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Enhancing the sustainability science agenda through Indigenous methodology

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Abstract

The successful cohabitation of Indigenous and sustainability sciences has much to offer the contemporary world of sustainable development in Indigenous communities. While the potentiality of authentic and respectful combination of these two worlds has been advanced significantly within the literature, there is still a lack of meaningful uptake of the potential methods and outcomes within the sustainability science space. This article is grounded in our collective experience in undertaking a Kaupapa Māori research project (an Indigenous research framework that reflects an approach that is by, with, and for Māori) with Kāti Huirapa Rūnaka ki Puketeraki, a Māori tribal community in the South Island of New Zealand, to achieve their sustainable development aspirations. Our aim is to reflect on and share nuanced lessons in building trusting researcher/Indigenous community relationships. We identify three interdependent principles, framed within a kaupapa Māori perspective including (a) Toitū te mātauranga (processes of sustaining and valuing Māori knowledges), (b) Whakawhanaungatanga (processes of establishing relationships), and (c) Kotahitanga (processes of unity and collective action). This article offers insight into the potential of Indigenous/non-Indigenous collaborations that aims to contribute to meaningful transformation of sustainability science research more generally.

Keywords Indigenous knowledge and methodologies · Kaupapa Māori research · Sustainability science

Introduction

Globally and throughout the ages, Indigenous communities have nurtured and sustained themselves through the application of systematic socio-ecological knowledges (Johnson et al. 2016; Magni 2017; Martin 2017; Rout and Reid 2020; Smith et al. 2016). Such knowledges have been developed and maintained through direct contact with their respective territories and as such are intergenerational repositories of information informing the close relationship between Indigenous knowledge and sustainability (Ens et al. 2015; Harmsworth and Awatere 2013; Robinson et al. 2016; Sandoval-Rivera 2020). The perspectives identified in Indigenous knowledge systems and cultural practices that embody these Indigenous epistemologies offer sustainability science efficient, culturally and environmentally relevant research processes. This applies to the research methodologies and methods that draw from, and are responsive to, particular

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place-based configurations which are more capable of driving wider social change and regime shifts.

Today the world is faced with a number of 'wicked problems,' such as increasing demands of growing populations, access to clean water, food security and energy supply, resulting from a changing climate. These problems are complex, interrelated and difficult to solve without new ways of organising human societies, and an approach that recognises the significance of social and environmental justice for achieving sustainability (Ens et al. 2012; Johnson et al. 2016; Weber 2019; Wright et al. 2012). Science research, in general is increasingly recognising that a 'one size fits all' approach is not the most appropriate method of dealing with such problems, but rather transformative solutions emerge at the local level (Arsenault et al. 2018; Broadhead and Howard 2011; Mistry and Berardi 2016; Robinson et al. 2016). As such, the international science community is increasingly recognising the importance and validity of Indigenous, local, and traditional forms of knowledge for environmental sustainability. Calls for the inclusion of Indigenous knowledge systems in sustainability research come from both Indigenous communities and international scientific forums. For example, the Intergovernmental Panel on Climate Change (Adger et al. 2014; David-Chavez and Gavin 2018), Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, the Convention on Biological Diversity (Díaz et al. 2015; Tengö et al. 2017), and the Sustainable Development Goals (Magni 2017; Sandoval-Rivera 2020). In addition, there is a flourishing growth of place-based science research highlighting the important role Indigenous knowledges have in enhancing equitable and sustainable outcomes for Indigenous communities (Arsenault et al. 2018; Castleden et al. 2017; Diver 2017; Harmsworth et al. 2016; Maclean et al. 2021; McGreavy et al. 2021; Woodward et al. 2020).

The intersection of Indigenous knowledges and science research bring together complex and diverse value systems embodied within natural resource and environmental management, and advocacy for self-determination and Indigenous rights (Bohensky and Maru 2011; Ens et al. 2012). The capacity for science research and researchers, conditioned within Western conceptions of the world and science, to access and understand the cultural systems, languages and practices that necessarily come to the fore when Indigenous knowledges are engaged is limited (Broadhead and Howard 2011). While there may be acknowledgement of the potentiality of Indigenous knowledges to the field, sustainability scientists generally remain mystified by the intent and meaning of protocols and values in practice (Bohensky and Maru 2011; Robinson et al. 2016; Whyte et al. 2016; Woodward and McTaggart 2016). As a consequence, the field is in danger of merely "adding values or worthy objectives while retaining faith in its core investigative principles" which fail

to produced desired outcomes (Broadhead and Howard p 302). Similar sentiment is asserted by Ens et al. (2015), who advocate for care to avoid the scientising or distillation of Indigenous knowledges so far removed from localised systems of knowledge they become unrecognisable.

This article reflects on how the sustainability science research agenda can benefit from Indigenous research methodologies and associated methods that reside in practice. It does this through the context of a research project grounded in Kaupapa Māori research, an Indigenous methodology unique to Aotearoa New Zealand and centred in Indigenous Māori onto-epistemologies. As a relational research methodology that privileges Mātauranga Māori (Māori epistemology) and locates as central culturally attuned approaches to research (Ruwhiu and Cone 2010; Smith 2012; Walker et al. 2006), kaupapa Māori is an invaluable approach for meeting the collective objectives of both the researchers and the community. It operates as a research framework that reflects an approach that is 'for, with and by' Māori, unless otherwise decided by Māori (Henry and Foley 2018; Walker et al. 2006) meaning it must be valued by, and of value to Māori (Haitana et al. 2020).

The emphasis of this article is on the process of research, rather than the fieldwork per se, and is grounded in our collective experiences in codesigning Indigenous research with an Indigenous community. First, we seek to share our approach to an Indigenous methodology in the implementation of a research project conducted with Kāti Huirapa Rūnaka ki Puketeraki, a small Māori community located north of Ōtepoti/ Dunedin, a city in the South Island of Aotearoa New Zealand. Māori are the Indigenous peoples of Aotearoa New Zealand whose contemporary lives are still very much connected to traditional knowledge systems and practices. As with Indigenous communities around the world, Māori developmental aspirations have an emphasis on self-determination and are focused on building intergenerational investment and infrastructure to achieve long-term cultural, social, environmental and economic goals (Amoamo et al. 2018; Barr and Reid 2014). Contribution to and participation in the conceptualisation and practice of sustainability science research is a vital ingredient to the achievement of these aspirations.

A second objective of this article is to offer insight on the process of researching with Indigenous communities that we believe have applicability and transferability for sustainability science research. Of note, our research team was wholly Indigenous and as such we had experience with the knowledge systems, values and practices expected of Kaupapa Māori research. However, an Indigenous methodology requires self-reflection, because by its very nature it is context and place specific (Bishop 1996; Henry and Foley, 2018; Kovach 2015; Smith 2012), and regardless of our Indigenous affiliation we are not exempt from this process. In so doing, we respond to calls for sustainability science scholars to resist continued colonisation of the field, and

move from the theorising of Indigenous perspectives to the normalisation of research that incorporates multiple methodologies and worldviews.

Literature review

Colonisation and the subsequent stripping of land, resources and power from Indigenous peoples has ultimately led to a lack of economic independence that is an enduring barrier to achieving equity and social justice (Anderson et al. 2006, 2007; Missens et al. 2010; Paulin 2007). For Indigenous communities to be able to thrive economically, socially, politically and culturally, it is imperative that they are able to assert authority and control over their lands, natural resources and people (Arsenault et al. 2018; Paulin 2007). Connecting and engaging the power of Indigenous knowledges within the sustainability science agenda, creates and sustains the transformative potential of research committed to the maintenance of Indigenous sovereignty (Broadhead and Howard 2011; McGreavy et al. 2021; Maclean et al. 2021; Muller et al. 2019). In that light, sustainability sciences, informed and validated by Indigenous knowledges have the potential to achieve not only deeper modes of understanding and enacting of research processes for sustaining resilient natural landscapes (Ens et al. 2012; Mistry and Berardi 2016; Díaz et al. 2015), but also the capacity to meet the developmental aspirations of Indigenous communities (Johnson et al. 2016; Diver 2017; McGreavy et al. 2021). However, there remains challenges at the philosophical level of understanding and the practical implementation of Indigenous preferred methods of sustainability science (Arsenault et al. 2018; Ens et al. 2015). It is imperative that the field of sustainability science looks to the features of Indigenous methodologies to extrapolate best practice to inform the practical dimensions of sustainability science research with Indigenous communities.

Indigenous knowledges and sustainability science

Indigenous knowledge is 'living knowledge' (Ens et al. 2015; Ryder et al. 2020) and a meaningful expression of Indigenous identity (Smith et al. 2016). Characterized by its local and context-specific nature, oral and practice-based transmission, Indigenous knowledge is, and collectivised through, shared social memory situated within multiple and interlinked facets of people's lives and the world around them (Mistry and Berardi 2016). The utility of Indigenous knowledge has long been recognised as pivotal to traditional natural resource management and is now being integrated with Western scientific knowledge to affect a more collaborative approach to benefit communities (Bawaka Country et al. 2016; Ens et al. 2015; Kovach 2015; Harmsworth et al.

2016; Mercer et al. 2010; Watene 2016). One example is the recent acknowledgement of traditional burning practices that have guided collaborative efforts between the Australian State and Federal Government and Indigenous-led enterprise in responding to hazard management, carbon emission avoidance and biodiversity outcomes (Altman et al. 2020; Ens et al. 2012). Further, Arsenault et al. (2018) considers the development of new water governance frameworks, informed by First Nations research methods in Canada. In Aotearoa New Zealand, we have seen greater acceptance and implementation of Kaupapa Māori (Māori approaches) to fresh water management (Harmsworth et al. 2016).

Unlike scientific knowledge, which is reductionist in nature, Indigenous knowledge is deeply rooted in detailed, holistic and intergenerational observations of the natural world and its interactions (Broadhead and Howard 2011; Martin 2017; Mercer et al. 2010; Sandoval-Rivera 2020; Smith et al. 2016). Western views of sustainability still allow the possibility of domination and exploitation, appropriated for economic gain, embedded in a sense of detachment between humans and nature (Mazzocchi 2020; Mistry and Berardi 2016; Weber 2019; Whyte et al. 2016). Conversely, from an Indigenous perspective, the human–nature relationship is one of reciprocity, interdependence and stewardship appropriated as a means of survival (Harmsworth and Awatere 2013; Johnson et al. 2016; Mazzocchi 2020; Sandoval-Rivera 2020; Whyte et al. 2016). Humans and nature exist in an enlivened world that situates human beings in a web of dynamic, living and continuously emergent creative relationships, embodying a commons of mutual transformation (Weber 2019). As Indigenous knowledges become increasingly valued and used alongside some areas of Western science, more work remains to narrow the gap between Indigenous and Western scientific worldviews (Johnson et al. 2016; Magni 2017; Mercer et al. 2010; Whyte et al. 2016).

Evidence suggests a shift in some of the hard sciences towards accepting Indigenous ways of thinking as complementary rather than oppositional, enabling different understandings of reality (Rout and Reid 2020). Diverse, place-based ways of knowing can be recognised and incorporated with integrity to understand and manage sustainability (Robinson et al. 2016). Such approaches are founded on a respectful and considered weaving together of diverse knowledges (Arsenault et al. 2018; Tengö et al. 2017), to facilitate effective knowledge co-production (Maclean et al. 2021). Recent examples of successful engagement of Indigenous knowledges and sustainability sciences are evident in natural resource management associated with the preservation and sustainability of water (see Castleden et al. 2017; Harmsworth et al. 2016; Maxwell et al. 2020) and land-based resources (see Diver 2017; Ens et al. 2012). In addition, there is growing recognition of the relationship between Indigenous knowledges, sustainability and socio-economic

development of Indigenous communities (Altman et al. 2020; Maclean et al. 2019; Mika and Scheyvens 2021; Sylvester et al. 2020; Whyte et al. 2016).

Indigenous knowledge is, by its very nature, distinctly place-based and intergenerational and can thus make a valuable contribution to sustainability science (Johnson et al 2016; Mercer et al. 2010; Sandoval-Rivera 2020; Whyte et al. 2016; Woodward and McTaggart 2016). It offers traditional science a new lens through which to look at sustainability, along with new ways to seek and capture this knowledge which is responsive to Indigenous beliefs, assumptions and epistemologies. In response, a growing number of researchers have been advancing the decolonisation and Indigenising of research methodologies (Smith et al. 2016; Kovach 2015; Whyte et al. 2016) that offer alternate philosophic orientation and methods to that which are currently endorsed by Western understandings and approaches to research.

Indigenous methodology

Indigenous peoples have a different way of viewing the world, through the lens of their own system of knowledges, logics, language and practice (Smith 2012; Smith et al. 2016). An Indigenous methodology has a number of characteristics: it has a connection to a particular Indigenous epistemology, it frequently has an aim of self-determination, it is relational, reflexive, collaborative and dialogic, and it has a distinct protocol situated in place and derived from an appropriate worldview (Datta 2018a; Henry and Foley 2018; Kovach 2015; Martin 2017; Smith 2012; Walker et al. 2006; Woodward and McTaggart 2016). This requires guidelines for research that provide respect for and protection of the rights, interests and sensitivities of the people being studied (Smith 2012).

Datta (2018a) notes that Indigenous approaches to knowledge are contextualised, relational and owned by the community. The methodology used to construct and use this knowledge should be respectful, inclusive, have a connection with the land and be empowering. Indeed, he states that Indigenous methodology is about the "insertion of Indigenous principles into research methodology so that research practices can play a role in the assertion of Indigenous peoples rights and sovereignty" (Datta 2018a, p 36). Indigenous methodology privileges Indigenous intellectual sovereignty in research design (Henry and Foley 2018; Ryder et al. 2020; Woodward and McTaggart 2016). Such an approach empowers Indigenous peoples and researchers. The research becomes 'ours', 'for our community' and reconnects traditional knowledges, the natural world and people (Datta 2018a; Smith 2012; Woodward et al. 2020).

More frequently, Indigenous researchers are positioning their own ontologies, epistemologies and methodologies firmly within their cultural contexts, which influences the process of research (Henry and Foley 2018; Mikahere-Hall 2017; Ryder et al. 2020). As noted by Smith (2012 p.196):

> When indigenous peoples become the researchers and not merely the researched, the activity of research is transformed. Questions are framed differently, priorities are ranked differently, problems are defined differently, and people participate on different terms.

At the same time, the science community has realised the value and need for collaborative, inclusive and community-based approaches to working with Indigenous peoples (Castleden et al. 2017). MacLean et al. (2021) highlights the need for researchers to realise their positionality to reconstitute the way power is positioned and expressed throughout the research process. Macfarlane and Macfarlane (2018) argue that researchers have a responsibility to know their cultural self, including their power and privilege before engaging in research with those whose culture is different from their own. Relationship-building in this context demands the creation of real and meaningful researcher/Indigenous community partnerships based on mutual respect, trust and commitment, to give effect to genuine research outcomes (Maclean and Cullen 2009; Woodward et al. 2020; Wright et al. 2012).

Reflections on research 'for, with and by' Māori

Indigenous methodology forms the interpretive link between the ways Indigenous knowledges are defined and understood, and appropriate practices of inquiry (Smith et al. 2016). It is imperative for Indigenous methodologies to incorporate methods that give back and sustain communities in ways that are meaningful and useful to them. Having a relationship with the community is critical, so the community can identify what is relevant (Datta 2018b; Kovach 2015; Smith 2012). Kaupapa Māori research is an Indigenous methodology that is specific to the Aotearoa New Zealand context, which refers to research that is 'for, with and by' Māori, not just 'about' (Henry and Foley 2018). This section provides a brief overview of the close relationship between Māori and the natural world, before outlining a kaupapa Māori research project conducted with Kāti Huirapa Rūnaka ki Puketeraki, a small Māori community.

Context

Māori live collectively and holistically guided by the socio-cultural institutions of te ao Māori—the Māori world, which provide an account of the connections and relationships between all things human, non-human and the natural world

(Marsden 2003; Watene 2016). Traditionally, Māori identify themselves by connection to mātauranga (knowledges, wisdom, and understanding), through whakapapa (ancestry) and beliefs, values and tikanga (practices) (Harmsworth et al. 2016). Māori values reflect a direct relationship with the natural world through the physical and spiritual manifestation of whakapapa (Watene 2016). As such, Māori have an intricate, holistic and interdependent relationship with the natural world and its resources (Harmsworth and Awatere 2013), acknowledging the interdependency and relationality of all living and non-living things.

Māori values, such as Kaitiakitanga (role of protection and guardianship over people and resources) combined with principles of Tino Rangatiratanga (self-determination) are the instruments by and through which Māori make sense of the world (Marsden 2003). Grounding the value of the natural world in terms of whakapapa, bestows a relational status onto landscapes, seascapes, waterways, natural resources and other creatures, creating obligation for Māori as kaitiaki (trustee, guardian) to protect, enhance and conserve (Harmsworth et al. 2016; Marsden 2003). Such an approach takes-for-granted that the natural world is relational and underscores that "value is derived from our co-existence and shared descent" (Watene 2016 p 292). Māori, as with Indigenous communities around the world, share a strong desire to ensure our socio-ecological knowledges are not lost to our future generations. This becomes ever more pressing in the field of sustainability science research, where it is evident that Indigenous knowledges offer a tried and tested methodology for research.

Mobilising sustainable development opportunities of a Māori community

> Unlike others that come and go from the area, we've been, and will be here forever
>
> Kāti Huirapa Rūnaka ki Puketeraki Komiti Rapu Ara Hou member (Arahanga-Doyle et al. 2016).

Kāti Huirapa Rūnaka ki Puketeraki is a Māori tribal assembly located in Karitāne, a small coastal township on the South Island of Aotearoa New Zealand. The Rūnaka operates as a cultural and spiritual base for Puketeraki whānau (families who make up hapū sub-tribe configurations) and who whakapapa (genealogical lineage) to Ngāi Tahu iwi (tribe). As noted in the quote above from a hapū member there is an innate sense of turangawaewae, belonging and therefore responsibility to the area. Kati Huirapa Rūnaka ki Puketeraki is part of the larger Te Rūnanga o Ngāi Tahu (TRoNT) structure that comprises 18 regional Papatipu Rūnaka (ancestral landscapes) across most of the South Island. Each Rūnaka has a generational responsibility to exercise rangatiratanga (authority) over the physical,

social and natural assets associated with their respective hapū, and in keeping with multi-level economic development that matches cultural patterns and expectations (Barr and Reid 2014).

As a coastal community, Puketeraki has traditionally held an abundance of natural resources that has provided for their hapū and associated whānau. For Kati Huirapa Rūnaka ki Puketeraki these collective assets include land and water resources, as well as various other physical assets that today are managed by the Rūnaka executive committee. All activities undertaken by TRoNT, and therefore the Rūnaka are governed by the whakatukī (proverb), *mō tātou, ā, mō kā uri ā muri ake nei—For us and our children after us*". A sentiment that prioritises an intergenerational and sustainable approach to everything it does (Arahanga-Doyle et al. 2016; Simmons-Donaldson et al. 2018).

The overarching goal of this research was to provide the Rūnaka with an evidence-based platform on which to plan for and develop their business ventures in line with their aspirations for sustainable development. In particular, using Māori methodology and Māori-centric business modelling. Kaupapa Māori research as a paradigm, guides research and ensures that Māori protocol will be followed during research processes (Henry and Foley 2018; Haitana et al. 2020; Mikahere-hall 2017; Walker et al. 2006). Kaupapa Māori research attempts to address the structural relations of power and provides clear boundaries for research teams that places the decision-making power with the respective Māori community (Walker et al. 2006). In relation to the research outcomes, this means two things. First, that the data collected comprises a genuine richness that foregrounds Māori viewpoints. Second, it enables complex data collection and analysis both with regard to participation inside the research, and with capacity to account for a myriad of perspectives, ways of valuing and interpreting (Ruwhiu and Cone 2010; Walker et al. 2006).

Co-design and research team creation

A partnership was developed to co-create the process and intended outcomes of the research that recognised and responded to the unique place-based needs of the community. In this instance, the Rūnaka was intent on ensuring the sustainable development of the natural, social and physical resources for which they were responsible. The genesis of the research relationship began in early 2015. Three of the authors, one a Māori academic, and two Māori professional staff involved in supporting Māori students in the Otago Business School, travelled 40 km to Karitāne to meet with representatives of the Rūnaka executive. The purpose was to discuss potential opportunities between research and work the Rūnaka was undertaking. Of note, the two professional

staff affiliated to Ngāi Tahu, with one having direct whaka-papa (genealogical connection) to the Rūnaka.

An outcome of the initial meeting was not a commitment to a specific project. The Rūnaka committee left the business school researchers with two expectations. The first was to recognise and understand that the social, natural and economic resources discussed were viewed by the Rūnaka as having mana (spiritual and physical authority and power) and mauri (a spiritual life essence) for which they were kaitiaki (guardians) (Watene 2016). Thus, whatever collaborative work undertaken, the research was not merely an exercise in 'money-making' or 'efficiencies'. Rather, it was important that the research process and outcomes were connected to the community, people and the natural world. The second was the importance of maintaining the relationship from that point onwards, to 'see what evolves' and finding a convergence of community and researcher expectation.

Later in 2015, opportunity arose for student scholarships, and the Otago Business School staff and Rūnaka worked collaboratively to create the projects. The two related projects were undertaken over the Summer periods of 2015/2016 and 2016/2017 respectively, both funded by a combined Ngā Pae o te Māramatanga (Māori Centre of Research Excellence) and Te Pūnaha Matatini (Complex Data Centre of Research Excellence) Māori undergraduate Student Scholarships (Arahanga-Doyle et al. 2016; Simmons-Donaldson et al. 2018). Noted authors of kaupapa Māori research (Henry and Foley 2018; Smith 2012; Walker et al. 2006) locate it as a paradigm that guides research ensuring that the outcomes expected from the research are determined by the community with which the research is to occur. In this instance, the project topic areas were a result of the Rūnaka identifying its priorities in regards to the development of its natural resources. Ultimately, the team was composed of one Māori academic, two Māori professional staff, two Māori undergraduate students (one of whom had whakapapa to Ngāi Tahu) and representatives of the Rūnaka executive to ensure appropriate 'knowledge holders' (Datta 2018b) were guiding the Kaupapa of the research.

Prior to fieldwork being undertaken, the research/community team submitted appropriate ethical approval forms as part of the required institutional processes. The Rūnaka was once again included in this process in two key ways. First, we updated them as to the process and shared the ethical approval form with them in a final draft. Second, was through an Otago University institutional process, the Ngāi Tahu Research consultation, which operates alongside our institutional ethical approval processes (see https://www.otago.ac.nz/research/maoriconsultation). It is a process that ensures Ngāi Tahu, as mana whenua, people of this land on which the institution stands, are appropriately consulted in matters of research. The Ngāi Tahu Research Committee

includes members of the three Ngāi Tahu Rūnaka from the local community, including Kāti Huirapa.

The projects

The first project (2015/2016) was aimed at gaining an overview of the nature and capacity of the economic, social, cultural and environmental assets of the Rūnaka. The research involved a Māori student researcher working with the Kāti Huirapa ki Puketeraki Komiti Rapu Ara Hou (Rūnaka Economic Development Committee) over a period of eight weeks to review strategic documents and inventory resources and assets available to the Rūnaka. During this time, the student researcher was based in the Rūnaka offices in Karitāne, observing meetings and activities, as well as spending time and speaking with five elders of the Rūnaka's executive committee to understand the socio-cultural priorities of the Rūnaka community. The student researcher, working with the research/community team then collated and analysed the data generated through this process. This enabled a thorough understanding of the current situation to be gained, along with an analysis of the development potential of Rūnaka assets. The outcome of this first project was a detailed report providing the Rūnaka with an inventory analysis and direction for their future economic decision-making, in keeping with their place-based and cultural expectations (Arahanga-Doyle et al. 2016).

The second project (2016/2017) developed project one further by focusing on the mobilisation of resources to achieve developmental aspirations through community-based entrepreneurship. Two meetings were held by one member of the research team and the second student researcher with the Rūnaka Economic Development Committee, to establish the Kaupapa (guidelines) of two four-hour workshops. The first focused on mind-mapping enterprise ideas based on the original report from project one, facilitating decision-making discussions, and finally introducing a Māori-centric business model. The second workshop focused on working more strategically on the business model, as well as identifying key areas for future work. The workshops were held on the marae (traditional meeting house) following appropriate cultural protocol. For example, karakia (blessing and acknowledgement) were held to start and end each workshop. The second project produced a business proposal for a water-based tourism venture that considered the values and aspirations of the Rūnaka, mitigation of risks and identification of potential partnerships (Simmons-Donaldson et al. 2018).

An outcome of these two projects was the launch of a Māori tourism venture, Karitāne Māori Tours based on the river and natural landscape in Karitāne in 2019. The

significance of the Rūnaka relationship with the natural world was emphasised by a Komiti Rapu Ara Hou Member who noted that *"We want to capitalise on the opportunity to engage with the river, the sea, and the landscape, in a way that provides an authentic Māori experience unique to Karitāne."* Therefore, the value proposition of the new venture was an ecological, cultural and recreational land and water-based experience that connects and engages with the story of the local river, its native species, and surrounding landscape.

He Kākano—the seed

E kore au e ngaro, he kākano i ruia mai i Rangiātea
I shall never be lost, I am a seed sown from Rangiātea

The seed as represented in this whakatauki (proverb) represents growth, development, and self-realisation. Being linked metaphorically to Rangiātea represents how growth and development is founded in the attainment of higher learning, as handed down through generations. The process of research with Māori communities, using this lens then becomes a part of the continuous, intergenerational cycle of knowledge creation and dissemination. Our aim with the remainder of this article is to reflect on lessons, formed through our collective experiences, to provide deeper insight useful for research practitioners working at the intersection of Indigenous knowledges and sustainability science. As Indigenous researchers we acknowledge our own individual responsibilities and relationships in the respect and advancement of Indigenous knowledge and development (Smith 2012; Walker et al. 2006; Wilson 2001). Therefore, we also highlight the often taken-for-granted and unspoken aspects, of doing Indigenous-engaged research.

Kaupapa Māori research is an Indigenous methodology that is derived from a particular worldview (Te Ao Māori) and connected to Māori onto-epistemology; includes purposeful enactment of a self-determining aim; is relational; and, brings with it a distinct socio-cultural protocol (Haitana et al. 2020; Smith 2012). We consider three interdependent principles, framed within a Kaupapa Māori perspective that might assist sustainability research and researchers in their future approaches to working with Indigenous communities. We suggest that these principles might offer a more collaborative approach to research that benefits both discipline and community. First, Toitū te mātauranga (processes of sustaining and valuing Māori knowledges) reflects an intentional stance in valuing culturally inclusive research (Macfarlane and Macfarlane 2018) and acknowledges the criticality of sustaining the onto-epistemological framings of Indigenous knowledges. Second, we share reflections on the deeper meaning and practice of research relationships in

Indigenous contexts through the lens of whakawhanaungatanga (processes of establishing relationships). Finally, kotahitanga (unity and collective action) expresses the culturally embodied processes and practicalities of collaboration and co-production of knowledges. In the discussion below, we suggest researchers from different cultural backgrounds can draw on these principles to inform their critical self-reflection and guide their contribution to the theory and practice of sustainability science.

Toitū te mātauranga: valuing and sustaining Indigenous knowledges

Kovach (2015 p 57) states, "The long and the short of it is that Indigenous methodologies, like any other, ought to be a choice; however, there must be a deep abiding respect for Indigenous knowledge systems and Indigenous experience." Te toitū te mātauranga represents the sanctity of te ao Māori as the genesis of the onto-epistemological landscape through which research with Māori is organised, interpreted and represented. Under the rubric of Kaupapa Māori in research, we are directed automatically to different sets of ideas and issues framed as assumptions, practices and methods that locate Māori philosophy, values (ethics) and knowledge in a central role. Kaupapa Māori research gives full recognition of Māori cultural values and systems, determines the assumptions, values, key ideas, and priorities of research, ensures that Māori maintain conceptual, methodological, and interpretive control over research, and ensures that Māori protocol will be followed during research processes (Walker et al. 2006). This resonates with the standpoint of Haitana et al. (2020), Henry and Foley (2018), Smith (2012), Mikahere-Hall (2017) and others who view the notion of kaupapa Māori as a deliberate practice that sets out to challenge the hegemonic, to strategically position and make space for Indigenous agendas and ways of knowing and being.

Indigenous knowledge recognises that the environment does not exist alone, but is intertwined with social and cultural meaning and connection, and is thus intertwined with the political in a colonising world (Arsenault et al. 2018; Johnson et al 2016). Māori researchers have long commented that Kaupapa Māori has a cultural and political agenda, conveyed as the taken-for-granted legitimacy of Māori knowledge; the reclamation and normalisation of te reo Māori; and, a critical mandate for self-determination (Marsden 2003; Henry and Foley 2018; Walker et al. 2006; Smith 2012). This is our reality as Indigenous researchers—a long and enduring struggle to have our systems of knowledge and practices accepted by the academy.

Researcher onto-epistemology frames the way we see the world, the way we organise ourselves in it, and in research, determines the nature of the questions, approaches and

solutions possible (Datta 2018b; Smith et al. 2016). For our science communities, being open-minded to alternative worldviews and accepting of difference becomes an important criterion to be embedded in the science research process. However, it is not enough for researchers to merely recognise or acknowledge the existence of different worldviews, or the persistence of colonialism, oppression and domination embedded in systems of Western research. All researchers hold the "responsibility and challenge to provide space for Indigenous methodologies and this is different than carrying out research in Indigenous communities" (Sylvester et al. 2020, p 52). Sustainability science researchers have to learn to see their own privilege and context (Johnson et al. 2016) and advance the significance of understanding researcher positionality in Indigenous contexts (Maclean et al. 2021). We extend these notions to consider the intentionality of researchers as non-neutral subjects (Datta 2018b), actively advancing the principles of Indigenous methodologies through opportunities to 'talk back to power' (Smith 2012), and consideration of how they can influence institutional protocols (Datta 2018b; Maclean et al. 2021). These ideals are important for non-Indigenous sustainability science researchers to consider to think critically and contribute research that is transformative in its capacity to meet the developmental aspirations of Indigenous communities and advance science.

Strong evidence exists on the uptake of Indigenous methods by sustainability scientists, derived from Indigenous methodologies that embody Indigenous knowledges and cultural values specific to respective Indigenous communities. Such approaches are typically enacted through collaborative processes and methods that embrace techniques of conversation and storytelling (Arsenault et al. 2018; Woodward and McTaggart 2016; Wright et al. 2012). In project one, the student researcher did not conduct interviews. Rather, the Rūnaka elders as knowledge holders (Datta 2018b; Tengö et al. 2017) shared their stories and memories, those experienced and passed down through generations, about the natural landscape and Māori tikanga (customary Māori practices). For example, what and how customary foods were harvested from the river, ocean and surrounding lands. In this context, storytelling emanating from experiences and traditions exemplified the interdependence of the human–nature relationship (Datta 2018a; Johnson et al. 2016; Mazzocchi 2020; Sandoval-Rivera 2020; Wright et al. 2012).

There is increasing awareness of institutional constraints associated with Indigenous research that can interfere with achievement of successful outcomes (Robinson et al. 2016; Sylvester et al. 2020), such as funding or the ethical approval process. As an example, in the second project shared above, ethical approval was applied for and received to conduct a series of workshops and observations. However, after the

full-day workshops were completed the Rūnaka committee decided they would like some reflections from the participants to inform future approaches to development. We had to undertake a retrospective ethical approval, which whilst ultimately approved required extra time and paperwork.

In this instance, we were fortunate our institutional protocol around ethical approval included recognition of Māori perspectives and approaches to research. Such culturally attuned processes are not the norm within research institutions. An indication that Western research processes are not designed to consider the emergent nature of the Indigenous research. Regardless of the principles and processes agreed between researchers and community it is important to note they are not fixed, but are fluid, as these are "premised on lived experience, relationality and allowing the agency of all entities to assert themselves" (Martin 2017 p. 1399). While, we acknowledge the commitment illustrated through the inclusion of an Indigenous ethical approval process, we should not forget it has taken many years of pressure sustained by the critical voices of Māori and non-Māori researchers, and the Māori community at large to pressure the institution to fulfil its obligations to the Treaty of Waitangi.

Whakawhanaungatanga: building meaningful and reciprocal relationships

Research practices in sustainability science incorporating acknowledgement of diverse systems of knowledge, and taking time to build trusting, reciprocal and meaningful relationships are well grounded (Arsenault et al. 2018; Johnson et al. 2016; Robinson et al. 2016; Smith 2012). The establishment of trust and a relationship were already present by virtue of some members of our research team having whakapapa to the Rūnaka. Whakawhanaungatanga is our culturally constituted way of understanding the processes of establishing relationships, identifying through culturally appropriate means, our connections, engagement and, therefore, unspoken commitment to other people (Bishop 1996). Indigenous systems of knowledge are built and nurtured on the relationships we have with those things central to who we are as a people, such as values, language, images, practices and so on (Martin 2017; Ryder et al. 2020; Wilson 2001).

Kaupapa Māori research offers a broader intellectual and political context that emphasizes interdependence and spirituality as fundamental to the process of knowledge production and dissemination, implicitly founded on collective cultural consciousness (Henry and Foley 2018). Importantly, for this is not a quick 'meet and move on' process, whakawhanaungatanga embodies the process of identifying, maintaining or forming past, present and future relationships to position themselves more clearly in present relationships

and therefore allow more in-depth information to be shared and entrusted (Walker et al 2006). For our team, an important part of the initial meetings was sharing our pepeha, method of introducing ourselves that includes our tribal and hapū affiliations, as well as recognition of the rohe, or region of Aotearoa New Zealand our ancestors are from. In this context, research relationships are not just between the researcher nor indigenous people as individuals. Rather, there is a wider spectrum of relationality at play, wherein the relationship and all associated connections, responsibilities and expectations are acknowledged and enacted "to wider social and institutional contexts" (Woodward and McTaggart 2016, p 136).

As such, in regards to establishing and building relationships, for researchers it is important to 'see' and acknowledge the multiplicity of relational strands that are in play for Indigenous research. Indeed, when working with Indigenous communities it is never just about you, the individual researcher. Being present and sharing who you are, your ancestry, your dreams, aspirations and even fears, can be a challenging landscape for non-Indigenous researchers to engage with. However, this process enables the community and the researchers to know who it is they are working with. For the community, it is important that they can assess whether or not the researcher is right for them and their expectations (Sylvester et al. 2020; Walker et al. 2006; Tengö et al. 2017). An imperative for sustainability science researchers is to learn about and understand that they too, by virtue of the relationship established, participate and contribute in this process.

Whakawhanaungatanga, also extends the parameters of what constitutes the boundaries of the research. Whilst the research might be technically over, it does not extinguish the obligations created through the research relationship (Sylvester et al. 2020; Maclean et al. 2021). Within the case study presented, the recognition that while the physical presence of the two projects have been completed there continues to be a relationship, and hence obligation. Therefore, although with involvement of other staff and students, the Rūnaka and the School continue to find opportunities to support each other in their respective aspirations, with further student projects as an example.

Kotahitanga: collective action

As more scholarship emerges using Indigenous methodologies and methods it is evident that both the research and Indigenous communities have indeed come a long way in the facilitation of productive and meaningful research collaborations (Maclean et al. 2021; McGreavy et al. 2021; Sylvester et al. 2020; Tengö et al. 2017). Evidence suggests that collaborative approaches are key to ensuring the authentic and balanced representation of different knowledge systems,

particularly of Indigenous and scientific knowledge (Johnson et al. 2016; Magni 2017; Robinson et al. 2016). However, it is critical that the notion of collaboration is framed within the boundaries of the specific Indigenous system of knowledge (Ens et al. 2015; Johnson et al. 2016; Sylvester et al. 2020). Kaupapa Māori research as a framework for self-determination affords an expectation that it is not about researcher control, but the collective care of knowledge, culture and values (Walker et al. 2006). Kotahitanga represents the interdependence among all living things and is expressed as unity and collective action (Henry and Foley 2018; Marsden 2003). In Māori research, it embodies the researcher responsibility and commitment to working collaboratively. In the case study, framed as it was within Kaupapa Māori, broader nuances to the research collaboration took effect, such as the importance of building Indigenous researcher capability, perception of time and ownership of the knowledge created.

Captured within collaboration with the Rūnaka was the commitment to build research capability and capacity within the Māori community and contribute to the next generation of Māori researchers, which is a sometimes-overlooked facet but central feature of Indigenous research (Walker et al. 2006). Within the research team the tuakana-teina relationships were an important consideration of the research design. Tuakana-teina generally refers to the relationship between an older (tuakana) and younger (teina) person and it is understood as a reciprocal flow of wisdom, knowledge and learning between the two. Our research team recognised the reciprocal learning that occurred between senior researchers with students (e.g. sharing experience of crafting and undertaking research), Rūnaka community with researchers and students (e.g. sharing the iwi and hapū mātauranga to enrich understanding of Ngai Tahu and Māoritanga), and researchers and students with the Rūnaka (e.g. sharing findings and recommendations). Of note, both of the students in these projects continued on to Doctoral level studies.

When working in Indigenous contexts collaborators have to work on complex relational dynamics, such as trust and cultural protocol, which become critical when forming research partnerships (Woodward et al. 2020). The extra commitment and care required and expected can be time consuming and often push the boundaries of institutional research protocol, such as ethics. Slowing down, focusing on and gaining a stronger understanding of the cultural world and protocol that is required is of paramount importance for effective collaboration (McGreavy et al. 2021; Sylvester et al. 2020). The relationship with the Rūnaka started ten months before any ethical approval or funding was sought. It was through this initial meeting wherein the team could reflect more deeply on the purpose and meaning of the potential research for the Rūnaka. Thus ensuring their involvement in the co-design of the research and that the

desired outcomes of the research were driven by the community and connected to traditional and local knowledges. Indigenous knowledges, methodologies and methods are not an 'add-on or afterthought' but the starting point of the research effort (Arsenault et al. 2018).

Another example of the need to take time and focus occurred in project two of the case study when it was apparent that due to the voluntary nature of the roles within the Rūnaka economic development committee, it was challenging trying to find times when all members were available. Therefore, it was important for the facilitators to be as flexible as possible, to ensure that all available time was utilised productively. The collaboration had to occur on their terms, not be fixed by the research agenda (Sylvester et al. 2020).

A final reflection from our experience, is the way the research is shared and disseminated. Approaches to collaboration with Indigenous communities in research acknowledge the dual ownership of the knowledge generated, but that the decision-making authority resides with the community (Bawaka Country et al. 2016; Henry and Foley 2018). That is, the community were recognized as equal partners, as co-designers, as the community of validation for the research project. The reports created through the case study research, took the position that the knowledge shared was taonga (a treasure) shared by the Rūnaka and therefore belonged to them. A summary document, approved by the Rūnaka was shared on the funder websites, but the full reports were maintained at the Rūnaka. This article is another such example, wherein the Rūnaka is involved in the authorship of the paper and just as we expect in the management of the fieldwork data (maintained under the collective guardianship of the Rūnaka), the decision to publish remains under the authority of the Rūnaka (Walker et al. 2006).

Conclusion

The potentiality of collaborative Indigenous and sustainability science research is essential for realising the developmental aspirations of our Indigenous communities in today's turbulent world. This article reflects the importance and criticality of Indigenous knowledges within the field of sustainability science and the academy more broadly. Indigenous knowledges have great potential to make major contributions to sustainability science through enabling a more realistic positioning of the social and natural world, and the Indigenous meanings attributed to them (Johnson et al. 2016; McGreavy et al. 2021; Muller et al. 2019; Rout and Reid 2020; Whyte et al. 2016). In particular, Indigenous methodologies imbue the successful engagement of Indigenous knowledges and sustainability science with mana (spiritual and physical authority and power) that enhances both of our worldviews and communities.

In this article, we have shared the nuances, fluidity and circularity embodied by Indigenous methodologies through sharing our experiences in a kaupapa Māori research project to give effect to the potential of sustainablility science research. Reflecting on our experience in undertaking research with Kāti Huirapa Rūnaka ki Puketeraki, our aim has been to illustrate the complexities involved in acknowledging diverse systems of knowledge and the establishment of trusting research relationship. We argue that in doing so enhances the potential to achieve desired outcomes, including effective co-production of knowledge through research with Indigenous communities (Johnson et al. 2016; Maclean and Cullen 2009; Maclean et al. 2021). Our hope is to foster further dialogue around what building a relationship with an Indigenous community entails and why it is so important to take those initiatives. As Indigenous researchers, our team understood and acknowledged our responsibility and relationships as a meaningful expression of Te ao Māori and who we are as a people. Our reflections in this paper, although drawn from our experiences, provide some insight for sustainability scientists into the complexity involved: in the grounding of the research process within a particular indigenous onto-epistemology (Toitū te mātauranga); understanding the subtleties of relationship building (Whakawhanaungatanga); and considered the obligations which then arose from researcher commitment to working with Indigenous communities collaboratively (Kotahitanga).

A vital takeaway for sustainable science researchers is the challenge to interrogate the power and privilege inherent in normative Western methodologies and methods, and those deeply entrenched institutional processes that perpetuate the status quo (Muller et al. 2019; Ryder et al. 2020). This extends to understanding researcher positionality and responsibility as extending well beyond the traditional auspices of research process, such as ethics approval and publishing as important caveats to include in discussions (Datta 2018b; Maclean et al. 2021; Smith et al. 2016). Taking an inclusive and collaborative methodological approach suggests the need to respect and honour the cultural protocol of significance to Indigenous communities (McGreavy et al. 2021; Sylvester et al. 2020; Wright et al. 2012). Understanding these facets of researching with Indigenous communities can be confronting when viewed against the objective conditions of science research. Yet, in our experience, taking opportunity to look beyond the 'research project' as the objective, offers much more insightful, rich and meaningful research outcomes, and transformative partnerships conducive for knowledge co-production and research practice in the Asia–Pacific region, and theory for sustainability science in general. By reimagining and reshaping practices at the intersection of Indigenous knowledges and sustainability science we may start to see truly cutting edge, yet responsible science research.

References

Adger WN, Pulhin JM, Barnett J, Dabelko GD, Hovelsrud GK, Levy M, Oswald Spring Ú, Vogel CH (2014) Human security. In: Field CB, Barros VR, Dokken DJ, Mach KJ, Mastrandrea MD, Bilir TE, Chatterjee M, Ebi KL, Estrada YO, Genova RC, Girma B, Kissel ES, Levy AN, MacCracken S, Mastrandrea PR, White LL (eds) Climate change 2014: impacts, adaptation, and vulnerability. Part A: global and sectoral aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, pp 755–791

Altman J, Ansell J, Yibarbuk D (2020) No ordinary company: Arnhem Land Fire Abatement (Northern Territory) Limited. Postcolon Stud 23(4):552–574

Amoamo M, Ruwhiu D, Carter L (2018) Framing the Māori economy: the complex business of Māori business. MAI Journal 7(1):66–78

Anderson RB, Dana LP, Dana TE (2006) Indigenous land rights, entrepreneurship, and economic development in Canada: "Opting-in" to the global economy. J World Bus 41:45–55

Anderson RB, McGillivray S, Giberson RJ (2007) The Nk'Mip cellars: wine and tourism with an aboriginal flavour. In: Dana LP, Anderson RB (eds) International handbook of research on indigenous entrepreneurship. Edward Elgar, Cheltenham, pp 336–351

Arahanga-Doyle H, Ruwhiu D, Kapa J, Bragg C (2016) Optimising the Economic Performance of Kāti Huirapa Rūnaka ki Puketeraki: a localised case study. Ngā Pae o te Māramatanga, New Zealand

Arsenault R, Diver S, McGregor D, Witham A, Bourassa C (2018) Shifting the framework of Canadian water governance through Indigenous research methods: acknowledging the past with an eye on the future. Water 10(1):49

Barr T, Reid J (2014) Centralized decentralization for tribal business development. J Enterp Communities 8(3):217–232

Bawaka Country, Wright S, Suchet-Pearson S, Lloyd K, Burarrwanga L, Ganambarr R, Ganambarr-Stubbs M, Ganambarr B, Maymuru D, Sweeney J (2016) Co-becoming Bawaka: towards a relational understanding of place/space. Prog Hum Geogr 40(4):455–475

Bishop R (1996) Whakawhanaungatanga: collaborative research stories. Dunmore Press Ltd, Palmerston North

Bohensky EL, Maru Y (2011) Indigenous knowledge, science, and resilience: what have we learned from a decade of international literature on "integration"? Ecol Soc 16(4):6. https://doi.org/10.5751/ES-04342-160406

Broadhead LA, Howard S (2011) Deepening the debate over 'sustainable science': indigenous perspectives as a guide on the journey. Sustain Dev 19(5):301–311

Castleden H, Hart C, Cunsolo A, Harper S, Martin D (2017) Reconciliation and relationality in water research and management in Canada: Implementing indigenous ontologies, epistemologies, and methodologies. In: Renzetti S, Dupont DP (eds) Water policy and governance in Canada, vol 17. Springer, Cham, pp 69–95

Datta R (2018a) Traditional storytelling: An effective Indigenous research methodology and its implications for environmental research. AlterNative Int J Indig Peoples 14(1):35–44

Datta R (2018b) Decolonizing both researcher and research and its effectiveness in Indigenous research. Res Ethics 14(2):1–24

David-Chavez DM, Gavin MC (2018) A global assessment of indigenous community engagement in climate research. Environ Res Lett 13(12):123005

Díaz S, Demissew S, Carabias J, Joly C, Lonsdale M, Ash N, Zlatanova D (2015) The IPBES Conceptual Framework—connecting nature and people. Curr Opin Environ Sustain 14:1–16

Diver S (2017) Negotiating Indigenous knowledge at the science-policy interface: Insights from the Xáxli'p Community Forest. Environ Sci Policy 73:1–11

Ens EJ, Finlayson M, Preuss K, Jackson S, Holcombe S (2012) Australian approaches for managing 'country' using Indigenous and non-Indigenous knowledge. Ecol Manag Restor 13(1):100–107

Ens EJ, Pert P, Clarke PA, Budden M, Clubb L, Doran B, Wason S (2015) Indigenous biocultural knowledge in ecosystem science and management: review and insight from Australia. Biol Cons 181:133–149

Haitana T, Pitama S, Cormack D, Clarke M, Lacey C (2020) The transformative potential of Kaupapa Māori research and Indigenous methodologies: Positioning Māori patient experiences of mental health services. Int J Qual Methods 19:1609406920953752

Harmsworth G, Awatere S (2013) Indigenous Māori knowledge and perspectives of ecosystems. In: Dymond JR (ed) Ecosystem services in New Zealand—conditions and trends. Manaaki Whenua Press, Lincoln

Harmsworth G, Awatere S, Robb M (2016) Indigenous Māori values and perspectives to inform freshwater management in Aotearoa-New Zealand. Ecol Soc 21(4):9

Henry E, Foley D (2018) Indigenous research: ontologies, axiologies, epistemologies and methodologies. In: Booysen LAE, Bendl R, Pringle JK (eds) Handbook of research methods in diversity management, equality and inclusion at work. Edward Elgar, Cheltenham, pp 212–227

Johnson JT, Howitt R, Cajete G, Berkes F, Louis RP, Kliskey A (2016) Weaving Indigenous and sustainability sciences to diversify our methods. Sustain Sci 11:1–11

Kovach M (2015) Emerging from the margins: Indigenous methodologies. Res Resist 2:43–64

Macfarlane A, Macfarlane S (2018) Toitū te Mātauranga: valuing culturally inclusive research in contemporary times. Psychol Aotearoa (jubilee Edition) 10(2):71–76

Maclean K, Cullen L (2009) Research methodologies for the co-production of knowledge for environmental management in Australia. J R Soc N Z 39(4):205–208

Maclean K, Woodward E, Jarvis D, Rowland D, Rist P, Turpin G, Martin P, Glover R (2019) A strategic sector development and research priority framework for the traditional owner-led bush products sector in northern Australia CSIRO, Australia. Accessed 01 July 2021. https://publications.csiro.au/rpr/download?pid=csiro:EP193300&dsid=DS1. Accessed 01 July 2021

Maclean K, Woodward E, Jarvis D, Turpin G, Rowland D, Rist P (2021) Decolonising knowledge co-production: examining the role of positionality and partnerships to support Indigenous-led bush product enterprises in northern Australia. Sustain Sci. https://doi.org/10.1007/s11625-021-00973-4

Magni G (2017) Indigenous knowledge and implications for the sustainable development agenda. Eur J Educ 52(4):437–447

Marsden M (2003) The woven universe: selected readings of Rev. Māori Marsden. The Estate of Rev. Māori Marsden, Otaki

Martin B (2017) Methodology is content: Indigenous approaches to research and knowledge. Educ Philos Theory 49(14):1392–1400

Maxwell KH, Ratana K, Davies KK, Taiapa C, Awatere S (2020) Navigating towards marine co-management with Indigenous communities on-board the Waka-Taurua. Mar Policy 111:103722

Mazzocchi F (2020) A deeper meaning of sustainability: Insights from indigenous knowledge. Anthropocene Rev 7(1):77–93

McGreavy B, Ranco D, Daigle J, Greenlaw S, Altvater N, Quiring T, Hart D (2021) Science in indigenous homelands: addressing power and justice in sustainability science from/with/in the Penobscot River. Sustain Sci 16(3):937–947

Mercer J, Kelman I, Taranis L, Suchet-Pearson S (2010) Framework for integrating indigenous and scientific knowledge for disaster risk reduction. Disasters 34(1):214–239

Mika JP, Scheyvens RA (2021) Te Awa Tupua: peace, justice and sustainability through indigenous tourism. J Sustain Tour. https://doi.org/10.1080/09669582.2021.1912056

Mikahere-Hall A (2017) Constructing research from an indigenous Kaupapa Māori perspective: an example of decolonising research. Psychother Polit Int 15(3):e1428

Missens R, Dana LP, Yule S (2010) Indigenous entrepreneurship in the wine industry: a comparative study of two indigenous approaches. J Aborig Econ Dev 7(1):26–38

Mistry J, Berardi A (2016) Bridging indigenous and scientific knowledge. Science 352(6291):1274–1275

Muller S, Hemming S, Rigney D (2019) Indigenous sovereignties: relational ontologies and environmental management. Geogr Res 57(4):399–410

Paulin C (2007) Ngāi Tahu: the New Zealand success story in Indigenous entrepreneurship. In: Dana LP, Anderson RB (eds) International handbook of research on indigenous entrepreneurship. Edward Elgar, Cheltenham, pp 549–556

Robinson CJ, Maclean K, Hill R, Bock E, Rist P (2016) Participatory mapping to negotiate indigenous knowledge used to assess environmental risk. Sustain Sci 11(1):115–126

Rout M, Reid J (2020) Embracing Indigenous metaphors: a new/old way of thinking about sustainability. Sustin Sci 15(3):945–954

Ruwhiu D, Cone M (2010) Advancing a pragmatist epistemology in organisational research. Qual Res Org Manag Int J 5(2):108–126

Ryder C, Mackean T, Coombs J, Williams H, Hunter K, Holland AJA, Ivers RQ (2020) Indigenous research methodology—weaving a research interface. Int J Soc Res Methodol 3(3):255–267

Sandoval-Rivera JCA (2020) Environmental education and indigenous knowledge: towards the connection of local wisdom with international agendas in the framework of the Sustainable Development Goals (SDGs). Diaspora Indig Minor Educ 14(1):14–24

Simmons-Donaldson R, Bragg C, Ruwhiu D, Kapa J (2018) Whai rawa: Mobilising the economic development aspirations of Kāti Huirapa Rūnaka ki Puketeraki. Ngā Pae o te Māramatanga, New Zealand

Smith LT (2012) Decolonising methodologies: research and indigenous peoples, 2nd edn. Zed Books, London

Smith L, Maxwell T, Puke H, Temara P (2016) Indigenous knowledge, methodology and mayhem: What is the role of methodology in producing Indigenous insights? A discussion from mātauranga Māori. Knowl Cult 4(3):131–156

Sylvester O, García Segura A, Crabtree SA, Man Z, Parker J (2020) Applying an Indigenous methodology to a North-South, cross-cultural collaboration: successes and remaining challenges. AlterNative Int J Indig Peoples 16(1):45–54

Tengö M, Hill R, Malmer P, Raymond CM, Spierenburg M, Danielsen F, Folke C (2017) Weaving knowledge systems in IPBES, CBD and beyond—lessons learned for sustainability. Curr Opin Environ Sustain 26:17–25

Walker S, Eketone A, Gibbs A (2006) An exploration of kaupapa Māori research, its principles, processes and applications. Int J Soc Res Methodol 9(4):331–344

Watene K (2016) Valuing nature: Māori philosophy and the capability approach. Oxf Dev Stud 44(3):287–296

Weber A (2019) Enlivenment: toward a poetics for the anthropocene, vol 16. MIT Press, Berlin

Whyte KP, Brewer JP, Johnson JT (2016) Weaving Indigenous science, protocols and sustainability science. Sustain Sci 11:25–32

Wilson S (2001) What is an Indigenous research methodology. Can J Native Educ 25(2):175–179

Woodward E, McTaggart PM (2016) Transforming cross-cultural water research through trust, participation and place. Geogr Res 54(2):129–142

Woodward E, Hill R, Harkness P and Archer, R (2020). Our Knowledge Our Way in caring for Country: Indigenous-led approaches to strengthening and sharing our knowledge for land and sea management. Best Practice Guidelines from Australian Experiences. https://www.csiro.au/en/research/indigenous-science/Indigenous-knowledge/Our-Knowledge-Our-Way/OKOW-resources. Accessed 2 Sep 2021.

Wright S, Lloyd K, Suchet-Pearson S, Burarrwanga L, Tofa M, Bawaka Country (2012) Telling stories in, through and with Country: engaging with Indigenous and more-than-human methodologies at Bawaka, NE Australia. J Cult Geogr 29(1):39–60