



## Kua takoto te mānuka: mātauranga Māori in New Zealand ecology

Tara G. McAllister<sup>1,2\*</sup> , Jacqueline R. Beggs<sup>3,4</sup> , Shaun Ogilvie<sup>5,6</sup> , Rauru Kirikiri<sup>7</sup>,  
Amanda Black<sup>8,9</sup> and Priscilla M Wehi<sup>2,10,11\*</sup> 

<sup>1</sup>Te Aitanga a Māhaki, Ngāti Porou

<sup>2</sup>Te Pūnaha Matatini Centre of Research Excellence for Complex Systems, University of Auckland, PO Box 92019, Auckland 1142, New Zealand

<sup>3</sup>Ngāti Awa

<sup>4</sup>Centre for Biodiversity and Biosecurity, School of Biological Sciences, University of Auckland, PO Box 92019, Auckland 1142, New Zealand

<sup>5</sup>Ngāti Awa, Te Arawa

<sup>6</sup>Cawthron Institute, 98 Halifax St, Nelson, New Zealand

<sup>7</sup>Te Whānau a Āpanui

<sup>8</sup>Tūhoe, Te Whakatōhea, Te Whānau a Āpanui

<sup>9</sup>Bio Protection Research Centre, Lincoln University, PO Box 84, Lincoln 7647, Christchurch, New Zealand

<sup>10</sup>Clans McDonald and Malcolm; also affiliated to Waikato-Tainui me Tūhoe

<sup>11</sup>Manaaki Whenua - Landcare Research, Private Bag 1930, Dunedin 9054, New Zealand

\*Authors for correspondence (Emails: tara.mcallister0@gmail.com; WehiP@landcareresearch.co.nz)

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**Auheke:** Mō te whakarauora i te taiao o Aotearoa me whakaū, me whakamana i te mātauranga o te hunga Māori. Nō nā tata nei, tē kitea i tēnei momo mātauranga ki ngā mahi pūtaiao, ngā mahi whakarauora taiao hoki o Aotearoa whānui. Mā te mahitahi ki ngā whānau, hapū me ngā iwi o te hunga Māori, ka kitea te huanga o ēnei aho mātauranga mo te oranga tonutanga o te hunga tangata me te taiao. Tekau mā toru ngā tuhinga kua whakakao mai mō tēnei whakaputanga. Mā ngā tuhinga o tēnei whakaputanga e whakatauiria i ngā momo ara taunaki i te whanaungatanga o te hunga Māori me te hunga pūtaiao. Waihoki, hei whakapūmau i te mātauranga o te Māori ki tēnei whakaputanga, kua tuhia ngā auheke mo ia tuhinga roa ki te reo Māori. Ka mutu, mā ēnei tuhinga e mirimiri i te hirikapo hei whakaoho i ngā mahi rangahau mo ngā mahi pūtaiao ā-Māori nei. Ko te pae tawhiti o tēnei whakaputanga he whakapātaritari i te hunga mātai hauropi ki te taunaki i te mātauranga Māori. Mā te whakaora i te whanaungatanga ki waenga i te iwi Māori ka ora ngā ōhaki o te iwi Māori, waihoki, te taiao o Aotearoa whānui.

**Abstract:** Mātauranga Maori, a knowledge system incorporating Maori philosophical thought, worldview and practice, provides important insight and practice and is vital for understanding and managing Aotearoa New Zealand's ecosystems. Yet, until recently, it has remained largely invisible to mainstream ecologists and resource managers in Aotearoa. Partnering with Maori and incorporating mātauranga into ecological research offers an additional dimension to neoclassical science, which we argue leads to better outcomes for society and the environment. This special issue brings together 13 papers that highlight key concepts and provide exemplars of good practice, which demonstrate development of authentic, long-term partnerships with Maori. The special issue itself has provided space for such scholarship, which does not necessarily align with western ideas of science, and has fostered the use of the Maori language by all papers having abstracts published in te reo Maori. Importantly, one of the key aims of this special issue is to stimulate further activity and research in this area. We contend that further research in this area will not only support Maori environmental and social aspirations but will also lead to holistic, enduring solutions for managing the unique biodiversity and ecosystems in Aotearoa. The challenge ahead for ecologists is to develop more widespread and effective partnerships with Maori and deeper understandings of mātauranga Maori.

**Keywords:** Community partnerships, Indigenous knowledge, Indigenous peoples, IPBES, social-ecological systems, traditional ecological knowledge

## Introduction

Globally there is growing recognition of the benefits that Indigenous peoples, knowledge systems and worldviews can bring to ecological research (Timoti et al. 2017; Whyte et al. 2016). Indigenous knowledge of, and connection to land and marine environments, which is transmitted intergenerationally, offers deep temporal and spatial insights that can help to re-shape our understanding of biodiversity, and thus create new pathways to slow biodiversity loss (e.g. Ban In Press). When modern Aotearoa New Zealand (hereafter referred to as Aotearoa) was founded through the signing of Te Tiriti o Waitangi in 1840, a new relationship between two cultures and two systems of law and morality was forged (Bioethics Panel 2019). Te Tiriti affirms and promises to uphold the mana (customary authority), tino rangatiratanga (leadership), and tikanga (law) of Māori, and commits to a relationship of equal partnership between Māori chiefs and the British Crown (Bioethics Panel 2019). In particular, Article Two guarantees ‘tino rangatiratanga’ in relation to lands and taonga, including the Indigenous language te reo Māori, flora, fauna, and mātauranga (Waitangi Tribunal 2011). As such, Te Tiriti o Waitangi provides a foundation for the inclusion of mātauranga, ethics, and tikanga in research.

Mātauranga Māori is an Indigenous knowledge system that incorporates Māori philosophical thought, worldview, and practice (Marsden & Henare 1992; Royal 2009). As such, traditional knowledge provides important insights for understanding and managing the unique ecosystems of Aotearoa (Lyver et al. 2008; Timoti et al. 2017; Clapcott et al. 2018; Wehi et al. 2018). However, mātauranga Māori has remained largely invisible in the body of ecological research produced by scientific researchers in Aotearoa. This absence is despite the significant benefits Indigenous and diverse perspectives bring to research. A search of past issues of the Proceedings of the Ecological Society and New Zealand Journal of Ecology from 1953 to 2018 revealed only three published papers that featured research partnerships with Māori and/or acknowledged and explored mātauranga Māori in a meaningful way (Wehi et al. 2019a). These have now been re-published in the New Zealand Journal of Ecology 2019 virtual issue ‘Ka mua, ka muri: the inclusion of mātauranga Māori in New Zealand ecology’. This search suggested that although excellent examples of this type of research have been published in other global journals (see Wehi 2009; O’Connell-Milne & Hepburn 2015; Harmsworth et al. 2016; Timoti et al. 2017), research that incorporates mātauranga or is conducted in partnership with Māori remains relatively uncommon and currently has a low profile in Aotearoa. The 2018 special issue of the New Zealand Journal of Marine and Freshwater Research that focused on mātauranga and the shaping of marine and freshwater futures (Clapcott et al. 2018) challenged this position, and noted the marginalisation of mātauranga that has occurred since European colonisation. Inspired by this example, we decided to address the dearth of mātauranga research in ecology more generally. Our vision is to continue growing the profile of this type of research in Aotearoa by highlighting ethical, collaborative research with Māori, and research that contributes to the revitalisation of both culture and biodiversity. Culture, language, and biodiversity itself are highly interlinked (e.g. Sutherland 2003; Maffi 2005; Wehi et al. 2018). In Aotearoa these connections are endemic, unique, and worth cherishing and uplifting to create positive

outcomes for te reo Māori (the Māori language), tikanga Māori (appropriate Māori processes), and ecosystems of Aotearoa.

This special issue of the New Zealand Journal of Ecology provides a snapshot of present research that reflects creative partnerships between both Māori and non-Māori scientists who have trained in neoclassical scientific methods and Māori community members. These community members include elders, leaders and many others who act as kaitiaki (environmental stewards; as in Te Urewera Act 2014) and advocate for biodiversity from a base of mātauranga and Indigenous ways of being, knowing and practice. Importantly, mātauranga incorporates a holistic approach, for instance spanning terrestrial and marine ecosystems and their interface, in a way that ecology in Aotearoa seldom achieves. Despite having a broader scope, the New Zealand Journal of Ecology publishes primarily on terrestrial ecosystems; however, we wished for a broader purview, so our call for papers in early 2019 was inclusive of all types of ecological research. Of the 38 abstracts initially submitted to the editorial team, we invited 27 author groups to submit a full manuscript for review. This invitation resulted in 13 manuscripts that we successfully assisted through the peer review process, and that we showcase in this special issue. The research in these papers spans communities and relationships from Ngāti Hine in the northern North Island, to Ngāti Peehi and Ngāti Te Kanawa in the west, to Tūhoe in the east, through to Taranaki in the mouth of North Island’s fish, in Wellington. It ranges further still to Ngāi Tahu in the South Island, before turning to cross the Pacific Ocean to the Quechua people of Peru. The authors discuss key concepts and provide exemplars of good practice, demonstrating the development of authentic, long-term partnerships with Māori. The papers highlight four common and interrelated themes; understanding ecosystems through te ao Māori (Māori worldview), research informed by mātauranga, use of te reo Māori in species names, and developing effective research partnerships with Māori. A critical and recurring theme was the discussion around what constitutes a good partnership, an important shift from past discussions that have focused on the requirement to partner with Māori. These papers offer an exciting insight into the future of ecology in Aotearoa.

## Understanding ecosystems through te ao Māori

Two-eyed seeing, as articulated by Canadian First Nations people (Bartlett 2012) is a powerful metaphor to assist people in conceptualising Indigenous and western knowledge systems and to uniquely combine the two in various ways. Two-eyed seeing can provide important insights for scientific research. Using this viewpoint, te ao Māori provides a different lens to enhance ecosystem management. Kahui et al. (2019) discuss how assigning legal personhood status to a natural ecosystem aligns with how Māori view themselves as an integral part of the ecosystem, rather than being separate from it. Legal personhood provides a governance framework such that activities of exploitation must be evaluated against impacts on the ecological health of the system as a whole. This framework is consistent with the Māori practice of guardianship of their land, rather than the ownership model commonly used by western countries. In 2017, the New Zealand parliament granted the Whanganui River legal personhood, thereby recognising the river as “an indivisible and living whole comprising the Whanganui River from the mountains to the sea” (Te Awa

Tupua 2017). Ecosystems as legal entities may provide a flexible and durable solution to the tragedy of the ecosystem commons where ‘free’ ecosystem services are degraded.

Kaitiakitanga can be described as place-based customary responsibilities and practices of Māori whose genealogical history connects them to land, based on principles of reciprocity and the desire to maintain these relationships for future generations. As such, kaitiakitanga embeds a vital link between Māori and Papatūānuku, who embodies the land itself, although Clapcott et al. (2018) contend that kaitiakitanga is the responsibility of all people in New Zealand. Walker et al. (2019) discuss how the speed and scale of urbanisation potentially disrupts relationships between people and their non-human kin. Loss of a close link to nature may damage the health and well-being of urban Māori; however, Walker et al. also highlight examples of how kaitiakitanga can be used to support ecological restoration of urban spaces. The authors consider how Māori living away from traditional tribal areas might enact kaitiakitanga, an important consideration if we are to improve environmental and human well-being outcomes in our strongly urbanised society.

Reihana et al. (2019) highlight ways that technology, specifically gamification, can increase environmental literacy and pro-environmental behaviours, thus addressing the increasing disconnection of Māori youth from the environment. Reihana et al. (2019) assert that increasing urban landscapes are resulting in a loss of external environmental interactions for youth, a consequence of which is a loss of emotional affinity to nature and a decline in pro-environmental behaviours, also known as ‘extinction of experience’. The authors successfully demonstrate, through their work with two Māori-medium schools, that Indigenous cultural frameworks and mechanisms can be transferred into digital platforms to mitigate the disconnection.

## Ecological research and mātauranga

Despite the paucity of published research combining ecology and mātauranga, we argue that using mātauranga alongside neoclassical or classical scientific approaches can re-shape our understanding of the environment, and thus create new pathways to address pressing environmental issues (Wehi et al. 2019a). This argument resonates with the work of Huambachano (2019), who uses the Khipu model to examine food sovereignty in Māori and Quechua communities in Aotearoa and Peru. Their study illustrates the importance of a continued connection between Indigenous communities and both traditional landscapes and intergenerational knowledge, linking the land, mātauranga, and yachay (Quechua knowledge system) to maintain traditional food practices. Huambachano (2019) highlights how loss of both land and sovereignty can detrimentally impact cultural systems. Through talking circles and wānanga with both Māori and Quechua people, she illustrates the deep-rooted connection of these Indigenous peoples with Papatūānuku and Pachamama (mother earth), which is driven by whakapapa (genealogy) and defines interactions with and care for the environment.

In their paper on traditional harvest, knowledge and management of tītī (sooty shearwaters, *Puffinus griseus*), Geary et al. (2019) illustrate that mātauranga Māori can provide valuable insights into historic abundance, contemporary ecology and conservation of species. The work of Geary et al. (2019) presents an important reminder that when Government

imposes a ban on the traditional harvest of a species, there is a subsequent decline in human interaction with that species. This loss of interaction degrades mātauranga and diminishes the potential contributions that Indigenous knowledge can make to the conservation and management of the species. This article also highlights that harvested species are highly-valued by Māori and therefore will be protected for future generations, as part of the harvest regime.

Ogilvie et al. (2019) undertook an oral gavage trial to assess the toxicity and humaneness of the New Zealand Indigenous plant extract tutin to Norway rats (*Rattus norvegicus*). In previous work, Pauling et al. (2009) used mātauranga to identify six native plants for their biologically active properties, both as toxins and medicines. The most promising of these plants for vertebrate pest control proved to be tutu (*Coriaria arborea*) containing the toxin tutin, a crystalline glucoside. As tutin is a toxin that naturally occurs in an Indigenous plant species, and is thus likely more culturally acceptable to Māori than synthetic toxins, Ogilvie et al. (2019) explored tutin as a potential control tool. Although the toxin was successful in a laboratory setting, further research is required to test whether a lethal dose is technically attainable in the field. This study highlights the value of mātauranga both to identify potential novel control tools and to develop culturally acceptable pest control.

Carter (2019) synthesises part of a research project in Te Waipounamu (South Island), Aotearoa to highlight Indigenous knowledge embedded in place names such as Matainaka, a place where Kāi Tahu (South Island Māori tribal group) gathered whitebait (inaaka, *Galaxias maculatus*): an important freshwater food resource species. In the landscape, mahika kai sites (resource gathering areas) are marked through place names, which act as central reference points (whai take) for a wider ecosystem catchment area and indicate changes over time. The project brought together Indigenous knowledge and science to find ways to improve future planning and adaptation for habitat restoration and modification, and to lessen impacts on inaaka spawning sites from the expected impacts of climate change.

## Use of te reo Māori in species names

The use of te reo Māori is critical to support the cultural aspirations of Māori and provides insight into Māori ways of knowing and doing. Although some scientists are beginning to acknowledge the importance of te reo Māori by creating scientific resources and writing abstracts in te reo (see Wehi et al. 2019a), we see potential for more widespread effort from the scientific community to support Māori language revitalisation. Globally, biodiversity and linguistic diversity are strongly linked (Maffi 2005), with both types of diversity facing drastic loss (Gorenflo et al. 2012; Tershy et al. 2015; Wilder et al. 2016). Linguists estimate up to 90% of the world’s languages will be extinct by the end of this century. Although there are signs of revitalisation, te reo Māori remains an endangered language (King 2018), and its loss would mean loss of mātauranga that otherwise could assist with the conservation of biodiversity.

Wehi et al. (2019b) discuss the use and value of Māori bird names in biodiversity reporting, demonstrating that there can be rapid uptake of these names. A wealth of ecological knowledge is embedded in bird names, from observations of behaviour to plant interactions and sexual dimorphism.

Wehi et al. (2019) point out that working with local Māori communities is important to support regional language variants that are often overlooked or ignored in national documents. The research suggests the need for a federated dataset of Māori bird names to be compiled and managed by local and regional Māori communities who will determine te reo names of species that are appropriate to a given area.

Veale et al. (2019) also explore the use of Indigenous languages in biology with a comprehensive review of the use of te reo Māori and tare Mori in the scientific naming of species that has taken place since European arrival in Aotearoa. The research tracks some of the changes in word use in scientific epithets, and highlights issues around naming that warrant attention. Highlighted are examples of Māori language use from the offensive to the pragmatic and beyond; the naming process has often not engaged with the appropriate Indigenous people. The authors emphasise the need for partnership with both Māori and Mori communities in naming new species that supports the full richness of engagement between people and nature and deepens species names and meanings.

## Developing effective research partnerships with Māori

A recurring and common theme of the papers in this special issue is the importance of co-development and co-creation of research through effective and meaningful partnerships with Māori. This special issue provides a broad range of examples that illustrate how scientists in Aotearoa can move beyond either no or one-off consultation with Māori, to a research process that acknowledges Māori as Treaty partners.

Collier-Robinson et al. (2019) show how kaupapa Māori principles can be meaningfully embedded in genomic research into two taonga species (Kēkēwai; freshwater crayfish, *Paranephrops zealandicus* / Kōwaro - Canterbury mudfish; *Neochanna burrowsius*). The authors co-developed a responsive research programme with Ngāi Tūāhuriri (hapū that are mana whenua / people with authority over the land from Hurunui to Hakatere in Te Waipounamu) that combines mātauranga with emerging genomic technologies and ecological data. The authors challenge researchers to build meaningful relationships with mana whenua and move beyond poorly thought out and executed consultation with Māori. Collier-Robinson et al. (2019) show that using a bicultural approach not only upholds the promises of Te Tiriti o Waitangi but also enriches research.

The importance of co-developing research with mana whenua (Taranaki whānui) is highlighted in Michel et al. (2019). Their case study of reconnecting mana whenua to a freshwater ecosystem documents how the Zealandia ecosanctuary has partnered with Taranaki whānui to restore native freshwater and forest ecosystems of the Kaiwharawhara stream catchment. Michel et al. (2019) show how both science and mātauranga Māori worked together to inform the translocation of kākahi (freshwater mussels, *Echyridella menziesii* and *E. aucklandica*). The authors also use narratives from both mana whenua and scientists, which provide insights into the successes and outcomes of this collaborative research.

Ratana et al. (2019) go further to provide an excellent example of how science can directly respond to the aspirations of Māori around ecological restoration. Working with Maniapoto (those affiliated to Ngāti Maniapoto, the Maniapoto Māori Trust Board, and Regional Management Committees) the

authors used participatory mapping approaches and wānanga/ interviews with mana whenua to capture mātauranga-ā-hapū surrounding wetlands and to develop a decision-support framework to help prioritise the restoration of ngā repo o Maniapoto (wetlands of Maniapoto). Ratana et al. (2019) illustrate how innovative scientific methods can assist Māori to reframe and prioritise their mātauranga to support iwi and hapū based decision-making, thus enabling the prioritisation of restoration efforts.

Similarly, Cisternas et al. (2019) developed a framework for amphibian conservation that was based on a successful partnership between mana whenua (Ngāti Peehi, Ngāti Te Kanawa and Te Hau Kainga o Pureora) and western science during the translocation of a native frog species (*Leiopelma archeyi*) in the King Country. The authors emphasise the importance of kanohi ki te kanohi or face-to-face collaboration to share experiences, skills and knowledge for long-term conservation gains.

## Challenges

As we collated the special issue, we encountered challenges along the way. Our shared vision was to support te reo Māori as a critical element of Māori identity now and in the future. We encouraged the use of regional dialects (see Carter et al. 2019), thereby promoting the integrity of te reo. Authors in the special issue (Veale et al. 2019; Wehi et al. 2019b) also examine the issue of regional dialects. Nevertheless, it became clear that it is not easy to foster the use of Indigenous languages in the global, technological world in which scientists publish and perish. We worried that we might disadvantage our authors by reducing the readership and searchability of articles, imposing an additional penalty on authors working in an already marginalised field (Roa et al. 2009). To mitigate the problem of searchability, macrons were omitted from English abstracts, but not from the te reo abstract or the main body of the article so that correct usage for these parts was maintained. We believed it was vitally important to provide an abstract in te reo Māori before the English version, so that te reo Māori was the first language heard and seen, even though that might reduce the uptake of the special issue. Our solution was to combine the English and te reo abstracts into one searchable entity that we hope supports both cultural integrity and the scientific aspirations of our authors. The monolingual focus of science generally disadvantages those who write and work in other languages and Māori are not alone in this regard. However, supporting the use of Indigenous languages in science is a critical contribution to maintaining cultural diversity, knowledge and different ways of interpreting the world. The issues we encountered when incorporating Indigenous languages into a western science framework exemplify some of the challenges faced by scientists who work with Indigenous knowledge.

## The future of mātauranga in ecology

Complex systems research on the United Nations Sustainable Development Goals demonstrates that prioritising social justice will create wins for biodiversity (Bennett et al. 2019; Dawes 2019). Being able to incorporate understandings from multiple knowledge systems is vital for a thorough understanding of the natural world (Allen et al. 2014), and therefore critical in

advancing ecology in Aotearoa. A core value in te ao Māori is manaakitanga (generosity / care / reciprocity); in this mindset we suggest a shift towards reciprocity between scientists and Māori. Such reciprocity will drive research towards a space where science is inclusive, and both scientists and Māori who are enacting customary practices and responsibilities can use all tools available (i.e. mātauranga and neoclassical science and technology).

At a recent hui (meeting), Sir Mason Durie discussed the nature of mātauranga and its strengths (Durie 2019). Strengths include the holistic approach of mātauranga, and the positive environmental relationships that are established by practitioners through observation and experience (Marsden & Henare 1992). Furthermore, mātauranga evolves over generations because human experience over time enhances knowledge (Given & Harris 1994; Berkes 1995; Huntington et al. 1999). Mātauranga is of fundamental importance as the continued persistence of Māori communities depends on detailed knowledge of their environment (Huntington & Mymrin 2001). This holistic understanding contrasts with the neoclassical science system where, environments are often compartmentalized and synergies across systems are seldom explored. In this instance, to help those present consider the nature of knowledge more deeply, Durie (2019) described mātauranga as centrifugal thinking, where everything moves outward, to give us a broader, holistic understanding of nature, whereas most neoclassical science is encapsulated within centripetal thinking, where everything moves inwards, to deeper knowledge about smaller parts of the system.

Conversation between mātauranga practitioners and scientists will continue to grow, focusing on both similarities and differences in perspectives. For example, Māori values express a relationship with nature grounded in the physical and spiritual dimensions of whakapapa, which differs from approaches that value nature in light of human agency (Bockstael & Watene 2016) or that are focused on biophysical data (Hikuroa 2017). Cross-cultural conversations provide opportunities to think beyond current limits, and allow transformation of ecological research. Durie's (2019) comments draw attention to the benefits of the position that we find ourselves in, with two knowledge systems through which to view and understand the world. In this way, ecologists have both a deeper appreciation of the world, and better understanding of our biases than when viewing through one lens alone. It is heartening that papers in this special issue stand as exemplars of cross-cultural conversations in action. They cover a spectrum of thinking from centripetal to centrifugal, and it is our hope that these conversations will continue to grow in strength, with New Zealand leading global change.

The whakataukī (proverb) “Kua takoto te mānuka” in our title refers to the laying down of mānuka leaves (*Leptospermum scoparium*) as part of a wero (traditional challenge). The wero that we lay here challenges ecologists to develop more widespread and effective partnerships with Māori, taking inspiration from the mātauranga and partnerships exemplified in this special issue. We demonstrate through this special issue that there is significant potential for mātauranga and research co-developed with Māori to inform and positively influence both our understanding of the ecology and management of the unique ecosystems in Aotearoa. The large number of abstracts submitted to this special issue highlight the need to create space for research that integrates mātauranga and western science and is responsive to Māori aspirations. We hope that, in the future, papers like those included in this

special issue will be regularly included in regular issues of the New Zealand Journal of Ecology and other New Zealand journals. The appointment of an editor with specific expertise in mātauranga and co-developing research with Māori would assist in advancing this aspiration.

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Editorial board member: George Perry