



*The Status of Biodiversity in the*  
**NORTH SASKATCHEWAN**  
**REGION**



*[THIS REPORT DESCRIBES THE STATUS OF BIODIVERSITY AND HUMAN FOOTPRINT IN THE NORTH SASKATCHEWAN REGION]*

*In partnership with:*



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*THE CHESTNUT-COLLARED LONGSPUR  
IS ONE OF SEVERAL GRASSLAND-  
ASSOCIATED SPECIES FOUND IN THE NORTH  
SASKATCHEWAN REGION. READ MORE ON  
PAGES 22 AND 34.*

# About the ABMI

The Alberta Biodiversity Monitoring Institute (ABMI) is an arm's-length, not-for-profit scientific organization. The business of the ABMI is to monitor and report on the status (current condition) and trends of Alberta's species, habitat, and human footprint.\* The goal of the ABMI is to provide relevant scientific information on the state of Alberta's biodiversity to support natural resource and land-use decision making in the province.

The ABMI is jointly delivered by Alberta Innovates - Technology Futures, the Royal Alberta Museum, the University of Alberta, and the University of Calgary. The ABMI Board of Directors includes representatives from the Government of Alberta; environmental non-governmental organizations; the forest, energy, and agriculture sectors; and the research community.

The ABMI reports on a range of biodiversity indicators that act as a guide for establishing biodiversity-related management goals and tracking performance against those goals. Notwithstanding, the ABMI is not a management agency and does not make management recommendations. The ABMI generates value-neutral, independent, and publicly accessible data.

The ABMI is guided by a core set of principles—we are independent, objective, credible, accessible, transparent, and relevant.



\*The ABMI defines "human footprint" as the visible conversion of native ecosystems to temporary or permanent residential, recreational, agricultural, or industrial landscapes.

# Report Summary

The Alberta Biodiversity Monitoring Institute (ABMI) measures and reports on the state of biodiversity and human footprint across the province. This report presents data on several indicators of environmental health for the North Saskatchewan Region of Alberta, one of seven land-use planning regions in the province.

The North Saskatchewan Region makes up 13% of Alberta's land area. Bisecting the province and encompassing five of Alberta's six natural regions, this varied landscape includes a diversity of ecosystems and land uses.

As of 2012, human footprint covered 53.3% of the North Saskatchewan Region, up from 50.1% in 1999.\*\* This increase was largely due to forestry footprint, which increased from 1.0% to 2.3% in the region. Agriculture footprint is the largest human footprint, covering 44.4% of the North Saskatchewan Region, and is located predominantly in the Parkland (69.2%), Boreal (45.6%), and Grassland (49.2%) Natural Regions. Transportation footprint was evenly dispersed across much of the region, covering 2.5% of the area. Forestry footprint, almost entirely located in the Foothills Natural Region, covers 2.3% of the area.

Overall, 10% of the North Saskatchewan Region is managed as protected areas, with Banff National Park accounting for the majority.

The ABMI assessed the status of 542 species in the North Saskatchewan Region and found them to be, on average, 65% intact.† Biodiversity intactness by natural region ranged from 55% in the Parkland Natural Region to 87% in the Foothills and Rocky Mountain Natural Regions. At present, the biggest ecological changes are associated with the lower than

expected abundance of species that require native prairie habitat for breeding, such as Baird's Sparrow, Sprague's Pipit, and many vascular plant species. A number of these species are at the northern extent of their breeding range in the Parkland Natural Region of the North Saskatchewan Region.

Additional results of note include the following:

- *Species that thrive in agricultural landscapes or disturbed habitat, such as the Coyote, Song Sparrow, and Red Fescue, were more abundant than expected.*
- *Species that prefer old-forest habitat, like the Brown Creeper, Marten and Fisher, and Spreading Woodfern, were found to be less abundant than expected.*
- *A total of 78 non-native plants were detected in the North Saskatchewan Region, including 9 noxious weeds and 15 nuisance weeds as defined by Alberta's Weed Control Act.*
- *The ABMI assessed the status of 37 species at risk‡ in the North Saskatchewan Region. Of the assessed species, most were less abundant than expected.*

This report describes the current status of biodiversity in the North Saskatchewan Region. Over the next few years, the ABMI will broaden its assessment of biodiversity to include status and trend reporting for lichens and wetlands, as well as trend analysis for all species groups included in this report. These same assessments will be generated and updated for all seven planning regions in the province.

\*\*The measure of forestry footprint includes both recent and older logging activity in the region. The ABMI is currently conducting research to determine how to account for the recovery of biodiversity in forests that are regenerating following logging.

†The ABMI's Intactness Index is used to report on the health of biodiversity within regions of Alberta. The index ranges from 100% intact to 0% intact—an area with little evidence of human impact is nearly 100% intact; a parking lot surrounded by big-box stores is nearly 0% intact. The Species Intactness Index is a measure of how much more or less common a species is relative to its respective reference conditions.

‡Threat categories for species at risk as identified by the Government of Canada and/or the Government of Alberta. This assessment includes species identified by Canada's Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as Endangered, Threatened, Special Concern, or Data Deficient; Canada's Species at Risk Act (SARA) as Endangered, Threatened, or Special Concern; Alberta's Ministry of Environment and Sustainable Resource Development (ESRD) as May Be at Risk, At Risk, Sensitive, or Undetermined; Alberta's Endangered Species Conservation Committee (AB ESCC) as Endangered, Threatened, Special Concern, Data Deficient, or In Process.

# Introduction

Alberta has experienced tremendous economic growth in recent decades, largely driven by resource development in the forest and energy industries. This development, along with a long history of agriculture in many parts of the province, has led to competing demands on the land base. To deal with these pressures, the Government of Alberta has initiated the Integrated Resource Management System (IRMS). The goal of the IRMS is to understand and manage the cumulative effects of economic development on Alberta's environment and communities.<sup>[1]</sup> Under this approach, targeted outcomes must be defined for environmental values (e.g., wildlife, water quality, fisheries) as well as social and economic values. Two government initiatives figure strongly in the province's IRMS—regional planning under Alberta's Land-use Framework and Alberta's environmental monitoring system.

Under the Land-use Framework, the Government of Alberta is developing seven land-use plans. In August 2012, the government approved the first of these plans—Lower Athabasca Regional Plan (LARP)<sup>[2]</sup>—followed by the South Saskatchewan Regional Plan in September, 2014. A large part of this planning process is managing the long-term trade-offs associated with economic, social, and environmental priorities. In support of the planning process, the Government of Alberta has stated that these land-use plans will identify clear environmental objectives for air, land, water, and biodiversity.

The ABMI is an independent monitoring organization that contributes to Alberta's environmental monitoring system. We measure the health of biodiversity and changes in human land use (i.e., human footprint) in Alberta, including the seven planning regions. Our biodiversity, habitat, and human footprint data are designed to measure progress toward environmental outcomes as identified in each land-use plan.

In this report, we describe the status of species, native habitat,\* and human footprint in one of the seven land-use planning regions—the North Saskatchewan Region (Figure 01). We report the current status of hundreds of species and highlight those that show the most sensitivity to human development. We also provide information on trend of human footprint over the past 13 years. The information in this report can be used as a foundation for evaluating the sustainability of resource development in the North Saskatchewan Region.

\*The ABMI defines "native habitat" as undeveloped habitat that is distant enough from human footprint that it meets the particular management objectives of stakeholders.

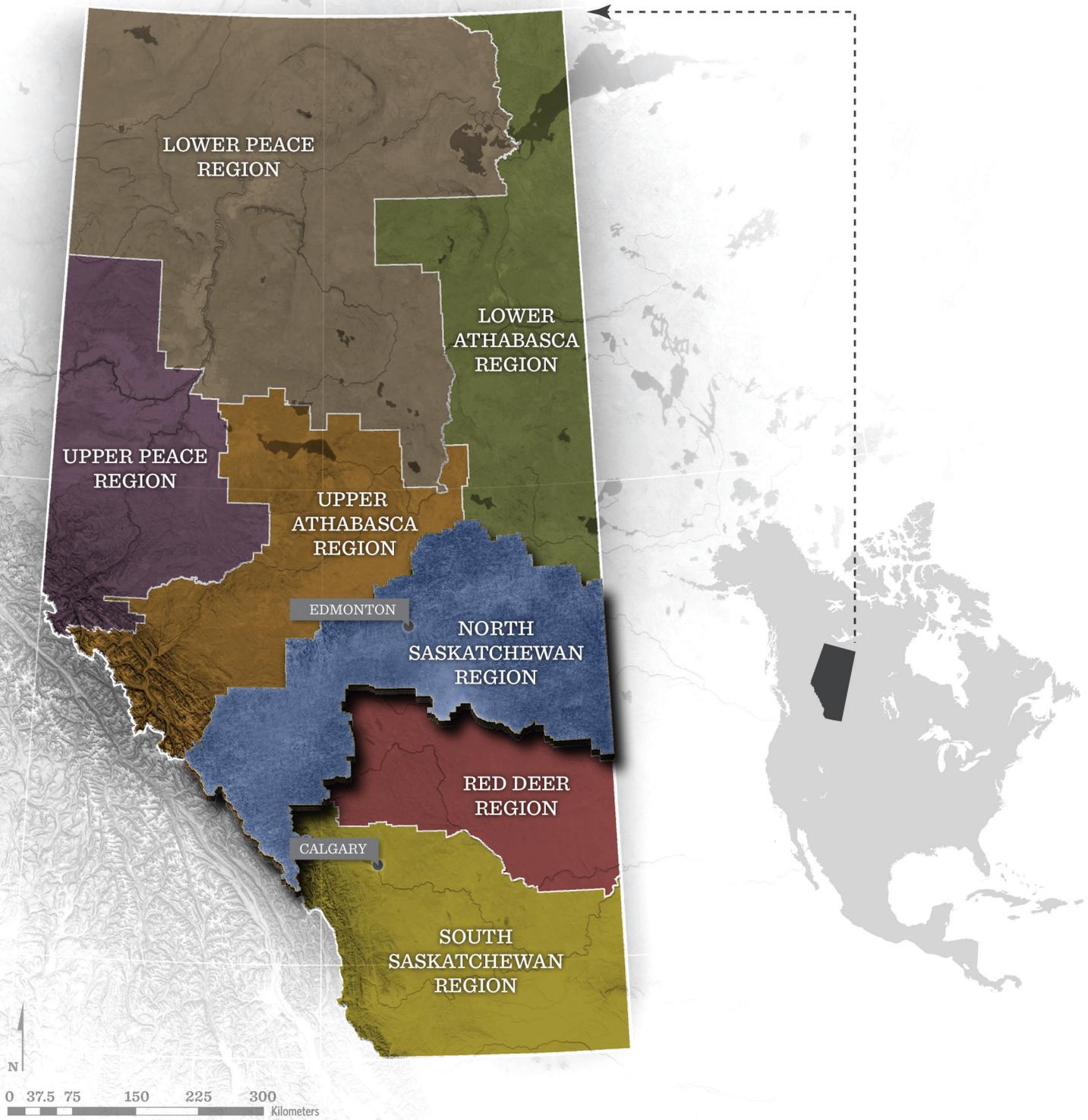


FIGURE 01

THERE ARE SEVEN LAND-USE PLANNING REGIONS IN ALBERTA; THIS REPORT FOCUSES ON THE NORTH SASKATCHEWAN REGION.

# Why Biodiversity Matters

Biodiversity is the variety of life on Earth—from the multitude of species that live in a drop of water to the vast array of wildlife that depends on the world’s largest ecosystems. Though its importance is not always immediately evident, biodiversity is critical to human health and well-being, providing us with a number of benefits that we often take for granted.

For example, ensuring healthy aquatic ecosystems in our environment is the most cost-effective way of providing a clean and reliable source of drinking water.<sup>[3]</sup> Productive forest ecosystems grow trees that not only supply our sawmills and pulp mills, but also

act as an important storehouse of carbon, which helps to mitigate climate change. Approximately one-third of the fruits and vegetables we buy at the grocery store require pollination by the many insect species that are an important part of biodiversity. In addition, the products we find in our medicine cabinets are often derived from plants. In fact, approximately 25% of the world’s bestselling prescription medications are derived from plant-based biodiversity products.<sup>[4]</sup> And finally, natural areas provide opportunities for hiking, hunting, fishing, and berry picking. Biodiversity is all around us every day, and it plays an enormous role in supporting our way of life.



# ABMI Measures Biodiversity

From the boreal forest in the north to the grasslands in the south, the ABMI monitors the state of Alberta's biodiversity. To do this, the ABMI employs a systematic grid of 1,656 site locations, spaced 20 km apart, to collect biodiversity information on terrestrial and wetland sites (Figure 02).

At each location, ABMI technicians record the species that are present, and measure a variety of habitat characteristics. For species that cannot be identified in the field (e.g., mites and lichen), ABMI taxonomists at the Royal Alberta Museum sort, identify, and archive samples to complete the Institute's species-level dataset. Through our field and laboratory efforts, the ABMI tracks over 2,000 species.

The ABMI's Geospatial Centre also monitors the state of Alberta's human footprint at two spatial scales:

1. Using a sampling design, the ABMI monitors human footprint annually in a  $3 \times 7$  km area around each ABMI site location. These detailed annual samples of human footprint are available from 1999 to 2012, except for 2000 and 2006.\*
2. At the provincial scale, existing satellite imagery is used to create a wall-to-wall inventory of human footprint of the entire province. This Inventory of Provincial Human Footprint is a compilation of externally sourced information about provincial human footprint, supplemented with ABMI remote sensing data that has undergone quality-control procedures. The Inventory of Provincial Human Footprint is available for 2007 and 2010.

These mapped products are updated at regular intervals to track changes in human footprint and habitat through time.

The ABMI's dataset is used to identify relationships between human land use, habitat, and species abundance when and where they exist. The scale and depth of the ABMI's monitoring program described above make it a unique program nationally, and a leader internationally. Members of the ABMI's Science Advisory Committee (an external review board) describe the ABMI as "one of the premier monitoring programs in the world" (Dr. Reed Noss of the University of Central Florida) and "leading the biodiversity monitoring charge in Canada" (Dr. Jeremy Kerr of the University of Ottawa).

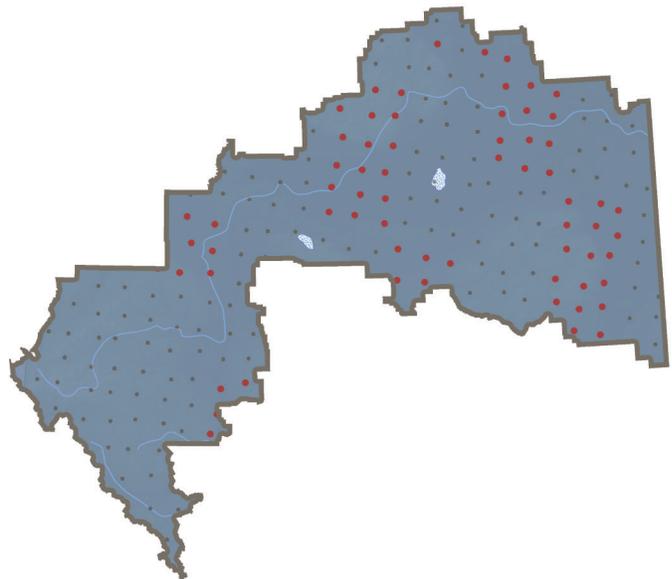


FIGURE 02

THE NORTH SASKATCHEWAN REGION REPRESENTS 13% (85,787 km<sup>2</sup>) OF ALBERTA'S TOTAL LAND AREA. THE ABMI HAS 210 OF OUR 1,656 SURVEY SITES IN THE NORTH SASKATCHEWAN; 68 OF THESE SITES HAVE BEEN SAMPLED FROM 2003 TO 2012.

\*Trend data from the years 2000 and 2006 are not included because data from those years are unreliable.

# Biodiversity Indicators in This Report

Habitat loss is a major driver of biodiversity decline on the planet.<sup>[5]</sup> In the North Saskatchewan Region, habitat is being modified by, or lost to, a range of human activities, particularly agriculture, forestry, and energy development. Responsible management of this region depends on understanding the complex interactions between species, habitat, and human footprint. Our data is used to generate indicators of these factors in the following ways:

## Species

To assess the status of species, the ABMI collects and analyzes data on breeding birds, winter-active mammals, armoured mites, vascular plants, and mosses. To report on the status of species, the ABMI has developed a metric called the Biodiversity Intactness Index. The index ranges from 0% to 100% and is interpreted as follows (see Figure 03 for a visual guide):

- *If a species is 100% intact in a given area, the abundance of the species is equal to the abundance one would expect in an area without any human footprint.*
- *As the index declines, it reflects one of two possible scenarios. In the first, the species abundance is lower relative to an area with no human footprint. In other words, the species has become rarer. In the second scenario, the species is more abundant than expected. In both instances, species abundance has been perturbed from a reference condition due to human impact.*

## Native Habitat

To assess the status of native habitat, the ABMI uses remotely sensed data. To report on the status of native habitat, the ABMI presents the percentage of land cover that has no human footprint, as well as the per cent area that is designated as protected in a region.

## Human Footprint

To assess the status of human footprint, the ABMI uses the GIS Inventory of Provincial Human Footprint and the 3 × 7 km detailed inventory of human footprint. To report on the status of human footprint, the ABMI presents the percentage of land directly altered by human activities, which is interpreted as follows:

- *0% means there is no visible human footprint.*
- *100% means the landscape has been completely modified by human footprint.*

In general, cities and cultivated fields have high human footprint, while protected and undeveloped areas have low human footprint. Trend information on human footprint is based on the 3 × 7 km detailed inventory of human footprint available from 1999 to 2012 (except for 2000 and 2006).

See the North Saskatchewan Planning Region Supplemental Report (available at [www.abmi.ca](http://www.abmi.ca)) for further details.

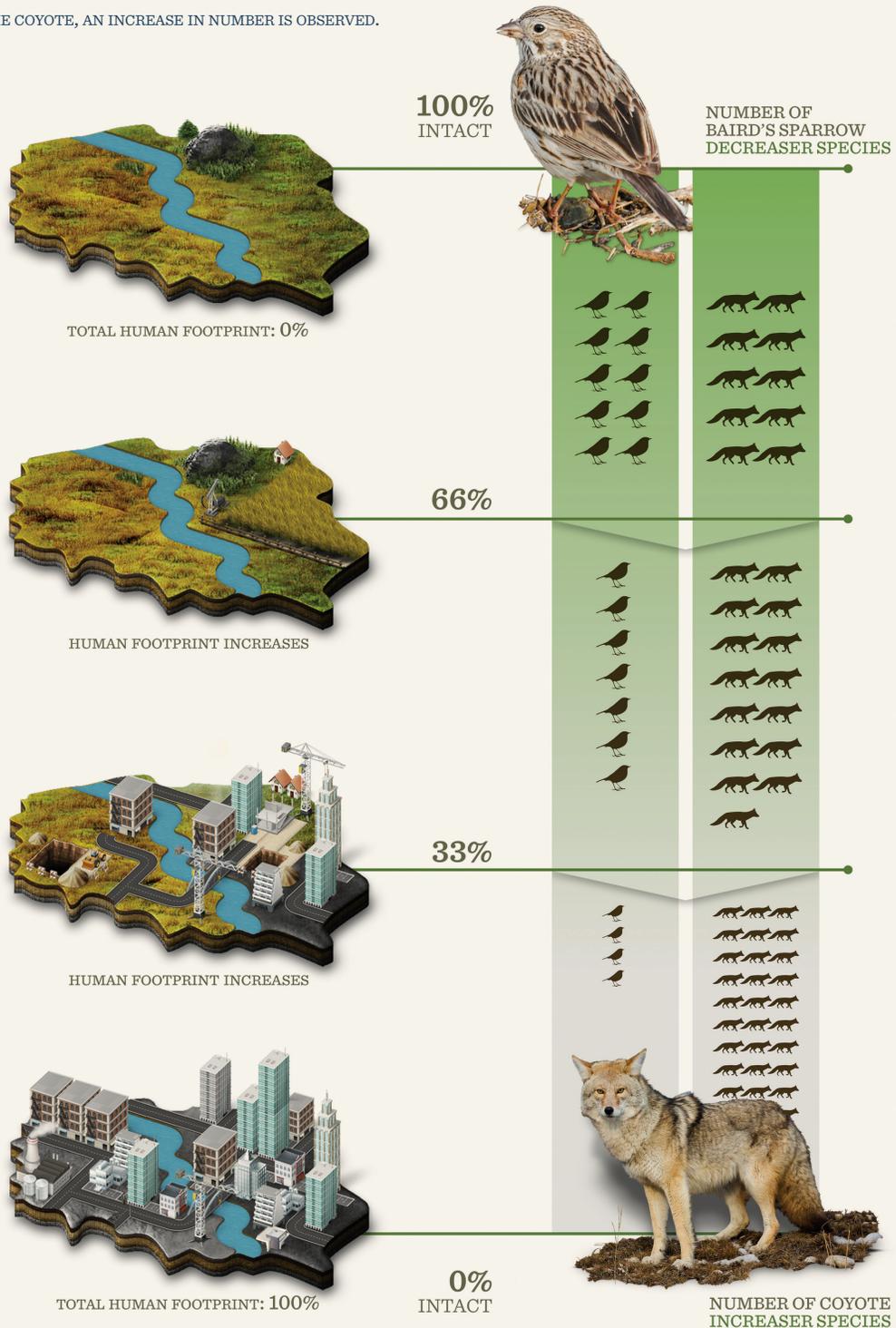
**FIGURE 03 THE ABMI BIODIVERSITY INTACTNESS INDEX**

THE ABMI USES THE BIODIVERSITY INTACTNESS INDEX TO REPORT ON THE HEALTH OF A SPECIES IN A REGION. IN THIS FIGURE, WE ILLUSTRATE HOW THE INDEX CHANGES FOR:

- A “DECREASER” SPECIES, THE BAIRD’S SPARROW
- AN “INCREASER” SPECIES, THE COYOTE

THE INTACTNESS INDEX RANGES FROM 0% TO 100%. AT 100% INTACT, THE ABUNDANCE OF BOTH SPECIES IS EQUAL TO THE ABUNDANCE EXPECTED IN AN UNDISTURBED AREA—ONE WITH 0% HUMAN FOOTPRINT. AS THE INTACTNESS INDEX DECLINES TOWARD 0%, IT REFLECTS A CHANGE IN THE ABUNDANCE OF A SPECIES IN RESPONSE TO HUMAN FOOTPRINT:

- FOR THE SPARROW, A DECREASE IN NUMBER IS OBSERVED.
- FOR THE COYOTE, AN INCREASE IN NUMBER IS OBSERVED.



# Reporting Area

The North Saskatchewan Region bisects the province from the Rocky Mountains in the west to the Saskatchewan border in the east, encompassing a diversity of ecosystems and land uses. The North Saskatchewan Region includes (Figure 04):

- 13%, or 85,787 km<sup>2</sup>, of Alberta—an area slightly smaller than the state of Maine.
- Five of Alberta's six natural regions. The Rocky Mountain Natural Region in the west gives way to the Foothills Natural Region, followed by the transitional Parkland Natural Region to the east. The Boreal Forest Natural Region also covers large areas while two small pockets of the Grassland Natural Region occur in the south.
- The Parkland Natural Region forms a broad transitional area between the drier grasslands to the south, and the boreal forest to the north. The parkland has characteristics of these surrounding ecosystems from mixed Aspen Poplar forests of the boreal to native grassland. This part of the North Saskatchewan Region has seen the greatest population growth and the most agricultural and industrial development.
- Privately owned land makes up more than 60 per cent of the region.
- The North Saskatchewan River is a glacier-fed river originating in the Rocky Mountains and flowing through the region. This is the main water supply for much of central Alberta.
- This region includes 19 Indian reserves, which belong to 14 different First Nations, two Métis settlements, and several administrative regions of the Métis Nation of Alberta. These First Nations groups are mainly descendants of the Cree, Nakota, Blackfoot, and Saulteaux-Ojibway people, who have lived in this area for millennia.

The status of biodiversity, native habitat, and human footprint in the North Saskatchewan Region is the focus of this report. Results are presented for the overall region, and broken down by Natural Region to reflect the shifts in ecosystems and land-uses moving from west to east across the region.



THERE ARE FOUR FOREST MANAGEMENT AGREEMENTS IN THE REGION, WHICH ARE RESPONSIBLE FOR APPROXIMATELY 12% OF THE PROVINCIAL ANNUAL ALLOWABLE CUT FOR CONIFEROUS FORESTS, AND 4% FOR DECIDUOUS FORESTS.

**FIGURE 04**

THE NORTH SASKATCHEWAN REGION, AN 85,787 KM<sup>2</sup> AREA IN CENTRAL ALBERTA, IS THE FOCUS OF THIS REPORT.



THE HEADWATERS OF THE NORTH SASKATCHEWAN RIVER ORIGINATE IN THE ROCKIES, PROVIDING CENTRAL ALBERTA WITH MUCH OF ITS WATER SUPPLY.



THE LARGEST CONCENTRATION OF INDUSTRIAL ACTIVITY IN ALBERTA IS LOCATED IN THE INDUSTRIAL HEARTLAND, NORTHEAST OF EDMONTON. THIS ACTIVITY INCLUDES PETROCHEMICAL PROCESSING PLANTS; OIL, NATURAL GAS, AND BITUMEN PIPELINES; TRANSMISSION LINES; AND TRANSPORTATION INFRASTRUCTURE.



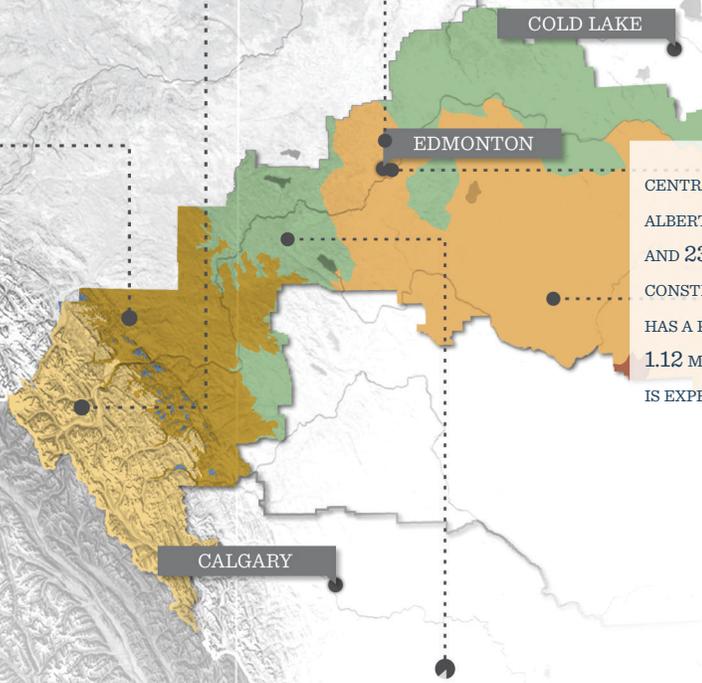
CENTRALLY LOCATED IS EDMONTON, ALBERTA'S CAPITAL CITY. EDMONTON AND 23 SURROUNDING COMMUNITIES CONSTITUTE THE CAPITAL REGION, WHICH HAS A POPULATION OF APPROXIMATELY 1.12 MILLION PEOPLE. THE POPULATION IS EXPECTED TO DOUBLE BY 2041.



AGRICULTURE, INCLUDING LIVESTOCK AND CROP PRODUCTION, IS ONE OF THE MAIN ECONOMIC DRIVERS IN THE REGION, SUPPORTING THE LIVELIHOOD OF MANY RURAL MUNICIPALITIES.

**LEGEND**

- BOREAL
- FOOTHILLS
- GRASSLAND
- PARKLAND
- ROCKY MOUNTAIN



SIX COAL MINES OPERATE IN THE NORTH SASKATCHEWAN REGION, WHICH PRODUCE MOST (~65%) OF ALBERTA'S COAL. THERE ARE TWO ADDITIONAL DEPOSITS OF COAL THAT ARE RECOVERABLE BY SURFACE MINING.



## RESULTS

HUMAN FOOTPRINT DATA, INCLUDING FOOTPRINT TYPE, AMOUNT, AND TREND, PROVIDE THE CONTEXT FOR INTERPRETING THE BIODIVERSITY INTACTNESS INDEX. AS THE PER CENT AREA OF HUMAN FOOTPRINT INCREASES, THE RISKS TO BIODIVERSITY IN THE REGION ALSO INCREASE. SOME SPECIES THRIVE IN LANDSCAPES WITH HIGH HUMAN FOOTPRINT WHILE OTHER SPECIES DECREASE IN ABUNDANCE.

# Human Footprint

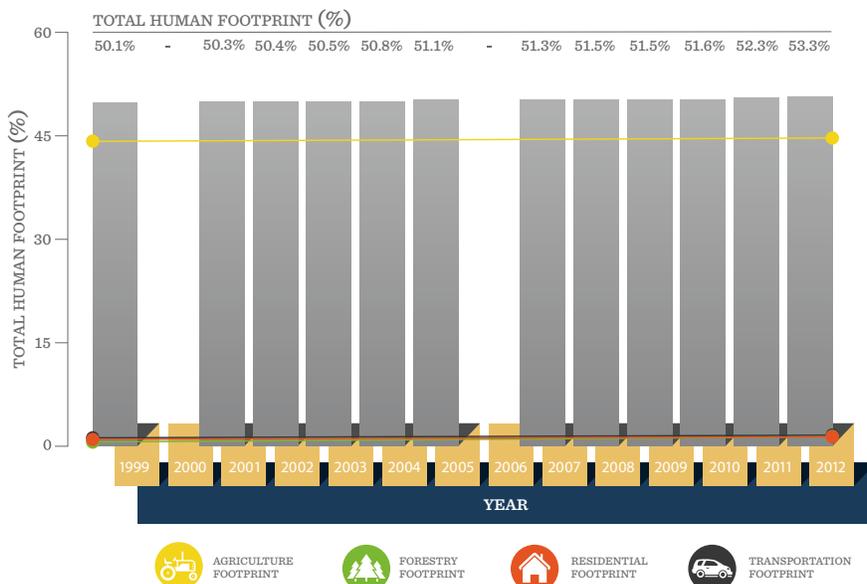
The ABMI defines human footprint as the visible conversion of native ecosystems to temporary or permanent residential, recreational, or industrial landscapes. This includes activities that support the energy, forest, and agriculture industries; residential settlement; and transportation infrastructure. At present, summaries of human footprint do not account for the recovery of biodiversity in forests that are regenerating following temporary disturbances such as logging or energy exploration (e.g., seismic lines). For example, a regenerating cutblock or seismic line is treated the same as a more recent disturbance of the same type. The ABMI is currently advancing the science necessary to account for this regeneration so that recovering areas can make a reduced contribution to the estimate of total human footprint.

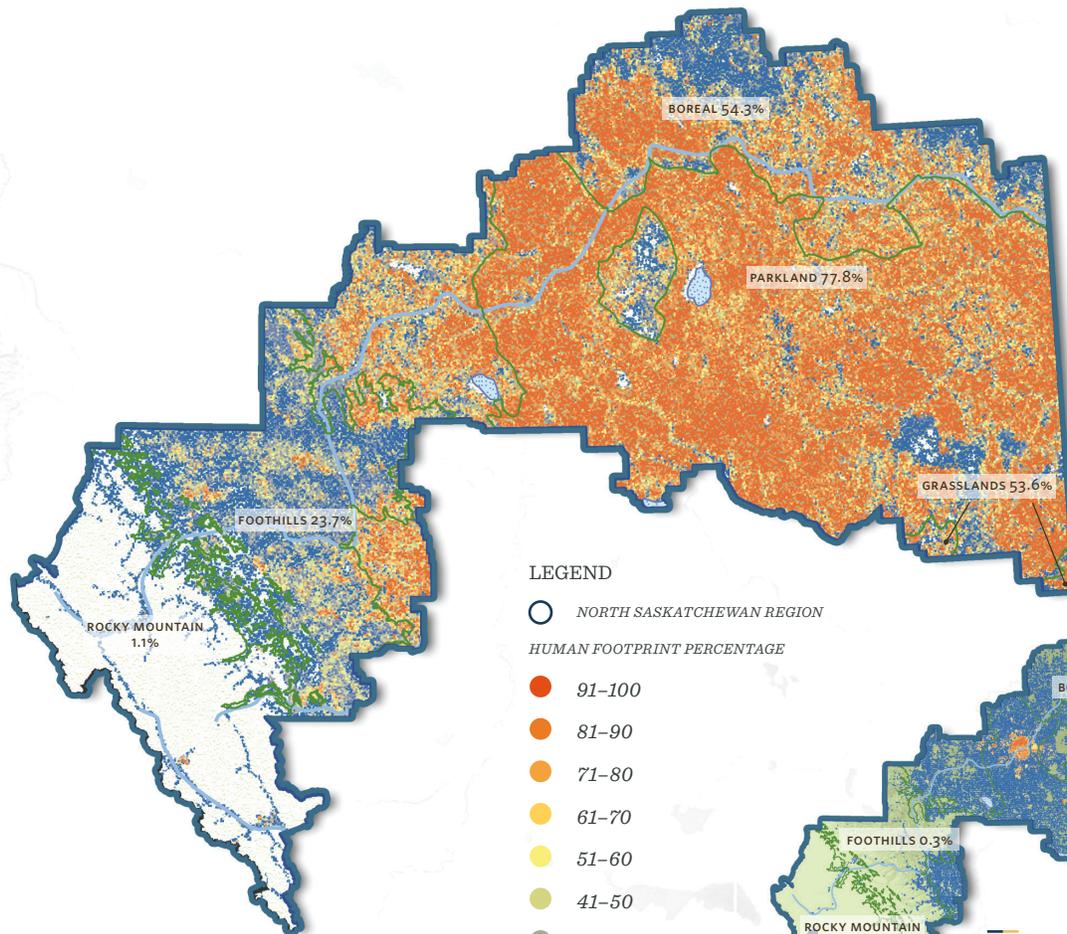
*AS OF 2012, THE TOTAL HUMAN FOOTPRINT ACROSS THE NORTH SASKATCHEWAN REGION WAS 53.3% (FIGURE 05, FIGURE 06A).*

Human footprint ranged from a low of 1.1% in the Rocky Mountain Natural Region to a high of 77.8% in the Parkland Natural Region (Figure 06A).

For the North Saskatchewan Region as a whole, agriculture footprint was the largest footprint, covering 44.4% of the area in 2012 (Figure 06B). Furthermore, agriculture was the dominant footprint in the Parkland, Boreal, and Grassland Natural Regions. Agriculture footprint is a legacy of the rich farming history in this region. The construction of the national railroad, combined with federal policies aimed at settling Western Canada, supported the conversion of much of the region's native parkland into cultivated agricultural land. Transportation footprint, the second-largest footprint at 2.5%, is evenly dispersed across much of the region (Figure 06C), followed closely by forestry footprint (concentrated in the Foothills Natural Region) at 2.3% (Figure 06D), and residential footprint at 2.0% (Figure 06E). Energy footprint and commercial footprint each covered approximately 1% of the North Saskatchewan Region (maps not shown).

The total area of human footprint in the North Saskatchewan Region increased by 3.2% between 1999 and 2012 from 50.1% to 53.3% (Figure 05). Forestry footprint showed the largest growth, increasing from 1.0% in 1999 to 2.3% in 2012, followed by commercial footprint, which increased by 0.7%, and agriculture footprint, which increased by 0.6%.





LEGEND

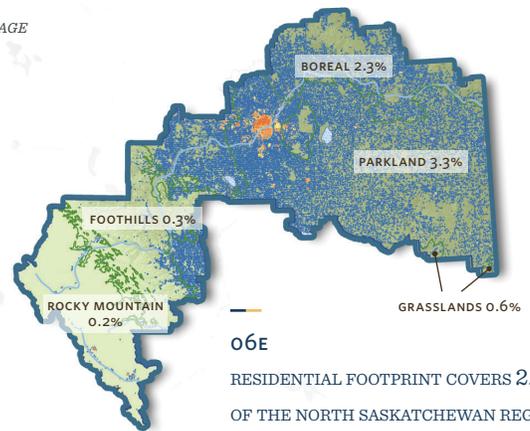
○ NORTH SASKATCHEWAN REGION

HUMAN FOOTPRINT PERCENTAGE

- 91-100
- 81-90
- 71-80
- 61-70
- 51-60
- 41-50
- 31-40
- 21-30
- 11-20
- 1-10
- 0

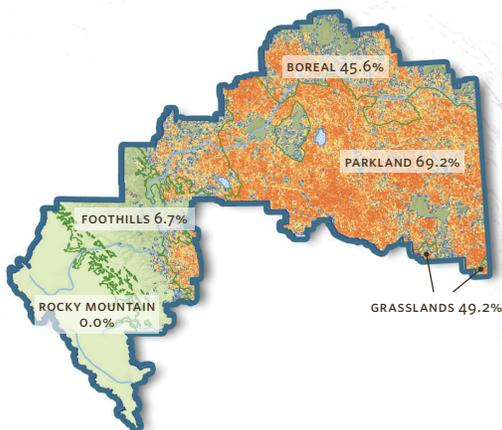
06A

TOTAL HUMAN FOOTPRINT COVERS 53.3% OF THE NORTH SASKATCHEWAN REGION. TOTAL HUMAN FOOTPRINT IS ALSO SUMMARIZED BY NATURAL REGION.



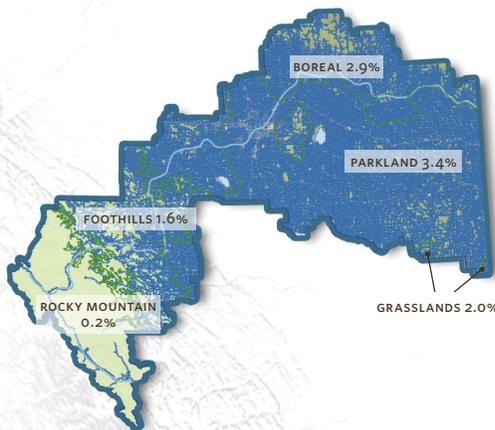
06E

RESIDENTIAL FOOTPRINT COVERS 2.0% OF THE NORTH SASKATCHEWAN REGION. RESIDENTIAL FOOTPRINT IS ALSO SUMMARIZED BY NATURAL REGION.



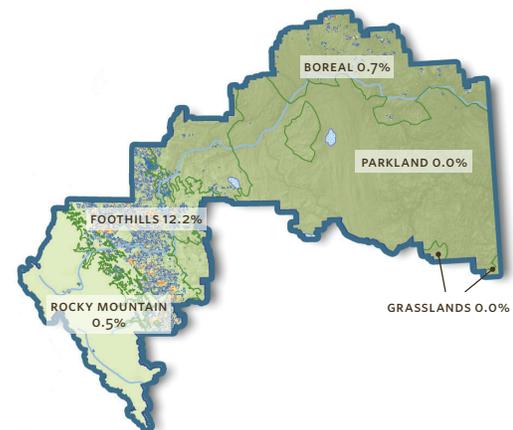
06B

AGRICULTURE FOOTPRINT COVERS 44.4% OF THE NORTH SASKATCHEWAN REGION. AGRICULTURE FOOTPRINT IS ALSO SUMMARIZED BY NATURAL REGION.



06C

TRANSPORTATION FOOTPRINT COVERS 2.5% OF THE NORTH SASKATCHEWAN REGION. TRANSPORTATION FOOTPRINT IS ALSO SUMMARIZED BY NATURAL REGION.



06D

FORESTRY FOOTPRINT COVERS 2.3% OF THE NORTH SASKATCHEWAN REGION. FORESTRY FOOTPRINT IS ALSO SUMMARIZED BY NATURAL REGION.

FIGURE 06

DISTRIBUTION OF HUMAN FOOTPRINT ACROSS THE NORTH SASKATCHEWAN REGION CIRCA 2010, INCLUDING: 06A. ALL HUMAN FOOTPRINT CATEGORIES COMBINED; 06B. AGRICULTURE FOOTPRINT; 06C. TRANSPORTATION FOOTPRINT; 06D. FORESTRY FOOTPRINT; 06E. RESIDENTIAL FOOTPRINT.

# Habitat and Protected Areas

## Native Habitat

People’s perception of wilderness often includes undisturbed expanses of forest, river, and lake ecosystems. The ABMI uses the phrase and concept of “native habitat” to identify areas in Alberta, including in the North Saskatchewan Region, that have not been visibly disturbed by humans. Natural disturbances, such as wildfire and insect outbreaks, and indirect effects of humans, like pollution, still occur. While many definitions of native habitat exist, the ABMI defines it as undeveloped vegetation that is distant enough from human footprint that it meets the particular management objectives of stakeholders.

Proximity of human footprint can affect how species use habitat. For example, some species can effectively use habitat that is adjacent to human footprint while others require habitat that is more distant. Therefore, we measure native habitat using four different buffer distances: 0 m, > 50 m, > 200 m, and > 2 km away from footprint. These distances delimit the amount

of native habitat available with a given “buffer” from human footprint. For example, at 0 m from human footprint, all native habitat in the region is included. However, at > 50 m, only native habitat that is at least 50 m away from human footprint is included.

As of 2010, 48% of the North Saskatchewan Region is composed of native habitat when no buffer is applied. When a 2 km buffer is applied to all human footprint, 10% of the North Saskatchewan would be classified as native habitat, all of which is located in Banff National Park (Figure 07).

As a note of caution, our summary of native habitat does not yet account for some forms of human land use (e.g., livestock grazing or hunting) that may not be consistent with the management objectives of a particular stakeholder. Successional recovery in cutblocks and seismic lines is also not yet accounted for.

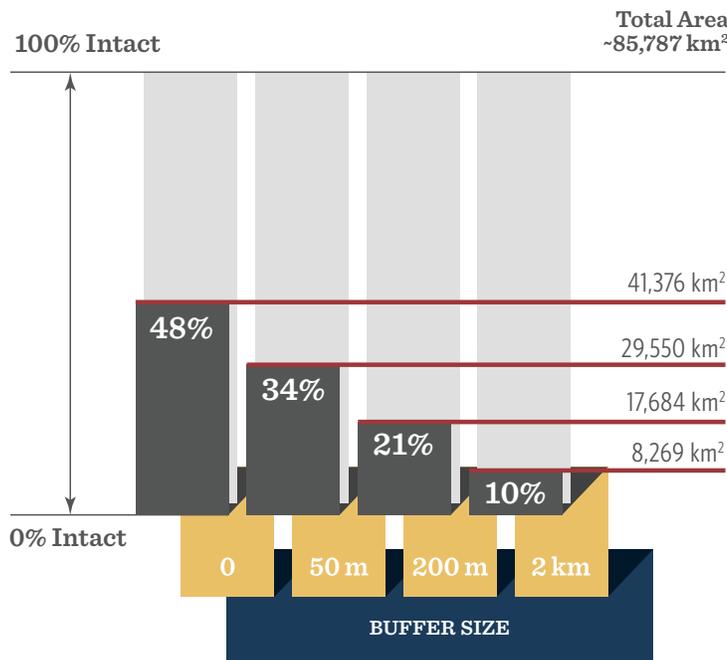


FIGURE 07

TOTAL AREA AND PER CENT AREA OF NATIVE HABITAT IN THE NORTH SASKATCHEWAN REGION.



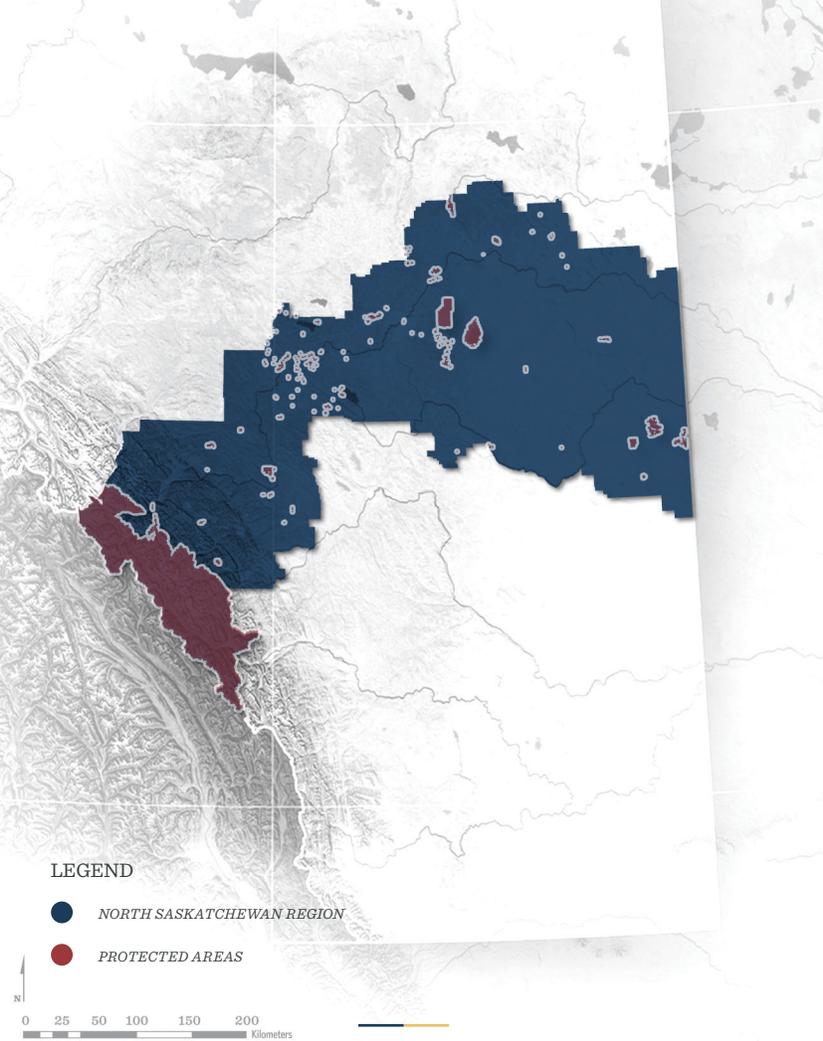
## Protected Areas

Protected areas are an important landscape-level management tool to conserve biodiversity. Resource managers and conservationists are often interested in protecting native ecosystems with little to no human footprint to maintain the biodiversity within these naturally functioning systems.<sup>[6]</sup>

Overall, 10% (8,611 km<sup>2</sup>) of the North Saskatchewan Region is managed as protected areas\* (Figure 08), including two national parks (Banff and Elk Island) and 135 parks in the provincial parks system (including provincial parks, provincial recreation areas, wildland provincial parks, wilderness areas, natural areas, and ecological reserves).

The largest and most well-known protected area in the North Saskatchewan Region is Banff National Park. Covering a total area of 6,697 km<sup>2</sup>, this park represents 77% of the protected area in the North Saskatchewan Region. Established in 1885 as Canada's first national park, Banff National Park is an iconic symbol of Canadian wilderness.

Elk Island National Park, the second-largest park in the region, protects native parkland, an ecosystem that has largely been converted to agriculture. This park is also home to a herd of free-roaming bison which has been used to support reintroduction efforts throughout the bison's former range.



**FIGURE 08**  
DISTRIBUTION OF PROTECTED AREAS  
IN THE NORTH SASKATCHEWAN  
REGION. OVERALL, 10% OF THE NORTH  
SASKATCHEWAN REGION IS MANAGED AS  
PROTECTED AREAS.



Banff National Park

\*The ABMI's definition of protected areas in the North Saskatchewan Region includes Alberta's parks and protected areas network, national parks, and National Wildlife Areas.

# Intactness of Biodiversity

Thousands of plant and animal species live in the North Saskatchewan Region. The ABMI assessed the status of species from five taxonomic groups—native birds, winter-active mammals, armoured mites, vascular plants, and mosses.\* These groups represent a small but diverse subset of all species in the region. For each group, intactness is presented for the North Saskatchewan Region as a whole, and for the following natural regions: Foothills and Rocky Mountain combined, Boreal, Parkland, and Grassland.

*THE ABMI ASSESSED THE STATUS OF 542 COMMON NATIVE SPECIES IN FIVE TAXONOMIC GROUPS IN THE NORTH SASKATCHEWAN REGION. INTACTNESS RANGED FROM 59% FOR NATIVE PLANTS TO 82% FOR WINTER-ACTIVE MAMMALS (TABLE 01).*

Biodiversity intactness by natural region ranged from 55% in the Parkland Natural Region to 87% in the Foothills and Rocky Mountain Natural Regions. Within each natural region, the groups that are most affected by human development are:

- *Foothills and Rocky Mountain: 76% for native birds*
- *Boreal: 53% for native birds*
- *Parkland: 39% for native plants*
- *Grassland: 54% for native plants*

It is important to note that the intactness results in this report are averages for specifically defined areas in the North Saskatchewan Region. As with most landscapes in Alberta, specific locations within this region are nearly 0% intact (e.g., active industrial sites in the Capital Region), and other sites are 100% intact (e.g., undeveloped forest and wetland habitat in the Rocky Mountains). See Figure 09 for an explanation of how the Biodiversity Intactness Index changes depending on the area of focus.

**TABLE 01**  
INTACTNESS\*\* FOR DIFFERENT COMPONENTS OF BIODIVERSITY IN THE NORTH SASKATCHEWAN REGION AS A WHOLE, AND CONSTITUENT NATURAL REGIONS.

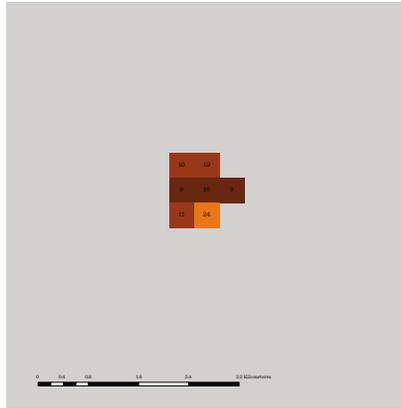
Natural Regions	Foothills & Rockies		Boreal		Parkland		Grassland		Overall Biodiversity Intactness	
	Number of Species	Intactness	Number of Species	Intactness	Number of Species	Intactness	Number of Species	Intactness	Total Number of Species	Intactness
Biodiversity Component	74	76 %	81	53 %	58	55 %	58	61 %	103	61 %
Native birds	10	94 %	10	62 %	4	86 %	4	86 %	10	82 %
Winter-active mammals†	25	87 %	62	64 %	17	46 %	17	57 %	71	63 %
Armoured mites	122	88 %	183	59 %	116	39 %	116	54 %	265	59 %
Native plants	63	88 %	90	55 %	15	48 %	15	62 %	93	62 %
Mosses	294	87 %	426	59 %	210	55 %	210	64 %	542	65 %
Overall intactness										

\*\*Overall intactness is calculated as the average of the five taxonomic groups as opposed to the average of individual species' intactness values.

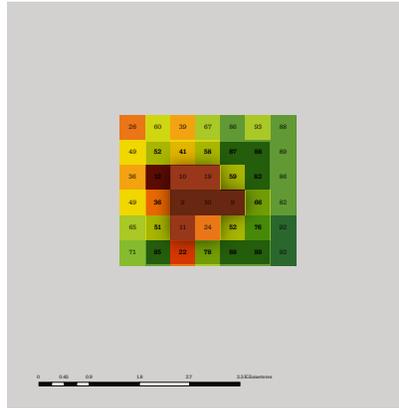
†With the exception of the Boreal Natural Region, mammal intactness results are somewhat higher than the other taxonomic groups, particularly in the Parkland and Grassland Natural Regions, raising overall biodiversity intactness for these regions.

\*We use the noun "mosses" to collectively refer to mosses, hornworts, and liverworts, which are non-vascular plants technically known as bryophytes.

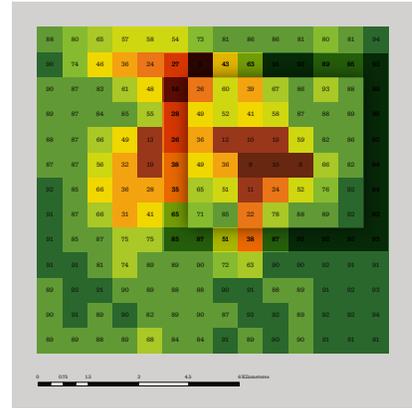
# For Biodiversity Intactness, Context Matters



09A. 7 QUARTER SECTIONS WITH INTENSE HUMAN DEVELOPMENT  
AVERAGE INTACTNESS: 13%



09B. 42 QUARTER SECTIONS WITH LOW TO INTENSE HUMAN DEVELOPMENT  
AVERAGE INTACTNESS: 56%



09C. 182 QUARTER SECTIONS WITH LOW TO INTENSE HUMAN DEVELOPMENT  
AVERAGE INTACTNESS: 72%

## FIGURE 09

ESTIMATED BIODIVERSITY INTACTNESS MAPS<sup>‡</sup> WITH BIODIVERSITY INTACTNESS INDEX VALUES FOR EACH QUARTER SECTION OF LAND WITHIN A GIVEN AREA. SHADING REPRESENTS BIODIVERSITY INTACTNESS FROM LOW (RED SQUARE: 0%–10%) TO HIGH (DARK GREEN SQUARE: 91%–100%). 09A. INTACTNESS VALUES (9%–24%) FOR 7 QUARTER SECTIONS. 09B. INTACTNESS VALUES (9%–93%) FOR 42 QUARTER SECTIONS, INCLUDING THE 7 QUARTER SECTIONS PRESENTED IN 09A. 09C. INTACTNESS VALUES (9%–99%) FOR 182 QUARTER SECTIONS, INCLUDING THE 42 QUARTER SECTIONS PRESENTED IN 09B.

Using statistical models, the ABMI estimates Biodiversity Intactness Index values for each quarter section in Alberta. Based on these, the average intactness for a given area can be calculated.

The example above, however, illustrates that average intactness depends on the area of focus. If we focus exclusively on an area of intense human development, such as the area in Figure 09A, average intactness will be very low. By contrast, if we consider areas with a range of human development from minimal to intense, such as those shown in Figures 09B and 09C, average intactness will increase accordingly.

The context dependence of the Biodiversity Intactness Index must be considered when interpreting data contained in this report.

<sup>‡</sup> Please refer to page 21 of the report for an explanation of how estimated biodiversity intactness maps are interpreted.

# *Estimated Intactness of Biodiversity*

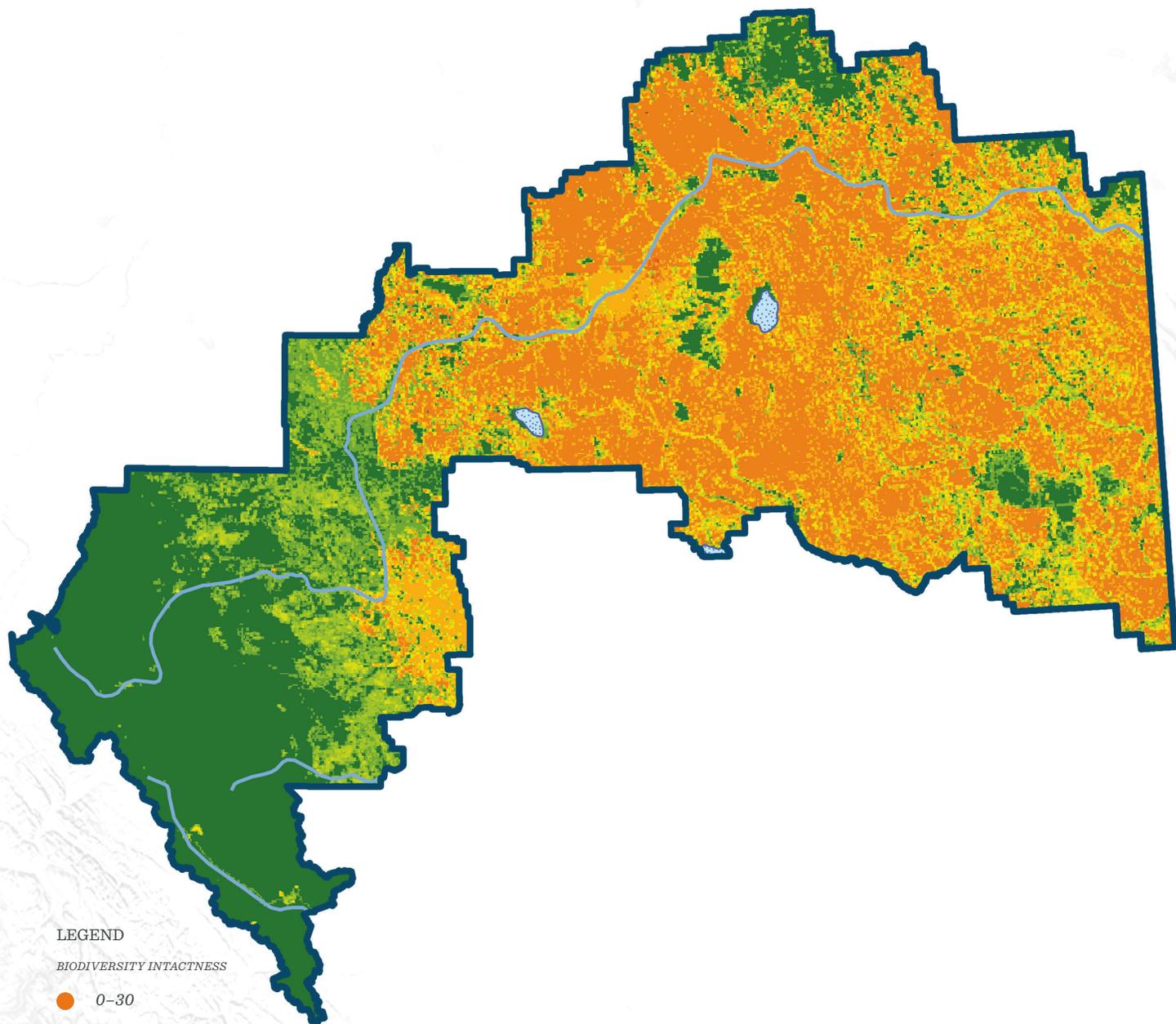
Based on data collected throughout the province, the ABMI has developed statistical models that describe the relationship between the relative abundance of individual species, habitat, and human footprint by natural region for each species that has sufficient data. These statistical models are used to calculate the Biodiversity Intactness Index for individual species in the North Saskatchewan Region. The models can be used to estimate the Intactness Index for each species for every quarter section of land in the North Saskatchewan Region—in other words, for locations where the ABMI is not directly monitoring. Using the ABMI's Inventory of Human Footprint (circa 2010) and data on vegetation types, the average intactness of over 500 species in the North Saskatchewan Region has been estimated and mapped to generate an overall picture of biodiversity across this landscape (Figure 10).

The estimated intactness map provides a visual representation of biodiversity intactness across the North Saskatchewan Region. Clearly, the map shows that some areas have little to no human footprint,

particularly on the western edge of the region, and thus higher biodiversity intactness (shown as green in Figure 10). On the other hand, much of the eastern half of the region has more intense human footprint, which results in lower biodiversity intactness (< 30%, shown as orange in Figure 10).

Any interpretations of estimated biodiversity intactness maps must take the following into account:

- The information in the estimated intactness map is preliminary and will change as analyses are refined and as more data are gathered.
- There may be considerable uncertainty in the intactness value for any particular quarter section. (i.e., variance in the quarter section predictions is not yet reported by the ABMI).
- ABMI estimated biodiversity intactness maps are intended to show broad patterns of intactness, not exact values for each quarter section.



LEGEND

*BIODIVERSITY INTACTNESS*

- 0-30
- 31-40
- 41-50
- 51-60
- 61-70
- 71-80
- 81-90
- 91-100

FIGURE 10

AVERAGE ESTIMATED INTACTNESS FOR OVER 500 SPECIES IN THE NORTH SASKATCHEWAN REGION. ORANGE IDENTIFIES THE QUARTER SECTIONS THAT ARE PREDICTED TO HAVE THE LOWEST AVERAGE BIODIVERSITY INTACTNESS WHILE DARK GREEN QUARTER SECTIONS HAVE THE HIGHEST AVERAGE INTACTNESS.

## SPECIES

IN THIS SECTION OF THE REPORT WE PROFILE (BY TAXONOMIC GROUP) SPECIES THAT SHOWED THE BIGGEST DIFFERENCE FROM REFERENCE CONDITIONS. WE ALSO PROFILE NON-NATIVE PLANTS AND SPECIES AT RISK. TO SEE THE COMPLETE DATASET ON ALL THE SPECIES ASSESSED, PLEASE CONSULT THE SUPPLEMENTAL MATERIAL ASSOCIATED WITH THIS REPORT (AVAILABLE AT WWW.ABMI.CA).

# Birds

The North Saskatchewan Region supports a diversity of birds in the many available habitats that result from the changes in vegetation and climate moving from west to east across the region. At the extremes are the alpine species in the Rockies to the west, and the grassland and wetland species in the prairies to the east.

In the mountains, the bird community changes from high elevation to low elevation. In alpine habitats, species like the Gray-crowned Rosy Finch and American Pipit are found. Moving down in elevation to the conifer-covered mountain slopes, bird species diversity increases substantially; we find species that aren't found anywhere else in Alberta, such as the Varied Thrush, Clark's Nutcracker, and Townsend's Warbler. Moving lower still in elevation to the foothills, we find many of the upper-slope species, but more boreal and parkland-associated species as well. One prominent species in the Foothills Natural Region is the Pileated Woodpecker. This woodpecker excavates holes in large dead and dying trees to nest; once vacated, these cavities are used by many other species.

The Parkland Natural Region is a transition zone between grassland ecosystems to the south and boreal ecosystems to the north. No bird species is unique to this region; instead, the bird community shares characteristics of both these ecosystems.

The eastern section of the North Saskatchewan Region is part of the prairie pothole region, otherwise known as the "duck factory" of North America. This is a globally significant breeding area for waterfowl, and several sites have been identified as Important Bird Areas in recognition of the essential habitat provided for bird populations.

*THE ABMI ASSESSED THE STATUS OF 103 NATIVE BIRDS IN THE NORTH SASKATCHEWAN REGION AND FOUND THEM TO BE, ON AVERAGE, 61% INTACT (FIGURE 11).*

Within natural regions, native birds ranged from 53% intact in the Boreal to 76% intact in the Foothills and Rocky Mountain Natural Region (Figure 11).

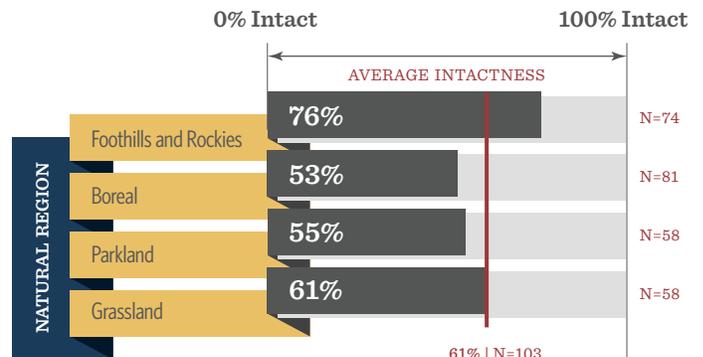


FIGURE 11

NATIVE BIRD AVERAGE SPECIES INTACTNESS OVERALL AND BY NATURAL REGION, INCLUDING THE FOOTHILLS AND ROCKY MOUNTAIN NATURAL REGIONS COMBINED, BOREAL NATURAL REGION, PARKLAND NATURAL REGION, AND GRASSLAND NATURAL REGION. NUMBER OF BIRDS (N) WITH SUFFICIENT DATA TO CALCULATE INTACTNESS IS SHOWN FOR EACH REGION.

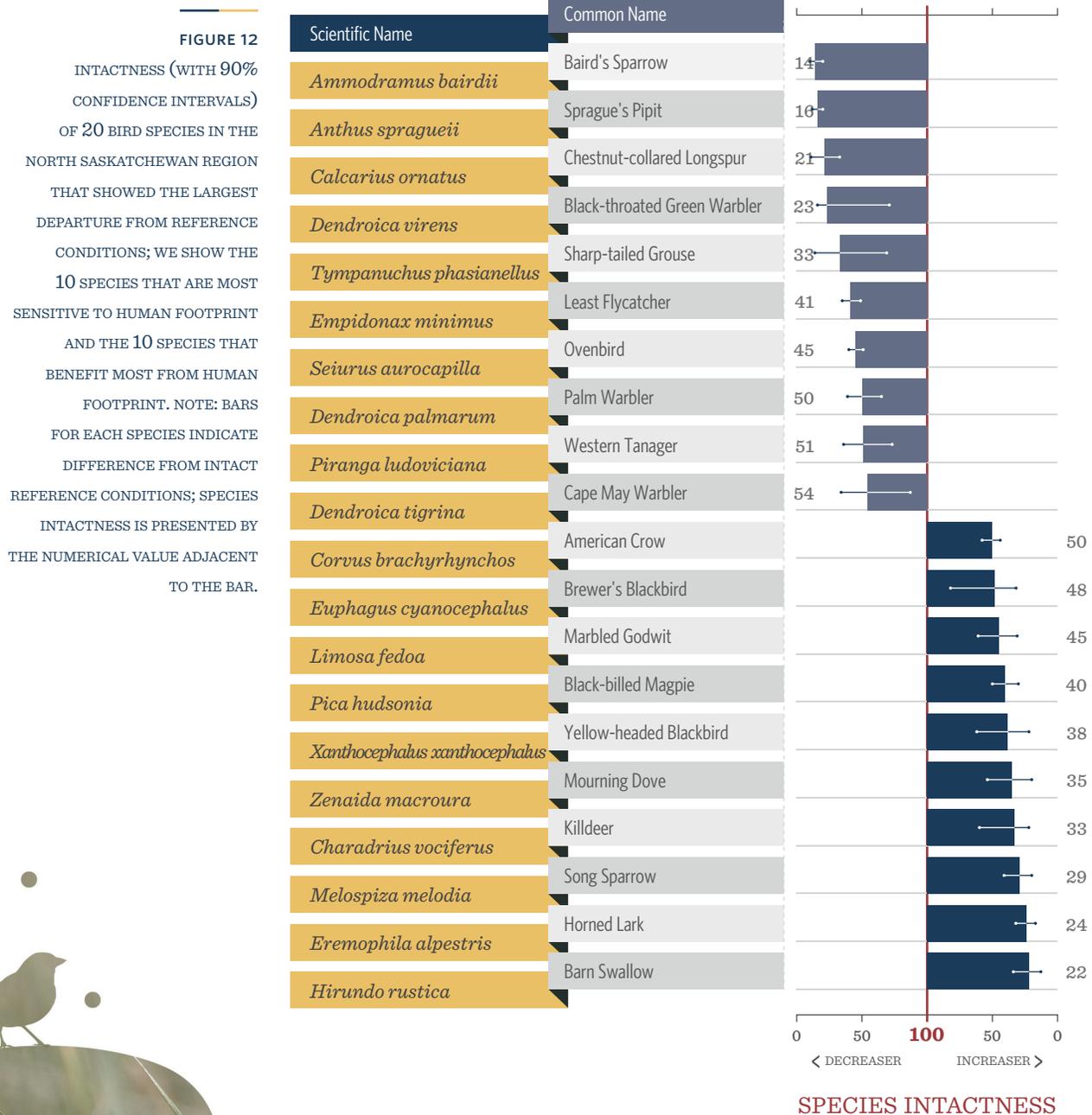
*SPRAGUE'S PIPIT IS A NATIVE GRASSLAND SPECIALIST, AVOIDING CULTIVATED AREAS, CROPLANDS, HAY FIELDS, AND TAME PASTURE. AT 16% INTACT, SPRAGUE'S PIPIT WAS 84% LESS ABUNDANT THAN EXPECTED.*



Of the 10 species most sensitive to human footprint (Figure 12), three species (Baird’s Sparrow, Sprague’s Pipit, and Chestnut-collared Longspur) are native grassland species; these species were only detected in the Parkland Natural Region. Similarly, the four species (Black-throated Green Warbler, Cape May Warbler, Ovenbird, Western Tanager) that prefer old-forest habitat for nesting and feeding were detected mostly in the Foothills and Boreal Natural Regions. Eight of the ten species are listed as “sensitive” in Alberta; only the Ovenbird and Palm Warbler are listed as “secure.”

The three species that benefit the most from human footprint are the Barn Swallow, Horned Lark, and Song Sparrow (Figure 12); all three species increase with agriculture footprint or linear footprint.

Overall, the strongest changes to birds in the North Saskatchewan Region are associated with the decrease in abundance of grassland and parkland species, and an increase in abundance of human-associated species.



## SPECIES

# Winter-active Mammals

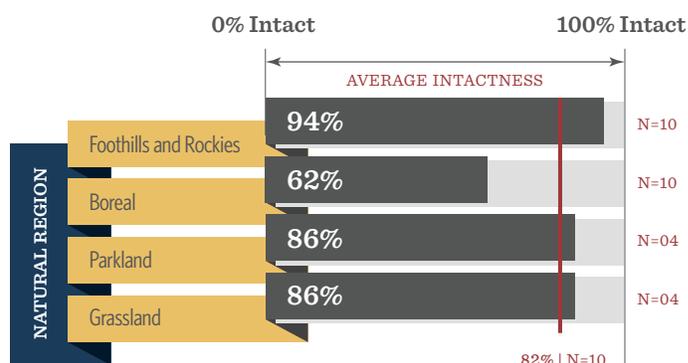
Mammals of the North Saskatchewan Region include many well-known species that are emblematic of the Canadian wilderness, such as Beaver, Moose, Elk, Canada Lynx, Grizzly Bear, and Gray Wolf. Even a small population of Bison, located in Elk Island National Park, can be found in this diverse landscape. But the assemblage of mammals in some parts of this region has changed significantly in the past 200 years as a result of the fur trade, human settlement, and industrial development.

Historically, herds of bison roamed this region, with top predators like the Gray Wolf and Grizzly Bear following in their wake as the bison's main predator. In the 19th century, however, the North Saskatchewan River was one of the most important fur trade routes in North America; fur traders were very efficient at removing fur-bearing mammals from the parkland of the North Saskatchewan Region. And, with the arrival of settlers in the late 1800s and early 1900s, much of the parkland was converted from native vegetation to agricultural land uses resulting in a decline in wildlife habitat.<sup>[7]</sup>

Despite the loss of large, iconic species from some areas of the North Saskatchewan Region, many mammal species are still abundant and are thriving in the human-altered landscape. White-tailed Deer find shelter in the woodlands and graze in the grassland and agricultural fields. The Snowshoe Hare and Red Squirrel are common in forested areas. Water-dependant animals like the Beaver and Muskrat can be found in ravines and wetlands, and Coyotes hunt the resident rodent populations. Larger mammals, such as the Grizzly Bear, Gray Wolf, and Wolverine, that require large undisturbed areas to make a living, are mostly found in remote areas to the north in the boreal forest, and to the west in the foothills and Rocky Mountains.

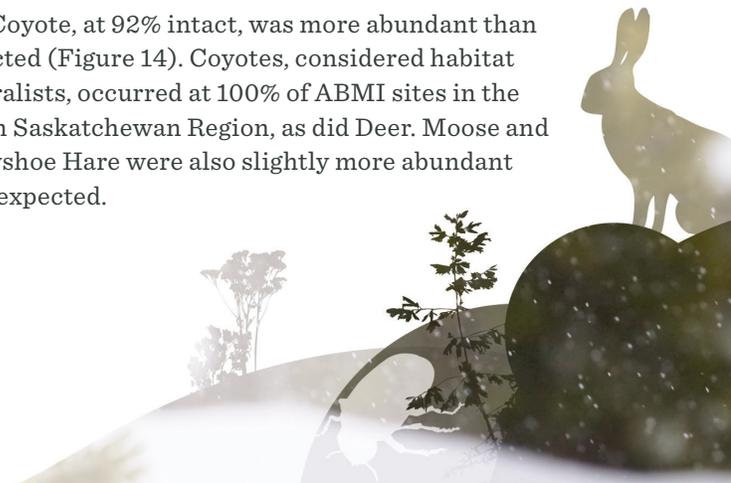
*THE ABMI ASSESSED THE STATUS OF 10 WINTER-ACTIVE MAMMAL SPECIES OR GROUPS OF SPECIES IN THE NORTH SASKATCHEWAN REGION USING WINTER TRACKING DATA. WE FOUND THEM TO BE, ON AVERAGE, 82% INTACT (FIGURE 13).*

Within natural regions, winter-active mammals ranged from 62% intact in the Boreal Natural Region to 94% intact in the Foothills and Rocky Mountain Natural Regions (Figure 13). Intactness was 86% in both the Parkland and Grassland Natural Regions, but these areas only include data for four mammal species/groups (Coyote, Deer, Snowshoe Hare, Mice and Voles) that are adapted to human-dominated landscapes. Because of human settlement, agriculture, and industrial development in these two natural regions, many mammal species, such as the Gray Wolf and Canada Lynx, no longer occur, or occur very rarely.



**FIGURE 13**  
WINTER-ACTIVE MAMMAL AVERAGE SPECIES INTACTNESS OVERALL AND BY NATURAL REGION, INCLUDING THE FOOTHILLS AND ROCKY MOUNTAIN NATURAL REGIONS COMBINED, BOREAL NATURAL REGION, PARKLAND NATURAL REGION, AND GRASSLAND NATURAL REGION. NUMBER OF MAMMALS (N) WITH SUFFICIENT DATA TO CALCULATE INTACTNESS IS SHOWN FOR EACH REGION.

The Coyote, at 92% intact, was more abundant than expected (Figure 14). Coyotes, considered habitat generalists, occurred at 100% of ABMI sites in the North Saskatchewan Region, as did Deer. Moose and Snowshoe Hare were also slightly more abundant than expected.



Seven of the ten mammals were less abundant than expected (Figure 14). Marten and Fisher (71% intact) and Canada Lynx (77% intact) showed the biggest departure from intact reference conditions. The range of the Canada Lynx may be contracting northward because of human development and competition with coyotes.<sup>[8]</sup>

The ABMI does not yet have enough data to determine intactness for uncommon species, such as the Wolverine.



**FIGURE 14**  
 INTACTNESS (WITH 90% CONFIDENCE INTERVALS) OF 10 MAMMAL SPECIES OR GROUPS IN THE NORTH SASKATCHEWAN REGION. NOTE: BARS FOR EACH SPECIES INDICATE DIFFERENCE FROM INTACT REFERENCE CONDITIONS; SPECIES INTACTNESS IS PRESENTED BY THE NUMERICAL VALUE ADJACENT TO THE BAR.



THE COYOTE, AS A HABITAT GENERALIST, CAN ADAPT TO NEW SURROUNDINGS VERY EASILY BY CHANGING WHAT IT EATS AND WHERE IT SLEEPS. AS A RESULT, THIS SPECIES CAN BE FOUND THROUGHOUT MUCH OF ALBERTA, INCLUDING URBAN AREAS LIKE EDMONTON.

SPECIES

# Armoured Mites

Armoured mites (also known as oribatid mites) are an important component of Alberta’s soil biodiversity. No larger than the tip of a ballpoint pen, several hundred thousand armoured mites can be found in a square metre of healthy topsoil. Of the 10,000 armoured mite species known to exist on the planet, at least 325 occur in our province.

Like mammals and birds, some species of armoured mites are carnivores and some are herbivores. However, the majority of these mites live off the remains of plants, animals, and fungi, playing an essential role in the formation and maintenance of soil structure. Armoured mites also serve as food for many small arthropods such as beetles, ants, and spiders, and for some small frogs and birds. As a result, these tiny unseen species are important to the maintenance of healthy soil in our province.

*THE ABMI ASSESSED THE STATUS OF 71 SPECIES OF ARMOURD MITES IN THE NORTH SASKATCHEWAN REGION AND FOUND THEM TO BE, ON AVERAGE, 63% INTACT (FIGURE 15).*

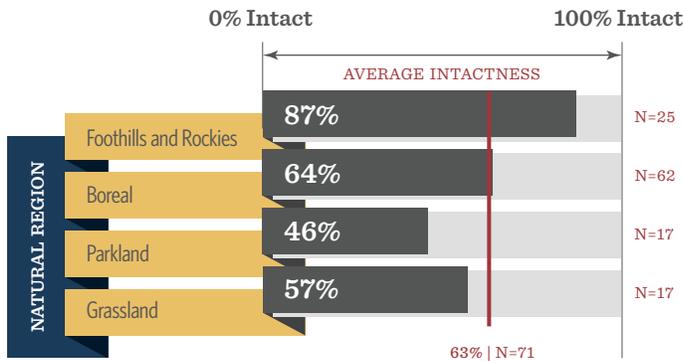
Within natural regions, armoured mites ranged from 46% intact in the Parkland Natural Region to 87% intact in the Foothills and Rocky Mountain Natural Regions (Figure 15).

Not much is known about armoured mites in the North Saskatchewan Region. However, ABMI data is providing new information about these species, including what types of habitat different species live in and how human footprint might influence them.

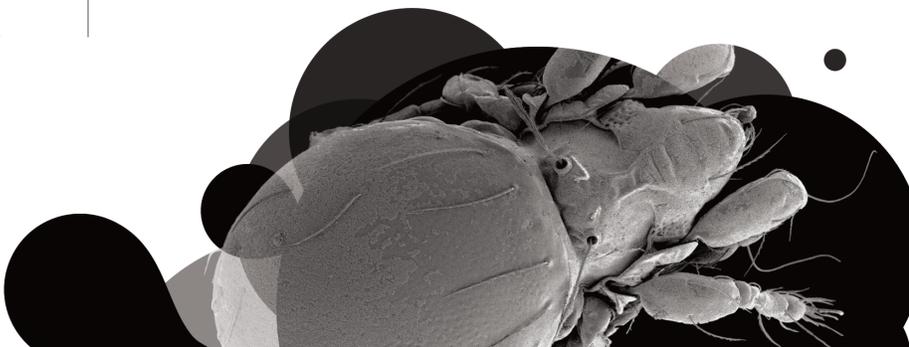
For example, some species are most abundant in pine forests in the Foothills (e.g., Furrowed Hermit Mite) (Figure 16A), while others (e.g., Canadian Dark-eye Mite) are associated with different soil types in parkland and grassland habitats (Figure 16B).

Some species of mites in the North Saskatchewan Region respond to human footprint on the landscape. In the Foothills, for example, the Furrowed Hermit Mite declines in abundance with increases in forestry footprint, urban and industrial footprint, and at high levels of linear footprint (Figure 17A). In the Parkland, several species, such as the Writing-on-Stone Hermit Mite, decline in abundance as all footprint types increase (Figure 17B). A few species increase in abundance with different footprints, such as the Saamis Yoked-Roamer Mite, which responds positively to agriculture footprint and urban and industrial footprint (Figure 17C).

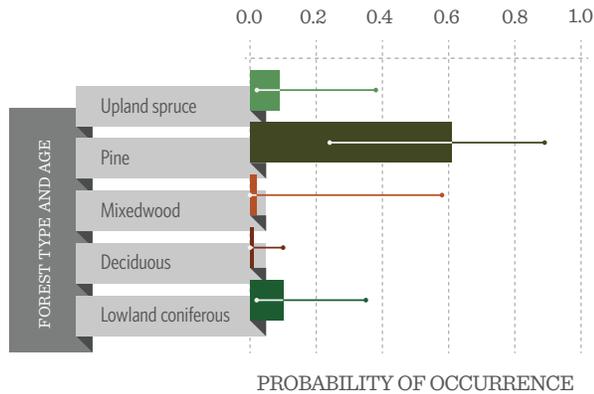
Overall, ABMI monitoring data provides not only information on mite species richness and where these species can be found, but also baseline data to assess how their populations are changing in response to human footprint.



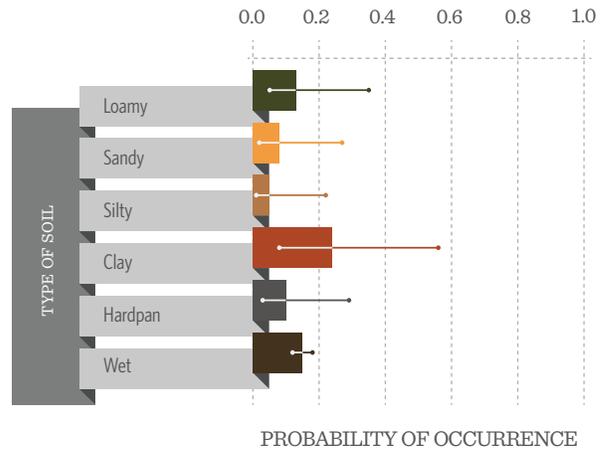
**FIGURE 15** ARMOURD MITE AVERAGE SPECIES INTACTNESS OVERALL AND BY NATURAL REGION, INCLUDING THE FOOTHILLS AND ROCKY MOUNTAIN NATURAL REGIONS COMBINED, BOREAL NATURAL REGION, PARKLAND NATURAL REGION, AND GRASSLAND NATURAL REGION. NUMBER OF MITES (N) WITH SUFFICIENT DATA TO CALCULATE INTACTNESS IS SHOWN FOR EACH REGION.



### 16A. FURROWED HERMIT MITE



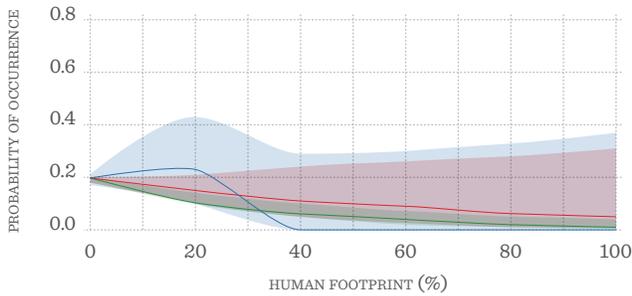
### 16B. CANADIAN DARK-EYE MITE



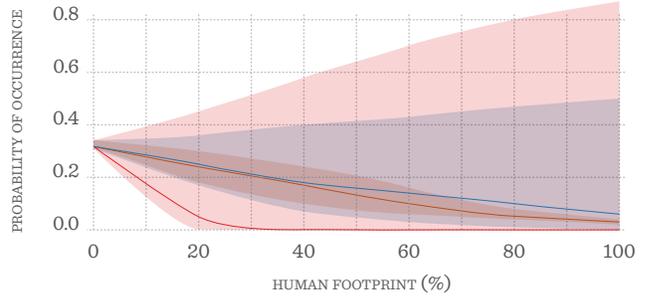
**FIGURE 16**

PROBABILITY OF OCCURRENCE (PER SOIL SAMPLE) IN A 1 HA PLOT OF A. THE FURROWED HERMIT MITE BY FOREST TYPE IN THE FOOTHILLS NATURAL REGION, AND B. CANADIAN DARK-EYE MITE BY SOIL TYPE IN THE PARKLAND AND GRASSLAND NATURAL REGIONS COMBINED. CONFIDENCE INTERVALS = 90%.

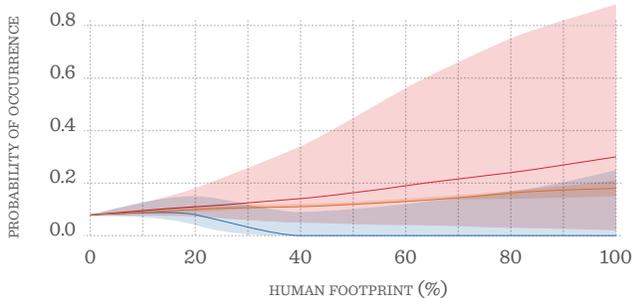
### 17A. FURROWED HERMIT MITE



### 17B. WRITING-ON-STONE HERMIT MITE



### 17C. SAAMIS YOKED-ROAMER MITE



- NON-AGRICULTURE ALIENATING  
INDUSTRIAL, ROADS, URBAN
- AGRICULTURE FOOTPRINT
- SUCCESSIONAL FOOTPRINT  
FORESTRY AND VEGETATED LINEAR FEATURES
- LINEAR FOOTPRINT

**FIGURE 17**

EXAMPLE OF THE RESPONSE OF TWO DECREASER SPECIES, 17A. FURROWED HERMIT MITE AND 17B. WRITING-ON-STONE HERMIT MITE, AND AN INCREASER SPECIES, 17C. SAAMIS YOKED-ROAMER MITE, TO DIFFERENT TYPES OF HUMAN FOOTPRINT IN THE NORTH SASKATCHEWAN REGION. SHADED AREAS REPRESENT 90% CONFIDENCE INTERVALS.

# Native Vascular Plants

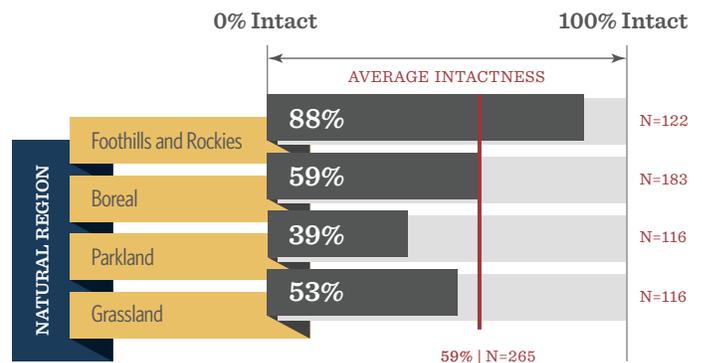
Vascular plants represent one of the most diverse and important components of biodiversity in the North Saskatchewan Region. The variation in topography and climate across the region results in a diversity of ecosystems, including five of Alberta's six natural regions. These natural regions each have characteristic vegetation communities adapted to regional environmental conditions, including:<sup>[9]</sup>

- The Rocky Mountain Natural Region is home to high-altitude alpine meadows characterized by dwarf shrub communities as well as a variety of grasses and flowering plants. At lower elevations, coniferous forests of Engelmann Spruce, Subalpine Fir, Lodgepole Pine, and White Spruce take over.
- The Foothills Natural Region is a zone of mixed deciduous and coniferous forests, rolling fields, and rocky outcrops. The vascular plant species found here are generally mixes of the surrounding natural regions.
- While much of the Parkland Natural Region has been converted for agricultural purposes, the remaining native vegetation is a mixture of grasslands interspersed with Aspen woodlands where well-known plants like Snowberry, Saskatoon, Chokecherry, and Prickly Rose are commonly found.
- The Boreal Natural Region is a mosaic of upland forests interspersed with lowland forest and an abundance of low-lying wetlands, bogs, and fens. A great diversity of plant species can be found depending on environmental conditions.
- Just the northern tip of the Grassland Natural Region extends into the North Saskatchewan Region. This classic prairie landscape includes a diversity of grasses and flowering plants.

The extreme contrasts in environmental conditions across the North Saskatchewan support a diversity of ecosystems, from alpine to forest to grassland. Planning for a future rich in biodiversity requires management of these different ecosystem types and the plant communities found within them.

*THE ABMI ASSESSED THE STATUS OF 265 NATIVE VASCULAR PLANTS IN THE NORTH SASKATCHEWAN REGION AND FOUND THEM TO BE, ON AVERAGE, 59% INTACT (FIGURE 18).*

Within natural regions, native plants ranged from 39% intact in the Parkland Natural Region to 88% intact in the Foothills and Rocky Mountain Natural Region (Figure 18).



**FIGURE 18**

NATIVE PLANT AVERAGE SPECIES INTACTNESS BY NATURAL REGION, INCLUDING THE FOOTHILLS AND ROCKY MOUNTAIN NATURAL REGIONS COMBINED, BOREAL NATURAL REGION, PARKLAND NATURAL REGION, AND GRASSLAND NATURAL REGION. NUMBER OF VASCULAR PLANTS (N) WITH SUFFICIENT DATA TO CALCULATE INTACTNESS IS SHOWN FOR EACH REGION.

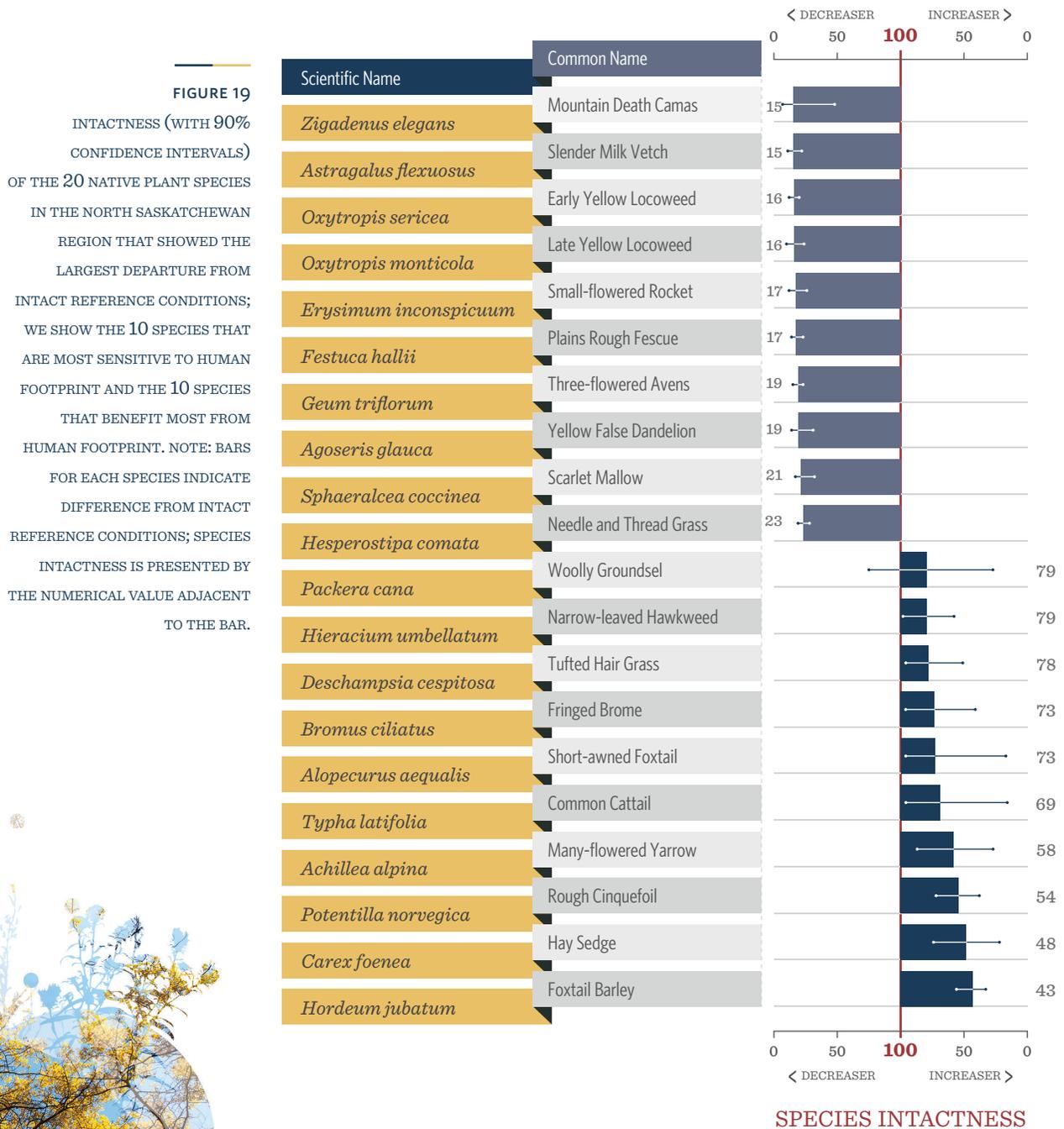
The 10 vascular plant species that are the most sensitive to human footprint are all approximately 80% less abundant than expected (Figure 19). Nine of these species (the exception being Mountain Death Camas) are associated with native grasslands. Grassland species declined with at least two of the

*TREMBLING ASPEN IS AN IMPORTANT TREE SPECIES IN THE PARKLAND REGION, SIGNALLING THE TRANSITION BETWEEN GRASSLAND ECOSYSTEMS AND THE BOREAL FOREST. AT 61% INTACT, TREMBLING ASPEN WAS LESS ABUNDANT THAN EXPECTED.*

three following footprint types: agriculture, linear, and urban and industrial footprint.

The 10 vascular plant species that benefit from human footprint ranged from 43% to 79% intact (Figure 19). Many of these species, such as Foxtail Barley (43% intact) and Hay Sedge (48% intact),

are considered “pioneer” species as they are among the first species to colonize recently disturbed areas. All of these species increased with at least one (often more than one) of urban and industrial footprint, linear footprint, forestry footprint, or agriculture footprint.



## Non-native Plants

Non-native plants are those species that have been introduced, intentionally or otherwise, into new areas beyond their natural habitat. While not all non-native species represent a threat to biodiversity, given the right conditions, non-native species can become a major ecological concern. In forested areas of the Foothills Natural Region, for example, some non-native plant species, like the Creeping Thistle and Narrow-leaved Hawksbeard, can interfere with tree regeneration after fire or forest harvesting.<sup>[10]</sup> Besides the ecological cost, the economic cost of controlling the spread of weedy species in the province runs into the millions of dollars every year. Non-native species cause a significant loss in the productivity of rangelands, croplands, and forested areas.

The ABMI found 78 non-native plants in the North Saskatchewan Region (Table O2 summarizes the most common non-native species; see supplementary material available at [www.abmi.ca](http://www.abmi.ca) for a complete list). Non-native plants were detected at 100% of ABMI sites that have been sampled in the North Saskatchewan Region, with an average of 11.9 non-native species detected per site. In the North Saskatchewan Region, the predicted number of non-native species per 1 ha plot ranged from 1 up to 30 species (Figure 20).

Common Dandelion was the most common non-native plant, occurring at 87% of ABMI sites in the North Saskatchewan Region. The second-most commonly detected species was Creeping Thistle.

Detected at 72% of sites, Creeping Thistle is one of nine species occurring in the North Saskatchewan Region that is listed as a noxious weed under the *Alberta Weed Control Act*; 15 of the detected species are listed as nuisance weeds. There are many agronomic species on the list of non-native species that occur in association with agriculture footprint in the North Saskatchewan Region.

The ABMI also found three non-native bird species in the North Saskatchewan Region, the European Starling, House Sparrow, and Ring-necked Pheasant, which occurred at 26%, 12%, and 2% of ABMI sites, respectively.

ABMI data can be used by managers to set regional targets for non-native species management, and to measure progress toward achieving those targets.

EUROPEAN STARLINGS IN NORTH AMERICA ORIGINATE FROM 100 BIRDS RELEASED IN NEW YORK'S CENTRAL PARK IN THE EARLY 1890S. THIS FLOCK WAS RELEASED BY A GROUP OF SHAKESPEARE ENTHUSIASTS WHO WANTED TO POPULATE NORTH AMERICA WITH ALL THE BIRDS THAT SHAKESPEARE MENTIONED IN HIS PLAYS.



TABLE 02

PERCENTAGE OCCURRENCE OF THE 10 MOST COMMONLY DETECTED NON-NATIVE VASCULAR PLANTS IN THE NORTH SASKATCHEWAN REGION. SPECIES LISTED AS NUISANCE WEEDS OR NOXIOUS WEEDS UNDER THE ALBERTA WEED CONTROL ACT ARE IDENTIFIED.

Scientific Name	Common Name	Percentage of ABMI Sites Where Detected	Alberta Weed Control Act Listing
	Common Dandelion	87	Nuisance
<i>Taraxacum officinale</i>	Creeping Thistle	72	Noxious
<i>Cirsium arvense</i>	Awnless Brome	66	
<i>Bromus inermis</i>	Kentucky Bluegrass	57	
<i>Poa pratensis</i>	Quack Grass	49	
<i>Elymus repens</i>	Hemp Nettle	43	Noxious
<i>Galeopsis tetrahit</i>	Common Plantain	42	
<i>Plantago major</i>	Timothy	40	
<i>Phleum pratense</i>	Stinkweed	40	
<i>Thlaspi arvense</i>	Lamb's Quarters	37	
<i>Chenopodium album</i>			

LEGEND

PREDICTED NUMBER OF NON-NATIVE PLANTS

- 0.0-1.0
- 1.0-1.5
- 1.5-3.0
- 3.0-5.0
- 5.0-10.0
- 10.0-15.0
- 15.0-30.0
- INSUFFICIENT DATA

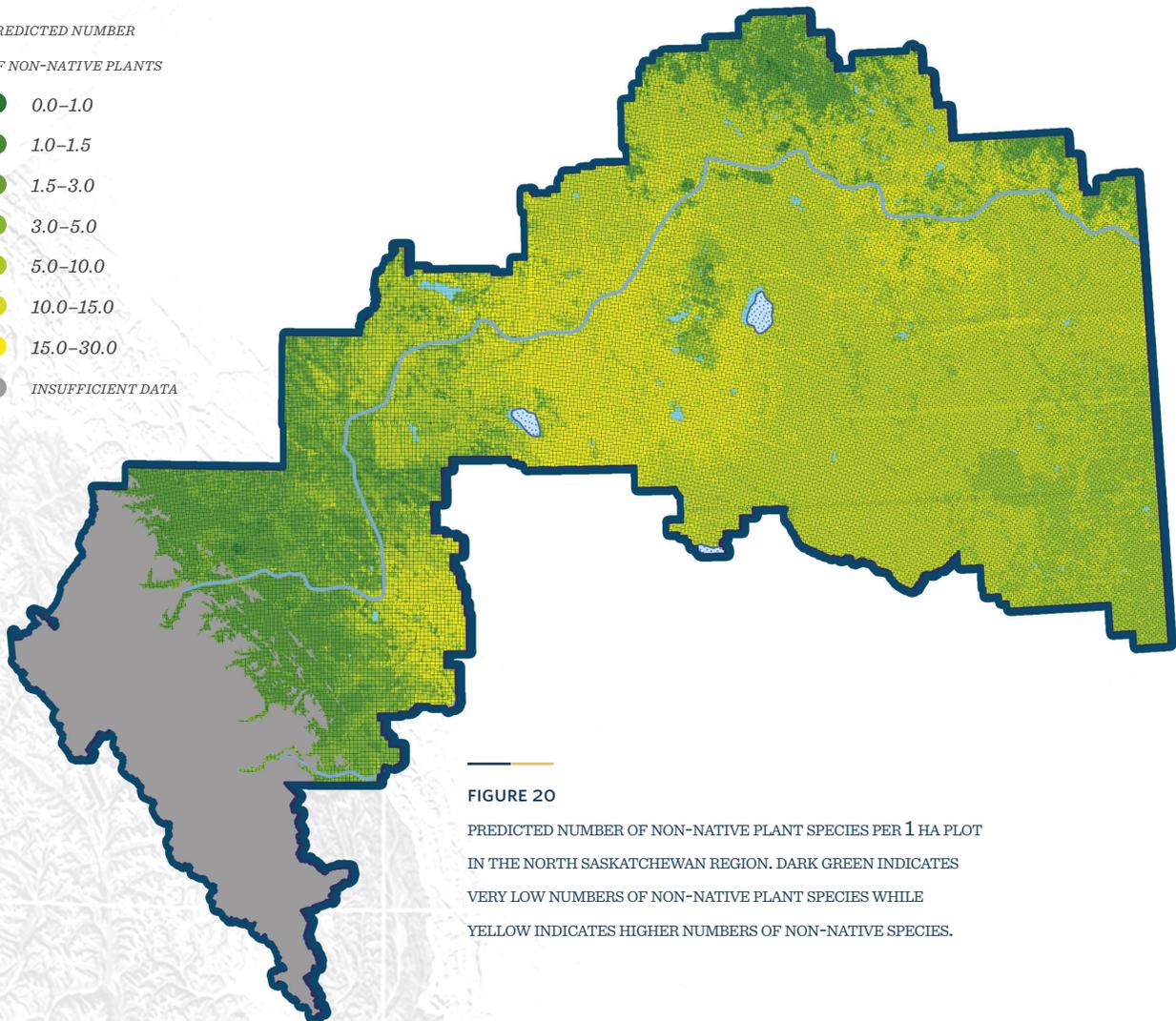


FIGURE 20

PREDICTED NUMBER OF NON-NATIVE PLANT SPECIES PER 1 HA PLOT IN THE NORTH SASKATCHEWAN REGION. DARK GREEN INDICATES VERY LOW NUMBERS OF NON-NATIVE PLANT SPECIES WHILE YELLOW INDICATES HIGHER NUMBERS OF NON-NATIVE SPECIES.

SPECIES

# Mosses

Moss is abundant in many ecosystems in the North Saskatchewan Region. For example, a high number of rare mosses can be found in alpine and cliff habitats in the Rocky Mountains.<sup>[11]</sup> A group of mosses known as feather mosses often carpet the ground in forests of the Rocky Mountain, Foothills, and Boreal Forest Natural Regions. These moss beds provide a number of important functions in forested ecosystems by insulating the soil, releasing important nutrients like nitrogen and absorbing carbon, limiting the establishment of understory plants, and providing a home to a diverse community of micro-organisms, such as fungi, bacteria, and mites.<sup>[12,13]</sup>

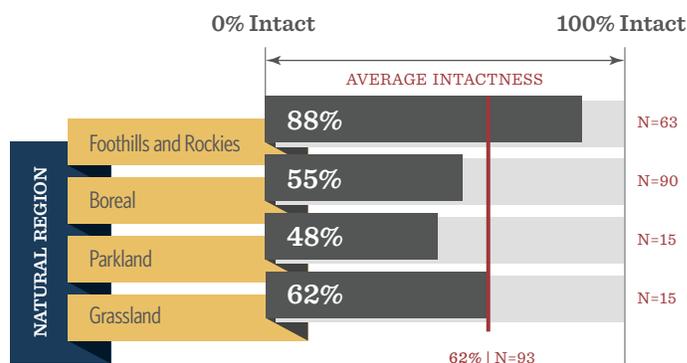
In the Parkland and Grassland Natural Regions of the province, moss diversity tends to be lower but no less important.<sup>[11]</sup> The Aspen and mixedwood forests throughout the parkland support mosses. In native grassland ecosystems, mosses (along with lichen and algae) can provide important cover in particular microsites, anchoring the soil, helping to keep it cool and moist, and preventing the establishment of weeds. Mosses can also be found in a number of nooks and hollows, such as at the base of trees and shrubs, in riparian areas, in the crevices of rocky outcrops, and in pockets of woodlands throughout the grasslands.

Mosses have an important role to play in all ecosystems in the North Saskatchewan Region, influencing water, nutrient, and carbon cycles, providing microhabitat for microscopic organisms, and affecting the establishment of other plants, including weeds.

*THE ABMI ASSESSED THE STATUS OF 93 MOSS SPECIES IN THE NORTH SASKATCHEWAN REGION AND FOUND THEM TO BE, ON AVERAGE, 62% INTACT (FIGURE 21).*

Within natural regions, mosses ranged from 48% intact in the Parkland Natural Region to 88% intact in the Foothills and Rocky Mountain Natural Regions (Figure 21).

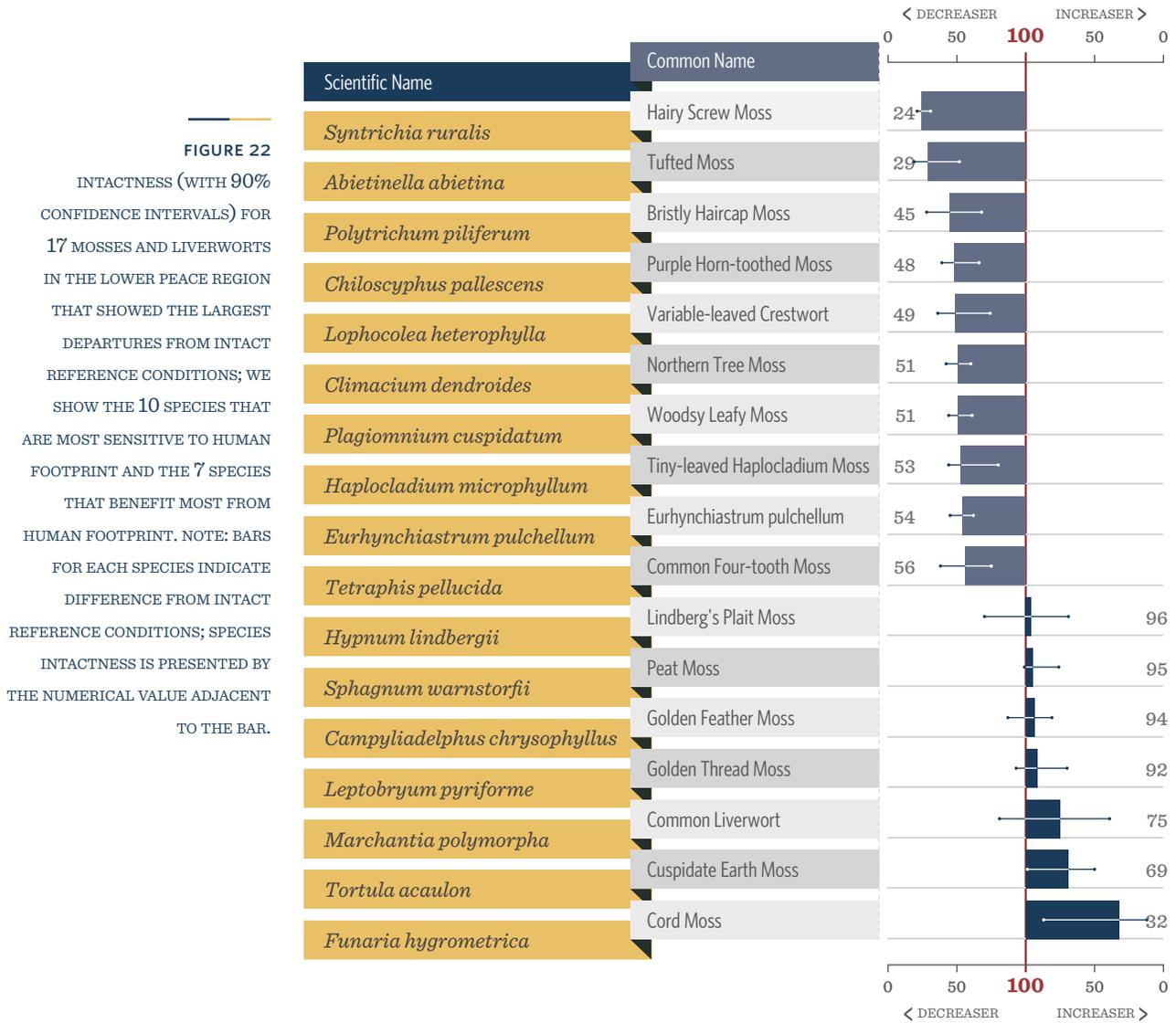
*WOODSY LEAFY MOSS IS MAINLY FOUND IN SHADED FORESTS, OCCURRING ON A NUMBER OF SUBSTRATES LIKE SOIL, DOWNED LOGS, AND ROCKS ALONG STREAMS. AT 24% INTACT, THE WOODSY LEAFY MOSS WAS LESS ABUNDANT THAN EXPECTED.*



**FIGURE 21**  
MOSS AVERAGE SPECIES INTACTNESS OVERALL AND BY NATURAL REGION, INCLUDING FOOTHILLS AND ROCKY MOUNTAIN NATURAL REGIONS COMBINED, BOREAL NATURAL REGION, PARKLAND NATURAL REGION, AND GRASSLAND NATURAL REGION. NUMBER OF MOSS SPECIES (N) WITH SUFFICIENT DATA TO CALCULATE INTACTNESS IS SHOWN FOR EACH REGION.

The 10 mosses that were most sensitive to human footprint ranged from 24% to 56% intact (Figure 22). All these species decreased in abundance with human footprint, including agriculture, linear, urban and industrial, and forestry footprint. A visual example of a decreaser species response to human footprint is shown in Figure 23.

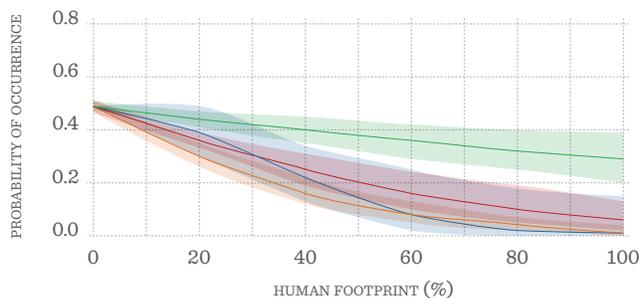
Only seven moss species appeared to benefit from human footprint, ranging from 32% to 96% intact (Figure 22). Several of these species, such as the Bristly Cord Moss (32% intact), Common Liverwort (75% intact), and Golden Thread Moss (92% intact), are commonly found in recent burns, pastures, and ditches.



**FIGURE 22**  
INTACTNESS (WITH 90% CONFIDENCE INTERVALS) FOR 17 MOSSES AND LIVERWORTS IN THE LOWER PEACE REGION THAT SHOWED THE LARGEST DEPARTURES FROM INTACT REFERENCE CONDITIONS; WE SHOW THE 10 SPECIES THAT ARE MOST SENSITIVE TO HUMAN FOOTPRINT AND THE 7 SPECIES THAT BENEFIT MOST FROM HUMAN FOOTPRINT. NOTE: BARS FOR EACH SPECIES INDICATE DIFFERENCE FROM INTACT REFERENCE CONDITIONS; SPECIES INTACTNESS IS PRESENTED BY THE NUMERICAL VALUE ADJACENT TO THE BAR.

**SPECIES INTACTNESS**

**WOODSY LEAFY MOSS**



- NON-AGRICULTURE ALIENATING  
INDUSTRIAL, ROADS, URBAN
- AGRICULTURE FOOTPRINT
- SUCCESSIONAL FOOTPRINT  
FORESTRY AND VEGETATED LINEAR FEATURES
- LINEAR FOOTPRINT

**FIGURE 23**  
EXAMPLE OF THE RESPONSE OF A DECREASER SPECIES, IN THIS CASE WOODSY LEAFY MOSS, TO DIFFERENT TYPES OF HUMAN FOOTPRINT IN THE FOOTHILLS OF THE NORTH SASKATCHEWAN REGION. PROBABILITY OF OCCURRENCE (IN A 50 × 50 M QUADRAT) IS A FUNCTION OF AMOUNT OF HUMAN FOOTPRINT ON A 1 HA PLOT. SHADED AREAS REPRESENT 90% CONFIDENCE INTERVALS.

## Species at Risk

The health of biodiversity in a region includes an assessment of species that are naturally rare or that have demonstrated a significant decline in abundance. These rare species are generally referred to as “species at risk” because future declines in abundance may result in the loss of the species from an area.

The ABMI was able to calculate intactness for 37 species at risk in the North Saskatchewan Region, including 6 species that are listed as threatened or of special concern by the Government of Canada and/or by the Government of Alberta (Table 03).

Of the species at risk assessed by the ABMI, most were less abundant than expected; only five species were more abundant than expected. Included on this list are several species of birds associated with native grassland habitat, such as the Baird’s Sparrow, Chestnut-collared Longspur, and Sprague’s Pipit, which were all approximately 80% less abundant than expected.

The ABMI cannot assess the status of all species at risk in the North Saskatchewan Region for one of the two following reasons. First, by virtue of their rarity, some species at risk are not detected with enough frequency to adequately assess their status (e.g., Wolverine). Second, ABMI monitoring protocols are not designed to monitor some species groups, such as amphibians, owls, waterfowl, and bats, which include some species at risk.



BAIRD’S SPARROW WAS LISTED BY CANADA’S COMMITTEE ON THE STATUS OF ENDANGERED WILDLIFE IN CANADA (COSEWIC) AS SPECIAL CONCERN IN 2012 BECAUSE OF EVIDENCE OF LONG-TERM DECLINES IN ITS POPULATION AND THREATS TO ITS PREFERRED BREEDING HABITAT, NATIVE GRASSLAND. AT 14% INTACT, THE BAIRD’S SPARROW WAS LESS ABUNDANT THAN EXPECTED IN THE NORTH SASKATCHEWAN REGION.

TABLE 03

SUMMARY OF INTACTNESS RESULTS FOR SPECIES AT RISK IN THE NORTH SASKATCHEWAN REGION. SPECIES LISTED AS UNDETERMINED ARE NOT SHOWN.

	Common Name	Scientific Name	Occurrence (%)	Intactness Index (0-100 scale)	Above or Below Reference Conditions	Threat*
BIRDS	Baird's Sparrow	<i>Ammodramus bairdii</i>	2%	14%	BELOW	ESRD - Sensitive   COSEWIC - Special Concern
	Baltimore Oriole	<i>Icterus galbula</i>	21%	91%	BELOW	ESRD - Sensitive
	Barn Swallow	<i>Hirundo rustica</i>	21%	22%	ABOVE	ESRD - Sensitive   COSEWIC - Threatened
	Bay-breasted Warbler	<i>Dendroica castanea</i>	2%	94%	BELOW	ESRD - Sensitive   AB ESCC 2010 - In Process
	Black-throated Green Warbler	<i>Dendroica virens</i>	3%	23%	BELOW	ESRD - Sensitive   AB ESCC 2010 - Species of Special Concern
	Brown Creeper	<i>Certhia americana</i>	10%	77%	BELOW	ESRD - Sensitive
	Canada Warbler	<i>Wilsonia canadensis</i>	2%	85%	BELOW	ESRD - Sensitive   COSEWIC - Threatened   SARA - Threatened
	Cape May Warbler	<i>Dendroica tigrina</i>	2%	54%	BELOW	ESRD - Sensitive   AB ESCC 2010 - In Process
	Chestnut-collared Longspur	<i>Calcarius ornatus</i>	2%	21%	BELOW	ESRD - Sensitive   COSEWIC - Threatened   SARA - Special Concern
	Common Yellowthroat	<i>Geothlypis trichas</i>	22%	90%	BELOW	ESRD - Sensitive
	Grasshopper Sparrow	<i>Ammodramus savannarum</i>	1%	60%	BELOW	ESRD - Sensitive
	Least Flycatcher	<i>Empidonax minimus</i>	48%	41%	BELOW	ESRD - Sensitive
	McCown's Longspur	<i>Calcarius mccownii</i>	2%	86%	BELOW	ESRD - Secure   COSEWIC - Special Concern   SARA - Special Concern
	Olive-sided Flycatcher	<i>Contopus cooperi</i>	5%	92%	BELOW	ESRD - May Be at Risk   COSEWIC - Threatened   SARA - Threatened
	Pileated Woodpecker	<i>Dryocopus pileatus</i>	19%	69%	BELOW	ESRD - Sensitive
	Rusty Blackbird	<i>Euphagus carolinus</i>	4%	54%	ABOVE	ESRD - Sensitive   COSEWIC - Special Concern   SARA - Special Concern
	Sharp-tailed Grouse	<i>Tympanuchus phasianellus</i>	1%	33%	BELOW	ESRD - Sensitive
	Sora	<i>Porzana carolina</i>	33%	85%	ABOVE	ESRD - Sensitive
	Sprague's Pipit	<i>Anthus spragueii</i>	9%	16%	BELOW	ESRD - Sensitive   AB ESCC 2010 - Species of Special Concern
	Upland Sandpiper	<i>Bartramia longicauda</i>	3%	91%	BELOW	ESRD - Sensitive
Western Tanager	<i>Piranga ludoviciana</i>	13%	51%	BELOW	ESRD - Sensitive	
Western Wood Pewee	<i>Contopus sordidulus</i>	17%	55%	ABOVE	ESRD - Sensitive	
MAMMALS	Canada Lynx	<i>Lynx canadensis</i>	27%	77%	BELOW	AB ESCC - Sensitive   COSEWIC - Not at Risk
	Marten and Fisher	<i>Martes</i>	31%	71%	BELOW	AB ESCC - Sensitive (Fisher)
VASCULAR PLANTS	Spreading Woodfern	<i>Dryopteris expansa</i>	9%	77%	BELOW	ESRD - Sensitive
	Purple Peavine	<i>Lathyrus venosus</i>	8%	71%	BELOW	ESRD - Sensitive
MOSSES	Flat-brocade Moss	<i>Platygyrium repens</i>	15%	69%	BELOW	ESRD - Sensitive

\*Threat categories for species at risk as identified by the Government of Canada and/or the Government of Alberta. This assessment includes species and sub-species identified by Canada's Committee on the Status of Endangered Wildlife in Canada (COSEWIC), listed under Canada's Species at Risk Act (SARA), recognized by Alberta's Ministry of Environment and Sustainable Resource Development (ESRD), and/or identified by Alberta's Endangered Species Conservation Committee (AB ESCC). This list is meant to be as inclusive as possible as species that are listed as Maybe at Risk, At Risk, Sensitive, or Undetermined by ESRD are included.

# Conclusion

Sustainable development of natural resources in the North Saskatchewan Region requires a clear understanding of the environmental costs linked to resource development, as well as the opportunities to preserve environmental values. As the Government of Alberta moves toward an integrated management system for managing resource development, the components of biodiversity set out in this report can be used to support land-use planning decisions. Specific results of note include the following:

- As of 2012, the total human footprint across the North Saskatchewan Region was 53.3%. Agriculture footprint was the largest human footprint category, covering 44.4% of the planning region in 2012, followed by transportation footprint at 2.5%, and forestry footprint at 2.3%. Human footprint is not evenly spread across the region as it ranged from a low of 1.1% in the Rocky Mountain Natural Region to a high of 77.8% in the Parkland Natural Region.
- Overall, 48% of the North Saskatchewan Region is composed of native habitat with a 0 m buffer from human footprint, while 10% of native habitat is at least 2 km away from development, all of that 10% in Banff National Park.
- Biodiversity intactness for the North Saskatchewan Region as of 2012 is 65%. By natural region, intactness was 87% for the Foothills and Rocky Mountain, 59% for the Boreal, 55% for the Parkland, and 64% for the Grassland.
- In general, the biggest ecological changes are associated with lower-than-expected abundances of native grassland species in the Parkland Natural Region.
- Non-native weeds were detected at all ABMI sites that have been sampled to date in the North Saskatchewan Region. Of the 78 species found, 9 are listed as noxious weeds under the *Alberta Weed Control Act* and 15 are considered nuisance weeds.

The biodiversity indicators set out in this report establish the current conditions that will be used to measure the sustainability of resource development in the North Saskatchewan Region, setting the stage for openly addressing management questions including:

1. What are the impacts of different types of resource development (e.g., agriculture, forestry, energy) on biodiversity?
2. What components of biodiversity are the most sensitive to resource development, and what might be done to minimize impacts?
3. What are the cumulative effects of resource development on biodiversity, and how effective are efforts to manage regional cumulative effects?

With the North Saskatchewan Region 65% intact today, there are challenges associated with land-use planning, particularly in the Parkland Natural Region, where much of the area has been converted to agricultural land uses. As the region's population and economy continue to grow, pressure on regional ecosystems is continually increasing. Now, more than ever, effective management of biodiversity through land-use planning is essential. As development continues to unfold in the North Saskatchewan Region, the ABMI will continue to measure and report on the changing state of human footprint and biodiversity.



## Next Steps

The ABMI will continue to work with federal and provincial agencies to implement scientifically credible monitoring systems for the province of Alberta. Among the highest priorities for the ABMI will be to ensure integration between monitoring and land-use planning activities and to support the coordination of biodiversity monitoring with water and air monitoring initiatives.

The analyses in this report are preliminary as not all ABMI sites in the North Saskatchewan Region have been sampled. As monitoring information for the North Saskatchewan accumulates and our analysis methods continually improve, the ABMI will report on more species and habitats. Similar reports for the six remaining planning regions are currently in various stages of development. Future reports will also report on biodiversity trends—the primary purpose of the ABMI. We look forward to providing updates to this report on a regular schedule.



# General Terms

## Limitations

The ABMI is designed primarily as a proactive tool used to identify the status, trends, and correlative relationships among common species, habitats, and human footprint.

The ABMI indices are based on the establishment of current, intact reference conditions that are statistical predictions designed to account for human footprint. These reference conditions and subsequent ABMI analyses and reporting do not account for historical changes in the overall abundance of a species (i.e., the ABMI cannot account for any change in a species that occurred before 2003). ABMI reference conditions have statistical uncertainty for individual species. This uncertainty will decrease as the ABMI surveys more sites in the North Saskatchewan Region.

## Looking Forward

The ABMI has made considerable strides in supporting biodiversity management in Alberta; however, we are just beginning. The ABMI continues to build momentum and is committed to:

- Ensuring the effective delivery of relevant, timely, and scientific biodiversity information
- Improving biodiversity management by contributing knowledge to decision-making systems
- Supporting governments and industries in meeting their domestic and international reporting obligations
- Eliminating duplication and redundancy in provincial biodiversity monitoring
- Facilitating the transfer of information to government, industry, the research community, and the public

## Scientific Integrity

The ABMI is committed to the responsible analysis and interpretation of data. The ABMI holds itself to the highest ethical standards, including operational transparency, honesty, conscientiousness, and integrity. The ABMI strongly encourages the responsible and ethical evaluation and interpretation of the knowledge contained in this report. For a complete discussion of the ethical behaviour endorsed by the ABMI, please see Honor in Science, published by Sigma Xi (1997), available at [www.sigmaxi.org/programs/ethics/Honor-in-Science.pdf](http://www.sigmaxi.org/programs/ethics/Honor-in-Science.pdf). A broader discussion about the use of ABMI data and information can be found in Scope and Application of the ABMI's Data and Information (00048), Version 2008-01-04, Alberta Biodiversity Monitoring Institute, Alberta, Canada. This report is also available at [www.abmi.ca](http://www.abmi.ca) under "Reports/Core Reports."

## Disclosure

Data used in the preparation of this report is available on the ABMI's website and include species, habitat, and remotely sensed data collected between 2003 and 2012. The scientific methods used in analyses of data for this report are described in the following documents:

1. Alberta Biodiversity Monitoring Institute. 2011. Manual for Estimating Species and Habitat Structure Intactness (20029), Version 2011-07-07. Alberta Biodiversity Monitoring Institute, Alberta, Canada. Available at [www.abmi.ca](http://www.abmi.ca) under "Reports/Intactness Analyses."
2. Alberta Biodiversity Monitoring Institute. 2012. Manual for Reporting Human Footprint (20030), Version 2013-03-26. Alberta Biodiversity Monitoring Institute, Alberta, Canada. Available at [www.abmi.ca](http://www.abmi.ca) under "Reports/Standards and Protocols/ Landscape Mapping Protocols."

Principal authors of this report are Katherine Maxcy, Dave Huggard, Tara Narwani, and Jim Herbers. Joan Fang and Daiyuan Pan analyzed and helped interpret the data. Jim Schieck provided technical and editorial insight on various aspects of the report.

# Terms and Conditions of Report

## Preparation

The ABMI is responsible for initiating and resourcing the creation of this report. The following terms were applied in the preparation of this report:

1. The ABMI reports on a standardized list of biodiversity indicators that are relevant to regional planning, policy, and management. Developed by the ABMI, these indicators will be consistently applied.
2. The ABMI maintains full control over all language and messaging in this report.
3. This biodiversity status report encompasses the North Saskatchewan Region and cannot be localized to smaller landscapes within the North Saskatchewan Region unless already specified in this report.
4. This biodiversity status report uses data collected between 2003 and 2012.
5. The report was released publicly in a timely manner.

## Image Credits

Cover page, credit: unknown / p.3: Chestnut-collared Longspur, credit: Glenn Bartley / p.4: ABMI vegetation plot, credit: unknown / p.4: ABMI soil core, credit: ABMI / p.8: foothills, credit: Tom Habib / p.8: Johnston Canyon, credit: unknown / p.12: North Saskatchewan River, credit: V.J. Matthew / p.12: aerial forestry photo, credit: unknown / p.13: Athabasca glacier, credit: Inga Locmele / p.13: Edmonton, credit: 2009fotofriend / p.13: agriculture, credit: 2009fotofriend / p.12: Industrial activity, credit: Nina Veselka / p.17: Lake Louise, credit: Janine Rietz / p.22: Sprague's Pipit, credit: Glenn Bartley / p.25: Coyote, credit: Hal Brindley / p.26: Furrowed Hermit Mite, credit: Royal Alberta Museum / p.29: Trembling Aspen, credit: colacat (Shutterstock) / p.30: European Starlings, credit: unknown / p.32: Woodsy Leafy Moss, credit: Michael Lüth / p.34: Baird's Sparrow, credit: Brandon Smith / p.37: Elk Island National Park, credit: Brandon Smith

## Preferred Citation

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