The status of biodiversity in the Grassland and Parkland Regions of Alberta

PRELIMINARY ASSESSMENT 2015

Alberta Biodiversity
Monitoring Institute

[THIS REPORT DESCRIBES THE STATUS OF BIODIVERSITY AND HUMAN FOOTPRINT IN THE GRASSLAND AND PARKLAND REGIONS OF ALBERTA]

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Agriculture is the dominant human footprint in the Prairie Region.

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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.

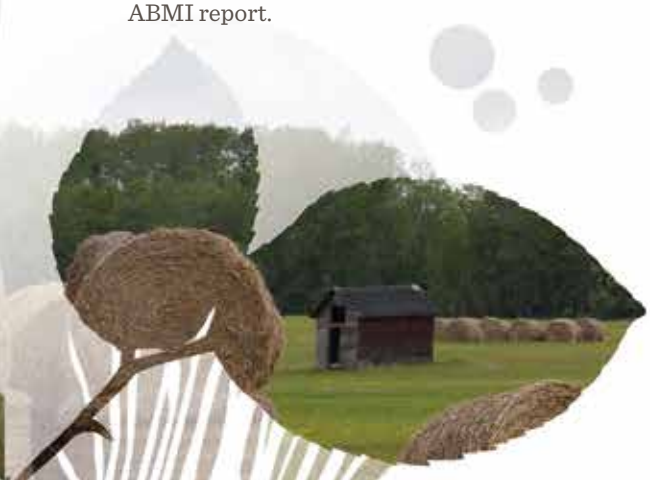
* The ABMI defines "human footprint" as the visible conversion of native ecosystems to temporary or permanent residential, recreational, agricultural, or industrial landscapes.

ABOUT THE PRAIRIE CONSERVATION FORUM

The Prairie Conservation Forum (PCF) requested the ABMI produce a preliminary report on the status of biodiversity in the Grassland and Parkland Natural Regions in Alberta. This report is the result of that request; it was prepared in consultation with the PCF (subject to Terms and Conditions, pg. 48) and produced in part with its financial support.

The PCF was established by the Government of Alberta in response to the original Prairie Conservation Action Plan (PCAP) that was released by World Wildlife Fund Canada and the governments of Alberta, Saskatchewan, and Manitoba in 1988. The PCAPs are five-year blueprints aimed at prairie-wide efforts to conserve and manage native prairie species, communities, and habitats. The PCF is a non-profit organization that includes representatives from approximately 50 member organizations and numerous individuals. It exists to promote the conservation of native biodiversity in prairie and parkland environments in Alberta, and to provide an ongoing profile for prairie and parkland conservation initiatives.

The 2011-2015 PCAP is the fifth action plan written and released in Alberta. It focuses on strategies to achieve three overarching outcomes: maintaining large native prairie and parkland landscapes; conserving connecting corridors for biodiversity; and protecting isolated native habitats. One of the strategies to support the outcomes involves completing inventories and assessments of native biodiversity. As a result, the PCF requested and funded the production of this ABMI report.



This ABMI report presents data and analysis on a sub-region within the Parkland and Grassland Natural Region identified as the High Value Landscape (HVL) which represents large and mainly intact tracts of native grasslands. The 2011 - 2015 PCAP delineated the HVL at a coarse-filter regional scale by combining mapping information on native vegetation, species at risk, ecosystem services, and environmentally significant areas in Alberta. This ABMI report is most relevant to outcome one (above) of the 2011 - 2015 PCAP and evaluates the biodiversity intactness of species within the HVL and contrasts it with remaining lands under more intensive land use.

The PCF's second desired outcome relates to biodiversity and connectivity. By assessing the effect of human footprint and calculating native patch size at various scales, this report provides preliminary insight into the influences of land use, linear features and landscape fragmentation on biodiversity as a whole.

The information in this report—derived from the ABMI's extensive monitoring of biodiversity and human footprint in the region—supports the PCF as they evaluate priorities as part of the upcoming 2016-2020 PCAP. Comparative values, such as the Biodiversity Intactness Index within and outside the HVL, provide valuable information necessary to develop new strategies and measure progress toward the 2016 – 2020 PCAP outcomes. The PCF also provides this information to its member organizations to support their own conservation work within the Grassland and Parkland Natural Regions of Alberta.

PRAIRIE CONSERVATION FORUM

REPORT SUMMARY

The 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 Grassland and Parkland Natural Regions (hereafter Prairie Region) of Alberta. This information provides a baseline to evaluate change in biodiversity in the Prairie Region and support land-use planning objectives defined in the PCAP.

The Reporting Area

The Prairie Region makes up 24% of Alberta's land area. This region is part of the vast Great Plains ecosystem that stretches from Canada's prairie provinces through to central Mexico in the interior of North America. Also highlighted in this report is the High Value Landscape within the Prairie Region, an area identified by the PCF because of its high biodiversity values.

Status of Human Footprint

As of 2013, human footprint covered 63.1% of the Prairie Region. Agriculture footprint is the largest human footprint type, covering 55.2% of the area. Transportation footprint (2.7%), energy footprint (2.5%), and urban, rural, and industrial footprint (2.3%) covered similar areas within this region. Human footprint was approximately two to three times higher outside the High Value Landscape than inside for all human footprint categories except energy footprint, which was higher in the High Value Landscape.

The per cent area of human footprint increased from 61.3% to 63.1% in the Prairie Region between 1999 and 2013. There was a larger increase in the per cent area of human footprint in the High Value Landscape, from 28.4% to 30.8% (a 2.4% increase) between 1999 and 2013, than outside the area, where the footprint increased from 80.7% to 82.3% (a 1.6% increase).

Status of Biodiversity

The ABMI assessed the status of 197 species in the Prairie Region and found them to be, on average, 53% intact;† intactness was 69% inside the High Value Landscape and 43% intact outside. In the Prairie Region, biodiversity intactness ranged from 51% for armoured mites to 63% for native birds. In the High Value Landscape, biodiversity intactness was similar for all taxa, ranging from 68% to 70%. Outside the High Value Landscape, intactness ranged from 32% for vascular plants to 58% for native birds.

At present, the biggest ecological changes are associated with the lower-than-expected abundance of species that require native prairie habitat, such as the 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.

Additional results of note include:

- Species that thrive in agricultural landscapes or disturbed habitat, such as the Coyote, Chipping Sparrow, and Foxtail Barley, were more abundant than expected.
- A total of 38 non-native plants were detected in the Prairie Region; an average of 9 non-native plant species were detected at each ABMI site. A number of these non-native species have been intentionally introduced for agricultural purposes, either as crops or as forage for livestock, and are associated with agriculture footprint.

† 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 Biodiversity Intactness Index is a measure of how much more or less common a species is relative to its respective reference conditions.

- The ABMI detected 73 species at risk[‡] and was able to assess the status for 17 of these species. Of the assessed species, most were less abundant than expected; this includes six species of native grassland-associated birds, which ranged from 9% to 76% less abundant than expected. Only three species were more abundant than expected.

Status of Native Habitat

As of 2012, 37% of the Prairie Region is composed of native vegetation when no buffer is applied. Most of this is within the High Value Landscape, as 69% of the High Value Landscape is composed of native vegetation compared to 18% outside. At 200 m from human footprint, native vegetation is highest in the High Value Landscape at 23% compared to only 2% outside.

Overall, 1.4% (2,218 km^2) of the Prairie Region is managed as protected areas. All natural subregions within the Prairie Region have < 2% representation in protected areas.

The ABMI measures one aspect of habitat fragmentation of native vegetation[§] by calculating the effective mesh size of the Prairie Region. Effective mesh size is a measure of the size of native vegetation patches combined with distance to edge at a particular scale. Larger mesh size values occur in bigger native vegetation patches further from the edge of human footprint, whereas smaller mesh size values indicate smaller patches and more human footprint. The average effective mesh size of the Prairie Region is 5.0 km^2 when linear features like roads are included as human footprint that divides native patches. The average effective mesh size in the High Value Landscape is 11.9 km^2 compared to only 0.4 km^2 outside, when linear features are counted as dividing native patches.

Report Spotlights

There are two spotlights in this report—Ecosystem Services and Wetlands. The following summarizes highlights from these sections.

Ecosystem Services: Native grasslands of Alberta supply a number of important ecosystem services, such as: forage production, water purification, pollination, and carbon storage. The ABMI has produced preliminary models and maps of above ground biomass and carbon storage across native grassland in Alberta. Highlights from this work include the depiction of spatial variability in these ecosystem services, and a preliminary approach for estimating their value. This work supports initiatives related to the development of market-based instruments and sustainability reporting.

Wetlands: Wetlands are incredibly productive environments rich in biodiversity that also provide a number of important benefits to people, such as water filtration and protection from floods. An estimated 60–70% of wetlands have been lost in southern Alberta, and the current annual rate of wetland losses in the province has been estimated at 0.3–0.5%.

Overall, this report describes the current status of biodiversity in the Prairie Region of Alberta. 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.

‡ 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 Parks (AEP) 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.

§ Habitat provides the specific resources and conditions necessary to support the occupancy of a particular species. We are not assessing habitat of any species but instead measuring patch size of native vegetation.

INTRODUCTION

Temperate native grasslands are among the most threatened ecosystems in the world.[1] In Alberta, approximately 68% of native prairie has been converted to other land uses, predominantly agriculture. The native prairie that remains is under increasing pressure as a result of a growing human population, intensification of agricultural practices, and expanding energy development.

Despite these pressures, southern Alberta is one of the few jurisdictions in North America that still contains large tracts of unbroken native prairie. These landscapes provide important opportunities for stewardship* of prairie biodiversity. These opportunities are not going unnoticed, as the stewardship value of native grasslands, along with the economic and ecological benefits, are increasingly being recognized. For example, a new class of protected areas called heritage rangelands was created in 2003 in Alberta, recognizing not only the value of native prairie but also the important role ranchers play in maintaining the health of these ecosystems through sustainable livestock grazing practices.[2] More recently, the preservation of native prairies was identified as a high priority as part of the South Saskatchewan Regional Plan.[3]

Biodiversity monitoring is a key part of land-use planning when preserving the integrity of native grassland and parkland ecosystems. 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 prairie and parkland ecosystems. Our biodiversity, habitat, and human footprint data are designed to measure progress toward environmental outcomes identified as part of land-use planning processes.

In this report, we describe the status of human footprint, species, and native habitat** in two of Alberta's Natural Regions, the Grassland Natural Region and the Parkland Natural Region (hereafter referred to as the Prairie Region), as well as the High Value Landscape within the Prairie Region (Figure 01). We describe the amount of human footprint and provide information on trend of human footprint over the past 14 years. We report on the current status of hundreds of species and highlight those that show the most sensitivity to human development. Finally, we report on the amount, level of protection, and degree of fragmentation of native habitat in the Prairie Region. The information in this report can be used as a foundation for evaluating the sustainability of resource development in the Prairie Region.

* Stewardship is a kind of land ethic that recognizes the importance of responsible management and protection of the land to conserve its environmental values.

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

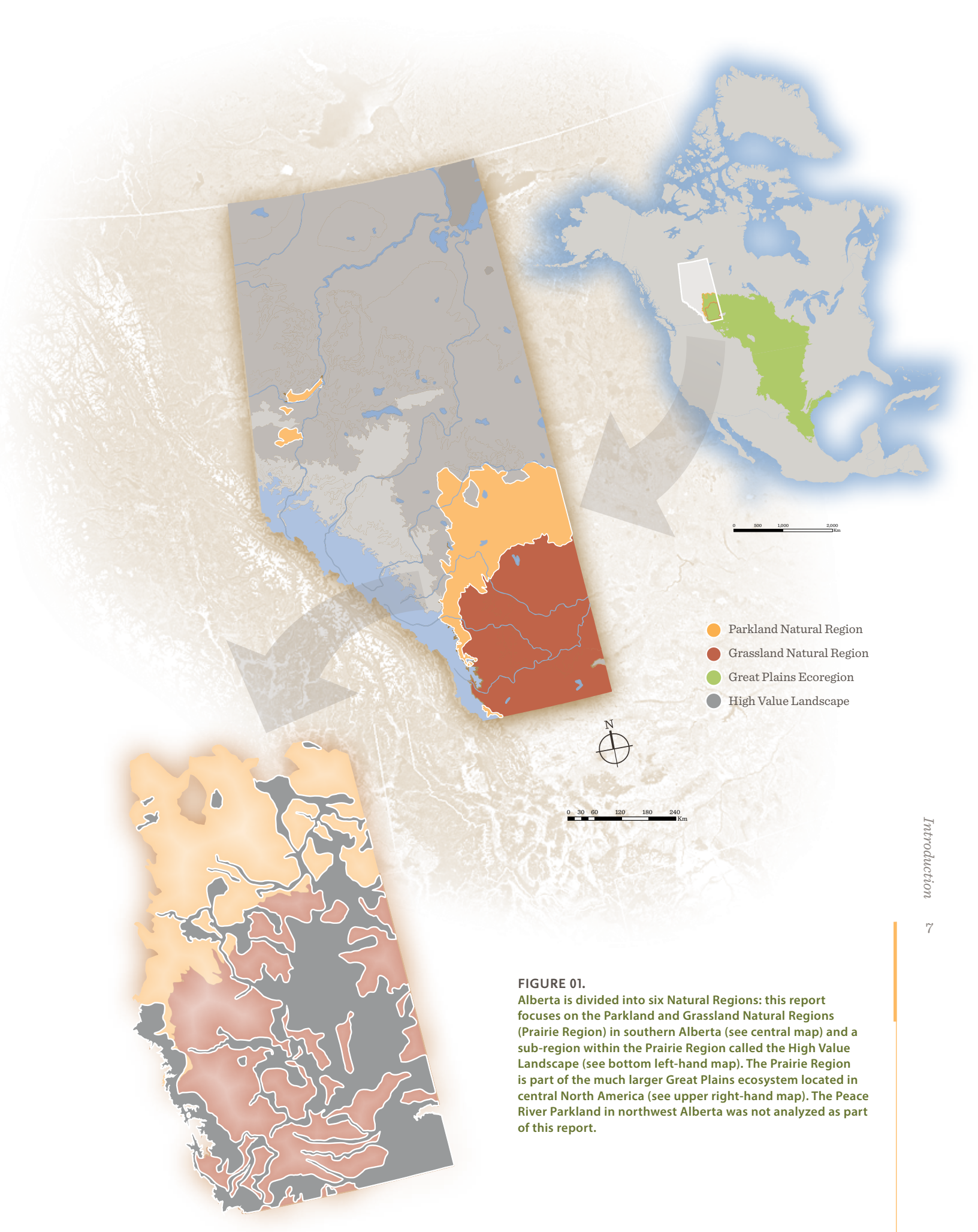


FIGURE 01.
Alberta is divided into six Natural Regions: this report focuses on the Parkland and Grassland Natural Regions (Prairie Region) in southern Alberta (see central map) and a sub-region within the Prairie Region called the High Value Landscape (see bottom left-hand map). The Prairie Region is part of the much larger Great Plains ecosystem located in central North America (see upper right-hand map). The Peace River Parkland in northwest Alberta was not analyzed as part of this report.

REPORTING AREA

Ecology of the Prairie Region

The Prairie Region covers an area of 156,318 km^2 (or 24%) of Alberta and includes two Natural Regions—the Grassland Natural Region and the Parkland Natural Region (Figure 02). This area is part of the vast Great Plains ecosystem that stretches from Canada's prairie provinces through to central Mexico in the interior of North America.

In the rain shadow of the Rocky Mountains to the west, the Prairie Region receives too little precipitation to support forests but too much precipitation to be considered a desert—hence the predominance of grasses and forbs that characterize Alberta's iconic prairie landscape. This vast grassland once supported millions of bison, elk, antelope, and deer, not to mention the diversity of predators that followed in their wake, like wolves and grizzly bears.

In addition, millions of wetlands left behind by retreating glaciers supported huge populations of waterfowl, shorebirds, and landbirds. These wetlands, along with a number of other landforms like ravines, coulees, badlands, and sand dunes, created a diverse landscape rich in biodiversity.

The rich, productive environment of the Prairie Region supported First Nations cultures for thousands of years and was also what attracted European settlers to the region. As a result of European settlement, much of the native prairie was converted to agriculture during the first half of the 19th century, creating a proud farming legacy that continues to define the economy and culture of southern Alberta to the present day. Livestock grazing is also an important industry that occurs in large areas of native grassland. The pressure to convert native grassland to other land uses continues as a result of a growing human population, intensification of agricultural practices, and expanding energy development.

Livestock grazing is a common land-use practice, and is an important rangeland management tool promoting healthy grassland ecosystems.

Linear human footprint, such as roads, power lines, and pipelines, crisscrosses much of the prairie landscape.

There are several glacier-fed river systems that flow from west to east through the Prairie Region, such as the Red Deer River, Bow River, and Oldman River. These rivers are the main water supplies for all of central and southern Alberta.

The majority of Alberta's residents live in the Prairie Region, concentrated mainly in urban centres like Calgary, Edmonton, and Lethbridge.

Conventional oil and gas development is common throughout much of the Prairie Region.

Agriculture, including livestock and crop production, is the main economic driver throughout much of the region, supporting the livelihood of many rural municipalities.

- Grassland Natural Region
- Parkland Natural Region

FIGURE 02.
The Prairie Region, including the Grassland and Parkland Natural Regions, represents 24% (156,318 km^2) of Alberta's total land area.

MEASUREMENTS

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 03).

The status of biodiversity, native habitat, and human footprint in the Prairie Region is the focus of this report. Of the ABMI's 1,656 sites, 383 are located in the Prairie Region (Figure 03).

This report also examines the status of biodiversity in the High Value Landscape, which occupies 37% (57,061 km^2) of the Prairie Region (Figure 01). The High Value Landscape was identified by the PCF by combining mapping information on native vegetation, species at risk, ecosystem services, and environmentally significant areas. At a coarse-filter regional scale, the High Value Landscape was defined to initiate a dialogue around two of the PCF PCAP's strategic outcomes: maintain large prairie and parkland landscapes, and conserve connecting corridors for biodiversity.

Biodiversity Data Collection

The ABMI implemented spring and summer data collection protocols at 204 of the Prairie Region's 383 sites between 2003 and 2012.

From May, to the end of June, ABMI technicians recorded breeding birds, collected armoured mite samples, and measured habitat characteristics at each site. In July, technicians recorded vascular plant and moss species that were present. Protocols were implemented in the same way at all sites in each sampling year, except where protocol updates are noted in our methodology (see Supplementary Report available at www.abmi.ca for further details).

For species that could not be identified in the field (e.g., mites), ABMI taxonomists at the Royal Alberta Museum sorted, identified, and archived samples to complete the Institute's species-level dataset.

We report on the status of biodiversity in the Prairie Region using only statistical results relevant to this region, or the High Value Landscape within this region. In this report, we present biodiversity results for the following:

- Breeding birds
- Armoured mites
- Vascular plants
- Non-native plants
- Mosses
- Species at risk

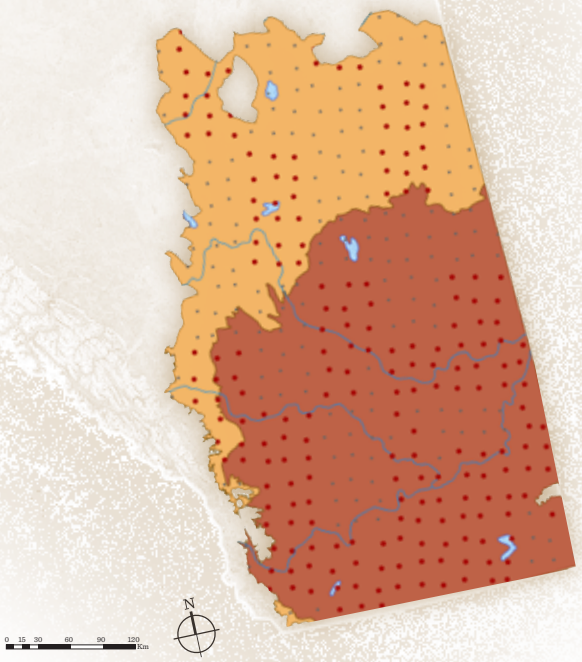


FIGURE 03.
Of the ABMI's 1,656 survey sites, 240 are in the Grassland Natural Region, and 143 are in the Parkland Natural Region; 146 of the grassland sites and 58 of the parkland sites were sampled from 2003 to 2012.

ABMI Measures Human Footprint

The ABMI monitors the state of Alberta's human footprint using satellite imagery and fine-resolution aerial photography. Human footprint refers to the geographic extent of areas under human use that have lost their natural cover (e.g., cities, roads, agricultural land, industrial areas) or whose natural cover is periodically or temporarily replaced by resource extraction activities (e.g., forestry, seismic lines, surface mining).

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

1. Using a sampling design that covers approximately 5% of the province, the ABMI monitors human footprint annually in a 3 × 7 km rectangular area centred on each ABMI site location. At each of the 1,656 locations, a 3 × 7 km rectangle is examined at a 1:5,000 scale to delineate all human footprint types present. These detailed annual samples of human footprint are available from 1999 to 2012, except for the year 2000. These sample areas are used to track changes in human footprint over time.
2. At the provincial scale, existing satellite imagery is used to create a wall-to-wall inventory of human footprint of the entire province at a 1:15,000 scale; this product is updated every two years. It is a compilation of externally sourced information about provincial human footprint, supplemented with ABMI remote sensing data that has undergone quality-control procedures. Available for 2007, 2010, and 2012[††] the wall-to-wall human footprint inventory is used to map human footprint and calculate intactness for regions.

At both spatial scales, the ABMI divides human footprint types into six categories for analysis:

1. **Agriculture footprint:** areas of annual or perennial cultivation, including crops and tame pasture, as well as confined feeding operations and other high-density livestock areas.
2. **Forestry footprint:** areas in forested landscapes where timber resource extraction has occurred for industrial purposes, including clear-cut and partial-cut logging methods.
3. **Human-created waterbodies:** waterbodies constructed for a variety of purposes, such as to extract fill (burrow-pits, sumps), water livestock (dugouts), transport water (canals), support municipal uses (water supply and sewage), and store water (reservoirs).
4. **Mines, wells, and other energy features (hereafter energy footprint):** areas where vegetation has been disturbed due to the creation of mine sites, peat mines, pipelines, seismic lines, transmission lines, well sites, wind generation facilities, etc.
5. **Transportation footprint:** railways, roadways, and trails with hard surfaces such as cement, asphalt, or gravel (i.e., hard linear features), roads or trails without gravel or pavement (i.e., soft linear features), and the vegetation strips alongside transportation features.
6. **Urban, rural, and industrial (hereafter residential footprint):** residences, buildings, and disturbed vegetation associated with urban and rural settlements, including homes and shopping centres, industrial areas, golf courses, etc., as well as bare ground cleared for industrial and commercial development.

[††] Due to changes in methodology, the 2007 and 2010 Inventory of Provincial Human Footprint are not directly comparable with the 2012 inventory.

Biodiversity Indicators in This Report

Habitat loss is a major driver of biodiversity decline on the planet.[4] In the Prairie Region, habitat has been modified or lost to a range of human activities, particularly agriculture, urban expansion, and energy development, and development continues. 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 as follows:

Species

To assess the status of species,[‡‡] the ABMI collects and analyzes data on breeding birds, armoured mites, vascular plants, and mosses. To report on the status of species, the ABMI has developed a metric called the Biodiversity Intactness Index. There are three steps in calculating biodiversity intactness. The first is fitting data to statistical models that describe the relationship between each species and human footprint. This step uses the field data from ABMI sites across broad regions (e.g., the Grassland and Parkland Natural Regions). The next step is to use these models to predict the current and reference abundance of each species at every quarter section in the reporting region. Current abundance is the abundance predicted with the current amount of each footprint type. Reference abundance is the abundance if there were no footprint. Abundance estimates are based on GIS summaries of human footprint and other variables in each quarter section in the reporting region. The third step is summing the predicted current abundances and reference abundances of each species across the region and using these to calculate intactness of each species, broader groups (e.g., grassland birds), and overall biodiversity.

The index ranges from 0% to 100% and is interpreted as follows (see Figure 04 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, human footprint reduces these species' abundance.[§§] 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 native vegetation at three different buffer distances (0 m, > 50 m, and > 200 m) away from footprint; fragmentation of native habitat using an index related to patch size (i.e., effective mesh size), and 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 samples 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 plots with detailed inventory of human footprint available from 1999 to 2013 (except for 2000). All maps of human footprint included in this report are based on the 2012 wall-to-wall Inventory of Provincial Human Footprint.

See the Prairie Supplemental Report (available at www.abmi.ca) for further details.

‡‡ We also collect data on mammals, lichens, wetland invertebrates, wetland plants, wetland chemistry, and habitat elements in the Prairie Region, but these data are not yet ready for reporting.

§§ While a species may be less abundant in human footprint, the population may still have increased, due to other factors such as climate or interactions with other species. The reverse may also be true.

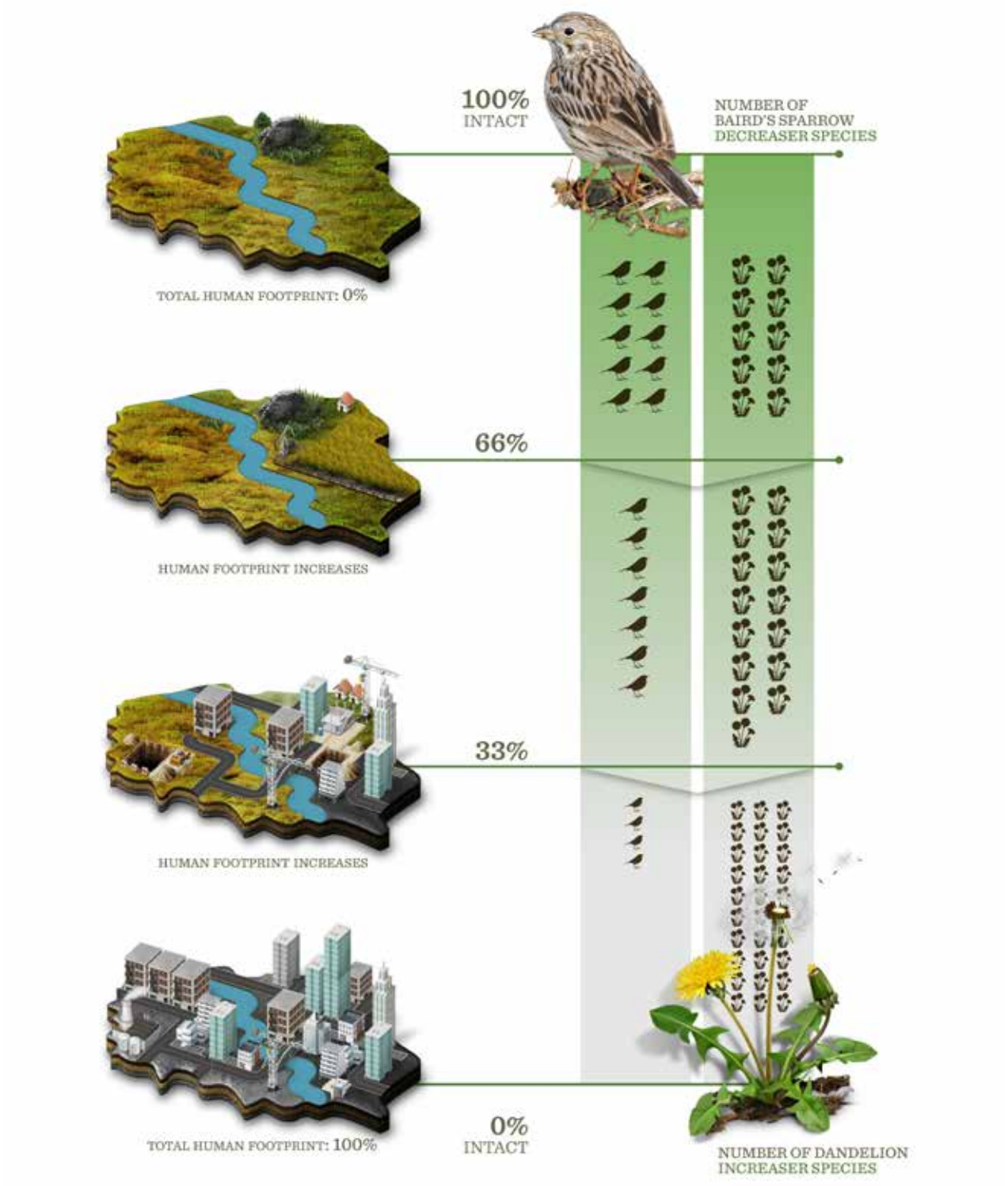
FIGURE 04.
THE ABMI BIODIVERSITY INTACTNESS INDEX

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 two grassland-associated species:

- **A "decreaser" species, the Baird's Sparrow**
- **An "increaser" species, the Dandelion**

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 Baird's Sparrow, a decrease in number is observed**
- **For the Dandelion, an increase in number is observed**



RESULTS

Human Footprint

Human footprint data, including footprint type, amount, and trend, provides 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.

As of 2013, the total human footprint in the Prairie Region was 63.1% (Figure 05, 06A).

Agriculture was the largest human footprint category in the Prairie Region, covering 55.2% of the area (Figure 06B). 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 grassland and parkland into cultivated agricultural land. Transportation footprint, energy footprint, and urban, rural, and industrial footprint, at 2.8%, 2.5%, and 2.3%, covered a low percentage area of the region but were broadly dispersed across the landscape (see Supplementary Report to view maps).

Human footprint was approximately two to three times higher outside the High Value Landscape than inside for all human footprint categories except energy footprint, where the reverse was true.

The per cent area of human footprint increased from 61.3% to 63.1% in the Prairie Region between 1999 and 2013 (Figure 05). There was a larger increase in the per cent area of human footprint in the High Value Landscape which increased by 2.4% from 28.4% to 30.8% between 1999 and 2013 compared to a 1.6% increase outside the High Value Landscape which increased from 80.7% to 82.3%. The increase in the High Value Landscape was largely driven by agriculture footprint, which increased by 1.3% during this time frame.

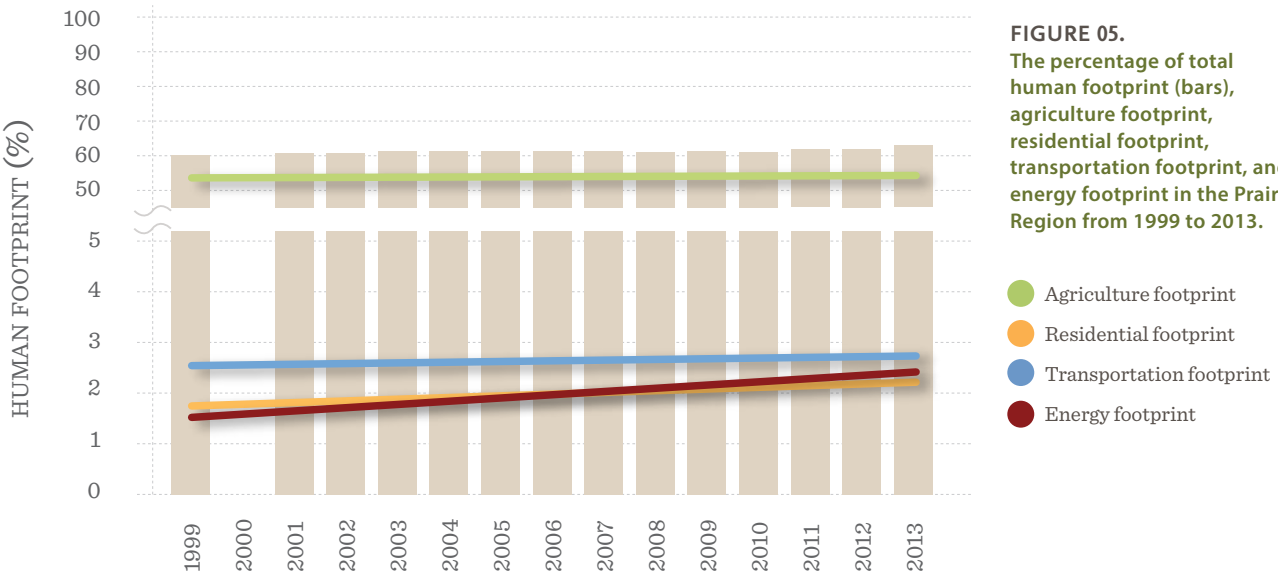
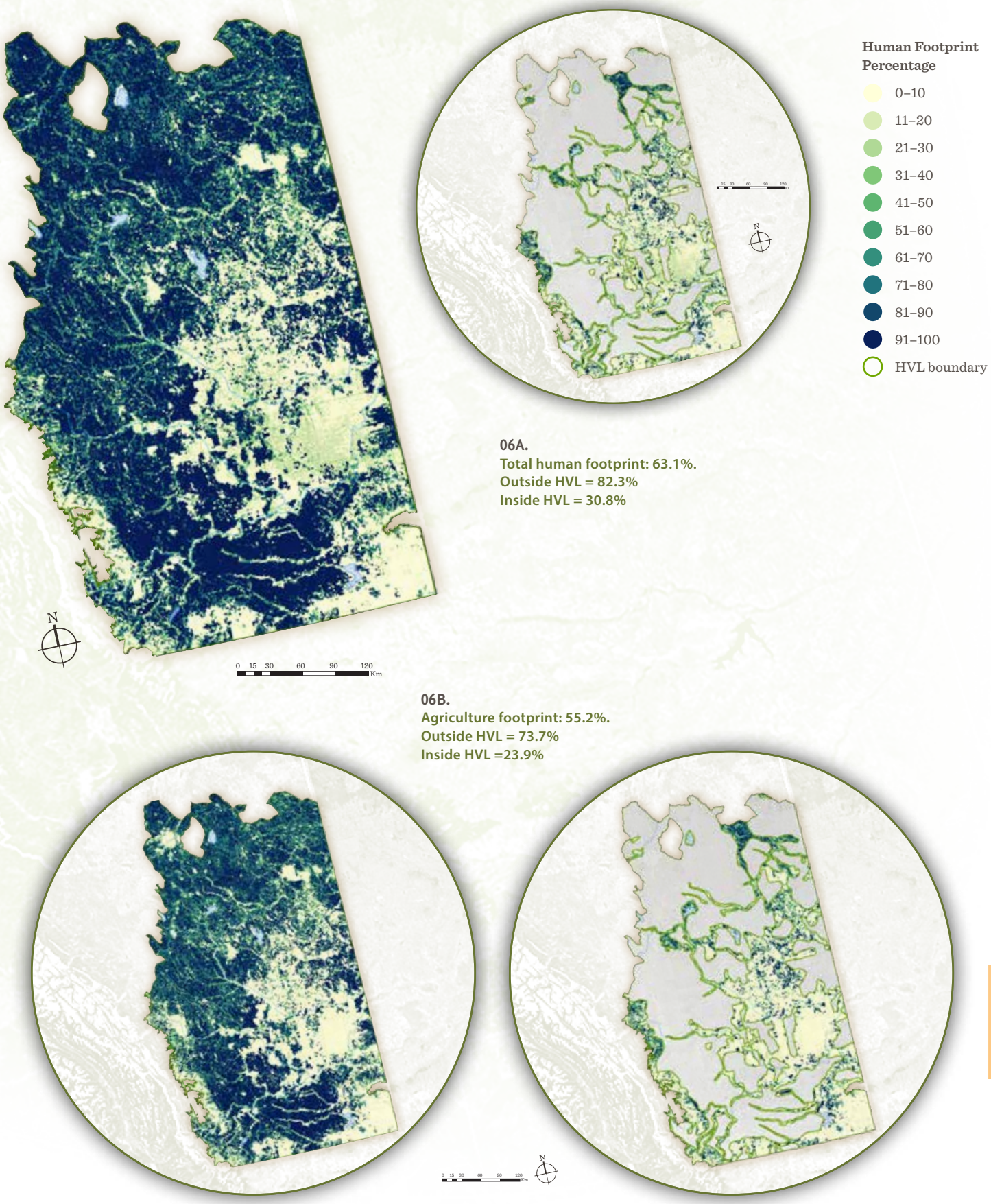


FIGURE 05.
The percentage of total human footprint (bars), agriculture footprint, residential footprint, transportation footprint, and energy footprint in the Prairie Region from 1999 to 2013.



06A.
Total human footprint: 63.1%.
Outside HVL = 82.3%
Inside HVL = 30.8%

06B.
Agriculture footprint: 55.2%.
Outside HVL = 73.7%
Inside HVL =23.9%

FIGURE 06.
Distribution of A. total human footprint, and B. agriculture footprint in the Prairie Region circa 2012. The percentage footprint in each category is provided for the entire Prairie Region (left map), as well as inside the High Value Landscape (HVL (right map)).

Biodiversity Intactness

Thousands of plant and animal species live in Alberta's Prairie Region. Native birds, armoured mites, vascular plants, and mosses represent a small but diverse subset of all species in the region.

The ABMI assessed the status of 197 native species in four taxonomic groups in the Prairie Region; intactness ranged from 47% to 63% (Table 01).

Inside the High Value Landscape, biodiversity intactness ranged from 68% for armoured mites and vascular plants to 70% for native birds.

Outside the High Value Landscape, biodiversity ranged from 32% for vascular plants to 58% for native birds.

Overall, intactness was 26% higher inside the High Value Landscape at 69%, compared to outside at 43%.

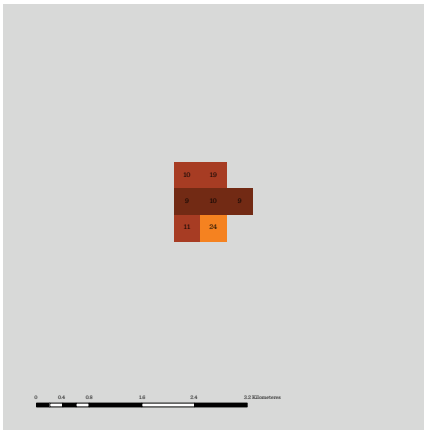
TABLE 01.
Per cent intactness* for different components of biodiversity in the Prairie Region, inside the High Value Landscape (HVL), and outside the High Value Landscape.

		BIODIVERSITY INTACTNESS		
Biodiversity Component	Number of Species	Prairie Region	Inside HVL	Outside HVL
Native birds	55	63	70	58
Armoured mites	17	51	68	40
Vascular plants	113	47	68	32
Mosses	12	49	69	41
*Overall intactness**	197	53	69	43

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

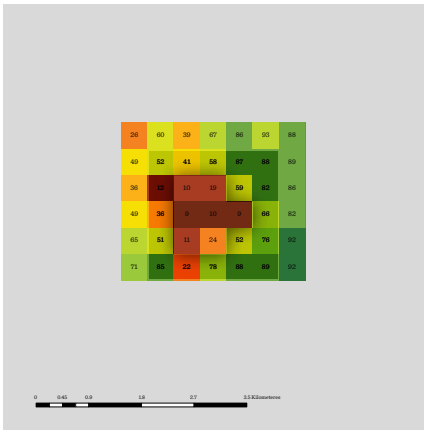
It is important to note that the intactness results in this report are averages that apply to three defined landscapes: the Prairie Region, inside the High Value Landscape, and outside the High Value Landscape. As with most landscapes in Alberta, specific locations within these regions are nearly 0% intact (e.g., active industrial sites in urban areas), and other sites are 100% intact (e.g., undeveloped grassland and wetland habitat). See Figure 07 for an explanation of how the Biodiversity Intactness Index changes depending on the area of focus.

For Biodiversity Intactness, Context Matters



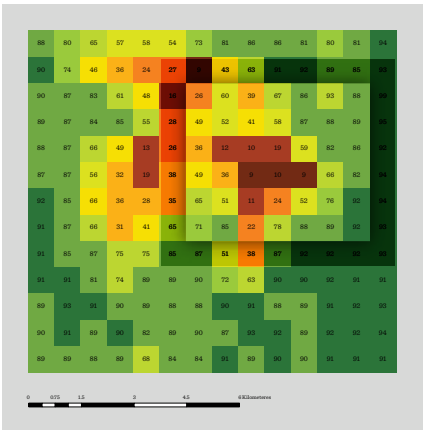
07A.
7 quarter sections with intense industrial development

Average intactness: 13%



07B.
42 quarter sections with low to intense industrial development

Average intactness: 56%



07C.
182 quarter sections with minimal to intense industrial development

Average intactness: 72%

FIGURE 07.
Estimated biodiversity intactness maps with Biodiversity Intactness Index values for each quarter section (QS) of land within a given area. (See p. 18 for information on interpreting estimated biodiversity intactness maps.) Shading represents biodiversity intactness from low (red brick square: 0%–10%) to high (dark green square: 91%–100%).

A. intactness values (9% to 24%) for 7 QSs
B. intactness values (9% to 93%) for 42 QSs, including the seven presented in A
C. intactness values (9% to 99%) for 182 QSs, including the 42 presented in B

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 is dependent on the area of focus. If we focus exclusively on an area of intense industrial development, such as the area in Figure 07A, average intactness will be very low. By contrast, if we consider areas with a range of industrial development from minimal to intense, such as shown in Figures 07B and 07C, average intactness will increase accordingly.

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

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 for each species that has sufficient data. These statistical models are used to calculate the Biodiversity Intactness Index for individual species in the Prairie Region. The models can be used to estimate the Intactness Index for each species for every quarter section of land in the prairie landscape—in other words, for locations where the ABMI is not directly monitoring. Using the ABMI's Inventory of Human Footprint (circa 2012) and data on vegetation types, the average intactness of 197 species in the Prairie Region have been estimated and mapped to generate an overall picture of biodiversity across this landscape (Figure 08).

The estimated intactness map provides a visual representation of biodiversity intactness across the Prairie Region. Clearly, the map shows that some of the region has low human footprint, particularly in the southeast, and consequently higher biodiversity intactness (shown as dark blue in Figure 08). On the other hand, much of the region has more intense human footprint, which results in lower biodiversity intactness (e.g., < 30%, shown as yellow in Figure 08).

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.

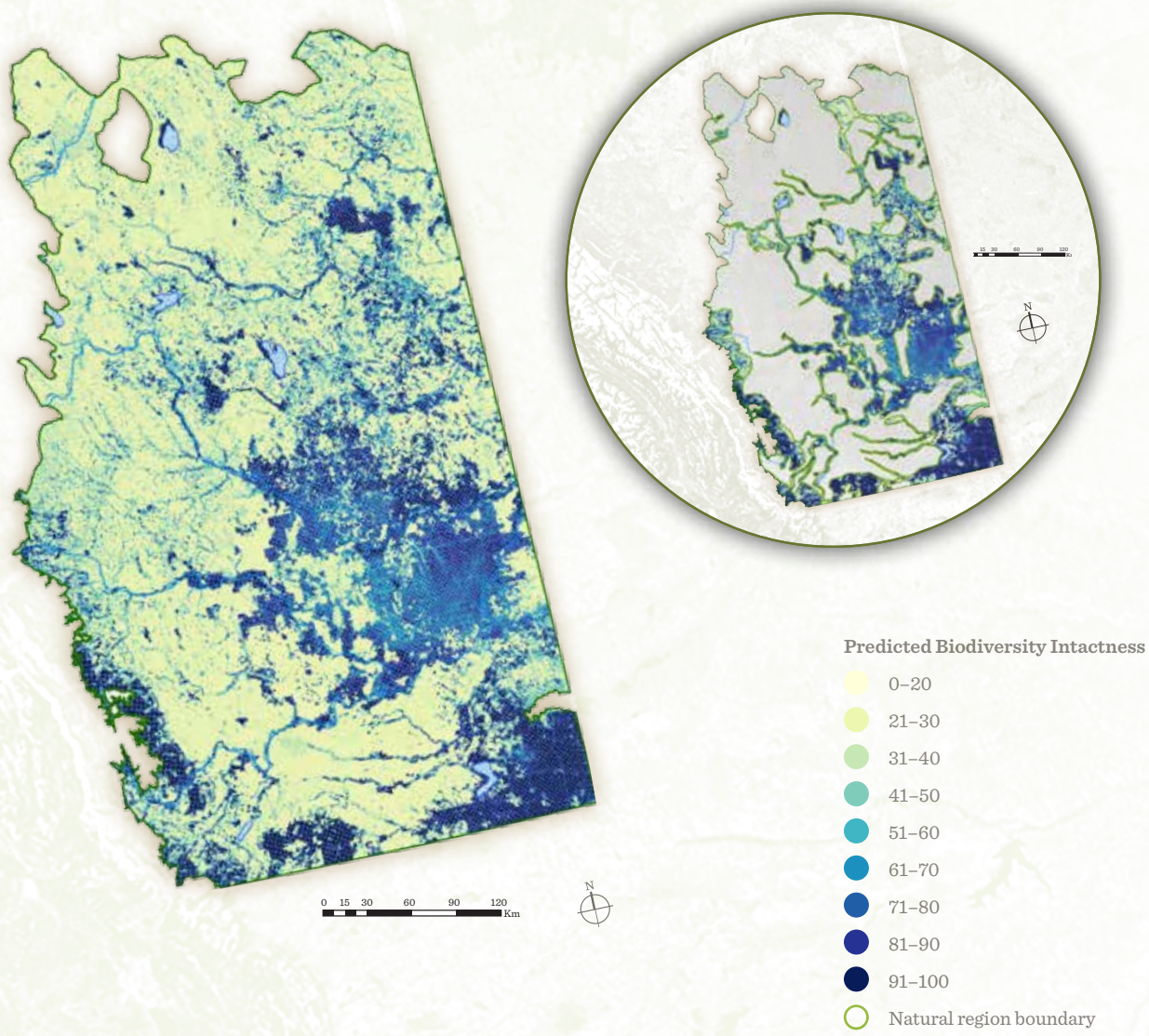


FIGURE 08.
Average predicted intactness in the Prairie Region (left map) and inside the High Value Landscape (right map). Yellow quarter sections are predicted to have the lowest average biodiversity intactness while dark blue quarter sections have the highest average intactness.

Species Intactness

Of the full suite of species assessed by the ABMI, in this report we highlight results for grassland birds, armoured mites, grassland vascular plants, and mosses for the following three regions: Prairie Region, inside the High Value Landscape, and outside the High Value Landscape. We also profile non-native species and species at risk. To see the complete datasets on all the species assessed, please consult the supplemental material associated with this report (available at www.abmi.ca).

Grassland Birds

The rolling prairies of the Grassland and Parkland Natural Regions support several bird species that are found nowhere else in Alberta. Many of these species, like the Baird's Sparrow, Sprague's Pipit, and Chestnut-collared Longspur, are considered grassland specialists because they rely on native prairie habitat for nesting and foraging, and they are sensitive to increases in agriculture footprint.

Of all bird groups in Canada, grassland specialists are showing the largest population declines.[5] Habitat loss and fragmentation of native prairie is one of the primary causes of the declines, but other factors such as increased grazing intensity, fire suppression, and the invasion of non-native plants also affect the quality of their living spaces. For these reasons, grassland specialists are sensitive to changes in native prairie habitat and are often highlighted as an indicator of the health of grassland ecosystems.

Of the 113 native bird species assessed by the ABMI in the Prairie Region, 11 are strongly associated with native grassland habitat.

> The ABMI assessed the status of 11 grassland birds in the Prairie Region, inside the High Value Landscape, and outside the High Value Landscape, and found them to be, on average, 66% intact, 77% intact, and 52% intact, respectively (Figure 09).

Overall, nine of the grassland birds were less abundant than expected in the three regions (Figure 09). The four species that differed the most from intact reference conditions were the Baird's Sparrow, Sprague's Pipit, Chestnut-collared Longspur, and Grasshopper Sparrow, which ranged from 34% intact to 63% intact in the Prairie Region; all are provincially and federally listed as species at risk.

There were two grassland-associated species that were more abundant than expected in all three regions, the Horned Lark, and the Long-billed Curlew (Figure 09). Both species have a positive relationship with agriculture footprint.

With the exception of McCown's Longspur, intactness of grassland-associated birds was higher inside the High Value Landscape compared to outside the High Value Landscape.

At 52% in the Prairie Region, the Chestnut-collared Longspur (a native grassland specialist) was less abundant than expected.

Grassland birds

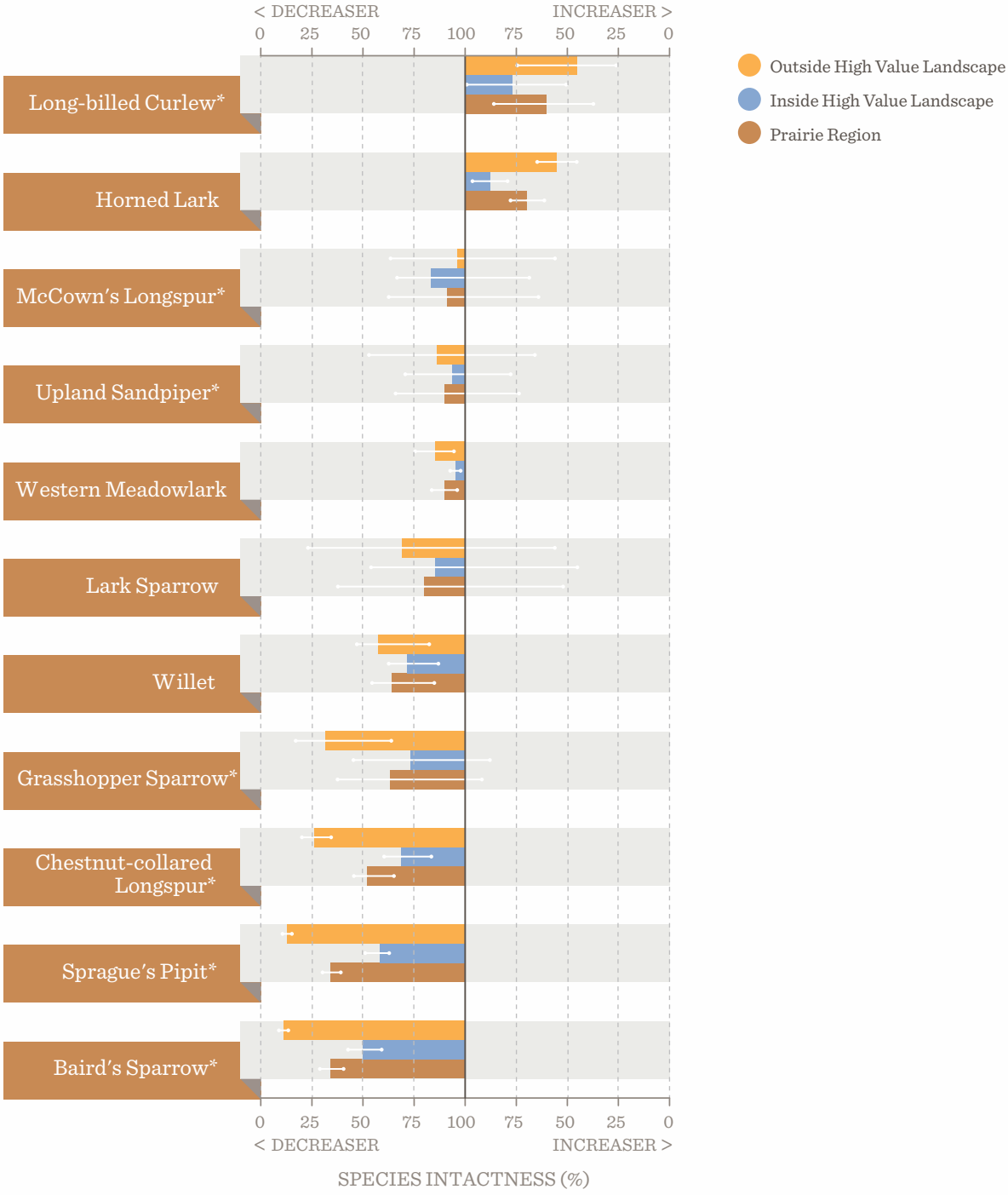


FIGURE 09.
Intactness (with 90% confidence intervals) of 11 grassland-associated bird species in the Prairie Region, inside the High Value Landscape, and outside the High Value Landscape. The order in which species are presented is determined by species intactness results for the Prairie Region. *Indicates provincially and/or federally listed species at risk. Note: Bars for each species indicate difference from intact reference conditions.

Species Profile – Baird's Sparrow and Sprague's Pipit

Baird's Sparrow and Sprague's Pipit are two characteristic birds of Alberta's grasslands. Both are small brown birds with stripes that help camouflage them among the dried grass. Baird's Sparrow is seldom seen, staying low in the grass, and preferring to run away from threats rather than fly. Fortunately, ABMI monitors birds by recording their songs with sensitive microphones that can easily pick up the sparrow's high-pitched twittering. Sprague's Pipit is less elusive. In fact, the male sings while flying high in the air for half an hour, an hour, or more—the longest display flight of any bird.

Both birds breed only in the Canadian prairies and the northern great plains of the United States, with the pipit extending into Alberta's parkland and southern boreal region. Their winter home is in the dry interior of northern Mexico and the southern states. Their breeding grounds are subject to local droughts, and, historically, large fires and roving bison herds. In response, the birds' populations can move around dramatically from year to year. This means that land-use changes in one part of the species' range can affect the population everywhere else—the offspring of birds breeding in one area of the prairies may be breeding in a totally different area several years later.

The populations of both species have been declining rapidly in recent decades. The North American Breeding Bird Survey, an annual continent-wide bird survey, has shown declines of 3.5% per year for Baird's Sparrow and 4.4% per year for Sprague's Pipit in Alberta's prairies from 1970 to 2009.[6] For every 100 sparrows that lived in Alberta in 1970, there are 25 left now, and for every 100 pipits, there are 17 left. These long-term declines led the Canadian government to list Baird's Sparrow as a species of special concern and Sprague's Pipit as threatened.

The **Breeding Bird Survey** *is an impressive long-term, continent-wide monitoring program. One limitation is that all surveys are done from roads. Areas near roads may not be representative of the entire prairie region—roads themselves affect many species, and more roads are near agriculture and settlements than in native habitats. ABMI's surveys are systematically located across the whole landscape, near and away from roads. ABMI results will complement the Breeding Bird Surveys by testing whether long-term trends from the roadside surveys are representative of trends for the whole region.*

Baird's Sparrow

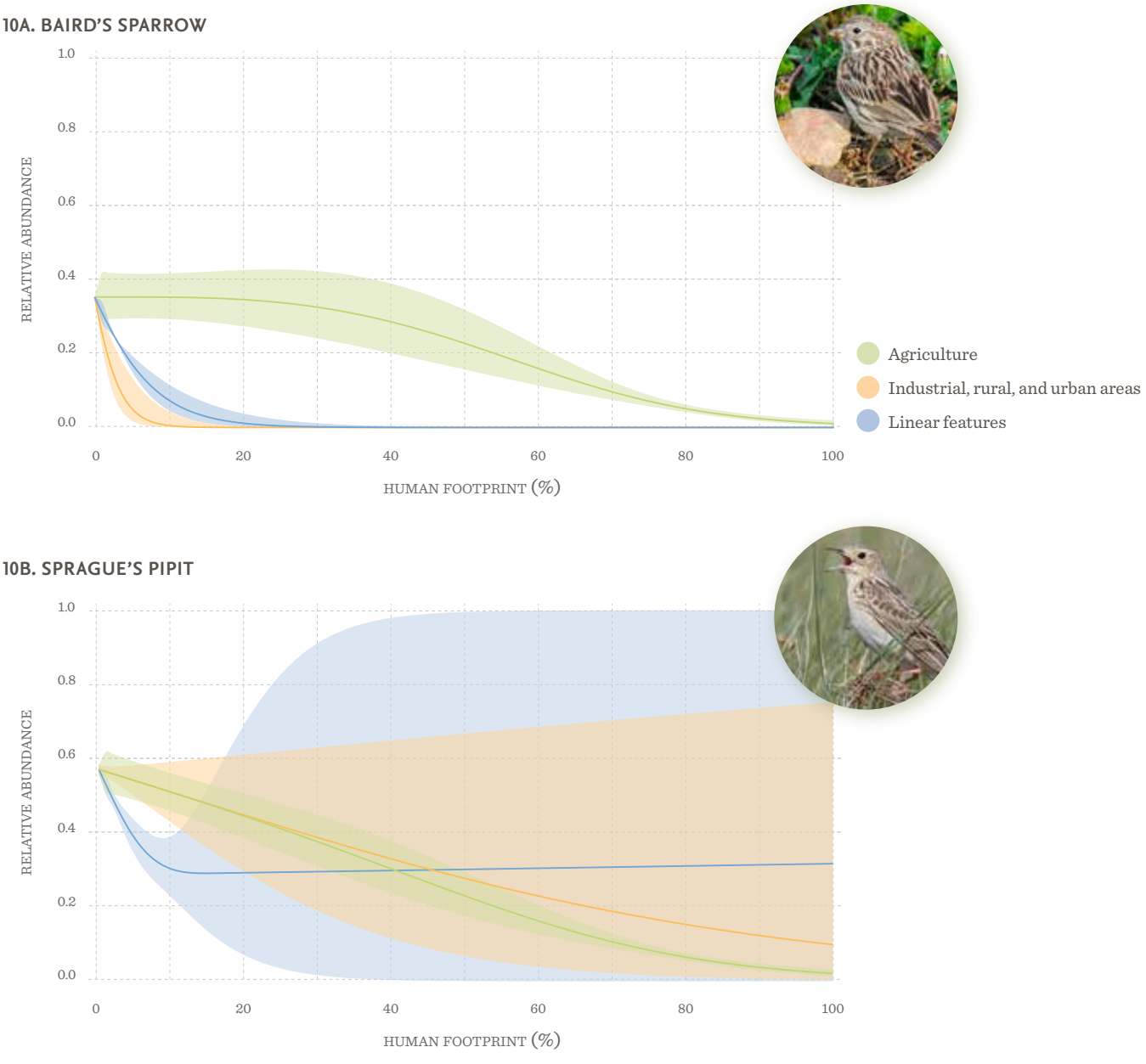
Sprague's Pipit

Relationship to Human Footprint

Loss and fragmentation of native prairie habitat due to agriculture and other development is considered the main reason for the population declines of the Baird's Sparrow and Sprague's Pipit. ABMI results confirm that both species decline as the amount of agriculture and other types of human footprint increase in their habitat (Figure 10A, 10B).

Strong negative responses to human footprint give these two species some of the lowest intactness values of all prairie species. However, most agriculture in Alberta has been in place since the mid-1900s, yet both species have declined in the last four decades, suggesting that more than just loss of breeding habitat is impacting them.

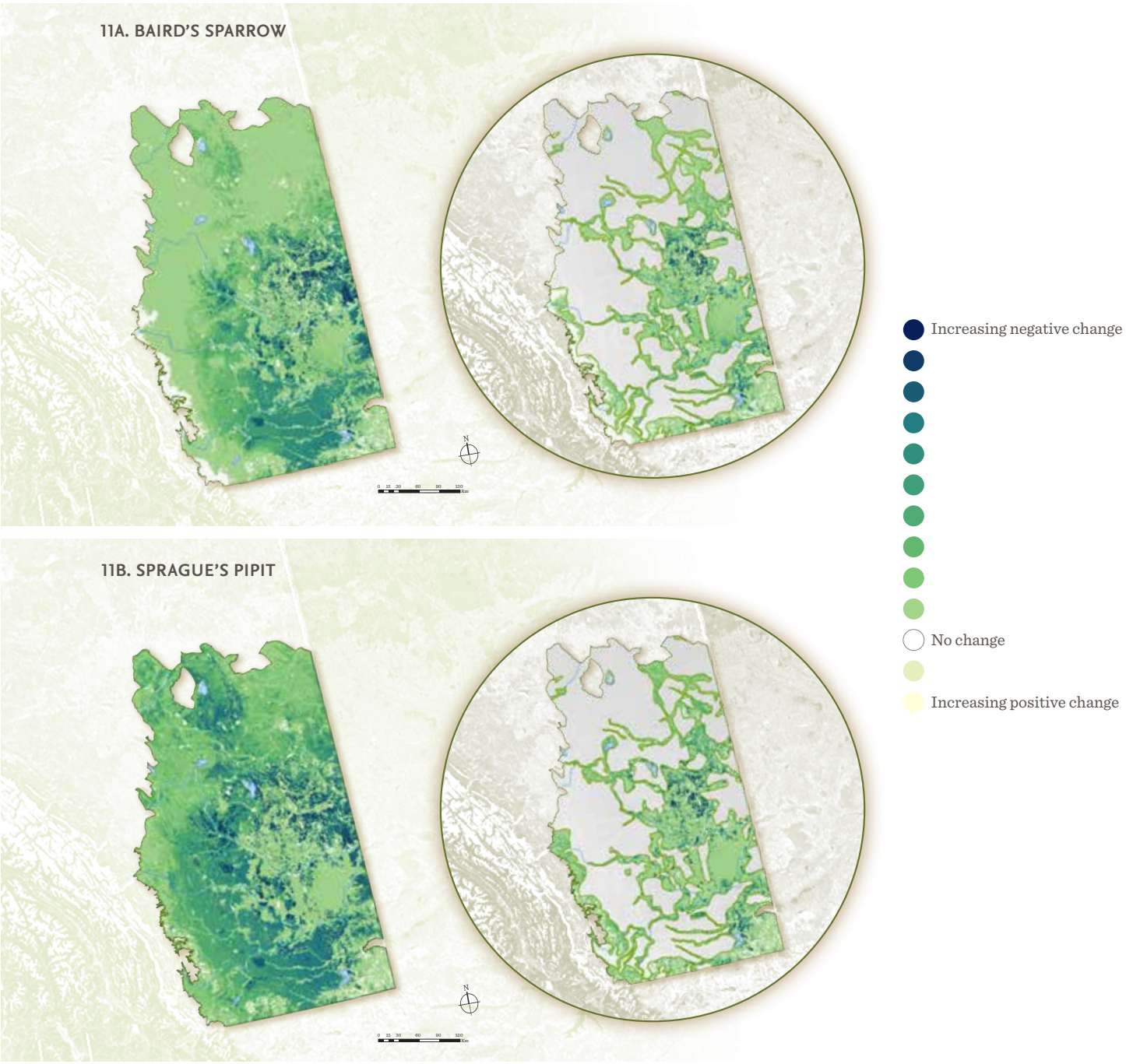
FIGURE 10.
Change in the abundance of A. Baird's Sparrow and B. Spragues' Pipit as human footprint in a territory changes from 0% to 100%.



Mapping Habitat Suitability of Grassland Birds

Using statistical relationships between human footprint, habitat, and the abundance of grassland bird species, it is possible to create maps that show the predicted habitat suitability of these species in every quarter section in the Prairie Region (Figure 11A, 11B). Habitat suitability is predicted to have decreased across much of the Prairie Region, but particularly in areas with extensive agriculture in the grassland region. Monitoring future changes in the populations of these two grassland specialists and reasons for the changes is a priority for ABMI monitoring in the prairies.

FIGURE 11.
Difference between reference conditions and current habitat suitability for A. Baird's Sparrow and B. Sprague's Pipit in Alberta (circa 2010).



Armoured Mites

Armoured mites (also known as oribatid mites) are a critical 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 349 occur in our province, with more being discovered each year.

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 a critical role in the formation and maintenance of soil structure by breaking down organic matter and helping to cycle nutrients back into the soil. The success of farmers and ranchers depends on productive, fertile soils created by the activities of creatures like armoured mites. Armoured mites also serve as food for many small arthropods such as beetles, ants, and spiders, and for some small frogs and birds.

> The ABMI assessed the status of 17 species of armoured mites in the Prairie Region, inside the High Value Landscape, and outside the High Value Landscape, and found them to be, on average, 51% intact, 68% intact, and 40% intact, respectively (Figure 12).

Of the 17 species assessed, 13 were less abundant than expected in all three regions, ranging from 21% to 64% intact in the Prairie Region (Figure 12). While little is known about mite ecology or habitat requirements, some of these species appear to be associated with native prairie habitat, such as the Writing-on-Stone Hermit Mite (For species results go to: species.abmi.ca/pages/mites).

Only four species were more abundant than expected in the Prairie Region, ranging from 59% to 81% intact. These species respond positively to human footprint. For example, the Saamis Yoked-roamer Mite is more abundant at higher levels of agriculture footprint, and urban and industrial footprint on the landscape.

For all assessed armoured mite species, intactness was higher inside the High Value Landscape than outside the High Value Landscape.

Armoured Mites

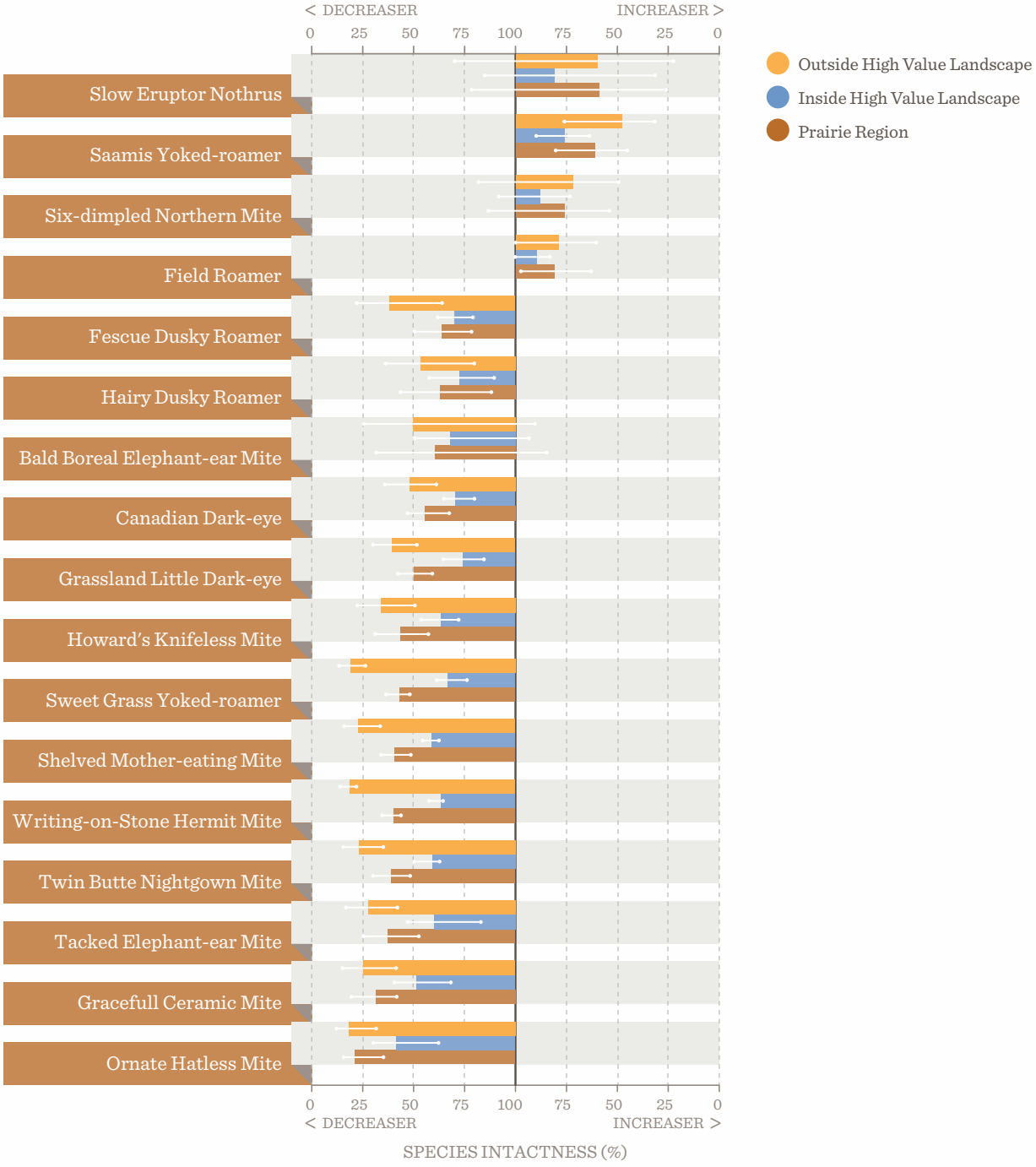


FIGURE 12.
Intactness (with 90% confidence intervals) of 17 armoured mite species in the Prairie Region, inside the High Value Landscape, and outside the High Value Landscape. The order in which species are presented is determined by species intactness results for the Prairie Region. Note: Bars for each species indicate difference from intact reference conditions.

Grassland Vascular Plants

Alberta's prairie landscape is defined by the diversity of grasses that cover the rolling terrain. Grasses have a number of features that make them well suited to the harsh prairie climate, including the long, cold prairie winters and dry, hot summers. For example, grasses often have extensive root systems up to 4 metres deep to access soil moisture and nutrients. Their narrow leaves and tough stems help to limit water loss, and may also discourage grazers. Grass species like the Blue Grama Grass, Northern Wheatgrass, and Needle-and-thread Grass are common grasses in native prairie.

While grass is the predominant vegetation of the prairie, other vegetation elements, such as trees, shrubs, and herbs, are also an important part of plant diversity. Trees and shrubs, such as the Narrow-leaf Cottonwood, Silver Sagebrush, and Prickly Rose are commonly found in depressions, along creeks, and in coulees and ravines where there is enough moisture to support their growth, and where they are sheltered from the wind to prevent evaporative water loss. And wildflowers are distributed throughout the prairie landscape. Beginning in the early spring with the first purple blooms of species like the Prairie Crocus and Three-flowered Avens, wildflowers add a succession of colour throughout the growing season in grassland ecosystems.

Native grassland plant communities support significant ecological processes and functions, such as nutrient cycling, capture and slow release of water, soil preservation, and wildlife habitat, not to mention forage for grazing livestock.[7] Preservation of native prairie habitat will help maintain grassland plant biodiversity and these important ecosystem functions.

> The ABMI assessed the status of 36 grassland-associated vascular plants in the Prairie Region, inside the High Value Landscape, and outside the High Value Landscape, and found them to be, on average, 45% intact, 69% intact, and 25% intact, respectively (Figure 13).

All 36 grassland-associated vascular plants were less abundant than would be expected in landscapes with no human footprint, ranging from 22% to 71% intact in the Prairie Region. While the intactness for all assessed grassland-associated vascular plants was higher inside the High Value Landscape compared to outside the High Value Landscape, all species were still less abundant than expected.

Half of the grassland species declined in abundance with increasing amounts of all footprint types, such as the Three-flowered Avens (species.abmi.ca/pages/vplants).

Several species, while negatively associated with agriculture and urban and industrial footprint, were positively associated with linear footprint.

In general, native prairie provides the most suitable conditions for grassland-associated vascular plants to thrive and grow.

Blue Grama Grass, once a favourite forage of roaming bison, provides nutritional forage for grazing livestock.

Vascular Plants

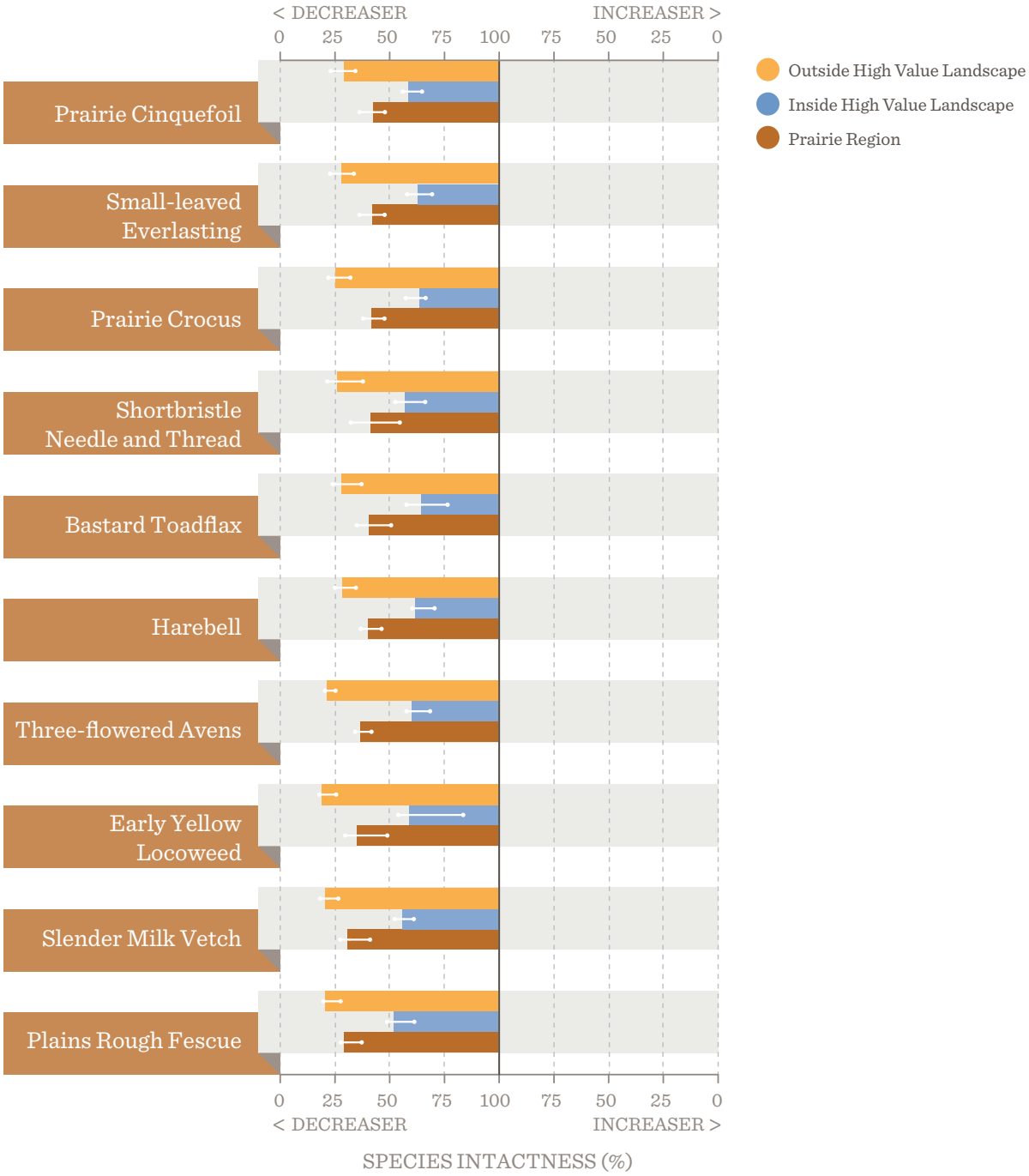


FIGURE 13.
Intactness (with 90% confidence intervals) of 10 grassland-associated vascular plants in the Prairie Region, inside the High Value Landscape, and outside the High Value Landscape, that are the most sensitive to human footprint. Results for the remaining 26 grassland-associated vascular plants can be found in the supplemental report (www.abmi.ca). The order in which the species are presented is determined by species intactness results for the Prairie Region. Note: Bars for species indicate difference from intact reference conditions.

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 prairie ecosystems, non-native plants can have a number of detrimental impacts.[8,9] For example, non-native species compete with and displace native plant species, altering wildlife habitat and reducing local biodiversity. Once established, non-native plants can alter soil and water cycles, potentially increasing soil erosion and decreasing water availability. The nutritional value of non-native plants for grazing livestock and wildlife is lower compared to native plants, and some invasive species are known to be toxic to grazers (e.g., Common Tansy, Tall Buttercup, Leafy Spurge). Overall, non-native plants cause a significant loss in the productivity of Alberta's rangelands and croplands. It is estimated that weeds cost Canadians $2.2 billion annually in reduced crop and pasture productivity. [9]

One of the challenges of managing non-native species is understanding when a species shifts from a low-impact introduction to an influential invader.[10] Monitoring data are a means to assess the current level of invasion and detect trends in invasion level through time, serving as a warning signal of potential risk to native biodiversity and grassland habitat. ABMI data can be used by managers to set regional targets for non-native species management, and to measure progress toward achieving those targets.

The ABMI found 38 non-native plants in the Prairie Region (Table 02 summarizes most abundant non-native species; see supplementary material available at www.abmi.ca for a complete list). Non-native plants were detected at all ABMI sites sampled in the region, and an average of 9 non-native species were present at each site. For each quarter section in the Prairie Region, the predicted number of non-native species per 1 ha plot was higher where there is agriculture footprint (Figure 14). In Alberta's Prairie Region, a number of non-native species have been intentionally introduced for agricultural purposes, either as crops or as forage for livestock, and are associated with agriculture footprint; these species are also included on the list of non-native species.

Common Dandelion, the most abundant non-native plant, was found at 86% of ABMI sites in the region. Two of the species detected are listed under the *Alberta Weed Control Act*, Creeping Thistle and Perennial Sow-thistle.

Three non-native bird species were detected in the Prairie Region: European Starling was detected at 25% of ABMI sites, House Sparrow at 20% of ABMI sites, and Ring-necked Pheasant at 18% of ABMI sites.

Common Goat's Beard, detected at 51% of ABMI sites in the Prairie Region, can be a concern in rangelands where it competes with native grassland species.

FIGURE 14.
Predicted number of non-native plant species per 1 ha plot in each quarter section of the Prairie Region (right map) and inside the High Value Landscape (left map). Dark blue indicates very low numbers of non-native plant species while light yellow indicates high numbers of non-native species.

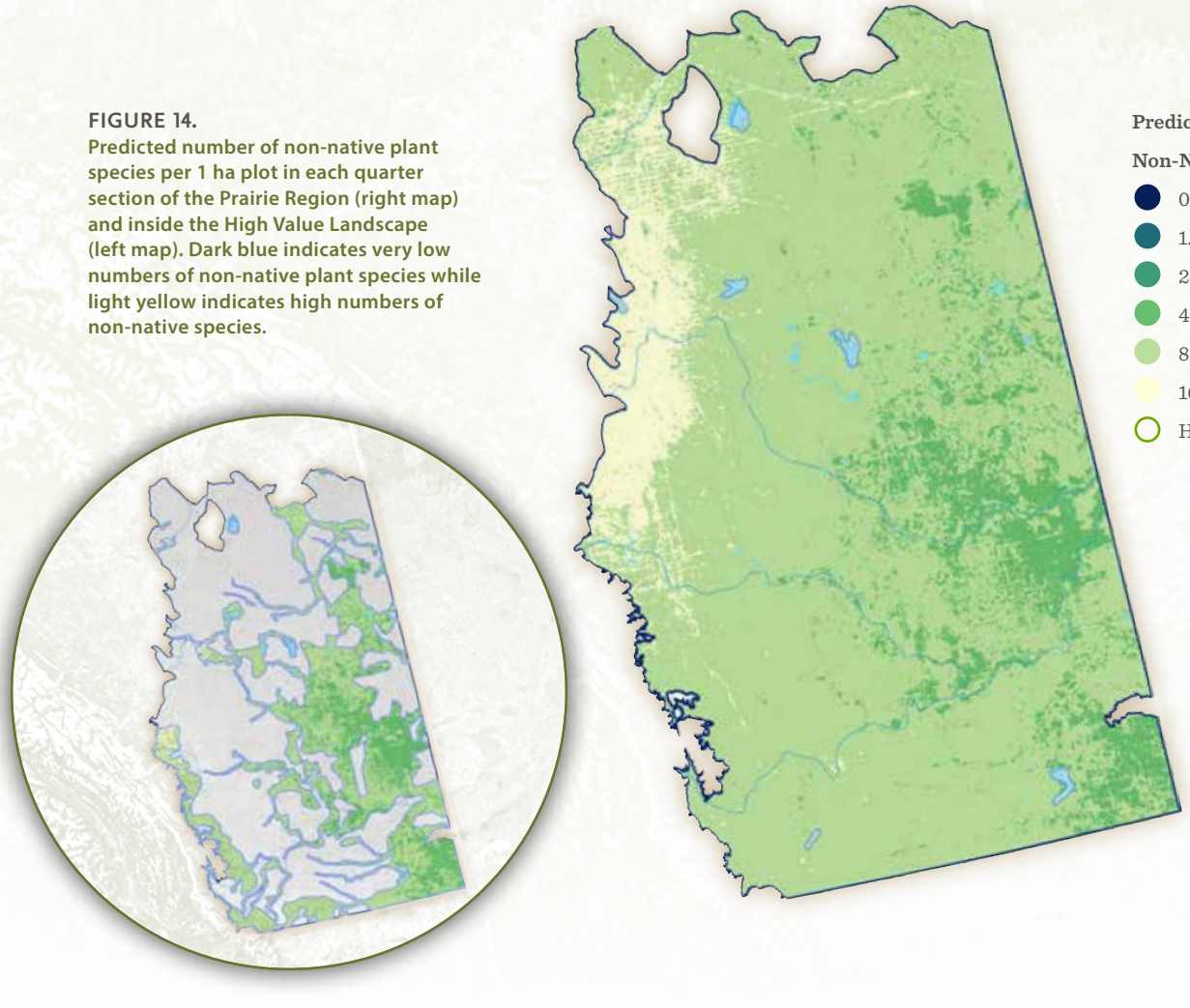


TABLE 02.
Percentage occurrence of the 10 most commonly detected non-native vascular plants in the Prairie Region.

Common Name	Scientific Name	Percentage of ABMI Sites Where Detected
Common Dandelion	*Taraxacum officinale*	86
Creeping Thistle*	*Cirsium arvense*	54
Common Goat's Beard	*Tragopogon dubius*	51
Kentucky Bluegrass	*Poa pratensis*	48
Flixweed	*Descurainia sophia*	41
Awnless Brome	*Bromus inermis*	41
Annual Hawk's Beard	*Crepis tectorum*	37
Lamb's Quarters	*Chenopodium album*	36
Alfalfa	*Medicago sativa*	32
Wild Buckwheat	*Fallopia convolvulus*	31

* Species identified as noxious weeds under the Alberta Weed Control Act (2010).

Mosses

Mosses are not an obvious element of prairie ecosystems, where grasses and colourful wildflowers immediately draw the eye. But mosses can be found in a number of nooks and hollows throughout the Prairie Region, such as at the base of trees and shrubs, along creeks and surrounding wetlands, in the crevices of rocky outcrops, and in pockets of woodlands. In addition to these niches, mosses can also be found on native prairie soil occupying the spaces between grasses and wildflowers, where they have an important ecological role to play.

Mosses, along with lichen, algae, and cyanobacteria, form a biological soil crust on the soil surface which has a number of important ecological functions in native grassland ecosystems.[11] For example, moss-carpeted surfaces slow down the overland flow of water from rain, snow melt and runoff, increasing infiltration into the soil and helping to maintain soil moisture. Moss cover is also incredibly effective at anchoring the soil, preventing soil erosion by wind and water. The establishment and performance of vascular plants, including weeds, is affected by the presence of soil crusts; in fact, weeds have a tougher time establishing themselves when moss is present. Biological soil crusts also improve soil fertility by increasing concentrations of carbon and nitrogen in the soil. Finally, mosses provide important habitat for all kinds of soil micro-organisms, like insects, fungi, bacteria, and mites. The presence, cover, and distribution of mosses as part of the biological soil crust community is one indicator of rangeland health.[11]

> The ABMI assessed the status of 12 moss species in the Prairie Region, inside the High Value Landscape, and outside the High Value Landscape, and found them to be, on average, 49% intact, 69% intact, and 41% intact, respectively (Figure 15).

The 10 mosses that were most sensitive to human footprint ranged from 22% to 73% intact in the Prairie Region (Figure 15). All these species decreased in abundance with human footprint in all three regions, including agriculture, linear, and/or urban and industrial footprint.

Only two moss species were more abundant than expected in all three regions. Knieff's Hook Moss is positively associated with linear footprint. Cuspidate Earth Moss is most abundant where there are intermediate levels of agriculture footprint.

The intactness for all assessed mosses was higher inside the High Value Landscape than outside the High Value Landscape.

Cuspidate Earth Moss, listed as undetermined by Alberta's Ministry of Environment and Parks, was detected at 24% of ABMI sites in the Prairie Region, and at 71% intact, was more abundant than expected.

Mosses

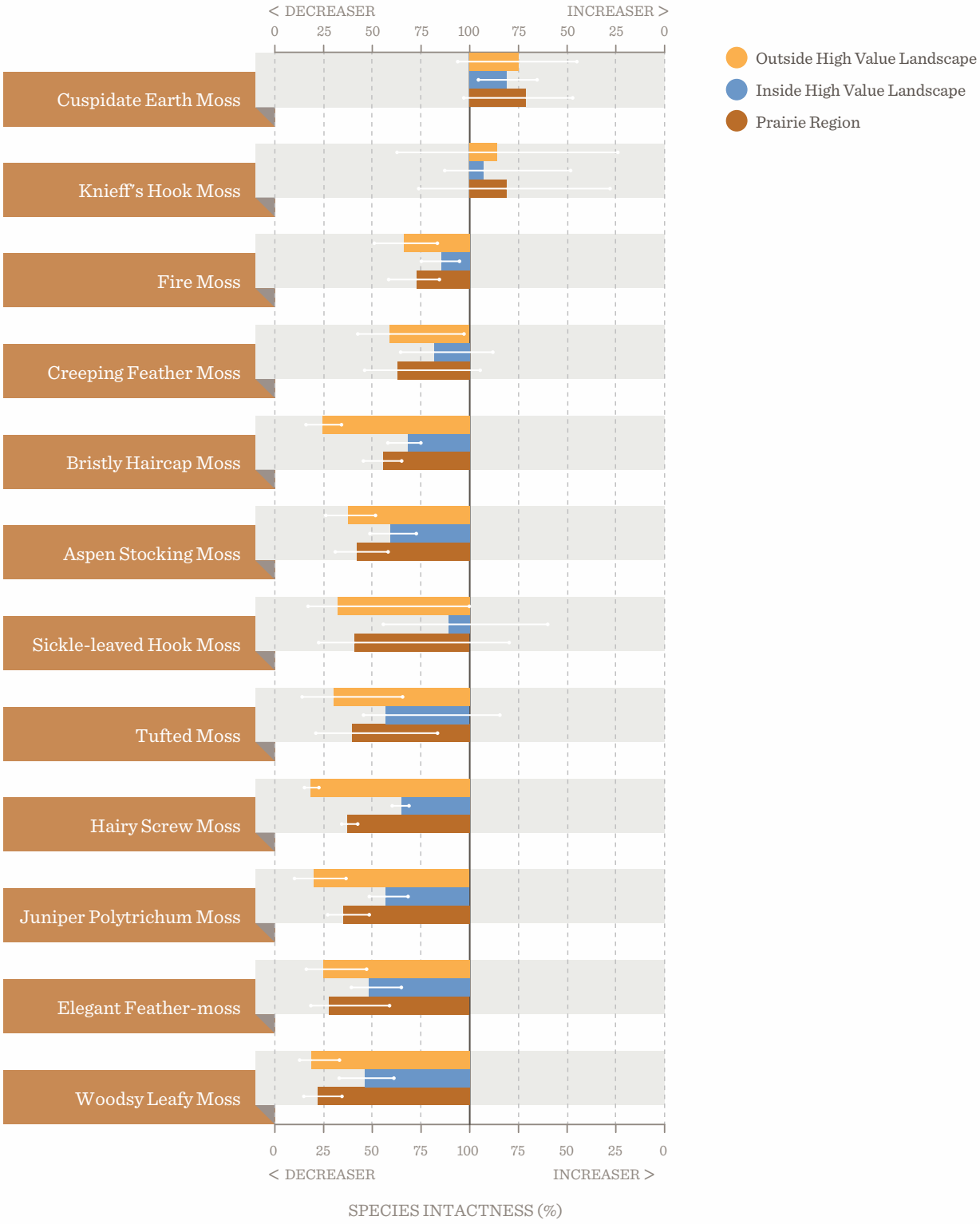


FIGURE 15.
Intactness (with 90% confidence intervals) of 12 moss species in the Prairie Region, inside the High Value Landscape, and outside the High Value Landscape. The order in which species are presented is determined by species intactness results for the Prairie Region. Note: Bars for each species indicate difference from intact reference conditions.

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.

Native grasslands are one of the most endangered ecosystems in the world.[1] So it should come as no surprise that approximately 80% of Alberta's species at risk are associated with grassland ecosystems. A number of mammal species have been extirpated*** from the region, such as Bison, Grizzly Bear, and Wolf. Grassland birds have declined by almost 40% since 1970, the most pronounced decrease of any bird group in Canada.[5, 12] About 25% of Alberta's rare plants are grassland-associated species. The widespread conversion of native grassland to agriculture and the intensification of agricultural practices in the Prairie Region have resulted in the loss of habitat for a number of grassland-associated species.

The ABMI detected 73 species at risk in the Prairie Region and was able to calculate intactness for 17 of these species, including seven 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 would be expected in landscapes with no human footprint. Included on this list are six species of birds associated with native grassland habitat, which were 9% to 76% less abundant than expected.

Only three species were more abundant than expected if there was no human footprint: Barn Swallow, Long-billed Curlew, and Cuspidate Earth Moss. Even though the Barn Swallow is found more often in human-modified landscapes in Alberta, it has experienced significant declines across parts of Canada in the past 30 years. The Long-billed Curlew is positively associated with agriculture habitat in Alberta but remains of concern because historically it was severely over-hunted, resulting in a small population size and range contractions. Cuspidate Earth Moss is listed as undetermined by Alberta's Ministry of Environment and Parks (AEP). This species may be more abundant in the Prairie Region than previously believed as it was detected at 24% of ABMI sites. This information can inform provincial status updates for this species.

The ABMI cannot assess the status of all species at risk in the Prairie Region for two reasons. First, by virtue of their rarity, some species at risk are not detected with enough frequency to adequately assess their status. 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.

The Grasshopper Sparrow gets its name not only from its preferred meal, but also from its buzzy insect-like song. At 63% intact, this species was less abundant than expected in the Prairie Region.

*** A species that has been extirpated is one that no longer occurs in parts of its range but it does occur elsewhere in the wild.

TABLE 03.
Summary of intactness results for species at risk* in the Prairie Region.

Common Name	Scientific Name	Occurrence (%)	Intactness Index (0–100 scale)	Above or Below Reference Conditions	Status
Baird's Sparrow	*Ammodramus bairdii*	32	34	BELOW	COSEWIC - Special Concern | AEP - Sensitive
Baltimore Oriole	*Icterus galbula*	18	87	BELOW	AEP - Sensitive
Barn Swallow	*Hirundo rustica*	25	37	ABOVE	COSEWIC - Threatened | AEP - Sensitive
Chestnut-collared Longspur	*Calcarius ornatus*	34	52	BELOW	COSEWIC - Threatened | AEP - Sensitive
Grasshopper Sparrow	*Ammodramus savannarum*	11	63	BELOW	COSEWIC - Special Concern | AEP - Sensitive
Least Flycatcher	*Empidonax minimus*	21	27	BELOW	AEP - Sensitive
Long-billed Curlew	*Numenius americanus*	36	60	ABOVE	COSEWIC - Special Concern | AEP - Sensitive
McCown's Longspur	*Rhynchophanes mccownii*	18	91	BELOW	COSEWIC - Special Concern | AEP - Secure
Sharp-tailed Grouse	*Tympanuchus phasianellus*	8	39	BELOW	AEP - Sensitive
Sora	*Porzana carolina*	44	96	BELOW	AEP - Sensitive
Sprague's Pipit	*Anthus spragueii*	46	34	BELOW	COSEWIC - Threatened | AEP - Sensitive
Upland Sandpiper	*Bartramia longicauda*	26	90	BELOW	AEP - Sensitive
Broad-leaved Everlasting	*Antennaria neglecta*	9	49	BELOW	AEP - Undetermined
Sun Loving Sedge	*Carex inops*	9	54	BELOW	AEP - Undetermined
Graceful Cinquefoil	*Potentilla gracilis*	14	41	BELOW	AEP - Undetermined
Canada Goldenrod	*Solidago canadensis*	19	58	BELOW	AEP - Undetermined
Cuspidate Earth Moss	*Tortula acaulon*	24	71	ABOVE	AEP - Undetermined

* 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 Parks (AEP), 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 AEP are included.

Status of Native Habitat

Habitat is fundamental to maintaining healthy ecosystems and is also the component of biodiversity where the most planning and management occurs—land-use planners most often manage habitat. In landscapes where there has been widespread conversion of native vegetation to other land uses, understanding how much native vegetation remains, where it is located, and its level of protection helps identify priorities for management.

The ABMI used geographic information system (GIS) analyses to summarize landscape characteristics of native habitat[†††] in the Prairie Region, including native habitat (amount of native vegetation remaining and proximity to human footprint), effective mesh size of native vegetation, and representation in protected areas.

Amount of Native Habitat

People's perception of wilderness often includes undisturbed expanses of prairie, river, and lake ecosystems. The ABMI uses the phrase and concept of "native habitat" to identify areas in Alberta that have not been visibly disturbed by humans, although 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, in the Prairie Region we measure native vegetation using three different buffer distances—0 m, > 50 m, and > 200 m—away from footprint. These distances delimit the amount of native vegetation available with a given "buffer" from human footprint. For example, at 0 m from human footprint, all native vegetation in the region is included. However, at > 50 m, only native vegetation that is at least 50 m away from human footprint is included.

As of 2012, 37% of the Prairie Region is composed of native vegetation when no buffer is applied (Figure 16). Most of this is within the High Value Landscape, as 69% of the High Value Landscape is composed of native vegetation compared to 18% outside. At 200 m from human footprint, native vegetation is highest in the High Value Landscape at 23% compared to only 2% outside.

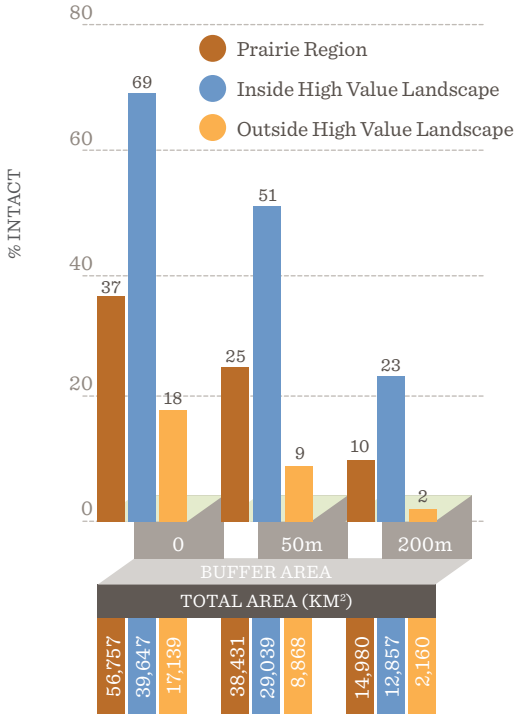


FIGURE 16.
Total area and per cent area of native vegetation in the Prairie Region, inside the High Value Landscape, and outside the High Value Landscape.

[†††] 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.

Native Vegetation Represented in 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.[13]

Overall, 1.4% (2,218 km^2) of the Prairie Region is managed as protected areas‡‡‡ (Figure 17). All Natural Subregions within the Prairie Region have < 2% representation in protected areas (Table 04).

There are opportunities for protection of native vegetation in each of the Natural Subregions. The Dry Mixedgrass and Foothills Parkland Natural Subregions have the most native vegetation remaining with more than 50%, and most of this area is located in the High Value Landscape (Table 04). In contrast, about one-quarter of the Central Parkland remains as native vegetation, with one-third of this located in the High Value Landscape.

FIGURE 17.
Distribution of protected areas in Southern Alberta. Overall, 1.4% of the Prairie Region is managed as protected areas.

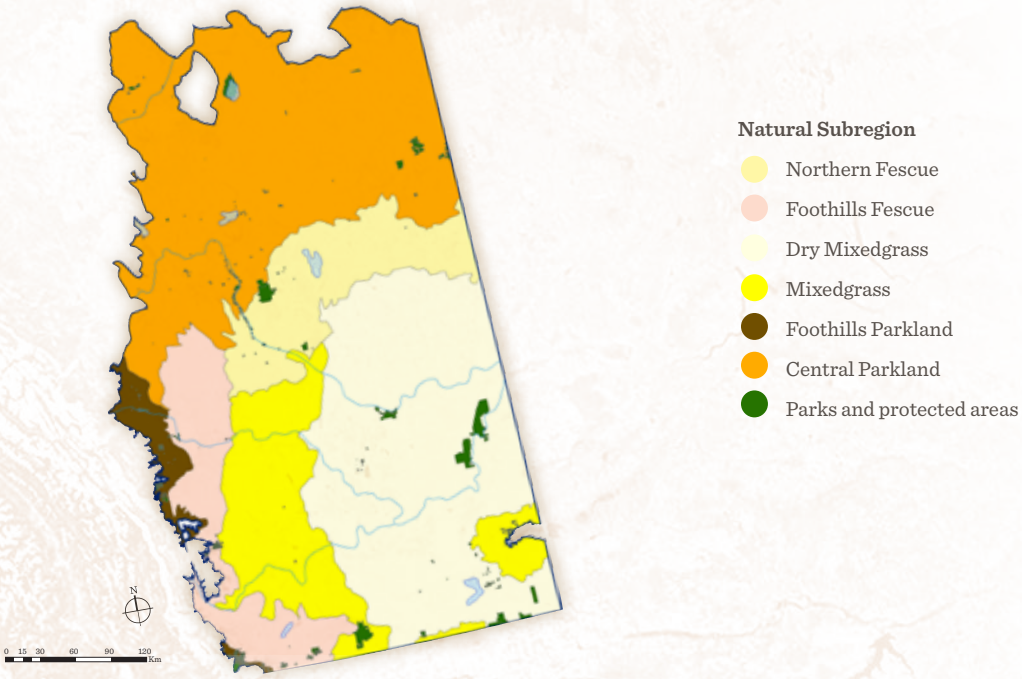


TABLE 04.
Per cent area of native vegetation by Natural Subregion.

	Natural Subregion	Percentage of Prairie Region	Percentage Native Vegetation	Of Remaining Native Vegetation, Percentage Area That is Inside High Value Landscape	Percentage of Sub-region Managed as Protected Area
Grassland	Northern Fescue	10	41	59	1.3
Grassland	Foothills Fescue	9	35	60	0.4
Grassland	Dry Mixedgrass	31	55	85	1.6
Grassland	Mixedgrass	13	35	77	0.9
Parkland	Foothills Parkland	3	52	90	1.1
Parkland	Central Parkland	36	24	33	0.9

‡‡‡ The ABMI's definition of protected areas includes Alberta's parks and protected areas network, national parks, and National Wildlife Areas.

Native Vegetation and Effective Mesh Size

Habitat fragmentation occurs when native vegetation is converted to human land uses, such as agriculture, urban development, and energy development. With conversion, native vegetation is gradually lost and subdivided into smaller pieces; after intensive conversion, the remaining fragments are often small, isolated patches of native vegetation separated from each other by cropland, urban areas, and paved roads.

The ability of wildlife species to persist in a fragmented landscape depends not only on the amount of suitable habitat available, but also on the species' ability to move safely through the modified landscape and locate what suitable habitat remains.[14] The movement of plants—or more specifically their pollen and seeds—is not so obvious but is also critically important. The transfer of pollen from one plant to another is required to create new seeds for most plant species. The dispersal of those seeds to suitable habitats by any number of means, such as wind, water, or animals and insects, is necessary for plant populations to thrive and grow. Not only does habitat fragmentation reduce the availability of habitat for some species, but that habitat may be harder to get to because patches of native vegetation are further apart.

The ABMI measures one aspect of habitat fragmentation of native vegetation[§§§] by calculating the effective mesh size of the Prairie Region. Effective mesh size is a measure of the size of native vegetation patches combined with distance to edge at a particular scale. Larger mesh size values occur in bigger native vegetation patches further from the edge of human footprint, whereas smaller mesh size values indicate smaller patches and more human footprint.

Because linear features have huge effects on effective mesh size, average effective mesh size is calculated in two ways—counting linear features as human footprint that separates native patches, and not counting linear features as footprint that separates patches. Both calculations make sense because, with the exception of major roads and highways, linear features are not significant barriers for all species. Furthermore, because linear features are pervasive throughout the Prairie Region, the exclusion of these features from the calculation of effective mesh size identifies larger patches of native habitat than would otherwise have been identified, supporting land-use planning. On the other hand, linear features can pose as movement barriers for some species, degrade the quality of nearby native habitat, and be important for invasive or early seral species getting places, so calculating effective mesh size with linear features is also important.[15]

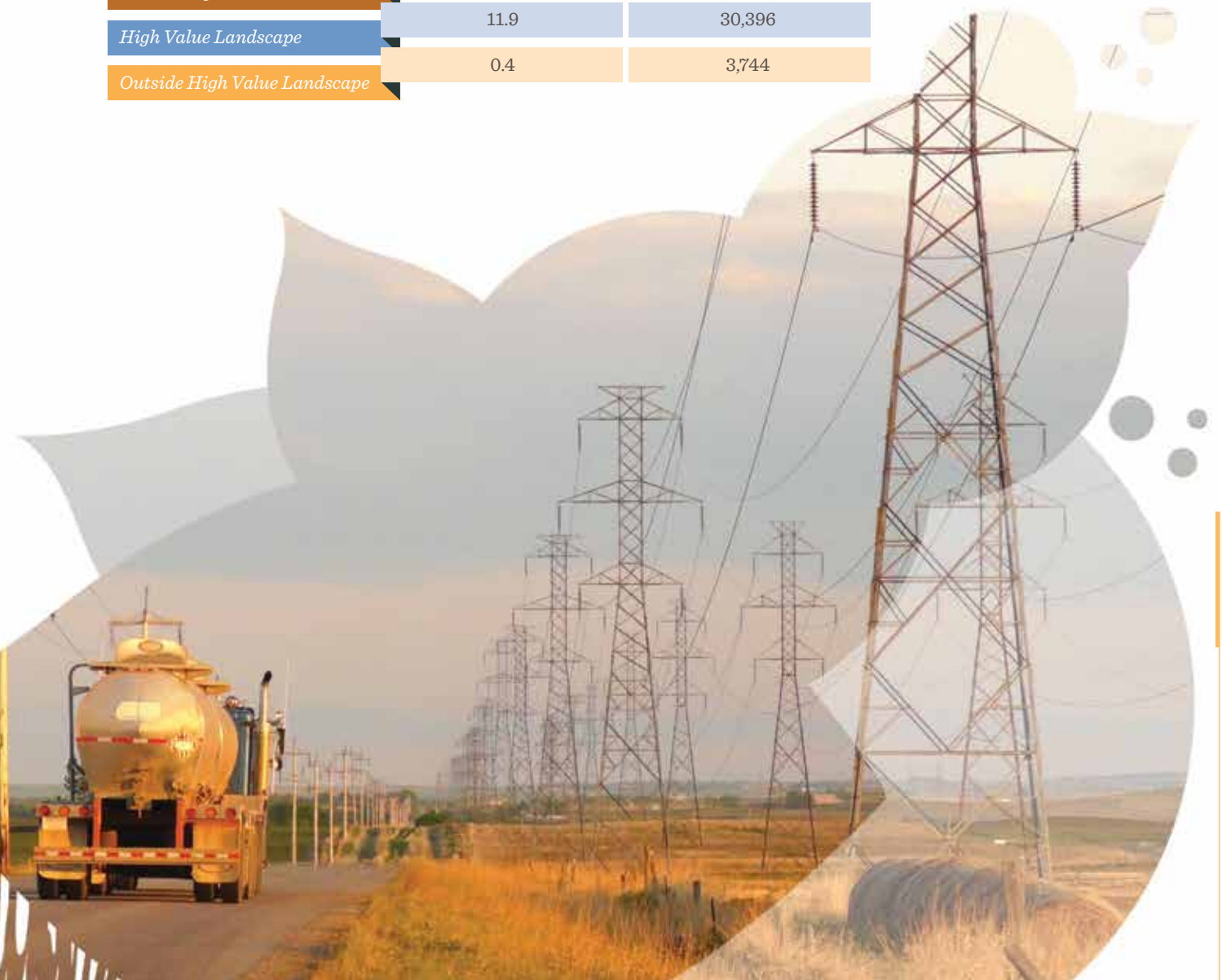
[§§§] Habitat is the specific resources and conditions necessary to support the occupancy of a particular species. We are not assessing habitat of any species but instead measuring patch size of native vegetation.

Average Effective Mesh Size

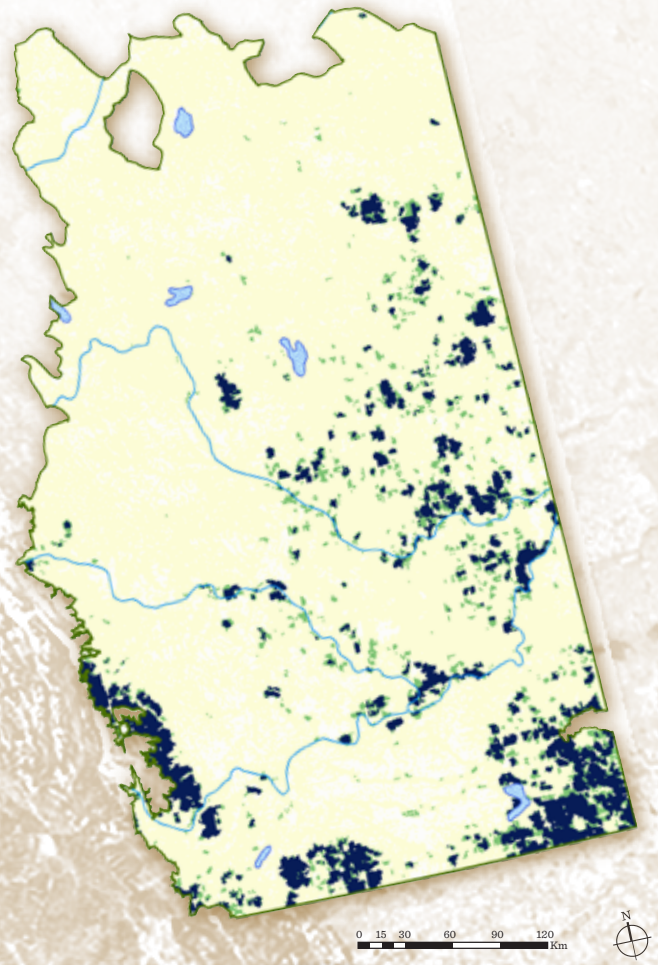
The average effective mesh size of the Prairie Region is 5.0 km^2 when linear features like roads are included as human footprint that divides native patches (Table 05; Figure 18); effective mesh size is 13,789 km^2 when linear features are not counted as footprint separating patches of native vegetation (Table 05; Figure 18). The average effective mesh size in the High Value Landscape is 11.9 km^2 compared to only 0.4 km^2 outside, when linear features are counted as dividing native patches. This analysis shows that areas outside the High Value Landscape are very heavily fragmented by human footprint features such as agricultural fields, roads, and urban area. When linear features are excluded from the analysis, larger patches are identified (mainly along major rivers) that connect High Value areas in the west of the region to those in the east (Figure 18).

TABLE 05.
Average effective mesh size for the Prairie Region, the High Value Landscape and outside the High Value Landscape. Average effective mesh size is calculated in two ways—counting linear features as human footprint that separates native patches, and not counting linear features as footprint that separates patches.

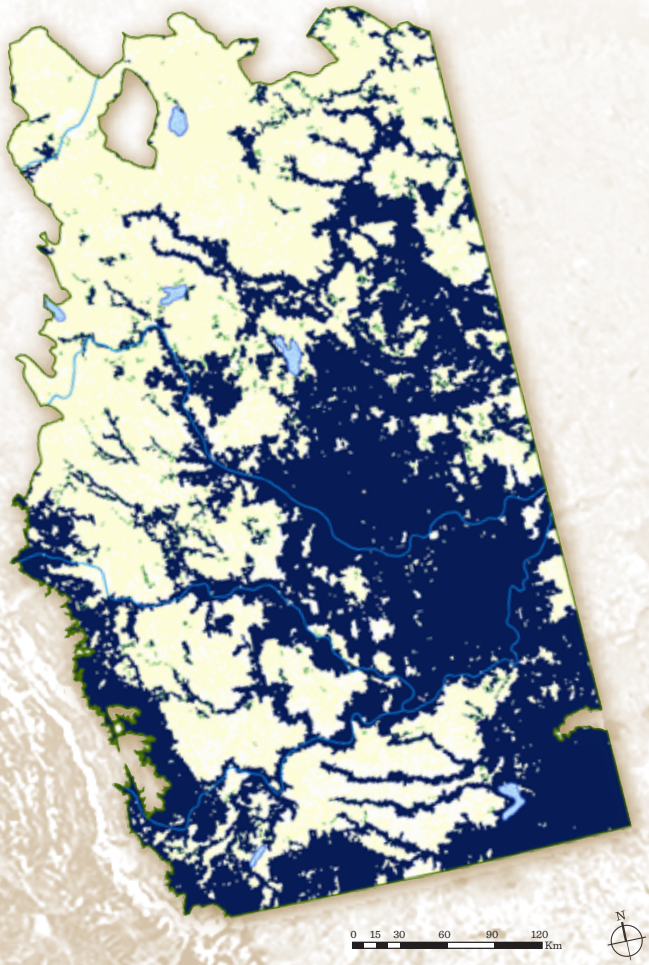
	AVERAGE EFFECTIVE MESH SIZE (KM^2)	
Landscape	Linear Features Divide Native Patches	Linear Features Do Not Divide Native Patches
Prairie Region	5.0	13,789
High Value Landscape	11.9	30,396
Outside High Value Landscape	0.4	3,744



18A.



18B.



Effective Mesh Size

- > 0–5 km²
- 5–10 km²
- > 10 km²
- HVL Boundary

FIGURE 18.
Distribution of large native vegetation patches in the Prairie Region (upper map) and inside the High Value Landscape (lower map) when A. linear features are included as footprint that divides native patches, and B. linear features are not counted as footprint that divides patches of native vegetation.

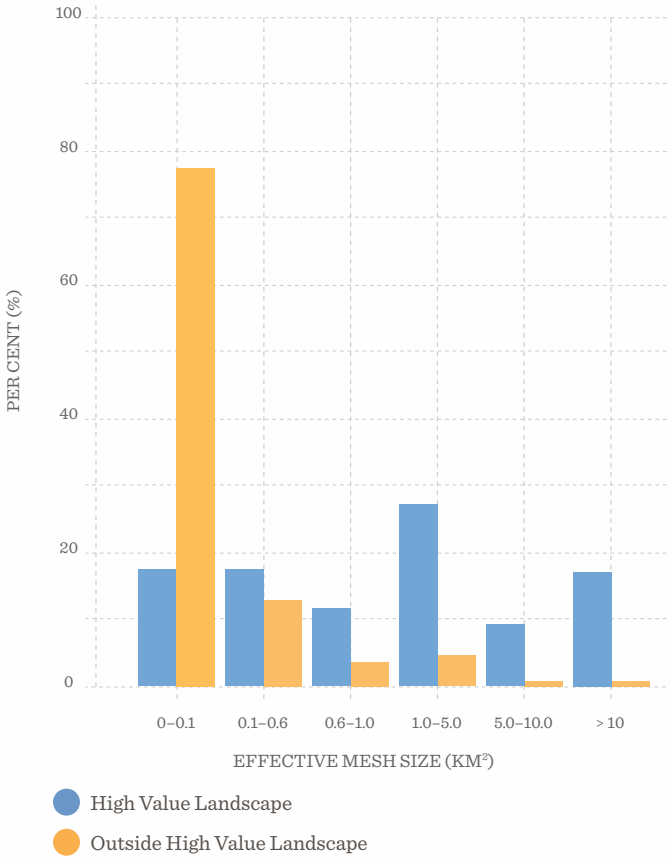


FIGURE 19.
The percentage of 1 km² hexagon reporting units in six effective mesh size (km²) size categories for the High Value Landscape and non-High Value Landscape. Linear features are included as footprint that fragments native vegetation patches in this summary.

The largest patches of native vegetation occur in the High Value Landscape, where over 25% of the 1 km² hexagon reporting units[****] have an effective mesh size > 5 km² when counting linear features as a footprint that fragments native vegetation patches (Figure 19). In contrast, almost 99% of the 1 km² hexagon reporting units outside the High Value Landscape have an effective mesh size of < 5 km², including 77% with an effective mesh size of < 0.1 km².

Analysis of effective mesh size is a simplified way of examining the effects of landscape fragmentation on biodiversity as a whole. This analysis identifies the amount and configuration of large patches of native vegetation in the Prairie Region, and can be used as a quantitative tool for monitoring trends and changes in native prairie fragmentation. This analysis does not identify amount and configuration of habitat suitable for individual grassland species because habitat preferences are species-specific—not all types of native vegetation are suitable for all species, and not all human footprint is impassable. This analysis also does not account for the quality of the native vegetation that remains. Finally, some habitats are naturally small and rare in the Prairie Region, such as sand dune habitats or riparian cottonwood forest, and some have become rare, such as the Mixedgrass Subregion, which makes them valuable regardless of their size.

[****] The calculation of effective mesh size used 1 km² hexagon unit areas to summarize the distribution of native vegetation patches across the landscape. See supplementary report for further details (www.abmi.ca).

SPOTLIGHT

Ecosystem Services

Native grasslands provide a diversity of services for people, ranging from water filtration to recreation opportunities to gorgeous scenery. The idea of "ecosystem services," which are the benefits we receive from nature, offers a new perspective on questions like why we should care about native prairie, or what is lost when native prairie is cultivated or developed. Too often, nature's benefits are overlooked when deciding how best to manage Alberta's native ecosystems.

For example, many Albertans are very familiar with the benefits of grassland forage production—ranchers have been grazing their cattle on native prairie for over a century. The value of this forage production "service" has many dimensions—productive grasslands are the heart of cowboy culture in Alberta, and nobody could put a price on that. But from another perspective, the direct economic benefits of grassland forage production are staggering; the value of native rangeland for grazing in Alberta has been assessed at over $160 million annually.[16]

Native grasslands around the world are also increasingly recognized for their huge reservoir of soil carbon. By removing atmospheric carbon dioxide (CO_2) and storing it below ground, native grasslands provide a really important service—they mitigate climate change.[17] Soils the world over store more than four times as much carbon as the atmosphere. Most prairie carbon is stored in the soil, and over half of soil carbon can be lost when grassland is converted to cropland.[18]

Converting marginal cropland back to native prairie, avoiding conversion of remaining native prairie remnants, and improving grazing management all support the capacity of native prairie to store carbon. New initiatives, such as Ducks Unlimited's Carbon Sequestration Program[19] in the U.S. Prairie Pothole Region, reward landowners, including ranchers, for storing carbon on native prairie. In Alberta, farmers receive cash payments in return for cultivation practices that increase soil carbon storage, and markets for carbon storage in native prairie are being developed.[20]

Both forage production and carbon storage depend on soil, vegetation, and climatic characteristics, as well as grazing management. So, where in Alberta is soil carbon storage highest? How does forage production vary across the province? We need maps to answer these questions and inform conservation and land use planning. To this end, ABMI's Ecosystem Services Assessment Project (www.ecosystemservices.abmi.ca) is assessing the supply and value of several services provided by Alberta's ecosystems. Here, we use maps to showcase the ABMI's assessment of aboveground biomass production (an estimate of forage production) and carbon storage across native grasslands in Alberta, two ecosystem services particularly relevant to the Prairie Region (soil carbon storage estimates are for the top 20-30 cm of the soil profile only; see the supplementary report available at www.abmi.ca for detailed methods).

Aboveground Biomass and Forage Production

The long-term average annual aboveground biomass production of native grasslands inside the HVL of the Prairie Region is estimated at 1,221 kg/ha. By contrast, native grasslands outside the HVL yield, on average, 1,437 kg/ha (Figure 20). Assuming an average allowable offtake* of 45 %, native grassland of the Prairie Region produces approximately 2.8 million tonnes of usable forage annually. At $55/tonne of feed, the total annual forage production represents a value of $150 million.

Applications for information on ecosystem services like forage production and carbon storage include regional planning, developing market approaches for enhancing ecosystem services, and sustainability and conservation reporting.

* "Offtake" refers to the portion of aboveground biomass that can be grazed without damaging the underlying system of resources (e.g. the parent plants) that generates the biomass.

Soil Carbon Storage

Approximately 192 million tonnes of carbon is stored in native grassland soils of the Prairie Region (Figure 21); the estimated long-term average soil carbon storage for native grasslands inside the HVL is 39 tonnes/ha, and 53 tonnes/ha outside (Figure 21). Based on a conservative estimate of one-third soil carbon loss when native grassland is converted to cultivated land, the native grasslands of the Prairie Region store an extra 64 million tonnes of carbon than would be the case if the land were cultivated.

With respect to aboveground biomass/forage and soil carbon storage, both metrics are lower inside the HVL than outside—in contrast to measures such as native habitat and biodiversity intactness described earlier in the report. The relative distribution of the HVL in the Grassland Region (90%) versus the Parkland Region (10%) and the variation of factors that influence productivity and soil carbon storage across them—such as soil type, climate, and vegetation—likely explain this difference. For example, brown soils are typically found in the Grassland Region, whereas, black soils, which are relatively more productive, mark the Parkland Region. These results suggest that including the provision of ecosystem services as a criterion for conservation might identify additional candidate areas as targets for land-use planning.

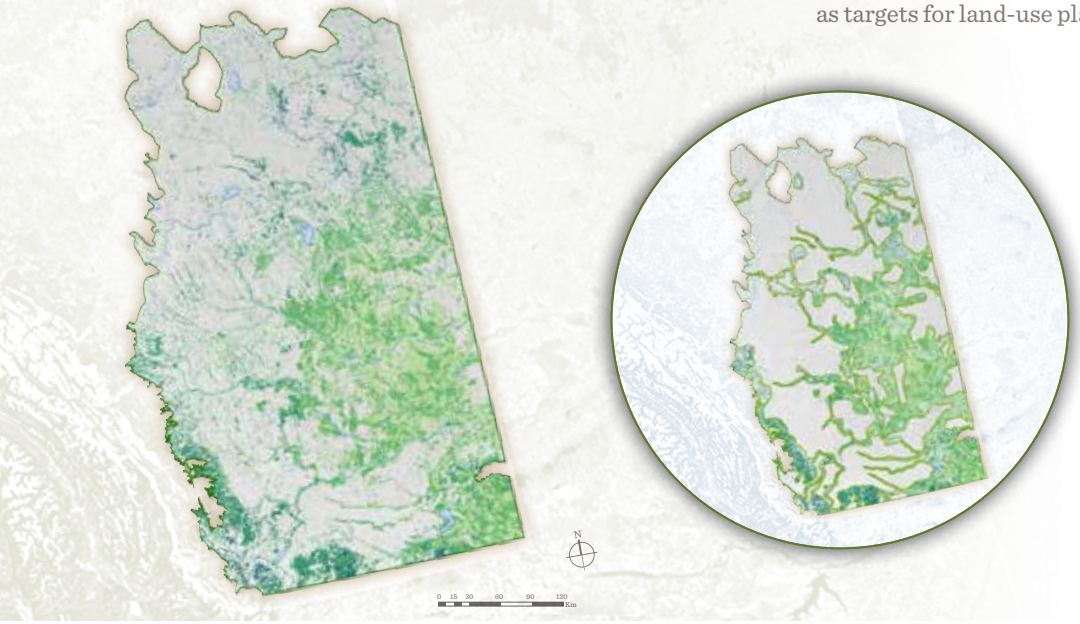


FIGURE 20.
Estimated average annual forage production (kg/ha), across native grassland in the Prairie Region (left map) and inside the High Value Landscape (right map).

Above Ground Biomass Production (kg/ha)

- < 500
- 501 - 1000
- 1001 - 1500
- 1501 - 2000
- 2001 - 2500
- > 2500
- HVL boundary

FIGURE 21.
Estimated soil carbon storage (tonnes/ha) across native grassland in the Prairie Region (left map) and inside the High Value Landscape (right map).

Soil Carbon (tonnes/ha)

- < 20
- 21 - 40
- 41 - 60
- 61 - 80
- 81 - 100
- > 100
- HVL boundary

Wetlands

The wetlands found in the Prairie Region of Alberta are part of an 800,000 km^2 area known as the Prairie Pothole Region (PPR) of North America. When the glaciers retreated approximately 10,000 years ago, millions of shallow water-gathering depressions were left behind, which today form the wetlands that dot Alberta's prairie landscape (Figure 22). Wetlands, also known as marshes, sloughs, and potholes, are incredibly productive environments rich in biodiversity that support large and complex food chains, and provide essential habitat for wildlife. This whole landscape is known as the "duck factory" of North America because it is a globally significant breeding and migratory stopover area for waterfowl, shorebirds, and landbirds. This area is so important that several sites have been identified as Important Bird Areas in recognition of the essential habitat provided for bird populations.

Wetlands provide a number of important benefits to people living on the prairies. As the "kidneys of the landscape," wetlands filter and enhance water quality. They stabilize water supplies and thereby reduce the negative effects of floods and droughts. Wetlands also provide a range of recreational and educational opportunities, like boating, fishing, and birdwatching.

In the last century, central and southern Alberta has lost between 60% and 70% of its wetlands,[21] mainly due to drainage for agriculture land uses. Despite their recognized importance, wetlands in the Prairie Region continue to be lost as a result of human development like road construction and urban expansion, in addition to agriculture. The current annual rate of wetlands losses in the province has been estimated at 0.3% to 0.5%.[22] Climate change is predicted to result in the loss of more wetlands in the Prairie Region due to higher temperatures and less precipitation.[23] The remaining wetlands are further altered by surrounding land uses. For example, agricultural practices can increase sedimentation, chemicals, and nutrient concentrations in wetlands, as well as change water levels.

The ABMI Monitors Wetlands

With the challenges in managing, protecting, and restoring wetlands in the Prairie Region, the ABMI aims to provide a baseline evaluation of the status of wetland biodiversity in these regions, and to monitor trends in wetland condition over time by measuring a number of wetland attributes (Table 06). Between 2007 and 2012, indicators of wetland biodiversity were measured in almost 200 wetlands in the Prairie Regions (Table 07).

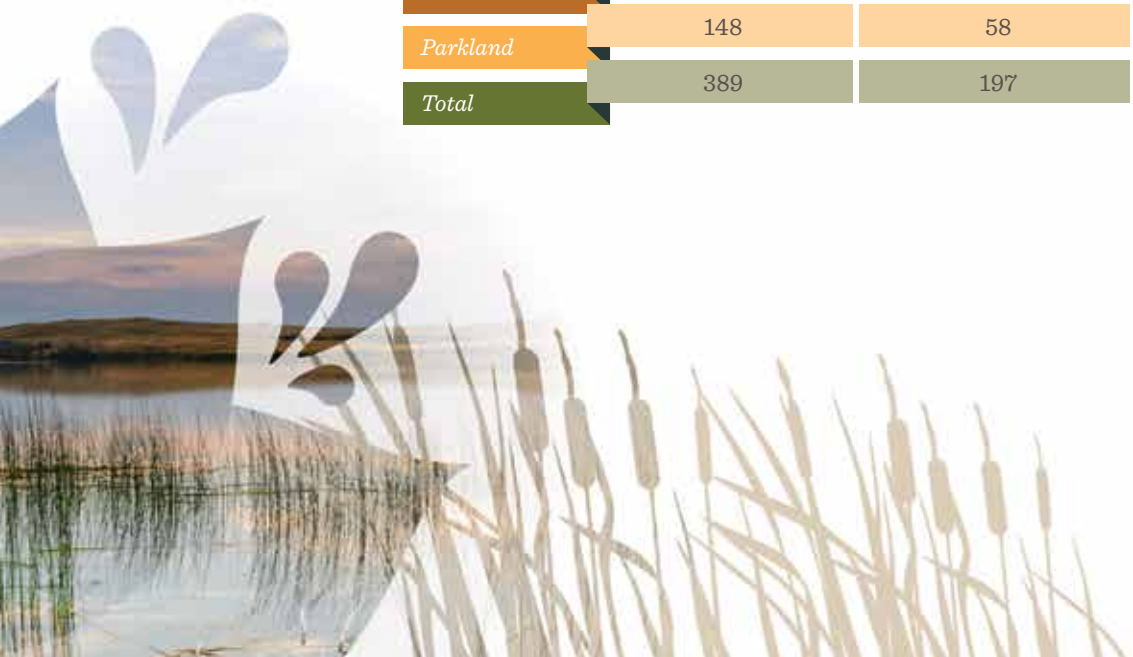
Analysis of wetland data is currently under way, examining how local factors such as human footprint, vegetation, and soil types, and landscape factors like climate, natural region, watershed, and wetland distance from vegetated edge influence overall wetland health and biodiversity. By monitoring wetlands in the Prairie Region, we will identify wetland reference conditions, establish benchmarks for wetlands management and restoration, and monitor the health of one of Alberta's most important ecosystems. Preliminary results are expected in 2016.

TABLE 06.
Summary of wetland attributes measured by the ABMI.

Wetland Species	Wetland Habitat	Human Footprint
• *Vascular plants* • *Invertebrates*	• *Wetland size and depth* • *Areas of wetland habitat zones* • *Water chemistry and physical variables*	• *Urban footprint* • *Agriculture footprint* • *Energy footprint* • *Linear features*

TABLE 07.
Number of wetlands assessed in the Grassland and Parkland Natural Regions and the number of vascular plant species detected in the wetlands of these regions (preliminary results).

Natural Regions	Number of ABMI Wetland Sites	Number of Wetlands Sampled (2007 to 2012)	Vascular Plant Species Detected (2007 to 2012)
Grassland	241	139	367
Parkland	148	58	304
Total	389	197	478



CONCLUSION

Maintaining the biodiversity of native prairie and parkland ecosystems is a fundamental goal of the PCF. The results in this report support this goal by providing baseline information on the current types of land uses in the Prairie Region, the current status of prairie species, the amount of native prairie remaining, and an index of fragmentation. Specific results of note include the following:

- As of 2013, the total human footprint across the Prairie Region was 63.1%. Agriculture footprint was the largest human footprint category, covering 55.2% of the planning region, followed by transportation footprint at 2.7%, and residential footprint at 2.8%. While human footprint was approximately two and half times bigger outside the High Value Landscape (82.3%) than inside (30.8%), human footprint in the High Value Landscape grew more quickly between 1999 and 2013, increasing by 2.4% compared to 1.6% outside the High Value Landscape.
- Biodiversity intactness for the Prairie Region, inside the High Value Landscape, and outside the High Value Landscape is 53%, 69%, and 43%, respectively.
- In general, the biggest ecological changes are associated with lower-than-expected abundances of native grassland species, particularly grassland-associated plants. All assessed grassland-associated vascular plants were less abundant than expected compared to intact reference conditions.
- Non-native plant species were detected at all ABMI sites that have been sampled to date in the Prairie Region, and an average of nine non-native species were detected at each site.
- As of 2012, 37% of the Prairie Region is composed of native vegetation. Most of this is within the High Value Landscape, as 69% of the High Value Landscape is composed of native vegetation compared to 18% outside. At 200 m from human footprint, native vegetation is highest in the High Value Landscape at 23% compared to only 2% outside. There is very little (< 1%) native vegetation that is at least 2 km from human footprint in the Prairie Region.
- Overall, 1.4% of the Prairie Region is managed as protected areas. All natural subregions within the Prairie Region have < 2% representation in protected areas.
- The average effective mesh size of the Prairie Region is 5.0 km^2 when linear features like roads are included as human footprint that divides native patches. The average effective mesh size in the High Value Landscape is 11.9 km^2 compared to only 0.4 km^2 outside, indicating a high level of fragmentation due to human footprint.

With biodiversity 53% intact today, there are challenges associated with the management of native prairie species and habitat in the Prairie Region, 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. Furthermore, Alberta's natural regions are expected to shift north under climate change, a trend that will have a variety of impacts on regional biodiversity (see biodiversityandclimate.abmi.ca to learn more about the ABMI's work on the effect of climate change on Alberta's species, ecosystems, and communities). As a result, now, more than ever, effective management and stewardship of prairie biodiversity are critical. As development continues to unfold, the ABMI will continue to measure and report on the changing state of human footprint and biodiversity, supporting PCF planning objectives related to stewardship and conservation of native grassland and associated biodiversity in the Prairie Region.

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 Parkland and Grassland Natural Regions.

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. 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 under "Publications."

Disclosure

Data used in the preparation of this report are 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. 2012. Manual for Estimating Species and Habitat Structure Intactness (20029), Version 2012-12-04. Alberta Biodiversity Monitoring Institute, Alberta, Canada. Available at www.abmi.ca under "Publications."
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 under "Publications."

Principal authors of this report are Katherine Maxcy, Dave Huggard, Tara Narwani, Jim Herbers, Shannon White and Majid Iravani (Spotlight: Ecosystem Services), and Marie-Claude Roy (Spotlight: Wetlands). Christine Gray provided GIS analysis and created maps. Special thanks to members of the PCF for thoughtful reviews of this report.

Terms and Conditions of Report Preparation

In 2014, the PCF requested that the ABMI produce a preliminary report on the status of biodiversity in the Grassland and Parkland Natural Regions in Alberta. The PCF funded the creation of this report. The following terms were applied as a condition of the ABMI preparing 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 Parkland and Grassland Natural Regions and cannot be localized to smaller landscapes within these regions 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.

Preferred Citation

The Alberta Biodiversity Monitoring Institute. 2015. The Status of Biodiversity in the Prairie and Parkland Regions of Alberta: Preliminary Assessment. Alberta Biodiversity Monitoring Institute, Alberta, Canada. Report available at www.abmi.ca.

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