



WBEA@Work

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VOLUME 2 ISSUE 1, JANUARY 2012



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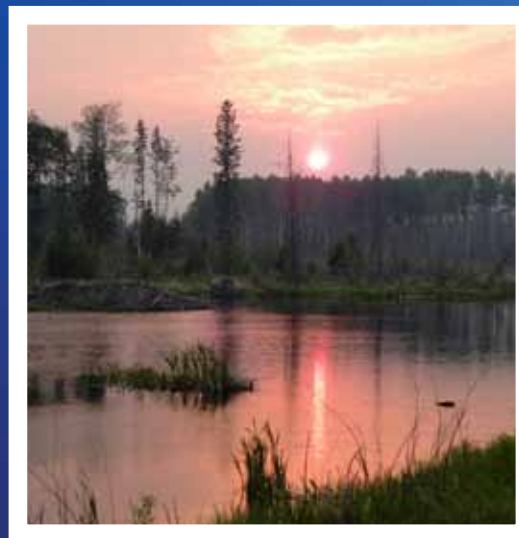
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Executive Director's Report

Dr. Kevin Percy

2011 was a very productive year for the Wood Buffalo Environmental Association. We welcomed new Members, and delivered on significant milestones set out in our 2011-2015 Strategic Plan. Among many notable achievements were:

- In April, WBEA presented to the Alberta Environmental Monitoring Panel
- WBEA Data Management acquired our servers and we brought data management systems in-house.
- WBEA commissioned an expert assessment of our air monitoring network that will guide us as we move forward into 2012.
- In May, at WBEA's International Symposium, "Alberta Oil Sands: Energy, Industry and the Environment", key papers were presented that demonstrated the innovative, scientific foundation of our monitoring activities and pilot projects.
- Throughout the 43rd Air Pollution Workshop, held in conjunction with the Symposium, WBEA hosted over 120 scientists engaged in air pollution research.
- During the Richardson wildfire in May and June, WBEA met significant air quality monitoring challenges posed by the high to extreme fine particulate matter levels, and played a key role for both members and the public by delivering continuous advisories.



Top: Participants in WBEA's International Symposium and the 43rd Air Pollution Workshop during a tour stop at the "Big Tire" on the Suncor Energy Inc. site.

Bottom: Smoke from regional wildfires affected air quality in the spring of 2011.

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Top: HEMP employs an E-Nose to monitor odour frequency and intensity at AMS 1 in Fort McKay.

Bottom: WBEA operates two Community Air Monitoring Stations in Fort McMurray.

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- In July, WBEA assumed responsibility for the Operation and Maintenance of our Ambient Air Monitoring network. Our new Field Operations Centre was acquired and renovated in support of this undertaking.
- In April and September, the Human Exposure Monitoring Program (HEMP) held successful workshops focused on Odour Compound identification and measurement.
- During a 6 week period in late summer, the Terrestrial Environmental Effects Monitoring (TEEM) program successfully and safely carried out the intensive 2011 Forest Health Monitoring Program.
- Several new staff joined WBEA in support of our activities during 2011.
- In October we held a Member's Tour and Open House; the first of what we hope will become an annual event.
- In the fall, Alberta Environment and Water introduced an Air Quality Health Index (AQHI). WBEA contributes hourly data to AEW for calculation of the AQHI.

Throughout the year, WBEA's staff and contractors worked diligently on your behalf to implement the vision and direction of our Membership. In 2012, WBEA will continue to work with governments on air quality monitoring planning and delivery in the RMWB, consider recommendations put forward in the 2011 Network Assessment, and continue to move forward with our science-based monitoring within the Regional Municipality of Wood Buffalo. ■ ■ ■ ■

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WBEA's 2012 Calendar

WBEA Communications has produced a 2012 calendar with 12 striking images reflecting our environmental monitoring work in the Regional Municipality of Wood Buffalo. Featured each month is a photo of an individual or activity associated with our science-based monitoring programs. Accompanying information tells the story of WBEA's multifaceted regional monitoring.

- **January**- AMS 1 at Fort McKay, one of WBEA's 15 regional air quality monitoring stations.
- **February**- Our passive monitoring tower network which measures pollutants at remote locations of the RMWB.
- **March**- A solar powered tower at a remote site allows measurement of meteorology and pollutant input outside the Athabasca River valley.
- **April**- Updates regarding WBEA's Human Exposure Monitoring Program, and the focus on odours.
- **May** - Our Mobile Monitoring Unit can be deployed to monitor specific air quality events.
- **June** - Lichenologist, Dr. Keith Puckett, collected lichens as part of TEEM's 2011 Forest Health Monitoring Survey.



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WBEA's 2012 Calendar

- **July** - Features a mine heavy hauler, one focus of the "real world" emissions characterization study conducted by scientists from the Desert Research Institute, Nevada, for WBEA.
- **August** - Highlights the 2011 Forest Health Monitoring Survey, conducted every six years by WBEA.
- **September** - Alberta Environment and Water's Air Quality Health Index is showcased.
- **October** - The WBEA -TEEM program's use of jack pine needles to investigate air pollution dispersion and deposition illustrates our integrated and intensive scientific monitoring programs.
- **November** - WBEA sponsors three "Crystal Clean Environment Awards" at the Wood Buffalo Regional

Science Fair each year. Student Tricia Robinson received one in 2011 for her project "Iron Levels".

- **December** - Features the visit of US Forest Service scientists assisting WBEA with optimization of remote monitoring tower placement, and demonstrates our commitment to consulting scientific expertise in all our activities.

WBEA anticipates a busy and exciting 2012 as we continue our commitment to monitoring environmental air quality and air related effects, on behalf of all those who live and work in the Regional Municipality of Wood Buffalo.

If you would like to receive a 2012 WBEA desk calendar please contact WBEA at 780-799-4420 or info@wbea.org. ■ ■ ■



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WBEA's Classroom Visit Program for Grade School and College Students

WBEA's classroom visit program is designed to help students learn more about WBEA's science based monitoring in the Regional Municipality of Wood Buffalo (RMWB).

Through WBEA's classroom visit program, WBEA scientists and technicians visit classrooms and present an informative program explaining our air quality and terrestrial environmental monitoring work. Our Mobile Monitoring Unit can also provide students with a first-hand look at air quality monitoring in action.

Additionally, WBEA's classroom visit program will allow students to:

Discover how our regional air quality is monitored and reported:

- Where WBEA's air monitoring stations are located and why
- Which pollutant specific instruments and analyzers are in use
- How you can access our hourly air quality data

Learn more about our terrestrial environmental monitoring:

- How our recent intensive forest health survey was conducted

- How trees, plants and lichens provide evidence of pollution dispersion

Hear about our emphasis on regional odour investigation:

- Unique instruments WBEA has installed in the region to decipher odour composition
- How our air quality data is used by the government to calculate the Air Quality Health Index

Enquire about working in the environmental field:

- Ask our scientists and technicians about their educational and career experience
- Find out how our staff perform their duties

Tour our Mobile Monitoring Unit:

- See air monitoring equipment in action

For more information on WBEA's school visit program, please contact Jane Percy, WBEA Communications, jpercy@wbea.org, 780-747-8212

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Terrestrial Environmental Effects Monitoring 2011 Forest Health Monitoring Program

Dr. Ken Foster, WBEA-Terrestrial Environmental Effects Monitoring (TEEM) Program Manager

Once every six years, TEEM completes an extensive series of integrated measurement and sampling of the plots in its jack pine monitoring site network in the Regional Municipality of Wood Buffalo (RMWB). This program was completed in 2011, and involved a large team of scientific and technical professionals. Planning began in May of 2010, with the actual field program being conducted in the summer of 2011. The information and data collected will be evaluated to determine if forest health is being affected by air emissions.

In May of 2010, TEEM hosted a scientific workshop at which each of the measurements and samples included in the Forest Health Monitoring Program were reviewed. Workshop participants included a number of world authorities on air pollution and its effects on forest ecosystems. A number of new measurements and/or sampling programs were recommended, several of which were included in the 2011 program.

Last winter WBEA prepared a detailed, comprehensive Procedures Manual that specifies the field and laboratory methods to be used during the Forest Health Monitoring Program, including methods for the new measurements and sampling programs. Every method is based on scientific sampling protocols. Standardization of field procedures, laboratory analyses, and record keeping ensure that data collected in one year are compatible with the data collected in past and future years. Much as the selection of similar jack pine stands is a means to reduce variability and improve the ability to detect effects, standardizing field methods and data collection reduces variability and the potential for errors, making the data more robust



Survey coordinator Dr. Ken Foster, Owl Moon Environmental Inc., and Prabal Roy, AEW, discuss the recent forest health survey at JPI04.

and increasing our ability to detect changes at one or more sites. Improvements to some procedures were identified by field crews in 2011, and an updated Procedures Manual will be prepared during the upcoming winter months.

The network of monitoring sites was expanded in 2011. New monitoring plots were selected on the basis of several years of evaluation by Dennis Jaques, Ecosat

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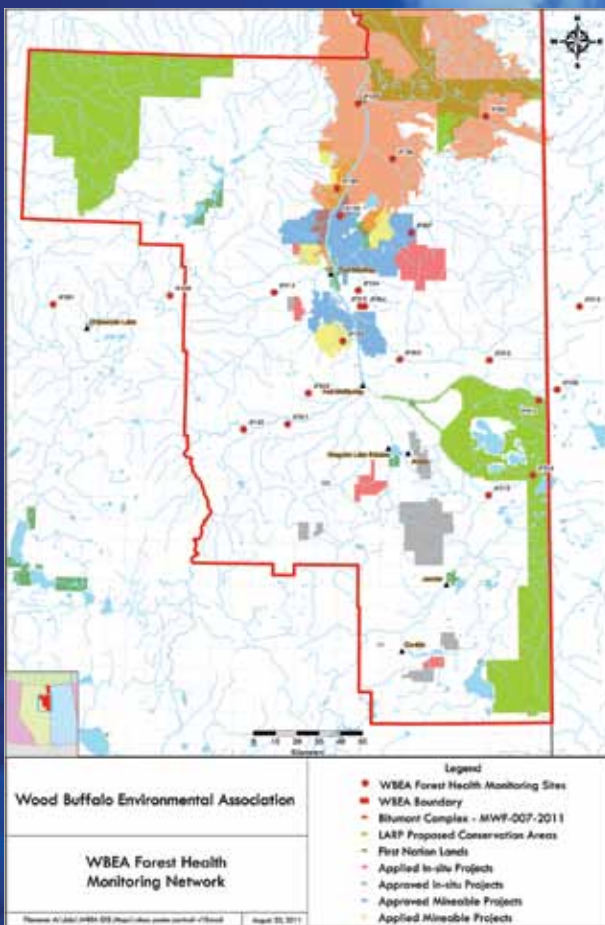
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TEEM 2011 Forest Health Monitoring Program



Map of the WBEA's 2011 Forest Health Monitoring Sites.



Ken Foster and Dennis Jaques during a forest health site identification trip in the spring.

Geobotanical Surveys Inc., in consultation with WBEA scientists. A substantial effort was made to select new sites that are very similar to each other, and to add to the sites already in the monitoring program. As a result of this effort, 10 new sites were accepted into the program, increasing the total number of sites to 23. Monitoring sites are spread through the region, at locations near to, and far from emission sources, and in every direction from them.

As a complicating factor, the spring Richardson backcountry wildfire burned through five of the 13 existing monitoring sites. A smaller fire affected a sixth site. Forest fire is a natural process in jack pine forest ecology, and therefore, these sites remain a part of the program and were included in the 2011 program.

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TEEM 2011 Forest Health Monitoring Program

Veronica Chisholm, Speedwell Environmental Associates Ltd., spent many hours and much effort constructing the 2011 program plan, paving the way for a successful season. Veronica's efforts were substantial, making sure that each of the program components were assigned to qualified, experienced teams. Six field teams were commissioned for the program, one each tasked with staking/restaking of plots, soil sampling, vegetation measurement and sampling, lichen sampling, tree health assessment, soil microbiology sampling.

Plots were staked at the new sites, and plots restaked at the existing sites, by teams comprising Veronica, Amanda Horning, Sarah Eaton, Zach Eastman, Melissa Le May, Chris Godwin-Sheppard, Alana DeBusschere and Marcus Phillips (University of Saskatchewan), and myself. Finding the plots at the burned sites proved challenging, but with a little detective work and some creative thinking, the original plots were found and restaked.

Mike Solohub and Robert Anderson of BioSync Consulting Inc. completed the soil sampling component of the program. In order to confirm that the soils at the new sites were pedogenically similar to existing sites, a soil pit was dug at each new site and soils described and sampled. Separate from the soil pit, a series of soil samples were taken from the soil plots. These samples will be analysed in the Canadian Forest Service laboratory in Victoria BC. The results of these analyses will tell us if the soil at one or more sites is being affected by acid deposition. Over 1,700 samples were collected, and the laboratory has begun the analyses. Data are expected in 2012.

Dean MacKenzie, Kevin Renkema, Erin Belva, Ashley Craig, and Jamie Lypowy from Navus Environmental Inc. completed the vegetation component of the program.

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Robert Anderson and Mike Solohub sample soil at JP201.



Soil samples from each plane of a soil pit.



Jamie Lypowy measures tree height.

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Jack pine tree heights were measured using a laser device, and trunk diameters were measured using a special tape measure.

At the new sites, a set of tree cores were taken to determine tree age, which is necessary to properly interpret the results of the field measurements and laboratory analyses.

A pole pruner was used to cut a branch from near the top of five trees at each site, and detailed growth measurements were taken on these branches. About 400 samples of needles were collected for chemical analyses at the CFS laboratory in Victoria, BC.

As tree needles may be affected by exposure to air emissions, the chemical composition of these needles will be determined. Another set of 200 needle samples was collected and sent to Dr. Sirkku Manninen in the Department of Environmental Sciences at the University of Helsinki, Finland. The structure and chemical composition of the waxy layer on the needle surface will be examined, providing early warning of change in tree condition following air emission exposure.

The Navus crew also completed a survey of the species growing in each plot at each monitoring site. Species composition can change over time in

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Left: Kevin Renkema takes a tree core sample.

Middle: A tree core provides information about age and growing conditions.

Right: Measuring branches.

Bottom: Pole pruners were used to cut branches from the tree crown.

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TEEM 2011 Forest Health Monitoring Program



response to stress, including stress created by air emissions and deposition. Comparing the soil chemistry, needle chemistry and species composition data is a means by which environmental responses to air emissions can be identified and quantified.

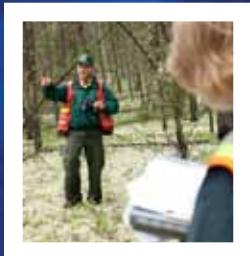
Dr. Keith Puckett, lichenologist, ECOFIN, completed the lichen sampling component. Keith's 30-year career includes tenure as a research scientist looking at the impacts of air pollutant emissions on plants and particularly lichens, which later evolved into a position as Director of the Air Quality Research Division of Environment Canada. Lichens are small slow-growing, long-lived organisms found on rocks, trees and soil. Lichens have a long history in air pollution monitoring, as several lichen species accumulate substances emitted into the air, and/or respond very strongly to air emissions. Keith collected samples of *Hypogymnia physodes* and *Evernia mesomorpha* from the branches of trees at each site (except where they had been burned). Each of the 40 samples was painstakingly sorted, cleaned and

packaged, and sent for chemical analysis at two laboratories in North Carolina.

Tom Hutchinson, Regional Forest Health Officer with Alberta Sustainable Resource Development (ASRD), examined the trees at each site for the presence of insects and diseases, and determined the health of each individual tree. Observations in other forests have led to the understanding that trees exposed to air emissions may become more susceptible to insect infestation or disease. Tom, assisted by Marty Robillard, ASRD, Sarah and Amanda, looked at nearly 1,000 trees in this forest health assessment component of the program.

Soil is a complex system of minerals, organic material, roots, and microorganisms. Dr. Sue Grayston, Professor and Canada Research Chair in Soil Microbial Ecology, at the University of British Columbia, and graduate student Carolyn Churchland collected soil samples at each of the 23 monitoring sites for an analysis of bacteria and fungal

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Top: Erin Belva completed the survey of forest plant species at each site.

Middle: Dr. Keith Puckett, ECOFIN, samples lichens at JP104.

Bottom: Tom Hutchinson, ASRD, during the forest health survey at JP201.

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composition. These 345 samples are now being analyzed by Kate Del Bel in Dr. Grayston's UBC laboratory.

Scientific input and oversight is an important feature of the TEEM Forest Health Monitoring Program. Scientific credibility of the program means that the results are accurate, and can be used in the management of air emissions in the region. Some of the scientists involved in the program have been with TEEM since the beginning, while others were welcomed into the program in 2011. In addition to those mentioned above, the following scientists are key members of the TEEM team:

Dr. Kevin Percy, science advisor to TEEM since 2006, Lead Scientist 2009-2011, and now Executive Director has published extensively on air pollution-forest response and on monitoring designs for forest health. Kevin proposed the forest health model to TEEM in 2007 and has been involved since in its implementation.

Dr. Doug Maynard, Canadian Forest Service, Natural Resources Canada, soil scientist and WBEA science advisor, has been involved in the region since 1998. Doug leads the soil disturbance working group at Pacific Forestry Centre (Victoria BC) focusing on a variety of issues related to forest soil disturbance. Doug provides scientific oversight to WBEA's field sampling protocols and laboratory analytical procedures. He is overseeing the analyses of soil and plant samples at the CFS laboratory managed by David Dunn and Grace Ross, and will be examining the data generated by the laboratory and providing key input into the statistical analyses of the data.

Dr. Allan Legge's involvement in environmental matters in the oil sands region predates the founding of WBEA and TEEM. Allan is an ecologist and President of BioSphere Solutions, and is a member of the WBEA science advisory team. Allan's experience in

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Top left: Dr Sue Grayston and Carolyn Churchland, UBC, sample soil for microorganisms.

Top right: Dr. Doug Maynard, NRCan, WBEA Science Advisor.

Bottom: Dr. Kevin Percy packages jack pine needles at JP104.

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TEEM 2011 Forest Health Monitoring Program

environmental responses to air emissions is extensive, including the experimental work at Whitecourt, AB, where many of the procedures applied in the TEEM Forest Health Monitoring Program were first developed. Allan continues to bring a wealth of local, provincial, Canadian and international expertise to the programs.

This year, TEEM and WBEA welcome Dr. Ellen Macdonald to the program. Ellen is Professor of Forest Ecology in the Department of Renewable Resources at the University of Alberta. Ellen's research focuses on the influence of natural and anthropogenic disturbances on the ecology and plant biodiversity of the boreal forest, regeneration processes and successional dynamics of boreal mixed wood forests, and environmental impacts of forest management. Ellen worked collaboratively with the Navus Environmental Inc. vegetation team, providing insight and guidance to the measurement of composition and abundance of each plant species present at each of the monitoring sites. Ellen will be

assisting in the statistical analyses and interpretation of these data, as well as the data generated by the analysis of needle samples.

In July, Veronica departed the program. WBEA and TEEM acknowledge, with respect and thanks, Veronica's significant efforts in making the arrangements necessary for a successful 2011 field program. Veronica was the facilitator of the successful May 2010 workshop, and she made substantial contributions to the Procedures Manual. Veronica's dedication to all TEEM projects, including the 2011 Forest Health Monitoring Program, has set the foundation for long-term success.

The most significant logistical challenge of the program is the remote location of the monitoring sites. Only one of the plots is accessible by road, and it is a 2-hour drive from Fort McMurray. Access to the rest of the plots

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Dr. Allan Legge, Biosphere Solutions, WBEA Science Advisor.



Dr. Ellen Macdonald (l) and the Navus Environmental Crew.



Veronica Chisholm, Speedwell Environmental Associates Ltd.

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TEEM 2011 Forest Health Monitoring Program

requires helicopter flights ranging from 10 minutes to one hour, one-way. Moving multiple crews to and from Fort McMurray, or between sites, required substantial planning and most importantly flexibility and adaptation by all program participants. Lakeshore Helicopter pilots Don Cleveland, Al Menard, and Greg Mahon were very helpful in guiding our flight planning, and very skilled at getting the field teams to, from, and between sites.

Each component of the program began with a safety briefing, and safety matters were discussed and addressed throughout the program. Safety items raised by the field crews were addressed, so that risks were constantly reduced. The 2011 Forest Health Monitoring Program was completed injury-free.

WBEA Communications arranged for a photographer to be present at one of the monitoring sites for a day, during which the activities of the field crews were captured in a series of digital photographs. A videography crew was also commissioned to capture field crew activities at a monitoring site. The video images have been compiled into a vignette describing the TEEM Forest Health Monitoring Program, which is now available to view at www.wbea.org.

The results of the 2011 Forest Health Monitoring Program will be compared with those obtained during the 1998 and 2004 sampling programs. This comparison will allow us to determine if the jack pine forest is changing over time, and if so, if air emissions and deposition are the cause of the change(s). Because of the number of laboratory analyses to be completed, and the volume of data to be processed, we expect that the report will take at least a year to prepare. ■ ■ ■ ■



Bottom: Videography Crew at JP104.

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