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Indigenous critiques and recommendations for reclaiming nature-based solutions

Melissa K. Nelson and Graeme Reed

Abstract

Indigenous peoples have long histories and diverse contemporary practices of caring for and enhancing biodiversity at different scales, in rural and urban contexts. As has been researched and documented by the Convention on Biological Diversity and others, Indigenous peoples globally only constitute 5% of the world's population and control and care for just 20% of the Earth's surface yet protect nearly 80% of the world's remaining biodiversity. Indigenous peoples have forms of biodiversity conservation that could be characterised as "nature-based solutions" (NbS), or would they be culture-based solutions? Given the extraordinary diversity of Indigenous peoples globally, there will never be a "one size fits all" solution. Yet there are general principles that have been articulated in the United Nations Declaration on the Rights of Indigenous Peoples that articulate global concepts of Indigenous Knowledge Systems (IKS) and Traditional Ecological Knowledge (TEK). IKS, TEK, and Native ways of knowing and caring for biodiversity can find both resonance and conflict with what is currently being called NbS. This article articulates Indigenous concerns and critiques of the conceptual and ontological framework of NbS, demonstrating that Indigenous Peoples' knowledge systems include a similar framework but extend it to include a distinctly biocultural and relational orientation that does not make an artificial division between nature and culture. Different Indigenous perspectives and approaches to sustainability will be highlighted, including two case stories. We conclude with recommendations for respectful, just, decolonial, and transparent ways to explore greater resonance between NbS and Indigenous peoples' rights.

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In the last 20 y, there has been tremendous growth and interest in the field of "nature-based solutions" by the scientific community to address seemingly intractable problems in what is often called the ecological crisis, from biodiversity loss to climate disruption, and how to create more sustainable human societies. "Nature-based solutions is a convenient umbrella concept that encompasses many related concepts such as ecosystem services, natural capital, ecosystem-based adaptation (EbA), and ecological engineering" (1). There is a tremendous and growing momentum of nature-based solutions in research, academia, government, and policy at local to global levels. The 2022 United Nations Environmental Assembly made a resolution, for example, to formally adopt a definition of nature-based solutions (NbS) (2). This definition states that NbS are "actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems, which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services and resilience and biodiversity benefits" (2). Additionally, "The 'Resolution on Nature-based Solutions for Supporting Sustainable Development' calls on the United Nations Environment Programme (UNEP) to support the implementation of NbS, which safeguards the rights of communities and indigenous peoples" (2, 3). As Indigenous scholars, we are interested in and concerned with this last point, of safeguarding Indigenous rights and investigating how Indigenous Peoples are involved in the NbS movement. Despite this growing emergence, Indigenous Peoples have been rarely discussed in the literature (2, 3).

Indigenous Peoples have long histories and diverse contemporary practices of protecting and enhancing biodiversity across the planet. As has been researched and documented by the World Bank of Australia (4), the Convention on Biological Diversity, the International Union on the Conservation of Nature (IUCN), and National Geographic, Indigenous peoples globally constitute only 5% of the world's population and control and care for just 20% of the Earth's surface yet live within the areas that contain 80% of the world's remaining biodiversity. Clearly, Indigenous Peoples have ways of "caring for place," i.e., biodiversity conservation that could be characterised as nature-based solutions. But in our distinct epistemologies, ontologies, worldviews, and languages, these solutions are characterised in vastly different ways.

Indigenous knowledges are always local, contextual, and embedded in the ecologies of Indigenous territories and the cultural heritage of Indigenous communities (5, 6). There are general principles, both rights and responsibilities to lands and waters, that have been articulated in the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP), in other documents and instruments, and by local Native communities that emerge from and coalesce around the concepts of Indigenous Knowledge Systems (IKS) and Traditional Ecological Knowledge (TEK). IKS, TEK, and Native ways of knowing and caring for biodiversity can find both resonance and conflict with what is currently being called "nature-based solutions." As an IUCN Report stated: "Recognition of the fundamental role that ecosystems play in supporting human well- being is a cornerstone of many [I]ndigenous [P]eoples' belief systems and has been reflected in traditional knowledge systems for centuries" (7). Knowing this past, how are today's Indigenous people engaging in solutions to pressing ecological and societal concerns?

Given the extraordinary diversity of Indigenous Peoples globally—approximately 370 million people on every continent speaking more than 4,000 of the world's approximately 6,700 languages (8), there will never be a "one size fits all" solution. Yet, today, Indigenous Peoples are being recognised as critical and essential rights holders in environmental, conservation, and climate decisions and their knowledges are seen as unique sources for addressing the accelerating problems of biodiversity loss, water scarcity, and climate disruption, among other concerns.

This article will articulate Indigenous concerns and critiques of the conceptual and ontological framework of NbS, demonstrating that while Indigenous Peoples' knowledge systems share certain elements, they extend the framework to include a distinctly biocultural (9) and relational orientation that does not make an artificial division between nature and culture. Different Indigenous perspectives and approaches to sustainability will be highlighted with recommendations for respectful, just, decolonial, and transparent ways to explore resonance between NbS and Indigenous peoples' rights. By way of example, we will also present two case stories, in urban and rural contexts, where Indigenous Peoples' self-determined knowledges and practices are advancing life-enhancing processes to solve real-world ecological issues.

Positionality

As Indigenous authors, it is important to acknowledge and be explicit with our positionality and orientation. We both identify as mixed-raced Indigenous scholar-activists, one based in the United States, and one based in Canada. We both identify as members of the Anishinaabeg/Ojibwe Nation, one of the largest Indigenous groups in North America. One works in a public university advancing Indigenous knowledges and rights in the United States and one for a First Nations advocacy organisation in Canada advocating for Indigenous rights and national policy change. One of us identifies as female and one as male, and we represent different generations, regions, and homelands. Although we both strongly identify with our Anishinaabe heritage, we also both recognise our settler ancestors from Europe. One of us has French and Norwegian heritage, and another Scottish, English, and German heritage. Both of us have doctoral degrees, one in ecology, one in rural studies, yet we both have a strong focus on serving Indigenous communities through nonprofit work and community organising at local, regional, and international levels. One of us is a long-term Indigenous ecologist yet new to the field of nature-based solutions; one is a fresh Ph.D. with a deep and thorough understanding of Nbs through the first comprehensive dissertation study of Indigenous "alternative visions of nature-based solutions." These personal and professional positionalities and "real-world" experiences give the authors a unique lens to examine Indigenous critiques, understandings, and approaches to Nature-based solutions. We humbly offer these observations in this perspectives article.

Context

Emergence of NbS. Despite the popularisation of the concept of nature-based solutions in the last several decades, it is not new for Indigenous Peoples. Due to their reciprocal relationship with the land and water, Indigenous Peoples have been practicing "nature-based" solutions since time immemorial. In mainstream discourse, the concept's emergence can be partly attributed to the momentous Paris Agreement where Parties acknowledged the importance of conservation and enhancement of carbon sinks, as well as the need to protect the integrity of biodiversity in all ecosystems. This commitment led to a growing uptake by governments, multilateral institutions, and private organisations, reflected in two references to nature-based solutions in the Kunming-Montreal Global Biodiversity Framework, adopted in 2022: Target 8 on minimising the impact of climate change and ocean acidification; and Target 11 on restoring, maintaining, and enhancing nature's contributions to people. A more detailed review of its emergence, while out of the scope of this paper, can be found in Seddon et al. (10).

Nature-based solutions are framed as an umbrella term for EbA, ecosystem-based disaster risk reduction, natural infrastructure, green and blue infrastructure, and forest and landscape restoration (10, 11). As the concept picked up momentum, the IUCN launched a process to create a Global Standard for Nature-Based Solutions ("Global Standard"). The Global Standard attempted to avoid any conceptual discrepancies by introducing a series of eight best practices to ensure rigor in the design, assessment, and scaling-up of nature-based solutions. The resolution at the United Nations Environment Assembly (UNEA) acknowledged a similar need for a multilaterally agreed definition "cognizant of and in

harmony with the concept of ecosystem-based approaches, and in the light of concerns about the potential misuse of the concept of nature-based solutions" (12).

Concerns and Critiques of NbS

The challenges and opportunities for nature-based solutions have been increasingly discussed within the literature (13). The most common concern is that nature-based solutions avoid conversations on rapid decarbonisation and the need to phase out fossil fuel usage (10). A concern that has required any purported mitigation benefits of nature-based solutions (such as the "30 percent of the cost-effective climate mitigation required to achieve the Paris Agreement targets") to be heavily caveated (14, 15). The concern underlying this criticism is the recognition that current nature-based solutions, as well as discussions on carbon pricing and carbon offsetting, are embedded within an economic system that prioritises growth and progress (15, 16). Chausson et al. (2023), for example, proposed four recommendations to ensure finance mechanisms are more just and equitable, stressing a move away from neoliberal, growth-based economic paradigms (often encapsulated by the emphasis on GDP) toward one that emphasises relational values focused on human and ecological well-being (17). This articulates another concern: the tendency to create an artificial dichotomy between people and nature by focusing exclusively on nature's benefits to society (18). There are clear benefits to prioritising solutions grounded in nature; however, current ontological orientations may be contradictory to the transformative action necessary to address the ecological crises facing the planet (19, 20).

Human and Nature? A component of the growing support for nature-based solutions is a recognition of their potential to reintroduce a human–nature relationship to a discourse dominated by Western scientific worldviews (21). Despite this recognition, the dominant conceptualisation of human–nature relationships is instrumental and technocratic, focused on the framing of biophysical and economic benefits of nature for people (22). For instance, Principle 7 of the IUCN Global Standard acknowledges the role of trade offers between economic benefits and ecosystem services. The concept of ecosystem services has been criticised by Indigenous Peoples for its instrumentalist framing as well as the absence of cultural values (23). If the concept of NbS cannot expand past these perspectives, its "…potential to support transformative change toward regenerative, healthy landscapes for people and nature will inherently be limited" (21). Potentially of more concern, "Without explicit consideration of equity and justice, [nature-based solutions] risk exacerbating inequities, rather than contributing to a more just society" (24).

Noting our wide diversity, Indigenous Peoples understanding of nature is deeply informed by their relationship with the Land (or Country in the Australian context). The Cambridge dictionary, by contrast, defines nature as "all the animals, plants, rocks, etc. in the world and all the features, forces, and processes that happen or exist independently of people." Land, and by extension nature, in an Indigenous context is more than just a territory or a home, it is spiritual and a relationship to place grounded in interconnection, interdependency, and relationships (25). Indigenous Peoples from Bawaka Country capture the complexity of this word: "…includes not just the territorial, land-based notion of a homeland, but encompasses humans as well as waters, seas and all that is tangible and non-tangible, and which become together in a mutually caring and multidirectional manner to create and nurture a homeland" (26). Blackfoot knowledge keeper Leroy Little Bear further reflected on this concept, sharing "we find our cultural resilience in the medicine of the land" (27). For Indigenous peoples, maintaining and protecting ancestral lands is essential for identity, health and well-being, and ongoing regeneration. This understanding is shared in countless oral literatures and teachings and encoded in several articles of the UNDRIP; for example article 25 states: Indigenous peoples have the right to maintain and strengthen their distinctive spiritual relationship with their traditionally owned or otherwise occupied and used lands,

territories, waters and coastal seas and other resources and to uphold their responsibilities to future generations in this regard" (28).

The difference between the two definitions of nature is stark: one that explicitly acknowledges processes that exist independently of people and the other that explicitly acknowledges the interconnection and intimate relationality of people and Land. These competing conceptual definitions have real-world implications for the design and implementation of NbS. For example, Osaka et al. (2021) critically examined the ways natural solutions to climate change have been conventionally framed, concluding that the dominant framing of these solutions can obscure the reality that they can be risky, expensive, and technocratic (29).

Indigenous Place-Thought. The understanding of Land by Indigenous Peoples is clearly quite distinct from Western concepts of superiority, dominance, and control, often neglecting the agency of the Land itself, a belief that is central to Indigenous ontologies and epistemologies (30). Watts (2013) captures this belief by introducing the concept of "Indigenous Place-Thought," a concept that understands where you are located possesses thought, acknowledging that the "…land is alive and thinking and that humans and non-humans derive agency through the extensions of these thoughts" (30). Mohawk environmental scholar Dan Longboat also supports this notion by stating: "that sacred ecology of mind is a consequence of long residence in traditional territory and enduring spiritual and intellectual relationships between people, clans, and landscape" (31). Hunt (2014) (32) echoes this definition, arguing that Indigenous ontologies cannot be separated from Land and more-than-human thought. The benefits of understanding this symbiotic relationship cannot be overstated. For example, Yunkaporta (2019) shares teachings from his Elders describing how you must work with the land, or the land will move you: a reality that is facing Indigenous Peoples today as they confront the implications of forced relocalisation due to severe climate impacts (33). In this way, Whyte (2020) describes the simultaneous ecological and relational tipping points that must be addressed together to avoid climate change's most severe impacts and the perpetuation of injustice (19, 34).

In nature-based solutions, "Nature," as represented by ecosystems, are seen as neutral, objective spaces without agency. Ecosystem processes such as the water cycle are seen as "assets" to exploit and harness for human use. For the Anishinaabeg, the living, diverse, non-human planet has life-force, agency, and a dynamism that must be respectfully observed and interacted with. The Water cycle, for example, is considered a sacred process of transformation as water shape-shifts through the liquid, solid, and gas states and moves through land, air, and sky. These transformations represent the changing seasons and constellations and mirror symmetrical processes of renewal in the human spirit. Putting a price tag on these ecological processes can seem sacrilegious to some communities (35).

Biocultural Diversity and Heritage

We understand that Indigenous peoples' knowledge systems are based on what western scientists call "nature," the plants, animals, fungi, and ecological processes that create life on Earth. But we also understand that Indigenous Knowledges are rooted in site-specific land-based cultural worldviews and practices and thus are as much culture based as Nature-based. The late physicist and philosopher David Bohm, who was a brilliant physicist yet a critic of the fragmentation in modern science, said that humans must make false unifications based on false divisions (36). We argue that the nature/culture division is one such false division, a cognitive artefact of what many call "Cartesian dualism." To address this issue in the English language we must come up with new language to indicate concepts more easily conveyed in Indigenous languages.

One term we propose utilising is the concept of "biocultural diversity" (37) and biocultural heritage (38–40). There has now been ample evidence that biological diversity shapes and is shaped by cultures (41, 42). Desert landscapes give rise to desert cultures, forest ecosystems give raise to forest cultures. Likewise, land-based cultures with centuries and millennia of history and occupancy of places anthropogenically "shape," the landscape by tending to and harvesting plants and animals, expanding culturally significant habitats, and stewarding the biological diversity of home ecosystems (43, 44). Indigenous peoples also influence ecosystem processes such as emulating fire as a management tool or creating water irrigation systems and small-scale dams to harvest fish or seafood and water food crops (45–47). Much of the literature on biocultural diversity and biocultural heritage is found in conservation biology, geography, and heritage studies, as well as in international development work focused on by the United Nations Educational, Scientific and Cultural Organization, International Union for the Conservation of Nature, and most importantly, by Indigenous communities themselves (48, 49). The International Institute of for Environment and Development defines biocultural heritage as

> *…a complex system of interdependent parts centred on the relationship between Indigenous Peoples and their natural environment. Its components include biological resources, from the genetic to the landscape level; and long-standing traditions, practices and knowledge for adaptation to environmental change and sustainable use of biodiversity.*

We find these concepts of biocultural diversity and biocultural heritage highly relevant yet lacking in discussions of nature-based solutions. Bioculturally based solutions encompass a broader suite of possibilities that resonate with Indigenous Peoples' lifeways and center their self-determined goals.

These concerns raise for us some important questions and conclusions: How can the Nbs framework be more inclusive of equity and justice considerations, with a particular focus on Indigenous rights and knowledge systems? What ethical guidelines should be considered for respectful collaboration with Indigenous Peoples and their communities? Can Nbs reexamine its core epistemological foundation to interrogate the use of "nature" as a separate and utilitarian resource for human use? As author Reed concluded in his dissertation: "Scholars, policymakers, advocates, and practitioners should take pause to reflexively unpack the assumptions implicit within certain words such as 'nature' before adopting them" (2).

To answer these questions, we draw on our personal and professional experience to reflect on the application of nature-based solutions from Indigenous perspectives. We rely on an Indigenous Research Paradigm, which directs the evaluative lens on "…the innumerable ways in which white sovereignty circumscribes and mitigates the exercise of Indigenous sovereignty" (50). Put another way, we are committed to a decolonial methodology that critiques the epistemic erasure of Indigenous knowledges in sciences and recommends respectfully acknowledging Indigenous ways of knowing as a form of epistemic justice (51). The use of case stories emphasises the importance of Indigenous storytelling practices and place-based stories for conveying and transmitting Indigenous knowledge and care of biocultural landscapes (52). We used a purposeful case story methodology, drawing on our experiences inside and outside the academy.

The two case stories highlight two examples of what Indigenous-led nature-based solutions could be. The first focuses on an urban environment in California where Indigenous Peoples are actively asserting their land back, in order to operationalise the concept of rematriation and reclaim Indigenous presence in urban spaces. The second, focused on the Pacific Northwest, introduces the concept of clam gardens, an ancient technique developed by First Nations to develop a mariculture practice that increases the abundance of clams, but also benefits the surrounding ecosystems. These case

stories are followed by a discussion that discusses their implications for advancing an Indigenous understanding of nature-based solutions.

The emphasis on case stories enables us to practically deconstruct the dominant assumptions underlying colonial systems of nature-based solutions by uplifting Indigenous sovereignty (53) and contribute to advancing Indigenous futures in policy and practice (54).

Case Story 1: Indigenous Land Back in Northern California, USA: Ohlone and Intertribal Peoples

After centuries of settler expropriation, theft, extraction, and commodification of Indigenous lands, today there is a growing Indigenous land back and land rematriation movement in the United States and Canada (55, 56). This movement is particularly active in California, USA, where dozens of Native American nations and intertribal community organisations are having land returned to them. How this land is being returned is beyond the scope of this short perspectives, yet in summary, Indigenous Peoples are reuniting with ancestral lands through a variety of means including occupation, demands, resistance, reparations, conservation, restoration, partnerships, and reconciliation (57).

One Indigenous-led organisation based in the San Francisco Bay Area, the Sogorea 'Te Land Trust (STLT), has been successful in restoring lands and creating endogenous solutions to pressing concerns and issues ranging from historical justice to food sovereignty (58). These land back initiatives are happening in both urban and rural landscapes where most Native peoples have been excluded and erased from their traditional territories. When Native peoples stop tending to the land and performing their world renewal ceremonies, for example, biodiversity often declines (43, 44). Of course, these land dispossessions happen due to invasive land exploitation such as mining, logging, dams, roads, or other negative impacts that drive the loss of biodiversity, disrupt watershed systems, and increase pollution and habitat fragmentation. Referring back to Little Bear's point, when these land "medicines" are damaged, First Nations are disrupted and harmed as the source of their resilience is injured and taken away.

The Ohlone peoples of the San Francisco Bay Area, for example, historically depended on the rich bay, coastline, and river ecosystems for securing food sources like salmon, abalone, clams, mussels, seaweed, and other marine life. Additionally, their diet consisted of deer, elk, and numerous berries, nuts, and edible seeds and underground tubers. They lived in many large, numerous villages and trade centers with high populations and complex societies (59, 60). Today, their homeland is a growing metropolis of interlocking cities and freeways including San Francisco, Oakland, and San Jose, creating a mega-tropolis of 7.5 million people, nearly all immigrants to Ohlone lands. This situation is like other Native peoples whose homelands have become major cities like the Tongva of Los Angeles, the Lenape of New York, the Anishinaabeg of Chicago, etc. For these nations whose lands have been colonized and turned into major urban centers, the first nature-based solution to their sustainability is getting their land back, even if one backyard or one acre at a time.

The STLT is an urban Indigenous women led land trust, the first of its kind in the world (55). Author Nelson has served on this board since its origins. The vision of STLT is to facilitate the return of Indigenous land to Indigenous peoples through a process of rematriation. For STLT, to rematriate is to restore a people to their rightful place in sacred relationship with their ancestral land (58). Since 2018, STLT has secured lands in Ohlone territory for urban gardens, food justice programs, climate resilient hubs, tribal housing, park lands, and ceremonial sites. STLT has worked with conservation organisations, city parks, university farms, private homeowners, and other partners to rematriate land through land

transfers, conservation easements, and other cooperative agreements. The goal and practice of rematriation is being used and applied to ancestral lands and waters as well as Native seeds, stories, and languages, virtually all critical areas of biocultural identity and heritage that tie Indigenous Peoples to their lands, ecosystems, and territories. As Johnella LaRose, cofounder and director of STLT has stated: The taking of the land, the heart of the people, was the cause of a lot of problems. And I believe that with the land trust, and you know, the land itself, I think that's really going to help us to find our way back" (58).

We argue that the rematriation efforts of STLT are a type of nature-based solution as they work toward all the goals listed in the 2022 UN Definition of Nbs referred to in the introduction of this article. For example, in terms of ecological actions, they "protect, sustainably manage, and restore natural and modified ecosystems" such as grasslands, oak woodlands, community gardens, and creeks and riparian areas through their multiple land sites. Additionally, they "address social, economic and environmental challenges" such as homelessness, poverty, food insecurity, and safety by providing safe spaces to gather, access healthy foods and medicines, and engage in cultural practices such as language recovery and food preservation. They also train youth and provide job training, internships, and employment opportunities for economic well-being.

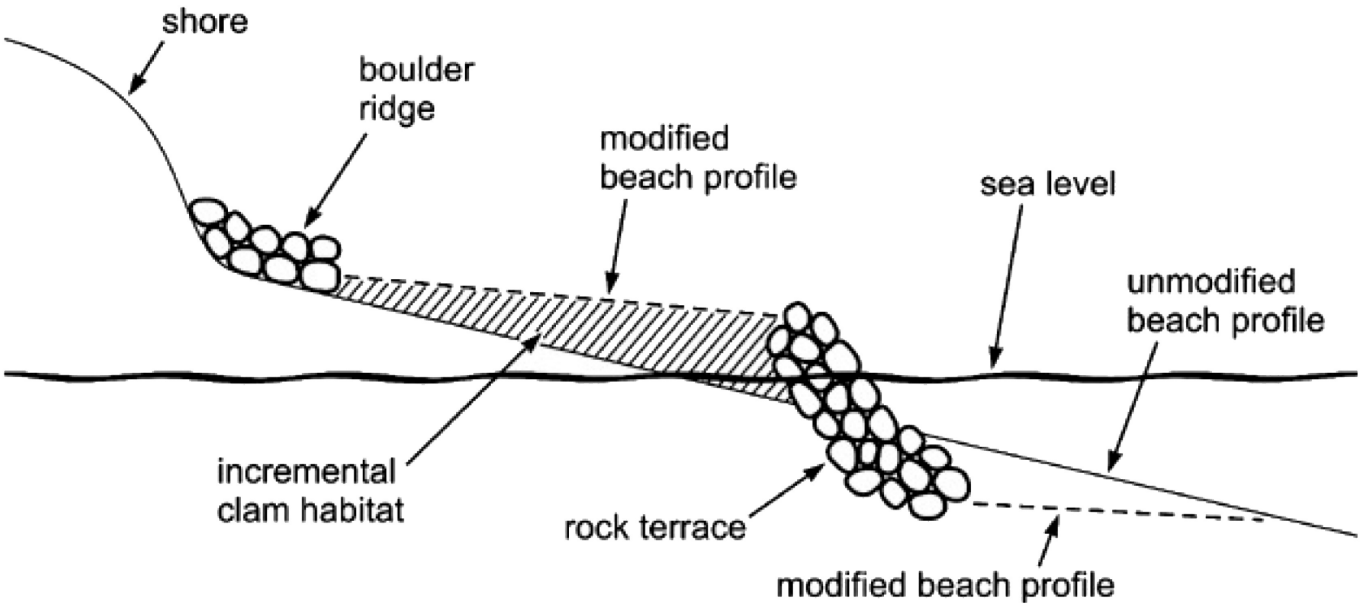
Given the goal of rematriating Indigenous lands with a holistic focus on community well-being, we suggest that rematriation is an integrated Indigenous solution that is based in repairing and healing the artificial divide between people and place, so that all thrive together.

Case Story 2: Clam Gardens—A Pacific Northwest Solution to Cultivating Abundance

In the context of Author Reed's dissertation, the concept of clam gardens was shared by one of the Indigenous experts participating in his work. The Expert explained how clam gardens could be conceptualised as an Indigenous nature-based solution, pointing to the experience of First Nations in the Pacific Northwest to cultivate abundance based on a reciprocal understanding of the ecosystem, including the tidal system. Clam gardens are considered a system of mariculture that uses a rock-walled terrace at low-tide to expand the beach area to support healthy clam development (Fig. 1). Through tending practices, such as turning over the sand, to increase the quantity and quality of clam habitat. Groesbeck et al. (2014), for instance, found that clam density and biomass was higher in clam garden beaches compared to nonclam gardens. First Nations drew on their relationship with the ecosystem to develop a complex "stewardship" strategy that increased productivity for clams improving food security for humans, but also the opportunity to benefit more-than-humans, such as birds, bears, and fish, and increase biodiversity. Other benefits of clam gardens included protecting the shoreline from erosion and participation in ecological restoration and community-based monitoring projects (61–63). The Fig. 1 demonstrates a schematic of the clam garden slowly extending habitat for clams, drawn from Augustine & Dearden (2014) (64).

One clear example of clam gardens is that of Metlakatla First Nation; a First Nation located five kilometers by boat north of Prince Rupert, British Columbia, and is a member of the larger Tsimshian Nation. Having a presence in the territory for thousands of years, the community is currently working to revitalise practices of clam digging and gardens to support intergenerational knowledge transmission, language development, and cultural revitalisation.* With the support of the Metlakatla Stewardship Society and researchers at Simon Fraser University (65, 66), Metlakatla First Nation has used its Cumulative Effects Management (CEM) Program to explore restoration projects related to the butter clam, a high-priority value for them. The CEM Program outlined several management actions intended to improve or restore habitat on butter

Figure 1.



Drawn from Augustine & Dearden, 2014 with permission. Reprinted with permission from ref. 3.

clam beaches to improve their productivity, and its connection to their food systems and well-being. Metlakatla territory is where all their food comes from, it is the Nation's fridge and freezer (67).

This understanding of the contributions of clam gardens aligns well with principle 3 of the IUCN Global Standard, demonstrating their contributions as a net gain to biodiversity and ecosystem integrity. However, the initiatives that Metlakatla are engaging in are more than just about biodiversity. The practice of restoring ancient clam gardens is also an active reclamation of First Nations decision-making practices, grounded in ceremony and spirituality. This revitalisation reflects a deep investment in future generations, as well as an assertion of First Nations jurisdiction to the foreshore area, while also uplifting First Nation knowledge systems. While this connects to principle 8 of the IUCN Global Standard, it does not acknowledge the depth of Indigenous jurisdiction and the role of clam gardens in reasserting that jurisdiction. Other examples of clam garden restoration projects are the Hul'q'umi'num and WSÁNEĆ Nations and Parks Canada, Gulf Islands National Park Reserve (68), and Swinomish Indian Tribal Community, Washington State (19). For more on clam gardens, and their current research, the "Clam Garden Network" is an important collaboration between First Nations, academics, and resource managers from the American and Canadian Pacific coast.

Discussion

Using the information contained within the two case stories, we can now return to the questions posed in the methods, encouraging readers, as well as policymakers to reflexively unpack their assumptions:
How can the Nbs framework be more inclusive of equity and justice considerations, with a particular focus on Indigenous rights and knowledge systems? What ethical guidelines should be considered for respectful collaboration with Indigenous Peoples when contemplating nature-based solutions? Can nature-based solutions reexamine their core epistemological foundation to interrogate the use of "nature" as a separate and utilitarian resource for human use?

We address each question in turn.

Can nature-based solutions reexamine their core epistemological foundation to interrogate the use of "nature" as a separate and utilitarian resource for human use?

The epistemological foundation for nature-based solutions often relies on a separation between humans and nature (69). By contrast, the two case stories explored above demonstrate how Indigenous Peoples actively challenge this artificial separation, understanding themselves as reciprocal members within the web of life. Nature-based solutions, in this context, focus heavily on protecting biodiversity and ecosystem processes while also improving the well-being of humans. The Anishinaabeg language includes a significant term for this concept, that is Mino-bimaadiziwin. This is an important concept that is generally defined as "good living" or "living a good, healthy life," but it includes more layers of meaning connected to biocultural health and regeneration of people in reciprocal relationship with nature. "Mino-bimaadiziwin includes the braiding together of well-being with economic development and ecology through respect and reciprocity" (70). This definition even includes the idea that economic activity can be done in a way that is respectful and in line with ecological limits, something Indigenous knowledges often emphasise along with Nbs. Kimmerer (70) uses her relationship with the serviceberry (Bozakmin in Potawatomi) to describe this as the gift economy acknowledging the abundance of gifts from the Earth shared by the collective (71). So, what does it take to actualise and embody this kind of solution?

The Nature-Based Climate Solutions conference hosted in Ottawa, Canada (2020) offered one example of what is needed to do this, where members of the Indigenous Caucus called for a "…transformation that shifts the paradigm away from a hyperconsumerist culture to a paradigm rooted in relationships that value the nexus of people, land and reciprocity".† The nexus of people, land, and reciprocity can also be understood through the concept of "all my relations," a concept commonly shared by Indigenous Peoples that captures an interconnectedness between humans and more-than-humans. Ferguson and Weaselboy (72) characterise this as "sustainable relations," a teaching that must inform how climate impacts and solutions are experienced and understood by Indigenous Peoples. For instance, the restoration of clam gardens by Metlakatla is grounded in an understanding that Indigenous Peoples work in partnership with the natural world to cultivate abundance.

Efforts, loosely framed under the "Land Back" movement, have been advancing Indigenous authority and jurisdiction through reconnection, rejecting the colonial-capitalist agenda that is causing loss of biodiversity and environmental imbalance (73–75). This notion is advanced by the STLT, as they assert rematriation as an integrated Indigenous solution actively repairing and healing the artificial divide between people and place by restoring urban biodiversity and reconnecting urban Indigenous people to ancestral practices and local places. Other examples include the growing phenomenon of Indigenous Protected and Conserved Areas (IPCAs) in Canada (76). In discussing the potential for IPCAs in Unama'ki, Elder Dr. Albert Marshall introduced principles of re-Indigenizing conservation, a process of thinking and acting on biodiversity conservation that advances Indigenous resilience and resurgence for the well-being of all ecology and peoples (26). The article identified M'sɨt No'kmaq, "all my relations," in the Mi'kmaq language, as lead author to "… honour the collective and to acknowledge that all stories, learning, and language come from the land" (26). This practice of making the land, or plants and animals, authors and coauthors, while uncommon in Canada, has been growing in other jurisdictions, such as by the Bawaka Collective in Australia (77).

How can the Nbs framework be more inclusive of equity and justice considerations, with a particular focus on Indigenous rights and knowledge systems?

Although the UNEA resolution on nature-based solutions acknowledges the need to support implementation that safeguards the rights of Indigenous Peoples, it is unclear how this is done in practice. For instance, Reed et al. (2022) reviewed references to nature-based solutions in nine Canadian government documents to explore their inclusion of Indigenous rights, knowledge systems, and participation. Despite a growth in references to these elements, the study identified a clear unwillingness to recognise Indigenous jurisdiction and Indigenous conceptualisations of land as systems of reciprocal relations. For Indigenous Peoples, as described in the context of STLT and clam gardens, nature-based solutions cannot be separated from the concepts of self-determination, rights, and knowledge systems. Professor Deborah McGregor described this point clearly: "…[our] own conception of what nature-based solutions are…being on the land…being there, understanding, hearing what the land has to say about what is happening" (78).

The nature-based solutions framework, therefore, must see equity, justice, and decolonization as key elements interwoven in their design, application, and implementation. But this is not only about inclusion for its own sake. Rather, the operationalisation of these elements is about designing better solutions for the biodiversity and climate crisis. Deranger et al. (2022) summarise this clearly: "…see[ing] the real inclusion of Indigenous Peoples and the respecting of our rights as not just a matter of justice and equity (though of course that is crucial), but also as a matter of designing solutions actually capable of addressing the climate crisis" (79). There will be, however, limitations to the current epistemological frame of nature-based solutions. We therefore propose echoing the perspective of Reed (2022) to introduce a set of Indigenous principles for nature-based solutions.

Indigenous Peoples have codified principles through ceremony, or other culturally appropriate ways), to describe key governance, decision-making, and cultural practices (80). For example, Umeek (2012) describes the four pillars of Ahousaht culture: isaakstalth (respecting one another); hahuupstalth (teaching one another); ya?akstalth (caring for one another); and huupiitstalth (helping one another), all upheld by the concept, heshook-ish tsawalk, signifying everything is one (21). Reed (2022) used this tradition, in conversation with seventeen Indigenous experts, to elaborate a series of seven Indigenous principles for nature-based solutions: i) embrace humility; ii) express relationality; iii) uphold rights and responsibilities; iv) embed spirituality; v) support reconnection; vi) incorporate interconnectivity; and vii) ensure Indigenous leadership. As the first set of nature-based solutions principles from the perspectives of Indigenous Peoples, he then closed with several recommendations, recommendations that would assist in the shift of nature-based solutions toward equity, justice, and decolonisation. To summarise, they are i) end the way that mainstream NbS dichotomises human–nature and instrumentalises nature; ii) engage Indigenous conceptualisations of Land and Water as systems of reciprocal relations to embed a relational framework; and iii) center Indigenous self-determination to reframe NbS toward a reciprocal, interdependent, and spiritual relationship with Mother Earth (2).

What ethical guidelines should be considered for respectful collaboration with Indigenous Peoples when contemplating nature-based solutions?

The current epistemological orientation of nature-based solutions upholds a belief that the biodiversity and climate crisis can be dealt with by technology, science, and markets alone (81). Even more problematic is the overrepresentation of Western scientists and economists in the production and assessment of evidence regarding the effectiveness of NbS, despite the projection that most NbS will occur in non-Western countries (82). Due to these significant concerns, we recommend a thoughtful reconsideration of how to approach NbS in Indigenous territories and with other local and structurally oppressed peoples. The UNDRIP outlined the need for "Free, Prior, and Informed Consent" (FPIC) when considering development, research, or conservation plans in Indigenous territories. The practice of implementing FPIC by NbS scientists would be an excellent, basic guideline to begin respectful collaboration. Since the passing of UNDRIP in 2007, and with various levels of national engagement since, there have been many toolkits created by international

organisations such as the Food and Agriculture Organization, USAID, and others, to facilitate the use of FPIC by businesses, researchers, and governments.

But more fundamental than even FPIC, which is a critically important tool, we recommend a transformation of applied ethics to truly embrace epistemic justice. Many Indigenous scholars, researchers, and knowledge holders have been examining how to best reconcile the traumatic and contentious histories of colonisation and the need for collective action today to address the poly-crises facing humanity. One framework that has gained attention is the "ethical space of engagement" (Ermine 2007), which is a framework that examines the engagement of different worldviews in an equitable and respectful way. Cree scholar Ermine explains:

> *The "ethical space" is formed when two societies, with disparate worldviews, are poised to engage each other. It is the thought about diverse societies and the space in between them that contributes to the development of a framework for dialogue between human communities* (83).

This framework had been successfully used in Canada for legal discussions, the Truth and Reconciliation process, environmental regulatory processes (84), and in the "conservation through reconciliation" movement to decolonize conservation and embrace Indigenous systems of land care to create Tribal Parks and IPCAs (85, 86). We believe it would be an effective tool and ethical practice for advancing nature-based solutions.

A related Indigenous framework is the concept of "two-eyed seeing" advanced by Mi'kmaq elders Albert and Murdena Marshall (87, 88). This approach is another way to strategically and respectfully include ways of knowing from Indigenous and western worldviews and traditions. "The Two-Eyed Seeing approach has been advocated for use in research with Indigenous people as it creates a space for Western and Indigenous ways of knowing to come together using the best of both worldviews to aid understanding and solve problems" (89).

Both concepts of "ethical space" and "two-eyed seeing" have also been linked to the coproduction of knowledge and the concept of "braiding knowledge," suggesting there is an intellectual hunger as well as a metaphoric and urgent need to understand how to do this well. This is encouraging as there appears to be more openness and interest by scientists, researchers, and policymakers to ethically understand and respect multiple epistemologies and ontologies and learn how to respectfully interface with them. We believe that the growing field of nature-based solutions must deeply consider and include these ethical frameworks when addressing sustainability challenges.

We are encouraged by this growing interest in Indigenous knowledge and ethical relations, but we are not minimising the complexity, time required, and hard work needed for these types of ethical encounters and to create reciprocal relations. As Cree educator Gwen Bridge and Lakota climate leader James Rattling Leaf say in their workshops on "getting ready for ethical space," one must be willing to be changed and transformed (89, 90). This ethical engagement requires an open, "beginner's mind," (2, 90) to suspend long-held assumptions, question cherished beliefs, and embrace alternative ways of knowing and interacting. In sum, it is a decolonial process that challenges the power structures that have minimised and oppressed Indigenous peoples in various sectors. As challenging as it may be, we feel this is critically important for true collaboration and transformation to make NbS more ethically aligned with Indigenous Peoples rights and ways of relating with and caring for biocultural landscapes.

Conclusions

In this paper, we explored Indigenous concerns and critiques of the conceptual and ontological framework of NbS and demonstrate, through case stories and analysis, that Indigenous Peoples' knowledge systems are deeply "nature-based," yet include a distinctly place-based cultural orientation rooted in Indigenous epistemologies and ontologies. We propose transforming understanding to include a broader biocultural emphasis that disrupts the artificial division between nature and culture and focuses on self-determined, endogenous problem-solving.

In terms of pragmatic recommendations, we humbly offer these concluding thoughts (in line with those proposed by Reed 2022 (19). First, IKSs offer an alternative and transformative conceptualisation of NbS by centring and prioritising rebalancing reciprocal relationships with the land, water, and more-than-human beings. Second, the use of NbS will only be transformative if it recognises Indigenous Peoples as Nations with an inherent right to self-determination and implements the minimum standards of the UNDRIP. For example, we can draw from the Canadian legislation Bill C-15: An Act respecting the UNDRIP, as this may facilitate the opportunity to review past climate policy decisions and investigate how NbS upholds these minimum standards. Third, NbS must not be considered outside of the broader Indigenous-settler government relations, recognising the ongoing legacy of colonisation, land dispossession, and environmental harm. Failure to do this may result in NbS propagating a form of climate colonialism instead of opening up institutional space for Indigenous-led decision-making to design, evaluate, and implement NbS (91, 92). Examples such as IPCAs, Indigenous land trusts, and Indigenous guardians offer great potential to simultaneously advance decolonisation and decarbonisation.

By ethically respecting Indigenous ways of knowing and honouring Indigenous rights, Indigenous peoples will be able to uphold their responsibilities to the Earth, protect biocultural diversity, and enhance the well-being of "all our relations."

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- **Authors the authors:** Melissa K. Nelson, School of Sustainability, Arizona State University, Tempe, AZ 85281. Graeme Reed, Centre for Indigenous Knowledges and Languages, York University. To whom correspondence may be addressed. Email: Melissa.k.nelson@asu.edu.

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