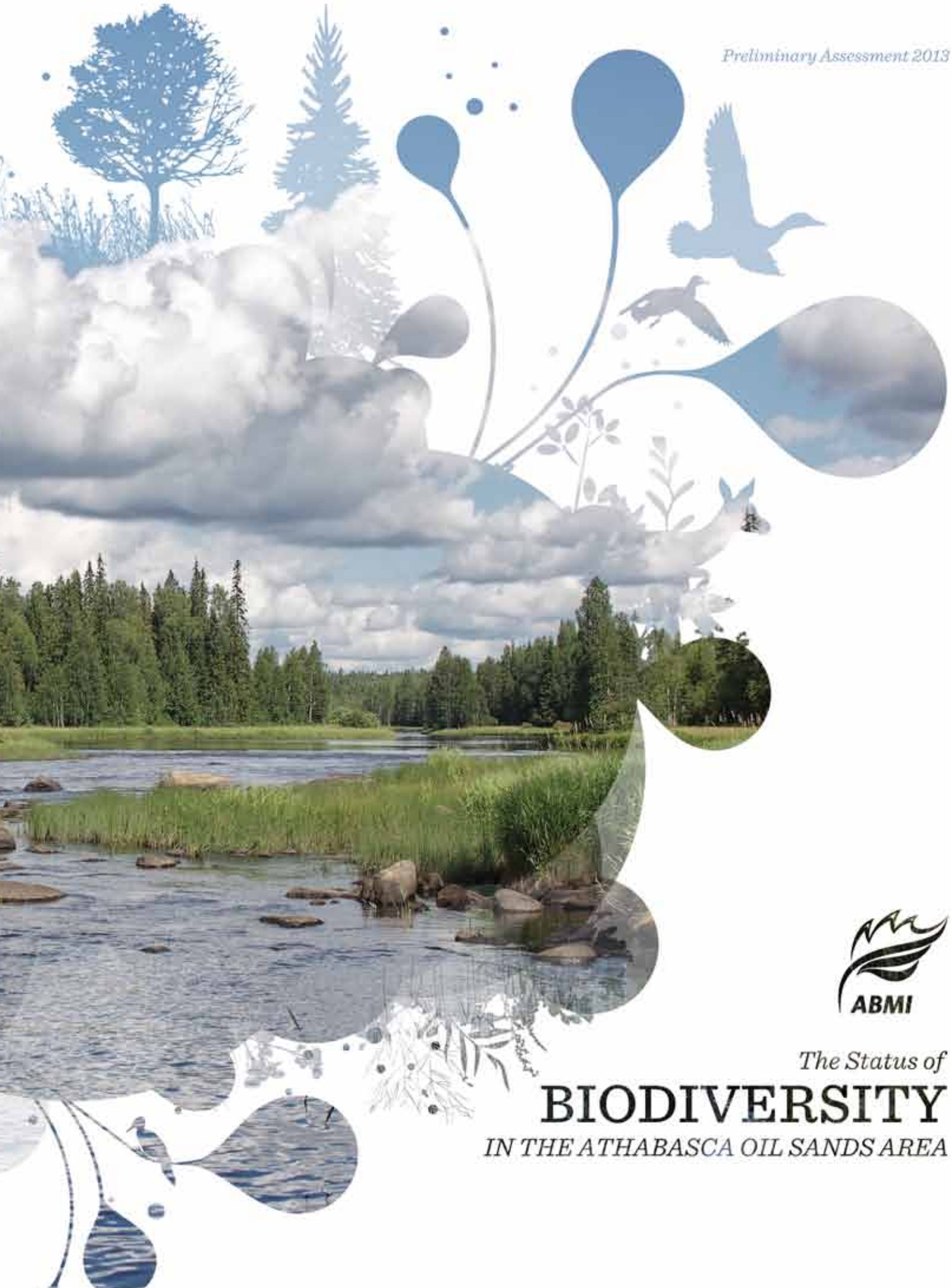


ABMI

The Status of

BIODIVERSITY

IN THE ATHABASCA OIL SANDS AREA

THIS REPORT DESCRIBES THE STATUS OF BIODIVERSITY AND HUMAN FOOTPRINT IN THE ATHABASCA OIL SANDS AREA

In partnership with:

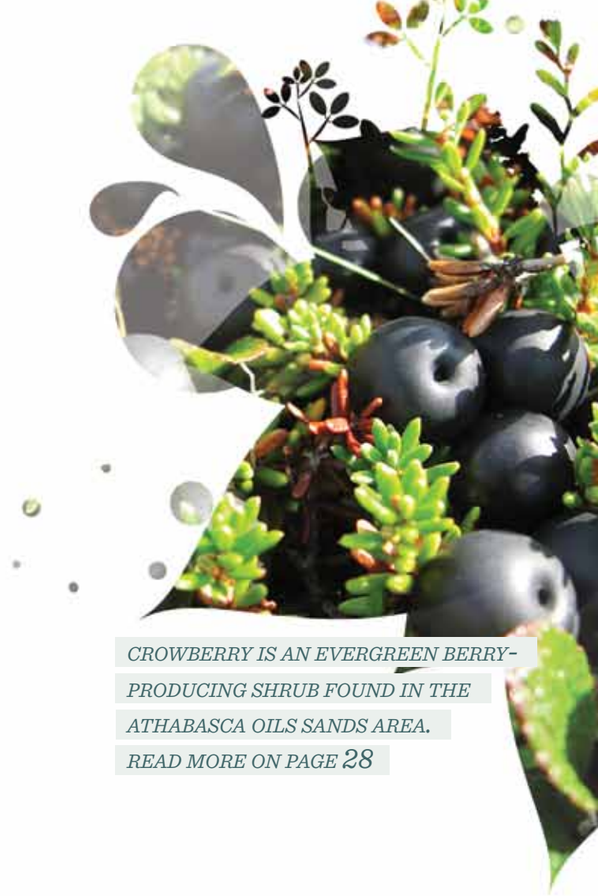
Alberta Innovates

Royal Alberta Museum

University of Alberta

University of Calgary

Contents



CROWBERRY IS AN EVERGREEN BERRY-PRODUCING SHRUB FOUND IN THE ATHABASCA OILS SANDS AREA.
READ MORE ON PAGE 28

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, publicly accessible data, and presents knowledge derived from the data in a value-neutral format.

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

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

Report Summary

The Alberta Biodiversity Monitoring Institute (ABMI) measures and reports on the state of biodiversity and human footprint across the province. This report presents data on several indicators of environmental health for the Athabasca Oil Sands Area (AOSA) in Alberta, and for two subregions within the AOSA: the Active In-situ Oil Sands Region (Active In-situ Region) and the Surface Mineable Oil Sands Region (Mineable Region).

The AOSA makes up 14% of Alberta's land area and is similar in size to the State of Maine and three times larger than Vancouver Island. The AOSA is situated within the Boreal Forest Natural Region; this heavily forested region is naturally regulated by disturbances like fire and insect outbreaks, which results in a patchy mixture of young and old forest across the landscape.

As of 2010, human footprint covered 6.8% of the AOSA land base. Forest harvesting represented the largest human footprint category at 3.1% of the region.† Human footprint in the Active In-situ Region was 7.7%, whereas it was 20.8% in the Mineable Region. Energy infrastructure was the largest human footprint type in the Mineable Region at 16.8%.

Overall, 9% of the AOSA is managed as protected areas.

The ABMI assessed the status (current condition) of over 350 species in the AOSA, Active In-situ Region, and Mineable Region and found the Biodiversity Intactness Index ‡ to be, on average, 94%, 91%, and 86% for each of the regions, respectively. The high intactness value for the AOSA is due to its relatively low human footprint. In the Mineable Region, where human footprint is higher, the biodiversity intactness is 8% lower. Even though active surface mines have a biodiversity intactness near 0%, much of the land base in the Mineable Region is not currently developed. These undeveloped areas have higher biodiversity intactness.

At present, the biggest ecological change in the AOSA is associated with higher-than-expected abundances of species that thrive in areas with human development, such as the Coyote and Song Sparrow.

Additional results of note include:

- *Species that prefer old-forest habitat, like the Marten, Fisher, and Bay-breasted Warbler, were less abundant than expected.*
- *Non-native weeds were detected at 32% of the sites surveyed. At sites where they were found, an average of 2.1 non-native weed species were detected.*

With respect to species at risk in the AOSA, the Woodland Caribou has the highest public profile. Government of Alberta data show that Woodland Caribou populations in the AOSA have been consistently declining over the past 20 years. ABMI analysis shows that the total amount of human footprint in all Woodland Caribou ranges increased between 2007 and 2010. In 2010 human footprint varied from a low of < 1% in the Richardson population range to a high of 7% in the Nipisi population range.

This report describes the current status of biodiversity in the AOSA and serves as an ecological baseline for evaluating land-use planning outcomes related to biodiversity in the 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 for the Peace River and Cold Lake Oil Sands Areas.

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

‡ The ABMI's 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, whereas a parking lot surrounded by big-box stores is considered 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.

Introduction

Canada has the third-largest volume of proven oil reserves in the world. Over 95% of these reserves are found in Alberta in three major oil sands deposits: the Athabasca, the Cold Lake, and the Peace River; these three deposits are overlaid by three Government of Alberta administrative units of the same name (Figure 01). This report describes the status of biodiversity and human footprint in the Athabasca Oil Sands Area (hereafter referred to as the AOSA).

The Athabasca deposit, located in northeastern Alberta, contains approximately 77% of Canada's proven oil reserves. Since Alberta's first oil sands mining operations opened in 1967, crude bitumen (see inset for definition) production has increased from 12,000 barrels/day to about 1.6 million barrels/day. With 87 active oil sands extraction projects currently in operation and 180 approved projects in different stages of development, crude bitumen production in the AOSA is expected to double by 2030.[1]

Clearly, the oil sands industry is a critical component of Alberta's economy. However, energy development is not the only land-use activity in the AOSA; there is also a robust forest industry. Much of the region is managed for timber production with four forest management agreement areas overlapping with the AOSA. Furthermore, the conventional natural gas industry has developed alongside the oil sands industry. Managing the cumulative effects of all the land-use activities is a key challenge to sustainable development in this area.

The AOSA makes up 14% of Alberta's land area and is similar in size to the State of Maine and three times larger than Vancouver Island. It is situated within the Boreal Forest Natural Region—an area that comprises a mosaic of upland Trembling Aspen and White Spruce forests and lowland Black Spruce forests. The region experiences frequent widespread natural disturbance, like fire and insect outbreaks, which results in a patchy mixture of young and old forest across the landscape.

> *"Oil sands" is a term used to describe geological deposits composed of a mixture of sand and clay saturated with bitumen. Bitumen is a thick, sticky form of crude oil that is similar in consistency to molasses at room temperature.*

The Government of Alberta recognizes the need to responsibly manage the environment in the AOSA, and has made a number of policy and legislative commitments designed to better manage the cumulative effects of economic growth. The most substantive of these commitments has been the implementation of Alberta's Land-use Framework, which is a regional planning process enabled by the Alberta Land Stewardship Act. In August 2012, as part of the Land-use Framework, the government approved the Lower Athabasca Regional Plan (LARP), which includes much of the AOSA.[2] One goal of LARP is to identify environmental management targets and outcomes for air, land, water, and biodiversity to provide a framework for land-use decisions in the area. Of the seven regional outcomes identified in LARP, "Outcome 3: Landscapes are managed to maintain ecosystem function and biodiversity" is of particular relevance to this report. Furthermore, LARP requires monitoring and reporting to track progress toward environmental outcomes.[2]

In this report, we describe the status of species, core native habitat,[§] and human footprint in the AOSA. We examine the status of hundreds of species and highlight those that show the most sensitivity to human development. Information from this report can be used as a foundation for evaluating the sustainability of resource development in the region.

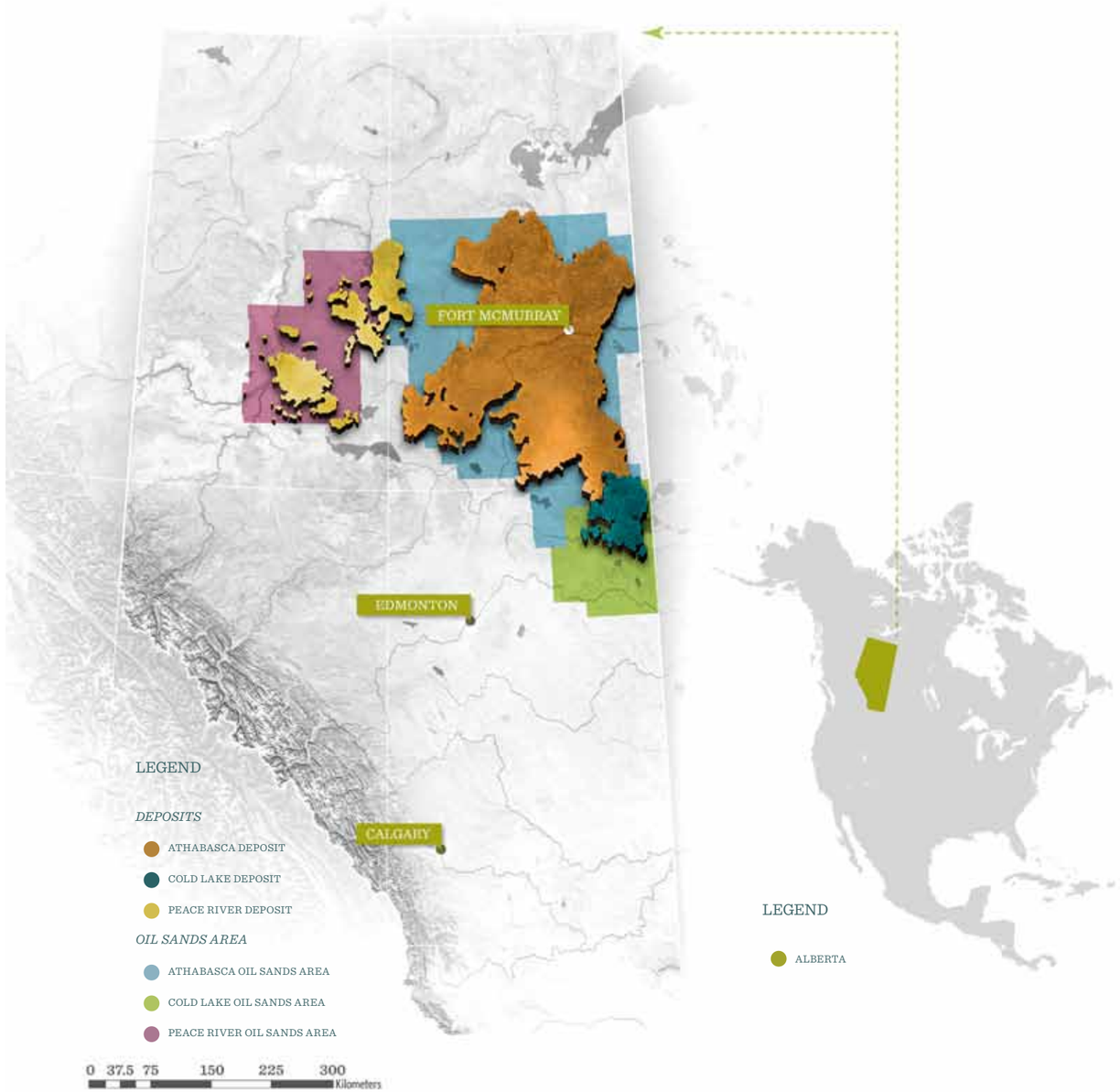


FIGURE 01
ALBERTA HAS THREE MAJOR OIL SANDS DEPOSITS: THE ATHABASCA, COLD LAKE, AND PEACE RIVER DEPOSITS. EACH DEPOSIT IS ASSOCIATED WITH AN ADMINISTRATIVE UNIT (OIL SANDS AREA) OF THE SAME NAME.

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

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 in the region provide opportunities for hiking, hunting, fishing, and berry picking. Biodiversity is all around us every day, and it plays an enormous role in supporting our way of life.

ABMI Measures Biodiversity

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

At each location, ABMI technicians record the species that are present, gather soil and water samples, and measure a variety of habitat characteristics. For species that cannot be identified in the field (e.g., mites and lichen), ABMI taxonomists located 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 and habitat using fine-resolution aerial photography and satellite imagery. The ABMI Remote Sensing Group conducts analyses of human footprint at two spatial scales:

1. For a 3 x 7 km area around each ABMI site location, detailed inventories of human footprint are created using fine-resolution aerial photography.

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.

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).

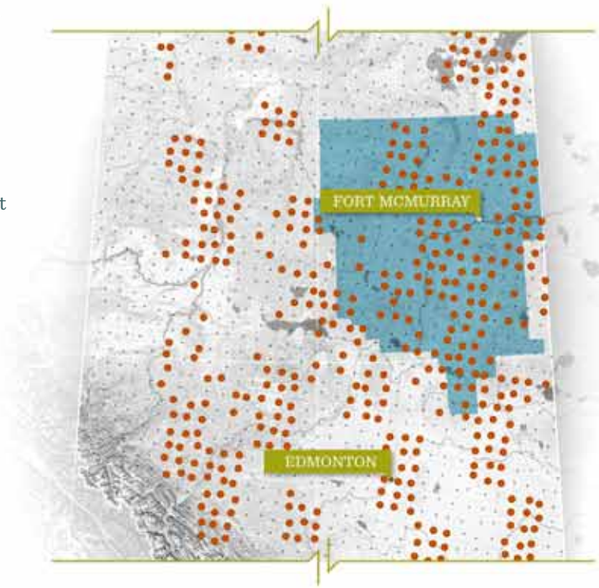


FIGURE 02
THE AOSA REPRESENTS 14% OF ALBERTA'S TOTAL LAND AREA. OF THE ABMI'S 1,656 SURVEY SITES, 235 ARE IN THE AOSA.

Biodiversity Indicators in This Report

Habitat loss is a major driver of biodiversity decline on the planet.[5] In the AOSA, habitat is being modified by, or lost to, a range of human activities including, forestry, energy development, and urban expansion. Responsible management of this region depends on an understanding of 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.*

Core Native Habitat

To assess the **status of core native habitat**, the ABMI uses the Geographic Information System (GIS) Inventory of Provincial Human Footprint. To report on the status of core native habitat, the ABMI presents the percentage of land cover that has no human footprint, as well as the percent 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. 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. Values presented in this report are based on complete human footprint inventories circa 2007 and 2010.

See the AOSA Data Supplement for further details (available at www.abmi.ca).

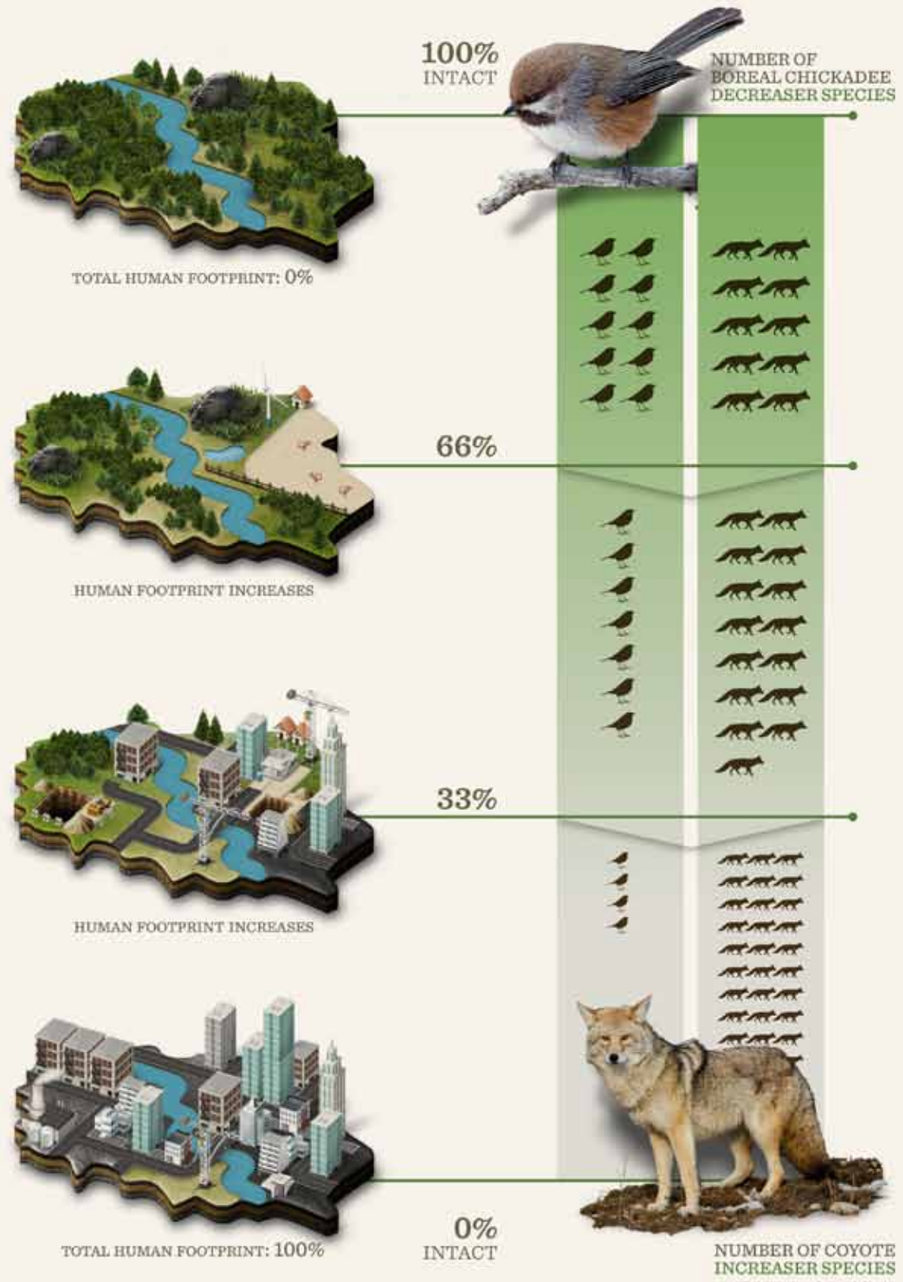
FIGURE 03 THE ABMI BIODIVERSITY INTACTNESS INDEX

THE ABMI USES A METRIC CALLED 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



Reporting Area

The status of biodiversity, habitat, and human footprint in the Athabasca Oil Sands Area (AOSA) is the focus of this report. Two subregions within the AOSA are also highlighted (Figure 04).

The Active In–situ Oil Sands Region (Active In-situ Region) is defined as all operating or approved in-situ projects that are completely or partially located within the Athabasca Oil Sands boundary but not in the Surface Mineable Region of the Athabasca Oil Sands. Although much of the region has been leased for energy development, a relatively small proportion of this land base is approved for in-situ operations.

The Surface Mineable Oil Sands Region (Mineable Region) as identified by the Government of Alberta is the 4,800 km^2 area north of Fort McMurray where surface mining of oil sands occurs.

Ecology of the Athabasca Oil Sands Area

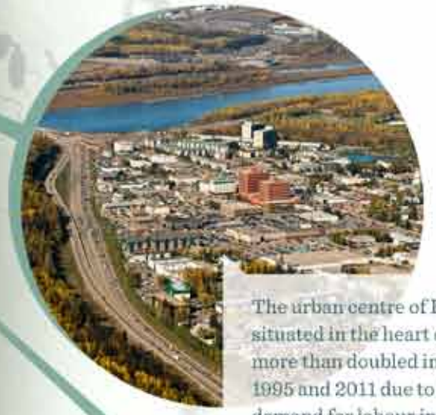
The AOSA is situated within the Boreal Forest Natural Region, which is characterized by a mosaic of upland forests composed of Trembling Aspen, White Spruce, Lodgepole Pine, and Jack Pine, and lowland forests composed of Black Spruce, Larch and open wetlands.

Multiple ice ages have created a flattened and rolling landscape dotted with numerous shallow lakes and wetlands connected by meandering streams, which largely feed into the Athabasca River system.

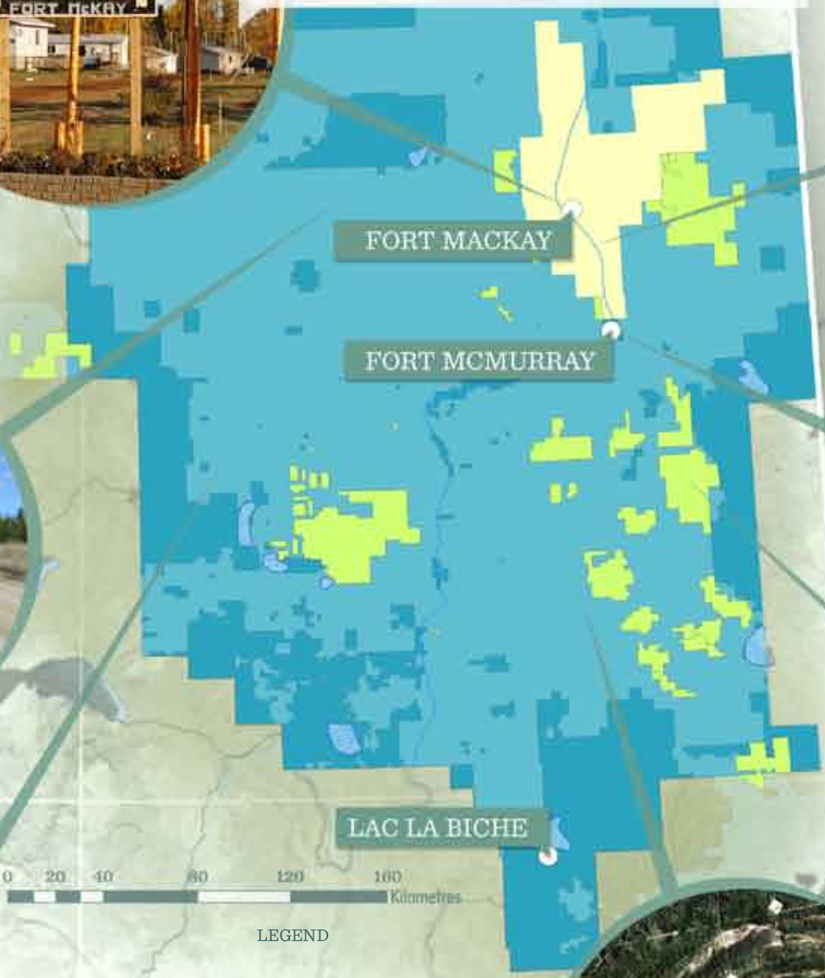
There are many Aboriginal communities in the AOSA, such as Fort MacKay First Nation. Aboriginal peoples remain significantly tied to traditional practices of hunting, trapping, and fishing, but are also actively involved in resource-based industries.

Surface mining is the most recognizable form of bitumen extraction and only occurs in the Mineable Region; large shovels are used to excavate the oil sands deposits located close to the earth's surface. The Mineable Region contains 20% of the AOSA bitumen deposits.

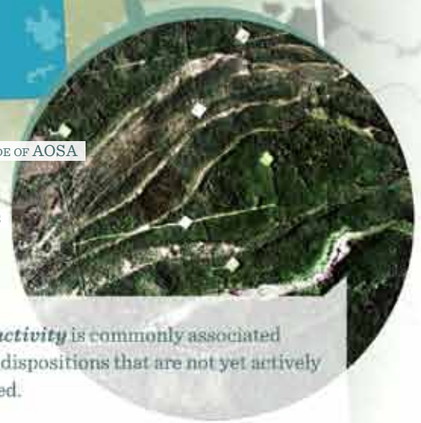
Much of the region is managed for timber production. There are four forest management agreement areas that overlap with the AOSA.



The urban centre of Fort McMurray, situated in the heart of the AOSA, has more than doubled in size between 1995 and 2011 due to the high demand for labour in the region



The forests of the region experience frequent natural disturbances like fire and insect outbreaks, which results in a mosaic of stands of different ages from young forests to forests more than 150 years old.



Exploration activity is commonly associated with oil sands dispositions that are not yet actively being developed.

In-situ extraction is used to extract the majority of bitumen deposits that are located deep (>75 m) underground. The term "in-situ" literally means the bitumen is recovered "in place" as it is heated and separated from sand underground and then pumped to the surface.

FIGURE 04

THE AOSA, 93,259 KM^2 IN NORTHEASTERN ALBERTA, IS THE FOCUS OF THIS REPORT. RESULTS FOR TWO SUBREGIONS, THE ACTIVE IN-SITU REGION AND MINEABLE REGION, ARE ALSO HIGHLIGHTED.

Human footprint data, including footprint type and amount, provide the context for interpreting the Biodiversity Intactness Index. As a result, we begin our presentation of the data for the AOSA with a discussion of the human footprint analyses.

Human Footprint

The ABMI defines "human footprint" as the visible conversion of native ecosystems to temporary or permanent residential, recreational, agriculture, or industrial landscapes. This includes activities that support the energy, forest, and agriculture industries, residential settlement, and transportation infrastructure. At present, however, the mapping of human footprint does not account for the recovery of biodiversity in forests that are regenerating following temporary disturbances such as logging or energy exploration (i.e., seismic lines). The ABMI is currently developing the science necessary to account for this so recovered areas can be credibly removed from the estimate of human footprint.

As of 2010, the total human footprint across the AOSA covered 6.8% of the land base (Figure 05); forest harvesting was the largest component of human footprint, covering 3.1% of the area (Table 01). The Active In-situ Region had 7.7% total human footprint; energy infrastructure was the largest human footprint in this subregion at 4.2%, followed by forestry at 2.6%. The human footprint in the Mineable Region, at 20.8%, was almost three times higher than the Active In-situ Region or the AOSA as a whole; energy infrastructure at 16.8% was the largest human footprint in this subregion.

Between 2007 and 2010, total human footprint increased by 0.7%, 1.3%, and 3.8% in the AOSA, Active In-situ Region, and Mineable Region, respectively. In the Mineable Region, the change in human footprint was largely driven by an increase in energy infrastructure.

As the amount of human footprint increases, 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, it becomes more likely that biodiversity will be impacted. Some species thrive in landscapes with a high high human footprint and increase in abundance, while other species decrease in abundance and become uncommon as a result of development.

TABLE 01

THE PERCENTAGE OF HUMAN FOOTPRINT IN THE AOSA, ACTIVE IN-SITU REGION, AND THE MINEABLE REGION IN 2010

	AOSA	Active In-situ Region	Mineable Region
Agriculture	0.8 %	< 0.01 %	< 0.01 %
Rural Commercial and Industrial	0.1 %	0.4 %	0.7 %
Energy and Mining	2.5 %	4.2 %	16.8 %
Forestry	3.1 %	2.6 %	2.8 %
Residential and Recreation	0.1 %	0.1 %	0.3 %
Transportation	0.3 %	0.5 %	0.3 %
Total	6.8%	7.7%	20.8%

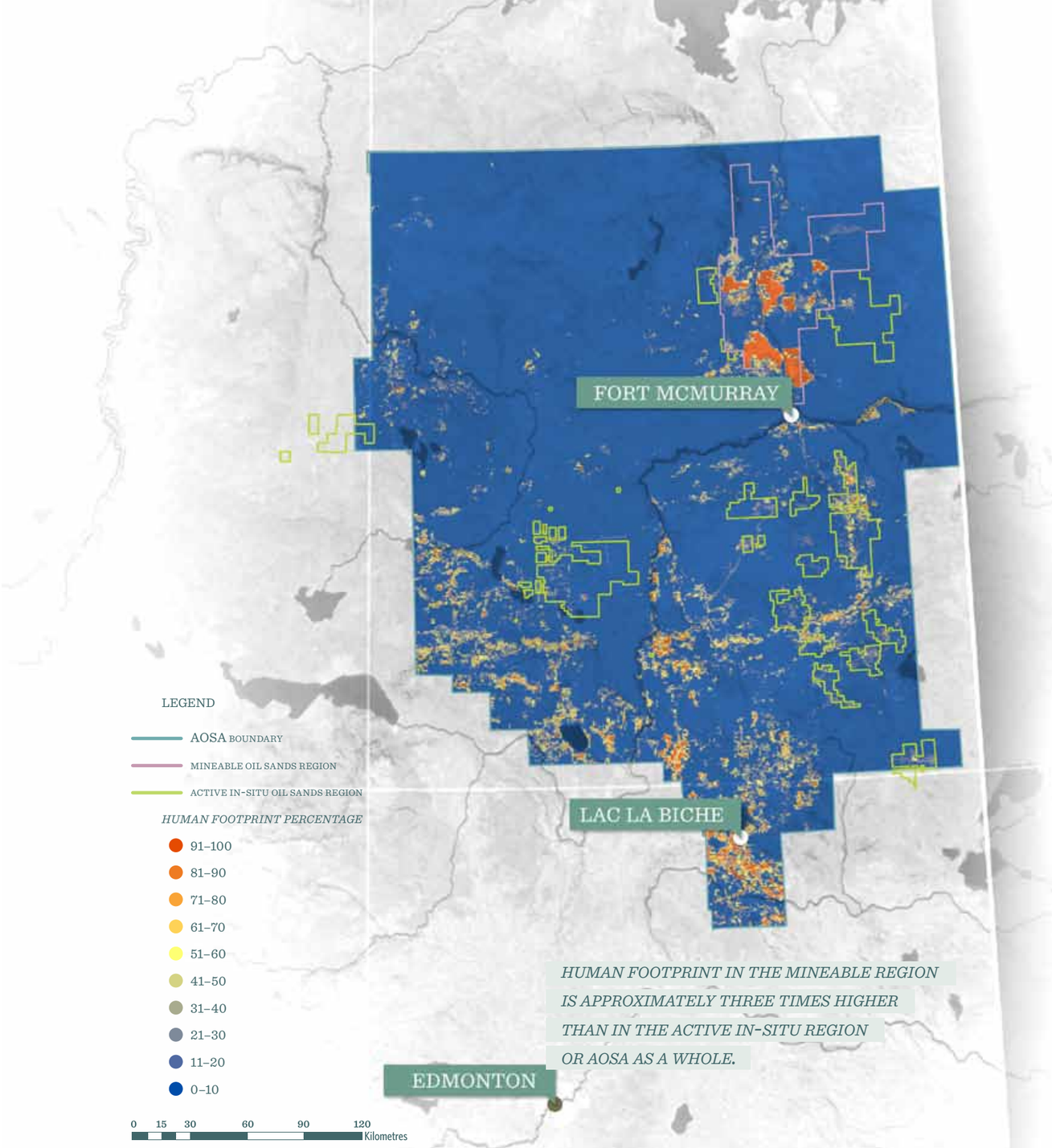


FIGURE 05

DISTRIBUTION OF HUMAN FOOTPRINT ACROSS THE AOSA.

Core Habitat and Protected Areas

Core Native Habitat

People's perception of wilderness often includes undisturbed expanses of forest, river, and lake ecosystems. The ABMI uses the phrase and concept of "core native habitat" to identify areas in Alberta, including in the AOSA, that have not been visibly disturbed by humans, although natural disturbances such as wildfire and insect outbreaks still occur. While many definitions of core 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 interact with core 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 core native habitat using four different buffer distances: 0 m (i.e., no buffer), > 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 in the measure.

Overall, 93%, 92%, and 79% of the AOSA, Active In-situ Region, and Mineable Region are composed of core native habitat when using a 0 m buffer on human footprint (Table 02). When considering a buffer of 2 km, core native habitat for all regions is less than 5%.

As a note of caution, our summary of core 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 core native habitat in cut blocks and seismic lines is also not yet accounted for in these summaries.

TABLE 02

PERCENTAGE OF THE AOSA, ACTIVE IN-SITU REGION, AND MINEABLE REGION CLASSIFIED AS CORE NATIVE HABITAT (AS OF 2010) USING FOUR DISTANCE-TO-EDGE (I.E., DISTANCE TO THE EDGE OF HUMAN FOOTPRINT) BUFFER WIDTHS.

	AOSA	Active In-situ Region	Mineable Region
0 m	93 %	92 %	79 %
50 m	76 %	62 %	60 %
200 m	46 %	28 %	29 %
2 km	4 %	1 %	1 %

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 in order to maintain the biodiversity within these naturally functioning systems.[6]

Overall, 9% of the AOSA is managed as protected areas (Figure 06).

The ABMI's definition of protected areas in the AOSA includes Alberta's provincial parks and protected areas network, national parks, and National Wildlife Areas. This definition also includes the Birch River Conservation Area (20% of the total protected area), which is classified as a Public Land-use Conservation Area within the Lower Athabasca Regional Plan 2012–22. Unlike other protected areas, the resource management plan for the Birch River Conservation Area may allow for forest harvesting. Wood Buffalo National Park is located just to the north of the AOSA and is not included in the protected area calculation.

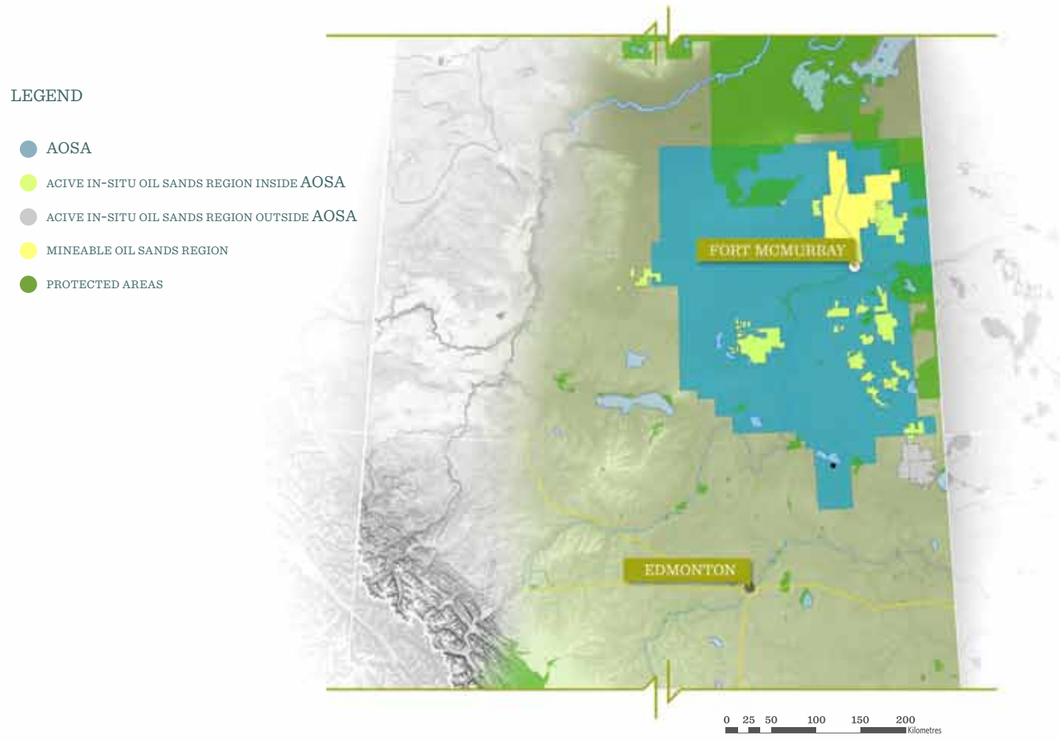


FIGURE 06

DISTRIBUTION OF PROTECTED AREAS IN NORTHEAST ALBERTA. OVERALL, 9% OF THE AOSA IS MANAGED AS PROTECTED AREAS.

Biodiversity Intactness

Thousands of plant and animal species live in the AOSA. The ABMI assessed the status of species from five main taxonomic groups—native birds, winter-active mammals, armoured mites, native plants, and mosses—which represent a diverse subset of all species in the region.

In the AOSA, the ABMI assessed the status of 386 common species from these five groups: their biodiversity intactness ranged from 92% to 96% intact (Table 03).

In the Active In-situ Region, 374† species across the five taxonomic groups were assessed, and intactness ranged from 88% to 94%.

In the Mineable Region, 370† species across the five taxonomic groups were assessed, and intactness ranged from 80% to 93%.

It is important to note that the intactness results in this report are averages that apply to three different spatial scales: the entire AOSA, two subregions within the AOSA (Active In-situ Region and Mineable Region), and at the quarter section scale, the scale used for the estimated intactness map. As with most landscapes in Alberta, specific sites within each region are nearly 0% intact (e.g., active industrial sites), and other sites are 100% intact (e.g., undeveloped forest or wetland habitat).

TABLE 03

INTACTNESS* FOR DIFFERENT COMPONENTS OF BIODIVERSITY IN THE AOSA, ACTIVE IN-SITU REGION, AND MINEABLE REGION.

	AOSA		Active In-situ Region		Mineable Region	
Biodiversity Component	No. of Species	Intactness	No. of Species	Intactness	No. of Species	Intactness
Native Birds	71	92 %	67	91 %	63	84 %
Winter-Active Mammals	13	95 %	13	90 %	13	93 %
Armoured Mites	62	95 %	62	91 %	62	88 %
Native Plants	165	93 %	156	88 %	156	80 %
Moss	75	96 %	76	94 %	76	85 %
Overall Intactness	386	94%	374	91%	370	86%

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

† Total numbers of species analyzed differ between the three regions because some species are too rare in a region to have meaningful results.

Estimated Biodiversity Intactness

The ABMI has developed statistical models that describe the relationship between the relative abundance of individual species, habitat, and human footprint for the Boreal Forest Natural Region. These statistical models are used to calculate the Biodiversity Intactness Index for each species in the region when we have sufficient data. The models can also be used to estimate the Intactness Index for each species for every quarter section of land in the AOSA—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 the percentage habitat, the average intactness of over 350 species in the AOSA has been estimated and mapped to generate an overall picture of biodiversity in the region (Figure 07).

Since the estimated intactness map provides a visual representation of biodiversity intactness across the region, it illustrates how the average biodiversity intactness value for the AOSA is calculated at 94%. Clearly, the map shows that much of the region has little to no human footprint, and therefore high biodiversity intactness (shown as green in Figure 07). On the other hand, some localized areas, such as the oil sands mines north of Fort McMurray, have more intense human footprint, which results in lower biodiversity intactness (e.g., < 20%, shown as red in Figure 07).

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.*
- *The maps are intended to show broad patterns of intactness, not exact values for each quarter-section.*
- *Field surveys are required to validate the estimates of intactness before the information is used for site-level (e.g., quarter section) management.*

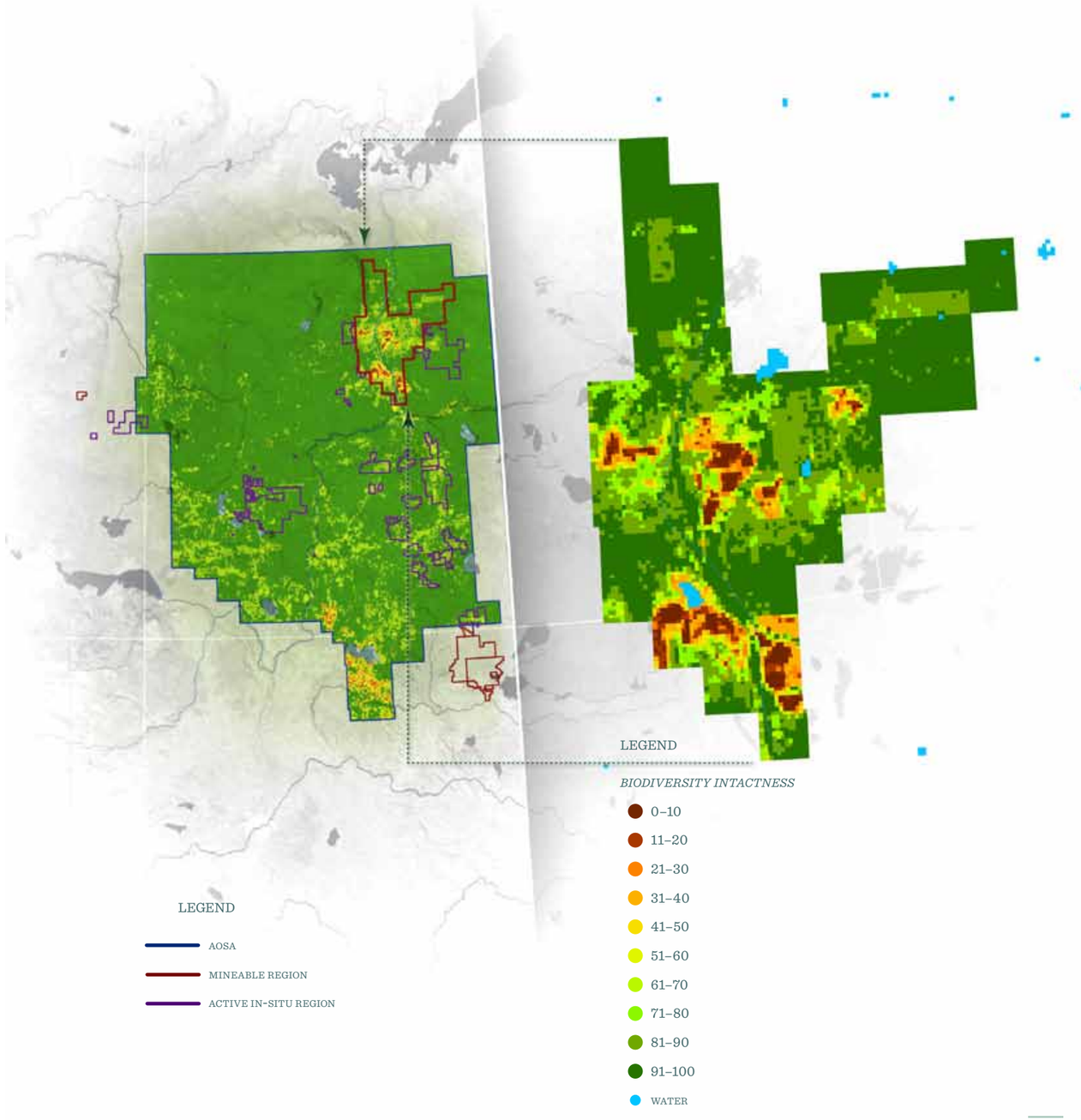


FIGURE 07

AVERAGE ESTIMATED INTACTNESS FOR OVER 350 SPECIES IN THE AOSA. DARK RED IDENTIFIES THE QUARTER SECTIONS THAT ARE ESTIMATED TO HAVE THE LOWEST AVERAGE BIODIVERSITY INTACTNESS, AND DARK GREEN IDENTIFIES QUARTER SECTIONS WITH THE HIGHEST INTACTNESS. THE ENLARGED AREA HIGHLIGHTS THE ESTIMATED INTACTNESS FOR QUARTER SECTIONS OF LAND IN THE MINEABLE REGION.

Of the full suite of species assessed by the ABMI in the AOSA, we profile old-forest birds, winter-active mammals, berry-producing shrubs, and armoured mites in this report. 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).

Old-Forest Birds

Old forests are commercially valued for timber production and ecologically valued for their unique habitat characteristics. Historically, the area of old forest in the boreal natural region was affected by frequent widespread natural disturbances such as fire, insect outbreaks, and wind. And while wildfire is still the single biggest factor affecting the amount of old forest, forest harvesting and energy exploration have caused declines in the amount of old forest.[7]

Almost one-third of all songbirds that breed in boreal forests meet their requirements for nesting and foraging in old-forest habitat.[8] These old-forest specialists respond to changes in the amount and configuration of old forest in the landscape. Within a forest stand, they respond to changes in forest age, composition, and habitat structure, such as the availability of large trees. For this reason, old-forest specialists are sensitive to changes in old-forest habitat and are often highlighted as an indicator of the health of the forest overall.

The ABMI assessed the status of 24 old-forest birds in the AOSA, 20 old-forest birds in the Active In-situ Region, and 20 old-forest birds in the Mineable Region and found them to be, on average, 93% intact, 91% intact, and 88% intact, respectively (Figure 08).

Overall, half of old-forest birds assessed by the ABMI were less abundant than we would expect to find if there were no human footprint in the AOSA, one-third were less abundant than expected in the Active In-situ Region, and most species assessed in the Mineable Region were less abundant than expected.

The following five old-forest specialists were consistently less abundant in all three regions that we assessed: the Bay-breasted Warbler, Boreal Chickadee, Cape May Warbler, Least Flycatcher, and Northern Waterthrush.

Two old-forest species, the Pileated Woodpecker and Hairy Woodpecker, were more abundant than we would expect to find (Figure 08). These two species excavate cavities in dead or dying trees for nesting.

CAVITY-NESTING BIRDS LIKE THE PILEATED WOODPECKER USE LARGE DEAD AND DYING TREES, AS WELL AS SNAGS, FOR NESTING AND FORAGING; THESE HABITAT ELEMENTS ARE TYPICAL OF OLDER FORESTS.

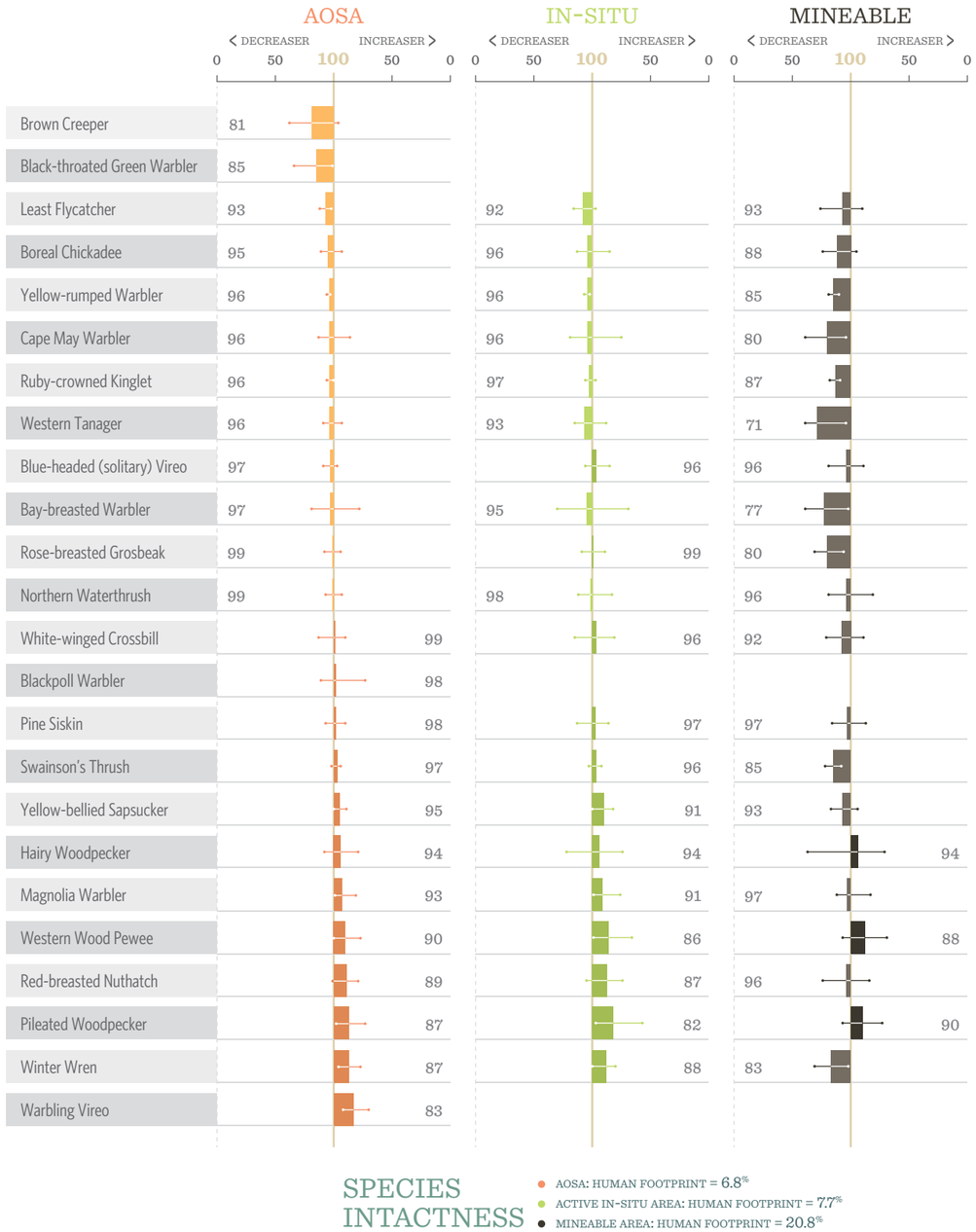


FIGURE 08

INTACTNESS OF 24, 20, AND 20 OLD-FOREST BIRD SPECIES IN THE AOSA, ACTIVE IN-SITU REGION, AND MINEABLE REGION, RESPECTIVELY. ERROR BARS REPRESENT 90% CONFIDENCE INTERVALS. THE ORDER IN WHICH SPECIES ARE PRESENTED IS DETERMINED BY SPECIES INTACTNESS RESULTS FOR THE AOSA. INTACTNESS COULD NOT BE CALCULATED FOR ALL 24 SPECIES IN THE ACTIVE IN-SITU REGION AND MINEABLE REGION BECAUSE THERE WAS NOT SUFFICIENT DATA.

Winter-Active Mammals

The AOSA is home to nearly 50 mammal species. Historically, fur-bearing mammals have played an important role in northeastern Alberta by providing subsistence for Aboriginal people for thousands of years. These mammals were also central to the fur trade, which initially attracted Europeans to the region.

While mammal populations in the AOSA have long been affected by hunting and trapping, more recent human activities, such as forestry and oil sands development, are also having an impact on their populations. Some species, like the Coyote and Deer (both White-tailed and Mule Deer), benefit from habitat created by human activities. In contrast, other species respond negatively to these activities. Forest fragmentation, the process of cutting contiguous tracts of forest into smaller, more isolated patches, has an impact on species that require large undisturbed areas, such as Woodland Caribou. Other forest-dwelling mammals, like the Fisher and Marten, may also be negatively influenced by human development due to associated habitat loss or increased predation risk.

The ABMI assessed the status of 13 winter-active mammal species or groups of species in the AOSA, Active In-situ Region, and Mineable Region using winter tracking data. We found them to be, on average, 95% intact, 90% intact, and 93% intact, respectively (Figure 09).

The Coyote was one of two species (the other being the River Otter) that was consistently more abundant than expected if there were no human footprint in all three regions. Coyotes are habitat generalists and readily adapt to human-dominated landscapes.

Marten and Fisher, and Red Squirrel, were consistently less abundant than expected if there were no human footprint. These species are associated with mature coniferous forest.

In the Mineable Region, all but two mammal species were less abundant than expected if there were no human footprint. This is presumably due to habitat loss in the mined area.

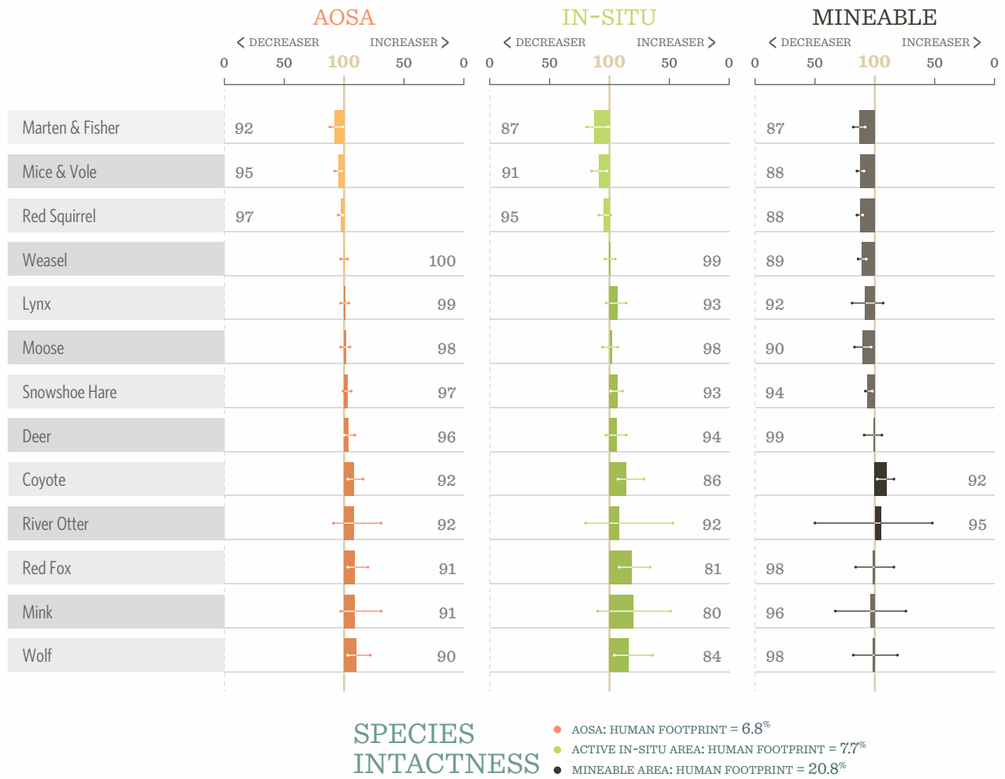


FIGURE09

INTACTNESS OF 13 MAMMAL SPECIES OR GROUPS IN THE AOSA, ACTIVE IN-SITU REGION, AND MINEABLE REGION. ERROR BARS REPRESENT 90% CONFIDENCE INTERVALS. THE ORDER IN WHICH SPECIES ARE PRESENTED IS DETERMINED BY SPECIES INTACTNESS RESULTS FOR THE AOSA.

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 cubic metre of healthy topsoil. Of the 10,000 armoured mite species known to exist on the planet, at least 325 occur in our province.

Like mammals and birds, some species of armoured mites are carnivores and some are herbivores. However, the majority of mites live off the remains of plants, animals, and fungi, and play 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 62 species of armoured mites in the AOSA, the Active In-situ Region, and in the Mineable Region and found them to be, on average: 95%, 91%, and 88% intact, respectively.

There is not a lot known about armoured mites in the AOSA or how human footprint influences them. ABMI monitoring data provide information on mite species richness and distribution, which act as baseline data to assess how their populations are changing. We highlight three of the species evaluated for this report.

Diana's Undulate-roamer (*Unduloribates dianae*) (see photo on page 27) was detected at 15% of ABMI sites in the AOSA and was found to be 93% intact. New to science, Diana's Undulate-roamer was first described in 2009 from samples collected in the boreal forests of northern Alberta. Little is known about how this species lives, but we believe it feeds on dead and decaying plant matter on the forest floor. There are at least three more newly discovered species from this region that are in the process of being described.

The ABMI detected the Six-dimpled Northern Mite at 5% of ABMI sites in the AOSA, and it was found to be 90% intact. The Six-dimpled Northern Mite (*Tectocepheus sarekensis*) belongs to the family Tectocepheidae. The presence and abundance of species in this family often indicate recent habitat disturbance.[9] Most species in this family are thelytokous, which means that they use a form of asexual reproduction where females are produced from unfertilized eggs. This form of reproduction may give these species an advantage in disturbed areas, as individuals don't require successful mating to produce offspring, allowing them to increase rapidly in number.

The Labrador Tea Wingtooth (*Dentizetes ledensis*) was detected at 16% of ABMI sites in the AOSA, and was 98% intact. The Labrador Tea Wingtooth is associated with the plant Labrador Tea: it grazes on fungal growths and takes refuge in the plant's densely haired leaves.

Berry-Producing Vascular Plants

A wide variety of berry-producing plant species are found in the AOSA. The berries of these plants support wildlife that lives in the region and are of great importance to local peoples.

Berries are a vital resource for animals in the late summer and fall as they prepare for the winter. The Black Bear depends on berries to accumulate fat reserves before winter hibernation. Many migratory bird species, like the America Robin and White-throated Sparrow, rely on berries as a major part of their diet before fall migration. Winter-resident bird species, like the Cedar Waxwing and Black-capped Chickadee, eat berries throughout the winter to give them energy and to help maintain their body heat in cold winter temperatures. Some berries, like the Crowberry, can survive undamaged under the snow, providing an important source of food in the early spring for a variety of animals when other food sources may be scarce.

Berries are not the only sought-after part of these woody plants; moose and deer also browse on their leaves and new growth. And because many of these plant species form dense mats that grow close to the ground, this cover provides shelter and protection from predators for small mammals and some birds.

In addition to their importance to the biodiversity of the region, the berries produced by these shrubs have been an essential part of the traditional diet of Aboriginal people for generations. Many of these shrubs, such as the Crowberry and Bog Cranberry, were used for a variety of medicinal purposes. Berry picking remains an important component of the culture of local people in northeastern Alberta.

The ABMI assessed the status of 23 berry-producing plants in the AOSA, Active In-situ Region, and Mineable Region and found them to be, on average, 97% intact, 95% intact, and 87% intact, respectively (Figure 10).

In all landscapes, the Wild Red Raspberry was consistently more abundant than would be expected if there was no human footprint (Figure 10). Wild Red Raspberry readily grows in open and disturbed sites such as burns, recently logged forest, and road edges.

Most berry-producing plants, including the Bristly Black Currant and Low-bush Cranberry, were consistently less abundant than would be expected if there was no human footprint; this difference was greatest in the Mineable Region (Figure 10). Bristly Black Currant and Low-bush Cranberry occur in moist to wet forests, seepage areas, swamps, and clearings and along streambanks.

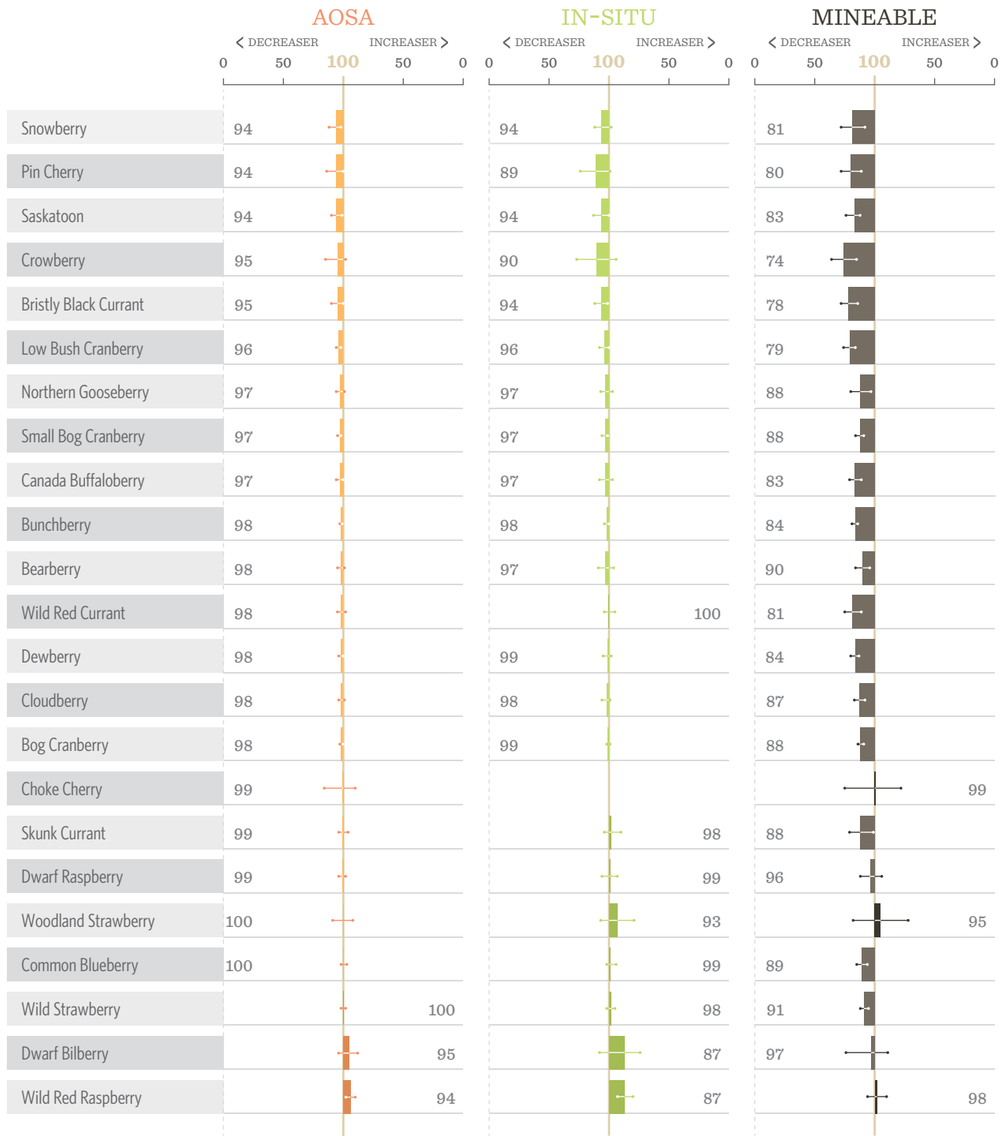


FIGURE 10

INTACTNESS OF 23 BERRY-PRODUCING VASCULAR PLANTS IN THE AOSA, ACTIVE IN-SITU REGION, AND MINEABLE REGION. ERROR BARS REPRESENT 90% CONFIDENCE INTERVALS. THE ORDER IN WHICH SPECIES ARE PRESENTED IS DETERMINED BY SPECIES INTACTNESS RESULTS FOR THE AOSA.

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.

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

The ABMI found 38 non-native plants in the AOSA (Table 04). Non-native plants were detected at 32% of ABMI sites in the AOSA. Most non-native species occurred very infrequently in the AOSA and were identified at less than 5% of ABMI sites. At the sites where they were found, an average of 2.1 non-native species were detected.

Common Dandelion was the most abundant non-native plant and was found at 25% of ABMI sites in the AOSA. Three of the non-native species detected are listed under the Alberta Weed Control Act, including Creeping Thistle, Perennial Sow-thistle, and Tall Buttercup.

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

CREEPING THISTLE, ALSO KNOWN AS THE CANADA THISTLE, IS A NOXIOUS WEED UNDER ALBERTA'S WEED CONTROL ACT (2010). THE CREEPING THISTLE WAS DETECTED AT 5% OF ABMI SITES IN THE AOSA.

TABLE 04
PERCENTAGE OCCURRENCE OF NON-NATIVE VASCULAR PLANTS IN THE AOSA.

Biodiversity Component	Scientific Name	Percentage of ABMI Sites
Common Dandelion	*Taraxacum officinale*	25 %
Alsike Clover	*Trifolium hybridum*	15 %
Timothy	*Phleum pratense*	14 %
Kentucky Bluegrass	*Poa pratensis*	12 %
Common Plantain	*Plantago major*	8 %
Yellow Sweet-clover	*Melilotus officinalis*	8 %
Annual Hawk's-beard	*Crepis tectorum*	8 %
White Sweet-clover	*Melilotus alba*	7 %
Perennial Sow-thistle*	*Sonchus arvensis*	6 %
Red Clover	*Trifolium pratense*	6 %
Awnless Brome	*Bromus inermis*	6 %
White Clover	*Trifolium repens*	5 %
Creeping Thistle*	*Cirsium arvense*	5 %
Pineapple Weed	*Matricaria discoidea*	5 %
Prickly Annual Sow-thistle	*Sonchus asper*	5 %
Lamb's Quarters	*Chenopodium album*	4 %
Hemp-nettle	*Galeopsis tetrahit*	3 %
Tall Buttercup*	*Ranunculus acris*	3 %
Alfalfa	*Medicago sativa*	2 %
Black Medick	*Medicago lupulina*	2 %
Curled Dock	*Rumex crispus*	2 %
Common Ragwort	*Senecio vulgaris*	2 %
Stinkweed	*Thlaspi arvense*	2 %
Cheat Grass	*Bromus tectorum*	1 %
Common Chickweed	*Stellaria media*	1 %
Common Sainfoin	*Onobrychis viciifolia*	1 %
Creeping Bentgrass	*Agrostis stolonifera*	1 %
Creeping Buttercup	*Ranunculus repens*	1 %
Crested Wheatgrass	*Agropyron cristatum*	1 %
Flixweed	*Descurainia sophia*	1 %
Meadow Fescue	*Lolium pratense*	1 %
Orchard Grass	*Dactylis glomerata*	1 %
Prostrate Knotweed	*Polygonum aviculare*	1 %
Quackgrass	*Elymus repens*	1 %
Scentless False Mayweed	*Tripleurospermum inodorum*	1 %
Shepherd's Purse	*Capsella bursa-pastoris*	1 %
Silvery Cinquefoil	*Potentilla argentea*	1 %
Wormseed Mustard	*Erysimum cheiranthoides*	1 %

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

Species at Risk

The health of biodiversity in a region includes an assessment of species that are naturally rare or that have previously demonstrated a significant decline in abundance. These 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.

In the AOSA, there are at least 28 species considered at risk, including 6 species that are listed as threatened by the Government of Canada and/or by the Government of Alberta (Table 05). No species occurring in the AOSA is listed as "endangered." The current ABMI monitoring system successfully tracks half of these species.

The ABMI cannot assess the status of all species at risk 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 yet designed to monitor some species groups, such as amphibians, owls, and waterfowl, which include some species at risk. The ABMI is partnering with the Ecological Monitoring Committee for the Lower Athabasca (EMCLA)** to enhance monitoring of rare plants and animals in northeastern Alberta, including federally listed species.

BLACK-THROATED GREEN WARBLERS, A SPECIES LISTED AS "SENSITIVE" IN ALBERTA, ARE MOST OFTEN FOUND IN OLDER CONIFEROUS OR MIXEDWOOD FORESTS, ESPECIALLY IF THERE ARE LARGE WHITE SPRUCE TREES PRESENT. WHITE SPRUCE TREES ARE PREFERRED FORAGING SITES AND SINGING POSTS. AT 85% INTACT, THE BLACK-THROATED GREEN WARBLER WAS FOUND TO BE LESS ABUNDANT THAN WOULD BE EXPECTED IF THERE WERE NO HUMAN FOOTPRINT IN THE AOSA.

*** The EMCLA is a joint industry-government group tasked with improving the quality of wildlife and biodiversity monitoring to support regulatory monitoring requirements in northeastern Alberta.*

TABLE05

SUMMARY OF SPECIES AT RISK IN THE AOSA. ARROWS INDICATE WHETHER THE SPECIES IS AN INCREASER (UP LIGHT ARROW = MORE ABUNDANT THAN EXPECTED) OR A DECREASER (DOWN DARK ARROW = LESS ABUNDANT THAN EXPECTED)

	Common Name	Federal or Provincial Designation	ABMI Assessment in AOSA		Percentage of ABMI Sites Where Detected
Mammals	Northern Myotis	Data Deficient - AB ESCC May Be at Risk - ESRD			Not assessed by ABMI
	Wolverine	Data Deficient - AB ESCC May Be at Risk - ESRD			Not assessed by ABMI
	Woodland Caribou	Threatened - AB ESCC, Wildlife Act At Risk - ESRD Special Concern - COSEWIC Threatened - SARA			Not assessed by ABMI
Fish	Arctic Grayling	Special Concern - AB ESCC Sensitive - ESRD			Not assessed by ABMI
Amphibians	Canadian Toad	Data Deficient - AB ESCC May Be at Risk - ESRD			Not assessed by ABMI
	Western Toad (Boreal Toad)	Sensitive - ESRD Special Concern - COSEWIC, SARA			Not assessed by ABMI
Birds	Common Nighthawk	Sensitive - ESRD Threatened - COSEWIC, SARA			Not assessed by ABMI
	Peregrine Falcon	Threatened - Wildlife Act, AB ESCC At Risk - ESRD Not at Risk - COSEWIC			Not assessed by ABMI
	Trumpeter Swan	Threatened - Wildlife Act, AB ESCC At Risk - ESRD Not at Risk - COSEWIC			Not assessed by ABMI
	Yellow Rail	Undetermined - ESRD Special Concern - COSEWIC, SARA			Not assessed by ABMI
	Barred Owl	Special Concern - AB ESCC Sensitive - ESRD			Not assessed by ABMI
	Horned Grebe	Sensitive - ESRD Special Concern - COSEWIC			Not assessed by ABMI
	Western Grebe	Special Concern - AB ESCC Sensitive - ESRD			Not assessed by ABMI
	White-winged Scoter	Special Concern - AB ESCC Sensitive - ESRD			Not assessed by ABMI
	Bay-breasted Warbler	Sensitive - ESRD In Process - AB ESCC 2010	97% Intact	^	15
	Black-throated Green Warbler	Sensitive - ESRD Species of Special Concern -AB ESCC 2010	85% Intact	v	4
	Brown Creeper	Sensitive – ESRD	81% Intact	v	10
	Canada Warbler	Sensitive - ESRD Threatened - COSEWIC Threatened - SARA	99% Intact	v	10
	Cape May Warbler	Sensitive - ESRD In Process - AB ESCC 2010	96% Intact	v	26
	Common Yellowthroat	Sensitive – ESRD	95% Intact	^	36
	Least Flycatcher	Sensitive – ESRD	93% Intact	v	44
	Olive-sided Flycatcher	ESRD - May Be at Risk Threatened - COSEWIC Threatened - SARA	99% Intact	^	17
	Pileated Woodpecker	Sensitive – ESRD	87% Intact	^	22
	Rusty Blackbird	Sensitive - ESRD | Special Concern - COSEWIC Special Concern - SARA	99% Intact	^	6
	Sora	Sensitive – ESRD	95% Intact	^	11
	Western Tanager	Sensitive – ESRD	96% Intact	v	36
	Western Wood Pewee	Sensitive – ESRD	90% Intact		14
	Yellow-bellied Flycatcher	Undetermined - ESRD	91% Intact	v	10

† Threat categories for species at risk as identified by the Government of Canada and/or the Government of Alberta. This assessment includes species and sub-species identified by Canada's Committee on the Status of Endangered Wildlife in Canada (COSEWIC), listed under Canada's Species at Risk Act (SARA), recognized by Alberta's Ministry of Environment and Sustainable Resource Development (ESRD), and/or identified by Alberta's Endangered Species Conservation Committee (AB ESCC)

SPECIES SPOTLIGHT

Woodland Caribou

The Woodland Caribou has the highest public profile of any species at risk that occurs in the AOSA. While the ABMI does not detect this species often enough to independently assess its status, comprehensive monitoring by the Alberta Caribou Committee, and now the Alberta Ministry of ESRD, has been in place for many caribou populations since 1993. The Government of Alberta 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. Only the Boreal Caribou is located in the AOSA with six populations occurring in and around this region (Figure 11):

- *Red Earth*
- *Richardson*
- *West-side Athabasca*
- *East-side Athabasca*
- *Nipisi*
- *Cold Lake*

Although the exact number of caribou in each of these six populations remains uncertain, the best available scientific evidence indicates that the populations have been consistently declining over the past 20 years. During that time period, the estimated rates of change for the populations range from -4.6 to -15.1% per year (Figure 12).

Recent genetic science suggests that the six populations in the AOSA are indistinguishable from one another.[12] However, these six populations are genetically distinct from other Boreal Caribou populations north and west of the Peace River and from those located in west-central Alberta. It is therefore unlikely that the AOSA populations will gain new members from caribou populations in other parts of the province.

The ABMI supports caribou management by working with the Alberta 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 AOSA, and to produce a seamless, province-wide habitat quality map.

Human Footprint in Woodland Caribou Population Ranges

Tracking the amount of human footprint and native habitat is important for the effective management of Woodland Caribou in the AOSA. Managing the rate of human land-use development is a key management tool relevant to caribou policy, decision making, and recovery. The ABMI provides scientific information on status and trend of human footprint for the province of Alberta, including the six population ranges that overlap with the AOSA.

In 2010, the total amount of human footprint in each of the six Woodland Caribou population ranges varied from a low of < 1% in the Richardson range to a high of over 7% in the Nipisi range (Table 06). The greatest net change in human footprint from 2007 to 2010 occurred in the Nipisi range with an increase of 1.26% total footprint.

TABLE 06

HUMAN FOOTPRINT IN SIX WOODLAND CARIBOU RANGES CIRCA 2007 AND 2010 IN AND AROUND THE AOSA

Woodland Caribou Range in Alberta	Total Area of Range (km²)	2007 Total Human Footprint	2010 Total Human Footprint	Change in Human Footprint (2007 to 2010)	Rate of Change in Human Footprint
Red Earth	24,700	2.75 %	2.81 %	0.06 %	2.1 %
Richardson	7,070	0.75 %	0.86 %	0.11 %	15.8 %
West-side Athabasca	15,700	2.09 %	2.41 %	0.32 %	15.8 %
East-side Athabasca	13,200	4.81 %	5.27 %	0.46 %	9.6 %
Nipisi	2,100	5.97 %	7.23 %	1.26 %	21.1 %
Cold Lake	6,730	2.81 %	3.28 %	0.47 %	16.5 %

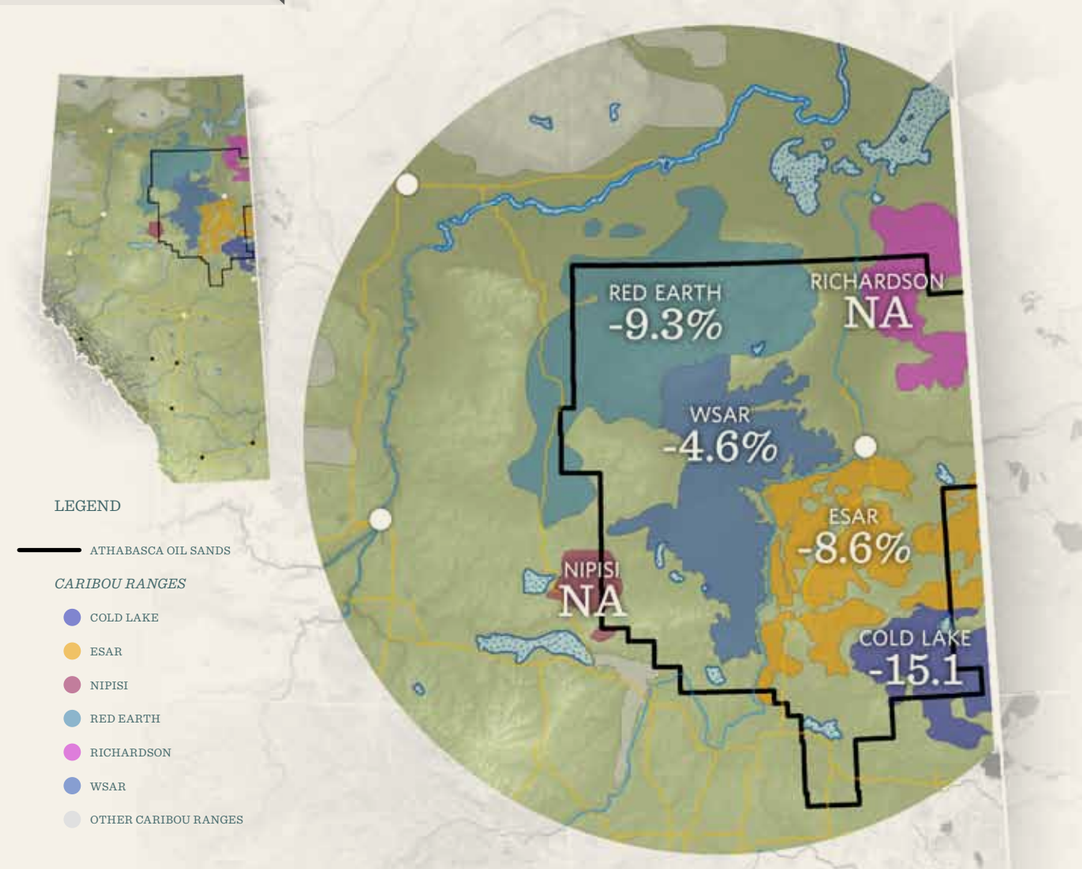


FIGURE 11

SIX BOREAL CARIBOU POPULATIONS THAT ARE COMPLETELY OR PARTIALLY COINCIDENTAL WITH THE AOSA.

FIGURE 12

AVERAGE ESTIMATED ANNUAL RATE OF CHANGE FOR SIX WOODLAND CARIBOU POPULATIONS THAT ARE COMPLETELY OR PARTIALLY COINCIDENTAL WITH THE AOSA

Reclamation in the AOSA

Reclamation is a critical part of sustainable oil sands development. It is the process of returning a developed site to a natural or semi-natural condition (termed "equivalent land capability"[13] by the Government of Alberta). Industry is legally required to reclaim developed sites following the extraction of energy resources; reclamation is the final step in the life cycle of energy development in the oil sands.

Land reclamation is currently not keeping pace with development. In 2011, the active footprint of oil sands mining activities covered just over 76,000 ha.[14] Of this footprint, 104 ha (0.14%) has been certified as reclaimed and returned to the Crown as public land; a further 4,700 ha (6.2%) has been permanently reclaimed, but ongoing monitoring of ecological recovery of this land is required before an application for reclamation certification can be made.[14]

In areas where surface mining has occurred, reclaiming an area that has been stripped of soil, wetlands, forests, and all associated biodiversity poses many challenges. Reclamation of energy development sites outside of the Mineable Region, which is nearly 30 times larger, is technically less challenging, but no less important.

Clearly, successful reclamation of the surface mines and the in-situ footprint is an important part of the long-term environmental sustainability of Alberta's oil sands regions. Currently, however, there are differing ideas about what constitutes successful reclamation; furthermore, there's a great deal of uncertainty around which ecosystems can be completely reclaimed.[e.g.15] The science of reclamation continues to develop. Monitoring reclamation efforts and applying corrective measures using ecologically appropriate knowledge increases the probability that sites will be successfully reclaimed.

The ABMI is currently developing an integrated, scientifically robust and financially sustainable reclamation monitoring program to track the long-term ecological recovery of Alberta's reclaimed upstream oil and gas facilities.

Conclusion

There is a duty to ensure that resource development in the AOSA is happening in a manner that is environmentally acceptable to Albertans and to more distant consumers and investors. Decisions regarding the acceptability of future development in the AOSA requires a clear understanding of the environmental costs linked to the continued expansion of energy infrastructure. The biodiversity indicators set out in this report establish the current conditions that will be used to help judge future success or failure of sustainable resource development. This report sets the stage for openly addressing questions including:

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

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

3. What contribution are reclamation efforts or offset schemes making toward biodiversity maintenance?

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

5. What is the impact of energy development on biodiversity as compared to other land uses, such as forestry?

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

Beyond the scientific information provided by the ABMI, determining how to respond to changes in biodiversity also includes consideration of economic, cultural, and political values, as well as legal and regulatory requirements. In the face of development, stakeholders and decision makers must decide what level of risk is acceptable and how to manage this risk.

With the AOSA 94% intact today, there's still significant opportunity 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 biodiversity.

Next Steps

The ABMI will continue to work with federal and provincial agencies to implement scientifically credible monitoring systems for the oil sands and for the province as a whole. 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 AOSA have been sampled. As monitoring information for the AOSA accumulates and our analysis methods continually improve, the ABMI will report on more species and habitats. In coming years, similar reports will be available for the Peace River Oil Sands Area and the Cold Lake Oil Sands Area. 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 monitoring program is designed primarily to be a proactive system to measure the status and trends of common species, habitat, and human footprint in Alberta, as well as determine the correlative relationships among these factors. The status and trends of most rare and endangered species and habitats are not yet directly evaluated by the ABMI monitoring program.

The ABMI biodiversity indices are based on the estimation of current, intact reference conditions that are model predictions designed to statistically remove effects attributed to 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 AOSA.

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*

The legacy created through the development of the ABMI is enormous. We are committed to continued excellence in biodiversity monitoring.

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 http://www.sigmaxi.org/programs/ethics/Honor-in-Science.pdf. A broader discussion about the use of ABMI data and information can be found in *Scope and Application of the ABMI's Data and Information* (00048), Version 2008-01-04, Alberta Biodiversity Monitoring Institute, Alberta, Canada. This report is also available at www.abmi.ca under "Reports/Core Reports."

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:

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."

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Terms and Conditions of Report

Preparation

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

1. The ABMI reports on a standardized list of biodiversity indicators that are relevant to regional planning, policy, and management. Developed by the ABMI, these indicators will be consistently applied.
2. The ABMI maintains full control over all language and messaging in this report.
3. This biodiversity status report encompasses the AOSA and cannot be localized to smaller landscapes within the AOSA 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

p.11: coyote, credit: Chris Martin / p.12-13: boreal landscape, credit: Shawn Milne / p.12-13: surface mining, credit: Pembina Institute / p.26: Diana's Undulate Roamer, credit: D.E. Walter / p.28: bog cranberry, credit: Wayne Lynch / p.30: creeping thistle, credit: Ivar Leidus / p.34: caribou, credit Chris Kolaczan / p.36: Reclamation photograph, credit: Sonya Poller

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