

# A reimagined One Health framework for wildlife conservation

Craig Stephen<sup>1</sup> , Alana Wilcox<sup>2</sup>, Sarah Sine<sup>2</sup> and Jennifer Provencher<sup>2</sup>

<sup>1</sup>McEachran Institute, Nanoose Bay, Canada and <sup>2</sup>Ecotoxicology and Wildlife Health Division, Environment and Climate Change Canada, Ottawa, Canada

## Results

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### Author for correspondence:

Craig Stephen,  
Email: [craigstephen.pes@gmail.com](mailto:craigstephen.pes@gmail.com)

## Abstract

The One Health discourse is dominated by the role of animal health as a determinant of human health. This discourse often disregards the intrinsic and ecological value of healthy animals and is thus an inadequate framing for wildlife conservation. Our paper reimagines One Health for conservation purposes based on five premises: (i) health is cumulative; (ii) there are multiple species with different health needs and goals in the same setting; (iii) One Health emphasizes “bundled” relationships unique to a setting, rather than independent and intersecting spheres of health; and One Health should be (iv) equity informed and (v) have a shared goal that can be achieved through intersectoral actions. The reimagined framework is centered on the guiding principle that all actions should ensure no species or generation is prevented from reaching good health by the actions to protect other species or generations. Grounded in the positive outcome of health equity, the framework uses three prompts to guide One Health planning – populations, places and goals. The paper discusses how the framework can be applied for research concerning wood bison herds under imminent threat in Canada.

## Introduction

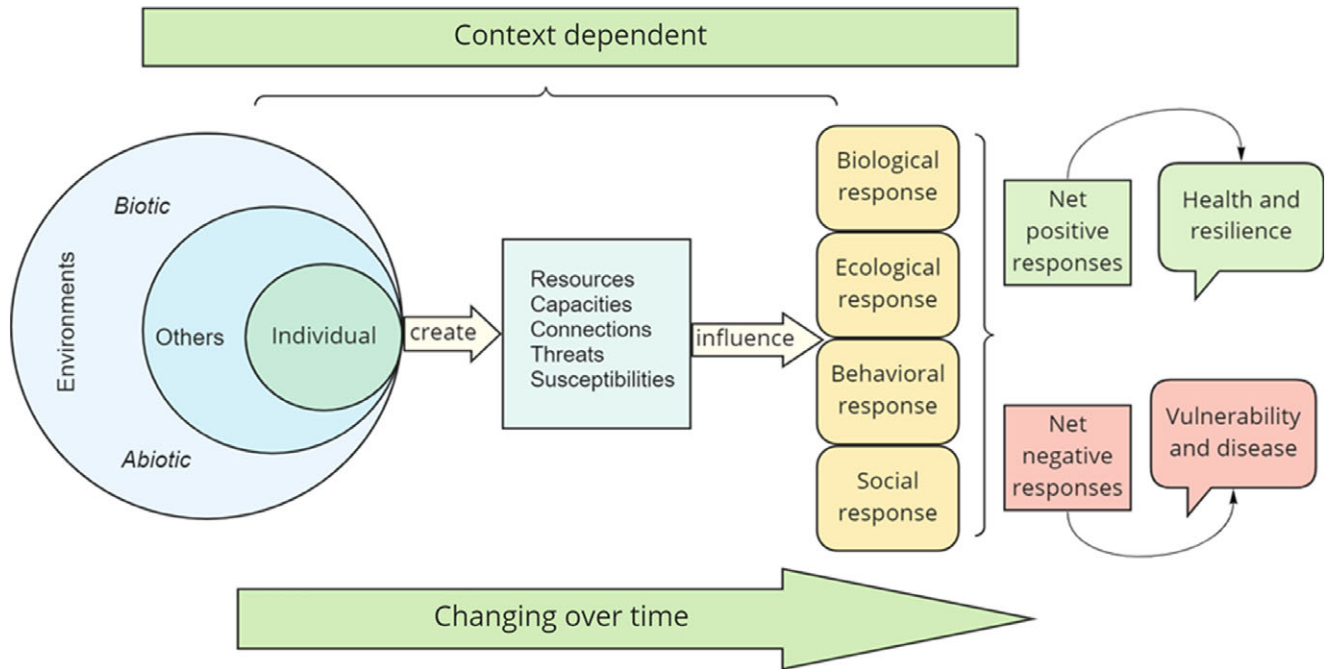
One Health emerged as a framework in the early 2000s to promote intersectoral action between human, animal and ecosystem health sectors. Intersectoral action refers to the way in which different sectors (i.e., government agencies, nongovernmental organizations and stakeholders) work together to improve the conditions that shape health. Intersectoral actions are needed when (i) programs are unable to address health challenges on their own; (ii) to improve coherence in addressing health challenges across sectors; and (iii) to increase and mobilize resources dedicated to improving health (WHO, 2018). To date, most One Health intersectoral action has been done to address proximate human health risks and needs, such as zoonotic disease management and food security (Gallagher et al., 2021). While conceptually One Health does not centralize one sphere (i.e., human, animal, or ecosystem health) over the other, the approach has come under scrutiny for its anthropogenic focus and failures to adequately attend to nonhuman well-being (Ferdowsian, 2021). One Health has principally aimed to manage animal health not for the moral and ecological value of healthy wild animal populations, but rather the extent that poor animal health affects human health and well-being (Bhakuni, 2021). As a result, the predominantly human-centric focus of One Health efforts can fail to realize a goal of health co-benefits across species and generations.

The preoccupation of One Health on zoonotic diseases for public health purposes has led to an emphasis on epidemiological approaches instead of socio-ecological systems approaches in research and practice (Gallagher et al., 2021). Putting people at the top of a hierarchy of human, animal and environment health has resulted in suggestions that One Health reproduces a western-centric biomedical epistemology, rather than enabling novel intersectoral action on the interdependencies between human, animal and environmental health (Davis and Sharp, 2020). Therefore, there is a need to reimagine One Health thinking for wildlife conservation by bringing a holistic socio-ecological framing to the forefront of a One Health discussion. Here we explore how we can transform the dominant human-centric One Health framing to use One Health within a wildlife conservation landscape.

## Context for method development

We undertook the development of the framework presented in this paper as part of an effort to address a critical need to reimagine One Health for an intersectoral approach for the purposes of Species At Risk (SAR) conservation in Canada. There are several species at risk in Canada where health in combination with habitat degradation is identified as the leading conservation concerns. For example, wood bison (*Bison bison athabascaae*) are classified as threatened under the Canadian Species at Risk Act (SARA; ECCO, 2018). Species management efforts have largely focused on the creation, protection and augmentation of herds within the historic wood bison

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**Figure 1.** Conceptual model of wildlife health as a cumulative effect that changes over time and is unique to each context.

range that are free of bovine tuberculosis and brucellosis (Shury *et al.*, 2015). In 2021, two disease-free herds were classified as being under imminent threat due to their small population size; threats of habitat alteration due to hydroelectric generation, oil and gas exploration and forestry; potential exposure to contaminants from oil extraction processes; proximity to a herd infected with bovine tuberculosis and brucellosis; and unregulated hunting (ECCC, 2020).

Alongside the requirement to respond to the SARA listing for species like wood bison is the essential need to conduct conservation work in a manner that supports reconciliation with Indigenous peoples in Canada, who have legal rights to a healthy, sustained environment and wildlife, as detailed in the Canadian Constitution (e.g., Section 35, rights to wildlife harvest), SARA (Section 53, consultation), and the UN resolution recognizing a healthy environment is a human right (United Nations Development Programme, 2022; United Nations Digital Library, 2022). At the same time, Canadian federal conservation agencies are being encouraged to apply One Health thinking to their work. These are currently driving factors shaping the conservation approaches for wood bison with partners and within a larger ecological context.

A zoonotic disease-focused One Health approach inadequately reflects the interacting challenges confronting at-risk species, such as the wood bison herds under imminent threat, as the current model lacks an operational framework to develop or communicate socially acceptable management plans that account for interacting human, ecosystem and wildlife health in the same geographic location. Below, we reimagine a conceptual framework for One Health with a conservation focus that is applicable across a range of species and ecosystems in Canada.

## Method development

### Core premises leading to the framework

**Premise 1** – Health is the cumulative effect of social and ecological determinants that create threats, susceptibilities, resources and

capacities that determine how well an individual, population or system can cope with its lived reality (Stephen, 2022). The term health is often undefined or not uniformly applied in wildlife health or One Health, leading the recommendations for authors to provide their definition of health (Sinclair, 2020, Wittrock *et al.*, 2019). As such, we provide Figure 1 to establish our perspective of health as the term is used in this paper (Figure 1).

Determinants of health enable access to the resources for daily living and functioning, capacity to cope with change and stressors, and ability to meet human expectations (Stephen, 2022). It has been proposed that there are six broad categories of wildlife health determinants: (i) needs for daily living; (ii) interactions with the abiotic and biotic environments; (iii) interactions within the animals' social environment; (iv) biological endowment; (v) direct mortality pressures; and (vi) human expectations and animal uses (Wittrock *et al.*, 2019). The relative contributions of these determinants change over the life course of an animal and will be different for different species and/or situations. Table 1 provides some illustrative examples of factors influencing each category of health determinants for wildlife health, using wood bison as an example.

**Premise 2** – There is not one health, but multiple types of health in one setting.

In every socio-ecological system, there is more than one species and more than one population. Each has its own unique requirements to be healthy, and each can be subject to different social expectations for their health. Therefore, there are multiple ways health can be measured, framed and experienced in the same setting.

The “One” in One Health can be taken to mean a single species (i.e., an anthropocentric bias) or that there is a single healthy setting shared by people and other organisms. The Ottawa Charter for Health Promotion states that health is created and lived within the settings of everyday life (WHO, 1986), forming the foundation for the healthy settings approach. The healthy settings approach applies whole system and multi-disciplinary methods that integrate action across risk factors and emphasizes strategies

**Table 1.** Illustrative examples of factors influencing wood bison's determinants of health (see Wittrock et al. (2019) for the Determinants of Health Conceptual Model for Wildlife Health)

Health determinant	Examples of factors contributing to the determinant
Needs for daily living	Habitat quality, forage availability and quality, habitat use, migration paths
Abiotic/biotic environment interactions	Contaminants, climate change, insect harassment, winter conditions, forest fire, flooding
Social environment of the animals	Demographics population dynamics, abundance, herd structure, competition
Biological endowment	Age, pathogens, parasites, disease, body condition, physiological stress, genetic diversity, microbiota
Direct mortality pressures	Hunting, predation, extreme weather, motor vehicle collisions
Human expectations and uses	Consumption, conservation management policy, Indigenous rights

that contribute to health in particular settings rather than targeting specific at-risk groups. Healthy setting programs think about places, which are defined relationally, rather than spatially. A place is where organisms actively use and shape the environment and where health problems are created or solved (Roberston, 2021). A setting, on the other hand, involves the time, place and circumstances in which something lives. Settings-based approaches target the specific circumstances of a place and engage with local issues and opportunities that are driven by complex, intersecting factors, requiring a cross-sectoral response (State Government of Victoria, 2020). The goal is to combine knowledge, policies and resources to make the setting healthier for all that live there, rather than addressing risks to only one group in a space shared with others. In the context of conservation, this requires One Health to use a holistic ecosystem approach which considers the wildlife, the environment, people and the historical and current setting.

**Premise 3** – The model of One Health as overlapping spheres inadequately reflects how human, animal and environmental health interrelate.

The usual One Health visual representation delineates human, animal and environmental health as distinct entities that overlap on a sub-set of issues (e.g. zoonoses), rather than an entangled assemblage of interactions of determinants of health (Davis and Sharp, 2020). The usual presentation of overlapping spheres suggests an unproblematic alignment of three sets of interests that are typically treated and managed separately. Separating them into three different categories of health rather than one, interconnected health can allow for one type of health (i.e., usually human) to overwhelm other types.

Instead of distinct spheres that overlap on some issues, conceiving One Health as an assemblage allows one to think about the ways human, animal and environmental health are “bundled” in distinctive social, behavioral, ecological and biological relationships unique to a setting. Operationalizing One Health, specifically when conservation of ecosystems is a central tenet, requires recognition that the bundles are messy and not discrete, and the consideration of linked health needs requires an analytical framework that is also complex and can accommodate bundles of information.

**Premise 4** – One Health should be equity informed.

Equity is about treating things justly according to their circumstances. Health equity exists when there is fair access to the resources and opportunities needed for health. Actualizing the ideal of One Health necessitates a focus on interspecies and inter-generational health equity. Health equity, from a One Health perspective, should ensure that all species and generations can reach their full health potential and are not disadvantaged from attaining it because of efforts to protect the health of one group in the current generation. The net gains in human well-being in

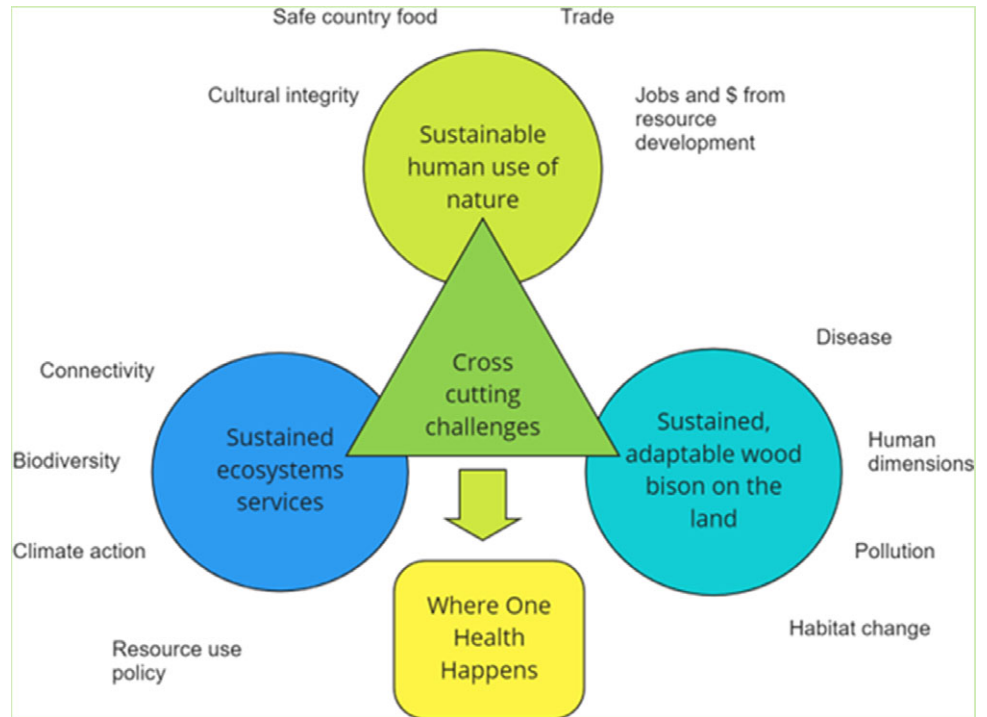
the past two generations have come at the cost of degraded ecosystems and diminished access to their benefits by future generations and other species (Lee and Diop, 2009). Promoting human health at the expense of other species, ecosystems or generations resemble colonial and racial inequalities in which one group prospers at the expense of the other (Shoreman-Ouimet and Kopnina, 2015) and have resulted in substantial and largely irreversible interruptions in the flow and sustainability of ecosystem services that are determinants of health equity.

Understanding and managing health from an interspecies point of view calls for the awareness of similarities and differences between the need of different living things in the same setting. Health equity and ecological justice in One Health ask how we should include the interests of nonhumans in One Health policies and programs. Ecological justice requires respect for the entitlements of human and nonhuman beings, as well as just relationships within and between species (Bhakuni, 2021). The related concepts of equity and ecological justice may provide the common ground needed to bring coherence to One Health various roles in identifying, preventing and mitigating health risk and in positively influencing social and ecological conditions that keep things well (Nieuwland, 2020). These ideas are critical in a conservation context given rights to harvest in both the Canadian Constitution and SAR legislation.

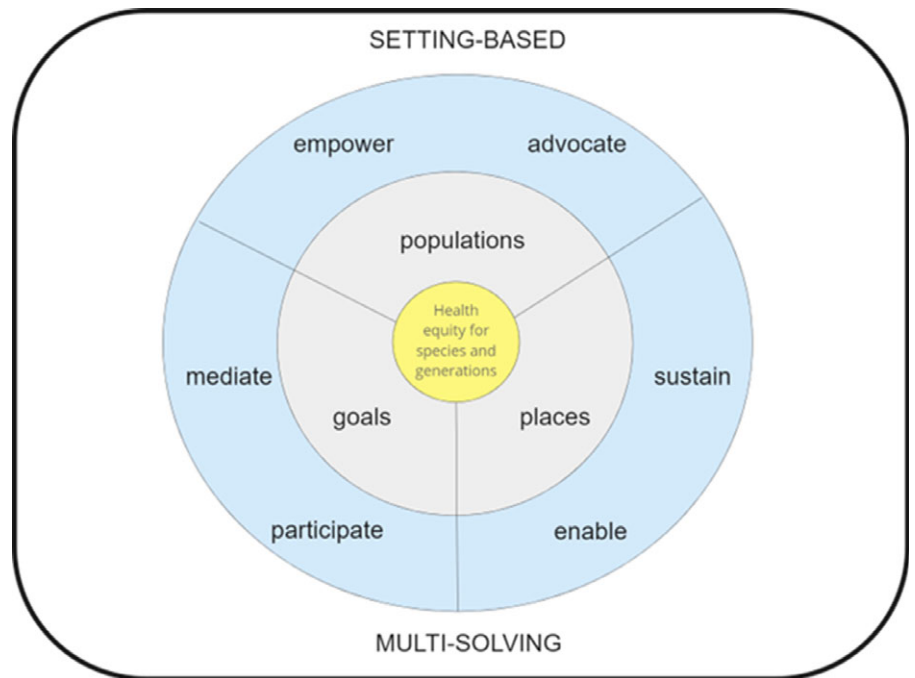
**Premise 5** – Intersectoral actions need a shared goal.

Effective collaborations for health are more likely when participants have a clearly stated purpose based on shared values and interests (PHAC, 2016). At times, the interests in One Health conflict, such as when public health practitioners advocate for the extermination of an animal host of an epidemic zoonotic pathogen, or when conservationists advocate for the end of the wildlife trade without acknowledging the critical contribution to household income and food security the trade provides its participants. Clear objectives and identified co-benefits among partners enable effective intersectoral action (WHO, 2018).

Agencies established to conserve wild species can quickly become overwhelmed. Many of the drivers of conservation are found outside of the legislated scope of conservation agencies (e.g., zoonoses from agriculture, pollution regulation, habitat degradation on lands beyond their jurisdiction). Therefore, partnerships are essential. In the wood bison case study, there are three prevailing objectives: (1) sustained human use of natural resources for social benefits; (2) sustained ecosystem services; and (3) wood bison herds that can adapt to changing conditions and be sustained on the land (Figure 2). Effective solutions need multi-sectoral coordination, collaboration and engagement to find shared paths forward despite different goals and values. To facilitate intersectoral actions for species of conservation concern, One Health



**Figure 2.** Goals (circles) and some issues surrounding them in the socio-ecological system of two wood bison herds in Alberta, Canada.



**Figure 3.** Equity informed One Health framework for conservation.

programs will need to identify, understand and manage issues that cut across multiple program goals. One Health programs need to function in ways that avoid creating or contributing to health inequities or limit potential to achieve complex interacting goals. They must support collaborations on solutions that lead to win-win-win scenarios for human, animal and ecosystem health.

*Draft One Health framework for intersectoral action in wildlife conservation*

The reimagined One Health framework is depicted in Figure 3. In the center is the guiding equity principle that actions should ensure that the protection of one species or generation does not have detrimental effects on the health of another species or generation. To accomplish this, the framework emphasizes health equity

**Table 2.** Guiding One Health questions

One Health focus	Guiding questions
Goals	<p>What are the socially constructed and scientifically determined goals for the populations in this setting?</p> <p>Where do enablers or impediments to meeting goals overlap between animal, human and environment sectors?</p>
Populations	<p>What are the health issues of the populations in the setting and how do they relate to each other?</p> <p>What populations influence the health issues(s) in the setting?</p>
Places	<p>What are the intersecting determinants of human, animal, and environmental health unique to this place?</p> <p>What is the local capacity for collective actions leading to improvements in health in this setting?</p>

for human, animal and environment health. Around those goals are the three prompts for One Health guiding questions: populations, places and goals (Table 2).

Around the three prompts are six action themes:

1. Goals
  - a. Using participatory means to develop a shared understanding of cross-sectoral and shared goals.
  - b. Mediating conflicts in goals by identifying entry points into problem-solving that promote collective action on collective goals.
2. Places
  - a. Enabling the local situations that are conducive to reach health goals in this place.
  - b. Sustaining the relationship, resources and capacities to promote health-conducive settings.
3. Populations
  - a. Empowering living entities to secure their needs for health by providing and protecting their determinants of health in an equitable manner.
  - b. Advocating for all human and nonhuman populations in the area to ensure unintended negative impacts on one population’s health does not arise when producing positive impacts on another population.

These goals, prompts and themes are embedded in a reminder that decisions and information are specific to a setting and that the intent is to produce co-benefits by working together across sectors to address multiple problems with complementary programs, policies and investments.

**Method application**

The proposed framework provides a conceptual foundation for researchers working on a sustainable conservation strategy for wildlife, such as the two wood bison herds under imminent threat (Table 3). The goal of the reimagined One Health framework will be to prompt inquiries to improve coherence and collaboration in addressing health challenges across agriculture, Indigenous well-being, public health and conservation sectors and find ways to increase and mobilize resources to address SAR conservation challenges. The framework will also provide a common vision for

**Table 3.** Establishing the relevance of the One Health framework to wood bison herds under imminent threat

Premise	Justification	Quote	Reference
1	Given the diverse and widespread habitats, bison are impacted by a variety of conservation threats and cumulative effects.	“While the threats are listed individually, many Indigenous communities and members of the scientific community raised concerns that the cumulative impact of these multiple threats over time remains unknown” (p. 10).	ECCC (2018)
2	Recovery and conservation efforts must consider the unique needs and barriers to good health for multiple herds in one location and those individuals that rely on the herds for their livelihood and well-being.	“Because of the nature of the threats to Wood Bison and the population and distribution objectives outlined in the recovery strategy, the imminent threat assessment considers the species as a whole, as well as individual herds, when responding to the imminent threat questions” (p. 6)	ECCC (2020)
3	A multitude of complex relationships defined the connection between the environment, bison, and humans, particularly where human expectations for the sustainability, use, and connection to bison are a concern.	“The following considerations are important to Indigenous people, but are not explicitly included in the site’s world heritage values . . . . Interconnections between all species, landscapes, and Indigenous people” (pp. 9–10).	Parks Canada (2019)
4	Long-term planning is needed to mitigate the threats, such as climate change and cumulative effects, to bison.	“While resource development activities (oil and gas exploration/extraction and forest harvesting) have been listed as individual threats, many Indigenous communities have raised concerns that the cumulative impact of these activities over time remains unknown” (p. 12).	ECCC (2020)
5	Many of the drivers of conservation are found outside of the legislated scope of conservation agencies.	“Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy and will	ECCC (2018)

(Continued)



**Table 3.** (Continued)

Premise	Justification	Quote	Reference
		not be achieved by Environment and Climate Change Canada and the Parks Canada Agency or any other jurisdiction alone” (p. i).	

research and actions that work towards co-benefit for the sectors (Figure 2), with the long-term conservation of wildlife grounding the work with partners. By situating places, goals and populations in a shared setting, the framework will remind the research team to think in a settings-based, systems perspective, rather than the traditional One Health Venn diagram which places emphasis on overlaps between health sectors on an issue-by-issue basis, excluding the majority of lived experiences of people, animals and ecosystems.

The framework will be used as a communication tool when explaining the projects’ objectives for setting-based conservation and to seek common interests on shared determinants of health that might produce co-benefits. It will help to show the objectives of the One Health approach the team is using (focused on shared goals in a shared place) rather than the more usual approach of animal or environmental management principally to benefit people.

The research team will adaptively refine the framework to help them identify conservation strategies that produce co-benefits while meeting species management goals and to better communicate their research strategy and recommendations to stakeholders and senior government officials. More specifically, lessons learned from a wood bison test case will be used to adapt the One Health for conservation framework for ongoing wood bison management and for applications to other species and conservation situations.

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**Conflict of interest.** The authors have no conflicts of interest

**Data availability.** All data used for this project were extracted from literature sources cited in the reference section of this paper.

**Author contributions.** CS drafted the initial framework based on the management needs expressed by JP and AW and by a literature review to develop the foundational premises. SS conducted a background literature review to provide context for the bison health situation within determinants of health context. All authors reviewed and refined the final framework.

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