# There is no word for 'nature' in our language: rethinking nature-based solutions from the perspective of Indigenous Peoples located in Canada

Graeme Reed[1] · Nicolas D. Brunet[2] · Deborah McGregor[3] · Curtis Scurr[4] ·
Tonio Sadik[4] · Jamie Lavigne[4] · Sheri Longboat[2]

## Abstract

Support for nature-based solutions (NbS) has grown significantly in the last 5 years. At the same time, recognition for the role of Indigenous Peoples in advancing 'life-enhancing' climate solutions has also increased. Despite this rapid growth, the exploration of the intersection of NbS and Indigenous Peoples has been much slower, as questions remain about the ability of NbS to be implemented while respecting Indigenous rights, governance, and knowledge systems, including in their conceptualizations. To address this knowledge gap, we draw on 17 conversational interviews with Indigenous leaders, including youth, women, technicians, and knowledge keepers from what is currently known as Canada to explore Indigenous conceptualizations of nature, nature-based solutions, and the joint biodiversity and climate crisis. Three drivers of the biodiversity and climate crisis were identified: structural legacy of colonization and capitalism, a problem of human values, and climate change as a cumulative impact from industrial disturbances. Building on this understanding, our findings indicate that shifting towards Indigenous conceptualizations of NbS as systems of reciprocal relationships would: challenge the dichotomization of humans and nature; emphasize the inseparability of land, water, and identity; internalize the principle of humility and responsibility; and invest in the revitalization of Indigenous knowledge systems. As the first exploration of Indigenous conceptualizations of nature within NbS literatures, we close with four reflections for academics, advocates, leaders, activists, and policymakers to uplift Indigenous climate solutions for a just, equitable, and resilient future.

**Keywords** Nature-based solutions · Indigenous Peoples · Nature · Self-determination · Indigenous knowledge

## 1 Introduction

Support for nature-based solutions (NbS) has grown significantly in the last 5 years (Hanson et al. 2020) as supporters highlight their ability to work with nature for biodiversity, people, and the climate in the face of indivisible societal challenges (Griscom et al. 2019; Chausson et al. 2020; Seddon et al. 2020b, 2021). Indeed, the joint crisis of biodiversity

---

collapse and climate change is expected to cause a series of cascading impacts ranging from increasingly severe weather, rising sea levels, to the extinction of over one million species, among many other unknown impacts (IPBES 2019; Bush and Lemmen 2019). To mitigate the most severe impacts, a growing number of national and international pledges, declarations, and funding commitments have been made recognizing the role of NbS to address these joint crises simultaneously. One example, the Leaders' Pledge for Nature at the United Nations Summit on Biodiversity (September 2021), captured this as Parties committed to '…step up global ambition for biodiversity and to commit to matching our collective ambition for nature, climate and people with the scale of the crisis at hand' (1).

At the same time, recognition for the role of Indigenous Peoples in advancing 'life-enhancing' climate solutions has been rising significantly (Wildcat 2009; Zurba and Papadopoulos 2021). The Glasgow Climate Pact at the twenty-sixth Conference of the Parties (COP 26),[1] for example, has six references to Indigenous Peoples including an emphasis on the role of their cultures and knowledges in effective action on climate change. This built on strong statements from the Intergovernmental Panel on Climate Change Working Group II Report (2022), the World Summit of the International Union of Conservation of Nature (2021), and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (2019). Internationally, Indigenous Peoples have also been sharing their perspectives on NbS, asserting that 'Indigenous Peoples knowledge systems are nature-based and honor the complex interdependence of all life forms. This is the root of success for the develop[ment] of effective solutions and practices for biodiversity conservation and climate change adaptation and mitigation' (Indigenous Peoples Forum on Climate Change and Indigenous Peoples Major Groups 2019). Clearly, Indigenous Peoples play a central role in protecting, sustainably managing, and restoring land and water ecosystems, generating co-benefits for mitigation, adaptation, and biodiversity (Reed et al. 2021).

Loosely known as solutions inspired and supported by nature (European Commission [EU Commission] 2015), the rapid growth in NbS has been attributed to the easily digestible notion of 'nature providing solutions' (Cohen-Shacham et al. 2019; Hanson et al. 2020). This has supported its usage in policy and corporate decision-making, despite criticism for the variable definition of NbS, often depending on the specific context (Welden et al. 2021). From this perspective, the vagueness of the concept has enabled, on one hand end-users and practitioners to build a shared understanding of 'nature' and 'solutions' through their ontological framework (enabling some constructive ambiguity); while on the other, perpetuated the dominant instrumentalist framing of ecosystem services (i.e. nature provides benefits to society) that reinforces a human-nature dichotomy (Maller 2021; Welden et al. 2021). Mairena-Cunningham and Araúz (2020), from an Indigenous perspective, problematize this dichotomization between humans and nature, extending it to the disregard for the rights of Indigenous Peoples (including land tenure) and the devaluing of Indigenous knowledge systems and cultural practices. Furthermore, Indigenous Peoples are concerned that NbS will replicate many of the problems with carbon markets, such as REDD+, and uphold a belief that the joint climate and biodiversity crisis can be dealt with markets, technology, and science (Forest Peoples Programme 2021; Seddon et al. 2021). Instead, Cameron et al. (2021) view these problems as '…a deeply human story about the relationality between humans and the planet, and the consequences associated with colonial ideologies and actions that subjugate humans, ecosystems, and ultimately planetary balance' (17).

---

[1] The decision can be found here: https://unfccc.int/sites/default/files/resource/cma2021_L16_adv.pdf

Despite this rapid growth, the exploration of the intersection of NbS and Indigenous Peoples has been much slower (Townsend et al. 2020; Indigenous Climate Action [ICA] 2021b). In a Canadian context, Reed et al. (2022) found that NbS only emerged in federal climate policy in 2019, following the election victory of Justin Trudeau's Liberal Party. Despite a growing recognition of Indigenous rights, knowledge systems, and participation in federal climate policy, the study identified an unwillingness to recognize Indigenous jurisdiction and Indigenous conceptualizations of land as systems of reciprocal relations. In this way, questions remain about the ability of NbS to be implemented without upholding Indigenous rights, governance, and knowledge systems (Townsend et al. 2020). This limited recognition not only contributes to the uncertainty of the concept, but also risks the justification of further violence and dispossession against Indigenous Peoples under the guise of anthropocentric 'nature-based' solutions (Whyte 2018; Dominguez and Luoma 2020). In this way, Whyte identifies a problem with '[t]hese solutions are being designed by non-Indigenous People[s] based on their conceptions of "nature", and their understandings of the causes of climate change' (cited in ICA 2021b, 13).

This paper uses an Indigenous Research Paradigm (IRP) to explore Indigenous conceptualizations of 'nature' in nature-based solutions to provide insight into Indigenous visions of NbS and the root causes of the joint biodiversity and climate crisis. In partnership with the Assembly of First Nations (AFN) and as a team of predominantly Indigenous authors,[2] we used an IRP to center Indigenous Peoples knowledge and experience in the research process to ensure the five Rs—respect, responsibility, reciprocity, relationality, and relevance—were appropriately included (Styres and Zinga 2013). Although there have been critical explorations of the acceptance of 'nature' from the perspective of Indigenous Peoples (Ferguson and Weaselboy 2020), this novel exploration has not yet been conducted in the NbS literature, despite calls for research on the political implications of nature (and the natural) (Osaka et al. 2021). We conclude with four reflections for academics, advocates, leaders, activists, and policymakers to uplift Indigenous climate solutions in the NbS discourse, contributing to the growing body of literature on Indigenous-led climate policy according to Indigenous ways of knowing, doing, and being (Reed et al. 2021, 2022; Deranger et al. 2022).

## 1.1 Conceptualizing nature-based solutions

Working with nature to address societal challenges is not new for Indigenous Peoples (ICA 2021b), nor is it new to climate discourse. Concepts such as ecosystem-based adaptation (EbA), natural infrastructure, and ecosystem-based disaster risk reduction have been around for decades (Seddon et al 2020a, 2021), yet academic, political, and corporate interest in NbS has grown in recent years (Griscom et al. 2017; Chausson et al. 2020; Hanson et al. 2020). To capture this momentum, the International Union for the Conservation of Nature (IUCN) developed a series of eight best practice principles and a definition: '…actions to protect, sustainably manage, and restore natural or modified ecosystems that address societal challenges (e.g. [climate change]) effectively and adaptively, simultaneously providing human well-being and biodiversity benefits' (Cohen-Shacham et al. 2016, 2). Since this time, other definitions have emerged, including from the European Commission (2015) as

---

[2] The author team is predominantly First Nations from Anishinaabe, Algonquin, and Mohawk backgrounds. The other two authors have collaborated closely with Indigenous Peoples for several decades.

'…[solutions] inspired and supported by nature, and they maintain and enhance natural capital. They are positive responses to societal challenges, and can have the potential to simultaneously meet environmental, social and economic objectives' (24), and by Baustian et al. (2020) as simply those solutions created by humans. A subset of NbS focuses on natural climate solutions (NbCS), which focuses more on climate change mitigation activities (Griscom et al. 2019; Schulte et al. 2022). A detailed review of NbS and NbCS emergence and scientific basis can be found in Seddon et al. (2021), as well as their challenges and opportunities (Chausson et al. 2020; Fleischman et al. 2020; Seymour 2020).

Scholars recognize the potential for NbS to introduce a new human-nature relationship to an international stage dominated by Western scientific worldviews (Welden et al. 2021); however, there is little to suggest that dominant efforts, including those represented by the IUCN, are attempting to do this (IUCN 2020). For example, Principle 7 of the Global Standards highlights the role of trade-offs between a few immediate economic benefits for the development and production of the full range of ecosystem services: a concept that has received criticism for its instrumentalist framing of biophysical and economic benefits of natural systems for people (Costanza et al. 2017). This has influenced also how human-nature relationships are conceptualized in NbS (Hanson et al. 2020), moulding around instrumental and technocratic perspectives that dominate international, national, and corporate policy-making (Bieling et al. 2020). If the concept of NbS does expand past these perspectives, its '…potential to support transformative change towards regenerative, healthy landscapes for people and nature will inherently be limited' (Welden et al. 2021, 973).

## 1.2 'Nature' in nature-based solutions

Although politics, culture, and history shape what counts as 'nature' (Escobar 2001), in the context of NbS, and their derivative NbCS, ontological tensions arise when considering the relationship between humans and nature. Jasanoff (2010), for example, describes how the dominant imaginary of climate change, endorsed by Western science, '…takes over from the subjective, situated and normative imaginations of human actors engaging directly with nature' (235). On the contrary, at the Nature-Based Climate Solutions conference hosted in Ottawa, Canada (2020), members of the Indigenous Caucus called for a '…transformation that shifts the paradigm away from a hyper-consumerist culture to a paradigm rooted in relationships that value the nexus of people, land and reciprocity'.[3] 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 as risky, expensive, and technocratic. Outside of this study, there have been limited discursive exploration of NbS, or its constitutive parts—'nature', 'nature-based', and 'solutions'.

---

[3] A member, Diandra Bruised Head from the Blood Tribe First Nation, read the statement developed by the Caucus in the conference plenary. A written version of the Statement can be found here. The recording can be found here beginning at 00:35 and ending at 5:15 here. https://static1.squarespace.com/static/5dee6 7fbbfc3d2411199251b/t/5e87db456df85b022533a73a/1585961801593/Indigenous+Caucus+Statement. pdf, https://www.youtube.com/watch?v=zgvKD2nLBoE.

### 1.3  Land, country, and Indigenous place-thought

Recognizing their diversity, Indigenous Peoples hold common understandings of their relationship with the Land or Country in the Australian context. By contrast, the Oxford dictionary (Stevenson 2010) defines land as 'the part of the earth's surface that is not covered by water' and 'an area of ground, especially in terms of its ownership or use'. Land in an Indigenous context is more than just a territory or a home, it is spiritual and relationship place grounded in interconnection, interdependency, and relationships (Styres and Zinga 2013). Indigenous Peoples in 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' (Bawaka Country et al. 2013, 186). These relationships are also central to the design of Land-based governance systems that are manifested through culture, ways of life, political structures, and economies (Whyte 2018).

This grounding is 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 (Watts 2013). Watts (2013) captures this belief by introducing the concept of Indigenous Place-Thought, a concept that believes 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' (Watts 2013, 2). Hunt (2014) 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 relocation due to severe climate impacts. 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.

## 2  Materials and methods

Broadly, this study is based on an IRP in order to refocus the evaluative lens on '…the innumerable ways in which white sovereignty circumscribes and mitigates the exercise of Indigenous sovereignty' (Nicoll 2004, 19). Furthermore, by centering Indigenous Peoples and their knowledge systems in the design, implementation, and collection of research, as well as in designing the Author team, we employ an IRP to counter the hegemonic occupation of Western systems of knowledge in the design and evaluation of NbS (Smith 2012). This approach enables us to deconstruct the dominant politics underlying colonial interpretations of nature (and by extension climate solutions) by 'being in' Indigenous sovereignty (Neville and Coulthard 2019). Finally, 'being in' Indigenous sovereignty contributes to a decolonial praxis that also advances everyday practices of resurgence (Corntassel 2012).

**Table 1**  List of interview questions used in this study

| Interview questions |
| --- |
| Introduction |
|    - Can you describe where you are from? Have you observed or experienced environmental changes over the course of your life? If so, what kind of changes? |
| Part 1: Indigenous Climate Leadership |
|    - What do you consider as causing these environmental changes? How should these be addressed? |
|    - What are Indigenous-led climate solutions? |
|    - Is Indigenous-led conservation an example of climate action? If so, how? |
| Part 2. Nature-based solutions |
|    - How do you describe 'nature'? How about 'climate change'? Is there a word in your language for it? |
|    - What does this concept (nature-based solutions) mean to you? |
|    - How do you perceive the federal government to describe it? Are there differences with how you describe it? |
|    - How should the rights and responsibilities of Indigenous Peoples be respected in these solutions? |
|    - What needs to happen or change (political, social, cultural, environmental, or economic) to support these? |
| Part 3: Building a framework for Indigenous-led nature-based climate solutions |
|    - Are there key principles that could guide the development of Indigenous-led nature-based solutions? If so, what are they? |
|    - Should these solutions interface with 'mainstream' nature-based solutions? If so, how? |
|    - Are there frameworks that could help guide the interaction of these two approaches? |
| Concluding remarks |
|    - Is there anything that I missed? Any additional points that you would like to share? |
|    - Could you share one or two people that could participate in this study? |

## 2.1 Methods

This project originated in a research partnership with the Assembly of First Nations (AFN), a national advocacy organization for First Nation citizens in Canada, as they work to develop a National Climate Strategy, as directed by the Chiefs-in-Assembly's resolution, 'Declaring a First Nations Climate Emergency'. Members from the AFN (TS, CS, JL) participated in the formulation of the research questions, the identification of interview candidates, and the analysis of the results (Wilson 2008). Experts were identified in partnership with AFN based on their Indigenous identity and professional experience working in climate and conservation-related fields. To do this, we used a purposive sampling strategy to focus on identifying a diversity of Indigenous voices, including leaders, youth, women, technicians, and knowledge keepers from across Canada (Creswell et al. 2007). We expanded this through a snowball sampling technique, where each Expert was asked to identify an additional 1 or 2 Experts. The term Expert is used to explicitly value the lived experience and knowledge that participating Indigenous Peoples brought to this study.

Interviews used a conversational method to '…[honour] orality as means of transmitting knowledge and upholds the relational which is necessary to maintain a collectivist tradition' (Kovach 2010, 42). In an Anishinaabe context, this approach aligns with traditional practice where if you wanted to know something, you would follow protocol by asking with an offering, which would then lead to a conversation (Chiblow 2021). A broad interview guide covered 14 questions along with sub-question prompts organized

**Table 2** List of Indigenous Experts interviewed

| Code | Nation |
|---|---|
| Hetxw'ms Gyetxw (Brett D. Huson) | Gitxsan Nation |
| Emily McDougall | Southern Tutchone and Tlingit |
| Kyle | Métis |
| Jocelyn Joe-Strack (Däk'äläma) | Champagne and Aishihik First Nations |
| Lisa | Membertou First Nation |
| Eriel | Dënesųłiné |
| Cree Legal Scholar | Neyaskweyahk, Ermineskin Cree Nation |
| Expert 8 | Anishinaabe-Métis |
| Spencer Greening (La'goot) | Tsimshian |
| Tyson Atleo | Ahousaht Nation |
| Becky Cook | Misipawistik Cree Nation |
| Quinn | Anishinaabe |
| Jordyn Burnouf | Nehiyaw |
| Cheyenne MacDonald | Sipekne'katik First Nation |
| Jesse McCormick | Anishinaabe |
| Crystal | Inuit |
| Chief Byron | Syilx Okanagan |

into four general categories, described in Table 1. Probing questions were asked during the interview to dive deeper into specific areas, enabling new themes and conversations to collaboratively emerge.

Although the original plan was to hold these conversations in person, COVID-19 changed the approach to online discussions via Zoom. Consent was given by participants either choosing to sign the consent forms or providing verbal consent on the online call. A total of 17 interviews, out of 26 invitations, were conducted in English, taking between 36 min to 1.5 h during the months of June to December 2021. Each was recorded (with permission) using Zoom, transcribed by one co-author (GR), and analyzed using NVivo, a qualitative data analysis software (Hsieh and Shannon 2005). Once the transcription was complete, it was shared with participants to ensure their message and intentions were appropriately characterized, as well as, in the specific instance where an Indigenous language was used; the proper spelling was correct. All quotes, preferred affiliation, and specific Indigenous Nation were approved by each Expert prior to their inclusion in this study, as per research ethics (REB 21-02-2017 at the University of Guelph). Table 2 shares the specific identifying information agreed by each Expert, ensuring that they receive appropriate credit for their contributions. Not all invited Indigenous experts participated in the research, thus not all geographic regions in Canada were represented (Quebec, Northwest Territories, and Newfoundland and Labrador).

In an IRP, analyzing data is also known as 'meaning-making' referring to a process that involves the spirit, heart, mind, and body (Absolon 2011; Archibald 2008). For example, Chiblow (2021) in describing an Anishinaabe coding process introduces the concepts of *bizindaage* (I listen to someone), *ozhibii'igi* (I wrote things down), *naanaagadawendam* (I consider, notice, think, reflect, realize), and *nisidotaagwad* (it is understood). Drawing on this framework, one co-author (GR) examined each transcription, at least twice, to identify recurring themes, which were then analyzed, discussed, and modified in an iterative fashion using NVivo (Bennett et al. 2019).

Climatic Change



**Fig. 1** Geographic representation of Indigenous Experts interviewed ($n=17$)

## 3  Results and discussion

Drawing on these conversational interviews, we sought to explore how Indigenous Peoples conceptualize 'nature' in *nature*-based solutions to open space for Indigenous-led climate solutions according to Indigenous knowledge systems. Interviews included representation from First Nations ($n=14$), Métis ($n=2$), and Inuit ($n=1$), the three recognized Indigenous Peoples in Canada,[4] holding many roles in the climate and conservation field and trained in both Indigenous and western education. These roles include First Nations leadership, young leaders, women, technicians, academics, and knowledge keepers from across Canada (see Fig. 1), and who work for different Indigenous organizations (both at the grassroots and national level), academics institutions, and non-governmental organizations.

---

[4] We stress that even within these groups of recognized Indigenous Peoples, there is great diversity.

As we heard from these Experts, it became apparent that to understand these conceptualizations, we had to first hear their perspectives on what the root causes (or drivers) of the joint biodiversity and climate crisis are. This exploration is essential to understand how NbS proponents (and the concept itself) characterize the 'societal challenges' these solutions are working to address. Compared to an emphasis on greenhouse gases emissions, our analysis identified three main drivers of the biodiversity and climate crisis: (i) the structural legacy of colonization and capitalism, (ii) a problem of human values, and (iii) climate change as the cumulative impact of industrial disturbances.

## 3.1  Structural legacy of colonization and capitalism

Experts often referenced the structural legacy of colonization and capitalism as a key driver of their observed and experienced environmental changes. They described the various efforts made by the colonial government (i.e. Canada) to remove them from their lands and waters and destroy their languages, cultures, and worldviews.[5] A Cree legal scholar from Neyaskweyahk, Ermineskin Cree Nation, for example, shared the goal and vicious circle of the colonial project: '…with the ultimate goal of genocide by the disappearance of [Indigenous Peoples]'. This lived reality of Indigenous Peoples is often actively excluded from discussions on climate change, adaptation, and NbS (Cameron 2012). In a similar vein, capitalism, and the pursuit for maximizing economic profit and growth, was seen as a major driver in our study for both the climate crisis but also for the ongoing impacts on their lands, waters, and territories. Chief Byron, a Syilx Okanagan, rhetorically asked, 'who is it that said that we have the right to destroy something simply for economic benefit?' Certain NbS proponents believe that NbS can respond to this question by helping transition away from a destructive economic model towards one that values nature and its contributions to people (Seddon et al. 2021). Others (Welden et al. 2021), however, question this transformative ability when NbS (and their designers) are imbedded within a dominant economic system that maintains certain ontological orientations towards the natural world as commodity, property, or resource. By contrast, the Experts were clear in their belief that all components of the world are alive and imbued with spirit, aligning with Indigenous scholars (Borrows 2002; Craft 2018; McGregor 2018).

## 3.2  A problem of human values

Many Experts in our study described a series of human values, developed by those colonial and capitalist systems, that influence behaviours and activities which drive the biodiversity and climate crisis in response to questions on the causes of environmental and climate change. Spencer Greening (La'goot), Tsimshian, puts it simply: '…the modern world, or the mainstream Western world, has lost touch with a human society that values relationships with ecosystems more than its own excess'. Knowledge Keepers at the Onjisay Aki Gathering echoed this point, explaining that the emergence of these values, such as greed, competition, selfishness, and domination, fuel destructive human behaviours, which in turn create severe impacts such as climate change, biodiversity decline, and poor health of people (Cameron et al. 2021). The artificial separation between humans and nature, as

---

[5] For more detail, please refer to the Final Reports of the Truth and Reconciliation Commission found here: https://nctr.ca/records/reports/ and the National Inquiry into Missing and Murdered Indigenous Women and Girls found here: https://www.mmiwg-ffada.ca/final-report/

described by the Experts, has enabled the paradigm of 'progress' and pursuit of economic growth to result in the failure of the last 30 years of climate policy (Stoddard et al. 2021). Kyle, Métis, shares a further tension in climate discussions: '…there [is] an increasing tension between how the world is supposed to work and how the dominant society want it to work'. He continues to describe climate change as '…a product of that tension… [with] those two things coming into conflict with each other'. Elder Dave Courchene-baa (as cited in Cameron et al. 2021) captures this well: 'climate change is really a reflection of values that are creating this imbalance that we're finding in today's world' (p. 6). Among all Experts, the restoration and resurgence of Indigenous knowledge systems were seen as a key priority to rebuild reciprocal relationships with the Land, returning to *kincentric* beliefs (Todd 2016; Reo 2019).

### 3.3 Climate, cumulative effects, and industrial disturbances

Our results demonstrated how Experts framed the biodiversity and climate crisis in a broader context—one characterized by a long, cumulative history of impacts on ecosystems by industrial development. Building on this, Eriel, Dënesųłiné, discussed the tendency to focus exclusively on oil and gas as a key driver of industrial disturbances, which neglects the '…long history of economic drivers that have been created and forced upon our communities by settler society without our participation… [such as] logging, agriculture, and mining for multiple different types of things in our territory'. This sentiment was echoed by Expert 8, Anishinaabe/Métis, challenging us to avoid looking at climate change as this '…abstract thing that is removed from all the industrial activities within the territory', continuing to urge that we take them '…as part of an equation and multiple components, looked at over time, so cumulative and compounding effects over time'. These reflections, in line with other Experts, recognize how Indigenous Peoples have been concerned about ecosystem destruction and environmental change long before dominant society officially recognized it as a crisis (McGregor et al. 2020).

## 4 Indigenous conceptualizations of 'nature' in nature-based solutions

We now shift our focus to how Experts conceptualized 'nature' in nature-based solutions to shed light on Indigenous visions of NbS and discuss their implications for critiquing dominant framings of NbS. While this exploration of NbS from the lens of Indigenous Peoples is novel and exploratory, it is not intended to provide a pan-Indigenous overview of 'nature', rather it will identify key themes and note specific examples based on the Expert's specific nation, upholding the importance of relational accountability (Reo 2019). The themes emerged from questions related to Indigenous understandings of nature and nature-based solutions, broadly summarized into four categories: (i) no word in their Indigenous language for nature; (ii) the inseparability of Indigenous Peoples, Land, and Water; (iii) humility and the responsibility of humans; and (iv) the revitalization of Indigenous knowledge systems.

### 4.1 No word in their Indigenous language for 'nature'

Broadly speaking, most Experts shared that there was no direct translation in their language for nature. Some provided examples, such as 'aki' in Anishinaabemowin and 'Wsitqamu'k'

in Mi'kmaw but clarified that this was a poor characterization of the concept. Spencer Greening (La'goot), Tsimshian, explained broadly why this was the case: '…there isn't really a word for [nature] in a lot of languages. And so it only becomes something when we other it. And so in an Indigenous sense, like, nature is just our place, our home, where we belong to. And you wouldn't need to define it in that way. But in a Canadian or Western sense, we're able to define it because we've othered it'. This point was echoed by Experts as they described their relationships with more-than-humans. More-than-humans in an Indigenous context, according to Kimmerer (2013), must be broadly understood as relatives, or more aptly teachers, for humans who have the least experience with how to live reciprocally with the world around us. Maller (2021) suggests more-than-human is useful for '…[moving NbS] past anthropocentric, colonial, and purely functionalist framings' (5).

Experts attributed these anthropocentric framings of NbS to the noun-based nature of English. In contrast, Quinn, Anishinaabe, discussed how Indigenous languages are generally verb-based, drawing on the example of Anishinaabemowin: '…[it] is really verb based, so you don't have *things*. The amount of verbs in the language far outweighs the amount of nouns so everything's in motion…things [that] are inanimate tend to be animate, where in English, and the idea of Western-thinking, things are always inanimate. In Anishinaabemowin, things are alive, they're more than just alive, you know, there's often things that are spiritual'. Echoing this sentiment, Jordyn Burnouf, member of Black Lake First Nation, provides an example of how specific teachings, and the phenomenon they relate to, cannot be conveniently translated into English: '…there are teachings in language that can explain phenomenon that we can't understand in scientific and Western terms, right? We can't translate that to English because that concept of our connection, our kinship between creator, the spirit and the land'. The concept of 'All my Relations' (or 'sustainable relations' according to Ferguson and Weaselboy 2020) captures this interconnectedness, relationship, and reciprocity and has been applied to describe how this teaching must inform how climate impacts and solutions are experienced and understood by Indigenous Peoples, such as by Fort William First Nation knowledge holders (Galway et al. 2022).

Our results show that due to the noun-based structure of English, the term 'nature' perpetuates a separation of humans and nature. This overlooks a foundational understanding in Indigenous ways of knowing that see the humans, spirit, and Land as interconnected, relational, and reciprocal, captured in the near non-existence of nature in the Indigenous languages shared by the Experts.

## 4.2 Land, Water, and identity are inseparable

All Experts discussed the inseparability and deep connection between them and the Land and Water, though they noted how these interconnections were exercised depending on the specific Nation. For example, Cheyenne MacDonald, Sipekne'katik First Nation**,** shared a Mi'kmaq word to represent interconnectedness: '…M'sɨt No'kmaq means all my relations, and that we're all interconnected with each other, which kind of encompasses how we are all very much connected and that when something happens in one area, it directly impacts others'. In an Inuit context, Crystal cited the principles of Inuit qaujimajatuqangit (IQ principles) to describe this reciprocal relationship: '…if we look at avatittinnik kamatsiarniq, respecting for the land, caring for the land, the animals and the environment. And really being true to that, allowing the natural, or nature to do its work that it's meant to do, because nature knows what they're doing'. This can be contrasted with the parentage of

current framings of 'nature' either from romantic idealism (i.e. nature as pristine, good, and possessed of valuable external social qualities) and environmental instrumentalism (i.e. nature should be protected for anthropogenic benefit) (Osaka et al. 2021). Eriel, Dënesųłiné, believes these framings run contrary to the Indigenous value system: '…we are a part of these systems in order to manage and maintain these systems for the rich biodiversity that they have, this requires us to be a part of that system and structure'.

In this context, Quinn, Anishinaabe, also responds to the question of describing nature by capturing its complexity: 'What is nature? You know, it's not a thing. It's not a noun. If you break it down linguistically, it's not a noun. Nature is more than what captures nature. It's the things that are connected: everything that's interconnected'. Many Experts echoed this reflection, acknowledging the specific practices of their culture, language, and knowledge system (similar to Galway et al. 2022). Recognizing the verb-based origin of Indigenous languages, Experts also described how this relationship is based on ongoing and reciprocal practice (i.e. taking action). Eriel provides an example of this in the Dënesųłiné context: '…practicing those things on the daily, you start to really see yourself as part of these ecosystems as opposed to someone enjoying it, or benefiting from it, you are a part of it. And there's no words to separate. There's the words for animals and medicines and different things. But there's no words that like say like that is nature and I am not'.

These findings countered the separation of humans and nature found in dominant NbS by demonstrating how Indigenous Peoples, as described by the Experts in our study, view themselves and the Land and Water as inseparable parts of a whole.

## 4.3 Humility and the responsibility of humans

Many Experts discussed the inherent humility in acknowledging that you are part of, not separate from, the Land and Water in response to questions on how their understood 'NbS'. Central to this recognition was the role of stopping the harmful practices and behaviours causing the climate and biodiversity crisis, a point echoed by many Experts and scholars alike (Cameron et al. 2021; Deranger et al. 2022). Specifically, Jesse McCormick, Chippewas of the Thames First Nation, discussed the impacts of these destructive systems—colonialism and capitalism—on Indigenous systems: '… [there was a] displacement of power that led to a diminished reliance on Indigenous systems as a basis for a better relationship with the land'. Agreeing with this characterization, Tyson Atleo, hereditary chief-in-line of the Ahousaht Nation, describes this relationship (and humility) as absent from decision-making: 'What I found as missing from decision making for and about our interaction with natural systems, which has been a major part of the cause of the problem is, is our relating to natural systems based on a certain set of values and assumptions'. The absence of this is not surprising in a climate context, where due to the dominant paradigm of 'progress', worldviews that offer alternatives are marginalized, undermined, or ignored (Stoddard et al. 2021).

As an example, Jocelyn Joe-Strack (Däk'äläma), Champagne and Aishihik First Nation, explained how decisions were being made '…without heart [and] without spirit…decisions that prioritize a theoretical system that humans have made up'. A system that, she continues, to '…set values and priorities that conflict with the needs of Earth and the needs of humanity and the needs of an individual life'. Becky Cook, Misipawistik Cree Nation, characterized the results of these values as the ongoing abuse of our systems and the ability of 'nature' to heal itself if given the chance: '…we can't keep harming Mother Earth, keep abusing her, and abusing those resources, and expect that the healing will happen. But Mother Earth does have the ability to heal herself, we just have to let her'. To avoid

this, she described how Indigenous perspectives on NbS must begin with an acknowledgement of humility: '…the Earth has the solution. We are only a small part of creation and we do not have the control we think. We need to repair our relationship with the Earth. We need to bring back respect and reciprocity. We need to stop exploiting and remember to take only what we need'. Jocelyn Joe-Strack (Däk'äläma), Champagne and Aishihik First Nation, rationalized these destructive behaviours due to an inability to connect with one's full self: '…we are walking around like half-a-person, we prioritize our mental and our physical. But we have this like emotional and spiritual element of ourselves that we have diminished and numbed through the practice of this culture that is dominating us'.

Extending this further, Experts also spoke about the deep connection between violence against the land and violence against humans, centering the concept of a healthy environment and healthy communities as part of that sacred relationship.[6] Eriel, Dënesųłiné, clearly spoke about this connection and the responsibilities that Indigenous Peoples carry: '…you have responsibilities to the land as well, you have responsibilities to all of your relations on the land. And you always have to have that balance'. These responsibilities are often juxtaposed against the way in which Westernized and industrial societies view the world for profit (M'sit No'kmaq et al. 2021). Experts also spoke about the implications of disrespecting these responsibilities and that balance, providing examples of the environmental and social changes happening around them. Jordyn Burnouf, member of Black Lake First Nation, highlighted this clearly: '…nature is telling us something. And it's not only a matter of listening, we can hear about it every day'. Furthering this point, Chief Byron described how the land would respond if we don't listen and continue a trajectory of irresponsible behaviour: 'the land itself will heal. We can push ourselves out of existence right now and have a mass extinction of our people's species. But the Earth will be like, oh, in a decade, you'll see a whole new environment, a whole new land just completely resolving itself'. The operationalization of a politics of humility, where human resituate themselves as part of the living system, is central to addressing the drivers of the biodiversity and climate crisis (Stoddard et al. 2021).

## 4.4 The revitalization of Indigenous knowledge systems and languages

Experts spoke about the essential role that Indigenous knowledge systems play in conceptualizing NbS and by extension all climate-related solutions. They also spoke about the essential work that Indigenous Peoples need to do to revitalize these knowledge systems for themselves, despite the structural and ongoing legacy of colonization. In doing this, they highlight how Indigenous knowledge systems continue to combat de-legitimization, disrespect, and minimization (Nadasdy 2007; Littlechild 2014). Quinn, for example, spoke about how Anishinaabe worldviews are often forced to bend to fit within Western systems: 'Anishinaabe-aadiziwin, worldview, [is] made to bend and curve in order to meet the need, the standard, or the validation from Western way of thinking'. He continues to describe the steps required for it to be understood by these systems: '…for it to be understood…it has to change, so what happens is the integrity of knowledge or the knowledge systems is bent or broken in order to be molded into something that's understood through a very specific lens'. These observations align with criticism of the 'integration' approach to working with

---

[6] For more information, see the work of the Women's Earth Alliance and Native Youth Sexual Health Network (2016) found here: http://landbodydefense.org/uploads/files/VLVBReportToolkit2016.pdf?

multiple knowledge systems (Nadasdy 2007), instead of emphasizing knowledge co-production in a process of mutual respect, kindness, and generosity (Reed et al. 2020).

Experts shared a general consensus that while an enhanced inclusion of Indigenous knowledge systems are central to conceptualizing NbS, it is not enough. Instead, this inclusion must extend towards centering Indigenous-self determination and sovereignty, especially in decision-making (Deranger et al. 2022). Quinn, Anishinaabe, eloquently summarized the role of revitalization of Indigenous, or in his context Anishinaabe, worldviews in Indigenous resurgence: '…helping to rebuild your family structures, which then help to rebuild your communities: healthy families create healthy communities, healthy communities create strong nations'. Unfortunately, many climate discussions continue to disregard this resurgence and commodify Indigenous knowledge and action as '…a last-ditch effort to be integrated into a battalion of adaptive solutions to save us all' (Dhillon 2018, 2). Two examples highlight this: the Pan-Canadian Framework on Clean Growth and Climate Change where, despite aspirational references to Indigenous Peoples and their inclusion, it failed to uphold their right to self-determination (Reed et al. 2021; ICA 2021a); and across federal Canadian climate policy that despite a similar growth in recognition of Indigenous rights and knowledge, there is a clear unwillingness to recognize Indigenous jurisdiction and Indigenous understandings of land in conversations on NbS (Reed et al. 2022).

To avoid this, Lisa, Mi'kmaw from Membertou First Nation, discussed some steps that Western science and decision-makers need to consider in acknowledging the legitimacy of Indigenous knowledge systems: '…it's not this philosophical perspective that we have… it's based on years and years and centuries of knowledge that we gained through our own science'. She continued to discuss the difference between these systems of knowledge: '… the difference is like the value system that we have in terms of our responsibilities to the land and our relationship with the land is the part I think that needs to be worked on'. This difference was captured in the principles of re-Indigenizing conservation, where Elder Albert Marshall described a process of thinking and acting on biodiversity conservation that advances Indigenous resilience and resurgence for the wellbeing of all ecology and peoples (M'sit No'kmaq et al. 2021). As an applied example of this practice, the article identified M'sit No'kmaq (described above by Cheyenne) as lead author to '…honour the collective and to acknowledge that all stories, learning, and language come from the land' (840). This practice, while uncommon in Canada, has been growing in other jurisdictions, such as by the Bawaka Collective in Australia (Bawaka Country et al. 2013, 2016).

Extending this point, Expert 8, Anishinaabe/ Métis, describes the importance of expanding the integration of Indigenous knowledge systems to the equitable consideration in decision-making, in terms of both mainstream governance frameworks and Indigenous decision-making: '…it's not [just] having a seat at the table in a Western table, and translating their knowledge into what's easily palatable from a Western perspective, but rather thinking about what exists outside of those tables, that is legitimate jurisdiction and authority being exercised, and how does that influence decision making? And how might Western decision making need to adapt to and not necessarily fully understand but provide deference to an Indigenous process?' Scholars are beginning to respond to this question in the context of climate change, a field that has traditionally valued western science and decision-making, by flipping the script and focusing on the ways that 'business-as-usual' research and policy actively harms Indigenous Peoples (Cameron et al. 2021; Deranger et al. 2022).

The revitalization of Indigenous knowledge systems, including Indigenous languages, was a clear priority stemming from the Experts. This revitalization is central to removing the structural legacy of colonization on Indigenous Peoples, as well as in the

conceptualization of NbS. Our results also point to a need for a meaningful discussion and engagement with Indigenous knowledge systems in decision-making processes surrounding the implementation of NbS.

## 5  Policy implications

In the above, we explore how the Indigenous Experts discussed the origins of the biodiversity and climate crisis, as well as how they conceptualized 'nature' in nature-based solutions in order to explore their implications. A separate paper based on this research introduces seven new principles for Indigenous-led nature-based solutions to inform how Indigenous Peoples can contribute to conservation (Reed et al. 2023). Based on these conversations, we offer four novel reflections for academic and policy discussions on NbS to uplift Indigenous ways of knowing, doing, and being for climate solutions a sustainable future (summarized in Table 3). These represent a preliminary exploration of these concepts within the NbS literature.

### 5.1  Centering decolonization as an interpretative framework for NbS

NbS cannot be separated from the structural legacy of colonization and capitalism and its ongoing assault against Indigenous Peoples and their rights, knowledge systems, and governance systems (Deranger et al. 2022). To describe this phenomenon, Whyte (2016) introduces the concept of 'colonial déjà vu' to characterize how climate injustice is imbedded within a cyclical, and larger, history of anthropogenic change driver by colonialism, industrialism, and capitalism. This cyclical, and structural, legacy has also manifested in the supremacy of one knowledge system and its description of the climate 'problem', blocking discussions on the root causes of the biodiversity and climate crisis (Stoddard et al. 2021). By contrast, the Experts describe a problem (and its root causes) based on Indigenous ontologies and epistemologies, summarized in sections 3.1 and 3.2, oriented towards a reflexive examination of human's behaviours and responsibilities (similar to Cameron et al. 2021; and Galway et al. 2022). This examination calls on NbS scholars and policymakers to conceptualize NbS as political exercises that cannot be separated from colonization and

**Table 3**  Policy recommendations to uplift Indigenous Peoples' perspectives on nature-based solutions

| Policy Recommendations |
| --- |
| 1. **Center decolonization as an interpretative framework for NbS**: Conceptualize NbS as political exercises that cannot be separated from colonization and a long, cumulative history of impacts on the ecosystems by industrial development, as well as the economic model that prioritizes growth and progress at all costs. |
| 2. **Uphold Indigenous self-determination and participation in decision-making**: Avoid the relegation of Indigenous Peoples to the role of contributor, participant, and stakeholders, and instead uphold their right to self-determination as rightsholders, captured within the minimum standards of the UN Declaration on the Rights of Indigenous Peoples. |
| 3. **Engage frameworks to braid ontologies and epistemologies for transformative NbS**: Build respectful frameworks of knowledge co-production and uphold the work of Indigenous Peoples to revitalize Indigenous ontologies and epistemologies. |
| 4. **Open space for Indigenous-led NbS**: Make space for Indigenous Peoples to lead research, design, and implementation of solutions based on their ways of knowing, doing, and being. |

a long, cumulative history of impacts on the ecosystems by industrial development, as well as the economic model that prioritizes growth and progress at all costs (Maller 2021).

Creating space for solutions that align with Indigenous economies was stressed by the Experts, as highlighted by Hetxw'ms Gyetxw (Brett D. Huson), Gitxsan Nation: 'Look at the reciprocity we have with the Land itself. The Gitxsan economy was driven by how much we can give, not by how much we can retain'. In this way, we echo the call from scholars to shift away from frameworks upholding colonization and capitalism towards those that center abundance and relationality, enabling NbS to focus on healing relationships between people and the land (Kimmerer 2022). Eriel, Dënesųłiné, summarizes this shift by calling on the acknowledgement of the structural legacy of colonialism on NbS (section 3.1) and the removal of the colonial lens to NbS: '…[when] we talk about decolonization, how are we removing the colonial lens in which we look at what a nature-based solution is? How are we removing a lens of how, who and what nature-based solution serve?' The removal of a colonial lens, or more aptly the application of decolonial lens, centers the legacy of colonization, land dispossession, and environmental harm in the design and evaluation of NbS to open space for Indigenous-led decision-making and self-determination. For example, Reed et al. (2022) describes how Canadian climate policy, such as the Pan-Canadian Framework on Clean Growth and Climate Change, erases Indigenous jurisdiction in sections on forestry, agriculture, and natural resources: sectors that are grounded in the removal of Indigenous Peoples from their lands, waters, and territories. To avoid reproducing this reality, a decolonial lens can assist in understanding how these histories manifest in the present day and propose solutions to governments to advance their decolonization imperative alongside decarbonization.

## 5.2 Uphold Indigenous self-determination and participation in decision-making

Seddon et al. (2021) shared four principles to ensure NbS benefit society, one of which emphasizes the full engagement and consent of Indigenous Peoples. While this is a constructive start, it frames Indigenous Peoples as the recipients of NbS, requiring their engagement while other actors—settler governments, private proponents, non-governmental organizations—design and implement these solutions (Townsend et al. 2020; ICA 2021b). This stakeholder framing minimizes the ability of Indigenous Peoples to exercise their self-determination and neglects the role that Indigenous Peoples have been playing in designing 'nature-based' solutions since time immemorial (von der Porten et al. 2015). Our Experts stressed that Indigenous NbS are grounded in Indigenous concepts of self-determination, rights and responsibilities, knowledge systems, and ceremonies (Sekulova and Anguelovski 2017; Reed et al. 2022). Deborah McGregor echoed this point '…[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' (as cited in ICA 2021b, 8).

These Indigenous conceptualizations of Land and Water need to enter NbS discussions in a meaningful way. As described above, the predominant model of conservation—captured in Principle 1 of the IUCN's Global Standard—has been central to the eviction, criminalization, and dispossession of Indigenous Peoples from their ancestral territories (Tran et al. 2020). This 'fortress conservation' model has been challenged by the emerging concept of Indigenous Protected and Conserved Areas (IPCAs), highlighting '…time-honoured ways of interacting with environments that support people and places alike' (Artelle et al. 2019, 8). As a result, we encourage scholars and policymakers to avoid the relegation

of Indigenous Peoples to the role of contributor, participant, and stakeholders, and instead uphold their right to self-determination as rightsholders, captured within the minimum standards of the UN Declaration on the Rights of Indigenous Peoples.

### 5.3 Engage frameworks to braid ontologies and epistemologies for transformative NbS

There are concerns that NbS will perpetuate a belief that the biodiversity and climate crisis can be dealt with technology, science, and markets alone (Welden et al. 2021). This is even more problematic when thinking about the overrepresentation of Western scientists and economics in the production of evidence assessing the effectiveness of NbS, despite the projection that most NbS will occur in non-Western countries (Schulte et al. 2022). Under this worldview, climate action is trying to solve the problem of greenhouse gases' emissions, which at its simplest form, avoids serious conversation on the political, economic, and social system that is creating those runaway emissions (Stoddard et al. 2021). In a similar context, proponents for the mitigation benefits of NbS have been criticized for their inability to discuss rapid decarbonization and thus excuse business-as-usual fossil fuel consumption (Anderson et al. 2019).

Clearly, and as our Experts shared, there is a need to critically assess how research and policy on NbS engages with different ontological and epistemological frameworks to avoid the ontological path dependency that currently exists. This act, prioritizing Indigenous ontologies and epistemologies, enables Indigenous resistance and resurgence against power imbalances in co-production research (Bang et al. 2014). Two experts, Cheyenne and Lisa, describe a concept, *Etuaptmumk* (two-eyed seeing), that could be used to advance this resistance as a tool that acknowledges the validity and credibility of Indigenous knowledge systems and westernized knowledge by framing them as lenses that together can create a holistic view of solutions. There are also other Indigenous-led approaches to knowledge co-production that could be relevant depending on where the NbS is: Ethical Space (Ermine 2007); Two-Way Knowing in Australia (Muller 2012; Preuss and Dixon 2012) and more recently, ScIQ (a term created by Inuit to describe a middle ground between science and Inuit Qaujimajatuqangit) in Nunavut, Canada (Pedersen et al. 2020). While distinct, each of these knowledge co-production frameworks understand Indigenous knowledge systems and westernized knowledge as equitably valid and explore opportunities, through the process of design, implementation, and evaluation of NbS, to include their respective methodologies in all places. Scholars and policy-makers can work to build respectful frameworks of knowledge co-production and uphold the work of Indigenous Peoples to revitalize Indigenous ontologies and epistemologies, contributing to the transformative potential of NbS (Welden et al. 2021).

### 5.4 Open space for Indigenous-led NbS

While Indigenous Peoples have been working to reframe climate research from Indigenous knowledge systems, there is a recognition of the inherent limitations of trying to 'fit' these systems into mainstream climate research and policy (Whyte 2018; Cameron et al. 2021; Deranger et al. 2022). Instead, Indigenous Peoples have been calling for an Indigenous-led climate agenda that seeks to dismantle settler colonialism, capitalism, and heteropatriarchy simultaneously (Reed et al. 2021). Central to this agenda is the recognition that meaningful solutions stem from understanding and addressing the foundational question of Land, or as

Behn and Bakker (2019) call 'rendering sacred'. Deranger et al. (2022) operationalize this call for scholars and policymakers by '…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' (19).

In an NbS context, our Experts describe several key themes that would enable this shift: challenge the dichotomization of humans and nature, advance the inseparability of land and identity, internalize the principle of humility and responsibility, and invest in the revitalization of Indigenous knowledge systems. Spencer Greening (La'goot), Tsimshian, summarizes this by describing how NbS could flourish by a return to a relationship of respect and reciprocity: '…nature-based solutions are just an expression of that, of finding that path again, where we're in tune and receptive to our relationship within an ecosystem that we live in'. As the rapid uptake of NbS continues, we call for scholars and policymakers to make space for Indigenous Peoples to lead research, design, and implementation of solutions based on their ways of knowing, doing, and being.[7]

## 6 Conclusion

Despite an exponential growth in the academic and political support for NbS over the last 5 years, there have been few studies exploring the intersection of these solutions and Indigenous Peoples. Confronted with a reality where NbS are being developed by non-Indigenous Peoples based on their conceptions of nature and understandings of the causes of climate change, we sought to address this gap by centering Indigenous knowledge systems (ICA 2021b). Through conversational interviews with Indigenous leaders, youth, women, technicians, and knowledge keepers, we identified three drivers of the biodiversity and climate crisis: structural legacy of colonization and capitalism, a problem of human values, and climate change as a cumulative impact. Building on this understanding, we then heard some common themes on Indigenous conceptualizations of the 'nature' in nature-based solutions: the absence of a word in their Indigenous language for nature; the deep connection between Indigenous Peoples, Land, and Water; the importance of humility and the responsibility of humans; and the revitalization of Indigenous knowledge systems. All told, these themes contribute to the growing body of work reframing climate change from Indigenous perspectives (Cameron et al. 2021; Reed et al. 2021; Deranger et al. 2022). Future Indigenous-led NbS research could examine whether or not the term NbS appropriately captures Indigenous knowledge systems, or whether a new term or set of principles for Indigenous-led NbS should be developed.

Given that this was the first exploration of these concepts in the NbS literature, we then made a series of four reflections for academic and policy work on NbS. First, the structural legacy of colonization and capitalism should be used as an interpretative framework for NbS to avoid perpetuating the legacy of colonization, land dispossession, and environmental harm. Second, efforts to advance NbS should uphold Indigenous self-determination and

---

[7] For a constructive example of this in Canadian federal climate policy, please refer to the Environment and Climate Change Canada's report Climate Science 2050: Advancing Science and Knowledge on Climate Change with a special emphasis on the section focused on Indigenous-led climate science and knowledge (page 9). The full report is found here: https://publications.gc.ca/collections/collection_2020/eccc/En4-414-2020-eng.pdf

participation in decision-making as rightsholders, avoiding the characterization of Indigenous Peoples as 'stakeholders' or 'contributors'. Third, based on the current supremacy of Western knowledge systems, academics should engage Indigenous-led knowledge co-production frameworks to ensure the respectful braiding of ontologies and epistemologies for transformative NbS. Finally, research must give space for Indigenous Peoples to lead research, design, and implementation of solutions based on their systems of knowledge. These reflections represent starting point, as deep discussions with Indigenous Peoples are needed to ensure their Nations' history, culture, and jurisdiction are reflected in the development of NbS. We close with a call for additional Indigenous-led research on NbS, echoing the reflection of McGregor et al. (2020) discussing the limitations of mainstream climate policy: '[i]t is therefore simply not rational for Indigenous Peoples to rely on these global, national, and regional economic and political frameworks for climate justice and a sustainable future' (36).

# References

Absolon KME (2011) Kaandossiwin: how we come to know. Fernwood Publishing, Halifax

Anderson CM, DeFries RS, Litterman R, Matson PA, Nepstad DC, Pacala S, Schlesinger WH, Shaw MR, Smith P, Weber C, Field CB (2019) Natural climate solutions are not enough. Science 363:933–934. https://doi.org/10.1126/science.aaw2741

Archibald JA (2008) Indigenous storywork: educating the heart, mind, body, and spirit. University of British Columbia Press, Vancouver

Artelle KA, Zurba M, Bhattacharyya J, Chan DE, Brown K, Housty J, Moola F (2019) Supporting resurgent Indigenous-led governance: a nascent mechanism for just and effective conservation. Biol Cons 240:108284. https://doi.org/10.1016/j.biocon.2019.108284

Bang M, Curley L, Kessel A, Marin A, Suzukovich ES III, Strack G (2014) Muskrat theories, tobacco in the streets, and living Chicago as Indigenous land. Environ Educ Res 20(1):37–55. https://doi.org/10.1080/13504622.2013.865113

Baustian MM, Jung H, Bienn HC, Barra M, Hemmerling SA, Wang Y, White E, Meselhe E (2020) Engaging coastal community members about natural and nature-based solutions to assess their ecosystem function. Ecol Eng 143:100015. https://doi.org/10.1016/j.ecoena.2019.100015

Bawaka Country including Suchet-Pearson S, Wright SL, Lloyd K, Burarrwanga L (2013) Caring as country: towards an ontology of co-becoming in natural resource management. Asia Pac Viewp 54:185-197. https://doi.org/10.1111/apv.12018

Bawaka Country including Wright SL, Suchet-Pearson S, Lloyd K, Burarrwanga L, Ganambarr R, Ganambarr-Stubbs M, Ganambarr B, Maymuru D (2016) The politics of ontology and ontological politics. Dialogues Hum Geogr 6(1):23-27. https://doi.org/10.1177/204382061562405

Behn C, Bakker K (2019) Rendering technical, rendering sacred: the politics of hydroelectric development on British Columbia's Saaghii Naachii/Peace River. Glob Environ Polit 19(3):98–119. https://doi.org/10.1162/glep_a_00518

Bennett B, Maar M, Manitowabi D, Moeke-Pickering T, Trudeau-Peltier D, Trudeau S (2019) The Gaataa'aabing visual research method: a culturally safe Anishinaabek transformation of photovoice. Int J Qual Methods 18. https://doi.org/10.1177/1609406919851635

Bieling C, Eser U, Plieninger T (2020) Towards a better understanding of values in sustainability transformations: ethical perspectives on landscape stewardship. Ecosyst People 16(1):188–196. https://doi.org/10.1080/26395916.2020.1786165

Borrows J (2002) Recovering Canada: the resurgence of Indigenous Law. University of Toronto Press, Toronto

Bush E, Lemmen DS (eds) (2019) Canada's changing climate report. Government of Canada. https://changingclimate.ca/CCCR2019. Accessed 13 Jun 2023

Cameron ES (2012) Securing Indigenous politics: a critique of the vulnerability and adaptation approach to the human dimensions of climate change in the Canadian Arctic. Glob Environ Chang 22(1):103–114. https://doi.org/10.1016/j.gloenvcha.2011.11.004

Cameron L, Courchene D, Ijaz S, Mauro I (2021) 'A change of heart': Indigenous perspectives from the Onjisay Aki Summit on climate change. Clim Change 164:43. https://doi.org/10.1007/s10584-021-03000-8

Chausson A, Turner B, Seddon D, Chabaneix N, Girardin CAJ, Kapos V, Key I, Roe D, Smith A, Woroniecki S, Seddon N (2020) Mapping the effectiveness of nature-based solutions for climate change adaptation. Glob Change Biol 26(11):6134–6155. https://doi.org/10.1111/gcb.15310

Chiblow S (2021) An Anishinaabe research methodology that utilizes Indigenous intelligence as a conceptual framework exploring humanity's relationship to N'bi (Water). Int J Qual Methods 20. https://doi.org/10.1177/16094069211058017

Cohen-Shacham E, Walters G, Janzen C, Maginnis S (eds) (2016) Nature-based solutions to address global societal challenges. International Union for Conservation of Nature (IUCN). https://doi.org/10.2305/IUCN.CH.2016.13.en

Cohen-Shacham E, Andrade A, Dalton J, Dudley N, Jones M, Kumar C, Maginnis S, Maynard S, Nelson CR, Renaud FG, Welling R, Walters G (2019) Core principles for successfully implementing and upscaling nature-based solutions. Environ Sci Policy 98:20–29. https://doi.org/10.1016/j.envsci.2019.04.014

Costanza R, de Groot R, Braat L, Kubiszewski I, Fioramonti L, Sutton P, Farber S, Grasso M (2017) Twenty years of ecosystem services: how far have we come and how far do we still need to go? Ecosyst Serv 28:1–16. https://doi.org/10.1016/j.ecoser.2017.09.008

Corntassel J (2012) Re-envisioning resurgence: Indigenous pathways to decolonization and sustainable self-determination. Decolonization: Indigeneity Educ Soc 1(1):86–101

Craft A (2018) Navigating our ongoing sacred legal relationship with Nibi (Water). In: Centre for International Governance Innovation, UNDRIP Implementation: more reflections on the braiding of international, domestic and indigenous laws, pp 53–61. https://www.cigionline.org/publications/undrip-implementation-more-reflections-braiding-international-domestic-and-indigenous/. Accessed 13 Jun 2023

Creswell JW, Hanson WE, Clark Plano VL, Morales A (2007) Qualitative research designs: selection and implementation. Couns Psychol 35(2):236–264. https://doi.org/10.1177/0011000006287739

Deranger ET, Sinclair R, Gray B, McGregor D, Gobby J (2022) Decolonizing climate research and policy: making space to tell our own stories, in our own ways. Community Dev J 57(1):52–73. https://doi.org/10.1093/cdj/bsab050

Dhillon J (2018) Introduction: Indigenous resurgence, decolonization, and movements for environmental justice. Environ Soc 9(1):1–5. https://doi.org/10.3167/ares.2018.090101

Dominguez L, Luoma C (2020) Decolonising conservation policy: how colonial land and conservation ideologies persist and perpetuate Indigenous injustices at the expense of the environment. Land 9(3):65. https://doi.org/10.3390/land9030065

Ermine W (2007) The ethical space of engagement. Indig Law J 6(1):193–203

Escobar A (2001) Culture sits in places: reflections on globalism and subaltern strategies of localization. Polit Geogr 20(2):139–174. https://doi.org/10.1016/S0962-6298(00)00064-0

European Commission, Directorate-General for Research and Innovation (2015) Towards an EU research and innovation policy agenda for nature-based solutions & re-naturing cities: final report of the Horizon 2020 expert group on 'Nature-based solutions and re-naturing cities' (full version). Publications Office. https://data.europa.eu/doi/10.2777/479582

Ferguson J, Weaselboy M (2020) Indigenous sustainable relations: considering land in language and language in land. Curr Opin Environ Sustain 43:1–7. https://doi.org/10.1016/j.cosust.2019.11.006

Fleischman F, Basant S, Chhatre A et al (2020) Pitfalls of tree planting show why we need people-centered natural climate solutions. Bioscience 70(11):947–950. https://doi.org/10.1093/biosci/biaa094

Forest Peoples Program (2021) Re-thinking nature-based solutions: seeking transformative change through culture and rights. https://www.forestpeoples.org/sites/default/files/documents/Re-thinking%20nature-based%20solutions_Seeking%20transformative%20change%20through%20culture%20and%20rights_0.pdf. Accessed 13 Jun 2023

Galway LP, Esquega E, Jones-Casey K (2022) "Land is everything, land is us": exploring the connections between climate change, land, and health in Fort William First Nation. Soc Sci Med 294:114700. https://doi.org/10.1016/j.socscimed.2022.114700

Griscom BW, Adams J, Ellis PW et al (2017) Natural climate solutions. Proc Natl Acad Sci 114(44):11645–11650. https://doi.org/10.1073/pnas.1710465114

Griscom BW, Lomax G, Kroeger T, Fargione JE, Adams J, Almond L, Bossio D, Cook-Patton SC, Ellis PW, Kennedy CM, Kiesecker J (2019) We need both natural and energy solutions to stabilize our climate. Glob Change Biol 25(6):1889–1890. https://doi.org/10.1111/gcb.14612

Hanson HI, Wickenberg B, Alkan Olsson J (2020) Working on the boundaries – how do science use and interpret the nature-based solution concept? Land Use Policy 90:104302. https://doi.org/10.1016/j.landusepol.2019.104302

Hunt S (2014) Ontologies of Indigeneity: the politics of embodying a concept. Cult Geogr 21(1):27–32. https://doi.org/10.1177/14744740135002

Hsieh HF, Shannon SE (2005) Three approaches to qualitative content analysis. Qual Health Res 15(9):1277–1288

Indigenous Climate Action [ICA] (2021a) Decolonizing climate policy in Canada: report from phase one. https://bit.ly/3nP48FP. Accessed 13 Jun 2023

Indigenous Climate Action [ICA] (2021b) The risks and threats of 'nature-based climate solutions" for Indigenous Peoples https://static1.squarespace.com/static/5e8e4b5ae8628564ab4bc44c/t/617dd09782932606fc3933c2/1635635372986/ICA_-_NbCS_Sneak_Peek_Report__final_.pdf. Accessed 13 Jun 2023

Indigenous Peoples Forum on Climate Change and Indigenous Peoples Major Group (2019) Securing rights to secure nature-based solutions to climate change. http://hdl.handle.net/20.500.11822/28890. Accessed 13 Jun 2023

IPBES (2019) Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (Version 1). Zenodo. https://doi.org/10.5281/zenodo.6417333

International Union for the Conservation of Nature (2020) IUCN global standard for nature-based solutions: a user-friendly framework for the verification, design and scaling up of NbS (first edition). https://doi.org/10.2305/IUCN.CH.2020.08.en

Jasanoff S (2010) A new climate for society. Theory Cult Soc 27(2–3):233–253. https://doi.org/10.1177/0263276409361497

Kimmerer RW (2013) Braiding sweetgrass: Indigenous wisdom, scientific knowledge and the teachings of plants. Milkweed Editions, Minnesota

Kimmerer RW (2022) The Serviceberry: an economy of abundance. Emergence Magazine. https://emergencemagazine.org/essay/the-serviceberry/. Accessed 13 Jun 2023

Kovach M (2010) Conversation method in Indigenous research. First Peoples Child & Family Review 5(1)40–48. https://fpcfr.com/index.php/FPCFR/article/view/172. Accessed 13 Jun 2023

Littlechild DB (2014) Transformation and re-formation: first nations and water in Canada. Dissertation, University of Victoria. http://hdl.handle.net/1828/5826. Accessed 13 Jun 2023

Mairena-Cunningham E, Arauz D (2020) Nature-based solutions (NbS) for climate change: a vision from Indigenous Peoples. Tebtebba. https://tebtebba.org/index.php/news-and-updates/nature-based-solutions-nbs-for-climate-change-a-vision-from-indigenous-peoples. Accessed 13 Jun 2023

Maller C (2021) Re-orienting nature-based solutions with more-than-human thinking. Cities 113:103155. https://doi.org/10.1016/j.cities.2021.103155

McGregor D (2018) Mino-Mnaamodzawin: achieving indigenous environmental justice in Canada. Environ Soc 9(1):7–24. https://doi.org/10.3167/ares.2018.090102

McGregor D, Whitaker S, Sritharan M (2020) Indigenous environmental justice and sustainability. Curr Opin Environ Sustain 43:35–40. https://doi.org/10.1016/j.cosust.2020.01.007

M'sit No'kmaq Marshall A, Beazley KF, Hum J, Joudry S, Papadopoulos A, Pictou S, Rabesca J, Young L, Zurba M (2021) "Awakening the sleeping giant": re-Indigenization principles for transforming biodiversity conservation in Canada and beyond. FACETS 6(1):839-869. https://doi.org/10.1139/facets-2020-0083

Muller S (2012) Two ways: bringing indigenous and nonindigenous knowledges together. In: JK Weir (ed) Country, native title and ecology, ANU Press, Canberra, pp 59–79. https://doi.org/10.22459/CNTE.03.2012

Nadasdy P (2007) The gift in the animal: the ontology of hunting and human-animal sociality. Am Ethnol 34(1):25–43. https://doi.org/10.1525/ae.2007.34.1.25

Neville KJ, Coulthard G (2019) Transformative water relations: Indigenous interventions in global political economies. Glob Environ Polit 19(3):1–15

Nicoll F (2004) Reconciliation in and out of perspective: white knowing, seeing, curating and being at home in and against Indigenous sovereignty. In: Moreton-Robinson A (ed) Whitening Race: essays in social and cultural criticism Aboriginal Studies Press, Canberra, pp 17–31

Osaka S, Bellamy R, Castree N (2021) Framing "nature-based" solutions to climate change. Wires Clim Change 12(5):e729. https://doi.org/10.1002/wcc.729

Pedersen C, Otokiak M, Koonoo I, Milton J, Maktar E, Anaviapik A, Milton M, Porter G, Scott A, Newman C, Porter C (2020) ScIQ: an invitation and recommendations to combine science and Inuit Qaujimajatuqangit for meaningful engagement of Inuit communities in research. Arctic Sci 6(3):326–339. https://doi.org/10.1139/as-2020-0015

Preuss K, Dixon M (2012) 'Looking after country two-ways': insights into Indigenous community-based conservation from the Southern Tanami. Ecol Manag Restor 13(1):2–15. https://doi.org/10.1111/j.1442-8903.2011.00631.x

Reed G (2023) Indigenous climate futures: Alternative visions for nature-based solutions. Dissertation. University of Guelph

Reed G, Dagli W, Odame HH (2020) Co-production of knowledge for sustainability: an application of reflective practice in doctoral studies. Reflective Pract 21(2):222–236. https://doi.org/10.1080/14623943.2020.1733954

Reed G, Gobby J, Sinclair R, Ivey R, Matthews HD (2021) Indigenizing climate policy in Canada: a critical examination of the Pan-Canadian framework and the ZéN RoadMap. Front Sustain Cities 3. https://doi.org/10.3389/frsc.2021.644675

Reed G, Brunet ND, McGregor D, Scurr C, Sadik T, Lavigne J, Longboat S (2022) Toward Indigenous visions of nature-based solutions: an exploration into Canadian federal climate policy. Clim Pol 22(4):514–533. https://doi.org/10.1080/14693062.2022.2047585

Reo N (2019) *Inawendiwin* and relational accountability in Anishnaabeg studies: the crux of the biscuit. J Ethnobiol 39(1):65–75. https://doi.org/10.2993/0278-0771-39.1.65

Schulte I, Eggers J, Nielsen JØ, Fuss S (2022) What influences the implementation of natural climate solutions? A systematic map and review of the evidence. Environ Res Lett 17(1):013002. https://doi.org/10.1088/1748-9326/ac4071

Seddon N, Chausson A, Berry P, Girardin CA, Smith A, Turner B (2020a) Understanding the value and limits of nature-based solutions to climate change and other global challenges. Philos Trans R Soc B 375(1794):20190120. https://doi.org/10.1098/rstb.2019.0120

Seddon N, Daniels E, Davis R, Chausson A, Harris R, Hou-Jones X, Huq S, Kapos V, Mace GM, Rizvi AR, Reid H, Roe D, Turner B, Wicander S (2020b) Global recognition of the importance of nature-based solutions to the impacts of climate change. Glob Sustain 3:e15. https://doi.org/10.1017/sus.2020.8

Seddon N, Smith A, Smith P, Key I, Chausson A, Girardin C, House J, Srivastava S, Turner B (2021) Getting the message right on nature-based solutions to climate change. Glob Change Biol 27(8):1518–1546. https://doi.org/10.1111/gcb.15513

Sekulova F, Anguelovski I (2017) The governance and politics of nature-based solutions. Naturvation European Commission. https://naturvation.eu/sites/default/files/news/files/naturvation_the_governance_and_politics_of_nature-based_solutions.pdf. Accessed 13 Jun 2023

Seymour F (2020) Seeing the forests as well as the (trillion) trees in corporate climate strategies. One Earth 2(5):390–393. https://doi.org/10.1016/j.oneear.2020.05.006

Smith LT (2012) Decolonizing methodologies: research and Indigenous Peoples, 2nd edn. Zed Books Ltd, New York

Stevenson A (2010) Oxford dictionary of English, 3rd edn. Oxford University Press, Oxford

Stoddard I, Anderson K, Capstick S, Carton W, Depledge J, Facer K, Gough C, Hache F, Hoolohan C, Hultman M, Hällström N (2021) Three decades of climate mitigation: why haven't we bent the global emissions curve? Annu Rev Environ Resour 46:653–689. https://doi.org/10.1146/annurev-environ-012220-011104

Styres S, Zinga D (2013) The community-first land-centred theoretical framework: bringing a 'good mind' to indigenous education research? Can J Educ 36(2):284–313. https://journals.sfu.ca/cje/index.php/cje-rce/article/view/1315. Accessed 13 Jun 2023

Todd Z (2016) An indigenous feminist's take on the ontological turn: 'ontology' is just another word for colonialism. J Hist Soc 29(1):4–22. https://doi.org/10.1111/johs.12124

Townsend J, Moola F, Craig MK (2020) Indigenous Peoples are critical to the success of nature-based solutions to climate change. FACETS 5(1):551–556. https://doi.org/10.1139/facets-2019-0058

Tran TC, Ban NC, Bhattacharyya J (2020) A review of successes, challenges, and lessons from Indigenous protected and conserved areas. Biol Cons 241:108271. https://doi.org/10.1016/j.biocon.2019.108271

von der Porten S, de Loë R, Plummer R (2015) Collaborative environmental governance and indigenous peoples: recommendations for practice. Environ Pract 17(2):134–144. https://doi.org/10.1017/S146604661500006X

Watts V (2013) Indigenous place-thought and agency amongst humans and non-humans (First Woman and Sky Woman go on a European world tour!). Decolonization: Indigeneity Educ Soc 2(1):20–34

Welden EA, Chausson A, Melanidis MS (2021) Leveraging nature-based Solutions for transformation: reconnecting people and nature. People Nat 3(5):966–977. https://doi.org/10.1002/pan3.10212

Whyte KP (2016) Is it colonial déjà vu? Indigenous peoples and climate injustice. In: Adamson J, Davis M, Huang H (eds) Humanities for the environment: integrating knowledges, forging new constellations of practice. Earthscan Publications, London, pp 88–104. https://doi.org/10.2139/ssrn.2925277

Whyte KP (2018) Indigenous science (fiction) for the Anthropocene: ancestral dystopias and fantasies of climate change crises. Environ Plan E: Nat Space 1(1–2):224–242. https://doi.org/10.1177/2514848618877762

Whyte KP (2020) Too late for indigenous climate justice: ecological and relational tipping points. Wires Clim Change 11(1):e603. https://doi.org/10.1002/wcc.603

Wildcat DR (2009) Red alert! Fulcrum Publishing, Golden, Saving the planet with indigenous knowledge

Wilson S (2008) Research is ceremony: Indigenous research methods. Fernwood Publishing, Halifax and Winnipeg

Yunkaporta T (2019) Sand talk: how Indigenous thinking can save the world. HarperOne, New York

Zurba M, Papadopoulos A (2021) Indigenous participation and the incorporation of indigenous knowledge and perspectives in global environmental governance forums: a systematic review. Environ Manage 72:84–99. https://doi.org/10.1007/s00267-021-01566-8

## Authors and Affiliations

**Graeme Reed[1]** ⬤ **· Nicolas D. Brunet[2] · Deborah McGregor[3] · Curtis Scurr[4] · Tonio Sadik[4] · Jamie Lavigne[4] · Sheri Longboat[2]**

✉  Graeme Reed
   graereed@yorku.ca

   Nicolas D. Brunet
   nicolas.brunet@uoguelph.ca

   Deborah McGregor
   DMcGregor@osgoode.yorku.ca

   Curtis Scurr
   cscurr@afn.ca

   Tonio Sadik
   tsadik@afn.ca

   Jamie Lavigne
   jlavigne@afn.ca

   Sheri Longboat
   slongboat@uoguelph.ca

[1]  Center for Indigenous Knowledges and Languages, York University, Third Floor, York Lanes, Rm. 353A 4700 Keele Street, Toronto, ON M3J 1P3, Canada

[2]  School of Environmental Design and Rural Development, University of Guelph, 50 Stone Road East, Guelph, ON N1G 2W1, Canada

[3]  Osgoode Hall Law School, York University, Ignat Kaneff Building, 4700 Keele Street, Toronto, ON M3J 1P3, Canada

[4]  Assembly of First Nations, 50 O'Connor Street, Suite 200, Ottawa, ON K1P 6L2, Canada