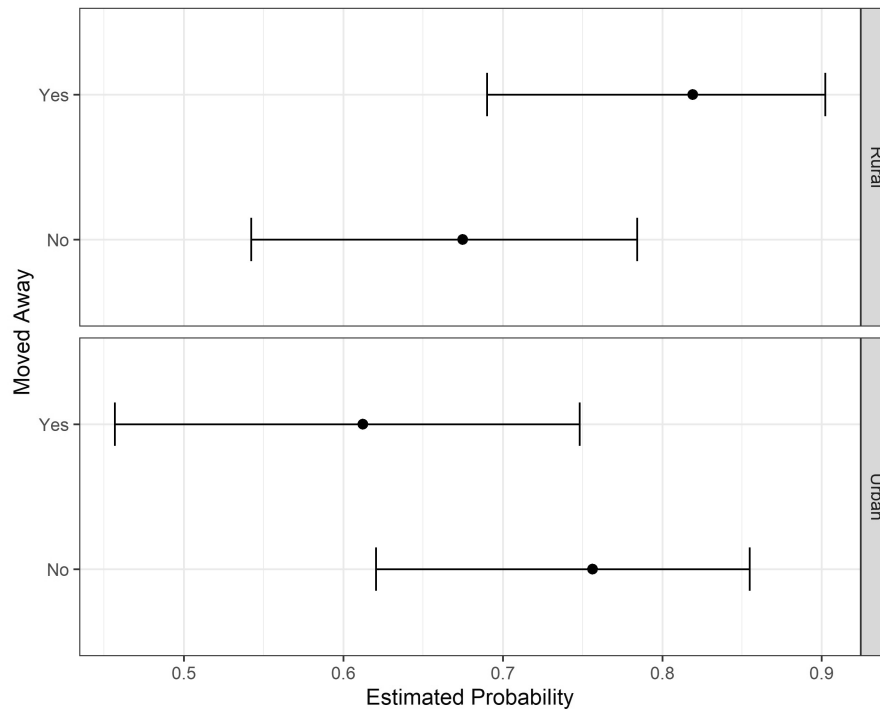


FIGURE 5 Data from survey participants show movement during childhood can further influence collection of natural resources. Participants who moved during their childhood and now reside in rural areas were more likely to gather natural resources. $N = 100$.

their tribal territories. In this study, participants who descend from other tribal groups and regions but have moved to urban spaces, continued to practice kaitiakitanga in urban areas, while also recognizing the local norms of urban tribes. Likewise, middle-aged urban Māori were also more likely to maintain cultural practices through activities such as gardening.

Survey participants shared a wealth of knowledge related to kaitiakitanga, ranging from stories of ancestors and gods, practices related to nature and knowledge. Importantly, they showed how kaitiakitanga is not limited to tribal territories, but can be applied in different contexts. As such, kaitiakitanga practices act as a mediator for Māori in urban spaces to feel connected to nature and culture. The findings emphasize that well-being of people, communities and the natural environment are intertwined and dependent on each other, which corresponds with the work of other researchers (Kawharu, 2000; Marsden & Henare, 1992; Roberts et al., 1995; Selby et al., 2010). This interdependence is critical in urban areas, where cultural spaces may be limited, minoritized or unsupported. Importantly, it shows the need for accessible areas of nature in urban spaces where cultural practice and knowledge can be expressed and shared.

The findings show how cultural knowledge and practices act as a vehicle for participants to navigate and adapt to the urban space in ways that are culturally safe. Urban spaces can be sites of reconciliation, helping to forge connections between lands, people, water, gods and ancestors (Deluze et al., 2023; Rey & Harrison, 2018). However, ensuring kaitiakitanga practices thrive in urban spaces means recognizing the barriers that challenge the continuity of

kaitiakitanga. Indigenous stewardship activities rely on the availability of natural areas and resources, as well as place-based knowledge (Deluze et al., 2023). In this study, ideas of disconnection were prominent in discussions about barriers to kaitiakitanga, along with time issues associated with modern lifestyles, and limited knowledge of the urban area, its biodiversity and local tribal peoples and customs. Limited knowledge was a particularly important barrier for transient participants, who were not always familiar with local tribal norms in urban areas. Supporting opportunities for local tribes to express and lead kaitiakitanga practices in urban spaces will provide wider benefits for many Indigenous and non-Indigenous people in their efforts to connect and maintain relationships with nature.

Analysis of participant responses in relation to demographic data highlighted the relationship between confidence and expression of practice. We have found through this study that confidence levels to carry out cultural practices were influenced by factors such as age, living identity, childhood movement and exposure to kaitiakitanga knowledge. In addition, participants were much less confident in some practices than in others, perhaps in part because some practices are reserved for particular ceremonies. Other practices such as whaikōrero and karanga are known to be strongly gender based within some cultural norms, with men generally undertaking whaikōrero and women karanga—patterns that are reflected here. Important roles within communities may also be maintained by those of a particular age group (Simpson et al., 2022). For the participants of this study, these sentiments were evident for older participants who were generally more confident in cultural practices than younger participants. For many Indigenous peoples, older

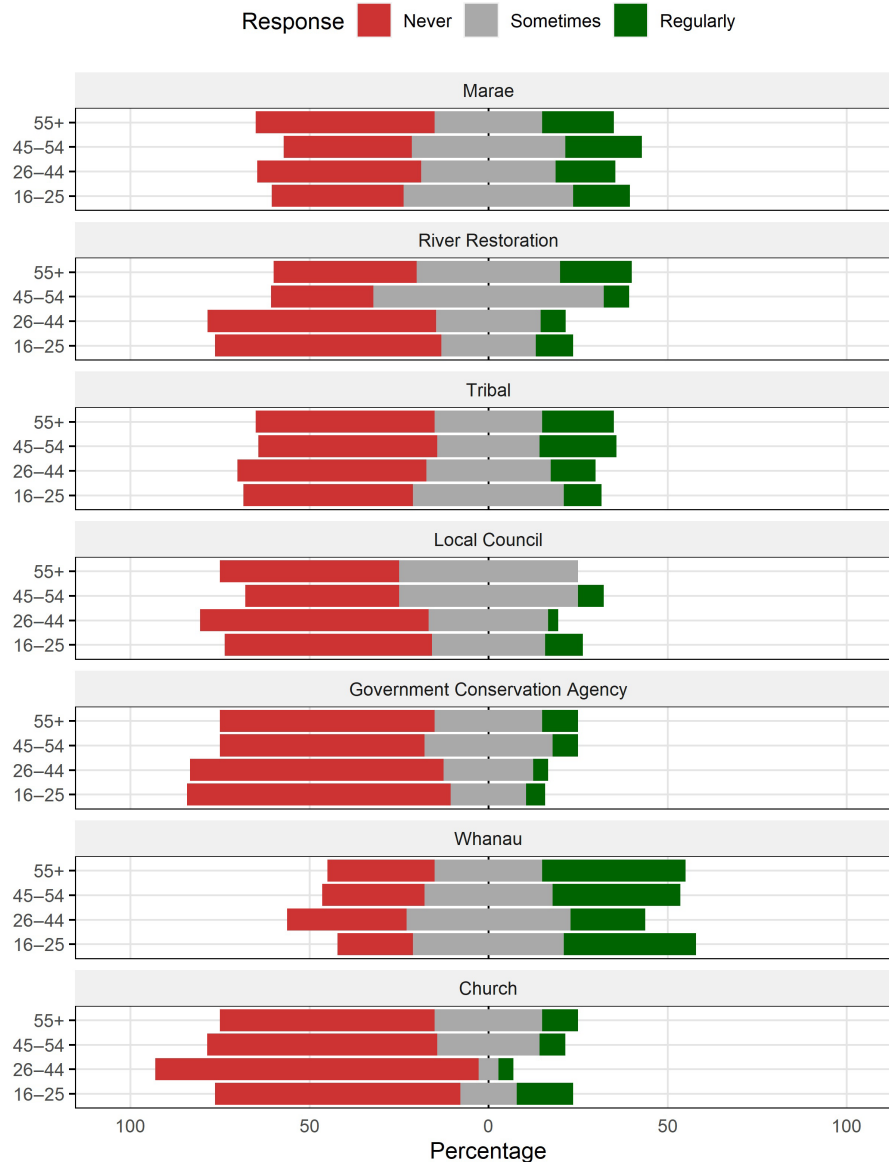


FIGURE 6 Age and restoration event attendance shows that whānau events are more likely to be frequented by participants. Importantly, the figure expresses that interest in restoration activities varies across age groups with more interest seen in the 55+ age bracket. $N = 184$.

participants or kaumātua are carriers of cultural knowledge and, therefore, more likely to be experts and maintain higher levels of confidence related to cultural practices (Simpson et al., 2022). This is useful when understanding challenges for young urban indigenous people who may not have the same level of knowledge, or access to elders from their own tribal areas.

Confidence levels to carry out cultural practices were also influenced by childhood exposure to kaitiakitanga. Cultural events are at the heart of many Māori communities, and ensure that generational knowledge can be shared and maintained by the tribal group (Wehi et al., 2023). Exposure to this knowledge, however, is often difficult for families who have migrated from rural areas and are now part of the large cohort of Māori living in the city (Gagné, 2013; Kukutai, 2013) and the role of urban spaces in severing ties to Indigenous knowledge systems through assimilation into Western

society is notable (Bedford et al., 2004; Haami, 2018; Harris, 2004; Nejad et al., 2020). Similarly, participant data indicating that rural living Māori who had moved as a child tended to gather more resources than urban living Māori who had moved suggests that aspects of mobility as well as the availability of resources in rural and urban areas influence feelings of engagement, connection and confidence in kaitiakitanga. Therefore, efforts that support early exposure to kaitiakitanga and increase access to ceremonial cultural practices and connection to others in the community in urban areas are critical to help grow confidence to participate in kaitiakitanga for young urban Māori particularly.

There were also some challenges in interpreting the survey. Relatively few Māori men responded, as was also the case for older participants. Although our models have factored the difference between gender and age from the survey data, improved survey design

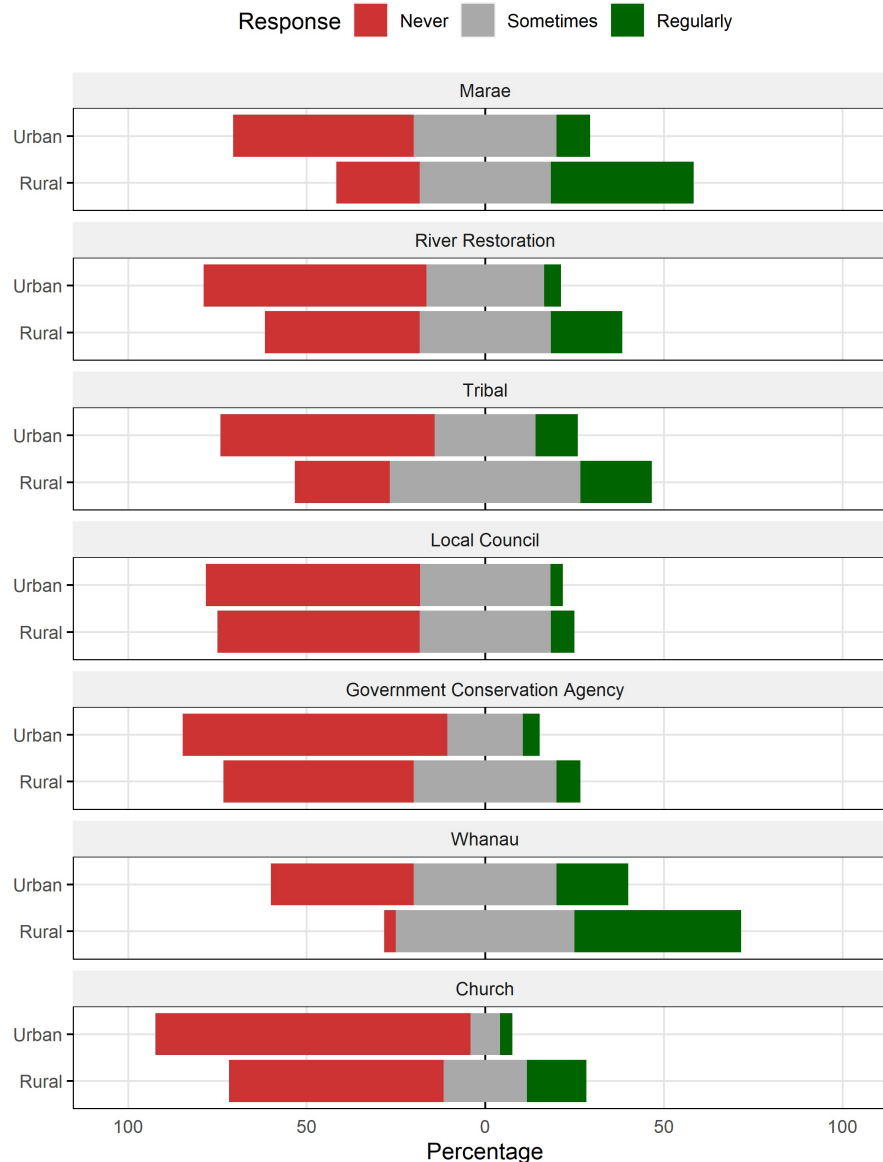


FIGURE 7 The figure shows living identity and restoration event attendance. Rural participants express more attendance at restoration events regardless of the type; however, both Marae and Whānau events still had high responses in the Regularly category. $N = 184$.

to ensure these voices are better represented should be considered in similar projects. One way of achieving this could be through the inclusion of interviews as well as survey data, or perhaps using probabilistic methods. More direct engagement with specific communities may also contribute to support the representation of the wider indigenous communities in urban areas.

4.2 | Restoration engagement

Attendance at restoration events was reported as low by most participants in this study. Nonetheless, whānau, marae and tribal environmental restoration events were more often attended than council run or other forms of restoration events. New Zealand's national census data shows that Māori are more likely to undertake

kaitiakitanga practices when they are in close proximity to their ancestral spaces such as marae (Stats NZ, 2021a, 2021b). This preference aligns to the findings related to exposure to kaitiakitanga as a child in determining the types of restoration events that participants feel comfortable to attend. More importantly, the maintenance of knowledge and practices from childhood and in tribal territories is key to improving engagement and expression of pro-environmental actions like kaitiakitanga and restoration activities. Together, these data suggest that cultural and community connection are important for participation of restoration activities in urban areas although these drivers are often unrecognized and restoration projects largely use environmental, economic and social objectives to drive restoration activities (Peters et al., 2015).

Age was also an important predictor of engagement frequency with restoration activities. Older participants who engaged in

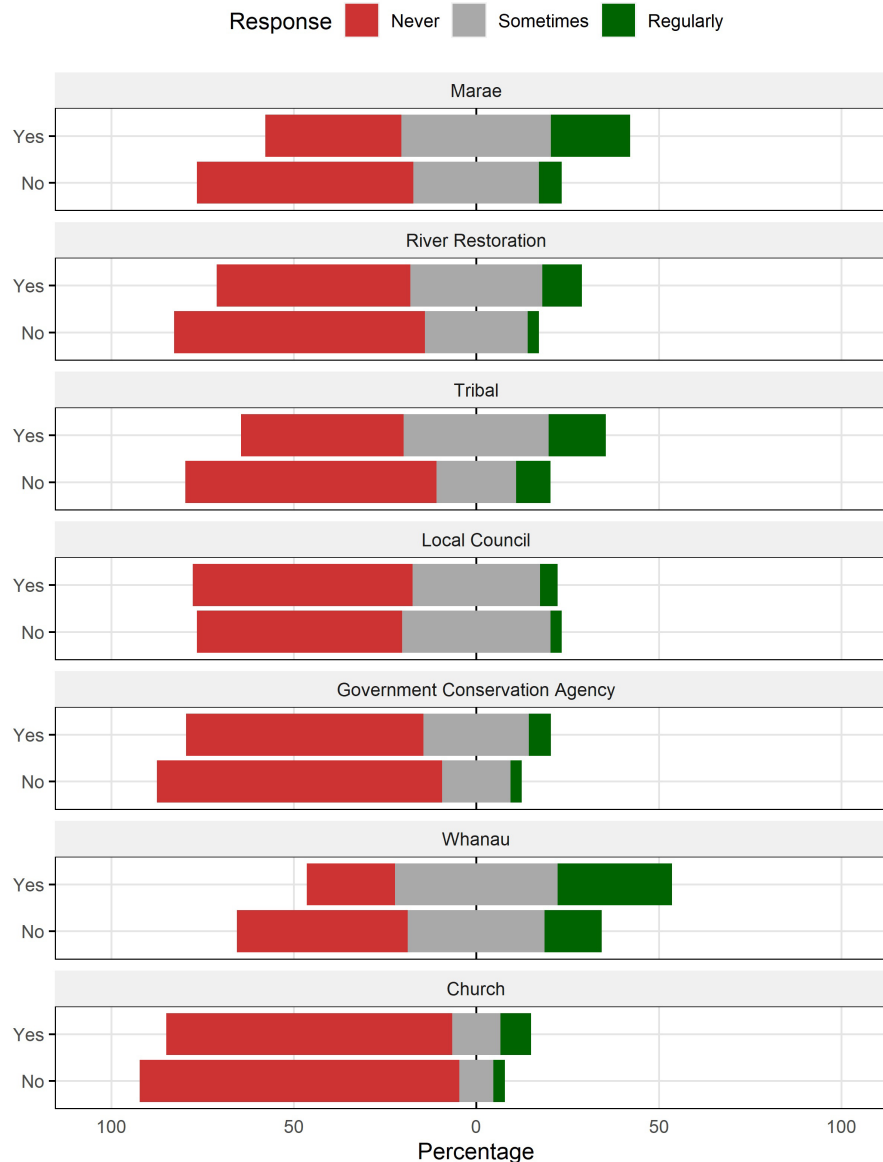


FIGURE 8 Exposure to Kaitiakitanga in childhood and restoration event attendance indicates that those who answered Yes, were more likely to attend whānau and Marae restoration events ($p=0.024$; $p=0.032$) and less likely to attend restoration events that were led by Local Councils ($OR=2.66$). $N=184$.

environmental activities reveal primary motivations such as creating and maintaining connection to nature, increased social interactions and independence. That is, older participants may have more opportunity to take part in restoration activities, while also seeking opportunities for social and cultural interaction. Because older Māori, as with other Indigenous peoples, are often holders of important mātauranga (knowledge) that could further support younger generations to grow their own confidence pertaining to kaitiakitanga, restoration and cultural practice, adding a cultural lens to restoration work could provide opportunities for younger Māori to learn, and support the confidence of varying age groups that are not well engaged in current restoration practices. Importantly, like examples from Australia, rediscovering knowledge through diverse cultural practices will support

the opportunity to foster and maintain connections between indigenous peoples, nature and important cultural knowledge (Ens et al., 2023).

5 | CONCLUSIONS

This research explored factors that can hinder or support engagement in urban restoration by Indigenous communities. It shows the value of including a biocultural lens to support Indigenous participation. Age, gender, location and childhood experiences influence the ways that Indigenous peoples connect to nature, and how often they do it, whilst they contend with the urban space itself. Voices and experiences of communities who are impacted need to be heard, to

better plan urban areas that recognize and respect the rich histories of indigenous communities and actively support the stewardship responsibilities of urban indigenous people.

Supporting Indigenous communities to lead restoration activities that embed cultural elements and tradition is important for supporting kaitiakitanga in urban spaces (McAllister et al., 2023; Walker et al., 2019). As one example, waiata and karakia, or the expression of other cultural practices, may be intertwined alongside physical restoration of nature with careful planning of restoration activities, essentially restoring nature and cultural knowledge simultaneously in urban space. This biocultural lens of restoration in cities will help to restore cultural knowledge, practice and heritage to sites that are important for urban Indigenous communities (Dawson et al., 2021; Reyes-García, 2023).

Cultural knowledge and practices are integral to not only welcome Indigenous communities into ecological restoration activities but also ensure generational stewardship in urban areas. Embracing kaitiakitanga as a foundation in these activities allows deeper consideration of the ways that restoration of nature can be impactful for generations to come and further prompts the exploration of appropriate practices suited to a range of age groups, knowledge levels and diverse experiences of urban communities. It further gives opportunity for those who may feel disconnected from the urban lands they live on to learn about the rich histories, practices and taonga (treasures) that exist in these places. It recognizes the integral role of social and cultural values, practices and knowledge in the conservation of nature, further supporting and maintaining the well-being of people and nature (Dawson et al., 2021; Reyes-García, 2023).

As challenges such as gentrification add to challenges of biodiversity loss (Rigolon & Németh, 2020; van Heezik et al., 2021), our research shows a clear opportunity to transform urban spaces through Indigenous concepts and knowledge, while also addressing impacts of age, urban and rural differences and childhood exposure to stewardship concepts. We argue that ecological restoration can both play an important role in supporting urban Indigenous peoples, and create pathways for Indigenous cultural practices and knowledge to thrive in urban areas, ensuring the longevity of knowledge and practices by generations of indigenous urban peoples. This encourages restoration practitioners, planners, policy makers and governance organizations of cities to engage directly with their indigenous communities and move beyond aesthetic representations of indigenous peoples and integrate indigenous knowledge, value systems and practices into the fabric and functions of urban areas.

AUTHOR CONTRIBUTIONS

Erana Walker, Priscilla M. Wehi and Hēmi Whaanga conceived the ideas and designed methodology; Erana Walker collected the data and analysed the data with Priscilla M. Wehi and Tim Jowett; Erana Walker and Priscilla M. Wehi led the writing of the manuscript. All authors contributed critically to the drafts and gave final approval for publication.

ACKNOWLEDGEMENTS

We would like to acknowledge and thank all survey participants who have contributed to this research by sharing experiences and knowledge of kaitiakitanga. We wish to thank Nicola Nelson for her contribution to this research project. Many thanks to Jenn Burt for providing code which we used to help shape the models. We thank the reviewers for their helpful comments. Erana Walker was supported by a Ph.D. scholarship from the People, Cities and Nature Programme (MBIE UOW1601), who also provided financial support for Hēmi Whaanga and Priscilla Wehi. Erana Walker was also provided support through the Te Pua Wananga ki te Ao Postgraduate Excellence Award. Priscilla Wehi was also funded by Te Aparangi Royal Society of New Zealand Rutherford Discovery Fellowship (14-LCR-001).

CONFLICT OF INTEREST STATEMENT

Priscilla Wehi is an Associate Editor for *People and Nature* but was not involved in the peer review and decision-making process pertaining to this manuscript.

DATA AVAILABILITY STATEMENT

Data pertaining to this research project will be archived on the University of Waikato cloud. As the data pertains to an indigenous group, we follow the CARE principles for data storage and use. Information pertaining to the content of the dataset can be viewed through <https://doi.org/10.6084/m9.figshare.26035798>. Access to the dataset must be requested from the corresponding author, Erana Walker.

ORCID

Erana Walker  <https://orcid.org/0000-0001-7790-8939>

Tim Jowett  <https://orcid.org/0000-0001-7146-5188>

Hēmi Whaanga  <https://orcid.org/0000-0002-5415-9960>

Priscilla M. Wehi  <https://orcid.org/0000-0001-9821-8160>

REFERENCES

- Abas, A., Aziz, A., & Awang, A. (2022). A systematic review on the local wisdom of indigenous people in nature conservation. *Sustainability (Basel, Switzerland)*, 14(6), 3415. <https://doi.org/10.3390/su14063415>
- Allred, B. W., Smith, W., Twidwell, D., Haggerty, J. H., Running, S. W., Naugle, D. E., & Fuhlendorf, S. D. (2015). Ecosystem services lost to oil and gas in North America. *Science (American Association for the Advancement of Science)*, 348(6233), 401–402. <https://doi.org/10.1126/science.aaa4785>
- Arora, K. (2018). *Indigenous forest management in the Andaman and Nicobar Islands, India* (1st ed.). Springer International Publishing. <https://doi.org/10.1007/978-3-030-00033-2>
- Bedford, R., Didham, R., Ho, E., & Hugo, G. (2004). Māori internal and international migration at the turn of the century: An Australasian perspective. *New Zealand Population Review*, 30(1&2), 131–141.
- Berkes, F. (2012). *Sacred ecology*. Routledge. <https://doi.org/10.4324/9780203123843>
- Berkes, F., Colding, J., & Folke, C. (2000). Rediscovery of traditional ecological knowledge as adaptive management. *Ecological Applications*, 10(5), 1251–1262. <https://doi.org/10.2307/2641280>

- Biernacki, P., & Waldorf, D. (2016). Snowball sampling: Problems and techniques of chain referral sampling. *Sociological Methods & Research*, 10(2), 141–163. <https://doi.org/10.1177/00491241810100020>
- Biggs, B. (2013). *English–Maori, Maori–English dictionary* (4th ed.). Auckland University Press.
- Braun, V., & Clarke, V. (2021). *Thematic analysis*. SAGE Publications Ltd.
- Brondízio, E. S., Aumeeruddy-Thomas, Y., Bates, P., Carino, J., Fernández-Llamazares, Á., Farhan Ferrari, M., Galvin, K., Reyes-García, V., McElwee, P., Molnár, Z., Samakov, A., & Babu Shrestha, U. (2021). Locally based, regionally manifested, and globally relevant: Indigenous and local knowledge, values, and practices for nature. *Annual Review of Environment and Resources*, 46(1), 481–509. <https://doi.org/10.1146/annurev-environ-012220-012127>
- Brooks, M., Kristensen, K., Benthem, K., Magnusson, A., Berg, C., Nielsen, A., Skaug, H., Mächler, M., & Bolker, B. (2017). glmmTMB balances speed and flexibility among packages for zero-inflated generalized linear mixed modeling. *The R Journal*, 9(2), 378. <https://doi.org/10.32614/RJ-2017-066>
- Christensen, R. H. B. (2019). *Ordinal—Regression models for ordinal data*. R package version 2019.12-10.
- Clarkson, B. D., Wehi, P. M., & Brabyn, L. K. (2007). *Bringing nature back into cities: urban land environments, indigenous cover and urban restoration*. CBER Contract Report No. 52. The University of Waikato.
- Cohen, N., & Arieli, T. (2011). Field research in conflict environments: Methodological challenges and snowball. *Journal of Peace Research*, 48(4), 423–435. <https://doi.org/10.1177/0022343311405698>
- Cox, D. T. C., & Gaston, K. J. (2015). Likeability of garden birds: Importance of species knowledge & richness in connecting people to nature. *PLoS One*, 10(11), e0141505. <https://doi.org/10.1371/journal.pone.0141505>
- Cox, D. T. C., Shanahan, D. F., Hudson, H. L., Fuller, R. A., Anderson, K., Hancock, S., & Gaston, K. J. (2017). Doses of nearby nature simultaneously associated with multiple health benefits. *International Journal of Environmental Research and Public Health*, 14(2), 172. <https://doi.org/10.3390/ijerph14020172>
- Cox, D. T. C., Shanahan, D. F., Hudson, H. L., Fuller, R. A., & Gaston, K. J. (2018). The impact of urbanisation on nature dose and the implications for human health. *Landscape and Urban Planning*, 179, 72–80. <https://doi.org/10.1016/j.landurbplan.2018.07.013>
- Cuerrier, A., Turner, N. J., Gomes, T. C., Garibaldi, A., & Downing, A. (2015). Cultural keystone places: Conservation and restoration in cultural landscapes. *Journal of Ethnobiology*, 35(3), 427–448.
- Dadvand, P., Bartoll, X., Basagaña, X., Dalmau-Bueno, A., Martínez, D., Ambros, A., Cirach, M., Triguero-Mas, M., Gascon, M., Borrell, C., & Nieuwenhuijsen, M. J. (2016). Green spaces and general health: Roles of mental health status, social support, and physical activity. *Environment International*, 91, 161–167. <https://doi.org/10.1016/j.envint.2016.02.029>
- Dawson, N., Coolsaet, B., Sterling, E., Loveridge, R., Nicole, D., Wongbusarakum, S., Sangha, K., Scherl, L., Phan, H. P., & Zafra-Calvo, N. (2021). The role of indigenous peoples and local communities in effective and equitable conservation. *Ecology and Society*, 26(3), 19.
- Deluze, A. K., Enos, K., Mossman, K., Gunasekera, I., Espiritu, D., Jay, C., Jackson, P., Connelly, S., Han, M. H., Giardina, C. P., McMillen, H., & Meyer, M. A. (2023). Urban 'Āina: An indigenous, biocultural pathway to transforming urban spaces. *Sustainability (Basel, Switzerland)*, 15(13), 9937. <https://doi.org/10.3390/su15139937>
- Ens, E. J., Rossetto, M., & Costello, O. (2023). Recognising Indigenous plant-use histories for inclusive biocultural restoration. *Trends in Ecology & Evolution*, 38(10), 896–898.
- Fitzgerald, S. J. (2015). *Native women and land: Narratives of dispossession and resurgence*. UNM Press.
- Foley, J. A., DeFries, R., Asner, G. P., Barford, C., Bonan, G., Carpenter, S. R., Chapin, F. S., Coe, M. T., Daily, G. C., Gibbs, H. K., Helkowski, J. H., Holloway, T., Howard, E. A., Kucharik, C. J., Monfreda, C., Patz, J. A., Prentice, I. C., Ramankutty, N., & Snyder, P. K. (2005). Global consequences of land use. *Science (American Association for the Advancement of Science)*, 309(5734), 570–574. <https://doi.org/10.1126/science.1111772>
- Fox, C. A., Reo, N. J., Turner, D. A., Cook, J., Dituri, F., Fessell, B., Jenkins, J., Johnson, A., Rakena, T. M., Riley, C., Turner, A., Williams, J., & Wilson, M. (2017). 'The river is us; the river is in our veins': Re-defining river restoration in three indigenous communities. *Sustainability Science*, 12(4), 521–533. <https://doi.org/10.1007/s11625-016-0421-1>
- Gagliardi, C., Pillemer, K., Gambella, E., Piccinini, F., & Fabbietti, P. (2020). Benefits for older people engaged in environmental volunteering and socializing activities in City parks: Preliminary results of a program in Italy. *International Journal of Environmental Research and Public Health*, 17(11), 3772. <https://doi.org/10.3390/ijerph17113772>
- Gagné, N. (2013). *Being Maori in the city: Indigenous everyday life in Auckland*. University of Toronto Press.
- Garnett, S. T., Burgess, N. D., Fa, J. E., Fernández-Llamazares, Á., Molnár, Z., Robinson, C. J., Watson, J. E. M., Zander, K. K., Austin, B., Brondízio, E. S., Collier, N. F., Duncan, T., Ellis, E., Geyle, H., Jackson, M. V., Jonas, H., Malmer, P., McGowan, B., Sivongxay, A., & Leiper, I. (2018). A spatial overview of the global importance of Indigenous lands for conservation. *Nature Sustainability*, 1(7), 369–374. <https://doi.org/10.1038/s41893-018-0100-6>
- Gould, R., Pai, M., Muraca, B., & Chan, K. (2019). He 'ike 'ana ia i ka pono (it is a recognizing of the right thing): How one indigenous worldview informs relational values and social values. *Sustainability Science*, 14(5), 1213–1232. <https://doi.org/10.1007/s11625-019-00721-9>
- Grimm, N. B., Faeth, S. H., Golubiewski, N. E., Redman, C. L., Wu, J., Bai, X., & Briggs, J. M. (2008). Global change and the ecology of cities. *Science (American Association for the Advancement of Science)*, 319(5864), 756–760. <https://doi.org/10.1126/science.1150195>
- Haami, B., & Te Whānau o Waipareira Trust, issuing body. (2018). *Urban Māori: The second great migration*. Oratia 304 Books.
- Hall, M., Wehi, P., Whaanga, H., Walker, E., Koia, J., & Wallace, K. (2021). Promoting social and environmental justice to support Indigenous partnerships in urban ecosystem restoration. *Restoration Ecology*, 29(1), e13305. <https://doi.org/10.1111/rec.13305>
- Harcourt, N., Awatere, S., Hyslop, J., Taura, Y., Wilcox, M., Taylor, L., Rau, J., & Timoti, P. (2021). Correction to: Kia Manawaroa Kia Puawai: Enduring Māori livelihoods. *Sustainability Science*, 17(3), 1135. <https://doi.org/10.1007/s11625-021-01060-4>
- Harris, A. (2004). *Hiko: Forty years of Māori protest*. Huia Publishers.
- Henwood, W., Moewaka-Barnes, H., Brockbank, T., Gregory, W., Hooper, K., & McCreanor, T. (2016). Ko Tāngonge Te Wai: Indigenous and technical data come together in restoration efforts. *EcoHealth*, 13(4), 623–632. <https://doi.org/10.1007/s10393-016-1170-4>
- Isbell, F., Balvanera, P., Mori, A. S., He, J., Bullock, J. M., Regmi, G. R., Seabloom, E. W., Ferrier, S., Sala, O. E., Guerrero-Ramírez, N. R., Tavella, J., Larkin, D. J., Schmid, B., Outhwaite, C. L., Pramual, P., Borer, E. T., Loreau, M., Omotoriogun, T. C., Obura, D. O., ... Vergara, P. M. (2023). Expert perspectives on global biodiversity loss and its drivers and impacts on people. *Frontiers in Ecology and the Environment*, 21(2), 94–103. <https://doi.org/10.1002/fee.2536>
- Ives, C. D., Giusti, M., Fischer, J., Abson, D. J., Klaniecki, K., Dorninger, C., Laudan, J., Barthel, S., Abernethy, P., Martín-López, B., Raymond, C. M., Kendal, D., & von Wehrden, H. (2017). Human–nature connection: A multidisciplinary review. *Current Opinion in Environmental Sustainability*, 26–27, 106–113. <https://doi.org/10.1016/j.cosust.2017.05.005>
- Jackson, W., & Ormsby, A. (2017). Urban sacred natural sites—A call for research. *Urban Ecosystems*, 20(3), 675–681.

- Jennings, V., Johnson, G., & Gragg, R. (2012). Promoting environmental justice through urban green space access: A synopsis. *Environmental Justice*, 5(1), 1–7.
- Kawharu, M. (2000). Kaitiakitanga: A Māori anthropological perspective of the Māori socio-environmental ethic of resource management. *The Journal of the Polynesian Society*, 109(4), 349–370.
- Kearney, A., Brady, L., & Bradley, J. (2018). A place of substance: Stories of indigenous place meaning in the Southwest Gulf of Carpentaria, northern Australia. *Journal of Anthropological Research*, 74(3), 360–387.
- Kukutai, T. (2013). The structure of urban Maori identities. In E. Peters & C. Anderson (Eds.), *Indigenous in the city: Contemporary identities and cultural innovation* (pp. 311–333). UBC Press.
- Li, T., Shilling, F., Thorne, J., Li, F., Schott, H., Boynton, R., & Berry, A. M. (2010). Fragmentation of China's landscape by roads and urban areas. *Landscape Ecology*, 25(6), 839–853. <https://doi.org/10.1007/s10980-010-9461-6>
- Lyver, P. O. (2008). Tūhoe Tuawhenua mātauranga of kererū (Hemiphaga novaezealandiae novaezealandiae) in Te Urewera. *New Zealand Journal of Ecology*, 32(1), 7–17.
- Mao, D., Wang, Z., Wu, J., Wu, B., Zeng, Y., Song, K., Yi, K., & Luo, L. (2018). China's wetlands loss to urban expansion. *Land Degradation & Development*, 29(8), 2644–2657. <https://doi.org/10.1002/ldr.2939>
- Marsden, M., & Henare, T. A. (1992). *Kaitiakitanga: A definitive introduction to the holistic world view of the Māori*. Ministry for the Environment.
- Marselle, M. R., Bowler, D. E., Watzema, J., Eichenberg, D., Kirsten, T., & Bonn, A. (2020). Urban street tree biodiversity and antidepressant prescriptions. *Scientific Reports*, 10(1), 22445. <https://doi.org/10.1038/s41598-020-79924-5>
- McAllister, T., Hikuroa, D., & Macinnis-Ng, C. (2023). Connecting science to indigenous knowledge: Kaitiakitanga, conservation, and resource management. *New Zealand Journal of Ecology*, 47(1), 3521. <https://doi.org/10.20417/nzjecol.47.3521>
- Moewaka-Barnes, H. M. (2000). Kaupapa maori: explaining the ordinary. In L. Pihama, S. Tiakiwai, & K. Southey (Eds.), *Kaupapa rangahau: A reader. A collection of readings from the Kaupapa Rangahau workshops series*. Te Kotahi Research Institute.
- Morishige, K., Andrade, P., Pascua, P., Steward, K., Cadiz, E., Kapono, L., & Chong, U. (2018). Nā kilo 'Āina: Visions of biocultural restoration through Indigenous relationships between people and place. *Sustainability (Basel, Switzerland)*, 10(10), 3368. <https://doi.org/10.3390/su10103368>
- Nejad, S., Walker, R., & Newhouse, D. (2020). Indigenous 311 place-making and the built environment: Toward transformative urban design. *Journal of Urban Design*, 25(4), 433–442. <https://doi.org/10.1080/13574809.2019.1641072>
- Peters, M., Hamilton, D., & Eames, C. (2015). Action on the ground: A review of community environmental groups' restoration objectives, activities and partnerships in New Zealand. *New Zealand Journal of Ecology*, 39(2), S1–S2.
- Pihama, L., Tiakiwai, S., & Southey, K. (2015). *Kaupapa rangahau: A reader. A collection of readings from the Kaupapa Rangahau workshops series*. Te Kotahi Research Institute.
- R Core Team. (2020). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing. <https://www.R-project.org>
- Rey, J., & Harrison, N. (2018). Sydney as an Indigenous place: 'Goanna walking' brings people together. *AlterNative: An International Journal of Indigenous Peoples*, 14(1), 81–89.
- Reyes-García, V. (2023). Indigenous and local knowledge contributions to social ecological systems' management. In S. Villamayor-Tomas & R. Muradian (Eds.), *The Barcelona school of ecological economics and political ecology: A companion in honour of Joan Martinez-Alier* (pp. 71–81). Springer.
- Rigolon, A., & Németh, J. (2020). Green gentrification or 'just green enough': Do park location, size and function affect whether a place gentrifies or not? *Urban Studies (Edinburgh, Scotland)*, 57(2), 402–420. <https://doi.org/10.1177/0042098019849380>
- Roberts, M. (2013). Ways of seeing: Whakapapa. Sites: A Journal of Social Anthropology and Cultural Studies, 10(1), 93–120. <https://doi.org/10.11157/sites-vol10iss1id236>
- Roberts, M., Norman, W., Minhinnick, N., Wihongi, D., & Kirkwood, C. (1995). Kaitiakitanga: Maori perspectives on conservation. *Pacific Conservation Biology*, 2(1), 7. <https://doi.org/10.1071/PC950007>
- Ryks, J., Pearson, A., & Waa, A. (2016). Mapping urban Māori: A population based study of Māori heterogeneity. *New Zealand Geographer*, 72(1), 28–40.
- Ryks, J., Simmonds, N., & Whitehead, J. (2019). Cities and indigenous communities. In *Handbook of global urban health* (1st ed., pp. 283–296). Routledge. <https://doi.org/10.4324/9781315465456-18>
- Selby, R., Moore, P., Mulholland, M., & Wānanga-o-Raukawa, T. (2010). *Māori and the environment: Kaitiaki*. Huia.
- Shochat, E., Lerman, S. B., Anderies, J. M., Warren, P. S., Faeth, S. H., & Nilon, C. H. (2010). Invasion, competition, and biodiversity loss in urban ecosystems. *BioScience*, 60(3), 199–208. <https://doi.org/10.1525/bio.2010.60.3.6>
- Simpson, M. L., Oetzel, J., Wilson, Y., Nock, S., Johnston, K., & Reddy, R. (2022). Codesigning a culture-centered age-friendly community for Māori Kaumātua: Cultural principles and practices. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences*, 77(12), 2265–2275. <https://doi.org/10.1093/geronb/gbac092>
- Soga, M., & Gaston, K. J. (2016). Extinction of experience: The loss of human–nature interactions. *Frontiers in Ecology and the Environment*, 14(2), 94–101. <https://doi.org/10.1002/fee.1225>
- Stats NZ. (2018). *Hamilton city*. <https://www.stats.govt.nz/tools/2018-census-place-summaries/hamilton-city>
- Stats NZ. (2021a). *Auckland's population falls for the first time*. <https://www.stats.govt.nz/news/aucklands-population-falls-for-the-first-time>
- Stats NZ. (2021b). *Te Pā Harakeke: Māori housing and wellbeing 2021*. <https://www.stats.govt.nz/reports/te-pa-harakeke-maori-housing-and-wellbeing-2021>
- Taylor, S. J., Bogdan, R., & DeVault, M. (2015). *Introduction to qualitative research methods: A guidebook and resource* (4th ed.). Wiley.
- Thompson, K., Hill, C., Ojeda, J., Ban, N., Picard, C., & Belgrano, A. (2020). Indigenous food harvesting as social–ecological monitoring: A case study with the Gitga'at First Nation. *People and Nature (Hoboken, N.J.)*, 2(4), 1085–1099. <https://doi.org/10.1002/pan3.10135>
- van Heezik, Y., Freeman, C., Falloon, A., Battered, Y., & Heyzer, A. (2021). Relationships between childhood experience of nature and green/blue space use, landscape preferences, connection with nature and pro-environmental behavior. *Landscape and Urban Planning*, 213, 104135.
- Walker, E., Wehi, P., Nelson, N., Beggs, J., & Whaanga, H. (2019). Kaitiakitanga, place and the urban restoration agenda. *New Zealand Journal of Ecology*, 43(3), 1–8. <https://doi.org/10.2307/26841824>
- Warbrick, I., Makiha, R., Heke, D., Hikuroa, D., Awatere, S., & Smith, V. (2023). Te Maramataka—An indigenous system of attuning with the environment, and its role in modern health and well-being. *International Journal of Environmental Research and Public Health*, 20(3), 2739. <https://doi.org/10.3390/ijerph20032739>
- Watene, K. (2022). *Reimagining the human-environment relationship: Indigenous philosophy and intergenerational justice*. http://collections.unu.edu/eserv/UNU:8829/UNUUNEP_Watene_RHER.pdf
- Wehi, P., Cox, M., Whaanga, H., & Roa, T. (2023). Tradition and change: Celebrating food systems resilience at two Indigenous Māori community events. *Ecology and Society*, 28(1). <https://doi.org/10.5751/ES-13786-280119>
- Wehi, P., & Lord, J. (2017). Importance of including cultural practices in ecological restoration. *Conservation Biology*, 31(5), 1109–1118. <https://doi.org/10.1111/cobi.12915>

- Whyte, K. (2013). Justice forward: Tribes, climate adaptation and responsibility. *Climatic Change*, 120(3), 517–530. <https://doi.org/10.1007/s10584-013-0743-2>
- Williams, H. W. (2000). *A dictionary of the Maori language* (7th ed./revised and augmented by the Advisory Committee on the Teaching of the Maori Language, Department of Education.). Legislation Direct.
- Williams, M. (2015). *Panguru and the city: Kāinga tahi, kāinga rua: An urban migration history* (1st ed.). Bridget Williams Books.
- Wright, S. (2014). *Our ice is vanishing/sikuvut nunguliqtuq: A history of inuit, newcomers, and climate change*. ProQuest Ebook Central. <https://ebookcentral-proquestcom.ezproxy.waikato.ac.nz>

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

Table S1: Supplementary questions developed to shape models were as follows.

Table S2: Questions from the survey that were used to inform the supplementary and overarching questions posed in this work, and to create the figures.

Table S3: Age ranges used for all survey participants (including non-Māori), and distribution of participants as a percentage of the total across these age ranges (total $n=244$).

Table S4: Location of all survey participants (including non-Māori), as a percentage of the total number of survey participants, at the time that they completed the survey in 2018 (total $n=244$).

How to cite this article: Walker, E., Jowett, T., Whaanga, H., & Wehi, P. M. (2024). Cultural stewardship in urban spaces: Reviving Indigenous knowledge for the restoration of nature. *People and Nature*, 6, 1696–1712. <https://doi.org/10.1002/pan3.10683>