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Planetary Health - Laws, Policies and Science on the 'One Health' Approach

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Indigenous Knowledges, One Health, and Planetary Health: Building Bridges for the Response to Climate Change

Brittany Bingham, Nicole Redvers, Sean Hillier, and Tamara Riley

Abstract The understanding and appreciation for One Health and Planetary Health movements, research, and practice are increasing alongside a similar increase in climate change-related events. There has additionally been an increase in the dialogue surrounding how Indigenous traditional knowledges (ITK) may connect to or with One Health and Planetary Health responses towards climate change; however, this has often been led and amplified by non-Indigenous peoples and voices. This chapter will therefore review One Health and Planetary Health from an Indigenous perspective with an aim to seek bridging dialogues for more coordinated responses to climate change and other global crises. This chapter will also explore the unique elements of Indigenous Peoples and their knowledges from a strengths-based perspective to situate and platform interconnected narratives in an increasingly siloed world.

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1 Background

The current "code red"[1] for humanity is becoming ever more apparent given the intersecting crises of climate change, biodiversity loss, marine degradation, and pollution. The current code red is additionally platformed on the awareness that six of the nine planetary boundaries have already been transgressed[2]—human beings are at a precipice. The activity of some human communities on the planet have caused devastating harm to the planet through nature disconnected governance, nature disconnected economic systems, nature disconnected education systems—all stemming from nature disconnected value systems. Many human communities have forgotten, and sometimes forcibly suppressed, the understanding that we are completely and utterly dependent on the health of the planet. Many humans have therefore "lost their identity as organisms within a larger system and thus have lost awareness of how to live sustainably with" the planet.[3] The interconnection within Nature of the human species has been stated to be a fundamental determinant of planetary health.[4] With this,

> [e]cological demise points to an impaired human relationship with its inner self (i.e., [as] humans are Nature and not apart from it). In the broader sense, there is evidence of the loss of an ecologically bound cultural identity. The disconnect from Nature manifests as a fragmented and dissociated identity that cannot recognise itself as part of a system, making it easier to project predatory and abusive impulses onto the environment.[5]

With expected further and continuing advancement of the intersecting planetary crises (e.g., climate change), that will continue to have significant impacts on human health, there has been an increase in the presence of fields, concepts, and movements that seek to bridge understandings of health and the environment.[6] Although environmental health-related lineages within academic fields have been more explicitly defined and operationalized in recent decades, they have been rooted within broader understandings of public health that have been in existence for much longer.[7] EcoHealth, One Health, and Planetary Health are examples of more recent concepts that have been realized through varied but interconnected academic traditions, often themselves growing from other academic lineages (see *Box 1*).

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[1] United Nations (2021).

[2] Richardson et al. (2023), p. eadh2458.

[3] Redvers et al. (2022), pp. e156–e163.

[4] Faerron Guzman et al. (2021), pp. e253–e255.

[5] Redvers et al. (2022), pp. e156–e163.

[6] Charron (2012); Talukder et al. (2024), pp. 66–75.

[7] Ancheta et al. (2021a), pp. 883–885; and Ancheta et al. (2021b), pp. 1131–1133.

Box 1 Environmental health-related field and practice concepts that have evolved within academic settings.

- *EcoHealth*: "Ecohealth is a field of research, education, and practice that adopts systems approaches to promote the health of people, animals, and ecosystems in the context of social and ecological interactions…As a field of scholarship, ecohealth research draws on the natural sciences, health sciences, social sciences, the humanities, and beyond, often working in collaboration with interested parties and community members to address issues at the interface of health, ecosystems, and society".[8]
- *Environmental Health*: "Environmental health centers on the relationships between people and their environment… The environmental health field advances policies and programs that reduce chemical and other environmental exposures in air, water, soil and food".[9]
- *One Health*: One Health is an integrated approach that aims to balance and optimize the health of humans, animals, plants and ecosystems. The One Health approach recognizes that the health of humans, animals, plants and the wider environment are interconnected and interdependent. A One Health approach mobilizes multiple sectors, disciplines and communities to work together and tackle threats to health and ecosystems. More specifically, addressing a collective need for clean water, air, safe and nutritious food and action on climate change and sustainable development.[10]
- *Planetary Health:* Planetary Health is a solutions-oriented, transdisciplinary field and social movement focused on analyzing and addressing the impacts of human disruptions to Earth's natural systems on human health and all life on Earth.[11]

One Health and Planetary Health concepts in particular have been getting increased exposure at regional, national, and international levels. Planetary Health, One Health, and EcoHealth concepts generally focus "on the interconnection between ecosystem protection and human-environment well-being"[12] from varied perspectives. The concepts are somewhat similar in acknowledging the "connections between ecological interactions, community involvement, and the health of people, animals, and the environment".[13] Although rarely acknowledged explicitly within academic publishing directly, in practice, there have been implicit disciplinary

[8] Parkes et al. (2014).

[9] American Public Health Association (2024).

[10] UN Environment Programme (2024).

[11] Planetary Health Alliance (2024).

[12] Talukder et al. (2024), pp. 66–75.

[13] Id.

conflicts between the fields of One Health and Planetary Health. One Health, for example, has been seen to have some structural problems with biomedical reductionistic framing being dominant resulting "in a focus on human health threats from animals" as one main pillar of investigation and practice. Varying additional theoretical frameworks, such as "Relational One Health" have been introduced to try to more explicitly bring in the environmental/ecosystem domain as a key pillar in on-the-ground One Health practice (Meisner et al., 2024). Planetary Health has been criticized on the other hand for being too human orientated with the emphasis "mainly on the consequences for our [human] health through disturbances in the environment".[14] Planetary Health has additionally been framed as a "new" field despite the underlying concepts not being new.[15]

More effort has recently been placed on leveraging the perceived differences between One Health and Planetary Health. Despite both concepts being built on relatively equivalent systemic principles, there continues to be "ongoing debate and emerging confusion around their differences and application areas".[16] Regardless, it has been stated that,

> One Health and Planetary Health are highly complementary fields of scientific inquiry with solid leverage for translation into policy and practice. There is an opportunity to build a stronger research community and transdisciplinary evidence to collectively address pressing public and global health issues in a truly integrated way. Above all, life on Earth is at risk, and our diversity will only make us stronger.[17]

1.1 Indigenous Knowledges

Perceived differences between academic disciplinary concepts (e.g., One Health/Planetary Health) that have been partially or fully conceptualized from within EuroWestern-centric knowledge traditions are arguably of little value to Indigenous Peoples. Indigenous Peoples and their knowledges (see *Box 2*) have from time immemorial been interconnected with plants, animals, ecosystems, and Mother Earth. With fundamental understandings that place humans as just one small part of the larger ecosystem (i.e., cosmocentric or ecocentric worldviews[18]), in comparison to the hierarchical approach of humans and 'certain' animal species being implicitly or explicitly dominant within research focuses (i.e., anthropocentric worldviews), Indigenous Peoples and their Knowledges are well placed to be a grounding point for academic research, policy, and practice.

[14] Martens (2024), pp. 128–129 and Martens (2023).

[15] Martens (2023).

[16] de Castañeda et al. (2023), pp. e109–e111.

[17] Id.

[18] Lucero and Cruz (2020), p. 1.

Box 2 Relevant terminologies used in this chapter

- *Indigenous Peoples*: “Indigenous Peoples and Nations are those which, having a historical continuity with pre-invasion and pre-colonial societies that developed on their territories, consider themselves distinct from other sectors of the societies now prevailing on those territories, or parts of them. They form at present non-dominant sectors of society and are determined to preserve, develop and transmit to future generations their ancestral territories, and their ethnic identity, as the basis of their continued existence as peoples, in accordance with their own cultural patterns, social institutions and legal system” (Martínez Cobo, 1981).
- *Indigenous Knowledges/Indigenous Traditional Knowledges*: Indigenous Knowledges are Traditional Knowledges or knowledge that comes from a community. Traditional Knowledges are transmitted from generation to generation; emerge from complete knowledge systems; ere expressed in many formats. eg. oral, ceremony, artistic creations, artifacts, etc.; are not all in the past; there is continued growth, innovation and change in knowledge and practices; includes history, law, spirituality, agriculture, environment, science, medicine, animal behaviour and migration patterns, art, music, dance, craft, construction, and more.[19]
- *Indigenous Knowledge Systems*: Indigenous knowledge systems (IKS) refers to the broader frameworks within which Indigenous knowledges are transmitted and practiced. IKS sets the framing for the cultural, spiritual, and ecological principles that guide how Indigenous knowledge is created, shared, and passed down for future generations. IKS includes the spiritual and cultural frameworks that guide how Indigenous Peoples validate knowledge, ethical frameworks, and collective decision making.
- *Indigenous Planetary Health*: “Planetary health as a ‘field’ is primarily a Western construct as Indigenous Traditional Knowledge systems have no clear separation between the health of the planet and the health of self or that of the community and the ecosystem at large. This means that the meaning and applications of planetary health are directly rooted in community values based on protocols for living in harmony with all that have existed for thousands of years”.[20]

Both One Health and Planetary Health in their conventional framings have been born from EuroWestern-centric academic traditions and worldviews. Their self-embraced interconnectivity between the health of people and the planet (animals, ecosystems, etc. included), have often caused field specific self-declared reflections that they are aligned with Indigenous world views. In other instances there are calls

[19] University of Alberta (2024).

[20] Redvers (2021), p. 678545.

for integrating Traditional Knowledges within the disciplines.[21] These declarations and calls have often not included Indigenous Peoples. Recently, however, there has been increasing interest from Indigenous scholars and communities themselves to examine the foundations of both One Health and Planetary Health from an Indigenous worldview. Therefore, the next sections of this chapter will present an overview of One Health and Planetary Health from 'Indigenous perspectives' with an aim to seek bridging dialogues for more coordinated responses to climate change and other global crises.

2 Positionality

It is increasingly expected within academic publishing in reference to Indigenous Peoples, that authors position themselves in the work.[22] This ensures a more appropriate evaluation of "nothing about Indigenous Peoples, without Indigenous Peoples".[23] With this, our positionality as Indigenous co-authors reflects viewpoints from different contexts and Indigenous territories across Canada and Australia, with our collective work and lived experiences grounding us in our cultures, contexts, and experiential community perspectives. We share commitments towards transformative approaches for Mother Earth's health. BB is a mixed ancestry woman and a member of the shíshálh nation, which is Coast Salish First Nations on the coast of British Columbia, Canada. BB is trained as a PhD public health and community-engaged scholar, researcher, and advocate focusing on Canadian Indigenous Peoples' equity, rights and wellness. BB approaches her work from a decolonial lens and orientation, participating in deep reflection on how Indigenous Knowledges, values, and epistemologies can position us to address the complexities and challenges of planetary health. NR is a member of the Deninu K'ue First Nation located in the sub-Arctic region of Canada. NR is a past-clinician, and Indigenous health scholar with a focus on Indigenous Planetary Health. TR is a Wiradjuri woman with family ties to western New South Wales in Australia. TR is a veterinarian and epidemiologist, and completed her PhD on the implications of One Health for Indigenous communities. TR adopts interdisciplinary One Health research approaches and Indigenous research methodologies to her work that aims to understand current and emerging health challenges for Indigenous populations. SH is of mixed ancestry, a member of the Qalipu First Nation and western European - he was raised on the southwest coast of Newfoundland. SH is a Mi'kmaw scholar with a focus on examining access to wholistic health for Indigenous Peoples and foregrounding Indigenous ways of knowing into One Health research projects.

[21] Padhi and Agarwal (2024).

[22] Lock et al. (2022), p. 7353; Roach and McMillan (2022), p. e0000999.

[23] Id.

3 Indigenous Perspectives of One Health

This section of the chapter will discuss One Health from an Indigenous perspective with discussion of the role of Indigenous Peoples, recognition of Traditional Indigenous Knowledges, and consideration of nature and zoonoses within the global One Health movement.

The One Health High-Level Expert Panel defines One Health as "an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals, and ecosystems. It recognizes the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and interdependent".[24] One Health is promoted internationally as an effective approach to understanding and combatting current and emerging health risks to humans. To date, One Health has been largely focused on how antimicrobial resistance and zoonosis impact human health. A key goal of using a One Health approach is to break down the traditional disciplinary silos in which zoonosis and antimicrobial resistance work has happened, generally within the confines of human health, animal health, or environmental health. However, in line with the definition, it also has a focus outside of human health, encapsulating the wellbeing of all species within ecosystems and the wider environment to address local and global health challenges.

The quadripartite (World Health Organization, Food and Agricultural Organization of the United Nations, World Organisation for Animal Health, the United Nations Environment Programme) supports countries adopting One Health approaches through a One Health joint action plan.[25] The One Health movement, however, has arguably been driven mainly through health organisations based in the Global North. With this, there is a critical need to highlight the relevance of the movement for the many communities outside of these health organizations and networks, including Indigenous communities globally. Only through the dismantling of the disciplinary silos within our research and health systems, alongside the formal challenging of the idea that there is a singular monolithic knowledge system, will we be able to combat inequities in resourcing and the imbalances of power within One Health movements.

In working to advance One Health, there is a need to reexamine how the current definitions of One Health are being taken up by researchers. We, as Indigenous co-authors, based on our experiences, question whether the current understanding of 'One Health' is relatable or applicable outside of people who work within western science. While the overarching goals and approach of the Western-developed definition of One Health could be argued to be aligned with Indigenous worldviews of wholistic health and wellbeing, it does not currently account for the cultural,

[24] Adisasmito et al. (2022), p. e1010537.

[25] Food and Agriculture Organization of the United Nations, United Nations Environment Programme, World Health Organization, World Organisation for Animal Health (2022).

ecological, or spiritual contexts and relationships that are central to Indigenous cultures and communities. In the widespread application of One Health currently, there is a continued foregrounding or prioritization—intentional or not—of human health outcomes. This includes main definitions which state, for example, that One Health seeks to "balance and optimize the health of people [listed as a first priority], animals, and ecosystems".[26] Much of the One Health work completed to date suggests that addressing animal and ecosystem health is being done only in so far as it works to mitigate the risk posed to human health. We continue to see ecosystem health as an area either fully ignored or largely limited within its scope, with a tendency to focus on animal and human interfaces. The implicit foci and end goal of One Health therefore remains the solving and addressing of human health that can be viewed in contrast to Indigenous teachings which promote our connection as stewards and protectors of the environments, ecosystems, waters, and animals. This connection is not done simply to result in our own good health but in recognition of our intimate connection to all things.

A lack of environmental and ecosystem engagement within One Health may be tied to the overall value placed on it by researchers when seeking answers to their questions. In *The Fourth World*, Arthur Manual (2019) offers that the conflict between western society and Indigenous Peoples is a struggle between two competing conceptions of how we view and understand Land. For Western society, land is a commodity to be "speculated, bought, sold, mortgaged, claimed by one state, surrendered or counter claimed by another".[27] For many Indigenous communities the Land is a relationship that gives rise to our practices and ways of life. The notion of Land as a relationship is incompatible with the idea of land as a commodity and creates the struggle between settlers and Indigenous Peoples. It results in a denial of Indigenous Peoples' ability to determine our own futures. Instead, Indigenous communities become what Eileen Moretun Robinson calls a white possession.[28] That Indigenous Peoples are the subjects of white settler majorities within white settler nations, nations that Indigenous Peoples do not claim as our own, and for most of history, refused to claim us. The denial of our conception of Land and the foreclosure of our ability to determine our own future makes us inhabitants of what Manual (2019) called the fourth world.

The implications of Manuals (2019) critique helps us to understand both the limitations and promise of One Health. First, while One Health seeks to include a more wholistic (or de-siloed) understanding of health and its connection to environmental systems, it does not seek to, nor is it capable of, fundamentally transforming the idea of land as a commodity. Without challenging territorial commodification and the ownership and control of Indigenous Lands by non-Indigenous majorities, Indigenous Peoples will always be subject to the externalities of capitalist production which expose us to disease and pollutants. This creates a dualism within One Health that makes it difficult for Indigenous Peoples to fully understand and

[26] Adisasmito et al. (2022), p. e1010537.

[27] Manuel and Posluns (2019), p. 6.

[28] Moreton-Robinson (2015).

embrace. The case of Asubpeeschoseewagong First Nations, commonly referred to as Grassy Narrows, provides an unsettling example of the effects of Land commodification on Indigenous bodies and health. For decades, a pulp mill in the nearby community of Dryden dumped ten tons of mercury-laced effluent into the Wabigoon-English River system.

One Health, as it is currently being used, does not embrace, understand, or account for the inherent spiritual and relational aspects of health and Land. The impacts mercury poison has and will have on humans, animals, and the environment for generations to come for Asubpeeschoseewagong First Nations must also be viewed with a lens of understanding those conditions before, during, and after an incident. As the case above demonstrates, One Health must integrate a temporal lens to the challenges it seeks to solve – by relying on the deep knowledges Indigenous Peoples have of the Lands they steward and how we can regain balance in both the immediate and long term. As an example, the Seventh Generation Principle, based on Haudenosaunee philosophy, states that the decisions we make today should result in a sustainable world seven generations into the future. The Seventh Generation Principle today is generally referred to in regard to decisions being made about our energy, water, and natural resources, and ensuring those decisions are sustainable for seven generations in the future. Maori Peoples of Aotearoa (i.e, New Zealand) have similar concepts to the Seventh Generation Principle. For example, in reciting whakapapa or the genealogy of all things, which is central to all Maori institutions and connects people to the past, present and future and the non-human world—all things are seen to be connected including the air, the water, the land, and the animals. "The Seven Generations Principle cannot be separated from correlating values within Indigenous cultures. These may include stand-alone values such as matrilineal family structures, respect for Elders, relationships with ancestors and preservation of culture; or the principle could be linked to a larger value system".[29] One Health practitioners should aim to address wholistic health challenges with a long-term view into the future.

3.1 *One Health and Zoonosis*

Many Indigenous communities have a strong connection to Land or Country ("the term Land is used in some parts of the world and Country in others"[30]), and have stewarded their Land and Waters for generations through traditional and sustainable practices, including carrying out complex wildlife surveillance for animal management. Despite these long-standing expert knowledges, a continued lack of Indigenous representation and perspectives within One Health persists.

[29] Rousseau-Thomas (2023).

[30] Redvers et al. (2022), pp. e156–e163.

Even though there are increasing numbers of studies utilizing a One Health approach with Indigenous Peoples, there continues to be limited work that has integrated and foregrounded local Indigenous knowledges into the One Health approach.[31] There additionally remains inadequate research that explores the application of One Health to broader Indigenous health and wellbeing outcomes.[32] Despite these issues, there are many opportunities for One Health to learn from Indigenous Traditional Knowledges that have used wholistic and de-siloed interventions for centuries to address threats and challenges to human health, as well as safeguarding and promoting environmental and animal health. Many Indigenous cultures and Traditional Knowledges recognise the deep interconnections, including spiritually, humans have with the Lands, Waters, and Animals we live amongst. As an example, there are many versions of the "Medicine Wheel"(Manitowabi, 2018) teachings passed on within some Indigenous communities in Canada. These teachings vary from one community to another, but the teachings describe the various aspects of life, both seen and unseen. The Medicine Wheel provides teachings about how to be wholistically healthy and the need for us to be in good relations with all living things and the spirit world. The four directions embodied within the Medicine Wheel (Manitowabi, 2018) remind us not only of the need to have wholistic (mental, spiritual, physical and emotional) balance to achieve health in our personal lives but that we must ensure balance (and good health) is maintained within the animals and environments that connect us. We cannot have one without the other. These ideals are transferable to a One Health approach when we view a key function of One Health to be about how to de-silo human, animal, and environmental fields of practice, and the bringing together of people to tackle real world problems with the end goal of restoring true wholistic balance to that problem.

Despite the challenges inherent within One Health, One Health approaches may be particularly helpful for under-resourced communities that live closely with animals and have strong connections to the environment, to combat the health inequities and food insecurity that they often face. Indigenous communities around the world find themselves under-resourced and facing disproportionate health risks across animal, human, and environmental spaces. This includes a lack of access to animal and preventative health care, greater contact with wild animals and vectors, large domestic animal populations, and inadequate/stable housing conditions, among others.[33] Additionally, the impact of the changing climate continues to disproportionately impact Indigenous populations through both exposure risks and widening health inequities.

Awareness of zoonoses has increased over recent years due to multiple outbreaks related to animals, with countries recognising the need to prepare for future

[31] Hillier et al. (2021), p. 100248.

[32] Hillier et al. (2021), p. 100248.; Riley et al. (2021), p. 11303.

[33] Ali et al. (2018), p. 2827; Burleigh et al. (2015), pp. 145–150.

outbreaks. Current national health approaches commonly operate within a siloed structure that does not allow for effective communication and collaboration. Importantly, even when comprehensive groups are brought together, Indigenous Peoples are typically forgotten. As the regions around the Arctic Circle continue to warm faster than any other region, Indigenous Peoples are likely to be at the forefront of possible zoonotic infections.[34] Even though Indigenous Peoples continue to steward vast parts of the world, placing them at the forefront of possible risk transmissions, they are generally excluded from surveillance and early knowledge sharing activities. These activities could benefit from Indigenous Knowledges that are deeply rooted in the Land which brings with it a strong understandings of the changes in the environments, animal migration and health, and waters in which communities rely on. In Canada for example, the three northern territories, which are largely rural, represent two-fifths (39.1%) of the country's landmass but 0.3% of its population.[35] Rural and remote populations, largely made up of Indigenous Peoples play a critical role in understanding the past and present conditions, while helping to determine and shape the future when their deep knowledge and usage of the Land is respected and accounted for. De-siloing current health approaches as well as reflecting on how we think about who has and can contribute knowledge to issues or solutions is needed. This requires operating outside of western disciplinary boundaries to truly undertake a One Health approach.

The One Health research approach incorporates components of animal, human, and environmental health within projects; however, when undertaking One Health research with Indigenous populations, the approach should also consider incorporating cultural, ecological, and social factors, as well as utilize respectfully with communities 'Indigenous research methodologies'.[36] Evidence has found the application of One Health with Indigenous communities to be limited and with minimal inclusion of Traditional Knowledge.[37] This gap creates the need for studies that support Indigenous leadership, priorities and viewpoints, to strengthen the evidence base and tailor One Health recommendations to communities.[38] Research that explored zoonoses within Australian Indigenous communities found that there was a small evidence base, that the existing studies mainly investigated the zoonotic pathogens from one health sector, and there was minimal examples of interdisciplinary approaches to zoonotic disease. As zoonoses are a multifaceted health risk, there is a need to consider the contribution of animal, human, and environmental health factors to the impact of zoonoses in Indigenous communities to inform effective disease management.[39]

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[34] Hillier et al. (2021), p. 100248.

[35] Statistics Canada (2022).

[36] Rigney (1999), pp. 109–121.

[37] Hillier et al. (2021), p. 100248.

[38] Riley et al. (2021), p. 11303.

[39] Riley et al. (2022), p. e0000921.

Box 3 One Health Case Study
Many Indigenous communities in Australia have large domestic animal populations with companion animals being an important part of community life, Traditional Knowledges, and stories. Yet, many communities face barriers in accessing animal health care leading to intersecting health risks including high rates of disease and welfare concerns. There are examples of addressing these health access barriers by implementing preventative animal health programs. One example presents a community animal health and management program driven by an Indigenous Ranger group in partnership with a not-for-profit organization in remote Australia, which involves assessing animal health and administering preventative health care to dogs and cats within the community.[40] An evaluation of this program found significant benefits to animal health and welfare outcomes with community involvement being an important factor for success. There is now a need to further evaluate if there have been improvements to human and environmental health within similar community programs.

4 Indigenous Perspectives of Planetary Health

This section of the chapter will discuss Planetary Health from an Indigenous perspective with discussion of the interconnectedness of all life, sacred reciprocity and stewardship, decolonizing practices, sovereignty and justice, knowledge co-production, and resilience and adaptation.

As noted previously, intersecting global and ecological crises are increasingly posing a threat to human health and wellbeing. More recent research attention has been focused on the impacts and effects that climate change has on health and wellness, with climate change begin described as one of the greatest public health challenges we will face this century. Aside from the *Box 1* definition (see *Box 1*), Planetary Health as a concept has been defined and understood as "the achievement of the highest attainable standard of health, wellbeing, and equity world-wide through judicious attention to human systems – political, economic, and social – that shape the future of humanity and the Earth's natural systems that define the safe environmental limits within which humanity can flourish".[41] There has been criticism, however, that the current field of Planetary Health has predominantly relied on Euro-Western-centric ideas of health and wellbeing that are inherently separated from natural systems. Over recent years, Indigenous scholarship has drawn focus to how important and essential Indigenous Knowledges are in the discussions surrounding Planetary Health. Indigenous understandings of the universe, including the Traditional Knowledges passed down through generations since time immemorial are pivotal to ensuring we have a healthy planet in the future.

[40] Riley et al. (2020), p. 1790.
[41] Whitmee et al. (2015), pp. 1973–2028.

The Lancet Commission on Planetary Health in 2015, concluded that the,

> …present systems of governance and organization of human knowledge are inadequate to address the threats to planetary health. We call for improved governance to aid in the integration of social, economic and environmental policies and for the creation, synthesis, and application of interdisciplinary knowledge to strengthen planetary health (Whitmee et al. 2015).

Additionally, scholars have increasingly called for greater consideration of the power dynamics including the critical analysis of climate change frameworks to consider colonization and contemporary processes of environmental dispossession, exploitation and ecocide, as well as considering climate change as a process that has been imposed on Indigenous Peoples through colonialism.[42] Redvers and colleagues in 2022, brought together a group of Indigenous scholars, practitioners, Land and Water defenders, Elders and Knowledge Holders to envision and define "the determinants of planetary health" from an Indigenous perspective.[43] In consultation with Indigenous leaders globally, the determinants of planetary health were described under three broader categories: Mother Earth level determinants, interconnecting determinants, and Indigenous People's level determinants (see Fig. 1). Mother Earth level determinants encompass respect for the feminine and the notion that women are the stewards of the natural environment and cultural identities; with ancestral personhood designation referring to the protection of both human and non-human relatives.[44] Interconnecting determinants refers to the human interconnectedness with nature; and self, and community relationships. Other interconnecting determinants include the modern scientific paradigm, referring to the dominance of western scientific methods, and the need to appreciate Indigenous science and methods for understanding the complexity of planetary health and the world.

4.1 *Interconnectedness of Life*

The scholarly literature is beginning to catch up to the knowledges that Indigenous Peoples have held for millennia about the intrinsic interconnectedness of all living things on Mother Earth. Yet this understanding and appreciation for the

Fig. 1 The interconnectedness of the determinants of planetary health (*used with permission from Redvers et al.* 2022)

[42] Whyte (2017), pp. 153–162.

[43] Redvers et al. (2022), pp. e156–e163.

[44] Id.

interconnectedness of all living things is not often explicitly discussed but is just known inherently within many Indigenous communities. Indigenous Knowledges are Land-based and rooted within spiritual values, as opposed to any kind of materialistic value as seen within a capitalist system.[45] Indigenous Knowledges and ways of seeing the world offer a deeply important way to view Planetary Health and accompanying climate change action.

Planetary Health frameworks have been predominantly anthropocentric (i.e., rooted in how earth's systems can benefit human needs), whereas Indigenous frameworks and concepts are rooted within the intrinsic value of Mother Earth and her inherent worth that exists regardless of human habitation. Natural Law or First Law refers, in the English language, to the guiding principles of many Indigenous Peoples in how our planet is governed through maintaining respectful and reciprocal relations with our non-human relatives and all living things on Mother Earth.[46] This deep personal relationship between all human and more than human beings, and the consequent dynamic balance of life is the essence of the Law. This Natural or First Law, as taught through generations of stories and passed down through generations, creates an ethical framework to live by, for maintaining peace, for thriving, and for living within spaces of love and reciprocity.[47] Indigenous Peoples are from the oldest societies in the world and ancient wisdom has been maintained through storytelling across generations. Stories of the interconnectedness of our world are in stark contrast to colonial laws. Colonial laws privilege human communities over the needs of Mother Earth and all other relatives, which serves to diminish Indigenous Natural or First Law that platforms innately a sense of responsibility, reciprocity, and sacred authority.

Natural or First Law are also Indigenous rules or protocols that are grounded in ceremonial action. Indigenous Peoples follow these protocols to ensure an ongoing and sustainable relationship with Mother Earth. The "Seven Grandfather Teachings"[48] are an example of principles and concepts to live a good life with concepts like respect, love, truth, bravery, wisdom, generosity and humility embodied within the teachings passed down. Within many Indigenous perspectives, Land-based does not mean that the Land is separate from or disconnected from ourselves as people. The Land is active in our healing processes, and it is well known within Indigenous communities, that the health benefits that can arise from our relationship and connection with the land are profound.[49] The value of humility becomes increasingly important for us as humans to acknowledge that we are just one small part of the greater system and web of Mother Earth.

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[45] Redvers (2018), p. 30.

[46] Redvers et al. (2020), pp. 90–107.

[47] Id.

[48] Seven Generations Education Institute (2021).

[49] Redvers (2020), pp. 90–107.

4.2 Decolonizing Practices, Sacred Responsibility, and Stewardship

> Elders are the most brilliant scientists of them all. Their understanding of the universe as described in their powerful and symbolic stories provides clues to their deep knowledge. It is our job to listen to those stories and interpret their meanings so that we do not lose the lessons of the past and can ensure better hope for a healthy planetary future.[50]

Indigenous Peoples, their voices, and knowledges have historically been overlooked in climate dialogue and international action. There is an increasing recognition of the value that Indigenous Knowledges bring to climate mitigation, adaptation, and action. Indigenous ways of knowing are expressed through how Indigenous Peoples see the world and the interconnection with the Land is expressed through language, song, stories, traditional medicines, and songs. Through traditional storytelling, the youngest generations learn from Elders how to interact with the environment and how to respect Mother Earth. Values of reciprocity embedded within the relationships with the Land are deeply intertwined in cultural practices and ceremony. When you take something from the Land, such as a medicine, it is protocol to ask permission for this gift. Some Indigenous groups will therefore gift back to Mother Earth through leaving something in return, as this is a common understanding of achieving balance in nature by acting in reciprocity.[51]

Climate change has been platformed as a form of colonialism that is imposed on Indigenous Peoples globally. Colonialism is about domination in many different forms, with the often exploitation of and extraction from Indigenous lands paving the way for capitalist systems to thrive.[52] Whyte (2017), highlights three key themes to Indigenous inquiries into climate change: (1) The anthropogenic (human-caused) climate change as imposed on Indigenous Peoples by historical and ongoing colonization; (2) Renewing Indigenous Knowledges, specifically Traditional Ecological Knowledges (TEK), and strengthening Indigenous self-determination in climate change action; and, (3) Indigenous visions of climate futures as deeply connecting to ancestral histories to adapt to environmental change and reckoning with the disruptions of ongoing practices due to colonialism and capitalism. Some scholars have discussed climate change as a new era of colonization with the risk of climate refugees having to flee climate events. With this, we are now in a stage of colonially-driven forced adaptation to the ongoing changes of environments.[53]

The term Traditional Ecological Knowledges (TEK) refers to the transmission of Indigenous traditional knowledge of Land stewardship principles that are transmitted through oral traditions between generations and interconnected with all other aspects of Indigenous ways of being. TEK is not homogenous and is diverse across

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[50] Redvers (2018), p. 30.

[51] Yellow Cloud and Redvers (2023), p. 11786302231157507.

[52] Whyte (2017), pp. 153–162.

[53] Id.

the globe, with common elements of being grounded within the Lands on which people are ancestrally tied to. TEK comes in many forms is inclusive for Indigenous Peoples with their relationships to animals and the environment. See *Box 4* below for an example of Indigenous relationships and understandings of TEK through daily lived experience for Iñupiaq Peoples.

The "Indigenous Determinants of Planetary Health" additionally highlights the importance of the "respect for the feminine" in our considerations of Mother Earth but also the importance and the acknowledgment that women in communities are

Box 4 Planetary Health Case Study

Sakakibira (2009), discusses her work with the Iñupiaq Peoples of the Arctic and the centrality of whales to cultural identity, as well as the interconnections of climate change to the spiritual and cultural practices of whaling. The Iñupiaq live an active subsistence lifestyle with year-round activities such as fishing, caribou hunting, sealing and whaling in the spring. There is meticulous preparation for subsistence, and the oneness between humans and the whales is acknowledged as the centre of life, grounded in ritual, ceremony, song, and drumming.[54] Sakakibira (2009) asserts that as climate change leads to changes to the natural environments of the Iñupiaq Peoples, performances and songs are used to express concerns about and adapt to these environmental changes. The Iñupiaq Peoples are so closely spiritually and culturally connected to whales, and this intimate connection is central to their cultural ceremonies, songs, drumming, and language. Sakakabira refers to this intimate connection as whale-consciousness or "cetaceousnes".[55]

Changes to climate and environmental degradation in this Arctic region threaten not only the whale hunt and subsistence, but the survival of these cultural protocols and the interconnectness to all ways of life for the Iñupiaq. For example, drum ceremonies have been central to whaling season, and these cultural protocols are now also used to express challenges, adaptations, and survival despite environmental change. The ceremonies invite back reciprocal relations between humans and the lived environment. "To the Iñupiaq, the drumbeat is the heartbeat of the people of the whales, and the instrument now has the power to reestablish the communication between the Iñupiaq and the whales".[56] The story of the Iñupiaq and the intimate connection with whales and cultural protocols illustrates sacred stewardship responsibility for the planet and the deep interconnections Indigenous knowledge has with the planet.

[54] Sakakibara (2009), pp. 289–303.

[55] Id.

[56] Id.

often the caretakers of culture and stewards of Land.[57] Scholars also highlight that climate change has a gendered impact, affecting Indigenous women more acutely as with all other colonial policies. Industries operating on Indigenous Lands pose greater security threats to vulnerable groups of Indigenous women, such as from oil production fields with threats of human trafficking in highly concentrated areas of industrial activity.[58] The importance of gender in systems of dominance and oppression must also be acknowledged in the field of Planetary Health. Oppression of Indigenous women was an instrument of colonization over hundreds of years and now as Indigenous territories deal with environmental change the leadership of Indigenous women must be elevated, acknowledged, and respected.

Hill et al. (2024) reflect on how rematriation is a key component that must be considered in the climate and environmental justice movements. Rematriation could be described as work to restore the sacred relationships between Indigenous Peoples and their ancestral land, honoring matrilineal societies, and being in opposition to patriarchal violence and dynamics (Sogorea Te' Land Trust, n.d.). Rematriation is central to the field of climate justice and to dismantling colonial systems which diminish matriarch roles in communities as knowledge holders and Land stewards who transmit cultural protocols to next generations. Indigenous Peoples Land-based traditions, such as the placenta burial ceremonies as an example, is an active practice grounded in kinship, and is led by matriarchs as a symbol of sacred connection to the spiritual and natural worlds.[59] Reclaiming ancestral Land-based practices led by matriarchs is key to healing and is vital to the sovereignty of Indigenous communities as matrilineal societies. Hill et al. (2024) explore the process of birthing justice and rematriation in the context of climate justice as an act of returning to the sacred mother. Rematriation is a transformative path towards Indigenous sovereignty and privileging Indigenous epistemologies and ontologies, honouring the sacred knowledge that is required to protect the water and the land, and to maintain access to sacred ceremonial practices.

> For Indigenous Peoples, the land is an ancestor who carries our memories, our stories, our traumas. Healing the land is inextricably linked with healing our people.[60]

4.3 Indigenous Self-determination, Sovereignty, and Nature Justice

Hundreds of years of colonization has disrupted Indigenous Peoples' relationship with their ancestral territories and as a result, has in some cased fractured the transmission of Indigenous Knowledges. TEK is the embodiment of Indigenous Peoples'

[57] Redvers et al. (2022), pp. e156–e163.

[58] Whyte (2017), pp. 153–162.

[59] Hill et al. (2024), p. 100314.

[60] Hill et al. (2024), p. 100314.

relationship to the land so when TEK transmission is prevented, it results in potentially great loss for communities.[61] Restoring ecosystems that have been damaged is an enormous task globally, but global governing bodies are beginning to acknowledge the necessity of Indigenous voices being at the table, and seeing the value of Indigenous Knowledges in managing natural resources.

As previously described, the ancestral personhood designation is a key determinant of Indigenous planetary health. A key example of this is the Whanganui River Claims Settlement, which granted the river legal personhood.[62] This was a key shift from identifying a river as an environmental object to instead identifying the river as a legal subject in and of itself.[63] "This argument – known as "nature jurisprudence" – posits that with legal personhood of the environment comes all the protection due under national and international statute".[64] Further in 2017, the Yarra River was legally recognized as a living entity in Australia.[65] These rivers are being acknowledged as imperative to Indigenous culture and inspires ideas for uplifting ancestral personhood and protecting our ancestral beings.[66] Nature jurisprudence has been seen throughout Indigenous Knowledge Systems where Indigenous Peoples refer to governance through their ancestral connections, and that this nature responsibility is a ultimately an overall personal and inherent responsibility to Mother Earth. The rights of nature for all beings on the planet is clearly understood and appreciated within TEK where relational approaches are applied as opposed to the transactional models currently seen in capitalist and extractive frameworks.[67] These nature rights legal cases have significant importance for future protection of animal relatives. More recently a movement to protect the Bison in North America has gained momentum with nations coming together to develop legal instruments to protect the Bison from a rights-based approach, acknowledging their value not only to the Land but as a cultural relative for generations.[68] These examples highlight the importance of Indigenous self-determination and privileging TEK as being key in protecting the Land and all of the more than human relatives.

[61] Robinson et al. (2021), p. e13381.

[62] Waitangi Tribunal (2019).

[63] Id.

[64] McDonough (2019), p. 143.; Id.

[65] Yarra River Protection Ministerial Advisory Committee (2016).

[66] Redvers et al. (2022), pp. e156–e163.

[67] Robinson et al. (2021), p. e13381.

[68] Id.

4.4 Knowledge Co-Production: Education, Research, and the Shifting of Discourses

The value and importance of embedding Indigenous Knowledges and values into Planetary Health initiatives are clear. There is a need to envision new ways to educate others to begin to move beyond status quo thinking and purely biomedical approaches to learning and training that can envision innovative solutions to the challenges that continue to put Mother Earth at risk. It is increasingly imperative to have Indigenous leadership in education spaces to bring learners and educators on a transformative journey to integrate Indigenous approaches into Planetary Health education. In 2021, the planetary health education framework was developed based on a task force which sought to build on 12 cross cutting principles for Planetary Health education, and bridge language across all disciplines and sectors.[69] The framework considers five intertwined domains at the core of the framework including: interconnection within nature, the Anthropocene and health, systems thinking and complexity, equity and justice, and movement building and systems change.[70] This framework serves to shift systems away from siloed approaches to education and serves as a guiding framework for transformative approaches to education in Planetary Health (see Fig. 2).

Additionally, the importance of collaboration between western and Indigenous Healing and Knowledge Systems is more amplified with the climate challenges ahead. Decolonizing research and methodologies are necessary to ensure that Indigenous voices are listened to and heard in Planetary Health policy, research, and practice. Health professionals and researchers are often not prepared or adequately trained to conduct work that responds to climate impacts, including being unprepared for the shift and transition to environmentally sustainable health care systems. There is a need for universities and educational institutions to embed Planetary Health training across their programming, particularly in the health professions. Education and research movements, however, need to be inclusive of educational approaches that develop students' knowledge and critical appraisal of decolonial world views as it pertains to our Mother Earth. Innovative educational approaches are therefore needed to encourage learners to better understand varied ways of understanding Planetary Health inclusive of embedded Indigenous Knowledges and approaches.[71]

Indigenous languages themselves are deeply rooted and interconnected to the planet and are like a blueprint of Traditional Ecological Knowledges for Indigenous Peoples.[72] Indigenous languages embody teachings about the Land inclusive of understandings of Natural Laws that often do not even have a translation to the English language. These language teachings are held in the hearts and minds of Elders to be transmitted to the next generations. Therefore, protecting the planet and

[69] Faerron Guzman et al. (2021), pp. e253–e255.

[70] Id.

[71] Brand et al. (2023), pp. e97–e102.

[72] Redvers et al. (2023a), pp. e4–e5.

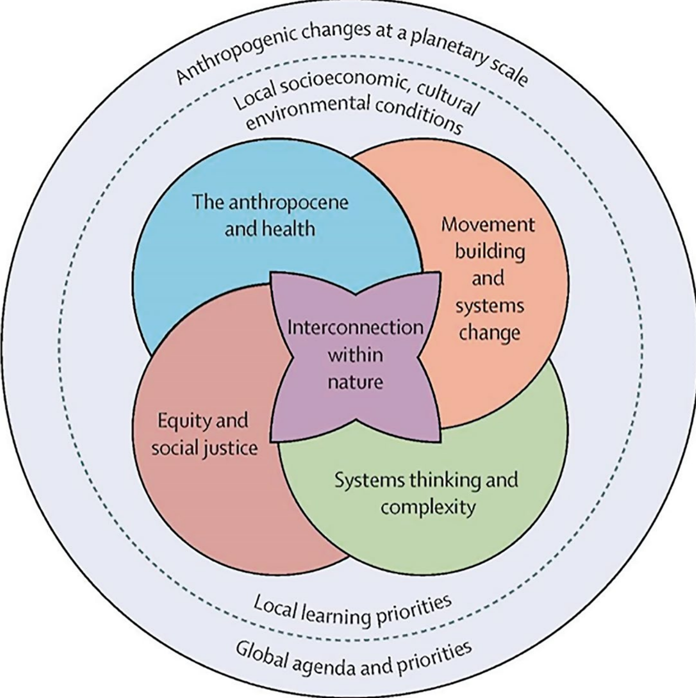

Fig. 2 The planetary health education framework (from Faerron Guzman et al. 2021)

privileging Indigenous Knowledges in Planetary Health also requires the protection and privileging of Indigenous languages. It has been documented that Indigenous Peoples speak more than 4000 of the world's languages but make up less than 6% of the global population.[73] As languages and Traditional Ecological Knowledges are so deeply interconnected, the loss of Indigenous languages due to colonialism has a direct impact on the protection of biodiversity on the planet. Redvers et al. (2023b), highlight that the protection of Indigenous languages is a fundamental determinant of planetary health.[74] Sarah Child additionally noted in 2022 that, "Indigenous languages are the medicine for our people and their revitalization is vital to our individual and collective wellness and the wellness of the earth" (Black Press Media Staff, 2022).

[73] The United Nations Permanent Forum on Indigenous Issues (n.d.).

[74] Redvers et al. (2023b), p. e0002474.

4.5 Resilience and Adaptation in the Face of Climate Change

As mentioned previously, Land dispossession as an act of colonization has threatened Indigenous Land-based knowledges, language, kinship systems, and relationality to ancestral lands. Indigenous scholars and climate activists have increasingly recognized the role of Indigenous communities in the protection of Lands and ecosystem stewardship in the face of ongoing colonialism and dispossession. It is often cited that Indigenous Peoples steward eighty percent of global biodiversity while only inhabiting twenty-two percent of the earth's surface and comprising under six percent of the global population.[75] Such numbers are powerful illustrations that support the recognition of the importance of Indigenous Peoples' rights to their lands, as well as the need for continued support for self-determination so they can continue to act as stewards of the living systems on their ancestral territories. Indigenous stewardship of Mother Earth ultimately benefits everyone.

In the face of climate change-related wildfires that are increasingly devastating communities in North America and across the globe, there is increasing focus on the reclamation of Indigenous Traditional Knowledges in fire management. Indigenous Peoples located in North American have Traditional Knowledge not only about fire prevention but also about how fires effect ecosystems, habitats, and resources. Indigenous fire stewardship practices have been maintained for millennia and there continues to be keepers of fire knowledge within many Indigenous communities.[76] Indigenous communities in Canada have had high intensity wildfires over recent years that have often been located in areas that directly impact Indigenous Peoples and threaten Indigenous territories and cultures. Hoffman et al. (2022), states that over 60% of Indigenous communities in Canada are in remote and forested areas and more than 30% are likely to be directly impacted or displaced by the outcomes of wildfires.[77] Cultural fire regimes were traditionally used to affect when, where, and how fires burned through Indigenous territories drawing on passed down cultural knowledge.[78] In Canada, First Nations Peoples regained the right to cultural burning on their lands and territories (it was banned by colonial governments for several decades) however, there remains significant tensions with the need for effective relationships and co-decision making with government oversight and wildfire management agencies.

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[75] Tauli-Corpuz (2016).

[76] Hoffman et al. (2022), pp. 464–481.

[77] Id.

[78] Lake et al. (2017), pp. 343–353.

Box 5 Case Study: Regenerating and Reviving Indigenous Knowledge in Fire Management

The Tsilhqot'in Peoples of British Columbia, Canada, have been disproportionately and devastatingly impacted by wildfires in their territories (particularly the wildfires of 2017). When the 2017 wildfires broke out in Western Canada, in the interior of British Columbia, over 1.2 million hectares of land was burnt which forced more than 65,000 people to evacuate. The Tsilhqot'in communities were impacted with two of the largest wildfires in the region affecting about 761,000 hectares of land. It then became a key priority for the communities to recover and prevent further damage. These fires occurred only several years after the Tsilhqot'in's Indigenous title was recognized in the Supreme Court of Canada. Despite this court decision, and assertion of jurisdiction over Indigenous territory, there remain challenges in reconciling land authority with the government of British Columbia. Emergency management, for example, remains an area that is managed by multiple jurisdictions from local, regional, provincial, and national bodies. Complex relationships between communities and governments creates jurisdictional complexity in the face of wildfire. Chief Joe Alphonse stated that, "[o]ur traditional, ecological and territorial knowledge of the Tsilhqot'in territory weaves an unbreakable thread through our generations for century upon century".[79]

In 2019, a pilot project was initiated to develop a traditional fire management program for the Tsilhqot'in lands led by the Yunesit'in and Xeni Gwet'in First Nations—both communities being within the Tsilhqot'in Nation. "[T]he Tsilhqot'in word for fire translates to "lightening the load off the land" an Elder shared".[80] Indigenous Peoples have a long history of using fire for their cultural practices and to manage fire risk on their territories. It is something, as noted previously, that has been done for generations and was suppressed as a practice through colonization. The Tsilhqot'in aim to revive and reinvigorate these practices of cultural burning as an integral path forward to prevent the devastation that happened in 2017. Cultural burns are different from controlled burns which are often done by government forest management services. These government led burns are done to address the built-up of fuel within the forests. Cultural burns on the other hand aim to promote growth of medicines, food plants, and fortify lands for all species to thrive. With the Indigenous led project, the Tsilhqot'in Peoples are leading the way in the revival and resurgence of traditional fire management approaches to address the urgent need within their communities. This project is a key example of drawing on the strengths of Indigenous Knowledge and community action for planetary health.

[79] Stacey et al. (2019).

[80] Boutsalis (2020).

> Historical conceptions of the boreal forest as a wilderness empty of complex human societies misses both the role that Indigenous peoples played in the boreal landscape, and in particular, the human hand which influences the expression of fire on the landscape and human relationships with other nonhuman things.[81]

Christianson et al. (2022) highlight the deep place-based Indigenous Knowledges of fire and wildland fire management, and that there are currently missed opportunities to bridge this knowledge into current land stewardship and wildfire management practices.[82] Conceptions of the forests being 'empty' landscapes that were untended was commonly used as a settler-colonial justification for claiming empty land through the "doctrine of discovery" when it is now acknowledged that Indigenous Peoples have intentionally tended to the land for generations, often through fire practices.[83] This viewpoint led to the further dispossession of Indigenous Peoples from their Land, disconnecting them from their inherent stewardship duties which were conducted for thousands of years.

Christianson et al. (2022) further explore the Indigenous beliefs that fire is a life-giving force and that everything is interconnected inclusive of fire. Fire is considered sacred to many Indigenous ceremonies and aspects of the culture, however, fire can also be seen as a force that is capable of growth, destruction, and then renewal. Christianson describes how many different Indigenous groups used techniques of fire and burning based on their Traditional Ecological Knowledge. For example, in the Labrador region of Canada, burns were conducted to improve hunting conditions, to create habitat for biodiversity, and to change migration patterns for caribou herd movements. In Northeastern British Columbia, fire is used for clearing vegetation, spiritual and ceremonial hunting, protection from animals and insects, and to improve bison habitat in the territory.[84] It is apparent that cultural burning practices and fire management-related Traditional Ecological Knowledges have been in existence for generations and fractured by ongoing colonialism. Efforts to revitalize fire practices are closely tied to the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP).[85] With climate change, the impact on forests and increased risks to Indigenous communities' health results in a call for increased Indigenous leadership in fire management and contemporary decision making on Indigenous lands. Finally, Indigenous leadership in fire management systems are increasingly essential to ensure that Land-based traditional and cultural sites of significance are protected for future generations.

[81] Christianson et al. (2022), pp. 257–276.

[82] Id.

[83] Id.

[84] Id.

[85] United Nations (2007).

5 Bridging Dialogues to Pave the Way Forward

The tensions and complexities of bridging ways of knowing (e.g., Indigenous and Western) is apparent alongside the urgent need of addressing the health of the planet from climate-related impacts. We must move beyond short-term visions and challenge the dominant knowledge systems and ideological frameworks while acknowledging the importance of Indigenous wisdoms and relational practices. Health systems cannot function independently from the understanding that without the health of people and the planet, we will not have functioning health systems or be able to adequately serve communities. Furthermore, the structural fault lines of inequities will widen as we begin to experience more and more climate events. We must re-examine the values that are held within burgeoning movements such as One Health and Planetary Health and consider and reflect deeply on how we value the planet. There is a definite need for more closer alignment with Indigenous values of relationality and planetary healing.[86] Redvers (2024) poses questions for re-examining core values of healthcare systems: "How do we value the planet? How do our own value systems impact the planet? How do we align our values with relational care of people and planet?".[87] One Health and Planetary Health need to establish a firm interconnection to the Land and Country, and to Land and Country-based principles, resisting the siloed nature of academic fields connecting to the micro, meso, and macro realities that impact the planet. As Indigenous scholars, we highlight in *Box 6* some key recommendation below for moving One Health and Planetary Health forward towards more respectful engagement and inclusion of Indigenous voices.

Box 6 Key recommendations to move One Health and Planetary Health forward towards more respectful engagement and inclusion of Indigenous voices.

- Acknowledge the historical and ongoing epistemicide (i.e., killing of knowledges) of Indigenous Traditional Knowledges within EuroWestern science traditions,[88] that has been present in both One Health and Planetary Health fields.
- Work to uplift Indigenous Peoples, their voices, and their knowledges within One Health and Planetary Health spaces.
- Work towards privileging and honouring Indigenous leadership at the forefront of One Health and Planetary Health project work.

[86] Redvers (2024).

[87] Id.

[88] Redvers et al. (2024), p. e0003634.

- Make space for listening and learning from Indigenous Peoples, and their Indigenous-led community examples of successful on the ground practice.
- Use a strengths-based lens over a deficit-based lens when working with Indigenous Peoples for research, policy, and practice.

6 Conclusion

The factors that contribute to public health risks are overlapping and multifaceted, existing across animal, human and environmental sectors. With the continuing threat of outbreaks from climate change and zoonotic origins, research that investigates the relationships between environmental and animal health is gaining momentum when it comes to their impacts on human health. If we are to accomplish the goal of sustained optimal human health, we must first start by placing a true priority on the wholistic health of the ecosystems and animals on which human health depends. Therefore, from our perspective, we must urgently work on addressing the root causes of climate change health disparities, and poor animal health with declining populations leading to zoonotic outbreaks. By tackling these risks to human health, we work towards a true Indigenous understanding of One Health and Planetary Health.

One Health and Planetary Health share many commonalities and favour wholistic approaches that recognise the importance of looking outside of the individual and acknowledging the shared environment to the benefit of health and wellbeing. These approaches are likely to continue to gain momentum with continuing health risks such as climate change, zoonotic disease, and antimicrobial resistance. Due to the intended wholistic nature of both One Health and Planetary Health, and the recognition of the need for approaching health challenges through desiloed and interdisciplinary approaches, they are likely to be an effective method to address health inequities within Indigenous populations if seeing Indigenous Peoples and their knowledges as co-partners. Substantial work is needed, however, to ensure Indigenous perspectives and opportunities are platformed within both the One Health and Planetary Health fields due to the current gaps in ensuring sustainable, effective, and appropriate interventions are implemented through policy, programs, and research fields.

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