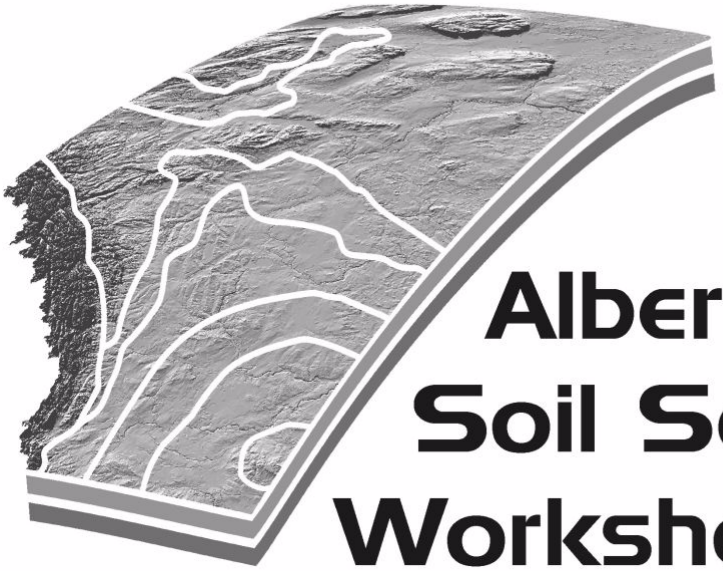
Program and Book of Abstracts for the 48th Annual:



Alberta Soil Science Workshop

Workshop Theme:

OBJECTIVITY AND ADVOCACY IN SOIL AND ENVIRONMENTAL SCIENCES

February 15 to 17, 2011

The Delta Calgary South
135 Southland Dr. S.E.
Calgary, Alberta
T2J 5X5

www.soilsworkshop.ab.ca

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HydroQual Laboratories/Golder Associates Ltd., Calgary

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Land Use: Rob Dunn,
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Karen Raven,
Alberta Agriculture and Rural Development,
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Land Reclamation: Deo Heeraman,
AMEC Earth and Environmental, Calgary;
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Forest, Riparian & Wetland Soils: Maria Strack,
Dept. Geography, University of Calgary, Calgary

SPONSORS OF THE 2011 ALBERTA SOIL SCIENCE WORKSHOP

We are grateful to the sponsors who have contributed to the 2011 Alberta Soil Science Workshop. Please consider sponsorship of future Workshops to support professional soil science in Alberta, and to enhance the visibility of your organization. For the 2011 Workshop we acknowledge the generosity of the following sponsors:

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ABOUT THE ALBERTA SOIL SCIENCE WORKSHOP

Background

The Alberta Soil Science Workshop is held to facilitate regional interaction among professionals in soil science. Typically 100 to 150 participants gather for a 1½ to 2 day program comprised of 40 to 60 oral and poster presentations. These include: keynote papers focussed on the workshop theme, technical papers within four distinct fields, and volunteer papers. Currently the four technical groups are: Land Use, Soil Fertility, Land Reclamation, and Forest, Riparian and Wetland Soils.

Workshop participants include a diversity of professionals from private industry (e.g. consultants in agronomy, pedology, reclamation, remediation, and environmental services; chemists from commercial analytical laboratories), government (federal, provincial, municipal) and academia (universities and colleges). The Workshop is graduate student-friendly, providing an excellent opportunity to enhance presentation skills in a supportive setting (travel bursaries are available for out-of-town students; awards are made for the best student presentations).

Note Abbreviations used in this program:

AAFC = Agriculture and Agri-Food Canada
ARD = Alberta Agriculture and Rural Development
UofA = University of Alberta, Edmonton
UofC = University of Calgary

PROGRAM FOR THE 2011 ALBERTA SOIL SCIENCE WORKSHOP

Tuesday, February 15, 2011 – Evening: Registration

7:00 – 10:00 PM	Registration, Delta Calgary South (Bonavista Ballroom) Technical Poster and Commercial Display Set-Up (Bonavista Ballroom Anteroom)

Wednesday, February 16, 2011 – Morning: Plenary Session, Bonavista Room

7:00 AM – 5:30 PM	Registration: Delta Calgary South, Bonavista Room
7:15 – 8:00 AM	Morning Coffee, Tea & Pastries
Plenary Session:	**"Objectivity and Advocacy in Soil and Environmental Science"**
8:00 – 8:15 AM	Welcome and Introduction Chair: Sylvia Chan Remillard HydroQual/Golder Associates, Calgary
8:15 – 9:00 AM	**Climatic and Environmental Changes in the Next Hundred Years: Issues of Scientific Inquiry and Advocacy** Dr. R. Cesar Izaurralde Joint Global Research Institute, Pacific Northwest National Laboratory and University of Maryland, USA
9:00 – 9:45 AM	**Objectivity and Advocacy in Science: Clarifying the Questions** Dr. Alan Richardson Department of Philosophy, University of British Columbia, Vancouver
9:45 – 10:10 AM	Coffee and refreshments, generously sponsored by Genivar and Amec
10:10 – 10:55 AM	**Is Science Biased Toward Natural?** Dr. Robert Lackey, Department of Fisheries and Wildlife, Oregon State University, USA
10:55 – 11:40 AM	**Scientific Advocacy – What Lines Must Not Be Crossed?** Dr. Lee Foote, Department of Renewable Resources, University of Alberta, Edmonton
11:40 – 12:00 AM	Panel discussion All speakers
12:00 – 1:00 PM	Lunch, Nakiska Room in Atrium Building

Wednesday, February 16, 2011 – Afternoon
Concurrent Volunteer Sessions

	SESSION 1 Willow Park	SESSION 2 Bonavista/Parkland
1:00 – 1:05 PM	**INTRODUCTION** Chair: Dr. Newton Lupwayi, Agriculture and Agri-Food Canada Research Centre, Lethbridge	**INTRODUCTION** Chair: Dr. Miles Dyck, Dept. Renewable Resources, UofA, Edmonton
1:05 – 1:25 PM	**SIMPLIFIED MICROTOX™ BIOASSAY FOR DRILLING WASTE DISPOSAL ON LEASE SOILS IN ALBERTA** John Ashworth[1] and Nicole Popek[2] ALS Environmental, Edmonton[1]/Grande Prairie[2], AB.	**CHARACTERIZATION OF WASTEWATER MOVEMENT FROM A SURFACE DISCHARGE SYSTEM TO SHALLOW GROUNDWATER** Amanuel Oqbit Weldeyohannes[1], R.G. Kachanoski[2] and M. Dyck[1] [1]Dept. Renewable Resources, University of Alberta, Edmonton, AB, [2]Memorial University of Newfoundland and University of Alberta *Student Competition*
1:25 – 1:45 PM	**ENVIRONMENTAL QUALITY OF LOWER LITTLE BOW RIVER AND RIPARIAN ZONE ALONG AN UNFENCED REACH WITH OFF-STREAM WATERING** J.J. Miller[1], T.W. Curtis[1]*, T. Entz[1], W.D. Willms[1], and D.S. Chanasyk[2] [1]Agriculture and Agri-Food Canada, Lethbridge, AB. [2]University of Alberta, Edmonton, AB	**DEVELOPMENT OF A SULFATE MICROELECTRODE FOR PROFILING ENVIRONMENTAL BIOFILMS** S. Ren[1], X. Zhou[2], H. Shi[2], S. Tan[1], and T. Yu[1] [1]Dept. of Civil and Environmental Engineering, University of Alberta, Edmonton, AB. [2]Dept. of Environmental Science and Engineering, Tsinghua University, Beijing, China, *Student Competition*
1:45 – 2:05 PM	**OPTIMIZING SOIL MONITORING PROGRAMS FOR INDUSTRIAL SITES TO ADDRESS POTENTIAL LIABILITY FROM CONTAMINATION** K. Bessie[1], N. Harckham EBA, A Tetra Tech Company Calgary, Alberta,	**NUTRIENT LOADING OF ASPEN SEEDLINGS FOR POTENTIAL OUT-PLANTING IN OIL SANDS RECLAMATION** Yue (Bobby) Hu[1] and Scott X. Chang Department of Renewable Resources, University of Alberta, Edmonton, AB *Student Competition*
2:05 – 2:25 PM	**ANAEROBIC FERMENTATIVE HYDROGEN PRODUCTION USING MANURE FROM CATTLE FED ON A MODIFIED DISTILLER'S GRAIN DIET** B. Gilroyed, C. Li, T.A. McAllister, X. Hao[1] Agriculture and Agri-Food Canada, Lethbridge Research Station Lethbridge, AB	**CO_2 AND N_2O EMISSIONS FROM WESTERN CANADIAN AGRICULTURAL SOILS UNDER LONG TERM NO TILL MANAGEMENT AFTER TILLAGE REVERSAL** Manjila Shahidi[1] and Miles Dyck[1] Department of Renewable Resources, University of Alberta, Canada *Student Competition*
2:25 – 2:50	Coffee & refreshments	

	SESSION 1 Willow Park	SESSION 2 Bonavista/Parkland
2:50 – 3:10 PM	**EVALUATING GREENHOUSE GAS EMISSIONS FROM A BIOCHAR AND STRAW AMENDED SOIL** Fengping Wu[1], Zhikuang Jia[2], Sunguo Wang[3], and Scott X. Chang[4], [1]College of Forestry, Northwest A&F University, Shaanxi, Yangling, China, and Dept. of Renewable Resources, University of Alberta, Edmonton, AB [2]The Agricultural Research Center in Arid and Semiarid Areas, Northwest A&F University, Shaanxi, Yangling, China, [3]Alberta Innovates-Technology Futures, Vegreville, AB ,[4]Dept of Renewable Resources, University of Alberta, Edmonton, AB	**GREENHOUSE GAS EMISSIONS FROM SOIL AMENDED WITH DDGS CATTLE MANURE AND COMPOST - THE EFFECT OF CONDENSED TANNIN CO-APPLICATION** Chunli Li[1], Xiying Hao[1]*, Guangrong Yang[1], Jeff Schoenau[2], Tim McAllister[1] [1]:Agriculture and Agri-Food Canada, Lethbridge Research Centre Lethbridge, AB. [2]Dept Soil Science, University of Saskatchewan
3:10 – 3:30 PM	**OPTIONS FOR ASSESSING SOIL METAL BIOAVAILABILITY** Dale Doram[1] Golder Associates Ltd. Edmonton, Alberta	**IDENTIFICATION OF SUITABLE STORAGE TEMPERATURE TO EXTEND THE SHELF LIFE OF TRICHODERMA VIRIDE IN COMPOST** R.R.D.T. NIRANGA, and D.B. KELANIYANGODA, Department of Horticulture and Landscape Gardening, Faculty of Agriculture and Plantation Management, Wayamba University of Sri Lanka, Makandura, Gonawila (NWP)
3:30 – 3:50 PM	Outstanding questions for all presenters and group discussion	**GREENHOUSE GAS EMISSION FROM STOCKPILING CATTLE FEEDLOT MANURE** Xiying Hao*, Chunli Li and Tim A. McAllister Agriculture and Agri-Food Canada. Lethbridge Research Centre
3:50 – 4:10		Outstanding questions for all presenters and group discussion

Wednesday, February 16, 2011 – Evening

5:00 – 7:00 PM	Poster Session (authors present), Commercial Displays (tradeshow), and Reception (includes one free beverage), Bonavista Ballroom Anterooms
7:00 – 9:00 PM	Banquet, Bonavista Ballroom
	Entertainment by Adrienne Schipperus (Harpist) Presentation of Student Awards

Wednesday & Thursday, February 16 & 17, 2011
Poster Presentations & Commercial Displays

Poster Session and Commercial Displays (in Bonavista Ballroom Anteroom)

Posters and displays may be set up from 7:00 – 10:00 PM on Tuesday February 15, 2011.

Authors present: 9:45 – 10:10 AM on Wednesday February 16, 2011
5:00 – 7:00 PM on Wednesday February 16, 2011

Posters and displays may be removed after 10:00 AM and must be removed by 1:00 PM on Thursday February 17, 2011

Poster No.

1. **MANAGEMENT STRATEGIES FOR INCREASING ORGANIC C AND N STORAGE IN SOIL IN THE CANADIAN PRAIRIES** S. S. Malhi[1], R. Lemke[2], B. McConkey[3], J. J. Schoenau[4] and C. A. Campbell[5]. [1]Agriculture and Agri-Food Canada, Melfort, SK, Canada S0E 1A0 (sukhdev.malhi@agr.gc.ca) [2]Agriculture and Agri-Food Canada, Saskatoon, SK, Canada S0E 1A0 [3]Agriculture and Agri-Food Canada, Swift Current, SK, Canada [4]Department of Soil Science, University of Saskatchewan, Saskatoon, SK, Canada [5]Agriculture and Agri-Food Canada, Ottawa, ON, Canada

2. **LONG-TERM STRAW MANAGEMENT AND N FERTILIZER RATE EFFECTS ON SOIL ORGANIC C AND N, AND SOME CHEMICAL PROPERTIES IN A GRAY LUVISOL** S. S. Malhi[1], M. Nyborg[2], E. D. Solberg[3], B. McConkey[4], M. Dyck[2], D. Puurveen[2] and D. Leach[1] [1]Agriculture and Agri-Food Canada, Melfort, Saskatchewan, Canada (sukhdev.malhi@agr.gc.ca) [2]Department of Renewable Resources, University of Alberta, Edmonton, Alberta, Canada [3]Alberta Agriculture, Food and Rural Development, Edmonton, Alberta, Canada [4]Agriculture and Agri-Food Canada, Swift Current, Saskatchewan, Canada

3. **LONG-TERM STRAW MANAGEMENT AND N FERTILIZER RATE EFFECTS ON SOIL ORGANIC C AND N, AND SOME CHEMICAL PROPERTIES IN A BLACK CHERNOZEM** S. S. Malhi[1], M. Nyborg[2], E. D. Solberg[3], B. McConkey[4], M. Dyck[2], D. Puurveen[2] and D. Leach[1] [1]Agriculture and Agri-Food Canada, Melfort, Saskatchewan, Canada (sukhdev.malhi@agr.gc.ca) [2]Department of Renewable Resources, University of Alberta, Edmonton, Alberta, Canada [3]Alberta Agriculture, Food and Rural Development, Edmonton, Alberta, Canada [4]Agriculture and Agri-Food Canada, Swift Current, Saskatchewan, Canada

4. **MACROAGGREGATE CHARACTERISTICS IN SOIL AMENDED WITH FRESH AND COMPOSTED CATTLE MANURE CONTAINING STRAW OR WOOD-CHIP BEDDING** J.J. Miller[1]*, B.W. Beasley[1], E. Bremer[2], C.F. Drury[3], B.J. Zebarth[4], [1]Agriculture and Agri-Food Canada, Lethbridge, AB, [2]Symbio Ag Consulting, Lethbridge, AB [3]Agriculture and Agri-Food Canada, Harrow, ON [4]Agriculture and Agri-Food Canada, Fredericton, NB

5. **WATER DYNAMICS IN SEASONALLY FROZEN SOIL** H.L. He and M.F. Dyck, Dept. of Renewable Resources, Univ. of Alberta, 751 GSB, Edmonton, AB T6G1H7

Thursday, February 17, 2011 – Morning
Concurrent Technical Sessions

7:30 – 10:00 AM Registration: Bonavista Ballroom Anteroom

	LAND USE Willow Park	LAND RECLAMATION Bonavista/Parkland
7:55 – 8:00 AM	Introduction Co-chairs: Rob Dunn and Karen Raven Alberta Agriculture and Rural Development, Edmonton	Introduction Co-Chairs: Dr. Deo Heeraman[1] and Jay Woosaree[2] [1]AMEC Earth and Environmental, Calgary, [2]Alberta Innovates – Technology Futures, Vegreville, AB
8:00 – 8:20 AM	**USE OF MANAGEMENT FRAMEWORKS TO PROTECT ENVIRONMENTAL QUALITY IN ALBERTA** Heather M. Sinton, Alberta Environment	**DOES BLACK CARBON HAVE A USE IN LAND RECLAMATION?** . D. MacKenzie Renewable Resources, 4-42 Earth Sciences Building, University of Alberta
8:20 – 8:40 AM	**MICRO-WATERSHED ATLAS OF ALBERTA** Sanjay K. Gupta, Environmental Resources Management Program, Faculty of Extension, University of Alberta	**EVALUATING THE AMELIORATIVE POTENTIAL OF BIOCHAR IN SOLONETZIC SOILS IN ALBERTA** Bonnie Drozdowski[1], Andrei Startsev and Anthony Anyia Bioresource Technologies, Alberta Research Council, Edmonton, AB.
8:40 – 9:00 AM	**CASE STUDIES OF BMP EVALUATION IN SOUTHERN ALBERTA** Lynda Miedema and Barry Olson, Alberta Agriculture and Rural Development	**EFFECT OF SUBSOILING AND INJECTION OF PELLETIZED ORGANIC MATTER ON SOIL QUALITY AND PRODUCTIVITY** Takele B. Zeleke[1] and Leonard A. Leskiw Paragon Soil and Environmental Consulting Inc., Edmonton, AB.
9:00 – 9:20 AM	**BENEFITS OF BIODIVERSITY AND ECOSYSTEM SERVICES ASSOCIATED WITH AGRICULTURAL PRODUCTION SYSTEMS** Mark Wonneck, Agri-Environment Services Branch, Agriculture and Agri-Food Canada	**COMPARING SOIL NUTRIENT AVAILABILITY TO ASPEN (POPULUS TREMULOIDES) UPTAKE FOR EIGHT DIFFERENT RECLAMATION SOIL TYPES FROM NORTHERN ALBERTA** S. D. Gupta, M.D. MacKenzie, S. Landhäusser, and S.A. Quideau Dept. of Renewable Resources, University of Alberta, Edmonton, Alberta. *Student Competition*
9:20 – 9:40 AM	**ENVIRONMENTAL FOOTPRINTING FOR AGRICULTURE IN ALBERTA** Roger Bryan and Kerrianne Koehler-Munro, Alberta Agriculture and Rural Development	**EFFECT OF RESTORATION ON CARBON DIOXIDE FLUX IN A MODERATELY RICH FEN** C. Robinson[1], M. S. Mahmood, and M. Strack Dept. of Geography, University of Calgary, Calgary, Alberta *Student Competition*
9:40 – 10:05 AM	Coffee & refreshments	

	SOIL FERTILITY Willow Park	FOREST, RIPARIAN & WETLAND SOILS Bonavista/Parkland
10:05 - 10:10 AM	Introduction Chair: Len Kryzanowski, Alberta Agriculture and Rural Development, Edmonton.	Introduction Chair: Dr. Maria Strack Dept. of Geography, University of Calgary
10:10 – 10:30 AM	**MANAGEMENT OF BIOSOLIDS IN ALBERTA – PRESENT AND FUTURE** G. Dinwoodie, Alberta Environment	**FOUR YEARS OF SIMULATED N AND S DEPOSITION AFFECTED N CYCLING IN A MIXED WOOD BOREAL FOREST ECOSYSTEM IN NORTHERN ALBERTA** Kangho Jung and Scott X. Chang Department of Renewable Resources, University of Alberta *Student Competition*
10:30 – 10:50 AM	**COLD WEATHER VOLATILITY OF AMMONIA FROM SURFACE-APPLIED UREA: A MICROMETEOROLOGICAL STUDY TO QUANTIFY LOSSES IN THE NORTHERN GREAT PLAINS OF AMERICA** Richard Engel, C. Jones, and R. Wallander Land Resources and Environmental Sciences, Montana State University-Bozeman	**CHARACTERIZATION OF NUTRIENT TRANSPORT BELOW THE ROOT ZONE OF A WILLOW PLANTATION IRRIGATED WITH MUNICIPAL WASTE WATER IN THE BOREAL-PARKLAND TRANSITION ZONE, ALBERTA, CANADA** Gainer, A.[1], M. Dyck[1] and G. Kachanoski[2] [1]Department of Renewable Resources, University of Alberta, [2]Memorial University *Student Competition*
10:50 – 11:10 AM	**THE CORRELATION BETWEEN SOIL TEST NUTRIENT AVAILABILITY AND NUTRIENT CONTENT IN SELECTED GENOTYPES OF WHEAT (TRITICUM AESTIVUM)** Tom Jensen, International Plant Nutrition Institute (IPNI)	**FIBER SATURATION REGULATES THE UNSATURATED HYDRAULIC CONDUCTIVITY (K(Ψ)) IN FOREST SOIL ORGANIC LAYER (DUFF)** B. Wilske[1]*, E. A. Johnson[1] & Y. Martin[2] [1]Biogeosciences Institute and Department of Biological Sciences, University of Calgary, [2]Department of Geography, University of Calgary
11:10 – 11:30 AM	**GENETIC IMPROVEMENT OF NITROGEN USE EFFICIENCY IN SPRING BARLEY** Yadeta Anbessa[1], Patricia Juskiw[1] and Allen Good[2] [1]Alberta Agriculture and Rural Development, [2]University of Alberta	**PEATLAND RESOURCE AND HORTICULTURAL USE IN CANADA** Short, P. Canadian Sphagnum Peat Moss Association
11:30 – 11:50 AM	**DEVELOPMENT OF A NITROUS OXIDE EMISSION REDUCTION PROTOCOL** R. Janzen[1], D. Beever[2], R. Dowbenko[2], C. Graham[3], K. Haugen-Kozyra[4], T. Jensen[5], T. Goddard[6] and L. Kryzanowski[6] [1]ClimateCHECK, [2]Agrium, [3]Canadian Fertilizer Institute, [4]KHK Consulting, [5]International Plant Nutrition Institute, [6]Alberta Agriculture and Rural Development	**THE EFFECTS OF PLANT COMMUNITY PRODUCTIVITY ON DISSOLVED ORGANIC CARBON CONCENTRATION** Yoseph Zuback, Maria Strack Department of Geography, University of Calgary *Student Competition*
11:50 AM	Technical Sessions Close	

Thursday, February 17, 2011 – mid-day

11:50 AM – 1:00 PM	Lunch, Bonavista Ballroom
12:30 – 1:00 PM	ASSW Business Meeting (including Acknowledgements & Student Awards), Grand Ballroom

ABSTRACTS FOR THE 2011 48TH ANNUAL ALBERTA SOIL SCIENCE WORKSHOP

Abstracts for the Plenary Session

CLIMATIC AND ENVIRONMENTAL CHANGES IN THE NEXT HUNDRED YEARS: ISSUES OF SCIENTIFIC INQUIRY AND ADVOCACY

Dr. R. César Izaurralde
Joint Global Research Institute
Pacific Northwest National Laboratory and
Univ. of Maryland , USA

In a recent essay published in the Soil Science Society of America Journal, a group of soil scientists described urgent issues facing humanity including climate change, food production, fresh water availability, energy alternatives, and loss of biodiversity in connection to land and soils. The authors then argued on the need to develop a more comprehensive understanding of soils to address some of these issues and for soil scientists to communicate better the findings of our scientific inquiry. This conclusion suggests that we, as soil and environmental scientists, perhaps do not engage enough in environmental advocacy. The question is, however, should we? And, if so, what should be the right extent of our engagement? The theme of this plenary session, "Objectivity and Advocacy in Soil and Environmental Sciences." is very timely as there is increasing demand for collective action with regards to issues of climatic and environmental changes. As soil and environmental scientists, we strive for objectivity in the reporting of our discoveries but somewhat wonder whether our role as advocates of environmental issues is sufficient or appropriate. In this presentation, I will describe my research on soil, climate, and environmental issues and the process for making the results useful to society and relevant for the formulation of policies.

Notes:

OBJECTIVITY AND ADVOCACY IN SCIENCE: CLARIFYING THE QUESTIONS

Dr. Alan W. Richardson
Department of Philosophy,
University of British Columbia
http://sts.arts.ubc.ca/alanr.htm
alanr@interchange.ubc.ca

The workshop title plays with a tension that is evident in recent public discourse regarding science: scientific research is supposed to be policy-relevant but it acquires its import for policy precisely by being disinterested and dispassionate, that is, objective. This is the "value-free ideal of objectivity" that has animated much discourse about science since the turn of the twentieth century. Two things have happened regarding the value-free ideal of scientific objectivity in the past twenty-five or so years: first, it has come under a great deal of pressure as a theoretically accurate account of objectivity in science and, second, the framework for public discussion of science that it sanctions has shown signs of stalemating. The stalemate is this: Once it is admitted that no one is ever entirely disinterested, entirely free of ethical, political or social values, it might seem that scientific objectivity is impossible and science has no privileged place in policy discussions. In my talk I want to explore some ways that objectivity in science is being retheorized by philosophers, historians, sociologists, and rhetorical and cultural theorists of science and then use that work to ask whether a better framing of the question of policy-relevant science wouldn't help public discourse about science.

Notes:

IS SCIENCE BIASED TOWARD NATURAL

Dr. Robert Lackey
Department of Fisheries and Wildlife
Oregon State University
http://oregonstate.edu/dept/fw/lackey/
Robert.Lackey@oregonstate.edu
(541)737-0569

Having accurate, accessible, understandable, and unbiased scientific information is central to the successful resolution of the typically contentious, divisive, and litigious environmental issue. Unfortunately there are many examples of the misuse of science in policy and politics, often quite unintentionally by scientists themselves. A policy bias toward "natural" is one common example of the misuse of science. Biases in science are often subtle and frequently the individual scientist is unaware. Especially with the divisive politics now prevalent in North America, scientists should be vigilant in guarding against the misuse of science. Otherwise, society risks marginalizing the helpful role that science and scientists can play in resolving important, but divisive issues. When performed appropriately and without a policy bias, science has much to offer society, decision makers, and individual citizens. Conversely, the scientific enterprise also has much to lose by doing otherwise.

Notes:

SCIENTIFIC ADVOCACY – WHAT LINES MUST NOT BE CROSSED?

Dr. Lee Foote
Department of Renewable Resources,
University of Alberta
http://www.ualberta.ca/~lfoote/
Lee.foote@ualberta.ca

Responsible advocacy involves advancing convincingly reasoned arguments that are supported by dependable knowledge and expertise that is circumspect and validated. However, experts must recognize that their notions of "good" are context-dependent. Advocacy is an important and useful service of professional organizations and scientists and failure to advocate undermines the social relevance of knowledge keepers and their institutions. Nonetheless, advocacy can have personal cost for the advocate. I offer the following four tenets on how scientists can effectively advocate positions in public debates: 1) be open about values and speak to the 'big picture'; 2) advocate with credibility; 3) address counterpoints and admit uncertainty where it exists; and 4) simplify complexity so that the undecided and the media can embrace the delivered message. Advocacy is a core scientific activity essential for addressing environmental issues in a responsible and accountable manner.

Notes:

ABSTRACTS FOR ORAL PRESENTATIONS IN THE VOLUNTEER SESSIONS

SESSION I

SIMPLIFIED MICROTOX™ BIOASSAY FOR DRILLING WASTE DISPOSAL ON LEASE SOILS IN ALBERTA

John Ashworth[1] and Nicole Popek[2]
ALS Environmental, 9936-67 Ave
[1]Edmonton, AB. T6E 0P5
[2]Grand Prairie

Each week, hundreds of wells are drilled for oil and natural gas in western Canada, mostly in Alberta. The resulting drilling waste by-product – composed of drilling fluids and additives, plus rock cuttings brought to the surface – can be disposed of on-site following environmental regulations (ERCB Directive 50). Required tests include the Microtox bioassay, which involves challenging the test organism with four serial dilutions of a waste sample so as to obtain the so-called EC50 value, based on a line of best fit through the 4 data points; for a Pass result, the value must exceed 75 % of the initial sample concentration. This paper will present data showing that an equally valid test result can in most cases be obtained by running the test at the 75 % dilution level only. Our simplified procedure has labour and cost-saving advantages.

Notes:

ENVIRONMENTAL QUALITY OF LOWER LITTLE BOW RIVER AND RIPARIAN ZONE ALONG AN UNFENCED REACH WITH OFF-STREAM WATERING

J.J. Miller[1], T.W. Curtis[1]*, T. Entz[1], W.D. Willms[1], and D.S. Chanasyk[2]
[1]Agriculture and Agri-Food Canada, 5403-1st Ave. South, Lethbridge, AB, T1J 4B1
[2]University of Alberta, Edmonton, AB
*Corresponding author: jim.miller@agr.gc.ca.

We conducted a four year (2005-2008) study on an unfenced 1.3 km reach of the Lower Little Bow (LLB) River in southern Alberta where three off-stream watering systems were installed 290 to ≥ 730 m from the river in August, 2005. Our hypothesis was that off-stream watering would reduce cattle activity at the river and contribute to improved riparian health, prevent river pollution by cattle, and improve the soil, vegetative, and rainfall simulation runoff variables at a cattle access site near the river. There was a reduction ($p > 0.10$) of 20% for median number of cattle on the river bank and a 72% reduction for cattle in the river. The BMP moderately improved the riparian health score from 60 % (2005) to 65% (2007), and it prevented pollution by cattle for the majority of variables at the downstream site during the post-BMP period (2006-2008). Certain vegetation properties were significantly increased during the post-BMP period. A reduction ($p > 01.0$) in cattle activity on the river bank and in the river one year after BMP installation may explain the moderate improvement in riparian health, prevention of river pollution by cattle and significant improvements in certain soil and vegetative properties at the cattle access site adjacent to the river.

Notes:

OPTIMIZING SOIL MONITORING PROGRAMS FOR INDUSTRIAL SITES TO ADDRESS POTENTIAL LIABILITY FROM CONTAMINATION

K. Bessie[1], N. Harckham
EBA, A Tetra Tech Company, #115, 200 Rivercrest Drive SE Calgary, Alberta,
[1]Corresponding author: kbessie@eba.ca

Alberta Environment (AENV) requires soil monitoring for industrial sites as part of the approval conditions and first published a Soil Monitoring Directive in 1996, then updated it in 2009. The original program was designed for ease of operator sampling and to answer questions about concentrations of baseline soil conditions and potential industrial compounds. Required parameters for analysis included more of the "routine" soil analysis like salts, pH, particle size analysis, cation exchange capacity (CEC) as well as potential compounds of concern (PCOC) from industrial activities such as metals. The sampling program was based on five subsample locations collected within defined plant use areas that were composted by specified depth increment defined by the guidelines. Composite sampling by plant use areas may be acceptable for uniform material types and deposition that is not spatially related for gross determination if there might be an issue but has limited suitability for identifying sources, delineation and liability management. Contamination is spatially related to a source and the mode by which it was deposited (solid by wind or water, gas or liquid) and/or transported through the matrix. Sampling strategies vary depending upon the Conceptual Site Model which identifies compound (hazard) characteristics, receptors and transport mechanisms. EBA's approach is to design a soil monitoring program that is scientifically defensible, meets AENV requirements but also can be used by the industry for potential environmental liability management. Control samples are sampled by horizon not depth since there is more variation between horizons than within horizons, but in uniform geological material the maximum depth increment suggested by AENV of 50 cm are used. Within each plant use area the potential sources of contamination are identified and sample locations selected judgementally to be as close to the highest risk areas as possible, for example, near underground storage tanks. The boreholes are sampled by material type first and foremost (i.e. gravel base or stained soils) and depth increments in uniform materials. Field screening tools like photoionization detectors for light molecular weight hydrocarbons are used to help identify samples with highest potential for contamination. Laboratory analysis is often staged by depth increment with the focus on analysis of the layer with highest potential for contamination. This allows industry to spend its dollars on the areas with highest potential liability and maximize the information they obtain to be on industrial contaminants versus analysis that has limited use for liability management

Notes:

***ANAEROBIC FERMENTATIVE HYDROGEN PRODUCTION USING MANURE FROM CATTLE FED ON A MODIFIED DISTILLER'S GRAIN DIET**

B. Gilroyed, C. Li, T.A. McAllister, X. Hao[1]
Agriculture and Agri-Food Canada, Lethbridge Research Station, 5403 1st Avenue South, Lethbridge, Alberta, Canada T1J 4B1
[1]Corresponding Author: xiying.hao@agr.gc.ca

Biohydrogen production was assessed from the manure of cattle fed on different modified dried distiller's grain and soluble (DDGS) diets. In one experiment, manure from cattle fed with either dry-rolled barley (DRB) and silage (control), or with DRB partially replaced by either 20 or 30 % triticale DDGS (tDDGS) was evaluated for biohydrogen production using anaerobic fermentation. In the second experiment, manure from cattle fed with either barley grain and DRB (control), or with barley grain and DRB partially replaced by either 18 or 36 % corn DDGS (cDDGS) as well as 2.5 % condensed tannins from Acacia mearnsii (DG40CT) was evaluated for biohydrogen production. Treatments were evaluated in quadruplicate using 2 L biodigesters operating at 55 °C in batch culture with an organic loading rate of 20 g L^{-1} volatile solids (VS) and a total operation time of 4 d. For the tDDGS experiment, hydrogen production (mL g-1 VS fed) was greatest for the control treatment ($P<0.05$) with no significant difference between 20 or 30 % tDDGS. For the cDDGS experiment, control and 36 % cDDGS treatments demonstrated the greatest hydrogen production ($P<0.001$). The inclusion of tannins in the diet of cattle had a negative effect on biohydrogen.

Notes:

EVALUATING GREENHOUSE GAS EMISSIONS FROM A BIOCHAR AND STRAW AMENDED SOIL

Fengping Wu[1], Zhikuang Jia[2], Sunguo Wang[3], and Scott X. Chang[4],
[1]College of Forestry, Northwest A&F University, Shaanxi, Yangling, China, 702100 and
Department of Renewable Resources, University of Alberta, Edmonton, AB T6G 2E3, Canada.
[2]The Agricultural Research Center in Arid and Semiarid Areas, Northwest A&F University, Shaanxi, Yangling, China, 712100.
[3]Alberta Innovates-Technology Futures, Vegreville, AB T9C 1T4 Canada,
[4]Department of Renewable Resources, University of Alberta, Edmonton, AB T6G 2E3, Canada
[4]Corresponding author: Scott.Chang@ales.ualberta.ca

Biochar produced from plant derived biomass has been shown to be very stable when applied to the soil as compared to uncharred biomass carbon. Biochar application has been reported to decrease greenhouse gas (GHG) emissions from the soil, while such effects were site specific and the mechanisms were not fully understood. In this study, we investigated the effects of biochar and straw applications (based on the same C content) on the emission of the three main GHGs (CO_2, CH_4 and N_2O) from the soil during a 100-day incubation. Soil enzymatic (urease, β-glycosidase and dehydrogenase) activities were determined at the end of incubation. We found that biochar application reduced the total production of CO_2 and N_2O by 81% and 96%, respectively, and increased total CH_4 production by 26%, as compared to the straw addition (at 1.68% of soil weight). Enzymatic activities were affected by the treatments as well. Dehydrogenase and β-glycosidase activities were reduced by 84% and 34% and urease activity was increased by 64%. Therefore, biochar addition was effective in suppressing GHG emission as compared with straw addition. Testing biochar on other soil types and under field condition in future research would broaden our understanding of the effectiveness of biochar on reducing GHG emissions.

Notes:

OPTIONS FOR ASSESSING SOIL METAL BIOAVAILABILITY

Dale Doram[1]
Golder Associates Ltd. Edmonton, Alberta

If a site has elevated metal concentrations above generic guidelines, remediation is required before a site can be reclaimed. The source of metals could be from natural sources or anthropogenic activities. While metals or trace elements are naturally present in our environment, in some instances they are elevated above provincial or federal generic soil quality guidelines due to industrial processes like air emissions. Theoretically, elevated soil metal concentrations above generic guidelines mean there could be potential impacts to terrestrial or aquatic receptors. Since generic regulatory guidelines are derived by analyzing "total" soil metals using strong acid digests, they do not consider the chemical form and bio-availability of the specific metals on a site-specific basis. Using case studies and the literature, the limitations of using generic soil metal guidelines will be discussed. Metal soil chemistry will be presented in relation to soil properties that affect metal bio-availability to receptors. Two tools for evaluating site-specific metal bio-availability, sequential extraction and bio-assays, will be discussed. Sequential extraction is an alternative soil metal analytical method that can show the proportion of the metals that are in various fractions including: bio- available (water soluble, exchangeable), potentially available (organic bound, oxide forms, carbonates) and unavailable (structurally bound). Bio-assays are eco-toxicity tests that can be used to assess metal impacts to terrestrial and aquatic receptors. The bio-assays discussed include bacterial luminescence, springtail survival, earthworm survival and vegetation seedling and root elongation tests. Case studies will be used to illustrate these tools.

Notes:

SESSION II

CHARACTERIZATION OF WASTEWATER MOVEMENT FROM A SURFACE DISCHARGE SYSTEM TO SHALLOW GROUNDWATER

Amanuel Oqbit Weldeyohannes[1], R.G. Kachanoski[2] and M. Dyck[1]
[1]Dept. Renewable Resources, 751 GSB, University of Alberta, Edmonton, AB, T6G 2H1
[2]Memorial University of Newfoundland (President) and Adjunct Prof. at UofA

A better understanding of multidimensional unsaturated and saturated flow and transport under boundary conditions typical of on-site wastewater disposal systems is required to assess the risk to groundwater contamination. In this study, in-situ spatial pattern of water flow and wastewater plume migration was characterized from at-grade (surface) line sources under shallow water table conditions. The research site is at Wetaskiwin Rest Stop, Alberta, located at Queen Elizabeth II (Highway 2) about 80 km south of Edmonton. In 2006, an on-site wastewater treatment system was established at Wetaskiwin Rest Stop. Field assessment and wastewater plume characterization was carried out by using Electromagnetic induction (EM31) and (EM38); and by installing a grid of 74 monitoring wells, 14 piezometers and 11 transducers. Groundwater analyses were conducted for selected tracers (pH, EC and Cl) and some microbiology (e.g. E. coli). From the preliminary results wastewater plume was delineated, and additional 68 monitoring wells in 17 nests and 31 temperature sensors in 5 nests were installed along the centerline of wastewater plume to track contaminant transport over time. Preliminary results and plans for future investigations will be presented.

Notes:

DEVELOPMENT OF A SULFATE MICROELECTRODE FOR PROFILING ENVIRONMENTAL BIOFILMS

S. Ren[1], X. Zhou[2], H. Shi[2], S. Tan[1], and T. Yu[1]
[1]Dept. of Civil and Environmental Engineering, University of Alberta, Edmonton, Alberta T6G 2W2. [2]Dept. of Environmental Science and Engineering, Tsinghua University, Beijing, China, 100084
[1]Corresponding author: Tong.Yu@ualberta.ca

The microsensor is an effective tool to study microenvironments in the stratified microbial communities such as biofilms, sediments, and soils. In this study, a sulfate microelectrode has been fabricated and used in measurement of environmental biofilms for the first time. A unique method was described for the preparation of the liquid sulfate-sensing membrane, which is the most critical part in the microelectrode fabrication. The composition of the liquid membrane was optimized in our laboratory. The sulfate microelectrode, with a tip diameter of 20 mm, exhibited satisfactory selectivity to SO_4^{2-}. It was characterized in terms of electromotive force response, slope, detection limit, response time, and lifetime. The sulfate microelectrode exhibited log-linear response to sulfate concentration change with a Nerstian slope of -26.7 mV per concentration decade. The detection limit was 10 mM (0.96 mg/L) SO_4^{2-} in ultrapure water. The response time was approximately 2 minutes, and the lifetime was one day. The sulfate microelectrode was used in measurement of biofilm samples from a membrane-aerated biofilm reactor. One sulfate profile was obtained, indicating that sulfate concentration was stratified inside the environmental biofilm. Sulfate was accumulated in aerobic zone, whereas reduced in anaerobic zone of the biofilm. Sometimes, interference from unknown substances in biofilm samples was observed.

Notes:

NUTRIENT LOADING OF ASPEN SEEDLINGS FOR POTENTIAL OUT-PLANTING IN OIL SANDS RECLAMATION

Yue (Bobby) Hu[1] and Scott X. Chang
Department of Renewable Resources, University of Alberta, Rm.442 Earth Sciences Building, Edmonton, AB, T6G 1H7
[1]Corresponding author: yhu6@ualberta.ca

Trembling aspen (*Populus tremuloides*) is the most widely distributed tree species in North America and one of the most common tree species planted for land reclamation in the oil sands region. As the salvaged surface soil material applied for land reclamation in the oil sands region has very low nutrient availabilities, it is very important to use nutrient loaded seedlings that are expected to have an advantage in gaining fast establishment on reclaimed sites. The objective of this study was to determine the target fertilization rate and model for effective nutrient loading to increase aspen seedlings nutrient storage in the nursery seedling production stage. The experiment was conducted from May to September in 2009 and results showed that aspen seedlings under exponential fertilization practices had a lower height growth as compared with the conventional fertilization regime but had similar amounts of nutrients stored in the seedling. Under conventional fertilization, aspen seedlings typically produce too much height growth and measures might be needed to cut the top growth in the nursery. In 2010, a modified nutrient loading regime is being studied to improve our understanding of nutrient supply, and nutrient requirement and seedling growth of aspen in the nursery.

Notes:

CO_2 AND N_2O EMISSIONS FROM WESTERN CANADIAN AGRICULTURAL SOILS UNDER LONG TERM NO TILL MANAGEMENT AFTER TILLAGE REVERSAL

Manjila Shahidi[1] and Miles Dyck[1]
Department of Renewable Resources, University of Alberta, Canada

Tillage in combination with different fertilizer management regimes and environmental drivers i.e. soil temperature and soil moisture is likely to affect the greenhouse gas emissions of agricultural soils. The present study aims at measuring growing season soil CO_2 and N_2O fluxes after tillage reversal on a Black Chernozemic soil at Ellerslie and a Grey Luvisolic soil at Breton, Alberta managed under long term no till. Non steady state chambers and a photoacoustic gas were used to measure CO_2 and N_2O emissions during 2009 and 2010 growing seasons. We hypothesized that (i) tillage causes higher CO_2 emission by stimulating microbial decomposition through improved aeration (ii) tillage reduces N_2O emission by facilitating aerobic condition that hinders the activities of denitrifying bacteria (iii) nitrogen fertilizer application stimulates CO_2 and N_2O emission from both till and no till plots through increased microbial growth and respiration. The study was further extended to explore the effects of soil type viz. organic matter rich Chernozem vs organic matter deficient Luvisol and environmental factors i.e. soil temperature and soil moisture. Our preliminary results showed that both CO_2 and N_2O fluxes were higher from tilled and N fertilized plots of each soil type with an exception of Luvisolic no tilled fertilized plots. Average CO_2 fluxes were higher in tilled fertilized plots during 2010 (9.914 mg m^{-2} min^{-1}) than that in 2009 (8.615 mg m^{-2} min^{-1}) from black Chernozem as expected since in 2010 it received almost double precipitation of the previous year. This study has its significance in calculating carbon sequestration through changes in tillage regime as well as assessing contingency factors for both soil types to account for the possibility of isolated tillage events for weed control.

Notes:

GREENHOUSE GAS EMISSIONS FROM SOIL AMENDED WITH DDGS CATTLE MANURE AND COMPOST: THE EFFECT OF CONDENSED TANNIN CO-APPLICATION

Chunli Li[1], Xiying Hao[1]*, Guangrong Yang[1], Jeff Schoenau[2], Tim McAllister[1]
[1]:Agriculture and Agri-Food Canada, Lethbridge Research Centre, 5403 1st Avenue South, Lethbridge, Alberta, Canada T1J 4B1.
[2]Dept Soil Science, University of Saskatchewan
* Corresponding author: phone: 1-403-317-2279; fax: 1-403-317-2187; email: xiying.hao@agr.gc.ca

The use of dried distillers' grains with solubles (DDGS) in diets for feedlot cattle (*Bos Taurus*) is increasing due to the expansion of the bio-ethanol industry. The objectives of this study were to investigate the effect of tannin on greenhouse gas (GHG) emissions from soil receiving DDGS manure and compost. Manure from cattle on two different DDGS diets (with or without Acacia mearnsii tannin) and their corresponding composts were used in a controlled environment study with eight treatments and three replications. Soil (Dark Brown Chernozem) was either left un-amended as control or amended with manure or compost with or without co-application of tannin at a soil:manure/compost:tannin ratio of 20.00:3.33:0.17. The soil and amendment were thoroughly mixed, wetted to 60% water holding capacity water content and incubated at 22 ± 1ºC temperature for 105 d. During the 105-d incubation, N_2O and CO_2 emissions were measured using a static chamber on d 1, 3, 7 and weekly thereafter.

Cumulative CO_2 emission was greater ($P<0.05$) in all manure and compost amendment treatments (ranging from 4.35 to 13.60 g C/kg) than in the Control (1.19 g C/kg) or tannin amended soil (1.54 g C/kg). Additionally, the CO_2 emission was lower ($P<0.05$) from compost (4.57g C/kg) than manure amended soil (12.92g C/kg). The lower CO_2 emission from compost amended soil than fresh manure amended soil was due to the lower C content, C availability and C/N ratio in compost amended soil. Inclusion of tannin in the diet or its addition to the soil had no effect on soil CO_2 emissions.

Cumulative N_2O emission was higher from fresh manure and compost amended soil (ranging from 4.0 to 27.1 mg N/kg) than from the control (-0.2 mg N/kg) or tannin amended soil (-0.4 mg N /kg). N_2O emissions were lower when soil received co-application of tannin and manure or soil received manure from cattle with tannin in their diet than amended with manure alone. For compost, the N_2O emissions were lower from soil amended with compost when tannin was included in the diet than soil amended with either compost or compost plus tannin. Tannin addition to cattle DDGS diets or co-applied to soil with DDGS manure reduced soil N_2O emission. There was a relationship between soil N_2O emission and the KCl-extractable ammonium content in soil ($r=0.686$, $n=8$, $P<0.1$), suggesting that nitrification might be responsible for the observed N_2O emission, as soil with 60% moisture is likely aerobic. The decreases in N_2O emission from soil with manure and tannin co-application but not compost and tannin co-application suggest that tannin might bind newly released mineral N as manure organic matter decomposes in the soil after application. Our results suggest that tannin could play a role in reducing N_2O emission from manure amended soil.

Notes:

IDENTIFICATION OF SUITABLE STORAGE TEMPERATURE TO EXTEND THE SHELF LIFE OF *TRICHODERMA VIRIDE* IN COMPOST

R.R.D.T. NIRANGA, and D.B. KELANIYANGODA,
Department of Horticulture and Landscape Gardening, Faculty of Agriculture and Plantation Management, Wayamba University of Sri Lanka, Makandura, Gonawila (NWP)
Corresponding Author : Thilina.niranga@yahoo.com/ agriculture@lankamail.com

Trichoderma spp. are commonly used as a soil reclamation agent and as a biological control agent due to their antagonistic effect on disease causing organisms. Although Trichoderma spp. could be successfully inoculated to compost, shelf life goes down quickly. This experiment was carried out to extend the shelf life of Trichoderma viride in compost.

Composts prepared from straw, water hyacinth and gliricidia were checked at different temperatures: refrigerator (8 ºC), poly tunnel (36 ºC) and room temperature (28 ºC). *Trchoderma viride* was inoculated by using cultured straw and non-inoculated compost samples were kept as controls. Spore population was counted through a compost dilution series and a laboratory culture series with one week intervals for eight weeks.

Most extended shelf life period was given by the refrigerator at 8ºC and it was significantly higher than others. At low temperature (approximately 8ºC) *T. viride* had successfully survived for a comparatively longer period, because of delayed growth rate. Gliricidia compost media showed significantly higher population and a shelf life period over straw compost media. That may be attributed to the higher percentage of Nitrogen content in gliricidia leaves. The difference between controlled samples and *T. viride* inoculated compost samples in refrigerator (8ºC) was determined through the same procedure of compost dilution series and laboratory culture series. *T. viride* inoculated compost samples showed the highest shelf life period over untreated compost samples.

Notes:

GREENHOUSE GAS EMISSION FROM STOCKPILING CATTLE FEEDLOT MANURE

Xiying Hao*, Chunli Li and Tim A. McAllister
Agriculture and Agri-Food Canada.
Lethbridge Research Centre
* Corresponding author: Xiying.hao@agr.gc.ca; 403 317-2279

The use of dried distillers' grains with solubles (DDGS) in feedlot cattle diets is increasing as the bio-ethanol industry expands. This study investigated greenhouse gas (GHG) emission from stockpiled manure from cattle fed diets with wheat DDGS. There were four treatments, corresponding to four finishing cattle diets, (1) Control: manure from cattle on the standard western Canadian finishing diet of 82.5% barley grain, 15% silage (DM basis); (2) DDG25: manure from cattle fed 62.5% barley grain, 10% barley silage and 25% DDGS, (3) DDG30: manure from cattle fed 62.5% barley grain, 5% barley silage and 30% DDGS; and (4) DDG35: manure from cattle fed 62.5% barley, 0% barley silage and 35% DDGS. The mineral supplement made up the remaining 2.5% of the diets. For the stockpile experiment, manure, bedded with straw, was cleaned out of feedlot pen at the end of July, 2010 and stockpiled on a clay pad. Two replicated piles were constructed for each type of manure. Each manure pile was approximately 13-15 m in length, 4.0 m in width, 1.8 m in height and weighed about 40 to 55 tonne (wet weight). Following pile construction, GHG emissions from each pile were collected using two vented static chambers at weekly intervals. Preliminary data collected in the first three months (July 29 to November 4, 2010) indicated that emissions peaked on day eight with most emissions occurring in the first 42 days, and decreased to near zero thereafter for CO_2 and CH_4. The rate of N_2O emission also peaked on day eight, but decreased gradually over time. The average emission rates over the first 3-months ranged from 2.70 to 3.92 g/m^2/day for CH_4 and from 0.049 to 0.065 g/m_2/day for N_2O, with no differences ($P>0.05$) among the four types of manure. On the other hand, CO_2 emissions from the Control (40.2 g/m2/day) were higher ($P<0.065$) than from the three DDG manures (21.0, 19.8, and 27.6 g /m^2/day, for DDG25, DDG30 and DDG35, respectively). It appears that including wheat DDG up to 35% DM in cattle diet had minimal effect on the rate of CH_4 and N_2O surface emission for the first three months of cattle manure stockpiling.

Notes:

ABSTRACTS FOR POSTER PRESENTATIONS

MANAGEMENT STRATEGIES FOR INCREASING ORGANIC C AND N STORAGE IN SOIL IN THE CANADIAN PRAIRIES

S. S. Malhi[1], R. Lemke[2], B. McConkey[3], J. J. Schoenau[4] and C. A. Campbell[5]
[1]Agriculture and Agri-Food Canada, Melfort, SK, Canada S0E 1A0 (sukhdev.malhi@agr.gc.ca)
[2]Agriculture and Agri-Food Canada, Saskatoon, SK, Canada S0E 1A0
[3]Agriculture and Agri-Food Canada, Swift Current, SK, Canada
[4]Department of Soil Science, University of Saskatchewan, Saskatoon, SK, Canada
[5]Agriculture and Agri-Food Canada, Ottawa, ON, Canada

We summarized research information on the impacts of tillage (no-tillage [NT], minimum tillage [MT] and conventional tillage [CT]), crop residue management (straw removed, straw retained and straw burnt), balanced fertilization, manure, crop rotation/diversity and frequency of summer fallow on cultivated cropland, and conversion of cultivated land to perennial grassland on storage of organic C and N in soil [total organic C (TOC) and N (TON), light fraction organic C (LFOC) and N (LFON), mineralizable C and N, microbial biomass C (MB-C), macro organic matter C (MOM-C) and N (MOM-N)]. No-tillage, straw retained and N fertilizer application usually improved TOC, TON, LFOC, LFON, MOM-N, and mineralizable C and N in soil compared to corresponding CT, straw removed and zero-N treatments. The differences were more pronounced for dynamic organic fractions. Storage of organic C and N can be increased in cultivated soils by minimizing summer fallow frequency, balanced fertilization, integrated/combined use of organic amendments and mineral fertilizers, and conversion of marginal cultivated lands to perennial grassland. The findings also suggested that C and N storage in soil can provide accompanying benefits of more sustainable crop production by improving soil quality and nutrient supplying power, and reducing the potential for greenhouse gas emissions.

LONG-TERM STRAW MANAGEMENT AND N FERTILIZER RATE EFFECTS ON SOIL ORGANIC C AND N, AND SOME CHEMICAL PROPERTIES IN A GRAY LUVISOL

S. S. Malhi[1], M. Nyborg[2], E. D. Solberg[3], B. McConkey[4], M. Dyck[2], D. Puurveen[2] and D. Leach[1]
[1]Agriculture and Agri-Food Canada, Melfort, Saskatchewan, Canada (sukhdev.malhi@agr.gc.ca)
[2]Department of Renewable Resources, University of Alberta, Edmonton, Alberta, Canada
[3]Alberta Agriculture, Food and Rural Development, Edmonton, Alberta, Canada
[4]Agriculture and Agri-Food Canada, Swift Current, Saskatchewan, Canada

Field experiment (with mainly barley; canola, wheat, triticale, or pea in a few years) was conducted on a Gray Luvisol (Typic Cryoboralf) loam at Breton, Alberta, Canada, to determine the effects of 27 years (from 1983 to 2009 growing seasons) of straw management [straw removed and straw retained] and N fertilizer rate (0, 25, 50 and 75 kg N ha^{-1}) on soil biochemical [total organic C (TOC) and N (TON), light fraction organic C (LFOC) and N (LFON)], and chemical (pH, extractable P, ammonium-N and nitrate-N) properties under conventional tillage. Straw retention and N fertilizer treatments increased mass of TOC, TON, LFOC and LFON in soil, but the differences were more pronounced for LFOC and LFON. There were close and significant correlations among most soil organic C or N fractions. Linear regressions between crop residue C input and soil organic C or N were significant in most cases. Application of N fertilizer reduced pH and extractable P in the 0-15 cm soil layer. Residual nitrate-N (though quite low) increased with N rate and also indicated some downward movement in the soil profile up to 90 cm depth. There was generally no effect of any treatment on ammonium-N in soil.

LONG-TERM STRAW MANAGEMENT AND N FERTILIZER RATE EFFECTS ON SOIL ORGANIC C AND N, AND SOME CHEMICAL PROPERTIES IN A BLACK CHERNOZEM

S. S. Malhi[1], M. Nyborg[2], E. D. Solberg[3], B. McConkey[4], M. Dyck[2], D. Puurveen[2] and D. Leach[1]

[1]Agriculture and Agri-Food Canada, Melfort, Saskatchewan, Canada (sukhdev.malhi@agr.gc.ca)

[2]Department of Renewable Resources, University of Alberta, Edmonton, Alberta, Canada

[3]Alberta Agriculture, Food and Rural Development, Edmonton, Alberta, Canada

[4]Agriculture and Agri-Food Canada, Swift Current, Saskatchewan, Canada

Field experiment (with mainly barley; canola, wheat, triticale, or pea in a few years) was conducted at Ellerslie [Black Chernozem (Albic Argicryoll) clay loam], Alberta, Canada, to determine the effects of 27 years (from 1983 to 2009 growing seasons) of straw management [straw removed (SRem) and straw retained (SRet)] and N fertilizer rate (0, 25, 50 and 75 kg N ha^{-1}) on soil biochemical [total organic C (TOC) and N (TON), light fraction organic C (LFOC) and N (LFON)], and chemical (pH, extractable P, ammonium-N and nitrate-N) properties under conventional tillage. The SRet and N fertilizer treatments had higher mass of only LFOC and LFON in soil compared to corresponding SRem and zero-N control treatments. There were close and significant correlations among most soil organic C or N fractions. Linear regressions between crop residue C input and soil organic C or N were significant in most cases. Application of N fertilizer reduced pH and extractable P in the 0-15 cm soil layer, but increased residual nitrate-N and indicated some downward movement in the soil profile up to 90 cm depth. There was no effect of any treatment on ammonium-N in soil.

Notes:

MACROAGGREGATE CHARACTERISTICS IN SOIL AMENDED WITH FRESH AND COMPOSTED CATTLE MANURE CONTAINING STRAW OR WOOD-CHIP BEDDING

J.J. Miller[1]*, B.W. Beasley[1], E. Bremer[2], C.F. Drury[3], B.J. Zebarth[4],

[1]Agriculture and Agri-Food Canada, 5403-1st Ave. South, Lethbridge, AB, T1J 4B1

[2]Symbio Ag Consulting, Lethbridge, AB

[3]Agriculture and Agri-Food Canada, Harrow, ON

[4]Agriculture and Agri-Food Canada, Fredericton, NB

*Corresponding author: jim.miller@agr.gc.ca.

Surface (0-15 cm) soil samples were obtained from a long-term field experiment where treatments were annual application of fresh or composted manure containing straw or wood-chips applied annually at 0 or 77 Mg ha-1 yr-1 for 11 y. Air-dried soil samples were separated into six dry-sieved fractions using a rotary sieve. The six soil fractions were analyzed for total C, total N, C:N ratio, soil mineralizable N (41 day incubation), total P, soil test P, and P saturation index. Application of feedlot manure significantly ($p \leq 0.05$) increased the proportion of small (<0.47 mm) macroaggregates and decreased the proportion of the larger (>12.7 mm) macroaggregates relative to the unamended control. Straw bedding increased the proportion of larger (> 12.7 mm) macroaggregates relative to wood-chip bedding. Total C, total N, total P, and soil test P concentrations were increased in all fractions irrespective of treatment. Significantly greater soil mineralizable N for straw than wood bedding for aggregate sizes ≥ 0.47 was attributed to the greater C:N ratio of wood than straw, and negative mineralization values for aggregates between 1.2 and > 12.7 mm indicated N immobilization. Significantly lower P saturation index values for soil with wood than straw.

Notes:

WATER DYNAMICS IN SEASONALLY FROZEN SOIL

H.L. He, M. F. Dyck
Dept. of Renewable Resources, Univ. of Alberta, 751GSB, Edmonton, T6G1H7
Corresponding author: hailong.he@ualberta.ca

In cold, semi-arid regions, water flow and heat transport in seasonally frozen soils significantly influence the soil water and energy balance. Water from spring snowmelt, for instance, may either contribute to recharging soil moisture reservoirs important for ecosystem productivity, or become runoff since soil infiltration capacity is inhibited by ice lenses, ice-filled pores or ice on the soil surface. Understanding the complex interactions between water flow and heat transport processes is key to predict the impact of climate change on food productivity in Great Plain which relays on snowmelt infiltration and to assess environmental risks as flooding, erosion, and non-point source pollution. Currently, methodology required for simultaneous, automated measurement of these important processes in seasonally frozen soil is limited. We develop a unique technology named frozen soil thermo-TDR (FSTTDR) combining heat pulse and TDR techniques, which enables simultaneous and automated measurement of soil volumetric liquid water content (θl), volumetric ice content (θi), liquid water flux/infiltration (Jl) and soil thermal properties (κ, kT, ρc, and λ etc) of frozen soils. Its applications in Lab are presented here.

Notes:

LAND USE

USE OF MANAGEMENT FRAMEWORKS TO PROTECT ENVIRONMENTAL QUALITY IN ALBERTA

Heather M. Sinton M.Sc., P.Ag. CPESC
2928 – 11 St. NE, Calgary, Alberta, Canada T2E 7L7
Phone: 403 297-3628 Fax: 403 297-6069
heather.sinton@gov.ab.ca

The Province of Alberta has passed new legislation, the Alberta Land Stewardship Act (2009), which enables regional planning. The Cumulative Effects Management System (CEMS) is an important part of the regional planning system. CEMS will more effectively regulate non-point, as well as point source pollution through the development and implementation of Environmental Management Frameworks (EMF). This case study explores the genesis and application of this outcome-focused and place-based approach for the Bow River, downstream from Calgary. Total phosphorus medians are currently above the EMF "limit". As a first step, Alberta Environment (AENV) has reduced the end of pipe limits for phosphorus at the wastewater treatment plants in Calgary. Water quality modeling shows that wastewater treatment plants and storm water outfalls contribute 58% of phosphorus loading. Non-point sources above Calgary are contributing 13% of phosphorus loading while non-point sources below the city are contributing up to 25% of phosphorus loading. The Bow River Basin Council (BRBC) is developing a second phase of their watershed management plan that will help to address nutrient and sediment loading from land use, as well as conservation and restoration of wetlands and riparian areas. In addition, Alberta Environment is working with stakeholders to develop a Loading Reduction Plan, which will address point and non-point sources of pollution. Erosion and sediment control (ESC) plans and inspection by qualified personnel are instrumental to meeting the ambient water quality objectives. The development and application of ESC municipal bylaws has been shown to be effective if a rigorous permit and compliance system is used. Reasonable planning measures to address extreme events are also necessary to prevent ESC failure and costly cleanups. The case study also looks at lessons learned to date in the development and application of this new governance system.

Notes:

MICRO-WATERSHED ATLAS OF ALBERTA

Sanjay K. Gupta
Environmental Resources Management program, Faculty of Extension, University of Alberta, Edmonton, AB T5J 4P6
Corresponding author: jay.ksanjay@gmail.com

Alberta is gifted with a variety of watersheds. Understanding them better would facilitate proper appraisal, evaluation, monitoring and management of our non-renewable natural resources.

Watershed has been used as the most systematic, scientific and rational unit of planning and development in Alberta since long owing to optimum interaction and synergistic effect of land, water and biota within a watershed. However, at present, there is an urgent need to divide the watershed into smaller units, and delineate and codify them following hierarchical system. This will facilitate the best micro level planning and management, and also help establish a better linkage between bigger and smaller units in the province. The size of the smallest unit could be restricted to a viable size dictated by the working feasibility.

This proposed framework of micro-watersheds in Alberta will help a great deal in adopting a more focused and site-specific approach for management of our resources requiring less money and less trained man-power.

Notes:

CASE STUDIES OF BMP EVALUATION IN SOUTHERN ALBERTA

Lynda Miedema[1], Barry Olson
Alberta Agriculture and Rural Development, 100, 5401 – 1st Ave. South Lethbridge, AB, T1J 4V6
[1]Corresponding author: lynda.miedema@gov.ab.ca

The ability of Alberta farmers to adopt beneficial management practices (BMPs) is critical for the agriculture industry to meet current and future environmental and economic expectations. Numerous BMPs are promoted; however, there are minimal data showing the effectiveness and practicality in the province. To help address this knowledge gap, a 6-yr study was initiated to evaluate BMPs in selected watersheds in southern Alberta. The objective of the project is to assess the environmental effectiveness and economic implications of BMPs at the field and watershed scales. This presentation will focus on two BMP sites: the Wintering (WIN) site in the Indianfarm Creek (IFC) watershed and the Lower Little Bow (LLB) site near Picture Butte. The WIN site is mainly in the riparian area along a portion of IFC. The issues at the WIN site are direct cattle access to the creek, a degraded riparian zone, and creek bank erosion. The BMPs being evaluated include relocation of a winter feeding area, controlled riparian pasture grazing, and bioengineering. The BMPs being evaluated at the LLB site includes a nutrient management plan to address very high soil phosphorus, caused by manure application, and irrigation management to reduce runoff from irrigation. Preliminary results on post-BMP effectiveness will be presented.

Notes:

BENEFITS OF BIODIVERSITY AND ECOSYSTEM SERVICES ASSOCIATED WITH AGRICULTURAL PRODUCTION SYSTEMS

Mark Wonneck,
Agri-Environment Services Branch,
Agriculture and Agri-Food Canada, Rm. 600,
138 – 4th Avenue SE, Calgary, Alberta,
Canada, T2G 4Z6,
Email: mark.wonneck@agr.gc.ca

Emerging ideas in ecological agriculture advocate the use of new forms of planned diversity that take into account the latest ecological theory and practices to maximize the potential for benefits derived from biodiversity and ecosystem services. While the literature in this field is still in early stages of development, there is already substantial evidence for opportunities to lever agricultural benefits both with regards to productivity and stability, as well in the areas of pollination, pest suppression and soil quality. Further, there is considerable overlap in agricultural management strategies that enhance these five functions and services. Landscape pattern, for example, has the potential to provide simultaneous, multiple benefits including: reliable wild pollination services by locating and providing a more varied assortment of pollinator forage, nesting sites and nesting materials in and around crops; improved pest suppression through strategically-located habitat for the natural enemies of pests (including predators, herbivores and parasitoids); and improved plant nutrient uptake, plant resistance to disease and contamination and improved soil structure as a result of rapid recolonization of arbuscular mycorrhiza fungi in tilled fields from intact mycorrhizal networks present in untilled field margins. By coupling and integrating landscape design with the judicious employment of biodiversity and by carefully managing external inputs, there are clear stacking opportunities for these and other ecosystem functions and services, Ultimately, more ecologically-based agricultural systems may allow for increased productivity, reduced risk, and decreased dependence on external inputs, while fostering the long term health of agroecosystems.

Notes:

ENVIRONMENTAL FOOTPRINTING FOR AGRICULTURE IN ALBERTA

R. Bryan[1] and K. Koehler-Munro
Environmental Stewardship Division, Alberta Agriculture and Rural Development
306, 7000 – 113 Street, Edmonton, Alberta
T6H 5T6
[1]Corresponding author: roger.bryan@gov.ab.ca

Alberta Agriculture and Rural Development (AARD) is currently working on a project for developing environmental footprinting for agriculture in Alberta. Environmental footprinting is a quantitative tool used by many countries and industries to determine the impacts of a product or processes. The concept can also be applied to calculate water, energy, or carbon footprints that can be used to help address a variety of climate, energy, water and land use challenges. Consumers are increasingly interested in the environmental attributes of food they purchase.

In response to this demand, food retailers and processors are moving towards documenting environmental footprints for their products and production practices including those of their primary suppliers. Governments are similarly interested in supporting new economic opportunities related to sustainable management practices and reducing the environmental impacts of agriculture. The goal of this project is to develop tools to help characterize agricultural products and processes to determine their environmental footprint. This information can be used to enhance production efficiencies and support development and access to markets. The project will span four years, from April 2010 to March 2014 and will consider a number of agricultural environmental footprints that include both crop and livestock commodities.

Notes:

LAND RECLAMATION

DOES BLACK CARBON HAVE A USE IN LAND RECLAMATION?

M.D. MacKenzie
Renewable Resources, 4-42 Earth Sciences Building, University of Alberta
Edmonton, AB, T6G 2E3 Tel: (780) 492-6388
Corresponding author:
m.derek.mackenzie@ualberta.ca

Recently, there has been increasing interest in the use of biochar as a potential fertility treatment for the production of everything from agricultural species to quick rotation silviculture. The use of biochar for the reduction of greenhouse gases and long-term carbon (C) sequestration is also being investigated. Much of this interest has been generated by results from tropical regions, specifically Tera Preta do Indio soils. Naturally pyrogenic ecosystems of both temperate and boreal latitudes produce charcoal, however very little is known about the quantity in soils of these ecosystems, it's spatial distribution, and the effect of that distribution on soil processes. Part of this lack of knowledge stems from the difficulty in quantifying black C, a substrate defined by a gradient of recalcitrance and elemental ratios, and part is due to the historic belief that charcoal is inert in soils. New methods including digestion techniques and FT mid-infrared spectroscopy have proven effective in quantifying charcoal in soils. Recent evidence suggests that wildfire produced charcoal plays an important role in plant nutrient availability. Coke, a by product of oil sands upgrading, is a black C substrate that may have a role in stimulating ecosystem processes similar to natural forests recovering from fire. Coke and biochar both reduced nitrogen mineralization in two different soil types commonly used in land reclamation and these results will be discussed.

Notes:

EVALUATING THE AMELIORATIVE POTENTIAL OF BIOCHAR IN SOLONETZIC SOILS IN ALBERTA

Bonnie Drozdowski, Andrei Startsev and Anthony Anyia
Bioresource Technologies, Alberta Research Council, 250 Karl Clark Road, Edmonton, Alberta, T6N 1E4

Solonetzic soils cover almost 73 000 km2 (0.7%) of Canada's land area, mostly occurring in Alberta. The origins, properties, and management options for solonetzic soils have been studied extensively both locally and internationally. Solonetzic soils develop in regional groundwater discharge areas where the groundwater has passed through saline marine shales. These soils have B horizons that are very hard when dry, swelling to a sticky, compact mass when wet. Poor soil structure, porosity, aeration and water holding capacity in the root zone affects crop performance. Established ameliorative methods include deep plowing/sub-soiling alone or in combination with an amendment of gypsum or other water-soluble chemicals that contain calcium. Biochar, a product of waste biomass carbonization, has potential to be used as an amendment in the ameliorative procedures on solonetzic soils. The anticipated benefit of biochar is partly associated with the fact that carbonization of biomass produces a considerable amount of carbonate salts of calcium and magnesium, the bivalent cations, which contribute to chemical amelioration similar to conventional gypsum applications or liming. Vegetation also benefits from the addition of biochar with regards to increased retention of water and nutrients, and microbial community enhancement. The objective of this study was to determine the crop response to incorporation of straw biochar into the Bnt horizon at a two different rates in comparison to deep trenching. Oats plants in biochar treated plots showed 'visual' higher seedling vigour, which may suggest that biochar can potentially be used as an amendment to ameliorate solonetzic soils in Alberta. The details of the experimental design and preliminary results will be presented and discussed.

Notes:

EFFECT OF SUBSOILING AND INJECTION OF PELLETIZED ORGANIC MATTER ON SOIL QUALITY AND PRODUCTIVITY

Takele B. Zeleke[1] and Leonard A. Leskiw
Paragon Soil and Environmental Consulting Inc.,
14805-119 Ave., Edmonton, AB, T5L 2N9
[1]Corresponding author: tzeleke@paragonsoil.com

Subsoil compaction is a widespread environmental problem in wellsite and pipeline reclamation and other industrial operations. The objective of our research was to evaluate effectiveness of coupling deep subsoiling with injection of organic matter (OM) pellets. The technique was tested at eleven sites in central Alberta. Treatments evaluated were subsoiling coupled with injection of 20 $Mg.ha^{-1}$ OM pellets (SP), subsoiling alone (SS), compacted right-of-way (C) and undisturbed control (UC). Data on soil physical properties, nutrient status, salinity and yield were collected in 2009 and 2010. The results showed that relative to C, the SP has lowered bulk density (17 to 40%; $p<0.05$, $n=6$) in all second year sites and half of first year sites. Both SP and SS increased soil water content (13 to 72%; $p<0.05$, $n=6$) relative to C. Organic carbon (OC) and total nitrogen (TN) contents of all sites were increased in SP treated plots ($p<0.05$, $n=21$). Nonetheless SP did not significantly increase available nutrients in the first year sites; implying that OM pellets release plant nutrients in a slower rate; a characteristic desirable in reducing leaching and maintain nutrient supply over longer period. Vegetative growth was also substantially better on SP plots and was comparable to UC.

Notes:

COMPARING SOIL NUTRIENT AVAILABILITY TO ASPEN (POPULUS TREMULOIDES) UPTAKE FOR EIGHT DIFFERENT RECLAMATION SOIL TYPES FROM NORTHERN ALBERTA

S. D. Gupta, M.D. MacKenzie, S. Landhäusser, and S.A. Quideau
Dept. of Renewable Resources, University of Alberta, Edmonton, Alberta, T6G 2E3

Oilsand operations in northern Alberta require large areas to be reclaimed after severe ground disturbance by surface mining activities. Reclamation processes involve using the organic matter, soil, and geologic substrate that were removed earlier to reconstruct land to be revegetated with native plant species. We examined the nutrient supply rate and growth potential of aspen (*Populus tremuloides*) in a greenhouse experiment using eight different soil types, including: peat mineral mix, forest floor mineral mix, four selectively salvaged B horizons with high phosphorus availability and different pH, parent geologic material, and tailing sand. Ionic exchange resins were used to determine the nutrient supply rate of soils and leaf samples were collected to measure foliar nutrients. Significant ($p<0.05$) differences in nutrient supply rate and foliar nutrient contents of aspen seedlings were found among soil types. Nutrient supply rates were not well correlated to foliar nutrition unless the supply rates were grouped by soil organic matter content. Ordination also showed distinct differences between soil nutrient supply rate and foliar nutrition among soil types. Soils rich in a specific nutrient had high supply rates of that nutrient, including P from the B horizons. Peat mineral mix had the highest macronutrient supply rate (except P), but forest floor mix had the highest biomass production.

Notes:

EFFECT OF RESTORATION ON CARBON DIOXIDE FLUX IN A MODERATELY RICH FEN

C. Robinson[1], M. S. Mahmood, M. Strack
Dept. of Geography, University of Calgary,
2500 University Dr. NW, Calgary, Alberta,
T2N 1N4
[1]Corresponding author cjrobinsoncan@gmail.com

Peatlands are a significant carbon sink, accounting for up to one-third of the world's soil carbon. Peat harvesting to produce horticultural products alters the eco-hydrological condition of Canadian peatlands, making them sources of atmospheric carbon. Restoration may help to re-establish peatland carbon budgets, however relatively little work has been done in the area of restoration or verification of carbon balances post-restoration, particularly for fens.

This study measured carbon dioxide flux along a moisture gradient in a restored moderately rich fen in Quebec, Canada. The site was harvested from 1946 until abandonment over the last few decades and extensive restoration was undertaken in Fall 2009. Results from the restored site were compared to carbon dioxide fluxes from a neighbouring undisturbed fen. Controls on resulting carbon dioxide flux to be discussed.

Notes:

SOIL FERTILITY

MANAGEMENT OF BIOSOLIDS IN ALBERTA – PRESENT AND FUTURE

G. Dinwoodie[1],
Air, Land and Waste Policy Branch, Alberta Environment, 10th Floor, 9820 - 106 Street, Edmonton, AB T5K 2J6
[1]Corresponding author: gordon.dinwoodie@gov.ab.ca

Application on agricultural land is the most common method of managing biosolids in Alberta. Proper management of biosolids includes consideration of nutrient application rates, potential contaminants, pathogens and odours. Land application is carried out by municipalities according to guidelines issued by Alberta Environment. Under Alberta's guidelines, application rates are based primarily on nitrogen loading targets with checks in place to ensure heavy metal concentrations are within acceptable levels. Application rates are adjusted for the degree of treatment (a surrogate for pathogens and odour) and site characteristics such as soil texture, slope, and depth to groundwater. Additional management restrictions provide setbacks around water wells, waterbodies, occupied buildings and recreational areas.

When Alberta's guidelines were developed in the early 1980s, nutrients, heavy metals, and pathogens were the primary drivers for management. Recently, questions have arisen about organic contaminants such as pharmaceuticals, fragrances, flame retardants, and plasticizers (commonly called "emerging contaminants"). Greenhouse gas emissions have also become a factor when choosing management options. The Canadian Council of Ministers of the Environment Biosolids Task Group is developing a common approach for managing biosolids across Canada that will address many of these issues. The Task Group has completed a number of activities including a review of Canadian legislation and a software tool for calculating greenhouse gas emissions under various management options. They have also completed a sampling program to characterize contaminants in biosolids from different types of wastewater treatment facilities, with a particular focus on emerging contaminants. Over the next few months the Task Group will be working on guidelines for biosolids management that will be based on beneficial use principles. The guidelines will address standard management topics, such as nutrients, pathogens, odours, and metals. They will also address the newer concerns such as greenhouse gas emissions and emerging contaminants, although the latter is still very much in a research and data gathering phase. The guidelines developed by the Biosolids Task Group will likely result in a revision to Alberta's guidelines over the next few years.

Notes:

COLD WEATHER VOLATILITY OF AMMONIA FROM SURFACE-APPLIED UREA: A MICROMETEOROLOGICAL STUDY TO QUANTIFY LOSSES IN THE NORTHERN GREAT PLAINS OF AMERICA

Richard Engel (rengel@montana.edu), Clain Jones, and Rosie Wallander
Land Resources and Environmental Sciences, MSU-Bozeman, Bozeman, MT

Surface application of urea to cold soils (<5 °C) is a common management practice for dryland winter wheat farmers in Montana. Although, the susceptibility of surface-applied urea to NH3 volatility losses has long been recognized, previous studies have not focused on losses that may occur under cold weather conditions. This study was undertaken to measured NH3 volatility losses from surface-applied to cold soils, and to evaluate the efficacy of the urease inhibitor, NBPT (884.5 mg kg^{-1} urea), in mitigating NH_3 losses. Emissions of NH_3 were monitored continuously over 7-10 wk gas sampling campaigns following N fertilization (100 kg N ha^{-1}). A mass-balance micrometeorological method with circular plots (20 m radius), center mast, and Leuning samplers provided time-integrated measurements of NH_3 flux from the soil. Ammonia losses from urea and NBPT-coated urea were quite variable, but surprisingly high, averaging 30.6% and 11.0% over six campaigns. In one trial, NH3 losses equivalent to 24.3% of the application rate occurred over a 10-wk period after urea was applied to a 14-cm snowpack. Surface soil moisture conditions at the time of fertilization, and the size and distribution of precipitation events that followed were the most critical factors affecting the magnitude of NH_3 loss. Large NH_3 effluxes, up to 134 g N ha^{-1} hr^{-1}, were associated with urea applications to damp or wet soil surfaces followed by a period of drying. The duration of volatility protection provided by NBPT was greater in calcareous soils (pH 8.3) compared to acidic soils (pH 5.5 to 6.5), suggesting NBPT persistence was greater at high pH. This study demonstrated that application of urea to cold soils did not provide protection against volatility losses.

Notes:

THE CORRELATION BETWEEN SOIL TEST NUTRIENT AVAILABILITY AND NUTRIENT CONTENT IN SELECTED GENOTYPES OF WHEAT (*Triticum aestivum*)

T. Jensen,
International Plant Nutrition Institute (IPNI),
102-411 Downey Rd,
Saskatoon, SK, S7N 4L8
Corresponding author: tjensen@ipni.net

The nutrient content of wheat (*Triticum aestivum*) grain is important for seed germination and emergence, and for nutrient supply to animals and humans consuming the grain. The content of plant required nutrients in grain has been studied and there are ranges of concentration that are suggested as optimum for seed germination and seedling emergence. If concentrations of nutrients in the grain are below suggested ranges the content is considered sub-optimum, and if above the suggested range it is considered excessive. It is thought that higher than required concentrations of plant nutrients is due to so-called "luxury consumption" when availability of some nutrients from the soil, and applied fertilizer or bio-solids is greater than that required for non-yield limiting growth. A study was conducted in Alberta and Saskatchewan in 2010 comparing the nutrient content of ten genotypically diverse wheat varieties grown at six different locations; near Delia, Three Hills and Vulcan, Alberta; and Watrous, Regina and Moose Jaw, Saskatchewan. Soils samples were taken in the spring of 2010 before fertilization and planting and analyzed for most plant required macro and micronutrients. Grain samples from each wheat genotype were analyzed for the same nutrients after harvest in 2010, and a correlation was conducted between soil test nutrient availability and nutrient content of grain.

Notes:

GENETIC IMPROVEMENT OF NITROGEN USE EFFICIENCY IN SPRING BARLEY

Yadeta Anbessa[1], Patricia Juskiw[1] and Allen Good[2]

Field Crop Development Centre, Alberta Agriculture and Rural Development, Lacombe, AB, T4L 1W8
[2]Department of Biological Sciences, University of Alberta, Edmonton, AB, T6G 2E9
[1]Corresponding author yadeta.kabeta@gov.ab.ca

Development and use of N efficient cultivars is an important component of the integrated strategies required to enhance nitrogen use efficiency (NUE) of cereals. The Field Crop Development Centre (FCDC), Alberta Agriculture and Rural Development, has recently initiated a program on genetic improvement of NUE in spring barley. We first 'mined' long-term data from the FCDC data bank to evaluate differences in NUE of the breeding lines. As well over the past four years, we have screened a large number of germplasm lines either developed at the FCDC or introduced from different parts of the world. Selected germplasm lines were evaluated under low and high N conditions at the FCDC main station near Lacombe. These barley genotypes varied significantly in NUE and its components (N uptake and utilization efficiencies) and yield performance under low and high N conditions. The cultivar Vivar has consistently shown superior NUE and grain yield under low and high N conditions. Others, including Xena and lines introduced from the University of Minnesota (I09502 and I09505), also showed good NUE. Crosses have been made among these relatively efficient lines in an attempt to pyramid the NUE genes and develop 'super-efficient' lines. When combined with improved N management practices, the use of these efficient cultivars should reduce N losses and its negative impact on the environment and unnecessary input costs to growers.

Notes:

DEVELOPMENT OF A NITROUS OXIDE EMISSION REDUCTION PROTOCOL

R. Janzen[1]*, D. Beever, R. Dowbenko[2], C. Graham[3], K. Haugen-Kozyra[4], T. Jensen[5], T. Goddard[6] and L. Kryzanowski[6]
[1]ClimateCHECK, 325 Dalhousie St, Suite 204, Ottawa, K1N 7G2
[2]Agrium, 13131 Lake Fraser Drive SE, Calgary, T2J 7E8
[3]Canadian Fertilizer Institute, 350 Sparks St., Ottawa, K1R 7S8
[4]KHK Consulting, 12207-42A Ave, Edmonton, AB T6J 0X5
[5]International Plant Nutrition Institute, 102, 411 Downey Rd., Saskatoon, S7N 4L8
[6]Alberta Agriculture and Rural Development, 7000 - 113 St, Edmonton, T6H 5T6
*Corresponding author: rj@climate-check.com

The Canadian Fertilizer Institute has received approval in the Alberta Offsets System for a protocol to quantify greenhouse gas emission reductions associated with best management practices ("BMPs") to decrease emission of nitrous oxide from management of nitrogen ("N") in the Canadian Prairies.

The implementation of this Protocol is begun. Online training is available to allow agricultural professionals to receive the accreditation necessary to sign off on the N management plans required by the Protocol. This training is based on the 4R stewardship model developed by the Canadian Fertilizer Institute and adopted by the global fertilizer industry — Right Source @ Right Rate, Right Time, Right Place™. This training is expected to allow initiation of the Protocol in time to generate offsets for sale in spring of 2012.

In addition, the requirements of the Protocol are expected to accrue benefits in addition to offsets. First, the professionally-developed 4R N management plans and BMPs will advance better N management to increase crop yields and to enhance farm profitability. Second, the quantification methods and record-keeping standards will provide evidence needed to assure claims for other ecological services. And, the Protocol is promoted as a support for food security and rural development efforts in global agriculture.

FOREST, RIPARIAN & WETLAND SOILS

FOUR YEARS OF SIMULATED N AND S DEPOSITION AFFECTED N CYCLING IN A MIXED WOOD BOREAL FOREST ECOSYSTEM IN NORTHERN ALBERTA

Kangho Jung[1] and Scott X. Chang
Department of Renewable Resources, University of Alberta, Edmonton, AB T6G 2E3
[1]Corresponding author: kangho@ualberta.ca

Boreal forests in the Athabasca oil sands region (AOSR) have been exposed to significant amounts of N and S deposition for decades. As N emission rates will increase with expansion of oil sands mining activities, long-term effects of N deposition have been of concern. We conducted a simulated N and S deposition experiment to evaluate changes in N pools and nutrient losses using the following four treatments; control (CK), N addition (+N), S addition (+S), and N+S addition (+NS) from 2006 to 2009. Plant and soil samples were collected in 2009. N addition increased tree growth in the +N and +NS treatments ($p<0.05$) while none of the treatments affected the growth of the understory. Soil microbial biomass C and N were also not affected by any of the treatments. No difference of inorganic N in soils was found between treatments except for the period right after fertilizer addition. Minimal amounts of NO_3^- were leached below 45 cm (considered the main rooting depth) of the soil profile in any of the treatments. Exchangeable Ca^{2+} and Mg^{2+} were decreased likely due to increased tree uptake following increased tree growth in the +N treatment and increased leaching with sulfate in the +S treatment. Based on our data of minimal N leaching and increased N uptake by trees, the risk of N saturation appeared low even after four years of elevated levels of simulated N deposition. However, the long-term effects of N deposition on N cycling in the ecosystems in the oil sands region remain to be studied.

Key words: nitrogen cycling, acid deposition, N saturation, base cation leaching, boreal forest, Athabasca oil sands region.

CHARACTERIZATION OF NUTRIENT TRANSPORT BELOW THE ROOT ZONE OF A WILLOW PLANTATION IRRIGATED WITH MUNICIPAL WASTE WATER IN THE BOREAL-PARKLAND TRANSITION ZONE, ALBERTA, CANADA

Gainer, A.[1], M. Dyck[1] and G. Kachanoski[2]
[1]University of Alberta, Dept. of Renewable Resources 751 General Services Building, Edmonton, Alberta, T6E 2B8
[2]Memorial University. Office of the President. St John's, Newfoundland, A1C 5S7

Irrigation of willow and poplar species with municipal waste water offers municipalities a variety of opportunities including reduced energy and waste management costs and preservation of surface water quality. Municipal waste water contains various nutrients that are beneficial to plants such as nitrogen and phosphorus. The woody species reduce treatment costs by further removing many of these nutrients and potentially using the resulting biomass to fuel the facilities. Diversion of municipal waste water from rivers and water bodies improves water quality by reducing the amount of nutrients entering water bodies, decreasing pollution such as eutrophication. As found by many European countries, the bioenergy combined with waste water treatment approach is promising but there are environmental drawbacks including nutrient leaching to groundwater and degradation to soil hydraulic properties. Various nitrogen forms like nitrate are of concern due to impacts on human and environmental health, most notably methemoglobinemia in infants. The overall objective of this research is to assess ecosystem resilience and sustainability with repeated applications of municipal wastewater over the life cycle of a willow plantation. The specific objective of this presentation is to quantify nutrient transport below the root zone of a poplar plantation previously irrigated with municipal waste water under natural climatic conditions using soil solution samplers at 4 depths (50 cm, 90 cm, 120 cm and 150 cm). Meteorological data (precipitation, temperature, evaporimeter) was collected as well. Transport of conservative tracers, bromide and chloride, are compared to the transport of nutrients (nitrogen forms and DOC,). Parameterization of the measured breakthrough curves may be used to predict

future nutrient fluxes. The goal of this research is to improve the design of municipal waste water subsurface irrigation systems by minimizing leaching and water losses.

Notes:

FIBER SATURATION REGULATES THE UNSATURATED HYDRAULIC CONDUCTIVITY (K(Ψ)) IN FOREST SOIL ORGANIC LAYER (DUFF)

B. Wilske[1]*, E. A. Johnson[1] and Y. Martin[2]
[1]Biogeosciences Institute and Department of Biological Sciences, University of Calgary Calgary, Alberta, Canada T2N 1N4
[2]Department of Geography, University of Calgary, Calgary, Alberta, Canada T2N 1N4
*Corresponding author: brkwils@yahoo.com

Duff is important for the ecohydrology of cold-climate forests, with its hydraulic properties affecting ecosystem water redistribution and storage, and smoldering combustion in wildfires. Lateral water redistribution through duff is confined to high water contents (θ) and small suction pressures (ψ). Our study objectives were (1) to examine K(ψ)duff at high to moderate θ, and (2) to investigate the effects of fiber saturation. K(ψ) of duff from subalpine spruce and pine forests was determined from constant flow experiments using a twin-suction disc apparatus. Effects of fiber saturation were also examined by means of drying and wetting experiments with samples exposed to different incubation periods. K(ψ) of fiber-saturated duff ranged from 1.98–6.06 m d^{-1} at ψ = -0.34 kPa to 6×10^{-4}–42×10^{-4} m d^{-1} at ψ = -3.07 kPa. Samples that were submerged ≤ 10 min contained 10–45% less water and K(ψ) was 40–80% lower than in samples submerged ≥ 12 h. This shows that fiber saturation represents (1) an additional pool to the pore water, and (2) an important regulator of K(ψ). Furthermore, fiber saturation seems to decrease the hydrophobicity of duff and thereby affect the water redistribution within the layers.

Notes:

PEATLAND RESOURCE AND HORTICULTURAL USE IN CANADA

Short, P.
Canadian Sphagnum Peat Moss Association, 2208 13 Mission Ave., St. Albert, AB, T8N 1H6
Email: paul.short@peatmoss.com

Presentation on the resource, its use, climate change impact, research and restoration processes and economic and social implication of the industry in Canada.

Notes:

THE EFFECTS OF PLANT COMMUNITY PRODUCTIVITY ON DISSOLVED ORGANIC CARBON CONCENTRATION

Yoseph Zuback[1], Maria Strack
Department of Geography, University of Calgary, 2500 University Drive NW, Calgary, AB T2N 1N4
[1]Corresponding Author (yca.zuback@ucalgary.ca)

Dissolved organic carbon (DOC) is an important component of water; DOC acts as an energy source, a pH buffer and a source of nutrients, contributes to the transport of metals and organic micropollutants, and it affects the penetration of water by light. Also, DOC represents a major issue in the treatment of water. It has been shown that the major sources of DOC are the most carbon rich soils within a catchment but little investigation has focused on the role substrate, and plant productivity have on the DOC being produced, particularly in relation to various disturbance regimes. In Bois-de-Bel, Quebec (N47.9671°,W69.4285°) 11.5 ha of peatbog was harvested from 1972 to 1980. After twenty years of abandonment 7.5 ha of the 11.5 ha site was restored according to North American guidelines. In 2010, ten years post restoration, thirty years post-abandonment, DOC samples were taken from the restored, abandoned and nearby natural control sites from May to October to coincide with CO_2 fixation and respiration chamber measurements from May to October. With net ecosystem exchanges calculated for: the restored, abandoned and nearby natural control sites; and plant communities, we can now see linkages between DOC concentration and CO_2 fixation.

Notes:

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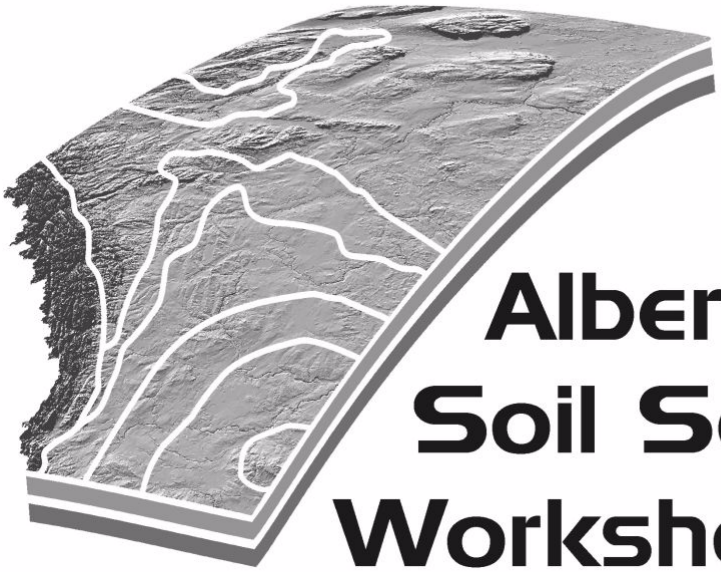

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