



POLICY FORUM

CONSERVATION

Braiding Indigenous rights and endangered species law

Recovery targets fall short of culturally meaningful abundance

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Endangered species laws effectively prevent species extinction but fall short in restoring abundance for culturally important species. Legal agreements between Indigenous peoples and countries recognize the importance of abundant, culturally important species that disproportionately contribute to peoples' food, material, spirituality, and sense of place (1). Despite this, recovery targets under endangered species laws do not account for such abundance, instead targeting minimum viable population (MVP) sizes that leave many species in a state of reduced abundance compared with their historical baselines. Using three keystone species in North America—caribou, bison, and salmon—we explore the implications of the gap between culturally meaningful abundance and minimum viable populations and argue for the need to establish recovery targets and processes that restore abundance beyond MVPs. Braiding endangered species law and Indigenous rights will help countries uphold the rights of Indigenous peoples, prevent species extinction, and ultimately provide benefits to society at large.

Under endangered species laws in Canada and the United States, recovery targets are left vague or are based on a MVP. In Canada, the Species at Risk Act (SARA) focuses on risks of extinction and does not explicitly define recovery, with a recent 2020 SARA policy document interpreting recovery in terms of reducing the risk of extinction or extirpation. In the United States, the focus of the Endangered Species Act (ESA) is on meeting targets of a MVP, that is, a species abundance that will enable population persistence with minimal human intervention. Such risk- and

MVP-based approaches generate modest recovery targets, tending to simply maintain populations at low levels in most recovery documents (2) [see supplementary materials (SM) for more detail on each act].

Critically, neither SARA nor ESA address how people interact with the species through harvest. Harvest reflects time-honored relationships that support food security, ceremonial practices, or other hallmarks of culture (3), yet harvested species are often excluded from listing under SARA because of socioeconomic concerns (4). A culturally meaningful recovery target for such species may require a greater abundance and/or different distribution than those prescribed by risk- or MVP-based approaches. Culturally meaningful recovery also requires more-inclusive policies to center Indigenous perspectives and people in the design and implementation of restorative actions (5–7).

Here, we describe three recovery efforts that demonstrate continued inequities in biodiversity conservation policies. We highlight the need to reconsider recovery targets for culturally important, harvested species in national endangered species laws and policies. We focus on three high-profile species in North America—caribou, bison, and salmon—which have formed central aspects of Indigenous peoples' diet, culture, and seasonal movements since time immemorial. In each case, the decline of these species impeded Indigenous peoples from carrying out cultural practices and exercising food sovereignty. Each of these three culturally important species has since shown some level of recovery, and we highlight how these recoveries—often considered conservation victories—remain distant from culturally meaningful levels of recovery. This mismatch is partly due to a lack of formal legislation supporting culturally meaningful recovery targets (see the first figure and SM section 1). The species highlighted here are emblematic of the many culturally important species that

are, at present, in a state of diminished abundance across the globe (1).

CARIBOU

Woodland caribou (*Rangifer tarandus*) have long been a primary food source for northern Indigenous peoples in North America. Caribou populations have declined extensively in the past century (see the second figure), especially in the southern portion of their range. Eleven of 38 southern mountain caribou subpopulations are extirpated, and the overall population has declined by more than 40% during the past 20 years, as observed using Western monitoring techniques (5). Indigenous Knowledge, whose relevance and value are increasingly being recognized by colonial governments and agencies, has been providing an invaluable historical baseline of abundance and harvest levels since well before Western science was engaged in species recovery. For example, in British Columbia, Canada, Elders from the Treaty No. 8 adherent West Moberly First Nations said that the Klinse-Za caribou subpopulation was once as abundant as bugs on the landscape, yet, by 2013, there were only 38 animals left (5). Facing a decline in caribou, West Moberly leadership and Elders imposed a moratorium on caribou harvest in 1970 that is still in effect today. Indeed, West Moberly First Nations sensed the endangerment of caribou well before colonial governments, who continued to permit extensive natural resource extraction in the heart of the Klinse-Za caribou habitat after West Moberly's cessation of hunting. The continued authorization of resource extraction reduces the abundance of caribou and causes extirpation, infringing on constitutionally protected Indigenous rights to sustain a culturally meaningful way of life (8).

Indigenous-led recovery efforts by West Moberly First Nations and Saulteau First Nations to recover the threatened Klinse-Za caribou have more than tripled caribou abundance in 8 years (5). Averting the looming extirpation of these caribou is an undeniable conservation success, yet their abundance remains below a level at which First Nations can participate in a culturally meaningful harvest. In 2022, there were 114 Klinse-Za caribou, an abundance that met a recovery target of >100 set by the Canadian government under the MVP-based approach. However, 114 caribou would provide only about three caribou annually for a sustainable Indigenous harvest, which does not meet historical levels of use by the community (see SM for harvest calculations). A West Moberly Elder's wish was to “eat caribou

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before I die,” which could be translated to a baseline cultural recovery target. If caribou are to be meaningfully harvested again, there should be enough for each community member to have some meaningful level of cultural engagement and food security met by caribou. For example, providing just one meal per year for each of the 1600 West Moberly and Saulteau First Nations members would require about six caribou, which could be annually harvested from a population of about 200 caribou. Providing 15 meals per person per year would require a population of about 3000 caribou, which is more reflective of the historic “bugs on the landscape” abundance. The discrepancy between the existing 114 caribou and the potential for >3000 caribou is a measurable gap in Western and Indigenous perspectives on recovery and reconciliation.

AMERICAN BISON

Before colonization, American bison (*Bison bison*) numbered 30 million to 60 million across North America (6). Many Indigenous peoples were deeply dependent on this once-abundant species, which ranged from Alaska to Mexico (see SM). By the turn of the 20th century, however, the great bison herds had been slaughtered down to only a few hundred animals, in part driven by explicit policies of cultural genocide (see the second figure). Such pronounced bison declines caused starvation, infighting, and the erosion of Indigenous culture (9).

The northern subspecies of American bison, wood bison (*Bison bison athabascae*), were listed as endangered under the ESA in 1979 and classified as endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 1978 (predating SARA). Recovery actions included establishing new wood bison populations, which led to an increased abundance of nearly 10,000 individuals within Canada by 2013. As a result, COSEWIC downlisted them to threatened, with at least five free-ranging populations of 1000 bison as the MVP goal. Despite this example of MVP recovery, some Indigenous peoples are often still prevented from harvesting bison. For example, although limited harvest does occur across the wood bison range, many Indigenous peoples in northern Canada were excluded from hunting within Wood Buffalo National Park despite the recovery of the population to a level that could sustain a harvest. Similarly, subsistence hunting rights remain curtailed for the wood bison herd of Aishihik, where Indigenous peoples of the Yukon are not permitted these rights because the animals orig-

inated from a transplant. Thus, wood bison recovery highlights the continued mismatch between MVP recovery and the culturally meaningful recovery of wood bison.

The precipitous decline of the southern bison subspecies, plains bison (*Bison bison bison*), occurred well before SARA or ESA came into effect (in 2002 and 1973, respectively). Nevertheless, wild plains bison are still clearly endangered. Today, the species remains at <1% of its historic abundance and occupies a markedly reduced range (see the second figure). Despite early recovery efforts, wild, free-ranging plains bison populations represent only 10% of the current abundance of plains bison; the remaining 90% are privately owned (6). Yet, plains

a prominent role in diet—is restored across broader landscapes.

PACIFIC SALMON

Millions of salmon (*Oncorhynchus* spp.) return annually to rivers across western North America, providing sustenance for people, wildlife, and ecosystems. Indigenous peoples in the Pacific Northwest often refer to themselves as “salmon people,” signifying their deeply rooted cultural connections with salmon (7).

The distribution and abundance of salmon have decreased over the past century through the effects of human activities. In the Columbia Basin region of the United States, salmon abundance has declined by ~75%; an estimated 7.5 million to 16 million salmon returned annually to the Columbia Basin before the 20th century, and now only 1 million to 4 million return (see the second figure) (11). The most commercially valuable and culturally important salmon species in Canada, sockeye salmon (*O. nerka*), declined in wild abundance by 69% over the past century in the country’s second-largest salmon watershed, the Skeena River (12). Salmon harvests by Indigenous communities in Canada have declined by more than 80% in the past 50 to 70 years (7), with some First Nations implementing self-imposed harvest bans (12).

Salmon recovery is demonstrably underserved by existing endangered species legislation. No salmon population has been listed in Canada under SARA, and although many have been listed in the United States under the ESA, abundance remains a fraction of historic levels. Given the lack

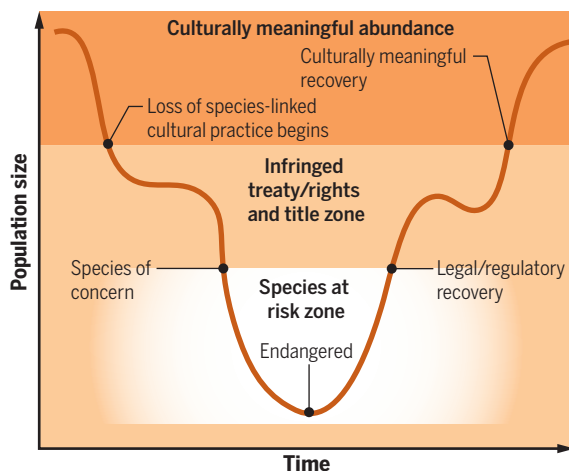
of formal protection, several Indigenous-led recovery plans for salmon have recently been developed. For example, after having endured ~60 years of diminished sockeye salmon returns, the Wet’suwet’en Nation on the west coast of Canada have implemented a rebuilding plan with an abundance target set to provide for community and ecosystem needs. However, ongoing commercial fisheries and industrial development projects undermine salmon recovery efforts. Thus, there remains a need for increased recognition of Indigenous rights that support the protection of diminished populations beyond endangered species legislation.

INDIGENOUS RIGHTS

Although international agreements and domestic laws compel governments to recover endangered species, colonial governments are also obligated to honor the legal treaty and constitutional rights of Indigenous

Diagram of species abundance over time

Violation of Indigenous rights, such as harvest, occurs at a much higher abundance than the focus of present endangered species laws, which is around achieving minimum viable populations.



bison remain unlisted in both Canada and the United States despite clear scientific recommendations to do so (10).

Recently, an inspiring example of Indigenous leadership in plains bison restoration began unfolding. On 23 September 2014, 13 First Nations and Native American tribes signed the first intertribal treaty in 150 years, the Buffalo Treaty, which focused on the ecological and cultural recovery of plains bison (6). Supported in part by the Buffalo Treaty, Banff National Park, Canada, initiated a plains bison restoration program in 2017. The long-term reintroduction goal in Banff is to include co-management of a culturally meaningful bison harvest with Buffalo Treaty signatories. The contemporary successes of bison restoration have increased the likelihood of bison recovery under MVP criteria. But bison recovery will remain incomplete until peoples’ cultural connection with bison—including, perhaps,

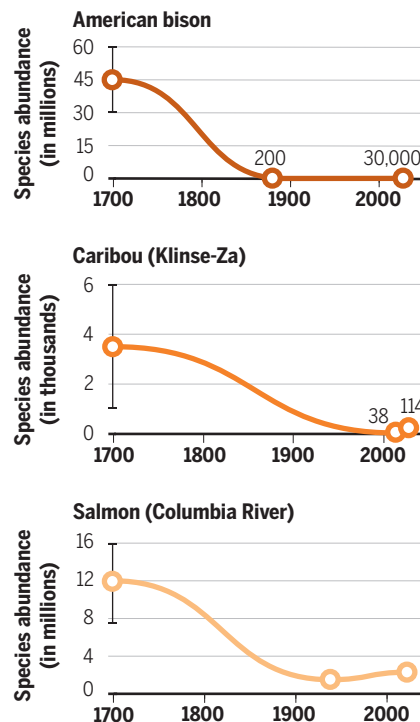
peoples, including rights to fish, hunt, and trap. In some cases, culturally important species are at the center of the interaction between Indigenous and non-Indigenous governments. For example, during negotiations of Treaty No. 8 in 1899, Canada promised Indigenous peoples in Treaty 8, which encompasses nearly 10% of Canada, that they “would be as free to hunt and fish after treaty as they would if they never entered into it” (13). A century and a half of colonization on these lands has substantially impeded the ability of Treaty 8 First Nations to hunt and fish as they once did (8). Treaty infringement was recently affirmed in the 2021 court case *Blueberry River First Nations (Yahey) v. Province of British Columbia*, which concluded that the Province of British Columbia had breached Treaty No. 8 and infringed the rights of Blueberry River First Nations. This was due to the cumulative impacts of rampant resource authorizations and development, which affected culturally important species such as caribou and moose.

We see multiple paths forward that could support increased recognition of legal obligations to Indigenous peoples and recover species to culturally meaningful abundances. A first path includes defining more ambitious recovery targets while still working within the confines of endangered species laws. Recovery plans for culturally important species could propose MVP targets as only a preliminary step toward full recovery. For species with abundances greater than a MVP, recovery status could be assessed against a new global standard, the International Union for Conservation of Nature (IUCN) Green List of species that assesses the degree a species has recovered, which complements the Red List that has been measuring species’ risk of extinction since 1964. The Green List sets out ambitious recovery targets—such as “full recovery,” which is defined by restoring historic abundance, distribution, and ecological function—and measures species’ progress toward these targets (14). We recommend that full recovery also include abundance targets that support food security, materials, and cultural relationships that rely on these animals. The 2016 wood bison recovery strategy provides a rare example of abundance targets to support Indigenous rights and particularly a culturally meaningful harvest (15). Such culturally meaningful recovery targets will likely be of similar magnitude to historic abundance but must also accommodate the evolving practices, cultures, and communities of Indigenous peoples.

We acknowledge that full recovery will remain challenging for some species, such as plains bison, because of decreases in their historic habitat due to agriculture, urbaniza-

Culturally meaningful North American species decline

Abundance estimates are for a species or a focal population with sufficient data to characterize a broader regional trend. Estimated abundances before colonization and large-scale industrial impacts are shown at year 1700. The lowest recorded population estimate after colonization is shown between 1900 and 2013; the most current estimate (2022) is shown on the right. Interpolated lines between estimates are for visualization purposes only (see supplementary materials for details on data and ranges).



tion, transportation infrastructure, and resource extraction. In such cases, a modified recovery target based on remaining or restorable habitat may be required. In all cases, culturally meaningful recovery targets must be codeveloped with Indigenous peoples and reflect their present and desired future relationships with a species and the land.

A second path includes legal enforcement of Indigenous rights. Consider the *Yahey* decision that extends beyond legally endangered species and includes many species whose populations are below culturally meaningful abundance thresholds. Here, litigation triggered mechanisms of recovery based on protection of Indigenous rights (see the first figure), which, to date, have included initial reparations of \$65 million to Blueberry River First Nations in 2021 and, in January 2023, a \$200 million restoration fund, an \$87.5 million financial package, more than 650,000 ha of land protections, and obligations related to land-use planning and wildlife management to begin

healing the land, increasing the abundance of harvested species, and protecting the Nations’ cultural way of life. Recovering species abundance to culturally meaningful levels would satisfy important aspects of presently infringed treaties between Indigenous peoples and governments.

We outline two potential solutions to recover culturally meaningful abundance, but it could be the case that entirely new laws are needed to support such recovery in some countries. We see the harmonization of biodiversity agreements with international agreements such as the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) as an opportunity to provide the foundation for recultivating available, accessible, and adequate food, with strong nutritional, cultural, and spiritual connections to a single species or entire ecosystems. This foundation would support creation of new laws to specifically address Indigenous rights violations and wildlife abundance shortfalls. Given that a fundamental reason for conserving species relates to human values of biodiversity, nature, and a responsibility to all life, restoring the very connections that propel recovery will serve to make efforts more successful while protecting critical relationships between people and the land. ■

REFERENCES AND NOTES

1. V. Reyes-Garcia et al., *Proc. Natl. Acad. Sci. U.S.A.* **120**, e2217303120 (2023).
2. K. A. Pawluk, C. H. Fox, C. N. Service, E. H. Stredulinsky, H. M. Bryan, *PLoS ONE* **14**, e0224021 (2019).
3. P. Priadka, B. Moses, C. Kozmik, S. Kell, J. N. Popp, *Ecol. Soc.* **27**, 30 (2022).
4. C. S. Findlay, S. Elgie, B. Giles, L. Burr, *Conserv. Biol.* **23**, 1609 (2009).
5. C. T. Lamb et al., *Ecol. Appl.* **32**, e2581 (2022).
6. H. Shamon et al., *Front. Ecol. Evol.* **10**, 826282 (2022).
7. A. J. Reid et al., *Fish Fish.* **22**, 243 (2021).
8. B. R. Muir, A. L. Booth, *Environ. Dev. Sustain.* **14**, 455 (2012).
9. J. Daschuk, *Clearing the Plains: Disease, Politics of Starvation, and the Loss of Indigenous Life* (Univ. Regina Press, 2019).
10. C. H. Freese et al., *Biol. Conserv.* **136**, 175 (2007).
11. C. L. Smith, “Salmon abundance and diversity in Oregon: Are we making progress?” (M/A-21, Oregon State University, 2014).
12. M. H. H. Price, J. W. Moore, B. M. Connors, K. L. Wilson, J. D. Reynolds, *J. Appl. Ecol.* **58**, 1477 (2021).
13. Government of Canada, “Report of the Commissioners for Treaty No. 8.” (1899); <https://www.rcaanc-cirnac.gc.ca/eng/1100100028813/1581293624572>.
14. M. K. Grace et al., *Conserv. Biol.* **35**, 1833 (2021).
15. Environment and Climate Change Canada, “Recovery strategy for the wood bison (*Bison bison athabasca*) in Canada,” Species at Risk Act Recovery Strategy Series (Environment and Climate Change Canada).

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