OIL SANDS MONITORING SYMPOSIUM

FEB 24-25 2015

PROGRAM

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The Oil Sands Monitoring Symposium is a two-day event featuring technical presentations on monitoring activities and results collected during the three year Joint Canada/Alberta Implementation Plan for Oil Sands Monitoring (JOSM). Scientists will present findings related to: air, water, biodiversity and wildlife health monitoring. Speakers will address the purpose of their work and the core scientific questions it was intended to address; what they have learned from data analysis about the condition of the environment; and, implications for future work.

AT A GLANCE

PROGRAM: TUESDAY, FEBRUARY 24TH

7:30-8:45 am Registration and Breakfast

8:45-8:55 am Welcome and Opening Remarks
Jay Nagendran, President and CEO, AEMERA

8:55-9:15 am Keynote Address: How science can inform policy and decision-making
Dr. Lorne Taylor, Board Chair, AEMERA

9:15-9:30 am Overview of the *Joint Canada-Alberta Implementation Plan for Oil Sands Monitoring*
Prasad Valupadas, AEMERA and David Boerner, Environment Canada

THEME 1: PRESSURES AND STRESSORS

Session 1: Emissions and Releases

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George Marson, Environment Canada

9:50-10:10 am 1.2 Dust source characterization
Dr. John Watson, Wood Buffalo Environmental Association

10:15-10:30 am Refreshment and Networking Break

Session 2: Resource Use

10:30-10:50 am 2.1 Landscape condition and human development in the oil sands region
Jim Herbers, Alberta Biodiversity Monitoring Institute

10:50-11:10 am 2.2 A hydrologic assessment of effects from oil sands operations using a simplified water balance approach
Anil Gupta, AEMERA and Steven Guenther, Hatfield Consultants

11:10-11:30 am 2.3 Hydrologic/hydraulic and sediment transport environmental projection modelling
Dr. Ian G. Droppo, Environment Canada

11:30-12:00 pm Presenter Panel – Pressures and Stressors

12:00-1:00 pm Lunch
Lunch Speaker: The Honourable Kyle Fawcett Minister of Environment and Sustainable Resource Development

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Michael Bisaga, Lakeland Industry and Community Association (LICA)

1:20 -1:50 pm 3.2 Overview of long-term air and terrestrial monitoring in the Wood Buffalo Region
Dr. Kevin Percy, Wood Buffalo Environmental Association

1:50-2:10 pm 3.3 Community odour monitoring program
Ray Porter and Abena Twumasi-Smith, Wood Buffalo Environmental Association

2:10-2:30 pm	3.4 16-year air concentration trends in the Wood Buffalo Region *Dr. Warren Kindzierski, University of Alberta*
2:30-2:45 pm	Refreshment and Networking Break

Session 4: Water and aquatic system health

2:45-3:05 pm	4.1 Assessment of changes in benthic invertebrate communities of the oil sands region *Anil Gupta, AEMERA and Bruce Kilgour, Hatfield Consultants/Kilgour and Associates Ltd.*
3:05-3:25 pm	4.2 Fish health and community endpoints as indicators of potential changes in the oil sands region *Anil Gupta, AEMERA and Heather Keith, Hatfield Consultants*
3:25-3:45 pm	4.3 Environmental archives of trace metal deposition in the oil sands region *Colin Cooke, AEMERA*
3:45-4:05 pm	4.4 Assessment of water quality patterns in 7 Canadian rivers in relation to oil sands industrial development, 1972 to 2010 *Patricia Chambers, Environment Canada*
4:05-4:35 pm	Presenter Panel – Long term water and air monitoring
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PROGRAM: WEDNESDAY, FEBRUARY 25TH

7:30-8:30 am	Registration and Breakfast
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8:45-9:30 am	Keynote Address: Making environmental monitoring a key asset for sustainable development *Dr. Arthur Hanson, Distinguished Fellow with the International Institute for Sustainable Development (IISD)*

THEME 2: LONG TERM MONITORING

Session 5: Biodiversity Monitoring in the Cold Lake, Athabasca and Peace River Regions

9:30-10:00 am	5.1 ABMI's long term biodiversity monitoring in the oil sands region: emerging results *Dr. Jim Schieck, Alberta Biodiversity Monitoring Institute*
10:00-10:20 am	5.2 Trend monitoring of priority migratory birds in oil sands areas: lessons learned 2012-2015 *Dr. Samantha Song, Environment Canada*
10:20-10:40 am	5.3 Use of aerial survey methods to estimate ungulate populations in the oil sands region *Simon Slater, AEMERA*
10:40-10:55 am	Refreshment and Networking Break

AT A GLANCE

Session 6: Wildlife and Forest Health

10:55-11:15 am	6.1 Monitoring amphibian and wetland health in the oil sands *Bruce Pauli, Environment Canada*
11:15-11:35 am	6.2 Additive and cumulative effects of forestry and energy sector disturbance on boreal landbirds in the Athabasca Oil Sands area *Dr. C. Lisa Mahon, Environment Canada*
11:35-11:55 am	6.3 Forest health monitoring *Dr. Kevin Percy, Dr. Allan Legge and Dr. Doug Maynard, Wood Buffalo Environmental Association*
12:00-1:00 pm	Lunch
1:00-1:30 pm	Presenter Panel – Long-term biodiversity, wildlife and forest health monitoring

THEME 3: FOCUSED MONITORING

Session 7: Heavy Metals and Organic Contaminants

1:30-2:00 pm	7.1 Atmospheric deposition of contaminants to the Athabasca Oil Sands Region *Jeff Brook and Jane Kirk, Environment Canada*
2:00-2:20 pm	7.2 Ambient monitoring of volatile organic compounds in Fort McKay *Dr. Matthew Parsons, Environment Canada*
2:20-2:40 pm	7.3 Open Path FTIR data collected at Fort McKay Station over the summer of 2014 *Long Fu, AEMERA; Longdong Zhang, Zaher Hashisho University of Alberta*
2:40-3:00 pm	7.4 Mercury trends in colonial waterbird eggs downstream of the oil sands region of Alberta, Canada *Bruce Pauli, Environment Canada*
3:00-3:15 pm	Refreshment and Networking Break

Session 8: Understanding Pollutant Transformation Processes

3:15-3:35 pm	8.1 Recent findings from the summer 2013 intensive monitoring campaign (both ground-based and airborne components) *Stewart Cober, Environment Canada*
3:35-3:55 pm	8.2 High resolution air mapping tool for the oil sands region in Alberta *Long Fu, AEMERA and Daniel Spitzer, A-Maps*
3:55-4:15 pm	8.3 High-resolution air quality modelling in the oil sands *Heather Morrison, Environment Canada*

Session 9: Human Disturbance Footprint

4:15-4:35 pm	9.1 Biodiversity hotspots: identifying areas that are extra-special importance to managers and planners *Dr. Jim Schieck, Alberta Biodiversity Monitoring Institute*
4:35-4:55 pm	9.2 What have we learned about oil sands wildlife by using automatic recording units *Dr. Erin Bayne, University of Alberta*
5:00 pm	Symposium Wrap-Up

PROGRAM: TUESDAY, FEBRUARY 24

7:30-8:45 a.m.

Registration and Breakfast

8:45-8:55 a.m.

Welcome and Opening Remarks
Jay Nagendran, President and CEO, AEMERA

8:55-9:15 a.m.

Keynote Address: How science can inform policy and decision-making
Dr. Lorne Taylor, Board Chair, AEMERA

The need for good science to inform environmental policy and decision-making is arguably more urgent today than ever before, as the demands for, and hence the issues related to managing Alberta's natural resources are more complex than ever before. But in an era where anyone with a computer and Internet connection can claim to be an expert, what qualifies as "good" science? How do you sort through to determine what is true versus what someone wants you to believe is true? Or who or what can you trust?

AEMERA Chair Dr. Lorne Taylor will offer insights on how scientists and decision-makers need to build a mutual understanding on the role of scientific evidence in informing policy, beginning with establishing mutual trust and respect, and simply speaking the same language. Dr. Taylor will also outline the steps AEMERA is taking to establish itself as a source of credible science and relevant information to facilitate that process.

BIOGRAPHY

Board Chair of the Alberta Environmental Monitoring Evaluation and Reporting Agency (AEMERA), Dr. Lorne Taylor is a consultant and businessman based in Medicine Hat in southeastern Alberta, and was the founding Chair of the Alberta Water Research Institute. He is currently the Special Advisor to Alberta WaterSMART. He has held tenured positions at several universities.

Dr. Taylor entered politics in 1993 by being elected to the Legislative Assembly of Alberta for the riding of Cypress Medicine Hat. From 1993 to 2004, he served as Alberta's Minister of Science, Research and Information Technology, Minister of Innovation and Science, and Minister of the Environment. While in government, Dr. Taylor was instrumental in the creation of the Alberta Ingenuity Fund, Alberta SuperNet, and the Water for Life Strategy which remains the government's water strategy to this day.

9:15-9:30 a.m.

Overview of the *Joint Canada - Alberta Implementation Plan for Oil Sands Monitoring*
Prasad Valupadas, AEMERA and David Boerner, Environment Canada

THEME 1: PRESSURES AND STRESSORS
Session: #1 – Emissions and Releases

9:30-9:50 a.m.

1.1 Better estimates of geography-based emissions from the oil sands
George Marson, Environment Canada

Several existing sources of emissions data were examined and compared for the purpose of quantifying emissions of atmospheric pollutants from the oil sands area. The geographical coverage of the review corresponds to the Alberta Energy Regulator defined Athabasca, Cold Lake and Peace River areas.

Emissions from three specific categories are discussed:

a) mine vehicle fleet;

b) conventional heavy oil extraction; and

c) conventional gas extraction and processing.

Similarities and differences between data sources vary with category and substances. Overall there is no single data source that could provide best emission estimates for all substances or categories.

Not all data sources may have been reviewed; next steps will consist of addressing potential gaps.

BIOGRAPHY

George Marson is a chemical engineer that specialized in the measurement and continuous monitoring of emissions from industrial processes. In this capacity, he has worked 34 years with engineering companies; and provincial and federal regulatory agencies. Currently, George is a Program Engineer at Environment Canada. He is an Ontario registered Professional Engineer (P.Eng.) and an emeritus member of the Air and Waste Management Association (AWMA).

9:50-10:10 a.m.

1.2 Dust source characterization
Dr. John Watson, Wood Buffalo Environmental Association

ABSTRACT

Large fugitive dust plumes are often visible when wind speeds are high and when vehicles are moving over dusty surfaces. Fugitive dust originates from paved and unpaved roads, construction sites, agriculture tilling, landfills, mine tailings, application of de-icing materials, and general wind erosion, contributing more than 80% of PM_{10} and $PM_{2.5}$ criteria contaminant emissions nationwide, with higher amounts in resource extraction regions. A portable wind tunnel was operated on stabilized and undisturbed surfaces that represent many of these sources. This sampling system determined the capacities of dust reservoirs, suspendable size distributions, emission rates as a function of wind speed, and chemical composition. A wide range of size distributions and sensitivity to wind speed was found. Dust suppression techniques, such as frequent watering, application of stabilizing compounds, and minimizing trackout onto paved roads, were effective in reducing dust emissions. N-alkanes and other organic compounds were enriched in surface dust for many unpaved roads, providing fingerprints that are applicable to apportioning ambient PM_{10} and $PM_{2.5}$ concentrations to their fugitive dust sources.

BIOGRAPHY

Dr. John G. Watson is a Research Professor at the Desert Research Institute of the University of Nevada. His research involves the development and application of sampling and analysis methods for the real-world characterization of source emissions and ambient concentrations for inhalable aerosols. He has authored more than 300 publications on these topics over his past 35 year involvement in the environmental sciences.

10:15-10:30 a.m.

Refreshment and Networking Break

Session: #2 – Resource Use

10:30-10:50 a.m.

2.1 Landscape condition and human development in the oil sands region
Jim Herbers, Alberta Biodiversity Monitoring Institute

ABSTRACT

The conversion of native land-cover to support human development is the greatest threat to biodiversity in the oil sands region. Empirically measuring additions and deletions in human development is important to making smart stewardship choices. Understanding (or lack of understanding) affects how we develop policy and regulation, evaluate planning trade-offs, and invest in restoration. Therefore, knowing the amount, type, location and duration of human development is required to manage biodiversity along with economic and social interests.

We define human development (i.e., human footprint) as the temporary or permanent transformation of native ecosystems to industrial, residential or recreational land uses. Human development was determined at two spatial scales: i) coarse: evaluation is conducted at a spatial scale of 1:15,000 for the entire province circa 2012; and, ii) fine: evaluation is conducted at a spatial scale of 1:5000 for each of 1656 sample plots of 21 km^2 spaced evenly—every 20 km—throughout Alberta. In addition, we are involved in monitoring programs designed to evaluate the effectiveness of successional recovery and reclamation in the forest and energy industries.

Collectively, this information provides the foundation for an integrated, long-term human development information system for the oil sands region of Alberta.

BIOGRAPHY

Jim Herbers has been actively sharing the story and the science of biodiversity in Alberta through his work at the Alberta Biodiversity Monitoring Institute (ABMI) since 2004. As the Director of the ABMI's Information Centre, Jim focuses primarily on outreach and communication tools that are relevant to industry, government, ENGO's, and the public.

10:50-11:10 a.m.

2.2 A hydrologic assessment of effects from oil sands operations using a simplified water balance approach
Anil Gupta, AEMERA and Steven Guenther, Hatfield Consultants

ABSTRACT

Climate and hydrology monitoring in the oil sands region has been conducted since 1997 as part of the Regional Aquatics Monitoring Program (RAMP) and has continued in support of the Joint Oil Sands Monitoring Plan (JOSMP). Data collection and data sharing has been a collaborative process between JOSMP implementation teams, government, and industry to limit data collection overlap and provide consistent and continued climate and hydrometric data collection in the region. Hydrologic data analysis, in the form of a water balance, is conducted on 14 watersheds in the region to determine effects of oil sands development on the hydrology of each watershed. This water balance approach allows for the assessment of effects on streamflow without the need for long-term historical datasets, which are not always available. The water balance utilizes a combination of collected field data, land change analysis from remote sensing imagery, JOSMP and Water Survey of Canada (WSC) streamflow data, and withdrawal, release, and diversion data provided by oil sands operators. These data are combined to estimate a pre-development (baseline) streamflow record to compare to monitored data to quantify the change to annual surface water streamflow. Effects on the stream environment are measured based on four hydrologic endpoints that are consistent with EIA predictions related to oil sands development: 1) mean open-water season streamflow; 2) mean winter streamflow; 3) annual maximum streamflow; and 4) open-water season minimum streamflow.

BIOGRAPHY

Steven Guenther has worked on projects related to monitoring and detecting the effects of watershed development on stream hydrology for over ten years. These projects have been related to forestry, mining, and oil and gas development across Canada. He has a MSc degree studying the effects of logging practices on the thermal regimes of streams. He has been the field program coordinator of the Climate and Hydrology component of RAMP since 2009 and the component manager since 2011 and has continued leading these monitoring activities in support of the JOSMP.

11:10-11:30 a.m.

2.3 Hydrologic/hydraulic and sediment transport environmental projection modelling
Dr. Ian G. Droppo, Environment Canada

ABSTRACT

The Joint Oil Sands Monitoring Plan (JOSMP: 2012) identified a need for a more systematic and comprehensive quantification and modelling of the source, transport and fate of materials and chemical substances entering the lower Athabasca watershed. Towards this end, integrated hydrodynamic, sediment transport and water quality models are being developed for the Lower Athabasca River (LAR). Such models are key to provide a predictive capacity for the management of the LAR, as current and future changes in hydro-climatic conditions may influence hydrologic, hydrodynamic and sediment/contaminant dynamic conditions and have concomitant influences on various related components within JOSMP. Within the Water Component, modelling links may be made with Benthic Invertebrates, Toxicology, Wild Fish Health and Water Quality, and cross-component links may be made with Atmospheric and Wildlife. This work employs both physical modelling of sediment dynamics and process-based predictive numerical hydro-climatic/hydrodynamic/sediment/quality models. The presentation will provide information on the integrated modelling approach used and where future work will be focused. Specifically, 1) sediment dynamic work within an annular flume will be described along with results from Ells River sediment transport modelling (MOBED and RIVFLOC), and 2) numerical modelling outcomes including the common Environment Canada/AEMERA modelling platform (EFDC), will be discussed with future predictive capabilities.

BIOGRAPHY

Dr. Ian G. Droppo is a Senior Research Scientist at Environment Canada, with over 25 years of experience focusing on sediment dynamics within natural and engineered systems. He has undertaken research in multiple environments including urban stormwater management, remediation of contaminated bed sediments, bed sediment stability, and in the source, fate and effect of sediments and associated contaminants. He has over 85 international research journal publications, and is currently the Lead for the Hydrology/Climatology/ Sediment Dynamics group under the Water Component of JOSMP. Dr. Droppo holds adjunct professorships at three Canadian universities, where he actively supervises and mentors undergraduate and graduate students.

11:30-12:00 p.m.

Presenter Panel – Pressures and Stressors

12:00-1:00 p.m.

Lunch

Lunch Speaker: The Honourable Kyle Fawcett
Minister of Environment and Sustainable Resource Development

On February 24, 2015 the Government of Alberta will announce a new strategy to protect and conserve Alberta's water resources in Northern Alberta. The Honourable Kyle Fawcett, Minister of Environment and Sustainable Resource Development will provide a brief overview of the strategy and discuss its implications to the environmental monitoring, evaluation and reporting activities through the Oil Sands Monitoring program.

THEME 2: LONG TERM MONITORING

Session: #3 – Air Monitoring in the Cold Lake and Athabasca Regions

1:00-1:20 p.m.

3.1 Overview of long-term air and soil acidification monitoring in the Cold Lake region
Michael Bisaga, Lakeland Industry and Community Association (LICA)

ABSTRACT

Lakeland Industry and Community Association (LICA) began implementing its regional environmental monitoring programs in 2003 with the commissioning of a passive air monitoring network. Over time, monitoring efforts grew to include continuous ambient air monitoring, integrated air sampling for hydrocarbons, soil acidification monitoring plots, acid sensitive lakes assessment and sampling, as well as special studies and monitoring projects to address stakeholder concerns. Looking into the future, further enhancements will include improvements to particulate matter monitoring technology and data, and new measurements to assess gully flows and their impact on visibility and local air quality around the Beaver River Valley.

This presentation provides an overview of the different long-term monitoring programs that LICA carries out in the Cold Lake Oil Sands Region. These programs improve characterization of the state of the environment and data are used to collect the information necessary to understand cumulative effects and address local concerns. An overall summary of 2014 data from the continuous and passive ambient air monitoring programs is presented. The triggers for commissioning its regional soil acidification monitoring program as well as an overview of LICA's ongoing work in the area of soil acidification are detailed. Results of the 2014 surface water sampling campaign and determination of buffering capacity of selected acid-sensitive regional lakes is also presented.

BIOGRAPHY

Michael earned a Bachelor of Environmental Studies degree with a specialization in Biophysical Systems from the University of Waterloo in 2004. While completing his studies, he had internships in Calgary and Cold Lake which ultimately led to a return to Alberta, beginning a career in Air Quality. Since 2006, he has been the Airshed Program Manager for Lakeland Industry and Community Association (LICA). At LICA, he oversaw the growth of its regional monitoring programs from a relatively simple network to a multi-parameter, multi-media system. Prior to joining LICA, Michael worked for Alberta Environment as an Air Quality Specialist. Michael has a keen interest in night sky astrophotography and has been a violinist since he first picked up a fiddle at age eight. He currently lives in Calgary with his wife and two Giant Schnauzers, Mezzo and Forte.

1:20–1:50 p.m.

3.2 Overview of long-term air and terrestrial monitoring in the Wood Buffalo Region
Dr. Kevin Percy, Wood Buffalo Environmental Association

ABSTRACT

The Wood Buffalo Environmental Association (WBEA) was founded in 1998 as a not-for-profit, multi-stakeholder monitoring organization. WBEA's Mission is to monitor air quality and air quality related environmental impacts in order to generate accurate and transparent information which enables stakeholders to make informed decisions. WBEA has 38 Aboriginal, industry, ENGO, and government members. It operates extensive air quality, and terrestrial environmental monitoring programs within the 68,000 km^2 Wood Buffalo Regional Municipality. The WBEA human exposure monitoring program is focused on community-based odour measurement. Respect for TEK is a core value within WBEA.

In 2008, WBEA embarked on a multi-year science enhancement centered on air pollutant source to sink monitoring enabled by on-site staff and a multi-disciplinary team of senior scientists. Measurements taken along the air pollutant pathway

include "real-world" emissions of mobile, fixed, and fugitive emission sources, continuous and time-integrated air quality, pollutant transfer and deposition, and a suite of environmental indicators for determination of cause-effect. Since 2011, air and terrestrial systems have been integrated through the use of forensic receptor modeling tools used for source apportionment purposes. This presentation will provide an overview of steps taken since 2008 to enhance monitoring and will provide an update on current status of WBEA air and terrestrial monitoring activities.

BIOGRAPHY

Dr. Kevin Percy is Executive Director of the not-for-profit, multi-stakeholder Wood Buffalo Environmental Monitoring Association (www.wbea.org) located in Fort McMurray. Prior to joining WBEA in 2009, he was Senior Scientist-Global Change with NRCan. Dr. Percy has published numerous articles, books, and reports on air quality, air quality/climate change effects, and retrospective reviews of monitoring programs. His appointments at the science-policy interface have included the International Union of Forest Research Organizations (IUFRO), the CCME, and the Council of Canadian Academies Expert Panel *The Potential for New and Emerging Technologies to Reduce the Environmental Impacts of Oil Sands Development.*

1:50-2:10 p.m.

3.3 Community odour monitoring program
Ray Porter and Abena Twumasi-Smith, Wood Buffalo Environmental Association

ABSTRACT

The WBEA Human Exposure Monitoring Program (HEMP) conducts projects focused on odour detection and chemical characterization in communities and areas of public concern. The projects are strategically integrated to assess and communicate environmental air-related human exposure concerns to stakeholders and the public in the Regional Municipality of Wood Buffalo (RMWB).

VOCs and RSCs are often associated with odour episodes. As the RMWB continues to experience substantial population, industrial, and commercial growth, this will result in increased emissions of potential concern. There is an imminent need to generate information that will enhance our understanding of relationships between air quality and human exposure in the Wood Buffalo Region.

WBEA monitors odours using different specialized odour detection evaluation and quantification instruments and method to continue to build on odour data in the region. An odour detection analyzer used by WBEA is an Electronic Nose (eNose) that measures odour intensity and frequency in odour units, to indicate odour strength. The other instrument method being a dual detector Pneumatic Focused Gas Chromatograph (PFGC) that provides hourly measurements of VOCs and RSCs.

WBEA Human Exposure Monitoring Program then takes these measurement methodologies and data that relate to odours from the different methods listed above and integrate into a synthesis in order to arrive at a unified message on the state of regional odours. One key component of synthesis is a community based odour monitoring project, which involves having community individuals participate as "odour observant(s)" in the classification and reporting of odours in the city.

BIOGRAPHY

Mr. Raymond Porter brings more than 30 years of technical knowledge and experience to a diverse team of people committed to measuring, modeling and reporting of odours with the goal of improving the quality of life while optimizing the of limited resources. Mr. Porter has served as a national technical resource for odour impact assessments and odour control projects. Mr. Porter has contributed to technical manuals of practice that address odour emissions and air quality compliance at wastewater treatment plants.

2:10-2:30 p.m.

3.4 16-year air concentration trends in the Wood Buffalo Region
Dr. Warren Kindzierski, University of Alberta

ABSTRACT

An investigation of ambient air quality was undertaken at three communities within the Athabasca Oil Sands Region (AOSR) of Alberta, Canada (Fort McKay, Fort McMurray, and Fort Chipewyan). Daily and seasonal patterns and 16-year trends were investigated for several criteria air pollutants over the period 1998 to 2013. A parametric trend detection method using percentiles from frequency distributions of 1 h concentrations for a pollutant during each year was used. Variables representing 50th, 65th, 80th, 90th, 95th and 98th percentile concentrations each year were identified from frequency distributions and used for trend analysis. Small increasing concentration trends were observed for NO_2 (<1 ppb/y) at Fort McKay and Fort McMurray over the period consistent with increasing emissions of oxides of nitrogen (ca. 1,000 tonne/y)

from industrial developments. Emissions from all oil sands facilities appear to be contributing to the trend at Fort McKay; whereas both emissions from within the community (vehicles and commercial) and oil sands facility emissions appear to be contributing to the trend at Fort McMurray. SO_2 emissions from industrial developments in the AOSR were unchanged during the period (101,00047,000 tonne/y; mean4standard deviation) and no meaningful trends were judged to be occurring at all community stations. No meaningful trends occurred for O_3 and $PM_{2.5}$ at all community stations and CO at one station in Fort McMurray. Air quality in Fort Chipewyan was much better and quite separate in terms of absence of factors influencing criteria air pollutant concentrations at the other community stations.

BIOGRAPHY

Dr. Warren Kindzierski is an associate professor at the School of Public Health at the University of Alberta, Edmonton. Prior to that, he was an associate professor in the Department of Civil and Environmental Engineering for nine years and the Head of Chemical Risk Assessment for Alberta Health for three years. He has trained 43 graduate students and nine research associates and post-doctorates, mainly in air quality investigations and health risk assessment and is an author/co-author of over 100 refereed journal and conference papers.

2:30-2:45 p.m.

Refreshment and Networking Break

Session: #4 – Water and Aquatic System Health

2:45-3:05 p.m.

4.1 Assessment of changes in benthic invertebrate communities of the oil sands region
Anil Gupta, AEMERA and Bruce Kilgour, Hatfield Consultants/Kilgour and Associates Ltd..

ABSTRACT

The Joint Oil Sands Monitoring Plan (JOSMP) continued the monitoring of benthic invertebrates communities that commenced under the Regional Aquatics Monitoring Program (RAMP) in 1998. The JOSMP has involved the collection of benthos from the lower reaches of major tributaries; areas anticipated to be the most likely to respond to the influences of land cover change associated with oil sands land preparation. Benthos are also collected from lake environments. The study design has produced baseline data collected before oil sands operations in reaches that will be potentially influenced in the future, and upstream baseline reaches that are used as local and regional 'controls', informing us of the normal natural variations in benthic community composition. Sampling designs have been statistically intensive, and are able to detect subtle variations in benthos composition. The program has documented the effects of oil sands operations on tributaries such as the Lower Tar River, including recovery of communities after mitigations have been installed. The data set is now large, and the data set has allowed for the development of novel approaches to the quantification of normal ranges of variation of measures of community health. Benthic communities in most tributary rivers contain diverse assemblages of sensitive organisms typical of the habitats being monitored.

BIOGRAPHY

Dr. Kilgour is an aquatic ecologist. He completed his undergraduate training at Guelph, and his PhD at Waterloo. Through positions with Fisheries and Oceans Canada, and later in the consulting industry, he developed expertise in environmental monitoring study design and statistics. He is now based in Ottawa, where he is self-employed. He works across the country with pulp mills, mines, land development companies, and government agencies in the design and delivery of monitoring programs. Dr. Kilgour has been working with Hatfield Consultants in the delivery of oil sands related monitoring for over 10 years. His presentation will summarize the approach and major findings associated with the monitoring of freshwater benthic communities in the oil sands region.

3:05-3:25 p.m.

4.2 Fish health and community endpoints as indicators of potential changes in the oil sands region
Anil Gupta, AEMERA and Heather Keith, Hatfield Consultants

ABSTRACT

Fish community monitoring in the Athabasca oil sands region focuses on characterizing the fish assemblage of regional rivers on the basis of fish abundance, richness, diversity, and species tolerance in areas downstream of oil sands development. The Joint Oil Sands Monitoring Plan (JOSMP) includes a significant fish community monitoring program on tributaries of the Athabasca River, based largely on a program that was originally initiated in 2009 under the Regional Aquatics Monitoring Program (RAMP). Fish community monitoring was included at locations where monitoring of hydrology, water quality, sediment quality, benthos, and in some cases, fish

health (sentinel fish species) was already occurring in order to provide a more holistic and harmonized approach to the assessment of the aquatic health of each river. By monitoring all aquatic components at a single location, there is a greater ability to detect long-term changes and distinguish between changes resulting from oil sands development versus natural variability in the physical, chemical, and biotic characteristics of the river. To date, there is at most six years of fish community data for many reaches; however, the sampling design was developed to identify long-term trends at reaches downstream of oil sands developments, and potential differences from regional baseline ranges of variability. Furthermore, the incorporation of community analyses improves our understanding of possible relationships and consistencies in trends between fish health endpoints (e.g., reproduction, age, growth, condition of fish) and fish community endpoints (e.g., abundance, richness, diversity) over time, as shown in monitoring of the Steepbank River from 2010 to 2013.

BIOGRAPHY

Heather Keith has a MSc in Resource Management and Environmental Studies from the University of British Columbia, focusing on fisheries management. Ms. Keith has been with Hatfield Consultants for nine years, managing multi-disciplinary environmental effects monitoring projects for the oil and gas, pulp-and-paper, and mining sectors. During her time at Hatfield, Heather has implemented aquatic components of environmental impact assessments, operator-specific and regional monitoring programs, and long-term monitoring plans for compensation habitat in the Athabasca oil sands region. Heather has been the program manager (2010 to 2014) and fish component lead (2007 to 2014) for the RAMP monitoring activities, now continued in support of the JOSMP.

3:25-3:45 p.m.

4.3 Environmental archives of trace metal deposition in the oil sands region
Colin Cooke, AEMERA

ABSTRACT

The extraction of bitumen from the Athabasca oil sands – one of the largest energy deposits in the world – began in earnest after 1960. Since that time, production in the oil sands region has grown from about 30,000 m^3/d in 1984 to 300,000 m^3 /d ($1.9x10^6$ barrels/d) in 2013. This increase in production has accelerated the release of environmental contaminants, including various trace elements known to be toxic at low concentrations. Of particular environmental concern are the atmospheric loadings and distributions of trace elements associated with oil sands surface-mining and processing activities. Here, I will review how various environmental archives (including: lake sediment cores; mosses; lichen; and snow packs) have been used to understand the atmospheric deposition of trace elements in both time and space.

BIOGRAPHY

Colin Cooke holds a PhD in earth science from the University of Alberta and worked as a research scientist at the University of Sydney, Yale University, and the University of Pittsburgh prior to joining AEMERA. He has published ~20 articles in scientific journals in the past five years, was awarded the Isaac Newton International Fellowship by the Royal Society in 2010 (to be held at Cambridge University), and has delivered research seminars at universities around the world.

3:45-4:05 p.m.

4.4 Assessment of water quality patterns in seven Canadian rivers in relation to oil sands industrial development, 1972 to 2010
Patricia Chambers, Environment Canada

ABSTRACT

To evaluate changes in water quality in relation to type and stage of oil sands mining activities in northern Alberta, Canada, we compiled a 38 year dataset (1972 to 2010) and used it to examine patterns in concentrations and loads of 6 water quality parameters (dissolved Se, As and B; total U, V, and As) along seven tributaries of the Athabasca and Clearwater rivers. Both type (open pit versus in situ drilling) and stage (pre-development, early land clearing and construction, and expanded development) of development affected water chemistry. Concentrations of 3 parameters (total U, total V, dissolved B) and loads of all 6 parameters were greater ($P<0.05$) post development compared to reference values. Moreover, loads for all 6 parameters were greater ($P<0.05$) during early exploration and land clearing compared to reference values; only dissolved B had loads during subsequent expansion periods that were greater than reference. Our results indicate that erosion and subsequent runoff associated with land clearing and early operational activities in the oil sands region have affected water quality, and highlight the need for continued systematic real-time monitoring of these systems.

BIOGRAPHY

Dr. Patricia Chambers is a Senior Scientist with Environment Canada at the Canada Centre for Inland Waters in Burlington, Ontario. Dr. Chambers received her BSc from Trent University and her PhD from the University of St. Andrews, Scotland. Her research focuses on a variety of scientific problems, in particular the effects of human activity such as industrial operations, agricultural land use, and sewage discharge on the chemistry and biology of lakes and rivers. Dr. Chambers has led national assessments on behalf of the Canadian government to investigate the impacts of nutrient loading on Canadian aquatic ecosystems and has contributed to the development of science-based policies. Most recently, she was the Environment Canada co-lead of the regional water quality component of the Joint Oil Sands Monitoring Plan.

4:05-4:35 p.m.

Presenter Panel – Long term water and air monitoring

4:35-4:45 p.m.

Poster Overview

5:00-7:00 p.m.

Networking Mixer and Poster Session

PROGRAM: WEDNESDAY, FEBRUARY 25

7:30-8:30 a.m.

Registration and Breakfast

8:30-8:45 a.m.

Second Day Opening

8:45-9:30 a.m.

Keynote Address: Making environmental monitoring a key asset for sustainable development
Dr. Arthur Hanson, Distinguished Fellow with the International Institute for Sustainable Development (IISD)

Looking into the future to make major development decisions today requires credible monitoring programs and storylines that can help prevent option foreclosure and disasters, and, very importantly, can provide insight into additional or better development choices. Consistent capacity to create trusted and usable knowledge derived from the broad range of data, information and analytical tools available will define the value and standing of an independent monitoring body such as AEMERA. The organization must come to be regarded as a key asset for Alberta's sustainable development, able to thrive no matter how controversial its findings may be perceived; and stable in the face of changing economic, social or environmental circumstances. It must be capable of bringing new environment and development concepts into its work, for example the idea of planetary boundaries; better understanding of ecological resilience and integrity, and ecological services; recognition of how climate change will affect ecological monitoring and outcomes; and, of course, how to best link various knowledge sources, including traditional knowledge, with the many sources of science-based data. Good understanding of cumulative environmental impacts and regional environmental change is utterly dependent on environmental monitoring but rarely is this done well enough or in a timely fashion. This problem will become important in defining the most significant sources of pressures and stressors, and in the geographic and ecological scale of monitoring. Good environmental monitoring requires a system of adaptive assessment, planning and management, and a high degree of interaction with end users of knowledge. Scientists and others gathering information need to become comfortable with interpretation of their information within meta-frameworks that may include storylines built cooperatively with stakeholders, and scenarios that incorporate social, economic, cultural and environmental information. There is good Canadian and international experience from which to learn. The timing of Alberta's decision to set up AEMERA is excellent. It will take 5 to 10 years for it to reach its full potential. That time frame should be recognized and supported by all involved.

BIOGRAPHY

Art Hanson is a Distinguished Fellow with the International Institute for Sustainable Development (IISD) and earlier served as IISD's President and CEO. He conducts research, and provides advisory services on innovation for sustainable development, environment and economy relationships, biodiversity, oceans, and international development. Currently, he is the International Chief Advisor and a Member of the China Council for International Cooperation on Environment and Development (CCICED). This body provides advice to the State Council and Premier of China.

Dr. Hanson has a strong interest in linking science to public policy, and has worked with government bodies in Canada, the United States and Asia on natural resources and environmental management, and on mechanisms of accountability and governance for sustainable development. Institutional strengthening and capacity-building projects have also been an important focus of his work. In recent years much of his professional time has been spent working with China. Previously, Dr. Hanson initiated major environment and development capacity-building efforts in Indonesia working with the government, NGOs, universities and the private sector. He is a member of the Indonesian Biodiversity Foundation (KEHATI) Board.

He served two terms on Canada's National Round Table on the Environment and Economy (NRTEE) and was Canada's Ministerial Ocean Ambassador with the Department of Fisheries and Oceans for four years. Dr. Hanson was a member of the Canada Foundation for Innovation (CFI) for a decade, and a Mentor in the Trudeau Foundation. He has provided advice to the Office of the Auditor General of Canada since 1990, and to many other branches of the Canadian Government.

From 1978 to 1991, he was Professor and Director of the School for Resource and Environmental Studies at Dalhousie University. Dr. Hanson holds a PhD from the University of Michigan in the field of Fisheries Ecology and Natural Resources and a Masters degree in Zoology/Fisheries from the

University of British Columbia. He has an Honorary Doctorate of Law Degree from Mount Allison University. He is an Officer of the Order of Canada. Arthur Hanson lives in Victoria, British Columbia, Canada

THEME 2: LONG TERM MONITORING

Session: #5 – Biodiversity Monitoring in the Cold Lake, Athabasca and Peace River Regions

9:30-10:00 a.m.

5.1 ABMI's long term biodiversity monitoring in the oil sands region: emerging results
Dr. Jim Schieck, Alberta Biodiversity Monitoring Institute

ABSTRACT

The Alberta Biodiversity Monitoring Institute (ABMI) samples terrestrial biota (lichens, mosses, vascular plants, mites, birds, mammals), aquatic biota (vascular plants, benthic invertebrates), and terrestrial and aquatic habitats (live and dead trees, shrubs, herbs, litter, soil, water physiochemistry, water basin characteristics) through Alberta. In addition, ABMI maps human footprint and vegetation throughout Alberta. Data collection in the oil sands region is supported by the Oil Sands Monitoring program.

ABMI information is analyzed to describe species habitat associations and changes in human footprint over time. All types of human disturbance have increased in the oil sands region during the past decade. Species and biodiversity intactness – a measure of ecosystem deviation from undisturbed condition – vary spatially throughout the oil sands region and are tightly coupled with human disturbance. ABMI information is used to describe distribution, abundance and cumulative effects on native species in the region. Although not presented, similar data are collected and analyzed for other regions of Alberta.

Raw data collected by the ABMI, plus analyzed and summarized information about species, habitats and human footprints are available on the ABMI website. Customized analyses and reports are created for the oil sands region and for other key regions in Alberta.

BIOGRAPHY

Dr. Jim Schieck received his BSc and MSc form University of Western Ontario, PhD from University of Alberta, and a Post Doc at Simon Fraser University. Jim presently is a research scientist at Alberta Innovates, an adjunct professor at the University of Alberta, and a science director for the Alberta Biodiversity Monitoring Institute. Jim's research interests include avian ecology, population dynamics, community ecology, forest ecology, and conservation biology.

10:00-10:20 a.m.

5.2 Trend monitoring of priority migratory birds in oil sands areas: lessons learned 2012-2015
Dr. Samantha Song, Environment Canada

ABSTRACT

In an effort to build a scientifically robust program, we break down the challenge of trend monitoring for migratory birds to reveal multiple decision points and their impacts on the monitoring information ultimately produced. We conducted a quantitative evaluation of existing programs for monitoring trends of migratory landbirds and waterfowl, and the relative value of augmenting existing designs through simple levers such as sampling intensity, frequency or program duration. Duration of monitoring was consistently the most important factor in trend monitoring, with most common species requiring 10-15 years to detect population trends. Time lags for trend detection highlight the need to pair trend monitoring with spatial comparisons or model-based approaches to estimate change more quickly. Existing program adequately monitor regional trends for common species, while species that are rare, use rarer habitats or possess behaviours that make them difficult to detect using standard surveys require alternate monitoring approaches. We present a stratified sampling program to augment monitoring of landbirds associated with old-growth forests, including Species At Risk. Data collection was initiated in the spring 2014 at 2490 sites, including 715 site revisits, across the Peace, Athabasca and Cold Lake oil sands areas. The stratified design more than doubled the detection frequency of a target species compared to a systematic design. Future work for landbirds will emphasize estimation of inter-annual variability to improve trend detection and efficiency of program design. For waterfowl, existing programs will continue and new efforts focus on waterfowl breeding population distribution and effects assessment monitoring.

BIOGRAPHY

Dr. Samantha Song is the Head of the Population Assessment Unit with Canadian Wildlife Service, Prairie & Northern Region, Environment Canada. In addition to oil sands monitoring, Song and her staff hold federal responsibilities for monitoring and management of non-game migratory bird populations across the Prairie Provinces, and regional status assessment and listing of Species at Risk.

Song is also a Steering Committee member of the Boreal Avian Modelling Project, an international collaboration to improve the science of boreal bird ecology, conservation and management. Song holds a PhD from University of Alberta, and an MScF from University of Toronto.

10:20-10:40 a.m.

5.3 Use of aerial survey methods to estimate ungulate populations in the oil sands region
Simon Slater, AEMERA

ABSTRACT

Oil sands development is believed to have changed ungulate population dynamics, especially in areas of higher landscape disturbance. Aerial surveys provide critical information to assess population size, distribution and trends in addition to examining the impacts of harvesting, predation or other disturbances on ungulate populations. The AEMERA-ESRD enhanced moose (Alces alces) and deer (Odocoileus virginianus and O. hemionus) monitoring program involves increasing the quantity and frequency of aerial ungulate surveys within the oil sands region in order to enhance the efficacy of population estimates. Wildlife Management Units that overlap (>50%) with the oil sands region were surveyed using Gasaway (2013) and Distance sampling survey methods (2014-2015). Eleven aerial ungulate surveys have been completed in the oil sands region since the inception of the JOSM program and results from the 2013 and 2014 surveys will be discussed.

BIOGRAPHY

Simon is a Wildlife Monitoring Specialist currently seconded to AEMERA. He was hired by Environment and Sustainable Resource Development (ESRD) to help deliver the ESRD Joint Oil Sands Monitoring wildlife biodiversity program. This program includes woodland caribou, barred owl and ungulate monitoring in the oil sands region. Simon received a Master's of Science in Conservation Biology from the University of Alberta with his research focusing on woodland caribou conservation in Alberta.

10:40-10:55 a.m.

Refreshment and Networking Break

Session: #6 – Wildlife and Forest Health

10:55 – 11:15 a.m.

6.1 Monitoring amphibian and wetland health in the oil sands
Bruce Pauli, Environment Canada

ABSTRACT

Wood frogs (Lithobates sylvaticus) and their wetland breeding habitats are being intensively monitored in the oil sands region to assess the effects of environmental change on these valued ecosystem components. Spatial and temporal patterns of contaminants in the wetland breeding habitats and the wood frogs, and wetland physico-chemical characteristics are being examined to evaluate wetland health in the oil sands region. Wood frogs are studied because they are abundant across the study region and their life cycle includes aquatic and terrestrial stages. Parameters being examined include general water chemistry, amphibian population biology, and levels of total mercury (THg) and other metals and organic contaminants such as polycyclic aromatic hydrocarbons (PAHs) and naphthenic acids in breeding pond water and amphibian tissues. Levels of PAHs were measured in water, tissue, and semipermeable membrane devices (SPMDs). THg in water ranged from 0.34 to 21.3 ng/L, did not exceed CCME safe limits for the protection of aquatic life at any of the 21 study sites, and did not vary significantly within or across years. THg was significantly lower in recently metamorphosed wood frogs compared to adults or tadpoles. Across all sites, THg in tissues ranged from below detection limits to 0.41 ×g/g dw. Linear mixed models indicated that variations in the concentration of THg in water and frog tissues were not related to distance from upgraders, while preliminary data suggests that PAHs, particularly alkylated PAHs, accumulated to a greater extent in SPMDs located within the vicinity of upgraders (<25 km).

BIOGRAPHY

Bruce Pauli's research on the effects of environmental pollution have the overarching goal of establishing techniques that can be used to evaluate and assess environmental change. His research focuses on aquatic ecosystems using amphibian species as sentinel organisms. This research has included efforts to standardize toxicity tests with native amphibian species, to examine determinants of disease in native amphibians, and attempts to further understand cumulative effects and the response of wild amphibian populations to multiple stressors. Bruce Pauli is currently a Research

Manager and Chief, Ecosystem Health Research Section within the Ecotoxicology and Wildlife Health Division of Environment Canada.

11:15-11:35 a.m.

6.2 Additive and cumulative effects of forestry and energy sector disturbance on boreal landbirds in the Athabasca Oil Sands area
Dr. C. Lisa Mahon, Environment Canada

ABSTRACT

Within northern Alberta, risks to regional landbird populations exist due to pervasive and intensive patterns of resource development. Industrial forestry and oil and gas exploration and extraction (conventional and oil sands) has raised concerns about the capacity of the boreal forest to absorb multiple, simultaneous disturbances. Although the effects of multiple stressors are often assumed to be additive (the impacts of two stressors are simply added together or =a + b), recent reviews suggest interactive effects (=a x b) in approximately 77% of studies leading to a major source of uncertainty for projections of biodiversity. We addressed this issue by examining the additive and interactive effects of forestry and energy stressors on boreal landbird density within the Athabasca Oil Sands Area. We used avian data (>2511 point counts from 279 survey areas), habitat data, and human disturbance data to create generalized additive models (GAMS) within sector groups (Forestry, Forestry-Energy, Energy). We included in our models multiple stressors associated with forestry, conventional oil and gas, and Steam Assisted Gravity Drainage (SAGD) development. The Forestry-Energy model group contained the best model for 17/30 (57%) of species while the Energy model group contained the best model for 13/30 (43%) species. For each of the 30 landbird species, the best model was an interactive model. Key stressors of importance within the best models included harvest units, wellsites, vegetated linear features, and roads. Comparing predicted density for landbird species between current and no disturbance landscapes revealed positive, negative, and neutral responses to multiple interacting stressors.

BIOGRAPHY

Dr. C. Lisa Mahon is the Boreal Landbird Biologist in the Prairie and Northern Region of the Canadian Wildlife Service, and Adjunct Professor at the Department of Biological Sciences, University of Alberta. She is project lead of Environment Canada's cause-effects monitoring program to examine the effects of oil sands disturbance on boreal landbirds. Her work involves collaboration with partners to (1) develop methods to model relationships between landbirds and disturbance, and (2) implement studies to examine landbird response (patterns, mechanisms) to disturbance at local and landscape scales. Over the past 25 years she has studied habitat relationships of landbirds in coast-interior, sub-boreal, and boreal forests, grasslands, and agricultural lands in Western Canada.

11:35 – 11:55 a.m.

6.3 Forest health monitoring
Dr. Kevin Percy, Dr. Allan Legge and Dr. Doug Maynard, Wood Buffalo Environmental Association

ABSTRACT

The Wood Buffalo Environmental Association (WBEA) was founded in 1998 as a not-for-profit, multi-stakeholder monitoring organization with a Mission to monitor air quality and air quality related environmental impacts to generate accurate and transparent information which enables stakeholders to make informed decisions. Currently, it has 38 Aboriginal, industry, ENGO, and government members. WBEA operates an extensive forest health monitoring program within the 68,000 km2 Wood Buffalo Region, nested within the Lower Athabasca Land Use Region.

WBEA initiated an Acid Deposition Monitoring Program (ADMP) in 1998 to determine if Athabasca Oil Sands Region (AOSR) industrial air emissions were having a long-term adverse effect on the terrestrial environment. The regional network of forest plots measured in 1998 and 2004 was centered on P. banksiana stands having acid sensitive soils. During 2006-2007, a science-review of the ADMP was completed. The forest health concept was adopted; the network enhanced and expanded using the ecological analogue concept. The third cycle of plot measurements was completed in 2011/12. In this presentation, key findings on the state of forest health summarized from a 2015 WBEA report will be presented.

BIOGRAPHY

Dr. Kevin Percy is Executive Director of the not-for-profit, multi-stakeholder Wood Buffalo Environmental Monitoring Association (www.wbea.org) located in Fort McMurray. Prior to joining WBEA in 2009, he was Senior Scientist-Global Change with NRCan. Dr. Percy has published numerous articles, books, and reports on air quality, air quality/climate change effects, and retrospective reviews of monitoring programs. His appointments at the science-policy interface have included the International Union of Forest Research Organizations

(IUFRO), the CCME, and the Council of Canadian Academies Expert Panel The Potential for New and Emerging Technologies to Reduce the Environmental Impacts of Oil Sands Development.

12:00-1:00 p.m.

Lunch

1:00-1:30 p.m.

Presenter Panel – Long term biodiversity, wildlife and forest health monitoring

THEME 3: FOCUSED MONITORING

Session: #7 – Heavy Metals and Organic Contaminants

1:30-2:00 p.m.

7.1 Atmospheric deposition of contaminants to the Athabasca Oil Sands Region
Jeff Brook and Jane Kirk, Environment Canada

ABSTRACT

Monitoring for toxic compounds such as polycyclic aromatic compounds (PACs), trace metals and mercury has been established in the Athabasca Oil Sands Region (AOSR) to determine their atmospheric fate, including transport, transformation, and deposition. We present results from measurements at sites within and outside the major mining development areas including: (1) air and precipitation measurements at 3 locations; (2) integrated passive sampling at 17 locations; (3) snowpack sampling at ~130 sites; and (4) analysis of 19 lake sediment cores to examine long-term (~100 years) trends in contaminant deposition. In addition, an approach to estimating dry deposition from observed air concentrations will be described. Air measurements show that concentrations of PACs and metals decrease with distance from the main surface mining and upgrading activities, that alkylated-PACs are more abundant than the unsubstituted PACs, and that crustal elements, such as iron, silicon, aluminum, and calcium, are some of the most elevated of the metals. Snowpack loadings of PACs and metals decrease with distance from the major developments, with the highest deposition occurring within 50 km of the main development area. Dated lake sediment cores suggest that PACs deposition is 1-19 times higher in recent decades (post-1990s) than before development began (pre-1960s) in lakes located within 50 km from major developments. Next steps include integration of air, snow, precipitation and sediment measurements with water and wildlife data to help improve understanding of the cumulative impact of contaminants on ecosystems within the AOSR. Models will be used to integrate these measurements along with emissions information.

BIOGRAPHY

Dr. Jeff Brook is a senior scientist at Environment Canada (EC) and an assistant professor in the Dalla Lana School of Public Health and Department of Chemical Engineering at the University of Toronto. Dr. Brook leads EC's mobile lab activities, and projects studying urban and regional air quality, emphasizing fine particulate matter, interactions with meteorology and exposure assessment related to a range of health studies. He co-leads a Canadian Network of Centres of Excellence (AllerGen) program on Genes and Environment and leads the environmental exposure assessment component of a national birth cohort, known as CHILD, examining the influences of environmental factors on children's health.

Dr. Jane Kirk did her PhD at the University of Alberta, and is now an Environment Canada Research Scientist in the Aquatic Contaminants Research Division and adjunct professor at the University of Toronto Mississauga. Dr. Kirk's research program aims to understand the impacts of environmental stressors on aquatic ecosystems.

2:00-2:20 p.m.

7.2 Ambient monitoring of volatile organic compounds in Fort McKay
Dr. Matthew Parsons, Environment Canada

ABSTRACT

Volatile organic compounds (VOCs) are important pollutants to monitor in the atmosphere due to health risks, odour issues, and environmental effects such as contributions to secondary pollutants. In collaboration with the Wood Buffalo Environmental Association (WBEA) and as a component of the Joint Oil Sands Monitoring Plan, the Edmonton-based Air Quality Science Unit of Environment Canada operates a semi-continuous gas chromatograph to measure ambient concentrations of selected VOCs at Fort McKay – Bertha Ganter air monitoring station (WBEA AMS 1). Recent results from 2014 are discussed for benzene, toluene, ethylbenzene, and xylene ambient concentrations. Analyses are described to gain further insight into the behaviour of these VOC species in the oil sands region.

BIOGRAPHY

Dr. Matt Parsons is a Senior Air Quality Scientist with Environment Canada as a member of the Air Quality Science Unit located in Edmonton, AB. In his current role, he has focused on a variety of air quality contaminants across the Canadian prairies, including atmospheric mercury, volatile organic compounds, and particulate matter. Dr. Parsons has a background in atmospheric chemistry, earning his Ph.D. from the University of British Columbia in 2006, and subsequent postdoctoral work at Colorado State University and the University of Alberta.

2:20-2:40 p.m.

7.3 Open Path FTIR data collected at Fort McKay Station over the summer of 2014
Long Fu, AEMERA; Longdong Zhang, Zaher Hashisho University of Alberta

ABSTRACT

OP-FTIR was deployed at Air Monitoring Station 1 (AMS1) in Fort McKay in the oil sands region for about two months to monitor odour compounds, volatile organic compounds and other gaseous compounds. Methane, alkanes, ammonia, formaldehyde and methanol were detected and quantified. High methane concentrations (>= 2.4 ppm) were recorded mainly under south-south-westerly wind. Non-Methane Hydrocarbon (NMHC) episodes were detected mainly under northerly wind. Hourly results of methane agreed well with those from AMS1 of WBEA. 5-min results of NMHC were calculated using alkane concentrations determined by OP-FTIR and then compared to NMHC results from AMS1. Consistent trends were observed for major NMHC episodes between OP-FTIR (calculated) and AMS1 (directly measured) results on 7 select days when both OP-FTIR and AMS1 detected NMHC. OP-FTIR was a compliment to AMS1 with speciation information and demonstrated its capability in monitoring multi-compounds simultaneously and continuously. More field campaigns for longer time periods in the oil sands region are necessary to have a better understanding of odour complaints and air emissions from oil sands operations.

BIOGRAPHY

Mr. Longdong Zhang is a Research Engineer at University of Alberta. He has more than 3 years' practical experience in air quality monitoring, more specifically in characterization and quantification of fugitive emissions, using advanced environmental sensing technologies in conjunction with eddy covariance and/or inverse dispersion techniques, in the oil sands region and other areas. In addition, he also worked on air pollution control research projects using activated carbons to capture volatile organic compounds or gaseous mercury. He graduated from University of Alberta with a Master's degree in 2014.

2:40-3:00 p.m.

7.4 Mercury trends in colonial waterbird eggs downstream of the oil sands region of Alberta, Canada
Bruce Pauli, Environment Canada

ABSTRACT

Colonial waterbird eggs have been used for decades to monitor levels and potential effects of environmental pollutants. In this study, colonial waterbird eggs were collected from two sites in northern Alberta and one site in southern Alberta over several years, with additional collection sites being added over the course of the study. Northern sites were located in receiving waters of the Athabasca River. Eggs collected from 1977, and from 2009-2013, were analysed for egg mercury (Hg) levels and for stable nitrogen isotope values (d15N) as an indicator of dietary change. In northern Alberta, results indicate a general increase across species (California Gulls, Ring-billed Gulls, Caspian Terns, Common Terns) in egg Hg concentrations compared to the earliest year of sampling for each species at each site. In southern Alberta, Hg concentrations in California Gull eggs declined through time, suggesting the pattern observed in northern Alberta is not consistent across the region. Bird dietary change was not responsible for any of these trends; neither were egg Hg trends related to recent forest fires. The data indicate the importance of local Hg sources in regulating regional Hg trends. Hg concentrations in gull and Common Tern eggs were generally below generic thresholds associated with toxic effects in birds, while in 2012, Hg levels in Caspian Tern eggs exceeded a lower toxicity threshold. Hg levels in eggs of multiple species nesting downstream of the oil sands region of northern Alberta warrant continued monitoring and research to further evaluate Hg trends and to conclusively identify sources.

BIOGRAPHY

Bruce Pauli's research on the effects of environmental pollution have the overarching goal of establishing techniques that can be used to evaluate and assess environmental change. His research focuses on aquatic ecosystems using amphibian species as sentinel organisms. This research has included efforts to standardize toxicity tests with native amphibian species, to examine determinants of disease in native amphibians, and attempts to further understand cumulative effects and the response of wild amphibian populations to multiple

stressors. Bruce Pauli is currently a Research Manager and Chief, Ecosystem Health Research Section within the Ecotoxicology and Wildlife Health Division of Environment Canada.

3:00-3:15 p.m.

Refreshment and Networking Break

Session: #8 – Understanding Pollutant Transformation Processes

3:15-3:35 p.m.

8.1 Recent findings from the summer 2013 intensive monitoring campaign (both ground-based and airborne components)
Stewart Cober, Environment Canada

ABSTRACT

A short term intensive measurement campaign was carried out in August and September 2013 in support of the Joint Oil Sands Monitoring Plan Air Component. The study had three objectives: 1) to quantify and characterize emissions of criteria air contaminants (CACs) and other air pollutants from individual facilities in the Athabasca oil sands region; 2) to understand the transport and transformation of primary pollutants as they move down stream of the oil sands region; and 3) to provide data for improvement and validation of satellite retrieval techniques and the Environment Canada numerical air quality prediction model. Surface measurements were collected at two sites including AMS 13 which is 3.5 km south of Fort McKay and the Oski-ôtin air monitoring site in Fort McKay. Airborne measurements were collected with the National Research Council of Canada Convair-580 aircraft, including 14 flights primarily for emission validation, 5 flights for transport and transformation of oil sands pollutants, and 5 flights for satellite data validation. Subsequent to the measurement campaign the data were quality controlled and much of the data are now available on the data portal. Several early results from this study will be highlighted including 1) the application of an algorithm that can be used to estimate total emission rates of pollutants from oil sand facilities; 2) an estimation of the formation of secondary organic aerosols and particulate matter from oil sands operations; and 3) an evaluation of focused measurements of reduced sulphur compounds in Fort McKay that suggest that compliance monitoring in the region may not be accurately capturing the characteristics of some of these events.

BIOGRAPHY

Dr. Stewart Cober completed his PhD in atmospheric physics at the University of Toronto in 1991, and joined Environment Canada as a Research Scientist. He became a research manager in 2001. In 2012 he became the section manager of the Air Quality Processes Research Section at Environment Canada.

3:35-3:55 p.m.

8.2 High resolution air mapping tool for the oil sands region in Alberta
Long Fu, AEMERA and Daniel Spitzer, A-Maps

ABSTRACT

In a joint effort, Alberta Environment Monitoring, Evaluation and Reporting Agency and A-MAPS Environmental recently developed and implemented a software tool designed for fast and easy access to the historical and real time Air Quality (AQ) information across the province of Alberta. Special attention is paid to the information processing over the oil sands area. The tool comprises software applications that are based on novel AQ monitoring technologies, such as integration of atmospheric satellite remote sensing with ground level monitoring measurements through geospatial and dispersion modeling. The applications are controlled through intuitive Graphical User Interfaces (GUI), which enable direct interactive displaying, manipulation and analysis of the AQ data in mapping (GIS), numerical and time series formats. In the software, processes are embedded that include acquisition of relevant ground level and satellite data, geo-statistical and dispersion modeling as well as formatting the outputs.

Methodology embedded in the AQ mapping tool is explained. Examples of GUI screenshots are presented and described, regarding the mapping and analysis of historical AQ data across the area of oil sands, time series of the air pollutant concentrations for a selected period of time, top-down modeling of the emission rates as well as forecasting the air pollutant concentration levels up to 24 hours ahead. Intuitive functionality of the GUI is described. Since new atmospheric satellite missions are planned (TROPOMI, TEMPO) with improved spectral, spatial and temporal resolution, it can be expected that the use of the atmospheric satellite remote sensing will expand in the future.

BIOGRAPHY

Daniel Spitzer studied Physics at the Technical University of Eindhoven. He received a PhD degree at the University of Groningen (the Netherlands). He continued his work on environmental spectroscopy as scientist at the Netherlands Institute for Sea Research. Later he became the head of the Remote Sensing Section at the Ministry of Public Works and Transportation, dealing with environmental applications of satellite earth observations. During his career, D. Spitzer fulfilled managerial positions at R&D departments of international corporations in the Netherlands and in Canada. In 2006 he established A-MAPS Environmental Inc., a successful SME focused on development of modern environmental monitoring methods. He has provided presentations at numerous conferences, has four filed patents and published more than sixty technical/scientific papers in international journals.

3:55-4:15 p.m.

8.3 High-resolution air quality modelling in the oil sands
Heather Morrison, Environment Canada

ABSTRACT

Under the Joint Oil Sands Monitoring Plan, Environment Canada is evaluating and applying its comprehensive, high-resolution air quality forecast model (GEM-MACH) to the oil sands region to quantify the relationship between air pollutant emissions, air quality, Air Quality Health Index and environmental health. The goal of the work is to integrate new information on air pollutant emissions, transformation and transport to answer questions including: Where are air quality concerns occurring?; What emissions sources are causing a concern?; and, Where should monitoring sites be located? To answer these questions, the model is being used for two types of simulations. The first type is ongoing regular forecasts of air pollution at 2.5km grid-square resolution which are carried out daily and archived for use in cumulative exposure assessments. The second type is retrospective simulations for the time period during which Environment Canada conducted an aircraft and ground-based monitoring intensive campaign (i.e., summer of 2013). These simulations are being used to evaluate the impact of new emissions data and other model improvements on model performance and identify areas where more improvements are required and inform the development of these improvements. Simulations include outputs that support the quantification of acute and cumulative impacts of air pollutants on environmental health. The model output is also being used to evaluate the siting of air quality monitoring stations. This presentation will provide a snapshot of some of the outcomes of this work to date.

BIOGRAPHY

Dr. Paul Makar is a Senior Research Scientist within the Air Quality Modelling and Integration Section of Environment Canada. He is one of the architects of the Global Environmental Multiscale – Modelling Air-quality and CHemistry (GEM-MACH) model. His work includes most aspects of air pollution modelling, with recent publications on feedbacks between weather and air pollution, the impact of climate change on air-quality, the manner in which local-scale meteorology influences air pollution, and comparisons between GEM-MACH and other air-quality models.

Dr. Heather Morrison is the manager of the Air Quality Modeling and Integration section of the Air Quality Research Division of Environment Canada.

Session: #9 – Human Disturbance Footprint

4:15-4:35 p.m.

9.1 Biodiversity hotspots: identifying areas that are extra-special importance to managers and planners
Dr. Jim Schieck, Alberta Biodiversity Monitoring Institute

ABSTRACT

All areas are unique, but for a variety of different reasons, some areas may be of extra-special importance to managers. Biodiversity hotspots occur in areas that are species rich, in areas that contain species and/or habitats that are rare on the landscape, in areas that have unique species/community assemblages, and in areas that have unique combinations of physical environments. It is possible to identify these species and/or habitats hotspots and conduct spatial gap analyses to identify combinations of hotspots that meet specific management objectives.

The Alberta Biodiversity Monitoring Institute (ABMI) samples hundreds of native species (lichens, mosses, vascular plants, mites, birds, mammals, benthic invertebrates) throughout Alberta. In addition, ABMI has GIS layers describing human footprint, vegetation, soils, wetlands, climate, and topography in the oil sands region and throughout Alberta. This is a rich source of information that is used to identify areas that have unique biota and habitats, and to identify areas that may be of extra-special importance to managers and planners.

During the past year ABMI has begun to map biodiversity hotspots and to conduct gap analyses. Preliminary maps have been produced; these will be revised over time.

BIOGRAPHY

Received his BSc and MSc form University of Western Ontario, PhD from University of Alberta, and a Post Doc at Simon Fraser University. Jim presently is a research scientist at Alberta Innovates, an adjunct professor at the University of Alberta, and a science director for the Alberta Biodiversity Monitoring Institute. Jim's research interests include avian ecology, population dynamics, community ecology, forest ecology, and conservation biology.

4:35-4:55 p.m.

9.2 What have we learned about oil sands wildlife by using automatic recording units
Dr. Erin Bayne, University of Alberta

ABSTRACT

Alberta's soundscape is a diverse mixture of wildlife, human, and other natural sounds. These sounds provide valuable information for assessing status and trends of wildlife, while simultaneously allowing us to evaluate how human activities influence the physical and acoustic quality of the environment. Historically, many animal populations have been monitored by human observers visiting a location for a short period of time once a year and recording the species heard. This approach has several limitations that can be improved upon by recording what is heard with automated recording units (ARUs). Unlike humans, ARUs can record sounds for long periods of time in any and all environmental conditions. The Acoustic Monitoring Group is a partnership that has developed new approaches to coordinating usage of ARUs, standardizing methods, and creating new ways of processing audio recordings to maximize information content. Recent advances in computer-based species recognition, proper handling of species detection error, and ARU sampling design will be demonstrated using data from case studies that evaluate the relative importance of anthropogenic noise versus structural alteration of vegetation caused by the energy sector in the boreal forest of northern Alberta.

BIOGRAPHY

Education: BSc (Hons.) – University of Regina; MSc and PhD (University of Saskatchewan). MSc and PhD done in collaboration with Environment Canada – Canadian Wildlife Service. Post-doc: University of Alberta

Overview: Twenty+ years experience in the field of Ecology and Environmental Biology. Interests are mainly on the behavioral, population, and community responses of different wildlife species to human impacts with an emphasis on birds and how humans alter relationships between birds, their predators, and their prey. Current focus is on how to use new technologies to advance ecological monitoring.

Publications: Author of 85 referred publications and 15 government/ industry reports. Collaborator on the Alberta Biodiversity Monitoring Institue, Integrated Landscape Management Group, and Boreal Avian Modeling Project at University of Alberta

Awards: Elected member of the American Ornithological Union (2003) and Society of Canadian Ornithologists (2009).

5:00 p.m.

Symposium Wrap-Up

POSTERS

Posters will be on display throughout the Symposium in Salons 5/6 & 19/20
A staffed poster session will be held concurrent to the evening reception on February 24th.

AIR

LICA's Regional Environmental Monitoring, Evaluation, and Reporting Programs

M. Bisaga

Established in 2000, Lakeland Industry and Community Association (LICA) is a community-based, multi-stakeholder partnership. LICA members work together to support a healthy and sustainable environment by establishing understanding and rapport, sharing information, and working toward mutually beneficial solutions to local concerns. LICA's poster complements its Symposium presentation by providing a high-level summary of the results from 2014's monitoring programs using different visualizations and maps. 2014 data from the continuous and passive ambient air monitoring programs as well as initial results from the lake acidification and soil acidification monitoring programs are presented.

Atmospheric Mercury Monitoring in the Oil Sands Region

D. McLennan, M. Parsons, A. Steffen, M. Lapalme, C. Nayet, C. Watt, R. Mintz

Environment Canada first measured Total Gaseous Mercury (TGM) in the Canadian oil sands region from June 2000 – July 2001 in Fort Chipewyan, Alberta. In 2010, Environment Canada began monitoring TGM in a Wood Buffalo Environmental Association (WBEA) air monitoring station located in the city of Fort McMurray. Under the Joint Oil Sands Monitoring Program, additional TGM and speciated mercury instruments have been added to existing WBEA air monitoring stations. The additional speciated mercury data will help inform and contribute to related mercury studies on wildlife health, biodiversity and water. TGM concentrations measured in the oil sands region appear to be driven by diurnal and seasonal trends superimposed over variability from a combination of long-range transport and regional surface to air flux of gaseous mercury. The highest concentrations occur in the spring and mid-day, and lowest concentrations in the fall and early morning. Average hourly TGM concentrations measured in the oil sands region are similar to other urban and rural sites across Canada.

Communicating Environmental Monitoring Results from Alberta's Oil Sands Region

Jane Percy, Melissa Pennell

A strategic communications and outreach program, endorsed by our multi-stakeholder membership, has enabled the Wood Buffalo Environmental Association (WBEA) to effectively meet stakeholder needs and address the four Joint Oil Sands Monitoring Plan(JOSMP) science questions. Results of our air, deposition and human exposure monitoring programs, and outcomes from our monitoring partners, are communicated openly and transparently. Our website, social media profiles, informational videos, printed materials, electronic newsletters, tours, open houses, advertising, attendance at community events and educational outreach are some of the platforms used to transfer this knowledge. Presenting our scientific monitoring results transparently, and in easily accessible formats, is a core WBEA value in support the wider AEMERA mandate.

Elemental Characterization of Atmospheric Aerosols in the Alberta Oil Sands Region

E. Dabek-Zlotorzynska , V. Celo and D. Mathieu

Since December 2010, trace metals are being measured in fine particulate matter (PM2.5) at three sites operated by the Wood Buffalo Environmental Association in close proximity to oil sands (OS) processing activities. This work is being undertaken by Environment Canada under the *Joint Canada-Alberta Implementation Plan* for Oil Sands Monitoring and will contribute to the overarching goal of JOSM to assess and understand deposition and long-range transport of chemical contaminants as the OS industrial development continues. Based on analysis of measurements to date, concentrations of crustal elements (e.g., Fe, Si, Al, Ca) were higher at the OS sites than measured at the urban sites within the National Air Pollution Surveillance (NAPS) program, and are likely associated with fugitive dust emissions of mining-related activities. Concentrations of trace metals were higher at the sites located closest to surface mining operations and upgrading plants than near a populated area. Levels were comparable with those observed at the NAPS urban sites. Of the thirteen elements listed as priority pollutants by the US Environmental Protection Agency and by the Canadian Environmental Protection Act, only As, Cd, Cu, Pb, and Zn were detected in more than 30% of the samples at each site. The concentrations of these elements were below federal and provincial guidelines and objectives. This work was conducted over a limited area. More data will be needed over a larger area to estimate deposition to ecosystems and understand cumulative environmental effects associated with current and planned OS activities.

Monitoring of the Canadian Oil Sands from the Aura Satellite

C. McLinden, M.W. Shephard, V. Fioletov, K.E. Cady-Pereira, N. Krotkov, F. Boersma, C. Li, M. Luo, P.K. Bhartia and J. Joiner

The NASA Aura satellite was used to study the air quality in and around the oil sands region (western Canada and the northern US) over a 10-year period. The aim was to examine distributions and trends in air concentrations, and emissions strengths, of several pollutants as measured by two satellite instruments. The two instruments were the Ozone Monitoring Instrument (OMI) and Tropospheric Emission Spectrometer (TES). The main findings are (i) nitrogen dioxide levels (NO_2) are generally increasing over the oil sands area (up to 10%/yr) but decreasing elsewhere in the region, (ii) sulphur dioxide (SO_2) levels are largely unchanged over the oil sands area with some significant decreases seen elsewhere in the region, (iii) the largest NO_2 increases are found at locations where no surface monitoring is performed, (iv) other pollutants such as carbon monoxide and ammonia do not show elevated concentrations over the oil sands , and (v) satellite-derived NO_x and SO_2 emissions over the surface mines are consistent with reported values. These results provide an independent source of information on emissions and serve as a preliminary step towards developing a satellite-derived estimate of acid deposition at and downwind of the oil sands.

Oski-Ôtin: A Comprehensive Air Pollutant and Meteorological Monitoring Site in Fort McKay

J.R. Brook, C. Mihele, I. Abboud , S. Cober, V. Fioletov, B. Firanski, K. Hayden, Z. Jiang, G. Lu, C. McLinden, R. Staebler, K. Strawbridge, G. Stupple, D. Wang, D. Worthy, E. Dabek-Zlotorzynska

Detailed air pollutant and meteorological monitoring was initiated in August 2013 within the Alberta oil sands region at a new site in the First Nations community of Fort McKay, Alberta. The purpose of this location is medium term monitoring (2-5 years) to obtain a representative dataset to link the observations with the main oil sands related activities. For this purpose, an extensive suite of in situ and vertical profile or column measurements are being made continuously. The purpose of this poster will be to provide an overview of what is being measured. Initial examination of the data indicates that, depending on meteorological conditions, a variety of different pollutant mixtures are observed and that events with concentrations significantly above the regional background occur on a regular basis. Overall, more detailed analysis, including comparisons with the measurements obtained during an intensive ground and aircraft monitoring over the same area in Aug.-Sept 2013, will provide insight into the nature of the air quality issues in the area and some of the main sources responsible for periods of high concentrations.

BIODIVERSITY

Conceptual Models to Support Monitoring of Biodiversity in the Oil Sands Area

Marc Nelitz, Alex Hall, Craig S. Machtans, Chris H.R. Wedeles, and Ben Beardmore. ESSA Technologies Ltd.; Canadian Wildlife Service, Environment Canada; ArborVitae Environmental Services; Centre for Limnology, University of Wisconsin-Madison.

A hierarchical set of conceptual models was developed to inform a biodiversity monitoring program in the oil sands area of Alberta, Canada. The models were developed in an iterative process informed by literature and expert opinion. Models included a systems model for the ecosystem, a state-transition model for landscape level habitats, and life-history models for the landscape, guild and species levels. Guild- and species-level models were tailored for birds and parsed into pathways of effect to support hypothesis testing and prediction in the monitoring program. Twenty-three generic stressors were identified from nine development sectors. These stressors were linked to impacts that affect birds' fecundity, summer growth/condition and/or survival. Patch clearing, vegetation extraction, water management, and linear clearing were rated by experts as currently having the most important influence on regional bird populations. Pathways of effect on habitat from forestry and agriculture were currently rated most influential on regional bird populations without prejudice to future conditions. The conceptual models and supporting materials indicate it will be difficult to isolate the impact of oil sands activities on regional populations of migratory birds from other industries, and also difficult given the influence of factors outside the study area for up to 70% of the birds' life cycle. The conceptual models and related development process proved useful for illuminating these challenges by helping characterize the ecosystem, clarify assumptions, and elicit the sometimes congruent, sometimes divergent opinions of experts.

Enumeration of Woodland Caribou in the Oil Sands Region

Agnieszka Sztaba, Wildlife Monitoring Biologist, AEMERA/ESRD

Woodland caribou *(Rangifer tarandus caribou)* are currently listed as *Threatened* in Alberta due to declining populations related to human-caused habitat alteration, forest fires and increased predation rates. The AEMERA-ESRD woodland caribou enumeration program is using non-invasive genetic sampling to develop and test sight-resight methods for determining caribou range population size and composition estimates. To date, fieldwork has focused on the East Side of the Athabasca, Cold Lake and West Side of the Athabasca caribou ranges. Lab analysis is ongoing and we expect results from the first year of sampling in the spring of 2015. We anticipate results from this program will help inform the development and implementation of well-considered, practical plans for caribou conservation and recovery in Alberta.

Monitoring Waterfowl Settling and Productivity in Response to Linear Features

Stuart Slattery, Manager Conservation Science & Planning, Institute for Wetlands and Waterfowl Research, Ducks Unlimited Canada

This project is being initiated to improve waterfowl monitoring and landscape management capability by identifying important areas for breeding waterfowl, and potential cause and effect relationships between energy sector activities and waterfowl abundance and productivity. Aerial survey plots will be sampled across a range of habitats and a gradient of linear feature density, specifically roads, pipelines and seismic lines in the oil sands area. All water will be surveyed within plots, permitting plot and wetland-level analyses of cause and effect relationships. Waterfowl, habitat and human disturbance data and hierarchical mixed model analyses will be used to quantify associations between waterfowl, habitats and gradients of linear feature density. These relationships will be used to develop predictive models to map waterfowl breeding distribution and estimate impacts of energy development.

Status of Biodiversity in the Oil Sands Region of Alberta

Lindsay Monk, Northern Communications Advisor, ABMI; Tara Narwani, Communications Manager, ABMI; Monica Kohler, Regional Monitoring Coordinator, ABMI; Jim Herbers, Director, Information Centre, ABMI; Jim Schieck, Co-Director, Science Centre, ABMI

The Alberta Biodiversity Monitoring Institute (ABMI) measures and reports on the state of biodiversity and human footprint across the province. This report, "The Status of Biodiversity in the Oil Sands Region of Alberta," assessed the current condition (status) of 425 species of plants and animals, with a focus on those most sensitive to human development, as well as the total human footprint. The ABMI Biodiversity Intactness Index for all 425 species assessed in the region is 88%. The Biodiversity Intactness Index is a measure of how much more or less common a species is compared to an undeveloped landscape free of human footprint. An intactness value of 88% represents a 12% deviation from expected abundance relative to an undisturbed area. As of 2012, the total human footprint across the oil sands region was 13.8%. While agriculture was the largest footprint type, covering 7.4% of the region, it has remained largely unchanged between 1999-2012. Over the same time, forestry and energy footprints have increased by 72% and 44%, respectively. There are seven Woodland Caribou populations whose ranges overlap with the oil sands region and the abundance of all ranges with measurable populations has declined over the past 20 years. This report serves as an ecological baseline from which we can measure change over time and evaluate land use planning outcomes related to biodiversity in this region. Data and information used in this report was partially funded through the Joint Oil Sands Monitoring Plan (JOSMP).

Testing a Habitat Model for Barred Owl in the Oil Sands Region

Scott Donker, Wildlife Monitoring Biologist, AEMERA/ESRD

Barred owls (Strix varia) are a provincial *Species of Special Concern*. This species is an indicator of old growth boreal forest health as it requires large areas of continuous old growth forests with large diameter trees for nesting. Since 2013 the AEMERA-ESRD barred owl monitoring program has utilized call-playback occupancy surveys and GPS data loggers attached to captured owls to examine habitat selection. Existing habitat models were tested and validated for use in the oil sands region. Results from this program will help determine the effects of oil sands development on barred owl populations and habitat, in addition to informing large-scale land-use planning, and guide regulatory actions.

Predictive Models for Migratory Landbirds

Péter Sólymos[1,2,3], Erin M. Bayne[2,3], and C. Lisa Mahon[2,3,4]
[1] Alberta Biodiversity Monitoring Institute [2] Boreal Avian Modelling Project [3] Department of Biological Sciences

Project results describe the habitats used by 77 species of forest songbirds and response by birds to human footprint (physical disturbance of vegetation cover by human activity). We used a modelling approach using data from surveys of boreal birds collected by Environment Canada, the Alberta Biodiversity Monitoring Institute, the North American Breeding Bird Survey, and additional data from studies also compiled by the Boreal Avian Modelling Project. The models described the habitat associations and responses to human footprint at different spatial scales. We created maps of current density and distribution of individual species across the oil sands areas. Using an estimate of what this landscape would have looked like with no industrial activity, we predicted how the density and distribution of birds would change. We predicted that species showing largest changes in their populations were either associated with habitats created by human disturbances in the landscape, or species whose habitats are most often affected by disturbances related to various forms of resource extraction in the oil sands region.

Use of Aerial Survey Methods to Estimate Ungulate Populations in the Oil Sands Region

Simon Slater, AEMERA/ESRD

Oil sands development is believed to have changed ungulate population dynamics, especially in areas of higher landscape disturbance. Aerial surveys provide critical information to assess population size, distribution and trends in addition to examining the impacts of harvesting, predation or other disturbances on ungulate populations. The AEMERA-ESRD enhanced moose *(Alces alces)* and deer *(Odocoileus virginianus* and *O. hemionus)* monitoring program involves increasing the quantity and frequency of aerial ungulate surveys within the oil sands region in order to enhance the efficacy of population estimates. Wildlife Management Units that overlap (>50%) with the oil sands region were surveyed using Gasaway (2013) and Distance sampling survey methods (2014-2015). Eleven aerial ungulate surveys have been completed in the oil sands region since the inception of the Joint Oil Sands Monitoring Plan and results from the 2013 and 2014 surveys will be discussed.

WILDLIFE HEALTH

Spatiotemporal Variation in Contaminants in Wetlands and Amphibians in the Oil Sands

Bruce Pauli, Environment Canada

This poster describes patterns of contaminants in wetlands and in amphibians inhabiting those wetlands in the oil sands region and in the regions surrounding the oil sands, based on analysis of samples collected from selected wetlands. The samples were collected as part of a multi-year project to evaluate wetland health in the oil sands using wood frogs *(Lithobates sylvaticus)* as the study species. Wood frogs are a useful sentinel species because they are abundant across the study region and their life cycle includes aquatic and terrestrial stages. The poster presents results from the measurement of parameters such as levels of total mercury and other metals in breeding pond water and amphibian tissues. Results are presented as levels measured across the geographical range of the study and in relation to distance from upgraders. The results indicate that there is variation in both space and time in contaminant concentrations in the study wetlands, and that further sampling is necessary to understand patterns of contaminants in wetlands and amphibians in the oil sands region. Results are also being used to inform and plan long term monitoring of wetland health in the oil sands region.

INNOVATION

An Innovative Approach for Environmental Data Visualization

Long Fu, AEMERA

In many countries around the world, environmental monitoring networks generate huge amount of data every day. With the help of fast computers and digital media, innovative approaches have been developed to visualize environmental data. This poster will present the conceptual design of an innovative approach for environmental data visualization. Air quality data from the oil sands monitoring program will be used to demonstrate this approach. Observations and conclusions will be presented. Future applications will be discussed.

Alberta's Advanced Air LiDAR

Quamrul Huda and Zheng Yang, AEMERA

Differential Absorption LiDAR (DIAL), as an advanced laser-based optical remote sensing technology, can remotely measure and map the air pollutant levels in the atmosphere. In 2012 AEMERA-ESRD acquired a DIAL mobile unit from the Space Dynamic Lab (SDL) of Utah State University. The unit uses the latest DIAL laser technology to measure ambient CO2, CH4 and Particulate Matter (PM). The design of the unit is based on almost 40 years of experience and knowledge. In 1978 National Physical Laboratory (NPL) and British Petroleum (BP) began an IR DIAL development project to measure hydrocarbon leaks at petrochemical facilities. In 1987 NPL and BP deployed a jointly funded mobile IR DIAL system and started joint DIAL tests at refineries and chemical plants in Europe. In 1992 NPL and Siemens built an IR DIAL for Shell and British Gas, who started using their DIAL system in house in 1994. Since then DIAL field studies and measurements were carried out extensively in Europe and North America. This poster summarizes the development history of DIAL technology based on an article by Alex Cuclis. The poster will also provide an update on the activities of Alberta DIAL unit.


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