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STRATEGIC ISSUES ARTICLE

Traditional ecological knowledge in restoration ecology: a call to listen deeply, to engage with, and respect Indigenous voices

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The United Nations heralded 2021–2030 as the UN Decade on Ecosystem Restoration. A socioecological approach to restoration has been proposed that honors the diversity in ecological landscapes and their respective cultures and peoples with the goal of repairing degraded ecosystems. Indigenous peoples are intimately interconnected with landscapes, which are under mounting pressure from anthropogenic global environmental change. Article 31 of the UN Declaration on the Rights of Indigenous Peoples states the rights of Indigenous peoples to maintain, protect, and control their culture and traditional ecological knowledge (TEK); however, these rights have not always been acknowledged. We are concerned that large global restoration goals will continue to promote TEK extraction that further perpetuates inequities and discrimination of Indigenous peoples. If the restoration sector wishes to partner with Indigenous communities leading TEK efforts, it needs to understand established international agreements and proactively protect intellectual property and data sovereignty rights. To illustrate a theme of ethical engagement, we present risks to TEK integrity while highlighting engagement that has successfully promoted Indigenous leadership and self-determination. We propose that a decade of *responsible* and *respectful* restoration will be achieved only with shared principles and an ethical code of conduct for TEK partnerships. We argue that deep listening with Indigenous peoples and engagement with humility and respect needs to be the starting point. Finally, we propose an Indigenous-led workshop to reimagine and re-develop equitable ways forward for TEK partnerships in restoration, with explicit considerations for the rights, livelihoods, and leadership of Indigenous peoples.

Key words: code of conduct, Ecohealth, Indigenous knowledge, Indigenous peoples, planetary health, restoration ecology, tacit knowledge, traditional ecological knowledge, UN Decade on Ecosystem Restoration

Implications for Practice

- Promoting Indigenous leadership and self-determination through shared principles in restoration ecology contributes to cultural and ecological restoration on a global scale.
- Protecting the rights and livelihoods of Indigenous peoples has intrinsic value and instrumental value. Protecting Indigenous peoples' rights will help protect traditional ecological knowledge, and restore knowledge, language, biodiversity, and ecological functions.
- Restoration should be a socioecological endeavor that embraces diversity in ecology and culture. The steps we propose promote ethical engagement and can be used to stimulate positive cultural change across disciplines.
- All of the above will contribute toward a decade of responsible and respectful restoration with the hope of inspiring long-term change.

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Introduction

Eighty percent of the world's remaining forest biodiversity is located within Indigenous peoples' territories, with evidence suggesting that lands managed by Indigenous communities emit at least 73% less carbon than lands managed by other groups (IUCN 2019). Indigenous peoples' lands have therefore resiliently prospered independently of recent conventions that bind contemporary land managers to the western scientific process. A mosaic of cultures, evolving in interconnected environments, has spawned a rich diversity of Indigenous ecological knowledges and value systems rooted within concepts of sustainability (Farooquee et al. 2004; Tengö et al. 2014).

Indigenous peoples often view nature as a densely tangled web of interrelated elements bound together in "relationship" as opposed to a collection of discrete unrelated objects (Salmón 2000; Gratani et al. 2016). With transmission of ecological knowledge through "oral traditions," Indigenous land stewardship principles are almost always based on an intimate knowledge of local ecosystems (Tengö et al. 2014). The knowledge pertaining to these ecosystems is known as traditional ecological knowledge (TEK) (Lefale 2010; Velázquez-Rosas et al. 2018); however, it is important to note that TEK is completely and utterly interconnected with other aspects of Indigenous ways of being. The separation noted with labeled Indigenous knowledge systems (e.g. TEK, traditional medicine knowledge, etc.) is somewhat artificial as Indigenous knowledge and practices are holistic and interdisciplinary, including elements of language, art, ceremony, medicine, and education, all with critical elements in how we maintain healthy human–environmental relations (Nelson & Shilling 2020). With this, the labeled delineation of various "knowledge systems" can at the very least help with focusing in on areas of disciplinary crossover with western scientific practice; however, the true nature of the interconnectedness of Indigenous traditional knowledges must not be forgotten in this process.

On a broader scale, TEK integrity is under threat from changes in educational practices, traditional livelihoods, practices and beliefs, and loss of rights (Tang & Gavin 2016), which are the direct result of colonization and subsequent loss of land tenure (Redvers et al. 2020). Indigenous peoples' freedom to access and protect their own traditional lands jeopardizes the persistence of TEK as cultures erode without the landscapes to support them (Farooquee et al. 2004; Loh & Harmon 2014). There is the potential for restoration to be a positive driver of self-determination while helping to conserve cultural practices, and protect the rights of Indigenous peoples (Wehi & Lord 2017). When the rights of Indigenous peoples are prioritized, there may be a higher likelihood of meeting global conservation goals with co-benefits for all on the planet. In addition to rights, the establishment of greater co-benefits is also strongly premised on the respectful honoring of traditional knowledge systems while directly prioritizing Indigenous leadership in restoration activities (Latulippe & Klenk 2020).

In 2004, the Society of Ecological Restoration (SER) published a paper that defined ecological restoration as "the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed" (SER 2004). This is often accepted as the standard definition; however, solely focusing on ecological outcomes undermines the capacity for the discipline to be a vehicle of cultural change. Solely focusing on ecological outcomes also undermines the potential to form deeper relationships and partnerships between TEK holders and their communities, and may fail to counter inequities between the perceived dominance of certain worldviews (Wheeler & Root-Bernstein 2020). In light of the narrow definition noted above, it is important to note that SER has developed a broad code of ethics (https://www.ser.org/page/CodeofEthics/Code-of-Ethics.htm); however, restoration ecology still lacks a focused code to govern acceptable conduct associated with TEK partnerships.

There are to some extent parallels between TEK and restoration ecology (revolving around environmental stewardship and resilience) but also notable and important differences. In particular, cultural value systems and traditional protocols, in addition to the deep/spiritual foundation of TEK, are sometimes branded to be unscientific, despite holding potential to improve systems-based approaches in restoration (Zedler & Stevens 2018). We believe ecological and cultural benefits can be achieved through ethical engagement with Indigenous peoples while prioritizing and supporting Indigenous-led projects. We find current narratives unnecessarily biased toward extracting "knowledge" without the reciprocity and respect for the rights and livelihoods of "Indigenous peoples" themselves. We also think there is a lack of acknowledgment for Indigenous peoples' ingenuity and selective historical assumptions, as discussed by Pascoe (2018).

We propose that to consider TEK partnerships in restoration, there must be proper engagement with Indigenous peoples. This includes partnerships strictly abiding by international declarations on free, prior, and informed consent, in addition to comprehensive Indigenous community input and consultation at all stages, with the ability of Indigenous peoples to withdraw consent at any time (UN 2016). Furthermore, we emphasize that any knowledge sharing must be done primarily through deep listening and proper engagement in a way that advocates Indigenous leadership and prevents erosion of ecological and cultural integrity. Additionally, the acknowledgment and recognition of Indigenous data and knowledge sovereignty with the expressed right "to own, control, access and possess data that derive from … [Indigenous Peoples] … and which pertain to their members, knowledge systems, customs or territories" is integral to successful partnerships (Kukutai et al. 2020). To illustrate this, we present risks to TEK integrity, and highlight case studies of collaborations founded on inclusivity and stewardship.

This article is a call to engage with and promote Indigenous leadership through collaboration. To reinforce this objective, we conclude with an Indigenous-led workshop proposal (Fig. 1). This workshop will aim to facilitate discussions on whether and how sharing of knowledge(s) could be achieved between Indigenous peoples and restoration ecologists. A primary outcome will be to establish a set of "*shared principles*," adaptable to local contexts, to further guide our work in promoting Indigenous leadership and considering TEK partnerships.

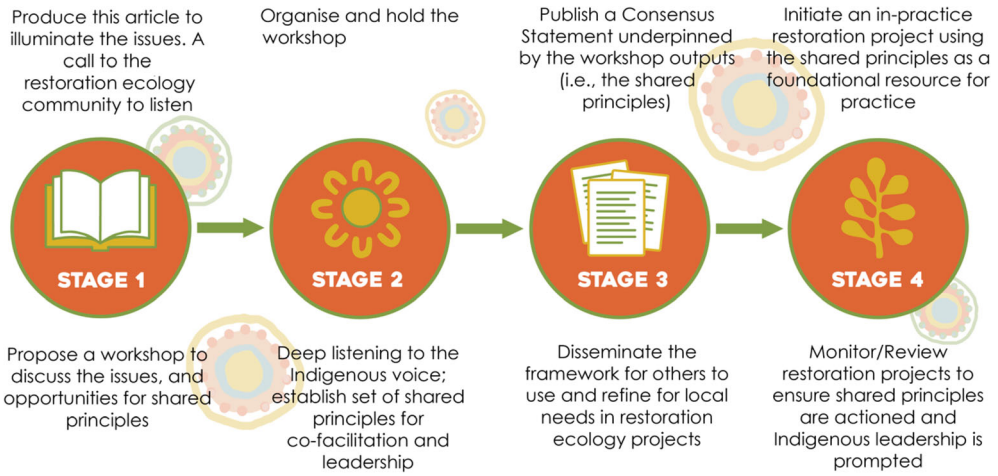

Figure 1. An outline of our intentions. This article represents Stage One (of four), that is: illuminating the key issues, a call to our restoration ecology community to listen to the Indigenous voice, and the workshop proposal (artwork by Barkindji, Malyangapa Designer Jasmine Craciun, 2020).

These principles will be refined into an ethical code of conduct in restoration ecology. This will help to guide approaches toward potential TEK partnerships—with explicit considerations for the rights, livelihoods, and leadership of Indigenous peoples. It is important to note explicitly that we recognize the vast diversity of Indigenous peoples and the lands they reside on globally. With this, any "shared principles" developed are amendable to the local contexts where cultural norms may be different, and therefore in need of different ethical or practical considerations. The respective Indigenous peoples themselves have the final say and right to uphold their own stated ethical and moral codes of conduct. This exercise is therefore meant to create awareness of the needs for ethical consideration, setting the stage for open dialogue around ethical work in restoration ecology, while setting general principles that can be an important starting point when engaging with Indigenous communities.

Restoration Ecology, Indigenous Peoples, and Global Standards

The UN General Assembly has declared 2021–2030 the "UN Decade on Ecosystem Restoration" to highlight the enormity in the task of restoring degraded landscapes globally (Ambe & Obeten 2020). However, restoration occurs over a spectrum of success (Wortley et al. 2013) and authors have urged for innovation (Matzek et al. 2017; Gellie et al. 2018). This includes drawing on complementary knowledge systems and collaboration with diverse stakeholders (Martin et al. 2010). The World Commission on Environment and Development clearly stated that Indigenous lifestyles offer modern societies lessons in the management of natural resources (Imperatives 1987).

In December 2016, the Society for Ecological Restoration (SER), which helped to set up the working group Indigenous Peoples Restoration Network in 1995, launched International Standards for the Practice of Ecological Restoration (hereafter referred to as SER Standards; McDonald et al. 2016). However, amid concerns about the inflexibility of SER Standards (Higgs et al. 2018) and the implications for Indigenous peoples (Evans & Davis 2018), the society defended its stance as a timely response to enormous international commitments (e.g. the Bonn Challenge). The SER Standards were later framed as a global, inclusive, and evolving document for the entire restoration sector (Gann et al. 2018), and also acknowledged the need for further consultation with Indigenous stakeholders (McDonald et al. 2016). Furthermore, land managers have since been urged to respect and include Indigenous perspectives in decision-making (Aronson et al. 2020). These discussion points on consultation, the need for respect, and inclusive decision-making processes with Indigenous peoples are considered more broadly in the United Nations (UN) Declaration on the Rights of Indigenous Peoples (UNDRIP). UNDRIP was developed to help protect and uphold the rights of Indigenous peoples with additional consideration for the needed engagement with Indigenous communities on their alignment with the UN Sustainable Development Goals (SDGs) (Smith & Mitchell 2020). Furthermore, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services Global Assessment is the first global-scale assessment to systematically engage with TEK holders in relation to global biodiversity conservation (McElwee et al. 2020). However, considerably more needs to be done to enable the prioritization of Indigenous leadership in restoration ecology and to alleviate the threats to Indigenous cultural integrity (Fischer et al. 2021).

Restoration Ecology and Threats to the Integrity of TEK

TEK and Indigenous Language and Culture

TEK is an embodiment of Indigenous peoples' storied and spiritual relationship to land. This knowledge is often shared orally within communities and intergenerationally through cultural practices such as storytelling, song, and ceremony (Moncada 2018). Even traditional Indigenous languages are intrinsically of the ecosystems and landscapes that bind them. Therefore, loss of biodiversity and free access and use of land significantly reduces or eliminates the practice and intergenerational transmission of TEK (Fig. 2). Ultimately, such losses are a major

Figure 2. Achieving Indigenous sovereignty in restoration ecology is an essential step toward conserving TEK.

threat to Indigenous peoples, with an erosion of Indigenous culture and language tied to erosion of the land itself.

It could be argued strongly that restoration projects exclusive of Indigenous needs are more akin to degradation than restoration. As the land is a "relative" to Indigenous peoples, when the land is not accessible and free to interact with, when the relative is lost or contact denied, the reciprocal teachings with that relative no longer happens. This loss of relationship is inclusive of Indigenous languages that are premised on a direct connection to land. We have seen that traditional botanical knowledge is lost as languages are lost and that languages are lost as biodiversity and access declines (Saynes-Vásquez et al. 2016). Therefore, TEK is under serious threat of loss and in need of revitalization and reclamation in some cases (Tang & Gavin 2016), alongside immediate regaining of land tenure rights for Indigenous peoples. With this, there is an opportunity here for the restoration ecology community to embody humble allyship, be community responsive, culturally safe, and ultimately partners in community-defined co-benefit actions that will have reverberating effects globally.

To be restorative is to have the capacity for continual renewal, and TEK has language to maintain its restorative potential over time. For example, Indigenous peoples have their own creation stories of how their existence came about, and these creation stories embody the direct relationships between all elements of the universe. Rooted in a sense of spiritual embodiment, and bound by the concept of "interconnectedness," harmony was not built but innate within the natural laws people lived by (Redvers et al. 2020). The ongoing stewardship of restorative ideals over many generations is in stark contrast to the colonial ideals and mindsets that have pervaded since the colonization of Indigenous lands. The Maralinga Tjarutja people, for example, tell stories of sustaining themselves on the Ooldea soak for 60,000 years (Brockwell et al. 1989), whereas it took only 60 years from colonization for the precious water source in Australia's desert outback to be ruined by western practices.

Perhaps western ecological science with its efforts at conservation and restoration is the industrialized world's beginning of that uphill process of harmonization with the land. However, scientific efforts at conservation and restoration are often rooted alongside the face of economic prerogatives. The current reality is that we are globally surrounded by communities of people that already know how to holistically manage the land, with the restorative and local nuance that still mystifies reductionist science. Perhaps restoration scientists can become co-facilitators and co-practitioners with Indigenous peoples for societal, linguistic, cultural, and ecological restoration, and ultimately, to become students of TEK. However, it is not up to restoration scientists to make this decision. Indigenous peoples have the final say in how their TEK is utilized, and assumptions made around Indigenous communities' willingness to share sets a dangerous precedent. Very complex histories in many areas of the globe demand efforts in reconciliation and trust-building first and foremost, while clearly recognizing and respecting Indigenous peoples' rights in the case where they are not yet ready to share.

TEK: A Call to Listen to and Properly Engage with Indigenous Voices

Collaborative approaches have the capacity to leverage mutual benefits if designed and delivered to remove barriers to Indigenous self-determination and access to land (Austin et al. 2019). Diverse Indigenous ontologies and nested knowledge systems that shape relationships to the environment exist in ways that can be profoundly distinct from western perspectives (Wilson 2008). However, these distinctions have commonly been miscalculated by western practitioners, overlooked, and in some instances dismissed as nonessential to restoration outcomes (Zedler & Stevens 2018).

Indigenous peoples have been referred to as "stakeholders" as opposed to self-determining nations with rights and responsibilities (Latulippe & Klenk 2020). Therefore, it is paramount for the development of new relational terms and perspectives for research and practice, and to give way for Indigenous leadership. As such, the recognition and presence of Indigenous communities within restoration ecology is beyond mere "inclusion." Achieving this may signal a paradigmatic shift toward building interdisciplinary literacy and the incorporation of decolonizing approaches toward prioritizing spaces for TEK. This shift challenges the dogmatic scientific voice within institutions and opens up advocacy and contextualization for Indigenous peoples experiences (Quayle & Sonn 2019).

We advocate for a sensitivity to how knowledge and "data" are co-opted. There is a push to mobilize Indigenous knowledge to understand and respond to global environmental and sustainability challenges; however, in practice there is a failure to apply deep listening, proper engagement, and respect for TEK integrity. As the interim independent report for the Environment Protection and Biodiversity Conservation (EPBC) Act in Australia (June 2020) acknowledges, "a culture of tokenism and symbolism" of Indigenous knowledge exists whereby views are not fully valued in decision-making. The EPBC Act highlights the prioritization of western scientific views, and by contrast, Indigenous knowledge and views are diluted in the formal provision of advice. As a result, TEK exploitation is endemic (Shawoo & Thornton 2019). Addressing and breaking down the biases at play is a complex endeavor. Borrowing from the social sciences, categorizations of collaboration can be understood along a continuum, e.g. "integration > inclusion > sovereignty" (Fig. 3), and it is essential that we strive to promote Indigenous sovereignty.

Previous calls have been made to work with Indigenous communities as self-determining nations and to support autonomous Indigenous research (Wheeler & Root-Bernstein 2020). A call for sovereignty can lead to complementary outcomes for TEK-western ecological knowledge (WEK) collaboration, which fosters psychosocial and material benefits. TEK promotes an intergenerational and community approach, which may galvanize marginalized peoples in ways that WEK cannot (Ludwig & Macnaghten 2020). TEK also acts as a catalyst for restoration with localized and culturally significant knowledge (Zedler & Stevens 2018). As the institutional and sociocultural norms giving rise to TEK exploitation are slowly being addressed, the call to listen to, properly engage with, and respect the Indigenous voice must also be addressed.

There is an acknowledgment by scientific communities that a collective response to the global environmental crises requires TEK knowledge; however, the western scientific community also needs to humbly acknowledge that processes of colonization and dogmatization of science have had long-lasting impacts for Indigenous communities and cultures. Now in crisis, the global community is soliciting the knowledge of Indigenous peoples as a tool for progress. Indigenous knowledge, however, must not be mere "data" that can be slotted into exogenous scientific models (Latulippe & Klenk 2020). Furthermore, as Hill et al. (2020) point out, intellectual property rights associated with TEK are not sufficiently protected. New policies, capability, and tools are needed to support the protection of TEK. Without addressing all of these issues noted above, there is a danger that the call to ecological action reinforces imbalances of relationships. So, in responding to the call for the importance of Indigenous peoples voices in restoration, there must be the consequent realization within the western restoration community that TEK-WEK collaboration is a multifaceted process with Indigenous leadership and protection of rights being a central critical variable.

Listening and Learning From Indigenous Voices

When western decision-makers have worked *alongside* Indigenous communities, broader benefits can arise (e.g. knowledge curation and transfer, recognition of historical precedence, and environmental empathy). Hence, despite a legacy of cultural appropriation and elitism undermining TEK partnerships in western science (Kim et al. 2017), there are important

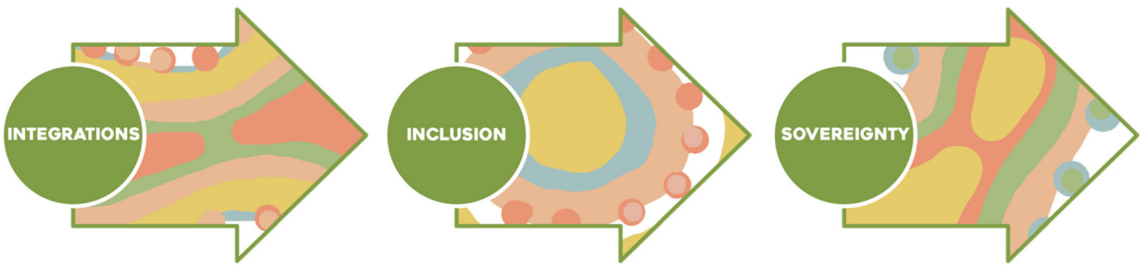

Figure 3. The continuum of collaboration. We must move beyond the narrative of integration and inclusivity, and strive to promote Indigenous sovereignty in restoration ecology (artwork by Barkindji, Malyangapa Designer Jasmine Craciun, 2020).

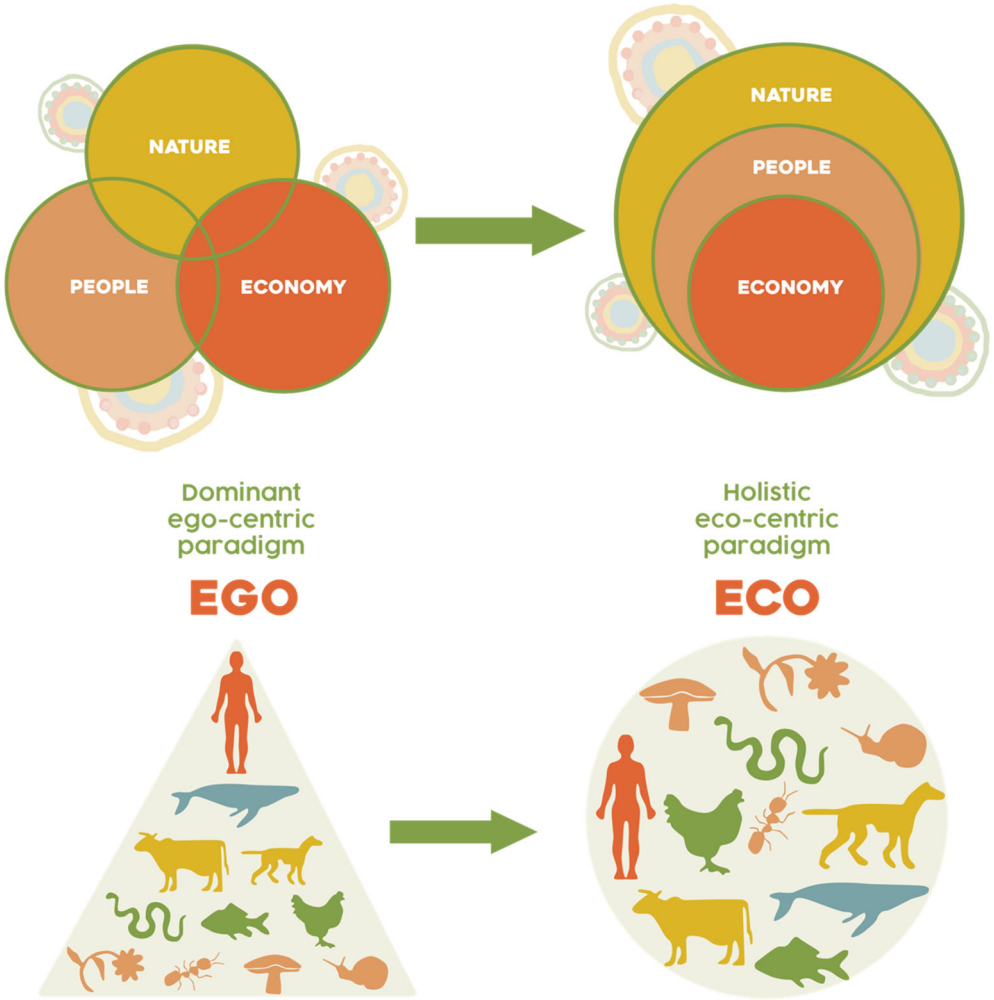

Figure 4. Top panel: the rights-of-nature paradigm versus current model of sustainability (adapted from Ito 2017); and bottom panel: ego- versus eco-centric views of nature (artwork by Barkindji, Malyangapa Designer Jasmine Craciun, 2020).

lessons to be learnt—particularly from broader philosophical frameworks.

Whanganui River, Aotearoa: the Rights-of-Nature Approach

The "rights of nature" (Fig. 4) is a legal argument that evolved in environmental law to shift the legal status of the environment from an object (e.g. a forest or river) to identifying the environment as an independent legal subject (Harden-Davies et al. 2020). This argument—known as "nature jurisprudence"—posits that with legal personhood of the environment comes all the protection due under national and international statute (McDonough 2020). Precursors for nature jurisprudence have been seen repeatedly in knowledge systems of Indigenous peoples. Rather than relying on environmental protection through a constitutional mandate, Indigenous peoples have applied this concept of governance through ancestral connection so that it remains a personal responsibility (Norman 2017). The rights-of-nature approach is founded in TEK and asks society to move away from a *transactional* model toward a more *relational* model for planetary health (Fig. 4).

For example, on the islands of Aotearoa (New Zealand), this legal concept is manifested in Maori culture as *Kaitiakitanga*, which governs the stewardship of soil, sky, and sea (Kahui & Cullinae 2019). New Zealand's primary industries—particularly forestry and dairy—have come under scrutiny for their impact on waterways (Death 2017). The Whanganui River became one of the first rivers in the world to be recognized as an indivisible and living being (Brierley et al. 2019) by being granted personhood in 2017 by the Te Awa Tupua Act 2017 of the New Zealand parliament. This legal argument is being used to frame responsible local resource management and restoration and, perhaps in the future, will help to formulate suitable penalties for environmental misuse.

Bison Personhood Treaty

In many areas of North America, the Bison are regarded as a touchstone species for Indigenous peoples. The Bison embodies

a ceremonial purpose as well as a relational purpose of cultural and ecological significance with direct relevance for creating and maintaining healthy ecosystems (Knapp et al. 1999). As the Whanganui River is considered woven into the lives of the Iwi, Bison have been considered a relative of the Indigenous peoples of North America for hundreds of generations. The Northern Tribes Buffalo Treaty, marking the first intertribal agreement in over 150 years, was signed in the autumn of 2014 by nearly a dozen Indigenous nations from Canada and the United States who together steward and control approximately 2.5 million hectares of prairie grasslands in North America (Lewson 2017). The occasion has stimulated momentum to create a new legal instrument in Canada that would ensure that Bison can effectively be "ecosystem engineers" (Government of Canada). If a new legal instrument were to be implemented, it would exemplify in action Canada's recent commitment to reconciliation with Indigenous peoples.

Bison as "person" could be viewed within the same legal framework of the "rights to nature," with it being given nonhuman entity legal standing. This important designation removes the animals from being considered solely as "property" to be used or managed by humans with no regard for their cultural or ecological significance or their intrinsic value. Instead they are seen as part of "Earth Person"—as viewed by the Blackfeet Peoples. This designation may substantially amplify and strengthen WEK campaigns to grow the North America Bison herd to 1 million by 2027. By respecting the interrelationships between us and "all our relations," including animals, plants, and Mother Earth, "as a means to embody the thoughts and beliefs of ecological balance" (Lynes 2017, p. 112), we have a greater chance of survivance.

The Whanganui River and Bison stewardship examples illustrate the myriad socioecological benefits that can arise from the push for Indigenous self-determination. There are multiple layers of complexity in the relationship between science and TEK that need to be resolved; however, the vision of restoration ecology (SER 2004) might be better achieved by the restoration sector if it takes the role of the pupil rather than assuming masterdom.

Workshop Proposal: Sharing of Knowledge(s) Between Indigenous Peoples and Restoration Ecology

We propose to organize an Indigenous-led workshop to discuss whether and how sharing of knowledge(s) between Indigenous peoples and restoration ecologists could be achieved. An important outcome of this workshop will be to establish "shared principles" to further guide our work and promote Indigenous leadership and greater equity (Latulippe & Klenk 2020). As mentioned earlier, it is important to recognize the vast diversity of Indigenous peoples and the lands they reside on globally. Therefore, the proposed "shared principles" developed, and any ethical and practical considerations, must be amendable to local contexts around the globe. The proposed workshop therefore aims to create awareness of the needs for ethical consideration, and open dialogue around ethical work in restoration ecology, while setting general principles as a starting point to engage with Indigenous communities. As Wheeler and Root-Bernstein (2020) state, "when working with multiple knowledge systems, a critical consideration is how knowledge is treated and that knowledge systems are treated in a fair and equitable way." Ethical engagement regarding how TEK and its knowledge holders are treated while promoting Indigenous leadership will be key priorities for the proposed workshop.

We aim to produce a consensus statement setting out the shared principles framed by representative participants of the workshop, which can then be amendable to local contexts. Specifically, this will provide a platform for the restoration community to ensure Indigenous knowledge is valued and respected. The principles will be further refined into a restoration ecology ethical code of conduct for considering TEK partnerships—with explicit considerations for the rights, livelihoods, and leadership of Indigenous peoples. Given that many existing global targets and goals associated with nature conservation and restoration do not necessarily reflect the heterogeneity of TEK and Indigenous worldviews, more connected local participatory targets could be used to better formulate global goals (McElwee et al. 2020). To be effective, such participatory approaches globally must engage the respective Indigenous peoples from the very beginning while promoting Indigenous leadership to construct scenarios that truly represent and protect Indigenous peoples, their TEK, and local priorities.

"Recognising, respecting and engaging with humanity's diverse knowledge systems can help secure the future of nature and nature's linkages with people" (Hill et al. 2020).

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