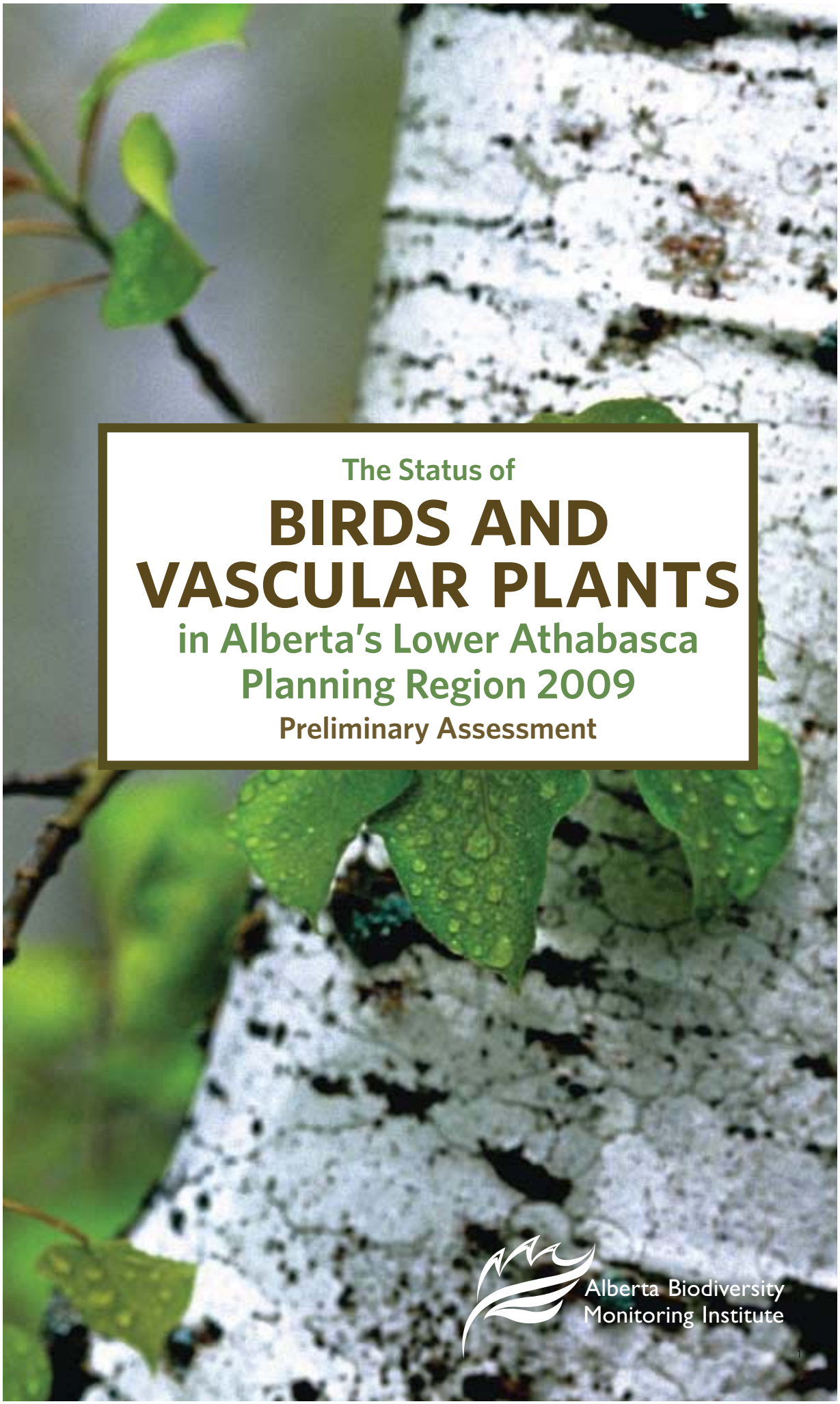

The Status of

BIRDS AND VASCULAR PLANTS

in Alberta's Lower Athabasca Planning Region 2009

Preliminary Assessment

Alberta Biodiversity Monitoring Institute

Headlines

Alberta's Lower Athabasca Planning Region is a vast area that is the same size as Portugal or the State of Maine. This region supplies billions of dollars annually in ecological services including the provisioning of clean water and air, recreational fishing and hunting opportunities, and habitat for thousands of wildlife species. It also accounts for nearly 10% of the world's proven oil reserves and 0.5% of global pulp fibre production.

The current status of human footprint in the Lower Athabasca is benchmarked at 7%. In other words, 7% of the Lower Athabasca has been altered as a result of human development. The aggregate footprint is composed of 3% agriculture footprint, 2% energy footprint, and 2% forestry footprint.

The healthy functioning of the Lower Athabasca Planning Region depends, in part, on the more than 650 bird and plant species that live in this area. The current intactness of biodiversity in Alberta's Lower Athabasca Planning Region is preliminarily benchmarked at 94% as determined by the current status of 149 birds and plants. Thirty-nine percent of these species were equal-to or more abundant than their reference conditions while the remaining 61% were equal-to or less abundant than their reference conditions. In general, this information indicates that the average abundance of birds and vascular plants in the Lower Athabasca departs from intact reference conditions by 6%.

As land-use planning in Alberta rolls out, the status of birds and plants is being used to set regional ecological benchmarks and objectives, and to provide the foundation for evaluating the future outcomes of resource management in the region.

Over the next few years, the Alberta Biodiversity Monitoring Institute will broaden the assessment of biodiversity in the Lower Athabasca to include the status of lichens, mosses, soil arthropods, fungi, wetland invertebrates, habitat quality, and other measures. These same assessments will be available for all other planning regions as well as customized regions throughout the province.

Disclosure

Data used in the preparation of this report are available at the ABMI website and include breeding bird, vascular plant, ecosite, and remotely-sensed data collected between 2003 and 2007. A comprehensive description of the scientific methods used in analyses of data for this report is provided in: Alberta Biodiversity Monitoring Institute. 2008. Manual for Estimating Biodiversity Intactness for Species (20029), Version 2008-12-23. Alberta Biodiversity Monitoring Institute, Alberta, Canada. Report available at: abmi.ca [February 1, 2009].

Jim Herbers was the principle author of this report. David Huggard and Gillian Holloway were responsible for data analysis and helped in interpretation. Jim Schieck, Erin Bayne, Stan Boutin, Katherine Maxcy, and Carrie Holcapek provided technical and editorial insight.

Image Credits

Suggested Citation

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Published February 2009.

The Status of BIRDS AND VASCULAR PLANTS in Alberta's Lower Athabasca Planning Region 2009

Preliminary Assessment

Contents

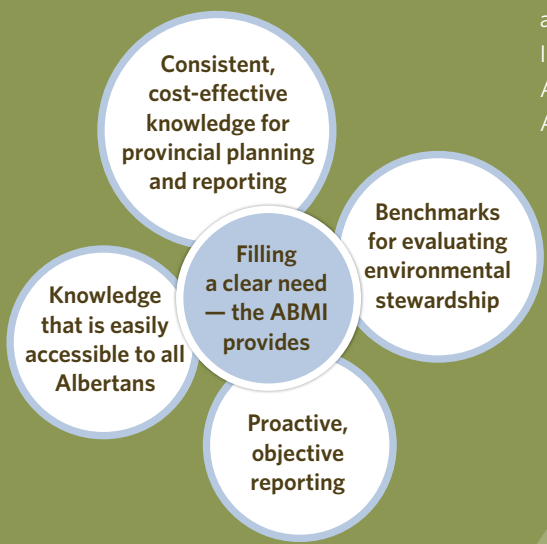
The Alberta Biodiversity Monitoring Institute

WORLD-CLASS MONITORING SYSTEM FOR ALBERTANS

Albertans are familiar with a range of well-accepted indicators that describe the condition of our economy and others that measure the state of our health. There are no such broadly-accepted indicators to describe the condition of the province's lands, waters, and living resources.

The Alberta Biodiversity Monitoring Institute (ABMI) monitoring program is a world-class system designed to measure and report on the state of land, water, and living resources across the province. Using scientifically-credible indicators of environmental health, the ABMI measures and reports on more than 2000 species and habitats using information collected from 1656 sites across the province (Figure 1). Data and knowledge generated by the ABMI are value-neutral, independent, and publicly accessible.

The ABMI provides comprehensive indicators that act as a common yardstick for establishing clear management goals as well as tracking performance against those goals.



ABOUT THIS REPORT

This report is a brief summary of breeding birds and plants in the Lower Athabasca. It is not designed to be comprehensive; rather, it highlights some data available from the ABMI while also demonstrating the range of information that is provided by the ABMI. In the near future, Albertans will be able to explore this and other biodiversity information in greater detail on our website.

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 Institute 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).

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. Report available at: abmi.ca.

Understanding and Applying ABMI Indices

It is important to understand the strengths and limitations of the ABMI's biodiversity indices and how they can be interpreted and applied.

THE INDICES

The ABMI uses two indices in this report. The Species Index is used to report on the intactness of birds and plants while the Human Footprint Index is used to report on the extent of human footprint.

1. SPECIES INDEX

Using the Species Index, the ABMI reports on the state of species by determining how far the abundance of each species departs from reference conditions. Reference conditions can be generally thought of as the condition of a species in landscapes with little human footprint (e.g., parks and protected areas). These reference conditions are predictions that statistically remove human footprint, and they do not account for historic changes in a species' overall abundance. Put another way, the Species Index identifies species that are most sensitive to human footprint, not those that have increased or decreased from historical conditions. The ABMI's Species Index ranges from 100% (high intactness) to 0% (low intactness).

High Intactness = Low Ecological Risk
Species that are near 100% intact show little change in abundance from their reference condition and have lower ecological risk.

Low Intactness = High Ecological Risk
Species that are near 0% intact show an extreme change in abundance from their reference condition and have higher ecological risk.

The species index declines from 100% toward 0% when common species become rare or absent from a region. The index also declines from 100% toward 0% when weedy species become very common in a region. Species becoming less abundant or more abundant than reference conditions both represent ecological risk.

SPECIES GUILDS AND STATISTICAL UNCERTAINTY

The ABMI index for guilds is a statistical estimate that averages the status of individual species. With most statistical estimates, uncertainty "cancels out," so that the estimated average is approximately correct. However, because our intactness index declines in both directions away from the reference condition, this cancelling out does not happen. As a result the statistical uncertainty has created a downward bias in our estimate of average intactness for guilds of species.

We use a statistical technique called "randomization" to figure out how big this bias is for each group of species, and remove the bias from the average intactness score. We present these corrected average scores for groups of species in our reports. This is our best estimate of the true average intactness of a group of species, without the bias due to statistical uncertainty.

2. HUMAN FOOTPRINT INDEX

The ABMI reports on the extent of human footprint by determining the area of land altered by human activities. The human land-use index is expressed as a percentage where 100% represents a landscape completely modified by human footprint and 0% represents no human footprint. In general, cities will have a high human footprint value while protected areas will have a lower index value.

Ecological Risk

Ecological risk is high when intactness values for species (or groups of species) are low. This risk takes two principle forms.

Ecological risk increases when intactness values for species (or groups of species) move toward 0%. Ecological risk takes two principle forms:

ABOVE REFERENCE

Species that are above reference conditions (i.e., abundance is higher than the reference condition) are unlikely to be lost from the province or region. However, these species may be the target of eradication or harm reduction management programs (e.g., weeds).

In some cases, species that are above reference conditions are "drivers" of environmental change and degrade the broader aspects of biodiversity by outcompeting less common species.

In other cases, species that are above reference conditions are "passengers" in environmental change. These species are simply taking advantage of changing environmental conditions and are less likely to represent an acute ecological risk compared to "drivers" of environmental change.

It is not always straightforward to determine if a species is a "driver" or "passenger." Take the example of the non-native plant Creeping Thistle. By definition, this invasive species has an abundance that exceeds reference conditions across most of Alberta. However, it is not always clear if this species presents a direct ecological risk to native biodiversity or if it is simply capitalizing on current management practices.

BELOW REFERENCE

Species that are below reference conditions (i.e., abundance is lower than the reference condition) may have direct conservation concerns associated with them. That is, the species itself may be at higher risk of becoming uncommon or lost from the province or region. These elements of biodiversity are often responding to changing environmental conditions.

DETERMINING IMPLICATIONS AND PRIORITIES

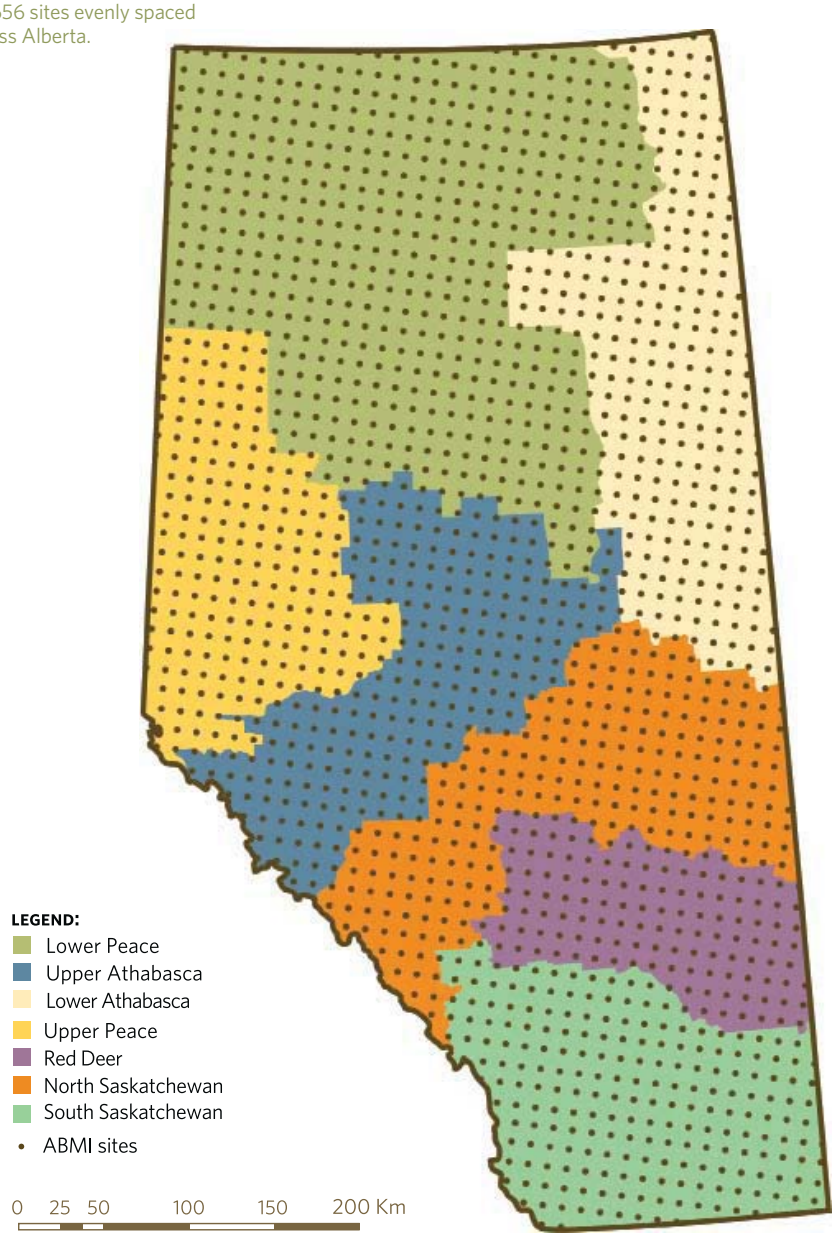
Deciding if and how to respond to changes in species' intactness requires consideration of the current intactness value, the degree of confidence in the intactness value, and an understanding of the magnitude and immediacy of ecological risk. Management attention is most likely to be prioritized toward species that present significant and immediate ecological risk.

Using the Species Index to interpret change in species abundance — a practical guide

Intactness Value	Above Reference	Below Reference
90%	abundance 11% above reference conditions	abundance 10% below reference conditions
50%	abundance 100% above reference conditions	abundance 50% below reference conditions
20%	abundance 500% above reference conditions	abundance 80% below reference conditions

Figure 1 **ABMI Survey Locations**

The ABMI surveys biodiversity at 1656 sites evenly spaced across Alberta.



The Status of Birds and Vascular Plants in the Lower Athabasca

The Lower Athabasca Planning Region (Lower Athabasca; Figure 2) encompasses 93,458 km^2 in north-eastern Alberta; comparatively, this region is three times the size of Vancouver Island and about the same size as the country of Portugal or the State of Maine. This area contains 14% of Alberta's land area, 25% of Alberta's Boreal Ecosystem, and 13% of Canada's Boreal Plains Ecosystem.

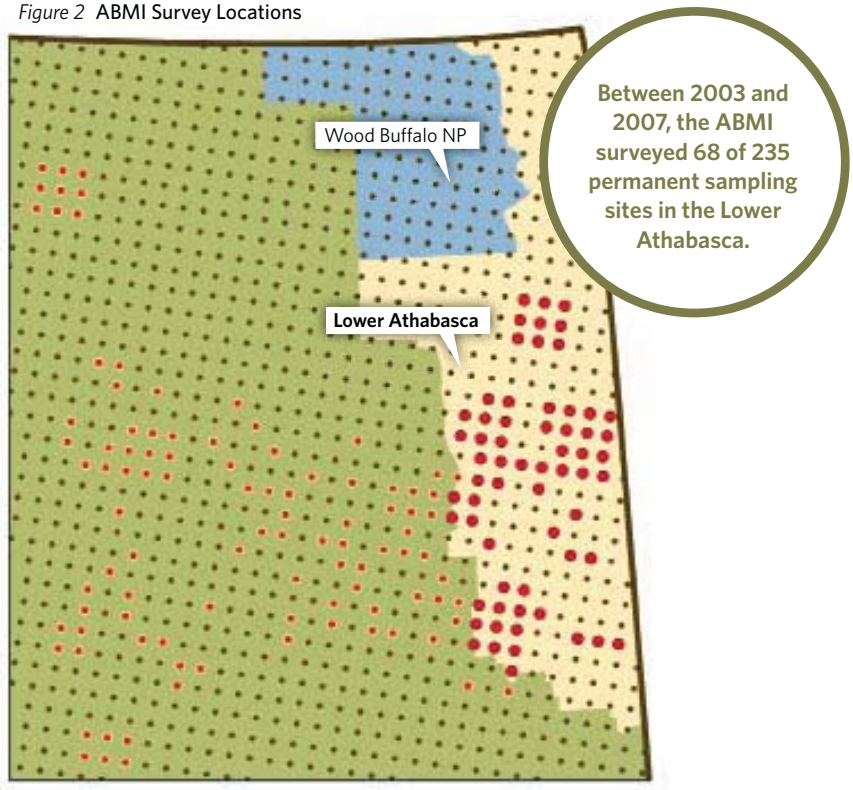
The Lower Athabasca is largely composed of Alberta's Central Mixedwood Natural Sub-region. Wet, poorly drained fens and bogs overlie much of the area while upland terrain is characterized by a mix of aspen-dominated deciduous forests, aspen-white spruce forests, white spruce, and jack pine stands.

The Lower Athabasca accounts for nearly 10% of the world's proven oil reserves and currently produces 1% of the global oil supply. It is expected to produce 3% of global supply by 2020. The Lower Athabasca also accounts for the production of nearly 0.5% of global pulp fibre production.

The human population in the Lower Athabasca is largely concentrated in the cities of Fort McMurray and Lac La Biche. The population is projected to exceed 100,000 by 2010.

The economic and social well-being of Alberta is closely linked to the ecological health of this vast environment.

Figure 2 **ABMI Survey Locations**



Human Footprint in the Lower Athabasca

Industrial, municipal, and recreational activities in the Lower Athabasca have the largest impact on biodiversity in the region. Understanding the current status of human footprint enables Albertans to set clear outcomes around how they wish development to unfold in the Lower Athabasca.

Based on the measurement of 23 human footprint variables at 235 permanent sampling plots in the Lower Athabasca, the current status of human footprint in the region is benchmarked at 7% (90% confidence interval [CI] ±1%). In other words, 7% of the landscape in the Lower Athabasca has been altered as a result of human development.

Subdivided, this aggregate footprint is composed of 3% agriculture, 2% energy, and 2% forestry footprint.

Seven percent of the landscape in the Lower Athabasca has been altered by human activities including agriculture, energy, and forestry operations.

Agricultural operations in the Lower Athabasca are concentrated in the far south of this planning region particularly in the southern half of the County of Lac La Biche and M. D. of Bonnyville. Agricultural operations are dominated by the production of alfalfa, oats, and barley.

Energy and forestry operations are diffused throughout much of the southern half of this region, principally ranging from Fort McKay to Lac La Biche. North of Fort MacKay, the energy and forestry footprints are 0.9% and 0.5% respectively.

Across the Lower Athabasca, the dominant energy footprint is seismic lines while the dominant forestry footprint is recent clearcuts.

The average density of linear features throughout the region is 1.3 km/km^2.

The type, rate, amount, and distribution of human footprint are all important in determining regional sustainability for the Lower Athabasca. Along with the Species Index, the Human Footprint Index can be used to set clear regional benchmarks and objectives, and to provide the foundation for evaluating future outcomes as resource management unfolds throughout the region.

BIODIVERSITY INDICATORS IN THIS REPORT

Every year, the ABMI monitors thousands of species representing 14 major indicator groups. Two of these indicator groups are breeding birds and vascular plants. These two groups represent distinctly different aspects of biodiversity. Feeding primarily on vegetation and insects, birds are highly mobile species that play an important role in pollination and seed dispersal. In contrast, vascular plants are non-mobile primary producers that play a significant role in carbon sequestration and nutrient cycling. Both groups are important indicators of the ecological health of the Lower Athabasca.

This report describes the status of common birds and plants in the Lower Athabasca. In order to be considered common, bird species had to occur at more than 15% of ABMI sites surveyed while plants had to occur at more than 10% of sites surveyed.

Every year, the ABMI monitors thousands of species representing 14 major indicator groups.

Intactness of Biodiversity in the Lower Athabasca

More than 150 species of birds and 500 species of vascular plants live in the Lower Athabasca. Based on the measurement of 52 birds and 97 vascular plants at 68 of 235 permanent sampling plots, the preliminary intactness of biodiversity in the Lower Athabasca is benchmarked at 94%. Thirty-nine percent of all species in the Lower Athabasca are equal-to or more abundant than their reference conditions while the remaining 61% of species are equal-to or less abundant than their reference conditions. The most extreme intactness values are consistently associated with species that exceed reference conditions (e.g., American Crow, American Robin, Alsike Clover, and Common Dandelion). In other words, the strongest ecological responses in the Lower Athabasca are linked to an increase in the abundance of weedy species or species that benefit from increasing human footprint.

This information indicates that the average abundance of birds and vascular plants in the Lower Athabasca departs from intact reference conditions by 6%. Most of this departure from reference conditions is associated with increases in common weedy species.

Albertans also want to know how different human footprint types impact the status of biodiversity. Understanding of these relationships is used to help resource managers predict the impact of human development on biodiversity. However, ABMI data in the Lower Athabasca region is not yet sufficient to determine conclusive relationships (correlations) between individual human footprints types (e.g., urbanization, energy development, or forestry) and biodiversity (plants and birds in this example). These relationships will be assessed in future reports.

Though preliminary, this report establishes the regional baseline of two ecologically and socially important components of biodiversity. As land-use planning in Alberta gains momentum, this knowledge can be used to set regional ecological goals and objectives, and serve as the foundation for evaluating outcomes of resource management in the Lower Athabasca.

The Common Blueberry was observed at 61% of sites surveyed in the Lower Athabasca Planning Region.

Birds in the Lower Athabasca

More than 150 species of birds live in Alberta's Lower Athabasca. Based on the measurement of 52 bird species at 68 of 235 permanent sampling plots in the Lower Athabasca, the current intactness of birds in the Lower Athabasca is preliminarily benchmarked at 95% (Figure 3). Forty-four percent of bird species are equal-to or more abundant than their reference conditions and the remaining 56% of species are equal-to or less abundant than their reference conditions. The most extreme departures from intact reference conditions are consistently related to species that are above reference conditions.

The American Crow was observed at 20% of sites surveyed in the Lower Athabasca Planning Region.

Figure 3 **Intactness of Birds in the Lower Athabasca**

The status (+ or - 90% CI) of 52 bird species in the Lower Athabasca measured at 68 locations between 2003 and 2007. The overall intactness value for breeding birds in the Lower Athabasca is 95%. Individually, 23 species show a positive relationship to human footprint (i.e., above reference) and 29 species show a negative relationship to human footprint (i.e., below reference). The American Crow (16% intactness) and the American Robin (48%) are more abundant than reference conditions while the Rose-breasted Grosbeak (72%) is less abundant than reference conditions. This figure shows bird species that occurred at 15% or more of the ABMI sites surveyed. The current ABMI Human Footprint Index (HFI) for the Lower Athabasca is 7%.

On average, this information indicates that the abundance of birds in the Lower Athabasca departs from intact reference conditions by 5%.

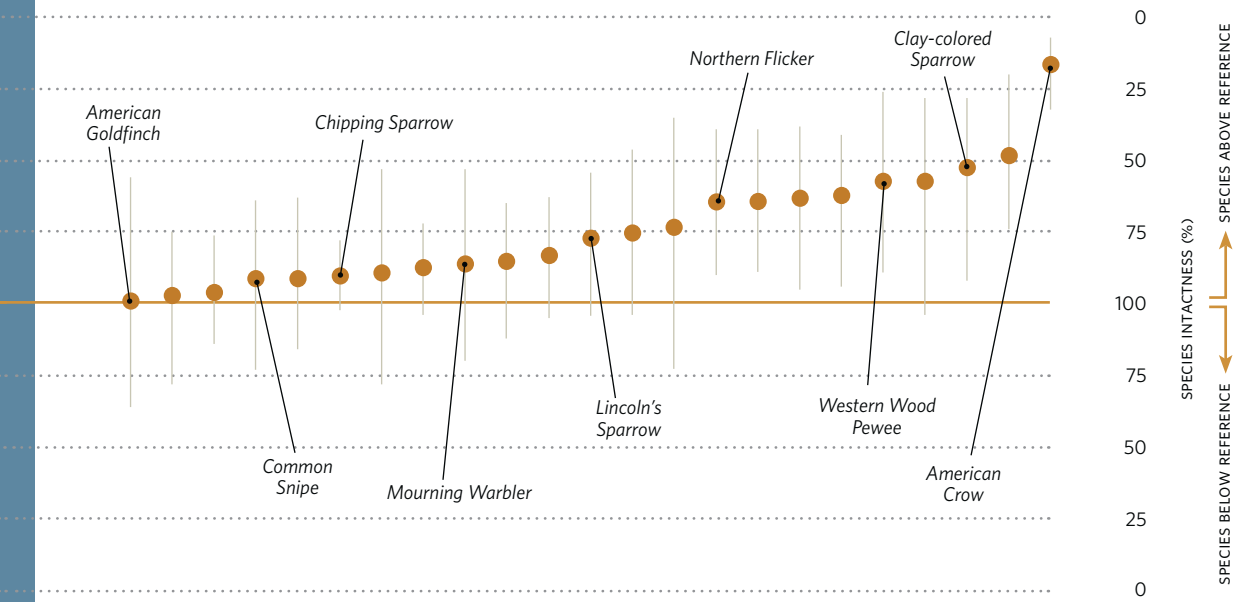
Highest ecological risk appears to be associated with five bird species in the Lower Athabasca (Table 1). Of these, the American Crow exceeds its reference conditions by sixfold while the American Robin is two times more abundant than its reference conditions. Across the Lower Athabasca, the American Crow had an average relative abundance of 0.82 birds per site compared to the reference condition of 0.13 per site. Similarly, the American Robin averages one bird per site compared to a reference condition of 0.48 per site. As these species increase in abundance, they may represent higher ecological risk to the region through processes such as nest predation and resource competition.

In the lower Athabasca, only one bird species tracked by the ABMI has an abundance lower than 25% of its reference conditions (the Rose-breasted Grosbeak); further, all of the species that are below their reference conditions have confidence intervals overlapping 100% intact (Figure 3). Overall, none of the common breeding birds monitored by the ABMI appear to be significantly below reference conditions.

Table 1 Ecological risk appears highest for five species of breeding birds in the Lower Athabasca which all have an abundance that is above reference conditions. These species all increase in abundance as human footprint increases.

Above Reference

Species	Intactness
Western Wood Pewee	57
Red-winged Blackbird	57
Clay-colored Sparrow	52
American Robin	48
American Crow	16



Old-Growth Birds in the Lower Athabasca

Alberta's old-growth forests contain large trees and highly merchantable timber. These forests also provide high value habitat for a number of forest-dwelling species. As a result, old forest species are often used as indicators in land-use planning.

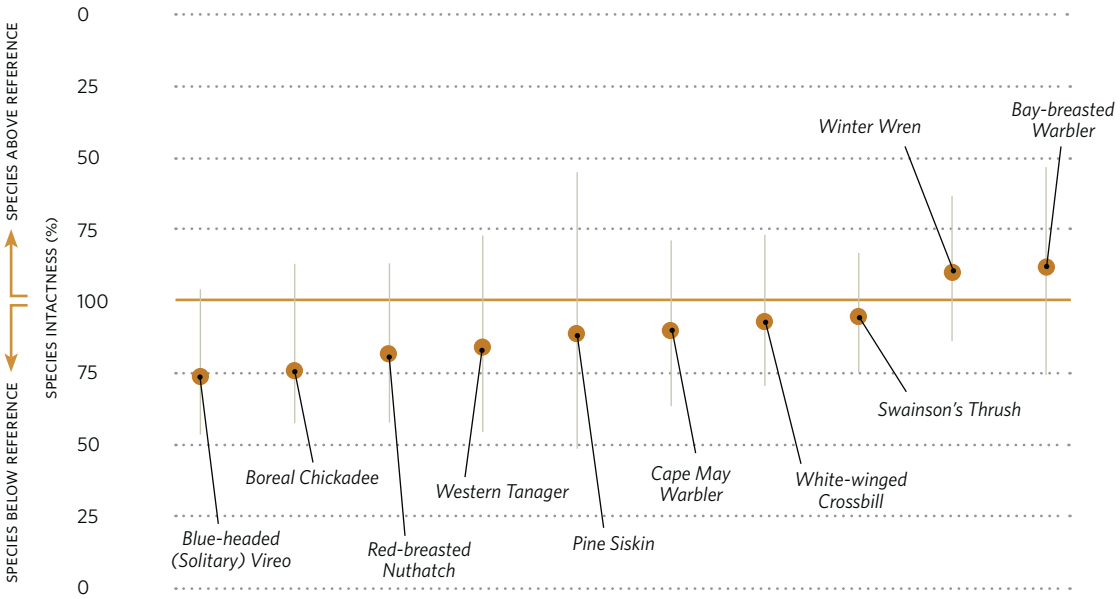
Based on the measurement of ten bird species, the intactness of old-growth dependent species (i.e., species strongly associated with forests greater than 80 years old) in the Lower Athabasca is preliminarily benchmarked at 96% (Figure 4).

These species have an intactness value between 75% and 100% and all have confidence intervals overlapping 100% intact.

Drilling into detail — the ABMI provides knowledge on the state of hundreds of groups (guilds) of indicator species. Obligate old-growth birds represents one example.

Figure 4 Intactness of Old-Growth Birds in the Lower Athabasca

The status (+ or - 90% CI) of ten old-growth bird species in the Lower Athabasca measured at 68 locations between 2003 and 2007. The overall status of old-growth birds in the Lower Athabasca is 96%. Two species are more abundant and eight less abundant compared to reference conditions. This figure shows old-growth bird species that occurred at 15% or more of the ABMI sites surveyed. The current ABMI Human Footprint Index (HFI) for the Lower Athabasca is 7%.



This information indicates that the average abundance of old-growth forest birds in the Lower Athabasca departs from intact reference conditions by 4%.

Of the old-growth species, the Blue-headed Vireo (formerly Solitary Vireo; 75% intactness) shows the strongest departure from intact reference conditions. The Blue-headed Vireo was detected at 30% of all sites surveyed and is 25% less abundant than reference conditions predicted. However, the wide confidence intervals associated with this species indicate that this finding should be cautiously interpreted.

The Blue-headed Vireo was observed at 30% of sites surveyed in the Lower Athabasca Planning Region.

Vascular Plants in the Lower Athabasca

More than 500 vascular plant species live in Alberta's Lower Athabasca. Based on the measurement of 97 species, the preliminary intactness of vascular plants in the Lower Athabasca is benchmarked at 94% (Figure 5). Thirty-six percent of vascular plant species are equal-to or more abundant than their reference conditions and the remaining 64% of species are equal-to or less abundant than their reference conditions. As with birds, the most extreme departures from intact reference conditions in vascular plants are consistently related to species that are above reference conditions.

Table 2 Ecological risk appears highest for six species of vascular plants in the Lower Athabasca Planning Region. These species show a strong response to human footprint with species that are below reference having lower-than-expected abundance and species that are above reference having higher-than-expected abundance.

Above Reference

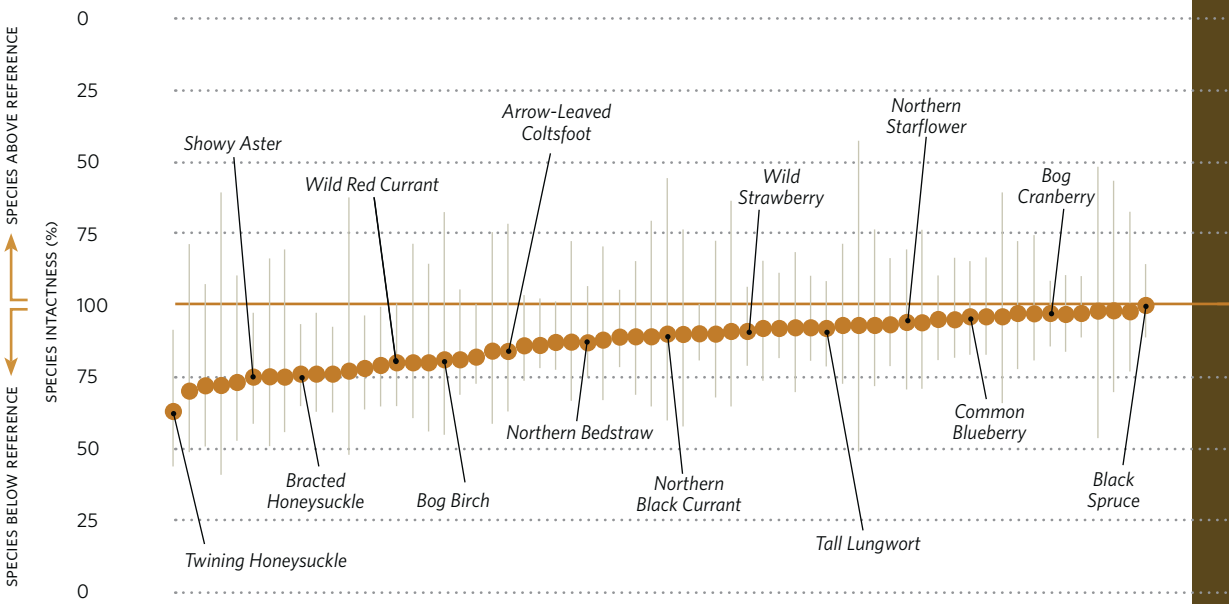
Species	Intactness
Common Dandelion	51
Flat-leaved Willow	45
Alsike Clover	10

Below Reference

Species	Intactness
Bracted Honeysuckle	76
Showy Aster	75
Twining Honeysuckle	63

Figure 5 **Intactness of Vascular Plants in the Lower Athabasca**

The status (+ or - 90% CI) of 97 vascular plant species in the Lower Athabasca measured at 68 locations between 2003 and 2007. The overall status of vascular plants in the Lower Athabasca is 94%. Individually, 35 species are more abundant and 62 species are less abundant compared to reference conditions. Alsike Clover (10% intact) showed the strongest increase in abundance while the Twining Honeysuckle (63%) showed the strongest decrease in abundance compared to reference conditions. This figure shows vascular plant species that occurred at 10% or more of the ABMI sites surveyed. The current ABMI Human Footprint Index (HFI) for the Lower Athabasca is 7%.



This information indicates that the average relative abundance of vascular plants in the Lower Athabasca departs from intact reference conditions by 6%.

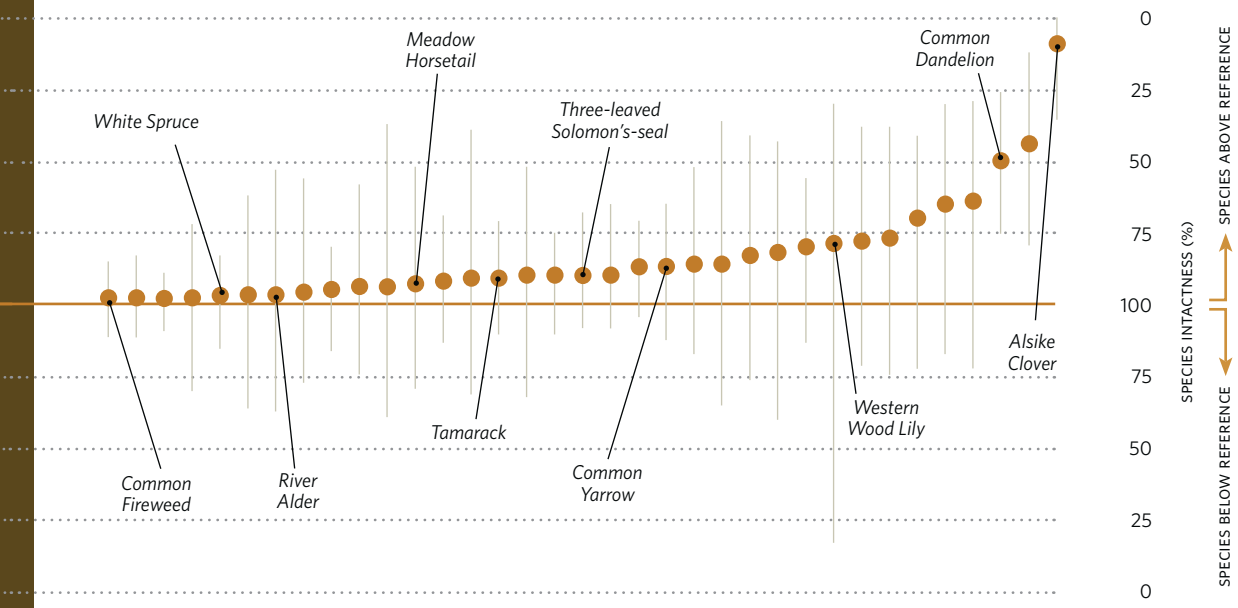
Highest ecological risk appears to be associated with six vascular plants in the Lower Athabasca (Table 2). Showing a tenfold increase over reference conditions, Alsike Clover has the strongest relationship to increasing human footprint.

Non-native species represent the second largest threat to native biological diversity and cost millions of dollars annually in lost crop productivity. Since European settlement, more than 290 non-native plants have become naturalized in Alberta. Alsike Clover and the Common Dandelion are the two most abundant non-native plants in the Lower Athabasca. Respectively, these species were found at 10% and 25% of all sites surveyed.

Although occurring at only 7% of sites (below the threshold to be formally included in this report), a preliminary assessment of Timothy (*Phleum pretense*) shows a twentyfold increase over reference conditions. Timothy is a non-native grass commonly used in forage crops and is used in the reclamation of industrial instillations such as wellsites and pipelines.

As non-native species become further established in the Lower Athabasca, competition with the native plant species is expected to intensify.

Twining Honeysuckle is a shrub that is native to Alberta and is commonly found in upland, dry forests throughout Alberta's boreal region. Globally and provincially, this species is considered secure and has a ranking of S5 (Secure) by the Alberta Natural Heritage Information Centre. Twining Honeysuckle (also known as Mountain Honeysuckle) occurred at 18% of sites surveyed and had an average relative abundance of 0.38 plants per site compared to an expected abundance of 0.60 per site in the Lower Athabasca.



Wetland Vascular Plants in the Lower Athabasca

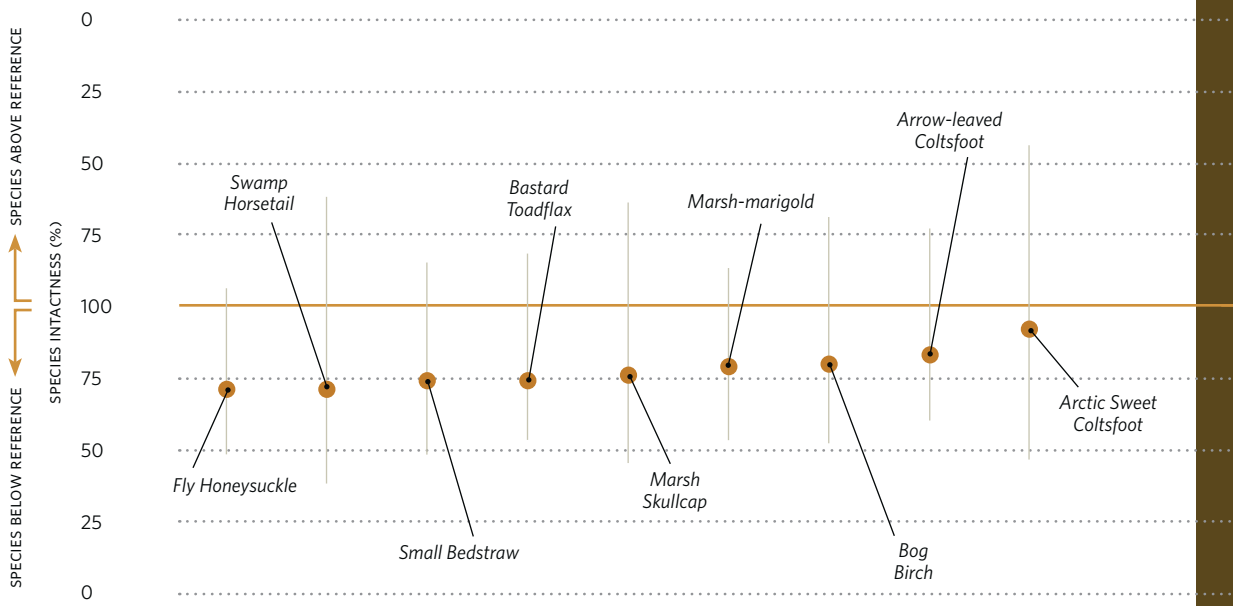
Wetlands deliver a wide range of services that contribute to the well-being of Albertans including clean and abundant water, climate regulation, flood regulation, and recreational opportunities. Vascular plants play a key role in the healthy functioning of wetlands.

Based on the measurement of 16 wetland plant species (i.e., species associated with wetlands such as marshes and ponds), the intactness of wetland species in the Lower Athabasca is preliminarily benchmarked at 91% (Figure 6). Seven wetland vascular plant species are equal-to or more abundant than their reference conditions while the remaining nine are equal-to or less abundant than their reference conditions. All but one of these species have intactness values between 70% and 100%.

Overall, this information indicates that the average relative abundance of wetland vascular plants in the Lower Athabasca departs from intact reference conditions by 9%.

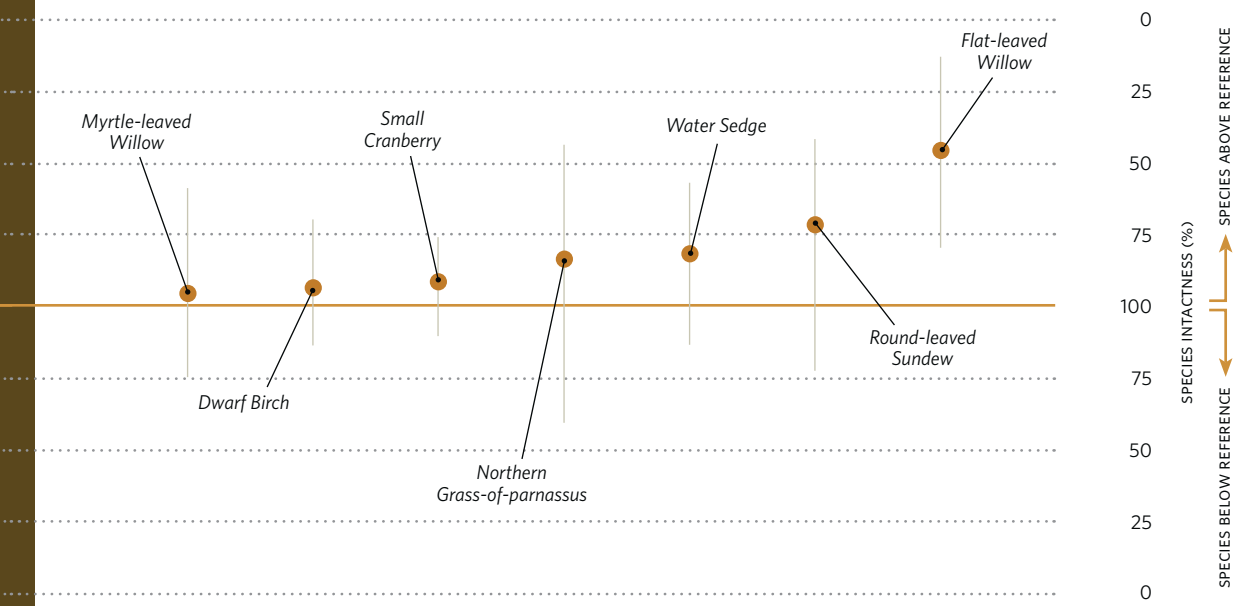
Figure 6 **Intactness of Wetland Vascular Plants in the Lower Athabasca**

The status (+ or - 90% CI) of 16 wetland vascular plant species in the Lower Athabasca measured at 68 locations between 2003 and 2007. The overall status of wetland vascular plants in the Lower Athabasca is 91%. Seven species are more abundant (i.e., above reference) and nine species are less abundant (i.e., below reference) relative to reference conditions. This figure shows only vascular plant species that occurred at 10% or more of the ABMI sites surveyed. The current ABMI Human Footprint Index (HFI) for the Lower Athabasca is 7%.



Of the 16 wetland species, ecological risk appears highest for the Flat-leaved Willow (45% intactness) in the Lower Athabasca. Globally and provincially, this species is considered secure and has a ranking of S5 (Secure) by the Alberta Natural Heritage Information Centre. The Flat-leaved Willow occurred at 15% of sites in the Lower Athabasca and showed a twofold increase over reference conditions.

Marsh-marigold was observed at 25% of the sites surveyed in the Lower Athabasca Planning Region.



Limitations

The ABMI is designed primarily as a proactive management tool — 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 effectively evaluated by the ABMI monitoring program, and thus, are not included in ABMI reporting. There are existing provincial and national systems that are specifically designed to support the management of rare and endangered species and habitats.

The ABMI Species Index is 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 historic changes in a species' overall abundance (i.e., the ABMI cannot account for any change in a species that occurred before 2003).

ABMI reference conditions have substantial statistical uncertainty for individual species as communicated through confidence intervals in the graphs. This uncertainty will decrease as the ABMI surveys more sites in the Lower Athabasca.

Looking Forward

Here we use the ABMI Species Index to report on the status of birds and vascular plants. As survey activities continue to grow, the Species Index will be used to report on the status and trends in mammals, plants, moss, lichen, fungi, and arthropods. In addition, the ABMI will use indices to determine status and trends in provincial and regional habitat and human footprint.

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

1. Ensuring the effective delivery of relevant, timely, and scientifically rigorous biodiversity information;
2. Improving biodiversity management by contributing critical knowledge to decision-making cycles (Figure 7);
3. Supporting governments and industries in meeting their domestic and international reporting obligations;
4. Eliminating duplication and redundancy in provincial biodiversity monitoring; and
5. Facilitating the seamless transfer of information to government, industry, and the research community.

The legacy created through the development of this world-class Institute is truly enormous. The ABMI is committed to continued excellence in biodiversity monitoring.

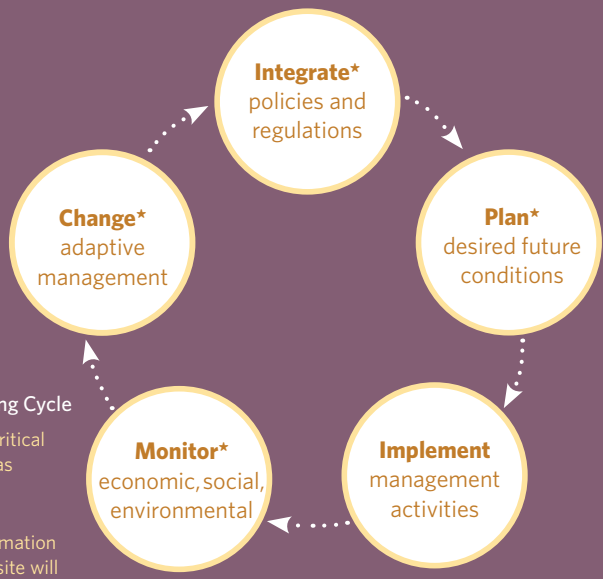


Figure 7 Decision-making Cycle

* The ABMI contributes critical knowledge in these areas

Please visit our website for access to more information on the health of Alberta's ecosystems. The website will soon enable users to select management areas tailored to user needs, access raw and summarized data for these areas, and generate status and trends reports.

Intactness of Monitored Species

Table 3 The ABMI intactness value for 23 breeding bird species in the Lower Athabasca Planning Region that are equal-to or more abundant than their reference conditions.

Above Reference — Breeding Birds

Common Name	Scientific Name	Intactness Value (%)	Percent Occurrence	Common Name	Scientific Name	Intactness Value (%)	Percent Occurrence
American Goldfinch	*Carduelis tristis*	99	23	Yellow-bellied Sapsucker	*Sphyrapicus varius*	75	31
Least Flycatcher	*Empidonax minimus*	97	54	Brown-headed Cowbird	*Molothrus ater*	73	18
Dark-eyed Junco	*Junco hyemalis*	96	74	Northern Flicker	*Colaptes auratus*	64	30
Common Snipe	*Gallinago galinago*	91	49	American Redstart	*Setophaga ruticilla*	64	34
Winter Wren	*Troglodytes troglodytes*	91	51	Solitary Sandpiper	*Tringa solitaria*	63	16
Chipping Sparrow	*Spizella passerina*	90	95	Alder Flycatcher	*Empidonax alnorum*	62	46
Bay-breasted Warbler	*Dendroica castanea*	89	31	Western Wood Pewee	*Contopus sordidulus*	57	15
White-throated Sparrow	*Zonotrichia albicollis*	87	92	Red-winged Blackbird	*Agelaius phoeniceus*	57	20
Mourning Warbler	*Oporornis philadelphia*	86	23	Clay-colored Sparrow	*Spizella pallida*	52	23
Red-eyed Vireo	*Vireo olivaceus*	85	61	American Robin	*Turdus migratorius*	48	30
Hermit Thrush	*Catharus guttatus*	83	75	American Crow	*Corvus brachyrhynchos*	16	20
Lincoln's Sparrow	*Melospiza lincolnii*	77	62				

Table 4 The ABMI intactness value for 29 breeding bird species in the Lower Athabasca Planning Region that are equal-to or less abundant than their reference conditions.

Below Reference — Breeding Birds

Common Name	Scientific Name	Intactness Value (%)	Percent Occurrence	Common Name	Scientific Name	Intactness Value (%)	Percent Occurrence
Olive-sided Flycatcher	*Contopus cooperi*	100	21	Greater Yellowlegs	*Tringa melanoleuca*	88	46
Magnolia Warbler	*Dendroica magnolia*	99	57	Ovenbird	*Seiurus aurocapillus*	88	69
Cedar Waxwing	*Bombycilla cedrorum*	99	23	Connecticut Warbler	*Oporornis agilis*	87	30
Blue Jay	*Cyanocitta cristata*	98	20	Orange-crowned Warbler	*Vermivora celata*	86	18
Swainson's Thrush	*Catharus ustulatus*	96	84	Black and White Warbler	*Mniotilta varia*	85	31
Canada Warbler	*Wilsonia canadensis*	96	20	Western Tanager	*Piranga ludoviciana*	85	39
Tennessee Warbler	*Vermivora peregrina*	96	89	Red-breasted Nuthatch	*Sitta canadensis*	83	33
Tree Swallow	*Tachycineta bicolor*	96	15	Common Raven	*Corvus corax*	82	44
Gray Jay	*Perisoreus canadensis*	95	89	Boreal Chickadee	*Poecile hudsonica*	77	48
Black-capped Chickadee	*Poecile atricapilla*	95	23	Palm Warbler	*Dendroica palmarum*	77	52
White-winged Crossbill	*Loxia leucoptera*	94	54	Ruffed Grouse	*Bonasa umbellus*	76	23
Yellow-rumped Warbler	*Dendroica coronata*	94	95	Blue-headed Vireo	*Vireo solitarius*	75	30
Cape May Warbler	*Dendroica tigrina*	91	41	Common Yellowthroat	*Geothlypis trichas*	75	38
Ruby-crowned Kinglet	*Regulus calendula*	91	93	Rose-breasted Grosbeak	*Pheucticus ludovicianus*	72	28
Pine Siskin	*Carduelis pinus*	90	33				

Intactness of Monitored Species

Table 5 The ABMI intactness value for 35 vascular plant species in the Lower Athabasca Planning Region that are equal-to or more abundant than their reference conditions.

Above Reference—Vascular Plants

Common Name	Scientific Name	Intactness Value (%)	Percent Occurrence	Common Name	Scientific Name	Intactness Value (%)	Percent Occurrence
Common Fireweed	*Epilobium angustifolium*	99	79	Common Wild Rose	*Rosa woodsii*	91	16
Wild Vetch	*Vicia americana*	99	41	Wild Red Raspberry	*Rubus idaeus*	88	39
Common Labrador Tea	*Ledum groenlandicum*	99	85	Common Yarrow	*Achillea millefolium*	88	51
Beaked Willow	*Salix bebbiana*	99	39	Dwarf Scouring-rush	*Equisetum scirpoides*	87	26
White Spruce	*Picea glauca*	98	64	Dwarf Bilberry	*Vaccinium caespitosum*	87	10
Skunk Currant	*Ribes glandulosum*	98	16	Sheathed Cotton Grass	*Eriophorum vaginatum*	84	16
River Alder	*Alnus incana*	98	13	Northern Grass-of-parnassus	*Parnassia palustris*	83	11
Red-osier Dogwood	*Cornus stolonifera*	97	23	Water Sedge	*Carex aquatilis*	81	25
Paper Birch	*Betula papyrifera*	96	57	Western Wood Lily	*Lilium philadelphicum*	80	18
Myrtle-leaved Willow	*Salix myrtillifolia*	95	16	Leatherleaf	*Chamaedaphne calyculata*	79	16
Silvery-flowered Sedge	*Carex aenea*	95	11	Sweet Grass	*Hierochloe hirta ssp. arctica*	78	21
Meadow Horsetail	*Equisetum pratense*	94	21	Round-leaved Sundew	*Drosera rotundifolia*	71	21
Dwarf Birch	*Betula pumila*	93	38	Balsam Groundsel	*Senecio pauperculus*	66	10
Common Nettle	*Urtica dioica*	92	10	Kentucky Bluegrass	*Poa pratensis*	65	15
Tamarack	*Larix laricina*	92	43	Common Dandelion	*Taraxacum officinale*	51	25
Northern Green Bog Orchid	*Platanthera hyperborea*	91	13	Flat-leaved Willow	*Salix planifolia*	45	15
Small Cranberry	*Vaccinium oxycoccos*	91	46	Alsike Clover	*Trifolium hybridum*	10	10
Three-leaved Solomon's-seal	*Maianthemum trifolium*	91	43				

Table 6 The ABMI intactness value for 62 vascular plant species in the Lower Athabasca Planning Region that are equal-to or less abundant than their reference conditions.

Below Reference—Vascular Plants

Common Name	Scientific Name	Intactness Value (%)	Percent Occurrence	Common Name	Scientific Name	Intactness Value (%)	Percent Occurrence
Black Spruce	*Picea mariana*	100	61	Woodland Horsetail	*Equisetum sylvaticum*	95	61
Hairy Wild Rye	*Leymus innovatus*	98	36	Cream-colored Vetchling	*Lathyrus ochroleucus*	95	44
Kidney-leaved Violet	*Viola renifolia*	98	20	Northern Bastard Toadflax	*Geocaulon lividum*	94	25
Balsam Willow	*Salix pyrifolia*	98	13	Northern Starflower	*Trientalis borealis*	94	38
Trembling Aspen	*Populus tremuloides*	97	70	Lindley's Aster	*Aster ciliolatus*	93	44
Prickly Rose	*Rosa acicularis*	97	57	Jack Pine	*Pinus banksiana*	93	33
Bog Cranberry	*Vaccinium vitis-idaea*	97	70	Arctic Sweet Coltsfoot	*Petasites frigidus*	93	11
Cloudberry	*Rubus chamaemorus*	97	34	Northern Gooseberry	*Ribes oxyacanthoides*	93	30
Green Alder	*Alnus viridis*	97	43	Tall Lungwort	*Mertensia paniculata*	92	49
Bristly Black Currant	*Ribes lacustre*	96	20	Bluejoint	*Calamagrostis canadensis*	92	69
Common Horsetail	*Equisetum arvense*	96	64	Canada Buffaloberry	*Shepherdia canadensis*	92	33
Common Blueberry	*Vaccinium myrtilloides*	96	61	Palmate-leaved Coltsfoot	*Petasites frigidus var. palmatus*	92	61

Intactness of Monitored Species

Below Reference — Vascular Plants

Common Name	Scientific Name	Intactness Value (%)	Percent Occurrence	Common Name	Scientific Name	Intactness Value (%)	Percent Occurrence
Balsam Poplar	*Populus balsamifera*	92	36	Common Pink Wintergreen	*Pyrola asarifolia*	81	51
Wild Strawberry	*Fragaria virginiana*	91	59	Bog Birch	*Betula glandulosa*	81	11
Two-seeded Sedge	*Carex disperma*	91	15	Marsh-marigold	*Caltha palustris*	80	25
One-sided Wintergreen	*Orthilia secunda*	90	38	Western Canada Violet	*Viola canadensis*	80	21
Bunchberry	*Cornus canadensis*	90	75	Wild Red Currant	*Ribes triste*	80	38
Common Bearberry	*Arctostaphylos uva-ursi*	90	21	Snowberry	*Symphoricarpos albus*	79	26
Northern Black Currant	*Ribes hudsonianum*	90	15	Red and White Baneberry	*Actaea rubra*	78	33
Long-leaved Chickweed	*Stellaria longifolia*	89	16	Marsh Skullcap	*Scutellaria galericulata*	77	10
Sweet-scented Bedstraw	*Galium triflorum*	89	33	Wild Sarsaparilla	*Aralia nudicaulis*	76	34
Low-bush Cranberry	*Viburnum edule*	89	49	Saskatoon	*Amelanchier alnifolia*	76	33
Stiff Club-moss	*Lycopodium annotinum*	88	33	Bracted Honeysuckle	*Lonicera involucrata*	76	31
Northern Bedstraw	*Galium boreale*	87	46	Bastard Toadflax	*Comandra umbellata*	75	21
Dwarf Raspberry	*Rubus arcticus*	87	23	Small Bedstraw	*Galium trifidum*	75	20
Dewberry	*Rubus pubescens*	87	59	Showy Aster	*Aster conspicuus*	75	20
Twinflower	*Linnaea borealis*	86	61	Ground-pine	*Lycopodium obscurum*	73	18
Wild Lily-of-the-valley	*Maianthemum canadense*	86	43	Swamp Horsetail	*Equisetum fluviatile*	72	10
Arrow-leaved Coltsfoot	*Petasites sagittatus*	84	23	Fly Honeysuckle	*Lonicera caerulea*	72	21
Purple Peavine	*Lathyrus venosus*	84	21	Balsam Fir	*Abies balsamea*	70	15
Bishop's-cap	*Mitella nuda*	82	56	Twining Honeysuckle	*Lonicera dioica*	63	18

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