Manitoba's Hudson Bay Lowlands

Ecosystem goods and services valuation

IISD REPORT

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MANITOBA CHAPTER

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International Institute for Sustainable Development

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Photo: Chris Benson

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Photo: Chris Benson

Executive Summary

The Hudson Bay Lowlands of Manitoba covers an expansive area of 67,181 km^2 in Northern Manitoba. The region exhibits low to zero human presence and is 97.5% intact. It holds immense value, serving as a habitat for globally threatened species, storing billions of tonnes of soil organic carbon, supporting Manitoba's northern tourism industry, and sustaining Indigenous cultures and identities. In a time when large intact regions around the world are becoming fragmented and highly modified at a fast rate, Canada and the Province of Manitoba have a special responsibility and opportunity to preserve pristine areas like Manitoba's Hudson Bay Lowlands. This effort would contribute to fulfilling the federal and provincial governments' commitments of protecting a minimum of 30% of terrestrial and inland water areas by 2030[1] while ensuring equitable governance and respecting the rights of Indigenous Peoples and local communities. Indigenous Peoples have a historical connection to and knowledge of the land. By taking a leadership role in their territories, it will be possible to achieve meaningful conservation outcomes and harness a range of important cultural and social benefits in local communities.

[1] The Kunming-Montreal Global Biodiversity Framework (KMGBF) draft Target 3 in the Environment and Climate Change Canada's (ECCC's) *Toward a 2030 Biodiversity Strategy for Canada* (ECCC, 2023). In addition, one of Manitoba's Minister for Environment and Climate Change's top priorities is working with Indigenous communities to protect "30% of Manitoba's diverse landscapes by 2030" (Premier of Manitoba, 2023).

The Hudson Bay Lowlands in Manitoba is globally and locally significant for several reasons:

- **Rich biodiversity:** The Hudson Bay Lowlands region in Manitoba provides habitats for over 1,100 plant species and more than 925 faunal species. It hosts iconic migratory birds and marine wildlife, including Western Hudson Bay polar bears and beluga whales. Protecting areas of "particular importance for biodiversity and ecosystem functions and services" is a priority under Canada's 2030 National Biodiversity Strategy (ECCC, 2023).
- **Large carbon stocks:** Manitoba's Hudson Bay Lowlands stores an estimated 7 billion tonnes of soil organic carbon, valued at a staggering CAD 1.28 trillion, which makes it a globally significant carbon pool and strong candidate for protection for carbon-related goals alone.[2]
- **Communities with historical ties to the land:** The region has a relatively small residential population (approx. 2,000 people) with three settlements—Churchill, the Fox Lake Cree Nation community of Bird, and the Shamattawa First Nation Reserve—situated within its boundaries. This region is also covered by the Treaty 5 adhesion, a historical agreement to share the land. Communities situated outside the Lowlands—Fox Lake Cree Nation, York Factory First Nation, Tataskweyak Cree Nation, Shamattawa First Nation, and War Lake First Nation—also have historical connections to the Lowlands and the coast.
- **Globally recognized tourism:** The Hudson Bay Lowlands in Manitoba is globally renowned for its marine wildlife, attracting thousands of visitors each year for polar bear sightings in Churchill and boat tours to observe beluga whales in Western Hudson Bay. Other popular tourist activities include birdwatching, dogsledding, all-terrain vehicle tours, and boating. There are also a limited number of fenced campgrounds within the Hudson Bay Lowlands.
- **Intact:** With an approximate intactness percentage of 97.5%, the Manitoba part of the Hudson Bay Lowlands stands out as an excellent candidate for conservation initiatives. Currently, 23% of Manitoba's Hudson Bay Lowlands is protected under wildlife management areas and national park destinations.

An ecosystem goods and services (EGS) assessment revealed that the region contributes **a minimum of CAD 247.7 million**[3] annually through services associated with biodiversity conservation, hunting, tourism, and mental health. This value does not fully represent the area's total worth due to data limitations and the inherent constraints of the EGS approach, which primarily relies on market-derived values. Many services, such as aesthetic benefits and spiritual connection to the land, are not captured in market transactions in the Hudson Bay Lowlands,

[2] Under the 2030 Emissions Reduction Plan, Canada aims to reach the emissions reduction target of 40% to 45% below 2005 levels by 2030, including through investing in nature and natural climate solutions (ECCC, 2022). Manitoba has also set a greenhouse gas emissions reduction goal for 2023–2027 of 5.6 megatonnes of carbon dioxide (CO_2) equivalent (Government of Manitoba, n.d.-c).

[3] In 2024 Canadian dollars.

making them challenging or impossible to quantify. Furthermore, the emphasis of the EGS approach on the instrumental value of nature overlooks the complex human–nature relationship, which also encompasses a sense of care and responsibility toward nature.

Interviews with Indigenous residents emphasized the importance of connecting with the natural environment in the Hudson Bay Lowlands for education, mental health, and community bonding. Land-based programs in the area have contributed to youth education, instilled cultural pride, and strengthened community ties by providing opportunities to learn from the land, share food, and participate in the arts inspired by these activities. It is crucial to consider these local, relational values in policy and decision-making processes around conservation. The insights shared in the interviews open additional dimensions of why Manitoba's Hudson Bay Lowlands is a special area to conserve and how strengthening local communities' ties with the land can contribute to reconciliation and better stewardship of protected areas due to local knowledge.

Development activities in the region are currently limited, with no plans for new dams and no active mine sites within the Hudson Bay Lowlands. However, the presence of four active mining claims and the expanding interest in critical minerals for the green energy transition raises concerns about the future of the region. Additionally, proposed projects, such as the Port Nelson redevelopment and the NeeStaNan rail corridor, which are designed to expedite the shipping of potash from Saskatchewan and petroleum products from Alberta via the Arctic Ocean to the global market, threaten the fragile ecosystems in the region. These threats include the risk of oil spills, the introduction of toxicants, and disturbances to marine mammals and seabird colonies caused by vessels.

Efforts are underway to protect more areas in the Hudson Bay Lowlands as Indigenous Protected and Conserved Areas (IPCAs) in Manitoba. Specifically, the Kitaskeenan Kaweekanawaynichikatek Indigenous Protected Area initiative was initiated in August 2020. This is a collaborative effort led by York Factory First Nation, Fox Lake Cree Nation, Tataskweyak Cree Nation, War Lake First Nation, and Shamattawa First Nation to protect shared ancestral lands in northeastern Manitoba and along the Hudson Bay coastline. Another initiative by the Manitoba Métis Federation aims to create an IPCA in the area between Caribou River Provincial Park and Wapusk National Park. By protecting these lands as IPCAs, local residents will benefit from their long-standing connection to the land, traditional activities, and educational opportunities for the best outcomes for nature and people. Overall, Indigenous-led conservation is both a matter of justice and respect for Indigenous rights and an effective path to sustaining conservation outcomes.

Table of Contents

List of Figures

List of Tables

List of Boxes

Abbreviations and Acronyms

COSEWIC	Committee on the Status of Endangered Wildlife in Canada
DUC	Ducks Unlimited Canada
ECCC	Environment & Climate Change Canada
EGS	ecosystem goods and services
IPCA	Indigenous Protected and Conserved Areas
MMF	Manitoba Métis Federation
QALY	quality-adjusted life years
RMA	Resource Management Areas
RMB	Resource Management Boards
SOC	soil organic carbon
TEV	total economic value
WMA	Wildlife Management Areas
WTP	willingness to pay

1.0
Introduction

Photo: Ron Thiessen

1.1 Imperative for Indigenous-Led Conservation in Northern Manitoba

The Hudson Bay Lowlands is one of the world's largest predominantly intact[4] ecosystems. Stretching from Northern Manitoba to the James Bay region of Northern Ontario and Quebec, the Hudson Bay Lowlands has a total area of 320,000 km^2, making it the world's third-largest wetland region[5] and the second-largest peatland system (Brackley, 2022; Harris, 2017; Packalen et al., 2014; World Wide Fund for Nature, 2022). Most of the area lies within the jurisdiction of Ontario, but the western portion of the Lowlands is situated within Northern Manitoba.

Manitoba's Hudson Bay Lowlands[6] covers 67,181 km^2 and stores an estimated 7 billion tonnes of soil organic carbon (see Section 3.3.1). The region is also a critically important ecosystem, providing a habitat for diverse wildlife, including polar bears, beluga whales, seals, moose, herds of caribou, and over 250 species of birds (Canadian Parks and Wilderness Society Manitoba Chapter [CPAWS], n.d.).

Fortunately, the Hudson Bay Lowlands is one of the few large-scale ecosystems that have been spared the fate of so many other wetlands globally. While many of the world's wetlands have been drained to make way for development, Manitoba's Hudson Bay Lowlands remains largely intact, with very low instances of anthropogenic disturbances. This fully functioning wetland is able to regulate, clean, and enrich water as it flows to the ocean while also capturing, storing, and regulating massive amounts of carbon (Vernier et al., 2022).

About 75% of the planet's terrestrial environment and 40% of its marine environment have been degraded, according to the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services assessment report (IBEPS, 2019). In addition to this devastating loss of wilderness, most of the natural spaces that remain are isolated and fragmented. The global loss of large-scale wilderness and habitat integrity means that more than 500,000 terrestrial species have insufficient habitat for long-term survival (IBESP, 2019). As fewer intact and connected ecosystems remain, intact areas larger than 10,000 km^2 are regarded as "globally significant" (Mittermeier et al., 2003).

The quality of the protected areas matters greatly. It is not enough to conserve isolated pockets of nature. We need to permanently protect large-scale areas of high conservation value to help mitigate the impacts of climate change and stem a devastating collapse of global biodiversity. We also need to establish meaningful conservation corridors that link protected areas to maximize

[4] Commonly, intactness is understood by the absence or very low levels of direct industrial human impact/anthropogenic influence and mapped from remotely sensed data (IFL Mapping Team, n.d.; Plumptre et al., 2021; Sims et al., 2022) Intactness is an important indication of ecological integrity and ability to maintain native biological diversity (Wildlife Conservation Society, 2019).

[5] After the West Siberian Lowland and Amazon River Basin (Keddy et al., 2009; Esri's StoryMaps team, n.d.).

[6] Hudson Bay Lowlands in Manitoba comprises 21% of the total area of the Hudson Bay Lowlands.

their impacts. Natural areas do not function as well when they are isolated and fragmented, according to a mounting body of research (Watson et al., 2018).

The global community has increasingly recognized the importance of protecting nature in order to preserve biodiversity and mitigate the impacts of climate change. A major commitment was reached at the 2022 UN Biodiversity Conference in Montreal when 196 countries agreed to conserve 30% of the world's land and 30% of the ocean by 2030 (Convention on Biological Diversity, 2022; ECCC, 2023). Importantly, the nations pledged to preserve nature in a way that benefits all equitably, particularly Indigenous Peoples and local communities.

Canada cannot achieve its commitment to protect 30% of its terrestrial lands and waters without the cooperation of provinces and territories which have jurisdiction over Crown lands. Manitoba was the third province to sign on to the 30% by 2030 pledge (following Quebec and British Columbia) when a new government was elected in October 2023.

Manitoba's Protected Area Initiative identified portions of the Western Hudson Bay Lowlands region that have significant potential to enhance Manitoba's network of protected areas and contribute to Canada's global commitments (Manitoba Government, n.d.-d). Efforts to establish additional large-scale protected areas in the Manitoba's Hudson Bay Lowlands will significantly contribute to achieving both Manitoba's and Canada's commitments to protect 30% by 2030. Preserving the vast carbon stores in the Hudson Bay Lowlands would also serve to support federal and provincial commitments and targets to address climate change.

Canada also cannot achieve its 30% protection by 2030 target without the support of Indigenous communities, which have constitutionally protected rights to their traditional territories. Fortunately, there is increasing recognition of Indigenous leadership in conservation with the substantive investments made by the Government of Canada. For example, in 2022, the federal government committed CAD 800 million to the protection of the areas in Northern Ontario's Hudson Bay Lowlands, the Northern Shelf Bioregion in British Columbia, the Qikiqtani Region in Nunavut, and the Northwest Territories that can collectively protect up to 1 million km^2 (Government of Canada, 2024). These initiatives not only safeguard the environment but also advance reconciliation. Overall, Indigenous communities are leading dozens of conservation initiatives across Canada, including at least eight initiatives in Manitoba (Government of Canada, n.d.-a).

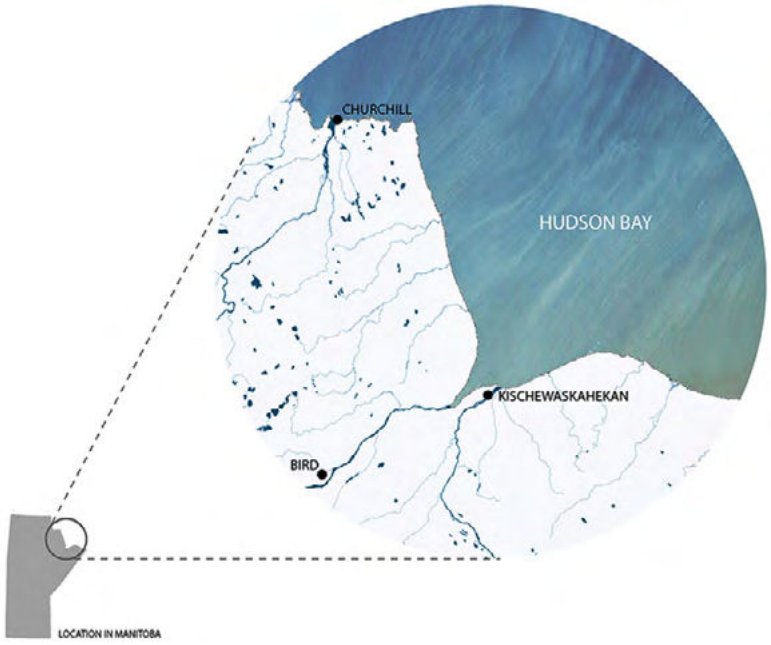
Two separate Indigenous-led conservation initiatives are seeking to establish large protected areas in Manitoba's Hudson Bay Lowlands.

Kitaskeenan Kaweekanawaynichikatek – Our Land We Want to Protect

The Kitaskeenan Kaweekanawaynichikatek Indigenous Protected Area initiative, initiated in August 2020, is a collaborative effort led by York Factory First Nation, Fox Lake Cree Nation, Tataskweyak Cree Nation, War Lake First Nation, and Shamattawa First Nation to protect

the shared "ancestral lands in northeastern Manitoba and along the Hudson Bay coastline" (Kitaskeenan Kaweekanawaynichikatek, n.d.). This project, marked by equal representation and responsibility among the participating nations, was shaped by the guidance and input of community members from all five nations. The five nations gathered together in August 2023 to sign a collective project vision and are now confirming the boundaries of the area that will be protected (Figure 1) (Kitaskeenan Kaweekanawaynichikatek, n.d.; HTFC Planning & Design Inc., 2023).

Figure 1. Kitaskeenan Kaweekanawaynichikatek general study area



Source: Kitaskeenan Kaweekanawaynichikatek, n.d. (reprinted with permission).

Manitoba Métis Federation, Manitoba's Caribou River Provincial Park to Wapusk National Park

Supported by a multi-year Contribution Agreement with Environment & Climate Change Canada (ECCC), the Manitoba Métis Federation (MMF) is in the process of creating an Indigenous Protected and Conserved Areas (IPCA) in the area between Caribou River Provincial Park and Wapusk National Park (MMF, 2023, n.d.; Thiessen, 2022). As part of this process, the MMF has initiated an IPCA survey to gather information from Métis citizens about the protection priorities, governance and management, and the acceptable uses of this IPCA (MMF, 2021).

Supporting Indigenous-led conservation is a meaningful path for reconciliation that will also lead to valuable environmental and social outcomes on provincial, national, and global scales. According to a United Nations 2019 *Global Assessment Report on Biodiversity and Ecosystem*

Services, lands managed by Indigenous Peoples and local communities typically demonstrate better health than other areas. A University of British Columbia study had similar conclusions (Schuster et al., 2019). A study of two Indigenous Guardians programs in the Northwest Territories shows that every dollar invested in Indigenous-led conservation in Canada leads to at least CAD 2.50 in social, economic, cultural, and environmental benefits (Dehcho First Nations, Lutsel K'e Dene First Nation, Indigenous Leadership Initiative & Tides Canada, 2016).

1.2 Objectives of the Report

This report was commissioned by the CPAWS Manitoba chapter in order to support Indigenous-led conservation efforts in Manitoba's Hudson Bay Lowlands region. It uses Western science to demonstrate the value of preserving the Hudson Bay Lowlands, especially for mitigating the effects of climate change, conserving species habitats, and supporting Indigenous cultures and livelihoods.

This report reviews the environmental goods and services (EGS) provided by Manitoba's Hudson Bay Lowlands based on existing data and new desk-based research. The economic valuation was informed by publicly available datasets and EGS literature along with original research by Ducks Unlimited Canada and Probe Research Inc., existing information from tourism operators, and communication with the Indigenous residents of the Hudson Bay Lowlands in Manitoba. It must be noted that this preliminary EGS assessment provides a Western science perspective, as it tries to capture the value of the watershed in monetary terms to strengthen the case for conservation. Like all EGS assessments, it is not complete and total. It captures only one dimension of value by considering nature's utilitarian role as a provider of benefits to people and economies. The value of conserving nature can also be based on its inherent worth regardless of human needs (intrinsic value) and on a reciprocal relationship with nature—feelings of care and responsibility toward nature that drive its protection (relational value). Nevertheless, as one approach, the EGS assessment allows for the collection of important data on the ecosystem and its uses, which is valuable for decision making. The report also aims to capture the relational values of nature in Manitoba's Hudson Bay Lowlands to residents and how these values can contribute to the just and equitable governance and stewardship of protected areas.

The first section of the report will describe the physical and human characteristics of the Hudson Bay Lowlands in Manitoba, followed by a description and valuation of the EGS identified. Next, the report will introduce insights from interviews with Indigenous residents of Manitoba's Hudson Bay Lowlands to add a qualitative assessment of the relational values of the region. Lastly, past and potential development scenarios in the watershed will be discussed, along with how the EGS values may be affected.

2.0
Physical and Human Characteristics of the Hudson Bay Lowlands in Manitoba

Photo: Chris Benson

The Hudson Bay Lowlands is one of the world's largest predominantly intact ecosystems. Stretching from Northern Manitoba to the James Bay region of Northern Ontario and Quebec, the Hudson Bay Lowlands have a total area of 320,000 km^2, making it the world's third-largest wetland region and the second-largest peatland system on Earth (Brackley, 2022; WWF, 2022). The region is poorly drained and flat. It is made up of peatlands, small lakes, ponds, creeks, and taiga forests that transition into subarctic tundra (Ecological Framework of Canada, n.d.-b). Natural processes in the peatlands store significant amounts of irrecoverable ecosystem carbon accumulated over millennia. This stored carbon is called "irrecoverable ecosystem carbon" because it is vulnerable to release due to land use and land-use change and, once released, is not recoverable "on time scales relevant to avoiding dangerous climate impacts" (Goldstein et al., 2020). This makes the Hudson Bay Lowlands one of the most critical carbon sinks in the world. Each hectare of peat soil in the Hudson Bay Lowlands region contains roughly 129–156 tonnes of irrecoverable carbon—more than anywhere else in Canada and among the highest numbers recorded around the world (Conservation International, 2022; Noon et al., 2022). The entire Hudson Bay Lowlands area contains roughly 26 billion–30 billion tonnes of irrecoverable ecosystem carbon (Sothe et al., 2022; Webster, 2013).

While the majority of the area is in Ontario, the western part of the Lowlands is situated within Northern Manitoba (Figure 2). Numerous rivers traverse the Manitoba section of the Lowlands, including the Churchill, Nelson, and Hayes rivers, before draining into Hudson Bay. The Manitoba section of the Hudson Bay Lowlands contains an estimated 7 billion tonnes of soil organic carbon (see Section 3.3.1).

This unique region is also home to a variety of terrestrial and marine mammals, birds, and plant species. The area is famous for its large polar bear population, as well as Arctic fox, Arctic hare, snowy owl, and barren-ground caribou herds living on the tundra (Churchill Wild, 2017). The taiga forest is home to a diverse population of caribou, moose, lynx, snowshoe hares, warblers, and woodpeckers (Churchill Wild, 2017). The region is also an important stopover for millions of migratory birds during their annual migration, where they converge at the tidal shores for feeding (Brackley, 2022; WWF, 2022). The rich biodiversity of the region is vulnerable to anthropogenic disturbances and ecological impacts.

Indigenous Peoples have lived in this region and acted as stewards of these lands and waters for thousands of years. The Hudson Bay Company set up important trading posts in the Hudson Bay Lowlands, and the Dene and Cree nations played a major role during the fur trade from the 17th to the 19th centuries (Marsh, 2015). A railway completed in 1929 helped to develop shipping capacities for the Port of Churchill, which is Canada's only Arctic port (Larson et al., 1997). Churchill's population grew with the establishment of Fort Churchill in 1942 (Payne, 1990). At the same time, large parts of the Hudson Bay Lowlands within Manitoba remain undisturbed and have little to no anthropogenic activities (Figure 4).

The following sub-sections introduce the physical and human characteristics of the Hudson Bay Lowlands in Manitoba—including the biophysical features of the Lowlands' ecozone, the

biodiversity of the region, human settlements and economic activities, and existing protected areas—to ground the EGS evaluation and discussions.

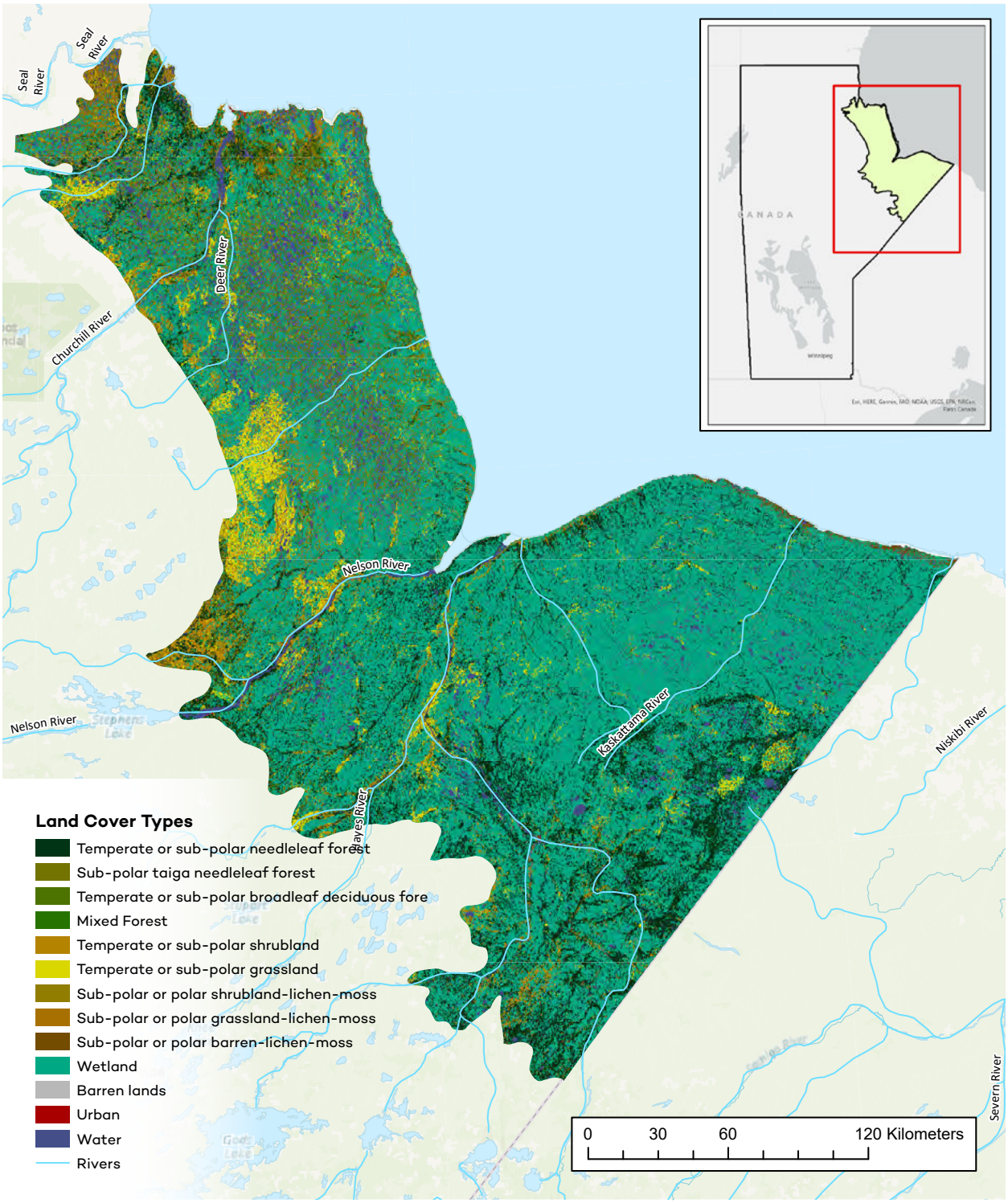
Figure 2. The Hudson Bay Lowlands in Manitoba

Source: Authors' diagram, based on data from Agriculture and Agri-Food Canada, 1999.

2.1 Land Cover and Geological Features

The Hudson Bay Lowlands were created during the last ice age, when the Laurentide Ice Sheet slowly pushed down on the land and retained massive amounts of fresh water after the ice sheet melted (Brackley, 2022). The soil that covers much of the ecozone is composed of finely textured silt and clay. Frozen organic soils are predominantly found near the coastal tundra. Since the last ice age, partially decayed organic soil and poor drainage promoted the development of wetlands toward the southern part of the Hudson Bay Lowlands (Ecological Framework of Canada, n.d.-a).

Figure 3. Land-cover map of the Hudson Bay Lowlands in Manitoba



Source: Authors' diagram, based on data from Natural Resources Canada, 2022.

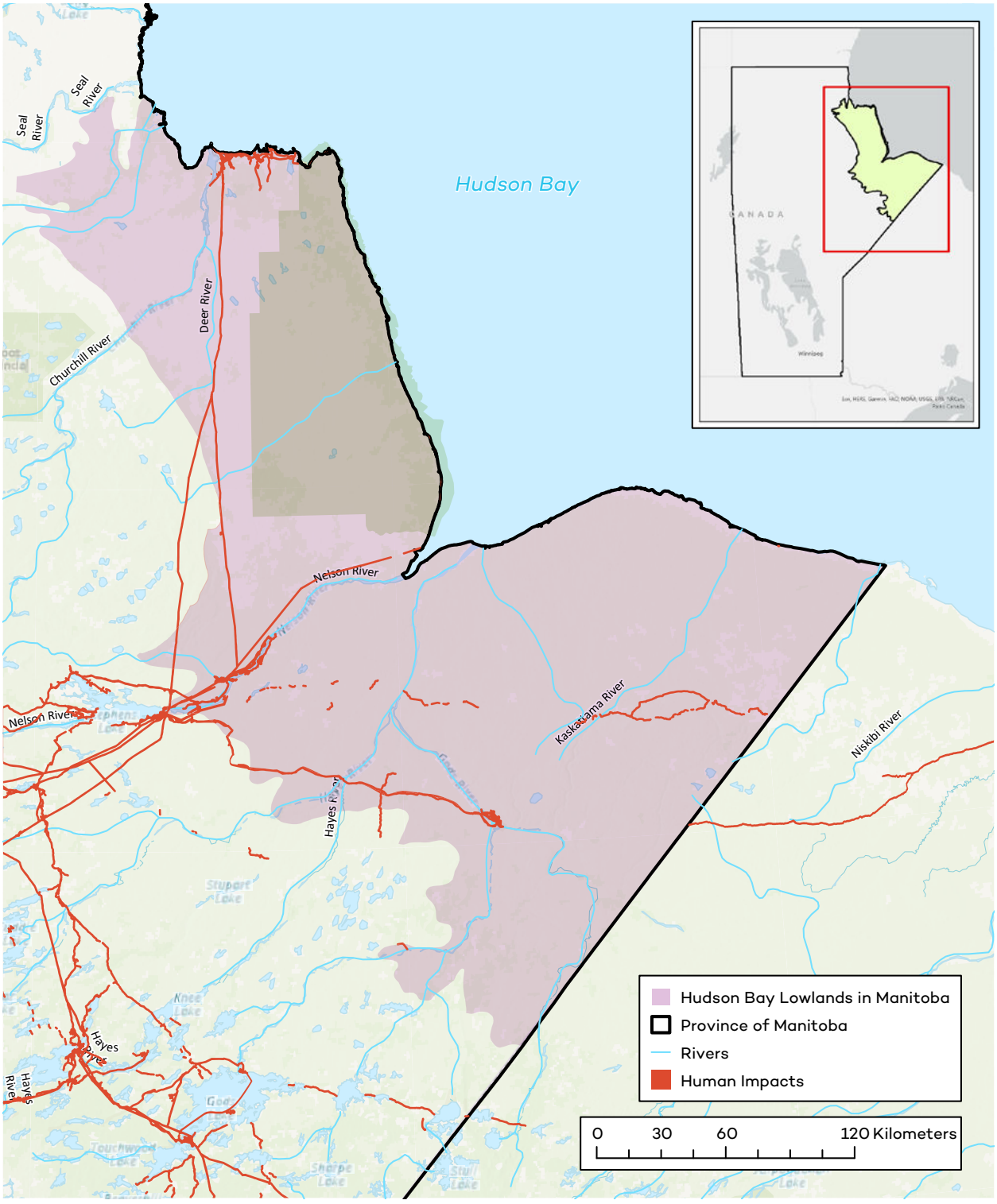
The Hudson Bay Lowlands consists of two ecoregions—the Hudson Bay Lowland ecoregion and the Coastal Hudson Bay Lowland ecoregion—differentiated by their respective land-cover features. The land cover for the Hudson Bay Lowland ecoregion includes primarily mixed forest, with coniferous species such as black spruce and balsam fir dominating the landscape (Ecological Framework of Canada, n.d.-b). There are also large areas of peatlands, bogs, ponds, creeks, small lakes, and fens. Toward the coastal ecoregion, the landscape is characterized by the tundra and boreal forest transition where tree growth is limited and there are extensive wetlands (Ecological Framework of Canada, n.d.-c). Along the riverbanks, there are numerous well-drained beaches forming a pattern of white spruce-covered ridges, fens, and peat plateaus (Stewart & Lockhart, 2005). The ecoregion is also known for its marshes north of the Nelson River.

The Manitoba part of the Hudson Bay Lowlands covers an area of 67,181 km^2 and is located in the northern part of the province. The coastline of Hudson Bay in Manitoba is relatively undeveloped, with a total length of approximately 1,000 km. The region is drained by several important rivers, including the Hayes River, which is approximately 724 km long; the Churchill River, which is approximately 1,609 km long; and the Nelson River, which is approximately 1,000 km long.

The total area degraded in the Manitoba part of the Hudson Bay Lowlands is estimated to be 1,675 km^2 (based on the most recently updated dataset from Global Forest Watch, 2013). Approximately 97.5% of the Manitoba part of the Hudson Bay Lowlands is intact (see Appendix A for a discussion of the methodology).

While the intactness estimate accounts for disturbances from transportation networks, settlements, and other infrastructure projects within the boundary of Manitoba's Hudson Bay Lowlands, it is important to mention that there are several Manitoba Hydro projects upstream on Nelson River and Churchill River that flow through Manitoba's Hudson Bay Lowlands and eventually discharge into the Hudson Bay (see Figure 3). The flows of these rivers have been altered by the Manitoba Hydro dams and flow diversion, which means that these are no longer free-flowing rivers. There are six hydroelectric generating stations on the Nelson River. In 2022, they generated 80.74% of power from the total amount of electrical energy generated and purchased by Manitoba Hydro (Manitoba Hydro, 2023). The Wuskwatim dam on the Burntwood River is also situated between the Churchill River and the Nelson River (Manitoba Hydro, 2024). Moreover, in the 1970s, much of the Churchill River flow was diverted out of Southern Indian Lake through the Churchill River Diversion to increase the flow to generating stations on the lower Nelson River (Government of Manitoba, n.d.-b).

Figure 4. Map of impacted areas



Source: Authors' diagram, based on data from Global Forest Watch Canada, 2016.

2.2 Biodiversity and Species

The Hudson Bay Lowlands in Manitoba contain a wealth of biodiversity, with over 1,100 plant species (Parks Canada, 2023b) and more than 925 different faunal species (iNaturalist, 2019; National Audubon Society [NAS] & CPAWS Manitoba, 2023) that call the region home. Faunal species include approximately 20 different terrestrial mammals, 50 freshwater fish, 250 birds, 600 insects, and several migratory and resident marine mammals, such as beluga whales, polar bears, and three species of seal: the ringed seal, harbour seal, and bearded seal (iNaturalist, 2019; NAS & CPAWS Manitoba, 2023; Petersen, 2022). The region also hosts 250 different species of lichen (Parks Canada, 2023b). The rich assortment of species in the area makes the Hudson Bay Lowlands a crucial habitat for wildlife.

Many iconic migratory birds can be seen in the Hudson Bay Lowlands in the spring, as approximately 131 different species travel to the region to breed (NAS & CPAWS Manitoba, 2023). The Coastal Hudson Bay Lowland ecoregion provides breeding and nesting habitats for several birds, including the Canada goose, northern pintail, sandhill crane, American gold plover, and dunlin. The bogs, wetlands, ponds, and lakes of the Hudson Bay Lowland ecoregion serve as ideal breeding locations for species such as the swamp sparrow, northern waterthrush and ring-necked duck. The ecoregion's mixed forest provides many opportunities for nesting to species like the bohemian waxwing, blackpoll warbler, and spruce grouse. Additionally, the transition zone between the boreal forest and tundra serves as an important breeding ground for Harris's sparrow (NAS & CPAWS Manitoba, 2023), a species of special concern according to the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (2017).

The Hudson Bay Lowlands are also world-renowned for their marine wildlife. Thousands of people across the globe visit the region annually to see the Western Hudson Bay polar bears. This subpopulation is the southernmost range of polar bears in the world (NAS & CPAWS, 2023). Their seasonal migration pattern differs from that of other subpopulations, as they migrate north in the fall toward sea ice habitats to hunt, feed, and mate. When the sea ice begins to break in June and July (Parks Canada, 2023b), Western Hudson Bay polar bears migrate south, come ashore, and begin moving inland to their denning grounds or situate themselves along the coast (Parks Canada, 2023a). The Hudson Bay Lowlands hosts one of the largest polar bear maternity denning grounds in the world (Parks Canada, 2010). These are the only polar bears that dig their dens in the ground rather than in snowbanks.

According to an aerial survey performed in 2021, there were approximately 618 polar bears living in the Hudson Bay Lowlands (Whiteman, 2023). This was a 27% decrease from the last surveyed year (2016), in which there were 842 bears recorded (Associated Press, 2022; Whiteman, 2023). This drastic change has been linked to climate change, as the sea ice season has and continues to decline every year due to warming sea temperatures (Associated Press, 2022; Parks Canada, 2023a). Young bears and female bears are particularly vulnerable to these changes, as young bears struggle to survive without sufficient food, which results in female bears using extra energy to care for their young (Associated Press, 2022). For this reason, the Western Hudson Bay subpopulation of polar bears is considered threatened by the Government of Manitoba under the

Endangered Species and Ecosystems Act (2018), a species of special concern by the Government of Canada under the Species At Risk Act (2002), and vulnerable by the International Union for Conservation of Nature Red List of Threatened Species (2015).

Along with polar bear viewing, many visitors embark on boat tours to see the Western Hudson Bay beluga whales. Approximately 57,000 beluga whales reside in the western portion of the Hudson Bay (Travel Manitoba, n.d.), making up 28% of all beluga whales in the world (NAS & CPAWS Manitoba, 2023). From mid-June to mid-September, every year, nearly 4,000 whales gather at the Churchill River estuary to begin their mating rituals and reproduction process (Travel Manitoba, n.d.). In addition to their draw for tourists, beluga whales and polar bears hold cultural significance for Indigenous communities in the Hudson Bay Lowlands.

Caribou, a culturally and ecologically important species for the region, are also among the diverse wildlife residing in the Hudson Bay Lowlands. Culturally, caribou hold significant value for regional First Nations. They are deeply embedded in Indigenous culture and traditions, such as through spirituality, knowledge, and hunting practices (Webb et al., 2022). Caribou have been essential to the survival of Indigenous communities in Northern Manitoba and continue to provide them with food, instruments, tools, and clothing (Parks Canada, 2023b; Webb et al., 2022). Ecologically, caribou are a keystone species, meaning they play an integral role in supporting their ecosystems as grazing animals and prey (Webb et al., 2022).

There are three migratory caribou herds present in the Manitoba Hudson Bay Lowlands: barren-ground caribou from the Qamanirjuaq herd, forest-tundra migratory woodland caribou from the Cape Churchill herd, and the Hudson Bay Coastal Lowland herd (formally known as the Pen Islands herd) (COSEWIC, 2011; Wildlife Resource Consulting Services MB Inc., 2019). Small numbers of caribou (174 caribou) from the Hudson Bay Coastal Lowland herd were observed along the coast of the Manitoba Hudson Bay Lowlands in the summer of 2008, as reported by Abraham et al. (2012). Variable numbers of the caribou of the same herd were observed in the Keeyask region close to Fox Lake Cree Nation and the boundary of the Hudson Bay Lowlands—from 30 caribou in winter 2011/12 to 13,985 caribou in February 2013, and 2,000 in 2018 (Wildlife Resource Consulting Services MB Inc., 2019). The Cape Churchill herd is of particular importance in conservation efforts because of their small herd size, which ranges from 1,000 to 3,000 (Parks Canada, 2023a). This is significantly less than that of a neighbouring barren-ground caribou herd (the Qamanirjuaq herd), which had a population of approximately 288,000 in 2017 (Parks Canada, 2023a). Moreover, 30% of the Cape Churchill herd's winter range is currently located outside of protected areas (Webb et al., 2022). Therefore, protecting and conserving the Hudson Bay Lowlands is of utmost importance to preserving this unique herd, as the region is an essential corridor that connects the calving and wintering grounds of the Cape Churchill caribou.

Within the Hudson Bay Lowlands of Manitoba, a multitude of species face the threat of extinction[7], notably the barren-ground and boreal caribou (mammals), Hudsonian godwit, short-

[7] Threatened species category denotes a wildlife species "likely to become endangered if limiting factors are not reversed." Endangered denotes a "wildlife species facing imminent extirpation or extinction" (COSEWIC, 2022).

eared owl, bank swallow, and lesser yellowlegs (birds) (COSEWIC, 2022). Moreover, several species are classified as being of special concern,[8] as evaluated by COSEWIC, such as polar bear, ringed seal (mammals), rusty blackbird, bobolink, olive-sided flycatcher, horned grebe, common nighthawk, yellow rail, and Harris's sparrow (birds) (COSEWIC, 2022).

2.3 Population, First Nations, and Settlements

For millennia, Indigenous Peoples have resided in Manitoba's Hudson Bay Lowlands, shaping the region's cultural and historical landscape. During the colonial period, the Hudson Bay Company set up bustling trading posts, including Fort Churchill and York Factory, to take advantage of the northern passage. In recent history, the economy of the region has been based primarily on commercial fishing, hunting, and tourism, along with military and scientific research and grain and commodities exports through the Port of Churchill.

The region is covered by the Treaty 5 adhesion, a historical agreement to share the land (Coates & Morrison, 1986; Government of Canada, 2021a). Many Indigenous communities continue to live in Manitoba's Hudson Bay Lowlands, where they are stewards of the land and play a critical role in the region's economy and cultural life (Brackley, 2022). The Hudson Bay Lowlands in Manitoba comprise traditional territories of the Cree, Métis, and Dene (to the west) (Whose Land, n.d.). In addition, the Fox Lake Cree Nation, Shamattawa First Nation, Tataskweyak Cree Nation, War Lake First Nation, and the York Factory First Nation all have historical connections to the Lowlands and the coast (Section 4).

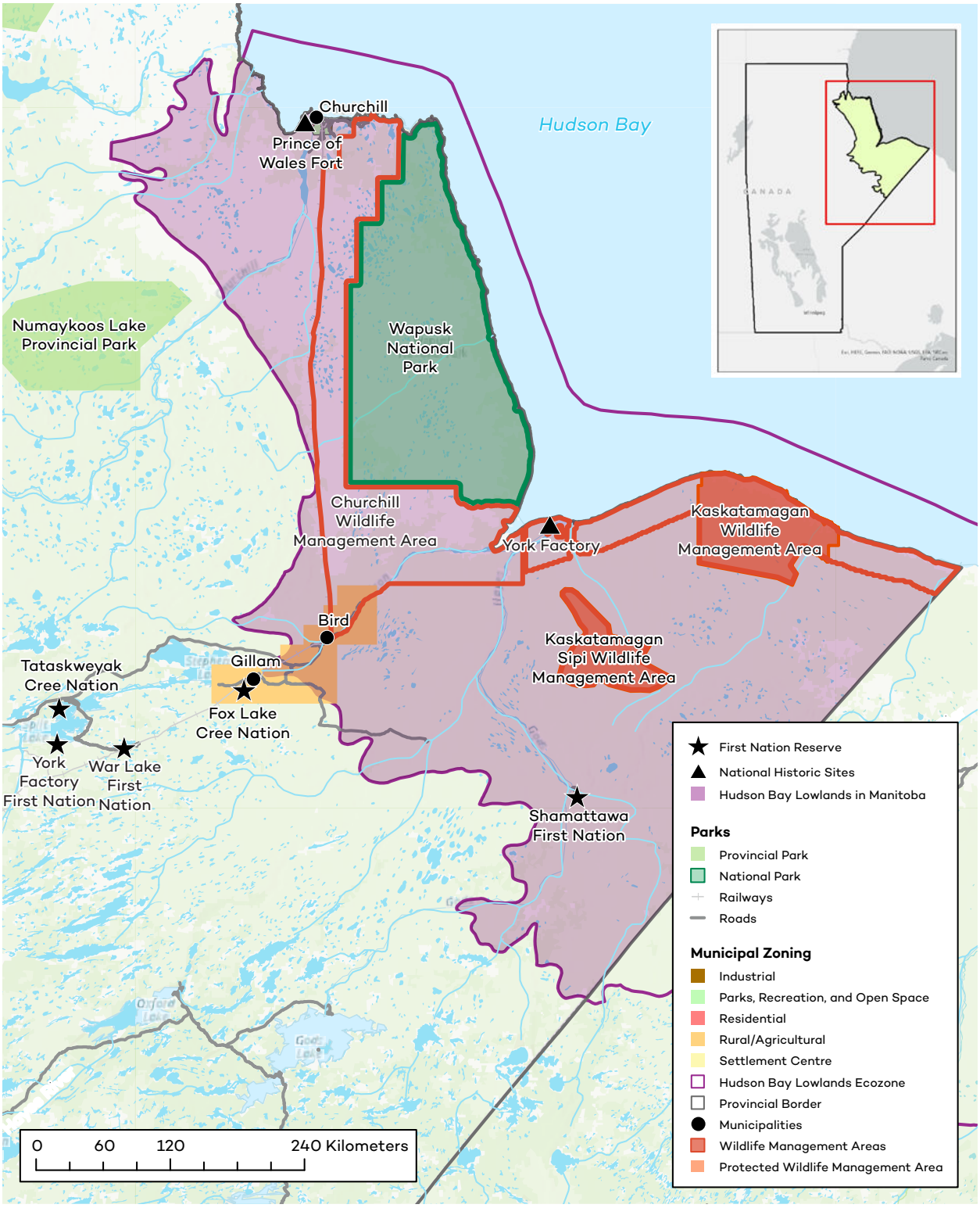
Today, Indigenous and non-Indigenous peoples live in a number of population centres in the Hudson Bay Lowlands, including Churchill, Shamattawa First Nation, and the Fox Lake Cree Nation community of Bird. The resident population of Manitoba's Hudson Bay Lowlands remains relatively small. Churchill had a population of approximately 900 people in 2020 (Statistics Canada, 2023), and the Shamattawa First Nation Reserve had a total registered population of 1,663 as of March 2024 (Crown-Indigenous Relations and Northern Affairs Canada, 2021). The Fox Lake Cree Nation's reserve land in Bird had about 130 residents in 2020 (Statistics Canada, 2023). The town of Gillam is located just outside of the Hudson Bay Lowlands, has a population of 1,007 in 2020, and services major hydro developments on the Nelson River (Statistics Canada, 2023).

2.4 National Parks, Wildlife Management Areas, and Resource Management Areas

National parks and Wildlife Management Areas (WMAs) play crucial roles in conserving wildlife habitats and providing opportunities for recreation in Manitoba. There is one national park and three WMAs in the Hudson Bay Lowlands in Manitoba: Wapusk National Park, the Churchill WMA, the Kaskatamagan WMA, and the Kaskatamagan Sipi WMA (see Figure 5).

[8] Special concern category denotes "a wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats" (COSEWIC, 2022).

Figure 5. National parks, WMAs, and other land-use zones of the Hudson Bay Lowlands in Manitoba



Source: Authors' diagram.

Wapusk National Park was established in 1996 alongside a management board with representatives from Fox Lake Cree Nation, York Factory First Nation, the Town of Churchill, the Province of Manitoba, and the Government of Canada (Parks Canada, 2024b). Spanning 11,475 km^2, the park contains Arctic tundra, boreal forest, and coastal ecosystems (Parks Canada, 2024c). The park's name, Wapusk, is the Cree word for polar bear, which complements its purpose to protect one of the world's largest maternity denning sites for polar bears (Parks Canada, 2010). It is famous for hosting over 220 types of birds, 38 types of mammals, two types of amphibians, and 1,100 different plant species (Parks Canada, 2023b; Parks Canada, 2024a).

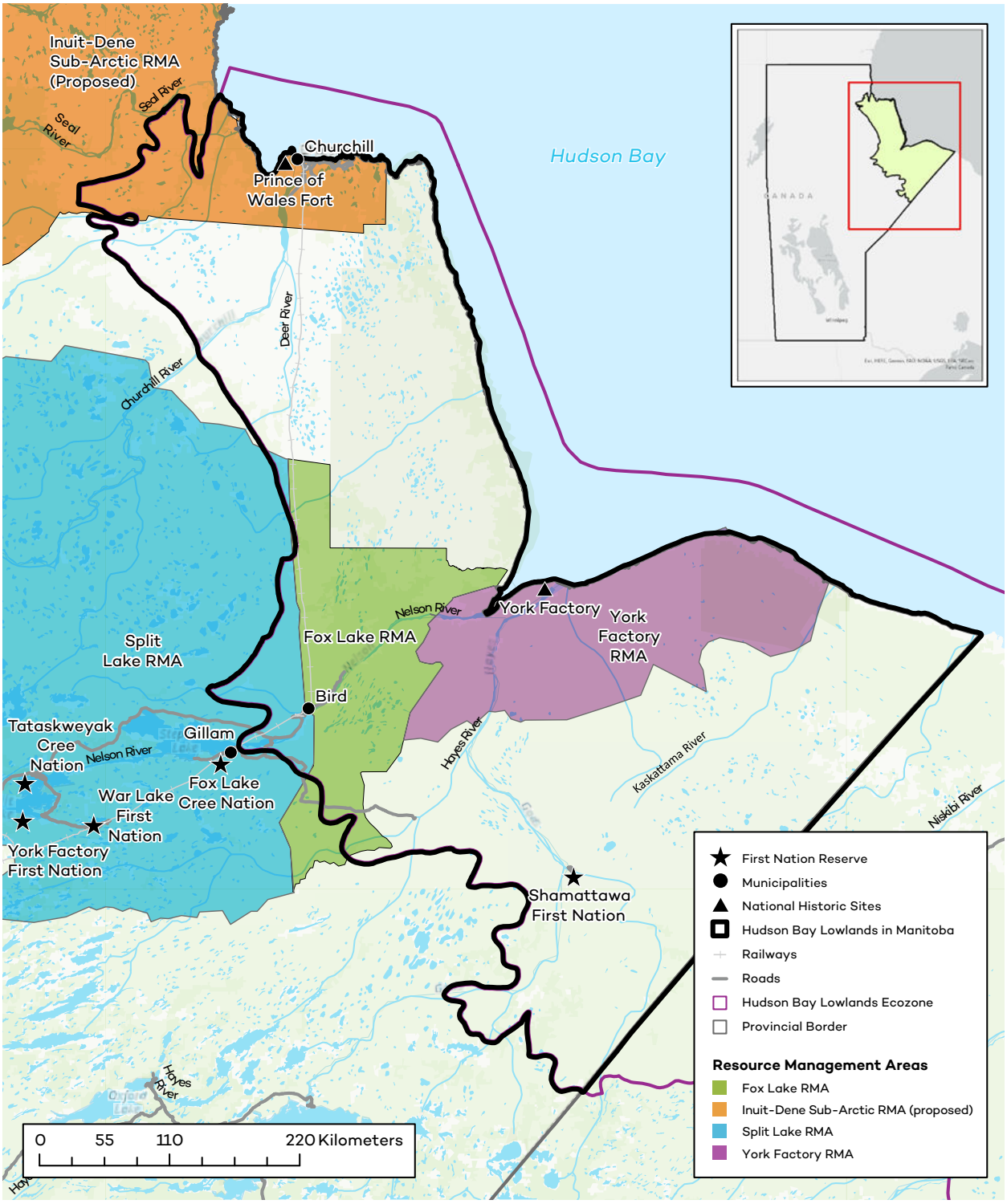
WMAs were established to conserve, enhance, and better manage wildlife in Manitoba and "exist for the benefit of wildlife and for the enjoyment of people" (Government of Manitoba, n.d.-f). The network of WMAs in the province covers nearly 20,000 km^2 of land. Hunting, trapping, and the use of vehicles and boats are generally—but not always—permitted (Government of Manitoba, n.d.-f). Logging, agriculture, mining, and hydrological developments are often—but not always—prohibited (The Wildlife Act, 1999). The legal protection status of each WMA varies, as some are fully protected, some are partially protected, and some are not protected at all. The different protection statuses are a cause for concern, as they leave areas with an abundance of biodiversity susceptible to habitat alteration, which can severely impact ecosystems.

The largest WMA in Manitoba is the Churchill WMA, which spans 8,540 km^2 of land (Government of Manitoba, 2023b). Established in 1978, the Churchill WMA is dominated by open tundra in the north and boreal forest in the south. It surrounds Wapusk National Park and contains a portion of the province's polar bear maternity denning grounds. The Churchill WMA is home to many notable wildlife species in Manitoba, including the Cape Churchill caribou herd and Ross's gull, making it world-renowned for ecotourism and wildlife research (Government of Manitoba, n.d.-e, 2023b). Although the Churchill WMA provides essential habitats for wildlife in the Hudson Bay Lowlands, it is not a legally protected area; thus, the land is subject to mineral extraction, if permitted.[9]

Formerly the Cape Tatnam WMA, the Kaskatamagan WMA was re-established in 2009 with a new name and increased area of 5619.64 km^2 (Government of Manitoba, 2009, 2023b). It shares a western border with the Churchill WMA and extends along the coast of the Hudson Bay until its eastern border with Ontario. The coastal tundra ecosystems of the WMA make it a critical habitat for shorebirds and polar bears (Government of Manitoba, n.d.-e). The Kaskatamagan WMA is only partially protected (see Figure 5), with 3,009 km^2 of land currently unprotected (Government of Manitoba, 2023b). The separation of the WMA into two unprotected areas surrounding one protected area makes it vulnerable to habitat fragmentation, which can have negative effects on biodiversity.

[9] Clause 7(1.1) of the Manitoba Wildlife Act's (1987) Use of Wildlife Lands Regulation (77/99) states that: "Clause (1)(d) does not apply to a person removing minerals under authority of a casual quarry permit issued under the Quarry Minerals Regulation, 1992, Manitoba Regulation 65/92" (Government of Manitoba, 2021b, p. 7).

Figure 6. Resource Management Areas (RMAs) in the Hudson Bay Lowlands in Manitoba



Source: Authors' diagram.

Alongside the Kaskatamagan WMA, the Kaskatamagan Sipi WMA was established in 2009. This WMA is classified as Category 1b under the International Union for Conservation of Nature's protected area categories, which indicates an area protected for its pristine wilderness. The Kaskatamagan Sipi WMA fully protects 1,344 km^2 of land, including boreal forest and Arctic tundra (Government of Manitoba, 2023b; Government of Manitoba, n.d.-e, 2023b). It provides a home to many game and fur-bearing species, such as caribou and beaver. The WMA is located in the traditional territory of the Shamattawa First Nation.

There are also three RMAs in the Hudson Bay Lowlands in Manitoba: Split Lake RMA, Fox Lake RMA and York Factory RMA, as well as one proposed RMA in the region: the Inuit–Dene Sub-Arctic RMA (see Figure 6). RMAs are areas of traditional use and currently make up approximately 22% of Manitoba's land base (Government of Manitoba, n.d.-g). They are co-managed and implemented, to varying extents, by Manitoba's Indigenous Reconciliation and Northern Relations department and Resource Management Boards (RMBs), which consist of representatives from local First Nations and the Government of Manitoba. It is important to note that RMAs are not protected areas but rather designated areas in which RMBs work cooperatively on land-use planning and resource management.

Located on the Hudson Bay coast, the York Factory RMA is co-managed by the York Factory First Nation. It covers 10,623.96 km^2 of land that overlaps with the Kaskatamagan and Kaskatamagan Sipi WMAs (Government of Manitoba, 2016). To the left is Fox Lake RMA, which spans 8,029.78 km^2 (Government of Manitoba, 2016). The Fox Lake Cree Nation is responsible for its co-management. To the west of Fox Lake RMA is Split Lake RMA, which covers an impressive 43,168.7 km^2 of land, making it the largest RMA to date (Government of Manitoba, 2016). It is co-managed by members of the Tataskweyak Cree Nation. An additional RMA, the Inuit–Dene Sub-Arctic RMA, has been proposed in Northern Manitoba. It would span 67,511.81 km^2 of land from the northwestern border of the Churchill WMA to the province's western border with Saskatchewan (Government of Manitoba, 2016). The proposed RMA would also provide an opportunity for the province's Inuit and Dene Peoples to guide land-use planning and the management of natural resources in the region.

2.5 Tourism

With its unique range of geological features and biodiversity, Northern Manitoba is a bustling hub for tourism. In 2019, Northern Manitoba saw approximately 527,300 visitors and generated more than CAD 131.4 million[10] in revenue from tourism (Travel Manitoba, 2019; Y. Cong, personal communication, 2023). People from all over the world visit the region to fish, hunt, and adventure through the wilderness. Northern Manitoba contains 258 well-located and accessible

[10] Northern Manitoba held a 5% share of all visitors and an 8% share of all tourism spending in Manitoba in 2019 (Y. Cong, personal communication, 2023). With a total visitation number of 10,546,000 and a total visitor spend of CAD 1,642,843,000 in 2019 (Travel Manitoba, 2019), it is estimated that Northern Manitoba saw 527,300 visitors and generated CAD 131,427,440 that year.

hunting lodges and outfitters and has over 250,000 licence holders (Travel Manitoba, 2016). Fishing was the most popular activity for tourists while visiting Northern Manitoba in 2014 (Travel Manitoba, 2016). The Hudson Bay Lowlands, which are part of Northern Manitoba, are highly regarded for their fishing and hunting products, such as the northern pike, walleye, moose, and caribou.

In recent decades, however, the region has seen a shift toward adventure tourism, as Churchill has positioned itself as a world-renowned destination for wildlife viewing (Travel Manitoba, 2016). Churchill is often referred to as the polar bear and beluga capital of the world. During the summer, people can see polar bears migrating to their dens and watch as thousands of belugas gather in the Churchill River estuary. **Polar bear sightings, which take place between October and November, draw approximately 12,000 visitors annually** (D'Souza et al., 2021). In addition to polar bears and belugas, black bears, wolves, caribou, seals, and over 200 species of birds can be spotted by visitors in the Hudson Bay Lowlands. Strategically placed wilderness lodges, such as Churchill Wild's Nanuk Polar Bear Lodge and Frontiers North Adventures' Tundra Buggy Lodge, make wildlife viewing simple for tourists. For example, Nanuk Polar Bear Lodge is located at "the only place in the world where polar bears and wolves cohabitate" (Churchill Wild, 2020). Tourists can also embark on week-long wildlife safaris with numerous excursion operators to get up close and personal with wildlife on tundra vehicles, kayaks, or on foot. These operations provide substantial local benefits, such as income for northern communities and opportunities to share culture and build relationships with visitors.

Churchill's visitor economy has a large impact on the Province of Manitoba. It supports 840 full-time jobs in Northern Manitoba (Travel Manitoba, 2021). It also supports CAD 10 million in local and provincial tax revenue. The vast majority of visitors to Churchill are international (80% are from the United States and overseas) (Travel Manitoba, 2021, pp. 80–81). According to Prairies Economic Development Canada, previously known as Western Economic Diversification, the Churchill region generated CAD 36.9 million in annual tourism expenditures in 2017 (Western Economic Diversification Canada, 2020).

In addition to the commercial lodges (Box 1), there is a significant ecotourism industry. Commercial operators offer excursions in and around Churchill and the Hudson Bay Lowlands. Polar bear viewing tours are offered primarily in Wapusk National Park, the Churchill WMA, and other areas around Churchill. There are six main operators: Tundra Buggy Adventure, Churchill Wild, Heartland International, Frontiers North Adventures, Great White Bear, and Lazy Bear. Bird watching, beluga whale tours, northern lights viewing, and other activities are provided by a wider range of operators, including Hudson Bay Helicopters, Churchill Nature Tours, Black Feather and Wilderness Spirit Arctic Nature Tours, Churchill Northern Studies Centre, Discover Churchill, and others (Everything Churchill, n.d.). All of these operators rely on a healthy and functioning Hudson Bay Lowlands ecosystem, which is the habitat for these key attractions.

Box 1. Commercial lodges located in Manitoba's Hudson Bay Lowlands

There are five commercial lodges in the Hudson Bay Lowlands:

- **The Frontiers North Adventures – Tundra Buggy Lodge**, located east of Churchill on the coastline of the Hudson Bay (Frontier North Adventures, n.d.).
- **The Nanuk Polar Bear Lodge**, located "250 km southeast of Churchill, Manitoba on the Hudson Bay coast near the historic York Factory" (Churchill Wild, n.d.-a).
- **Dymond Lake Ecolodge**, located "30 km and 15 minute flight north of Churchill on a strip of land bordered by Dymond Lake and Hudson Bay" (Churchill Wild, n.d.-b).
- **The Lazy Bear Lodge**, located directly in Churchill (Lazy Bear Expedition, n.d.).
- **The Wat'chee Lodge**, located 40 miles south of Churchill "in the middle of the world's largest polar bear denning area adjacent to Wapusk National Park" (Wat'chee, n.d.).

Other popular tourist activities include birdwatching, dogsledding, all-terrain vehicle tours, and boating. There are also a limited number of fenced campgrounds within the Hudson Bay Lowlands, due to polar bear safety precautions, where visitors can spend the night in the pristine boreal forest and catch a glimpse of the northern lights, which can be seen up to 300 nights per year (Travel Manitoba, 2016). Additionally, the region hosts important heritage assets, such as the York Factory Historic Site, a fur-trading post established by the Hudson's Bay Company in 1682 (Government of Canada, n.d.-c), and the Itsanitaq Museum, which displays Inuit artifacts and carvings dating as far back as 1700 BC (Travel Manitoba, n.d.). Hayes River in Manitoba's Hudson Bay Lowlands is known internationally for its wilderness paddling opportunities (Canadian Heritage Rivers System, n.d.). In 2006, it was designated to the Canadian Heritage Rivers System "in recognition of its outstanding heritage and recreational values" (Government of Manitoba, n.d.-a).

2.7 Summary

The Manitoba part of the Hudson Bay Lowlands is a unique and ecologically important region characterized by its mixed forests, extensive peatlands, numerous lakes and rivers, and diverse wildlife. It plays a crucial role in regulating the global carbon cycle—acting as one of the most important peatland regions with some of the highest levels of stored irrecoverable ecosystem carbon—and aids in maintaining both the terrestrial and marine biodiversity in the region. The health of the Hudson Bay Lowlands is also relevant to the Northern tourism industry and the local economy. Despite the region having a deep history of habitation and human settlements, 97.5% of the Manitoba's Hudson Bay Lowlands is intact, further strengthening the case for conservation.

3.0
ESG Valuation of Manitoba's Hudson Bay Lowlands

The Hudson Bay Lowlands in Manitoba remains a critically important ecosystem for its ecological functions and processes, such as regulating, cleaning, and enriching water as it flows to the ocean and capturing and sequestering carbon from the atmosphere. These processes are the foundation of our socio-economic and environmental well-being. The Hudson Bay Lowlands' unfragmented and nearly unaltered state is especially valuable, providing ecological connectivity and hosting an abundance of native species. Overall, this region sustains important cultural, social, economic, and environmental values.

This section aims to capture the benefits of Manitoba's Hudson Bay Lowlands ecosystems to both local and global communities—also known as EGS—and monetize their economic value using appropriate valuation methods.

3.1 What Are EGS?

EGS are tangible and intangible benefits that people derive from ecosystem functioning. Estimating the value of EGS in physical and monetary units helps decision-makers better understand nature's previously undervalued contributions to people and the economy and informs more sustainable use of natural resources and long-term societal well-being. These EGS can either be material or non-material to humans (United Nations et al., 2021).

There are three categories of EGS, as classified in the System of Environmental Economic Accounting— Ecosystem Accounting (SEEA EA) framework.[11]

1. **Provisioning services** are goods and services that can be extracted or harvested from ecosystems for consumption, such as food, fuel, and drinking water.
2. **Regulating services** result from "the ability of ecosystems to regulate biological processes and to influence climate, hydrological and biochemical cycles, and thereby maintain environmental conditions beneficial to individuals and society" (United Nations et al., 2021, p. 130), such as flood mitigation, carbon sequestration, erosion control.
3. **Cultural services** are intangible services "related to the perceived or actual qualities of ecosystems whose existence and functioning contributes to a range of cultural benefits" (United Nations et al., 2021, p. 130), such as spiritual and recreational services.

The values assigned to these services can also be categorized as "use" or "non-use" values. Use values result from direct[12] or indirect[13] interaction with the environment, and non-use values occur irrespective of people's current use of the ecosystem or intent to use the ecosystem in the future. There are two main types of the non-use value:

[11] This framework was adopted by the United Nations Statistical Commission in 2021 was an international statistical standard.

[12] For example, harvesting wildlife and medicinal plants for consumption, drinking clean water, and canoeing in the river.

[13] For example, benefitting from flood mitigation and reduced soil erosion provided by a well-preserved wetland.

1. Bequest value: represents the value individuals assign to conserving an ecosystem for future generations.
2. Existence value: represents the value of knowing that this ecosystem exists in the present.

Even if people are not using the ecosystems directly or indirectly, the benefits associated with bequest and existence values still accrue to them in the present, which is important for capturing the total economic value of an ecosystem.

The SEEA EA framework, which includes an EGS assessment, is intended to fill important gaps in the official statistics, particularly National Economic Accounts that access national production and consumption, and is recommended for use in policy making. Initiatives to implement the SEEA EA framework are taking place in a number of countries, including Canada (United Nations, n.d.).

The SEEA EA accounting framework also includes the valuation of natural capital stocks as an important component. In contrast to EGS, which are expressed as the annual values of services to people (i.e., "flows"), stocks of capital measure the amount and monetary values of the stocks of renewable and non-renewable resources.

The EGS concept is anthropocentric, prioritizing human interests and economic uses in judging the value of different elements of natural ecosystems. As noted by the United Nations Department of Economic and Social Affairs (2021), "accounting for ecosystem services does not provide a complete assessment of the entire relationship between ecosystems and people." There are other types of value, such as intrinsic and relational value, that could guide decisions about the protection of the natural environment. The pluralism of values needs to be recognized in decision-making processes. Therefore, in addition to the partial economic value (Section 3), we interviewed five residents of the Hudson Bay Lowlands in Manitoba to highlight this region's relational values (Section 4). Relational values are anthropocentric—they view nature from the human perspective—however, they are non-instrumental as compared to the EGS, meaning they do not treat nature as a means to an end; they also acknowledge reciprocal relationships with nature.

As for the EGS assessment, in this report, we provided an assessment of both carbon storage[14] and select EGS in Manitoba's Hudson Bay Lowlands, for which the data was available (Section 3.3). A similar assessment was previously done for the Seal River Watershed Indigenous Protected Area (Puzyreva et al., 2022).

3.2 EGS Valuation Methods

There are multiple ways to estimate the economic value[15] of EGS. People's preferences can be

[14] The carbon storage value is expressed as a total dollar value of a natural asset (as a stock) in a particular year in contrast to the EGS that are the flows of ecosystem services supplied by the natural asset *annually*.

[15] According to Banton (2023) economic value is "the value that person places on an economic good based on the benefit that they derive from the good." Often determined by the highest price they are willing to pay. Economic value may surpass market value.

1. observed in existing markets (e.g., price paid for caribou meat, fuel, tourism spending),
2. derived from observations of market behaviours, and
3. obtained through conducting analyses of hypothetical markets.

For example, the *hedonic pricing* method could be applied when the demand for a commodity is reflected in the price of an associated good—for example, when the market price of a property situated beside a natural area such as a lake reflects people's preferences for the ecosystem characteristics of this natural area (e.g., clean water, aesthetic value) as compared to properties situated without these features. If the market information is not available, a contingent valuation method could be applied, which involves describing a hypothetical market in a questionnaire and asking people about their willingness to pay in a survey.[16] If the valuation information is not readily available for EGS in a particular location, it is possible to apply existing valuation estimates from comparable sites with available data (benefit transfer approach; applied in Sections 3.3.2 and 3.3.4). By summing up the individual use and non-use values of relevant EGS, it is possible to calculate the total economic value (TEV), which captures the total benefit to society provided by a particular natural area or an asset.

However, it is often challenging to assess the economic value of EGS since markets for the majority of EGS—particularly regulating and cultural EGS—do not exist. Therefore, most valuations, including the one in this report, should be regarded as partial estimates of the TEV and a starting point for the discussion of the value of the region for planning and decision making.

3.3 EGS Provided by Manitoba's Hudson Bay Lowlands

The following presents the partial economic value of the critical ecosystem services of Manitoba's Hudson Bay Lowlands based on publicly available data.

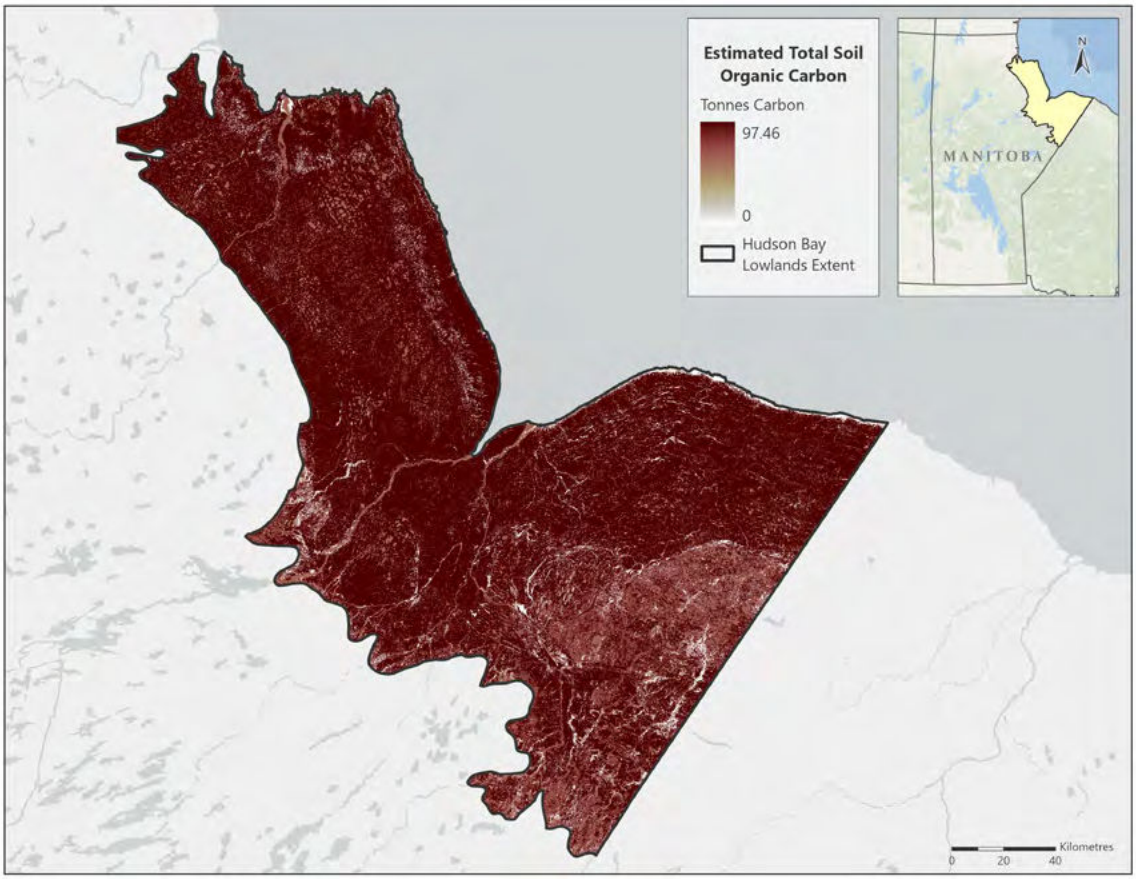
3.3.1 Carbon Storage

The maintenance of carbon storage and sequestration of carbon from the atmosphere are essential in our climate change mitigation efforts and, therefore, for maintaining the integrity of Manitoba's Hudson Bay Lowlands. This region is covered by peatlands, which contain very large quantities of soil organic matter and soil organic carbon (SOC) that have been accumulating for thousands of years, making it a major carbon sink. Ducks Unlimited Canada (DUC) estimated that **there is 6,966,972,179.504 tonnes of SOC contained within Manitoba's Hudson Bay Lowlands** (Figure 7). To estimate the total SOC, DUC overlaid the spatial boundaries of Manitoba's Hudson Bay Lowlands with the Manitoba SOC layer, summing the SOC values for each region. The Manitoba SOC layer was derived by assigning soil carbon density estimates identified in a literature review (Badiou et al., 2011; Bernal & Mitsch, 2012; Bork & Badiou, 2017; Siltanen et al., 1997; VandenBygaart et al., 2010; Zoltai et al., 2000) with their

[16] For the review of other valuation methods, see United Nations et al. (2021), Section 9.3, Techniques for valuing transactions in ecosystem services.

associated land cover classes and is calculated as tonnes of carbon per pixel. The Manitoba land-cover dataset was compiled by DUC in 2023 using a combination of the following datasets: the Canadian Wetland Inventory Map v.3 (Mahdianpari et al., 2021), the Manitoba Forest Inventory (Manitoba Natural Resources and Northern Development & Forestry and Peatland Branch, 2022; Forestry and Peatlands Branch, 2024), and the Earth Observation for Sustainable Developments of Forests dataset (Wulder et al., 2008).

Figure 7. Distribution of SOC in Manitoba's Hudson Bay Lowlands



Source: Ducks Unlimited Canada (printed with permission).

To estimate its value in monetary units, it is appropriate to apply the social cost of carbon, which is "a monetary measure of the global damage expected from an additional tonne of CO_2 emissions for a given year" (Government of Canada, 2021c), and incorporate a number of assumptions and predictions regarding global emissions pathways, climate response, the economy, and the discount rate. The ECCC provides estimates of the social cost of greenhouse gas (GHG) emissions (Government of Canada, 2023b). The updated 2024 social cost of carbon at a 2.5% discount rate is CAD 164/tonne of CO_2 equivalent (CO_2e) in 2021 CAD (CAD 184.02 tonnes of

CO_2e in 2024 dollars after adjusting for inflation[17]). Based on this, **the TEV of carbon stored in Manitoba's Hudson Bay Lowlands is a staggering CAD 1.28 trillion.**

3.3.2 Biodiversity Conservation

Willingness to Pay for Conservation of Manitoba Hudson Bay Lowlands in Manitoba

When no market data is available to estimate the value of the EGS, researchers may turn to the contingent valuation method to determine people's preferences. Under the contingent valuation method, respondents are asked about their willingness to pay for (WTP) or willingness to accept a change in the level of provision of the good or service in a hypothetical scenario (OECD, 2006). This method is commonly used to elicit preferences for biodiversity-related non-use services (e.g., how much would you be willing to pay to preserve the polar bear habitat even though you may never see a polar bear in your life? How much is this habitat worth to you?). While this method is helpful in identifying preferences for non-market goods, it is important to carefully construct the questionnaires and apply sound survey-based techniques to avoid biases, overstatement of WTP and obtain the most accurate information (OECD, 2006).

In December 2022, Probe Research Inc. conducted a survey of 1,000 adults residing in Manitoba[18] to understand Manitobans' preference regarding the conservation of Manitoba's Hudson Bay Lowlands and estimate the WTP to preserve its biodiversity. The average Manitoban would consider giving CAD 28/year (or CAD 29.4 in 2024 dollars), which is the WTP by Manitobans for the biodiversity of Manitoba's Hudson Bay Lowlands. The number of adults 18 years old and above in Manitoba as of July 1, 2024, was 1,171,743 (Manitoba Bureau of Statistics, 2024). Based on these estimates, **the annual biodiversity value of Manitoba's Hudson Bay Lowlands is around CAD 34.45 million/year**. It is important to note that this total captures only the value from the adult population of Manitoba. Given the global recognition of the region as an aspirational tourism destination and an iconic Canadian landscape, the full biodiversity conservation value is considerably higher.

WTP for Conservation of the Breeding Habitat of Northern Pintails in Manitoba's Hudson Bay Lowlands by the Households of Canada, the United States, and Mexico

To capture some of the global value of the species habitat provided by Manitoba's Hudson Bay Lowlands, we relied on Haefele et al. (2019), who mapped out the habitat of northern pintails in North America and estimated the WTP for the protection of their habitat in Canada, the United States, and Mexico. The northern pintail is a bird species with a breeding and migratory habitat in Canada, and Manitoba's Hudson by Lowlands in particular (see Figure 8). The authors designed and administered a questionnaire to a sample of representative households in Canada, the United

[17] Using Bank of Canada's inflation calculator, available at https://www.bankofcanada.ca/rates/related/inflation-calculator/

[18] According to Probe Research Inc. (2022), "With a sample of 1 000 one can say with 95 per cent certainty that the results are within ±31 percentage points of what they would have been if the entire adult population of Manitoba had been surveyed" (p. 3). Probe Research's survey was background research for this report and is unpublished.

States, and Mexico, presenting them with certain conservation scenarios. The first scenario—Program A—would conserve northern pintails' habitat and halt their decline, maintaining their population at the current level of around 3 million birds. The second scenario—Program B—would create habitats to support the growth of the pintail population, aligning it with the long-term abundance goals (Haefele et al., 2019). Using WTP estimates derived from Program A for Canada, which aims to stabilize the northern pintail population (Table 1) and the share of Manitoba's Hudson Bay Lowlands area in the total northern pintail habitat area in Canada (1.52%) (Figure 8), we estimated the WTP for northern pintail conservation in Manitoba's Hudson Bay Lowlands by the households of Mexico, the United States, and Canada which amounts to CAD 74.38 million in 2024 dollars.[19]

Table 1. WTP to stabilize the population of northern pintails in Canada and Manitoba's Hudson Bay Lowlands

WTP to stabilize population in Canada, annual	Canadian households	U.S. households	Mexican households	Total
Habitat in Canada, 2016 USD, mean	11.64	18.07	5.11	
Habitat in Canada, 2016 CAD, mean	16.05	24.92	7.047	
Habitat in Canada, 2024 CAD, mean	20.19	31.35	10.93	
Number of households, 2024	15,203,845[20]	133,268,937[21]	37,400,000[22]	
Total national WTP, 2024 CAD	306,965,631	4,177,981,175	408,782,000	4,893,728,806
WTP for habitat conservation in the Manitoba's Hudson Bay Lowlands, 2024 CAD*	**4,665,878**	**63,505,314**	**6,213,486**	**74,384,678**

Source: Based on data from Haefele et al., 2019.

* Multiplied by the proportion of Manitoba's Hudson Bay Lowlands habitat area in the total Canadian habitat—1.52%.

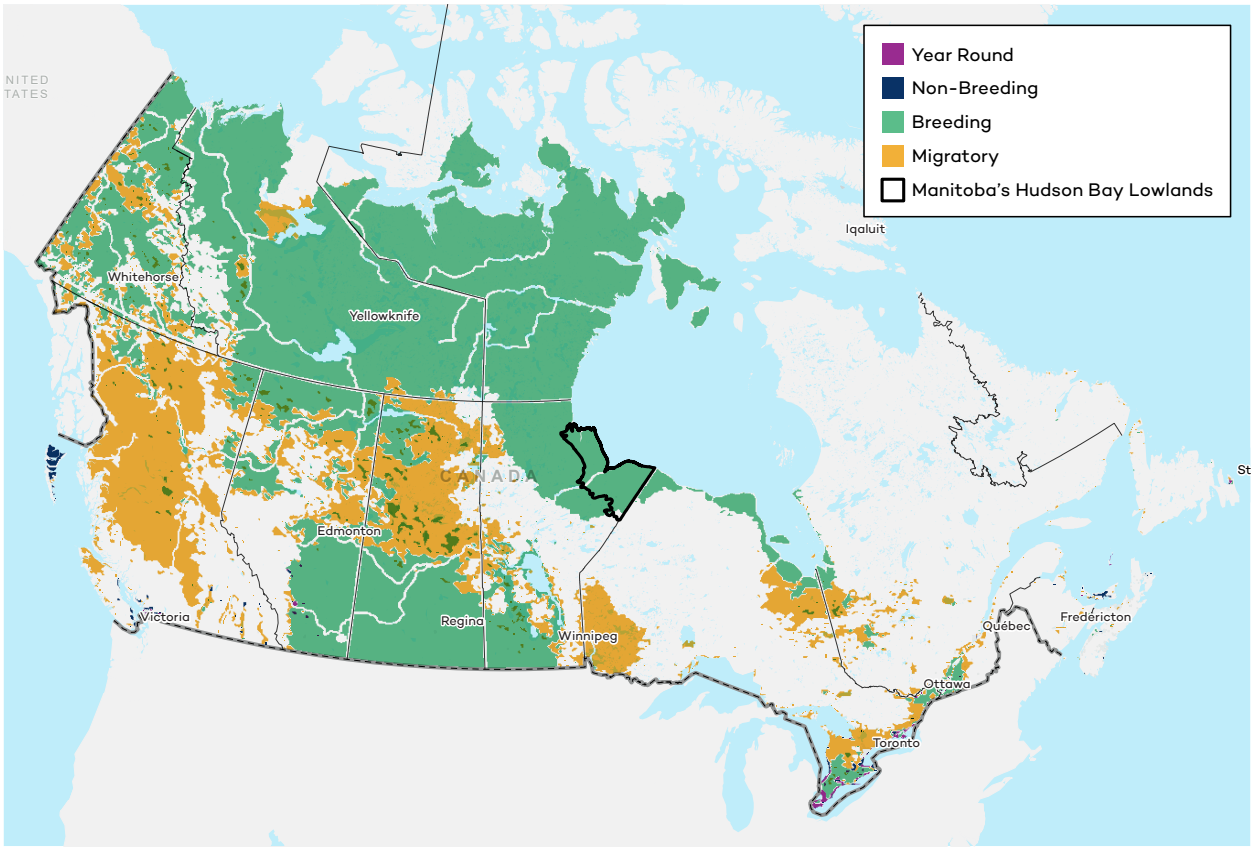
[19] Note that the WTP estimate for Canadian households excludes Manitoba households since their WTP for conservation of the biodiversity of Manitoba's Hudson Bay Lowlands was estimated in December 2022 by Probe Research Inc. (value presented in Section 3.3.2).

[20] Manitoba households excluded; projected using the compound annual growth rate for the period of 2015–2020 (Statistics Canada, 2017, 2023).

[21] Estimated based on the average 2021-2023 growth rate from the American Community Survey (ACS) 1-Year Estimates (U.S. Census Bureau & U.S. Department of Commerce, n.d.-a; n.d.-b; n.d.-c).

[22] Based on the 2022 estimate in INEGI (2023) https://www.inegi.org.mx/contenidos/saladeprensa/boletines/2023/ENIGH-E/ENIGH-E2022.pdf

Figure 8. Northern pintail range in Canada and Hudson Bay Lowlands within the Manitoba boundary



Source: Fink et al., 2020 (reprinted with permission).

It is important to note that the adjustment by the proportion of the range of northern pintails in Manitoba's Hudson Bay Lowlands to the total habitat in Canada does not account for the density of breeding pairs across their habitat and assumes an even contribution of all breeding and migratory habitat areas to stabilizing the northern pintails population.

3.3.3 Tourism and Recreation

The recreational and tourism value of the Hudson Bay Lowlands is tied to its largely undeveloped environment and natural and cultural heritage. Manitoba's North and the Hudson Bay Lowlands offer an array of tourism experiences, including migratory bird spotting, river canoeing and sea kayaking, Aurora Borealis gazing, wildlife, and nature walking tours, wilderness camping, and ecotourism adventures.

Unfortunately, accurate information on visitor spending from tourism operators in the Hudson Bay Lowlands, as well as visitor numbers in Churchill, is lacking. Current tourism data is largely centred around Churchill or Northern Manitoba, making it difficult to determine exact numbers

for the Hudson Bay Lowlands specifically. It is important to note that Churchill is not the only touristic draw to the Hudson Bay Lowlands. The region is popular among locals and international visitors for its fishing and hunting opportunities, as well as its important heritage assets, such as the York Factory Historic Site and Itsanitaq Museum.

As mentioned, the most popular destination in the region—Churchill—attracts numerous visits every year. According to Western Economic Diversification Canada[23] (2020), it generated around CAD 36.9 million in direct annual expenditures related to tourism in 2017. Assuming the same level of spending on an annual basis and adjusting for inflation to reflect 2024 prices, **the resulting value of tourism equals CAD 45.47 million/year**.[24]

3.3.4 Health Services

Those who visit Northern Manitoba's Hudson Bay Lowlands as ecotourists, hunters, and fishers also receive health benefits. Spending time in nature improves physical and mental well-being (Bratman et al., 2019; Buxton et al., 2024); the mental health benefits of protected areas have been documented and monetized (Buckley et al., 2019). The economic benefits resulting from improved mental health can be translated into reduced health care expenditures, caregiver costs, and improved workplace productivity. Buckley et al. (2019) estimated the effects of protected area visitation on mental health based on the data from the visitors in two Australian subtropical national parks. The study found that the visitation resulted in an increase in the Personal Wellbeing Index of around 2.5% per year, which is equivalent to a gain of 0.025 quality-adjusted life years (QALY). QALY is a measure commonly used in health policy and economics that captures additional years of life in perfect health that result from an intervention. In the absence of national or provincial data for Canada on the mental health value from visits to national parks—and given the similar social, economic, and cultural contexts of Australia and Canada—we applied this estimate in Buckley et al. (2019) to evaluate the mental health benefit from visiting Manitoba's Hudson Bay Lowlands.

By taking the value of 1 QALY as USD 200,000,[25] the mental health cost savings amount to USD 5,000 per person per year or CAD 7,755 in 2024 Canadian dollars. Based on the number of visitors travelling to Manitoba's Hudson Bay Lowlands for polar bear viewing—12,000 tourists per year (D'Souza & Dawson, 2021)—**the mental health value of visiting Manitoba's Hudson Bay Lowlands amounts to CAD 93 million**. Again, it is important to note that the underlying assumptions for the mental health improvements from visiting protected areas are based on an Australian study, and we are assuming that the same

[23] Currently known as Prairies Economic Development Canada.

[24] This does not include the opportunity cost of people's time to travel and visit Churchill, and well as the value of tourism outside Churchill.

[25] The value of QALY in developed countries used in Buckley et al. (2019).

health improvements are applicable in the Manitoba context (benefit transfer method[26]). For an estimate of the mental health value *specific to Manitoba*, local studies would need to be conducted asking visitors about changes in their mental well-being from ecotourism and other activities in the northern regions of Manitoba.

It is important to note that the above value does not capture the mental health value for those visiting Manitoba's Hudson Bay Lowlands for other purposes (e.g., beluga whale tourism, hunting, and fishing) and to other locations in the Hudson Bay Lowlands, such as Wapusk National Park, York Factory National Historic Site, Fox Lake Cree Nation, and Shamattawa First Nation.

3.3.5 Hunting and Gathering

In Canada, boreal caribou hold significant cultural and historical importance for Indigenous Peoples. These animals are a crucial food source and vital for maintaining traditions such as hunting and other activities that are central to Indigenous Peoples' spiritual and cultural connection to the land (Government of Canada, 2023a). As mentioned in Section 2.2, there are three migratory caribou herds present in Manitoba's Hudson Bay Lowlands: barren-ground caribou from the Qamanirjuaq herd, the forest-tundra migratory woodland caribou from the Cape Churchill herd, and the Hudson Bay Coastal Lowland herd (formally known as the Pen Islands herd). Data on the Cape Churchill and the Hudson Bay Coastal Lowland herds is lacking; nevertheless, according to the interviews conducted as part of this study and COSEWIC (2017b), some subsistence caribou hunting and a limited sport hunt of these caribou herds takes place in the Lowlands. However, there are available estimates of caribou harvest for the Beverly and Qamanirjuaq caribou herd (InterGroup Consultants, 2013).

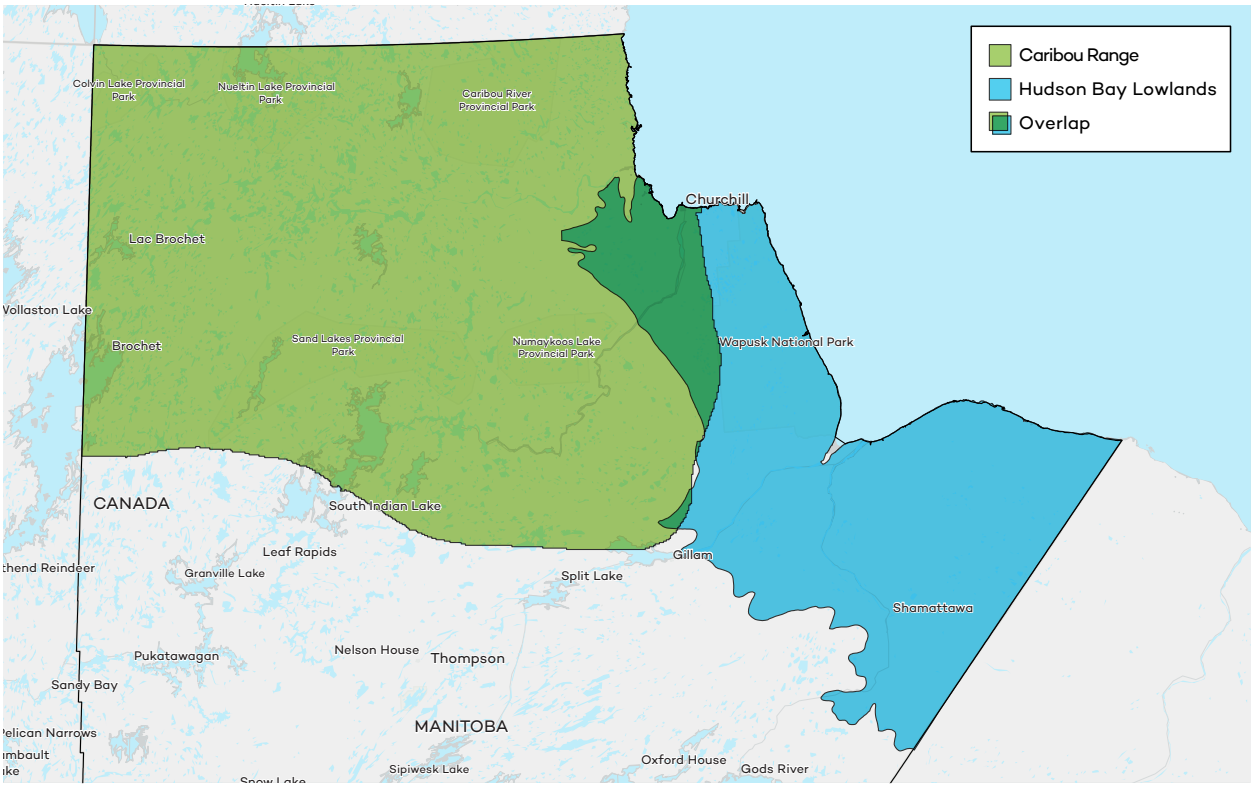
InterGroup Consultants conducted an economic valuation for three types of harvest activities in relation to the Beverly and Qamanirjuaq caribou herd: domestic harvest, commercial harvest, and outfitting harvest. Approximately 2,070 caribou, inclusive of domestic, licensed, and outfitted harvests, were harvested in Manitoba in 2005/2006 (InterGroup Consultants, 2013). The direct, quantifiable economic value of caribou harvest is the sum of the values of all meat, hides, and antlers harvested. For the meat, the values were calculated using the replacement cost method—an equivalent amount of food that harvesters would need to purchase to obtain the same nutritional value. Using these methods, InterGroup Consultants (2013) estimated the economic value of the caribou harvest in Manitoba at CAD 3.8 million (CAD 2006).

Given an overlap of the Qamanirjuaq caribou herd with Manitoba's Hudson Bay Lowlands region, this data could be applied to the EGS estimate of hunting and gathering. For the present valuation, we are assuming the same harvest volumes in 2024/2025 as in 2005/2006—which are the available harvest numbers from InterGroup Consultants (2013). We have adjusted the net annual value of the caribou harvest in Manitoba (CAD 3,805,448 [2006 dollars]) by inflation and

[26] The benefit transfer method allows for transferring the economic values of specific EGS from studies conducted in other regions comparable to the study region.

multiplied by the share of the barren-ground caribou range in Manitoba's Hudson Bay Lowlands to the caribou range in Manitoba (6.62%), as depicted in Figure 9, to arrive at a value of **CAD 371, 203 (2024 CAD) for the net annual value of caribou harvest** in the Hudson Bay Lowlands. While the estimates are based on the Manitoba harvest, it is important to acknowledge that the harvest outside Manitoba also depends on the healthy caribou habitat in the Hudson Bay Lowlands.

Figure 9. Overlap between the Beverly and Qamanirjuaq caribou ranges and the boundary of Manitoba's Hudson Bay Lowlands



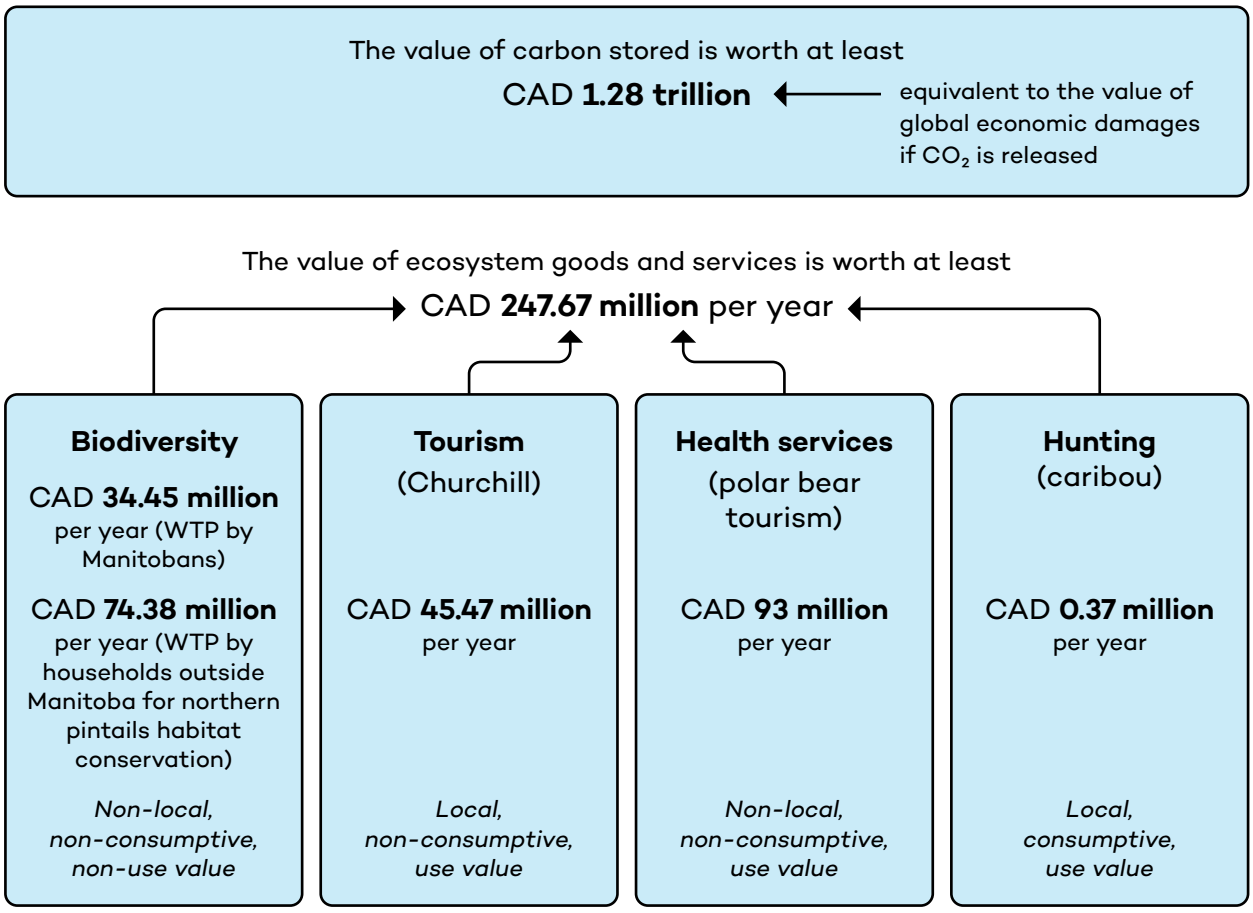
Source: Authors.

3.4 EGS Results Summary

Figure 10 captures a *partial* value of Manitoba's Hudson Bay Lowlands, which was based on many significant EGS with available data. These values can inform the protection of the region for future generations. They do not include the economic value of tourism outside of Churchill and the associated mental health benefits, the value of conservation of various species (apart from northern pintails) from people who are willing to protect them but do not reside in Manitoba, the spiritual and cultural value of habitat protection for local Indigenous nations and for Indigenous sovereignty and identity, the value of medicinal plant harvests, the value of clean water and air

provided for people living in the region, the education value of knowledge exchange between visitors and local knowledge holders, and the value of carbon sequestered on an annual basis.

Figure 10. Summary of the selected EGS derived from Manitoba's Hudson Bay Lowlands



Source: Authors' diagram.

4.0
Relational Values of Manitoba's Hudson Bay Lowlands to Indigenous Communities

As noted earlier, the approach taken in this report to identify and monetize ecosystem services for which data are available is one aspect of understanding the value of a certain action for the society—in this case, preserving an intact Hudson Bay Lowlands for future generations (United Nations Department of Economic and Social Affairs, 2021). This approach exhibits a Western and dominant worldview. However, perceptions of nature are diverse and shaped by "personal experiences, cultural values, and histories" (Palmer, 2023). They are not exclusive to instrumental values—the EGS monetized in this report—where nature is regarded as a certain means to an end. The EGS approach treats nature as a provider of benefits and does not account for the concept of services to nature and the reciprocity of human–nature relationships, which is core to Indigenous worldviews (Himes & Muraca, 2018). Living *from* nature is only one way to approach valuation. People can also live with, in, and as nature (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, 2022). Bearing this in mind, experts distinguish three categories of value—instrumental, relational, and intrinsic. Instrumental values are services from nature to people (EGS), intrinsic value is the concept of the inherent value of nature regardless of any human use, and relational values capture relationships with and responsibilities to nature.[27]

Conceptualizations and interpretations of the relational values differ (Himes & Muraca, 2018; Pratson et al., 2023). For example, it could be said that the cultural EGS category captures some of the relational values, such as having a spiritual and artistic connection to an ecosystem (United Nations Department of Economic and Social Affairs, 2021). Overall, relational values provide space for a more nuanced understanding of value and honours diverse perspectives. Most commonly, it is associated with a sense of place, connectedness, spirituality, livelihoods, individual and collective identities, care, responsibility, reciprocity, stewardship, heritage, and beauty (Himes & Muraca, 2018; Pratson et al., 2023; Schröter et al., 2020). As mentioned in Himes and Muraca (2018), "relational values are essential to adequately represent non-Western languages of valuation." Importantly, the entities contributing to relational values are non-substitutable or replaceable, which is an important distinction from the instrumental value (EGS) approach.[28]

Considering this, in addition to the EGS, we want to point out the more personal and nuanced perspectives of the value of the Manitoba Hudson Bay Lowlands as shared by five residents of Churchill and Fox Lake Cree Nation. Through interviews, they shared details about their meaningful interactions with the nature of the Lowlands and among people through nature.

The Hudson Bay Lowlands is a vast wetland that is mostly inaccessible to local people. However, it is possible to travel along the coast. An interviewee noted a special relationship of Fox Lake Cree Nation, Shamattawa First Nation, Tataskweyak Cree Nation, War Lake First Nation, and the

[27] In the definition by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (n.d.): "Relational values refer to the importance of desirable, meaningful, and often reciprocal relationships—beyond means to an end—between humans and nature, and among humans (including across generations) through nature (e.g. sense of place, spirituality, responsibility, care, reciprocity, stewardship)."

[28] For example, biodiversity in the Hudson Bay Lowlands and biodiversity in another region of northern Manitoba are non-substitutable.

York Factory First Nation[29] with saltwater and their important historical connection to the coast, which relates to the history of the York Factory trading post. In 1684, the York Factory trading post was established by the Hudson's Bay Company close to the coast (Pannekoek & Scott, 2006). The York Factory trading post was an important gathering place where the signing of the adhesion to Treaty 5 took place on August 10, 1910 (Coates & Morrison 1986). As mentioned in Government of Canada (2024a), "The immediate area around the Factory was inhabited by the Cree who trapped, hunted and fished for the Company. An Indigenous community was situated one kilometre downstream of the fort." There were also other communities in the vicinity of the factory. After the closure of the Hudson's Bay York Factory in 1957, the Indigenous residents were relocated to York Factory First Nation or left to live in the Tataskweyak Cree Nation and Shamattawa First Nation (Coutts, 1992; York Factory First Nation, n.d.-a). Present-day members of Fox Lake Cree Nation also have ancestors from the Homeguard Cree of York Factory (Hill, 1993). While these First Nations are presently located inland (see Figure 3), many people still take the journey to the York Factory National Historic Site to visit their ancestral home (York Factory First Nation, n.d.-b).

> "I feel like I can breathe and really connect to the land near those coastal lands."
>
> Heather Spence-Botelho, Churchill, Manitoba
> Fox Lake Cree Nation Member

Another interviewee living in Churchill noted that when hunting out east in the tundra, they can observe the pristine nature and abundance of wildlife:

> "It just feels so untouched. Like, that's the only way I can describe it [...]. The wildlife out there is so abundant. Going out there, we see everything from swans to polar bears to caribou."
>
> Antonina Kandiurin, youth
> Churchill and York Factory First Nation, Manitoba

There is a lot of activity in and around communities in the Hudson Bay Lowlands tied to nature, particularly in Churchill, close to the coast and inland in Gillam/Fox Lake Cree Nation. Local people engage in fishing, hunting (geese, moose, caribou, and ptarmigan), trapping, snowshoeing, cross-country skiing, paddle boarding, boating, berry picking (cranberries, blueberries, crowberries, cloudberries), and other activities organized to reintroduce people to the land. The programs are offered to a variety of participants, such as men and women experiencing mental health challenges and mentored hunts for youth. Overall, participation in these nature activities has greatly increased since the COVID-19 pandemic.

[29] Also known as York Factory Cree Nation and York Landing First Nation.

> "[In Churchill,] now there's probably like 50 people that paddleboard and kayak when it was mainly something that was kind of done by tourists with the odd exception. A lot of the kayaking and paddle boarding is done in the mouth of the Churchill River."
>
> Jill Larkin, Program Manager, Warrior Caregiver Program
> Red River Métis, longtime resident of Churchill

As noted by the interviewees, the organization of and participation in these activities have far-reaching positive outcomes for communities—promoting youth education, instilling a sense of pride and belonging, connection to one's identity, greater participation in local arts inspired by these activities, and community bonding—all of which improve the quality of life of individuals and communities holistically.

> "There are lots of benefits when we try to do everything start to finish. Before going on the land, the youth have to learn the camping skills, shooting skills, how to clean the birds, and then after the trip, they learn how to cook the meat and share the meat with family, friends and Elders. This gives them a sense of community, belonging and pride. [...] I had a mother tell me that when their son came back from the hunt, it seemed like he grew 2 inches taller because of the confidence that he got from the hunt. [...] The mentors as well [...] get that sense of giving back to the community because they're teaching these young people."
>
> Jill Larkin, Program Manager, Warrior Caregiver Program
> Red River Métis, longtime resident of Churchill

> "It's really interesting to think that generations of my family have utilized the coast of the Hudson Bay and the Hudson Bay Lowlands to provide for them for years, whether it's clothing or food. And I'm still able to do that today, which means a lot to me. And being able to go out there and harvest a caribou and bring it back to my community to share with people who are unable to do that is really special to me."
>
> Antonina Kandiurin, youth
> Churchill and York Factory First Nation, Manitoba

One interviewee commented on a snow goose hunting trip and community cook-off organized by Parks Canada and the Subarctic Friendship Circle (a community group led by the Churchill Health Centre) for the residents in Churchill.[30] This event attracted the participation of hundreds of people and energized the whole community:

[30] The mentored hunt program has been running since 2018.

> "The meat from the mentored hunt was shared. People who didn't come on the hunt cooked and they set up tables and people went around and tasted. […] There were even a couple of Indigenous ladies that started up a square dance group with little kids because they wanted to perform at the snow goose cook-off, so it brought back square dancing. […] There was also a drama group. One of the teachers organized a little skit […] about snow goose hunting, and they performed it on stage."
>
> Jill Larkin, Program Manager, Warrior Caregiver Program
> Red River Métis, longtime resident of Churchill

Moreover, there were a number of instances witnessed by the interviewees where the land programs were life-changing for men and women with mental health challenges and addiction, pointing to the importance of the human–nature connection for well-being and the exceptional importance for local residents to continue to exercise traditional practices.

> "We found that our young people that get involved with that [land programs, camps] tend to do better in life, tend to be more apt to take a chance in terms of learning something new. They tend to take a chance in buying the equipment that they need to go on the land, like ski-doos and canoes, kayaks."
>
> Conway Arthurson
> Senior Advisor to Council, Fox Lake Cree Nation

One interviewee also expressed admiration for the "hidden" beauty of the tundra and its rich biodiversity. They mentioned the importance of shifting focus and noticing small things around oneself:

> "There's a lot of beauty that you have to get on your hands and knees to see. […] You look down and you can see all the mushrooms, little flowers and many different species of lichen. I think it's really valuable to take time to do that. If you notice the small things and shift your focus a little bit, it can give you a little bit more joy and happiness in your life. […] That's the thing with berry picking too. The berries here grow close to the ground, so you can lay down and pick them. Once you get down on the ground, you see that there are maybe five or six different species of lichen. And for berries, it's not just cranberries and blueberries, there are also bearberry and crowberry plants and multiple different things that you're not going see unless you're right down on the ground."
>
> Jill Larkin, Program Manager, Warrior Caregiver Program
> Red River Métis, longtime resident of Churchill

All these outdoor activities, the positive benefits derived from them, and the meaningful relationships developed with the Hudson Bay Lowlands depend on a healthy environment,

including thriving biodiversity, clean air, and water. To sustain and increase these benefits with the help of land-based programming, the health of the Lowlands needs to be ensured, particularly through Indigenous-led conservation and land stewardship.

However, existing and proposed developments in the Lowlands are a cause for concern since they can impact the animals and plants, the ability to exercise traditional activities, and cultural and spiritual connections to the land. As mentioned by the interviewees, these developments are

- the Churchill River Diversion[31] and the big fluctuations in the water level,
- the rocks[32] harvested along the coastline off Churchill to repair the rail line,
- tourism practices and their impacts on the movement of animals and their well-being,
- concerns around the redevelopment of Port Nelson[33] to allow it to accept major shipping and potentially transport fossil fuels from out West, and
- the impacts of global warming.

The interviewees mentioned that the relationships developed with the land call for a moral responsibility to protect nature in the Lowlands.

> "We [humans] are only one piece of that puzzle. And if you affect one piece of that puzzle, something else, it'll be affected. It'll be ripple effects. So you gotta be careful in what you do. Like right now it's so unbalanced with all the development. […] We need to let Mother Nature heal herself because we've been picking at her for decades already, and we need to allow her to get her strength back, to make things more natural."
>
> Conway Arthurson
> Senior Advisor to Council, Fox Lake Cree Nation

The following section reviews major developments in the Hudson Bay Lowlands and their potential impact on the value of the ecosystem.

[31] For more information about the diversion, see: https://www.hydro.mb.ca/corporate/facilities/water_levels/churchill_river_diversion/

[32] For more information about rock harvesting, see: https://www.manitoba.ca/iem/geo/field/roa00pdfs/00gs-39.pdf

[33] For more information about the Port Nelson redevelopment, see: https://www.winnipegfreepress.com/breakingnews/2023/08/05/deepwater-port-project-seeks-to-revive-century-old-proposed-trade-route

5.0
Potential Development and Impacts on EGS Values

The EGS assessment provides an overview and understanding of the economic values generated by the Hudson Bay Lowlands in Manitoba from its ecological processes. It also allows us to understand the potential impacts on ecosystem services from mineral, hydrocarbon, or hydroelectricity developments if they were to take place. The values generated by an intact ecosystem like the Hudson Bay Lowlands—including the value of stored carbon, fish for food and recreation, ecotourism, clean water, and regulation of larger systems—could be lost with mining, hydroelectricity, or other development.

There are currently no roads connecting the Hudson Bay Lowlands to southern Manitoba, which has limited the commercial viability of logging and other developments. Road construction within the region is also limited by the vast expanses of wetlands. However, recent upgrades to the rail line to the Port of Churchill and longer ice-free periods in Hudson Bay have increased the commercial viability of developments in the region.

The following section describes the hypothetical development scenarios in the Hudson Bay Lowlands in Manitoba and their likely implications on EGS without presenting changes in monetary values.

5.1 Mineral and Hydrocarbon Development

Mining activities can produce long-lasting effects on the environment and the health of local communities. While several mineral explorations have taken place in the Hudson Bay Lowlands, exploration success remains low, in part due to the challenging, drift-covered terrain (Nicolas & Lavoie, 2012).

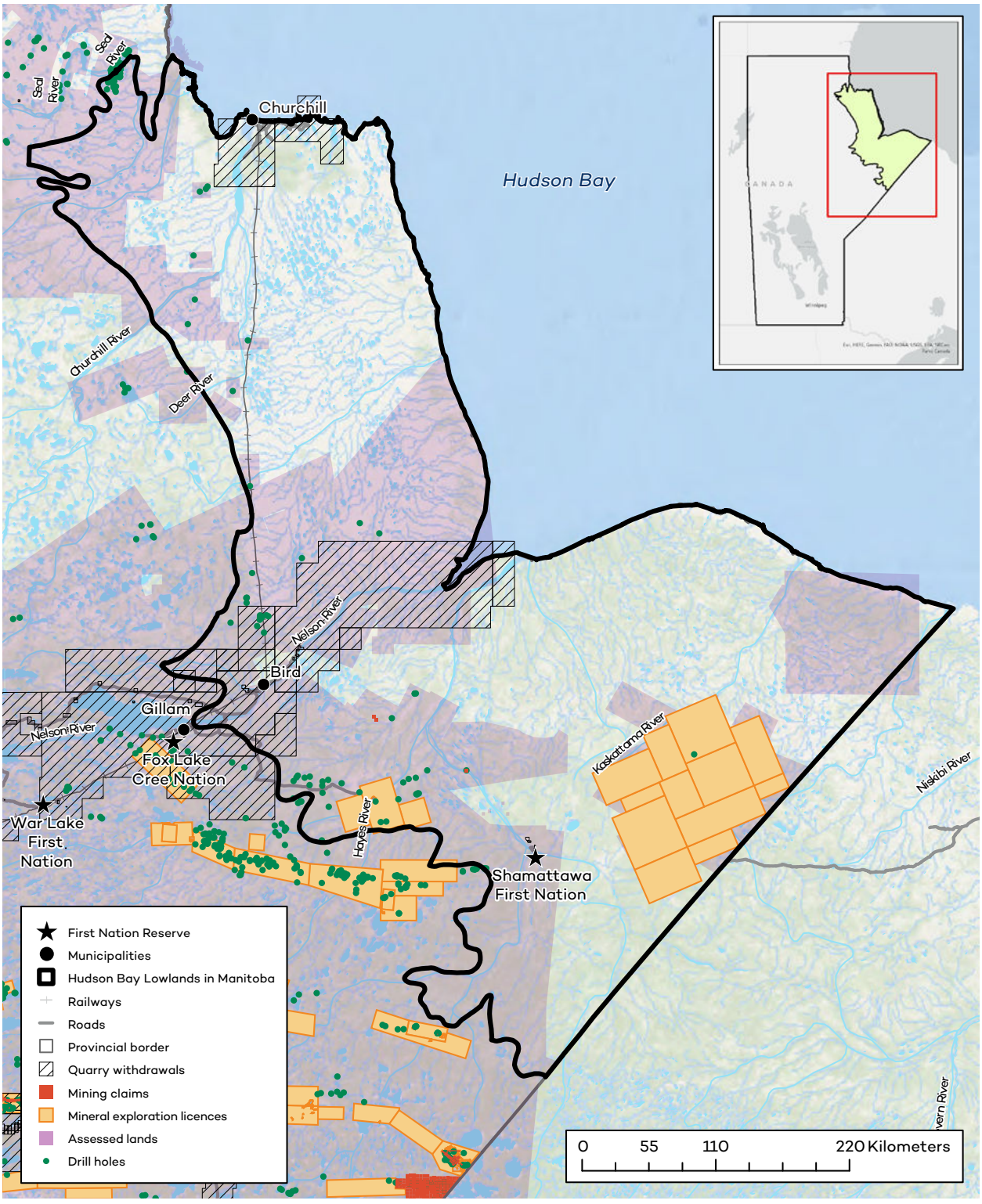
There are no active mine sites within the Hudson Bay Lowlands in Manitoba. However, according to the Province of Manitoba's Mineral Disposition map gallery,[34] there are a handful of small sites in the upstream reaches of the Hayes (10 sites) and Nelson (~25 sites) rivers outside the boundary of Manitoba's Hudson Bay Lowlands. Among these sites, only six are currently operational and are producing copper, nickel, gold, silver, cobalt, and zinc.

There are about 40 drill holes for mineral exploration across the Lowlands in Manitoba. It must be noted that the data does not provide a date of the drilling, so many of these drill holes could be relatively old. There are four active mining claims within the Hudson Bay Lowland area, all by WS Ferreira Ltd., along the same region of the Hayes River. All of these mining claims are 250 hectares or less. There are several active mineral licences along the eastern border of Manitoba and along the Hayes River. See Figure 11 for the mining and quarrying activity map.

The relatively new quest for critical minerals to support the green energy transition could lead to increased exploration of the Hudson Bay Lowlands within Manitoba in the coming years (Government of Manitoba, 2024).

[34] Find the Map Gallery viewer here: https://rdmaps.gov.mb.ca/Html5Viewer/index.html?viewer=MapGallery_Mining.MapGallery

Figure 11. Mining and quarrying activity in the Hudson Bay Lowlands in Manitoba



Source: Authors' diagram, based on data from the Government of Manitoba's GIS Map Gallery (Government of Manitoba, n.d.-h).

There has been very little hydrocarbon exploration in the Hudson Bay basin, with the most recent efforts dating back more than 35 years. Only nine wells have been drilled: five offshore in the basin's centre and four onshore, three of which are in Manitoba (Nicolas & Lavoie, 2012). However, new research on the hydrocarbon systems in the Hudson Bay Lowlands has shed light on the potential of hydrocarbons, concluding that the Hudson Bay basin has, at least locally, hypothetically higher oil potential than previously assumed (Dewing et al., 2023; Lavoie et al., 2019). While oil reserves have been estimated, their extraction has not been economically attractive.

Currently, there are no offshore mineral or hydrocarbon developments in Hudson Bay. Although there has been some mineral exploration and oil drilling in the southwestern Hudson Bay area, specifically the Hudson Platform, no oil or gas has been found, and no exploration activities are ongoing (Lavoie et al., 2019; Stewart & Lockhart, 2005).

If mining activities were undertaken in the Hudson Bay Lowlands, there could be long-lasting impacts on the wildlife and local populations. Moreover, finding the right solutions and implementing activities to stop and prevent negative effects can take considerable amounts of time and resources. For example, in the case of the Giant gold mine, situated on the shores of Great Slave Lake in Yellowknife, NWT, and active from 1948 to 2004, the process of gold extraction from arsenopyrite rock created large quantities of a highly toxic by-product—arsenic trioxide dust—which was stored in chambers underground (Government of Canada, 2019). The cost of remediation is measured at CAD 4.38 billion to prevent contamination of the surrounding water over the long term, and it will not be completed until 2038 (Cohen, 2022; Struzik, 2023). In another case, the historic operations of a radium and uranium refinery in the municipality of Port Hope, Ontario, resulted in the accumulation of radioactive waste and contaminated soils that will cost CAD 2.6 billion for the clean-up and long-term monitoring of the new waste management facility, which will not be completed until 2031 (Canadian Nuclear Laboratories, n.d.; Government of Canada, 2021b).

5.2 Hydroelectric Development

Hydroelectric projects have the highest existing and potential future impacts on the ecosystems of the Hudson Bay Lowlands in the short and long terms (Stewart & Lockhart, 2005). Hydroelectric development alters river flows and can result in flooded land, thus impacting aquatic and terrestrial habitats and the ability to practice traditional Indigenous livelihoods (CBC News, 2018; Elkaim, 2020). Artificial fluctuations in water levels lead to erosion and difficulties navigating the water by boat (CBC News, 2018; Elkaim, 2020). Moreover, hydroelectricity contributes to the release of GHGs and the growing problem of climate change. Flooding of the land fuels microbial decomposition, which converts organic matter stored in above- and belowground biomass into GHG emissions (Deemer et al., 2016; Harrison et al., 2021; Soued et al., 2022). Methane is also released as water, and the dissolved GHGs approach and tumble their way through the turbines that generate electricity (Turns, 2024). For a long time, the global carbon footprint of reservoirs has not been comprehensively explored; however, dams' environmental impacts are higher than previously understood (Helmholtz Centre for Environmental Research – UFZ, 2021).

Currently, there are no plans for new dams in Manitoba (Bacher & Beaton, 2021). However, there have been hydroelectric projects built in the past few decades that have had considerable impacts on local First Nations and the overall ecosystem. In 1976, 75% of the flow of water from the Churchill River was diverted into the Nelson River, using South Indian Lake as a water reservoir to produce hydroelectric power (Stewart & Lockhart, 2005). This has reduced runoff from the Churchill River while increasing it in the Nelson River. Raising the levels of South Indian Lake also meant the Indigenous community of South Indian Lake had to relocate because of flooding, and the surrounding land was permanently altered. The community was forced to relocate to the other side of the lake, and the project ultimately had many negative impacts on wildlife and the health of the community (Kischi Sipi Namao, n.d.). Due to the lack of baseline marine data, the long-term effects of these diversions on the marine environment are not well understood (Stewart & Lockhart, 2005). There is uncertainty and controversy surrounding the environmental impacts of altering the seasonal runoff regime by damming rivers that flow into Hudson Bay (Stewart & Lockhart, 2005).

To meet growing domestic and external energy demand, Manitoba Hydro considered the construction of two more projects on the Nelson River—the 695 MW Gull (Keeyask) Generating Station about 30 km west of Gillam and the 1,380 MW Conawapa Generating Station on the lower Nelson River (Manitoba Hydro, 2022).

The Keeyask Generating Station was brought online in 2021 (Manitoba Hydro, 2022), built within the Split Lake Resource Management Area immediately upstream of Stephen's Lake between two existing Manitoba Hydro generating stations. The Keeyask Cree Nations evaluation processes and environmental effects assessment acknowledged and summarized some of the effects the project will have on the physical, aquatic, and terrestrial environments (Keeyask Hydropower Limited Partnership, 2012).

As part of the approval of the Keeyask Generating Station, Manitoba's Public Utilities Board recommended not to approve the construction of the Conawapa Project due to the risks associated with it and its speculative nature, given the changing conditions in North American electricity markets (The Public Utilities Board, 2014).

While there are no further hydroelectric development plans for Northern Manitoba and the Hudson Bay Lowlands, hydroelectric developments have already altered the flow regimes of the Churchill and Nelson rivers, which drain into southwest Hudson Bay (Bacher & Beaton, 2021; Durkalec et al., 2021). The impacts of these changes on the estuaries cannot be accurately assessed in the absence of pre-project data. However, the impacts on northern Indigenous communities have historically been adverse (Shebahkeget, 2023; Wilt, 2019). The flooding of rivers to create reservoirs has submerged thousands of km^2 of land, which has led to the loss of unique and valuable wildlife habitat. The flooding has also caused erosion and destabilized shorelines. As a result, fisheries were destroyed and traplines were flooded or made inaccessible by fences where it had not flooded. Traditional livelihoods were irreversibly damaged, and the sharing of land-based knowledge was interrupted. Some communities experienced a forced transition to a wage economy or, worse, were forced to relocate (Wa Ni Ska Tan, n.d.). The effects

of such modifications to the land are long lasting for wildlife and people, and the disturbed balance is extremely difficult to restore. If another dam were to be constructed on the rivers of the Lowlands, the pristine nature of the region would be altered, with consequences for species, traditional activities, tourism, and climate change mitigation efforts.[35] Therefore, the total environmental, cultural, and social costs and local priorities of Indigenous communities need to be thoroughly considered in any decision about dam planning and construction.

5.3 Transportation

No roads connect the Hudson Bay Lowlands to the rest of North America. Most people access the region by air, though a twice-weekly passenger train service is popular with some residents and tourists. Major upgrades to the railway were supported by the federal and provincial governments after flooding in 2017 led to an 18-month closure, which had significant impacts on regional communities. Ownership of the Hudson Bay Railway was also transferred to a partnership of 41 First Nation and Bayline communities called Arctic Gateway Group Limited (Bergen, 2022). These upgrades sparked conversations about using the railway for future energy exports through Churchill, increasing the uncertainty and potential risk this could have on the Hudson Bay Lowlands marine ecosystem (Canadian Press, 2022).

Hudson Bay sees yearly vessel traffic that includes freighters for grain shipment and ships or coastal barges providing northern communities with food, dry goods, and fuel. It is mostly limited to the open water season, and icebreaking is seldom required (Stewart & Lockhart, 2005). Influenced by trade relations, sea ice conditions, and extractive prospects, shipping through the Northwest Passage is expected to grow over the coming 25 years (Durkalec et al., 2021). According to projections, the average ice-free season in Hudson Bay is projected to extend by 49 days between 2041 and 2070, increasing the ice-free shipping period and the potential for new northern ports (Durkalec et al., 2021). In response to this emerging pressure, the federal government has been working with affected communities to establish low-impact shipping corridors (Durkalec et al., 2021). Plans have emerged to modernize shipping facilities at Port Nelson, including upgrading the Nelson Slipway with a CAD 20 million redevelopment project that started in June 2023 (Port Nelson, 2023, 2024; RNZ, 2023). Additionally, there's a proposal to utilize Port Nelson for shipping potash from Saskatchewan and petroleum products from Alberta through the Arctic Ocean as part of the NeeStaNan project (Kives, 2023; NeeStaNan, n.d.). Manitoba has pledged CAD 6.7 million to study the feasibility of the NeeStaNan corridor, contingent on funding from Alberta, Saskatchewan, and First Nation communities toward the total cost of CAD 26.6 million (Government of Manitoba, 2023a). If implemented, the project would reduce the shipping distance of Prairie commodities such as potash and bitumen to international markets by over 30%; however, it would also pose a risk to the fragile ecosystem of the Lowlands due to potential spills and the remoteness of the region for timely remediation (Kives, 2023; NeeStaNan, n.d.).

[35] Flooding of the new land to create reservoirs can result in additional carbon from the flooded soil being transformed into GHG emissions (International Hydropower Association, 2021).

Overall, since ecologically significant regions cover most of the Hudson Bay coastline, the threats to these sensitive areas cannot be entirely removed (Durkalec et al., 2021). There will always be potential for oil spills during community re-supply, the introduction of toxic substances, and disturbances to marine mammals and seabird colonies by vessels and tourists (Stewart & Lockhart, 2005).

6.0
Conclusion

The Hudson Bay Lowlands region in Manitoba is an estimated 97.5% intact and holds immense value due to its globally significant carbon stocks, diverse wildlife, and rich Indigenous heritage. An EGS assessment of many significant benefits revealed that the region provides at least CAD 247.7 million annually in services related to biodiversity, hunting, tourism, and mental health. However, this valuation only captures a portion of the total value, as it does not encompass aspects like the economic value of tourism beyond Churchill, the cultural significance of the Lowlands, or the willingness of non-Manitoba residents to conserve its species. Furthermore, the region plays a crucial role in mitigating climate change, with its trillion-dollar carbon storage value.

The qualitative insights gathered through interviews with local Indigenous residents opened new dimensions of value and highlighted the importance of preserving the integrity of the local environment for Indigenous culture, mental health and well-being, community bonding, active living, and reconciliation. They demonstrated that there is an immense depth in perception and interaction with the natural environment that should also be accounted for in policy-making and decision-making processes related to conservation and development.

The largely pristine nature of the Lowlands; its rich cultural heritage, with Cree, Métis, and Dene communities having historical ties to the Lowlands; and the coast position this region well for conservation and protection under an IPCA to meet Canada's and Manitoba's targets to protect 30% of its lands by 2030 and advance reconciliation.

While development activities in the region are currently limited, proposed projects like the Port Nelson redevelopment and the NeeStaNan corridor pose threats to its sensitive ecosystems. Also, the growing interest in mining critical minerals for the green energy transition makes conservation planning in advance of mineral exploration a wise investment.

Given the rapid decline of large wild areas, safeguarding Manitoba's Hudson Bay Lowlands for future generations is imperative. Implementing Indigenous-led conservation initiatives will not only protect the environment but also empower local Indigenous nations, leading to a more equitable and sustainable future for all.

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Appendix A. Calculation of the Intactness of the Hudson Bay Lowlands in Manitoba

Intactness of the Hudson Bay Lowlands in Manitoba was calculated using Canada's Intact Forest Landscapes dataset (CIFL) (Global Forest Watch, 2016), last updated in 2013 (for a review of forest cover, human impact, and intactness datasets; cf. Vernier et al., 2021). To minimize errors in the area calculations (e.g., from overlapping polygons), the total impacted area was calculated by removing the CIFL intact areas from the total Hudson Bay Lowlands in Manitoba (determined using the Terrestrial Ecoregions of Canada open dataset [Government of Canada, n.d.-b]). This total impacted area was then calculated to be 1,675 km^2—about 2.5% of the total 67,181 km^2 area of the Hudson Bay Lowlands in Manitoba. This shows that the region is 97.5% intact. Further analysis of the CIFL's human impact dataset suggests that, of the 1,675 km^2 of impacted land in the region, 282 km^2 (about 17%) was impacted between 2000 and 2013 alone.