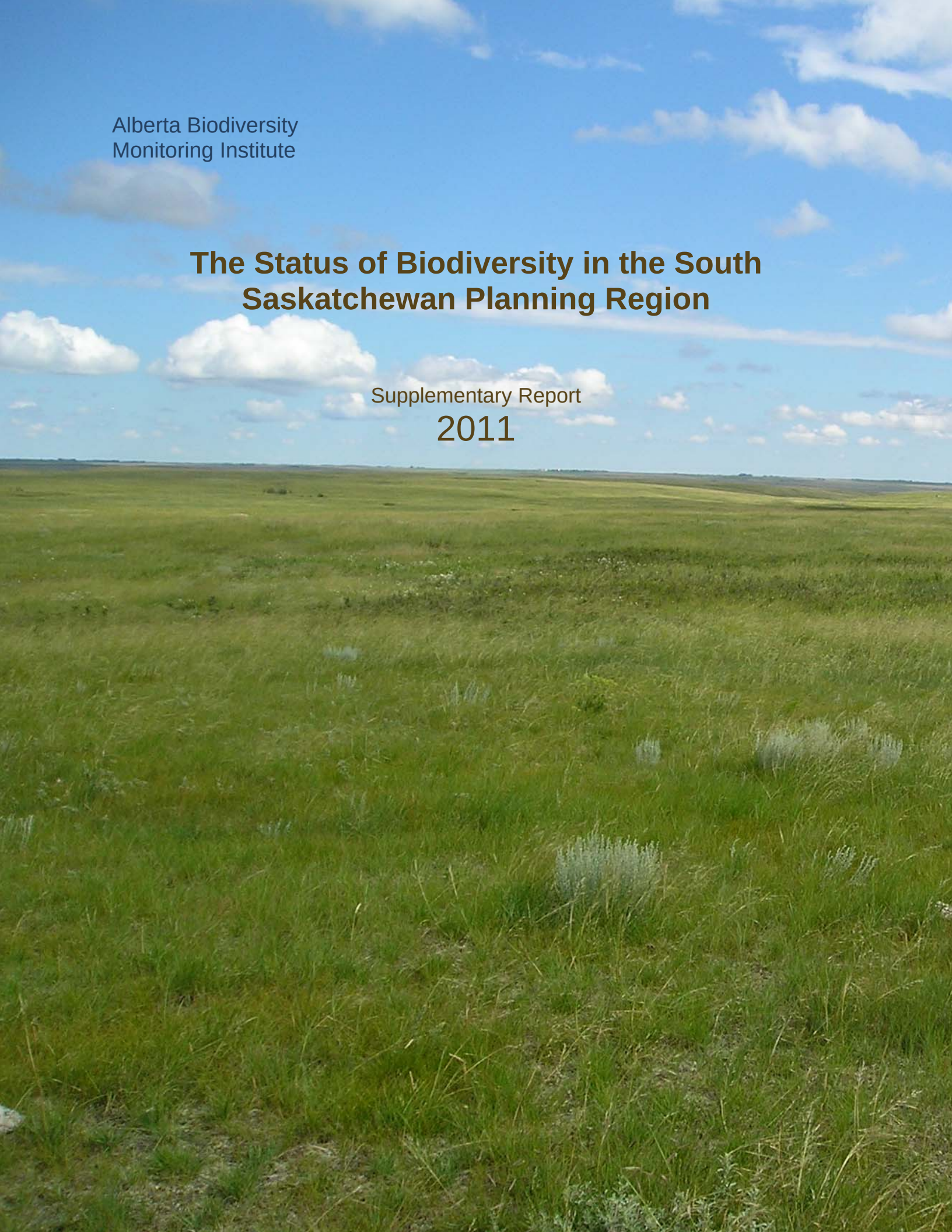

Alberta Biodiversity
Monitoring Institute

The Status of Biodiversity in the South Saskatchewan Planning Region

Supplementary Report

2011

Introduction

For brevity, the core report *Status of Biodiversity in the South Saskatchewan Planning Region* provides a high-level overview of human development, species, and habitat in southern Alberta.This supplemental report provides the detailed methods and results that the Alberta Biodiversity Monitoring Institute (ABMI) used to generate the high-level findings presented in the overview status report.

About the ABMI

The ABMI is a province-wide, long-term monitoring program designed to support natural resource decision-making. The ABMI provides relevant, timely and credible scientific knowledge on the state of provincial biodiversity and wildlife. Services offered by the Institute include: public access to raw data, and public access to value-added information products. These two services are designed to encourage:

1. ***Application –*** Return on investment in biodiversity monitoring is realized only if the resulting knowledge is applied. Public and timely access to ABMI products encourages the use of information in decision-making processes including resource management and public policy.
2. ***Transparency*** – Scientific credibility is at the foundation of the ABMI. Scientific inference produced by the Institute, or any other third-party, must be subject to independent audit and verification by the greater research and management community.
3. ***Efficiency –*** Collection and management of comprehensive, science-based biodiversity data is a significant investment. Use of this information by many stakeholders will reduce redundancy and costs in provincial environmental monitoring.
4. ***Innovation*** – Long-term, scientifically rigorous environmental data sets are highly valuable to the research and management communities. By making the ABMI's data publicly available, significant innovation is anticipated to occur in the discipline of sustainable resource management.
5. ***Awareness*** –The ABMI produces publicly available information on the status of biodiversity in different regions of interest in the province. Public access to this information raises awareness about changes in provincial biodiversity over time.

The ABMI is a key component in achieving the vision of sustainable resource management. Under sustainable resource management systems, monitoring information is needed to assess the effectiveness of policies and programs. Monitoring allows for confirmation when actions are successful or provides insight into what changes might be needed when desired outcomes are not being attained. As applied to biodiversity, monitoring should assess the effectiveness of resource management and support its improvement. The ABMI's information can be used to support the preparation of management plans and responses, as well as to identify any gaps in our understanding of the implications associated with changes in biodiversity.
This description of the ABMI's strengths is not meant to be restrictive. The ABMI recognizes, and encourages, the innovative use of the Institute's information. However, we strongly encourage that practitioners making use of ABMI information do so in a responsible manner.

"Preliminary" Characterization of the Core Report

We characterize the core report as a preliminary assessment of biodiversity in the South Saskatchewan Planning Region(SSPR) for two reasons. First, we have not implemented ABMI

protocols at all sites in the SSPR. As a result, the statistical confidence associated with results presented in the core report will be enhanced as additional data is collected and analyzed for the SSPR. At the same time, we will be expanding our reporting to include biodiversity indicators for other natural regions in the SSPR. As we collect this additional data, we will remove the “preliminarily” characterization of the report.

Second, we have not presented results for all the indicator types that are monitored by the ABMI. Future reports will include the assessment of status and trends for mammals, fish, lichens, mosses, and wetlands. These same assessments will be available for other planning regions as well as other regions of interest in Alberta

Sampling Design

We had our monitoring survey design and methods extensively peer-reviewed by the greater scientific community to ensure scientific credibility.We implemented ABMI spring and summer data collection protocols at 63 permanent ABMI monitoring sites and 19 supplemental monitoring sites in Alberta’s Grassland Natural Region. While the 63 permanent ABMI sites were systematically located throughout the SSPR, the 19 supplemental sites were located on native grassland that was at least 500 meters from any known human development. Sixty of the permanent ABMI monitoring sites and seven of the supplemental sites were located in the South Saskatchewan Planning Region (SSPR) and the remaining sites were located in the Red Deer Planning Region. Starting in May, through to the end of June, we implemented springterrestrial data collection protocols at each site. In the spring we sampled breeding birds, soil arthropods (armoured mites), site capability, physical characteristics, downed woody materials and trees. Starting at the end of June through to the first week in August, we implemented summer terrestrial data collection protocols at the same sites to assess vascular plants, moss, lichen, tree ages, and surface substrate. Field data used in the SSPR status report was collected between 2007 and 2010.We implemented protocols in the same way at all sites in each sampling year, except where protocol updates are noted in our methodology (see Further Reading at the end of this document).We analyzed data in Marchthrough June of 2011 and used analyses that were appropriate to each data set being evaluated.Detailed data analysis protocols are available from the ABMI website under Information Pyramids and Intactness Manuals: ABMI documents 20028, 20029, and 20030 (see Further Reading at the end of this document).

We conducted statistical analyses using only ABMI data collected at permanent and supplemental sites. We report on the status of biodiversity in the SSPR using only statistical results relevant to the SSPR region and subregions.

Site Description—Physical Characteristics and Site Capability Surveys

We determined elevation using hand-held GPS units, and site slope and aspect using a hand-held compass. We identified the ABMI site centre in the field using hand-held GPS units. We used site centre as the reference point for all subsequent terrestrial protocols. We use the term “central hectare” to describe the 100 × 100 m area centered on site centre. We use the term “quadrant” to describe the four 0.25 ha (50 × 50 m) plots that subdivide the central hectare and originate from site centre.

Site capability was used to broadly describe the ecological habitat potential at each site and was described according to Grassland Vegetation Inventory (GVI) Site Types (1 through 24; GVI

2006). Where human development existed at a site, we used macro soil characteristics and topography to predict the GVI Site Type. We classified the primary ecological site type within a 150 m radius around site centre.

We used physical characteristics and site capability information as covariates in determining ABMI intactness values for each species assessed in the SSPR.

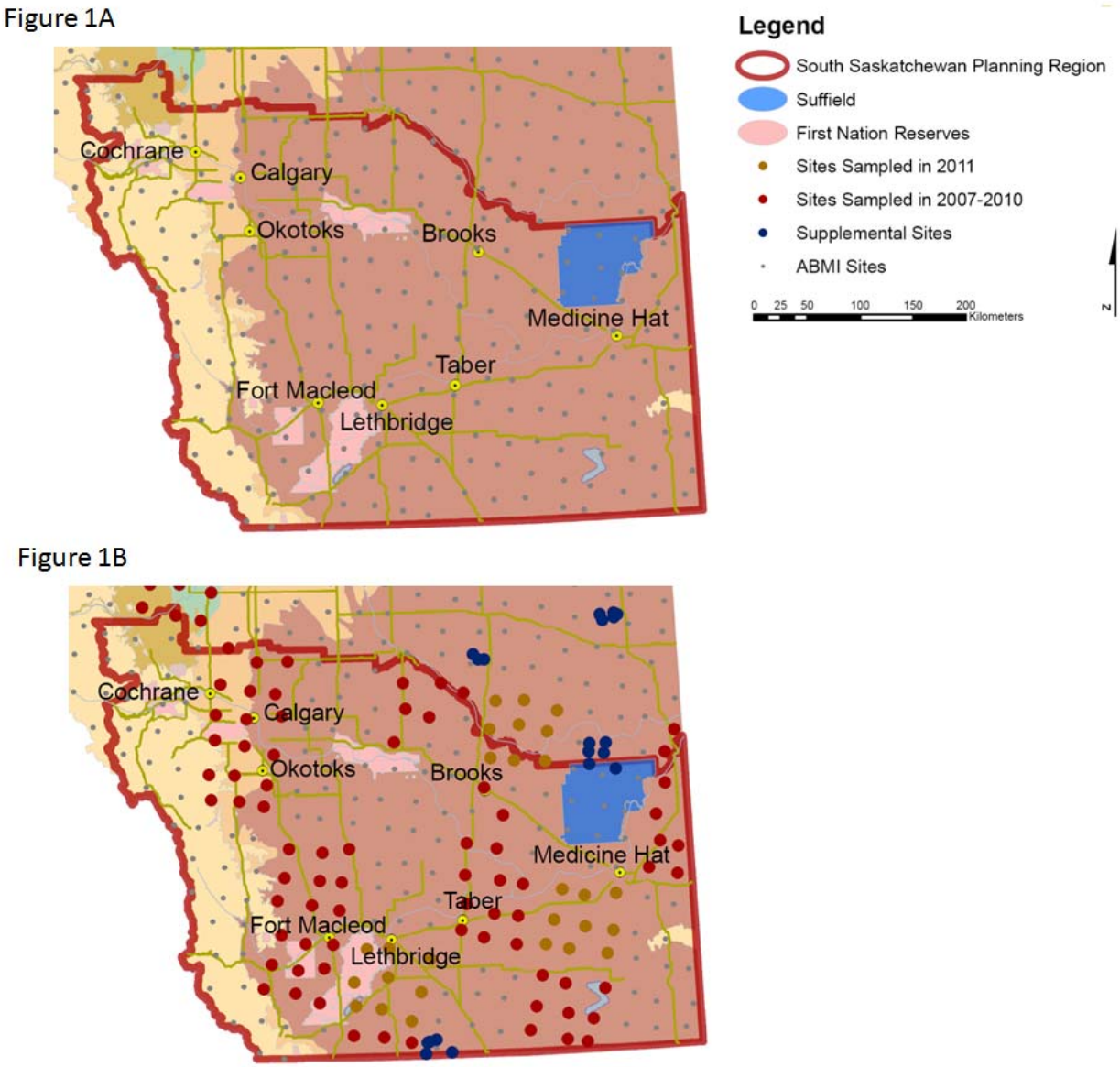

Figure 1. A) The ABMI has 211 core sites located in the SSPR. B) Between 2007 and 2010, we surveyed 63 core sites in the Grassland Region, 60 of which were located in the SSPR. We surveyed an additional 19 supplemental sites in the Grassland Regions, 7 of which were located in the SSPR. We will survey the remaining core sites in coming years.

Birds—Breeding Birds Surveys

At each site, we measured breeding birds at nine point count stations arranged in a grid pattern with point count station #1 located at site-centre and the remaining stations located 300 m apart

in a square around site centre. We conducted breeding bird surveys from one half hour before sunrise to 10:00 hrs.

We recorded vocalizations of birds for 10 minutes at each point count station using an omni-directional microphone (CZM microphone; River Forks Research Corp.) mounted at ear level on a professional tripod and connected to a mini hard drive recorder. We recorded birds on an iRiver HP-120 Recorder or a Marantz PMD670 Solid State recorder at 320 kbps in .mp3 format. We calibrated the recorder volume to be in the mid ranges.

While conducting the 10-minute bird recordings, we scanned the areas surrounding the point count station for all birds (even those vocalizing), noting species, number of individuals (including flock sizes of birds flying overhead), and distance from the point count station, for all bird observations. We also noted factors that potentially bias bird recordings, such as wind speed, precipitation, and human-caused noise.

For bird points located within a waterbody, we established a new point if we were able to get within 100 m of the point (i.e., <200 m from the last point), recording distance and direction from the original point. If it was not possible to get within 100 m of the point (i.e., <200 m from the last point), we conducted a 10-minute visual point count of the waterbody recording observations into the microphone. We may not have sampled certain points because they were inaccessible (e.g., a stream made access hazardous or impossible).

We analyzed bird recordings in a laboratory setting. We identified the species, time of first detection (within 10 second intervals), behaviour (e.g., singing, calling, or alarm-calling), and the time interval that individual birds were detected. We recognized 3 time intervals: Interval 1 (0–200 seconds), Interval 2 (201–400 seconds), and Interval 3 (401–600 seconds). Individual birds were detected in 1, 2, or 3 of the time intervals.

Using life-history characteristics, we identified 12 bird species as being strongly associated with native grassland habitat.

For each species detected at each site, we calculated the relative abundance as the average number of detections per point count station. We determined intactness values for each species that was detected at 10 sites in the Grassland Natural Region (inclusive of ABMI permanent sites and supplemental sites). A comprehensive description of the scientific methods used in analyses of data for this report is described in:

- Alberta Biodiversity Monitoring Institute. 2011. *Manual for Estimating Species and Habitat Structure Intactness* (20029), Version 2011-07- 07. Alberta Biodiversity Monitoring Institute, Alberta, Canada. Report available at http://abmi.ca/abmi/reports/reports.jsp [accessed August 1, 2011].

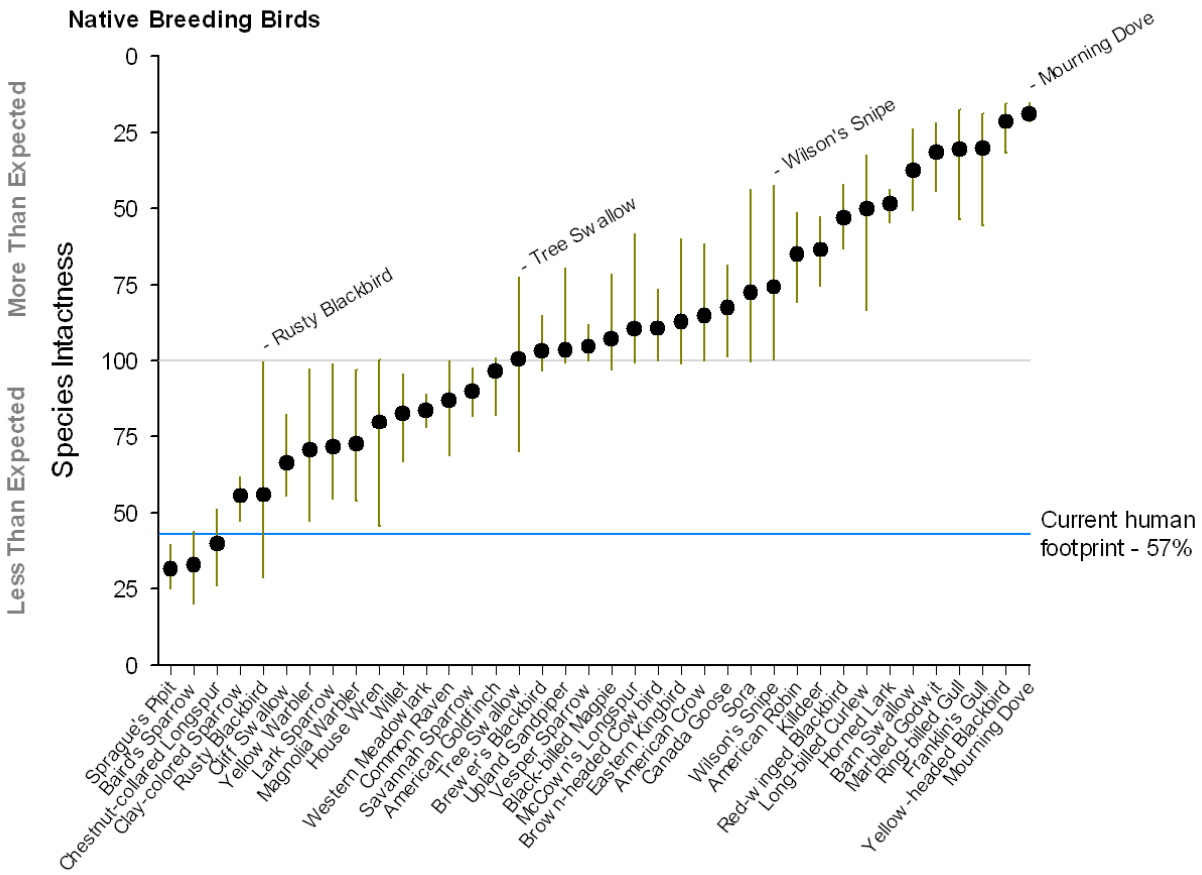

Figure 1. Intactness (±90%) of 38 native breeding bird species in the Grassland Region of the SSPR measured at 60 locations between 2007 and 2010. The average intactness value for native breeding birds is 67%. The current level of human development in the Grassland Region of the SSPR is 57%. Detailed statistics available in *Status of Biodiversity in the South Saskatchewan Planning Region: Supplementary Data File 2011* (00065), Version 2011-08-13, AlbertaBiodiversity Monitoring Institute, Alberta,Canada.

Plants—Vascular Plant Surveys

We conducted 90-minute vascular plant searches at each ABMI site. We surveyed for vascular plants to determine the presence of as many species as possible within the central hectare.We spent the first 10 minutes at site-centre recording all vascular plant species observed. During the initial 10-minute survey, we located the most diverse habitat types within the site and spent time recording species that occurred in these habitats. We then spent 20 minutes in each of 4 quadrants (NE, SE, SW, NW) within the central hectare for a total of 80 minutes recording the presence of as many vascular plants as possible. To maintain consistency among observers we started the searches at the centre of each quadrant, moved to within 5 to 10 m of the site-centre, then moved in a clockwise direction around the quadrant staying approximately 5-10 m from the quadrant edge. We started surveys in the NE quadrant and progressed clockwise to the next quadrant (NE, SE, SW, NW). When unknown or uncertain species were encountered, we collected voucher specimens for identification after the 90-minute searches were complete. This ensured that the 20 minutes spent in each quadrant were expended looking for species

rather than identifying plants. Voucher specimens were identified in a laboratory setting by experts when they could not be identified in the field.
Prior to the 20-minute survey in each quadrant, we identified all “common” and “dominant” species that occurred within the 10 x 10 m medium tree plots. “Common” and “dominant” species were present in >50% and >80% of the plot, respectively, if the plot was subdivided into 10 equally-sized sections. Depending on the site, quadrants may have contained many common and/or dominant species (diverse sites) whereas some quadrants may not have contained any common/dominant plants species (e.g., few species sparsely dispersed).

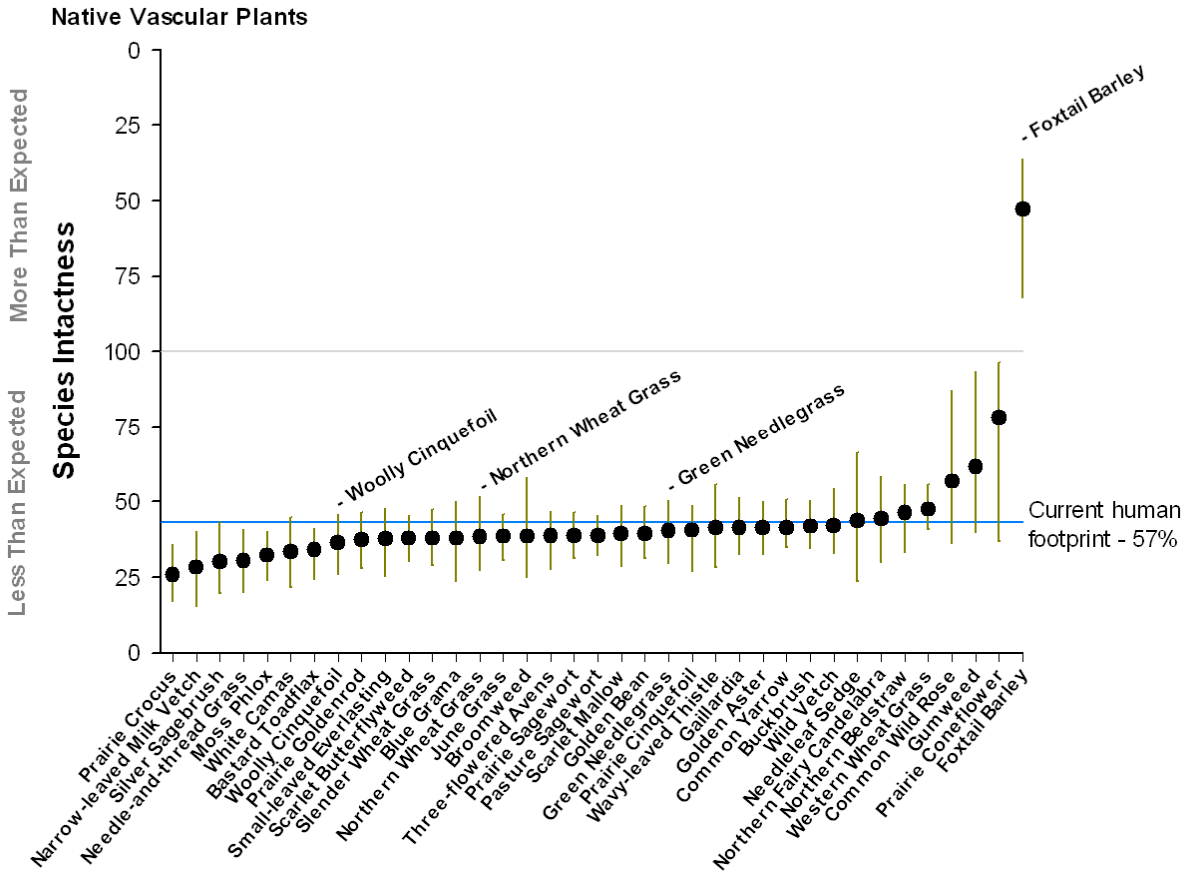

Figure 2. Intactness (±90%) of 37 native vascular plants in the Grassland Region of the SSPR measured at 60 locations between 2007 and 20010. The average intactness value for native vascular plants is 41%. The current level of human development in the Grassland Region of the SSPR is 57%. Detailed statistics available in *Status of Biodiversity in the South Saskatchewan Planning Region: Supplementary Data File 2011* (00065), Version 2011-08-13, AlbertaBiodiversity Monitoring Institute, Alberta,Canada.

We calculated the relative abundance of plant species at each site by scoring each species according to the number of quadrants in which they were present. Relative abundance values for each species at each site range from 1 (present in a single quadrant) to 4 (present in all 4 quadrants).

We determined intactness values for each species that was detected at 10 sites in the Grassland Natural Region (inclusive of ABMI permanent sites and supplemental sites). A

comprehensive description of the scientific methods used in analyses of data for this report is described in:

- Alberta Biodiversity Monitoring Institute. 2011. *Manual for Estimating Species and Habitat Structure Intactness* (20029), Version 2011-07- 07. Alberta Biodiversity Monitoring Institute, Alberta, Canada. Report available at http://abmi.ca/abmi/reports/reports.jsp [accessed August 1, 2011].

Armoured Mites — Soil Arthropod Surveys

We took samples of the organic component of the soil profile (litter, fermentation, and humus horizons) for armoured mite (oribatid mites) collection. We used a 2 inch diameter soilcorer to collect organic soil.Soil samples were taken 80 m from site center in each ofthe sub-ordinal directions. We collected a total of 500 mlof organic material from each sample location (quadrant),equaling 2 L of organic material per site. We took aminimum of 4 cores from each sample location(quadrant), but took additional cores if more wererequired to accumulate 500 ml of organic material.Additional cores were sampled in a clockwise fashion until we obtained 500 ml oruntil we collected 24 cores. We took a maximum of 24 cores per sample location even if less than 500ml was obtained, and we recorded the number of cores taken.When the LFH was indistinct (i.e. grasslands), we collected the plant rooting zone. When there was nodistinct LFH layer (i.e. cultivated agriculture fields), we collected only the litter. When the corelocation was situated in standing water, we did not collect a sample unless a vegetative mat waspresent above the water table. When the organic layer was deeper than our corer could penetrate (i.e.black spruce/tamarack bogs), we collectedthe entire 40 cm of organic material whichthe corer extracted.We also described each core location.

We recorded the primary ecotype/structural stage and percentage of dominant ecotype in the sampling area. We also recorded type of disturbance (human or natural) present and the percentage of area disturbed at each sampling area.

Armoured mites were extracted from organic soil samples using Berlese funnels, and adult mites were identified to the lowest taxonomic level possible in the lab. Detailed field sampling protocols and laboratory sampling manuals are available at www.abmi.ca.

We determined intactness values for each species that was detected at 10 sites in the Grassland Natural Region (inclusive of ABMI permanent sites and supplemental sites). A comprehensive description of the scientific methods used in analyses of data for this report is described in:

- Alberta Biodiversity Monitoring Institute. 2011. *Manual for Estimating Species and Habitat Structure Intactness* (20029), Version 2011-07- 07. Alberta Biodiversity Monitoring Institute, Alberta, Canada. Report available at http://abmi.ca/abmi/reports/reports.jsp [accessed August 1, 2011].

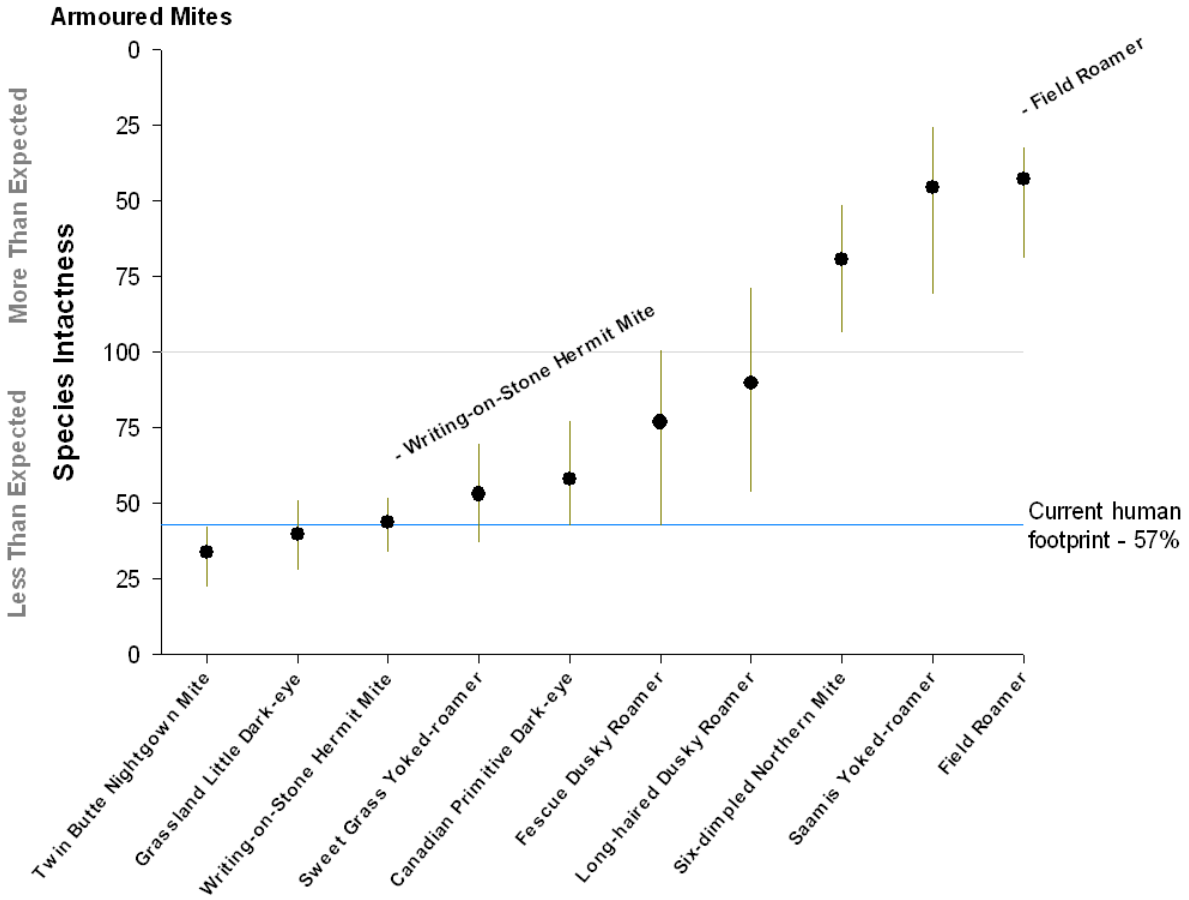

Figure 3. Intactness (±90%) of 10 Armoured Mites in the Grassland Region of the SSPR measured at 60 locations between 2007 and 2010. The average intactness value for Armoured Mites is 55%. The current level of human development in the Grassland Region of the SSPR is 57%. Detailed statistics available in *Status of Biodiversity in the South Saskatchewan Planning Region: Supplementary Data File 2011* (00065), Version 2011-08-13, AlbertaBiodiversity Monitoring Institute, Alberta,Canada.

Amount of Human Development —Remote Sensing Surveys

One of the products we have developed and manage is an inventory of human development for Alberta. We update this product regularly in order to track the status and trends in land-use for any region in the province. At present, we have developed and validated an inventory for Alberta (circa 2007) for all major human development activity with one exception. As of August 2011, we arefinalizing inventory of agriculture for the province (circa 2007) and are updating all human development activity for the province circa 2010. When these are complete, we will report in a comprehensive, consistent, and scientifically credible manner on changes in human development. We will update this inventory every 2-3 years conditional on resources.

The ABMI defines human development(aka, human land-use or human footprint) as the visible conversion of native ecosystems to temporary or permanent residential, recreational, or industrial landscapes. This includes land conversion activities that support the forest,

agriculture and energy industries; commercial and residential settlement; recreational infrastructure, and transportation infrastructure.

Methods

Using existing provincial GIS layers in conjunction with ABMI created or validated provincial inventories, we assessed human development across Alberta including the SSPR.We started with Government of Alberta (GoA) GIS data sources (Table 1) to represent human footprint features on the landscape. We then invested significant resources to validate the accuracy of primary data sources. We corrected or created human development features when source data was inaccurate or missing (e.g., forest harvesting). We developed new provincial inventories for human residential features and for provincial agriculture. We validated source data and created new provincial inventories using SPOTS imagery (circa 2007).

Table 1: Sources for base features used to represent human footprint.

Features	**Source**	**Year Represented**
Forest harvesting	Alberta Vegetation Inventory (AVI) and AVI Updatesand in conjunction with ABMI created inventory(based on SPOT 2007 mosaic of the Province)	2007
Agriculture	Grassland Vegetation Inventory (GVI) in conjunction with ABMI created provincial inventory(based on SPOT 2007 mosaic of the Province)	2007
Cities and Settlements	ABMI created inventory (based on SPOT 2007 mosaic of the Province)	2007
Roads	Provincial "roads" GIS data layer (line; GoA source) and in conjunction with ABMI created area estimates for linear features.	2008
Wellsites	Provincial "wellsites" GIS data layer (point;GoA source) and in conjunction with ABMI validation procedures.	2007
Pipelines	Provincial "pipelines" GIS data layer (line; GoA source)	2008
Power Lines	Provincial "powerlines" GIS data layer (line; GoA source)	2008
Rail Lines	Provincial "raillines" GIS data layer (line; GoA source)	2006
Cutlines	Provincial "cutlines" GIS data layer (line; GoA source)	2008
Facilities	Provincial "facilities" GIS data layer (line; GoA source) and in conjunction with ABMI validation procedures.	2007

We completely created new inventory for cities, human settlement, oil-sands facilities and mines, and farmsteads so that data would conform to ABMI's human development categories and was scientifically credible. Other data used included roads, well sites, facilities, pipelines, power lines, railways, and cutlines (seismic lines and narrow trails).

Species at Risk

We derived summary statistics on the number and type of species at risk in the SSPR from the following sources:

1. Canada's Species at Risk Act,
2. Alberta's Wildlife Act,
3. Canada's Committee on the Status of Endangered Wildlife in Canada, and
4. Alberta's Endangered Species Conservation Committee.

In reporting, we did not consider the 11 species that are identified as data-deficient or that are currently being evaluated for designation as a conservation concern. A detailed list of species

and at risk designations is available in the Supplementary Data File (00065) associated with this report and that can be found at www.abmi.ca.

We cite Sage-grouse (*Centrocercus urophasianus urophasianus)* population numbers from:

1. Connelly, J. W., S. T. Knick, M. A. Schroeder, and S. J. Stiver. 2004. Conservation Assessment of Greater Sage-grouse and Sagebrush Habitats. Western Association of Fish and Wildlife Agencies. Unpublished Report. Cheyenne, Wyoming.

Intactness in Native Prairie-dominated Landscapes

The Government of Alberta has developed aninventory of native vegetation resources in the SSPR. This inventory highlights all quartersections in the SSPR with between 50% and100% undeveloped native prairie habitat (prairie-dominated landscapes). The Government of Alberta provided the ABMI with a GIS data file that identified these native prairie dominated landscapes.

We used species models previously generated by the ABMI for the entire Grassland Natural Region along with the human development values for the prairie-dominated landscapes in the Grassland Region of the SSPR in order to calculate intactness for this region.

We used human development information by natural sub-region, which wasn't specifically part of the original models. Because there was a spatial surface fit in the original models, we represented natural sub-region by a mean latitude and longitude for each sub-region in the prairie-dominated landbase (with two mean latitudes used for the Mixed-grass Natural Sub-region, one around the Cypress Hills, the other in the west). We only included the Dry Mixed-grass, Mixed-grass and Foothills Fescue, because these three grassland types represent 84.5% of the prairie-dominated landbase, and other ecosystem types (e.g., Parkland, and Montane ecoregions) were not included in the original model fitting.

We calculated reference abundances and observed abundances for each species for each of the 4 areas (three natural subregions, with two areas for the Mixed-grass). We then took an average, weighted by the proportion of the prairie-dominatedlandscape in those four areas. Intactness was calculated from these values as described in:

- Alberta Biodiversity Monitoring Institute. 2011. *Manual for Estimating Species and Habitat Structure Intactness* (20029), Version 2011-07- 07. Alberta Biodiversity Monitoring Institute, Alberta, Canada. Report available at http://abmi.ca/abmi/reports/reports.jsp [accessed August 1, 2011].

Detailed statistics for the prairie-dominated landscape is available in *Status of Biodiversity in the South Saskatchewan Planning Region: Supplementary Data File 2011* (00065), Version 2011-08-13, AlbertaBiodiversity Monitoring Institute, Alberta,Canada.

Further Reading

Additional detail on the ABMI field protocols and analytical methodology can be found at our website under reports section (www.abmi.ca) including:
ABMI Report 10001— Terrestrial Data Collection Protocols,
ABMI Report 10003— Terrestrial Data Collection Field Sheets,
ABMI Report 10012— Vascular Plant Laboratory Identification Protocols,
ABMI Report 10006— Breeding Bird Laboratory Identification Protocols,
ABMI Report 10045 — Terrestrial Data Collection Protocols (Abridged), and
ABMI Report 20030 — Manual for Estimating Human Footprint Intactness.