ALBERTA BIODIVERSITY MONITORING INSTITUTE

18–19 Annual Report

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Message from the Executive Director

> *2018–19 was a busy and exciting year for the ABMI as we implemented the learnings from last year's 10-year program review and began to see the fruits of these efforts.*

Feedback from the independent external reviewers was highly positive, describing the ABMI's progress to date as a "monumental achievement" and emphasizing that "its comprehensive approach to environmental monitoring is unique in the world." The program review and stakeholder engagement process revealed a keen interest in the ABMI's activities from many sectors. Over 2018–19, the ABMI worked to satisfy this appetite for information by providing new opportunities for conversations and outreach around the ABMI's various data products and platforms.

A highlight of the year was our External Forum, which took place in January at the Royal Alberta Museum. Attended by more than 125 representatives from the full spectrum of the ABMI's partners, stakeholders, and collaborators, the Forum featured presentations and dedicated breakout sessions highlighting core ABMI projects and activities, plus time for conversations and feedback. This feedback further underlined the desire for a more dialogue-based approach to the development of new ABMI products and services.

Based on what we heard, we have expanded our engagement with stakeholders and data users. Response to these efforts has been positive, and has already resulted in new opportunities for collaboration. 2018–19 saw the strengthening of existing relationships, the establishment of new relationships with municipalities and Indigenous Communities across Alberta, and new and emerging partnerships around the WildTrax platform, including a federal agreement that will see it gain national adoption and bring together partners to create a common community that shares an open data vision.

Even as we forge new relationships and renew old ones, we of course continue to deliver our core data and data products, from our online Data and Mapping Portals, to our region-specific summary reports, to our ever-expanding geospatial inventories. The depth and quality of the ABMI's data and expertise remain an Alberta success story.

Successes in 2018–19 have come amid continued changes in Alberta's regulatory and administrative environment as a new government settles in and begins to plan for the coming years. With the ABMI's renewed focus on relationship-building, we see this as another opportunity to showcase the value our program brings to Alberta, and we look forward to working with government, industry, and all our clients and stakeholders to ensure Alberta's decision makers have access to the best possible environmental data and planning tools.

The ABMI continues to accumulate a unique and growing wealth of biodiversity data and knowledge, and has been working for over a decade to make these important resources

accessible to key decision-makers. We are also working to increase "bio-literacy" in the public—the current and future stewards of our province. Looking forward, we remain committed to providing data and data products of the highest quality, and to working with our clients to ensure they receive maximum benefit from our work. By doing so, we will continue to serve as a leader in biodiversity monitoring, and a model for other jurisdictions.

With thanks to the ABMI's Board and staff for everything they do,

Stephen Lougheed
Executive Director,
Alberta Biodiversity Monitoring Institute

"We have expanded our engagement with stakeholders and data users. Response to these efforts has been positive, and has already resulted in new opportunities for collaboration."

Reports from the Centres

> *The ABMI painstakingly collects, analyzes and reports on the status of more than 2000 of these species. To do this, the ABMI surveys 1656 site locations systematically located — every 20 km — across the province.*

Alberta is home to more than 80,000 species including plants, animals, arthropods, bacteria, fungi, and algae. At each location, we collect data on both terrestrial and aquatic ecosystems. We also track changes in habitat structure and human development.

Over the years the ABMI's values have not changed: we deliver scientifically credible, value-neutral, independent, and publicly accessible data. Our purpose is to inform government, industry, environmental communities, First Nations and the public about what is happening in our environment so that they can make informed decisions and plan for the future.


80,000
SPECIES IN ALBERTA

Executive Office

The Executive Office ensures that the program is being run efficiently and effectively, and is the primary interface between the ABMI, its Board of Directors, and stakeholders. During 2018–19, Stephen Lougheed continued to undertake the Executive Director role, having recused himself from his Board role. In 2018-19, the Executive Office ensured that operational deliverables met Board expectations, and achieved the following results:

FINANCIAL RESOURCES

Sufficient funds were secured for our targeted operations this fiscal year (e.g., core program grant, OSM agreement); however, we continue to require additional and secure funding for the ongoing growth and maintenance of the program to achieve full capacity. This remains our number one long-term priority.

PROVINCIAL MONITORING SYSTEM

The ABMI continued to work with Alberta Environment and Parks to support provincial monitoring in Alberta. For the Executive Office, that work included collaborating on the development of grant agreements, negotiations to achieve a long-term Memorandum of Agreement, and supporting discussions with Oil Sands Monitoring stakeholder groups. All of these interactions and relationships continue to grow and mature.

PARTNER AGREEMENTS

The success of the ABMI has largely been due to the involvement and long-term dedication of our partner organizations. 2018–19 marked a year of new master agreements with each of our partners. We also successfully negotiated renewals to those agreements for the 2019–20 fiscal year.

COMMUNICATION AND OUTREACH

We continued to engage with a variety of audiences, including elected officials, industry, and other stakeholder groups, to emphasize the importance of the ABMI as part of Alberta's resource management and monitoring systems. The Executive Office led all government relations activities, and identified and promoted program applications to enhance the ABMI's value. We also reviewed and approved all publicly-directed reports, engaged with stakeholders in the release of these reports, and provided oversight of all marketing materials. A key element of the outreach program in 2018–19 related to the ABMI's Ten-year Program Review. We were very pleased with the level of stakeholder engagement and quality of responses received, and were especially gratified by the strong support of our program demonstrated via the final report and recommendations.

BOARD OF DIRECTORS

A key element of the Executive Office's work involves supporting our Board of Directors. In 2018–19, we held four Board meetings and our Annual General meeting. We also supported the Board as they considered recruiting additional Voting Members and Board Directors.

Overview of the ABMI's centres and bases of operation

ABMI EXECUTIVE OFFICE — UNIVERSITY OF ALBERTA

- MONITORING CENTRE — InnoTech Alberta
- PROCESSING CENTRE — Royal Alberta Museum
- INFORMATION CENTRE — University of Alberta
- SCIENCE CENTRE — University of Alberta; InnoTech Alberta; University of Calgary
- GEOSPATIAL CENTRE — University of Alberta; InnoTech Alberta; University of Calgary
- APPLICATION CENTRE — University of Alberta

Monitoring Centre

The Monitoring Centre is responsible for the ABMI's complex system of biodiversity data collection throughout the province. As the primary function of the ABMI, data collection activities receive a dominant share of program resources. In the field, we implement spring and summer terrestrial surveys and summer wetland surveys, and have completed our transition to new technology for the collection of bird and mammal information. During the 2018–19 season we achieved the following results:

PROJECT MANAGEMENT

InnoTech Alberta's Vegreville location continues to serve as the Monitoring Centre's year-round base of operations. InnoTech provides 2700 sq.ft. of office space, over 500 sq.ft. of heated storage, and 7000 sq.ft. of covered outdoor storage for over 60 ATVs, Argos, snowmobiles, and other field-related gear for exclusive use by the ABMI. We are grateful for their ongoing support.

DATA COLLECTION

The Monitoring Centre had a successful year in 2018–19. In addition to our full-time and contract staff, we recruited 42 seasonal staff to undertake our summer monitoring program collecting data at 105 terrestrial and wetland Ecosystem Health sites. Twenty-six of these sites were located in the alpine above the tree line. These sites presented significant challenges for both access and data collection, but added valuable information for the east slopes.

The ABMI also introduced targeted Focal Areas field work at 115 previously visited sample locations. This work involved the collection of fewer protocols but allowed staff to be much more efficient, often collecting data at multiple sites per day. In addition, and in conjunction with the Bayne lab at the University of Alberta and the ABMI's Application Centre, a further 130+ cameras were retrieved at "directed research" sites. Directed research sites strengthen the analysis of ABMI data by supplementing the database with information on habitat types that do not frequently occur on the core sampling grid.

"The Monitoring Centre deployed over 630 paired cameras and ARUs in support of our Ecosystem Health and Focal Areas field work for 2019–20. "

The ABMI's moss and lichen data collection protocol was updated in 2009, resulting in 75 sites with data collected using the original protocol. 2018–19 allowed us the opportunity to resample 43 of these sites using the new protocol.

Finally, post-field-season activities included processing field data, completing quality checks, and preparing for the 2019–20 field season. Part of that preparation is the deployment of cameras and autonomous recording units (ARUs) to sample locations that will be visited in the next field season. The Monitoring Centre deployed over 630 paired cameras and ARUs in support of our Ecosystem Health and Focal Areas field work for 2019–20.

Processing Centre

The ABMI Processing Centre, located at the Royal Alberta Museum (RAM), helps to generate the Institute's species-level datasets, while archiving thousands of specimens for verification and future research. Our dedicated team of highly specialized scientists and technicians provides the Institute's support network of laboratory, taxonomic, and curatorial expertise.

KEY RESPONSIBILITIES OF THE PROCESSING CENTRE INCLUDE:

- receiving, tracking and sorting field samples;
- species-level specimen identification and data generation;
- research and advancement of taxonomic expertise;
- training new taxonomic specialists;
- providing specialized taxonomic training for the ABMI's field technicians;
- developing interactive, user-friendly species identification tools; and
- curating specimens for long-term verification and future research.

CENTRE OVERVIEW

In 2018–19, Processing Centre teams sorted and identified 69,481 specimens from various taxonomic groups including mites, vascular plants, lichens, bryophytes, and aquatic invertebrates, helping to form the basis of the ABMI's species-level datasets for these taxonomic groups. Once again, we supported the specialized taxonomic training of the ABMI's field technicians and then, in preparation for more detailed taxonomic work throughout the year, successfully led this workforce through the month-long, post-season sorting of field samples. We also contributed 33 presentations and 13 publications (peer reviewed and non-peer reviewed), an effort that continues to help raise awareness of the ABMI's work and the general importance of monitoring biodiversity throughout Alberta.

This past year, taxonomic teams at RAM added 66 species, which were previously unknown in the province. For example, we discovered the first Alberta record of the aquatic leaf beetle, Neohemonia melsheimeri *(LaCordaire, 1845) in samples collected from an anthropogenic pond 50 km northeast of Brooks.*

In addition to providing taxonomic support to the Institute, this year we also began investigating the use of archived ABMI bryophytes and lichens for monitoring contaminants (e.g., heavy metals) with a particular focus on specimens collected in the Alberta Oil Sands Region. We conducted a detailed literature review, established an advisory panel and engaged local and international experts to assist in this endeavour. Preliminary studies of contaminant loads in two common species, *Hypogymnia physodes* (lichen) and *Pleurozium schreberi* (moss) using energy dispersive spectroscopy and x-ray florescence were promising but inconclusive, indicating that more work is needed to establish the most appropriate analytical methods and taxa—work that we plan to continue in the year ahead.

The Institute now tracks more than 3000 species and each sample we process helps to broaden our understanding of Alberta's biodiversity. This past year, taxonomic teams at RAM added 66 species, which were previously unknown in the province. For example, we discovered the first Alberta record of the aquatic leaf beetle, *Neohemonia melsheimeri* (LaCordaire, 1845) in samples collected from an anthropogenic pond 50 km northeast of Brooks. Like all species tracked by the Institute, voucher specimens of this beetle are now safely archived among the museum's natural history collections for future study. Although very little is known about the ecology of this beetle and many of the newly discovered species, we now know they are here and can begin to ask questions about their ecological roles and habitat needs.

Science Centre

The Science Centre is responsible for maintaining and continuously improving scientific excellence in all aspects of the ABMI. The Science Centre works closely with other ABMI Centres to improve data collection, apply quality control, advance data analysis and interpretation, and ensure the ABMI's communication products meet the needs of decision makers. Our integrated team ensures that the scientific credibility of the Institute remains world class.

DATA COLLECTION

New to this year, we advised on concentrated deployment of ARUs and remote cameras (for monitoring of birds and mammals) in three focal landscapes in the Oil Sands Region. In collaboration with other ABMI Centres, we reviewed and updated field protocols based on sampling that was done throughout the year. To improve efficiency, data processing methods for cameras and ARUs were tested and revised. We are continuing to develop and test methods to rapidly survey vascular plants

STATUS AND CUMULATIVE EFFECTS FOR SPECIES

For almost 1000 species (including mammals, birds, vascular plants, mosses, lichens, and mites), we updated information on species distribution, habitat associations, and predicted abundance under reference and current conditions. This is the first time the ABMI has been able to present models for almost 100 of these species. In addition, we determined the cumulative effects of current human development on each species, and evaluated how each of the major sectors (energy, forestry, agriculture, and urban infrastructure) influenced the species' abundance.

We expanded our understanding of these sector effects, from a regional understanding only, to one that focuses on disturbed areas. For the first time, this year we were able to differentiate biodiversity responses across three unique agriculture types: crop, tame pasture, and rough pasture. New field information collected during 2017 was incorporated into the analyses, along with updated information about vegetation and human disturbance throughout Alberta. New analysis methods for aquatic invertebrates were tested, along with modelling approaches for a taxon new to the ABMI: amphibians.

SHARING ABMI ANALYSES AND RESULTS

Information on how species use native and human-created habitats, and how these habitats change over time, are key inputs into resource management in Alberta. To ensure managers and the general public can easily access ABMI information, we updated information on the ABMI website (abmi.ca/data). Each species has its own web page describing its unique distribution, habitat associations and the effects of industrial sectors on the species, along with tabular and GIS summaries that can be downloaded for additional analyses. In addition, maps of species richness, uniqueness, intactness and other multi-species summaries are presented.

New this year is the publicly-available Custom Reporting for Intactness and Sector Effects ("cure4insect") R package (https://github.com/ABbiodiversity/cure4insect). The package provides an interface to enable custom reporting for intactness and sector effects based on estimates and predictions created by the ABMI in collaboration with the Boreal Avian Modelling Project. The package can provide summaries for 974 species in any custom reporting region, including habitat associations, spatial distribution, intactness, and sector effects. The package is also being used in the Government of Alberta's draft Biodiversity Management Framework and scenario based planning (Al-Pac project with Patchworks output, Alces online, and climate change project with CFS).

SUPPORT FOR ENVIRONMENTAL MANAGEMENT IN ALBERTA

A wide variety of ABMI information on species and landscapes has been incorporated into the Government of Alberta's Biodiversity Management Framework, and is used to describe the state of Alberta's environments and how these are changing over time. A multi-organization collaboration has resulted in WildTrax, a web-based platform that facilitates storing, managing, and sharing camera and ARU data collected in Alberta and beyond.

SCIENTIFIC PROFILE

Science Centre staff, and associated researchers, published more than 20 papers in peer-reviewed journals, helped produce 2 ABMI reports, presented 4 papers/projects at international conferences, and participated in dozens of management workshops across Alberta. Three research collaborations were initiated, and 8 continued from previous years.

Geospatial Centre

The ABMI's Geospatial Centre supports and continuously improves operational and integrated applications of geospatial technologies for use by the ABMI and other land-use decision makers and resource managers in Alberta. These efforts include creating province-wide, regional, and sample-based information and data products for human footprint and vegetation, developing and maintaining GIS layers for use by the ABMI and public, and collaborating on geospatial research and development with various partner and stakeholder organizations.

During 2018–19 the Geospatial Centre continued to expand its role within the ABMI. Since its establishment in April 2014, the GC has directly supported the ABMI's operational program, dealing with all aspects of geospatial data acquisition, processing, analysis, data QA/QC, and research. It has placed special emphasis on novel applications and rapid advancement of technologies to support the operational need for geospatial products from industry, academia, and governments of all levels.

HUMAN FOOTPRINT MAPPING PROGRAM

We completed updates for the 2017 wall-to-wall Human Footprint Inventory in March 2018. We also made further progress on the wall-to-wall Human Footprint Inventory for 2000 conditions. Additionally, we mapped detailed sample-based human footprint information for each of the ABMI's 1,656 3 × 7-km sites for 2017 conditions. This information was added to the ABMI's time-series (now spanning 1999–2017; available at abmi.ca) of human footprint in Alberta, which is used to assess trend in change over time. Human footprint features were also mapped and verified for the ABMI's 2017 wetland and terrestrial site locations. As part of the ABMI's ongoing efforts to enhance HF information, we developed a mapping protocol to account for functional and structural vegetation regeneration on linear features (seismic lines) in the non-OSR Boreal Forest Natural Region. The resulting derived product, Enhanced Cutlines, is a geospatial inventory of legacy seismic cutlines in boreal and foothills Alberta, derived from AB Base Features and then further spatially and thematically enhanced using a high-resolution canopy height model created from LiDAR data. Automated processes were developed and used to extract metrics of both structural recovery and functional recovery, which can be used to inform the prioritization and planning of seismic reclamation treatments, among other applications.

ADVANCED LANDCOVER PREDICTION AND HABITAT ASSESSMENT (ALPHA) PROGRAM AND DETAILED VEGETATION MAPPING

The ABMI's Advanced Landcover Prediction and Habitat Assessment (ALPHA) program combines the fields of remote sensing, GIS, machine learning, cloud computing, and geospatial data science to map and monitor landcover dynamics across Alberta. The ALPHA program's

deliverables for 2018–2019 were categorized into: 1) topographic variables; 2) hydrographic variables, and 3) landcover classes.

In 2018–2019 the ABMI continued to generate a suite of topographic variables for current and reference conditions. We generated these topographic indices from several digital elevation models (DEMs) produced from the Advanced Land Observing Satellite (ALOS), NASA's Shuttle Radar Topography Mission (SRTM), and a combination of GoA LiDAR that covers Alberta's green and white zones. The current condition indices include: SAGA Wetness Index; Topographic Position Index (window sizes: 250 m, 500 m, 750 m); Multi-Resolution Index of Valley Bottom Flatness; and Topographic Ruggedness Index. In addition to current conditions, the ABMI developed and piloted a mapping protocol for reference elevation model-based metrics where GoA's LiDAR is available. Areas completed in the province include the OSR, the Grand Prairie area and most of Northern Alberta.

As part of ALPHA's hydrographic data, we updated layers to track seasonal cycles of surface water in Alberta (Hydro Temporal Variability dataset; available at abmi.ca). For this work, we collaborated with Synthetic Aperture Radar (SAR) experts like Dr. Brian Brisco and his team at the Canadian Centre for Mapping and Earth Observation to produce dynamic surface water maps for all of Alberta. In addition, we initiated development of a surface water web portal to show the current state of surface water and other summary statistics such as wetland hydroperiod.

Under the landcover classes, we produced the Predictive Landcover (PLC) 2.1 dataset. This dataset represents four wetland classes and two other classes (open water and upland) for about 75% of Alberta at a 10 m spatial resolution. The PLC 2.1 dataset is used internally to identify wetland areas and externally by the GoA's draft Biodiversity Management Frameworks (wetland cover and fen cover indicators). To monitor long-term trends in landcover the ABMI uses the Landsat historical satellite archive, which provides consistent data from 1984 to the present. We used Google Earth Engine to develop and test a prototype web application to monitor surface water and climate- vs. land-use-driven interactions to track lake area, temperature, precipitation, and human footprint land use over 30 years.

In addition to these ALPHA deliverables, we also updated a GIS layer describing detailed Vegetation and Landcover on the ABMI's 3 × 7-km photo-plot sites by mapping vegetation information for 94 sites. During 2018–19 we completed all of the photo-plot sites located within the Oil Sands region. In addition, we delivered the updated 2018–19 information to the National Forestry Inventory.

SUPPORT FOR LAND-USE PLANNING

During 2018–19, the GC directly supported methods development to analyze human footprint and land cover information in support of regional and sub-regional planning, as well as reporting against regional land-use targets established by government (e.g., Biodiversity Management Framework). In addition, the Centre's staff continuously supported the delivery of mapping outputs for the Regional Industry Caribou Collaboration (RICC) and the ABMI's Caribou Monitoring Unit. Specifically, the Centre's staff has been directly involved in developing methods to assess and map cumulative impacts of human disturbance on Boreal Caribou in Alberta.

Information Centre

The Information Centre is responsible for knowledge translation, information management, and land access at the ABMI. These activities include ensuring ABMI data meet the highest quality standards, developing and maintaining information delivery platforms, producing reports and other publications, building stakeholder relationships, and ensuring the ABMI has access to private and public lands to conduct our biodiversity surveys.

STAKEHOLDER ENGAGEMENT

In response to the ABMI's 10-year Science and Program Review, completed in 2017–18, the ABMI committed to increasing its stakeholder engagement activities and ensuring engagement is a crosscutting capacity. As a result, an internal stakeholder engagement team—the Internal Tran-SEKT (Stakeholder Engagement and Knowledge Translation) Team—was formed. This group meets monthly to ensure the ABMI is tracking and responding to stakeholder feedback and to initiate and coordinate engagement activities as programs and services are launched or expanded. The Internal TranSEKT Team has implemented several 10-year Review recommendations related to increasing the impact of the ABMI program, such as launching a webinar series, increasing newsletter and blog releases, and hosting additional lunch-and-learns and in-person meetings.

SURVEY SITE ACCESS

In response to recommendations of the 10-year Science and Program Review, the 2018 field season focused on two priorities: 1) completing the full survey of the ABMI's systematic monitoring grid, and 2) detecting rapid change in species abundance, if occurring, in areas of relatively rapid development. As a result, survey sites fell into one of two categories: new sites (never previously visited) that were surveyed with a full suite of protocols, and targeted revisits with a reduced suite of protocols.

To support this work, the ABMI successfully gained access to 268 terrestrial sites (105 new, 115 targeted revisits, and 48 at which only moss and lichen protocols were implemented) and 220 wetland sites (107 new, 113 targeted revisits). Approximately 108 of the terrestrial sites were established on private land or grazing dispositions in the White Zone.

The access team also distributed over 300 information packages to land- and disposition holders visited in the 2017 field season, providing them with information about the ABMI's findings on their land. Furthermore, the access team worked closely with numerous representatives from national, provincial and municipal jurisdictions to negotiate long-term access to Alberta's land bases.

To support the 2019 field season, the ABMI must gain access to 108 systematic sites (terrestrial and wetland) to be surveyed with the full suite of protocols. For the first time, the access team will gain access to sites for the newly developed Focal Areas Program (FAP); 372 will be located within the Oil Sands Monitoring area, and approximately 100 will be in the southwest of the province, to be surveyed in partnership with Lethbridge College. The FAP will consist solely of cameras and ARUs to monitor mammals and vocalizing species, respectively. By March 31, 2019, an estimated 83% of the required access work was complete.

DATA MANAGEMENT

Throughout 2018–19, the ABMI's data management systems continued to undergo development and refinement. Associated activities include:

- Implementation of updates on the ABMI's field tablet software to improve user workflow and data validation processes of various field protocols, and to reflect protocol changes associated with our focal species monitoring program.
- Addition of new functions to the ABMI remote camera image processing website which include:
    - Implementation of two-stage subsampling for images of wild animals to reduce the number of images that require manual processing.
    - Development and implementation of an updated data management system to allow users to apply multiple tags to an image, manage their project team, tasks and workflows, and easily access and download data.

- In collaboration with the Bioacoustic Unit at the University of Alberta, implementation of a Bioacoustic Information System (BIS) to manage and analyze acoustic data. The BIS facilitates efficient acoustic file transcription by providing transcribers: 1) a visual representation (a spectrogram) of what they're hearing as they process each sound file, and 2) the ability to easily tag the spectrogram with species names as they identify individual species. Various new features were also added to the system, including:
    - Implementation and testing of species identity prediction (using machine learning-based autorecognition software).
    - Incorporation of seasonality information for bird species, whereby the probability of detection for a given species is generated based on location and time of year.
- Completion of the user interface for WildTrax, an online environmental sensor network, with public release expected in fall 2019. WildTrax will host the remote camera and bioacoustic processing platforms described above with a view to accommodating additional sensors in the future. WildTrax provides a secure and user-friendly environment to support data storage, data management, processing, and reporting for the ABMI and third parties (partners, stakeholders, and citizens) that currently collect or have an interest in collecting wildlife data in Alberta and elsewhere.

WEBSITE AND DATA ACCESSIBILITY

In 2018–19, information on the ABMI Data & Analytics portal was updated to 2017 conditions. Over a hundred new complete species profiles were added to the Biodiversity Browser, and mammal data based on remote camera image analysis was made available for the first time. The ABMI's 2018–19 field-collected habitat and species data will be made publicly available in fall 2019, also via the portal.

Based on stakeholder feedback gathered through the ABMI's 10-year Science and Program Review, the ABMI's information management team began enhancing the ABMI's mapping portal (abmi.ca/maps) to increase scalability and handle more complex data layers, such as the ABMI's Human Footprint Inventory. In addition, to support user-defined queries within a future custom reporting online environment, a new database was implemented.

PUBLICATIONS

During 2018–19, ABMI staff continued to work on multiple reporting products. Key efforts include:

- Throughout summer and fall 2018, the ABMI reporting team completed a draft of the online report, "The State of the Environment (land and biodiversity) for the Oil Sands Region of Alberta". The ABMI shared this draft with land-use decision makers across multiple sectors to gather feedback on the report format. Based on the feedback received, the ABMI chose to update the report to effectively communicate with a wider range of audiences. This work continued through 2019, with a public release anticipated in the fall.
- In January 2019, the ABMI released the online report "Evaluating 10 years of Biodiversity Monitoring in Alberta", which presents the results of the ABMI's 10-year Science and Program Review conducted in 2017–18 (abmi10years.ca).

CITIZEN SCIENCE

In July 2018, the ABMI officially launched NatureLynx™, an Alberta-based citizen science application available for both desktop and mobile computing platforms. With NatureLynx, users upload photographs of local flora and fauna in support of various biodiversity monitoring initiatives. In addition to managing their own profiles, users can join "Groups" that bring people together around shared interests, compete in "Missions" to accomplish specific goals, and interact with rich biodiversity content. Species names of user sightings are verified by a community of experts, which provides feedback to NatureLynx users less familiar with Alberta's biodiversity.

In October 2018, the ABMI launched its first in an ongoing series of province-wide citizen science Missions hosted on the NatureLynx platform. These "Hands on Alberta" projects allow Albertans to connect across the province over a common goal, and will be hosted occasionally to monitor

biodiversity over time. On October 27th and 28th, users shared sightings of wild hare to monitor their seasonal colour change from brown to white. The goal: to increase our understanding of the impact of a changing climate on this evolutionary response to a change in seasons. A second "Hands on Alberta" mission was hosted in February, inviting participants to share their observations of animal snow tracks throughout the province.

The remainder of the 2018–19 year was dedicated to promoting the app's release, gathering user feedback, and continuing development on the platform in preparation for spring/summer 2019.

"In 2018–19, over a hundred new complete species profiles were added to the Biodiversity Browser, and mammal data (based on remote camera image analysis) was made available for the first time."

Application Centre

The Application Centre demonstrates the value of the ABMI's biodiversity data, scientific approaches, and know-how. Through applied research and development funded by numerous sponsors, Albertans are increasingly able to manage biodiversity while balancing land-use needs, apply market forces to promote biodiversity conservation and stewardship, and monitor rare plants and animals in the Oil Sands Region.

BIOACOUSTIC UNIT

The Bioacoustic Unit (BU) supports research and development to monitor wildlife populations using ARUs. A collaboration between the University of Alberta and the ABMI, the BU has developed protocols for ARU deployment and data processing. A significant focus in 2018–19 was growth and operation of the acoustic portion of the WildTrax platform. WildTrax is an open source web application for the management, analysis, and dissemination of bioacoustic and camera data. Development of the WildTrax platform included the initiation of collaborative efforts to centralize and standardize acoustic data from across Canada. In addition, the BU continued to provide data processing services to a variety of ARU users, including the ABMI's regional monitoring program and government, industry, and NGO programs. The BU processed over 12,000 recordings across multiple projects. Going forward, our emphasis is on automating species identification through machine learning. This year we submitted/published three scientific papers documenting how automated processing is most effectively done.

Environment and Climate Change Canada and the Canadian Oil Sands Innovation Alliance sponsored the development of WildTrax. Field research partners this year included Al-Pac, West Fraser, Parks Canada, NSERC, Suncor, CNRL, Imperial Oil, Cenovus, Devon Canada, Conoco-Phillips, and the Petroleum Technology Alliance of Canada.

FOCAL PLANTS PROJECT

The Focal Plants Project, led by Dr. Jacqueline Dennett and Dr. Scott Nielsen at the University of Alberta, is focused on developing information on culturally-valued plant species and on building partnerships with Indigenous communities in Alberta's Oil Sands Region. The ABMI provided project support for engagement initiatives including events and engagement with several Indigenous communities.

Core funding for this project is provided through the Applied Conservation Lab at the University of Alberta, with support from the Oil Sands Monitoring Initiative.

ECOSYSTEM SERVICES ASSESSMENT PROGRAM

The ABMI has developed tools to assess the supply of multiple ecosystem services across Alberta, as part of the Ecosystem Services and Biodiversity Network. Using applied research, this program has applied simulation models to estimate and map baseline measures of ecosystem services, and implemented the resulting tools to predict the supply of

ecosystem services. The program includes services related to forage production, timber production, soil carbon storage, pollination, water storage, water purification, recreation, and biodiversity. The program's focus in 2018–19 was the delivery of tools and models to assess ecosystem services, as well as to support land use planning, sustainability reporting, and policy for market-based options. The project's outcomes were presented to participants from different sectors in the Role of Science in Creating Ecosystem Service and Biodiversity Markets symposium.

In addition, the ABMI completed a final report for Ecosystem Services assessment Phase II.

The report is structured around the Program's three objectives:

- **Objective 1:** Assessment and Demonstration. Robust validation and demonstration of protocols and models (systems) to assess ecosystem services and biodiversity through case studies, pilots, and applied research.
- **Objective 2:** Outreach Tools. Delivery of ESA application and outreach tools to support land-use planning, sustainability reporting, and policy for market-based options.
- **Objective 3:** New Model Development. Development of three additional models that can be integrated into systems to assess ecosystem services and biodiversity.

The ecosystem services mapping portal is being updated with the newly developed information and maps to support stakeholders, including land trust and stewardship organizations; farmers and ranchers; counties and municipalities; and regional planning initiatives.

Core funding for this project is provided by Alberta Innovates.

BIODIVERSITY ASSESSMENT OF ALBERTA'S BEEF INDUSTRY

The collaborative research project *Biodiversity of Alberta's Beef Industry: filling the gaps and identifying opportunities* is developing a framework and methodology for assessing the positive and negative implications of beef production systems in Alberta. Key achievements in 2018–19 include the completion of analysis of relationships between measures of multi-taxa diversity and rangeland health, cattle stocking rate management, and other management decisions (e.g., seeding pastures). In addition, a framework has been proposed to incorporate biodiversity into a life cycle assessment of beef production. The proposed framework is currently being further developed through a collaboration with Agriculture and Agri-Food Canada "A regionalized life cycle impact assessment model for the assessment of Canadian beef farming effects on biodiversity".

The core sponsor of this project is Alberta Agriculture and Forestry, with collaborators from the University of Alberta, Agriculture and Agri-Food Canada, and the Government of Alberta.

CARIBOU MONITORING UNIT

Increasing human disturbance and changes in climate are driving declines in Woodland Caribou populations. The ABMI's Caribou Monitoring Unit (CMU) was developed to support Woodland Caribou recovery in western Canada. The CMU works with academics, industry, and government to facilitate meaningful research and provide scientific expertise to evaluate and monitor caribou recovery options and provide decision-makers with tools to make ecologically informed land-use decisions.

Current CMU programs focus on testing Woodland Caribou recovery options, prioritizing habitat restoration, and conducting research to understand the mechanisms leading to caribou declines. Specific projects include evaluating the relative influence of climate- and human-derived habitat alteration on predator and prey populations implicated in caribou declines, testing and predicting the efficacy of habitat restoration, and understanding the relationships among natural habitat, human disturbance, predators, and prey. The CMU continues to develop relationships with stakeholder groups and support efforts to increase the collective understanding of issues facing Woodland Caribou in Western Canada.

"Caribou Monitoring Unit programs focus on testing Woodland Caribou recovery options, prioritizing habitat restoration, and conducting research to understand the mechanisms leading to caribou declines."

Core funding is provided by the Regional Industry Caribou Collaboration, Government of Alberta, Canadian Oil Sands Innovation Alliance, Government of British Columbia, Government of Northwest Territories, Fish and Wildlife Compensation Program, and Habitat Conservation Trust Fund.

SUPPORT FOR REGIONAL PLANNING

In 2018–19, the ABMI provided scientific and logistical support for the development of the Biodiversity Management Frameworks (part of Alberta's Land-use Framework) for the Lower Athabasca, South Saskatchewan, and North Saskatchewan regions, as well as providing technical calculations for all regions in the province. Working closely with the Government of Alberta, the ABMI helped develop key biodiversity indicators that will be used to measure if and how Alberta's species and their habitats are changing in each of these regions. Each indicator must be measurable, cost-effective, and relevant to the diverse needs of stakeholders in both northern and southern Alberta. Through these efforts, Albertans will have the tools to evaluate our collective performance as stewards of Alberta's land and water.

COMMUNITY BASED MONITORING AND INDIGENOUS ENGAGEMENT

In 2018–19, the ABMI collaborated with several Indigenous communities across the province to support Indigenous-led community-based monitoring. This included wetland monitoring, and the use of ARUs and Wildlife Cameras to track culturally important mammals, birds, and amphibians. The ABMI continues to engage and work with Indigenous communities to gain a better understanding of monitoring needs and how traditional ecological knowledge can be used to provide a more comprehensive picture of biodiversity in Alberta.

Core funding is provided through Environment and Climate Change Canada's Funding for Community-based Monitoring in the Oil Sands Region of Alberta.

Summarized Financial Statements

of the Alberta Biodiversity Monitoring Institute

Year Ended March 31, 2019

Report of the Independent Auditor on the Summary Financial Statements

To the Board of Directors
Alberta Biodiversity Monitoring Institute

Opinion

The summary financial statements, which comprise the summary statements of operations and net assets for the year ended March 31, 2019 and the summary statement of financial position as at March 31, 2019 are derived from the audited non-consolidated financial statements of Alberta Biodiversity Monitoring Institute for the year ended March 31, 2019.

In our opinion, the accompanying summary financial statements are a fair summary of the audited financial statements, in accordance with Canadian Accounting Standards for Not-for-Profit Organizations.

Summary Financial Statements

The summary financial statements do not contain all the disclosures required by Canadian Accounting Standards for Not-for-Profit Organizations. Reading the summary financial statements and the auditor's report thereon, therefore, is not a substitute for reading the audited financial statements and the auditor's report thereon. The summary financial statements and the audited financial statements do not reflect the effects of events that occurred subsequent to the date of our report on the audited financial statements.

The Audited Financial Statements and Our Report Thereon

We expressed an unmodified audit opinion on the audited financial statements in our report dated September 9, 2019.

Management's Responsibility for the Summary Financial Statements

Management is responsible for the preparation of the summary financial statements in accordance with Canadian Standards for Not-for-Profit Organizations.

Auditor's Responsibility

Our responsibility is to express an opinion on whether the summary financial statements are a fair summary of the audited financial statements based on our procedures, which were conducted in accordance with Canadian Auditing Standard (CAS) 810, *Engagements to Report on Summary Financial Statements.*

Coyle & Company
Chartered Accountants

September 9, 2019
Edmonton, Alberta

ALBERTA BIODIVERSITY MONITORING INSTITUTE

Summarized Financial Statements

As at and for the year ended March 31, 2019

RESULTS FROM OPERATIONS	2019	2018
REVENUE		
Oil Sands Monitoring	$ 5,710,000	$ 5,510,000
Government of Alberta	4,363,292	4,964,867
Application Centre	1,975,503	2,412,556
Private Sector	127,677	55,214
Government of Canada	98,100	
Interest Income	11,332	22,782
	12,285,904	12,965,419
STAFFING		
Executive Office	375,462	400,426
Science Centre	509,110	597,657
Information Centre	1,145,982	1,064,527
Data Collection Centre	1,728,679	1,920,917
Lab Processing and Identification Centre	1,097,211	1,085,219
Application Centre	666,340	696,704
Geospatial Centre	1,279,759	1,166,391
	6,802,543	6,931,841
PROGRAM EXPENDITURES		
Executive Office	257,505	239,814
Science Centre	121,826	168,253
Information Centre	518,181	480,195
Data Collection Centre	2,657,916	2,422,588
Lab Processing and Identification Centre	206,867	213,171
Application Centre	1,476,533	1,944,860
Geospatial Centre	441,133	270,627
Expense Recoveries and Other	(42,419)	(49,115)
	5,637,542	5,690,393
EXCESS (DEFICIENCY) OF REVENUE OVER EXPENDITURES	(154,181)	343,185
NET ASSETS - BEGINNING OF YEAR	1,748,326	1,405,141
NET ASSETS - END OF YEAR	$ 1,594,145	$ 1,748,326

FINANCIAL POSITION	2019	2018
ASSETS		
Cash	$ 1,642,277	$ 1,303,162
Short term investment	-	3,238,582
Accounts receivable	1,426,618	242,269
Prepaid expenses	10,951	-
	3,079,846	4,784,013
Capital Assets	521,606	368,174
Long Term Investments	200,068	-
	$ 3,801,520	$ 5,152,187
LIABILITIES AND NET ASSETS		
Accounts payable and accrued liabilities	$ 1,321,338	$ 2,080,020
Deferred revenue	886,037	1,323,841
NET ASSETS		
Unrestricted	1,594,145	1,748,326
	$ 3,801,520	$ 5,152,187

ON BEHALF OF THE BOARD

Director

Director

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