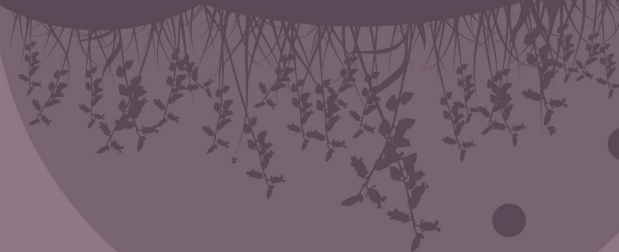*The Status of Biodiversity in the*

UPPER PEACE REGION

ABMI

[THIS REPORT DESCRIBES THE STATUS OF BIODIVERSITY AND HUMAN FOOTPRINT IN THE UPPER PEACE REGION]

In partnership with:

Alberta Innovates

ROYAL ALBERTA MUSEUM

UNIVERSITY OF ALBERTA

UNIVERSITY OF CALGARY

Contents

COVERING 20.3% OF THE UPPER PEACE REGION, AGRICULTURE FOOTPRINT IS THE LARGEST HUMAN FOOTPRINT IN THE REGION. READ MORE ON PAGE 14 AND 38.

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.

THE STATUS OF BIODIVERSITY IN THE UPPER PEACE REGION

Report Summary

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

The Upper Peace Region makes up 11% of Alberta's land area. The diverse ecosystems in this region, from the Rocky Mountains and Foothills to the Boreal Forest and Parklands, support a wide range of biodiversity including many forest-dwelling and grassland-associated species.

As of 2012, human footprint[†] covered 32.1% of the Upper Peace Region, up from 27.2% in 1999. Agriculture footprint represented the largest human footprint category, covering 20.3% of the region, almost three times larger than the next largest human footprint, forestry, which covered 7.9% of the region. Energy footprint covered 2.1% of the region. The increase in footprint between 1999 and 2012 was largely driven by forestry footprint, which increased from 4.4% to 7.9% coverage in this time.

Overall, 9% of the Upper Peace Region is managed as protected areas.

The ABMI assessed the status of 396 species in the Upper Peace Region and found them to be, on average, 81% intact.[‡] At present, the biggest ecological changes are associated with the higher-than-expected abundance of human-associated species, such as Coyote, Vesper Sparrow, and Red Fescue.

Additional results of note include:

- *Species that prefer old forest habitat, like the Black-throated Green Warbler, Marten and Fisher, and Aspen Stocking Moss were found to be less abundant than expected.*

- *The abundance of several plant species associated with prairie habitats—such as June Grass, Western Wheat Grass, and Harebell—declined with increasing agricultural footprint.*

- *A total of 50 non-native weeds were detected in the Upper Peace Region. Non-native weeds were detected at 58% of the sites surveyed, and, at sites where they were found, an average of 5.2 non-native weed species was present.*

- *The ABMI detected 79 species at risk[§] in the Upper Peace Region and was able to calculate intactness for 25 of these species. Of those assessed, most were less abundant than expected.*

The White Area, defined as agricultural land in the Upper Peace Region, covers 34% of the land base. As of 2010, the total human footprint in the White Area was 63.4%. Not unexpectedly, this footprint was predominantly agriculture (56.4%). The ABMI assessed the status of 396 species in the White Area and found them to be, on average, 50% intact, 30% lower compared to intactness of the Upper Peace Region as a whole.

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

[†] *The measure of forestry footprint includes both recent and older logging activity in the region. The ABMI is currently developing the science necessary to account for regeneration of harvested areas so that these areas can make a reduced contribution to the estimate of total human footprint.*

[‡] *The ABMI's Biodiversity Intactness Index is used to report on the health of biodiversity, including birds, winter-active mammals, armoured mites, vascular plants, and mosses and liverworts within 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 the case when no human footprint is present.*

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

Introduction

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

Under the Land-use Framework, the Government of Alberta is developing seven land-use plans. In August 2012, the government approved the first of these plans—Lower Athabasca Regional Plan (LARP)[2]—with the other planning regions to follow. A large part of this planning process is managing the long-term trade-offs associated with economic, social, and environmental priorities. In support of the planning process, land-use plans will identify clear environmental objectives for air, land, water, and biodiversity.

The ABMI is part of Alberta's environmental monitoring system. We measure the health of biodiversity and changes in human land-use (i.e. human footprint) in Alberta, including the seven planning regions. Our biodiversity data and human footprint data are designed to measure progress towards the environmental objectives as identified in each land-use plan.

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

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

LOWER PEACE
REGION

LOWER
ATHABASCA
REGION

UPPER PEACE
REGION

UPPER
ATHABASCA
REGION

EDMONTON

NORTH
SASKATCHEWAN
REGION

RED DEER
REGION

CALGARY

SOUTH
SASKATCHEWAN
REGION

LEGEND

● ALBERTA

N

0 37.5 75   150   225   300
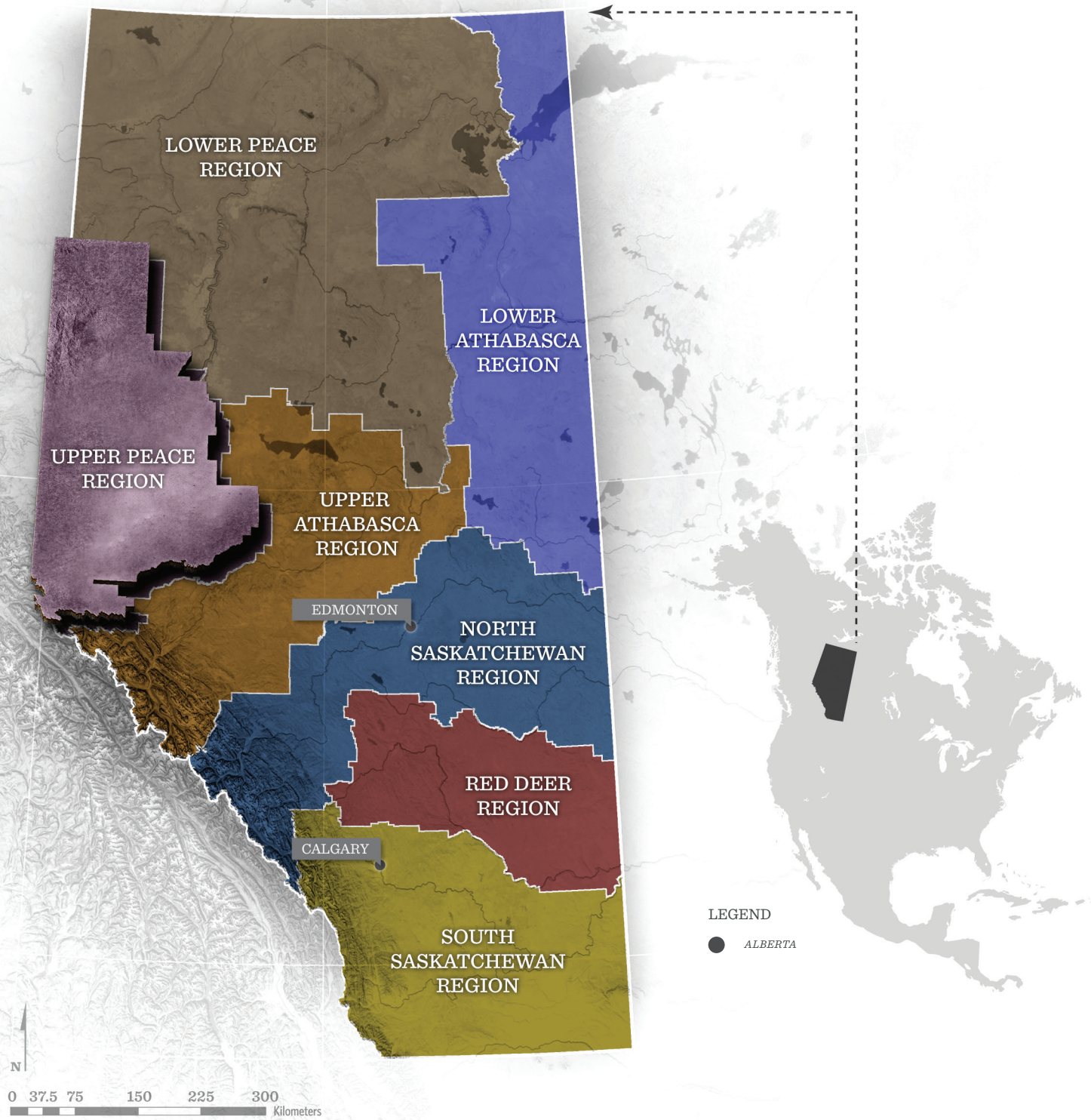   Kilometers

FIGURE 01

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

Why Biodiversity Matters

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

For example, ensuring healthy aquatic ecosystems in our environment is the most cost-effective way of providing a clean and reliable source of drinking water.[3] Productive forest ecosystems grow trees that not only supply our sawmills and pulp mills, but also act as an important storehouse of carbon, which helps to mitigate climate change. Approximately one-third of the fruits and vegetables we buy at the grocery store require pollination by the many insect species that are an important part of biodiversity. In addition, the products we find in our medicine cabinets are often derived from plants. In fact, approximately 25% of the world's bestselling prescription medications are derived from plant-based biodiversity products.[4] And finally, natural areas provide opportunities for hiking, hunting, fishing, and berry picking. Biodiversity is all around us everyday, and it plays an enormous role in supporting our way of life.

ABMI Measures Biodiversity

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

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

The ABMI also monitors the state of Alberta's human footprint using fine-resolution aerial photography and satellite imagery. The ABMI's Geospatial Centre conducts analyses of human footprint at two spatial scales:

1. For a 3 × 7 km area around each ABMI site location, detailed inventories of human footprint are created using satellite imagery. Detailed inventories are available from 1999 to 2012, except for 2000 and 2006.[†]

2. At the provincial scale, existing satellite imagery is used to create a wall-to-wall human footprint map of the entire province. This Geographic Information System (GIS) Inventory of Provincial Human Footprint is a compilation of externally sourced information about provincial human footprint, supplemented with ABMI remote sensing data that has undergone ABMI quality-control procedures. The Inventory of Provincial Human Footprint is available for 2007 and 2010.

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

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

LEGEND

● UPPER PEACE REGION
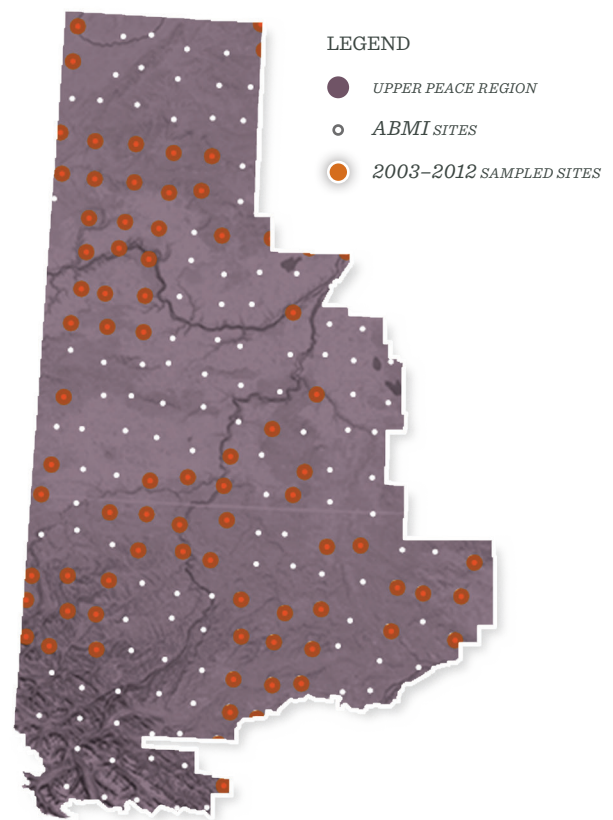
○ ABMI SITES

● 2003–2012 SAMPLED SITES

FIGURE 02

THE UPPER PEACE REGION REPRESENTS 11% (74,270 KM²) OF ALBERTA'S TOTAL LAND AREA. THE ABMI HAS 182 OF OUR 1,656 SURVEY SITES IN THE UPPER PEACE; 81 OF THESE SITES HAVE BEEN SAMPLED FROM 2003 TO 2012.

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

Biodiversity Indicators in This Report

Habitat loss is a major driver of biodiversity decline on the planet.[5] In the Upper Peace Region, habitat is being modified by, or lost to, a range of human activities, particularly agriculture and forestry. 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 species, habitat, and human footprint in the following way:

Species

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

- *If a species is 100% intact in a given area, the abundance of the species is equal to the abundance one would expect in an undisturbed area—one 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 undisturbed area. In other words, the species has become more rare. In the second scenario, the species is more abundant than expected. In both instances, species abundance has been altered from a reference condition due to human impact.*

Native Habitat

To assess the status of native habitat, the ABMI uses the GIS Inventory of Provincial Human Footprint. To report on the status of native habitat, the ABMI presents the percentage of land cover that has no human footprint, as well as the percentage of 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 x 7 km detailed inventory of human footprint. To report on the status of human footprint, the ABMI presents the percentage of land directly altered by human activities, which is interpreted as follows:

- *0% means there is no visible human footprint.*

- *100% means the landscape has been completely modified by human footprint.*

In general, cities and cultivated fields have high human footprint, while protected and undeveloped areas have low human footprint. Trend information on human footprint is based on the 3 × 7 detailed inventory of human footprint available from 1999 to 2012 (except for 2000 and 2006). Human footprint data for caribou population ranges and the White Area is calculated using the GIS Inventory of Provincial Human Footprint circa 2007 and 2010.

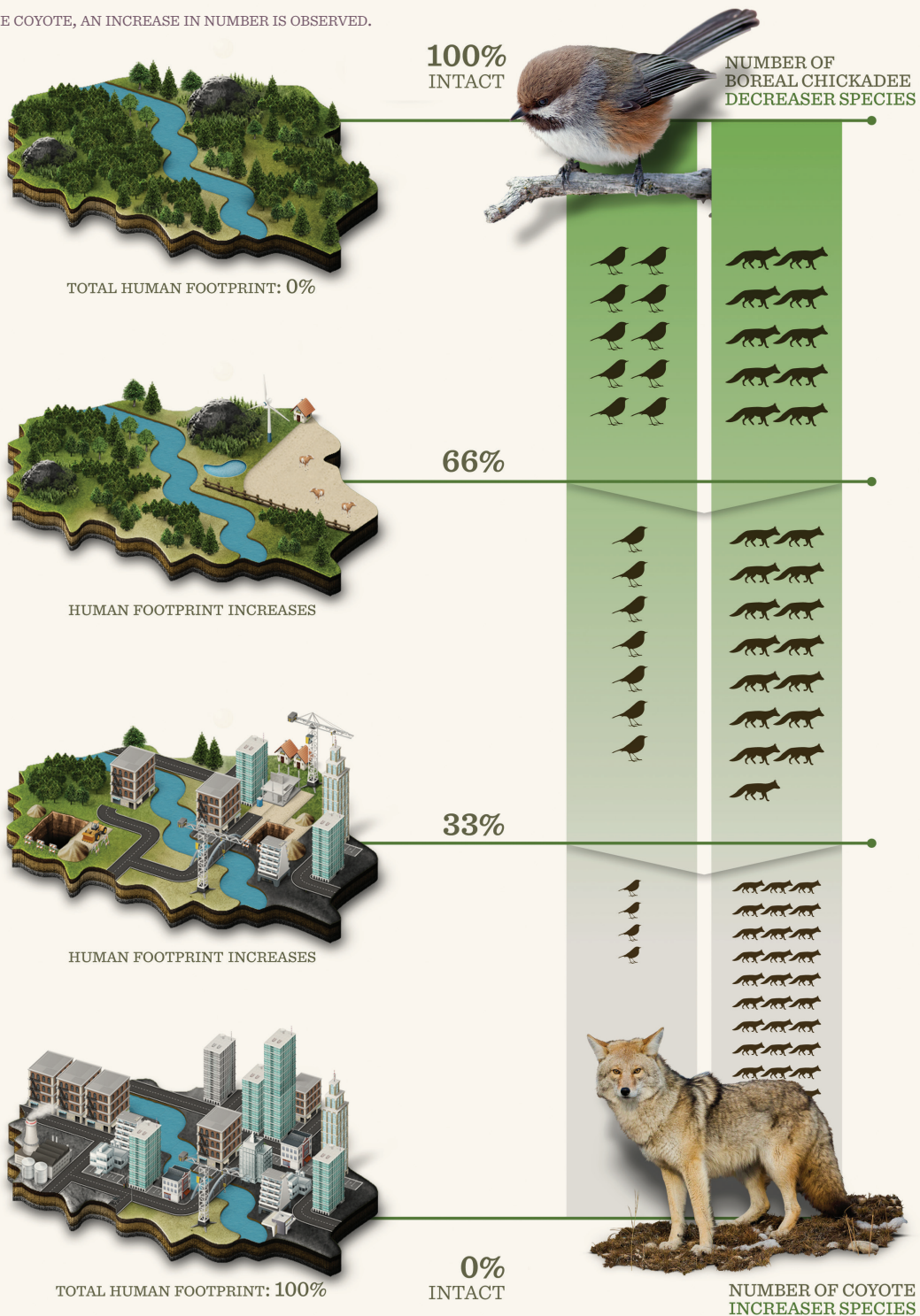See the Upper Peace Region Data Supplement for further details (available at www.abmi.ca).

FIGURE 03

THE ABMI BIODIVERSITY INTACTNESS INDEX

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

- A "DECREASER" SPECIES, THE BOREAL CHICKADEE.
- AN "INCREASER" SPECIES, THE COYOTE.

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

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

100% INTACT

NUMBER OF
BOREAL CHICKADEE
DECREASER SPECIES

TOTAL HUMAN FOOTPRINT: 0%

66%

HUMAN FOOTPRINT INCREASES

33%

HUMAN FOOTPRINT INCREASES

TOTAL HUMAN FOOTPRINT: 100%

0% INTACT

NUMBER OF COYOTE
INCREASER SPECIES

Reporting Area

The Upper Peace Region covers an area greater than 74,000 km^2 in the central northwest portion of Alberta (Figure 04). The topography and ecosystems of the region is diverse, from the tree-covered foothills in the southwest to the broad prairie-like plains in the northeast.

The Upper Peace Region includes:

- 11% of Alberta—an area similar in size to Ireland or the province of New Brunswick.

- Four of the six Natural Regions found in the province: Foothills (29%), Rocky Mountains (18%), Boreal (11%), and Parkland (5%).

- Vast forested areas that support a wide range of wildlife and plants. These forests have been shaped by wildfire for thousands of years, resulting in a mosaic of stands of different ages from young forests to forests more than 150 years old.

- Parkland habitats that support an array of species typically found in ecosystems in the southern parts of the province. Much of the Upper Peace Region parkland ecosystem has been converted to agricultural use.

- The Peace River valley dominates the topography as the river flows north and east through the region toward Lake Athabasca.

THE REGION OVERLAPS WITH 11 FOREST MANAGEMENT AGREEMENT (FMA) AREAS, AND HOSTS ONE OF THE TOP 10 PULP PRODUCERS IN NORTH AMERICA.
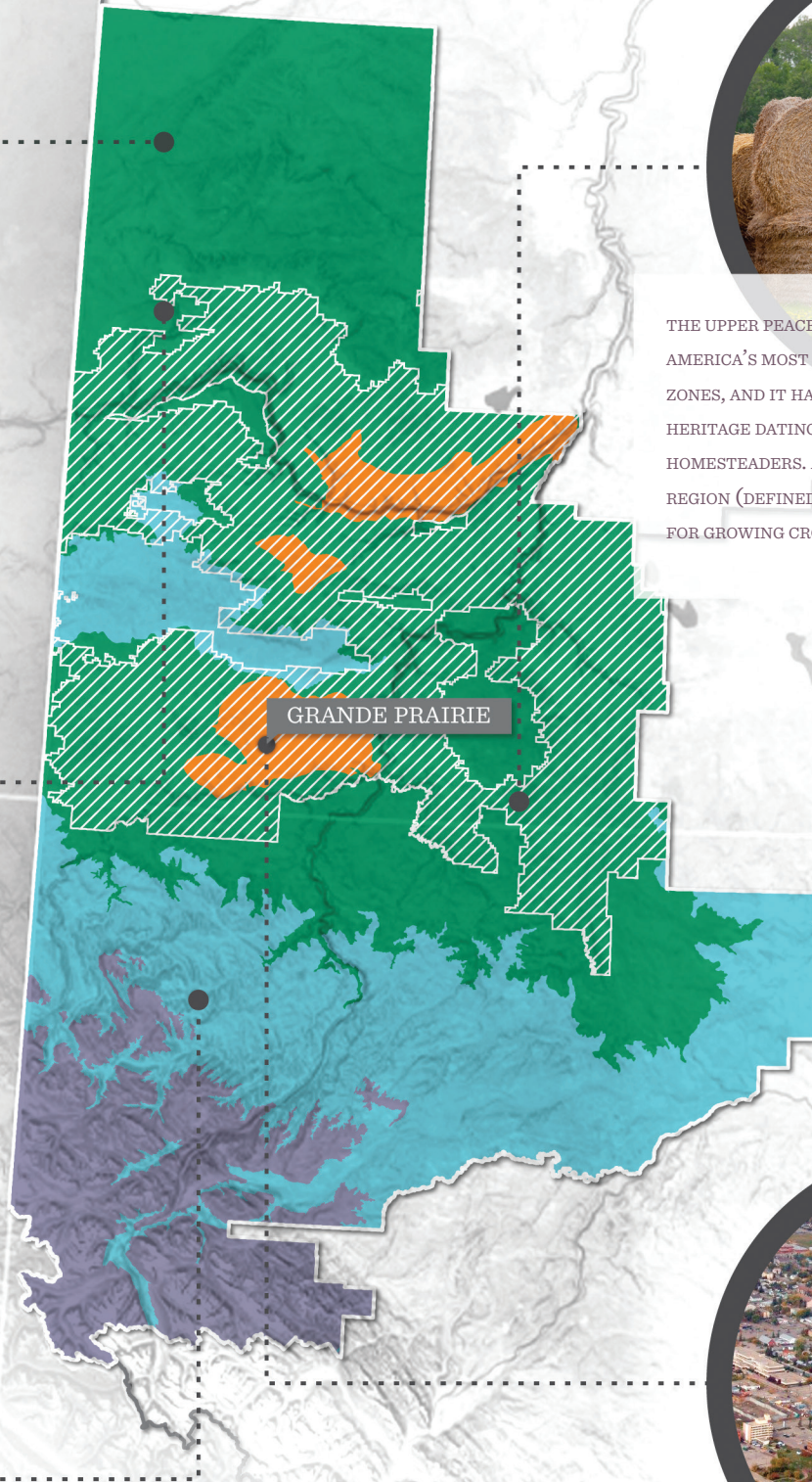

THE REGION IS A MAJOR SUPPLIER OF OIL AND NATURAL GAS, WITH OIL AND GAS WELLS PRODUCING APPROXIMATELY 4.9 MILLION M^3 OF OIL PER YEAR, AND OVER 30 BILLION M^3 OF NATURAL GAS.

THE REGION IS KNOWN AS BEAR COUNTRY AND CONTAINS AREAS IDENTIFIED AS HIGH OR GOOD HABITAT VALUE FOR GRIZZLY BEAR AND WOODLAND CARIBOU—BOTH PROVINCIALLY LISTED AS THREATENED.

THE UPPER PEACE REGION IS ONE OF NORTH AMERICA'S MOST NORTHERLY AGRICULTURAL ZONES, AND IT HAS A RICH AGRICULTURAL HERITAGE DATING BACK TO SETTLEMENT BY HOMESTEADERS. APPROXIMATELY 34% OF THE REGION (DEFINED AS THE WHITE AREA) IS USED FOR GROWING CROPS AND FEEDING LIVESTOCK.

GRANDE PRAIRIE

LEGEND

- PARKLAND
- BOREAL
- FOOTHILLS
- ROCKY MOUNTAINS
- WHITE ZONE AREA

N

FIGURE 04

THE UPPER PEACE REGION, A 74,270 KM² AREA IN NORTHWESTERN ALBERTA, IS THE FOCUS OF THIS REPORT.

0 10 20 40 60
Kilometers

THE URBAN CENTRE OF GRANDE PRAIRIE— SITUATED IN THE HEART OF THE UPPER PEACE REGION —IS SURROUNDED BY FARMLAND TO THE NORTH, EAST, AND WEST, AND BOREAL FOREST TO THE SOUTH. IT IS A KEY HUB FOR RESOURCE DEVELOPMENT.

13

HUMAN FOOTPRINT DATA, INCLUDING FOOTPRINT TYPE, AMOUNT, AND TREND, PROVIDE THE CONTEXT FOR INTERPRETING THE BIODIVERSITY INTACTNESS INDEX.

Human Footprint

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

AS OF 2012, THE TOTAL HUMAN FOOTPRINT ACROSS THE UPPER PEACE REGION WAS 32.1% (FIGURE 05, FIGURE 06A).

Agriculture footprint was the largest human footprint category covering 20.3% of the planning region in 2010 (Figure 06B), followed by forestry footprint at 7.6% (Figure 06C), and energy footprint at 2.0% (Figure 06D).

The total area of human footprint in the Upper Peace Region increased by almost 5% between 1999 and 2012, from 27.2% to 32.1% of the region (Figure 05). This increase was largely driven by the creation of new forestry footprint in the form of clear-cuts and partial cuts; forestry footprint increased from 4.4% coverage in 1999 to 7.9% coverage in 2012. Energy footprint increased slightly during this period, covering approximately 2% of the land base as of 2012. Agriculture footprint remained virtually unchanged from 1999 to 2012, increasing by 0.6%.

The human footprint data provides the context for interpreting the current status of biodiversity as reflected by the Biodiversity Intactness Index. As the percentage of area of human footprint increases toward 100%, the risks to biodiversity in a region also increase. These risks are initially small and can go unnoticed. However, as the area of human footprint increases, the more likely it will have an impact on biodiversity. Some species thrive in landscapes with high human footprint and increase in abundance, while other species decrease in abundance and become uncommon as a result of development.

TOTAL HUMAN FOOTPRINT (%)

| 27.2% | – | 27.8% | 27.8% | 28.0% | 29.2% | 29.4% | – | 30.4% | 30.6% | 30.9% | 31.3% | 31.6% | 32.1% |

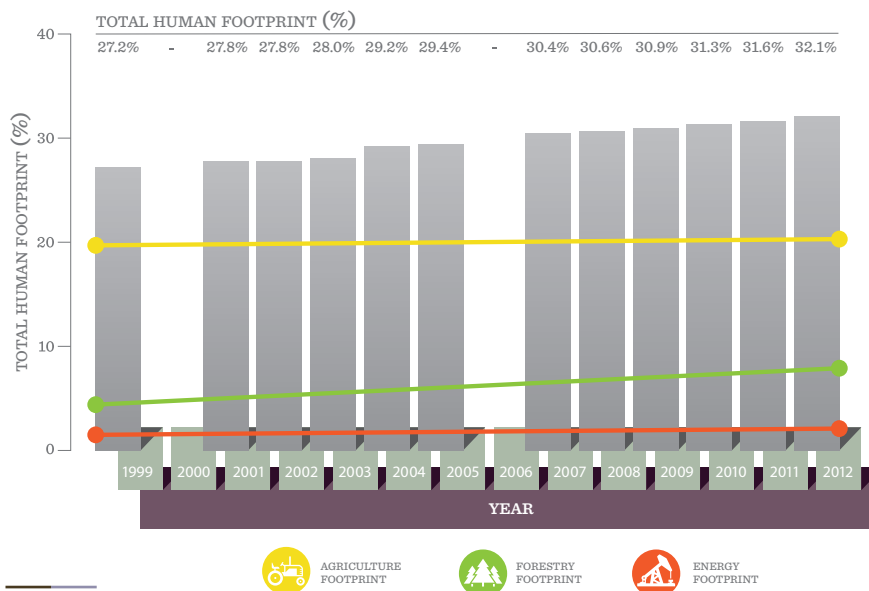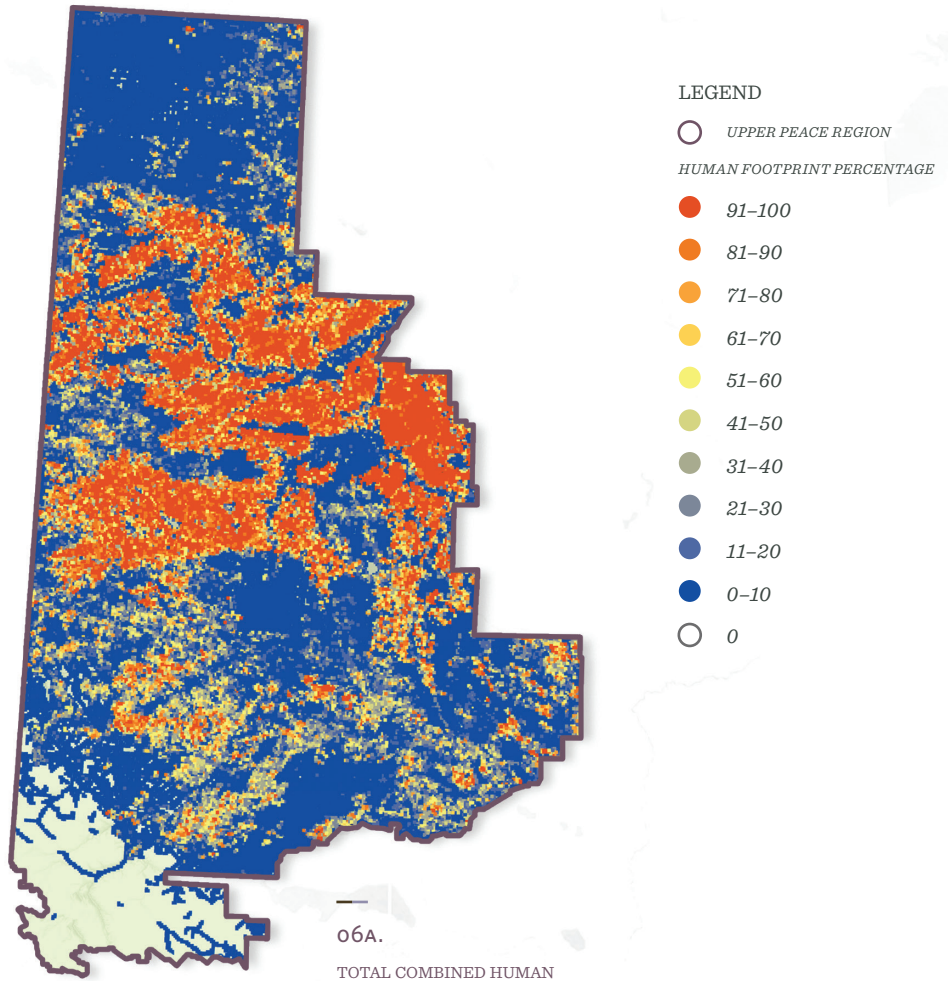AGRICULTURE FOOTPRINT   FORESTRY FOOTPRINT   ENERGY FOOTPRINT

FIGURE 05

THE PERCENTAGE OF TOTAL HUMAN FOOTPRINT, AGRICULTURE FOOTPRINT, FORESTRY FOOTPRINT, AND ENERGY FOOTPRINT IN THE UPPER PEACE REGION FROM 1999 TO 2012.

LEGEND

○ *UPPER PEACE REGION*

HUMAN FOOTPRINT PERCENTAGE

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

06A.
TOTAL COMBINED HUMAN
FOOTPRINT IN THE
UPPER PEACE REGION.
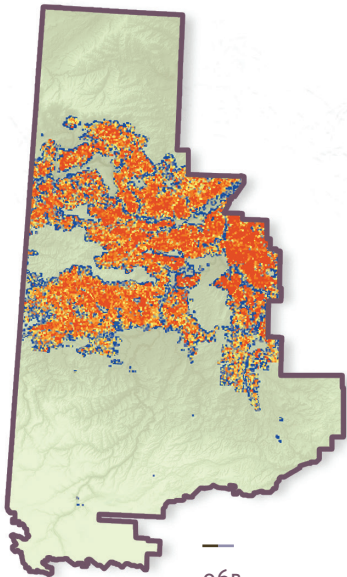
06B.
AGRICULTURE FOOTPRINT
COVERS 20.3% OF THE
UPPER PEACE REGION.
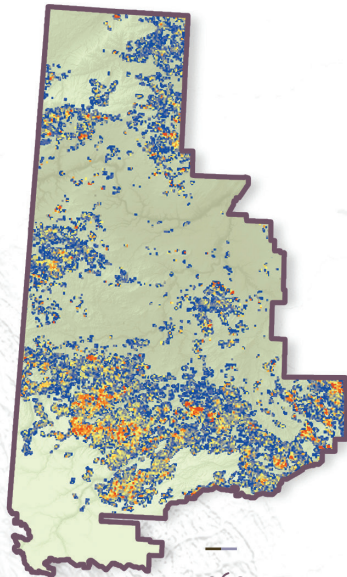
06C.
FORESTRY FOOTPRINT
COVERS 7.6% OF THE
UPPER PEACE REGION.
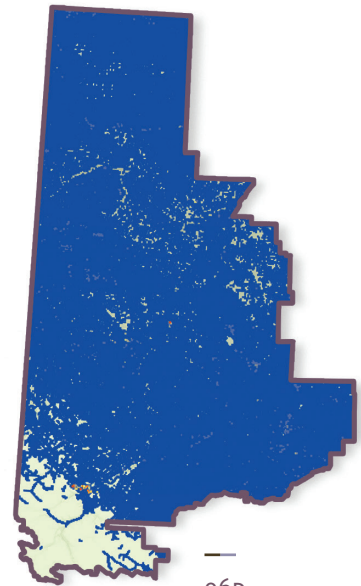
06D.
ENERGY FOOTPRINT
COVERS 2.0% OF THE
UPPER PEACE REGION.

FIGURE 06

DISTRIBUTION OF HUMAN FOOTPRINT ACROSS THE UPPER PEACE REGION CIRCA 2010, INCLUDING: 06A. TOTAL HUMAN FOOTPRINT
CATEGORIES COMBINED; 06B. AGRICULTURE FOOTPRINT; 06C. FORESTRY FOOTPRINT; 06D. ENERGY FOOTPRINT.

Habitat and Protected Areas

Native Habitat

People's perception of wilderness often includes undisturbed expanses of forest, grassland, river, and lake ecosystems. The ABMI uses the phrase and concept of "native habitat" to identify areas in Alberta, including in the Upper Peace Region, 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 native habitat 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 native habitat. For example, some species can effectively use habitat that is adjacent to human footprint while others require habitat that is more distant. Therefore, we measure native habitat using four different buffer distances: 0 m, > 50 m, > 200 m, and > 2 km away from footprint. These distances delimit the amount of native habitat available with a given "buffer" from human footprint. For example, at 0 m from human footprint, all native habitat in the region is included. However, at > 50 m, only native habitat that is at least 50 m away from human footprint is included.

Overall, 69% of the Upper Peace Region is composed of native habitat with a 0 m buffer from human footprint, whereas in the case of native habitat that is at least 2 km away from development, 6% remains (Figure 07).

As a note of caution, our summary of native habitat does not yet account for some forms of human land use (e.g., livestock grazing or hunting) that may not be consistent with the management objectives of a particular stakeholder. Successional recovery to native habitat in cutblocks and seismic lines is also not yet accounted for in these summaries.
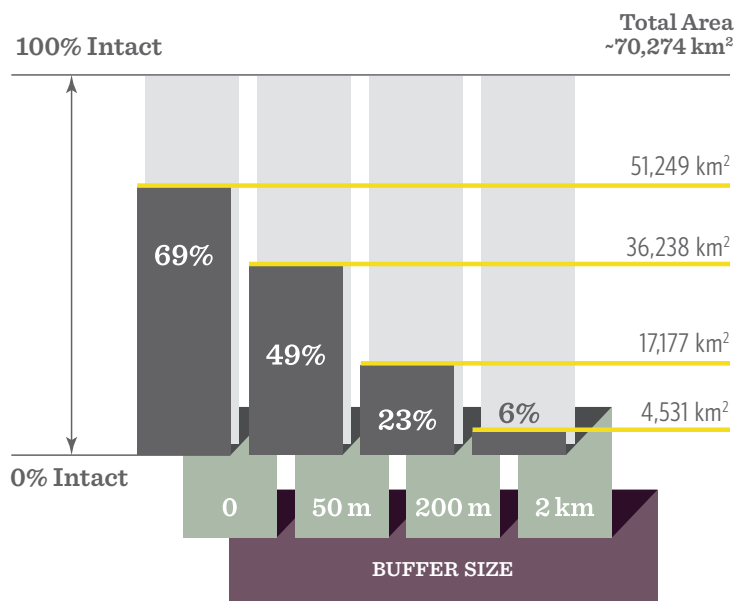
FIGURE 07

TOTAL AND PERCENTAGE OF NATIVE HABITAT IN THE UPPER PEACE REGION USING FOUR DIFFERENT BUFFER DISTANCES.
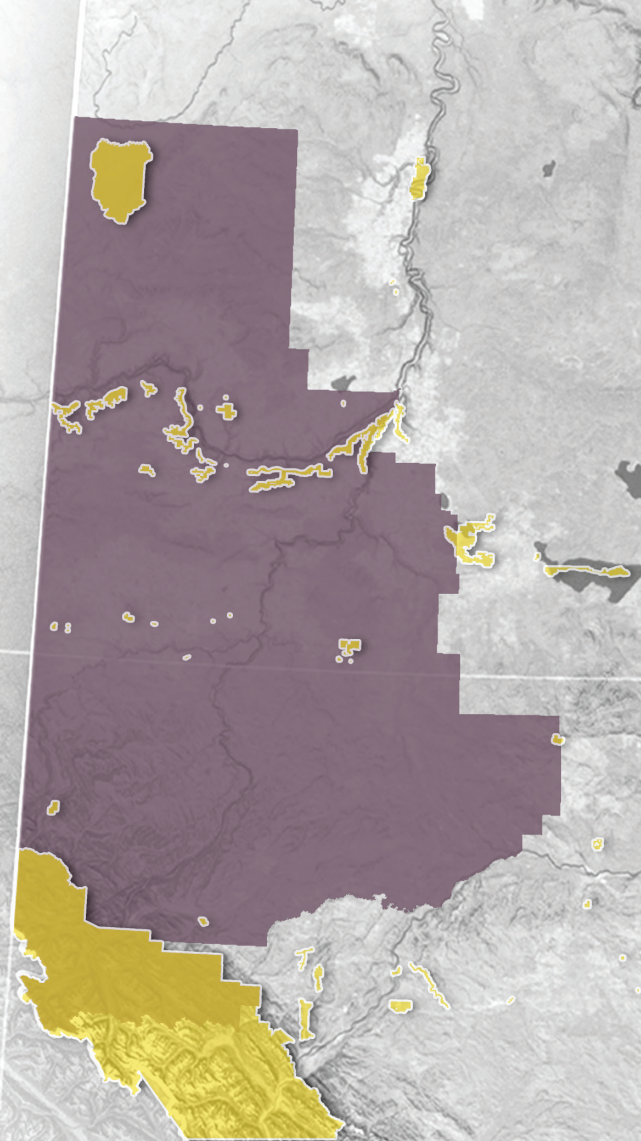
Protected Areas

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.[6]

Overall, 9% of the Upper Peace Region is managed as protected areas[†], including (Figure 08): eleven provincial parks, nineteen provincial recreation areas, four natural areas, five wildland provincial parks, one wilderness park, and two ecological reserves.

Of the protected areas within the Upper Peace Region, most (69%) is part of the Willmore Wilderness Park located in the southwest corner of the planning region. The second largest protected area in the Upper Peace Region is the Chinchaga Wildland Provincial Park located in the north-west. This provincial park falls within the Chinchaga Woodland Caribou range, and also provides critical habitat for Grizzly Bear and Wolverine.

LEGEND

- UPPER PEACE REGION
- PROTECTED AREAS

FIGURE 08

DISTRIBUTION OF PROTECTED AREAS IN THE UPPER PEACE REGION. OVERALL, 9% (6,641 KM²) OF THE REGION IS MANAGED AS PROTECTED AREAS.

Willmore Wilderness Park

† *The ABMI's definition of protected areas in the Upper Peace Region includes Alberta's parks and protected areas network, national parks, and national wildlife areas.*

Intactness of Biodiversity

Thousands of plant and animal species live in the Upper Peace Region. The ABMI assessed the status of species from five taxonomic groups—native birds, winter-active mammals, armoured mites, native plants, and mosses.[‡] These groups represent a small but diverse subset of all species in the region.

THE ABMI ASSESSED THE STATUS OF 396 COMMON NATIVE SPECIES IN FIVE TAXONOMIC GROUPS IN THE UPPER PEACE REGION. INTACTNESS RANGED FROM 74% TO 90% (TABLE 01).

At 74% intact, native birds showed the greatest deviation from reference conditions while mammals, at 90% intact, showed the least.

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

TABLE 01

INTACTNESS* FOR DIFFERENT COMPONENTS OF BIODIVERSITY IN THE UPPER PEACE REGION.

Biodiversity Component	Number of Species	Intactness
Native birds	80	74 %
Winter-active mammals	10	90 %
Armoured mites	53	83 %
Native plants	173	79 %
Moss	80	81 %
Overall intactness	396	81 %

* OVERALL INTACTNESS IS CALCULATED AS THE AVERAGE OF THE FIVE TAXONOMIC GROUPS AS OPPOSED TO THE AVERAGE OF INDIVIDUAL SPECIES' INTACTNESS VALUES.

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

For Biodiversity Intactness, Context Matters
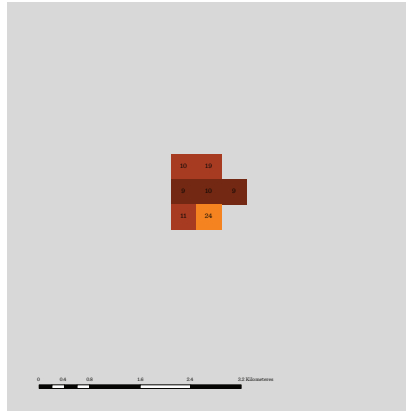
09A. 7 QUARTER SECTIONS WITH INTENSE
HUMAN DEVELOPMENT
AVERAGE INTACTNESS: 13%
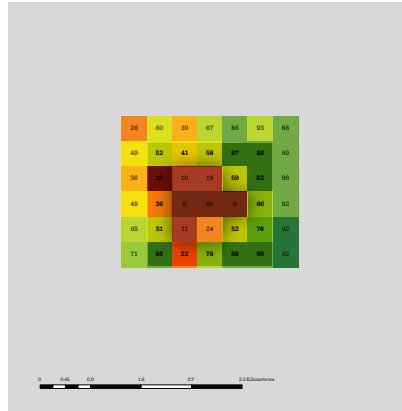
09B. 42 QUARTER SECTIONS WITH LOW TO
INTENSE HUMAN DEVELOPMENT
AVERAGE INTACTNESS: 56%
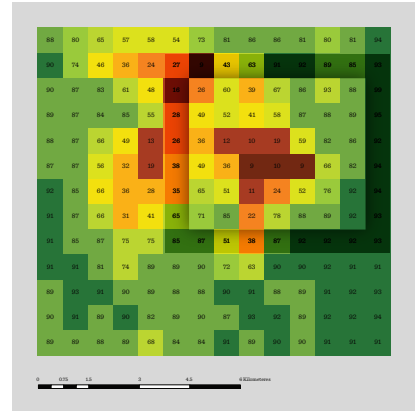
09C. 182 QUARTER SECTIONS WITH LOW TO
INTENSE HUMAN DEVELOPMENT
AVERAGE INTACTNESS: 72%

FIGURE 09.

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

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

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

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

*** Please refer to page 21 of the report for an explanation of how estimated biodiversity intactness maps are interpreted.*

Estimated Intactness of Biodiversity

Based on collected data, the ABMI has developed statistical models that describe the relationship between the relative abundance of individual species, habitat, and human footprint. These statistical models are used to calculate the Biodiversity Intactness Index for individual species in the Upper Peace Region. The models can also be used to estimate intactness for each species for every quarter section of land in the Upper Peace Region—in other words, for locations where the ABMI is not directly monitoring. Using the ABMI's Inventory of Human Footprint (circa 2010) and data on vegetation types, the average intactness of 396 species in the Upper Peace Region has been estimated and mapped to generate an overall picture of biodiversity in the region (Figure 10).

The estimated intactness map provides a visual representation of biodiversity intactness across the Upper Peace Region. Clearly, the map shows that some of the region has little to no human footprint, and therefore higher biodiversity intactness (shown as green in Figure 10). On the other hand, other areas, particularly those located in and around the Peace River Valley, have more intense human footprint, which results in lower biodiversity intactness (e.g., < 20%, shown as orange in Figure 10).

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

- *The information in the estimated intactness map is preliminary and will change as analyses are refined and as more data are gathered.*

- *There may be considerable uncertainty in the intactness value for any particular quarter section, (i.e., variance in the quarter section predictions is not yet reported by the ABMI).*

- *ABMI estimated biodiversity intactness maps are intended to show broad patterns of intactness, not exact values for each quarter section.*

LEGEND

BIODIVERSITY INTACTNESS

- 🟠 *0–30*
- 🟠 *31–40*
- 🟡 *41–50*
- 🟡 *51–60*
- 🟢 *61–70*
- 🟢 *71–80*
- 🟢 *81–90*
- 🟢 *91–100*

GRANDE PRAIRIE
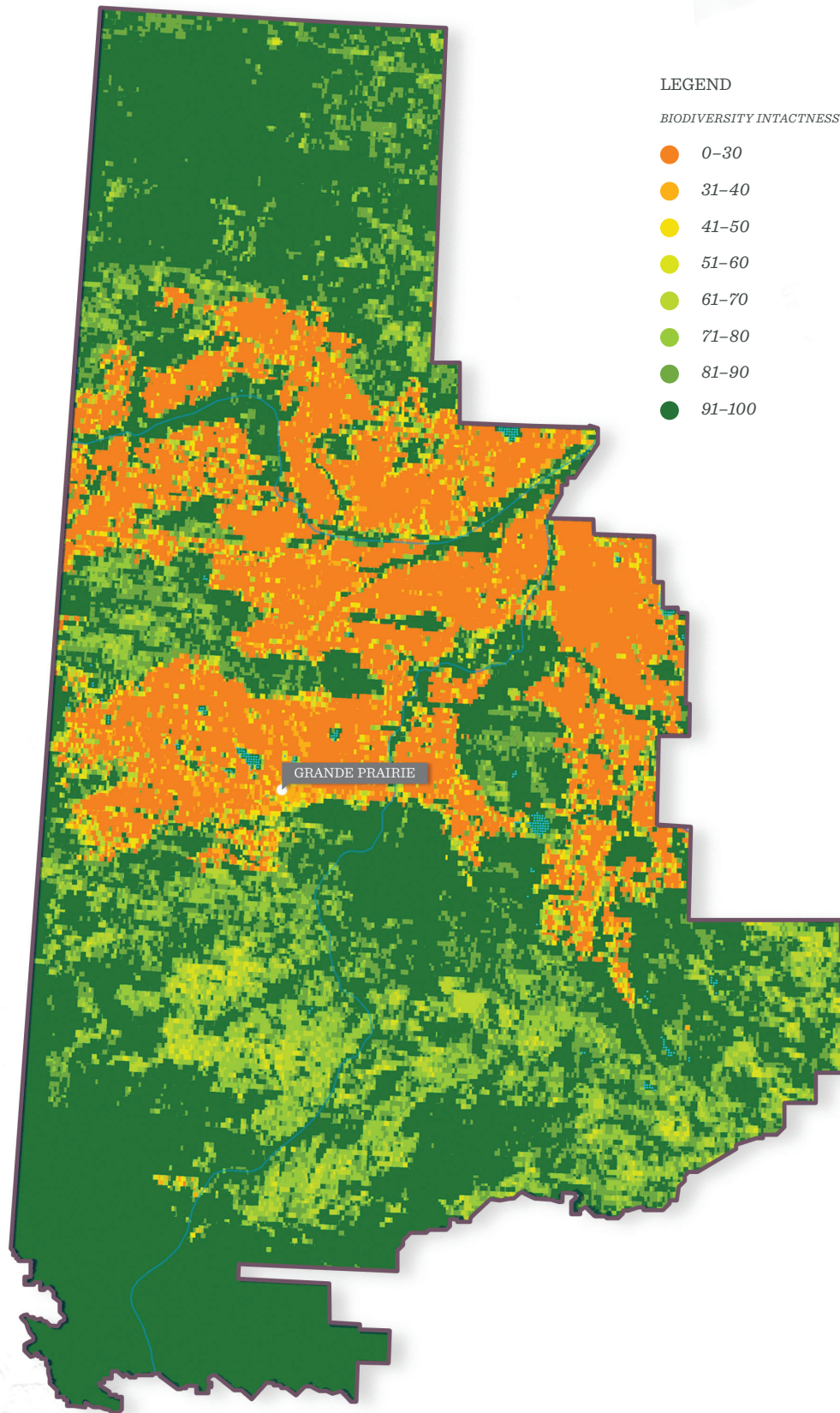
FIGURE 10

AVERAGE ESTIMATED INTACTNESS FOR 396 SPECIES IN THE UPPER PEACE REGION.
ORANGE IDENTIFIES THE QUARTER SECTIONS THAT ARE PREDICTED TO HAVE THE LOWEST
AVERAGE BIODIVERSITY INTACTNESS, AND DARK GREEN IDENTIFIES QUARTER SECTIONS
WITH THE HIGHEST INTACTNESS.

OF THE FULL SUITE OF SPECIES ASSESSED BY THE ABMI IN THE UPPER PEACE REGION, WE PROFILE (BY TAXONOMIC GROUP) RESULTS FOR SPECIES THAT SHOWED THE BIGGEST DIFFERENCE FROM REFERENCE CONDITIONS INCLUDING SPECIES THAT WERE MORE ABUNDANT AND LESS ABUNDANT THAN EXPECTED. WE ALSO PROFILE NON-NATIVE PLANTS AND SPECIES AT RISK. TO SEE THE COMPLETE DATASET ON ALL THE SPECIES ASSESSED, PLEASE CONSULT THE SUPPLEMENTAL MATERIAL ASSOCIATED WITH THIS REPORT (AVAILABLE AT WWW.ABMI.CA).

Birds

The diverse natural landscape of the Upper Peace Region supports an incredible variety of birds during the breeding season. This includes the numerous songbirds, such as warblers, that are commonly found in the boreal forest. The region's parkland habitats also support a wide range of associated grassland species, like the Western Meadowlark and Vesper Sparrow.

The importance of this area for birds is well recognized. In fact, the Grande Prairie Trumpeter Swan Important Bird Area and the Saskatoon Lake Migratory Bird Sanctuary were established in the Upper Peace Region to conserve important bird habitat. From ducks and shorebirds, to warblers and sparrows, the array of bird types that take advantage of the abundant food and the diverse habitat available in the Upper Peace Region is impressive.

THE ABMI ASSESSED THE STATUS OF 80 NATIVE BIRDS IN THE UPPER PEACE REGION AND FOUND THEM TO BE, ON AVERAGE, 74% INTACT.

For the 10 species that showed the greatest negative difference from reference conditions, intactness ranged from 57% to 81% (Figure 11). Most of these species prefer old-forest habitat for nesting and

feeding. Five species (Black-throated Green Warbler, Cape May Warbler, Blue-headed Vireo, Brown Creeper, and Boreal Chickadee) prefer old conifer-dominated forests, while three species (Ovenbird, Western Tanager, and Canada Warbler) are often most abundant in older deciduous and mixedwood forests. The remaining two species, Palm Warbler and Solitary Sandpiper, are associated with bogs and lowland spruce/larch forests.

Of the 10 species that were more abundant than expected, intactness ranged from 10% to 48% (Figure 11); this means these species were all at least two times more abundant than expected. Eight of the ten species are human-associated species, and therefore benefit from our land-use activities. The Vesper Sparrow, at 10% intact, showed the biggest departure from reference conditions; this is a grassland-associated species that can live in a variety of open habitats. The remaining two species, the Alder Flycatcher and Clay-coloured Sparrow, are associated with young forest habitat.

Overall, the strongest change to birds in the Upper Peace Region is due to the higher than expected abundance of human-associated species and young forest-associated species.

VESPER SPARROW IS ASSOCIATED WITH GRASSLAND HABITAT. WHILE THEY AVOID CROPLAND, THE VESPER SPARROW WILL READILY NEST IN DITCHES AND ALONG FENCE ROWS. AT 10% INTACT, THE VESPER SPARROW WAS MORE ABUNDANT THAN EXPECTED.

Scientific Name	Common Name	DECREASER / INCREASER value
Dendroica virens	Black-throated Green Warbler	57
Seiurus aurocapilla	Ovenbird	62
Piranga ludoviciana	Western Tanager	67
Dendroica tigrina	Cap May Warbler	71
Vireo solitarius	Blue-headed (solitary) Vireo	72
Certhia americana	Brown Creeper	74
Wilsonia canadensis	Canada Warbler	75
Dendroica palmarum	Palm Warbler	75
Tringa solitaria	Solitary Sandpiper	77
Poecile hudsonica	Boreal Chickadee	77
Empidonax alnorum	Alder Flycatcher	48
Agelaius phoeniceus	Red-winged Blackbird	46
Spizella pallida	Clay-coloured Sparrow	34
Hirundo rustica	Barn Swallow	22
Corvus brachyrhynchos	American Crow	21
Passerculus sandwichensis	Savannah Sparrow	19
Pica hudsonia	Black-billed Magpie	17
Melospiza melodia	Song Sparrow	15
Charadrius vociferus	Killdeer	13
Pooecetes gramineus	Vesper Sparrow	10

SPECIES INTACTNESS

FIGURE 11

INTACTNESS (WITH 90% CONFIDENCE INTERVALS) FOR THE 20 BIRD SPECIES IN THE UPPER PEACE REGION THAT SHOWED THE LARGEST DEPARTURE FROM INTACT REFERENCE CONDITIONS; WE SHOW 10 SPECIES THAT WERE LESS ABUNDANT THAN EXPECTED AND 10 SPECIES THAT WERE MORE ABUNDANT THAN EXPECTED. NOTE: BARS FOR EACH SPECIES INDICATE DIFFERENCE FROM INTACT REFERENCE CONDITIONS; SPECIES INTACTNESS IS PRESENTED BY THE NUMERICAL VALUE ADJACENT TO THE BAR.

Winter-active Mammals

The Upper Peace Region is home to nearly 50 mammal species. Historically, fur-bearing mammals played an important role in northwestern Alberta by providing subsistence for First Nations people for thousands of years. Some of these mammals were also central to the fur trade, which initially attracted European settlers to the region.

While mammal populations throughout the Upper Peace Region have long been affected by hunting and trapping, settlement and agricultural development beginning in the late 1800s resulted in the loss of wildlife habitat. In addition, more recent human activities, such as forestry and energy development, are also impacting wildlife habitat. Some mammals benefit from changes to habitat as a result of human activities; for example, Coyote and Deer (both White-tailed and Mule Deer) use habitat in agricultural landscapes as well as young, regenerating forests. Other species are more sensitive to these activities. Species like Grizzly Bear, Wolverine, and Woodland Caribou require large undisturbed areas. Other forest-dwelling mammals, like Fisher and Marten, can also be negatively influenced by human development due to associated habitat alteration and loss, or increased predation risk.

THE ABMI ASSESSED THE STATUS OF 10 WINTER-ACTIVE MAMMAL SPECIES OR GROUPS OF SPECIES IN THE UPPER PEACE REGION USING WINTER TRACKING DATA. WE FOUND THEM TO BE, ON AVERAGE, 90% INTACT (FIGURE 12).

Eight of the ten mammal species were less abundant than expected in the Upper Peace Region. Only Coyote and Mice and Voles, at 88% and 98% intact respectively, were more abundant than expected. Coyotes occurred at 92% of ABMI sites in the Upper Peace Region and readily adapts to human-modified landscapes.

At 68% intact, Marten and Fisher showed the biggest departure from intact reference conditions, as they were 32% less abundant than expected. These species are associated with mature coniferous forest.

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

THE FISHER IS A MID-SIZED CARNIVORE THAT IS ASSOCIATED WITH RIPARIAN HABITATS AND DENSE FORESTS AS WELL AS LARGE, OLD TREES WITH CAVITIES THAT PROVIDE WARM RESTING AND DENNING SITES, SECURITY FROM PREDATORS, AND FORAGING HABITAT.

Scientific Name	Common Name	Species Intactness
	Common Name	
Martes	Marten and Fisher	71
Lynx canadensis	Canada Lynx	83
Tamiasciurus hudsonicus	Red Squirrel	86
Canis lupus	Gray Wolf	90
-	Voles and Mice	93
Mustela	Weasels	96
Lepus americanus	Showshoe Hare	99
Alces alces	Moose	99
Odocoileus	Deer	96
Canis latrans	Coyote	67

SPECIES INTACTNESS
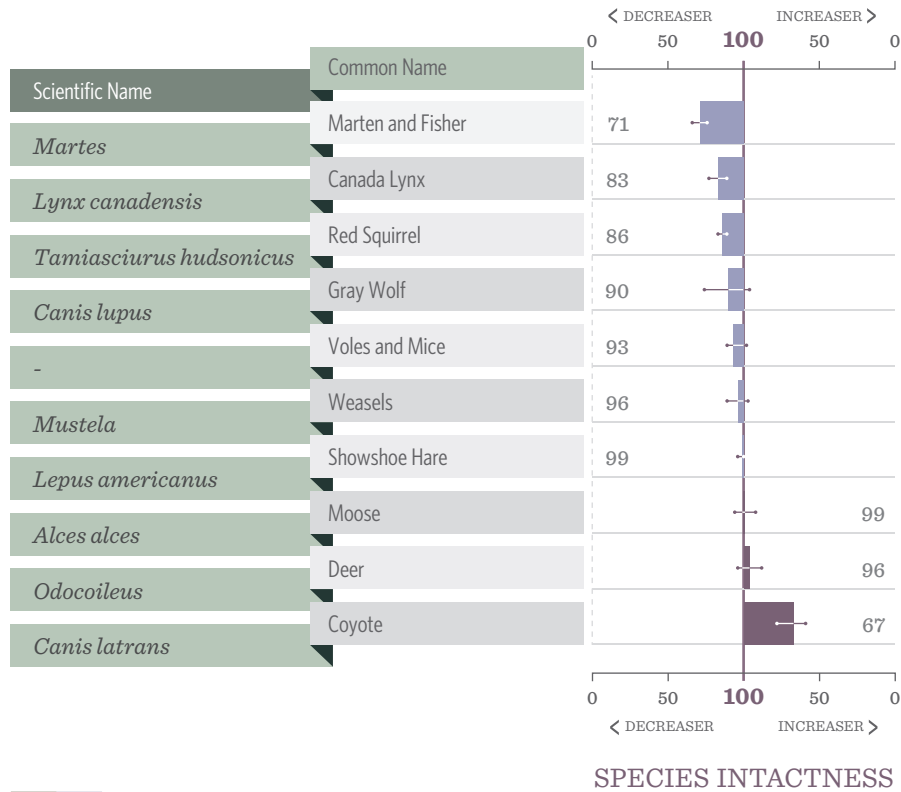
FIGURE 12

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

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 325 occur in our province, and more are being discovered each year.

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

THE ABMI ASSESSED THE STATUS OF 53 SPECIES OF ARMOURED MITES IN THE UPPER PEACE REGION AND FOUND THEM TO BE, ON AVERAGE, 83% INTACT.

Not a lot is known about armoured mites in the Upper Peace Region or how human footprint influences them. However, ABMI data is providing new information about these species, including what types of habitat different species live in, and how human footprint might influence them.

For example, the Hairy Dusky Roamer has been detected in a variety of forest types but appears to be primarily associated with old forest habitat (Figure 13). It is most abundant in old spruce forests, followed by intermediate-aged lowland conifer forests and deciduous forests.
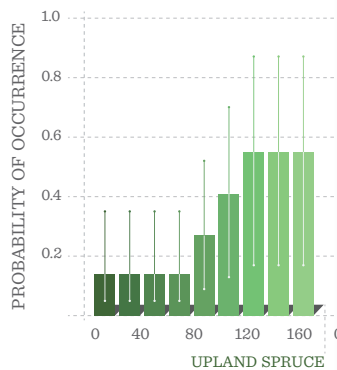
Correction

While average biodiversity for mites in the Upper Peace Region remains at 83% intact, the probability of occurrence of the Hairy Dusky Roamer (*Peloribates pilosus*; Figure 13) as a function of vegetation type is incorrect. For the correct habitat associations for this species, please visit species.abmi.ca.
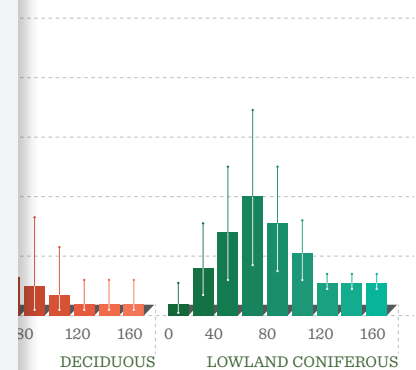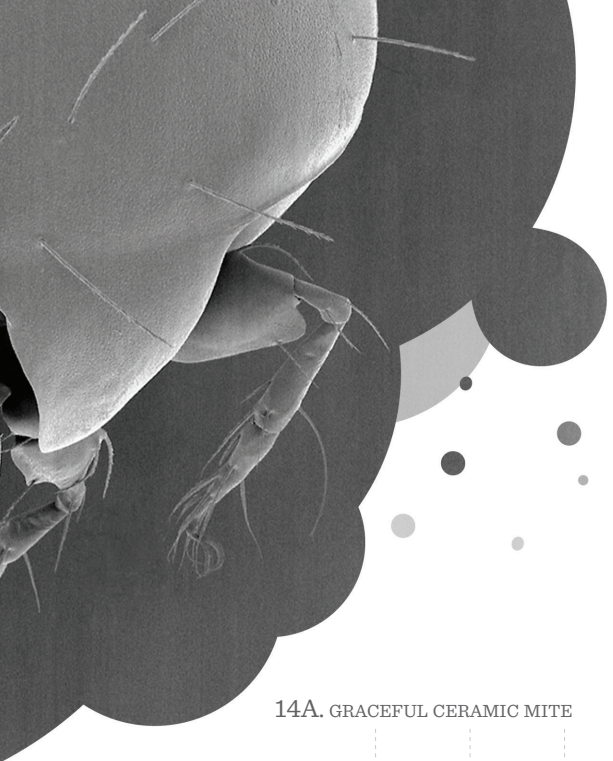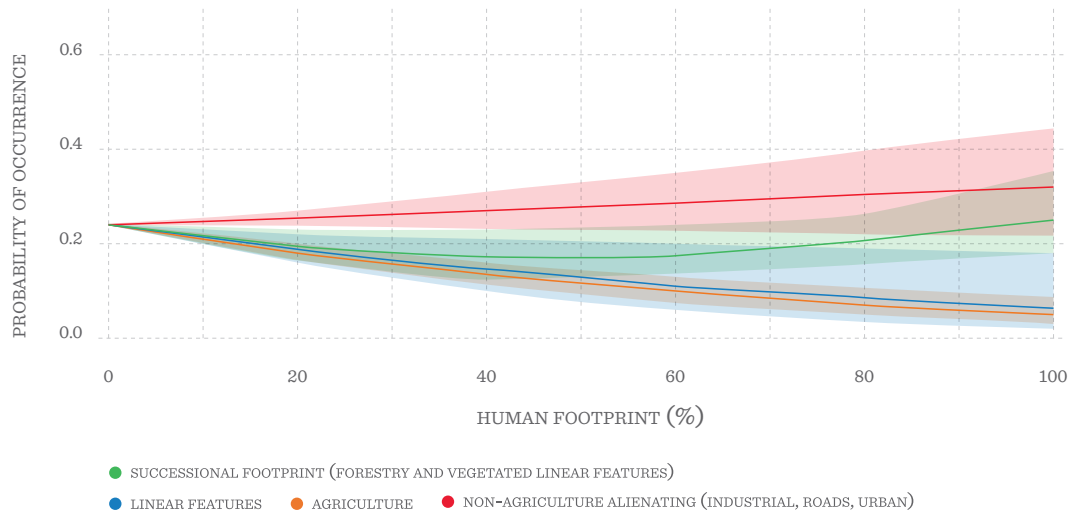
ABMI

FIGURE 13

PROBABILITY OF OCCURRENCE OF THE HAIRY DUSKY ROAMER BY FOREST TYPE AND AGE. PROBABILITY OF OCCURRENCE (IN A SOIL SAMPLE) IS STANDARDIZED TO A SCALE OF 0 TO 1 AND INCLUDES 90% CONFIDENCE INTERVALS.

Some species of mites detected in the Upper Peace Region respond to human footprint on the landscape. For example, several species, such as the Graceful Ceramic Mite decline in abundance as agriculture footprint increases (Figure 14A). A few species, such as the Six-Dimpled Northern Mite, increase in abundance with agriculture footprint (Figure 14B).

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

14A. GRACEFUL CERAMIC MITE

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

14B. SIX-DIMPLED NORTHERN MITE

SUCCESSIONAL FOOTPRINT (FORESTRY AND VEGETATED LINEAR FEATURES)
LINEAR FEATURES   AGRICULTURE   NON-AGRICULTURE ALIENATING (INDUSTRIAL, ROADS, URBAN)
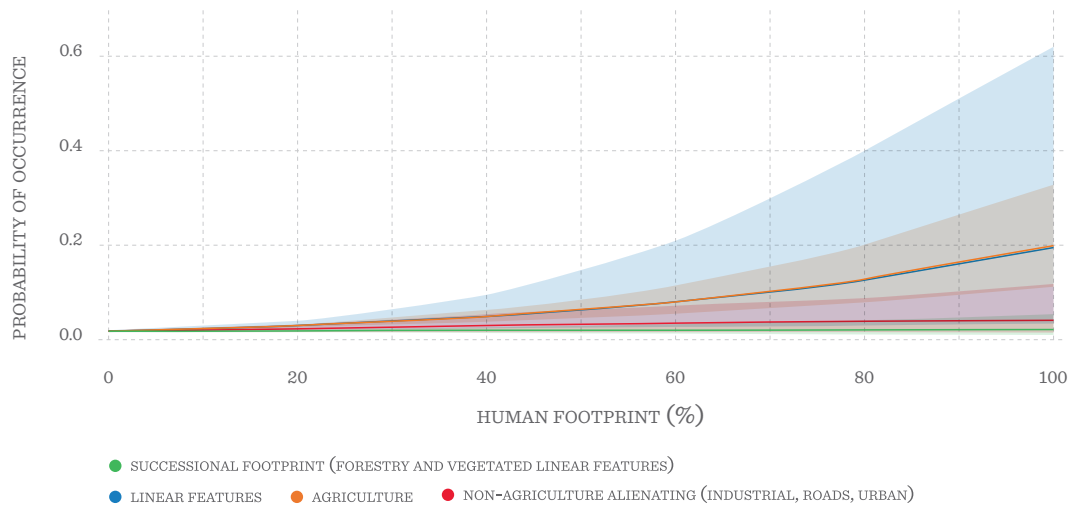
FIGURE 14

EXAMPLE OF THE RESPONSE OF A DECREASER SPECIES (GRACEFUL CERAMIC MITE) AND AN INCREASER (SIX-DIMPLED NORTHERN MITE) TO DIFFERENT TYPES OF HUMAN FOOTPRINT IN THE UPPER PEACE REGION. PROBABILITY OF OCCURRENCE (IN A SOIL SAMPLE) IS STANDARDIZED TO A SCALE OF 0 TO 1. SHADED AREAS REPRESENT 90% CONFIDENCE INTERVALS.

Vascular Plants

Vascular plants represent one of the most diverse and important components of biodiversity in the Upper Peace Region. Over 500 species of vascular plants have adapted to the diverse environmental conditions found in the boreal forest and its major ecosystem types, including deciduous forest, mixedwood forest, coniferous forest, and wetland ecosystems. Species like the Wild Red Currant or Prickly Rose thrive under the high light conditions, warmer temperatures, and nutrient-rich soils that characterize deciduous forests. Mixedwood forests have a considerable diversity of plants that are characteristic of both conifer and deciduous forest. In coniferous forests, shade-tolerant evergreen species, like the Twinflower and Greenish-flowered Wintergreen, are common. One common type of wetland in the boreal forest, known as peatlands, provides a unique set of ecological conditions (e.g, limited oxygen, low nutrient availability, acidic soil) that support a very distinct set of vascular plants.

Furthermore, the Upper Peace Region is also unique as parts of this region fall in the Peace River Parkland Natural Subregion. The Peace River Parkland Subregion is home to many northern outlier species of vascular plants, such as needle grasses and the Brittle Prickly Pear, that are primarily found in grassland ecosystems much further south in the province.

Overall, plant communities are an important part of Upper Peace Region ecosystem biodiversity, providing vital food resources and habitat for wildlife in the region, and supporting the development of forests and healthy soil. Maintaining the rich biodiversity of the region going forward requires management of these different ecosystem types and the plant communities found within them.

THE ABMI ASSESSED THE STATUS OF 173 VASCULAR PLANTS IN THE UPPER PEACE REGION AND FOUND THEM TO BE, ON AVERAGE, 79% INTACT.

The 10 vascular plant species that showed the greatest negative difference compared to intact reference conditions ranged from 23% to 66% intact (Figure 15). Several of these species are associated with prairie habitats such as June Grass, Western Wheat Grass, and Harebell. The abundance of these species declines with increasing agriculture footprint. Other species are associated with different forest types in the boreal. For example, Beaked Hazelnut can be a dominant shrub in the understory of young deciduous forests, and Western Canada Violet are common in deciduous and mixedwood forests. The abundance of these forest-associated species tends to decline with increasing forestry and agriculture footprint.

The 10 vascular plant species that were more abundant than expected ranged from 27% to 36% intact (Figure 15). Many of these species, such as Red Fescue (27% intact) and Rough Hair Grass (32% intact), are considered "pioneer" species, as they are among the first species to colonize recently disturbed areas. All of the increaser species showed a positive relationship to increasing alienating footprint (e.g, wellpads and compressor stations), and linear footprint (e.g, roads). Most of these species also increased with increasing amount of agriculture footprint. Several species peaked in abundance in landscapes with intermediate levels of forestry footprint. A visual example of an increaser species' response to human footprint can be seen in Figure 16.

HAREBELL IS A LOVELY PRAIRIE-ASSOCIATED PLANT THAT HAS INSPIRED POETRY BY THE LIKES OF WILLIAM SHAKESPEARE AND EMILY DICKINSON. THE HAREBELL IS 50% LESS ABUNDANT THAN EXPECTED.
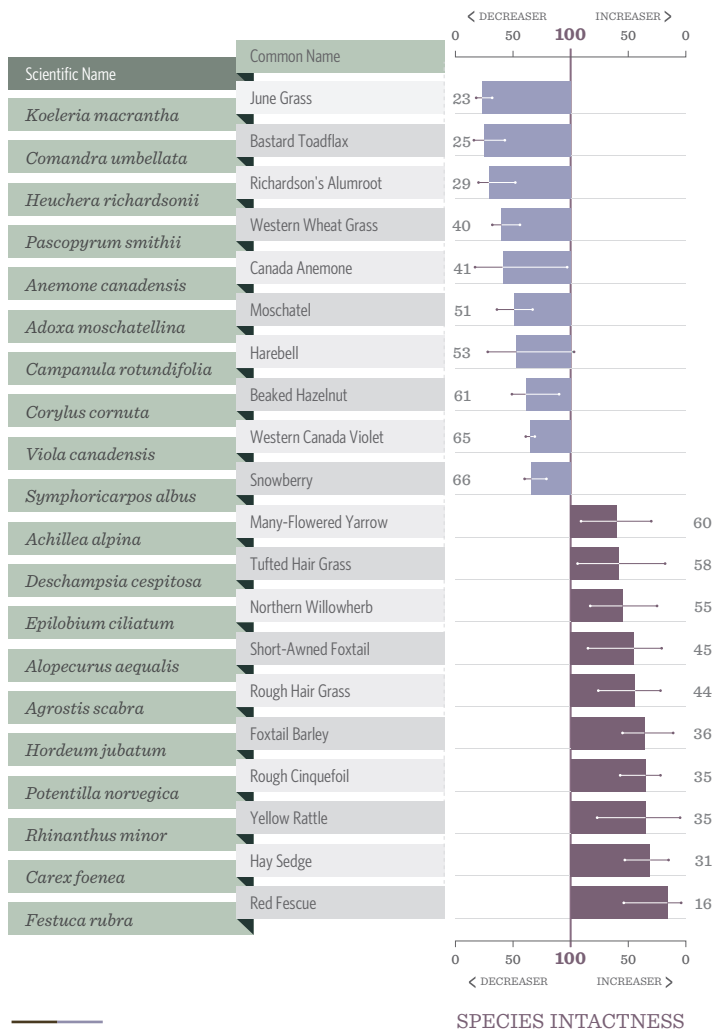
	< DECREASER	INCREASER >	
	0 50	**100** 50	0
Scientific Name	Common Name		
Koeleria macrantha	June Grass	23	
Comandra umbellata	Bastard Toadflax	25	
Heuchera richardsonii	Richardson's Alumroot	29	
Pascopyrum smithii	Western Wheat Grass	40	
Anemone canadensis	Canada Anemone	41	
Adoxa moschatellina	Moschatel	51	
Campanula rotundifolia	Harebell	53	
Corylus cornuta	Beaked Hazelnut	61	
Viola canadensis	Western Canada Violet	65	
Symphoricarpos albus	Snowberry	66	
Achillea alpina	Many-Flowered Yarrow		60
Deschampsia cespitosa	Tufted Hair Grass		58
Epilobium ciliatum	Northern Willowherb		55
Alopecurus aequalis	Short-Awned Foxtail		45
Agrostis scabra	Rough Hair Grass		44
Hordeum jubatum	Foxtail Barley		36
Potentilla norvegica	Rough Cinquefoil		35
Rhinanthus minor	Yellow Rattle		35
Carex foenea	Hay Sedge		31
Festuca rubra	Red Fescue		16

0 50 **100** 50 0
< DECREASER INCREASER >

SPECIES INTACTNESS

FIGURE 15

INTACTNESS (WITH 90% CONFIDENCE INTERVALS) FOR 20 VASCULAR PLANTS IN THE UPPER PEACE REGION THAT SHOWED THE LARGEST DEPARTURES FROM INTACT REFERENCE CONDITIONS. WE SHOW 10 SPECIES THAT WERE LESS ABUNDANT THAN EXPECTED AND 10 SPECIES THAT WERE MORE ABUNDANT THAN EXPECTED. NOTE: BARS FOR EACH SPECIES INDICATE DIFFERENCE FROM INTACT REFERENCE CONDITIONS; SPECIES INTACTNESS IS PRESENTED BY THE NUMERICAL VALUE ADJACENT TO THE BAR.
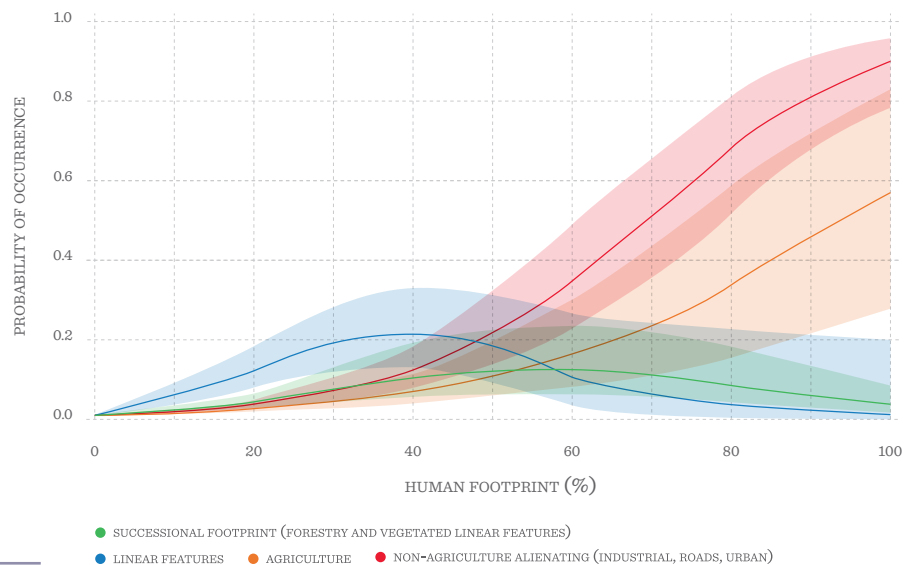

● SUCCESSIONAL FOOTPRINT (FORESTRY AND VEGETATED LINEAR FEATURES)
● LINEAR FEATURES   ● AGRICULTURE   ● NON-AGRICULTURE ALIENATING (INDUSTRIAL, ROADS, URBAN)

FIGURE 16

EXAMPLE OF THE RESPONSE OF AN INCREASER SPECIES, IN THIS CASE FOXTAIL BARLEY, TO DIFFERENT TYPES OF HUMAN FOOTPRINT IN THE UPPER PEACE REGION. PROBABILITY OF OCCURRENCE (IN A 50 × 50 M QUADRAT) IS STANDARDIZED TO A SCALE OF 0 TO 1. SHADED AREAS REPRESENT 90% CONFIDENCE INTERVALS.

Non-native Species

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 the boreal forest, for example, some non-native plant species, like Creeping Thistle and Narrow-leaved Hawksbeard, can interfere with tree regeneration after fire or forest harvesting.[7]

Early action is the most effective way of managing non-native species before serious impacts occur. Monitoring data are a means to assess the current level of invasion and detect trends in invasion level through time, serving as an early warning signal of potential risk to native biodiversity.

The ABMI found 50 non-native plants in the Upper Peace Region (see supplementary material available at www.abmi.ca for a complete list). Combined, non-native plants were detected at 58% of ABMI sites in the Upper Peace Region. Most of the non-native species detected occurred very infrequently; 37 of the 50 species occurred at less than 5% of ABMI sites. At sites where they were found, an average of 5.2 non-native species were detected. For each quarter section in the Upper Peace Region, the predicted number of non-native species per 1 ha plot ranged from an average of < 1 up to 27 species (Figure 17).

Common Dandelion was the most abundant non-native plant and was found at 46% of ABMI sites in the Upper Peace Region (Table 02). Three species that are commonly planted as greenfeed (crops used directly as fresh forage for livestock) were detected at more than 25% of ABMI sites in the region, including Timothy, Kentucky Bluegrass, and Alsike Clover. Three of the non-native species detected are listed as noxious weeds under the Alberta Weed Control Act: Creeping Thistle, Perennial Sow-thistle, and Tall Buttercup.

Also present were two non-native birds, European Starling and House Sparrow, both of which were detected at 1% of ABMI sites in the Upper Peace Region.

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

FORAGE CROPS, SUCH AS ALSIKE CLOVER, REQUIRE POLLINATION BY HONEYBEES AND THE NECTAR OF THESE PLANTS HELP TO SUPPORT THE THOUSANDS OF BEEHIVES IN THE AREA. THE HIGH QUALITY HONEY THAT IS PRODUCED IS SHIPPED ALL OVER THE WORLD.
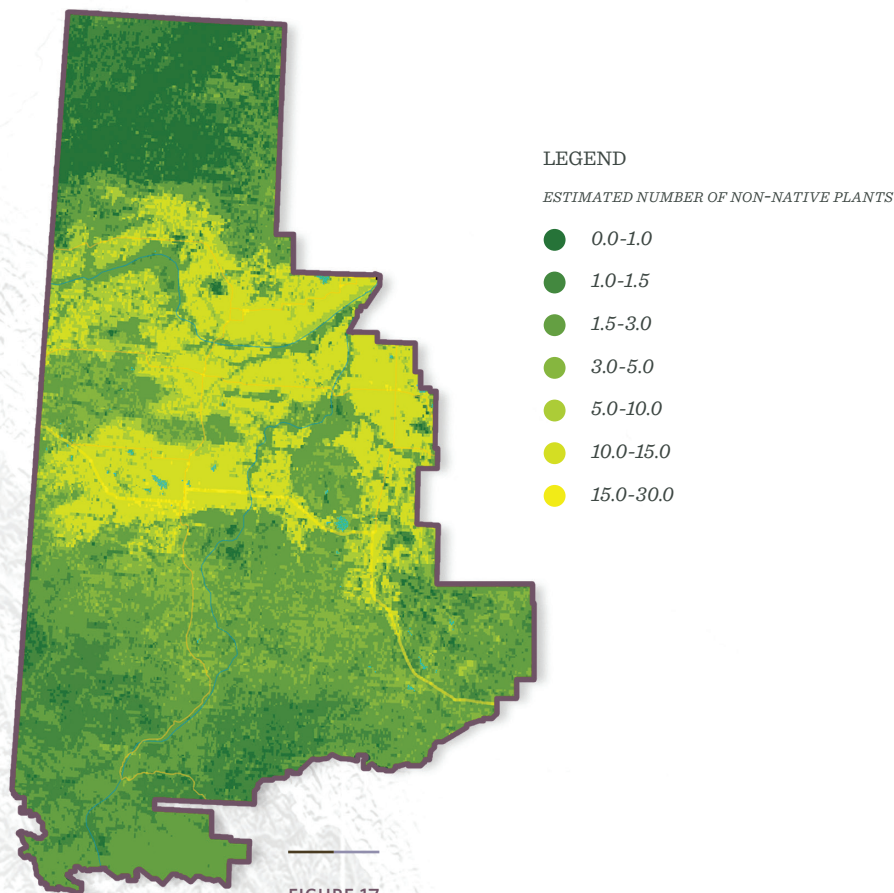
TABLE 02

PERCENTAGE OCCURRENCE OF THE 10 MOST COMMONLY DETECTED
NON-NATIVE VASCULAR PLANTS IN THE UPPER PEACE REGION.

Common Name	Scientific Name	Percentage of ABMI sites where detected
Common Dandelion	*Taraxacum officinale*	46 %
Timothy	*Phleum pratense*	27 %
Kentucky Bluegrass	*Poa pratensis*	26 %
Alsike Clover	*Trifolium hybridum*	26 %
Common Plantain	*Plantago major*	17 %
Red Clover	*Trifolium pratense*	15 %
Creeping Thistle*	*Cirsium arvense*	12 %
Awnless Brome	*Bromus inermis*	11 %
White Sweet-clover	*Melilotus officinalis*	11 %
White Clover	*Trifolium repens*	11 %

*THE ABMI DETECTED 50 NON-NATIVE VASCULAR PLANTS IN THE UPPER PEACE REGION. THREE OF THESE SPECIES
ARE LISTED AS NOXIOUS WEEDS UNDER THE ALBERTA WEED CONTROL ACT (2010); THEY ARE CREEPING THISTLE AND
TWO SPECIES NOT LISTED IN TABLE 02, PERENNIAL SOW-THISTLE, AND TALL BUTTERCUP.

LEGEND

ESTIMATED NUMBER OF NON-NATIVE PLANTS

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

FIGURE 17

ESTIMATED NUMBER OF NON-NATIVE PLANT SPECIES PER 1 HA PLOT IN EACH QUARTER SECTION OF THE
UPPER PEACE REGION. DARK GREEN INDICATES AREAS ESTIMATED TO HAVE VERY LOW NUMBERS OF
NON-NATIVE PLANT SPECIES, WHILE YELLOW INDICATES HIGH NUMBERS OF NON-NATIVE SPECIES.

Mosses

Mosses often carpet the forest floor in boreal ecosystems. Mosses provide a number of important functions in these northern ecosystems.[8] For instance, a blanket of moss provides a layer of insulation, keeping the soil moist and cool during the summer, and "warm" during the winter, protecting overwintering micro-organisms. Mosses intercept the majority of incoming nutrients, such as nitrogen, and make these nutrients available to other plants. These moss beds can also limit the establishment of understory plants as well as tree seedlings, thereby directly affecting the boreal plant community. In the case of non-native plants, the moss layer may actually function as a buffer, limiting their establishment.[7] Mosses are also home to a diverse community of micro-organisms, such as fungi, bacteria, and mites, that play critical roles in decomposing plant material and maintaining healthy soil.

But mosses aren't restricted to forest ecosystems. Peaty wetlands are common across the boreal landscape, and the creation of these wetlands is strongly influenced by a particular group of mosses known as sphagnum mosses. In a process known as paludification, boreal forests growing on mineral soil are slowly converted to treed peatlands as dead vegetative material (peat) accumulates on the forest floor and the water table rises. Sphagnum mosses become established on this peat substrate, and these mosses slowly accumulate and expand in areas over thousands of years. The unique ecological conditions of peatlands, such as limited oxygen, low nutrient availability, and acidic soil provide habitat for a distinctive set of flora that are rarely found elsewhere in the boreal forest.

Mosses are ubiquitous throughout the boreal forest, influencing water, nutrient, and carbons cycles; providing microhabitat for microscopic organisms; and affecting the natural development of forests.
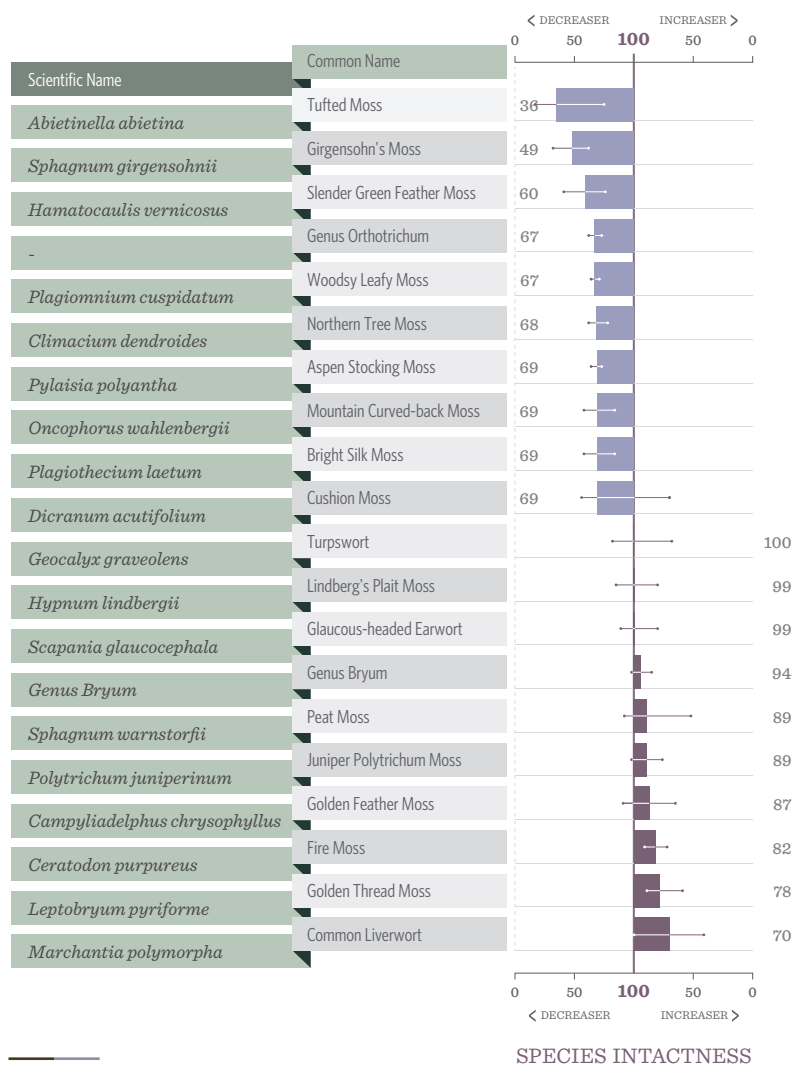
THE ABMI ASSESSED THE STATUS OF 80 MOSSES IN THE UPPER PEACE REGION AND FOUND THEM TO BE, ON AVERAGE, 81% INTACT (FIGURE 18).

ASPEN STOCKING MOSS COMMONLY GROWS ON THE BARK OF ASPEN TREES. THIS MOSS IS MORE LIKELY TO BE PRESENT ON LARGE ASPEN TREES IN OLDER FORESTS.[9] AT 69% INTACT, THE ASPEN STOCKING MOSS WAS LESS ABUNDANT THAN EXPECTED.

Of the 80 mosses assessed by the ABMI, 70 of these species or species groups were less abundant than expected. The 10 mosses and liverworts that showed the biggest departure from intact reference conditions ranged from 36% to 70% intact (Figure 18). Tufted Moss, at 36% intact, was the most sensitive to human footprint. Tufted Moss is associated with native grassland and declines as agriculture footprint and alienating footprint increases. The remaining species, such as Woodsy Leafy Moss and Aspen Stocking Moss, are forest-associated species; these species tend to have a negative relationship with agriculture, linear, and alienating footprint, and sometimes forestry footprint. A visual example of a decreaser species response to human footprint can be seen in Figure 19.

Only 10 moss and liverwort species were as abundant or more abundant than expected if there was no human footprint; intactness for these species ranged from 70% to 100%. Several of these species, such as the Common Liverwort (70% intact), Golden Thread Moss (78% intact), and Fire Moss (82% intact), do well in disturbed areas, such as recent burns, pastures, roadsides, and ditches. Many of these species are positively associated with forestry, linear, and alienating footprint.

Scientific Name	Common Name	Species Intactness
Abietinella abietina	Tufted Moss	36
Sphagnum girgensohnii	Girgensohn's Moss	49
Hamatocaulis vernicosus	Slender Green Feather Moss	60
-	Genus Orthotrichum	67
Plagiomnium cuspidatum	Woodsy Leafy Moss	67
Climacium dendroides	Northern Tree Moss	68
Pylaisia polyantha	Aspen Stocking Moss	69
Oncophorus wahlenbergii	Mountain Curved-back Moss	69
Plagiothecium laetum	Bright Silk Moss	69
Dicranum acutifolium	Cushion Moss	69
Geocalyx graveolens	Turpswort	100
Hypnum lindbergii	Lindberg's Plait Moss	99
Scapania glaucocephala	Glaucous-headed Earwort	99
Genus Bryum	Genus Bryum	94
Sphagnum warnstorfii	Peat Moss	89
Polytrichum juniperinum	Juniper Polytrichum Moss	89
Campyliadelphus chrysophyllus	Golden Feather Moss	87
Ceratodon purpureus	Fire Moss	82
Leptobryum pyriforme	Golden Thread Moss	78
Marchantia polymorpha	Common Liverwort	70

SPECIES INTACTNESS

FIGURE 18

INTACTNESS (WITH 90% CONFIDENCE INTERVALS) FOR 20 MOSSES AND LIVERWORTS IN THE UPPER PEACE REGION THAT SHOWED THE LARGEST DEPARTURES FROM INTACT REFERENCE CONDITIONS; WE SHOW 10 SPECIES THAT WERE LESS ABUNDANT THAN EXPECTED AND 10 SPECIES THAT WERE MORE ABUNDANT THAN EXPECTED.

NOTE: BARS FOR EACH SPECIES INDICATE DIFFERENCE FROM INTACT REFERENCE CONDITIONS; SPECIES INTACTNESS IS PRESENTED BY THE NUMERICAL VALUE ADJACENT TO THE BAR.
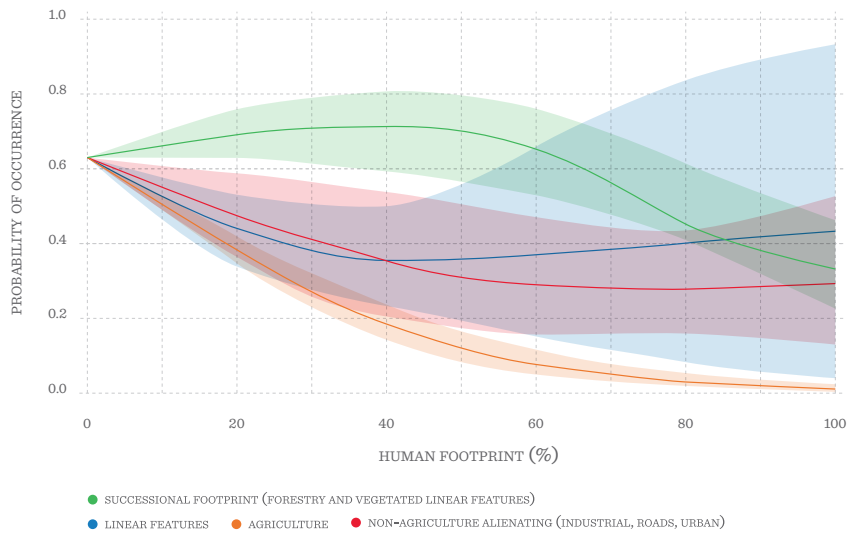
FIGURE 19

EXAMPLE OF THE RESPONSE OF A DECREASER SPECIES, IN THIS CASE ASPEN STOCKING MOSS, TO DIFFERENT TYPES OF HUMAN FOOTPRINT IN THE UPPER PEACE REGION. PROBABILITY OF OCCURRENCE (IN A 50 × 50 M QUADRAT) IS STANDARDIZED TO A SCALE OF 0 TO 1. SHADED AREAS REPRESENT 90% CONFIDENCE INTERVALS.

Species at Risk

Evaluating 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.

There are at least 83 species at risk in the Upper Peace Region; the ABMI detected 79 of these species (see the Supplemental Report available at www.abmi.ca for a complete list). Twenty-five of these species occurred with enough frequency to allow us to calculate species intactness, including five species listed as threatened or of special concern by the Government of Canada and/or by the Government of Alberta (Table 03). No species occurring in the Upper Peace Region are listed as endangered.

Of the species assessed by the ABMI, the majority of species were less abundant than expected if there was no human footprint (Table 03). Included in this assessment are several species of vascular plants and mosses with an "undetermined" status, as identified by Alberta's Ministry of Environment and Sustainable Resource Development (ESRD). The ABMI can help identify species that are more common in Alberta's landscape than previously believed, such as Drummond's Leafy Moss and Canada Goldenrod, which were detected at 26% and 19% of ABMI sites in the Upper Peace Region, respectively. This information can inform provincial status updates for these species.

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

OLIVE-SIDED FLYCATCHER IS A PROVINCIALLY AND FEDERALLY LISTED NEOTROPICAL MIGRANT. THIS SPECIES' PREFERRED BREEDING HABITAT IS CONIFEROUS FOREST EDGES CLOSE TO OPENINGS SUCH AS RIVERS, WETLANDS, YOUNG BURNS, AND YOUNG POST-HARVEST STANDS. AT 98% INTACT, THE OLIVE-SIDED FLYCATCHER WAS LESS ABUNDANT THAN EXPECTED IN THE UPPER PEACE REGION.

TABLE 03

SUMMARY OF INTACTNESS RESULTS FOR SPECIES AT RISK[†] IN THE UPPER PEACE REGION.

	Common Name	Species Scientific Name	Occurence (%)	Intactness Index (0–100 scale)	Above or Below Reference Conditions	Threat
BIRDS	Barn Swallow	*Hirundo rustica*	6%	22%	ABOVE	ESRD - Sensitive | AB ESCC 2010 Sensitive COSEWIC - Threatened | SARA - Eligible for listing
	Bay-breasted Warbler	*Dendroica casanea*	6%	97%	BELOW	ESRD - Sensitive | AB ESCC 2010 - In Process
	Black-throated Green Warbler	*Dendroica virens*	27%	57%	BELOW	ESRD - Sensitive | AB ESCC 2010 - Species of Special Concern
	Brown Creeper	*Certhia americana*	11%	74%	BELOW	ESRD - Sensitive
	Canada Warbler	*Wilsonia canadensis*	14%	75%	BELOW	ESRD - Sensitive | COSEWIC - Threatened SARA - Threatened
	Cape May Warbler	*Dendroica tigrina*	23%	96%	ABOVE	ESRD - Sensitive
	Common Yellowthroat	*Geothlypis trichas*	23%	96%	ABOVE	ESRD - Sensitive
	Least Flycatcher	*Empidonax minimus*	51%	84%	BELOW	ESRD - Sensitive
	Olive-sided Flycatcher	*Contopus cooperi*	12%	98%	BELOW	ESRD - May Be at Risk | COSEWIC - Threatened SARA - Threatened
	Pileated Woodpecker	*Dryocopus pileatus*	11%	89%	BELOW	ESRD - Sensitive
	Rusty Blackbird	*Euphagus carolinus*	9%	67%	ABOVE	ESRD - Sensitive | COSEWIC - Special Concern SARA - Special Concern
	Sora	*Porzana carolina*	13%	62%	ABOVE	ESRD - Sensitive
	Western Tanager	*Piranga ludoviciana*	36%	67%	BELOW	ESRD - Sensitive
	Western Wood Pewee	*Contopus sordidulus*	17%	65%	ABOVE	ESRD - Sensitive
	Yellow-bellied Flycatcher	*Empidonax flaviventris*	5%	92%	BELOW	ESRD - Undetermined
MAMMALS	Canada Lynx	*Lynx canadensis*	77%	92%	BELOW	AB ESCC - Sensitive | COSEWIC - Not at Risk
	Marten & Fisher	*Martes*	85%	74%	BELOW	AB ESCC - Sensitive (Fisher)
VASCULAR PLANTS	Silvery Sedge	*Carex canescens*	3%	99%	ABOVE	Undetermined
	Northern Wood Fern	*Dryopteris expansa*	5%	77%	BELOW	Sensitive
	Veiny Vetchling	*Lathyrus venosus*	10%	93%	BELOW	Sensitive
	Canada Goldenrod	*Solidago canadensis*	19%	80%	ABOVE	Undetermined
MOSSES & LIVERWORTS	Sharp-leaved Broom Moss	*Dicranum acutifolium*	8%	69%	BELOW	Undetermined
	Drummond's Leafy Moss	*Plagiomnium drummondii*	26%	74%	BELOW	Undetermined
	Flat-brocade Moss	*Platygyrium repens*	6%	82%	BELOW	Sensitive

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

Woodland Caribou

The Woodland Caribou has the highest public profile of any species at risk that occurs in the Upper Peace Region. While the ABMI does not detect this species often enough to assess its status, comprehensive monitoring by the Alberta Caribou Committee, and now the Ministry of ESRD, has been in place for many populations since 1993. The Government of Alberta has published the results of this monitoring activity as recently as 2010.[10]

In Alberta, there are a total of 16 caribou populations that have recently been grouped into two recognized conservation units (termed "Designatable Units" by COSEWIC 2011) [11]: Central Mountain and Boreal. Five populations of caribou occur in and around the Upper Peace Region (Figure 20). The Chinchaga population is part of the Boreal Designatable Unit. The A La Peche, Little Smoky, Narraway, and Redrock-Prairie Creek populations are part of the Central Mountain Designatable Unit.

Although the exact number of caribou in some of these populations remains uncertain, the best available scientific evidence indicates that 4 of the 5 populations have been declining over the past 20 years (Figure 20, Table 04). The largest estimated annual rates of change are for the Narraway population (-13%) and the Chinchaga population (-11%).

Recent genetic science suggests that the Chinchaga population is connected to other populations in British Columbia, but separate from herds that live to the east and south of the Peace River.[12] Therefore, animals from Chinchaga cannot be expected to supplement smaller populations elsewhere in Alberta, including those from the West Central range. Caribou herds from the West Central range are also separate from all other population ranges in Alberta, although they are connected to populations in southern British Columbia. The only exception is the Little Smokey herd (Figure 20), which is genetically separate from all other herds, likely because of its small population size and geographic isolation.

The ABMI supports caribou management by working with the provincial government, the forest industry, and the energy industry to coordinate research and monitoring activities. Specifically, our Caribou Monitoring Unit is engaged in a collaborative process designed to update caribou population estimates in the Athabasca Oil Sands Area, and to produce a seamless, province-wide habitat quality map. The ABMI Caribou Monitoring Unit is also engaged in management trials aimed at reducing the use of linear features by wolves, a primary predator of Woodland Caribou. These trials will help inform managers about ways to accelerate habitat restoration for Woodland Caribou.

Human Footprint in Woodland Caribou Population Ranges

Tracking the amount of human footprint and habitat is important for the effective management of Woodland Caribou in the Upper Peace Region. Managing the rate of human land-use development and recovery is an important component of caribou recovery. The ABMI's GIS Inventory of Provincial Human Footprint provides scientific information on status and trend of human footprint for the five population ranges that overlap with the Upper Peace Region.

In 2010, the total amount of human footprint in each population range was 4.0% for the A La Peche range and up to 15.3% for the Narraway range (Table 04). The greatest rate of change in human footprint was in the Narraway population range which increased from 11.8% in 2007 to 15.3% in 2010.
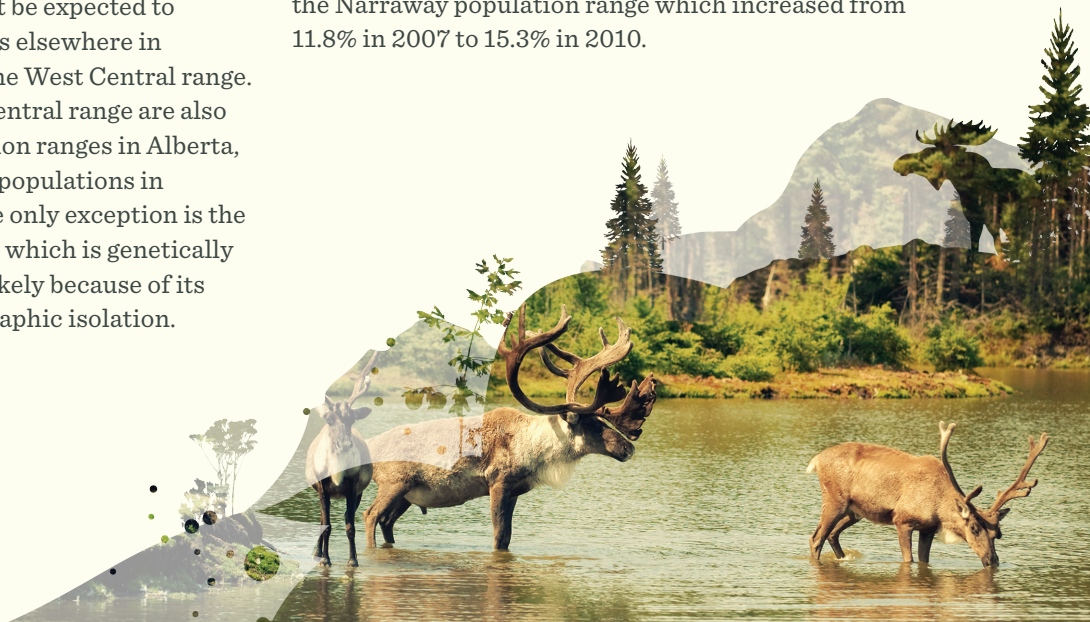
CHANGES IN HUMAN FOOTPRINT (CIRCA 2007 AND 2010), AND ANNUAL RATE OF POPULATION
CHANGE FOR FIVE CARIBOU POPULATIONS THAT OVERLAP WITH THE UPPER PEACE REGION.

|	Range/Population	Total Area of Range (km²)	2007 Total Human Footprint	2010 Total Human Footprint	Net Change in Human Footprint (2007 to 2010)	Rate of Change in Human Footprint (2007 to 2010)	Annual Rate of Population Change
Boreal Ecotype	Chinchaga	17,644	5.3 %	5.8 %	0.5 %	9.7 %	-11 %
	Little Smoky	3,084	13.1 %	14.0 %	0.9 %	6.7 %	-9 %
	Narraway	1,041	11.8 %	15.3 %	3.5 %	29.9 %	-13 %
Mountain Ecotype	Redrock-Prairie	4,829	6.7 %	-	0.2 %	3.3 %	-15 %
	A La Peche	6,615	3.7 %	4.0 %	0.3 %	7.8 %	1 %
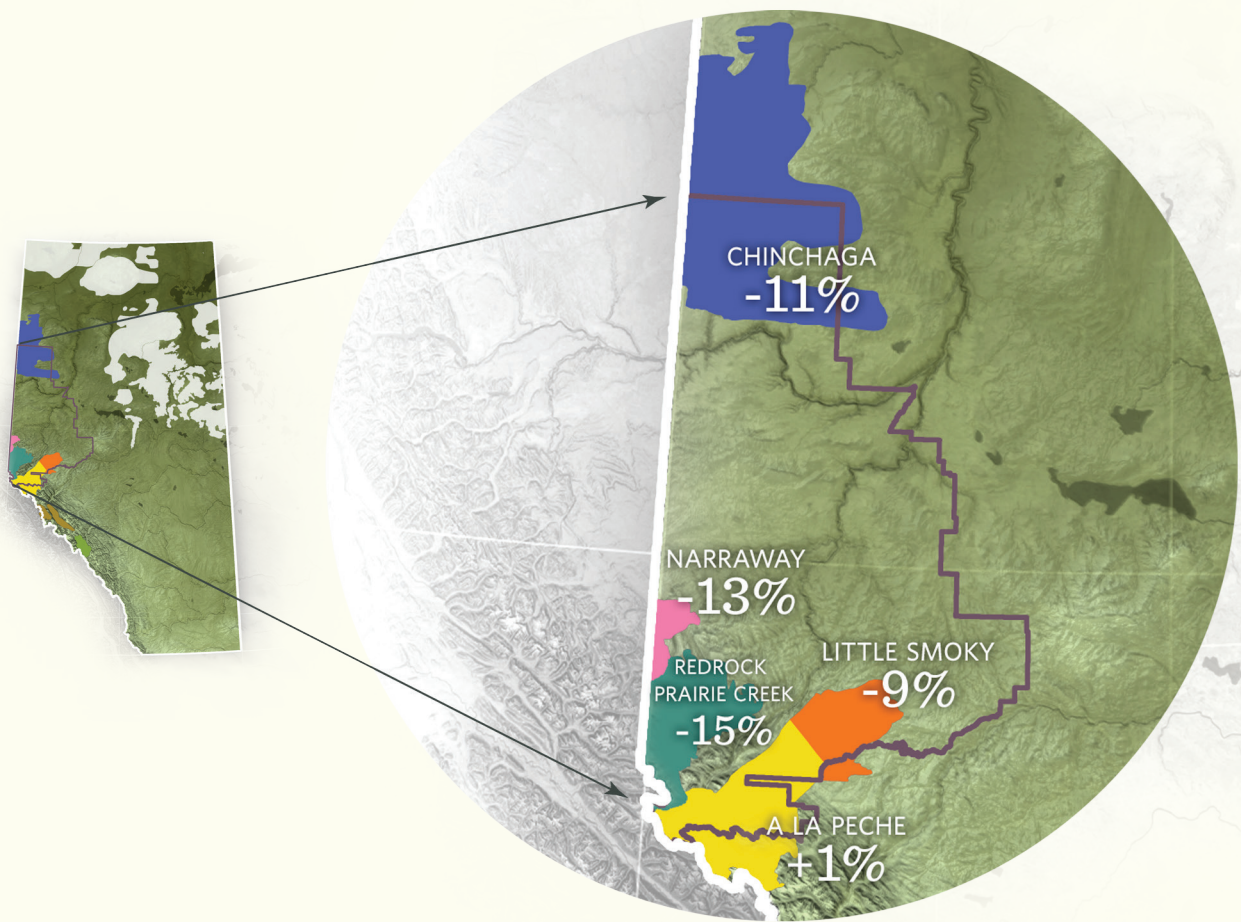
FIGURE 20

FIVE BOREAL CARIBOU POPULATIONS OVERLAP WITH THE UPPER PEACE REGION.

AVERAGE ESTIMATED ANNUAL RATE OF CHANGE IS PRESENTED FOR EACH POPULATION.

White Area in the Upper Peace Region

The White Area (or agricultural land) in the Upper Peace Region is some of Canada's northern-most agricultural land (Figure 21). The White Area coincides with the Peace River Parkland Natural Subregion, which supports species typically found in the grasslands and parklands of southern and central Alberta. Very little of the original ecosystem remains, however, as much of the land was historically converted to agriculture.[13]

Despite the large areas of land given over to farming, agricultural landscapes can support a range of biodiversity, provided there is sufficient natural and semi-natural land in the surrounding area. Wetlands, riparian areas, and forests adjacent to agricultural land can provide necessary breeding and foraging habitat to support many types of biodiversity. The decline of these natural habitats and the intensification of agricultural practices in the White Area may reduce the availability and quality of habitat for species like grassland birds.[13]

The ABMI monitors the status of human footprint and species in the White Area of the Upper Peace Region. This information is important to support the long-term stewardship of this economically and socially important region.

Human Footprint

As of 2010, the total human footprint in the White Area of the Upper Peace Region was 63.4% (Figure 21). Agriculture footprint was, by far, the dominant human footprint, accounting for 56.4% of human footprint, with transportation footprint at 2.3% a distant second. Forestry footprint (1.7%), energy footprint (1.5%), and residential footprint (1.4%) were similar in area.

Biodiversity Intactness

THE ABMI ASSESSED THE STATUS OF 396 COMMON NATIVE SPECIES IN FIVE TAXONOMIC GROUPS IN THE WHITE AREA OF THE PEACE RIVER PLANNING REGION; THESE GROUPS RANGED FROM 38% TO 71% INTACT (TABLE 05).

The average intactness for the White Area, at 50%, was 31% lower than for the Upper Peace Region as a whole.

TABLE 05

INTACTNESS* FOR DIFFERENT COMPONENTS OF BIODIVERSITY IN THE WHITE AREA OF THE UPPER PEACE REGION.

Biodiversity Component	White Area		Upper Peace Region (White Area included in analysis)	
	No. of Species	Intactness	No. of Species	Intactness
Native Birds	80	53 %	80	74 %
Winter-active Mammals	10	71 %	10	90 %
Armoured Mites	53	42 %	53	83 %
Native Plants	173	45 %	173	79 %
Moss	80	38 %	80	81 %
Overall Intactness	396	**50%**	396	**81%**

*OVERALL INTACTNESS IS CALCULATED AS THE AVERAGE OF THE FIVE TAXONOMIC GROUPS AS OPPOSED TO THE AVERAGE OF INDIVIDUAL SPECIES INTACTNESS VALUES.

PEACE RIVER

GRANDE PRAIRIE

N

0   12.5   25   50   75
                                            Kilometers
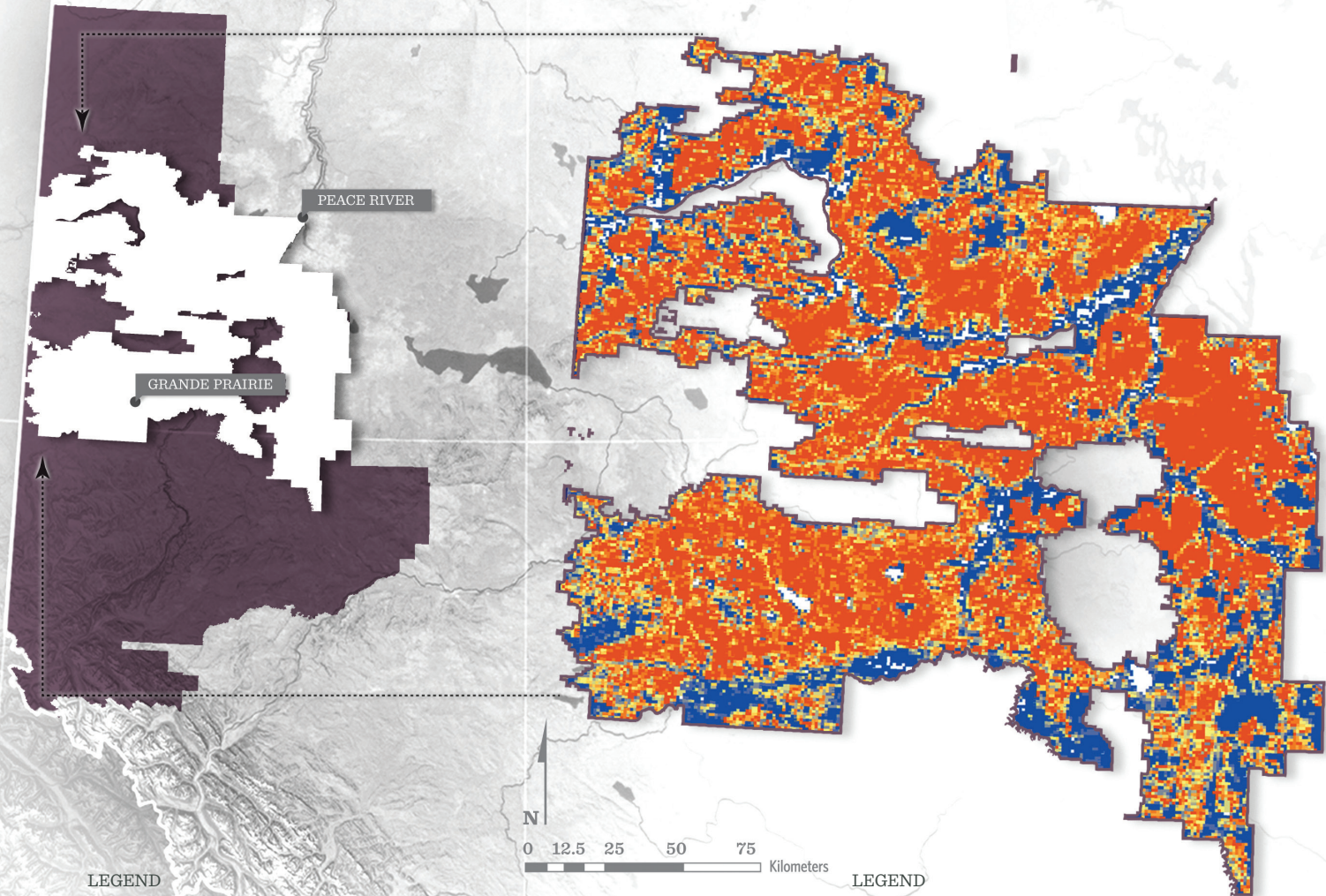
LEGEND

⬤ *UPPER PEACE REGION*

◯ *WHITE AREA*

LEGEND

HUMAN FOOTPRINT PERCENTAGE

⬤ *91–100*

⬤ *81–90*

⬤ *71–80*

⬤ *61–70*

⬤ *51–60*

⬤ *41–50*

⬤ *31–40*

⬤ *21–30*

⬤ *11–20*

⬤ *1–10*

◯ *0*

FIGURE 21

THE WHITE AREA MAKES UP 34% OF THE UPPER PEACE REGION. TOTAL
HUMAN FOOTPRINT IN THE WHITE AREA OF THE UPPER PEACE REGION
WAS 63.4% AS OF 2010.

Conclusion

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

- *As of 2012, the total human footprint across the Upper Peace Region was 32.1%. Agriculture footprint was the largest human footprint category, covering 20.3% of the planning region in 2012, followed by forestry footprint, at 7.9%, and energy footprint at 2.1%. Human footprint trend information indicates forestry footprint has increased the most since 1999.*

- *Overall, 69% of the Upper Peace Region is composed of native habitat with a 0 m buffer from human footprint, while 6% of native habitat is at least 2 km away from development remains.*

- *Biodiversity intactness for the Upper Peace Region as of 2012 is 81%. The biggest ecological changes are associated with higher than expected abundance of species that thrive in open or disturbed habitat, such as the Coyote, Vesper Sparrow, and Red Fescue. Species that prefer old forest habitat were found to be less abundant than expected.*

- *The total human footprint in the White Area was 63.4%, which was dominated by agriculture footprint. Biodiversity intactness for the White Area is 50%, 31% lower than for the Upper Peace Region as a whole.*

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

1. *What are the impacts of different types of resource development (e.g., agriculture, forestry, energy) on biodiversity?*

2. *What components of biodiversity are the most sensitive to resource development, and what might be done to minimize impacts?*

3. *What are the cumulative effects of resource development on biodiversity?*

4. *How effective are efforts to manage regional cumulative effects?*

5. *How effective is the protected areas network at maintaining regional biodiversity?*

6. *What level of biodiversity change is desirable to residents of the Upper Peace Region?*

With the Upper Peace Region 81% intact today, there are opportunities for land and resource managers to make informed and deliberate choices about its future. As development continues to unfold in the region, the ABMI will continue to measure and report on the changing state of human footprint and biodiversity.

Next Steps

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

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

General Terms

Limitations

The ABMI is designed primarily as a proactive tool used to identify the status, trends, and correlative relationships among common species, habitats, and human footprint. The status and trends in rare and endangered species and habitats are not yet directly evaluated by the ABMI monitoring program for all species.

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. ABMI reference conditions have statistical uncertainty for individual species. This uncertainty will decrease as the ABMI surveys more sites in the Upper Peace Region.

Looking Forward

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

- *Ensuring the effective delivery of relevant, timely, and scientific biodiversity information.*

- *Improving biodiversity management by contributing knowledge to decision-making systems.*

- *Supporting governments and industries in meeting their domestic and international reporting obligations.*

- *Eliminating duplication and redundancy in provincial biodiversity monitoring.*

- *Facilitating the transfer of information to government, industry, the research community, and the public.*

Scientific Integrity

The ABMI is committed to the responsible analysis and interpretation of data. The ABMI holds itself to the highest ethical standards, including operational transparency, honesty, conscientiousness, and integrity. The ABMI strongly encourages the responsible and ethical evaluation and interpretation of the knowledge contained in this report. For a complete discussion of the ethical behaviour endorsed by the ABMI, please see Honor in Science, published by Sigma Xi (1997), available at: www.sigmaxi.org/programs/ethics/Honor-in-Science.pdf. 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 "Reports/Core Reports."

Disclosure

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

Alberta Biodiversity Monitoring Institute. 2011. Manual for Estimating Species and Habitat Structure Intactness (20029), Version 2011—07—07. Alberta Biodiversity Monitoring Institute, Alberta, Canada. Available at: www.abmi.ca under "Reports/Intactness Analyses."

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 "Reports/Standards and Protocols/Landscape Mapping Protocols."

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

Terms and Conditions of Report

Preparation

The ABMI is responsible for initiating and resourcing the creation of this report. The following terms were applied in 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 Upper Peace Region and cannot be localized to smaller landscapes within the region, unless already specified in this report.

4. This biodiversity status report uses data collected between 2003 and 2012.

5. The report was released publicly in a timely manner.

Image Credits

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References

1. Government of Alberta. 2010. Describing the Integrated Land Management Approach. Available at: www.srd.alberta.ca/LandsForests/IntegratedLandManagement/default.aspx.

2. Government of Alberta. 2012. Lower Athabasca Regional Plan. Available at: www.landuse.alberta.ca.

3. Stanton, T. et al. 2010. State of Watershed Payments: An Emerging Marketplace. Available at: www.forest-trends.org/documents/files/doc_2438.pdf.

4. Balunas, M. J. and A.D. Kinghorn. 2005. Life Sciences 78(5): 431–441.

5. Brook. B.W. et al. 2008. Trends in Ecology and Evolution 23(8): 453–460.

6. Andrew, M.E. et al. 2012. Biological Conservation 146(1): 97–107.

7. Sanderson, L.A. et al. 2012. Forestry 85: 329–339.

8. Turestsky, M.R. et al. 2012. New Phytologist 196: 49–67.

9. Hazell, P. et al. 1998. Forest Ecology and Management. 107(1–3): 147–158.

10. Status of the Woodland Caribou *(Rangifer tarandus caribou)* in Alberta: Update 2010. Available at: www.srd.alberta.ca/Fishwildlife/SpeciesAtRisk/ DetailedStatus/Mammals/documents.

11. COSEWIC. 2011. Designatable Units for Caribou *(Rangifer tarandus)* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 88 pp.

12. Serrouya, R. et al. 2012. Molecular Ecology 21: 2588–2601.

13. Javorek, S.K. and M.C. Grant. 2011. Trends in wildlife habitat capacity on agricultural land in Canada, 1986–2006. Canadian Biodiversity: Ecosystem Status and Trends 2010, Technical Thematic Report No. 14. Canadian Councils of Resource Ministers. Ottawa, ON. vi + 46 pp.